

Dell Networking X-Series Auto-Configuration Deployment Guide

Auto-deployment for the X-Series Dell Networking Campus switches

Dell Network Solutions Engineering
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Revisions

Date	Description	Authors
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1 Introduction

Dell Networking provides customers with the most efficient use of current networking equipment at the lowest cost, while still providing today's great new technologies focused around the explosive data growth in the industry. The various application demands have driven the need for increased bandwidth, lower latency and converged infrastructure in today's networks. Dell EMC's portfolio covers all these key areas to provide the best in service and customer experience.

Today's businesses find it difficult to keep pace with the changing networking and enterprise landscape. With limited resources, they must support a variety of devices that provide key business functions, deliver Information Technology (IT) services that are reliable and flexible, and provide discernible cost savings.

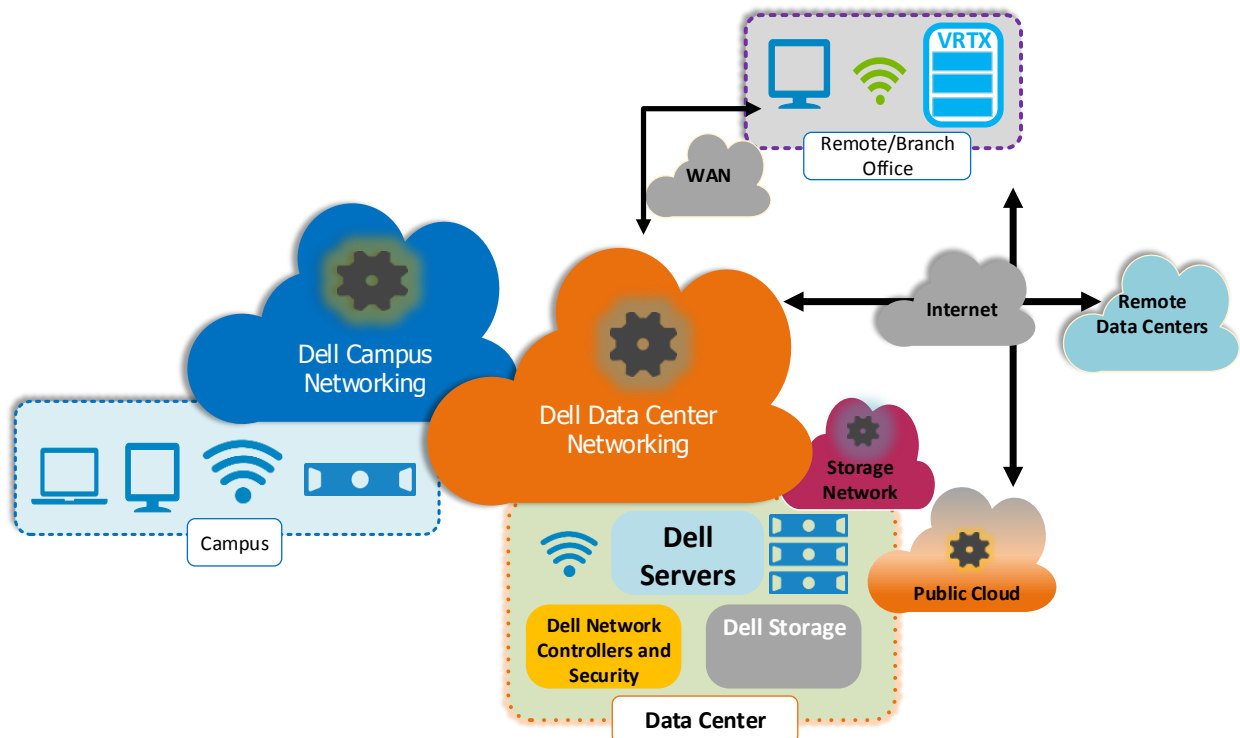


Figure 1 Networking Architecture Overview

The X-Series line of switches is Dell Networking's latest generation of Smart Managed (GUI based un-managed/managed via push button) Ethernet switches.

This deployment guide is a step-by-step configuration for auto-deployment of an X-Series Dell Networking Campus switch. The X-Series switches utilized in this white paper are the mid-range X1018 and the X1026.

Note: The following default settings were used during the creation of this best practices guide.

