เอกสารประกอบ

๑) เครื่องคอมพิวเตอร์แม่ข่าย แบบที่ ๑:
สำหรับระบบเชื่อมโยงข้อมูลร่วม (Realtime Data Gateway)

POWEREDGE R440

Optimized for dense, scale-out computing

The PowerEdge R440 delivers the perfect combination of performance and density for HPC and web-tech deployments with a feature set right-sized for scale-out infrastructure environments.

Deliver performance at scale with the Dell EMC PowerEdge portfolio

Modern compute platforms from Dell EMC easily scale and leverage key technologies to maximize application performance. The PowerEdge R440 is built on a scalable architecture that provides the choice and flexibility to optimize performance and density.

- Scale compute resources with 2nd Generation Intel® Xeon® Scalable processors, and tailor performance based on your unique workload requirements.
- Flexible storage with up to 10 x 2.5 SAS/SATA/SSD with up to 4 NVMe PCIe SSD's or 4 x 3.5.
- Free up storage with boot optimized M.2 SSDs.

Intuitive systems management with intelligent automation

The Dell EMC OpenManage™ portfolio helps deliver peak efficiency for PowerEdge servers, delivering intelligent, automated management of routine tasks. Combined with unique agent-free management capabilities, the R640 is simply managed, freeing up time for high profile projects.

- Simplify management of your servers with OpenManage Essentials, a 1:many console that automates all phases of lifecycle management: deployment, updates, monitoring, and maintenance.
- Use Quick Sync 2, a wireless module, and the OpenManage Mobile app for at-server management, to configure or troubleshoot in the data center, and to receive alerts when you're on the go.

Rely on PowerEdge with built-in security

Every PowerEdge server is made with a cyber-resilient architecture, building security into all parts of a server's life cycle. The R440 uses these new security features so you can reliably and securely deliver the right data to where your customers are, no matter where they are. Dell EMC consider each part of system security, from design to end of life, to ensure trust and deliver worry-free, secure systems.

- Rely on a secure supply chain that protects servers from factory to the data center.
- Maintain data safety with cryptographically signed firmware packages and Secure Boot.
- Prevent unauthorized or malicious change with Server Lockdown.
- Wipe all data from storage media including hard drives, SSDs and system memory quickly and securely with System Erase.

PowerEdge R440

- 1U, 2 socket server
- Up to 10 2.5 drives with up to 4 NMVe
- Internal M.2 boot drives

PowerEdge R440

Features	Technical Specification	
Processor	Up to two 2nd Generation Intel® Xeon® Scalable processors, up to 24 cores per processor	
Memory	16 DDR4 DIMM slots, Supports RDIMM /LRDIMM, speeds up to 2666MT/s, 1TB max[1]	
Storage controllers	Internal controllers: PERC H330, H730P, H740P, HBA330, Software RAID (SWRAID) S140 Boot Optimized Storage Subsystem: HWRAID 2 x M.2 SSDs 120GB, 240 GB External PERC (RAID): H840 External HBAs (non-RAID): 12 Gbps SAS HBA	
Drive bays	Front drive bays: Up to 10 x 2.5" SAS/SATA (HDD/SSD) with up to 4 NVMe SSD max 76.8TB or up to 4 x 3.5 SAS/SATA HDD max 64TB Optional DVD-ROM, DVD+RW	
Power supplies	Bronze 450W (Cabled PSU), Platinum 550W (Hot plug PSU with full redundancy option)	
Fans	Up to six fans	
Sizing	Form factor: Rack (1U)	Height: 42.8mm (1.68") Width*: 434mm (17.08") Depth*: 714.62mm (28.13") Weight: 17.6kg (38.9lbs.) *Dimensions do not include bezel
Bezel	Optional LCD or security bezel	
Embedded / At-Server	iDRAC9 iDRAC Direct	iDRAC REST API with Redfish Quick Sync 2 BLE/wireless module
Consoles & Mobile	OpenManage Enterprise OpenManage Essentials	OpenManage Mobile OpenManage Power Center
Integrations	OpenManage integrations: Microsoft® System Center, VMware® vCenter™, BMC Truesight, Red Hat® Ansible® Modules	
Connections	OpenManage connections: Nagios® & Nagios® XI, IBM Tivoli Netcool/OMNIbus, Micro Focus Operations Manager I	
Tools	Dell EMC Repository Manager Dell EMC Update Package Dell EMC System Update Dell EMC Server Update Utility	iDRAC Service Module OpenManage Server Administrator OpenManage Storage Services
Security	TPM 1.2/2.0, TCM 2.0 optional Cryptographically signed firmware Silicon Root of Trust	Secure Boot System Lockdown (requires OpenManage Enterprise) System Erase
I/O & Ports	Network options 2 x 1GbE LOM + (optional) LOM Riser 2 x 1GbE or 2x 10GbE SFP+ or 2 x 10GbE BaseT Front ports: 1 x Dedicated iDRAC Direct USB, 1 x USB 2.0, 1 x USB 3.0 (Optional), 1 x Video Rear ports: 1 x Dedicated iDRAC network port, 1 x Serial, 2 x USB 3.0, 1 x Video Up to 2 x PCIe Gen 3 slots all x16	
Supported operating systems	Canonical® Ubuntu® Server LTS Citrix® Hypervisor Microsoft Windows Server® LTSC with Hyper-V Red Hat® Enterprise Linux SUSE® Linux Enterprise Server VMware® ESXi	For specifications and interoperability details, see Dell.com/OSsupport.
OEM-ready version available	From bezel to BIOS to packaging, your servers can look and feel as if they were designed and built by you. For more information, visit Dell.com/OEM.	
Recommended support and services	Choose Dell ProSupport Plus for critical systems or Dell ProSupport for premium hardware and software support for your PowerEdge solution. Consulting and deployment offerings are also available. Contact your Dell representative today for more information. Availability and terms of Dell Services vary by region. For more information, visit dell.com/itlifecycleservices.	
Dell Financial Services	Deliver results with easy financing. Explore financial options that move at the speed of business. For more information, visit https://www.emc.com/products/how-to-buy/global-financial-services/index.htm.*	

[1] 768GB max memory is recommended for performance optimized configurations

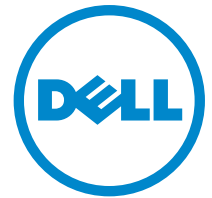## Learn more at Dell.com/PowerEdge

End-to-end technology solutions

Reduce IT complexity, lower costs and eliminate inefficiencies by making IT and business solutions work harder for you. You can count on Dell EMC for end-to-end solutions to maximize your performance and uptime. A proven leader in Servers, Storage and Networking, Dell EMC Services deliver innovation at any scale. And if you're looking to preserve cash or increase operational efficiency, Dell Financial Services™ has a wide range of options to make technology acquisition easy and affordable. Contact your Dell Sales Representative for more information.*

DELL EMC

Dell 17 Monitor | E1715S
43.2 cm (17.0 inches)

Dell 17 Monitor

E1715S
17"

Reliable and efficient, offering essential features for business

The Dell 17 Monitor is your smart choice for essential features for business productivity, unmatched reliability, and energy-saving environment and regulatory compliance. In addition, the Dell 17 Monitor offers the security of Dell's Limited Hardware Warranty[1] and Advanced Exchange Service[2].

The Dell 17 Monitor is perfect for:

- **Retail point-of-sale use with legacy custom applications requiring 5:4 aspect ratio**
- **Call centres, data entry centres, sales order input and administration**
- **Educational institutions (computer labs, classrooms)**

The Dell 17 Monitor offers you:

Essential features for business productivity

- Work in small spaces easily with this compact 5:4 aspect ratio, 17" monitor that's compatible with legacy custom applications, making upgrades simple and fast.

- Enjoy access to virtually any peripheral or device with plug and play VGA and DisplayPort connectivity.

- Get impressive screen quality when you view applications and spreadsheets with the HD resolution and fast 5ms (typical) response time of the Dell 17 Monitor.

- Adjust the monitor up to 5.5° forward or 22° backward to your preferred angle with the smooth tilt function.

Reliability you can count on

- Enjoy peace of mind with Dell's Limited Hardware Warranty[1] and Advanced Exchange Service[2].

- Benefit from Dell's quality monitoring and rigorous product development requirements which help ensure reliability, avoiding downtime and keeping your workforce productive.

- Plan transitions easily with Dell's stable product life cycles.

Environmental efficiency

- Do your part to help reduce your business' carbon footprint and environmental impact with the Dell 17 Monitor, which meets latest regulatory and environmental standards.

- Experience the increased energy efficiency of the Dell 17 Monitor with the low power consumption of LED backlights and typical operation at only 11 W.

- Manage power consumption wisely with PowerNap, a brightness dimming feature which, when enabled, puts the monitor into sleep mode when it's not in use.
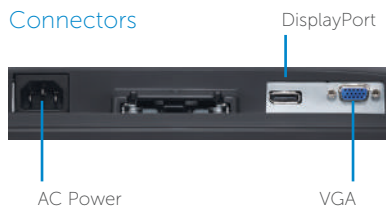
Dell 17 Monitor | E1715S
43.2 cm (17.0 inches)

Designed with essential features for business productivity

Tilt   Back view

Maximum tilt 5.5° forward or 22° backward.

Connectors

DisplayPort

AC Power   VGA

What's in the box?

Monitor, stand, VESA™ screw cover, power cables (vary with country), Drivers and Documentation Media, Quick Set Up Guide, Product Information Guide, VGA cable.

Dell recommends that customers dispose used computer hardware, including monitors, in an environmentally sound manner. Potential methods include reuse of parts or whole products and recycling of product, components and/or materials. For more information, please visit http://dell.com/recycling_programs and www.dell.com/environment

Dell 17 Monitor | E1715S 17"

Display	
Model number	E1715S
Viewable image size (diagonal)	43.2 cm (17 inches)

Active display area
  Horizontal
  Vertical
	
	337.92 mm (13.3 inches)
	270.33 mm (10.64 inches)

Maximum resolution	1280 x 1024 at 60 Hz
Aspect ratio	5:4
Pixel pitch	0.264 mm
Brightness (typical)	250 cd/m^2
Colour gamut (typical)	85%[3]
Colour depth	16.7 million colours
Contrast ratio (typical)	1000:1
Viewing angle (typical) (vertical/horizontal)	160°/ 170°
Response time (typical)	5 ms (black to white)
Panel technology	TN (active matrix –TFT LCD), Anti-glare
Backlight	LED
Connectivity	
Connectors	VGA, DisplayPort
Remote asset management	Yes, via Dell Display Manager
Design features	
Stand	Tilt only (Typical: 5° forward or 21° backward; Maximum: 5.5° forward or 22° backward)
VESA mounting support (wall mount kit sold separately)	VESA 100 mm x 100 mm via quick release
Security	Security lock slot and stand lock (security lock not included)
Power	
AC input voltage/frequency/current	100 to 240 VAC/50 or 60 Hz $\pm$ 3 Hz/1.5 A (typical)
Power consumption	11W (typical)
Power consumption standby/sleep mode	<0.5 W
Dimensions (with stand)	
Height	389.5 mm (15.33 inches)
Width	374.5 mm (14.74 inches)
Depth	165.0 mm (6.52 inches)
Weight	
Weight (panel only – no stand)	2.08 kg (4.85 lb)
Weight (with stand)	2.68 kg (5.90 lb)
Shipping weight	3.75 kg (8.24 lb)

Standard service plan	Environmental compliance
• 3 years Advanced Exchange Service[2] & Limited Hardware Warranty[1]	TCO Certified Displays, China Energy Label (CEL), CECP, RoHS

[1] For a copy of the Limited Hardware Warranty, write to Dell Products, Dell House, The Boulevard, Cain Road, Bracknell, Berkshire, RG12 1LF, UK or see dell.com/warranty.
[2] Advanced Exchange Service: Replacement part/unit dispatched, if needed, following completion of phone/online diagnosis. Fee charged for failure to return defective unit. Availability varies. Other conditions apply.
[3] Colour gamut (typical) is based on CIE1976 (85%) and CIE1931 (72%) test standards.
[4] Please check with your sales representative for availability of upgrade product.

Based on Ad #A14000002   dell.co.uk/monitors
Product availability varies by country. Please contact your Dell representative for more information.

๒) อุปกรณ์สำหรับจัดเก็บข้อมูลแบบภายนอก (External Storage):
สำหรับระบบฐานข้อมูลงานบริการประชาชน

Dell EMC MD1400 and MD1420

Dell EMC introduces the latest technology in the MD Series of direct-attach storage enclosures designed to maximize your server storage capacity. The MD1400 and the MD1420 offer low-cost storage expansion with double the bandwidth using 12Gbps SAS connectivity to support your growing application workloads.

Cost-effective storage

As data continues to grow, the need to store and access that data increases exponentially as well. The Dell EMC MD Series offers affordable storage expansion for Dell PowerEdge servers[1]. The MD1400 and MD1420 models are designed to scale capacity behind Dell's PowerEdge servers, without busting your storage budget. When cost is an issue, and you need to optimize your cost per terabyte, the MD Series offers a simple and cost-effective solution while ensuring your performance requirements are met.

The intelligence of the Dell PowerEdge RAID Controller (PERC) H830 or H840 HostRAID adapter, which enables the software to recognize all of your storage as a single unit, helps increase reliability and fault tolerance. You can place up to eight MD enclosures behind a PowerEdge server using a 12Gb SAS HBA or the PERC9 series with a 12Gb RAID controller. Directly connected to your PowerEdge server, either configuration gives you a viable storage solution, creating an end-to-end performance centric 12Gb solution.

Designed for capacity and performance

The MD Series offers the versatility needed to meet both your storage capacity and performance requirements. The MD1400 and MD1420 models are specifically designed to work with the latest PowerEdge servers using the PERC H830 or H840 RAID controllers with 12Gbps SAS offering unmatched I/O performance for database applications, streaming digital media environments and storage intensive applications.

Meet your high-capacity storage requirements with the MD Series by choosing the drive type and speed that meets

your data center specifications. The MD1400 and MD1420 models offer the flexibility to mix and match NL-SAS, SAS and SSD drives within an enclosure to assist with your data tiering initiatives. With the option of either 12 or 24 hard drives in an enclosure, you can scale non-disruptively to meet your application demands.

The MD1400 offers the flexibility of 3.5-inch or 2.5-inch hard drives (with specially designed carriers) in a 2U, 12-drive enclosure. This model can expand to 8 enclosures and up to 96 hard drives behind the PowerEdge server.

The MD1420 supports 24 2.5-inch hard drives in a 2U form-factor, expanding up to 8 enclosures and up to 192 hard drives supporting high storage capacity requirements.

Seamless integration and management

Leveraging the technology and design of PowerEdge servers, the MD1400 and the MD1420 use the same hot-swappable drives, fans and power supplies to minimize the cost of spares. If drive security is a priority, the option to use self-encrypted drives (SED) with drive-level encryption ensures your data is secure, even if the drive is removed. Additionally, SEDs support instant Secure Erase of drives which permanently removes data when repurposing or decommissioning drives.

Data can be managed simply through Dell OpenManage™ system management technology, leveraging iDRAC (Integrated Dell Remote Access Controller) to help simplify and automate your most essential management tasks across server, storage and networking platforms in multi-hypervisor and OS environments.

You can manage both the internal and external storage as a single interface, optimizing performance with the end-to-end 12Gbps connectivity. This helps reduce resource load on the system and enables easier navigation for the user.

When combined with Dell's storage- optimized PowerEdge servers and the new MD Series of expansion enclosures, you have an affordable direct-attached storage option in Microsoft environments.

Maximize your PowerEdge server capacity with the MD1400 and MD1420 storage expansion enclosures

Dell EMC MD1400 and MD1420 technical specifications

Feature	MD1400	MD1420
Drives	Up to 12 hot-pluggable 3.5" or 2.5" drives (2.5" available with adapter)	Up to 24 hot-pluggable 2.5" drives
Drive performance and capacities	3.5" and 2.5" NL-SAS, 2.5" SAS and 2.5" SSD drives	2.5" NL-SAS, SAS and SSD drives
Maximum capacity per enclosure	Up to 168TB when using 12 x 14TB NL-SAS 3.5" HDDs	Up to 57.6TB when using 24 x 2.4TB NL-SAS 2.5" HDDs
Expansion capabilities	PERC H830/H840 HBA enables expansion to 8 enclosures, PCIe 3.0, 12Gbps SAS, dual -port, 4 ports per enclosure	
Host connectivity		
Unified mode	Unified mode (single path) for daisy chaining of up to 8 enclosures per PERC H830/H840 (4 enclosures per port, single path) Unified mode (recommended redundant path) for daisy chaining up to 4 enclosures per PERC H830 (4 enclosures connected to both ports via redundant path cabling)	
Enclosure management modules (EMM) and RAID levels		
EMM	2 EMM provide redundant enclosure management capability	
RAID levels	0, 1, 5, 6, 10, 50, 60	
Back-panel connectors per EMM		
Connectivity	4 mini-SAS HD connector for connection to the host or expansion	
Service management	USB mini-B connector (for factory use only)	
Power supplies per PSU		
Wattage - AC and DC power	AC - 600W; DC - 700W	
Host heat dissipation	AC - 2047BTU/hr.; DC - 2388BTU/hr.	
Input voltage range	100-240V AC, auto-sensing; 48V DC	
Frequency range	50/60Hz	
Amperage	8.6A at 100V, 4.3A at 240V	
Available hard drive power (per slot)		
Supported continuous consumption	Up to 1.2A at +5V Up to 0.5A at +12V	
Physical		
Rack support	Dell ReadyRails™ II static rails for tool-less mounting in 4-post racks with square or unthreaded round holes or tooled mounting in 4-post threaded-hole racks	
Height x width x depth	8.7 cm (3.43") x 48.2 cm (18.98") x 54.61 (23.3") depth includes PSU	8.7 cm (3.43") x 48.2 cm (18.98") x 53.9 (21.22") depth includes PSU
Weight	28.59 kg (63.03 lb) (maximum configuration) 9.0 kg (19.8 lb) (empty)	24.2 kg (53.35 lb) (maximum configuration) 8.8 kg (19.4 lb) (empty)

Feature	MD1400	MD1420
Environmental		
Temperature	Operating: 10° to 35°C (50° to 95°F) with maximum temperature gradation of 10°C per hour Storage: -40° to 65°C (-40° to 149°F) with temperature gradation of 20°C per hour	
Relative humidity	Operating: 8% to 85% (non-condensing) with maximum humidity gradation of 10% per hour Storage: 5% to 95% (non-condensing)	
Altitude	Operating: -16 to 3048 m (-50 to 10,000 ft) Storage: -16 to 10,600 m (-50 to 35,000 ft)	

¹ See the compatibility matrix on Dell.com/Support for more information on supported PowerEdge servers.

Global services and support

Reduce IT complexity, lower costs and eliminate inefciencies by making IT and business solutions work harder for you. You can count on Dell for endto- end solutions to maximize your performance and uptime. A proven leader in Servers, Storage and Networking, Dell Enterprise Solutions and Services deliver innovation at any scale. And if you're looking to preserve cash or increase operational efciency, Dell Financial Services has a wide range of options to make technology acquisition easy and afordable. Contact your Dell Sales Representative for more information.

OEM-ready version available

From bezel to BIOS to packaging, your storage arrays can look and feel as if they were designed and built by you. For more information, visit Dell.com/OEM.

Maximize your TCO at Dell.com/Storage

DELLEMC

๓) เครื่องคอมพิวเตอร์ สำหรับงานประมวลผล แบบที่ ๒:
สำหรับเครื่องลูกข่ายระบบบริหารจัดการสถานการณ์
(Situation Management Workstation)

DELL

Unmatched performance & affordability in an expandable mini-tower.
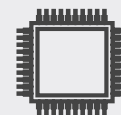
PRECISION 3630 TOWER

SPACE-SAVING DESIGN
New industrial design is 23% smaller than its predecessor with greater expandability to grow with your business needs without sacrificing power. A range of easy-to-reach ports keep you connected to everything you need while the optional Smart Card reader seamlessly keeps your IP secure.

PROFESSIONAL PERFORMANCE
Power through intensive tasks easily with 8th Generation Intel® Core™ and Xeon® processors and get real-time results with up to 64GB of faster 2666Mhz UDIMM memory.

LATEST TECHNOLOGY
Create VR content without limits thanks to Radeon™ Pro or NVIDIA® Quadro® professional-grade graphics with up to 225W of graphics supports. Scalable storage with SATA or PCIe NVMe SSD options up to 16TB deliver plenty of room for every project.

PEACE OF MIND
Dell Precision Optimizer Premium is the only AI-based performance optimizer software in the industry to automatically tune your workstation to run popular ISV applications at the fastest speeds possible. Independent Software Vendor (ISV) certified to ensure the high-performance applications you rely on every day run smoothly.

Recommended Accessories

PRECISION 3630 TOWER

DELL PREMIER WIRELESS KEYBOARD AND MOUSE | KM717

Enhance productivity and enjoy its elegant design that will fit into virtually any workspace. For increased productivity you can simultaneously pair up to two compatible devices with Bluetooth LE.

DELL ULTRASHARP 27 4K MONITOR | U2718Q

With the the world's first 27" 4K monitor with InfinityEdge you get stunning colors and details on a virtually borderless display made for multi-tasking.

PRECISION MINI-TOWER DUST FILTER

Custom built for your Precision, the external dust filter is easy to install and rinse clean while keeping your internal components clean and running smoothly.

DELL CANVAS

Bring your ideas to life with the groundbreaking new workspace tool that uses an intuitive touch screen, pen and totem to enable natural digital creation.

DELL 24 MONITOR | P2418D

See vividly clear visuals and get up to 18% more done with dual monitors by taking advantage of the 3 sided ultrathin bezel which is perfect for dual monitor setup.

PRECISION MINI-TOWER CABLE COVERS

Reduce clutter and provide secure cable management for your Precision with custom built cable covers.

WIRED MOUSE WITH FINGERPRINT READER

Enjoy secure authentication by just touching this mouse, that operates seamlessly with Microsoft's biometric sign-in features.

JABRA EVOLVE 75

With the ambient noise cancellation feature of this wireless headset you can hear every word clearly on your next call. This easy to carry device is certified for Microsoft Skype for Business.

3DCONNEXION SPACEMOUSE COMPACT

With its iconic, pure design, the SpaceMouse Compact is small enough to fit on every desk while the brushed steel base ensures the device stability for precise 3D navigation.

Built for business

SECURE

Only Dell provides innovative data security solutions that meet security challenges and business concerns head-on to protect your most critical and at-risk asset, your data. With Dell Data Security solutions, end users can work where and how they want knowing that data is protected.
- Dell Data Guardian protects data where ever it goes.
- Dell Endpoint Security Suite, powered by Cylance, stops up to 99% of malware.

MANAGEABLE

Part of the world's most manageable line of commercial PCs featuring the free Dell Client Command Suite toolkit for flexible and automated BIOS and system configurations. Optional vPro extensions allow for out-of-band systems management.

RELIABLE

Dell Reliable Memory Technology (RMT) Pro protects your work from potential crashes. In addition Dell commercial PCs have the lowest reported failure rate.

Features & Technical Specifications

Feature	Precision 3630 Tower Technical Specifications
Processor Options[1]	8th generation Intel Core i7 (Including I7-8700K Processor) and i5 and i3; Intel® Xeon® E Processors Intel Turbo Boost Technology and Intel Integrated HD Graphics on select Processors; optional vPro™ Technology (coming soon)
Operating System Options[2]	Windows® 10 Professional (64 bit) Windows® 10 Pro for Workstations (64 bit) w/ Intel Xeon processors Windows® 10 Home (64 bit) Red Hat® Enterprise Linux® 7.5 (coming soon) Ubuntu Linux 16.04 NeoKylin 6.0 SP3 (China only)
Chipset	Intel® C246 Chipset
Memory Options[3]	4 Dimm Slots; Up to 64GB 2666Mhz Non-ECC & ECC DDR4 Memory
Graphics Options[3]	One PCI Express® x16 Gen 3 Graphics card up to 225W (Total for Graphics) (Some cards available in Dual Config) **Mid-range 3D cards:** AMD Radeon Pro WX 7100 AMD Radeon Pro WX 5100 & Dual WX 5100 AMD Radeon Pro WX 4100 & Dual WX 4100 NVIDIA Quadro P4000 & Dual P4000 NVIDIA Quadro P5000 NVIDIA Quadro P2000 & Dual P2000 **Entry 3D cards:** AMD Radeon Pro WX 3100 & Dual WX 3100 AMD Radeon Pro WX 2100 & Dual WX 2100 NVIDIA Quadro P1000 & Dual P1000 NVIDIA Quadro P620 & Dual P620 NVIDIA Quadro P400 & Dual P400 **Professional 2D cards:** Intel HD Graphics 630 **Consumer Graphics:** AMD Radeon RX 580 NVIDIA GTX 1060 NVIDIA GTX 1080
Storage Options[4]	Support for up to (1) M.2 PCIe SSD on motherboard slot and Up to (3) 3.5" SATA or (4) 2.5" SATA. Support for Intel Ready Mode technology Support for up to (1) additional PCIe SSD on Dell Precision Ultra-Speed drive (x8) with active cooling **M.2 PCIe SSD (NVMe)** Up to (1) 2TB on M/B Up to (1) 2TB on Dell Precision Ultra-Speed drive **2.5" SATA SSD** Up to (4) 1TB **2.5" SATA 7200 RPM** Up to (4) 1TB 7200 RPM **3.5" SATA** Up to (3) 4TB 5400 RPM Up to (3) 2TB 7200 RPM **Self Encrypting Drives** 500GB 2.5" 7200 RPM 512GB M.2 NVMe SSD 512 GB 2.5" SSD
Storage Controller	**Integrated:** Intel Rapid Storage Controller 12.0 supporting SATA 6Gb/s and host based RAID 0/1/5/10
Communications	**Integrated:** Intel Ethernet Connection I219-LM 10/100/1000 **Optional:** Intel 10/100/1000 PCIe Gigabit Networking card Aquantia® AQtion™ AQN-108 5/2.5 GbE NIC Adapter **Optional:** Wireless / Bluetooth w / vPro support

Features & Technical Specifications

Feature	Precision 3630 Tower Technical Specifications
Audio Controller	Integrated Realtek ALC3861 High Definition Audio Codec (2 Channel)
Speakers	Internal Speaker; Optional Dell 2.0 stereo speaker systems available and Dell sound bar for select flat-panel displays
Add-in cards	Support for up to (1) additional PCIe SSD on Dell Precision Ultra-Speed drive (x8) with active cooling **Optional:** Thunderbolt 3 PCIe Card Serial and Parallel Port PCIe Card (Full Height) USB Type-C 3.1 Gen 2 PCIe Card (Full Height) Powered USB 3.1 PCIe Card Remote Access Host Card, Tera2 Smart Card Reader (CAC/PIV)
I/O Ports	**Front** 2 - USB 2.0 Type A 1 - USB 3.1 Type A (5Gb) 1 - USB 3.1 Type C (10Gb), data only 1 - Microphone 1 - Headphone **Internal** 1 – USB 3.0 4 – SATA 6Gb/s **Rear** 2 - USB 2.0 Type A (with SmartPower) 4 - USB 3.1 Type A (5Gb) 2 - PS2 2 - DisplayPort 1 - Optional Port (VGA, HDMI 2.0, DP++ 1.2, Type C w/DP-Alt mode) 1 - RJ45 Network Connector 1 - Serial 1 - Audio Line out
Chassis	**HxWxD:** 13.19" x 6.95" x 13.58" (33.5cm x 17.7cm x 34.5cm), Min weight: 9.358Kg **Bays:** (3) internal 3.5" bays - supports (3) 3.5" or (4) 2.5" drives **Slots:** (1) Full Height PCIe x16 Gen3; (2) Full Height PCIe x4 Gen3 (open ended); (1) Full Height PCI; (1) M.2 (22x80 mm) **Power Supply:** 460W 90% efficient PSU (80PLUS Gold Certified Certified) Energy Star compliant; 300W 85% efficient PSU (80PLUS Bronze Certified) Energy Star Compliant
Storage devices	Optional: 1 optical drive: DVD-ROM; DVD+/-RW, Blu Ray Writer (Note: optical drive not available with Smart Card Reader (CAC/PIV)) SD Card Reader
Security Options[5]	Trusted Platform Module TPM 2.0, Dell Data Guardian, Dell Endpoint Security Suite Enterprise, Dell HW Crypto Accelerator, Microsoft Windows Bitlocker, Local HDD data wipe via BIOS ("Secure Erase"), Encryption - SED HDD (Opal FIPS), Chassis lock slot support, Chassis Intrusion Switch, D-Pedigree (Secure Supply Chain Functionality), Setup/BIOS Password, Optional Smart Card keyboards, Intel® Trusted Execution Technology, Intel® Identity Protection Technology, Dell Secure Works, BIOS support optional Computrace, Intel Software Guard extensions
Systems Management[6]	Dell Client Command Suite; via vPro (coming soon)
Regulatory & Environmental	ENERGY STAR® configurations available including 80 PLUS® Bronze and Gold power supplies (Bronze not available in the Americas); EPEAT® registered (see epeat.net for specific registration rating/status by country); China CECP; GS Mark. For a complete listing of declarations & certifications, see Dell's regulatory & compliance homepage at dell.com/regulatory_compliance
Warranty & Support Services[7]	3-Year Limited Hardware Warranty and 3-year NBD On-Site Service after Remote Diagnosis Optional: Dell ProSupport is designed to rapidly respond to your business's needs, help protect your investment and sensitive data and provide enhanced proactive support services to help reduce risk and complexity within your IT environment

Unmatched performance & affordability in an expandable mini-tower.

PRECISION 3630 TOWER

Transform how you work.

DELL 22 MONITOR | P2219H

OPTIMIZE YOUR WORKSPACE

Free up valuable desk space with this 21.5" FHD monitor featuring a small footprint and thin panel profile. Easily hide away cable clutter with the improved cable management design.

MAXIMIZE PRODUCTIVITY

The 3-sided ultrathin bezel delivers a seamless view across multiple monitors, while Easy Arrange in Dell Display Manager software helps you stay organized when multitasking.
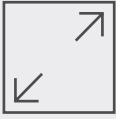
WORK COMFORTABLY

Pivot, tilt, swivel and adjust the height of your monitor to your exact preference. Stay focused longer with a flicker-free screen and ComfortView that optimize eye comfort.

TRUSTED RELIABILITY

Dell monitors — World's number 1 monitor brand[1] Enjoy peace of mind with Dell Premium Panel Exchange, 3 year Advanced Exchange Service[2] and optional ProSupport.[3]
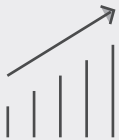
Maximize productivity

OPTIMIZED WORKSPACE

More room to work: Free up valuable desk space with a thin monitor profile and a small monitor base that's approximately 22% smaller than its predecessor.[4]

Clutter-free: Focus on your work while hiding away cable clutter with an improved cable management design.

Consistent and rich colors: A wide viewing angle enabled by In-Plane Switching technology lets you see vibrant colors—no matter where you sit.

MAXIMIZE PRODUCTIVITY

Expand your efficiency: The three-sided ultrathin bezel design lets you enjoy an uninterrupted view of your content across multiple monitors. And, with dual monitors, you can increase your productivity by up to 18%.[5]

More ways to multitask: Work conveniently across multiple screens and select from predefined templates with the Easy Arrange feature on Dell Display Manager software. Quickly tile and arrange your applications and get back to work faster with Auto-restore, a feature that remembers where you left off.

WORK COMFORTABLY

Adjust to your comfort: Pivot, tilt, swivel and adjust the height of your monitor for a comfortable setup all day long. Or choose from a variety of mounts and stands, including VESA, for even more flexibility.

Easy on the eyes: This TÜV[6] Certified monitor has a flicker-free screen with ComfortView, a feature that reduces harmful blue light emissions. It's designed to optimize eye comfort even over extended viewing.

TRUSTED RELIABILITY

DELL MONITORS – WORLD'S NUMBER 1 MONITOR BRAND[1]

Peace of mind: Dell Premium Panel Exchange allows a free panel replacement during the Limited Hardware Warranty[7] period even if only one bright pixel is found.

Minimize downtime: Your monitor comes with a 3-year Advanced Exchange Service[2] so that if a replacement becomes necessary, it will be shipped to you the next business day during your 3-year Limited Hardware Warranty.[7]

Get a higher level of support: Upgrade to 24x7, in-region technical phone support from qualified engineers with Dell ProSupport option.[3]

Features & Technical Specifications

Monitor	Dell 22 Monitor - P2219H
Diagonal Viewing Size	54.61 cm (21.5 inches)
Active Display Area	
Height	476.06 mm (18.74")
Width	267.79 mm (10.54")
Maximum Preset Resolution	1920 x 1080 at 60 Hz
Aspect Ratio	16:9
Pixel Pitch	0.248 mm x 0.248 mm
Pixel Per Inch (PPI)	102
Brightness	250 cd/m² (typical)
Color Support	Color Gamut (typical): 72% (CIE1931)[8]
	Color Depth: 16.7 Million colors
Contrast Ratio	1000: 1 (typical)
Viewing Angle	178°/178°
Response Time	8 ms (Normal); 5 ms (Fast) - (gray to gray)
Panel Type	In-Plane Switching Technology
Backlight Technology	LED Edgelight System
ComfortView with Flicker-free screen	Yes
Dell Display Manager Compatibility	Yes
Remote Asset Management	Yes, via Dell Command | Monitor
Display Screen Coating	Antiglare with 3H hardness

Connectivity

Connectors	1 x DisplayPort version 1.2, 1 x HDMI port version 1.4, 1 x VGA port, 1 x USB 3.0 upstream port (bottom), 2 x USB 3.0 downstream ports (side), 2 x USB 2.0 downstream ports (bottom)
Built-in Devices	USB 3.0 super-speed hub (with 1 x USB 3.0 upstream port), 2 x USB 3.0 downstream ports, 2 x USB 2.0 downstream ports

Design Features

Adjustability	Height-adjustable stand (130 mm), Tilt (-5° to 21°)
	Swivel (-45° to 45°), Pivot (-90° to 90°)
Security	Security lock slot (cable lock sold separately)
Flat Panel Mount Interface	VESA (100 mm x 100 mm)

Power

AC input voltage/frequency/current	100 VAC to 240 VAC / 50 Hz or 60 Hz ± 3 Hz / 1.5 A (typical)
Power Consumption (Operational)	17W (typical) / 37W (maximum)[9]
Power Consumption Stand by / Sleep	Less than 0.3W

Dimensions (with stand)

Height (Compressed ~ Extended)	353.4 mm ~ 472.0 mm; 13.91" ~ 18.58"
Width	487.3 mm (19.19")
Depth	166.0 mm (6.54")

Weight

Weight (panel only - for VESA mount)	2.75 kg (6.06 lb)
Weight (with stand)	4.72 kg (10.41 lb)
Weight (with packaging)	6.26 kg (13.80 lb)

Standard Service Plan	Premium Panel Exchange, 3 Years Advanced Exchange Service[2] & Limited Hardware Warranty[7]
Optional Service Plan	Dell ProSupport[3]
Environmental Compliance	ENERGY STAR®, EPEAT® Gold[10], RoHS Compliant, TCO-Certified Display, BFR/PVC free monitor (excluding external cables), Arsenic-Free glass and Mercury-Free for the panel only

What's in the box?

Components
- Monitor with stand

Cables
- DisplayPort cable
- USB 3.0 upstream cable
- Power cable

Documentation
- Quick Setup Guide
- Safety and regulatory information

Adjustability and connectivity

DELL 22 MONITOR | P2219H

Easily adjust the panel to your preferred viewing position.

21° / 5°
130 mm
90° 90°
45° 45°

Back view -
Cable management slot

Tilt and height adjustable

Pivot

Swivel

Connectivity

H

A Power connector
B HDMI port
C Stand lock feature
D DisplayPort

E VGA connector
F USB upstream port
G USB downstream ports (x2)
H USB downstream ports (x2)

RECOMMENDED ACCESSORIES

DELL DUAL MONITOR STAND | MDS19

Enjoy toolless monitor installation with Quick Release and the flexibility to pivot, tilt, swivel and adjust the height of each monitor independently. Features a small footprint and neat cable management.

DELL PRO STEREO SOUNDBAR | AE515M

Optimize conference calls and multimedia streaming with exceptional audio clarity. Minimize background noise with the dual mic array and echo-cancelling feature.

DELL WIRELESS KEYBOARD AND MOUSE | KM636

Elevated and spacious chiclet keys with muted typing sound. Pair up to 6 devices with Dell Universal Pairing.

๔)	จอแสดงภาพขนาด ๒๑.๕ นิ้ว
สำหรับเครื่องลูกข่ายระบบบริหารจัดการสถานการณ์

![Dell logo]

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130 mm

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Cable management slot

Tilt and height adjustable

Pivot

Swivel

Connectivity

A Power connector	**E** VGA connector
B HDMI port	**F** USB upstream port
C Stand lock feature	**G** USB downstream ports (x2)
D DisplayPort	**H** USB downstream ports (x2)

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๕) เครื่องคอมพิวเตอร์ สำหรับงานประมวลผล แบบที่ ๒:
สำหรับเครื่องลูกข่ายระบบบริหารจัดการระบบงาน
(Admin Workstation)

Unmatched performance & affordability in an expandable mini-tower.

PRECISION 3630 TOWER

SPACE-SAVING DESIGN

New industrial design is 23% smaller than its predecessor with greater expandability to grow with your business needs without sacrificing power. A range of easy-to-reach ports keep you connected to everything you need while the optional Smart Card reader seamlessly keeps your IP secure.

PROFESSIONAL PERFORMANCE

Power through intensive tasks easily with 8th Generation Intel® Core™ and Xeon® processors and get real-time results with up to 64GB of faster 2666Mhz UDIMM memory.

LATEST TECHNOLOGY

Create VR content without limits thanks to Radeon™ Pro or NVIDIA® Quadro® professional-grade graphics with up to 225W of graphics supports. Scalable storage with SATA or PCIe NVMe SSD options up to 16TB deliver plenty of room for every project.

PEACE OF MIND

Dell Precision Optimizer Premium is the only AI-based performance optimizer software in the industry to automatically tune your workstation to run popular ISV applications at the fastest speeds possible. Independent Software Vendor (ISV) certified to ensure the high-performance applications you rely on every day run smoothly.

Recommended Accessories

PRECISION 3630 TOWER

DELL PREMIER WIRELESS KEYBOARD AND MOUSE | KM717

Enhance productivity and enjoy its elegant design that will fit into virtually any workspace. For increased productivity you can simultaneously pair up to two compatible devices with Bluetooth LE.

DELL ULTRASHARP 27 4K MONITOR | U2718Q

With the the world's first 27" 4K monitor with InfinityEdge you get stunning colors and details on a virtually borderless display made for multi-tasking.

PRECISION MINI-TOWER DUST FILTER

Custom built for your Precision, the external dust filter is easy to install and rinse clean while keeping your internal components clean and running smoothly.

DELL CANVAS

Bring your ideas to life with the groundbreaking new workspace tool that uses an intuitive touch screen, pen and totem to enable natural digital creation.

DELL 24 MONITOR | P2418D

See vividly clear visuals and get up to 18% more done with dual monitors by taking advantage of the 3 sided ultrathin bezel which is perfect for dual monitor setup.

PRECISION MINI-TOWER CABLE COVERS

Reduce clutter and provide secure cable management for your Precision with custom built cable covers.

WIRED MOUSE WITH FINGERPRINT READER

Enjoy secure authentication by just touching this mouse, that operates seamlessly with Microsoft's biometric sign-in features.

JABRA EVOLVE 75

With the ambient noise cancellation feature of this wireless headset you can hear every word clearly on your next call. This easy to carry device is certified for Microsoft Skype for Business.

3DCONNEXION SPACEMOUSE COMPACT

With its iconic, pure design, the SpaceMouse Compact is small enough to fit on every desk while the brushed steel base ensures the device stability for precise 3D navigation.

Built for business

SECURE

Only Dell provides innovative data security solutions that meet security challenges and business concerns head-on to protect your most critical and at-risk asset, your data. With Dell Data Security solutions, end users can work where and how they want knowing that data is protected.
- Dell Data Guardian protects data where ever it goes.
- Dell Endpoint Security Suite, powered by Cylance, stops up to 99% of malware.

MANAGEABLE

Part of the world's most manageable line of commercial PCs featuring the free Dell Client Command Suite toolkit for flexible and automated BIOS and system configurations. Optional vPro extensions allow for out-of-band systems management.

RELIABLE

Dell Reliable Memory Technology (RMT) Pro protects your work from potential crashes. In addition Dell commercial PCs have the lowest reported failure rate.

Features & Technical Specifications

Feature	Precision 3630 Tower Technical Specifications
Processor Options[1]	8th generation Intel Core i7 (Including I7-8700K Processor) and i5 and i3; Intel® Xeon® E Processors Intel Turbo Boost Technology and Intel Integrated HD Graphics on select Processors; optional vPro™ Technology (coming soon)
Operating System Options[2]	Windows® 10 Professional (64 bit) Windows® 10 Pro for Workstations (64 bit) w/ Intel Xeon processors Windows® 10 Home (64 bit) Red Hat® Enterprise Linux® 7.5 (coming soon) Ubuntu Linux 16.04 NeoKylin 6.0 SP3 (China only)
Chipset	Intel® C246 Chipset
Memory Options[3]	4 Dimm Slots; Up to 64GB 2666Mhz Non-ECC & ECC DDR4 Memory
Graphics Options[3]	One PCI Express® x16 Gen 3 Graphics card up to 225W (Total for Graphics) (Some cards available in Dual Config) **Mid-range 3D cards:** AMD Radeon Pro WX 7100 AMD Radeon Pro WX 5100 & Dual WX 5100 AMD Radeon Pro WX 4100 & Dual WX 4100 NVIDIA Quadro P4000 & Dual P4000 NVIDIA Quadro P5000 NVIDIA Quadro P2000 & Dual P2000 **Entry 3D cards:** AMD Radeon Pro WX 3100 & Dual WX 3100 AMD Radeon Pro WX 2100 & Dual WX 2100 NVIDIA Quadro P1000 & Dual P1000 NVIDIA Quadro P620 & Dual P620 NVIDIA Quadro P400 & Dual P400 **Professional 2D cards:** Intel HD Graphics 630 **Consumer Graphics:** AMD Radeon RX 580 NVIDIA GTX 1060 NVIDIA GTX 1080
Storage Options[4]	Support for up to (1) M.2 PCIe SSD on motherboard slot and Up to (3) 3.5" SATA or (4) 2.5" SATA. Support for Intel Ready Mode technology Support for up to (1) additional PCIe SSD on Dell Precision Ultra-Speed drive (x8) with active cooling **M.2 PCIe SSD (NVMe)** Up to (1) 2TB on M/B Up to (1) 2TB on Dell Precision Ultra-Speed drive **2.5" SATA SSD** Up to (4) 1TB **2.5" SATA 7200 RPM** Up to (4) 1TB 7200 RPM **3.5" SATA** Up to (3) 4TB 5400 RPM Up to (3) 2TB 7200 RPM **Self Encrypting Drives** 500GB 2.5" 7200 RPM 512GB M.2 NVMe SSD 512 GB 2.5" SSD
Storage Controller	**Integrated:** Intel Rapid Storage Controller 12.0 supporting SATA 6Gb/s and host based RAID 0/1/5/10
Communications	**Integrated:** Intel Ethernet Connection I219-LM 10/100/1000 **Optional:** Intel 10/100/1000 PCIe Gigabit Networking card Aquantia® AQtion™ AQN-108 5/2.5 GbE NIC Adapter **Optional:** Wireless / Bluetooth w / vPro support

Features & Technical Specifications

Feature	Precision 3630 Tower Technical Specifications
Audio Controller	Integrated Realtek ALC3861 High Definition Audio Codec (2 Channel)
Speakers	Internal Speaker; Optional Dell 2.0 stereo speaker systems available and Dell sound bar for select flat-panel displays
Add-in cards	Support for up to (1) additional PCIe SSD on Dell Precision Ultra-Speed drive (x8) with active cooling **Optional:** Thunderbolt 3 PCIe Card Serial and Parallel Port PCIe Card (Full Height) USB Type-C 3.1 Gen 2 PCIe Card (Full Height) Powered USB 3.1 PCIe Card Remote Access Host Card, Tera2 Smart Card Reader (CAC/PIV)
I/O Ports	**Front** 2 - USB 2.0 Type A 1 - USB 3.1 Type A (5Gb) 1 - USB 3.1 Type C (10Gb), data only 1 - Microphone 1 - Headphone **Internal** 1 – USB 3.0 4 – SATA 6Gb/s **Rear** 2 - USB 2.0 Type A (with SmartPower) 4 - USB 3.1 Type A (5Gb) 2 - PS2 2 - DisplayPort 1 - Optional Port (VGA, HDMI 2.0, DP++ 1.2, Type C w/DP-Alt mode) 1 - RJ45 Network Connector 1 - Serial 1 - Audio Line out
Chassis	**HxWxD:** 13.19" x 6.95" x 13.58" (33.5cm x 17.7cm x 34.5cm), Min weight: 9.358Kg **Bays:** (3) internal 3.5" bays - supports (3) 3.5" or (4) 2.5" drives **Slots:** (1) Full Height PCIe x16 Gen3; (2) Full Height PCIe x4 Gen3 (open ended); (1) Full Height PCI; (1) M.2 (22x80 mm) **Power Supply:** 460W 90% efficient PSU (80PLUS Gold Certified Certified) Energy Star compliant; 300W 85% efficient PSU (80PLUS Bronze Certified) Energy Star Compliant
Storage devices	Optional: 1 optical drive: DVD-ROM; DVD+/-RW, Blu Ray Writer (Note: optical drive not available with Smart Card Reader (CAC/PIV)) SD Card Reader
Security Options[5]	Trusted Platform Module TPM 2.0, Dell Data Guardian, Dell Endpoint Security Suite Enterprise, Dell HW Crypto Accelerator, Microsoft Windows Bitlocker, Local HDD data wipe via BIOS ("Secure Erase"), Encryption - SED HDD (Opal FIPS), Chassis lock slot support, Chassis Intrusion Switch, D-Pedigree (Secure Supply Chain Functionality), Setup/BIOS Password, Optional Smart Card keyboards, Intel® Trusted Execution Technology, Intel® Identity Protection Technology, Dell Secure Works, BIOS support optional Computrace, Intel Software Guard extensions
Systems Management[6]	Dell Client Command Suite; via vPro (coming soon)
Regulatory & Environmental	ENERGY STAR® configurations available including 80 PLUS® Bronze and Gold power supplies (Bronze not available in the Americas); EPEAT® registered (see epeat.net for specific registration rating/status by country); China CECP; GS Mark. For a complete listing of declarations & certifications, see Dell's regulatory & compliance homepage at dell.com/regulatory_compliance
Warranty & Support Services[7]	3-Year Limited Hardware Warranty and 3-year NBD On-Site Service after Remote Diagnosis Optional: Dell ProSupport is designed to rapidly respond to your business's needs, help protect your investment and sensitive data and provide enhanced proactive support services to help reduce risk and complexity within your IT environment

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90° 90°

45° / 45°

Back view -
Cable management slot

Tilt and height adjustable

Pivot

Swivel

Connectivity

H

A Power connector
B HDMI port
C Stand lock feature
D DisplayPort

E VGA connector
F USB upstream port
G USB downstream ports (x2)
H USB downstream ports (x2)

RECOMMENDED ACCESSORIES

DELL DUAL MONITOR STAND | MDS19

Enjoy toolless monitor installation with Quick Release and the flexibility to pivot, tilt, swivel and adjust the height of each monitor independently. Features a small footprint and neat cable management.

DELL PRO STEREO SOUNDBAR | AE515M

Optimize conference calls and multimedia streaming with exceptional audio clarity. Minimize background noise with the dual mic array and echo-cancelling feature.

DELL WIRELESS KEYBOARD AND MOUSE | KM636

Elevated and spacious chiclet keys with muted typing sound. Pair up to 6 devices with Dell Universal Pairing.

v.2 06/2018

๖) จอแสดงภาพขนาด ๑๙ นิ้ว
สำหรับเครื่องลูกข่ายระบบบริหารจัดการระบบงาน

DELL 20 MONITOR – E2020H

Elevate your everyday display.

ALL THE ESSENTIALS

Enhance your everyday workspace with a 1600 x 900 resolution monitor with improved cable management and a smaller footprint.

DELL DISPLAY MANAGER

Superior productivity and manageability featuring quick access keys, preset layouts, multi-monitor configuration and remote management for IT managers.

ECO-CONSCIOUS INSIDE AND OUT

A comprehensive ENERGY STAR®[1] certified monitor that meets stringent, energy efficient requirements.

TRUSTED RELIABILITY

As the world's #1 monitor company*, we take pride in our unyielding commitment to quality and the utmost satisfaction of our customers.

Reliable, eco-friendly monitors at a great value

ALL THE ESSENTIALS

Screen performance: The 1600 X 900 HD+ resolution is ideal for routine tasks, while ComfortView is ready for extended screen periods reducing up to 60% of harmful light emissions.[2]

Enhance your workspace: A thinner profile than the previous generation and improved cable management create a smaller footprint, lending itself to a clean, uncluttered desk.

Plug in: Quickly connect legacy or non-legacy PCs with VGA and DP ports.

Adapts to your needs: Make your workspace your own with VESA-compatible mounts and stands.

ECO-CONSCIOUS INSIDE AND OUT

Guaranteed green: With a comprehensive ENERGY STAR®[1] certified portfolio, E series monitors meet stringent, energy requirements while in sleep, on and off modes. These monitors are also EPEAT registered, TCO-certified and meets all regulatory and environmental standards.

Reduce energy: Save energy with PowerNap[3], a feature that dims or puts the monitor to sleep when not in use.

Clean disposal: Composting or recycling the packaging is easy since it's made with at least 75% recycled cardboard with zero Styrofoam packaging.[4]

DELL DISPLAY MANAGER

Productive at every level: Dell Display Manager's (DDM) Easy Arrange feature lets you quickly tile and view your applications side by side across one or more connected screens for multi-tasking efficiency.

Seamless transitions: The Auto-Restore feature remembers where you left off, so applications will go back to where you left them — even after you've unplugged.

The key to convenience: Shortcut keys can save you time, allowing quick access to commonly used controls that let you work faster.

More ways to manage: Asset management reports allow IT managers to quickly capture and track monitor information as well as configure multiple displays at once through a single setup.

THANK YOU FOR MAKING DELL MONITORS #1 WORLDWIDE**

Uncompromised testing: Rigorous development processes help ensure consistent, reliable performance in busy office environments.

Minimize downtime: Your monitor comes with a 3-year Advanced Exchange Service[5] so that if a replacement becomes necessary, it will be shipped to you the next business day during your 3-year Limited Hardware Warranty.[6]

Get a higher level of support: Upgrade to 24 X 7, in-region technical phone support from qualified engineers with Dell ProSupport option.[7]

Features & Technical Specifications

Monitor

	Dell 20 Monitor – E2020H
Diagonal Viewing Size	49.53 cm (19.5 inches)
Horizontal	432.96 ± 0.96 mm (17.05 inches)
Vertical	238.05 ± 1.71 mm (9.37 inches)
Maximum Preset Resolution	1600 x 900 at 60 Hz
Aspect Ratio	16:9
Pixel Pitch	0.27 mm x 0.27 mm
Pixel Per Inch (PPI)	94
Brightness	250 cd/m² (typical)
Color Support	Color gamut (typical): 83% (CIE1976) 72% (CIE1931)
	Color depth: 16.7 Million
Contrast Ratio	1000:1 (typical)
Viewing Angle	160°/170°
Response Time	5 ms typical (Normal) (gray to gray)
Panel Type	TN (Twisted Nematic)
Display Screen Coating	Anti-Glare
Backlight Technology	LED
ComfortView with Flicker-free screen	Yes
Dell Display Manager Compatibility	Yes
Remote Asset Management	Yes, via Dell Command I Monitor
GSA/TAA	No
Optional Soundbar	Dell Stereo Soundbar – AC511M

Connectivity

Connectors	1 x VGA
	1 x DisplayPort 1.2
HDCP Support	DisplayPort HDCP 1.2

Design Features

Adjustability	Tilt Only (-5° to 21°)
Security	Security lock slot (cable lock sold separately)
Flat Panel Mount Interface	VESA (100 mm)

Power

AC input voltage/frequency/current	100 VAC to 240 VAC / 50 Hz or 60 Hz ± 3 Hz / 0.7 A (typical)
Power Consumption (Operational)	11W (Typ). 14W (Max). 9.37W (ENERGY STAR®)
Power Consumption Stand by/Sleep	Less than 0.3W

Dimensions (with stand)

Height	368.96 mm (14.53 inches)
Width	471.52 mm (18.56 inches)
Depth	171.0 mm (6.73 inches)

Weight

Weight (panel only - for VESA mount/ no cables)	2.20 kg (4.85 lbs)
Weight (monitor and cables with stand)	2.94 kg (6.48 lbs)
Weight (with packaging)	3.94 kg (8.68 lbs)

Standard Service Plan

3-Years Advanced Exchange Service[5] and Limited Hardware Warranty[6]

Optional Service Plan

Dell ProSupport[7]

Environmental Compliance

ENERGY STAR®, EPEAT® registered where applicable[8], TCO Certified Display

What's in the box?

Components
- Monitor with stand

Cables
- Power cable
- 1 x DP Cable (DP to DP)
- 1 x VGA Cable (EMEA and Japan only)
- 1 x VESA screw cover

Documentation
- Quick Setup Guide
- Safety and Regulatory Information

Recommended Accessories

DELL 20 MONITOR – E2020H

Easily adjust the panel to your preferred viewing position.

Back view -
Cable management slot

21º   5º

Tilt

Connectivity

1 Power connector
2 DisplayPort 1.2
3 VGA Port

RECOMMENDED ACCESSORIES

DELL SINGLE MONITOR ARM I MSA20

For greater viewing flexibility and a smaller footprint, choose the Dell Single Monitor Arm. Set up is virtually tool-free and its advanced cable management features offer a neat and clutter-free desk.

DELL STEREO SOUNDBAR | AC511M

The Dell Stereo Soundbar AC511M offers clear stereo sound, allowing you to enjoy audio on your favorite games, music and movies, without sacrificing desk space.

DELL WIRELESS KEYBOARD AND MOUSE | KM636

Designed with sleek lines, a compact size and chiclet keys, the Dell Wireless Keyboard and Mouse KM636 offers a contemporary and comfortable design with the convenience of wireless performance.

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๗) เครื่องคอมพิวเตอร์ สำหรับงานประมวลผล แบบที่ ๒:
สำหรับเครื่องลูกข่ายระบบการให้บริการข้อมูล
(Client Workstation)

Unmatched performance & affordability in an expandable mini-tower.

PRECISION 3630 TOWER

SPACE-SAVING DESIGN

New industrial design is 23% smaller than its predecessor with greater expandability to grow with your business needs without sacrificing power. A range of easy-to-reach ports keep you connected to everything you need while the optional Smart Card reader seamlessly keeps your IP secure.

PROFESSIONAL PERFORMANCE

Power through intensive tasks easily with 8th Generation Intel® Core™ and Xeon® processors and get real-time results with up to 64GB of faster 2666Mhz UDIMM memory.

LATEST TECHNOLOGY

Create VR content without limits thanks to Radeon™ Pro or NVIDIA® Quadro® professional-grade graphics with up to 225W of graphics supports. Scalable storage with SATA or PCIe NVMe SSD options up to 16TB deliver plenty of room for every project.

PEACE OF MIND

Dell Precision Optimizer Premium is the only AI-based performance optimizer software in the industry to automatically tune your workstation to run popular ISV applications at the fastest speeds possible. Independent Software Vendor (ISV) certified to ensure the high-performance applications you rely on every day run smoothly.

Recommended Accessories

PRECISION 3630 TOWER

DELL PREMIER WIRELESS KEYBOARD AND MOUSE | KM717

Enhance productivity and enjoy its elegant design that will fit into virtually any workspace. For increased productivity you can simultaneously pair up to two compatible devices with Bluetooth LE.

DELL ULTRASHARP 27 4K MONITOR | U2718Q

With the the world's first 27" 4K monitor with InfinityEdge you get stunning colors and details on a virtually borderless display made for multi-tasking.

PRECISION MINI-TOWER DUST FILTER

Custom built for your Precision, the external dust filter is easy to install and rinse clean while keeping your internal components clean and running smoothly.

DELL CANVAS

Bring your ideas to life with the groundbreaking new workspace tool that uses an intuitive touch screen, pen and totem to enable natural digital creation.

DELL 24 MONITOR | P2418D

See vividly clear visuals and get up to 18% more done with dual monitors by taking advantage of the 3 sided ultrathin bezel which is perfect for dual monitor setup.

PRECISION MINI-TOWER CABLE COVERS

Reduce clutter and provide secure cable management for your Precision with custom built cable covers.

WIRED MOUSE WITH FINGERPRINT READER

Enjoy secure authentication by just touching this mouse, that operates seamlessly with Microsoft's biometric sign-in features.

JABRA EVOLVE 75

With the ambient noise cancellation feature of this wireless headset you can hear every word clearly on your next call. This easy to carry device is certified for Microsoft Skype for Business.

3DCONNEXION SPACEMOUSE COMPACT

With its iconic, pure design, the SpaceMouse Compact is small enough to fit on every desk while the brushed steel base ensures the device stability for precise 3D navigation.

Built for business

SECURE

Only Dell provides innovative data security solutions that meet security challenges and business concerns head-on to protect your most critical and at-risk asset, your data. With Dell Data Security solutions, end users can work where and how they want knowing that data is protected.
- Dell Data Guardian protects data where ever it goes.
- Dell Endpoint Security Suite, powered by Cylance, stops up to 99% of malware.

MANAGEABLE

Part of the world's most manageable line of commercial PCs featuring the free Dell Client Command Suite toolkit for flexible and automated BIOS and system configurations. Optional vPro extensions allow for out-of-band systems management.

RELIABLE

Dell Reliable Memory Technology (RMT) Pro protects your work from potential crashes. In addition Dell commercial PCs have the lowest reported failure rate.

Features & Technical Specifications

Feature	Precision 3630 Tower Technical Specifications
Processor Options[1]	8th generation Intel Core i7 (Including I7-8700K Processor) and i5 and i3; Intel® Xeon® E Processors Intel Turbo Boost Technology and Intel Integrated HD Graphics on select Processors; optional vPro™ Technology (coming soon)
Operating System Options[2]	Windows® 10 Professional (64 bit) Windows® 10 Pro for Workstations (64 bit) w/ Intel Xeon processors Windows® 10 Home (64 bit) Red Hat® Enterprise Linux® 7.5 (coming soon) Ubuntu Linux 16.04 NeoKylin 6.0 SP3 (China only)
Chipset	Intel® C246 Chipset
Memory Options[3]	4 Dimm Slots; Up to 64GB 2666Mhz Non-ECC & ECC DDR4 Memory
Graphics Options[3]	One PCI Express® x16 Gen 3 Graphics card up to 225W (Total for Graphics) (Some cards available in Dual Config) **Mid-range 3D cards:** AMD Radeon Pro WX 7100 AMD Radeon Pro WX 5100 & Dual WX 5100 AMD Radeon Pro WX 4100 & Dual WX 4100 NVIDIA Quadro P4000 & Dual P4000 NVIDIA Quadro P5000 NVIDIA Quadro P2000 & Dual P2000 **Entry 3D cards:** AMD Radeon Pro WX 3100 & Dual WX 3100 AMD Radeon Pro WX 2100 & Dual WX 2100 NVIDIA Quadro P1000 & Dual P1000 NVIDIA Quadro P620 & Dual P620 NVIDIA Quadro P400 & Dual P400 **Professional 2D cards:** Intel HD Graphics 630 **Consumer Graphics:** AMD Radeon RX 580 NVIDIA GTX 1060 NVIDIA GTX 1080
Storage Options[4]	Support for up to (1) M.2 PCIe SSD on motherboard slot and Up to (3) 3.5" SATA or (4) 2.5" SATA. Support for Intel Ready Mode technology Support for up to (1) additional PCIe SSD on Dell Precision Ultra-Speed drive (x8) with active cooling **M.2 PCIe SSD (NVMe)** Up to (1) 2TB on M/B Up to (1) 2TB on Dell Precision Ultra-Speed drive **2.5" SATA SSD** Up to (4) 1TB **2.5" SATA 7200 RPM** Up to (4) 1TB 7200 RPM **3.5" SATA** Up to (3) 4TB 5400 RPM Up to (3) 2TB 7200 RPM **Self Encrypting Drives** 500GB 2.5" 7200 RPM 512GB M.2 NVMe SSD 512 GB 2.5" SSD
Storage Controller	**Integrated:** Intel Rapid Storage Controller 12.0 supporting SATA 6Gb/s and host based RAID 0/1/5/10
Communications	**Integrated:** Intel Ethernet Connection I219-LM 10/100/1000 **Optional:** Intel 10/100/1000 PCIe Gigabit Networking card Aquantia® AQtion™ AQN-108 5/2.5 GbE NIC Adapter **Optional:** Wireless / Bluetooth w / vPro support

Features & Technical Specifications

Feature	Precision 3630 Tower Technical Specifications
Audio Controller	Integrated Realtek ALC3861 High Definition Audio Codec (2 Channel)
Speakers	Internal Speaker; Optional Dell 2.0 stereo speaker systems available and Dell sound bar for select flat-panel displays
Add-in cards	Support for up to (1) additional PCIe SSD on Dell Precision Ultra-Speed drive (x8) with active cooling **Optional:** Thunderbolt 3 PCIe Card Serial and Parallel Port PCIe Card (Full Height) USB Type-C 3.1 Gen 2 PCIe Card (Full Height) Powered USB 3.1 PCIe Card Remote Access Host Card, Tera2 Smart Card Reader (CAC/PIV)
I/O Ports	**Front** 2 - USB 2.0 Type A 1 - USB 3.1 Type A (5Gb) 1 - USB 3.1 Type C (10Gb), data only 1 - Microphone 1 - Headphone **Internal** 1 – USB 3.0 4 – SATA 6Gb/s **Rear** 2 - USB 2.0 Type A (with SmartPower) 4 - USB 3.1 Type A (5Gb) 2 - PS2 2 - DisplayPort 1 - Optional Port (VGA, HDMI 2.0, DP++ 1.2, Type C w/DP-Alt mode) 1 - RJ45 Network Connector 1 - Serial 1 - Audio Line out
Chassis	**HxWxD:** 13.19" x 6.95" x 13.58" (33.5cm x 17.7cm x 34.5cm), Min weight: 9.358Kg **Bays:** (3) internal 3.5" bays - supports (3) 3.5" or (4) 2.5" drives **Slots:** (1) Full Height PCIe x16 Gen3; (2) Full Height PCIe x4 Gen3 (open ended); (1) Full Height PCI; (1) M.2 (22x80 mm) **Power Supply:** 460W 90% efficient PSU (80PLUS Gold Certified Certified) Energy Star compliant; 300W 85% efficient PSU (80PLUS Bronze Certified) Energy Star Compliant
Storage devices	Optional: 1 optical drive: DVD-ROM; DVD+/-RW, Blu Ray Writer (Note: optical drive not available with Smart Card Reader (CAC/PIV)) SD Card Reader
Security Options[5]	Trusted Platform Module TPM 2.0, Dell Data Guardian, Dell Endpoint Security Suite Enterprise, Dell HW Crypto Accelerator, Microsoft Windows Bitlocker, Local HDD data wipe via BIOS ("Secure Erase"), Encryption - SED HDD (Opal FIPS), Chassis lock slot support, Chassis Intrusion Switch, D-Pedigree (Secure Supply Chain Functionality), Setup/BIOS Password, Optional Smart Card keyboards, Intel® Trusted Execution Technology, Intel® Identity Protection Technology, Dell Secure Works, BIOS support optional Computrace, Intel Software Guard extensions
Systems Management[6]	Dell Client Command Suite; via vPro (coming soon)
Regulatory & Environmental	ENERGY STAR® configurations available including 80 PLUS® Bronze and Gold power supplies (Bronze not available in the Americas); EPEAT® registered (see epeat.net for specific registration rating/status by country); China CECP; GS Mark. For a complete listing of declarations & certifications, see Dell's regulatory & compliance homepage at dell.com/regulatory_compliance
Warranty & Support Services[7]	3-Year Limited Hardware Warranty and 3-year NBD On-Site Service after Remote Diagnosis Optional: Dell ProSupport is designed to rapidly respond to your business's needs, help protect your investment and sensitive data and provide enhanced proactive support services to help reduce risk and complexity within your IT environment

Unmatched performance & affordability in an expandable mini-tower.

PRECISION 3630 TOWER

Dell

Transform how you work.

DELL 22 MONITOR | P2219H

OPTIMIZE YOUR WORKSPACE

Free up valuable desk space with this 21.5" FHD monitor featuring a small footprint and thin panel profile. Easily hide away cable clutter with the improved cable management design.

MAXIMIZE PRODUCTIVITY

The 3-sided ultrathin bezel delivers a seamless view across multiple monitors, while Easy Arrange in Dell Display Manager software helps you stay organized when multitasking.

WORK COMFORTABLY

Pivot, tilt, swivel and adjust the height of your monitor to your exact preference. Stay focused longer with a flicker-free screen and ComfortView that optimize eye comfort.

TRUSTED RELIABILITY

Dell monitors — World's number 1 monitor brand[1] Enjoy peace of mind with Dell Premium Panel Exchange, 3 year Advanced Exchange Service[2] and optional ProSupport.[3]

Maximize productivity

OPTIMIZED WORKSPACE

More room to work: Free up valuable desk space with a thin monitor profile and a small monitor base that's approximately 22% smaller than its predecessor.[4]

Clutter-free: Focus on your work while hiding away cable clutter with an improved cable management design.

Consistent and rich colors: A wide viewing angle enabled by In-Plane Switching technology lets you see vibrant colors—no matter where you sit.

MAXIMIZE PRODUCTIVITY

Expand your efficiency: The three-sided ultrathin bezel design lets you enjoy an uninterrupted view of your content across multiple monitors. And, with dual monitors, you can increase your productivity by up to 18%.[5]

More ways to multitask: Work conveniently across multiple screens and select from predefined templates with the Easy Arrange feature on Dell Display Manager software. Quickly tile and arrange your applications and get back to work faster with Auto-restore, a feature that remembers where you left off.

WORK COMFORTABLY

Adjust to your comfort: Pivot, tilt, swivel and adjust the height of your monitor for a comfortable setup all day long. Or choose from a variety of mounts and stands, including VESA, for even more flexibility.

Easy on the eyes: This TÜV[6] Certified monitor has a flicker-free screen with ComfortView, a feature that reduces harmful blue light emissions. It's designed to optimize eye comfort even over extended viewing.

TRUSTED RELIABILITY

DELL MONITORS – WORLD'S NUMBER 1 MONITOR BRAND[1]

Peace of mind: Dell Premium Panel Exchange allows a free panel replacement during the Limited Hardware Warranty[7] period even if only one bright pixel is found.

Minimize downtime: Your monitor comes with a 3-year Advanced Exchange Service[2] so that if a replacement becomes necessary, it will be shipped to you the next business day during your 3-year Limited Hardware Warranty.[7]

Get a higher level of support: Upgrade to 24x7, in-region technical phone support from qualified engineers with Dell ProSupport option.[3]

Features & Technical Specifications

Monitor	Dell 22 Monitor - P2219H
Diagonal Viewing Size	54.61 cm (21.5 inches)
Active Display Area	
Height	476.06 mm (18.74")
Width	267.79 mm (10.54")
Maximum Preset Resolution	1920 x 1080 at 60 Hz
Aspect Ratio	16:9
Pixel Pitch	0.248 mm x 0.248 mm
Pixel Per Inch (PPI)	102
Brightness	250 cd/m² (typical)
Color Support	Color Gamut (typical): 72% (CIE1931)[8]
	Color Depth: 16.7 Million colors
Contrast Ratio	1000: 1 (typical)
Viewing Angle	178°/178°
Response Time	8 ms (Normal); 5 ms (Fast) - (gray to gray)
Panel Type	In-Plane Switching Technology
Backlight Technology	LED Edgelight System
ComfortView with Flicker-free screen	Yes
Dell Display Manager Compatibility	Yes
Remote Asset Management	Yes, via Dell Command	Monitor
Display Screen Coating	Antiglare with 3H hardness

Connectivity

Connectors	1 x DisplayPort version 1.2, 1 x HDMI port version 1.4, 1 x VGA port, 1 x USB 3.0 upstream port (bottom), 2 x USB 3.0 downstream ports (side), 2 x USB 2.0 downstream ports (bottom)
Built-in Devices	USB 3.0 super-speed hub (with 1 x USB 3.0 upstream port), 2 x USB 3.0 downstream ports, 2 x USB 2.0 downstream ports

Design Features

Adjustability	Height-adjustable stand (130 mm), Tilt (-5° to 21°)
	Swivel (-45° to 45°), Pivot (-90° to 90°)
Security	Security lock slot (cable lock sold separately)
Flat Panel Mount Interface	VESA (100 mm x 100 mm)

Power

AC input voltage/frequency/current	100 VAC to 240 VAC / 50 Hz or 60 Hz ± 3 Hz / 1.5 A (typical)
Power Consumption (Operational)	17W (typical) / 37W (maximum)[9]
Power Consumption Stand by / Sleep	Less than 0.3W

Dimensions (with stand)

Height (Compressed ~ Extended)	353.4 mm ~ 472.0 mm; 13.91" ~ 18.58"
Width	487.3 mm (19.19")
Depth	166.0 mm (6.54")

Weight

Weight (panel only - for VESA mount)	2.75 kg (6.06 lb)
Weight (with stand)	4.72 kg (10.41 lb)
Weight (with packaging)	6.26 kg (13.80 lb)

Standard Service Plan	Premium Panel Exchange, 3 Years Advanced Exchange Service[2] & Limited Hardware Warranty[7]
Optional Service Plan	Dell ProSupport[3]
Environmental Compliance	ENERGY STAR®, EPEAT® Gold[10], RoHS Compliant, TCO-Certified Display, BFR/PVC free monitor (excluding external cables), Arsenic-Free glass and Mercury-Free for the panel only

What's in the box?

Components
- Monitor with stand

Cables
- DisplayPort cable
- USB 3.0 upstream cable
- Power cable

Documentation
- Quick Setup Guide
- Safety and regulatory information

Adjustability and connectivity

DELL 22 MONITOR | P2219H

Easily adjust the panel to your preferred viewing position.

21°   5°

130 mm

90°   90°

45°   45°

Back view -
Cable management slot

Tilt and height adjustable

Pivot

Swivel

Connectivity

H

A Power connector
B HDMI port
C Stand lock feature
D DisplayPort

E VGA connector
F USB upstream port
G USB downstream ports (x2)
H USB downstream ports (x2)

RECOMMENDED ACCESSORIES

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๘) จอแสดงภาพขนาด ๑๙ นิ้ว สำหรับเครื่องลูกข่ายระบบการ
ให้บริการข้อมูล

DELL

DELL 20 MONITOR – E2020H

Elevate your everyday display.

ALL THE ESSENTIALS

Enhance your everyday workspace with a 1600 x 900 resolution monitor with improved cable management and a smaller footprint.

ECO-CONSCIOUS INSIDE AND OUT

A comprehensive ENERGY STAR®[1] certified monitor that meets stringent, energy efficient requirements.

DELL DISPLAY MANAGER

Superior productivity and manageability featuring quick access keys, preset layouts, multi-monitor configuration and remote management for IT managers.

TRUSTED RELIABILITY

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Reliable, eco-friendly monitors at a great value

ALL THE ESSENTIALS

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Enhance your workspace: A thinner profile than the previous generation and improved cable management create a smaller footprint, lending itself to a clean, uncluttered desk.

Plug in: Quickly connect legacy or non-legacy PCs with VGA and DP ports.

Adapts to your needs: Make your workspace your own with VESA-compatible mounts and stands.

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Reduce energy: Save energy with PowerNap[3], a feature that dims or puts the monitor to sleep when not in use.

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THANK YOU FOR MAKING DELL MONITORS #1 WORLDWIDE**

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Features & Technical Specifications

Monitor

	Dell 20 Monitor – E2020H
Diagonal Viewing Size	49.53 cm (19.5 inches)
Horizontal	432.96 ± 0.96 mm (17.05 inches)
Vertical	238.05 ± 1.71 mm (9.37 inches)
Maximum Preset Resolution	1600 x 900 at 60 Hz
Aspect Ratio	16:9
Pixel Pitch	0.27 mm x 0.27 mm
Pixel Per Inch (PPI)	94
Brightness	250 cd/m² (typical)
Color Support	Color gamut (typical): 83% (CIE1976) 72% (CIE1931)
	Color depth: 16.7 Million
Contrast Ratio	1000:1 (typical)
Viewing Angle	160º/170º
Response Time	5 ms typical (Normal) (gray to gray)
Panel Type	TN (Twisted Nematic)
Display Screen Coating	Anti-Glare
Backlight Technology	LED
ComfortView with Flicker-free screen	Yes
Dell Display Manager Compatibility	Yes
Remote Asset Management	Yes, via Dell Command I Monitor
GSA/TAA	No
Optional Soundbar	Dell Stereo Soundbar – AC511M

Connectivity

Connectors	1 x VGA
	1 x DisplayPort 1.2
HDCP Support	DisplayPort HDCP 1.2

Design Features

Adjustability	Tilt Only (-5º to 21º)
Security	Security lock slot (cable lock sold separately)
Flat Panel Mount Interface	VESA (100 mm)

Power

AC input voltage/frequency/current	100 VAC to 240 VAC / 50 Hz or 60 Hz ± 3 Hz / 0.7 A (typical)
Power Consumption (Operational)	11W (Typ). 14W (Max). 9.37W (ENERGY STAR®)
Power Consumption Stand by/Sleep	Less than 0.3W

Dimensions (with stand)

Height	368.96 mm (14.53 inches)
Width	471.52 mm (18.56 inches)
Depth	171.0 mm (6.73 inches)

Weight

Weight (panel only - for VESA mount/ no cables)	2.20 kg (4.85 lbs)
Weight (monitor and cables with stand)	2.94 kg (6.48 lbs)
Weight (with packaging)	3.94 kg (8.68 lbs)

Standard Service Plan	3-Years Advanced Exchange Service[5] and Limited Hardware Warranty[6]
Optional Service Plan	Dell ProSupport[7]
Environmental Compliance	ENERGY STAR®, EPEAT® registered where applicable[8], TCO Certified Display

What's in the box?

Components
- Monitor with stand

Cables
- Power cable
- 1 x DP Cable (DP to DP)
- 1 x VGA Cable (EMEA and Japan only)
- 1 x VESA screw cover

Documentation
- Quick Setup Guide
- Safety and Regulatory Information

Recommended Accessories

DELL 20 MONITOR – E2020H

Easily adjust the panel to your preferred viewing position.

21º ⤹ ⤸ 5º

Back view -
Cable management slot

Tilt

Connectivity

1 Power connector
2 DisplayPort 1.2
3 VGA Port

RECOMMENDED ACCESSORIES

DELL SINGLE MONITOR ARM I MSA20

For greater viewing flexibility and a smaller footprint, choose the Dell Single Monitor Arm. Set up is virtually tool-free and its advanced cable management features offer a neat and clutter-free desk.

DELL STEREO SOUNDBAR | AC511M

The Dell Stereo Soundbar AC511M offers clear stereo sound, allowing you to enjoy audio on your favorite games, music and movies, without sacrificing desk space.

DELL WIRELESS KEYBOARD AND MOUSE | KM636

Designed with sleek lines, a compact size and chiclet keys, the Dell Wireless Keyboard and Mouse KM636 offers a contemporary and comfortable design with the convenience of wireless performance.

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๙) เครื่องคอมพิวเตอร์ สำหรับงานประมวลผล แบบที่ ๑ : สำหรับ
เครื่องลูกข่ายผู้ใช้งาน (User Workstation)

DELL

PRECISION 3431 TOWER

Unmatched performance & affordability in a small form factor.

SPACE-SAVING DESIGN

The small form factor is ideal for space-constrained workspaces that need workstation-class performance and reliability. Optional WiFi capabilites and a range of accessible ports keep you connected to everything you need.

INTELLIGENT PERFORMANCE

Dell Precision Optimizer software comes on every Precision workstations and will tuned your workstation to provide there best performance for your applications you use most.

Optional Dell Precision Optimizer Premium is the only AI-based performance optimizer software in the industry to automatically adjust your workstation settings not only for the applications you use, but how you use them - truly customizing your system's performance for you.

LATEST TECHNOLOGY

Power through intensive tasks easily with 8th Generation Intel® Core™ and Xeon® processors and faster memory speeds of up to 2666MHz, 64GB. Run applications at top speeds with next generation AMD Radeon™ Pro or NVIDIA Quadro® professional graphics with up to 55W of graphics support. Scalable storage with SATA or PCIe NVMe SSD options, up to 6TB deliver plenty of room for every project.

MISSION CRITICAL RELIABILITY

Independent Software Vendor (ISV) certified to ensure the high-performance applications you rely on every day run smoothly. Also, with Xeon processors you can get Error Correcting Code (ECC) memory which identifies and corrects single bit memory errors. Our exclusive Reliable Memory Pro software works on top of ECC memory to identify and map out bad memory sectors and will alert you when the memory is at a critical level and needs replaced - providing layers of protection against memory related errors.

Recommended Accessories

PRECISION 3431 Tower

DELL PREMIER WIRELESS KEYBOARD AND MOUSE | KM717

Enhance productivity and enjoy its elegant design that will fit into virtually any workspace. For increased productivity you can simultaneously pair up to two compatible devices with Bluetooth

DELL SMALL FORM FACTOR ALL-IN-ONE STAND (OSS17)

Free up desk space by securely mounting your Precision small form factor desktop and Dell monitor on the compact stand.

PRECISION SMALL FORM FACTOR DUST FILTER

Custom built for your Precision, the external dust filter is easy to install and rinse clean while keeping your internal components clean and running smoothly.

DELL CANVAS

Bring your ideas to life with the groundbreaking new workspace tool that uses an intuitive touch screen, pen and totem to enable natural digital creation.

DELL ULTRASHARP 25 MONITOR | U2518D

This 25" Ultrasharp monitor with InfinityEdge features stunning colors and spectacular clarity on a QHD display. Discover ultimate efficiency with incredibly thin bezels, deal for a multiple monitor setup.

DELL 24 MONITOR | P2418D

See vividly clear visuals and get up to 18% more done with dual monitors by taking advantage of the 3 sided ultrathin bezel which is perfect for dual monitor setup.

Built for business

Dell Technologies Unified Workspace

Dell Technologies Unified Workspace is the most comprehensive solution to deploy, secure, manage and support virtually all devices from the cloud. We designed this revolutionary solution with intelligence and automation providing you with visibility across the entire endpoint environment. We help you save time, improve user experience, optimize resources and strenthen security.

DEPLOY

Our modern deployment solution, ProDeploy in the Unified Workspace allows you to revolutionize the way deployment gets done. By spending just one hour for set up , IT can then hand deployment to Dell and have preconfigured systems shipped directly to the end users--wherever they are.

SECURE

Dell Endpoint Security for the Unified Workspace helps you manage growing cyber risks while embracing workforce transformation. With Dell SafeGuard and Response powered by Secureworks, you gain actionable insight to help you quickly and efficiently prevent, detect and respond to cyber-attacks - keeping your environment free from harm.

MANAGE

We integrated our hardware management solution Dell Client Command Suite with VMware Workspace ONE, allowing you to take advantage of unified endpoint management (UEM) and manage the firmware, operating system and applications for all devices from the Workspace ONE console. UEM simplifies the management of the entire environment saving IT time from having to work between separate consoles for PCs and phones.

SUPPORT

ProSupport Plus continues to be the only predictive and proactive support in the market. When compared to key competitors, ProSupport Plus with SupportAssist reduced time to resolve a failed hard drive with up to 11x faster time to resolution[*]

*Based on a Principled Technologies test report, "Spend Less Time and Effort Troubleshooting Laptop Hardware Failures" dated April 2018. Testing ommissioned by Dell, conducted in the United States. Actual results will vary. Full report: http://facts.pt/L52XKM

Features & Technical Specifications

PRECISION 3431 TOWER

Feature	Precision 3431 Tower Technical Specifications
Processor Options[1]	9th generation Intel® Core™ i9, i7, i5, i3, and Pentium; Intel® Xeon® E Processors; Intel® Pentium® Gold G5420, 2 Core, 4MB Cache, 3.8 Ghz w/UHD Graphics 630 Intel® Core™ i3-9100, 4 Core, 6MB Cache, 3.6Ghz, 4.2 Ghz Turbo w/UHD Graphics 630 Intel® Core™ i5-9500, 6 Core, 9MB Cache, 3.0Ghz, 4.4 Ghz Turbo w/UHD Graphics 630 Intel® Core™i5-9600, 6 Core, 9MB Cache, 3.1Ghz, 4.6 Ghz Turbo w/UHD Graphics 630 Intel® Core™ i7-8700 (6 Core, 12MB Cache, 3.20GHz, 4.6Ghz Turbo w/ HD Graphics 630) Intel® Core™ i7-9700, 8 Core, 12MB Cache, 3.0Ghz, 4.8 Ghz Turbo w/UHD Graphics 630 Intel® Core™ i9-9900, 8 Core, 16MB Cache, 3.1Ghz, 4.9 Ghz Turbo w/UHD Graphics 630 Intel® Xeon® E-2224, 4 Core, 8MB Cache, 3.4Ghz, 4.6Ghz Turbo Intel® Xeon® E Processor E-2174G (4 Core HT, 8MB Cache, 3.8Ghz, 4.7GHz Turbo) Intel® Xeon® E-2236, 6 Core, 8MB Cache, 3.4Ghz, 4.8Ghz Turbo Intel® Xeon® E-2246G, 6 Core, 8MB Cache, 3.6Ghz, 4.8Ghz Turbo w/UHD Graphics 630 Intel® Xeon® E-2224G, 4 Core, 8MB Cache, 3.5Ghz, 4.7Ghz Turbo w/UHD Graphics 630
Operating System Options[2]	Windows® 10 Professional (64 bit) Windows® 10 Pro for Workstations (64 bit) w/ Intel Xeon processors Windows® 10 Home (64 bit) Red Hat® Enterprise Linux® 7.5 (coming soon) Red Hat 8.0 (coming soon) Ubuntu Linux 16.04 Ubuntu Linux 18.04 NeoKylin 6.0 SP3 (China only)
Chipset	Intel® C246 Chipset
Memory Options[3]	4 Dimm Slots; Up to 64GB 2666Mhz Non-ECC & ECC DDR4 Memory
Graphics Options[3]	One PCI Express® x16 Gen 3 Graphics card up to 55W Entry 3D cards: AMD Radeon Pro WX 4100 AMD Radeon Pro WX 3100 AMD Radeon Pro WX 3200 (coming soon) AMD Radeon Pro WX 2100 NVIDIA Quadro P1000 NVIDIA Quadro P620 NVIDIA Quadro P400 Professional 2D cards: Intel HD Graphics 630
Storage Options[4]	Support for up to (1) M.2 PCIe SSD on motherboard slot and Up to (1) 3.5" SATA or (2) 2.5" SATA. Support for Intel Ready Mode technology Support for up to (1) additional PCIe SSD on Dell Precision Ultra-Speed drive (x8) with active cooling 2.5", 500 GB/1 TB, 7200, SATA, HDD 2.5", 500 GB, 7200, SATA, HDD FIPS Self

Storage Options[4]	Encrypting Opal 2.0 2.5", 2 TB, 5400, SATA, HDD 2.5", 256 GB/512 GB/1 TB, SATA 20, SSD 2.5", 512 GB/1 TB, SATA, SSD SED 3.5", 500 GB/1 TB/2 TB/4 TB/8TB, 7200, SATA, HDD 3.5", 4 TB, 5400, SATA, HDD M.2 2280, 256 GB/512 GB/1 TB/2 TB PCIe 40, SSD M.2 2280, 512 GB/1 TB PCIe 50, SSD M.2 2280, 512 PCIe 40, SSD SED (Opal 2.0)
Storage Controller	Integrated: Intel Rapid storage Controller 12.0 supporting SATA 6Gb/s and host based RAID 0/1
Communications	Integrated: Intel Ethernet Connection I219-LM 10/100/1000 Optional: Intel 10/100/1000 PCIe Gigabit Networking card Aquantia® AQtion™ AQN-108 5/2.5 GbE NIC Adapter Optional: Wireless / Bluetooth w/ vPro support
Audio Controller	Integrated Realtek ALC3234 High Definition Audio Codec (2 Channel)
Speakers	Internal Speaker; Optional Dell 2.0 stereo speaker systems available and Dell sound bar for select flat-panel displays
Add-in cards	Thunderbolt 3 PCIe Card Support for up to (1) additional PCIe SSD on Dell Precision Ultra-Speed drive (x8) with active cooling Serial Port PCIe Card Parallel Port PCIe Card Smart Card Reader (CAC/PIV) Remote Access Host Card, Tera2 USB Type-C 3.1 Gen 2 PCIe Card
I/O Ports	Front 2 - USB 2.0 Type A 1 - USB 3.1 Type A (5Gb) 1 - USB 3.1 Type C (10Gb), data only 1 – Universal Audio Jack 1 – Internal SD Card reader (Optional) Internal 3 – SATA 6Gb/s Rear 2 - USB 2.0 Type A (with SmartPower) 4 - USB 3.1 Type A (5Gb) 2 - PS2 2 - Display Port 1 - Optional Port (VGA, HDMI 2.0, DP++ 1.2, Type C w/DP-Alt mode) 1 - RJ45 Network Connector 1 - Serial 1 - Audio Line out 2 - SMA
Chassis	HxWxD: 11.42" x 3.65" x 11.5" (29cm x 9.26cm x 29.2cm), Min weight: 5.117kg Bays: (1) internal 3.5" bay - supports (1) 3.5" or (2) 2.5" drives; (1) external slimline optical bay Slots: (1) half height PCIe x16 Gen3; (1) half height PCIe x4 Gen 3; (1) M.2 (22x80mm) Power Supply: 260W 92% efficient PSU (80PLUS Platinum Certified) Energy Star Compliant; 200W 85% efficient PSU (80PLUS Bronze Certified) Energy Star Compliant 200W 85% efficient PSU (80PLUS Gold Certified) Energy Star Compliant

Feature	Precision 3431 Tower Technical Specifications
Storage devices	Optional: 1 optical drive: DVD-ROM; DVD+/-RW, Blu Ray Writer (Note: optical drive not available with Smart Card Reader (CAC/PIV)) SD Card Reader
Security Options[5]	Trusted Platform Module TPM 2.0, Dell Data Guardian, Dell Endpoint Security Suite Enterprise, Dell HW Crypto Accelerator, Microsoft Windows Bitlocker, Local HDD data wipe via BIOS ("Secure Erase"), Encryption - SED HDD (Opal FIPS), Chassis lock slot support, Chassis Intrusion Switch, D-Pedigree (Secure Supply Chain Functionality), Setup/BIOS Password, Optional Smart Card keyboards, Optional Smart Card Reader, Intel® Trusted Execution Technology, Intel® Identity Protection Technology, Dell Secure Works, BIOS support optional Computrace, Intel Software Guard extensions
Systems Management[6]	Dell Client Command Suite; via vPro (coming soon)
Regulatory & Environmental	ENERGY STAR® configurations available including 80 PLUS® Bronze and Platinum power supplies; EPEAT® registered (see epeat.net for specific registration rating/status by country); China CECP; GS Mark. For a complete listing of declarations & certifications, see Dell's regulatory & compliance homepage at dell.com/regulatory_compliance
Warranty & Support Services[7]	3-Year Limited Hardware Warranty and 3-year NBD On-Site Service after Remote Diagnosis Optional: Dell ProSupport is designed to rapidly respond to your business's needs, help protect your investment and sensitive data and provide enhanced proactive support services to help reduce risk and complexity within your IT environment

PRECISION 3431 TOWER

Unmatched performance & affordability in a small form factor.

DELL 20 MONITOR – E2020H

Elevate your everyday display.

ALL THE ESSENTIALS

Enhance your everyday workspace with a 1600 x 900 resolution monitor with improved cable management and a smaller footprint.

ECO-CONSCIOUS INSIDE AND OUT

A comprehensive ENERGY STAR®[1] certified monitor that meets stringent, energy efficient requirements.

DELL DISPLAY MANAGER

Superior productivity and manageability featuring quick access keys, preset layouts, multi-monitor configuration and remote management for IT managers.

TRUSTED RELIABILITY

As the world's #1 monitor company*, we take pride in our unyielding commitment to quality and the utmost satisfaction of our customers.

Reliable, eco-friendly monitors at a great value

ALL THE ESSENTIALS

Screen performance: The 1600 X 900 HD+ resolution is ideal for routine tasks, while ComfortView is ready for extended screen periods reducing up to 60% of harmful light emissions.[2]

Enhance your workspace: A thinner profile than the previous generation and improved cable management create a smaller footprint, lending itself to a clean, uncluttered desk.

Plug in: Quickly connect legacy or non-legacy PCs with VGA and DP ports.

Adapts to your needs: Make your workspace your own with VESA-compatible mounts and stands.

