Allied Telesis

x540L Series

10 Gigabit Stackable Switches

Allied Telesis x540L Series 10 Gigabit Layer 3 stackable switches provide highspeed distribution or edge connectivity. All ports support up to 10G speed enabling seamless communication for modern applications, and Multi-Gigabit support ensures flexible deployment.

Overview

Allied Telesis x540L Series switches provide high performance with up to 10G connectivity on every port. At the distribution layer, the power of Virtual Chassis Stacking (VCStack[™]) enables a resilient solution where up to 4¹ units, whether copper of fiber models, can be managed as a single virtual device for simplicity and flexibility.

The x540L-28XTm supports Multi-Gigabit (1/2.5/5/10G) copper ports for flexible deployment, while the x540L-28XS has 1/10G SFP fiber ports for secure long distance connectivity.

High-speed for next generation networks

The x540L Series provides both copper and fiber connectivity options at up to 10G. Support next-generation networks, with their increasingly high bandwidth demands for modern applications like remote working and high-definition videoconferencing.

Device and network management

The Device GUI enables graphical monitoring of key switch features to support easy management.

Integrated into the Device GUI, Vista Manager[™] mini supports visibility and management of AMF Plus wired and AWC wireless network devices, making it ideal as a one-stop solution for small to medium-sized networks.

AWC is an intelligent, easy to use Wireless LAN controller that automatically maintains optimal wireless coverage. Vista Manager mini includes AWC floor and heat maps showing wireless coverage. It also supports AWC Channel Blanket hybrid operation, providing maximum performance and seamless roaming, as well as AWC Smart Connect for simplified deployment, and a resilient Wi-Fi network solution using wireless uplink connectivity.

¹ Up to 2-units stacking is supported at initial release. 4-units stacking will be supported in a future software release

² Supported in a future software release

Resiliency

Converging network services means increasing demand for highly available networks with minimal downtime. VCStack, in conjunction with link aggregation, provides a network with no single point of failure, and provides access application resiliency.

Ethernet Protection Switched Ring (EPSRing™), and the standards-based G.8032 Ethernet Ring Protection, ensure distributed networks have highspeed access to online resources and applications.

Advanced Layer 3 performance

The x540L Series support both static routes and RIP, OSPF and BGP routing protocols. Easily manage Layer 3 environments, and increase routing capability when required with licensing.

Secure

The x530 Series offers powerful control over network traffic types, secure management options, loop guard to protect against cabling mistakes, and triauthentication for comprehensive access control.

Network protection

Advanced storm protection features include bandwidth limiting, policy-based storm protection and packet storm protection.

Network storms are often caused by cabling errors that result in a network loop. The x540L Series provide features to detect loops as soon as they are created. Loop detection and thrash limiting take immediate action to prevent network storms.

Future-proof

x540L Series switches are Software Defined Networking (SDN) ready and support OpenFlow v1.3.

Powerful network management

Autonomous Management Framework[™] Plus (AMF Plus) automates everyday management tasks, as the complete network can be managed as a single virtual device. Growing the network

AMF^{PLUS} EPSRING[™] VCSTACK[™] ACTIVE FIBER MONITORING[™] Allied Ware Plus

is plug-and-play simple, and device recovery fully zero-touch.

Cybersecurity

The x540L Series acting as AMF Plus members are compatible with our AMF-Security solution, which enables a self-defending network. The AMF–Sec controller responds immediately to any internal malware threats by instructing the x540L Series to isolate the affected part of the network, and quarantine the suspect device. Vista Manager EX alerts networks administrators of threats that have been dealt with.

Key Features

- ► AlliedWare Plus fully featured OS
- Autonomous Management Framework Plus (AMF Plus)
- ► AMF-Security compatible
- 1/2.5/5/10G (Multi-Gigabit) connectivity on copper ports
- 1/10G (SFP and SFP+) connectivity on fiber ports
- VCStack 4 units¹ at any speed
- EPSR and G.8032 high-speed resilient rings
- Active Fiber Monitoring
- Link Monitoring
- VLAN ACLs
- Precision Time Protocol (PTP) transparent mode²
- VLAN mirroring (RSPAN)
- Upstream Forwarding Only (UFO)
- OpenFlow v1.3 for SDN
- Static and dynamic routing for L3 environments
- NETCONF/RESTCONF with YANG data modelling
- Vista Manager mini enables:
 - » Wired and wireless network visibility
 - » AWC wireless network management
 - » AWC-Channel Blanket hybrid wireless
- » AWC-Smart Connect wireless uplinks

