Cisco Extensible Network Controller

Product Overview

Today's resource intensive applications are making the network traffic grow exponentially putting high demands on the existing network. Companies are finding it challenging to differentiate the critical applications from non-critical ones and to dynamically allocate the network resources to higher priority applications. As a result, customers are seeking a solution to make the network application-aware by intelligently monitoring and routing the network traffic. The Cisco® Extensible Network Controller (XNC), which is based on OpenDaylight, addresses the challenges by providing automation and orchestration of the network fabric, and by allowing dynamic, application-based configuration of networks and services. With XNC, Cisco is introducing the programmability functions into the platform and software-defined networking (SDN). SDN is an approach to programmable networks that separates and abstracts some of the control-plane functions from the network devices and places them in a centralized controller.

Cisco has taken a hybrid approach, in which the traditional control plane continues to exist along with a centralized external controller that will program the network based on applications or business use case requirements. Cisco XNC allows business applications to extract network data, make decisions about how they want the network to behave, and then program the network using a policy-based approach. Cisco XNC then communicates with the network devices to program the network functions for specific business use cases. Cisco XNC is designed to support multiple protocols for device communication. Cisco XNC Release 1.0 supports OpenFlow and will be adding Cisco Open Network Environment (ONE) Platform Kit (onePK) support.

Cisco XNC is built for extensibility using the Java OSGi application framework. This framework provides the flexibility needed for Cisco and Cisco partners and customers to extend the functions of the controller based on business needs. Cisco XNC also provides robust northbound Representational State Transfer (REST) APIs for business applications to access and program policies.

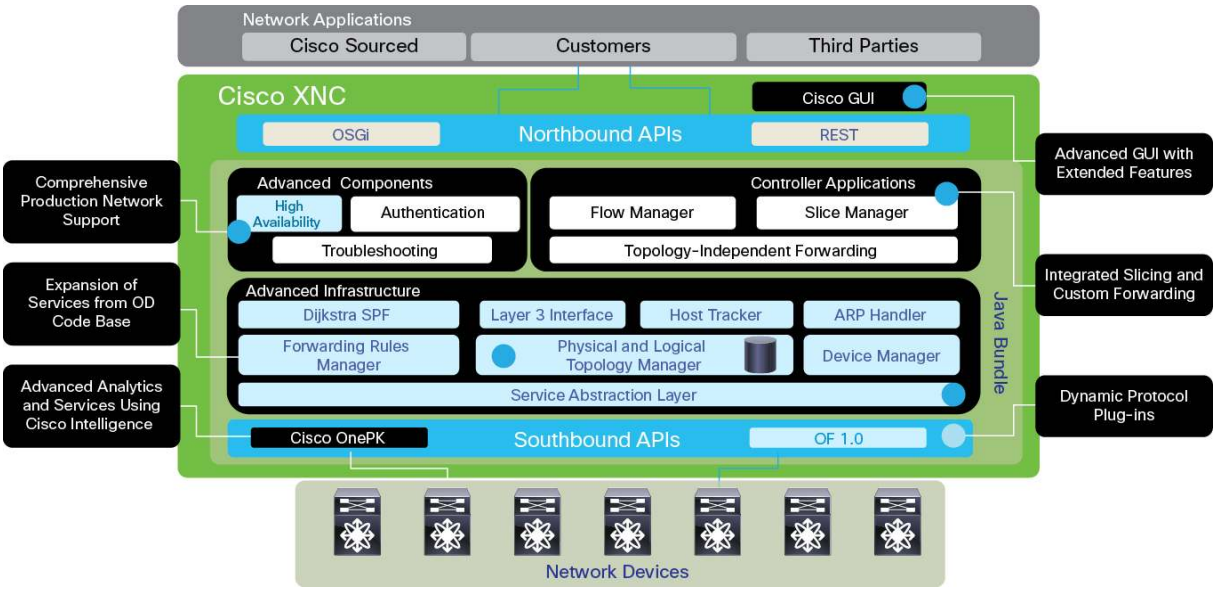
Cisco XNC is the industry's first controller with the capability to support multiple protocols for device communication. In addition, by using a service abstraction layer (SAL), Cisco XNC provides the abstraction for northbound business applications.

