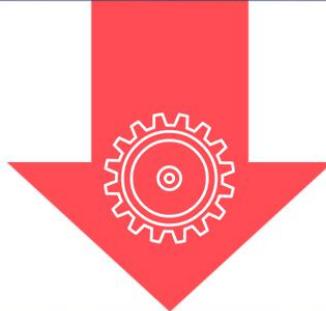


Faster, simpler hardware profile cloning

Lenovo® ThinkServer® RD550 powered by the Intel® Xeon® processor E5-2600 v3 product family



up to **73.7%** fewer steps to replicate settings to 20 servers



up to **25.3%** less time required to replicate settings to 20 servers



versus manually creating hardware profiles

Organizations value every second of an IT administrator's day. Areas of IT that are repetitive, require manual intervention or oversight, and are prone to human error dig into the time that your IT administrator can use for other more important tasks. Automated server deployment is an area where adopting new technology can save time and lower operational expenses. As your organization grows and requires new resources, your IT admin needs hardware and tools that allow for quick creation, cloning, and deployment of hardware profiles. The new Lenovo ThinkServer RD550, which helps automate these day-to-day tasks, can offer such benefits.

Lenovo offers two tools to help with server management embedded within the ThinkServer RD550: ThinkServer Deployment Manager (TDM) and ThinkServer System Manager (TSM). In addition, TSM contains ThinkServer System Manager Command Line Interface (TSMCLI). TDM allows for automated configuration of hardware, deployment of an operating system (OS), and cloning a hardware profile to streamline the configuration process. TSM and TSMCLI offer remote management of the server through a Web interface of the command line with Microsoft® PowerShell®. For details on TDM and TSM, see [Appendix A](#).

Here in the labs at Principled Technologies, we tested the hardware profile cloning and remote management capabilities of the latest generation ThinkServer

RD550. We measured the time and steps to create a cloned hardware profile with TDM and then deploy the profile onto another system. We then compared this to a more traditional method, where we manually executed the hardware configuration process on the ThinkServer RD550. Finally, we compared the time and steps to complete three common remote management functions using TSM with Microsoft PowerShell versus manual execution: creating a user, changing permissions for a user, and deleting a user.

We found the automated approach of the ThinkServer RD550 powered by the Intel Xeon processor E5-2600 v3 family would reduce the number of steps required to replicate hardware profile configuration to 20 servers by up to 73.7 percent and would decrease the amount of time by up to 25.3 percent compared to using a manual approach with the RD550. Using the automated approach, cloning hardware profiles to 20 Lenovo ThinkServer RD550 servers would require up to 57 minutes and 20 seconds less in administrative time. In addition, using TSM with Microsoft PowerShell required less time to complete common remote management functions.

INCREASE VALUE WITH AUTOMATION

Before considering expensive or complicated options to solve challenges of limited admin time, one method to reduce the burden on an IT admin is automation, which can reduce the time that an IT admin must spend on repetitive and time-consuming tasks. This allows your business to do more without acquiring more staffing—instead, your admin has more time to focus on strategic projects that promote business growth.

Before current levels of available datacenter automation, configuring and cloning hardware profiles across multiple servers required administrators remove the source servers from service, manually capture the hardware settings, and then explicitly change each setting on the target systems. In addition to being labor-intensive, this manual process was prone to human error, which led to inconsistencies and, in turn, potentially sub-optimal performance in the new systems. As it is now, it was especially critical that hardware profile configurations on each node were correct for applications that required specific hardware settings.

By automating the server-provisioning process, IT staff can now extract settings from an existing source-server hardware profile and replicate them to new target hardware without this tedious manual workflow and potential for error. In addition, automating processes within an infrastructure allows one to create customization to meet workload needs or environment restrictions, such as those from virtualization and cloud technologies, and allow IT admins to perform server profile updates en masse. Deploying hardware profiles through automation on the Lenovo ThinkServer RD550 by using cloning methodologies and scripting technologies available with embedded TDM,

Lenovo ThinkServer Deployment Manager (TDM) can automate a single deployment and can clone hardware profile settings to help deployment to multiple servers.

TSM, and TSMCLI tools can save valuable time for your IT admins and reduce the need for their intervention into a tangled web of virtualization and cloud complexity.

