

# Configuring ThinkServer RAID 100 on the TS140 and TS440

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Lenovo ThinkServer TS Series Servers

Lenovo Enterprise Product Group

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## Overview

This paper provides an overview of Lenovo ThinkServer RAID 100 on the TS140 and TS440, and gives basic instructions for using the pre-boot Configuration Utility to setup and manage RAID storage configurations on the server.

## RAID 100 Features on TS140 and TS440

ThinkServer RAID 100 provides the following features:

- RAID 0, 1, 5, and 10 Support
- Mixed capacity drives in RAID array
- Up to two independent RAID volumes within a single RAID array (a Matrix Array)
- RAID migration – RAID-Ready configuration to RAID 0, 1, 5, or RAID 10 configuration
- Rebuild w/ check pointing
- Verify & Repair / Bad Block Management
- >2TB HDD Support for data volumes

## RAID Overview

The first step to creating a RAID configuration is to configure the drives into an *array*, which holds one or more partitions known as *virtual drives*. The virtual drive will be assigned a *RAID level*, which is seen by the host computer system as a single drive volume.

### Choosing the RAID Level

The RAID level selected should be based on consideration of several factors, the most important being performance, fault tolerance, and storage capacity. Not all of these factors can be optimized at the same time. These factors are discussed in each of the following RAID level descriptions.

### RAID 0

RAID 0 combines hard drives so that all data is divided into manageable blocks called stripes. The stripes are distributed across all the drives in the RAID array.

However, data stored in a RAID 0 volume is not redundant. Therefore, if one hard drive fails, all data on the virtual drive is lost.

Read/write performance is generally improved, especially for sequential access, because adjacent data can be accessed from more than one hard drive simultaneously.

The RAID 0 volume appears as a single physical hard drive with a capacity equal to the size of the smallest hard drive multiplied by the number of drives in the array<sup>1</sup>.

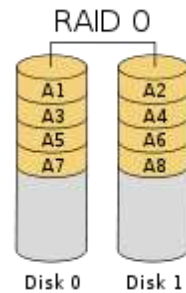


Figure 1 – RAID 0

## RAID 1

RAID 1 combines even numbers of hard drives so that all data written to one drive is simultaneously written to another drive in the array.

This provides complete, real-time redundancy of all data on the first drive, also called a mirror.

Performance is minimally impacted by the overhead associated with duplicating the data.

The RAID 1 volume appears as a single physical hard drive with a capacity equal to half that of the total drive capacity<sup>2</sup>.

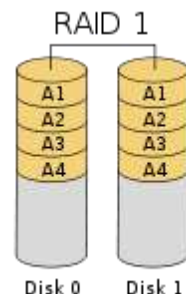


Figure 2 – RAID 1

## RAID 5

RAID 5 uses disk striping and parity data across all drives (distributed parity).

RAID 5 provides redundancy, protecting against a single drive failure with the smallest reduction in total storage capacity.

High data throughput can be achieved, especially for small random read transactions. Read performance is almost as good as RAID 0 for the same number of disks. Random write performance, however, can suffer due to the overhead of updating parity for each write.

<sup>1,2</sup> This capacity statement assumes that only one RAID volume is configured in the array. Two RAID volumes are supported per array (see the section on *Matrix RAID* for more information).

The RAID 5 volume appears as a single physical hard drive with a capacity equal to the total drive capacity less the capacity of one drive, which is used to hold the parity data.

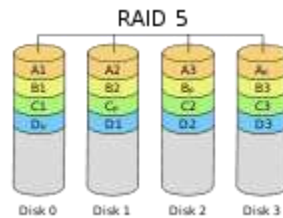


Figure 3 – RAID 5

## RAID 10

RAID 10 is a combination of RAID 0 and RAID 1, and consists of striped data across mirrored spans. An even number of drives in each RAID 1 span must be used.

RAID 10 provides full redundancy within in each span.

By striping data across spans, performance is increased by enabling access to multiple drive groups simultaneously. In most cases, RAID 10 provides better throughput and latency than all other RAID levels except RAID 0 (which can have greater throughput). It is the preferable RAID level for I/O-intensive applications.

The RAID 10 volume appears as a single physical hard drive with a capacity equal to  $\frac{1}{2}$  of the total drive capacity in the configuration.

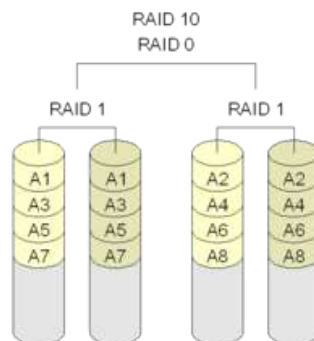


Figure 4 – RAID 10

## Configuring RAID

This section provides a basic overview of the steps required to setup and configure a RAID array on the ThinkServer TS140 and TS440. Details are the same for TS140 and the TS440 except where noted.

Configure RAID using the pre-boot Intel Rapid Storage Technology Enterprise Configuration Utility. The Configuration Utility allows the creation, management, and deletion of RAID arrays from the available physical drives attached to the TS140 or TS440 servers. If RAID volumes have already been configured, the Configuration Utility does not automatically change their configuration.

