



ExtremeXOS 16.2 Feature License Requirements



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Preface

This section discusses the conventions used in this guide, ways to provide feedback, additional help, and other Extreme Networks publications.

Conventions

This section discusses the conventions used in this guide.

Text Conventions

The following tables list text conventions that are used throughout this guide.

Table 1: Notice Icons





Icon	Notice Type	Alerts you to...
	General Notice	Helpful tips and notices for using the product.
	Note	Important features or instructions.
	Caution	Risk of personal injury, system damage, or loss of data.
	Warning	Risk of severe personal injury.
<i>New!</i>	New Content	Displayed next to new content. This is searchable text within the PDF.

Table 2: Text Conventions

Convention	Description
<code>Screen displays</code>	This typeface indicates command syntax, or represents information as it appears on the screen.
The words enter and type	When you see the word “enter” in this guide, you must type something, and then press the Return or Enter key. Do not press the Return or Enter key when an instruction simply says “type.”
[Key] names	Key names are written with brackets, such as [Return] or [Esc] . If you must press two or more keys simultaneously, the key names are linked with a plus sign (+). Example: Press [Ctrl]+[Alt]+[Del]
<i>Words in italicized type</i>	Italics emphasize a point or denote new terms at the place where they are defined in the text. Italics are also used when referring to publication titles.

Platform-Dependent Conventions

Unless otherwise noted, all information applies to all platforms supported by software, which are the following:

- ExtremeSwitching® switches
- Summit® switches
- SummitStack™

When a feature or feature implementation applies to specific platforms, the specific platform is noted in the heading for the section describing that implementation in the ExtremeXOS command documentation (see the Extreme Documentation page at [.extremenetworks.com](#)). In many cases, although the command is available on all platforms, each platform uses specific keywords. These keywords specific to each platform are shown in the Syntax Description and discussed in the Usage Guidelines sections.

Terminology

When features, functionality, or operation is specific to a switch family, such as [S6700](#) or [S6710](#), the family name is used. Explanations about features and operations that are the same across all product families simply refer to the product as the switch.

Providing Feedback to Us

We are always striving to improve our documentation and help you work better, so we want to hear from you! We welcome all feedback but especially want to know about:

- Content errors or confusing or conflicting information.
- Ideas for improvements to our documentation so you can find the information you need faster.
- Broken links or usability issues.

If you would like to provide feedback to the Information Development team about this document, please contact us using our short [online feedback form](#). You can also email us directly at [feedback@extremenetworks.com](#).

Getting Help

If you require assistance, contact using one of the following methods:

- **GTAC (Global Technical Assistance Center) for Immediate Support**
 - **Phone:** 1-800-998-2408 (toll-free in U.S. and Canada) or +1 408-579-2826.
 - **Email:** [gtac@extremenetworks.com](#). To expedite your message, enter the product name or model number in the subject line.
- **Extreme Portal** — Search the GTAC knowledge base, manage support cases and service contracts, download software, and obtain product licensing, training, and certifications.
- **The Hub** — A forum for customers to connect with one another, answer questions, and share ideas and feedback. This community is monitored by Extreme Networks employees, but is not intended to replace specific guidance from GTAC.

Before contacting for technical support, have the following information ready:

- Your service contract number and/or serial numbers for all involved products
- A description of the failure
- A description of any action(s) already taken to resolve the problem

- A description of your network environment (such as layout, cable type, other relevant environmental information)
- Network load at the time of trouble (if known)
- The device history (for example, if you have returned the device before, or if this is a recurring problem)
- Any related RMA (Return Material Authorization) numbers

Related Publications

Publications

- *ACL Solutions Guide*
- *ExtremeXOS 16.2 Command Reference Guide*
- *ExtremeXOS 16.2 EMS Messages Catalog*
- *ExtremeXOS 16.2 Feature License Requirements*
- *ExtremeXOS 16.2 User Guide*
- *OpenFlow User Guide*
- *Quick Guide*
- *Legacy CLI Quick Reference Guide*
- *Release Notes*
- *Extreme Hardware/Software Compatibility and Recommendation Matrices*
- *Switch Configuration with Chalet for ExtremeXOS 16.2 and Earlier*
- *Using AVB with Extreme Switches*

Open Source Declarations

Some software files have been licensed under certain open source licenses. More information is available at: www.extremenetworks.com/support/policies/software-licensing/.

1 Overview

Overview

Displaying the Installed Licenses and Feature Packs Trial Licenses

Overview

This document introduces the licenses and feature packs available for the ExtremeXOS 16.2 software and lists the features they support.

