INTEGRATION ANALYSIS AND GUIDE:
LENOVO THINKSERVER TS430 IN A DELL ENVIRONMENT

NEW LENOVO SERVER,
SAME MANAGEMENT FRAMEWORK.

Even if you manage your servers with Dell software, the Lenovo ThinkServer TS430 fits right in.

(intel)

You are expanding your IT infrastructure and it's time to select new server hardware. You've heard about the new Lenovo servers that can deliver everything you need for an excellent price; same rack and tower form factors, same memory, drives, and processors running the same operating systems. You'd like to take advantage of the price/performance advantages of these Lenovo servers but you're concerned they might not easily fit into your existing management environment. The great news is that these servers will fit right in.

As an example, we looked at placing a Lenovo ThinkServer TS430, equipped with the Lenovo Remote Management Module (RMM), into a representative Dell OpenManage Essentials (Dell OME) environment.

Our findings? The Lenovo ThinkServer TS430 offers the management capabilities an IT administrator needs to effectively co-exist in a Dell OME environment. There was no need to replace or augment the pre-existing management software. The TS430 joined the Dell OME-managed group easily, and the IT administrator could access many of the same management features directly through Dell OME, or through the advanced Lenovo Remote Management Module.

In this report, we demonstrate the use of Dell OME managing the TS430. We show you how to integrate the Lenovo ThinkServer platform into your existing Dell environment. We also show you the key management features that are available, and provide a step-by-step guide to accessing the available management features of the server.

A DAY IN THE LIFE OF AN IT ADMINISTRATOR

As a busy IT administrator, you juggle a wide range of tasks, from keeping up with server maintenance to handling emergencies to planning new upgrades. You use systems management software tools to remotely manage and monitor your servers. You also rely on email alerting features to notify you in the event of a server malfunction or sub-optimal operating conditions. You have spent numerous hours learning the features and operation of your specific management tool and the last thing you want is to have to overhaul your existing infrastructure and learn another.

You already know that Lenovo servers are a great option for your environment but you cannot afford the time to install and learn to use new management tools. Lenovo make this part simple: You can easily add the Lenovo servers to your existing Dell OME environment and still get the monitoring, alerts, and remote access features you need, without spending any extra money on additional management software or a new server management infrastructure.

LENOVO THINKSERVER TS430 INTEGRATED EASILY

In our tests, the Lenovo ThinkServer TS430 integrated easily into the Dell-managed environment. We used a typical suite of commonly used features— discovery, health monitoring, system events, email alerts, remote functions, and KVM console and virtual media—to evaluate the ease of manageability of the TS430.

We successfully used our existing Dell OME environment to discover and monitor the TS430. The normal steps and wizards associated with discovering a Dell server worked with the TS430. We did note that some detailed management features such as power cycling the server remotely were not readily available through Dell OME, but we demonstrate the general functionality that is still there and provide an alternate approach by leveraging the management capability provided by the RMM in the TS430.

In conjunction with Dell OME, the functions available through the Remote Management Module of the Lenovo ThinkServer TS430 offer you a complete server management solution. These features, including the optional virtual media and KVM console available with RMM Premium, allow hardware monitoring that can alert you to a faltering component, let you carry out many maintenance and repair operations remotely, and provide KVM access that lets you work on the server remotely as if you were right beside it.

HOW WE TESTED

Our test bed consisted of two Dell PowerEdge T310 servers and a single Lenovo ThinkServer TS430. We used a Dell server as the central management server running the Dell OME management software. The Dell servers had iDRAC 6 Enterprise remote management and the Lenovo ThinkServer TS430 had the Remote Management Module Premium. All servers in our test bed ran Windows Server 2008 R2 SP1 with the latest available updates. See Appendix A for detailed hardware information.

Below is an overview of the use cases we performed on the Lenovo ThinkServer TS430 in the Dell OME environment:

- **Discovery.** We demonstrated successful discovery of the Lenovo ThinkServer TS430 in Dell OME, and walk you through the steps to perform the server discovery.
- **Health monitoring/system display.** We viewed the basic health status, including network connectivity, OS information, and basic hardware information on the Lenovo TS430 from Dell OME. We also show you additional monitoring features from RMM.
- **System events.** We simulated loss of connectivity, fan malfunction, and temperature warnings on the Lenovo ThinkServer TS430 and show how these alerts display directly in Dell OME.
- **Email alerts.** In addition to email alerting inherent to Dell OME, we configured the Lenovo RMM to trigger email alerts for available platform events.
- **Remote functions.** We accessed power cycling options and remote BIOS/BMC upgrade features on the Lenovo ThinkServer TS430 from the RMM.
- **KVM console and virtual media.** We used the KVM console and virtual media features of the Lenovo RMM to access BIOS settings, configure a new virtual drive in the RAID controller, access the LSI MSM tool for drive and RAID controller email alerts, and show you how to complete additional firmware upgrades.

The following sections cover each of these use cases in detail.

ABOUT THE LENOVO THINKSERVER TS430

The Lenovo ThinkServer TS430 server provides businesses with the superior performance of the latest Intel® Xeon® processors, ample storage capacity of up to 16 TB, and 24/7 uptime reliability. It also provides a combination of powerful manageability and hardware at a very attractive price.

- **Performance and storage capacity.** The Intel Xeon processor E3-1200 family that powers the ThinkServer TS430 provides a performance improvement of up to 30 percent over previous-generation Intel processors. Features such as Turbo

Boost 2.0 further increase processor performance when you need it most. A storage capacity of 16TB SATA or 4.8TB NL SAS and eight hot-swap drives provide you with plenty of room to grow.

- **Reliability.** Optional redundant power supplies and a selection of RAID adapters protect you from data loss.
- **Power efficiency and quiet operation.** Intel Xeon E3-1200 family processors, rated at only 80 watts, are more energy efficient than previous generations. The ThinkServer TS430 is also certified with Energy Star 1.0, and Climate Savers. Because Lenovo designed the ThinkServer TS430 to perform at "whisper-quiet" noise levels, you can use your TS430 in a front office without introducing an unacceptable level of noise.
- **Ease of use.** ThinkServer EasyStartup is a convenient software solution that enables you to easily install, maintain, and manage your ThinkServer TS430. Its intuitive design makes it suitable for businesses with minimal IT staff. Lenovo ThinkPlus® Productivity and ThinkPlus Priority Support further assist you in installation and IT support, and the ThinkServer Management Module (an industry standards-based management subsystem) makes remote management easy.

For detailed information about the Lenovo ThinkServer TS430, visit the Lenovo server site at Lenovo.com.

The Lenovo Remote Management Module

The Lenovo Remote Management Module (RMM), standard in Lenovo servers, helps your IT staff manage your ThinkServer TS430 remotely while keeping your server secure.[1] The RMM allows proactive server management by helping you catch possible failures before they occur, which minimizes downtime. Should a failure occur, the Lenovo RMM lets you access and repair your server from any location.

This module allows you to access convenient Lenovo management features, including the following:

- Additional hardware monitoring
- Updating the BIOS/BMC remotely
- Power cycling the server remotely
- KVM console (optional upgrade)
- Remote virtual media (optional upgrade)

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[1] Note: On March 16, 2012, Lenovo released an update to the BMC firmware (ver. 2.60) that renamed the RMM to ThinkServer Management Module (TMM) and TMM Premium for the optional remote KVM and media upgrade.

