



CATE Storage and Backup Engineering
Citigroup Architecture & Technology Engineering

NetApp FAS6040/6080

CSBE-08032-RN

Release Notes

Version 1.4.1

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1 Version Control

Version	Date	Author	Reviewed	Comments
0.1	10-OCT-2008	Richard Sopp	Stephen Hopkins	Peer Review
0.2	21-OCT-2008	Richard Sopp	Stakeholders	RFC
1.0	29-OCT-2008	Richard Sopp	Stakeholders	Production Release
1.1	22-DEC-2008	Richard Sopp	n/a	AT-FCX FW 37 and 450GB FC drives
1.2	06-AUG-2010	Richard Sopp	n/a	DS4243 and Flash Cache support added
1.3	28-JUN-2013	Richard Sopp	n/a	Add RLM F/W 4.1 Add bug 618662 Other updates
1.4	23-JUL-2013	Richard Sopp	Stakeholders	Production Release
1.4.1	26-JUL-2013	Richard Sopp	Stakeholders	Change to bug 618662 procedure

2 Legal Notice

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3 Contact

Please address any comments or questions regarding the information contained in this document via email to the “CATE Storage and Backup Engineering” distribution list or alternatively to gdse@citi.com.

4 Latest Versions

It is recommended that the latest version of the document be used from the CATE Storage Engineering website <https://catecollaboration.citigroup.net/domains/platstor/gdse/Pages/default.aspx>. Newer versions may include certification on additional platforms, or comments on issues discovered after deployment.

5 Regional Reviewers

The purpose of this section is to list all the stakeholders who reviewed this document during the Request for Comment process.

Region	Reviewed by
Asia Pacific	No response received
EMEA	Jason Palmer, Paul Mcinerney
Japan	No response received
Latin America / Mexico	n/a
North America	No response received

5.1 - Regional stakeholder review

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7 Introduction

The second generation FAS6000 series hardware platform (FAS6040 and FAS6080) replaces the existing first generation FAS6030 and FAS6070 hardware due to the vendor End of Availability of the first generation systems on 15th November 2008. The scope of these release notes is to provide hardware related best practices for the use of the FAS6040/6080 for ONTAP 7G environments.

The FAS6000 series are traditionally used in environments where a large amount of archive storage needs to be served by a single storage controller, or in I/O intensive environments that benefit for the extra CPU and cache resources available over the mid-tier NAS offerings from NetApp.

7.1 Operating System dependencies

The following operating system version (ONTAP) dependencies apply when considering use of the FAS6040 and 6080. The following table demonstrates which hardware platform is supported with ONTAP 7G.

Supported Platform	ONTAP 7G
FAS6040	Y
FAS6080	Y

7.1 - Hardware platform by Operating System Support Matrix

The second generation FAS6000 series support more CPU cores are available for processing, however for certain ONTAP releases these extended resources are not immediately available. The table below provides a list of the minimum required version of ONTAP and the release in which the extended CPU resources are leveraged. At the time of writing this document some of the versions of ONTAP may not have been released by NetApp or alternately may not have been certified for use within Citi.

Functionality	ONTAP 7G
Minimum support	7.2.4
Extended CPU usage	7.3

7.2 - Minimum ONTAP required

7.2 Summary of differences between 6030/6070 and 6040/6080

The main differences between the first and second generation hardware are summarized in the following table. The values listed below are per Filer. If deploying a clustered environment then the following numbers need to be doubled.

Feature	6030 → 6040	6070 → 6080
CPU (# Cores ¹)	2 (2)	4 (4) ²
RAM	16GB	32GB
NV-RAM	512MB	2GB
Native 4GB FC ports	N	Y
Height	6U	6U
Weight	121lb (54.8kg)	121lb (54.8kg)
AC Power ³	110-120V 11A 220-240V 5.5A	110-120V 10.8A 220-240V 5.6A
Thermal	3071 BTU/hr	1870 BTU/hr

7.3 – Environmental feature comparison

¹ Number of cores is the number in brackets. **Each figure is a per Filer amount. These figures should be doubled in a clustered configuration.**

² Only the first 4 cores can be used until ONTAP 7.3 is certified and installed.

³ Line voltage for standalone systems dependent on local power distribution; system cabinets are 200 to 240V only.

The following figures represent the maximum size configurations NetApp supports on these hardware platforms.



These figures differ with what CATE Storage Engineering supports in terms of the hardware capacity as CATE Storage Engineering does not support configuring the hardware at more than 75% total supported storage capacity. The values below are provided for comparison purposes only between the old and new models. For the storage capacity configuration supported by CATE Storage Engineering refer to section [8.1.2](#).

When comparing single controller and cluster configurations the following figures represent the storage supported by a single controller or a cluster. For example if you were considering deploying a FAS6040 cluster with 300GB FC drives the maximum raw configuration supported by NetApp would be 252TB (126TB per storage controller in the two node cluster).

