

# ACTIVEDGE 5140 SERVICE AGGREGATION SWITCH



## Features and Benefits

- Offers the bandwidth and scalability to support thousands of Carrier Ethernet business, residential, and transport applications, including wireless backhaul, on a single, all-GbE system
- Features state-of-the-art hardware design, including copper and optical interfaces for all interface ports, a wirespeed 24 Gb/s full duplex switching fabric, enhanced CPU and system memory, redundant fans, high-capacity extended temperature, and integrated DC power in an ETSI cabinet-compliant form factor
- Supports operational efficiency and advanced Ethernet features within a modular service-aware operating system, for high-end business and transport services including PBB-TE and Ethernet Virtual Private Line/LAN/Tree and G.8032
- Provides MAC address and VLAN scalability, interworking flexibility between disparate encapsulation formats, and improved security for customer L2VPNs through sophisticated virtual switching software architecture
- Helps ensure SLAs with carrier-class, MEF-14 compliant QoS features for broad service stratification and robust bandwidth allocation

Ciena's ActivEdge 5140 Service Aggregation Switch is a next-generation Ethernet access system that cost-effectively delivers sophisticated business, transport, and residential services via fiber or copper connections. The 5140 features a high-capacity switching fabric with 24 Gigabit Ethernet (GbE) ports in a compact 2RU form factor that allows front access to power and all system interfaces.

The 5140 has an extended temperature range (-40 to +65C) and a robust physical design that supports deployment in a wide variety of unconditioned environments, including GR-487 and ETSI-compliant outdoor cabinets. Because the switch provides both SFP and RJ-45 connectors for each of its 24 GbE interface ports, the 5140 can support service aggregation, transport, and demarcation applications in a wide variety of network topologies, including fiber and microwave rings, point-to-point fiber, microwave mesh, fiber or copper to subscriber, MTU/ MDU/FTTx, and more.

The 5140 is based on Ciena's field-proven True Carrier Ethernet® technology, deployed by dozens of network operators in tens of thousands of businesses, homes, and mobile base station cell sites. The switch combines the low cost and high capacity of Ethernet with the reliability, management, and service quality usually associated with SONET/ SDH networking systems. The 5140 software architecture is based on the common service-aware operating system used in all Ciena service delivery and aggregation switches to provide operational efficiency and consistent system and service attributes.

The core of the 5140 is a high-performance switching platform that incorporates the latest innovations in Ethernet switching technology, control plane protocols, and encapsulation techniques, and Carrier Ethernet Operations, Administration, and Maintenance (OAM) mechanisms. The result of these combined capabilities is a state-of-the-art design that enables the 5140 to deliver the sophisticated Quality of Service (QoS) capabilities, superior Virtual LAN (VLAN) and virtual switching functions, and robust management and

performance monitoring features required to support carrier-grade Layer 2 Virtual Private Networks (L2VPNs), mission-critical data, high-speed Internet, and high-quality IPTV and VoIP services.

The advanced design and service-rich architecture of the 5140 enable network operators to deploy reliable and scalable offerings that leverage the inherent high capacity and cost-effectiveness of Ethernet technology to generate maximum revenue. Ethernet business, transport, wireless backhaul, and residential services can be rolled out quickly and reliably, with low cost per subscriber and optimum utilization of network resources.

### Key Element of 4G Mobile Backhaul

The rapid expansion of wireless networks and evolution to 3G and high-bandwidth WiMax and 4G services means network providers must be prepared to support new mobile backhaul traffic patterns and application requirements, including dark fiber and microwave ring-based topologies with backup paths and sub-50 ms link restoration. The 5140 is the ideal Ethernet access and aggregation system to address these needs. The 5140's True Carrier Ethernet feature set—including advanced OAM, G.8032 Ethernet rings, PBB-TE-based protection schemes, and dual homing capabilities—help create the foundation of a resilient and robust Ethernet transport infrastructure that can support simplified service architectures for 3G and 4G wireless IP and Ethernet services and seamless migration to 4G networks.

### Flexible, Cost-Effective Ethernet Service Aggregation

The 5140 has the features and capabilities to thrive in diverse carrier networks and topologies, with a focus on the following applications:

- N x GbE/GbE aggregation for wireless backhaul, business, and residential services
- N x GbE/GbE/100 Mb/s service demarcation for wireless backhaul, business, and residential services
- N x GbE/GbE FTTx/MTU/MDU aggregation and handoff to metro edge/core

The 5140 includes 24 GbE ports that support 100/1000 Mb/s operation over fiber via SFP connectors, and 10/100/1000 Mb/s operation over copper via RJ-45 connectors.