Key Features

Vista Manager mini

Integrated into the Device GUI, Vista Manager mini provides full network visibility of AMF Plus wired and AWC wireless devices. Manage and simplify wireless deployment with AWC-Smart Connect, and support optimal wireless performance from AWC hybrid operation with maximum throughput and a seamless 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 administration.
- The x540L Series can operate as the AMF Plus master, storing firmware and configuration backups for other network nodes. The AMF Plus master enables auto-backup and auto-recovery for zero-touch device replacement, while auto-provisioning and auto-upgrade provide appropriate files to new network members. New network devices can be pre-provisioned, making installation plug-and-play easy because no onsite configuration is required.
- An AMF Plus license provides all standard AMF network management and automation features, and also enables the AMF Plus intent-based networking features menu in Vista Manager EX (from version 3.10.1 onwards).

AWC Wireless Management

- Optimize wireless network performance with the Autonomous Wave Controller (AWC), built-in to the x540L Series. AWC analyzes wireless traffic patterns and automatically reconfigures access points to meet demand.
- Wireless network operation in multi-channel, single-channel (Channel Blanket), and hybrid (multi-channel and Channel Blanket) modes, supports maximum data throughput and seamless roaming for the most flexible wireless solution available.
- AWC-Smart Connect (AWC-SC) enables plug-and play wireless network growth, as new APs only need a power connection, and will then automatically create resilient wireless uplink connections to other APs.

High Speed

The x540L Series supports Multi-Gigabit (1/2.5/5/10G) speeds on copper and SFP and SFP+ (1/10G) speeds on fiber, for flexible high-density high-speed distribution or edge connectivity in next-generation networks.

Virtual Chassis Stacking (VCStack™)

Create a VCStack of up to four units' with 40Gbps stacking bandwidth to each unit, which has dual links for increased 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.

Ethernet Protection Switched Ring (EPSRing[™])

EPSRing allows several x540L switches to join a protected ring capable of recovery within as little as 50ms. This feature is perfect for high availability in enterprise networks.

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.

Advanced Layer 3 routing

The x540L Series support both static routes and RIP, OSPF and BGP. Increased routing capacity can be added with the premium software license.

Access Control Lists (ACLs)

ACLs filter network traffic to control whether routed packets are forwarded or blocked, and can be applied to a specific port or a VLAN. This provides a powerful network security mechanism to select the types of traffic to be analyzed, forwarded, or influenced in some way

NETCONF/RESTCONF

 NETCONF/RESTCONF with YANG data modeling provides a standardized way to represent data and securely configure devices.

Storm protection

- Protect the network from broadcast storms::
- Bandwidth limiting minimizes the effects of the storm by reducing the amount of flooding traffic.
- Policy-based storm protection is more powerful than bandwidth limiting. It restricts storm damage to within the storming VLAN, with a defined traffic rate. The action the device should take when it detects a storm can be configured, such as disabling or shutting down the port.

Loop protection

Thrash limiting, also known as Rapid MAC movement, detects and resolves network loops. It is highly user-configurable — from the rate of looping traffic to the type of action the switch should take when it detects a loop.

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 a real-time view of network traffic.

Tri-authentication

Authentication options include 802.1x port authentication, web authentication for guest access, and MAC authentication for end points without an 802.1x supplicant. All three can be used simultaneously.

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.

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 an AAA solution.

UniDirectional Link Detection

UniDirectional Link Detection (UDLD) is useful for monitoring fiber-optic links between two switches that use two single-direction fibers to transmit and receive packets. UDLD prevents traffic from being sent across a bad link by blocking the ports at both ends of the link in the event that either the individual transmitter or receiver for that connection fails.

Optical DDM

Most SFP/SFP+/XFPs support Digital Diagnostics Monitoring (DDM) functions, which enables real time monitoring of transceiver parameters, such as optical output power, temperature, laser bias current and supply voltage. This simplifies diagnosing problems with optical modules and fiber connections.

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.

VLAN Mirroring (RSPAN)

VLAN mirroring allows traffic from a port on a remote switch to be analyzed locally. Traffic being transmitted or received on the port is duplicated and sent across the network on a special VLAN.

Find Me

In busy server rooms it can be quite a job finding the correct switch quickly. "Find Me" is a simple visual way to identify the switch by causing its LEDs to flash in a specified pattern.