The ExtremeXOS software supports the following license options:

- L2 Edge
- Edge
- Advanced Edge
- Core
- Feature Packs

The L2 Edge license provides a basic feature set and the Core license includes the highest level of functionality. Each license level builds on the features of the license level below it. For example, the Advanced Edge license includes all of the features in the L2 Edge and Edge licenses, plus the features in the Advance Edge license. The following table lists the software licenses available for each platform that supports ExtremeXOS software.



Note

The Advanced Core license is no longer offered.

Table 3: Standard and Upgrade Licenses for ExtremeXOS Switches

Switch Platform	L2 Edge License	Edge License	Advanced Edge License	Core License
Summit X430	Standard	—	—	—
Summit X440 series	—	Standard	Upgrade	—
Summit X450-G2 series	—	Standard	Upgrade	—
Summit X460 series	—	Standard	Upgrade	Upgrade
Summit X460-G2 series	—	Standard	Upgrade	Upgrade
Summit X480 series	—	—	Standard	Upgrade
Summit X670 series	—	—	Standard	Upgrade
Summit X670-G2 series	—	—	Standard	Upgrade
Summit X770 series	—	—	Standard	Upgrade

Table 3: Standard and Upgrade Licenses for ExtremeXOS Switches (continued)

Switch Platform	L2 Edge License	Edge License	Advanced Edge License	Core License
E4G-200	—	Standard	Upgrade	Upgrade
E4G-400	—	—	Standard	Upgrade
BlackDiamond X8 series	—	—	Standard	Upgrade
BlackDiamond 8800 series	—	—	Standard	Upgrade

Software keys are stored in the EEPROM of the chassis and, once enabled, persist through reboots, software upgrades, power outages, and reconfigurations. Because the license is stored in the EEPROM of the chassis (and not on the MSM/MM card), the license persists even if you change MSM/MM cards. The keys are unique to the chassis or switch and are not transferable.

If you attempt to execute a command and you either do not have the required license or have reached the limits defined by the current license level, the system returns one of the following messages:

```
Error: This command cannot be executed at the current license level.
Error: You have reached the maximum limit for this feature at this license level.
```

Displaying the Installed Licenses and Feature Packs

You can display the types of licenses and feature packs installed on your Extreme Networks switch by using the `show licenses` command.

Trial Licenses

You can obtain a trial license, which allows you to use the license for 30 days, and you can downgrade trial licenses to a lower software license level during the trial period. You can extend the time of the trial by 30 days two times (for a total of 90 days). Most feature packs are enabled. After you enable the trial license, the switch behaves as if all software license levels and feature packs are enabled. The trial license key contains all the necessary information on the license level and the number of days. Trial licenses can be applied only once for each software version; if you upgrade to a different software version, you can reapply your trial license. It is not recommended to use a trial license in production.



Note

The Network Timing feature pack is not included in the trial license.

To enable a trial license, execute `debug epm enable trial-license`.

To clear a trial license, execute `debug epm clear trial-license`. A reboot is required before the clear license takes effect.



Note

Enabling a newly obtained license requires clearing the trial license, and then rebooting the switch.

2 Switch License Features

L2 Edge License Features
Edge License Features
Advanced Edge License Features
Core License Features

L2 Edge License Features

The L2 Edge license provides all Layer 2 switch applicable capabilities of the ExtremeXOS software that are not licensed by the higher license levels (the Edge, Advanced Edge, and Core licenses) and the Feature Packs.

The following table lists most of the L2 Edge license features.



Note

Listed platforms that do not support this license support these features with a higher license level.

Table 4: ExtremeXOS L2 Edge License Features

ExtremeXOS Software Feature	Supported Platforms
EDP	All platforms
Extreme Network Virtualization (XNV)	All platforms except Summit X430
Identity Management	All platforms except Summit X430
LLDP 802.1ab	All platforms
LLDP-MED extensions	All platforms
VLANs—Port based and tagged trunks	All platforms
VLANs—MAC based	All platforms
VLANs—Protocol based	All platforms
VLANs—Private VLANs	All platforms
VLANs—VLAN translation	All platforms
VMANs—Q-in-Q tunneling (IEEE 802.1ad VMAN tunneling standard)	All platforms
VMANs—Egress queue selection based on 802.1p value in S-tag	All platforms
VMANs—Egress queue selection based on 802.1p value in C-tag	All platforms.
VMANs—Secondary ethertype support	All platforms
VMAN Customer Edge Port (CEP—also known as Selective Q-in-Q)	All platforms.