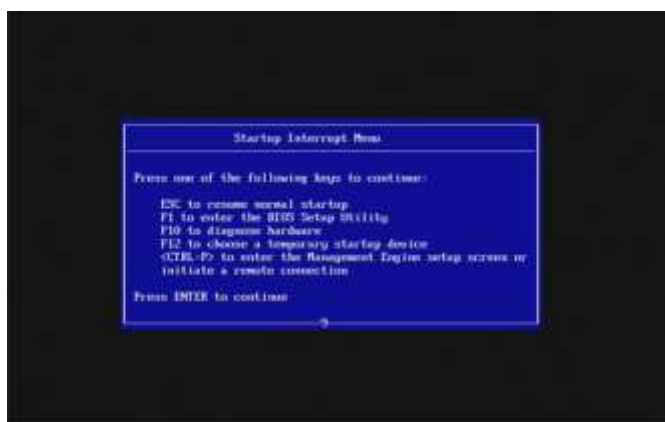
The basic steps to create a RAID configuration are as follows:

- a. Configure BIOS to enable RAID
- b. Select a RAID configuration
- c. Configure the properties and select the drives that will make up the RAID group
- d. Define the virtual drive(s) using the space in the RAID group.

## BIOS Setup

Configure BIOS for RAID operation. The SATA controller must be set to RAID mode.

1. Power on the Server.
2. Press the **ENTER** key to bring up boot options.
3. Press the **F1** key to enter the BIOS Setup Utility.



- In the BIOS Setup Utility, go to the “Devices” tab and select “ATA Drive Setup.”



- Set “SATA Controller” to “Enabled” and “Configure SATA as” to “RAID.”

If the SATA Controller is set to “Disabled” then internal SATA drive support will not be enabled and the option to configure RAID will not be available.

“Hard Disk Pre-delay can be set to “Disabled” (the default).

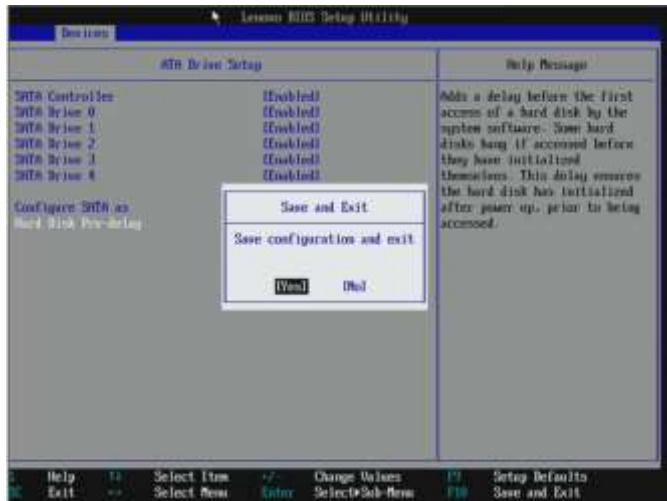


- Select the “Startup” tab from the menu, then select “CSM” and set it to “Enabled.”





- To accept the changes press **F10** and select “Yes” when prompted to “Save Configuration and Exit.”

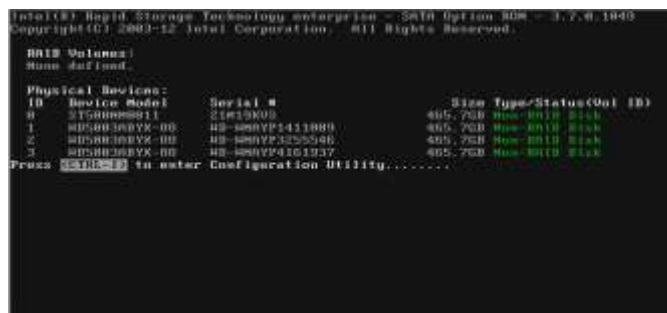


## RAID Configuration

Configure RAID using the pre-boot Intel Rapid Storage Technology Configuration Utility.

- If BIOS was just configured for RAID operation, the ThinkServer will soon restart itself. Otherwise reboot the system.

If the SATA controller was configured for RAID mode, the following prompt will be displayed (in this example, four HDD’s are installed).



At the prompt, again press **CTRL-I** to bring up the Intel Rapid Storage Technology Configuration Utility.

- The Intel Rapid Storage Technology Enterprise Configuration Utility will allow the creation, management, and deletion of RAID volumes on drives installed on the ThinkServer.

The physical disks and the ports they are installed on are displayed in the “Disk/Volume Information” area.



Use the Up and Down arrow keys to select from the menu, “1. Create RAID Volume” and press **ENTER** key to enter the “Create Volume Menu.”

3. Type a name for the new RAID volume to be created.

In this example, the default "Volume0" is used.



4. Press **TAB** to move to the next entry. Select the RAID Level from the selection using the up and down arrow keys.

In this example, select "RAID0 (Stripe)."



5. Press **TAB** to move to the next entry. Press **ENTER** to select the disks to use in the RAID.



6. Press **SPACE** to mark each individual disk to add. Select the disks from the selection using the up and down arrow keys. Press **ENTER** when you are done selecting.

In this example, all four disks are selected.



- Press **TAB** to move to the next entry.  
Enter the strip size.

In this example, use the default 128KB.

Help text provides guidance on the value to select for Strip size.

Strip size is not applicable for a RAID 1 configuration.

- Press **TAB** to move to the next entry.  
Enter the size to be given to this RAID volume.

The default value displayed is the maximum capacity that can be used given the physical disks involved. Entering a lower value will allow the creation of two volumes on these disks (for example, a RAID 0 and a RAID 1 volume on the same disks).

- Press **TAB** to highlight “Create Volume”, and Press **ENTER** to create the specified volume.

