



**Hewlett Packard
Enterprise**

Integrated Smart Update Tools 2.4.5.0 User Guide for Windows, Linux, and VMware ESXi

Abstract

This document describes how to use Integrated Smart Update Tools to update firmware and operating system drivers on HPE ProLiant servers. This document is intended for individuals who understand the configuration and operations of Microsoft Windows, Windows Server, Linux, VMware, Service Pack for ProLiant (SPP), and Smart Components.

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iSUT introduction

Integrated Smart Update Tools

Integrated Smart Update Tools (iSUT) is a software utility used only with iLO Amplifier Pack, HPE OneView, and Smart Update Manager (SUM) to stage, install, and activate firmware and driver updates.

- **iSUT:** Polls iLO to check for requests from HPE OneView, SUM, or iLO Amplifier Pack for updates through the management network and orchestrates staging, deploying, and activating updates. You can adjust the polling interval by issuing the appropriate command-line option provided by iSUT. Performs inventory on target servers, stages deployment, deploys updates, and then reboots the servers.
- **iLO 5 with integrated Smart Update** (Gen10 servers only): Performs iLO Repository-based updates by downloading the components from iLO Repository when iLO Installation Queue has the components which can be updated by iSUT.
- **iLO Amplifier Pack:** Displays available updates for servers. Communicates with iSUT (or SUT 1.x) to initiate updates using the iLO Redfish interface. iSUT reports the status of updates to iLO Amplifier Pack via iLO Restful Interface.
- **HPE OneView:** Displays available updates for servers. Communicates with iSUT (or SUT 1.x) to initiate updates, reports the status on the **Firmware** section of the **Server Profile** page of HPE OneView. HPE OneView provides automated compliance reporting in the dashboard.
- **SPP:** A comprehensive systems software and firmware update solution, which is delivered as a single ISO image.
- **SUM:** A tool for firmware and driver maintenance for HPE ProLiant servers and associated options.

NOTE: SUM, iLO Amplifier Pack, and HPE OneView should not manage the same nodes.

Platform support

Operating System	Version supported
Windows	Integrated Smart Update Tools 2.4.5.0 for Windows
Linux	Integrated Smart Update Tools 2.4.5.0 for Linux
VMware ESXi	Integrated Smart Update Tools 2.4.5.0 for VMware ESXi

iSUT operating modes

iSUT runs in the following modes:

- **OnDemand mode** (default): OnDemand mode enables the administrator to write commands in the CLI window that:
 - Stages updates
 - Deploys updates
 - Reboots servers
- **Auto mode:** iSUT runs in the following Auto modes:
 - AutoStage

- Mounts the SPP through iLO Virtual Media.
- Uses SUM present in the SPP to inventory the server.
- Copies the applicable components from the SPP to the server for deployment.

NOTE: None of these operations are performed in this mode when iLO Repository-based updates are performed. Components are staged in iLO Repository and no components are found in iSUT staging directory during stage operation.

- AutoDeploy

- Performs all the tasks in AutoStage mode.
- Updates the applicable components found in the iSUT staging directory on the host server.

NOTE: Components that are updated by iSUT in iLO Repository-based updates are downloaded to the iSUT staging directory before updating.

- AutoDeployReboot

- Performs all the tasks in AutoDeploy mode.
- If required, reboots the host server.

NOTE: For VMware ESXi, the server must be in Maintenance mode.

NOTE: HPE OneView schedules online firmware updates by specifying a schedule time. iSUT for Windows and Linux supports the scheduling only if it is configured in AutoDeployReboot mode or AutoDeploy mode.

NOTE: If the deployment succeeds, iSUT verifies the updates by default. Use the command `sut /deploy noautoverify` to prevent the default verification. This is not applicable for iLO Repository-based updates.

Use the `status` command to view which mode iSUT is running.

SUM iLO 5 update options

Gen10 servers with iLO 5 allow you to update the servers using SUM (Smart Update Manager). SUM loads the updates to iLO 5. iSUT deploys the updates based on the iSUT mode.

This option needs AMS management tools (AMS) to be installed on the target server on which iSUT is installed. If AMS is not installed, HPE OneView reports it as a Warning alert in the profile when a profile is applied with any of the iSUT options.

NOTE: For more information, see the [Smart Update Manager 8.4.0 User Guide](#).

