Cisco Dynamic Fabric Automation Solution Guide

Last Modified: May 19, 2014

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Text Part Number:
CONTENTS

Preface  v
  Audience  v
  Document Conventions  v
  Related Documentation for Cisco DFA  vi
  Documentation Feedback  vii
  Obtaining Documentation and Submitting a Service Request  viii

CHAPTER 1  New and Changed Information  1
  New and Changed Information  1

CHAPTER 2  Information About Cisco DFA  3
  Finding Feature Information  3
  Terminology  4
  Cisco Dynamic Fabric Automation Overview  5
  Fabric Management  5
    Cisco Prime Data Center Network Manager  6
  CLI-Based Auto Configuration  7
  Optimized Networking  7
    Frame Encapsulation  7
  Cisco DFA Services Support  8
  OpenStack for Cisco DFA  9

CHAPTER 3  Deploying Cisco DFA  11
  Finding Feature Information  11
  Platform Requirements  11
  Licensing Requirements for Cisco DFA  13
  Guidelines and Limitations for Cisco DFA  15
Contents

How to Cable the Network Fabric and Servers for Cisco DFA 16

Fabric Management Network and Console 16

Fabric Connectivity 16

Server Connectivity 17

Fabric Management 19

Deploying Cisco DFA 19
Preface

The Preface contains the following sections:

- Audience, page v
- Document Conventions, page v
- Related Documentation for Cisco DFA, page vi
- Documentation Feedback, page vii
- Obtaining Documentation and Submitting a Service Request, page viii

Audience

This publication is for network administrators who configure and maintain Cisco Nexus devices.

Document Conventions

Command descriptions use the following conventions:

<table>
<thead>
<tr>
<th>Convention</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>bold</strong></td>
<td>Bold text indicates the commands and keywords that you enter literally as shown.</td>
</tr>
<tr>
<td><em>Italic</em></td>
<td>Italic text indicates arguments for which the user supplies the values.</td>
</tr>
<tr>
<td>[x]</td>
<td>Square brackets enclose an optional element (keyword or argument).</td>
</tr>
<tr>
<td>[x</td>
<td>y]</td>
</tr>
<tr>
<td>{x</td>
<td>y}</td>
</tr>
<tr>
<td>Convention</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>[x {y</td>
<td>z}]</td>
</tr>
<tr>
<td>variable</td>
<td>Indicates a variable for which you supply values, in context where italics cannot be used.</td>
</tr>
<tr>
<td>string</td>
<td>A nonquoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.</td>
</tr>
</tbody>
</table>

Examples use the following conventions:

<table>
<thead>
<tr>
<th>Convention</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>screen font</td>
<td>Terminal sessions and information the switch displays are in screen font.</td>
</tr>
<tr>
<td>boldface screen font</td>
<td>Information you must enter is in boldface screen font.</td>
</tr>
<tr>
<td>italic screen font</td>
<td>Arguments for which you supply values are in italic screen font.</td>
</tr>
<tr>
<td>&lt;&gt;</td>
<td>Nonprinting characters, such as passwords, are in angle brackets.</td>
</tr>
<tr>
<td>[ ]</td>
<td>Default responses to system prompts are in square brackets.</td>
</tr>
<tr>
<td>!, #</td>
<td>An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.</td>
</tr>
</tbody>
</table>

This document uses the following conventions:

**Note**

Means reader take note. Notes contain helpful suggestions or references to material not covered in the manual.

**Caution**

Means reader be careful. In this situation, you might do something that could result in equipment damage or loss of data.

### Related Documentation for Cisco DFA


The Cisco Nexus 1000V switch for VMware vSphere documentation is at the following URL: http://www.cisco.com/en/US/products/ps9902/tsd_products_support_series_home.html. The documentation therein includes the following guides for Cisco DFA. Additional information pertaining to troubleshooting can be located in the Cisco Nexus 1000V documentation for Cisco NX-OS Release 4.2(1)SV2(2.2).

