Tenable Network Monitor 6.6.x User Guide

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Welcome to Tenable Network Monitor

This user guide describes the Tenable Network Monitor® (formerly known as NNM) 6.6.x (Patent 7,761,918 B2) architecture, installation, operation, and integration with Tenable Security Center and Tenable One Vulnerability Management, and export of data to third parties. For assistance, contact Tenable Support.

> **Tip:** If you are new to Tenable Network Monitor, see the Workflow.

Passive vulnerability scanning is the process of monitoring network traffic at the packet layer to determine topology, clients, applications, and related security issues. Tenable Network Monitor also profiles traffic and detects compromised systems.

Tenable Network Monitor can:

- Highlight all interactive and encrypted network sessions.
- Detect when new hosts are added to a network.
- Track which systems are communicating on which ports.
- Detect which ports are served and which are browsed by each system.
- Detect the number of hops to each monitored host.

> **Note:** For security purposes, Tenable® does not recommend configuring Tenable Network Monitor as internet facing software.

Passive Scanning vs. Active Scanning

Active scanning generates network traffic by establishing connections to hosts. Tenable Network Monitor instead listens passively to packets on the wire, which avoids disruption to critical assets in your network. Tenable Network Monitor must be connected to a SPAN port or network tap that provides a bi-directional view of traffic between machines.

Tenable Network Monitor derives information from the network protocols that machines use as they communicate. As a result, attributes such as operating system, MAC address, and NetBIOS name

may take time to appear – or may not be discoverable at all – depending on the traffic present in your environment.

Do not expect passive scan results to match those from an active scanner. Some attributes, such as BIOS UUID, are only available when a scanner actively logs in to a host – as Tenable Nessus and Tenable Agentsdo. Tenable Network Monitor, Tenable Nessus, and Tenable Agents cover complementary aspects of your environment and are most effective when used together.

Get Started with Tenable Network Monitor

1. Ensure that your setup meets the minimum system requirements:
    - Tenable Network Monitor Hardware Requirements
    - Tenable Network Monitor Software Requirements
2. Obtain the proper license or Activation Code for Tenable Network Monitor for your configuration.

    > **Note:** See special activation code instructions for integration with Tenable Security Center or Tenable One Vulnerability Management.

3. Follow the installation steps for your environment:
    - Linux
    - Windows
    - Tenable Core
4. (Optional) Configure Virtual Switches for use with Tenable Network Monitor.
5. Perform the initial configuration steps for Tenable Network Monitor in the web interface.

    After configuration, Tenable Network Monitor begins monitoring incoming traffic immediately.

    > **Note:** If you wish to register Tenable Network Monitor offline or run Tenable Network Monitor in High Performance mode, you must follow several additional configuration steps.

6. Create users in Tenable Network Monitor and set administrative privileges as necessary.

7. You can view monitored traffic results in dashboards on the **Monitoring** page and historical data in snapshots and reports on the **Results** page.

> **Note:** By default, Tenable Network Monitor has discovery mode enabled when installed. You must disable discovery mode for Tenable Network Monitor to load plugins into memory. For more information on discovery mode, see Tenable Network Monitor Settings Section.

For more Tenable Network Monitor deployment information, see the Tenable Network Monitor Deployment Guide.

Tenable Network Monitor Navigation

The top navigation menu displays two main pages: **Monitoring** and **Results**. All of Tenable Network Monitor's primary analysis tasks can be performed using these two pages. Click a page name to open that page.

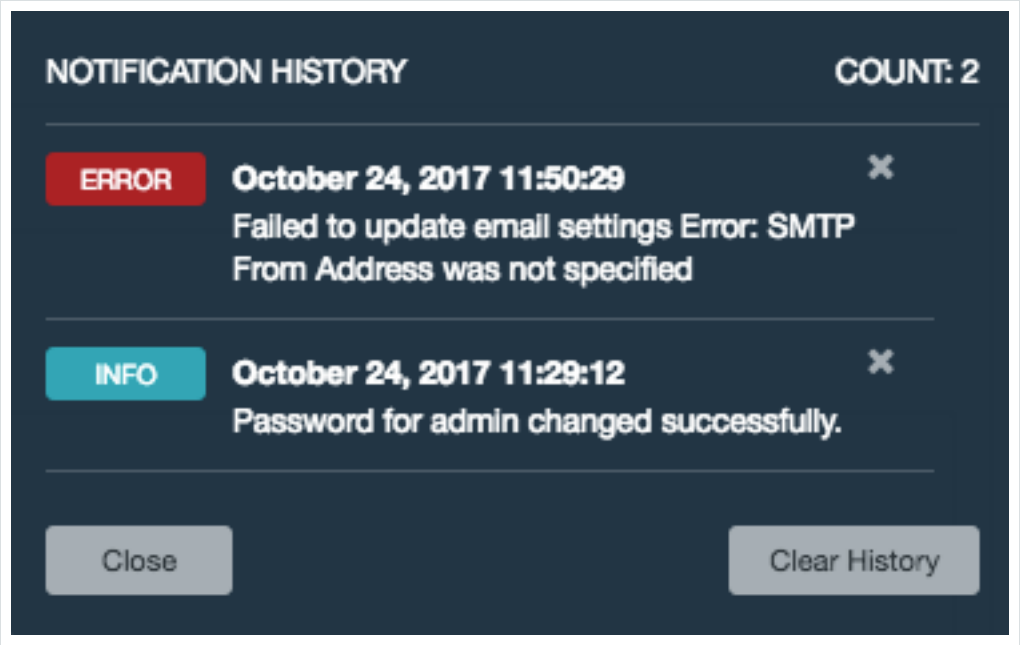
From the right side of the top navigation menu, you can access settings (⚙), current user settings (username of the currently logged-in user), and notifications (🔔).

- Click the ⚙ icon to display the **Users** and **Configuration** options, where you can make administrative changes to Tenable Network Monitor.

  > **Note:** The **Users** and **Configuration** pages are available only to users with administrative privileges.

- Click your username to display a drop-down box with the following options:
  - **Change Password** - Change password for the current user.
  - **Help & Support** - View Tenable Network Monitor Information and documentation.
  - **Sign Out** - Log out as the current user.

- The bell (🔔) icon toggles the **Notification History** box, which displays a list of notifications, successful or unsuccessful login attempts, errors, and system information generated by Tenable Network Monitor. The color of the bell changes based on the nature of the notifications in the list. If there are no alerts, or all notifications are information alerts, then the bell is blue (🔔). If there are error alerts in the notification list, then the bell is red (🔔). The **Notification History** box displays up to 1,000 alerts. Once the limit is reached, no new alerts can be listed until old ones are cleared.



To remove notifications individually, click the ✖ button to the right of the description of each event. Alternatively, click the **Clear History** button in the bottom right corner of the box to delete the entire notification history.

> **Note:** Notifications are not preserved between sessions. Unread notifications are removed from the list when the user logs out.

View Tenable Network Monitor Information

You can view information about your instance of Tenable Network Monitor such as the version number, web server version, HTML client version, license information, feed ID, the feed expiration date, and performance mode.

To view information about your instance of Tenable Network Monitor:

- In the top navigation bar, click your username > **Help & Support**.

  View information for your instance of Tenable Network Monitor.

System Requirements

This section describes the following system requirements for Tenable Network Monitor:

- Tenable Network Monitor Hardware Requirements
- Tenable Network Monitor Software Requirements
- Tenable Network Monitor Licensing Requirements

Tenable Network Monitor Hardware Requirements

Enterprise networks can vary in performance, capacity, protocols, and overall activity. Resource requirements to consider for Tenable Network Monitor deployments include raw network speed, the size of the network being monitored, and the configuration of Tenable Network Monitor.

The following chart outlines some basic hardware requirements for operating Tenable Network Monitor:

Version	Installation scenario	RAM	Processor	Hard Disk
All Versions	Tenable Network Monitor managing up to 50,000 hosts * (**)	2 GB RAM (4 GB RAM recommended)	2 2GHz cores	20 GB HDD minimum
	Tenable	4 GB RAM (8 GB	4 2GHz cores	20 GB HDD

Version	Installation scenario	RAM	Processor	Hard Disk
	Network Monitor managing more than 50,000 hosts **	RAM recommended)		minimum
	Tenable Network Monitor running in High Performance mode	16 GB RAM (HugePages memory: 2 GB)	10 2GHz cores with hyper-threading enabled	20 GB HDD minimum

*The ability to monitor a given number of hosts depends on the bandwidth, memory, and processing power available to the system running Tenable Network Monitor.

**For optimal data collection, Tenable Network Monitor must be connected to the network segment via a hub, spanned port, or network tap to have a full, continuous view of network traffic.

Note: Research your VM software vendor for comparative recommendations, as VMs typically see up to a 30% loss in efficiency compared to dedicated servers. Tenable Network Monitor supports VMware's vmxnet3 driver.

Note: The 20 GB minimum hard disk requirement does not account for disk space used by real-time event logging. When you enable real-time event logging, Tenable Network Monitor writes high-volume capture data to text files at `/opt/nnm/var/nnm/logs/`. At high SPAN capture rates, these files can consume significant disk space. Provision additional disk capacity for the partition containing `/opt/nnm` based on your expected capture rate, configured file size limit, and maximum number of log files. For more information, see the **Realtime Events File Size** and **Maximum Realtime Log Files** settings.

High Performance Mode

To run Tenable Network Monitor in High Performance mode, a minimum of two of the following types of Intel NICs are required; one as a management interface and at least one as a monitoring interface:

- e1000 (82540, 82545, 82546)
- e1000e (82571, 82574, 82583, ICH8.ICH10, PCH.PCH2)
- igb (82575, 82576, 82580, I210, I211, I350, I354, DH89xx)
- ixgbe (82598, 82599, X540, X550)
- i40e (X710, XL710)
- NT40A01-4x1
- Intel E810

  Note: Intel E810 devices require an `ice.pkg` file in the `/lib/firmware/intel/ice/ddp directory`. Intel 800-series adapters (including E810, E822, E823, E825, and E830) support speeds from 10 Gbps to 200 Gbps; however, Tenable Network Monitor supports only 10 Gbps throughput when you use High Performance Mode.

  Intel adapters or Linux systems provide the Dynamic Device Personalization (DDP) package as a compressed file (for example, `ice.pkg.xz`). You must uncompress the package and its associated version file (for example, `ice-1.3.30.0.pkg.xz`) using the `unxz` command:

  ```
  unxz ice.pkg.xz
  ```

Tenable Network Monitor Software Requirements

Note: Tenable Network Monitor only supports the following listed services and operating systems.

Tenable Network Monitor is available for the following platforms:

Version	Software Requirements
6.6.x	**Note:** For all versions of Red Hat Linux ES and CentOS, Tenable Network Monitor requires that you have `systemd` and `firewalld` on your system. • Red Hat Linux ES 7 64-bit

- Red Hat Linux ES 8 64-bit

  > **Note:** This RPM is also supported in Oracle Linux 8 in Red Hat Compatible Kernel (RHCK) mode.

- Red Hat Linux ES 9 64-bit
- Microsoft Windows 10, Windows 11, Server 2016, Server 2019, Server 2022, and Server 2025 64-bit

  > **Note:** Tenable Network Monitor requires Microsoft Visual C++ Redistributable for Visual Studio 2015, 2017 and 2019. You must download the specific package `vc_redist.x64.exe` from the Microsoft downloads site.

  High Performance mode only available on:

- RH7 (RH 7.0 through RH 7.9) : 3.10.0-1160
- RH8 (RH 8.0 through RH 8.5): 4.18.0-425
- RH8 (RH 8.6-8.10): 4.18.0-553
- RH9 (RH 9.0-9.8): 5.14.0-611

You can use ERSPAN to mirror traffic from one or more source ports on a virtual switch, physical switch, or router and send the traffic to a destination IP host running Tenable Network Monitor. Tenable Network Monitor supports the following ERSPAN virtual environments:

- VMware ERSPAN (Transparent Ethernet Bridging)
- Cisco ERSPAN (ERSPAN Type II)

> **Tip:** Refer to the Configuring Virtual Switches for Use with Tenable Network Monitor document for details on configuring your virtual environment.

High Performance Mode

To run Tenable Network Monitor in High Performance mode, you must enable HugePages support. HugePages is a performance feature of the Linux kernel and is necessary for the large memory pool

allocation used for packet buffers. If your Linux kernel does not have HugePages configured, Tenable Network Monitor automatically configures HugePages per the appropriate settings. Otherwise, if your Linux kernel has defined HugePages, refer to the Configuring HugePages instructions in the Linux Command Line Operations section.

Tenable Network Monitor Licensing Requirements

Tenable Network Monitor Subscription

An Tenable Network Monitor subscription Activation Code is available that enables Tenable Network Monitor to operate in Standalone mode. Use this mode to view results from an HTML interface enabled on the Tenable Network Monitor server.

Activation Code

To obtain a Trial Activation Code for Tenable Network Monitor, contact sales@tenable.com. Trial Activation Codes are handled the same way by Tenable Network Monitor as full Activation Codes, except that Trial Activation Codes allow monitoring for only 30 days. During a trial of Tenable Network Monitor, all features are available.

Tenable Security Center Continuous View

Tenable Security Center CV includes Tenable Network Monitor as part of a bundled license package with Tenable Security Center. This license allows an unlimited number of Tenable Network Monitor deployments to monitor an unlimited number of networks. Tenable Security Center CV's IP view is constrained by the license with which it is purchased.

Tenable One Vulnerability Management

Tenable One Vulnerability Management includes Tenable Network Monitor as part of a bundled license package with Tenable One Vulnerability Management. This license allows an unlimited number of Tenable Network Monitor deployments to monitor an unlimited number of networks.

Tenable One Vulnerability Management's Asset view is constrained by the license with which it is purchased.

High Performance Mode

Tenable Network Monitor in High Performance Mode can be licensed in Standalone mode or bundled with Tenable Security Center.

Download Tenable Network Monitor

To download Tenable Network Monitor:

1. Access the Tenable Downloads page.
2. Click **Tenable Network Monitor**.
3. Select the correct version for your operating system.

   After you accept the license agreement, a download begins.

   > **Note:** To ensure binary compatibility, be sure to download the correct build for your operating environment.

4. Confirm the integrity of the installation package by comparing the download checksum with the checksum on the Tenable downloads page, as described in the knowledge base article.

Install Tenable Network Monitor

Before You Begin

- Download the Tenable Network Monitor package.
- Ensure you can run the following commands with administrative or root privileges.

Linux

To ensure audit record time stamp consistency between Tenable Network Monitor and Tenable Security Center, ensure the underlying OS uses NTP as described in the Red Hat documentation.

Tip: Ensure that organizational and OS firewall rules permit access to port 8835 on the Tenable Network Monitor server.

To install Tenable Network Monitor on Linux:

1. Install the Tenable Network Monitor **.rpm** file downloaded from the Tenable Downloads page in RedHat or CentOS with the following command. The specific file name varies depending on your platform and version.

   ```
   # rpm -i nnm-6.x.x-esx.x86_64.rpm
   Preparing...      ########################################### [100%]
   1:NNM             ########################################### [100%]
   [*] Tenable Network Monitor installation completed.
   #
   ```

   Note: If `rpm` is not available on your system, you can use `yum` or `dnf` instead. For example: `yum install nnm-6.x.x-esx.x86_64.rpm` or `dnf install nnm-6.x.x-esx.x86_64.rpm`.

   The installation creates the **/opt/nnm** directory, which contains the Tenable Network Monitor software, default plugins, and directory structure.

2. (Optional) You can verify the rpm's signature before deploying. See Verify the RPM Signature.

3. Start Tenable Network Monitor for Red Hat and CentOS systems using the following command:

   # service nnm start

4. Navigate to **https://<IP address or hostname>:8835**, which displays the Tenable Network Monitor web front end to log in for the first time.

   Refer to Configure Tenable Network Monitor to complete the initial login.

Windows

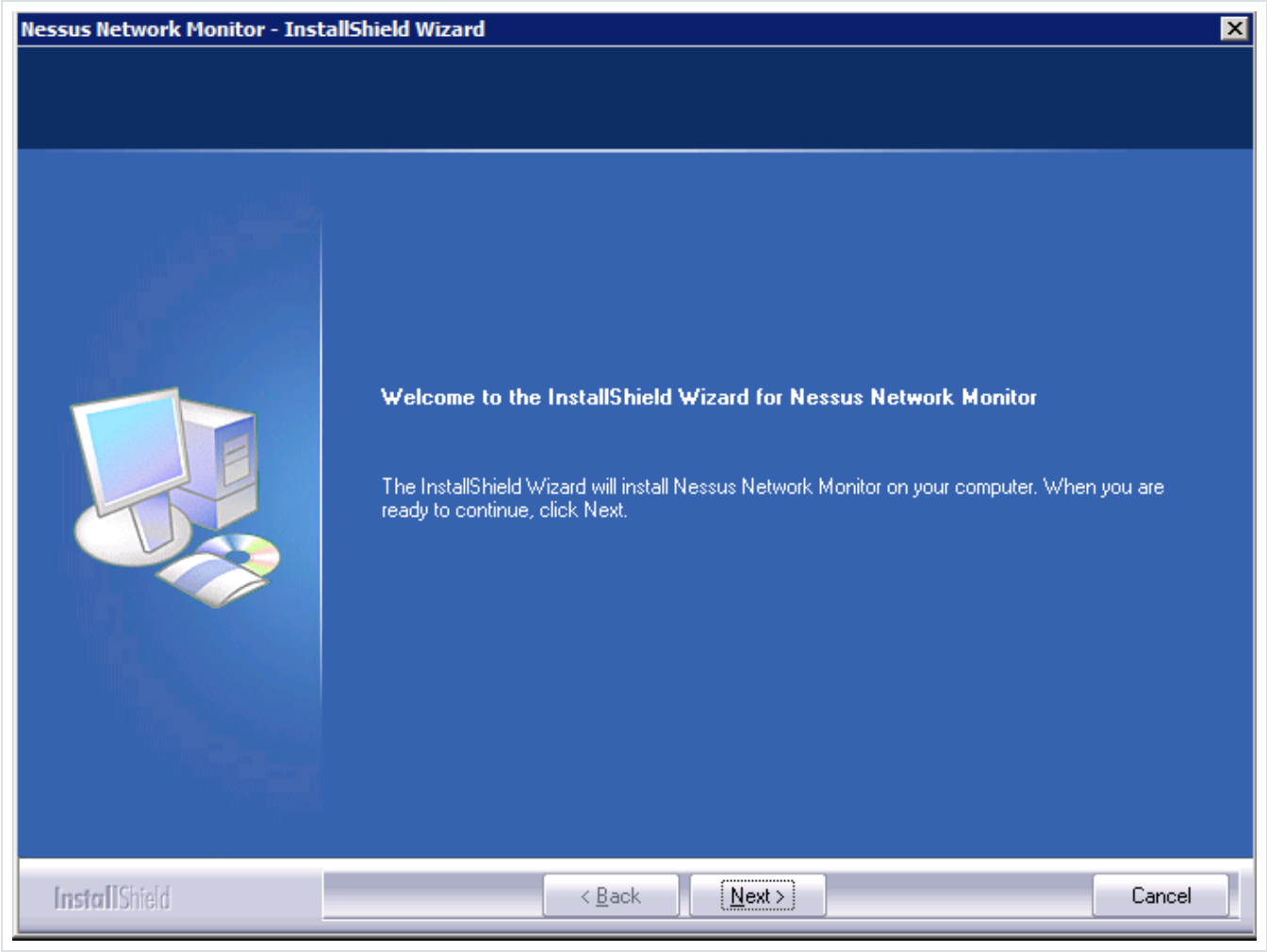
Before You Begin:

- Ensure that you have installed the latest version of Microsoft Visual C++ 2010 Redistributable Package for your 64-bit platform and architecture.
- Ensure that the directory or directories containing the Tenable Network Monitor folder are not writable by regular users. The directories that contain the Tenable Network Monitor binaries must be writable only by special users like administrators to prevent other users from acquiring elevated privileges granted to Tenable Network Monitor.
- Stop any other programs on your system that utilize Npcap.

To install Tenable Network Monitor on Windows:

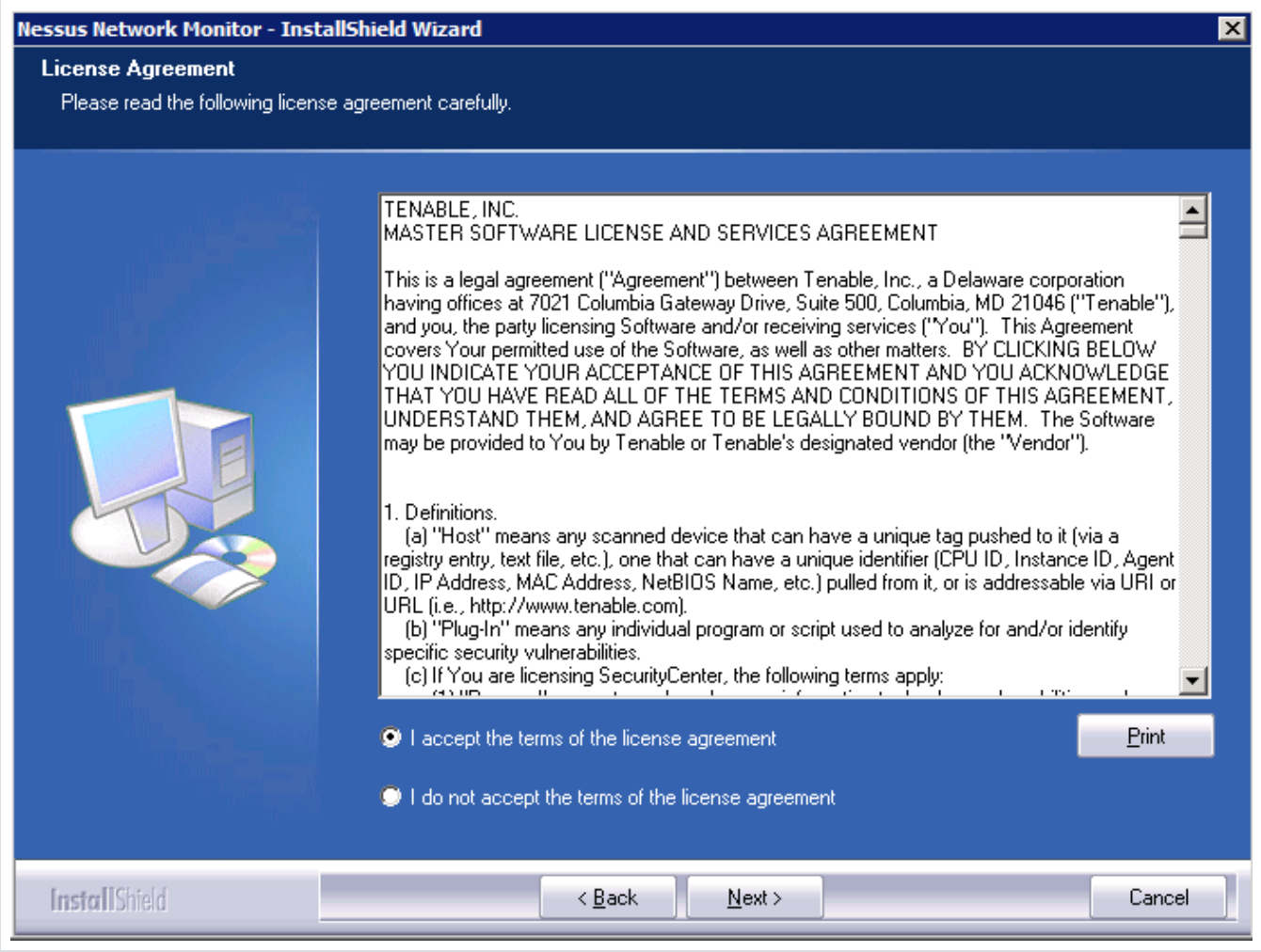
5. Double-click the **.exe** file downloaded from the Tenable Downloads page. The specific file name varies depending on your version.

   The InstallShield Wizard launches, which walks you through the installation process and required configuration steps.



6. Click the **Next** button.

   The **License Agreement** screen appears.

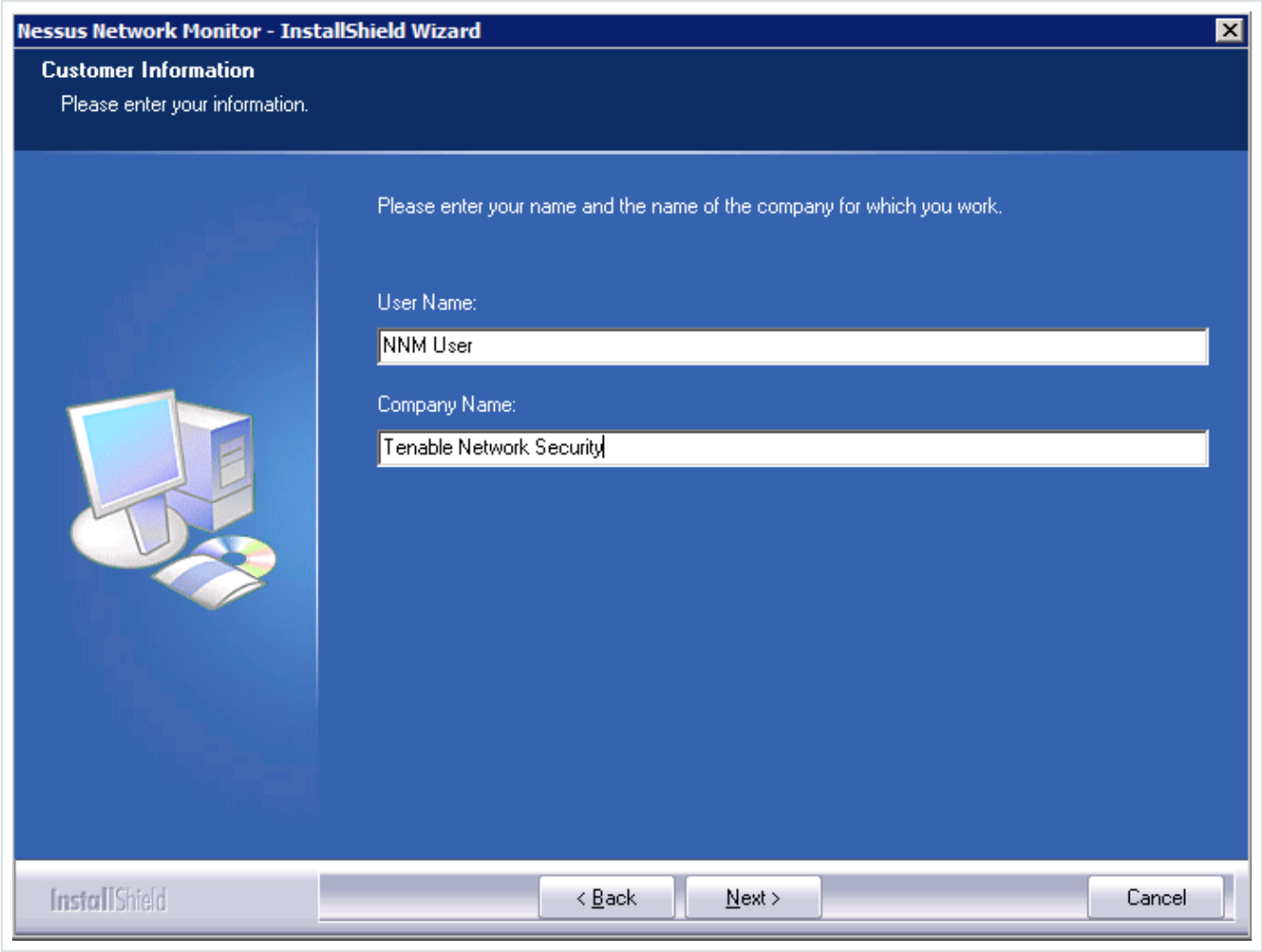


7. Agree to the terms to continue the installation process and use Tenable Network Monitor.

> **Tip:** You can copy the text of the agreement into a separate document for reference, or you can click the **Print** button to print the agreement directly from this screen.

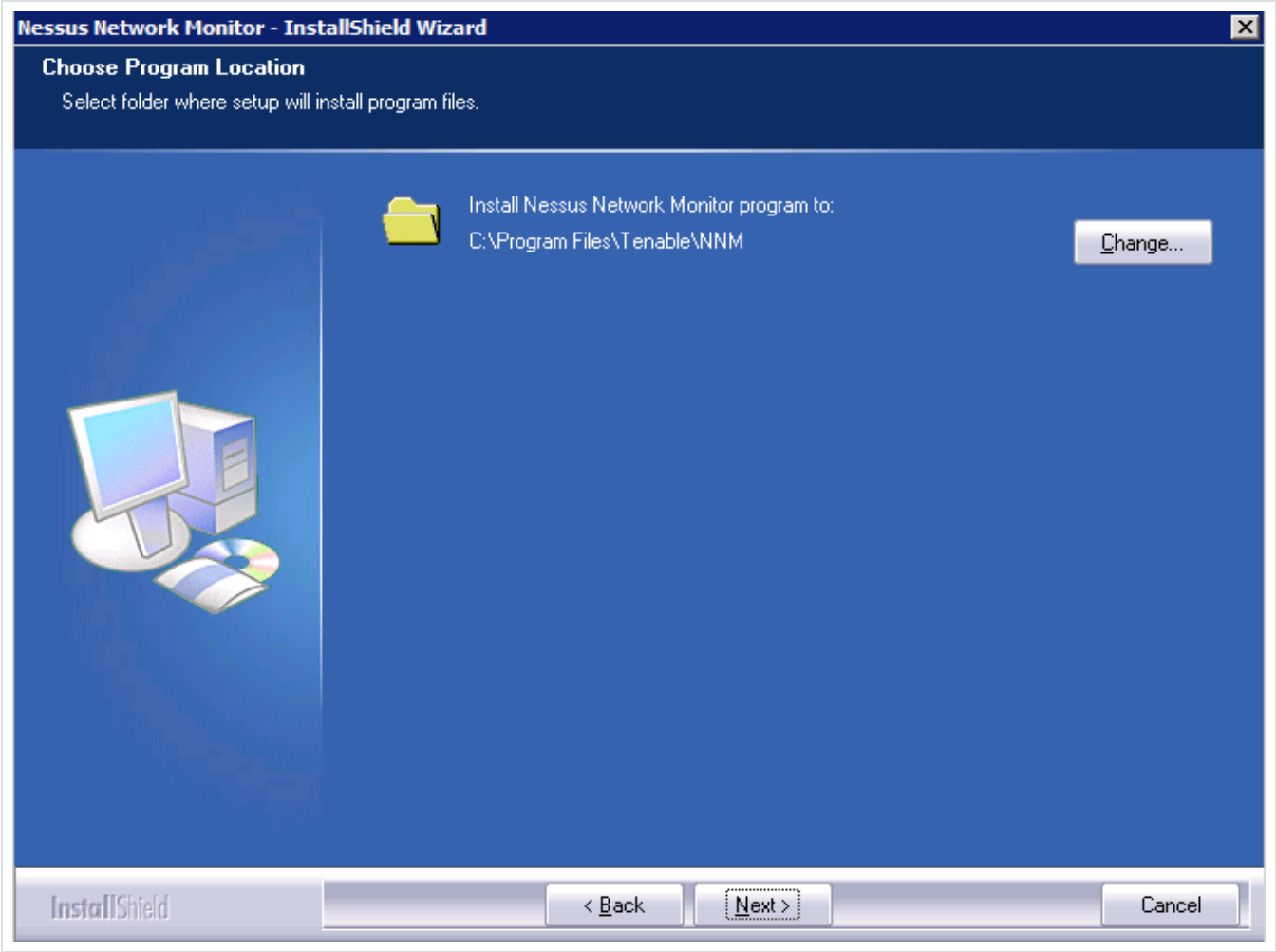
8. Click the **Next** button.

   The **Customer Information** screen appears. The **User Name** and **Company Name** boxes are used to customize the installation, but are not related to any configuration options (for example, for interfacing with Tenable Security Center).



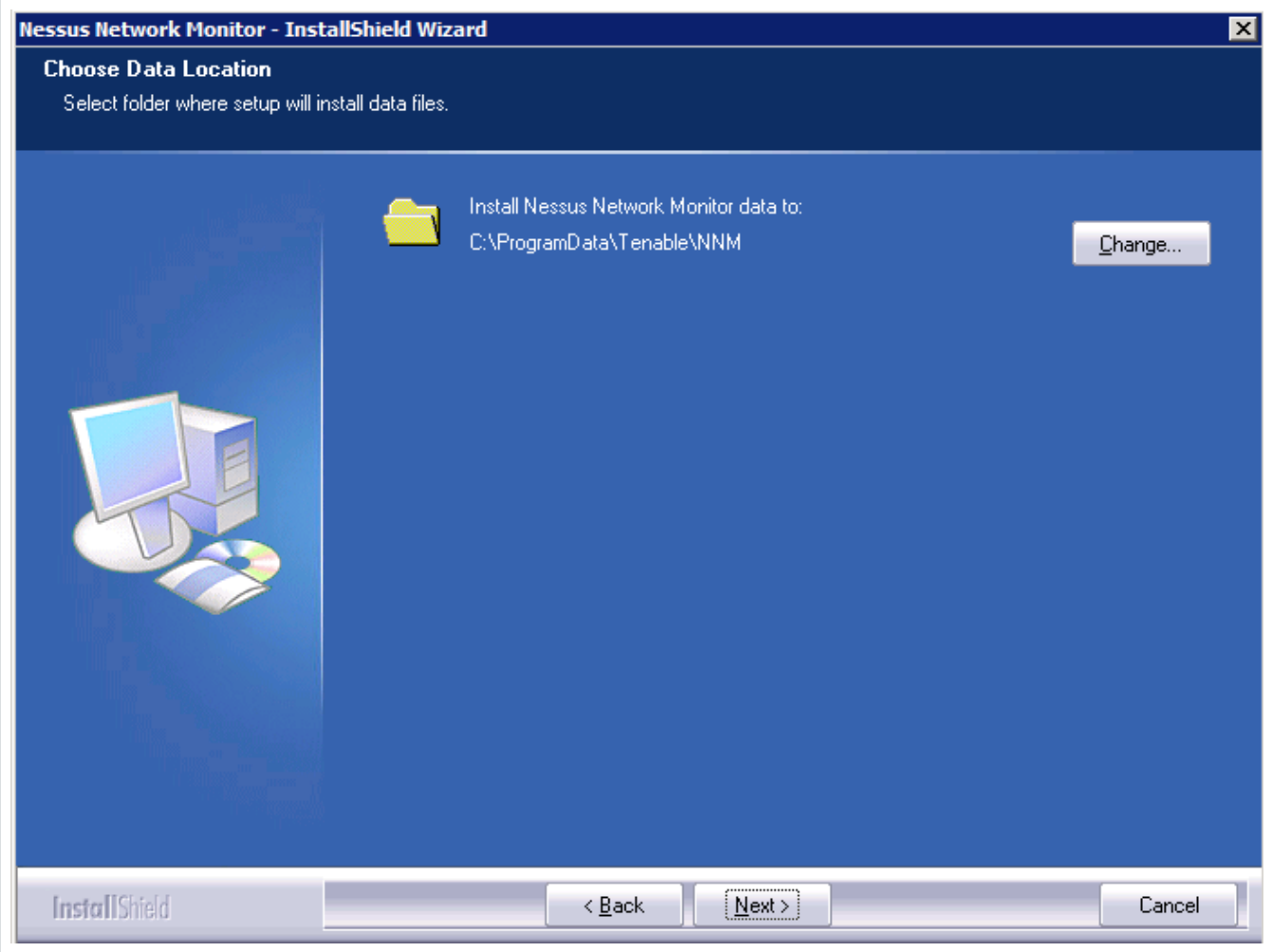
9. Click the **Next** button.

   The **Choose Program Location** screen appears, where you can verify the location in which the Tenable Network Monitor binaries are installed.



10. Click the **Change** button to specify a custom path.
11. Click the **Next** button.

    The **Choose Data Location** screen appears, where you can verify the location in which user data generated by Tenable Network Monitor is stored.

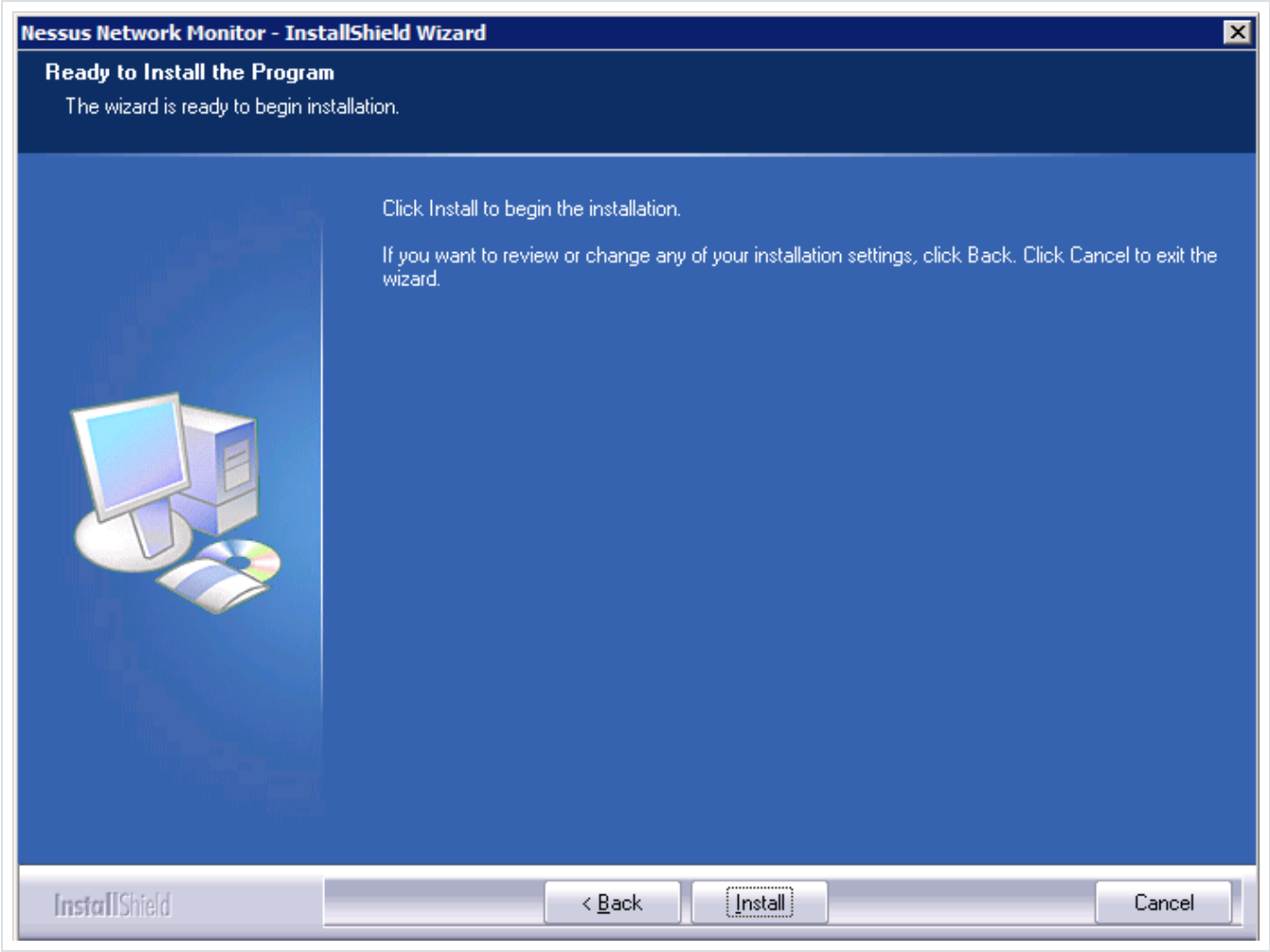


12. Click the **Change** button to specify a custom path.

    Tip: If you connect Tenable Network Monitor to Tenable Security Center, altering the data path disables Tenable Security Center from retrieving reports.

13. Click the **Next** button.

    The **Ready to Install the Program** screen appears, where you can review and edit the information supplied on previous screens.



14. Click the **Install** button.

    The **Installing** message appears for about 30 seconds, and Tenable Network Monitor deploys Npcap automatically.

    > **Tip:** Use the provided version of Npcap or newer. Tenable Network Monitor has been designed and tested using the supplied version of Npcap.

15. Start Tenable Network Monitor.

Upgrade Tenable Network Monitor

This section describes how to upgrade an existing Tenable Network Monitor instance on the following platforms:

- Linux
- Windows

Upgrade Tenable Network Monitor on Linux

Before You Begin

These steps assume you have backed up your custom SSL certificates. They also assume that you are running all commands with root privileges.

Additionally, if you have used an Tenable Network Monitor RPM to install Tenable Network Monitor previously, an upgrade retains configuration settings. You must transfer the Tenable Network Monitor RPM package to the system on which it is being installed. Confirm the integrity of the installation package by comparing the download MD5 checksum with the one listed in the product release notes.

To upgrade Tenable Network Monitor on Linux:

1. Stop Tenable Network Monitor with the following command:

   ```
   # service nnm stop
   ```

2. Install the Tenable Network Monitor **.rpm** file downloaded from the Tenable Downloads page with the following command. The specific filename varies depending on your version:

   ```
   # rpm -Uvh Tenable Network Monitor-5.x.x-esx.x86_64.rpm
   Preparing...                ########################################### [100%]
   1:Tenable Network Monitor ########################################### [100%]
   [*] Tenable Network Monitor installation completed.
   #
   ```

3. Once the upgrade is complete, start Tenable Network Monitor with the following command:

   ```
   # service nnm start
   ```

4. Navigate to `https://<ip address or hostname>:8835`, which displays the Tenable Network Monitor web front end to log in.

   > **Tip:** Ensure that organizational firewall rules permit access to port 8835 on the Tenable Network Monitor server.

Upgrade Tenable Network Monitor on Windows

Before You Begin

These steps assume you have backed up your custom SSL certificates. They also assume that you are running all programs as a local user with administrative privileges. To do so, when UAC is enabled, right-click on the installer program and select **Run as Administrator**.

Additionally, you must ensure the latest version of the Microsoft Visual C++ 2010 Redistributable Package is installed for your 64-bit platform and architecture. Be sure to stop any other programs on your system that are utilizing WinPcap.

To upgrade Tenable Network Monitor on Windows:

1. Stop the Tenable Tenable Network Monitor Proxy Service from the Windows Services control panel.
2. Double-click the `.exe` file downloaded from the Tenable Downloads page. The specific filename varies depending on your platform and/or version.