Capacity ⁴	6030 → 6040	6070 → 6080
System Capacity Raw Maximum ⁵		
Fiber Channel 300GB	252TB	302TB
SATA 500GB	420TB	504TB
SATA 1TB	840TB	1008TB
Aggregate / Volume Maximum Size ⁶	16TB	16TB
Maximum backend FC Loops	10	12
Maximum disks per loop	84	84

7.4 - NetApp supported storage capacity

⁴ Assumes 6030 and 6070 are running ONTAP 7.2.4 for this comparison (support for extra capacity was added with this release)

⁵ System capacity is derived using base10 arithmetic

⁶ Volume / aggregate size is calculated using base2 arithmetic

8 Best Practices and Recommended Configurations

This section presents the recommended configurations and scaling for both the 6040 and 6080 series.

8.1 ONTAP 7G implementations

This section details best practices when configuring second generation FAS6000 series with ONTAP 7G.

8.1.1 Connecting to Power Distribution Units

The FAS6000 series chassis contains two power supply units (PSUs). To ensure system availability, connect each PSU to a separate Power Distribution Unit (PDU) within the data center.

8.1.2 Firmware requirements

There are two hardware components on the FAS6000 series that are capable of receiving a field firmware upgrade. To upgrade the firmware follow the procedures as published on the NetApp support website (support.netapp.com). The Remote LAN Management (RLM) firmware upgrade can be performed without impacting the Filer's ability to serve data as the RLM is for management traffic only. However the system board firmware upgrade will require a cluster failover maintenance event in order to reboot the Filer to the latest level of firmware.

Component	Firmware Type	Minimum Firmware	Recommended Firmware
System board	Service Image (BIOS)	Version: 1.9 File: 30802414.zip Release date: 18 Jan 2013	Latest available
Remote LAN Management	Remote LAN Management Image	Version: 4.1 File: RLM_FW ⁷ Release date: 15 Jun 2012	For use with ONTAP 7.3.6 : Version: 4.1 File: RLM_FW ⁸ Release date: 15 Jun 2012

8.1 - Recommended Firmware Levels

For SAS and ACP firmware minimum and recommended levels refer to the [DS4243](#) and [DS2246](#) disk shelf release notes as appropriate.

As a FPGA device (field-programmable gate array) the FlashCache card could also be considered as running a "type" of firmware, however these firmware images are included as part of an ONTAP release and will not be distributed or upgraded separately (unlike system board, service processor and disk shelf firmware).

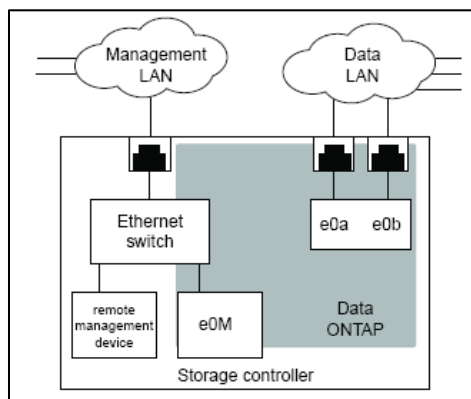
⁷ File listed for the image is for installation from the Data ONTAP prompt.

⁸ File listed for the image is for installation from the Data ONTAP prompt.

8.1.3 The Remote LAN Management port (RLM)

The Remote LAN Management port (RLM) is NetApp's remote management functionality for the Filer. The RLM performs Field Replaceable Unit (FRU) reporting, FRU tracking; monitors and reports on internal sensors; reports on and can set LED states; and actively manages fan speed. The RLM only uses SSH and does not support Telnet or RSH.

The RLM and e0M management interfaces share the same physical RJ45 port on the center of the storage controller's rear panel which is indicated by the wrench or spanner icon above it. The two interfaces can share the same port due to a small network switch embedded in on the controller's system board.



7.1 - RLM (remote management device) and e0M network connections



At the time of writing this document the CATE recommendation is not to attach the RLM to the general corporate network (sometimes referred to as the GRN/GSS) as the micro kernel on the RLM lacks the IP ACL functionality found in ONTAP which allows management of the storage controller to be restricted to certain designated 'management stations' within the environment. This limitation is specific to the firmware used on the RLM and is independent of the version of ONTAP running on the system or the specific hardware model of the Filer. CATE Storage and Backup Engineering will continue to work on methods and designs to connect the RLM to Citi Data Center networks while at the same time not increasing the overall risk rating of the NetApp NAS Filer product.

Where local regulations and Citi Information Security policy allows, a vendor support engineer may connect the RLM to their laptop in order to obtain log file and diagnostic data. If you are unsure about your local regulations or IS policy you should contact your BISO.

8.1.4 The Management Port (e0M)

All models in the FAS6000 series feature an e0M interface that uses the same physical RJ45 port as the RLM located on the center of the storage controller's rear panel which is indicated by the wrench or spanner icon above it. The e0M port allows for the separation of data and management traffic on the storage system and supports all the management protocols which are available on other interfaces on the storage system (SSH, HTTPS and SNMP).

As the e0M interface shares the same physical interface as the RLM its use is also constrained by the same recommendations outlined in the cautionary note above in section [7.1.3](#).

8.1.5 NICs

CATE storage engineering recommends using a combination of the on-board Ethernet ports and a **quad port Ethernet NIC in slot 5** as part of both multi-path HA clustered configurations and single controller dual-path configurations. Use of a quad port card even with a 1Gb or 2Gb configuration will allow the IP bandwidth to be expanded over time without the need to shutdown the Filer to replace NIC hardware.

