To:         T10 Technical Committee
From:       Steven Fairchild, HP (steve.Fairchild@hp.com)
Date:       26 August 2002
Subject:    Proposal to allow an initiator based configuration of the SAS topology

Revision r4:
- Incorporated changes from 8/21-8/23 SAS Protocol Working group meeting.

Revision r3:
- Change ASSIGNED fields to IGNORED fields.
- Change INFORMATION UNIT TYPE to SMP FRAME TYPE.
- Change ROUTE to DISABLE EXPANDER ROUTE ENTRY, changed definition accordingly.
- Removed reference to clouds.
- Changed sas-00 to SAS.
- Changed reference from addendum to annex.
- Added definition of; EXPANDER ROUTE TABLE, EXPANDER ROUTE ENTRY, EXPANDER ROUTE SLOT and EXPANDER ROUTE INDEX.
- Changed MAXIMUM ROUTE SLOT to EXPANDER ROUTE SLOTS.
- Changed MAXIMUM ROUTE INDEXES to EXPANDER ROUTE INDEXES.
- Added UPDATE FAR END SAS ADDRESS and UPDATE DISABLE ROUTE ENTRY for SMP CONFIGURE ROUTE command.

Revision r2:
- Cleanup pass on Open, Identify and SMP commands that have common payloads to maximize re-use (requested by BREA).
- Removed Edge Route device type in favor of making a device type "configurable". Report General will report whether or not a device is configurable (because of general comments received).
- Added definition of **ASSIGNED** field, which means the field position has been assigned to or defined by another command or frame, which re-uses this frame's structure either partially or in its entirety.  Unlike a **RESERVED** field, this field may contain non-0 values, but shall not be redefined or reused.  The receiver shall ignore an **ASSIGNED** field.  This could just as easily be converted to **RESTRICTED** if that definition is more appropriate.
- Added FUNCTION to SMP response frame so that analyzers can more easily decode response frames (requested by I-TECH).

Revision r1:
- Identify address frame now includes two SAS addresses, one for this phy, and one for the far end phy, placed in the same positions are they occur in the Open address frame.  The Discover, Report Route Information, and Configure Route Information have the same change.
- Identify address frame has wording that indicates [prog] min/max phy link rate field(s) may be reported as rate unknown.

This is a multi-part proposal that:
- Modifies the Identify Frame format.
- Modifies the SMP Request/Response format.
- Modifies the SMP Discover function to re-use the Identify Frame payload and support a shift in discovery from a "by Expander" mechanism to a "by Phy" mechanism.
- Modifies the SMP Report General function to remove the bit mask fields and add route fields and a configuration bit.
- Deletes the SMP functions; Report Phy and Report Phy Device Names, because their information is provided in the modified Discover payload.
- Adds the SMP functions; Report Route Information and Configure Route Information, to facilitate the implementation of an initiator based topology discovery.
- Add an annex for guidelines on how an initiator can discover and configure the topology.

**Background**

The purpose for the recommended changes is to reduce the complexity of the expander devices and improve topology error detection. Additionally an annex is provided that will allow the configuration of edge and fanout devices by one or more initiators.

In the current SAS specification, discovery is on a "by Expander" basis. The recommendation is to change this to a "by Phy" basis so that expander devices are not required to consolidate information across multiple phys. This will reduce the expander complexity and increase the flexibility available in building the expander devices.

Also, the current SAS specification imposes rules about the number of edge devices or fanout devices that may be connected to each other, implying that topologies will fail if the rules are broken. The recommendation is to not restrict the interconnection of any end, edge or fanout device. During Discovery, when an initiator determines that an illegal topology has been created, it may take appropriate action. Disabling illegal links and reporting un-reachable SAS addresses as necessary.

## Comparison of frame layout for common or overloaded fields

| | Open Address Frame | Identify Address Frame | | SMP Discover / SMP Report General / SMP Report Route / SMP Configure Route / SMP Phy Control / SMP Phy Margin Control |
|---|---|---|---|---|
| | | | 0 | REQUEST (40H) / RESPONSE (41H) |
| | | | 1 | FUNCTION |
| | | | 2 | RESULT |
| | | | 3 | RESERVED |
| | | | 4 5 | EXPANDER ROUTE SLOT / EXPANDER ROUTE SLOTS |
| | | | 6 7 | EXPANDER ROUTE INDEX / EXPANDER ROUTE INDEXES |
| | | | 8 | RESERVED |
| | | | 9 | PHY IDENTIFIER / NUMBER OF PHYS |
| | | | 10 | PHY OPERATION / CONFIGURE ROUTE [0] |
| | | | 11 | RESERVED |
| 0 | INITIATOR [7] PROTOCOL [4:6] ADDRESS FRAME TYPE [0:3] | IGNORED [7] DEVICE TYPE [4:6] ADDRESS FRAME TYPE [0:3] | 12 | DISABLE EXPANDER ROUTE ENTRY [7] / EXPANDER ROUTE ENTRY DISABLED [7] DEVICE TYPE [4:6] ADDRESS DECODE [0:3] |
| 1 | FEATURES [4:7] LINK RATE [0:3] | IGNORED [4:7] PHY LINK RATE [0:3] | 13 | RESERVED [4:6] PHY LINK RATE [0:3] |
| 2 3 | INITIATOR CONNECTION TAG | RESERVED [4:7] SSP INITIATOR [3] STP INITIATOR [2] SMP INITIATOR [1] RESERVED [0] | 14 | RESERVED [4:7] SSP INITIATOR [3] STP INITIATOR [2] SMP INITIATOR [1] RESERVED [0] |
| | | RESERVED [4:7] SSP TARGET [3] STP TARGET [2] SMP TARGET [1] IGNORED [0] | 15 | RESERVED [4:7] SSP TARGET [3] STP TARGET [2] SMP TARGET [1] SATA TARGET [0] |
| 4 11 | DESTINATION SAS ADDRESS | IGNORED | 16 23 | ATTACHED SAS ADDRESS |
| 12 19 | SOURCE SAS ADDRESS | SAS ADDRESS | 24 31 | SAS ADDRESS |
| 20 21 | RESERVED | IGNORED | 32 | PROG MIN PHY RATE [4:7] MIN PHY RATE [0:3] |
| | PATHWAY BLOCK COUNT | | 33 | PROG MAX PHY RATE [4:7] MAX PHY RATE [0:3] |
| 22 23 | ARBITRATION WAIT TIME | | 34 35 | VENDOR-SPECIFIC |
| 24 27 | RESERVED | RESERVED | 36 39 | RESERVED |
| 28 31 | CRC | CRC | 40 43 | CRC |