   The InstallShield Wizard launches and begins the upgrade process.
3. Click the **Next** button.

   The automated upgrade process begins.

   > **Note:** If the version of WinPcap is not at the appropriate level during the upgrade process, an upgrade window appears and begins the process of upgrading WinPcap. Failure to install the recommended version of WinPcap may result in errors with Tenable Network Monitor monitoring.
4. When the upgrade is complete, start Tenable Network Monitor.

5. Navigate to **`https://<ip address or hostname>:8835`** to display the Tenable Network Monitor web front end to log in.

   > **Tip:** Ensure that organizational firewall rules permit access to port 8835 on the Tenable Network Monitor server.

Set up Tenable Network Monitor

Tenable Network Monitor configuration follows the same steps for all operating systems. This section provides instructions for the following:

- Configure Tenable Network Monitor
- Register Tenable Network Monitor Offline via the Tenable Network Monitor Interface
- Register Tenable Network Monitor Offline via the CLI
- Configure High Performance Mode

Configure Tenable Network Monitor

To configure Tenable Network Monitor:

1. In a web browser, navigate to **`https://<ip address or hostname>:8835`**.
2. Type the default username and password, which are both **`admin`**.
3. Click **Sign In To Continue**.
4. The **Change Default Password** screen of the **Quick Setup** window appears, where you can change the default password. The new password must meet the following minimum requirements:
   - Minimum 5 characters long
   - One capital letter
   - One lowercase letter

- One numeric digit
- One special character from the following list: `!@#$%^&*()`

5. Click **Next Step**.

   The **Set Activation Code** screen appears.

6. To register Tenable Network Monitor offline, select the **Register Offline** check box and see Register Tenable Network Monitor Offline via the CLI.

7. In the **Activation Code** box, type the appropriate text based on your setup:

   - If Tenable Network Monitor is acting as a standalone device, type an Activation Code.
   - If Tenable Network Monitor is managed by Industrial Security, type **IndustrialSecurity**.

     > Industrial Security is end-of-life (EOL). For information about EOL dates and policies for Tenable products, see the Tenable Software Release Lifecycle Matrix and Policy.

     a. In the **Industrial Security Host** box, type the IP address of the Industrial Security instance.

     b. In the **Industrial Security Port** box, type the port of the Industrial Security instance.

     c. In the **Industrial Security Key** box, type the key copied from the Industrial Security instance. See the Industrial Security User Guide for more information.

     d. In the **NNM Name** box, type a name for the Tenable Network Monitor instance. This name appears in the Industrial Security interface.

   - If Tenable Network Monitor is managed by Tenable One Vulnerability Management, type **Cloud**.

     Four configuration options appear: **Cloud Host**, **Cloud Port**, **Cloud Key**, and **Tenable Network Monitor Name**. See the Cloud Settings section for more information.

   - If Tenable Network Monitor is managed by Tenable Security Center, type **SecurityCenter**. See the Tenable Security Center User Guide for more information.

   In all cases, a valid Activation Code must be typed in the **Activation Code** box.

8. Click **Next Step**.

   The **Monitoring Configuration** screen appears.

- The **Monitored Network Interfaces** box displays the monitored interfaces identified by Tenable Network Monitor. You can select one or more of the defined interfaces. The caret icon displays additional information about each interface.
- The **Monitored Network IP Addresses and Ranges** box displays the IP address ranges Tenable Network Monitor monitors.
- The **Excluded Network IP Addresses and Ranges** box displays the IP address ranges Tenable Network Monitor does not monitor.

The **Monitored Network IP Addresses and Ranges** and **Excluded Network IP Addresses and Ranges** boxes accept both IPv4 and IPv6 CIDR address definitions. When using multiple addresses, separate the entries using commas or new lines.

> **Note:** Tenable Network Security does not recommend typing large ranges such as 0.0.0.0/0. Because this indicates to Tenable Network Monitor that any and all network addresses belong in the network, performance may be severely impacted. Please only include addresses in your network, as each address undergoes in-depth processing.

9. Click **Finish**.

   The **Monitoring** page appears. Once Tenable Network Monitor starts monitoring traffic, the page displays various high-level charts about the vulnerabilities, assets, connections, and bandwidth usage that Tenable Network Monitor has detected, as well as real-time events that Tenable Network Monitor has triggered.

> **Note:** By default, Tenable Network Monitor has discovery mode enabled when installed. You must disable discovery mode for Tenable Network Monitor to load plugins into memory. For more information on discovery mode, see Tenable Network Monitor Settings Section.

Verify Your RPM Signature

To verify the rpms:

1. Download the 4096 signing key at the Tenable Download Site.

   You will get a file named **tenable-4096.gpg**.

2. Run the following command to import the file.

```
rpm --import tenable-4096.gpg
```

3. Run the following command to check your downloaded rpm, (for example. nnm-6.1.0-es7.x86_64.rpm).

```
rpm -Kv nnm-6.1.0-es7.x86_64.rpm
```

Tenable Network Monitor outputs the results of the command. (The 4096 bit key is "V3 RSA/SHA256"):

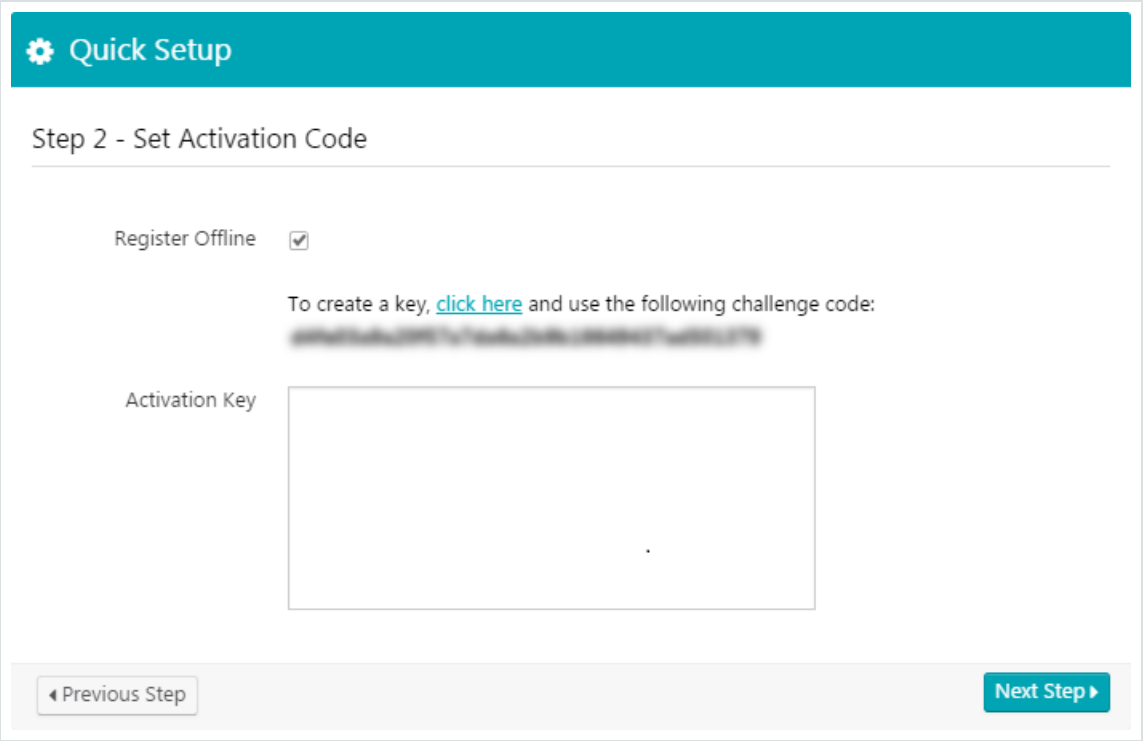
```
Header V3 RSA/SHA256 Signature, key ID 2f12969d: OK
Header SHA1 digest: OK (118e3221435977b9ae64b51aab0f2aaef16b0336)
V3 RSA/SHA256 Signature, key ID 2f12969d: OK
MD5 digest: OK (491691a5e08510e83757c93eeeeb15a1)
```

Register Tenable Network Monitor Offline via the Tenable Network Monitor Interface

To register Tenable Network Monitor offline via the Tenable Network Monitor interface:

1. During the **Initial Configuration**, on the **Quick Setup** window, select the **Register Offline** check box.

   A challenge code and the **Activation Key** box appear.



2. Copy the challenge code and, in a web browser, navigate to https://plugins.nessus.org/v2/offline-pvs.php.
3. In the appropriate boxes, paste your challenge code and type the Activation Code you received from Tenable.
4. Click **Submit**.

   The page generates a URL to download the Tenable Network Monitor plugins tarball. Save this URL, as it is used every time you update your plugins. Additionally, a license key appears.
5. Copy the license key.
6. Navigate to the Tenable Network Monitor interface.
7. Paste the license key into the **Activation Key** box on the **Quick Setup** window.
8. Click the **Next Step** button.
9. Continue with Step 5 of the **Initial Configuration** instructions.

> **Note:** After configuring Tenable Network Monitor, upload the plugins tarball in the **Offline Update** area of the **Feed Settings** section.

Register Tenable Network Monitor Offline via the CLI

If your Tenable Network Monitor installation cannot reach the Internet directly, use the following procedure to register and update plugins:

1. On the system running Tenable Network Monitor, type the following command:

Platform	Command to Run
Red Hat Linux / CentOS	`# /opt/nnm/bin/nnm --challenge`
Windows	`C:\Program Files\Tenable\NNM\nnm --challenge`

   This produces a challenge code similar to the following:

   569ccd9ac72ab3a62a3115a945ef8e710c0d73b8

2. Go to https://plugins.nessus.org/v2/offline-NNM.php.
3. Paste the challenge code as well as the Activation Code you received previously from Tenable into the appropriate text boxes.

   This produces a URL that gives you direct access to the Tenable Network Monitor plugins.

4. Save the URL as it is used every time you update your plugins.

   Additionally, a license key and the associated **`NNM.license`** file are produced.

5. Copy this file to the host running Tenable Network Monitor in the appropriate directory.
6. Once the **`NNM.license`** file is copied, run the **`Tenable Network Monitor --register-offline`** command to install the file:

Platform	Directory
Red Hat Linux / CentOS	`# /opt/nnm/bin/nnm --register-offline /path/to/NNM.license`
Windows	`C:\Program Files\Tenable\NNM\nnm --register-offline "C:\path\to\NNM.license"`

7. To obtain the newest plugins, navigate to the URL provided in the previous step.

   You receive a TAR file (e.g., **sc-passive.tar.gz**).

8. Copy the file to Tenable Network Monitor and then type the appropriate command for your platform:

Platform	Command
Red Hat Linux / CentOS	`# /opt/nnm/bin/nnm --update-plugins /path/to/sc-passive.tar.gz`
Windows	`C:\Program Files\Tenable\NNM\nnm --update-plugins C:\path\to\sc-passive.tar.gz`

Register High Performance Mode Tenable Network Monitor for Tenable Security Center in an Air-gapped Environment

To register Tenable Network Monitor for Tenable Security Center in an air-gapped environment, you must either update your current install or configure a fresh install of Tenable Network Monitor

> **Note:** These steps apply to High Performance, 10G mode.

Update the Current Install from Tenable Network Monitor

1. From a CLI on Tenable Network Monitor, stop the Tenable Network Monitor service.
2. Run the following command:

   ```
   /opt/nnm/bin/nnm --config "Enable High Performance Mode" "1"
   ```

3. Start the Tenable Network Monitor service.
4. In a browser, open Tenable Network Monitor.
5. Click **Configuration** > **Feed Settings**.
6. In the **Activation Code** box type 'XXXX'.

> **Note:** This allows the (required) High Performance license to persist and enables the **Fetch Plugins From** drop-down box.

7. From the **Fetch Plugins From** drop-down box, select **SecurityCenter**.
8. Click **Update**.

Update the Current Install from Tenable Security Center

1. Open a browser and log in to Tenable Security Center.
2. Add Tenable Network Monitor, as described in the Add a Tenable Network Monitor in the *Tenable Security Center User Guide*.
3. Click **Submit**.

   The system adds Tenable Network Monitor to Tenable Security Center.

> **Note:** The Tenable Network Monitor status changes to **Plugins Out of Sync** while the plugins are first downloaded to Tenable Network Monitor from Tenable Security Center. The next time Tenable Security Center polls Tenable Network Monitor, the status updates to **Working**.

Configure a Fresh Install from Tenable Network Monitor

1. From a CLI on Tenable Network Monitor, run the following command:

   ```
   /opt/nnm/bin/nnm --config "Enable High Performance Mode" "1"
   ```
2. Start the Tenable Network Monitor service.
3. In a browser, open Tenable Network Monitor.
4. In Step 2 of the **Quick Setup** steps, check the **Register Offline** check box.
5. In a browser, navigate to https://plugins.nessus.org/v2/offline.php .
6. Type the Tenable Network Monitor challenge code.
7. Type the activation code.
8. In Tenable Network Monitor complete the **Quick Setup** steps.
9. Click **Configuration** > **Feed Settings**.
10. In the **Activation Code** box type 'XXXX'.

> **Note:** This allows the (required) High Performance license to persist and enables the **Fetch Plugins From** drop-down box.

11. From the **Fetch Plugins From** drop-down box, select **SecurityCenter**.
12. Click **Update**.

Configure a Fresh Install from Tenable Security Center

1. Open a browser and connect to Tenable Security Center.
2. Add Tenable Network Monitor, as described in the Add a Tenable Network Monitor in the *Tenable Security Center User Guide*.
3. Click **Submit**.

   The system adds Tenable Network Monitor to Tenable Security Center.

   > **Note:** The Tenable Network Monitor status changes to **Plugins Out of Sync** while the plugins are first downloaded to Tenable Network Monitor from Tenable Security Center. The next time Tenable Security Center polls Tenable Network Monitor, the status updates to **Working**.

Disable Secure Boot for Tenable Network Monitor High Performance Mode

On some versions of Linux, the operating system has a Secure Boot option that prevents programs from loading kernel modules. In some versions, such as Red Hat Enterprise Linux 8, Secure Boot is enabled by default. If your Linux operating system has Secure Boot enabled, you must disable Secure Boot mode to run Tenable Network Monitor in high performance mode.

> **Note:** SELinux is a Linux kernel security module and has rules to prevent programs from loading kernel modules. Tenable Network Monitor modules comply with these rules, so these security measures are still in place for your system even if you disable Secure Boot.

To disable Secure Boot mode in Red Hat Enterprise Linux:

1. As a root user, access the system's console.
2. To check whether your system has Secure Boot enabled or disabled, type:

```
/usr/bin/mokutil --sb-state
```

If Secure Boot is disabled, you can run Tenable Network Monitor in High Performance Mode. If Secure Boot is enabled, continue with the rest of the procedure.

2. To disable Secure Boot mode, type:

```
/usr/bin/mokutil --disable-validation
```

The system prompts you for a password.

4. Type a temporary password and confirm the password when prompted.

> **Tip:** Ensure you remember this temporary password because you are required to enter it when you first restart the system after changing the Secure Boot state.

5. To restart the system, type:

```
reboot
```

The system restarts and displays the MOK management screen.

6. On the MOK management screen, press any key to advance.
7. Select **Change Secure Boot state**.
8. Follow the prompts to enter characters from your temporary password.
9. When prompted to disable Secure Boot, select **Yes**.

   The system prompts you to restart.

10. Restart your system.

    The system restarts with Secure Boot mode disabled. You can now run Tenable Network Monitor in High Performance mode.

What to do next:

- Configure High Performance Mode

Configure High Performance Mode

The following steps are required to operate Tenable Network Monitor in High Performance mode. Alternatively, a user with administrative privileges can enable High Performance mode via the UI.

Tenable Network Monitor uses multiple cores to process packets received from monitored interfaces. These are known as worker cores. The Tenable Network Monitor UI displays the number of available cores which depends on the hardware being used. This number can be changed using the configuration parameter **Number Of Worker Cores** in the Tenable Network Monitor UI.

> **Note:** Tenable Network Monitor supports a maximum number of 12 worker cores if you are monitoring only one port in your 10 Gbps card. If you monitor both ports, the maximum number is 11 worker cores.

> **Note:** If you set the **Number Of Worker Cores** parameter to 0, Tenable Network Monitor automatically changes the value to the minimum number of worker cores needed to run Tenable Network Monitor in High Performance mode.

For example, suppose you have 20 available logical cores in your machine. Four of those cores are used by the system for internal processing and the kernel. Tenable Network Monitor will use an additional core to manage the database and another core to process PASL plugins script processing.

If you want to use the 12 available work cores for Tenable Network Monitor, then you can change the value for the parameter **Number Of Worker Cores** to 12 if you are monitoring 1 port, or 11 if you are monitoring both ports.

Before you begin:

- Ensure you have a High Performance Activation Code so you can run Tenable Network Monitor in High Performance mode.
- If you are running Red Hat Enterprise Linux, ensure Secure Boot mode is disabled, as described in Disable Secure Boot for Tenable Network Monitor High Performance Mode.

To configure High Performance Mode:

1. Stop Tenable Network Monitor with the following command:

   ```
   # service nnm stop
   ```

2. Enable High Performance mode with the following command:

   ```
   /opt/nnm/bin/nnm --config "Enable High Performance Mode" "1"
   ```

3. Confirm that the management network interface is different from the monitoring network interface that you configured initially.

   > **Note:** If the configured monitored interface has bound IPv4 addresses, you cannot complete the Quick Setup Wizard to configure Tenable Network Monitor because no usable NICs appear in the **Monitored Network Interfaces** list.

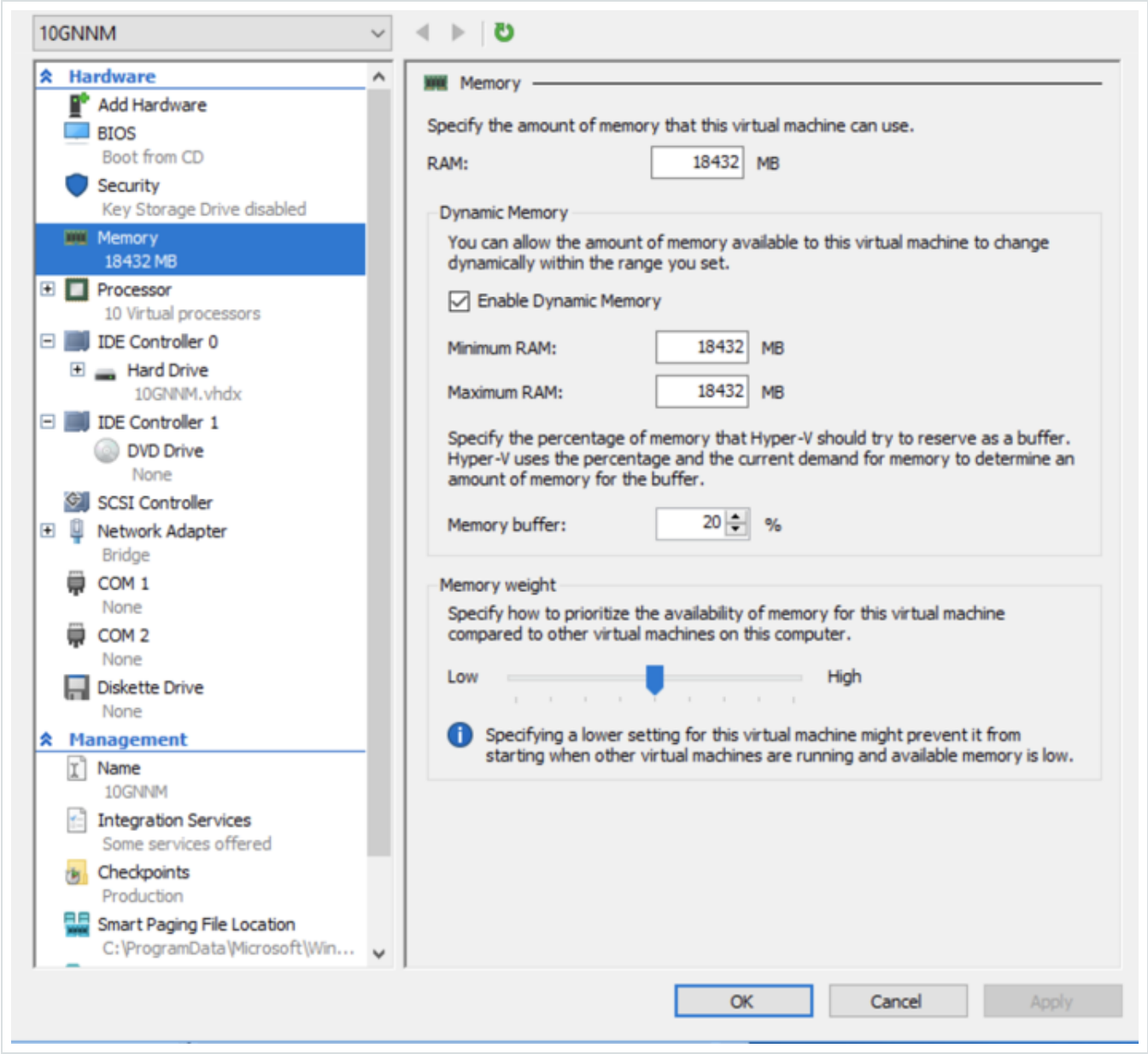
4. Start Tenable Network Monitor with the following command:

   ```
   # service nnm start
   ```

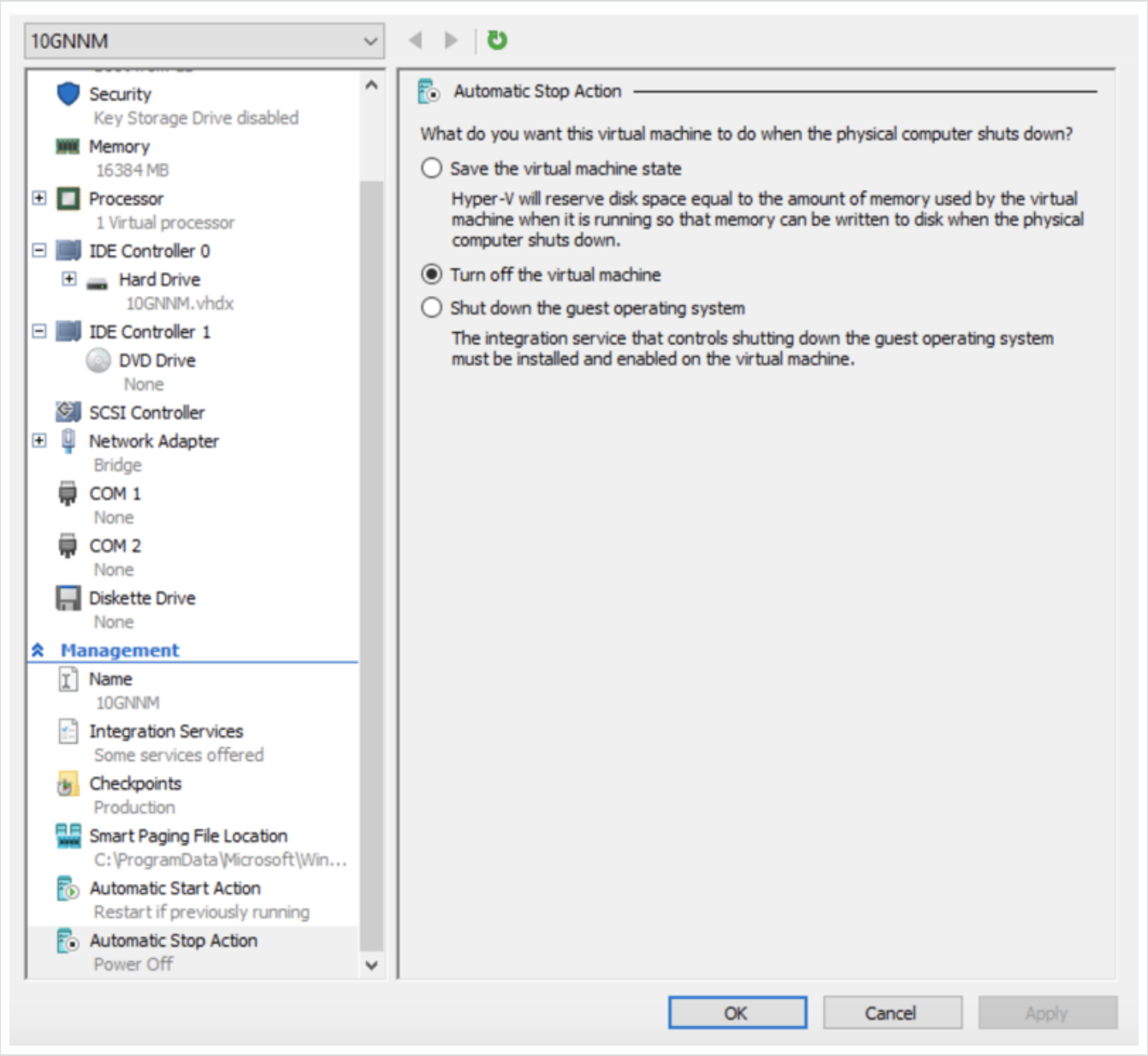
Configure Tenable Network Monitor in High Performance Mode on Hyper-V

To configure Tenable Network Monitor in High Performance Mode on Hyper-V:

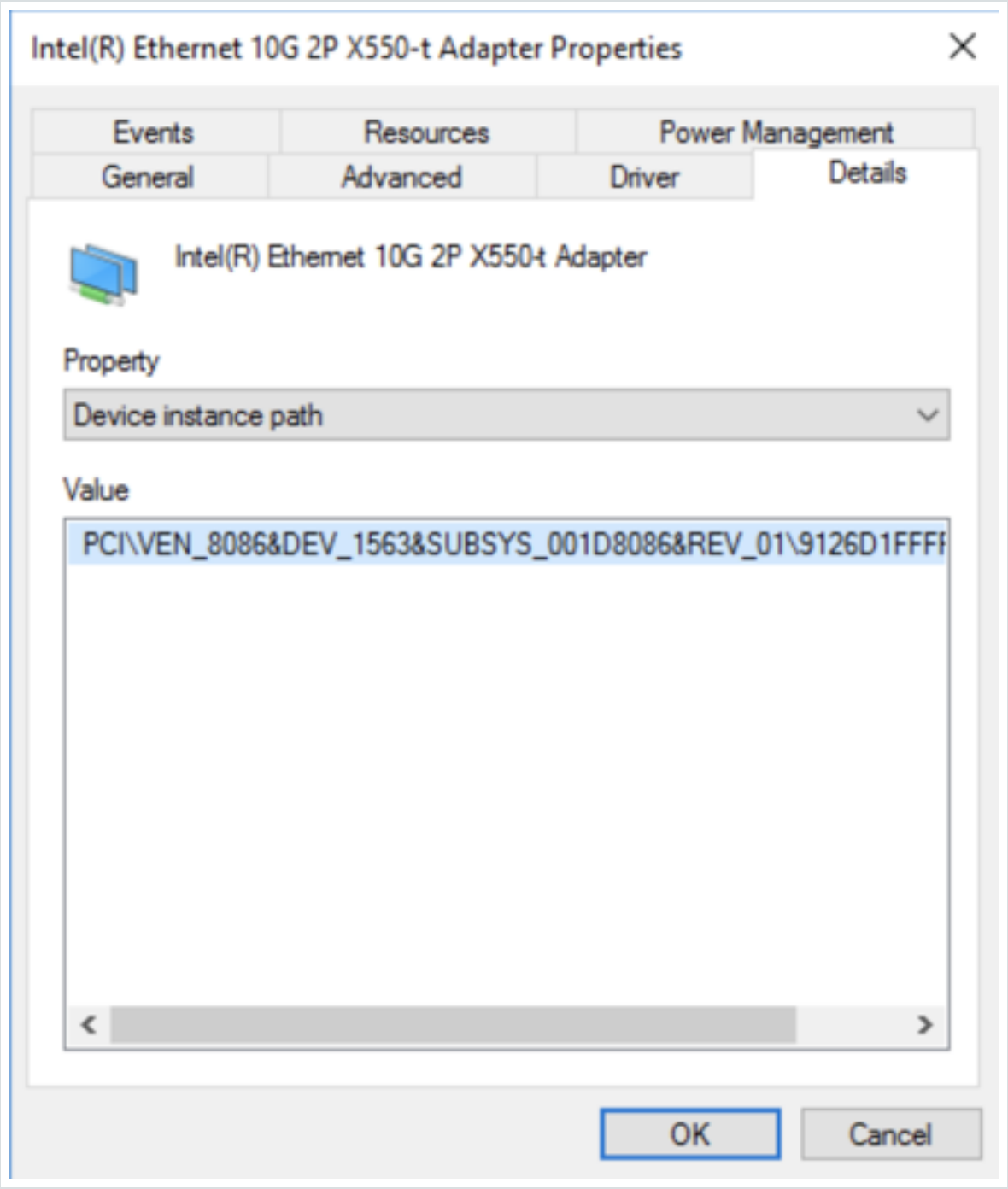
1. Install the CentOS VM.
2. Shut down the VM after install completes.
3. Right click the VM and navigate to **Settings**.
4. In the **Memory** section, check the **Enable Dynamic Memory** check box.



5. Set the **Minimum RAM** to the startup RAM setting.
6. In the **Automatic Stop Action** section, select the **Turn off the virtual machine** radio button.



7. Click **OK**.
8. Open **Device Manager**.
9. Right click on the device you want to configure for passthrough.
10. In the **Properties** dialog, click the **Details** tab.
11. In the **Property** drop-down box, select **Device instance path**.
12. Copy the value from the **Value** box.



13. In Powershell, use the following commands to perform the DDA configuration:

```
# Setting up environment
# Configure VMName
```

```
$vmName = '10GNNM'

# Configure Instance ID
$instanceId = 'PCI\VEN_8086&DEV_1563&SUBSYS_001D8086&REV_01\9126D1FFFF74000000'

# Configure Extra variable
$vm = Get-VM -Name $vmName
$dev = (Get-PnpDevice -PresentOnly).Where{ $_.InstanceId -like $instanceId }

# Disable device from hosts
Disable-PnpDevice -InstanceId $dev.InstanceId -Confirm:$false

# Setup location path and dismount the device from hosts
$locationPath = (Get-PnpDeviceProperty -KeyName DEVPKEY_Device_LocationPaths -
InstanceId
$dev.InstanceId).Data[0]
echo $locationPath

# Dismount device from the host
Dismount-VmHostAssignableDevice -LocationPath $locationPath -Force -Verbose

# Assign the device to our VM
Add-VMAssignableDevice -VM $vm -LocationPath $locationPath -Verbose
```

Use the following commands if you do not intend to use the device with Tenable Network Monitor in the VM:

```
# Roll back, shutdown the VM first

# Remove the device from the VM
Remove-VMAssignableDevice -VMName $vmName -Verbose

# Return the device to host
Get-VMHostAssignableDevice | Mount-VmHostAssignableDevice -Verbose
```

```
# Enable it in devmgmt.msc
(Get-PnpDevice -PresentOnly).Where{ $_.InstanceId -like $instanceId  }| Enable-
PnpDevice -Confirm:$false -Verbose
```

14. Turn on the VM.
15. Install Tenable Network Monitor.
16. Configure huge pages with the commands listed in the Linux Command Line Operations documentation.
17. Enable High Performance Mode.

Configure Hyper-V NIC in Promiscuous Mode

To allow Tenable Network Monitor to monitor external traffic on a Hyper-V host, configure the virtual switch for port mirroring and set the Tenable Network Monitor VM network adapter as the mirroring destination.

1. Open PowerShell on your Hyper-V host as an Administrator.
2. Add the port monitor mode feature to the virtual switch that the Tenable Network Monitor VM is connected to. Replace <vSwitchName> with the name or ID of the virtual switch.

```
$A = Get-VMSystemSwitchExtensionPortFeature -FeatureName "Ethernet Switch Port
Security Settings"
$A.SettingData.MonitorMode = 2
Add-VMSwitchExtensionPortFeature -ExternalPort -SwitchName <vSwitchName> -
VMSwitchExtensionFeature $A
```

3. Verify that the feature was added:

```
Get-VMSwitchExtensionPortFeature -ExternalPort -SwitchName <vSwitchName> –
FeatureName "Ethernet Switch Port Security Settings"
```

4. Change the `PortMirroring` attribute of the VM network adapter. You can also do this in the Hyper-V Manager GUI. Replace <VMName> with the name of the Tenable Network Monitor VM and <MACAddr> with the MAC address of its network adapter.

```
Get-VMNetworkAdapter -VMName <VMName> | ? MacAddress -eq '<MACAddr>' | Set-
VMNetworkAdapter -PortMirroring Destination
```

Configure Tenable Network Monitor on Machines Hosting Napatech Acceleration Cards

If you use Napatech Link™ Capture Software v12.4.3 or later, you can configure your machine to use Tenable Network Monitor in High Performance Mode to acquire network traffic from your hardware acceleration devices. For more information, see Configure High Performance Mode.

Note: Tenable Network Monitor only supports this feature on Red Hat 7 or CentOS 7 platforms because they use the latest performance improvements of the Linux Kernel.

Requirements

Product	Manufacturer	Operating System	Comments
Tenable Network Monitor 6.4 or later	Tenable, Inc.®	RH7 or CentOS7	Requires High Performance Mode licensing
Napatech Link™ Capture Software v12.4.3 or later	Napatech Inc.	RH7 or CentOS7	Napatech product number: 810-0048-09-10

Configure the Napatech Deployment

1. Download Napatech Link.
2. In a text editor, append the following line to the `/etc/bashrc` file:

```
export NAPATECH3_PATH=/opt/napatech3
```

3. Deploy `ntanl_package_3gd-12.4.3.1-linux.tar.gz` as follows in /tmp or any temporary directory by running the following command:

```
tar xfz ntanl_package_3gd-12.4.3.1-linux.tar.gz
cd ntanl_package_3gd-12.4.3.1-linux
package_install_3gd-12.4.3.1.sh --noprompt
/opt/napatech3/bin/ntstart.sh
```

4. Do one of the following:
   - If the Napatech software reports any issues, contact Napatech Support.
   - If the Napatech software does not report any issues, run the following command:

```
/opt/napatech3/bin/ntstop.sh
```

Configure the Tenable Network Monitor Deployment

1. Do one of the following:
   - For a new deployment, run the following command:

```
rpm -i nnm-6.0.0-es7.x86_64.rpm
```

> **Note:** In this example, the Tenable Network Monitor version is 6.0.0. Please ensure this version number matches the version you want to install.

   - For an existing deployment, run the following command:

```
rpm -U nnm-6.0.0-es7.x86_64.rpm
```

> **Note:** In this example, the Tenable Network Monitor version is 6.0.0. Please ensure this version number matches the version you have installed.

HugePages Configuration

During installation, the file `/opt/napatech3/config/ntservice.ini` is automatically updated to include the following line:

```
# [How many, page_size, NUMA_ID]
HostBuffersRx = [16,16,-1]
```

Verify that the `/opt/napatech3/config/ntservice.ini` file contains the line; otherwise, edit the file manually to include this line.

Troubleshoot Issues with Napatech in Tenable Network Monitor

Cannot engage Tenable Network Monitor in High Performance Mode from the UI

If you are unable to engage Tenable Network Monitor in High Performance Mode from the UI or command line:

1. Check the Tenable Network Monitor log file at `/opt/nnm/var/nnm/logs/yyyymm.log` where *yyymm* is the year and month (for example, `/opt/nnm/var/nnm/logs/201909.log`)
2. If you see a **Cannot Create Ring for Worker Core X** message, edit the `/opt/napatech3/config/ntservice.ini` file to match the **Number of Worker Cores** configured in the Tenable Network Monitor Settings Section.
3. Restart the `ntservice` and `nnm` services.

No Traffic seen in Tenable Network Monitor UI

1. Run the following command to display the traffic going through the Napatech card:

   ```
   /opt/napatech3/bin/monitoring
   ```

2. If you see traffic in the Napatech card but not in the Tenable Network Monitor user interface, perform the following steps:

   a. Run the following command:

      ```
      kill -10 `cat /var/run/nnm.pid`
      ```

   b. Run the following command, where *yyyymm* is the year and month (for example, `/opt/nnm/var/nnm/logs/201909.log`):

      ```
      less /opt/nnm/var/nnm/logs/yyyymm.log
      ```

   c. Go to the bottom of the file. If you see messages like the following, then you must restart the the ntservice and nnm services:

      Sep 11, 2019 10:38:32 (NNM Core) [INFO] NIC port 0: **received: 2098625**
      Sep 11, 2019 10:38:32 (NNM Core) [INFO] Worker core 1 (Rx core 0, NIC port 0): **processed: 0**
      Sep 11, 2019 10:38:32 (NNM Core) [INFO] Worker core 2 (Rx core 0, NIC port 0): **processed: 0**
      …

Remove Tenable Network Monitor

The following instructions describe how to remove Tenable Network Monitor from the following platforms:

- Linux
- Windows

Remove Tenable Network Monitor from Linux

To remove Tenable Network Monitor from Linux:

1. Stop Tenable Network Monitor with the following command:

   ```
   # service nnm stop
   ```

3. Remove the Tenable Network Monitor RPM with the following command:

   ```
   # rpm -e NNM
   ```

4. Some user-created and user-modified files are not removed with the `-e` command. Remove any remaining files with the following command:

   ```
   # rm -rf /opt/nnm
   ```

   Tenable Network Monitor is removed.

Remove Tenable Network Monitor from Windows

To remove Tenable Network Monitor from Windows:

1. Depending on your version of Windows, in the **Control Panel**, under **Programs**, click one of the following:
   - **Programs and Features**
   - **Add or Remove Programs**
2. Select **Tenable Tenable Network Monitor**.
3. Click **Change/Remove**.

   The InstallShield Wizard appears.
4. Follow the directions in this wizard to completely remove Tenable Network Monitor.
5. Select **Yes** to remove the Tenable Network Monitor program and all its files, folders, and features from the system.

   -or-

   Select **No** to remove only the Tenable Network Monitor program. All user-created files and relevant file folders remain on the system.
6. Restart your machine to complete the removal.

7. Follow the same instructions to remove Npcap if there are no other applications that use Npcap (for example, Tenable Agents for Windows).

Monitoring Page

The **Monitoring** page provides a centralized view of vulnerabilities discovered by Tenable Network Monitor. On this page, vulnerabilities may be viewed in several categories, including **Dashboards**, **Hosts**, **Vulnerabilities**, **Applications**, **Operating Systems**, **Connections**, and **Mobile Devices**. The results may also be exported in different formats for use in other programs.

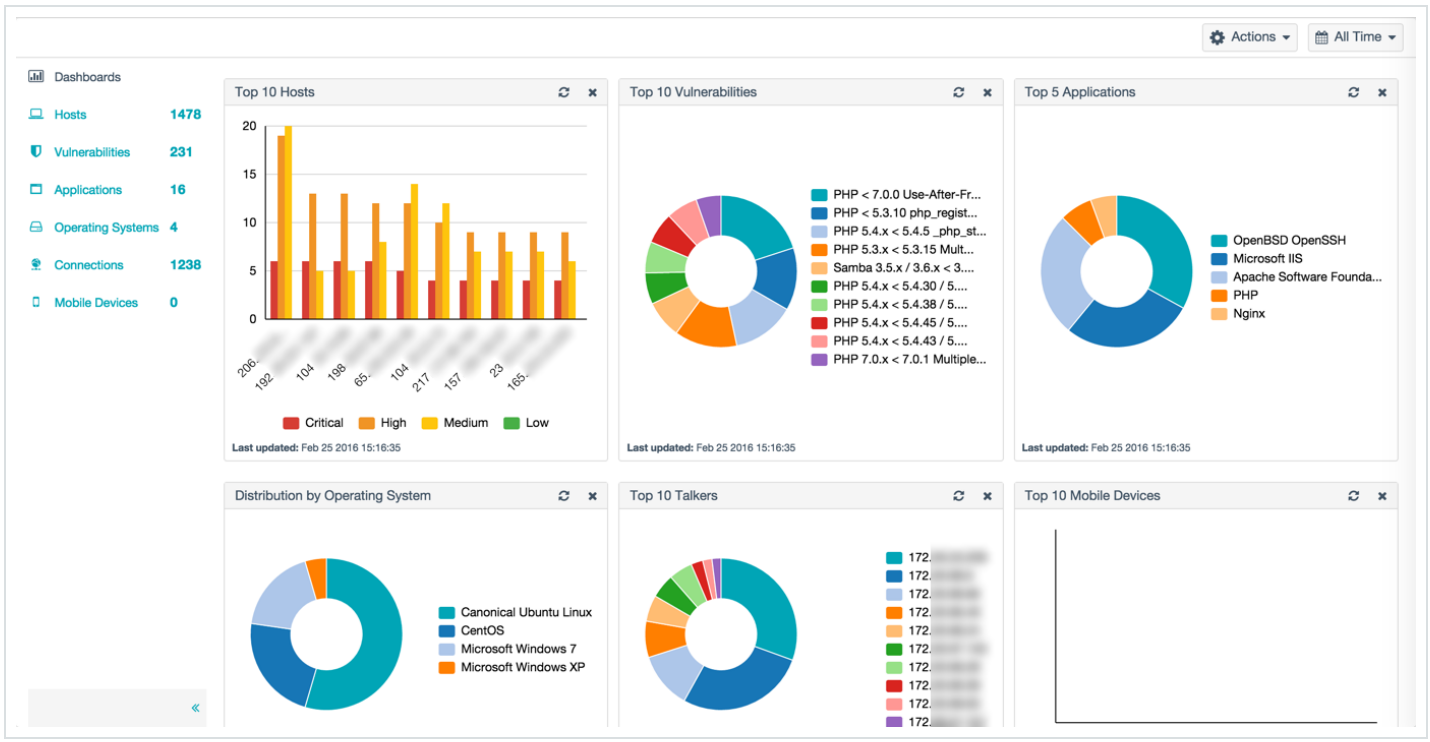
Across all of the viewable methods available on the **Monitoring** page, filter options are available to increase granularity when viewing results. Click the heading of a column to sort items within that section of the **Monitoring** page in ascending or descending order.

The **Actions** drop-down box allows you to export results, delete results, or launch a Tenable Nessus scan.

> **Note:** After deleting results, you must restart Tenable Network Monitor to see the most up-to-date information.