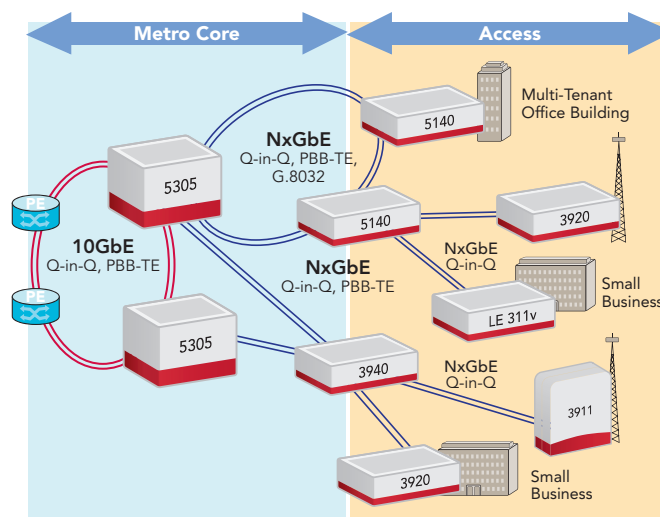
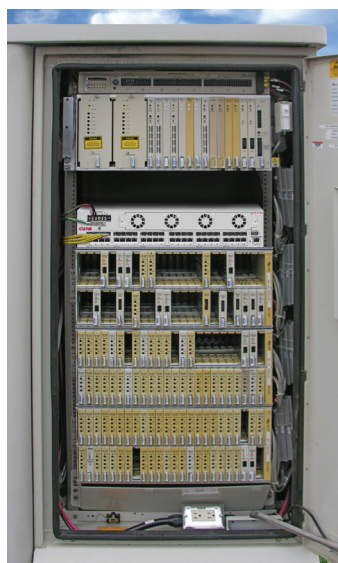


Figure 1. 5140 aggregation and MTU demarcation

### Carrier-Class QoS

The 5140 implements carrier-class, MEF-14-compliant QoS mechanisms that enable the delivery of a wide range of traffic types and rates over a single access infrastructure without interference or degradation.

These capabilities include:

- Rich classification of traffic flows based on Layer 1 through Layer 4 parameters, including physical port, MAC address, VLAN tag, and IP or Layer 4 port address
- Flexible priority resolution for Class of Service mapping based on priority settings contained in IP packet headers and VLAN, MPLS and PBB-TE tags
- Sophisticated ingress metering for Committed Information Rate (CIR), Excess Information Rate (EIR), Committed Burst Size (CBS), and Excess Burst Size (EBS) service delivery
- Two-rate Three-Color Marking (trTCM) and Random Early Drop (RED) for sophisticated congestion handling

### Carrier Ethernet Services, Transport, PBB-TE

The 5140 offers a variety of Carrier Ethernet transport options, including:

- 802.1q VLANs
- 802.1ad Provider VLANs (Q-in-Q)
- MEF Ethernet connections—including Ethernet Virtual Private Line/LAN/Tree services
- 802.1Qay PBB-TE (Provider Backbone Bridging-Traffic Engineering) tunnels with PBB-TE Ethernet virtual circuits
- ITU-T G.8032 Ethernet Ring Protection Switching

Ciena is an industry leader in the implementation of PBB-TE, which extends and adapts Ethernet to provide carrier-grade transport over Metro and Wide Area Networks (MANs and WANs). The 5140's advanced PBB-TE feature set delivers a reliable, resilient, and cost-effective transport solution, ideal for delivering a variety of new services to a fast-growing customer base. This feature set includes the PBB-TE tunneling protocol with built-in backup tunnels, a dual homing tunnel option, tunnel monitoring with Ethernet OAM Continuity Check Messages, and advanced management mechanisms that support the provisioning of PBB-TE service instances.

Based on extensions to current Ethernet standards, PBB-TE-enabled products maintain compatibility with existing Ethernet deployments, enabling the 5140 to deliver a wide range of connectivity services with guaranteed QoS while interoperating seamlessly with an installed base of multi-vendor switching and routing systems that do not support PBB-TE. Because the advantages of PBB-TE are available without necessitating major changes to existing network equipment or architectures, the 5140 offers superior investment protection.

