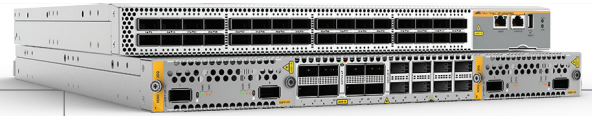


# x980 Series

## 40/100/400 Gigabit Layer 3 Data Center Switches



Allied Telesis x980 Series powers data-driven environments, and support the demand for instant access to business information, always connected apps, and cloud-first networking, all in a scalable future-proof solution.

High-performing models come with 32 x 100/400G or 32 x 40/100G ports, and a rich data center and enterprise feature set that ensures flexible deployment.

Enable high-speed spine and leaf Clos network topology in the data center at up to 400Gbps – while the capacity and performance of the x980 Series also supports powerful enterprise core environments.

### Data center performance

Ensure lossless low latency data forwarding from Top-of-Rack server deployment, with data center bridging features like Enhanced Transmission Selection (ETS) and Priority-based Flow Control (PFC).

The x980 Series provides always-on data availability and network resiliency with Multi-Chassis LAG (MLAG)<sup>1</sup>, while workload mobility, virtual scalability, and seamless connectivity are provided by Ethernet VPN (EVPN)<sup>1</sup> and VXLAN<sup>2</sup>.

### Hyper-Converged Infrastructure (HCI)

The x980 Series 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

The x980 Series comes pre-installed with the AlliedWare Plus™ operating system. They can also be deployed running the Community SONiC operating system – see your Allied Telesis representative for further information.

For easy integration into complex networks such as HCI that comprise physical, virtual, and multi-vendor devices, the x980 Series features:

- NETCONF/RESTCONF<sup>1</sup> APIs with OpenConfig YANG models.
- Ansible<sup>1</sup> Playbook libraries for automating common Day-1/Day-2 operations.

### 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™ 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.

### Enterprise resiliency

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.

For enterprise network core deployment, the x980 series can form a VCStack of multiple 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.

## Key Features



- 32 x 100/400G ports (x980-32DQ)
- 32 x 40/100G ports (x980-32CQ)
- AlliedWare Plus and SONiC modes of operation
- Data Center Bridging Capabilities Exchange Protocol (DCBX)
- Enhanced Transmission Selection (ETS)
- Priority-based Flow Control (PFC)
- Multi-Chassis LAG (MLAG)<sup>1</sup>
- Ethernet VPN (EVPN)<sup>1</sup>
- Virtual Extensible LAN (VXLAN)<sup>2</sup>
- Autonomous Management Framework Plus™ (AMF Plus)
- Virtual Chassis Stacking (VCStack™)
- EPSRing™ and G.8032, ERPS for resilient rings
- Active Fiber Monitoring for fiber data and stacking links
- Link Monitoring
- NETCONF/RESTCONF<sup>1</sup> with OpenConfig YANG models
- Virtual Routing and Forwarding (VRF) Lite
- Bidirectional Forwarding Detection (BFD)
- Upstream Forwarding Only (UFO)

## Reliable

Hot-swappable components such as fans, and load-sharing Power Supply Units (PSUs) pair with near hitless online stack reconfiguration, to ensure that maintenance doesn't affect network uptime.

<sup>1</sup> Available in a future software release

<sup>2</sup> VXLAN static tunnels supported. Dynamic tunnels available in a future software release

# KEY FEATURES

## Data center features

Data Center Bridging Capabilities Exchange Protocol (DCBX) lets network devices in the data center automatically discover and negotiate settings for DCB features, ensuring optimized performance.

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.

Multi-Chassis LAG (MLAG)<sup>1</sup> ensures resilience in data center networks by enabling multiple switches to act as a single logical device, coordinating their forwarding states to ensure load-balancing and redundancy.

Ethernet VPN (EVPN)<sup>1</sup> extends L2 connectivity across L3 networks providing a unified control plane, and partners with VXLAN as the data plane.

Virtual Extensible LAN (VXLAN)<sup>2</sup> tunnels join two or more L2 networks over an L3 IP network to form a single L2 broadcast domain. EVPN can automatically create VXLAN tunnels for flexibility and scalability in dynamic data center environments.