- The switch is in unmanaged mode (factory default for X1008, X1018, and X1026)
- The switch has a default IP address of 192.168.2.1

2 Dell Networking X-Series Switches

The X-Series family of switches (Figure 2) consist of the X1008, X1018, X1026, X1052, X4012 and their associated PoE (Power over Ethernet) versions. This family of 1GbE or 10GbE switches offer enterprise-class features and intuitive GUI-based management.



Figure 2 X-Series Family of Switches

The specifications/features of the various X-Series switches are listed below.

Dell Networking X1008/X1008P

- 8-port smart managed switch with easy GUI-based management, a compact design and optional PoE.
- 8 GbE ports
- Silent, fanless operation
- Compact design for flexible placement — desk, wall or ceiling mounting
- Optionally powered by an upstream PoE switch (X1008 model only)

Dell Networking X1018/X1018P

- 18-port smart managed switch with easy GUI-based management and optional PoE.
- 16 GbE ports
- 2 x 1Gb SFP ports
- Silent, fanless operation (X1018 model)

Dell Networking X1026/X1026P

- 26-port smart managed switch with easy GUI-based management, plus optional PoE and PoE+.
- 24 GbE ports
- 2 x 1Gb SFP ports
- Silent, fanless operation (X1026 model only)

Dell Networking X1052/X1052P

- 52-port smart managed switch with easy GUI-based management, plus optional PoE and PoE+.
- 48 GbE ports
- 4 x 10Gb SFP+ ports

Dell Networking X4012

- 10Gb smart managed switch with easy GUI-based management and 12 x 10Gb SFP+ ports for high-speed server and storage access and network aggregation.
- 12 x 10Gb SFP+ ports

3 X-Series Auto-Configuration

The Dell Networking X-Series switches include several features that allow the automatic configuration (Auto Config) and automatic updating of firmware (Auto Update) too many switches at once. In addition to this deployment guide, the auto configuration/updating instructions can be found in the [X1000 series User's Guide](#) under Chapter 6, Switch Management's Auto Update section.

3.1 Understanding X-Series System files

When performing a running/startup Auto Config and firmware Auto Update of the X-Series switches, it is necessary to understand the key system files that the Auto Config and Auto Update processes will be deploying.

- **Startup Configuration File** – This file contains the switch configuration applied at startup or after a reload (reboot). The startup configuration file is created by saving the current “running configuration” file or by downloading or importing the file from a network location such as TFTP or USB.
- **Running Configuration File** – This is file contains the active configuration file being used by the switch. This file is a copy of the “startup configuration” file copied into memory from the last switch boot, but holds all the changes that have been made since that last reload (reboot) without overwriting the original “startup configuration” file. The running configuration is often saved to the startup configuration prior to shutting down or rebooting the switch.
- **Image Files** - These files are the networking operating system files that provide the underlying code for the switch to operate. These files have the **.ros** extension i.e. **x10xx-30064.ros**

4 X-Series Auto-Provisioning

X-Series Auto-Provisioning provides network administrators the ability to configure the switches with:

- Dynamic Host Configuration Protocol (DHCP) requested IP addresses
- Deployment of Running-Config (Auto-Configuration)
- Updating of the firmware image system file (Firmware Auto-Update)

There are two ways to create an Auto-Configuration environment on the X-Series switches, the one file read and the multi-file read method. These two methods are explained in further detail below. Each method requires creating and editing configuration files as well as configuring the DHCP server.

4.1 Initial Configuration Steps and Prerequisites

X-Series switches require the following prerequisites.

- A DHCP server
- DHCP IP scopes that have been identified and configured
- A Trivial File Transfer Protocol (TFTP) server
- X-Series switches that are in Managed mode with no existing startup configuration
- X-Series **.ros** Firmware image
- Running-Configuration file(s)
- Fp-net.cfg file
- indirect-Astute.txt file

When the switch is first powered up, the X-Series switches will need to be put into Managed mode by using a paper clip or pen to press the Managed mode button for seven seconds. See Chapter 3 of the [X1000 series User's Guide](#) for the location of the Managed mode button. Once this occurs the switch will reboot and come back online in managed mode. The switch is in Managed mode when the Management LED (Mgmt) on the front of the switch is on.