- The OpenFlow 1.0 implementation in Cisco XNC is standards compliant and supports interoperability with Cisco and third-party network devices.
- Cisco onePK enables access to the vast amount of intelligence present in Cisco network devices, providing a comprehensive set of analytic data to applications and improving the integration of the applications and the network.

Product Architecture and Functions

The controller consists of many different modules that interact through the Java OSGi application framework to provide the full capabilities of the solution. Figure 1 shows the controller and its modules.

Figure 1. Cisco XNC Architecture



The services built into Cisco XNC are grouped into four categories:

- Southbound API modules handle the interconnectivity and interoperability between Cisco XNC and the network devices (through the agents running on those devices). Cisco XNC can support a variety of protocols for southbound device communication, thereby providing the foundation for future expansion as new protocol standards emerge.
- The infrastructure core is a group of modules that provide the core services for Cisco XNC. These modules include the Topology Manager; the Forwarding Rules Manager, which handles forwarding; and the Dijkstra shortest-path first (SPF) algorithm, which provides the optimal path for a given optimization criterion.
- Network applications are programs that interact with the infrastructure core directly to provide extended support services northbound. Examples are the Network Slicing and Monitor Manager applications.
- Northbound APIs such as Java OSGi and HTTP and REST support the interaction between applications and Cisco XNC.

Features and Benefits

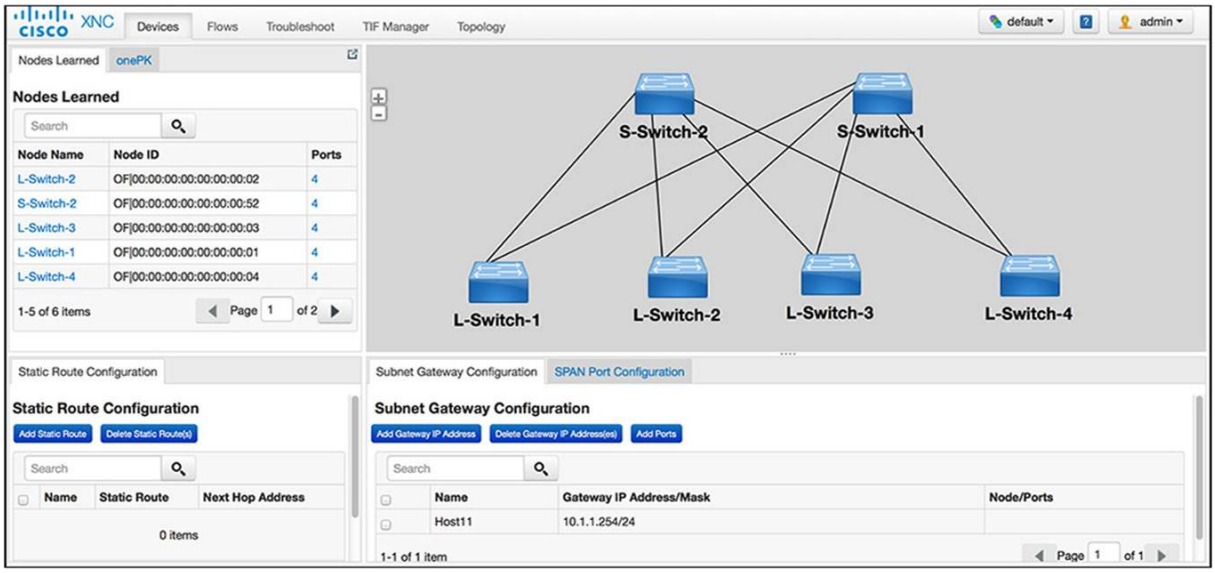
Cisco XNC is based on a highly available, scalable, and extensible architecture designed to support a production network. Table 1 summarizes the main features and benefits of Cisco XNC.