The **Filter <section name>** box allows for quick filtering of the **Monitoring** page. To view a list of filterable plugin attributes, click the down arrow for any quick filter box. Results appear based on a match of **Any** or **All** filters. The search box contains example hints when empty, but if an incorrect filter value is introduced, the box displays a red border.

> **Note:** The **Filter <section name>** box is not available in the **Dashboards** section.



Filter Text

Name	Description
Bugtraq ID	Filter the results of discovered vulnerabilities based on their Bugtraq identifications.
CPE	Filter the results of discovered vulnerabilities based on their CPE identifiers.
CVE	Filter the results of discovered vulnerabilities based on their CVE identifiers.
CVSS Base Score	Filter the results of discovered vulnerabilities based on the base CVSS score as reported by vulnerability plugins.
CVSS Temporal Score	Filter the results of discovered vulnerabilities based on the temporal CVSS score as reported by vulnerability plugins.

Name	Description
CVSS Temporal Vector	Filter the results of discovered vulnerabilities based on the CVSS temporal vector as reported by vulnerability plugins.
CVSS Vector	Filter the results of discovered vulnerabilities based on the CVSS vector as reported by vulnerability plugins.
CVSS v3.0 Base Score	Filter the results of discovered vulnerabilities based on the CVSS v3.0 base score as reported by vulnerability plugins.
CVSS v3.0 Temporal Score	Filter the results of discovered vulnerabilities based on the temporal CVSS v3.0 score as reported by vulnerability plugins.
CVSS v3.0 Temporal Vector	Filter the results of discovered vulnerabilities based on the temporal CVSS v3.0 vector as reported by vulnerability plugins.
CVSS v3.0 Vector	Filter the results of discovered vulnerabilities based on the CVSS v3.0 vector as reported by vulnerability plugins.
Host	Filter the results of discovered vulnerabilities based on the discovered IP address of the device.
IAVA ID	Filter the results of discovered vulnerabilities based on the IAVA IDs of the vulnerabilities.
IAVB ID	Filter the results of discovered vulnerabilities based on the IAVB IDs of the vulnerabilities.
IAVT ID	Filter the results of discovered vulnerabilities based on the IAVT IDs of the vulnerabilities.

Name	Description
OSVDB ID	Filter the results of discovered vulnerabilities based on the discovered OSVDB identifiers.
Plugin Description	Filter the results of discovered vulnerabilities based on text available in the descriptions of the vulnerabilities.
Plugin Family	Filter the results of discovered vulnerabilities based on a family of discovered vulnerabilities.
Plugin ID	Filter the results of discovered vulnerabilities based on the IDs of the plugins that identified the vulnerabilities.
Plugin Name	Filter the results of discovered vulnerabilities based on text available in the names of the plugins that identified the vulnerabilities.
Plugin Output	Filter the results of discovered vulnerabilities based on text contained in the output of the plugin that discovered the vulnerability.
Port	Filter the results of discovered vulnerabilities based on the port on which the vulnerability was discovered.
Protocol	Filter the results of discovered vulnerabilities based on the detected protocol: tcp, udp, or icmp.
STIG Severity	Filter the results of discovered vulnerabilities based on STIG severity level of the plugin.
See Also	Filter the results of discovered vulnerabilities based on the text available in the **See Also** box of the plugin.
Severity	Filter the results of discovered vulnerabilities based on the identified severity.

Name	Description
Solution	Filter the results of discovered vulnerabilities based on text available in the solution section of the plugin.
Synopsis	Filter the results of discovered vulnerabilities based on text available in the synopsis section of the plugin.
System Type	Filter the results of discovered vulnerabilities based on the system type of the device.
VLAN ID	Filter the results of discovered vulnerabilities based on the VLAN ID of the device.

Dashboards Section

The **Dashboards** section displays the contents of the vulnerability tab in a graphical layout. The default dashboard layout displays the following charts:

- Top 10 Hosts
- Top 10 Vulnerabilities
- Top 5 Applications
- Distribution by Operating System
- Top 10 Talkers

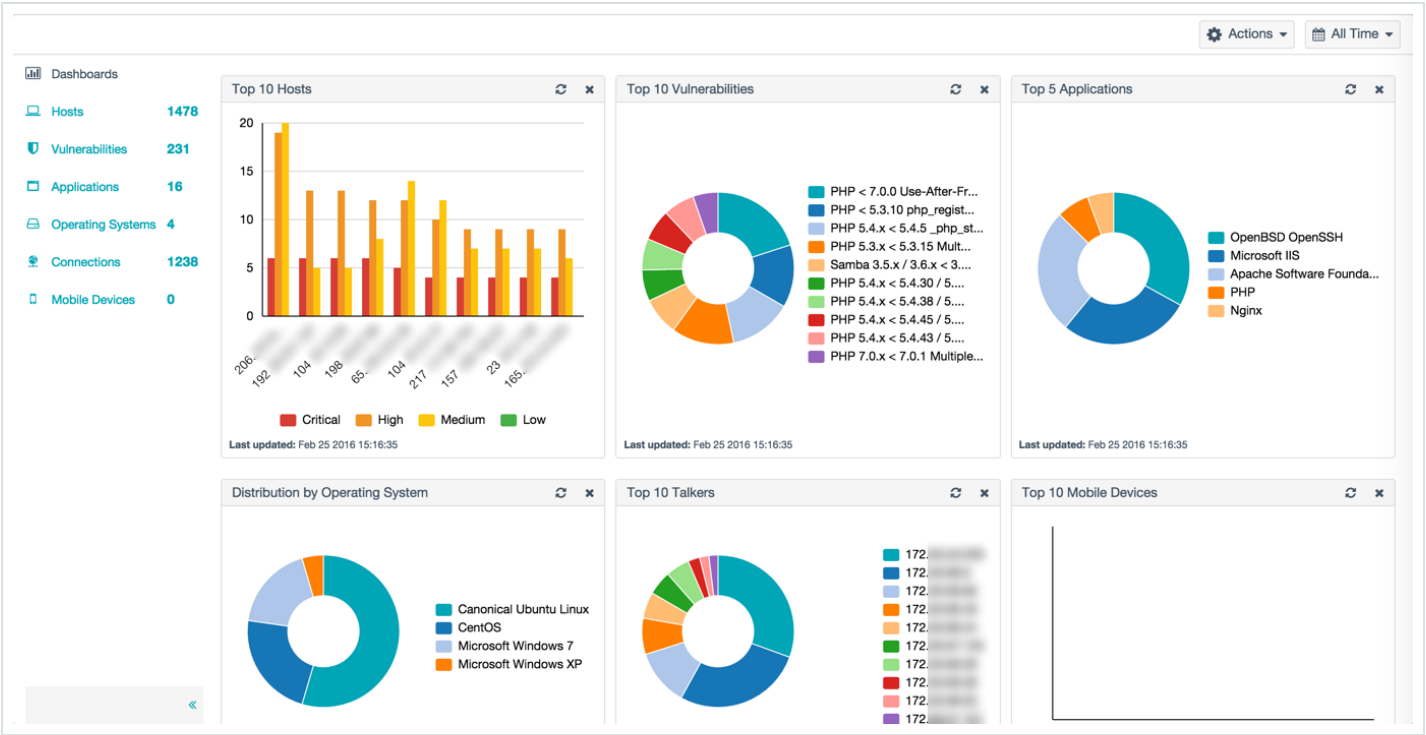
  > **Note:** The 10 Top Talkers chart only lists client machines that call or talk to the servers. If you are interested in viewing both servers and clients, enable the **Enable Connection Analysis Module** setting in the Tenable Network Monitor Settings Section.

- Top 10 Mobile Devices
- Distribution of Mobile Devices by Operating System
- Top 10 Mobile Devices by Hardware

- Distribution of Mobile Applications by Application
- SCADA Vulnerability Distribution by Severity
- Top 10 SCADA Hosts
- SCADA Host Distribution by Protocol
- SCADA Host Distribution by System Type
- Client Connections
- Network Bandwidth by Byte Count
- Event Trending

Note: Your Tenable Network Monitor configuration determines which charts appear in the **Dashboards** section.

Click on the data within a chart to see more information about the data. Additionally, you can drag-and-drop charts to rearrange them on the dashboard for the duration of your session. The **Client Connections**, **Network Bandwidth by Byte Count**, and **Event Trending** charts cannot be moved. For more information, see Rearrange Charts.

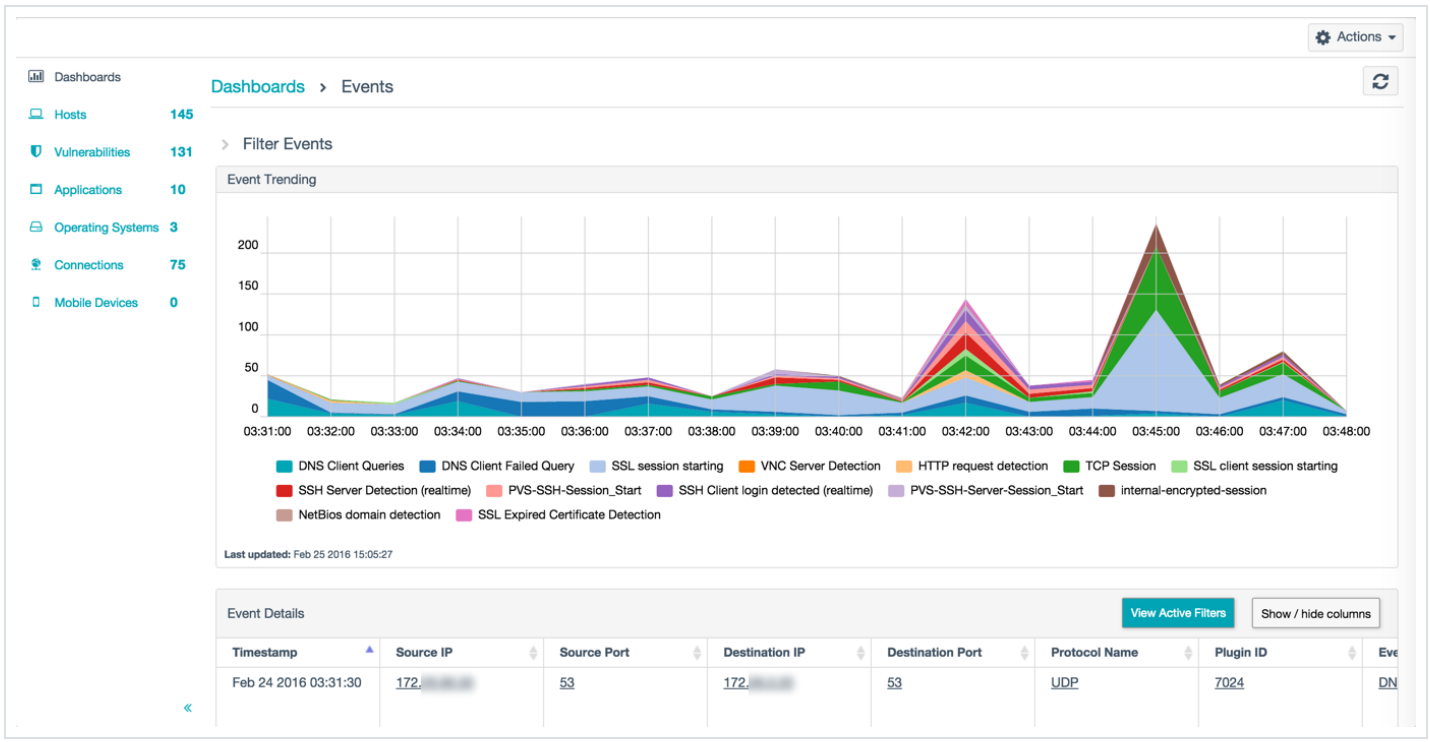


The following table describes the options available in the **Dashboards** section:

Option	Description
<click on the chart>	Opens a **Details** section with more information about the data displayed in a chart. **Note:** You cannot click on the **Top 10 Mobile Devices by Hardware** chart.
× button	Removes the chart from the **Dashboards** section for the duration of your session.
↻ button	Refreshes the chart.
button	Provides options to **Export Results**, **Delete Results**, or **Launch Scan**.
button	Provides options to filter chart data based on a specified date range.

Events Dashboard

Click on the **Event Trending** chart to Access the **Events** dashboard. The **Events** dashboard displays a graphical representation of the number of maximum viewable real-time events as defined in the **Realtime Events** setting type in the **Tenable Network Monitor Settings** section.



The **Event Details** table can be customized by sorting columns, showing or hiding columns, filtering content by clicking **View Active Filters**, or by clicking underlined columns in the table.

Rearrange Charts

To rearrange charts on the Dashboard:

1. In the **Dashboards** section, select the heading of the chart you want to reposition.
2. Drag the chart to a different location on the dashboard.
3. Release the pointer.

   The chart moves and the dashboard configuration saves for the duration of your session.

> **Note:** You cannot move the **Client Connections**, **Network Bandwidth by Byte Count**, or **Event Trending** charts.

Refresh a Chart

To refresh a chart on the Dashboard:

1. In the **Dashboards** section, in the upper right corner of the chart you want to refresh, click the ↻ button.

   The selected chart refreshes.

Set a Date Range for the Dashboards Section

To set a date range for the charts on the Dashboard:

1. In the **Dashboards** section, in the upper right corner, click the 📅 drop-down box.
2. Do one of the following:
   - Select one of the preset time intervals.
   - Select a start and end date from the available calendars and specify a time associated with each date.
   - Manually type dates in the two text boxes in YYYY/MM/DD format and specify a time associated with each date.

   All the charts on the page refresh to reflect the selected time interval.

Remove a Chart from a Dashboard

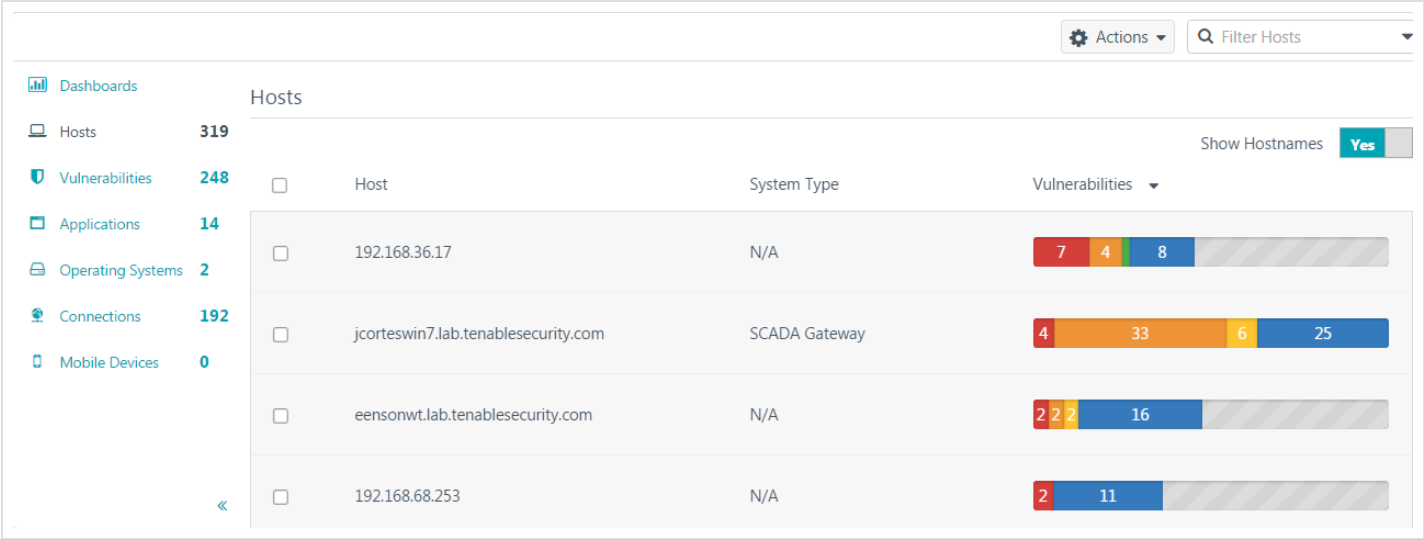
To remove a chart from a dashboard:

1. In the **Dashboards** section, in the upper right corner of the chart you want to remove, click the ✖ button.

   The selected chart is removed from the dashboard for the duration of your session.

Hosts Section

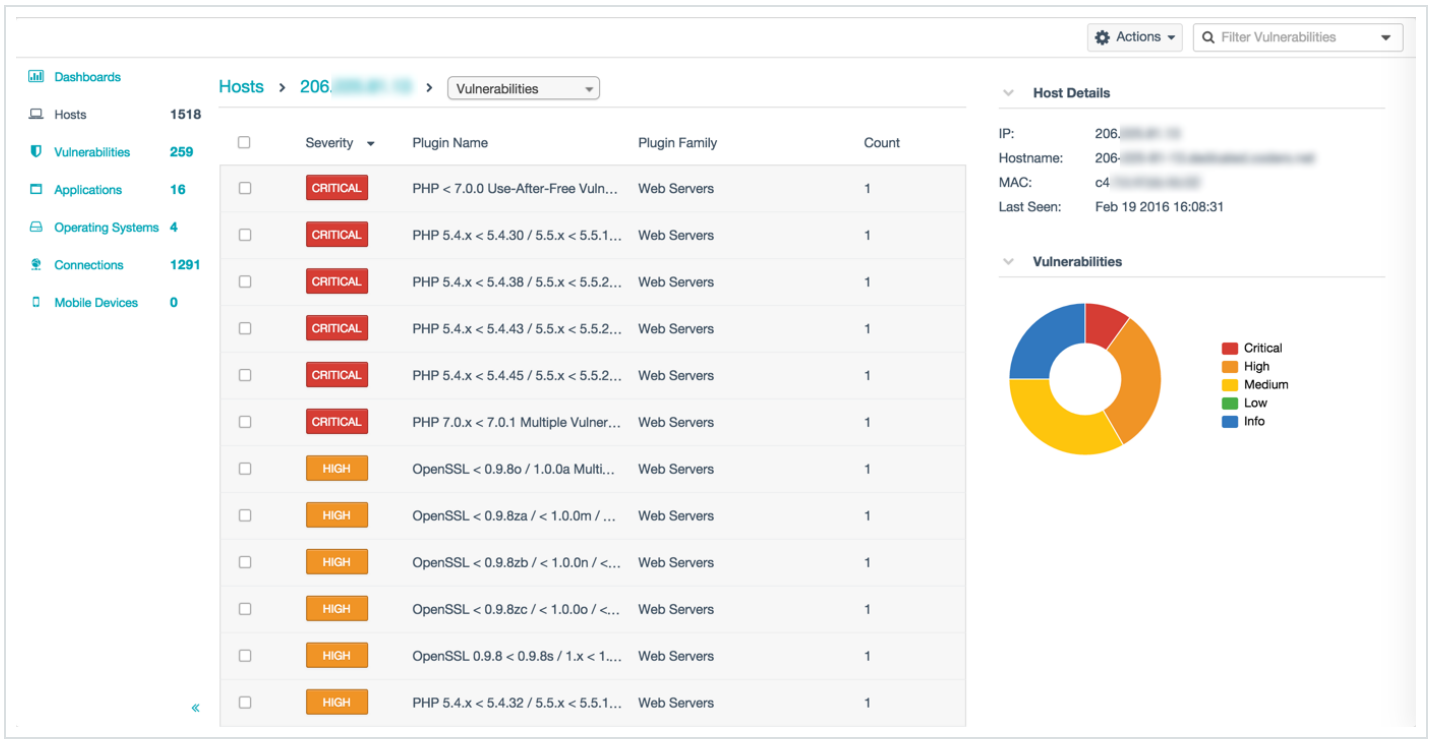
The **Hosts** section of the **Monitoring** page displays a list of the discovered hosts, the system type of the hosts, and a stacked bar chart. The chart is labeled and color-coded to indicate both the number and severity level of vulnerabilities detected on the host.



Select a host from the list to display the host's attributes and discovered vulnerabilities. In the drop-down box at the top of the section, select one of the following options to view relevant information.

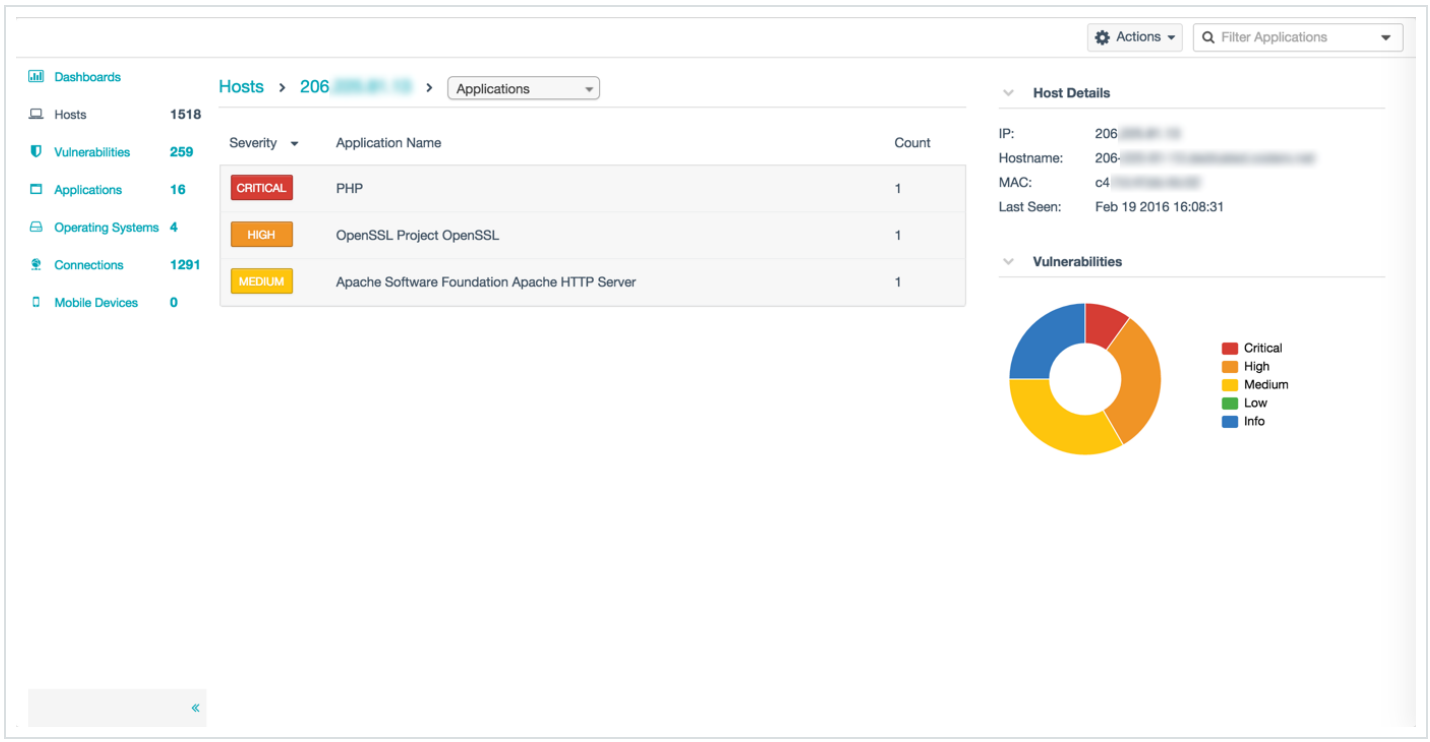
Vulnerabilities

Vulnerabilities detected on this host appear in descending order of severity. The **Vulnerabilities** list displays the name of each vulnerability, the vulnerability family, and the number of vulnerabilities discovered. Select a vulnerability from the list to display vulnerability details including a synopsis, a description, a solution, plugin details, risk information, reference information, and affected hosts and services for the host.



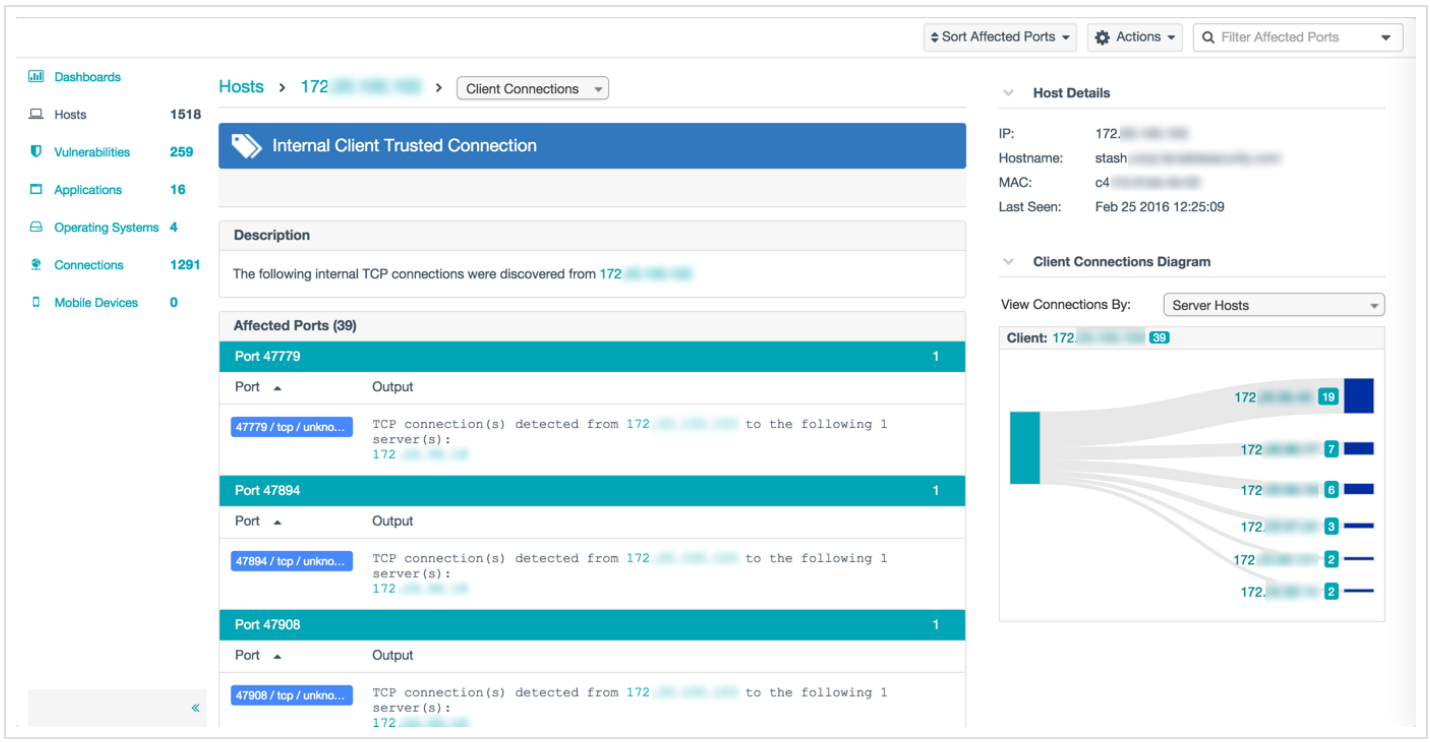
Applications

Applications appear in descending order of severity. The **Applications** list displays the name and number of each application. Select an application from the list to display information about the application observed on this host. The list includes the name and number of discoveries, the affected port and protocol, the software and version, and the services available.



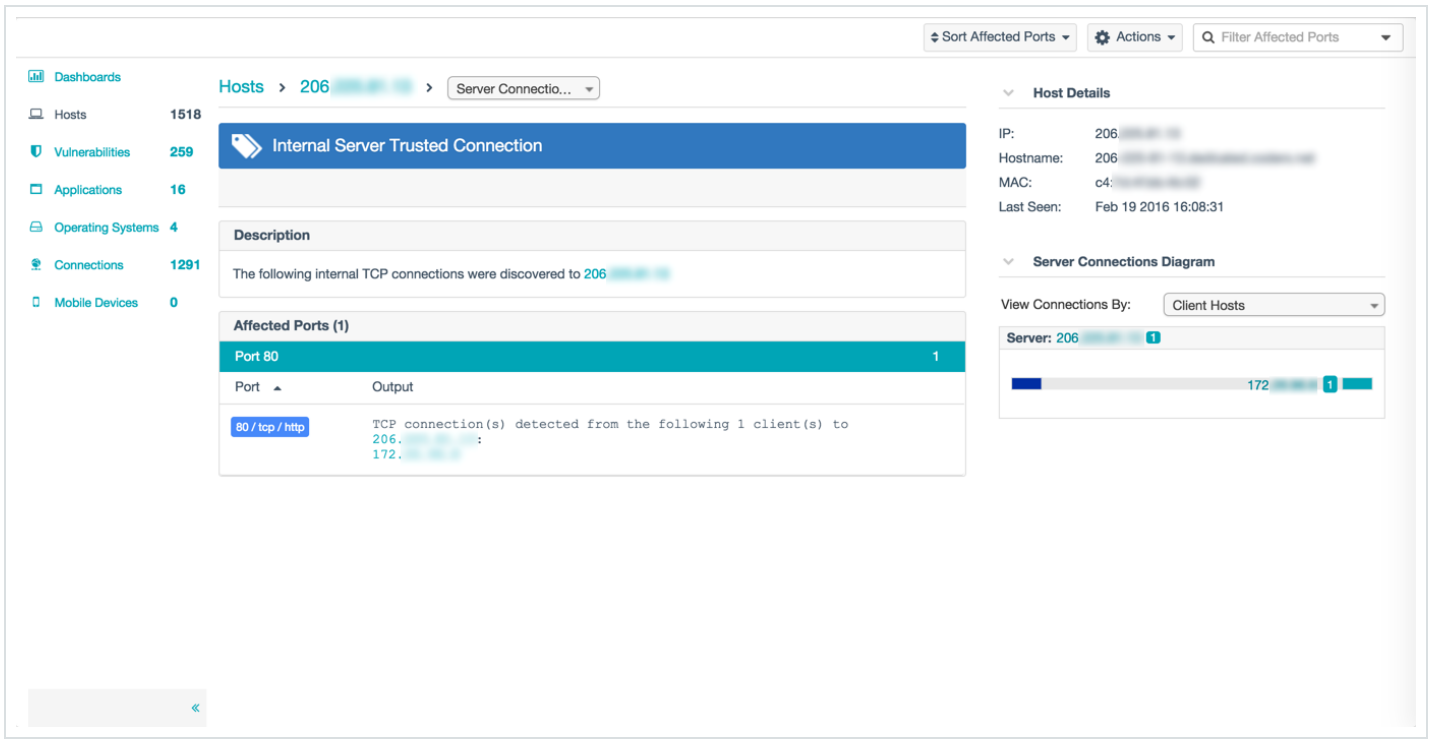
Client Connections

Hosts to which the selected host has connected are grouped by port. The **Client Connections** list displays information about connections from the selected host to other hosts, which port(s) were used, and, if known, the services. Click on a client connection to display a **Connections** sidebar that displays **Host Details**, a **Client Connections** diagram, and, where applicable, a **Recent Sessions** table.



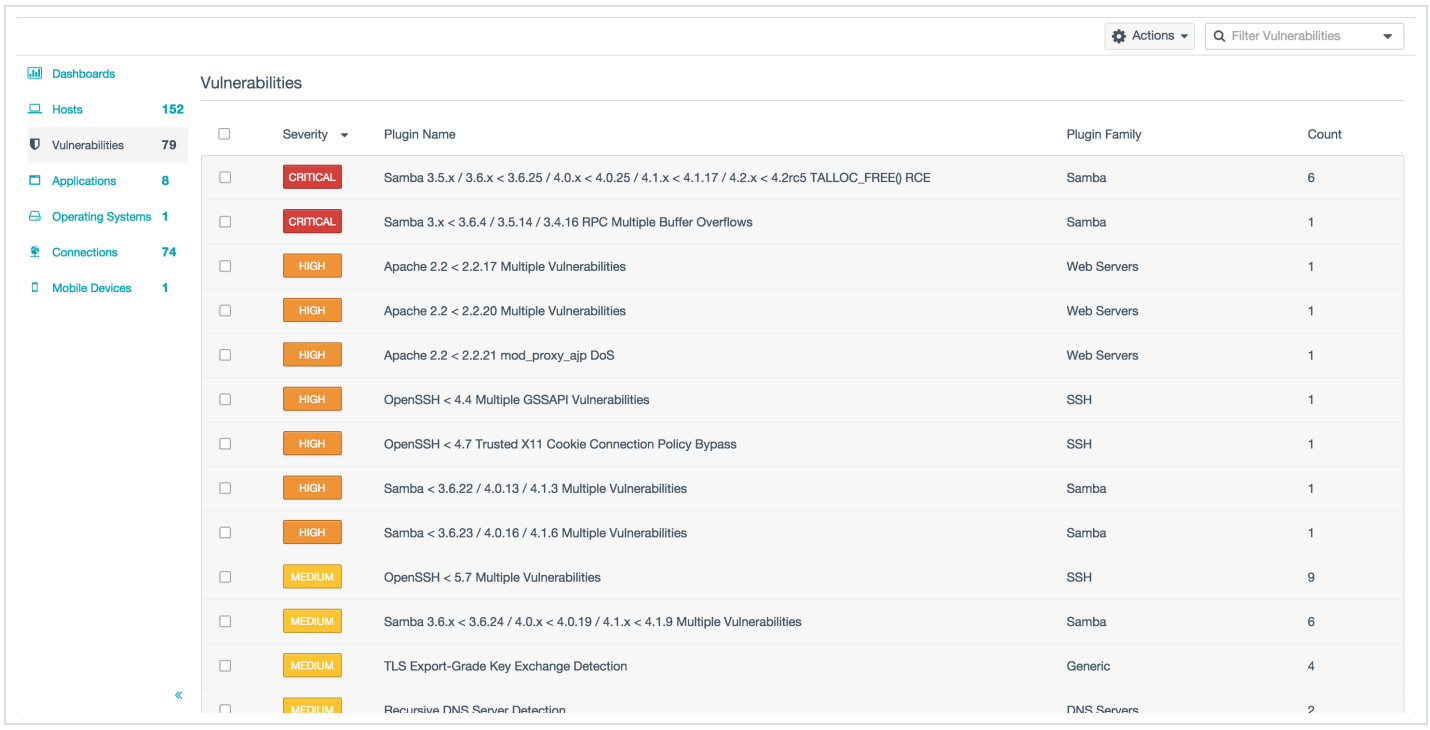
Server Connections

Hosts that have connected to the selected host are grouped by port. The **Server Connections** list displays information about connections to the selected host from other hosts, which port(s) were used, and, if known, the services. Click on a server connection to display a **Connections** sidebar that displays **Host Details**, a **Server Connections** diagram, and, where applicable, a **Recent Sessions** table.



Vulnerabilities Section

The **Vulnerabilities** section of the **Monitoring** page provides a list of the vulnerabilities detected by Tenable Network Monitor. Additionally, you can view a vulnerability's plugin family and the number of detected vulnerabilities.



Select a vulnerability from the list to view the following vulnerability details:

- A **Synopsis** of the vulnerability.
- A **Description** of the vulnerability.
- A **Solution** for the vulnerability.
- A **See Also** section that features additional reference material about the vulnerability.
- A list of **Affected Hosts**.
- The vulnerability's **Plugin Details**.
- **Risk Information** about the vulnerability.
- **Reference Information** about the vulnerability.

Delete a Vulnerability

To delete one vulnerability:

1. In the **Vulnerabilities** section, hover over the vulnerability you want to delete.
2. On the right side of the row, click the ✖ button.

   The vulnerability is deleted.

To delete multiple vulnerabilities:

1. On the **Vulnerabilities** page, on the left side of the row for the vulnerability you want to delete, select the check box. Repeat this step for each vulnerability you want to delete.
2. Click **Actions** > **Delete Vulnerabilities**.

   The vulnerabilities are deleted.

SIEM Analysis Section

Security Information and Event Management (SIEM) analysis allows you to import data from SIEM providers (for example, Splunk) to evaluate events that may warrant re-scanning the affected hosts.

Note: SIEM analysis features are only available for RH/CentOS 7 and RH/CentOS 8. Additionally, discovery mode must be turned off to view SIEM analysis features (see Tenable Network Monitor Settings Section for more information).

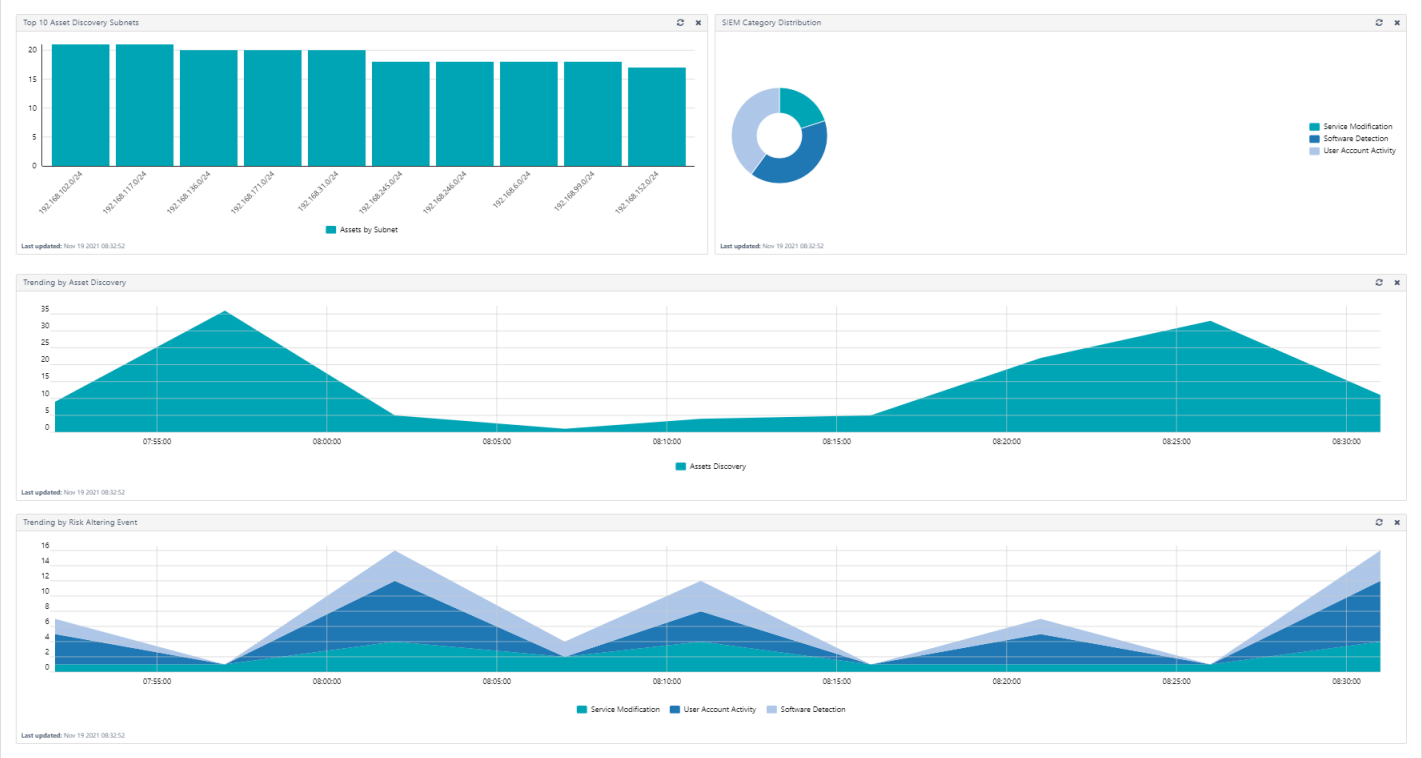
Note: You must deploy Tenable Network Monitor using the RPM appropriate to your site to activate the SIEM analysis feature.

Note: Tenable recommends that you only use trusted self signed certs for Splunk instances that are used with Tenable Network Monitor.

The **SIEM Analysis** section of the **Monitoring** page shows four charts that help you track and understand SIEM-related events occurring in your system:

- **Top 10 Asset Discovery Subnets**
- **SIEM Category Distribution**
- **Trending by Asset Discovery**
- **Trending by Risk Altering Event**

Note: The data collection that creates these charts can be configured in the **SIEM Processing Options** and **SIEM Servers** settings. See Tenable Network Monitor Settings Section for more information.



