

# SummitStack™ Stacking Technology

## Introduction

The access layer of a network can be implemented using either chassis or fixed-format switches. A chassis has the advantage of simplifying management, but it also has the disadvantage of requiring the allocation of more space than what the initial port counts may require. Fixed-format switches have the advantage of being less expensive and easier to fit into open rack slots, but the disadvantage is that each new addition of access ports brings with it another device to manage.

Stacking technology can reduce the management overhead of fixed-format switches, but often at a cost in overall performance and reliability. A stacking architecture that lacks adequate bandwidth or incurs forwarding penalties results in a serious loss of performance, which is unsuitable to support new converged applications.

Summit® X450 series and Summit X250 series switches with SummitStack stacking architecture were designed to support converged services. The significant throughput provided by SummitStack stacking, up to 320 Gigabits per Second (Gbps) per stack, and the distributed, shortest path forwarding can provide performance comparable with chassis switches. Resiliency is of key importance for these applications and is provided by redundant bidirectional ring architecture and n-1 master redundancy, distributed Layer 2 and Layer 3 link aggregation, link redundancy and distributed uplinks.

SummitStack stacking on Summit X450 series and Summit X250 series switches delivers the best of both worlds: the benefits of a chassis at the cost of a stackable, in an architecture designed to support today's evolving LAN applications. The resulting network simplification can provide lower management and maintenance costs while enhancing overall availability.

## Benefits of SummitStack

SummitStack stacking offers management simplicity like modular chassis at lower entry cost. Benefits of SummitStack stacking technology are summarized as follows:

### Connectivity Cost

Using Extreme Networks® special stacking interconnect cables to connect Summit X450 switches and Summit X250 switches with built-in dedicated high-speed stacking interfaces together provides a lower cost inter-switch connectivity alternative to 10 Gigabit Ethernet links.

### Combined Management

ExtremeXOS™ SummitStack creates a single management point of control for configuring and managing all of the member switches in a stack. Configuring Layer 2 VLANs or Layer 3 routing interfaces is simplified with a single management view of all the ports in the entire stack.

### Pay as You Grow

With ExtremeXOS SummitStack, you can start out with a single switch and grow to eight switches in a single stack. Features such as Link Aggregation, Multicast and Port Mirroring operate with ports on a single switch or operate on ports spread across multiple stack member switches. You can add ports to your Extreme Networks SummitStack when customers need additional port density.

### Mix To Fit

By using ExtremeXOS SummitStack, you can mix switches with different interface types and port densities in a single stack to support a range of applications.

Interfaces available are:

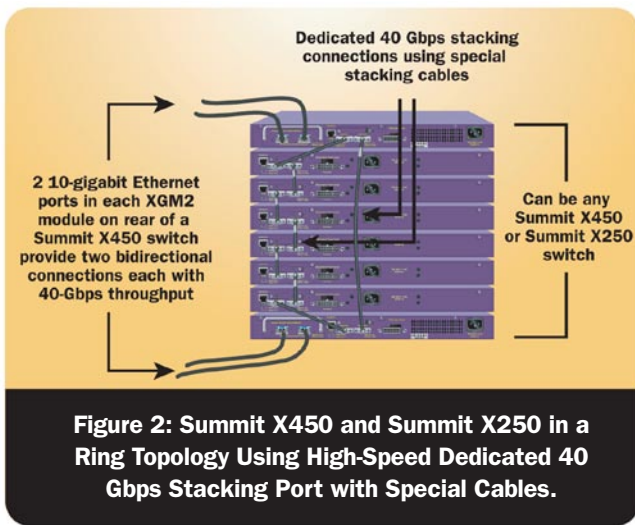
- 10/100/1000BASE-T available in AC and DC powered versions
- 10/100/1000BASE-T with Power Over Ethernet (PoE) in AC powered versions
- 100/1000BASE-X mini-GBIC (SFP) available in AC and DC powered versions
- 10/100BASE-TX with or without PoE in AC powered versions

## Stacking Topologies

Typical stacking topologies have a stack of up to eight Summit switches in a ring or linear configuration. Both Summit X450 series and Summit X250 series switches have dedicated high speed stacking ports at the rear of the switches that run at 10Gbps per port.

### Ring Topology with Sub-Second Failover

Supported switch models can be arranged in a stack using a ring topology. A ring configuration has built-in redundancy in case a link between two of the switches fails or if an entire switch fails. This helps ensure sub-second failover to the redundant data path in the ring topology on the stack.