Network Interface Card Configuration (Gigabit Ethernet)	Slot and Port Assignments	
	6040	6080
Active / Passive (single mode) 1Gb	e0a, e5a	e0a, e5a
Etherchannel (multi-mode) Active / Passive (single mode) 2Gb	e0a and e0c e5a and e5c	e0a and e0c e5a and e5c
Etherchannel (multi-mode) Active / Passive (single mode) 4Gb	e0a, e0b, e0c and e0d e5a, e5b, e5c and e5d	e0a, e0b, e0c and e0d e5a, e5b, e5c and e5d

8.2 - Gigabit Ethernet Port Assignments

The following table provides the best practice port assignment when using 10Gb optical NICs. Use of 10GBe NICs is not for general deployment and implementations requiring 10GBe must be reviewed and approved by both CATE Storage Engineering and CATE Network Engineering. It should be noted that while these 10Gb cards do have TOE capability the TOE functionality is disabled when the ports are joined together in active/passive (single-mode) failover virtual interface.

Network Interface Card Configuration (10 Gigabit Ethernet)	Slot and Port Assignments	
	6040	6080
Active / Passive (single mode) 10Gb Single port NIC (restricted use – not certified for general use)	e9a and e3a	e9a and e3a

8.3 - Ten-gig Ethernet Port Assignments

While dual port 10GBe NICs are supported and certified on a restricted release basis they are not listed here. The preference is to use the single port NICs that use the PCI-X expansion slots to in order to maximize the number of available PCI-e slots for Fiber Channel Disk Controllers.

8.1.6 Storage

This section discusses all aspects of system configuration that relate to the backend storage subsystem and is presented in terms of each type of disk shelf offered by NetApp.

8.1.6.1 DS14 disk shelf

The DS14 enclosure has been the main disk shelf available from NetApp since the year 2000. It supports FC and SATA drives through the use of different controller modules (ESH and AT-FCX). In late 2009 NetApp announced the SAS based DS4243 shelf which will eventually replace the DS14. The DS4243 is presented in the next section. The following table presents the amount of raw storage supported on each hardware platform given different drive types and sizes. The table compares the values supported by NetApp and compares that to the quantity of raw storage certified by CATE Storage Engineering which applies a standard rule of 75% of manufacturer's specification.

Capacity	6040		6080	
System Capacity Raw Maximum Multipath-HA and single head (dual path) configurations	NetApp	Citi	NetApp	Citi
Fiber Channel 146GB	122TB	92TB	171TB	128TB
Fiber Channel 300GB	252TB	189TB	352TB	264TB
Fiber Channel 450GB ⁹	370TB	277TB	517TB	388TB
Fiber Channel 600GB ¹⁰	492TB	369TB	689TB	517TB
SATA 500GB	420TB	315TB	588TB	434TB
SATA 1TB	840TB	630TB	1176TB	882TB
System Capacity Maximum Number of Disks Multipath-HA and single head (dual path) configurations	NetApp	Citi	NetApp	Citi
Fiber Channel 146GB	840	630	1176	882
Fiber Channel 300GB	840	630	1176	882
Fiber Channel 450GB	840	630	1176	882
Fiber Channel 600GB	840	630	1176	882
SATA 500GB	840	630	1176	882
SATA 1TB	840	630	1176	882
Aggregate / Volume Maximum Size	16TB	16TB	16TB	16TB
Maximum backend FC Loops	10	10	12	12
Maximum disks per loop	84	84	84	84

8.4 – DS14 Supported RAW storage capacities

⁹ Requires ONTAP 7.2.5.1 or above

¹⁰ Requires ONTAP 7.3.3 or above

The following tables provide best practice port assignments for the fiber channel loops that connect the disk shelves to the storage controller. These port assignments apply consistently regardless of whether FC or SATA drives are used. The first table should be used when implementing a 7G cluster configuration and the second table should be used in a single (standalone) configuration. The recommended best practices shown below make use of quad port FC adapters.

The 6040 supports less FC backend loops than the 6080. Use the second column in each table to determine whether the 6040 meets your requirements in terms of backend loops.

If you wish to connect your Filer to a backup infrastructure via Fiber Channel, then the number of available Fiber Channel loops available for disk will decrease to 4 primary loops per controller (irrespective of whether you are using the 6040 or 6080). See section [8.1.3](#) regarding the port and slot assignments for Fiber Channel tape connectivity.

For Fiber Channel drives CATE Storage Engineering recommends using the DS14MK4 disk shelves to achieve a backend 4GB line speed. When installing DS14MK4 shelves ensure the speed switch on the ESH module is set to 4Gb (by default these are shipped set at 2Gb). If you add a shelf configured at a lower speed to an existing loop running at 4Gb, the entire loop will reset to the speed of the shelf with the slowest configured line rate. This is why it is important to be consistent with your shelf configurations.