Table 1. Main Features and Benefits

Feature	Benefit
Extensible, modular architecture	• Capability to add, update, and delete modules without the need to restart Cisco XNC • Java OSGi-based architecture, which allows customers and partners to extend Cisco XNC functions using Java or Python • Service abstraction layer, which abstracts the southbound plug-ins (for device communication) to the northbound applications
Multiple access methods and access controls	• Consistent management access through the GUI or through Java or REST northbound APIs • Security features such as role-based access control (RBAC); integration with the enterprise authentication, authorization, and accounting (AAA) infrastructure; and secure control protocols
Network visibility and troubleshooting	• Functions to support network visibility and programmability, such as network topology discovery, network device management and forwarding rules programming, and access to detailed network statistics • Troubleshooting tools that provide flow-level visibility for each device
High availability through clustering	• Support for deployment of multiple instances in an active-active model • Active-active deployment model, making the controller both highly available and scalable • Synchronization of information and state across all controllers in real time, helping prevent loss of information in the event of a failure
Multiprotocol support	• The industry's first multiprotocol support for device communication starting with OpenFlow 1.0 and adding Cisco onePK support soon • Multiprotocol support that enables business applications to extend their use cases transparently across a multivendor network

Cisco XNC has a built-in GUI. Figure 2 shows an example of the GUI.

Figure 2. Cisco XNC GUI



Cisco XNC also offers users the flexibility to configure individual flows in each network device and to specify forwarding rules using the Flow Programmer feature. Using the Flow Programmer feature, the user can identify a flow based on Layer 1 through Layer 4 criteria and can specify the actions to be performed on the packets that match the flow specification. Possible actions are as follows:

- Drop or forward the packet to one or more interfaces
- Set the VLAN ID and priority
- Remove the VLAN header
- Modify the source and destination MAC addresses
- Modify the source and destination IP addresses
- Set the type-of-service (ToS) bits
- Modify the source and destination Layer 4 ports
- Set the next hop
- Send the packet to the controller

Main Use Cases Supported in Cisco XNC Release 1.0

Cisco XNC Release 1.0 supports the following three use cases:

- Monitor Manager: Application that applies the SDN approach to provide visibility into the network traffic
- Network Slicing: Application that provides the capability to partition the network based on physical or logical (flow) criteria
- Topology-Independent Forwarding (TIF): Application that provides the capability to define the forwarding path in the network based on application requirements

Table 2 summarizes the challenges addressed and the main features and benefits for each use case.

Table 2. Main Use Cases and Benefits

Use Case	Challenge	Features and Benefits
Monitor Manager	The amount of data traversing the data center is increasing dramatically, and IT departments need to find ways to maintain visibility into the traffic in a scalable and event-based manner. With Cisco XNC, the Monitor Manager application, and Cisco Nexus® 3000 Series Switches, Cisco addresses the challenges that exist with the conventional tapping approach.	Cisco's SDN-based solution addresses the challenges that exist with conventional tapping approaches: • Replacement of purpose-built hardware with familiar production switches saves capital expenditures (CapEx) and operating expenses (OpEx) over time, also increasing the scalability of the solution. • SDN enables the controller to enforce policy in real time and through event-based activities. • Controller northbound interfaces provide a programmatic option to develop custom tools to capture traffic details and trigger policies dynamically. For more information, please refer to the Monitor Manager data sheet available at http://www.cisco.com/go/xnc.
Network Slicing	As enterprise IT infrastructure expands, customers are looking for ways to create logical network separation that goes beyond VLANs and also can be created programmatically as needed.	The Cisco XNC Network Slicing application allows the network administrator to partition the network based on physical and logical criteria for multiple user communities. Slicing provides the logical separation required to manage the network traffic domains. A slice can be based on: • Network devices (a network device can be shared by multiple slices) • Network device interfaces (an interface can be shared by multiple slices) • Flow specification (source and destination IP addresses, protocol, or source and destination TCP ports) Two or more slices can share the same physical switch and interface, because each data flow is individually assigned to a slice on the basis of the flow specification. For more information, please refer to the Network Slicing and TIF data sheet available at http://www.cisco.com/go/xnc.