## Features and Benefits

SummitStack stacking technology from Extreme Networks enables a simple and extensible network access solution that provides the following features:

- High availability using multiple resiliency mechanisms
- Non-blocking performance with distributed Layer 2 and Layer 3 forwarding and high-speed uplinks from the stack to the network core
- Simple management of standalone switches
- Feature flexibility and extensibility of a modular chassis

### High Availability

SummitStack stacking technology provides multiple resiliency mechanisms to help ensure high availability for the stack.

### N-1 Master Redundancy

Every switch in the stack can assume the role of stack master. If the current master fails, another master is elected from the stack.

### Protocol Support for Hitless Failover

Like the BlackDiamond® chassis switch, SummitStack offers hitless protocol support when master node performs failover to backup node. Hitless protocol supports include Spanning Tree Protocol (STP), Ethernet Automatic Protection Switching (EAPS), Extreme Standby Router Protocol (ESRP), Virtual Router Redundancy Protocol (VRRP), Link Aggregation Control Protocol (LACP), Open Shortest Path Fast (OSPF), Border Gateway Protocol (BGP), etc. Hitless Failover also supports features such as PoE and Network Login/802.1x to minimize network downtime.

### Ring Topology with Sub-Second Failover

In a ring topology, stack members are connected over redundant paths (shown in Figure 1). In case of a link or switch failure, stack members automatically use the redundant link to communicate with the master.

### Stack Segmentation Recovery for Continuous Connectivity

Stack segmentation can result from dual failures in a ring topology or from a single failure in a daisy-chain topology. The unique design of SummitStack stacking allows the two segments of the stack to become fully functional independent stacks by automatically electing a stack master for each stack segment without user intervention. Each of the segmented stacks inherits the same configuration from the previous single stack.

When a stack splits into two segments, each segment could become unmanageable or inaccessible through telnet. Assigning a fallback management IP address to each slot or stack member ensures continuous connectivity to the stack in the event of segmentation. Fallback management IP address is used as the IP address of the management port in the event a stack member becomes the stack master after stack segmentation.

### Non-Blocking Performance

The interconnections between stack members in a stack ensure packets are forwarded at line rates. The dedicated stacking ports on the rear of the switch provide high-speed 40Gbps connections that can be used to connect to other stack members or merge multiple stacks.

### High-Speed 10 Gigabit Ethernet Uplinks from the Stack to the Network Core

In addition to the dedicated stacking ports, Summit X450 series switches provide an optional XGM2 module with two 10 Gigabit Ethernet ports, each with 20Gbps throughput for high-speed, bidirectional uplink connections to the core of the network.

## Distributed Layer 2 and Layer 3 Forwarding

Each stack member maintains local hardware tables that receive updates from the stack master. Each stack member can perform Layer 2 and Layer 3 forwarding—a distributed, resilient and highly efficient switching architecture.

## Efficient Multicast

The stack master is responsible for programming the multicast tables on all slave switches. As a result, each stack member will have an updated list of Layer 2 and Layer 3 multicast data streams and will be able to forward multicast data packets automatically.

## Simple Management of a Standalone Switch

SummitStack stacking technology ensures that the stack is seen as a single, logical switching unit that can be managed as a single switch with a single management IP address. This provides simple management for Telnet, EPICenter®, SNMP and RMON.

## Software Upgrade

SummitStack architecture provides simple software upgrade for multiple switches in a stack. Once Software upgrade is requested through Command Line Interface (CLI) or EPICenter, stack master starts upgrading all switches in a stack simultaneously and once these upgrade process completed, stack master upgrades itself.

A CLI that is similar to the commonly used interface in Extreme Networks chassis products manages and displays all the members in a stack.

## Feature Flexibility and Extensibility of a Modular Chassis

Critical access features can span ports across different members of the stack allowing flexibility for feature configuration. Also, stack members can be added to the stack as new features are enabled on the network, providing the extensibility of a modular chassis.

## Load Sharing

SummitStack architecture supports load sharing (link aggregation) across a stack of switches. Ports can be tied together into a load share group to provide increased bandwidth and resiliency. This feature is very useful in a stack where there are two high-speed ports available as uplink ports on either end of the stack.

## Open Shortest Path First (OSPF)

OSPF distributes routing information between routers belonging to a single IP domain. An advanced license is required for each switch in the stack to run OSPF. Enabling OSPF on all stack members allows multiple equal-cost routes to be used concurrently across different stack members.