Fiber Channel Loops for clustered configuration					
Configuration	Number of primary loops (per controller)	Port / Slot Assignments			
		Primary		Redundant	
		Local	Partner	Local	Partner
Node A of a clustered (HA) pair	1	0a	0b	6a	6b
	2	0c	0d	6c	6d
	3	0e	0f	7a	7b
	4	0g	0h	7c	7d
	5	8a	8b	2a	2b
	6 (6080 only)	8c	8d	2c	2d
Node B of a clustered (HA) pair	1	0b	0a	6b	6a
	2	0d	0c	6d	6c
	3	0f	0e	7b	7a
	4	0h	0g	7d	7c
	5	8b	8a	2b	2a
	6 (6080 only)	8d	8c	2d	2c

8.5 – DS14 Fiber Channel Loop Configurations for HA-Pair

Fiber Channel Loops for standalone configuration					
Configuration	Number of primary loops (per controller)	Port / Slot Assignments			
		Primary		Redundant	
		Local	Partner	Local	Partner
Single head (dual path)	1	0a	n/a	6a	n/a
	2	0c	n/a	6c	n/a
	3	0e	n/a	7a	n/a
	4	0g	n/a	7c	n/a
	5	8a	n/a	2a	n/a
	6	8c	n/a	2c	n/a
	7	0b	n/a	6b	n/a
	8	0d	n/a	6d	n/a
	9	0f	n/a	7b	n/a
	10	0h	n/a	7d	n/a
	11 (6080 only)	8b	n/a	2b	n/a
	12 (6080 only)	8d	n/a	2d	n/a

8.6 – DS14 Fiber Channel Loop Configurations for Standalone implementation

CATE Storage Engineering recommends the following minimum shelf firmware when implementing the second generation 6000 series for ONTAP 7G.

Drive type	Shelf firmware	Sysconfig output
Fiber Channel (ESH4)	ESH4.1300.SFW	ESH4 Firmware rev: 13
SATA (AT-FCX)	AT-FCX.3800	AT-FCX Firmware rev: 38

8.7 – DS14 Recommended minimum shelf firmware versions

8.1.6.2 DS4243 disk shelf

Support for the new SAS based DS4243 enclosure was added with ONTAP 7.3.2 and above. The first Citigroup release of ONTAP to support the DS4243 was ONTAP 7.3.3P5. Due to the inevitable end of availability of the DS14 CATE Storage and Backup Engineering recommends that all new NetApp installations are configured using the DS4243 shelf once the pre-requisite ONTAP version is released for production use within Citi.

For full details on the DS4243 storage administrators are encouraged to review the [DS4243 release notes](#).

System Capacity (Multipath-HA and single head [dual path] configurations)				
Platform	6040		6080	
Maximum Number of Disks	NetApp	Citi	NetApp	Citi
All drive types & sizes	840	624	1176	864
Storage Raw Maximum				
SAS 300GB	246TB	183TB	345TB	253TB
SAS 450GB	369TB	274TB	517TB	380TB
SAS 600GB	492TB	366TB	689TB	506TB
BSAS (SATA) 1TB	840TB	624TB	1176TB	864TB
Maximum DS4243 shelf count				
All drive types & sizes	35	26	49	36
Maximum shelves per stack	10	10	10	10
Implied stack count	4	3	5	4
Maximum disks per stack	240	240	240	240
Aggregate Maximum Size with ONTAP 7.3	16TB	16TB	16TB	16TB

8.8 - DS4243 Supported RAW storage capacities

The following table provides best practice slot assignments for the SAS HBAs that connect the disk shelves to the storage controller. These slot assignments apply consistently regardless of whether SAS or BSAS (SATA) drives are used. Two SAS HBAs are required irrespective of the number of SAS stacks to be connected to the storage controller in order to simplify future system growth and provide the appropriate fault tolerance / load balancing in accordance with NetApp's best practices.

SAS HBA Configuration	Slot Assignments
	6040 / 6080
Quad Port 3GB SAS HBA	HBA 1 = slot 8 HBA 2 = slot 2

8.9 – DS4243 SAS HBA PCI slot allocations

The SAS cabling schedule between these HBAs and the IOM3 modules on the DS4243 shelves is detailed in Table 7.5 (clustered configuration) and Table 7.6 (standalone configuration) of the [DS4243 release notes](#).

The other shelf connectivity component of the DS4243 shelf is the ACP subnet. The ACP subnet (Alternative Control Path) is a private Ethernet network that enables the ACP processor in the SAS module to communicate both with Data ONTAP and with the SAS IOMs in the disk shelves. This network is separate from the I/O data path that connects the disk shelves to the HBA on the storage controller.

When you configure ACP on one of the system's network interfaces, you must supply a private domain name that conforms to RFC1918. You can use the system default domain, 198.15.1.0, or another network name (that is, an IP address ending in 0) that conforms to RFC1918. If you are configuring ACP for disk shelves attached to an active/active configuration, you must supply the same ACP domain name and network mask for both systems.

Do not connect the ACP port to a routed network, and do not configure switches or hubs between the ACP port and the designated Ethernet port. Doing so is not supported and will cause interruptions in service.

For the FAS6040 and FAS6080 series any available Ethernet port on the storage controller can be used to connect the storage controller to the first DS4243 shelf in the first SAS. For further details on ACP please refer to the [DS4243 release notes](#).

8.1.6.3 RAID configuration

CATE Storage Engineering recommends the following best practices when implementing RAID group configurations. Note the RAID-4 is not supported by CATE Storage Engineering on this hardware platform.