### Proven Service-Aware Operating System

The 5140 software architecture is based on the common service-aware operating system used in all Ciena service delivery and aggregation switches. This operating system delivers consistent benefits across all Ethernet access and aggregation applications, including:

- Rapid implementation of the latest advances in Ethernet technologies, new services, and standards proposed by the IEEE, IETF, and MEF
- Interoperability with Ethernet equipment from other vendors
- Improved efficiency and cost savings resulting from a common deployment and service provisioning model
- Ubiquitous service offerings, permitting rapid rollout of new services across the entire network

The 5140 software is designed to deliver plug-and-play activation, making new service rollout fast and easy. The switch also supports an advanced automatic activation feature that can upgrade default settings to deploy operator-specific configurations, reducing new platform integration time and enabling network operators to extend services to new subscribers rapidly and efficiently.

### Carrier-Grade Ethernet OAM

The 5140 supports a rich set of OAM features defined in the latest versions of IEEE, ITU, and IETF standards, including:

- IEEE 802.3ah Ethernet in the First Mile (EFM) physical layer OAM, including link events and remote loopback
- IEEE 802.1ag Connectivity Fault Management (CFM), including MAC Ping/Traceroute and Continuity Check
- ITU Y.1731 performance management
- 802.1AB Link Layer Discovery Protocol (LLDP)
- IETF RFC 5618 Two-Way Active Management Protocol (TWAMP) with complete sender and receiver capabilities

These capabilities enable the 5140 to monitor the status of system and network links; measure the performance of customer Ethernet services; confirm that link and service throughput and quality conform to SLAs; and distribute this management information across point-to-point, point-to-multipoint, and multipoint-to-multipoint connections.

### Ethernet Services Manager (ESM)

Ciena's Ethernet Services Manager (ESM) is a groundbreaking carrier-grade, automated service activation, creation, and management platform for managing service delivery and aggregation networks, allowing users to:

- Build and deploy large-scale Carrier Ethernet networks quickly and easily
- Cut time to market for new services
- Accelerate service revenue
- Maximize service availability
- Assure service quality
- Leverage existing systems
- Enable subscriber-managed services

Each of these functions cuts total cost of ownership and allows operators to implement new services quickly and cost-effectively for increased revenue and competitiveness.

## Technical Information

### Interfaces

4 x 100/1000M SFP/RJ-45 NNI/UNI ports  
20 x 100/1000M SFP/RJ-45 UNI ports  
1 x 10/100/1000M RJ-45 Management port  
1 x Console Port (EIA-232, DB9)

### Ethernet

IEEE 802.3 Ethernet  
IEEE 802.3u Fast Ethernet  
IEEE 802.3z Gigabit Ethernet  
IEEE 802.1D MAC Bridges  
IEEE 802.1Q VLANs - Including .1p Priority  
IEEE 802.1ad Provider Bridging (Q-in-Q)  
VLANs with full S-VLAN range  
VLAN tunneling (Q-in-Q) for Transparent LAN Services (TLS)  
Single and double VLAN tag translations on ingress and egress  
Per VLAN MAC Learning Control  
Per-Port MAC Learning Control  
ITU-T G.8032 Ethernet Ring Protection Switching  
IEEE 802.3ad Link Aggregation Control Protocol (LACP)  
Jumbo Frames to 9216 bytes  
Layer 2 Control Frame Tunneling

### Carrier Ethernet OAM

IEEE 802.1ag Connectivity Fault Management (CFM)  
IEEE 802.3ah Ethernet in the First Mile (EFM)  
IEEE 802.1AB Link Layer Discovery Protocol (LLDP)  
ITU-T Y.1731 - Performance Monitoring  
RFC 5618 TWAMP Responder and Receiver  
TWAMP Sender  
TWAMP +/- 1ms timestamp accuracy  
Dying Gasp with Syslog and SNMP Traps

### PBB-TE (Provider Backbone Bridging-Traffic Engineering)

IEEE 802.1Qay PBB-TE  
IEEE 802.1ah PBB frame format  
PBB-TE Multi-homed Protection Failover