- Cisco Nexus 1000V DFA Configuration Guide, Release 4.2(1)SV2(2.2)
- Cisco Nexus 1000V VDP Configuration Guide, Release 4.2(1)SV2(2.2)

The Cisco Prime Data Center Network Manager (DCNM) documentation is at the following URL: http://www.cisco.com/en/US/products/ps9369/tsd_products_support_series_home.html. The Cisco Prime DCNM documentation for Cisco DFA includes but is not limited to the following guides:

- Cisco DCNM 7.0 OVA Installation Guide.
- Cisco DCNM 7.0 Fundamentals Guide
- Cisco DCNM DFA REST 7.0 API Guide


The OpenStack for Cisco DFA install documentation includes the following guide and documents:

- Open Source Used In OpenStack for Cisco DFA 1.0 at the following URL: http://www.cisco.com/en/US/docs/switches/datacenter/dfa/openstack/opensource/OpenStack_for_Cisco_DFA_1.0_Open_Source_Documentation.pdf

**Documentation Feedback**

To provide technical feedback on this document, or to report an error or omission, please send your comments to:

We appreciate your feedback.
Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see What's New in Cisco Product Documentation, at:  

Subscribe to What's New in Cisco Product Documentation, which lists all new and revised Cisco technical documentation, as an RSS feed and deliver content directly to your desktop using a reader application. The RSS feeds are a free service.
New and Changed Information

This chapter includes the following sections:

- New and Changed Information, page 1

New and Changed Information

The table below summarizes the new and changed features for this document and shows the releases in which each feature is supported. Your software release might not support all the features in this document. For the latest caveats and feature information, see the Bug Search Tool at https://tools.cisco.com/bugsearch/ and the release notes for your software release.

Table 1: New and Changed Information

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
<th>Where Documented</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 19, 2014</td>
<td>Updated licensing information for the Cisco Nexus 5600 Series and 6000 Series switches as a spine or leaf switch in the &quot;Licensing Requirements for Cisco DFA&quot; section.</td>
<td>“Deploying Cisco DFA” chapter</td>
</tr>
<tr>
<td>Date</td>
<td>Description</td>
<td>Where Documented</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| April 25, 2014   | • Updated for Cisco NX-OS Release 7.0(2)N1.(1).  
• Added support Cisco Nexus 5600 Series switches as a spine, leaf, border leaf, and route reflector to the "Platform Requirements" and "Licensing Requirements for Cisco DFA" sections.  
• Added information about the CLI-based auto configuration for Cisco Nexus 55xx Series switches. | "Deploying Cisco DFA" chapter  
"CLI-Based Auto Configuration" section in the "Information About Cisco DFA" chapter |
| April 1, 2014    | Added Cisco Nexus 5500 Series switches to the "Licensing Requirements for Cisco DFA" section.                                                                                                                                 | "Deploying Cisco DFA" chapter                                                   |
| March 27, 2014   | Added support for Cisco Nexus 5600 Series switches as a spine, leaf, border leaf, and route reflector to the "Platform Requirements" and "Licensing Requirements for Cisco DFA" sections. | "Deploying Cisco DFA" chapter                                                   |
| February 26, 2014| Added support for Cisco Nexus 7000 Series switches as a route reflector to the "Platform Requirements" and "Licensing Requirements for Cisco DFA" sections.                                                        | "Deploying Cisco DFA" chapter                                                   |
| February 13, 2014| Added Cisco Nexus 5500 Series switches to the "Platform Requirements" section.                                                                                                                                 | "Deploying Cisco DFA" chapter                                                   |
| January 31, 2013 | This book was created for Cisco Dynamic Fabric Automation (DFA) 1.0.                                                                                                                                         | —                                                                               |
CHAPTER 2

Information About Cisco DFA

This chapter includes the following sections:

- Finding Feature Information, page 3
- Terminology, page 4
- Cisco Dynamic Fabric Automation Overview, page 5
- Fabric Management, page 5
- CLI-Based Auto Configuration, page 7
- Optimized Networking, page 7
- Cisco DFA Services Support, page 8
- OpenStack for Cisco DFA, page 9

Finding Feature Information

Your software release might not support all the features documented in this module. For the latest caveats and feature information, see the Bug Search Tool at https://tools.cisco.com/bugsearch/ and the release notes for your software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the "New and Changed Information" chapter.
Terminology

The following figure shows the terms that are used for a Cisco Dynamic Fabric Automation (DFA) deployment. You should understand these terms and definitions before you deploy Cisco Dynamic Fabric Automation (DFA).

