x560-28YSQ

25 Gigabit Stackable Layer 3 Switch

Overview

Allied Telesis x560-28YSQ 25 Gigabit Layer 3 switch features high capacity, resiliency, and easy management. Flexible connectivity options make it the ideal choice for demanding data delivery applications. Enable 25G server connectivity for today's data-driven services, or high-performance in enterprise distribution environments.

24 x 1/10/25G ports and 4 x 40/100G uplinks provide deployment flexibility, while Virtual Chassis Stacking (VCStack™) enables a resilient solution where 2 units operate and are managed as a single virtual device.

Network automation

Allied Telesis Autonomous Management Framework™ Plus (AMF Plus) meets the increasing management requirements of modern converged networks, by automating many everyday tasks. AMF Plus has powerful features that allow an entire network to be easily managed as a single virtual device.

Vista Manager™ EX is an intuitive graphical tool for monitoring and managing AMF Plus wired, Autonomous Wave Control (AWC) wireless, and third-party endpoint devices. Full visibility and powerful features enable proactive management of large networks.

Resilient

The convergence of network services, and the need for always-on access to critical business applications, has led to increasing demand for highly available networks with minimal downtime.

Allied Telesis Virtual Chassis Stacking (VCStack), in conjunction with link aggregation, provides a network with no single point of failure and a resilient solution for high-availability applications.

The x560-28YSQ can form a VCStack of 2 units at any port speed, for enhanced resiliency and simplified device management. Stacks can also be created over long distance fiber links, making it the perfect choice for distributed environments too.

Allied Telesis Ethernet Protection Switched Ring (EPSRing™), and the standards-based G.8032 Ethernet Ring Protection, ensure that distributed network segments have high-speed, resilient access to online resources and applications.

Reliable

The x560-28YSQ is designed with reliability in mind to guarantee continual delivery of essential services. Dual built in power supplies and near-hitless online stack reconfiguration enable maintenance to be performed without affecting network uptime.

Hyper-Converged Infrastructure (HCI)

The x560-28YSQ has the performance and resilience to support hyperconverged infrastructure, where servers, storage, and switches connect seamlessly for data-driven environments that are software controlled.

This lowers cost and complexity while enabling better scalability and agility in managing and deploying IT services.

Network orchestration

For easy integration into complex networks such as HCI that comprise physical, virtual, and multi-vendor devices, the x560-28YSQ features:

- NETCONF/RESTCONF + YANG data modelling for network automation.
- OpenFlow v1.3 for Software Defined Networking (SDN) orchestration.

AlliedWare Plus™ OPERATING SYSTEM

Key Features

- 2.0 Terabit fabric
- SFP28 slots support 1/10/25G modules
- QSFP28 uplink slots support 40/100G modules
- Autonomous Management Framework Plus™ (AMF Plus)
- AMF Security compatible
- Active Fiber Monitoring for fiber data and stacking links
- VCStack 2 units locally or over distance
- EPSRing and G.8032 ERPS for resilient rings
- EPSR Master
- Enhanced Transmission Selection (ETS)
- Priority-based Flow Control (PFC)
- Media Access Control Security (MACSec)
- Multicast Source Discovery Protocol (MSDP)
- Link Monitoring
- Bidirectional Forwarding Detection (BFD)
- Upstream Forwarding Only (UFO)
- VXLAN static tunnels
- NETCONF/RESTCONF with YANG data modelling
- OpenFlow v1.3 for SDN

KEY FEATURES

Virtual Chassis Stacking (VCStack™)

Create a VCStack of two units at any port speed. Stacking links are connected in a ring so each device has dual connections to further improve resiliency. VCStack provides a highly available system where network resources are spread out across stacked units, reducing the impact tif one of the units fails, Aggregating switch port on different units across the stack provides excellent network resiliency.

Long-Distance Stacking (VCStack LD)

Long Distance stacking allows a VCStack to be created over fiber links to span longer distances, perfect for a distributed network environment.

AWC Wireless Management

Optimize wireless network performance with the Autonomous Wave Control (AWC) wireless controller built-in to the Device GUI. AWC analyzes wireless traffic patterns and automatically reconfigures access points to meet demand, and ensure a superior Wi-Fi user experience.

Allied Telesis Autonomous Management Framework™ Plus (AMF Plus)

AMF Plus is a sophisticated suite of management tools that provide a simplified approach to network management. Common tasks are automated or made so simple that the everyday running of a network can be achieved without the need for highly-trained, and expensive, network engineers. Powerful features like centralized management, auto-backup, auto-upgrade, auto-provisioning and auto-recovery enable plug-and-play networking and zero-touch management.

The x560-28YSQ operating as the AMF Plus master stores firmware and configuration backups for all other network nodes. This enables auto-provisioning and auto-upgrade by providing appropriate files to new network members.

An AMF Plus license provides all standard AMF network management and automation features, and also enables the AMF Plus intent-based networking features in Vista Manager EX.

AMF Security and Application Proxy

The AMF-Security (AMF-Sec) solution enables internal LAN threat detection and automatic end-point isolation to protect the network. The AMF Application Proxy (included for free in the base license) enables the AMF-Sec controller to communicate with the AMF Plus master when a threat is detected, so the AMF Plus master can take action to block the threat at source by quarantining the infected end-point.

