SNA Switching Services

Cisco Systems announces enhancements to the CiscoBlue road map, including Systems Network Architecture (SNA) Switching Services (SNASw)—new Advanced Peer-to-Peer Networking (APPN) features for the data center. Cisco has been developing features for IBM processors and protocols as part of the CiscoBlue road map since 1991. The most recent enhancements to the road map include the solutions shown in Table 1.

Table 1 CiscoBlue Road Map Enhancements

Solution	Features
e-nable the WAN	DLSw+ availability, scalability, and performance enhancements; CiscoWorks Blue enhancements
e-nable the Data Center	SNASw, CIP performance enhancements
e-nable the Application	Cisco WebClient enhancements, Cisco Transaction Connection, TN3270 enhancements
e-nable the Campus	Gigabit Token Ring

The SNASw solution is a feature of the "e-nable the data center" road map, which provides a new way to deliver APPN services while supporting development of the IP infrastructure. This new solution provides a way for enterprises to reduce the amount of SNA traffic in the network while maintaining the needed native SNA functionality. The SNASw solution eliminates APPN network node (NN) routers from the network and provides options that support today's trend to minimize SNA traffic while building a robust IP infrastructure.

Cisco has supported APPN NN routing in the Cisco IOS® software since 1995. This original APPN architecture required significant resources in the router to maintain the topology maps and to support the broadcast traffic to locate resources. Also, this architecture did not provide a scalable solution for larger enterprises and was inconsistent with today's current trend toward an IP infrastructure. The SNASw solution replaces that functionality with the Branch Extender (BX) architecture, which eliminates the need for the full NN functionality in the network, provides a more scalable solution, and effectively eliminates SNA topology and most broadcast search traffic from the network.

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The SNASw solution also provides the Enterprise Extender (EX) feature, which transports SNA data over an IP network. Although Data-Link Switching Plus (DLSw+) also provides this capability, the EX functionality is unique because EX is also supported on the enterprise server. EX, therefore, provides the only solution that allows a pure TCP/IP data center and campus to support legacy SNA applications and desktops. As enterprises migrate to the latest releases of enterprise server software, EX functionality will provide a means to simplify data center design while enhancing availability.

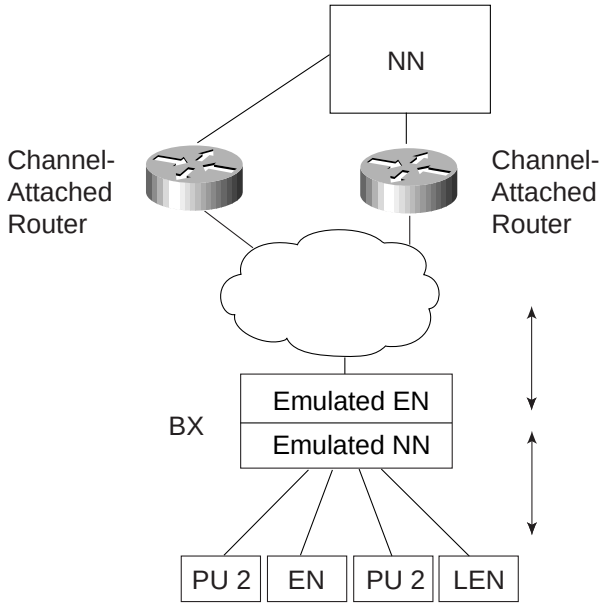
Finally, the SNASw solution provides a number of new usability and management features. With four years of APPN experience, Cisco has worked with enterprises to reduce configuration requirements, to provide options for distributing traffic across the network, and to provide the necessary management information.

Features at a Glance

BX Feature

BX provides a "dual personality" in the network, as shown in Figure 1. To the enterprise server upstream, it appears as an end node (EN), using the enterprise server as its NN server. This means that SNASw nodes do not send or receive topology updates from NNs, nor do they broadcast directory requests to all NNs in the network. To downstream devices, SNASw nodes provide NN server functionality. For pre-High Performance Routing (HPR) SNA devices, SNASw nodes work with the enterprise server to locate resources and setup sessions. For HPR-capable devices downstream, SNASw nodes participate in session setup, assisting in path selection with other HPR-capable devices. SNASw nodes also register resources with a central directory server (CDS) to minimize discovery broadcasts.