For details on the hardware we tested, see [Appendix A](#). For detailed steps on how we tested, with the automated features and our manual comparison steps, see [Appendix B](#). See [Appendix C](#) for details on the specific changes we made to the Lenovo RD550 BIOS, Windows PowerShell, and device settings.

Hardware configuration and scalable advantages of cloning

To demonstrate the functionality and benefits of the Lenovo ThinkServer RD550 with TDM, we first manually configured the server hardware and recorded the time and hands-on administrative steps involved. We then used this configuration to create a hardware profile for an automated deployment and backed it up to USB device. We used TDM to perform an automated extraction of the hardware profile from our USB device and to replicate the server settings to the target ThinkServer RD550 server. For both approaches, we began recording time to when the OS installation could begin.

As Figure 1 shows, the manual configuration, which required an IT admin to configure all hardware settings, took 11 minutes and 20 seconds. In comparison, conducting an automated configuration of the hardware profile with TDM took 8 minutes and 28 seconds—a savings of 2 minutes and 52 seconds, or 21.8 percent less time than manual configuration for a single server.

Figure 1 also shows that when extrapolating from a single server deployment to 20 servers, this would save up to 57 minutes and 20 seconds, almost one hour of administrative time, or 25.3 percent less time than the manual approach.

	Automated		Manual		Savings from automation	
	Time (hh:mm:ss)	Steps	Time (hh:mm:ss)	Steps	Time (hh:mm:ss)	Steps
Deploying OS to one Lenovo ThinkServer RD550 server	00:08:28	10	00:11:20	38	00:02:52	28
Deploying OS to 20 Lenovo ThinkServer RD550 servers	02:49:20	200	03:46:40	760	00:57:20	560

Figure 1: Total time and number of steps to deploy one OS to the Lenovo ThinkServer RD550, projected time and steps to deploy 20 OSs, and savings by using automation with ThinkServer Deployment Manager.

Remote management

Lenovo offers remote management of its newest ThinkServers, such as the ThinkServer RD550, through TSM. TSM has two options for management: a Web-based graphical user interface (GUI) and TSMCLI using Microsoft PowerShell. The TSMCLI can help reduce the time to manage multiple Lenovo ThinkServer RD550 servers with PowerShell scripts.

Modifying user accounts

To show the advantages of TSMCLI, we looked at the time savings one can expect using the TSMCLI compared to using the GUI. To do this, we recorded time and steps when creating new users, changing permissions for a user, and deleting a user account.

As Figure 2 shows, the largest savings in time and steps came when creating a new user. It took just three steps and 15 seconds to create a new user using TSMCLI. We used a pre-configured script to create the user, which meant opening the TSMCLI, changing to the correct directory, and executing the script. When using the Web interface to create a new user, we had to log in and create the user from menu options, which took six steps and over a minute.

The savings in time and steps when using the automated approach scales up for 20 ThinkServer RD550 servers because executing a script requires no more time for multiple servers than it does for a single server, and prevents having to log into each ThinkServer RD550 GUI and execute the user creation steps. As Figure 2 shows, creating a new user for 20 Lenovo ThinkServer RD550 servers with TSMCLI can lead to a time savings of over 24 minutes by running a single script compared to the manual approach of using the Web-based GUI. Note: Although each task uses a different script in TSMCLI, the automated time and steps in Figure 2 assume running each script would require the same steps regardless of script size.

	Automated		Manual		Savings from automation	
	Time (hh:mm:ss)	Steps	Time (hh:mm:ss)	Steps	Time (hh:mm:ss)	Steps
Creating a new user on 1 server	00:00:15	3	0:01:13	6	0:00:58	3
Creating a new user on 20 servers	00:00:15	3	0:24:20	120	0:24:05	117
Changing permissions for a user on 1 server	00:00:15	3	0:00:40	6	0:00:25	3
Changing permissions for a user on 20 servers	00:00:15	3	0:13:20	120	0:13:05	117
Deleting a user on 1 server	00:00:15	3	0:00:45	6	0:00:30	3
Deleting a user on 20 servers	00:00:15	3	0:15:00	120	0:14:45	117

Figure 2: Total times and steps to modify users in the Lenovo ThinkServer RD550 TSM, projected times and steps to modify 20 servers.