Precision Time Protocol (PTP)²

 PTP (IEEE 1588v2) sychronizes clocks throughout the network with micro-second accuracy, supporting industrial automation and control systems.

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 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 x540L Series is VRF aware, enabling the supply of IP addresses to clients across multiple isolated networks.
- ¹ Up to 2-units stacking is supported at initial release. 4-units stacking will be supported in a future software release
- ² Supported in a future software release

Key Solutions

Flexible edge connectivity

Modern networks require superior performance to support the latest high-bandwidth applications, as well as the increasing number of wireless devices accessing online business resources. A high-speed resilient EPSR ring ensures always-on connectivity.

As shown in diagram 1, the x540L Series supports multi-gigabit speeds of 2.5 and 5G, which are ideal for high-speed wireless, while 10G supports high performance server connectivity.

High performing network distribution

As shown in diagram 2, the x540L Series is provides up to 10G connectivity on every port for high performance. VCStack enables deploying a single virtual unit comprised of up to 4 physical copper and/or fiber switches for a fully resilient network distribution layer solution.

When combined with other advanced Allied Telesis products, such as x250/x240/x230 series edge switches, and the SBx908 GEN2 and x950 core switches, networks with high-capacity right to the edge can be deployed.

AMF Plus network management and automation provides an easy yet powerful solution. Simplified management of multiple devices, zero-touch replacement, and plug-and-play upgrades reduce administration time and effort.

VCSTACKTM



10 Gigabit lii 5 Gigabit lini

1 Gigabit link

Link aggregation

Key Solutions

Integrated wireless LAN management



Allied Telesis Autonomous Wave Controller (AWC) offers solutions for two of the most common problems with Wireless LANs: initial setup complexity and on-going performance degradation. Initial WLAN set-up usually requires a site survey to achieve the best coverage; and performance of WLANs can often change over time as external sources of radio interference reduce coverage and bandwidth. These issues can be time-consuming to identify and resolve.

AWC features an intelligent process that automatically re-calibrates the signal strength and radio channel of each Access Point (AP) for optimal WLAN performance.

AWC Smart Connect (AWC-SC) uses wireless uplink connections between APs, so deployment is as easy as plugging in and powering on the new APs, which automatically extend the Wi-Fi network, creating a resilient solution. Vista Manager mini is integrated into the Device GUI of the x540L Series and provides an ideal solution for modern enterprise networks, enabling management of both the wired (with AMF plus) and wireless (with AWC) networks to be automated. This reduces both the time and cost of network administration, as well as maximizing network performance for a superior user experience.

Up to 5 TQ Series wireless APs can be managed for free, and up to a further 50 APs (max 55) with feature licenses, available separately.

On some AP models, hybrid channel blanket enables multi-channel and single-channel WiFi operation simultaneously. This supports seamless roaming and maximum throughput. Channel Blanket licenses are available for up to 50 APs, which enable both Channel Blanket (AWC-CB) and Smart Connect (AWC-SC).

Product Specifications

PRODUCT	100/1000T/2.5/5/10G (RJ-45) COPPER PORTS	1/10G SFP+ PORTS	TOTAL PORTS	SWITCHING FABRIC	FORWARDING RATE
x540L-28XTm	24	4	28	560Gbps	416.7Mpps
x540L-28XS	-	28	28	560Gbps	416.7Mpps

1GBPS

4.48

3.59

PORT SPEED (us)

2.5GBPS

8.43

5GBPS

5.72

10GBPS

2.73

1.60

Latency (microseconds)

PRODUCT

x540L-28XTm

x540L-28XS

Physical Specifications

PRODUCT	WIDTH X DEPTH X HEIGHT	WEIGHT
x540L-28XTm	440 x 290 x 44 mm (17.32 x 11.41 x 1.73 in)	4.0 kg (8.8 lb)
x540L-28XS	440 x 290 x 44 mm (17.32 x 11.41 x 1.73 in)	3.8 kg (8.3 lb)

Power and Noise Characteristics

	MAX POWER CONSUMPTION	MAX HEAT DISSIPATION	NOISE
x540L-28XTm	160W	540 BTU/h	46 - 63 db
x540L-28XS	86W	293 BTU/h	39 - 52 db

Noise: tested to ISO7779; front bystander position

Performance

- Up to 32K MAC addresses
- ▶ Up to 1,000 static routes
- Up to 256 dynamic routes
- 2GB DDR SDRAM
- 4094 configurable VLANs
- > 256MB flash memory
- Packet Buffer memory: 8MB
- Supports 9KB L2 jumbo frames
- Wirespeed forwarding

