



# HP Network Virtualization for LoadRunner and Performance Center

Software Version: 12.50

## User Guide

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# Contents

What's new in Network Virtualization 12.50 .....	7
Chapter 1: Network Virtualization Overview .....	8
NV components .....	8
NV log files .....	10
Chapter 2: Network Virtualization Installation .....	12
System requirements .....	13
Install HP Network Virtualization .....	13
Silent installation of HP Network Virtualization .....	16
Silently uninstall HP Network Virtualization .....	19
Post-installation tasks .....	20
Chapter 3: Configure licensing .....	21
Licensing methods .....	21
Access the NV License Manager .....	22
Install a seat license .....	22
Set up your license server .....	22
Use floating licenses .....	23
Chapter 4: Customize NV .....	25
Set the active adapter on NV for Load Generator .....	26
Change the NV for Controller port .....	26
Change the NV for Load Generator and NV Network Editor port .....	27
Set the maximum packet list buffer size on NV for Load Generator .....	28
Enable the cleanup threshold on NV for Load Generator .....	28
Chapter 5: Add and configure virtual locations .....	30
Enable network virtualization .....	32
Set the network virtualization mode .....	33
Define virtual location test level settings .....	33
Define packet capture [test level settings] .....	34
Create a global IP filter [test level settings] .....	35
Select virtual location definition method .....	36
Configuring virtual locations .....	37
Define custom virtual location parameters .....	37
Extract virtual location parameters from the NV Global Library .....	38
Import virtual location parameters from an NV profile .....	39
Specify virtual location runtime settings .....	41
Allocate bandwidth to Vusers .....	42
Set packet capture for a virtual location .....	43
Create a local IP filter for a virtual location .....	44
Exclude machines from network virtualization .....	45
Chapter 6: Analyze test results .....	46
Chapter 7: Configure NV profiles with Network Editor .....	48
Network Editor overview .....	48
Open Network Editor .....	48

Create NV profiles .....	49
Configure gateway parameters .....	50
Configure the WAN parameters .....	53
Latency and packet loss [WAN Parameters] .....	53
Packet effects [WAN Parameters] .....	56
Link faults [WAN Parameters] .....	57
NV profile parameters .....	58
Send Us Feedback .....	62



# What's new in Network Virtualization 12.50

This What's New provides an overview of the features that were introduced or enhanced in HP Network Virtualization for LoadRunner and Performance Center 12.50.

- **Full protocol support.** You can now define virtual locations for all supported LoadRunner and Performance Center protocols.
- **NV Analytics report integration with VuGen.** Analyze your script before using it in your tests. After you run a script in VuGen, review the NV Analytics report in the replay summary.
- **Integrated installation.** NV 12.50 is now a part of the LoadRunner and Performance Center installation process. At the end of the LoadRunner and Performance Center installations, you have the option to install the NV 12.50 components.
- **Integrated licensing.**
  - **Unified licensing management.** LoadRunner and Performance Center now manage licensing for Network Virtualization Vusers, which enable you to run scenarios that incorporate NV virtual locations.
  - **HP AutoPass license server.** The HP AutoPass floating licensing model was implemented for NV Analytics licenses, including the integrated NV Analytics reports in VuGen.
- **Language support.** Network Virtualization now includes a localized user interface for the following languages: French, German, Spanish, Japanese and Simplified Chinese.
- **Microsoft Windows.** Support was added for Windows 8.1 and Windows Server 2012 R2.
- **Improved user interface and usability.**

# Chapter 1: Network Virtualization Overview

HP Network Virtualization (NV) helps to improve the accuracy of your LoadRunner scenarios and Performance Center tests. HP NV achieves this by enabling you to emulate real-world network conditions – in your testing environment. While the emulated network conditions typically include latency, packet loss, and bandwidth, various other network conditions can be emulated if required. By introducing these network conditions into a test, the test can more accurately emulate the real-world network conditions. This, in turn, enables you to more accurately emulate the actual deployment of your system or application in the real world.

- HP NV includes various components. See "[NV components](#)" below for an introduction to these components.
- To enable the network virtualization functionality in LoadRunner or Performance Center, various NV components must be installed. For installation instructions, see "[Network Virtualization Installation](#)" on page 12.

## About this guide

The *LoadRunner User Guide* and the *Performance Center User Guide* contain details about network virtualization, and how to implement network virtualization in LoadRunner scenarios and Performance Center tests.

This guide describes NV topics that are not covered in the *LoadRunner User Guide* and the *Performance Center User Guide*:



## NV components

The HP NV bundle includes the following base components. These components must be installed as part of any HP NV installation.

- **HP NV for Controller**

The HP NV for Controller component provides the functionality that is used to implement network virtualization in LoadRunner scenarios and Performance Center tests. The primary tool in the HP NV for Controller is the Virtual Location Editor. For details on how to use the Virtual Location Editor, see "[Add and configure virtual locations](#)" on page 30.

HP NV for Controller must be installed on the same computer as the LoadRunner Controller or Performance Center Host.

- **HP NV for Load Generator**

HP NV for Load Generator is the component that runs on each LoadRunner or Performance Center load , and on VuGen. HP NV for Load Generator includes a network virtualization driver that applies

specified network conditions for traffic that flows between the load generator and the application servers being tested. HP NV for Load Generator does not have its own executable file or UI. Instead, the LoadRunner Controller and Performance Center communicate directly with HP NV for Load Generator as required.

HP NV for Load Generator must be installed on all LoadRunner or Performance Center load generators and VuGen installations that will implement network virtualization.

- **HP NV for Performance Center Server**

The HP NV for Performance Center Server component provides the functionality that is used to implement network virtualization in Performance Center tests. The primary tool in the HP NV for PC Server is the Virtual Location Editor. For details on how to use the Virtual Location Editor, see ["Add and configure virtual locations" on page 30](#).

HP NV for Performance Center Server must be installed on the same computer as the Performance Center Server.

The following optional components are included in your HP NV bundle.

- **HP Network Editor**

HP Network Editor allows you to define complex NV profiles and to save the profiles to a file. You can then import the NV profiles into a LoadRunner scenario or a Performance Center test, as part of a virtual location definition. For more details about creating and saving complex NV profiles, see ["Network Editor overview" on page 48](#).

HP Network Editor is automatically installed whenever the HP NV for Load Generator is installed.

- **HP NV Predictor**

NV Predictor analyzes test results from HP LoadRunner, and generates automated reports for SLO (service level objective) compliance. NV Predictor evaluates results of one or more key metrics for SLO compliance by virtual location based on static values and/or baseline performance. The customizable reports produce a comprehensive analysis of application performance by virtual location.

For details on how to install and use NV Predictor, see the *NV Predictor User Guide*.

- **HP NV Analytics**

NV Analytics conducts an analysis based on emulation results which assists in pinpointing factors that negatively impact an application's operation across a network. NV Analytics conducts an analysis based on packet list data, then displays the resulting data in informative reports that provide insight into an application's operation.

**Note:** NV Analytics reports are a part of Network Virtualization. If you have installed NV on your VuGen machine, you can view the NV Analytics reports directly in VuGen, without the need to install the standalone NV Analytics version.

If you are already using the standalone version of NV Analytics, you can install the updated 12.50 version, included with the NV installation files.

For details on how to install and use NV Analytics, see the *NV Analytics User Guide*.

- **HP NV Global Library**

The NV Global Library contains a vast collection of mobile and land-line network conditions between various locations on the globe. These conditions include latency, packet loss and bandwidth. This regularly updated library, including millions of data points, provides real world point-to-point network

conditions that were recorded around the world. You can import these network conditions to define a virtual location in a LoadRunner scenario or a Performance Center test.

**Note:** To access the full set of geographic locations in the NV Global Library, you must be connected to the internet and be licensed to access the NV Global Library. If either of these two conditions is not met, then you will have access to a limited set of geographic locations. For details on licensing, see ["Configure licensing" on page 21](#).

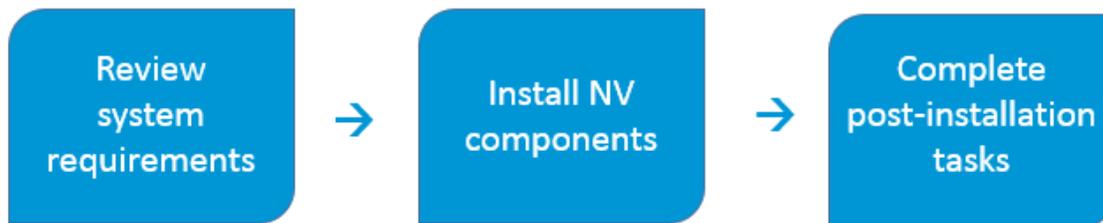
## NV log files

HP Network Virtualization products' log files are located in the <installation directory>\logs. By default, in \Program Files\HP\NV\logs or \Program Files (x86)\HP\NV\logs.



# Chapter 2: Network Virtualization Installation

The installation process includes these steps:



This section includes:

- System requirements ..... 13
- Install HP Network Virtualization ..... 13
- Silent installation of HP Network Virtualization ..... 16
- Silently uninstall HP Network Virtualization ..... 19
- Post-installation tasks ..... 20

## System requirements

To install **HP Network Virtualization for LoadRunner and Performance Center** components, the appropriate LoadRunner or Performance Center version, 12.50 or later, must be installed.

System requirements for running HP Network Virtualization components are the same as system requirements for LoadRunner or Performance Center, unless otherwise specified below.

The minimum requirements for running HP NV components on HP Load Generator are as follows:

<b>Processor</b>	Quad core processor or higher
<b>Memory (RAM)</b>	4 GB RAM or more
<b>HP Load Generator</b>	HP Load Generator for LoadRunner or Performance Center 12.50

### Third-party components

The following third-party components are prerequisites for HP Network Virtualization.

- Java Runtime Environment (JRE) 6.0 update 24 (32-bit) or later
- Microsoft .NET Framework 4.0 Full or later

If a minimum required version is not already installed on the host, the LoadRunner full, the standalone Load Generator, or VuGen installations install the prerequisites.

The Performance Center Server installation does not install the NV prerequisites. If the minimum required versions are not already installed on the host machine, the following versions are installed during installation of the NV for Performance Center component.

- Java Runtime Environment (JRE) 8.0 update 45
- Microsoft .NET Framework 4.5.2 Full

## Install HP Network Virtualization

To gain access to the HP Network Virtualization (NV) functionality in either LoadRunner or Performance Center, you must install the NV components.

**NV upgrade:** If a previous version of HP Network Virtualization is installed on the machine, you must uninstall all NV components before you can install NV 12.50.

To retain results from your current version of NV, during the uninstallation select the option to save existing data.

To uninstall: From the **Control Panel > Programs and Features**, right-click the HP NV component and click **Uninstall**.

At the end of LoadRunner or Performance Center installation wizards, you are prompted to install Network Virtualization. You can continue with the NV installation, or choose to install manually at a later time.

If you choose to install NV components, follow the on-screen instructions. You can select one of the following installation modes:

- Typical. Installs the component with default options.
- Custom. Enables you to configure several options before installation. For details, see ["Setup wizard options" on the next page.](#)

The following components are installed:

NV component name	Installed with:
HP NV for Controller	LoadRunner full installation Performance Center Host installation
HP NV for Performance Center Server	Performance Center Server installation
HP NV for Load Generator	Load Generator (standalone) installation LoadRunner full installation Performance Center Host installation VuGen installation

### Manual installation

If you did not install the NV components as part of the LoadRunner or Performance Center installations, you can run the NV installations manually at any time.

**Prerequisite:** The appropriate LoadRunner or Performance Center components, version 12.50 or later, must be installed before you can install the NV components.

The installation files are located in the following folders:

- LoadRunner: <LoadRunner installation DVD>\Additional Components\HP NV\
- Performance Center: <Performance Center installation DVD>\AdditionalComponents\HPNV\

Run the installation files, according to your needs:

For this LoadRunner or Performance Center component...	You need to install this NV component...	NV installation file
LoadRunner full installation	NV for Controller NV for Load Generator	NV4HPControllerSetup.exe NV4HPLGSetup.exe
Load Generator (standalone)	NV for Load Generator	NV4HPLGSetup.exe
VuGen	NV for Load Generator (The NV for Load Generator component is required because it contains NV Analytics reports, which are integrated with VuGen.)	NV4HPLGSetup.exe
Performance Center Server	NV for Performance Center Server	NV4HPPCSetup.exe
Performance Center Host	NV for Controller NV for Load Generator	NV4HPControllerSetup.exe NV4HPLGSetup.exe

**Note:** You must restart the machine after installation or uninstallation of the **NV for Load Generator** component.

## Setup wizard options

If you have chosen to run a custom installation during the setup wizard, or are installing the NV components manually, you can configure several options. Some options are enabled when installing the first NV component on a machine only.