Dual boot environment notes

If you have an environment where servers boot to both Windows and Linux operating systems.

If you run iSUT in one operating system, and then are going to run it in on another, change the staging directory to the correct path. Use the following command:

```
sut -set stagingdirectory=<staging_directory_path>
```



IMPORTANT: iSUT requires permission to write to the staging directory.

Downloading iSUT

Downloading iSUT

iSUT is available through the product downloads page.

Procedure

Download iSUT from <https://www.hpe.com/servers/sut>.

Downloading SUM

If iSUT is not installed on the target system, you can download SUM to install iSUT for the first time on the target system using the SUM GUI. For more information, see [Installing iSUT with the SUM GUI](#).

NOTE: iSUT cannot be installed on Gen10 VMware ESXi systems using SUM.

Procedure

1. Go to <https://www.hpe.com/servers/sum>.
2. Click **Download**.
3. Select the SUM version you want to download.
4. In the **Delivery Options** area, select the SUM file you want to download.

Downloading iSUT RPM keys

Procedure

Open the link <https://downloads.linux.hpe.com/SDR/keys.html> in a web browser and follow the instructions.

Installing iSUT for Windows and Linux

iSUT installation

iSUT must be installed manually the first time. Ensure that every Windows or Linux system on which SPP must be applied has iSUT installed.

After you install iSUT, the default mode of iSUT is set to OnDemand mode. During every SPP upgrade, iSUT self-upgrades itself if the version of iSUT found in SPP is higher. During self-upgrade, iSUT configurations such as mode are retained. You can change the iSUT mode to a mode of your choice after a successful iSUT installation. To do so, use the following command:

```
sut -set mode=<OnDemand/AutoStage/AutoDeployAutoDeployReboot>
```

iSUT installation for Windows

To install iSUT on Windows, perform the following steps:

1. Download the Smart Component (cpxxxxxx.exe) file to a local directory on the server where you want to install the software.
2. Change to the directory.
3. Run the .exe file by double-clicking it. A dialog box appears.
4. Click the **Install** button to install iSUT.

iSUT installation for Linux

Prerequisites

- Linux OS configuration is required.
- Directories /tmp and /var/tmp/sut must have exec permission.
- If you are mounting file systems to the /tmp or /var/tmp/sut directories, you must mount them as read/write.

To install iSUT on Linux, use the following command:

```
rpm -ivh <dir_location>/sut-<version>.linux.x86_64.rpm
```

Configuring iSUT components

You can use the following two methods to configure the iSUT component to change the default configuration.

Method 1

1. Run SUM and set the mode to one of the auto modes (AutoStage/AutoDeploy/AutoDeployReboot) on the Baseline configuration page.
2. Export the configuration details to a directory.
3. Use this configuration file and run the component independently by passing the /config_file option:
 - For Windows: Use the command, cpxxxxxx.exe /silent /config_file C:\temp\cpxxxxxx_conf\sut_cfg.dat.
 - For Linux: Copy the sut_cfg.dat file to /usr/local/hp/ directory and run the install command.

Method 2

1. Extract the component to a directory.
2. Copy sut_cfg.dat to a different directory.
3. Edit the file to set the mode to one of the automodes.
4. Use this configuration file and run the component independently by passing the /config_file option:
 - For Windows:
 - Use the command, cpxxxxxx.exe /silent /config_file C:\temp\cpxxxxxx_conf\sut_cfg.dat.
 - For Linux:
 - Extract the RPM using the command: rpm2cpio sut-<version>-<build>.linux.x86_64 | cpio -id
 - Edit the sut_cfg.dat file and copy it to the /usr/local/hp/ directory and run the install command.

Configuring iSUT for High Security/CNSA/FIPS

Prerequisite

iLO must already be set in one of the modes: High Security/CNSA/FIPS

Procedure

1. Provide the iLO credentials to SUT using the following command: `sut -set ilusername=<> ilopassword=<>`
2. Change the SUT mode to the requisite mode.
3. Initiate updates.

Configuring iSUT with the SUM GUI

For more information on using SUM, see the SUM documentation at <http://www.hpe.com/info/sum-docs>.

Prerequisites

Directory containing the iSUT components.

Procedure

1. Launch SUM in GUI mode.
2. On the **Baseline Library** Screen, click **Add Baseline**, and then map to the directory that contains the configured iSUT components.
3. To sort the iSUT components, click **Configurable**.
4. Click **Components**.

