VMware Operating System Optimization Tool Guide

VMware Horizon 7
VMware Horizon Cloud
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How This Guide Is Organized
This guide is organized into the following sections:

Introduction provides a brief description of the guide and its target audience, and summarizes the VMware Horizon 7 and VMware Horizon Cloud products.

Why Optimize explains how Microsoft Windows can be optimized for virtual machines, the specific areas in the OS that you can customize, and the benefits of doing so.

VMware OS Optimization Tool presents an overview of the tool, the link to download it, and the steps to use it.

Note: The section Steps for Using the OSOT outlines the steps to perform an optimization. It is the quickest path to get started on the process. You can use the other parts of this document as a reference when you have questions along the way.

Introduction
This guide describes how to optimize virtual and physical desktops and servers with the VMware Operating System Optimization Tool (OSOT) for VMware Horizon 7 and VMware Horizon Cloud.

VMware Operating System Optimization Tool
The free OSOT makes it easy to apply configuration settings to desktops and servers. It includes settings to optimize the following Windows operating systems for both desktops and servers that reside in the data center and in the cloud:

- Windows 7
- Windows 8
- Windows 8.1
- Windows 10
- Windows Server 2008 (including R2)
- Windows Server 2012 (including R2)
- Windows Server 2016
- Windows Server 2019

The OSOT optimizes RDSH servers for Horizon 7, and Horizon Cloud.

Notes:
- The OSOT does not support optimizing Windows Server 2008 or 2012 when those operating systems are used as single-session desktops.
- The optimization information in this guide does not pertain to Windows XP, which Microsoft no longer supports. For more information, see the Windows XP Deployment Guide.

Audience
This guide is written for data center administrators and IT personnel who want to optimize Windows operating systems. The guide assists you in working with the OSOT and provides an ongoing reference as you become a more proficient OSOT user. VMware will periodically update this document to reflect continuing enhancements to the OSOT and future releases of the Windows operating system.
Horizon 7

Horizon 7 is a desktop virtualization solution that enables organizations to deliver virtualized or remote desktops and applications to end users through a single platform.

All Horizon 7 editions include View as their foundation. Each edition builds successively on the others. For example, Horizon 7 Advanced Edition is based on Horizon 7 Standard Edition with additional components and products, and Horizon 7 Enterprise Edition extends the capabilities of Horizon 7 Advanced Edition.

For more information, see the VMware Horizon Pricing, Packaging, and Licensing white paper.

Horizon Cloud

Horizon Cloud provides virtual desktops and hosted apps as a cloud service, deploying and managing them in the cloud. Like the user experience in Horizon 7, users can securely access their desktops and apps from any device or browser.

Why Optimize?

Windows was designed for physical hardware, specifically desktops, and for that hardware to be accessed by just one user at a time. Windows uses many resources to present a responsive desktop, but many of its settings are unnecessary or even detrimental when applied to a virtual environment. These actions include, for example, animating windows as the user opens them. Performing this animation takes significant CPU resources, which decreases the number of desktops that you can host per VMware vSphere server. Consequently, this nonessential function in a virtual machine (VM) environment increases the amount of system hardware that you need. Even if hardware is plentiful, Windows animations do not perform well when accessed remotely, especially when connecting over a slow WAN or Internet connection. As a result, keeping animations enabled (in addition to other features unnecessary for VMs) impairs the end-user experience.

Another example of desktop optimization in a virtual machine environment is to disable Windows Update so that control of the service is isolated to administrators. Administrators can run Windows Update in batch mode for the VMs as opposed to users performing this task.

Note: You can also optimize physical machines by removing nonessential functions in a similar manner. However, the focus of this document is on the administration of master images to be deployed to end users or used as RDSH servers.

What Are You Optimizing?

Using the recommendations provided in the OSOT, you are maximizing the efficiency and performance of your virtual desktops and RDSH servers.

Optimizing virtual desktops:

- Increases their performance
- Increases their density, boosting the number of virtual desktops that can be hosted per vSphere server, thereby reducing infrastructure costs
- Improves end-user experience
- Reduces end-user support incidents
Optimizing RDSH servers:

- Increases hosted desktop and application performance.
- Reduces the amount of system resources that each RDSH server requires.
- Increases the density and the number of RDSH servers that can be hosted.
- Increases the number of users that can be supported per RDSH server.
- Improves the end-user hosted desktop and application experience.
- Reduces system support incidents.