Option	NV component
<b>Destination Folder</b>	Enter a location on the file system to install the component, or accept the default location: C:\Program Files (x86)\HP\NV.
<b>Data Folder</b>	Stores temporary internal application data and user data, such as test run results. By default, C:\Data.
<b>Server Port</b>	The port that will be used for communication between various NV components. There is typically no need to change this value from the default of 8182. If you select to <b>Enable Remote Connections</b> , NV will add an exception to the Windows Firewall, enabling remote access to web-based NV components, using the specified server port.
<b>Enable Remote Connections</b>	Adds an exception to Windows Firewall. This is required for accessing NV statistics and NV Network Editor from remote machines, or to access the NV License Manager remotely.

## More NV applications

You can install the following optional HP Network Virtualization components on any machine that meets the system requirements. For installation file locations, see ["Manual installation" on the previous page](#).

NV application	Description	NV installation file
HP NV Analytics	<p>Provides in-depth analysis of your application's performance, based on test results from tests that use NV functionality. Helps to identify factors that negatively impact your application's performance.</p> <p><b>Note:</b> NV Analytics reports are a part of Network Virtualization. If you have installed NV on your VuGen machine, you can view the NV Analytics reports directly in VuGen, without the need to install this standalone NV Analytics version.</p> <p>If you are already using the standalone version of NV Analytics, you can install the updated 12.50 version, included with the NV installation files.</p>	Analytics_setup.exe
HP NV Predictor	Analyzes test results from HP LoadRunner, and generates automated reports for SLO (service level objective) compliance. Evaluates results of one or more key metrics for SLO compliance by virtual location based on static values and/or baseline performance. The customizable reports produce a comprehensive analysis of application performance by virtual location.	NVPredictorSetup.exe

## Installation logs

Installation logs are located under C:\HP Log. Log files are named as follows:

<Product name>\_<date>\_<time>.log

For example:

HP NV for Load Generator\_6-4-2015\_15-29-27.log

HP NV for Controller\_6-4-2015\_15-37-38.log

## Silent installation of HP Network Virtualization

You can silently install the HP NV components for LoadRunner and Performance Center.

**Note:**

- During a silent installation of HP LoadRunner or HP Performance Center, the appropriate NV components are installed by default. For more information, refer to the LoadRunner or Performance Center documentation.

Consider before you begin:

- When performing a silent installation of NV LoadRunner for Controller, you must be logged in as an Administrator.
- Make sure that all system requirements are met before beginning the installation. For details, see ["System requirements" on page 13](#).
- You will not be notified if the silent installation fails. The installation log is located under C:\HP Logs. Log files are named as follows:

<Product name>\_<date>\_<time>.log

For example:

HP NV for Load Generator\_6-4-2015\_15-29-27.log

HP NV for Controller\_6-4-2015\_15-37-38.log

The installation files are located in the following folders:

- LoadRunner: <LoadRunner installation DVD>\Additional Components\HP NV\
- Performance Center: <Performance Center installation DVD>\AdditionalComponents\HPNV\

For this LoadRunner or Performance Center component...	You need to install this NV component...	NV installation file
LoadRunner full installation	NV for Controller NV for Load Generator	NV4HPControllerSetup.exe NV4HPLGSetup.exe
Load Generator (standalone)	NV for Load Generator	NV4HPLGSetup.exe
VuGen	NV for Load Generator  (The NV for Load Generator component is required because it contains NV Analytics reports, which are integrated with VuGen.)	NV4HPLGSetup.exe
Performance Center Server	NV for Performance Center Server	NV4HPPCSetup.exe

For this LoadRunner or Performance Center component...	You need to install this NV component...	NV installation file
Performance Center Host	NV for Controller NV for Load Generator	NV4HPControllerSetup.exe NV4HPLGSetup.exe

**Note:** You must restart the machine after installation or uninstallation of the **NV for Load Generator** component.

See below for detailed installation instructions:

### Silently install NV for Controller

1. Copy the NV4HPControllerSetup.exe file to a convenient location on the LoadRunner or Performance Center Host machine.
2. Run a command prompt with elevated privileges. From the Windows Start menu, click **All Programs > Accessories**, right-click **Command Prompt**, and then click **Run as administrator**.
3. In the Command Prompt window, navigate to the location of the file copied in step 1, and enter the following command together with the required command line options:

```
NV4HPControllerSetup.exe /s /v"/qn <command_line_options>"
```

Command line options:

Option	Description	Required/Optional	Default value
<b>PORT=&lt;port number&gt;</b>	The port used to connect to NV for Controller.	<b>REQUIRED</b>	8182
<b>INSTALLDIR="&lt;path to installation folder&gt;"</b>	The location where the application files will be installed.	OPTIONAL	C:\Program Files (x86)\HP\NV
<b>ENABLE_REMOTE=&lt;TRUE   FALSE&gt;</b>	Opens the port in the firewall. Required for enabling remote access to web-based NV components.	OPTIONAL	TRUE
<b>REBOOT_IF_NEED=&lt;TRUE   FALSE&gt;</b>	If a reboot is required, automatically reboots the computer after installation completes.  <b>Note:</b> Even if the FALSE value is used, you will need to reboot the machine before NV for Controller is operational.	OPTIONAL	FALSE
<b>DATA_FOLDER="&lt;path to data dir&gt;"</b>	The location where temporary internal application data and user data is saved.	OPTIONAL	C:\%ProgramData%\HP\NV

Example:

```
NV4HPControllerSetup.exe /s /v"/qn PORT=8182"
```

### Silently install NV for Performance Center

1. Copy the NV4HPPCSetup.exe file to a convenient location on the Performance Center Server machine.
2. Run a command prompt with elevated privileges. From the Windows Start menu, click **All Programs > Accessories**, right-click **Command Prompt**, and then click **Run as administrator**.
3. In the Command Prompt window, navigate to the location of the file copied in step 1, and enter the following command together with the required command line options:

```
NV4HPPCSetup.exe /s /v"/qn <command_line_options>"
```

Command line options:

Option	Description	Required/Optional	Default value
<b>PORT=&lt;port number&gt;</b>	The port used to connect to NV for Performance Center.	<b>REQUIRED</b>	8182
<b>INSTALLDIR="\&lt;path to installation folder&gt;"</b>	The location where the application files will be installed.	OPTIONAL	C:\Program Files (x86)\HP\NV
<b>ENABLE_REMOTE=&lt;TRUE   FALSE&gt;</b>	Opens the port in the firewall. Required for enabling remote access to web-based NV components.	OPTIONAL	TRUE
<b>REBOOT_IF_NEED=&lt;TRUE   FALSE&gt;</b>	If a reboot is required, automatically reboots the computer after installation completes.  <b>Note:</b> Even if the FALSE value is used, you will need to reboot the machine before NV for Performance Center is operational.	OPTIONAL	FALSE
<b>DATA_FOLDER="&lt;path to data dir&gt;"</b>	The location where temporary internal application data and user data is saved.	OPTIONAL	C:\%ProgramData%\HP\NV

Example:

```
NV4HPPCSetup.exe /s /v"/qn PORT=8182"
```

## Silently install NV for Load Generator

1. Copy the NV4HPLGSetup.exe file to a convenient location on the Load Generator machine.
2. Run a command prompt with elevated privileges. From the Windows Start menu, click **All Programs > Accessories**, right-click **Command Prompt**, and then click **Run as administrator**.
3. In the Command Prompt window, navigate to the location of the file copied in step 1, and enter the following command together with the required command line options:

```
NV4HPLGSetup.exe /s /v"/qn <command_line_options>"
```

Command line options:

Option	Description	Required/Optional	Default value
<b>PORT=&lt;port number&gt;</b>	The port used to connect to NV for Load Generator.	<b>REQUIRED</b>	8182
<b>INSTALLDIR="&lt;path to installation folder&gt;"</b>	The location where the application files will be installed.	OPTIONAL	C:\Program Files (x86)\HP\NV
<b>ENABLE_REMOTE=&lt;TRUE   FALSE&gt;</b>	Opens the port in the firewall. Required for remote access to the NV statistics and the NV Network Editor.	OPTIONAL	TRUE
<b>REBOOT_IF_NEED=&lt;TRUE   FALSE&gt;</b>	If a reboot is required, automatically reboots the computer after installation completes.  <b>Note:</b> Even if the FALSE value is used, you will need to reboot the machine before NV for Load Generator is operational.	OPTIONAL	FALSE
<b>DATA_FOLDER="&lt;path to data dir&gt;"</b>	The location where temporary internal application data and user data is saved.	OPTIONAL	C:\%ProgramData%\HP\NV

Example:

```
NV4HPLGSetup.exe /s /v"/qn PORT=8182"
```

## Silently uninstall HP Network Virtualization

To uninstall NV 12.50 silently, you must be logged in as administrator.

At the command line, enter the command for the component you want to uninstall:

NV component	Uninstall command
NV for Controller	NV4HPControllerSetup.exe /s /removeonly /v"/qn PORT=<port number> REBOOT_IF_NEED=<TRUE   FALSE>" PORT - optional; removes the port from the firewall
NV for Performance Center	NV4HPPCSetup.exe /s /removeonly /v"/qn PORT=<port number> REBOOT_IF_NEED=<TRUE   FALSE>" PORT - optional; removes the port from the firewall
NV for Load Generator	NV4HPLGSetup.exe /s /removeonly /v"/qn PORT=<port number> REBOOT_IF_NEED=<TRUE   FALSE>" PORT - optional; removes the port from the firewall

**Note:** You must restart the machine after installation or uninstallation of the **NV for Load Generator** component.

## Post-installation tasks

After installing NV components, you need to:

- install licenses
- configure the active adapter
- optionally configure addition NV customization

For details, see the relevant sections of the HP Network Virtualization for LoadRunner and Performance Center User Guide.

# Chapter 3: Configure licensing

After installing HP Network Virtualization components, you need to install the NV Analytics licenses. An NV Analytics license is required for the Network Virtualization for LoadRunner and Performance Center analysis functionality that is integrated with VuGen, and for using the standalone version of NV Analytics.

NV Analytics licenses are managed from the NV License Manager.

**Note:** Licensing for general NV emulation functionality and access to the NV Global Library is managed by the LoadRunner/Performance Center licensing utility, according to Network Virtualization Vuser licenses.

## What do you want to do?

- Learn about: ["Licensing methods" below](#)
- ["Access the NV License Manager" on the next page](#)
- ["Install a seat license" on the next page](#)
- ["Set up your license server" on the next page](#)
- ["Use floating licenses" on page 23](#)

## Licensing methods

The following licensing methods are available for the Network Virtualization products:

### Seat licenses

A seat license is created for a specific Network Virtualization product on a specific computer, and cannot be transferred to another computer.

### Floating licenses

When using floating licenses, licenses are held by a license server and you check them out as necessary. To use floating licenses, you must have the HP AutoPass License Server 8.3 or later installed on your network.

When you are finished using the licenses, you return the licenses to the license server so that they can be used by other NV installations.

### Trial licenses

NV Analytics has a thirty (30) day trial license. The trial license gives access to all product functionality.

**NV Analytics reports in VuGen:** The trial period begins the first time you use the NV Analytics functionality in VuGen.

**NV Analytics:** The trial period begins the first time you run an analysis.

**Caution:** If you install any Network Virtualization product on a virtual machine, do not clone the machine after the trial license has started.

## Access the NV License Manager

You can access the NV License Manager in the following ways:

- From the Windows **Start** menu, select **All Programs > HP Software > HP Network Virtualization > NV License Manager**.  
In Windows 8.x or higher, you can access NV License Manager from the **Start** or **Apps** screen.
- From a web browser, navigate to the following URL:

```
http://<hostname>:<port>/shunra/license/
```

For example:

```
http://198.51.100.24:8182/shunra/license/
```

## Install a seat license

When using seat licenses, you must apply a license to every computer that uses NV Analytics.

1. Open the NV License Manager on the desired computer.
2. Click **Update license**.
3. Click **Update via: > File or key**.
4. Copy the **machine code** displayed below.
5. Click **HP license portal** to connect to the HP Licensing site.
6. Enter a valid license Entitlement Order Number (EON). You will be redirected to a page where you can enter the machine code that you previously copied, and generate a license file.
7. Enter the license key or click the folder icon  that appears to the right of the **License File** box, locate and upload the license file.
8. Click **Update**. The updated license details are displayed in the NV License Manager main page.

