# Windows Server 2008

# Linux Integration Services 3.4 for Hyper-V Readme

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## Abstract

This guide discusses the installation and functionality of Linux Integration Services for Hyper-V® technology when the components are installed on a virtual machine. This version supports the following versions of Hyper-V: Windows Server 2012, Microsoft Hyper-V Server 2012, Windows 8 Pro, Windows Server 2008 R2, Microsoft Hyper-V Server 2008 R2, Windows Server 2008, and Microsoft Hyper-V Server 2008.

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## Linux Integration Services Version 3.4 for Microsoft Hyper-V Features

When installed on a virtual machine that is running a supported Linux operating system, Linux Integration Services for Hyper-V provides the following functionality:

- **Driver support:** Linux Integration Services supports the network controller, and the IDE and SCSI storage controllers that were developed specifically for Hyper-V.

- **Fastpath boot support for Hyper-V:** Boot devices take advantage of the block Virtualization Service Client (VSC) to provide enhanced performance.

- **Time Keeping:** The clock inside the virtual machine will remain accurate by synchronizing to the clock on the virtualization server via Timesync service, and with the help of the pluggable time source device.

- **Integrated shutdown:** Virtual machines running Linux can be shut down from either Hyper-V Manager or System Center Virtual Machine Manager by using the "Shut down" command.

- **Symmetric multiprocessing (SMP) support:** Supported Linux distributions can use multiple virtual processors per virtual machine. The actual number of virtual processors that can be allocated to a virtual machine is only limited by the underlying hypervisor.

📝 **Note**

SMP support is not available for 32-bit Linux guest operating systems running on Windows Server 2008 Hyper-V or Microsoft Hyper-V Server 2008.

- **Heartbeat:** This feature allows the virtualization server to detect whether the virtual machine is running and responsive.

- **KVP (Key-Value Pair) Exchange:** Information about the running Linux virtual machine can be obtained by using the Key-Value Pair Exchange functionality on the Windows Server 2008 virtualization server.

- **Integrated mouse support:** Linux Integration Services provides full mouse support for Linux guest virtual machines.

- **Live Migration:** Linux virtual machines can undergo live migration for load balancing purposes.

- **Jumbo Frames:** Linux virtual machines can be configured to use Ethernet frames with more than 1500 bytes of payload.

- **VLAN tagging and trunking:** Administrators can attach single or multiple VLAN ids to synthetic network adapters.

## Supported Virtualization Server Operating Systems

This version of Linux Integration Services supports the following versions of Hyper-V:

- Windows Server® 2008 Standard, Windows Server 2008 Enterprise, and Windows Server 2008 Datacenter (64-bit versions only)
- Microsoft® Hyper-V Server 2008
- Windows Server 2008 R2 Standard, Windows Server 2008 R2 Enterprise, and Windows Server 2008 R2 Datacenter
- Microsoft Hyper-V Server 2008 R2
- Windows 8 Pro
- Windows Server 2012
- Microsoft Hyper-V Server 2012

📝 **Note**

Supported versions include those updated with Service Pack 1 or Service Pack 2, where available.

## Supported Guest Operating Systems

This version of Linux Integration Services supports the following guest operating systems:

- Red Hat Enterprise Linux 5.7, 5.8, 6.0-6.3 x86 and x64
- CentOS 5.7, 5.8, 6.0-6.3 x86 and x64

# Installing Linux Integration Services Version 3.4 on Red Hat Enterprise Linux 6

▶ **To install Linux Integration Services Version 3.4:**

1. Open Hyper-V Manager: Click **Start**, point to **Administrative Tools**, and then click **Hyper-V Manager**.
2. Create a new virtual machine where you will install Linux: In the **Actions** menu, click **New**, and then click **Virtual Machine**.

3. Specify the Linux installation media: Right-click the virtual machine that you created, and then click **Settings**. In **IDE Controller**, specify one of the following:

   - An image file in ISO format that contains the files required for installation
   - A physical CD/DVD drive that contains the installation media

4. Turn on the virtual machine: Right-click the virtual machine that you created, and then click **Connect**.

5. Begin installing Linux.

6. When prompted, restart the virtual machine and complete any first-boot configuration tasks.

   📝 **Note**

   > Unless a legacy network adapter was added during the virtual machine's initial configuration, the virtual machine will not have any network support.

7. Log on to the virtual machine.

8. In Hyper-V Manager, configure **LinuxICv34.ISO** (located in the directory where you extracted the downloaded files) as a virtual CD/DVD drive on the virtual machine.