## 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 x980 Series 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.

## 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 x980 Series is VRF aware, enabling the supply of IP addresses to clients across multiple isolated networks

## VCStack

Create a VCStack of multiple 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 if one of the units fails. Aggregating switch ports on different units across the stack provides excellent network resiliency.

## Long Distance Stacking

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

## 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 x980 series 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 can be deployed stand-alone, or 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

Active Fiber Monitoring 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. Active Fiber Monitoring is supported on fiber data and fiber stacking links

## 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.

## Bi-Directional Forwarding Detection (BFD)

BFD enables fast detection of link failures, to minimize recovery. It works with static routes, and alongside BGP and OSPF 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 manages 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.

## NETCONF/RESTCONF

NETCONF/RESTCONF<sup>1</sup> 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.

## Wireless network management

Integrated into the Device GUI, the wireless manager provides full network visibility of AMF Plus wired and AWC wireless devices. Manage and simplify wireless deployment, and provide a superior user experience with AWC automated wireless network optimization.

## AMF Security and Application Proxy

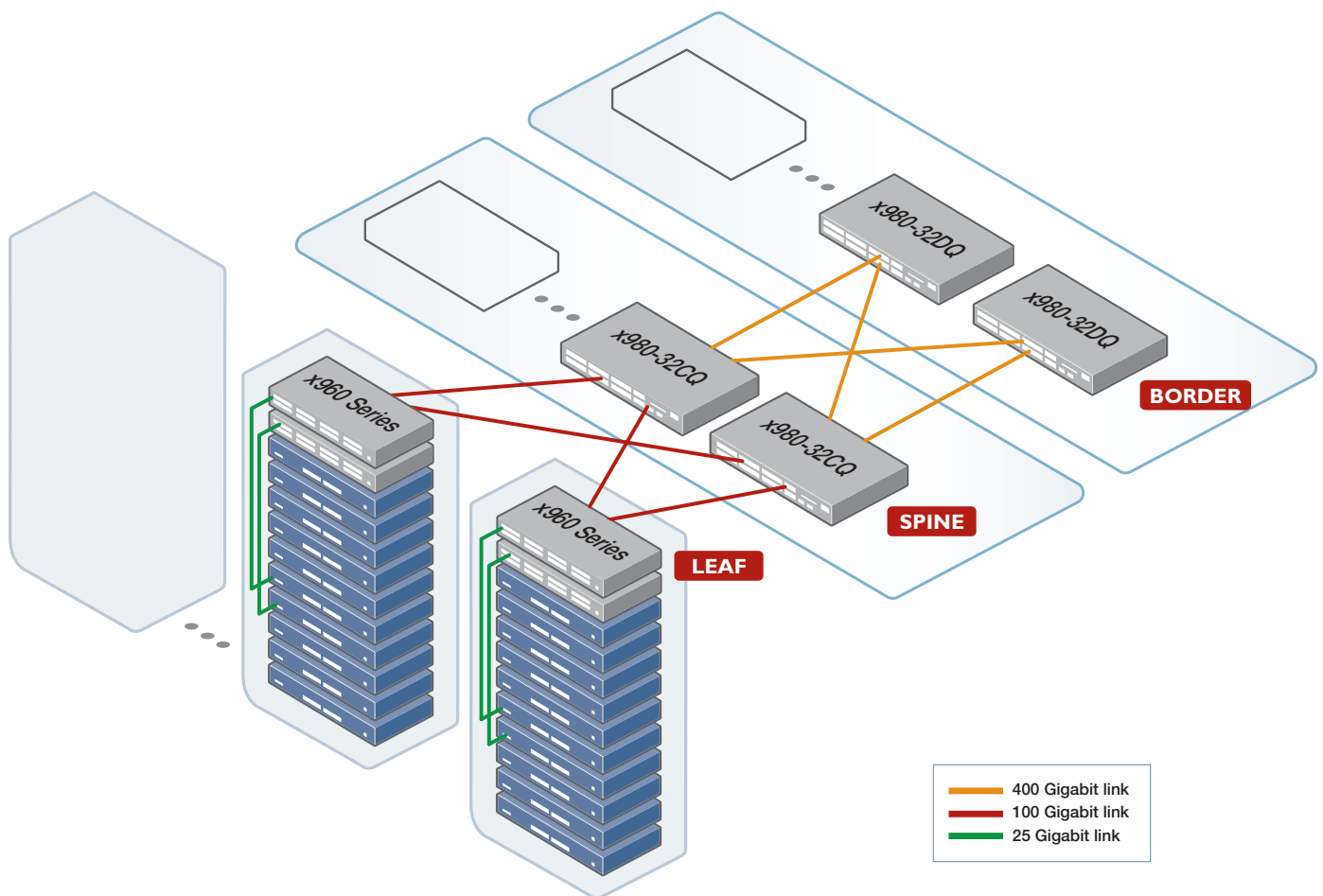
The AMF-Security (AMF-Sec) solution enables internal LAN threat detection and automatic end-point isolation to protect the network. The AMF Application Proxy (included for free in the base license) enables the AMF-Sec controller to communicate with the AMF Plus master when a threat is detected, so the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