Reliability

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

Flexibility and compatibility

- 10G SFP+ ports will support any combination of Allied Telesis 1000Mbps SFP and 10GbE SFP+ modules and direct attach cables listed in this document under Ordering Information
- Flexi-stacking use any port-speed to stack

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
- 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 standardsbased 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

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

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- 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 with 10G SFP+ modules (LD-VCStack)
- ▶ Virtual Router Redundancy Protocol (VRRP)

Security Features

- Access Control Lists (ACLs) based on layer 3 and 4 headers
- 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
- 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

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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 609501
- Certifications: UL, cUL, UL-EU

Restrictions on Hazardous Substances (RoHS) Compliance

- EU RoHS compliant
- China RoHS compliant-1

Standards and Protocols

AlliedWare Plus Operating System Version 5.5.5

Authentication

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

Border Gateway Protocol (BGP)

BGP	dynamic	capability
BGP	outboun	d route filtering
RFC	1772	Application of the Border Gateway Protocol
		(BGP) in the Internet
RFC	1997	BGP communities attribute

- BEC 2385 Protection of BGP sessions via the TCP MD5 signature option
- BEC 2439 BGP route flap damping RFC 2545 Use of BGP-4 multiprotocol extensions for
- IPv6 inter-domain routing RFC 2918 Route refresh capability for 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
- **BEC 4456** BGP route reflection - an alternative to full mesh iBGP
- RFC 4724 BGP graceful restart
- RFC 4760 BGP multiprotocol extensions
- 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

BNG (AES128/192/256) DES MD5

Ethernet

- IEEE 802.2 Logical Link Control (LLC)
- IFFF 802.3 Ethernet
- IEEE 802.3ab1000BASE-T IEEE 802.3ae10 Gigabit Ethernet
- IEEE 802.3an10GBASE-T
- IEEE 802.3azEnergy Efficient Ethernet (EEE)
- IEEE 802.3bz2.5GBASE-T and 5GBASE-T ("multi-gigabit")
- IEEE 802.3x Flow control full-duplex operation
- IEEE 802.3z 1000BASE-X

IPv4 Features

RFC 5095

RFC 5175

RFC 6105

Management

Optical DDM MIB

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
	4
DEC 1001	Deth MTU diagonary for IDvC
RFC 1901	Paul IVITU UISCOVELY TOT IP VO
RFC 2400	Transmission of IDVC neekste over Ethernet
REC 2404	nansmission of IPvo packets over Ethernet
DEC 2494	Default address selection for IDv6
DEC 2597	IPv6 global unicast address format
DEC 2506	DNS extensions to support IPv6
REC 4007	IPv6 scoped address architecture
REC /103	Unique local IPv6 unicast addresses
REC 4213	Transition mechanisms for IPv6 hosts and
11 0 72 10	routers
REC 4291	IPv6 addressing architecture
RFC 4443	Internet Control Message Protocol (ICMPv6)
RFC 4861	Neighbor discovery for IPv6

BEC 4862 IPv6 Stateless Address Auto-Configuration (SLAAC) RFC 5014 IPv6 socket API for source address selection

AT Enterprise MIB including AMF Plus MIB and SNMP traps

Deprecation of type 0 routing headers in IPv6

IPv6 Router Advertisement (RA) flags option

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IPv6 Router Advertisement (RA) guard

SNMPv1, v	2c 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			
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			
000.0410	management frameworks			
RFC 3412	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			
DE0 5 40 -	ping, traceroute and lookup operations			
KFC 5424	I ne Syslog protocol			
RFC 0527	Deminuons of managed objects for VRRPV3			
Multica	ust Support			
Bootstran F	Router (BSR) mechanism for PIM-SM			
CMD quary solicitation				