## Set up your license server

When using the floating license method, licenses are held by a license server and you check them out as necessary. Network Virtualization works with HP AutoPass License Server to manage floating licenses.

1. Select a machine to host the license server. The license server must be accessible by all machines on which you will generate NV Analytics reports.
2. Install HP AutoPass License Server. The installation folder **autopass-8.3.zip** is located together

with the Network Virtualization installation files.

The installation files are located in the following folders:

- LoadRunner: <LoadRunner installation DVD>\Additional Components\HP NV\
- Performance Center: <Performance Center installation DVD>\AdditionalComponents\HPNV\

Unzip and run the appropriate setup file. For more information, refer to the AutoPass documentation, located in the same folder.

3. Connect to the [HP license portal](http://h30580.www3.hp.com/): <http://h30580.www3.hp.com/>, and enter a valid license Entitlement Order Number (EON). Follow the instructions on the HP site to obtain the licenses and install them on your license server.

## Use floating licenses

Floating licenses are held by a license server and you check them out as necessary. A license is checked out for a specified number of days, at the end of which it is automatically returned to license server. You can return a license early, if desired.

### What do you want to do?

- ["Check out a license" below](#)
- ["Return a license" on the next page](#)

### Check out a license

**Note:** The maximum number of days that a license can be checked out can be configured on the HP AutoPass License Server. Refer to the AutoPass documentation for details.

1. Open the NV License Manager on the machine that needs to check out a license. For details, see ["Access the NV License Manager" on the previous page](#).
2. Click **Update License**.
3. Choose **Update via: License server**.
4. In the **License server address** field, select the machine where the license server is installed. If the license server does not appear in the list, enter its address.
5. In the **License duration (days)** field, choose for how long to check out the license. By default, the maximum number of days a license can be checked out is 30.
6. Under **more settings**:
  - a. Configure the port for the AutoPass License Server. By default, 5814. The machine that checks out a license must have access to the license server.
  - b. Select **Use secured communication** to use secure communication between the NV License Manager and the license server.
7. Click **Checkout license**. The license is checked out from the license server.

### **Return a license**

1. Open the NV License Manager on the machine that needs to return a license.
2. Click the **Update License** button.
3. Choose **Update via: License server**.
4. Click **Return license**. The license is returned to the license server.

# Chapter 4: Customize NV

You can customize various NV settings to meet your needs.

## What do you want to do?

- [Set the active adapter on NV for Load Generator](#) .....26
- [Change the NV for Controller port](#) ..... 26
- [Change the NV for Load Generator and NV Network Editor port](#) .....27
- [Set the maximum packet list buffer size on NV for Load Generator](#) ..... 28
- [Enable the cleanup threshold on NV for Load Generator](#) .....28

## Set the active adapter on NV for Load Generator

LoadRunner and Performance Center use the active adapter on each Load Generator to impose the required network conditions for network virtualization. For each Load Generator machine that has more than one NIC [network interface card], perform the following task on the NV for Load Generator machine to specify the NIC to be used.

1. On the NV for Load Generator computer, select **Start > All Programs > HP Software > HP Network Virtualization > HP NV for Load Generator > NV Agent**. The NV Agent icon appears in the system tray of the Load Generator machine.
2. Right-click the NV Agent icon and select **Active Adapter Settings**.
3. In the Active Adapter dialog box, click **Set Active Adapter**, and select the required NIC.

## Change the NV for Controller port

By default, port 8182 is the port number that is used to access NV for Controller, for both LoadRunner and Performance Center. Although there is typically no need to change the port number, if required, you can change the port number as described below.

**Note:** Perform the procedure below only if NV for Controller is installed, and NV for Load Generator is not installed on the same computer. If both NV for Controller and NV for Load Generator are installed on the same computer, see ["Change the NV for Load Generator and NV Network Editor port" on the next page](#).

### On the NV for Controller computer:

1. Make sure that no tests are running.
2. Make sure that the new port has been allowed in the firewall.
3. Navigate to the following folder: <installation\_folder>\conf.  
By default, <installation\_folder> is C:\Program Files (x86)\HP\NV\ or C:\Program Files\HP\NV\.
4. Open the *config.properties* file in a text editor.
5. Change:

```
com.shunra.bootstrapper.port=<current port number>
```

to

```
com.shunra.bootstrapper.port=<new port number>
```

6. Save the file.
7. Restart the **HP Network Virtualization** service (NVWatchDogService).
8. Navigate to the following folder: <installation\_folder>\conf.  
By default, <installation\_folder> is C:\Program Files (x86)\HP\NV\ or C:\Program Files\HP\NV\.

9. Right-click the file *License.url* and select **Properties**. In the **URL**, replace the old port number with the new port number.
10. In all browser shortcuts to the License Manager, replace the old port number with the new port number.

## Change the NV for Load Generator and NV Network Editor port

By default, port 8182 is the port number that is used by a browser to access the NV Network Editor, and the port number that is used to access the NV for Load Generator component. Although there is typically no need to change the port number, if required, you can change the port number as described below.

For details on how to change the NV for Controller port number, see ["Change the NV for Controller port" on the previous page](#).

### **On each computer on which the NV for Load Generator or NV Network Editor are installed:**

1. Make sure that no tests are running.
2. Make sure that the new port has been allowed in the firewall.
3. Navigate to the following folder: <installation\_folder>\conf.  
By default, <installation\_folder> is C:\Program Files (x86)\HP\NV\ or C:\Program Files\HP\NV\.
4. Open the *vcat.properties* file in a text editor.
5. Change:

```
com.shunra.vcat.port=<current port number>
```

to

```
com.shunra.vcat.port=<new port number>
```

6. Save the file.
7. Open the *config.properties* file in a text editor.
8. Change:

```
com.shunra.bootstrapper.port=<current port number>
```

to

```
com.shunra.bootstrapper.port=<new port number>
```

9. Navigate to the following folder: <installation\_folder>\lib\shunra\vcat\  
By default, <installation\_folder> is C:\Program Files (x86)\HP\NV\ or C:\Program Files\HP\NV\.

10. Open the *NVAgent.exe.config* file in a text editor.
11. Search for and replace "8182" (or the current port) with the new port number.
12. Restart the **HP Network Virtualization** service (NVWatchDogService).
13. Navigate to the following folder: <installation\_folder>\conf.  
By default, <installation\_folder> is C:\Program Files (x86)\HP\NV\ or C:\Program Files\HP\NV\.
14. Right-click the file *Network Editor.url* and select **Properties**. In the **URL**, replace the old port number with the new port number.
15. Right-click the file *License.url* and select **Properties**. In the **URL**, replace the old port number with the new port number.
16. In all browser shortcuts to the NV Network Editor, replace the old port number with the new port number.

## Set the maximum packet list buffer size on NV for Load Generator

You can specify that when a LoadRunner or Performance Center test runs, the network packets that are transmitted across the network are captured, and stored in a buffer for future analysis. Packet capture is configured within a virtual location. One of the packet capture settings you configure in a virtual location is the maximum size of the packet list. For details, see ["Define virtual location test level settings" on page 33](#).

When using the option to generate NV Analytics reports in VuGen, the maximum packet list size is defined by the **PacketListMaxSizeMB** property, in the NV configuration file. You can modify the maximum buffer size as described below.

### To modify the packet list buffer size:

1. Stop all network virtualization tests that are currently running.
2. Navigate to the following folder: <installation\_folder>\conf.  
By default, <installation\_folder> is C:\Program Files (x86)\HP\NV\ or C:\Program Files\HP\NV\.
3. Open the file *userConfiguration.xml* file in a text editor.
4. Locate the **PacketListMaxSizeMB** property, and set it to the required value.  
The permitted range is 10 - 1000 MB.
5. Save the file.
6. Restart the **HP Network Virtualization** service (NVWatchDogService).

## Enable the cleanup threshold on NV for Load Generator

The NV cleanup threshold is a mechanism for deleting NV packet lists saved on the NV for Load Generator to free up disk space.

Test results are saved in the NV for Load Generator's **Data folder**, as defined during setup. The Data folder is located by default in `\\%programdata%\HP\NV\Emulation\Runs`.

When starting a test, if the defined free disk threshold on the NV for Load Generator isn't met, the test results folders will be deleted one by one from the oldest until the threshold is restored, or until only two folders are left. If only two folders are left and the threshold wasn't restored and the test does not start on the HP Load Generator, consider deleting unnecessary data or reducing the threshold.

The cleanup threshold is 3 times that of the packet list size that is defined on the NV for Load Generator. For details on customizing the packet list size, see ["Set the maximum packet list buffer size on NV for Load Generator" on the previous page](#).

**By default the cleanup threshold mechanism is disabled. You can enable it on each machine where NV for Load Generator is installed.**

1. Stop all network virtualization tests that are currently running.
2. Navigate to the following folder: `<installation_folder>\conf`.  
By default, `<installation_folder>` is `C:\Program Files (x86)\HP\NV\` or `C:\Program Files\HP\NV\`.
3. Open the file `userConfiguration.xml` file in a text editor.
4. Locate the `IsCleanupEnabled` property, and set it to `true`.
5. Save the file.
6. Restart the **HP Network Virtualization** service (`NVWatchDogService`).

# Chapter 5: Add and configure virtual locations

You create virtual locations

in the LoadRunner Controller or Performance Center, and then include them in your LoadRunner scenarios or Performance Center tests. You can also use several predefined virtual locations that NV provides.

## What do you want to do?

- ["Read more about virtual locations" below](#)
- ["Learn about predefined virtual locations" below](#)
- ["Open the Virtual Location Editor in LoadRunner" on the next page](#)
- ["Open the Virtual Location Editor in Performance Center" on the next page](#)

## Read more about virtual locations

The characteristics of a network are influenced by a variety of factors. One factor that has a significant effect on the character of a network is the geographic locations of the clients and the servers in the network. For example, consider a server based in New York. This server is accessed by clients that are based in London and in Sydney. One can expect the London-New York network to behave at least somewhat differently from the Sydney-New York network. The difference in behavior between the two networks may be significant. When you implement network virtualization for this system, you add London and Sydney as two *virtual locations*. For each of these virtual locations, you define the characteristics of the network to emulate – the network between the client and the server in New York.

When you develop a LoadRunner scenario or a Performance Center test, you specify which virtual location is associated with each Vuser group or with each load generator. The virtual location defines the network conditions that are emulated when the Vusers run.

See also:

- ["Enable network virtualization" on page 32](#)
- ["Set the network virtualization mode" on page 33](#)

## Learn about predefined virtual locations

NV includes a number of predefined virtual locations. Each predefined virtual location includes parameters that define a common network testing environment. You can select one of these predefined locations when you configure scenarios or tests in LoadRunner or Performance Center.

**Note:** You cannot edit, delete, or rename a predefined location.

Virtual location name	Latency [ms]	Packet loss [%]	Bandwidth-in [kb/s]	Bandwidth-out [kb/s]
2.5G Busy	300	0.5	128	56
3G Busy	200	0.5	384	128

Virtual location name	Latency [ms]	Packet loss [%]	Bandwidth-in [kb/s]	Bandwidth-out [kb/s]
<b>3G Typical</b>	120	0	512	256
<b>3G Good</b>	80	0	2,000	512
<b>4G Good</b>	40	0	10,000	7,500
<b>AUS to US EC</b> (Australia to U.S. East Coast)	120	0.5	4,000	2,000
<b>China to US EC</b>	210	1.0	4,000	2,000
<b>India to US EC</b>	160	0.5	5,000	2,000
<b>London to US EC</b>	55	0	10,000	4,000
<b>Satellite</b>	0	0	2,000	1,000

## Open the Virtual Location Editor in LoadRunner

1. In the HP LoadRunner Controller, click the **Network Virtualization Settings** button  on the toolbar to open the Network Virtualization Settings dialog box.
2. Make sure that **Enable Network Virtualization** is selected.
3. Under **Virtual Locations**, in the **Virtual Location** column, type the name of a location.

You cannot use the following characters:

```
\ / : " ? ' < > | * % ^ , ! { } ( ) ; = #
```

4. Enter a description for the virtual location.

You cannot use the following characters:

```
\ / : " ? ' < > | * % ^ , ! { } ( ) ; = #
```

5. Click **Configure** to open the Virtual Location Editor.

For details on how to proceed with the Virtual Location Editor, see ["Configuring virtual locations" on page 37](#).