4.2 DHCP Options Configuration

DHCP is the protocol commonly used by network hosts to dynamically assign and configure basic networking parameters such as IP address, subnet mask and default gateway. Configuration parameters in DHCP are known as options. Dell Networking X-Series switches require some additional DHCP options to be passed by the DHCP server to facilitate Auto-Provisioning of the firmware and running configuration. The options needed for these features are listed below.

- Option 66 – This option provides the IP address or hostname of the TFTP server
- Option 67 – This option provides the filename to be downloaded from the TFTP server specified in Option 66 (Auto-Configuration one file method only)
- Option 125 – This option allows the exchange of vendor specific information between the switch and the DHCP server. This option has an entry for the file **indirect-Astute.txt** that tells the TFTP server what firmware image to download to the X-Series switch. (Firmware Auto-Update only)

When configuring DHCP for Auto-Update and Auto-Configuration the first step is confirming that DHCP is at a known good default configuration. Figure 3 shows that the DHCP IP scope has been enabled, Option 003 for the default gateway has been setup and Option 006 for the DNS servers has been setup.

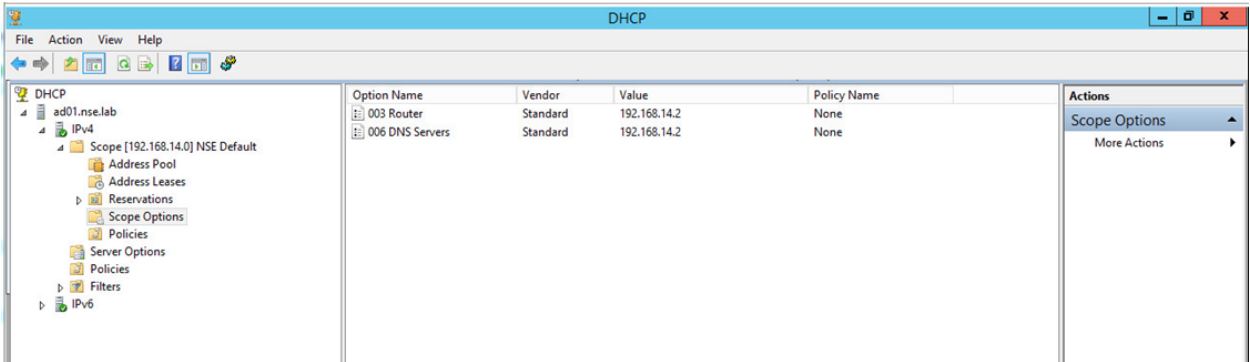


Figure 3 DHCP Initial Configuration View

4.2.1 DHCP Option 66

DHCP Option 66 (Figure 4) is used for TFTP server configuration. The IP address or hostname of the TFTP server is entered in the **Data Entry** field. This field is a string value that requires a valid IP address or hostname.