<sup>1</sup> Available in a future software release

<sup>2</sup> VXLAN static tunnels supported. Dynamic tunnels available in a future software release

## KEY SOLUTIONS

# Data center spine and leaf connectivity



Today's businesses consume more data than ever, which has become critical to effective operation with always-on access to online resources and applications required. The move to using tools like generative AI and real-time collaboration has lifted the demand for increased performance and information delivery.

Data center Hyper-Converged Infrastructure (HCI) enables servers, storage, and switches to connect seamlessly in supporting data-driven environments. Centralized SDN management powers hardware and software resources which can be pooled as required. This lowers cost and complexity while enabling better scalability

and agility in managing and deploying IT services.

The x980 series enables high-performing spine and leaf connectivity at up to 400G. Partnered with x960 Series (available soon) Top of Rack (TOR) switches to provide 25G to servers, data transfer and information delivery is immediate.

Data Center Bridging Capabilities Exchange Protocol (DCBX) lets network devices in the data center automatically discover and negotiate settings for DCB features, ensuring optimized performance.

Ensure consistent bandwidth control and lossless forwarding with Enhanced

Transmissions Selection (ETS) and Priority-based Flow Control (PFC).

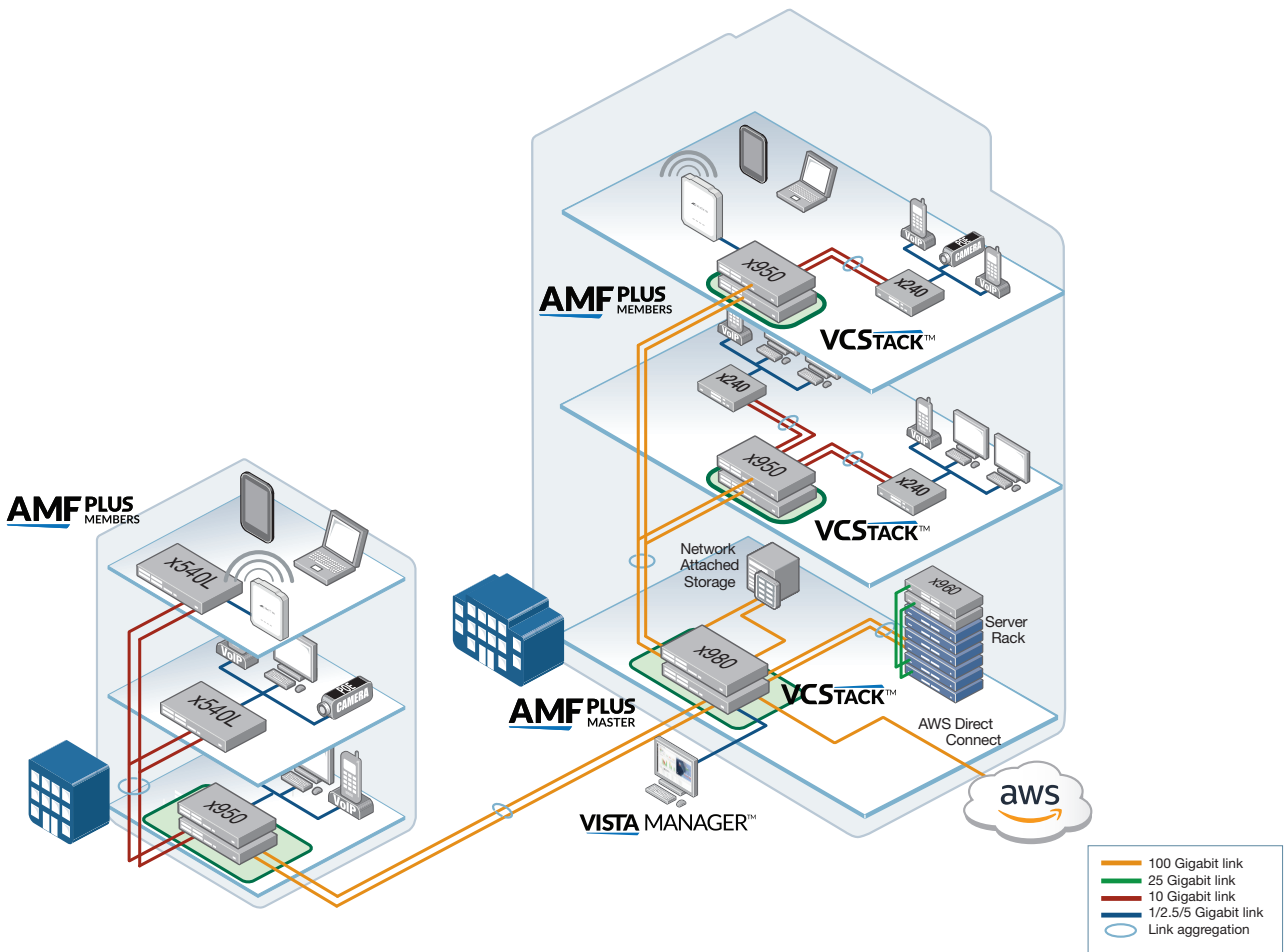
Network resiliency is assured using Multi-Chassis LAG (MLAG)<sup>1</sup>, while workload mobility, virtual scalability, and seamless connectivity are provided by Ethernet VPN (EVPN)<sup>1</sup> and VXLAN<sup>2</sup>.

