

# Linux Integration Services 3.5 for Hyper-V Readme

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Microsoft Corporation

Published: December 2013

## Abstract

Hyper-V supports both emulated (“legacy”) and Hyper-V-specific (“synthetic”) devices for Linux virtual machines. When a Linux virtual machine is running with emulated devices, no additional software is required to be installed. However, emulated devices do not provide high performance and cannot leverage the rich virtual machine management infrastructure that the Hyper-V technology offers. To make full use of all benefits that Hyper-V provides, it is best to use Hyper-V specific devices for Linux. The collection of drivers that are required to run Hyper-V-specific devices is known as Linux Integration Services (LIS).

For certain older Linux distributions, Microsoft provides an ISO file containing installable LIS drivers for Linux virtual machines. For newer Linux distributions, LIS is built into the Linux operating system, and no separate download or installation is required. This guide discusses the installation and functionality of LIS drivers on older Linux distributions. Please refer to [Linux Virtual Machines on Hyper-V](#) topics for up to date information on the LIS feature set, all supported Linux distributions, availability and download locations.

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## Contents

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Linux Integration Services 3.5 for Hyper-V Readme .....	
4	
Supported Virtualization Server Operating Systems .....	4
Supported Linux Distributions .....	4
Linux Integration Services 3.5 Feature Set .....	4
Installing Linux Integration Services 3.5 .....	
7	
Upgrading to Linux Integration Services 3.5 .....	
8	
Verifying Linux Integration Services 3.5 Functionality .....	
9	
Using Key-Value Pair (KVP) Exchange with a Linux Virtual Machine.....	
10	
Configuring the Hyper-V-specific Network Adapter in Red Hat Enterprise Linux .....	
11	
Configuring the Hyper-V-specific Storage Controller in Red Hat Enterprise Linux .....	
12	
Uninstalling Linux Integration Services.....	
12	

Source Code for Linux Integration Services 3.5 .....	13
Additional Information About Linux Integration Services 3.5 .....	
13 Release Notes .....	13
Features Not Available .....	15
Important Considerations for Making Linux Virtual Machines Highly Available in Failover Clustering and Hyper-V .....	
16	

# Linux Integration Services 3.5 for Hyper-V Readme

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## Supported Virtualization Server Operating Systems

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

- 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 8.1 Pro
- Windows Server 2012
- Windows Server 2012 R2
- Microsoft Hyper-V Server 2012
- Microsoft Hyper-V Server 2012 R2



### Note

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

## Supported Linux Distributions

This version of LIS supports the following legacy guest operating systems:

- Red Hat Enterprise Linux (RHEL) 5.5-5.8, 6.0-6.3 x86 and x64
- CentOS 5.5-5.8, 6.0-6.3 x86 and x64

Note that in comparison to LIS 3.4, LIS 3.5 expands the list of supported distributions to include RHEL/CentOS 5.5-5.6. Also note that this version of LIS only supports limited legacy Linux distributions. Please refer to the [Linux Virtual Machines on Hyper-V](#) topics for up to date information on the LIS feature set, all supported Linux distributions, availability and download locations.

## Linux Integration Services 3.5 Feature Set

When installed on a virtual machine that is running a supported Linux distribution, LIS 3.5 for Hyper-V provides the functionality listed in the table below. For comparative purposes, we also list the features available in LIS 3.4. This allows users to decide if they want to upgrade from LIS 3.4 to LIS 3.5.

More details on individual features can be found at <http://technet.microsoft.com/enus/library/dn531031.aspx>.

### Table Legend

√ - Feature available

(*blank*) - Feature not available

Feature	Hyper-V Version	RHEL/CentOS 6.0-6.3		RHEL/CentOS 5.7-5.8		RHEL/CentOS 5.5-5.6	
		LIS 3.5	LIS 3.4	LIS 3.5	LIS 3.4	LIS 3.5	LIS 3.4
<b>Core</b>	2012 R2, 2012, 2008 R2	√	√	√	√	√	
<b>Networking</b>							
Jumbo frames	2012 R2, 2012, 2008 R2	√	√	√	√	√	
VLAN tagging and trunking	2012 R2, 2012, 2008 R2	√	√	√	√	√	

Live migration	2012 R2, 2012, 2008 R2	√	√	√	√	√	
Static IP injection	2012 R2, 2012	√ Note 1	√ Note 1	√ Note 1		√ Note 1	
<b>Storage</b>							
VHDX resize	2012 R2	√		√		√	
Virtual Fibre Channel	2012 R2	√ Note 2		√ Note 2		√ Note 2	
Live virtual machine backup	2012 R2	√ Note 3, 4		√ Note 3, 4		√ Note 3, 4	
TRIM support	2012 R2						