IGMP query s	solicitation
IGMP snoopi	ng (IGMPv1, v2 and v3)
IGMP snoopi	ng fast-leave
IGMP/MLD n	nulticast forwarding (IGMP/MLD proxy)
MLD snoopin	ng (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
DEC 4607	Multicast
RFC 4607	Source-specific multicast for IP
NF67701	(PIM-SM)
Open Sh	ortest Path First (OSPE)
OSPE link-loo	
OSPF MD5 a	uthentication
Out-of-band	LSDB resvnc
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
	Dorder routers
REC 2620	Traffic opgingering extensions to OSPE
REC 4552	Authentication/confidentiality for OSPEv3
REC 5329	Traffic engineering extensions to OSPEv3
RFC 5340	OSPFv3 for IPv6 (partial support)
Quality	of Sorrigo (OoS)
IEEE 802 1n	Priority tagging
REC 2211	Specification of the controlled-load network
111 0 2 2 11	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)
Resilien	cy Features
ITU-T G.803	2 / Y.1344 Ethernet Ring Protection Switching
IEEE 000 1	(EKPS)
IEEE OUZ.18(
IEEE 802 14	V Link addredation (static and LΔCP)
IFFF 802.10	MAC bridges
IEEE 002.10	Multiple Spapping Tree Protocol (MSTD)

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 2081RIPng protocol applicability statementRFC 2082RIP-2 MD5 authentication
- RFC 2082 RIP-2 MD5 8 RFC 2453 RIPv2

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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")		
BEC 2865	BADIUS authentication		
REC 2866	BADIUS accounting		
DEC 2000	RADIUS attributes for tuppel protocol support		
DEC 2000	RADIOS attributes for turner protocol support		
RFC 2900	specification v1.7		
DEC 2546	Transport Lavor Socurity (TLS) ovtansions		
DEC 2570	RADIUS support for Extensible Authentication		
RFC 30/9	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 laver protocol		
REC 4254	Secure Shell (SSHv2) connection protocol		
REC 5176	BADIUS Change of Authorization (CoA)		
REC 5246	Transport Laver Security (TLS) v1 2		
REC 5280	X 500 certificate and Certificate Revocation		
11 0 0200	List (CBL) profile		
BEC 5425	Transport Laver Security (TLS) transport		
11 0 0 4 2 0	manning for Syslog		
REC 5656	Elliptic curve algorithm integration for SSH		
DEC 6125	Demain based application service identity		
1100123	within DKL using X 500 cortification with TLS		
	Transport Lover Coourity (TLC) apprintion for		
RFC 0014	DADUC		
	RADIUS		
NFC 0000	SHA-2 data integrity vernication 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		
BEC 2821	Simple Mail Transfer Protocol (SMTP)		
REC 2822	Internet message format		
REC 3046	DHCP relay agent information option (DHCP		
ontion 921	error rolay agont mormation option (DHOF		
BEC 3315	DHCPv6 (server relay and client)		
REC 3306	Encoding long options in DHCPv/		
BEC 3633	IPv6 profix options for DHCDv6		
DEC 3646			
NEC 2002	Subacribar ID subaction for DUCD relay accest		
1120 0330	Subscriber-ID Suboption for DHOP relay agent		

 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

option

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 802.3acVLAN tagging

Feature Licenses

NAME	DESCRIPTION	INCLUDES	STACK LICENSING
AT-FL-x540L-01	DESCRIPTION INCLUDES x540L premium license > OSPFv2 (256 routes) ³ > BGP4 (256 routes) ³ > BGP4 (256 routes) ³ > PIMv4-SM, DM and SSM v4 > RIPng (256 routes) > OSPFv3 (256 routes) > OSPFv3 (256 routes) > MLDv1/v2 > PIM-SMv6/SSMv6 > VLAN doube tagging (Q-in-Q) > VLAN Translation > PTP Transparent Mode ⁴ > RADIUS Full > VRF-Lite (64 domains) > VRF-Lite (64 domains)		One license per stack member
AT-SW-APM10-1YR ^{5,6}	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 ^{5, 6}	Cumulative AMF Plus Master license	► AMF Plus Master license for up to 10 nodes for 5 years	One license per stack
AT-SW-AWC10-1YR ⁷	Cumulative AWC license	► Autonomous Wave Control (AWC) license for up to 10 access points for 1 year	One license per stack
AT-SW-AWC10-5YR ⁷	Cumulative AWC license	► Autonomous Wave Control (AWC) license for up to 10 access points for 5 years	One license per stack
AT-SW-CB10-1YR-20228	Cumulative AWC-CB and AWC-SC license	AWC Channel Blanket and AWC Smart Connect license for up to 10 access points for 1 year	One license per stack
AT-SW-CB10-5YR-2022 ⁸	Cumulative AWC-CB and AWC-SC license	AWC Channel Blanket and AWC Smart Connect license for up to 10 access points for 5 years	One license per stack
AT-FL-x540L-0F13-1YR	OpenFlow license for 1 year	► OpenFlow v1.3 for 1 year	Not supported on a stack
AT-FL-x540L-0F13-5YR	OpenFlow license for 5 years	► OpenFlow v1.3 for 5 years	Not supported on a stack