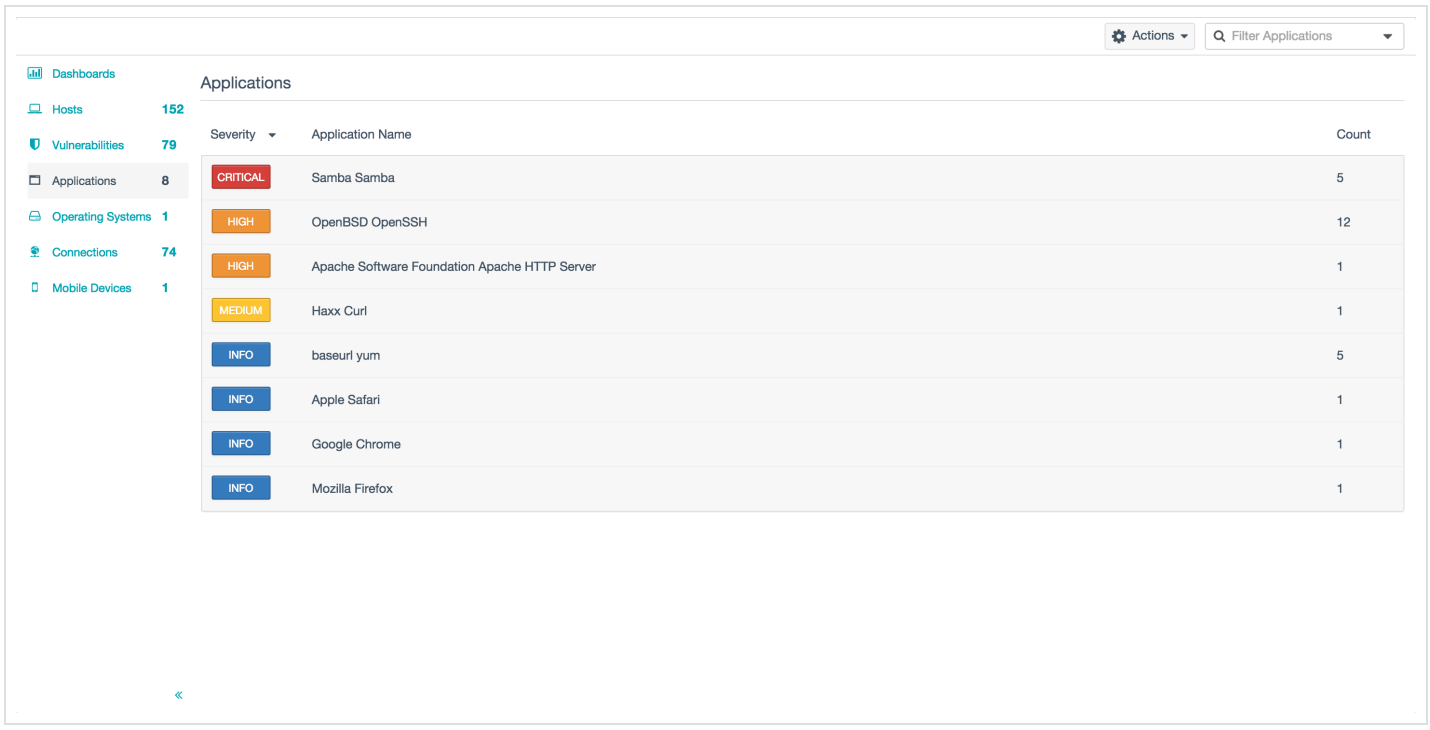
The **SIEM Category Distribution** and **Trending by Risk Altering Events** show data based on the risk-altering events discovered in your system. There are four risk-altering event types:

Event Type	Description
Assets Discovery	Instances where assets are discovered using DHCP events.
User Account Activity	Instances where a user account on an asset is modified in one of the following ways: • Account is created or deleted • Account is added or removed to/from a group • Account password modified

	• Policy that affects user accounts is modified (i.e. password policy, lockout policy)
Software Detection	Instances where software is added or removed by a user or the software management system. For example: • RPM installations • Software added via YUM • Installations on Windows using standard install tools **Note:** This type does not include instances where binaries are copied on the system and run without execution.
Service Modification	Instances where the software service is modified in one of the following ways: • Service starts or stops • Service fails to start • Service reboots • Service is installed or uninstalled

Applications Section

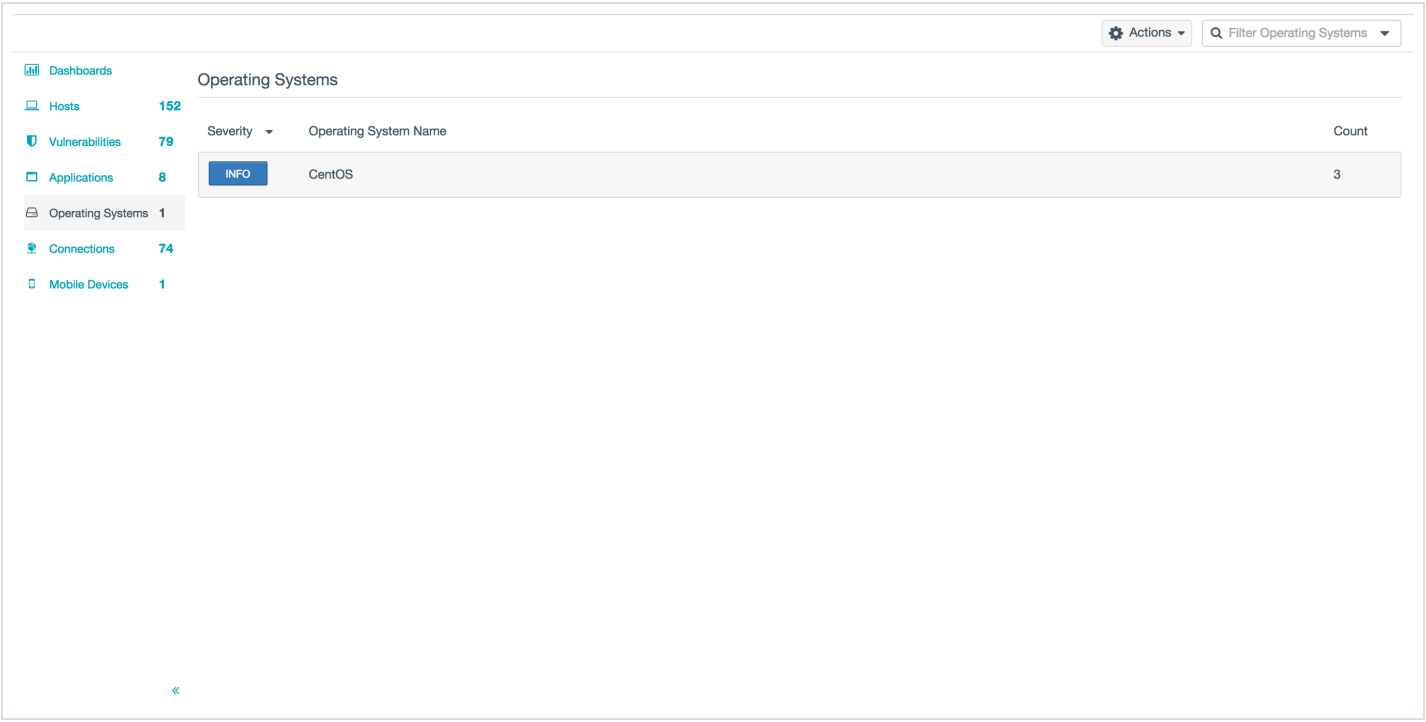
The **Applications** section displays a list of discovered applications. Click an application to display a list of affected hosts. The list includes the name and number of discoveries, the affected port and protocol, the software and version, and the services available.



Operating Systems Section

The **Operating Systems** section displays a list of discovered operating systems. This section lists the severity, operating system name as detected, and the number of discoveries.

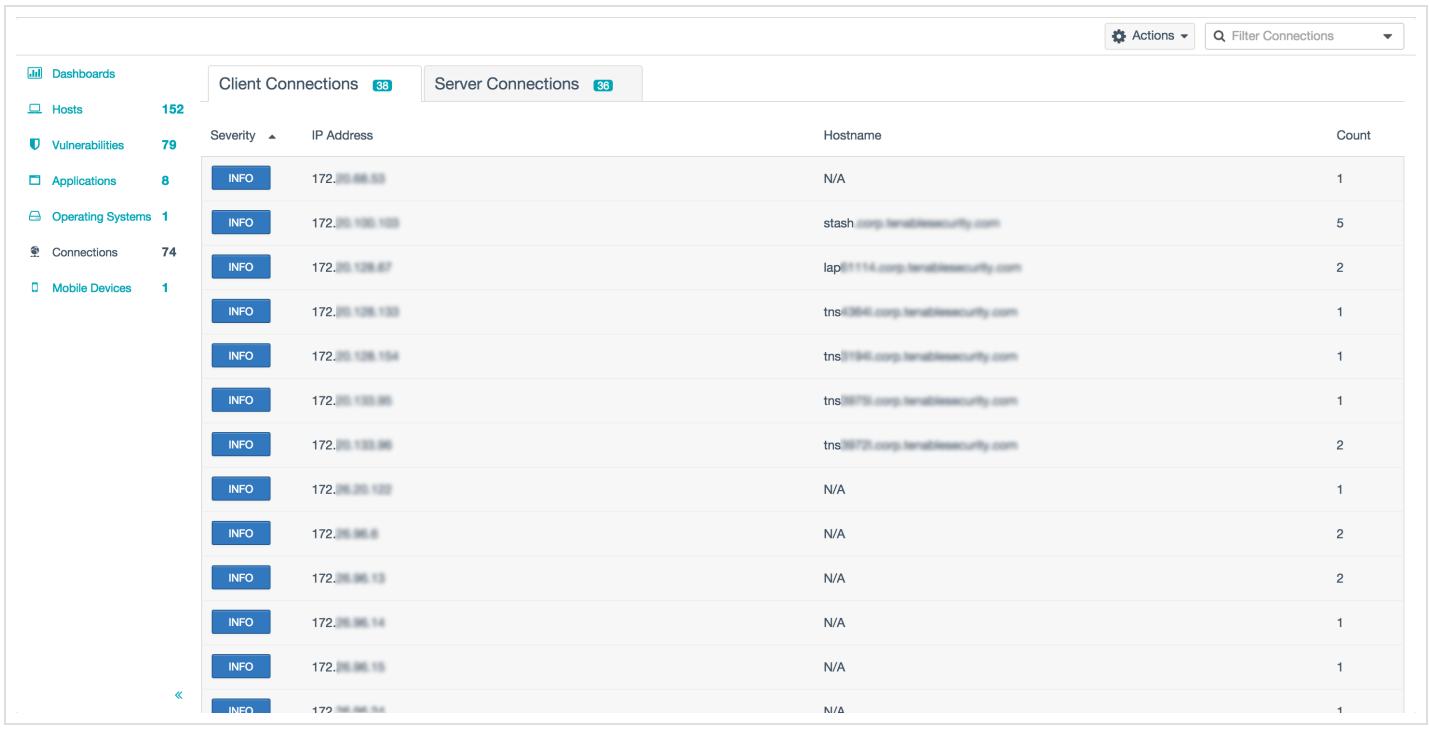
Click an operating system to display a list of affected hosts. The list includes the severity, the version of the operating system, and the services available.



Connections Section

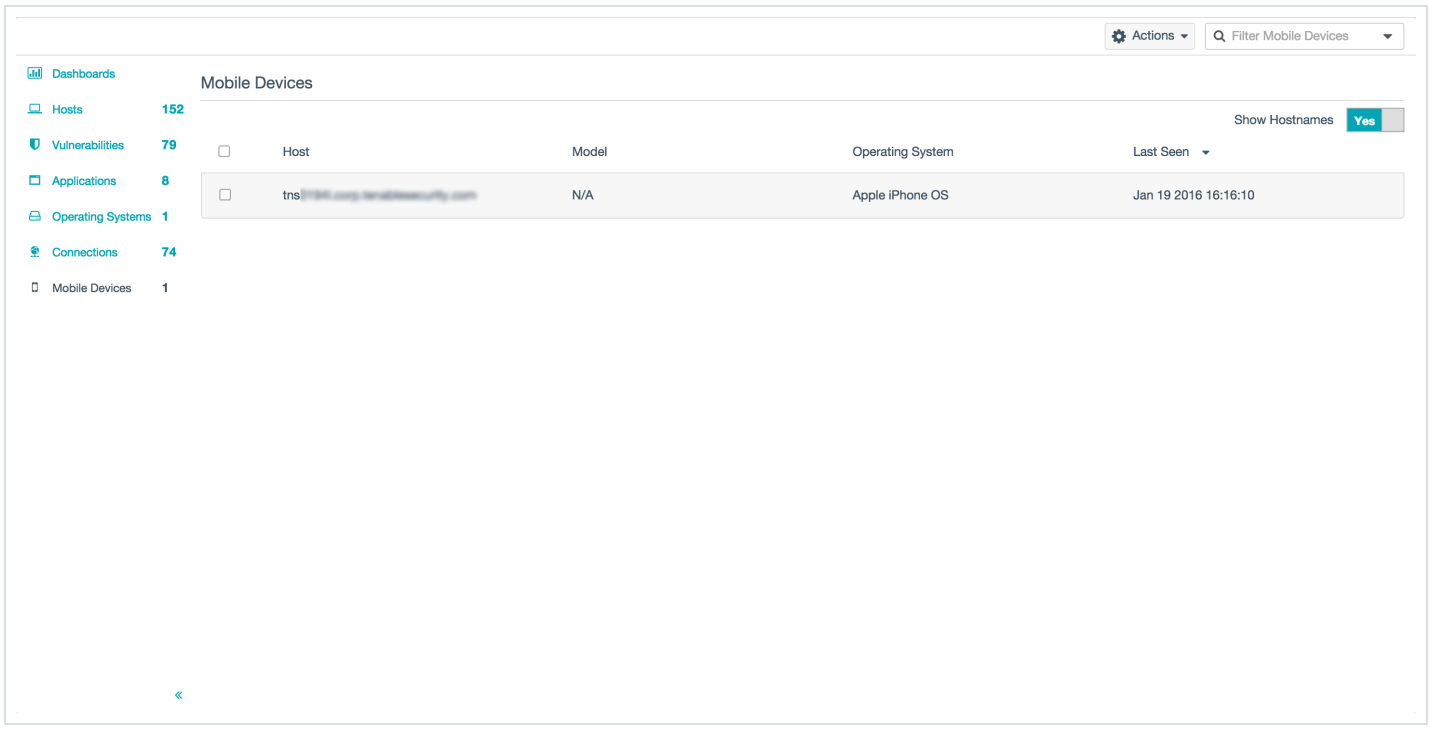
The **Connections** section displays information in two tabs:

- The **Client Connections** tab displays a list of hosts. Click on a host to display connections from the selected host to other hosts, the port(s) used, and, if known, the services. Additionally, the **Connections** sidebar displays **Host Details**, a **Client Connections** diagram, and, where applicable, a **Recent Sessions** table.
- The **Server Connections** tab displays a list of hosts. Click on a host to display connections to the selected host from other hosts, the port(s) used, and, if known, the services. Additionally, the **Connections** sidebar displays **Host Details**, a **Server Connections** diagram, and, where applicable, a **Recent Sessions** table.



Mobile Devices Section

The **Mobile Devices** section displays a list of discovered mobile devices. The summary page displays the IP address, model, operating system, and last seen timestamp for each mobile device within the monitored network range. Select a device name from the list to display the device's list of vulnerabilities and a list of applications for the mobile device.



Filter Monitoring Results

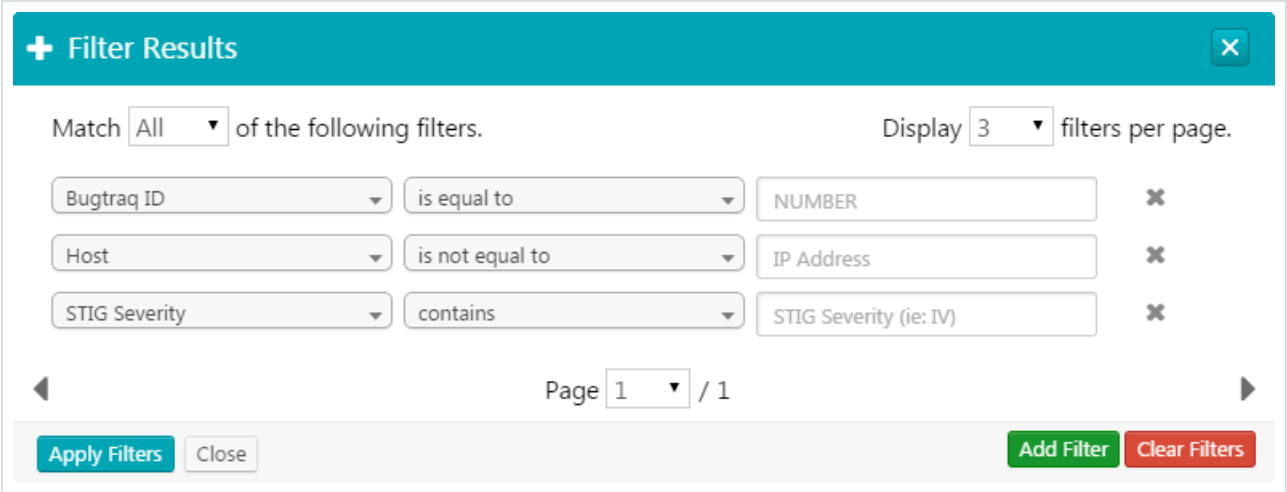
To filter monitoring results:

1. In the **Hosts**, **Vulnerabilities**, **Applications**, **Operating Systems**, **Connections**, or **Mobile Devices** section, in the upper right corner, click the **Filter <section name>** drop-down box.
2. Type the criteria by which you want to filter results directly into the box.

   -or-

   Click the ▾ button in the box.

   The **Filter Results** window appears.



3. Configure the filter options as necessary.
4. Click the **Apply Filters** button.

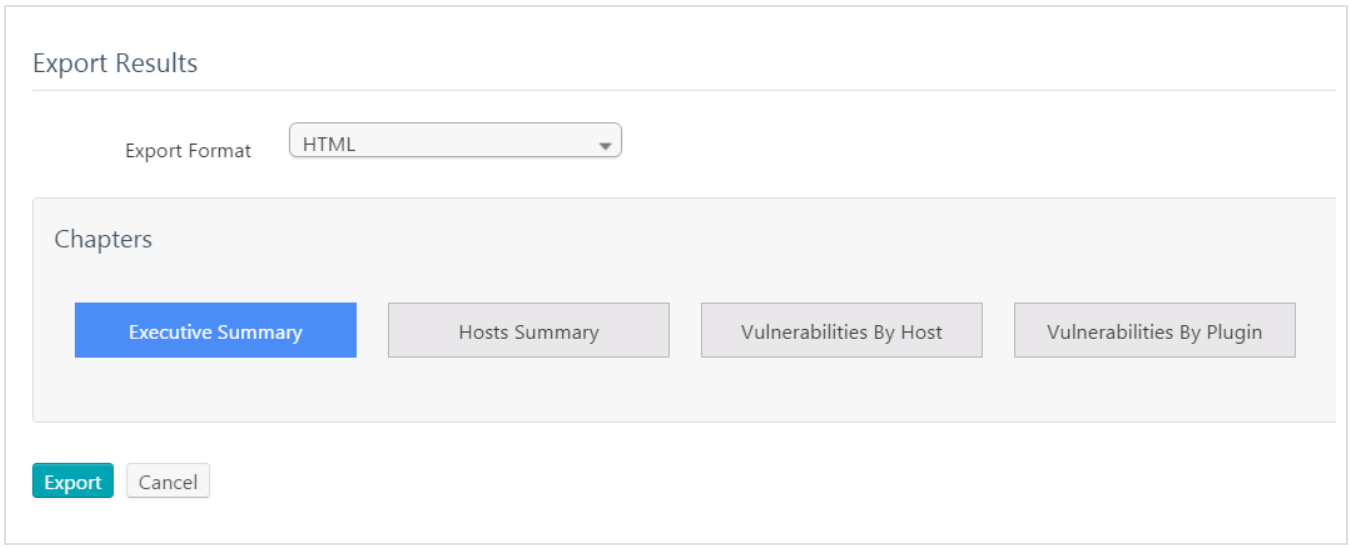
> **Note:** On-the-fly filter results cannot be exported. If you want to export filter results, you must configure the filter(s) in the **Filter Results** window. Additionally, on-the-fly filter results are not stored when a user navigates to another page in Tenable Network Monitor.

Export Monitoring Results

To export monitoring results:

1. Click **Monitoring** > **Actions** > **Export Results**.

   The **Export Results** screen appears.



2. Select the export format and chapter layout.
3. Click the **Export** button.

   An automatic download begins. You can save the report from the web browser.

> **Note:** On-the-fly filter results cannot be exported. If you want to export filter results, you must configure the filter(s) in the **Filter Results** window.

Launch a Tenable Nessus Scan

To launch a Tenable Nessus scan:

1. Do one of the following:
   - Click **Monitoring** > **Actions** > **Launch Scan**.
   - Click **Assets** or **Vulnerabilites** > select the check boxes for the assets you want to scan > **Actions** > **Launch Scan**.

   The **Launch Basic Nessus Scan** window appears.
2. Configure the scan options as necessary.
3. Click the **Launch** button.

   The scan opens in the Tenable Nessus interface. Refer to the Tenable Nessus user guide for further instructions.

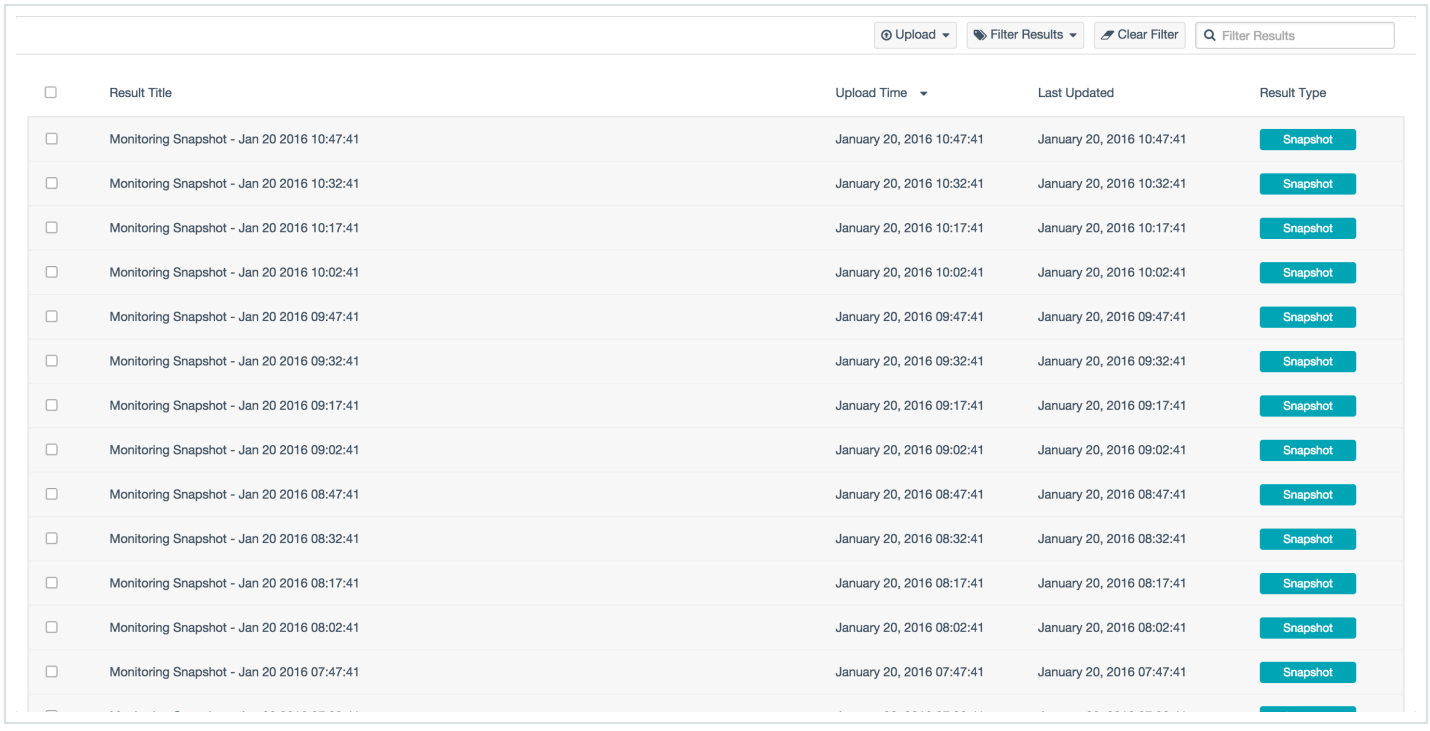
Note: To launch scans on Tenable Nessus 6.8.x or higher, Tenable Network Monitor must be configured to restrict access to TLS 1.2 or higher. See the Tenable Network Monitor Settings Section for more information.

Results Page

The **Results** page contains snapshots of monitored data, results from Pcap files entered manually via the command line or the client UI, and uploaded Tenable Network Monitor reports. The **Monitoring Snapshots** generate regularly based on the **Report Frequency** setting. They are stored until deleted or the **Report Lifetime** setting removes them. Select a result grouping to view it using the same analysis tools described in the **Monitoring** section of this user guide:

- Hosts
- Vulnerabilities
- Applications
- Operating Systems
- Connections
- Mobile Devices

Additionally, to compare two snapshots, check the desired snapshot results and select the **Diff Snapshots** option from the **Actions** drop-down box.



Upload a Report

To upload a report:

1. Click **Results** > **Upload** > **Report**.

   The **Upload Results** window appears.
2. Select a file to upload.
3. Click the **Upload Results** button.

   The report appears in a new row at the top of the **Listing Results** list on the **Results** page.

Upload a Pcap

Before You Begin

The maximum total file size for uploaded Pcaps is 100 MB. Running a Pcap pauses live monitoring.

To upload a Pcap:

1. Click **Results** > **Upload** > **Pcaps**.

   The **Upload Pcaps** window appears.
2. Select one or more files to upload.
3. Click the **Upload Pcap(s)** button.

   A new row for the Pcap(s) appears at the top of the **Listing Results** list on the **Results** page.

Filter Results

To filter results:

1. On the **Results** page, in the upper right corner, click the **Filter Results** drop-down box.
2. Select **Snapshot**, **Manual**, or **Pcap**.

The **Listing Results** list filters by the selected report type. Click **Clear Filter** to remove the filter from the list.

Delete Results

To delete one result:

1. On the **Results** page, hover over the result you wish to delete.
2. Click the ✖ button.

   A dialog box appears confirming your selection to delete the result.
3. Click the **Delete** button.

   The result is deleted.

To delete multiple results:

1. On the left side of the row for the result you want to delete, select the check box. Repeat this step for each result you want to delete.
2. Click **Actions** > **Delete Result**.

   A dialog box appears confirming your selection to delete the results.
3. Click the **Delete** button.

   The results are deleted.

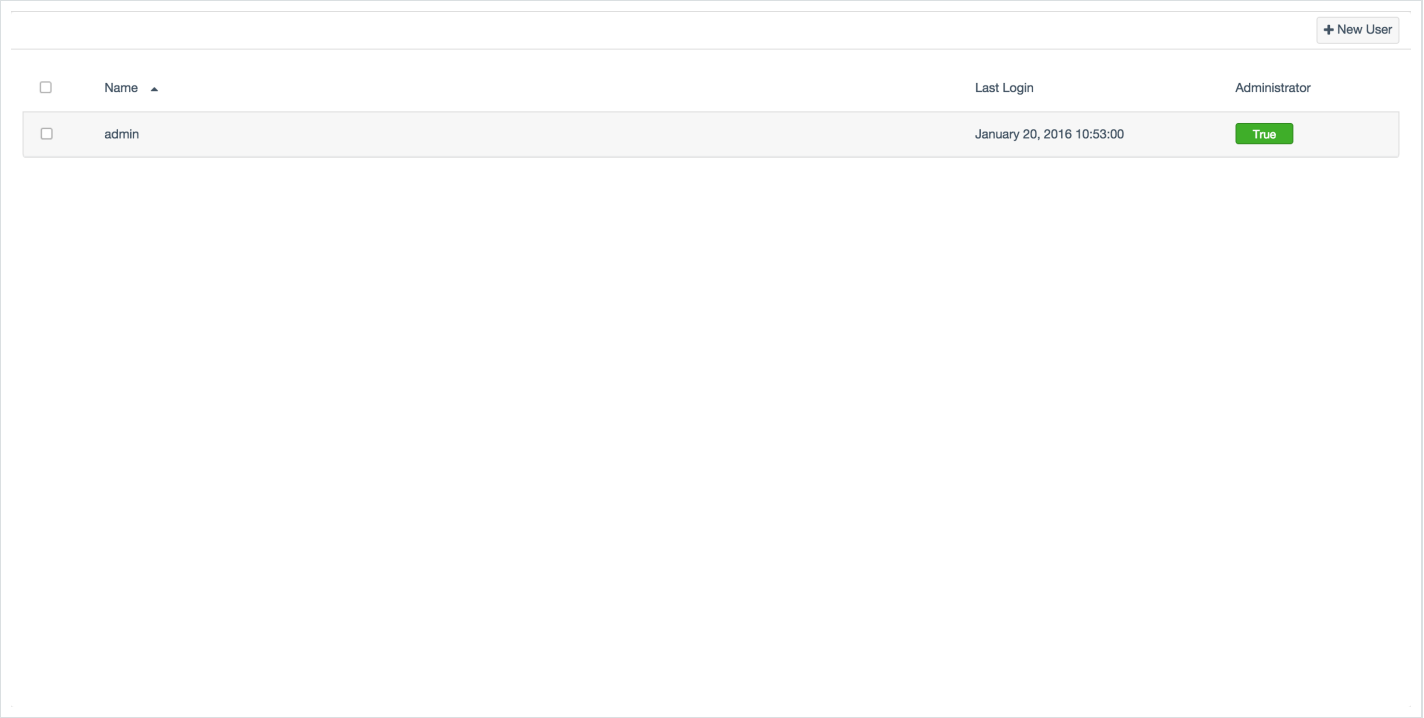
Users Page

The **Users** page lists the available users on the Tenable Network Monitor server. Also, you can view account configuration options for each user. This page is visible only to users with administrative privileges.

To access the Users page:

1. In the top navigation bar, click the ⚙ icon.
2. In the drop-down box, click **Users**.

   The **Users** page appears.



Click on a user modify the user's account. For more information, see Modify a User Account.

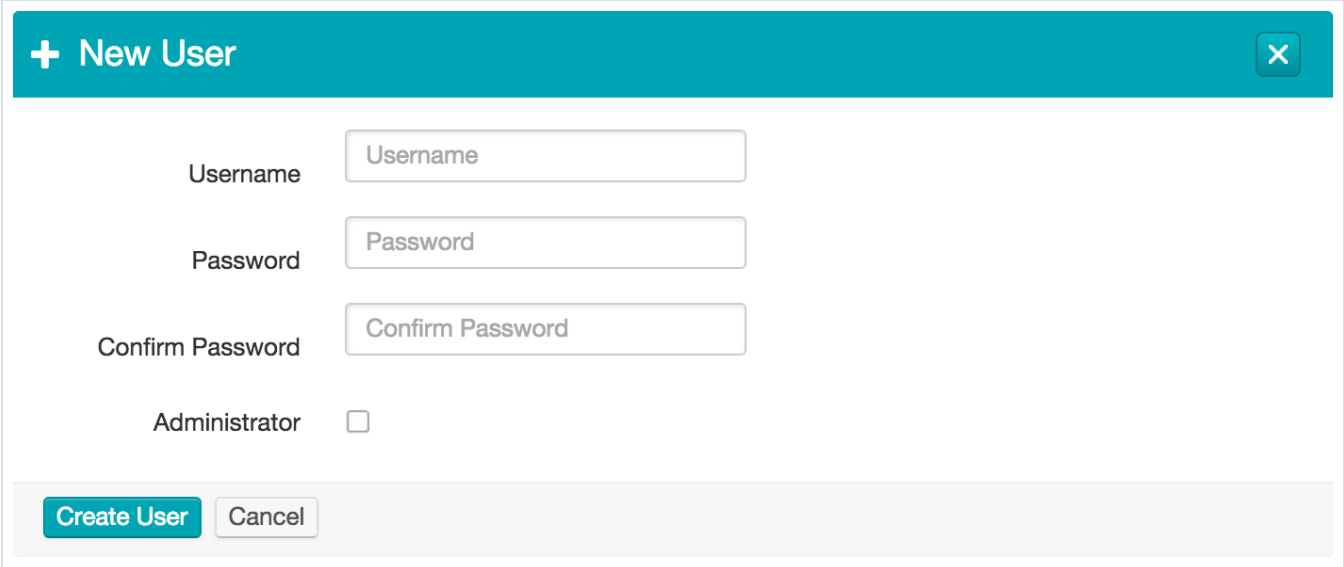
Note: Tenable Network Monitor complies with STIG APSC-DV-001740. Tenable Network Monitor stores a cryptographic representation of user passwords (rather than storing the cleartext passwords themselves) in its encrypted database. These passwords are encrypted with salted cryptographic hashes which have no useful value to an attacker.

Create a New User

To create a new user:

1. On the **Users** page, in the upper right corner, click the **New User** button.

   The **New User** window appears.



2. In the **Username** box, type a username for the user.
3. In the **Password** box, type a password for the user.

   Note: The username is case sensitive and the password must conform to the Tenable Network Monitor password policy:

   - Minimum length of five characters
   - At least one uppercase character
   - At least one lowercase character
   - At least one number
   - At least one of the following special characters: ! @ # $ % ^ & * ( )

4. In the **Confirm Password** box, type the password for the user a second time.
5. If the new user should have administrative privileges, select the **Administrator** check box.

   Tip: When you create a user it authenticates with SSL Client Certificates. The username must match the Common Name in the certificate.

6. Click the **Create User** button.

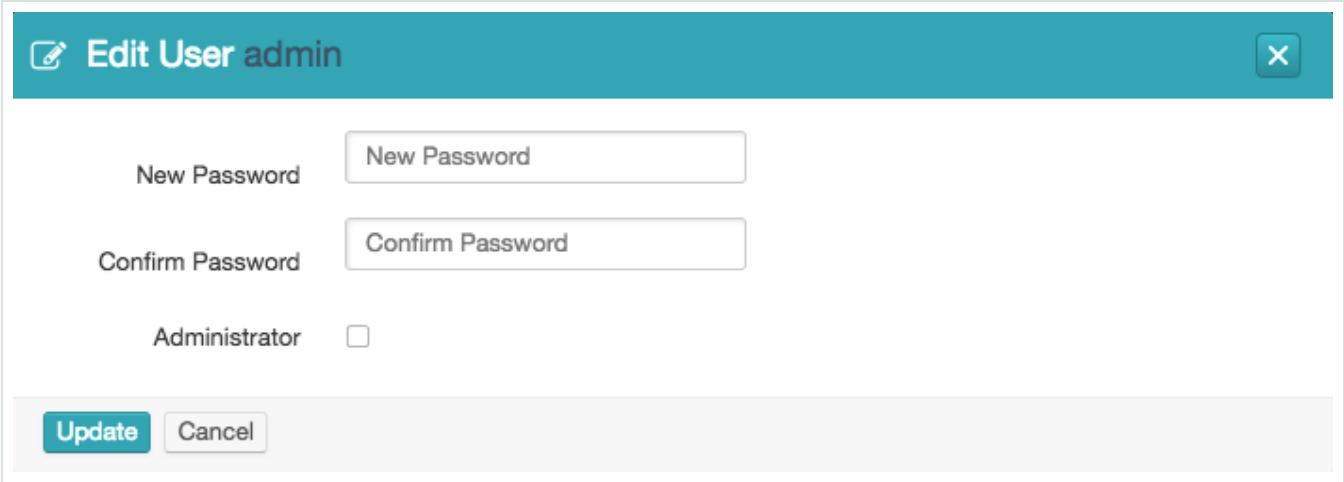
   The user saves and appears in the **Users** list.

Modify a User Account

To modify a user account:

1. On the **Users** page, select a user from the list.

   The **Edit User <username>** window appears.



2. Modify the properties as needed.
3. Click **Update**.

Tip: To reset user account passwords via the command line, use the following command from the **NNM** binary directory:
/opt/nnm/bin/nnm --users --chpasswd <username>

Reset a Locked Account

To reset a locked account:

1. In the command line interface, use the appropriate command for your operating system to delete the hash.lockedout file:

Operating System	Command
Linux	`# rm /opt/nnm/var/nnm/users/<locked account name>/hash.lockedout`
Windows	`del C:\ProgramData\Tenable\NNM\nnm\users\<locked_account_name>\hash.lockedout`

> **Tip:** Alternatively, a user with administrative privileges can navigate to this directory and manually delete the hash.lockedout file.

2. After deleting the hash.lockedout file, if needed, a user with administrative privileges can follow the steps under Modify a User Account to reset the user's password.

Delete a User

To delete a user:

To delete one user:

1. On the **Users** page, hover over the user you want to delete.

   On the right side of the row, the ✖ button appears.

2. Click the ✖ button.

   A dialog box appears confirming your selection to delete the user.

3. Click **Delete**.

   The user is deleted.

To delete multiple users:

1. On the **Users** page, on the left side of the row for the user you want to delete, select the check box. Repeat this step for each user you want to delete.
2. Click **Actions** > **Delete Users**.

   A dialog box appears confirming your selection to delete the user.
3. Click **Delete**.

   The users are deleted.

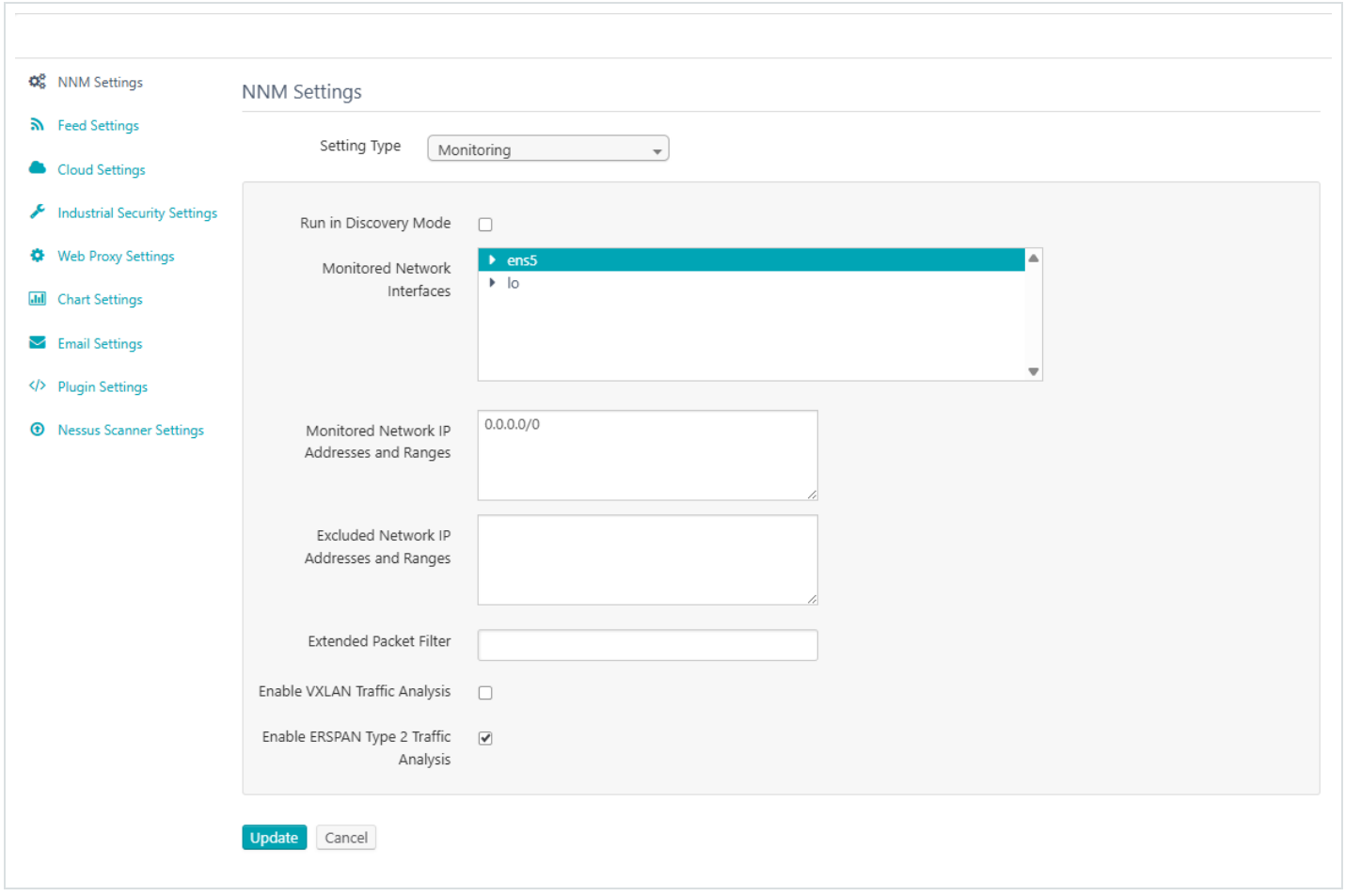
Configuration Page

The **Configuration** page allows users with administrative privileges to configure Tenable Network Monitor for their local environment.

To access the Configuration page:

1. In the top navigation bar, click the ⚙ icon.
2. In the drop-down box, click **Configuration**.

   The **Configuration** page appears.



Tenable Network Monitor Settings Section

The **Tenable Network Monitor Settings** section provides options for configuring the network settings for Tenable Network Monitor. This includes what networks are monitored or excluded, how to monitor those networks, and what network interfaces Tenable Network Monitor has identified for monitoring. If your Tenable Network Monitor is licensed to run in High Performance mode, you can also Configure Tenable Network Monitor Performance Mode.

Note: While you can configure many advanced settings via the command line using custom parameters, others use standard parameters. For example, while the **ACAS Classification** setting uses the custom **--add** parameter, the **Login Banner** setting does not require the **--add** parameter.

Note: The **Network Interfaces Settings** view only shows network interfaces that don't have IP addresses assigned to them. As a result, if all interfaces have assigned IP addresses, in High Performance mode, the list is empty.

Name	Description
ACAS Classification	
ACAS	You can enable support for ACAS banners from the command line of the Tenable Network Monitor server service using the **/opt/nnm/bin/nnm --config --add "ACAS Classification" "SECRET"** command. **SECRET** may be replaced by a different classification, for example, **UNCLASSIFIED**, **CONFIDENTIAL**, or **TOP SECRET**. This field supports alphanumeric characters and the following special characters: / - . _ # Once enabled, a drop-down box for the ACAS option appears in the user interface front end. You can disable support for ACAS banners from the command line of the Tenable Network Monitor server using the **/opt/nnm/bin/nnm --config --delete "ACAS Classification"** command from the binary directory on the server. Tenable Network Monitor does not display user-defined options in the UI

Name	Description
	to avoid vulnerabilities from malicious script code.
Advanced	
Maximum Plugins Update Frequency	Specifies the maximum frequency with which plugins update.
Login Banner	Specifies a login banner. **Note:** You can also configure login banners via the command line using the **`/opt/nnm/bin/nnm --config "Login Banner" "NNM Banner Text"`** command.
HTTP Header Hostname Validation	If you use a domain name to connect to Tenable Network Monitor, specify it in this box. Also enable **Validate Host**. To protect against malicious attacks such as header injection, Tenable Network Monitor validates that the domain name given to the browser matches your Tenable Network Monitor server. The check is case insensitive.
Validate Host	When enabled, specifies whether Tenable Network Monitor should validate the hostname to protect against malicious attacks. If you enable this setting, you must enter a value for **HTTP Header Hostname Validation**.
Validate CSRF	When enabled, Tenable Network Monitor sends anti-Cross Source Request Forgery (CSRF) tokens. This protects against malicious attacks.
Session Data Size	A box in which you can specify the maximum number of bytes of application layer data (e.g., FTP, HTTP, or SSH data) stored in the

Name	Description
	transport layer session cache per session. By default, the value is 3072 bytes. You can specify a minimum of 1024 bytes and a maximum of 2147483647 bytes.
Enable PII Obfuscation	Specifies whether or not to mask data from plugins that are expected to contain sensitive information (like Personally Identifiable Information [PII]). When enabled, the sensitive data is masked with asterisks. When disabled, the sensitive information appears in clear text in plugin output and logs. Type 0 to disable and 1 to enable the obfuscation. **Note:** By default, this option is enabled. This option cannot be disabled if your Tenable Network Monitor is connected to another application (for example, Industrial Security, Tenable One Vulnerability Management, Tenable Security Center).
Maximum Event Trending Data Points	Adjust this value to increase the number of sample points to take for events. By default, this option is set to 10,000. **Note:** Increasing this value requires Tenable Network Monitor to allocate more memory, Tenable recommends you keep it at 10,000.
Event Data Sample Interval In Minutes	Increase this value by multiples of 5, up to the maximum of 60 (1 hour), to extend the Event Data sampling interval. The default of one minute allows you to save data for up to a week. You can also increase the number of sample points to take for events with the **Maximum Event Trending Data Points** and **Maximum SIEM Trending Data Points** options. By default, this option is set to 1.
Analysis Modules	
Enable	Enables the SCADA/ICS Analysis Module. Click the caret button to the

Name	Description
SCADA/ICS Analysis Module	left of the setting name to display a list of individual module detections within the module. Click on individual module detections within the list to disable/enable them. Disabling a SCADA/ICS module detection enables the legacy PASL. See the SCADA/ICS Analysis Module for more information.
Enable Connection Analysis Module	Enables the Connection Analysis Module. Click the caret button to the left of the setting name to display a list of individual module detections within the module. Click on individual module detections within the list to disable/enable them. See the Connection Analysis Module for more information.
Enable IoT Analysis Module	When enabled, Tenable Network Monitor detects plugins in the IoT family. By default, this option is enabled.
DNS Query	
DNS Cache Lifetime Analysis Module	Specifies the amount of time Tenable Network Monitor retains and stores a given host's DNS record, in seconds. By default, this option is set to 43200 (12 hours), but can be set to any value between 3600 and 172800 (48 hours).
DNS Query Time Interval	Specifies the delay between sets of DNS queries, in seconds. By default, this option is set to 5, but can be set to any value between 1 and 120.
DNS Queries per Interval	Specifies the maximum number of concurrent DNS requests made at the time of the **DNS Query**, in seconds. By default, this option is set to 5, but can be set to any value between 0 and 1000. Setting this value to 0 disables this feature and prevents further DNS queries from being made.