| | SMP Discover | | SMP Report General | |
|---|---|---|---|---|
| | **SMP Discover** | | **SMP Report General** | |
| 0 | REQUEST (40H) | RESPONSE (41H) | REQUEST (40H) | RESPONSE (41H) |
| 1 | FUNCTION (00H) | FUNCTION (00H) | FUNCTION (01H) | FUNCTION (01H) |
| 2 | RESERVED | RESULT (00H) | RESERVED | RESULT (00H) |
| 3 | | RESERVED | | RESERVED |
| 4 5 | IGNORED | IGNORED | IGNORED | EXPANDER ROUTE SLOTS |
| 6 7 | | | | EXPANDER ROUTE INDEXES |
| 8 | RESERVED | RESERVED | RESERVED | RESERVED |
| 9 | PHY IDENTIFIER | PHY IDENTIFIER | IGNORED | NUMBER OF PHYS |
| 10 | IGNORED | IGNORED | | RESERVED [1:7] <br> CONFIGURABLE ROUTE [0] |
| 11 | RESERVED | RESERVED | RESERVED | RESERVED |
| 12 | CRC | IGNORED [7] <br> DEVICE TYPE [4:6] <br> ADDRESS DECODE [0:3] | CRC | CRC |
| 13 | | RESERVED [4:7] <br> PHY LINK RATE [0:3] | | |
| 14 | | RESERVED [4:7] <br> SSP INITIATOR [3] <br> STP INITIATOR [2] <br> SMP INITIATOR [1] <br> RESERVED [0] | | |
| 15 | | RESERVED [4:7] <br> SSP TARGET [3] <br> STP TARGET [2] <br> SMP TARGET [1] <br> SATA TARGET [0] | | |
| 16 23 | | ATTACHED SAS ADDRESS | | |
| 24 31 | | SAS ADDRESS | | |
| 32 | | PROG MIN PHY RATE [4:7] <br> MIN PHY RATE [0:3] | | |
| 33 | | PROG MAX PHY RATE [4:7] <br> MAX PHY RATE [0:3] | | |
| 34 35 | | IGNORED | | |
| 36 39 | | RESERVED | | |
| 40 43 | | CRC | | |

| | SMP Report SATA Capabilities | | SMP Manufacturer Information | |
|---|---|---|---|---|
| 0 | REQUEST (40H) | RESPONSE (41H) | REQUEST (40H) | RESPONSE (41H) |
| 1 | FUNCTION (02H) | FUNCTION (02H) | FUNCTION (03H) | FUNCTION (03H) |
| 2 | RESERVED | RESULT (00H) | RESERVED | RESULT (00H) |
| 3 | | RESERVED | | RESERVED |
| 4–7 | CRC | IGNORED | CRC | IGNORED |
| 8 | | RESERVED | | RESERVED |
| 9–10 | | IGNORED | | IGNORED |
| 11 | | RESERVED | | RESERVED |
| 12 | | RESERVED [2:7] ATA QUEUING CAPABLE [1] SATA CAPABLE [0] | | VENDOR IDENTIFICATION |
| 13–15 | | RESERVED | | |
| 16 | | NUMBER OF INITIATORS | | |
| 17 | | SATA VERSION | | |
| 18–19 | | RESERVED | | |
| 20–23 | | CRC | | PRODUCT IDENTIFICATION |
| 24–35 | | | | |
| 36–39 | | | | PRODUCT REVISION LEVEL |
| 40–59 | | | | VENDOR-SPECIFIC |
| 60–63 | | | | CRC |

| | SMP Report Phy Error Log | | SMP Phy SATA | |
|---|---|---|---|---|
| 0 | REQUEST (40H) | RESPONSE (41H) | REQUEST (40H) | RESPONSE (41H) |
| 1 | FUNCTION (11H) | FUNCTION (11H) | FUNCTION (12H) | FUNCTION (12H) |
| 2 | RESERVED | RESULT (00H) | RESERVED | RESULT (00H) |
| 3 | | RESERVED | | RESERVED |
| 4–7 | IGNORED | IGNORED | IGNORED | IGNORED |
| 8 | RESERVED | RESERVED | RESERVED | RESERVED |
| 9 | PHY IDENTIFIER | PHY IDENTIFIER | PHY IDENTIFIER | PHY IDENTIFIER |
| 10 | IGNORED | IGNORED | IGNORED | IGNORED |
| 11 | RESERVED | RESERVED | RESERVED | RESERVED |
| 12–15 | CRC | INVALID CHARACTER COUNT | CRC | REGISTER DEVICE TO HOST FIS |
| 16–19 | | DISPARITY ERROR COUNT | | |
| 20–23 | | LOSS OF BIT SYNC COUNT | | |
| 24–27 | | PHY RESET PROBLEM COUNT | | |
| 28–31 | | CRC | | |
| 32–35 | | | | CRC |

| | SMP Report Route | | SMP Configure Route | |
|---|---|---|---|---|
| 0 | REQUEST (40H) | RESPONSE (41H) | REQUEST (40H) | RESPONSE (41H) |
| 1 | FUNCTION (04H) | FUNCTION (04H) | FUNCTION (80H) | FUNCTION (80H) |
| 2 | RESERVED | RESULT (00H) | RESERVED | RESULT (00H) |
| 3 | | RESERVED | | RESERVED |
| 4 5 | EXPANDER ROUTE SLOT | EXPANDER ROUTE SLOT | EXPANDER ROUTE SLOT | CRC |
| 6 7 | EXPANDER ROUTE INDEX | EXPANDER ROUTE INDEX | EXPANDER ROUTE INDEX | |
| 8 | RESERVED | RESERVED | RESERVED | |
| 9 | IGNORED | IGNORED | IGNORED | |
| 10 | IGNORED | IGNORED | RESERVED | |
| 11 | RESERVED | RESERVED | RESERVED | |
| 12 | CRC | ROUTE ENTRY DISABLED [7] IGNORED [0:6] | DISABLE ROUTE ENTRY [7] IGNORED [0:6] | |
| 13 15 | | IGNORED | IGNORED | |
| 16 23 | | ATTACHED SAS ADDRESS | ATTACHED SAS ADDRESS | |
| 24 35 | | IGNORED | IGNORED | |
| 36 39 | | RESERVED | RESERVED | |
| 40 43 | | CRC | CRC | |