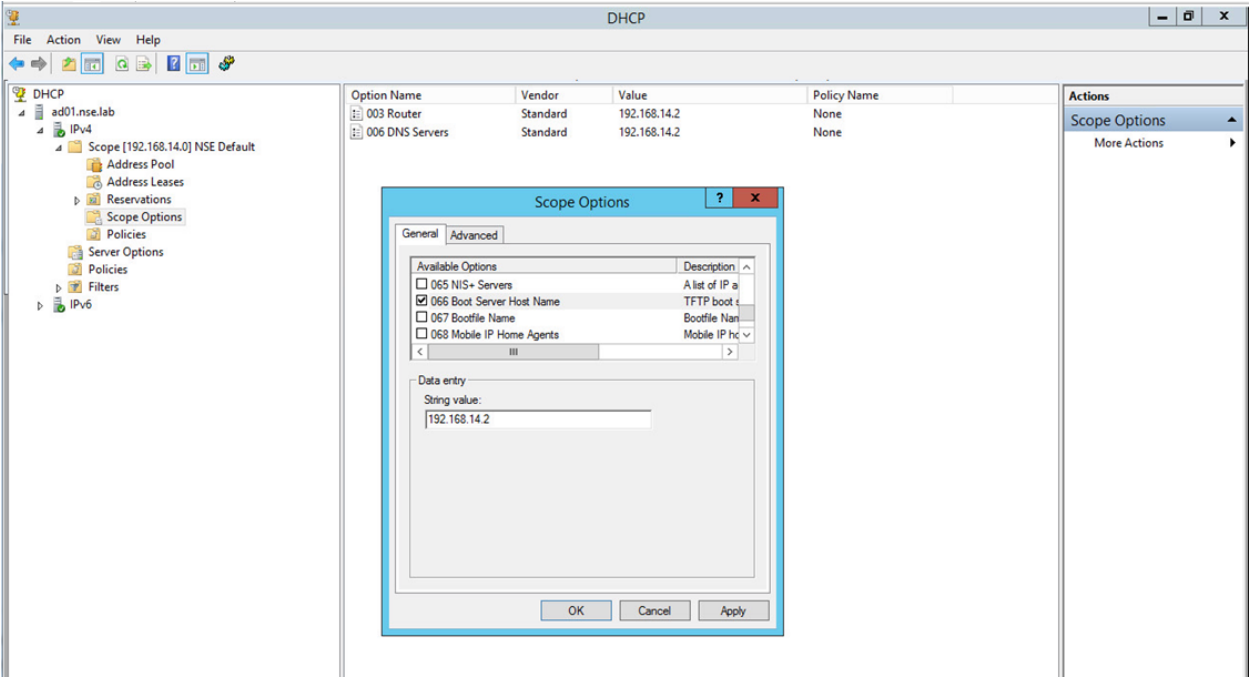


Figure 4 DHCP Option 66 Configuration

4.2.2 DHCP Option 67

DHCP Option 67 (Figure 5) is used to specify the X-Series switches running-configuration filename to be retrieved from the TFTP server. Set this option if you want to use the one file read method for switch Auto-Configuration.

In this example **config.txt** is the name of the file to be copied from the TFTP server (specified with option 66) to the switch's running-config.

