Third-Party NOS Installation Guide for Dell EMC PowerSwitch Data Center Switches

DELLEMC

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Introduction

The Open Network Install Environment, or ONIE, is an open-source project within the Open Computer Project that provides an installation environment for bare metal networking switches. ONIE also provides the option to install different network operating systems on a common set of networking hardware. For more information, see http://www.onie.org/, www.opencompute.org, and https://github.com/opencomputeproject/onie.

Dell EMC PowerSwitch switches:

- Provide an environment where hardware and software are fully modular. You can select the software that you want to install, and the hardware platforms you would like to use for your networking needs.
- Come with a factory-installed Dell EMC SmartFabric OS10 (OS10) image and its license.

⚠ **CAUTION: When you install a third-party network operating system (NOS), the factory-installed OS10 is uninstalled and the license is removed. This process is not reversible.**

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Supported hardware

The procedures described in this installation guide are applicable only for the following platforms:

- S4112F-ON/S4112T-ON
- S4128F-ON/S4128T-ON
- S4148F-ON/S4148FE-ON/S4148T-ON/S4148U-ON
- S5212F-ON/S5224F-ON
- S5232F-ON/S5248F-ON/S5296F-ON
- Z9264F-ON
- Z9332F-ON
- N3248TE-ON

Install a third-party NOS

Install an ONIE-enabled software image using automatic or manual installation methods.

⚠️ **CAUTION: Installing a third-party NOS erases all OS10 configurations on the switch. The configuration settings are not recoverable. Back up all software configurations and installed licenses on the switch before performing operating system updates or changes. Store a regular backup of the switch configuration off the switch.**

- **Automatic installation**—Zero-touch deployment (ZTD) discovers network information including the Dynamic Host Configuration Protocol (DHCP) server, connects to an image server, and downloads and installs an image automatically. ZTD supports the following discovery methods:
  - DHCP discovery process
  - IPv6 HTTP discovery process

  For more information, see Automatic installation.
- **Manual installation**—Manually boot into ONIE, if a DHCP or HTTP server is not available. For more information, see Manual installation.

Prerequisites

- ONIE-enabled network device with factory-installed OS10 software.
- ONIE-enabled software image stored on a DHCP or HTTP server.

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Automatic installation

You can automatically install a third-party NOS image on a Dell EMC ONIE-enabled device.

System setup

Before you proceed, verify that the system is connected correctly:

1. Connect a serial cable and terminal emulator to the console serial port—serial port settings are 115200 baud rate, 8 data bits, and no parity.
2. Connect the Management port to the network if you prefer downloading an image over a network. To locate the Console port and the Management port, see the *Getting Started Guide* shipped with your switch or the platform-specific Installation Guide at www.dell.com/support.
3. Power on the switch.

Zero-touch deployment

The ZTD process that is built into the OS10 software is enabled by default. ZTD starts an automatic discovery process, which is similar to the ONIE discovery process.

> ⚠ **CAUTION: If the ZTD discovery process detects a third-party NOS, the switch boots into ONIE. This process is not reversible. You cannot return back to the factory-installed OS10 image. The OS10 image and its license are uninstalled.**

DHCP discovery process

ZTD starts the DHCP client on all the interfaces, including management and front-panel ports. ZTD sends DHCP discovery packets with DHCP option 60 (vendor-class specifier) on all the interfaces and listens for the DHCP offer. The DHCP server responds with any of the following options in its response (the DHCP offer):

> ⓘ **NOTE:** The DHCP server response with Option 67 or Option 114 must be received through the management port. The DHCP server response with Option 240 can be received through the management port or a front-panel port.

- Option 240 (Includes the valid OS10 image and configuration files)—The system proceeds with ZTD, installs OS10 image, and executes the configuration files.
- Option 67 (Includes the valid image and the `onie-installer` string in the DHCP offer)—The system does the following:
  1. Boots to the ONIE prompt.
  2. Uninstalls the factory-installed OS10 image and license.
  3. Installs the image present in the TFTP server.
- Option 114 (Includes the default URL and the "onie-installer" string in the DHCP offer)—The system does the following:
  1. Boots to the ONIE prompt.
  2. Uninstalls the factory-installed OS10 image and license.
  3. Processes the URL.