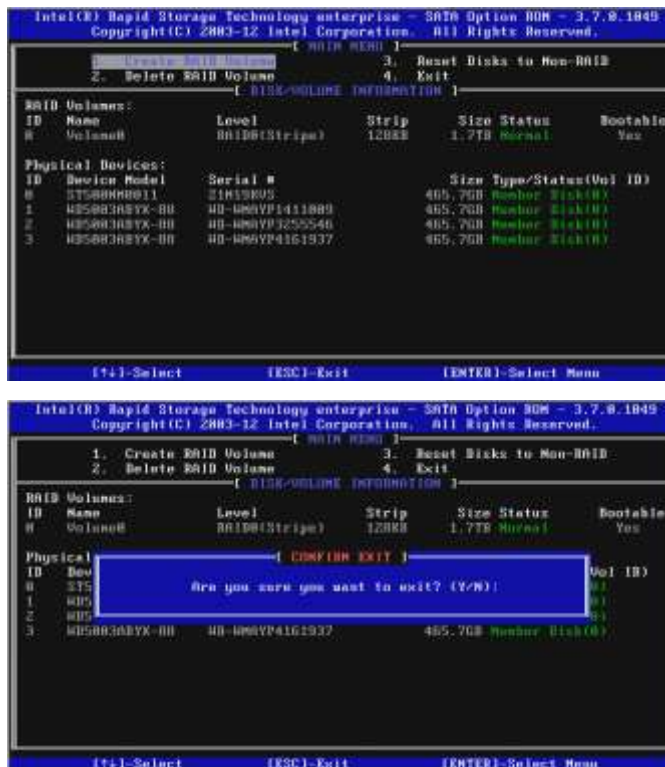
A warning message will pop up on screen. Confirm that any previous data on the drives is no longer needed. Press “Y” to create the new RAID volume, or press “N” to cancel the operation.



- After the RAID volume is created, the main menu is displayed. “Disk/Volume Information” displays key information such as Volume ID Number, RAID Volume Name, RAID Level, Strip Size, Volume Size, Status, and whether this is a bootable volume.

Confirm the RAID array has been configured properly.

- Press **ESC** to exit. Select Y to confirm exiting the RAID configuration.



## Understanding Options

### Matrix RAID

ThinkServer RAID 100 will support up to two logical RAID volumes in the same array. When configuring the array, simply allocate less than the maximum available space for the array for the first logical volume. The remaining disk space can be used for the second array.

### Delete RAID Volume

For any RAID volume that is no longer needed, choose “2. Delete RAID Volume” and press the Enter key to enter the Delete Volume Menu. All data on the volume will be lost.

### Reset Disks to Non-RAID

This feature is used when specific disk needs to be set back to non-RAID mode. For example, in a RAID 1 volume, if one disk is set to non-RAID mode, this disk can work in pass-through (non-RAID) mode. The RAID 1 volume will be in degraded mode due to loss of this disk, and can be rebuilt if another disk joins this RAID 1 volume. This feature is useful when a specific drive needs to be replaced by another one. In the Main Menu, choose “3. Reset Disks to Non-RAID” and press Enter key to enter the Reset Disk Data option menu.

### RAID Ready

A RAID-Ready system refers to a system that has been configured to support RAID (The system BIOS and the controller has been configured for RAID mode), but the RAID array has not yet been defined. The

actual RAID configuration can later be defined using the management console rather than using the pre-boot Configuration Utility. For example, in a RAID-Ready configuration, a system built with a single drive can be converted into a supported RAID volume by using the Rapid Storage User Interface (Management Console GUI application). This process does not require the reinstallation of the operating system. All applications and data will remain intact.

## Driver Installation

A ThinkServer RAID 100 device driver must be installed if CSM is “Disabled” before the Windows operating system can use a RAID volume. A driver is not needed if CSM is “Enabled,” or a single hard drive connected to the controller when configured in RAID mode.

In addition, the driver that comes with Microsoft Windows Server 2008, Server 2008R2, Server 2012, and Windows Storage Server 2012 may not be current and should be updated to take advantage of the new features available in the driver. If ThinkServer EasyStartup is used to configure RAID and install the Operating System, the updated drivers will be installed automatically. ThinkServer EasyStartup can be downloaded from the following link:

[http://support.lenovo.com/en\\_US/downloads/detail.page?DocID=DS014935](http://support.lenovo.com/en_US/downloads/detail.page?DocID=DS014935)

If installing the Operating System manually, the driver can be updated during the initial OS install, or after the OS installation is completed. The driver can be downloaded from the following link:

<http://support.lenovo.com>

## Manually Installing the Driver During OS Installation

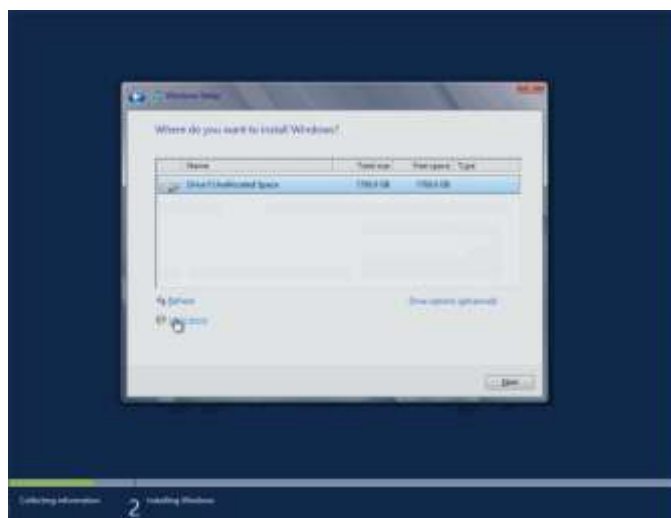
Perform the following steps to install the device driver in a new Windows operating system installation. This example shows the steps for installing in Windows Server 2012. The Windows operating system automatically adds the driver to the registry and copies the driver to the appropriate directory.