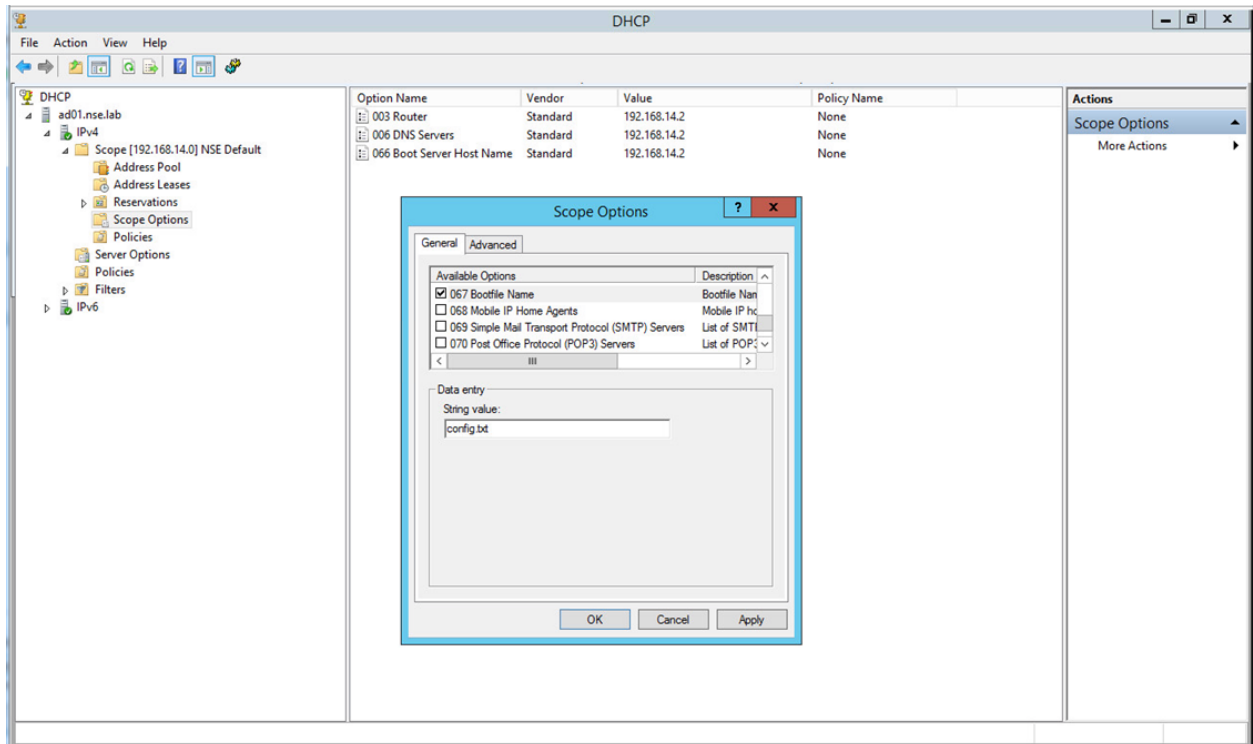


Figure 5 DHCP Option 67 Configuration

4.2.3 DHCP Option 125

DHCP option 125 is used for the Firmware Auto-Update feature. This feature downloads firmware to a switch based on the vendor unique information and a text file that is utilized by the option.

The first step is add option 125 to DHCP by right-clicking on IPv4 and choosing **Predefined Options and Values** (Figure 6), then click **Add** and fill out the fields:

- **Name** – Enter **Vendor Information** (This is a descriptive field).
- **Data Type** – Choose **Encapsulated** from the drop down menu.
- **Code** – Enter **125** in this field.
- **Description** – This field is a free form description. In this example, **Vendor Information** was entered in this field.

Finally, click **OK**.

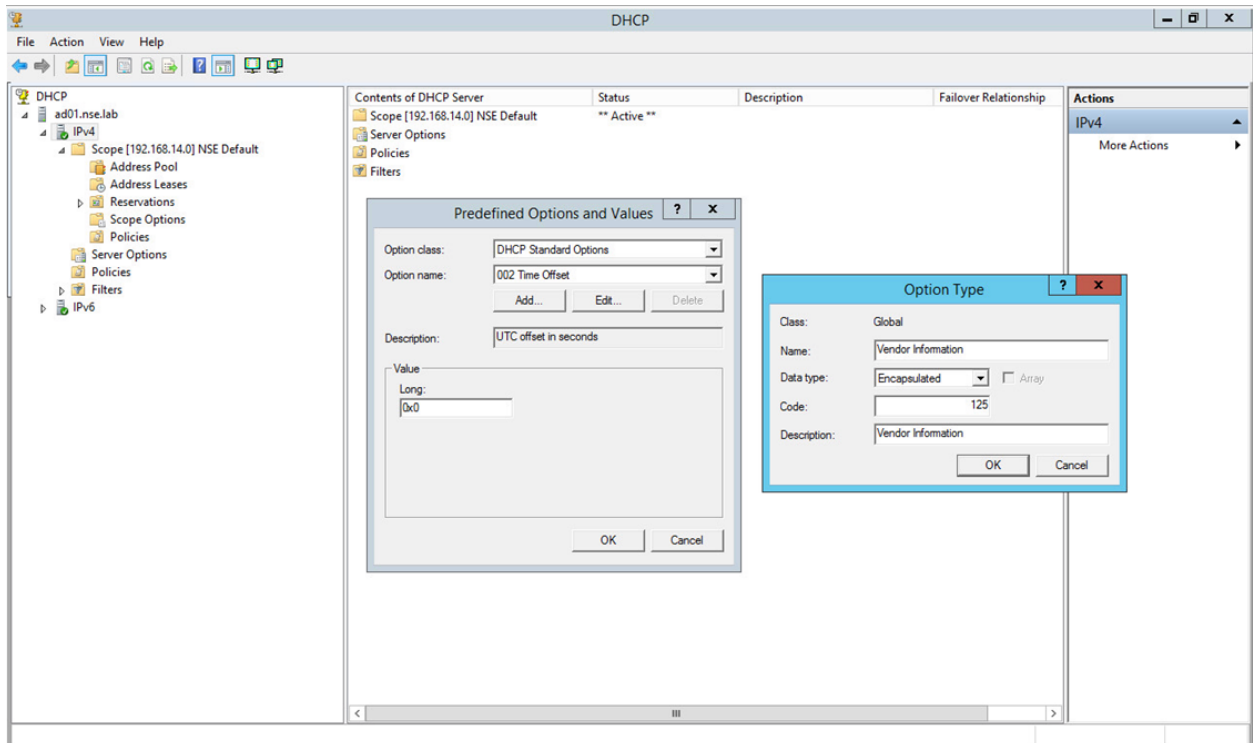


Figure 6 DHCP 125 Predefined Options and Values

Next, to configure option 125 (Figure 7), right-click on **Scope Options**, and choose **Options**, under **Available Options**, place a check mark next to option **125**.