Figure 1 BX Functionality

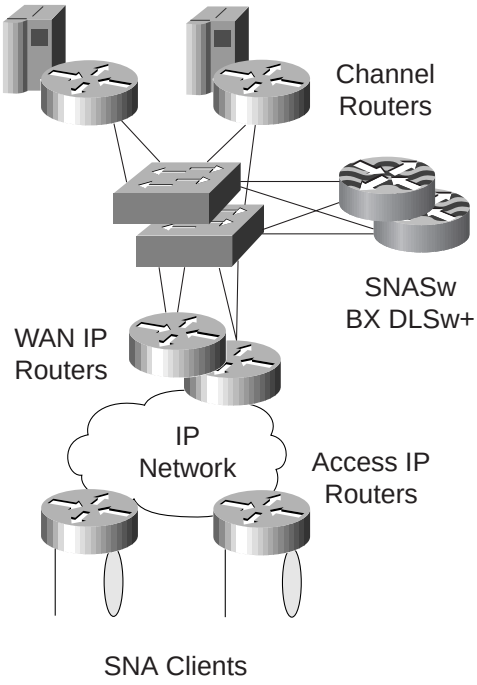


BX has the added value of reducing and simplifying configuration. Because the BX does not participate in NN-to-NN exchanges, minimal configuration is required. Combined with the usability enhancements listed later in this document, SNASw configurations can be reduced by more than 50 percent when compared with APPN NN configurations.

Although the BX feature addresses a key scalability issue of APPN, enabling SNASw functionality to be dispersed to branch offices, most enterprises are choosing to transport SNA over IP. Hence, the most likely place to implement SNASw with the BX feature is in the data center, as shown in Figure 2. Keeping APPN functionality in the data center minimizes the complexity in the branch routers as well as minimizing their memory requirements. Also note that although SNASw can be implemented in the

channel routers, most enterprises choose to implement the functionality in separate routers for change and fault management reasons. In a separate router, SNASw changes do not impact all the other traffic going to the enterprise server, and the fault domain of any single SNASw node can be minimized by using the appropriate number of high-speed, low-cost routers, such as one of the Cisco 7200 series routers. This design also results in a more scalable network, because additional branches can be brought on line nondisruptively by the addition of SNASw routers.

Figure 2 BX Network Design



EX Feature

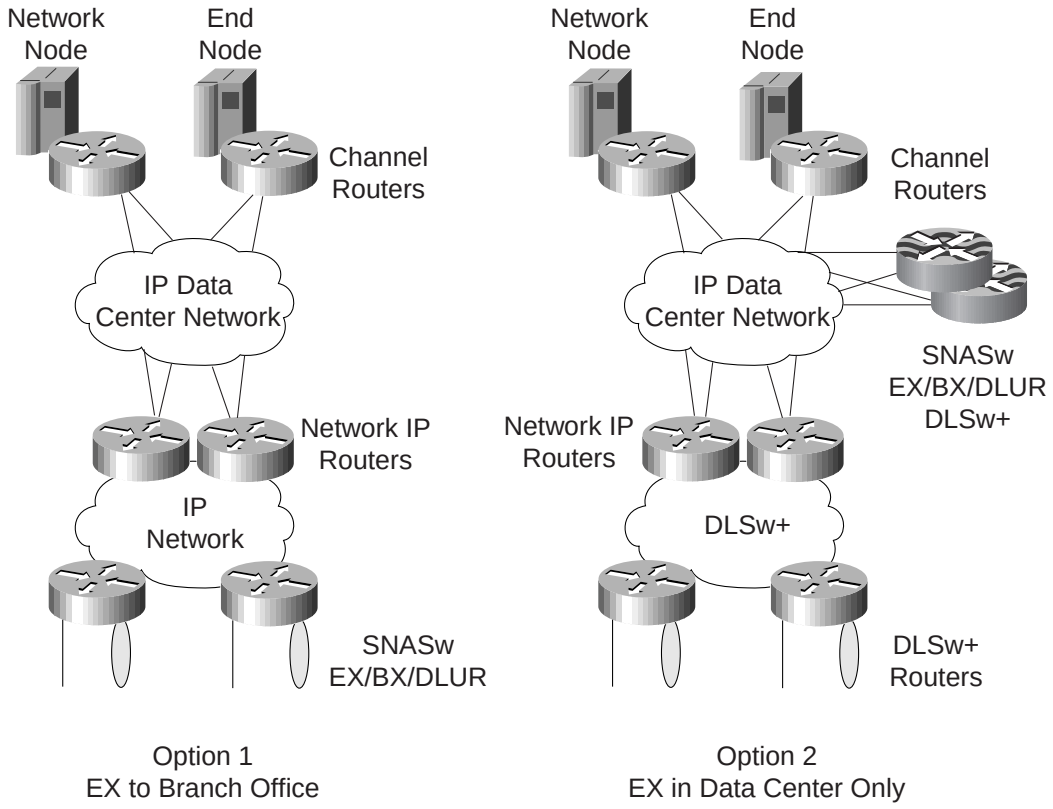
The EX feature of SNASw provides reliable transport of SNA data over an IP infrastructure, using UDP packets. SNA resources are identified using IP addresses and an IP routing algorithm, such as Open Shortest Path First (OSPF), is used to route the IP packet through the network. Reliability is provided by the Rapid Transport Protocol (RTP) layer of HPR. Using RTP provides end-to-end error detection and control, flow control using the Adaptive Rate-Based (ARB) algorithm of HPR, and segmentation. Additionally, traffic prioritization is provided by mapping the transmission priority bits in the SNA header to the IP precedence bits in the IP header.

