PICMG® 3.0 Revision 3.0
AdvancedTCA® Base Specification

Engineering Change Notice

ECN 3.0-3.0-001

Adopted April 20 2015
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Foreword: Adding IPv6 awareness to PICMG 3.0

Description

¶1 The focus of this ECN is to add IPv6 awareness to the PICMG 3.0 R3.0 specification. The changes include additions and changes for informative and normative text, including tables, that enable compliant implementations to support IPv6 in the System Manager Interface. PICMG 3.0 R3.0 defines only IPv4 in the System Manager Interface. The added support for IPv6 is optional. Support for IPv4 continues to be mandatory, but a Shelf can be configured to operate only with IPv6 if desired. These additions leverage recent revisions of the IPMI 2.0 specification, which have IPv6 awareness as well. This ECN is the work of the Hardware Platform Management subcommittee.

Justification

¶2 The base IPv6 specification (RFC 2460) was published in December, 1998. It was motivated by numerous issues or impending challenges with IPv4, given the explosive growth of the Internet, which has only accelerated in the almost two decades since then. One key challenge was the impending exhaustion of IPv4 addresses. The availability of Native Address Translation (NAT) has allowed public IPv4 addresses to be conserved, because a handful of public addresses can provide access to hundreds of thousands or more private addresses behind a NAT interface. But NAT-based architectures have their own challenges, and the burgeoning Internet of Things (IoT) is making it ever more crucial to continue and accelerate the availability of IPv6.

¶3 The IPMI 2.0 specification added IPv6 awareness as of October, 2013. Since the hardware platform management layer of PICMG 3.0 is based on IPMI, that addition simplifies adding IPMI-compatible IPv6 awareness to PICMG 3.0.

Style

¶4 The key conventions used in this document are summarized below. Since the last of them is new to PICMG specifications and especially crucial to understanding this ECN, it is shown in a bold font for emphasis

- Each subsection, figure and table that is intended to replace a corresponding PICMG 3.0 specification element has a number and caption that match the target specification element and a simple tag, “[‡ full replacement],” to indicate that that element is a full replacement for the corresponding PICMG 3.0 element. For simplicity, subsection headings within a fully replaced section do not have this tag.

- Where a PICMG 3.0 specification section is only partially modified, the section number and title also match, but there is no tag on the section title and the content of the section describes the small changes to it.

- Sections of PICMG 3.0 that are not modified by this ECN are not mentioned here.

- For PICMG 3.0 tables where this ECN solely provides one or more replacement and/or added rows and not a full table replacement, the caption tag takes the form “[‡ updated row(s) only]”.

PICMG 3.0 R3.0: ECN 3.0-3.0-001; adopted April 20, 2015
New figures and tables use a similar convention, except that the target figure/table numbers start at 2000 to distinguish them from modified versions of existing figures and tables. Starting new figure and table numbers at 2000 minimizes overlap with the new figure and table numbers assigned in PICMG 3.7, the AdvancedTCA Base Extensions Specification, which also defines new elements that are intended to augment PICMG 3.0 R3.0.

PICMG 3.0 requirements that are not modified by this ECN have the same number as in PICMG 3.0.

PICMG 3.0 requirements that are modified by this ECN have an appended suffix letter to distinguish them (‘a’ in this ECN for modified requirements that have not been modified previously).

New requirements are numbered starting at 2000 (e.g. 3-2000 for the first one) to avoid conflicts with existing Section 3 requirement numbers and new requirements defined in PICMG 3.7.

All references to PICMG 3.0 in this document are to Revision 3.0, unless otherwise specified.

All changes to existing PICMG 3.0 language are highlighted with a gray background. New text simply has that gray background. Deletions of existing text in PICMG 3.0 use the same gray background, but with a single strikethrough font variant to identify the deleted text.
1 Introduction

¶5 This section of PICMG 3.0 needs a few updates.

¶6 A new reference to IPMI v2.0 is inserted after PICMG 3.0, Section 1.2.1, ¶37 as a new paragraph:


¶7 A new section, 1.2.4, is added after section 1.2.3.

1.2.4 Internet Protocol version 6 references

¶8 A collection of IPv6-related Internet Engineering Task Force (IETF) Request for Comment (RFC) documents is listed here. All IETF RFCs are available at https://www.ietf.org/rfc.html.


¶11 RFC 4191 Default Router Preferences and More-Specific Routes R. Draves, D. Thaler [November 2005]

¶12 RFC 4286 Multicast Router Discovery B. Haberman, J. Martin [December 2005]


¶14 RFC 4429 Optimistic Duplicate Address Detection (DAD) for IPv6 N. Moore [April 2006]


¶19 RFC 6059 Simple Procedures for Detecting Network Attachment in IPv6 S. Krishnan, G. Daley [November 2010]


Section 1


¶23 RFC 7404 Using Only Link-Local Addressing inside an IPv6 Network M. Behringer, E. Vyncke [November 2014] Errata

¶24 The “Shelf Manager IP Address” term in PICMG 3.0 Section 1.6 is replaced by the “Active Shelf Manager IP Address Set” term, as follows; the original term is deleted:

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Shelf Manager IP Address Set</td>
<td>A set of Internet Protocol (IP) addresses that includes: 1) an RFC790 compliant IPv4 address and/or 2) one or two RFC 4291 compliant IPv6 addresses. Each address in this set uniquely designates a single network access point to the active Shelf Manager and provides a contact point for the System Manager in addressing the Shelf. This set of IP addresses can be transferred at any time between the IP interfaces of redundant Shelf Manager instances.</td>
</tr>
</tbody>
</table>
3 Hardware platform management

¶25 This section provides replacements for the portions of PICMG 3.0 Section 3 that are impacted by the addition of IPv6 support.