As Figure 2 shows, the time and steps savings are not limited to just creating users. Across 20 servers, we saw a 14 minute and 45 seconds time savings when deleting a user and just over 13 minutes when changing user permissions. This shows that there are time savings with various other tasks.

Firmware updates

Another time-consuming task for IT admins is performing firmware updates. In the past, an admin would log into each server individually and perform the update. With TSMCLI, the admin can perform all tasks from their desktop through the command line. The TSMCLI offers an option to pull all firmware versions from local disk or network share and perform the firmware update. Doing this from a command line saves time and automates the process.

To update the firmware through the TSMCLI, only three commands are necessary. We show the commands to perform the update below.

1. Put the server into firmware update mode with the following command:

```
Invoke-TSMCLI -CommandName enter-fwupdatemode -  
ComputerName Computer1 -Port 80 -Authentication  
basic -Credential credentials.xml
```

2. Upload the firmware:

```
Invoke-TSMCLI -CommandName upload-fwimage -  
ComputerName Computer1 -Port 80 -Authentication  
basic -Credential .\credentials.xml -CommandArgs  
{updateid="123456789"; fwFile="file.bdl"}
```

3. Perform the update:

```
Invoke-TSMCLI -CommandName start-fwupdate -  
ComputerName Computer1 -Port 80 -Authentication  
basic -Credential .\credentials.xml -CommandArgs  
{updateId="123456789"; rebootAfterUpdate="auto"}
```

With these three steps, we were able to update the various available firmware on the server. With this procedure, an administrator could update numerous servers from their desktop and save time by not having to update servers individually.

Additional administrative tasks

Using TSMCLI offers more administrative tasks than just managing users and updating firmware. Below, we present some of the tasks available using TSMCLI.

- Backing up server configuration to file
- Restoring a server configuration
- Resetting to factory defaults
- Checking server power state
- Configuring the NTP server
- Managing network configuration

For the full list of available TSMCLI commands, download the Lenovo ThinkServer System Manager Command Line Interface User Guide at download.lenovo.com/ibmdl/pub/pc/pccbbs/thinkservers/tsmcli_user_guide_1.0.2.pdf.

CONCLUSION

Having many servers in your environment can bring many performance benefits, but making changes to those servers and deploying new ones can consume valuable IT admin time. The new Lenovo ThinkServer RD550 powered by the Intel Xeon processor E5-2600 v3 family provides tools such as ThinkServer Deployment Manager and ThinkServer Server Management Interface Command Line to automate cloning hardware profiles, saving time from the manual process to complete these tasks. We found replicating hardware configuration profiles to 20 ThinkServer RD550 servers would take up to 25.3 percent less time and 73.7 percent fewer steps than the manual approach to performing the same tasks. By choosing the Lenovo ThinkServer RD550 for your server needs, you can free IT admin time to focus more on ventures that will grow your business.

APPENDIX A – ABOUT THE COMPONENTS

About the Lenovo ThinkServer RD550

The Lenovo ThinkServer RD550 is a 1U rack server that features up to two Intel Xeon E5-2600 v3 Series processors and supports up to 768 GB of memory. The RD550 has high storage density and I/O connectivity, offering 12 storage bays in an AnyBay design, which lets you use multiple storage types in the same drive bay. With Lenovo AnyFabric design, the RD550 has up to eight 10Gb Ethernet ports for increased network bandwidth. Reliability features of the ThinkServer RD550 include error correcting code (ECC) memory, hot-swappable disks, and redundant, hot-swappable power supplies and cooling fans.

To learn more about the Lenovo ThinkServer RD550, visit shop.lenovo.com/us/en/servers/thinkserver/racks/rd550/.

About Lenovo ThinkServer Deployment Manager

In conjunction with ThinkServer System Manager, ThinkServer systems also include a set of embedded tools to simplify lifecycle management—ThinkServer Deployment Manager. ThinkServer Deployment Manager lets you configure hardware, deploy operating systems, and update firmware and OS device drivers through a local graphic user interface. Administrators can clone hardware configurations from a network share to ease deployment.

For more information about Lenovo ThinkServer Deployment Manager, see www.lenovo.com/images/products/server/pdfs/datasheets/thinkserver_systemmanager_ds.pdf.