As well as Allied Telesis innovative management tools like AMF Plus and Vista Manager, the x980 Series supports industry standard control protocols such as Netconf/Restconf<sup>1</sup>, OpenFlow, and Ansible<sup>1</sup>, so custom data center management applications and tools can be easily integrated.

<sup>1</sup> Available in a future software release

<sup>2</sup> VXLAN static tunnels supported. Dynamic tunnels available in a future software release

# Enterprise network core



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 100G network core features the x980-32CQ (32 x 100G port) switch, and Virtual Chassis Stacking (VcStack) for high availability, increased capacity and ease of management.

Using VcStack at the core 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 Amazon 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.

AMF Plus allows the entire network to be unified for ease of management. The x980-32CQ acts as the AMF Plus Master, 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.

The x980-32CQ delivers a protocol-less and Active/Active campus backbone solution, with high performance and flexible scalability.

# SPECIFICATIONS

	10G SFP ports	40/100G QSFP28 ports	100/400 QSFP56-DD ports	Switching Fabric	Forwarding Rate
<b>x980-32DQ</b>	2	-	32	25.6Tbps	5.6Bpps
<b>x980-32CQ</b>	-	32	-	6.4Tbps	2.8Bpps

## Physical Specifications

	Width	Depth	Height	Mounting	Weight
<b>x980-32DQ</b>	440 mm (17.32 in)	572 mm (22.51 in)	44 mm (1.73 in)	Rack-mount 1 RU	12.2 kg (26.9 lb)
<b>x980-32CQ</b>	440 mm (17.32 in)	490 mm (19.29 in)	44 mm (1.73 in)	Rack-mount 1 RU	9.4 kg (20.7 lb)