5. Click **Configurable** or **Configured**. Components labeled **Configurable** have no configuration settings. Components labeled **Configured** have saved configuration settings.
6. Change the configuration parameters, and then click **Save in SUM** or **Save and Export**.

Installing iSUT with the SUM GUI

You can also use the SUM CLI, CLI with Input File, and interactive CLI modes to install iSUT. For more information on using SUM, see the *Smart Update Manager CLI and Interactive CLI Guide* at <https://www.hpe.com/info/sum-docs>.

Prerequisites

Directory with the iSUT components.

Procedure

1. Launch SUM in GUI mode.
2. On the **Baseline Library** screen, add a baseline, and then map to the directory that contains the configured iSUT components.
3. On the **Nodes Library** screen, add the nodes where you are installing iSUT and assign the baseline with the iSUT components.
4. On the **Nodes Library** screen, perform inventory on the nodes where you are installing iSUT.
5. Install the components.

Verifying iSUT installation

Procedure

Issue the following command on the host:

```
sut -status
```

If iSUT is installed, the command output displays iSUT settings, such as mode of update and polling interval.

Setting the staging directory

If you do not want to use the default iSUT staging directory, issue the following command to assign the staging directory.

Procedure

1. Open a command-line window.
2. Enter the command `sut /set stagingdirectory=<directory_path>` (Window/Linux/VMware ESXi).

iSUT creates a backup configuration file that iSUT can use in future sessions.

Reinstalling iSUT with the SUM GUI

You can reinstall iSUT with SUM and overwrite the currently installed version of iSUT. You can reinstall iSUT to change the configuration for multiple servers at the same time.

Prerequisites

Directory with iSUT components configured.

Procedure

1. Launch SUM in GUI mode.
2. On the **Baseline Library** screen, add a baseline, and then map to the directory that contains the configured iSUT components.
3. On the **Nodes Library** screen, add the nodes where you are installing SUM and assign the baseline with the iSUT components.
4. On the **Nodes Library** screen, perform inventory on the nodes where you are installing iSUT.
5. Install the components. Use the **Advanced Deployment** mode and **Force** the component updates.

Installing iSUT for VMware ESXi

Installing iSUT VMware ESXi (Gen10 only)

Procedure

1. Extract the offline bundle from the iSUT component(cpxxxxx.zip).
2. Copy the iSUT offline bundle (sut-esxi<esxi version>-bundle-<iSUT version>.zip) to the VMware ESXi system.
3. Install the iSUT offline bundle on the VMware ESXi host—`esxcli software vib install -d <iSUT offline bundle>`
4. Reboot the VMware ESXi host.
5. To clear the iLO settings used by the earlier iSUT installation, execute the `sut -deregister` command.
6. Set the iSUT mode using the OnDemand command, `sut -set mode=<OnDemand/AutoDeploy/AutodeployReboot>`.

NOTE: You can set the iSUT mode to AutoDeployReboot mode. However, iSUT reboots the VMware ESXi host only if the host is in Maintenance mode. To set the VMware ESXi host in Maintenance mode, run the command `esxcli system maintenanceMode set -e true` on the VMware ESXi host.

Installing VMware software Smart Components on Gen10 using SUM and iSUT

To install the VMware ESXi software bundle Smart Components on Gen10 servers, you must configure the ESXi host with iSUT.

Starting Configuration

Install the HPE custom image for the required version of VMware ESXi.

Set up the ESXi host with iSUT

1. Install the appropriate vSphere Installation Bundle (VIB) for iSUT.

NOTE: Currently, the iSUT products are smart components that do not unzip correctly on the ESXi platform. Unzip the Smart Component in Linux or uncompress them on Windows.

2. After you unzip the smart component to extract the sut-esxi<esxi OS version>-bundle-<iSUT Version>.zip file, copy the sut-esxi<esxi OS version>-bundle-<iSUT Version>.zip file to the ESXi platform, and then install the VIB:

```
esxcli software vib install -d <sut-esxi**-bundle-***.zip>
```

3. Reboot the server.
4. If you want iSUT to run in Automode, change the mode to one of the auto modes. For example, `sut -set mode=autodeployreboot`.