Figure 1: Terms Used in a Cisco DFA Deployment

- **Cisco DFA fabric**—A multistage, switching network in which every connected device is reachable through the same number of hops. The Cisco DFA fabric enables the use of a scale-out model for optimized growth.

- **Cisco DFA switch**—A leaf, border leaf, or spine device.

- **Leaf**—Switches with ports that are connected to Ethernet devices, such as servers (host interfaces) and ports (fabric interfaces), that are connected to the Cisco DFA fabric. Leaf switches forward traffic based on the enhanced control-plane functionality of Cisco DFA optimized networking, which requires segment ID-based forwarding.

- **Border leaf**—Switches that connect external network devices or services, such as firewalls and router ports, to a Cisco DFA fabric. Border leaf switches are similar to leaf switches and can perform segment ID-based forwarding.

- **Spine**—Switches through which all leaf and border leaf switches are connected to each other and to which no end nodes are connected. Spine switches forward traffic based on Cisco DFA-optimized networking with enhanced or traditional forwarding.
• Host interface—Leaf-to-server interfaces that receive traffic for connected VLANs to be extended across the Cisco DFA fabric.

• Fabric interface—Ports through which Cisco DFA switches are connected to one another.

Cisco Dynamic Fabric Automation Overview

Cisco Dynamic Fabric Automation (DFA) optimizes data centers through integration. The Cisco DFA architecture eliminates the need for overlay networks that can hinder traffic visibility and optimization and reduce scalability when physical server and virtual machine environments are integrated. This architecture enables zero-touch provisioning and greater orchestration, while delivering more predictable performance and latency for large cloud networks. The following building blocks are the foundation of Cisco DFA:

• Fabric Management—Simplifies workload visibility, optimizes troubleshooting, and automates fabric component configuration.

• Workload Automation—Integrates with automation and orchestration tools through northbound application programming interfaces (APIs) and also provides control for provisioning fabric components by automatically applying templates that leverage southbound APIs and/or standard-based protocols. These automation mechanisms are also extensible to network services.

• Optimized Networking—Uses a simple distributed gateway mechanism to support any subnet, anywhere, concurrently. Existing redundancy models are also used to provide N+ redundancy across the entire fabric.

• Virtual Fabrics—Extends the boundaries of segmented environments to different routing and switching instances by using logical fabric isolation and segmentation within the fabric. All of these technologies can be combined to support hosting, cloud, and/or multitenancy environments.

Fabric Management

The fabric management network in Cisco Dynamic Fabric Automation (DFA) represents a dedicated out-of-band network that is responsible for bootstrapping and managing the individual networking devices, such as spines, leafs, and border leaf switches that are controlled by fabric management. The fabric management network is responsible for transporting the protocols that are required for the different fabric management functions. The following table lists the functions and protocols across the fabric management network.

Table 2: Functions and Protocols Across the Fabric Management Network

<table>
<thead>
<tr>
<th>Function</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power On Auto provisioning (POAP) for automatically configuring network devices</td>
<td>• Dynamic Host Configuration Protocol (DHCP)</td>
</tr>
<tr>
<td></td>
<td>• Trivial File Transfer Protocol (TFTP)</td>
</tr>
<tr>
<td></td>
<td>• Serial Control Protocol (SCP)</td>
</tr>
<tr>
<td>Fabric discovery</td>
<td>Simple Network Management Protocol (SNMP)</td>
</tr>
</tbody>
</table>
The management network, also known as the management access, is the network administrator-facing interface for accessing fabric management. The management network represents the portion of your network from which you, as the network administrator, can connect to an Element Manager or a network management station (NMS) and to switches and routers.

The Cisco Prime Data Center Network Manager (DCNM) is a turn-key management system for fabric management, visibility, and an extensible set of functions to more efficiently control the data center fabric. Cisco Prime DCNM uses standards-based control protocol components to provide you with an extensive level of customization and integration with an operations support system (OSS) network.