9. Once configured, the **LinuxICv34.ISO** should appear mounted under `/media/CDROM` if automount is enabled. If automount is not enabled, use the following command to mount the ISO file:

   ```
   # mount /dev/cdrom /media
   ```

10. As the root user, change to the directory relevant to your distribution:

    For RHEL / CentOS 5.7:
    ```
    # cd /media/CDROM/RHEL57
    ```
    For RHEL / CentOS 5.8:
    ```
    # cd /media/CDROM/RHEL58
    ```
    For RHEL / CentOS 6.0, 6.1, 6.2:
    ```
    # cd /media/CDROM/RHEL6012
    ```
    For RHEL / CentOS 6.3:
    ```
    # cd /media/CDROM/RHEL63
    ```

11. Run the following command to install the Hyper-V-specific (or "synthetic") drivers. A reboot is required after installation.

    For RHEL / CentOS 5.7:
    ```
    # ./install-rhel57.sh
    ```
    For RHEL / CentOS 5.8:
    ```
    # ./install-rhel58.sh
    ```

For RHEL  / CentOS 6.0, 6.1, 6.2:
```
# ./install.sh
```
For RHEL / CentOS 6.3:
```
# ./install.sh
```

# Upgrading to Linux Integration Services Version 3.4 on Red Hat Enterprise Linux 6

▶ **To upgrade to Linux Integration Services Version 3.4 from Version 3.3:**

1.  Open Hyper-V Manager: Click **Start**, point to **Administrative Tools**, and then click **Hyper-V Manager**.

2.  In Hyper-V Manager, configure **LinuxIC v34.ISO** (located in the directory where you extracted the downloaded files) as a virtual CD/DVD drive on the virtual machine.

3.  Once configured the **LinuxICv34.ISO** should appear mounted under `/media/CDROM` if automount is enabled. If automount is not enabled then please use the following command to mount the ISO file:

    ```
    # mount /dev/cdrom /media
    ```

4.  As the root user, change to the directory relevant to your distribution:

    For RHEL  / CentOS 6.0, 6.1, 6.2:
    ```
    # cd /media/CDROM/RHEL6012
    ```
    For RHEL  / CentOS 6.3:
    ```
    # cd /media/CDROM/RHEL63
    ```

5.  Run the following command to upgrade the Hyper-V-specific (or "synthetic") drivers. A reboot is required after upgrade.

    ```
    # ./upgrade.sh
    ```

    ```
    # reboot
    ```

# Verifying Linux Integration Services Version 3.4 Functionality

Linux Integration Services provides support for the **modinfo** command. To get module information for each installed kernel module, run the following command:

```
# /sbin/modinfo hv_vmbus
filename:       /lib/modules/2.6.32-71.el6.i686/extra/hv_vmbus.ko
version:        3.4
license:        GPL
srcversion:     56F00728DAE99444BE1FD9B
alias:          acpi*:VMBus:*
alias:          acpi*:VMBUS:*
depends:
vermagic:       2.6.32-71.el6.i686 SMP mod_unload modversions 686
parm:           vmbus_loglevel:int
```

This command can be repeated for all kernel modules (hv_vmbus, hv_netvsc, hv_storvsc, hv_blkvsc, and hv_utils).

To verify that all subcomponents are running as the root user, issue the following command at a shell prompt:

```
# /sbin/lsmod | grep hv
```

The output should include lines similar to the following example:

```
hv_utils       42032  0
hv_netvsc      55424  0
hv_timesource  35584  0 [permanent]
hv_storvsc     47616  0
hv_mouse        3373  0
hv_vmbus       70120  3 hv_netvsc,hv_storvsc, hv_mouse,hv_utils,hv_timesource,[permanent]
```

📝 **Note**

Your file system type or other local factors might result in different file sizes in your deployment.

- "hv_netvsc" provides support for the Hyper-V-specific (or "synthetic") network adapter.
- "hv_storvsc" provides support for all storage devices.
- "hv_timesource" is the pluggable time source module to assist in accurate timekeeping in the virtual machine.
- "hv_vmbus" is the fast communication channel between the server running Hyper-V and the virtual machine.
- "hv_mouse" is the virtual mouse driver.
- "hv_utils" provides integrated shutdown, key-value pair data exchange, and heartbeat.

