



## RSL2-48X

### PRODUCT OVERVIEW

The Ray Switch Series provides cost-effective, reliable and secure access layer connectivity for enterprises, branch offices and small and midsize businesses.

These fully managed switches deliver Layer 2 capabilities with enhanced access security, traffic prioritization, sFlow, and IPv6 host support. Right size deployment is available with a range of Gigabit and Fast Ethernet models including compact and fanless models which are ideal for use in quiet work spaces. PoE+ models deliver up to 370W to power access points, IP phones and cameras.

The Ray Switch Series is easy to deploy, use and manage using Ray One (Platform). Ray One offers Network Access Control and captive portal support. The switches include a Limited Lifetime Warranty.

Ray switches provide Layer 2 access switching, ideal for branch and campus deployments. The Ray Switch series features a variety of power options designed to meet the diverse needs of branch and campus deployments.

With different models, capable of providing up to 740W of power over a variety of port densities, including SFP capable uplinks, the Ray Switch line is fully ready to support future wireless infrastructure deployments across a variety of different environments.

It supports comprehensive QoS, enhanced VLAN functions (Dynamic VLAN, Voice VLAN, QinQ, N:1 VLAN Translation etc), Ethernet Ring Protection Protocol (G.8032), classified bandwidth control, intelligent security control, OAM(Operations, Administration and Maintenance), manageability functions and services which fulfill the network requirements demanded by carrier network, Ray Switch offers green features like Fan-less design feature, which can dramatically lower power consumption, achieve green energy and save the cost for the carrier and MAN users.

Ray Switch is equipped with the full GE ports and 4 SFP+ uplink ports, it integrates advanced management and security functions to provide performance and scalability.

### Key Features

- › Cost-effective, reliable and secure Ray Layer 2 switch series
- › Flexible Management via Ray One
- › Right size deployment with choice of 8, 24 and 48 port Gigabit and Fast Ethernet models
- › Up to 370W PoE+ to power IoT, APs and cameras
- › REST API support
- › Simple deployment with Zero Touch Provisioning
- › Managed via single pane of glass dashboard
- › Remote Packet Capture Tools via Ray One
- › Automatic Firmware upgrades
- › SNMP/Syslog Integration
- › IPv4/6 ACL support
- › 802.1q VLAN tagging
- › DHCP Snooping
- › 802.1X Authentication
- › 10/100/1000 Mbps RJ45
- › 4x 1000 Mbps SFP models available
- › PoE and PoE+ models available for device level powering



## Enhanced Features

### Wired and Wireless Support

- » Switch auto-configuration automatically configures switch for different settings such as VLAN, CoS, PoE max power, and PoE priority when an Ray access point is detected
- » Local User Role defines a set of switch-based policies in areas such as security, authentication, and QoS. A User Role can be assigned to a group of users or devices, using local switch configuration.

### Quality of Service (QoS)

- » Traffic prioritization (IEEE 802.1p) for real-time traffic classification. Support for eight priority levels mapped to either two or four queues, and uses weighted deficit round robin (WDRR) or strict priority
- » Simplified quality of service (QoS) configuration Port-based traffic prioritization by specifying a port and priority level
- » VLAN-based traffic prioritization by specifying a VLAN and priority level
- » Class of Service (CoS) sets the IEEE 802.1p priority tag based on IP address, IP Type of Service (ToS), Layer 3 protocol, TCP/UDP port number, source port, and DiffServ Rate limiting establishes per-port ingress-enforced maximums for all traffic or for broadcast, multicast, or unknown destination traffic
- » Layer 4 prioritization enables priorities based on TCP/UDP port numbers
- » Flow control delivers reliable communication during full-duplex operation