Flexible Port Speeds

24 x SFP28 slots support any combination of 1G, 10G, and 25G modules, while the 4 x QSFP28 uplink slots support 40G or 100G modules. This flexibility enables easy connectivity to a variety of systems, and simple performance upgrades.

Quality of Service

Enhanced Transmission Selection (ETS) provides quality of service by allocating bandwidth to important traffic classes, with the flexibility to share remaining bandwidth to maximize traffic throughput and performance.

Priority-based Flow Control (PFC) enables lossless data forwarding by managing high priority traffic queues to support their class-of-service.

Virtual Routing and Forwarding (VRF-Lite)

VRF-Lite provides Layer 3 network virtualization by dividing a single switch into multiple independent virtual routing domains. With independent routing domains, IP addresses can overlap without causing conflict, allowing multiple customers to have their own secure virtual network within the same physical infrastructure. VRF-Lite supports IPv4 and IPv6 unicast and multicast traffic.

The built-in DHCP Server on the x560-28YSQ is VRF aware, enabling the supply of IP addresses to clients across multiple isolated networks.

Ethernet Protection Switched Ring (EPSRing™)

EPSRing allows several switches to form protected rings with 50ms failover—perfect for high performance at the core of Enterprise or Provider Access networks. The AT-x560-28YSQ can act as the EPSR Master.

SuperLoop Protection enables a link between two EPSR nodes to be in separate EPSR domains, improving redundancy and network fault resiliency.

G.8032 Ethernet Ring Protection

G.8032 provides standards-based high-speed ring protection, that also interoperate with Allied Telesis EPSR.

Ethernet Connectivity Fault Monitoring (CFM) proactively monitors links and VLANs, and provides alerts when a fault is detected.

sFlow

sFlow is an industry-standard technology for monitoring high-speed switched networks. It provides complete visibility into network use, enabling performance optimization, usage accounting/billing, and defense against security threats. Sampled packets sent to a collector (up to 5 collectors can be configured) ensure it always has a real-time view of network traffic

Active Fiber Monitoring (AFM)

AFM prevents eavesdropping on fiber communications by monitoring received optical power. If an intrusion is detected, the link can be automatically shut down, or an operator alert can be sent.

Media Access Control Security (MACSec)

802.1AE MACSec secures all traffic on point-to-point Ethernet links between directly connected nodes, ensuring protection against security threats such as denial of service, intrusion, man-in-the-middle, passive wiretapping, and playback attacks.

TACACS+ Command Authorization

TACACS+ Command Authorization offers centralized control over which commands may be issued by each specific AlliedWare Plus device user. It complements authentication and accounting services for a complete AAA solution.

VLAN Translation

Service Providers can use VLAN Translation to provide customer traffic with a unique VLAN-ID for use within the SP's network. It does this by mapping traffic arriving on a VLAN to a different VLAN on the outgoing paired interface.

This feature is also useful in Enterprise environments where it can be used to merge two networks together, without manually reconfiguring the VLAN numbering scheme.

Bidirection Forwarding Detection (BFD)

BFD enables fast detection of link failures, so recovery time is minimized. BFD works with static routes, and also alongside BGP and OSPF dynamic routing protocols supporting faster shutdown of neighbor connections if a peer session goes down. When using VRF-Lite, BFD is supported globally or within a domain.

Upstream Forwarding Only (UFO)

UFO lets you manage which ports in a VLAN can communicate with each other, and which only have upstream access to services, for secure multi-user deployment.

Multicast Source Discovery Protocol (MSDP)

MSDP enables two or more PIM-SM (Sparse Mode) domains to share information on active multicast sources, for more efficient forwarding of multicast traffic.

Link Monitoring (Linkmon)

Linkmon enables network health monitoring by regularly sending probes over key links to gather metrics comprising latency, jitter, and probe loss.

This supports pro-active network management and can also be used with triggers to automate a change to device or network configuration in response to the declining health of a monitored link.

Virtual Extensible LAN (VXLAN) tunnels

VXLAN tunnels let you join two or more L2 networks over an L3 IP network to form a single L2 broadcast domain. VXLAN adds scalability to cloud computing environments. The x560-28YSQ supports static VXLAN tunnels.