# Using Key-Value Pair (KVP) Exchange with a Linux Virtual Machine

After Linux Integration Services is installed on the virtual machine, Key-Value Pair Exchange functionality is activated. This allows the virtual machine to provide the following information to the virtualization server:

- Fully qualified domain name of the virtual machine
- Version of the Linux Integration Services that is installed
- IP addresses (both IPv4 and IPv6) for all Ethernet adapters in the virtual machine
- Operating system build information, including the distribution and kernel version
- Processor architecture (x86 or x86-64)

The data can be viewed using the Hyper-V WMI provider, and accessed through Windows PowerShell. Instructions for viewing Key-Value Pair Exchange data are available at these websites:

- http://social.technet.microsoft.com/wiki/contents/articles/hyper-v-script-to-check-ic-version.aspx
- http://blogs.msdn.com/b/virtual_pc_guy/archive/2008/11/18/hyper-v-script-looking-at-kvp-guestintrinsicexchangeitems.aspx

# Configuring the Hyper-V-specific Network Adapter in Red Hat Enterprise Linux

Use the network configuration tool (in System/Preferences/Network Connections) to configure the newly installed Hyper-V-specific (or "synthetic") network adapter. Configure the virtual Ethernet adapter, which is a Hyper-V-specific network card with enhanced performance. After successful configuration, **eth0** should appear in the output of the **ifconfig** command, similar to the following example:

```
$/sbin/ifconfig

eth0        Link encap:Ethernet HWaddr 00:15:5D:01:08:77
```

Alternatively, you can manually configure the network device to obtain an address through DHCP as follows. Note that if the file does not exist in step 1 or step 2, you will need to create the file.

1. Modify /etc/sysconfig/network to enable networking.

   ```
   NETWORKING=yes
   ```

2. Create /etc/sysconfig/network-scripts/ifcfg-eth0.
   ```
   DEVICE=eth0
   ONBOOT=yes
   BOOTPROTO=dhcp
   ```
3. Bring up the eth0 interface.
   ```
   ifup eth0
   ```

# Configuring the Hyper-V-specific Storage Controller in Red Hat Enterprise Linux

▶**To configure the Hyper-V-specific (or "synthetic") storage controller:**

1. If you have a SCSI disk attached, as the root user, execute the following command at a shell prompt:

   ```
   # cat /proc/scsi/scsi
   ```

   This displays the information for the Hyper-V-specific SCSI controller.

   ```
   Attached devices:

   Host: scsi0 Channel: 00 Id: 00 Lun: 00 Vendor: Msft Model: Virtual Disk Rev: 1.0

   Type: Direct-Access ANSI SCSI Revision: 04
   ```

   This indicates that the Hyper-V-specific SCSI controller has been enumerated correctly.

2. Next, as the root user, execute the following command at a shell prompt to verify that there are

disk(s) attached to the SCSI controller:

```
# ls /dev/sd*

brw-r----- 1 root disk 8,0 Nov 27 17:25 /dev/sda
```

3. After you confirm the presence of the disk(s), use the **fdisk** tool (as the root user) to create a partition on the disk.

# Uninstalling Linux Integration Services

▶ **To uninstall Linux Integration Services:**

Execute the following steps in the bash shell.

1. First, execute:

```
rpm –qa | grep microsoft
```

**Example:**

On a RHEL 5.8 system, you will see the following:

```
# rpm –qa | grep microsoft

kmod-microsoft-hyper-v-3.4-1.20120727

microsoft-hyper-v-3.4.20120727
```

2. Next, execute:

```
rpm –e microsoft-hyper-v-<version string from step 1> kmod-microsoft-hyper-v-<version

string from step 1>
```

**Example:**

On a RHEL 5.8 system, you may invoke:

```
# rpm –e microsoft-hyper-v-3.4.20120727 kmod-microsoft-hyper-v-3.4-1.20120727
```

# Additional Information About Linux Integration Services Version 3.4

## Release Notes

- To mount an ISO file in the virtual machine, you must run the following command before executing the **mount** command:

```
# insmod /lib/modules/$(uname -r)/kernel/drivers/ata/ata_piix.ko
```
Alternatively, copy the ISO file into the virtual machine and mount it using the -o loop option.

- Formatting a VHDX file with an ext3 file system might fail. To work around this issue, either use an ext4 file system, or create the .VHDX file with a smaller block size, such as 1 MB. Using the ext4 file system is recommended for production deployments of Linux on Hyper-V.