Setup and execute the test using SUM

1. Get the appropriate SPP file.
2. If you are hosting the SPP on a Windows 10 environment, right-click the file, and then mount the *.iso.

NOTE: If you are not hosting the SPP on a Windows 10 environment, use Virtual Clone Drive to mount ISOs.

3. Navigate to the folder that has the SPP files mounted, and then click **launch_sum.bat**. The SUM GUI screen appears.
4. Click **Baseline Library** at the upper-left corner of the SUM GUI.
5. To add an additional baseline package, click **Add Baseline** in the top-left pane. The Add Baseline Options screen appears.
6. Click **Add Baseline** in the pop-up window. The Add Baseline screen appears.

NOTE: You must have both the cp*.zip and cp*.compsig files for the smart component available in the same location as the smart components.

7. Click **Add**. The “Additional package” gets added with a list of the smart components found at the location you specified.

NOTE: Use the “Additional package” as your baseline if you want to test the installation of the new components. You can test the installation by adding nodes.

For Gen10 servers, add an iLO node (use iLO IP for requested IP address).

8. Select Smart Update Manger in the top-left corner of the GUI, and then click **Nodes**. SUM starts performing “discovery” actions.

After adding a node, you can perform an inventory, and then deploy the smart components.

iSUT log files

About log files

iSUT automatically saves the logs after:

- Deploying updates
- Staging updates
- Verifying updates

iSUT saves the log files in the following location:

- Linux: `/var/tmp/sut`
- Windows:
 - OnDemand mode: `C:\Users\Administrator\AppData\Local\sut\logs`
 - Auto mode: `C:\Users\System32\config\systemprofile\AppData\Local\sut\logs`

VMware ESXi: `var/tmp/sut`

Collecting log files

Procedure

1. Use one of the following commands:

- Windows: `C:\Program Files\SUT\bin\gatherlogs_x64.exe.`
- Linux: `/opt/sut/bin/gatherlogs.sh`
- VMware ESXi: `/opt/sut/bin/gatherlogs.sh`

Uninstalling iSUT

Uninstalling iSUT in Windows

Procedure

1. On your Windows server, open **Programs and Features**.
2. Select **Integrated Smart Update Tools for Windows**, and then click **Uninstall**.

Uninstalling iSUT in Linux

Procedure

Use the following command to uninstall iSUT:

```
- rpm -e sut
```

Uninstalling iSUT in VMware ESXi

Procedure

1. Execute the `sut -deregister` command.
2. Execute the `sut -clearilocreds` command only if iLO is configured in a High Security mode, such as FIPS.
3. Use the following command to uninstall iSUT: `esxcli software vib remove --vibname sut`

iSUT troubleshooting

Baseline URI not Detected as a Supported Baseline

Symptom

The URI provided is not detected as a supported baseline ISO.

Cause

The directory contents do not match the SPP structure.

Action

1. Verify that the SPP ISO is valid.
2. Reissue the request.

iSUT unexpectedly installs a CHIF driver

Symptom

iSUT installs an HPE iLO Channel Interface (CHIF) driver when you did not select it for installation.

Cause

iSUT requires the CHIF driver to perform tasks.

Action

No action.

Cannot clear the iSUT staging directory

Symptom

While staging components, iSUT cannot clear the staging directory.

Solution 1

Cause

The user does not have execution permissions for the directory or file.

Action

Make sure that the administrator has write permissions for the directory.

Solution 2

Cause

Other processes are using the staged files.

Action

Verify that other processes are not using the staged files.

iSUT is installed, but does not issue commands

Symptom

iSUT installed succeeds, but commands do not function.

Cause

A user account without administrator or root user privileges installed iSUT.

Action

Uninstall iSUT and reinstall with an administrator account or root user.

iSUT does not recognize a configuration file

Symptom

iSUT does not recognize the specified configuration file.

Cause

The path to the configuration file includes spaces.

Action

Remove all empty spaces from the directory path to a configuration file.

iSUT cannot stage files

Symptom

iSUT cannot stage files.

Solution 1**Cause**

iSUT files require more space than available on the disk.

Action

Clear disk space on staging drive and retry the staging operation.

Solution 2**Cause**

The component is not in the baseline SPP.

Action

Verify that the component is in the baseline SPP.

Solution 3**Cause**

SPP fails security validation on Windows.

