IBM ioMemory VSL 4.1.0



Release Notes

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Introduction

This document describes details about the 4.1.0 ioMemory VSL software release:

- System requirements, including supported operating systems and hardware requirements.
- Upgrade Notes, including the firmware version required for this release.
- Changes since the last generally available release.
- Issues that may arise using this release.

NOTE-

Throughout this document, when you see a reference to an IBM io3 Flash Adapter, you may substitute your particular device(s) from the list of <u>See Supported Devices on page 9</u>.

System Requirements

This section outlines the hardware requirements, supported devices, and supported operating systems for this release of the ioMemory VSL software.

Hardware Requirements

NOTE-

For complete hardware requirements and installation instructions, please refer to the *IBM io3 Flash* Adapter Hardware Installation Guide.

NOTE-

For the latest IBM System x server configuration information and requirements for IBM io3 Flash Adapters, please see the URL below:

http://www.ibm.com/support/entry/portal/docdisplay?Indocid=SERV-IO3

Sufficient System Memory (RAM)

The amount of RAM the ioMemory VSL software requires varies according to the average block size written to the device. Using the average block size table below, you can estimate the amount of system memory needed.

Sector Sizes

Depending on your operating system, you can reduce worst-case memory use by formatting your IBM io3 Flash Adapter with a 4096-byte sector size and thereby force the average written block size to be 4096 bytes (4KiB) or greater. However, some operating systems do not allow 4KiB sector sizes.

io3 Enterprise Value Adapters and io3 Enterprise Adapters ship with 4KiB sector sizes.

Attention!

512B-only Support

Some applications and operating systems will only work with 512B sector sizes. These operating systems include: VMware ESXi.

Consult the fio-format section for your operating system's *IBM ioMemory VSL User Guide* for more information.

Attention!

Windows 4KiB Support

While Microsoft does not officially support 4KiB sector sizes with Windows Server 2008 R2, 4KiB sector sizes do work with many applications. The performance benefit of 4KiB sectors is significant enough in Windows operating systems that we recommend testing 4KiB sectors for use with your application.

Microsoft does support 4KiB sector sizes on Windows Server 2012.

Even if you cannot use a device formatted with native 4KiB sector sizes, the average write I/O size for most workloads is 4KiB or larger. For this reason, 4KiB average write size is typically the most accurate representation of memory utilization.

Maximum RAM Requirements

The amount of RAM required by the ioMemory VSL software depends on the IBM io3 Flash Adapter capacity, formated sector size, and how it is used. This section describes the upper limit of RAM that may be required of your system in a worst-case scenario.

	Worst case GB of RAM Required for Formatted Block Sizes (bytes)			
Device Capacity	4096-byte Blocks	2048-byte Blocks	1024-byte Blocks	512-byte Blocks
1.0TB	2.4GB	4.7GB	9.2GB	18.2GB
1.25TB	3.0GB	5.8GB	11.4GB	22.6GB
1.3TB	3.1GB	6.0GB	11.8GB	23.5GB
1.6TB	3.7GB	7.3GB	14.5GB	28.8GB
2.6TB	6.0GB	11.8GB	23.5GB	46.9GB
3.2TB	7.3GB	14.5GB	28.8GB	57.8GB
5.2TB	11.7GB	23.3GB	46.4GB	92.6GB
6.4TB	14.3GB	28.5GB	59.9GB	113.7GB

For example, if your system is equipped with a device that has a total capacity of 3200GB (3.2TB) formatted to use 4096 byte sectors, your system may require as much as 7.3GB of system RAM in a worst-case scenario.

Attention!

The amount of RAM used by the ioMemory VSL software will depend on your use case; the table entries above are worst-case numbers. Actual RAM usage will likely be less than the amount listed.

You may run fio-status -a on the command line to see how much RAM the ioMemory VSL software is using per IBM io3 Flash Adapter.