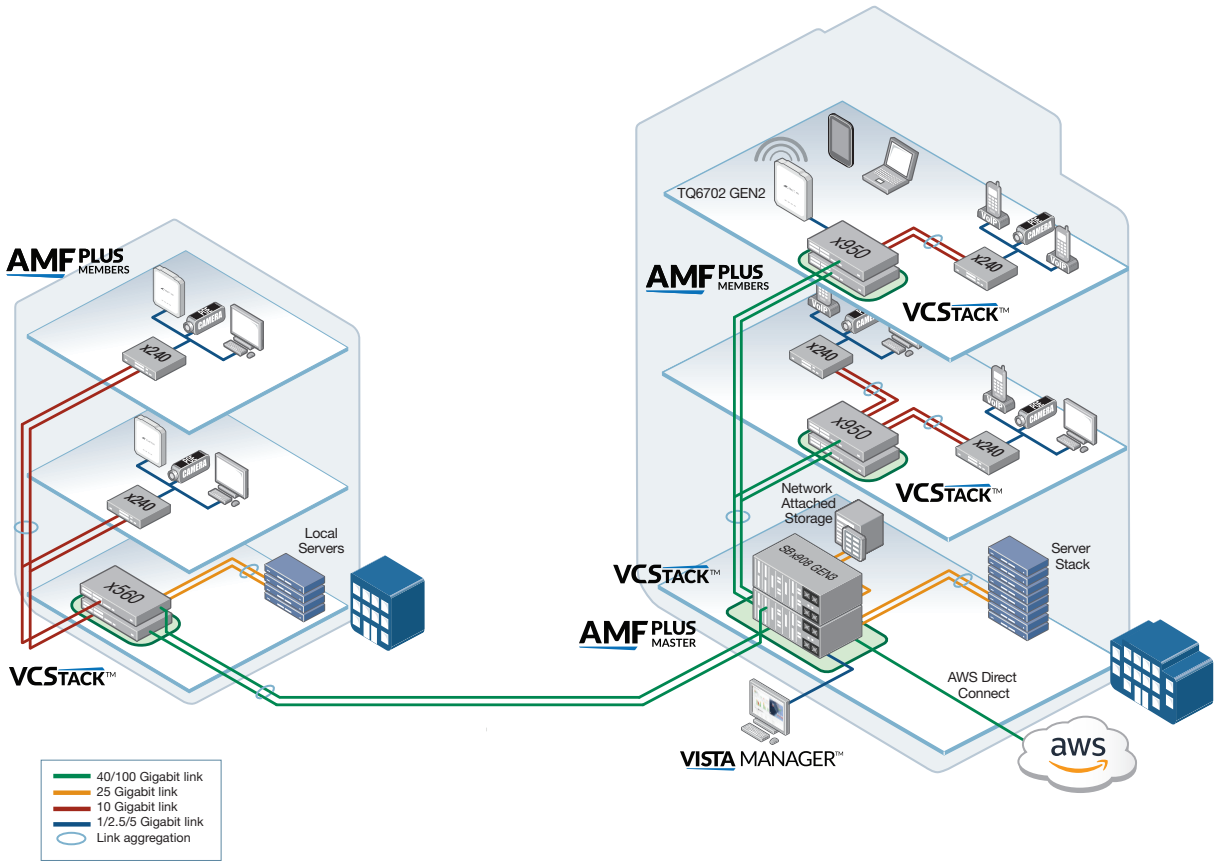
NETCONF/RESTCONF

NETCONF/RESTCONF with YANG data modeling provides a standardized way to represent data and securely configure devices, supporting existing management systems.

Software Defined Networking (SDN)

OpenFlow is a key technology for SDN orchestration. SDN controllers and other tools support automated behavior in a network and allow customized applications and services to be run.

Flexible distribution



Today's enterprises demand ready access to online resources and applications and require a high-performing network that can seamlessly carry multiple converged services. This campus solution uses the x560-28YSQ for flexible distribution partnered with a SwitchBlade x908 GEN3 network core, providing high availability and capacity, along with ease of management.

Using VCStack at the core and distribution layers of the network allows multiple switches to appear as a single virtual chassis, simplifying management. In normal operation, the full bandwidth of the network is used, ensuring always-available online services.

Using Amazom Web Services (AWS) Direct Connect ensures immediate access to cloud-based services, alongside locally stored business data and applications, to fully support modern hybrid-cloud environments.

The flexibility of the x560-28YSQ to connect at 10G and 25G speeds supports high-speed edge switches and server access, while 40G and 100G uplinks provide immediate data transfer to the network core. Dual power supplies in the x560 distribution switches maximize network uptime and ensure connectivity to business-critical information.

AMF Plus allows the network to be unified for ease of management, with the Master device automatically backing up the entire network, and enabling plug-and-play networking with zero touch expansion and recovery. Vista Manager enables visual management and monitoring of the entire network including all wired, wireless, and endpoint devices.

SPECIFICATIONS

	1/10/25G SFP28 ports	40/100G QSFP28 ports	Switching Fabric	Forwarding Rate
x560-28YSQ	24	4	2.0Tbps	800Mpps

Physical Specifications

	Width	Depth	Height	Mounting	Weight
x560-28YSQ	441 mm (17.36 in)	421 mm (16.57 in)	44 mm (1.73 in)	Rack-mount 1 RU	5.95 kg (13.11 lb)

Power and Noise Characteristics

	Max Power Consumption	Max Heat Dissipation	Noise
x560-28YSQ	300W	1024 BTU/h	50-60 db

Latency (microseconds)

	Port Speed				
	1Gbps	10Gbps	25Gbps	40Gbps	100Gbps
x560-28YSQ	4.55µs	2.66µs	2.24µs	2.04µs	1.59µs

Performance

- Up to 64K MAC addresses
- Up to 1,000 static routes
- Up to 12,000 dynamic routes
- 2GB DDR SDRAM
- 4096 configurable VLANs
- 256 MB flash memory
- Packet Buffer memory: 8MB
- Supports up to 10KB L2 jumbo frames

Reliability

- Modular AlliedWare™ operating system
- Dual built-in power supplies
- Full environmental monitoring of PSU internal temperature and internal voltages. SNMP traps alert network managers in case of any failure