Table 4: ExtremeXOS L2 Edge License Features (continued)

ExtremeXOS Software Feature	Supported Platforms
VMAN Customer Edge Port CVID Egress Filtering / CVID Translation	All platforms except Summit X430
L2 Ping / Traceroute 802.1ag	All platforms
Jumbo frames (including all related items, MTU disc. IP frag.)	All platforms
QoS—egress port rate shaping/limiting	All platforms
QoS—egress queue rate shaping/limiting	All platforms
Link Aggregation Groups (LAG), static 802.3ad	All platforms
LAG dynamic (802.3ad LACP) edge, to servers only!	All platforms
LAG (802.3ad LACP) core, between switches	All platforms
Port loopback detection and shutdown (ELRP CLI)	All platforms
Software redundant port	All platforms
STP 802.1D	All platforms
STP EMISTP + PVST+ Compatibility mode (1 domain per port)	All platforms
STP EMISTP, PVST+ Full (multi-domain support)	All platforms
STP 802.1s	All platforms
STP 802.1w	All platforms
ERPS (4 max rings with matching ring ports)	All platforms
ESRP aware	All platforms
EAPS edge (4 max domains with matching ring ports) Note: As of ExtremeXOS 15.7, 64 max domains on Summit X670-G2. Note: as of ExtremeXOS 16.1, 64 max domains on Summit X670-G2, X450-G2, and X770.	All platforms
Link Fault Signaling (LFS)	All platforms
ELSM (Extreme Link Status Monitoring)	All platforms
ACLs, applied on ingress ports <ul style="list-style-type: none"> • IPv4 • Static 	All platforms
ACLs, applied on ingress ports <ul style="list-style-type: none"> • IPv6 • Dynamic 	All platforms
ACLs, applied on egress ports	All platforms except Summit X430
ACLs, ingress meters	All platforms
ACLs, egress meters	All platforms except Summit X430

Table 4: ExtremeXOS L2 Edge License Features (continued)

ExtremeXOS Software Feature	Supported Platforms
ACLs <ul style="list-style-type: none"> Layer-2 protocol tunneling Byte counters 	All platforms
MSM/MM hitless failover for STP	BlackDiamond 8000 series
MSM hitless failover for ESRP	BlackDiamond 8000 series
MSM/MM hitless failover - Additional capabilities: EAPS, NetLogin, PoE. Graceful Restart for OSPF, BGP	BlackDiamond 8000 series
CPU DoS protect	All platforms
CPU Monitoring	All platforms
SNMPv3	All platforms
SSH2 server	All platforms
SSH2 client	All platforms
SCP/SFTP client	All platforms
SCP/SFTP server	All platforms
RADIUS and TACACS+ per command authentication	All platforms
Network login <ul style="list-style-type: none"> Web based method 802.1X method MAC-based method Local database for MAC/web-based methods Integration with Microsoft NAP Multiple supplicants - same VLAN HTTPS/SSL for web-based method 	All platforms
Network login—Multiple supplicants - multiple VLANs	All platforms
Trusted OUI	All platforms
MAC security <ul style="list-style-type: none"> Lockdown Limit 	All platforms
IP address security: <ul style="list-style-type: none"> DHCP snooping Trusted DHCP server Source IP lockdown ARP validation 	All platforms that support the Edge, Advanced Edge, and Core licenses
IP security—DHCP Option 82—L2 mode	All platforms
IP security—DHCP Option 82—L2 mode VLAN ID	All platforms
IP security—DHCP IP lockdown	All platforms
IP security—Trusted DHCP server ports	All platforms

Table 4: ExtremeXOS L2 Edge License Features (continued)