SERVER DISCOVERY

The process for discovering a Windows-based Lenovo server in the Dell management environment is the same as it would be for discovering a Dell server. Since the ThinkServer TS430 does not support the Dell-proprietary OpenManage Server Administrator agent, the discovery process relies mainly on WMI for the Windows interface and SNMP for the RMM.

Below are the steps we used to discover our Windows-based Lenovo ThinkServer TS430:

1. Open OME.
2. Enable RMM on server to send SNMP traps to OME server.
3. Click Manage→Discovery and Inventory.
4. Click Add Discovery Range, enter IP information or range of IPs for the server and management port, and click Add.
5. Select WMI, and enter credentials.
6. Select SNMP, check enable SNMP discovery box, enter desired information, and click Finish.

HEALTH MONITORING/SYSTEM DISPLAY

Upon completing discovery, you may notice that the Lenovo ThinkServer TS430 displays two entities, one the Windows-based server IP address, and the other the RMM IP address. Since OME does not recognize it as a Dell server, it will display the system as "unknown" and categorize it as "unclassified." In our tests, this did not affect OME's ability to display general system information for the ThinkServer TS430 due to WMI and SNMP compatibility between the server and Dell OME. Below is the detailed information retrieved from the Lenovo TS430, running Windows Server 2008 R2 SP1.

- Shows system link as up or down based on the RMM IP module
- Displays OS information, device name, model, and serial number
- Displays NIC information
- Shows system BIOS and BMC version
- Memory size and number of modules

Additionally, you can also access more detailed server information by using the Lenovo RMM. The Lenovo RMM is accessible by using the following steps:

1. Open a Web browser, and enter the RMM IP address.
2. Enter the appropriate credentials (default username and password are lenovo/lenovo).

Use the Lenovo RMM to access more detailed information on temperature, power readings, and fan operation. To view the monitoring information on temperature, fans, and power, complete the steps below.

Temperature

To manually monitor temperature, follow these steps:

1. In the left pane, select Thermal.
2. Select Temperatures to display current readings.

Fans

To manually monitor fans, follow these steps:

1. In the left pane, select Thermal.
2. Select Fans to display current readings.

Power

To manually monitor current voltage readings, follow these steps:

1. In the left pane, expand Server Information→Power.
2. Select Voltages to display current voltage readings.

SYSTEM EVENTS

In our tests, we were able to see the following system events for the Lenovo ThinkServer TS430 in Dell OME: a simulated a loss of network connectivity causing the system to be unreachable, a simulated fan malfunction, and triggering of a temperature sensor to send a high temperature warning. The Dell OME comes with an intuitive dashboard that is displayed at startup (see Figure 1). It gives you a quick view of discovered devices with inventory and discovery status as well as alerts and a list of OME tasks that have already run or are currently running from the server. This dashboard view is completely customizable, and OME can also be configured to forward SNMP traps to other servers if needed.
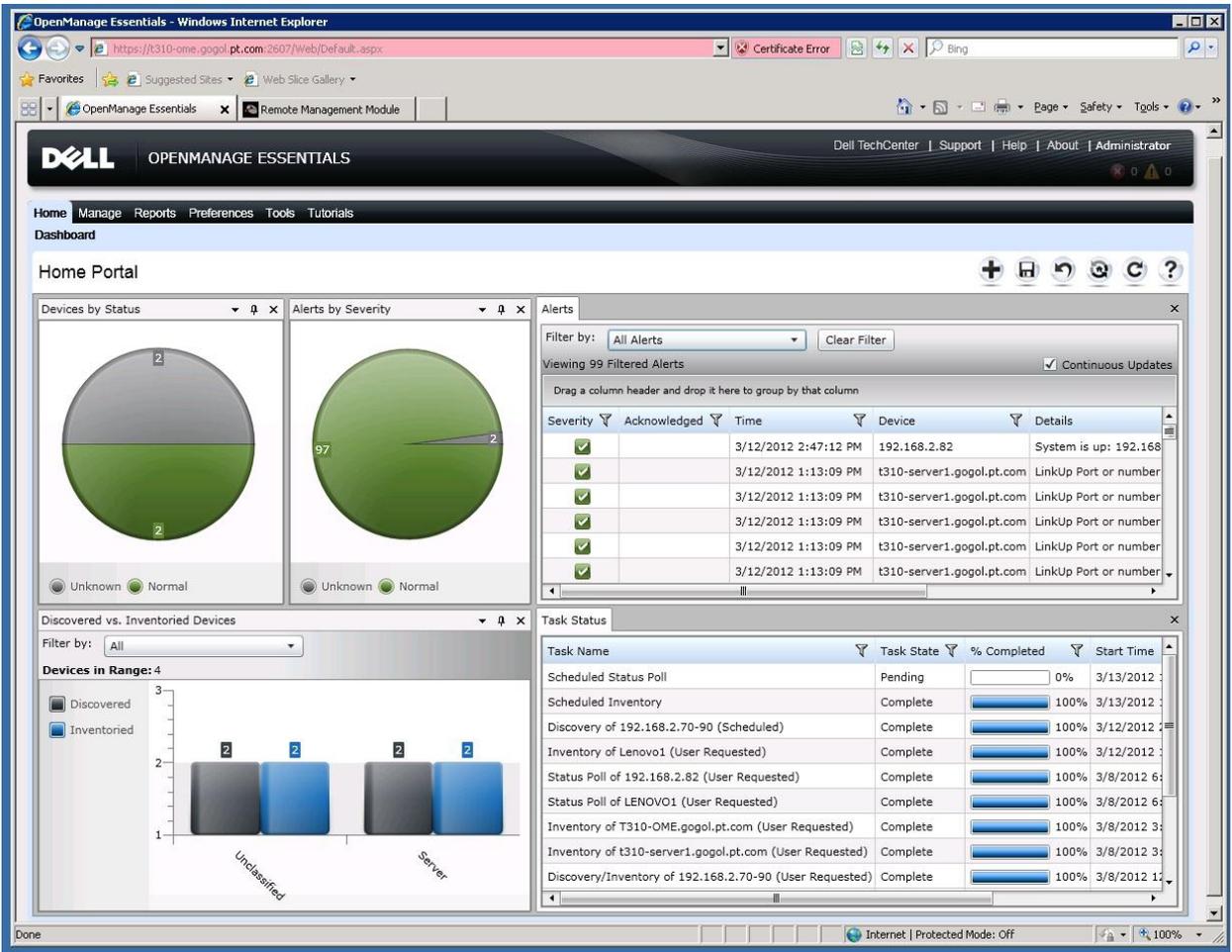
Figure 1. Dell OpenManage Essentials Dashboard.

We ran several tests to generate alerts. We observed and recorded the following results shown in Figure 2.

Test Performed	Result/Observation
Unplugged network cable to LAN	Received alert from OME
Affected fan speed	Received alert in OME from the SNMP trap sent from the RMM
Increased temperature on front panel sensor	Received alert in OME from the SNMP trap sent from the RMM

Figure 2. Alert tests and results performed on TS430.

Figure 3 shows a graphical view of the alert generated when we unplugged the network cable on the TS430. Figure 4 shows the details of the alert message.