### Simplified Configuration and Management

- » Ray One cloud-based management platform offers a simple, secure and cost effective way to manage switches.
- » Zero-Touch-Provisioning (ZTP) simplifies installation of the switch infrastructure using DHCP-based process
- » Flexible management – Supports both cloud-based and on-premise without ripping and replacing switching infrastructure
- » Choice of management interfaces HTML-based easy-to-use Web GUI allows configuration of the switch from any Web browser
- » Robust CLI provides advanced configuration and diagnostics
- » Simple network management protocol (SNMPv1/v2c/v3) allows the switch to be managed with a variety of third-party network management applications
- » Provides single IP address management for up to 16 switches individually
- » Ray delivers wire-speed traffic accounting and monitoring, configured by SNMP and CLI with three terminal encrypted receivers
- » IEEE 802.1AB Link-Layer Discovery Protocol (LLDP) automates device discovery protocol for easy mapping by network management applications
- » Provides local and remote logging of events via SNMP (v2c and v3) and syslog; provides log throttling and log filtering to reduce the number of log events generated
- » Port mirroring allows traffic to be mirrored on any port or a network analyzer to assist with diagnostics or detecting network attacks
- » Remote monitoring (RMON) provides advanced monitoring and reporting capabilities for statistics, history, alarms, and events
- » Friendly port names allows assignment of descriptive names to ports
- » Dual flash images provides independent primary and secondary operating system files for backup while upgrading
- » Multiple configuration files are easily stored with a flash image
- » Front-panel LEDs Locator LEDs allows users to set the locator LED on a specific switch to turn on, blink, or turn off; and simplifies troubleshooting by making it easy to locate a particular switch within a rack of similar switches
- » Per-port LEDs provides an at-a-glance view of the status, activity, speed, and full-duplex operation
- » Power and fault LEDs display issues, if any

### Connectivity

- » Compact and fanless models offer quiet operation for acoustically sensitive areas and uplink flexibility with two dual-personality ports that can be used as either RJ-45 Gigabit Ethernet or SFP ports
- » Gigabit models have small form factor pluggable (SFP) for fiber connectivity and Fast Ethernet models have two SFP and two RJ-45 Gigabit uplinks
- » IPv6 IPv6 host allows the switch to be deployed and managed at the edge of an IPv6 network
- » Dual stack (IPv4/IPv6) supports connectivity for both protocols; provides a transition mechanism from IPv4 to IPv6
- » MLD snooping forwards IPv6 multicast traffic to appropriate interface; prevents IPv6 multicast traffic from flooding the network
- » IPv6 ACL/QoS supports ACL and QoS for IPv6 network traffic on Gigabit and 48 port 10/100 models
- » Security RA Guard, DHCPv6 Protection, Dynamic IPv6 Lockdown (YA only)
- » IEEE 802.3at Power over Ethernet (PoE+) provides up to 30 W per port that allows support of the latest PoE+ capable devices such as IP phones, wireless access points, and security cameras, as well as any IEEE 802.3af compliant end device; eliminates the cost of additional electrical cabling and circuits that would otherwise be necessary in IP phone and WLAN deployments
- » Auto-MDIX adjusts automatically for straight-through or crossover cables on all ports
- » Pre-standard PoE support detects and provides power to pre-standard PoE devices
- » SFP slots provides fiber connectivity such as Gigabit-SX, LX, LH, and BX with four SFP slots on all 24- and 48-port Gigabit Ethernet models. Fast Ethernet 24- and 48-port models have two SFP slots and two RJ-45 Gigabit uplinks; 8-port models have two dual-personality ports supporting either SFP or RJ-45 Gigabit uplinks
- » Dual-personality (RJ-45 or USB micro-B) serial console port gives easy access to switch CLI with front-of-switch location and the flexibility of using either an RJ-45 or USB micro-B serial console port

### Layer 2 switching

- » Support for 512 VLANs and 4,094 VLAN IDs
- » Jumbo packet support improves the performance of large data transfers; supports frame size of up to 9,220 bytes; 8- and 24-port Fast Ethernet models automatically support up to 2,000-byte frames with no configuration needed
- » 16K MAC address table provides access to many Layer 2 devices
- » GARP VLAN Registration Protocol allows automatic learning and dynamic assignment of VLANs
- » Rapid Per-VLAN Spanning Tree (RPVST+) allows each VLAN to build a separate spanning tree to improve link bandwidth usage; is compatible with PVST+