3.3.1.2 Internet Protocol addressing of the Shelf Manager [‡ full replacement]

¶26 Each Shelf Manager supports (that is, implements) a minimum of one IP (Internet Protocol) capable interface (possibly IEEE 802.3 Ethernet) for remote access by the System Manager. The physical implementation of any 802.3 interface(s) used for this purpose is via the internal Zone 2 Base Interface and/or an externally accessible industry standard 8-wire modular Ethernet connector. A Handle Switch on the FRU containing the Shelf Manager is recommended and may be configured to disable such 802.3 interface(s) when open.

¶27 To maximize interoperability, Shelf Managers support the IPMI LAN Interface (as defined in Section 12 of the IPMI v1.5 and Section 13 of the IPMI v2.0 specification) in their System Manager Interface. As mentioned above, an in-Shelf System Manager can implement some other private communication mechanism with its corresponding Shelf Manager. Also, while IPMI emphasizes Ethernet as the physical medium for the LAN Interface, some AdvancedTCA® systems can use other Internet Protocol capable media.

¶28 The System Manager’s access to the Shelf Manager depends on the definition of one or more single IP addresses called the Active Shelf Manager IP (Internet Protocol) Address Sets. An Active Shelf Manager IP Address Set is a logical IP address that can include more than one physical IP address, each one considered an element of the logical address. For instance, a logical address could include the IPv4 address and/or one or two IPv6 addresses. All elements of this logical-This IPv4 address are allocated to only one physical interface at any point in time.

¶29 The default IPv4 element of an Active Shelf Manager IP Address Set can be defined in the Shelf FRU Information via the record defined in Table 3-35, “Shelf Manager IPv4 Connection record [‡ full replacement].” The default address is not required, but when present and documented, it can simplify the initial configuration and testing of a Shelf and/or its Shelf Manager. Shelf vendors are urged to use a RFC1597 non-routable IP address as the default address to aid in installation and diagnostic testing. A factory fresh, Ethernet accessible, Shelf Manager FRU and/or Shelf that complies with this recommendation can be brought up, attached to an Ethernet link, and respond to ICMP ping commands to verify network connectivity, without any prior configuration steps. That validated IP link can then be used to establish a unique default IPv4 Shelf Manager IP Address for the Shelf’s on-going operation.

¶30 In a Shelf that implements ShMC Cross-connects or other redundant interfaces, the Shelf Manager can use multiple separate Active Shelf Manager IP Address Sets for its redundant network interfaces. To allow that, a Shelf can define multiple default addresses for the Shelf Manager’s Active Shelf Manager IP Address Sets. In this case, multiple Shelf Manager IPv4 Connection records are present in the Shelf FRU Information and define IPv4 elements of these default Active Shelf Manager IP Address Sets. A Shelf Manager applies the information in these Shelf FRU Information records sequentially to its IPMI LAN channels, in ascending order of those LAN channel numbers.
A Default Gateway IPv4 Address (IPv4 address Address of the gateway used when the Shelf Manager sends a message or alert) and IPv4 Subnet Mask can also be defined via fields in this same record (see Table 3-35, “Shelf Manager IPv4 Connection record [‡ full replacement]”). Note that the Default Gateway IPv4 Address and IPv4 Subnet Mask are not present in the 00h version of this record that is defined in the PICMG 3.0 R1.0 specification.

Table 3-35 Shelf Manager IPv4 Connection record [‡ full replacement]

<table>
<thead>
<tr>
<th>Offset</th>
<th>Length</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>Record Type ID. For all records defined in this specification a value of C0h (OEM) is used.</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>End of List / Version. 7:7 – End of List. Set to one for the last record. 6:4 – Reserved. Write as 0. 3:0 – Record format version. Set to 2h for this definition.</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Record Length.</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>Record Checksum.</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>Header Checksum.</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>Manufacturer ID. LS byte first. Write as the three byte ID assigned to PICMG®. For this specification, the value 12634 (00315Ah) is used.</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>PICMG Record ID. For the Shelf Manager IPv4 Connection record, the value 13h is used.</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>Record Format Version. For this specification, the value 01h is used.</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td>Shelf Manager IPv4 Address. MS-byte first. The default IPv4 address used to connect with the Shelf Manager after Shelf Manager initialization. The value 0.0.0.0 indicates that no default IPv4 address is defined in the Active Shelf Manager IP Address Set.</td>
</tr>
<tr>
<td>14</td>
<td>4</td>
<td>Default Gateway IPv4 Address[1]. MS-byte first. The IPv4 This is the IP address of the gateway (router) used when the Shelf Manager sends a message or alert to a party on a different subnet. The value 0.0.0.0 indicates that no Default Gateway IPv4 Address is defined.</td>
</tr>
<tr>
<td>18</td>
<td>4</td>
<td>IPv4 Subnet Mask[1]. MS-byte first. A mask that identifies the network (vs. host) part of the Shelf Manager IPv4 Address. The value 0.0.0.0 indicates that no IPv4 Subnet Mask is defined.</td>
</tr>
</tbody>
</table>

NOTES:

[1] Field added in Engineering Change Notice 3.0-1.0-001 of this specification and Record Format Version updated from 00h to 01h.

[2] Engineering Change Notice 3.0-3.0-001 makes some changes in the field names of this record: specifically, the addition of “IPv4” to several of the field names for clarity. However, since the binary form and functional effect of the record are not affected by these field name changes, the Record Format Version remains at 01h to simplify backward compatibility.