Supported Devices

io3 Enterprise Value Adapter

- IBM 1250GB Enterprise Value io3 Flash Adapter for Systems x
- IBM 1600GB Enterprise Value io3 Flash Adapter for Systems x
- IBM 3200GB Enterprise Value io3 Flash Adapter for Systems x
- IBM 6400GB Enterprise Value io3 Flash Adapter for Systems x

io3 Enterprise Adapter

- IBM 1000GB Enterprise io3 Flash Adapter for Systems x
- IBM 1300GB Enterprise io3 Flash Adapter for Systems x
- IBM 2600GB Enterprise io3 Flash Adapter for Systems x
- IBM 5200GB Enterprise io3 Flash Adapter for Systems x

NOTE-

The Supported Devices referenced in this documentation are referred to throughout as IBM io3

Flash Adapters. Substitute your particular adapter for IBM io3 Flash Adapter when referenced in this documentation.

Supported Operating Systems

All operating systems must be 64-bit and they must be x86 architecture to support IBM io3 Flash Adapters. Running the latest service pack / update of a release is strongly recommended.

Supported Microsoft Windows Operating Systems

- Microsoft Windows Server 2008 R2 SP1 64-Bit
- Microsoft Windows Server 2012
- Microsoft Windows Server 2012 R2
- Microsoft Hyper-V Server 2012
- Microsoft Hyper-V Server 2012 R2

NOTE-

IBM io3 Flash Adapters cannot be used as hibernation devices.

Hyper-V support

Hyper-V, as a Type 2 hypervisor on top of Windows Server 2008 R2, Windows Server 2012, or Windows Server 2012 R2, is supported.

Attention!

With Hyper-V on Windows Server 2008 R2, only a 512B sector size is supported on IBM io3 Flash Adapters. For more information on sector sizes in Windows, see the following Microsoft Knowledge Base article:http://support.microsoft.com/kb/2510009.

Supported Linux Distributions

Attention!

The following distributions are supported. Some distribution versions may have binary packages available for download. If your version does not have a binary package available, you can build the installation package from the available source package. Check the download folders for available packages.

- Red Hat Enterprise Linux 5 (up to 5.10), 6 (up to 6.5), 7.0
- SUSE Linux Enterprise Server (SLES) 11, 11 SP2, 11 SP3

Supported VMware Operating Systems

- ESXi 5.1
- ESXi 5.5

NOTE-

All ESXi updates are supported unless otherwise specified.

NOTE-

Only SCSI versions of the ioMemory VSL software for ESXi are supported.

IBM io3 Flash Adapters are only compatible with operating systems that are 64-bit x86 architecture. This means the following scenarios are supported:

- 1. Using the IBM io3 Flash Adapter as VMFS datastore within the hypervisor, and then sharing that storage with guest operating systems. Guest operating systems can be 32-bit or 64-bit because they are not directly using the IBM io3 Flash Adapter.
- 2. Using VMDirectPathIO, allow a virtual machine to directly use the IBM io3 Flash Adapter. In this case, only supported operating systems can use the device.

Attention!

VMDirectPathIO is currently supported on Windows and Linux operating systems that are supported by IBM.

See either the *IBM ioMemory VSL User Guide for Linux* or the *IBM ioMemory VSL User Guide for Windows* for installation instructions.

If you are using VMDirectPathIO, you do not need to install the ioMemory VSL software on the ESXi system. Instead, install the driver on the guest system. Only install the driver if you plan on creating a VMFS on the device(s). For more information on using VMDirectPathIO, see the VMDirectPathIO appendix in the *IBM ioMemory VSL User Guide for ESX and ESXi*.

Upgrade Notes

This version of the ioMemory VSL software only supports io3 Enterprise Adapters and io3 Enterprise Value Adapters, and it does not support devices that were compatible with ioMemory VSL software version 3.x.x or earlier.

Firmware Version

Use the firmware archive file that is released with this version of the ioMemory VSL software. The archive file fio-firmware-highiops-<version>.<date>.fff contains the controller firmware version 8.7.5.117244 for all IBM io3 Flash Adapters.