- All RAID groups must be configured RAID-DP
- The maximum supported number of RAID groups in an aggregate is 3

Drive type	NetApp Max Size	NetApp Default Size	Citi Recommended Size
Fiber Channel	28	16	16 to 18
SATA	16	14	14 ¹¹

8.10 - Recommended RAID group sizes

Some exceptions may require a RAID configuration different from the recommended setting listed above. With each exception a design document stating the recommended RAID group configuration will be provided by CATE Storage Engineering. If the values in the design document differ from those shown above then the design document values take precedence.

8.1.6.4 Root Volume Sizing

All volumes must be created as Flexvols to optimize the provisioning model of NetApp NAS Filers. The following table lists the recommended root volume size per hardware model. The Citi recommended value is essentially triple the NetApp recommendation to allow enough space for log files.

Hardware model	NetApp Recommended Root Vol Size	Citi Recommended Root Vol Size
6040	37GB	111GB
6080	69GB	207GB

8.11 - Recommended Root Volume Size

8.1.7 Tape Connectivity

This section provides the best practice expansion port assignments to use when considering attaching your Filer to a Fiber Channel attached backup infrastructure. You can use either dual or quad port adapters depending on your requirements. Where supported by your infrastructure CATE Storage Engineering recommends you ensure these cards are set to a 4GB line speed.

Filer Model	Slot assignment
6040	2
6080	2

8.12 - Expansion slot assignment for backup FC connectivity

¹¹ Refer to the [Data ONTAP Solutions Guide](#) for best practices when using 1TB SATA drives.

8.1.8 Virtual Servers (vFilers)

As of ONTAP v7.2, you can configure up to 65 usable vFilers on a single storage controller (up to 130 in a cluster), depending on the memory capacity of the hosting filer. The maximum limits for number of vFilers are shown in the table below, and highlights the maximum value supported by NetApp and the value certified by CATE Storage Engineering.

Filer memory	NetApp	Citi
Less than 1GB	11	8
1GB or more	26	20
2GB or more	65	49

8.13 - Supported vFiler quantities per storage controller

8.1.9 Flash Cache (formerly known as PAM II)

Support for the new read only cache expansion card, Flash Cache (formerly known as PAM II) was added with ONTAP 7.3.2 and above. The first Citigroup release of ONTAP to support Flash Cache was ONTAP 7.3.3P5.

The amount of cache capacity on a given card is the same for all models of the FAS6000 series.

Filer model	Per card capacity
FAS6040	512GB
FAS6080	512GB

8.14 - Flash Cache capacity per PCI card based on Filer model

Based on current thinking the majority of Flash Cache cards are expected to be installed on new systems as opposed to being retrofitted onto existing configurations. With the expectation that these cards will be installed on new systems that will also be using the new DS4243 enclosure which require quad port SAS port HBAs in slots 8 and 2 the following table has been devised to communicate a PCI slot preference for Flash Cache card installs. More than one card may be installed in a given system however the potential Flash Cache capacity will depend on the number of available PCIe slots.

Preference	PCI Slot Number
1	5
2	6
3	7
4	2

7.15 - Flash Cache PCI slot utilization order preference

For further information about when to use and how to use Flash Cache refer to the Storage Optimization chapter (section 11.7) in the [ONTAP 7.3 Solutions Guide](#).

8.1.10 Memory Management

The final factor for comparison relates to how memory is managed when a nearstore personality license is installed, and as such how many concurrent snapmirror and snapvault operations can be supported by a device.

Also note that the results depend on the version of ONTAP running on the system. ONTAP 7.3 contains improvements that increase the number of concurrent replication operations on all platforms.

Memory management	6030→6040		6070→6080	
Snapvault streams with ONTAP 7.2	96	96	128	128
Snapvault streams with ONTAP 7.3	384	384	512	512
Source volume snapmirror streams with ONTAP 7.2	96	96	128	128
Destination volume snapmirror streams with ONTAP 7.2	96	96	128	128
Source volume snapmirror streams with ONTAP 7.3	100	100	150	150
Destination volume snapmirror streams with ONTAP 7.3	200	200	300	300

8.16 - Nearstore personality stream count

8.2 ONTAP GX implementations

This section previously detailed best practices when configuring second generation FAS6000 series for use with ONTAP GX. This section has been removed subsequent to the End of Vendor Support date being reached for ONTAP GX (September 30th 2012).

9 Known Issues

This section details the known and publicized issues with the FAS6000 series platform.

Bug #	Description	Workaround / Resolution / Notes
618662	Unexpected takeover or power cycle due to spurious power sensor readings from agent hardware during RLM firmware upgrade FAS storage systems configured for HA operation might experience one of the following issues while upgrading RLM firmware, due to spurious "bad" power sensor readings from agent hardware: • Unexpected power-cycle of the storage systems leading to takeover • Unexpected watchdog reset When the RLM reboots after a firmware upgrade, I2C communication issues can cause a L2 watchdog reset or panic condition.	Follow the procedure in section 11.2 of this document to determine if the symptoms for this problem exist on your FAS6000 series system. If the system is found to have symptoms of bad sensors then follow the prescribed remediation steps in NetApp Knowledge Base Article ID 2017726.

10 Document version control

This section contains a detailed list of the updates made during each document release. Section 1 is purely an overview.