Cisco Prime Data Center Network Manager

An Open Virtual Appliance (OVA) is a prebuilt software solution that comprises one or more virtual machines (VMs) that are packaged, maintained, updated, and managed as a single unit. The Cisco DCNM OVA includes an application functionality that is necessary for Cisco Dynamic Fabric Automation (DFA). Cisco Prime Data Center Network Manager (DCNM) as an OVA can be deployed on a VMware vSphere infrastructure.

Cisco Prime DCNM provides the following functionality:

• Device auto configuration is the process of bringing up the Cisco DFA fabric by applying preset configuration templates to any device that joins the fabric. Auto configuration installs an image or applies the basic configuration.
• Cable-plan consistency checks the physical connectivity of the fabric against a documented cable plan for compliance. The lack of compliance prevents specific links from being active and protects the fabric from unwanted errors.
• Common point-of-fabric access allows you, as a network administrator, to interact with the fabric as a single entity (system) to simplify queries and to eliminate switch-by-switch troubleshooting efforts.
• Automated network provisioning provides a new layer of automation integration in which the data center fabric-switching infrastructure is automatically provisioned for the physical or virtual workload that is being instantiated.
• Network, virtual fabric, and host visibility is provided by the management GUI and displays a single set of active network elements that belong to an organization in the fabric.

The Cisco DFA DCNM access network is the network administrator-facing interface for accessing fabric management and for connecting northbound application program interfaces (APIs) to orchestrators.
CLI-Based Auto Configuration

Cisco Dynamic Fabric Automation (DFA) supports a command-line interface (CLI) based auto configuration for preprovisioning network devices. The auto configuration is the same as any configuration that is based on network triggers such as data packet and virtual discovery protocol (VDP).

For Cisco Nexus 55xx switches and Cisco NX-OS Release 7.0(2)N1(1), use the `fabric database auto-pull` command to run the command-line (CLI) based auto configuration. See the Cisco Dynamic Fabric Automation Command Reference for more information.

The following guidelines and limitations apply when using the CLI-based auto configuration option:

- CLI-based auto configuration is the only supported configuration option for Cisco Nexus 55xx switches with Cisco NX-OS Release 7.0(2)N1(1).
- The `fabric database auto-pull` command must be executed on all switches where the auto configuration is required, including both switches in a virtual port channel+ (vPC+) topology.
- Use the "defaultNetworkL2GblVlanProfile" profile for the Cisco Nexus 55xx auto-configuration. The SVIs for the global VLANs must exist on the border leaf.
- If you are using a script to issue this command on switches, make sure that the configuration has successfully completed before starting the next request.
- If you need to save the auto configuration, use the `copy running start` command on all switches, including both switches in a vPC+ topology.

Once an auto configuration is created on a switch, you can use existing Cisco DFA commands, such as the `clear fabric database host` command, to manage the switch configuration.

For Cisco Nexus 55xx switches and supported earlier Cisco NX-OS releases, see the Cisco Nexus 5500 Series NX-OS Layer 2 Switching Configuration Guide to configure the software to meet your requirements.

Optimized Networking

Optimized networking in Cisco Dynamic Fabric Automation (DFA) uses a simple distributed gateway mechanism to support any subnet, anywhere, concurrently.

Frame Encapsulation

Optimized networking in a Cisco Dynamic Fabric Automation (DFA) deployment uses Cisco FabricPath Frame Encapsulation (FE) for efficient forwarding based on a Shortest Path First (SPF) algorithm for unicast and multicast IP traffic. Host route distribution across the fabric is accomplished using a scalable multi-protocol Border Gateway Protocol (MP-BGP) control plane.

The Cisco DFA enhanced forwarding improves Cisco FabricPath FE by optimizing the conversational learning from Layer 2 to Layer 3. In addition to the enhanced control and data plane for unicast and multicast forwarding, Cisco DFA reduces the Layer 2 failure domain by having the Layer2/Layer 3 demarcation on the host-connected leaf switch, which terminates the host-originated discovery protocols at this layer.