The data entry field contains the following information, represented in hex format.

- Dell Enterprise 674 – This is a vendor unique identifier for the X-Series switches. The hex equivalent to the decimal 674 is: 00 00 02 A2, but, the X-Series switches require the information be written from right to left, **A2 02 00 00**
- Data length is **15**
- Sub option code is **01**
- Sub option length is **13** (This represents the number of letters in indirect-Astute.txt in hex)
- Indirect-Astute.txt – this text file contains the filename of the FW image that will be downloaded to the switch via the TFTP server specified in option 66. The hex equivalent to the ASCII file name that will be typed into the data entry field is: **69 6e 64 69 72 65 63 74 2d 41 73 74 75 74 65 2e 74 78 74**

Now that the individual pieces have been defined, the following is typed into the option 125 **Data Entry** field:
A2 02 00 00 15 01 13 69 6e 64 69 72 65 63 74 2d 41 73 74 75 74 65 2e 74 78 74

Click **Apply**, then **OK**.

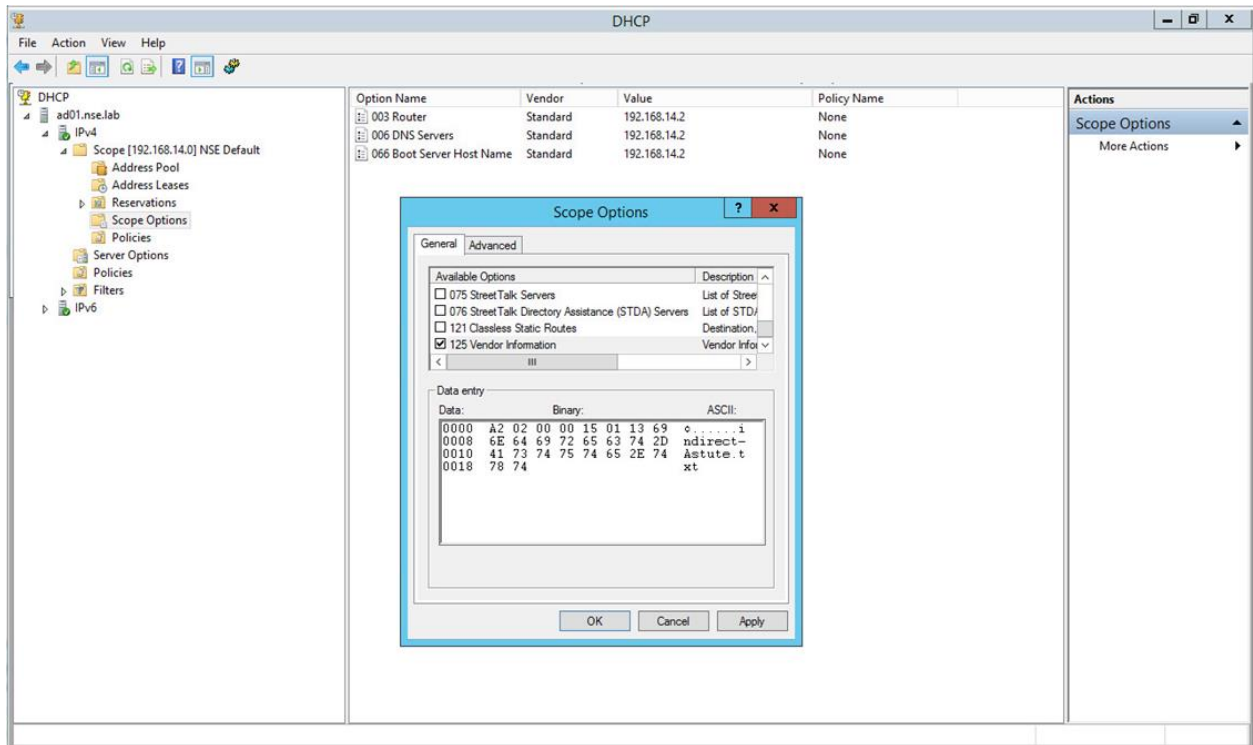


Figure 7 DHCP Option 125 Value Entry

4.3 Firmware Auto-Update

If DHCP option 125 has been correctly setup, firmware Auto-Update is the first provisioning task to take place after the switch completes the DHCP discovery process.