Action

Update the Windows root certificates. Manually update the GlobalSign Root CA and AddTrust External Root CA certificates.

iSUT cannot mount baseline ISO through iLO Virtual Media

Symptom

Mounting the baseline ISO through the iLO Virtual Media failed.

Cause

- The baseline is not accessible.
- The HTTPS server hosting the baseline ISO is busy.
- There is no HPE iLO Advanced license installed.

Action

1. Check to see if another baseline ISO is already mounted through iLO Virtual Media.
2. Verify that an HPE iLO Advanced license is installed.
3. Verify that the staging directory URI is accessible.
4. Retry the operation.

iSUT cannot start deployment

Symptom

iSUT cannot deploy updates.

Solution 1**Cause**

The staging directory is not accessible or has been deleted.

Action

Verify that the staging directory is valid.

Solution 2

Cause

For Gen10 iLO Repository-based updates, if the system is connected to HPE OneView and you manually add components to the iLO queue, iSUT does not pick components for update.

Action

Remove the server from HPE OneView or initiate the deployment from HPE OneView.

iSUT cannot reboot a server

Symptom

iSUT cannot reboot a server after deploying updates to the server.

Action

Manually reboot the server.

Components in an iLO installation queue are marked as Exception

Symptom

iSUT marks the component state in iLO installation queue as `Exception` with message ID as `InvalidFile`.

Cause

This can occur if the component signature is not imported into the rpm database.

Windows certificates are not current.

Action

1. Make sure that the certificates are up-to-date on the system.

Linux: Import the HPE rpm keys at <http://downloads.linux.hpe.com/SDR/keys.html>. Use the `rpm --import` command.

iSUT does not launch SUM

Symptom

SUM does not execute.

Solution 1

Cause

The SUM binary does not exist in the staging location.

Action

Make sure that SUM exists in the SPP ISO.

Solution 2**Cause**

The SUM binary does not have the correct permissions.

Action

Make sure that the SUM binary has the correct permissions.

iSUT does not support the version of SUM

Symptom

iSUT cannot launch SUM.

Cause

The version of SUM is too old.

Action

Verify that the version of SUM is supported. For more information, see the *Integrated Smart Update Tools Release Notes*.

An unprivileged account installed iSUT

Symptom

iSUT installed succeeds, but commands do not function.

Cause

A user account without administrator or root user privileges installed iSUT.

Action

Uninstall iSUT and reinstall with an administrator account or root user.

iSUT unexpectedly changes the command

Symptom

A requested command changes during processing.

Cause

A user sent a request while iSUT processed another request.

Action

Reissue the command that changed. Make sure that one command ends before issuing another command.

Firmware update is delayed when firmware is applied in mixed mode

Symptom

When you create a profile in mixed mode, the firmware update schedule is delayed.

Cause

A group of nodes picked by SUT for concurrent deployment can have a maximum of 20 nodes. The scheduled nodes that have similar attributes for Force Flag, Install type, Baseline URI, and Schedule time are grouped. These nodes are then sent for concurrent updates. If the update for a concurrent group is already in progress, the schedule for the subsequent group is delayed by 1 hour to allow the scheduled nodes to complete their updates.

Action

Ensure that a single group of nodes sent to SUT for deployment has the following matching properties: Force Flag, Install type, Baseline URI, and Schedule time (if specified).

Websites and support

Websites

Hewlett Packard Enterprise Information Library	<u>www.hpe.com/info/EIL</u>
Smart Update Manager	<u>www.hpe.com/servers/sum</u>
Smart Update Manager Information Library	<u>www.hpe.com/info/sum-docs</u>
Smart Update Tools	<u>www.hpe.com/servers/sut</u>
Smart Update Tools Information Library	<u>www.hpe.com/info/isut-docs</u>
Service Pack for ProLiant	<u>www.hpe.com/servers/spp</u>
Service Pack for ProLiant documentation	<u>www.hpe.com/info/spp/documentation</u>
Service Pack for ProLiant downloads	<u>www.hpe.com/servers/spp/download</u>
Service Pack for ProLiant custom downloads	<u>www.hpe.com/servers/spp/custom</u>
HPE SDR site	<u>downloads.linux.hpe.com</u>

For additional websites, see [**Support and other resources**](#).