Version	Changes
0.1	Initial release
0.2	Minor corrections and updates
1.0	No changes – moved to production release status
1.1	- Added 450GB FC drives to Table 8.3 - Updated minimum AT-FCX shelf firmware requirements for ONTAP 7G to version 37 in Table 8.6
1.2	- Split section 8.1.2 disk shelf type – DS14 and DS4243 - Added 600GB FC drives to table 8.3 – DS14 Supported RAW storage capacities - Updated AT-FCX firmware in table 8.6 – DS14 Recommended minimum shelf firmware versions to version 38 - Added section 8.1.5 detailing Flash Cache capacity per hardware platform and PCI slot assignment requirements - Updated table 8.16 - Nearstore personality stream count to include concurrent stream count improvements with ONTAP 7.3
1.3	- Updated link to CSBE home page in section 4 - Added draft document designation - Updated document definition from GDSE to CSBE - Removed contents of section 8.2 as ONTAP GX has reached EOVS - Removed references to ONTAP GX from section 7 - Removed IOM3 and ACP firmware versions as these are duplicates of information already in the DS4243 and DS2246 enclosure release notes - Added bug 618662 to section 9 - Added best practices for PDU connectivity - Added recommendations for BIOS and RLM firmware versions - Added information on the RLM and dedicated management port - Added Appendices for RLM firmware upgrade procedure (section 11.1) - Added section 11.2 detailing the steps to detect bug 618662
1.4	Removed draft document designation
1.4.1	- Removed CTRL+G option from step 1a in section 11.2 as the RLM does not support this feature - Added requirement for temporary network connectivity to perform check for bug 618662

11 Appendices

11.1 Remote LAN Management (RLM) Firmware upgrade procedure

For reference purposes the FAS3100 RLM firmware update procedure is shown below. The example demonstrates an upgrade from 4.0 to 4.1.

The complete procedure is available on NetApp's support site at the following location:

http://support.netapp.com/NOW/download/tools/rlm_fw/4.1.0/ontap_cli.shtml

CAUTION

1. Prior to attempting this upgrade process you must ensure that the current RLM firmware is at least version 3.1 before attempting an upgrade to version 4.1. Use the RLM status command from the ONTAP CLI to confirm the current running firmware version:

```
d7-fas3140-01> rlm status
Remote LAN Module      Status: Online
  Part Number:         110-00057
  Revision:            G0
  Serial Number:       495077
  Firmware Version:    4.0
  Mgmt MAC Address:    00:A0:98:11:9F:CC
  Ethernet Link:       up, 100Mb, full duplex, auto-neg complete
  Using DHCP:          no
IPv4 configuration:
  IP Address:          10.40.35.43
  Netmask:             255.255.255.0
  Gateway:             10.40.35.3
IPv6 configuration:    Disabled
```

CAUTION

2. Prior to attempting this upgrade process you must ensure that the FAS6000 RLM is not susceptible to bug 618662 – “Unexpected takeover or power cycle due to spurious power sensor readings from agent hardware during RLM firmware upgrade”. See section [11.2](#) to determine if there is a hardware issue involving the I2C interface between the FAS6000 and the RLM which would trigger bug 618662
3. Download the firmware archive (zip) file from the above location
4. Rename the firmware archive RLM_FW.zip
5. Save the RLM_FW.zip file to a web server to be used as a distribution server for this upgrade

6. SSH to the FAS6000 series system and confirm the RLM firmware version currently running. In this example note that version 4.0 is installed and is therefore a candidate to upgrade to version 4.1. If the RLM has an existing network configuration, make a note of the details to confirm the IP address, netmask and gateway values are correct post upgrade. **If this RLM is running a version of firmware prior to version 3.1 then you must upgrade the firmware to at least version 3.1 before attempting the upgrade to version 4.1.**

```
d7-fas3140-01> rlm status
Remote LAN Module      Status: Online
  Part Number:         110-00057
  Revision:            G0
  Serial Number:       495077
  Firmware Version:    4.0
  Mgmt MAC Address:    00:A0:98:11:9F:CC
  Ethernet Link:       up, 100Mb, full duplex, auto-neg complete
  Using DHCP:          no
IPv4 configuration:
  IP Address:          10.40.35.43
  Netmask:             255.255.255.0
  Gateway:             10.40.35.3
IPv6 configuration:    Disabled
```

7. Confirm if a pre-existing RLM firmware image is in the local software repository (/etc/software) and delete it if one exists (this is preferred to using the software install –f approach). Confirm the firmware image has been removed:

```
d7-fas3140-01> software list
RLM_FW.zip
733P5D8_setup_q.exe
30801612.zip
736P2_setup_q.exe

d7-fas3140-01> software delete RLM_FW.zip

d7-fas3140-01> software list
733P5D8_setup_q.exe
30801612.zip
736P2_setup_q.exe
```

8. Download the latest firmware image from your distribution server used in step 5. In this example a lab distribution server 10.40.42.115 is used. Note the command is all one line but is word wrapped here for presentation purposes.

```
d7-fas3140-01> software install
http://10.40.42.115/repo/netapp/firmware/rlm/4.1/RLM_FW.zip
software: You can cancel this operation by hitting Ctrl-C in the next 6
seconds.
software: Depending on system load, it may take many minutes
software: to complete this operation. Until it finishes, you will
software: not be able to use the console.
software: copying to RLM_FW.zip
software: 100% file read from location.
software: /etc/software/RLM_FW.zip has been copied.
software: installing software, this could take a few minutes...
software: installation of RLM_FW.zip completed.
Thu Jun 27 11:45:27 EDT [d7-fas3140-01: cmds.software.installDone:info]:
Software: Installation of RLM_FW.zip was completed.
Please type 'rlm update' to load the new RLM firmware.
```