Name	Description
Database	
Enable Malformed Database Recovery	When enabled, allows Tenable Network Monitor to recover a malformed database.
Memory	
Sessions Cache Size	Specifies the size, in megabytes, of the session table. Adjust the session size as needed for the local network. By default, this option is set to 50.
Packet Cache Size	Specifies the maximum size, in megabytes, of the cache used to store the contents of the packets collected before processing. By default, this option is set to 128 MB with a maximum size of 512 MB. When the cache is full, any subsequent packets captured drop until space in the cache becomes available.
Monitoring	
Run in Discovery Mode	Specifies whether or not Tenable Network Monitor runs in discovery mode. When enabled, Tenable Network Monitor discovers basic asset data instead of reporting vulnerabilities. This includes IP addresses, MAC addresses, hostnames, and other relevant asset data. This option is enabled by default during initial Tenable Network Monitor installation. **Note:** The Tenable Network Monitor dashboards do not display informational-level plugins. Dashboards display vulnerability plugins with a higher severity level. **Note:** If you want to link Tenable Network Monitor to an instance of Industrial Security, disable this option.

Name	Description
	In discovery mode, users can expect to see the following detections: • 0: Open Port. • 12: Number of Hops • 18: Generic Protocol Detection • 19: VLAN ID Detection • 20: Generic IPv6 Tunnel Traffic Detection • 113: VXLAN ID Detection • 132: Host Attribute Enumeration
Monitored Network Interfaces	A list of the network devices used for sniffing packets. You can select devices individually or in multiples. Select at least one interface from the list of available devices. **Note:** High Performance mode does not support e1000 NICs as monitored interfaces on virtual machines. If you are running Tenable Network Monitor on a virtual machine in High Performance mode and select an e1000 monitored interface, Tenable Network Monitor automatically reverts to Standard mode.
Monitored Network IP Addresses and Ranges	Specifies the networks monitored. The default setting is 0.0.0.0/0, which instructs Tenable Network Monitor to monitor all IPv4 addresses. Change this to monitor only target networks; otherwise Tenable Network Monitor may quickly become overwhelmed. Separate multiple addresses by commas. When monitoring VLAN networks, you must use the syntax **`vlan ipaddress/subnet`**. Example: 192.0.2.0/24,2001:DB8::/64,10.2.3.0/22,vlan 192.0.2.0/16,192.168.3.123/32

Name	Description
	Note: The syntax is case-sensitive.
Excluded Network IP Addresses and Ranges	Specifies, in CIDR notation, any networks to exclude specifically from Tenable Network Monitor monitoring. This option accepts both IPv4 and IPv6 addresses. Separate multiple addresses by commas. When excluding VLAN networks, you must use the syntax **`vlan ipaddress/subnet`**. No addresses are excluded if this box is left blank. **Note:** You can exclude up to 128 CIDR entries at one time. Example: 192.0.2.0/24,2001:DB8::/64,10.2.3.0/22,vlan 192.0.2.0/16,192.168.3.123/32
Extended Packet Filter	Specifies a Berkeley Packet Filtering (BPF) expression to expand or narrow down the IP addresses being monitored. Use "or" or "and" to join your expression to the total expression for packet filtering. For example: • To filter vlan hierarchies two levels deep in addition to the IP address list, in the **Extended Packet Filter** dialog, enter: `or (vlan && vlan)`. • To require that the packets filtered by the IP address list also be two levels deep, in the **Extended Packet Filter** dialog, enter:`and (vlan && vlan)`. **Note:** These options are for packet filtering experts only. For information about available primitives, see the PCAP Filter man page.
Enable VXLAN Traffic Analysis	Enables decoding of Virtual Extensible LAN protocol (VXLAN) traffic.

Name	Description
Enable ERSPAN Type 2 Traffic Analysis	If your network uses the ERSPAN Type 2 tunneling protocol, you must enable this option for NNM to properly decode and analyze the traffic. If you upgrade from a previous version of Tenable Network Monitor to version 6.4.0, Tenable recommends you remove all previous results and allow Tenable Network Monitor to rebuild its database.
Tenable Network Monitor Proxy	
Tenable Network Monitor Restart Attempts	The number of times the Tenable Network Monitor proxy attempts to restart the Tenable Network Monitor engine in the event the engine stops running. By default, this option is set to 10, but can be set to any value between 1 and 15. Once the restart attempt limit is reached, the proxy stops trying for 30 minutes.
Tenable Network Monitor Restart Interval	The amount of time, in minutes, between Tenable Network Monitor restart attempts. By default, this option is set to 10, but can be set to any value between 1 and 3600.
Tenable Network Monitor Web Server	
Enable SSL for Web Server	When selected, enables SSL protection for connections to the web server. By default, this check box is selected. Tenable does not recommend clearing the check box, as it allows the sending of unencrypted traffic between a browser and Tenable Network Monitor. You may install custom SSL certificates in the `/opt/nnm/var/nnm/ssl` directory. Restart Tenable Network Monitor after making changes to this setting. **Note:** Changing this option while Tenable Network Monitor is running makes communication between the client and server either encrypted or

Name	Description
	unencrypted. If you select or clear the **Enable SSL for Web Server** check box, the Web Server automatically ends your current Tenable Network Monitor session.
Minimum Password Length	Specifies the lowest number of characters a password may contain. By default, this option is set to 5, but can be set to any value between 5 and 32.
Tenable Network Monitor Web Server Address	Specifies the IPv4 or IPv6 address on which the Tenable Network Monitor web server listens. The default setting is 0.0.0.0, which instructs the web server to listen on all available IPv4 and 1Pv6 addresses. **Note:** Link-local addresses are not supported for IPv6 addresses.
Tenable Network Monitor Web Server Port	Specifies the Tenable Network Monitor web server-listening port. The default setting is 8835, but can be changed as appropriate for the local environment. **Note:** If you change the value in this box, the Web Server automatically ends your current Tenable Network Monitor session.
Tenable Network Monitor Web Server Idle Session Timeout	Specifies the number of minutes of inactivity before a web session becomes idle. By default, this option is set to 30, but can be set to any value between 5 and 60.
Enable SSL Client Certificate Authentication	When enabled, allows the web server to accept only SSL client certificates for user authentication.
Enable Debug	When enabled, allows the web server to include debug information in the

Name	Description
Logging for Tenable Network Monitor Web Server	logs for troubleshooting issues related to the web server. The logs become large if this option is enabled routinely.
Maximum User Login Attempts	Specifies the number of times a user can type an incorrect password in a 24-hour period before the user's account is locked.
Max Sessions per User	Specifies the number of concurrent sessions a user can have running at one time.
Enforce Complex Passwords	When enabled, forces the user's passwords to contain at least one uppercase character, one lowercase character, one digit, and one special character from the following: !@#$%^&*().
Use TLS 1.2	When enabled, the Tenable Network Monitor web server uses TLS 1.2 communications. By default, this option is enabled. **Note:** If you disable this option, the Tenable Network Monitor web server uses TLS 1.1, which is less secure.
Disable CBC Ciphers	When enabled, disables the use of CBC ciphers in TLS 1.2. By default, this option is disabled. **Note**: This setting is used in conjunction with **Enable NIAP Mode**. For more information, see Configure Tenable Network Monitor for NIAP Compliance.
Enable Strong Encryption	When enabled, forces Tenable Network Monitor to select the strongest ciphers in the TLS 1.2 communications suite. By default, this option is enabled.

Name	Description
	When strong encryption is enabled, the user can expect to see typical ciphers such as: • TLS_RSA_WITH_AES_128_CBC_SHA • TLS_RSA_WITH_AES_128_CBC_SHA256 • TLS_RSA_WITH_AES_128_GCM_SHA256 • TLS_RSA_WITH_AES_256_CBC_SHA • TLS_RSA_WITH_AES_256_CBC_SHA256 • TLS_RSA_WITH_AES_256_GCM_SHA384 • TLS_RSA_WITH_CAMELLIA_128_CBC_SHA • TLS_RSA_WITH_CAMELLIA_256_CBC_SHA If this option is disabled, the Tenable Network Monitor uses the following ciphers: • TLS_RSA_WITH_AES_128_CBC_SHA • TLS_RSA_WITH_AES_256_CBC_SHA To configure NIAP-compliant ciphers, see Configure Tenable Network Monitor for NIAP Compliance. **Tip**: For a list of Tenable-supported ciphers, see System Requirements in the *Tenable One Vulnerability Management User Guide*.
Plugins	
Process High Speed Plugins Only	Tenable Network Monitor is designed to find various protocols on non-standard ports. For example, Tenable Network Monitor can easily find an Apache server running on a port other than 80. However, on a high traffic network, Tenable Network Monitor can be run in High Performance

Name	Description
	mode, which allows it to focus certain plugins on specific ports. When High Performance mode is enabled and this check box is selected, any plugin that utilizes the keywords **hs_dport** or **hs_sport** are executed only on traffic traversing the specified ports.
Realtime Events	
Realtime Events File Size	Specifies the maximum amount of data from real-time events that Tenable Network Monitor stores in one text file. The option must be specified in kilobytes, megabytes, or gigabytes by appending a **K**, **M**, or **G**, respectively, to the value. When a file reaches this size limit, Tenable Network Monitor internally rotates it by renaming `realtime-logs-##.txt` to `realtime-logs-##.txt.1` before writing a new file.
Log Realtime Events to Realtime Log File	When enabled, allows Tenable Network Monitor detected real-time events to be recorded to a log file in the following location: **`/opt/nnm/var/nnm/logs/realtime-logs-##.txt`** You can configure this option via the CLI.
Enable Realtime Event Analysis	When enabled, allows Tenable Network Monitor to analyze real-time events.
Maximum Viewable Realtime Events	Specifies the maximum number of most recent events cached by the Tenable Network Monitor engine. This setting is in effect only when Realtime Event Analysis is enabled.
Maximum Realtime Log Files	Specifies the maximum number of real-time log files written to the disk. To estimate total disk usage for real-time logs, multiply this value by the **Realtime Events File Size** setting, then multiply by two to account for

Name	Description
	both the active file and its internally rotated counterpart (`.txt.1`). At high SPAN capture rates, provision your `/opt` partition accordingly.
Reports	
Report Threshold	Specifies the number of times the encryption detection algorithm executes during a session. Once the threshold is reached, the algorithm no longer executes during the session. By default, this option is set to 3 by def.
Report Lifetime	Specifies, in days, how long vulnerabilities and snapshot reports are cached. After the configured number of days is met, discovered vulnerabilities and snapshot reports are removed. This option can be set to a maximum value of 90 days. By default, this option is set to 7 and cannot be set higher than the **Host Lifetime** value.
Host Lifetime	Specifies, in days, how long hosts are cached. After the configured number of days is met, discovered hosts are removed. This option can be set to a maximum value of 365 days. By default, this option is set to 7 and cannot be set lower than the **Report Lifetime** value.
Report Frequency	Specifies, in minutes, how often Tenable Network Monitor writes a report. By default, this option is set to 15. Tenable Security Center retrieves the Tenable Network Monitor report every 15 minutes.
Knowledgebase Lifetime	Specifies, in seconds, the maximum length of time that a knowledgebase entry remains valid after its addition. By default, this option is set to 864000.
New Asset Discovery Interval	Specifies, in days, how long Tenable Network Monitor monitors traffic before detecting new hosts. Tenable Network Monitor listens to network

Name	Description
	traffic and attempts to discover when a new host has been added. To do this, Tenable Network Monitor constantly compares a list of hosts that have generated traffic in the past to those currently generating traffic. If it finds a new host generating traffic, it issues a “new host alert” via the real-time log. For large networks, Tenable Network Monitor can be configured to run for several days to gain knowledge about which hosts are active. This prevents Tenable Network Monitor from issuing an alert for hosts that already exist. For large networks, Tenable® recommends that Tenable Network Monitor operate for at least two days before detecting new hosts. By default, this option is set to 2.
Connections to Services	When enabled, allows Tenable Network Monitor to log which clients attempt to connect to servers on the network and to what port they attempt to connect. They indicate only that an attempt to connect was made, not whether the connection was successful. Events detected by Tenable Network Monitor of this type are logged as Tenable Network Monitor internal plugin ID **2**.
Show Connections	When enabled, instructs Tenable Network Monitor to record clients in the focus network that attempt to connect to a server IP address and port and receive a positive response. The record contains the client IP address, the server IP address, and the server port that the client attempted to connect to. For example, if four different hosts within the focus network attempt to connect with a server IP over port 80 and received a positive response, then a list of those hosts are reported under Tenable Network Monitor internal plugin ID **3** and port 80.
Known Hosts File	**Note:** You can only configure this feature via the command-line interface.

Name	Description
	A configuration parameter in which you can type the location of the **known-hosts.txt** file. Manually create the Known Hosts file. This feature supports a single row for each IP (IPv4 or IPv6). Hyphenated ranges and CIDR notation are not supported. New host alerts no longer appear for the hosts listed in this file. **Note:** Blank rows are ignored, and invalid entries are noted in the Tenable Network Monitor log file. If you make any changes to the Known Hosts file, you must restart Tenable Network Monitor.
Security Options	
Enable FIPS Mode	When enabled, Tenable Network Monitor uses OpenSSL 3.0 FIPS module security features. The OpenSSL 3.0 FIPS module is a set of encryption modules satisfying the requirements of the FIPS 140-2 standard defined by the National Institute of Standards and Technology (NIST). **Note:** If you use the FIPS module, you may need to restart Tenable Network Monitor a few times.
Enable National Information Assurance Partnership (NIAP) Mode	When enabled, Tenable Network Monitor uses NIAP ciphers in compliance with NIAP standards. If you enable this setting, then you must also enable **Enable FIPS Mode**.
NIAP Mode Disabled Due to Upgrade	When enabled, Tenable Network Monitor does not use FIPS or NIAP security features.

Name	Description
Session Analysis	
Encrypted Sessions Dependency Plugins	Specifies the Plugin IDs, separated by commas, used to detect encrypted traffic.
Encrypted Sessions Excluded Network Ranges	Specifies the IPv4 and IPv6 addresses and ports, in CIDR notation, excluded from monitoring for encrypted traffic. Example: 192.0.2.0/24,2001:DB8::/64,10.2.3.0/22,vlan 192.0.2.0/16,192.168.3.123/32
Interactive Sessions Dependency Plugins	Specifies the plugin IDs, separated by commas, used to detect interactive sessions.
Interactive Sessions Excluded Network Ranges	Specifies the IPv4 and IPv6 addresses and ports, in CIDR notation, excluded from monitoring for interactive sessions. Example: 192.0.2.0/24,2001:DB8::/64,10.2.3.0/22,vlan 192.0.2.0/16,192.168.3.123/32
SIEM Processing Options	
Note: SIEM analysis features are only available for RH/CentOS 7 and RH/CentOS 8.	
Enable SIEM Assets Discovery	When selected, allows Tenable Network Monitor to discover assets through SIEM analysis. For more information, see SIEM Analysis Section.

Name	Description
Enable SIEM User Account Activity	When selected, allows Tenable Network Monitor to detect user account activity through SIEM analysis. For more information, see SIEM Analysis Section.
Enable SIEM Software Detection	When selected, allows Tenable Network Monitor to detect software events through SIEM analysis. For more information, see SIEM Analysis Section.
Enable SIEM Service Modification	When selected, allows Tenable Network Monitor to detect service modification events through SIEM analysis. For more information, see SIEM Analysis Section.
SIEM Polling Interval	The interval, in minutes, after which Tenable Network Monitor updates its status with the SIEM servers and asks for a list of jobs. Options are in the range of 5-10 minutes.
Maximum SIEM Trending Data Points	Adjust this value to increase the number of SIEM Trending Data Points to take for events. SIEM events can also be increased with the **Maximum Event Trending Data Points** option. By default, this option is set to 10,000. **Note:** Increasing this value requires Tenable Network Monitor to allocate more memory, Tenable recommends you keep it at 10,000.
SIEM Servers	
SIEM Servers List	**Note:** SIEM analysis features are only available for RH/CentOS 7 and RH/CentOS 8. Lists the servers used to track SIEM-related events. The charts shown in the **SIEM Analysis** section pull data from these servers. This section

Name	Description

	provides three options:
	• **Add** - Add a new SIEM server setting. Enter the following information:
	  • **IP** - The server IP address.
	  • **Port (TCP)** - The server IP port number.
	  • **SIEM Type** - The server's SIEM type (**Splunk**).
	  • **User** - The username that grants server access.
	  • **Password** - The password that grants server access.
	• **Edit** - Edit the SIEM server settings listed above.
	• **Delete** - Delete the selected SIEM server and all related SIEM queries.
	Note: SIEM server entries are displayed as `User@IP_Address:Port` (e.g., `admin@1.2.3.4:8089`). The combination of these three parameters is unique; entries with the same three parameters are rejected.
	Note: Tenable recommends that you only use trusted self-signed certificates for Splunk instances used with Tenable Network Monitor.

Syslog	
Realtime Syslog Server List	Specifies the IPv4 or IPv6 address and port of a Syslog server to receive real-time events from Tenable Network Monitor. Click **Add** to save the address. A local Syslog daemon is not required. Syslog items can be specified to Standard or CEF formats and UDP or TCP protocols. Example: 192.0.2.12:4567,10.10.10.10:514,[2001:DB8::23B4]:514

Name	Description
Vulnerability Syslog Server List	Specifies the IPv4 or IPv6 address and port of a Syslog server to receive vulnerability data from Tenable Network Monitor. Click **Add** to save the address. A local Syslog daemon is not required. You can specify Syslog items to Standard or CEF formats and UDP or TCP protocols. Example: 192.0.2.12:4567,10.10.10.10:514,[2001:DB8::23B4]:514 **Note:** While Tenable Network Monitor may display multiple log events related to one connection, it sends only a single event to the remote Syslog server(s).

Configure Tenable Network Monitor Performance Mode

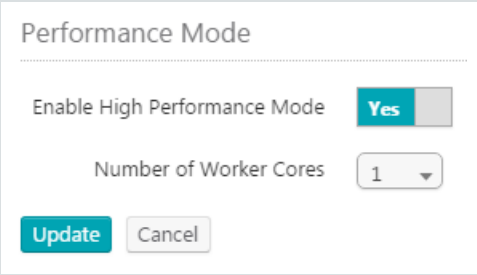
Before you begin:

This option appears only when Tenable Network Monitor is licensed to run in High Performance mode and the machine running Tenable Network Monitor meets the hardware and software requirements for High Performance mode. By default, all instances of Tenable Network Monitor run in Standard mode.

Tenable Network Monitor must restart when switching between performance modes.

To configure performance mode:

1. Click **Configuration** > **Tenable Network Monitor Settings**.
2. Under the **Performance Mode** heading, click the **Enable High Performance Mode** box to toggle between **Yes** and **No**. If you select **Yes**, continue to step 3. If you select **No**, continue to step 4.



3. In the **Number of Worker Cores** drop-down box, select the appropriate number of worker cores.

   > **Note:** This option cannot be changed when Tenable Network Monitor is already running in High Performance mode.

4. Click the **Update** button.

   A dialog box appears confirming your selection to change the performance mode.

5. Click the **Confirm** button.

   Tenable Network Monitor restarts and the login screen appears. When the Tenable Network Monitor server resumes, a notification appears indicating whether the configuration change was successful.

   > **Note:** Tenable Network Monitor may use a different number of cores than the number you select. Based on system constraints and your selection, Tenable Network Monitor selects the closest number of worker cores that it can feasibly support.

6. Log in to Tenable Network Monitor.

   The performance mode updates.

Feed Settings Section

The **Feed Settings** section allows you to:

Name	Description
Register Offline check box	A check box that allows offline registration of Tenable Network

Name	Description
	Monitor.
Activation Code box	Updates the activation code. The Activation Code only needs to be updated when it expires.
Fetch Plugins From drop-down box	A drop-down box from which you can specify where you wish to fetch plugins. Click **Update** to fetch the plugins.
Offline Plugin Archive	Uploads plugins to perform offline updates. **Choose File** to select the file to upload, then click **Upload Archive** to upload the archive.
Host Address box	A box in which you can specify a custom plugin feed host. Click **Update** to save the host.

Offline Update

The **Offline Update** allows a user with administrative privileges to manually update plugins when the Tenable Network Monitor host cannot connect to the Internet.

1. Download the plugin update archive from Tenable®.
2. Click **Choose File**.
3. Select the archive tarball to upload.
4. Click the **Upload Archive** button to send the file to the Tenable Network Monitor host.
5. Click the **Upload Archive** button again to update the plugins.
6. If a new client is part of the update, you must refresh the web browser to see the updated client.

The **Custom Plugin Feed** host is an alternate feed host. These are typically hosted on a local network to provide custom Tenable Network Monitor plugins.

When running Standalone Tenable Network Monitor or Tenable Network Monitor in High Performance mode as **Managed by Tenable Security Center** or **Managed by Tenable One Vulnerability Management**, you must type an Activation Code before clicking the **Update** button. The ↻ button schedules a plugin update when Tenable Network Monitor is running in **Standalone** mode. Additionally, when registering Tenable Network Monitor in **Offline** mode, you need the Activation Code to obtain the Activation Key.

Download New Vulnerability Plugins

Before You Begin

When Tenable Network Monitor is registered in **Standalone** mode using an Activation code, plugins are updated automatically every 24 hours after the service is started.

If Tenable Security Center or Tenable One Vulnerability Management is used to manage Tenable Network Monitor, new plugins for Tenable Network Monitor are automatically sent at scheduled intervals.

To manually download new vulnerability plugins:

1. Click **Configuration** > **Feed Settings**.
2. Next to the **Fetch Plugins From** drop-down box, click the ↻ button.

> **Tip:** The plugins can also be updated by using the following command. You must run this command as root or with `sudo`.
>
> ```
> /opt/nnm/bin/nnm --update-plugins
> ```

Updating the Tenable Network Monitor Management Interface

On occasion, the Tenable Network Monitor management interface must be updated to provide new or updated features.

To manually update the plugins:

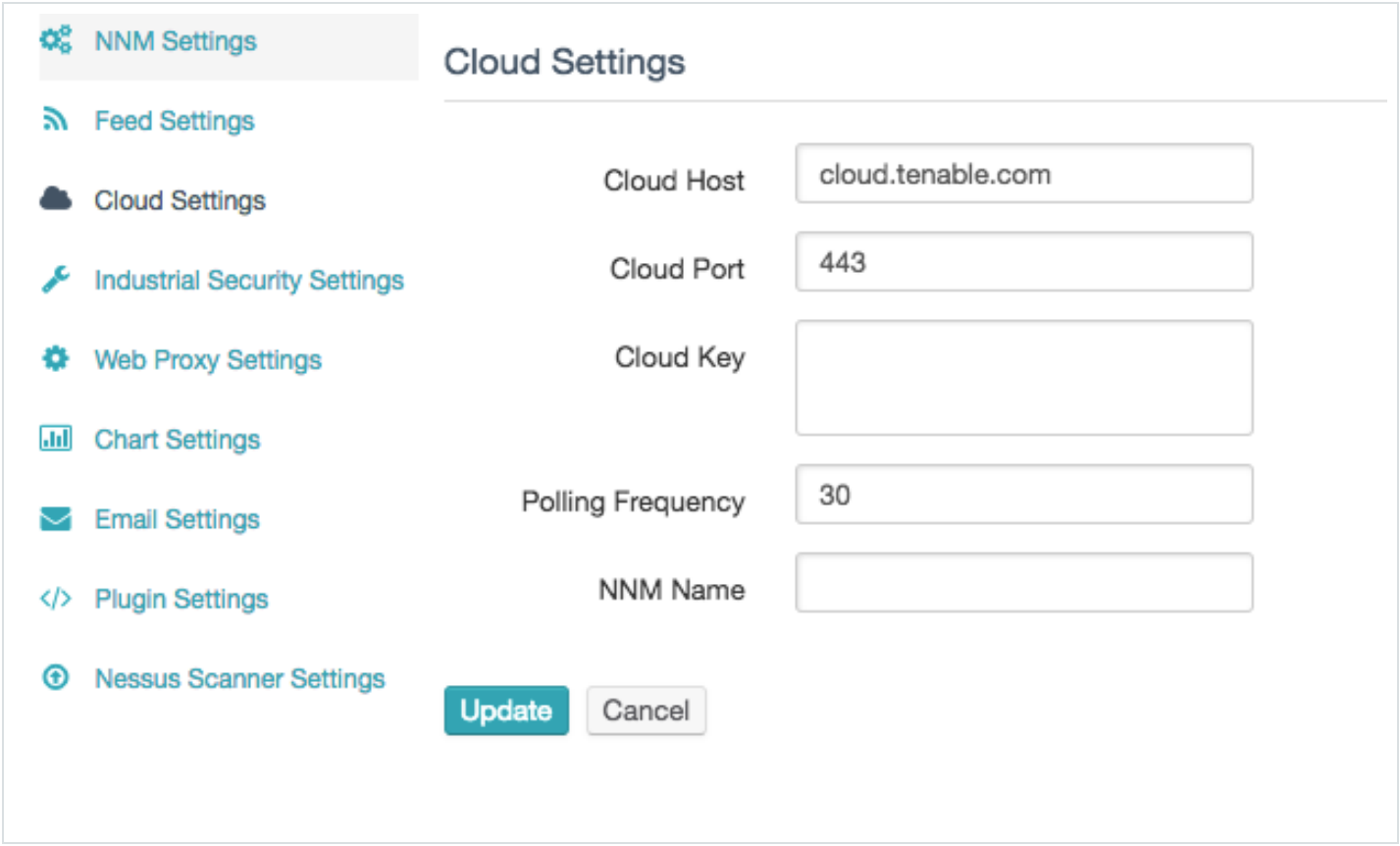
1. Download the latest plugins using the URL created during the offline registration process.
2. Log in to the Tenable Network Monitor interface as a user with administrative privileges.
3. Click **Configuration** > **Feed Settings**.
4. In the **Offline Update** section, click **Choose File**.

   A dialog box appears.
5. Select the archive file to upload.
6. Click **Upload Archive** to send the file to the Tenable Network Monitor host, which updates the plugins.
7. Stop Tenable Network Monitor on the host.
8. Restart Tenable Network Monitor on the host.

   The new interface is available for use.

Cloud Settings Section

The **Cloud Settings** section provides options for configuring Tenable Network Monitor to communicate with Tenable One Vulnerability Management.



Note: Tenable Network Monitor processes a large amount of data. When you connect to Tenable One Vulnerability Management, use multiple Tenable Network Monitor scanners to filter the data. If your Tenable Network Monitor is managed by Tenable One Vulnerability Management, each Tenable Network Monitor report file can have a maximum of 5000 hosts or 1 GB of data.

If your report file exceeds the maximum size or number of hosts, the next time you log in to Tenable Network Monitor, a warning appears indicating that the results of the last file uploaded to Tenable One Vulnerability Management were truncated. A similar warning appears in Tenable One Vulnerability Management, in the Tenable Network Monitor scan details.

You can adjust your monitored ranges to prevent truncated results in Tenable One Vulnerability Management. For example, if you want to monitor 50 networks, you can use two Tenable Network Monitor scanners covering 25 networks each.

These limits apply only to Tenable Network Monitor instances managed by Tenable One Vulnerability Management.

Note: You cannot connect Tenable Network Monitor instances running in High Performance Mode to Tenable One Vulnerability Management because of the volume of data and the required processing time. For this configuration in an intranet environment, use Tenable Security Center.

Name	Description
Cloud Host	The domain name or IP address of the Tenable One Vulnerability Management server: **sensor.cloud.tenable.com** or **fedcloud.tenable.com**. **Note:** If you are connecting to Tenable One Vulnerability Management through Tenable Nessus scanners, Tenable Agents, Tenable One Web App Scanning scanners, or Tenable Network Monitors (NNM) located in mainland China, you must connect through sensor.cloud.tenablecloud.cn instead of sensor.cloud.tenable.com.
Cloud Port	The port of the Tenable One Vulnerability Management server: **443**.
Cloud Key	The Tenable One Vulnerability Management key used to link this instance of Tenable Network Monitor to a Tenable One Vulnerability Management account. See Link a Sensor in the Tenable One Vulnerability Management User Guide for more information.
Polling Frequency	The frequency, in seconds, with which Tenable Network Monitor updates its status with Tenable One Vulnerability Management and asks for a list of jobs.
NNM Name	The unique name used to identify this instance of Tenable Network Monitor in Tenable One Vulnerability Management.

By default, Tenable One Vulnerability Management retrieves data from the Tenable Network Monitor scanner every 60 minutes. The **Report Frequency** setting in Tenable One Vulnerability Management determines this interval. When you add a linked Tenable Network Monitor scanner to Tenable One Vulnerability Management, the system automatically creates a scan and collects results from Tenable Network Monitor. If you change the **Report Frequency** setting, the scans adjust automatically.

Caution: Do not set the Report Frequency to less than 60 minutes. If the frequency is too short, Tenable Vulnerability Management may abort Tenable Network Monitor scans and lose data consistency.

Review the scan history in Tenable One Vulnerability Management to ensure the application has sufficient time to process the Tenable Network Monitor data. Increase the frequency as needed.

Note: When you link a Tenable Network Monitor scanner to Tenable One Vulnerability Management, Tenable Network Monitor also uploads the IP address of the Tenable Network Monitor server. For example, *198.51.100.64* from *https://198.51.100.64:8835* or *https://my_host:8835*.

To use an opaque IP address (for example, *127.0.0.1*), use the following steps:

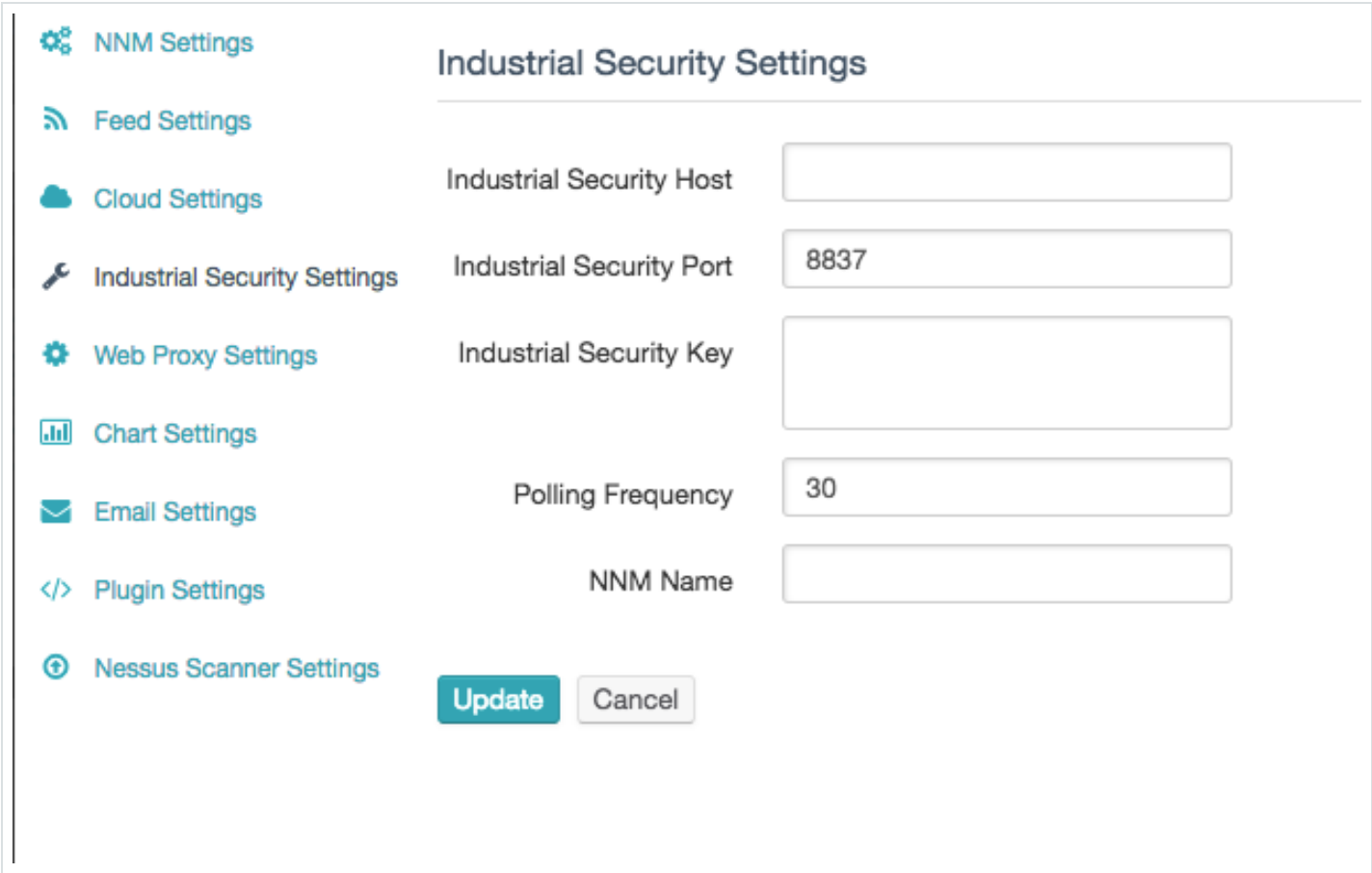
1. Remove your Tenable Network Monitor server from Tenable One Vulnerability Management.
2. In the command line interface, use the `Clear NNM IP Address for Tenable Vulnerability Management` option.
3. In your browser, use the desired IP address to register Tenable Network Monitor.
4. Connect your Tenable Network Monitor server to Tenable One Vulnerability Management again.

Industrial Security Settings Section

Industrial Security is end-of-life (EOL). For information about EOL dates and policies for Tenable products, see the Tenable Software Release Lifecycle Matrix and Policy.

The **Industrial Security Settings** section provides options for configuring Industrial Security with Tenable Network Monitor. For more information, see Configure Tenable Network Monitor for use with Industrial Security.

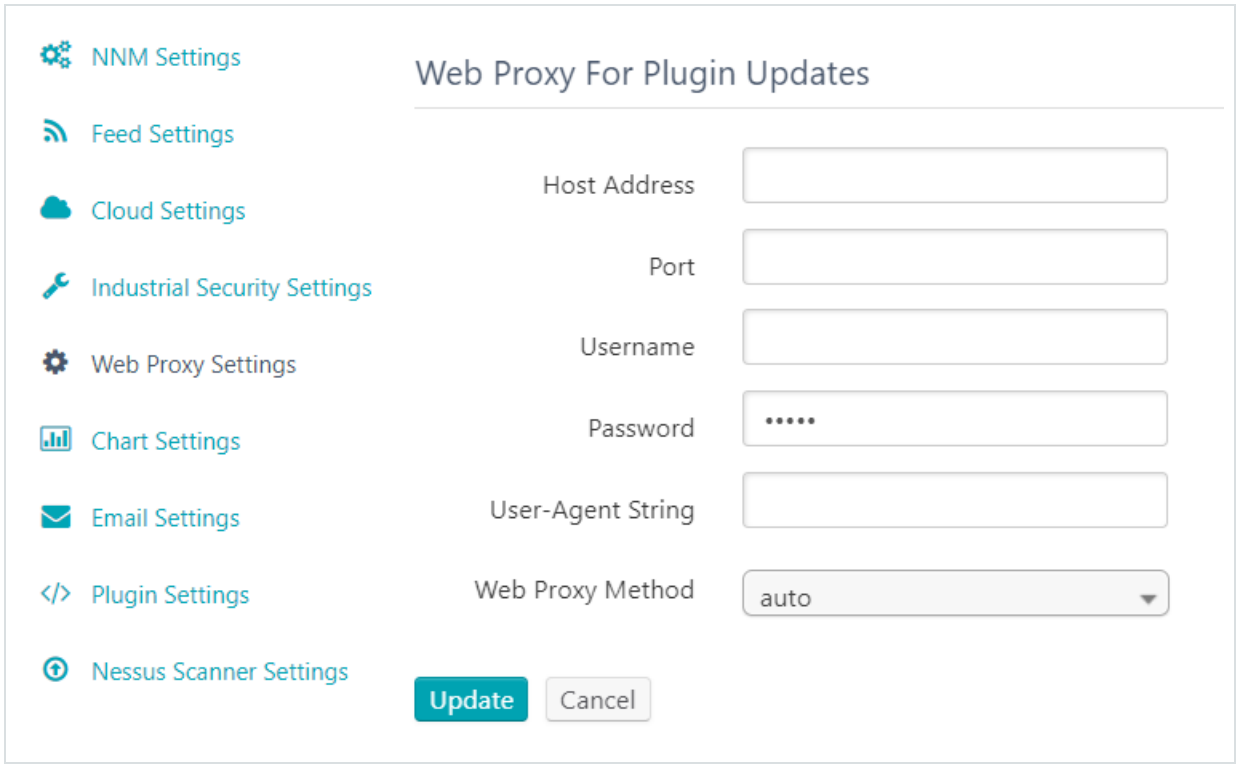
Note: To use Tenable Network Monitor with Industrial Security, disable the discovery mode option. For more information, see Tenable Network Monitor Settings Section.



Name	Description
Industrial Security Host	The domain name or IP address of the Industrial Security server.
Industrial Security Port	The port of the Industrial Security server.
Industrial Security Key	The key used to link this instance of Tenable Network Monitor to a Industrial Security account.
Polling Frequency	The frequency, in seconds, with which Tenable Network Monitor updates its status with Industrial Security and asks for a list of jobs.
Tenable Network Monitor Name	The unique name used to identify this instance of Tenable Network Monitor on Industrial Security.

Web Proxy Settings Section

The **Web Proxy Settings** section configures the settings for a web proxy if one is needed for plugin updates. These settings include the proxy host IP address, port, username, password, and, if a custom agent string is needed, a user-agent box.



Name	Description
Host Address	The host address of the web proxy server.
Port	The port of the web proxy server.
Username	The username for the web proxy server.
Password	The password for the web proxy server.
User-Agent String	The user agent for the web proxy server, if your proxy requires a preset user agent.

Web Proxy Method	The authentication method Tenable Network Monitor uses to connect to the web proxy server. Select one of the following from the drop-down: **Note:** For the *auto* and *basic* methods, the web proxy **Username** and **Password** values are required for Tenable Network Monitor to engage with the proxy. For Tenable Network Monitor 6.5.3 and later versions, if your network proxy does not require them then they can be blank. • `auto` - Tenable Network Monitor detects and uses the method available for the web proxy. • `basic` - Tenable Network Monitor uses basic authentication, which encodes the username and password with Base64. • `digest` - Tenable Network Monitor uses HTTP Digest authentication, which uses a hash function to encrypt the username and password.

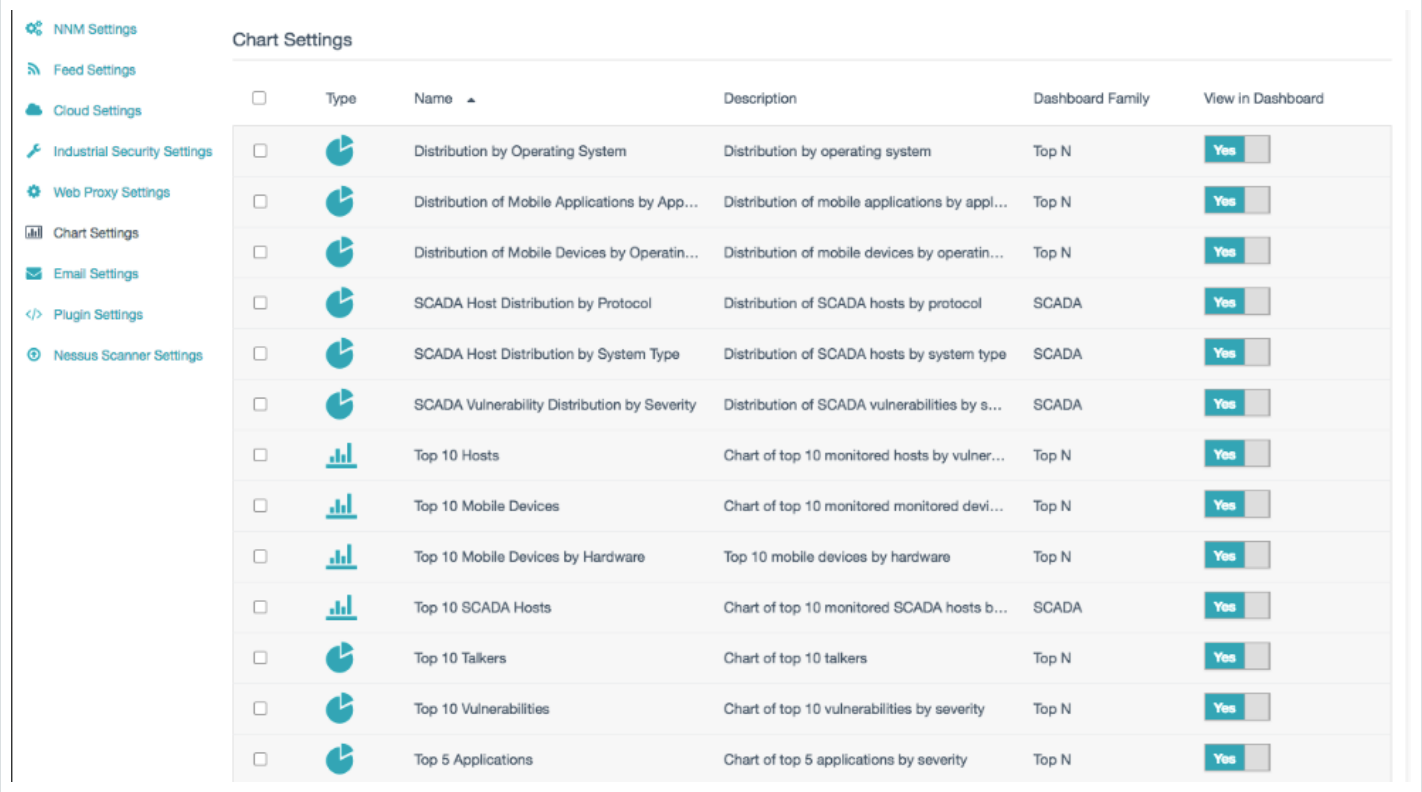
Chart Settings Section

The **Chart Settings** section displays all charts available, provides options for creating and configuring charts, and allows the user to add or remove charts in the **Dashboards** section.