When Do You Optimize?

The traditional approach to optimizing virtual desktops or RDSH servers is to use a master image. You apply optimizations to the master image, which is used to create a desktop pool. You can also use a master image to deploy multiple RDSH servers.

Another type of optimization that is frequently performed is one that is made spontaneously to remote systems. This kind of optimization is often performed to tune something that was not optimized when the system was first deployed. However, it is also performed because something has changed, and new optimizations are needed on remote systems that cannot be redeployed. You can perform both types of optimization using the OSOT.
VMware OS Optimization Tool

The OSOT provides the easiest and most efficient way to optimize your Windows desktop and server master images. It offers many advantages over traditional scripts, including the ability to roll back changes, selectively edit optimization values, and view detailed audit information before applying optimizations.

The OSOT includes customizable built-in templates to enable or disable Windows features and system services across multiple platforms. You use the OSOT to improve Windows performance, as per VMware recommendations and best practices.

The OSOT is a free VMware Fling that you can download.

Using the OSOT

Before using the OSOT, which contains recommended configurations in the built-in OSOT templates, your IT organization should investigate and evaluate the benefits of the various optimizations. There is sometimes a trade-off between productivity and optimization. Also, test before and after using the OSOT to ensure that optimizations do not interfere with other software that might be in use within your organization.

Steps for Using the OSOT

Using the OSOT involves the following steps:

1. Snapshot the master before you start.
2. Analyze the master image.
3. (Optional but recommended) Configure the Common Options settings.
4. Verify that the list of optimizations checked are those that you want to apply.
5. (Optional) Export the analysis results to an HTML file.
6. Optimize the master image.
7. Analyze the optimization results. (Each optimization will include the status SUCCESS or FAILED.)
8. Troubleshoot FAILED results: Click the respective FAILED links to review error code and error string information.
9. Address the cause of the failure and optimize again.
10. (Optional) View the optimization history.
11. (Optional) Perform a rollback (if you want to return a master image to its pre-optimized state).
12. (Optional) Create a custom OSOT template.

Best Practices

To make the most of the OSOT, follow these best practices:

- Use the OSOT on a base image. Apply the tool to an unused system that has been built to match the configuration that you will deploy for virtual desktops or RDSH servers.
- Disable as many unnecessary Windows OS components as possible. Consider disabling everything and then performing user-acceptance testing (UAT) to see if there are problems. Re-enable any components that cause a problem when disabled.
- Take VM level snapshots before applying any changes so that you can easily revert to the previous state if needed.

OSOT Features

This section describes some of the tool’s graphical features.

Tab Functions

A row of tabs provides the main functions of the OSOT:
• **Analyze** – Analyze the registry entries, services, and scheduled tasks of the virtual machines that you want to optimize.
• **History** – View optimization history, and roll back virtual machines to a pre-optimized state.
• **Remote Analysis** – Browse a list of virtual machines in a remote desktop environment to analyze them.
• **My Templates** – Edit the built-in OSOT templates and save the changes to create your own OSOT templates.
• **Public Templates**
• **References** – Use the links provided to
  - Download the latest version of the OSOT
  - Provide feedback or submit your questions to the OSOT development team and the community
  - Access third-party reference guides

Figure 1: Tabs Available in the OSOT

**OSOT Template Choices**

The following built-in OSOT templates come with a list of modifications for a standard master image. Each OSOT template is an XML file that contains the coding for the optimizations. The default settings are the recommended values for optimizing your Windows operating system.

- Windows 10 1809-1909-Server 2019
- Windows 10 1507-1803-Server 2016
- Windows 7 – Optimizes Windows 7 desktops.
- Windows 8 – Optimizes all versions of Windows 8 desktops.
- Windows 8.1 – Optimizes all versions of Windows 8.1 desktops.

Note: The OSOT does not support optimizing Windows Server 2008 or 2012 when those operating systems are used as single-session desktops.

The key to optimization is to configure services and settings specific to the operating system being used. Therefore, always use the OSOT template that matches the OS version that your virtual machine is using.

- For example, if the target system is running Windows 10 version 1909, use the Windows 10 1809-1909-Server 2019 (built-in) template to optimize it.
- The OSOT attempts to select the appropriate built-in OSOT template by detecting the OS of the target machine. However, verify that the correct OSOT template is selected for your VM before applying optimizations.
You can also create your own templates within the OSOT, as described in Customizing Built-In OSOT Templates.