**Notes**

Memory							
Configuration of MMIO gap	2012 R2	√	√	√	√	√	
Dynamic Memory – hot-add	2012 R2, 2012, 2008 R2						
Dynamic Memory – “ballooning”	2012 R2, 2012	√ Note 5		√ Note 5		√ Note 5	
Video							
Hyper-V-specific (“synthetic”) video device	2012 R2, 2012, 2008 R2	√		√		√	
Miscellaneous							
Key-value pair	2012 R2, 2012, 2008 R2	√		√		√	
Non-maskable interrupt	2012 R2	√	√	√	√	√	
PAE Kernel Support	2012 R2, 2012, 2008 R2	√	√	√		√	

1. Static IP injection might not work if Network Manager has been configured for a given HyperV-specific network adapter on the virtual machine. To ensure smooth functioning of static IP injection, ensure that either Network Manager is turned off completely, or has been turned off for a specific network adapter through its `lfcfg-ethX` file.
2. When you use Virtual Fibre Channel devices, ensure that logical unit number 0 (LUN 0) has been populated. If LUN 0 has not been populated, a Linux virtual machine might not be able to mount Virtual Fibre Channel devices natively.
3. If there are open file handles during a live virtual machine backup operation, the backed-up virtual hard disks (VHDs) might have to undergo a file system consistency check (fsck) when restored.
4. Live backup operations can fail silently if the virtual machine has an attached iSCSI device or a physical disk that is directly attached to a virtual machine (“pass-through disk”).
5. LIS 3.5 only provides Dynamic Memory ballooning support—it does not provide hot-add support. In such a scenario, the Dynamic Memory feature can be used by setting the **Startup memory** parameter to a value which is equal to the **Maximum memory** parameter. This results in all the requisite memory being allocated to the virtual machine at boot time—and then later, depending upon the memory requirements of the host, Hyper-V can freely reclaim any memory from the guest. Also, ensure that Startup Memory and Minimum Memory are not configured below distribution recommended values.

# Installing Linux Integration Services 3.5

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▶ **To install Linux Integration Services 3.5:**

1. Open 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 **LinuxIcV35.ISO** (located in the directory where you extracted the downloaded files) as a virtual CD/DVD drive on the virtual machine.
9. After it is configured, **LinuxIcV35.ISO** should appear mounted under `/media/CDROM` if automount is enabled. If automount is not enabled, then 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 5.5:

```
# cd /media/CDROM/RHEL55
```

For RHEL / CentOS 5.6:

```
# cd /media/CDROM/RHEL56
```

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 5.5:
# ./install-rhel55.sh
For RHEL / CentOS 5.6:
# ./install-rhel56.sh
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 3.5

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### To upgrade to LIS 3.5 from LIS 3.4:

1. Open Hyper-V Manager.
2. In Hyper-V Manager, configure **LinuxIcv35.ISO** (located in the directory where you extracted the downloaded files) as a virtual CD/DVD drive on the virtual machine.
3. After it is configured, **LinuxIcv35.ISO** should appear mounted under `/media/CDROM` if automount is enabled. If automount is not enabled, then 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 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
```

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 3.5 Functionality

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LIS 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.x86_64/extra/microsoft-hyperv/hv_vmbus.ko version: 3.5 license: GPL srcversion: ACE0AA64B58744D00E54C12 alias: acpi*:VMBus:* alias: acpi*:VMBUS:* depends: vermagic: 2.6.32-71.el6.x86_64 SMP mod_unload modversions
```

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, run the following command:

```
# /sbin/lsmmod | grep hv
```

The output should include lines similar to the following:

```
hv_balloon          10538  0 [permanent] hv_netvsc          24309  0
hv_utils            9499   0 hv_timesource      1079   0 [permanent]
hv_storvsc         11641  2 hv_vmbus          146721  7
hv_balloon,hid_hyperv,hv_netvsc,hv_utils,hv_timesource,hyperv_fb,hv_storvsc
```



### Note

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

- “hv\_balloon” provides Dynamic Memory support for virtual machines.
- “hv\_netvsc” provides support for a Hyper-V-specific (or “synthetic”) network adapter.□
- “hv\_utils” provides integrated shutdown, key-value pair data exchange, heartbeat, mouse and live backup.
- “hv\_timesource” is the pluggable time source module to assist in accurate timekeeping in the virtual machine.
- “hv\_storvsc” provides support for all storage devices attached to a virtual machine.
- “hv\_vmbus” is the fast communication channel between the server running Hyper-V and the virtual machine.