1. Start the Windows installation by booting from the appropriate Windows CD-ROM. The system BIOS must support booting from a CD-ROM. BIOS settings might require changes to allow CD-ROM booting. See your system documentation.
2. Begin the Operating System installation selecting the language, the OS version to install, and finally reading and accepting the license agreement.

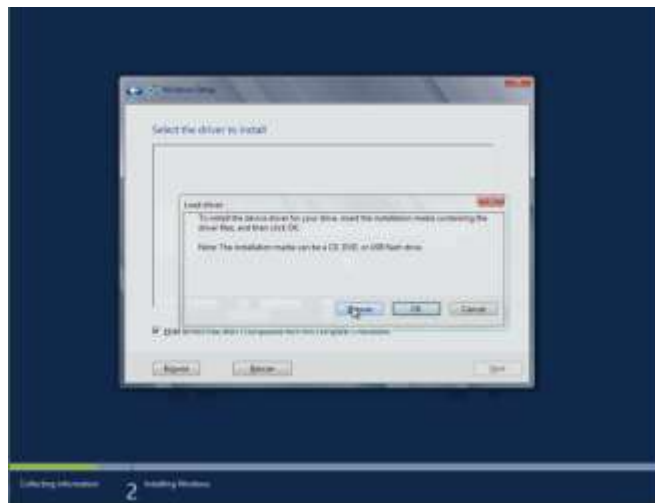
3. When presented with the screen “What type of installation do you want?” select “Custom (advanced)” install.



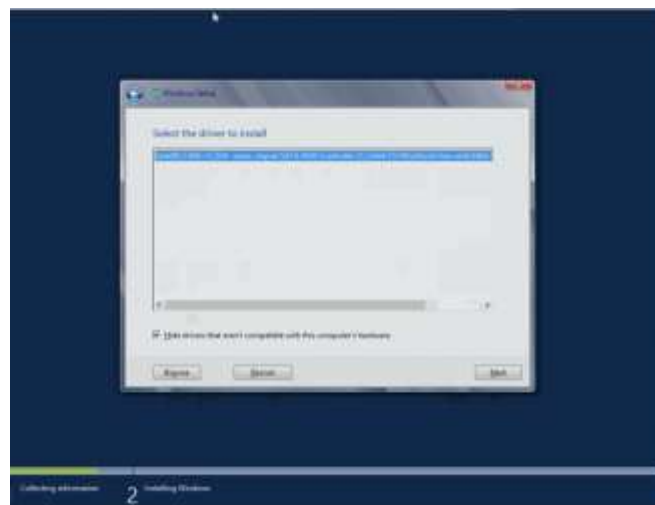
4. To install the driver, click “Load Driver.”



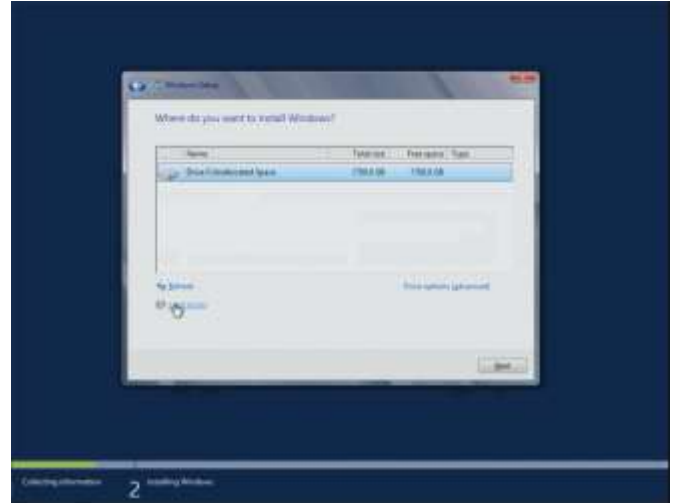
5. Insert the media that contains the driver and select “Browse.”



6. Navigate to where the driver is located (device and folder). The correct driver should be highlighted. If not, select the “Intel C600+ / C200+ series Chipset RAID Controller” driver and select “Next.”



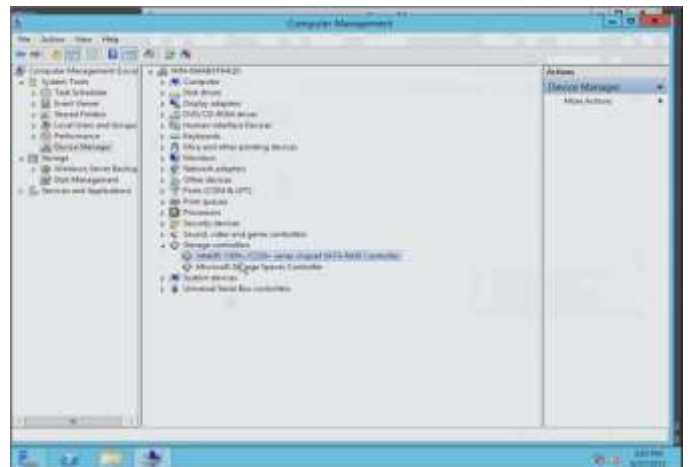
- At this point, Windows installation will continue. The remaining steps are the standard steps to complete the OS installation.