ECO-CONSCIOUS INSIDE AND OUT

Guaranteed green: With a comprehensive ENERGY STAR®[1] certified portfolio, E series monitors meet stringent, energy requirements while in sleep, on and off modes. These monitors are also EPEAT registered, TCO-certified and meets all regulatory and environmental standards.

Reduce energy: Save energy with PowerNap[3], a feature that dims or puts the monitor to sleep when not in use.

Clean disposal: Composting or recycling the packaging is easy since it's made with at least 75% recycled cardboard with zero Styrofoam packaging.[4]

DELL DISPLAY MANAGER

Productive at every level: Dell Display Manager's (DDM) Easy Arrange feature lets you quickly tile and view your applications side by side across one or more connected screens for multi-tasking efficiency.

Seamless transitions: The Auto-Restore feature remembers where you left off, so applications will go back to where you left them — even after you've unplugged.

The key to convenience: Shortcut keys can save you time, allowing quick access to commonly used controls that let you work faster.

More ways to manage: Asset management reports allow IT managers to quickly capture and track monitor information as well as configure multiple displays at once through a single setup.

THANK YOU FOR MAKING DELL MONITORS #1 WORLDWIDE**

Uncompromised testing: Rigorous development processes help ensure consistent, reliable performance in busy office environments.

Minimize downtime: Your monitor comes with a 3-year Advanced Exchange Service[5] so that if a replacement becomes necessary, it will be shipped to you the next business day during your 3-year Limited Hardware Warranty.[6]

Get a higher level of support: Upgrade to 24 X 7, in-region technical phone support from qualified engineers with Dell ProSupport option.[7]

Features & Technical Specifications

Monitor

	Dell 20 Monitor – E2020H
Diagonal Viewing Size	49.53 cm (19.5 inches)
Horizontal	432.96 ± 0.96 mm (17.05 inches)
Vertical	238.05 ± 1.71 mm (9.37 inches)
Maximum Preset Resolution	1600 x 900 at 60 Hz
Aspect Ratio	16:9
Pixel Pitch	0.27 mm x 0.27 mm
Pixel Per Inch (PPI)	94
Brightness	250 cd/m² (typical)
Color Support	Color gamut (typical): 83% (CIE1976) 72% (CIE1931)
	Color depth: 16.7 Million
Contrast Ratio	1000:1 (typical)
Viewing Angle	160º/170º
Response Time	5 ms typical (Normal) (gray to gray)
Panel Type	TN (Twisted Nematic)
Display Screen Coating	Anti-Glare
Backlight Technology	LED
ComfortView with Flicker-free screen	Yes
Dell Display Manager Compatibility	Yes
Remote Asset Management	Yes, via Dell Command	Monitor
GSA/TAA	No
Optional Soundbar	Dell Stereo Soundbar – AC511M

Connectivity

Connectors	1 x VGA
	1 x DisplayPort 1.2
HDCP Support	DisplayPort HDCP 1.2

Design Features

Adjustability	Tilt Only (-5º to 21º)
Security	Security lock slot (cable lock sold separately)
Flat Panel Mount Interface	VESA (100 mm)

Power

AC input voltage/frequency/current	100 VAC to 240 VAC / 50 Hz or 60 Hz ± 3 Hz / 0.7 A (typical)
Power Consumption (Operational)	11W (Typ). 14W (Max). 9.37W (ENERGY STAR®)
Power Consumption Stand by/Sleep	Less than 0.3W

Dimensions (with stand)

Height	368.96 mm (14.53 inches)
Width	471.52 mm (18.56 inches)
Depth	171.0 mm (6.73 inches)

Weight

Weight (panel only - for VESA mount/ no cables)	2.20 kg (4.85 lbs)
Weight (monitor and cables with stand)	2.94 kg (6.48 lbs)
Weight (with packaging)	3.94 kg (8.68 lbs)

Standard Service Plan	3-Years Advanced Exchange Service[5] and Limited Hardware Warranty[6]
Optional Service Plan	Dell ProSupport[7]
Environmental Compliance	ENERGY STAR®, EPEAT® registered where applicable[8], TCO Certified Display

What's in the box?

Components
- Monitor with stand

Cables
- Power cable
- 1 x DP Cable (DP to DP)
- 1 x VGA Cable (EMEA and Japan only)
- 1 x VESA screw cover

Documentation
- Quick Setup Guide
- Safety and Regulatory Information

Recommended Accessories

DELL 20 MONITOR – E2020H

Easily adjust the panel to your preferred viewing position.

Back view -
Cable management slot

21º   5º

Tilt

Connectivity

1
2   3

1 Power connector
2 DisplayPort 1.2
3 VGA Port

RECOMMENDED ACCESSORIES

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๑๐) อุปกรณ์กระจายสัญญาน (L๒ Switch) ขนาด ๑๖ ช่อง

GS1100 Series

8/16/24-port GbE Unmanaged Switch

The Zyxel GS1100 Series is the best solution for instant Gigabit connectivity in office environments demanding silent operation and better energy efficiency. With power-saving functions, Gigabit Ethernet and a fanless design, the GS1100 Series provides plug-and-play simplicity for high-bandwidth network applications.

Benefits

Green networking

The GS1100 Series not only offers Gigabit Ethernet connectivity for high-bandwidth network applications, but also power-saving functions for better energy efficiency. Capable of dynamically adjusting power output according to traffic, active links and cable length, the GS1100 Series can reduce energy consumption for lowered operating costs.

Traffic detection — Energy Efficient Ethernet (EEE) compliance

The IEEE 802.3az Energy Efficient Ethernet (EEE) feature automatically detects network traffic and adjusts power consumption dynamically, enabling the switch to reduce power consumption during low link utilization periods.

Inactive link detection

The inactive link detection function automatically reduces power usage when inactive links or devices are detected. The GS1100 Series can adjust power consumption according to link status and the number of active network devices.

Cable length detection compliance

This green feature enables the switch to automatically detect the length of connected Ethernet cables and adjust power usage accordingly. The shorter the cable length, the less power it consumes.

- Plug and play Gigabit wire-speed connectivity
- Efficient Energy saving with green Ethernet features
- Fanless design for whisper quiet operation
- Easily to check status with intuitive port LED
- GS1100-10HP supports PoE+
- Flexible choices from 8-port to 24-port

Datasheet GS1100 Series

Fanless design

The GS1100 Series has fanless design that ensures silent operation in small or quiet office environments. The GS1100-10HP PoE model is specifically designed with an external power adapter that eliminates the need for an additional fan to cool down the device, making it perfect for quiet PoE deployments.

Gigabit to the desktop

The GS1100 Series offer 8/16/24-port Gigabit non-blocking wire-speed transmission. In addition, the GS1100-24 and GS1100-10HP are equipped with 2 extra SFP slots supporting dual rate (GbE and 100M speed) connections for long-distance deployments. With superior Gigabit performance and flexible port options, the GS1100 Series is the ideal solution for bandwidth-intensive applications in small office environments.

Freedom of installation via PoE

The GS1100-10HP supports the IEEE 802.3at PoE+ standard to ease the installation of network devices in challenging spaces such as ceilings or walls. PoE+ allows 30 watts per port to power PoE-enabled WLAN APs, VoIP phones and IP surveillance cameras through CAT-5E cables reducing the need of power adapters saving installation time and cost. The GS1100-10HP has been designed with eight full PoE+ ports with total PoE power budget of up to 130 Watts, which makes it an ideal connectivity solution for high-density powered device deployments.

Model List

GS1100-10HP
8-port GbE Unmanaged PoE switch with GbE Uplink

- 8 x GbE PoE RJ-45 ports
- 2 x GbE SFP ports
- PoE power budget: 130 W

GS1100-24E
24-port GbE Unmanaged Switch

- 24 x GbE RJ-45 ports

GS1100-16
16-port GbE Unmanaged Switch

- 16 x GbE RJ-45 ports

GS1100-24
24-port GbE Unmanaged Switch with GbE Uplink

- 24 x GbE RJ-45 ports
- 2 x GbE SFP ports

Specifications

Model	GS1100-10HP	GS1100-16	GS1100-24E	GS1100-24
Product name	8-port GbE Unmanaged PoE switch with GbE Uplink	16-port GbE Unmanaged Switch	24-port GbE Unmanaged Switch	24-port GbE Unmanaged Switch with GbE Uplink
Switch class	Unmanaged	Unmanaged	Unmanaged	Unmanaged
Port Density				
Total port count	10	16	24	26
100/1000 Mbps	8	16	24	24
Gigabit SFP	2	-	-	2
PoE				
802.3at PoE ports	8	-	-	-
Total PoE budget (watts)	130	-	-	-
Performance				
Switching capacity (Gbps)	20	32	48	52
Forwarding rate (Mpps)	14.88	23.8	35.7	38.7
Packet buffer (byte)	256 K	525 K	525 K	525 K
MAC address table	8 K	8 K	8 K	8 K
Jumbo frame	9 K	9 K	10 K	10 K
Auto MDI/MDI-X	Yes	Yes	Yes	Yes
802.1p CoS	Yes	Yes	Yes	Yes
VLAN packet pass-through	Yes	Yes	Yes	Yes
Power				
Input	100 - 240 V AC, 50/60 Hz	100 - 240 V AC, 50/60 Hz	100 - 240 V AC, 50/60 Hz	100 - 240 V AC, 50/60 Hz
Power supply	External	Internal	Internal	Internal
Max. power consumption (watt)	156.1	10	13	14.5
Physical Specifications				
Dimensions (WxDxH) (mm/in.)	250 x 104 x 27/ 9.84 x 4.10 x 1.06	215 x 133 x 42/ 8.46 x 5.24 x 1.65	267 x 162 x 42/ 10.51 x 6.38 x 1.65	441 x 131 x 44/ 17.36 x 5.16 x 1.73
Weight (kg/lb.)	0.73/1.6	0.9/1.98	1.5/3.3	1.8/3.96
Included accessories	• Power adapter • Power cord • Wall-mount kit	• Power cord • Wall-mount kit • Rack mounting kit	• Power cord • Wall-mount kit • Rack mounting kit	• Power cord • Rack mounting kit
Green Features				
Fanless	Yes	Yes	Yes	Yes
Environmental Specifications				
Operating Temperature	0°C to 50°C/32°F to 122°F	0°C to 40°C/32°F to 104°F	0°C to 40°C/32°F to 104°F	0°C to 40°C/32°F to 104°F
Operating Humidity	10% to 90% (non-condensing)			
Storage Temperature	-40°C to 70°C/-40°F to 158°F			
Storage Humidity	10% to 95% (non-condensing)			
MTBF (hr)	1,000,070	1,156,942	366,919	388,378
Heat dissipation (BTU/hr)	89	32.86	43.53	51.25

Feature

Standard Compliance

- IEEE 802.3 10BASE-T Ethernet
- IEEE 802.3u 100BASE-TX Ethernet
- IEEE 802.3ab 1000BASE-T Ethernet
- IEEE 802.3az EEE support
- IEEE 802.3x flow control
- IEEE 802.3z 1000BASE-X
- IEEE 802.1p CoS
- IEEE 802.3af PoE (GS1100-10HP)
- IEEE 802.3at PoE+ (GS1100-10HP)

Certifications Safety

- Safety:
  - LVD
  - BSMI
- EMC (GS1100-10HP: Class B, GS1100-16/24/24E: Class A)
  - CE
  - FCC
  - RCM
  - ICES-003
  - BSMI
- RoHS
- REACH

Warranty

- Limited life-time warranty*

* Warranty terms, service availability, and service response times may vary from country or region to country or region

Accessories

Transceivers (Optional)

Model	Speed	Connector	Wavelength	Max. Distance	DDMI
SFP-1000T	Gigabit	RJ-45	-	0.1 km (109 yd)	-
SFP-SX-D	Gigabit	LC	850 nm	0.55 km (601 yd)	Yes
SFP-SX-E	Gigabit	LC	850 nm	0.55 km (601 yd)	Yes
SFP-LX-10-D	Gigabit	LC	1310 nm	10 km (10936 yd)	Yes
SFP-LX-10-E	Gigabit	LC	1310 nm	10 km (10936 yd)	Yes
SFP-LHX1310-40-D	Gigabit	LC	1310 nm	40 km (43744 yd)	Yes
SFP-ZX-80-D	Gigabit	LC	1550 nm	80 km (87488 yd)	Yes
SFP-BX1310-10-D	Gigabit	LC	1310 nm (Tx) 1490 nm (Rx)	10 km (10936 yd)	Yes
SFP-BX1310-E	Gigabit	LC	1310 nm (Tx) 1550 nm (Rx)	20 km (21872 yd)	Yes
SFP-BX1490-10-D	Gigabit	LC	1490 nm (Tx) 1310 nm (Rx)	10 km (10936 yd)	Yes
SFP-BX1550-E	Gigabit	LC / SC	1550 nm (TX) 1310 nm (RX)	20 km (21872 yd)	Yes

25/09/20

๑๑) อุปกรณ์กระจายสัญญาน (L๒ Switch)
ขนาด ๒๔ ช่อง แบบที่ ๒

ZYXEL NETWORKS

GS1920v2 Series

8/24/48-port GbE Smart Managed Switch

Benefits

Introducing the new hybrid switch

The Zyxel GS1920v2 Smart Managed Switch Series introduces Zyxel NebulaFlex™ that allows you to easily switch between standalone and our license-free Nebula cloud management platform anytime with just a few simple clicks.

The NebulaFlex™ protects your investment on wired technology by offering the flexibility to transition to the cloud in your own time, without worrying about additional ongoing licensing costs.

Taking advantage of Nebula, you can centrally manage and access real-time network information to have effortless control over the GS1920v2 Smart Managed switches and other Hybrid and Nebula devices – all under a single intuitive platform without the need to install any software.

Still like the standalone style?

With rich L2 features such as LACP, advanced QoS, VLAN, ACL and multicast IGMP snooping, the GS1920v2 Series offers intuitive web-based interface for those who still stick on standalone management to access them without learning complex command-line interface (CLI). Additionally, the GS1920v2 Series is also part of the Zyxel One Network, which means that you can use the complimentary ZON Utility to easily perform repetitive operations during the deployment phases.

NebulaFlex™ gives you the flexibility to switch between standalone and our license-free Nebula cloud management

Nebula cloud management allows easy deployment, real-time configurations and effortless access to all your cloud devices anytime

Using user-friendly web-based GUI to manage and set up the switch without learning complex CLI

Smart fan and fanless designs offer silent operations in your office

Check real-time status intuitively by cloud and PoE LED indicators

nebula

Zyxel **one** network
Redefining network integration

What's the benefit of Cloud central management?

When you're ready to join our Nebula cloud management solution, simply register your GS1920v2 Series via the Nebula Control Center (NCC); the device automatically joins, provisions and begins to give real-time information. The intuitive platform allows your switches to form a group, controlled centrally and gain access to diagnostics tools all under a single platform. The Nebula platform does not limit the number of your switches to be added, giving you an easy-to-use, scalable platform to access anytime, anywhere. What's more, the Nebula offers a mobile app for you to register hundreds of devices quickly on NCC with the built-in QR code scanner as well as to monitor the real-time network status.

Experience whisper-silent operations

The GS1920v2 Series includes fanless and built-in smart fan models. The smart fan is designed to automatically adjust speeds based on the device temperature, starting at 26 dBA max at 25°C ambient with GS1920-48v2. You can barely hear the sound while the GS1920v2 Series is working. It is ideal for your office environment.

Maximum flexibility for your Gig

Small and medium-sized businesses (SMBs) today expect a higher level of performance from their networks—more connections to support diverse applications and easier management. The GS1920v2 Series is ideal for SMB deployments in multiple scenarios by providing up to 28 Gigabit copper ports for 24-port models or up to 6 Gigabit fiber ports for 48-port models to futureproof the network for growth.

Support intelligent PoE functions

The GS1920v2 Series PoE switches support 802.3at PoE Plus standards to offer 30-watt per port and a 375-watt high-power budget to meet the needs from power-hungry devices. The default consumption mode allows delivery of only the actual power required by devices connected to the switch for better business ROI. The user-friendly PoE consumption indicator located on the front panel and Web GUI to provide real-time power utilization.

Model List

GS1920-8HPv2
8-port GbE Smart Managed PoE Switch

- 8 x GbE PoE RJ-45 ports
- 2 x GbE combo ports
- PoE power budget: 130 W

GS1920-24v2
24-port GbE Smart Managed Switch

- 24 x GbE RJ-45 ports
- 4 x GbE combo ports

GS1920-24HPv2
24-port GbE Smart Managed PoE Switch

- 24 x GbE PoE RJ-45 ports
- 4 x GbE combo ports
- PoE power budget: 375 W

GS1920-48v2
48-port GbE Smart Managed Switch

- 44 x GbE RJ-45 ports
- 4 x GbE combo ports
- 2 x GbE SFP slots

GS1920-48HPv2
48-port GbE Smart Managed PoE Switch

- 48 x GbE PoE RJ-45 ports
- 4 x GbE combo ports
- 2 x GbE SFP slots
- PoE power budget: 375 W

Application Diagram

Standalone Management

Internet

ZyWALL USG110
Unified Security
Gateway

XGS2210-28
24-port GbE L2
Switch with
10GbE Uplink

Server Farms

GS1920-8HPv2
8-port GbE
Smart Managed
PoE Switch

GS1920-24v2
24-port GbE
Smart Managed
Switch

GS1920-48HPv2
48-port GbE
Smart Managed
PoE Switch

NWA1123-ACv2
802.11ac
Dual-Radio
Ceiling Mount
PoE Access Point

NWA1123-AC PRO
802.11ac
Dual-Radio Dual
Mount PoE
Access Point

Workgroup

NWA5123-AC HD
802.11ac Wave 2
Dual-Radio Unified
Access Point

WAC6303D-S
802.11ac Wave 2
Dual-Radio Unified
Pro Access Point

IP CAM

IP Phone

──── 10G Fiber
──── Gigabit
······ Gigabit PoE

Cloud Management

**Browser & Apps-based
Management**

**K-12
Campus**

**Branch
Office**

**Cloud
Hosted
Network
Service**
nebula

**Boutique
Hotel**

**Retail Store/
Teleworker**

NWA1123-AC HD
Hybrid AP

**Department
Store**

GS1920v2 Series
Hybrid Switch

🔒 Management
Traffic

Nebula Security
Gateway

Specifications

Model	GS1920-8HPv2	GS1920-24v2	GS1920-24HPv2	GS1920-48v2	GS1920-48HPv2
Product name	8-port GbE Smart Managed PoE Switch	24-port GbE Smart Managed Switch	24-port GbE Smart Managed PoE Switch	48-port GbE Smart Managed Switch	48-port GbE Smart Managed PoE Switch
Switch class	Smart Managed	Smart Managed	Smart Managed	Smart Managed	Smart Managed
Port Density					
Total port count	10	28	28	50	50
100/1000 Mbps	8	24	24	44	44
Gigabit Combo (RJ-45/SFP)	2	4	4	4	4
Gigabit SFP	-	-	-	2	2
PoE					
PoE ports	8	-	24	-	48
Total PoE budget (Watts)	130	-	375	-	375
High power PoE 802.3at	Yes	-	Yes	-	Yes
Performance					
Switching capacity (Gbps)	20	56	56	100	100
Forwarding rate (Mpps)	15	42	42	74	74
Packet buffer (byte)	1.5 M	1.5 M	1.5 M	1.5 M	1.5 M
MAC address table	16 K	16 K	16 K	16 K	16 K
Flash/RAM	32 MB/256 MB	32 MB/256 MB	32 MB/256 MB	32 MB/256 MB	32 MB/256 MB
Power					
Input	100 to 240 V AC, 50/60 Hz	100 to 240 V AC, 50/60 Hz	100 to 240 V AC, 50/60 Hz	100 to 240 V AC, 50/60 Hz	100 to 240 V AC, 50/60 Hz
Max. power consumption (watt)	161.8	22.5	463.5	36.9	474.3
Physical Specifications					
Item — Dimensions (WxDxH) (mm/in.)	267 x 162 x 44/ 10.51 x 6.38 x 1.73	441 x 131 x 44/ 17.36 x 5.16 x 1.73	441 x 270 x 44/ 17.36 x 10.63 x 1.73	440 x 200 x 44.5/ 17.32 x 7.87 x 1.75	441 x 270 x 44/ 17.36 x 10.63 x 1.73
Item — Weight (kg/lb.)	1.9/4.19	2.1/4.63	3.8/8.38	2.8/6.17	4.1/9.04
Packing — Dimensions (WxDxH) (mm/in.)	375 x 235 x 61/ 14.76 x 9.25 x 2.4	558 x 214 x 79/ 21.97 x 8.43 x 3.11	616 x 355 x 107/ 24.25 x 13.98 x 4.21	496 x 289 x 90/ 19.53 x 11.38 x 3.54	616 x 355 x 107/ 24.25 x 13.98 x 4.21
Packing — Weight (kg/lb.)	2.73/6.02	2.91/6.42	4.97/10.96	3.97/8.75	5.25/11.57
Included accessories	• Power cord • Desk-mount kit • Wall-mount kit	• Power cord • Rack mounting kit	• Power cord • Rack mounting kit	• Power cord • Rack mounting kit	• Power cord • Rack mounting kit
Green Feature					
Fanless	Yes	Yes	-	-	-
Environmental Specifications					
Operating environment — Temperature	0°C to 50°C/ 32°F to 122°F	0°C to 50°C/ 32°F to 122°F	0°C to 50°C/ 32°F to 122°F	0°C to 50°C/ 32°F to 122°F	0°C to 50°C/ 32°F to 122°F
Operating environment — Humidity	10% to 95% (non-condensing)	10% to 95% (non-condensing)	10% to 95% (non-condensing)	10% to 95% (non-condensing)	10% to 95% (non-condensing)
Storage environment — Temperature	-40°C to 70°C/ -40°F to 158°F	-40°C to 70°C/ -40°F to 158°F	-40°C to 70°C/ -40°F to 158°F	-40°C to 70°C/ -40°F to 158°F	-40°C to 70°C/ -40°F to 158°F
Storage environment — Humidity	10% to 95% (non-condensing)	10% to 95% (non-condensing)	10% to 95% (non-condensing)	10% to 95% (non-condensing)	10% to 95% (non-condensing)
MTBF (hr)	513,985	911,301	638,691	672,235	502,509
Heat dissipation (BTU/hr)	551.74	76.73	1,580.54	125.83	1,617.36
Acoustic noise @ 25°C (dBA)	0	0	27.2	26.0	26.5

Features

Standard Compliance

- IEEE 802.3u 100BASE-TX Ethernet*
- IEEE 802.3ab 1000BASE-T Ethernet*
- IEEE 802.3z 1000BASE-X*
- IEEE 802.3af PoE*
- IEEE 802.3at PoE Plus*
- IEEE 802.3az EEE*
- IEEE 802.3x flow control
- IEEE 802.1AB LLDP/LLDP-MED
- IEEE 802.3ad LACP aggregation*
- IEEE 802.1D Spanning Tree Protocol (STP)*
- IEEE 802.1w Rapid Spanning Tree Protocol (RSTP)*
- IEEE 802.1s Multiple Spanning Tree Protocol (MSTP)
- IEEE 802.1Q VLAN tagging*
- IEEE 802.1p Class of Service (CoS) prioritization*
- IEEE 802.1X port authentication*

Resilience and Availability

- IEEE 802.1D Spanning Tree Protocol (STP)*
- IEEE 802.1w Rapid Spanning Tree Protocol (RSTP)*
- IEEE 802.1s Multiple Spanning Tree Protocol (MSTP)
- IEEE 802.3ad LACP (Max # Trunks/ Links per Trunk): 8/8*
- Loop guard*
- ErrDisable recovery
- MRSTP (Zyxel proprietary)
- Dual configuration files
- Dual images*

Traffic Control

- 802.1Q Static VLANs*/Dynamic VLANs: 1 K/4 K
- Port-based VLAN*
- Protocol-based VLAN
- IP Subnet-based VLAN
- MAC-based VLAN
- Private VLAN
- Voice VLAN*
- VLAN ingress filtering
- LACP algorithm of source/ destination MAC/IP
- GVRP
- L2PT

Security

- 802.1X*
- Port security*
- Layer 2 MAC filtering
- Layer 3 IP filtering
- Layer 4 TCP/UDP socket filtering

- Static MAC forwarding
- Multiple RADIUS servers*
- Multiple TACACS+ servers
- 802.1x VLAN and 802.1p assignment by RADIUS*
- Login authentication by RADIUS*
- Login authentication by TACACS+
- TACACS+ accounting
- Authorization on RADIUS*
- Authorization on TACACS+
- SSL*
- MAC freeze
- DHCP snooping IPv4*
- DHCP snooping IPv6
- ARP inspection
- Static IP-MAC-Port binding
- Policy-based security filtering
- Port isolation
- IP source guard
- MAC search
- Guest VLAN*
- ACL packet filtering (IPv4/IPv6)*
- CPU protection
- Interface related trap enable/disable (by port)
- IPv6 Duplicated Address Detection (DAD)*

Quality of Service (QoS)

- No. of hardware queues per port: 8*
- 802.1p queuing methods: SPQ, WRR, WFQ*
- Storm control: broadcast, multicast, unknown unicast (DLF)*
- Port-based rate limiting (ingress/egress)
- Rate limiting per IP/TCP/UDP per port
- Policy-based rate limiting
- 802.3x flow control
- 802.1p Class of Service (SPQ, WFQ, SPQ/WFQ combination capable)
- DiffServ (DSCP)

Layer 2 Multicast

- L2 multicast
- IGMP snooping (v1, v2, v3)*
- IGMP snooping fast Leave
- Configurable IGMP snooping timer and priority
- IGMP snooping statistics
- IGMP throttling
- MVR support
- IGMP filtering
- IGMP snooping immediate leave
- IGMP proxy mode & snooping mode selection
- MLD snooping

Manageability

- SNMP v1, v2c, v3
- SNMP trap group
- RMON (1, 2, 3, 9)
- ICMP echo/echo reply
- Syslog*
- IEEE 802.1AB LLDP
- IEEE 802.1AB LLDP-MED
- Custom default
- Syslog (IPv4/IPv6)
- Display port utilization*
- Support NebulaFlex™ for hybrid mode

IPv6 Management

- IPv6 over Ethernet (RFC 2464)
- IPv6 addressing architecture (RFC 4291)
- Dual stack (RFC 4213)
- ICMPv6 (RFC 4443)
- Path MTU (RFC 1981)
- Minimum path MTU size of 1280 (RFC 5095)
- Encapsulation for maximum MTU of 1500
- Neighbor discovery (RFC 4861)
- DHCPv6 relay
- Default DHCP client mode*
- DAD (Duplicated Address Detection)*

Device Management

- Standalone management by Web interface
- Cloud management by Nebula Control Center*
- Zyxel iStacking™
- Web interface
- Management through SNMP
- Remote firmware upgrade by Web
- Configuration saving and retrieving
- Configure clone
- DHCP relay per VLAN
- DHCP client IPv4*
- DHCP client IPv6
- Daylight saving*
- NTP Server (IPv4/IPv6) – Support DNS format*
- Port mirroring*
- Scheduled PoE*
- PoE default consumption mode*
- Restore to last custom default

* Cloud and standalone modes supported features.

MIB

- Zyxel private common MIB
- RFC 1066 TCP/IP-based MIB
- RFC 1213, 1157 SNMPv2c/v3 MIB
- RFC 1493 bridge MIB
- RFC 1643 Ethernet MIB
- RFC 1757 RMON Group 1, 2, 3, 9
- RFC 2011, 2012, 2013 SNMPv2 MIB
- RFC 2233 SMIv2 MIB
- RFC 2358 Ethernet-like MIB
- RFC 2674 bridge MIB extension
- RFC 2819, 2925 remote management MIB
- RFC 3621 power Ethernet MIB
- RFC 4022 management information base for transmission control protocol
- RFC 4113 management information base for user datagram protocol
- RFC 4292 IP forwarding table MIB
- RFC 4293 Management Information Base (MIB) for IP

Certifications

Safety
- LVD
- BSMI

EMC
- FCC Part 15 (Class A)
- CE EMC (Class A)
- BSMI ENC

RoHS
- Level A

Zyxel One Network

ZON Utility*
- Discovery of Zyxel switches, APs and gateways
- Centralized and batch configurations:
  - IP configuration
  - IP renew
  - Device factory reset
  - Device reboot
  - Device locating
  - Web GUI access
  - Password configuration
  - One-click quick association with Zyxel AP Configurator (ZAC)

- Automatic detection of the latest firmware
- Displays device serial number and hardware version
- Cloud mode on/off option for Hybrid series devices

Smart Connect
- Discover neighboring devices
- One-click remote management access to the neighboring Zyxel devices
- Reset neighboring devices remotely to factory defaults
- Power cycle neighboring powered devices (PoE switches only)

Warranty
- Limited life-time warranty**

* Cloud and standalone modes supported features.

** Warranty terms, service availability, and service response times may vary from country or region to country or region.

Accessories

Transceivers (Optional)

Model	Speed	Connector	Wavelength	Max. Distance	DDMI
SFP-1000T	Gigabit	RJ-45	-	0.1 km (109 yd)	-
SFP-SX-D	Gigabit	LC	850 nm	0.55 km (601 yd)	Yes
SFP-SX-E	Gigabit	LC	850 nm	0.55 km (601 yd)	Yes
SFP-LX-10-D	Gigabit	LC	1310 nm	10 km (10936 yd)	Yes
SFP-LX-10-E	Gigabit	LC	1310 nm	10 km (10936 yd)	Yes
SFP-LHX1310-40-D	Gigabit	LC	1310 nm	40 km (43744 yd)	Yes
SFP-ZX-80-D	Gigabit	LC	1550 nm	80 km (87488 yd)	Yes
SFP-BX1310-10-D	Gigabit	LC	1310 nm (Tx) 1490 nm (Rx)	10 km (10936 yd)	Yes
SFP-BX1310-E	Gigabit	LC	1310 nm (Tx) 1550 nm (Rx)	20 km (21872 yd)	Yes
SFP-BX1490-10-D	Gigabit	LC	1490 nm (Tx) 1310 nm (Rx)	10 km (10936 yd)	Yes
SFP-BX1550-E	Gigabit	LC/SC	1550 nm (Tx) 1310 nm (Rx)	20 km (21872 yd)	Yes

04/11/20

๑๒) อุปกรณ์กระจายสัญญาน (L๓ Switch) ขนาด ๒๔ ช่อง

Cisco Catalyst 3650 Series Switches

The Cisco® Catalyst® 3650 Series is the next generation of enterprise-class standalone and stackable access-layer switches that provide the foundation for full convergence between wired and wireless on a single platform. The 3650 Series is built on the advanced Cisco StackWise®-160, and takes advantage of the new Cisco Unified Access™ Data Plane (UADP) application-specific integrated circuit (ASIC). This switch can enable uniform wired-wireless policy enforcement, application visibility, flexibility, application optimization, and superior resiliency. The 3650 Series switches support full IEEE 802.3at Power over Ethernet Plus (PoE+), Cisco Universal Power over Ethernet (Cisco UPOE®) on the Cisco Catalyst 3650 Series multigigabit switches, and offer modular and field-replaceable redundant fans and power supplies. The 3650 Series switches also come in a 12-inch lower depth form factor so that you can deploy them in tight wiring closets in remote branches and offices where depth of the switch is a concern. In addition, the 3650 multigigabit switches support current and next-generation wireless speeds and standards (including 802.11ac Wave 2) on existing cabling infrastructure. The 3650 Series switches help increase wireless productivity and reduce TCO.

Contents

Product Overview

- Integrated wireless controller capability with:
  - Up to 40G of wireless capacity per switch (48-port models)
  - Support for up to 50 access points and 1000 wireless clients on each switching entity (switch or stack)
- 24 and 48 10/100/1000 data and PoE+ models with energy-efficient Ethernet (EEE) supported ports
- 24 and 48 100-Mbps and 1-, 2.5-, 5-, and 10-Gbps (multigigabit) Cisco UPOE and PoE+ models with EEE[1]
- Five fixed-uplink models with four Gigabit Ethernet, two 10 Gigabit Ethernet, four 10 Gigabit Ethernet, eight 10 Gigabit Ethernet, or two 40 Gigabit Ethernet Quad Small Form-Factor Pluggable Plus (QSFP+) ports
- 24-port and 48-port 10/100/1000 PoE+ models with lower noise and reduced depth of 11.62 inches for shallow depth cabinets in enterprise, retail, and branch-office environments
- Optional Cisco StackWise-160 technology that provides scalability and resiliency with 160 Gbps of stack throughput
- Dual redundant, modular power supplies and three modular fans providing redundancy[2]
- Support for external power system RPS 2300 on the 3650 mini SKUs for power redundancy
- Full IEEE 802.3at (PoE+) with 30W power on all ports in 1 rack unit (RU) form factor
- Cisco UPOE with 60W power per port in 1 rack unit (RU) form factor
- IEEE 802.3bz (2.5GBASE-T and 5GBASE-T) to go beyond 1 Gbps with existing Category 5e and Category 6
- IEEE 802.1ba Audio Video Bridging (AVB) built in to provide a better AV experience, including improved time synchronization and quality of service (QoS)
- Software support for IPv4 and IPv6 routing, multicast routing, modular QoS, Flexible NetFlow (FNF) Version 9, and enhanced security features
- Single universal Cisco IOS® Software image across all license levels, providing an easy upgrade path for software features
- Enhanced limited lifetime warranty (E-LLW) with next business day (NBD) advance hardware replacement and 90-day access to Cisco Technical Assistance Center (TAC) support

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[1] 3650 multigigabit switches use different power supplies than the non-multigigabit models. Please refer to Table 3.

[2] 3650 mini SKUs (WS-C3650-24PDM and WS-C3650-48FQM) support fixed power supply and fans only. They also support RPS2300 for redundancy. RPS 2300 is not supported on other SKUs.

Switch Models and Configurations

All Cisco Catalyst 3650 Series Switches have fixed, built-in uplink ports and ship with one power supply. Tables 1 through 5 provide further details. Figure 1 is an image of the Cisco Catalyst 3650 Series Switches.

Figure 1.
Cisco Catalyst 3650 Series Switches

Table 1 shows the Cisco Catalyst 3650 Series configurations.

Table 1.   Cisco Catalyst 3650 Series Configurations

Models	Fixed Uplinks	Total 10/100/1000 Ethernet Ports	Default AC Power Supply	Available PoE Power
WS-C3650-24TS	4 x Gigabit Ethernet with Small Form-Factor Pluggable (SFP)	24	250 WAC	-
WS-C3650-48TS		48		
WS-C3650-24PS		24 PoE+	640 WAC	390 W
WS-C3650-48PS		48 PoE+		
WS-C3650-48FS		48 PoE+	1025 WAC	775 W
WS-C3650-24TD	2 x 10 Gigabit Ethernet with SFP+ and 2 x 1 Gigabit Ethernet with SFP	24	250 WAC	
WS-C3650-48TD		48		
WS-C3650-24PD		24 PoE+	640 WAC	390 W
WS-C3650-24PDM		24 PoE+	Fixed 640 WAC	390 W
WS-C3650-48PD		48 PoE+	640 WAC	390 W
WS-C3650-48FD		48 PoE+	1025 WAC	775 W
WS-C3650-8X24PD		24 PoE+ (with 8 100-Mbps and 1-, 2.5-, 5-, and 10-Gbps ports)	715 WAC	435 W
WS-C3650-12X48FD		48 PoE+ (with 12 100-Mbps and 1-, 2.5-, 5-, and 10-Gbps ports)	1100 WAC	660 W

Models	Fixed Uplinks	Total 10/100/1000 Ethernet Ports	Default AC Power Supply	Available PoE Power
WS-C3650-48TQ	4 x 10 Gigabit Ethernet with SFP+ or 4 x Gigabit Ethernet with SFP	48	250 WAC	
WS-C3650-48PQ		48 PoE+	640 WAC	390 W
WS-C3650-48FQ		48 PoE+	1025 WAC	775 W
WS-C3650-48FQM		48 PoE+	Fixed 975 WAC	775 W
WS-C3650-8X24UQ		24 UPOE (with 8 100-Mbps and 1-, 2.5-, 5-, and 10-Gbps ports)	1100 WAC	820 W
WS-C3650-12X48UQ		48 UPOE (with 12 100-Mbps and 1-, 2.5-, 5-, and 10-Gbps ports)	1100 WAC	660 W
WS-C3650-12X48UR	8 x 10 Gigabit Ethernet with SFP+ or 8 x Gigabit Ethernet with SFP	48 UPOE (with 12 100-Mbps and 1-, 2.5-, 5-, and 10-Gbps ports)	1100 WAC	660 W
WS-C3650-12X48UZ	2 x 40 Gigabit Ethernet with QSFP+	48 UPOE (with 12 100-Mbps and 1-, 2.5-, 5-, and 10-Gbps ports)	1100 WAC	660 W

Fixed Uplinks

All Cisco Catalyst 3650 Series Switches have fixed, built-in uplink ports. Customers can choose from five types of uplink ports at the time of the switch purchase:

- Four Gigabit Ethernet with Small Form-Factor Pluggable (SFP)
- Two 10 Gigabit Ethernet with SFP+ and two 10 Gigabit Ethernet with SFP or four Gigabit Ethernet with SFP
- Four 10 Gigabit Ethernet with SFP+ or four Gigabit Ethernet with SFP
- Eight 10 Gigabit Ethernet with SFP+ or eight Gigabit Ethernet with SFP
- Two 40 Gigabit Ethernet with QSFP+

The SFP+ interface supports both 10 Gigabit Ethernet and Gigabit Ethernet ports. Refer to Table 1 for a description of the basic switch models and the corresponding uplink ports. Refer to Table 2 for a description of the various uplink port interface options.

Table 2.   1 and 10 Gigabit Fixed Uplink Configurations

	Interface Options	
Fixed Uplink Ports	**10 Gigabit Ethernet SFP+ Ports**	**Gigabit Ethernet SFP Ports**
4 x Gigabit Ethernet fixed uplink ports	0	4
4 x Gigabit Ethernet or 2 x 10 and 2 x 1 Gigabit Ethernet fixed uplink ports	2	0
	0	4
	2	2

	Interface Options	
4 x Gigabit Ethernet and 4 x 10 Gigabit Ethernet fixed uplink ports	4	0
	0	4
	2	2
	3	1
	1	3
8 x Gigabit Ethernet or 8 x 10 Gigabit Ethernet fixed uplink ports	8	0
	0	8
	Any combination of 10 Gigabit Ethernet and remaining 1 Gigabit Ethernet uplink ports	

Dual Redundant Modular Power Supplies and External RPS2300

The Cisco Catalyst 3650 Series Switches support dual redundant power supplies (see Figure 2). The switch ships with one power supply by default, and the second power supply can be purchased at the time of ordering the switch or at a later time. If only one power supply is installed, it should always be in power supply bay 1. The switch also ships with three field-replaceable fans.

Figure 2.
Redundant Power Supplies

Table 3 shows the different power supplies available in these switches and available PoE power.

Table 3.   Switch Models and Corresponding Default Power Supplies

Models	Default Power Supply	Available PoE Power	Support Secondary Power Supply
24-port data switch	PWR-C2-250WAC	-	Yes
48-port data switch			Yes
24-port PoE switch	PWR-C2-640WAC	390 W	Yes
48-port PoE switch			Yes
48-port full PoE switch	PWR-C2-1025WAC	775 W	Yes
24-port mini PoE switch	Fixed 640 WAC	390W	No, but supports RPS 2300
48-port mini PoE switch	Fixed 975 WAC	775W	No, but supports RPS 2300
24-port Multigigabit PoE switch	PWR-C1-715WAC	435 W	Yes

Models	Default Power Supply	Available PoE Power	Support Secondary Power Supply
24-port Multigigabit UPOE switch	PWR-C1-1100WAC	820 W	Yes
48-port Multigigabit full PoE switch			
48-port Multigigabit UPOE switch		660 W	Yes

The multigigabit switches support a different set of power supplies than the non-multigigabit switches. In addition the PWR-C1-350WAC is **not** supported on the multigigabit switches. In addition to the power supplies listed in Table 3, a 640W DC power supply is available at the time of order or as a spare on all non-multigigabit switch models. The DC power supply also delivers PoE capabilities for maximum flexibility (refer to Table 4 for available PoE budget with DC power supplies). Customers can mix and match the AC and DC power supplies in the two available power supply slots. Any of these power supplies can be installed in any of the switches.

Table 4. Available PoE with DC Power Supply

Model	Number of DC Power Supplies	Total Available PoE Budget
24-port or 48-port PoE Switch (non-multigigabit)	1	390 W
	2	780 W
24-port PoE Switch (Multigigabit)	1	160 W
	2	600 W
48-port PoE Switch (Multigigabit)	1	0 W
	2	440 W

Power over Ethernet Plus (PoE+)

The Cisco Catalyst 3650 Series Switches support both PoE (IEEE 802.3af) and PoE+ (IEEE 802.3at standard), which provide up to 30 W of power per port. PoE removes the need for wall power to each PoE-enabled device and eliminates the cost for additional electrical cabling and circuits that would otherwise be necessary in IP phone and WLAN deployments. The 3650 Series can provide a lower TCO for deployments that incorporate Cisco IP phones, Cisco Aironet[®] wireless LAN (WLAN) access points, or any IEEE 802.3at-compliant end device. Table 5 shows the power supply combinations required for different PoE needs.

Table 5. Minimum Power Supply Requirements for Full PoE and PoE+

	24-Port PoE Switch	48-Port PoE Switch
PoE on All Ports (15.4 W per port)	One PWR-C2-640 WAC	One PWR-C2-1025WAC or Two PWR-C2-640 WAC
PoE+ on All Ports (30 W per port)	One PWR-C2-1025WAC or Two PWR-C2-640 WAC	Two PWR-C2-1025 WAC

Cisco Universal Power over Ethernet (Cisco UPOE)

Cisco UPOE is a breakthrough technology, offering the following services and benefits:

- 60W per port to enable a variety of end devices such as Samsung VDI client, BT IP turret systems in trading floors, Cisco Catalyst compact switches in retail and hospitality environments, personal Cisco TelePresence® systems, and physical access control devices

- High availability for power and guaranteed uninterrupted services, a requirement for critical applications (e911)

- Lower OpEx by providing network resiliency at lower cost by consolidating backup power into the wiring closet

- Faster deployment of new campus access networking infrastructures by eliminating the need for a power outlet for every endpoint

The Cisco UPOE capability is available only on select multigigabit models.

Table 6 shows the power supply requirements for Cisco UPOE.

Table 6.   Power Supply Requirements for Cisco UPOE

	24-Port Multigigabit Cisco UPOE Switch	48-Port Multigigabit Cisco UPOE Switch
Cisco UPOE (60W per port) on all (24-port switch) or max. 29 ports (48-port switch)	One 1100W and one 715W power supplies or two 1100W power supplies	Two 1100W power supplies

Cisco Catalyst Multigigabit Technology

Cisco Multigigabit Ethernet is a unique innovation to the new Cisco Catalyst Ethernet access switches. With the enormous growth of 802.11ac and new wireless applications, wireless devices are promoting the demand for more network bandwidth. This creates a need for a technology that supports speeds higher than 1 Gbps on all cabling infrastructure. Cisco multigigabit technology allows you to achieve bandwidth speeds from 1 Gbps through 10 Gbps over traditional Category 5e (Cat 5e) cabling or above. In addition, the multigigabit ports on select Cisco Catalyst switches support Cisco UPOE, which is increasingly important for next-generation workspaces and Internet of Things (IoT) ecosystems.

Cisco multigigabit technology offers significant benefits for a diverse range of speeds, cable types, and PoE power. The benefits can be grouped into three different areas:

- **Multiple speeds:** Cisco Catalyst Multigigabit Technology supports autonegotiation of multiple speeds on switch ports. The supported speeds are 100 Mbps, 1 Gbps, 2.5 Gbps, and 5 Gbps on Cat 5e cable and up to 10 Gbps over Cat 6a cabling

- **Cable type:** The technology supports a wide range of cable types, including Cat 5e, Cat 6, and Cat 6a or above

- **PoE power:** The technology supports PoE, PoE+, and Cisco UPOE for all the supported speeds and cable types

Cisco Catalyst 3650 Mini Switches

The Cisco Catalyst 3650 Series adds new mini switches to the existing 3650 family of switches. These switches are less than 12" deep and quieter than the existing 3650 switches, making them perfect to deploy in tight wiring cabinets, racks, or user spaces where depth of the switch is a concern. You can avoid replacing the cabinets or mounting the switch at an angle and as a result reduce downtime to the network. These switches enable the same uniform wired-wireless policy enforcement, application visibility, flexibility, application optimization, and superior resiliency as the existing 3650 switches. They come in 24- and 48-port 10M/100M/1000M switch SKUs (WS-C3650-24PDM and WS-C3650-48FQM) and support all the same features as the existing 3650 switches except that they come with fixed fans, fixed power supplies, and support for external RPS2300 for redundancy. These PoE switches support both PoE (IEEE 802.3af) and PoE+ (IEEE 802.3at standard), providing up to 30W of power for 12 ports for a total of 390W on the 24-port model and up to 30W of power for 24 ports for a total of 775W on the 48-port model. The 24-port switch has 2x1 Gigabit Ethernet SFP and 2x10 Gigabit Ethernet SFP+ uplinks; the 48-port switch has 4x10 Gigabit Ethernet SFP+ uplinks to support any high-bandwidth application. These switches support stacking and can stack with each other or the existing 3650 switches using the same Cisco StackWise-160 technology. The 3650 mini and 3650 use the same software and thus can be deployed and managed using the same policies, configuration, and so on as the existing 3650 switches. Some use cases for the 3650 mini are the following:

Small Offices and Branches

Many small branches and satellite offices where there are few employees do not have larger wiring closets because of space constraints. A typical office like this has smaller cabinets and would need a switch that can serve few employees, provide PoE support, can manage wired-wireless networks, and applies the same consistent policies as a bigger branch or office. Because of its less than 12" depth, lower noise, and support for 10G uplinks along with stacking, advanced security, and wired-wireless convergence, the 3650 mini is the perfect switch for this type of space.

Education

The 3650 mini switch extends access to labs, classrooms, and other training rooms from the central/floor distribution rooms, reducing cost of cabling and providing superior quality of service with enhanced security, wired-wireless convergence, and enterprise network features. Because of its shallow depth and lower noise, these switches are ideally suited for classrooms or confined areas.

Retail

A typical retail outlet needs to serve customers at multiple sales points, each with a POS machine, access points, phone, printer, video display with network, and some PoE powering. These retail outlets connect to the access router that connects them to the outside network and typically need switches that fit in shallow depth cabinets. Because of the 12" depth of these switches along with advanced security and networking features, they can help retailers efficiently utilize space and save on real estate cost.

Benefits

Converged Wired plus Wireless Access

The Cisco Catalyst 3650 Series is a standalone and stackable access switching platform that enables wired plus wireless services on a single Cisco IOS XE Software-based platform. With this, Cisco has pioneered a host of rich capabilities such as high availability based on stateful switchover (SSO) on stacking, granular QoS, security, and Flexible NetFlow (FNF) across wired and wireless in a seamless fashion. Also, the wired plus wireless features are bundled into a single Cisco IOS Software image, which reduces the number of software images that users have to qualify/certify before enabling them in their network. The single console port for command-line interface (CLI) management reduces the number of touch points to manage for wired plus wireless services, thereby reducing network complexity, simplifying network operations, and lowering the TCO to manage the infrastructure.

Converged wired plus wireless not only improves wireless bandwidth across the network but also the scale of wireless deployment. Each 48-port Cisco Catalyst 3650 provides 40 Gbps of wireless throughput (20 Gbps on the 24-port model). This wireless capacity increases with the number of members in the stack. This makes sure that the network can scale with current wireless bandwidth requirements, as dictated by IEEE 802.11n-based access points and with future wireless standards such as IEEE 802.11ac. Additionally, the Cisco Catalyst 3650 distributes the wireless controller functions to achieve better scalability. Each Cisco Catalyst 3650 switch/stack can operate as the wireless controller in two modes:

- **Mobility agent (MA):** This is the default mode in which the Cisco Catalyst 3650 switch ships. In this mode the switch is capable of terminating the CAPWAP tunnels from the access points and providing wireless connectivity to wireless clients. Maintaining wireless client databases and configuring and enforcing security and QoS policies for wireless clients and access points can be enforced in this mode. No additional license on top of IP Base is required to operate in the mobility agent mode.

- **Mobility controller (MC):** In this mode, the Cisco Catalyst 3650 switch can perform all the mobility agent tasks in addition to mobility coordination, radio resource management (RRM), and Cisco CleanAir® coordination within a mobility subdomain. The mobility controller mode can be enabled on the switch CLI. IP Base license level is required when the Cisco Catalyst 3650 switch is acting as the mobility controller. A centrally located Cisco 5508 Wireless LAN Controller (WLC 5508), Cisco Wireless Services Module 2 (WiSM2) (when running AireOS Version 7.3), and Wireless LAN Controller 5760 can also perform this role for larger deployments.

  With mobility agents located in the wiring closets providing 40 Gbps of wireless per switch (**n** x 40 Gbps for a stack of **n** switches) and mobility controllers managing some of the central wireless functions, the converged access-based wireless deployment provides best-in-class scalability for wireless and significantly improved wireless throughput.
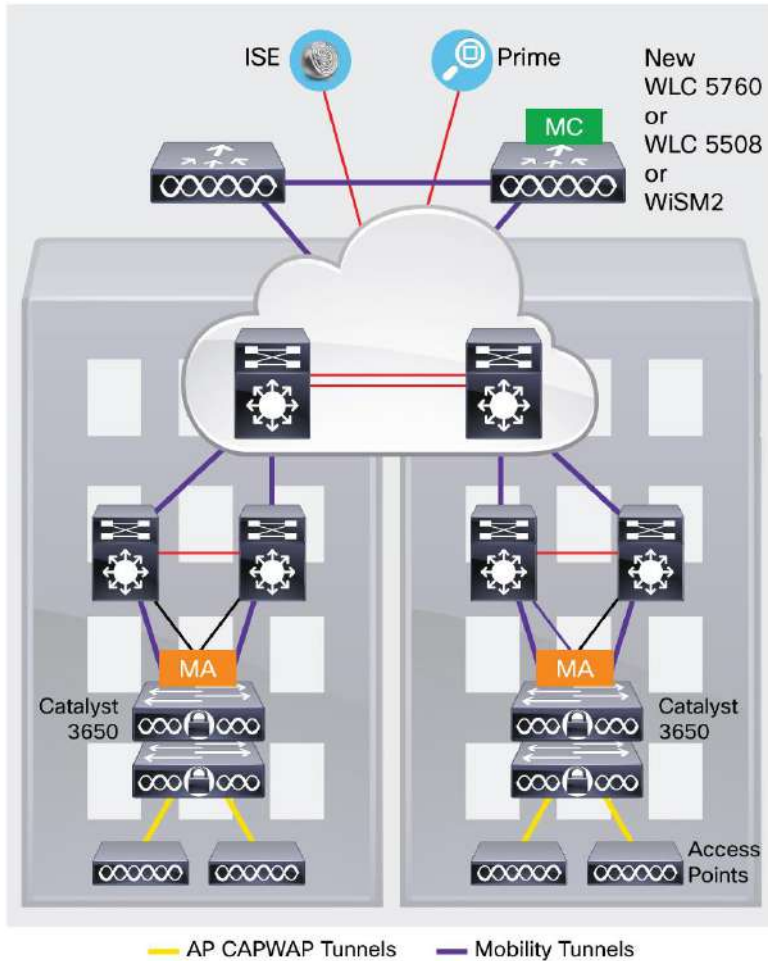
Figure 3.
Mobility Controller (MC) and Mobility Agent (MA)

Distributed Intelligent Services
Flexible NetFlow (FNF)

Full visibility into the wired plus wireless traffic is achieved because of the access point Control and Provisioning of Wireless Access Points (CAPWAP) tunnel termination on the switch. This helps identify users and user traffic flows in order to identify potential attackers and take corrective action at the access layer before the attack penetrates further into the network. This is achieved using FNF, which monitors every single flow entering and exiting the switch stack for wired and wireless users. It also helps identify the top wired/wireless talkers and enforce appropriate bandwidth provisioning policies.

QoS

The 3650 switch has advanced wired plus wireless QoS capabilities. It uses the Cisco modular QoS command line interface (MQC). The switch manages wireless bandwidth using unprecedented hierarchical bandwidth management starting at the per-access-point level and drilling further down to per-radio, per-service set identification (SSID), and per-user levels. This helps manage and prioritize available bandwidth between various radios and various SSIDs (enterprise, guest, and so on) within each radio on a percentage basis. The switch is also capable of automatically allocating equal bandwidth among the connected users within a given SSID. This makes sure that all users within a given SSID get a fair share of the available bandwidth while being connected to the network. The UADP ASIC enables the hierarchical bandwidth management and fair sharing of bandwidth, thereby providing hardware-based QoS for optimized performance at line-rate traffic.

In addition to these capabilities, the switch is able to do class of service (CoS) or differentiated services code point (DSCP) based queuing, policing, shaping, and marking of wired plus wireless traffic. This enables users to create common policies that can be used across wired plus wireless traffic. The 3650 also supports downloadable policy names from the Cisco Identity Services Engine (ISE) when a user successfully authenticates to the network using the ISE.

Security

The Cisco Catalyst 3650 provides a rich set of security features for wired plus wireless users. Features such as IEEE 802.1x, Dynamic Host Configuration Protocol (DHCP) snooping, IP Source Guard and control plane protection, wireless intrusion prevention systems (WIPSs), and so on enable protection against unauthorized users and attackers. With a variety of wired plus wireless users connecting to the network, the switch supports session-aware networking, in which each device connected to the network is identified as one session, and unique access control lists (ACLs) and/or QoS policies can be defined and applied using the ISE for each of these sessions, providing better control on the devices connecting to the network.

Resiliency
Cisco StackWise-160 Technology

The Cisco Catalyst 3650 supports an optional stacking module that is based on the Cisco StackWise-160 technology. Cisco StackWise-160 technology is built on the highly successful industry-leading StackWise technology, which is a premium stacking architecture. StackWise-160 has a stack bandwidth of 160 Gbps. StackWise-160 uses Cisco IOS Software SSO for providing resiliency within the stack. The stack behaves as a single switching unit that is managed by an "active" switch elected by the member switches. The active switch automatically elects a standby switch within the stack. The active switch creates and updates all the switching/routing/wireless information and constantly synchronizes that information with the standby switch. If the active switch fails, the standby switch assumes the role of the active switch and continues to the keep the stack operational. Access points continue to remain connected during an active-to-standby switchover. A working stack can accept new members or delete old ones without service interruption. StackWise-160 creates a highly resilient single unified system of up to nine switches, providing simplified management using a single IP address, single Telnet session, single CLI, auto-version checking, auto-upgrading, auto-configuration, and more. StackWise-160 also enables local switching in Cisco Catalyst 3650 Series Switches. (See Figure 4.)

Figure 4.
StackWise-160 Kit with Stack Adapters and Cables

Foundation for Open Network Environment

The heart of the Cisco Catalyst 3650 is the UADP ASIC with programmability for future features and intelligence with investment protection. The new ASIC provides the foundation for converged APIs across wired and wireless, Cisco Open Network Environment, software-defined networking (SDN) readiness and OnePK SDK through software updates over the product lifetime.

Software Features and Services on Cisco Catalyst 3650 Series Switches

Software services supported on the Cisco Catalyst 3650 Series Switches can be classified into five broad categories:

- Ease of operations
- Advanced security features
- Resiliency
- Application visibility and control
- Audio Video Bridging (AVB)

Ease of Operations

The Cisco Catalyst 3650 helps reduce the operating costs through:

- Cisco Catalyst Smart Operations
- Easy-to-use deployment and control features
- Efficient switch operations
- Network management tools

Cisco Catalyst Smart Operations

Cisco Catalyst Smart Operations are a comprehensive set of capabilities that simplify LAN deployment, configuration, and troubleshooting. In addition to adaptive, always-on technologies such as StackWise-160, Cisco Catalyst Smart Operations enable zero-touch installation and replacement of switches, fast upgrade, and ease of troubleshooting with reduced operational cost. Cisco Catalyst Smart Operations are a set of features that includes Smart Install, Auto Smartports, Smart Configuration and Smart Troubleshooting to enhance operational excellence:

- Cisco Smart Install is a transparent plug-and-play technology to configure the Cisco IOS Software image and switch configuration without user intervention. Smart Install utilizes dynamic IP address allocation and the assistance of other switches to facilitate installation, providing transparent network plug and play.
- Cisco Auto Smartports provide automatic configuration as devices connect to the switch port, allowing auto-detection and plug and play of the device onto the network.
- Cisco Smart Troubleshooting is an extensive array of debug diagnostic commands and system health checks within the switch, including Generic Online Diagnostics (GOLD) and Onboard Failure Logging (OBFL).
- Embedded Event Manager (EEM) is a powerful and flexible feature that provides real-time network event detection and onboard automation. Using EEM, customers can adapt the behavior of their network devices to align with their business needs. This feature requires the IP Base feature set.

Easy-to-Use Deployment and Control Features

- User experience:
  - IP service-level agreements (SLAs) enable customers to assure new business-critical IP applications, as well as IP services that utilize data, voice, and video, in an IP network. This feature requires the IP Services feature set.
  - DHCP autoconfiguration of multiple switches through a boot server eases switch deployment.

- ◦ Automatic QoS (AutoQoS) simplifies QoS configuration in voice over IP (VoIP) networks by issuing interface and global switch commands to detect Cisco IP phones, classify traffic, and help enable egress queue configuration.
- ◦ Autonegotiation on all ports automatically selects half- or full-duplex transmission mode to optimize bandwidth.
- ◦ Automatic media-dependent interface crossover (MDIX) automatically adjusts transmit and receive pairs if an incorrect cable type (crossover or straight through) is installed.
- Simplified configuration and connectivity:
  - ◦ Dynamic Trunking Protocol (DTP) facilitates dynamic trunk configuration across all switch ports.
  - ◦ Port Aggregation Protocol (PAgP) automates the creation of Cisco Fast EtherChannel groups or Gigabit EtherChannel groups to link to another switch, router, or server.
  - ◦ Link Aggregation Control Protocol (LACP) allows the creation of Ethernet channeling with devices that conform to IEEE 802.3ad. This feature is similar to Cisco EtherChannel technology and PAgP.
  - ◦ Unidirectional Link Detection Protocol (UDLD) and aggressive UDLD allow unidirectional links caused by incorrect fiber-optic wiring or port faults to be detected and disabled on fiber-optic interfaces.
  - ◦ Cisco VLAN Trunking Protocol (VTP) Version 3 supports dynamic VLANs and dynamic trunk configuration across all switches.
- Efficient switch operation:
  - ◦ Switching database manager (SDM) templates, VLAN template (specific to LAN Base license level), and advanced template allow the administrator to automatically optimize the ternary content-addressable memory (TCAM) allocation to the desired features based on deployment-specific requirements.
  - ◦ Local proxy Address Resolution Protocol (ARP) works in conjunction with private VLAN edge to minimize broadcasts and maximize available bandwidth.
  - ◦ Stacking master configuration management with Cisco StackWise-160 technology helps make sure that all switches are automatically upgraded when the master switch receives a new software version. Automatic software version checking and updating help ensure that all stack members have the same software version.
  - ◦ Trivial File Transfer Protocol (TFTP) reduces the cost of administering software upgrades by downloading from a centralized location.
  - ◦ Network Timing Protocol (NTP) provides an accurate and consistent timestamp to all intranet switches.
- Multicast:
  - ◦ Optimized multicast for wired plus wireless: Cisco Catalyst 3650 offers greater multicast efficiency by receiving only one multicast stream and replicating it for all connected wired plus wireless devices connected to that switch.
  - ◦ Internet Group Management Protocol (IGMP) v1, v2, v3 snooping for IPv4: multicast listener discovery (MLD) v1 and v2 snooping provides fast client joins and leaves of multicast streams and limits bandwidth-intensive video traffic to only the requestors.
- Monitoring:
  - ◦ Remote Switch Port Analyzer (RSPAN) allows administrators to remotely monitor ports in a Layer 2 switch network from any other switch in the same network.
  - ◦ For enhanced traffic management, monitoring, and analysis, the Embedded Remote Monitoring (RMON) software agent supports four RMON groups (history, statistics, alarms, and events).
  - ◦ Layer 2 traceroute eases troubleshooting by identifying the physical path that a packet takes from source to destination.
  - ◦ Wireless RF management provides both real-time and historical information about RF interference affecting network performance across controllers using systemwide Cisco CleanAir technology integration.

Efficient Switch Operation

Cisco Catalyst 3650 Series Switches, designed and engineered by Cisco, provide optimum power-saving, EEE, low-power operations for industry best-in-class power management and power consumption capabilities. The Cisco Catalyst 3650 ports are capable of reduced power modes so that ports not in use can move into a lower power utilization state. Other efficient switch operation features are:

- Cisco Discovery Protocol Version 2 allows the Cisco Catalyst 3650 Series Switches to negotiate a more granular power setting when connecting to a Cisco powered device such as IP phones or access points than what is provided by IEEE classification.
- Per-port power consumption command allows customers to specify a maximum power setting on an individual port. Per-port PoE power sensing measures actual power being drawn, enabling more intelligent control of powered devices.
- The PoE MIB provides proactive visibility into power usage and allows customers to set different power-level thresholds.

Environmentally Responsible

Organizations may choose to turn off access point radios to reduce power consumption during off-peak hours. The integrated wireless LAN controller avoids the deployment of additional devices in the network.

Network Management Tools

The Cisco Catalyst 3650 Series Switches offer both a superior CLI for detailed configuration and Cisco Prime™ infrastructure for unified wired plus wireless management. Cisco Prime infrastructure provides day 0 and ongoing provisioning, ongoing monitoring and maintenance, configuration templates, and device and user 360-degree views and serves as the FNF collector for user traffic views using the Cisco Prime Assurance Manager module.

For detailed information about Cisco Prime infrastructure, go to https://www.cisco.com/en/US/products/ps12239/index.html.

Advanced Security Features

Cisco Catalyst 3650 Series Switches support advanced security features including but not limited to:

- Protection against attackers:
  - Port security secures the access to an access or trunk port based on MAC address. It limits the number of learned MAC addresses to deny MAC address flooding.
  - DHCP snooping prevents malicious users from spoofing a DHCP server and sending out bogus addresses. This feature is used by other primary security features to prevent a number of other attacks such as ARP poisoning.
  - Dynamic ARP inspection (DAI) helps ensure user integrity by preventing malicious users from exploiting the insecure nature of ARP.
  - IP source guard prevents a malicious user from spoofing or taking over another user's IP address by creating a binding table between the client's IP and MAC address, port, and VLAN.
  - The Unicast Reverse Path Forwarding (RPF) feature helps mitigate problems caused by the introduction of malformed or forged (spoofed) IP source addresses into a network by discarding IP packets that lack a verifiable IP source address.
  - Bidirectional data support on the SPAN port allows the Cisco intrusion detection system (IDS) to take action when an intruder is detected.
- User authentication:
  - Flexible authentication that supports multiple authentication mechanisms, including 802.1X, MAC authentication bypass, and web authentication using a single, consistent configuration.

- ◦ RADIUS change of authorization and downloadable calls for comprehensive policy management capabilities.
- ◦ Private VLANs restrict traffic between hosts in a common segment by segregating traffic at Layer 2, turning a broadcast segment into a nonbroadcast multiaccess like segment. Private VLAN edge provides security and isolation between switch ports, which helps ensure that users cannot snoop on other users' traffic.
- ◦ Multidomain authentication allows an IP phone and a PC to authenticate on the same switch port while placing them on appropriate voice and data VLAN.
- ◦ MAC address notification allows administrators to be notified of users added to or removed from the network.
- ◦ Mobility and security for secure, reliable wireless connectivity and consistent end-user experience. Increased network availability through proactive blocking of known threats.
- ◦ IGMP filtering provides multicast authentication by filtering out nonsubscribers and limits the number of concurrent multicast streams available per port.
- ACLs:
  - ◦ Cisco security VLAN ACLs on all VLANs prevent unauthorized data flows from being bridged within VLANs.
  - ◦ Cisco standard and extended IP security router ACLs define security policies on routed interfaces for control-plane and data-plane traffic. IPv6 ACLs can be applied to filter IPv6 traffic.
  - ◦ Port-based ACLs for Layer 2 interfaces allow security policies to be applied on individual switch ports.
- Device access:
  - ◦ Secure Shell (SSH) Protocol, Kerberos, and Simple Network Management Protocol Version 3 (SNMPv3) provide network security by encrypting administrator traffic during Telnet and SNMP sessions. SSH Protocol, Kerberos, and the cryptographic version of SNMPv3 require a special cryptographic software image because of U.S. export restrictions.
  - ◦ TACACS+ and RADIUS authentication facilitates centralized control of the switch and restricts unauthorized users from altering the configuration.
  - ◦ Multilevel security on console access prevents unauthorized users from altering the switch configuration.
- Bridge protocol data unit (BPDU) Guard shuts down Spanning Tree PortFast-enabled interfaces when BPDUs are received to avoid accidental topology loops.
- Spanning Tree Root Guard (STRG) prevents edge devices not in the network administrator's control from becoming Spanning Tree Protocol root nodes.
- Wireless end-to-end security offers CAPWAP-compliant DTLS encryption to make sure of encryption between access points and controllers across remote WAN/LAN links.

Resiliency

Borderless networks enable enterprise mobility and business-grade video services. Industry's first unified network (wired plus wireless) location services enable tracking of mobile assets and the users of those assets for both wired plus wireless devices. The true borderless experience is enabled by the following feature sets in the Cisco Catalyst 3650 Series Switches:

- High availability
- High-performance IP routing
- Superior QoS

High Availability

In addition to StackWise-160, the Cisco Catalyst 3650 Series supports high-availability features including but not limited to the following:

- Cross-Stack EtherChannel provides the ability to configure Cisco EtherChannel technology across different members of the stack for high resiliency.
- Flexlink provides link redundancy with convergence time less than 100ms.
- IEEE 802.1s/w Rapid Spanning Tree Protocol (RSTP) and Multiple Spanning Tree Protocol (MSTP) provide rapid spanning-tree convergence independent of spanning-tree timers and also offer the benefit of Layer 2 load balancing and distributed processing. Stacked units behave as a single spanning-tree node.

- Per-VLAN Rapid Spanning Tree (PVRST+) allows rapid spanning-tree reconvergence on a per-VLAN spanning-tree basis, without requiring the implementation of spanning-tree instances.
- Switch-port autorecovery (Err-disable) automatically attempts to reactivate a link that is disabled because of a network error.

High-Performance IP Routing

The Cisco Express Forwarding hardware routing architecture delivers extremely high-performance IP routing in the Cisco Catalyst 3650 Series Switches:

- IP unicast routing protocols (static, Routing Information Protocol Version 1 [RIPv1], and RIPv2, RIPng, Enhanced Interior Gateway Routing Protocol [EIGRP] stub) are supported for small-network routing applications with the IP Base feature set. Limited static routing with the LAN Base feature set. Equal-cost routing facilitates Layer 3 load balancing and redundancy across the stack.
- Advanced IP unicast routing protocols (Open Shortest Path First [OSPF], EIGRP, Border Gateway Protocol Version 4 [BGPv4], and Intermediate System-to-Intermediate System Version 4 [IS-ISv4]) are supported for load balancing and constructing scalable LANs. IPv6 routing (OSPFv3, EIGRPv6) is supported in hardware for maximum performance. OSPF for routed access is included in the IP Base image. The IP Services feature set is required for full OSPF, EIGRP, BGPv4, and IS-ISv4.
- Policy-based routing (PBR) allows superior control by facilitating flow redirection regardless of the routing protocol configured. Virtual routing and forwarding (VRF)-Lite enables a service provider to support two or more VPNs, with overlapping IP addresses. The IP Base feature set is required.
- Protocol-independent multicast (PIM) for IP multicast routing is supported, including PIM sparse mode (PIM-SM), PIM dense mode (PIM-DM), PIM sparse-dense mode, and source-specific multicast (SSM). The IP Services feature set is required.
- IPv6 addressing is supported on interfaces with appropriate show commands for monitoring and troubleshooting.

Superior QoS

The Cisco Catalyst 3650 Series offers Gigabit Ethernet speed with intelligent services that keep traffic flowing smoothly, even at 10 times the normal network speed. Industry-leading mechanisms for cross-stack marking, classification, and scheduling deliver superior performance for data, voice, and video traffic, all at wire speed.

The following are some of the QoS features supported in the Cisco Catalyst 3650 Series Switches:

- Granular wireless bandwidth management and fair sharing use Cisco's proven Cisco IOS Software and UADP ASIC technology to provide hierarchical bandwidth management at line rate (per access point, per radio, per SSID, per client-based policies). Fair sharing across the users within an SSID makes sure that no single user is starved because of other heavy-hitting users. Fair sharing is automatically enabled for wireless at user level as well as SSID level.
- 802.1p CoS and DSCP field classification is provided, using marking and reclassification on a per-packet basis by source and destination IP address, MAC address, or Layer 4 Transmission Control Protocol/User Datagram Protocol (TCP/UDP) port number.
- Shaped round robin (SRR) scheduling helps ensure differential prioritization of packet flows by intelligently servicing the ingress queues and egress queues. Weighted tail drop (WTD) provides congestion avoidance at the ingress and egress queues before a disruption occurs. Strict priority queuing helps ensure that the highest priority packets are serviced ahead of all other traffic.
- The Cisco committed information rate (CIR) function provides bandwidth in increments as low as 8 Kbps.

- Rate limiting is provided based on source and destination IP address, source and destination MAC address, Layer 4 TCP/UDP information, or any combination of these fields, using QoS ACLs (IP ACLs or MAC ACLs), class maps, and policy maps.
- Eight egress queues per port for wired traffic and four egress queues for wireless help enable differentiated management of different traffic types across the stack for wired traffic. Up to 2000 aggregate policers are available per switch.

Application Visibility and Control Using Flexible NetFlow (FNF)

Cisco IOS Software FNF is the next generation in flow visibility technology, allowing optimization of the network infrastructure, reducing operation costs, and improving capacity planning and security incident detection with increased flexibility and scalability. The Cisco Catalyst 3650 provides optimized application visibility with FNF across wired plus wireless. The switch is capable of 48,000 flow entries on 48-port models and 24,000 flow entries on 24-port models across wired and wireless. With UADP ASIC, Cisco Catalyst 3650 delivers next-generation flow technology with unprecedented flexibility and comprehensive visibility extending from Layer 2 (MAC and VLAN) to Layer 4 (TCP/UDP) flags and so on across wired plus wireless traffic. The Cisco Catalyst 3650 switch is medianet capable to provide visibility and troubleshooting capabilities across wired plus wireless video traffic. Specific medianet features will be enabled in future software updates.

The flow data collected by FNF can be exported to an external collector for analysis and reporting or tracked by the EEM. The Cisco Catalyst 3650 enables powerful on-box and customizable event correlation and policy actions with EEM, allowing the switches to trigger customized event alarms or policy actions when the predefined condition is met. With no external appliance required, customers are able to use existing infrastructure to perform traffic monitoring, making traffic analysis economical even on a large IP network.

Details about Cisco FNF are available at
https://www.cisco.com/en/US/prod/collateral/iosswrel/ps6537/ps6555/ps6601/ps6965/product_data_sheet0900aecd804b590b.html.

The Cisco Catalyst 3650 supports Wireshark, the world's foremost network protocol analyzer, and is ideal for proactive debugging, troubleshooting and network performance monitoring. Using Wireshark, a user can capture control and data wired and wireless packets, easily displaying and analyzing them on a screen or a Wireshark GUI. Using Flexible NetFlow and Embedded Event Manager, a Wireshark packet capture can be initiated in events such as SYN flood attacks or abnormal bandwidth usage by specific users.

High-performance video over wireless integrates Cisco VideoStream technology to optimize the delivery of video applications across the WLAN.

Wired plus wireless IP telephony supports unified communications for improved collaboration through messaging, presence, and conferencing and supports all Cisco Unified Communications wireless IP phones for cost-effective, real-time voice service.

Audio Video Bridging

With Cisco IOS® XE Software Release 16.3, select* Cisco Catalyst 3650 Series models support the IEEE 802.1 AVB standard. This standard provides the means for highly reliable delivery of low-latency, time-synchronized AV streaming services through Layer 2 Ethernet networks. The standard also makes it easier to integrate new services and for AV equipment from different vendors to interoperate. Whether the AV endpoint connections are analog or are inflexible digital one to one, the network transport enables many-to-many transparent plug-and-play connections for multiple AV endpoints.

Benefits:

- Improves quality of experience by lowering jitter and latency for time-synchronized delivery of high-quality AV
- Provides scalability of applications across networked deployments, including expansive and complex AV infrastructure
- Lowers total cost of ownership (TCO) with reduced cabling (lowers CapEx) and no license fees (lowers OpEx)

*For more details about AVB and specific models supported, check https://www.cisco.com/go/avb.

Deployment Options
Campus

In a campus-type deployment, operating the Cisco Catalyst 3650 in the mobility agent mode and centralizing the mobility controller functionality in a WLC 5760, WLC 5508, or WiSM2 helps achieve better scalability and performance. The Cisco Catalyst 3650 provides CAPWAP termination for access points, uniform policy enforcement for wireless clients, better wireless bandwidth, and uniform Cisco IOS Software-based configuration and monitoring for wired plus wireless features. The mobility controller provides central mobility, RRM, and CleanAir coordination.

Backward compatibility with traditional centralized wireless deployment mode on the WLC 5508, WiSM2, and WLC 5760 helps ensure that customers can migrate to the Cisco Catalyst 3650-based converged access approach in phases, providing a continued controller for existing access points. This migration also provides investment protection on the existing wireless controller infrastructure. A phased adoption of the new Cisco Catalyst 3650 helps ensure that migration to the converged access mode of wireless is seamless. Figure 5 shows the Cisco Catalyst 3650 in a campus deployment.
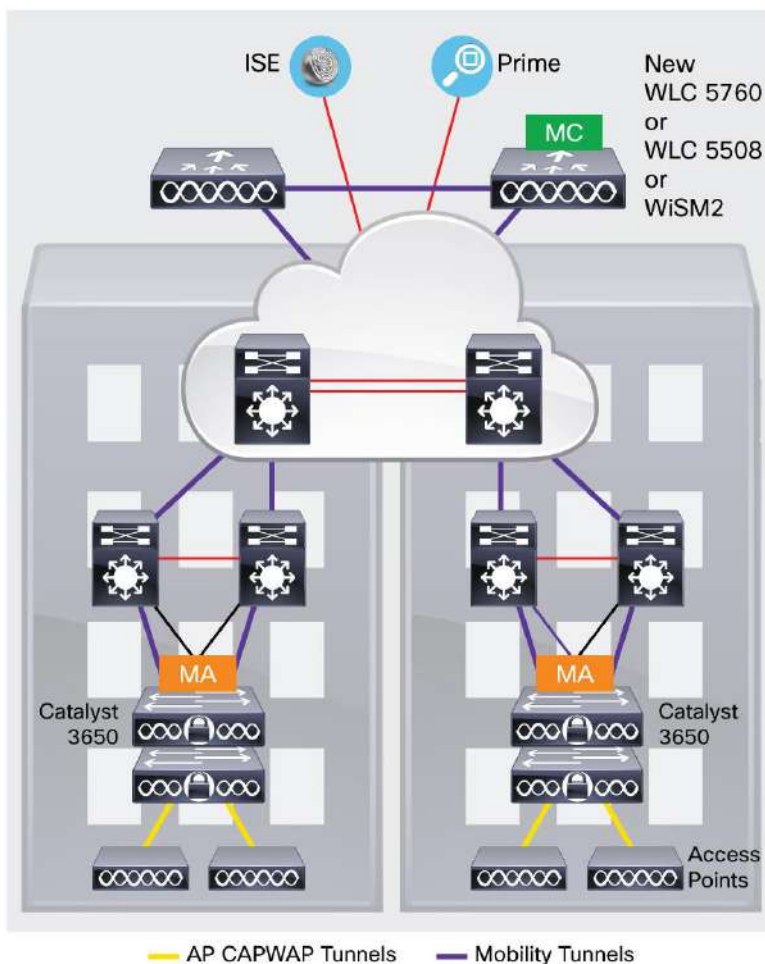
Figure 5.
Deploying Cisco Catalyst 3650 in a Branch Environment

Branch

3650 is optimized for branch deployments when it operates in mobility controller mode. In this mode, not only can the switch terminate CAPWAP tunnels from the access points and provide client connectivity, it can also manage mobility within the branch. This eliminates the need for a local controller in every branch in addition to the access-layer switches. Also, complete visibility into the wired plus wireless traffic means that the WAN router can prioritize the right wired plus wireless traffic in and out of the branch. Figure 6 shows the Cisco Catalyst 3650 in a branch deployment.
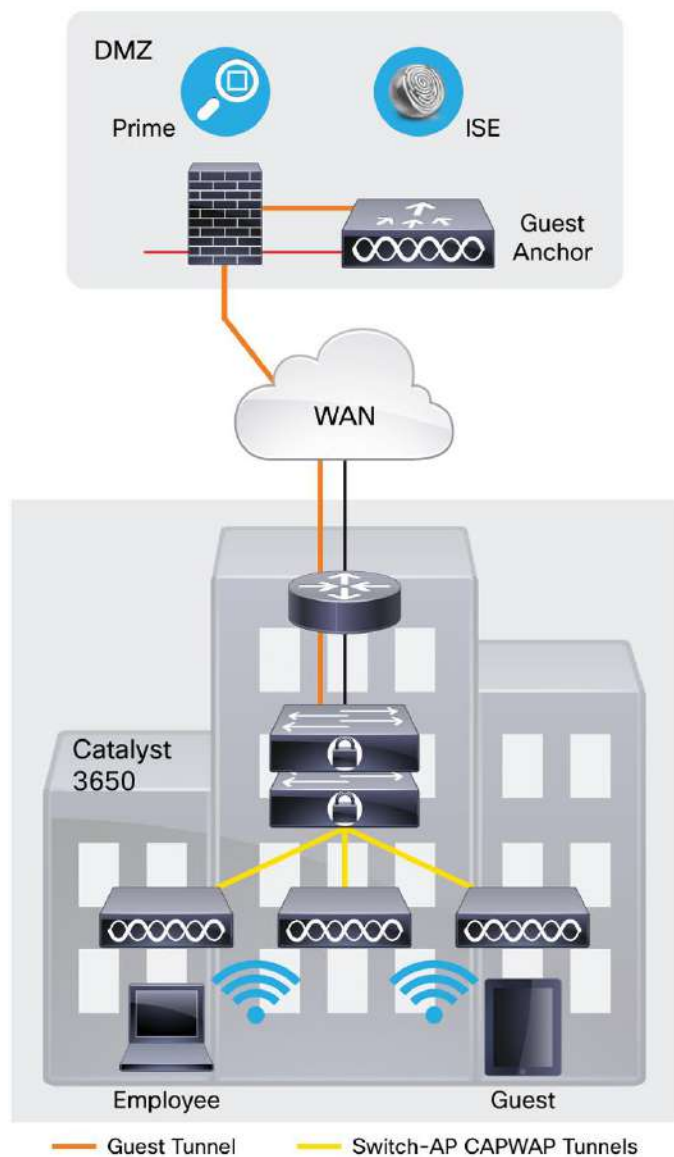
Figure 6.
Deploying Cisco Catalyst 3650 in a Branch Location

Specifications

Cisco Catalyst 3650 Series Specifications
Switch Performance

Table 7 shows Cisco Catalyst 3650 Series Switches performance specifications.

Table 7.   Cisco Catalyst 3650 Performance Specifications

Performance Numbers for All Switch Models	
Switching capacity	176 Gbps on 48-port models (non-multigigabit models)
	92 Gbps on 24-port models (non-multigigabit models)
	254 Gbps on 24-port Multigigabit models with 2x10G uplink
	272 Gbps on 24-port Multigigabit models with 4x10G uplink
	392 Gbps on 48-port Multigigabit models with 4x10G uplink
	472 Gbps on 48-port Multigigabit models with 8x10G uplink
	472 Gbps on 48-port Multigigabit models with 2x40G uplink
Stacking bandwidth	160 Gbps
Total number of MAC addresses	32,000
Total number of IPv4 routes (ARP plus learned routes)	24,000
FNF entries	48,000 flow on 48-port models
	24,000 flows on 24-port models
DRAM	4 GB
Flash	2 GB (non-Multigigabit models) and 4GB (Multigigabit models)
VLAN IDs	4,094
Total switched virtual interfaces (SVIs)	1,000
Jumbo frame	9198 bytes
Total routed ports per 3650 stack	208
Wireless	
Number of access points per switch/stack	25
Number of wireless clients per switch/stack	1000
Total number of WLANs per switch	64
Wireless bandwidth per switch	Up to 40 Gbps on 48-port models
	Up to 20 Gbps on 24-port models
Supported Aironet access point series	3700, 3600, 3500, 2600, 1600, 1260, 1140, 1040
Forwarding Rate of Switch Models	

Performance Numbers for All Switch Models	
Model	**Forwarding Rate**
4 x 1 Gigabit Ethernet Uplink-Models	
3650-24TS	41.66 Mpps
3650-24PS	
3650-48TS	77.37 Mpps
3650-48PS	
3650-48FS	
2 x 10 Gigabit Ethernet Uplink-Models	
3650-24TD 3650-24PD 3650-24PDM	68.45 Mpps
3650-48TD 3650-48PD 3650-48FD	104.16 Mpps
3650-8X24PD	172.61 Mpps
3650-12X48FD	261.90 Mpps
4 x 10 Gigabit Ethernet Uplink-Models	
3650-48TQ 3650-48PQ 3650-48FQ 3650-48FQM	130.95 Mpps
3650-8X24UQ	202.38 Mpps
3650-12X48UQ	291.66 Mpps
8 x 10 Gigabit Ethernet Uplink-Models	
3650-12X48UR	351.19 Mpps
2 x 40 QSFP+ Uplink-Models	
3650-12X48UZ	351.19 Mpps

Dimensions, Weight, Acoustic, Mean Time between Failures, and Environmental Range Specifications for Cisco Catalyst 3650 Series Switches

Table 8 shows dimensions, weight, acoustic, mean time between failure (MTBF), and environmental range. Weight includes the chassis assembly as it is shipped: three fans, two StackWise adapters, and one power supply blank. The weight also includes the default power supply that is shipped with the unit.

Table 8. Dimensions, Weight, Acoustic, MTBF, and Environmental Range

Dimensions (H x W x D)	Inches	Centimeters
WS-C3650-24T WS-C3650-24P WS-C3650-48T WS-C3650-48P	1.73 x 17.5 x 17.625	4.4 x 44.5 x 44.8

Dimensions (H x W x D)	Inches	Centimeters
WS-C3650-8X24PD		
WS-C3650-48F WS-C3650-8X24UQ WS-C3650-12X48UQ WS-C3650-12X48UR WS-C3650-12X48UZ	1.73 x 17.5 x 19.125	4.4 x 44.5 x 48.6
WS-C3650-12X48FD		
WS-C3650-24PDM WS-C3650-48FQM	1.73 x 17.5 x 11.625	4.4 x 44.5 x 29.6
Weight	**Pounds**	**Kilograms**
WS-C3650-24T	15.15	6.87
WS-C3650-24P	16.00	7.26
WS-C3650-24PDM	12.26	5.56
WS-C3650-8X24PD	16.60	7.53
WS-C3650-8X24UQ	16.71	7.58
WS-C3650-48T	15.90	7.21
WS-C3650-48P	16.75	7.60
WS-C3650-48F	17.20	7.80
WS-C3650-12X48FD	17.75	8.05
WS-C3650-12X48UQ	17.75	8.05
WS-C3650-12X48UR	17.80	8.08
WS-C3650-12X48UZ	17.80	8.08
WS-C3650-48FQM	12.65	5.74
STACK-T2-BLANK	0.1	0.05
C3650-STACK-KIT	0.25	0.11
MTBF Hours		
WS-C3650-24T	661,800	
WS-C3650-24P	528,280	
WS-C3650-8X24PD	335,930	

Dimensions (H x W x D)	Inches	Centimeters
WS-C3650-8X24UQ	233,780	
WS-C3650-24PDM (with power supply)	304,860	
WS-C3650-48T	527,580	
WS-C3650-48P	383,760	
WS-C3650-48F	383,760	
WS-C3650-12X48FD	227,490	
WS-C3650-12X48UQ	203,130	
WS-C3650-12X48UR	201,680	
WS-C3650-12X48UZ	203,190	
WS-C3650-48FQM (with power supply)	272,260	
PWR-C2-250WAC	751,642	
PWR-C2-640WAC	693,692	
PWR-C2-1025WAC	570,259	
PWR-C2-640WDC	706,759	
PWR-C1-715WAC	664,055	
PWR-C1-1100WAC	392,174	
FAN-T1	16,661,470	
Environmental Ranges		
With AC Power Supply **Operating Environment and Altitude**	Normal operating temperature[*] and altitudes: -5ºC to +45ºC, up to 5000 feet (1500m) -5ºC to +40ºC, up to 10,000 feet (3000m) -5ºC to +35ºC, up to 13,000 feet (4000m) -5ºC to +30ºC, up to 16,400 feet (5000m) [*] Minimum ambient temperature for cold start is 32°F (0°C).	
	Short-term[*] exceptional conditions: -5ºC to +50ºC, up to 5000 feet (1500m) -5ºC to +45ºC, up to 10,000 feet (3000m) -5ºC to +40ºC, up to 13,000 feet (4000m) -5ºC to +35ºC, up to 16,400 feet (5000m) -5ºC to +45ºC, at sea level with single fan failure	

Dimensions (H x W x D)	Inches	Centimeters
	* Not more than following in one-year period: 96 consecutive hours, or 360 hours total, or 15 occurrences.	
With AC Power Supply **Operating Environment and Altitude for WS-C3650-24PDM and WS-C3650-48FQM**	Normal operating temperature* and altitudes: -5ºC to +45ºC, up to 5000 feet (1500m) -5ºC to +45ºC, up to 10,000 feet (3000m) * Minimum ambient temperature for cold start is 32°F (0°C).	
	Short-term* exceptional conditions: -5ºC to +50ºC, up to 5000 feet (1500m) -5ºC to +50ºC, up to 10,000 feet (3000m) * Not more than following in one-year period: 96 consecutive hours, or 360 hours total, or 15 occurrences.	
With DC Power Supply **Operating Environment and Altitude (NEBS)**	Normal operating temperature and altitudes: -5ºC to +45ºC, up to 6000 feet (1800m) -5ºC to +40ºC, up to 10,000 feet (3000m) -5ºC to +35ºC, up to 13,000 feet (4000m) -5ºC to +30ºC, up to 16,400 feet (5000m)	
	Short-term* exceptional conditions: -5ºC to +55ºC, up to 6000 feet (1800m) -5ºC to +50ºC, up to 10,000 feet (3000m) -5ºC to +45ºC, up to 13,000 feet (4000m) -5ºC to +40ºC, up to 16,400 feet (5000m) -5ºC to +45ºC, at sea level with single fan failure * Not more than following in one-year period: 96 consecutive hours, or 360 hours total, or 15 occurrences.	
Relative Humidity	5% to 96%, noncondensing	
Acoustic Noise **Measured Per ISO 7779 and Declared Per ISO 9296** **Bystander Positions Operating to an Ambient Temperature of 25°C**	With AC or DC power supply (with 16 PoE+ ports loaded): LpA: 45dB typical, 48dB maximum 42dB typical, 45dB maximum for WS-C3650-24PDM and WS-C3650-48FQM LwA: 5.5B typical, 5.8B maximum 5.3B typical, 5.6B maximum for WS-C3650-24PDM and WS-C3650-48FQM Typical: Noise emission for a typical configuration Maximum: Statistical maximum to account for variation in production	
Storage Environment	Temperature: -40 to 158º F (-40 to 70º C) Altitude: 16,400 ft (5,000 m)	
Vibration	Operating: 0.41Grms from 3 to 500Hz with spectral break points of 0.0005 G2/Hz at 10Hz and 200Hz 5dB/octave roll off at each end.	
	Nonoperating: 1.12Grms from 3 to 500Hz with spectral break points of 0.0065 G2/Hz at 10Hz and 100Hz 5dB/octave roll off at each end.	

Dimensions (H x W x D)	Inches	Centimeters
Shock	Operating: 30G, 2ms half sine	
	Nonoperating: 55G, 10ms trapezoid	

Connectors for Cisco Catalyst 3650 Series

Table 9 shows connectors.

Table 9. Connectors

Connectors and cabling	• 1000BASE-T ports: RJ-45 connectors, 4-pair Cat-5E UTP cabling • 1000BASE-T SFP-based ports: RJ-45 connectors, 4-pair Cat-5E UTP cabling • 100BASE-FX, 1000BASE-SX, -LX/LH, -ZX, -BX10, DWDM and CWDM SFP transceivers: LC fiber connectors (single-mode or multimode fiber) • 10GBASE-SR, LR, LRM, CX1 (v02 or higher) SFP+ transceivers: LC fiber connectors (single-mode or multimode fiber) • Cisco StackWise-160 stacking ports: copper-based Cisco StackWise cabling • Ethernet management port: RJ-45 connectors, 4-pair Cat-5 UTP cabling • Management console port: RJ-45-to-DB9 cable for PC connections
Power connectors	• Customers can provide power to a switch by using the internal power. The connectors are located at the back of the switch • Internal power supply connector: The internal power supply is an auto-ranging unit. The internal power supply supports input voltages between 100 and 240VAC. Use the supplied AC power cord to connect the AC power connector to an AC power outlet

Management and Standards Support for Cisco Catalyst 3650 Series Switches

Table 10 shows management and standards support for the Cisco Catalyst 3650 Series.

