Technical white paper

Support for Customer-Created Windows 10 IoT Enterprise Images on Select HP Thin Clients

Table of contents

Overview

The purpose of this white paper is to outline HP support for customer-created Windows® 10 IoT Enterprise images on the following HP thin clients:

- t520
- t620 / t620 PLUS
- t730
- mt42
- t628
- t630

Windows 10 IoT Enterprise is offered on these models out of the factory; however, HP also supports Windows 10 IoT Enterprise on these platforms if you purchase an operating system upgrade from Microsoft or an authorized Microsoft reseller and enroll the device in the Volume Licensing and Software Assurance programs. Customers running a qualified Windows operating system can purchase the Windows 10 IoT Enterprise upgrade. This upgrade gives you access to the base operating system image so that you can create your own custom image. Before upgrading your operating system, discuss the changes required when transitioning from OEM to Volume Licensing with the appropriate Microsoft representative.

HP support and requirements

HP supports customers running Windows 10 Enterprise 2016 LTSB or Windows 10 Enterprise 2015 LTSB (both are equivalent to Windows 10 IoT Enterprise) on a supported HP thin client under the following conditions:

- The operating system upgrade was purchased from Microsoft or an authorized Microsoft reseller.
- The operating system is the latest 64-bit version and has update KB3213986 installed.
- The language is English, Norwegian, Spanish, French, German, Dutch, Arabic, Russian, Simplified Chinese, Traditional Chinese, Korean, or Japanese.
- The HP hardware-enabling drivers are installed on the thin client.
- The flash drive and SDRAM minimum capacity requirements are met (see Flash storage and memory).

> **Note**
> Third-party flash drives and memory are allowed, but HP does not support issues with or provide warranties for any third-party parts.

- Unified Write Filter (UWF) is enabled at all times, except in the following scenarios:
  - An administrator is configuring the system.
  - The system is configured with a flash drive that has a sufficient endurance for a large amount of writes.
- No Windows Page File exists on the system.

If the above conditions are not met, HP cannot provide support and your system could experience symptoms such as slow performance, premature wear of the flash drive, or other system integrity issues.

> **Note**
> To help expedite the support process for your custom Windows 10 IoT Enterprise installation, HP recommends that you duplicate any symptoms using the base Windows 10 IoT Enterprise image with only the HP driver pack installed (no additional configurations or add-ons), and then contact HP for support.

Hardware-enabling drivers

The HP hardware-enabling drivers for Windows 10 IoT Enterprise can be found bundled as a single driver pack at http://www.hp.com/support (search for the thin client model, and then see the **Download options** section of the support page for that model). The HP driver pack contains all the necessary hardware-enabling drivers along with two Control Panel apps:

- HP RAM Disk Manager—Allows you to configure the size of the RAM drive
- HP Unified Write Filter Configuration—Allows you to manage UWF

Flash storage and memory

Windows 10 IoT Enterprise requires a minimum flash drive capacity of 32 GB and a minimum of 4 GB SDRAM. HP recommends a 64 GB flash drive and 8 GB SDRAM for optimal performance. If you are upgrading an existing system that is configured with a 16 GB or smaller flash drive, contact your HP representative to discuss your available options.

Note
Third-party flash drives and memory are allowed, but HP does not support issues with or provide warranties for any third-party parts.

Operating system support

After a customer enters a Volume Licensing agreement with Microsoft and creates a custom image, the support for that image changes hands. Traditionally, support for Windows Embedded (now Windows IoT) operating systems has been available from the OEM only. The creation and support of Windows images handled through a Volume License Agreement are the responsibility of **the customer**, **the third-party ISVs**, and **Microsoft**.

Before creating and deploying a custom Windows 10 IoT Enterprise image, you should review the Windows services, apps, and user account setup intended for your image to determine whether writes to the flash drive need to be minimized.

Next, develop an action plan to minimize attempted writes to the flash drive (to prevent the write filter overlay cache from filling up). Possible actions include the following:
- Disabling unneeded services
- Redirecting temp files and logs to the RAM drive instead

Following these guidelines helps ensure that your HP thin client remains stable and in working condition.

Service

If you need to send a thin client to HP for service, all third-party parts (flash drive and memory) should be removed first, because they might not be returned with the system. When the system is returned, it ships as initially configured in the factory, including the original operating system. You can reinstall the third-party parts and your custom image after the thin client is returned.

Supported software

Note
The HP driver pack described in Hardware-enabling drivers must be installed before any additional software.

The following software is supported:
- HP Device Manager (HPDM)
- HP Easy Shell
- HP Hotkey Filter
- HP ThinUpdate

Note
Only the add-on download feature of HP ThinUpdate is supported. You cannot use HP ThinUpdate to capture and deploy an image if the base OS was not provided by HP.

- HP Velocity
- Microsoft® System Center Configuration Manager

You can download HP ThinUpdate from your thin client model's support page at http://www.hp.com/support (same as the HP driver pack). After HP ThinUpdate is downloaded and installed, updates for it can be downloaded from within the app itself.