**OSOT Templates and Groups**

Each OSOT template has a list of modifications, called Steps, which are organized into Groups.

**System Information**

The System Information pane, below the five main tabs, has details about the machine (local or remote) that you are targeting. System Information details include:

- OS – Operating system on machine being viewed.
- User Name – Current logged-in user.
- Physical Memory – Installed physical memory.
- Windows Locale – OS setting that identifies, by geographical location, the language used by the targeted machine.

<table>
<thead>
<tr>
<th>System Information</th>
<th>OS</th>
<th>System Name</th>
<th>Version</th>
<th>User Name</th>
<th>Administrator</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS</td>
<td>Microsoft Windows 10 Pro</td>
<td>System Name</td>
<td>System Name</td>
<td>User Name</td>
<td>Administrator</td>
</tr>
<tr>
<td>Processor</td>
<td>Intel(R) Core(TM) i7-8550U CPU @ 1.80GHz</td>
<td>System Directory</td>
<td>C:\Windows</td>
<td>C:\Windows\system32</td>
<td></td>
</tr>
<tr>
<td>System Type</td>
<td>64-bit</td>
<td>System Directory</td>
<td>C:\Windows\system32</td>
<td>C:\Windows\system32</td>
<td></td>
</tr>
<tr>
<td>Physical Memory</td>
<td>4.00 GB</td>
<td>Windows Locale</td>
<td>Ireland</td>
<td>Ireland</td>
<td>Ireland</td>
</tr>
<tr>
<td>Display Controller</td>
<td>VMware SVGA 3D</td>
<td>Display Adapter RAM</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Network Adapter</td>
<td>Intel(R) 82574L Gigabit Network Connection</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Figure 4: System Information Pane of the Main OSOT Window
Analyze a Master Image

You view the OSOT Optimization pane by selecting the Analyze tab.

Figure 5: Main OSOT Pane Before You Analyze

- After you select a template from the Template Name menu and perform an analysis by clicking the Analyze button, the columns populate with the optimizations that you can perform.
- You see a check box before each optimization item, with some check boxes selected and others unselected.
- The selected items indicate those that are included for optimization. Some items are not selected for optimization by default because they can cause unexpected results.

Note: If you create your own template, you can configure an optimization item to be selected by default. For more information, see Customizing Built-In OSOT Templates.

First, you analyze the current state of a desktop master image, and later (when you optimize), you apply the template’s optimizations according to your choices.

To analyze a master image:

1. Run the OSOT from the master image that you want to optimize.
   Apply the tool to an unused system that has been built to match the configuration that you will deploy as virtual desktops or RDSH servers.

2. From the Template Name drop-down menu in the left pane, select a built-in or custom OSOT template that matches the OS of the system you are optimizing.
   The optimizations for your selected template are listed in the left pane.

Note: Use a template that matches the OS of the target machine. This step is critical because each OS has different optimizations. If you see an element in the template that is marked with a red ‘x’, it is not available in the targeted image that you are optimizing, and the OSOT cannot perform that optimization.

3. Click Analyze to produce a list of optimizations for the selected template:
4. **Click Compatibility** if you are using Persona Management. This excludes the Volume Shadow Copy Service from optimization and ensures that Persona Management continues to function.
   - Note: In the Product/Feature Compatibility dialog, you can also deselect the Persona Management check box, click OK, and the OSOT will analyze the master image without the feature. (The results are the same as clicking the Analyze button.)
   - Note: For more information on Persona Management, see the VMware View Persona Management Deployment Guide.

The lower-right pane shows detailed optimization information for the targeted system.

5. The Optimizations column shows a list of selected and unselected items.
6. The Expected Result column can be compared to the Actual Result column. If an item in the two columns is different, it means that item’s setting is not optimized.
7. Most items have an icon indicating how important it is to optimize it.
8. Note: Those items without an icon are not settings that will be configured, but actions that will be performed when optimization is run. The action that will be performed is shown in the Description column.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>❌</td>
<td>Mandatory – You must apply the optimization to the item in the target system because of problems or issues that the OSOT has identified.</td>
</tr>
<tr>
<td>⚠️</td>
<td>Recommended – Even if the OSOT recommends an optimization, there can be valid reasons to not apply it. Determine if the recommended setting is applicable to your organization’s use cases.</td>
</tr>
<tr>
<td>🔄</td>
<td>Optional – The OSOT has no recommendation regarding applying the optimization to the item in the target system. Determine if the setting is applicable to your organization’s use cases.</td>
</tr>
<tr>
<td>✅</td>
<td>OK – The item already has the proper value or setting and does not require any optimization.</td>
</tr>
</tbody>
</table>
9. The Analysis Summary pane in the upper-right of the main OSOT window provides a graphical representation of the current optimization of the targeted system.

