LEGAL NOTICE:

This NVM Express Management Interface revision 1.1 technical proposal is proprietary to the NVM Express, Inc. (also referred to as "Company") and/or its successors and assigns.

NOTICE TO USERS WHO ARE NVM EXPRESS, INC. MEMBERS: Members of NVM Express, Inc. have the right to use and implement this NVM Express Management Interface revision 1.1 technical proposal subject, however, to the Member's continued compliance with the Company's Intellectual Property Policy and Bylaws and the Member's Participation Agreement.

NOTICE TO NON-MEMBERS OF NVM EXPRESS, INC.: If you are not a Member of NVM Express, Inc. and you have obtained a copy of this document, you only have a right to review this document or make reference to or cite this document. Any such references or citations to this document must acknowledge NVM Express, Inc. copyright ownership of this document. The proper copyright citation or reference is as follows: **"© 2007 - 2020 NVM Express, Inc. ALL RIGHTS RESERVED."** When making any such citations or references to this document you are not permitted to revise, alter, modify, make any derivatives of, or otherwise amend the referenced portion of this document in any way without the prior express written permission of NVM Express, Inc. Nothing contained in this document shall be deemed as granting you any kind of license to implement or use this document or the specification described therein, or any of its contents, either expressly or impliedly, or to any intellectual property owned or controlled by NVM Express, Inc., including, without limitation, any trademarks of NVM Express, Inc.

LEGAL DISCLAIMER:

THIS DOCUMENT AND THE INFORMATION CONTAINED HEREIN IS PROVIDED ON AN "**AS IS**" BASIS. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, NVM EXPRESS, INC. (ALONG WITH THE CONTRIBUTORS TO THIS DOCUMENT) HEREBY DISCLAIM ALL REPRESENTATIONS, WARRANTIES AND/OR COVENANTS, EITHER EXPRESS OR IMPLIED, STATUTORY OR AT COMMON LAW, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE, VALIDITY, AND/OR NONINFRINGEMENT.

All product names, trademarks, registered trademarks, and/or servicemarks may be claimed as the property of their respective owners.

NVM Express Management Interface Workgroup
c/o VTM, Inc.
3855 SW 153rd Drive
Beaverton, OR 97003 USA
info@nvmexpress.org

NVM Express Technical Proposal for New Feature

Technical Proposal ID	**6012 – NVMe 1.4 Alignment**
Change Date	**2020-04-20**
Builds on Specification	**NVMe-MI 1.1**

Technical Proposal Author(s)

Name	Company
Mike Allison	Intel

Aligns the NVMe 1.1 specification to the NVMe 1.4 specification.

Revision History

Revision Date	Change Description
2019-09-11	Initial version
2019-09-16	Get LBA Status Admin command is optional for a Storage Device. Added statement to rename NVM Express specification and provided an example with section 1.1.. Added section 8.1 changes.
2019-10-28	Aligned the definition of the word reserved to the words updated by the NVMe Technical WG on 10/24/2019. This version is ready for Phase 2 exit vote.
2019-12-09	Made the document Phase 3 ready by only changing date and filename.
2019-12-19	Filename change only for 30 day member review.
2020-03-12	Ratification Ready
2020-04-20	Ratified

Description for NVMe-MI Changes Document

To align with the NVMe 1.4 specification the following changes are specified:

- Update NVM Express Base Specification to version 1.4
- Use the common conventions defined by NVMe 1.4
    - Compatibility change:
        - The definition of the word reserved was aligned to the definition of the NVMe Base Specification that removed the requirement that a recipient is required to not validate that of reserved bits, bytes, words, or fields are cleared to 0h. The change now allows the recipient the option to validate that of reserved bits, bytes, words, or fields are cleared to 0h.
- Define support for new NVMe Admin commands

Description of Specification Changes

Markup Conventions:

Black:	Unchanged (however, hot links are removed)
~~Red Strikethrough~~:	Deleted
Blue:	New
Blue Highlighted:	TBD values, anchors, and links to be inserted in new text.
<Green Bracketed>:	Notes to editor

NVMe 1.4 change the name of the specification from "NVM Express specification" to "NVM Express Base Specification". To align with this name change, all reference to "NVM Express specification" shall be change to "NVM Express Base Specification". Showing the change for section 1.1 only:

1.1 Overview

The NVM Express™ (NVMe™) interface is a register-level interface that allows in-band host software to communicate with an NVM Subsystem. Since this specification builds on the NVM Express Base S~~s~~pecification, knowledge of the NVM Express specification is assumed.

This specification defines several mechanisms to manage NVMe Storage Devices (refer to section 1.8.18) or NVMe Enclosures (refer to section 1.8.16). One mechanism allows a Management Controller to communicate out-of-band with an NVMe Storage Device or NVMe Enclosure over one or more external interfaces. Another mechanism is the in-band tunneling mechanism which allows the NVMe-MI Management Interface Command Set to be tunneled in-band via the NVMe Admin Commands NVMe-MI Send and NVMe-MI Receive to an NVMe Storage Device or NVMe Enclosure. Refer to the NVM Express Base S~~s~~pecification and section 4.3 of this specification for additional details on the NVMe-MI Send and NVMe-MI Receive commands.

Modify a portion of section 1.7 as shown below:

1.7 Conventions

Hardware shall return 0h~~zero~~ for all bits, fields, and registers that are marked as reserved. The Requester should not rely on a value of 0h~~zero~~ being returned as future revisions of this specification may contain non-zero values. The Requester should write all reserved bits and registers with the value of 0h~~zero~~. Future revisions of this specification may rely on a 0h~~zero~~ value being written for backward compatibility.