HP Easy Shell, HP Hotkey Filter, and HP Velocity (server-side and client-side) can be downloaded/updated via HP ThinUpdate.

For HPDM, see the following:

- The HPDM server-side installer can be downloaded from your thin client model's support page at http://www.hp.com/support or from ftp://ftp.hp.com/pub/hpdm.
- Installation files for HPDM Agent (the client-side component) are located on the HPDM Repository server at \HPDM\Repository\Agents\HPWE8_64\.

Configuration Manager components can be acquired from Microsoft.

Creating an image

To create a Windows 10 IoT Enterprise image for a supported HP thin client:

Note
The following procedure assumes you will log on to Windows as an administrator each time a Windows logon is required. For information about enabling and disabling UWF as required in this procedure, see Appendix A—Unified Write Filter.

1. Install the base operating system (from Microsoft) on the thin client.
2. If you do not plan to use HPDM for imaging, skip to step 3. If you plan to use HPDM for imaging, follow this procedure to verify the disk partitions:

   A. In Windows, open **Command Prompt (Admin)**.
   B. Execute each of the following commands in succession:
   ```
   diskpart
   select disk 0
   list par
   ```
   C. If three partitions are listed by the output displayed in Command Prompt, skip to step 3 in this procedure.
   – or –
   If four partitions are listed, Partition 1 is a recovery partition that must be removed by doing the following:
   i. Execute each of the following commands in succession:
   ```
   select par 1
   delete par override
   ```
   ii. Restart the thin client.
3. Install the HP driver pack.
4. Disable UWF, which requires a restart of the thin client.
5. After the restart, install the desired software programs, and then restart the thin client again.
6. Execute each of the following commands in **Command Prompt (Admin)**:
   ```
   C:\Windows\Microsoft.NET\Framework\v4.0.30319\ngen.exe executequeueditems
   C:\Windows\Microsoft.NET\Framework64\v4.0.30319\ngen.exe executeQueuedItems
   ```

   Important
   Before you proceed to the next step, the Ngen.exe process must complete. If the process does not complete, newly installed .NET programs, such as HP Easy Shell, will always have a delayed startup time because of .NET elements being recompiled every time the program starts.

7. Enable UWF, which requires a restart of the thin client.

To install additional software in the future, repeat steps 4–6 in the previous procedure.

Appendix A—Unified Write Filter

Unified Write Filter (UWF) is an operating system component that protects the contents of and decreases wear on the flash drive of a thin client by redirecting and caching writes in an overlay, which is a virtual storage space in RAM that tracks changes to a protected volume (the flash drive). The user experience in Windows is unaffected because the operating system maintains the appearance of writing to the flash drive. When a system restart occurs, the overlay cache is cleared, and any changes made since the last system startup are lost permanently. If it is necessary to make permanent system configurations, an administrator can commit (persist by writing through to the protected volume) changes stored in the overlay cache prior to a system restart.

Note
The overlay cache is cleared only by a system restart, so users can log out or switch between user accounts without losing the cached information.

UWF allows you to manage on a per-file basis, so you can immediately (without a system restart) commit files individually or restore files to their previous state from the underlying volume by discarding the changes. You can also exclude files from protection so that changes to them are always written directly to the flash drive. However, you cannot commit the entire UWF overlay cache in a single command.

Caution
HP highly recommends the following:

• Ensure the write filter is used properly for standard thin client use cases. Proper usage includes making sure the write filter is enabled during end-user (non-administrator) operation and is disabled only temporarily by an administrator needing to make changes to the system. The write filter should be reenabled as soon as the changes are completed.

• Never enable the Windows Page File feature unless the system is configured with a flash drive that has an endurance sufficient for the high volume of writes this feature produces. The use of the Windows Page File feature with lower-endurance flash drives will result in premature wearing of the flash drive, decreased performance, and a decrease in the lifespan of the thin client.

• Use virtualized security software instead of standard PC security software, which can cause excessive wear of the flash drive.

• For use cases that require frequent writes, such as active system logging, call center phone and video recording, and industrial logging, you should configure the thin client to write to a server. If local writes are necessary, they should be done in the overlay cache. Please contact HP for help determining an appropriate interval schedule for committing the overlay cache, or preferably log the data from the overlay cache to a server.

If your use case requires non-standard write filter usage, please contact HP to ensure that your thin clients are configured properly.

UWF management overview

There are three tools you can use to manage UWF: a notification icon, a Control Panel app, and a command-line tool. Some commands can be performed using any of the tools, but other commands might be exclusive to one or two of the tools.

Notification icon
The UWF notification icon is located in the Windows notification area. The following commands can be executed by right-clicking the notification icon and selecting the desired option:

• **Enable UWF**—Enables UWF (requires a system restart)

• **Disable UWF**—Disables UWF (requires a system restart)

• **Clear commands**—Clears the previously-set boot command (such as Enable or Disable)

The following table describes the possible states of the UWF notification icon.