A distributed anycast gateway on all of the Cisco DFA leaf switches for a VLAN improves resilience and enables the fabric to scale to more hosts by keeping a short path for intra- and inter-VLAN forwarding. Cisco
DFA leaf switches that operate as border leaf switches interconnect the Cisco DFA fabric to external networks. Cisco DFA border leaf switches peer with external standard unicast and multicast routing protocols.

**Cisco DFA Services Support**

Services such as a firewall, load balancer, and virtual private networks (VPNs) are deployed at the aggregation layer in the traditional data center. In a Cisco Dynamic Fabric Automation (DFA) deployment, services nodes are deployed at regular leaf switches for both east-west and north-south traffic. Services can be physical or virtual services nodes.

The following figure shows the interaction between the Cisco Prime Network Services Controller (NSC) and the Cisco DFA deployment through Cisco Data Center Network Manager (DCNM).

*Figure 2: Cisco DFA with Services*

The Cisco Prime NSC is the services orchestrator for Cisco DFA. The NSC Adapter in the Cisco Prime DCNM Open Virtual Appliance (OVA) performs the following functions:

- Provides connectivity between Cisco Prime DCNM and the Cisco Prime NSC services orchestrator
- Automatically populates the Cisco Prime NSC with the organizations, partitions, and networks that are created in Cisco Prime DCNM
- Populates Cisco Prime DCNM with the services that are stitched through Cisco Prime NSC
• Allows the use of multiple Cisco Prime NSC instances to match the Cisco Prime DCNM scale

In Cisco DFA, configuration profile templates and instantiating the profiles on a leaf switch provide network automation. The templates are extended to support services in Cisco DFA. The profile templates are packaged in Cisco Prime DCNM for the services orchestrator. The table below includes a list of profile templates that are available for Cisco DFA services. It is important that you select the correct profile to orchestrate and automate services in the Cisco DFA fabric.

**Table 3: Cisco Templates for Services Support**

<table>
<thead>
<tr>
<th>Service</th>
<th>Network</th>
<th>Routing</th>
<th>Service Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edge Firewall</td>
<td>Host Network</td>
<td>N/A</td>
<td>defaultNetworkIpv4EfEdgeServiceProfile</td>
</tr>
<tr>
<td>Edge Firewall</td>
<td>Static</td>
<td>defaultNetworkIpv4TfEdgeServiceProfile</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dynamic</td>
<td>serviceNetworkIpv4TfDynamicRoutingProfile</td>
<td></td>
</tr>
<tr>
<td>Tenant External Service Network</td>
<td>Static</td>
<td>defaultExternalNetworkIpv4TfProfile</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dynamic</td>
<td>externalNetworkIpv4TfDynamicRoutingProfile</td>
<td></td>
</tr>
<tr>
<td>Service Node as Router/Default Gateway</td>
<td>Host Network</td>
<td>N/A</td>
<td>defaultNetworkL2Profile</td>
</tr>
</tbody>
</table>

For NSC Adapter installation information, see the *Cisco DCNM 7.0 OVA Installation Guide*.

**OpenStack for Cisco DFA**

OpenStack creates a human and machine-accessible service for managing the entire life cycle of the infrastructure and applications within OpenStack clouds. The technology consists of a series of interrelated projects that control pools of processing, storage, and networking resources throughout a data center that can be managed or provisioned through a web-based dashboard, command line tools, or a RESTful application programming interface (API).

The OpenStack for Cisco DFA software is included in the Cisco OpenStack Installer with its Grizzly-based release for this initial Cisco Dynamic Fabric Automation (DFA) release. OpenStack for Cisco DFA provides orchestration of the cloud that is enabled by Cisco DFA.

A minimum of three Cisco UCS C-series servers, each with a minimum 500.1 GB hard disk space, are required for using the pre-installed OpenStack for Cisco DFA. The initial release (1.0) of OpenStack for Cisco DFA is supported only through the web-based dashboard. The role and responsibilities for each Cisco UCS server is described in the following list:

- **Build server**—One server is a dedicated puppet build server.
- **Controller**—One server is a dedicated OpenStack controller for performing orchestration.
- **Compute**—One or more servers provide the hypervisor function for virtual machines (VMs); VMs run in the computes. You can have as many computes as is required and each compute can host multiple VMs.
The following figure shows a sample topology for OpenStack for Cisco DFA.