- Windows Server 2012 includes support for 4K sector size disks. However, the use of 4K drives is limited to Linux kernels that support them. Red Hat Enterprise Linux (RHEL) did not include support for 4K drives until version 6.0.

- Virtual machines running Ubuntu 12.04 might not work correctly if they are configured with a legacy network adapter. A workaround is to configure Ubuntu 12.04 virtual machines with only Hyper-V-specific (or "synthetic") network adapters. Ubuntu 12.04 includes the Linux Integration Services drivers.

- The command "lsmod | grep hv_" might not list the hv_netvsc driver. This occurs if the virtual machine is not configured with a Hyper-V-specific network adapter. The hv_netvsc driver is loaded only if a Hyper-V-specific network adapter is detected.

- The Hyper-V bridge.sys driver is not compatible with all WI-FI routers. This might result in a virtual machine not receiving an address through DHCP. This only occurs if the virtual machine's network switch is bound to a wireless network adapter and the WI-FI router is incompatible with bridge.sys. This issue does not occur when the network switch is bound to a wired network adapter.

  The following steps can be used to work around the issue:

  1. Configure the WI-FI router to assign a static IP address to the host's wireless network adapter.
  2. On the host, configure the wireless network adapter to use a static IP address. The IP address will be the same address configured in step 1.
  3. Using Hyper-V Manager, create an external network switch that is bound to the host's wireless network adapter.

- To ensure that all disks connected to the virtual machine are seen, all disks connected to a SCSI controller must start with location "0".

- If a disk was hot-removed from the system, the connected disks will not be rescanned until a new disk is added.

- To use kdump functionality, configure kdump before installing the Linux Integration Services.

- You might see entries in /var/log/messages similar to the following:
```
[   44.870261] STORVSC: WARNING! cmd 0x12 scsi status 0x2 srb status 0x4
```
These messages can be safely ignored.

- If you have virtual machines configured to use more than 7 virtual processors, you should add "numa=off" to the GRUB boot.cfg to work around a known issue in the Linux kernel.

- If you have virtual machines configured to use more than 30 GB RAM, you should add "numa=off" to the GRUB boot.cfg.
- If Linux Integration Services is removed from a virtual machine configured to use more than one virtual processor, then you should disable the irqbalance service to allow successful shutdown of the virtual machine.
- The ISO file also contains a .src.rpm (Source RPM) and debugging RPM. The debugging information should not be used unless instructed by Microsoft Support.
- This version of Linux Integration Services no longer includes the Hypercall adapter that was present in earlier versions.
- Verifying the digital signature of the RPM packages under Red Hat Enterprise Linux (by executing the rpm -K command) returns a "KEYS ARE NOT OK" message.
- Support for this version of Linux Integration Services is provided through the Microsoft TechNet forums (http://go.microsoft.com/fwlink/?LinkID=193443), or by contacting the appropriate support for Microsoft or Red Hat.
- Event log entries: You might see event log entries similar to the following. These messages can be safely ignored.
    - Networking driver on 'Virtual Machine' loaded but has a different version from the server. Server version 3.2 Client version 2.0 (Virtual machine ID DC1CCF5C-0C1A-4825-B32C-9A4F8F85AA9D). The device will work, but this is an unsupported configuration. This means that technical support will not be provided until this problem is resolved. To fix this problem, upgrade the integration services. To upgrade, connect to the virtual machine and select Insert Integration Services Setup Disk from the Action menu.
    - A storage device in 'Virtual Machine' loaded but has a different version from the server. Server version 4.2 Client version 2.0 (Virtual machine ID DC1CCF5C-0C1A-4825-B32C-9A4F8F85AA9D). The device will work, but this is an unsupported configuration. This means that technical support will not be provided until this problem is resolved. To fix this problem, upgrade the integration services. To upgrade, connect to the virtual machine and select Insert Integration Services Setup Disk from the Action menu.

## Features Not Available

The following features are not available in this version of Linux Integration Services:

- Integration services: Volume Snapshot Backup
- Networking: TCP Offload

# Important Considerations for Making Linux Virtual Machines Highly Available in Failover Clustering and Hyper-V

Linux virtual machines that will be deployed in a highly available scenario (using Failover Clustering) should be configured with static MAC addresses for each virtual network adapter. Because of the way Linux configures the network adapter, in some versions of Linux, it is possible that the networking configuration will be lost after failover because a new MAC address might be assigned to the virtual network adapter. To work around this issue, ensure that each virtual network adapter has a static MAC address by editing the settings of the virtual machine in Hyper-V Manager.