## Manually Installing the Driver after OS Installation

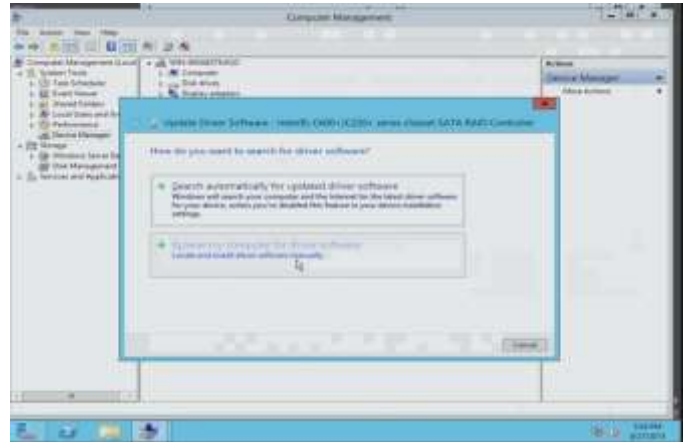
Perform the following steps to install the device driver after the OS has been installed, or to upgrade a driver to a newer version. The driver installation automatically adds the driver to the registry and copies the driver to the appropriate directory. The example below describes the steps required for Windows Server 2012.

- To install the driver manually, launch the “Device Manager” in the Operating System.
- Locate the “Intel C600+ / C200+ series Chipset SATA RAID Controller” device within “Storage Controllers.” Right click to access the context menu and select “Update Device Software” from the menu.

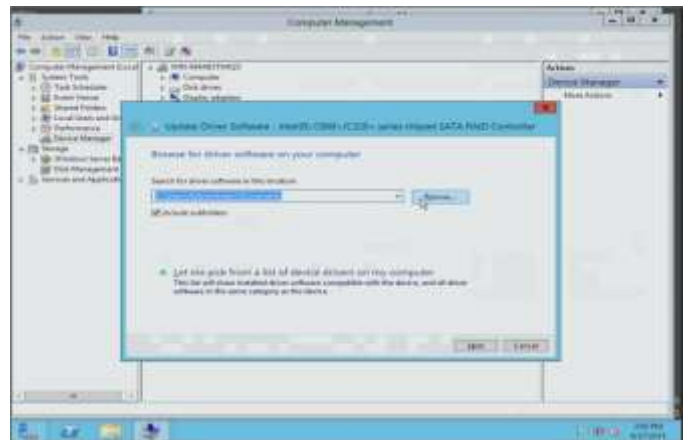




3. Select Browse to locate the driver.

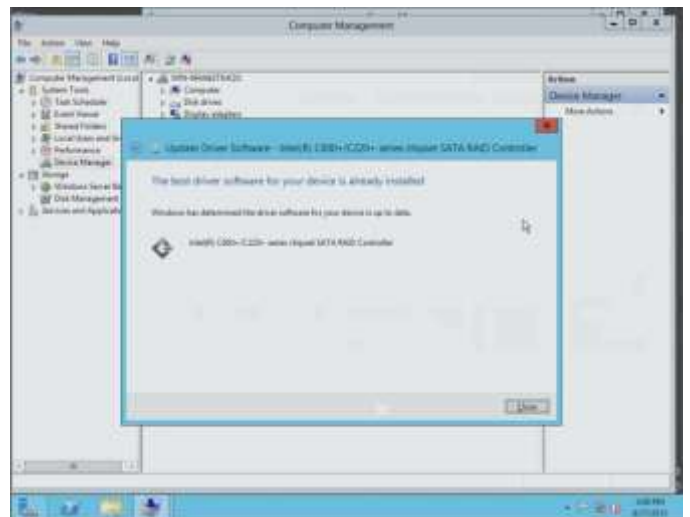


4. Navigate to the folder where the driver is located and press NEXT.



5. The driver will be installed.

When prompted, restart the server to complete the installation.



## Managing ThinkServer RAID 100 on TS140 and TS440

The Intel Rapid Storage Enterprise Technology User Interface software is a utility that enables configuration, monitoring, and maintenance of storage configurations. This section gives a basic

overview of the storage management console, how to manage arrays, and how to setup alerts and notifications. Additional information is available from the Help menu from within the application.

Rapid Storage Technology User Interface can be downloaded from the following link:

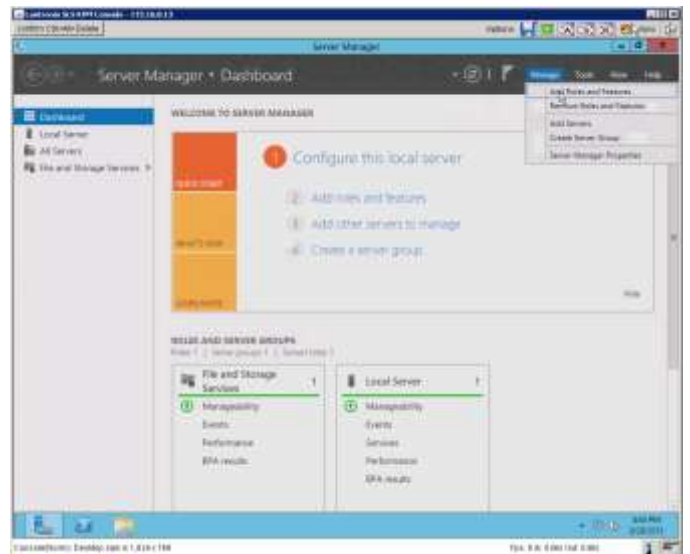
<http://support.lenovo.com>

## Installing the Storage Management Console

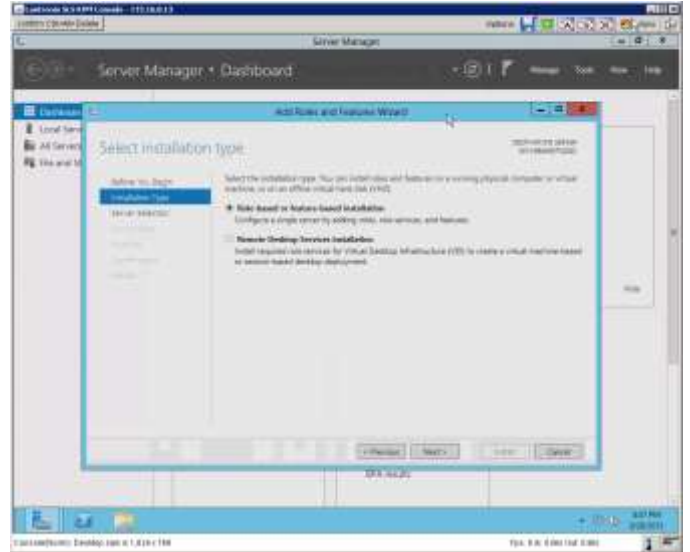
After installing an operating system onto a RAID volume or on a SATA hard drive when in RAID mode, the Rapid Storage Technology Enterprise User Interface can be loaded from within Windows. This installs the user interface (the Storage Management Console), the tray icon service, and the monitor service onto the system, enabling the health of the RAID volumes and hard drives to be monitored locally. The Storage Manager also enables the creation and deletion of RAID volumes, as well as other configuration and management features that the pre-boot Configuration Utility does not support.

Microsoft .NET 3.5 is a prerequisite to the installation of the management console. Microsoft Windows Server 2012 already includes the installation of .NET 3.5, but it must be enabled (prior versions of Windows Server OS require that it be downloaded and installed). The following steps show an example of how to enable it in Microsoft Windows Server 2012 Standard.

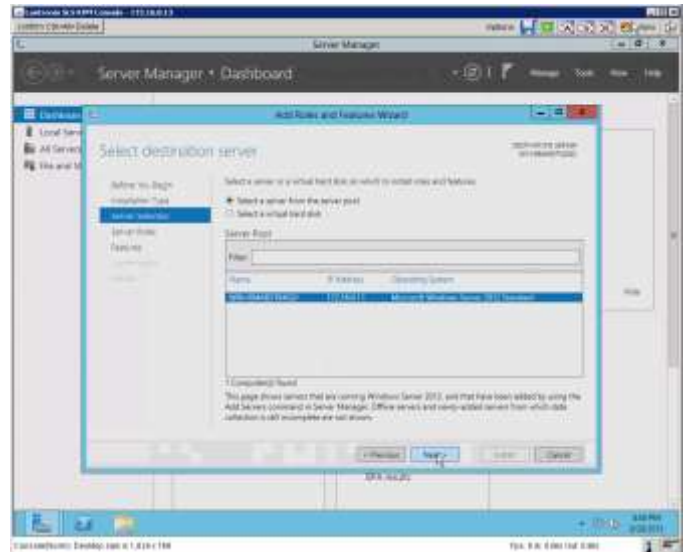
1. In Server Manager and click Manage then “Add Roles or Features.” The “Select Features” dialog will be displayed.



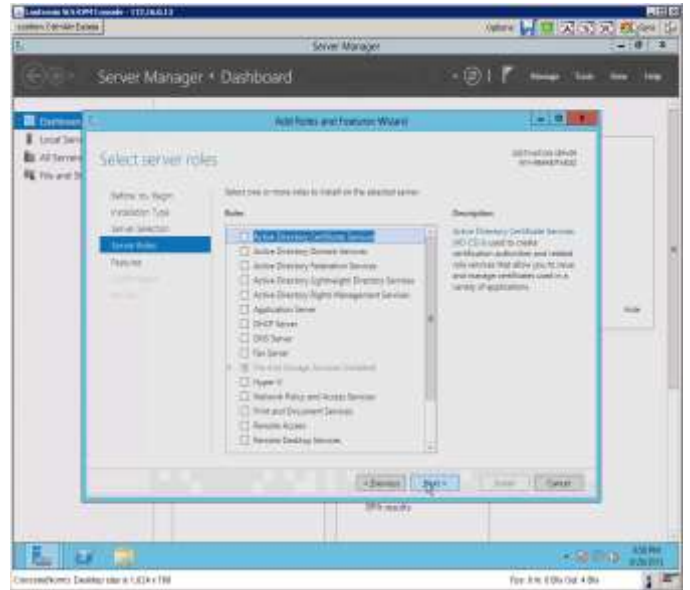
2. In the Add Roles or Feature wizard, select "Role-based or Feature-based installation." Click Next to continue.



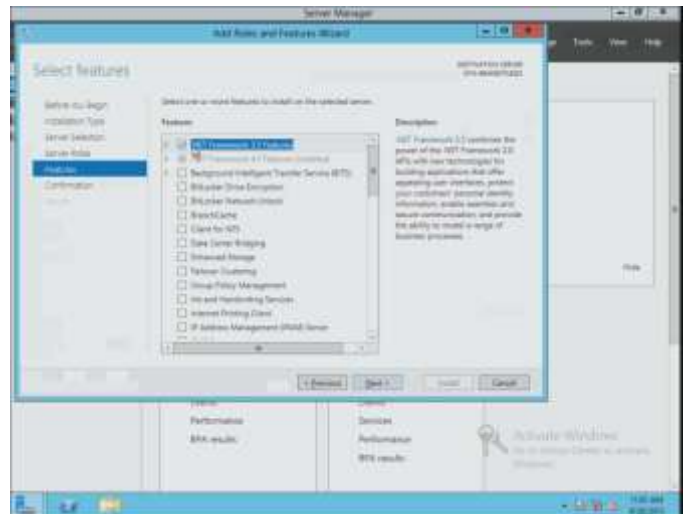
3. In Server Selection, The current sever is already selected. Click Next to continue.