### Security

- » Access control lists (ACLs) accommodate IPv4/IPv6 port and VLAN-based ACLs (IPv6 ACL is supported only on Gigabit Ethernet and 48-port models.)
- » Source-port filtering allows only specified ports to communicate with each other
- » RADIUS/TACACS+eases switch management security administration by using a password authentication server
- » Secure Sockets Layer (SSL) encrypts all HTTP traffic, allowing secure access to the browser-based management GUI in the switch
- » Port security allows access only to specified MAC addresses, which can be learned or specified by the administrator
- » MAC address lockout prevents particular configured MAC addresses from connecting to the network
- » Multiple user authentication methods Uses an IEEE 802.1X supplicant on the client in conjunction with a RADIUS server to authenticate in accordance with industry standards
- » Web-based authentication provides a browser-based environment, similar to IEEE 802.1X, to authenticate clients that do not support the IEEE 802.1X supplicant

- » Supports MAC-based client authentication
- » Secure shell (SSH) v2 encrypts all transmitted data for secure remote CLI access over IP networks
- » STP BPDU port protection blocks Bridge Protocol Data Units (BPDUs) on ports that do not require BPDUs, preventing forged BPDU attacks
- » STP root guard protects the root bridge from malicious attacks or configuration mistakes
- » Secure management access delivers protected encryption of all access methods (CLI, GUI, or MIB) through SSHv2 and SNMPv3
- » Custom banner displays security policy when users log in to the switch
- » Secure FTP allows secure file transfer to and from the switch; protects against unwanted file downloads or unauthorized copying of a switch configuration file
- » Protected ports CLI offers intuitive CLI to configure the source-port filter feature, by allowing specified ports to be isolated from all other ports on the switch; the protected port or ports can communicate only with the uplink or shared resources
- » Authentication flexibility Multiple IEEE 802.1X users per port provides authentication for up to 32 IEEE 802.1X users per port; prevents a user from "piggybacking" on another user's IEEE 802.1X authentication
- » Concurrent IEEE 802.1X, Web or MAC authentication schemes per port allows a switch port to accept IEEE 802.1X and either Web or MAC authentications
- » Switch management logon security helps secure switch CLI logon by optionally requiring either RADIUS or TACACS+ authentication
- » DHCP protection blocks DHCP packets from unauthorized DHCP servers, preventing denial-of-service attacks
- » Dynamic ARP protection blocks ARP broadcasts from unauthorized hosts, preventing eavesdropping or theft of network data
- » Dynamic IP lockdown works with DHCP protection to block traffic from unauthorized hosts, preventing IP source address spoofing
- » MAC Pinning allows non-chatty legacy devices to stay authenticated by pinning client MAC addresses to the port until the clients logoff or get disconnected

### Convergence

- » IEEE 802.1AB Link Layer Discovery Protocol (LLDP) facilitates easy mapping using network management applications with LLDP automated device discovery protocol
- » LLDP-MED (Media Endpoint Discovery) defines a standard extension of LLDP that stores values for parameters such as QoS and VLAN to automatically configure network devices such as IP phones
- » PoE and PoE+ allocations support multiple methods (automatic, IEEE 802.3at dynamic, LLDP-MED fine grain, IEEE 802.3af device class or user-specified), to allocate and manage PoE/PoE+ power for more efficient energy savings
- » Voice VLAN uses LLDP-MED to automatically configure a VLAN for IP phones
- » IP multicast (IGMP) prevents flooding of IP multicast traffic
- » LLDP-CDP compatibility receives and recognizes CDP packets from Cisco's IP phones for seamless interoperation
- » Local MAC Authentication assigns attributes such as VLAN and QoS using locally configured profile that can be a list of MAC prefixes Unified Wired and Wireless