## Power and Noise Characteristics

	Max Power Consumption	Max Heat Dissipation	Noise
<b>x980-32DQ</b>	1120W	3,823 BTU/hr	78 dBA
<b>x980-32CQ</b>	649W	2,215 BTU/hr	66 dBA

## Performance

- Up to 160K MAC addresses
- Up to 1,000 static routes
- Up to 16,000 dynamic routes
- Up to 10KB jumbo frames
- 4K configurable VLANs
- 16GB DDR SDRAM
- 64GB SSD storage (x980-32DQ)
- 128GB SSD storage (x980-32CQ)

## Reliability

- Modular AlliedWare Plus operating system
- Dual hot swappable PSUs with 1 + 1 redundancy
- Dual feed support: a separate power circuit can feed each power supply providing extra reliability
- Hot-swappable fan modules
- Full environmental monitoring of PSUs, fans, temperature and internal voltages, with SNMP traps to 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
- 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
- NTP 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
- NETCONF/RESTCONF<sup>1</sup> northbound interface with YANG data modelling
- OpenAPI compliant RESTful APIs
- 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

<sup>1</sup> Available in a future software release

- 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
- Data Center Bridging Capabilities Exchange Protocol (DCBX)
- 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
- Multi-Chassis LAG (MLAG)<sup>1</sup>
- 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
- 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
- Simple Certificate Enrollment Protocol (SCEP) supports secure management

- 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

- Electro Magnetic Compatibility: ICES-003 Issue 7 (2020), EN55032+EN55035, EN300386, BS55032/55035
- Electro Magnetic Interference: FCC Class A, EN55032 Class A, CISPR 32, VCCI Class A

## Safety

- x980-32CQ: UL62368-1 ed.3, CB IEC/EN 62368-1 ed.2, TUV T-mark EN62368-1 2014
- x980-32DQ: UL62368-1 ed.3, CB IEC/EN 62368-1 ed.3, TUV T-mark EN IEC 62368-1 2020+A11

## Restrictions on Hazardous Substances (RoHS) Compliance

- EU RoHS compliant
- China RoHS compliant-1

# STANDARDS & PROTOCOLS

## AlliedWare Plus Operating System

Version 5.5.6-0

### 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 802.2 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 802.3bs 400GBASE-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

<sup>1</sup> Available in a future software release

## 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 Data Center Bridging Capabilities Exchange Protocol (DCBX)
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-suplicant 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 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
RFC 8446 Transport Layer Security (TLS) v1.3
RFC 8894 Simple Certificate Enrollment Protocol (SCEP)

## 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
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## FEATURE LICENSES

	Description	Includes	Stack Licensing
<b>AT-FL-x980-01</b>	x980 Premium license	<ul style="list-style-type: none"> <li>■ OSPF (16,000 routes)<sup>3</sup></li> <li>■ BGP (16,000 routes)<sup>3</sup></li> <li>■ PIMv4-SM, DM and SSM (2,000 entries)</li> <li>■ RIPng (8,000 routes)</li> <li>■ QSPFv3 (8,000 routes)</li> <li>■ BGP4+ (8,000 routes)</li> <li>■ PIMv6-SM and SSM (1,000 entries)</li> <li>■ MLDv1 and v2</li> <li>■ RADIUS Full</li> <li>■ UDLD</li> <li>■ VLAN double tagging (Q-in-Q)</li> <li>■ VLAN Translation</li> <li>■ VXLAN</li> <li>■ PTP Transparent Mode</li> <li>■ VRF lite (64 domains)</li> </ul>	<ul style="list-style-type: none"> <li>■ One license per stack member</li> </ul>
<b>AT-SW-APM10-1YR<sup>4,5</sup></b>	Cumulative AMF Plus Master license	<ul style="list-style-type: none"> <li>■ AMF Plus Master license for up to 10 nodes for 1 year</li> </ul>	<ul style="list-style-type: none"> <li>■ One license per stack</li> </ul>
<b>AT-SW-APM10-5YR<sup>4,5</sup></b>	Cumulative AMF Plus Master license	<ul style="list-style-type: none"> <li>■ AMF Plus Master license for up to 10 nodes for 5 years</li> </ul>	<ul style="list-style-type: none"> <li>■ One license per stack</li> </ul>
<b>AT-FL-x980-OF13-1YR</b>	OpenFlow license	<ul style="list-style-type: none"> <li>■ OpenFlow v1.3 for 1 year</li> </ul>	<ul style="list-style-type: none"> <li>■ Not supported on a stack</li> </ul>
<b>AT-FL-x980-OF13-5YR</b>	OpenFlow license	<ul style="list-style-type: none"> <li>■ OpenFlow v1.3 for 5 years</li> </ul>	<ul style="list-style-type: none"> <li>■ Not supported on a stack</li> </ul>
<b>AT-FL-x980-VLF</b>	VRF-Lite Full license	<ul style="list-style-type: none"> <li>■ VRF lite (600 domains)</li> </ul>	<ul style="list-style-type: none"> <li>■ One license per stack member</li> </ul>