Table 10. Management and Standards Support for the Cisco Catalyst 3650 Series

Description	Specification	
Management	BRIDGE-MIB	CISCO-SNMP-TARGET-EXT-MIB
	CISCO-AUTH-FRAMEWORK-MIB	CISCO-STACKMAKER-MIB
	CISCO-BGP4-MIB, BGP4-MIB	CISCO-MEMORY-POOL-MIB
	CISCO-BRIDGE-EXT-MIB	CISCO-STP-EXTENSIONS-MIB
	CISCO-BULK-FILE-MIB	CISCO-SYSLOG-MIB
	CISCO-CABLE-DIAG-MIB	CISCO-TCP-MIB
	CISCO-CALLHOME-MIB	CISCO-UDLDP-MIB
	CISCO-CEF-MIB	CISCO-VLAN-IFTABLE-RELATIONSHIP-MIB
	CISCO-CIRCUIT-INTERFACE-MIB	CISCO-VLAN-MEMBERSHIP-MIB
	CISCO-ENTITY-VENDORTYPE-OID-MIB	CISCO-VTP-MIB
	CISCO-CONTEXT-MAPPING-MIB	EtherLike-MIB
	CISCO-DEVICE-LOCATION-MIB	HC-RMON-MIB
	CISCO-DHCP-SNOOPING-MIB	IEEE8021-PAE-MIB
	CISCO-EIGRP-MIB	IEEE8023-LAG-MIB
	CISCO-EMBEDDED-EVENT-MGR-MIB	IF-MIB
	CISCO-ENTITY-FRU-CONTROL-MIB	IGMP-MIB
	CISCO-ENTITY-SENSOR-MIB	IGMP-STD-MIB
	ENTITY-MIB	IP-FORWARD-MIB

Description	Specification	
	CISCO-ERR-DISABLE-MIB	IP-MIB
	CISCO-CONFIG-COPY-MIB	IPMROUTE-STD-MIB
	CISCO-FLOW-MONITOR-MIB	LLDP-EXT-MED-MIB
	CISCO-FTP-CLIENT-MIB	LLDP-MIB
	CISCO-HSRP-EXT-MIB	NOTIFICATION-LOG-MIB
	CISCO-HSRP-MIB	OLD-CISCO-MEMORY-MIB
	CISCO-IETF-ISIS-MIB	CISCO-CDP-MIB
	CISCO-IF-EXTENSION-MIB	POWER-ETHERNET-MIB
	CISCO-IGMP-FILTER-MIB	RMON2-MIB
	CISCO-CONFIG-MAN-MIB	RMON-MIB
	CISCO-IP-CBR-METRICS-MIB	SNMP-COMMUNITY-MIB
	CISCO-IPMROUTE-MIB	SNMP-FRAMEWORK-MIB
	CISCO-IP-STAT-MIB	SNMP-MPD-MIB
	CISCO-IP-URPF-MIB	SNMP-NOTIFICATION-MIB
	CISCO-L2L3-INTERFACE-CONFIG-MIB	SNMP-PROXY-MIB
	CISCO-LAG-MIB	SNMP-TARGET-MIB
	CISCO-LICENSE-MGMT-MIB	SNMP-USM-MIB
	CISCO-MAC-AUTH-BYPASS-MIB	SNMPv2-MIB
	CISCO-MAC-NOTIFICATION-MIB	SNMP-VIEW-BASED-ACM-MIB
	CISCO-MDI-METRICS-MIB	TCP-MIB
	CISCO-FLASH-MIB	UDP-MIB
	CISCO-OSPF-MIB	CISCO-IMAGE-MIB
	CISCO-OSPF-TRAP-MIB	CISCO-STACKWISE-MIB
	CISCO-PAE-MIB	AIRESPMACE-WIRELESS-MIB
	CISCO-PAGP-MIB	CISCO-LWAPP-IDS-MIB
	CISCO-PIM-MIB	CISCO-LWAPP-AP-MIB
	CISCO-PING-MIB	CISCO-LWAPP-CCX-RM-MIB
	CISCO-PORT-QOS-MIB	CISCO-LWAPP-CLIENT-ROAMING-MIB
	CISCO-PORT-SECURITY-MIB	CISCO-LWAPP-DOT11-CCX-CLIENT-DIAG-MIB
	CISCO-PORT-STORM-CONTROL-MIB	CISCO-LWAPP-DOT11-CCX-CLIENT-MIB
	CISCO-POWER-ETHERNET-EXT-MIB	CISCO-LWAPP-DOT11-CLIENT-CCX-REPORTS-MIB
	CISCO-PRIVATE-VLAN-MIB	CISCO-LWAPP-DOT11-CLIENT-MIB
	CISCO-PROCESS-MIB	CISCO-LWAPP-DOT11-MIB
	CISCO-PRODUCTS-MIB	CISCO-LWAPP-DOWNLOAD-MIB
	CISCO-RF-MIB	CISCO-LWAPP-LINKTEST-MIB
	CISCO-RTP-METRICS-MIB	CISCO-LWAPP-MFP-MIB
	CISCO-RTTMON-MIB	CISCO-LWAPP-MOBILITY-EXT-MIB
	CISCO-SMART-INSTALL-MIB	CISCO-LWAPP-QOS-MIB
		CISCO-LWAPP-REAP-MIB
		CISCO-LWAPP-ROGUE-MIB
		CISCO-LWAPP-RRM-MIB
		CISCO-LWAPP-SI-MIB
		CISCO-LWAPP-TSM-MIB

Description	Specification	
		CISCO-LWAPP-WLAN-MIB
		CISCO-LWAPP-WLAN-SECURITY-MIB
Standards	IEEE 802.1as	RMON I and II standards
	IEEE 802.1s	SNMPv1, SNMPv2c, and SNMPv3
	IEEE 802.1w	
	IEEE 802.11	
	IEEE 802.1x	
	IEEE 802.1x-Rev	
	IEEE 802.3ad	
	IEEE 802.3af	
	IEEE 802.3at	
	IEEE 802.3bz	
	IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports	
	IEEE 802.1D Spanning Tree Protocol	
	IEEE 802.1p CoS prioritization	
	IEEE 802.1Qat Stream Reservation Protocol	
	IEEE 802.1Qav	
	IEEE 802.1Q VLAN	
	IEEE 802.3 10BASE-T specification	
	IEEE 802.3u 100BASE-TX specification	
	IEEE 802.3ab 1000BASE-T specification	
	IEEE 802.3z 1000BASE-X specification	

Power Supply Specifications

Table 11 lists the power specifications for the Cisco Catalyst 3650 Series based on the kind of power supply used.

Table 11. Power Specifications for Cisco Catalyst 3650 Series

Description	Specification				
	PWR-C2-1025 WAC	PWR-C2-640 WAC	PWR-C2-250 WAC	PWR-C2-640 WDC	WS-C3650-24PDM/WS-C3650-48FQM Switches
Power Supply Rated Maximum	1025W	640W	250W	640W	975W
Total Output BTU (Note: 1000 BTU per hr = 293 W)	3497 BTU/hr, 1025W	2183 BTU/hr, 640W	853 BTU/hr, 250W	2188 BTU/hr, 640W	3326.8 BTU/hr, 975W

Description	Specification				
Input-Voltage Range and Frequency (Note: ±10% of "Input-Voltage Range")	115-240VAC, 50-60 Hz	100-240VAC, 50-60 Hz	100-240VAC, 50-60 Hz	-36VDC to -72VDC	100-240VAC, 50-60 Hz
Input Current	12-6A	8-4A	4-2A	21 - 10.5 A	12-5A
Output Ratings	12V @ 20.83A -54V @ 14.6A	12V @ 20.83A -54V @ 7.36A	12V @ 20.83A	12V @ 20.83A -54V @ 7.36A	12V @ 16.66A -54V @ 14.3A
Output Holdup Time	10 ms minimum @ 102.5VAC	16.7 ms minimum @ 100VAC	16.7 ms minimum @ 100VAC	> 2ms@-48VDC	20 ms minimum @ 100VAC
Power-Supply Input Receptacles	IEC 320-C16 (IEC60320-C16)	IEC 320-C16 (IEC60320-C16)	IEC 320-C13 (IEC60320-C13)	Terminal strip	IEC 320-C16 (IEC60320-C16)
Power Cord Rating	13A	13A	10A	20A @ 100VDC	15A
Physical Specifications	(H x W x D): 1.58 X 3.75 X 13.25 in (4.0 x 9.5 x 33.7 cm) Weight: 3.55 lb (1.61 kg)	(H x W x D): 1.58 X 3.75 X 11.75 in (4.0 x 9.5 x 29.8 cm) Weight: 3.1 lb (1.41 kg)	(H x W x D): 1.58 X 3.75 X 11.75 in (4.0 x 9.5 x 29.8 cm) Weight: 2.55 lb (1.16 kg)	(H x W x D): 1.58 X 3.75 X 11.75 in (4.0 x 9.5 x 29.8 cm) Weight: 2.75 lb (1.25 kg)	N/A
Operating Temperature	For the operating temperature ranges at various altitudes of AC and DC power supply module powered switches, see Table 1.				
Storage Temperature	-40 to 158°F (-40 to 70°C)				
Relative Humidity Operating and Nonoperating Noncondensing	5 to 96% noncondensing				5 to 95% noncondensing
Altitude	16,400 ft. (5,000 meters)				10,000 ft. (3,000 meters)
MTBF	Calculated MTBF must be greater than 300,000 using Telcordia SR-332, Method 1, Issue 3. Demonstrated MTBF is 500,000 hr (with 90% confidence level).				
EMI and EMC Compliance	"AC OK": Input power to the power supply is OK "PS OK": Output power from the power supply is OK				
Safety Compliance	For the operating temperature ranges at various altitudes of AC and DC power supply module powered switches, see Table 1.				
LED Indicators	-40 to 158°F (-40 to 70°C)				N/A

Description	Specification	
	PWR-C1-1100WAC	PWR-C1-715WAC
Power supply rated maximum	1100W	715W
Total output BTU (Note: 1000 BTU/hr = 293W)	3793 BTU/hr, 1100W	2465 BTU/hr, 715W
Input-voltage range and frequency	115-240VAC, 50-60 Hz	100-240VAC, 50-60 Hz
Input current	12-6A	10-5A
Output ratings	-56V at 19.64A	-56V at 12.8A
Output holdup time	10 ms minimum at 102.5VAC	16.7 ms minimum at 100VAC
Power-supply input receptacles	IEC 320-C16 (IEC60320-C16)	IEC 320-C16 (IEC60320-C16)
Power cord rating	13A	13A
Physical specifications	(H x W x D): 1.58 X 3.25 X 13.7 in Weight: 3 lb (1.4 kg)	(H x W x D): 1.58 X 3.25 X 12.20 in Weight: 2.8 lb (1.3 kg)
Operating temperature	23 to 113°F (-5 to 45°C)	
Storage temperature	-40 to 158°F (-40 to 70°C)	
Relative humidity operating and nonoperating noncondensing	5 to 90% noncondensing	
Altitude	10,000 ft. (3000 meters), up to 45°C	
MTBF	Calculated MTBF must be greater than 300,000 using Telcordia SR-332, Method 1, Case 3. Demonstrated MTBF is 500,000 hr (with 90% confidence level).	
EMI and EMC compliance	FCC Part 15 (CFR 47) Class A ICES-003 Class A EN 55022 Class A CISPR 22 Class A AS/NZS 3548 Class A BSMI Class A (AC input models only) VCCI Class A EN 55024, EN300386, EN 50082-1, EN 61000-3-2, EN 61000-3-3 EN61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-5, EN61000-4-6, EN 61000-6-1	

Description	Specification
Safety compliance	UL 60950-1, CAN/CSA-C22.2 No. 60950-1, EN 60950-1, IEC 60950-1, CCC, CE Marking
LED indicators	"AC OK": Input power to the power supply is OK "PS OK": Output power from the power supply is OK

Power Consumption of Standalone Cisco Catalyst 3650 Series Switches

Table 12 shows power consumption of standalone Cisco Catalyst 3650 Series Switches based on Alliance for Telecommunications Industry Solutions (ATIS) testing using IMIX distribution stream traffic, with input voltage of 115VAC @ 60 Hz, Energy Efficient Ethernet (EEE) enabled, and no PoE loading. The values given are the maximum possible power consumption numbers under the respective test scenarios.

Table 12. Power Consumptions (in Watts) of Standalone Cisco Catalyst 3650 Series

Model	Fixed Uplink	Power Consumption (Watts) (No More Than)			
		0% Traffic	10% Traffic	100% Traffic	Weighted Average
WS-C3650-24TS	4 x Gigabit Ethernet with Small Form-Factor Pluggable (SFP)	43.9	56.4	57.1	55.21
WS-C3650-48TS		61.1	85.1	86.4	82.85
WS-C3650-24PS		53.8	65.3	65.9	64.18
WS-C3650-48PS		81.4	98.7	99.5	97.09
WS-C3650-48FS		90.8	108.7	109.4	106.98
WS-C3650-24TD	2 x 10 Gigabit Ethernet with SFP+ and 2 x 10 Gigabit Ethernet with SFP+ or 4 x Gigabit Ethernet with SFP	54.0	60.8	63.0	60.35
WS-C3650-48TD		73.3	90.9	93.9	89.40
WS-C3650-24PD		61.1	68.3	70.1	67.75
WS-C3650-24PDM		63.8	72.3	76.2	71.9
WS-C3650-48PD		80.3	99.1	101.5	97.45
WS-C3650-48FD		88.8	106.5	109.4	105.03
WS-C3650-8X24PD		103	107.8	111.5	107.7
WS-C3650-12X48FD		158.7	168.6	172.7	168
WS-C3650-48TQ	4 x 10 Gigabit Ethernet with SFP+ or 4 x Gigabit Ethernet with SFP	73.0	91.9	96.7	90.47
WS-C3650-48PQ		86.4	103.4	107.4	102.10
WS-C3650-48FQ		96.6	116.2	120.5	114.69
WS-C3650-48FQM		74.1	89.2	95.8	88.4
WS-C3650-8X24UQ		110.0	115.3	123.3	115.6

Model	Fixed Uplink	Power Consumption (Watts) (No More Than)			
		0% Traffic	10% Traffic	100% Traffic	Weighted Average
WS-C3650-12X48UQ		170.4	179.9	186.6	179.7
WS-C3650-12X48UR	8 x 10 Gigabit Ethernet with SFP+ or 8 x Gigabit Ethernet with SFP	174.5	184.9	195.7	184.9
WS-C3650-12X48UZ	2 x 40 Gigabit Ethernet with Quad Small Form-Factor Pluggable+ (QSFP+)	162.4	173.7	184.0	173.6

Safety and Compliance

Table 13 lists the safety and compliance information for the Cisco Catalyst 3650 Series.

Table 13. Safety and Compliance Information for Cisco Catalyst 3650 Series

Description	Specification
Safety Certifications	UL 60950-1 Second Edition CAN/CSA-C22.2 No. 60950-1 Second Edition EN 60950-1 Second Edition IEC 60950-1 Second Edition GOST NOM (obtained by partners and distributors)
Electromagnetic Emissions Certifications	47CFR Part 15 (CFR 47) Class A (FCC Part 15 Class A) AS/NZS CISPR22 Class A CISPR22 Class A EN55022 Class A ICES003 Class A VCCI Class A EN61000-3-2 EN61000-3-3 KN22 Class A KCC CNS13438 Class A EN55024 CISPR24 KN24
Environmental	Reduction of Hazardous Substances (ROHS) 5
Noise Specifications	Office Product Spec: 48dBA at 25°C (refer to ISO 7779)
Telco	Common Language Equipment Identifier (CLEI) Code

Warranty

Cisco Enhanced Limited Lifetime Hardware Warranty

The Cisco Catalyst 3650 Series Switches come with an E-LLW that includes NBD delivery of replacement hardware where available and 90 days of 8x5 Cisco TAC support.

Your formal warranty statement, including the warranty applicable to Cisco software, appears in the Cisco information packet that accompanies your Cisco product. We encourage you to review carefully the warranty statement shipped with your specific product before use.

Cisco reserves the right to refund the purchase price as its exclusive warranty remedy.

For further information on warranty terms, visit https://www.cisco.com/go/warranty. Table 14 provides information about the E-LLW.

Table 14.   E-LLW Details

	Cisco E-LLW
Device Covered	Applies to Cisco Catalyst 3650 Series Switches.
Warranty Duration	As long as the original customer owns the product.
EoL Policy	In the event of discontinuance of product manufacture, Cisco warranty support is limited to 5 years from the announcement of discontinuance.
Hardware Replacement	Cisco or its service center will use commercially reasonable efforts to ship a replacement for NBD delivery, where available. Otherwise, a replacement will be shipped within 10 working days after receipt of the RMA request. Actual delivery times might vary depending on customer location.
Effective Date	Hardware warranty commences from the date of shipment to customer (and in case of resale by a Cisco reseller, not more than 90 days after original shipment by Cisco).
TAC Support	Cisco will provide during business hours, 8 hours per day, 5 days per week basic configuration, diagnosis, and troubleshooting of device-level problems for up to a 90-day period from the date of shipment of the originally purchased Cisco Catalyst 3650 product. This support does not include solution or network-level support beyond the specific device under consideration.
Cisco.com Access	Warranty allows guest access only to Cisco.com.

Licensing

Licensing for Cisco Catalyst 3650 Series Switches

The three feature sets available with all Cisco Catalyst 3650 Series Switches are:

- LAN Base: Enterprise access layer 2 switching features
- IP Base: Enterprise access layer 3 switching features
- IP Services: Advanced enterprise layer 3 switching (IPv4 and IPv6) features

The LAN Base feature set offers enhanced intelligent services that include comprehensive Layer 2 features, with up to 255 VLANs. The IP Base feature set provides entry-level enterprise services in addition to all LAN Base features, with 4094 VLANs. IP Base also includes the support for wireless controller functionality (mobility agent and mobility controller role; additional access point license required for mobility controller role), routed access, smart operations, FNF, and so on. The IP Services feature set provides full enterprise services that include advanced Layer 3 features such as EIGRP, OSPF, BGP, PIM, and IPv6 routing such as OSPFv3 and EIGRPv6. All software feature sets support advanced security and MQC-based QoS.

The Cisco Catalyst 3650 Series Switches with LAN Base feature set can only stack with other Cisco Catalyst 3650 Series LAN Base switches. The same applies to IP Base and IP Services as well. A mixed stack of LAN Base switch with IP Base or IP Services feature set is not supported.

Customers can transparently upgrade the software feature set in the Cisco Catalyst 3650 Series Switches through Cisco IOS Software CLI using the right to use (RTU)-based software upgrade process. Software activation enables the Cisco IOS Software feature sets. Based on the license's type, Cisco IOS Software activates the appropriate feature set. License types can be changed, or upgraded, to activate a different feature set.

Access Point License for Cisco Catalyst 3650

An access point license is required for Cisco Catalyst 3650 operating in mobility controller mode. No access point license is required for 3650 operating in mobility agent mode. This functionality is included in the IP Base feature set. Other devices that can act as mobility controller are the WLC 5760, WLC 5508, and WiSM2 wireless controllers. Access point licenses can be transferred only between two 3650 switches or between 3650 and 5760 controller and vice versa.

Software Policy for Cisco Catalyst 3650 Series Switches

Customers with Cisco Catalyst LAN Base and IP Base software feature sets will be provided with maintenance updates and bug fixes designed to maintain the compliance of the software with published specifications, release notes, and industry standards compliance as long as the original end user continues to own or use the product or up to one year from the end-of-sale date for this product, whichever occurs earlier. Customers with licenses for our IP Services software images require a service support contract such as Cisco Smart Net Total Care™ Service to download updates. This policy supersedes any previous warranty or software statement and is subject to change without notice.

Cisco and Partner Services

Cisco and Partner Services for Next-Generation Cisco Catalyst Fixed Switches

Enable the innovative, secure, intelligent edge in the Borderless Network Architecture using personalized services from Cisco and our partners. Through a discovery process that begins with understanding your business objectives, we help you integrate the next-generation Cisco Catalyst fixed switches into your architecture and incorporate network services onto that platform. Sharing knowledge and leading practices, we support your success every step of the way as you deploy, absorb, manage, and scale new technology. Choose from a flexible suite of support services designed to meet your business needs and help you maintain high-quality network performance while controlling operational costs. (See Table 15.)

Table 15. Technical Services Available for Cisco Catalyst 3650 Switches

Technical Services
Cisco Smart Net Total Care Service   • Around-the-clock, global access to the Cisco TAC

Technical Services

- Unrestricted access to the extensive Cisco.com knowledge base and tools
- Next-business-day, 8x5x4, 24x7x4, and 24x7x2 advance hardware replacement and onsite parts replacement and installation available
- Ongoing operating system software updates within the licensed feature set
- Proactive diagnostics and real-time alerts on Smart Call Home-enabled devices

Cisco Smart Foundation Service

- NBD advance hardware replacement as available
- Business hours access to SMB TAC (access levels vary by region)
- Access to Cisco.com SMB knowledge base
- Online technical resources through Smart Foundation Portal
- Operating system software bug fixes and patches

Cisco SP Base Service

- Around-the-clock, global access to the Cisco TAC
- Registered access to Cisco.com
- NBD, 8x5x4, 24x7x4, and 24x7x2 advance hardware replacement; return to factory option available[2]
- Ongoing operating system software updates[1]

Cisco Focused Technical Support Services

- Three levels of premium, high-touch services are available:
  - Cisco High-Touch Operations Management Service
  - Cisco High-Touch Technical Support Service
  - Cisco High-Touch Engineering Service
- Valid Cisco Smart Net Total Care or SP Base contracts on all network equipment are required

Notes:

[1] Cisco operating system updates include the following: maintenance releases, minor updates, and major updates within the licensed feature set.

[2] Advance hardware replacement is available in various service-level combinations. For example, 8x5xNBD indicates that shipment will be initiated during the standard 8-hour business day, 5 days a week (the generally accepted business days within the relevant region), with NBD delivery. Where NBD is not available, same day ship is provided. Restrictions apply; for details, review the appropriate service descriptions.

Ordering Information

Table 16 lists ordering information for the Cisco Catalyst 3650 Series. To place an order, visit the Cisco Ordering homepage at https://www.cisco.com/en/US/ordering/or13/or8/order_customer_help_how_to_order_listing.html.

Table 16.   Cisco Catalyst 3650 Series Ordering Information

Product Number	Product Description
Cisco Catalyst 3650 4x1G Uplink Series	
WS-C3650-24TS-L	Standalone with Optional Stacking 24 10/100/1000 Ethernet and 4x1G Uplink ports, with 250WAC power supply, 1 RU, LAN Base feature set
WS-C3650-48TS-L	Standalone with Optional Stacking 48 10/100/1000 Ethernet and 4x1G Uplink ports, with 250WAC power supply, 1 RU, LAN Base feature set
WS-C3650-24PS-L	Standalone with Optional Stacking 24 10/100/1000 Ethernet PoE+ and 4x1G Uplink ports, with 640WAC power supply, 1 RU, LAN Base feature set
WS-C3650-48PS-L	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 4x1G Uplink ports, with 640WAC power supply, 1 RU, LAN Base feature set
WS-C3650-48FS-L	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 4x1G Uplink ports, with 1025WAC power supply, 1 RU, LAN Base feature set
WS-C3650-24TS-S	Standalone with Optional Stacking 24 10/100/1000 Ethernet and 4x1G Uplink ports, with 250WAC power supply, 1 RU, IP Base feature set
WS-C3650-48TS-S	Standalone with Optional Stacking 48 10/100/1000 Ethernet and 4x1G Uplink ports, with 250WAC power supply, 1 RU, IP Base feature set
WS-C3650-24PS-S	Standalone with Optional Stacking 24 10/100/1000 Ethernet PoE+ and 4x1G Uplink ports, with 640WAC power supply, 1 RU, IP Base feature set
WS-C3650-48PS-S	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 4x1G Uplink ports, with 640WAC power supply, 1 RU, IP Base feature set
WS-C3650-48FS-S	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 4x1G Uplink ports, with 1025WAC power supply, 1 RU, IP Base feature set
WS-C3650-24TS-E	Standalone with Optional Stacking 24 10/100/1000 Ethernet and 4x1G Uplink ports, with 250WAC power supply, 1 RU, IP Services feature set
WS-C3650-48TS-E	Standalone with Optional Stacking 48 10/100/1000 Ethernet and 4x1G Uplink ports, with 250WAC power supply, 1 RU, IP Services feature set
WS-C3650-24PS-E	Standalone with Optional Stacking 24 10/100/1000 Ethernet PoE+ and 4x1G Uplink ports, with 640WAC power supply, 1 RU, IP Services feature set
WS-C3650-48PS-E	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 4x1G Uplink ports, with 640WAC power supply, 1 RU, IP Services feature set
WS-C3650-48FS-E	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 4x1G Uplink ports, with 1025WAC power supply, 1 RU, IP Services feature set
Cisco Catalyst 3650 2x10G and 2x1G Uplink Series	
WS-C3650-24TD-L	Standalone with Optional Stacking 24 10/100/1000 Ethernet and 2x10G Uplink ports, with 250WAC power supply, 1 RU, LAN Base feature set
WS-C3650-48TD-L	Standalone with Optional Stacking 48 10/100/1000 Ethernet and 2x10G Uplink ports, with 250WAC power supply,

Product Number	Product Description
	1 RU, LAN Base feature set
WS-C3650-24PD-L	Standalone with Optional Stacking 24 10/100/1000 Ethernet PoE+ and 2x10G Uplink ports, with 640WAC power supply, 1 RU, LAN Base feature set
WS-C3650-24PDM-L	Standalone with Optional Stacking 24 10/100/1000 Ethernet PoE+ and 2x10G Uplink ports, with fixed 640WAC power supply, 1 RU, LAN Base feature set
WS-C3650-48PD-L	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 2x10G Uplink ports, with 640WAC power supply, 1 RU, LAN Base feature set
WS-C3650-48FD-L	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 2x10G Uplink ports, with 1025WAC power supply, 1 RU, LAN Base feature set
WS-C3650-24TD-S	Standalone with Optional Stacking 24 10/100/1000 Ethernet and 2x10G Uplink ports, with 250WAC power supply, 1 RU, IP Base feature set
WS-C3650-48TD-S	Standalone with Optional Stacking 48 10/100/1000 Ethernet and 2x10G Uplink ports, with 250WAC power supply, 1 RU, IP Base feature set
WS-C3650-24PD-S	Standalone with Optional Stacking 24 10/100/1000 Ethernet PoE+ and 2x10G Uplink ports, with 640WAC power supply, 1 RU, IP Base feature set
WS-C3650-24PDM-S	Standalone with Optional Stacking 24 10/100/1000 Ethernet PoE+ and 2x10G Uplink ports, with fixed 640WAC power supply, 1 RU, IP Base feature set
WS-C3650-48PD-S	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 2x10G Uplink ports, with 640WAC power supply, 1 RU, IP Base feature set
WS-C3650-48FD-S	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 2x10G Uplink ports, with 1025WAC power supply, 1 RU, IP Base feature set
WS-C3650-24TD-E	Standalone with Optional Stacking 24 10/100/1000 Ethernet and 2x10G Uplink ports, with 250WAC power supply, 1 RU, IP Services feature set
WS-C3650-48TD-E	Standalone with Optional Stacking 48 10/100/1000 Ethernet and 2x10G Uplink ports, with 250WAC power supply, 1 RU, IP Services feature set
WS-C3650-24PD-E	Standalone with Optional Stacking 24 10/100/1000 Ethernet PoE+ and 2x10G Uplink ports, with 640WAC power supply, 1 RU, IP Services feature set
WS-C3650-24PDM-E	Standalone with Optional Stacking 24 10/100/1000 Ethernet PoE+ and 2x10G Uplink ports, with fixed 640WAC power supply, 1 RU, IP Services feature set
WS-C3650-48PD-E	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 2x10G Uplink ports, with 640WAC power supply, 1 RU, IP Services feature set
WS-C3650-48FD-E	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 2x10G Uplink ports, with 1025WAC power supply, 1 RU, IP Services feature set
WS-C3650-8X24PD-L	Standalone with Optional Stacking 24 (16 10/100/1000 and 8 100Mbps/1/2.5/5/10 Gbps) Ethernet and 2x10G Uplink ports, with 715WAC power supply, 1 RU, LAN Base feature set
WS-C3650-8X24PD-S	Standalone with Optional Stacking 24 (16 10/100/1000 and 8 100Mbps/1/2.5/5/10 Gbps) Ethernet and 2x10G Uplink ports, with 715WAC power supply, 1 RU, IP Base feature set
WS-C3650-8X24PD-E	Standalone with Optional Stacking 24 (16 10/100/1000 and 8 100Mbps/1/2.5/5/10 Gbps) Ethernet and 2x10G Uplink ports, with 715WAC power supply, 1 RU, IP Services feature set

Product Number	Product Description
WS-C3650-12X48FD-L	Standalone with Optional Stacking 48 (36 10/100/1000 and 12 100Mbps/1/2.5/5/10 Gbps) Ethernet and 2x10G Uplink ports, with 1100WAC power supply, 1 RU, LAN Base feature set
WS-C3650-12X48FD-S	Standalone with Optional Stacking 48 (36 10/100/1000 and 12 100Mbps/1/2.5/5/10 Gbps) Ethernet and 2x10G Uplink ports, with 1100WAC power supply, 1 RU, IP Base feature set
WS-C3650-12X48FD-E	Standalone with Optional Stacking 48 (36 10/100/1000 and 12 100Mbps/1/2.5/5/10 Gbps) Ethernet and 2x10G Uplink ports, with 1100WAC power supply, 1 RU, IP Services feature set
Cisco Catalyst 3650 4x10G Uplink Series	
WS-C3650-48TQ-L	Standalone with Optional Stacking 48 10/100/1000 Ethernet and 4x10G Uplink ports, with 250WAC power supply, 1 RU, LAN Base feature set
WS-C3650-48PQ-L	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 4x10G Uplink ports, with 640WAC power supply, 1 RU, LAN Base feature set
WS-C3650-48FQ-L	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 4x10G Uplink ports, with 1025WAC power supply, 1 RU, LAN Base feature set
WS-C3650-48FQM-L	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 4x10G Uplink ports, with fixed 975WAC power supply, 1 RU, LAN Base feature set
WS-C3650-48TQ-S	Standalone with Optional Stacking 48 10/100/1000 Ethernet and 4x10G Uplink ports, with 250WAC power supply, 1 RU, IP Base feature set
WS-C3650-48PQ-S	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 4x10G Uplink ports, with 640WAC power supply, 1 RU, IP Base feature set
WS-C3650-48FQ-S	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 4x10G Uplink ports, with 1025WAC power supply, 1 RU, IP Base feature set
WS-C3650-8X24UQ-L	Standalone with Optional Stacking 24 (16 10/100/1000 and 8 100Mbps/1/2.5/5/10 Gbps) Ethernet and 4x10G Uplink ports, with 1100WAC power supply, 1 RU, LAN Base feature set
WS-C3650-8X24UQ-S	Standalone with Optional Stacking 24 (16 10/100/1000 and 8 100Mbps/1/2.5/5/10 Gbps) Ethernet and 4x10G Uplink ports, with 1100WAC power supply, 1 RU, IP Base feature set
WS-C3650-8X24UQ-E	Standalone with Optional Stacking 24 (16 10/100/1000 and 8 100Mbps/1/2.5/5/10 Gbps) Ethernet and 4x10G Uplink ports, with 1100WAC power supply, 1 RU, IP Services feature set
WS-C3650-12X48UQ-L	Standalone with Optional Stacking 48 (36 10/100/1000 and 12 100Mbps/1/2.5/5/10 Gbps) Ethernet and 4x10G Uplink ports, with 1100WAC power supply, 1 RU, LAN Base feature set
WS-C3650-12X48UQ-S	Standalone with Optional Stacking 48 (36 10/100/1000 and 12 100Mbps/1/2.5/5/10 Gbps) Ethernet and 4x10G Uplink ports, with 1100WAC power supply, 1 RU, IP Base feature set
WS-C3650-12X48UQ-E	Standalone with Optional Stacking 48 (36 10/100/1000 and 12 100Mbps/1/2.5/5/10 Gbps) Ethernet and 4x10G Uplink ports, with 1100WAC power supply, 1 RU, IP Services feature set
WS-C3650-48FQM-S	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 4x10G Uplink ports, with fixed 975WAC power supply, 1 RU, IP Base feature set
WS-C3650-48TQ-E	Standalone with Optional Stacking 48 10/100/1000 Ethernet and 4x10G Uplink ports, with 250WAC power supply, 1 RU, IP Services feature set
WS-C3650-48PQ-E	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 4x10G Uplink ports, with 640WAC power supply, 1 RU, IP Services feature set

Product Number	Product Description
WS-C3650-48FQ-E	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 4x10G Uplink ports, with 1025WAC power supply, 1 RU, IP Services feature set
WS-C3650-48FQM-E	Standalone with Optional Stacking 48 10/100/1000 Ethernet PoE+ and 4x10G Uplink ports, with fixed 975WAC power supply, 1 RU, IP Services feature set
Cisco Catalyst 3650 8x10G Uplink Series	
WS-C3650-12X48UR-L	Standalone with Optional Stacking 48 (36 10/100/1000 and 12 100Mbps/1/2.5/5/10 Gbps) Ethernet and 8x10G Uplink ports, with 1100WAC power supply, 1 RU, LAN Base feature set
WS-C3650-12X48UR-S	Standalone with Optional Stacking 48 (36 10/100/1000 and 12 100Mbps/1/2.5/5/10 Gbps) Ethernet and 8x10G Uplink ports, with 1100WAC power supply, 1 RU, IP Base feature set
WS-C3650-12X48UR-E	Standalone with Optional Stacking 48 (36 10/100/1000 and 12 100Mbps/1/2.5/5/10 Gbps) Ethernet and 8x10G Uplink ports, with 1100WAC power supply, 1 RU, IP Services feature set
Cisco Catalyst 3650 2x40G Uplink Series	
WS-C3650-12X48UZ-L	Standalone with Optional Stacking 48 (36 10/100/1000 and 12 100Mbps/1/2.5/5/10 Gbps) Ethernet and 2x40G Uplink ports, with 1100WAC power supply, 1 RU, LAN Base feature set
WS-C3650-12X48UZ-S	Standalone with Optional Stacking 48 (36 10/100/1000 and 12 100Mbps/1/2.5/5/10 Gbps) Ethernet and 2x40G Uplink ports, with 1100WAC power supply, 1 RU, IP Base feature set
WS-C3650-12X48UZ-E	Standalone with Optional Stacking 48 (36 10/100/1000 and 12 100Mbps/1/2.5/5/10 Gbps) Ethernet and 2x40G Uplink ports, with 1100WAC power supply, 1 RU, IP Services feature set
Cisco Catalyst 3650 Bundles	
WS-C3650-24PWS-S	Cisco Catalyst 3650 24 Port PoE 4x1G Uplink w/5 AP licenses IPB
WS-C3650-24PWD-S	Cisco Catalyst 3650 24 Port PoE 2x10G Uplink w/5 AP licenses IPB
WS-C3650-48FWS-S	Cisco Catalyst 3650 48 Port FPoE 4x1G Uplink w/5 AP licenses IPB
WS-C3650-48FWD-S	Cisco Catalyst 3650 48 Port FPoE 2x10G Uplink w/5 AP licenses IPB
WS-C3650-48FWQ-S	Cisco Catalyst 3650 48 Port FPoE 4x10G Uplink w/5 AP licenses IPB
WS-C3650-48PWD-S	Cisco Catalyst 3650 48 Port PoE 2x10G Uplink w/5 AP licenses IPB
WS-C3650-48PWS-S	Cisco Catalyst 3650 48 Port PoE 4x1G Uplink w/5 AP licenses IPB
Cisco Catalyst 3650 Series Spare StackWise-160 Module, Cables and Blank	
C3650-STACK-KIT=	Cisco Catalyst 3650 Stack Module spare
STACK-T2-50CM=	Cisco StackWise-160 50CM Stacking Cable Spare
STACK-T2-1M=	Cisco StackWise-160 1M Stacking Cable Spare
STACK-T2-3M=	Cisco StackWise-160 3M Stacking Cable Spare
STACK-T2-BLANK=	Cisco Catalyst 3650 Stacking Blank Spare
Cisco Catalyst 3650 Series RTU Feature License and Software Options	

Product Number	Product Description
C3650-RTU=	Paper SW License for Cisco Catalyst 3650 Switches
C3650-48-L-E	Cisco Catalyst 3650 48-port LAN Base to IP Services Paper RTU License
C3650-24-S-E	Cisco Catalyst 3650 24-port IP Base to IP Services Paper RTU License
C3650-24-L-S	Cisco Catalyst 3650 24-port LAN Base to IP Base Paper RTU License
C3650-48-L-S	Cisco Catalyst 3650 48-port LAN Base to IP Base Paper RTU License
C3650-24-L-E	Cisco Catalyst 3650 24-port LAN Base to IP Services Paper RTU License
C3650-48-S-E	Cisco Catalyst 3650 48-port IP Base to IP Services Paper RTU License
L-C3650-RTU=	Electronic SW License for Cisco Catalyst 3650 Switches
L-C3650-48-S-E	Cisco Catalyst 3650 48-port Switch IP Base to IP Services Electronic RTU License
L-C3650-48-L-S	Cisco Catalyst 3650 48-port Switch LAN Base to IP Base Electronic RTU License
L-C3650-48-L-E	Cisco Catalyst 3650 48-port Switch LAN Base to IP Services Electronic RTU License
L-C3650-24-L-S	Cisco Catalyst 3650 24-port Switch LAN Base to IP Base Electronic RTU License
L-C3650-24-S-E	Cisco Catalyst 3650 24-port Switch IP Base to IP Services Electronic RTU License
L-C3650-24-L-E	Cisco Catalyst 3650 24-port Switch LAN Base to IP Services Electronic RTU License
Access Point Licenses	
L-LIC-CT3650-UPG	Primary upgrade license SKU for Cisco 3650 wireless controller (e-delivery)
L-LIC-CTIOS-1A	1 access point adder license for Cisco IOS Software based wireless controller (e-delivery)
LIC-CT3650-UPG	Primary upgrade license SKU for Cisco 3650 wireless controller (paper license)
LIC-CTIOS-1A	1 access point adder license for the Cisco IOS Software based wireless controller (paper license)
Cisco Catalyst 3650 Series Spare Power Supplies and Fan	
PWR-C2-250WAC=	250 WAC power supply spare
PWR-C2-640WAC=	640 WAC power supply spare
PWR-C2-1025WAC=	1025 WAC power supply spare
PWR-C2-640WDC=	640 WDC power supply spare
PWR-C1-715WAC=	715WAC power supply spare
PWR-C1-1100WAC=	1100WAC power supply spare
PWR-C1-440WDC=	440WDC power supply spare

Product Number	Product Description
PWR-C2-BLANK=	Power supply blank spare
FAN-T1=	Fan module spare
Cisco Catalyst 3650 Series Spare Power Cords	
CAB-TA-NA=	AC power cord for Cisco Catalyst 3650 (North America)
CAB-TA-AP=	AC power cord for Cisco Catalyst 3650 (Australia)
CAB-TA-AR=	AC power cord for Cisco Catalyst 3650 (Argentina)
CAB-TA-SW=	AC power cord for Cisco Catalyst 3650 (Switzerland)
CAB-TA-UK=	AC power cord for Cisco Catalyst 3650 (United Kingdom)
CAB-TA-JP=	AC power cord for Cisco Catalyst 3650 (Japan)
CAB-TA-250V-JP=	Japan 250VAC power cord for Cisco Catalyst 3650 (Japan)
CAB-TA-EU=	AC power cord for Cisco Catalyst 3650 (Europe)
CAB-TA-IT=	AC power cord for Cisco Catalyst 3650 (Italy)
CAB-TA-IN=	AC power cord for Cisco Catalyst 3650 (India)
CAB-TA-CN=	AC power cord for Cisco Catalyst 3650 (China)
CAB-TA-DN=	AC power cord for Cisco Catalyst 3650 (Denmark)
CAB-TA-IS=	AC power cord for Cisco Catalyst 3650 (Israel)
CAB-C15-CBN=	Cabinet jumper power cord, 250 VAC 13A, C14-C15 connectors
CAB-C15-CBN-JP=	Japan Cabinet Jumper Power Cord, 250 VAC 13A, C14-C15
Cisco Catalyst 3650 Series Spare Accessory and Rack Mount Kits	
ACC-KIT-T1=	Accessory kit for Cisco Catalyst 3650 Series
RACK-KIT-T1=	Rack mount kit for Cisco Catalyst 3650 Series
4PT-KIT-T1=	Extension rails and brackets for four-point mounting for Cisco Catalyst 3650 Series

Optics Compatibility Information

The Cisco Catalyst 3650 Series supports a wide range of optics. Because the list of supported optics is updated on a regular basis, consult the tables available here for the latest SFP compatibility information:
https://www.cisco.com/en/US/products/hw/modules/ps5455/products_device_support_tables_list.html.

Cisco Capital

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Cisco Capital® financing can help you acquire the technology you need to achieve your objectives and stay competitive. We can help you reduce CapEx. Accelerate your growth. Optimize your investment dollars and ROI. Cisco Capital financing gives you flexibility in acquiring hardware, software, services, and complementary third-party equipment. And there's just one predictable payment. Cisco Capital is available in more than 100 countries. Learn more.

๑๓) อุปกรณ์ป้องกันเครือข่าย (Next Generation Firewall)
แบบที่ ๒

Cisco Firepower 4100 Series

Enterprise Firewall

Next Generation Firewall

Next Generation IPS

Contents

Cisco Firepower 4100 Series appliances

The Cisco Firepower 4100 Series is a family of seven threat-focused NGFW security platforms. Their throughput range addresses data center and internet edge use cases. They deliver superior threat defense, at faster speeds, with a smaller footprint. Cisco Firepower 4100 Series supports flow-offloading, programmatic orchestration, and the management of security services with RESTful APIs. Network Equipment Building Standards (NEBS)-compliance is supported by the Cisco Firepower 4120 platform. The 4100 Series platforms can run either the Cisco ASA Firewall or Cisco Firepower Threat Defense (FTD) software.

Model overview

Cisco Firepower 4100 Series summary:

Model	Firewall	NGFW	NGIPS	Interfaces	Optional Interfaces
FPR-4110	35G	11G	15G	8 x SFP+ on-chassis	2 x NM's: 1/10/40G, FTW
FPR-4115(New)	80G	26G	27G	8 x SFP+ on-chassis	2 x NMs: 1/10/40G, FTW
FPR-4120	60G	19G	27G	8 x SFP+ on-chassis	2 x NM's: 1/10/40G, FTW
FPR-4125(New)	80G	35G	41G	8 x SFP+ on-chassis	2 x NMs: 1/10/40G, FTW
FPR-4140	70G	27G	38G	8 x SFP+ on-chassis	2 x NM's: 1/10/40G, FTW
FPR-4145(New)	80G	45G	55G	8 x SFP+ on-chassis	2 x NMs: 1/10/40G, FTW
FPR-4150	75G	39G	52G	8 x SFP+ on-chassis	2 x NM's: 1/10/40G, FTW

Detailed performance specifications and feature highlights

Table 1. Performance specifications and feature highlights for Firepower 4100 with the Cisco Firepower Threat defense image

Features	4110	4115	4120	4125	4140	4145	4150
Throughput: FW + AVC (1024B)	13 Gbps	27 Gbps	22 Gbps	40 Gbps	32 Gbps	53 Gbps	45 Gbps
Throughput: FW + AVC + IPS (1024B)	11 Gbps	26 Gbps	19 Gbps	35 Gbps	27 Gbps	45 Gbps	39 Gbps
Maximum concurrent sessions, with AVC	10 million	15 million	15 million	25 million	25 million	30 million	30 million
Maximum new connections per second, with AVC	64K	200K	118K	265K	172K	350K	263K
TLS (Hardware Decryption)[1]	4.5 Gbps	6.5 Gbps	7.1 Gbps	8 Gbps	7.3 Gbps	10 Gbps	7.5 Gbps
Throughput: NGIPS (1024B)	15 Gbps	27 Gbps	27 Gbps	41 Gbps	38 Gbps	55 Gbps	52 Gbps
IPSec VPN Throughput (1024B TCP w/Fastpath)	6 Gbps	8 Gbps	10 Gbps	14 Gbps	13 Gbps	18 Gbps	14 Gbps
Maximum VPN Peers	10,000	15,000	15,000	20,000	20,000	20,000	20,000
Multi-Instance Capable	Yes						
Centralized management	Centralized configuration, logging, monitoring, and reporting are performed by the Management Center or alternatively in the cloud with Cisco Defense Orchestrator						
Application Visibility and Control (AVC)	Standard, supporting more than 4000 applications, as well as geolocations, users, and websites						
AVC: OpenAppID support for custom, open source, application detectors	Standard						
Cisco Security Intelligence	Standard, with IP, URL, and DNS threat intelligence						
Cisco Firepower NGIPS	Available; can passively detect endpoints and infrastructure for threat correlation and Indicators of Compromise (IoC) intelligence						
Cisco AMP for Networks	Available; enables detection, blocking, tracking, analysis, and containment of targeted and persistent malware, addressing the attack continuum both during and after attacks. Integrated threat correlation with Cisco AMP for Endpoints is also optionally available						
Cisco AMP Threat Grid sandboxing	Available						
URL Filtering: number of categories	More than 80						
URL Filtering: number of URLs categorized	More than 280 million						
Automated threat feed and IPS signature updates	Yes: class-leading Collective Security Intelligence (CSI) from the Cisco Talos Group (https://www.cisco.com/c/en/us/products/security/talos.html)						

Features	4110	4115	4120	4125	4140	4145	4150
Third-party and open-source ecosystem	Open API for integrations with third-party products; Snort® and OpenAppID community resources for new and specific threats						
High availability and clustering	Active/standby. Cisco Firepower 4100 Series allows clustering of up to 6 chassis						
Cisco Trust Anchor Technologies	Firepower 4100 Series platforms include Trust Anchor Technologies for supply chain and software image assurance.						

NOTE: Performance will vary depending on features activated, and network traffic protocol mix, and packet size characteristics. Performance is subject to change with new software releases. Consult your Cisco representative for detailed sizing guidance.

[1] Throughput measured with 50% TLS 1.2 traffic with AES256-SHA with RSA 2048B keys

Table 2. ASA Performance and capabilities on Firepower 4100 appliances

Features	4110	4115	4120	4125	4140	4145	4150
Stateful inspection firewall throughput[1]	35 Gbps	80 Gbps	60 Gbps	80 Gbps	70 Gbps	80 Gbps	75 Gbps
Stateful inspection firewall throughput (multiprotocol)[2]	15 Gbps	40 Gbps	30 Gbps	45 Gbps	40 Gbps	50 Gbps	50 Gbps
Concurrent firewall connections	10 million	15 million	15 million	25 million	25 million	40 million	35 million
Firewall latency (UDP 64B microseconds)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
New connections per second	150,000	848K	250,000	1.1 million	350,000	1.5 million	800,000
IPsec VPN throughput (450B UDP L2L test)	8 Gbps	15 Gbps	10 Gbps	19 Gbps	14 Gbps	23 Gbps	15 Gbps
Maximum VPN Peers	10,000	15,000	15,000	20,000	20,000	20,000	20,000
Security contexts (included; maximum)	10; 250	10; 250	10; 250	10; 250	10; 250	10; 250	10; 250
High availability	Active/active and active/standby						
Clustering	Up to 16 appliances						
Scalability	VPN Load Balancing, Firewall Clustering.						
Centralized management	Centralized configuration, logging, monitoring, and reporting are performed by Cisco Security Manager or alternatively in the cloud with Cisco Defense Orchestrator						
Adaptive Security	Web-based, local management for small-scale deployments						

Features	4110	4115	4120	4125	4140	4145	4150
Device Manager							

[1] Throughput measured with 1500B User Datagram Protocol (UDP) traffic measured under ideal test conditions.

[2] "Multiprotocol" refers to a traffic profile consisting primarily of TCP-based protocols and applications like HTTP, SMTP, FTP, IMAPv4, BitTorrent, and DNS.

[3] In unclustered configuration.

Performance testing methodologies LINK

Hardware specifications

Table 3.   Cisco Firepower 4100 Series hardware specifications

Features	4110	4115	4120	4125	4140	4145	4150
Dimensions (H x W x D)	1.75 x 16.89 x 29.7 in. (4.4 x 42.9 x 75.4 cm)						
Form factor (rack units)	1RU						
Supervisor	Cisco Firepower 4000 Supervisor with 8 x 10 Gigabit Ethernet ports and 2 Network Module (NM) slots for I/O expansion						
Network modules	8 x 10 Gigabit Ethernet Enhanced Small Form-Factor Pluggable (SFP+) network modules 4 x 40 Gigabit Ethernet Quad SFP+ network modules 8-port 1Gbps copper, FTW (fail to wire) Network Module 6-port 1 Gbps SX Fiber FTW (fail to wire) Network Module 6-port 10Gbps SR Fiber FTW (fail to wire) Network Module 6-port 10Gbps LR Fiber FTW (fail to wire) Network Module						
Maximum number of interfaces	Up to 24 x 10 Gigabit Ethernet (SFP+) interfaces; up to 8 x 40 Gigabit Ethernet (QSFP+) interfaces with 2 network modules						
Integrated network management ports	1 Gigabit Ethernet Supports 1-G fiber or copper SFPs						
Serial port	1 x RJ-45 console						
USB	1 x USB 2.0						
Storage	200 GB	400 GB	200 GB	800 GB	400 GB	800 GB	400 GB

Features		4110	4115	4120	4125	4140	4145	4150
Power supplies	Configuration	Single 1100W AC, dual optional. Single/dual 950W DC optional[1, 2]	optional. Single/dual 950W DC optional[1, 2]	Single 1100W AC, dual optional. Single/dual 950W DC optional[1]	Dual 1100W AC[1]	Dual 1100W AC[1]	Dual 1100W AC[1]	Dual 1100W AC[1]
	AC input voltage	100 to 240V AC						
	AC maximum input current	13A						
	AC maximum output power	1100W						
	AC frequency	50 to 60 Hz						
	AC efficiency	>92% at 50% load						
	DC input voltage	-40V to -60VDC						
	DC maximum input current	27A						
	DC maximum output power	950W						
	DC efficiency	>92.5% at 50% load						
	Redundancy	1+1						
Fans		6 hot-swappable fans						
Noise		78 dBA						
Rack mountable		Yes, mount rails included (4-post EIA-310-D rack)						
Weight		36 lb (16 kg): 2 x power supplies, 2 x NMs, 6x fans; 30 lb (13.6 kg): no power supplies, no NMs, no fans						
Temperature: operating		32 to 104°F (0 to 40°C)	32 to 104°F (0 to 40°C)	32 to 104°F (0 to 40°C) or NEBS operation (see below)	32 to 104°F (0 to 40°C)	32 to 95°F (0 to 35°C), at sea level	32 to 95°F (0 to 35°C), at sea level	32 to 95°F (0 to 35°C), at sea level
Temperature: nonoperating		-40 to 149°F (-40 to 65°C)						
Humidity: operating		5 to 95% noncondensing						
Humidity: nonoperating		5 to 95% noncondensing						
Altitude: operating		10,000 ft (max)	10,000 ft (max)	10,000 ft (max) or NEBS operation (see below)	10,000 ft (max)	10,000 ft (max)	10,000 ft (max)	10,000 ft (max)
Altitude: nonoperating		40,000 ft (max)						
NEBS operation (FPR 4120 only)		Operating altitude: 0 to 13,000 ft (3960 m) Operating temperature: Long term: 0 to 45°C, up to 6,000 ft (1829 m)						

Features	4110	4115	4120	4125	4140	4145	4150
	Long term: 0 to 35°C, 6,000 to 13,000 ft (1829 to 3964 m)						
	Short term: -5 to 50°C, up to 6,000 ft (1829 m)						

[1] Dual power supplies are hot-swappable.

Table 4. Cisco Firepower 4100 Series NEBS, Regulatory, Safety, and EMC Compliance

Specification	Description
Regulatory compliance	Products comply with CE markings per directives 2004/108/EC and 2006/108/EC
Safety	- UL 60950-1 - CAN/CSA-C22.2 No. 60950-1 - EN 60950-1 - IEC 60950-1 - AS/NZS 60950-1 - GB4943
EMC: emissions	47CFR Part 15 (CFR 47) Class A (FCC Class A) - AS/NZS CISPR22 Class A - CISPR22 CLASS A - EN55022 Class A - ICES003 Class A - VCCI Class A - EN61000-3-2 - EN61000-3-3 - KN22 Class A - CNS13438 Class A - EN300386 - TCVN7189
EMC: Immunity	- EN55024 - CISPR24 - EN300386 - KN24 - TVCN 7317 - EN-61000-4-2, EN-61000-4-3, EN-61000-4-4, EN-61000-4-5, EN-61000-4-6, EN-61000-4-8, EN61000-4-11

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Cisco Capital makes it easier to get the right technology to achieve your objectives, enable business transformation and help you stay competitive. We can help you reduce the total cost of ownership, conserve capital, and accelerate growth. In more than 100 countries, our flexible payment solutions can help you acquire hardware, software, services and complementary third-party equipment in easy, predictable payments. Learn more.

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๑๔) เครื่องพิมพ์ Multifunction เลเซอร์ หรือ LED สี

HP Color LaserJet Pro MFP M479 series

Lighten your workload, focus on your business

Winning in business means working smarter. The HP Color LaserJet Pro MFP M479 is designed to let you focus your time where it's most effective-growing your business and staying ahead of the competition.

HP Color LaserJet Pro M479dw

HP Color LaserJet Pro M479fnw

Dynamic security enabled printer. Only intended to be used with cartridges using an HP original chip. Cartridges using a non-HP chip may not work, and those that work today may not work in the future. Learn more at: http://www.hp.com/go/learnaboutsupplies

Highlights

- 2 sided printing
- Dual-band Wi-Fi & wireless
- Embedded Security features
- HP Roam enabled
- Scan to Sharepoint, email, USB and network folders

2-sided printing

Color touchscreen

USB drive

Wireless

Mobile printing

Printer security settings
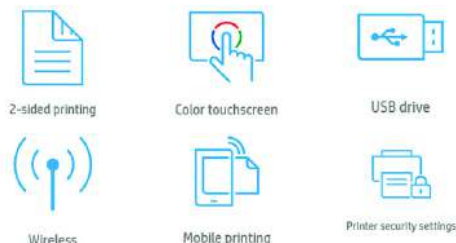
Built to keep you – and your business – moving forward

- Scan files directly to Microsoft® SharePoint®, email, USB, and network folders.[1]
- Help save time by automating all the steps in a complicated workflow and apply saved settings.[2]
- Print wirelessly with or without the network, stay connected with dual band Wi-Fi and Wi-Fi direct.[3,4,5]
- Print effortlessly from any device, virtually anywhere, to any HP printer – securely through the cloud.[6]

HP's best-in-class security – detect and stop attacks[7]

- A suite of embedded security features help protect your MFP from being an entry point for attacks.[7]
- Help ensure security of confidential information with optional PIN/Pull printing to retrieve print jobs.[8]
- Optional HP JetAdvantage Security Manager lets you set configuration.
- Thwart potential attacks and take immediate action with instant notification of security issues.[9]

Simply designed to uncomplicate your day

- Set up this MFP fast, and easily manage device settings to help increase overall printing efficiency.
- Tackle tasks quickly and easily – with the simple 10.9 cm colour touchscreen.
- Print Microsoft® office formatted files in addition to PDFs right off your USB drive.[10]
- Avoid interruptions with an HP LaserJet MFP designed to be streamlined for maximum productivity.

Sustainability is smart business

- Avoid frustrating reprints, wasted supplies, and service calls using Original HP toner cartridges.
- Help save paper right out of the box. The duplex print setting is set at default paper savings mode.[11]
- Saves up to 18% energy over prior products.[12]
- Help save energy with HP Auto-on/Auto-off technology. [13]

Product walkaround

HP Color LaserJet Pro MFP M479fdw shown

1. 10.9 cm customisable colour touchscreen
2. Easy-access USB port
3. Front door release button
4. Front door (access to HP JetIntelligence toner cartridges)
5. Hi-Speed USB 2.0 port, USB port for job storage and PIN printing, 2 Gigabit Ethernet LAN port, Fax port
6. 50 sheet ADF with single-pass, two-sided scanning supports media sizes up to 216 x 356 mm
7. Flatbed scanner handles media sizes up to A4
8. 150 sheet output bin
9. Dual-band Wi-Fi with Bluetooth® Low Energy for easy wireless printing and setup
10. 50 sheet multipurpose tray 1 supports media sizes up to 216 x 356 mm
11. Automatic two-sided printing
12. 250 sheet tray 2 supports media sizes up to 216 x 356 mm

Series at a glance

Model	HP Color LaserJet Pro MFP M479dw	HP Color LaserJet Pro MFP M479fnw	HP Color LaserJet Pro MFP M479fdn	HP Color LaserJet Pro MFP M479fdw
Product number	W1A77A	W1A78A	W1A79A	W1A80A
Functions	Print, scan, copy	Print, scan, copy, fax		
Print speeds (black and colour)	Up to 27 pages per minute (ppm)			
Scan speeds	Simplex: 29/20 ppm (black/colour)	Simplex: 29/20 ppm (black/colour); Duplex: 46/35 ipm (black/ colour)	Simplex: 29/20 ppm (black/colour); Duplex: 46/35 images per minute (ipm) (black/colour)	Simplex: 29/20 ppm (black/colour); Duplex: 46/35 ipm (black/ colour)
Scanning	50 sheet ADF with simplex scanning	50-sheet ADF with single-pass, two-sided scanning	50 sheet ADF with single-pass, two-sided scanning	50-sheet ADF with single-pass, two-sided scanning
Two-sided printing	Automatic		Manual	Automatic
50 sheet multipurpose tray 1, 250 sheet tray 2	Yes			
Optional 550 sheet tray	Add up to one			
Input capacity (standard/maximum)	Up to 300/850 sheets			
Control panel display	10.9 cm customisable colour touchscreen			
Recommended monthly page volume	Up to 4,000 pages			
Cartridge yields (A/X)	Black: ~2,400/7,500 pages; Colour: ~2,100/6,000 pages			
Dual-band Wi-Fi with Bluetooth® Low Energy	Yes			Not available

Accessories, Supplies and Support

Supplies	**W2030A** HP 415A Black Original LaserJet Toner Cartridge (2,400 pages)
	W2030X HP 415X High Yield Black Original LaserJet Toner Cartridge (7,500 pages)
	W2031A HP 415A Cyan Original LaserJet Toner Cartridge (2,100 pages)
	W2031X HP 415X High Yield Cyan Original LaserJet Toner Cartridge (6,000 pages)
	W2032A HP 415A Yellow Original LaserJet Toner Cartridge (2,100 pages)
	W2032X HP 415X High Yield Yellow Original LaserJet Toner Cartridge (6,000 pages)
	W2033A HP 415A Magenta Original LaserJet Toner Cartridge (2,100 pages)
	W2033X HP 415X High Yield Magenta Original LaserJet Toner Cartridge (6,000 pages)
	W2030XC HP 415X Black Contract LaserJet Toner Cartridge (7,500 pages) **W2031XC** HP 415X Cyan Contract LaserJet Toner Cartridge (6,000 pages) **W2032XC** HP 415X Yellow Contract LaserJet Toner Cartridge (6,000 pages) **W2033XC** HP 415X Magenta Contract LaserJet Toner Cartridge (6,000 pages)
Accessories	**CF404A** HP LaserJet 550-sheet Feeder Tray
Service and Support	**UB9S6E** HP 3 year Next Business Day Color LaserJet Pro MFP M479 Service **UB9T5PE** HP 1 year Post Warranty Next Business Day Color LaserJet Pro MFP M479 Service

Technical specifications

Model	HP Color LaserJet Pro MFP M479dw	HP Color LaserJet Pro MFP M479fnw	HP Color LaserJet Pro MFP M479fdn	HP Color LaserJet Pro MFP M479fdw
Product number	W1A77A	W1A78A	W1A79A	W1A80A
Functions	Print, copy, scan, email	Print, copy, scan, fax, email		
Control panel	10.92 cm (4.3 in) intuitive colour touchscreen (CGD); 3 Buttons (Home, Help, Back)			
Print				
Print technology	Laser			
Print speed[1]	**Black (A4, normal)** Up to 27 ppm; **Colour (A4, normal)**: Up to 27 ppm; **Black (A4, duplex)**: Up to 24 ipm; **Colour (A4, duplex)**: Up to 24 ipm;			
First page out[2]	**Black (A4, ready)**: As fast as 9.7 sec; **Colour (A4, ready)**: As fast as 11.3 sec; **Black (A4, sleep)**: As fast as 13.8 sec; **Colour (A4, sleep)**: As fast as 15.3 sec;			
Print resolution	**Black (best)**: 600 x 600 dpi, Up to 38, 400 x 600 enhanced dpi; **Colour (best)**: 600 x 600 dpi, Up to 38, 400 x 600 enhanced dpi; **Technology**: HP ImageREt 3600, PANTONE® calibrated;			
Monthly duty cycle[3]	Up to 50,000 pages A4; **Recommended monthly page volume**[4]: 750 to 4,000			
Printer smart software features	Apple AirPrint™, Mopria certified, Google Cloud Print 2.0, Wi-Fi Direct Printing, ROAM enabled for easy printing, HP ePrint, HP Auto-On/Auto-Off Technology, Bluetooth® Low-Energy, Intuitive 10.92 cm touchscreen control panel, Scan/print from Cloud using business apps on the control panel, Job Storage with PIN printing, Print from USB, N-up printing, collation	Apple AirPrint™, Mopria certified, Google Cloud Print 2.0, ROAM capable for easy printing, HP ePrint, HP Auto-On/Auto-Off Technology, Intuitive 10.92 cm touchscreen control panel, Scan/print from Cloud using business apps on the control panel, Job Storage with PIN printing, Print from USB, N-up printing, collation	Apple AirPrint™, Mopria certified, Google Cloud Print 2.0, Wi-Fi Direct Printing, ROAM enabled for easy printing, HP ePrint, HP Auto-On/Auto-Off Technology, Bluetooth® Low-Energy, Intuitive 10.92 cm touchscreen control panel, Scan/print from Cloud using business apps on the control panel, Job Storage with PIN printing, Print from USB, N-up printing, collation
Standard print languages	HP PCL 6, HP PCL 5c, HP postscript level 3 emulation, PDF, URF, Native Office, PWG Raster			
Fonts and typefaces	84 scalable TrueType fonts			
Print area	**Print margins** Top: 4.23 mm, Bottom: 4.23 mm, Left: 4.23 mm, Right: 4.23 mm; Maximum print area:			
Duplex printing	Automatic (default)	Manual (driver support provided)	Automatic (default)	
Copy				
Copy speed[5]	**Black (A4)**: Up to 27 cpm; **Colour (A4)**: Up to 27 cpm			
Copier specifications	ID Copy; Number of copies; Resize (including 2-Up); Lighter/Darker; Enhancements; Original Size; Binding Margin; Collation; Tray Selection; Two-Sided; Quality (Draft/Normal/Best); Save Current Settings; Restore Factory Defaults; **Maximum number of copies**: Up to 999 copies; **Reduce/Enlarge**: 25 to 400%;			
Scan				
Scan speed	**Normal (A4)**: Up to 29 ppm (black and white), up to 20 ppm (colour);	**Normal (A4)**: Up to 29 ppm/46 ipm (black and white), up to 20 ppm/35 ipm (colour); **Duplex (A4)**: Up to 46 ipm (black and white), up to 34 ipm (colour)	**Normal (A4)**: Up to 29 ppm/46 ipm (black and white), up to 20 ppm/34 ipm (colour); **Duplex (A4)**: Up to 46 ipm (black and white), up to 34 ipm (colour)	**Normal (A4)**: Up to 29 ppm/46 ipm (black and white), up to 20 ppm/35 ipm (colour); **Duplex (A4)**: Up to 46 ipm (black and white), up to 34 ipm (colour)
Scan file format	PDF; JPG; TIFF			
Scanner specifications	**Scanner type**: Flatbed, ADF; **Scan technology**: Contact Image Sensor (CIS); **Scan input modes**: Front-panel scan, copy, email, or file buttons, HP Scan software, and user application via TWAIN or WIA; **Twain version**: Version 2.3; **Duplex ADF scanning**: No; **Scan size maximum (flatbed)**: 216 x 297 mm; **Optical scan resolution**: Up to 1200 x 1200 dpi	**Scanner type**: Flatbed, ADF; **Scan technology**: Contact Image Sensor (CIS); **Scan input modes**: Front-panel scan, copy, email, or file buttons, HP Scan software, and user application via TWAIN or WIA; **Twain version**: Version 2.3; **Duplex ADF scanning**: Yes; **Scan size maximum (flatbed)**: 216 x 297 mm; **Optical scan resolution**: Up to 1200 x 1200 dpi		

Model	HP Color LaserJet Pro MFP M479dw	HP Color LaserJet Pro MFP M479fnw	HP Color LaserJet Pro MFP M479fdn	HP Color LaserJet Pro MFP M479fdw
Product number	W1A77A	W1A78A	W1A79A	W1A80A
Scanner advanced features	Scan to cloud (Google Drive and DropBox); Scan to email with LDAP email address lookup; Scan to network folder; Scan to USB; Scan to Microsoft SharePoint®; Scan to computer with software; Quick Sets	Single-pass 2-sided scanning ADF; Scan to cloud (Google Drive and DropBox); Scan to email with LDAP email address lookup; Scan to network folder; Scan to USB; Scan to Microsoft SharePoint®; Scan to computer with software; Fax archive to network folder; Fax archive to email; Fax to computer; Enable/disable fax; Quick Sets		
Recommended monthly scan volume	750 to 4000			
Scannable area	**Maximum media size (flatbed)**: 216 x 297 mm; **Minimum media size (ADF)**: 102 x 152 mm **Maximum media size (ADF)**: 216 x 356 mm			
Bit depth/ Grey scale levels	30-bit / 256			
Digital sending	Standard: Scan to email with LDAP email address lookup; Scan to network folder; Scan to USB; Scan to Microsoft SharePoint®; Scan to computer with software; Quick Sets	Standard: Scan to email with LDAP email address lookup; Scan to network folder; Scan to USB; Scan to Microsoft SharePoint®; Scan to computer with software; Fax archive to network folder; Fax archive to email; Fax to computer; Enable/disable fax; Quick Sets		

Fax

	HP Color LaserJet Pro MFP M479dw	HP Color LaserJet Pro MFP M479fnw	HP Color LaserJet Pro MFP M479fdn	HP Color LaserJet Pro MFP M479fdw
Fax		Yes, 33.6 kbps		
Fax specifications	**Telecom compliance**: Wireless: EU Radio Equipment Directive 2014/53/EU; EN301 489-1 V2.1.1; EN301 489-17 V3.1.1; IEC62311:2007; EN62311:2008; EN300 328 V2.1.1(2.4 GHz); EN301 893 V2.1.1	**Fax memory**: Up to 400 pages; **Fax resolution**: Standard: 203 x 96 dpi; Fine: Up to 203 x 196 dpi; Superfine: Up to 300 x 300 dpi (no halftone); **Quick dialing**: Up to 120 numbers; **Telecom compliance**: Wireless: EU Radio Equipment Directive 2014/53/EU; EN301 489-1 V2.1.1; EN301 489-17 V3.1.1; IEC62311:2007; EN62311:2008; EN300 328 V2.1.1(2.4 GHz); EN301 893 V2.1.1(5 GHz); Fax Telecom: ETSI ES 203 021; Other Telecom approvals as required by individual countries.	**Fax memory**: Up to 400 pages; **Fax resolution**: Standard: 203 x 96 dpi; Fine: Up to 203 x 196 dpi; Superfine: Up to 300 x 300 dpi (no halftone); **Quick dialing**: Up to 120 numbers; **Telecom compliance**: Fax Telecom: ETSI ES 203 021; Other Telecom approvals as required by individual countries.	**Fax memory**: Up to 400 pages; **Fax resolution**: Standard: 203 x 96 dpi; Fine: Up to 203 x 196 dpi; Superfine: Up to 300 x 300 dpi (no halftone); **Quick dialing**: Up to 120 numbers; **Telecom compliance**: Wireless: EU Radio Equipment Directive 2014/53/EU; EN301 489-1 V2.1.1; EN301 489-17 V3.1.1; IEC62311:2007; EN62311:2008; EN300 328 V2.1.1(2.4 GHz); EN301 893 V2.1.1(5 GHz); Fax Telecom: ETSI ES 203 021; Other Telecom approvals as required by individual countries.
Fax smart software features		Permanent fax memory backup; Auto fax reduction; Auto redialing; Delayed sending; Fax forwarding; TAM interface; Junk barrier; Distinctive ring detection; Cover page; Block fax; Billing codes; Save and load; Fax activity reports; Dial prefix setting; Print fax log; HP Digital Fax		
Processor speed	1200 MHz			

Connectivity

	HP Color LaserJet Pro MFP M479dw	HP Color LaserJet Pro MFP M479fnw	HP Color LaserJet Pro MFP M479fdn	HP Color LaserJet Pro MFP M479fdw
Standard	1 Hi-Speed USB 2.0 port; 1 host USB at rear side; Built-in Gigabit Ethernet 10/100/1000 Base-TX network port; 1 Wireless 802.11b/g/n/2.4/5 GHz Wi-Fi radio		1 Hi-Speed USB 2.0 port; 1 host USB at rear side; Built-in Gigabit Ethernet 10/100/1000 Base-TX network port	1 Hi-Speed USB 2.0 port; 1 host USB at rear side; Built-in Gigabit Ethernet 10/100/1000 Base-TX network port; 1 Wireless 802.11b/g/n/2.4/5 GHz Wi-Fi radio
Wireless	Yes, built-in dual-band Wi-Fi; Authentication via WEP, WPA/WPA2, WPA Enterprise; Encryption via AES or TKIP; WPS; Wi-Fi Direct; Bluetooth Low-Energy			Yes, built-in dual-band Wi-Fi; Authentication via WEP, WPA/WPA2, WPA Enterprise; Encryption via AES or TKIP; WPS; Wi-Fi Direct; Bluetooth Low-Energy
Mobile printing capability[6]	Apple AirPrint™; Google Cloud Print™; HP ePrint; HP Smart App; Mobile Apps; Mopria™ Certified; Wi-Fi® Direct Printing; Roam capable for easy printing		Apple AirPrint™; Google Cloud Print™; HP ePrint; HP Smart App; Mobile Apps; Mopria™ Certified; Roam capable for easy printing	Apple AirPrint™; Google Cloud Print™; HP ePrint; HP Smart App; Mobile Apps; Mopria™ Certified; Wi-Fi® Direct Printing; Roam capable for easy printing
Supported network protocols	TCP/IP, IPv4, IPv6; Print: TCP-IP port 9100 Direct Mode, LPD (raw queue support only), Web Services Printing, HP ePrint, Apple AirPrint™, Google Cloud Print 2.0, Mopria, IPP Print; Discovery: SLP, Bonjour, Web Services Discovery; IP Config: IPv4 (BootP, DHCP, AutoIP, Manual), IPv6 (Stateless Link-Local and via Router, Stateful via DHCPv6), SSL Security and Certificate management; Management: SNMPv1, SNMPv2, SNMPv3, HTTP/HTTPS, Syslog, FTP FW Download			
Memory	**Standard**: 512 MB NAND Flash, 512 MB DRAM; **Maximum**: 512 MB NAND Flash, 512 MB DRAM			

Media handling

	HP Color LaserJet Pro MFP M479dw	HP Color LaserJet Pro MFP M479fnw	HP Color LaserJet Pro MFP M479fdn	HP Color LaserJet Pro MFP M479fdw
Number of paper trays	**Standard**: 2 **; Maximum**: 3			
Media types	Paper (bond, brochure, coloured, glossy, photo, plain, preprinted, prepunched, recycled, rough), postcards, labels, envelopes			
Media size	**Custom (metric)**: Tray 1: 76 x 127 to 216 x 356 mm; Tray 2, optional Tray 3: 100 x 148 to 216 x 356 mm **; Supported (metric)**: Tray 1, Tray 2: A4; A5; A6; B5 (JIS); B6 (JIS); 16K (195 x 270 mm, 184 x 260 mm, 197 x 273 mm); 10 x 15 cm; Oficio (216 x 340 mm); Postcards (JIS single, JIS double); Envelopes (DL, C5, B5); Optional Tray 3: A4; A5; A6; B5 (JIS); B6 (JIS); 16K (195 x 270 mm, 184 x 260 mm, 197 x 273 mm); 10 x 15 cm; Oficio (216 x 340 mm); Postcards (JIS single, JIS double); Automatic duplexer: A4; B5; 16K (195 x 270 mm, 184 x 260 mm, 197 x 273 mm); Oficio (216 x 340 mm) **; ADF**: A4; Custom sizes 102 x 152 to 216 x 356 mm	**Custom (metric)**: Tray 1: 76 x 127 to 216 x 356 mm; Tray 2, optional Tray 3: 100 x 148 to 216 x 356 mm **; Supported (metric)**: Tray 1, Tray 2: A4; A5; A6; B5 (JIS); B6 (JIS); 16K (195 x 270 mm, 184 x 260 mm, 197 x 273 mm); 10 x 15 cm; Oficio (216 x 340 mm); Postcards (JIS single, JIS double); Envelopes (DL, C5, B5); Optional Tray 3: A4; A5; A6; B5 (JIS); B6 (JIS); 16K (195 x 270 mm, 184 x 260 mm, 197 x 273 mm); 10 x 15 cm; Oficio (216 x 340 mm); Postcards (JIS single, JIS double) **; ADF**: A4; Custom sizes 102 x 152 to 216 x 356 mm	**Custom (metric)**: Tray 1: 76 x 127 to 216 x 356 mm; Tray 2, optional Tray 3: 100 x 148 to 216 x 356 mm **; Supported (metric)**: Tray 1, Tray 2: A4; A5; A6; B5 (JIS); B6 (JIS); 16K (195 x 270 mm, 184 x 260 mm, 197 x 273 mm); 10 x 15 cm; Oficio (216 x 340 mm); Postcards (JIS single, JIS double); Envelopes (DL, C5, B5); Optional Tray 3: A4; A5; A6; B5 (JIS); B6 (JIS); 16K (195 x 270 mm, 184 x 260 mm, 197 x 273 mm); 10 x 15 cm; Oficio (216 x 340 mm); Postcards (JIS single, JIS double); Automatic duplexer: A4; B5; 16K (195 x 270 mm, 184 x 260 mm; 197 x 273 mm); Oficio (216 x 340 mm) **; ADF**: A4; Custom sizes 102 x 152 to 216 x 356 mm	
Media handling	**Standard input**: 50 sheet multipurpose tray, 250 sheet input tray, 50 sheet Automatic Document Feeder (ADF) **Standard output**: 150 sheet output bin **Optional input**: Optional 550 sheet tray **ADF**: Standard, 50 sheets uncurled			
Media weight	Tray 1: 60 to 176 g/m² (up to 200 g/m² with postcards and HP Color laser glossy photo papers); Tray 2: 60 to 163 g/m² (up to 176 g/m² with postcards, up to 200 g/m² HP Color laser glossy photo papers); Optional Tray 3: 60 to 163 g/m² (up to 176 g/m² with postcards, up to 150 g/m² Glossy media); Automatic duplexer: 60 to 163 g/m²; **ADF**: 60 to 120 g/m²	Tray 1: 60 to 176 g/m² (up to 200 g/m² with postcards and HP Color laser glossy photo papers); Tray 2: 60 to 163 g/m² (up to 176 g/m² with postcards, up to 200 g/m² HP Color laser glossy photo papers); Optional Tray 3: 60 to 163 g/m² (up to 176 g/m² with postcards, up to 150 g/m² Glossy media); **ADF**: 60 to 120 g/m²	Tray 1: 60 to 176 g/m² (up to 200 g/m² with postcards and HP Color laser glossy photo papers); Tray 2: 60 to 163 g/m² (up to 176 g/m² with postcards, up to 200 g/m² HP Color laser glossy photo papers); Optional Tray 3: 60 to 163 g/m² (up to 176 g/m² with postcards, up to 150 g/m² Glossy media); Automatic duplexer: 60 to 163 g/m²; **ADF**: 60 to 120 g/m²	

Model	HP Color LaserJet Pro MFP M479dw	HP Color LaserJet Pro MFP M479fnw	HP Color LaserJet Pro MFP M479fdn	HP Color LaserJet Pro MFP M479fdw
Product number	W1A77A	W1A78A	W1A79A	W1A80A
Input capacity	**Tray 1**: Sheets: 50; Envelopes: 5 **Tray 2**: Sheets: 250; Envelopes: 10 **Tray 3**: Sheets: 550 **Maximum**: Up to 850 sheets (with Optional 550 sheet tray) **ADF**: Standard, 50 sheets uncurled			
Output capacity	**Standard**: Up to 150 sheets Envelopes: Up to 20 envelopes **Maximum**: Up to 150 sheets			
Compatible operating systems	Windows Client OS (32/64-bit), Win10, Win8.1, Win 8 Basic, Win8 Pro, Win8 Enterprise, Win8 Enterprise N, Win7 Starter Edition SP1, UPD Win7 Ultimate, Mobile OS, iOS, Android, Mac, Apple® macOS Sierra v10.12, Apple® macOS High Sierra v10.13, Apple® macOS Mojave v10.14, Discrete PCL6 Printer Driver, for more information on the supported operating systems go to http://www.support.hp.com, enter your product name and search, click on User Guides and enter your product name and search for User Guide, search for your (Product Name) User Guide, search for the Supported Operating Systems section, UPD PCL6 / PS Printer Drivers, Supported Operating systems, for more information on the supported operating systems see http://www.hp.com/go/upd			
Compatible network operating systems	Windows Server 2008 R2 64-bit, Windows Server 2008 R2 64-bit (SP1), Windows Server 2012 64-bit, Windows Server 2012 R2 64-bit, Windows Server 2016 64-bit, Failover Cluster 2008 R2, Failover Cluster 2012 R2, Terminal server 2008 R2, Remote Desktop server 2012 R2, Citrix Server 6.5, Citrix xenApp & xenDesktop 7.6, Novell iPrint server, Citrix Ready Kit Certification - up to Citrix Server 7.18 for more information see http://www.citrixready.citrix.com, Linux - for more information see http://www.developers.hp.com/hp-linux-imaging-and-printing, Unix - for more information see http://www.hp.com/go/unixmodelscripts, UPD PCL6/PS Printer Drivers, Supported for Compatible Network Operating systems please see http://www.hp.com/go/upd			
Minimum system requirements	**Windows**: 2 GB available hard disk space, Internet connection, USB port, Internet browser, for additional OS hardware requirements see http://www.microsoft.com; **Mac**: 2 GB available hard disk space, Internet connection or USB port, for additional OS hardware requirements see http://www.apple.com			
Software included	No software solutions are included in the Box, only on http://www.hp.com, http://www.123.hp.com/laserjet			
Security management	Secure Boot, Secure Firmware Integrity, Runtime Code Integrity, password protected EWS, secure browsing via SSL/TLS 1.0, TLS 1.1, TLS 1.2; IPP over TLS; Network: enable/disable network ports and features, unused protocol and service disablement, SNMPv1, SNMPv2, and SNMPv3, community password change; HP ePrint: HTTPS with certificate validation, HTTP Basic Access Authentication, SASL authentication; LDAP authentication and authorization: Firewall and ACL, Control panel lock, certificates configuration, UPD PIN printing, Syslog, signed firmware, administrator settings, access control, 802.1x authentication (EAP-TLS, and PEAP), authentication via WEP, WPA/WPA2 Personal, WPA2-enterprise; encryption via AES or TKIP; Encrypted data storage; Secure data erase; Automatic firmware updates; Secure Encrypted Print via optional job storage, compatible with optional HP JetAdvantage Security Manager, IPPS	Secure Boot, Secure Firmware Integrity, Runtime Code Integrity, password protected EWS, secure browsing via SSL/TLS 1.0, TLS 1.1, TLS 1.2; IPP over TLS; Network: enable/disable network ports and features, unused protocol and service disablement, SNMPv1, SNMPv2, and SNMPv3, community password change; HP ePrint: HTTPS with certificate validation, HTTP Basic Access Authentication, SASL authentication; LDAP authentication and authorization; Firewall and ACL; control panel lock, certificates configuration, UPD PIN printing, Syslog, signed firmware, administrator settings, access control, 802.1x authentication (EAP-TLS, and PEAP), authentication via WEP, WPA/WPA2 Personal, WPA2-enterprise; encryption via AES or TKIP; Encrypted data storage; Secure data erase; Automatic firmware updates; Secure Encrypted Print via optional job storage, compatible with optional HP JetAdvantage Security Manager, IPPS	Secure Boot, Secure Firmware Integrity, Runtime Code Integrity, password protected EWS, secure browsing via SSL/TLS 1.0, TLS 1.1, TLS 1.2, IPP over TLS; Network: enable/disable network ports and features, unused protocol and service disablement, SNMPv1, SNMPv2, and SNMPv3, community password change; HP ePrint: HTTPS with certificate validation, HTTP Basic Access Authentication, SASL authentication; LDAP authentication and authorization: Firewall and ACL, control panel lock, certificates configuration, UPD PIN printing, Syslog, signed firmware, administrator settings, access control, 802.1x authentication (EAP-TLS, and PEAP); Encrypted data storage; Secure data erase; Automatic firmware updates; Secure Encrypted Print via optional job storage, compatible with optional HP JetAdvantage Security Manager	Secure Boot, Secure Firmware Integrity, Runtime Code Integrity, password protected EWS, secure browsing via SSL/TLS 1.0, TLS 1.1, TLS 1.2; IPP over TLS; Network: enable/disable network ports and features, unused protocol and service disablement, SNMPv1, SNMPv2, and SNMPv3, community password change; HP ePrint: HTTPS with certificate validation, HTTP Basic Access Authentication, SASL authentication; LDAP authentication and authorization: Firewall and ACL, control panel lock, certificates configuration, UPD PIN printing, Syslog, signed firmware, administrator settings, access control, 802.1x authentication (EAP-TLS, and PEAP), authentication via WEP, WPA/WPA2 Personal, WPA2-enterprise; Encryption via AES or TKIP; Encrypted data storage; Secure data erase; Automatic firmware updates; Secure Encrypted Print via optional job storage, compatible with optional HP JetAdvantage Security Manager, IPPS
Printer management	HP Printer Assistant; HP Utility (Mac); HP Device Toolbox; HP Web JetAdmin Software; HP JetAdvantage Security Manager; HP SNMP Proxy Agent; HP WS Pro Proxy Agent; Printer Administrator Resource Kit for HP Universal Print Driver (Driver Configuration Utility - Driver Deployment Utility - Managed Printing Administrator)			
Dimensions and weight				
Printer dimensions (W x D x H)	**Minimum** 416 x 472 x 400 mm; **Maximum**: 426 x 652 x 414 mm;	**Minimum** 416 x 461 x 400 mm; **Maximum**: 426 x 641 x 414 mm;	**Minimum** 416 x 472 x 400 mm; **Maximum**: 426 x 652 x 414 mm;	
Package dimensions (W x D x H)	597 x 497 x 490 mm			
Printer weight	23.3 kg	22.6 kg	23.4 kg	
Package weight	26.8 kg	26.2 kg	26.7 kg	26.8 kg
Operating environment	**Temperature**: 15 to 30°C; **Humidity**: 20 to 70% RH (non-condensing)			
Storage conditions	**Temperature**: -20 to 40°C;			
Acoustics[7]	**Acoustic power emissions**: 6.2 B(A); **Acoustic pressure emissions**: 49 dB(A)	**Acoustic power emissions**: 6.3 B(A); **Acoustic pressure emissions**: 49 dB(A)		
Power[8]	**Requirements**: 220-volt input voltage: 220 to 240 VAC (+/- 10%), 50/60 Hz (+/- 3 Hz); **Consumption**: 550 watts (Active Printing), 20 watts (Ready), 0.7 watts (Sleep), 0.7 watts (Auto-Off/Auto-On), 0.06 watts (Auto-off/Manual On), 0.06 watts (Off); **Typical Electricity Consumption (TEC)**[9]: Energy Star: 1.116 kWh/week; Blue Angel: 1.084 kWh/week; **Power supply type**: Internal (Built-in) power supply;			
Energy savings feature technology	HP Auto-On/Auto-Off Technology; Instant-on Technology			
Certifications[10]	CISPR 32:2012/EN 55032:2012 - Class B, CISPR 32:2015/EN 55032:2015 - Class B, EN 61000-3-2:2014, EN 61000-3-3:2013, EN 55024:2010+A1:2015 ENERGY STAR® qualified; EPEAT® Silver; CECP; Blue Angel RAL-UZ 205 **Blue Angel compliant** Yes, Blue Angel RAL-UZ 205	CISPR 32:2012/EN 55032:2012 - Class B, CISPR 32:2015/EN 55032:2015 - Class B, EN 61000-3-2:2014, EN 61000-3-3:2013, EN 55024:2010+A1:2015 CECP	CISPR 32:2012/EN 55032:2012 - Class B, CISPR 32:2015/EN 55032:2015 - Class B, EN 61000-3-2:2014, EN 61000-3-3:2013, EN 55024:2010+A1:2015 ENERGY STAR® qualified; EPEAT® Silver; CECP; Blue Angel RAL-UZ 205 **Blue Angel compliant** Yes, Blue Angel RAL-UZ 205	
What's in the box[11]	HP Color LaserJet Pro M479dw; 4 preinstalled Introductory HP LaserJet Toner cartridges (black 2,400 pages, cyan, magenta, yellow: 1,200 pages); In-box documentation (Getting Started Guide, Install Poster); Warranty card (where required); Internet connection is required to set up the printer; HP printer software is available at http://www.hp.com/support; Power cord; USB cable; Fax cable	HP Color LaserJet Pro M479fnw; 4 preinstalled Introductory HP LaserJet Toner cartridges (black: 2,400 pages, cyan, magenta, yellow: 1,200 pages); In-box documentation (Getting Started Guide, Install Poster); Warranty card (where required); Internet connection is required to set up the printer; HP printer software is available at http://www.hp.com/support; Power cord; USB cable; Fax cable	HP Color LaserJet Pro M479fdn; 4 preinstalled Introductory HP LaserJet Toner cartridges (Black 2,400 pages, cyan, magenta, yellow: 1,200 pages); In-box documentation (Getting Started Guide, Install Poster); Warranty card (where required); Internet connection is required to set up the printer; HP printer software is available at http://www.hp.com/support; Power cord; Fax cable	HP Color LaserJet Pro M479fdw; 4 preinstalled Introductory HP LaserJet Toner cartridges (black: 2,400 pages, cyan, magenta, yellow: 1,200 pages); In-box documentation (Getting Started Guide, Install Poster); Warranty card (where required); Internet connection is required to set up the printer; HP printer software is available at http://www.hp.com/support; Power cord; USB cable; Fax cable
Warranty	One-year, next-business day, onsite warranty. Warranty and support options vary by product, country and local legal requirements. Contact your Contractual Vendor or go to http://www.hp.com/support to learn about HP award winning service and support options in your region.			

Footnotes

[1] Requires an Internet connection to the printer. Services may require registration. App availability varies by country, language, and agreements. For details, see http://www.hpconnected.com.

[2] Connect printer/MFP to the network and complete customisation through the Embedded Web.

[3] Wireless operations are compatible with 2.4 GHz and 5 GHz operations. App or software and HP ePrint account registration may also be required. Some features require purchase of an optional accessory. Learn more at http://www.hp.com/go/mobileprinting.

[4] Feature is only supported by the HP Color LaserJet Pro MFP M479dw, M479fdw, and M477fnw. Wireless performance is dependent on physical environment and distance from access point, and may be limited during active VPN connections.

[5] Feature is supported on the HP LaserJet Pro M479dw/M479fnw/M479fdw only. Mobile device needs to be connected directly to the Wi-Fi network of a wireless direct–capable MFP or printer prior to printing. Depending on mobile device, an app or driver may also be required. Learn more at http://www.hp.com/go/businessmobileprinting.

[6] To enable HP Roam, some devices may require firmware to be upgraded and an optional accessory to add Bluetooth® Low Energy (BLE) beaconing capabilities. Subscription may be required. For more information, visit http://www.hp.com/go/roam.

[7] Based on HP review of 2019 published security features of HP in-class printers. HP offers a combination of security features that can monitor to detect and automatically stop an attack then self-validate software integrity in a reboot. For a list of printers, visit http://www.hp.com/go/PrintersThatProtect.

[8] Pin printing enabled via USB installed in rear of device.

[9] Instant threat notifications can appear on the device control panel when a potential threat occurs from malicious intent or there is a bug or vulnerability in the firmware code of the device. If this error raises concern, please contact your company IT representative or, if unavailable, HP Support, who can investigate the cause through analysis of device syslog data using a standard SIEM tool from McAfee, Splunk, Arcsight or SIEMonster. The control panel error message may show an error code on a blue screen during code signature checks or memory write intrusions.