### Resiliency and high availability

- » Port trunking and link aggregation Trunking supports up

- to eight links per trunk to increase bandwidth and create redundant connections; and supports L2, L3, and L4 trunk load-balancing algorithm (L4 trunk load balancing is supported only on Gigabit Ethernet and 48-port models.)
- » IEEE 802.3ad Link Aggregation Control Protocol (LACP) eases configuration of trunks through automatic configuration
- » IEEE 802.1s Multiple Spanning Tree provides high link availability in multiple VLAN environments by allowing multiple spanning trees; provides legacy support for IEEE 802.1d and IEEE 802.1w
- » SmartLink provides easy-to-configure link redundancy of active and standby links

### Product architecture

- » Energy-efficient design IEEE 802.3az reduces power consumption during periods of low data activity on Gigabit Ethernet switches
- » Port low-power mode enables the port to automatically go into low-power mode to conserve energy when no link is detected
- » Fan-less and variable-speed fans decrease power consumption in fan-less as well as variable-speed fan switches
- » Port LEDs conserves energy by optionally turning off port link and activity LEDs
- » Switch on a chip provides a highly integrated, high-performance switch design with a nonblocking architecture

### Flexibility

- » Power Savings with Energy Efficient Design Rack mountable allows the switch to be mounted on a standard 19-inch rack, with the hardware included
- » Wall mountable allows the switch to be mounted on a wall, using the hardware included
- » Surface mountable allows the switch to be mounted above or below a surface (such as a desk or table), using the hardware included
- » Quiet operation lowers noise, making it suitable for deployments in acoustically sensitive environments such as conference rooms and office spaces
- » Compact size reduces space requirements (refer to the product specifications for the exact dimensions)

RSL2-48X	
<b>RJ-45</b>	
<b>RJ-45 10/100/1000 PoE+ ports</b>	<b>48</b>
RJ-45 10/100/1000 PoE+ Specs	IEEE 802.3 Type 10BASE-T, IEEE 802.3u Type 100BASE-TX, IEEE 802.3ab Type 1000BASE-T, IEEE 802.3at PoE+
RJ-45 10/100/1000 Media Type	Auto-MDIX; Duplex: 10BASE-T/100BASE-TX: half or full; 1000BASE-T: full only
<b>SFP</b>	
SFP Ports	0
<b>SFP+</b>	
SFP+ Ports	4
<b>Console Ports</b>	
RJ-45 Serial Console	1
<b>Dimensions</b>	
Weight	
<b>Performance</b>	
Switching Capacity	176 Gbps
Forwarding rate	131Mpps
MAC Address	16K
Jumbo Frame	10K bytes
ACL Table	512
VLAN Table	4K
Queues per port	8
<b>Environment</b>	
Operating temperature	0°C to 50°C
Operating relative humidity	"10% to 90% @ 104°F (40°C), noncondensing"
Nonoperating/Storage temperature	-40°F to 158°F (-40°C to 70°C)
Nonoperating/Storage relative humidity	"15% to 90% @ 149°F (65°C), noncondensing"
Altitude	up to 10,000 ft (3 km)
Acoustic	Power: 0 dB, Pressure: 0 dB

Electrical Characteristics	
Frequency	50/60 Hz
Maximum heat dissipation	"65 BTU/hr (68.58 kJ/hr), (switch only: 65 BTU/hr; combined switch + max. PoE devices: 293 BTU/hr)"
AC voltage	100 - 240 VAC
Current	5.8/2.9 A
Maximum power rating	740 W
Idle power	40.1 W
PoE power	740 W

Immunity	
Generic	EN 55024, CISPR 24
EN	EN 55024, CISPR 24
ESD	IEC 61000-4-2
Radiated	IEC 61000-4-3
EFT/Burst	IEC 61000-4-4
Surge	IEC 61000-4-5
Conducted	IEC 61000-4-6
Power frequency magnetic field	IEC 61000-4-8
Voltage dips and interruptions	IEC 61000-4-11
Harmonics	EN 61000-3-2, IEC 61000-3-2
Flicker	EN 61000-3-3, IEC 61000-3-3