## Open the Virtual Location Editor in Performance Center

1. In Performance Center > Performance Test Designer, click **Groups & Workload**.
2. Click **Virtual Location Editor**.
3. Make sure that **Virtual Location Mode** is turned on.
4. In the **Add new virtual location** box, type the name of the new virtual location.

You cannot use the following characters:

```
\/:“?‘<>|*% ^,!{ }();=#
```

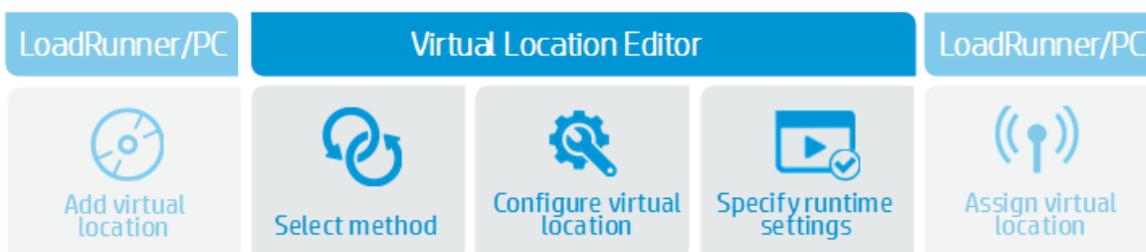
5. Click **Add** to open the Virtual Location Editor.

For details on how to proceed with the Virtual Location Editor, see ["Configuring virtual locations" on page 37](#).

For more details on how to work with virtual locations in LoadRunner and Performance Center, see the *LoadRunner User Guide* or the *Performance Center User Guide*.

### What's next?

["Select virtual location definition method" on page 36](#)



## Enable network virtualization

You can enable or disable network virtualization for a LoadRunner scenario or a Performance Center test. When NV is enabled, the network conditions that are specified in the virtual locations are applied to the specified running Vusers. When NV is not enabled, network conditions are not emulated. When you create a new LoadRunner scenario or a Performance Center test, NV is enabled by default.

After you enable network virtualization, you must specify the mode that will be used to implement the network virtualization. For details, see ["Set the network virtualization mode" on the next page](#).

### To enable network virtualization for a LoadRunner scenario or a Performance Center test

1. **LoadRunner:**

On the LoadRunner Controller toolbar, click the **Network Virtualization Settings** button  to open the Network Virtualization Settings dialog box.

#### Performance Center:

On the **Performance Center > Workload** tab toolbar, click the **Network Virtualization Settings** button  to open the Network Virtualization Settings dialog box.

2. Select **Enable Network Virtualization**.

## Set the network virtualization mode

When you implement network virtualization for a LoadRunner scenario or a Performance Center test, you select the mode that LoadRunner or Performance Center uses to implement the virtualization:

- **Per Group.** This option performs network virtualization per Vuser group. You specify the NV profile (virtual location) that will be applied to all the Vusers in each Vuser group. You can specify a different virtual location for each Vuser group, even if the Vuser groups are running on the same load generator.
- **Per Load Generator.** This option performs network virtualization per load generator. You specify the network emulation profile (virtual location) that will be applied to all Vusers running on each load generator.

### Vuser protocol limitations

Some Vuser protocols do not support the **Per Group** emulation mode: Citrix ICA, Java Record Replay, Java Vuser, COM/DCOM, MAPI.

If you select the **Per Group** emulation mode, and a particular Vuser group runs a Vuser protocol that does not support the **Per Group** functionality, the **Per Load Generator** emulation mode is applied to the Vuser group. When the Vuser group runs, the load generator's default virtual location is applied to the Vusers, and not the virtual location that is specified for the Vuser group.

See ["Allocate bandwidth to Vusers" on page 42](#) for other limitations of these Vuser protocols.

### To specify the NV emulation mode for a LoadRunner scenario or a Performance Center test

1. Make sure that network virtualization is enabled for the test or the scenario. For details, see ["Enable network virtualization" on the previous page](#).
2. Select a method for implementing the network virtualization, **Per Group** or **Per Load generator**.

## Define virtual location test level settings

The NV **Virtual Location Test Level Settings** apply to all virtual locations and load generators that are included in the test or a scenario.

- **Packet Capture.** For details, see ["Define packet capture \[test level settings\]" on the next page](#).
- **IP Filters.** For details, see ["Create a global IP filter \[test level settings\]" on page 35](#).

After you specify these global settings, you can specify the settings for a particular virtual location or load generator. For details, see ["Specify virtual location runtime settings" on page 41](#).

### Where do I find it?

LoadRunner:

1. In the HP LoadRunner Controller, click the **Show Virtual Location Settings** button  on the toolbar.
2. Make sure that **Enable Network Virtualization** is selected.
3. Click **Common Settings**.

Performance Center:

1. In Performance Center, click the  **Virtual Location Editor** button on the toolbar.
2. Make sure that **Virtual Location Mode** is turned on.
3. Click **Runtime Settings**.

## Define packet capture [test level settings]

You can configure HP Network Virtualization to capture the packets that are transferred across a network while a LoadRunner scenario or Performance Center test runs.

**Note:** Packet capture test level settings apply to all virtual locations and load generators participating in the scenario or test.

After you enable packet capture on the global level, you must enable packet capture for particular virtual locations in the scenario or test, as required, and specify the packet capture settings. For details, see "[Set packet capture for a virtual location](#)" on page 43.

When you configure the Packet Capture common settings, you specify the following:

- Packet capture (On/Off)
- Maximum total packet size
- Packet capture method

### Packet capture (On/Off)

You can select to capture the packets that are transferred across the network while the scenario or test runs.

If you turn on **Common/Runtime Settings > Packet Capture**, then you can turn on **Packet Capture** for the virtual locations in the scenario or test. If you turn off **Common/Runtime Settings > Packet Capture**, then you cannot turn on **Packet Capture** for the virtual locations in the scenario or test.

**Note:** Make sure to consider the use of disk space on the Load Generator. Depending on your packet capture settings, each test can save a packet list of up to 1GB. Consider configuring the NV cleanup threshold to clean the captured packets, or do a manual cleanup as needed.

For details on enabling the cleanup threshold, see "[Enable the cleanup threshold on NV for Load Generator](#)" on page 28.

### Maximum total packet list size

The maximum memory space that is allocated on each load generator in the scenario or test to store

captured packets. The default size of the maximum space is 300 MB per load generator.

**Note:** The **Total packet list size** cannot be more than 25% of the RAM on the load generator.

For details on customizing the default maximum size, see ["Set the maximum packet list buffer size on NV for Load Generator" on page 28](#).

## Packet capture method

Defines what happens when packets are captured and the maximum total packet size is reached.

- **Cyclic:** When the maximum total packet size is reached, the oldest packets are erased, and the newest packets continue to be recorded.
- **Non-cyclic:** When the maximum total packet size is reached, new packets are no longer recorded.

Follow the procedure below to set the packet capture common settings.

### To set the common packet capture settings

1. In the LoadRunner Controller or Performance Center, display the virtual location test level settings, as described in ["Define virtual location test level settings" on page 33](#).
2. Under **Packet Capture**, click the switch to enable packet capture.
3. In **Total packet list size**, specify the maximum memory space that is allocated on each load generator in the scenario or test to store captured packets.
4. Select the packet capturing method: **Cyclic** or **Non-cyclic**. For details, see [Packet capture method](#) above.
5. Click **OK** to save the settings.

## Create a global IP filter [test level settings]

While you run a scenario or test that incorporates network virtualization, LoadRunner or Performance Center applies various network conditions to the networks that are used by the Vusers that run during the scenario or test. These network conditions are applied to network traffic to-and-from all load generators that are associated with the virtual locations in the scenario or test.

But what if, for some reason, you do not want to apply network virtualization to traffic associated with a specific IP address? You can create *IP filters* that include lists of IP addresses to which you do not want to apply network virtualization. Network conditions are not applied to network traffic to-or-from a specific IP address if that IP address is included in the relevant IP filter, either as the source or the destination of network traffic.

For reasons why you may want to exclude an IP address from network virtualization, see ["Exclude machines from network virtualization" on page 45](#).

In LoadRunner and Performance Center, there are two types of IP filters:

- **Global IP filter.** A *global IP filter* is a list of IP addresses to which you do not want to apply network virtualization. The global IP filter applies to all virtual locations in the scenario or test. Network impairments will not be applied to network traffic if an IP address in the global IP filter is either the source or the destination of the network traffic.
- **Local IP filters.** You can create a *local IP filter* for each virtual location in a scenario or test. The

local IP filter includes those IP addresses to which you do not want to apply network virtualization. These locally "excluded addresses" are in addition to the IP addresses that are excluded because they appear in the global IP filter.

A local IP filter applies only to the virtual location with which the local IP filter is associated.

For details on how to maintain a global IP filter, see below.

For details on creating a local IP filter, see ["Create a local IP filter for a virtual location" on page 44.](#)

### To maintain a global IP filter

1. In the LoadRunner Controller or Performance Center, display the test level network virtualization settings, as described in ["Define virtual location test level settings" on page 33.](#)
2. Under **Exclude these IP's** box, type the IP address that you want to exclude, and then click the "+" sign. The IP address is added to the global IP filter.
3. Repeat the previous step for all the IP addresses that you want to exclude.

IP addresses that are included in the global IP filter are displayed in gray in the local IP filter when you configure the runtime settings for a virtual location. For details, see ["Create a local IP filter for a virtual location" on page 44.](#)

To remove an IP address from the global IP filter list, select the IP address, and then click "X".

4. Click **OK** to save the settings.

## Select virtual location definition method



After you create a new virtual location in either the LoadRunner Controller or Performance Center, you use the Virtual Location Editor to configure the virtual location.

### Virtual location configuration methods

The first page in the Virtual Location Editor provides three methods that you can use to configure the NV profile parameters for a virtual location:

1. **Custom.** Manually specify the network profile parameters. For details, see ["Define custom virtual location parameters" on the next page.](#)
2. **Global Library.** Import the network profile parameters from the NV Global Library. For details, see ["Extract virtual location parameters from the NV Global Library" on page 38.](#)

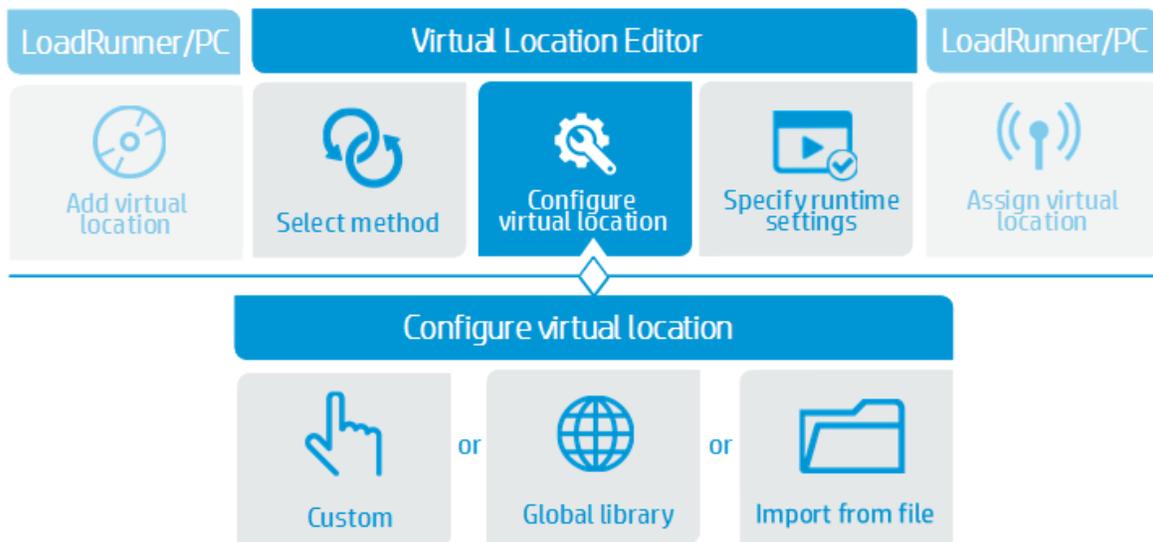
3. **Import from a file.** Import the network profile parameters from a file. The file may have been produced by HP Network Editor, HP Network Capture, or HP Network Capture Express. For details, see ["Import virtual location parameters from an NV profile" on page 39.](#)

### What's Next?

After you select the method to use to configure the virtual location, you proceed to the next page of the Virtual Location Editor where you configure the virtual location. For details, see ["Configuring virtual locations" below.](#)

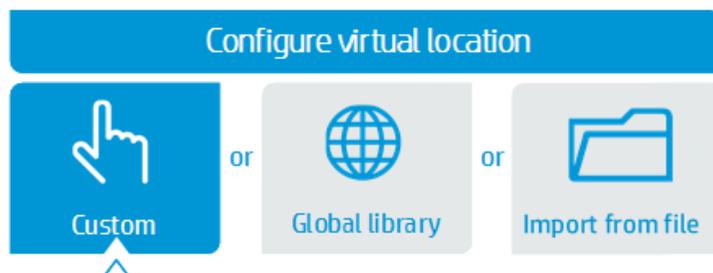
## Configuring virtual locations

After you create a new virtual location, you choose the method that you will use to configure the virtual location. The configuration process differs according to the method that you choose.