Although DLSw+ also provides a reliable transport and mapping of priority bits, DLSw+ is not supported in the enterprise server. EX, on the other hand, has been implemented in OS/390 in V2 R6 with authorized program analysis report (APAR) OW36113, as well as in later versions of OS/390. Hence, the key advantage of the EX feature of SNASw is its ability to communicate directly to OS/390 over an IP network, migrating the network one step closer to pure IP.

This capability greatly simplifies campus network design and enhances availability. As more and more enterprises implement Fast Ethernet or Gigabit Ethernet backbones on the campus, redundancy issues of transparent bridging have created complexity when bridging SNA over those LANs. By transporting SNA over IP on the campus, media issues disappear and the campus benefits from the rerouting capabilities of IP.

By combining the BX and EX features, SNASw can feasibly be run at the branch. BX addresses the scalability issues and EX enables IP transport. However, the key benefit of EX is that it runs in the enterprise server; therefore, the software in the enterprise server must be at the appropriate level. EX can be used in one of two network designs, as shown in Figure 3. In Option 1, EX is used in the data center between the enterprise server and the SNASw node, while DLSw+ is used in the WAN. In Option 2, EX is used from the enterprise server to the branch office, eliminating DLSw+ in the WAN.

Figure 3 EX Design Alternatives



Selection of the appropriate design will be based on the technology comparison in Table 2.

Table 2 Technical Comparison of Design Options

Feature	Option 1—EX End-to-End	Option 2—EX in Data Center, DLSw+ in WAN
Traffic Prioritization	Set IP precedence	Set IP precedence
Points of Failure	Enterprise server and SNASw router at the branch	Enterprise server, SNASw router at data center, and DLSw+ router at the branch
Rerouting	Nondisruptive rerouting around failures between host and branch	Nondisruptive rerouting around failures between enterprise servers and data center DLSw+ routers and between DLSw+ routers
Rerouting Time	Can exceed several minutes depending on the size of the network and the location of the outage due to VTAM having to reestablish all RTP connections	Generally between 30 seconds and two minutes depending on adjustable timer settings
Enterprise Server Cycle Utilization	RTP connection maintenance proportional to number of branches	Relatively small, because there are only a few RTP connections from VTAM to SNASw
Branch Router Memory and Processor Overhead	More memory and cycles required	Less memory and cycles required

Table 2 Technical Comparison of Design Options (Continued)

Feature	Option 1—EX End-to-End	Option 2—EX in Data Center, DLSw+ in WAN
Risk	Relatively high: new enterprise server operating system, new technology, not widely deployed	WAN component, low: widely deployed. Data center component, relatively high: new operating system and new technology

Usability Enhancements

As part of the continued efforts of Cisco to improve the usability of its products, based on customer experience with the earlier APPN product, the SNASw solution provides the following enhancements.

Dynamic Control Point Name Generation

The control point (CP) name must be unique within a network. As an alternative to configuring a unique name in each SNASw node, the Cisco IOS software can generate a unique name based on the host name or IP address. This capability guarantees uniqueness and reduces configuration requirements.