The Shelf Manager can also support the IPv6 protocol and provide IPv6-based access for the System Manager. This optional IPv6 support is in addition to the IPv4 support that has been mandated in PICMG 3.0 from the beginning. This access conforms to the model defined in IPMI v2.0, Section 23. In particular, the Shelf Manager implements the IPv6-related LAN configuration parameters (50 through 80) and allows IPv6 support to be dynamically turned on and off by means of LAN Configuration parameter 51 IPv6/IPv4 Addressing enables. The IPv6 addresses of the Shelf Manager can be configured using the LAN Configuration parameter 56 IPv6 Static Addresses. With respect to IPv4 support, an implementation can allow that support to be dynamically turned on and off, but is not allowed to omit it completely.
¶33 The default IPv6 components of an Active Shelf Manager IP Address Set can be defined in the Shelf FRU Information via the record defined in Table 3-2000, “Shelf Manager IPv6 Connection record.” The default addresses are not required, but when present and documented, they can simplify the initial configuration and testing of a Shelf and/or its Shelf Manager.

¶34 Multiple Shelf Manager IPv6 Connection records can be present in the Shelf FRU Information; in the case of multiple records, each record specifies the addressing information for one redundant network interface (e.g. an ShMC Cross-connect Channel) of the Shelf Manager. A Shelf Manager applies the information in these Shelf FRU Information records sequentially to its IPMI LAN channels, in ascending order of those LAN channel numbers. Each record includes one or two IPv6 address entries and zero, one, or two router information entries. Each record can contain a default IPv6 address for a particular Shelf Manager IP interface and its associated IPMI channel for RMCP/RMCP+ communication, together with the corresponding prefix length (so there can be two default IPv6 addresses for each interface). An IPv6 address of all zeros indicates that this default IPv6 address is not configured. Each router information entry contains the IPv6 address of the corresponding router, the optional router MAC address, and the prefix served by the router together with its length. An IPv6 address of all zeros for a router indicates that this router is not configured.

¶35 An empty Shelf Manager IPv6 Connection record (with IPv6 Address Entries Count=0) can be utilized as a placeholder for an IPMI channel that does not support IPv6.

Table 3-2000 Shelf Manager IPv6 Connection record

<table>
<thead>
<tr>
<th>Offset</th>
<th>Length</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>Record Type ID. For all records defined in this specification, a value of C0h is used.</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>End of List/Version</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[7] - End of List. Set to one for the last record</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[6:4] - Reserved, write as 0h</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[3:0] - Record format version (=2h for this definition)</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Record Length</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>Record Checksum. Holds the zero checksum of the record.</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>Header Checksum. Holds the zero checksum of the header.</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>Manufacturer ID. LS byte first. Write as the three byte ID assigned to PICMG. For this specification the value 12634 (00315Ah) is used.</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>PICMG Record ID. For the Shelf Manager IPv6 Connection record, the value 1Fh is used.</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>Record Format Version. For this specification the value 00h is used.</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>IPv6 Address Entries Count. Indicates the number of following IPv6 Address Entries. Must be in the range 0..2.</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>IPv6 Router Information Entries Count. Indicates the number of following IPv6 Router Information Entries. Must be in the range 0..2.</td>
</tr>
<tr>
<td>12</td>
<td>N</td>
<td>IPv6 Address Entries. This is an array of IPv6 Address Entries. Each entry is formatted as shown in Table 3-2001, “IPv6 Address Entry”, N = (IPv6 Address Entries Count *17)</td>
</tr>
<tr>
<td>12+N</td>
<td>M</td>
<td>IPv6 Router Information Entries. This is an array of IPv6 Router Information Entries. Each entry is formatted as shown in Table 3-2002, “IPv6 Router Information Entry”, M = (IPv6 Router Information Entries Count *39)</td>
</tr>
</tbody>
</table>
Table 3-2001 IPv6 Address Entry

<table>
<thead>
<tr>
<th>Offset</th>
<th>Length</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>16</td>
<td>IPv6 Address. A static IPv6 address assigned to the Shelf Manager, in network byte order. This address is assigned to the active Shelf Manager and is subject to failover to the newly active Shelf Manager in the case of a switchover. A value of all 0s indicates that this entry does not specify a valid static IPv6 address to assign to the Active Shelf Manager IP Address Set; it can be used as a placeholder.</td>
</tr>
<tr>
<td>16</td>
<td>1</td>
<td>Prefix Length. The number of bits allocated to the network part of the address. Must be in the range 0..128.</td>
</tr>
</tbody>
</table>

Table 3-2002 IPv6 Router Information Entry

<table>
<thead>
<tr>
<th>Offset</th>
<th>Length</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>16</td>
<td>Router IPv6 Address. This is the IPv6 address of the router, in network byte order</td>
</tr>
<tr>
<td>16</td>
<td>6</td>
<td>Router MAC Address. Optional; consists of six zero bytes if not specified</td>
</tr>
<tr>
<td>22</td>
<td>16</td>
<td>Router Prefix. This prefix defines the range of IPv6 destination addresses served by this router; packets directed to these addresses must be sent through this router. For a default router, this field must consist of all zeros. This field is in network byte order.</td>
</tr>
<tr>
<td>38</td>
<td>1</td>
<td>Router Prefix Length. The number of significant bits in the Router Prefix. For the default router, this field must be 0.</td>
</tr>
</tbody>
</table>

¶36 A Shelf generally has IPv4 and possibly IPv6 addresses on the network in addition to besides the Active Shelf Manager IP Address Sets (with their IPv4 element(s) and/or IPv6 element(s)). Each Shelf Manager in a Shelf generally has one IPv4 address and zero or more IPv6 addresses for every IP interface it owns. In addition, the addresses from the Active Shelf Manager IP Address Sets are enabled on one the active Shelf Manager. A System Manager generally monitors each interface on every Shelf Manager; otherwise the system can silently lose a network connection to an inactive Shelf Manager.

¶37 The “Get Shelf Manager IP Addresses” command provides access to all the IP addresses used by Shelf Managers (both IPv4 and IPv6). Each IP address is for one or more Shelf Managers and must not be unavailable for more than the time given for the address.