| | SMP Phy Control | | SMP Phy Margin Control | |
|---|---|---|---|---|
| 0 | REQUEST (40H) | RESPONSE (41H) | REQUEST (40H) | RESPONSE (41H) |
| 1 | FUNCTION (90H) | FUNCTION (90H) | FUNCTION (91H) | FUNCTION (91H) |
| 2 | RESERVED | RESULT (00H) | RESERVED | RESULT (00H) |
| 3 | | RESERVED | | RESERVED |
| 4 7 | IGNORED | CRC | IGNORED | IGNORED |
| 8 | RESERVED | | RESERVED | RESERVED |
| 9 | PHY IDENTIFIER | | PHY IDENTIFIER | PHY IDENTIFIER |
| 10 | PHY OPERATION | | IGNORED | IGNORED |
| 11 | RESERVED | | RESERVED | RESERVED |
| 12 15 | IGNORED | | IGNORED | IGNORED |
| 16 31 | | | | |
| 32 | PROG MIN PHY RATE [4:7] IGNORED [0:3] | | | |
| 33 | PROG MAX PHY RATE [4:7] IGNORED [0:3] | | | |
| 34 35 | IGNORED | | VENDOR-SPECIFIC | VENDOR-SPECIFIC |
| 36 39 | RESERVED | | RESERVED | RESERVED |
| 40 43 | CRC | | CRC | CRC |

**Change 1: Modify the Identify Frame format**

from:

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | | Reserved | | | | ADDRESS FRAME TYPE (0h) | | |
| 1 | | | | PHY IDENTIFIER | | | | |
| 2 | | Reserved | | | | MAXIMUM PHYSICAL LINK RATE | | |
| 3 | DEVICE TYPE | | STP INITIATOR | STP TARGET | SSP INITIATOR | SSP TARGET | SMP INITIATOR | SMP TARGET |
| 4 ... 11 | | | | DEVICE NAME | | | | |
| 12 ... 27 | (MSB) | | | Reserved | | | | (LSB) |
| 28 ... 31 | (MSB) | | | CRC | | | | (LSB) |

to:

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | Ignored | DEVICE TYPE | | | ADDRESS FRAME TYPE (0h) | | | |
| 1 | Ignored | | | | PHY LINK RATE | | | |
| 2 | Reserved | | | | SSP INITIATOR | STP INITIATOR | SMP INITIATOR | Reserved |
| 3 | Reserved | | | | SSP TARGET | STP TARGET | SMP TARGET | Ignored |
| 4 ... 11 | | | | Ignored | | | | |
| 12 ... 19 | (MSB) | | | SAS ADDRESS | | | | (LSB) |
| 20 ... 21 | | | | Ignored | | | | |
| 22 ... 27 | | | | Reserved | | | | |
| 28 ... 31 | (MSB) | | | CRC | | | | (LSB) |

The ADDRESS FRAME TYPE field as defined in SAS.

The DEVICE TYPE field as defined in SAS, with the exception of an increase from a 2-bit field to a 3-bit field.

The PHY LINK RATE field indicates the current physical link rate negotiated on this phy and is defined in Table 1.

Table 1. Physical Link Rate

| PHY LINK RATE | Physical link rate |
|---------------|--------------------|
| 0000b – 0100b | Reserved |
| 0101b | 1,5 Gbps |
| 0100b | 3,0 Gbps |
| 0101b – 1111b | Reserved |

The SMP INITIATOR bit as defined in SAS.

The STP INITIATOR bit as defined in SAS.

The SSP INITIATOR bit as defined in SAS.

The SMP TARGET bit as defined in SAS.

The STP TARGET bit as defined in SAS.

The SSP TARGET bit as defined in SAS.

The SAS ADDRESS field as defined in SAS.

## Change 2: Modify the SMP Request/Response Format

from:

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | INFORMATION UNIT TYPE (40h) | | | | | | | |
| 1 | Reserved | | | | | | | |
| 23 | | | | | | | | |
| 24 | FUNCTION | | | | | | | |
| 25 | ADDITIONAL REQUEST BYTES | | | | | | | |
| m | | | | | | | | |
| | Fill bytes, if needed | | | | | | | |
| n - 3 | (MSB) | | | CRC | | | | |
| n | | | | | | | | (LSB) |

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | INFORMATION UNIT TYPE (41h) | | | | | | | |
| 1 | Reserved | | | | | | | |
| 23 | | | | | | | | |
| 24 | FUNCTION RESULT | | | | | | | |
| 25 | ADDITIONAL RESPONSE BYTES | | | | | | | |
| m | | | | | | | | |
| | Fill bytes, if needed | | | | | | | |
| n - 3 | (MSB) | | | CRC | | | | |
| n | | | | | | | | (LSB) |

to:

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (40h) | | | | | | | |
| 1 | FUNCTION | | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | | | | | | | | |
| 4 | ADDITIONAL REQUEST BYTES | | | | | | | |
| n -4 | | | | | | | | |
| n -3 | (MSB) | | | CRC | | | | |
| n | | | | | | | | (LSB) |

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (41h) | | | | | | | |
| 1 | FUNCTION | | | | | | | |
| 2 | RESULT | | | | | | | |
| 3 | Reserved | | | | | | | |
| 4 | ADDITIONAL RESPONSE BYTES | | | | | | | |
| n -4 | | | | | | | | |
| n -3 | (MSB) | | | CRC | | | | |
| n | | | | | | | | (LSB) |

The CRC field shall begin on a four-byte boundary.