The graphical chart makes it easy to review how close the analyzed system is to being optimally configured for best performance in terms of the optimization importance.

Within each severity level, the number of items in which settings do not match the expected values (orange) or which they do match expected values (blue) is shown.

10. Review the list of selected and deselected items to be optimized.
11. Select additional items that you want to optimize or deselect those you do not want to optimize.

Caution:
- If the icon next to an item is a blue ⊙, and it has been deselected by the OSOT, selecting it for optimization can cause instability. Test the optimization of this item before putting it into a production environment.

To select or deselect all items, select the check box in the title bar. Selecting the check box for a grouping will select all items within that group.
Note: If the icon next to an item is a green check mark, selecting or deselecting the item will make no difference.

**Common Options**

The Common Options button opens a dialog where the tabs allow you to quickly and easily choose and set preferences to control common functionality.
These options normally involve configuring multiple individual settings. By grouping the actions together, the individual settings get configured as necessary to give the desired outcome. Changes made in the common options tabs will be reflected in the selection or deselection of individual items in the template.

Amongst the settings in the common options dialog there is the option to remove Windows 10 Store Apps while keeping the commonly used ones. In the example below, all Windows Store Apps will be removed apart from Alarms & Clock, Calculator, and Paint3D.

Note that the Windows Store App itself and the StorePurchaseApp are always retained.

The common options tabs also contain the ability to select system cleanup tasks to run. These are not selected by default but are generally recommended after running a Windows Update. They can take some time to execute.
Export Results

Before you optimize the master image, you can export the analysis results to an HTML file for record keeping and to share with other personnel. You can also compare the analysis results with the post optimization results.

1. In the lower-right corner of the main OSOT window, click Export Analysis Result.

2. Save the HTML file in your preferred location.
Optimize the Master Image

When you are satisfied with the optimizations that you have selected in the Optimizations column during the Analyze step, you are ready to perform the optimization.

You can see that the Analyze tab is still active and that the Optimize button is now accessible.

![Main OSOT Window Ready to Optimize](image)

**Figure 8: Main OSOT Window Ready to Optimize**

1. Click the Optimize button.
2. Wait for the optimization to complete, as indicated by the progress bar showing 100% and a new tab being displayed.

The new tab shows:
- A new Optimize tab (active) in the row of OSOT tabs.
- A new Optimization Result column in the OSOT pane, which appears before the Steps column.
Review the Optimization Results

In the Optimization Result column, SUCCESS means that the item has been successfully optimized. From the OSOT perspective, this value has been corrected.

If you see SUCCESS, you do not have to be concerned about the Expected Result or Actual Result values in their respective columns because the item has been optimized.

For those items that show a FAILED result, click the FAILED link to review the error code and error string, and troubleshoot the issue as needed.

<table>
<thead>
<tr>
<th>Disable Features (7 items)</th>
<th>SUCCESS</th>
<th>FAILED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boot GUI</td>
<td></td>
<td>Delete Restore Points For System Restore</td>
</tr>
<tr>
<td>Disable the graphic for the Windows 7 boot</td>
<td></td>
<td>Removes all restore points if they exist</td>
</tr>
</tbody>
</table>
A failure can occur for numerous reasons. Permissions, an incorrect configuration, or a group policy are just some of the possibilities. For example, if the system is in a domain and the system administrator prevents users from changing their desktop settings, the optimization can fail.

After troubleshooting, click Analyze again to see whether the optimizations are now successful.

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Error String</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>`Error -&gt; Registry Optimizer Module] The command vssadmin delete shadows /All /Quiet executed but returns an error.</td>
</tr>
</tbody>
</table>
View Optimization History

You can view the details of the optimization operations that you have performed.