¶38 The System Manager can use the addresses provided by the “Get Shelf Manager IP Addresses” command to monitor all interfaces. If an address stops responding, it could be a configuration change, a network problem, or it might be an actual device failure. If an address stops responding, the System Manager needs to check if the addresses have changed. It does this first by fetching the first address and checking if the “Shelf IP Address Last Change Timestamp” field has changed. If that field has changed, the Shelf Manager needs to read all the addresses. If the failed address is no longer in the addresses then the address has been removed because of a reconfiguration. If the timestamp has not changed or the failed address is still in the list of addresses, the address has failed.

¶39 In the “Get Shelf Manager IP Addresses” command, the retrieval of an IPv6 address and its corresponding address information are done in two separate invocations of the command.
Section 3

This is necessary because of the limit on the size of messages (specifically, response messages in this case) that can be carried on IPMB.

Table 3-36 Get Shelf Manager IP Addresses command [‡ full replacement]

<table>
<thead>
<tr>
<th>Byte</th>
<th>Data Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PICMG Identifier&lt;br&gt;Indicates that this is a PICMG-defined group extension command. A value of 00h is used.</td>
</tr>
<tr>
<td>2</td>
<td>Address Number. Indicates the particular address to fetch. The addresses start at zero and are monotonically increasing to one less than the Address Count. At least one address must always be present. Address Number = 0 always refers to the Shelf Manager IP Address.</td>
</tr>
<tr>
<td>3</td>
<td>Request Type. Indicates the particular address family and type of output requested. The families that are currently defined are IPv4 and IPv6. Numbering of addresses is separate within each family. The following values are defined for this field:&lt;br&gt;00h = IPv4 family&lt;br&gt;01h = IPv6 family, return the address information&lt;br&gt;02h = IPv6 family, return the address itself&lt;br&gt;Other values are reserved.&lt;br&gt;This field is optional with the default value = 00h (IPv4 family).</td>
</tr>
<tr>
<td>1</td>
<td>Completion Code</td>
</tr>
<tr>
<td>2</td>
<td>PICMG Identifier&lt;br&gt;Indicates that this is a PICMG-defined group extension command. A value of 00h is used.</td>
</tr>
<tr>
<td>3-6</td>
<td>Shelf IP Address Last Change Timestamp. This value must be the last time a Shelf IP Address was added, deleted, or changed. For Request Type = 00h, IPv4 family</td>
</tr>
<tr>
<td>7</td>
<td>Address Count. The number of Shelf IP Addresses within the requested family.</td>
</tr>
<tr>
<td>8</td>
<td>Site Type. Indicates the particular Site Type that owns this IP address at this time.</td>
</tr>
<tr>
<td>9</td>
<td>Site Number. Indicates the particular Site Number that owns this IP address at this time.</td>
</tr>
<tr>
<td>10</td>
<td>Maximum Unavailable Time. Indicates the maximum time in seconds that this particular IP address could become unavailable due to a normal maintenance operation. If the IP address is unavailable for longer than this time, then the interface can be assumed to have a failure unless it has been removed from the Shelf IP Addresses.</td>
</tr>
<tr>
<td>11</td>
<td>Address Type. Indicates the type of address that follows.&lt;br&gt;[7] - If this bit is set to 1, this address is in the Active Shelf Manager IP Address Set.&lt;br&gt;[6-0] - The particular type of address that follows in bytes 12-n:&lt;br&gt;00h - IPv4 address. Described in Table 3-37, “IPv4 Address format”&lt;br&gt;01h-5fh - reserved&lt;br&gt;60h-7fh – OEM</td>
</tr>
<tr>
<td>12-15</td>
<td>IPv4 Address. The IPv4 address in network order</td>
</tr>
<tr>
<td>16-17</td>
<td>RMCP Port. The RMCP port in network order. The Shelf Manager must respond to &quot;RMCP/RSP Presence Ping&quot; messages on this port on the IPv4 address specified in bytes 12-15. For Request Type = 01h, IPv6 family, return the address information</td>
</tr>
<tr>
<td>7</td>
<td>Address Count. The number of Shelf IP Addresses within the requested family.</td>
</tr>
<tr>
<td>8</td>
<td>Site Type. Indicates the particular Site Type that owns this IP address at this time.</td>
</tr>
<tr>
<td>9</td>
<td>Site Number. Indicates the particular Site Number that owns this IP address at this time.</td>
</tr>
</tbody>
</table>
Section 3

<table>
<thead>
<tr>
<th>Byte</th>
<th>Data Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Maximum Unavailable Time. Indicates the maximum time in seconds that this particular IP address could become unavailable due to a normal maintenance operation. If this IP address is unavailable for longer than this time, the interface can be assumed to have a failure unless it has been removed from the Shelf IP Addresses.</td>
</tr>
<tr>
<td>11</td>
<td>Address Type. Indicates the type of address that follows. [7] - If this bit is set to 1, this address is in the Active Shelf Manager IP Address Set. [6-0] - reserved, set to 0</td>
</tr>
<tr>
<td>12-13</td>
<td>RMCP Port. The RMCP port in network order. The Shelf Manager must respond to “RMCP/ASF Presence Ping” messages on this port on the corresponding IPv6 address.</td>
</tr>
<tr>
<td></td>
<td>For Request Type = 02h, IPv6 family, return the address itself</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Byte</th>
<th>Data Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-22</td>
<td>IPv6 Address. The IPv6 address in network order</td>
</tr>
<tr>
<td>23</td>
<td>Prefix Length. The number of bits allocated to the network part of the address. Must be in the range 0..128;</td>
</tr>
</tbody>
</table>

**Table 3-37 IPv4 address format**

<table>
<thead>
<tr>
<th>Byte</th>
<th>Data field</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4</td>
<td>The IPv4 address in network order.</td>
</tr>
<tr>
<td>5-6</td>
<td>RMCP port in network order. The Shelf Manager must respond to “RMCP/ASF Presence Ping” messages on this port on the IPv4 address specified in bytes 1-4.</td>
</tr>
</tbody>
</table>

The following requirements are independent of which particular IP-based upper layer protocols are used to interact with the Shelf Manager. The requirements in the next section focus on IPMI-defined ways to accomplish that interaction.