[10] Microsoft and PowerPoint are U.S. registered trademarks of the Microsoft group of companies. Feature works with Microsoft Word and PowerPoint 2003 and later. Only Latin language fonts are supported.

[11] Dependent upon country setup specifications. All new product introductions beginning in Fall 2019 will include consistent worldwide default duplex settings (across bundles/drivers); Spring 2019 will include consistent worldwide default duplex settings for most products across the most common drivers.

[12] Based on HP Internal testing using normalised TEC Value, 2019.

[13] HP Auto-On/Auto-Off Technology capabilities subject to printer and settings; may require a firmware upgrade.

Technical specifications disclaimers

[1] Measured using ISO/IEC 24734, excludes first set of test documents. For more information see http://www.hp.com/go/printerclaims. Exact speed varies depending on the system configuration, software application, driver, and document complexity.

[2] Measured using ISO/IEC 17629. For more information see http://www.hp.com/go/printerclaims. Exact speed varies depending on the system configuration, software application, driver, and document complexity.

[3] Duty cycle is defined as the maximum number of pages per month of imaged output. This value provides a comparison of product robustness in relation to other HP LaserJet or HP Color LaserJet devices, and enables appropriate deployment of printers and MFPs to satisfy the demands of connected individuals or groups.

[4] HP recommends that the number of pages per month of imaged output be within the stated range for optimum device performance, based on factors including supplies replacement intervals and device life over an extended warranty period.

[5] First Copy Out from Ready and Simplex Copy Speed measured using ISO/IEC 29183, Duplex Copy Speed measured using ISO/IEC 24735, excludes first set of test documents. For more information see http://www.hp.com/go/printerclaims. Exact speed varies depending on the system configuration, software application and document complexity.

[6] Local printing requires mobile device and printer to be on the same network (usually Wi-Fi access points bridge wireless to wired connections) or have a direct wireless connection. Wireless performance is dependent on physical environment and distance from access point. Remote printing requires an Internet connection to an HP web-connected printer. Wireless broadband use requires separately purchased service contract for mobile devices. Check with service provider for coverage and availability in your area. For more information visit http://www.hp.com/go/mobileprinting. To enable HP Roam, some devices may require firmware to be upgraded and an optional accessory to add Bluetooth® Low Energy (BLE) beaconing capabilities. Subscription may be required. For more information, visit http://www.hp.com/go/roam.

[7] Acoustic values are subject to change. For current information see http://www.hp.com/support. Configuration tested: base model, simplex printing, A4 paper at an average of 27 ppm.

[8] Power requirements are based on the country/region where the printer is sold. Do not convert operating voltages. This will damage the printer and void the product warranty. Power consumption values typically based on measurement of 115V device.

[9] Blue Angel TEC is equal to Best TEC. Power requirements are based on the country/region where the printer is sold. Do not convert operating voltages. This will damage the printer and void the product warranty. Energy Star value typically based on measurement of 115V device.

[10] EPEAT® registered where applicable. EPEAT registration varies by country. See http://www.epeat.net for registration status by country.

[11] In box cartridges yield: 1,200 colour composite (C/Y/M) and 2,400 black pages based on ISO/IEC 19798 and continuous printing. Actual yields vary considerably based on images printed and other factors. For details see: http://www.hp.com/go/learnaboutsupplies. Pages may vary based on customer printing conditions.

http://www.hp.com/uk

๑๕) เครื่องพิมพ์เลเซอร์ หรือ LED ขาวดำ

Print, Wireless[6]

HP Laser 107 Printer Series

Laser performance at an affordable price

Get productive print performance at an affordable price. Produce high-quality results and print and scan from your phone.[1,6]

Dynamic security enabled printer. Only intended to be used with cartridges using an HP original chip. Cartridges using a non-HP chip may not work, and those that work today may not work in the future. Learn more at hp.com/go/learnaboutsupplies

(HP Laser 107a Printer)

(HP Laser 107w Printer)

Legendary quality, surprisingly affordable price

- This surprisingly small laser delivers exceptional quality, page after page.
- Produce sharp text, bold blacks and crisp graphics.
- Rely on a high-performance laser printer at an affordable price.

Designed to fit your space

- You can fit this printer almost anywhere – it's that small and compact.
- Get print speeds up to 20 ppm (A4).[2]

Easy mobile printing and scanning with HP Smart app[6]

- Get simple setup, print and scan from your phone, with the HP Smart app.[1,6]
- Easily print from a variety of smartphones and tablets.[3,6]
- Easily share resources – access and print with wireless networking.[4,6]
- Connect your smartphone or tablet directly to your printer – and easily print without accessing a network.[5,6]

Product walkaround

HP Laser 107w Printer shown

RMPV as high as 1,500 pages

150-sheet input, 100-sheet output

Wireless technology so you can print on the go[3,4]
- Wi-Fi direct
- AirPrint 1.8

USB 2.0 high-speed connectivity

HP Smart app[1,4]
- Print from virtually anywhere with your smartphone
- Simple setup from your phone
- Receive printer status notifications

Speeds up to 20 ppm (A4)[2]

Advanced toner placement technology

Space-saving design

Series at a glance

	HP Laser 107a Printer	HP Laser 107w Printer
Product number	4ZB77A	4ZB78A
Function	Print	Print, wireless
Memory / processor	64MB / 400MHz	64MB / 400MHz
Control panel	Buttons (Power, Cancel); LED indicator lights (Power, Toner, Attention)	Buttons (Power, Cancel, Wireless); LED indicator lights (Power, Wireless, Toner, Attention)
Mobile printing	Not available	Apple AirPrint™; Google Cloud Print™; Mobile Apps; Mopria™ Certified; Wi-Fi® Direct printing
Connectivity	Hi-Speed USB 2.0 port	Hi-Speed USB 2.0 port, Wireless 802.11 b/g/n
Recommended monthly page volume	100 to 1,500 pages	100 to 1,500 pages
Print speed	**Black (normal, A4):** Up to 20 ppm	**Black (normal, A4):** Up to 20 ppm

[1] Requires the HP Smart app download. For details on local printing requirements, see hp.com/go/mobileprinting. [2] Excludes first set of ISO test pages. For details, see hp.com/go/printerclaims. [3] Wireless performance is dependent upon physical environment and distance from access point and may be limited during active VPN connections. [4] Applicable to HP Laser 107w Printer model only.

HP Services

Downtime can have serious consequences, so HP provides support beyond the standard warranty. You benefit from reduced risk, maximized uptime, predictable service delivery and no unbudgeted repair costs. Choose from:

Optimized Care (optimum performance and stability): 4 hour Onsite Support, Maintenance Kit Replacement Service, Installation with Network Configuration Service

Standard Care (high level of uptime): Next Business Day Onsite Support, Maintenance Kit Replacement Service, Installation with Network Configuration Service

Basic Care (minimum recommended support): Next Business Day Onsite Support

4 hour Onsite Support: Onsite support within four hours after a service call received within the coverage window

Next Business Day Onsite Support: Onsite service the next business day after the service call is received

Maintenance Kit Replacement Service: Onsite replacement of your printer's maintenance kit including parts, materials, and labor

Installation with Network Configuration Service: Assembly, network configuration, and basic administrator familiarization. For more information about HP Care Pack, HP Contractual, or HP Managed Print Services, visit hp.com/go/printservices

Mac

Windows 10

USB

Top Features

Get the quality you trust and sharp black text with this affordable printer.

Quickly and easily print with a printer that's designed to fit into your workspace like a glove.

Print from virtually anywhere, and get simple setup on your phone.[1,2]

Product	
4ZB77A	HP Laser 107a Printer
4ZB78A	HP Laser 107w Printer

Replacement Cartridges[3]	
W1107A	HP 107A Black Original Laser Toner Cartridge (~1,000 pages) - APJ excluding CH/IN

HP Care Packs	
UB4V5E	HP 3-year Onsite Exchange Laser 10x MFP SVC
UB4V8E	HP 3-year Next Business Day Exchange Laser 10x MFP SVC
UB4W1E	HP 3-year Standard Exchange Laser 10x MFP SVC
UB4W4E	HP 3-year Return to Depot Laser 10x MFP SVC

Protect your investment with HP Care Pack. Let HP certified engineers resolve your technical issues.
For more details on HP Care Pack, go to hp.com/go/cpc

Hewlett-Packard offices		
Indonesia	(62-21) 5799 1088	hp.com/id
Philippines	(632) 888 5900	hp.com/ph
Thailand	(662) 353 9500	hp.com/th
Vietnam	(848) 3823 4151	hp.com/vn

Recommended Papers[4]	
CG964A	HP Professional Laser Paper, Glossy, A4, 250 sheets, 120 gsm
CG965A	HP Professional Laser Paper, Glossy, A4, 150 sheets, 150 gsm
CG966A	HP Professional Laser Photo Paper, Glossy, A4, 100 sheets, 200 gsm
Q6550A	HP Professional Laser Photo Paper, Matte, A4, 100 sheets

Please visit hp.com/apac/paper for more details

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[1] Requires the HP Smart app download. For details on local printing requirements see hp.com/go/mobileprinting [2] Applicable to HP Laser 107w Printer model only. [3] Declared yield value in accordance with ISO/IEC 19752 and continuous printing. Actual yields vary considerably based on images printed and other factors. For details see hp.com/go/learnaboutsupplies. [4] Available in selected countries only.

Technical specifications

Model	HP Laser 107a Printer (4ZB77A)	HP Laser 107w Printer (4ZB78A)
Number of user	1-5 Users	
Functions	Print only	Print, Wireless
Print		
Technology	Laser	
Speed[1]	**Black (normal, A4):** Up to 20 ppm	
Duplex print options	Manual (driver support provided)	
First page out[2]	**Black (A4, ready):** As fast as 8.3 seconds; **Black (A4, sleep):** As fast as 18 seconds (15 min)	
Resolution	**Black (best):** Up to 1200 x 1200 dpi; **Black (normal):** Up to 600 x 600 dpi	
Cartridges number	1 (black)	
Standard print languages	SPL	
Display	LED	
Control panel	Buttons (Power, Cancel); LED indicator lights (Power, Toner, Attention)	Buttons (Power, Cancel, Wireless); LED indicator lights (Power, Wireless, Toner, Attention)
Duty cycle (monthly, A4)[3]	Up to 10,000 pages	
Recommended monthly page volume[4]	100 to 1,500 pages	
Media		
Sizes (Supported)	A4; A5; A5(LEF); B5 (JIS); Oficio; Envelope (DL, C5); 76 x 127 to 216 x 356mm	
Weight (Supported)	60 to 163 g/m²	
Types	Plain, Thick, Thin, Cotton, Colour, Preprinted, Recycled, Labels, CardStock, Bond, Archive, Envelope	
Paper handling	**Input:** 150-sheet input tray; **Output:** 100-sheet output bin	
Memory	**Standard/Maximum:** 64 MB	
Processor speed	400 MHz	
Operating system compatibility	Windows®: 7 (32/64 bit), 2008 Server R2, 8 (32/64 bit), 8.1 (32/64 bit), 10 (32/64 bit), 2012 Server, 2016 Server	
Minimum system requirements	**PC:** Windows 7 or newer, Intel® Pentium® IV 1 GHz 32-bit or 64-bit processor or higher, 1 GB RAM, 16 GB HDD	
Connectivity		
Connectivity (standard)	Hi-Speed USB 2.0 port	Hi-Speed USB 2.0 port, Wireless 802.11 b/g/n
Wireless capability	Not available	Yes, built-in Wi-Fi 802.11b/g/n
Mobile printing capability	Not available	Apple AirPrint™; Google Cloud Print™; Mobile Apps; Mopria™ Certified; Wi-Fi® Direct printing
Supported network protocols	Not available	Via built-in networking solution: TCP/IP, IPv4, IPv6; print: TCP-IP port 9100 Direct Mode, LPD (raw queue support only), WSD; discovery: SLP, Bonjour, WS-Discovery; IP Config: IPv4 (BootP, DHCP, AutoIP, Manual), IPv6 (Stateless Link-Local and via Router, Stateful via DHCPv6); management: SNMPv1/v2/v3, HTTP
Security management	Not available	Password-protected network embedded Web server; enable/disable Network ports; SNMPv1 community password change; SNMPV2&V3; IPSec; Filtering : MAC, IPv4, IPv6
Environmental		
Acoustics	**Acoustic power emissions (active, printing):** 6.5 B(A)	
Operating environment	**Operating temperature range:** 10 to 30° C; **Recommended operating temperature:** 15 to 27° C; **Operating humidity range:** 10 to 80% RH (non-condensing); **Recommended operating humidity range:** 20 to 70% RH (non-condensing); **Storage temperature range:** -20 to 40° C	
Energy Savings Feature Technology	HP Auto-Off Technology; Power save	
Power specifications	**Power supply type:** Internal (Built-in) power supply; **Power supply required:** 110-volt input voltage: 110 to 127 VAC, 50/60Hz and 220-volt input voltage: 220 to 240 VAC, 50/60Hz; **Power consumption:**[5] 320 watts (Active Printing), 33 watts (Ready), 1.1 watts (Sleep), 0.2 watts (Manual off), 0.2 watts (Auto off/Manual on); **Typical Electricity Consumption (TEC):**[6] 0.731 kWh/Week (BA), 0.775 kWh/Week (ES)	
Dimension (W x D x H)[7]	331 x 215 x 178 mm	
Weight[8]	4.18 kg	
Warranty	One-year limited hardware warranty; For more info please visit us at support.hp.com	
What's in the box[9]	HP Laser 107a Printer; Preinstalled introductory HP LaserJet Black print cartridges (~0.5K pages, WW); Setup Guide; Reference Guide; Regulatory Statements Flyer; Power cord; USB cable	HP Laser 107w Printer; Preinstalled introductory HP LaserJet Black print cartridges (~0.5K pages, WW); Setup Guide; Reference Guide; Regulatory Statements Flyer; Power cord; USB cable

To learn more, visit hp.com

๑๖) สแกนเนอร์ สำหรับงานเก็บเอกสารทั่วไป

ออกแบบให้มีขนาดกะทัดรัด สแกนได้ทุกที่ ให้ประสิทธิภาพการสแกนที่เหนือกว่า

Epson Perfection™ V39 ให้ประสิทธิภาพการสแกนที่ดีเยี่ยมและคุณสมบัติการสแกนที่เหนือกว่า
เพื่อครอบคลุมรายละเอียดให้ได้มากที่สุด สแกนเนอร์ V39 ออกแบบให้ประหยัดพื้นที่ ขนาดกะทัดรัด
และน้ำหนักเบา สะดวกต่อการใช้งานและสามารถเคลื่อนย้ายได้ ด้วยขาตั้งที่มาพร้อมตัวเครื่อง
คุณสามารถสแกนในแนวตั้งได้อย่างง่ายดายโดยไม่ต้องคำนึงถึงข้อจำกัดด้านพื้นที่

V39

| USB Powered | สแกน สูงสุด A4 | ไฟ LED | Easy Photo Scan | Scan 4800 dpi |

IT'S IN THE DETAILS.

สะดวกสบายกว่า
เพียงเชื่อมต่อสแกนเนอร์กับ USB
ผ่านเครื่องคอมพิวเตอร์หรือ Laptop
เพื่อเริ่มการสแกน ได้ทุกที่ ทุกเวลา

เอนกประสงค์และล้ำสมัย
สแกนเนอร์ใช้พื้นที่ที่จำกัด มาพร้อมขาตั้งภายในตัวเครื่อง
ออกแบบให้มีขนาดกะทัดรัด สวยงามและล้ำสมัย

สแกนได้ง่าย
ด้วยบานพับที่สามารถขยายได้และฝาปิดที่ถอดได้
คุณสามารถสแกนเอกสารและหนังสือที่มีความหนา
ได้อย่างง่ายดาย

Document
Capture
PRO

อัดแน่นด้วยคุณสมบัติที่ล้ำสมัย เช่น เทคโนโลยี ReadyScan LED และ Document Capture Software สแกนเนอร์ประสิทธิภาพสูง ช่วยให้คุณสามารถแปลงเป็นไฟล์ดิจิทัล สำหรับตรวจสอบและจัดการเอกสารของคุณได้อย่างง่ายดาย ออกแบบให้มีขนาดกะทัดรัดและล้ำสมัย คุณจะพบกับประสิทธิภาพการสแกนที่ดีเยี่ยมในระหว่างการเดินทาง

สะดวกสบายกว่า

ประหยัดพื้นที่และลดความยุ่งยากในการติดตั้งที่ซับซ้อน สแกนเนอร์ V39 สามารถเชื่อมต่อเครื่องสแกนกับเครื่องคอมพิวเตอร์ด้วยสาย USB เพียงเส้นเดียวเพื่อเริ่มการสแกน

เพิ่มความสะดวกมากขึ้น คุณสามารถเปิดสแกนเนอร์ V39 ด้วย USB port จาก Laptop ของคุณ สำหรับการสแกนได้ทุกที่ ทุกเวลา

เอนกประสงค์และล้ำสมัย

ออกแบบให้มีขนาดเล็กและกะทัดรัด สแกนเนอร์ V39 สามารถนำติดตัวไปได้ทุกที่ มาพร้อมขาตั้งภายในตัวเครื่อง คุณสามารถใช้สแกนเนอร์ในแนวตั้งกับสถานที่ที่มีพื้นที่จำกัดได้อย่างง่ายดาย

สแกนได้ง่าย

Document Capture Software*

ง่ายต่อการสแกน ตรวจสอบ แก้ไข บันทึกและโอนเอกสารที่สแกน Software สามารถอ่านบาร์โค้ด ตัวอักษร และหน้าว่างในเอกสาร ที่สแกนเพื่อแยก Sections เข้าไปใน Folders ที่แตกต่างกัน รองรับการกำหนดค่าโดยผู้ใช้ถึง 30 ค่า ช่วยให้คุณจัดการไฟล์ที่สแกนทั้งหลายได้อย่างรวดเร็วและง่ายดาย

Software ยังให้การเข้าถึงอย่างสะดวกและรวดเร็วไปยังปลายทางหลังการสแกนจำนวนมาก รวมถึง scan-to-print, email, Windows® Public Folder, FTP, Web Folder, และ Scan-to-Cloud services เช่น Microsoft® SharePoint Server, Evernote® Google® Drive™ และ SugarSync®

*Document Capture Pro (Windows), Document Capture (Mac OS X)

Easy Photo Scan

ด้วย User Interface คุณสามารถสแกน ตรวจสอบ แก้ไข บันทึกและโอนเอกสารที่สแกนได้อย่างง่ายดาย ผ่าน Easy Photo Scan มาพร้อมฟังก์ชั่นแก้ไขภาพถ่ายถึง 8 ฟังก์ชั่น เช่น การหมุนภาพ การปรับภาพอัตโนมัติ และปรับภาพด้วยตัวเอง Soft Focus และการแก้ไขตาแดง ช่วยให้คุณปรับและแก้ไขภาพถ่ายได้ตามต้องการ โหมดแสดงตัวอย่างและโหมดแสดงภาพแบบย่อ ช่วยให้คุณสามารถเลือก แก้ไขและตรวจสอบภาพก่อนพิมพ์ได้ง่ายใน application

Post-scan destinations รวมถึง Local Folder, Web Folder, email, Facebook, Picasa™, Evernote® และ SugarSync® สามารถเข้าถึงได้อย่างง่ายดายผ่าน Software
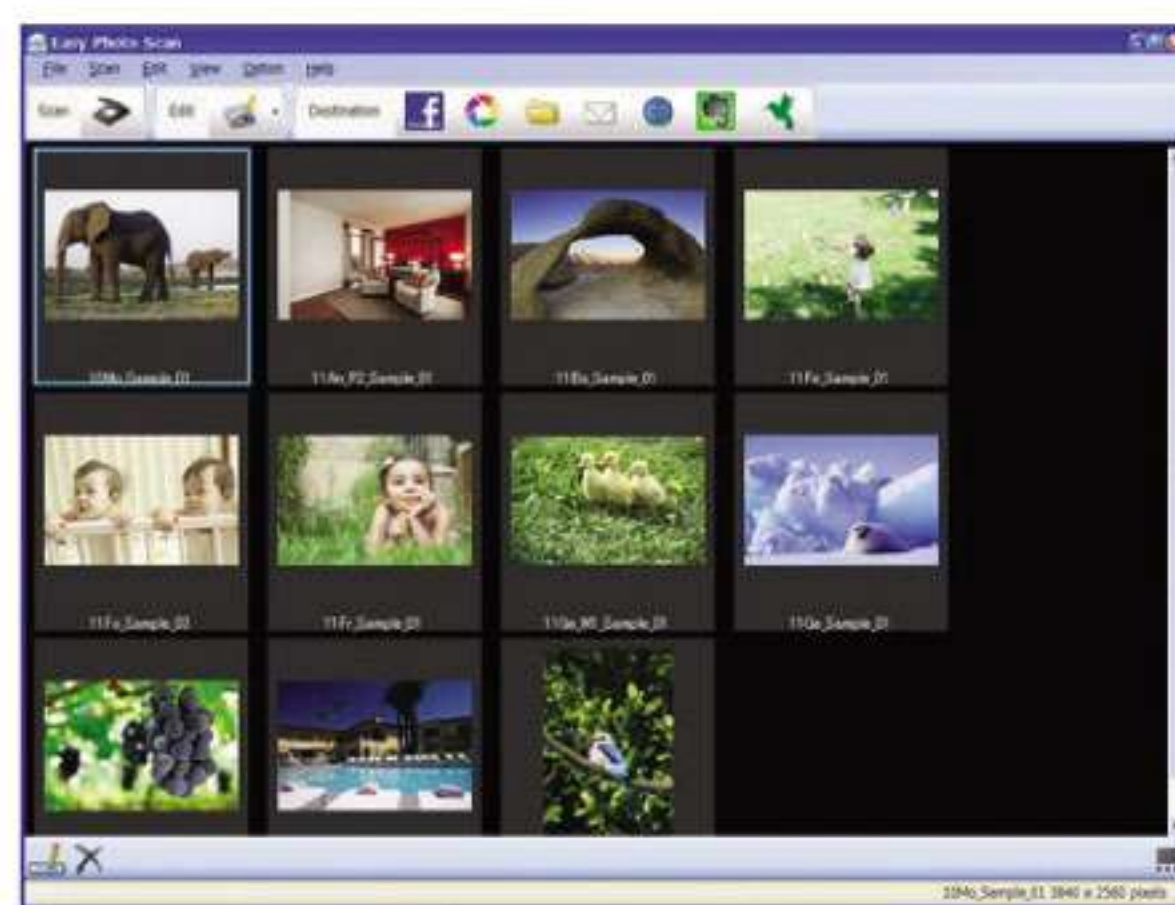
Epson ScanSmart

คุณสามารถสแกนเอกสารขนาดใหญ่และรวมเป็นภาพเดียวกันได้ด้วย Epson ScanSmart ซอฟต์แวร์อัจฉริยะที่ช่วยให้คุณปรับแต่งเอกสารได้อย่างง่ายดาย รวมถึงเรียงหน้ากระดาษ จัดเอกสาร ปรับรูปภาพโดยอัตโนมัติและบันทึกไฟล์ได้หลากหลายนามสกุล อีกทั้งยังสามารถสร้างไฟล์ PDF ที่ง่ายต่อการค้นหาและจัดเก็บ
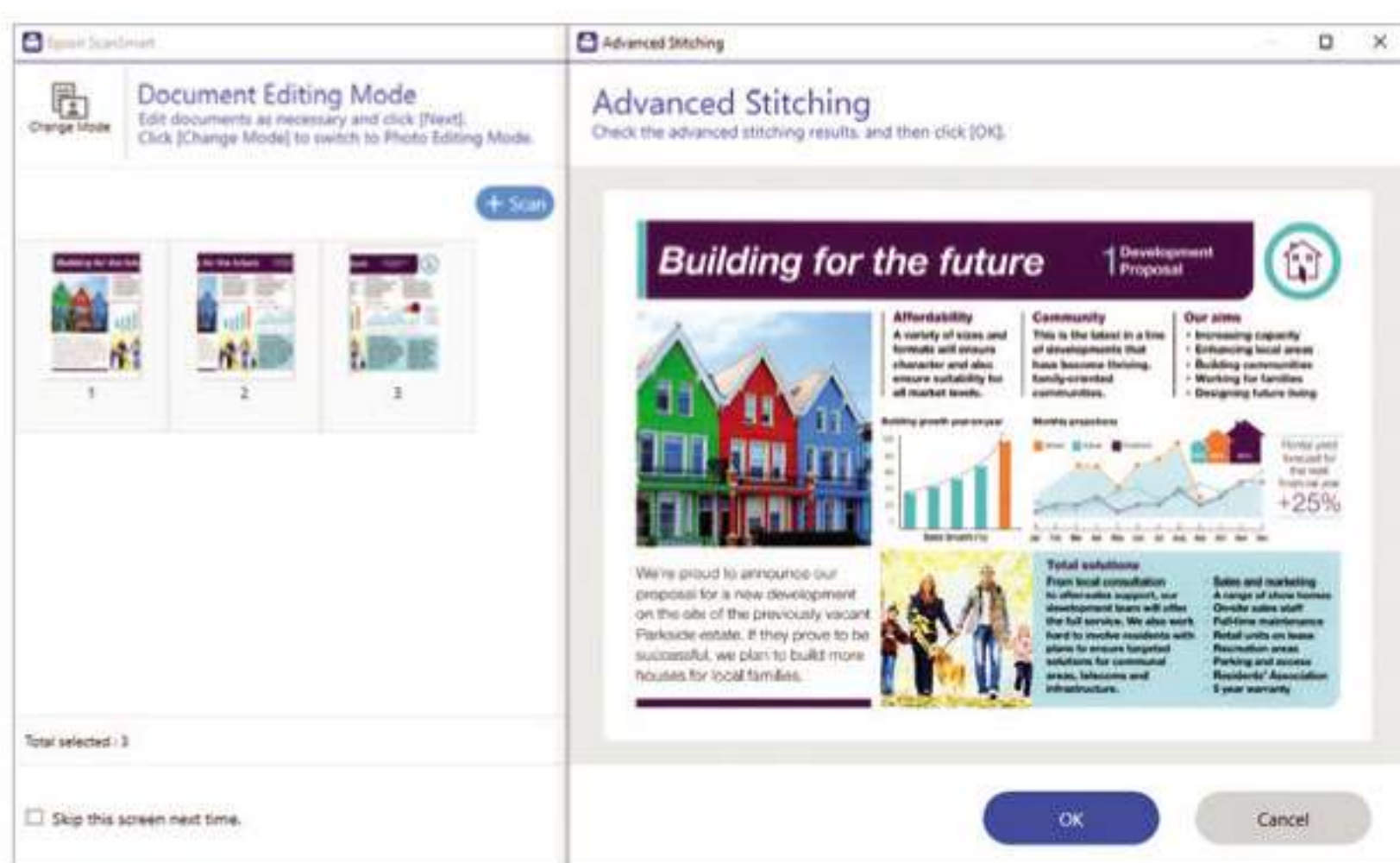
ฟังก์ชั่นใช้งานเพียงสัมผัสเดียว

สแกนเนอร์ V39 มีปุ่มสัมผัสเดียวถึง 4 ปุ่ม ที่สามารถกำหนดค่าล่วงหน้าได้ เหมาะสำหรับการสแกนงานประจำให้ง่ายขึ้น Epson Event Manager ช่วยให้คุณกำหนดค่าโดยผู้ใช้ได้ถึง 10 ค่าและสั่งงานโดยการกดปุ่มบนสแกนเนอร์

สแกนไปยัง PDF	ส่งไปยัง Easy Photo Scan	ทำสำเนา	สแกนและบันทึก
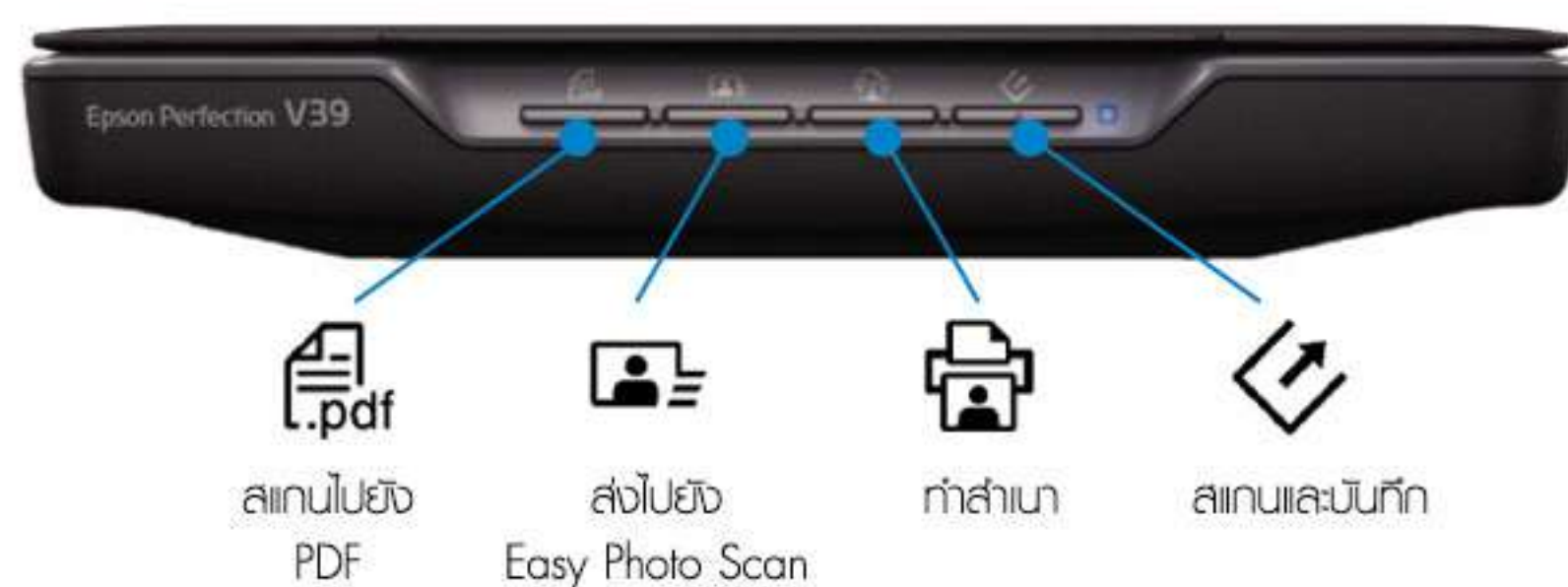
บานพับขยายได้และฝาปิดถอดได้

บานพับขยายได้ของสแกนเนอร์ V39 ช่วยให้คุณสามารถสแกนเอกสารได้หนาถึง 6 มิลลิเมตร ด้วยการปิดฝา และสำหรับเอกสารที่หนากว่านั้น เช่น หนังสือหรืออัลบั้มภาพถ่าย ก็สามารถสแกนได้อย่างง่ายดายเพียงถอดฝาปิดออก

ไม่ต้อง Warm-Up และคุณสมบัติที่เป็นมิตรกับสิ่งแวดล้อม

ด้วยเทคโนโลยี Epson ReadyScan LED ของสแกนเนอร์ V39 การสแกนเริ่มต้นทันทีโดยไม่จำเป็นต้องใช้เวลา Warm-Up โดยการใช้แหล่งกำเนิดแสงแบบ LED ปราศจากสารปรอท สแกนเนอร์เป็นมิตรกับสิ่งแวดล้อม การกระจายตัวต่ำในความร้อนทำให้คุณประหยัดพลังงานและประหยัดค่าใช้จ่าย

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รุ่น	V39
ข้อมูลพื้นฐาน	
ประเภทสแกนเนอร์	สแกนเนอร์ภาพสีแนวระนาบ
ความละเอียดออปติค*1	4,800 x 4,800 dpi
ขนาดเอกสาร	สูงถึง 216 x 297 มิลลิเมตร
พอร์ตเชื่อมต่อ	Hi-Speed USB 2.0
ระบบเครื่อง	
เซ็นเซอร์ออปติค	Contact Image Sensors (CIS)
	40,800 x 56,160 พิกเซล (4,800 dpi)
แหล่งกำเนิดแสง	LED
วิธีการสแกนรอง	เอกสารอยู่กับที่และแคร่เลื่อนที่
ประสิทธิภาพ	
ความละเอียดเอาต์พุต*2	50 - 4,800 dpi, 7,200 dpi, 9,600 dpi
	(50 - 4,800 dpi เพิ่มขั้นละ 1 dpi)

ความลึกพิกเซล

	สี	48-bit input, 24-bit output
	เฉดสีเทา	16-bit input, 8-bit output
	ขาวดำ	16-bit input, 1-bit output

ความเร็วการสแกน

การสแกนแบบสะท้อนแสง

		DPI	ความเร็ว
	แสดงตัวอย่าง		10.4 วินาที
	ขาวดำ 1 บิต	300	10.4 วินาที
		600	12.0 วินาที
		1,200	37.0 วินาที
	สี 24 บิต	300	9.9 วินาที
		600	29.0 วินาที
		1,200	103.0 วินาที

ฟังก์ชั่น

Driver และ Software ภายในตัวเครื่อง	Epson Scan
	Epson OCR Component (Win)
	Document Capture Pro (Win)/Document Capture (Mac)
	Easy Photo Scan
	Epson Event Manager
	Epson Copy Utility
	Epson ScanSmart
รองรับระบบ	Microsoft Windows XP SP2/Vista/7/8/8.1/10
	Mac OS X 10.6.x หรือสูงกว่า

สภาพแวดล้อมการทำงาน

อุณหภูมิ	ขณะทำงาน	10 - 35°C
	จัดเก็บ	-20 - 60°C
ความชื้น	ขณะทำงาน	20 - 80% (ไม่มีการควบแน่น)
	จัดเก็บ	20 - 80% (ไม่มีการควบแน่น)

ข้อมูลจำเพาะทางไฟฟ้า

แรงดัน		5.0V (USB Bus Power)
การสิ้นเปลืองพลังงาน	ขณะทำงาน	2.5W
	เตรียมพร้อม	1.1W
	ปิดเครื่อง	0.0125W

ขนาดและน้ำหนัก

V39
น้ำหนัก: 1.5 กก. (3.4 ปอนด์)

39 มม. (1.6 นิ้ว)
364 มม. (14.4 นิ้ว)
249 มม. (9.9 นิ้ว)

*1 ความละเอียด Optical ตามมาตรฐาน ISO 14473

*2 ตามการประมาณค่า พื้นที่การสแกนอาจจะจำกัด ถ้ากำหนดค่าความละเอียดสูง

ตราประทับของตัวแทนจำหน่าย

เมษายน 2563

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บริษัท เอปสัน (ประเทศไทย) จำกัด
1 อาคารเอ็มไพร์ทาวเวอร์ ชั้น 42 ถนนสาทรใต้
ยานนาวา สาทร กรุงเทพฯ 10120
โทรศัพท์ : 662-685-9888
โทรสาร : 662-670-0688

EpsonThailand
YouTube Epson Thailand
Call Center 0-2685-9899

๑๗) ตู้สำหรับจัดเก็บเครื่องคอมพิวเตอร์และอุปกรณ์

แบบที่ ๓ (ขนาด ๔๒ U)
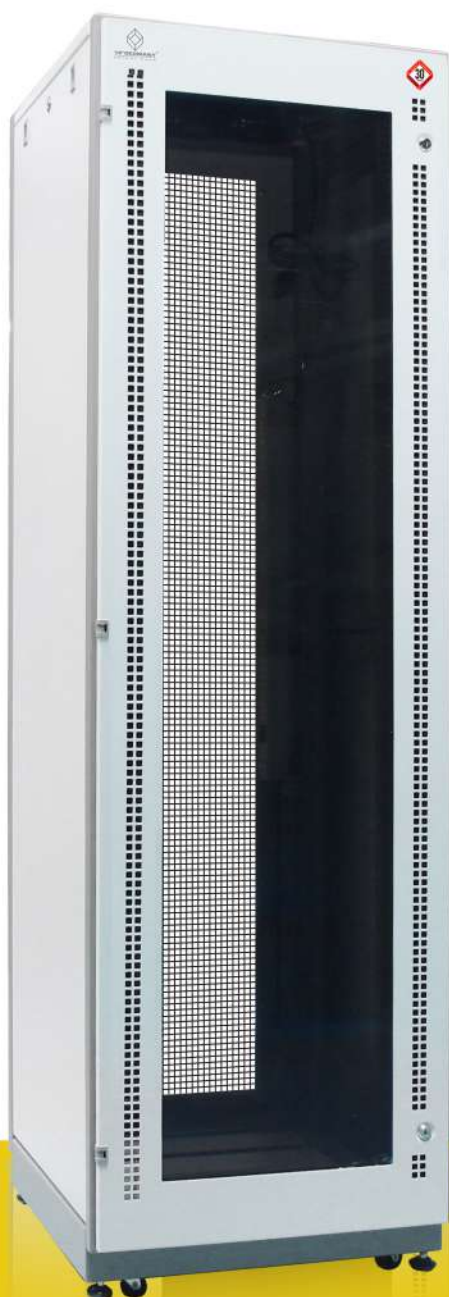
SERVER RACK

G4 SERIES

Ventilation Slot

Mounting Pole w/screen UH

Front Door w/logo

Security Cam Locks

FEATURES

◈ **Designed and Manufactured** to comply with the standard of ANSI/EIA-310D-1992 (Rev.EIA-310C), IEC60297-1, IEC60297-2, BS5954 Part : 2, DIN 41494, 19" Standard.

◈ **Modular Knock Down** System in order to be delivered conveniently.VCD manual displaying every step of assembly is provided.

◈ **Produced** from Electro-Galvanized Sheet Steel with thickness of 1.5 mm. Mounting Pole, Frame Structure and Base made of 2.0 mm. Electro-galvanized Sheet Steel. Castor Base stand made of 3.0 mm. steel, 100% rust proof.

◈ **The structure** mounted as wedge lock for strength increasing.

◈ **Mounting Pole** were designed to be C-shape Angle in order to increase the strength. Punching of square mounting hole 10 x 10 mm. on both flange. They can be adjusted in/out freely to meet customer's needs. And provide the U-height screened on the mounting pole.

◈ **Front Door** is the steel frame with Acrylic 5.0 mm. thickness with film protection and the width of acrylic is 38 cm. (the height is being influenced by the size of the rack) which is perforated tetragon surounding the acrylic (same as honney comb). Door edge is bore with gray dust-proof rubber seal (3 fins). Security locks with 19" Germany Master Key.

◈ **Rear Door** is the steel door with perforated tetragon ventilation 50% of door's area (same as honney comb) to prevent the heat accumulation inside the cabinet to extend the life of all network equipments and servers. Door edge is bore with gray dust-proof rubber seal (3 fins). Security locks with 19" Germany Master Key which is the same set as the front door.

◈ **Hinge** is 19" Germany Export Rack products made from 3 pieces of high strength special PVC (ABS), rust-free and without any interfering noise. The reversibility of front and rear door opening from left of right by adjusting at one screw nut of hinge.

◈ **Side Panels** are steel with two handles of 19" Germany Slide Latch on the top part in order to easily removable. Inside the side panel has the vertical frame 70 mm. width mounted to prevent the panel for strenghten. Security lock with 19" Germany Master Key which is the same set as the front door.

◈ **Roof Cover** can be mounted with various type of single, dual and triple ventilating fans which can be maximum mounted 6 ventilating fans and can also be changed to vented raised roof cover in option.

◈ **Base** has the same width and depth of cabinet to fully supportive to all the weight. The bottom is three parts plinth with slide shutter for cable entry and gray sponge to protect any inner-passing by animals, any kind of ventilating fan can be equipped there as well.

◈ **Pedestal** was equipped with the castor base and is adjustable; by all of the 4 Pedestal's base made of black ABS and can be freely adjustable 180 degree to suit the slope and protect all effects from Electrostatic and earth leakage.

◈ **Castor** is 19" Germany Export Rack made of back nylon six with the diameter of 50 mm; equipped on the 360 degree swivel that allow to be moving conveniently with capacity the static load 150 kgs per castor.

◈ **New Shine Light Gray** Two-Tone color by Electrostatic Powder Coating paint for scratch resistance.

◈ **Grounding** with color stripe green and yellow copper wire 2.5 mm.; connecting between all removable part of Rack.

◈ **Screw Set** compose of Screws, Captive nuts, plastic Washer; by each were coated with nickel and M6 thread system.

◈ **Static load rating** 1200 kgs. certificated by KMUTT. The result shall be less than 3.0 mm. or 0.14 %.

◈ **Manufacturing and Distribution** by ISO 9001:2008 Company.

Grounding

Slide Latch w/logo

Pedestal

Castor w/logo

ORDERING INFORMATION

W=Width 600 mm. Standard

1U = 44.45 mm.	Overall Height (mm.)	Order No. of Different Depth (mm.)				
		D = 600	D = 800	D = 900	D = 1000	D = 1100
15U	850	G4-60615	G4-60815	G4-60915	G4-61015	G4-61115
27U	1390	G4-60627	G4-60827	G4-60927	G4-61027	G4-61127
36U	1790	G4-60636	G4-60836	G4-60936	G4-61036	G4-61136
39U	1850	G4-60639	G4-60839	G4-60939	G4-61039	G4-61139
42U	2050	G4-60642	G4-60842	G4-60942	G4-61042	G4-61142
45U	2185	G4-60645	G4-60845	G4-60945	G4-61045	G4-61145

W=Width 800 mm. Standard

1U = 44.45 mm.	Overall Height (mm.)	Order No. of Different Depth (mm.)			
		D = 800	D = 900	D = 1000	D = 11000
15U	850	G4-80815	G4-80915	G4-81015	G4-81115
27U	1390	G4-80827	G4-80927	G4-81027	G4-81127
36U	1790	G4-80836	G4-80936	G4-81036	G4-81136
39U	1850	G4-80839	G4-80939	G4-81039	G4-81139
42U	2050	G4-80842	G4-80942	G4-81042	G4-81142
45U	2185	G4-80845	G4-80945	G4-81045	G4-81145

* Order No. for Black Color   G4-XXXXXB

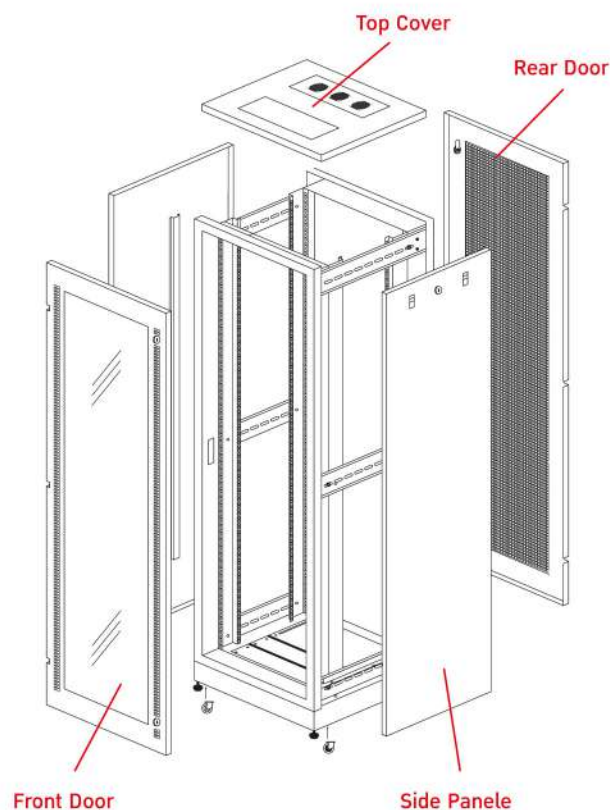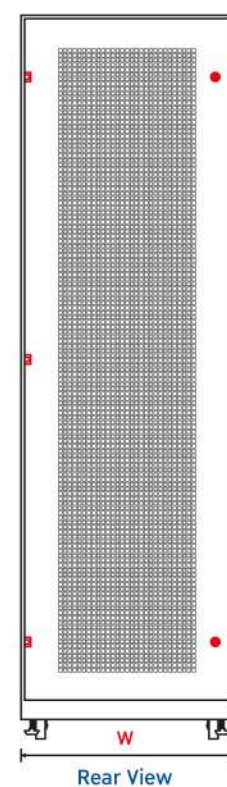Sample : G4-60642B   Server Rack 42U, 60 x 60 cm., Black Color

Options

Color	*Black or other
Width	21 inch or 23 inch
Thickness	1.6 mm or other
Door	Double door or Handle lock

Deliverly with

- 3 Master keys with trademark and number on the keys.
- Set of nut and screw according to the size of rack.

Drawing

Top Cover

Rear Door

Front Door

Side Panele

Top View

Bottom View

Front View

Rear View

ACYLIC
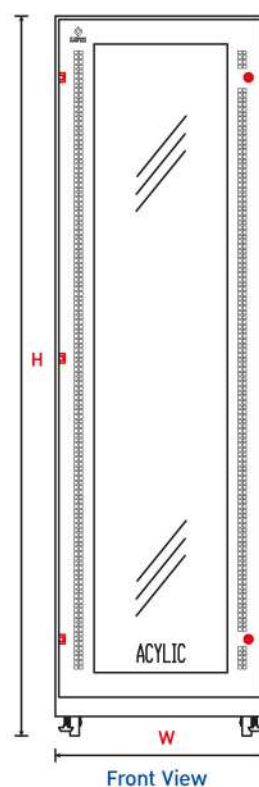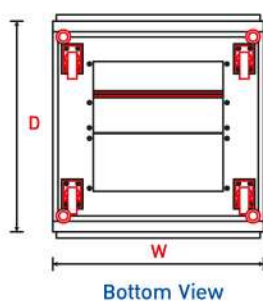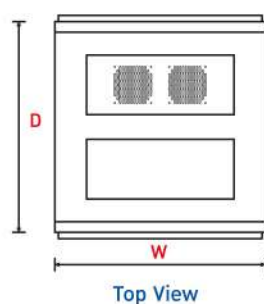
KL1508A (KL1508AM: 17" LCD; KL1508AN: 19" LCD)
KL1516A (KL1516AM: 17" LCD; KL1516AN: 19" LCD)
8/16-Port Cat 5 High-Density Dual Rail LCD KVM Switch

● ATEN ALTUSEN KL1508A / KL1516A LCD KVM Switch features independently retractable, dual slide 17" or 19" LED-backlit LCD monitor and keyboard with built-in touchpad. The KL1508A and KL1516A KVM switches are control units that allow IT administrators to access and control multiple computers from the LCD console and an extra PS/2 or USB KVM console.

For increased reliability and efficiency, RJ-45 connectors and Cat 5e/6 cable are used to link to the computers. Utilizing KVM Adapter Cables for the final linkup, the KL1508A / KL1516A permits any combination of PCs, Macs, Sun computers, and serial devices to coexist on the installation.

These switches have been designed with unique and powerful features that enable administrators to manage their entire server room and data center devices easily and conveniently.

For example, the advanced Adapter ID feature stores the Adapter Cable's configuration information – such as its ID, port name, OS, keyboard language, etc. This feature allows administrators to relocate servers to different ports without having to reconfigure the adapters . Other advances found with these switches includes enhanced video quality – extending the distance to the servers to up to 50 m* at a resolution of 1280 x 1024.

A KL1508A or KL1516A installation provides one of the best and most economical solutions ATEN offers to the SMB market. There is no better way to save time, space, and money than with a KL1508A or KL1516A KVM switch.

*With KVM Adapter Cable KA7000 series, please see page 4 for details.

KL1508A

Features

- Exclusive LED illumination light – designed by ATEN to illuminate the keyboard and touchpad to allow visibility in low-light conditions
- Integrated KVM console with 17" or 19" LED-backlit LCD monitor in a Dual Rail housing
- A single console controls up to 8 (KL1508A) or 16 (KL1516A) computers
- Space-Saving RJ-45 connectors and Cat 5e/6 cabling
- KVM adapter cables* designed with automatic conversion to allow flexible interface combinations (PS/2, USB, Sun and serial) to control all computer types
- OSD tree structure makes finding and managing computers easy
- Conveniently located station and port selectors with LED displays to quickly switch to target computers
- Dual Rail housing is slightly less than 1U with top and bottom clearance for smooth operation in 1U of rack space
- Extra console port – manage computers in the LCD KVM switch from an external console (monitor, USB or PS/2 keyboard, and USB or PS/2 mouse)
- Supports external USB mouse
- Dual Rail – LCD monitor slides independently of the keyboard/touchpad
- LCD module rotates up to 120 degrees for a more comfortable viewing angle
- Console lock – enables the console drawer to remain securely locked away in position when not in use
- Dedicated Hotkey Mode and OSD Invocation Keys reduce the number of keystrokes and provide quick access to these functions
- Daisy chain up to 31 additional KVM switches to control up to 512 computers
- Auto Scan mode enables continuous monitoring of user-selected computers
- Multiplatform support: PC, Mac, Sun and Serial
- Superior Video Quality- Supports the video resolutions up to 1280x1024@75 Hz for up to 50 meters*
- Configure port access rights for users on a port - by - port basis
- Three port selection methods: Manual (via front panel pushbuttons), Hotkey, and multi-language OSD (On Screen Display)
- Multiple User Accounts – Supports up to 10 user and 1 administrator accounts
- Two-Level Password Security – Supports one administrator and ten user profiles. Strong password protection prevents unauthorized accessing to the installation
- LCD power button helps save energy and prolong displays' life
- Broadcast Mode sends commands from the console to all computers – allowing you to perform operations (such as software installation, upgrades, shutdowns, etc.), on them simultaneously
- Adapter ID
- Firmware Upgradeable

Benefits

Flexibility	The LCD module rotates up to 120 degrees for a more comfortable viewing angle.
Easy Operation	Three port selection methods: Manual (via front panel pushbuttons), Hotkey, and multi-language OSD (On Screen Display). Multi-language keyboard support includes English(US); English(UK); French, German, German(Swiss), Greek, Hungarian, Italian, Japanese, Korean, Russian, Spanish, Swedish and Traditional Chinese.
Auto Scanning and Broadcast Mode	Auto scanning provides hands-free monitoring of selected devices at variable rates. Broadcast Mode sends commands from the console to all computers –allowing you to perform operations (such as software installation, upgrades, shutdowns, etc.), on them simultaneously
Superior Video Quality	Supports the video resolutions up to 1600x1200@60Hz for up to 40 meters, and 1280x1024@75Hz for up to 50 meters with the new ATEN KVM Cable Adapter KA7000 series.
Multiple User Accounts	Supports up to 10 user and 1 administrator accounts
Space-Saving RJ-45 Connectors and Cat 5e/6 Cabling	This space-saving innovation means that the KL1508A /KL1516A can be conveniently installed in a 1U system rack. Reduces cable clutter for a neat and tidy data center environment
Adapter Cables with ID	The KL1508A / KL1516A KVM series supports automatic ID recognition of the new ATEN KVM Cable Adapter KA7000 series. Using the new adapter cables with ID means it is not required to change cable configuration settings when moving cables from port to port. Device ID and attributes are stored in the adapter cables allowing you to hot-swap port connections without having to reconfigure attributes.

KL1516A

KA7520

External Console
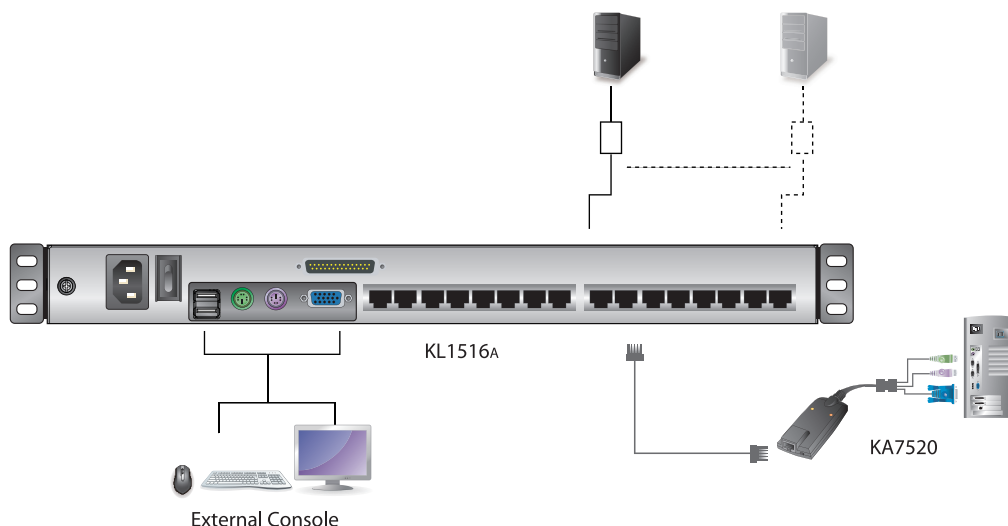
Optional

Single Person Easy Installation (Optional)

ATEN ALTUSEN LCD KVM Switches allow you to choose from a host of optional rack mount kits to meet your needs, including the Single Person Easy Installation Rack Mount Kit, which streamlines the rack mounting process. Normal rack mounting procedures call for at least two people to rack mount a KVM switch. The Single Person Easy Installation Rack Mount Kit enables one person to rack mount a LCD KVM Switch. In just a matter of minutes, your new LCD KVM Switch can go from the box to the rack.

Rack Mount Kits

For convenience and flexibility, there is one standard, and three optional rack mounting kits available:

| 2X-010G | Short | 2X-012G | 2X-011G |

	Rack Mount Kit	Depth (cm)
17" LCD / 19" LCD	Short (Standard)	42.0-77.0
17" LCD	2X-010G (Long/Optional)	68.0-105.0
19" LCD	2X-010G (Long/Optional)	68.0-105.0

	Easy Installation Rack Mount Kit	Depth (cm)
17" LCD	2X-011G (Short/Optional)	57.0-70.0
	2X-012G (Long/Optional)	68.0-105.0
19" LCD	2X-011G (Short/Optional)	63.0-70.0
	2X-012G (Long/Optional)	74.0-105.0

The following KVM Adapter Cables are required for use with the KL1508A / KL1516A:

	KA7120/KA7520	KA7170/KA7570	KA7920	KA7970	KA7130	KA9140	KA7166	KA7168	KA7169
Type:	PS/2	USB	PS/2	USB	Sun Legacy	Serial	USB	USB	USB
Interface:	6-pin Mini-DIN Male / 6-pin Mini-DIN Male / HDB-15 Male	USB Type A Male / HDB-15 Male	6-pin Mini-DIN Male / 6-pin Mini-DIN Male / HDB-15 Male	USB Type A Male / HDB-15 Male	13W3 Male / DIN 8 pin Male	RS-232 DB-9 Female	USB Type A Male / USB Type A Male / DVI-D Male (Single Link)	USB Type A Male / USB Type A Male / HDMI Male	USB Type A Male / USB Type A Male / DisplayPort Male

Specification

Function			KL1508A	KL1516A
Computer Connections	Direct		8	16
	Max		256 (via Daisy Chain)	512 (via Daisy Chain)
Port Selection			OSD (On Screen Display); Hotkeys Pushbuttons	
Connectors	Console Ports	Keyboard	1 x 6-pin Mini-DIN Female (Purple); 1 x USB Type A Female (White)	
		Video	1 x HDB-15 Female (Blue)	
		Mouse	1 x 6-pin Mini-DIN Female (Green); 1 x USB Type A Female (White)	
	KVM Ports		8 x RJ-45 Female (Black)	16 x RJ-45 Female (Black)
	Daisy Chain	Chain Out	1 x DB-25 Male (Black)	
	FW Upgrade		1 x RJ-11 Male (Black)	
	Power		1 x 3-Prong AC socket	
	External Mouse		1 x USB Type A (Female)	
Switches	Port Selection		8 x Pushbutton	16 x Pushbutton
	KVM Reset		1 x Semi-recessed pushbutton	
	F/W Upgrade		1 x Slide	
	Power		1 x Rocker	
	LCD Power		1 x Pushbutton	
	LCD Adjustment		4 x Pushbutton	
	Station		2 x Pushbutton	
LEDs	Port	On Line	8 (Green)	16 (Green)
		Selected	8 (Orange)	16 (Orange)
	Power		1 (Blue)	
	Station ID		1 x 2 Digit 7-segment (Orange)	
	Lock		1 x Num Lock (Green)	
			1 x Caps Lock (Green)	
			1 x Scroll Lock (Green)	
	LCD Power		1 (Orange)	
Emulation	Keyboard / Mouse		PS/2; USB (PC, Mac, Sun); Serial	
Video			1280 x 1024@ 75 Hz (50 m)*	
Scan Interval			1–255 sec.	
I/P Rating			100-240 V AC; 50/60 Hz; 1A	
Power Consumption	17" LCD		100V/23.2W; 230V/24.4W	100V/24.5W; 230V/24.5W
	19" LCD		100V/23W; 230V/23W	100V/23W; 230V/23W
Environment	Operating Temp.		0–40° C	
	Storage Temp.		-20–60° C	
	Humidity		0–80% RH, Non-condensing	
Physical Properties	Housing		Metal	
	Weight	17" LCD	16.84 kg	16.86 kg
		19" LCD	18.31 kg	18.33 kg
	Dimensions (L x W x H)	17" LCD	70.12 x 48.00 x 4.40 cm	70.12 x 48.00 x 4.40 cm
		19" LCD	70.12 x 48.00 x 4.40 cm	70.12 x 48.00 x 4.40 cm

* With KVM Adapter Cable KA7000 series, please see page 4 for details.

๑๘) เครื่องสำรองไฟฟ้า ขนาด ๘๐๐ VA

APC Back-UPS® 800 / 1100

Battery Backup with Voltage Regulation and Schuko Sockets for Electronics and Computers

APC's Back-UPS 800 and 1100 provides enough battery backup power to allow you to work through short length power outages. Specifically designed for areas with rugged power conditions, Back-UPS 800 and 1100 features Automatic Voltage Regulation (AVR), which stabilizes output voltage to protect your electronics over a wide range of mains dips and swells, so you can work indefinitely during brownouts and over voltages. UPS is available with Schuko sockets for easy-to-use connection of protected equipment. Coupled with all the other standard features of the Back-UPS series, the 800 and 1100 series are perfect units to protect your productivity from the constant threat of bad power and lost data.
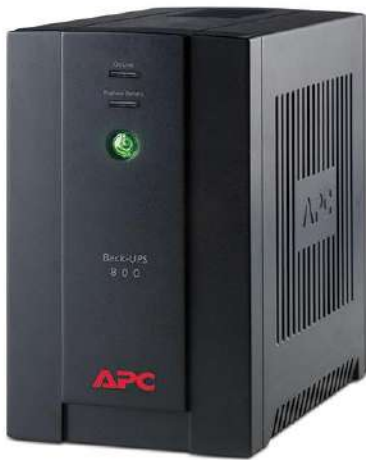
Product Applications:

- **PC and peripherals**
- **Networking equipment (router, modem)**
- **Game Consoles**
- **LCD / LED TV**
- **Projectors with impulse power**

Product Features:

1 **Automatic Voltage Regulation (AVR, input voltage range 150 – 280 V)** stabilizes output voltage to protect your electronics over a wide range of mains dips and swells.

2 **4 Schuko "Battery Backup & Surge Protected" Sockets** provide easy-to-use connection for a PC, monitor, router and other protected equipment.

3 **USB Connection and PowerChute Software** protects your system by enabling unattended shut down or hibernation of PC OS when UPS battery is low. Downloadable Windows software enables access to UPS power monitoring and features to set operation of interface, shut down and energy savings.

4 **Push Button Circuit Breaker** enables quick recovery from overload.

5 **2 Yr Warranty**, free technical phone and online support.

![APC by Schneider Electric logo]

Specifications

Model Number	BX800CI-RS	BX1100CI-RS
Output		
Output Capacity	800 VA / 480 Watts	1100 VA / 660 Watts
Output Voltage / Frequency (On utility)	230V / 50/60+/-3Hz	
Output Voltage / Frequency (On battery)	230V +/-8%, 50 or 60 Hz +/-1 Hz (auto-sensing)	
Output Connections	4 Schuko sockets (all with battery backup and surge protection)	
Waveform Type	Stepped Approximation to Sine Wave	
Input		
Input Voltage / Frequency	150 – 280 V / 50/60Hz +/-3Hz (default:50Hz)	
Input Connection	1.2M power cable with Schuko plug	
Surge Protection		
AC Power Surge Protection	All sockets	
Data Line Surge Protection	Analog phone line, RJ-11 (single line, 2-wire). For phone, fax, modem, DSL.	
Physical		
Unit Dimensions (H x W x D)	215 x 130 x 336 mm	
Unit Weight	8.0 Kg	12.0 Kg
Shipping Dimensions (H x W x D)	295 x 245 x 440 mm	
Shipping Weight	9.0 Kg	12.9 Kg
Color	Black	
UPC Code	731304291473	731304291404
Battery		
Battery Type	Maintenance-free, sealed lead-acid battery, leak proof	
Battery Size	12 volt, 9.0 Ah	12 volt, 7.2 Ah x 2
Management		
Alarms	Visual (LED) and audible alarms	
Adjustable Sensitivity and Transfer Voltage	Low, Medium (default), High	
Auto-Shutdown Software	PowerChute Personal Edition (Via USB interface. USB cable not included)	

APC *by Schneider Electric*
132 Fairgrounds Rd
West Kingston, RI 02892

www.apc.com

APC®
by Schneider Electric

๑๙) เครื่องสำรองไฟฟ้า ขนาด ๑ kVA

Smart-UPS Online 1kVA

Introducing state of the art, Next Gen Online UPS

SRC1KUXI, SRC1KI-IN

>

1 **>90% efficiency** (Double-conversion)

- **Save Rs 2k** every year*
- Save even more in Green mode - 93% efficiency

2 **High-Power Charger (UXI model)**
Allows up to 3 hrs backup without additional charger at full load

3 **Selectable charging current (UXI)**
2A/4A/8A/12A – Flexibility to use different capacity batteries for all kinds of runtime.

4 **SMF / Flooded (UXI model)**

Battery type selection

5 **Internal Battery (-IN model)** 3 x 9Ah

6 **Graphical LCD** easy-to-use interface & Audible Alarm with mute option

7 **SmartSlot** for all management card options

8 **Genset**-compatible

9 **Remote Management of UPS** thru PCBE

APC®
by Schneider Electric

Product feature	SRC1KUXI	SRC1KI-IN
Input Specifications		
Nominal Input Voltage	230 V	
Input Frequency	40-70 Hz	
Input Voltage	110-280 V Output de-rated < 175 V … 50% capacity at 110V	
Input Power Factor	0.98	
Input Protection	Circuit Breaker	
Output Specifications		
Output Power Capacity	1000 VA / 800 W	
Nominal Output Voltage	230 V	
Other Programmable Voltages	220 V / 240 V	
Efficiency at Full Load (Double-Conversion, AC-AC)	> 90%	
Annual savings, typical*	Rs 2,000	
Efficiency at Full Load (Green mode)	93%	
Waveform	Sine wave	
Bypass Specifications		
Bypass Type	Internal Bypass (automatic & manual),	
Bypass Input Voltage Range	160V – 276V	
Battery Charger Specifications		
Supported Battery Types	SMF / Flooded (selectable)	
Battery Bank Voltage	24V	36V
Charger Current	12 A max (User selectable)	1.5A
Environmental Specifications		
Operating Temp	0 – 50^{0}C (Output de-rated above 40^{0}C)	
Storage Temp	-20^{0}C to 60^{0}C	
Operating Elevation	1000m without de-rating	
Storage Elevation	15000m	
Humidity	0 to 95% RH, non-condensing	
Physical Specifications		
Dimensions without pack	145 mm (W) x 220 mm (H) x 397 mm (D)	
Dimensions with packing	472 mm (W) x 230 mm (H) x 325 mm (D)	
Weight without packing	4.1 kg	13.1 kg
Weight with packing	5.5 kg	14.50 kg

 * Compared to typical UPS: 75% load, 21 hours on utility (Rs 8.5/kWh), 3 hours on battery per day

APC
by Schneider Electric

๒๐) คอมพิวเตอร์แท็ปเล็ต แบบที่ ๒

SAMSUNG

Tablet mobility, PC power, plus 5G speed

*Book Cover Keyboard sold separately

samsung.com/b2btablets

Better conference calls, streaming and downloads with the first 5G-enabled tablet in the U.S.

The Galaxy Tab S7 and Galaxy Tab S7+ empowers your team to be productive, no matter where they are.

- Work smarter and faster with the first 5G-enabled tablet[1] in the U.S.
- Use the expanded edge-to-edge screen[2] to increase work area and improve collaboration
- Enjoy a PC-like experience with Samsung DeX

All these benefits enable your team to work efficiently, without a PC or laptop.

Foster productivity

- The Infinity Display delivers vibrant colors and an immersive experience for better presentations
- The 12.4" Galaxy Tab S7+ screen and expanded keyboard provide dedicated function keys, shortcuts and a large touchpad with gesture control
- Samsung DeX, when paired with a Samsung Book Cover, enables a fully functional desktop interface on a tablet, or connect wirelessly to an external monitor or TV for an enhanced experience
- The S Pen[3] delivers a dynamic and sensitive drawing experience, without charging or pairing to the device
- Memory and storage on-par with ultra-premium PCs[4]
- Long-lasting battery enables long work sessions without charging[5]

Blazing-fast connectivity

- Connect to what matters most with nearly no lag thanks to the first 5G-enabled tablet in the U.S.
- Converts to a hotspot with simple one-touch tethering after logging into Samsung account
- Rapidly share pictures, videos and files to multiple people and nearby devices through Wi-Fi or Bluetooth[6]
- Automatically sync chat, texts, search history, mail and apps[7] from a Samsung smartphone to a Galaxy Tab S7/S7+

Secure everything you do

- Transform your workspace into a secure workspace with Knox defense-grade security
- Samsung Knox enables IT to remotely secure, deploy and manage devices at scale
- Use the fingerprint scanner on Galaxy Tab S7/S7+ for the most secure way to keep what's yours, yours
- Go beyond Android Enterprise to address complex security and manageability requirements with Knox Suite
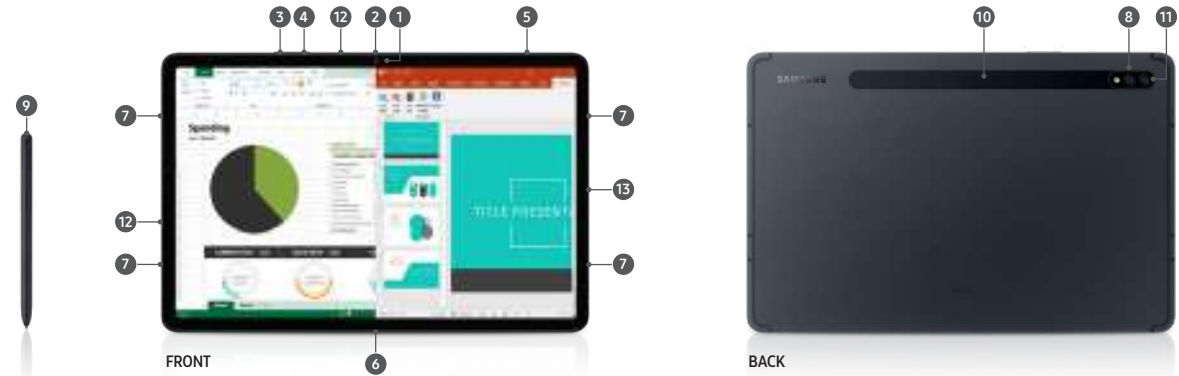
Galaxy Tab S7 | Tab S7+

Specifications	Galaxy Tab S7 (Wi-Fi)		Galaxy Tab S7 (5G)	Galaxy Tab S7+ (Wi-Fi)		Galaxy Tab S7+ (5G)
Part Numbers	128 GB	Mystic Black SM-T870NZKAXAR Mystic Silver SM-T870NZSAXAR	Verizon Mystic Black SM-T878UZKAVZW AT&T Mystic Black SM-T878UZKAATT T-Mobile Mystic Black SM-T878UZKATMB USCC Mystic Black SM-T878UZKAUSC	128 GB	Mystic Black SM-T970NZKAXAR Mystic Silver SM-T970NZSAXAR	Verizon Mystic Black SM-T978UZKAVZW T-Mobile Mystic Black SM-T978UZKATMB USCC Mystic Black SM-T978UZKAUSC
	256 GB	Mystic Black SM-T870NZKEXAR Mystic Silver SM-T870NZSEXAR		256 GB	Mystic Black SM-T970NZKEXAR Mystic Silver SM-T970NZSEXAR	
Operating System	Android 10		Android 10	Android 10		Android 10
CPU	Qualcomm Snapdragon 865 Plus		Qualcomm Snapdragon 865 Plus	Qualcomm Snapdragon 865 Plus		Qualcomm Snapdragon 865 Plus
Processor	Octa Core (3.09GHz + 2.4GHz + 1.8GHz)		Octa Core (3.09GHz + 2.4GHz + 1.8GHz)	Octa Core (3.09GHz + 2.4GHz + 1.8GHz)		Octa Core (3.09GHz + 2.4GHz + 1.8GHz)
S Pen	Yes		Yes	Yes		Yes
Samsung DeX	Wireless, Stand-alone		Wireless, Stand-alone	Wireless, Stand-alone		Wireless, Stand-alone
Memory[9,10,11]	RAM: 6GB, 8GB ROM: 128GB, 256GB microSD: up to 1TB		RAM: 6GB, 8GB ROM: 128GB microSD: up to 1TB	RAM: 6GB, 8GB ROM: 128GB, 256GB microSD: up to 1TB		RAM: 6GB, 8GB ROM: 128GB microSD: up to 1TB
Display Screen Size[2]	11"		11"	12.4"		12.4"
Display Type	LTPS TFT		LTPS TFT	sAMOLED		sAMOLED
Display Resolution	2560 x 1600 (WQXGA), 120Hz		2560 x 1600 (WQXGA), 120Hz	2800 x 1752 (WQXGA), 120Hz		2800 x 1752 (WQXGA), 120Hz
Speakers	Quad Speaker Sound by AKG, Dolby Atmos		Quad Speaker Sound by AKG, Dolby Atmos	Quad Speaker Sound by AKG, Dolby Atmos		Quad Speaker Sound by AKG, Dolby Atmos
Camera	Rear: 13MP (Main) + 5MP (Ultra Wide) + Flash Front: 8MP FF		Rear: 13MP (Main) + 5MP (Ultra Wide) + Flash Front: 8MP FF	Rear: 13MP (Main) + 5MP (Ultra Wide) + Flash Front: 8MP FF		Rear: 13MP (Main) + 5MP (Ultra Wide) + Flash Front: 8MP FF
USB/USB Port	USB Type-C		USB Type-C	USB Type-C		USB Type-C
Keyboard Support	POGO		POGO	POGO		POGO
SIM Support	No		Yes	No		Yes
Wi-Fi 6	802.11 a/b/g/n/ac/ax		802.11 a/b/g/n/ac/ax	802.11 a/b/g/n/ac/ax		802.11 a/b/g/n/ac/ax
Wi-Fi Direct	Yes		Yes	Yes		Yes
Bluetooth	5.0		5.0	5.0		5.0
Battery Capacity[5]	Type: Li-Ion 8000mAh Play Time: Up to 15 Hours		Type: Li-Ion 8000mAh Play Time: Up to 15 Hours	Type: Li-Po 10,090mAh Play Time: Up to 14 Hours		Type: Li-Po 10,090mAh Play Time: Up to 14 Hours
Security	Knox, Fingerprint Sensor, Face Recognition		Knox, Fingerprint Sensor, Face Recognition	Knox, FOD, Face Recognition		Knox, FOD, Face Recognition
Dimensions (H x W x D)	9.99" x 6.51" x 0.25"		9.99" x 6.51" x 0.25"	11.22" x 7.28" x 0.22"		11.22" x 7.28" x 0.22"
Weight	1.2 lbs.		1.2 lbs.	1.27 lbs.		1.27 lbs.
Sensors	Accelerometer, Compass, Gyro, Light, Fingerprint, Hall		Accelerometer, Compass, Gyro, Light, Fingerprint, Hall	Accelerometer, Compass, Gyro, Light, Fingerprint, Hall		Accelerometer, Compass, Gyro, Light, Fingerprint, Hall
Accessory[8]	S Pen (BLE, In-box), Book Cover, Book Cover Keyboard		S Pen (BLE, In-box), Book Cover, Book Cover Keyboard	S Pen (BLE, In-box), Book Cover, Book Cover Keyboard		S Pen (BLE, In-box), Book Cover, Book Cover Keyboard

SAMSUNG

Galaxy Tab S7 | Tab S7+

Device Layout

1. Light / Proximity Sensor
2. Front Camera
3. Power Button
4. Volume Button
5. SIM / microSD
6. Pogo
7. Speaker
8. Main Camera
9. S Pen (included)
10. S Pen Holder
11. Dual Camera
12. Microphone
13. USB Charger / Accessory Port

Galaxy Tab S7 (11")

FRONT

BACK

Galaxy Tab S7+ (12.4")

FRONT

BACK

Learn More   samsung.com/business   insights.samsung.com   samsung.com/b2btablets

Product Support   1-866-SAM4BIZ   **Follow Us**   ▶ youtube.com/samsungbizusa   🐦 @SamsungBizUSA

SAMSUNG

๒๑) อุปกรณ์อ่านบัตรแบบอเนกประสงค์ (Smart Card Reader)

SCR331

The Premier USB Solution

Technical data

Host interface	• Full speed USB (12 Mbps) • Bus powered device • CCID compliant
Smart Card Interface	• T=0, T=1 protocol support • Memory card support through SCM MCARD API • Communication speed up to 344,105 bps (PPS, FI parameter) • Frequency up to 12 MHz (PPS, DI parameter) • Support ISO 7816 Class A and AB smart card
Smart Card Connector	• 8 contacts - ISO location • Certified for 100,000 insertions • Sliding contact
Human Interface	• One dual state green LED
Cable/Power	• Cable: 1.5m long with USB type A connector • Power through USB bus
Dimension	• LWH 90 x 70 x 16.5 mm
Operating Temperature	• 0° to 50° Celsius
OS	• Windows® 98, Me, 2000, XP, Server 2003 • Windows® CE • MacOS, Linux, Solaris
API	• PC/SC • CT-API (thru wrapper on top of PC/SC) • OCF upon request
Approvals	• FCC Class B part 15, cULus, CE, VCCI • USB • Microsoft® WHQL Me, 2000, XP, Server 2003 • EMV Level 1

Overview

The SCR331 is the first of a new family of Smart Card Readers based on SCM's STC II micro controller. This device includes support for multiple interfaces, multiple reader devices and relevant security standards. Together, these features provide SCM with the unique ability to offer high performance and cost effective solutions. In addition, the SCR331 is the industry's first to offer on-board flash. This enables future firmware and application enhancements that guarantee against obsolescence.
The SCR331 offers the best price/performance ratio in the market.

SCR331 Benefits

• On-board flash provides seamless firmware upgrades in the field
• EMV Level 1 AND PC/SC certification based on a single solution
• High performance
• Fully tested and compliant with all major Smart Cards in the market
• Customizing options: casing, colors, and company logo

The SCM Microsystems Advantage

SCM Microsystems brings over a decade of experience in ASIC and Smart Card Reader development to this unique product, including:
• More than 60 patents
• Support for all current and emerging international standards
• Customer base of global, top tier PC OEMs, systems integrators and Smart Card industry leaders
• Industry endorsed SmartOS™ middleware
• Direct significant long-term relationships with all leading Smart Card manufacturers and application providers
• High quality mass production capability

www.scmmicro.com

๒๒) ชุดโปรแกรมระบบปฏิบัติการสำหรับเครื่องคอมพิวเตอร์แม่ข่าย (Server) ที่มีลิขสิทธิ์ถูกต้องตามกฎหมาย

Licensing
Windows Server 2016

Product overview

Windows Server 2016 is the cloud-ready operating system that supports customer workloads while introducing new technologies that make it easy for customers to transition to cloud computing when they are ready. Windows Server 2016 delivers powerful new layers of security along with Azure-inspired innovation for the applications and infrastructure that power business.

Editions overview

Customers can choose from three primary editions of Windows Server, based on the size of the organization as well as virtualization and datacenter requirements:

- **Datacenter Edition** is ideal for highly virtualized and software-defined datacenter environments.

- **Standard Edition** is ideal for customers with low density or non-virtualized environments.

- **Essentials Edition** is a cloud-connected first server, ideal for small businesses with up to 25 users and 50 devices. Essentials is a good option for customers currently using the Foundation Edition, which is not available with Windows Server 2016.

Windows Server 2016 features

Windows Server 2016 customers benefit from a variety of new features. New features in Standard Edition include Nano Server and unlimited Windows Server containers; customers also receive rights to two Operating System Environments (OSEs) or Windows Server containers with Hyper-V isolation. New features exclusive to Datacenter Edition include Shielded Virtual Machines, software-defined networking, Storage Spaces Direct, and Storage Replica; customers receive rights to unlimited OSEs or Windows Server containers with Hyper-V isolation.

Feature	Datacenter Edition	Standard Edition
Core functionality of Windows Server	✓	✓
Operating System Environments (OSEs/Windows Servers containers with Hyper-V isolation)	Unlimited	2
Windows Server containers	Unlimited	Unlimited
Host Guardian Service	✓	✓
Nano Server*	✓	✓
Storage features including Storage Spaces Direct and Storage Replica	✓	
Shielded Virtual Machines	✓	
Networking stack	✓	
Price**	$6,155	$883

* Software Assurance is required to install and use Nano Server.

** Pricing for Open (NL) ERP license for 16 core licenses. Actual customer prices may vary.

Windows Server 2016 licensing model

The business model for Standard and Datacenter editions transitioned from processor-based to core-based licensing in October 2016 with the general availability of Windows Server 2016 (all other editions of Windows Server 2016 continue to be on the processor-based licensing model). Core-based licensing provides a more consistent licensing metric across environments, enabling multi-cloud environments, improving workload portability for Windows Server through benefits like Azure Hybrid Benefit, and helping remove friction across different licensing models.

Customers with Software Assurance will transition to core-based licensing at their first renewal after the general availability of Windows Server 2016, although they can deploy Windows Server 2016 at any time.

The Windows Server 2016 licensing model includes both Cores + Client Access Licenses (CALs). Each user and/or device accessing a licensed Windows Server Standard, Datacenter, or Multipoint edition requires a Windows Server CAL or Windows Server and Remote Desktop Services CAL. A Windows Server CAL gives a user or device the right to access any edition of Windows Server of the same or earlier version. Each Window Server CAL allows access to multiple licenses of Windows Server.

Edition	Licensing model	CAL requirements
Datacenter	Core-based*	Windows Server CAL**
Standard	Core-based*	Windows Server CAL**
Essentials	Specialty server	No CAL required

  * All physical cores on the server must be licensed, subject to a minimum of 8 core licenses per physical processor and a minimum of 16 core licenses per server.

** CALs are required for every user or device accessing a server. See the Product Terms for details.

Windows Server 2016 Standard and Datacenter: Core-based licensing

Core-based licensing requires all physical cores in the server to be licensed. Servers are licensed based on the number of processor cores in the physical server.

- A minimum of 8 core licenses is required for each physical processor and a minimum of 16 core licenses is required for each server.

- Core licenses are sold in packs of two.*

- Standard Edition provides rights for up to 2 Operating System Environments or Windows Servers containers with Hyper-V isolation when all physical cores in the server are licensed. For each additional 1 or 2 VMs, all the physical cores in the server must be licensed again.

- The price of a set of 16 core licenses (for a 2-processor server) for Windows Server 2016 Datacenter and Standard editions is the same price** as the 2-processor license of the corresponding edition of Windows Server 2012 R2.

  * 8 two-core packs will be the minimum required to license each physical server. The two-core pack for each edition is 1/8th the price of a license for a 2-processor server for corresponding Windows Server 2012 R2 editions.

** Rounding may result in slight variations in the final price of eight 2-pack core SKUs relative to the price of one Windows Server 2012 R2 processor SKU.

Azure Hybrid Benefit

With the Azure Hybrid Benefit, customers with Software Assurance can benefit from special pricing for new Windows Server virtual machines in Azure. Customers pay only for the base compute rate, which is currently the same as the Linux rate for virtual machines. For complete details, visit www.azure.com/ahub.

Windows Server 2016 Licensing

Physical cores per processor				
2	4	6	8	10

Processors per server	2	4	6	8	10
1	8	8	8	8	8
2	8	8	8	8	10
4*	16	16	16	16	20

Licensing costs are same as Windows Server 2012 R2

Additional licensing required

* Standard Edition may need additional licensing.

Moving to core-based licensing

Customers purchasing net new licenses, for example, through MPSA or from an OEM, will purchase licenses under the core-based model.

Existing customers with Software Assurance will transition from processor-based to core-based licensing at the first renewal after the general availability of Windows Server 2016.

- **Renewal before the general availability of Windows Server 2016:** Customers with Software Assurance will be on processor-based licensing and true-ups will also be processor-based.

- **Renewal after the general availability of Windows Server 2016:** Customers with Software Assurance will transition to core-based licensing and true-ups will also be core-based.

Core license grants overview

Customers with servers under Software Assurance will receive core license grants at the expiration of Software Assurance coverage. Depending on the core density of existing servers, there are two categories of core license grants: Full core licenses and additional core licenses.

1. **Full core license grants:** Customers with a server density of 8 or fewer cores per processor and 16 or fewer cores per server are eligible to receive full core license grants. Customers will receive a minimum of 8 cores per processor and 16 cores per server at the expiration of Software Assurance coverage after the general availability of Windows Server 2016. To receive full core license grants, customers do not need to document their environments.

2. **Additional core license grants:** Customers with a server density of more than 8 cores per processor and 16 cores per server are eligible to receive additional core license grants and pay only Software Assurance on the incremental cores. To receive additional core license grants, customers must maintain a record of the physical hardware and the configuration of the licensed server by using the Microsoft Software Inventory Logging tool (SIL) or any equivalent software. Inventory must be maintained at the first expiration of the Software Assurance coverage after the general availability of Windows Server 2016 or before September 30, 2019.

Note: Customers are not required to share inventory with Microsoft, but may be asked to share inventory if required.

Core grants	Eligibility	What customers receive	Documentation	Price impact
Full core license grants	Servers with ≤8 cores per processor and ≤16 cores per server.	A minimum of 8 cores per processor and 16 cores per server for the corresponding edition of Windows Server 2016.	Customer is not required to establish or maintain documentation of their server environment.	**No price impact:** Customer licensing Windows Server 2016 on servers with ≤ 8 cores per processor and ≤ 16 cores per server pay approximately the same amount* as they did for a 2-processor Windows Server 2012 R2 license.
Additional core license grants	Servers with >8 cores per processor and >16 cores per server.	Grants for core licenses for servers greater than 8 per processor and 16 cores per server and customer pays Software Assurance on incremental cores.	Customer is required to establish and maintain documentation of their server environment.	**Price impact:** Customer pays Software Assurance on incremental cores.

* Rounding may result in slight variations in the final price of eight 2-pack core SKUs relative to the price of one Windows Server 2012 R2 processor SKU.

Announcing servicing guidelines for Windows Server 2016

With prior releases, Windows Server has been serviced and supported through a 5+5 model, with 5 years of mainstream support and 5 years of extended support. This model—renamed Long Term Servicing Branch (LTSB)—will continue with Windows Server 2016 for customers who choose to install full Windows Server 2016 with Desktop Experience or Server Core.

Customers can also opt into a more active servicing model—known as the Semi-Annual Channel—similar to the experience with Windows 10. This approach supports customers who are moving at a cloud cadence of rapid development lifecycles and wish to innovate more quickly. Since this servicing model continues to provide new features and functionality, Software Assurance is also required to install and use Nano Server as a container image.

For more information about Windows Server 2016,
visit www.microsoft.com/windowsserver2016

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Windows 10 Desktop Operating System

Contents

Introduction

Windows 10 helps you achieve more and transform your business with the most secure Windows ever.

Microsoft Commercial Licensing solutions provide the most flexible and cost-effective way to give your organization access to the latest Windows Desktop technologies. Whether you want to upgrade your PCs to Windows 10, gain access to exclusive offerings such as Windows 10 Enterprise edition and the Microsoft Desktop Optimization Pack, or use Windows with greater flexibility, there's a Commercial Licensing option that's right for your organization.

This document provides an overview of the products available through Commercial Licensing, information about the products that are eligible for upgrades, and the key choices you have for using Windows in your organization.

Content included is for informational purposes only and isn't meant to replace or override other licensing documentation such as the Windows 10 End User License Agreement or [Commercial Licensing Product Terms](.).

Windows 10 Editions and Related Products

Windows 10 Editions

There's an edition of Windows software designed to meet the needs of every organization, from a small, growing business to a multinational enterprise. The following table lists the editions of Windows 10 available through each Microsoft distribution channel.

Full Packaged Product (Retail)	Preinstalled on PC (OEM)	Commercial Licensing
Windows 10 Pro Windows 10 Home	Windows 10 Pro Windows 10 Home*	Windows 10 Pro Windows 10 Enterprise Windows 10 Enterprise LTSC Windows 10 Education

*In select emerging markets, a local language-only edition of Windows 10 (Windows 10 Single Language) may be available.

Volume Licensing Reference Guide for Windows 10 Desktop Operating System

Windows Desktop Offerings available through Commercial Licensing

The following offerings are available for purchase through Microsoft Commercial Licensing:

Product	Description
Windows 10 Pro Upgrade	Windows 10 Pro is designed for small and medium businesses and enables organizations to manage their devices and apps, protect their business data, facilitate remote and mobile scenarios, and take advantage of the cloud technologies for their organizations. Windows 10 Pro devices are a good choice for organizations that support CYOD programs and "prosumer" customers. The Windows 10 Pro Upgrade in Commercial Licensing upgrades a device from a previous version of Windows Pro.
Windows 10 Enterprise E3	Windows 10 Enterprise E3 builds on Windows 10 Pro by adding more advanced features designed to address the needs of large and mid-size organizations. Examples include advanced protection against modern security threats, the broadest range of options for operating system deployment and update control, and comprehensive device and app management. Windows 10 Enterprise E3 is available per device or per user and includes Software Assurance in some Commercial Licensing programs.
Windows 10 Enterprise E5	Windows 10 Enterprise E5 is for organizations that want to take advantage of everything in Windows 10 Enterprise E3 with the addition of Windows Defender Advanced Threat Protection (Windows Defender ATP), a new service that helps enterprises detect, investigate, and respond to advanced attacks on their networks. Windows 10 Enterprise E5 is available per device and includes Software Assurance in some Commercial Licensing programs.
Windows 10 Enterprise LTSC	Windows 10 Enterprise LTSC is designed for systems that have strict change management policies with only security and critical bug fixes. By using a Long Term Servicing Channel, you can apply regular Windows 10 security updates for specialized devices while holding back new-feature updates for an extended period of time, up to 10 years.
Windows 10 Education E3	Windows 10 Education E3 offers the benefits of Windows 10 Enterprise to academic institutions, and is designed to address advanced security and comprehensive device control and management needs. Available to staff, administrators, and students through academic Commercial Licensing, it's built to simplify deployment by allowing in-place upgrades from Windows 10 Home or Pro without needing to wipe and reload the operating system.
Windows 10 Education E5	Windows 10 Education E5 includes all of the benefits of Education E3 with the addition of Windows Defender Advanced Threat Protection (Windows Defender ATP), which provides a new layer of post-breach security that enables you to detect, investigate, and respond to advanced attacks on your network. Note that WDATP doesn't come with student use benefits; students must be covered explicitly.
Windows Virtual Desktop Access (VDA) Subscription License	The Windows VDA subscription license provides the right to access virtual Windows desktop environments from devices that aren't covered by a Commercial Licensing offer that includes VDA rights, such as thin clients. Windows VDA is available on a per device or per user basis.

Windows 10 Pro Upgrade License

Windows 10 Pro is designed for small and medium businesses and enables you to manage your devices and apps, protect your business data, facilitate remote and mobile scenarios, and take advantage of the cloud technologies for your organization. Windows 10 Pro has enterprise-grade security to help protect your data, and it's simple to set up and manage for multiple users. It works across your devices so you can stay mobile, and integrates seamlessly with Office 365*—connecting your team to maximize productivity.

*Subscription sold separately

The Windows 10 Pro Upgrade license is recommended if you want to:

- Upgrade Windows 7/8/8.1 Pro devices to Windows 10 Pro
- Upgrade Windows XP Pro or earlier Qualifying Operating Systems to Windows 10 Pro

Windows 10 Enterprise

There are two core Windows 10 Enterprise offers: Windows 10 Enterprise E3 and Windows 10 Enterprise E5. Each of these can be purchased on a per device or per user basis, and are available only through Commercial Licensing, including the Cloud Solution Provider program.

Windows 10 Enterprise E3

Windows 10 Enterprise E3 builds on Windows 10 Pro by adding more advanced features designed to address the needs of large and mid-size organizations. Examples include advanced protection against modern security threats, the broadest range of options for operating system deployment and update, and comprehensive device and app management. Customers with devices running Windows 10 Enterprise will be able to take advantage of the latest security and feature updates on an ongoing basis, while having the ability to choose the pace at which they adopt new technology. Windows 10 Enterprise E3 can be licensed per user or per device.