Diagnostic Tools

- Active Fiber Monitoring detects tampering on optical links
- Cable fault locator (TDR)
- Find-me device locator
- Connectivity Fault Management (CFM) for use with G.8032 ERPS
- Link Monitoring
- Automatic link flap detection and port shutdown
- Optical Digital Diagnostic Monitoring (DDM)
- Ping polling for IPv4 and IPv6
- Port mirroring
  - No limit on mirrored ports
  - Up to 7 mirror (analyzer) ports
- VLAN mirroring (RSPAN)
- TraceRoute for IPv4 and IPv6
- Uni-Directional Link Detection (UDLD)

IPv4 Features

- Black hole routing
- DHCP client, relay and server for IPv4 and IPv6
- Directed broadcast forwarding
- DNS relay
- Equal Cost Multi Path (ECMP) routing
- Policy-based routing
- Route maps
- Route redistribution (OSPF, BGP, RIP)
- Static IPv4 multicast routing
- Static unicast routing for IPv4
- UDP broadcast helper (IP helper)
- Virtual Routing and Forwarding Lite (VRF-Lite) up to 64 domains

IPv6 Features

- DHCPv6 client and relay
- DNSv6 client, DNSv6 relay
- IPv4 and IPv6 dual stack
- IPv6 aware storm protection and QoS
- IPv6 hardware ACLs
- Device management over IPv6 networks with SNMPv6, Telnetv6 and SSHv6
- IPv6 QoS support
- NTPv6 client and server
- Static and dynamic IPv6 multicast routing
- Static and dynamic unicast routing for IPv6
- Log to IPv6 hosts with Syslog v6
- VRF-Lite

Management

- Autonomous Management Framework Plus (AMF plus) enables powerful centralized management and zero-touch device installation and recovery
- Try AMF Plus for free with the built-in Starter license (includes network management and automation features, but not Vista Manager AMF Plus menu features)
- NETCONF/RESTCONF northbound interface with YANG data modelling
- OpenFlow northbound interface
- Console management port on the front panel for ease of access
- Eco-friendly mode allows ports and LEDs to be disabled to save power
- Industry-standard CLI with context-sensitive help
- Powerful CLI scripting engine
- Comprehensive SNMP MIB support for standards-based device management
- Built-in text editor
- Event-based triggers allow user-defined scripts to be executed upon selected system events
- USB interface allows software release files, configurations and other files to be stored for backup and distribution to other devices
- Vista Mini for easy network-wide management
- Web-based Graphical User Interface (GUI)

Quality of Service (QoS)

- 8 priority queues with a hierarchy of high priority queues for real time traffic, and mixed scheduling, for each switch port
- Limit bandwidth per port or per traffic class down to 64kbps
- Wirespeed traffic classification with low latency essential for VoIP and real-time streaming media applications
- Policy-based QoS based on VLAN, port, MAC and general packet classifiers
- Policy-based storm protection
- Extensive remarking capabilities
- Taildrop for queue congestion control
- Queue scheduling options for strict priority, weighted round robin or mixed scheduling
- IP precedence and DiffServ marking based on layer 2, 3 and 4 headers
- Enhanced Transmission Selection (ETS)
- Priority-based Flow Control (PFC)

Resiliency Features

- Control Plane Prioritization (CPP) ensures the CPU always has sufficient bandwidth to process network control traffic
- Dynamic link failover (host attach)
- EPSR (Ethernet Protection Switched Rings)
- EPSRing SuperLoop Protection (SLP)
- Ethernet Ring Protection Switching (ITU-T G.8032 ERPS)
- Link aggregation (LACP) on LAN ports
- Loop protection: loop detection and thrash limiting
- PVST+ compatibility mode
- Spanning Tree Protocols (STP, RSTP, MSTP)
- STP root guard
- VCStack fast failover minimizes network disruption
- Flexi-stacking - use any port-speed to stack
- Long-distance stacking (LD-VCStack)
- Virtual Router Redundancy Protocol (VRRP)

Security Features

- Access Control Lists (ACLs) based on layer 3 and 4 headers
- Configurable ACLs for management traffic
- Dynamic ACLs assigned via port authentication
- ACL Groups enable multiple hosts/ports to be included in a single ACL, reducing configuration
- Auth fail and guest VLANs
- RADIUS and TACACS+ Authentication, Authorisation and Accounting (AAA)
- Bootloader can be password protected for device security
- BPDU protection
- DHCP snooping, IP source guard and Dynamic ARP Inspection (DAI)
- DoS attack blocking and virus throttling
- Dynamic VLAN assignment
- Local RADIUS server for user and device authentication
- MAC-based authentication
- MAC address filtering and MAC address lock-down
- Media Access Control Security (MACSec)
- Network Access and Control (NAC) features manage endpoint security
- Port-based learn limits (intrusion detection)
- RADIUS group selection per VLAN or port
- RADIUS proxy
- Secure Copy (SCP)
- Secure File Transfer Protocol (SFTP) client
- Strong password security and encryption
- Tri-authentication: MAC-based, web-based and IEEE 802.1x

VLAN Support

- Private VLANs provide security and port isolation for multiple customers using the same VLAN
- Upstream Forwarding Only (UFO)
- VLAN ID translation
- Voice VLAN

Environmental Specifications

- Operating temperature range:
  0°C to 50°C (32°F to 122°F)
  Derated by 1°C per 305 meters (1,000 ft)
- Storage temperature range:
  -25°C to 70°C (-13°F to 158°F)
- Operating relative humidity range:
  5% to 90% non-condensing
- Storage relative humidity range:
  5% to 95% non-condensing
- Operating altitude:
  3,000 meters maximum (9,843 ft)