**Change 3: Modify the SMP Discover Format**

from:

*The Discover function returns the SAS Addresses attached to a device. This function shall be implemented by all expander devices and may be implemented by other types of devices.*

*Table x defines the request format.*

### Table x. DISCOVER request

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | FUNCTION (00h) | | | | | | | |
| 1 | Reserved | | | | | | | |
| 3 | | | | | | | | |

*Table y defines the response format.*

### Table y. DISCOVER response

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | FUNCTION RESULT | | | | | | | |
| 1 | Reserved | | | | | | | |
| 3 | | | | | | | | |
| 4 | (MSB) | | | DEVICE NAME VALID BITMASK | | | | |
| 11 | | | | | | | | (LSB) |
| 12 | (MSB) | | | ATTACHED FANOUT EXPANDER BITMASK | | | | |
| 19 | | | | | | | | (LSB) |
| 20 | Reserved | | | | | | | |
| 31 | | | | | | | | |
| 32 | (MSB) | | | DEVICE NAME 0 | | | | |
| 39 | | | | | | | | (LSB) |
| … | | | | … | | | | |
| 536 | (MSB) | | | DEVICE NAME 63 | | | | |
| 543 | | | | | | | | (LSB) |
| 544 | (MSB) | | | CRC | | | | |
| 547 | | | | | | | | (LSB) |

to:

The DISCOVER function returns the physical link configuration information for the physical link specified. All expander devices shall implement this function. If other device types implement SMP requests and responses, those devices shall return a function result of unknown function.  The physical link configuration information provides details about the attached device SAS address, the protocols supported by the attached device, the link rate and the addressing support provided by the physical link.

Table x defines the request format.

**Table x. DISCOVER request**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (40h) | | | | | | | |
| 1 | FUNCTION (00h) | | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | | | | | | | | |
| 4 | Ignored | | | | | | | |
| 7 | | | | | | | | |
| 8 | Reserved | | | | | | | |
| 9 | PHY IDENTIFIER | | | | | | | |
| 10 | Ignored | | | | | | | |
| 11 | Reserved | | | | | | | |
| 12 | (MSB) | | | | CRC | | | |
| 15 | | | | | | | | (LSB) |

The PHY IDENTIFIER field indicates the physical link for which the physical link configuration information is being requested.

Table y defines the response format.

**Table y. DISCOVER response**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (41h) | | | | | | | |
| 1 | FUNCTION (00h) | | | | | | | |
| 2 | RESULT | | | | | | | |
| 3 | Reserved | | | | | | | |
| 4–7 | Ignored | | | | | | | |
| 8 | Reserved | | | | | | | |
| 9 | PHY IDENTIFIER | | | | | | | |
| 10 | Ignored | | | | | | | |
| 11 | Reserved | | | | | | | |
| 12 | ROUTE ENTRY DISABLED | DEVICE TYPE | | | ADDRESS DECODE | | | |
| 13 | Reserved | | | | PHY LINK RATE | | | |
| 14 | Reserved | | | | SSP INITIATOR | STP INITIATOR | SMP INITIATOR | Reserved |
| 15 | Reserved | | | | SSP TARGET | STP TARGET | SMP TARGET | SATA TARGET |
| 16–23 | (MSB) ATTACHED SAS ADDRESS (LSB) | | | | | | | |
| 24–31 | (MSB) SAS ADDRESS (LSB) | | | | | | | |
| 32 | PROG MIN PHY RATE | | | | MIN PHY RATE | | | |
| 33 | PROG MAX PHY RATE | | | | MAX PHY RATE | | | |
| 34–35 | Ignored | | | | | | | |
| 36–39 | Reserved | | | | | | | |
| 40–43 | (MSB) CRC (LSB) | | | | | | | |

The PHY IDENTIFIER field indicates the physical link for which the physical configuration link information is being requested.

The ADDRESS DECODE field indicates the method of address decode supported by this phy and is defined in Table 1. An expander device which is capable of supporting multiple decode mechanisms should report the most capable method. Table decode is the most capable, Single decode is the least capable.

Table 1. Address Decode

| ADDRESS DECODE | Address Decode |
|---|---|
| 000b | Single |
| 001b | Subtractive |
| 010b | Table |
| 011b-111b | Reserved |

Expander phys defined as supporting Single address decode shall be used to route the end device SAS Address.

Expander phys defined as supporting Subtractive address decode shall be used to route any SAS Address that is not resolved within the expander component. When multiple phys within an expander component are defined as Subtractive they shall terminate at attached phys with identical SAS Addresses, defining a single wide SAS port. If they do not terminate at identical SAS Addresses, the topology discovery function (see x.x.x) will indicate an illegal topology.

Expander phys defined as supporting Table address decode shall have a expander route table associated with them that shall contain SAS Addresses that may be resolved at or beyond the attached

phy.  Only SAS Addresses with references in the associated expander route table may be routed out this phy.  The EXPANDER ROUTE INDEX and EXPANDER ROUTE SLOT fields in the REPORT ROUTE INFORMATION and CONFIGURE ROUTE INFORMATION functions are used to address expander route entries within the expander route table.

The DEVICE TYPE field as defined in SAS, with the exception of an increase from a 2-bit field to a 3-bit field.

The ROUTE ENTRY DISABLED bit indicates the content of the frame is valid for routing.  A value of one indicates the route table entry has been determined to be in violation of connection rules and shall not be used for routing a SAS Address.

The PHY LINK RATE field indicates the current physical link rate negotiated on this phy and is defined in Table 2.

Table 2. Physical Link Rate

| PHY LINK RATE | Physical link rate |
|---|---|
| 0000b | Rate unknown |
| 0001b | Phy does not exist |
| 0010b | Disabled |
| 0011b | Failed |
| 0100b | Spinup hold OOB (see STP) |
| 0101b | 1,5 Gbps |
| 0110b | 3,0 Gbps |
| 0111b – 1111b | Reserved |

The SMP INITIATOR bit as defined in SAS.

The STP INITIATOR bit as defined in SAS.

The SSP INITIATOR bit as defined in SAS.

The SATA TARGET bit indicates the far end device is an SATA target device.

The SMP TARGET bit as defined in SAS.

The STP TARGET bit as defined in SAS.

The SSP TARGET bit as defined in SAS.

The SAS ADDRESS field as defined in SAS.

The ATTACHED SAS ADDRESS field contains the device name for the far end phy.

The SAS ADDRESS field contains the device name of this phy.

The MIN PHY RATE field indicates the minimum physical link rate supported on this phy and is defined in Table 2.

The PROG MIN PHY RATE field indicates the minimum physical link rate programmed on this phy and is defined in Table 2.

The MAX PHY RATE field indicates the maximum physical link rate supported on this phy and is defined in Table 2.

The PROG MAX PHY RATE field indicates the maximum physical link rate programmed on this phy and is defined in Table 2.