When the switch is powered up it will acquire an IP address from the DHCP server, the switch will then utilize Option 125 to download a firmware image file from the TFTP server. Utilizing the Option 125 configuration provided above, the switch first downloads **indirect-Astute.txt** and extracts the name of the image file from the downloaded text file. The switch then downloads the firmware image file. If the version of the image file differs from the version currently loaded, then the image file is loaded and the switch is rebooted. If the image file versions match then this step will be skipped.

4.4 One File Read Method

The One File Read Method is attempted first if a configuration file is specified with DHCP option 67. The One File Read Method utilizes the following

- Option 66 for the IP address of the TFTP server
- Option 67 for the configuration file to download to the switch from the TFTP server

By default, the X-Series switches have the following default settings:

- **Configuration Auto-Config Enabled** – This setting only allows a configuration file if the Startup configuration file is non-existent.
- **Force Configuration Download at Next Startup Disabled** – If enabled, this setting will always perform the Auto-Configuration process.

4.5 Multi-File Read Method

The Multi-File Read Method is used if the One File method fails or a configuration filename is not specified with DHCP option 67. The switch first requests the file **fp-net.cfg** from the TFTP server. The format of **fp-net.cfg** is: `ip host hostname ip-address`. Each line in **fp-net.cfg** maps an ip address to a hostname. DHCP reservations are recommended to ensure consistent IP address to hostname mappings. The switch will then attempt to copy the files below to its own running-configuration. The switch will only attempt to copy the first two filenames if a match was found in **fp-net.cfg** and substitute *hostname* with the first entry found (eg switch1-config, switch1.cfg).

- *hostname*-config
- *hostname*.cfg (if the previous file does not exist)
- host.cfg (if the previous files do not exist)

Note: Once the configuration file has been copied to the switch, this file is now held in volatile Flash memory as the running-config. In order to commit this file to non-volatile Flash memory as the Startup-Config the command `boot host auto-save` should be added to the configuration file.

Example **fp-net.cfg**

```
ip host switch1 10.0.0.1
ip host switch2 10.0.0.2
ip host switch3 10.0.0.3
```

5 Conclusions

This deployment guide has shown that an X-Series multi-switch deployment scenario is easily achievable via DHCP. The necessary file editing and prerequisite preparation is minimal and can be performed quickly and easily. This X-Series line of switches have been designed with ease of use and configuration in mind.