![vmware OS Optimization Tool](image)

<table>
<thead>
<tr>
<th>SCREEN ITEM</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Template Name</td>
<td>Name of the template used for an operation</td>
</tr>
<tr>
<td>Machine Name</td>
<td>Name of the machine on which an operation was performed</td>
</tr>
<tr>
<td>Date</td>
<td>Date when the operation was completed</td>
</tr>
<tr>
<td>Time</td>
<td>Time when the operation was completed</td>
</tr>
<tr>
<td>Type</td>
<td>Operation type, either Optimization or Rollback</td>
</tr>
</tbody>
</table>

Table 2: Optimization History Elements

Roll Back to the Pre-Optimized State of the Master Image

A Rollback returns the master image to its pre-optimized state. You can roll back any master image that you have optimized and reverse optimizations that you made with the OSOT.
1. Click the History tab.
2. In the Template Name column, select the check box for the optimized entry that you want to rollback and click Rollback.
3. When the Rollback operation is complete, click OK in the dialog box.

Perform Remote Analysis of View Desktops

Remote analysis enables you to analyze desktops in your environment that are managed by a Connection Server. You can determine which optimizations have or have not been applied.

Note: You cannot remotely optimize these desktops this way. However, you can optimize the desktops if the OSOT is run from them locally.
   1. Click the Remote Analysis tab.

2. In the Login window, enter your View Connection Server information to browse a list of desktops it manages.

3. Click Login.
4. When connected, perform an analysis just as you would on a local machine.
Command Line

The OSOT can be run from the command line by specifying parameters to control the behavior. Run a CMD prompt as an Administrator.

Standard Commands

For readability the options available have been listed on separate lines. When used these should not contain line breaks and should be entered as a single command.

```
VMwareOSOptimizationTool.exe
[-h]
[-v]
[-r report_file_path_name]
[-o [default | all | recommended | mandatory]]
[-t template]
[-visualeffect [performance | balanced | quality]] [-notification [enable | disable]]
[-notification [enable | disable]]
[-windowsupdate [enable | disable]]
[-storeapp [keep-all | remove-all [--exclude [Alarms | ScreenSketch | Camera | SoundRecorder | Calculator | StickyNotes | MSPaint | WebExtension]]]
[-systemcleanup [0|1|2|3]
[-background #000000]
```

Where:
- **-h:** Display the command line help. This will also list the available templates.
- **-v:** Enable verbose mode.
- **-r:** Save analysis report as a file.
- **-o:** Optimize items with the specific level and above.
  - If the `-o` is not specified, no optimization is performed.
  - If no level is specified, the default selected items will be optimized.
- **-t:** Specify the template to use.
  - The template can be a template name in default template repository, or the absolute path of a template file.
  - For example `-t “VMware Templates\Windows 10 1809-1909-Server 2019”`

Examples

Generate an analysis report, without performing any optimization.

```
VMwareOSOptimizationTool.exe -r c:\reports\n```

Optimize, using the default template and the default selected items to optimize.

```
VMwareOSOptimizationTool.exe -o
```
Optimize, using with the default template, for only recommended items and mandatory items. Show verbose messages.
   VMwareOSOptimizationTool.exe -o recommended -v

Optimize all default selected items, with a specified VMware template.
   VMwareOSOptimizationTool.exe -o -t "VMware Templates\Windows 10 1809-1909-Server 2019"

Optimize all default selected items, with specified a custom template.
   VMwareOSOptimizationTool.exe -o -t "My Templates\My Windows 10 1809-1909"

Optimize all default selected items, with specified template file.
   VMwareOSOptimizationTool.exe -o -t c:\temp\mytmpl.xml

Optimize with the default template, default selected items and write output to a file.
   VMwareOSOptimizationTool.exe -o -v > c:\temp\mylog.txt 2>&1

### Controlling Common Options

When running an `optimize` command (`-o`) you can also specify the **common options settings**. The common options interface only supports official VMware Windows 10 templates, which means that the template name is mandatory in.
Currently the template should be either:

- “VMware Templates\Windows 10 1809-1909-Server 2019”
- “VMware Templates\Windows 10 1507-1803-Server 2016”

### Visual Effect

Specify the visual effects level.
   VMwareOSOptimizationTool.exe -o -t template [-visualeffect [performance | balanced | quality]]

This controls the system advanced properties changing Visual Effects to one of the following:

- **Performance**: Turns off all of the visual effects settings to prioritize performance,
- **Balanced**: Turns off all of the visual effects settings apart from *Smooth edges of font screens* and *Use drop shadows for icon labels on the desktop*.
- **Quality**: Leaves all visual effects settings turned on. This prioritizes the user experience but will consume more resources.

### Example

Optimize using a specified template with the default selected items and setting the common options of visual effect to performance.
   VMwareOSOptimizationTool.exe -o -t "VMware Templates\Windows 10 1809-1909-Server 2019" -visualeffect performance

### Notification

Specify whether system notifications are enabled or disabled. These include balloon tips, lock screen notification, security and maintenance notifications.
VMwareOSOptimizationTool.exe -o -t template [-notification [enable | disable]]

**Example**

Optimize using a specified template with the default selected items and disabling system notifications.