 $^{\scriptscriptstyle 3}$ 64 OSPFv2 and BGP4 routes are provided free in the base license

⁴ Supported in a future software release

⁵ 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 menu in Vista Manager EX (from version 3.10.1 onwards)

⁶ Purchase one license per 10 nodes (up to 50 nodes maximum)

⁷ 5 APs can be managed for free. Purchase one license per 10 additional APs (up to 50 APs maximum)

⁸ Channel Blanket and Smart Connect are not available as free services. Both an AWC-CB license and an AWC license are required for Channel Blanket and/or Smart Connect to operate. Purchase one AWC-CB license per 10 APs (up to 50 APs maximum).

Ordering Information

AT-x540L-28XTm

24-port 100M/1/2.5/5/10G stackable copper switch with 4 x SFP/SFP+ports, and a single fixed PSU

AT-x540L-28XS

28-port SFP/SFP+ stackable fiber switch, with a single fixed PSU

10G SFP+ Modules

Any 10G SFP+ module or cable can be used for stacking with the front panel 10G ports

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-SP10LRa/I 10GER 1310 nm medium-haul, 10 km with SMF industrial temperature, TAA⁹

AT-SP10ER40/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 1G/2.5G/5G/10G, 100m copper, TAA⁹ (note that 2.5G/5G speeds are not supported)

AT-SP10BD10/I-12 10 GbE Bi-Di (1270 nm Tx, 1330 nm Rx) fiber up to 10 km industrial temperature, TAA⁹

AT-SP10BD10/I-13

10 GbE Bi-Di (1330 nm Tx, 1270 nm Rx) fiber up to 10 km industrial temperature, TAA $^{\rm 9}$

AT-SP10BD20-12 10 GbE Bi-Di (1270 nm Tx, 1330 nm Rx) fiber up to 20 km, TAA⁹

AT-SP10BD20-13 10 GbE Bi-Di (1330 nm Tx, 1270 nm Rx) fiber up to 20 km, TAA⁹

AT-SP10BD40/I-12 10 GbE Bi-Di (1270 nm Tx, 1330 nm Rx) fiber up to 40 km industrial temperature, TAA⁹

AT-SP10BD40/I-13 10 GbE Bi-Di (1330 nm Tx, 1270 nm Rx) fiber up to 40 km industrial temperature, TAA⁹

AT-SP10BD80/I-14 10 GbE Bi-Di (1490 nm Tx, 1550 nm Rx) fiber up to 80 km industrial temperature, TAA⁹

AT-SP10BD80/I-15 10 GbE Bi-Di (1550nm Tx, 1490 nm Rx) fiber up to 80 km industrial temperature, TAA⁹

AT-SP10TW1 1 meter SFP+ direct attach cable

AT-SP10TW3 3 meter SFP+ direct attach cable 1000Mbps SFP Modules

AT-SPSX 1000SX GbE multi-mode 850 nm fiber up to 550 m

AT-SPLX10a 1000LX GbE single-mode 1310 nm fiber up to 10 km

AT-SPLX10/I 1000LX GbE single-mode 1310 nm fiber up to 10 km, industrial temperature

AT-SPBD10-13 1000LX (LC) GbE Bi-Di (1310 nm Tx, 1490 nm Rx) fiber up to 10 km

AT-SPBD10-14 1000LX (LC) GbE Bi-Di (1490 nm Tx, 1310 nm Rx) fiber up to 10 km

AT-SPBD20-13/I 1000BX GbE Bi-Di (1310 nm Tx, 1490 nm Rx) fiber up to 20 km

AT-SPBD20-14/I 1000BX GbE Bi-Di (1490 nm Tx, 1310 nm Rx) fiber up to 20 km

AT-SPBD40-13/I 1000LX (LC) GbE single-mode Bi-Di (1310 nm

TX, 1490 nm Rx) fiber up to 40 km, industrial temperature

AT-SPBD40-14/I

1000LX (LC) GbE single-mode Bi-Di (1490 nm Tx, 1310 nm Rx) fiber up to 40 km, industrial temperature

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

AT-SPTXc 10/100/1000 TX (RJ45), up to 100 m

9 Trade Agreement Act compliant