**Note:** To learn more about virtual locations, see ["Add and configure virtual locations" on page 30.](#)

### Define custom virtual location parameters



## Custom virtual location parameters

Specify the following parameters to define a custom virtual location:

- **Latency.** The amount of time that it takes for an IP packet to travel across the network, from the client to the server, or from server to client. The valid range is 0 to 8,000 msec.
- **Packet Loss.** The percentage of IP packets that are sent through the network, but do not reach their destination. The valid range is 0 to 100%.
- **Download Bandwidth.** The maximum throughput through the network [in KBs per second], for data traveling from the server to the client.
- **Upload Bandwidth.** The maximum throughput through the network [in KBs per second], for data traveling from the client to the server.

## To manually specify virtual location parameters

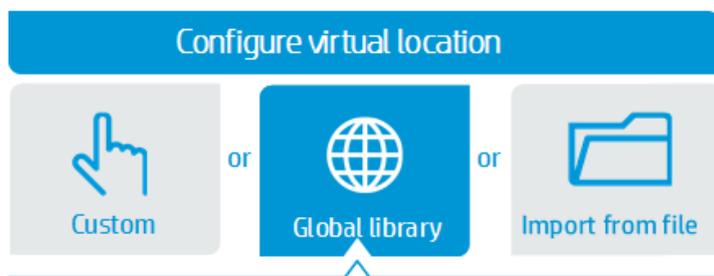
1. In the LoadRunner Controller or Performance Center, create a new virtual location, and then open the virtual location in the Virtual Location Editor. For details, see ["Add and configure virtual locations" on page 30](#).
2. Click **Custom**.
3. Specify each of the NV profile parameters: **Latency**, **Packet loss**, **Download Bandwidth**, and **Upload Bandwidth**. See above for details about each of the parameters.

**Note:** For **Download Bandwidth** and **Upload Bandwidth**, you can select **Unlimited** to impose no bandwidth limitation on the network.

## What's Next?

After you specify custom parameters for a virtual location, you can configure various runtime settings for the virtual location. For details, see ["Specify virtual location runtime settings" on page 41](#).

## Extract virtual location parameters from the NV Global Library



When you configure a virtual location, you can extract the network parameters from the NV Global Library.

## NV Global Library

The HP NV Global Library contains extensive real-world network-related data that helps you to define the parameters of a virtual location. You supply a number of input parameters to the library, and the

library returns parameters that define the virtual location.

**Note:** To access the full set of geographic locations in the NV Global Library, you must be connected to the internet and be licensed to access the NV Global Library. If either of these two conditions is not met, then you will have access to a limited set of geographic locations.

After you extract the parameters for a virtual location profile, you can configure various runtime settings for the virtual location. For details, see ["Specify virtual location runtime settings" on page 41](#).

## To extract virtual location parameters from the NV Global Library

1. In the LoadRunner Controller or Performance Center, create a new virtual location, and then open the virtual location in the Virtual Location Editor. For details, see ["Add and configure virtual locations" on page 30](#).
2. Click **Global Library**.
3. Specify the **Client Location** and the **Server Location**. These locations are typically the cities or states in which the client and server are located.

**Note:** To access the full set of geographic locations in the NV Global Library, you must be connected to the internet and be licensed to access the NV Global Library. If either of these two conditions is not met, then you will have access to a limited set of geographic locations.

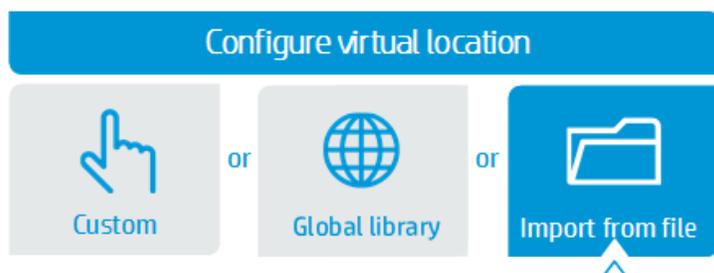
4. Click the **Next** button.
5. Specify the technology of the network between the client and server:
  - **Technology.** The technology on which the network is based.
  - **Carrier.** The carrier that operates the network.
  - **Time.** Specifies if the network communication occurs during business hours or outside of business hours.
  - **Communication Quality.** The quality of the connection.

**Note:** The editor displays only those options that are available for the network client and server locations that you specified.

## What's Next

After you import parameters for a virtual location, you can configure various runtime settings for the virtual location. For details, see ["Specify virtual location runtime settings" on page 41](#).

## Import virtual location parameters from an NV profile



You can import network profile parameters from an NV profile file into LoadRunner or Performance Center, as part of a virtual location definition. There are various HP software tools that you can use to create an NV profile file that contains the required network profile parameters.

## Tools to develop network profiles

- **HP Network Editor** allows you to define a complex NV profile, and to save the parameters in a NV profile file. You can then import the parameters into LoadRunner or Performance Center, as part of a virtual location definition.

HP Network Editor is automatically installed whenever the HP NV for Load Generator is installed. For details about installing Network Editor and using the Network Editor to create and save NV profiles, see ["Network Editor overview" on page 48](#).

- **HP Network Capture** and **HP Network Capture Express** can analyze a specified network, and then determine and record the parameters that define the network. These parameters include, amongst others, the latency, packet loss and bandwidth of the network. The recorded network parameters can then be imported into LoadRunner or Performance Center, as part of a virtual location definition.

For details about installing Network Capture and using Network Capture to record and save NV profiles, refer to the *Network Capture User Guide*. You can download Network Capture Express free from AppStore (iOS version) and Google Play (Android version).

## To import NV profile parameters from a file

1. In the LoadRunner Controller or Performance Center, create a new virtual location, and then open the virtual location in the Virtual Location Editor. For details, see ["Add and configure virtual locations" on page 30](#).
2. Click **Import from a file**.
3. Under **Specify network profile**, click **Browse**.
4. In the Choose File to Upload dialog box, locate and select the file that contains the required NV parameters, and then click **Open**.
5. If the network profile file contains more than one flow for the network, select the required flow from the list of flows.

### Note:

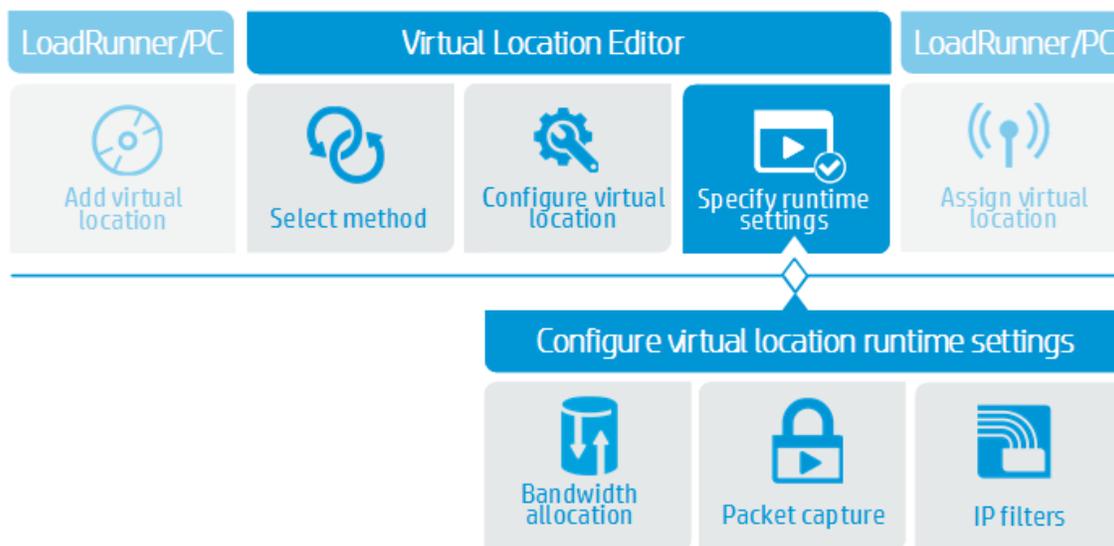
- An NV profile file has either a .ntx or a .ntxx extension – depending on the software application that was used to create the NV profile file.
- When you import an NV profile file that was created using the Network Editor, IP addresses and Excluded IPs are not imported into the virtual location.
- If the imported file contains recorded bandwidth data, then the resulting virtual location can use **Shared Bandwidth** bandwidth allocation only, not **Individual Bandwidth**. For details, see ["Allocate bandwidth to Vusers" on page 42](#).

## What's Next?

After you import parameters for a virtual location, you can configure various runtime settings for the virtual location. For details, see ["Specify virtual location runtime settings" on the next page](#).

## Specify virtual location runtime settings

After you specify the parameters for a virtual location, configure the runtime settings for the virtual location.



### Virtual location runtime settings

- **Bandwidth Allocation.** Allows you to specify if the specified network bandwidth is shared by all Users on the Load Generator, or is available to each individual User.
- **Packet Capture.** Allows you to specify if packets are captured on the Load Generator. You can enable this option only if packet capture has been enabled globally for the scenario or test.  
For details on enabling packet capture for the scenario or test, see ["Define packet capture \[test level settings\]"](#) on page 34.  
For details on enabling packet capture for a Load Generator, see ["Set packet capture for a virtual location"](#) on page 43.
- **IP Filters.** Enables you to specify the list of IP addresses to which network impairments will not be applied when a LoadRunner scenario or Performance Center test runs.  
For details on specifying the global IP filter list that applies to the scenario or the test, see ["Create a global IP filter \[test level settings\]"](#) on page 35.  
For details on specifying the local IP filter list that applies to an individual load generator in a scenario or test, see ["Create a local IP filter for a virtual location"](#) on page 44.

### To specify the runtime settings for a virtual location

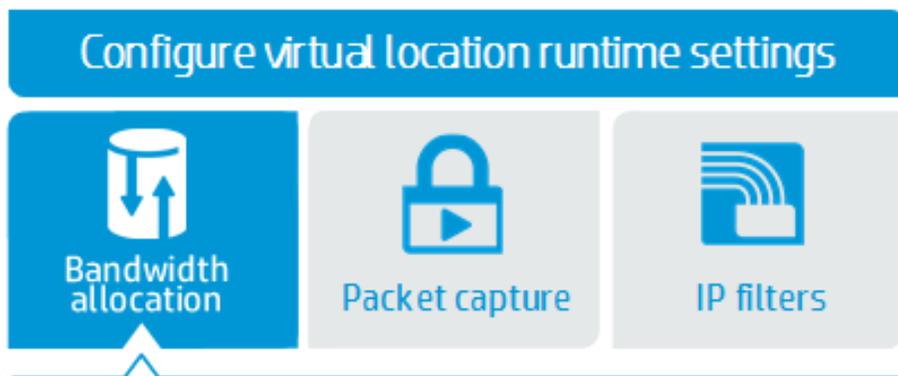
1. In LoadRunner or Performance Center, create a new virtual location, and then open the virtual location in the Virtual Location Editor. For details, see ["Add and configure virtual locations"](#) on page 30.

2. Specify the NV profile parameters as described in ["Add and configure virtual locations" on page 30](#).
3. Click **Next** to display the **Runtime settings** page.
4. Specify the required runtime settings for the virtual location. For details, see:
  - ["Allocate bandwidth to Vusers" below](#)
  - ["Set packet capture for a virtual location" on the next page](#)
  - ["Create a local IP filter for a virtual location" on page 44](#)

### What's Next?

After you specify the runtime settings for a virtual location, you can incorporate the virtual location in a scenario or test. For details, see the *LoadRunner User Guide* or the *Performance Center User Guide*.