```
VMwareOSOptimizationTool.exe -o -t "VMware Templates\Windows 10 1809-1909-Server 2019" - notification disable
```

**Windows Update**

Specify whether Windows Update is enabled or disabled. When enabled Windows updates will be downloaded and installed. With non-persistent desktops it is highly recommended to disable Windows updates and handle updates through the master VM and by updating the pool.

```
VMwareOSOptimizationTool.exe -o -t template [-windowsupdate [enable | disable]]
```

**Example**

Optimize using a specified template with the default selected items and enabling Windows Updates.

```
VMwareOSOptimizationTool.exe -o -t "VMware Templates\Windows 10 1809-1909-Server 2019" -windowsupdate enable
```

**Store Apps**

Allows for the removal of Windows store applications

```
VMwareOSOptimizationTool.exe -o -t template [-storeapp [keep-all | remove-all [--exclude [Alarms | ScreenSketch | Camera | SoundRecorder | Calculator | StickyNotes | MSPaint | WebExtension]]]
```

Where:

- **Keep-all:** Retains all of the windows store applications.
- **Remove-all:** Removes all of the windows store applications.
- **--exclude:** can be used on conjunction with the remove-all parameter to specify certain applications to be kept.

Note: There is a known error in the command line that will be corrected in a future version. If you want to retain the Paint3D application, use the value MSPaint (i.e., `-storeapp -remove-all --exclude mspaint`)

**Example**

Optimize using a specified template with the default selected items and removing all of the Windows Store Apps apart from the alarms and calculator applications.

```
VMwareOSOptimizationTool.exe -o -t "VMware Templates\Windows 10 1809-1909-Server 2019" -storeapp remove-all --exclude alarms calculator
```

Optimize using a specified template with the default selected items and keep all of the Windows Store Apps.

```
VMwareOSOptimizationTool.exe -o -t "VMware Templates\Windows 10 1809-1909-Server 2019" -storeapp keep-all
```
**System Cleanup**

Run system cleanup tasks. These are generally recommended to be run after a Windows installation or update.

```
VMwareOSOptimizationTool.exe -o -t template [-systemcleanup [0|1|2|3]]
```

*Where:*

- 0: Native Image Generator (NGEN)
- 1: Side by Side Component Cleanup (DISM)
- 2: Compact
- 3: Disk Cleanup

**Example**

Optimize using a specified template with the default selected items and running all four system clean up tasks.

```
VMwareOSOptimizationTool.exe -o -t "VMware Templates\Windows 10 1809-1909-Server 2019" -systemcleanup 0 1 2 3
```

**Background**

Set the background (wallpaper) to a solid color.

```
VMwareOSOptimizationTool.exe -o -t template [-background #000000]
```

*Where:*

- #000000: Is the hex value of the color. See [https://htmlcolorcodes.com/color-names/](https://htmlcolorcodes.com/color-names/) for a list of possible colors and the corresponding hex value.

**Examples**

Optimize using a specified template with the default selected items and set the background to sky blue.

```
VMwareOSOptimizationTool.exe -o -t "VMware Templates\Windows 10 1809-1909-Server 2019" -background #87CEEB
```

**Combining Command Line Parameters**

You can combine the various optimize and common option parameters together into a single command.

The following example optimizes using a specified template, applying the recommended items and:

- Disables system notifications
- Sets Visual Effects to performance.
- Leaves Windows Update enabled.
- Removes all of the Windows Store Apps apart from the Paint3D and calculator applications.
- Runs system clean up tasks, NGEN, DISM,
- Sets the background to light sea green.