Electrical approvals and compliances

- EMC: ETSI EN300-386, EN300-132-2,
- FCC class A, VCCI class A
- Immunity: EN55024, EN61000-3-levels 2 (Harmonics), and 3 (Flicker) – AC models only

Safety

- Standards: UL62368-1, CAN/CSA-C22.2 No. 60950-1-03, EN60950-1, EN60825-1, AS/NZS 60950.1
- Certifications: UL, cUL, UL-EU

Restrictions on Hazardous Substances (RoHS) Compliance

- EU RoHS compliant
- China RoHS compliant-1

STANDARDS & PROTOCOLS

AlliedWare Plus Operating System

Version 5.5.5-2

Authentication

RFC 1321	MD5 Message-Digest algorithm
RFC 1828	IP authentication using keyed MD5

Border Gateway Protocol (BGP)

BGP dynamic capability
BGP outbound route filtering

RFC 1772	Application of the Border Gateway Protocol (BGP) in the Internet
RFC 1997	BGP communities attribute
RFC 2385	Protection of BGP sessions via the TCP MD5 signature option
RFC 2439	BGP route flap damping
RFC 2545	Use of BGP-4 multiprotocol extensions for IPv6 inter-domain routing
RFC 2858	Multiprotocol extensions for BGP-4
RFC 2918	Route refresh capability for BGP-4
RFC 3392	Capabilities advertisement with BGP-4
RFC 3882	Configuring BGP to block Denial-of-Service (DoS) attacks
RFC 4271	Border Gateway Protocol 4 (BGP-4)
RFC 4360	BGP extended communities
RFC 4456	BGP route reflection - an alternative to full mesh iBGP
RFC 4724	BGP graceful restart
RFC 4893	BGP support for four-octet AS number space
RFC 5065	Autonomous system confederations for BGP
RFC 5492	Capabilities advertisement with BGP-4
RFC 5925	The TCP authentication option
RFC 6793	BGP support for four-octet AS number space
RFC 7606	Revised error handling for BGP UPDATE messages

Cryptographic Algorithms

FIPS Approved Algorithms
Encryption (Block Ciphers):
AES (ECB, CBC, CFB and OFB Modes)
3DES (ECB, CBC, CFB and OFB Modes)
Block Cipher Modes:
CCM
CMAC
GCM
XTS
Digital Signatures & Asymmetric Key Generation:
DSA
ECDSA
RSA
Secure Hashing:
SHA-1
SHA-2 (SHA-224, SHA-256, SHA-384. SHA-512)
Message Authentication:
HMAC (SHA-1, SHA-2(224, 256, 384, 512)
Random Number Generation:
DRBG (Hash, HMAC and Counter)

Non FIPS Approved Algorithms
RNG (AES128/192/256)
DES
MD5

Ethernet Standards

IEEE 802.1AE Media Access Control Security (MACSec)
IEEE 802.2 Logical Link Control (LLC)
IEEE 802.3 Ethernet
IEEE 802.3ab1000BASE-T
IEEE 802.3ae10 Gigabit Ethernet
IEEE 802.3an10GBASE-T
IEEE 802.3azEnergy Efficient Ethernet (EEE)
IEEE 802.3ba 40GBASE-X
IEEE 802.3bj 100GBASE-X
IEEE 802.3by 25GBASE-X
IEEE 802.3x Flow control - full-duplex operation
IEEE 802.3z 1000BASE-X

IPv4 Features

RFC 768	User Datagram Protocol (UDP)
RFC 791	Internet Protocol (IP)
RFC 792	Internet Control Message Protocol (ICMP)
RFC 793	Transmission Control Protocol (TCP)
RFC 826	Address Resolution Protocol (ARP)
RFC 894	Standard for the transmission of IP datagrams over Ethernet networks
RFC 919	Broadcasting Internet datagrams
RFC 922	Broadcasting Internet datagrams in the presence of subnets
RFC 932	Subnetwork addressing scheme
RFC 950	Internet standard subnetting procedure
RFC 951	Bootstrap Protocol (BootP)
RFC 1027	Proxy ARP
RFC 1035	DNS client
RFC 1042	Standard for the transmission of IP datagrams over IEEE 802 networks
RFC 1071	Computing the Internet checksum
RFC 1122	Internet host requirements
RFC 1191	Path MTU discovery
RFC 1256	ICMP router discovery messages
RFC 1518	An architecture for IP address allocation with CIDR
RFC 1519	Classless Inter-Domain Routing (CIDR)
RFC 1542	Clarifications and extensions for BootP
RFC 1591	Domain Name System (DNS)
RFC 1812	Requirements for IPv4 routers
RFC 1918	IP addressing
RFC 2581	TCP congestion control
RFC 3021	Using 31-Bit Prefixes on IPv4 Point-to-Point Links