**Requirements**

REQ 3.291a A single Shelf Manager **shall** implement one or more Internet Protocol (IPv4) capable interfaces for communication with the System Manager.

REQ 3.2000 A single Shelf Manager **may** implement IPv6 on some or all of its Internet Protocol (IPv4) capable interfaces.

REQ 3.2001 If a Shelf Manager implements IPv6 on an interface, the IPv6 implementation **shall** comply with the IPMI v2.0 specification, in particular with Section 13 (IPMI LAN Interface) and Section 23.2 (IPv6-related LAN Configuration Parameters).

REQ 3.2002 If a Shelf Manager implements IPv6 on an interface, it **shall** support enabling and disabling IPv6 addressing on the interface via the LAN Configuration Parameter IPv6/IPv4 Addressing enables (51).

REQ 3.2003 If a Shelf Manager implements IPv6 on an interface, it **shall** report 1b in the Implementation can be configured to use both IPv4 and IPv6 addresses simultaneously bit of the IPv6/IPv4 Support LAN Configuration Parameter (50) and accept the Enable IPv6 and IPv4 addressing simultaneously (02h) value for the IPv6/IPv4 Addressing enables LAN Configuration Parameter (51).

REQ 3.2004 If a Shelf Manager implements IPv6 on an interface, it **may** report 1b in the Implementation can be configured to use IPv6 addresses only bit of the IPv6/IPv4
Support LAN Configuration Parameter (50) and accept the Enable IPv6 addressing only. IPv4 addressing is disabled. (01h) value for the IPv6/IPv4 Addressing enables LAN Configuration Parameter (51).

REQ 3.292 The Active Shelf Manager IP Address Set capable interfaces may include IEEE 802.3 interface(s) and use one or more of the following implementations:

Zone 2 Base Interface
Front Board Face Plate external ISO/IEC 8877 (1992) compliant connector.

REQ 3.293 Any IEEE 802.3 interface used for the System Manager Interface on the FRU containing the Shelf Manager may be disabled when the FRU is in a non-active Operational State.

REQ 3.294 Any IEEE 802.3 interface used for the System Manager Interface on the FRU containing the Shelf Manager should include a visible GREEN indicator signaling that the interface is active.

REQ 3.295a Unless IPv4 addressing is disabled on an interface, the active Shelf Manager shall respond to System Manager requests received on that interface and directed at a single RFC790 (IPv4) address which is part of the Active Shelf Manager IP Address Set for that interface.

REQ 3.2005 An active Shelf Manager that supports IPv6 and has it enabled shall respond to System Manager requests directed at any of the RFC4291 (IPv6) address elements within any of its Active Shelf Manager IP Address Sets.

REQ 3.296a An AdvancedTCA® Shelf Manager shall support modifying the Default Gateway IPv4 Address and IPv4 Subnet Mask fields in the Shelf Manager IPv4 Connection record via the IPMI LAN channel used for connection with the System Manager.

REQ 3.297a At least one Shelf Manager IPv4 Connection record shall be implemented in the Shelf FRU Information as defined in Table 3-35, “Shelf Manager IP-IPv4 Connection record [‡ full replacement].”

REQ 3.2006 Additional Shelf Manager IPv4 Connection records may be implemented in the Shelf FRU Information in order to support ShMC Cross-connects or other redundant Shelf Manager interfaces.

REQ 3.2007 Additional Shelf Manager IPv6 Connection records may be implemented in the Shelf FRU Information in order to support ShMC Cross-connects or other redundant Shelf Manager interfaces.

REQ 3.2008 An active Shelf Manager shall apply each Shelf Manager IPv4 Connection record from the Shelf FRU Information to one IPMI LAN channel, with the physical order of records in the Shelf FRU Information mapped sequentially to the ascending sequence of
Section 3

IPMI LAN channel numbers implemented by the Shelf Manager, ignoring any records in excess of the number of IPMI LAN channels.

REQ 3.2010 An active Shelf Manager that supports IPv6 shall apply each Shelf Manager IPv6 Connection record from the Shelf FRU Information to one IPMI LAN channel, with the physical order of records in the Shelf FRU Information mapped sequentially to the ascending sequence of IPMI LAN channel numbers implemented by the Shelf Manager, ignoring any records in excess of the number of IPMI LAN channels.

REQ 3.298a Each Shelf Manager IPv4 Connection record should provide a default Shelf Manager IPv4 Address.

REQ 3.299a Each Shelf Manager IPv4 Connection record may also provide a Default Gateway IPv4 Address and IPv4 Subnet Mask.

REQ 3.300a The 00h version of the Shelf Manager IP Connection record as defined in PICMG 3.0 R1.0 (the Shelf Manager IPv4 Connection record in this ECN) is valid and shall be supported by the Shelf Manager in addition to the current version.

REQ 3.301a A default Shelf Manager IPv4 Address, if provided, should use one of the non-routable IP address ranges documented in RFC1597.

REQ 3.302a Shelf vendors may use a default Shelf Manager IPv4 Address of 192.168.16.17 for one of the Shelf Manager IPv4 Connection records.

REQ 3.303a If a default value(s) for the Shelf Manager IPv4 Address are established, they shall be documented and highlighted for installers. After Shelf bring up, a system integrator would change the Shelf Manager IPv4 Addresses to appropriate values for operational use.

REQ 3.304a If a default Shelf Manager IPv4 Address is present in the Shelf Manager IPv4 Connection record, and IPv4 addressing is not disabled on the System Manager Interface, the Shelf Manager shall respond to all UDP, ARP, and ICMP traffic on the System Manager Interface within 1 s after the Shelf Manager FRU enters Operational State M4.