Dynamic SNA Basic Transmission Unit Size Generation

Traditionally, APPN has required that a maximum basic transmission unit (BTU) size be generated. With this release, the SNASw solution analyzes the interface maximum transmission unit (MTU) and dynamically assigns the SNA BTU based on the best value for a specific port or from the MAXDATA value received from the enterprise server for a downstream device.

Dependent Logical Unit Requestor (DLUR) Connect-Out

If a subarea SNA device is configured in the enterprise server to receive a dial-out, the SNASw node receives the connect-out instruction from the enterprise server and makes the dial connection.

Improved ARB Flow Control

In its original release, the ARB algorithm was inefficient in increasing and decreasing the amount of data sent between HPR nodes. The APPN Implementers Workshop (AIW) has developed and approved a new algorithm, which improves the data flow. This enhancement is included in SNASw.

User-Settable Port Limits

The SNASw solution offers full control of the number of devices supported by a specific node. A configuration operand can be used to limit the number of devices that are served by a particular SNASw node. When the limit is reached, an SNASw node discontinues responses to test or explorer frames supporting new session setup. This feature enables load sharing among different SNASw nodes that offer service to the same SNA Media Access Control (MAC) address.

Management Enhancements

In the four years of supporting the full APPN NN, Cisco has received many recommendations from enterprises regarding how to better manage APPN. The SNASw solution includes a number of unique enhancements based on this input.

APPN Trap MIB Support

This Management Information Base (MIB) proactively sends traps with information about changes in status of SNA resources. This enhancement provides more information, more efficiently, on the status of the network and reduces the amount of Simple Network Management Protocol (SNMP) polling necessary to manage the SNA devices.

Data Link Tracing Options

SNA frames entering or leaving the SNASw component of the router can be traced to a console or to a cyclic buffer. The frames are then analyzed local to the router or transferred to a file server for analysis. When sent to a file server, the trace is in an SNA-formatted text file or a binary-formatted file, readable by popular network management applications. With this support, network analyzers on the lines are no longer necessary to diagnose SNA problems, because the SNASw can provide the information natively.

Console Message Archiving

Messages issued by SNASw are now archived in a buffer log, which can be queried and searched on a console or transferred to a file server for analysis. Using the buffer log, additional information is collected and maintained and can be queried as needed to gather more information about SNASw.

Interprocess Signal Tracing

As control is transferred from one process to another within SNASw, a trace entry is generated in binary format. The trace can then be examined to identify the activities occurring within SNASw.

Maps and SNA View Enhancements

These two CiscoWorks Blue network management applications will be enhanced to support additional standard MIBs for APPN. Additional enhancements will support the new features of SNASw.

Benefits

Migration to a Consolidated IP Infrastructure

Limiting SNASw routers to the data center and using the BX feature can significantly reduce SNA broadcasts from the IP network. With EX, SNA traffic is routed using the IP routing infrastructure while maintaining end-to-end SNA services.

Scalable APPN Support

With the addition of the BX feature, the number of NNs and, therefore, the amount of broadcast traffic is reduced. This means that large topology tables are no longer required in SNASw routers.

Reduced Configuration Requirements

By eliminating NNs and using the BX feature, configuration is minimized. Additionally, Cisco has enhanced its autoconfiguration capability to eliminate previously required commands.

Network Design Simplicity

By eliminating NNs, much simpler networks can be designed. By placing the SNASw routers in the data center, very few SNA routers are required; they can be configured easily using virtually identical configurations, and the network impact of SNA traffic is minimized.

Improved Availability

By adding unique Cisco capabilities to distribute traffic across multiple ports, traffic can be load balanced. Additionally, by supporting the newest HPR ARB flow control algorithm, bandwidth management for SNA traffic is improved. By using the EX feature in the data center, the lack of parallel paths in Fast Ethernet and Gigabit Ethernet environments can be overcome by using the IP routing infrastructure.

Increased Management Capabilities

Two new traces, interprocess and data link, provide an easier way to see APPN activity. The APPN Trap MIB provides the ability to notify the operator of events in the network. Console message archiving provides better tracking of network activity. Finally, by providing the option to create traces in a format readable by other management products, management is simplified and results are more readily available.