IPv6 Features

RFC 1981	Path MTU discovery for IPv6
RFC 2460	IPv6 specification
RFC 2464	Transmission of IPv6 packets over Ethernet networks
RFC 3484	Default address selection for IPv6
RFC 3587	IPv6 global unicast address format
RFC 3596	DNS extensions to support IPv6
RFC 4007	IPv6 scoped address architecture
RFC 4193	Unique local IPv6 unicast addresses
RFC 4213	Transition mechanisms for IPv6 hosts and routers
RFC 4291	IPv6 addressing architecture
RFC 4443	Internet Control Message Protocol (ICMPv6)
RFC 4861	Neighbor discovery for IPv6
RFC 4862	IPv6 Stateless Address Auto-Configuration (SLAAC)
RFC 5014	IPv6 socket API for source address selection
RFC 5095	Deprecation of type 0 routing headers in IPv6
RFC 5175	IPv6 Router Advertisement (RA) flags option
RFC 6105	IPv6 Router Advertisement (RA) guard

Management

AT Enterprise MIB including AMF Plus MIB and SNMP traps
Optical DDM MIB
SNMPv1, v2c and v3
ANSI/TIA-1057 LLDP-Media Endpoint Detection
IEEE 802.1AB Link Layer Discovery Protocol (LLDP)

RFC 1155	Structure and identification of management information for TCP/IP-based Internets

RFC 1157 Simple Network Management Protocol (SNMP)
RFC 1212 Concise MIB definitions
RFC 1213 MIB for network management of TCP/IP-based Internets: MIB-II
RFC 1215 Convention for defining traps for use with the SNMP
RFC 1227 SNMP MUX protocol and MIB
RFC 1239 Standard MIB
RFC 1724 RIPv2 MIB extension
RFC 2578 Structure of Management Information v2 (SMIv2)
RFC 2579 Textual conventions for SMIv2
RFC 2580 Conformance statements for SMIv2
RFC 2674 Definitions of managed objects for bridges with traffic classes, multicast filtering and VLAN
RFC 2741 Agent extensibility (AgentX) protocol
RFC 2787 Definitions of managed objects for VRRP
RFC 2819 RMON MIB (groups 1,2,3 and 9)
RFC 2863 Interfaces group MIB
RFC 3176 sFlow: a method for monitoring traffic in switched and routed networks
RFC 3411 An architecture for describing SNMP management frameworks
RFC 3412 Message processing and dispatching for the SNMP
RFC 3413 SNMP applications
RFC 3414 User-based Security Model (USM) for SNMPv3
RFC 3415 View-based Access Control Model (VACM) for SNMP
RFC 3416 Version 2 of the protocol operations for the SNMP
RFC 3417 Transport mappings for the SNMP
RFC 3418 MIB for SNMP
RFC 3635 Definitions of managed objects for the Ethernet-like interface types
RFC 3636 IEEE 802.3 MAU MIB
RFC 4022 MIB for the Transmission Control Protocol (TCP)
RFC 4113 MIB for the User Datagram Protocol (UDP)
RFC 4188 Definitions of managed objects for bridges
RFC 4292 IP forwarding table MIB
RFC 4293 MIB for the Internet Protocol (IP)
RFC 4318 Definitions of managed objects for bridges with RSTP
RFC 4560 Definitions of managed objects for remote ping, traceroute and lookup operations
RFC 5424 The Syslog protocol
RFC 6020 YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)
RFC 6241 Network Configuration Protocol (NETCONF)
RFC 6244 Architecture for Network Management Using NETCONF and YANG
RFC 6527 Definitions of managed objects for VRRPv3
RFC 7950 The YANG 1.1 Data Modeling Language
RFC 8040 RESTCONF Protocol

Multicast Support

Bootstrap Router (BSR) mechanism for PIM-SM
IGMP query solicitation
IGMP snooping (IGMPv1, v2 and v3)
IGMP snooping fast-leave
IGMP/MLD multicast forwarding (IGMP/MLD proxy)
MLD snooping (MLDv1 and v2)
PIM and PIM SSM for IPv6
RFC 1112 Host extensions for IP multicasting (IGMPv1)
RFC 2236 Internet Group Management Protocol v2 (IGMPv2)
RFC 2710 Multicast Listener Discovery (MLD) for IPv6
RFC 2715 Interoperability rules for multicast routing protocols
RFC 3306 Unicast-prefix-based IPv6 multicast addresses
RFC 3376 IGMPv3
RFC 3590 Source address selection for the Multicast Listener Discovery (MLD) protocol
RFC 3618 Multicast Source Discovery Protocol (MSDP)
RFC 3810 Multicast Listener Discovery v2 (MLDv2) for IPv6
RFC 3956 Embedding the Rendezvous Point (RP) address in an IPv6 multicast address
RFC 3973 PIM Dense Mode (DM)
RFC 4541 IGMP and MLD snooping switches
RFC 4604 Using IGMPv3 and MLDv2 for source-specific multicast
RFC 4607 Source-specific multicast for IP
RFC 7761 Protocol Independent Multicast - Sparse Mode (PIM-SM)

Open Shortest Path First (OSPF)

OSPF link-local signaling
OSPF MD5 authentication
Out-of-band LSDB resync
RFC 1245 OSPF protocol analysis
RFC 1246 Experience with the OSPF protocol
RFC 1370 Applicability statement for OSPF
RFC 1765 OSPF database overflow
RFC 2328 OSPFv2
RFC 2370 OSPF opaque LSA option
RFC 2740 OSPFv3 for IPv6
RFC 3101 OSPF Not-So-Stubby Area (NSSA) option
RFC 3509 Alternative implementations of OSPF area border routers
RFC 3623 Graceful OSPF restart
RFC 3630 Traffic engineering extensions to OSPF
RFC 4552 Authentication/confidentiality for OSPFv3
RFC 5329 Traffic engineering extensions to OSPFv3
RFC 5340 OSPFv3 for IPv6 (partial support)