Figure 3. Dell OpenManage Essentials Dashboard with network cable disconnected to TS430.
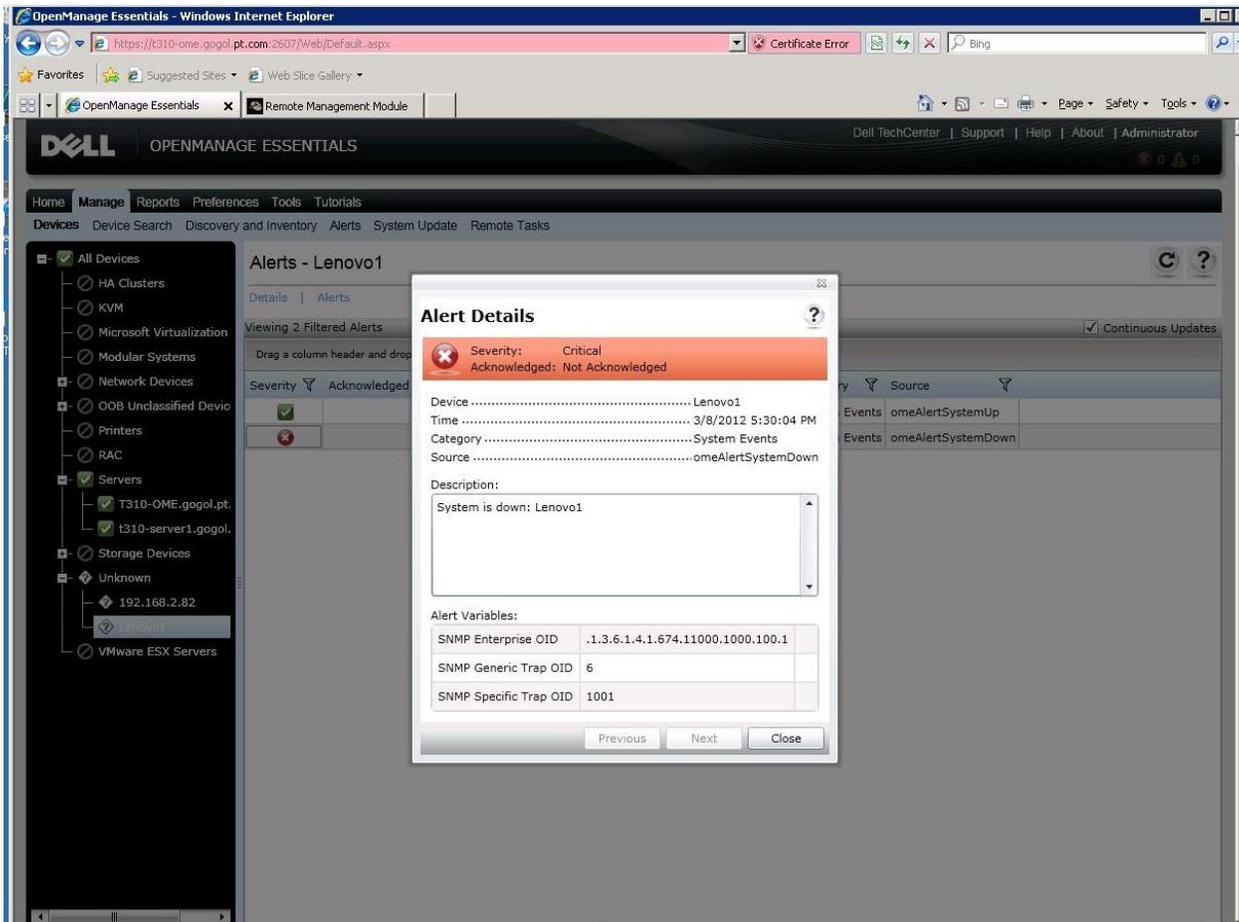
Figure 4. Dell OpenManage Essentials detailed critical alert showing network cable disconnected to TS430.

We were able to generate alerts by intentionally preventing a fan from spinning at the correct RPM, shown in Figures 5, 6, and 7. These alerts, generated in the RMM, are sent via SNMP to the OME server. We demonstrate the fan speed being below threshold causing warning message (Figure 5) and a critical alert when the fan is far below minimum speed and may cause cooling issues on the server.
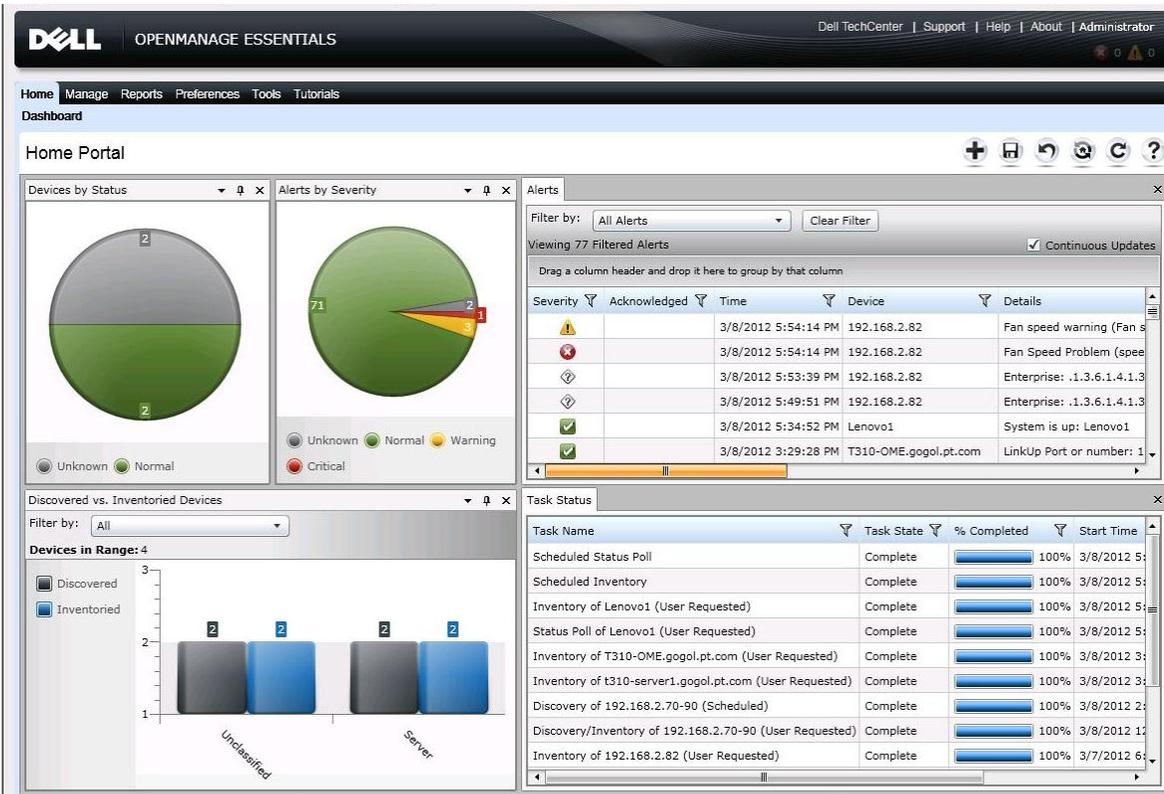
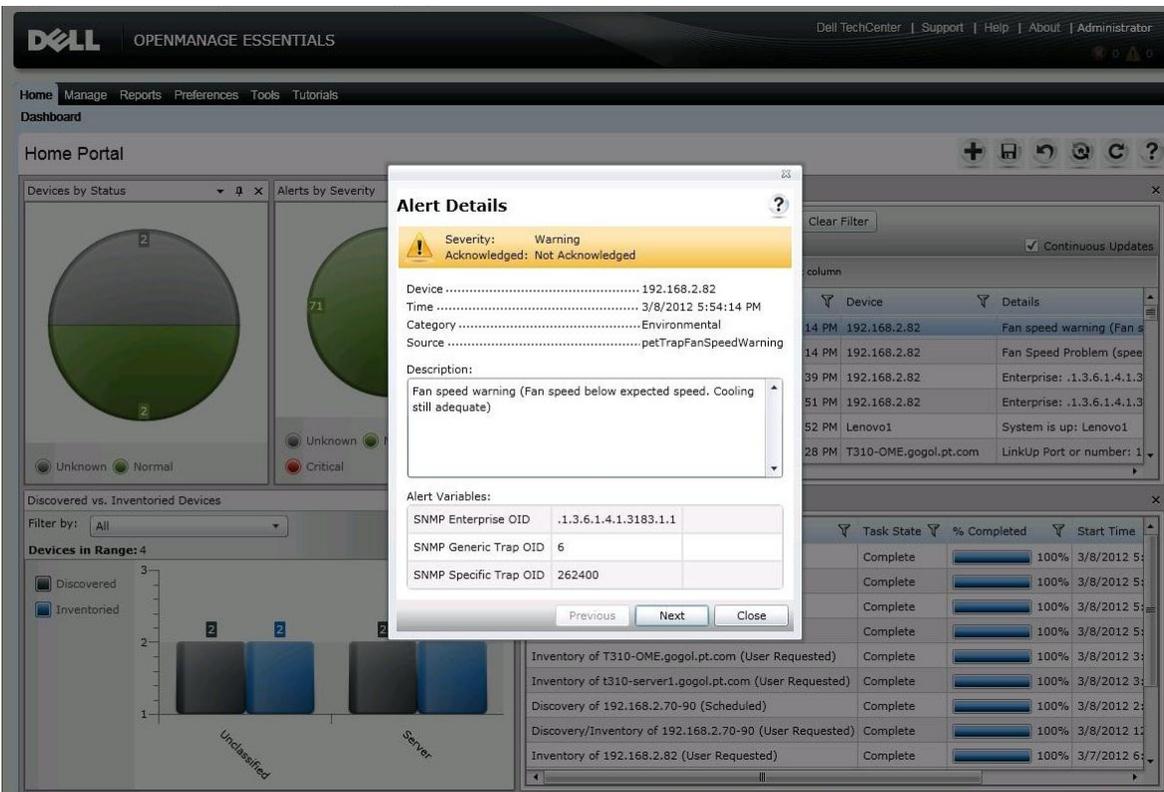**Figure 5. Dell OpenManage Essentials dashboard view of fan alerts on the TS430.**