9. Initiate the firmware update process with the 'rlm update -f' command.
When upgrading to RLM firmware version 4.1 it is imperative that the '-f' (full upgrade switch) be used. This requires the console to be advanced privilege mode. Before performing this step ensure your SSH session is established through an interface other than the RLM. In tests this stage took between 25 and 30 minutes.

```
d7-fas3140-01> priv set advanced
Warning: These advanced commands are potentially dangerous; use
        them only when directed to do so by NetApp
        personnel.
d7-fas3140-01*> rlm update -f
Updating the RLM firmware.
Please ensure you have run 'software install' command with correct
parameters for 'rlm update' prior to this step.
DO NOT reset this system during this process.
This might take about 27 mins...

New RLM version : 4.1
Current RLM version : 4.0
Sending files to RLM
.....
.....
.....
RLM: Firmware updated successfully!
You need to reboot the RLM for the new image to take effect
NOTE : If your console connection is through the RLM, it will be disconnected
```

10. Confirm the RLM reboot request by entering 'Y'. Note rebooting the RLM does not impact the FAS6000 series systems ability to serve data. An RLM reboot takes about 5 minutes on average.

```
Do you want to reboot the RLM now? (y/n) : y
Console connection through the RLM will now be dropped
```

11. Once the RLM has completed its reboot confirm the new firmware version and check that the network settings are consistent with those collected in step 6. Use the 'rlm status' command to complete this task.

```
d7-fas3140-01*> rlm status
Remote LAN Module      Status: Online
  Part Number:         110-00057
  Revision:            G0
  Serial Number:       495077
  Firmware Version:    4.1
  Mgmt MAC Address:    00:A0:98:11:9F:CC
  Ethernet Link:       up
  Using DHCP:          no
IPv4 configuration:
  IP Address:          10.40.35.43
  Netmask:             255.255.255.0
  Gateway:             10.40.35.3
IPv6 configuration:    Disabled
```

11.2 How to determine if a FAS6000 is susceptible to bug 618662

You must perform this check prior to upgrading the RLM firmware on a FAS6000 series Filer. Failure to do so may cause an unexpected takeover or power cycle due to spurious power sensor readings from agent hardware during RLM firmware upgrade.

This information can also be found in NetApp Knowledgebase article 2017726.

1. Check that all power sensor values on the RLM report in a 'good' state. In order to perform this check follow these steps:

- a. Login to the RLM prompt
 - As it is not possible to login to the RLM from the ONTAP serial console a temporary network connection or site visit with a laptop and Ethernet cross-over cable is required to facilitate login to the RLM
 - If a login prompt is presented ensure that a local account is used to authenticate as the RLM does not support authentication of domain accounts.
- b. Place the RLM prompt in diagnostic mode:

```
RLM d7-fas3140-01*> priv set diag
Warning: These diagnostic commands are for use by support personnel only.
```

- c. Check the state of the system sensors and ensure all the power supply sensors are listed as a 'good' state.

```
RLM d7-fas3140-01*> system sensors
```

Sensor ID	Sensor Name	Sensor State	Current Value
=====	=====	=====	=====
...	...	...	...
...	...	...	...
...	...	...	...
0x032	POW1_AC_OK	good	A
0x033	POW1_GOOD	good	A
...	...	...	...
0x035	POW2_AC_OK	good	A
0x036	POW2_GOOD	good	A
...	...	...	...
...	...	...	...
...	...	...	...

If any of the sensor states return a value of 'bad' then follow the remediation steps detailed in NetApp Knowledgebase article 2017726.

- d. Return to the ONTAP CLI and confirm the status of the system chassis sensors. Note the following output is from a 3100 series system and there may be some difference in the sensor names reported for a 6000 series.

```
d7-fas3140-01> environment status chassis list-sensors
```

Sensor Name	State	Current Reading	Critical Low	Warning Low	Warning High	Critical High