Quality of Service (QoS)

IEEE 802.1p Priority tagging
IEEE 802.1Qaz Enhanced Transmission Selection (ETS)
IEEE 802.1Qbb Priority-based Flow Control (PFC)
RFC 2211 Specification of the controlled-load network element service
RFC 2474 DiffServ precedence for eight queues/port
RFC 2475 DiffServ architecture
RFC 2597 DiffServ Assured Forwarding (AF)
RFC 2697 A single-rate three-color marker
RFC 2698 A two-rate three-color marker
RFC 3246 DiffServ Expedited Forwarding (EF)

Resiliency Features

ITU-T G.8032 / Y.1344 Ethernet Ring Protection Switching (ERPS)
IEEE 802.1ag Connectivity Fault Management (CFM), Continuity Check Protocol (CCP)
IEEE 802.1AX Link aggregation (static and LACP)
IEEE 802.1D MAC bridges
IEEE 802.1s Multiple Spanning Tree Protocol (MSTP)
IEEE 802.1w Rapid Spanning Tree Protocol (RSTP)
IEEE 802.3ad Static and dynamic link aggregation
RFC 5798 Virtual Router Redundancy Protocol version 3 (VRRPv3) for IPv4 and IPv6

Routing Information Protocol (RIP)

RFC 1058 Routing Information Protocol (RIP)
RFC 2080 RIPng for IPv6
RFC 2081 RIPng protocol applicability statement
RFC 2082 RIP-2 MD5 authentication
RFC 2453 RIPv2

Security Features

SSH remote login
SSLv2 and SSLv3
IEEE 802.1X authentication protocols (TLS, TTLS, PEAP and MD5)
IEEE 802.1X multi-supplicant authentication
IEEE 802.1X port-based network access control
RFC 2560 X.509 Online Certificate Status Protocol (OCSP)
RFC 2818 HTTP over TLS ("HTTPS")
RFC 2865 RADIUS authentication
RFC 2866 RADIUS accounting
RFC 2868 RADIUS attributes for tunnel protocol support
RFC 2986 PKCS #10: certification request syntax specification v1.7
RFC 3546 Transport Layer Security (TLS) extensions
RFC 3579 RADIUS support for Extensible Authentication Protocol (EAP)
RFC 3580 IEEE 802.1x RADIUS usage guidelines
RFC 3748 PPP Extensible Authentication Protocol (EAP)
RFC 4251 Secure Shell (SSHv2) protocol architecture
RFC 4252 Secure Shell (SSHv2) authentication protocol
RFC 4253 Secure Shell (SSHv2) transport layer protocol
RFC 4254 Secure Shell (SSHv2) connection protocol
RFC 5176 RADIUS Change of Authorization (CoA)
RFC 5246 Transport Layer Security (TLS) v1.2
RFC 5280 X.509 certificate and Certificate Revocation List (CRL) profile
RFC 5425 Transport Layer Security (TLS) transport mapping for Syslog
RFC 5656 Elliptic curve algorithm integration for SSH
RFC 6125 Domain-based application service identity within PKI using X.509 certificates with TLS
RFC 6614 Transport Layer Security (TLS) encryption for RADIUS
RFC 6668 SHA-2 data integrity verification for SSH

Services

RFC 854 Telnet protocol specification
RFC 855 Telnet option specifications
RFC 857 Telnet echo option
RFC 858 Telnet suppress go ahead option
RFC 1091 Telnet terminal-type option
RFC 1350 Trivial File Transfer Protocol (TFTP)
RFC 1985 SMTP service extension
RFC 2049 MIME
RFC 2131 DHCPv4 (server, relay and client)
RFC 2132 DHCP options and BootP vendor extensions
RFC 2616 Hypertext Transfer Protocol - HTTP/1.1
RFC 2821 Simple Mail Transfer Protocol (SMTP)
RFC 2822 Internet message format
RFC 3046 DHCP relay agent information option (DHCP option 82)
RFC 3315 DHCPv6 (server, relay and client)
RFC 3396 Encoding long options in DHCPv4
RFC 3633 IPv6 prefix options for DHCPv6
RFC 3646 DNS configuration options for DHCPv6
RFC 3993 Subscriber-ID suboption for DHCP relay agent option
RFC 4330 Simple Network Time Protocol (SNTP) version 4
RFC 4954 SMTP service extension for authentication
RFC 5905 Network Time Protocol (NTP) version 4

VLAN Support

Generic VLAN Registration Protocol (GVRP)
IEEE 802.1ad Provider bridges (VLAN stacking, Q-in-Q)
IEEE 802.1Q Virtual LAN (VLAN) bridges
IEEE 802.1v VLAN classification by protocol and port
IEEE 802.3ac VLAN tagging
Static VXLAN tunnels (part of RFC 7348)

Voice over IP (VoIP)