```
VMwareOSOptimizationTool.exe -o recommended -t "VMware Templates\Windows 10 1809-1909-Server 2019" -notification disable -visualeffect performance -windowsupdate enable -storeapp remove-all --exclude mspaint calculator -systemcleanup 0 1 -background #20B2AA
```
Customizing Built-In OSOT Templates

Beyond its built-in optimization capabilities, the OSOT enables you to create custom templates. Using the OSOT template editor, you can create and apply your own optimizations.

Figure 13: OSOT Template Editor

The built-in OSOT templates are read-only, so you do not have to worry about accidentally changing them. You can copy any built-in OSOT template to create your own version that is editable.

You can customize OSOT templates in these ways:

- Add or remove a Group or Step
- Change the order of the Steps
- Edit the properties of Steps and their action types
- Execute particular Steps on different operating systems

Note: If you have not saved your changes, you can remove all your changes by clicking the Reset button.
In the example above, the built-in Windows 10 1809-1909-Server 2019 template has been copied. This allows you to edit and change settings.

- Note the Default Selected option in the Step Details area. This defines whether this item and setting will be selected in the template by default.
- The Preview section shows the setting that will be applied.

**Groups**

A Group is a set of optimization settings that are organized as a category, such as Apply HKLM Settings. You can add, edit, or remove a Group to customize an OSOT template.

**Add Groups**

You can add a Group to an existing or new OSOT template.
Figure 15: Add a Group to a Template

1. Click the Templates tab, and from the Template list, select the template you want to modify.
2. Right-click an existing group.
3. Click the Add Group button.
4. In the Add Group dialog box:
   a. Enter the Name of the Group
   b. Enter a Description of the Group.
   c. Select either Current Level or Nested Level.
      i. The current level option adds the Group to the same level as the selected Group.
      ii. The nested level option adds the Group as a subgroup of the selected Group.
5. Click Add.
6. Click Save.

**Rename Existing Groups**

You can rename an existing Group.
1. Click the **Templates** tab, and from the Template Name drop-down menu, select the template.
2. Select the Group to edit.
3. Change the name and description of the Group.

**Remove Groups**

You can remove a Group from a template. You can also remove a Group that is nested in another Group.

1. Click the **Templates** tab, and from the Template Name drop-down menu, select the template.
2. Right-click the Group to remove and click **Remove**.
3. Click **Save**.
Steps

A Step is an optimization setting within a Group. You can create and add Steps and edit, reorder, or remove them to customize an OSOT template.

Caution: In the Group Apply HKEY_USERS Settings to Registry, do not change any settings in the Steps for:

- Load HKCU for editing
- Unload HKCU for editing

Changes to these settings can cause the Steps to fail.

![Image](image.png)

Figure 16: Do Not Change Settings for Load HKCU for editing or Unload HKCU for editing

Add Steps

You can add a new Step under a Group.

1. Click the **Templates** tab, and from the Template Name drop-down menu, select the template to edit.
2. Right-click the Group to which you want to add a Step and click **Add Step**.
3. In the Step Details section, add information about the Step.
4. Provide a name and optional description for the Step.
5. Select the values for Category, Reboot Required, Operating System, and Default Selected.
6. Select what type of step this is. In most cases, this can be left as the default Base Information.

Note: Custom Optimization is used to add an additional operation during optimization, and Custom RollBack is used to add an additional operation during rollback. Entering information for one Action Type does not negate any information already entered for another Action Type. These operations are additive.

7. Select the Action parameters.
   After you select the action parameter type from the Type drop-down menu, the text box names change according to your selection.
Figure 17: Action Parameters for a Registry Step

The text box names and values for each action parameter type are described in the following substeps and tables.

a. If configuring a registry setting, provide the following information for the Registry action parameter type.

<table>
<thead>
<tr>
<th>TEXT BOX</th>
<th>DESCRIPTION AND VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command</td>
<td>Command to execute. The options are</td>
</tr>
<tr>