If the current controller firmware version on any device is lower than the version number listed above, we recommend upgrading to the latest version. However, this version of the ioMemory VSL software will work with any controller firmware versions within this range:

- Minimum firmware required with this release: 8.7.2
- Maximum firmware version supported with this release: 8.7.254

Do Not Downgrade Device Firmware

Attention!

Do not downgrade the IBM io3 Flash Adapter to an earlier version of the firmware. Earlier versions of the firmware are not compatible with the device, and downgrading the firmware will result in data loss. If you have issues with your firmware upgrade, contact Customer Support <u>http://www.ibm.com/systems/support</u> for compatibility information and to discuss your use case.

Change Log

4.1.0 Change Log

In addition to various improvements, the following are changes made to the ioMemory VSL software since version 3.2.8, including:

General Changes

General Improvements and Features

- Updated support for IBM io3 Flash Adapters, See See Supported Devices on page 9 for details.
- Updated supported operating systems. See See Supported Operating Systems on page 10 for details.
- Improved read and write IOPS by reducing per IO overhead.
- Improved sustained IO performance by improving the performance of internal data movement operations.
- Increased the number of PCI devices that the fio-pci-check utility can detect.
- Reduced the size of system log entries for watchdog events by converting the entries to a binary format.
- The ioMemory VSL software name has changed from iomemory-vsl to iomemory-vsl4. You may need to update any scripts made for previous versions of the ioMemory VSL software.
- Support for upgrading firmware on newer IBM io3 Flash Adapters while the device is attached. For more information, see the fio-update-iodrive documentation in the *IBM ioMemory VSL User Guide* for your platform.

Fixed General Issues

• Issues with more than 384 PCI functions

Issue	When running ioMemory VSL software utilities on a system with more than 384 PCIe functions, the utility may fail a segfault.
Resolution	The ioMemory VSL software utilities will no longer fail with this many PCIe functions.

Windows Changes

Fixed Windows Issues

• Issues with multiple PCI domains

Issue	Not all IBM io3 Flash Adapters would attach in a system configured with multiple PCI domains and many IBM io3 Flash Adapters installed (for example, more than 32 devices). This was due to PCI address collisions.
Resolution	The ioMemory VSL software now detects the domain number to avoid address collisions.

• PCI address not printing for each device

Issue	The ioMemory VSL softwaree utilities did not print the PCI address of each IBM io3 Flash Adapter in the system.
Resolution	The utilities now print the the PCI address of each device.

Linux Changes

Linux Improvements

• New ioMemory VSL utility fio-firmware, available for Linux operation systems, allows you to determine the firmware version on each IBM io3 Flash Adapter installed in the system without loading the ioMemory VSL software driver. See the *IBM ioMemory VSL User Guide for Linux* for more information.

Known Issues

This section describes issues you may encounter when using this ioMemory VSL release.

General

Don't disable CPUs after loading the ioMemory VSL driver

If you plan to take any CPUs offline (including disabling Hyper-Threading Technology), you should do so before the ioMemory VSL driver loads and begins to use the available CPUs. If you disable any CPUs that were being used by the ioMemory VSL software, then the software may hang.

Keep default Message Signaled Interrupts for better performance

All IBM io3 Flash Adapters use message signaled interrupts (MSI). This improves performance while decreasing CPU load.

If you wish to continue using legacy interrupts, set the disable_msi VSL module parameter value to 1. For examples on setting module parameters, please see the **Module Parameter** appendix in the *IBM ioMemory VSL User Guide* for your platform (Windows uses the fio-config utility and the parameter is in all caps: DISABLE_MSI).

Proper Time On Startup

If the IBM io3 Flash Adapter does not boot up with proper time set on system, this may delay starting the software as the ioMemory VSL software self-tunes to the difference between the reflected age data and actual age of data.