*Figure 3: OpenStack for Cisco DFA Topology*

Each of the Cisco UCS servers in your implementation must be connected to each other and the Cisco Prime DCNM must be connected to the control node. In the sample topology shown in the preceding figure, the build server, the controller and the computes are all connected through eth0 on the Cisco OpenStack Installer network (COI in the figure).

All of the Cisco UCS servers in your implementation must be configured with the Cisco Integrated Management Controller (IMC), also called CIMC. All of the Cisco IMC ports on the build server, controller, and computes must be connected to the Cisco IMC network. The Cisco IMC network performs the management functions against each Cisco UCS server.

For information about Open Source used in OpenStack for Cisco DFA 1.0, see the *Open Source used in OpenStack for Cisco DFA 1.0* document.
Deploying Cisco DFA

This section describes how to deploy Cisco Dynamic Fabric Automation (DFA).

This section includes the following topics:

- Finding Feature Information, page 11
- Platform Requirements, page 11
- Licensing Requirements for Cisco DFA, page 13
- Guidelines and Limitations for Cisco DFA, page 15
- How to Cable the Network Fabric and Servers for Cisco DFA, page 16
- Deploying Cisco DFA, page 19

Finding Feature Information

Your software release might not support all the features documented in this module. For the latest caveats and feature information, see the Bug Search Tool at https://tools.cisco.com/bugsearch/ and the release notes for your software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the "New and Changed Information" chapter.

Platform Requirements

Table 4: Cisco Dynamic Fabric Automation Platform Support

<table>
<thead>
<tr>
<th>Product</th>
<th>Function</th>
<th>Software Release (and later releases)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spine</td>
<td>Leaf</td>
</tr>
<tr>
<td>Cisco Nexus 6001 Series switch</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Product</td>
<td>Function</td>
<td>Software Release (and later releases)</td>
</tr>
<tr>
<td>---------</td>
<td>----------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Spine</td>
<td>Leaf</td>
</tr>
<tr>
<td>Cisco Nexus 6004 Series switch</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Cisco Nexus 7000 Series switch</td>
<td>Yes¹</td>
<td></td>
</tr>
<tr>
<td>Cisco Nexus 5672UP switch</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Cisco Nexus 56128 switch</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Cisco Nexus 5596UP switch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cisco Nexus 5548P and 5548UP switches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cisco Nexus 1000V switch for VMware vSphere 5.1 and 5.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cisco Prime Data Center Network Manager (DCNM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cisco Prime Network Services Controller (NSC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OpenStack for Cisco DFA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
With Cisco Nexus 7000 F2, F2e, and F3 Series modules.

With Cisco Nexus 7000 F3 Series module.

Cisco DFA requires a minimum of one multiprotocol BGP route-reflector (RR). As an integrated function of Cisco DFA, the following platforms can support this function:

- Nexus 6000 Series switches with Cisco NX-OS Release 7.0(0)N1(1) and later releases
- Nexus 5600 Series switches with Cisco NX-OS Release 7.0(1)N1(1) and later releases
- Nexus 7000 Series switches with Cisco NX-OS Release 6.2(6a) and an MPLS feature, grace period, or evaluation license

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Licensing Requirements for Cisco DFA

Review the other hardware and software components of your existing fabric with respect to the Cisco Dynamic Fabric Automation (DFA) release requirements and compatibility constraints. Because Cisco DFA implements an architectural solution with a switch topology that is different from what you have previously used, devices might be required to perform different roles when used in a Cisco DFA implementation, and might be subject to new licensing requirements. For more information, see the "Platform Requirements" section of this guide.