Support and other resources

Accessing Hewlett Packard Enterprise Support

- For live assistance, go to the Contact Hewlett Packard Enterprise Worldwide website:
[**http://www.hpe.com/assistance**](http://www.hpe.com/assistance)
- To access documentation and support services, go to the Hewlett Packard Enterprise Support Center website:
[**http://www.hpe.com/support/hpesc**](http://www.hpe.com/support/hpesc)

Information to collect

- Technical support registration number (if applicable)
- Product name, model or version, and serial number
- Operating system name and version
- Firmware version
- Error messages
- Product-specific reports and logs

- Add-on products or components
- Third-party products or components

Accessing updates

- Some software products provide a mechanism for accessing software updates through the product interface. Review your product documentation to identify the recommended software update method.

- To download product updates:

Hewlett Packard Enterprise Support Center

www.hpe.com/support/hpesc

Hewlett Packard Enterprise Support Center: Software downloads

www.hpe.com/support/downloads

Software Depot

www.hpe.com/support/softwaredepot

- To subscribe to eNewsletters and alerts:

www.hpe.com/support/e-updates

- To view and update your entitlements, and to link your contracts and warranties with your profile, go to the Hewlett Packard Enterprise Support Center **More Information on Access to Support Materials** page:

www.hpe.com/support/AccessToSupportMaterials

-
- ⓘ **IMPORTANT:** Access to some updates might require product entitlement when accessed through the Hewlett Packard Enterprise Support Center. You must have an HPE Passport set up with relevant entitlements.
-

Customer self repair

Hewlett Packard Enterprise customer self repair (CSR) programs allow you to repair your product. If a CSR part needs to be replaced, it will be shipped directly to you so that you can install it at your convenience. Some parts do not qualify for CSR. Your Hewlett Packard Enterprise authorized service provider will determine whether a repair can be accomplished by CSR.

For more information about CSR, contact your local service provider or go to the CSR website:

<http://www.hpe.com/support/selfrepair>

Remote support

Remote support is available with supported devices as part of your warranty or contractual support agreement. It provides intelligent event diagnosis, and automatic, secure submission of hardware event notifications to Hewlett Packard Enterprise, which will initiate a fast and accurate resolution based on your product's service level. Hewlett Packard Enterprise strongly recommends that you register your device for remote support.

If your product includes additional remote support details, use search to locate that information.

Remote support and Proactive Care information

HPE Get Connected

www.hpe.com/services/getconnected

HPE Proactive Care services

www.hpe.com/services/proactivecare

HPE Proactive Care service: Supported products list

www.hpe.com/services/proactivecaresupportedproducts

HPE Proactive Care advanced service: Supported products list

www.hpe.com/services/proactivecareadvancedsupportedproducts

Proactive Care customer information

Proactive Care central

www.hpe.com/services/proactivecarecentral

Proactive Care service activation

www.hpe.com/services/proactivecarecentralgetstarted

Warranty information

To view the warranty for your product or to view the *Safety and Compliance Information for Server, Storage, Power, Networking, and Rack Products* reference document, go to the Enterprise Safety and Compliance website:

www.hpe.com/support/Safety-Compliance-EnterpriseProducts

Additional warranty information

HPE ProLiant and x86 Servers and Options

www.hpe.com/support/ProLiantServers-Warranties

HPE Enterprise Servers

www.hpe.com/support/EnterpriseServers-Warranties

HPE Storage Products

www.hpe.com/support/Storage-Warranties

HPE Networking Products

www.hpe.com/support/Networking-Warranties

Regulatory information

To view the regulatory information for your product, view the *Safety and Compliance Information for Server, Storage, Power, Networking, and Rack Products*, available at the Hewlett Packard Enterprise Support Center:

www.hpe.com/support/Safety-Compliance-EnterpriseProducts

Additional regulatory information

Hewlett Packard Enterprise is committed to providing our customers with information about the chemical substances in our products as needed to comply with legal requirements such as REACH (Regulation EC No 1907/2006 of the European Parliament and the Council). A chemical information report for this product can be found at:

www.hpe.com/info/reach

For Hewlett Packard Enterprise product environmental and safety information and compliance data, including RoHS and REACH, see:

www.hpe.com/info/ecodata

For Hewlett Packard Enterprise environmental information, including company programs, product recycling, and energy efficiency, see:

www.hpe.com/info/environment

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