Figure 6. Dell OpenManage Essentials detailed warning alert showing fan speed below expected speed on the TS430.
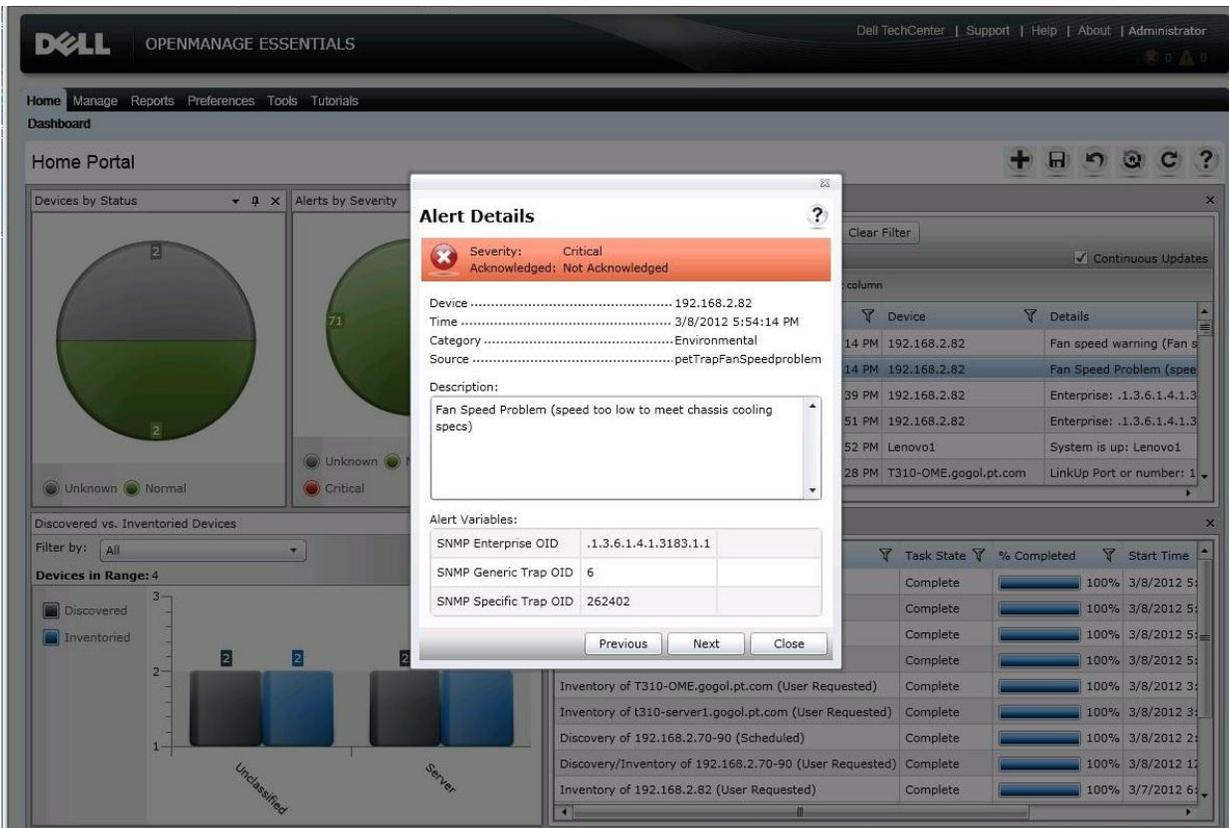
Figure 7. Dell OpenManage Essentials detailed critical alert showing fan speed below expected speed for proper cooling on the TS430.

By increasing the temperature on the front panel sensor, we were able to generate alerts picked up by the RMM and sent to OME via the SNMP trap (Figures 8 and 9).

Figure 8. Dell OpenManage Essentials dashboard view showing temperature alert on the TS430.

Figure 9. Dell OpenManage Essentials detailed warning alert showing temperature above expected limit on the TS430.

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EMAIL ALERTS

Dell OME has built-in email alerting, allowing you to receive notifications when something is wrong so you can take appropriate action. Therefore, system events from the Lenovo ThinkServer TS430 that display in Dell OME can also be configured to generate an email alert from Dell OME. You can receive more detailed alerts about voltage, temperature, and memory directly from the Lenovo RMM. LSI™ MegaRAID® Storage Manager (MSM) can provide details about the hard drives and storage controller. In the sections below, we show you how to configure these additional email alerts from RMM and from MSM.