LLDP-MED ANSI/
Voice VLAN

FEATURE LICENSES

	Description	Includes	Stack Licensing
AT-FL-x560-01	x560 Premium license	■ OSPFv2 (12,000 routes)[1] ■ BGP4 (5,000 routes)[1] ■ PIMv4-SM, DM and SSM v4 ■ RIPng (12,000 routes) ■ OSPFv3 (12,000 routes) ■ MLDv1/v2 ■ PIM-SMv6/SSMv6 ■ VLAN doube tagging (Q-in-Q) ■ VLAN Translation ■ RADIUS Full ■ VRF-Lite (64 domains)	■ One license per stack member
AT-SW-APM10-1YR[2]	Cumulative AMF Plus Master license	■ AMF Plus Master license for up to 10 nodes for 1 year	■ One license per stack
AT-SW-APM10-5YR[2]	Cumulative AMF Plus Master license	■ AMF Plus Master license for up to 10 nodes for 5 years	■ One license per stack
AT-FL-x560-OF13-1YR	OpenFlow license	■ OpenFlow v1.3 for 1 year	■ Not supported on a stack
AT-FL-x560-OF13-5YR	OpenFlow license	■ OpenFlow v1.3 for 5 years	■ Not supported on a stack
AT-FL-x560-MSEC[3]	MACSec license	■ Media Access Control Security	■ One license per stack

[1] 64 OSPF and BGP routes included in base license
[2] Purchase one license per 10 nodes (up to 50 nodes maximum)
[3] MACSec is only supported on ports 1–16, and uplink ports 25–28

ORDERING INFORMATION

AT-x560-28YSQ	24-port 1/10/25G SPF28 stackable switch with 4 x 40/100G QSFP28 uplink ports, and dual fixed power supplies
AT-VT-Kit3	Management cable (USB to serial console)

Accessories

100G QSFP28 Modules	
AT-QSFP28-SR4	100GSR 850 nm short-haul up to 100 mwith MMF
AT-QSFP28-LR4	100GLR 1310 nm medium-haul, 10 km with SMF
AT-QSFP28-1CU	1 meter QSFP28 direct attach cable
AT-QSFP28-3CU	3 meter QSFP28 direct attach cable
40G QSFP+ Modules	
AT-QSFPSR4	40GSR4 850nm short-haul up to 150 m with MMF, MPO-12
AT-QSFPSR4LCa	40GSR4 850 nm short-haul up to 150 m with MMF, LC
AT-QSFPLR4	40GLR4 1310 nm medium-haul, 10 km with SMF
AT-QSFPER4	40GER4 1310 nm long-haul, 40 km with SMF
AT-QSFP1CU	1 meter QSFP+ direct attach cable
AT-QSFP3CU	3 meter QSFP+ direct attach cable

25G SFP28 Modules	
AT-SP25SR/I	100 m, 25G SFP, LC, MMF, 850 nm, industrial temperature, TAA[4]
AT-SP25LR/I	10 km, 25G SFP, LC, SMF, 1310 nm, industrial temperature, TAA[4]
AT-SP25TW1	1 m, 25G SFP, direct attach cable
AT-SP25TW3	3 m, 25G SFP, direct attach cable
10GbE SFP+ Modules	
AT-SP10SR	10GSR 850 nm short-haul, 300 m with MMF
AT-SP10SR/I	10GSR 850 nm short-haul, 300 m with MMF industrial temperature
AT-SP10LRM	10GLRM 1310 nm short-haul, 220 m with MMF
AT-SP10LR	10GLR 1310 nm medium-haul, 10 km with SMF
AT-SP10LRa/I	10GLR 1310 nm medium-haul, 10 km with SMF industrial temperature

[4] Trade Act Agreement compliant

10GbE SFP+ Modules	
AT-SP10ER20/I	10GER 1310 nm long-haul, 20 km with SMF industrial temperature
AT-SP10ER40a/I	10GER 1310 nm long-haul, 40 km with SMF industrial temperature
AT-SP10ZR80/I	10GER 1550 nm long-haul, 80 km with SMF industrial temperature
AT-SP10TM/I	1G/2.5G/5G/10G, 100 m copper, industrial temperature, TAA[4]
AT-SP10TW1	1 meter SFP+ direct attach cable
AT-SP10TW3	3 meter SFP+ direct attach cable
AT-SP10TW7	7 meter SFP+ direct attach cable

[4] Trade Act Agreement compliant

1000Mbps SFP Modules	
AT-SPSX/I	1000SX GbE multi-mode 850 nm fiber up to 550 m industrial temperature
AT-SPTX	10/100/1000T 100 m copper
AT-SPSX	1000SX GbE multi-mode 850 nm fiber up to 550 m
AT-SPEX	1000X GbE multi-mode 1310 nm fiber up to 2 km
AT-SPLX10a	1000LX GbE single-mode 1310 nm fiber up to 10 km, TAA[4]
AT-SPLX10/I	1000LX GbE single-mode 1310 nm fiber up to 10 km industrial temperature
AT-SPBD10-13	1000LX GbE Bi-Di (1310 nm Tx, 1490 nm Rx) fiber up to 10 km
AT-SPBD10-14	1000LX GbE Bi-Di (1490 nm Tx, 1310 nm Rx) fiber up to 10 km
AT-SPLX40	1000LX GbE single-mode 1310 nm fiber up to 40 km
AT-SPZX80	1000ZX GbE single-mode 1550 nm fiber up to 80 km