**Change 4: Modify the SMP Report General format**

from:

*Table x defines the request format.*

**Table x. REPORT GENERAL request**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | FUNCTION *(01h)* | | | | | | | |
| 1 | Reserved | | | | | | | |
| 3 | | | | | | | | |

*Table y defines the response format.*

**Table y. REPORT GENERAL response**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | FUNCTION RESULT | | | | | | | |
| 1 | Reserved | | | | | | | |
| 2 | NUMBER OF PHYS | | | | | | | |
| 3 | INPUT PHY IDENTIFIER | | | | | | | |
| 4 | Reserved | | | | | | | |
| 15 | | | | | | | | |
| 16 | (MSB) | | | ACTIVE PHY BITMASK | | | | |
| 23 | | | | | | | | (LSB) |
| 24 | (MSB) | | | ATTACHED FANOUT EXPANDER BITMASK | | | | |
| 31 | | | | | | | | (LSB) |
| 32 | (MSB) | | | ATTACHED EDGE EXPANDER BITMASK | | | | |
| 39 | | | | | | | | (LSB) |
| 40 | (MSB) | | | ATTACHED SAS INITIATOR BITMASK | | | | |
| 47 | | | | | | | | (LSB) |
| 48 | (MSB) | | | ATTACHED SAS TARGET BITMASK | | | | |
| 53 | | | | | | | | (LSB) |
| 54 | (MSB) | | | ATTACHED SATA BITMASK | | | | |
| 75 | | | | | | | | (LSB) |
| 76 | (MSB) | | | PHY RATE MULTIBITMASK | | | | |
| 83 | | | | | | | | (LSB) |
| 84 | (MSB) | | | FUNCTIONS SUPPORTED BITMASK | | | | |
| 115 | | | | | | | | (LSB) |

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to:

Table x defines the request format.

**Table x. REPORT GENERAL request**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (40h) | | | | | | | |
| 1 | FUNCTION (01h) | | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | | | | | | | | |
| 4 | (MSB) | | | | | | | |
| 7 | CRC | | | | | | | (LSB) |

Table y defines the response format.

**Table y. REPORT GENERAL response**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | INFORMATION UNIT TYPE (41h) | | | | | | | |
| 1 | FUNCTION (01h) | | | | | | | |
| 2 | RESULT | | | | | | | |
| 3 | Reserved | | | | | | | |
| 4 | (MSB) | | | EXPANDER ROUTE SLOTS | | | | |
| 5 | | | | | | | | (LSB) |
| 6 | (MSB) | | | EXPANDER ROUTE INDEXES | | | | |
| 7 | | | | | | | | (LSB) |
| 8 | Reserved | | | | | | | |
| 9 | NUMBER OF PHYS | | | | | | | |
| 10 | Reserved | | | | | | | CONFIGURABLE ROUTE TABLE |
| 11 | Reserved | | | | | | | |
| 12 | (MSB) | | | CRC | | | | |
| 15 | | | | | | | | (LSB) |

The EXPANDER ROUTE SLOTS field contains the maximum number of route slots for an expander device. Expander devices shall support this field. Other device types shall return a zero value in this field, indicating that no expander route table is supported. If an expander device supports an expander route table, then the number of expander route slots shall be at least equal to the number of phys on the expander device.

The EXPANDER ROUTE INDEXES field contains the maximum number of route indexes for an expander device. Expander devices shall support this field. Other device types shall return a zero value in this field, indicating that no expander route table is supported. If an expander device supports an expander route table, then the number of expander route indexes shall be greater than or equal to the number of phys on the attached device for an edge device or shall be greater than or equal to the maximum supported devices in an edge device for a fanout device (see 4.1.9).

The NUMBER OF PHYS field contains the number of phys in the device.

The CONFIGURABLE ROUTE TABLE bit indicates whether the expander device has an expander route table that shall be configured. An expander device with a configurable route table shall have the configurable route table bit set to one and shall have defined values for the EXPANDER ROUTE SLOTS and EXPANDER ROUTE INDEXES. An expander device without a configurable route table shall have the configurable route table bit set to zero and may have defined values for the expander route slots and expander route indexes.

**Change 5: Delete the SMP functions; Report Phy and Report Phy Devices**

Note: These functions are no longer needed; because their functionality has been consolidated into the Identify frame and Discover response.

## Change 6: Modify the SMP function, Report SATA Capabilities

from:

*Table x defines the request format.*

### Table x. REPORT SATA CAPABILITIES request

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | FUNCTION (02h) | | | | | | | |
| 1 | Reserved | | | | | | | |
| 3 | | | | | | | | |

*Table y defines the response format.*

### Table y. REPORT SATA CAPABILITIES response

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | FUNCTION RESULT | | | | | | | |
| 1 | Reserved | | | | | | ATA QUEUING CAPABLE | SATA CAPABLE |
| 2 | SATA VERSION | | | | | | | |
| 3 | NUMBER OF INITIATOR PORTS | | | | | | | |

to:

Table x defines the request format.

**Table x. REPORT SATA CAPABILITIES request**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (40h) | | | | | | | |
| 1 | FUNCTION (02h) | | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | | | | | | | | |
| 4 | (MSB) | | | CRC | | | | |
| 7 | | | | | | | | (LSB) |

Table y defines the response format.

**Table y. REPORT SATA CAPABILITIES response**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (41h) | | | | | | | |
| 1 | FUNCTION (02h) | | | | | | | |
| 2 | RESULT | | | | | | | |
| 3 | Reserved | | | | | | | |
| 4 | Ignored | | | | | | | |
| 7 | | | | | | | | |
| 8 | Reserved | | | | | | | |
| 9 | Ignored | | | | | | | |
| 10 | | | | | | | | |
| 11 | Reserved | | | | | | | |
| 12 | Reserved | | | | | | ATA QUEUEING CAPABLE | SATA CAPABLE |
| 13 | Reserved | | | | | | | |
| 15 | | | | | | | | |
| 16 | NUMBER OF INITIATORS | | | | | | | |
| 17 | SATA VERSION | | | | | | | |
| 18 | Reserved | | | | | | | |
| 19 | | | | | | | | |
| 20 | (MSB) | | | CRC | | | | |
| 23 | | | | | | | | (LSB) |

The SATA CAPABLE bit as defined in SAS.

The ATA QUEUEING CAPABLE bit as defined in SAS.

The NUMBER OF INITIATORS field as defined in SAS.

The SATA VERSION field as defined in SAS.