Configuring SMTP mail alerting using the Lenovo RMM

The Lenovo Remote Management Module comes equipped with the ability to generate and send out email alerts using an SMTP mail server. This feature brings certain warnings and critical errors to the immediate attention of IT administrators so they can log into the management server and identify the issue in Dell OME or the Lenovo RMM. There is no need to wait for an alert message to appear on a management dashboard. You can set the RMM to generate an email alert for platform events, including abnormalities in voltage, temperature, and fan operation. To configure this feature, complete the following steps:

1. In the Lenovo Remote Management Module, click Platform Events under Event Management in the left pane. Ensure that the Global Alerting Enable check box is checked, and then check the Generate PET checkbox for any of the platform events for which you want to enable alerts.
2. After making your selections, click Apply Changes to save your settings.
3. Next, click Email Settings under Event Management in the left pane. Enter up to four destination email addresses and modify the email description (subject) as needed.
4. Enter the IP address of the SMTP or mail server. If your SMTP server requires authentication, enter the appropriate credentials and check the Enable check box. (See Figure 10.)
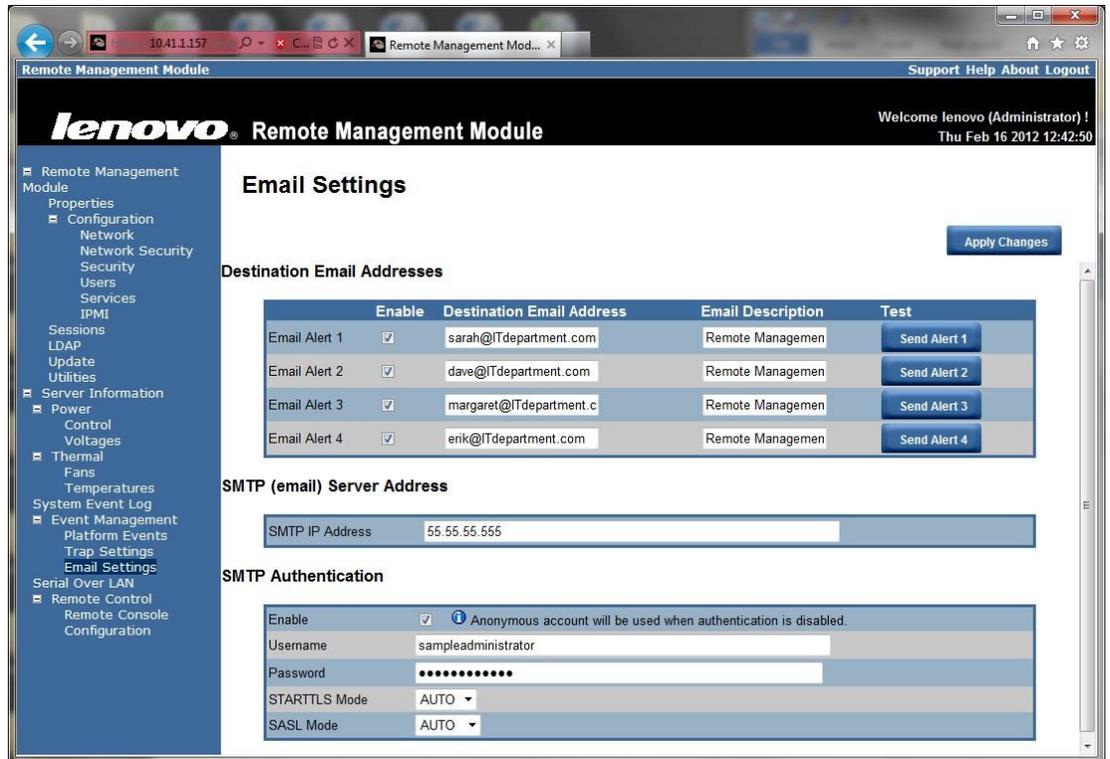
Figure 10. Configuring email alert settings on the Lenovo Remote Management Module.

5. To save your email settings, click Apply Changes. To ensure that you entered the configuration information correctly, click the Send Alert button for any of the destination email addresses. You will receive a confirmation pop-up window if the test alert succeeds as well as a test email at the specified email destination.

Configuring storage email alerts using the LSI MSM

The LSI MSM, which numerous OS platforms support, is a software application that allows you to view and make configuration changes to any hard drives connected to the storage controller. Additionally, you can change the built-in monitor alerts to notify you by email of events or event categories you wish to capture. For example, if you want to be notified via email if the virtual disk state becomes degraded, you can modify the settings to send you an email alert should that specific event occur. For our testing purposes, we completed this setup on a Windows OS. For information on using the MSM utility with other operating systems, as well as downloads, go to Lenovo's support Web site at http://support.lenovo.com, or the LSI support Web site at http://www.lsi.com/support.

To set up email alerting using the LSI MSM, follow these steps:

1. Launch MSM from the desktop.
2. Click the local server IP and log into the management console using the appropriate credentials to log into management console. (See Figure 11.)
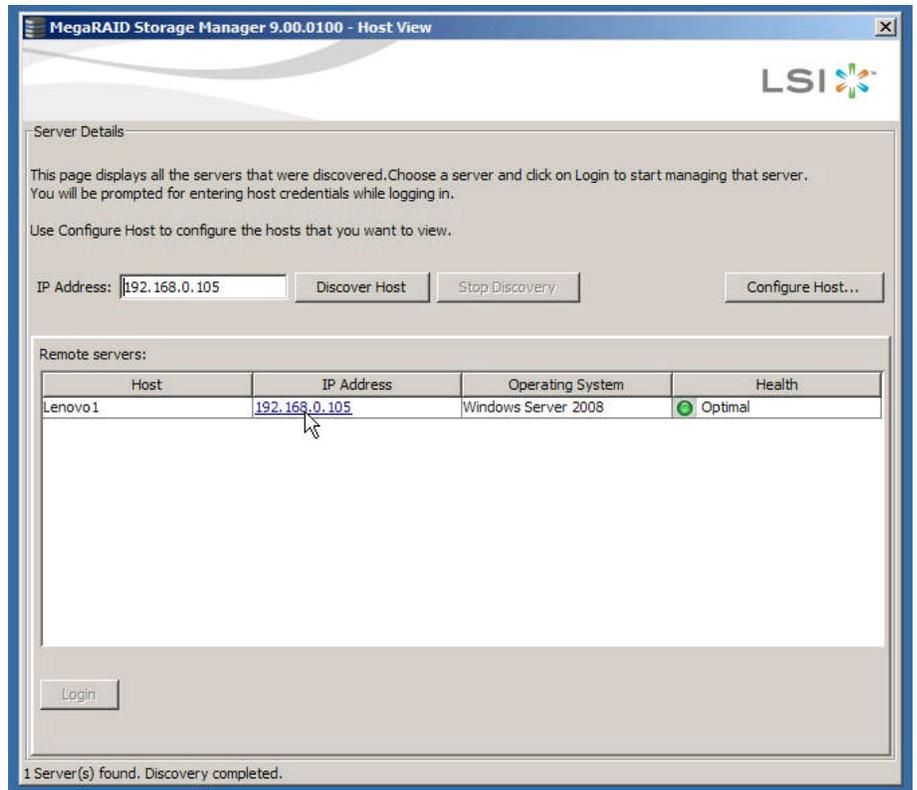
Figure 11. Selecting the local server IP address.