Windows 10 Enterprise E5

Windows 10 Enterprise E5 is the newest offer for customers who want to take advantage of everything in E3 with the addition of Windows Defender Advanced Threat Protection (Windows Defender ATP), a new service that helps enterprises detect, investigate, and respond to advanced attacks on their networks.

Building on the existing security defenses in Windows 10, Windows Defender ATP provides a new post-breach layer of protection to the Windows 10 security stack. With a combination of client technology built into Windows 10 and a robust cloud service, it can help detect threats that have made it past other defenses, provide enterprises with information to investigate the breach across endpoints, and offer response recommendations.

Volume Licensing Reference Guide for Windows 10 Desktop Operating System

With Windows 10 Enterprise, you can take advantage of the following features and capabilities not available in Windows 10 Pro.

Feature	Description
Device Guard	Device Guard puts you in control of your environment with rigorous access controls that help protect the Windows system core and prevent malware, untrusted apps, and executables from running on your devices. For more information, see Introduction to Device Guard.
Credential Guard	Credential Guard helps protect user access tokens from being hacked by storing them inside a secure hardware isolated container, defeating a key tactic used to compromise networks.
Windows To Go Creator	Allows the creation of a fully manageable corporate desktop running Windows 10 Enterprise edition on a bootable USB drive.
Start screen control	Enables IT to control the Start screen layout that users will see (but cannot change) through centrally managed Group Policies.
DirectAccess	Allows remote users to seamlessly access resources inside a corporate network without having to launch a separate VPN.
BranchCache	Allows users' PCs to cache files, websites, and other content from central servers, so content isn't repeatedly downloaded across the wide area network (WAN).
AppLocker	AppLocker helps IT pros determine which applications and files users can run on a device (also known as "whitelisting"). The applications and files that can be managed include executable files, scripts, Windows Installer files, dynamic-link libraries (DLLs), packaged apps, and packaged app installers. For more information, see AppLocker.
Virtual Desktop Infrastructure (VDI) enhancements**	Enhancements in Microsoft RemoteFX and Windows Server 2019 R2 provide users a rich desktop experience with the ability to have RemoteApps look more like local apps, adjust screen resolution and orientation on demand, and reconnect to your desktop quickly across any type of network (LAN or WAN) for VDI scenarios. **Requires Software Assurance
Managed User Experience	With the managed user experience capabilities included in Windows 10, you can create a consistent, predictable experience for users across the organization and configure devices for single-purpose scenarios.

Feature	Description
Application Virtualization (App-V)	This feature makes applications available to end users without installing the applications directly on users' devices. App-V transforms applications into centrally managed services that are never installed and don't conflict with other applications. This feature also helps ensure that applications are kept current with the latest security updates.
Windows Defender Advanced Threat Protection (WDATP) ^{NEW}	Windows Defender Advanced Threat Protection (WDATP) provides a new post-breach layer of protection to the Windows 10 security stack. It gives you the ability to detect, investigate, and remediate advanced attacks and data breaches on their networks.
	With a combination of client technology built into Windows 10 and a robust cloud service, it helps detect threats that have made it past other defenses, provides enterprises with information to investigate the breach across endpoints, and offers response recommendations.
	Windows Defender Advanced Threat Protection is available only with Windows 10 Enterprise E5 and Windows 10 Education E5.

Learn more about Windows 10 Enterprise.

Windows 10 Education

Windows 10 Education builds on Windows 10 Enterprise adding enterprise-grade features to address the advanced security and comprehensive device control and management needs of today's educational institutions.

Windows 10 Education E3

Windows 10 Education E3 (formerly Windows 10 Education) is Microsoft's best offering for Academic institutions and includes all of the functionality of Windows 10 Enterprise E3 while allowing in-place upgrades from Windows Home edition. Microsoft Desktop Optimization Pack (MDOP) is included as a standard component of Education E3 to help administrators manage their IT environments. (MDOP access isn't included as part of the student use benefit.)

Windows 10 Education E5

Windows 10 Education E5 is a new offering for academic institutions. It includes all of the benefits of Windows 10 Education E3, with the addition of Windows Defender Advanced Threat Protection (WDATP). WDATP provides a new layer of post-breach security that enables you to detect, investigate, and respond to advanced attacks on your network.

Qualifying Operating Systems

Windows licenses available through Commercial Licensing are upgrade-only licenses (except for VDA licenses). They don't replace the base "qualifying" licenses for operating system software that comes preinstalled on new PCs. Each PC that runs the Windows 10 Pro or Enterprise upgrade must first be licensed to run one of the qualifying operating systems identified below—otherwise the PC won't have a valid, legal Windows license. If you don't have a preexisting license for a genuine, qualifying operating system on your PC, see the Get Genuine options section in this guide.

User licenses may only be assigned to users that are the primary user of at least one device with a Qualifying Operating System.

Device licenses may only be assigned to devices with a Qualifying Operating System

VDA licenses (user or device) may be assigned to any user or device. VDA licenses do not require Qualifying Operating Systems.

Per User Qualifying Operating SystemsQualifying Operating Systems	Enterprise Agreement, Microsoft Products and Services Agreement, Select, Select Plus	Microsoft Cloud Agreement
Windows 10		
Enterprise, IoT Enterprise, Pro, Pro for Workstations, Pro in S mode	X	X
Windows 7 / 8 / 8.1		
Enterprise, Pro, Professional, Ultimate, Windows 7 Professional/Ultimate for Embedded Systems, Windows Embedded 8/8.1 Pro, Industry Pro	X	

Per Device Qualifying Operating Systems

Qualifying Operating Systems	New Enterprise Agreement (EA)/Open Value Company-Wide (OV-CW)[2]	Existing EA/ OV-CW[3]	Microsoft Products and Services Agreement (MPSA)/Select Plus[4]/Open[5]	Microsoft Cloud Agreement	Academic and Charity[6]
Windows 10					
Enterprise, Pro, Pro for Workstations, Pro in S mode	✓	✓	✓	✓	✓
Education, Home, Home in S mode					✓
Windows 8/8.1					
Enterprise, Pro	✓	✓	✓		✓
Windows 8/8.1					✓
Windows 7					
Enterprise, Professional, Ultimate	✓	✓	✓		✓
Home Premium, Home Basic, Starter Edition					✓
Windows Vista					
Enterprise, Business, Ultimate	✓		✓		✓
Home Premium, Home Basic, Starter Edition					✓
Windows XP					

Volume Licensing Reference Guide for Windows 10 Desktop Operating System

Qualifying Operating Systems	New Enterprise Agreement (EA)/Open Value Company-Wide (OV-CW)[2]	Existing EA/OV-CW[3]	Microsoft Products and Services Agreement (MPSA)/Select Plus[4]/Open[5]	Microsoft Cloud Agreement	Academic and Charity[6]
Professional, Tablet Edition, Pro Blade PC	✓		✓		✓
Home, Starter Edition					✓
Apple					
macOS	✓		✓		✓

Qualifying Operating Systems[1]	New Enterprise Agreement (EA)/Open Value Company-Wide (OV-CW)[2]	Existing EA/OV-CW[3]	Microsoft Products and Services Agreement (MPSA)/Select Plus[4]/Open[5]	Microsoft Cloud Agreement	Academic and Charity[6]
Windows Embedded Operating Systems					
Windows 10 IoT Enterprise	X	X	X	X	X
Windows 2000 Professional for Embedded Systems	X		X		X
Windows XP Professional for Embedded Systems	X		X		X
Windows Vista Business/Ultimate for Embedded Systems	X		X		X
Windows 7 Professional/Ultimate for Embedded Systems	X	X	X		X
Windows Embedded 8/8.1 Pro, Industry Pro	X	X	X		X
Windows 10 IoT Enterprise for Retail or Thin Clients	X		X		X
Windows Embedded 8 and 8.1 Industry Retail[1]			X		X
Windows Embedded POSReady 7 Pro[1]			X		X
Windows Embedded for Point of Service[1]			X		X
Windows Embedded POSReady 2009[1]			X		X
Windows Embedded POSReady 7[1]			X		X
Windows XP Embedded[1]			X		X
Windows Embedded Standard 7[1]			X		X
Windows Embedded Standard 2009[1]			X		X
Windows Embedded 8 Standard[1]			X		X

[1]Use restrictions apply. Refer to the Commercial Licensing Product Terms for details.

Software Assurance and Windows Virtual Desktop Access (VDA)

Software Assurance includes a core set of benefits to help improve workforce productivity, streamline software deployment, and reduce costs. It also provides the greatest flexibility for how you use Windows because it includes access to enterprise offerings and use rights that aren't available through other licensing programs. Software Assurance is the path to supporting users' flexible work styles by providing access to Windows in a variety of ways across devices. It's available with Windows 10 Enterprise through Commercial Licensing but isn't offered with the Cloud Solution Provider program.

Volume Licensing Reference Guide for Windows 10 Desktop Operating System

For devices or users that don't qualify for Windows 10 Enterprise offers, you can license Windows VDA for access to the benefits of Software Assurance. With Software Assurance and Windows VDA, you get flexible access to Windows Enterprise, Microsoft Desktop Optimization Pack (MDOP), and a number of additional benefits, which are described in the following table.

Benefits of Software Assurance or Windows VDA

Whether you license Software Assurance or Windows VDA on a per device or per user basis, you receive a number of benefits specific to Windows. See below for an overview of the benefits.

Note: "Licensed device" refers to any device covered by either Software Assurance or a Windows VDA on a per device basis. "Licensed user" refers to any user covered by either Software Assurance or a Windows VDA on a per user basis.

Benefit	Description
New Version Rights	With New Version Rights, you have access to new releases of Windows on any licensed device or by any licensed user as soon as they're released for no additional cost. With the launch of Windows 10, this will include future LTSCs, as well as the Current Channel and Current Channel for Business for Enterprise (or Education) edition.
Microsoft Desktop Optimization Pack (MDOP)	MDOP enables businesses to virtualize the operating system applications and the user experience, manage Windows features, and restore user productivity after a system issue. See the Microsoft Desktop Optimization Pack section of this document for more details.
Windows Thin PC	Windows Thin PC is a smaller footprint version of Windows 7 that enables organizations to repurpose existing PCs as thin clients, thereby reducing the need for new thin client hardware. This benefit applies only to devices or users licensed with Software Assurance (and not VDA).
Windows Virtual Desktop Access (VDA) Rights	Windows VDA Rights enable users to access virtual instances of Windows in a variety of user scenarios.
Windows To Go Use Rights	Windows To Go is a fully manageable corporate desktop running Windows 10 Enterprise edition on a bootable USB stick. This use right allows Windows To Go to be run on any licensed device or by any licensed user. See the Windows To Go section of this document for more details.
Long Term Servicing Channel Support	Get security updates regularly, without new features, for the duration of the five-year mainstream support period plus an additional five-year extended support period.

With Software Assurance or Windows VDA, you also have access to the following benefits:

- **Extended Hotfix support:** Provides specific product fixes on a per customer incident basis, beyond the standard product support.
- **24x7 Problem Resolution Support:** Provides around-the-clock phone support for business-critical issues or business hours phone support for non-critical issues. Unlimited email support can be used for non-critical

problems. The number of support incidences and type (phone and web) for which you're eligible is based on the type of Commercial Licensing agreement and qualifying products.

- **Enterprise Source Licensing Program**: Provides access to Windows source code for internal development and support.
- **Training Vouchers**: Provides in-depth technical classroom training for IT professionals and developers.
- **E-Learning**: Offers self-paced interactive training for end users and IT professionals; delivered over the Internet or an intranet.
- **Spread Payments**: Payment for licenses and Software Assurance may be spread across three equal, annual sums.

Notes:

- The rights above apply only to Windows, and license requirements for other software still apply.
- Benefit eligibility varies by Commercial Licensing program and products. Refer to the Microsoft Commercial Licensing Product Terms to verify eligibility by program and products.

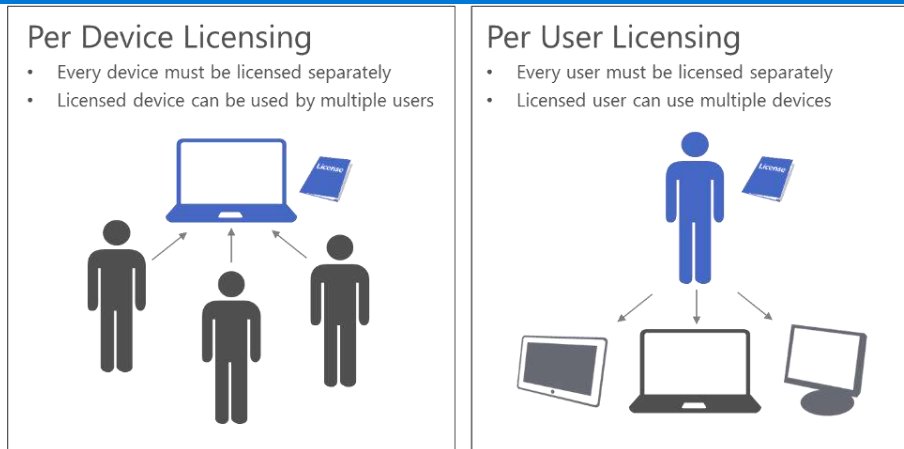## Licensing Windows 10 Enterprise or Windows VDA on a per device basis

You can license Windows on a per device basis in the following ways:

- When purchasing Windows 10 Enterprise E3 (or Windows 10 Education E3), Software Assurance is included in some Commercial Licensing programs such as Enterprise Agreement, Enterprise Subscription Agreement, Open Value, Open Value Subscription, and Enrollment for Education Solutions.
- If you have devices that don't have or aren't eligible for Windows 10 Enterprise (such as thin clients), you can access many of the benefits of Software Assurance by licensing those devices with a Windows VDA subscription.

Licensing Windows 10 Enterprise or Windows VDA on a per user basis

You can license Windows 10 Enterprise and Windows VDA on a per user basis. With per user licensing, you license an individual instead of a device, and that individual receives use rights for any device. This puts your users at the center of your Windows licensing solution, gives you flexible options for how you deploy and access Windows across devices, and simplifies Windows licensing and management.

Per Device Licensing
- Every device must be licensed separately
- Licensed device can be used by multiple users

Per User Licensing
- Every user must be licensed separately
- Licensed user can use multiple devices

There are three different options for how you license access to Windows on a per user basis: **Windows 10 Enterprise per User**, **Windows VDA per User**, and **Windows 10 Enterprise per User Add-on**.

Here's a comparison of the three options:

Note: "Primary user's primary device" means the user is the primary user of a device AND that device is that user's primary work device.

	Windows 10 Enterprise per User	Windows VDA per User	Windows 10 Enterprise per User Add-on: When added to Windows 10 Enterprise per Device	Windows 10 Enterprise per User Add-on: When added to Windows VDA per Device
Licensing requirements	Primary user's primary device must be licensed for Windows 7/8/8.1/10 Pro, Enterprise, or Education	No device requirements; may be assigned to any user	Primary user's primary device must already be covered by Windows 10 Enterprise per Device	Primary user's primary device must already be covered by Windows VDA
License Model	Per user; no device limits	Per user; no device limits	Per user; no device limits	Per user; no device limits
Local install of Windows Enterprise	On any Windows 7/8/8.1/10 Pro, Enterprise, or Education device or Windows tablet ≤ 10.1 inches	On any Windows 7/8/8.1/10 Pro, Enterprise, or Education device or Windows tablet ≤ 10.1 inches	On any Windows 7/8/8.1/10 Pro, Enterprise, or Education device or Windows tablet ≤ 10.1 inches	On any Windows 7/8/8.1/10 Pro, Enterprise, or Education device or Windows tablet ≤ 10.1 inches
VDI Access and Windows To Go	Any device	Any device	Any device	Any device

Here's how to choose the right option:

Windows 10 Enterprise per User

Windows 10 Enterprise per User is the right option if ALL of the following apply:

- The user is the primary user of at least one device licensed for Windows 10 Pro, Enterprise, or Education; Windows 8/8.1 Pro or Enterprise; or Windows 7 Professional or Enterprise
  AND
- The device is the user's primary work device
  AND
- The device isn't already covered by Windows 10 Enterprise or Windows VDA.

Windows VDA per User

Windows VDA per User is the right option if either one of the following applies:

- The user isn't the primary user of at least one device licensed for Windows 10 Pro, Enterprise, or Education; Windows 8/8.1 Pro or Enterprise; or Windows 7 Professional or Enterprise
  OR
- The user uses a device licensed for Windows 10 Pro, Enterprise, or Education; Windows 8/8.1 Pro or Enterprise, or Windows 7 Professional or Enterprise, but that device isn't the user's primary work device.

Note: Because there's no requirement that the user is the primary user of a primary device licensed for Windows 10 Pro, Enterprise, or Education, Windows 8/8.1 Pro or Enterprise, or Windows 7 Professional or Enterprise, Windows VDA per User is the least restrictive option. If you were to license every user with Windows VDA per User, every user would have access to Windows Enterprise without the need to track the operating system license(s) on the user's device(s) (except for devices on which you install the software locally).

Windows 10 Enterprise per User Add-on

Windows 10 Enterprise per User Add-on is the right option if either *one* of the following applies:

- The user is the primary user of a primary device with active Windows 10 Enterprise coverage
  or
- The user is the primary user of a primary device with active Windows VDA coverage.

With the Windows 10 Enterprise per User Add-on, you get all of the benefits of Windows 10 Enterprise Per User or Windows VDA per User at a price that recognizes your existing investment. When you license the primary user of a primary device that's already covered with Windows 10 Enterprise, the Windows 10 Enterprise per User Add-on grants the licensed user with all of the benefits of Windows 10 Enterprise per User. When you license the primary user of a primary device that's already covered with Windows VDA, the Windows 10 Enterprise per User Add-on grants the licensed user with all of the benefits of Windows VDA per User.

	Underlying device license:	Underlying device license:
	Windows 10 Enterprise	Windows VDA
Add-on license	Windows 10 Enterprise Per User Add-on	Windows 10 Enterprise Per User Add-on
Use Rights granted by Add-on	Windows 10 Enterprise per User	Windows VDA per User

Use this flow chart to help you choose the right per user option:
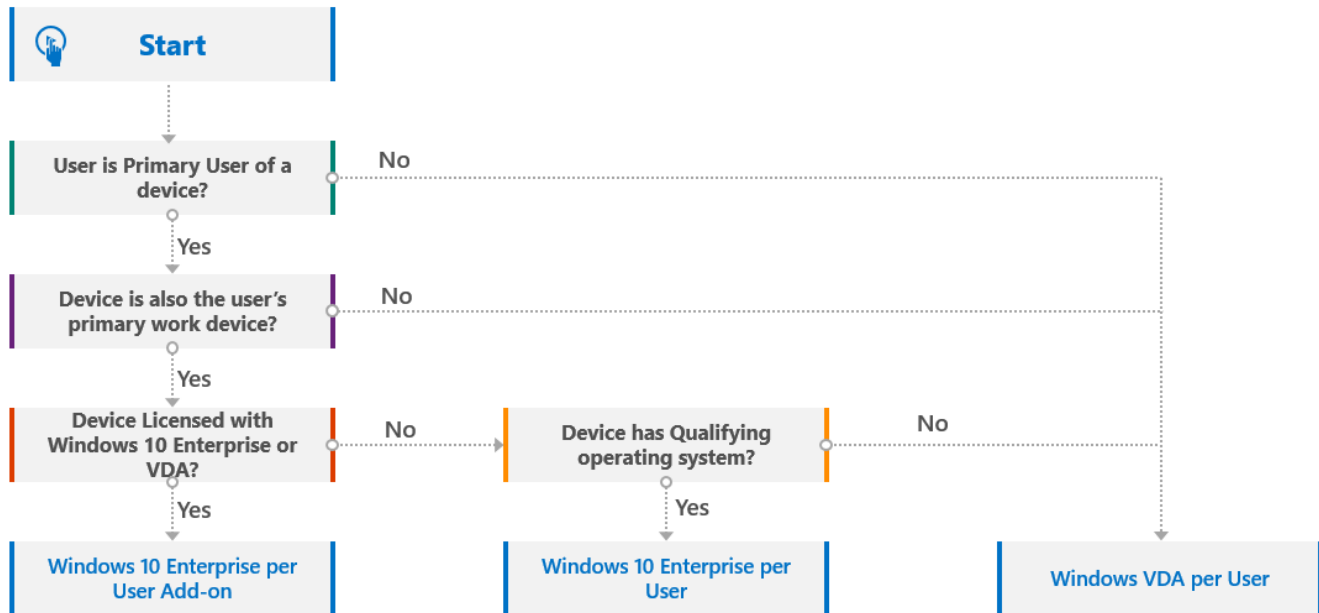
Perpetual Use Rights for Windows Enterprise

The use rights for Windows 10 Enterprise LTSC are perpetual for the licensed device at the point that Windows 10 Enterprise coverage ends (unless the Windows 10 Enterprise upgrade is acquired under a subscription license).

If Windows 10 Enterprise expires, the perpetual use rights will be for the LTSC that was current at the time that the Software Assurance coverage expired, as well as any past LTSCs.

Windows 10 Enterprise per User doesn't have an underlying Windows Enterprise upgrade license with Software Assurance, therefore perpetual use rights aren't granted.

Microsoft Desktop Optimization Pack

Microsoft Desktop Optimization Pack (MDOP) is a suite of technologies that helps enterprise customers take advantage of desktop virtualization, better manage Windows devices, and deliver advanced system restore capabilities. It's a benefit of Software Assurance and Windows VDA subscription.

Note: Customers with Windows VDA subscription without MDOP prior to August 1, 2015, will receive entitlement to MDOP at their next renewal.

If you license Software Assurance or Windows VDA on a per device basis, then your MDOP subscription is also licensed on a per device basis, and it covers each specific licensed device. If you license Software Assurance or Windows VDA on a per user basis or you have the Windows per User Add-on, then your MDOP subscription is also licensed on a per user basis, so it covers all of each licensed user's devices. Learn more about MDOP.

Windows To Go Rights

By using Windows To Go, users can travel light without sacrificing productivity, organizations can enable new "Bring Your Own PC" scenarios, and contingent staff can get up and running faster with more security.

Windows To Go enables IT administrators to provide users with a corporate Windows image that can include line-of-business apps, settings, and corporate data on a compatible USB storage device. Users can boot and operate Windows To Go from any supported corporate or personal PC (Windows 7, Windows 8/8.1, or Windows 10 logo-certified) and continue to enjoy a rich and consistent Windows 10 experience.

Windows To Go Rights
Any supported device covered by either Software Assurance or Windows VDA subscription is licensed to run Windows To Go.
The primary user of any device licensed at work with Software Assurance or Windows VDA can run Windows To Go while at home or on the road from a supported non-corporate PC (for example, personally owned or hotel business center PCs) under Roaming Use Rights.
A user licensed with Software Assurance per User or Windows VDA per User is licensed to run Windows To Go for their exclusive use on any supported device.

Note: Windows To Go requires volume activation, either by using the Key Management Service (KMS) server in your organization or by using Active Directory-based volume activation. See the Volume activation section of this document for more details.

Windows 10 Downgrade Rights

Your rights to use prior versions of Windows in place of Windows 10 ("downgrade rights") depend on how the license was acquired.

Preinstalled on PC (OEM)	Commercial Licensing
OEM downgrade rights are limited to the equivalent edition for Windows 8.1 and Windows 7.	Commercial Licensing downgrade rights provide the greatest flexibility, with downgrades to any prior version.

Version Downgrade to	OEM preinstall	Commercial Licensing	Commercial Licensing	Commercial Licensing
	Windows 10 Pro	Windows 10 Pro	Windows 10 Enterprise	Windows 10 Education
Windows 8/8.1 Enterprise			✔	✔
Windows 8.1 Pro	✔	✔	✔	✔

Windows 7 Enterprise			✓	✓
Windows 7 Professional	✓	✓	✓	✓
Windows Vista Enterprise			✓	✓
Windows Vista Business		✓	✓	✓
Windows XP Pro		✓	✓	✓
Windows 2000 Professional		✓	✓	✓
Windows 95/98/NT		✓	✓	✓

PCs purchased with Windows 10 Pro preinstalled by an OEM will have the option to downgrade to either Windows 8.1 Pro or Windows 7 Professional. For circumstances requiring Windows Vista, Windows XP, or other prior versions, the rights to downgrade to these versions are available only through Commercial Licensing, not the OEM preinstall license.

Note: There are no downgrade rights to Windows 7 Ultimate.

Volume activation

Windows product activation is a set of technologies that enables customers to confirm that their copy of Windows is properly licensed. Product activation is required for all editions of Windows 10.

Volume activation applies to computers that are covered under a Commercial Licensing program and allows enterprise customers to automate the activation process, making it transparent to users. It's used strictly as a tool for activation, and isn't used for license invoicing or billing.

Activation through Key Management Service and Multiple Activation Key

Key Management Service (KMS) allows organizations to activate computers within customer environment through an internally hosted service (KMS), and Multiple Activation Key (MAK) activates computers on a one-time basis by using the hosted activation services provided by Microsoft. You can use either or both key types to activate computers in your environments, but each device that hasn't activated by a KMS must use a MAK.

Activation through Microsoft Active Directory

During Active Directory-based activation, any Windows 10 or Windows Server 2019 computers connected to the domain will activate automatically and transparently during computer setup. These clients stay activated as long as they remain members of the domain and maintain periodic contact with a domain controller.

Learn more about volume activation.

Windows 10 Education Activation

Windows 10 Enterprise is configured for use by commercial customers. We recommend Windows 10 Education for all K-12 customers, as it includes the data configuration designed for students and provides the most complete and secure edition for education environments. Depending upon your license, you can either directly deploy Windows 10 Education, or configure Windows 10 Enterprise so that it mirrors the data configuration for students of Windows 10 Education. As described below, all of our Windows commercial editions can be configured to support the needs of schools, through group policies, domain join, and more.

Availability of Windows 10 Education through Microsoft Volume Licensing. Windows 10 Education is only available through Microsoft Volume Licensing. Customers who are using Multi Activation Keys (MAK) or Key Management Service (KMS) for activations have the option to deploy either Windows 10 Enterprise or Windows 10 Education editions. As noted above, we recommend Windows 10 Education to all K-12 customers. If you don't have access to Windows 10 Education, contact your Microsoft representative or see more information [here](#).

Configuring Windows 10 Enterprise for K-12. Customers who deploy Windows 10 Enterprise can configure the product to have similar settings to Windows 10 Education by using Intune for Education, other MDM tools or Group Policy. More detailed information on these policies and the configuration steps required is available in [Manage Windows 10 and Microsoft Store tips, tricks, and suggestions](#). We recommend that K-12 customers using commercial Windows 10 Enterprise read the [document](#) and apply desired settings for your environment.

Schools also have the option to use AAD to upgrade Windows 10 Pro* devices to Windows 10 Enterprise. In that case we recommend using Intune for Education, or other MDM tools, or Group Policy to configure the product to have similar settings to Windows 10 Education. More detailed information on these policies and the configuration steps required is available in [Manage Windows 10 and Microsoft Store tips, tricks, and suggestions](#)

*Customers who have purchased devices running Windows 10 Pro Education (Shape the Future program) can upgrade to Windows 10 Education or Windows 10 Enterprise edition by using MAK/KMS activation only, for the time being.

Get Genuine Windows Agreement

The best and most cost-effective way to acquire full Windows licenses is through preinstalled licenses on a new PC. However, if you discover counterfeit software or have applied a Commercial Licensing Windows upgrade license without a qualified base operating system on your computers, there are solutions available through Commercial Licensing that can help remedy this noncompliant situation.

To purchase the correct Windows 10 Pro licenses through Commercial Licensing, the Get Genuine Windows Agreement (GGWA) has two options: GGWA for Small and Medium Organizations and GGWA for Large Organizations. Academic customers can purchase Windows 10 Home licenses via GGWA for Academic Organizations. [Learn more about Get Genuine options.](#)

Volume Licensing Reference Guide for Windows 10 Desktop Operating System

	GGWA for Small and Medium Organizations	GGWA for Large Organizations	GGWA for Academic Organizations
Audience	Small Business, Mid-market, Commercial, and Government customers	Mid-market, Large Commercial, and Government customers with a large installed base of PCs	Academic institution customers
Channel	Sold through Microsoft Resellers	Sold through Microsoft Licensing Solution Providers or direct from Microsoft	Sold through Microsoft Academic Resellers
Details	Non-signed commitment to buy legal going forward	Pre-signed agreement that includes an audit clause	Non-signed commitment to buy legal going forward
	No transferability of license	Commitment that future Windows software acquisitions will contain legal software	No transferability of license
	Commercial Licensing downgrade rights available	Placement of a one-time–only order	Needs to be combined with Academic Windows Upgrade Volume License
	Support is available for purchase from a Microsoft Reseller	No transferability of license	Downgrade rights not available; available only with Academic Volume License
		A Master Business and Services Agreement must be in place or one must be set up	No media or bits available for either download or purchase
		Commercial Licensing downgrade rights available	Support is available for purchase from a Microsoft Reseller
		Support is available for purchase from either Microsoft or Microsoft Licensing Solutions Provider	

Windows Offerings by Commercial Licensing program

Microsoft Commercial Licensing offers customized programs that help organizations purchase software licenses. Tailored for different organization type, size, and purchasing preferences, Microsoft Commercial Licensing programs provide flexible and affordable solutions designed to help you manage your licenses with ease. Whether you have five or thousands of desktop PCs, there's a Microsoft Commercial Licensing program for you.

Volume Licensing Reference Guide for Windows 10 Desktop Operating System

Windows Desktop Products available for purchase by Commercial Licensing program

Offering	Open License	Open Value and Subscription	Select Plus[1] and Microsoft Products and Services Agreement	Enterprise Agreement and Subscription	Enrollment for Education Solutions (Under a Campus and School Agreement)	School Enrollment	Cloud Solution Provider (CSP)
Windows 10 Pro Upgrade	✓		✓				
Windows 10 Enterprise (per device)	✓	✓	✓	✓		✓	
Windows 10 Enterprise E3			✓	✓			✓
Windows 10 Enterprise E5			✓ [2]	✓			✓
Windows 10 Education A3					✓		✓
Windows 10 Education A5					✓		✓
Windows 10 Enterprise LTSC	✓		✓				
Windows VDA E3			✓	✓			✓
Windows VDA E5			✓	✓			
Windows VDA per device			✓	✓	✓		

[1] Effective July 1, 2016, in markets where the MPSA is available, Microsoft will stop accepting new orders and Software Assurance renewals through existing commercial Select Plus agreements at your next agreement anniversary date. This retirement doesn't apply to government and academic Select Plus agreements. Learn more.

[2] Windows 10 Enterprise E5 isn't available in Select Plus.

How to acquire Licenses through Commercial Licensing

To acquire the latest Microsoft technology at a significant cost savings over full packaged products through Microsoft Commercial Licensing, contact your Microsoft representative or Microsoft Reseller Partner.

Your preferred Microsoft Commercial Licensing reseller can help you acquire Windows 10 Enterprise, which can be ordered through any Microsoft Commercial Licensing program. To find a Microsoft Commercial Licensing reseller:

- In the United States, call (800) 426-9400 or visit Microsoft partners.
- In Canada, contact the Microsoft Resource Centre at (877) 568-2495.
- Outside the United States or Canada, contact your local Microsoft subsidiary. To locate licensing information for your local subsidiary, visit Microsoft Licensing worldwide.

๒๔) ชุดโปรแกรมจัดการสำนักงาน ที่มีลิขสิทธิ์ถูกต้องตามกฎหมาย

Microsoft

Licensing brief

Licensing Microsoft Office software in Commercial Licensing

April 2020

This brief applies to all Microsoft Licensing programs.

Contents

Summary

This licensing brief addresses the commonly asked questions about licensing Microsoft Office suites in Microsoft Volume Licensing programs.

This brief only addresses questions about use rights for Microsoft Office for the Windows operating system acquired as a software product under a desktop application license (typically, a perpetual license). For more information about use rights for Microsoft Office acquired as a subscription service as part of Microsoft Office 365, see the "Licensing Microsoft Office 365 ProPlus Subscription Service" brief. To learn more about licensing Microsoft Office for Mac, see the "Licensing Windows and Microsoft Office to use on the Macintosh" brief.

Details

Per Device Microsoft Office Licensing

Microsoft Office 2019 software is licensed on a "per device" basis. Users must assign each Microsoft Office license to a single physical hardware system ("licensed device"). The license permits use of the software on the licensed device.

Commercial Licensing customers have the right to install and use any number of copies of the software on the licensed device on physical and/or virtual machines.

Customers may access Microsoft Office remotely, but one license is required for each physical device running or accessing the application. This includes situations where you run the software on your local device or access the software installed on another device like a server. See more detail in the Remote Access for Microsoft Office section.

Remote Access for Microsoft Office

Microsoft Office Application device licenses include Remote Use Rights, which allows remote access to the software from any licensed device. With Remote Use Rights, a company may install Microsoft Office on a single device for remote access two different ways.

- When installing the software on a desktop, the desktop device must be licensed. The primary user (the primary user is the user who uses the licensed device more than 50 percent of the time in any 90-day period) of the licensed device may remotely access the software running on the licensed device from any other device. Non-primary users may also access the software running on the device if the device they access from is also licensed for Office.

- Customers may choose to host Office applications on a dedicated server for remote access by their end users from their own devices. This option does not require a license to be assigned to the server itself but does require an Office license for each device remotely accessing the software on the server (see exception under Roaming Rights section below). The customer may alternatively choose to use a third party to host the server, if the server is dedicated to the specific customer. This is often referred to as "Outsourcing Software Management" and requires the third party to be an Authorized Outsourcer. An Authorized Outsourcer is any third party that is not designated as a Listed Provider. A list of Listed Providers can be found at https://aka.ms/ListedProviders.

  Note: The license terms for Outsourcing Software Management were updated October 1, 2019. The use of a Listed Provider was not restricted prior to the terms being updated and licenses acquired prior to this date aren't impacted. See Microsoft's Product Terms for details.

Licensing Office for use with Windows To Go

You can use Office installed on a USB drive with Windows To Go when you license the work device for the following:

- Windows 10 with Software Assurance for the Windows desktop operating system or Windows Virtual Desktop Access subscription license, and

- Office Professional Plus 2019/2016 or Office Standard 2019/2016

As a result, a user can use a USB drive to run Office on any licensed work device while on company premises. If you also have active Software Assurance for your Office suite license, the primary user of the licensed device can use the USB drive to run Office on devices outside of the workplace through the Office Roaming Rights benefits.

Office Suites available through Commercial Licensing

Office Standard 2019, Office Professional Plus 2019, and Office for Mac 2019 are available as software products under desktop application licenses through Microsoft Commercial Licensing.

		Office Standard 2019	Office Professional Plus 2019	Office for Mac 2019
Applications	Word	●	●	●
	Excel	●	●	●
	PowerPoint	●	●	●
	OneNote	●	●	●
	Outlook	●	●	●
	Publisher	●	●	
	Access		●	
	Skype for Business		●	
Premium Value	Volume Activation	●	●	●
	Group Policy[1]	●	●	
	Use with RDS	●	●	
	App Telemetry	●	●	●
	Update Controls	●	●	●
	Email Retention[2]		●	
	Access Site Mailboxes[2]		●	
	Access In-Place Archive Folder[2,3]		●	●
	Spreadsheet Controls		●	
	Business Intelligence		●	
	Create IRM Email[2]		●	●
	Data Loss Prevention[2]		●	
	Enterprise Voice[2,4]		●	

[1]Allows the organization to push certain configuration settings (security settings, app settings, Active Directory roaming, etc.) for Office to machines logging onto the corporate network.

[2]The suites provide different levels of integration with business productivity servers.

[3]Archive email from Outlook—no .pst files needed—and set retention policies that automatically archive or delete email. IT admins can centrally manage the In-Place Archive.

[4]Enterprise Voice includes several advanced calling features as well, such as delegation, team calling, Group Call Pickup, and Response Groups.

[5]Software Assurance required.

Licensing Microsoft Office software in Commercial Licensing

Acquiring Microsoft Office Licenses in Commercial Licensing

Volume Licensing programs where different editions of Microsoft Office are available as a software product under desktop application licenses vary (as shown in the following table).

Volume Licensing program	Office Standard 2019	Office Professional Plus 2019	Office for Mac 2019
Open	●	●	●
Open Value*	●	●	●
Open Value Subscription**	●	●	●
Select Plus	●	●	●
Microsoft Products and Services Agreement (MPSA)	●	●	●
School Enrollment		●	
Enterprise Agreement**		●	
Enterprise Subscription Agreement**		●	

*Office Professional Plus must be licensed as an enterprise product in an Open Value Organization-wide agreement.

**Office Professional Plus must be licensed as an enterprise product.

Microsoft Office Downgrade Rights

Some customers who have rights to more recent versions of Microsoft Office suites might want to continue using prior versions of those suites. This is permitted for Microsoft Office under desktop application licenses and is known as a "downgrade right." Customers may downgrade to earlier versions of the Microsoft Office software products, but only to the same edition of software product for which their device is licensed. That is, a customer may not downgrade from Office Standard 2019 to Office Professional Plus 2016.

The following shows the downgrade rights for the most recent Microsoft Office version:

Microsoft Office license	Downgrade rights
Office Standard 2019	Office Standard 2016
Office Professional Plus 2019	Office Professional Plus 2016
Office for Mac 2019	Office for Mac 2016

Software Assurance benefits for Microsoft Office

The Microsoft Software Assurance benefits vary by product and product pool. The following are key Software Assurance benefits applicable to Microsoft Office.

New Version Rights

With Software Assurance, customers are eligible to upgrade to new versions of licensed software. New Version Rights means the right to upgrade to the latest version of that software made available during the Software Assurance coverage period. Customers may run the new version of software in place of the licensed product. For example, if a new version of Microsoft Office is made available during the term of your

coverage, your licenses will be automatically upgraded to the new version (for example, from Office Standard 2016 to Office Standard 2019 or from Office Professional Plus 2016 to Office Professional Plus 2019).

Customers who acquired perpetual (i.e. non-subscription) licenses through Software Assurance can deploy the upgrades after their coverage has expired.

Roaming Use Rights

Customers with active Software Assurance for Microsoft Office software products are eligible to use roaming rights benefits. The single primary user of the licensed device may remotely access the software running on servers dedicated to the customer's use (for example, in your data center) from a qualifying third-party device or run the software in a virtual Operating System Environment (OSE) on a qualifying third-party device when the user is not on you or your affiliates premises. Additionally, if the device is also licensed for Software Assurance for the Windows desktop operating system, you may run Office from a USB device with Windows To Go.

A qualifying third-party device is a device that's not controlled, directly or indirectly, by you or your affiliates (for example, a third party's public kiosk or an employee's personal device). When the primary user is on you or your affiliates' premises, Roaming Use Rights aren't applicable. For example, an employee may not use their personal devices on premises and exercise their roaming rights benefits. This same user may access Microsoft Office from this personal device when at home.

Microsoft Home Use Program

Under the Microsoft Home Use Program, customers' employees may acquire Office 365 subscriptions for their personal use at a discount off the retail price. Employees may renew their subscriptions under this program indefinitely, regardless of customers' licensing status.

Office for the web and Office Online Server

Microsoft Office Online Server offers view-only access to Office documents on an Internet browser. For editing of Office documents, you need Software Assurance for an Office suite license acquired through Commercial Licensing. The single primary user* of an Office licensed device can edit documents using Office Online Server from any device, including those not licensed for Office. External users** don't need an Office suite license to view or edit Office documents on an Internet browser.

Primary users of an Office licensed device with active Software Assurance may also access Office Online*** service to view and edit Office documents.

Find more information about Office Online Server.

*The primary user is the user who uses the licensed device more than 50 percent of the time in any 90-day period.

**External users are those users that are neither your or your affiliates' employees, nor your or your affiliates' on-site contractors or on-site agents.

***Users must also be licensed for SharePoint Online or OneDrive for Business plans to access Office for the web services.

Frequently asked questions

1. I have an employee from our marketing organization that only needs to use Microsoft PowerPoint. Can an employee from our finance organization that doesn't need PowerPoint share their Microsoft Office suite with the marketing organization user?

    Office Standard and Office Professional Plus are Microsoft Office suites which consist of more than one software product offered under a single license. Users may not separate the software for use on more than one computer. If you have employees that only need to use a single Microsoft Office application

individual Office application licenses are available for purchase on a stand-alone basis in Open, MPSA, and Select programs.

2. Our company has a mixed deployment with both Office Standard 2019 and Office Professional Plus 2019. What Microsoft Office licenses do I need if my users access Microsoft Office remotely from a server?

   Customers must license all devices accessing a server for the same Microsoft Office suite installed on their licensed devices. The organization may accomplish this by, 1) deploying a single Microsoft Office edition company-wide; or 2) maintaining separate servers for each Microsoft Office edition.

3. Our company has a mixed deployment with both Office Professional Plus 2019 in German language and English language. What Microsoft Office licenses do I need?

   Microsoft Office 2019 licenses include the Multi-Language Pack and proofing tools. The ability to change languages or use multiple languages is included with all Office 2019 suites and applications' software (such as Excel). For Office 2019, the Office Multi-Language Pack is now included as part of the product. Customers with prior versions covered with Software Assurance will continue to receive this right as part of their Software Assurance coverage.

4. I have a personal laptop device I like using at work for meetings. May I access a Microsoft Office copy remotely that is deployed on a company server using Remote Desktop Services?

   The company would need to assign an Office device license to your personal laptop that is the same version and edition of Office being remotely accessed on the company's dedicated server. Since you are using your personal device on premises, Office Roaming Rights would not apply. Only third-party qualified desktops used outside of company premises may exercise Office Roaming Rights. Some examples include home and airport kiosk devices.

5. How can I be licensed for access to the Office Online Server for editing?

   Office suite licenses with Software Assurance allow you to edit Office files using the Office Online Server from the licensed device. Users licensed for Office 365 ProPlus can also edit files using Office Online Server.

6. When licensed with Office Professional Plus 2019, Office Standard 2019, or Office for Mac 2019 are Office Online applications licensed on a per device or per user basis?

   Office client suites are licensed per device. The primary user of a device licensed for this Office software with active Software Assurance is licensed for access to the online companion Office Online applications from any device. In these situations, the primary user is enabled for remote online access through Office Online Server.

7. What licenses are required for external users collaborating with licensed employees?

   External users accessing Office Online documents for viewing or editing aren't required to license the new Office suites. External users are those users who aren't either your or your affiliates' employees or your or your affiliates' on-site contractors or on-site agents.

8. Do my employees need an Office Professional Plus 2019, Office Standard 2019, or Office for Mac 2019 license for viewing only Office Online documents?

   No. Office suite licenses with Software Assurance are only required for those employees editing Office Online Server documents.

9. What's included in Office Online Server?

   Office Online Server provides browser-based versions of Word, PowerPoint, Excel, and OneNote from on-premises environments. Office Online Server is version-less and provides most of Office Online service features through regular software updates.

10. Can I install a copy of Office Professional Plus 2019 or Office Standard 2019 on a USB drive with my Windows To Go rights?

    Yes. You can install a copy of Office Professional Plus 2019 or Office Standard 2019 on a USB drive and use Office on any licensed work device. Those rights only apply for using a copy of Office on a USB drive on company premises. If the primary user's licensed device is licensed with Software Assurance, the user can also use Office via Windows to Go off company premises on a personal device. Note that you must also have active Software Assurance for Windows to be licensed for Windows To Go rights.

11. Our company has deployed Office Professional Plus 2019 in a virtual machine hosted on a company dedicated network server for remote access by one or multiple end users. Can a single device license be assigned to the virtual machine and be accessed by any user, since the virtual machine is where the software is installed?

    No. Each device an end user uses to access Office software on a server is required to be licensed. .

Appendix: Microsoft Office as a software product

Customers may license Office as a software product or a subscription service. See below for the main differences between the two offerings.

	Microsoft Office as a software product	Microsoft Office as a subscription service
Licensing Model	• Per device	• Per user, (may activate the software on up to five concurrent OSEs)
Product Editions	• Office Standard, Office Professional Plus	• Office 365 ProPlus, Office 365 Business
Downgrade	• User may downgrade to earlier version of same Microsoft Office edition licensed for device.	• Downgrade rights aren't applicable.
Remote Use	• Software Assurance Roaming Use Rights • Remote Use Rights permitted including via Virtual Desktop Infrastructure (VDI) or Remote Desktop Services (RDS) • Installation and use of Office from a USB device**	• Users may install activate the software on up to five devices and use Microsoft Office locally on those devices from anywhere. • Remote Use Rights permitted including via Virtual Desktop Infrastructure (VDI) or Remote Desktop Services with shared computer activation enabled • Installation and use of Office from a USB device**
Home Use	• Work At Home (WAH) licenses • Software Assurance Home Use Program (HUP) • Software Assurance Roaming Use Rights • Installation and use of Office from a USB device**	• Users may install one or more copies on home devices on up to five devices per user license. • Installation and use of Office from a USB device**
Multi-Language Pack	• Multi-Language Pack is included with Office 2019 licenses. • Multi-Language Pack 2013 license may be acquired in Open or Select Volume Licensing programs.	• Multi-Language Pack is included

*Office 365 Business is only available in Open, Open Value and Open Value Subscription programs. Effective July 1, 2016, in markets where the MPSA is available, Microsoft will stop accepting new orders and Software Assurance renewals through existing commercial Select Plus agreements at your next agreement anniversary date. This retirement does not apply to government and academic Select Plus agreements. More information is at https://www.microsoft.com/en-us/licensing/licensing-programs/select.aspx.

**Requires Windows To Go, which is available as a benefit of Software Assurance for the Windows desktop operating system or Windows Virtual Desktop Access (VDA) subscription.

๒๕) ระบบเครื่องแสดงผลข้อมูลผู้บริหาร (Executive Display)

SAMSUNG

DM-D SERIES COMMERCIAL LED LCD DISPLAYS

WHEN MAXIMUM UPTIME MATTERS

SAMSUNG SMART SIGNAGE PLATFORM

ULTRA-SLIM DISPLAYS WITH FULL CONNECTIVITY AND 24/7 DEPENDABILITY

Around the clock reliability. It's now within reach thanks to the Samsung DM-D Series. Available in four sizes of 32", 40", 48" and 55", the competitively priced displays deliver an outstanding visual experience wherever 24/7 operation is mandatory, such as public spaces, restaurants and retail stores. The screens in Full HD deliver amazing imagery, lightweight designs ensure installation ease, and an optional touch overlay can enable up to 10 simultaneous touch points for a new level of interactivity. The New Business Experience

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KEY FEATURES

Reliable 24/7 Continuous Operation
Innovative Samsung cooling technologies allow your message to be displayed with highly reliable 24/7 continuous operation.

Enhanced System-on-Chip Performance with Quad-Core CPU
Powered by a System-on-Chip semiconductor and quad-core CPU, Samsung's Smart Signage Platform reduces TCO for digital signage deployments, providing savings in hardware, installation and operating costs.

New Industrial Design
A sleek, stylish new look features a 9.5mm bezel with optional customizable bezel trim kits (white, titanium silver, matte black, wood grain).

Ultra-Slim 2.0" Chassis
The stylishly thin chassis helps simplify installation while meeting ADA compliance requirements.

Slim-Direct LED Backlight
The slim-direct-lit displays of the DM-D Series feature 1920 x 1080 Full HD resolution with 450 nits brightness and 5000:1 contrast ratio for sharp, detail-rich images and crisp, easily legible type.

Built-In Wi-Fi and AllShare Cast
Enjoy the advantages of expanded connectivity to mobile devices and simple mirroring of content on a tablet to the display.

Optional Touch Overlay
Add an optional IR touch overlay accessory to enable up to 10 simultaneous touch points.

Magic Info-s Digital Signage Software
The software allows you to create playlists, set playback schedules and publish contact directly to the display. Most traditional file formats are supported including RSS feed and live web pages.

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EXPERIENCE

# Samsung DM-D Series Commercial LED LCD Displays

KEY SPECIFICATIONS
For complete product specifications, visit samsung.com/prodisplay

		DM32D	DM40D	DM48D	DM55D
Display	Model Number	DM32D	DM40D	DM48D	DM55D
	Screen Size	32"	40"	48"	55"
	Panel Technology	60Hz Slim D-LED BLU	60Hz Slim D-LED BLU	60Hz Slim D-LED BLU	120Hz Slim D-LED BLU
	Resolution	1920x1080 (16:9)	1920x1080 (16:9)	1920x1080 (16:9)	1920x1080 (16:9)
	Brightness	420 nits	450 nits	450 nits	450 nits
	Contrast Ratio	5000:1	5000:1	5000:1	5000:1
	Viewing Angle (Horizontal/Vertical)	178° / 178°	178° / 178°	178° / 178°	178° / 178°
	Orientation	Landscape / Portrait	Landscape / Portrait	Landscape / Portrait	Landscape / Portrait
	Response Time (G-to-G)	8ms	8ms	8ms	8ms
Connectivity	Input	Video: VGA (D-Sub 15 Pin), DVI-D, Component/Composite, HDMI, Audio: Stereo Mini Jack	Video: VGA (D-Sub 15 Pin), DVI-D, DisplayPort 1.2, Component/Composite, HDMI, Audio: Stereo Mini Jack	Video: VGA (D-Sub 15 Pin), DVI-D, DisplayPort 1.2, Component/Composite, HDMI, Audio: Stereo Mini Jack	Video: VGA (D-Sub 15 Pin), DVI-D, DisplayPort 1.2, Component/Composite, HDMI, Audio: Stereo Mini Jack
	Output	Audio: Stereo Mini Jack	Video: DisplayPort 1.2 (Loop-Out), Audio: Stereo Mini Jack	Video: DisplayPort 1.2 (Loop-Out), Audio: Stereo Mini Jack	Video: DisplayPort 1.2 (Loop-Out), Audio: Stereo Mini Jack
	External Control	RS232C (In/Out) thru Stereo Jack, RJ45	RS232C (In/Out) thru Stereo Jack, RJ45	RS232C (In/Out) thru Stereo Jack, RJ45	RS232C (In/Out) thru Stereo Jack, RJ45
	External Sensor	IR, Ambient Light	IR, Ambient Light	IR, Ambient Light	IR, Ambient Light
Power	Power Supply	AC 100 - 240 V~ (+/- 10 %), 50/60 Hz	AC 100 - 240 V~ (+/- 10 %), 50/60 Hz	AC 100 - 240 V~ (+/- 10 %), 50/60 Hz	AC 100 - 240 V~ (+/- 10 %), 50/60 Hz
	Power Consumption (Typical/Max)	61W / 77W	86W / 121W	100W / 132W	130W / 176W
	Power Consumption (Standby)	< 0.5W	< 0.5W	< 0.5W	< 0.5W
Environmental Conditions	Operating Temperature	0°C - 40°C	0°C - 40°C	0°C - 40°C	0°C - 40°C
	Operating Humidity	10%~80%	10%~80%	10%~80%	10%~80%
Features		Slim & Light LFD with Built-in MagicInfo Player S2	Slim & Light LFD with Built-in MagicInfo Player S2	Slim & Light LFD with Built-in MagicInfo Player S2	Slim & Light LFD with Built-in MagicInfo Player S2
	Special — Hardware	Super Clear Coating, Temperature Sensor, Videowall (15x15), Pivot Display, Clock Battery(80hrs Clock Keeping), Built in Speaker, Wi-Fi Module Embedded, AllShare Screen Mirroring, SD Card Slot	Super Clear Coating, Temperature Sensor, Videowall (15x15), Pivot Display, Clock Battery(80hrs Clock Keeping), Built in Speaker, Wi-Fi Module Embedded, AllShare Screen Mirroring, SD Card Slot	Super Clear Coating, Temperature Sensor, Videowall (15x15), Pivot Display, Clock Battery(80hrs Clock Keeping), Built in Speaker, Wi-Fi Module Embedded, AllShare Screen Mirroring, SD Card Slot	Super Clear Coating, Temperature Sensor, Videowall (15x15), Pivot Display, Clock Battery(80hrs Clock Keeping), Built in Speaker, Wi-Fi Module Embedded, AllShare Screen Mirroring, SD Card Slot
	Special — Software	Magic Clone (to USB), Auto Source Switching & Recovery, Lamp Error Detection, RS232C/RJ45 MDC, Plug and Play (DDC2B), PIP/PBP, Image Rotation, Button Lock, DP 1.2 Digital Daisy Chain (Supporting 2x2 UHD Resolution, HDCP Support), Smart Scheduling, Smart F/W update, Built In MagicInfo Player S2, Firmware Update by Network, LFD New Home Screen, PC-less Videowall, Predefined Template for Vertical Usage, Multi Channel, Mobile Control, Event Schedule, Backup Player, PC-less Touch	Magic Clone (to USB), Auto Source Switching & Recovery, Lamp Error Detection, RS232C/RJ45 MDC, Plug and Play (DDC2B), PIP/PBP, Image Rotation, Button Lock, DP 1.2 Digital Daisy Chain (Supporting 2x2 UHD Resolution, HDCP Support), Smart Scheduling, Smart F/W update, Built In MagicInfo Player S2, Firmware Update by Network, LFD New Home Screen, PC-less Videowall, Predefined Template for Vertical Usage, Multi Channel, Mobile Control, Event Schedule, Backup Player, PC-less Touch	Magic Clone (to USB), Auto Source Switching & Recovery, Lamp Error Detection, RS232C/RJ45 MDC, Plug and Play (DDC2B), PIP/PBP, Image Rotation, Button Lock, DP 1.2 Digital Daisy Chain (Supporting 2x2 UHD Resolution, HDCP Support), Smart Scheduling, Smart F/W update, Built In MagicInfo Player S2, Firmware Update by Network, LFD New Home Screen, PC-less Videowall, Predefined Template for Vertical Usage, Multi Channel, Mobile Control, Event Schedule, Backup Player, PC-less Touch	Magic Clone (to USB), Auto Source Switching & Recovery, Lamp Error Detection, RS232C/RJ45 MDC, Plug and Play (DDC2B), PIP/PBP, Image Rotation, Button Lock, DP 1.2 Digital Daisy Chain (Supporting 2x2 UHD Resolution, HDCP Support), Smart Scheduling, Smart F/W update, Built In MagicInfo Player S2, Firmware Update by Network, LFD New Home Screen, PC-less Videowall, Predefined Template for Vertical Usage, Multi Channel, Mobile Control, Event Schedule, Backup Player, PC-less Touch
	Tuner	Yes	Yes	Yes	Yes
	SMART Signage Platform Compliant	Yes	Yes	Yes	Yes
	Internal Media Player	Cortex-A9 1GHz Quad Core, 1.5GB DDR3, 4GB FDM, USB 2.0, Linux OS	Cortex-A9 1GHz Quad Core, 1.5GB DDR3, 4GB FDM, USB 2.0, Linux OS	Cortex-A9 1GHz Quad Core, 1.5GB DDR3, 4GB FDM, USB 2.0, Linux OS	Cortex-A9 1GHz Quad Core, 1.5GB DDR3, 4GB FDM, USB 2.0, Linux OS
	VESA Standard Wall Mount Interface	200 x 200mm	200 x 200mm	400 x 400mm	400 x 400mm
	24/7 Operation	Yes	Yes	Yes	Yes
Dimensions	Product Dimensions (without stand)	28.4" x 16.5" x 2.0"	35.7" x 20.7" x 2.0"	42.3" x 24.4" x 2.0"	48.4" x 27.8" x 2.0"
	Packaging Dimensions	31.5" x 18.5" x 4.6"	39.8" x 23" x 5"	46.7" x 28.1" x 5.8"	53.1" x 31.9" x 5.8"
	Bezel Width	10.5mm (U/L), 15.0mm (R/B)	9.5mm (U/L), 15.0mm (R/B)	9.5mm (U/L), 15.0mm (R/B)	9.5mm (U/L), 15.0mm (R/B)
Weight	Product Weight	10.7 lbs.	16.6 lbs.	24.5 lbs.	34 lbs.
	Shipping Weight	13 lbs.	20.1 lbs.	30.9 lbs.	43 lbs.
Service	Standard Warranty	3 Years On-Site (Parts / Labor / Backlight)	3 Years On-Site (Parts / Labor / Backlight)	3 Years On-Site (Parts / Labor / Backlight)	3 Years On-Site (Parts / Labor / Backlight)
Accessories	Included	Quick Setup Guide, Warranty Card, D-Sub Cable, Power Cord, Remote Controller, Batteries	Quick Setup Guide, Warranty Card, D-Sub Cable, Power Cord, Remote Controller, Batteries	Quick Setup Guide, Warranty Card, D-Sub Cable, Power Cord, Remote Controller, Batteries	Quick Setup Guide, Warranty Card, D-Sub Cable, Power Cord, Remote Controller, Batteries
	Optional Mount	WMN4070SD, WMN250MD	WMN4070SD, WMN250MD	WMN4270SD, WMN250MD	WMN4270SD, WMN250MD
	Optional Stand	STN-L3240E	STN-L3240E	STN-L4655E	STN-L4655E
	Optional Media Player	SBB-C, SBB-CD7, SBB-CQ7	SBB-C, SBB-CD7, SBB-CQ7	SBB-C, SBB-CD7, SBB-CQ7	SBB-C, SBB-CD7, SBB-CQ7
	Optional Touch Overlay	CY-TD32	CY-TD40	CY-TD48	CY-TD55
Green Management	Emission Standard	EMC	EMC	EMC	EMC
	ENERGY STAR® 6.0 Compliant	Yes	Yes	Yes	Yes
	RoHS Compliant	Yes	Yes	Yes	Yes
	Packaging Recyclability	Packing Materials Recyclable	Packing Materials Recyclable	Packing Materials Recyclable	Packing Materials Recyclable

CONNECTIVITY

1. RS232C In
2. RS232C Out
3. IR/Ambient Sensor In
4. Audio In
5. Audio Out
6. SD Card Slot
7. USB
8. DVI In
9. DisplayPort In
10. HDMI In
11. VGA In
12. Display Port Out
13. Antenna In
14. AV In
15. IR Out
16. RJ45 In

Note: 32" model does not have DisplayPort In/Out.
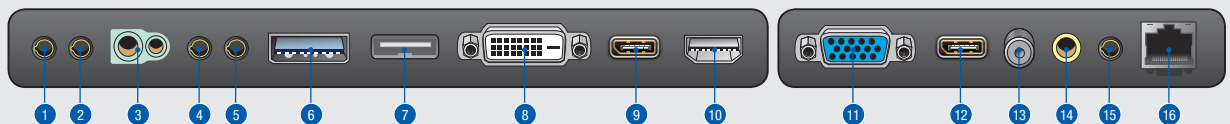
SAMSUNG

For complete product information and accessories, visit samsung.com/business or samsung.com/prodisplay

Sales Support: 1-800-SAMSUNG or 1-866-SAM4BIZ | Follow us: youtube.com/samsungbizusa | @SamsungBizUSA

Samsung Electronics has been named 2013 ENERGY STAR Partner of the Year in the product manufacturing category by the U.S. Environmental Protection Agency (EPA).

Dell Large Displays

LARGE FORMAT MONITORS AND PROJECTORS

CONNECT. PRESENT. COLLABORATE.

Experience smarter, faster collaboration in meeting rooms or classrooms with Dell Large Format Monitors and Projectors, from the world's number one monitor brand*. Capture real-time collaboration in conference or meeting rooms, or present to large or small audiences, simply and effectively. Connect, Present, Collaborate — it's that easy.

Contact your Dell representative or visit **Dell.com/largeformatmonitors** to learn more.

Dell Large Displays

FOR MEETING AND LEARNING SPACES

Transform your meeting space with the right Dell Large Format Monitor or Projector. Our products are built to fit different spaces and requirements, and with our open standards approach, you can create a customized end-to-end display solution that is tailored to the way your team members meet.

CHOOSE THE RIGHT PRODUCTS ACCORDING TO YOUR MEETING SPACE

Small spaces and open areas
- **Accommodates:** 2 – 4 people
- **Suggested viewing distance:** approx. 8 feet (2.5 m) from the screen to furthest seat

8 feet (2.5 m)
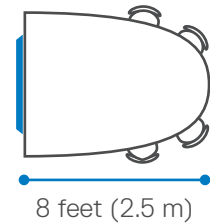
Medium spaces
- **Accommodates:** 5 – 9 people
- **Suggested viewing distance:** approx. 12 feet (3.7 m) from the screen to furthest seat

12 feet (3.7 m)
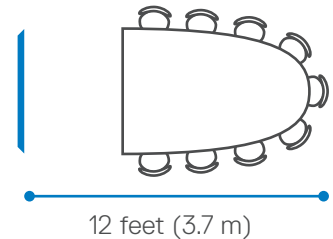
Large spaces
- **Accommodates:** 10 – 15 people
- **Suggested viewing distance:** approx. 15 feet (4.5 m) from the screen to furthest seat

15 feet (4.5 m)

Learning spaces
- **Accommodates:** > 20 people
- **Suggested viewing distance:** approx. 18 feet (5.5 m) from the screen to furthest seat

18 feet (5.5 m)
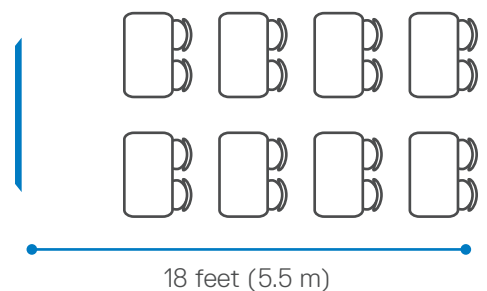
Dell Large Format Monitors

CONNECT. PRESENT. COLLABORATE.

CONNECT

Dell Large Format Monitors are easy to setup and use, allowing you and your teams to connect quickly without disruption. They are software and hardware agnostic so you can use them with virtually any PC, OS or software. And, they come with a wide variety of connectivity options, so you can quickly connect to the display and seamlessly switch between presenters, allowing your audience to enjoy a smooth and continuous presentation.

PRESENT

Captivate your audiences with impressive visuals in up to 4K resolution[1]. See crisp, sharp text and consistent color from virtually anywhere in the room, thanks to In-Plane Switching technology. Plus, anti-glare and anti-smudge coatings reduce distracting reflections or fingerprints to improve clarity.
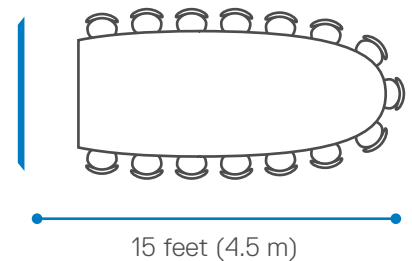
COLLABORATE

Group collaboration is seamless and intuitive with our interactive touch monitors that enable multiple users to write, edit, annotate or erase notes simultaneously — with up to 20 touch points. Exclusive Dell Screen Drop feature, available in our 4K interactive touch monitors, improves reachability for users from different heights.

EASY TO DEPLOY AND MANAGE

Dell Large Format Monitors are VESA compatible, making it easy to pick a mounting solution that best fits your space, whether that's a mobile cart, stand or wall mount. And, with HDMI CEC, RS45 and RJ232 ports[1], your IT can conveniently control your monitor via the network or meeting room control systems.

"

Our own team can effortlessly deploy the Dell 86 4K monitors. We use our own Windows image to ensure compliance with our standards and security policies. That reduces the total cost of the devices even more."

— Paul Wilmore, Director of IT, Stonyhurst College

Source: Dell/Stonyhurst College customer reference case study, December 2018

Present your best

WITH DELL 4K INTERACTIVE TOUCH MONITORS

IMPRESSIVE SCREEN PERFORMANCE

Keep your audience engaged with a 55, 75 or 86-inch 4K interactive touch display, designed for seamless collaboration.
See brilliant images in 4K resolution and experience consistent colors across the screen from virtually anywhere in the room,
thanks to the wide viewing angle enabled by IPS technology. Anti-glare and anti-smudge coatings reduce distracting reflections
and fingerprints for consistent clarity.

COLLABORATE WITH EASE

Group collaboration is intuitive and effortless with up to twenty points of touch interactivity. Write or draw in real time with your
fingers or stylus, and erase written content with the palm of your hand — with virtually zero lag. Experience natural and intuitive
touch functionality that is compatible with most industry-standard software.

EASY ON THE EYES

Dell ComfortView reduces blue light emissions to help optimize eye comfort over extended viewing periods.

Present your best

WITH DELL 4K INTERACTIVE TOUCH MONITORS

INCLUSIVE FOR ALL. EXCLUSIVE TO DELL.

Exclusive Dell Screen Drop is the world's first accessibility feature that improves reachability for users working from different heights.** Buttons at the side of the panel enable users to lower the displayed image to 3 different height setting so it's within easy reach. This feature is available on Dell 4K Interactive Touch Monitors — C5518QT, C7520QT, C8618QT.

Dell Screen Drop feature provides four convenient height settings:

| 100% | 66% | 50% | 33% |

ALL-IN-ONE SOLUTION

Dell 4K Interactive Touch Monitors feature a unique design that's compatible with the Dell OptiPlex Micro PC (sold separately), which integrates seamlessly into the back panel. This creates an all-in-one solution that simplifies deployment, network management, and allows your IT to easily upload your organization's standard OS image for a display solution that adheres to your company's security and service standards.

LOCK IT DOWN

Prevent accidental shutdown or settings changes with lock mode, a feature that allows IT managers to control the menu and power options.

Why choose Dell Large Format Monitors

IMPRESSIVE VISUALS. IMPACTFUL PRESENTATIONS.

Dell Large Format Monitors are available as standalone displays or they can be complemented with hardware and software from Dell or other manufacturers like Intel, Chief, FlatFrog, Logitech and Zoom, to create a total solution that meets the unique needs of your organization.

OPEN PLATFORM

Displays should fit the way your employees meet, not the other way around. With our open platform approach, you can deploy our monitors into your meeting spaces and continue to use the technology that you're comfortable with. This makes your new monitor inherently easy to deploy and use — without the need for calibration or training.

CUSTOMIZATION

Dell offers a variety of hardware and software technologies that complements our Large Displays, making it easy for you to create an all-to-end display solution that meets the needs of your business.

SUPPORT

Dell Large Format Monitors comes with a 3-year Advanced Exchange Service (upgradeable to 5 years)[3] so that if needed, we will send you a replacement display the next business day, ensuring your spaces are always ready for a meeting. Upgrade to 24x7 specialist technical phone support with the Dell ProSupport option.

"

The Dell Large Format Monitors don't require any training at all. After a rapid setup, teachers and students are ready to use the Dell 86 4K monitors immediately."

– Paul Wilmore, Director of IT, Stonyhurst College

Source: Dell/Stonyhurst College customer reference case study, December 2018

Meet the Dell Large Format Monitors Family

	C5519Q	C5518QT	C7017T	C7520QT	C8618QT
Resolution	4K	4K	Full HD	4K	4K
OptiPlex Micro Mounting via:	Optional bracket	PC slot	Optional bracket	PC slot	PC slot
Touch/Non-Touch	Non-touch	20 points of touch	10 points of touch	20 points of touch	20 points of touch
Image Size	54.6 in	54.6 in	69.5 in	75 in	85.6 in
Panel Type	Vertical Alignment Glass	IPS Glass	Vertical Alignment Glass	IPS Glass	IPS Glass
Surface	Anti-glare	Anti-glare, Anti-smudge	Anti-glare, Anti-smudge	Anti-glare, Anti-smudge	Anti-glare, Anti-smudge
Mount	Optional wall mount	Optional wall mount	Wall mount included	Optional wall mount	Optional wall mount
Connectivity	2x HDMI 1x DisplayPort 1x VGA 4x USB 1x Audio-In/-Out 1x RS232 1x RJ45	3x HDMI 1x DisplayPort 1x VGA 7x USB 1x Audio-In/-Out 1x RS232 1x RJ45	3x HDMI 1x DisplayPort 1x VGA 4x USB 1x Audio-In/-Out 1x RS232 1x RJ45	3x HDMI 1x DisplayPort 1x VGA 4x USB 1x Audio-In/-Out 1x RS232 1x RJ45	4x HDMI 1x DisplayPort 1x VGA 7x USB 1x Audio-In/-Out 1x RS232 1x RJ45
Mount	Optional wall mount	Optional wall mount	Wall mount included	Optional wall mount	Optional wall mount

MOUNTS AND STANDS

CHIEF LARGE FUSION FIXED FLAT PANEL WALL MOUNT | LSA1U

This robust mount with quick installation features secures heavy displays. Plumb adjustment helps to vertically align the display. Compatible with C5519Q, C5518QT, C7017T and C7520QT.

CHIEF FUSION MOUNTING COMPONENT | FCA520 (FOR CART) / FCA112 (FOR WALL MOUNT)

Attach a micro PC or other devices to the back of your Large Format Monitor with this versatile clamping kit. Compatible with C5519Q and C7017T.

DELL HEAVY DUTY FIXED DISPLAY MOUNT FOR C8618QT

This heavy duty fixed mount with quick installation features securely mounts your C8618QT to the wall. Plumb adjustment helps to vertically align the display.

CHIEF TABLE STAND | LDS1U

Organize your meeting room exactly as you envisioned, without worrying about wall space, by placing your conference room monitor on a flat surface. Compatible with C5519Q and C5518QT.

CHIEF LARGE FUSION FLOOR STAND | LFAUB

This height adjustable floor stand incorporates rounded edges and sleek features to give a softer, professional feel that fits well in corporate and classroom environments. Compatible with C5519Q, C5518QT, C7017T and C7520QT. The C8618QT is compatible with XFAUB.

CHIEF LARGE FUSION MANUAL HEIGHT ADJUSTABLE MOBILE AV CART | LPAUB

Take your display to wherever the meeting is taking place with an easy to move cart that is also height adjustable. Compatible with C5519Q, C5518QT, C7017T and C7520QT. The C8618QT is compatible with XP1AUB.

Recommended accessories

ESSENTIALS

DELL OPTIPLEX MICRO PC
WITH OPTIONAL INTEL UNITE

Dell OptiPlex Micro PC provides an all-in-one like experience, allowing video conferencing, whiteboarding, presentations and other applications to be run directly on the monitor. When combined with software such as Intel Unite, Quicklaunch, Microsoft Whiteboard or Zoom Rooms, this provides for a very easy to use meeting experience.

DELL WIRELESS
KEYBOARD & MOUSE

Connect to the PC wirelessly with a lightweight keyboard and mouse that allows for multiple PCs to be connected with a simple switch.

CONFERENCE CAMERAS AND SPEAKERS

LOGITECH MEETUP
CONFERENCE CAMERA

Ideal fo small and medium spaces, this conference camera offers a 120 degree field of view and with comes with integrated audio, making this perfect for video conferencing when combined with conference software.

ACTIONTEC SCREENBEAM
ENTERPRISE 960

Suitable for small and medium spaces, this enterprise-grade wireless display receiver enables users to present from anywhere in the room, and even allows wireless touchscreen operation.

LOGITECH GROUP VIDEO
CONFERENCING KIT
WITH EXPANSION MICROPHONES

Hear and be heard with life-life clarity with Logitech Group Video Conferencing Kit with Expansion Microphones, featuring 4 omnidirectional microphones and 360-degree coverage. Ideal for large and learning spaces.

Recommended software

DELL LARGE FORMAT MONITORS

SOFTWARE SOLUTIONS

intel® UNITE™

The Intel Unite® solution lets you easily create and manage a secure content sharing and collaboration platform for your organization. Wirelessly connect displays, employees, and mixed technology environments so your team can share and collaborate seamlessly, wherever they are.

quicklaunch™
welcome to better meetings

A simple and secure meeting room management interface. With one touch users can join meetings, start applications, access data and content, and share device screens.

FlatFrog
the future at your fingertips

FlatFrog works just like a typical whiteboard — allowing presenters to annotate on the surface and capture annotations with differentiated pen functionality for multiple users and natural palm erase.
License included with C5518QT, C7520QT and C8618QT.

DisplayNote®

DisplayNote software helps to make presentations more interactive. Allowing users to connect and contribute to the presentation and collaborate with each other from their own devices.
License included with C5518QT, C7017T, C8618QT.

zoom

Zoom Rooms is a software that combines video conferencing, wireless content sharing, and integrated audio into one easy-to-use platform. It can be used for room only attendees or remote attendees joining from a another room, from their desktop, or from their mobile device.

SOFTWARE FOR EDUCATION

Google for Education

Google for Education offers secure and straightforward cloud-based management with automatic updates and built-in security features. Students and teachers can connect their Chromebooks directly to the Large Format Monitor using one of the many available inputs, or connect wirelessly using Chromecast. They can annotate and interact with compatible applications directly on the display or from their touch-enabled Chromebook.

Microsoft

With Microsoft in Education, students and teachers can easily connect to external devices such as speakers, cameras, and digital microscopes, as well as an infinite number of software applications. Choose from web, mobile, and desktop version of apps that students can annotate over simultaneously and in real time, such as Microsoft Edge, PowerPoint and OneNote.

Dell Laser Projectors

THE FUTURE OF PROJECTION

GO LAMPLESS

Dell Laser Projectors offer brilliant image quality and crisp text that everyone in the room can see. They are virtually maintenance free and do not require warm up or cool down time so you can get your meetings started in seconds.

See as much detail as you need: Showcase details in your presentations, even in large venues, with our 4K projector. Or, select our Full HD projector for general viewing.

Big picture, bigger impact: Project clear, brilliant images up to 300"[1] — ideal for medium to large spaces, such as a classroom, conference room or auditorium.

Any angle, anytime: Dell Laser Projectors are engineered to project perfectly — even on their side or upside down. They can run 24/7 and have low-power consumption, making them perfect for use in demanding environments such as digital signage.

Manage your meeting spaces: With RS232 and RJ45 connectivity, you can connect to a variety of AV network control systems to manage and maintain your projector remotely.

Low maintenance: Dell Laser Projectors last up to 10 years[2]. And, with a dust resistant design (IP5X certified) and no bulbs or filters to replace, they are virtually maintenance free.

Comprehensive support: Dell Laser Projectors are backed by a 2-Year Advanced Exchange Warranty[4], and the laser system is covered under the same warranty for up to 20,000 hours of use. If you opt to extend your warranty to 3-, 4-, or 5-years, the laser system is still covered for 20,000 hours use or the term of the warranty.

Lamp vs. Laser
Hours of illumination

LASER
20,000

LAMP
3,000
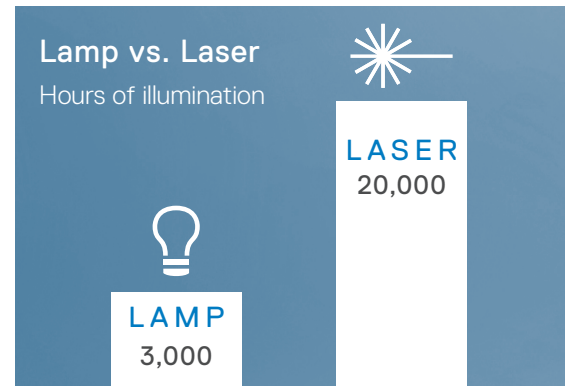
The laser light source of the projector lasts for up to 10 years of life (which is approx 20,000 hours)[2]

DID YOU KNOW?

Some manufacturers offer laser hybrids that can quickly lose brightness and only cover the light source for 1-3 years. Dell Laser Projectors are covered by a 2-Year Advanced Exchange Warranty[4] or for up to 20,000 hours of use[5] (whichever comes first).

Meet the Dell Laser Projector Family

	S718QL	7760	P519HL
Resolution	4K UHD (3840 x 2160)	FullHD 1080p (1920 x 1080)	FullHD 1080p (1920 x 1080)
Aspect Ratio	16:9	16:9	16:9
Light Source	Laser	Laser	Laser
Brightness/Lumens	5,000	5,400	4,000
Lamp/Light Hours	Up to 20K (Nor)	Up to 20K (Nor)	Up to 20K (Nor)
Contrast Ratio			
Typical (Full on/Full off)	2,000:1	1,800:1	1,800:1
High Contrast Mode	100,000:1	100,000:1	100,000 :1
Projected Image Size	100" ~ 130"	27" ~ 300"	20" ~ 300"
Connectivity	1x HDMI 2.0 (HDCP 2.2) 2x HDMI 1.4a 1x RJ45 1x RS232 1x SPDIF out 1x Audio out 2x Powered USB Type A (5V / 1.8 A Output) 1x USB-A 3.0 1x Mini USB-B Bluetooth Audio 4.2	3x HDMI 1.4a 1x D-Sub VGA-In 1x D-Sub VGA-Out 1x RS232 1x RJ45 1x Audio in, Audio out 1x Microphone (3.5mm) 2x Powered USB Type A (5V / 1.8 A Output) 1x 12V DC / 200 mA max. relay output for driver automatic screen 1x Mini USB-B	2x HDMI 1.4a 1x D-Sub VGA-In 1x RS232 1x RJ45 1x Audio in, Audio out 1x Powered USB-A (5V/1.8A Output) (Shared) 1x USB-A (for optional Wi-Fi adapter WD518) 1x Mini USB-B

RECOMMENDED ACCESSORIES

DELL PROJECTOR CEILING MOUNT

This mount holds your Dell Projector firmly to the ceiling and enables you to flush mount the projector without disassembly. (Projector sold separately).

DA-LITE 29732 PROJECTOR SCREEN

Recommended for 4K projectors, this Da-lite Projector Screen features Parallax, Da-Lite's first ambient light rejecting surface. This new surface is glare and sparkle-free and makes use of an advanced optical lens system in order to reject light, so uses can enjoy projected images in full brightness, from almost any in the room.

WIRELESS DONGLE – WD518

Perfect for casting presentations in large conference rooms, the Wireless Dongle provides a reliable connection for up to 4 users simultaneously, making it quick and easy to switch presenters. Compatible with Dell Projector models S718QL and P519HL.

Dell Large Format Monitors and Projectors

TRUSTED RELIABILITY

Enjoy peace of mind with the commitment to quality, reliability and service that you expect from Dell — backed by our Advanced Exchange Service[3], upgradeable to 5 years, and optional ProSupport.

Product availability varies by country. Contact your Dell representative or visit **Dell.com/largeformatmonitors** to learn more.

> " We're saving money in every classroom with a Dell monitor, and we've gone from having 20 or more trouble tickets each day, to just 1 or 2 with our Dell monitors — and most are user errors. That's pretty remarkable."
>
> – Brian Zimmer, Director of Educational Technology and Information, Webster Central School District

HP LD5512 4K UHD Conferencing Display

A big-screen showcase for your best brainstorming

Inspire collaboration and productivity among small and medium groups with the extra-large HP LD5512 4K UHD Display. Show and share every detail in 3840 x 2160 resolution on a 139.7 cm (55") diagonal screen with integrated dual stereo speakers.

See it all
- Experience excellent content readability and brilliant imagery from more than 8 million pixels and 3840 x 2160 resolution. Get great views from across the room with 178-degree wide viewing angles.

Partner with a collaboration-enhanced PC
- Pair the display with an HP Elite Slice for Meeting Rooms, HP Collaboration PC with optional Intel Unite® solution[1] or HP Chromebox to turn your everyday conference room into a world-class collaboration center.

Set up in moments
- Quickly connect to your video source with DisplayPort™, HDMI or VGA. Enjoy stereo audio from two integrated 6W speakers and control settings with the included remote.

Featuring
- Use the display on an optional stand1 in conference rooms and workspaces where you need large-scale views of data and content, or mount[2] on a wall in small spaces with the integrated VESA mount.[1]
- Rest assured that your IT investment is supported by a three-year standard limited warranty.

HP LD5512 4K UHD Conferencing Display
Specifications Table

Product Color	Black and Silver
Display size (diagonal)	139.7 cm (55")
Display Type	ADS w/LED backlight
Panel Active Area	120.96 x 68.04 cm;
Viewing Angle	178° horizontal; 178° vertical
Brightness	350 cd/m²[1]
Contrast Ratio	1200:1 static[1]
Response Ratio	8 ms gray to gray[1]
Aspect Ratio	16:09
Native Resolution	4K UHD (3840 x 2160 @ 60 Hz)
Resolutions Supported	3840 x 2160; 2560 x 1600; 2560 x 1440; 1920 x 1080; 1600 x 1200; 1680 x 1050; 1440 x 900; 1280 x 1024; 1280 x 768; 1280 x 720; 1024 x 768; 800 x 600; 720 x 400; 640 x 480
Display Features	Anti-glare; Language selection; LED Backlights; On-screen controls; Plug and Play; User programmable; Asset Control; Anti-static
User Controls	Auto; Input Control; Menu; Minus ("-"); OK; Plus ("+"); Power
Input signal	1 VGA; 1 HDMI 2.0; 2 HDMI 1.4; 1 DisplayPort™ 1.2 with HDCP support on DisplayPort™ and HDMI
Ports and Connectors	1 USB 2.0[1]
Input power	Input voltage: 100 to 240 VAC
Power consumption	Panel Active Area: 120.96 x 68.04 cm; Power consumption Description: 130 W (maximum), 90 W (typical), 0.5 W (standby); Screen resolution: 4K UHD (3840 x 2160 @ 60 Hz)
Dimensions with Stand (W x D x H)	124.16 x 77.97 x 23.74 cm
Dimensions without Stand (W x D x H)	124.16 x 72.12 x 69.9mm
Weight	14.4 kg (With stand)
Multimedia	Two 6 W integrated speakers
Certification and Compliance	VCCI; J-MOSS Green Mark; 25JEITA-CP No.27(VOC); JIS C 61000-3-2; PSE(J60950)
Environmental	Mercury-free display backlights
Energy Efficiency Compliance	ENERGY STAR® certified
What's in the box	AC power cord; DisplayPort™ 1.2 cable; Documentation; HDMI cable
Warranty	3 year limited warranty including 3 year of parts and labour. Certain restrictions and exclusions apply.

HP LD5512 4K UHD Conferencing Display

Accessories and services (not included)

HP DSD Security Wall Mount

HP offers a variety of optional products (each sold separately) designed to complement our monitors and enhance the overall computing and viewing experience. The HP Digital Signage Wall Mount Solution with Quick Release and Security Plate is the newest option designed for use with HP-branded LCD digital signage displays. The wall mount has a 90-degree pivot for use in landscape or portrait position, and can be used in tandem with an HP 8000 Series USDT PC or compatible thin client to create a complete hardware solution for HP customers.
Product number: Z2J20AA

HP 5 year Next business day
XLarge Monitor Only
Hardware Support

Receive 5 years of next business day onsite HW Support from an HP-qualified technician for your computing device, if the issue cannot be solved remotely.
Product number: UE370E

HP LD5512 4K UHD Conferencing Display

Messaging Footnotes

[1] Sold as a configurable option at the time of purchase.
[2] Stand and wall mounting hardware sold separately.

Technical specifications disclaimers

[1] All specifications represent the typical specifications provided by HP's component manufacturers, actual performance may vary either higher or lower.

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๒๖) ชุดโปรแกรมจัดการฐานข้อมูลเชิงสัมพันธ์

(SQL Server ๒๐๑๙ Enterprise Edition)

Product Overview

SQL Server 2019 now comes with Apache Spark and Hadoop Distributed File System (HDFS) for intelligence over all your data. With SQL Server 2019 Enterprise and Standard edition, customers can deploy Big Data Clusters. SQL Server 2019 Big Data Clusters makes it easier to manage a big data environment. It provides key elements of a data lake—Hadoop Distributed File System (HDFS), Spark, and analytics tools—deeply integrated with SQL Server and fully supported by Microsoft. SQL Server 2019 Big Data Clusters can be easily deployed using Linux containers on a Kubernetes-managed cluster.

SQL Server Big Data Clusters: SQL Server 2019 Big Data Clusters makes it easier to manage a big data environment. It provides key elements of a data lake—Hadoop Distributed File System (HDFS), Spark, and analytics tools—deeply integrated with SQL Server and fully supported by Microsoft. A SQL Server 2019 Big Data Cluster consists of two distinct components

- **SQL Server Master Instance** is SQL Server 2019 Enterprise or Standard Edition on Linux with all the typical features.
- **Big Data Nodes** are the worker nodes with HDFS, Spark and SQL Server engine for scale-out storage and compute.

Editions overview

The SQL Server 2019 editions align with how customers are deploying applications and solutions:

- **Enterprise Edition** is ideal for applications requiring mission critical in-memory performance, security and high availability
- **Standard Edition** delivers fully featured database capabilities for mid-tier applications and data marts

SQL Server 2019 is also available in free Developer and Express editions. Web Edition is offered in the Services Provider License Agreement (SPLA) program only.

Additionally, for SQL Server Enterprise and Standard core, customers can purchase **SQL Server Big Data Node cores** for worker nodes of SQL Server 2019 Big Data Clusters.

SQL Server 2019 licensing models

SQL Server 2019 offers customers a variety of licensing options aligned with how customers typically purchase specific workloads. There are two main licensing models that apply to SQL Server:

PER CORE: Gives customers a more precise measure of computing power and a more consistent licensing metric, regardless of whether solutions are deployed on physical servers on-premises, or in virtual or cloud environments.

- Core based licensing is appropriate when customers are unable to count users/devices, have Internet/Extranet workloads or systems that integrate with external facing workloads.
- To license a physical server—when running SQL Server in a **physical OSE**—all physical cores on the server must be licensed.
- A minimum of four core licenses are required for each physical processor on the server.

SERVER + CAL: Provides the option to license users and/or devices, with low cost access to incremental SQL Server deployments.

- Each server running SQL Server software requires a server license.
- Each user and/or device accessing a licensed SQL Server requires a SQL Server CAL that is the same version or newer – for example, to access a SQL Server 2012 Standard Edition server, a user would need a SQL Server 2012 or 2019 CAL.
- Each SQL Server CAL allows access to multiple licensed SQL Servers, including Standard Edition and legacy Business Intelligence and Enterprise Edition Servers.

SQL Server 2019 Editions availability by licensing model:

SQL Server 2019 Edition	Licensing Options	
	Server + CAL	Per Core
Enterprise	•	•
Standard	•	•
Developer	Free edition	
Express	Free edition	

Additionally, for SQL Server Enterprise and Standard core, customers can purchase SQL Server Big Data Node cores worker nodes for SQL Server 2019 Big Data Clusters.

SQL Server 2019 Big Data Node	Licensing Options	
	Server + CAL	Per Core
SQL Server Big Data Node cores*		•

*SQL Server Big Data Node cores are only for SQL Server Big data nodes. Master instances should be licensed with Enterprise or Standard Edition.

SQL Server 2019 Big Data Cluster licensing

To license SQL Server 2019 Big Data Cluster, both components must be licensed

- **SQL Server Master Instance -** The Server running the SQL Server Master Instance must be assigned an appropriate number of SQL Server 2019 Enterprise or Standard Edition core licenses.
- **SQL Server Big Data Nodes** – Servers used for SQL Server Big data nodes must be licensed using SQL Server Big Data node cores.

Additionally, SQL Server SA benefit for Big Data Nodes core entitlement will provide a limited number of Big Data node cores at no additional costs. For deployments larger than the SA benefit, servers used for additional Big Data node cores must be licensed with SQL Server Big Data Node Cores.

- SQL Server 2019 Big Data Clusters with Enterprise Edition as Master instance get 8 times the master instance cores as Big Data Nodes core SA entitlement

-
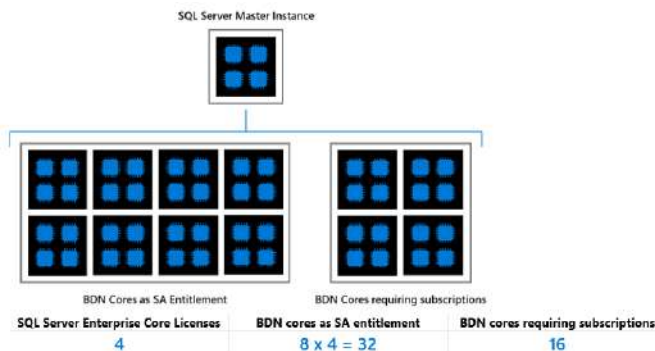
- SQL Server 2019 Big Data Clusters Standard Edition as Master instance get the same number of Big Data node cores licenses as the number of licenses for master instance for Big Data Nodes core SA entitlement
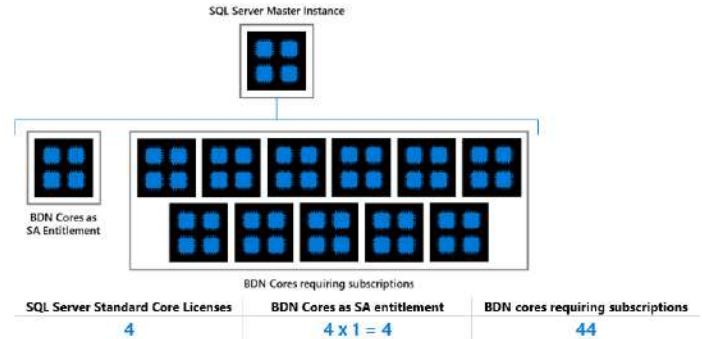
Benefits of SQL Server 2019 with SA

Software Assurance coverage helps customers take full advantage of their SQL Server license investment. With SA, SQL Server customers unlock valuable benefits including:

Software Assurance Benefit	SQL Server 2019 Editions	
	Standard	Enterprise
Big Data Nodes core entitlement New	•	•
Fail-Over servers for disaster recovery New	•	•
Fail-Over servers for disaster recovery in Azure New	•	•
Fail-Over servers for high availability	•	•
Unlimited virtualization		•
Machine Learning Server for Hadoop		•
Power BI Report Server		•

By combining mission critical performance, scale and availability of SQL Server Enterprise Edition with the benefits provided through SA, customers unlock the full power of SQL Server:

- Setup a Big Data Cluster for big data/Hadoop analytics workloads
- Stay current with all SQL Server features

- Access an unlimited number of virtual machines
- Modernize to the cloud with existing licenses
- Take advantage of high availability scenarios at no additional licensing cost
- Extend their data estate through advanced analytics on Hadoop
- Generate data visualizations on premises with Power BI Report Server

Licensing for virtualization and containers

SQL Server 2019 offers use rights for virtual machines and containers, to provide flexibility for customers' deployments. There are two primary 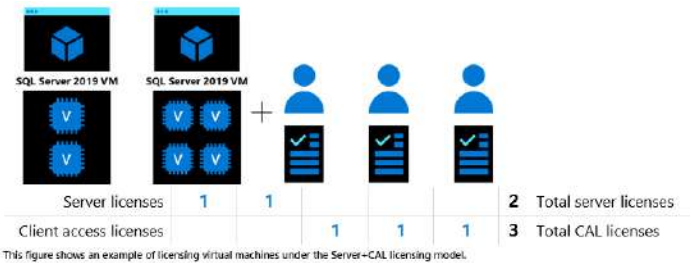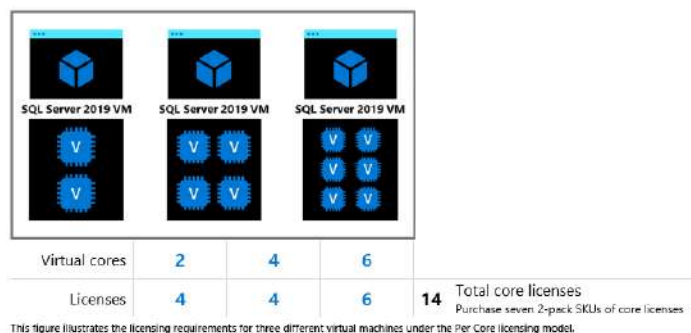licensing options for virtual machines and containers in SQL Server 2019 – the ability to license individual virtual machines and containers and the ability to license for maximum densities in highly virtualized or high-density container environments.