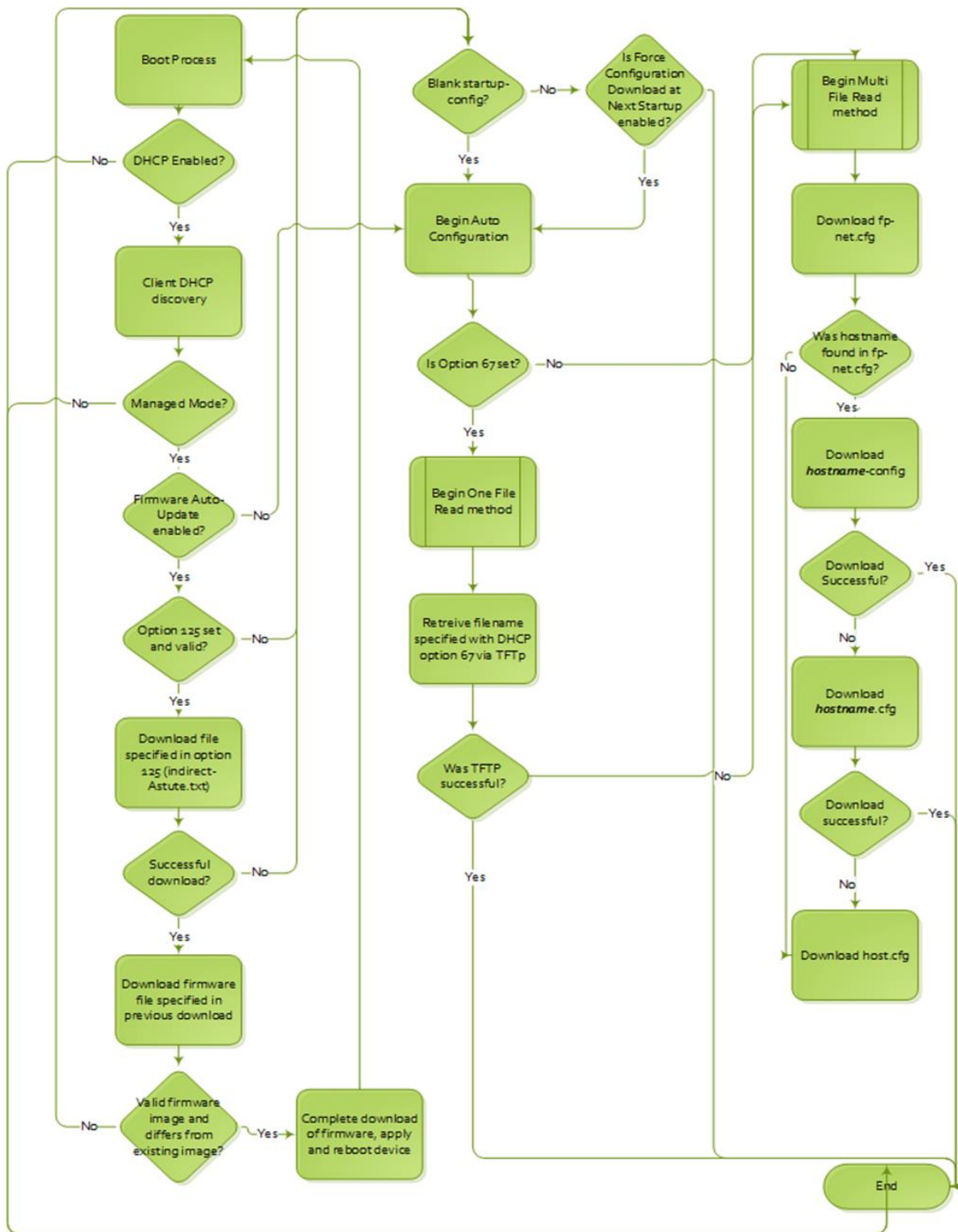
A Configuration Details

This paper was compiled using the following components and versions (Table 1).

Table 1 Components and Versions

Component	Version
Dell Networking X1026P	3.0.0.64
Dell Networking X1018	3.0.0.64

B X-Series Auto-Configuration Flow Chart



C Glossary

Term	Description
DHCP Server	Any device running the DHCP service.
DHCP Client	Any device that has DHCP settings enabled.
Scope	The full, consecutive range of possible IP addresses for a network. DHCP services can be offered to scopes, which typically define a single physical subnet on a network. DHCP servers primarily use scopes to manage network distribution and assignment of IP addresses and any related configuration parameters.
Superscope	An administrative grouping of scopes that are used to support multiple, logical IP subnets on the same physical subnet. Superscopes contain a list of member scopes (or child scopes) that can be activated as a collection.
Exclusion range	Ensures that any IP address listed in that range is not offered by the DHCP server to any DHCP clients.
Address pool	Available IP addresses form an address pool within the scope. Pooled addresses are available for dynamic assignment by the DHCP server to DHCP clients.
Lease	The length of time, specified by the DHCP server, a client computer can use a dynamically assigned IP address. When a lease is made to a client, the lease is considered active. Before the lease expires, the client renews its lease with the DHCP server. A lease becomes inactive when it either expires or is deleted by the server. The lease duration determines when the lease expires and how often the client needs to renew its lease with the DHCP server.
Reservation	Creates a permanent address lease assignment from the DHCP server to the client. Reservations ensure that a specified hardware device on the subnet can always use the same IP address. This is useful for computers such as remote access gateways, WINS, or DNS servers that must have a static IP address.
Option types	Other client configuration parameters a DHCP server can assign when offering an IP address lease to a client. Typically, these option types are enabled and configured for each scope. Most options are predefined through RFC 2132, but you can use DHCP Manager to define and add custom option types as needed.
Option class	A way for the DHCP server to further manage option types provided to clients. Option classes can be configured on your DHCP servers to offer specialized client support. When an option class is added to the server, clients of that class can be provided class-specific option types for their configuration.
TFTP	Trivial File Transfer Protocol. Uses User Data Protocol (UDP) without security features to transfer files.

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