<table>
<thead>
<tr>
<th>Product</th>
<th>License Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco Nexus 5500 Series switches</td>
<td>Cisco DFA requires the FabricPath Services package (ENHANCED_LAYER2_PKG ) license. For a complete explanation of the Cisco NX-OS licensing scheme and how to obtain and apply licenses, see the Cisco NX-OS Licensing Guide.</td>
</tr>
<tr>
<td>Cisco Nexus 5600 Series switches, including the 5672UP and 56129 switches</td>
<td>• Cisco DFA requires the FabricPath Services package (ENHANCED_LAYER2_PKG ) license. • For a Cisco Nexus 5672UP or 56129 switch as a Cisco DFA spine or leaf switch, the Enterprise Services Package (LAN_ENTERPRISE_SERVICES_PKG) is required. • For a Cisco Nexus 5672UP or 56129 switch as a Cisco DFA spine or leaf switch, the Layer 3 Base Services Package (LAN_BASE_SERVICES_PKG) is required. For a complete explanation of the Cisco NX-OS licensing scheme and how to obtain and apply licenses, see the Cisco NX-OS Licensing Guide.</td>
</tr>
<tr>
<td>Product</td>
<td>License Requirement</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Cisco Nexus 6000 Series switches</td>
<td>• Cisco DFA requires the FabricPath Services package (ENHANCED_LAYER2_PKG ) license.</td>
</tr>
<tr>
<td></td>
<td>• For a Cisco Nexus 6000 Series switch as a Cisco DFA spine or leaf switch, the Enterprise Services Package (LAN_ENTERPRISE_SERVICES_PKG) is required.</td>
</tr>
<tr>
<td></td>
<td>• For a Cisco Nexus 6000 Series switch as a Cisco DFA spine or leaf switch, the Layer 3 Base Services Package (LAN_BASE_SERVICES_PKG) is required.</td>
</tr>
<tr>
<td></td>
<td>For a complete explanation of the Cisco NX-OS licensing scheme and how to obtain and apply licenses, see the <em>Cisco NX-OS Licensing Guide</em>.</td>
</tr>
<tr>
<td>Cisco Nexus 7000 Series switches</td>
<td>• Cisco DFA requires the FabricPath Services package (ENHANCED_LAYER2_PKG ) license.</td>
</tr>
<tr>
<td></td>
<td>• For a Cisco Nexus 7000 Series switch as a Cisco DFA spine switch, the Enterprise Services Package (LAN_ENTERPRISE_SERVICES_PKG) is required.</td>
</tr>
<tr>
<td></td>
<td>• For a Cisco Nexus 7000 Series switch as a Cisco DFA route reflector, the MPLS Services Package (MPLS_PKG) license is required.</td>
</tr>
<tr>
<td></td>
<td>For a complete explanation of the Cisco NX-OS licensing scheme and how to obtain and apply licenses, see the <em>Cisco NX-OS Licensing Guide</em>.</td>
</tr>
<tr>
<td>Cisco Prime Data Center Network Manager (DCNM)</td>
<td><strong>Note</strong> The switch feature licenses must be installed before you install the Cisco Prime DCNM license.</td>
</tr>
<tr>
<td></td>
<td>Cisco DFA features and capabilities are covered by the Cisco DCNM Base license. The basic unlicensed version of Cisco DCNM-SAN Server is included in the software download. To get licensed features, such as Performance Manager, remote client support, and continuously monitored fabrics, you must buy and install the Cisco DCNM-SAN Server package.</td>
</tr>
<tr>
<td></td>
<td>For information, see the <em>Cisco DCNM Installation and Licensing Guide, Release 7.x</em>.</td>
</tr>
</tbody>
</table>
Guidelines and Limitations for Cisco DFA

Cisco Dynamic Fabric Automation (DFA) has the following guidelines and limitations:

- The fabric management network can support only one Dynamic Host Configuration Protocol (DHCP) server. You can use either the DHCP server in Cisco Prime Data Center Network Manager (DCNM) or another designated DHCP server, but not both.

- To ensure that Cisco DFA device auto configuration does not interfere with other DHCP servers on your network, we recommend that you use a dedicated VLAN and subnet for the fabric management network. Cisco Prime DCNM and the Ethernet out-of-band ports of the Cisco DFA switches (mgmt0) reside in the fabric management network. You have the option to interconnect the fabric management network with your existing out-of-band management network.

- The management connectivity for Cisco DFA must come through the Cisco NX-OS device management interface (mgmt0).

- The management port on any Cisco DFA switch must be connected to the same management subnet that includes the Cisco Prime DCNM user interface.

- Every Cisco DFA switch to be managed by fabric management must be connected to the fabric management network through the Ethernet out-of-band network.