REQ 3.305a A Shelf Manager, if IPv4 addressing is not disabled on the System Manager Interface, shall implement the “Get Shelf Manager IP Addresses” command as defined in Table 3-36, “Get Shelf Manager IP Addresses command [‡ full replacement],” with the optional field Request Type absent or explicitly set to 00h (IPv4 family).

REQ 3.3011 A Shelf Manager that supports IPv6 and has it enabled shall implement the “Get Shelf Manager IP Addresses” command with Request Type values 01h (IPv6 family, return the address information) and 02h (IPv6 family, return the address itself).

REQ 3.306a Every IP-capable interface on any Shelf Manager in a Shelf that could take over the Active Shelf Manager IP Address Sets shall be reported by the “Get Shelf Manager IP Addresses” command. The Shelf Manager IP Address shall be reported as Address Number 0.
REQ 3.2012 In the “Get Shelf Manager IP Addresses” response, the IPv4 addresses from the Active Shelf Manager IP Address Sets shall be reported before any other IPv4 addresses when Request Type is 00h (IPv4 family).

REQ 3.2013 In the “Get Shelf Manager IP Addresses” response, the IPv6 addresses from the Active Shelf Manager IP Address Sets and their attributes shall be reported before any other IPv6 addresses, when the Request Type parameters are 01h and 02h (IPv6 family).

REQ 3.307 To monitor all interfaces on the Shelf, a System Manager should periodically check all IP addresses acquired via the “Get Shelf Manager IP Addresses” command to any changes, and in the case of a response failing for a period longer than given via the “Get Shelf Manager IP Addresses” command, immediately reissue the “Get Shelf Manager IP Addresses” command to adopt a change or to recognize an interface failure.

REQ 3.308a A Shelf Manager shall respond to any “RMCP/ASF Presence Ping” message with a properly formatted “RMCP/ASF Pong” response message on any address (whether IPv4 or IPv6) advertised by the “Get Shelf Manager IP Addresses” command response for that Shelf that matches the Shelf Manager’s Site Type and Site Number.

### 3.3.1.3 IPMI-oriented System Manager communications [+ full replacement]

¶41 To maximize interoperability, Shelf Managers support the IPMI LAN Interface (as defined in Section 12 of the IPMI v1.5 and Section 13 of the IPMI v2.0 specification) in their System Manager Interface. As mentioned above, an in-Shelf System Manager can implement some other private communication mechanism with its corresponding Shelf Manager. Also, while IPMI emphasizes Ethernet as the physical medium for the LAN Interface, AdvancedTCA® systems can use other Internet Protocol capable media. The IPMI LAN Interface is based on the Remote Management Control Protocol (RMCP) that runs on top of UDP. However, some features of the IPMI LAN Interface are specific to Ethernet, such as the provision for setting six-byte MAC addresses in the “Set LAN Configuration Parameters” command. This specification does not address the handling and/or replacement of such features for a non-Ethernet System Manager Interface.

¶42 In addition to IPv4, the Shelf Manager can support IPv6 for the interface with the System Manager.

¶43 The AdvancedTCA-specific privilege level requirements for handling “Send Message” commands are defined in Section 3.3.1.4, “AdvancedTCA® extensions to IPMI’s BMC requirements.”

### Requirements

REQ 3.309 An AdvancedTCA® Shelf Manager may connect to the ShMC Port on the Base Interface.

REQ 3.310 An AdvancedTCA® Shelf Manager shall facilitate interoperability at the System Manager Interface across AdvancedTCA® Shelves and with other IPMI-managed platforms via an IPMI LAN Interface over Ethernet or (if Ethernet is not available) another Internet Protocol capable medium.

REQ 3.311 An AdvancedTCA® Shelf Manager shall provide a mechanism for disabling RMCP.
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REQ 3.312 An AdvancedTCA® Shelf Manager shall support modifying the IPv4 address in an Active Shelf Manager IP Address Set and related network settings via the IPMI “Set LAN Configuration Parameters Command” with changes in the IP Address, Subnet Mask, or Default Gateway Address configuration parameters for the IPMI LAN Channel used for connection with the System Manager.

REQ 3.2014 An AdvancedTCA® Shelf Manager that supports IPv6 on a network interface shall support modifying the IPv6 addresses in an Active Shelf Manager IP Address Set and related settings via the IPMI “Set LAN Configuration Parameters” command with changes in the IPv6 Static Addresses, IPv6 Static Router 1/2 IP Address, IPv6 Static Router 1/2 MAC Address, IPv6 Static Router 1/2 Prefix Length, IPv6 Static Router 1/2 Prefix Value configuration parameters for an IPMI LAN Channel used for connection with the System Manager.

REQ 3.313 An AdvancedTCA® Shelf Manager shall ensure that any changes made via the IPMI “Set LAN Configuration Parameters Command” result in corresponding changes in the Shelf Manager IPv4 Connection record in the Shelf FRU Information (including redundant instances), so that default IP address settings for the Shelf are consistent.

REQ 3.2015 An AdvancedTCA® Shelf Manager that supports IPv6 on a network interface shall ensure that any changes made via the IPMI “Set LAN Configuration Parameters” command for the corresponding IPMI channel result in equivalent changes in the corresponding Shelf Manager IPv6 Connection record in the Shelf FRU Information (including redundant instances), so that default IPv6 address settings for the Shelf are consistent.

REQ 3.314 An AdvancedTCA® Shelf Manager shall support the “Send Message with response tracking” command through the System Manager Interface so the Shelf Manager can act as a pass-through to IPMB-0.

REQ 3.315 An AdvancedTCA® Shelf Manager may provide an IPMI Serial/Modem Interface in accordance with the IPMI specification (see especially Section 13 of the IPMI v1.5 and Section 14 of the IPMI v2.0 specification).