3. In the menu bar, select Tools→Configure Alerts.
4. In the Alert Settings tab, you can set email alerts for all events based on severity level, or you can modify an alert setting for an individual event. (See Figure 12.)
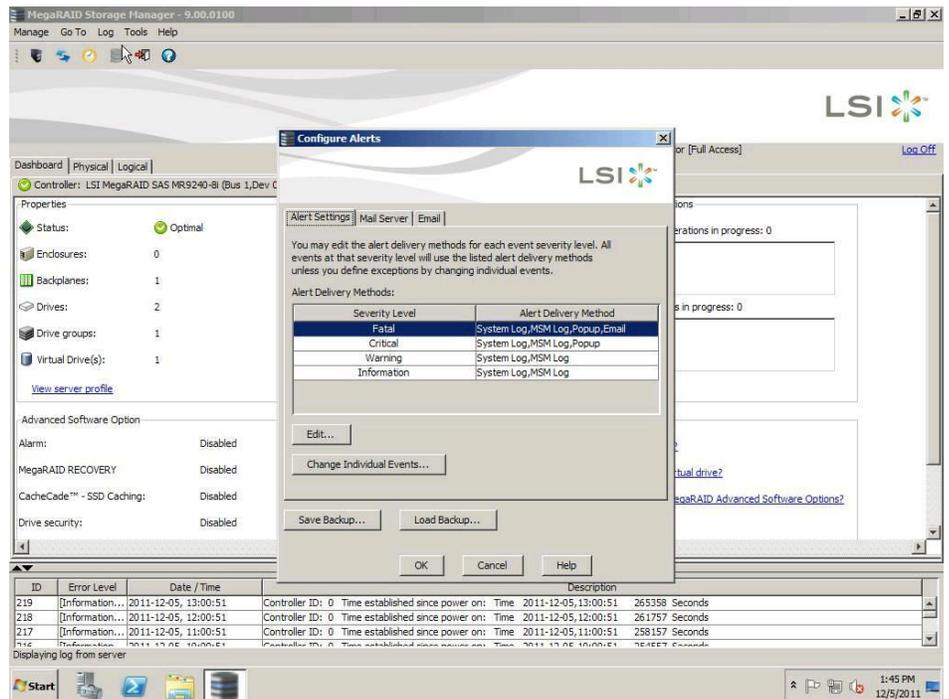

Figure 12. Displaying all events.

a. To enable email alerts for all events within a specific severity level, select the appropriate severity level, click Edit…, select email as the alert delivery method, and click OK.
b. To enable email alerts for an individual event, click Change Individual Events… to display all events. In our tests, we generated an email alert for when a virtual drive becomes degraded (Event ID 251). To enable email alerts for an event, select that event ID, check the Email check box, and click OK. (See Figure 13.)
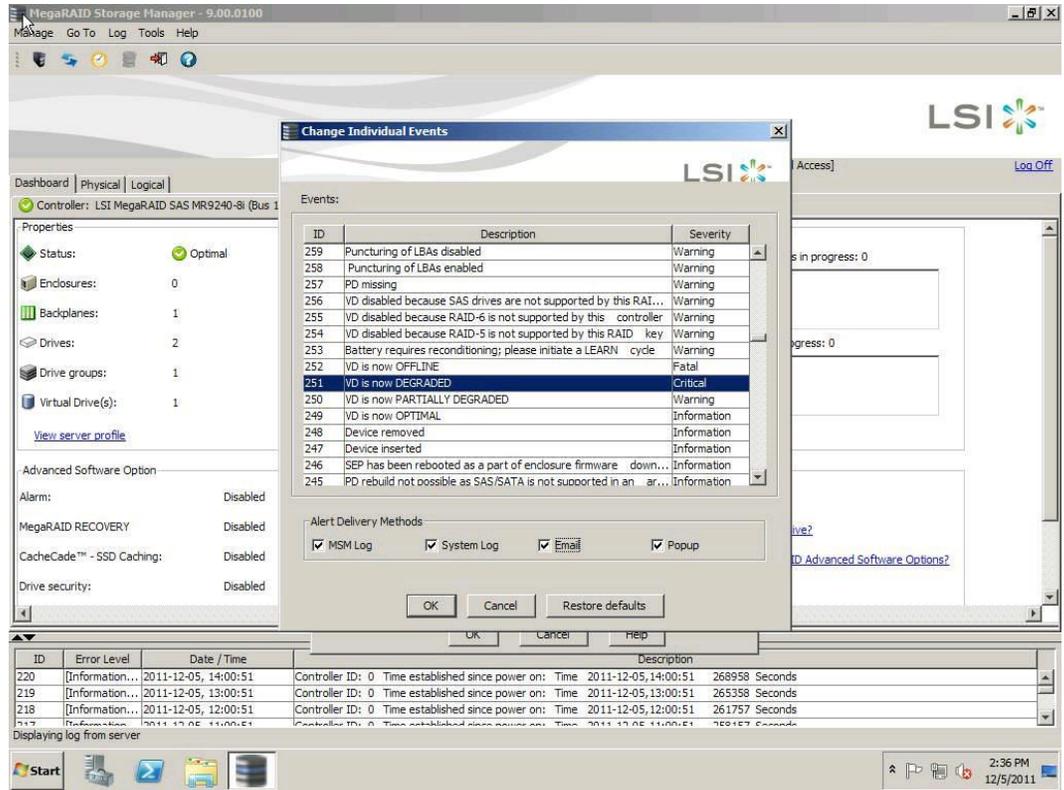

Figure 13. Enabling email alerts for an event.

5. Next, select the Mail Server tab, and enter your mail server information as well as authentication credentials for SMTP if applicable. (See Figure 14.)
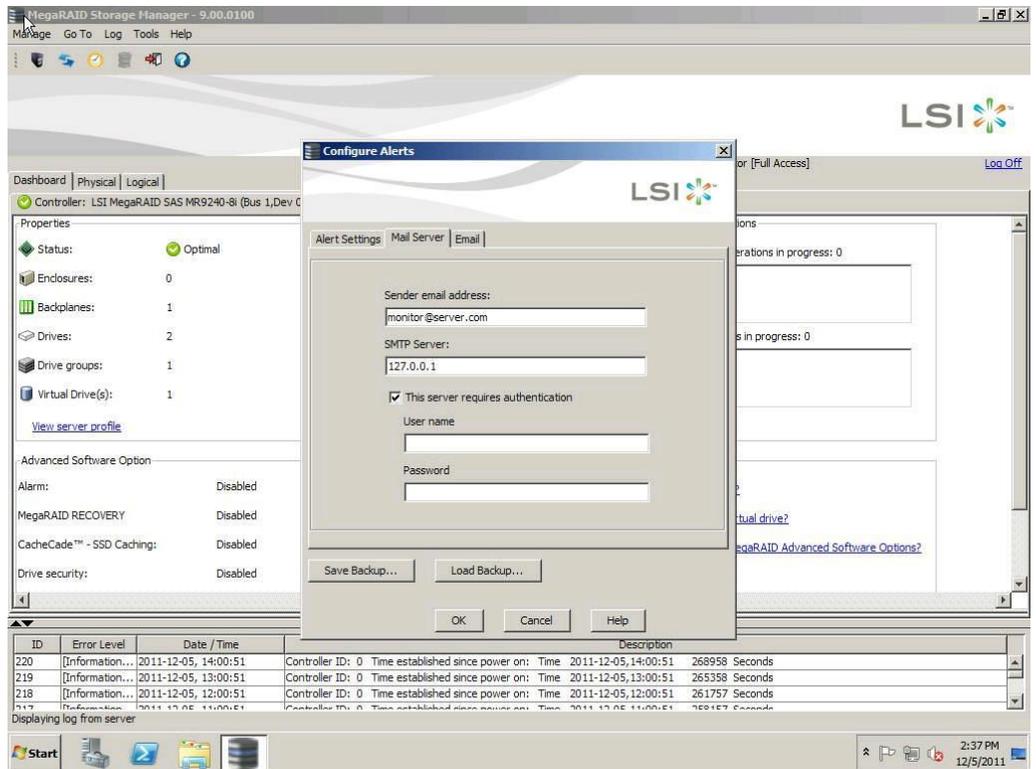
Figure 14. Entering your mail server information to configure alerts.