Management	
	CLI GUI

Device Management	
<b>Device management</b>	<ul style="list-style-type: none"> <li>› RFC 1591 DNS (client)</li> <li>› SSHv1/SSHv2 Secure Shell</li> <li>› RFC 2576 (Coexistence between SNMP V1, V2, V3)</li> <li>› RFC 2579 (SMIPv2 Text Conventions)</li> <li>› RFC 2580 (SMIPv2 Conformance)</li> <li>› RFC 3416 (SNMP Protocol Operations v2)</li> <li>› RFC 3417 (SNMP Transport Mappings)</li> </ul>
Quality of Service (QoS)	
<b>Class of Service</b>	<ul style="list-style-type: none"> <li>› 8 Priority Queues Per Port</li> <li>› 802.1p</li> <li>› CoS</li> <li>› DSCP Priority</li> <li>› IP Precedence</li> <li>› Port Based</li> <li>› IPv4 QoS</li> <li>› IPv6 QoS</li> <li>› Bandwidth Control</li> <li>› Flow Redirect</li> <li>› Classification based on ACL, VLAN ID, COS, TOS, DSCP</li> <li>› Policing Based on Port and VLAN</li> <li>› Single Rate single barrel double color for Policing</li> <li>› Remark DSCP, COS/802.1p, Precedence, TOS</li> <li>› SP, WRR, SWRR, DWRR for Scheduling</li> <li>› Match the IP fragmentation of a message</li> <li>› RFC 2474 DiffServ precedence, with 4 queues per port</li> <li>› RFC 2475 DiffServ Architecture</li> <li>› RFC 2597 DiffServ Assured Forwarding (AF)</li> <li>› RFC 2598 DiffServ Expedited Forwarding (EF)</li> </ul>
<b>Queue Scheduling</b>	<ul style="list-style-type: none"> <li>› SP (Strict Priority)</li> <li>› WRR (Weighted Round Robin)</li> <li>› SP+WRR</li> <li>› DSCP &amp; CS</li> </ul>
<b>Bandwidth Control</b>	<ul style="list-style-type: none"> <li>› Port based Rating Limiting: (Ingress, Egress)</li> <li>› Flow based Rating Limiting: (Ingress, Egress)</li> </ul>
<b>Action of Flows</b>	<ul style="list-style-type: none"> <li>› Mirror (to supported interface)</li> <li>› Rate Limit</li> <li>› QoS Remark</li> </ul>
Layer 3	
<b>Layer 3 Capabilities</b>	<ul style="list-style-type: none"> <li>› DHCP Server</li> <li>› DHCP Relay</li> <li>› DHCP Interface Relay</li> <li>› DHCP L2 Relay</li> <li>› Static Routing</li> <li>› Policy Based Routing</li> </ul>
IPv6	
<b>IPv6</b>	<ul style="list-style-type: none"> <li>› Dual IPv6/IPv4 stack</li> <li>› IPv6 Web/SSL</li> <li>› IPv6 SNTP (Simple Network Time Protocol)</li> <li>› IPv6 Telnet / SSH</li> <li>› IPv6 Ping/Traceroute</li> <li>› IPv6 TFTP</li> <li>› IPv6 RADIUS/TACACS+</li> <li>› IPv6 SNMP</li> <li>› RFC 1981 IPv6 Path MTU Discovery</li> <li>› RFC 2460 IPv6 Specification</li> <li>› RFC 2464 Transmission of IPv6 over Ethernet Networks</li> <li>› RFC 2925 Remote Operations MIB (Ping only)</li> <li>› RFC 3315 DHCPv6 (client only)</li> <li>› RFC 3484 Default Address Selection for IPv6</li> <li>› RFC 3513 IPv6 Addressing Architecture</li> <li>› RFC 3596 DNS Extension for IPv6</li> <li>› RFC 3810 Multicast Listener Discovery Version 2 (MLDv2) for IPv6</li> <li>› RFC 4022 MIB for TCP</li> <li>› RFC 4113 MIB for UDP</li> <li>› RFC 4251 SSHv6 Architecture</li> <li>› RFC 4252 SSHv6 Authentication</li> <li>› RFC 4252 SSHv6 Transport Layer</li> </ul>