### Quality of Service

8 Hardware Queues per Port  
Committed and Excess Information Rate (CIR and EIR)  
Per-port per-VLAN QoS with CIR and EIR traffic on Egress Queues  
Classification based on IEEE 802.1D priority  
Classification based on VLAN, source port, destination port, TCP/UDP port  
Classification based on IP Precedence and IP DiffServ Code Point (DSCP)  
Ingress metering per-port  
Ingress metering per-port per-CoS  
Ingress metering per-port per-VLAN  
Up to 64 Ingress Meters per port  
Up to 512 Ingress Meters per system  
Configurable metering burst size

Configurable L2 frame bandwidth calculation  
Per Port RED Egress Queuing  
Egress Shaping and Scheduling  
Traffic Profile on Port/C-VLAN ID/C-VLAN Priority Marking  
L2 Priority mapping from IP DSCP/TOS  
IP DSCP/TOS priority mapping from L2 Priority  
C-VLAN Priority to S-VLAN Priority Mapping  
S-VLAN Priority based on C-VLAN ID  
Per-VLAN Classification, Metering and Statistics

### Multicast Management

RFC 2236 IGMPv2 Snooping  
IGMP Domains  
IGMP Message Filtering  
IGMP Inquisitive Leave  
Broadcast/Multicast Storm Control  
Unknown Multicast Filtering  
Well-known Protocol Forwarding

### Network Management

Enhanced CLI  
CLI-based configuration files  
SNMP v1/v2c/v3  
SNMPv3 Authentication and Message Encryption  
RFC 1213 SNMP MIB II  
RFC 1493 Bridge MIB  
RFC 1643 Ethernet-like Interface MIB  
RFC 1573 MIB II interfaces  
RFC 1757 RMON MIB - inc. persistent configuration  
RFC 2021 RMON II and RMON Statistics  
Per-VLAN Statistics  
RADIUS Client and RADIUS Authentication  
TACACS+ AAA  
RFC 2131 DHCP Client  
RFC 1305 NTP Client  
RFC 1035 DNS Client  
Telnet Server  
Secure File Transfer Protocol (SFTP)  
RFC 1350 Trivial File Transfer Protocol (TFTP)  
Secure Shell (SSHv2)  
Syslog with Syslog Accounting  
Port State Mirroring  
Local Console Port  
Comprehensive Management via Ethernet Services Manager (ESM)  
Remote Autoconfiguration via FTP, TFTP, SFTP  
Software download/upgrade via FTP, TFTP, SFTP

### Service Security

802.1x Port-based Network Access Control  
Egress Port Restriction  
Layer 2, 3, 4 Protocol Filtering  
Broadcast Containment  
User Access Rights  
Per-port or per-VLAN Service Access Control  
Hardware-based DOS Attack Prevention  
Hardware-based Access Control Lists (ACLs)

### MAC Address Table Capacity

16,000 MAC addresses

### Power Requirements

DC Input: -48V, -24V, +24V DC (nominal)  
Maximum Power Input: 84W

### Agency Approvals

#### Safety Certifications:

NRTL (TUV Rheinland)  
European Union, CE mark  
(Declaration of Conformity)  
UL 60950-1 (US)  
IEC 60950-1 (International)  
EN 60950-1 (EU)  
AS/NZS 60950-1:2003 (Australia and New Zealand)  
CAN/CSA 22.2 No. 60950-1-03 (Canada)

#### Emissions:

EN 5502 (CISPR 22): 2006, Class A  
(ACMA) AS/NZS CISPR22: 2004, Class A  
FCC (CFR), Part 15 Subpart B, Class A  
ICES-003 Issue 4, February 2004, Class A  
VCCI V-1/93.11, V-2/97.04, V-3/97.04, V-4/97, R-2368, and C-2588 Class A  
EN 55024: 1998 + A1:2001 + A2: 2003

#### NEBS:

NEBS Level 3

#### Environmental:

RoHS 2002/95/EC  
WEEE 2002/96/EC

#### Laser Safety:

FCC 21 CFR subpart (J) (Safety of Laser Products)  
Europe: EN60825-1:1994  
+A11:1996+A2:2001 (European Safety of Lasers)

### Environmental Characteristics

#### Operating Temperature:

-40°F to +149°F (-40°C to +65°C)

#### Storage Temperature:

-40°F to +158°F (-40°C to +70°C)

Relative Humidity: 5% to 90% Non-Condensing

### Physical Characteristics

**Dimensions:** 3.5 in (H) x 17.5 in (W) x 10.5 in (D);  
88.9 mm (H) x 444.5 mm (W) x 266.7 mm (D)

**Weight:** 17 lbs; 7.7 kg

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