The autodiscovery process uses the following DHCP options and the corresponding ONIE values.

Table 1. DHCP options and ONIE values

DHCP Option Number	DHCP Option	ONIE Value
Option-60	Vendor-Class-Specifier	`onie_vendor:<arch_name>-<vendor_machine_name>-r<revision no.>`
Option-77	User-Class	`onie_dhcp_user_class`

Table 1. DHCP options and ONIE values (continued)

DHCP Option Number	DHCP Option	ONIE Value
Option-55	List of Parameters Requested	• 1 - Subnet Mask • 3 - Default Gateway • 6 - Domain Server • 7 - Log Server • 12 - Hostname • 15 - Domain Name • 42 - NTP Servers • 54 - DHCP Server Identifier • 66 - TFTP Server Name • 67 - TFTP Bootfile Name • 72 - HTTP Server IP • 114 - Default URL • 150 - TFTP Server
Option-61	Client Identifier (dhcp-client-identifier)	*<Management MAC Address >*
Option-125	Vendor Identified Vendor Sub Options (VIVSO)	• 3 - Platform Name (*vendor_machine_name*) • 4 - CPU Architecture (*arch_name*) • 5 - Machine Revision (*revision no.*)

IPv6 HTTP discovery process

The HTTP discovery process queries its IPv4 and IPv6 neighbors using a broadcast ping message. This process searches for a HTTP server and the presence of the ONIE installer file. If an ONIE installer file is found, the system uninstalls the factory-installed OS10 software and boots into ONIE for installing the third-party NOS.

Supported ONIE installer filenames and the order of search is:

1. onie-installer-*<arch>-<vendor>_<machine>*-r*<machine_revision>*
2. onie-installer-*<arch>-<vendor>_<machine>*-r*<machine_revision>*.bin
3. onie-installer-*<arch>-<vendor>_<machine>*
4. onie-installer-*<arch>-<vendor>_<machine>*.bin
5. onie-installer-*<vendor>_<machine>*
6. onie-installer-*<vendor>_<machine>*.bin
7. onie-installer-*<cpu_arch>-<switch_silicon_vendor>*
8. onie-installer-*<cpu_arch>-<switch_silicon_vendor>*.bin
9. onie-installer-*<arch>*
10. onie-installer-*<arch>*.bin
11. onie-installer
12. onie-installer.bin

ⓘ **NOTE:** ZTD does not support the following discovery methods for third-party NOS installation:
   - Statically configured path that is passed from the boot loader
   - Search file systems on locally attached devices, such as USB
   - Search the inexact URLs based on the DHCP responses.
   - Start a TFTP waterfall.

The ZTD autodiscovery continuously performs the following steps:

1. ZTD autodiscovery—Times out in 60 s.
2. DHCP discovery process—Times out in 60 s.
3. IPv6 HTTP discovery process.

For example, if you are using the IPv6 HTTP discovery process, the system takes approximately 120 seconds before it begins this discovery process.

The ZTD auto discovery runs continuously until any of the discovery methods complete or you cancel the ZTD process manually using the `ztd cancel` command or you enter into CONFIGURATION mode.

If the ZTD autodiscovery process is successful, the ONIE zero-touch install process begins and the system automatically:

1. Boots into `ONIE: Uninstall OS` mode and removes the factory-installed OS10 image.

   (i) **NOTE:** Before the system boots into ONIE mode, a syslog message similar to the following one appears:

   - If the DHCP discovery process is successful:

     ```
     <164>1 2021-10-19T03:04:04.614432+00:00 OS10 root 4449 - - ONIE-Installer
     Image found in DHCP Offer - URL(http://20.20.20.20/ztd/onie-installer).<164>1
     2021-10-19T03:04:04.632243+00:00 OS10 root 4450 - - Rebooting in ONIE...
     ```

   - If the IPv6 HTTP discovery process is successful:

     ```
     HTTP Syslog - <165>1 2020-10-17T17:23:44.925204+00:00 OS10 dn-app-ztd 849 - -
     Node.1-Unit.1:PRI [event], Dell EMC (OS10) %ZTD-HTTP-DISCOVER: ONIE-Installer
     Image found in HTTP URL(http://[fe80::250:56ff:fe63:3f8e%eth0]/onie-installer-
     x86_64-dellemc_z9200_c3538-r0).
     ```

2. Locates the stored software image, downloads, and installs it.
3. Reboots the device with the new image.

   (i) **NOTE:**

   - All ONIE autodiscovery methods download and run only supported default file names, such as `onie-installer`. The required file names and search order are described on the Open Network Install Environment website at Image Discovery and Execution. For more information, see the *Open Networking Hardware Diagnostic Guide* on the Dell EMC Support site.

   - If you use a DHCPv4 server, ONIE autodiscovery obtains the hostname, domain name, Management interface IP address, and the IP address of the domain name server (DNS) from the DHCP server and DHCP options. It also searches SCP, FTP, or TFTP servers with the default DNS of the ONIE server. DHCP options are not used to provide the server IP.

   - If you use a USB storage device, ONIE searches only FAT or EXT2 file systems for third-party NOS.

Manual installation

If a DHCP server or HTTP server is not available, install the third-party NOS manually using ONIE.

System setup

Before you proceed, verify that the system is connected correctly:

- Connect a serial cable and terminal emulator to the console serial port—serial port settings are 115200-baud rate, 8 data bits, and no parity.
- Connect the Management port to the network if you prefer downloading an image over a network. To locate the Console port and the Management port, see the *Getting Started Guide* shipped with your switch or the platform-specific Installation Guide at www.dell.com/support.

Log in to the switch

Log in to the switch, power on, and wait for the system to boot. Enter `admin` for both the default username and user password.

Boot into ONIE

To install the third-party NOS manually, you must boot into `ONIE: Uninstall OS` mode. The Dell EMC PowerSwitch switches come with factory-installed OS10 software and license. To uninstall the existing operating system and boot into ONIE, enter the following command from the Command-Line Interface (CLI):

```
OS10# reload onie uninstall
```

A warning message similar to the following one appears:

```
Warning: The System will boot in ONIE Uninstall mode.

Warning: OS10 will be uninstalled, License will be removed and system will boot in ONIE
mode.
Proceed to reboot the system? [confirm yes/no]:
```

Enter `yes` to uninstall the existing operating system and boot into the `ONIE: Uninstall OS` mode.

⚠ **CAUTION: This command uninstalls the factory-installed OS10 software and its license.**

After you boot into ONIE, you can install the software using any of the following methods:

- Install software from an SCP, TFTP, or FTP server.
- Install software using a USB drive.

Install software from an SCP, TFTP, or FTP server

1. Save the NOS software image on an SCP, TFTP, or FTP server.
2. Do one of the following:
   - If the device boots to `ONIE: Install OS` mode, stop ONIE discovery.

     ```
     $ onie-discovery-stop
     ```

   - Select `ONIE: Rescue` for manual installation.

3. Configure the IP addresses on the Management port, where *x.x.x.x* represents your internal IP address. After you configure the Management port, the response is `up`.

```
$ ifconfig eth0 x.x.x.x netmask 255.255.0.0 up
```

4. Install the software on the device. The installation command accesses the NOS software from the specified SCP, TFTP, or FTP URL, creates partitions, verifies installation, and reboots itself.

```
$ onie-nos-install image_url
```

For example, enter

```
ONIE:/ # onie-nos-install tftp://a.b.c.d/example-nos-filename.bin
```

Where `a.b.c.d` represents the location to download the image file from, and `example-nos-filename.bin` represents the software to install.

Install software using a USB drive

You can manually install the NOS software image using a USB device. Verify that the USB device supports a FAT or EXT2 file system. For instructions to format a USB device in FAT or EXT2 format, see the accompanying Windows documentation for FAT formatting or Linux documentation for FAT or EXT2 formatting.

1. Plug the USB storage device into the USB storage port on the switch.
2. Do one of the following:
   - If the device boots to `ONIE: Install OS` mode, stop ONIE discovery.