Use Case	Challenge	Features and Benefits
Topology Independent Forwarding	As network traffic increases, using conventional techniques, IT administrators are finding it impossible to configure and maintain the traffic forwarding path for mission-critical applications.	The TIF application on Cisco XNC allows IT administrators to configure the forwarding path using both conventional metrics and custom metrics such as bandwidth, monetary cost for the link, etc. The TIF application includes logic that can compute the optimal path on the basis of a given property and criteria, thereby making the network application aware. Network-aware applications also can request a forwarding path that meets certain criteria before sending the traffic, thereby enhancing the application experience for the end users. For more information, please refer to the Network Slicing and TIF data sheet available at http://www.cisco.com/go/xnc.

Minimum System Requirements for running Cisco XNC

Cisco XNC can run on a bare metal server or a VM (Virtual Machine) that meets the following requirements

- 6 core Processor
- 8 GB RAM
- 40 GB free space in the directory where Cisco XNC will be installed
- 64-bit Linux Operating System
- Java 1.7

Licensing and Ordering Information

Licensing for Cisco XNC depends on the application or the base controller itself. Table 3 and Table 4 provide ordering information for Cisco XNC and applications.

Table 3. Base Cisco XNC (No Applications) Part Numbers

Part Number	Description
L-XNC-S-K9=	XNC Controller with Right To Manage 10 device
L-XNC-M-K9=	XNC Controller with Right To Manage 50 device
L-XNC-L-K9=	XNC Controller with Right To Manage 100 device

Table 4. Cisco XNC and Cisco XNC Applications Promotional Bundles

Part Number	Description
L-XNC-MM-B-ST-K9	Starter Bundle that includes one instance of Cisco XNC and Monitor Manager application RTM 5 Top of Rack (1-2 RU) Nexus fixed switches
L-XNC-MM-B-S-K9	Small size deployment Bundle that includes two instance of Cisco XNC for HA and Monitor Manager application RTM 10 Top of Rack (1-2 RU) Nexus fixed switches
L-XNC-MM-B-M-K9	Medium size deployment Bundle that includes two instance of Cisco XNC for HA and Monitor Manager application RTM 25 Top of Rack (1-2 RU) Nexus fixed switches
L-XNC-MM-B-L-K9	Large size deployment Bundle that includes two instance of Cisco XNC for HA and Monitor Manager application RTM 50 Top of Rack (1-2 RU) Nexus fixed switches
L-XNC-TNS-B-ST-K9	Starter Bundle that includes one instance of Cisco XNC and TIF and Network Slicing applications RTM 5 Top of Rack (1-2 RU) Nexus fixed switches
L-XNC-TNS-B-S-K9	Small size deployment Bundle that includes two instance of Cisco XNC for HA and TIF and Network Slicing applications RTM 10 Top of Rack (1-2 RU) Nexus fixed switches
L-XNC-TNS-B-M-K9	Medium size deployment Bundle that includes two instance of Cisco XNC for HA and TIF and Network Slicing applications RTM 25 Top of Rack (1-2 RU) Nexus fixed switches
L-XNC-TNS-B-L-K9	Large size deployment Bundle that includes two instance of Cisco XNC for HA and TIF and Network Slicing applications RTM 50 Top of Rack (1-2 RU) Nexus fixed switches

Table 5. Combined Cisco XNC and Hardware Bundles for Monitor Manager Application

Part Number	Description
N3K-XNC-MM-B-ST	Starter bundle that includes XNC with Monitor Manager application and flexibility to choose up to 5 Nexus 3000 devices (3048/3064/3016)
N3K-XNC-MM-B-SM	Small size deployment bundle that includes XNC with Monitor Manager application and flexibility to choose up to 10 Nexus 3000 devices (3048/3064/3016)

For More Information

For more information about Cisco XNC, visit http://www.cisco.com/go/xnc or contact your local account representative.

Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV Amsterdam,
The Netherlands

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at www.cisco.com/go/offices.

Printed in USA C78-729453-01 12/13