ExtremeXOS Software Feature	Supported Platforms
Static IGMP membership, IGMP filters	All platforms
IPv4 unicast L2 switching	All platforms
IPv4 multicast L2 switching	All platforms
IPv4 directed broadcast	All platforms
IPv4 <ul style="list-style-type: none"> • Fast-direct broadcast • Ignore broadcast 	All platforms, except Summit X430
IPv6 unicast L2 switching	All platforms
IPv6 multicast L2 switching	All platforms
IPv6 netTools—Ping, traceroute, BOOTP relay, DHCP, DNS, and SNMP.	All platforms
IGMP v1/v2 snooping	All platforms
IGMP v3 snooping	All platforms
Multicast VLAN Registration (MVR)	All platforms, except Summit X430
Static MLD membership, MLD filters	All platforms
MLD v1 snooping	All platforms
MLD v2 snooping	All platforms
sFlow accounting	All platforms
CLI scripting	All platforms
Web-based device management	All platforms
Web based management—HTTPS/SSL support	All platforms
XML APIs (for partner integration)	All platforms
MIBs - Entity, for inventory	All platforms
Connectivity Fault Management (CFM)	All platforms
Remote mirroring	All platforms
Egress mirroring	All platforms
Y.1731 compliant frame delay and delay variance measurement	All platforms, except Summit X430
MVRP - VLAN Topology Management	All platforms
EFM OAM - Unidirectional Link Fault Management	All platforms, except Summit X430
Universal Port—VoIP auto configuration	All platforms
Universal Port—Dynamic user-based security policies	All platforms
Universal Port—Time-of-day policies	All platforms

Edge License Features

The Edge License includes all L2 Edge license features and the features in the following table.

Table 5: ExtremeXOS Edge License Features

ExtremeXOS Software Feature	Supported Platforms
CLEARFlow	All platforms that support the Edge, Advanced Edge, and Core licenses
EAPS edge (4 max domains, single physical ring) Note: You can increase the number of domains by upgrading to the Advanced Edge license (see Advanced Edge License Features on page 15).	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹
GRE Tunnel Note: ExtremeXOS 15.4 and above supports creating a GRE-based IPv4 tunnel, and routing IPv4 traffic over it. Note: In ExtremeXOS Release 15.5, the following hardware is supported: <ul style="list-style-type: none"> Summit X460, X460-G2 X480, X670, and X770. SummitStack Note: From ExtremeXOS Release 15.6, the Summit X460-G2 and X670-G2 series is supported.	This feature is supported on all platforms that have GRE tunneling support. GRE tunnels are IP tunnels which require L3 Function. L3 features are supported with EDGE license and above. All of the supported platforms' default license is EDGE or above, which include L3 features. In a stack all of the nodes must be GRE capable. For GRE in a stack, allstack nodes must be GRE hardware capable.
System virtual routers (VRs)	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹
User-created Virtual Routers (VRs) Virtual Router and Forwarding (VRF)	All platforms that support the Edge, Advanced Edge, and Core licenses
VLAN aggregation	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹
Multinetting for forwarding	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹
UDP Forwarding	All platforms that support the Edge, Advanced Edge, and Core licenses
UDP BootP relay forwarding	All platforms that support the Edge, Advanced Edge, and Core licenses
IPv4 unicast routing, including static routes	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹
IPv4 multicast routing, including static routes Note: This feature has limitations in the Edge and Advanced Edge licenses. See the ExtremeXOS 16.2 User Guide .	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹

¹ see [Table 3](#) on page 7

Table 5: ExtremeXOS Edge License Features (continued)

ExtremeXOS Software Feature	Supported Platforms
IPv4 Duplicate Address Detection (DAD)	All platforms that support the Edge, Advanced Edge, and Core licenses
IPv6 unicast routing, including static routes	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹
IPv6 interworking—IPv6-to-IPv4 and IPv6-in-IPv4 configured tunnels	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹
IPv6 Duplicate Address Detection (DAD) without CLI management	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹
IPv6 Duplicate Address Detection (DAD) with CLI management	All platforms that support the Edge, Advanced Edge, and Core licenses
IP security: <ul style="list-style-type: none"> • DHCP Option 82—L3 mode • DHCP Option 82—L3 mode VLAN ID • Disable ARP learning • Gratuitous ARP protection • DHCP secured ARP / ARP validation 	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹
DHCPv4: <ul style="list-style-type: none"> • DHCPv4 server • DHCPv4 client • DHCPv4 relay • DHCPv4 smart relay 	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹
DHCPv6: <ul style="list-style-type: none"> • DHCPv6 client • DHCPv6 relay • DHCPv4 prefix delegation snooping 	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹
IP Flow Information Export (IPFIX)	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹
Multi-Switch Link Aggregation Group (MLAG)	All platforms that support the Edge, Advanced Edge, and Core licenses
Policy based routing (PBR) for IPv4	All platforms that support the Edge, Advanced Edge, and Core licenses
Policy based routing (PBR) for IPv6	All platforms that support the Edge, Advanced Edge, and Core licenses
PIM snooping Note: This feature has limitations in the Edge and Advanced Edge licenses. See the <i>ExtremeXOS 16.2 User Guide</i> .	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹
Protocol-based VLANs	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹
RIP v1/v2	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹

Table 5: ExtremeXOS Edge License Features (continued)

ExtremeXOS Software Feature	Supported Platforms
RIPng	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹
Routing access policies	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹
Route maps	All platforms that support the Edge, Advanced Edge, and Core licenses. ¹
SummitStack (switch stacking using native or dedicated ports)	Summit X440-24p, X440-24t, X440-8p and X440-48p using dedicated SummitStack ports, X460 family switches, and E4G-400 with a SummitStack or SummitStack V-80 module. Summit X440-8t, X440-48t with dedicated SummitStack ports. Summit X440-24t-10G with ethernet ports. Summit X460-G2 with X460-G2-VIM-2SS optional card. Summit X480 family switches with a VIM2-SummitStack, VIM2-SummitStack-V80, or VIM2-SummitStack128 module. Summit X670V switches with a VIM4-40G4X module.
SummitStack-V (switch stacking using dual purpose data ports)	See the specific models listed the "Support for Alternate Stacking Ports" section of the ExtremeXOS 16.2 User Guide .
Python scripting	All platforms.

Advanced Edge License Features

The Advanced Edge License includes all Edge License features and the features in the following table.

Table 6: ExtremeXOS Advanced Edge License Features

ExtremeXOS Software Feature	Supported Platforms
EAPS Advanced Edge (multiple physical rings)	All platforms that support the Advanced Edge and Core licenses.
ERPS-more domains (allows 32 rings with matching ring ports) and multi-ring support	BlackDiamond 8000 series Summit family switches
ESRP-Full	Summit X460, X480, X670, and X770 series switches BlackDiamond 8000 series
ESRP-Virtual MAC	BlackDiamond 8000 series Summit family switches
OSPFv2-Edge (limited to max of 4 active interfaces)	All platforms that support the Advanced Edge and Core licenses. ²

² see [Table 3](#) on page 7

Table 6: ExtremeXOS Advanced Edge License Features (continued)

ExtremeXOS Software Feature	Supported Platforms
OSPFv3-Edge (limited to max of 4 active interfaces)	All platforms that support the Advanced Edge and Core licenses. ²
PIM-SM-Edge (limited to max of 4 active interfaces)	All platforms that support the Advanced Edge and Core licenses. ²
VXLAN	All platforms that support the Advanced Edge and Core licenses.
VRRP	All platforms that support the Advanced Edge and Core licenses. ²
PSTag	All platforms.

Core License Features

The Core License includes all Advanced Edge License features and the features in the following table.

Table 7: ExtremeXOS Core License Features

ExtremeXOS Software Feature	Supported Platforms
EAPS "Full" (common links)	Core license platforms listed in Table 3 on page 7
PIM DM "Full"	Core license platforms listed in Table 3 on page 7
PIM SM "Full"	Core license platforms listed in Table 3 on page 7
PIM SSM "Full"	Core license platforms listed in Table 3 on page 7
OSPFv2 "Full" (not limited to 4 active interfaces)	Core license platforms listed in Table 3 on page 7
OSPFv3 "Full" (not limited to 4 active interfaces)	Core license platforms listed in Table 3 on page 7
BGP4 and MBGP (BGP4+) for IPv4 ECMP	Core license platforms listed in Table 3 on page 7
BGP4 and MBGP (BGP4+) for IPv6	Core license platforms listed in Table 3 on page 7
IS-IS for IPv4	Core license platforms listed in Table 3 on page 7
IS-IS for IPv6	Core license platforms listed in Table 3 on page 7
MSDP	Core license platforms listed in Table 3 on page 7
Anycast RP	Core license platforms listed in Table 3 on page 7

3 Feature Pack Features

Direct Attach Feature Pack
MPLS Feature Pack (IPv4 Only)
Network Timing Feature Pack

The ExtremeXOS software features listed in the following table are managed as feature packs.

Feature packs are distributed in one of the following forms:

- **In ExtremeXOS software** (standard software component)—You must purchase a license to use the feature pack.
- **Modular software package** (xmod file, due to .xmod filename extension)—You must request the xmod file from your supplier and install it.

For feature pack license and installation instructions, see "Installing a Modular Software Package" in the [ExtremeXOS 16.2 User Guide](#).