   ```
   $ onie-discovery-stop
   ```

   - Select `ONIE: Rescue` for manual installation.
3. Create a USB mount location on the system.

```
$ mkdir /mnt/media
```

4. Identify the path to the USB drive.

```
$ fdisk -l
```

5. Mount the USB media plugged in the USB port on the device.

```
$ mount -t vfat usb-drive-path /mnt/media
```

6. Install the software from the USB, where `/mnt/media` specifies the path where the USB partition is mounted.

```
$ onie-nos-install /mnt/media/image_file
```

The ONIE autodiscovery process discovers the image file at the specified USB path, loads the software image, and reboots the switch. For more information, see the ONIE User Guide.

DHCP server configuration for mixed-mode deployment

This section describes the DHCP server configuration that is required to install a third-party NOS in a deployment that has switches running different network operating systems.

- This example assumes that some switches run OS10 software and others run third-party NOS.
- To provision the third-party NOS, the DHCP server can use Option-67 (TFTP Boot Filename) or Option-114 (Default URL).
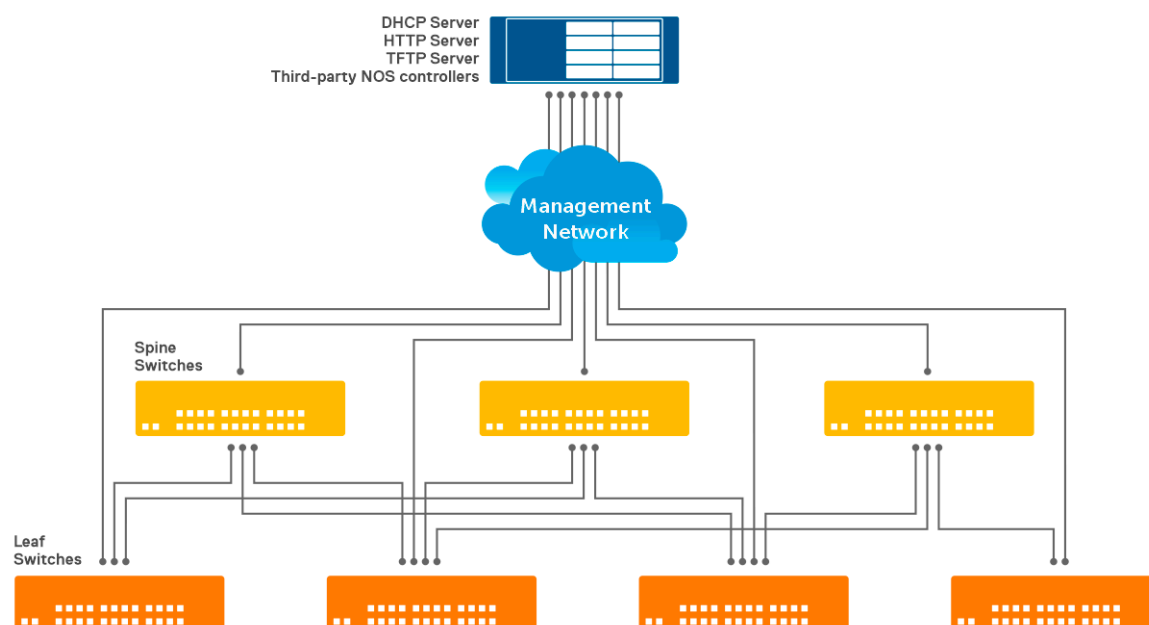
You can use any of the following attributes to install the software on these switches:

- `MAC Address`—Specify the MAC address of each of the switches and provision them individually.
- `Vendor Class Identifier`—Specify the Vendor Class Identifier and perform a bulk provisioning.