REQ 3.316 An AdvancedTCA® Shelf Manager may provide Platform Event Filtering, as defined in the IPMI specification (see especially Section 15 of the IPMI v1.5 and Section 17 of the IPMI v2.0 specification). Platform Event Filtering allows the Shelf Manager to perform a configurable action based on an event, by matching the event against a set of “event filters.”

REQ 3.317 An AdvancedTCA® Shelf Manager may support IPMI Alert Processing according to the IPMI specification (see especially Section 15 of the IPMI v1.5 and Section 17 of the IPMI v2.0 specification). This function enables a Shelf Manager to deliver alerts, such as SNMP Traps, in Platform Event Trap (PET) format over media such as LAN and PPP.

REQ 3.2016 An AdvancedTCA® Shelf Manager that supports IPv6 on a network interface may support sending IPMI Alerts to IPv6 addresses, specified via the LAN configuration parameter Destination Addresses with Address Format set to 1h (IPv6 IP Address).
3.3.1.4 AdvancedTCA® extensions to IPMI’s BMC requirements

The final group of overall requirements addresses Shelf Manager functions that represent significant AdvancedTCA® extensions to IPMI’s BMC requirements.

### 3.3.1.4.1 Active/backup communication

The most substantial extension is a recommendation that the Shelf Manager implement active/backup counterpart instances for redundancy. However, this specification purposely does not define the details of how these instances (which are assumed to be provided by the same vendor) interact with each other, such as how they coordinate their actions, maintain consistency, or change roles between active and backup.

If the Shelf Manager FRU has a Handle Switch, action on this switch can affect the activation status of a Shelf Manager, including potentially triggering a switchover from the active to a backup Shelf Manager.

Other key extensions to IPMI’s BMC requirements are covered in Section 3.3.2, “Shelf Manager initialization,” Section 3.6.4, “Shelf FRU Information,” and Section 3.9, “Shelf power and cooling.”

### Requirements

**REQ 3.318** An AdvancedTCA® Shelf Manager **should** implement active/backup counterparts instances for redundancy.

**REQ 3.319** A FRU containing the Shelf Manager **should** implement a Handle Switch.

**REQ 3.320** If implemented on a FRU that includes a Handle Switch, an AdvancedTCA® Shelf Manager **should** use that switch to affect a Shelf Manager’s activation state such that a Shelf Manager is active only when the FRU is in an active Operational State.

### 3.3.1.4.2 Chassis command extensions

Additional requirements clarify the behavior of the Shelf Manager when it receives the IPMI v1.5/v2.0 Chassis Commands.

### Requirements

**REQ 3.321a** The Shelf Manager **should** implement the IPMI Chassis Commands (see Section 22 of the IPMI v1.5 and Section 28 of the IPMI v2.0 specification).

**REQ 3.321.1** In the “Get Chassis Status” command, any references to AC power **shall** be generalized to either AC or DC power.

**REQ 3.321.2** When a Shelf Manager receives a “Chassis Control (Power Down)” command, it **shall** send a “Set Power Level” command with a Power Level of 0 to all FRUs to power down Payload functions.

**REQ 3.321.3** When a Shelf Manager in a powered down Shelf receives a “Chassis Control (Power Up)” command, it **shall** step through power sequencing as if it were an initial power-up.
REQ 3.321.4 When a Shelf Manager in a powered up Shelf receives a “Chassis Control (Power Cycle)” command, it may send a “Set FRU Activation (Deactivate FRU)” command followed by a “Set FRU Activation Policy (Clear Locked)” command after the FRU reaches the M1 state and a “Set FRU Activation (Activate FRU)” command, after it reaches the M2 state, to each FRU that is currently powered.

REQ 3.321.5 When a Shelf Manager receives a “Chassis Control (Hard Reset)” command, it shall send a “FRU Control (Cold Reset)” command to each powered up FRU.

REQ 3.321.6 When a Shelf Manager receives a “Chassis Control (Pulse Diagnostic Interrupt)” command, it may send a “FRU Control (Issue Diagnostic Interrupt)” command to each powered up FRU.

REQ 3.321.7 When a Shelf Manager receives a “Chassis Control (Soft Shutdown)” command, it shall send a “Set FRU Activation (Deactivate FRU)” command to all FRUs to power down Payload functions gracefully.

3.3.1.4.3 Shelf Manager failover network communication

¶49 Additional requirements clarify the assumptions that a System Manager can make when it communicates at the IP/UDP level with a Shelf Manager that may have active/backup instances.

¶50 In the event of a shut down of the Shelf Manager instance using the Active Shelf Manager IP Address Sets, the addresses from these sets are reallocated via private mechanisms to the backup Shelf Manager instance. The backup instance enables these IP addresses for UDP packet communications within one second. If the Shelf Manager supports IPv6 elements of the Active Shelf Manager IP Address Sets, they are also reallocated to the backup Shelf Manager and become available for UDP packet communications within one second. TCP behavior across a transfer requires reestablishment of the IP Port connections and states; this specification does not define a time period for activation of the TCP ports. 802.3 interfaces must not transfer MAC addresses between them.

Requirements

REQ 3.322 If a Shelf has two operating Shelf Manager instances, one active and one backup, there shall not be a period of more than one second where a Shelf Manager is unable to transmit and receive UDP packets using the addresses from the Active Shelf Manager IP Address Sets.

REQ 3.323a When a Shelf Manager instance assumes the active role, and IPv4 addressing is enabled on an interface, it shall send at least one unsolicited RFC 826 compliant ARP message before transmitting any other UDP packets on that interface.

REQ 3.323.1a When a Shelf Manager instance assumes the active role, and IPv4 addressing is enabled on an interface, it should send two additional unsolicited RFC 826 compliant ARP messages on that interface in addition to the one required in REQ 3.323.