	<ul style="list-style-type: none"> <li>› RFC 4254 SSHv6 Connection</li> <li>› RFC 4291 IP Version 6 Addressing Architecture</li> <li>› RFC 4293 MIB for IP</li> <li>› RFC 4419 Key Exchange for SSH</li> <li>› RFC 4443 ICMPv6</li> <li>› RFC 4861 IPv6 Neighbor Discovery</li> <li>› RFC 4862 IPv6 Stateless Address Auto-configuration</li> <li>› RFC 5095 Deprecation of Type 0 Routing Headers in IPv6</li> </ul>
Layer 2	
<b>Access Control List (ACL)</b>	<ul style="list-style-type: none"> <li>› IPv4/IPv6 IP-based ACL</li> <li>› MAC-based ACL</li> <li>› IPv4/IPv6 IP-based ACE</li> <li>› MAC-based ACE</li> <li>› Management Access List</li> <li>› MAC-IP ACL</li> <li>› User-Defined ACL</li> <li>› Time Range ACL</li> <li>› L2+/L3/L4</li> <li>› IPv6 Support</li> </ul>
<b>IGMP Snooping</b>	<ul style="list-style-type: none"> <li>› RFC 2236 IGMPv2</li> <li>› IGMP Authentication</li> <li>› IGMP Snooping v1/v2/v3</li> <li>› MLD Snooping v1/v2</li> <li>› MVR</li> <li>› Up to 256 multicast groups</li> <li>› Internet Group Management Protocol (IGMP) limits bandwidth-intensive multicast traffic to only the requesters; it supports 4000 multicast groups (source-specific multicasting is also supported)</li> <li>› IGMP querier used to support a Layer 2 multicast domain of snooping switches in the absence of a multicast router</li> <li>› IGMP snooping for multicast filtering</li> </ul>
<b>LACP</b>	<ul style="list-style-type: none"> <li>› Static Trunk</li> <li>› IEEE 802.3ad LAG</li> <li>› 8 Groups / 8 Ports (RSL2-8P)</li> <li>› 16 Groups / 8 Ports (RSL2-24P)</li> </ul>
<b>Spanning Tree</b>	<ul style="list-style-type: none"> <li>› IEEE 802.1D -Spanning Tree</li> <li>› IEEE 802.1w -Rapid SpanningTree</li> <li>› IEEE 802.1s -Multiple Spanning Tree</li> <li>› BPDU Guard</li> <li>› STP Root Guard</li> <li>› Loop Detection</li> <li>› STP BPDU Guard,</li> <li>› BPDU Filtering</li> <li>› BPDU Forwarding</li> </ul>
<b>L2 Ring Protection</b>	<ul style="list-style-type: none"> <li>› MRPP</li> <li>› ERPS (G.8032)</li> <li>› Loopback Detection</li> <li>› Fast Link</li> </ul>
<b>Switching Capabilities</b>	<ul style="list-style-type: none"> <li>› Auto-Negotiation</li> <li>› Crossover Detection</li> <li>› Loopback direction</li> <li>› Unidirectional Link Detection (UDLD)</li> <li>› 802.1ab Link Layer Discovery Protocol (LLDP)</li> <li>› Ethernet Ring Protection Switching (ERPS) optimizes recovery under redundancy and failover conditions</li> </ul>