6. Select the Email tab and enter the desired recipient email address that will receive the alert. Press Add… to add each email address. You can also perform a test to verify that the configuration information is correct by pressing the Test button.
7. Press OK to close the Configure Alerts window.

REMOTE FUNCTIONS

The RMM interface allows you to perform power cycling and BIOS/BMC updates on the Lenovo ThinkServer TS430. In the following sections, we show you how to perform these tasks.

Updating BIOS/BMC from the RMM

In addition to updating the BIOS, you can also use this menu to update the BMC by leaving BMC selected in step 2 below.

1. In the left menu, click Update.
2. Change the drop-down selection from BMC to BIOS.
3. Browse to the file that you downloaded from the Lenovo's Web site for the particular model server you are updating.
4. Click Upload to apply the update.

Power options from within the RMM

In the Power section under Server Information, you can choose to power on, power off, power cycle, or perform a hard reset on the system. The following steps demonstrate a hard reset or restart of the system:

1. Expand Server Information.
2. Expand Power, and click Control.
3. Select Hard Reset (Restart), and click Apply Changes.

KVM CONSOLE AND VIRTUAL MEDIA

Accessing the KVM console and applying virtual media to the TS430 via the premium features of the Lenovo RMM, are also quick, straightforward tasks. These features provide more control and the ability to further utilize the features of the Lenovo RMM and connect directly to the server. In the sections below, we show you how to:

- Connect to virtual media
- Access the KVM console
- Power cycle your server from the KVM
- Access and change BIOS settings
- Access the RAID controller and bring a drive online or create a new RAID group
- Perform additional firmware upgrades

Connecting to virtual media

Through the RMM, you can create an image to map virtual media, such as a CD or USB key, from your management server to your Lenovo ThinkServer TS430 for remote software installation or data copy. To perform this task, complete the following steps:

1. Launch RMM and log in.
2. Expand Server Information→Remote Control, and select Remote Console.
3. Click Launch Java VM Client.
4. Click Create Image.
5. Browse to the location of the files that need to be copied or the application installation directory you would like to access.
6. Click Open to select the directory.
7. Click Yes to create the image.
8. Select the checkbox for the image location you just created to make it available to target the Lenovo system.
9. Minimize, but do not close the Virtual Media Session.
10. Click Launch Java KVM Client if you do not already have a remote console open.
11. Click Open folder to view the files.
12. Copy the installation file to the location on the local server, and deploy it as you would normally.

Remote access using the KVM console feature

The Lenovo ThinkServer Remote Management Module has a KVM console feature that allows complete remote access to the server, including access to pre-OS menus, such as the BIOS and RAID controller BIOS. This includes changing BIOS settings and granting access to the KVM console.

Log into the Remote Management Module to launch the KVM and perform these tasks:

1. Launch RMM and log in.
2. Expand Server Information→Remote Control, and select Remote Console.
3. To launch the console, click Launch Java KVM Client.

From this Video Viewer, you can perform several tasks on the target Lenovo system.

Power options from the KVM

The KVM console conveniently offers power options directly from the console window, including graceful shutdown, reset system (warm boot), powering the system on and off, and power cycling the system as a cold boot. (See Figure 15.)
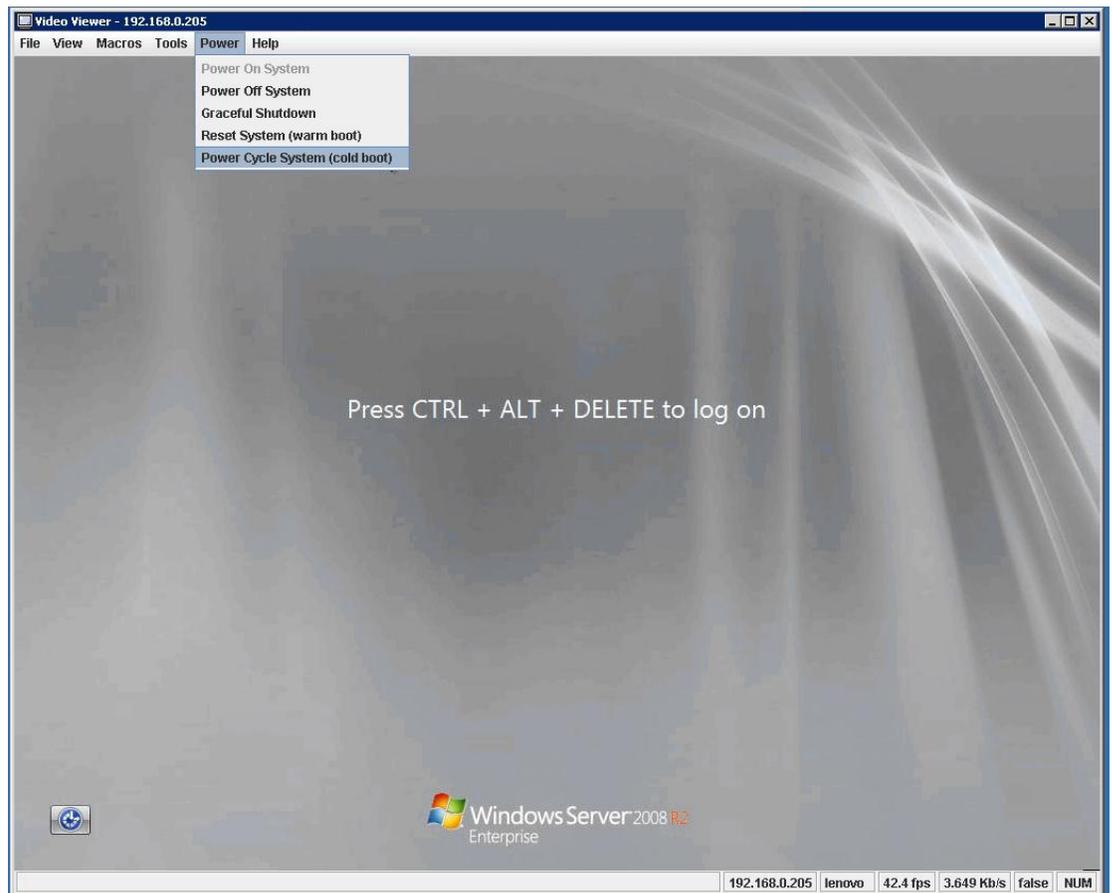

Figure 15. The Video Viewer Power options.

These boot options are available from the viewer menu bar on the KVM console, under Power.