## Port Mirroring

Port mirroring allows copying of all traffic associated with one or more ports to a monitoring port. Mirroring support on all members of a stack increases the flexibility of monitoring network traffic from any stack member.

## Jumbo Frames

Jumbo frames are used between end stations that support larger frame sizes for more efficient transfers of bulk data. SummitStack allows jumbo frames to be enabled stack-wide in a stack of switches, enabling high-speed data transfers between end stations connected to ports on different stack members in the stack.

## Ethernet Automatic Protection Switching (EAPS)

The EAPS protocol provides fast protection switching to Layer 2 switches interconnected in an Ethernet ring topology, such as a Metropolitan Area Network or a large enterprise network. Running EAPS on a stack allows standalone switches in a stack to simulate chassis-like operation in a large campus network. EAPS does not re-converge even under master switch failure by SummitStack hitless protocol support.

## RADIUS and TACACS+

RADIUS and TACACS+ are two methods that ExtremeXOS provides to authenticate users who login to the switch. An advanced license is required on each switch in a stack to enable RADIUS/TACACS across a stack. The stack master manages all RADIUS and TACACS authorization requests. This simplifies user management across all the switches in the stack. As new users connect to the network, security parameters on the stack can be easily updated for all users connecting to members of the stack.

## 802.1x/Network Login

802.1x/Network Login controls the admission of user packets into a network by giving accesses only to users that are properly authenticated. The stack master handles all Network Login and 802.1x processing. This allows the network operator to set security parameters for all ports on the stack at once allowing simple implementation of security parameters across all the ports in the stack.

## ESRP and VRRP Redundancy Protocols

ESRP and VRRP are protocols that allow multiple switches to provide redundant routing services to users. ESRP and VRRP redundant ports can span across any stack member in the stack allowing a flexible redundancy design. The stack manager handles all protocol messages that communicate with all stack members, creating a chassis-like redundancy operation.

## SummitStack Stacking Design Considerations

Up to eight switches can be configured in a stack using SummitStack stacking. Refer to the ExtremeXOS Concept Guide for additional design recommendations.

Consistent ExtremeXOS Images and Licensing support SummitStack stacking support is available in ExtremeXOS 12.0. ExtremeXOS images and software licenses must be consistent across all members of the stack to provide correct stack operation. The feature set supported for the stack is the minimum set of features (or license) supported on any member of the stack. If any switch in the stack has a basic edge license, the entire stack will come up with the basic edge license.

When adding new stack members, the stack master determines whether a new switch can be added to the stack. The master determines if the new member has appropriate license before allowing it to join the stack. If the new member has advanced edge license and the stack is running the edge license, the new member will be allowed to join the stack with only the edge license capability. If the new member has basic edge license and the stack is running the advanced edge license, the new member will not be allowed to join the stack until new member switch has the advanced edge license installed.

### Building a Stack

After ExtremeXOS 12.0 is downloaded to the same partition on each standalone Summit switch, they are ready to be connected to form a SummitStack. Connect the switches to each other, using the special stacking interconnect cables, so that the connections form a communications ring as shown in Figure 2.

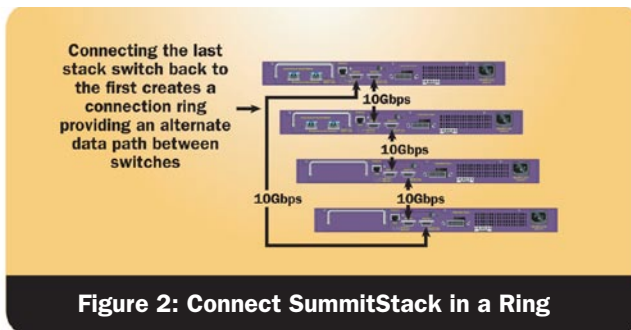


Figure 2: Connect SummitStack in a Ring

When standalone Summits running ExtremeXOS 12.0 are connected this way, it is possible to configure the entire stack and enable stacking from a single switch.

### Enabling SummitStack

Select the individual Summit switch that will be the stack master and login to the console port of that switch. The stack master switch runs the management and control protocols for the entire stack and maintains the stack configuration information.