## Allocate bandwidth to Vusers



When you configure the runtime settings for a virtual location, you specify how the bandwidth of the network is allocated when the Vusers run.

- **Shared bandwidth.** The specified bandwidth is shared between all Vusers in the Vuser group. This is the default option.  
If the Vuser group using the virtual location runs on multiple Load Generators, the specified bandwidth is assigned to each Load Generator. It is not shared between Load Generators.
- **Individual bandwidth.** The network's specified bandwidth is available to each Vuser that uses the network. This option is recommended for Vusers that emulate mobile-based users and home-based users because each device has access to the full bandwidth.

### Bandwidth allocation limitations

Some Vuser protocols support only the **Shared bandwidth** mode of bandwidth allocation: Citrix ICA, Java Record Replay, Java Vuser, COM/DCOM, MAPI.

If you specify **Individual bandwidth** mode for a protocol that does not support this type of bandwidth allocation, the **Shared bandwidth** mode will be applied when the Vusers run.

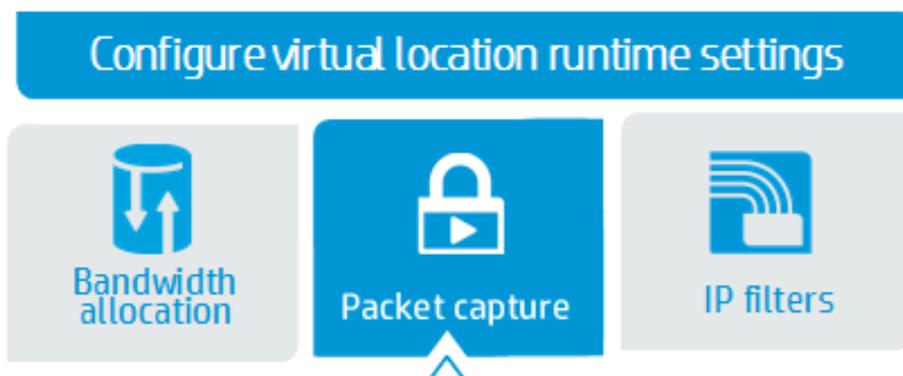
When you import NV profile parameters from a file, if the imported file contains recorded bandwidth data, then the resulting virtual location can use **Shared Bandwidth** bandwidth allocation only, not **Individual Bandwidth**.

See ["Set the network virtualization mode" on page 33](#) for other limitations of these Vuser protocols.

### Specify the bandwidth allocation for a virtual location:

1. In the LoadRunner Controller or Performance Center, open a virtual location in the Virtual Location Editor. For details, see ["Add and configure virtual locations" on page 30](#).
2. Display the **Runtime settings** page.
3. Under **Bandwidth Allocation**, click one of the available options, **Share bandwidth** or **Individual bandwidth**. See above for definitions of each of these options.
4. Click **Next** to display a summary of the virtual location parameters and runtime settings.

## Set packet capture for a virtual location



You can configure LoadRunner or Performance Center to capture the packets that are transferred across networks while a scenario or test runs. For details, see ["Define packet capture \[test level settings\]" on page 34](#). After the packets have been captured, you can use HP NV Analytics to analyze the captured packets. After enabling and configuring packet capture globally for a scenario or test, you can enable packet capture for the individual virtual locations, as required. This procedure is described below.

#### Note:

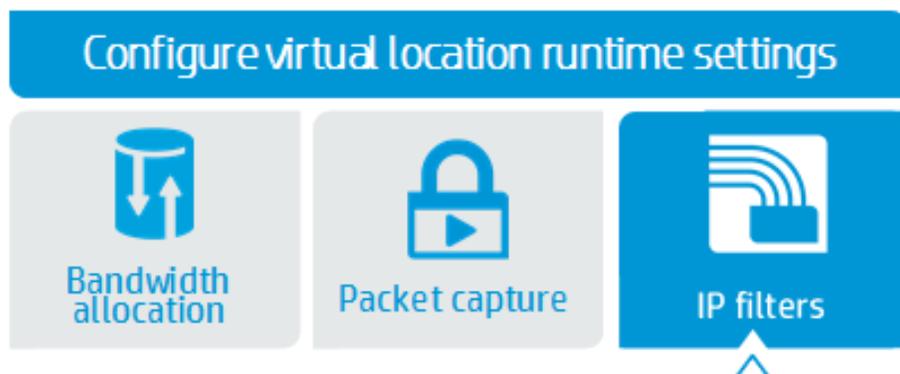
- Capturing packets is relevant only when a Vuser group (that is associated with a specific virtual location) contains only a single Vuser.
- You can enable the **Capture Packets** option for a virtual location only if packet capture has been enabled globally for the scenario or test, using the NV virtual location test level settings. For details, see ["Define packet capture \[test level settings\]" on page 34](#).

### To enable or disable packet capture for a specific virtual location

1. In the LoadRunner Controller or Performance Center, open a virtual location in the Virtual Location Editor. For details, see ["Add and configure virtual locations" on page 30](#).
2. Display the **Runtime settings** page.

3. Under **Capture Packets**, click **On** to enable packet capture, or **Off** to disable packet capture for the virtual location.
4. Click **Next** to display a summary of the virtual location parameters and runtime settings.

## Create a local IP filter for a virtual location



While you run a scenario or test that incorporates network virtualization, LoadRunner or Performance Center applies various network conditions to the networks that are used by the Vusers that run during the scenario or test. These network conditions are applied to network traffic to-and-from all load generators that are associated with the virtual locations in the scenario or test.

But what if, for some reason, you do not want to apply network virtualization to traffic associated with a specific IP address? You can create *IP filters* that include lists of IP addresses to which you do not want to apply network virtualization. Network conditions are not applied to network traffic to-or-from a specific IP address if that IP address is included in the relevant IP filter, either as the source or the destination of network traffic.

For reasons why you may want to exclude an IP address from network virtualization, see "[Exclude machines from network virtualization](#)" on the next page.

In LoadRunner and Performance Center, there are two types of IP filters:

- **Global IP filter.** A *global IP filter* is a list of IP addresses to which you do not want to apply network virtualization. The global IP filter applies to all virtual locations in the scenario or test. Network impairments will not be applied to network traffic if an IP address in the global IP filter is either the source or the destination of the network traffic.
- **Local IP filters.** You can create a *local IP filter* for each virtual location in a scenario or test. The local IP filter includes those IP addresses to which you do not want to apply network virtualization. These locally "excluded addresses" are in addition to the IP addresses that are excluded because they appear in the global IP filter.

A local IP filter applies only to the virtual location with which the local IP filter is associated.

For details on how to create a local IP filter, see below.

For details on maintaining a global IP filter, see "[Create a global IP filter \[test level settings\]](#)" on page 35.

## To create a local IP filter – to exclude IP addresses from a virtual location

1. In the LoadRunner Controller or Performance Center, open a virtual location in the Virtual Location Editor. For details, see ["Add and configure virtual locations" on page 30](#).
2. Display the **Runtime settings** page.
3. In the box under **Exclude these IP's**, type the IP address that you want to exclude, and then click the "+" sign.
4. Repeat the previous step for all the IP addresses you want to exclude.

**Note:** IP addresses that are included in the global IP filter are displayed in gray.

To remove an IP address from the local IP filter, select the address and click "X".

5. Click **Next** to display a summary of the virtual location parameters and runtime settings.

## Exclude machines from network virtualization

In some situations, you may need to exclude certain machines from network virtualization. For example, consider the following real-life situation. Users operate an application that accesses a number of servers. All the servers are located far away from the users, except for a single server that is located close to the users. When this scenario is emulated in a testing environment, network virtualization should be applied to all the emulated distant servers, whereas the near-by server should be excluded from network virtualization.

To exclude a machine from network virtualization, you add the IP address of the machine to an *IP filter*. For details, see ["Create a global IP filter \[test level settings\]" on page 35](#) and ["Create a local IP filter for a virtual location" on the previous page](#).

The following are situations to consider excluding a machine from network virtualization:

- In a multi-protocol scenario or test that includes a Web server and a database server. If information from the database server is not required as a part of the load test, then you should exclude the database server.
- Deployment and software upgrade servers.
- Servers that run and store scripts on a shared network drive.

# Chapter 6: Analyze test results

After you run a test or scenario, you can analyze the results of the scenario run. There are various HP tools that you can use to analyze the results:

- HP LoadRunner Analysis
- NV Analytics
- NV Predictor

## • HP LoadRunner Analysis

This is the standard LoadRunner tool that enables you to analyze the results of your LoadRunner tests. Analysis can also be installed and used with Performance Center.

After running a test with the LoadRunner Controller, select **Results > Analyze Results**. HP LoadRunner Analysis opens, analyzes the scenario results, and presents the analyzed results in a set of graphs.

There are a number of graphs specific to scenarios run with Network Virtualization, the most significant of which is the **Transaction Response Time by Location** graph. This graph enables you to compare response times of several virtual locations, to determine whether the transactions performed satisfactorily under the different emulated real-world network conditions.

**Note:** You can specify that HP LoadRunner Analysis opens automatically after each test run. For details, see the *LoadRunner User Guide*.

For details on how to install and use HP LoadRunner Analysis, see the *LoadRunner Analysis User Guide* or the *LoadRunner User Guide*.

## • NV Analytics

Provides in-depth analysis of your application's performance during a test, and helps to identify factors that negatively impact your application's performance.

**Note:** NV Analytics reports are a part of Network Virtualization. If you have installed NV on your VuGen machine, you can view the NV Analytics reports directly in VuGen, without the need to install the standalone NV Analytics version.

If you are already using the standalone version of NV Analytics, you can install the updated 12.50 version, included with the NV installation files.

To make the test results available to NV Analytics, make sure that packets are captured while the test runs. For details, see ["Define packet capture \[test level settings\]" on page 34](#) and ["Set packet capture for a virtual location" on page 43](#).

After the test run, the LoadRunner Controller and Performance Center save the captured packets on the load generator computers, in the following default location:

```
C:\ProgramData\Shunra\Emulation\Runs\
```

For details on how to install and use NV Analytics, see the *NV Analytics User Guide*.

## • NV Predictor

HP Predictor analyzes test results from HP LoadRunner , and generates reports for SLO (service level objective) compliance. HP Predictor evaluates results of one or more key metrics for SLO compliance, based on static values and/or baseline performance. The customizable reports display a comprehensive analysis of application performance - based on virtual location.

For details on how to install and use NV Predictor, see the *NV Predictor User Guide*.

# Chapter 7: Configure NV profiles with Network Editor

HP Network Editor lets you create complex NV profiles. Thereafter, you import the parameters from the profile into virtual locations, inside LoadRunner or Performance Center. To learn more about NV profiles, see ["Network Editor overview" below](#).

## Network Editor overview

The Virtual Location Editor enables you to create virtual locations inside HP LoadRunner or Performance Center that include only latency, packet loss, and bandwidth parameters. Alternatively, you can import network emulation parameters from the NV Global Library to create a virtual location.

If a virtual location requires additional emulation parameters, you can import these parameters from an NV profile using the Virtual Location Editor. You use **NV Network Editor** to create these NV profiles.

This section describes how to use the Network Editor.

- For a list of NV profile parameters, see ["NV profile parameters" on page 58](#).
- For details on using the Virtual Location Editor, see ["Add and configure virtual locations" on page 30](#).

**Note:** Each NV profile file that you create with Network Editor can include multiple flows. A flow is a set of parameters that defines a network. When you import parameters into LoadRunner or Performance Center, you specify from which flow to import the parameters.

The Network Editor is installed as part of the HP NV for Load Generator installation – Network Editor is installed automatically each time HP NV for Load Generator is installed. For details, see ["Network Virtualization Installation" on page 12](#).

### For more information, see:

- ["Open Network Editor" below](#)
- ["Create NV profiles" on the next page](#)

## Open Network Editor

Network Editor is a browser-based application that can be opened from an HP NV for Load Generator host, or from a browser on any other computer.

### To open the Network Editor from an HP NV for Load Generator host machine

Select **Start > All Programs > HP Software > HP Network Virtualization > HP NV for Load Generator > NV Network Editor**.

In Windows 8.x or higher, you can access Network Editor from the **Start** or **Apps** screen.