## Change 7: Modify the SMP function, Report Manufacturer Information

from:

*Table x defines the request format.*

**Table x. REPORT MANUFACTURER INFORMATION request**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | FUNCTION (03h) | | | | | | | |
| 1 | Reserved | | | | | | | |
| 3 | | | | | | | | |

*Table y defines the response format.*

**Table y. REPORT MANUFACTURER INFORMATION response**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | FUNCTION RESULT | | | | | | | |
| 1 | Reserved | | | | | | | |
| 3 | | | | | | | | |
| 4 | ADDITIONAL LENGTH (33h) | | | | | | | |
| 5 | Reserved | | | | | | | |
| 7 | | | | | | | | |
| 8 | (MSB) | | VENDOR IDENTIFICATION | | | | | |
| 15 | | | | | | | | (LSB) |
| 16 | (MSB) | | PRODUCT IDENTIFICATION | | | | | |
| 31 | | | | | | | | (LSB) |
| 32 | (MSB) | | PRODUCT REVISION LEVEL | | | | | |
| 35 | | | | | | | | (LSB) |
| 36 | Vendor-specific | | | | | | | |
| 55 | | | | | | | | |

to:

Table x defines the request format.

**Table x. REPORT MANUFACTURER INFORMATION request**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (40h) | | | | | | | |
| 1 | FUNCTION (03h) | | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | | | | | | | | |
| 4 | (MSB) | | | CRC | | | | |
| 7 | | | | | | | | (LSB) |

Table y defines the response format.

**Table y. REPORT MANUFACTURER INFORMATION response**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (41h) | | | | | | | |
| 1 | FUNCTION (03h) | | | | | | | |
| 2 | RESULT | | | | | | | |
| 3 | Reserved | | | | | | | |
| 4 | Ignored | | | | | | | |
| 7 | | | | | | | | |
| 8 | Reserved | | | | | | | |
| 9 | Ignored | | | | | | | |
| 10 | | | | | | | | |
| 11 | Reserved | | | | | | | |
| 12 | VENDOR INFORMATION | | | | | | | |
| 19 | | | | | | | | |
| 20 | PRODUCT IDENTIFICATION | | | | | | | |
| 35 | | | | | | | | |
| 36 | PRODUCT REVISION LEVEL | | | | | | | |
| 39 | | | | | | | | |
| 40 | Vendor-Specific | | | | | | | |
| 59 | | | | | | | | |
| 60 | (MSB) | | | CRC | | | | |
| 63 | | | | | | | | (LSB) |

The VENDOR INFORMATION field as defined in SAS.

The PRODUCT IDENTIFICATION field as defined in SAS.

The PRODUCT REVISION LEVEL field as defined in SAS.

## Change 8: Modify the SMP function, Report Phy Error Log

from:

*Table x defines the request format.*

### Table x. REPORT PHY ERROR LOG request

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | FUNCTION (11h) | | | | | | | |
| 1 | Reserved | | | | | | | |
| 2 | | | | | | | | |
| 3 | PHY IDENTIFIER | | | | | | | |

*Table y defines the response format.*

### Table y. REPORT PHY ERROR LOG response

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | FUNCTION RESULT | | | | | | | |
| 1 | REPORT PHY ERROR LOG RESULT | | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | | | | | | | | |
| 4 | (MSB) | | | INVALID CHARACTER COUNT | | | | |
| 7 | | | | | | | | (LSB) |
| 8 | (MSB) | | | DISPARITY ERROR COUNT | | | | |
| 11 | | | | | | | | (LSB) |
| 12 | (MSB) | | | LOSS OF BIT SYNCHRONIZATION COUNT | | | | |
| 15 | | | | | | | | (LSB) |

to:

Table x defines the request format.

**Table x. REPORT PHY ERROR LOG request**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (40h) | | | | | | | |
| 1 | FUNCTION (11h) | | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | | | | | | | | |
| 4 | Ignored | | | | | | | |
| 7 | | | | | | | | |
| 8 | Reserved | | | | | | | |
| 9 | PHY IDENTIFIER | | | | | | | |
| 10 | Ignored | | | | | | | |
| 11 | Reserved | | | | | | | |
| 12 | (MSB) | | | | CRC | | | |
| 15 | | | | | | | | (LSB) |

Table y defines the response format.

**Table y. REPORT PHY ERROR LOG response**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (41h) | | | | | | | |
| 1 | FUNCTION (11h) | | | | | | | |
| 2 | RESULT | | | | | | | |
| 3 | Reserved | | | | | | | |
| 4 | Ignored | | | | | | | |
| 7 | | | | | | | | |
| 8 | Reserved | | | | | | | |
| 9 | PHY IDENTIFIER | | | | | | | |
| 10 | Ignored | | | | | | | |
| 11 | Reserved | | | | | | | |
| 12 | INVALID CHARACTER COUNT | | | | | | | |
| 15 | | | | | | | | |
| 16 | DISPARITY ERROR COUNT | | | | | | | |
| 19 | | | | | | | | |
| 20 | LOSS OF BIT SYNC COUNT | | | | | | | |
| 23 | | | | | | | | |
| 24 | PHY RESET PROBLEM COUNT | | | | | | | |
| 27 | | | | | | | | |
| 28 | (MSB) | | | | CRC | | | |
| 31 | | | | | | | | (LSB) |

The PHY IDENTIFIER field as defined in SAS.

The INVALID CHARACTER COUNT field as defined in SAS.

The DISPARITY ERROR COUNT field as defined in SAS.

The LOSS OF BIT SYNC COUNT field as defined in SAS.

The PHY RESET PROBLEM COUNT field as defined in SAS.

## Change 9: Modify the SMP function, Report Phy SATA

from:

*Table x defines the request format.*

**Table x. REPORT PHY SATA request**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | FUNCTION (12h) | | | | | | | |
| 1 | Reserved | | | | | | | |
| 2 | | | | | | | | |
| 3 | PHY IDENTIFIER | | | | | | | |

*Table y defines the response format.*

**Table y. REPORT PHY SATA response**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | FUNCTION RESULT | | | | | | | |
| 1 | REPORT PHY SATA RESULT | | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | Reserved | | | | | | | |
| 4 | REGISTER DEVICE TO HOST FIS | | | | | | | |
| 23 | | | | | | | | |

to:

Table x defines the request format.