REQ 3.2017 When a Shelf Manager instance that supports IPv6 and has IPv6 enabled assumes the active role, it shall send at least one unsolicited RFC 4861 compliant Neighbor...
Advertisement message for each of the reallocated IPv6 addresses before transmitting any other UDP packets.

REQ 3.2018 When a Shelf Manager instance that supports IPv6 and has IPv6 enabled assumes the active role, it **should** send two additional unsolicited RFC 4861 compliant Neighbor Advertisement messages for each of the reallocated IPv6 addresses in addition to the one required in REQ 3.2014.

REQ 3.324 When a backup Shelf Manager instance assumes the active role, it **shall** inherit and maintain all UDP port allocations and states from the deactivated Shelf Manager instance.

REQ 3.325 When switching Shelf Manager IP Addresses between physical interfaces, the Shelf Manager **may** maintain TCP port allocations or states. Note that RMCP uses only UDP ports.

REQ 3.326a If a Shelf has two operating Shelf Manager instances, one active and one backup, and IPv4 addressing is enabled on an interface, only the active Shelf Manager instance **shall** respond on that interface using the RFC 826 ARP protocol to resolve the MAC address for the Shelf Manager IPv4 Address.

REQ 3.2019 If a Shelf has two operating Shelf Manager instances, one active and one backup, and IPv6 is supported and enabled on an interface, only the active Shelf Manager instance **shall** respond on that interface using the RFC 4861 Neighbor Discovery protocol to resolve the MAC address for the Shelf Manager IPv6 Address(es).

### 3.3.1.4.4 IPMI LAN Interface between System and Shelf Managers

¶51 The following set of requirements provides similar guidance at the IPMI level for System Manager interactions with a Shelf Manager, with a focus on the aspect of that interface that is required in AdvancedTCA®, an implementation of the IPMI LAN Interface.

¶52 Only a single Shelf Manager instance can be active at any given time; however, it can expose multiple network interfaces for communication with the System Manager. The Shelf Manager instances must synchronize their data, including FRU Information, IPMI configuration parameters, and active sessions, to guarantee that the Shelf Manager state is preserved during instance switchovers. This specification does not define either: 1) any private interface between the redundant Shelf Manager instances or 2) any protocol used for synchronizing their states. The specification does provide guidance, however, regarding the System Manager Interface presented by a Shelf Manager that implements redundant instances.

**Requirements**

REQ 3.327 The redundant Shelf Manager instances **shall** contain equivalent IPMI configuration parameters and FRU Information at all times, except while the active instance is processing a command that modifies its data and during Shelf Manager instance initialization.
REQ 3.328 For IPMI commands received over the IPMI LAN Interface, the Shelf Manager **should** ensure that when a response is sent, any resulting state changes are reflected on all redundant instances of the Shelf Manager.

REQ 3.329 After Shelf Manager instance switchovers, all IPMI sessions that were active on the previously active instance **should** remain active on the newly active instance.

REQ 3.330 If the System Manager sends an IPMI command to the Shelf Manager and does not receive a response within 1 second, it **should** resend the command with incrementing IPMI sequence numbers at 1 second intervals, up to 3 times, and assume that the Shelf Manager has terminated the session if no response is received.

REQ 3.331 If the System Manager sends an IPMI command to the Shelf Manager and the command remains unanswered, the System Manager **shall not** make assumptions about whether or not the command has been executed by the Shelf Manager.

REQ 3.332 In the response to an RMCP or RMCP+ command, as defined in Section 13.6, Table 13-8 of the IPMI v2.0 specification, the “Source IP Address” **shall** be set to the “Destination IP Address” of the corresponding request. Similarly, the “Destination IP Address” of every such response **shall** be set to the “Source IP Address” of the corresponding request. This requirement applies both to IPv4 and IPv6, when used as the underlying network protocol.

### 3.3.1.4.5 Send Message extensions

1. Additional requirements below clarify the behavior of the Shelf Manager when it receives the IPMI v1.5/v2.0 “Send Message” Command. Unlike the IPMI specification, an AdvancedTCA® Shelf Manager does not use the Operator privilege level for “Send Message” commands sent to channel #0 (IPMB). Instead, the privilege level defined for the message that is embedded in the “Send Message” command is used.

2. Shelf Managers could have additional security-related provisions (such as in connection with Multi-Tenancy support), all of which are outside the scope of this specification.

### Requirements

REQ 3.333 For channel #0 (IPMB), the privilege level of the “Send Message” command depends on the privilege level of the message it contains. An AdvancedTCA® Shelf Manager **shall** return a “Cannot execute command. Insufficient privilege level (D4h)” *Completion Code* for any “Send Message” command that contains a message requiring a higher privilege level than the current privilege level of the session in which this command is received. A message with a privilege level allowed in this session **shall** be passed to the specified destination channel.

REQ 3.334a For channels other than channel #0 (IPMB), an AdvancedTCA® Shelf Manager **shall** use privilege levels defined for the “Send Message” command in the IPMI v1.5/v2.0 specification.

### 3.11.2 AdvancedTCA® FRU Information records, sensors and Entity IDs

The only change in this section is an added row in Table 3-102.
### Table 3-102 PICMG® FRU Information records: type ID = C0h (OEM) [‡ updated rows only]

<table>
<thead>
<tr>
<th>Record description</th>
<th>PICMG® 3.0</th>
<th>Record ID</th>
<th>Record present in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shelf Manager IPv4 Connection record</td>
<td>Table 3-35, “Shelf Manager IPv4 Connection record [‡ full replacement]”</td>
<td>13h</td>
<td>Shelf FRU Information</td>
</tr>
<tr>
<td>Shelf Manager IPv6 Connection record</td>
<td>Table 3-2000, “Shelf Manager IPv6 Connection record”</td>
<td>1Fh</td>
<td>Shelf FRU Information</td>
</tr>
</tbody>
</table>
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