Table 8: ExtremeXOS Feature Pack Features

Feature Pack	Feature	Platform Support	XMOD Required
Direct Attach. See Direct Attach Feature Pack on page 19.	Direct attach	Summit X460, X460-G2, X480, X670, X670-G2, X450-G2, and X770 series switches BlackDiamond 8800 series switches BlackDiamond X8 series switches	No
MPLS (IPv4 only). See MPLS Feature Pack (IPv4 Only) on page 19.	<ul style="list-style-type: none"> • MPLS • LDP • Static LSPs • OSPF-TE • MPLS label • EXP bit replacement and classification • RSVP-TE • VPLS / H-VPLS for VLANs • VPLS STP Redundancy • VPLS with ESRP redundant access • VPLS with EAPS redundancy • Fast Reroute (FRR) • Support for PW counters • User Virtual Routers • L3VPN 	Summit X460, X460-G2, X480, X670, X670-G2 and X770 series switches. E4G-200 and E4G-400 cell site routers. BlackDiamond 8900 xl-series modules. BlackDiamond 8900 xm-series modules BlackDiamond X8 series switches	No
Network Timing. See Network Timing Feature Pack on page 19.	Precision Time Protocol (PTPv2)	E4G-200 and E4G-400 cell site routers Summit X460, X460-G2, X670-G2, and X770 Series switches	No
AVB	<ul style="list-style-type: none"> • Generalized Precision Time Protocol (GPTP) • Multiple VLAN Registration Protocol (MVRP) • Multiple Stream Registration Protocol (MSRP) • Platform Support 	Summit X430, X440, X450-G2, X460, X460-G2, X670, X670-G2, and X770 series switches	No

³ For the E4G-200, you obtain the MPLS feature pack by upgrading to an Advanced Edge license. For the E4G-400, the Advanced Edge license is standard and already includes the MPLS feature pack.

⁴ To run MPLS with BlackDiamond 8900 xl-series modules, a BlackDiamond 8800 series switch requires ExtremeXOS Release 12.5 or later. BlackDiamond 8900-MSM128, and BlackDiamond 8900 xl-series modules are supported. No other modules are supported when MPLS runs on a BlackDiamond 8800 series switch with ExtremeXOS 12.5.

⁵ To run MPLS with BlackDiamond 8900 xm-series modules, a BlackDiamond 8800 series switch requires ExtremeXOS Release 12.6 or later, BlackDiamond 8900-MSM128, and BlackDiamond 8900 xl- or xm-series modules. No other modules are supported when MPLS runs on a BlackDiamond 8800 series switch with ExtremeXOS 12.6 or later.

Table 8: ExtremeXOS Feature Pack Features (continued)

Feature Pack	Feature	Platform Support	XMOD Required
OpenFlow	OpenFlow	Summit X440, X460, X460-G2, X480, X670, X670-G2, and X770 series switches	Yes
TRILL	TRILL	Summit X670, X770 series switches BlackDiamond X8 series switches	No

Note

Starting with ExtremeXOS 16.2, Secure Shell 2 (SSH2) is no longer provided as a feature pack. It is incorporated into the main ExtremeXOS software image and is no longer provided as an XMOD. However, SSH2 contains strong encryption algorithms that heighten the export controls required in the US and other countries. When downloading the ExtremeXOS software image, you are required to verify that you meet the export clearance requirements. For more information, see "Software Upgrade and Boot Options" in the *ExtremeXOS 16.2 User Guide*. For more information on SSH2, see "Using Secure Shell 2" in the *ExtremeXOS 16.2 User Guide*.

Direct Attach Feature Pack

The Direct Attach feature, which is based on the IEEE version of VEPA, eliminates the virtual switch layer, simplifying the network and improving performance.

Direct Attach enables data center simplification by reducing network tiers from four or five tiers to just two or three tiers, depending on the size of the data center.

This feature pack is included with all ExtremeXOS software licenses and can be enabled by purchasing and enabling a feature pack license key.

For more information about the direct attach feature, see "Managing Direct Attach to Support VEPA" in the *ExtremeXOS 16.2 User Guide*.

MPLS Feature Pack (IPv4 Only)

The MPLS Feature Pack provides MPLS support including VPLS L2 VPNs and L3 VPNs.

A separate feature pack must be purchased for each switch that runs MPLS and VPLS.

MPLS requires an Advanced Edge or Core software license.

After you enable the feature pack, the feature CLI commands are visible; without an enabled MPLS feature pack, you do not see any feature commands on the console.

Network Timing Feature Pack

The Network Timing Feature Pack supports the Precision Time Protocol (PTPv2).

This feature pack is included with all ExtremeXOS software licenses and can be enabled by purchasing and enabling a feature pack license key.

For more information about PTPv2, see "Overview of PTP" in the [ExtremeXOS 16.2 User Guide](#).