**Table x. REPORT PHY SATA request**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (40h) | | | | | | | |
| 1 | FUNCTION (12h) | | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | | | | | | | | |
| 4 | Ignored | | | | | | | |
| 7 | | | | | | | | |
| 8 | Reserved | | | | | | | |
| 9 | PHY IDENTIFIER | | | | | | | |
| 10 | Ignored | | | | | | | |
| 11 | Reserved | | | | | | | |
| 12 | (MSB) | | | CRC | | | | |
| 15 | | | | | | | | (LSB) |

Table y defines the response format.

**Table y. REPORT PHY SATA response**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (41h) | | | | | | | |
| 1 | FUNCTION (12h) | | | | | | | |
| 2 | RESULT | | | | | | | |
| 3 | Reserved | | | | | | | |
| 4 | Ignored | | | | | | | |
| 7 | | | | | | | | |
| 8 | Reserved | | | | | | | |
| 9 | PHY IDENTIFIER | | | | | | | |
| 10 | Ignored | | | | | | | |
| 11 | Reserved | | | | | | | |
| 12 | REGISTER DEVICE TO HOST FIS | | | | | | | |
| 31 | | | | | | | | |
| 32 | (MSB) | | | CRC | | | | |
| 35 | | | | | | | | (LSB) |

The PHY IDENTIFIER field as defined in SAS.

The REGISTER DEVICE TO HOST FIS field as defined in SAS.

## Change 10: Add the SMP function, Report Route Information

The REPORT ROUTE INFORMATION function returns the route table information for a specific expander route slot and expander route index within an expander device. Expander devices shall support this function if the Report General function has non-zero values for EXPANDER ROUTE SLOTS and EXPANDER ROUTE INDEXES. This function is used primarily as a diagnostic tool to resolve topology issues.

Table x defines the request format.

**Table x. REPORT ROUTE INFORMATION request**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (40h) | | | | | | | |
| 1 | FUNCTION (04h) | | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | | | | | | | | |
| 4 | (MSB) | | | EXPANDER ROUTE SLOT | | | | |
| 5 | | | | | | | | (LSB) |
| 6 | (MSB) | | | EXPANDER ROUTE INDEX | | | | |
| 7 | | | | | | | | (LSB) |
| 8 | Reserved | | | | | | | |
| 9 | Ignored | | | | | | | |
| 10 | | | | | | | | |
| 11 | Reserved | | | | | | | |
| 12 | (MSB) | | | CRC | | | | |
| 15 | | | | | | | | (LSB) |

The EXPANDER ROUTE SLOT field indicates the route slot for which the Report Route information is being requested. The value must be in the range of 0 to EXPANDER ROUTE SLOTS or a function result unknown function shall occur.

The EXPANDER ROUTE INDEX field indicates the route index for which the Report Route information is being requested. The value must be in the range of 0 to EXPANDER ROUTE INDEXES or a function result unknown function shall occur.

Table y defines the response format.

**Table y. REPORT ROUTE INFORMATION response**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (41h) | | | | | | | |
| 1 | FUNCTION (04h) | | | | | | | |
| 2 | RESULT | | | | | | | |
| 3 | Reserved | | | | | | | |
| 4 | (MSB) | | | EXPANDER ROUTE SLOT | | | | |
| 5 | | | | | | | | (LSB) |
| 6 | (MSB) | | | EXPANDER ROUTE INDEX | | | | |
| 7 | | | | | | | | (LSB) |
| 8 | Reserved | | | | | | | |
| 9 | PHY IDENTIFIER | | | | | | | |
| 10 | Ignored | | | | | | | |
| 11 | Reserved | | | | | | | |
| 12 | ROUTE ENTRY DISABLED | Ignored | | | | | | |
| 13 | Ignored | | | | | | | |
| 15 | | | | | | | | |
| 16 | (MSB) | | | ATTACHED SAS ADDRESS | | | | |
| 23 | | | | | | | | (LSB) |
| 24 | Ignored | | | | | | | |
| 35 | | | | | | | | |
| 36 | Reserved | | | | | | | |
| 39 | | | | | | | | |
| 40 | (MSB) | | | CRC | | | | |
| 43 | | | | | | | | (LSB) |

The EXPANDER ROUTE SLOT field indicates the route slot for which the Report Route information has been requested.

The EXPANDER ROUTE INDEX field indicates the route index for which the Report Route information has been requested.

The ROUTE ENTRY DISABLED field indicates the content of the frame is valid for routing.  The 1b value indicates the route has been determined to be in violation of connection rules.

The ATTACHED SAS ADDRESS field contains the device name for the far end phy.

## Change 11: Add the SMP function, Configure Route Information

The CONFIGURE ROUTE INFORMATION function sets the expander route table information for a specific expander route slot and expander route index within the expander route table of a configurable expander device. Expander devices that do not have a configurable route table or end devices shall not support this function. Expander devices shall support this function if the Report General function has the CONFIGURABLE ROUTE TABLE field set.

Table x defines the request format.

**Table x. CONFIGURE ROUTE INFORMATION request**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (40h) | | | | | | | |
| 1 | FUNCTION (80h) | | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | | | | | | | | |
| 4 | (MSB) | | | EXPANDER ROUTE SLOT | | | | |
| 5 | | | | | | | | (LSB) |
| 6 | (MSB) | | | EXPANDER ROUTE INDEX | | | | |
| 7 | | | | | | | | (LSB) |
| 8 | Reserved | | | | | | | |
| 9 | PHY IDENTIFIER | | | | | | | |
| 10 | Reserved | | | | | | | |
| 11 | Reserved | | | | | | | |
| 12 | DISABLE ROUTE ENTRY | Ignored | | | | | | |
| 13 | Ignored | | | | | | | |
| 15 | | | | | | | | |
| 16 | (MSB) | | | ATTACHED SAS ADDRESS | | | | |
| 23 | | | | | | | | (LSB) |
| 24 | Ignored | | | | | | | |
| 35 | | | | | | | | |
| 36 | Reserved | | | | | | | |
| 39 | | | | | | | | |
| 40 | (MSB) | | | CRC | | | | |
| 43 | | | | | | | | (LSB) |

The EXPANDER ROUTE SLOT field indicates the route slot for which the Configure Route information is being configured. The value must be in the range of zero to EXPANDER ROUTE SLOTS or a function result unknown function shall occur.

The EXPANDER ROUTE INDEX field indicates the route index for which the Configure Route information is being configured. The value must be in the range of zero to EXPANDER ROUTE INDEXES or a function result unknown function shall occur.