INDIVIDUAL VIRTUAL MACHINES OR CONTAINERS

As hardware capabilities grow, it continues to be more common for each database to use a fraction of its server's computing power. When deploying databases on Virtual Machines (VMs) or containers that use just a fraction of a physical server, savings can be achieved by licensing individual VMs or containers.

Note: For licensing, Containers follow the same rules as licensing SQL Server for virtual machines.

Virtual cores	2	4	6	
Licenses	4	4	6	14 Total core licenses Purchase seven 2-pack SKUs of core licenses

This figure illustrates the licensing requirements for three different virtual machines under the Per Core licensing model.

| Server licenses | 1 | 1 | | | | 2 | Total server licenses |
| Client access licenses | | | 1 | 1 | 1 | 3 | Total CAL licenses |

This figure shows an example of licensing virtual machines under the Server+CAL licensing model.

Note: When licensing VMs or containers under the Server + CAL model, the number of virtual or physical cores does not affect the number of server licenses required.

- To license a VM or container with core licenses, purchase a core license for each virtual core (virtual thread) allocated to the VM or the number of cores configured for access by the container (with a minimum of 4 core licenses per VM or container).
- To license a single VM or container with a server license (for Standard Edition only), purchase a server license for each VM or container, and a CAL for each user or device.
- Each licensed VM or container covered with SA can be moved frequently within a server farm, or to a third-party hoster or cloud services provider, without the need to purchase additional SQL Server licenses.

HIGH-DENSITY VIRTUALIZATION OR CONTAINER DEPLOYMENT

Further savings can be achieved by licensing SQL Server high density VM or container deployments. This is a great option for customers who want to take advantage of the full computing power of their physical servers and have very dynamic provisioning and de-provisioning of virtual resources or container images.

| Physical cores | 6 | 6 | 12 | Total physical cores |
| Core licenses | 6 | 6 | 12 | Total core licenses |

Shown is an example of licensing a 12-core physical server for unlimited VMs with Enterprise Edition core licenses and SA.
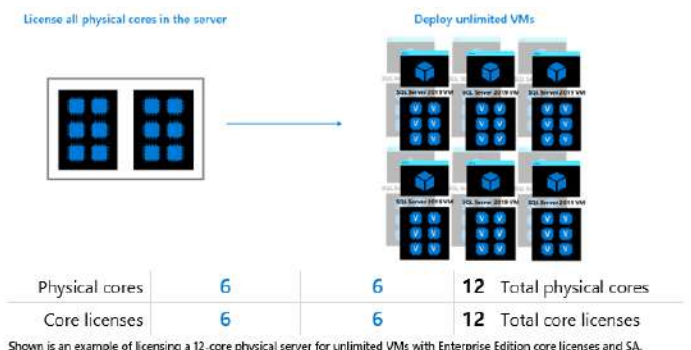
- Customers can deploy an unlimited number of VMs or containers on the server and utilize the full capacity of the licensed hardware, by fully licensing the server (or server farm) with Enterprise Edition core licenses and SA coverage based on the total number of physical cores on the servers.

- SA enables the ability to run an unlimited number of virtual machines or containers to handle dynamic workloads and fully utilize the hardware's computing power.

Licensing for high availability and Disaster Recovery

SQL Server software can be configured so that if one server fails, its processing will be picked up, recovered and continued by another server. Each active server licensed with SA coverage allows the installation of a single passive server used for fail-over support.

For each on-prem server with SQL Server 2019 and covered by active SA, customers can use the following passive replicas in anticipation of a failover event:

- One passive fail-over replica for High Availability in a separate server

- One passive fail-over replica for Disaster Recovery in a separate server

- One passive fail-over replica for Disaster Recovery in a single VM on Azure
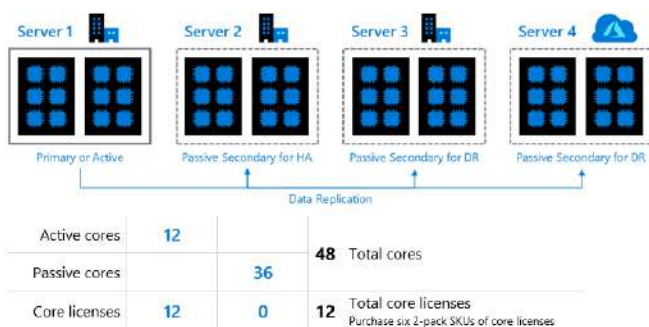
Licensing for non-production use

SQL Server 2019 Developer Edition provides a fully featured version of SQL Server software—including all the features and capabilities of Enterprise Edition—licensed for development, test and demonstration purposes only.

Customers may install and run the SQL Server Developer

Edition software on any number of devices. This is significant because it allows customers to run the software on multiple devices (for testing purposes, for example) without having to license each non-production server system for SQL Server.

A production environment is defined as an environment that is accessed by end-users of an application (such as an Internet website) and that is used for more than gathering feedback or acceptance testing of that application.

A production environment is defined as an environment that is accessed by end-users of an application (such as an Internet website) and that is used for more than gathering feedback or acceptance testing of that application.

SQL Server 2019 Developer Edition is a free product, available for download at the SQL Server Application Development site: aka.ms/SQLServerAppDev

Developers can also gain access to SQL Server Developer through the Visual Studio Dev Essentials program, which also provides access to many other valuable developer resources. For more information visit: aka.ms/ Visual_Studio_Dev

๒๗) เครื่องคอมพิวเตอร์แม่ข่ายระบบ Hypervisor
พร้อมโปรแกรมสำเร็จรูปเพื่อใช้สำหรับสร้างเครื่องคอมพิวเตอร์
แม่ข่ายเสมือน (Virtualization Server) สำหรับระบบบริหาร
จัดการระบบงานแบบ Near-Realtime
(NRT Application System)

Overview

HPE SimpliVity 380 Gen10

HPE SimpliVity 380, based on the HPE ProLiant DL380 Gen10 Servers, is a compact, scalable 2U rack-mounted building block that delivers server, storage, and storage networking services. Adaptable for diverse virtualized workloads, the secure 2U HPE ProLiant DL380 Gen10 delivers world-class performance with the right balance of expandability and scalability. It also provides a complete set of advanced functionality that enables dramatic improvements to the efficiency, management, protection, and performance—at a fraction of the cost and complexity of today's traditional infrastructure stack.

What's New

- Now available on HPE DL380 Gen10 Servers
- Intel® Xeon® Scalable Processors
- Extra Small through Extra Large Storage Capacity Points
- Automatic Cluster Rebalancing
- Heterogeneous Cluster Support (previous SimpliVity Generations with Gen 10)
- Optional Data Encryption support
- Optional RapidDR support

Scalable and Configurable

- Expandable in 1 node increments up to 32 total nodes*
- Processor - Choice of Intel® Xeon® Scalable Processors
- Memory - 144GB to 1536GB (Per Node)
- Network - 10Gb, 1Gb
- Power – Redundant
- Virtualization Software and Licensing
- All in a compact 2U form factor

NOTE: It is strongly recommended that an HPE SimpliVity 380 Gen10 cluster have a minimum of two nodes to realize the full benefit of the high availability hyperconverged solution.
NOTE:*Single cluster support up to 8 nodes, single federation support up to 32 nodes. Scalability varies by Hypervisor. See product documentation for details.

Software Features

- VMware vSphere
- HPE SimpliVity management plugin for VMware vCenter

Overview

- Microsoft Hyper-V
- HPE SimpliVity management plugin for Microsoft System Center

Hardware Availability Features

- Cluster expansion without downtime
- Hot-pluggable SSD
- Redundant power supplies
- Integrated storage controller with battery-backed cache
- HPE ProLiant Integrated Lights-Out Advanced (iLO) 5 Remote Management

Services

- HPE Pointnext full suite of support offerings (Foundation Care, Proactive Care and Datacenter Care).
- Remote support technology to provide 24x7 secure remote support

NOTE: For the best support experience, HPE Pointnext Installation Services and 24x7x365 support recommended.

Standard Features

HPE SimpliVity 380 Gen10 At-a-Glance	
Node Size	2U
Processors	2x Intel® Xeon® Scalable Processors 8 to 22 cores selectable, 1 or 2CPU options
Memory	144GB to 1536GB per node selectable
Storage	Two All Flash Storage Options(4000/6000 Series) and 5 Capacity Points: Extra Small - 5 x 960GB SSD Kit Small - 5 x 1.92TB SSD Kit Medium - 9x 1.92TB SSD Kit Large - 12 x 1.92TB SSD Kit Extra Large – 12 x 3.84TB SSD Kit (Series 4000 only)
Network Ports	Ethernet 1Gb LOM embedded, Choice of 2 x 10Gb FLOM
Power Supplies	HPE 800W FS Plat Ht Plg Pwr Supply Kit* HPE 800W FS -48VDC Ht Plg Pwr Supply Kit* HPE 800W FS Ti Ht Plg Pwr Supply Kit* HPE 800W FS Univrsal Ht Plg Pwr Spply Kit* HPE 1600W FS Plat Ht Plg LH Pwr Sply Kit
Hardware Warranty[1]	Server Warranty includes 3-Year Parts, 3-Year Labor, 3-Year Onsite support with next business day response
Hardware Support	3-year HPE SimpliVity 380 Gen10 solution support (required)
NOTE[1]: Warranty for SSDs is subject to maximum usage limitations. Maximum usage limit is the maximum amount of data that can be written to the drive. Drives that have reached this limit will not be eligible for replacement. **NOTE*:** 800W Power Supply is only supported with specific configurations.	

Features and Benefits

Fully integrated system

Combines x86 resources, storage, and storage networking in a single hyperconverged system. Simplifies management and delivers great cost efficiency and agility with increased visibility and control.

Peak and predictable performance

The all-flash solution provides predictable and linear performance at near‑wire speeds with reduced latency. Hardware-assisted inline deduplication, compression, and optimization helps minimize I/O and network traffic, improving performance while delivering great storage and bandwidth efficiency.

Scale in and scale out

Easily expand or shrink configurations as your needs change. Each node supports a large number of fully protected virtual machines (VMs), with the networked collection of nodes at both local and remote sites managed as a single entity.

VM centricity and mobility

Enables all actions, policies, and management at the VM level. Global unified management and integration with established administrative systems streamline operations and improve IT agility.

Dramatic TCO reduction

Drastically reduce the need to purchase multiple discrete components, optimize storage capacity with guaranteed 10:1 data efficiency, and prevent over-provisioning for performance and capacity with on‑demand expansion.

Software Overview

Pre-integrated software
- HPE SimpliVity Startup Wizard

Standard Features

Virtualization Platform Software and Licenses
NOTE: The HPE SimpliVity 380 Gen10 supports VMware ESXi 6.0 and 6.5 and Microsoft Hyper-V Server 2016.
- VMware vSphere installation media is required to complete the installation and is available from HPE when ordering the HPE SimpliVity 380 Gen10
- Valid licenses for the following VMware software components are required and is available from HPE when ordering the HPE SimpliVity 380 Gen10
  - (1 or 2) VMware vSphere license(s) per node depending on CPU count
  - (1) VMware vCenter license
- Microsoft Hyper-V Server installation media is required to complete the installation and is available from HPE when ordering the HPE SimpliVity 380 Gen10
- Valid licenses for the following Microsoft software components are required and is available from HPE when ordering the HPE SimpliVity 380 Gen10
  - (1 or 2) Microsoft Hyper-V Server 2016 license(s) per node depending on CPU and core count
  - (1) Microsoft Systems Center 2016 Virtual Machine Manager license
  - (1) Microsoft Active Directory Server

NOTE: HPE SimpliVity 380 Gen10 for VMware vSphere requires valid VMware vSphere, and vCenter licenses. VMware licenses can only be removed from the order if it is confirmed that the end-customer has a valid licenses in place (Enterprise License Agreement (ELA), vCloud Air Partner or unused Enterprise Purchasing Program tokens).
Purchasing VMware licenses from Hewlett Packard Enterprise allows Hewlett Packard Enterprise to be the single point of contact for the entire solution inclusive of the virtualization software and is recommended.
NOTE: HPE SimpliVity 380 Gen10 for Microsoft Hyper-V requires valid Microsoft Hyper-V Server, and Systems Center Virtual Machine Manager licenses. Microsoft licenses can only be removed from the order if it is confirmed that the end-customer has a valid licenses in place.
NOTE: Purchasing Microsoft licenses from Hewlett Packard Enterprise allows Hewlett Packard Enterprise to be the single point of contact for the entire solution inclusive of the virtualization software and is recommended.

Management
- VMware vCenter
- HPE SimpliVity management plugin for VMware vCenter
- Microsoft System Center
- HPE SimpliVity management plugin for Microsoft System Center

NOTE: The HPE SimpliVity 380 Gen10 supports VMware vCenter 6.0 and 6.5 as well as Microsoft System Center 2016.
NOTE: For VMware, Microsoft and HW compatibility, please see the interoperability guide **http://h22208.www2.hpe.com/eginfolib/servers/docs/simplivity/HPE%20SimpliVity%20Interoperability%20Guide-3.7.1.pdf**

Configuration Information

Overview

Step 1: Start with the base node
Step 2: Select the hardware options to add to the base node: processors, memory, storage, networking, power, HW options
Step 3: Auto Add of SW that correlates to node configuration
Step 3: Select the software options to add to the node: VMware vSphere
Step 4: Select service and support

Step 1: Base Node

Action	Description	Part #
Select the base node	HPE SimpliVity 380 Gen10 Node	Q8D81A
Select Hypervisor Option	VMware ESXi Option	#001
	Microsoft Hyper-V Option	#002

Processors

CPU Configurations

Action	Details	Description	CPU SKU
Select CPUs for the node	**Primary**		
	8C 2.1GHz 85W	HPE DL380 Gen10 Intel® Xeon-Silver 4110 (2.1GHz/8-core/85W) FIO Processor Kit	826846-L21
In the case of Single CPU only L21 SKU will be included by the configurator.	8C 1.8GHz 85W	HPE DL380 Gen10 Intel Xeon-Silver 4108 (1.8GHz/8-core/85W) FIO Processor Kit	826848-L21
	10C 2.2GHz 85W	HPE DL380 Gen10 Intel Xeon-Silver 4114 (2.2GHz/10-core/85W) FIO Processor Kit	826850-L21
In the case of dual CPU: both the L21 and the B21 SKU will be included by the configurator	12C 2.1GHz 85W	HPE DL380 Gen10 Intel Xeon-Silver 4116 (2.1GHz/12-core/85W) FIO Processor Kit	826852-L21
	12C 2.3GHz 105W	HPE DL380 Gen10 Intel Xeon-Gold 5118 (2.3GHz/12-core/105W) FIO Processor Kit	826854-L21
	14C 2.2GHz 105W	HPE DL380 Gen10 Intel® Xeon-Gold 5120 (2.2GHz/14-core/105W) FIO Processor Kit	826856-L21
	12C 2.6GHz 125W	HPE DL380 Gen10 Intel Xeon-Gold 6126 (2.6GHz/12-core/120W) FIO Processor Kit	826862-L21
	16C 2.1GHz 125W	HPE DL380 Gen10 Intel Xeon-Gold 6130 (2.1GHz/16-core/120W) FIO Processor Kit	826866-L21
	14C 2.6GHz 140W	HPE DL380 Gen10 Intel Xeon-Gold 6132 (2.6GHz/14-core/140W) FIO Processor Kit	826870-L21
	8C 3.2GHz 130W	HPE DL380 Gen10 Intel Xeon-Gold 6134 (3.2GHz/8-core/130W) FIO Processor Kit	826872-L21
	18C 2.3GHz 140W	HPE DL380 Gen10 Intel Xeon-Gold 6140 (2.3GHz/18-core/150W) FIO Processor Kit	826878-L21
	16C 2.6GHz 150W	HPE DL380 Gen10 Intel® Xeon-Gold 6140M (2.3GHz/18-core/135W) FIO Processor Kit	874762-L21
	18C 2.7GHz 165W	HPE DL380 Gen10 Intel Xeon-Gold 6150 (2.7GHz/18-core/165W) FIO Processor Kit	826884-L21
	22C 2.1GHz 140W	Intel Xeon-Gold Special Processor Kits	826886-L21
	18C 3.0GHz 200W	HPE DL380 Gen10 Intel Xeon-Gold 6154 (3.0GHz/18-core/200W) FIO Processor Kit	826888-L21
	16C 2.6GHz 150W	HPE DL380 Gen10 Intel® Xeon-Gold 6142M (2.6GHz/16-core/150W) FIO Processor Kit	874760-L21
	10C 2.4GHz 85W	HPE DL380 Gen10 Intel® Xeon-Gold 5115 (2.4GHz/10-core/85W) FIO Processor Kit	876562-L21

Configuration Information

	22C 2.1GHz 140W	Intel Xeon-Gold Special Processor Kits	826886-L21
	16C 2.6GHz 150W	HPE DL380 Gen10 Intel® Xeon-Gold 6140M (2.3GHz/18-core/135W) FIO Processor Kit	874762-L21
	Secondary		
	8C 2.1GHz 85W	HPE DL380 Gen10 Intel Xeon-Silver 4110 (2.1GHz/8-core/85W) Processor Kit	826846-B21
	8C 1.8GHz 85W	HPE DL380 Gen10 Intel Xeon-Silver 4108 (1.8GHz/8-core/85W) Processor Kit	826848-B21
	10C 2.2GHz 85W	HPE DL380 Gen10 Intel Xeon-Silver 4114 (2.2GHz/10-core/85W) Processor Kit	826850-B21
	12C 2.1GHz 85W	HPE DL380 Gen10 Intel Xeon-Silver 4116 (2.1GHz/12-core/85W) Processor Kit	826852-B21
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	14C 2.2GHz 105W	HPE DL380 Gen10 Intel Xeon-Gold 5120 (2.2GHz/14-core/105W) Processor Kit	826856-B21
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	18C 2.3GHz 140W	HPE DL380 Gen10 Intel Xeon-Gold 6140 (2.3GHz/18-core/150W) Processor Kit	826878-B21
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	10C 2.4GHz 85W	HPE DL380 Gen10 Intel Xeon-Gold 5115 (2.4GHz/10-core/85W) Processor Kit	876562-B21
	22C 2.1GHz 140W	HPE DL380 Gen10 Intel Xeon-Gold 6152 (2.1GHz/22-core/140W) Processor Kit	826886-B21
	16C 2.6GHz 150W	HPE DL380 Gen10 Intel Xeon-Gold 6140M (2.3GHz/18-core/135W) Processor Kit	874762-B21

Memory

	Details	Description	SKU
Select a memory capacity for the node	6x 8GB AND 6x 16GB RDIMMs	HPE SimpliVity 144G 12 DIMM FIO Kit	Q8D82A
	12x 16GB RDIMMs	HPE SimpliVity 192G 12 DIMM FIO Kit	Q8D83A
	6x 32GB RDIMMs	HPE SimpliVity 192G 6 DIMM FIO Kit	Q8D84A

Configuration Information

The appropriate memory and quantity will be included by the configurator **1 Kit required per CPU**	6x 32GB AND 6x 8GB RDIMMs	HPE SimpliVity 240G 12 DIMM FIO Kit	Q8D85A
	6x 32GB AND 6x 16GB RDIMMs	HPE SimpliVity 288G 12 DIMM FIO Kit	Q8D86A
	12x 32GB RDIMMs	HPE SimpliVity 384G 12 DIMM FIO Kit	Q8D87A
	6x 64GB LRDIMMs	HPE SimpliVity 384G 6 DIMM FIO Kit	Q8D88A
	12x 64GB LRDIMMs	HPE SimpliVity 768G 12 DIMM FIO Kit	Q8D89A
NOTE: For more information go to: **http://www.hpe.com/docs/memory-population-rules**			

Storage

Effective capacity varies by environment, and is a function of realized deduplication and compression rates. The capacities in this table offer a conservative range based on compression and deduplication rates found in standard, primary storage use cases.

Action	Effective Capacity	Description	Part #
Select one of two storage configurations for the node	3-6TB	HPE SimpliVity 380 for 4000 Series Extra Small Storage Kit	Q8D90A
	6–12 TB	HPE SimpliVity 380 for 4000 Series Small Storage Kit	Q8D91A
	12-25TB	HPE SimpliVity 380 for 4000 Series Medium Storge Kit	Q8D92A
	20-40TB	HPE SimpliVity 380 for 4000 Series Large Storage Kit	Q8D93A
	40-80TB	HPE SimpliVity 380 for 4000 Series Extra Large Storage Kit	Q9J90A
	3-6TB	HPE SimpliVity 380 for 6000 Series Extra Small Storage Kit	Q8D94A
	6–12 TB	HPE SimpliVity 380 for 6000 Series Small Storage Kit	Q5V86A
	12-25TB	HPE SimpliVity 380 for 6000 Series Medium Storage Kit	Q5V87A
	20-40TB	HPE SimpliVity 380 for 6000 Series Large Storage Kit	Q5V88A

Networking

Action	Description	Part #
A 10GbE FlexLOM is required. This is in addition to the standard 4 port 1GbE LOM included in the base node	HPE FlexFabric 10Gb 2-port 534FLR-SFP+ Adapter	700751-B21
	HPE FlexFabric 10Gb 2-port 533FLR-T Adapter	700759-B21
	HPE Ethernet 10/25Gb 2P 640FLR-SFP28 Adapter	817749-B21

PCI Adapter

Action	System Max	Description	Part #
Additional PCI Adapaters can be added in the case of dual socket with secondary riser.	3	HPE Ethernet 1Gb 4-port 331T Adapter	647594-B21
	3	HPE Ethernet 10Gb 2-port 530SFP Adapter	652503-B21
	3	HPE Ethernet 10Gb 2-port 530T Adapter	656596-B21
	3	HPE Ethernet 1Gb 4-port 366T Adapter	811546-B21
	3	HPE Ethernet 10/25Gb 2-port 640SFP28 Adapter	817753-B21

Optional Fibre Channel HBA cards

Configuration Information

Action	System Max	Description	Part #
Optional FC HBAs may be added if slots are available,	3	HPE StoreFabric SN1100Q 16Gb Dual Port Fibre Channel Host Bus Adapter	P9D94A
	3	HPE StoreFabric SN1600Q 32Gb Dual Port Fibre Channel Host Bus Adapter	P9M76A

Optional Video cards

Action	System Max	Description	Part #
Optional Graphic Accelerator(1) may be added in the case of dual CPU with secondary riser	1	NVIDIA Tesla M10 Quad GPU Module	Q0J62A

Power Supplies

Action	Description	Part #
Two power supplies are required.	HPE 800W Flex Slot Platinum Hot Plug Low Halogen Power Supply Kit*	865414-B21
	HPE 800W Flex Slot Universal Hot Plug Low Halogen Power Supply Kit*	865428-B21
	HPE 800W Flex Slot -48VDC Hot Plug Low Halogen Power Supply Kit*	865434-B21
	HPE 800W Flex Slot Titanium Hot Plug Low Halogen Power Supply Kit*	865438-B21
	HPE 1600W Flex Slot Platinum Hot Plug Low Halogen Power Supply Kit	830272-B21

NOTE: The power supply requirement can vary based configuration and environment. 800W Power Supply is only supported with specific configurations. Please refer to HPE Power Advisor for proper power sizing.
NOTE: All configured nodes ship with a standard 6-foot IEC C-13/C-14 jumper cord (A0K02A). This jumper cord is also included with each standard AC power supply option kit. If a different power cord is required, please check the ProLiant Power Cables web page. **https://h20195.www2.hpe.com/v2/getpdf.aspx/4AA6-6836ENW.pdf**

Action	Description	Part #
Additional hardware options are available	HPE FlexNetwork X240 10G SFP+ to SFP+ 1.2m Direct Attach Copper Cable	JD096C
	HPE FlexNetwork X240 10G SFP+ to SFP+ 3m Direct Attach Copper Cable	JD097C
	HPE FlexNetwork X240 10G SFP+ to SFP+ 5m Direct Attach Copper Cable	JG081C
	HPE FlexNetwork X240 10G SFP+ SFP+ 7m Direct Attach Copper Cable	JC784C
	HPE B-series SFP+ to SFP+ Active Copper 1.0m Direct Attach Cable	AP818A
	HPE B-series SFP+ to SFP+ Active Copper 3.0m Direct Attach Cable	AP819A
	HPE B-series SFP+ to SFP+ Active Copper 5.0m Direct Attach Cable	AP820A
	HPE LC to LC Multi-mode OM3 2-Fiber 1.0m 1-Pack Fiber Optic Cable	AJ834A
	HPE LC to LC Multi-mode OM3 2-Fiber 2.0m 1-Pack Fiber Optic Cable	AJ835A
	HPE LC to LC Multi-mode OM3 2-Fiber 5.0m 1-Pack Fiber Optic Cable	AJ836A
	HPE LC to LC Multi-mode OM3 2-Fiber 15.0m 1-Pack Fiber Optic Cable	AJ837A
	HPE BladeSystem c-Class 10Gb SFP+ SR Transceiver	455883-B21
	HPE BladeSystem c-Class 10Gb SFP+ LR Transceiver	455886-B21
	HPE BladeSystem c-Class Virtual Connect 1G SFP SX Transceiver	453151-B21
	HPE 100Gb QSFP28 MPO SR4 100m Transceiver	845966-B21
	HP 0.9M Blue CAT6 STP Cable Data	AF594A

Configuration Information

	HPE 3m, Blue, Cat6 STP Data Cable	AF595A
	HPE 10m, Blue, Cat6 STP Data Cable	AF596A
	HPE 1.2m/4ft CAT5 RJ45 M/M Ethernet Cable	C7533A
	HPE RJ45 to RJ45 Cat5e Black M/M 7.6ft 1-pack Data Cable	C7535A
	HPE 4.3m/14ft CAT5 RJ45 M/M Ethernet Cable	C7536A

Action	Description	Part #
IT Rack Enclosures – all G2 Advanced and G2 Enterprise models are compatible.	HPE 42U 600mmx1075mm G2 Kitted Advanced Pallet Rack with Side Panels and Baying	P9K07A
	HPE 42U 600mmx1075mm G2 Kitted Advanced Shock Rack with Side Panels and Baying	P9K08A
	HPE 42U 600mmx1200mm G2 Kitted Advanced Pallet Rack with Side Panels and Baying	P9K09A
	HPE 42U 600mmx1200mm G2 Kitted Advanced Shock Rack with Side Panels and Baying	P9K10A
	HPE 42U 600mmx1075mm G2 Enterprise Pallet Rack	P9K37A
	HPE 42U 600mmx1075mm G2 Enterprise Shock Rack	P9K38A
	HPE 42U 600mmx1200mm G2 Enterprise Pallet Rack	P9K39A
	HPE 42U 600mmx1200mm G2 Enterprise Shock Rack	P9K40A
NOTE: For more information on HPE rack enclosures, review the QuickSpecs at: **https://www.hpe.com/us/en/product-catalog/servers/server-racks.hits-12.html**.		

KVM Switches and Consoles		
KVM Switches and Consoles – choose keyboard/video/ mouse switch options supporting remote and/or local access – add a console to complete your rack-based solution.	HPE 0x1x8 G3 KVM Console Switch	AF651A
	HPE 0x2x16 G3 KVM Console Switch	AF652A
	HPE 1x1Ex8 KVM IP Console Switch G2 with Virtual Media CAC Software	AF620A
	HPE 2x1Ex16 KVM IP Console Switch G2 with Virtual Media CAC Software	AF621A
	HPE 4x1Ex32 KVM IP Console Switch G2 with Virtual Media CAC Software	AF622A
	HPE LCD8500 1U US Rackmount Console Kit	AF630A
	HPE LCD8500 1U UK Rackmount Console Kit	AF631A
	HPE LCD8500 1U INTL Rackmount Console Kit	AF644A
NOTE: For more information on KVM switches, review the QuickSpecs at: **https://www.hpe.com/us/en/product-catalog/servers/rack-console-switches.hits-12.html.**		
NOTE: For more information on KVM consoles, review the QuickSpecs at: **https://www.hpe.com/us/en/product-catalog/servers/server-console-kits.hits-12.html**.		

Power Distribution Units		
Power Distribution Units (PDU) – add a 2nd PDU to create a redundant power configuration	HPE G2 Basic 3.6kVA/IEC C20 Detachable 16A/100-240V Outlets (20) C13 (2) C19/Vertical WW PDU	P9Q38A
	HPE G2 Metered 3.6kVA/IEC C20 Detachable 16A/100-240V Outlets (12) C13/1U Horizontal WW PDU	P9R50A
	HPE G2 Metered/Switched 4.9kVA/L6-30P 24A/208V Outlets (20) C13 (4) C19/Vertical NA/JP PDU	P9S15A
	HPE G2 Metered/Switched 7.3kVA/60309 3-wire 32A/230V Outlets (20) C13 (4) C19/Vertical INTL PDU	P9S18A
NOTE: For more information on HPE PDU models and accessories, review the quickspec at: **https://www.hpe.com/us/en/product-catalog/servers/power-distribution-units.hits-12.html.**		

Uninterruptible Power Supply		
Uninterruptible Power Supply (UPS) – add a reliable UPS to provide protection against power loss.	HPE R/T3000 G4 High Voltage NA/JP Uninterruptible Power System	J2R02A
	HPE R/T3000 G4 High Voltage INTL Uninterruptible Power System	J2R04A
	HPE R5000 3U L630 High Voltage NA/JP Uninterruptible Power System	AF460A
	HPE R5000 3U IEC309-32A High Voltage INTL Uninterruptible Power System	AF461A
NOTE: For more information on UPS products, review the QuickSpecs at: **https://www.hpe.com/us/en/product-catalog/servers/uninterruptible-power-system.hits-12.html.**		

Configuration Information

Additional Server Options		
Action	**Description**	**Part #**
Additional hardware options are available	HPE DL380 Gen10 SFF Systems Insight Display Kit	826703-B21
	HPE DL3XX Gen10 Rear Serial Cable and Enablement Kit	873770-B21
	HPE 2U Small Form Factor Ball Bearing Rail Kit	720863-B21
	HPE 2U Cable Management Arm for Ball Bearing Rail Kit	720865-B21
	HPE 2U Small Form Factor Easy Install Rail Kit	733660-B21

HPE OmniStack Software

Action	**Description**	**Part #**
Based on the hardware configurations in step 1 & 2 the appropriate software will be included by the configurator. The software is determined by CPU and storage configuration and is required	HPE OmniStack 8-14c 1P Extra Small SW	Q8A57A
	HPE OmniStack 8-14c 2P Extra Small SW	Q8A58A
	HPE OmniStack 8-14c 1P Small SW	Q8A59A
	HPE OmniStack 8-14c 2P Small SW	Q8A60A
	HPE OmniStack 8-14c 1P Medium SW	Q8A61A
	HPE OmniStack 8-14c 2P Medium SW	Q8A62A
	HPE OmniStack 8-14c 1P Large SW	Q8A63A
	HPE OmniStack 8-14c 2P Large SW	Q8A64A
	HPE OmniStack 8-14c 1P Extra Large Software	Q9J86A
	HPE OmniStack 8-14c 2P Extra Large Software	Q9J87A
	HPE OmniStack 16-22c 1P Extra Small SW	Q8A65A
	HPE OmniStack 16-22c 2P Extra Small SW	Q8A66A
	HPE OmniStack 16-22c 1P Small SW	Q8A67A
	HPE OmniStack 16-22c 2P Small SW	Q8A68A
	HPE OmniStack 16-22c 1P Medium SW	Q8A69A
	HPE OmniStack 16-22c 2P Medium SW	Q8A70A
	HPE OmniStack 16-22c 1P Large SW	Q8A71A
	HPE OmniStack 16-22c 2P Large SW	Q8A72A
	HPE OmniStack 16-22c 1P Extra Large Software	Q9J88A
	HPE OmniStack 16-22c 2P Extra Large Software	Q9J89A

VMware Software

vSphere

NOTE: The HPE SimpliVity 380 Gen10 supports ESXi 6.0 and 6.5.

Action	**Description**	**Part #**
A valid VMware vSphere license is required for each CPU to complete deployment. If an order is placed without VMware licenses, the user agrees to supply the necessary license.	VMware vSphere Standard 1 Processor 3yr E-LTU	BD711AAE
	VMware vSphere Enterprise Plus 1 Processor 3yr Software	BD715A
	VMware vSphere Enterprise Plus 1 Processor 3yr E-LTU	BD715AAE
	VMware vSphere Remote Office Branch Office Standard 25VM 3yr E-LTU	P9A82AAE
	VMware vSphere Remote Office Branch Office Advanced 25VM 3yr E-LTU	P9A85AAE
	VMware vSphere Standard 1 Processor 5yr Software	BD512A
	VMware vSphere Standard 1 Processor 5yr E-LTU	BD512AAE
	VMware vSphere Enterprise Plus 1 Processor 5yr Software	BD514A
	VMware vSphere Enterprise Plus 1 Processor 5yr E-LTU	BD514AAE
NOTE: HPE SimpliVity 380 Gen10 for VMware vSphere requires valid VMware vSphere, and vCenter licenses. VMware licenses can only be removed from the order if it is confirmed that the end-customer has a valid licenses in place (Enterprise License Agreement (ELA), vCloud Air Partner or unused Enterprise Purchasing Program tokens).		

Configuration Information

> **NOTE:** Purchasing VMware licenses from Hewlett Packard Enterprise allows Hewlett Packard Enterprise to be the single point of contact for the entire solution inclusive of the virtualization software and is recommended. When the VMware license is not included on the order the solution level support experience is impacted.

vCenter

Action	Description	Part #
Optional vCenter License	VMware vCenter Server Standard for vSphere (per Instance) 3yr E-LTU	P9U41AAE
	VMware vCenter Server Standard for vSphere (per Instance) 5yr E-LTU	P9U42AAE

NOTE: The customer is responsible for ensuring licensing compliance on all running virtual machines. Licenses may be added to the order as standalone items from the catalog. Licenses added at the node level will be cloned with the node.

NOTE: Information on available licenses for non-preinstalled Operating Systems can be found on the relevant product pages:

- Microsoft Windows Server 2016': **https://www.hpe.com/us/en/product-catalog/detail/pip.microsoft-windows-server-2016.1009480090.html**
- Red Hat Enterprise Linux': **https://www.hpe.com/us/en/product-catalog/detail/pip.5393115.html**
- SUSE Linux Enterprise Server': **https://www.hpe.com/us/en/product-catalog/detail/pip.5379857.html**

HPE Integrated Lights Out Advanced Software (iLO Advanced)

Action	Description	Part #
The HPE iLO Advanced license is required	HPE iLO Advanced 1-server License with 3yr Support on iLO Licensed Features	BD505A

Service and Support

Step 4: Service and Support

Services for customers purchasing from Hewlett Packard Enterprise or an enterprise reseller are quoted using Hewlett Packard Enterprise order configuration tools.

Technology Services for increased uptime, productivity and ROI

At HPE, our priority is to maximize your workload uptime, avoiding problems before they occur. As the experts for the HPE SimpliVity 380 Gen10, HPE Pointnext support will be your 24x7x 365 single point-of-contact for all of your support needs with HPE Pointnext Proactive Care Support. This means you can spend more time developing apps and adding value to the business rather than maintaining your infrastructure.

If there is a potential risk in your infrastructure, our remote support technology will proactively notify HPE and initiate the resolution process. If you are experiencing any issue with your solution, HPE Pointnext Proactive Care will provide you immediate access to our team of solution experts, whose first priority is to ensure your workloads are up and running, and then immediately start diagnosing the failure.

HPE Pointnext offers its full portfolio of support services. This includes Foundation Care, Proactive Care, Proactive Care Advanced and Datacenter Care. Flexible Capacity and Operational Support Services are also available.

HPE SimpliVity 380 Gen10 is supported by the power of HPE, in 30+ different languages, with local presence across 140 countries.

Please consult your HPE Sales Representative for any additional questions and support options.

Installation and Startup Services

HPE Pointnext provides a full set of installation and startup services to meet your unique requirements.

Action	Description	Part #
Hardware install service	HPE SVT 380 Hardware Install service	HA114A1#5LY
Remote software install service	HPE SVT 380 Remote software install service	HA124A1#5LZ
Onsite software install service	HPE SVT 380 Onsite Software install service	HA124A1#5MF
Update your firmware and SVT/VMware software	HPE SVT 380 Software and Firmware update service.	HA124A1#5MK
NOTE: Please contact your HPE Sales Representative for more information. **NOTE:** For more information on Technology Services please visit: **https://www.hpe.com/us/en/services.html**		

Warranty

This product is covered by a global limited warranty and supported by Hewlett Packard Enterprise Pointnext and a worldwide network of Hewlett Packard Enterprise Authorized Channel Partners resellers. Hardware diagnostic support and repair is available for three years from date of purchase. Support for software and initial setup is available for 90 days from date of purchase. Enhancements to warranty services are available through HPE Pointnext operational services or customized service agreements. Hard drives have either a one year or three year warranty; refer to the specific hard drive QuickSpecs for details.

This hardware warranty includes 3-Year Parts, 3-Year Labor, 3-Year Onsite support with next business day response. Warranty repairs may be accomplished through the use of Customer Self Repair (CSR) parts. These parts fall into two categories: 1) Mandatory CSR parts are designed for easy replacement. A travel and labor charge will result when customers decline to replace a Mandatory CSR part; 2) Optional CSR parts are also designed for easy replacement but may involve added complexity. Customers may choose to have Hewlett Packard Enterprise replace Optional CSR parts at no charge.

Parts and Materials	Hewlett Packard Enterprise will provide HPE-supported replacement parts and materials necessary to maintain the covered hardware product in operating condition, including parts and materials for available and recommended engineering improvements.

Configuration Information

Parts and components that have reached their maximum supported lifetime and/or the maximum usage limitations as set forth in the manufacturer's operating manual, product quick-specs, or the technical product data sheet will not be provided, repaired, or replaced as part of these services.

The defective media retention service feature option applies only to Disk or eligible SSD/Flash Drives replaced by Hewlett Packard Enterprise due to malfunction.

Technical Specifications

Physical Dimensions

2U form factor: 3.44 x 26.75 x 17.54 in (8.73 x 67.94 x 44.54 cm)

End-of-life Management and Recycling

Hewlett-Packard offers end-of-life Hewlett Packard Enterprise product return, trade-in, and recycling programs in many geographic areas. For trade-in information, please go to: http://www.hp.com/go/green. To recycle your product, please go to: http://www.hp.com/go/green or contact your nearest Hewlett Packard Enterprise sales office. Products returned to Hewlett Packard Enterprise will be recycled, recovered or disposed of in a responsible manner.

The EU WEEE directive (2002/95/EC) requires manufacturers to provide treatment information for each product type for use by treatment facilities. This information (product disassembly instructions) is posted on the Hewlett Packard Enterprise web site at: http://www.hp.com/go/green. These instructions may be used by recyclers and other WEEE treatment facilities as well as Hewlett Packard Enterprise OEM customers who integrate and re-sell Hewlett Packard Enterprise equipment.

Summary of Changes

Date	Version History	Action	Description of Change
07-May-2018	Version 6	Added	Standard Features and Configuration Information sections were updated.
05-Mar-2018	Version 5	Changed	Overview, Standard Features and Configuration Information sections were updated.
		Added	SKUs were added in Configuration Information section: 826872-B21, 826872-L21, 874762-B21, 874762-L21, Q9J90A, 700759-B21, 817749-B21, Q8A61A, Q8A62A, Q8A63A, Q8A64A, Q9J86A, Q9J87A, Q8A69A, Q8A70A, Q8A71A, Q8A72A, Q9J88A, Q9J89A.
04-Dec-2017	Version 4	Changed	Standard Features, Configuration Information, Service and Support, and Technical Specifications sections were updated.
		Added	SKUs were added in Configuration Information: 874762-L21, Q8D94A, Q5V86A, Q5V87A, Q5V88A, 811546-B21.
06-Nov-2017	Version 3	Changed	Changes made to the document
02-Oct-2017	Version 2	Changed	Changes made to the entire document
25-Sept-2017	Version 1	New	QuickSpecs created.

Sign up for updates

a00021989enw - 16060 - Worldwide - V6 - 7-May-2018

Dell EMC VxRail G560 and G560F Appliance

Owner's Manual

DELLEMC

Notes, cautions, and warnings

ⓘ | **NOTE: A NOTE indicates important information that helps you make better use of your product.**

⚠ | **CAUTION: A CAUTION indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.**

⚠ | **WARNING: A WARNING indicates a potential for property damage, personal injury, or death.**

Contents

Overview

The VxRail G Series appliance is an ultra-dense 2U enclosure that can support up to four independent one-socket (1S) or two-socket (2S) sleds. Each sled supports up to two Intel Xeon Scalable product family processors up to 28 cores per processor. The sled also supports 16 memory modules, dedicated mezzanine, PCIe and Open Compute Project (OCP) adapters for expansion and connectivity. The appliance supports up to 24 x 2.5 inch SAS or SATA drives including up to 4 NVMe SSDs.

Topics:

- Supported configurations
- Front view of the appliance
- Back view of the appliance
- Diagnostic indicators
- Locating serial number of your appliance

Supported configurations

The VxRail G Series appliance supports the following configurations:

AC PSUs: 2000 W or 2400 W

Up to 4 sleds

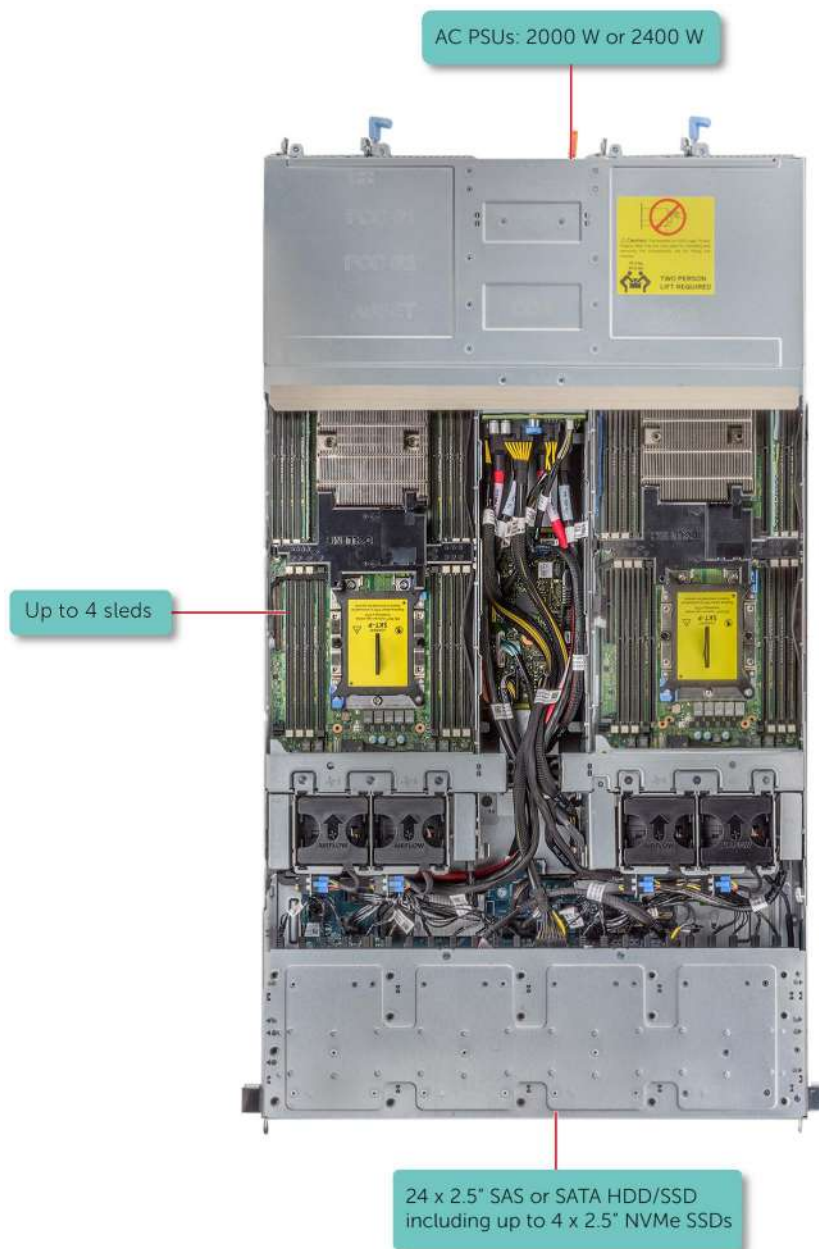**24 x 2.5" SAS or SATA HDD/SSD including up to 4 x 2.5" NVMe SSDs**

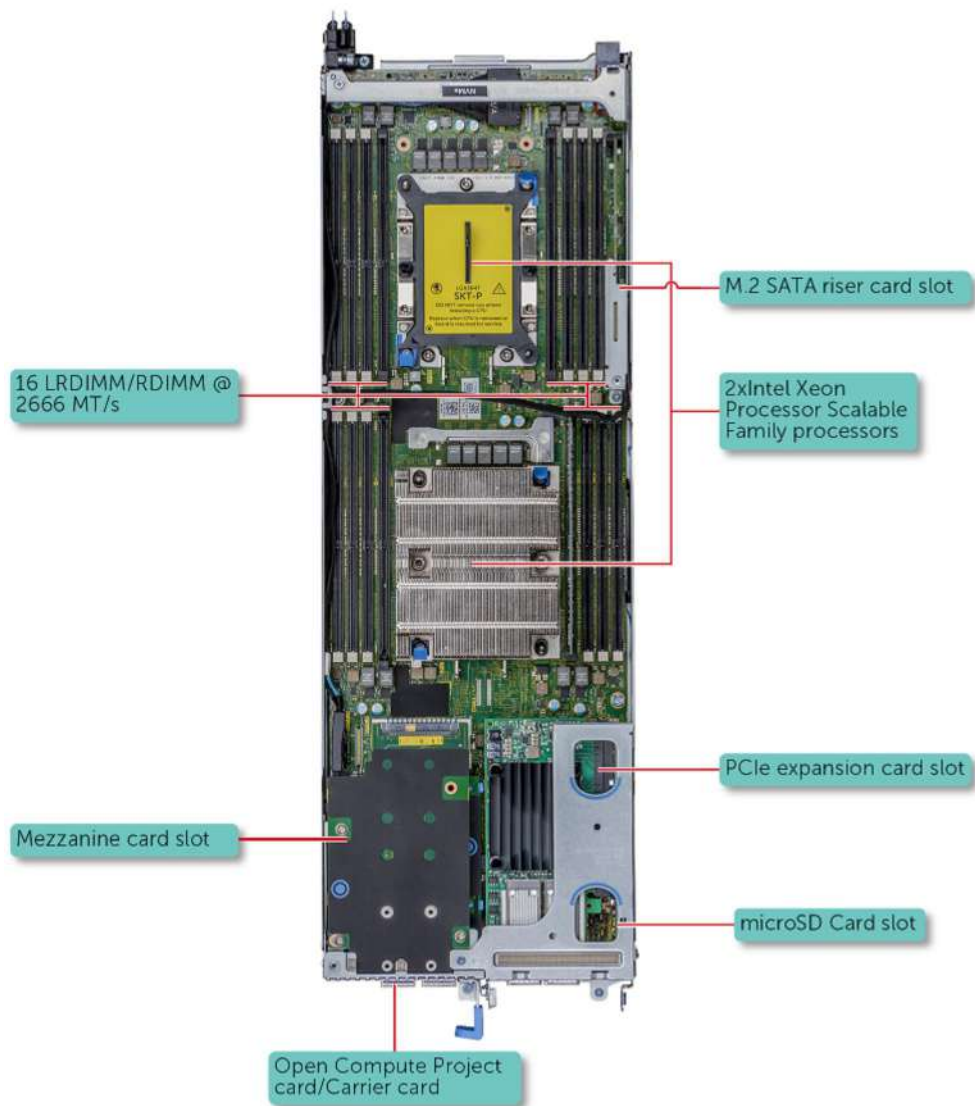**Figure 1. Supported configurations for enclosure**

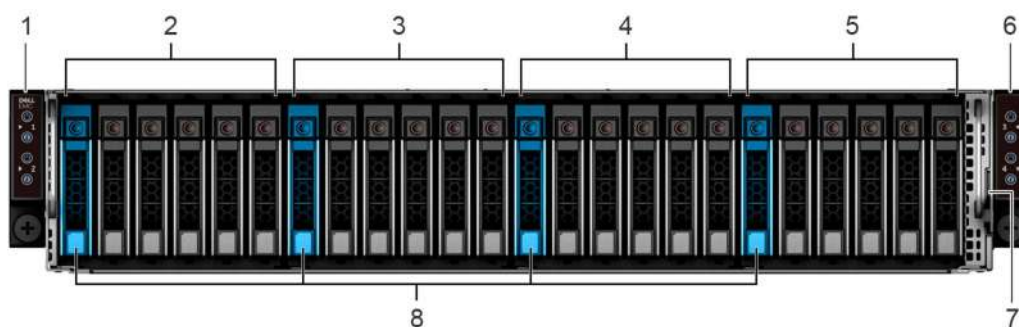**Figure 2. Supported configurations for sled**

Front view of the appliance

Figure 3. Front view of the enclosure with 24 x 2.5 inch drives

| 1 | left control panel | 2 | drives 0–5 mapped to sled 1 |

3	drives 6-11 mapped to sled 2	4	drives 12-17 mapped to sled 3
5	drives 18-23 mapped to sled 5	6	right control panel
7	EST tag	8	(optional) NVMe hard drive location

Front view of the control panels

Figure 4. Front view of the left and right control panels

Table 1. Control panel

Item	Indicator or button	Icon	Description
1	left control panel	-	The power-on indicator and system identification LED for sleds 1 and 2 are located on the left control panel.
2	right control panel	-	The power-on indicator and system identification LED for sleds 3 and 4 are located on the right control panel.
3	power-on indicator or system state indicator or power button for sleds 1 and 3	⏻	Press the power button to turn the sled on or off. The power-on indicator turns amber when a critical system event occurs. ⓘ NOTE: **To gracefully shut down an ACPI-compliant operating system, press the power button.**
4	system identification button for sleds 1 and 3	ⓘ	Press the system ID button: • To locate a particular sled within the enclosure. • To turn the system ID on or off. ⓘ NOTE: **If the sled stops responding during POST, press and hold the system ID button (for more than five seconds) to enter the BIOS progress mode.**
5	power-on indicator or system state indicator or power button for sleds 2 and 4	⏻	Press the power button to turn the sled on or off. The power-on indicator turns amber when a critical system event occurs.

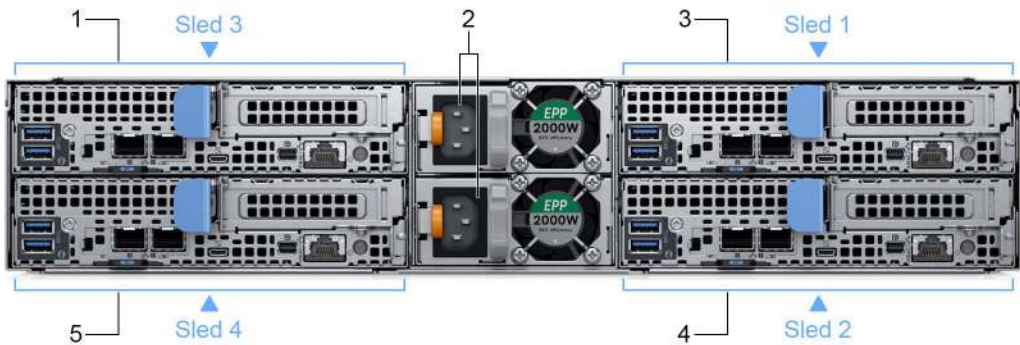| Item	Indicator or button	Icon	Description
			ⓘ NOTE: To gracefully shut down an ACPI-compliant operating system, press the power button.
6	system identification button for sleds 2 and 4	*ⓘ*	Press the system ID button: • To locate a particular sled within the enclosure. • To turn the system ID on or off. ⓘ NOTE: If the sled stops responding during POST, press and hold the system ID button (for more than five seconds) to enter the BIOS progress mode.

Back view of the appliance

Figure 5. Back view of the enclosure with sleds

1	sled 3	2	power supply unit (2)
3	sled 1	4	sled 2
5	sled 4		
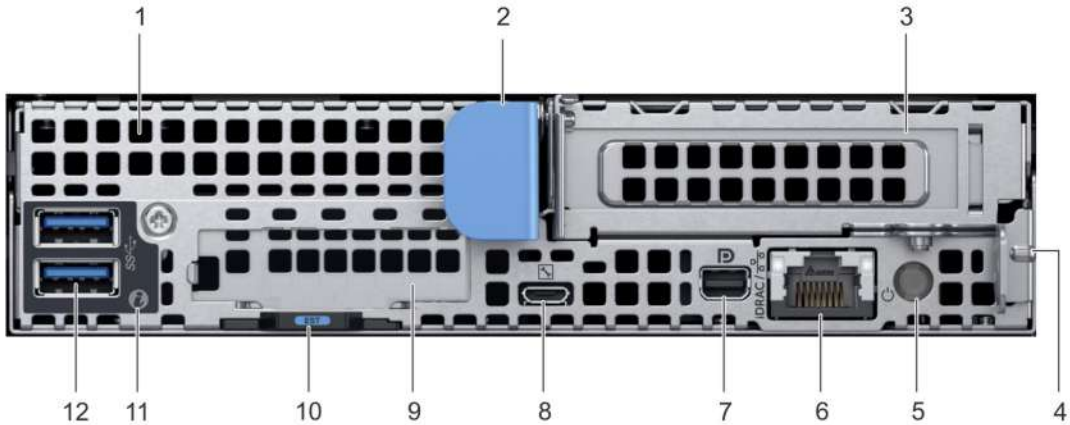
Figure 6. Back view of the sled

Table 2. Back panel features

Item	Indicator, button, or connector	Icon	Description
1	mezzanine card slot	N/A	Enables you to connect mezzanine expansion cards. For more information, see Technical specifications.
2	sled release handle	N/A	Enables you to remove the sled from the enclosure.
3	Low Profile PCIe card slot	N/A	Enables you to connect PCI Express expansion cards. For more information, see Technical specifications.
4	sled release lock	N/A	Enables you to remove the sled from the enclosure.
5	rear power button	N/A	Enables you to power on the sled while accessing it from the rear.
6	iDRAC or NIC port	iDRAC / 🖧	Enables you to remotely access iDRAC.
7	mini display port	D	Enables you to connect a display device to the system. For more information, see Technical specifications.
8	iDRAC Direct micro USB port	🔧	Enables you to connect a portable device to the sled.
9	OCP card slot	N/A	Enables you to connect Open Compute Project (OCP) expansion cards. For more information, see Technical specifications.
10	EST pull out tab	N/A	This tab has the unique Express Service Code, Service Tag, and MAC address labels.
11	system id indicator	ⓘ	The System Identification (ID) LED is available on the back of the system. Press the system ID button on the front of the enclosure to identify a system in a rack.
12	USB 3.0 port (2)	SS⮂	The USB ports are 9-pin and 3.0-compliant. These ports enable you to connect USB devices to the system.

Diagnostic indicators

The diagnostic indicators on the appliance indicate operation and error status.

Drive indicator codes

Each drive carrier has an activity LED indicator and a status LED indicator. The indicators provide information about the current status of the drive. The activity LED indicator indicates whether the drive is currently in use or not. The status LED indicator indicates the power condition of the drive.

Figure 7. Drive indicators

1	Drive activity LED indicator	2	Drive status LED indicator
3	Drive capacity label		

ⓘ **NOTE: This appliance uses a passive backplane and the status LED indicator does not turn on.**

ⓘ **NOTE: Drive status indicator behavior is managed by VxRail. Not all drive status indicators may be used.**

Power supply unit indicator codes

AC power supply units (PSUs) have an illuminated translucent handle that serves as an indicator. The indicator shows whether power is present or if a power fault has occurred.

ⓘ **NOTE: The 2400 W and 2000 W PSUs use a C19 or C20 connector.**
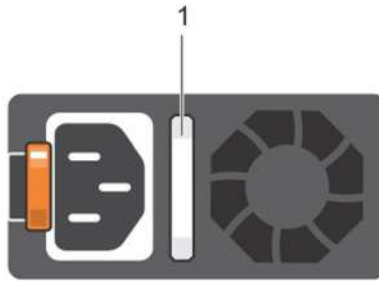
Figure 8. AC PSU status indicator

1   AC PSU status indicator/handle

Table 3. AC PSU status indicator codes

Power indicator codes	Condition
Green	A valid power source is connected to the PSU and the PSU is operational.
Blinking amber	Indicates a problem with the PSU.
Not illuminated	Power is not connected to the PSU.
Blinking green	When the firmware of the PSU is being updated, the PSU handle blinks green.
	⚠ **CAUTION: Do not disconnect the power cable or unplug the PSU when updating firmware. If firmware update is interrupted, the PSUs do not function.**
Blinking green and turns off	When hot-plugging a PSU, the PSU handle blinks green five times at a rate of 4 Hz and turns off. This indicates a PSU mismatch with respect to efficiency, feature set, health status, or supported voltage.
	⚠ **CAUTION: The PSUs must have the same type of label; for example, Extended Power Performance (EPP) label. Mixing PSUs from previous generations of VxRail servers is not supported, even if the PSUs have the same power rating. This results in a PSU mismatch condition or failure to turn the system on.**
	⚠ **CAUTION: When correcting a PSU mismatch, replace only the PSU with the blinking indicator. Swapping the PSU to make a matched pair can result in an error condition and unexpected system shutdown. To change from a high output configuration to a low output configuration or vice versa, you must turn off the system.**
	⚠ **CAUTION: If two PSUs are used, they must be of the same type and have the same maximum output power.**

Locating serial number of your appliance

To get support for your appliance, use the VxRail Appliance serial number, also called the Product Serial Number Tag (PSNT). The PSNT is a 14-digit number used to identify your appliance to Dell EMC support.

ⓘ **NOTE: Only use the VxRail Appliance serial number to contact Customer Support. Sometimes, you may need to supply the 7-digit Service Tag number.**

There are two identification tags on your appliance:

· The VxRail appliance serial number—You can find the serial number in **VxRail Manager**, or printed on the information tag.
· The Service Tag — You can find the Service Tag printed on the physical appliance.

Looking up your appliance serial number in VxRail Manager

1   In **VxRail Manager**, on the left navigation bar, click **Health**.
2   To display appliance information, click **Physical**.
3   Observe the VxRail Appliance serial number, listed under the appliance ID as the **PSNT**.

Locating your physical VxRail Service Tag number and PSNT

Your hardware is identified by a unique Service Tag number and Product Serial Number Tag (PSNT) . The Service Tag and PSNT is found on the front of the appliance by pulling out the information tag.

Alternatively, the information may be on a sticker on the chassis of the appliance. This information is used by Dell EMC to route support calls to the appropriate personnel.

(i) **NOTE: Use the 7-digit Service Tag, only if instructed by Technical Support.**
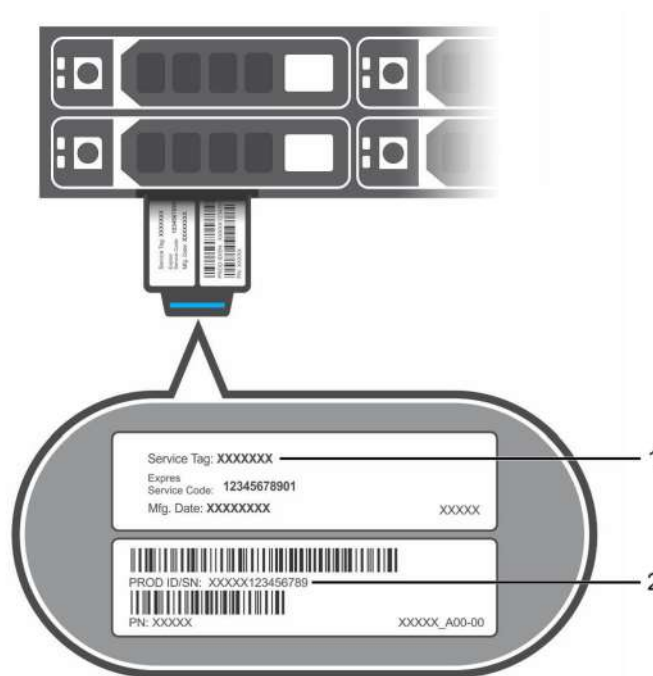
Figure 9. VxRail Service Tag

1   Service Tag number   2   PSNT

Technical specifications

The technical and environmental specifications of your appliance are outlined in this section.

Topics:

Dimensions of the VxRail G Series appliance
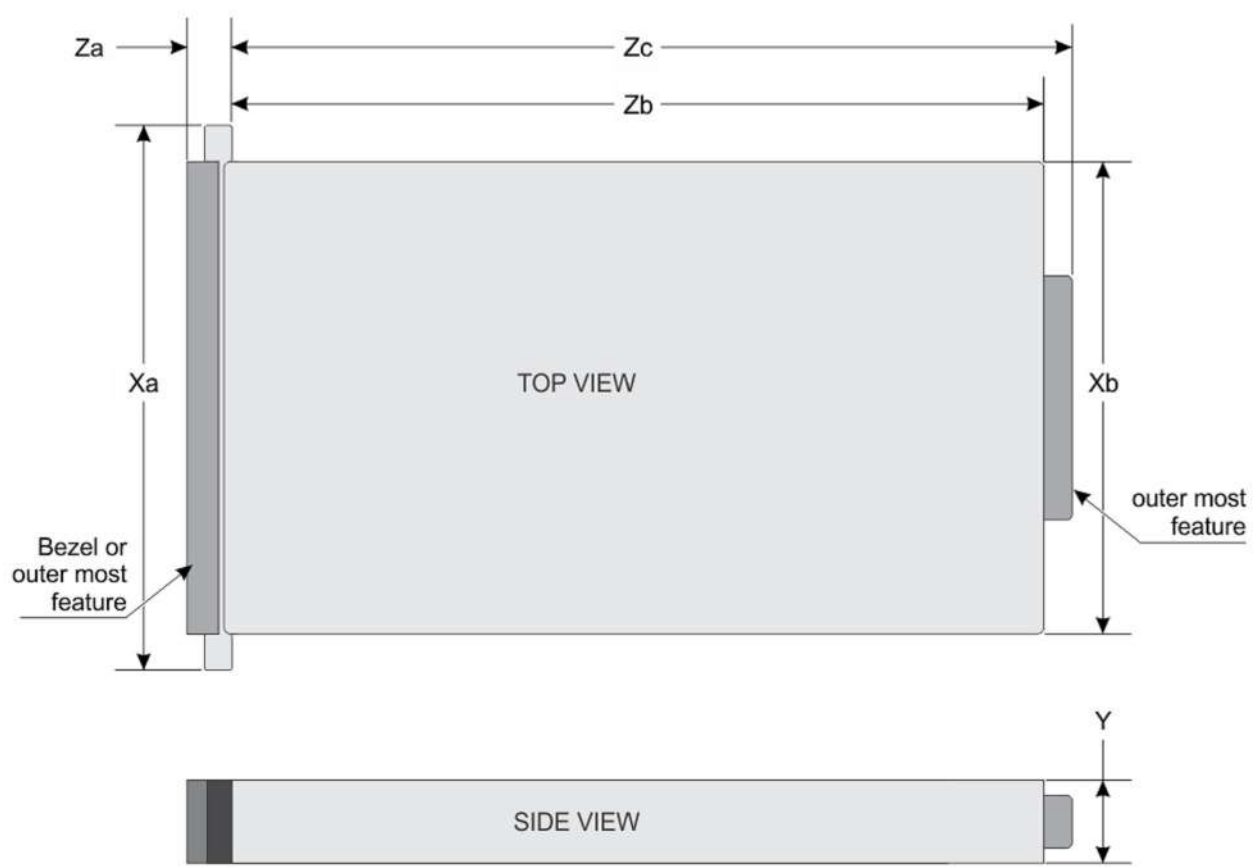
Figure 10. Dimensions of the enclosure

Table 4. Dimensions of the enclosure

Xa	Xb	Y	Za	Zb	Zc
482.6 mm (19 inches)	448 mm (17.63 inches)	86.8 mm (3.41 inches)	26.8 mm (1.05 inches)	763.2 mm (30.28 inches)	797.3 mm (31.38 inches)

Figure 11. Dimensions of the sled

Table 5. Dimensions of the sled

X	Y	Z
17.44 mm (6.86 inches)	4.05 mm (1.59 inches)	57.45 mm (22.61 inches)

Chassis weight

Table 6. Chassis weight of the VxRail G Series appliance

System	Maximum weight (with all sleds and drives)
24 x 2.5-inch hard drive systems	41.46 Kg (91.40 lb)

Processor specifications

The VxRail G Series appliance supports up to two Intel Xeon Scalable product family processors in each of the four independent sleds. Each processor supports up to 28 cores.

PSU specifications

The VxRail G Series appliance supports two AC power supply units (PSUs).

Table 7. PSU specifications

PSU wattage	Class	Heat dissipation (maximum)	Frequency	Voltage	Maximum input current
2400 W AC	Platinum	715 BTU/hr	50/60 Hz	100–240 V AC, autoranging	14 A–16 A
2000 W AC	Platinum	635 BTU/hr	50/60 Hz	100–240 V AC, autoranging	11.5 A

(i) **NOTE:** Heat dissipation is calculated using the PSU wattage rating.

(i) **NOTE:** This system is also designed to connect to the IT power systems with a phase to phase voltage not exceeding 240 V.

(i) **NOTE:** If a system with 2400 W AC PSU operates at low line 100–120 V AC, then the power rating per PSU is derated to 1400 W.

(i) **NOTE:** If a system with 2000 W AC PSU operates at low line 100–120 V AC, then the power rating per PSU is derated to 1000 W.

System battery

The VxRail G Series appliance uses a CR 2032 3V replaceable lithium coin cell battery.

Expansion bus specifications

The VxRail G Series appliance supports four Generation 3 capable PCIe slots.

Table 8. Expansion bus specifications

PCIe Slots	Description	Form factor
x8 Mezz PCIe riser	Slot 1: x8 PCIe Gen3 from CPU 1	Custom form factor
x8+x8 OCP Mezz riser	Slot 3: x8 PCIe Gen3 from CPU 1	Standard Open Compute Project (OCP) form factor
x16 PCIe main riser	Slot 4: x16 PCIe Gen3 CPU 1	Standard Low Profile PCIe form factor
x16 buried PCIe riser	Slot 5: x16 PCIe Gen3 from CPU 2	Custom form factor
		(i) **NOTE:** M.2 SATA riser is supported on the buried riser.

Memory specifications

The VxRail G Series appliance supports DDR4 registered DIMMs (RDIMMs) and Load Reduced DIMMS (LRDIMMs).

Table 9. Memory specifications

Memory module sockets	Architecture	Memory capacity and ranking	Minimum RAM	Maximum RAM
Sixteen 288-pin	2666 MT/s DDR4 RDIMMs and LRDIMMS with support for advanced ECC or memory optimized operation	· Dual rank - 16 GB · Dual rank - 32 GB · Dual rank - 64 GB · Octa rank - 128GB	· 64 GB with a single processor · 128 GB with dual processor	· 1024 GB with a single processor · 2048 GB with dual processor

Hard drives and storage specifications

The VxRail G Series appliance supports SAS and SATA hard drives and Solid State Drives (SSDs).

Table 10. Supported drives for appliance

Maximum number of drives in the enclosure	Maximum number of drives assigned per sled
24 x 2.5-inch drive systems with NVMe	The NVMe backplane supports either of these configurations:

Maximum number of drives in the enclosure	Maximum number of drives assigned per sled
	• One NVMe drive and five SAS or SATA hard drives and SSDs per sled • Six SAS or SATA hard drives and SSDs per sled
M.2 SATA drive	The supported capacity of the M.2 SATA card is 240 GB (i) **NOTE: The M.2 SATA card can be installed on the x16 riser slot (slot 5).**
microSD card (64 GB)	One on each PCIe riser of each sled

Video specifications

The VxRail G Series appliance supports a Matrox G200 integrated graphics card with 16 MB RAM.

Table 11. Supported video resolution options

Resolution	Refresh rate (Hz)	Color depth (bits)
1024 x 768	60	up to 24
1280 x 800	60	up to 24
1280 x 1024	60	up to 24
1360 x 768	60	up to 24
1440 x 900	60	up to 24

Environmental specifications

The sections below contains information about the environmental specifications of the system.

Temperature specifications

Table 12. Temperature specifications

Temperature	Specifications
Storage	−40°C to 65°C (−40°F to 149°F)
Continuous operation (for altitude less than 950 m or 3117 ft)	10°C to 35°C (50°F to 95°F) with no direct sunlight on the equipment.
Fresh air	For information about fresh air, see Expanded operating temperature.
Maximum temperature gradient (operating and storage)	20°C/h (36°F/h)

(i) **NOTE: Some configurations require a lower ambient temperature for more information, see Standard operating temperature specifications.**

Relative humidity specifications

Table 13. Relative humidity specifications

Relative humidity	Specifications
Storage	5% to 95% RH with 33°C (91°F) maximum dew point. Atmosphere must be non-condensing at all times.
Operating	10% to 80% relative humidity with 29°C (84.2°F)

Maximum vibration specifications

Table 14. Maximum vibration specifications

Maximum vibration	Specifications
Operating	0.26 Grms at 5 Hz to 350 Hz (all operation orientations).
Storage	1.88 Grms at 10 Hz to 500 Hz for 15 min (all six sides tested).

Maximum shock specifications

Table 15. Maximum shock specifications

Maximum shock	Specifications
Operating	24 executed shock pulses 6 G in the positive and negative x, y, z axis for up to 11 ms (four pulses on each side of the system).
Storage	Six consecutively executed shock pulses of 71 G in the positive and negative x, y, z axes for up to 2 ms (one pulse on each side of the system).

Maximum altitude specifications

Table 16. Maximum altitude specifications

Maximum altitude	Specifications
Operating	3048 m (10,000 ft)
Storage	12,000 m (39,370 ft)

Operating temperature de-rating specifications

Table 17. Operating temperature

Operating temperature de-rating	Specifications
Up to 35°C (95°F)	Maximum temperature is reduced by 1°C/300 m (1°F/547 ft) above 950 m (3,117 ft).
35°C to 40°C (95°F to 104°F)	Maximum temperature is reduced by 1°C/175 m (1°F/319 ft) above 950 m (3,117 ft).
40°C to 45°C (104°F to 113°F)	Maximum temperature is reduced by 1°C/125 m (1°F/228

Particulate and gaseous contamination specifications

Table 18. Particulate contamination specifications

Particulate contamination	Specifications
Air filtration	Data center air filtration as defined by ISO Class 8 per ISO 14644-1 with a 95% upper confidence limit.

ⓘ **NOTE: This condition applies only to data center environments. Air filtration requirements do not apply to IT equipment designed to be used outside a data center, in environments such as an office or factory floor.**

ⓘ **NOTE: Air entering the data center must have MERV11 or MERV13 filtration.**

Conductive dust	Air must be free of conductive dust, zinc whiskers, or other conductive particles.

ⓘ **NOTE: This condition applies to data center and non-data center environments.**

Corrosive dust	Air must be free of corrosive dust.

Residual dust present in the air must have a deliquescent point less than 60% relative humidity.

ⓘ **NOTE: This condition applies to data center and non-data center environments.**

Table 19. Gaseous contamination specifications

Gaseous contamination	Specifications
Copper coupon corrosion rate	<300 Å/month per Class G1 as defined by ANSI/ISA71.04-1985.
Silver coupon corrosion rate	<200 Å/month as defined by AHSRAE TC9.9.

ⓘ **NOTE: Maximum corrosive contaminant levels measured at ≤50% relative humidity.**

Standard operating temperature specifications

ⓘ **NOTE:** All components including the DIMMs, communication cards, M.2 SATA, and PERC cards can be supported with sufficient thermal margin if the ambient temperature is equal to or below to the maximum continuous operating temperature listed in these tables with the exception of the Mellanox DP LP card.

Table 20. Standard operating temperature specifications

Standard operating temperature	Specifications
Temperature ranges (for altitude less than 950 m or 3117 ft)	10°C to 35°C (50°F to 95°F) with no direct sunlight on the equipment.

ⓘ **NOTE:** Some configurations require a lower ambient temperature. For more information see the following tables.

ⓘ **NOTE:** Not supported: Indicates that the configuration is not thermally supported.

Table 21. Maximum continuous operating temperature for dual processor configuration

TDP (W)	Processor model number	Supported heat sinks	Max DIMM count per CPU	24x 2.5" HDDs enclosure
205 W	8180	CPU1: FMM2M | CPU2: V2DRD	CPU1: 6 | CPU2: 8	Not supported
	8180M	CPU1: FMM2M | CPU2: V2DRD	CPU1: 6 | CPU2: 8	
	8168	CPU1: FMM2M | CPU2: V2DRD	CPU1: 6 | CPU2: 8	
200 W	6154	CPU1: FMM2M | CPU2: V2DRD	CPU1: 6 | CPU2: 8	Not supported
165 W	6150	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	Not supported
	6146	CPU1: JYKMM | CPU2: V2DRD	CPU1: 6 | CPU2: 8	
	8176	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	
	8176M	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	
	8170M	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	
	8170	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	
155 W	6144	CPU1: FMM2M | CPU2: V2DRD	CPU1: 6 | CPU2: 8	
150 W	6148	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	30°C/86°F
	6142	CPU1: FMM2M | CPU2: V2DRD	CPU1: 8 | CPU2: 8	30°C/86°F
	6136	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	30°C/86°F
	8164	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	30°C/86°F
	8160M	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	30°C/86°F

TDP (W)	Processor model number	Supported heat sinks	Max DIMM count per CPU	24x 2.5" HDDs enclosure
140 W	8160	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	30°C/86°F
	6132	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	30°C/86°F
	6152	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	30°C/86°F
	6140M	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	30°C/86°F
	6140	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	30°C/86°F
130 W	6134	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	30°C/86°F
125 W	6126	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	30°C/86°F
	8153	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	30°C/86°F
	6138	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	30°C/86°F
	6130	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	30°C/86°F
115 W	6128	CPU1: FMM2M | CPU2: V2DRD	CPU1: 6 | CPU2: 8	30°C/86°F
105 W	5122	CPU1: FMM2M | CPU2: V2DRD	CPU1: 6 | CPU2: 8	35°C/95°F
	5120	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	35°C/95°F
	5118	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	35°C/95°F
85 W	5115	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	35°C/95°F
	4116	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	35°C/95°F
	4114	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	35°C/95°F
	4112	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	35°C/95°F
	4110	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	35°C/95°F
	4108	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	35°C/95°F
	3106	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	35°C/95°F
	3104	CPU1: JYKMM | CPU2: V2DRD	CPU1: 8 | CPU2: 8	35°C/95°F

Table 22. Maximum continuous operating temperature for single processor configuration

TDP (W)	Processor model number	Supported heat sinks	Max DIMM count per CPU	24x 2.5" HDDs enclosure
205 W	8180	CPU1: FMM2M	CPU1: 6	35°C/95°F
	8180M	CPU1: FMM2M	CPU1: 6	35°C/95°F

TDP (W)	Processor model number	Supported heat sinks	Max DIMM count per CPU	24x 2.5" HDDs enclosure
	8168	CPU1: FMM2M	CPU1: 6	35ºC/95ºF
200 W	6154	CPU1: FMM2M	CPU1: 6	35ºC/95ºF
165 W	6150	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	6146	CPU1: FMM2M	CPU1: 6	35ºC/95ºF
	8176	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	8176M	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	8170M	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	8170	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
155 W	6144	CPU1: FMM2M	CPU1: 6	35ºC/95ºF
150 W	6148	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	6142	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	6136	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	8164	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	8160M	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	8160	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
140 W	6132	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	6152	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	6140M	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	6140	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
130 W	6134	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
125 W	6126	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	8153	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	6138	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	6130	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
115 W	6128	CPU1: FMM2M	CPU1: 6	35ºC/95ºF
105 W	5122	CPU1: FMM2M	CPU1: 6	35ºC/95ºF
	5120	CPU1: FMM2M	CPU1: 8	35ºC/95ºF

TDP (W)	Processor model number	Supported heat sinks	Max DIMM count per CPU	24x 2.5" HDDs enclosure
	5118	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
85 W	5115	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	4116	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	4114	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	4112	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	4110	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	4108	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	3106	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
	3104	CPU1: FMM2M	CPU1: 8	35ºC/95ºF
70 W	4109T	CPU1: FMM2M	CPU1: 8	35ºC/95ºF

Expanded operating temperature specifications

Table 23. Expanded operating temperature

Expanded operating temperature	Specifications
Continuous operation	5ºC to 40ºC at 5% to 85% RH with 29ºC dew point.
	ⓘ **NOTE: Outside the standard operating temperature (10ºC to 35ºC), the system can operate continuously in temperatures as low as 5ºC and as high as 40ºC.**
	For temperatures between 35ºC and 40ºC, de-rate maximum allowable temperature by 1ºC per 175 m above 950 m (1ºF per 319 ft).
≤ 1% of annual operating hours	−5ºC to 45ºC at 5% to 90% RH with 29ºC dew point.
	ⓘ **NOTE: Outside the standard operating temperature (10ºC to 35ºC), the system can operate down to −5ºC or up to 45ºC for a maximum of 1% of its annual operating hours.**
	For temperatures between 40ºC and 45ºC, de-rate maximum allowable temperature by 1ºC per 125 m above 950 m (1ºF per 228 ft).

ⓘ **NOTE: When operating in the expanded temperature range, system performance may be impacted.**

ⓘ **NOTE: When operating in the expanded temperature range, ambient temperature warnings may be reported in the System Event Log.**

Documentation resources

The documentation resources provides information on documents that you can refer while setting up and managing your appliance.

Table 24. Documentation resources

Document	Provides information about...	Location
Software Documents		
Online help in the VxRail Manager UI	all admin tasks, licensing, and product architecture information.	VxRail Manager Online Help
Administrator Guide	admin tasks and conceptual information.	**emc.com/vxrailsupport**
Release Notes	the product and any critical information about the release.	**emc.com/vxrailsupport**
Hardware Documents		
Getting started with your appliance	setting up your appliance.	**emc.com/vxrailsupport**
Owner's Manual	hardware details for your appliance along with technical specifications.	**emc.com/vxrailsupport**
Service Procedure Documents		
SolVe Desktop application	the SolVe Desktop application. The SolVe Desktop application gathers critical information from EMC product guides and combines it with expert Dell EMC support advice to generate a procedure document that is concise and task driven.	EMC Online Support site ⓘ **NOTE: Download the SolVe Desktop application, all generators are available within the Solve Desktop.**

4

Initial setup and configuration

For assistance on installation and deployment, contact your Dell EMC account team or your reseller for installation services.

⚠ **WARNING: During the VxRail deployment process, an iDRAC account named vxadmin or PTAdmin is created. This account provides hardware information the VxRail Manager and is required for VxRail Manager and cluster to function properly. Ensure that you do not modify or delete this account.**

ⓘ **NOTE: Do not install the appliance into a rack, or turn on the appliance without the initial configuration of your appliance.**

Pre-operating system management applications

You can manage basic settings and features of an appliance without booting to the operating system by using the appliance firmware.

(i) **NOTE:**

- This appliance requires installation and deployment services. Do not rack the appliance, or turn on the appliance without the initial configurations on your appliance. Contact your Dell EMC account team or your reseller for setting up your appliance.
- Dell EMC has optimized your appliance. It is not recommended to change any of these settings.

Topics:

Options to manage the pre-operating system applications

Your appliance has the following options to manage the pre-operating system applications:

- System Setup
- Boot Manager
- Dell Lifecycle Controller
- Preboot Execution Environment (PXE)

(i) **NOTE: Dell EMC has optimized your appliance and it is not recommended to change any of these settings.**

iDRAC configuration

The Integrated Dell Remote Access Controller (iDRAC) is designed to make appliance administrators more productive and improve the overall availability of Dell EMC appliances. iDRAC alerts administrators to appliance issues, helps them perform remote appliance management, and reduces the need for physical access to the appliance.

Log in to iDRAC

You can log in to iDRAC as:

- iDRAC user
- Microsoft Active Directory user
- Lightweight Directory Access Protocol (LDAP) user

If you have opted for secure default access to iDRAC, the iDRAC secure default password is available on the back of the appliance Information tag. If you have not opted for secure default access to iDRAC, then the default user name and password are `root` and `calvin`. You can also log in by using Single Sign-On or Smart Card.

ⓘ **NOTE:** You must have iDRAC credentials to log in to iDRAC.

ⓘ **NOTE: Ensure that you change the default user name and password after setting up the iDRAC IP address.**

The iDRAC IP address is pre-configured for DHCP. This can be changed to a static IP address by logging into iDRAC.

ⓘ **NOTE:**
  · To access iDRAC, connect the network cable to the Ethernet connector 1 on the system board.
  · Ensure that you change the default user name and password after setting up the iDRAC IP address.

Replacing and adding hardware

Adding or replacing hardware component procedures on your VxRail appliance, such as hard disk drives (HDDs), solid state drives (SSDs), and power supply units must be performed only by Dell EMC certified service technicians. For certain hardware components, you may need to contact Customer Support for repair or replacement.

Using the SolVe Desktop application for VxRail Series hardware tasks

Step-by-step hardware component tasks such as replacement and upgrade procedures are available through the SolVe Desktop application.
You must have an online support account to use the SolVe Desktop application.

ⓘ NOTE: You can access SolVe Online at **https://solveonline.emc.com.**

⚠ WARNING: The VxRail Series procedures in the SolVe Desktop application for replacing hardware or any upgrade procedures must be performed only by Dell EMC certified service technicians.

⚠ CAUTION: To avoid data loss, ensure that you refer to the VxRail Series procedures in the SolVe Desktop application before replacing hardware or performing any upgrade procedures.

1   Log in to the EMC Online Support site.
2   Click **SolVe** on the main page.
3   Click the download link for the SolVe Desktop application.
4   Save the executable file and then run it to install the SolVe Desktop.

ⓘ NOTE: You can access support resources for your VxRail Series at https://solve.emc.com.

Supported hardware components

ⓘ NOTE: The list of FRU and CRU components is not exhaustive.

Table 25. Supported hardware components

Hardware Components	Customer Replaceable Unit (CRU)	Field Replaceable Unit (FRU)
System Memory	No	Yes
Hard Drive	Yes	No
Solid State Drive	Yes	No
PCIe Network Interface Cards	No	Yes
Micro SDHC Card	No	Yes
Power Supply Unit	Yes	No
Processor	No	Yes
System board	No	Yes
Host Bus Adapter (HBA330)	No	Yes

Hardware Components	Customer Replaceable Unit (CRU)	Field Replaceable Unit (FRU)
M.2 SATA disk	No	Yes
Intel Ethernet X710 OCP server adapter	No	Yes

System memory

The system supports DDR4 registered DIMMs (RDIMMs) and load reduced DIMMs (LRDIMMs). System memory holds the instructions that are executed by the processor.

ⓘ **NOTE: MT/s indicates DIMM speed in MegaTransfers per second.**

Memory bus operating frequency can be 2666 MT/s, 2400 MT/s, or 2133 MT/s depending on the following factors:

- DIMM type (RDIMM or LRDIMM)
- Number of DIMMs populated per channel
- System profile selected (for example, Performance Optimized, or Custom [can be run at high speed or lower])
- Maximum supported DIMM frequency of the processors

Your system contains 16 memory sockets split into two sets of 8 sockets, one set per processor. Each 8-socket set is organized into channels. In each channel, the release tabs of the first socket are marked white, the second socket black.
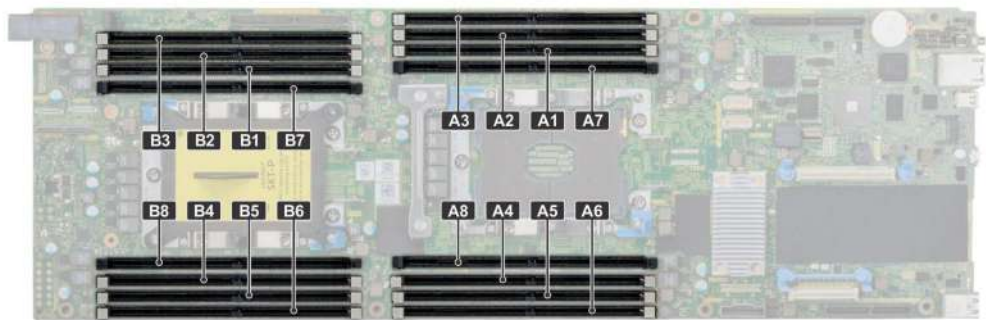

Figure 12. Memory socket locations

Memory channels are organized as follows:

Table 26. Memory channels

Processor	Channel 0	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5
Processor 1	Slots A1 and A7	Slots A2	Slots A3	Slots A8 and A4	Slots A5	Slots A6
Processor 2	Slots B1 and B7	Slots B2	Slots B3	Slots B8 and B4	Slots B5	Slots B6

General memory module installation guidelines

ⓘ **NOTE: Memory configurations that fail to observe these guidelines can prevent your appliance from booting, stop responding during memory configuration, or operating with reduced memory.**

The following are the recommended guidelines for installing memory modules:

- RDIMMs and LRDIMMs must not be mixed.

- Up to two RDIMMs can be populated per channel.
- Up to two LRDIMMs can be populated per channel.
- If memory modules with different speeds are installed, they will operate at the speed of the slowest installed memory module(s) or slower depending on appliance DIMM configuration.
- Populate memory module sockets only if a processor is installed. For single-processor appliance, sockets A1 to A12 are available. For dual-processor appliance, sockets A1 to A12 and sockets B1 to B12 are available.
- Populate all the sockets with white release tabs first, and then followed by the black release tabs.
- In a dual-processor configuration, the memory configuration for each processor should be identical. For example, if you populate socket A1 for processor 1, then populate socket B1 for processor 2, and so on.

Expansion cards

PCIe slot priority

Table 27. Supported expansion options

Riser	Form factor	Slot	CPU mapping	Slot width	Maximum power consumption
PCIe Slot (slot 4)	Low profile	4	CPU1	PCIe Gen3 x16 (x16 connector)	75 W
Mezzanine slot (slot 1)	Mezzanine	1	CPU1	PCIe Gen3 x8 (through Bridge Board)	25 W
Open Computing Project (OCP) mezzanine slot (slot 3)	Mezzanine	3	CPU1	PCIe Gen3 x16	25 W
Riser slot (SATA M.2) (slot 5)	Low profile	5	CPU2	PCIe connector data lanes not used for M.2 SATA Riser	25 W

ⓘ **NOTE: For the expansion bus specification see Expansion bus specifications.**

Table 28. Supported expansion cards

Location	Card type	Form factor	Link width	Slot priority	Maximum number of cards
OCP (slot 3)	Intel CNA X710 - Dual Port Adapter	Mezzanine	x8	3	1
Mezzanine (slot 1)	Dell HBA H330 mini Adapter	Mezzanine	x8	1	1
Slot 5	SATA M.2	Low profile	x16	4	1
Slot 4	Intel Ethernet CNA XL710-Q2 Adapter	Low profile	x8	4	1
Slot 4	Intel Ethernet 10G Dual Port X550-t Adapter	Low profile	x4	4	1

Location	Card type	Form factor	Link width	Slot priority	Maximum number of cards
Slot 4	Broadcom BCM57414 25G SFP Dual Port Adapter	Low profile	x8	4	1
Slot 4	Intel Ethernet X710 Dual port 10 GbE SFP+ Adapter	Low profile	x8	4	1
Slot 4	Intel 10 GbE Quad Port X710-t Adapter	Low profile	x8	4	1

Getting help

Topics:

Contacting Dell EMC

You can link your Online Support account with **VxRail Manager** and access support resources without having to log in separately.