## To open the Network Editor from a browser

Type the following:

```
http://<HP NV for Load Generator host IP>:<HP NV for Load Generator Port>/Shunra/networkeditor/
```

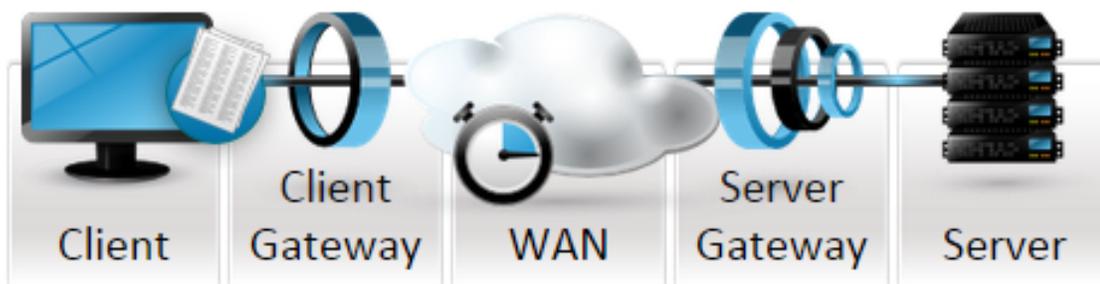
For example:

```
http://192.0.2.0:8182/Shunra/networkeditor/
```

The *HP NV for Load Generator Port* is set initially when HP NV for Load Generator is installed. Port 8182 is the default port.

## Create NV profiles

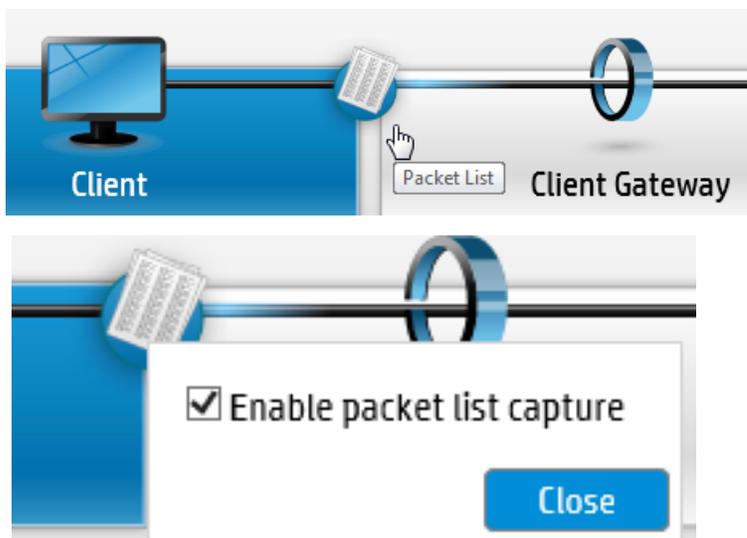
1. Open HP Network Editor, and on the home page, click **New**.
2. Click **Add new flow**.
3. In the New Flow page, specify the required parameters as described below:



- a. **Setting Client and Server IP Ranges:** In order to be able to save the NV profile, it is necessary to enter at least a single client IP address range and a single server IP address range.

**Note:** These IP addresses are not used by LoadRunner or Performance Center, so it is not necessary to specify actual addresses.

- b. **Configuring Gateway Parameters:** For details, see "[Configure gateway parameters](#)" on the [next page](#).
  - c. **Configuring the WAN Shape:** For details, see "[Configure the WAN parameters](#)" on [page 53](#).
4. To enable packet capture, click Packet List, and select **Enable packet list capture**.

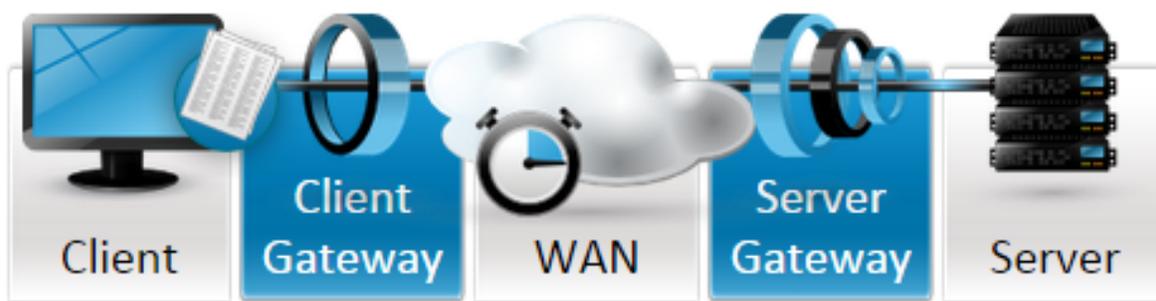


5. After selecting the required parameters, click **OK**. The **Flow Summary** displays all the flows in the NV profiles. To edit a flow, click the pencil icon; to delete a flow, click the "x"; to delete all flows, click the table icon.
6. Click **Save** to save the NV profile to a file called (by default) "HP Emulation Profile.ntxx," located in the browser's default download folder.

**What's next?**

You can now import the NV profile file into LoadRunner or Performance Center. For details, see ["Import virtual location parameters from an NV profile" on page 39](#).

## Configure gateway parameters



When you use Network Editor to create an NV profile, you can specify gateway parameters, as described in this section, and WAN parameters, as described in ["Configure the WAN parameters" on page 53](#).

When network virtualization is applied, gateway parameters are used to emulate the behavior of access gateways on the real networks. For example, in the NV profile, you can specify the bandwidth or queue limitation that a specific gateway imposes on the actual network.

**Note:**

- Entering gateway parameters is optional when you configure an NV profile.
- The definitions of the gateway parameters are the same for both the client and the server gateways.

The gateway parameters can be configured separately for incoming and outgoing traffic.

Click the **Client Gateway** and **Server Gateway** tabs to configure the gateway parameter settings.

The gateway settings include the following:

- [Bandwidth Settings](#)
- [Queue Settings](#)

## Bandwidth Settings

Bandwidth values can be either defined or imported from a pre-recorded file.

You can specify different bandwidth values for upstream network traffic and downstream network traffic.

**Note:** The following procedures are valid for both the upstream and downstream settings.

### Define Bandwidth Settings

You can select pre-defined bandwidth settings, or specify custom bandwidth settings.

1. In the **Client Gateway** or the **Server Gateway** tab, select one of the following options:
  - a. **Predefined:** Select one of the available values. (The available values correspond to common bandwidth settings, such as T1, etc.)
  - b. **Custom:** Specify a specific bandwidth. (Valid values are between 2.4 and 10,000,000 Kbps.)
2. Click **OK**.

### Import Recorded Bandwidth Settings

You can import the bandwidth values from a recorded file. Use HP Network Capture or HP Network Capture Express to record the bandwidth of a network over a period of time. Network Capture and Network Capture Express measure and record the bandwidth, and save the values to an .ntx file.

**Note:**

- Importing recorded bandwidth settings is supported only for Vuser groups that share the specified bandwidths – not by Vuser groups that allocate the specified bandwidth to each Vuser. For details, see ["Allocate bandwidth to Vusers" on page 42](#).
- You can import recorded parameters from a .ntx file directly into a virtual location, as described in ["Import virtual location parameters from an NV profile" on page 39](#). Import the recorded parameters into an NV profile (using Network Editor) only if you want to edit the recorded parameters, before importing them into a virtual location.

1. In the **Client Gateway** or the **Server Gateway** tab, click **Recorded** then click **Choose File**.
2. Locate and select the required file, and then click **Open**.

## Queue Settings

The Queue settings define the queue limitations and packet overhead that you want to use in your emulations.

### Enable Queue Limitation

This group contains parameters that emulate limitations imposed on the maximum size of IP packet queues at the gateway NIC. If you specify a queue size, HP NV emulates network behavior by dropping data packets when the queue is full.

1. In the **Client Gateway** or the **Server Gateway** tab, select **Queue Limitation**.
2. Select from the following parameters:

Parameter	Description
<b>Queue Size</b>	Select the amount of memory (KB) that HP NV allocates to the queue [16 to 4,096 MB].
<b>Drop Mode</b>	
<ul style="list-style-type: none"> <li>• <b>Drop Tail</b></li> </ul>	Select this option for HP NV to drop newer data packets when the queue is full.
<ul style="list-style-type: none"> <li>• <b>Random Early Detection (RED)</b></li> </ul>	<p>This option provides a more sophisticated queue management method. The RED algorithm keeps track of the average increase in queue occupancy. If it detects an increase, it signals to the packet source that the queue may soon be full, by randomly dropping very small amounts of data packets.</p> <p><b>Keep Queue size between:</b></p> <p>Indicate the minimum and maximum average occupancy. The system issues signals (by dropping data packets) when the average occupancy fluctuates between the two values. It drops all packets if the average occupancy exceeds the maximum threshold.</p>
<b>Fill mode</b>	<ul style="list-style-type: none"> <li>• Use the fixed size: 1,500 bytes for each packet.</li> <li>• Use the actual packet size.</li> </ul>

### Enable Packet Overhead

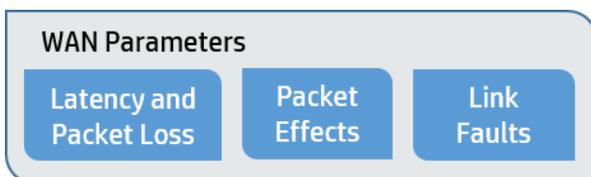
If your gateway adds overhead bytes to the IP data that flows through the gateway NIC, use this parameter to specify the number of additional bytes, in order to emulate the bandwidth consumption they impose on the network.

1. Select **Packet Overhead**.
2. Select either **Ethernet** (adds 18 bytes to each packet) or **PPP** (adds 9 bytes to each packet).

## Configure the WAN parameters



When you use Network Editor to create NV profiles, you can define the following WAN parameters:

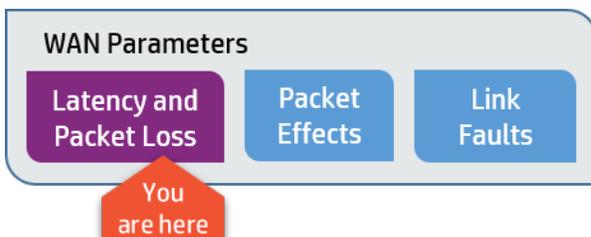


- **Latency and Packet Loss:** The latency defines the time it takes an IP packet to cross the WAN (one-way); the packet loss determines how many packets are dropped.  
For details, see "[Latency and packet loss \[WAN Parameters\]](#)" below.
- **Packet Effects:** Dynamic IP packet routing effects, including out-of-order packets (reordering), duplicated packets, and packet fragmentation.  
For details, see "[Packet effects \[WAN Parameters\]](#)" on page 56.
- **Link Faults:** Possible damage to bit streams, network disconnections, and network congestion.  
For details, see "[Link faults \[WAN Parameters\]](#)" on page 57.

**Note:** You can manually specify the latency and packet loss parameters, or you can import the parameters from an .ntx file. Packet Effects and Link Faults are always set manually, i.e. they cannot be imported from a file.

- For details on how to set the client and server gateway parameters, see "[Configure gateway parameters](#)" on page 50.

## Latency and packet loss [WAN Parameters]



Latency is the time it takes an IP packet to cross the WAN. You can define a fixed latency or a statistically distributed latency.

## Set latency and packet loss parameters

1. Click the **WAN** tab, and then select **Latency and Packet Loss**.
2. Select:
  - **Custom:** To set the parameters manually. For details, see [Specifying Custom Latency and Packet Loss](#).
  - **Recorded:** To import a recorded file (.ntx) produced by HP Network Capture or HP Network Capture Express. For details, see [Importing network conditions from a recorded file](#) below.

## Specify Custom Latency and Packet Loss

1. To define the settings manually, click **Custom**.
2. To set the latency values, select one of the following options:
  - **Fixed:** Enter the number of milliseconds, from 0 to 8,000.
  - **Uniform distribution:** Specifies a changing latency over time (also referred to as jitter). Type the minimum and maximum latency values in the **Minimum** and **Maximum** boxes. This causes NV to randomly change the latency between the minimum and maximum values (from 0 to 8,000 ms).

You can limit the change in latency between each two consecutive packets to a specified number. To use this option, select **Limit latency change** and enter the maximum allowed change, in milliseconds. For example, if you enter 45, NV will change the latency by a maximum of 45 milliseconds between two consecutive packets.

- **Normal distribution:** Causes latency to fluctuate randomly and non-uniformly around an average value (milliseconds) that you specify in the **Average** box. This option can be used to emulate jitter conditions.