About the Lenovo ThinkServer System Manager

ThinkServer rack and tower servers integrate Lenovo ThinkServer System manager for secure, remote systems management. ThinkServer System Manager lets you configure, update, and monitor servers from anywhere and can send alerts to administrators when any significant system events occur. The optional ThinkServer System Manager Premium provides you with even more options, including remote KVM access, which lets you perform most support functions remotely, letting you run local media on your remote server.

To learn more about Lenovo ThinkServer System Manager, visit www.lenovo.com/images/products/server/pdfs/datasheets/thinkserver_systemmanager_ds.pdf.

About the Lenovo ThinkServer System Manager Command Line Interface

The Lenovo ThinkServer System Manager Command Line Interface is a Microsoft PowerShell module that offers embedded tools for administrators to monitor and control ThinkServer System Manager as well as some tools for administrators to manage ThinkServer operations such as power control and remote media images. With ThinkServer System Manager Command Line Interface, administrators can use scripts to manage things such as users, network settings, and platform event filters of one or more ThinkServer units. Administrators or others using TSMCLI should have a basic knowledge of Microsoft PowerShell.

To learn more about Lenovo ThinkServer System Manager Command Line Interface and download a user guide, please visit support.lenovo.com/ca/en/downloads/ds101157.

About the Intel Xeon processor E5-2600 v3 product family

According to Intel, the Intel Xeon processor E5-2600 v3 product family “helps IT address the growing demands placed on infrastructure, from supporting business growth to enabling new services faster, delivering new applications in the enterprise, technical computing, communications, storage, and cloud.” It also delivers benefits in performance, power efficiency, virtualization, and security.

The E5-2600 v3 product family has up to 50 percent more cores and cache than processors from the previous generation. Other features include the following:

- Intel Advanced Vector Extensions 2 (AVX2)
- Intel Quick Path Interconnect link
- Up to 18 cores and 36 threads per socket
- Up to 45MB of last level cache
- Next-generation DDR4 memory support
- Intel Integrated I/O providing up to 80 PCIe® lanes per two-socket server
- Intel AES-NI data encryption/decryption

The Intel Xeon processor E5-2600 v3 product family also uses Intel Intelligent Power technology and per-core P states to maximize energy efficiency. Learn more at www.intel.com/content/www/us/en/processors/xeon/xeon-e5-brief.html.

APPENDIX B – SYSTEM CONFIGURATION INFORMATION

Figure 3 provides detailed configuration information for the test systems.

System	Lenovo ThinkServer RD550
Power supplies	
Total number	2
Vendor and model number	Delta DPS-750AB-21
Wattage of each (W)	750
Cooling fans	
Total number	8
Vendor and model number	GFM0412SS-DE1P
Volts	12
Amps	1.40
General	
Number of processor packages	2
Number of cores per processor	8
Number of hardware threads per core	2
System power management policy	Balanced
CPU	
Vendor	Intel
Name	Xeon
Model number	E5-2640 v3
Socket type	LGA 2011-3
Core frequency (GHz)	2.60
Bus frequency	8 GT/s
L1 cache	32 KB + 32 KB (per core)
L2 cache	256 KB (per core)
L3 cache	20 MB
Platform	
Vendor and model number	ThinkServer RD550
BIOS name and version	1.10.0
BIOS settings	Default
Memory module(s)	
Total RAM in system (GB)	128
Vendor and model number	Hynix HMA42GR7MFR4N
Type	PC4-2133P
Speed (MHz)	2,133
Speed running in the system (MHz)	2,133
Timing/Latency (tCL-tRCD-tRP-tRASmin)	11-11-11-33
Size (GB)	16
Number of RAM module(s)	8
Chip organization	Dual sided
Rank	Dual

System	Lenovo ThinkServer RD550
Operating system	
Name	Windows Server® 2012 R2 Datacenter
Build number	9200
File system	NTFS
Language	English
RAID controller	
Vendor and model number	Lenovo ThinkServer RAID 720i AnyRAID
Driver version	6.703.3.0
Hard drives	
Vendor and model number	Seagate® ST4000NM0033
Number of drives	4
Size (GB)	4,000
RPM	7,200
Type	SATA
Ethernet adapters	
Vendor and model number	Lenovo ThinkServer X540-T2
Type	Integrated
Driver	3.9.58.0

Figure 3: Detailed information for the test system.