VLAN	
<b>VLAN</b>	<ul style="list-style-type: none"> <li>› Management VLAN</li> <li>› Voice VLAN</li> <li>› Surveillance-VLAN</li> <li>› Q-in-Q (Double Tag)</li> <li>› 802.1v Protocol VLAN</li> <li>› MAC-Based VLAN</li> <li>› Port-based and 802.1Q tag-based VLANs</li> <li>› Management VLAN</li> <li>› Protocol-based VLAN</li> <li>› IP subnet-based VLAN</li> <li>› Dynamic VLAN assignment using RADIUS server along with 802.1X client authentication</li> <li>› Q-in-Q (VLANs transparently cross over a service provider network while isolating traffic among customers)</li> <li>› Generic VLAN Registration Protocol (GVRP) and Generic Attribute Registration Protocol (GARP) enable automatic propagation and configuration of VLANs in a bridged domain</li> <li>› 802.1Q VLAN and trunking support for up to 4,094 VLANs</li> <li>› Private VLAN</li> <li>› Protocol VLAN</li> <li>› MAC VLAN</li> <li>› Normal QinQ, Selective QinQ, Flexible QinQ</li> <li>› VLAN Translation, N:1 VLAN Translation</li> </ul>
Security	
<b>Authentication</b>	<ul style="list-style-type: none"> <li>› RADIUS Authentication, Authorization, Accounting</li> <li>› TACACS+ Authentication</li> <li>› IEEE 802.1X port-based authentication</li> <li>› IEEE802.1x AAA</li> </ul>
<b>DHCP</b>	<ul style="list-style-type: none"> <li>› IPv4/IPv6 DHCP Client</li> <li>› IPv4/IPv6 DHCP Relay</li> <li>› DHCP Option 82</li> <li>› DHCP Option 37/38</li> <li>› IPv4/IPv6 DHCP Server</li> <li>› IPv4/IPv6 DHCP Snooping, Detection and Blocking</li> </ul>
<b>Other Security Features</b>	<ul style="list-style-type: none"> <li>› Sticky MAC, MAC Whitelisting</li> <li>› IP-MAC port binding</li> <li>› MAC filtering</li> <li>› Static MAC Address</li> <li>› Port Isolation</li> <li>› Network DoS Filter</li> <li>› DoS/DDoS attack prevention</li> <li>› ARP inspection</li> <li>› IP source guard</li> <li>› Storm control support</li> <li>› Broadcast/unknown unicast/unknown multicast</li> <li>› Secure Management Interfaces (SSH, SSL, SNMP v3)]</li> <li>› Storm Control based on packets and bytes</li> <li>› Port Security, MAC Limit based on VLAN and Port</li> <li>› Anti-ARP-Spoofing, Anti-ARP-Scan, ARP Binding</li> <li>› ND Snooping</li> <li>› DAI</li> <li>› IEEE 802.1X Port Based Network Access Control</li> <li>› RFC 1492 TACACS+</li> <li>› RFC 2138 RADIUS Authentication</li> <li>› RFC 2866 RADIUS Accounting</li> <li>› RFC 7030 Enrollment over Secure Transport</li> <li>› Secure Sockets Layer (SSL)</li> </ul>

Green Energy	
<b>Green Energy</b>	<ul style="list-style-type: none"> <li>› IEEE 802.3az (Energy Efficient Ethernet)</li> <li>› Fanless</li> <li>› LED Shut-off</li> </ul>
MIBs	
<b>MIBs</b>	<ul style="list-style-type: none"> <li>› RFC 1155 Structure and Identification of Management Information for TCP/IP Internets</li> <li>› RFC 1212 Concise MIB Definitions</li> <li>› RFC 1213 MIB II</li> <li>› RFC 1493 Bridge MIB</li> <li>› RFC 2021 RMONv2 MIB</li> <li>› RFC 2578 Structure of Management Information Version 2 (SMIv2)</li> <li>› RFC 2579 Textual Conventions for SMIv2</li> <li>› RFC 2613 SMON MIB</li> <li>› RFC 2618 RADIUS Client MIB</li> <li>› RFC 2620 RADIUS Accounting Client MIB</li> <li>› RFC 2665 Ethernet-Like-MIB 2</li> <li>› RFC 2668 802.3 MAU MIB</li> <li>› RFC 2674 802.1p and IEEE 802.1Q Bridge MIB</li> <li>› RFC 2737 Entity MIB (Version 2)</li> <li>› RFC 2863 The Interfaces Group MIB</li> <li>› RFC 4836 Managed Objects for 802.3 Medium Attachment Units (MAU)</li> </ul>
Network Management	
	<ul style="list-style-type: none"> <li>› IEEE 802.1AB Link Layer Discovery Protocol (LLDP)</li> <li>› RFC 1098 A Simple Network Management Protocol (SNMP)</li> <li>› RFC 1155 Structure of Management Information</li> <li>› RFC 2819 Four groups of RMON: 1 (statistics), 2 (history) 3 (alarm) and 9 (events)</li> <li>› RFC 3411 SNMP Management Frameworks</li> <li>› RFC 3412 Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)</li> <li>› RFC 3413 Simple Network Management Protocol (SNMP) Applications</li> <li>› RFC 3414 User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)</li> <li>› RFC 3415 View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)</li> <li>› RFC 3418 Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)</li> <li>› RFC 5424 Syslog Protocol</li> <li>› ANSI/TIA-1057 LLDP Media Endpoint Discovery (LLDP-MED)</li> <li>› SNMPv1/v2c/v3</li> </ul>