> ⓘ **NOTE:** **If you plan to set up EMC Secure Remote Services (ESRS), you must link your Online Support account to VxRail Manager under the same ID or it may not work properly.**

Registering for online support

You can create an **Online Support** account to access support resources such as:

- Register your appliance.
- Obtain product license files and software updates.
- Download Dell EMC VxRail Series product documentation.
- Download the SolVe Desktop application.
- Browse the Dell EMC VxRail Series community and support information.
- Link your support account for access to resources from within **VxRail Manager**.

To register for online support:

1 Open **emc.com/vxrailsupport** or **support.emc.com**.
2 Click **Register here**.
3 Fill in the required information.

You will receive a confirmation email within 48 hours.

Accessing support resources

You can access support resources for your VxRail Series using one of the following methods:

- VxRail Manager Support
- **emc.com/vxrailsupport** (or **support.emc.com**)
- **https://solve.emc.com**

> ⓘ **NOTE:** **Additional VxRail Series information is available through the SolVe Desktop application. SolVe includes step-by-step procedures for replacing certain hardware components, and other tasks.**

๒๘) โปรแกรมระบบจัดการข้อมูลแบบทันท่วงที (Near-Realtime Data Management)

DATALINK

TOTAL SOLUTION OF INFORMATION MANAGEMENT

Data · IoT · AI · Analytics · Automation · Cloud Services · Control Towers
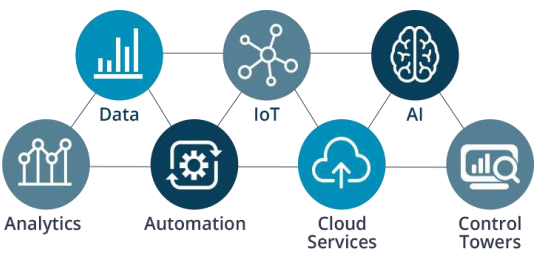
Real-Time Data Management Services Solution

DIGITAL DATA TRANSFORMATION
Enterprise Data Integration with Digital Transformation Platform and

Pims Technologies

DATALINK

Integration

OPTIMIZATION

ANALYTIC

Transformation

Information

BIG DATA

REAL-TIME

INTERFACE

VISUALIZATION

Real-Time Data Integration
Embedded with seamless data integration, Fully programmable platform

DATALINK, digital transformation with Real-Time Data Services designed solutions for Management Information System and Situation Awareness Application.

Integrate various data with built-in data platform, Digital Transformation with multiple data manipulation tools, Data Visualization with stunning dashboards and reporting tools. It is the perfect solution for Real-time Data Analytic and Report which allows real-time applications to communicate with enterprise and any others legacy applications source of data.

BENEFITS

- Real-time / Near Real-time Data Management and Data Analytics
- Ease of Integration, accelerates with Modern and Legacy platform
- Get Insights Data faster with Graphic Visualization
- Enhances situational awareness
- Flexible platform and smart tools with user friendly
- Modern system platform, Less maintenance and Reduce software life cycle costs
- Customizable design and enhancement for business intelligence data visualization

CAPABILITIES

- Delivers throughput up to millions of messages per second
- Provides consistent microsecond- order low latency
- Supports ad hoc systems without administration or servers
- Communicates reliably over unreliable and non-TCP links
- Supports security and safety standards
- Connects diverse enterprise, mobile and embedded platforms
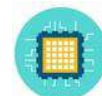
DATALINK Digital Transformation

DATALINK offer customizable module for Digital Data Transformation with tailor functional and design to meet each customer operation and environment.
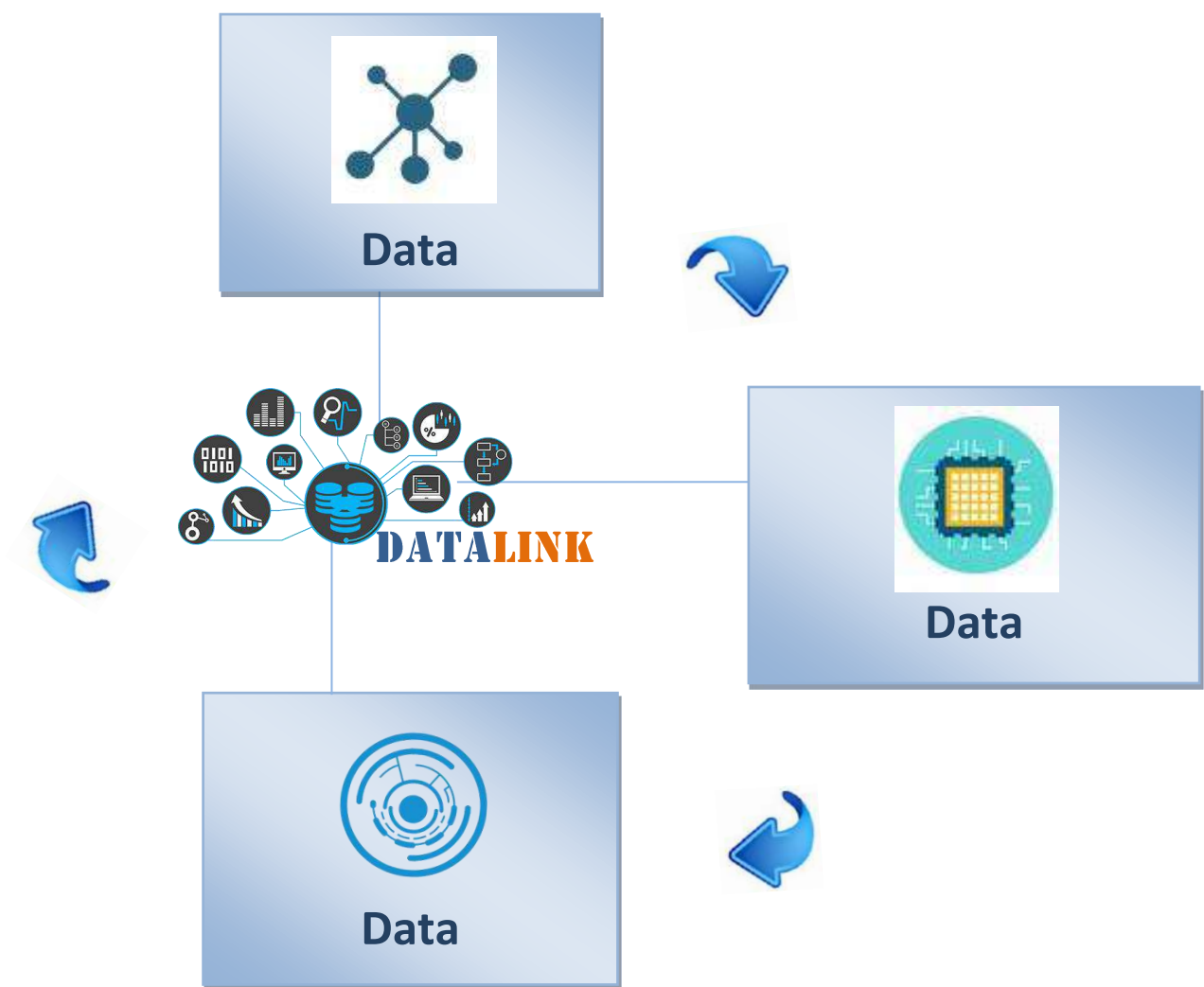
Data Integration

Ease of connecting to work with any data from multiple data sources using the business intelligence and integration tools, DATALINK includes a powerful set of data connector interface capabilities to develop and integrate distributed applications builds on Data Distribution Service for Real-Time Systems (DDS) standard.

Connect to any data source including relational databases, OLAP databases and cubes, file-based data, web services and simple text files. It extends DDS with support for other integration standards, advanced transformation and routing capabilities, and a comprehensive set of tools and run-time services. Embedded with seamless data integration, fully programmable platform, designed with customization, extensibility and ease of integration. It supports many levels of customizations from simple end user configurations to CSS styling and full scripting.

Real-time Data Integrates and Applications

Easily integrate Real-Time Data into systems and other applications, the features are flexible to consolidate data from any data source, providing seamless data delivery and a consistent user experience.

- With flexible platform, full API support and extended scripting. The interface module can integrated and embedded into existing systems and applications
- APIs allow for easy integration and support for authentication, user management and administration
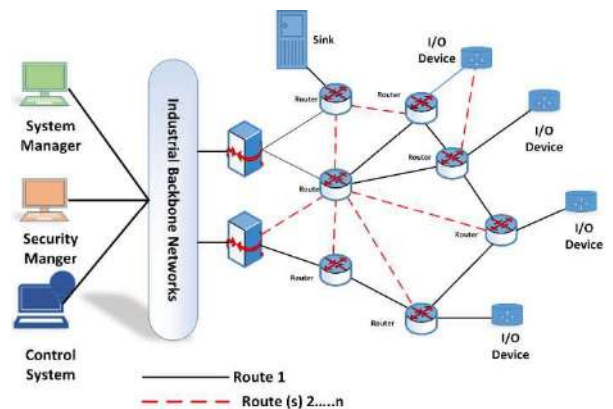
The system comes with public APIs for developers to customize and extend the platform to meet specific needs;

- Authentication - manage users, change security settings and log users in and out
- Visualization Controls - add your own visualizations
- Data Providers - connect to legacy or otherwise unsupported data source
- Export - export data into new formats

- File System - manage file system objects

- Formulas - create new mathematical formulas that users can add to their dashboards

- Accounts Provider - Sync users, groups and tenants with existing applications

Interface Protocol Support
- Modbus
- BACnet
- MQTT
- HTTP
- SNMP
- Serial
- MBus
- DNP3
- POP3
- Allen Bradley
- Haystack

Data Interface Support
- Relational Database (RDBMS)
- Programming Interfaces
- OLAP Database and Cubes
- Web-Based Data
- Files-Based Data

DATALINK provides end-to-end support for the full Microsoft BI (MSBI) stack and integrates with entire suite of Microsoft BI technologies.

Authentication

DATALINK provides optional support to integrate with Windows authentication. The users can log in to the system using a Single Sign On (SSO) with their Windows domain credentials. Businesses running non-Windows networks can either use the built-in account management system, or integrate with a custom network using our public authentication API.

Web Integration

Embedded and integrated into existing websites adding powerful interactive dashboards and reports to your internal or public websites which is easily integrates with

all major web technologies, including:

- SharePoint

- Basic HTML pages

- Mobile-friendly HTML5 pages

- Web applications

## Data Transformation

Explore Data

Access and easily see which data and metric sets are available and then perform various actions to Explore, analyze and visualize all data including copy, move and edit. Managing data structures including database table fields and cube measures and dimensions, and transform onto the dashboard for further data discovery, filtering, sorting, grouping and drill downs.

Data Relationship

Uncover hidden relationships within your data using relationship diagrams visualizing explicit connections between many different data points at a glance.
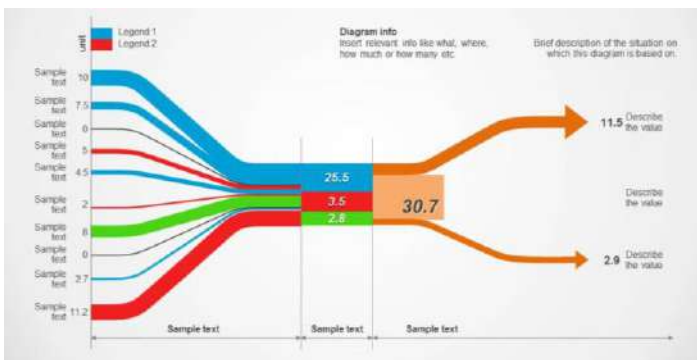
Use visual diagrams to visualize distribution and flow of data values such as energy/money/material in graphic.

Data Grid

The data grid control gives the ability to visualize tabular data in a way that looks and operates better than a standard spreadsheet or table. Use the grid control to display lists, rankings or highly detailed information that attractive, highly interactive and meaningful.
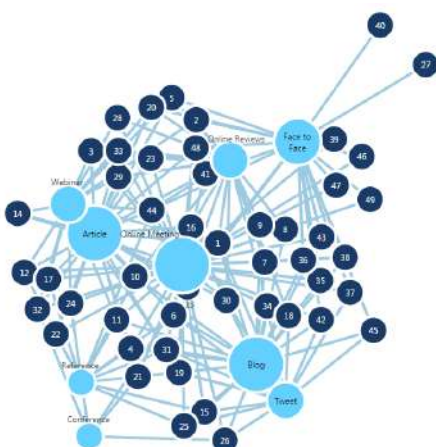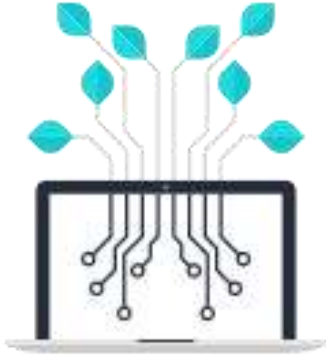
Real-Time Data Analytics

Get tailored with real-time visual access and analytics for all data, information and results.

Experience predictive and advanced data analytics with powerful transitions and animations for data changes and data analysis on any device to quickly observe, monitor and realize the data analytic value.

Interact and analyze data

Advanced data analytics detects hierarchies and time dimensions that enable powerful drill down to analyze data faster and thoroughly, and improve performance in all data areas.

Predictive

To uncover patterns of data and predict trends, the analysis lets you write scripts programming language to perform statistical and predictive analysis on data. Using advanced statistical computing to visualize and interact with advanced interactivity and intuitive data discovery operations for superior data analysis with trend and forecasting, priority ranking and statistics for data manipulation.

High Performance Time Series Historian

DATALINK historian is capability design to storing billions of historical values to a complementary set of time-series database applications that are developed for Real-Time operational process data with high frequency throughput while utilizing of small storage disk space.
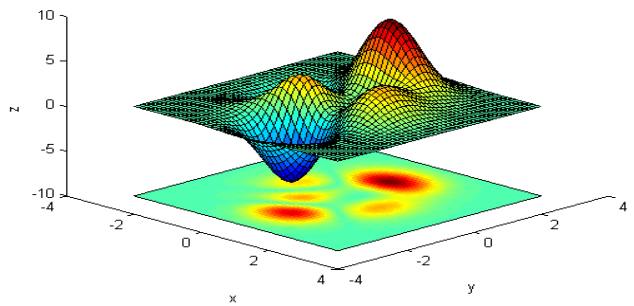
Data Visualization

The DataLink system comes complete with highly-customizable graphic visualizations including interactive charts, table, trend, gauges, maps, scorecards and more customization options and visual design element to create powerful Dashboard & Reports.
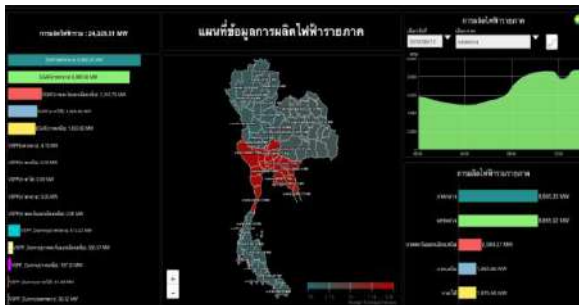
Graphic Visualizations

Chart and Graph

The Chart and Graph control offers numerous graphic visualization and chart types to choose from such as column, bars, stacked, lines, point, bubble, pie, areas, box plot, dots, radar, funnel, range, radial graphs, candlestick and stock.

Chart control features include:

- Annotations
- Secondary axes, Mixed chart types
- Chart animations
- Multiple axes per chart side
- Data point markers
- Data selection, date, time, and report template predefine
- X & Y axes with smart axis labeling, major & minor tick marks, major & minor grid lines, and customizable intervals
- Data and user annotations (plus user annotations along a range of dates)
- Support for plotting against numeric, date/time and categorical
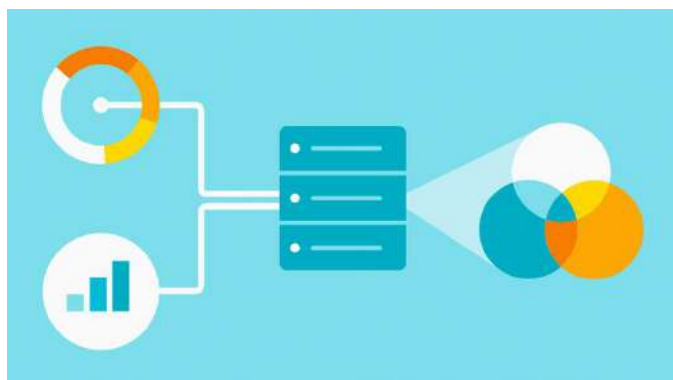
Map

The Map control provides a visualization and interactivity, to enhance the dashboard by displaying and customizing a wide variety of maps.

Display in 2D and 3D map are making geographic data easier to read and interpret, adding custom actions to the maps to control or filter what data is displayed on the dashboard by region, city or other map elements is most powerful tools.

- Supports ESRI and XAML shape files, which allows for the drawing of diagrams via Expression Blend
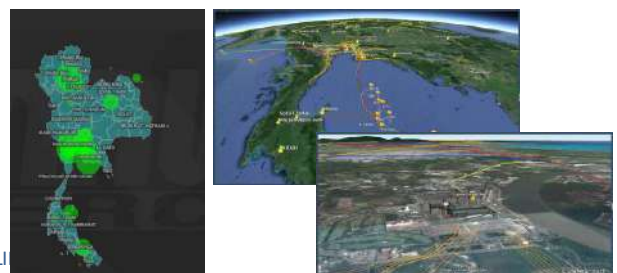
Reports

The reporting service support to create any business intelligence report needs, whether multi-page reports or ad-hoc reports. The dashboard and reporting tools are easy to create complex views. All of the required details can be easily combined into a single report and support grouped of predefines report as needed for maximum insight.

Reports can be interactive and designed to be simply viewed or exported and printed.

Customizable reports are available to provide report template which include table, chart, trend and any 2D/3D geographical view to enhance creation of report visualization.

- Predefine report template to increase efficiency and save time by eliminating manual reporting processes
- Define template or Scenario setup to better versioning control for specific task and routine reports
- Encourage user collaboration through built-in annotations, alert notifications, and scheduled reports
- Keep dashboards and reports in a single familiar portal rather than navigating to a different tool for reporting
- Export report and data to various formats, CSV, Excel, spreadsheet, PDF, etc.

Notifications

A notification is an automated sent out in response to the specific event. DATALINK can be set up to send automatic notifications when data reaches certain conditions or recurring schedule.
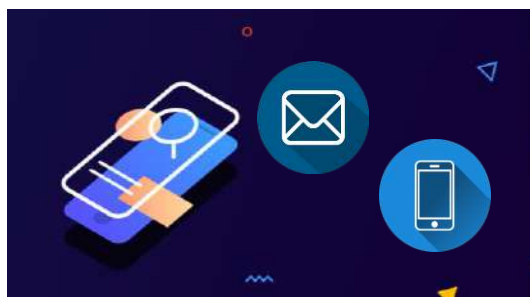
Display on Mobile

With the display on mobile, the smart phone, tablet or mobile devices are supported. The system provides the HTML5 interact with the report and dashboards directly web base application from standard web browser.

The dashboards and reports are fully interactive infographic and can be viewed on all devices screen, tablets, smart phones, desktop PCs and laptops via web browser. The users get immediate access to the data without having to install any custom software or application.

- Tile-Based Layout for a sleek and modern look
- Customize the home screen to view the most relevant metrics
- Drill-Down to powerful dashboards by tapping
- Interface designed for small screens to be touch friendly
- Scale zoom in to maximize the available screen size without compromising the aspect ratio

WORKFLOW PROCESS MANAGEMENT

DataLink workflow management with process flow application for automates document intensive in Approval Processes. Business oriented notation is readily understandable by all business users in Business Process Model and Notation (BPMN) standard.

The DataLink Process Design with drag and drop to create and manage workflow using BPMN 2.0 process modeling tools are intuitive and powerful.

BPMN 2.0 Process Designer
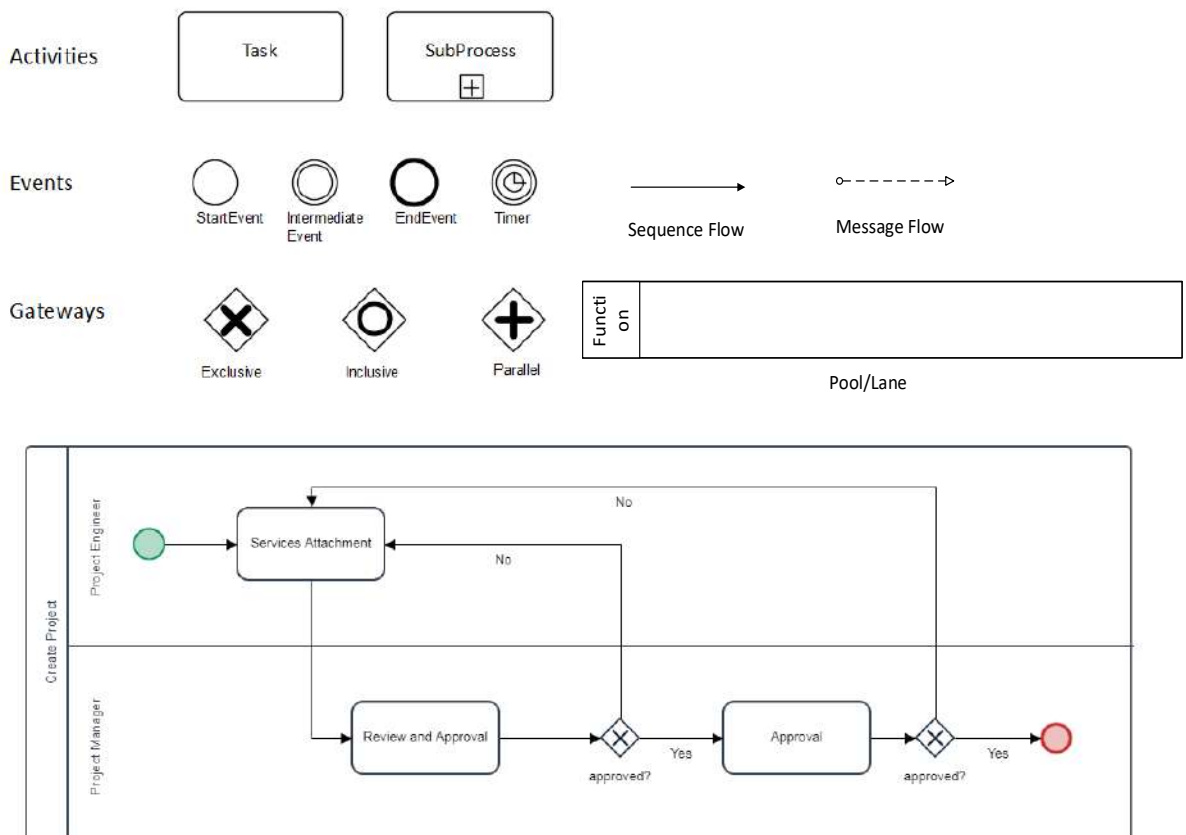
- Drag and drop layout of activities, events and gateways
- Easy to move, resize and label all process elements
- Gateways based on customizable conditions
- Pools for multiple processes in a project
- Definable variables for fields in forms and printable documents
- Message types for process communications

- Import/export of processes in the BPMN 2.0 format

Dynamic Form

The Form are design with the following functionality:

- SubForms
- Grids
- Javascript editor
- Integration with process variables
- Import/export of Forms in JSON format
- Support for uploading files in forms
- Preview of forms in different platforms (desktop, tablet & smart phone)
- Responsive forms that auto adjust for the desktop, tablet & smart phone

User Portal
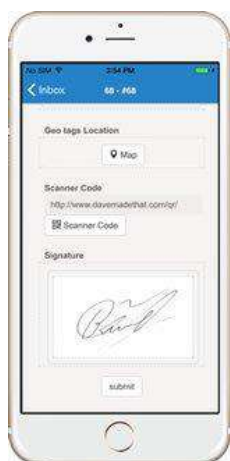
The User Portal consists of the Cases Inbox, Documents and Search. Users can track the progress of requests, initiated or input information. The advanced search makes it easy to find past cases. The Inbox is designed to be easy to use as E-mail inbox.

DATALINK

DATA MINING

orange python

Interactive Data Visualization

DataLink Data Mining service include Orange Library and Python application coding, it is all about data visualizations that help to uncover hidden data patterns, provide intuition behind data analysis procedures or support communication between data scientists and domain experts. Visualization widgets include scatter plot, box plot and histogram, and model-specific visualizations like dendrogram, silhouette plot, tree visualizations and more. Many other visualizations are available in add-ons and include visualizations of networks, word clouds, geographical maps, and more.

Exploratory Data Analysis

Interactive visualizations enable exploratory data analysis. One can select interesting data subsets directly from plots, graphs and data tables and mine them in them downstream widgets or machine learning.

Integration

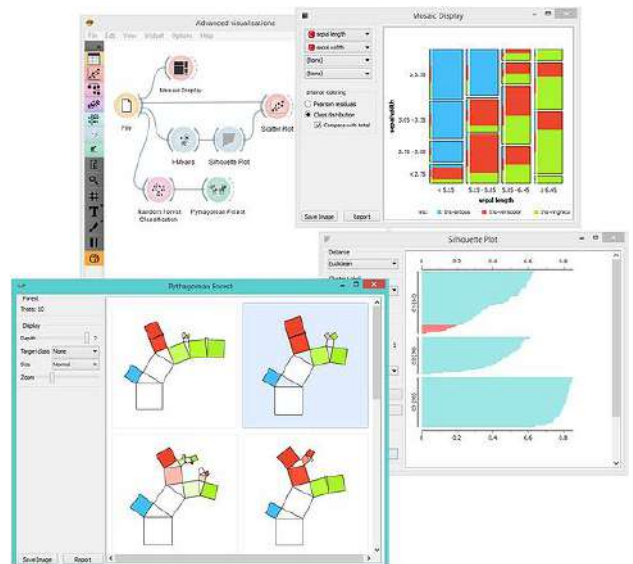Ready to integrate with business intelligent and data management platform.
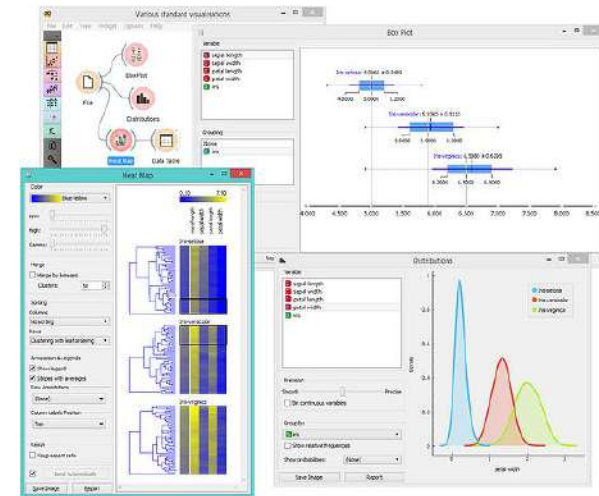
Reporting

Include the most important visualizations, statistics and information about the models into the report with a single click. It includes clever reporting where you can access workflow history for every widget and visualization directly from the report.

Algorithms

Classification Algorithms

- Learners and Classifiers
- Probabilistic Classification
- Cross-Validation
- Handful of Classifiers

Regression Algorithms

- Linear Regression
- Polynomial
- Mean
- Random Forest
- Simple Random Forest
- Regression Tree
- Neural Network

Segmentation Algorithms

- Hierarchical

Association Algorithms

- Frequent Itemsets
- Association Rules

Sequence Analysis Algorithms

- Sequential Recursion

Time Series Algorithms

- As Timeseries
- Interpolate
- Moving Transform
- Line Chart
- Periodogram
- Correlogram
- Spiralogram
- Granger Causality
- Model Evaluation
- Time Slice
- Aggregate
- Difference
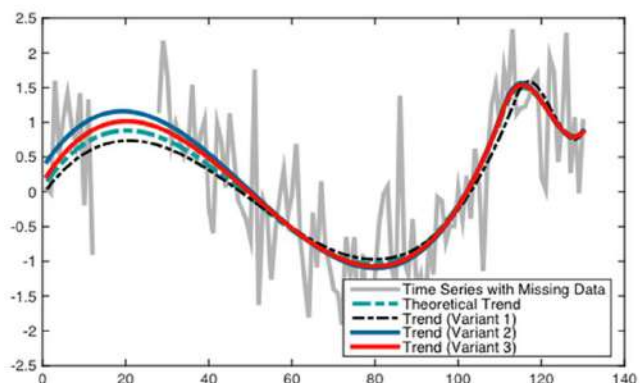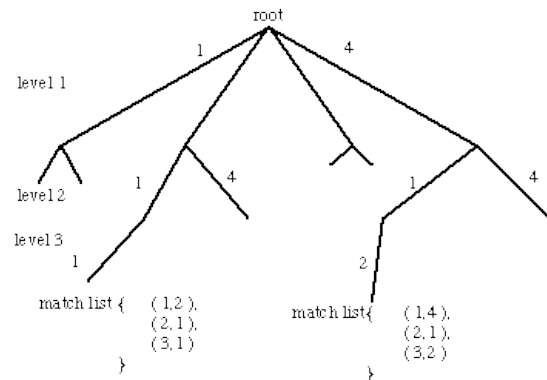
RTI Connext 6

THE FIRST CONNECTIVITY SOFTWARE FOR HIGHLY AUTONOMOUS SYSTEMS

HIGHLIGHTS

Efficient High-Bandwidth Data Distribution for increased throughput and reduced latency.

Integration with Standardized Frameworks and Platforms to ease integration between OEMs and suppliers, from research through production.

Safety Certification Pathway to meet the stringent requirements of ISO 26262 ASIL-D, reducing risk, time and project costs.

Built on Data Distribution Service (DDS), the proven connectivity standard used by AUTOSAR Adaptive and ROS2 for autonomous vehicles.

Accelerate the development, deployment and management of autonomous systems with Connext 6, the first connectivity software for the highest levels of autonomy. Its standard-based framework manages complex data distribution for real-time, scalable connectivity across platforms and systems.

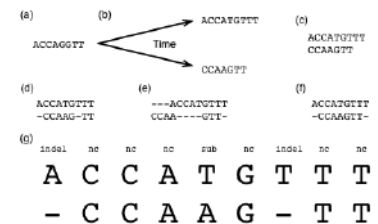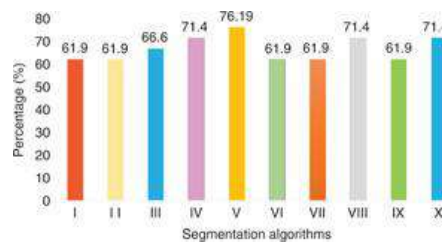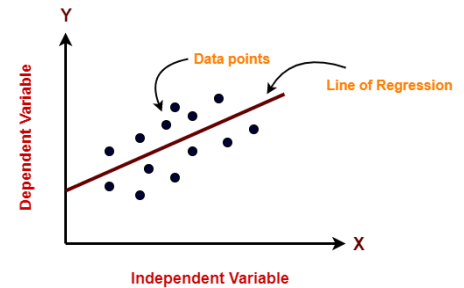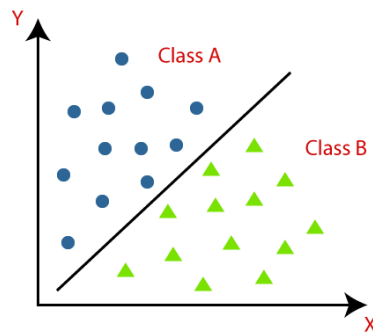**THE FIRST CONNECTIVITY SOFTWARE FOR HIGHLY AUTONOMOUS SYSTEMS**

Advancements in artificial intelligence and sensor technology are driving autonomy across the IIoT. Yet these highly and fully autonomous systems pose challenges that are unaddressed by traditional approaches to data communications. In particular, AI algorithms must efficiently assimilate high volumes and high rates of data from disparate sensors while assuring resilience, security and safety. RTI Connext® DDS is the first connectivity framework designed for these demanding requirements.

RTI Connext 6, the newest release of the RTI Connext Product Suite, includes:

- Connext DDS Professional 6.0
- Connext DDS Secure 6.0
- Connext DDS Micro 3.0

WHAT'S NEW

Connext 6 supports autonomous system development from research to production. It is the first standards-based connectivity framework to handle the complex integration and data distribution challenges of sensor fusion applications in autonomous systems. It enables level 4 and level 5 autonomy through fast, scalable, and efficient distribution of high-bandwidth sensor data. Integration with standardized software frameworks, like AUTOSAR Adaptive and ROS, combined with a path to safety certification saves months of development time.

Connext 6 delivers new capabilities for improved application performance, scalability and functionality, plus developer productivity features including:

Optimized Data Processing
The new RTI FlatData™ representation significantly reduces latency and CPU utilization for large and small data samples. Systems running multiple applications on the same node can use the optimized shared memory transport to nearly eliminate end-to-end latency and overhead in Connext DDS Professional, Connext DDS Secure and Connext DDS Micro.

Easy System Integration

The new generation of Routing Service simplifies bridging data domains with support for advanced transformations including aggregation, splitting and enrichment. The new diagram-based view of Routing Service in Administration Console allows users to intuitively manage routes and monitor performance.

Enhanced Performance

With support for the latest Object Management Group® (OMG®) DDS Extensible Types standard, applications will benefit from network bandwidth savings. An optimized Dynamic Data implementation delivers improved serialization performance, reducing end-to-end latency. XTypes annotations and optional members provide a simpler, more affordable approach to evolving complex, safety-critical systems.

Simplified Data Recording

The new Recording Service offers improved record/replay performance and easier configuration. It includes support for data transformations and content filtering, and a new API for integrating custom storage plugins.

Updated DDS Security

Connext products are compliant with the latest OMG DDS Security specification. Connext 6 extends support for DDS Security plugins to Connext DDS Micro, RTI Persistence Service and several Connext utilities.

Configurable Micro Applications

With XML-Based Application Creation, users can simply define and configure their Connext applications. Connext 6 provides additional tools for maintaining interoperability between Connext DDS Micro, Connext DDS Professional and Connext DDS Secure applications.

Extended Platform Support

Connext 6 expands its broad support for compute platforms and embedded systems with libraries for the latest Linux, QNX, Integrity, and VxWorks platforms.
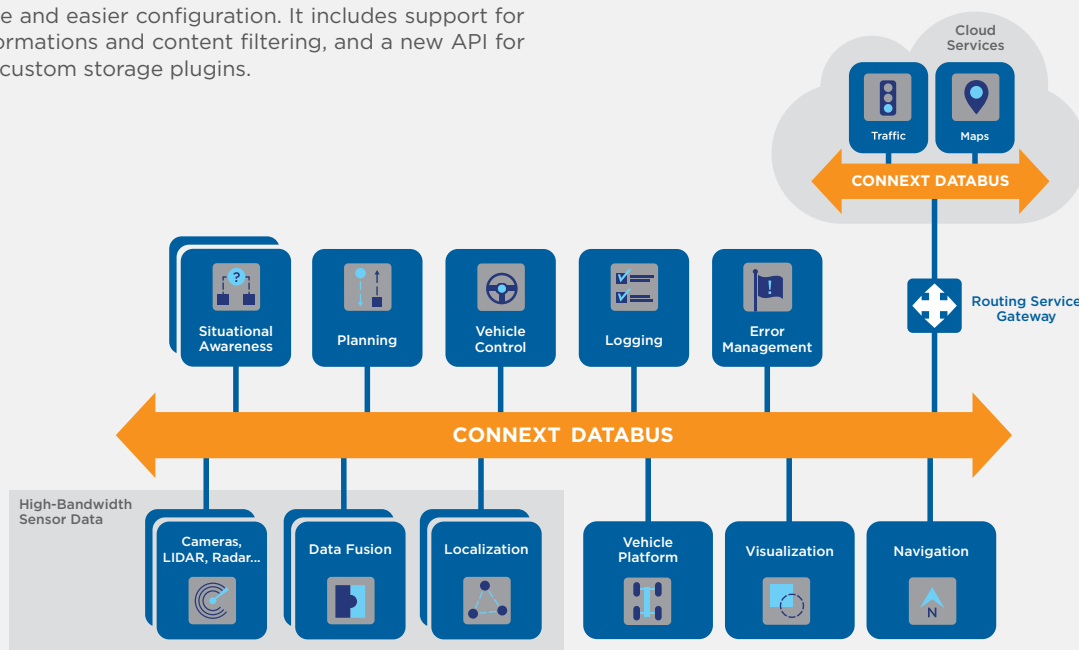
ABOUT RTI

Real-Time Innovations (RTI) is the Industrial Internet of Things (IIoT) connectivity company. The RTI Connext® Databus is a software framework that shares information in real time, making applications work together as one, integrated system. It connects across field, fog and cloud. Its reliability, security, performance and scalability are proven in the most demanding industrial systems. Deployed systems include medical devices and imaging; wind, hydro and solar power; autonomous planes, trains and cars; traffic control; Oil and Gas; robotics, ships, and defense.

RTI lives at the intersection of functional artificial intelligence and pervasive networking℠.

RTI is the largest vendor of products based on the Object Management Group (OMG) Data Distribution Service™ (DDS) standard. RTI is privately held and headquartered in Sunnyvale, Calif.

Download a free 30-day trial of the latest, fully-functional Connext DDS software today: https://www.rti.com/downloads.

**Your systems.
Working as one.**

CORPORATE HEADQUARTERS

232 E. Java Drive, Sunnyvale, CA 94089
Telephone: +1 (408) 990-7400
Fax: +1 (408) 990-7402
info@rti.com

rti.com
rti_software
rtisoftware
company/rti
connextpodcast
rti_software

Evaluation and Benchmarking Guide

Release 6.x

Contents

1

Preface

1.1 About the Evaluation & Benchmarking Guide

The *Evaluation & Benchmarking Guide* is the starting point for anyone who wants to evaluate Vortex OpenSplice.

This Evaluation Guide contains:

- a general introduction to ...

- descriptions of how to ...

- *etc.*

1.2 Conventions

The icons shown below are used in ADLINK product documentation to help readers to quickly identify information relevant to their specific use of OpenSplice.

Icon	Meaning
⚠	Item of special significance or where caution needs to be taken.
i	Item contains helpful hint or special information.
Windows	Information applies to Windows (*e.g.* XP, 2003, Windows 7) only.
Unix	Information applies to Unix-based systems (*e.g.* Solaris) only.
Linux	Information applies to Linux-based systems (*e.g.* Ubuntu) only.
C	C language specific.
C++	C++ language specific.
C#	C# language specific.
Java	Java language specific.

2

Introduction

One of the key differentiators of Vortex OpenSplice is that it provides a user with the ability to choose exactly how to deploy Data Distribution Service (DDS) applications, *i.e.* there are different DDS system architecture deployment modes and also different networking service protocols. This allows a user to maximize both *intra*-nodal and *inter*-nodal performance based on requirements specific to their own use case. When evaluating Vortex OpenSplice it is very important to understand all of these features and benefits to ensure that the most appropriate combination is evaluated against your specific performance criteria. Once the performance figures have been observed the choice is usually clear.

Every customer use case and set of requirements is different, so let us briefly guide you through how to best deploy Vortex OpenSplice so that it meets and exceeds your expectations. Here we explain how easy it is to get started with Vortex OpenSplice and observe the excellent performance and scalability it provides. Vortex OpenSplice is even shipped with dedicated performance tests that the user can build and run easily.

Note that this Guide *serves only as an introduction and does not replace the full Vortex OpenSplice reference and user guides.*

3

Vortex OpenSplice Basics

Vortex OpenSplice is configured using an XML configuration file. In this file, the user specifies the architectural model and the Vortex OpenSplice services that are to run when the DDS infrastructure is started.

The `OSPL_URI` environment variable refers to the specific XML configuration file that is used for the current deployment. The default value refers to the `ospl.xml` file located in the `etc/config` directory of the Vortex OpenSplice installation. The installation directory itself can be referred to by the `OSPL_HOME` environment variable. Please see *The Vortex OpenSplice Environment* for details of how to set up the Vortex OpenSplice environment.

A number of other sample configuration files that can be used when benchmarking Vortex OpenSplice are also provided in the `etc/config` directory.

The `OSPL_URI` variable is of the form:

Linux
```
OSPL_URI=file://$OSPL_HOME/etc/config/ospl.xml
```

Windows
```
OSPL_URI=file://%OSPL_HOME%\etc\config\ospl.xml
```

You can refer to the `OpenSplice_DeploymentGuide.pdf` later for more details of the `OSPL_URI` variable; for now, let us see what aspects of the OpenSplice deployment are controlled by this file.

i The Vortex OpenSplice Launcher tool assists with the selection of the `OSPL_URI` variable. There is a *Configurations* menu that lists the sample configuration files that are available.

Figure 3.1: **The Launcher tool**

The Vortex OpenSplice Launcher tool is also able to run the examples and performance tests that are described later in this document.

4

Vortex OpenSplice Architectural Modes

Vortex OpenSplice provides two main architectural modes. These are the **Single Process** deployment mode, which provides a **Standalone** architecture, and, unique to OpenSplice, the **Shared Memory** deployment mode which provides a **Federated** architecture.

4.1 The Single Process or Standalone deployment

Features of this mode are:

- Simplest to run and get started with.
- Each DDS application process contains the entire DDS infrastructure.
- Uses in-process heap memory for the DDS database.
- Vortex OpenSplice services run as threads within the application process.
- When there are multiple DDS application processes on a single machine, the communication between them must be done *via* a networking service; this introduces additional overhead so performance in this scenario is not optimal.
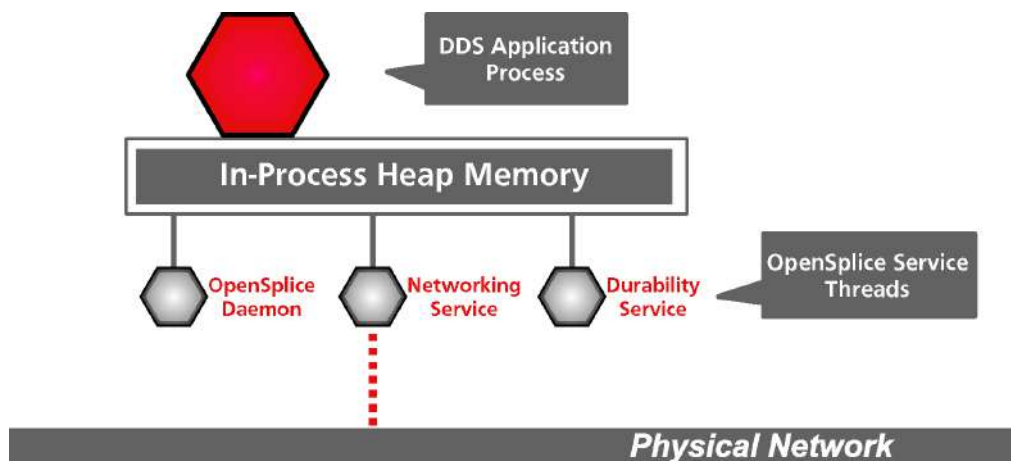
Figure 4.1: **Single Process or Standalone deployment**

4.2 The Shared Memory or Federated deployment

Features of this mode are:

- The DDS infrastructure is started once per machine.
- Uses shared memory for the DDS database.

- Each DDS application process interfaces with the shared memory rather than creating the DDS infrastructure itself.

- Allows the data to be physically present only once on any machine.

- Reading and writing directly to locally-mapped memory is far more efficient than having to actually move the data *via* a networking service, allowing for improved performance and scalability.

- Vortex OpenSplice services are able to arbitrate over all of the DDS data on the node, and so can make smart decisions with respect to data delivery so that priority QoS values (for example) are respected; this is not possible when there are multiple standalone deployments on a machine.
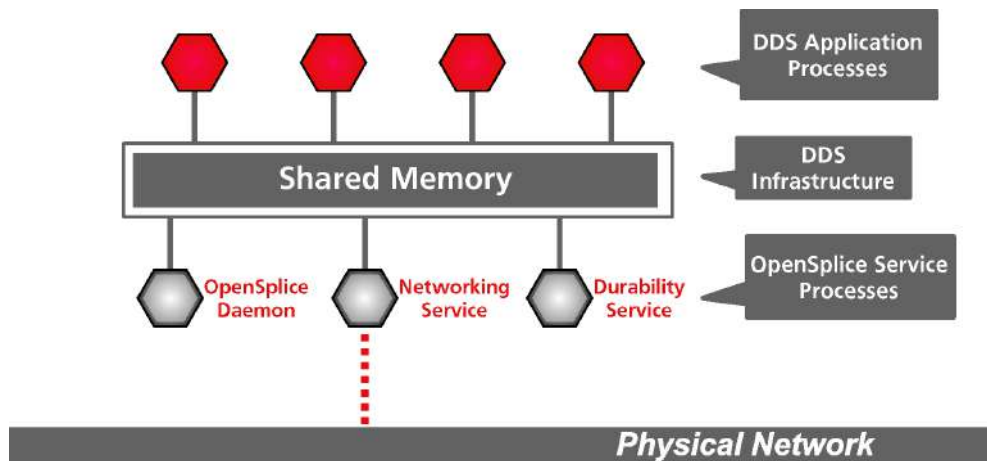
Figure 4.2: **Shared Memory or Federated deployment**

When there are multiple DDS applications running on a single computing node, the use of OpenSplice's unique Shared Memory architecture can provide greater performance, smaller footprint and better scalability than other DDS deployment options.

4.3 How to select the Architectural Mode

- For a Single Process deployment, set the OSPL_URI variable to refer to a single process (sp) xml file such as `ospl_sp_ddsi.xml` or `ospl_sp_nativeRT.xml`. Note that a networking service (such as ddsi or nativeRT) is required for two DDS application processes to communicate even if they are running on the same physical machine. See the next section for more details on networking options.

A single process deployment is enabled when the Domain section of the XML configuration contains a '<SingleProcess> TRUE' attribute.

NOTE for VxWorks kernel mode builds of OpenSplice the single process feature of the OpenSplice domain must not be enabled. i.e. "<SingleProcess>true</SingleProcess>" must not be included in the OpenSplice Configuration xml. The model used on VxWorks kernel builds is always that an area of kernel memory is allocated to store the domain database (the size of which is controlled by the size option in the Database configuration for opensplice as is used on other platforms for the shared memory model.) This can then be accessed by any task on the same VxWorks node.

- For a Shared Memory deployment, set the OSPL_URI variable to refer to a shared memory (*shmem*) xml file such as `ospl_shmem_no_network.xml`, `ospl_shmem_ddsi.xml`, or `ospl_shmem_nativeRT.xml`. Note that two or more DDS applications running on the same physical machine are able to communicate *via* the shared memory so a networking service (such as ddsi or nativeRT) is not necessarily required.

A shared memory deployment is enabled when the Domain section of the XML configuration does not contain a '<SingleProcess> TRUE' attribute but does contain a '<Database>' attribute.

⚠ Note that by default the `OSPL_URI` environment variable refers to a *Single Process* configuration, so to see the extra performance and scalability benefits of Vortex OpenSplice's Shared Memory architecture it is necessary to switch from the default.

5

Vortex OpenSplice Networking Options

Vortex OpenSplice provides several networking options for the delivery of DDS data between nodes. The networking service selection is largely transparent to the user; the difference is observed in the CPU consumption, networking load, and ultimately how fast and efficiently the data is delivered between nodes. The most applicable service is dependent on the requirements of the use case.

Vortex OpenSplice DDSI is the industry standard protocol providing vendor interoperability that operates using a typed 'pull' style model.

Vortex OpenSplice RTNetworking is an alternative to the DDSI wire protocol. RTNetworking uses a type-less 'push' style model in contrast to DDSI and is often the more performant, scalable option. RTNetworking also offers prioritization of network traffic via 'channels', partitioning to separate data flows and optional compression for low-bandwidth environments. **Vortex OpenSplice SecureRTNetworking** provides these features together with encryption and access control.

Vortex OpenSplice DDSI2E is the 'enhanced' version of the interoperable service. DDSI2E offers the benefits of the DDSI protocol (such as its automatic unicast delivery in the case of there being a single subscribing endpoint), together with some of the performance features of the RTNetworking service such as channels, partitioning and encryption.

5.1 How to select the Networking Protocol

As with the architectural deployment choice, the selection of the networking service is described by the XML configuration file. Note that this choice is independent of and orthogonal to the architectural deployment: you can have single process or shared memory with any of the networking service protocols.

- To run with a **DDSI** service, set the `OSPL_URI`variable to refer to a DDSI xml file such as `ospl_sp_ddsi.xml` or `ospl_shmem_ddsi.xml`.

- To run with an **RTNetworking** service, set the `OSPL_URI` variable to refer to an RTNetworking xml file such as `ospl_sp_nativeRT.xml` or `ospl_shmem_nativeRT.xml`.

- To run with a **SecureRTNetworking** service, set the `OSPL_URI`variable to refer to the `ospl_shem_secure_nativeRT.xml` SecureRTNetworking xml file.

- To run with a **DDSI2E** deployment, set the `OSPL_URI` variable to refer to a DDSI2E xml file such as `ospl_sp_ddsi2e.xml` or `ospl_shmem_ddsi2e.xml`.

⚠ Note that by default, the `OSPL_URI` environment variable refers to a *DDSI* configuration, so to see the extra performance and scalability benefits of Vortex OpenSplice's RTNetworking or DDSI2E it is necessary to switch from the default.

6

Benchmarking OpenSplice: Decision Trees

DDS provides many functional benefits that set it apart from other middleware technologies, but users often still have specific performance requirements for latency, throughput, CPU and network utilization. Vortex OpenSplice provides the functional benefits of the technology whilst remaining committed to excellent performance.

The flowcharts in this chapter show the decision criteria that may be applied in order to decide on the most appropriate test case, architectural mode, and networking protocol options for your specific use case and requirements.

. How to run Vortex OpenSplice:
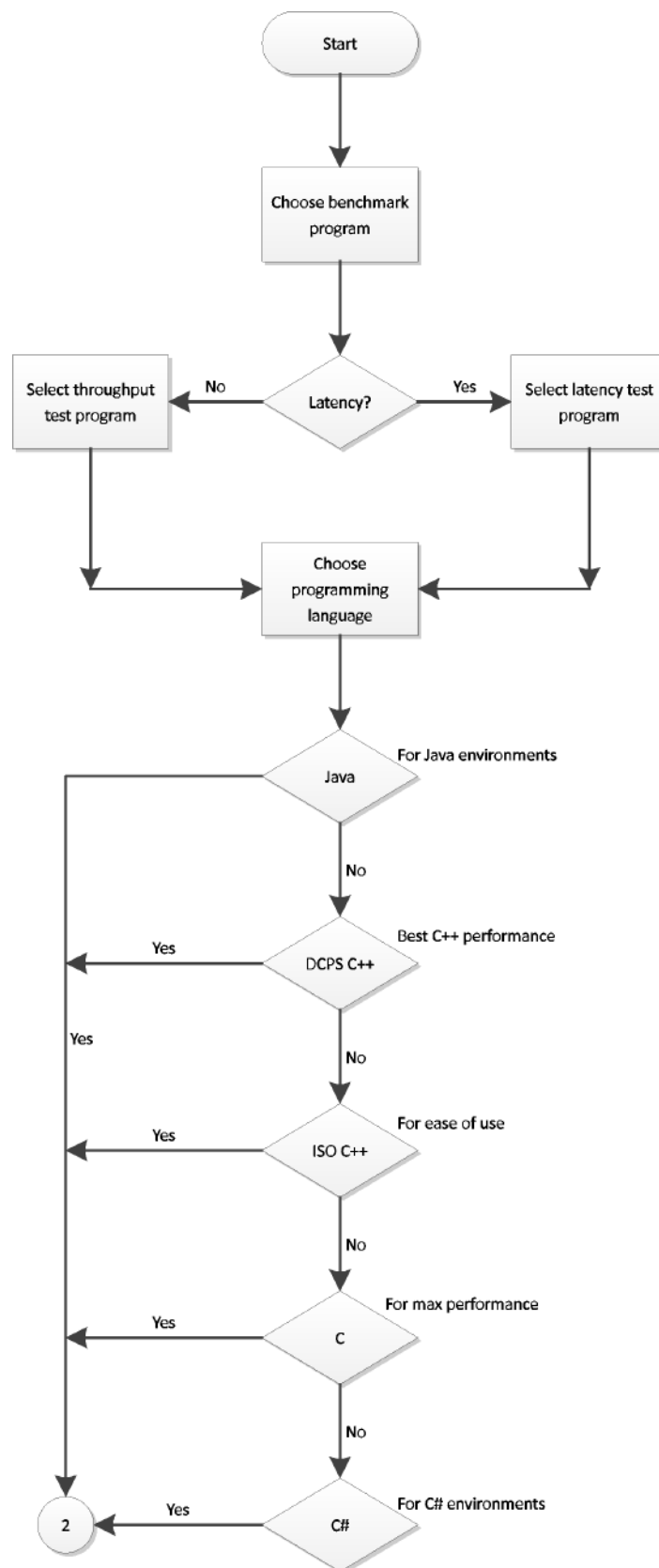
Figure 6.1: **Selecting a specific performance test and programming language**
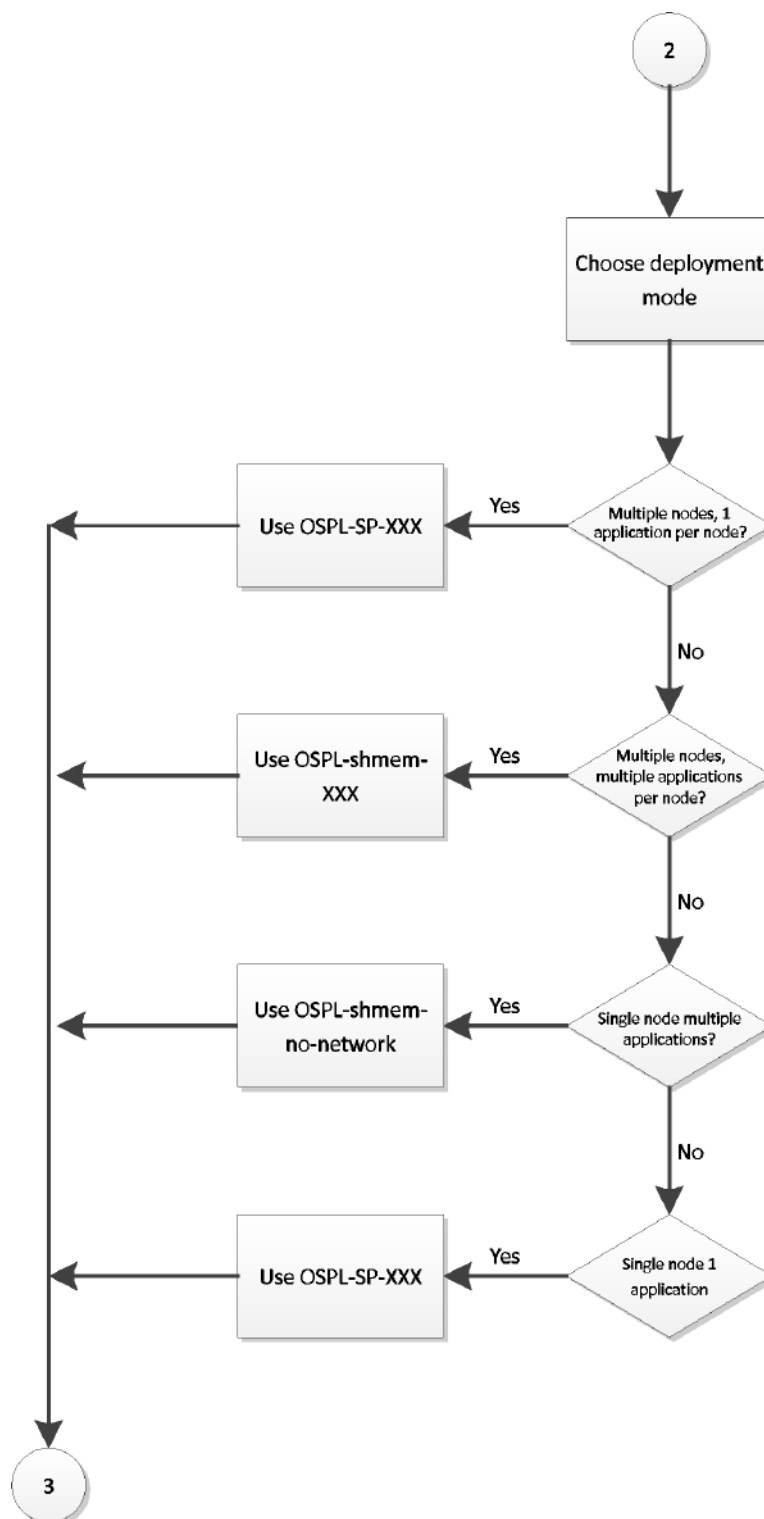
Figure 6.2: **Selecting the architectural deployment mode**
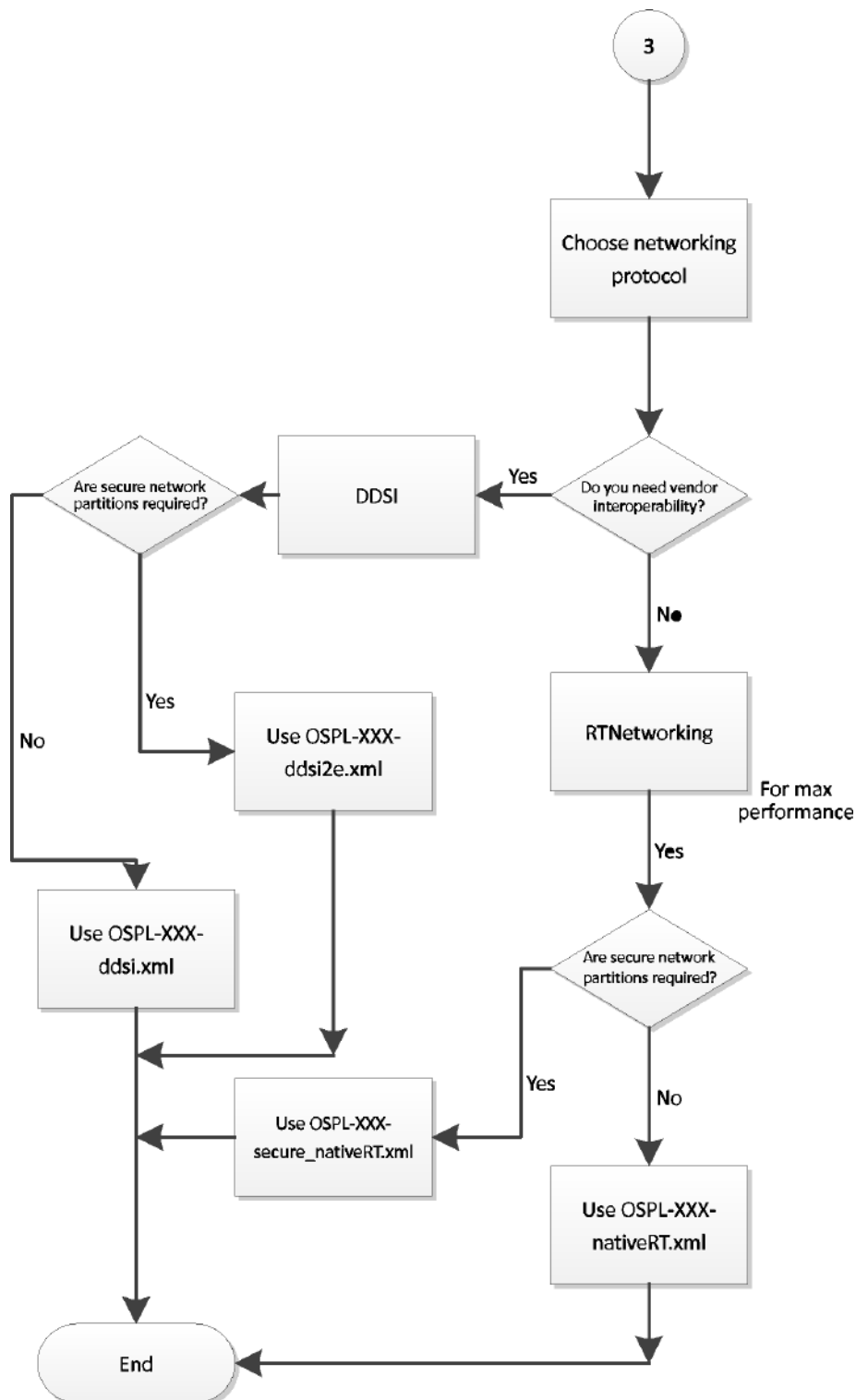
Figure 6.3: **Selecting the network protocol options**

7

How to run Vortex OpenSplice

7.1 The Vortex OpenSplice Environment

A release file is provided with the Vortex OpenSplice installation which contains the environment variables that are required.

Create an Vortex OpenSplice environment as follows.

First:

> **Linux**
>
> > Open a shell and source the `release.com` file from the Vortex OpenSplice installation directory.

> **Windows**
>
> > Open a *Windows Command prompt* and run the `release.bat` file in the Vortex OpenSplice installation directory.

> **Windows**
>
> > Alternatively, use the *Vortex OpenSplice Command Prompt* that can be accessed from the Windows *Start* menu (this will implicitly run `release.bat`).

> *i* Note that the Vortex OpenSplice Launcher tool also provides a `Console` option which sets up the Vortex OpenSplice environment.

Next:

Set the `OSPL_URI` variable to refer to the Vortex OpenSplice configuration that is required (see the section *How to select the Architectural Mode*).

7.2 Running Single Process and Shared Memory Modes

- With an `OSPL_URI` variable referring to a *Single Process* deployment, you just need to start the DDS application process. The `create_participant()` operation, which is the entry into the DDS Domain, will create the entire DDS infrastructure within the application process and the services will be started as threads.

- With an `OSPL_URI` variable referring to a *Shared Memory* deployment, it is necessary to start the DDS infrastructure before starting your DDS application processes. That is done by using the `ospl` utility tool:

```
ospl start
# now run the DDS application processes as normal
ospl stop
```

8

Performance Tests and Examples

To make the evaluation process as easy as possible, Vortex OpenSplice is shipped with dedicated performance tests that can be used to measure latency and throughput. The tests are simple and clear, allowing the user to obtain performance results easily.

The easiest way to build and run the performance tests is to use the Vortex OpenSplice *Launcher* tool. In the *Examples* menu select the specific example and the appropriate language and configuration. Click the *Compile Example* button and then *Run Example*. This will run the DDS applications, and if running with a shared memory configuration it will also manage the starting and stopping of Vortex OpenSplice.

Vortex OpenSplice also provides dedicated performance testing scripts which:

- Test multiple API bindings

- Use a varying range of payload sizes

- Timestamp and append results to a CSV file

- Set process priority and CPU affinity

Please see the `html` files for the individual performance tests for details of how to run these scripts.

8.1 Round-Trip Latency Performance

The latency of a DDS implementation is an expression of how fast data can be delivered between two DDS applications. *Round-trip latency* is the time taken for an individual DDS data sample to be delivered from Application A to Application B and back again, so importantly it includes metrics for both data delivery and reception.

The easiest way to build and run the performance tests is to use the Vortex OpenSplice *Launcher* tool as explained above.

Alternatively, to manually build and run the round-trip performance test, for example for the ISO C++ API:

Linux

```
# In an Vortex OpenSplice environment:
cd $OSPL_HOME/examples/dcps/RoundTrip/isocpp
make

cd $OSPL_HOME/examples/dcps/RoundTrip/isocpp
# If using shared memory do "ospl start"
./pong
# If using shared memory do "ospl stop"

# In another Vortex OpenSplice environment:
cd $OSPL_HOME/examples/dcps/RoundTrip/isocpp
# If using shared memory do "ospl start"
./ping 20 100
# If using shared memory do "ospl stop"
```

Windows

```
# Load the Vortex OpenSplice examples project solution
# into Visual Studio and build the required projects

# In an Vortex OpenSplice environment:
cd %OSPL_HOME%\examples\dcps\RoundTrip\isocpp
# If using shared memory do "ospl start"
pong.exe
# If using shared memory do "ospl stop"

# In another Vortex OpenSplice environment:
cd %OSPL_HOME%\examples\dcps\RoundTrip\isocpp
# If using shared memory do "ospl start"
ping.exe 20 100
# If using shared memory do "ospl stop"
```

The `ping` application will report the roundtrip time taken to send DDS data samples back and forth between the applications. The test utilizes the `ReliabilityQoS` set to `RELIABLE` by default in order to show the maximal performance whilst maintaining the guaranteed delivery of DDS samples. See the `README` file for the test for further details.

The lowest roundtrip latency may be achieved by tuning the test parameters appropriately.

As mentioned above, the performance testing script described in the `html` for the example is a convenient way to test and record the running of this test.

⚠ Note that the default `OSPL_URI` value refers to a *Single Process* deployment with *DDSI* networking.

- To observe the best performance within a node it is suggested that you use a *Shared Memory* configuration.
- To observe the best performance between nodes it is suggested that you use an *RTNetworking* service configuration.

8.2 Throughput Performance

The throughput of a DDS implementation is an expression of the rate of data delivery through the DDS system. Measured in bits per second, it describes the ability of the DDS implementation to effectively deliver DDS data without data loss.

As with the round-trip test, the easiest way to build and run the throughput performance test is to use the Vortex OpenSplice *Launcher* tool.

Alternatively, to manually build and run the throughput performance test, for example for the ISO C++ API:

Linux

```
# In an Vortex OpenSplice environment:
cd $OSPL_HOME/examples/dcps/Throughput/isocpp
make
cd $OSPL_HOME/examples/dcps/Throughput/isocpp
# If using shared memory do "ospl start"
./publisher
# If using shared memory do "ospl stop"

# In another In an Vortex OpenSplice environment:
cd $OSPL_HOME/examples/dcps/Throughput/isocpp
# If using shared memory do "ospl start"
./subscriber
# If using shared memory do "ospl stop"
```

Windows

```
# Load the Vortex OpenSplice examples project solution
# into Visual Studio and build the required projects

# In an Vortex OpenSplice environment:
cd %OSPL_HOME%\examples\dcps\Throughput\isocpp
# If using shared memory do "ospl start"
publisher.exe
# If using shared memory do "ospl stop"

# In another Vortex OpenSplice environment:
cd %OSPL_HOME%\examples\dcps\Throughput\isocpp
# If using shared memory do "ospl start"
subscriber.exe
# If using shared memory do "ospl stop"
```

The subscriber application will report the DDS data throughput by default once per second. This and many other aspects of the test can be configured on the command line. The test utilizes the 'ReliabilityQoS set to RELIABLE by default in order to show the maximal performance whilst maintaining the guaranteed delivery of DDS samples. See the README file for the test for further details.

The maximum throughput may be achieved by tuning the test parameters appropriately.

As mentioned above, the performance testing script described in the html for the example is a convenient way to test and record the running of this test.

⚠ Note that the default OSPL_URI value refers to a *Single Process* deployment with *DDSI* networking.

- To observe the best performance within a node it is suggested that you use a *Shared Memory* configuration.

- To observe the best performance between nodes it is suggested that you use an *RTNetworking* service configuration.

8.2.1 Achieving Maximum Throughput

Where there is a requirement to support continuous flows or 'streams' of data with minimal overhead consider the use of Vortex OpenSplice Streams. The ability to deliver potentially millions of samples per second is realized by the Streams feature transparently batching (packing and queuing) the periodic samples.

Figure 8.1: **Streams Architecture**

The streams performance example is located in the examples/streams directory within the installation.

9

Bibliography

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'Data Distribution Service for Real-Time Systems Version 1.4',
Available specification formal/15-04-10

OMG DDSI 2.1

Object Management Group,
*'The Real-Time Publish-Subscribe Wire Protocol DDS
Interoperability Wire Protocol Specification Version 2.1'*,
Document Number: formal/2009-01-05

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Object Management Group,
*'The Real-Time Publish-Subscribe Wire Protocol DDS
Interoperability Wire Protocol Specification Version 2.2'*,
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OMG DDS XTYPES 1.0

Object Management Group,
'Extensible and Dynamic Topic Types for DDS Version 1.0',
Document Number: formal/2012-11-10

10

Contacts & Notices

10.1 Contacts

ADLINK Technology Corporation
400 TradeCenter
Suite 5900
Woburn, MA
01801
USA
Tel: +1 781 569 5819

ADLINK Technology Limited
The Edge
5th Avenue
Team Valley
Gateshead
NE11 0XA
UK
Tel: +44 (0)191 497 9900

ADLINK Technology SARL
28 rue Jean Rostand
91400 Orsay
France
Tel: +33 (1) 69 015354

Web: http://ist.adlinktech.com/

Contact: http://ist.adlinktech.com

E-mail: ist_info@adlinktech.com

LinkedIn: https://www.linkedin.com/company/79111/

Twitter: https://twitter.com/ADLINKTech_usa

Facebook: https://www.facebook.com/ADLINKTECH

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๒๙) โปรแกรมระบบบริหารจัดการข้อมูลและการให้บริการข้อมูล
(Information Management Platform)

DATALINK

DATALINK

The Real-Time Data Services for

Management Information System and Situation Awareness
Application

Total Solution of Data Interfaces and Reporting

Pims
Technologies

Fast and Flexible Real-Time Application Integration

DATALINK is a Real-Time Data Services for Management Information System and Situation Awareness Application is an integration platform for real-time systems. Based on a server less software bus, it allows real-time applications to communicate with each other and with enterprise and legacy applications.

DATALINK features a unique combination of high performance and broad standards support. It gives integrators of demanding applications an alternative to custom integration that is off-the-shelf and supports an open architecture

Highlights

Replaces complex, stovepipe and brittle point-to-point integration with loosely coupled and net-centric publish/subscribe communication

Satisfies demanding real-time and mission-critical requirements that are well beyond the reach of traditional Enterprise Service Bus (ESB) implementations

Provides a peer-to-peer foundation for a Real-Time Service Oriented Architecture (RT-SOA) that is high performance, embedded and completely decentralized

Complies with DDS and other popular standards including JMS and Web Services

BENEFITS

- Real-time / Near Real-time data management and application services
- Accelerates integration and technology insertion
- Increases reuse
- Reduces software lifecycle costs
- Enhances situational awareness
- Eliminates vendor dependence
- Avoids obsolescence

CAPABILITIES

- Delivers throughput up to millions of messages per second
- Provides consistent microsecond-order low latency
- Supports ad hoc systems without administration or servers
- Communicates reliably over unreliable and non-TCP links
- Supports security and safety standards
- Connects diverse enterprise, mobile and embedded platforms

DATALINK Comprehensive Integration Platform

DATALINK includes a powerful set of capabilities to develop and integrate distributed applications

DATALINK builds on Data Distribution Service for Real-Time Systems (DDS) standard. It extends DDS with support for other integration standards, advanced transformation and routing capabilities, and a comprehensive set of tools and run-time services. This accelerates the integration of DDS applications with non-DDS applications and into Systems of Systems
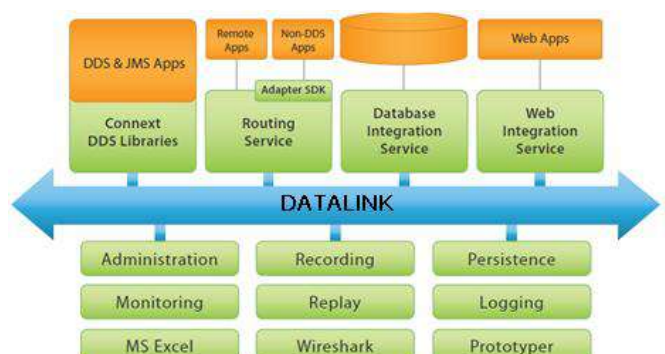
Broad Interface Support, Support for a wide range of standard interfaces and protocols accelerates the integration of both new and legacy applications.

Secure and WAN Transport, provides authentication and encryption over local and wide area networks using OpenSSL, TLS and DTLS

Rich Run-Time Tools and Services, DATALINK have tools accelerate debugging and testing while easing management of deployed systems.

Prototyper, Lets you quickly simulate system components to test your applications and assess scalability before development is complete.

Embedded DDS and JMS, Included libraries comply with the DDS and Java Message Service (JMS) standards. Applications that use DATALINK libraries can communicate peer-to-peer for the highest possible performance

Analyzer, Accelerates integration and debugging by providing visibility into a running system including applications, QoS and interface definitions

RTPS interoperability, Native support for the DDS Real-Time Publish-Subscribe (RTPS) wire protocol provides direct interoperability with applications that use other RTPS compliant middleware. No bridge is required.

Administration Console, Is a centralized tool for monitoring, configuring and debugging Connext DDS infrastructure services. It allows users to view system-wide logging messages and provides non-intrusive visibility into a running system —including nodes, participants, topics, types, and QoS. A new Match Analyses capability actively identifies incompatibilities inhibiting communication.

Monitor, Accelerates testing and optimization while easing management of deployed systems. Provides comprehensive insight into real-time performance and system health

Web and Database integration, Web and enterprise applications can interface to real-time applications through a database or using Web services interfaces, including WSDL/SOAP and REST. Near Real-time online data configurable supported for performance optimization.

Spreadsheet Add-in, Allows use of Microsoft Excel for real-time data visualization, analysis and injection.

Systems of Systems Integration, DATALINK Routing Service provides on-the-fly data transformation and cross-network routing to support the integration of disparate and geographically dispersed systems. It can interface to multiple protocols using off-the-shelf or custom developed adapters, including to third-party JMS implementations and legacy data links.

Recording and Playback, DATALINK Recording Service logs high-speed real-time data for future analysis and replay. The service publishes recorded data for back testing and real-time simulation.

Persistence Service, Persists real-time data in-memory or to disk, making it available to late-joining subscribers even if the original publisher is no longer accessible

Optimized for Real-Time and Embedded Systems
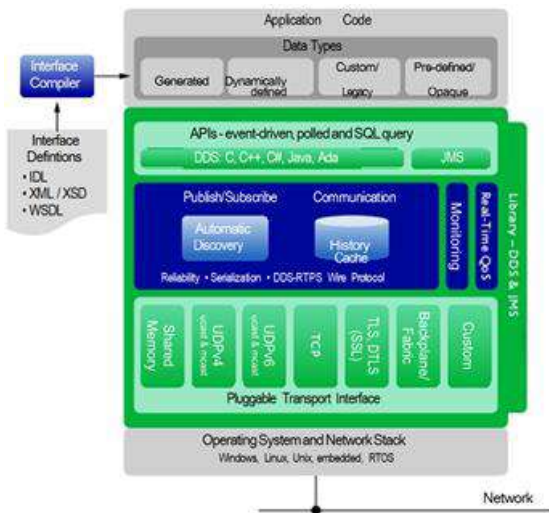
Peer-to-Peer Communication, An innovative, completely decentralized architecture delivers ultra-low latency, high throughput and virtually unlimited scalability. Applications directly exchange data in a true peer-to-peer manner. There are no servers, message brokers or daemon processes acting as bottlenecks or single points of failure.

Plug-and-play integration, Applications are automatically discovered and connected at run-time. No system administration or directory service is required, allowing use in autonomous, dynamic and ad hoc systems

Integrated data cache, A built-in data cache frees developers from having to write complex data structures and search algorithms. SQL like queries provide fast and flexible data access

Real-time Quality of Service (QoS), Applications have comprehensive control over and visibility into real-time behavior, including timing, deadlines, resource utilization and system state. QoS can be specified per-topic and per-subscriber.

Transport flexibility, Applications are independent of the underlying transport and protocol. TCP and IP are not required. DATALINK reliability protocol supports unreliable, bandwidth-limited and high-delay networks such as wireless and satellite links

Optimized publish/subscribe, Data can be reliably multicast to multiple subscribers for extremely efficient streaming data distribution. Messages are routed and filtered by the switch, not by software.

Wire efficiency, The DDS-RTPS wire protocol is extremely wire efficient. Data is sent in a compact binary representation. Most metadata is only exchanged once, at discovery time

Systems of Systems Integration, DATALINK Routing Service provides on-the-fly data transformation and cross-network routing to support the integration of disparate and geographically dispersed systems. It can interface to multiple protocols using off-the-shelf or custom developed adapters, including to third-party JMS implementations and legacy data links.

High-performance architecture, Zero-copy interfaces and shared memory communication support High Performance Computing (HPC). Core libraries are written in C for maximum performance and efficiency. Non-Java applications do not require a Java Virtual Machine (JVM) or Application Server.

Well Suited for Mission-Critical Systems

High availability, DATALINK server less architecture has no single point of failure. Systems are self-healing when applications disconnect and reconnect. Automatic failover provides continuous availability when an application is no longer accessible

Inherently secure architecture, Because applications directly communicate, security policies can be enforced by the operating system (OS)—such as a Mandatory Access Control (MAC) or partitioned OS. Secure transports are also supported for authentication and encryption.

PROCESSOR FAMILIES
- x86
- ARM
- SPARC

OMG DDS COMPLIANCE
- DDS API 1.2
- Persistence profile
- Ownership profile
- Web-enabled DDS (draft)
- Extensible and Dynamic Topic Types(draft)

OMG DDS COMPLIANCE
- DDS API 1.2
- Persistence profile
- Ownership profile
- Web-enabled DDS (draft)
- Extensible and Dynamic Topic Types(draft)

STANDARD INTERFACES
- DDS - ANSI C, C++, C# (.NET), Java, Ada
- JMS
- WSDL/SOAP
- SQL
- Sockets
- File
- Custom via adapter interface

Relational Databases
- Microsoft SQL Server 2005+
- MySQL 5.0.45 or higher
- Oracle 10g or higher
- Oracle XE 10g or higher
- Teradata Database 12.0+
- Microsoft Access
- FoxPro and dBase
- SAP MaxDB 7.x
- ODBC
- Sybase
- PostgreSQL

Programming Interfaces
- DDS: C, C++, C#/.NET, Java, Ada
- Java Message Service (JMS)
- LabVIEW
- MATLAB*, Simulink*

ADAPTERS
- Relational databases
- Microsoft Excel
- Complex Event Processing (CEP) engines
- Visualization platforms
- Application Servers and ESBs

Transports
- Shared memory
- UDPv4, v6 unicast and multicast
- TCP/IP, Ethernet via LAN/WAN
- OpenSSL: TLS/SSL, DTLS
- Low bandwidth

OLAP Databases and Cubes
- Microsoft SQL Server Analysis Services (SSAS) 2005+
- SAP NetWeaver BW 7.0
- Microsoft PowerPivot
- Oracle Hyperion Essbase 11

ODBC Data Sources
- DB2
- Informix
- Ingres
- Pervasive PSQL
- PostgreSQL
- Sybase
- Microsoft SQL
- Quickbooks
- Reuters
- SAS
- SPSS
- SQL Anywhere
- Vertica

File-Based Data
- Microsoft Excel
- Microsoft Access
- Comma-delimited (CSV) and other delimited text
- dBase (.dbf) files
- XML files
- Text (.txt) files

Web-Based Data
- SharePoint Lists
- SharePoint Excel Services
- Google Analytics
- Sales force CRM
- Microsoft Dynamics CRM
- Open Data Protocol (Windows Azure DataMarket, SharePoint 2010, etc.)
- Custom Web Services

DATALINK integrate with Google Earth Enterprise Solutions

DATALINK can integrate to explore geographic information with the power of Google Earth Enterprise, a 3D visualization of the earth that integrates, organizes and publishes your enterprise's location data

Google Earth Enterprise allows you to put the power of Google Earth inside your organization. Combine enterprise data with ASP-delivered Google Earth data. Or host your own complete dataset. Now with support for 2D browser-based access using the Google Maps API, your valuable geospatial data can be integrated into web-based applications or viewed by any user, regardless of their client software.

The Google Earth Enterprise Solution is comprised of three elements:

Google Earth Fusion to store, style, and organize data into a seamless viewable globe or 2D brows able map

Google Earth Server to host and serve data to end user software

Google Earth Enterprise Client or browser-based 2D maps for viewing, printing, searching and data authoring

Key Features

- **Massively scalable architecture** publishes terabytes of geo-data to many users from a server cluster

- **3D view** provides a complete picture of the area of interest by fusing imagery, elevation data, points, lines polygons, 3D models, and dynamic KML

- **2D browser based view** gives your users a Google Maps like view of your imagery and vector data, inside your network

- **Fluid and responsive interaction** streaming technology enables easy exploration of massive datasets via the Google Earth Client or brows able 2D maps

- **Search** functions allow users to search geographic data attributes and databases

- **Collaboration and sharing** are enabled through built in tools to email views, place marks and annotations using KML, a dynamic and flexible XML format

Google Earth's technology adds value to your organization's current geospatial, GIS and LBS investments with rich styling, attribute search, multiple hosting options and the easy to use Google Earth Client and Google Maps interface. The Google Earth Enterprise solution integrates and operates with your geospatial, GIS and LBS environments, and completes the life cycle of your operations by distributing this data to your users in a fast, easy to use system.

Google Earth Fusion

Google Earth Fusion integrates your geospatial data (both terrestrial and astronomical) into the Google Earth Enterprise system - raster (imagery and terrain), vector, KML, 3D models and even data stored in traditional databases. Once data has been integrated and styled, it is delivered to the client software using Google Earth Server. Datasets can be selected and optimized using a friendly GUI. A command line interface is available for
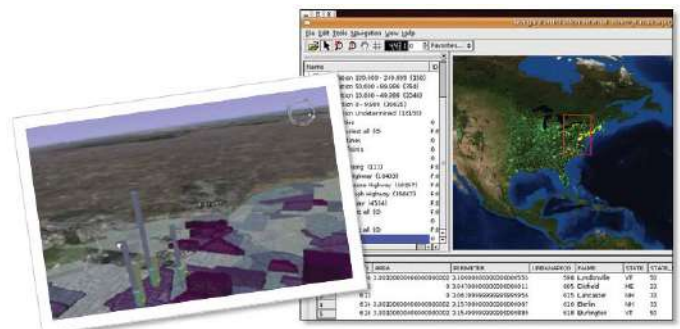
power users, complex integrations and automation. Google Earth Fusion can be configured to update data so that your Google Earth Enterprise system is synchronized to the latest available datasets

Google Earth Fusion features:
- Supports imagery, terrain, polygons, points, lines, KML, regionated KML overlays, and 3D models
- Supports distributed data processing across multiple CPUs and machines
- Easy-to-use GUI
- Scriptable interface to automate data ingestion, database completion and integrate with existing Geographic Information Systems
- Project metaphor - create projects for different collections of data and use these projects to build multiple 3D globes or 2D browsable maps
- Built-in projection handling
- Virtual mosaicing capability
- Rich styling support in GUI to create themes in vector data
- Support for common raster and vector data formats
  - KML streaming
    - Support for KML
    - Google SketchUp Models
    - Superoverlay Image processing
  - Vector (Point, Line, and Polygon)
    - ESRI Shapefile .SHP
    - MapInfo Tab .TAB
    - Comma Separated Values .CSV
  - Imagery and Terrain
    - GeoTIFF, Erdas IMG, JPEG2000, MrSID (32-bit version only)
    - TIFF, JPEG, GIF, PNG, BIL, BIP
    - DTED, USGS SDTS DEM, ASCII DEM

Google Earth Server

Google Earth Enterprise Server software can meet your data hosting needs, ranging from hosting flyable worlds of vector-only datasets for use with the online Google Earth, to fully stand-alone worlds with terabytes of imagery, terrain, and vector data. Your organization can serve your data in a standalone 3D globe to be viewed in the Google Earth Enterprise Client or in a 2D browser-based map utilizing the Google Maps technology.

The Google Earth Enterprise Server "overlay mode" combines the best of two worlds, by publishing a world build from your organizational vector data, and allowing users to view this data in the Google Earth Enterprise Client or 2D maps interface, on top of Google's public data. Enterprises that possess large amounts of imagery, terrain, vector and KML data may utilize the Google Earth Enterprise Server in "stand alone" mode to host and deliver data to the entire organization, to view using the Google Earth Enterprise Client, or Google's 2D Maps Interface.

Google Earth Server features:
- Efficient design enables fast access to massive datasets
- 250 concurrent users supported per license
- Designed, tested, and proven support for load-balanced configurations supporting many thousands of concurrent users
- Search Framework - allows multiple search services to be accessed through one API
  - City-level geocode module included
  - Points of Interest (POI) Search — allows vector attribution search for included vector data.

- Utilizes Apache 2.2
  - Support for data transmission over HTTP or HTTPS
  - Multiple authentication methods supported by Apache available to secure flyable worlds
- Virtual Server support to host multiple, flyable globes on same system
  - Hostname-based virtual servers
  - Location-based virtual servers
  - Port-based virtual servers

Google Earth Enterprise Client and Browser-based 2D Maps
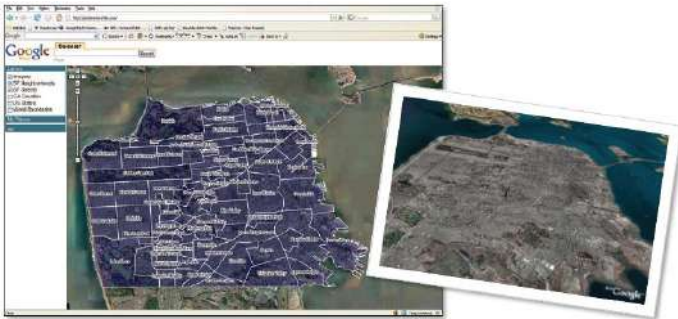
Google Earth Enterprise Client has the additional features found in Google Earth Pro, plus allows your users to connect to your enterprise's 3D Globe containing the data fused, authored and styled in Google Earth Enterprise Fusion and hosted from Google Earth Enterprise Server. Optional Search plugin allows your users to query and search the attribute data for your organization's vector data.

Browser based custom 2D Maps can be built using Google Earth Enterprise Fusion and served from Google Earth Enterprise Server. Your users can connect to your geospatial data using a browser, just as they connect to Google Maps, but securely from within your internal network.

3D Map Visualization

Visualization

Picture perfect! Our best-in-class 3D city models enable you to view existing areas and virtually "see" planned changes with dynamic geographical view before/after scenarios. If a picture's worth a thousand words, a top class 3D GIS model is priceless.

Line of Sight

Perspective! Assess current visibility and determine how new projects will affect your views or access from one point to another in a stunning 3D map. Ideal for surveillance security placements and developments.
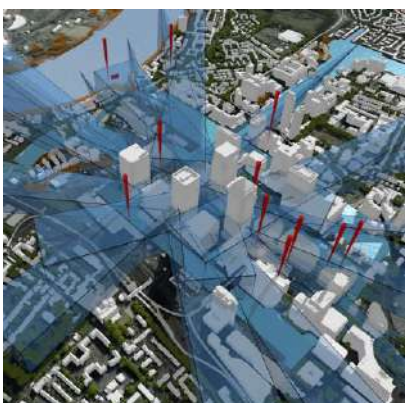
Transportation

Move! Motivate stakeholders with 3D content that clearly presents your vision. Ideal for roadwork, rail service, highway modeling and airport development.

Data Integration

Embedded with seamless data integration, fully programmable platform, designed with customization, extensibility and ease of integration. It supports many levels of customizations from simple end user configurations to CSS styling and full scripting.

Easily Integrates Into Existing Systems and Applications

Easily integrate into existing systems and work like other applications. The features are flexible that can consolidate data from any data source, providing seamless data delivery and a consistent user experience.

- o With an open, flexible platform and full API support and extended scripting can be easily integrated and embedded into existing systems, applications and administration
- o Seamlessly embedded into existing systems such as Client Portals, Intranet or CRM system
- o APIs allow for easy integration and support for authentication, user management and administration

Web Integration

Embedded and integrated into existing websites adding powerful interactive dashboards and reports to your internal or public websites which is easily integrates with all major web technologies, including:

- o SharePoint
- o Basic HTML pages
- o Mobile-friendly HTML5 pages
- o Web applications

Authentication

DATALINK provides optional support for Windows authentication. This means that users can log in to the system using a Single Sign On (SSO) with their Windows domain credentials. Businesses running non-Windows networks can either use our built-in account management system, or integrate with a custom network using our public authentication API.

Extensibility

All of the required functionality, we provide public APIs so developers can customize and extend the platform to meet specific needs;

- o Authentication API – manage users, change security settings and log users in and out
- o Visualization Controls API – add your own visualizations
- o Data Providers API – connect to legacy or otherwise unsupported data source
- o Export API – export data into new formats
- o File System API – manage file system objects
- o Formulas API – create new mathematical formulas that users can add to their dashboards
- o Accounts Provider API – Sync users, groups and tenants with existing applications

Data Analytics

Explore data

The users can access and easily see which data and metric sets are available and then perform various actions to Explore, analyze and visualize all data including copy, move and edit. They can also easily see their data structures including database table fields and cube measures and dimensions, and then drag and drop them onto the dashboard for further data discovery, filtering, sorting, grouping and drill downs to learn more about them.