Icon	Description
🔒	UWF is enabled, and no boot command is set.
🔒	UWF will be disabled (requires a system restart)
🔓	UWF is disabled, and no boot command is set.
🔓	UWF will be enabled (requires a system restart)
🔒	The memory usage of the UWF overlay cache has reached a warning level.

🔒	The memory usage of the UWF overlay cache has reached a warning level, and UWF will be disabled (requires a system restart)
🔓	The memory usage of the UWF overlay cache has reached a critical level.
🔒	The memory usage of the UWF overlay cache has reached a critical level, and UWF will be disabled (requires a system restart)
✖	UWF is corrupted.

HP Unified Write Filter Configuration

HP Unified Write Filter Configuration is a Control Panel app for managing UWF. To open this app:

▲ Double-click the notification icon.

  – or –

  In Control Panel, select **HP Unified Write Filter Configuration**.

The tasks you can perform in this app include the following:

• Disable or enable UWF (requires a system restart)

• View information about UWF and the overlay cache

• Enable or disable UWF Servicing Mode

Note

For more information about UWF Servicing Mode, go to https://msdn.microsoft.com/en-us/library/windows/hardware/mt571993(v=vs.85).aspx.

• Edit the exclusion list to add or remove files and folders (requires a system restart)

• Set the overlay cache threshold (requires a system restart)

• Set the percentage of cache usage at which warning and critical messages each display

• Set the delay for an automatic system restart that occurs when a critical state is reached

Command-line tool

The following table describes common-line options for UWF.

UWF command	Description
`uwfmgr filter disable`	Disables UWF (requires a system restart)
`uwfmgr filter enable`	Enables UWF (requires a system restart)
`uwfmgr.exe file commit <file>`	Commits the specified file immediately
`uwfmgr.exe file add-exclusion <file>`	Adds the specified file to the exclusion list (requires a system restart)
`uwfmgr overlay set-size <size>`	Sets the overlay cache threshold in MB (requires a system restart)
For more information and a full list of commands, go to https://msdn.microsoft.com/en-us/library/windows/hardware/mt572002(v=vs.85).aspx.	

Making permanent system configurations

The following table describes the possible methods for making permanent system configurations.

Caution

HP strongly recommends using method 1 in most situations.

Method 1	Method 2	Method 3
1. Disable UWF (requires a system restart). 2. Make the necessary configurations. 3. Enable UWF (requires a system restart).	1. Make the necessary configurations. 2. Commit individual cached files. The action takes effect immediately.	▲ Use the HP Unified Write Filter Configuration app or the command line to add files or folders to the exclusion list, and then restart the thin client.
See the following sections for more information about performing these various tasks: • Disabling or enabling UWF • Committing changes to the flash drive • Adding files and folders to the exclusion list		

Disabling or enabling UWF

The following table describes the possible methods for disabling or enabling UWF.

Method 1	Method 2	Method 3
1. Right-click the notification icon and select the desired state. 2. Restart the thin client.	1. Open the HP Unified Write Filter Configuration app. 2. On the **General** panel, select an option to set the desired state. 3. Restart the thin client.	1. Use the command line to set the desired state. 2. Restart the thin client.
Tip: Method 1 is the quickest way to disable or enable UWF.		

Committing changes to the flash drive

To commit changes to the flash drive:

▲ Use the command line to commit individual files. The action takes effect immediately.

Adding files and folders to the exclusion list

The following table describes the possible methods for adding files and folders to the exclusion list.

Method 1	Method 2
1. Open the HP Unified Write Filter Configuration app and select the **File Exclusion List** tab. 2. Select the **Choose a folder** button or the **Choose a file** button to add an item to the exclusion list (repeat as necessary). 3. Restart the thin client.	1. Use the command line to add an item to the exclusion list (repeat as necessary). 2. Restart the thin client.
Caution: Changes to items in the exclusion list are always written directly to the flash drive, so keep the exclusion list to a minimum. **Note**: Items can be removed from the exclusion list using either the HP Unified Write Filter Configuration app or the command-line option (requires a system restart).	

The following table describes the icons used for the exclusion list in the HP Unified Write Filter Configuration app.

Icon	Description
✔	The item is excluded.
🖼	The item will be added to the exclusion list (requires a system restart).
✘	The item will be removed from the exclusion list (requires a system restart).

Clearing the boot command

To clear the boot command:

▲ Right-click the notification icon and select **Clear commands**.

Registry filtering

Caution

The UWF component by Microsoft provides registry-filtering functionality, which includes the ability to add registry keys to a registry exclusion list and to commit individual registry keys. However, documentation about the registry filter is limited, and due to the complexity of Windows, dependencies are not always clear. Although the HP Unified Write Filter Configuration app provides easy access to the registry exclusion list, HP does **NOT** support or recommend using the registry filtering capabilities of UWF. Usage of this functionality is **at your own risk**.

For more information

For more information about HP thin clients, go to the following websites:

- http://www.hp.com/support (Search for your thin client model. For documentation, select **Manuals**.)
- http://www.hp.com/go/thinclient

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