In the **Chart Settings** section you can view:

- The chart **Type**.
- The **Name** of the chart.
- A **Description** of the chart.
- The chart's **Dashboard Family**.
- A toggle that determines if the chart appears in the Dashboard. Click the option to toggle between **Yes** and **No**.

Click on a chart to edit the chart.



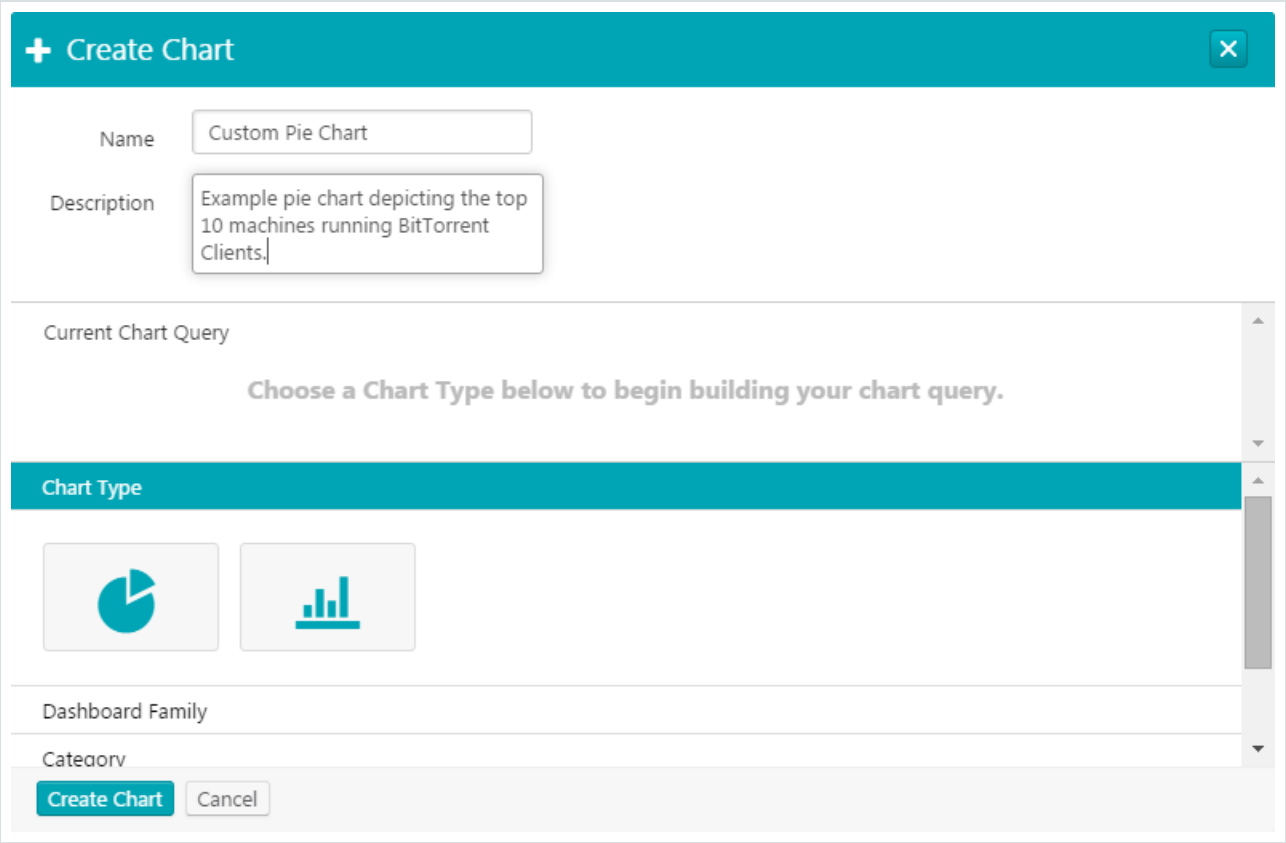
Create a Custom Chart

> **Required User Role:** Administrator

To create a custom chart:

1. Click **Configuration** > **Chart Settings** > **Create Chart**.

   The **Create Chart** window appears.



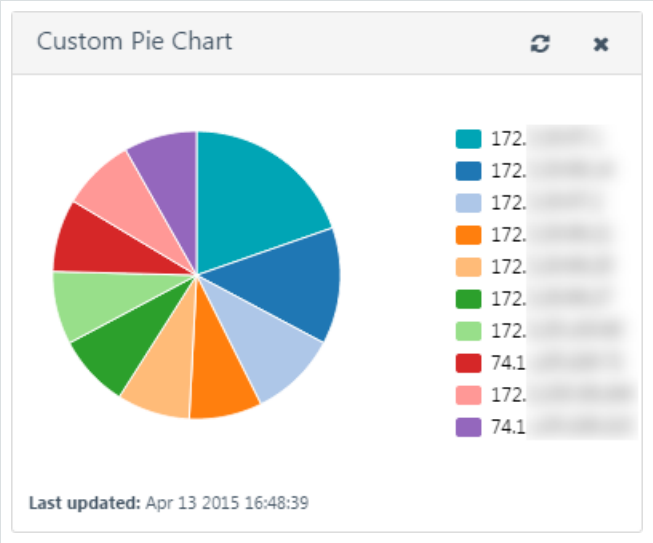
2. In the **Name** box, type a name for the chart.

> **Note:** In this example, we are creating a chart that displays the top vulnerabilities for machines reporting associated BitTorrent activity.

3. In the **Description** box, type a description for the chart.
4. In the **Chart Type** section, select the type of chart you want to create.
5. In the **Dashboard Family** section, type a numeric value between 1 and 20 that represents the number of items returned for this chart.
6. Click **Top** to add the value to the **Current Chart Query** section.
7. In the **Category** section, select a chart category. The selected category determines the type of items displayed on the chart, such as hosts, vulnerabilities, applications, operating systems, or connections.
8. In the **Filters** section, configure the options by which you want to filter the results.

> **Note:** In this example, we are creating a filter based on the Plugin ID 3920. This triggers when BitTorrent client activity is detected.

9. Click the **+** button to apply the rule to the chart.
10. In the **Viewable** section, select whether you want the chart to appear on the main dashboard.
11. Click the **Create Chart** button. The chart appears in the **Dashboards** section of the **Monitoring** page.



Delete a Chart

> **Note:** You cannot delete default charts.

To delete a chart:

To delete one chart:

1. Click **Configuration** > **Chart Settings**.
2. Hover over the chart you want to delete.
3. On the right side of the row, click the ✖ button.

   A dialog box appears confirming your selection to delete the chart.

4. Click **Delete**.

   The chart is deleted.

To delete multiple charts:

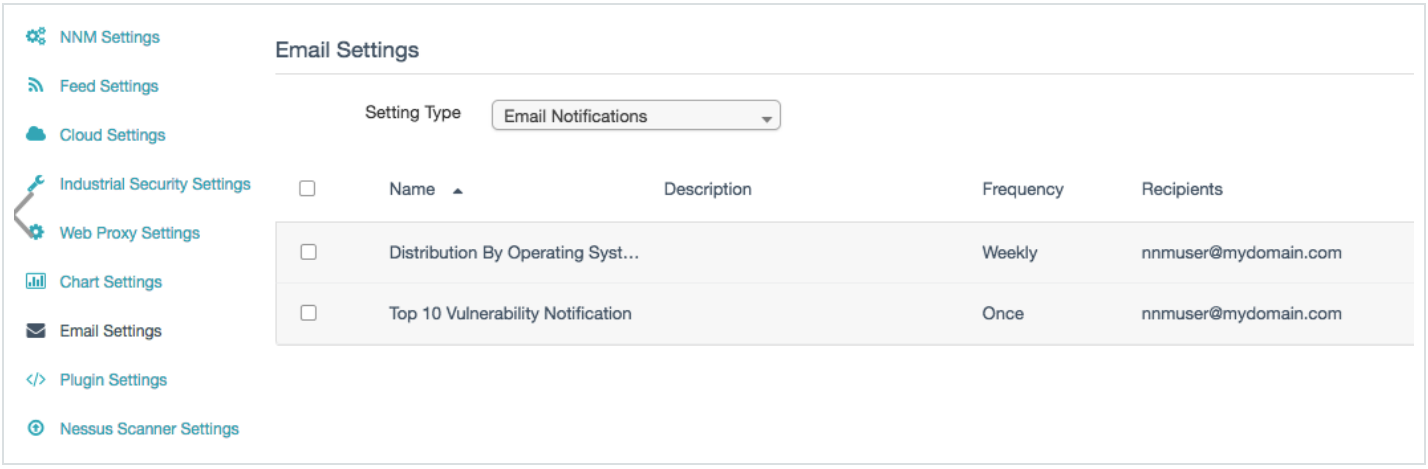
1. Click **Configuration** > **Chart Settings**.
2. On the left side of the row for the chart you want to delete, select the check box.
3. Repeat step 2 for each chart you want to delete.
4. Click **Actions** > **Delete Charts**.

   A dialog box appears confirming your selection to delete the charts.
5. Click **Delete**.

   The charts are deleted.

Email Settings Section

The **Email Settings** section allows you to Create an Email Notification for Tenable Network Monitor. You can specify the recipients of the email notifications, what charts appear in email notifications, and the time and frequency with which email notifications are sent. To send a report immediately, in the **Email Settings** section, hover over an existing email notification and click the paper airplane icon.



When you select **SMTP Server** in the **Setting Type** drop-down box, the following options for configuring the SMTP server appear:

Name	Description
Host	The host or IP of the SMTP server (e.g., smtp.example.com).
Port	The port of the SMTP server (e.g., 25).
From	The name that appears in the "From" line of the email report.
Tenable Network Monitor Location	The IP address or hostname of your Tenable Network Monitor server. This works only if the user that receives the email report can reach the Tenable Network Monitor host.
Auth Method	The method by which the SMTP server is authenticated. Supported methods are **None**, **Plain**, **NTLM**, **Login**, and **CRAM-MD5**. **Note:** If this option is set to **None**, the **Username** and **Password** boxes are hidden.
Username	The username used to authenticate to the SMTP server.
Password	The password associated with the username, provided that a password is required by the SMTP server.

Create an Email Notification

To create an email notification:

1. Click **Email Settings** > **Create Email Notification**.

   The **Create Email Notification** window appears.
2. In the **Name** box, type a name for the email notification.

3. In the **Description** box, type a description for the email notification.
4. Click **Next Step**.

   The **Add Charts** screen appears.
5. Select the check boxes that correspond to the charts you want to add to the email notification.
6. Reorder the charts by clicking and dragging the appropriate button.
7. Click **Next Step**.

   The **Schedule Email Notification** screen appears.
8. Select the frequency, date, and time at which you want the email notification to be sent. Depending on the option you select in the **Frequency** box, the following additional options appear:

Frequency	Options
Once	None
Hourly	**Repeat Every** - a drop-down box that includes options from 1 to 20 hours.
Daily	**Repeat Every** - a drop-down box that includes options from 1 to 20 days.
Weekly	**Repeat Every** - a drop-down box that includes options from 1 to 20 weeks. **Repeat On** - a multi-selectable list of the days of the week.
Monthly	**Repeat Every** - a drop-down box that includes options from 1 to 20 months. **Repeat By** - a drop-down box that includes the options Week of Month and Day of Month.
Yearly	**Repeat Every** - a drop-down box that includes options from 1 to 20

Frequency	Options
	years.

The **Summary** box updates automatically depending on your selection.

9. Click **Next Step**.

   The **Add Recipients** screen appears.

10. In the **Recipients** box, type an email address and click the ⊕ button until you have added all desired recipients.

11. Click **Next Step**.

    The **Review Email Notification** screen appears, which displays a summary of your email notification configuration.

12. Review the notification details.

13. Click **Finish**.

Delete an Email Notification

To delete an email notification:

To delete one email notification:

1. Click **Configuration** > **Email Settings**.
2. Hover over the email notification you want to delete.
3. On the right side of the row, click the ✖ button.

   A dialog box appears confirming your selection to delete the email notification.

4. Click the **Delete** button.

   The email notification is deleted and the corresponding notifications are no longer sent.

To delete multiple email notifications:

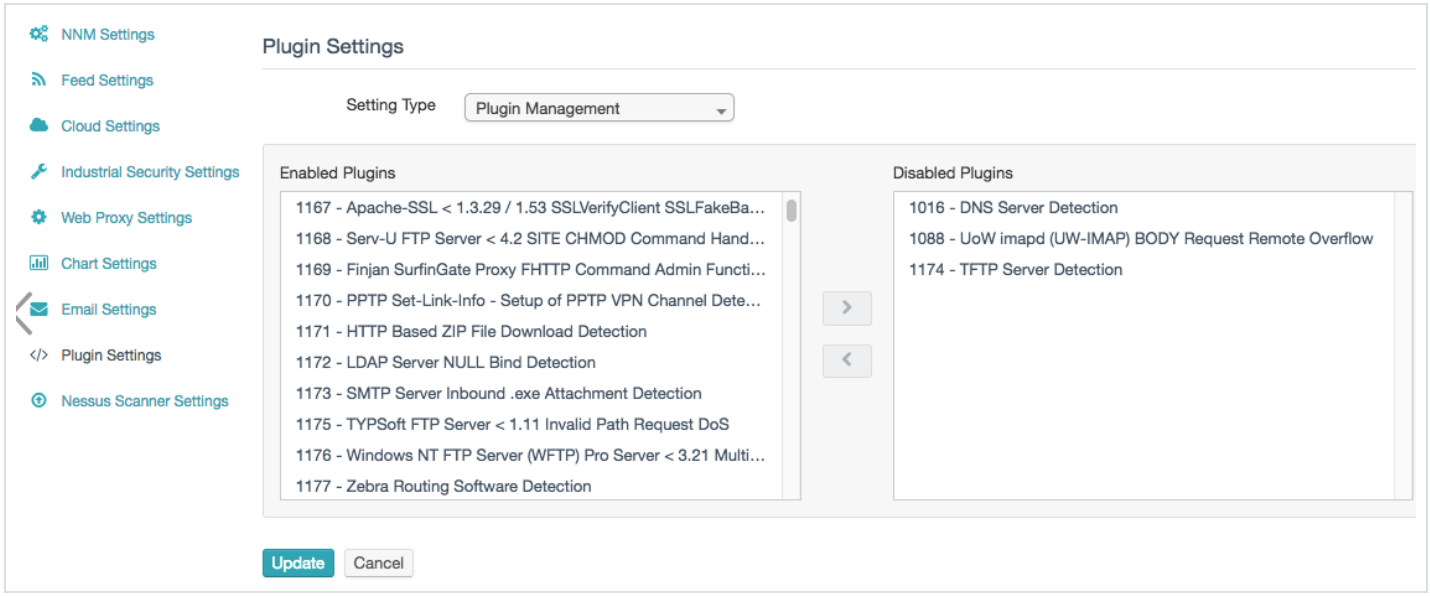
1. Click **Configuration** > **Email Settings** section.
2. On the left side of the row for the email notification you want to delete, select the check box.
3. Repeat step 2 for each email notification you want to delete.
4. Click **Actions** > **Delete Notifications**.

   A dialog box appears confirming your selection to delete the email notifications.
5. Click the **Delete** button.

   The email notifications are deleted and the corresponding notifications are no longer sent.

Plugin Settings Section

The **Plugin Settings** section allows you to create custom, passive plugins, enable/disable existing plugins and PASLs, and modify the SIEM core queries.



The **Plugin Settings** section contains the following subsections:

- **Plugin Management** - Provides a list of enabled and disabled plugins, respectively, the options to move plugins between those lists, and the option to delete custom plugins.
- **PASL Management** - Provides a list of enabled and disabled PASLs, respectively, and the options to move PASLs between those lists.

- **SIEM Plugin Management** - Shows options for managing plugins related to SIEM analysis.

  > **Note:** SIEM analysis features are only available for RH/CentOS 7 and RH/CentOS 8.

  The following table provides a brief summary of each SIEM plugin setting:

SIEM Plugin Option	Purpose
Key Name	The SIEM event category for events collected from a Windows or Linux system.
Plugin IDs	The plugin IDs associated with the selected SIEM event category/**Key Name**.
SIEM Server	The SIEM server related to the plugin. The options for this box are configured in the **SIEM Servers** section of the Tenable Network Monitor Settings Section.
Query Prefix	(Optional) The custom query prefix for additional query functionality.
Core Query	The system-generated query related to the selected **Key Name**. This query is not configurable.
Query Suffix	(Optional) The custom query suffix for additional query functionality.

- **Create Custom Plugin** - Shows options for creating custom plugins and creating new plugin fields.

  The following table provides a brief summary of each custom plugin option:

Custom Plugin Option	Purpose
ID	The unique numeric ID of the plugin.
Name	The name of the plugin. The plugin name should start with the vendor name.
Description	The full text description of the vulnerability.
Synopsis	A brief description of the plugin or vulnerability.
Solution	Remediation information for the vulnerability.
See Also	External references to additional information regarding the vulnerability.
Risk	**Info**, **Low**, **Medium**, **High**, or **Critical** risk factor.
Plugin Output	Displays dynamic data in Tenable Network Monitor plugin reports.
Family	The family to which the plugin belongs.
Dependency	Other dependencies required to trigger the custom plugin.
NoPlugin	Prevents a plugin from being evaluated if another plugin has already matched. For example, it may make sense to write a plugin that looks for a specific anonymous FTP vulnerability, but to disable it if another plugin that checked for anonymous FTP had already failed.
No Output	For plugins that are written specifically to be used as part of a dependency with another plugin. When enabled, this keyword causes Tenable Network Monitor not to report anything for any plugin.

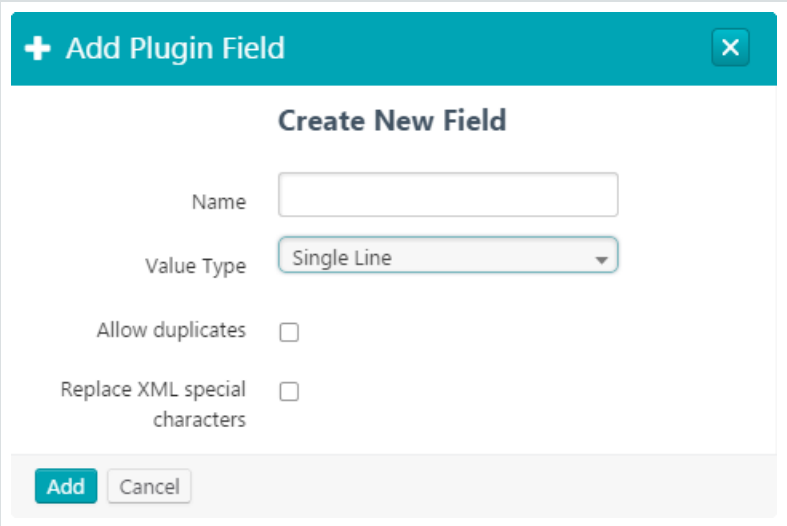
Custom Plugin Option	Purpose
Client Issue	Indicates the vulnerability is located on the client side.
Plugin Type	**Vuln**, **realtime**, or **realtimeonly** plugin type.
cve	The CVE reference.
bid	The Bugtraq ID (BID) reference.
osvdb	The external reference (e.g., OSVDB, Secunie, MS Advisory).
nid	To track compatibility with the Tenable Nessus vulnerability scanner, Tenable® associates Tenable Network Monitor vulnerability checks with relevant Tenable Nessus vulnerability checks. Multiple Tenable Nessus IDs can be listed under one **`nid`** entry such as **`nid=10222,10223`**.
cpe	Filters the result of discovered vulnerabilities based on their CPE identifier.
Match	This keyword specifies a set of one or more simple ASCII patterns that must be present in order for the more complex pattern analysis to take place. The **`match`** keyword gives Tenable Network Monitor significant performance and functionality.
Regex	Specifies a complex regular expression search rule applied to the network session.
Revision	The revision number associated with custom plugin.
Raw Text Preview	A preview of the custom plugin in raw text. An xample of a custom plugin created to find a IMAP Banner of Tenable Rocks is:

Custom Plugin Option	Purpose
	id=79000 name=IMAP Banner description=An IMAP server is running on this port. Its banner is Tenable Rocks risk=NONE match=OK match=IMAP match=server ready regex=^.*OK.*IMAP.*Tenable Rocks

Add a Plugin Field

1. Click **Configuration** > **Plugin Settings** > **Setting Type** > **Create Custom Plugin** > **Add Plugin Field**.

   The **Add Plugin Field** window appears.



2. In the **Name** box, type a name for the plugin.
3. From the **Value Type** drop-down box, select a value type for the plugin.

4. If you wish to allow duplicates of this plugin, select the **Allow Duplicates** check box.
5. If you wish to replace XML special characters, select the **Replace XML Special Characters** check box.
6. Click **Add**.

   The new plugin fields appear below the **No Output** check box.

Delete a Custom Plugin

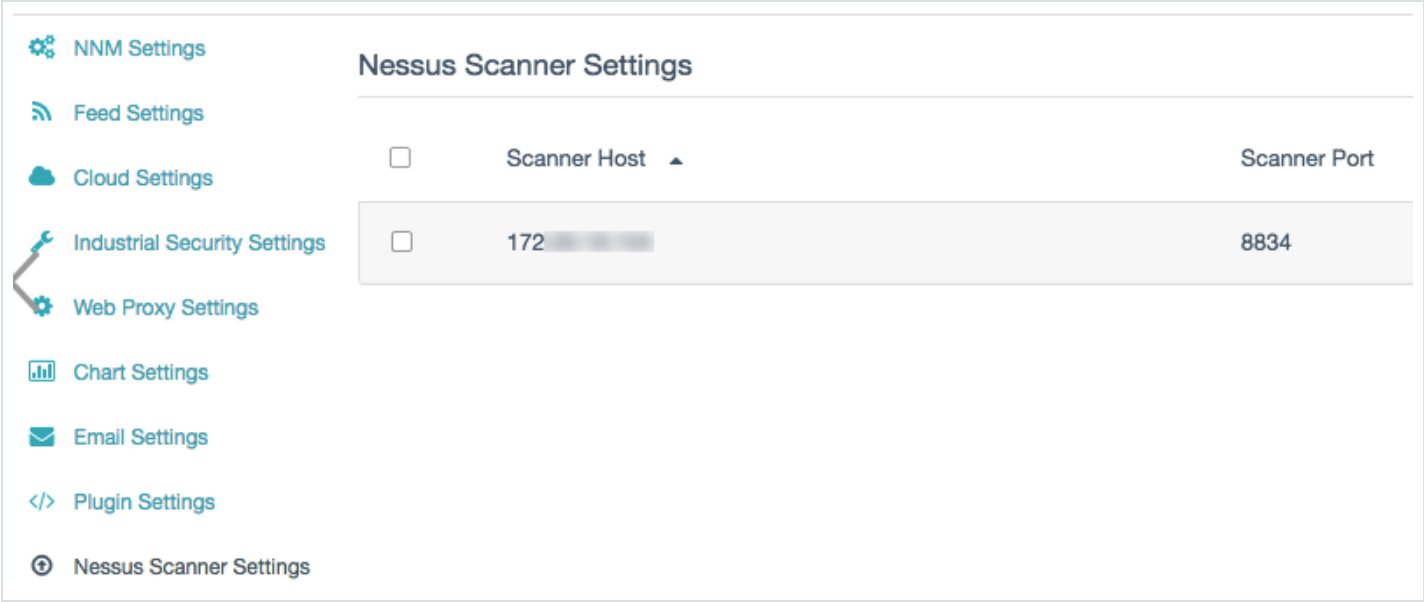
1. Click **Configuration** > **Plugin Settings**.
2. Select one or more custom plugins that you want to delete.
3. Click **Actions** > **Delete Custom Plugins**.

   A dialog box appears confirming your selection to delete the custom plugins. You can delete only user-created plugins.
4. Click **Delete**.

   The custom plugins are deleted.

Nessus Scanner Settings Section

The **Nessus Scanner Settings** section provides a list of the available Tenable Nessus 6.4+ scanners and the ability to add, edit, or remove a Tenable Nessus scanner.



Note: Tenable Nessus Professional 7 is not supported.

Each Tenable Nessus scanner must be configured with the following parameters:

Name	Description
Scanner Host	The domain name or IP address of the Tenable Nessus server.
Scanner Port	The port of the Tenable Nessus server.
Access Key	The first half of a Tenable Nessus API Key, which is used to authenticate with the Tenable Nessus REST API.
Secret Key	The second half of a Tenable Nessus API Key, which is used to authenticate with the Tenable Nessus REST API.

Note: For details on how to obtain an API Key (Access Key and Secret Key), refer to the Tenable Nessus user guide.

Add a Tenable Nessus Scanner

To add a Tenable Nessus Scanner:

1. Click **Configuration** > **Nessus Scanner Settings** > **Add Nessus Scanner**.

   The **Add Nessus Scanner** window appears.
2. In the **Scanner Host** box, type the domain name or IP address of the Tenable Nessus server.
3. In the **Scanner Port** box, type the port of the Tenable Nessus server.
4. In the **Access Key** box, type the first half of a Tenable Nessus API Key, which is used to authenticate with the Tenable Nessus REST API.
5. In the **Secret Key** box, type the second half of a Tenable Nessus API Key, which is used to authenticate with the Tenable Nessus REST API.
6. Click the **Add Nessus Scanner** button.

   The Tenable Nessus scanner appears in the **Nessus Scanner Settings** section.

Delete a Tenable Nessus Scanner

To delete one Tenable Nessus scanner:

1. Click **Configuration** > **Nessus Scanner Settings**.
2. Hover over the scanner you want to delete.
3. Click the ✖ button.

   A dialog box appears confirming your selection to delete the scanner.
4. Click **Delete**.

   The scanner is deleted.

To delete multiple Tenable Nessus scanners:

1. Click **Configuration** > **Nessus Scanner Settings** section.
2. On the left side of the row for the scanner you want to delete, select the check box.
3. Repeat step 2 for each scanner you want to delete.

4. Click **Actions** > **Delete Nessus Scanners**.

   A dialog box appears confirming your selection to delete the scanners.

5. Click **Delete**.

   The scanners are deleted.

Additional Resources

This section describes the following information about Tenable Network Monitor that is not included in the **Features** and **How To** sections:

- Command Line Operations
- Unknown or Customized Ports
- Real-Time Traffic Analysis Configuration Theory
- Modules
- Internal Tenable Network Monitor Plugin IDs
- Tenable Network Monitor Plugins
- Working with Tenable Security Center
- Standard Syslog Message Types
- Custom SSL Certificates
- Configure Tenable Network Monitor for Certificates

For more Tenable Network Monitor deployment information, see the Tenable Network Monitor Deployment Guide.

Command Line Operations

The Tenable Network Monitor engine provides many options to update and configure Tenable Network Monitor from the command line in Linux and Windows. All command lines should be run by users with root or administrative privileges.

- Common Command Line Operations
- Linux Command Line Operations
- Windows Command Line Operations

Common Command Line Operations

Tenable Network Monitor can be run from the command line to update plugins, perform configuration tasks, and analyze Pcap files to generate a report file for use with Tenable Security Center or other programs. Running the Tenable Network Monitor binary with the **-h** option displays a list of available options.

Note: You must stop Tenable Network Monitor before running command line operations.

Tenable Network Monitor Binary Locations

The Tenable Network Monitor binary for Linux can be found in the following location:

```
# /opt/nnm/bin/nnm
```

The Tenable Network Monitor binary for Windows can be found in the following location:

```
C:\Program Files\Tenable\NNM\nnm.exe
```

Tenable Network Monitor Command Line Options

Note: While you can configure many advanced settings via the command line using custom parameters, others use standard parameters. For example, while the **ACAS Classification** setting uses the custom **--add** parameter, the **Login Banner** setting does not require the **--add** parameter.

Option	Purpose
`-a <activation code>`	Type the Activation Code to activate Tenable Network Monitor in standalone mode to enable plugin updates and monitoring functions. If your Tenable Network Monitor system is managed by Tenable Security Center and is running in Standard mode, you can use the following command: **-a SecurityCenter** If your Tenable Network Monitor system is managed by Tenable Security Center and is running in High Performance mode, you can use the following command: **-a SecurityCenter <activation code>**

Option	Purpose
	If your Tenable Network Monitor system is managed by Tenable One Vulnerability Management and is running in Standard mode, you can use the following command: **`-a Cloud`** Before running the -a command for Tenable Network Monitor that is managed by Tenable One Vulnerability Management, you should first configure the **`Cloud Host`**, **`Cloud Port`**, **`Cloud Key`**, and **`NNM Name`** parameters.
`--config --add "custom_paramater name" "parameter value"`	Add a custom configuration parameter for Tenable Network Monitor or an Tenable Network Monitor Proxy. The double quote characters are required, although single quotes may be used when special characters are required.
`--config --delete "custom_parameter name"`	The **`delete`** command may be used to remove custom configuration parameters.
`--config --list`	Lists the current Tenable Network Monitor and Tenable Network Monitor Proxy configuration parameters. Parameter values are listed to the left of the colon character and are case sensitive. The value of the parameter displays to the right of the colon character.
`--config "parameter name" ["parameter`	Displays the defined parameter value. If a value is added at the end of the command, the parameter updates with the new setting. The double quote characters are required, although single quotes may be used when special characters are required.

Option	Purpose
`value"]`	**Note:** While CLI changes to some parameters do not require restarting Tenable Network Monitor for the change to take effect, you must restart Tenable Network Monitor after changing the location of the realtime log file.
`--config "Send Telemetry Data" <0-1>`	When enabled, Tenable Network Monitor periodically and securely sends non-confidential, anonymous product usage data to Tenable. Usage statistics include Tenable Network Monitor license and operational mode (discovery or detailed vulnerability analysis), Tenable Network Monitor version being used to verify that systems have been upgraded properly with the latest release, etc. Tenable uses the data to see how Tenable Network Monitor is being used by customers to make it more useful and to verify that Tenable Network Monitor is being upgraded properly. Disable this option at any time by setting it to 0.
`-d debug mode`	Runs Tenable Network Monitor in debug mode for troubleshooting purposes. This option causes the system to use more resources and should be enabled only when directed by a Tenable Support Technician.
`-f packet_dump_file`	Replaces **`packet_dump_file`** with the path to the .pcap or .pcapng file you want Tenable Network Monitor to process. **Note:** Windows does not support the **pcapng** format.
`-h`	Displays the command line options help file.
`-k`	Displays the Tenable Network Monitor activation status.
`-L`	Displays a list of the license declarations.

Option	Purpose
`-l`	Displays a list of the plugin IDs that are loaded by Tenable Network Monitor.
`--list-interfaces`	Displays the interfaces that Tenable Network Monitor can access for packet collection. Useful to display interfaces to 10Gb cards running in high performance mode.
`-m`	Shows various aspects of memory usage during the processing of the **NNM** command.
`-p packet_dump_file`	Dumps payload packet data in Hex and ASCII to the specified packet_dump_file. This command dumps internal data from packet and plugins processing. This can be useful for debugging plugin issues.
`Tenable Network Monitor --users --add`	Adds a new user to Tenable Network Monitor with the expected values of: ["username" "password" admin]: add new user. Expected values for “admin” flag are either: 1 - grant user administrative privileges, or 0 - don’t grant user administrative privileges. Adds a new user to Tenable Network Monitor. Optionally, you can add the following arguments: **`NNM --users --add ["username" "password" admin]`** Expected values for “admin” flag are: • 1 - grant user administrative privileges • 0 - don’t grant user administrative privileges
`Tenable Network Monitor --`	Changes an Tenable Network Monitor user's password.

Option	Purpose
`users --chpasswd`	
`Tenable Network Monitor --users --delete "user"`	Removes a user from Tenable Network Monitor, where "user" is the username to be deleted.
`--register-offline <license file>`	Registers Tenable Network Monitor in offline mode when you insert the license file obtained from Tenable®.
`--config 'Software Update Type' <0-3>`	Configures the type of software update that runs when Tenable Network Monitor updates. • `0` - Disables all updates. • `1` - Updates only plugins. • `2` - Updates web server, HTML client, and plugins. • `3` - Updates all components (web server, HTML client, plugins, and engine).
`--update-software <update package tarball>`	Runs a software update using the setting you configured for `Software Update Type`. Optionally, if you are running Tenable Network Monitor in offline mode and have a custom update package, append the update package tarball name.
`-v`	Shows the version information about the installed instance of Tenable Network Monitor.

Linux Command Line Operations

You must run all commands with root privileges.

Start, Stop, or Restart Tenable Network Monitor

Action	Command to Manage Tenable Network Monitor

Start	`# service nnm start`
	then
	`# ps aux|grep nnm`

Stop	`# service nnm stop`
Restart	`# service nnm restart`

Once a day, as scheduled, if Tenable Security Center has received new Tenable Network Monitor plugins from Tenable®, it installs them in the Tenable Network Monitor plugin directory. Tenable Network Monitor detects the change, automatically reloads, and begins using the new plugins.

Real-time Tenable Network Monitor data is communicated to the configured Tenable Log Correlation Engine server or Syslog server(s) in real-time.

Configure HugePages

Before You Begin

These steps assume that your system meets the System Requirements necessary for running Tenable Network Monitor in High Performance mode.

To configure HugePages:

1. Ensure your HugePages settings are correct by using the following command:

```
# grep Huge /proc/meminfo
AnonHugePages: 0kB
HugePages_Total: 1024
HugePages_Free: 1024
HugePages_Rsvd: 0
HugePages_Surp: 0
Hugepagesize: 2048kB
```

   The **Hugepagesize** parameter is set to 2048 kB by default, but this option is configurable. Tenable Network Monitor requires a minimum of 1024 HugePages that are at least 2048 kB in size.

   > **Note:** In some cases, the HugePages_Free parameter may be set to 0, however, this does not necessarily indicate insufficient HugePage memory.

2. Reserve a certain amount of memory to be used as HugePages by using the following command to update the kernel parameter manually:

   /bin/echo 1024 > /sys/devices/system/node/node0/hugepages/hugepages-2048kB/nr_hugepages

   The number of HugePages reserved by the kernel changes to 1024, and HugePages become available.

   > **Note:** If the kernel does not have enough memory available to satisfy this request, the command may fail without notifying the user. After running this command, the HugePages configuration should be checked again using the command in step 1.

3. To ensure that your HugePages configuration persists across system reboots, refer to the following section that corresponds to your Linux kernel version.

CentOS 6

Update the persistent kernel configuration files using one of the following commands:

In the **/etc/sysctl.conf** file, add the **vm.nr_hugepages=1024** parameter and reload the kernel configuration with the **sysctl -p** command. Alternatively, you can reboot the system.

-or-

In the **/etc/grub.conf** file, on the kernel startup line, add the **hugepages=1024** parameter and reboot the system.

CentOS 7, 8

Update the persistent kernel configuration files using one of the following commands:

In the **/etc/sysctl.conf** file, add the **vm.nr_hugepages=1024** parameter and reload the kernel configuration with the **sysctl -p** command. Alternatively, you can reboot the system.

-or-

In the **/etc/sysconfig/grub** file, on the kernel startup command **(GRUB_CMDLINE_LINUX)**, add the **hugepages=1024** parameter. Reload the kernel configuration with the **grub2-mkconfig -o /etc/grub2** command and reboot the system.

4. Connect the file system to the HugePages subsystem using the following steps:
   a. Execute the **/bin/mkdir -p /mnt/nnm_huge** command.
   b. Execute the **/bin/mount -t hugetlbfs nodev /mnt/nnm_huge** command.
   c. Additionally, open the **/etc/fstab** file location and add the following record:

      nodev /mnt/nnm_huge hugetlbfs rw 0 0

File Locations

Tenable Network Monitor installs its files in the following locations:

Path	Purpose
/opt/nnm	Base directory.
/opt/nnm/bin	Location of the **NNM** and **Tenable Network Monitor Proxy** executables, plus several helper tools for the **Tenable Network**

Path	Purpose
	Monitor Proxy daemon.
/opt/nnm/docs	Contains the software license agreement for Tenable Network Monitor.
/opt/nnm/var	Contains the folders for Tenable Network Monitor and the Tenable Network Monitor-Proxy.
/opt/nnm/var/nnm	Contains plugins, discovered vulnerabilities, log files, keys, and other miscellaneous items.
db	Contains the database files related to the configuration, reports, and users for Tenable Network Monitor.
kb	Stores the Tenable Network Monitor knowledge base, if used.
logs	Contains Tenable Network Monitor logs.
plugins	Contains the Tenable Network Monitor plugins delivered via Tenable Security Center, Tenable One Vulnerability Management, the Tenable Network Monitor Feed, or updated via the command line or web interface if Tenable Network Monitor is running in Offline mode. **Note:** If Tenable Security Center is used to manage the plugins, do not change this path from the default **/opt/nnm/var/nnm**.
nnm-services	A file Tenable Network Monitor uses to map service names to ports. This file may be edited by the user. Plugin updates do not overwrite modifications to the file.
reports	Contains reports generated by Tenable Network Monitor. This

Path	Purpose
	folder contains the `.nessus` file generated by default.
`scripts`	Contains the files for the Tenable Network Monitor Web server.
`ssl`	Contains SSL certificates used by the proxy and web server for the SSL connection between itself and Tenable Security Center or the web browser.
`users`	Contains folders for user files and reports.
`www`	Contains the files for the Tenable Network Monitor web front-end.
`/opt/nnm/var/nnm-proxy`	Parent folder for files used/created by the Tenable Network Monitor proxy.
`logs`	Contains the Tenable Network Monitor proxy and Tenable Network Monitor proxy service logs.

Windows Command Line Operations

You must run all programs as a local user with administrative privileges. To do so, when UAC is enabled, right-click on the installer program and select **Run as Administrator**.

Start or Stop Tenable Network Monitor

Action	Command to Manage Tenable Network Monitor
Start	`net start "Tenable NNM Proxy"`
Stop	`net stop "Tenable NNM Proxy"`

Alternatively, Tenable Network Monitor can be managed via the **Services** control panel utility. Under the list of services, find **Tenable NNM Proxy Service**. Right click on the service to provide a list of options for the services, including the ability to start or stop the **Tenable NNM** or **Tenable NNM Proxy** service.

File Locations

Tenable Network Monitor installs its files in the following locations:

Path	Purpose
C:\Program Files\Tenable\NNM	Contains Tenable Network Monitor binaries and dependent libraries.
C:\ProgramData\Tenable\NNM	Contains all data files consumed and output by Tenable Network Monitor and Tenable Network Monitor Proxy (e.g., configuration, plugins, logs, and reports). **Note:** This directory does not appear unless the Windows Hidden Files and Folders option is enabled.

The following table contains the folder layout under **`C:\ProgramData\Tenable\NNM`**:

Folder	Purpose
docs	Contains the software license agreement for Tenable Network Monitor.
`NNM`	Parent folder for Tenable Network Monitor logs, reports, plugins, and scripts directories. Also contains the Tenable Network Monitor-services file.
`db`	Contains the database files relating to the configuration, reports, and users for Tenable Network Monitor.

Folder	Purpose
`kb`	Stores the Tenable Network Monitor knowledge base, if used.
`logs`	Contains Tenable Network Monitor logs.
`plugins`	Contains the Tenable Network Monitor plugins delivered via Tenable Security Center, Tenable One Vulnerability Management, the Tenable Network Monitor Feed, or updated via the command line or web interface if Tenable Network Monitor is running in Offline mode. **Note:** Do not change this path from the default `C:\ProgramData\Tenable\NNM\nnm` if Tenable Security Center is used to manage the plugins.
`nnm-services`	A file Tenable Network Monitor uses to map service names to ports. This file may be edited by the user. Plugin updates do not overwrite modifications to the file.
`reports`	Contains reports generated by Tenable Network Monitor . This folder contains the `.nessus` file generated by default.
`scripts`	Contains the files for the Tenable Network Monitor Web server.
`ssl`	Contains SSL certificates used by the proxy and web server for the SSL connection between itself and Tenable Security Center or the web browser.
`users`	Contains folders for user files and reports.
`www`	Contains the files for the Tenable Network Monitor web front-end.
`nnm-proxy`	Parent folder for files used/created by the Tenable Network Monitor proxy.
`logs`	Contains Tenable Network Monitor proxy and Tenable Network Monitor proxy service logs.

Folder	Purpose
`run`	Contains process ID temporary files.

Configure Tenable Network Monitor for Certificates

To allow SSL certificate authentication, you must first configure the Tenable Network Monitor web server with a server certificate and CA.

This process allows the web server to trust certificates created by the CA for authentication purposes. Generated files related to certificates must be owned by root:root and, by default, have the correct permissions.

This section contains the following instructions:

- Create Self-Signed SSL Certificates for Tenable Network Monitor
- Generate a Certificate Signing Request and Import a Signed Certificate
- Create Tenable Network Monitor SSL Certificates for Login
- Connect to Tenable Network Monitor with a User Certificate

Create Self-Signed SSL Certificates for Tenable Network Monitor

By default, Tenable Network Monitor uses a self-signed SSL certificate for secure communication. You can generate a new self-signed certificate if your current certificate expires or if you need to update the certificate information.