Predictive

To uncover patterns of data and predict trends. The analysis lets you write scripts programming language to perform statistical and predictive analysis on data. Using advanced statistical computing to visualize and interact with advanced interactivity and intuitive data discovery operations for superior data analysis with trend and forecasting, priority ranking and statistics for data manipulation.

Interact and analyze data

Advanced data analytics detects hierarchies and time dimensions that enable powerful drill down to analyze data faster and thoroughly, and improve performance in all data areas.

- o Hierarchies – easily interact with multi-dimensional hierarchies including geographic and product hierarchies. Very intuitive process with enhanced filtering, sorting, grouping and drill downs
- o Time Dimensions – automatically aggregate date based data into years, half years, quarters, months, weeks and days
- o Metric Sets – easily refine the available data for quick development and ease of use
- o Data Tools – setup contextual metrics to support data analysis including period over period, states setup and formulas

- o Formula Visualizations - generate new visualizations out of formula calculations or automatically summarize data distribution.
- o Statistic calculation tools – easily evaluate trends and forecasting data with statistical formula, Cumulative Total, Standard Deviation, Exponential Moving Average (EMA), etc.

Dashboards & Reports

Graphic Visualizations

The system comes complete with highly-customizable graphic visualizations including interactive charts, table, trend, gauges, maps, scorecards and more customization options.
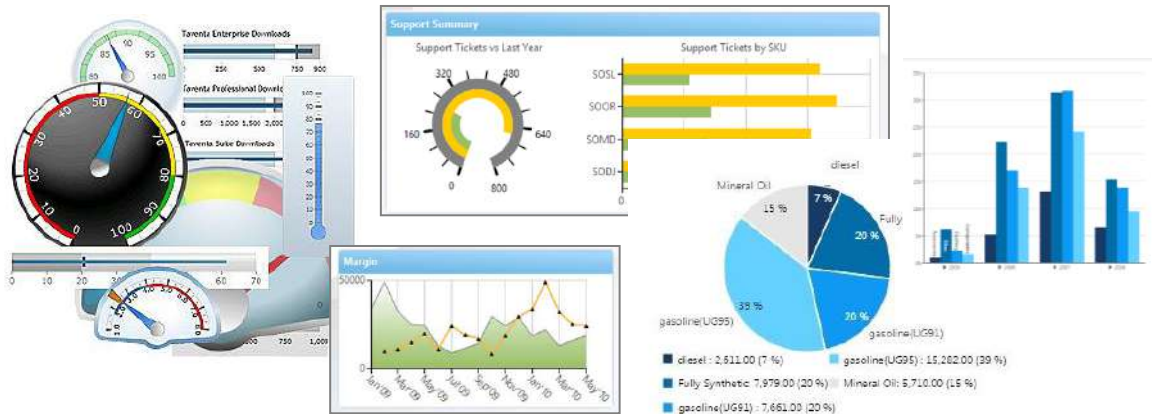
Chart Control

The Chart control offers numerous graphic visualization and chart types to choose from such as column, bars, stacked, lines, point, bubble, pie, areas, box plot, dots, radar, funnel, range, radial graphs, candlestick and stock.

Chart control features include:

- Annotations
- Secondary axes, Mixed chart types
- Chart animations
- Multiple axes per chart side
- Data point markers
- Data selection, date, time, and report template predefine
- X & Y axes with smart axis labeling, major & minor tick marks, major & minor grid lines, and customizable intervals
- Data and user annotations (plus user annotations along a range of dates)
- Support for plotting against numeric, date/time and categorical scales
- Settings for controlling the appearance of everything above, such as colors, gradients, borders and line dash styles
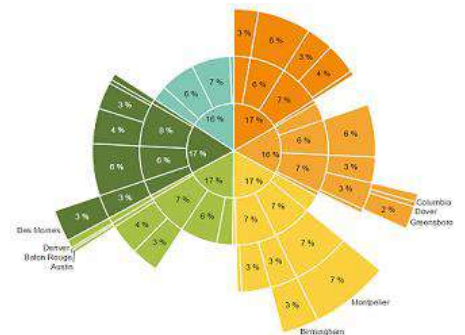
Gauge Control

Gauge controls visualize dynamic data on an ongoing basis. They also display historic calculations that become a single value, so they offer a complementary function to charts.

Gauge control supports both linear and radial (circular) gauge types, as well as a wide variety of appearances and styles. Frames are fully customizable (e.g., semi-circles and quadrant types), while users can change visual-element properties like scales, pointers and ranges, which put context to pointer values and can also indicate a particular state.

Available types of gauges:

- Circular gauge
- Linear
- Thermometer
- Bullet graph

- A wide variety of marker, bar and needle styles as added indicators (depending on the gauge type)

Map Control

The Map control provides a visualization and interactivity, to enhance the dashboard by displaying (and customizing) a wide variety of maps, making geographic data easier to read and interpret. Adding custom actions to the maps to control or filter what data is displayed on the dashboard by region, city or other map elements is possible as well.

- Supports ESRI and XAML shape files, which allows for the drawing of diagrams via Expression Blend

-Visualizes data via color-coded shapes and in addition, predefined map element properties can bind to data (e.g., color, border, other visual properties)

-Provides mouse panning and mouse zooming

-Includes legend integration

Data Grid Control

The data grid control gives the ability to visualize tabular data in a way that looks and operates better than a standard spreadsheet or table. Use the grid control to display lists, rankings or highly detailed information that attractive, highly interactive and meaningful.
Features Include:

- Custom column/row/cell styling
- KPI states integration to provide scorecard capabilities
- Hierarchical capabilities
- Auto-sizing
- Sorting and basic filtering
- Row grouping and selection
- Column grouping, reordering, resizing and freezing
- Frozen columns and rows
- Vertical and horizontal scrolling

Display on Mobile

With the display on mobile, the smart phone, tablet or mobile devices are supported. The system provides the HTML5 interact with the report and dashboards directly web base application from standard web browser such as Google chrome, Internet Explorer and Mozilla Firefox.

The dashboards and reports are fully interactive infographic and can be viewed on all devices - tablets, smart phones, desktop PCs and laptops by web browser. The users get immediate access to the data without having to install custom software.

-Tile-Based Layout for a sleek and modern look
-Customize the home screen to view the most relevant metrics
-Drill-Down to powerful dashboards by tapping
-Interface designed for small screens to be touch friendly
-Scale zoom in to maximize the available screen size without compromising the aspect ratio

Reports

Reports are ideal for displaying data in a multi-page report with a fixed layout. Users can access and read the report easily. The dashboard reporting tool provides specific capabilities allowing for automation of the entire reports usage process including email delivery scheduling and printing. Reports can be interactive and designed to be simply viewed or exported and printed.

The reporting service support to create any business intelligence report needs, whether multi-page reports or ad-hoc reports. The dashboard and reporting tools are easy to create complex views. All of the required details can be easily combined into a single report and support grouped of predefines report as needed for maximum insight.

Customizable reports are available to provide report template which include table, chart, trend and any 2D/3D geographical view to enhance creation of report visualization.

- Predefine report template to increase efficiency and save time by eliminating manual reporting processes
- Define template or Scenario setup to better versioning control for specific task and routine reports
- Encourage user collaboration through built-in annotations, alert notifications, and scheduled reports
- Keep dashboards and reports in a single familiar portal rather than navigating to a different tool for reporting
- Export report and data to various formats, CSV, Excel, spreadsheet, PDF, etc.

D A T A L I N K

TOTAL SOLUTION OF DATA INTERFACE AND REPORTING

Cloud Data Management Assessment

Take control of your data and command your future

It's impossible to ignore the maelstrom of activity surrounding cloud and data management platforms. Organizations must have a dual focus — one eye on the external environment and another on internal priorities and objectives. Decisions regarding everything from data volume to compliance regulations to cost management require a keen ability to imagine solutions capable of responding to diverse demands.

Our Cloud Data Management Assessment helps you take a simplified and streamlined approach. This collaborative offering takes place over four to six weeks, beginning with an initial kickoff meeting to define project scope and continuing in three core phases.
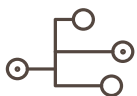
1. Map and probe existing data management and storage architecture.

- Data collection and collation
- Identify orphaned and oversubscribed data
- Qualitative analysis

2. Determine which platforms are most efficient to deliver applications.

- Solution options
- Requirement and cost analysis
- Cloud resource evaluation

3. Present recommendations and roadmaps.

- Existing solution improvements
- Reports and designs to support use case
- Implementation plans

The assessment combines quantitative and qualitative methods in order to provide insight into strategic new areas that may be either in the planning stage or not currently under the direction of IT services. Deliverables are specific and customized to your environment so that you can make well-informed decisions and drive operational efficiency moving forward.

The service is designed to support most large enterprise environments, but in some cases may need to be focused on core solutions to prevent overextended engagements.

Our NetApp partnership

NetApp has the most extensive portfolio of data management solutions from all-flash data center solutions, hybrid solutions, and cloud solutions from Cloud Volumes OnTap to Cloud Volumes and Azure® NetApp Files. We have led the market as the leading Flash Provider, FlexPod Partner of the Year, first to deliver NetApp Private Storage as a Service (hybrid), and first traditional NetApp Cloud First Partner.

Deliverables to drive your data management strategy

In order to help you execute a new or revised data management strategy, we deliver actionable insights and outline next steps. Performing a Cloud Data Management Assessment provides your organization with in-depth information such as:

- An on-premises infrastructure evaluation that maps systems, processes, dependencies, availabilities, and resource usage.
- Data collected and reviewed using Aptare® IT Analytics™.
- Services to tune workloads residing on-premises or in the cloud.
- Recommendations for migrations and cloud integration, with solutions that include private, public, and hybrid cloud.

Data collation and analysis with Aptare

The assessment will leverage Aptare IT Analytics, an industry-leading analytics tool, for baseline information about your environment. Aptare is a SaaS platform that is non-invasive and simple to implement, requiring only read access to in-scope platforms. Once in place, it securely transfers metadata to the host at Cloud + Data Center Transformation (CDCT) where it can be analyzed by industry experts to create valuable insights.
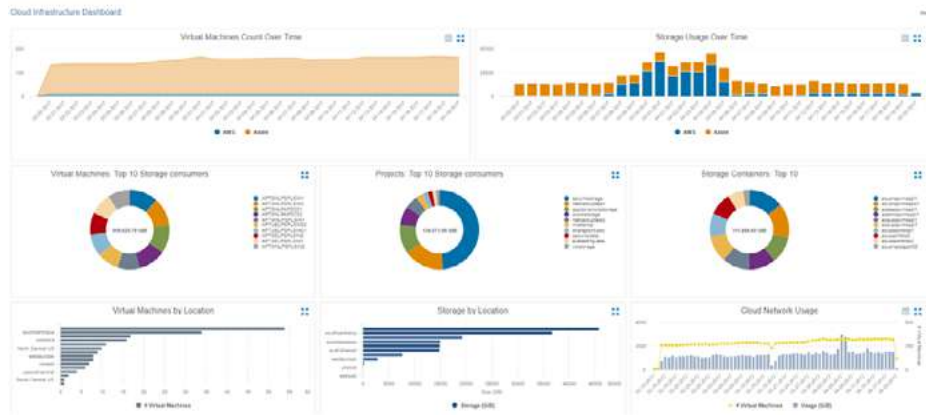
Continuing the conversation

In some cases, we may want to dive deeper into data management solutions across cloud and data center. CDCT may recommend additional engagements that include:

- Workload and platform alignment
- Migration, support, and managed services
- Business continuity, data protection, or disaster recovery (DR) services
- Data governance and compliance services

Meaningful solutions driving business outcomes

We help our clients modernize and secure critical platforms to transform IT. We believe data is a key driver, hybrid models are accelerators, and secure networks are well integrated. Our end-to-end services empower companies to effectively leverage technology solutions to overcome challenges, support growth and innovation, reduce risk, and transform the business.

Learn more at:
insightCDCT.com | insight.com

SAS® Data Management
Better data is the foundation for better decisions

ssas
THE POWER TO KNOW®
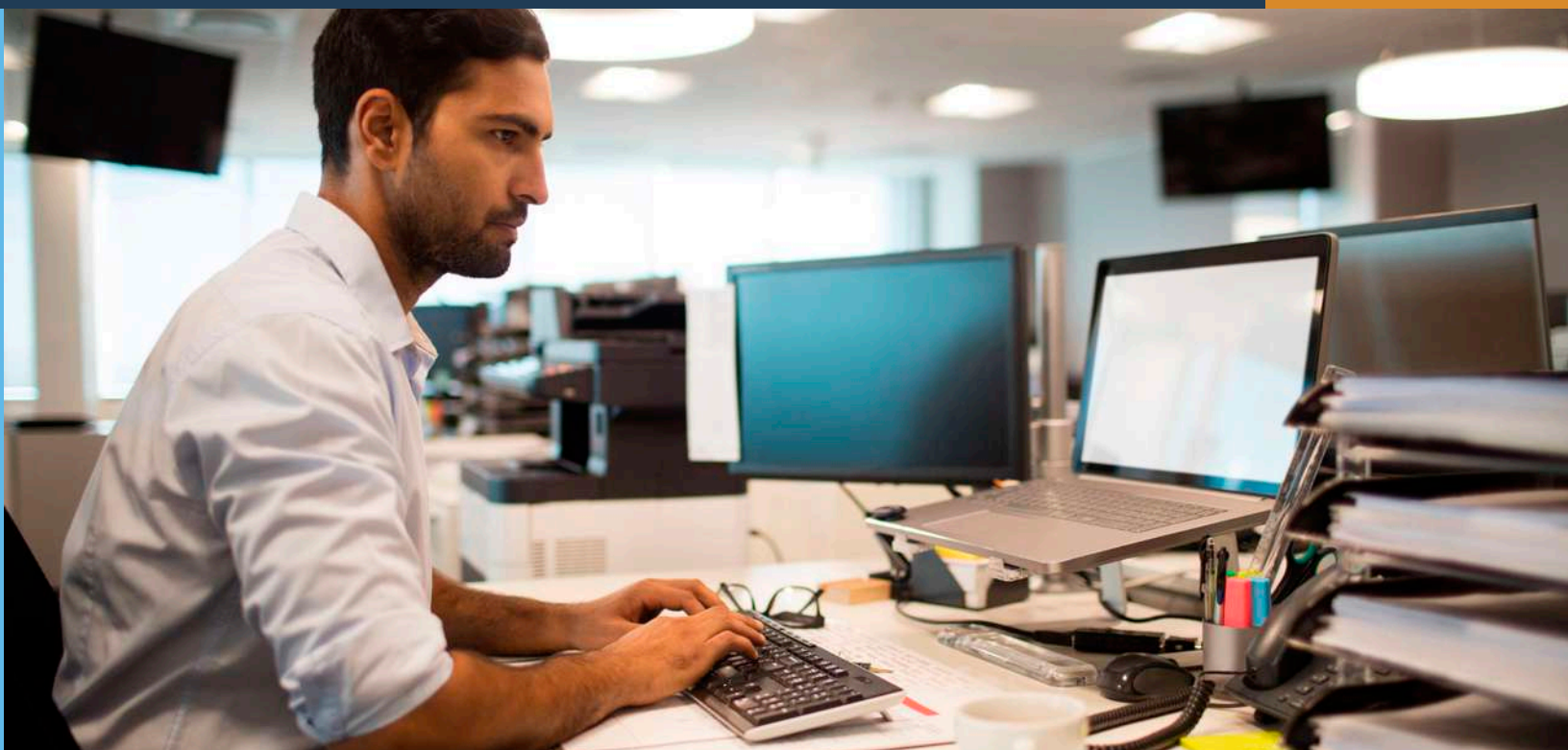
Overview

Data is the heart and soul of every organization, regardless of size, industry or expertise. And data management underlies virtually every process organizations depend on. In fact, 95 percent of C-level business executives believe data is an integral part of forming their business strategy.[1]

But there are challenges. Only one-third of respondents to a TDWI survey[2] said they were data-driven, meaning they analyze data to drive decisions and actions. In the same study, 37 percent of respondents cited difficulty in accessing and integrating all relevant data as a challenge to being data-driven. Lack of executive support was cited as a roadblock by 42 percent of respondents. Twenty-seven percent cited insufficient data quality, and 27 percent said data governance and security concerns were a barrier to becoming data-driven.

Why are there so many obstacles?

A data-driven organization depends on tight collaboration between business and IT, and a culture that trusts its data to inform business decisions. It demands leaders who support this mindset and a technology foundation that ensures excellent data quality and governance. Most organizations that are truly data-driven, according to TDWI, also have an integrated analytics and data management strategy.[3]

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[1] *2018 Global Data Management Benchmark Report*. Experian.
[2] *What It Takes to Be Data-Driven: Technologies and Best Practices for Becoming a Smarter Organization*.
     TDWI Best Practices Report. Fern Halper and David Stodder. Q4 2017.
[3] *Five Data Management and Analytics Best Practices for Becoming Data-Driven*. TDWI Checklist Report. Fern Halper.
     2018.

Unfortunately, many organizations still rely on manual efforts to combine, cleanse and transform their data – processes that are hard to repeat or share. And after devoting time to search for relevant data, some find that the data is flawed.

SAS Data Management is a trusted foundation for analytics that gives you access to clean, well-governed data – at the right time and in the right format. Across the entire analytics life cycle – from data to discovery to deployment – SAS can help you make data-driven decisions for your business.

Our Approach

To run an agile business in the face of changing markets and innovations, organizations need fast, easy access to new and variable types of data – and a software platform that promotes collaboration. Many organizations will have to adopt new technologies and modernize their existing IT infrastructures to accommodate these changes and embrace new business strategies (such as data monetization).

SAS extends data management beyond traditional boundaries to help you make better decisions, faster. With SAS, you can manage data at its source to improve productivity and performance. Our software automates and supplements manual tasks – with machine learning, natural language processing and advanced statistical techniques – to help your data direct actions for transformations, adjustments and process refinement. With data that's thoroughly prepped, high quality, fully governed and ready to use for any purpose, you'll be positioned to stave off competitive threats and pursue new business opportunities.

SAS® Data Management capabilities

Through an integrated, comprehensive suite of capabilities, SAS Data Management helps you take charge of all your data and treat it as a valuable business asset that guides your data-driven business decisions. Our software works consistently across data types, sources and locations to ensure you operate and make analytically sound decisions based on clean, trusted data.

SAS is an analyst-recognized leader in data integration, data quality and analytics – 96 of the top 100 companies on the 2017 Fortune Global 500® are SAS customers.

Data access

Give technical and business users fast, secure access to the information they need, no matter what format it's in or where it's stored. SAS/ACCESS® software provides seamless, transparent read, write and update rights to more than 60 data sources – including relational and nonrelational databases, text files, spreadsheets, Hadoop/Spark, Amazon Redshift, data warehouses and more – on-site or in the cloud. Our software honors the native security of the target data source and makes all data sources appear as though they are a native SAS data type. As a result, it facilitates data interaction across sources and with SAS procedures, SAS DATA step and SAS solutions like SAS Event Stream Processing. You can also access data through web service APIs. SAS is built on trusted integration standards, including ODBC, JDBC (on SAS® Viya®), Spark SQL (on SAS Viya) and OLE DB.

Data integration

Break down data silos with the industry's leading integration technology, which speeds integration processes by up to 66 percent. From legacy systems like data warehouses to spreadsheets, data lakes and the cloud, SAS lets you integrate any data you need – streaming, real time or batch. An intuitive interface with a single point of control makes it easy for business users to work independently, freeing IT for other tasks. Auditing tools monitor processing and source data lineage so you know your data is ready for analytics or reporting. Data federation lets you virtually blend data from multiple underlying sources without moving or storing it – so you can keep your data secure and use the combined data whenever it's needed.

Benefits

- **Take charge of your data wherever it lives, as fast as it comes**. Access and integrate all types of data. Apply data management techniques anywhere, whether it's in stream, in database, in memory or in cloud. Taking data management closer to the source means better speed, agility, productivity and performance.

- **Uncover analytics insights faster**. Free IT to do more by giving business users self-service data preparation tools. Automate tasks with machine learning and deep learning techniques to get a faster view into hidden problems, issues with data elements and processing, and potential new opportunities.

- **Act confidently as you make data-driven decisions based on a trusted data foundation**. With best practices embedded into every element of our technology, your data will be consistent, accurate, analytically valid and well-governed.

- **Support all users who need analytics insights**. A common platform and easy-to-use interface make analytics accessible to everyone – across all types of data and problems of any size or complexity.

Data quality

Make sure data quality is embedded into every process. There's no need to move or extract data. Analyst-validated SAS Data Quality profiles, standardizes, enriches, monitors, transforms and verifies data where it exists – in motion or at rest. You can customize, automate and reuse data quality business rules within process job flows. Establish repeatable processes to build and maintain high-quality data across the entire data life cycle. And create a master record to get a single view across multiple sources for one domain.

Data preparation

Reduce time spent preparing data so you can spend more time on analytics. SAS Data Preparation lets you access, cleanse, manipulate and prepare data for analytics with an intuitive interface – no special coding or SQL skills required. SAS combines advanced analytics, data quality, visualization and data preparation capabilities on a single platform. As a result, you have more time to explore data, get answers and respond to situations – in near-real time. Nontechnical people can use a point-and-click interface to profile, cleanse, blend and move data on their own. Data prep tools can suggest data sets and guide users to work with the data without coding. Improve efficiency as you collaborate and share data and jobs among team members – while reusing existing plans, scheduling and automating tasks, and monitoring jobs.

Data governance

Establish and enforce policies and get a consistent view of your data using the web-based environment and dashboards in SAS Data Governance. You can create a repository of governed terms and sources to use across any system – including third-party systems – to enhance stewardship and enforce governance. With the SAS Visual Analytics reporting engine (included in SAS Data Governance), you can visually and interactively flag issues, route them to the appropriate person and make sure they get fixed. An integrated business data glossary, metadata management and lineage visualization promote better collaboration.

Metadata management

Improve trust in data by providing complete transparency. Visually trace your data's life cycle both in and out of the SAS environment using lineage capabilities – so you'll understand the impact of making changes to data rows and tables before you act. Keep a common glossary to ensure that everyone is on the same page when discussing access to new data sources and the requirements of meeting business objectives.

Event stream processing

Analyze streaming data while it's in motion – from operations, transactions, IoT sensors and other devices. SAS Event Stream Processing analyzes millions of events per second, determining which data requires immediate attention, what you can ignore and what can be stored for later use. SAS assesses data streams using a suite of prebuilt operators, functions, routines and advanced analytics – providing instant insight into events so you can take appropriate actions. It also provides in-stream data quality and includes a single, intuitive interface to let you define patterns and address scenarios from any aspect of your business. With its machine learning capabilities, the software can teach itself what events warrant a closer look – without human intervention.

Data protection

Meet compliance and auditing requirements as you protect data across your organization. SAS for Personal Data Protection identifies all sources that contain the data you need to protect – and includes tools like identification analysis, standardization and pattern matching. Examine data attributes, patterns and contexts as you evaluate data to minimize risk. Use data governance to establish and monitor rules and policies that link systems, processes and business owners in data flows across the organization. Safeguards like authentication and authorization control who accesses the data. Techniques like role-based data masking, pseudonymization, anonymization and encryption protect sensitive and personal data. As you log, monitor and audit data use, you'll be able to provide clear documentation and reports to auditors to prove your data is safe.

The SAS® Difference

Data processing at the source

Moving routine execution closer to the source of the data takes advantage of existing hardware, minimizes data movement and simplifies access. In turn, processing is faster and downstream use becomes more consistent, requiring fewer computing resources. Consider streaming data from the IoT. By embedding in-stream data management and normalization functions before data is stored, you can identify what's worth keeping – correcting it as needed before you incur unnecessary, incremental storage costs. This helps modernize your infrastructure while taking advantage of investments in legacy technology.

Data management for multiple roles

Finding the right data source and shaping it to meet project-specific needs should be easy. SAS Data Management presents pertinent suggestions to help users fine-tune and understand what changes need to be made to the data for it to be useful. Combining legacy and modern sources, SAS sends alerts when data changes are made or need to be made, helping to streamline workflows and keep results current. Our software is designed for people with a range of skill levels: IT developers who support the data infrastructure; analysts and business users who need to prepare data for reporting and analytics; and data stewards and data governance council members who must assess data health over time and continually validate the data governance program's effectiveness.

Built-in artificial intelligence and advanced analytics

SAS Data Management incorporates artificial intelligence capabilities (such as natural language processing) to manage data in native character sets and ensure the data is accurately tokenized, normalized and enhanced. Fuzzy matching uses scoring to reveal similarities (matches) between data. Self-tuning systems make automatic adjustments to maximize the computing infrastructure and optimize processing. Algorithms discover and curate business rules within operational data. Parallel profiling discovers and identifies new metadata insights – providing direction for data management transformation and cleansing tasks. And SAS defines groups of similar data events to be assessed for common patterns by integrating learning models in data streams.

SAS participates in the Data for Good movement, which gives us opportunities to use data – and our software – to change lives.

Multiple cloud options

SAS Data Management can access cloud-based data from many environments, including Amazon Aurora, Amazon Redshift, Amazon Elastic MapReduce, Azure SQL Database and the cloud versions of traditional databases. Our software can be deployed in cloud environments like Amazon Web Services, Microsoft Azure, Google Cloud Platform, OpenStack, VMware and other infrastructure-as-a-service providers. SAS also provides its own cloud hosting environment, SAS Cloud, which handles the details of installing, configuring and administering your computing environment so you can focus on running your business.

A cohesive platform

The SAS Platform is built on more than four decades of expertise in analytics, helping customers across virtually every industry uncover insights from all types of data, in all types of environments. Our platform supports every phase of the analytics life cycle – from data to discovery to deployment. Programmers, data scientists and executives all rely on SAS to manage traditional and new types of data and ensure governance and security across the entire analytics ecosystem.

Learn More

Find out how SAS helps organizations around the world transform their data into intelligence and build successful, data-driven businesses. Visit sas.com/data.

๓๐) อุปกรณ์ระบบบริหารจัดการคิวอิเล็กทรอนิกส์

Queuing
Management
System

INFINITE

Queue Innovations

ลูกค้าลงทะเบียน โปรโมชั่นแพคเกจ

รับของที่ระลึก ติดต่อฝ่ายขาย

INFINITE

TECHNOLOGY FOR A BETTER LIFE
Infinite Technology Corporation Co.,Ltd.

Queuing Management System (QMS)

ระบบคิวอัตโนมัติ Queuing Management System (QMS) เป็นระบบบริหารจัดการคิวทุกประเภทรองรับตั้งแต่ธุรกิจขนาดเล็ก ไปจนถึงธุรกิจขนาดใหญ่ ที่มีสาขาจำนวนมาก หรือลักษณะหน่วยงานที่มีระบบซับซ้อน หลายขั้นตอน

ระบบคิวอัตโนมัติของอินฟินิท มีระบบฐานข้อมูลส่วนกลาง ที่สำนักงานใหญ่ เพื่อจัดเก็บข้อมูลการให้บริการต่างๆ เช่น รายงาน ทางสถิติ เป็นแบบ Web Server ทำให้สามารถสั่งพิมพ์รายงาน และดูข้อมูลได้ผ่านทาง Web Server ปัจจุบันบริษัท อินฟินิท เทคโนโลยี คอร์ปอเรชั่น จำกัด ยังคงพัฒนาระบบคิวอัตโนมัติอย่างต่อเนื่อง เพื่อให้ลูกค้าได้สินค้าที่ตรงกับความต้องการ และเพื่อการบริการที่มี ประสิทธิภาพมากยิ่งขึ้น

Q-Enterprise / TOUCH SCREEN
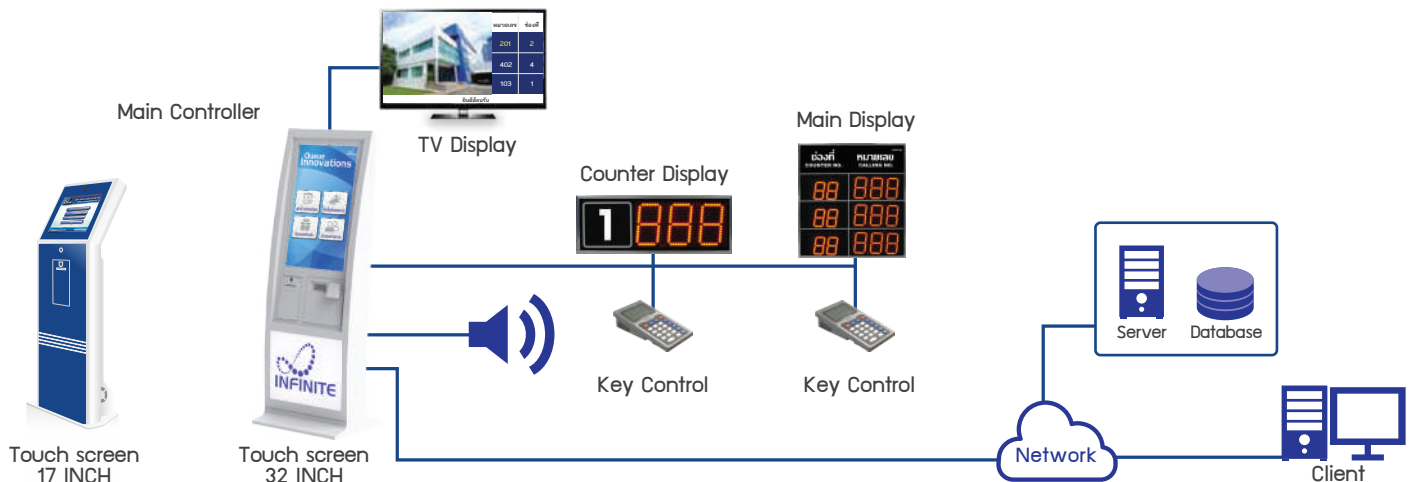
Q-Business / TOUCH PANEL
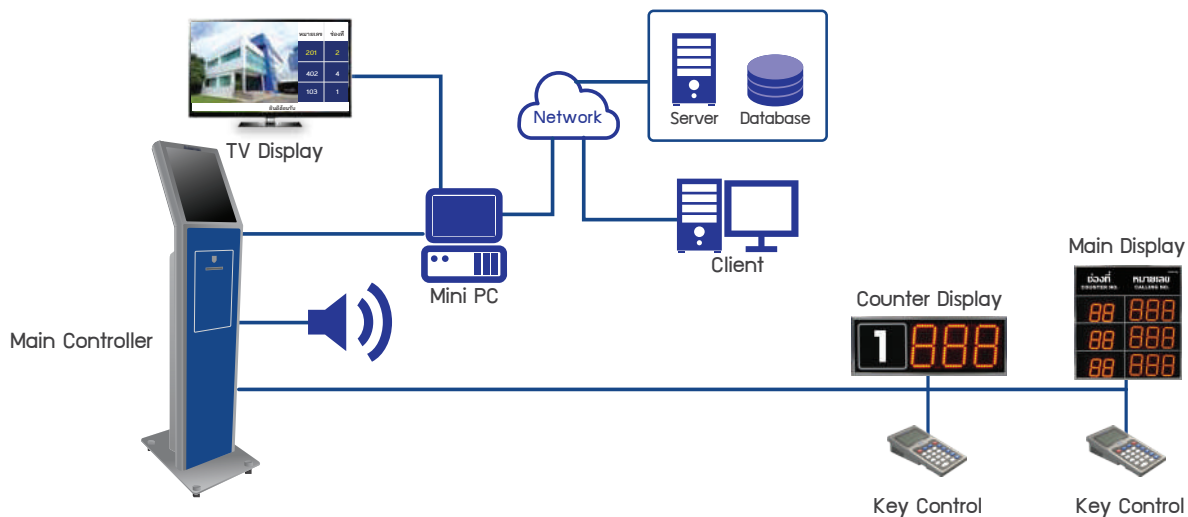
Q-EASY
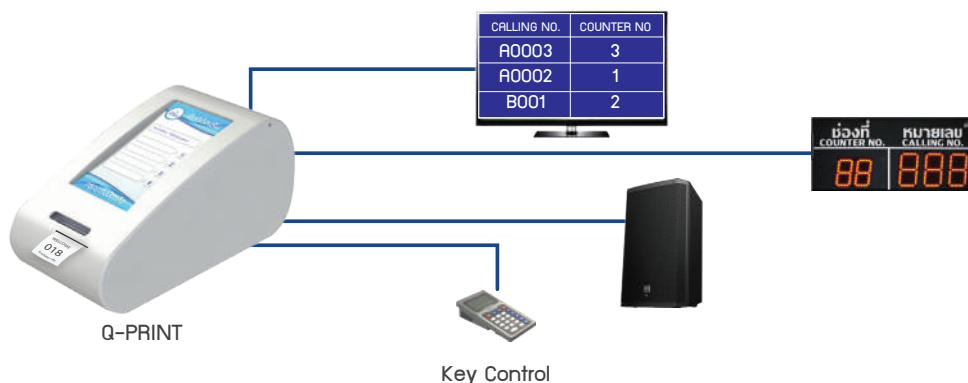
1.1 หน้าจอ LCD
แบบสัมผัส 17", 32"
(LCD TOUCH SCREEN 24", 32")

1.2 แบบปุ่มกดสัมผัส
(TOUCH PANEL)

1.3 Q-EASY

32" 17"

Main Feature QMS V7	TOUCH SCREEN (KIOSK)	TOUCH PANEL	Q-EASY
ประเภทบริการที่รองรับ	200	32	3
กลุ่มงานบริการที่รองรับ	16	32	3
รองรับช่องบริการ	48	32	3
ป้ายกลาง (Main Display)	10 (ไม่เกิน 5 บรรทัดต่อป้าย)	10 (ไม่เกิน 5 บรรทัดต่อป้าย)	1 (ป้าย 1 บรรทัด)
ป้ายช่อง (Counter Display)	48	32	3
Soft Key	48	32	✗
ScoreBox	48	32	✗
รองรับการเรียกคิวด้วยแป้นกดรุ่น KEY-LCD	✓	✓	✓
รองรับการเรียกคิวด้วยแป้นกดรุ่น KEY-TOUCH	✓	✓	✓
รองรับการเรียกคิวด้วยแป้นกดรุ่น KEY-LCD-V2R02	✓	✓	✓
Amplifier 20W Built-in	✓	✓	✓
กระดาษมีความกว้างของกระดาษบัตรคิว 57 มม.	✓ (ยาว 200 เมตร)	✓ (ยาว 200 เมตร)	✓ (ยาว 50 เมตร)
เครื่องพิมพ์เป็นชนิดความร้อน (ไม่ใช้หมึก)	✓	✓	✓
ผู้ใช้สามารถออกแบบรูปแบบบัตรคิวได้	✓	✓	✓
ตัดกระดาษอัตโนมัติ (Auto Cutting)	✓	✓	✓
ความเร็วการพิมพ์ต่อบัตรคิว 1 ใบ < 2วินาที	✓	✓	✓
มีระบบเตือนกระดาษหมดหรือใกล้หมด	✓	✓	✓
เชื่อมต่อแท่นลูก	มากสุด 3 แท่น	มากสุด 3 แท่น	✗
รองรับการส่งข้อมูลไปยัง Digital Signage ผ่านระบบ TCP/IP	3 ตัว	3 ตัว (ต่อ Mini PC เพิ่ม)	3 ตัว (ต่อ Mini PC เพิ่ม)
Built-in TV Display (Main Display On LCD)	5 แบบ	5 แบบ (ต่อ Mini PC เพิ่ม)	5 แบบ (ต่อ Mini PC เพิ่ม)
รองรับการเชื่อมต่อ Barcode Reader (Option)	✓	✗	✗
รองรับการเชื่อมต่อ Smart Card Reader (Option)	✓	✗	✗
รองรับการต่อกล้อง Webcam (Option)	✓	✗	✗
รองรับ 2 ภาษา (ไทย-อังกฤษ)	✓	✓	✓
Dashboard	2 Dashboards	✗	✗
รายงานสาขา	แบบมาตรฐาน INNET 10 รายงาน ผ่านทาง Web application	แบบมาตรฐานINNET 10 รายงาน ผ่านทาง Web application	Daily Report (Ticket Report)
รายงานส่วนกลาง	แบบมาตรฐาน INNET 10 รายงาน ผ่านทาง Web application	แบบมาตรฐาน INNET 10 รายงาน ผ่านทาง Web application	✗
ฐานข้อมูลของสาขา (Database)	SQLSERVER EXPRESS	MYSQL	✗
ฐานข้อมูลของส่วนกลาง (Database)	SQLSERVER	SQLSERVER	✗

2. ประเภทของป้าย มี 2 ประเภท

1. ป้ายแสดงผลประจำช่องบริการ (Counter Display)

คุณสมบัติป้ายแสดงผลประจำช่องบริการ (Counter Display)

1. เป็นแบบ LED 7- Segment มีความสูงของตัวเลขคิว 10 ซม.
2. ตัวเลขเป็นชนิด LED Super Bright ขนาดเส้นผ่านศูนย์กลาง 5 มม.
3. หมายเลขคิวเลือกได้ตั้งแต่ 3 - 4 หลัก หรือเลือกชนิดที่มีอักษรภาษาอังกฤษนำหน้า
4. กรอบป้ายเป็นเหล็กมีความคงทนและมีความหนาไม่เกิน 3 ซม.

2. ป้ายแสดงผลรวม (Main Display)
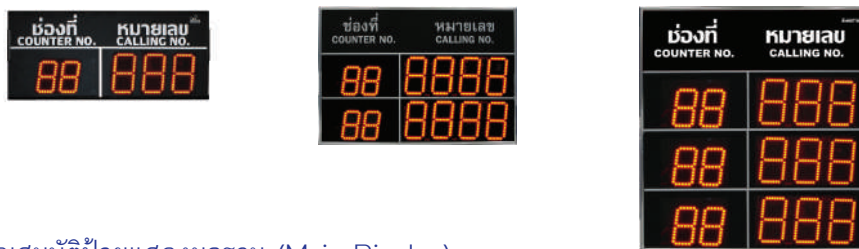
คุณสมบัติป้ายแสดงผลรวม (Main Display)

1. เป็นแบบ LED 7- Segment มีความสูงของตัวเลขคิว 10 ซม. ความสูงของตัวเลขบอกช่อง 7.5 ซม.
2. ตัวเลขเป็นชนิด LED Super Bright ขนาดเส้นผ่านศูนย์กลาง 5 มม.
3. หมายเลขคิวเลือกได้ตั้งแต่ 3 - 4 หลัก หรือเลือกชนิดที่มีอักษรภาษาอังกฤษนำหน้า
4. กรอบป้ายเป็นเหล็กมีความคงทนและมีความหนาไม่เกิน 3 ซม.
5. แสดงผลได้ไม่เกิน 5 บรรทัดต่อ 1 ป้าย
6. หมายเลขช่องมี 2 หลักพร้อมลูกศรชี้ทิศทาง
7. สามารถแยกแสดงตามประเภทบริการได้

3. บัตรคิว (Ticket)

คุณสมบัติ

1. กระดาษบัตรคิวเป็นชนิดความร้อน กว้าง 57 มม.
2. สามารถพิมพ์รูปภาพโลโก้ได้
3. สามารถพิมพ์ข้อความต้อนรับ และผู้ใช้สามารถเปลี่ยนแปลงแก้ไขเองได้
4. สามารถพิมพ์ข้อความของแต่ละประเภทบริการให้มีข้อความที่แตกต่างกันได้ และผู้ใช้สามารถเปลี่ยนแปลงแก้ไขเองได้
5. สามารถพิมพ์ข้อความประชาสัมพันธ์ต่างๆได้ไม่น้อยกว่า 4 บรรทัด และผู้ใช้สามารถเปลี่ยนแปลงแก้ไขเองได้
6. ผู้ใช้สามารถเลือกได้ว่าจะให้เครื่องพิมพ์จำนวนลูกค้ารอก่อนหน้า หรือเวลาที่คาดว่าจะได้รับบริการ

INFINITE
ยินดีต้อนรับ

008

จำนวนคิวรอ 2 คิว
30/04/2014 13.30

4. เครื่องกดเรียกคิว (Key Control) มี 3 ประเภท

KEY-LCD

KEY-LCD-V2R02

Soft-Key

Feature KEY Control	KEY-LCD	KEY-LCD-V2R02	Soft-Key
ปุ่มกดเป็นแบบปุ่มยางนูน	✓	✓	✗
จอแสดงผลเป็นแบบ GRAPHIC LCD แสดงภาษาไทยได้	✗	✓	✗
สื่อสารด้วยมาตรฐาน RS485	✓	✓	✗
มีฟังก์ชันสำหรับ Log in เพื่อเริ่มทำงานของเจ้าหน้าที่	✓	✓	✓
ฟังก์ชันสำหรับเรียกลูกค้าเข้ารับบริการตามลำดับคิว (NEXT)	✓	✓	✓
ฟังก์ชันสำหรับเรียกซ้ำ (RECALL)	✓	✓	✓
ฟังก์ชันสำหรับนับจำนวนรายการที่ให้บริการ (TRANSACTION)	✓	✓	✓
ฟังก์ชันสำหรับโอนคิวไปรับบริการยังประเภทบริการอื่น (TRANSFER)	✓	✓	✓
ฟังก์ชันสำหรับบันทึกรายการลูกค้าที่ไม่มารับบัตรคิว (WALK DIRECT)	✓	✓	✓
ฟังก์ชันสำหรับเก็บคิวที่เรียกแล้วไม่มารับบริการ (HOLD)	✓	✓	✓
ฟังก์ชันสำหรับเรียกคิวที่เก็บไว้ (CALL HOLD)	✓	✓	✓
ฟังก์ชันสำหรับขอความช่วยเหลือ (HELP)	✓	✓	✓
ฟังก์ชันสำหรับบันทึกรายการย่อย (Sub Division)	✓	✓	✓
ฟังก์ชันสำหรับพักการให้บริการ (PAUSE)	✓	✓	✓
ฟังก์ชันสำหรับเปลี่ยนกลุ่มงานไปช่วยกลุ่มงานอื่นได้ (CHANGE GROUP)	✓	✓	✓
ฟังก์ชันสำหรับเรียกคิวโดยเจาะจงหมายเลขคิว (DIRECT CALL)	✓	✓	✓
ฟังก์ชันสำหรับบันทึกคิวที่เรียกแล้วไม่มารับบริการ (CANCEL)	✓	✓	✓
ฟังก์ชันสำหรับจบการให้บริการ (END TRANSACTION)	✗	✓	✓
สามารถแสดงจำนวนคิวรอ,หมายเลขคิว,จำนวนคิวที่เก็บไว้	✓	✓	✓
สามารถแสดงข้อความเตือนเมื่อคิวรอเกินกำหนด,เวลารอเกินกำหนด, กระดาษใกล้หมด	✓	✓	✓

5. เสียงเรียกอัตโนมัติ (Sound)

คุณสมบัติ

1. มีเสียงเรียกให้เลือก 3 ชนิด คือ กรณีภาษาไทยมีเสียงผู้หญิง เสียงผู้ชาย ส่วนภาษาอังกฤษมีเสียงผู้หญิง
2. มีปุ่มปรับความดังที่แท่นกดบัตรคิว ซึ่งเจ้าหน้าที่สามารถปรับเสียงเองได้

สามารถรองรับการแสดงผลออกทางจอโทรทัศน์ได้ (TV Display) 5 รูปแบบ

การแสดงผลแบบที่ 1

การแสดงผลแบบที่ 2

การแสดงผลแบบที่ 3
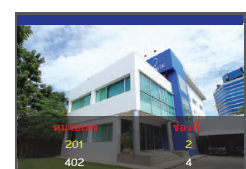
การแสดงผลแบบที่ 4

การแสดงผลแบบที่ 5

1. การแสดงผลแบบที่ 1 จะเป็นการแสดงผลมีพื้นที่เต็มจอและมีหมายเลขคิว
และช่องบริการที่เรียกแสดงแบบ 3 บรรทัดเต็มจอสามารถเปลี่ยนสีของตัวเลขที่แสดงได้
และมีข้อความวิ่งด้านล่าง

การแสดงผลแบบที่ 1

2. การแสดงผลแบบที่2 จะเป็นการแสดงผลมีพื้นเป็นภาพยนตร์หรือรายการโฆษณา
ของทางหน่วยงาน และมีหมายเลขคิวที่เรียกแสดงแบบ 2 บรรทัดกินพื้นที่ 1/3 ของจอภาพ

การแสดงผลแบบที่ 2

3. การแสดงผลแบบที่3 จะเป็นการแสดงผลมีพื้นเป็นภาพยนตร์หรือรายการโฆษณา
ของทางหน่วยงาน และมีหมายเลขคิวที่เรียกแสดงลอยอยู่ แบบ 3 บรรทัดเต็มจอ
เป็นลักษณะการซ้อนภาพ สามารถเปลี่ยนสีและขนาดของตัวเลขที่แสดงได้
และมีข้อความวิ่งด้านล่าง

การแสดงผลแบบที่ 3

4. การแสดงผลแบบที่4 จะเป็นการแสดงผลออกทางจอภาพโทรทัศน์โดยมีพื้น
เป็นภาพยนตร์หรือรายการโฆษณาของทางหน่วยงาน และมีหมายเลขคิวที่เรียกแสดง
แบบ 2 บรรทัดในลักษณะของ SubTitle

การแสดงผลแบบที่ 4

5. การแสดงผลแบบที่5 จะเป็นการแสดงผลมีพื้นเป็นภาพยนตร์หรือรายการโฆษณา
ของทางหน่วยงานทางด้านซ้ายของจอ และมีหมายเลขคิวที่เรียกแสดงแบบ 3 บรรทัด
ทางด้านขวาของจอ และมีข้อความวิ่งด้านล่าง

การแสดงผลแบบที่ 5

รายงานการให้บริการลูกค้ารายวัน

สำนักงาน : 1 : QV7-TS TEST1

วันที่ : 02/09/2017   ถึงวันที่ :02/09/2017

เวลาทำการ	จำนวนคิว	จำนวนคิวที่รับบริการ	จำนวนคิวที่ไม่ได้รับบริการ	เวลารอคิวเฉลี่ย	เวลาให้บริการเฉลี่ยต่อรายการ
-08:00:00	0	0	0	00:00:00	00:00:00
08:00:00-09:00:00	0	0	0	00:00:00	00:00:00
09:00:00-10:00:00	0	0	0	00:00:00	00:00:00
10:00:00-11:00:00	0	0	0	00:00:00	00:00:00
11:00:00-12:00:00	0	0	0	00:00:00	00:00:00
12:00:00-13:00:00	0	0	0	00:00:00	00:00:00
13:00:00-14:00:00	0	0	0	00:00:00	00:00:00
14:00:00-15:00:00	0	0	0	00:00:00	00:00:00
15:00:00-16:00:00	0	0	0	00:00:00	00:00:00
16:00:00-17:00:00	0	0	0	00:00:00	00:00:00
17:00:00-18:00:00	0	0	0	00:00:00	00:00:00
18:00:00-19:00:00	0	0	0	00:00:00	00:00:00
19:00:00-20:00:00	0	0	0	00:00:00	00:00:00
20:00:00-	0	0	0	00:00:00	00:00:00
รวม	0	0	0	00:00:00	00:00:00
เฉลี่ย	0	0	0.00	00:00:00	00:00:00

1. รายงานการให้บริการลูกค้ารายวัน

รายงานการให้บริการรายวันของแต่ละแผนก

สาขา1 : QV7-TS TEST1   Division : ALL

From :01/01/2560   To : 02/09/2560

เวลาทำการ	จำนวนคิว	จำนวนคิวที่รับบริการ	จำนวนคิวที่ไม่ได้รับบริการ	จำนวนคิวที่รอมากที่สุด	เวลารอคิวเฉลี่ย	เวลาให้บริการเฉลี่ย
- 08:00:00	5	4	1	1	00:01:22	00:03:08
08:00:00 - 09:00:00	189	57	132	94	08:19:13	00:07:01
09:00:00 - 10:00:00	788	28	760	494	04:23:23	00:05:44
10:00:00 - 11:00:00	135	45	90	19	01:08:11	00:06:43
11:00:00 - 12:00:00	49	20	29	11	09:16:54	00:34:09
12:00:00 - 13:00:00	36	6	30	18	07:39:41	00:36:03
13:00:00 - 14:00:00	49	17	32	9	03:33:49	00:03:43
14:00:00 - 15:00:00	7	1	6	6	01:18:55	00:00:24
15:00:00 - 16:00:00	5	3	2	0	00:00:10	00:12:45
16:00:00 - 17:00:00	19	3	16	6	00:57:16	00:01:28
17:00:00 - 18:00:00	9	0	9	4	00:04:47	00:00:00
18:00:00 - 19:00:00	24	5	19	7	00:04:39	00:03:19
19:00:00 - 20:00:00	3	2	1	2	00:00:19	00:00:12
20:00:00 -	19	18	1	2	00:00:30	00:00:58
รวมทั้งหมด	1,337	209	1,128		36:49:09	01:55:36
เฉลี่ยทั้งหมด	96	16	81	52	04:34:40	00:09:10

2. รายงานการให้บริการรายวันของแต่ละแผนก

รายงานการให้บริการของช่องบริการตามช่วงเวลา

สำนักงาน : 1 : QV7-TS TEST1

วันเริ่มต้น: 01/12/2559   วันสิ้นสุด: 02/09/2560

หมายเลขช่องบริการ	จำนวนคิว	จำนวนคิวที่รับบริการ	จำนวนคิวที่ไม่ได้รับบริการ	จำนวนวันที่เปิดให้บริการ	จำนวนคิวเฉลี่ยต่อวัน	เวลาบริการคิวเฉลี่ย	เวลารอคิวเฉลี่ย	รวมเวลาบริการคิวตามช่วงเวลา
Counter 1	249	137	112	31	8	00:40:41	00:40:41	19:11:44
Counter 2	112	78	34	18	6	00:41:44	00:41:44	15:45:20
Counter 3	98	67	31	17	6	00:24:16	00:24:16	04:58:48
Counter 5	132	75	57	4	33	00:57:00	00:57:00	05:51:52
Counter 9	10	4	6	1	10	02:13:38	02:13:38	00:00:42
Counter 25	2	2	0	1	2	00:00:15	00:00:15	00:08:49
Counter 26	2	1	1	1	2	00:04:02	00:04:02	00:09:14
Counter 27	1	1	0	1	1	00:01:14	00:01:14	00:08:35
รวมทั้งหมด	606	365	241	74				46:15:04
เฉลี่ยทั้งหมด	21	13	8	4	5	00:43:00	01:35:41

3. รายงานการให้บริการของช่องบริการตามช่วงเวลา

รายงานการให้บริการของช่องบริการต่อเดือน

สำนักงาน : QV7-TS TEST1

ประจำเดือน : 01/2017   ถึง : 09/2017

หมายเลขช่องบริการ	จำนวนคิว	จำนวนคิวที่ได้รับบริการ	จำนวนคิวที่ไม่ได้รับบริการ	จำนวนวันที่เปิดให้บริการ	จำนวนคิวเฉลี่ยต่อวัน	เวลาให้บริการคิวเฉลี่ย	เวลารอคิวเฉลี่ย	รวมเวลาให้บริการคิวทั้งเดือน
1	249	137	112	31	8	00:08:24	00:40:41	19:11:44
2	112	78	34	18	6	00:12:07	00:41:44	15:45:20
3	98	67	31	17	6	00:04:28	00:24:16	04:58:48
5	132	75	57	4	33	00:04:41	00:57:00	05:51:52
9	10	4	6	1	10	00:00:10	02:13:38	00:00:42
25	2	2	0	1	2	00:04:24	00:00:15	00:08:49
26	2	1	1	1	2	00:09:14	00:04:02	00:09:14
27	1	1	0	1	1	00:08:35	00:01:14	00:08:35
รวมทั้งหมด	606	365	241	74				46:15:04
เฉลี่ยทั้งหมด	76	46	30	9	8	00:07:36	00:43:00	05:46:53

4. รายงานการให้บริการของช่องบริการต่อเดือน

รายงานรายสัปดาห์ของแต่ละแผนก

สำนักงาน : 1 : QV7-TS TEST1   วันเริ่มต้น : 01/01/2560

แผนก : ALL   วันสิ้นสุด : 02/09/2560

ที่อยู่ : INNET TS2

วันที่	ลูกค้า				คิวรถคนละเวลา	เวลารอคิว		เวลาให้บริการ		รวมเวลาให้บริการ	จำนวนช่องที่เปิดให้บริการ	จำนวนคิวต่อช่องบริการ
	จำนวนคิว	จำนวนคิวที่รับบริการ	จำนวนคิวที่ไม่ได้รับบริการ	จำนวนคิวรอมากที่สุด		เฉลี่ย	สูงสุด	เฉลี่ย	สูงสุด			
10/02/2017	1	1	0	0	08:02:10	00:00:00	00:00:00	00:00:14	00:00:14	00:00:14	1	1
11/02/2017	15	14	1	2	20:46:46	00:00:29	00:04:07	00:01:08	00:04:46	00:15:48	2	7
12/02/2017	5	4	1	3	18:12:55	01:04:58	04:25:02	00:05:30	00:13:14	00:22:02	1	4
16/02/2017	1	1	0	0	15:40:10	00:00:00	00:00:00	00:36:27	00:36:27	00:36:27	1	1
28/02/2017	57	8	49	7	18:23:25	02:07:54	06:28:03	00:03:25	00:09:14	00:27:20	6	1
02/03/2017	1	1	0	0	00:00:00	00:00:07	00:00:07	00:01:17	00:01:17	00:01:17	1	1
03/03/2017	23	10	13	9	13:42:57	02:56:41	00:15:27	00:03:02	00:10:35	00:30:15	4	3
04/03/2017	106	92	14	18	08:09:10	01:05:49	02:26:27	00:07:59	00:31:16	12:14:02	3	31
05/03/2017	26	6	20	5	12:01:13	00:01:22	00:06:30	00:01:50	00:04:57	00:10:57	2	3
06/03/2017	3	0	3	4	17:41:34	01:21:11	04:03:04	00:00:00	00:00:00	00:00:00	3	0
18/03/2017	2	0	2	1	06:13:24	17:54:02	18:00:28	00:00:00	00:00:00	00:00:00	1	0
29/03/2017	11	0	11	7	06:01:20	08:43:29	12:03:57	00:00:00	00:00:00	00:00:00	2	0
30/03/2017	6	3	3	3	08:51:33	00:00:24	00:00:42	00:00:17	00:00:22	00:00:50	1	3
28/04/2017	13	0	13	4	03:26:53	94:16:47	95:57:58	00:00:00	00:00:00	00:00:00	1	0
03/05/2017	317	0	317	314	09:30:12	14:51:12	15:16:38	00:00:00	00:00:00	00:00:00	1	0
05/05/2017	5	0	5	2	10:23:31	00:00:08	00:00:21	00:00:00	00:00:00	00:00:00	2	0

เวลาที่พิมพ์รายงาน 02/09/2017 17:33:52   Page 1 of 3

5. รายงานรายสัปดาห์ของแต่ละแผนก

รายงานรายเดือนรวมทุกแผนก

สำนักงาน : อินฟินิท   ที่อยู่ :

ประจำเดือน : 01/2017   ถึง : 09/2017

วันที่	ลูกค้า				ที่เวลา	เวลารอคิว		เวลาให้บริการ		รวมเวลาให้บริการ	จำนวนช่องที่เปิดให้บริการ	จำนวนคิวต่อช่องบริการ
	จำนวนคิว	จำนวนคิวที่รับบริการ	จำนวนคิวที่ไม่ได้รับบริการ	จำนวนคิวที่รอมากที่สุด		เฉลี่ย	สูงสุด	เฉลี่ย	สูงสุด			
20/03/2017	3	1	2	3	15:58:27	03:58:17	05:39:53	00:00:20	00:01:00	00:01:00	1	3
22/03/2017	9	7	2	2	15:11:52	00:00:19	00:00:56	00:26:49	03:54:56	04:01:24	2	5
01/06/2017	3	1	2	3	02:12:39	18:33:06	18:35:37	00:00:47	00:02:21	00:02:21	1	3
02/06/2017	1	1	0	0	10:06:24	02:02:07	02:02:07	00:00:10	00:00:10	00:00:10	1	1
05/06/2017	7	6	1	2	03:16:36	00:05:39	00:34:23	00:01:00	00:03:56	00:07:03	2	4
06/06/2017	1	1	0	0	03:33:41	00:00:42	00:00:42	00:00:28	00:00:28	00:00:28	1	1
27/08/2017	4	1	3	5	16:51:04	00:00:53	00:01:02	00:00:02	00:00:10	00:00:10	1	4
01/09/2017	5	4	1	5	14:59:53	00:02:58	00:03:32	00:00:22	00:00:44	00:01:49	3	2
รวมทั้งหมด	33	22	11							04:14:25		
เฉลี่ยทั้งหมด	4	3	1			02:08:25	03:22:16	00:07:43	00:30:28	00:31:48	1	3
ค่าสูงสุด	9	7	3	5		18:33:06	18:35:37	00:26:49	03:54:56	04:01:24	3	5

6. รายงานรายเดือนรวมทุกแผนก

7. รายงานประจำปีรวมทุกแผนก

8. รายงานสรุปทำงานเจ้าหน้าที่

**9. รายงานสรุปการบริการ
แจกแจงตามแผนก**

**10. รายงานการให้บริการ
แต่ละแผนกต่อเดือน**

8. รูปแบบรายงานแสดงข้อมูล Dashboard (Dashboard Report)

Dashboard 1

Dashboard 2

9. รูปแบบ Software มาตรฐาน (Standard Software)

1. สามารถ RUN บน Windows 7, Windows 8, Windows 10 ได้

2. รายงานเป็นแบบ Web base Application
   (สามารถเปิดดูรายงานและตั้งค่าต่างๆของระบบคิวผ่านทาง Internet Browserได้
   เช่น Internet Explorer, Chrome, Firefox)

3. สามารถกำหนดสิทธิ์การเข้าถึงข้อมูล โดยใช้ Username และ Password
   และมีระดับการเข้าถึง 2 สิทธิ์ คือสิทธิ์ Admin และ สิทธิ์ User

4. สามารถเชื่อมต่อกับโปรแกรมที่ส่วนกลางหรือสำนักงานใหญ่ เพื่อ Monitor
   ข้อมูลของแต่ละสาขาได้จากส่วนกลางและสามารถพิมพ์รายงานได้-จากส่วนกลางผ่านทาง Web Browser

Additional Service

ปัจจุบัน หากผู้ให้บริการ (องค์กรหรือร้านค้า) มีระบบบริหารจัดการคิว (Queue Kiosk) ให้บริการอยู่ที่สาขาแล้ว สามารถเลือกใช้บริการพิเศษ "Queue on Mobile" ที่สามารถสมัครผ่านแอพพลิเคชั่น ของผู้ให้บริการ ซึ่งช่วยเพิ่มความสะดวก ให้ผู้ใช้บริการจองคิวจากโทรศัพท์มือถือ (E ticket) ได้ล่วงหน้า (Make advance queue appointment) ผ่านแอพพลิเคชั่น ทำได้โดยเลือกสาขาที่ใกล้เคียง, เลือกประเภทการบริการ และช่วงเวลาที่ต้องการเข้ารับบริการได้

WAVETEC®
QUEUE
MANAGEMENT
SYSTEM

Empowering customer service areas

THE CONCEPT

Wavetec Queue Management System is an enterprise solution specially designed to organize and manage the customer flow in the service area. Developed for organizations committed to obtain the best results in terms of efficiency, customer experience and service quality.

Organize the customer flow

Real time monitoring staff and branch performance

Increases service productivity

Manage offices from a centralized location

MAIN BENEFITS

Manages the customer flow reducing overall service costs.

Monitors the performance of the staff in real-time.

Measures the branch service level from any location.

Reduces customer waiting time by 30% and increases loyalty by 15 %.

Provides personalized customer experience.

Builds a customer centric organization.

SYSTEM ARCHITECTURE IN A SERVICE AREA

Virtual ticket

Waiting Area

Feedback

Ticket

Customer service

Service area

Service area

Service area

Centralized monitoring

Service area

Service area

Please visit our www.wavetec.com for more information about **other queuing models**.
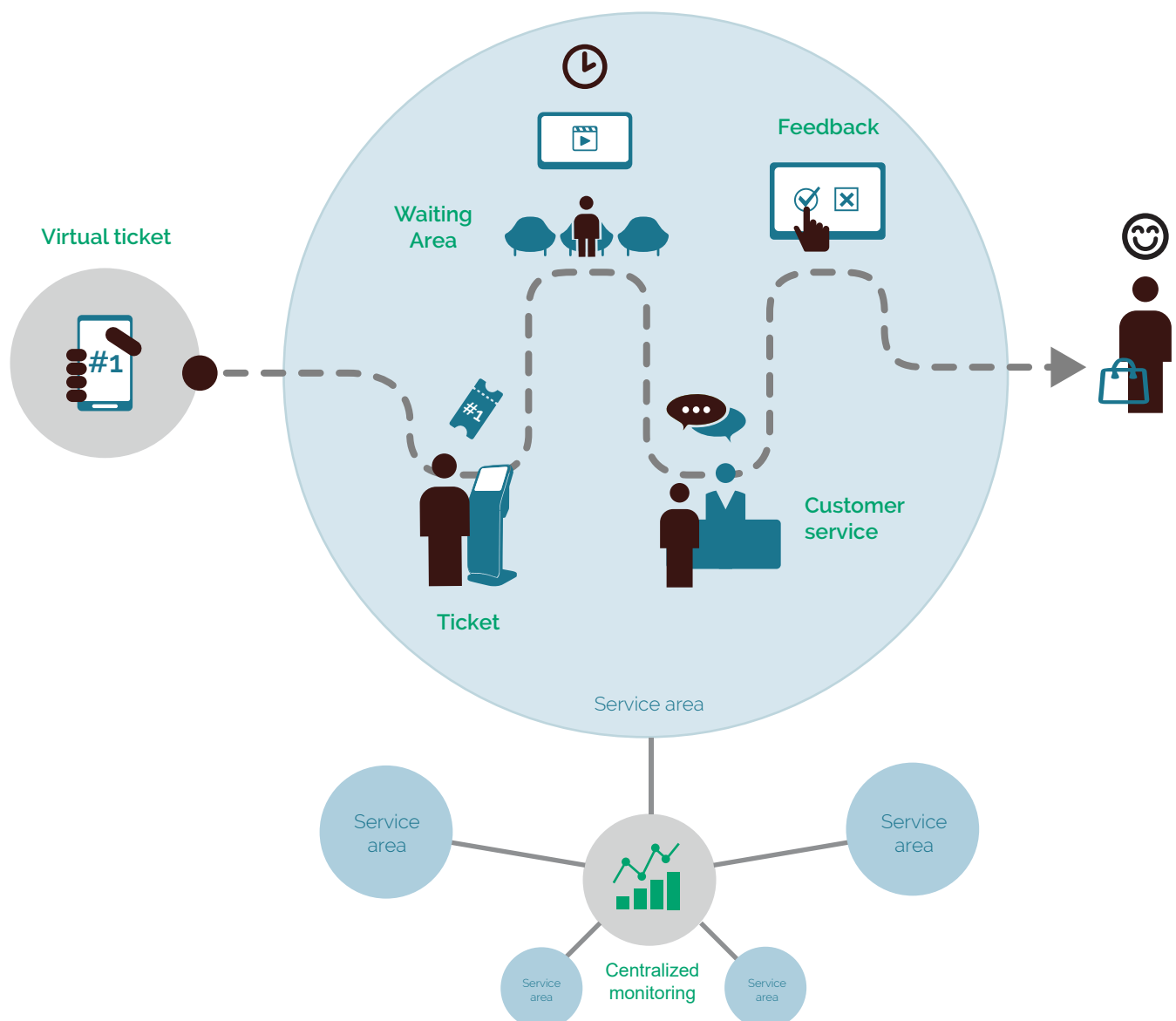
Ticket Dispenser Kiosk

- Dual-Printer for continuous ticket dispensing
- 17" LCD highly responsive capacitive touch screen
- Magnetic card Barcode Reader (Optional)
- LED Light Indicator in ticket and card reader slots
- Magnetic/Chip Card and Barcode Reader (Optional)
- ADA module for disables. (optional)
- Customizable screens and ticket designing.
- Paperless ticket.

- Integration with third party applications and database (Optional)
- Resistant Powder Coated Steel Enclosure
- Easy and centralized ticket configuration and screen template design
- Content Scheduling
- Unlimited branding options
- Wifi (Optional)
- Designed in UK

Ticket Dispenser TDU Lite

- 10.1" highly responsive capacitive LCD touch screen
- Complies with the American & European Disability Access standards
- High speed & quality printing

Ticket Dispenser Desktop

- 10.1" highly responsive capacitive LCD touch screen
- External printer and one additional peripheral (e.g. bar code reader)

External Printer

Queue Mobile App

Choose the branch with less waiting time and take a ticket on the go

- More opportunities to create cross-channel experiences
- Integration with the existing tools and platforms like Mobile Banking
- Personalized and targeted messages for users
- Better use of resources and physical space assigned to waiting areas
- Timely configurable notifications

Status of The Queue LED Matrix Lines

- Adjustable Number of DisplayLines (From 1 to 5)
- Red, Green and Amber colors
- Resolution of 16 (H) x 64 (W) dots

Status of The Queue LED Matrix Display

- Compact 19" Display
- Red, Green and Amber colors
- Resolution of 32 (H) x 64 (W) dots

- Multilingual
- Customizable Flipping Messages
- Wireless (Optional)
- Five characters including single or double prefixes

Queue Informational Display LCD

- Compact 19" HD LCD screen
- Information of tickets in wait
- Displays information messaging

Digital Signage Suite

- Media Player Stand alone Digital Signage with multiple templates and flipping messages
- Live Streaming (Optional)
- Donatello Suite Centralized Content Management, Scheduler and Designer (Optional)

donatello®

Counter Display Unit

- Five Characters Ticket Denomination
- Customized Message during Idle-Time
- Wireless (Optional)
- Resolution of 16 (H) x 48 (W) dots
- White Digits (Optional)

Web TSU
Calling Application

- User Interactive Layout
- Multiple methods of calling
- Customer information display
- Transactions record
- Transfer of user, customer or counter

- Next, Repeat, Random Call, Local Wait, No Show, Auto-Next
- Sub-Categories Selection
- User, Category and Counter Transfer

Teller Station Calling Unit

- Stand alone unit (desktop PC is not required)

Customer Feedback Kiosk

Opinion Plus

- **o** 17" highly capacitive and responsive LCD touch screen
- **o** Unlimited Branding Options

- Unlimited Customization of Templates for Feedback Questionnaire
- Idle Time Promotional Videos
- Targeted Messages integration with CRM or Database (Optional)
- Real Time Dashboard and Historical Reports
- Wireless compatibility
- Web-based Central Configuration & Content Management
- Can be integrated with our Queue Management System

Customer Feedback Tablets

- **o** 10.1" capacitive touchscreen

Announcement Speakers

- **o** Chime and/or Voice announcement
- **o** English, Spanish, Russian, French, Arabic, Hindi/Urdu (Other Languages Optional)

Queuing Controller

Spectra Engine

Brain of the entire Queue Management System

- **o** Industrial Grade Linux embedded controller
- **o** Stores local configuration and runs operations in online and offline mode
- **o** In-Built Audio Amplifier

Spectra
Reporting & Management Portal

- Real-Time Monitoring Dashboards
- Over 50 Historical Reports such as:
  - Service Quality Levels
  - Employee Performance
  - Branch & Region Performance
  - Time Attendance
- Central Configuration and Management of the System
- Multilingual (English, Spanish, French, Arabic, Other Languages (Optional)
- Custom Designed Reports
- Drill Down Reports
- KPI Management
- Different Roles and Right Management
- Hardware Monitoring
- Custom Dashboard.
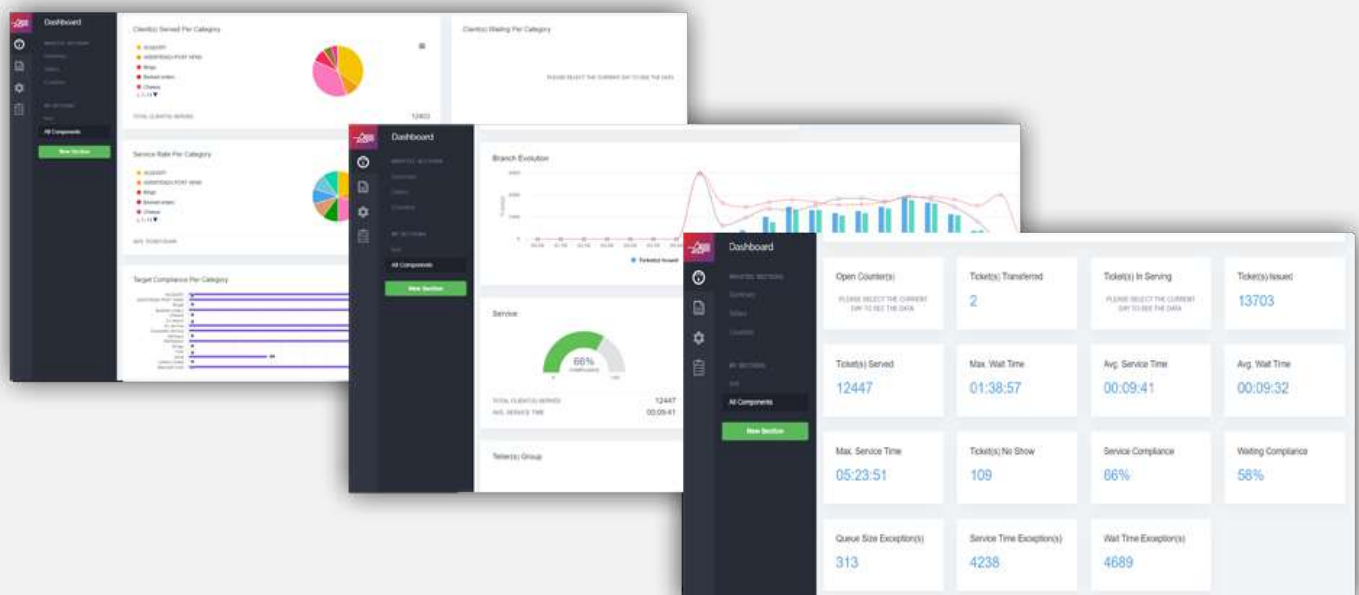
ENTERPRISE SOLUTIONS

Increase efficiency
and improve customer experience
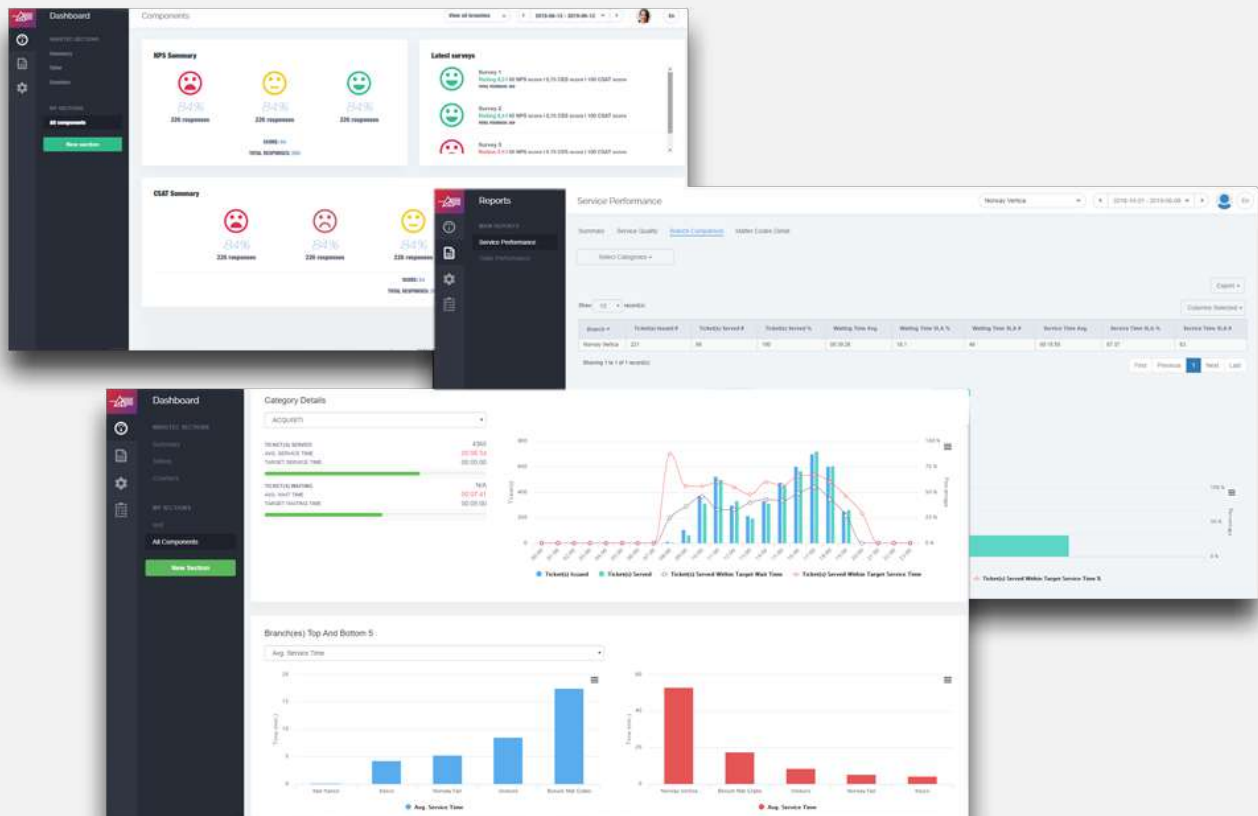
GET THE COMPLETE SOLUTION

Learn about our
solutions

WAVETEC®
QUEUE
MANAGEMENT
SYSTEM

Barcelona | Dubai | Karachi | Lima | London | Mexico | Nairobi | Riyadh | Santiago

๓๑) เครื่องอ่านโค้ดอเนกประสงค์ (QR/Barcode Scanner)

Youjie HH660
Area-Imaging Scanner

Across many industries, 2D bar coding is becoming the new standard. Not only is it possible to hold much more data in a 2D code, but government regulations and supplier mandates are requiring their adoption. Enterprises are also looking to leverage emerging trends that require area-imaging technology—today or in the near future—without the need to purchase additional scanning hardware, or settle for reduced scanning performance.

HH660 offers aggressive 1D, 2D and PDF417 bar code scanning performance—even when reading damaged, partially obscured, or poorly printed bar codes. HH660 features a customized decode algorithm and enhanced-resolution sensor for rapid, trouble-free scans.

This product offers an exceptional value for enterprises that require the versatility of area-imaging technology today or may need it in the future. HH660 demonstrates strong capability of reading colorful barcodes as well as the barcodes on mobile screens, and therefore, is able to cover a large variety of new applications in the emerging Marketing. Produced by a company with decades of experience in engineering quality data capture solutions, Honeywell's HH660 area-imaging scanner would be your ideal investment.

Features

Reliable Data Collection: Offers omnidirectional reading of virtually all linear bar codes and the most widely used 2D bar codes, including poor quality and mobile bar codes.
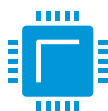
Customized Platform: HH660 is a customized variant of the popular 1450g scanner, but features a decode algorithm and enhanced-resolution scanner.

Future Proof: Delivers affordable scanning of 2D bar codes, allowing enterprises to meet their current and future bar code scanning needs with a single device.

Mobile Phone Reading: Scans coupons, mobile tickets and digital wallets from the screens of mobile devices.

Youjie HH660 Technical Specifications

Mechanical

Dimensions : 6 2 x 169 x 82 mm (2.4" x 6.6" x 3.2")

Weight: 130g (4.6 oz)

Mechanical

Input Voltage: 4.0 to 5.5 VDC

Operating Power: 2.00 W (400mA @ 5 VDC)

Standby Power: 0.45 W (90mA @ 5 VDC)

Interface: USB

Environmental

Operating Temperature[1]: 0°C to 40°C (32°F to 104°F)

Storage Temperature: -40°C to 60°C (-40°F to 140°F)

Humidity: 5% to 95% relative humidity, non-condensing

Drop: Designed to withstand 30 1.5m (5') drops to concrete

Environmental Sealing: IP42

Light Levels: 0 to 100,000 lux (9,290 foot-candles)

Scan Performance

Scan Pattern: Area Image (1280 x 800 pixel array)

Scan Angle: Horizontal 47°; Vertical 30°

Symbol Contrast: 35% minimum reflectance difference

Pitch, Skew: $\pm$60°, $\pm$70°

Decode Capability: All standard 1D, PDF417, and 2D symbologies (including high resolution)

Warranty: 3 year factory warranty

Refer to the Honeywell Scanning & Mobility Compliance Center (www.honeywellaidc.com/compliance) to review and download any publicly available documentation pertaining to the certification of this product in a given country.

Refer to the Honeywell Scanning & Mobility Supported Symbologies Datasheet (www.honeywellaidc.com/symbologies) for a complete listing of all supported bar code symbologies.

Specifications are subject to change without notice.

Typical DOF Performance*		
Narrow Width	Near	Far
5 mil Code 39	58mm	190mm
10 mil Code 39	15mm	320mm
100% UPC/EAN	28mm	254mm
20 mil Code 39	30mm	450mm
6.7 mil PDF 417	38mm	160mm
10 mil PDF 417	32mm	220mm
10 mil Data Matrix	36mm	130mm
10 mil QR	35 mm	135mm
20 mil QR Code	46mm	216mm
* Performance may be impacted by bar code quality and environmental condition		

For more information:

www.honeywellaidc.com

Honeywell Safety & Productivity Solutions

9680 Old Bailes Road

Fort Mill, SC 29707

800.582.4263

www.honeywell.com

Honeywell

AS-9200

The most cost-effective scanning solution

Applications

⚡ Fast 1D/2D barcode reading

AS-9200 is the ideal 1D/2D barcode scanner for high speed processing applications.

⇄ Special USB cable design, easily to replace

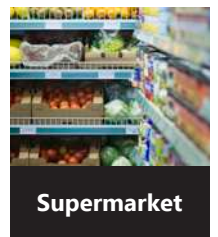With tool-free USB cable release design, AS-9200 provides long service life and ease of maintenance.

👁 Up to 3mil reading capacity

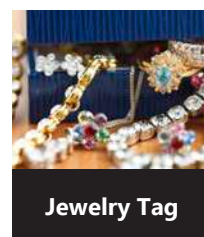High density resolution that can capture the code on 3mil barcode such as jewelry tag.

Retail

Supermarket

Jewelry Tag

Manufacturing

General Specifications

Optical Characteristics	AS-9200
Sensor Resolution	960*640
Sensor Type	CMOS
Light Source	White LED
Sighting Device	Red LED, 617nm

Physical Characteristics	
Dimensions	97mm*68mm*170mm
Weight	146g/pc without cable
Interface Supported	USB

Symbology Decode Capability	
1-D Symbologies	UPC/EAN (UPCA/UPCE/EAN-8/EAN-13), Code39, Code 93, Code 128, EAN128, Codabar/NW7, Industrial 2 of 5, Interleave 2 of 5, Matrix 2 of 5, MSI, Postal code
2-D Symbologies	PDF417, DataMatrix, QR code
Resolution	1D (3mils): Code 39 2D (9mils): QR
Print Contrast	Min. 30%
Motion Tolerance	100mm/sec 13mil UPC

User Environment	
Operation Temperature	0˚C to 40˚C (32˚F to 104˚F)
Storage Temperature	-20˚C to 60˚C (-4˚F to 140˚F)
Humidity	5% to 95% related humidity, non-condensing
Drop Specifications	Withstands multiple 1.5M drops to concrete
Contaminants	Seals to resist airborne particulate contaminants (IP42)
Light Level	Up to 100,000 LUX

Electrical Characteristics	
Input Voltage	4~5.5VDC
Operation Current	400 mA@5V-tipical value
Operation Power	2W
Standby Current	90mA@5V-tipical value
Standby Power	0.45W
Safety Standard	EN60950-1
EMC	EN55022, EN55024
LED Safety Certificate	IEC 62471

Reading Performance			
	Testing Code	DOF (Min.)	DOF (Max.)
Depth of Field	5mil Code39	33mm (1.3in)	95mm (3.7in)
	13mil UPC-A	32mm (1.3in)	255mm (10in)
	20mil Code39	35mm (1.4in)	355mm (14in)
	6.7mil PDF417	30mm (1.2in)	95mm (3.7in)
	10mil DM	30mm (1.2in)	100mm (3.9in)
	15mil DM	21mm (0.8in)	162mm (6.4in)
	20mil QR	23mm (0.9in)	200mm (7.9in)

*This data sheet is for informational purpose only. Argox makes no warranties, expressed or implied in this summary. Specifications are subject to change without notice. All trade marks are the property of their respective owners. For more specific information, please refer to owner's manual.

YJ4600 | Area Imaging Scanner

The YJ4600 is a general purpose area imaging scanner targeting low to middle segments of the 2D market. With competitive pricing, outstanding performance, ergonomic design, and optimal functionality, it meets the demands of a wide variety of applications. The YJ4600 area imaging scanner offers both high performance and cost-efficiency.

2D barcodes are becoming increasingly popular and widely used in many industrial applications. QR Codes on high-speed train tickets, PDF 417 barcodes on airline boarding passes, and mobile phone coupons have all greatly contributed to the increasing prevalence of 2D barcodes.

Many enterprises have realized the importance of imaging technology, but the cost of most 2D scanners remains high. Many users find themselves caught between limited budgets and needing to upgrade their scanner technology to a 2D platform . Additionally, savvy purchasers are looking for a cost-effective scanning solution that can read images both on traditional paper and on other media forms, such as mobile screens.

The YJ4600 2D imaging scanner presents an affordable solution for enterprises who wish to upgrade their equipment. Not only does it accurately and efficiently read both 1D and 2D barcodes, it also seamlessly captures barcodes on electronic screens (such as a mobile phone) and provides an effective data capturing tool for e-coupons and e-tickets. With advanced imaging and decoding technology, the YJ4600 has a superior first-pass read rate on poorly printed and low quality bar codes. This product is an ideal choice for a wide variety of applications, including aviation and railway transportation, banking and securities, e-tickets, and many more.

Features

- **Cost-effective:** Competitive pricing, outstanding performance
- **Compact, lightweight, user-friendly design:** Fast and accurate scanning, elegant and ergonomic design allows for a natural and comfortable grip
- **Versatile scanning modes:** Supports both manual and presentation scanning modes with automatic object detection and scanning. It also supports mobile phone read mode
- **Advanced decoding software:** Cutting-edge decoding technology, able to scan both 1D and 2D barcodes quickly and accurately
- **Reliable data capture ability:** Supports most standard 1D and mainstream 2D symbology, as well as those on electronic screens (such as mobile phones)
- **Future-proof investment:** Protects your future investment with 2D capability at an affordable price meeting both current and future barcode scanning needs

YJ4600 Technical Specifications

Mechanical

Dimensions (length x width x height): 170mm x 66mm x 85mm

Weight: 120g

Electrical

Input Voltage: 4 ~ 5.5 V DC

Operating Power: 2W; 400 mA @ 5V - typical

Standby Power: 0.45w, 90mA@ 5V - typical

DC Power: Class2; 5.2VDC@1°

EMC: EN55022, EN55024 class B

LED Safety Certification: IEC62471

CB: IEC60950

Comprehensive Certification: GOST-R (Russia), CE

Environmental

Operating Temperature: 0°C - 40°C

Storage Temperature: -40°C - 60°C

Humidity: 5% - 95% relative humidity, non-condensing

Light Levels: 0 - 100,000LUX

Drop: designed to withstand falls from a height of up to 1.0m

Environmental Sealing: Sealed to resist airborne particulate contaminants

IP Level: IP40

Motion Tolerance: 100mm per second, 13 mil UPC

Performance

Light Source: white LED

Sight: Red LED, 617nm

Visual Indicators: Green = decoding successful; Red = decoding failed

System Interface: KBW, USB

Scan Pattern: Image

Scan Angle: Pitch ± 70 °, Tilt ± 60 °, Rotation ± 180 °

Print Contrast: Minimum 35% contrast

Decoding: supports most standard 1D and mainstream 2D symbology, as well as those on electronic screens (such as mobile phones)

Typical Performance*	
Narrow Width	**Depth of Field**
5 mil Code39	42mm - 111mm
13 mil UPC-A	36mm - 261mm
20 mil Code 39	41mm - 361mm
6.7 mil PDF417	41mm - 106mm
10mil Data Matrix	41mm - 111mm
15mil Data Matrix	30mm - 170mm
20mil QR	31mm - 211mm
Resolution: 4 mil	
*Performance may be impacted by bar code quality and environmental conditions	

YOUJIE
by Honeywell

Partner Information

Get more details from Youjie website: www.Youjieaidc.com

๓๒) ชุดโปรแกรม Microsoft Windows Server ๒๐๑๙

DataCenter Edition

Licensing Windows Server 2019

The operating system that bridges on-premises and Azure services

Overview of Windows Server 2019

Windows Server 2019 is the operating system that bridges on-premises environments with Azure services, enabling hybrid scenarios that maximize existing investments. Increase security and reduce business risk with multiple layers of protection built into the operating system. Evolve your datacenter infrastructure to achieve greater efficiency and scale with Hyper-converged Infrastructure. Enable developers and IT pros to create cloud native applications and modernize their traditional apps using containers and micro-services.

Unique hybrid capabilities with Azure	Advanced multi-layer security	Faster innovation for applications	Unprecedented Hyper-Converged

Windows Server 2019 editions

The right edition for your organization size, datacenter, and virtualization requirements.

| Editions	Description	Licensing model	CAL requirements	Pricing
Windows Server 2019 Datacenter	For highly virtualized datacenters and cloud environments	Core based	WS CAL	$6,155
Windows Server 2019 Standard	For physical or minimally virtualized environments	Core based	WS CAL	$972
Windows Server 2019 Essentials	For small businesses with up to 25 users and 50 devices	Specialty server	No CAL required	$501
Microsoft Hyper-V Server 2019	Free hypervisor download.	N/A	N/A	N/A

Datacenter and Standard edition per-core licensing

Windows Server 2019 Datacenter and Standard editions are licensed by physical core. Licenses are sold in 2-packs and 16-packs.

Minimum license requirements
- All physical cores must be licensed
- 8 core licenses per processor
- 16 core licenses per server

Per-core licensing scenarios

	Physical Cores per Processor	2	4	8	10	12	14	16	Processors per server
Number of 2-core packs needed		8	8	8	8	8	8	8	1 processor
		8	8	8	10	12	14	16	2 processors
		12	12	12	15	18	21	24	3 processors

Standard edition license stacking for OSEs

- Standard edition is licensed for 2 operating system environments (OSEs)[1] or Hyper-V containers. Additional OSEs require additional licenses.

Azure Hybrid Benefit

Customers with Software Assurance save significantly on Azure over the cost of running Windows Server in other public clouds:

What is Azure Hybrid Benefit?
A Software Assurance benefit that enables you to migrate to cloud at big savings. Save up to 49% on Windows Server virtual machines (VMs) by paying base compute[2] rates.

How do I qualify?
You qualify if you have active Software Assurance on your on-premises Windows Server licenses.[3]

Save up to 80% on Windows Server with
Azure Hybrid Benefit and Reserved Instances.

For more details, see Azure.com/ahub.

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[1] Datacenter is licensed for unlimited OSEs.

[2] Base compute equals Linux rates.

[3] Each Windows Server 2-processor license OR each 16-core license set is entitled to two Azure instances with up to 8 cores each, or one instance up to 16 cores. Benefit applies both to Standard and Datacenter editions. No program restrictions, i.e. benefit available irrespective of where customer buys their Azure: EA, CSP, Web direct, etc.

How do I activate this benefit?
- Deploy a new VM in minutes using Azure Marketplace images.[4]
- Upload a custom VM.
- Migrate free[5] with Azure Site Recovery.

Is it applicable for all VMs?
Use with Azure marketplace images, on-premises images, and workloads from other cloud providers.

Semi-Annual Channel benefit
Receive the latest features as they become available when you have Software Assurance.

	Recommended Scenarios	New Release	Supported For	Editions	Who can use	Installation Options
Long-term Servicing Channel	**General purpose** file Servers, first and third party workloads, traditional apps, and other infrastructure roles	Every **2–3** years	**5** years of Mainstream support **+5** years of Extended support	**All** available Windows Server editions	**All** customers through all channels	**Server Core** and **Server with Desktop Experience**
Semi-annual Channel	Containerized applications, container hosts, and application scenarios benefiting from **faster innovation**	Every **6** months	**18** months	**Standard** and **Datacenter**	**Software Assurance** and **cloud** customers only	**Server Core** and **Nano Server** container image

Service Providers (Hosters)
Q: Does the price of Windows Server vary based on Service Providers (hosters)?

A: In order to provide customers with a variety of options to license Windows Server, Microsoft makes licenses for Windows Server available to Service Providers for sale to customers as part of Service Provider solutions. This is done through agreement between Microsoft and Service Providers. Pricing for these Windows Server licenses that are provided by the Service Provider is set by the Service Provider.

For more information
Visit Microsoft.com/windowsserver

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[4] Pre-built gallery images are available only for Enterprise Agreement customers.
[5] Free for first 31 days.