If the time is set backwards on a running system, this may result in decreased card performance for the lesser of 1 day or the amount the time is set backwards.

"Proper time" is within a few minutes of actual time.

Management Specific

Make sure the utilities match the ioMemory VSL software version

When you install this version of the ioMemory VSL software, ensure that you install the utilities that go with this version. Each set of utilities is designed to work with a specific version of the ioMemory VSL software.

If you use a set of utilities that does not match the ioMemory VSL software, you may see an error in the command line or logs such as unhandled ioctl or Error: This version of <utility> is not compatible with the running driver. To solve this issue, reinstall the utilities using the package with the correct version number.

Utility failed while running fio-bugreport

The fio-bugreport utility uses other utilities to create the report. Depending on the operating system, some of these additional utilities may not be available and fio-bugreport will display an error that a fio utility failed or was not found.

The fio-bugreport utility is designed to continue even if a component fails and the report will still be created.

fio-status may not display failed devices

On rare occasions, when an IBM io3 Flash Adapter fails, the device may no longer appear in fio-status. If your device has failed, contact Customer Support.

Windows Specific

ioMemory VSL software not loading or attaching devices after install

If the ioMemory VSL software is not loading or attaching IBM io3 Flash Adapters after installation (including an upgrade), make sure that you have rebooted the system after the installation.

If a reboot does not solve the problem, follow the manual installation procedure in the appendix of the *IBM ioMemory VSL User Guide for Windows*. Repeat this procedure to install each device.

Linux Specific

The 3.14 kernel is incompatible with the ioMemory VSL software

This version of the ioMemory VSL software is not compatible with the 3.14 Linux kernel. You should not attempt to use this version of the ioMemory VSL software with the 3.14 Linux kernel.

SCSI Performance Limitations on OracleVM

The OracleVM requires the use of a SCSI interface for IBM io3 Flash Adapters. Due to SCSI performance limitiations inherent in the Linux kernel, performance is limited compared other operating systems.

Upgrading the Kernel in Linux

If you ever plan to upgrade the kernel when the ioMemory VSL software is installed, you must:

- 1. Unload the ioMemory VSL driver.
- 2. Uninstall the ioMemory VSL software.
- 3. Upgrade the kernel.
- 4. Install an ioMemory VSL software package that is compiled for the new kernel.

Failure to follow this procedure may result in driver load issues.

Compiler Cache (ccache) causes ioMemory VSL software src.rpm rebuild failures on some distributions

If the ccache package is installed, rebuilding the ioMemory VSL software src.rpm may fail with an error similar to the following:

```
CC [M] /root/fio/iomemory-vsl-<version>/root/usr/src/iomemory-vsl/driver_
init.o /root/fio/iomemory-vsl-<version>/root/usr/src/iomemory-vsl/driver_
init.c:116: error: initializer element is not constant
[...]
```

To allow the VSL to rebuild, remove the ccache package or disable ccache.

Rare error on driver unload using kernels older than 2.6.24

An issue in Linux kernels prior to 2.6.24 can cause a general protection fault or other kernel error when the driver is unloaded. This issue also affects non-IBM drivers. The issue has been resolved in newer kernels.

Because this is an issue in the Linux kernel, IBM cannot resolve this issue for older kernels.

ext4 in Kernel 2.6.33 or earlier may silently corrupt data when discard (TRIM) is enabled

The ext4 filesystem in kernel.org kernel 2.6.33 and earlier has an issue where the data in a portion of a file may be improperly discarded (set to all 0x00) under some workloads. Use the 2.6.34 Linux kernel or newer to avoid this issue. For more info see the patch [1] and bug report [2] below.

The fix is included in RHEL6 as of pre-release kernel kernel-2.6.32-23.el6. The production RHEL6 kernel is not affected by this issue.

Discard support was added to the kernel.org mainline ext4 in the 2.6.28 Linux kernel and was enabled by default. Discard was set to default to disabled in v2.6.33-rc1 and was back ported to 2.6.31.8 and v2.6.32.1.