MAC Address Provisioning

Edit the `dhcpd.conf` file to include the following information. This example shows how you can use the `MAC Address` attribute to provision some switches with OS10 and others with the third-party NOS. In the following example:

- `hardware ethernet`—Specifies the MAC address of the switches.
- `option bootfile-name`—Specifies the location from where the third-party NOS installer is obtained.
- `option ztd-provision-url`—Specifies the location from where the OS10 installer is obtained.

```
# ZTD Option 240 - declaration
option ztd-provision-url code 240 = text;

default-lease-time 3600;
max-lease-time 7200;

# Generic Provisioning using Subnet
# Provisioning OS10 Switch
subnet 10.10.10.0 netmask 255.255.255.0 {
   authoritative;
```

```
    range 10.10.10.100 10.10.10.200;
    option subnet-mask 255.255.255.0;
    option broadcast-address 10.10.10.255;
    option routers 10.10.10.0;
    # Sending ztd-provision-url in DHCP Offer
    option ztd-provision-url "http://10.10.10.10/ztd.sh";

  # Provisioning the Switch with MAC Address
  # ---------------------------------------

  # Provisioning Switch1 - Option 67
  host SW-1 {
    hardware ethernet 08:00:07:26:c0:a5;
    option bootfile-name "tftp://10.1.1.1/NOS1/onie-installer";
  }

  # Provisioning Switch2 - Option 67
  host SW-2 {
    hardware ethernet 01:75:07:67:c0:de;
    option bootfile-name "tftp://10.1.1.1/NOS2/onie-installer";
  }

  # Provisioning Switch3 - Option 114
  host SW-3 {
    hardware ethernet 01:00:75:26:c0:b3;
    option default-url "http://10.1.1.1/ztd/NOS1/onie-installer";
  }

  # Provisioning Switch4 - Option 114
  host SW-4 {
    hardware ethernet 05:75:07:64:c0:ab;
    option default-url "http://10.1.1.1/ztd/NOS2/onie-installer";
  }
}
```

Vendor Class Identifier Provisioning

Edit the dhcpd.conf file to include the following information. This example shows how you can use the Vendor Class Identifier attribute to perform a bulk provision of some switches with OS10 and others with third-party NOS. This example uses the S4112T-ON and S5224F-ON ONIE-enabled switches:

- S4112T-ON
- S5224F-ON

```
# ZTD Option 240 - declaration
option ztd-provision-url code 240 = text;

default-lease-time 3600;
max-lease-time 7200;

# Generic Provisioning using Subnet
# Provisioning OS10 Switch
subnet 10.10.10.0 netmask 255.255.255.0 {
   authoritative;
   range 10.10.10.100 10.10.10.200;
   option subnet-mask 255.255.255.0;
   option broadcast-address 10.10.10.255;
   option routers 10.10.10.0;
   # Sending ztd-provision-url in DHCP Offer
   option ztd-provision-url "http://10.10.10.10/ztd.sh";

  # Provisioning the Switch with Vendor Class identifier
  # ----------------------------------------------------

  class "vendor-classes" {
    match option vendor-class-identifier;
  }

  subclass "vendor-classes" "onie_vendor:x86_64-dellemc_s4112t_c2338-r0" {
```

```
    option default-url "http://20.20.20.20/ztd/NOS1/onie-installer";
  }

  subclass "vendor-classes" "onie_vendor:x86_64-dellemc_s5224f_c3538-r0" {
    option default-url "http://20.20.20.20/ztd/NOS2/onie-installer";
  }
}
```

Support resources

The Dell Networking Support site provides a range of documents and tools to assist you with using Dell Networking devices. Through the support site you can obtain technical information regarding Dell Networking products, access software upgrades and patches, download available management software, and manage your open cases. The Dell Networking support site provides integrated, secure access to these services.

To access the Dell Networking Support site, go to www.dell.com/support/. To display information in your language, scroll down to the bottom of the page and select your country from the drop-down menu.

● To obtain product-specific information, enter the 7-character service tag or 11-digit express service code of your switch and click **Submit**.

   To view the service tag or express service code, pull out the luggage tag on the chassis or enter the `show chassis` command from the CLI.

● To receive additional kinds of technical support, click **Contact Us**, then click **Technical Support**.

To access system documentation, see www.dell.com/manuals/.

To search for drivers and downloads, see www.dell.com/drivers/.

To participate in Dell community blogs and forums, see www.dell.com/community.