APPENDIX C – HOW WE TESTED

Configuring the RD550 through ThinkServer Deployment Manager

We used ThinkServer Deployment Manager to deploy a hardware profile on a new RD550 server. We created a four-disk RAID 10 for the OS installation.

1. Power on the ThinkServer RD550, and press F10 when prompted to enter TDM.
2. Click BIOS Setup.
3. Modify settings in the BIOS Setup menu.
4. Click Save & Reset.
5. Click Yes on the confirmation popup window.
6. Click Yes when asked if you would like to save a response file.
7. Wait for server to reboot.
8. Press F10 when prompted to enter TDM.
9. Click Storage Management.
10. Click Configuration Management.
11. Click Create Virtual Drive.
12. In the Select RAID Level drop down menu, select RAID10.
13. Under Span 1:, click Select Drives.
14. Next to the first drive, select Enabled.
15. Next to the second drive, select Enabled.
16. Click Apply Changes.
17. Click OK.
18. Click Add More Spans.
19. Under Span 2:, click Select Drives.
20. Next to the third drive, select Enabled.
21. Next to the fourth drive, select Enabled.
22. Click Apply Changes.
23. Click OK.
24. Click Save Configuration.
25. Next to Confirm, select Enabled.
26. Click Yes.
27. Click OK.
28. Next to Default Initialization, select Full.
29. Click Save & Exit.
30. Click Yes.
31. Click Yes when asked if you would like to save a response file.
32. Click Deployment.
33. Select volume to install the OS, and click Next.
34. Select the OS Family, OS Edition, and OS Image location, and click the Next arrow.

35. Set the Installation Type, Boot Mode, Time Zone, OS Language and Keyboard, License Key, Computer Name, Administrator Password, and any advanced options, and click the Next arrow.
36. Select partition size, and click the Next arrow.
37. Check the Save response file as (.xml) checkbox if you would like to save a response file, and click the Next arrow.
38. Accept the License Agreement, and click Next to begin installation.

Cloning the ThinkServer RD550 TDM

We used the steps below to clone the BIOS and RAID settings to a new ThinkServer RD550 and deploy the OS. The steps below assume you get response files from another RD550 server as outlined in the Configure the RD550 section.

1. Power on the ThinkServer RD550, and press F10 when prompted to enter ThinkServer Deployment Manager (TDM).
2. Click cloning.
3. Select the BIOS, and browse to the response file.
4. Click the Next arrow.
5. Click OK to confirm that the BIOS has been reset, and allow the server to reboot.
6. Press F10 when prompted to enter TDM.
7. Select RAID, and browse to the response file location.
8. Select OS Installation, and browse to the response file location.
9. Click the Next arrow.
10. Accept the license agreement, and click Next to begin the installation.

Modifying user settings in ThinkServer System Manager

The steps below show how to create users through the TSM Web interface. The steps are the same to change user privileges. You just select privileges on step four and do not adjust user name or password.

1. Log in to the TSM Web interface.
2. Click the Users button.
3. Click Add User.
4. Enter the username and password and select the privilege. Click Apply.
5. Click OK on the user created popup.
6. Close User Management.

The steps below show how to delete users through the TSM Web interface.

1. Log in to the TSM Web interface.
2. Click the Users button.
3. Put a checkmark in the box next to the user, and click Delete User.
4. Click Yes at confirmation popup.
5. Click OK at the success popup window.
6. Close User Management.

Modifying user settings in ThinkServer System Manager Command Line Interface

We used the commands below to create a user, modify user privileges, and delete the user through the TSMCLI.

Creating user

```
Invoke-TSMCLI -CommandName create-user -ComputerName Computer1 -Port 80 -Authentication basic -Credential $cred -CommandArgs @{username="tester";password="1234";role="user"}
```

Modifying user privileges

```
Invoke-TSMCLI -CommandName set-user -ComputerName Computer1 -Port 80 -Authentication basic -Credential $cred -CommandArgs @{userID=2;role="administrator"}
```

Deleting user

```
Invoke-TSMCLI -CommandName delete-user -ComputerName Computer1 -Port 80 -Authentication basic -Credential $cred -CommandArgs @{userID=2}
```

ABOUT PRINCIPLED TECHNOLOGIES



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