- A console connection for fabric management is recommended but not required for Cisco DFA.

- If Cisco Prime DCNM is your repository server, you must upload the Cisco NX-OS kickstart and system images to Cisco Prime DCNM using the Serial Copy Protocol (SCP) or Secure File Transfer Protocol (SFTP).
How to Cable the Network Fabric and Servers for Cisco DFA

Fabric Management Network and Console

Every Cisco DFA switch that is to be managed by Cisco Dynamic Fabric Automation (DFA) fabric management must connect to the fabric management network through the Ethernet out-of-band port (mgmt0).

*Figure 4: Cabling the Fabric Management Network*

Fabric Connectivity

The fabric interfaces of the Cisco Dynamic fabric Automation (DFA) fabric connect the Cisco DFA switches to one another. Fabric interfaces are configured with Cisco FabricPath Frame Encapsulation (FE) for efficient...
forwarding based on a Shortest Path First (SPF) algorithm. You do not configure VLAN trunking or pruning for the transported VLANs on Cisco DFA fabric interfaces.

Figure 5: Cabling the Cisco DFA Network Fabric and Servers

Server Connectivity

To transport data traffic across the Cisco Dynamic Fabric Automation (DFA) Fabric, the leaf switch must receive the traffic for connected VLANs that are to be extended across the fabric. The leaf-to-server interfaces are called host interfaces.
Always connect servers to Cisco DFA leaf or border leaf switches. You must not connect servers to Cisco DFA spine switches.

**Note**

*Figure 6: How to Cable Server Connectivity*

Note: Resilient Server connection with virtual Port-Channel technology (vPC+) is supported at Leaf-Layer
Fabric Management

The Cisco Prime Data Center Network Manager (DCNM) is the central point of management for Cisco DFA.

Figure 7: Preparing to Deploy Cisco Prime DCNM

Deploying Cisco DFA

Note
If this is not a new Cisco Dynamic Fabric Automation (DFA) deployment, see the Cisco Dynamic Fabric Automation Migration Guide for migrating your existing fabric to a Cisco DFA deployment.

1 Ensure that you have the appropriate Cisco Nexus devices with the minimum required Cisco NX-OS software releases to support Cisco Dynamic Fabric Automation DFA). See the "Platform requirements" section of this guide.

2 Install the Data Center devices. For information, see the appropriate install guides for your Cisco DFA switches.

3 Install and configure the Cisco Nexus 1000V switch for VMware vSphere for Cisco DFA. For information, see the Cisco Nexus 1000V Installation and Upgrade Guide and the Cisco Nexus 1000V DFA Configuration Guide.

Note
To deploy Cisco Prime DCNM, two port groups or port profiles are required on the virtual switch.
4 Create a cabling plan and cable your Cisco Nexus devices for Cisco DFA. For information, see the "How to Cable the Network Fabric and Servers for Cisco DFA" section of this guide.

5 Install the Cisco Prime Data Center Network Manager (DCNM) Open Virtual Appliance (OVA) to manage all the applications for the central point of management. For information, see the Cisco DCNM 7.0 OVA Installation Guide.

6 Start the Prime NSC adapter in the Cisco Prime DCNM OVA and configure Services support for Cisco DFA. For information, see the "Network Services" section of the Cisco DCNM 7.0 OVA Installation Guide.

7 (Optional) Use one of the following options to install OpenStack for Cisco DFA:
   a Install the Cisco OpenStack Installer to install the OpenStack for Cisco DFA orchestrator. For information, see the OpenStack for Cisco DFA Install Guide Using Cisco OpenStack Installer.

   Note
   - Before installing the Cisco OpenStack installer, the Cisco DFA fabric, switches, and Cisco Prime DCNM OVA must be already installed.
   - To support OpenStack for Cisco DFA, Cisco Prime DCNM must be accessible via the OpenStack controller and the Cisco DFA fabric.

   b Use the pre-built OpenStack for Cisco DFA images to install the OpenStack for Cisco DFA orchestrator. For information, see the following guides:
      - OpenStack for Cisco DFA Install Guide for Using Pre-built OpenStack for Cisco DFA Images
      - Quick Guide to Clonezilla