Accessing and changing BIOS settings

Using the KVM remote console, you can reboot the machine and press F1 when prompted to access the BIOS. This allows for the remote modification of any BIOS settings as if you were connecting directly to the server using a monitor and keyboard.

Bringing new drives online and creating a new virtual drive

To add drives and a virtual drive, complete the following steps through the Remote KVM console.

1. Reboot the server.
2. Press CTRL+H when prompted to launch WEBBIOS configuration GUI.
3. Press Start to select a controller adapter.
4. Select Physical view to show drives.
5. Select the new unconfigured drive(s).
6. Select Make Unconf Good, and click Go.
7. Click Home, and select Configuration Wizard.
8. Select Add Configuration, and click Next.
9. Select Manual Configuration, and click Next.
10. When you have added all the appropriate drives, click Accept DG in the Drive Groups pane. Click Next.
11. In the Span Definition window, select the appropriate drive group in the Array With Free Space pane, and click Add to Span. Repeat this with other drive groups if necessary. Click Next.
12. In the Virtual Drive Definition window, select the appropriate RAID Level, read and write policies, and volume size, and click Accept.
13. At the Confirm the selected write policy prompt, click Yes.
14. Click Next.
15. In the Configuration Preview window, click Accept.
16. At the Save this Configuration? prompt, click Yes.
17. At the Do you want to Initialize prompt, click Yes.
18. Click Home, and click Exit.
19. Click Yes to exit the application.
20. In the menu bar, click Power, and select Power Cycle System (cold boot).
21. Click Yes to confirm reboot.
22. Log into Windows.
23. Select Start, right-click Computer, and select Manage.
24. Expand Storage, and select Disk Management.
25. Click to accept initialization of new disk.
26. Right-click the disk, and select New Simple Volume.
27. Click Next.
28. On the Specify Volume Size screen, click Next.
29. Assign a drive letter, and click Next.
30. Select your desired Format options, and click Next.
31. Click Finish, and close Server Manager.

Upgrading additional firmware

Download the Firmware Updater for ThinkServer EasyUpdate 1.6 from the Lenovo Web site (http://support.lenovo.com/en_US/downloads/default.page) and create a CD. Apply the updates from the CD using the following steps:

1. Download the updater from the Web site and burn it to a CD.
2. Reboot using the CD image, and let the Updater execute.
3. Select Language, and click OK.
4. Click Next.

When the check completes, it will inform you if firmware updates are available for your server.

CONCLUSION

As we have shown, integrating the Lenovo ThinkServer TS430 into an existing Dell environment is not only possible – it's easy. The Lenovo server fits right into the Dell environment, and you or your IT administrator can access key management features and alerting capabilities. Setting up and configuring your Lenovo ThinkServer TS430 for operation in a Dell-managed environment is a simple, straightforward process that allows you to bring the benefits of the Lenovo ThinkServer TS430 into your existing environment.

APPENDIX A – SYSTEM CONFIGURATION INFORMATION

Figure 16 provides detailed configuration information about the test servers.

System	Lenovo ThinkServer TS430	Dell PowerEdge T310
Power supplies		
Total number	1	1
Vendor and model number	Delta Electronics® GPS-400CB	Dell L375E-S0
Wattage of each (W)	400	375
Cooling fan 1		
Total number	1	1
Vendor and model number	AVC® DS09225R23HP235	Delta Electronics AFC1212DE
Dimensions (h x w) of each	4" x 1"	4" x 2"
Volts	12	12
Amps	0.41	1.60
Cooling fan 2		
Total number	1	NA
Vendor and model number	AVC DS12025B12H	NA
Dimensions (h x w) of each	5" x 1"	NA
Volts	12	NA
Amps	0.75	NA
General		
Number of processor packages	1	1
Number of cores per processor	4	4
Number of hardware threads per core	2	2
System power management policy	Balanced	Balanced
CPU		
Vendor	Intel	Intel
Name	Xeon	Xeon
Model number	E3-1240	X3470
Stepping	D2	B1
Socket type	1155 LGA	1156 LGA
Core frequency (GHz)	3.30	2.93
L1 cache	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)
L2 cache	256 KB (per core)	256 KB (per core)
L3 cache	8 MB (shared)	8 MB (shared)
Platform		
Vendor and model number	Lenovo GA-6UASV2	PowerEdge T310
Motherboard model number	038911U	Dell 02P9X9
Motherboard chipset	Intel C202	Intel 3420
BIOS name and version	American Megatrends® Inc. 2.10 (09/01/2011)	Dell 1.8.2 (08/17/2011)
BIOS settings	Default	Default
Memory module(s)		
Total RAM in system (GB)	16	16
Vendor and model number	Hynix™ HMT351U7BFR8C	Hynix HMT351R7BFR8A

System	Lenovo ThinkServer TS430	Dell PowerEdge T310
Type	PC3-10600E	PC3L-10600R
Speed (MHz)	1,333	1,333
Speed running in the system (MHz)	1,333	1,333
Timing/Latency (tCL-tRCD-tRP-tRASmin)	9-9-9-24	9-9-9-24
Size (GB)	4	4
Number of RAM module(s)	4	4
Chip organization	Double-sided	Double-sided
Rank	Dual	Dual
Hard disk		
Vendor and model number	Seagate® ST3500514NS	Seagate ST1000NM011
Number of disks in system	2	2
Size (GB)	500	1
Buffer size (MB)	32	64
RPM	7,200	7,200
Type	SATA	SATA
Disk controller		
Vendor and model	LSI MegaRaid SAS MR9240-8i	Dell PERC H200A
Controller cache	N/A	N/A
Controller driver	LSI 5.1.110.64 (5/12/2011)	Dell 2.0.35.10 (12/14/2010)
Controller firmware	20.7.1-0020	7.11.10.00 (6/02/2011)
RAID configuration	RAID 1	RAID 1
Operating system		
Name	Windows Server 2008 R2 Enterprise	Windows Server 2008 R2 Enterprise
Build number	7601	7601
Service pack	SP1	SP1
File system	NTFS	NTFS
Kernel	ACPI x64-based PC	ACPI x64-based PC
Language	English	English
Ethernet 1		
Number of ports	1	1
Vendor and model number	Intel 82579LM	Broadcom BCM5716C NetXtreme II GigE
Type	Integrated	Integrated
Driver	Intel 11.8.74.0 (9/21/2010)	6.0.29.0 (9/2/2010)
Ethernet 2		
Number of ports	1	1
Vendor and model number	Intel 82574L	Broadcom BCM5716C NetXtreme II GigE
Type	Integrated	Integrated
Driver	Intel 11.7.32.0 (8/5/2010)	6.0.29.0 (9/2/2010)
Optical drive(s)		
Vendor and model number	TSSTcorp TS-H353C	PLDS DVD-ROM DH-16D5S
Type	DVD	DVD

System	Lenovo ThinkServer TS430	Dell PowerEdge T310
USB ports		
Number	6	6
Type	2.0	2.0

Figure 16. Configuration information for the two test servers.

ABOUT PRINCIPLED TECHNOLOGIES

Principled Technologies®

Principled Technologies, Inc.
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We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

When the assessment is complete, we know how to present the results to a broad range of target audiences. We provide our clients with the materials they need, from market-focused data to use in their own collateral to custom sales aids, such as test reports, performance assessments, and white papers. Every document reflects the results of our trusted independent analysis.

We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to help our clients assess how it will fare against its competition, its performance, its market readiness, and its quality and reliability.

Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.