CPU_3.3V_Active	normal	3339 mV	--	3135 mV	3465 mV	--
CPU_3.3V_Standby	normal	3339 mV	--	3135 mV	3465 mV	--
CPU_5V	normal	4986 mV	--	4750 mV	5250 mV	--
CPU_12V	normal	11937 mV	--	11400 mV	12600 mV	--
RTC Battery	normal	3291 mV	--	2800 mV	3500 mV	--
MB_Temperature-CPU	normal	23 C	0 C	9 C	49 C	59 C
MB_Temperature-Front	normal	24 C	0 C	12 C	42 C	52 C
MB_Temperature-Central	normal	28 C	0 C	9 C	49 C	59 C
SYS_FAN_A1_Fan1	normal	2403 RPM	1200 RPM	1250 RPM	--	--
SYS_FAN_A1_Fan2	normal	2483 RPM	1200 RPM	1250 RPM	--	--
SYS_FAN_A2_Fan1	normal	2276 RPM	1200 RPM	1250 RPM	--	--
SYS_FAN_A2_Fan2	normal	1692 RPM	1200 RPM	1250 RPM	--	--
SYS_FAN_A3_Fan1	normal	2128 RPM	1200 RPM	1250 RPM	--	--
SYS_FAN_A3_Fan2	normal	1816 RPM	1200 RPM	1250 RPM	--	--
PSU1_Present	normal	good				
PSU1_Power_Input	normal	good				
PSU1_12V	normal	good				
PSU1_Status	normal	good				
PSU1_Temperature	normal	23 C	0 C	1 C	51 C	61 C
PSU1_FAN1	normal	13110 RPM	3000 RPM	3500 RPM	--	--
PSU1_FAN2	normal	13050 RPM	3000 RPM	3500 RPM	--	--
PSU2_Present	normal	good				
PSU2_Power_Input	normal	good				
PSU2_12V	normal	good				
PSU2_Status	normal	good				
PSU2_Temperature	normal	24 C	0 C	1 C	51 C	61 C
PSU2_FAN1	normal	13530 RPM	3000 RPM	3500 RPM	--	--
PSU2_FAN2	normal	13230 RPM	3000 RPM	3500 RPM	--	--
NVRAM7-temperature-0	normal	25 C	0 C	14 C	49 C	64 C
NVRAM7-battery-0	normal	3960 mV	3499 mV	3699 mV	4250 mV	4250 mV

If any of the sensor states return a value of 'bad' then follow the remediation steps detailed in NetApp Knowledgebase article 2017726.

- e. Return once more to the RLM CLI and check the output of the RLM CLI command "events all" to ensure that the RLM system event log does not contain any power failure or "BAD" power sensor values. Its recommended that you copy the output from the "events all" command to a text editor to allow you to search the output for the string 'BAD'.

```
RLM d7-fas3140-01*> events all
Record 1944: Fri May 17 19:03:53 2013 [RLM CLI.notice]: rs01146Plog out "log
out"
Record 1945: Fri May 17 19:19:06 2013 [ONTAP.notice]: Appliance user command ha
lt.
Record 1946: Fri May 17 19:19:29 2013 [RLM.critical]: Filer Reboots
Record 1947: Fri May 17 19:19:46 2013 [RLM CLI.notice]: rs01146 "log in"
Record 1948: Fri May 17 19:19:49 2013 [RLM CLI.notice]: rs01146alog out "log
out"
Record 1949: Fri May 17 19:30:29 2013 [RLM.critical]: Heartbeat stopped
Record 1950: Thu Jan 1 00:00:31 1970 [Agent Event.notice]: FIFO 0x202A - Agent
0x51, Appliance command 0x2a (disable watchdog)
Record 1951: Thu Jan 1 00:00:31 1970 [Agent Event.notice]: FIFO 0x202A - Agent
0x51, Appliance command 0x2a (disable watchdog)
Record 1952: Thu Jan 1 00:00:31 1970 [Agent Event.notice]: FIFO 0x2029 - Agent
0x51, Appliance command 0x29 (enable watchdog)
Record 1953: Thu Jan 1 00:00:31 1970 [Agent Event.notice]: FIFO 0x202A - Agent
0x51, Appliance command 0x2a (disable watchdog)
Record 1954: Thu Jan 1 00:00:31 1970 [Agent Event.notice]: FIFO 0x2029 - Agent
0x51, Appliance command 0x29 (enable watchdog)
Record 1955: Thu Jan 1 00:00:31 1970 [Agent Event.notice]: FIFO 0x202A - Agent
0x51, Appliance command 0x2a (disable watchdog)
Record 1956: Thu Jan 1 00:00:31 1970 [Agent Event.notice]: FIFO 0x202A - Agent
0x51, Appliance command 0x2a (disable watchdog)
Record 1957: Thu Jan 1 00:00:31 1970 [Agent Event.notice]: FIFO 0x202A - Agent
0x51, Appliance command 0x2a (disable watchdog)
Record 1958: Thu Jan 1 00:00:31 1970 [Agent Event.notice]: FIFO 0x2029 - Agent
0x51, Appliance command 0x29 (enable watchdog)
Record 1959: Thu Jan 1 00:00:31 1970 [Agent Event.notice]: FIFO 0x301C - Agent
0x51, RLM command 0x1c (dump_state)
Record 1960: Thu Jan 1 00:00:31 1970 [Agent Event.warning]: FIFO 0x9008 -
Agent 0x51, ADM1026_INT initially asserted.
Record 1961: Thu Jan 1 00:01:05 1970 [RLM.normal]: Heartbeat started
Record 1962: Thu Jan 1 00:01:05 1970 [Heartbeat.notice]: Set RLM time. Old
time: Thu Jan 1 00:01:05 1970. New time: Mon May 20 13:50:42 2013.
Record 1963: Mon May 20 13:51:22 2013 [Agent Event.normal]: FIFO 0x0008 - Agent
0x51, ADM1026_INT deasserted.
Record 1964: Thu Jun 27 15:38:21 2013 [RLM CLI.notice]: rs01146 "log in"
RLM d7-fas3140-01*>
```

If any of the sensor states return a value of 'bad' then follow the remediation steps detailed in NetApp Knowledgebase article 2017726.

- f. If no 'BAD' sensor entries are returned in the above three tests then you may proceed with the RLM firmware upgrade.