> **Note:** These certificates are specific to Tenable Network Monitor and are not compatible with CA-signed certificates. To install CA-signed SSL certificates, see Custom SSL Certificates. Additionally, if you created SSL certificates to log in to your Tenable Network Monitor host, you must recreate them.

Before you begin:

Before you generate a new certificate, you must stop the Tenable Network Monitor service.

1. Open your terminal or command prompt.
2. Stop the Tenable Network Monitor service:
    1. Linux: `# service nnm stop`
    2. Windows: Use the Services snap-in to stop the Tenable Network Monitor service.

To generate a new self-signed certificate for Tenable Network Monitor:

Use the `nnm-make-cert` utility to create a new certificate and private key.

1. Navigate to the directory where Tenable Network Monitor is installed.
2. Run the `nnm-make-cert` utility:

Operating System	Command
Linux	`# /opt/nnm/bin/nnm-make-cert`
Windows	`C:\Program Files\Tenable\NNM\nnm-make-cert.exe`

3. When the utility prompts you with the question `Do you want to create a NEW NNM SSL certificate?`, answer `y`.
4. Follow the on-screen prompts to enter your organization details, such as:
    - Country Name
    - State or Province
    - Common Name (use the FQDN or IP address of your Tenable Network Monitor server)

    The utility generates two files in the ssl directory:
    - `cacert.pem`
    - `servercert.pem`

What to do next:

- Restart the Tenable Network Monitor service:

Operating System	Command
Linux	`# service nnm restart`
Windows	Restart the Tenable Network Monitor service from the Services snap-in.

- Open your browser and navigate to the Tenable Network Monitor interface (for example, `https://<your-ip-address>:8835`).
- Verify the new certificate details in your browser's security settings.

Generate a Certificate Signing Request and Import a Signed Certificate

To prevent browser warnings about untrusted certificates, you can have a certificate authority (CA) sign the server certificate for Tenable Network Monitor. Use the `nnm-make-cert` utility to generate a certificate signing request (CSR) for the CA to sign, and then import the signed certificate.

The `nnm-make-cert` utility creates the CSR from the existing server private key on the Tenable Network Monitor host. The private key never leaves the host, and the utility does not modify it.

> **Note:** These options support simple public key infrastructure (PKI) implementations. For more complex implementations, consult a PKI expert to provide valid certificates.

Process Overview

1. On the Tenable Network Monitor host, generate a CSR with `nnm-make-cert generate-csr`.
2. Submit the CSR to your CA. The CA returns a signed server certificate and its CA certificate.
3. On the Tenable Network Monitor host, import the signed certificate with `nnm-make-cert import-signed-cert`.

Generate a Certificate Signing Request

Run `nnm-make-cert generate-csr` without options to accept the default values. For required values, such as the common name, Tenable Network Monitor uses the host name. Tenable Network Monitor leaves optional values, such as the organizational unit and email address, blank.

To generate a certificate signing request:

1. On the Tenable Network Monitor host, run the `nnm-make-cert generate-csr` command. Include any options you want to set. For example, to set the common name, subject alternative names, and output location:

Operating System	Command
Linux	`# /opt/nnm/bin/nnm-make-cert generate-csr --cn=nnm.example.com --san=dns:nnm.example.com,ip:192.0.2.10 --output=/root/server.csr`
Windows	`C:\Program Files\Tenable\NNM\nnm-make-cert.exe generate-csr --cn=nnm.example.com --san=dns:nnm.example.com,ip:192.0.2.10 --output=C:\certs\server.csr`

   If you do not specify `--output`, Tenable Network Monitor creates the `server.csr` file in a temporary directory.
2. Submit the `server.csr` file to your CA.
3. When the CA returns the signed server certificate, save the signed certificate, the CA certificate, and (if provided) the server chain file to a location on the Tenable Network Monitor host.

generate-csr Options

Option	Description
`--cn=<hostname>`	The common name for the certificate. Default value: the host name of the Tenable Network Monitor host.
`--country=<CC>`	The two-letter ISO 3166-1 alpha-2 country code.
`--state=<state>`	The state or province.
`--location=<city>`	The city or locality.
`--org=<name>`	The organization name.
`--orgunit=<unit>`	The organizational unit.
`--email=<address>`	The contact email address.
`--san=dns:<host>,ip:<address>,...`	A comma-separated list of subject alternative names. Each entry must start with `dns:` or `ip:`.
`--output=<csr_path>`	The path where Tenable Network Monitor creates the CSR. Use this option to save the CSR to a directory you control instead of a temporary directory.
`--no_x509_exts=1`	Omits the x509 extensions that Tenable Network Monitor adds by default to meet NIAP requirements. Use this option only if the extensions conflict with your requirements.

Note: To avoid issues with spaces in file paths and to prevent code injection, file paths can contain only the following characters: `a-z A-Z 0-9 . _ / \ : -`

x509 Extensions

By default, Tenable Network Monitor includes the following x509 extensions in the CSR to meet NIAP requirements:

Extension	Value
`key_usage`	critical, nonRepudiation, digitalSignature, keyEncipherment
`ext_key_usage`	serverAuth

Your CA or PKI expert must add the following extensions when signing the certificate:

Extension	Value
`authority_key_identifier`	keyid from the CA
`subject_key_identifier`	hash

Import a Signed Server Certificate

After your CA signs the CSR, import the signed certificate. The utility installs the signed certificate in the Tenable Network Monitor SSL directory as `servercert.pem`, replacing the existing file, and installs the CA certificate as `cacert.pem`.

The SSL directory for each operating system is:

Operating System	SSL Directory
Linux	`/opt/nnm/var/nnm/ssl`
Windows	`C:\ProgramData\Tenable\NNM\nnm\ssl`

To import a signed server certificate:

1. Back up the existing `.pem` files in the SSL directory.
2. On the Tenable Network Monitor host, run the `nnm-make-cert import-signed-cert` command with the paths to the files from your CA:

Operating System	Command
Linux	`# /opt/nnm/bin/nnm-make-cert import-signed-cert --servercert=<path> --cacert=<path>`
Windows	`C:\Program Files\Tenable\NNM\nnm-make-cert.exe import-signed-cert --servercert=<path> --cacert=<path>`

3. Restart the Tenable Network Monitor service.
4. Connect to the Tenable Network Monitor web interface (`https://<host>:8835`) and confirm that your browser trusts the certificate.

import-signed-cert Options

Option	Description
`--servercert=<server_cert_path>`	The path to the signed server certificate from your CA. The utility installs this file in the Tenable Network Monitor SSL directory as `servercert.pem`.
`--cacert=<cacert_path>`	The path to the public certificate of your CA. The utility installs this file in the SSL directory as `cacert.pem`.
`--serverchain=<serverchain_path>`	Optional. The path to a file that establishes the chain of trust to your server certificate. If your CA provides multiple files, the file must include the complete trust chain. The utility installs this file in the SSL directory as `serverchain.pem`.

Option	Description
`--verbose=1`	Optional. Displays additional information if OpenSSL considers the certificates invalid.

The utility verifies the certificates against the CA certificates in the `known_CA.inc` and `custom_CA.inc` files in the Tenable Network Monitor `plugins` directory. If your CA is not in `known_CA.inc`, add your CA certificate to `custom_CA.inc` in the same directory.

Tip: To check your files before you import them, use the OpenSSL `verify` command. For example: `openssl verify -CAfile ca.pem servercert.crt`

Create Tenable Network Monitor SSL Certificates for Login

You can log in to an Tenable Network Monitor server with SSL certificates. Once certificate authentication is enabled, username and password login is disabled. You must create the certificates using the **`nnm-make-cert`** command.

Note: When asked if you want to create a server certificate, select **no** to be prompted for the user certificate information.

To create Tenable Network Monitor SSL certificates for login:

1. On the Tenable Network Monitor server, run the **`nnm-make-cert`** command.

Operating System	Command
Linux	**`# /opt/nnm/bin/nnm-make-cert`**
Windows	**`C:\Program Files\Tenable\NNM\nnm-make-cert`**

2. To create an NNM SSL certificate, respond y to the question `Do you want to create NEW NNM SSL certificate?`

   New certificate files are created, for example, `cacert.pem` and `cakey.pem`.

Operating System	Directory
Linux	**/opt/nnm/var/nnm/ssl**
Windows	**C:\ProgramData\Tenable\NNM\nnm\ssl**

Follow the next steps to create SSL user certificates for login:

a. To create an SSL user certificate, respond `n` to the question `Do you want to create NEW NNM SSL certificate?` and answer the remaining questions.

b. Two files, the certificate and the key, are created in the temporary directory, for example, `nnm-4d931cce`.

Operating System	Directory
Linux	**/opt/nnm/var/nnm/temp**
Windows	**C:\ProgramData\Tenable\NNM\nnm\temp**

3. Combine your login SSL certificates and export the certificate and key file into a format that can be imported into the web browser, such as `.pfx`.

   In the following example where the username is admin, the files `cert_admin.pem` and `key_admin.pem` are combined into the file `combined_admin.pfx` .

   Note: The username you type must correspond with an existing username in Tenable Network Monitor. By default, Tenable Network Monitor has only one administrative user. If you add another administrative user, then you can use more than one certificate.

```
openssl pkcs12 -export -out combined_admin.pfx -inkey key_admin.pem -in cert_admin.pem -chain -CAfile /opt/nnm/var/nnm/ssl/cacert.pem -passout 'pass:password' -name 'Tenable Network Monitor User Certificate for: admin'
```

   The resulting file is created in the directory from which the command was launched.

Note: If your Tenable Network Monitor is managed by Tenable Security Center you must concatenate the cert_admin.pem and key_admin.pem files into a new file (for example, "sc_admin.pem"). Upload this file to Tenable Security Center to log on to NNM using SSL certificates.

4. Import the combined file into the web browser's personal certificate store.
5. Configure the Tenable Network Monitor server for certificate authentication using the appropriate command for your operating system.

   Once certificate authentication is enabled, username and password login is disabled.

Operating System	Command
Linux	`# /opt/nnm/bin/nnm --config "Enable SSL Client Certificate Authentication" "1"`
Windows	`C:\Program Files\Tenable\NNM\nnm --config "Enable SSL Client Certificate Authentication" "1"`

Connect to Tenable Network Monitor with a User Certificate

To connect to Tenable Network Monitor with a user certificate:

1. In a web browser, navigate to **`https://<ip address or hostname>:8835`**.

   The browser displays a list of available certificates.
2. Select the appropriate certificate.

   The certificate becomes available for the current Tenable Network Monitor session.
3. Click the **Sign In** button.

   You are automatically logged in as the designated user and Tenable Network Monitor can be used normally.

Note: If you log out of Tenable Network Monitor, the standard Tenable Network Monitor login

screen appears. If you want to log in with the same certificate, refresh your browser. If you want to use a different certificate, restart your browser session.

Custom SSL Certificates

By default, Tenable Network Monitor is installed and managed using HTTPS and SSL support and uses port 8835. Default installations of Tenable Network Monitor use a self-signed SSL certificate.

To avoid browser warnings, use a custom SSL certificate specific to your organization. During the installation, Tenable Network Monitor creates two files that make up the certificate: servercert.pem and serverkey.pem. Replace these files with certificate files generated by your organization or a trusted CA. Also, you may have to update cacert.pem and cakey.pem if your servercert.pem is signed by intermediate CAs.

A certificate chain link from your servercert.pem certificate must be defined where the subject/issuer pairs of intermediate CAs match all the way to a root certificate or there is a link to the signing CA in the final intermediate CA. The certificate chain can be defined in cacert.pem or a serverchain.pem file. Use the openssl s_client utility to troubleshoot your certificate chains. You may have to consult with a PKI expert to set up your certificates. For example, **`openssl s_client -connect host_name:8835 -state -debug`** shows the certificates being used and the subject/issuer chain link.

Before replacing the certificate files:

1. Stop the Tenable Network Monitor server.
2. Back up the original files in case you need to restore them.
3. Replace the files and re-start the Tenable Network Monitor server.

Note: If the certificate is generated by a trusted CA, subsequent connections to the scanner do not show an error.

Certificate File Locations

Operating System	Directory
Linux	`/opt/nnm/var/nnm/ssl/servercert.pem` `/opt/nnm/var/nnm/ssl/serverkey.pem`
Windows	`C:\ProgramData\Tenable\NNM\nnm\ssl\servercert.pem` `C:\ProgramData\Tenable\NNM\nnm\ssl\serverkey.pem`

Tip: Optionally, you can use the /getcert switch to install the root CA in your browser, which removes the warning:
https://<IP address>:8835/getcert

To set up an intermediate certificate chain, place a file named **`serverchain.pem`** in the same directory as the **`servercert.pem`** file.

This file must contain the 1-n intermediate certificates (concatenated public certificates) necessary to construct the full certificate chain from the Tenable Network Monitor server to its ultimate root certificate (one trusted by the user's browser).

SSL Client Certificate Authentication

Tenable Network Monitor supports use of SSL client certificate authentication. When the browser is configured for this method, the use of SSL client certificates is allowed.

Tenable Network Monitor allows for password-based or SSL Certificate authentication methods for user accounts. When creating a user for SSL certificate authentication, use the Tenable Network Monitor-make-cert-client utility through the command line on the Tenable Network Monitor server.

Configure Tenable Network Monitor for NIAP Compliance

If your organization requires that your instance of Tenable Network Monitor meets National Information Assurance Partnership (NIAP) standards, you can configure Tenable Network Monitor so that relevant settings are compliant with NIAP standards.

Configure Tenable Network Monitor

Before you begin:

- Ensure you are running Tenable Network Monitor version 6.3.2 or later.
- If you are using SSL certificates to log in to Tenable Network Monitor, ensure your server and client certificates are NIAP compliant.
- To force all passwords to use NIAP-compliant hashing, the administrator must force resets on all passwords.
- Confirm you have enabled the full disk encryption capabilities provided by the operating system on the host where Tenable Network Monitor is installed.

Tenable Network Monitor 6.6.x supports OpenSSL 3.0.0 and later. Open SSL 3.0.x exhibits the following behaviors and limitations:

- OpenSSL 3.0.x is more strict with SSL Client Certificates than OpenSSL 1.1.1.
- SSL certificates that do not include the **Authority Key Identification** or **Subject Key Identification** sections are not valid in OpenSSL 3.0.7 and later.
- NIAP Mode in Tenable Network Monitor will not allow connections if the user's SSL client certificate does not have the required sections.
- If your SSL certificate includes OCSP servers in the **Authority Information Access** section, these OCSP servers will be used to verify your certificate. Those servers must have **OCSP Signing** enabled in the **Extended Key Usage** section.
- The Tenable Network Monitor User Interface does not allow the user to enable the NIAP option unless the SSL certificate provides the required sections.

To configure Tenable Network Monitor for NIAP compliance:

1. Log in to Tenable Network Monitor using one of the following methods:
   - Username and password.
   - SSL certificates, as described in Connect to Tenable Network Monitor with a User Certificate.
2. Set the Tenable Network Monitor web server to use TLS 1.2 communications:
   a. Click the button.
   b. Click **Configuration**.

      By default, the **NNM Settings** section appears.
   c. In the **Setting Type** drop-down menu, select **NNM Web Server**.
   d. Set **Use TLS 1.2** to **Enabled**.
3. Enable NIAP mode:
   - In the user interface:
     a. Click the button.
     b. Click **Configuration**.

        By default, the **NNM Settings** section appears.
     c. In the **Setting Type** drop-down menu, select **Security Options**.
     d. Set **Enable FIPS Mode**.
     e. Set **Enable NIAP Mode**.
   - In the command line interface:
     a. Access Tenable Network Monitor from a command line interface.
     b. In the command line, enter the following command:

        ```
        nnm --config "Enable FIPS Mode" 1
        ```

        Linux example:

```
/opt/nnm/bin/nnm --config "Enable FIPS Mode" 1
```

c. In the command line, enter the following command:

```
nnm --config "Enable NIAP Mode" 1
```

Linux example:

```
/opt/nnm/bin/nnm --config "Enable NIAP Mode" 1
```

- Tenable Network Monitor does the following:
  - Verifies that Tenable Network Monitor is using TLS 1.2.
  - Regardless of the **Enable Strong Encryption** setting, Tenable Network Monitor overrides the selected cipher suites with the following ciphers: `ECDHE-RSA-AES128-SHA256:ECDHE-RSA-AES128-GCM-SHA256:ECDHE-RSA-AES256-SHA384:ECDHE-RSA-AES256-GCM-SHA384`

    Note: When Tenable Network Monitor is in NIAP mode, Tenable Network Monitor overrides the cipher suites as long as Tenable Network Monitor remains in NIAP mode. If you disable NIAP mode, Tenable Network Monitor reverts to what you had set before.

  - Tenable Network Monitor uses strict certificate validation:
    - Disallows certificate chains if any intermediate certificate lacks the CA extension.
    - Authenticates a server certificate, using the signing CA certificate.
    - Authenticates a client certificate when using client certificate authentication for login.
    - OCSP servers with certificates that do not have **OCSP Signing** in the **Extended Key Usage** section are disallowed and the connection will be terminated, per the requirements specified by NIAP standards.

- Checks the revocation status of a CA certificate using the Online Certificate Status Protocol (OCSP). If the response is that the certificate is revoked or has an unknown CA, then the certificate will be marked as invalid. If the OCSP server is down and there is no response, then the certificate will not be marked as invalid, and its use will be permitted if it is otherwise valid.

Database Encryption

You can convert encrypted databases from the default format (OFB-AES-128) to NIAP-compliant encryption (XTS-AES-256).

Tenable Network Monitor in NIAP mode can read databases with the default format (OFB-AES-128).

To convert encrypted databases to NIAP-compliant encryption:

1. Ensure NIAP mode is enabled, as described in the previous procedure.
2. Stop Tenable Network Monitor.
3. Monitor the files in `/opt/nnm/var/nnm/db` to ensure there are no `.db_shm` or `.db_wal` temporary files in the directory.
4. Enter the following command:

   ```
   nnm security niapconvert
   ```

   Tenable Network Monitor converts encrypted databases to XTS-AES-256 format.

Encryption Strength

Tenable Network Monitor uses the following default encryption for storage and communications.

> **Note:** If your organization requires that your instance of Tenable Network Monitor meets National Information Assurance Partnership (NIAP) standards, certain settings may be configured differently

han the following information. For more information, see Configure Tenable Network Monitor for NIAP Compliance

Function	Encryption
Storing user account passwords	SHA-512 and the PBKDF2 function with a 512 bit key
Database encryption	OFB-AES-128 XTS-AES-256 when configured for NIAP compliance.
Passphrase for SSL browser certificates	Tenable Network Monitor does not store passphrases for any certificates. For information on how OpenSSL encrypts and stores passphrases for SSL certificates, see the OpenSSL documentation.
Communications between Tenable Network Monitor and clients (Tenable Network Monitor user interface users).	TLS 1.2 with the strongest encryption method supported by Tenable Network Monitor and your browser. For information on cipher suites used, see Enable Strong Encryption. Cipher suites are overriden when configured for NIAP compliance.
Communications between Tenable Network Monitor and the Tenable product registration server	TLS 1.2 with ECDHE-RSA-AES256-GCM-SHA384.
Communications between Tenable Network Monitor and the Tenable plugin update server	TLS 1.2 with ECDHE-RSA-AES256-GCM-SHA384.

File and Process Allow List

If you use third-party endpoint security products such as anti-virus applications and host-based intrusion and prevention systems, you should add Tenable Network Monitor to the allow list.

The following table contains a list of Tenable Network Monitor folders, files, and processes that should be allowed.

Note: If your Windows installation uses a non-standard drive or folder structure, use the `%PROGRAMFILES%` and `%PROGRAMDATA%` environment variables.

Windows
Files
C:\Program Files\Tenable\NNM*
C:\ProgramData\Tenable\NNM*
Processes
C:\Program Files\Tenable\NNM\nnm.exe
C:\Program Files\Tenable\NNM\nnm-proxy.exe
C:\Program Files\Tenable\NNM\nnm-proxy-service.exe
Linux
Files (for RHEL 6/CentOS 6 and compatible distributions)
/opt/nnm/*
/etc/init.d/nnm
Files (for RHEL 7/CentOS 7 and later, and compatible distributions like Oracle Linux)

/opt/nnm/*
/usr/lib/systemd/system/nnm.service
/usr/lib/systemd/system/nnm-proxy.service
Processes
/opt/nnm/bin/nnm
/opt/nnm/bin/nnm-proxy

Modules

Tenable Network Monitor includes analysis modules that analyze network traffic based on certain criteria. These modules modularize Tenable Network Monitor detection capabilities and provide users the ability to enable or disable them. There are two analysis modules:

- **SCADA/ICS Analysis Module**

  Note: This module is only available for Industrial Security customers.

  Industrial Security is end-of-life (EOL). For information about EOL dates and policies for Tenable products, see the Tenable Software Release Lifecycle Matrix and Policy.

  This module analyzes SCADA network traffic to discover SCADA assets and their vulnerabilities. In addition, the module provides deep visibility into the type of SCADA devices discovered. This module is enabled by default and can be disabled in environments that do not contain SCADA devices. You can use the Tenable Search page to search for specific device detection information. This module is only available for Industrial Security customers.

- **Connection Analysis Module**

  This module reports connection duration and bandwidth information including for IPv6 and tunneled traffic. This module is disabled by default.

Note: You must restart Tenable Network Monitor after enabling a module for the module to function correctly within Tenable Network Monitor.

Connection Analysis Module

Module Detection ID	Module Detection Name	Module Detection Description	Risk Factor
97	TCP Session Bandwidth (1 - 10 MB)	Tenable Network Monitor computes the bytes exchanged between each TCP endpoint when the session ends. The total bytes exchanged during the lifetime of this session is between 1 and 10 MB.	INFO
98	TCP Session Bandwidth (10 - 100 MB)	Tenable Network Monitor computes the bytes exchanged between each TCP endpoint when the session ends. The total bytes exchanged during the lifetime of this session is more than 10 MB but less than or equal to 100 MB.	INFO
99	TCP Session Bandwidth (10 - 100 MB)	Tenable Network Monitor computes the bytes exchanged between each TCP endpoint when the session ends. The total bytes exchanged during the lifetime of this session is more than 100 MB but less than or equal to 1 GB.	INFO
100	TCP Session Bandwidth (> 1 GB)	Tenable Network Monitor computes the bytes exchanged between each TCP endpoint when the session ends. The total bytes exchanged during the lifetime of this session is more than 1 GB.	INFO

Module Detection ID	Module Detection Name	Module Detection Description	Risk Factor
101	TCP Session Duration (< 1 minute)	Tenable Network Monitor computes the duration of each TCP session when the session ends. This TCP session duration is less than 1 minute.	INFO
102	TCP Session Duration (1 - 15 minutes	Tenable Network Monitor computes the duration of each TCP session when the session ends. This TCP session duration is between 1 minute and 15 minutes.	INFO
103	TCP Session Duration (15 - 25 minutes)	Tenable Network Monitor computes the duration of each TCP session when the session ends. This TCP session duration is more than 15 but less than or equal to 25 minutes.	INFO
104	TCP Session Duration (25 - 40 minutes)	Tenable Network Monitor computes the duration of each TCP session when the session ends. This TCP session duration is more than 25 but less than or equal to 40 minutes.	INFO
105	TCP Session Duration (40 - 55 minutes)	Tenable Network Monitor computes the duration of each TCP session when the session ends. This TCP session duration is more than 40 but less than or equal to 55 minutes.	INFO
106	TCP Session Duration (55 - 100 minutes)	Tenable Network Monitor computes the duration of each TCP session when the session ends. This TCP session duration is more than 55 but less than or equal to 100 minutes.	INFO

Module Detection ID	Module Detection Name	Module Detection Description	Risk Factor
107	TCP Session Duration (100 minutes - 24 hours)	Tenable Network Monitor computes the duration of each TCP session when the session ends. This TCP session duration is more than 100 minutes but less than or equal to 24 hours.	INFO
108	TCP Session Duration (24 - 47 hours)	Tenable Network Monitor computes the duration of each TCP session when the session ends. This TCP session duration is more than 24 hours but less than or equal to 47 hours.	INFO
109	TCP Session Duration (> 47 hours)	Tenable Network Monitor computes the duration of each TCP session when the session ends. This TCP session duration is more than 47 hours.	INFO
110	UDP Activity	UDP activity observed	INFO
111	ICMP Activity	ICMP activity observed	INFO
112	IGMP Activity	IGMP activity observed	INFO

Tenable Network Monitor Plugins

This section provides the following information about Tenable Network Monitor plugins:

- Vulnerability and Passive Fingerprinting
- Tenable Network Monitor Fingerprinting
- Tenable Network Monitor Plugin Syntax

- Tenable Network Monitor Real-Time Plugin Syntax and Examples
- Tenable Network Monitor Corporate Policy Plugins

About Tenable Network Monitor Plugins

Tenable Network Monitor has two sources of plugin information: the **.prmx** and **.prm** plugin libraries in the **plugins** directory.

Tenable distributes its passive vulnerability plugin database in an encrypted format. The encrypted file is named **tenable_plugins.prmx** and, if necessary, can be updated daily. Tenable Network Monitor plugins written by the customer or third parties have the **.prm** extension.

Tenable has also implemented passive fingerprinting technology based on the open-source **SinFP** tool. With permission from the author, Tenable includes the database of passive operating system fingerprints for the fingerprinting technology in this distribution of Tenable Network Monitor.

Writing Custom Plugins

Tenable Network Monitor customers can write their own passive plugins, which are added into the **plugins** directory in the Tenable Network Monitor installation directory. The plugin must end with a **.prm** extension to be visible by Tenable Network Monitor.

> **Note:** You must restart Tenable Network Monitor if:
>
> - You add a new custom plugin to the **plugins** directory. Tenable Network Monitor does not fire the plugin until you restart.
> - You delete a **.prm** file manually from the **plugins** directory. Tenable Network Monitor continues to fire the plugin until you restart.

Tenable Network Monitor Fingerprinting

Tenable uses a hybrid approach to operating system fingerprinting. Primarily, plugins are used to detect and identify the OS of a host. If this is not possible, Tenable Network Monitor uses detected packets to identify the OS.

Tenable Network Monitor has the ability to guess the operating system of a host by looking at the packets it generates. Specific combinations of TCP packet entries, such as the window size and initial time-to-live (TTL) values, allow Tenable Network Monitor to predict the operating system generating the traffic.

These unique TCP values are present when a server makes or responds to a TCP request. All TCP traffic is initiated with a “SYN” packet. If the server accepts the connection, it sends a response known as a “SYN-ACK” packet. If the server cannot or will not communicate, it sends a reset (RST) packet. When a server sends a “SYN” packet, Tenable Network Monitor applies these list of operating system fingerprints and attempts to determine the operating system type.

Tenable Network Monitor Plugin Syntax

Plugins

Tenable Network Monitor plugins allow spaces and comment fields that start with a number (#) sign. Each plugin must be separated with the word “NEXT” on a single line. Create a **`.prm`** file in the **`plugins`** directory to make it available for use. You must restart Tenable Network Monitor to use new custom plugins.

Plugin Keywords

There are several keywords available for writing passive vulnerability plugins for Tenable Network Monitor. Some of these keywords are mandatory and some are optional. In the table below, mandatory keywords are boldened.

Name	Description
`bid`	Tenable assigns SecurityFocus Bugtraq IDs (BID) to Tenable Network Monitor plugins. This allows a user reading a report generated by Tenable Network Monitor to link to more information available at http://www.securityfocus.com/bid. Multiple Bugtraq

Name	Description
	entries can be typed on one line if separated by commas.
`bmatch`	This is the same as **`match`** but can look for any type of data. A **`bmatch`** must always have an even number of alphanumeric characters.
`clientissue`	If a vulnerability is determined in a network client such as a web browser or an email tool, a server **`port`** is associated with the reported vulnerability.
`cve`	Tenable also assigns Common Vulnerability and Exposure (CVE) tags to each Tenable Network Monitor plugin. This allows a user reading a report generated by Tenable Network Monitor to link to more information available at http://cve.mitre.org/. Multiple CVE entries can be typed on one line if separated by commas.
`dependency`	This is the opposite of **`noplugin`**. Instead of specifying another plugin that has failed, this keyword specifies which plugin must succeed. This keyword specifies a Tenable Network Monitor ID that should exist to evaluate the plugin. In addition, this plugin can take the form of **`dependency=ephemeral-server-port`**, which means the evaluated server must have an open port above port 1024.
`dport`	This is the same as **`sport`**, but for destination ports.

`Exploitability:`
 	
`canvas`
 	
`core`
 	
`cvsstemporal`
	Displays exploitability factors for the selected vulnerability. For example, if the vulnerability is exploitable via both Canvas and Core and has a unique CVSS temporal score, the following tags may be displayed in the plugin output:
	
	CANVAS : D2ExploitPack

Name	Description
metasploit	CORE : true CVSSTEMPORAL : CVSS2#E:F/RL:OF/RC:C
family	Each Tenable plugin for Tenable Network Monitor is included in a family. This designation allows Tenable to group Tenable Network Monitor plugins into easily managed sets that can be reported on individually.
hs_dport	This is the same as **hs_sport** except for destination ports.
hs_sport	Normally, when Tenable Network Monitor runs its plugins, they are either free ranging looking for matches on any port, or fixed to specific ports with the **sport** or **dport** keywords. In very high speed networks, many plugins have a fallback port, known as a high-speed port, which focuses the plugin only on one specific port. In High Performance mode, the performance of a Tenable Network Monitor plugin with an **hs_sport** keyword is exactly the same as if the plugin was written with the **sport** keyword.
	Each Tenable Network Monitor plugin needs a unique rule ID. Tenable assigns these 16 bit numbers within the overall Tenable Network Monitor range of valid entries. A list of the current Tenable Network Monitor plugin IDs can be found on the Tenable website.
match	This keyword specifies a set of one or more simple ASCII patterns that must be present in order for the more complex pattern analysis to take place. The **match** keyword gives Tenable Network Monitor a lot of its performance and functionality. With this keyword, if it does not see a simple pattern, the entire plugin does not match.

Name	Description
	This is the name of the vulnerability Tenable Network Monitor has detected. Though multiple Tenable Network Monitor plugins can have the same name, it is not encouraged.
`nid`	To track compatibility with the Tenable Nessus vulnerability scanner, Tenable associates Tenable Network Monitor vulnerability checks with relevant Tenable Nessus vulnerability checks. Multiple Tenable Nessus IDs can be listed under one **`nid`** entry such as **`nid=10222,10223`**.
`nooutput`	For plugins that are written specifically to be used as part of a dependency with another plugin, the **`nooutput`** keyword causes Tenable Network Monitor not to report anything for any plugin with this keyword enabled.
`noplugin`	This keyword prevents a plugin from being evaluated if another plugin has already matched. For example, it may make sense to write a plugin that looks for a specific anonymous FTP vulnerability, but disable it if another plugin that checked for anonymous FTP has already failed.
`pbmatch`	This is the same as **`bmatch`** except for binary data on the previous side of the reconstructed network session.
`plugin_output`	This keyword displays dynamic data for a given vulnerability or event. The dynamic data is usually represented using %L or %P, and its value is obtained from the regular expressions defined using regex, regexi, pregex, or pregexi.
`pmatch`	This keyword is the same as **`match`** but is applied against the previous packet on the other side of the reconstructed network

Name	Description
	session.
`pregex`	This is the same as **`regex`** except the regular expression is applied to the previous side of the reconstructed network session.
`pregexi`	This is the same as **`pregex`** except the pattern matching is not case sensitive.
`protocol_id`	This keyword is used to specify the protocol number of the protocol causing the plugin to fire.
`regex`	This keyword specifies a complex regular expression search rule applied to the network session.
`regexi`	This is the same as **`regex`** except the pattern matching is not case sensitive.
	All Tenable Network Monitor plugins need a risk setting. Risks are classified as INFO, LOW, MEDIUM, HIGH, and CRITICAL. An INFO risk is an informational vulnerability such as client or server detection. A LOW risk is an informational vulnerability such as an active port or service. A MEDIUM risk is something that may be exploitable or discloses information. A HIGH risk is something that is easily exploitable. A CRITICAL risk is something that is very easily exploitable and allows for malicious attacks.
`seealso`	If one or more URLs are available, this keyword can be used to display them. Multiple URLs can be specified on one line if separated by commas. Example entries for this include CERT advisories and vendor information websites.

Name	Description
`solution`	If a solution is available, it can be described here. The report section highlights the solution with different text.
`sport`	This setting applies the Tenable Network Monitor plugin to just one port. For example, you may wish to write a SNMP plugin that just looks for activity on port 162. However, for detection of off-port services like a web server running on port 8080, a **`sport`** field is not used in the plugin.
	This field describes on one line the nature of the detected vulnerability. This data is printed out by Tenable Network Monitor when printing the vulnerability report. Macros are available that allow the printing of matched network traffic such as banner information and are discussed in the examples below. For line breaks, the characters “\n” can be used to invoke a new line.
`timed-dependency`	This keyword slightly modifies the functionality of the **`noplugin`** and **`dependency`** keywords such that the evaluation must have occurred within the last *N* seconds.
`udp`	This keyword specifies that plugins are to be based on the UDP protocol rather than TCP protocol.

Tip: In addition to tcp or udp, the following protocols are supported: sctp, icmp, igmp, ipip, egp, pup, idp, tp, rsvp, gre, pim, esp, ah, mtp, encap, comp, ipv6, ospf, eigrp, isis, raw, or other.

Related Information

- Network Client Detection
- Pattern Matching

- Time Dependent Plugins
- Plugin Examples

Network Client Detection

Match patterns that begin with the **^** symbol mean at least one line in the packet payload must begin with the following pattern. Match patterns that begin with the **!** symbol indicate that the string must NOT match anything in the packet payload. In this case, the **!** and **^** symbols are combined to indicate that Tenable Network Monitor should not evaluate any packet whose payload contains a line starting with the pattern `Received:`.

The **^** is more expensive to evaluate than the **>** symbol. So, while both match patterns `^<pattern>` and `><pattern>` would find `<pattern>` at the beginning of a packet payload, the use of **>** is more desirable as it is less costly. Use **^** when looking for the occurrence of a string at the beginning of a line, but not at the beginning of the packet payload. In the latter case, use the **>** character instead.

```
id=79526
hs_dport=25
clientissue
name=Buffer overflow in multiple IMAP clients
description=The remote e-mail client is Mozilla 1.3 or 1.4a which is vulnerable to a
boundary condition error whereby a malicious IMAP server may be able to crash or
execute code on the client.
solution=Upgrade to either 1.3.1 or 1.4a
risk=HIGH
match=^From:
match=^To:
match=^Date:
match=^User-Agent: Mozilla
match=!^Received:
regex=^User-Agent: Mozilla/.* \(.*rv:(1\.3|1\.4a)
```

Pattern Matching

Tenable Network Monitor Can Match "Previous" Packets

Tenable Network Monitor allows matching on patterns in the current packet as well as patterns in the previous packet in the current session. This plugin shows how we can make use of this feature to determine if a Unix password file is sent by a web server:

```
id=79175
name=Password file obtained by HTTP (GET)
family=Generic
sport=80
description=It seems that a Unix password file was sent by the remote web server when
the following request was made :\n%P\nWe saw : \n%L
pmatch=>GET /
pmatch=HTTP/1.
match=root
match=daemon
match=bin
regex=root:.*:0:0:.*:.*
```

Here we see **match** patterns for a root entry in a Unix password file. We also see **pmatch** patterns that match against a packet that makes an HTTP GET request to a web server. The **match** patterns apply the current packet in a session and the **pmatch** patterns apply to the packet that was captured immediately before the one in the current session. To explain this visually, we are looking for occurrences of the following:

```
           GET / HTTP/1.*

1) client ------------------------> server:port 80

           Contents of password file:

           root:.*:0:0:.*:.*

2) client <------------------------ server:port 80
```

Our **match** pattern would focus on the contents in packet 2) and our **pmatch** pattern would focus on packet 1) payload contents.

Tenable Network Monitor Can Match Binary Data

Tenable Network Monitor also allows matching against binary patterns. Here is an example plugin that makes use of binary pattern matching to detect the usage of the well-known community string "public" in SNMPv1 response packets (The "#" is used to denote a comment):

```
###
# SNMPv1 response
#
# Matches on the following:
# 0x30              - ASN.1 header
# 0x02 0x01 0x00    - (integer) (byte length) (SNMP version - 1)
# 0x04 0x06 public - (string)  (byte length) (community string - "public")
# 0xa2              - message type - RESPONSE
# 0x02 0x01 0x00    - (integer) (byte length) (error status - 0)
# 0x02 0x01 0x00    - (integer) (byte length) (error index - 0)
###
id=71975
udp
sport=161
name=SNMP public community string
description=The remote host is running an SNMPv1 server that uses a well-known
community string - public
bmatch=>0:30
bmatch=>2:020100
bmatch=>5:04067075626c6963a2
bmatch=020100020100
```

Binary match patterns take the following form:

```
bmatch=[<>[off]:]<hex>
```

Binary match starts at <off>'th offset of the packet or at the last <offset> of the packet, depending on the use of > (start) or < (end). <hex> is a hex string we look for.

```
bmatch=<:ffffffff
```

This matches any packet whose last four bytes are set to 0xFFFFFFFF.

```
bmatch=>4:41414141
```

This matches any packet that contains the string "AAAA" (0x41414141 in hex) starting at its fourth byte.

```
bmatch=123456789ABCDEF5
```

This matches any packet that contains the hex string above.

Negative Matches

Tenable Network Monitor plugins can also be negated. Here are two examples:

```
pmatch=!pattern
```

```
pbmatch=>0:!414141
```

In each of these cases, the plugin does not match if the patterns contained in these "not" statements are present. For example, in the first **pmatch** statement, if the pattern named "pattern" is present, then the plugin does not match. In the second statement, the binary pattern of "AAA" (the letter "A" in ASCII hex is 0x41) only matches if it does not present the first three characters.

Time Dependent Plugins

The last plugin example shows some more advanced features of the Tenable Network Monitor plugin language that allows a plugin to be time dependent as well as make use of the evaluation of other plugins. The plugin shows how Tenable Network Monitor detects an anonymous FTP server. Use the **NEXT** keyword to separate plugins in the plugin file.

```
id=79200
nooutput
hs_sport=21
name=Anonymous FTP (login: ftp)
pmatch=^USER ftp
match=^331
NEXT #-----------------------------------------------------------
id=79201
dependency=79200
timed-dependency=5
hs_sport=21
name=Anonymous FTP enabled
description=The remote FTP server has anonymous access enabled.
risk=LOW
pmatch=^PASS
match=^230
```

Since we want to detect an anonymous FTP server, we must look for the following traffic pattern:

```
                USER ftp

1) FTP client ------------------------> FTP server

                331 Guest login ok, ...

2) FTP client <------------------------ FTP server

                PASS joe@fake.com

3) FTP client ------------------------> FTP server

                230 Logged in

4) FTP client <------------------------ FTP server
```

Here we cannot use a single plugin to detect this entire session. So, instead we use two plugins: the first plugin looks for packets 1) and 2) and the second plugin looks for packets 3) and 4).

A review of the above plugin shows that plugin 79200 matches 1) and 2) in the session by keying on the patterns “USER ftp” and the 331 return code. Plugin 79201 matches on 3) and 4) by keying on the patterns “PASS” and the 230 return code.

Notice that plugin 79201 contains the following field: **`dependency=79200`**. This field indicates the plugin 79200 must evaluate successfully before plugin 79201 may be evaluated.

To complete the plugin for the anonymous FTP session, we must ensure both plugins are evaluating the same FTP session. To do this, we attach a time dependency to plugin 79201. The field **`time-dependency=5`** indicates that plugin 79200 must evaluate successfully in the last five seconds for 79201 to evaluate. This way, we can ensure that both plugins evaluate the same FTP session.

Plugin Examples

Basic Example

This plugin illustrates the basic concepts of Tenable Network Monitor plugin writing:

```
id=79873
nid=11414
hs_sport=143
name=IMAP Banner
description=An IMAP server is running on this port. Its banner is :\n %L
risk=NONE
match=OK
match=IMAP
match=server ready
regex=^.*OK.*IMAP.*server ready
```

This example uses the following fields:

- **`id`** - A unique number assigned to this plugin.
- **`nid`** - The Tenable Nessus ID of the corresponding Tenable Nessus NASL script.
- **`hs_sport`** - The source port to key on if High Performance mode is enabled.

- **name** - The name of the plugin.
- **description** - A description of the problem or service.
- **match** - The set of match patterns that must be found in the payload of the packet before the regular expression can be evaluated.
- **regex** - The regular expression to apply to the packet payload.

Tip: The description contains the %L macro. If this plugin evaluates successfully, then the string pattern in the payload that matched the regular expression is stored in %L and prints out at report time.

Complex Example

```
id=79004
nid=10382
cve=CVE-2000-0318
bid=1144
hs_sport=143
name=Atrium Mercur Mailserver
description=The remote imap server is Mercur Mailserver 3.20. There is a flaw in this
server (present up to version 3.20.02) which allow any authenticated user to read any
file on the system. This includes other user mailboxes, or any system file. Warning :
this flaw has not been actually checked but was deduced from the server banner
solution=There was no solution ready when this vulnerability was written; Please
contact the vendor for updates that address this vulnerability.
risk=HIGH
match=>* OK
match=MERCUR
match=IMAP4-Server
regex=^\* OK.*MERCUR IMAP4-Server.*v3\.20\..*$
```

Tip: The first match pattern makes use of the **>** symbol. The **>** symbol indicates that the subsequent string must be at the beginning of the packet payload. Use of the **>** symbol is encouraged where possible as it is an inexpensive operation.