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

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After LIS is installed on the virtual machine, key-value pair 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 LIS 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-icversion.aspx>
- [http://blogs.msdn.com/b/virtual\\_pc\\_guy/archive/2008/11/18/hyper-v-script-looking-at-kvpquestintrinsicexchangeitems.aspx](http://blogs.msdn.com/b/virtual_pc_guy/archive/2008/11/18/hyper-v-script-looking-at-kvpquestintrinsicexchangeitems.aspx)

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

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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

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 **To configure the Hyper-V-specific (or “synthetic”) storage controller:**

1. If you have a SCSI disk attached, as the root user, run the following command:

```
# 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, run the following command 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

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To uninstall LIS, run the following steps:

1. `rpm -qa | grep microsoft`

Example: On a RHEL 6.0 system, you will see the following:

```
# rpm -qa | grep microsoft microsoft-hyper-v-rhel6012.3.5-1.20131031.x86_64 kmod-microsoft-hyper-v-rhel6012.3.5-1.20131031.x86_64
```

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

Example: On a RHEL 6.0 system, you may invoke:

```
# rpm -e microsoft-hyper-v-rhel6012.3.5-1.20131031.x86_64 kmod-microsoft-hyper-v-rhel6012.3.5-1.20131031.x86_64
```

## Source Code for Linux Integration Services 3.5

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You can access LIS 3.5 source code in two ways:

a) **Source RPMs on the LIS 3.5 ISO.** All LIS 3.5 source code is available inside the LIS 3.5 ISO. In the folder for each distribution, you should see a `Src.rpm` file. As an example, in the folder `RHEL58`, you should see a file named `Microsoft-hyper-v-3.5-1.20131102.src.rpm`.

This rpm can be installed using the `rpm -iv microsoft-hyper-v-3.5-1.20131102.src.rpm` command, and then you can browse the source code for RHEL 5.8 at `/root/rpmbuild`.

Similar `src.rpm` files exist for all distributions supported by LIS 3.5.

b) **GitHub repository for LIS 3.5.** To simplify code access, we have also created a GitHub repository for LIS 3.5. The link to the repository is: <https://github.com/LIS/LIS3.5>

## Additional Information About Linux Integration Services 3.5

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## Release Notes

- To mount an ISO file in the virtual machine, you must run the following command before running 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 it. Red Hat Enterprise Linux (RHEL) did not include support for 4K drives until version 6.0.
- 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. Similarly, the *hv\_balloon* driver might not show up in the list if Dynamic Memory has not been configured for the virtual machine.
- The Hyper-V bridge.sys driver is not compatible with all Wi-Fi routers. This may result in a virtual machine not receiving an address through DHCP. This only occurs if the virtual machine's virtual 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 virtual 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 hosts 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 that was configured in step 1.
  3. Using the Hyper-V Manager, create an external virtual switch that is bound to the host's wireless network adapter.
- To ensure 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 I/O is initiated.
  - If you would like to use **kdump** functionality on a server running Hyper-V released prior to Windows Server 2012 R2, then configure **kdump** before installing LIS. No preconfiguration of **kdump** is required if you are running virtual machines on Windows Server 2012 R2.
  - 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.

- Virtual machines configured to use more than 7 virtual processors should add “numa=off” to the GRUB boot.cfg to work around a known issue in the Linux kernel. This is a due to a known issue on 2.6.x Linux kernels.
- Virtual machines configured to use more than 30 GB RAM should add “numa=off” to the GRUB boot.cfg.
- If LIS is removed from a virtual machine configured to use more than one virtual processor, then the irqbalance service should be disabled 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 LIS 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 running the **rpm -K** command) will return a “KEYS ARE NOT OK” message.
- Support for this version of LIS is provided through the Microsoft TechNet forums (<http://social.technet.microsoft.com/Forums/windowsserver/enus/home?forum=linuxintegration/services>), or by contacting the appropriate support channels for Microsoft or Red Hat.
- On AMD 4100 and 6000 series, you might see panics while booting RHEL 5.5 on Hyper-V. This is due to an issue in the Linux kernel, and Red Hat has addressed it here: <https://access.redhat.com/site/articles/37935>
- If both legacy and Hyper-V-specific (“synthetic”) network adapters are attached to a virtual machine, then the network names in the output of “ifconfig -a” might show random values such as “\_\_tmp12000801310”. To avoid this issue, remove all legacy network adapters when using Hyper-V-specific network adapters in a Linux virtual machine.
- While running LIS 3.5, you might see the following entries in Hyper-V event logs on the host:
  - 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-B32C9A4F8F85AA9D). 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.

**Users can safely ignore these entries. Microsoft will provide the requisite technical support even if these entries are logged in the system.**

## Features Not Available

The following features are not available in this version of LIS:

- Dynamic Memory hot-add support
- TRIM support
- TCP offload□
- vRSS□

## 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.