…

A 0's based value is a numbering scheme for which the number 0h represents a value of ~~1h and thus produces the pattern of 0h represents 1h~~, 1h represents 2h, 2h represents 3h, etc. In this numbering scheme, there is not a method for specifying the value of 0h. Values in this specification are 1-based (i.e., the number 1h represents a value of 1h, 2h represents 2h, etc.) unless otherwise specified.

Some parameters are defined as a string of ASCII or UTF-8 characters. ASCII strings~~data fields~~ shall contain only code values 20h to 7Eh. UTF-8 is backwards compatible with ASCII encoding and supports additional characters with variable length encoding. For the string "Copyright", the character "C" is the first byte, the character "o" is the second byte, etc. The string is left justified and shall be padded with spaces (ASCII character 20h) to the right if necessary.

…

Modify a portion of section 1.9.5 as shown below:

1.9.5 reserved

A keyword ~~indicating~~ referring to ~~reserved~~ bits, bytes, words, fields, and opcode values that are set-aside for future standardization. Their use and interpretation may be specified by future extensions to this or other specifications. A reserved bit, byte, word, field, or register shall be cleared to 0h~~zero~~, or in accordance with a future extension to this specification. The recipient of a Request Message or a register write is ~~shall~~ not required to check the value of reserved bits, bytes, words, or fields. Receipt of reserved coded values in defined fields in Request Messages shall be reported as an error. Writing a reserved coded value into a controller register field produces undefined results.

Modify a portion of section 1.10 as shown below:

1.10 Byte, Word, and Dword Relationships

Figure 14 illustrates the relationship between bytes, words, and dwords. Unless otherwise stated, ~~T~~this specification specifies data in a little-endian format.

…

Modify a portion of section 1.11 as shown below:

1.11 References

…

NVM Express Base S~~s~~pecification, revision 1.4~~3a~~. Available from http://www.nvmexpress.org.

…

Modify a portion of Figure 110 in section 6 as shown below:

6 NVM Express Admin Command Set

....

Figure 110: List of NVMe Admin Commands Supported using the Out-of-Band Mechanism

Command	NVMe Storage Device O/M/P [1]	NVMe Enclosure O/M/P [1]
Abort	P	P
Asynchronous Event Request	P	P
Create I/O Completion Queue	P	P
Create I/O Submission Queue	P	P
Delete I/O Completion Queue	P	P
Delete I/O Submission Queue	P	P
Device Self-test	O	O
Directive Receive	P	P
Directive Send	P	P
Doorbell Buffer Config	P	P
Firmware ~~Activate/~~Commit [2]	O	O
Firmware Image Download	O	O
Format NVM	O	P
Get Features	M	O
Get LBA Status	O	P

Figure 110: List of NVMe Admin Commands Supported using the Out-of-Band Mechanism

Command	NVMe Storage Device O/M/P [1]	NVMe Enclosure O/M/P [1]
Get Log Page	M	O
Identify	M	O
Keep Alive	P	P
Namespace Management	O	P
Namespace Attachment	O	P
NVMe-MI Receive	P	P
NVMe-MI Send	P	P
Sanitize	O	O
Security Send	O	P
Security Receive	O	P
Set Features	O	O
Vendor Specific	O	O
Virtualization Management	O	O

NOTES:
1. O/M/P definition: O = Optional, M = Mandatory, P = Prohibited from being supported. An NVMe Enclosure that is also an NVMe Storage Device (i.e., implements namespaces) shall implement mandatory commands required by either an NVMe Storage Device or an NVMe Enclosure and may implement optional commands allowed by either an NVMe Storage Device or an NVMe Enclosure. Mandatory commands shall be supported if the NVMe Controller specified by the Controller ID field supports the command.
2. This command was known in NVM Express revisions 1.0 and 1.1 as "Firmware Activate".

Modify a portion of Figure 137 in section 8.1 as shown below:

8.1 Management Interface Specific Features

The NVMe Get Features and Set Features Admin commands are used to retrieve and modify Feature values. Feature Identifiers 78h to 7Fh have been allocated by the NVM Express specification for this specification and are defined below.

Figure 137: NVMe Management Interface Feature Identifiers

Feature Identifier	NVMe Storage Device O/M [1]	NVMe Enclosure O/M [1]	Current Setting Persists~~ent~~ Across Power Cycle~~States~~ and Reset [2]	Uses Memory Buffer for Attributes	Description
78h to 7Dh	-	-	-	-	Reserved
7Eh	M	M	No	Yes	Controller Metadata
7Fh	M	O	No	Yes	Namespace Metadata

NOTES:
1. O/M definition: O = Optional, M = Mandatory. Mandatory features shall be supported if the NVM Subsystem implements a Management Endpoint. These features are not mandatory if the NVM Subsystem does not implement a Management Endpoint.
2. This column is only valid if the feature is not saveable. If the feature is saveable, then this column is not used.~~bit 4 in the Optional NVM Command Support field of the Identify Controller Data Structure is cleared to '0'~~. Refer to the NVM Express Base S~~s~~pecification.

Modify all figures that have bytes and bits columns to use "Bytes" and "Bits" respectfully. Aligns with NVMe 1.4 convention and cleans up the mixed usage in NVMe 1.1 specification. Figure 136 uses "Bytes" and "Bits", Figure 18 uses "Byte" and "Bits", Figure 41 uses "Byte" and "Bit". Every figure needs to be checked for aligning to common usage and not listed in this TP specifically.