Case-Insensitive Example

There is a tool called **SmartDownLoader** that uploads and downloads large files. Unfortunately, versions 0.1 through 1.3 use the capitalization **SmartDownloader**, versions 1.4 through 2.7 use **smartdownloader** and versions 2.8 through current use **SMARTdownloader**. Searching for the various combinations of this text with purely the **regex** command would cause us to use a statement that looks like this:

```
regex=[sS][mM][aA][rR][tT][dD]own[lL]oader
```

However, with the **regexi** command, the search string is much less complex and less prone to creating an error:

```
regexi=smartdownloader
```

By using **regexi**, we can more quickly match on all three versions as well as future permutations of the string **smartdownloader**. In a case such as this, **regexi** is the logical choice.

```
id=79910
dependency=1442
hs_sport=6789
name=SmartDownLoader Detection
description=The remote host is running SmartDownLoader, a tool for performing
rudimentary uploads and downloads of large binary files.
solution=Ensure that this application is in keeping with Corporate policies and
guidelines
risk=MEDIUM
family=PeerToPeer
match=ownloader
regexi=smartdownloader
```

Above is a complete example Tenable Network Monitor plugin using the **regexi** keyword. The use of the **match** keyword searching for the string **ownloader** is not a typo. By searching for network sessions that have this string in them first, Tenable Network Monitor can avoid invoking the expensive **regexi** search algorithm unless the **ownloader** pattern is present.

Tenable Network Monitor Real-Time Plugin Syntax

Real-Time Plugin Model

Tenable Network Monitor real-time plugins are exactly the same as Tenable Network Monitor vulnerability plugins with two exceptions:

- They can occur multiple times.
- Their occurrence may not be recorded as a vulnerability.

For example, an attacker may attempt to retrieve the source code for a Perl script from an Apache web server. If Tenable Network Monitor observes this event, it would be logical to send a real-time alert. It would also be logical to mark that the Apache server is potentially vulnerable to some sort of Perl script source code download. In other cases, it may be more logical to just log the attempt as an event, but not a vulnerability. For example, a login failure over FTP is an event that may be worth logging, but does not indicate a vulnerability.

As the real-time plugins are written, there are two keywords that indicate to Tenable Network Monitor that these are not regular vulnerability plugins. These are the **`real-time`** and **`realtimeonly`** keywords.

In the previous example, the FTP user login failure would be marked as a **`realtimeonly`** event because we would like real-time alerting, but not a new entry into the vulnerability database.

Real-Time Plugin Keywords

Name	Description
`real-time`	If a plugin has this keyword, then Tenable Network Monitor will generate a SYSLOG message or real-time log file entry the first time this plugin matches. This prevents vulnerabilities that are worm related from causing millions of events. For example, the plugins for the Sasser worm generate only one event. Output from plugins with this keyword will show up in the vulnerability report.

Name	Description
`realtimeonly`	If a plugin has this keyword, then Tenable Network Monitor will generate a SYSLOG message or real-time log file entry each time the plugin evaluates successfully. These plugins never show up in the report file.
`track-session`	This keyword will cause the contents of a session to be reported (via SYSLOG or the real-time log file) a specified number of times after the plugin containing this keyword was matched. This is an excellent way to discover what a hacker “did next” or possibly what the contents of a retrieved file were real-time.
`trigger-dependency`	Normally if a plugin has multiple dependencies, then all of those dependencies must be successful for the current plugin to evaluate. However, the **`trigger-dependency`** keyword allows a plugin to be evaluated as long as at least one of its dependencies is successful.

Real-Time Plugin Examples

Failed Telnet Login Plugin

The easiest way to learn about Tenable Network Monitor real-time plugins is to evaluate some of those included by Tenable. Below is a plugin that detects a failed Telnet login to a FreeBSD server.

```
# Look for failed logins into an FreeBSD telnet server
id=79400
hs_sport=23
dependency=1903
realtimeonly
name=Failed login attempt
description=Tenable Network Monitor detected a failed login attempt to a telnet server
risk=LOW
```

```
match=Login incorrect
```

This plugin has many of the same features as a vulnerability plugin. The ID of the plugin is 79400. The high-speed port is 23. We need to be dependent on plugin 1903 (which detects a Telnet service). The **realtimeonly** keyword tells Tenable Network Monitor that if it observes this pattern, then it should alert on the activity, but not record any vulnerability.

In Tenable Security Center, events from Tenable Network Monitor are recorded alongside other IDS tools.

Finger User List Enumeration Plugin

The **finger** daemon is an older Internet protocol that allowed system users to query remote servers to get information about a user on that box. There have been several security holes in this protocol that allowed an attacker to elicit user and system information that could be useful to attackers.

```
id=79500
dependency=1277
hs_sport=79
track-session=10
realtimeonly
name=App Subversion - Successful finger query to multiple users
description=A response from a known finger daemon was observed which indicated that the
attacker was able to retrieve a list of three or more valid user names.
risk=HIGH
match=Directory:
match=Directory:
match=Directory:
```

This plugin looks for these patterns only on systems where a working **finger** daemon has been identified (dependency #1277). However, the addition of the **track-session** keyword means that if this plugin is launched with a value of 10, the session data from the next 10 packets is tracked and logged in either the SYSLOG or real-time log file.

During a normal finger query, if only one valid user is queried, then only one home directory is returned. However, many of the exploits for finger involve querying for users such as *NULL*, .., or 0. This causes vulnerable **`finger`** daemons to return a listing of all users. In that case, this plugin would be activated because of the multiple “Directory:” matches.

Unix Password File Download Web Server Plugin

This plugin below looks for any download from a web server that does not look like HTML traffic, but does look like the contents of a generic Unix password file.

```
id=79300
dependency=1442
hs_sport=80
track-session=10
realtimeonly
name=Web Subversion - /etc/passwd file obtained
description=A file which looks like a Linux /etc/passwd file was downloaded from a web
server.
risk=HIGH
match=!<HTML>
match=!<html>
match=^root:x:0:0:root:/root:/bin/bash
match=^bin:x:1:1:bin:
match=^daemon:x:2:2:daemon:
```

The plugin is dependent on Tenable Network Monitor ID 1442, which detects web servers. In the match statements, we attempt to ignore any traffic that contains valid HTML tags, but also has lines that start with common Unix password file entries.

Generic Buffer Overflow Detection on Windows Plugin

One of Tenable Network Monitor’s strongest intrusion detection features is its ability to recognize specific services, and then to look for traffic occurring on those services that should never occur unless they have been compromised. Since Tenable Network Monitor can keep track of both sides

of a conversation and make decisions based on the content of each, it is ideal to look for Unix and Windows command shells occurring in services that should not have those command shells in them. Here is an example plugin:

```
# look for Windows error when a user tries to
# switch to a drive that doesn't exist
id=79201
include=services.inc
trigger-dependency
track-session=10
realtimeonly
name=Successful shell attack detected - Failed cd command
description=The results of an unsuccessful attempt to change drives on a Windows
machine occurred in a TCP session normally used for a standard service. This may
indicate a successful compromise of this service has occurred.
risk=HIGH
pmatch=!>GET
pregexi=cd
match=!>550
match=^The system cannot find the
match=specified.
```

This plugin uses the **include** keyword that identifies a file that lists several dozen Tenable Network Monitor IDs, which identify well known services such as HTTP, DNS, and NTP. The plugin is not evaluated unless the target host is running one of those services.

The keyword **trigger-dependency** is needed to ensure the plugin is evaluated even if there is only one match in the **services.inc** file. Otherwise, Tenable Network Monitor evaluates this plugin only if the target host was running all Tenable Network Monitor IDs present in the **services.inc** file. The **trigger-dependency** keyword says that at least one Tenable Network Monitor ID must be specified by one or more dependency or include rules must be present.

Finally, the logic of plugin detection looks for the following type of response on a Windows system:

In this case, a user has attempted to use the cd command to change directories within a file system and the attempt was not allowed. This is a common event that occurs when a remote hacker compromises a Windows 2000 or Windows 2003 server with a buffer overflow. The Tenable Network Monitor plugin looks for a network session that should not be there.

In the plugin logic, there are **`pmatch`** and **`pregexi`** statements that attempt to ensure that the session is not an HTTP session, and that the previous side of the session contains the string **`cd`**.

> **Tip:** The pregexi statement could be expanded to include the trailing space after the “d” character and also the first character.

The plugin then looks for the expected results of the failed cd command. The first match statement makes sure this pattern is not part of the FTP protocol. Looking for “cd” in one side of a session and the error of attempting to change to a directory in an FTP session causes false positives for this plugin. Adding a rule to ignore if a line starts with “550” avoids this. While writing and testing this plugin, Tenable considered having a different set of plugins just for FTP, but the additional filter statement took care of any false positives. Finally, the last two match statements look for the results of the failed change directory attempt. They are spread across two match statements and could have been combined into one regular expression statement, but there was enough content in the basic message to split them into higher-speed matching.

Tenable Network Monitor Corporate Policy Plugins

Most companies have an “Acceptable Use Policy” that defines appropriate use of the company’s IT facilities. Often, this policy is abused to some extent since detecting abuse can be difficult.

Tenable Network Monitor can help in this regard through use of Tenable Network Monitor Corporate Policy plugins. These plugins can be used to look for policy violations and items such as credit card numbers, Social Security numbers, and other sensitive content in motion.

Tenable ships Tenable Network Monitor with a large number of plugins that are frequently updated. The primary focus of these plugins is to discover hosts, applications and their related client/server vulnerabilities. To search for a specific plugin, visit http://www.tenable.com/NNM-plugins.

Many of the available plugins already detect activities that would fall into the “Inappropriate Use” category in most companies. Some of the activities that are detected through these plugins include (but are not limited to):

- Game servers
- Botnet clients and servers
- Peer to peer file sharing
- IRC clients and servers
- Chat clients
- Tunneling software or applications like Tor, GoToMyPC, and LogMeIn

Related Information

- Detecting Custom Activity Prohibited by Policy
- Detecting Confidential Data in Motion

Detecting Custom Activity Prohibited by Policy

The plugins provided with Tenable Network Monitor are useful for detecting generally inappropriate activities, but there may be times when more specific activities need to be detected. For example, a company may want to generate an alert when email is sent to a competitor’s mail service or if users are managing their Facebook accounts from the corporate network.

Tenable provides the ability for users to write their own custom plugins, as documented in Tenable Network Monitor Plugin Syntax. These plugins are saved as **`prm`** files.

The following example shows how to create a custom plugin to detect users logging into their Facebook accounts. First, a unique plugin ID is assigned, in this case *79420*. So, the first line of our plugin is:

```
id=79420
```

Next, we want a description of what the vulnerability detects:

```
description=The remote client was observed logging into a Facebook account.
You should ensure that such behavior is in alignment with corporate policies
and guidelines.  For your information, the user account was logged as:\n %L
```

The **%L** is the results of our regular expression statement that is created later. We want to log the source address of the offending computer as well as the user ID that was used to log in. Next, we create a distinct name for our plugin.

```
name=POLICY - Facebook usage detection
```

Note that the name begins with the string POLICY. This makes all POLICY violations easily searchable from the Tenable Security Center interface.

You can also define a Tenable Security Center dynamic asset that contains only POLICY violators.

The next field defines a family. For this example, the application is a web browser, so the family ID is defined as follows:

```
family=Web Clients
```

Since this is a web browser, a dependency can be assigned that tells Tenable Network Monitor to look at only those clients that have been observed surfing the web:

```
dependency=1735
```

Furthermore, since we are looking at client traffic, we define:

```
clientissue
```

Next, we assign a risk rating for the observed behavior:

```
risk=MEDIUM
```

In the final section we create **match** and **regex** statements that Tenable Network Monitor looks for passively. We want all of these statements to be true before the client is flagged for inappropriate usage:

```
match=>POST /
```

The web request must begin with a POST verb. This weeds out all “GET” requests.

```
match=^Host: *.facebook.com
```

The statement above ensures that they are posting a host with a domain of `*.facebook.com`.

Finally, we have a **match** and **regex** statement that detects the user’s login credentials:

```
match=email=

regex=email=.*%40[^&]+
```

Altogether, we have a single plugin as follows:

```
id=79420
family=Web Clients
clientissue
dependency=1735
name=Facebook_Usage
description=The remote client was observed logging into a Facebook account.
You should ensure that such behavior is in alignment with
Corporate Policies and guidelines.  For your information, the user account
was logged as:
risk=MEDIUM
solution=Stay off of Facebook.
match=>POST /
match=^Host: *.facebook.com
match=email=
regex=email=.*%40[^&]+
```

This plugin could be named **Facebook.prm** and added into the **/opt/nnm/var/nnm/plugins/** directory. If Tenable Security Center is used to manage one or more Tenable Network Monitor systems, use the plugin upload dialog to add the new **.prm** file.

If you wish to create a policy file that includes multiple checks, use the reserved word *NEXT* within the policy file. For example:

```
id=79420
…
rest of plugin
…
NEXT
id=79421
…
etc.
```

Detecting Confidential Data in Motion

Many organizations want to ensure that confidential data does not leave the network. Tenable Network Monitor can aid in this by looking at binary patterns within observed network traffic. If critical documents or data can be tagged with a binary string, such as an MD5 checksum, Tenable Network Monitor can detect these files being passed outside the network. For example:

Create a document that has a binary string of:

0xde1d7f362734c4d71ecc93a23bb5dd4c and 0x747f029fbf8f7e0ade2a6198560c3278

A Tenable Network Monitor plugin can then be created to look for this pattern as follows:

```
id=79580
trigger-dependency
dependency=2004
dependency=2005
hs_dport=25
description=POLICY - Confidential data passed outside the
```

```
corporate network.  The Confidential file don'tshare.doc was
just observed leaving the network via email.
name=Confidential file misuse
family=Generic
clientissue
risk=HIGH
bmatch=de1d7f362734c4d71ecc93a23bb5dd4c
bmatch=747f029fbf8f7e0ade2a6198560c3278
```

These binary codes were created by simply generating md5 hashes of the following strings:

`"Copyright 2006 BigCorp, file: don'tshare.doc"`

`"file: don'tshare.doc"`

The security compliance group maintains the list of mappings (confidential file to md5 hash). The md5 hash can be embedded within the binary file and can then be tracked as it traverses the network.

Similar checks can be performed against ASCII strings to detect, for example, if confidential data was cut-and-pasted into an email. Simply create text watermarks that appear benign to the casual observer and map to a specific file name. For example:

`"Reference data at \\192.168.0.2\c$\shares\employmentfiles for HR data regarding Jane Mcintyre" could be a string which maps to a file named Finances.xls.`

A Tenable Network Monitor plugin can look for the string as follows:

```
id=79581
trigger-dependency
dependency=2004
dependency=2005
hs_dport=25
description=POLICY - Confidential data passed outside the
```

```
corporate network.  Data from the confidential file Finances.xls was just
observed leaving the network via email.
name=Confidential file misuse
family=Generic
clientissue
risk=HIGH
match=Reference data at
match=192.168.0.2\c$\shares\employmentfiles
match=for HR data regarding Jane Mcintyre
```

The two example plugins above (IDs 79580 and 79581) detect files leaving the network via email. Most corporations have a list of ports that are allowed outbound access. SMTP is typically one of these ports. Other ports may include FTP, Messenger client ports (for example, AIM, Yahoo and ICQ), or peer-to-peer (for example, GNUTELLA and BitTorrent). Depending on your specific network policy, you may wish to clone plugins 79580 and 79581 to detect these strings on other outbound protocols.

Internal Tenable Network Monitor Plugin IDs

Each vulnerability and real-time check Tenable Network Monitor performs has a unique associated ID. Tenable Network Monitor IDs are within the range 0 to 10000.

Internal Tenable Network Monitor IDs

Some of Tenable Network Monitor's checks, such as detecting open ports, are built in. The following chart lists some of the more commonly encountered internal checks and describes what they mean:

NNM ID	Name	Description
0	Detection of Open Port	Tenable Network Monitor has observed a SYN-ACK leave from a server.
1	Operating	Tenable Network Monitor has observed enough traffic about a

NNM ID	Name	Description
	System Fingerprint	server to guess the operating system.
2	Service Connection	Tenable Network Monitor has observed browsing traffic from a host.
3	Internal Client Trusted Connections	Tenable Network Monitor has logged a unique network session of source IP, destination IP, and destination port.
4	Internal Interactive Session	Tenable Network Monitor has detected one or more interactive network sessions between two hosts within your focus network.
5	Outbound Interactive Sessions	Tenable Network Monitor has detected one or more interactive network sessions originating from within your focus network and destined for one or more addresses on the Internet.
6	Inbound Interactive Sessions	Tenable Network Monitor has detected one or more interactive network sessions originating from one or more addresses on the Internet to this address within your focus network.
7	Internal Encrypted Session	Tenable Network Monitor has detected one or more encrypted network sessions between two hosts within your focus network.
8	Outbound Encrypted Session	Tenable Network Monitor has detected one or more encrypted network sessions originating from within your focus network and destined for one or more addresses on the Internet.
9	Inbound	Tenable Network Monitor has detected one or more encrypted

NNM ID	Name	Description
	Encrypted Session	network sessions originating from one or more addresses on the Internet to this address within your focus network.
12	Number of Hops	Tenable Network Monitor logs the number of hops away each host is located.
14	Accepts External Connections	Tenable Network Monitor detects an external connection to this host. Specific IP addresses are not reported by this plugin, but it does track the destination port and protocol used. You can view full connection details in the real-time event log. This is the opposite of plugin 16, which reports on outbound connections.
15	Internal Server Trusted Connections	Tenable Network Monitor has logged a unique network session of source IP, destination IP, and destination port. Specific IP addresses are not reported by this plugin, but it does track which destination port and protocol was used. You can view full connection details in the real-time event log. This is the opposite of plugin 14, which reports on inbound connections.
16	Outbound External Connection	Tenable Network Monitor has detected an external connection from this host.
17	TCP Session	Tenable Network Monitor identifies TCP sessions and reports the start time, number of bytes of data downloaded during, and end time of these sessions. This plugin is reported at the end of each TCP session.
18	IP Protocol Detection	Tenable Network Monitor detects all IP protocols.

NNM ID	Name	Description
19	VLAN ID Reporting	Tenable Network Monitor reports all observed VLAN tags per host.
20	IPv6 Tunneling	Tenable Network Monitor identifies and processes tunneled IPv6 traffic.

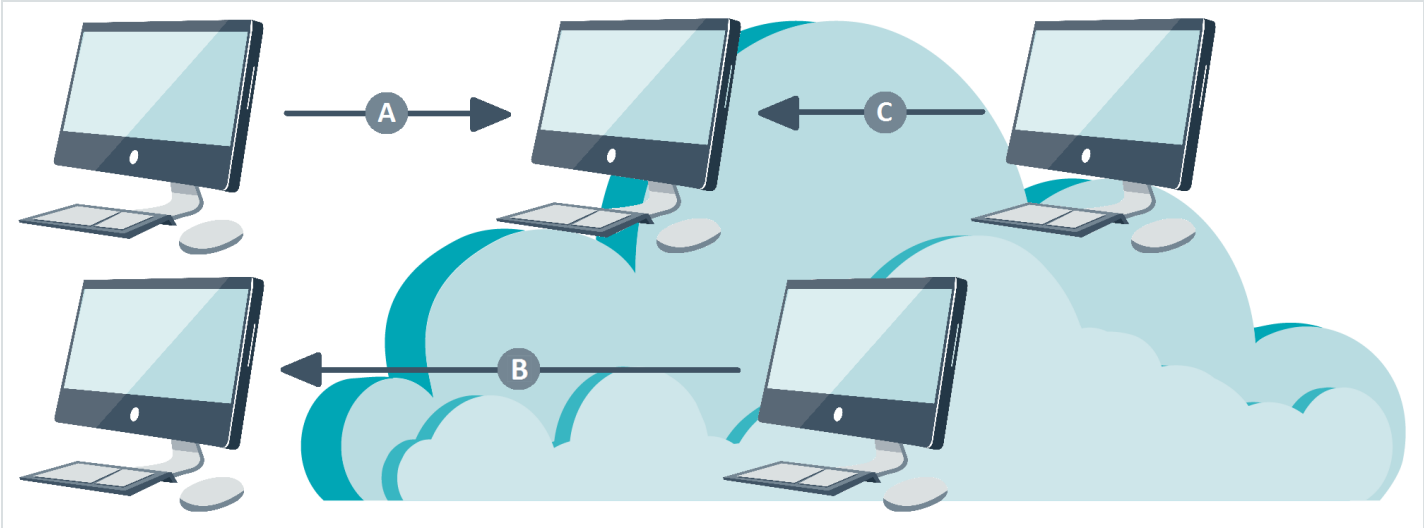
Real-Time Traffic Analysis Configuration Theory

This section describes how configuration options affect Tenable Network Monitor operation and provides the following details on Tenable Network Monitor architecture:

- Focus Network
- Detecting Server and Client Ports
- Detecting Specific Server and Client Port Usage
- Firewall Rules
- Working with Tenable Security Center
- Selecting Rule Libraries and Filtering Rules
- Detecting Encrypted and Interactive Sessions
- Routes and Hop Distance
- Alerting

Focus Network

When a focus network is specified via the `Monitored Networks IP Addresses and Ranges` configuration parameter, only one side of a session must match in the list. For example, if you have a DMZ that is part of the focus network list, Tenable Network Monitor reports on vulnerabilities of the web server there, but not on web clients visiting from outside the network. However, a browser within the DMZ visiting the same web server is reported.



In the diagram above, three sessions labeled A, B, and C are shown communicating to, from, and inside a focus network. In session A, Tenable Network Monitor analyzes only those vulnerabilities observed on the server inside the focus network and does not report client-side vulnerabilities. In session B, Tenable Network Monitor ignores vulnerabilities on the destination server, but reports client-side vulnerabilities. In session C, both client and server vulnerabilities are reported.

There is another filter that Tenable Network Monitor uses while looking for unique sessions. This is a dependency that requires the host to run a major service. These dependencies are defined by a list of Tenable Network Monitor plugin IDs that identify SSL, FTP, and several dozen other services.

Finally, the entire process of detecting these sessions can be filtered by specific network ranges and ports. For example, if a University ran a public FTP server that had thousands of downloads each hour, they may want to disable interactive sessions on port 21 on that FTP server. Similarly, disabling encryption detection on ports such as 22 and 443 also eliminates some noise for Tenable Network Monitor.

Detecting Server and Client Ports

The method used by TCP connections to initiate communication is known as the “three-way handshake.” This method can be compared to how a common telephone conversation is initiated. If Bob calls Alice, he has effectively sent her, in TCP terms, a “SYN” packet. She may or may not answer. If Alice answers, she has effectively sent a “SYN-ACK” packet. The communication is still

not established, since Bob may have hung up as she was answering. The communication is established when Bob replies to Alice, sending her an “ACK.”

The Tenable Network Monitor configuration option “connections to services” enables Tenable Network Monitor to log network client to server activity.

Whenever a system within the monitored network range tries to connect to a server over TCP, the connecting system emits a TCP “SYN” packet. If the port the client connects on is open, then the server responds with a TCP “SYN/ACK” packet. At this point, Tenable Network Monitor records both the client address and the server port the client connects to. If the port on the server is not open, then the server does not respond with a TCP “SYN/ACK” packet. In this case, since Tenable Network Monitor never sees a TCP “SYN/ACK” response from the server, Tenable Network Monitor does not record the fact that the client tried to connect to the server port, since the port is not available to that client.

The **Connections to Services** configuration parameter does not track how many times the connection was made. If the same host browses the same web server a million times, or browses a million different web servers once, the host is still marked as having browsed on port 80. This data is logged as Tenable Network Monitor internal plugin ID 2.

Tenable Network Monitor detects many applications through plugin and protocol analysis. At a lower level, Tenable Network Monitor also detects open ports and outbound ports in use on the monitored networks. By default, Tenable Network Monitor detects any TCP server on the protected network if it sees a TCP “SYN-ACK” packet.

In combination, the detection of server ports and client destination ports allows a network administrator to see who on their network is serving a particular protocol and who on their network is speaking that protocol.

Detecting Specific Server and Client Port Usage

The **Show Connections** configuration parameter keeps track of host communication within the focus network. When the **Show Connections** configuration parameter is enabled, if one of the hosts is in the defined focus network, Tenable Network Monitor records the client, server, and server port

every time a host connects to another host. It does not track the frequency or time stamp of the connections – just that a connection was made.

The **Show Connections** configuration parameter provides a greater level of detail than the **Connections to Services** configuration parameter. For example, if your IPv4 address is 1.1.1.1 or your IPv6 address is 2001:DB8::AE59:3FC2 and you use the SSH service to connect to “some_company.com”, then the use of these options records the following:

```
Show Connections

      some_company.com:SSH

2001:DB8::AE59:3FC2 -> some_company.com
```

```
Connections to Services

      SSH

2001:DB8::AE59:3FC2 -> SSH
```

Using the **Connections to Services** configuration parameter lets you know that the system at 1.1.1.1 and 2001:DB8::AE59:3FC2 uses the SSH protocol. This information may be useful regardless of where the service is used.

Tenable Network Monitor does not log a session-by-session list of communications. Instead, it logs the relationship between the systems. For example, if system A is detected using the SSH protocol on port 22 connecting to system B, and both systems are within the focus network, Tenable Network Monitor would log:

- System A browses on port 22
- System B offers a service (listens) on port 22
- System A communicates with System B on port 22

If system B were outside of the focus network, Tenable Network Monitor would not record anything about the service system B offers, and would also log that system A browses outside of the focus network on port 22. Tenable Network Monitor does not log how often a connection occurs, only that it occurred at least once. For connections outside of the focus network, Tenable Network Monitor logs only which ports are browsed, not the actual destinations.

> **Note:** If logging session-by-session network events is a requirement for your network analysis, Tenable offers the Tenable Log Correlation Engine product, which can log firewall, web server, router, and sniffer logs.

Firewall Rules

If Tenable Network Monitor is placed immediately behind a firewall such that all of the traffic presented to Tenable Network Monitor flows through the firewall, then the list of served ports, client-side ports, and the respective IP addresses of the users are readily available.

Tools such as the Tenable Security Center Vulnerability Analysis page allow information about these ports (both client and server) to be browsed, sorted, and reported on. You can also view lists of IP addresses and networks using these client and server ports.

Working with Tenable Security Center

When Tenable Security Center manages multiple Tenable Network Monitor sensors, users of Tenable Security Center can analyze the aggregate types of open ports, browsed ports, and communication activity that occurs on the focus network. Since Tenable Security Center has several different types of users and privileges, many different IT and network engineering accounts can be created across an enterprise so they can share and benefit from the information detected by Tenable Network Monitor.

Selecting Rule Libraries and Filtering Rules

Tenable ships an encrypted library of passive vulnerability detection scripts. This file cannot be modified by the end users of Tenable Network Monitor. However, if certain scripts must be disabled, they can be specified by the PASL ID and ".pasl" appended. For example, *1234.pasl*, disables the PASL with the ID of 1234 on a single line in the **`disabled-scripts.txt`** file.

If a plugin must be disabled, type its ID on a single line in the **`disabled-plugins.txt`** file. If a plugin must be real-time enabled, type its ID on a single line in the **`realtime-plugins.txt`** file.

> When adding Tenable Network Monitor plugins to the disabled plugin list, be sure to leave an empty blank line after typing the last plugin to be disabled. Failure to return to the next line can result in a non-functional disabled plugin list.
> Example: 1234 [return]

If any of the referenced files do not exist, create them using the appropriate method for the operating system. The file locations are as follows:

Operating System	File Path
Linux	**`/opt/nnm/var/nnm`**
Windows	**`C:\ProgramData\Tenable\NNM\nnm`**

Detecting Encrypted and Interactive Sessions

Tenable Network Monitor can be configured to detect both encrypted and interactive sessions. An encrypted session is a TCP or UDP session that contains sufficiently random payloads. An interactive session uses timing and statistical profiling of the packets in a session to determine if the session involves human input at a command line prompt.

In both cases, Tenable Network Monitor identifies these sessions for the given port and IP protocol. It then lists the detected interactive or encrypted session as vulnerabilities.

Tenable Network Monitor has a variety of plugins to recognize telnet, Secure Shell (SSH), Secure Socket Layer (SSL), and other protocols. Combined with the detection of the interactive and encryption algorithms, Tenable Network Monitor may log multiple forms of identification for the detected sessions.

For example, Tenable Network Monitor may recognize not only an SSH service running on a high port as an encrypted session, but also recognize the version of SSH and determine any vulnerabilities associated with it.

Routes and Hop Distance

For active scans, one host can find the default route and an actual list of all routers between it and a target platform. To do this, it sends one packet after another with a slightly larger TTL (time to live) value. Each time a router receives a packet, it decrements the TTL value and sends it on. If a router receives a packet with a TTL value of one, it sends a message back to the originating server stating that the TTL has expired. The server sends packets to the target host with greater and greater TTL values and collects the IP addresses of the routers sending expiration messages in-between.

Since Tenable Network Monitor is entirely passive, it cannot send or elicit packets from the routers or target computers. It can however, record the TTL value of a target machine. The TTL value is an 8-bit field, which means it can contain a value between 0 and 255. Most machines use an initial TTL value of 32, 64, 128, or 255. Since there is a maximum of 16 hops between your host and any other host on the internet, Tenable Network Monitor uses an algorithm to map any TTL to the number of hops.

For example, if Tenable Network Monitor sniffed a server sending a packet with a TTL of 126, it detects that 128 is two hops away. Tenable Network Monitor does not know the IP address of the in-between routers.

> **Note:** Modern networks have many devices such as NAT firewalls, proxies, load balancers, intrusion prevention, routers, and VPNs that rewrite or reset the TTL value. In these cases, Tenable Network Monitor may report inconsistent hop counts.

Alerting

When Tenable Network Monitor detects a real-time event, it can:

- Send the event to a local log file.
- Send the event via Syslog to a log aggregator such as Tenable Log Correlation Engine, an internal log aggregation server.
- Send the event to a third party security event management vendor.

New Host Alerting

You can configure Tenable Network Monitor to detect when a new host has been added to the network. By default, Tenable Network Monitor has no knowledge of your network's active hosts, so the first packets Tenable Network Monitor sniffs trigger an alert. To avoid this, you can configure Tenable Network Monitor to learn the network over a period of days. Once this period is over, any "new" traffic must be from a host that has not communicated during the initial training.

To prevent Tenable Network Monitor from triggering new host alerts on known hosts, you can create a known hosts file in the location to which the Known Hosts File configuration parameter is set. Each line of the Known

Hosts File supports a single IPv4 or IPv6 address. Hyphenated ranges and CIDR notation are not supported. Tenable Network Monitor must be restarted after creating or making any changes to the Known Hosts File.

> **Note:** When Tenable Network Monitor logs a new host, the Ethernet address saves in the message. When Tenable Network Monitor is more than one hop away from the sniffed traffic, the Ethernet address is that of the local switch and not the actual host. If the scanner is deployed in the same collision domain as the sniffed server, then the Ethernet address is accurate.
>
> For DHCP networks, Tenable Network Monitor often detects a "new" host. Tenable® recommends deploying this feature on non-volatile networks such as DMZ. Users should also consider analyzing Tenable Network Monitor "new" host alerts with Tenable Security Center, which can sort real-time Tenable Network Monitor events by networks.

Syslog Messages

Tenable Network Monitor provides options to send real-time and vulnerability data as Syslog messages. This section describes the available Syslog message types:

- Standard Syslog Message Types
- CEF Syslog Message Types

Standard Syslog Message Types

Message Types

- Syslog message format for real-time Syslog entries generated by realtimeonly PRMs:

```
<priority>timestamp nnm: src_ip:src_port|dst_ip:dst_port|protocol|plugin_
id|plugin_name|matched_text_current_packet|matched_text_previous_packet|risk
```

- Syslog message format for vulnerability and real-time Syslog entries generated by PASLs, PRMs, and internal plugins:

```
<priority>timestamp nnm: src_ip:src_port|dst_ip:dst_port|protocol|plugin_
id|plugin_name|plugin_description|plugin_output|risk
```

Message Fields

Name	Description
`dst_ip`	Displays the destination IP address for reported traffic.
`dst_port`	Displays the destination port for reported traffic.
`matched_text_ current_packet`	Reports the payload, causing a match in the packet to trigger the Tenable Network Monitor event.
`matched_text_`	Reports the payload that was observed prior to the payload in the

Name	Description
previous_packet	matched_text_current_packet field.
plugin_id	Displays the reported Tenable Network Monitor plugin or PASL ID triggered by reported traffic.
plugin_name	Displays the name of the Tenable Network Monitor plugin or PASL ID triggered by reported traffic.
plugin_output	Displays dynamic data for a given vulnerability or event. This field may be empty if there is no plugin-specific data.
priority	Displays the Syslog facility level of the message.
protocol	Reports the integer value for the protocol used for the reported traffic.
risk	Displays the associated risk level of the reported vulnerability. This can be **NONE**, **LOW**, **MEDIUM**, **HIGH**, **CRITICAL**, or **INFO**.
src_ip	Displays the source IP address reported for the traffic.
src_port	Displays the source port for the reported traffic.
timestamp	Displays the date and time of the Syslog message.

CEF Syslog Message Types

Message Type

Syslog message format for vulnerability and real-time Syslog entries generated by PASLs, PRMs, and internal plugins:

```
timestamp CEF: Version|Device Vendor|Device Product|Device Version|Signature
ID|Name|Severity|Extension
```

Message Fields

Name	Description
`Device Product`	Displays the name of the product on the detected sending device.
`Device Vendor`	Displays the vendor of the product on the detected sending device.
`Device Version`	Displays the version of the product on the detected sending device.
`Extension`	Displays key-value pairs for one or more of the following additional fields: src, dst, spt, dpt, proto, and msg.
`Name`	Displays the name of the Tenable Network Monitor plugin or PASL ID triggered by the reported traffic.
`Severity`	Displays the associated severity level of the reported vulnerability.
`Signature ID`	Displays the reported Tenable Network Monitor plugin or PASL ID triggered by the reported traffic.
`timestamp`	Displays the date and time of the Syslog message.
`Version`	Displays the version of the CEF format version.

Unknown or Customized Ports

Many networks contain traffic on ports Tenable Network Monitor defines as different traffic types or alternate ports. If the port is not defined, it displays as **Unknown**. The **NNM-services** file may be edited to either customize or add the port information to provide accurate reporting for ports on the network.

For example, by default, there are two lines in the **NNM-services** file that define SMTP traffic. They read `smtp 25/tcp` and `smtp 25/udp`. If the organization routinely sends SMTP data over port 2525 those lines can be updated to read `smtp 2525/tcp` and `smtp 2525/udp`.

Working with Tenable Security Center

Tenable Network Monitor can operate under the control of Tenable Security Center, which provides Tenable Network Monitor with passive vulnerability data and retrieves scanned data. Tenable Security Center has a variety of reporting, remediation, and notification mechanisms to efficiently distribute vulnerability information across large enterprises. In addition, it can also control a distributed set of Tenable Nessus active vulnerability scanners. By combining active and passive vulnerability scanning, Tenable Security Center can be used to efficiently and accurately manage security across large networks.

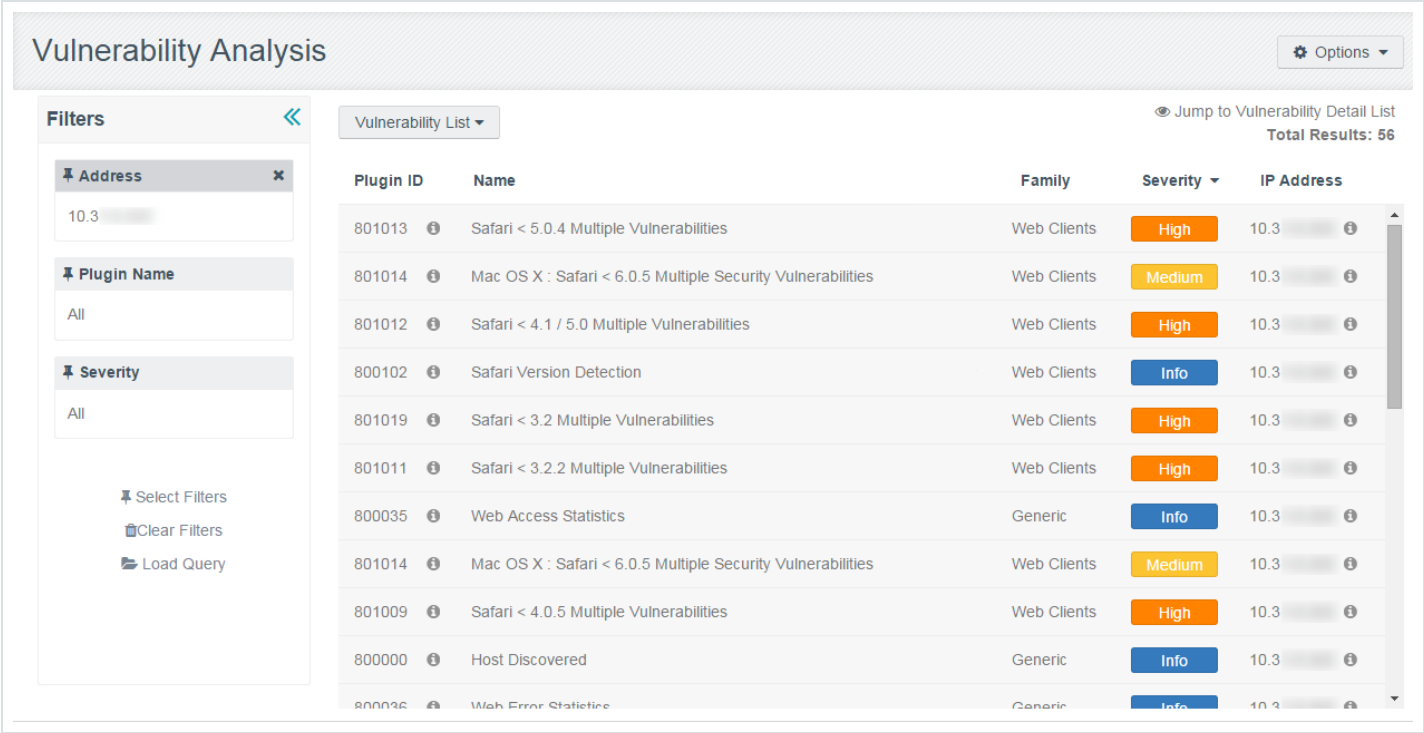
This section contains the following information about Tenable Network Monitor integration with Tenable Security Center.

- Managing Vulnerabilities
- Updating the Tenable Network Monitor Management Interface

Managing Vulnerabilities

Tenable Security Center displays a summary of vulnerabilities detected by Tenable Network Monitor. These vulnerabilities can be independently viewed by many different users with different access control. Tenable Security Center also allows security managers to issue recommendations that help guide network administrators as to which vulnerabilities should be mitigated.

For more information, see the *Tenable Security Center User Guide*.



Tenable Network Monitor is Real-Time

Since Tenable Network Monitor's vulnerability data is constantly fed into Tenable Security Center and Tenable Network Monitor's plugins are updated by Tenable®, the accuracy of the passive vulnerability data in Tenable Security Center greatly enhances the quality of the security information available to Tenable Security Center users.

Offline Tenable Network Monitor Plugin Update in Tenable Security Center

To perform an offline Tenable Network Monitor plugin update:

1. If not already in place, install a Tenable Network Monitor scanner on the same host as Tenable Security Center. It does not need to be started or otherwise configured.
2. To prevent the Tenable Network Monitor scanner from starting automatically upon restarting the system, run the following command:

```
# /sbin/systemctl is-enabled nnm off
```

3. Run the following command and save the challenge string that is displayed:

```
# /opt/nnm/bin/nnm -challenge
```

4. Do one of the following:
   - If you are using PVS versions 4.2.1 to 5.3.x, in your browser, navigate to https://plugins.nessus.org/v2/offline-pvs.php.
   - If you are using Tenable Network Monitor versions 5.4.x or later, in your browser, navigate to https://plugins.nessus.org/v2/offline-nnm.php.
5. Paste the challenge string from Step 3 and your Activation Code in the appropriate boxes on the web page.
6. Click **Submit**.
7. On the next page, copy the link that starts with **https://plugins.nessus.org/v2/...** and bookmark it in your browser. The other information on the page is not relevant for use with Tenable Security Center.
8. Click the bookmarked link.

   The page prompts you to download a file.
9. Download the file, which is called `sc-passive.tar.gz`.
10. Save the `sc-passive.tar.gz` on the system used to access your Tenable Security Center GUI.

    Note: Access the Tenable Network Monitor feed setting and change the activation from offline to Tenable Security Center.
11. Log in to Tenable Security Center as an administrator.
12. Click **System > Configuration**.

    The **Configuration** page appears.
13. Click **Plugins/Feed**.

    The **Plugins/Feed Configuration** page appears.
14. In the **Schedules** section, expand the **Passive Plugins** options.

15. Click **Choose File** and browse to the saved `sc-passive.tar.gz` file.
16. Click **Submit**.

    After several minutes, the plugin update finishes and the page updates the **Last Updated** date and time.

Tenable Security Center Troubleshooting

Tenable Network Monitor server does not appear to be operational

1. Log in to Tenable Security Center as an administrator.
2. Verify that the Tenable Network Monitor server appears as **Unable to Connect** under **Status**.
3. SSH to the remote Tenable Network Monitor host to make sure the underlying operating system is operational.
4. Confirm that the Tenable Network Monitor is running (Linux example below):

```
# service nnm status

NNM is stopped
NNM Proxy (pid 3142) is running
#
```

5. If the Tenable Network Monitor service is not running, start the service:

```
# service nnm start
Starting NNM Proxy                                         [  OK  ]
Starting NNM                                               [  OK  ]
#
```

Cannot add an Tenable Network Monitor server

1. Confirm that the Tenable Network Monitor proxy is listening on the same port as Tenable Security Center (port 8835 by default):

```
# ss -pan | grep 8835
tcp        0      0 0.0.0.0:8835    0.0.0.0:*     LISTEN      406/nnm
```

2. Check connectivity by telnetting from the Tenable Security Center console into the Tenable Network Monitor server on port 8835 (the Tenable Network Monitor listening port). If successful, the response includes: Escape character is '^]'.

No vulnerabilities are being received from the Tenable Network Monitor server

1. Ensure that the Tenable Network Monitor service is running on the Tenable Network Monitor host.
2. Ensure that the Tenable Network Monitor appears in Tenable Security Center under **Resources > Passive Scanners** and that the status of the Tenable Network Monitor appears as **Working**.
3. Click **Edit** to ensure that the IP address or hostname, port, username, password, and selected repositories for the Tenable Network Monitor are correct.
4. Edit any incorrect entries to their correct state.
5. Click **Submit** to attempt to reinitialize the Tenable Network Monitor scanning interface.

Tenable Network Monitor plugins fail to update

1. Manually test a plugin update under **Plugins** with **Update Plugins**.

   If successful, **Passive Plugins Last Updated** updates to the current date and time.
2. Ensure that the Tenable Security Center host allows outbound HTTPS connectivity to the Tenable Network Monitor Plugin Update Site.
3. For all other Tenable Network Monitor plugin update issues, contact Tenable Support.