## Standards

Standards	
	<ul style="list-style-type: none"> <li>› IEEE 802.1ab LLDP</li> <li>› IEEE 802.1ag</li> <li>› IEEE 802.1D MAC Bridges</li> <li>› IEEE 802.1D Spanning Tree Protocol</li> <li>› IEEE 802.1p Class of Service</li> <li>› IEEE 802.1p Priority</li> <li>› IEEE 802.1Q VLAN Tagging</li> <li>› IEEE 802.1Q VLANs</li> <li>› IEEE 802.1s Multiple Spanning Tree Protocol</li> <li>› IEEE 802.1s Multiple Spanning Trees</li> <li>› IEEE 802.1w Rapid Reconfiguration of Spanning Tree</li> <li>› IEEE 802.1w Rapid Spanning Tree Protocol</li> <li>› IEEE 802.1x Port Authentication Network Control</li> <li>› IEEE 802.3 10BASE-T</li> <li>› IEEE 802.3 Type 10BASE-T</li> <li>› IEEE 802.3ab 1000BASE-T</li> <li>› IEEE 802.3ab Gigabit 1000BASE-T</li> <li>› IEEE 802.3ad Link Aggregation Control Protocol (LACP)</li> <li>› IEEE 802.3ad port trunk with LACP</li> <li>› IEEE 802.3af Power over Ethernet</li> <li>› IEEE 802.3at Power over Ethernet Plus</li> <li>› IEEE 802.3az Energy Efficient Ethernet</li> <li>› IEEE 802.3u 100BASE-TX/100BASE-FX</li> <li>› IEEE 802.3x Flow Control</li> <li>› IEEE 802.3x flow control and back pressure</li> <li>› IEEE 802.3z Gigabit SX/LX</li> <li>› IEEE802.3ah</li> <li>› RFC 1112 IGMP version 1</li> <li>› RFC 1350 TFTP Protocol (revision 2)</li> <li>› RFC 1542 BOOTP Extensions</li> <li>› RFC 1918 Address Allocation for Private Internet</li> <li>› RFC 2030 Simple Network Time Protocol (SNTP) v4</li> <li>› RFC 2068 HTTP</li> <li>› RFC 2131 DHCP</li> <li>› RFC 2236 IGMP version 2</li> <li>› RFC 2710 MLD version 1</li> <li>› RFC 3376 IGMP version 3</li> <li>› RFC 3411 An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks</li> <li>› RFC 3412 Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)</li> <li>› RFC 3413 Simple Network Management Protocol (SNMP) Applications</li> <li>› RFC 3414 User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)</li> <li>› RFC 3415 View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)</li> <li>› RFC 3575 IANA Considerations for RADIUS</li> <li>› RFC 3810 MLD version 2</li> <li>› RFC 5905 NTP Client</li> <li>› RFC 768 UDP</li> <li>› RFC 783 TFTP Protocol (revision 2)</li> <li>› RFC 791 IP</li> <li>› RFC 792 ICMP</li> <li>› RFC 793 TCP</li> <li>› RFC 793 TFTP</li> <li>› RFC 826 ARP</li> <li>› RFC 854 TELNET</li> <li>› RFC 868 Time Protocol</li> <li>› RFC 951 BOOTP</li> <li>› RFC 3575 IANA Considerations for RADIUS</li> <li>› RFC 5905 NTP Client</li> </ul>

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