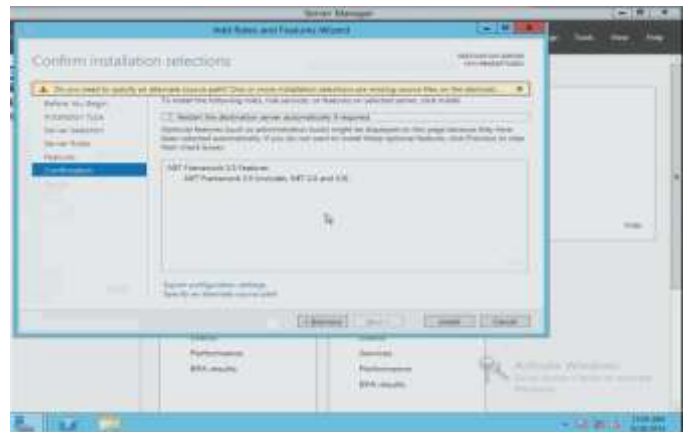
- The “Select Roles” options are displayed. Click next.



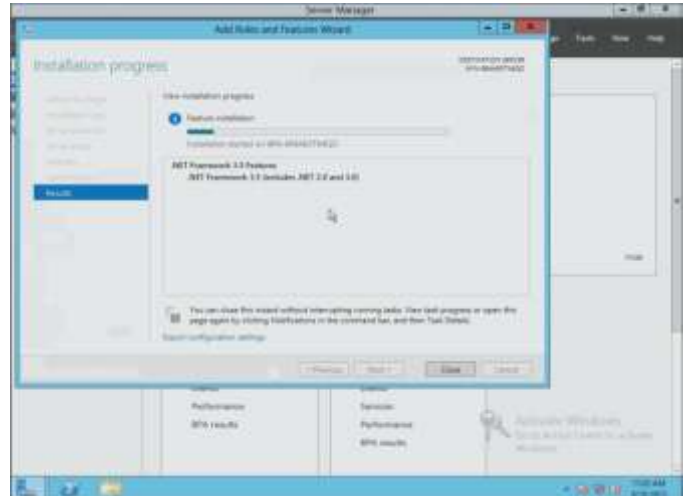
- Check “.NET Framework 3.5 Features” from the list. Click next to continue.



- Confirm the .Net 3.5 Framework feature to be installed. Click Install.



- Installation of the selected features and roles will begin. At the completion of the installation, press Close to exit.



- The Storage Management Console application can now be installed by executing the installation file, and completing the steps as directed.

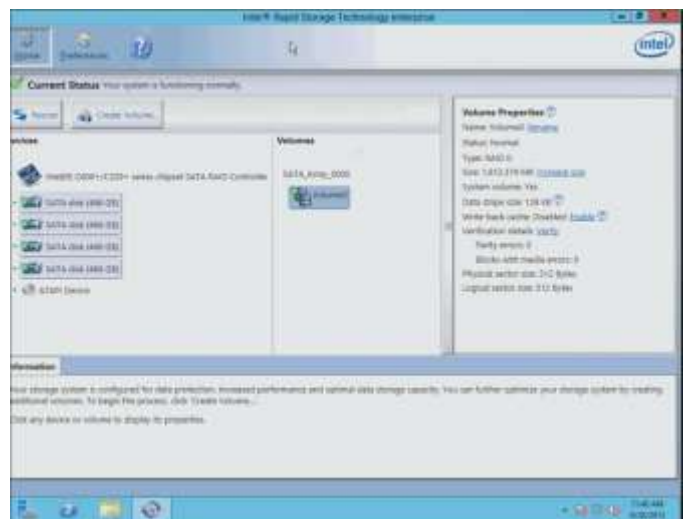
### Using the Storage Management Console

The Storage management Console can be used to locally manage RAID volumes and member drives, as well as configure alerts and notifications. This section gives a basic overview of these capabilities.

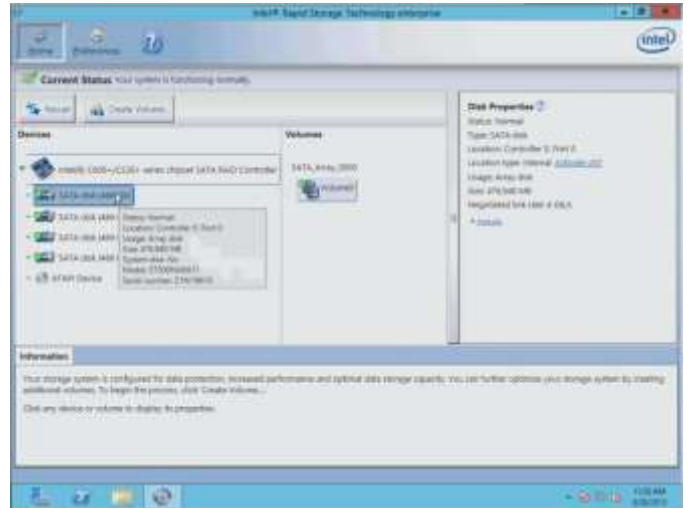
- When the system is active, a notification icon in the system tray reports basic health status of the RAID array and the member drives. Clicking the icon will open the management console.