The “easy-setup” command provides an easy way of initially configuring the stacking parameters of all nodes in a new stack:

configure **stacking easy-setup**

This “easy-setup” command will perform the following functions:

- Advise the user of the stacking parameters that will be set.
- Tell the user whether minimal or no redundancy will be configured, and which slot will normally contain the Master node.
- Tell the user the slot number that will be assigned to the node on which the user’s management session is being run.
- If applicable, warn the user that the current configuration file changes will be lost and that the user needs to save them.
- If a daisy chain is present, warn the customer that he should wire the stack as a ring before running this command.
- Ask the user for a confirmation to proceed. Assume the user answers “yes”.
- Enable stacking on all nodes.
- Configure the stacking MAC address using the factory address of the current node.
- Configure a slot number for each node.
- Configure redundancy to minimal in a ring topology or none in a daisy chain topology.
- Reboot the stack topology.

After the ‘reboot stack-topology’ command, all of the switches connected together in the stack should reboot.

### Commands for SummitStack

For the users who would like to manually provision the stacking parameters, the following commands are available. This sequence of commands can also be used to enable SummitStack.

**enable stacking**—Once individual switches are connected using the special stacking interconnect cable, ExtremeXOS allows stack configuration from any single switch in the stack. Entering this command on one switch enables SummitStack on all connected switches.

**configure stacking slot-number automatic**—SummitStack requires that ‘slot’ numbers are assigned by the user. This command is a quick way to assign slot numbers based on how the stack is connected with the special stacking interconnect cables. The switch where this command is entered will be slot 1. The slot number should be displayed on the front panel for all of the switches in the stack after the reboot stack-topology command.

**configure stacking MAC address**—For a SummitStack to work as a single switching system, a single Ethernet MAC address is needed for management and control protocols such as SNMP and EAPS. This command uses the unique MAC address of the switch, where the command was entered, as the MAC address for the entire stack.

**configure stacking redundancy minimal**—One of the benefits of SummitStack is management and control protocol redundancy. One of the switches in a SummitStack is the stack master where the management and control protocols are running. A backup switch is selected from the other stack members and is kept in sync with updates to the master switch. Should the master switch fail or be disconnected from the stack, the backup would assume control of the stack and become master.

Using this command limits the selection of master/backup to two switches in the stack. It has the advantage of restricting which switches need management/console connectivity for managing the entire stack. (Which node of the stacked switches becomes backup switch? Random or associated to slot number? I think we suggest master and backup nodes to be adjacent each other, would it be done automatically?)

**(if needed) configure stacking license-level**—If this command is used, SummitStack contains switches running at different license levels such as a Summit X450a series and a Summit X450e series. In this example, either:

- upgrade the Summit X450e switch to an Advanced Edge license
- or issue the configure stacking license-level edge command to achieve a common license level of Edge license for the entire stack.

**reboot stack-topology**—The ‘stack-topology’ option is required to tell the reboot command to reboot all switches connected with special stacking interconnect cables. After the reboot, SummitStack is enabled.

## Using SummitStack

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Once the stack is up and running, its behavior is similar to an Extreme Networks chassis system. Individual switches work together as a system and take on additional characteristics.

### Slot Numbers and Port identifiers

Similar to a chassis system, each switch in a SummitStack has a user assigned unique ‘slot’ number from 1 to 8. Unlike a chassis where slot numbers are assigned to physical locations, slot numbers for a SummitStack are not restricted to where a switch is physically connected in a SummitStack. E.g. a switch connected to slot 1 using a special stacking interconnect cable does not have to be numbered slot 2. Slot numbering and stack cabling are independent of each other.

Port numbers in a SummitStack use the chassis format of slot:port (e.g. slot 3, port 14 would be 3:14). When a Summit is operating as a standalone switch, only the port number is provided.

### Switch Roles

When acting like a chassis system, SummitStack switches dynamically take on different roles and responsibilities in contrast to fixed function locations within a chassis system.

- **Master switch**—A Master switch is the single point of contact for management and routing protocols for the entire stack. Configuration information is distributed to the other stack member switches from the Master switch configuration data base. In addition to management information, Layer 2 and Layer 3 protocols run on the Master switch. Data forwarding information obtained from these protocols are distributed throughout the stack member switches.
- **Backup switch**—A backup switch is selected to serve as a management and Layer 2/Layer 3 protocol backup. Master switch state is fully duplicated on the Backup switch, and is continually updated as needed. In the event of a Master switch failure, the Backup switch will assume control over the stack.
- **Standby switch**—A Standby switch may be called upon to take on the role of master or backup.

### Useful Commands

SummitStack has additional commands. For a complete description, see ExtremeXOS 12.0 User Guide or the ExtremeXOS 12.0 Command Reference Guide.