The **Standard Deviation** parameter allows you to exert some control over the random change in latency. Entering a value in this parameter sets a range for two thirds of the random values. For example, if the average is 600 milliseconds and the standard deviation is 100 milliseconds, two thirds of random latency values will be between 500 and 700.

- **Linear Latency:** Allows you to set a range of latency values and to indicate the time it takes latency to increase from the minimum to the maximum value in the range.

Enter the range in Minimum and Maximum (from 0 to 8,000 ms), and the cycle duration in Graph duration (from 1 to 65,535 seconds). For example, if you define a range of 100 to 200 milliseconds and a cycle duration of 100 seconds, NV will increase latency by one millisecond each second.

When the NV reaches maximum latency, it cycles back to the minimum value.

3. To add packet loss parameters into an NV profile, select a **Packet Loss** option:

**Note:** Packet loss can also be imported in a recorded file.

- **No packet loss:** WAN behavior is not affected by packet loss. In this case, HP NV does not lose any packets and the impairment is not applied to network traffic.
- **Periodic loss:** HP NV discards one packet for every xth packet that passes through the WAN.

Enter a number (from 2 to 65,535) in the **Lose one packet every x packets** box. For example, if you enter 8, NV discards every 8th packet that enters the WAN.

HP NV counts packets separately in both directions. It loses the incoming xth packet and the outgoing xth packet.

- **Random Loss:** Allows you to set the probability for losing each packet (enter a percentage from 0.01 to 90). For example, entering 2 means that each packet has a 2 percent chance of being dropped while passing through the emulated WAN cloud.
- **Burst Loss:** Allows you to introduce a "bursty" packet loss model in the emulated WAN cloud, by setting a number of packets to lose (burst size) every time a loss event occurs. You can specify the probability of the loss event (Burst Probability), and the Minimum and Maximum parameters (from 1 to 65,535 packets) that specify a range for the random size of each packet loss burst.
- **Gilbert-Eliot Loss:** Allows you to emulate a good state and a bad state in the network by specifying an average packet loss percentage in the Lose parameter of the two states (from 0.01% to 100%).

In **Change state**, you specify the chances that the network will leave the specific state and move to the other (from 0.01% to 99.99%). For example, if the tested network has, at any given time, a 10% chance of moving from good to bad and a 50% chance of moving from bad to good, you specify 10 and 50 in the respective **Change State** fields.

## Import network conditions from a recorded file

### Note:

- Importing recorded network conditions is supported only for Vuser groups that share the specified bandwidths – not by Vuser groups that allocate the specified bandwidth to each Vuser. For details, see ["Allocate bandwidth to Vusers" on page 42](#).
- You can import recorded parameters from a .ntx file directly into a virtual location, as described in ["Import virtual location parameters from an NV profile" on page 39](#). Import the recorded parameters into an NV profile (using Network Editor) only if you want to edit the recorded parameters, before importing them into a virtual location.

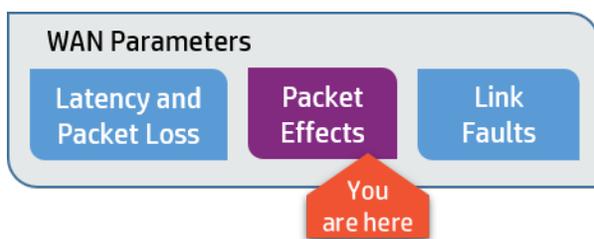
1. Select **Recorded** and then click **Choose file**.
2. Locate and select the required .ntx file, and then click **Open**. A summary of the network conditions is displayed.
3. Modify the latency and packet loss by selecting a percentage in the **Multiply latency values by** and **Multiply loss value by** lists.

This factor allows you to predict future load cases or to prepare some margins of service level over the current status. In this field, you can specify a number between 0 and 200 percent to have the latency and packet loss values multiplied by it. For example, the value of 100% means that NV will use the recorded values as they are. The value 200 means that each value will be doubled (multiplied by 200%).

4. Select a **Packet Loss** value.
5. Select a **Playback Mode**.

<b>Play imported values sequentially</b>	While emulating the network, HP NV will cyclically use the latency values one after the other in the order in which they were recorded.
<b>Play imported values randomly</b>	While emulating the network, HP NV will pick one of the recorded values randomly, for each packet. This allows you to experience random values from the real network to predict more network scenarios.

## Packet effects [WAN Parameters]



Emulate IP routing effects such as disruption of packet order (reordering), packet duplication, and fragmentation.

Select the effect you want to emulate, and then configure the associated parameters:

- **Out of Order**

To emulate packet reordering, HP NV can generate an out-of-order event, based on the probability set in the Chance parameter (from 1% to 50%), by randomly removing a packet from the data stream. Then it starts counting the incoming packets. It returns the removed packet after the nth packet has entered. The nth packet is picked randomly from the range that you indicate in the Maximum and Minimum (Packet offset from original location) parameters (from 1 to 64 packets).

For example, if you indicate a range of 5 to 10, HP NV will return the removed packet randomly to the data stream (after the 5th, or 6th...or 10th packet that follows the removed one). In order to have HP NV return all removed packets after a predefined number of incoming packets, the same value can be used for both Minimum and Maximum offset.

- **Duplicate Packets**

HP NV emulates duplication by copying a packet that it selects randomly. The number of copies that will be created when the event occurs is specified in the Minimum and Maximum parameters (from 1 to 20 packets).

For example, if you specify a range of 2-4 packets, HP NV duplicates a packet 2, 3, or 4 times (randomly), when it decides to do so (according to the probability specified in Chance – from 1% to 99%). To create a pre-defined number of copies, enter the same value in both the Minimum and Maximum parameters. For example, entering 3 in both parameters causes HP NV to create 3 copies of the packet when the event occurs.

- **Fragmentation**

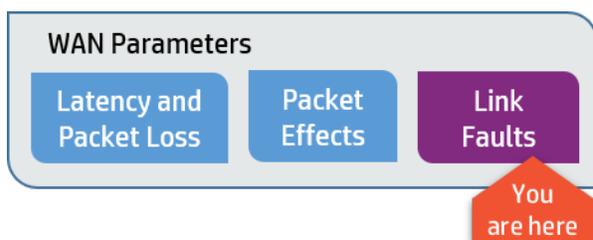
To emulate the packet fragmentation effect you need to set a packet size, in bytes, in the Maximum Transmission Unit parameter (from 64 to 1,460 bytes). This would be the maximum size a gateway along the path route would allow (MTU). Bigger packets are likely to be fragmented or discarded

when the fragmentation event occurs (according to the probability set in Chance – from 1% to 99%). Whether or not the packets will be eventually fragmented depends on the state of the Do Not Fragment (DF) bit in the packet's IP header and on the policy you define via the options included in the Fragmentation group. If the flag is OFF, the packet is fragmented anyway. If the flag is set to ON, the policy you select applies.

A description of the DF=ON policies is as follows:

Option	Effect
<b>Ignore Do Not Fragment (DF) bit</b>	Fragment the packet.
<b>Generate ICMP Error Messages to Source</b>	Discard the packet and inform the packet's source, using an ICMP packet.
<b>Do Not Generate ICMP Error Messages</b>	Discard the packet without informing the packet's source.

## Link faults [WAN Parameters]



Link faults consist of effects caused by physical link malfunctions, specifically bit errors and disconnections. HP NV emulates bit errors by toggling bits at a given frequency. To achieve "disconnection" in the WAN Cloud, you can tell HP NV to stop responding for a given period. Click the **Link Faults** tab to set the parameters that help emulate the link faults.

You can emulate any of the link faults or all of them. Select the check box of the fault type that you want to emulate, and then enter the parameters described below:

### Bit Error

In the Average Frequency box, type a number of bits (from 102 to 1,012). Bit toggling will occur every time that the indicated number of bits (on average) has crossed the WAN Cloud.

In the Minimum and Maximum parameters (Number of toggled bits), enter a range of numbers from 1 to 500. HP NV randomly picks a number in the range and toggles as many bits.

### Disconnect

The parameters in this group allow you to emulate a physical disconnection of the network. In the Average Frequency box type the desired number of seconds (from 3 to 300). HP NV will emulate a disconnection once every so many seconds on average. In the Minimum and Maximum boxes (Disconnection time span), indicate a time range in milliseconds (from 10 to 30,000 ms). HP NV will randomly pick a time value from this range and the lines will remain "disconnected" during this time, by dropping all packets that go through the WAN Cloud during this period.

## Congestion

The Congestion feature helps you emulate a periodic and momentary rise in WAN Cloud traffic, which results in increased latency and packet loss.

**Note:** The Latency and Packet Loss values during the congestion event override the original values (either manually defined or imported).

Congestion Parameter	Description
<b>Average congestion frequency</b>	Type the frequency in seconds (from 1 to 300). For example, entering 20 means that HP NV will increase latency and packet loss every 20 seconds on average.
<b>Congestion time span</b>	The duration of the event in milliseconds (from 10 to 65,535). Type a range in the Maximum and Minimum parameters. HP NV randomly picks a value from this range and sets the latency and packet loss to the values you indicate in the Fixed Latency and Loss fields (below), for the selected duration. After this time, latency and packet loss return to their original settings (as described under the Latency and Packet Loss branches).
<b>Congestion event properties</b>	
<b>Fixed Latency</b>	Enter the latency, in milliseconds, that will prevail during the congestion time (from 0 to 8,000 ms). This value replaces the original latency setting.
<b>Lose x% of all packets</b>	Enter a percentage of packets to be lost during the congestion time (from 0% to 90%). This value replaces the original setting for packet loss.

## NV profile parameters

You can use Network Editor to configure the following parameters in a NV profile.

### WAN Specifications

<b>Latency</b>	
Fixed Latency	0-8,000 ms (Granularity = 1 ms)
Uniform Distributed Latency (minimum/maximum):	0-8,000 ms (Granularity = 1 ms)
Latency change limit	0-4,000 ms (Granularity = 1 ms)
Normal Distributed Latency:	
Average	0-8,000 ms (Granularity = 1 ms)
Standard Deviation	0-8,000 ms (Granularity = 1 ms)
Linear Latency (minimum/maximum):	0-8,000 ms (Granularity = 1 ms)
Cycle Duration	1-65,535 sec
<b>Packet Loss</b>	
Periodic Loss - Lose every n <sup>th</sup> packet	n=2-65,535
Random Loss	0-100% (Granularity = 0.01%)

<b>Burst Loss:</b>	
Probability	0.01-90% (Granularity = 0.01%)
Burst Size	1-65,534 packets
<b>Gilbert-Elliot Loss Two State Loss Model:</b>	
Loss Probability	0.0-100% (Granularity = 0.01%)
Transition to Other State	0.0-99.99% (Granularity = 0.01%)
<b>Packet Effects</b>	
<b>Out Of Order:</b>	
Probability	1-50%
Offset	1-64 packets
<b>Packet Duplication:</b>	
Probability	1-99%
Number of duplicates	1-20 packets
<b>Fragmentation:</b>	
Probability	1-99%
MTU	64-1,460 bytes
DF Policy	<ul style="list-style-type: none"> <li>Ignore DF and fragment packet.</li> <li>Discard packet and generate ICMP message.</li> <li>Discard packet and do not send a message.</li> </ul>
<b>Link Faults</b>	
<b>Bit Error:</b>	
Frequency	$1/10^2 - 1/10^{12}$ bits
Number of Toggled Bits	1-500 bits
<b>Disconnection:</b>	
Average Frequency	3-300 sec
Disconnection Time	10-30,000 ms
<b>Congestion:</b>	
Frequency	1-300 sec
Time span	10-65,535 ms
<b>Event Properties:</b>	
Fixed Latency	0-8000 ms
Packet Loss Probability	0%-90% (Granularity = 0.01%)

## Gateway Specifications

### Bandwidth Settings

Symmetric Bandwidth	2.4 Kbps - 10 Gbps
Asymmetric Bandwidth:	
Uplink/Downlink	2.4 Kbps - 10 Gbps
Packet Overhead Length	0-1000 bytes
<b>Queue Limitations</b>	
Queue Size	2-65,535 KB
Drop Mode:	Drop Tail or RED
RED Queue (Minimum/Maximum Threshold)	2-65,535 KB
Fill Mode (Queue Size Policy)	Byte Mode or Packet Mode
Packet Overhead	<ul style="list-style-type: none"> <li>• Ethernet (Add 18 bytes to each packet)</li> <li>• PPP (Add 9 bytes to each packet)</li> </ul>
Traffic Type Support	IPv4



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