- From the console status tab, health status of the storage subsystem is readily available. Clicking on the RAID Volume icon provides access to additional details about the array, and enables various management tasks.

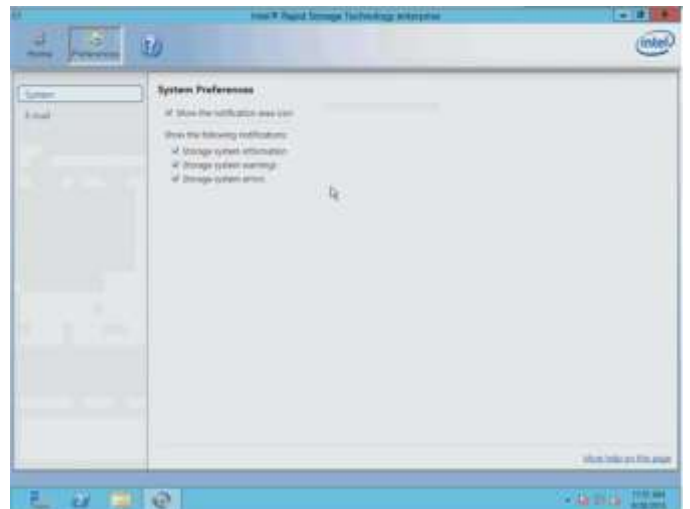


3. Clicking on the physical disk icon provides access to additional details about the HDD.



4. In the “Preferences” tab, System Preferences allows configuration of the types of notifications to be indicated locally in the system tray notification icon (see the Appendix – Monitor Service Event Detection for a list of supported events).

Select from the choices provided or disable notifications completely.

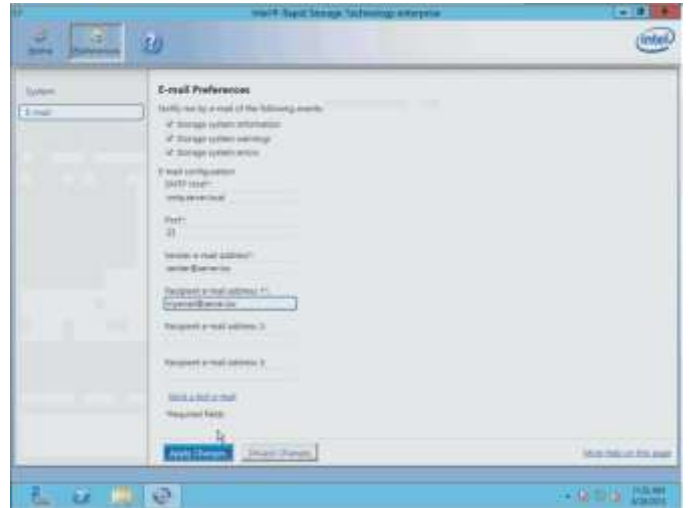


5. In the “Preferences” tab, E-mail Preferences enables configuring the platform to send alert emails for each storage subsystem event that gets reported by the RST monitor service (see the Appendix – Monitor Service Event Detection for a list of supported events).

Select from the choices provided to choose the types of notifications to be sent to an email address, or disable notifications completely. If notifications are selected, also provide the e-mail configuration settings:

- SMTP host (required)
- Port (required)
- Return email address (required)
- Recipient email addresses (one address required, up to 3 maximum)

Test e-mails can be sent to all addresses specified.



## Appendix – Monitor Service Event Detection

Event Type	Event Level	String	Notification Area Icon	Event Log	E-Mail Notification
<b>Disk Triggered Events</b>					
Failed	Error	Disk on port {n}: Failed. Open the application for details.	Yes	Yes	Yes
S.M.A.R.T.	Warning	Disk on port {n}: At risk. Open the application for details.	Yes	Yes	Yes
Unlocked	Info	Disk on port {n}: Unlocked.	Yes	Yes	Yes
Added	Info	Disk on port {n}: Detected.	Yes	Yes	Yes
Removed	Info	Disk on port {n}: Removed.	Yes	Yes	Yes
<b>RAID Volume Triggered Events</b>					
Failed	Error	Volume {n}: Failed. Open the application for details.	Yes	Yes	Yes
Degraded	Warning	Volume {n}: Degraded. Open the application for details.	Yes	Yes	Yes
Detected	Info	A new volume was found.	Yes	Yes	Yes
RebuildComplete	Info	Volume {n}: Rebuilding complete.	Yes	Yes	Yes
VerifyStop	Info	Volume {n}: Verification complete.	Yes	Yes	Yes
VerifyAndRepairStop	Info	Volume {n}: Verification and repair complete.	Yes	Yes	Yes
MigrationComplete	Info	Volume {n}: Data migration complete.	Yes	Yes	Yes
InitializeComplete	Info	Volume {n}: Initialization complete.	Yes	Yes	Yes
Unlocked	Info	Volume {n}: Unlocked.	Yes	Yes	Yes
NotPresent	Info	Volume {n}: No longer present on system.	Yes	Yes	Yes
RebuildStarted	Info	Volume {n}: Rebuilding in progress.	Yes	No	No
VerifyStarted	Info	Volume {n}: Verification in progress.	Yes	No	No
VerifyAndRepairStarted	Info	Volume {n}: Verification and repair in progress.	Yes	No	No
MigrationStarted	Info	Volume {n}: Data migration in progress.	Yes	No	No
InitializeStarted	Info	Volume {n}: Initialization in progress.	Yes	No	No
<b>General Events</b>					
Server start failed	Error	Server failed to start. Additional information:	No	Yes	Yes
Event manager started	Info	Started the event manager	No	Yes	Yes