<sup>3</sup> 64 OSPF and BGP routes included in base license

<sup>4</sup> From AW+ version 5.5.2-2 onwards, AMF Plus licenses provide all standard AMF network management and automation features. They also enable the AMF Plus intent-based networking features in Vista Manager EX (from version 3.10.1 onwards)

<sup>5</sup> Purchase one license per 10 nodes (up to 180 nodes maximum)

## ORDERING INFORMATION

### x980-32DQ

<b>AT-x980-32DQ</b>	Lossless, Low-latency Data center Layer 3 switch with 32 x 100G/400G QSFP28/QSFP-DD ports, dual hot-swappable PSUs, and 6 x Fan modules bays. (6 x Fan modules included. 2 x PSUs need to be ordered separately).
<b>AT-PWRSYS5-xy0<sup>6</sup></b>	1600W AC system power supply, Front-to-back airflow
<b>AT-PWRSYS5-x80<sup>6</sup></b>	1600W DC system power supply, Front-to-back airflow

### x980-32CQ

<b>AT-x980-32CQ</b>	Lossless, Low-latency Data center Layer 3 switch with 32 x 40G/100G QSFP+/QSFP28 ports, dual hot-swappable PSUs, and 5 x Fan modules bays. (5 x Fan modules included. 2 x PSUs need to be ordered separately).
<b>AT-PWRSYS4-xy0<sup>6,7</sup></b>	1600W AC system power supply, Front-to-back airflow
<b>AT-PWRSYS4-x80<sup>6,7</sup></b>	1600W DC system power supply, Front-to-back airflow
<b>AT-PWRSYS4R-xy0<sup>6,7,8</sup></b>	1600W AC system power supply, Back-to-front reverse airflow
<b>AT-PWRSYS4R-x80<sup>6,7,8</sup></b>	1600W DC system power supply, Back-to-front reverse airflow
<b>AT-FAN17</b>	Hot-swappable fan module, Front-to-back airflow
<b>AT-FAN17R<sup>8</sup></b>	Hot-swappable fan module, Back-to-front reverse airflow

<sup>6</sup> Where x = 0 for non-TAA and 9 for TAA compliant  
Where y = 1 for US power cord  
3 for UK power cord  
4 for AU power cord  
5 for EU power cord

<sup>7</sup> PSUs used in the switch must be of the identical part number. Using non-matching PSUs voids the product warranty.

<sup>8</sup> Reverse airflow support available in a future software release.

## Accessories

400G QSFP56-DD Modules	
AT-QSFPDD-SR8 <sup>9</sup>	400G, QSFPDD, MPO, 850 nm short-haul up to 100 m with MMF
AT-QSFPDD-1CU	1 meter QSFPDD direct attach cable
AT-QSFPDD-2.5CU	2.5 meter QSFPDD direct attach cable
100G QSFP28 Modules	
AT-QSFP28-SR4	100GSR 850nm short-haul up to 100 m with MMF
AT-QSFP28-LR4	100GLR 1310nm 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 850 nm 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

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
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

<sup>9</sup> Available soon