Architectural Compliance

Even though the SNASw solution is easier to use and SNASw networks are easier to design, SNASw can interface to all APPN implementations on the market today: ENs, NNs, and low-entry network (LEN) nodes. It also provides full DLUR support to allow older resources to take advantage of the APPN network.

Applications

SNA Routing

Where multiple data centers or multiple enterprise servers exist, SNA routing decisions must be made and traffic directed to the correct location. SNASw nodes interface with VTAM to send all messages directly to the correct server for all SNA traffic.

SNA Traffic Prioritization

As a BX node, an SNASw node works with other HPR nodes to provide the correct SNA class of service (COS)—selecting the correct path through the network and establishing transmission priority. Additionally, using EX, that support can be extended to transport across an IP network.

Support for an IP Infrastructure

The SNASw solution allows migration from a front-end processor (FEP)-based data center with subarea SNA traffic to a consolidated data center that supports SNA and TCP/IP applications concurrently. Using the EX feature, either in the data center in conjunction with DLSw+ in the network or end-to-end, SNA is efficiently transported over the converged IP infrastructure.

SNASw Features, Functions, and Benefits Summary

Table 3 provides a summary of SNASw features and their benefits.

Table 3 Feature and Benefit Matrix

Features	Comments/Descriptions	Benefits
BX	EN image to VTAM, NN image to downstream devices	• Reduced broadcast traffic • Simpler network design • Reduced configuration
EX	APPN traffic transported across IP routed infrastructure	Supports consolidated IP infrastructure while providing end-to-end SNA features
Dynamic CP Name Generation	Eliminates need to configure CP name	Reduced configuration
Dynamic SNA BTU Size Generation	Eliminates need to determine and configure BTU size	Reduced configuration
DLUR Connect-Out	Allows connect-out to downstream devices	Added flexibility for communications with remote devices
Improved ARB Flow Control	Implement enhanced flow control architecture	Better bandwidth management
User-Settable Port Limits	Configure maximum number of sessions by port	Better load distribution across multiple ports and routers
APPN Trap MIB Support	Support MIB that proactively generates traps when events in the SNASw network occur	Improved network management
Data Link Tracing Options	Trace inbound and outbound messages to console or buffer in SNA or standard analyzer format	• Enhanced network information • Eliminate need for network analyzer
Console Message Archiving	Store console messages plus additional information in a buffer	Improved router management
Interprocess Signal Tracing	Trace process changes within SNASw	Improved problem diagnosis
Maps and SNA View Enhancements	Support for additional standard MIBs and new SNASw features	Improved consolidated SNA/IP management

Availability and Orderability

The SNASw solution is orderable and shipping on September, 7, 1999, as part of Cisco IOS Release 12.0(5)XN. SNASw will also be orderable during the fourth quarter of 1999 as part of Cisco IOS Release 12.1.

When purchasing new Cisco routers, the SNASw solution is available in the Cisco IOS subsets shown in Table 4.