The DISABLE ROUTE ENTRY bit when set to zero indicates the content of the frame is valid for routing. The expander route entry specified by the expander route slot and expander route index in the expander route table shall be ignored by the expander, if the disable route entry bit is set to one.

The ATTACHED SAS ADDRESS field contains the device name for the far end phy.

Table y defines the response format.

**Table y. CONFIGURE ROUTE INFORMATION response**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (41h) | | | | | | | |
| 1 | FUNCTION (80h) | | | | | | | |
| 2 | RESPONSE | | | | | | | |
| 3 | Reserved | | | | | | | |
| 4 | (MSB) | | | CRC | | | | |
| 7 | | | | | | | | (LSB) |

## Change 12: Modify SMP function Phy Control

from:

*Table x defines the request format.*

**Table x. PHY CONTROL request**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | | | | *FUNCTION (90h)* | | | | |
| 1 | | | | *Reserved* | | | | |
| 2 | | | | | | | | |
| 3 | | | | *PHY IDENTIFIER* | | | | |
| 4 | | | | *PHY OPERATION* | | | | |
| 5 | | *MINIMUM PHYSICAL LINK RATE* | | | | *MAXIMUM PHYSICAL LINK RATE* | | |
| 6 | | | | *Reserved* | | | | |
| 7 | | | | | | | | |

*Table y defines the response format.*

**Table y. PHY CONTROL response**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | | | | *FUNCTION RESULT* | | | | |
| 1 | | | | *PHY CONTROL RESULT* | | | | |
| 2 | | | | *Reserved* | | | | |
| 3 | | | | *Reserved* | | | | |

to:

Table x defines the request format.

**Table x. PHY CONTROL request**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | | | | SMP FRAME TYPE (40h) | | | | |
| 1 | | | | FUNCTION (90h) | | | | |
| 2 | | | | Reserved | | | | |
| 3 | | | | | | | | |
| 4 | | | | Ignored | | | | |
| 7 | | | | | | | | |
| 8 | | | | Reserved | | | | |
| 9 | | | | PHY IDENTIFIER | | | | |
| 10 | | | | PHY OPERATION | | | | |
| 11 | | | | Reserved | | | | |
| 12 | | | | Ignored | | | | |
| 31 | | | | | | | | |
| 32 | | PROG MIN PHY RATE | | | | Ignored | | |
| 33 | | PROG MAX PHY RATE | | | | Ignored | | |
| 34 | | | | Ignored | | | | |
| 35 | | | | | | | | |
| 36 | | | | Reserved | | | | |
| 39 | | | | | | | | |
| 40 | (MSB) | | | CRC | | | | |
| 43 | | | | | | | | (LSB) |

The PHY IDENTIFIER field as defined in SAS.

The PHY OPERATION field as defined in SAS.

The PROG MIN PHY RATE field indicates the minimum physical link rate programmed on this phy and is defined in Table 1.

The PROG MAX PHY RATE field indicates the maximum physical link rate programmed on this phy and is defined in Table 1.

Table 1. Physical Link Rate

| PHY LINK RATE | Physical link rate |
|---|---|
| 0000b | Rate unknown |
| 0001b | Phy does not exist |
| 0010b | Disabled |
| 0011b | Failed |
| 0100b | Spinup hold OOB (see STP) |
| 0101b | 1,5 Gbps |
| 0110b | 3,0 Gbps |
| 0111b – 1111b | Reserved |

Table y defines the response format.

**Table y. PHY CONTROL response**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (41h) | | | | | | | |
| 1 | FUNCTION (90h) | | | | | | | |
| 2 | RESPONSE | | | | | | | |
| 3 | Reserved | | | | | | | |
| 4 | (MSB) | | | CRC | | | | |
| 7 | | | | | | | | (LSB) |

## Change 13: Modify SMP function Phy Margin Control

from:

*Table x defines the request format.*

**Table x. PHY MARGIN CONTROL request**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | FUNCTION (91h) | | | | | | | |
| 1 | Reserved | | | | | | | |
| 2 | | | | | | | | |
| 3 | PHY IDENTIFIER | | | | | | | |
| 4 | Reserved | | | | | | | |
| 5 | Reserved | | | | | | | |
| 6 | Vendor-specific | | | | | | | |
| 7 | Vendor-specific | | | | | | | |

*Table y defines the response format.*

**Table y. PHY MARGIN CONTROL response**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------|---|---|---|---|---|---|---|---|
| 0 | FUNCTION RESULT | | | | | | | |
| 1 | PHY CONTROL RESULT | | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | Reserved | | | | | | | |

to:

Table x defines the request format.

**Table x. PHY MARGIN CONTROL request**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (40h) | | | | | | | |
| 1 | FUNCTION (91h) | | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | | | | | | | | |
| 4 | Ignored | | | | | | | |
| 7 | | | | | | | | |
| 8 | Reserved | | | | | | | |
| 9 | PHY IDENTIFIER | | | | | | | |
| 10 | Ignored | | | | | | | |
| 11 | Reserved | | | | | | | |
| 12 | Ignored | | | | | | | |
| 33 | | | | | | | | |
| 34 | Vendor-Specific | | | | | | | |
| 35 | | | | | | | | |
| 36 | Reserved | | | | | | | |
| 39 | | | | | | | | |
| 40 | (MSB) | | | CRC | | | | |
| 43 | | | | | | | | (LSB) |

The PHY IDENTIFIER field as defined in SAS.

Table y defines the response format.

**Table y. PHY MARGIN CONTROL response**

| Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | SMP FRAME TYPE (41h) | | | | | | | |
| 1 | FUNCTION (91h) | | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | | | | | | | | |
| 4 | Ignored | | | | | | | |
| 7 | | | | | | | | |
| 8 | Reserved | | | | | | | |
| 9 | PHY IDENTIFIER | | | | | | | |
| 10 | Ignored | | | | | | | |
| 11 | Reserved | | | | | | | |
| 12 | Ignored | | | | | | | |
| 33 | | | | | | | | |
| 34 | Vendor-Specific | | | | | | | |
| 35 | | | | | | | | |
| 36 | Reserved | | | | | | | |
| 39 | | | | | | | | |
| 40 | (MSB) | | | CRC | | | | |
| 43 | | | | | | | | (LSB) |

The PHY IDENTIFIER field as defined in SAS.