A few commands are illustrated below:

```
* Slot-1 Stack.1 # show stacking
Stack Topology is a Ring
Active Topology is a Ring
```

Node MAC Address	Slot	Stack State	Role	Flags
*00:04:96:26:6c:df	1	Active	Master	CA-
00:04:96:26:6c:e3	2	Active	Backup	CA-
00:04:96:26:6b:e4	3	Active	Standby	CA-
00:04:96:26:6b:f7	4	Active	Standby	CA-
00:04:96:26:6b:ed	5	Active	Standby	CA-
00:04:96:26:6b:ec	6	Active	Standby	CA-
00:04:96:26:6d:1f	7	Active	Standby	CA-
00:04:96:26:6a:e9	8	Active	Standby	CA-

\* - Indicates this node

Flags: (C) Candidate for this active topology, (A) Active Node  
(O) node may be in Other active topology

```
* Slot-1 Stack.2 # show stacking configuration
Stack MAC in use: 02:04:96:26:6c:df
```

Node MAC Address	Slot Cfg	Cur	Prio	Alternate Mgmt IP / Mask	Alternate Gateway	Flags	Lic
*00:04:96:26:6c:df	1	1	Auto	10.66.13.200/24	10.66.13.1	CcEeMm-	Ee
00:04:96:26:6c:e3	2	2	Auto	10.66.13.201/24	10.66.13.1	CcEeMm-	Ee
00:04:96:26:6b:e4	3	3	Auto	10.66.13.202/24	10.66.13.1	--EeMm-	Ee
00:04:96:26:6b:f7	4	4	Auto	10.66.13.203/24	10.66.13.1	--EeMm-	Ee
00:04:96:26:6b:ed	5	5	Auto	10.66.13.204/24	10.66.13.1	--EeMm-	Ee
00:04:96:26:6b:ec	6	6	Auto	10.66.13.205/24	10.66.13.1	--EeMm-	Ee
00:04:96:26:6d:1f	7	7	Auto	10.66.13.206/24	10.66.13.1	--EeMm-	Ee
00:04:96:26:6a:e9	8	8	Auto	10.66.13.207/24	10.66.13.1	--EeMm-	Ee

\* - Indicates this node

Flags: (C) master-Capable in use, (c) master-capable is configured,  
(E) Stacking is currently Enabled, (e) Stacking is configured Enabled,  
(M) Stack MAC in use, (m) Stack MACs configured and in use are the same,  
(i) Stack MACs configured and in use are not the same or unknown,  
(-) Not in use or not configured

License Level Restrictions: (C) Core, (A) Advanced edge, or (E) Edge in use,  
(c) Core, (a) Advanced edge, or (e) Edge configured,  
(-) Not in use or not configured

```
* Slot-1 Stack.3 #
```

*Notice that the user prompt contains the slot number on which the console session is running. Also notice that the platform has changed to Stack.*

\* Slot-1 Stack.3 # show slot

Slots	Type	Configured	State	Port
Slot-1	X450a-24x		Operational	26
Slot-1	X450a-24xdc		Operational	26
Slot-3	X450a-24tdc		Operational	26
Slot-4	X450a-24tdc		Operational	26
Slot-5	X450a-24tdc		Operational	26
Slot-6	X450a-24tdc		Operational	26
Slot-7	X450a-24xdc		Operational	26
Slot-8	X450e-48p		Operational	26

\* Slot-1 Stack.1 # show ports stack-ports statistics

Port Statistics

Thu Sep 20 10:07:46 2029

Port	Link Status	Tx Pkt Count	Tx Byte Count	Rx Pkt Count	Rx Byte Count	Rx Bcast	Rx Mcast
1:1	A	0	0	0	0	0	0
1:2	A	1	66	0	0	0	0

=====  
 Link Status : A-Active, R-Ready, NP-Port Not Present L-Loopback  
 0->Clear Counters U->page up D->page down ESC->exit

## Summary

SummitStack stacking technology provides a convergence grade stacking solution with its highly available architecture and simplified management by allowing a set of switches to be managed by a single IP address. Each stack preserves a switch fallback IP address to prevent duplicate addresses in case of stack segmentation. The stack provides for n-1 times redun-

dancy with each stack member equipped with an independent CPU and power supply. Cross module support across the stack for critical access features enhances application of the stack as a single virtual switch. With redundant uplinks available on two different stack members, the stack provides a resilient solution that continues to operate even in the event of multiple failures.



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