Table 4 Cisco IOS Subsets Containing the SNASw Solution for New Router Purchases

Product Number	Description
S25CR1S-12.0.5XN	Cisco 2500 Series IOS IP/IBM/SNASwitch
S25AR1L-12.0.5XN	Cisco 2500 Series IOS Enterprise/SNASwitch Plus IPSec 56
S26AR1P-12.0.5XN	Cisco 2600 Series IOS Enterprise/SNASwitch Plus
S26AR1L-12.0.5XN	Cisco 2600 Series IOS Enterprise/SNASwitch Plus IPSec 56
S26AR1K2-12.0.5XN	Cisco 2600 Series IOS Enterprise/SNASwitch Plus IPSec 3DES
S362AR1P-12.0.5XN	Cisco 3620 Series IOS Enterprise/SNASwitch Plus
S362AR1L-12.0.5XN	Cisco 3620 Series IOS Enterpris /SNASwitch Plus IPSec 56
S362ARK2-12.0.5XN	Cisco 3620 Series IOS Enterprise/SNASwitch IPSec 3DES
S364AR1P-12.0.5XN	Cisco 3640 Series IOS Enterprise/SNASwitch Plus
S364AR1L-12.0.5XN	Cisco 3640 Series IOS Enterprise/SNASwitch Plus IPSec 56
S364ARK2-12.0.5XN	Cisco 3640 Series IOS Enterprise/SNASwitch IPSec 3DES
S366AR1P-12.0.5XN	Cisco 3660 Series IOS Enterprise/SNASwitch Plus
S366AR1L-12.0.5XN	Cisco 3660 Series IOS Enterprise/SNASwitch Plus IPSec 56
S366ARK2-12.0.5XN	Cisco 3660 Series IOS Enterprise/SNASwitch IPSec 3DES
S4AR1P-12.0.5XN	Cisco 4000 Series IOS Enterprise/SNASwitch Plus
S4AR1L-12.0.5XN	Cisco 4000 Series IOS Enterprise/SNASwitch Plus IPSec 56
S4ARK2-12.0.5XN	Cisco 4000 Series IOS Enterprise/SNASwitch Plus IPSec 3DES
S45AR1P-12.0.5XN	Cisco 4500/4700 Series IOS Enterprise/SNASwitch Plus
S45AR1L-12.0.5XN	Cisco 4500/4700 Series IOS Enterpris /SNASwitch Plus IPSec 56
S45AR1K2-12.0.5XN	Cisco 4500/4700 Series IOS Enterprise/SNASwitch Plus IPSec 3DES
S72AR1-12.0.5XN	Cisco 7200 Series IOS Enterprise/SNASwitch
S72AR1L-12.0.5XN	Cisco 7200 Series IOS Enterprise/SNASwitch IPSec 56
S72AR1K2-12.0.5XN	Cisco 7200 Series IOS Enterprise/SNASwitch IPSec 3DES
S75AR1-12.0.5XN	Cisco RSPx Series IOS Enterprise/SNASwitch
S75AR1L-12.0.5XN	Cisco RSPx Series IOS Enterprise/SNASwitch IPSec 56
S75AR1K2-12.0.5XN	Cisco RSPx Series IOS Enterprise/SNASwitch IPSec 3DES
SC5AR1-12.0.5XN	Cisco Catalyst 5000 Series IOS Enterprise/SNASwitch
SC5AR1L-12.0.5XN	Cisco Catalyst 5000 Series IOS Enterprise/SNASwitch IPSec 56
SC5AR1K2-12.0.5XN	Cisco Catalyst 5000 Series IOS Enterprise/SNASwitch IPSec 3 DES

For existing Cisco routers without a Cisco IOS subset that contains APPN, the existing subset must be upgraded to the Enterprise subset on that platform. Then one of the SNASw feature licenses shown in Table 5 must be purchased.

Table 5 SNASw Subset Upgrades for Existing Routers without APPN Functionality

Product Number	Description
FL25-R1=	Cisco IOS 2500 Series SNASwitch Upgrade
FL26-R1=	Cisco IOS 2600 Series SNASwitch Upgrade

Table 5 SNASw Subset Upgrades for Existing Routers without APPN Functionality (Continued)

Product Number	Description
FL36-R1=	Cisco IOS 3600 Series SNASwitch Upgrade
FL4-R1=	Cisco IOS 4000 Series SNASwitch Upgrade
FL45-R1=	Cisco IOS 4500/4700 Series SNASwitch Upgrade
FL72-R1=	Cisco IOS 7200 Series SNASwitch Upgrade
FL75-R1=	Cisco IOS RSPx Series SNASwitch Upgrade
FLC5-R1=	Cisco Catalyst 5000 Series SNASwitch Upgrade

For existing Cisco routers with a Cisco IOS subset that contains APPN, the existing subset must be upgraded with one of the SNASw feature licenses shown in Table 6.

Table 6 SNASw Subset Upgrades for Existing Routers with APPN Functionality

Product Number	Description
FL25-N-R1=	Cisco IOS 2500 Series APPN to SNASwitch Upgrade
FL26-N-R1=	Cisco IOS 2600 Series APPN to SNASwitch Upgrade
FL36-N-R1=	Cisco IOS 3600 Series APPN to SNASwitch Upgrade
FL4-N-R1=	Cisco IOS 4000 Series APPN to SNASwitch Upgrade
FL45-N-R1=	Cisco IOS 4500/4700 Series APPN to SNASwitch Upgrade
FL72-N-R1=	Cisco IOS 7200 Series APPN to SNASwitch Upgrade
FL75-N-R1=	Cisco IOS 7500 Series APPN to SNASwitch Upgrade
FLC5-N-R1=	Cisco Catalyst 5000 Series APPN to SNASwitch Upgrade

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