<td></td>
<td>• <em>ADD</em> – Add a registry key and value to the host that you are optimizing</td>
</tr>
<tr>
<td></td>
<td>• <em>DELETEKEY</em> – Delete a Registry Editor folder</td>
</tr>
<tr>
<td></td>
<td>• <em>DELETEVALUE</em> – Delete a value or item in that Registry Editor folder</td>
</tr>
<tr>
<td></td>
<td>• <em>LOAD</em> – Open the HKCU registry hive for editing</td>
</tr>
<tr>
<td></td>
<td>• <em>UNLOAD</em> – Close the HKCU registry hive after editing is completed to save the changes</td>
</tr>
<tr>
<td>Key Name</td>
<td>The registry path where the registry key is located.</td>
</tr>
<tr>
<td>Value</td>
<td>The name of the registry key being edited.</td>
</tr>
<tr>
<td>Type</td>
<td>Data type of the specified value. The supported data types are:</td>
</tr>
<tr>
<td></td>
<td>• <em>REG_BINARY</em></td>
</tr>
<tr>
<td></td>
<td>• <em>REG_DWORD</em></td>
</tr>
<tr>
<td></td>
<td>• <em>REG_SZ</em></td>
</tr>
<tr>
<td></td>
<td>• <em>REG_MULTI_SZ</em></td>
</tr>
<tr>
<td>Expected Data</td>
<td>The value of the registry key.</td>
</tr>
</tbody>
</table>

Table 3: Parameters for the Registry Type
Caution: Do not use a `DELETEKEY` or `DELETEVALUE` command unless you are certain of the effect it will have.

b. If configuring a service, provide the following information for the Service action parameter type.

![Figure 18: Action Parameters for a Service Step](image)

<table>
<thead>
<tr>
<th>TEXT BOX</th>
<th>DESCRIPTION AND VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Name</td>
<td>Name of a service.</td>
</tr>
<tr>
<td>Start Mode</td>
<td>Startup mode for the service. The options are:</td>
</tr>
<tr>
<td></td>
<td>AUTO</td>
</tr>
<tr>
<td></td>
<td>DISABLED</td>
</tr>
<tr>
<td></td>
<td>MANUAL</td>
</tr>
</tbody>
</table>

Table 4: Parameters for the Service Type

c. If running a command, provide the following information for the ShellExecute action parameter type.

![Figure 19: Action Parameters for a ShellExecute Step](image)

<table>
<thead>
<tr>
<th>TEXT BOX</th>
<th>DESCRIPTION AND VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command</td>
<td>The command to execute.</td>
</tr>
</tbody>
</table>

Table 5: Parameters for the ShellExecute Type

d. If configuring a Scheduled Task, provide the following information for the SchTasks action parameter type.
Figure 20: Action Parameters for a Scheduled Task (SchTasks) Step

<table>
<thead>
<tr>
<th>TEXT BOX</th>
<th>DESCRIPTION AND VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task Name</td>
<td>The full path of the task as it appears in Task Scheduler. For example:</td>
</tr>
<tr>
<td></td>
<td>Microsoft\Office\Office Automatic Updates</td>
</tr>
<tr>
<td>Status</td>
<td>The supported status values are</td>
</tr>
<tr>
<td></td>
<td>• ENABLED</td>
</tr>
<tr>
<td></td>
<td>• DISABLED</td>
</tr>
</tbody>
</table>

Table 6: Parameters for the SchTasks Type

8. Click **Add** to save the new Step.
9. Click **Save** to save the template.

**Edit Steps**

You can edit an existing Step under a Group.

1. Click the **Templates** tab, and from the Template Name drop-down menu, select the template to edit.
2. Click the Step to edit.
3. Edit the Step information.
4. Click **Save**, to save the template.

Caution: For the Steps in the Group Apply HKEY_USERS Settings to Registry, do not change the HKEY_USERS\temp\ part of the path in the Key Name text box. Changes to HKEY_USERS\temp\ can cause the Steps in the custom template to fail. However, you can change any other elements in the path name.
Figure 21: Changes to HKEY_USERS\temp Can Cause Steps in the Custom Template to Fail

Remove Steps
You can remove a step from an OSOT template.

1. Click the Templates tab, and from the Template Name drop-down menu, select the template to edit.
2. Click the Step to remove and click Remove.
3. Click Save, to save the template.

Change the Order of Steps
You can change the order of the Steps within an OSOT template.

1. Click the Templates tab, and from the Template Name drop-down menu, select the template to edit.
2. Click a Step to move, and click Up or Down to move it.
3. Click Save, to save the template.
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- Kaipo Batoon, Jim Britt of Ensynch, Inc., wrote the original version of this paper with Aaron Black of VMware.

Additionally, many people have contributed their knowledge and assistance to the various versions of this document:

Matthew Mabias, Phillip Helming, Todd Dayton, Jeff Birnbaum, Charles A. Windom Sr., John Dodge, Marilyn Basanta, Rory Clements, Aaron Black, Timothy Federwitz, Rasmus Jensen, Erik Haire, Linus Bourque, Jason Miles, Warren Ponder

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