- 1. http://git.kernel.org/?p=linux/kernel/git/torvalds/linux-2.6.git;a=commitdiff;h=b90f687018e6d6
- 2. https://bugzilla.kernel.org/show_bug.cgi?id=15579
- 3. http://git.kernel.org/?p=linux/kernel/git/torvalds/linux-2.6.git;a=commitdiff;h=5328e635315734d

Kernels 2.6.34/35 don't handle switching interrupt types

Linux kernels around 2.6.34/35 may have problems processing interrupts if the ioMemory VSL driver is loaded using one interrupt type, unloaded, and then loaded again using a different interrupt type. The primary symptom is that the ioMemory device is unusable, and the kernel logs have errors with "doIRQ". For example, the following sequence on an affected system would likely result in errors.

1. Load the driver with the module parameter disable msi=1 which selects APIC interrupts

```
$ modprobe iomemory-vsl4
$ modprobe -r iomemory-vsl4
```

2. Load the driver, enabling MSI interrupts

\$ modprobe iomemory-vsl4 disable_msi=0

To work around this issue, reboot if you see the error and always load with the same interrupt type selected. To change between interrupt types, reboot first.

RHEL6 udevd warning

When using an IBM io3 Flash Adapter under RHEL6 (or any Linux distro with udev version 147 or greater), udevd may emit the following innocuous messages:

```
udevd[154]: worker [19174] unexpectedly returned with status 0x0100
udevd[154]: worker [19174] failed while handling
'/devices/virtual/block/fioa'
```

You can ignore this warning.

RHEL6 warn_slowpath during device attach

When attaching an IBM io3 Flash Adapter under RHEL6, you may find log messages similar to the following:

This is due to an issue in the 2.6.32 kernel, and the warning can safely be ignored.

Switching interrupt types with newer kernels can cause errors

With newer Linux kernels, switching interrupt types after initial driver load can cause doIRQ errors to be reported by the kernel. As a work around, reboot your system before loading the driver with the new interrupt type specified.

Do not use an IBM io3 Flash Adapter as a kdump target

Do not direct kdump to dump the crash information to an IBM io3 Flash Adapter. Due to the restricted memory environment in kdump, the ioMemory VSL software should not load in the kdump crashkernel and IBM io3 Flash Adapters are not supported as kdump targets.

VMware Specific

ESXi 5.5 Rollup Driver Installer

The Rollup Driver installer for ESXi 5.5 includes version 3.2.6 of the ioMemory VSL software. If you use this version of the ESXi 5.5 installer, you will need to uninstall ioMemory VSL version 3.2.6 before you install any newer version, such as this version 4.1.0 of the ioMemory VSL software. See the *IBM ioMemory VSL User Guide for VMware ESXi* for more information.

Only 512B Sectors Supported

Only a 512B sector size is supported onVMware hypervisors. After you install the ioMemory VSL software, you must reformat the sectors to a 512B size on io3 Enterprise Value Adapters and io3 Enterprise Adapters before using the devices. Consult the fio-format section of the *IBM ioMemory VSL User Guide* for more information.

ESXi 5.x injected installer allows installation on an IBM io3 Flash Adapter

IBM io3 Flash Adapters are not designed to be bootable, therefore you should not install the host OS on an IBM io3 Flash Adapter. The ESXi injected installer will permit you to install the OS on an IBM io3 Flash Adapter, but the installation will fail on reboot.

vCenter cannot manage extents on IBM io3 Flash Adapters

You cannot use vSphere vCenter to manage extents on IBM io3 Flash Adapters, including growing or spanning extents. However, you can connect directly to the host using the vSphere client and manage extents on IBM io3 Flash Adapters.

Download Location

Software, utilities, and related documentation for this version can be found at http://www.ibm.com/support/entry/portal/docdisplay?Indocid=MIGR-65723 (follow that link and then select IBM High IOPS and io3 software matrix)