Date: 4/28/04

To: T10 Committee (SCSI)

From: George Penokie (IBM/Tivoli)

Subject: SAS UML Corrections

4 General

4.1 Architecture

4.1.1 Architecture overview

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Figure 6 shows the class diagram for a SAS domain, showing the relationships between SAS domain, SCSI domain, service delivery subsystem, expander device, expander port, SAS device, SCSI device, SAS port, SCSI port, and phy classes. Relationships to ATA classes (e.g., ATA domain) are not shown in figure 6.
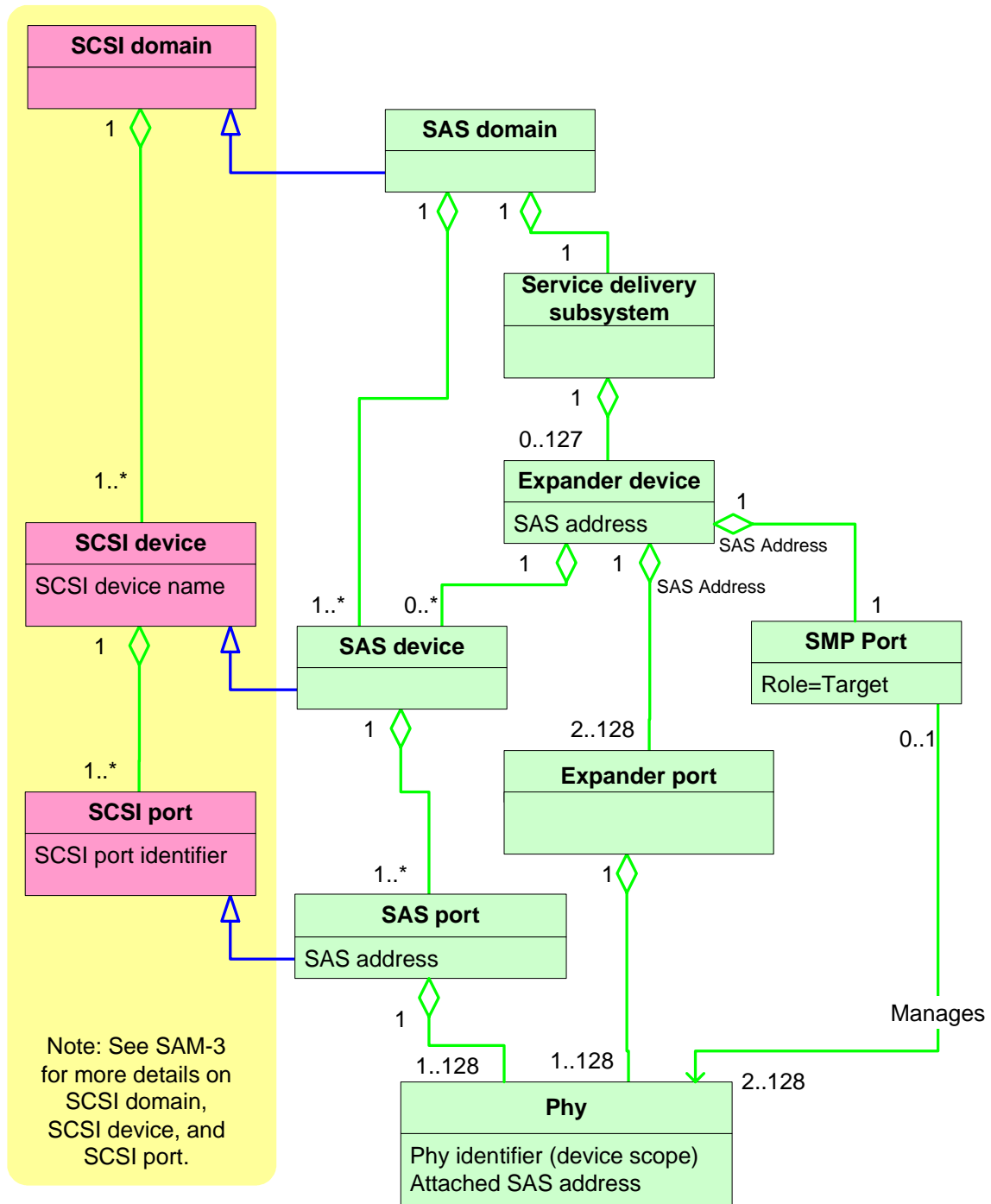

Figure 6 — SAS domain class diagram
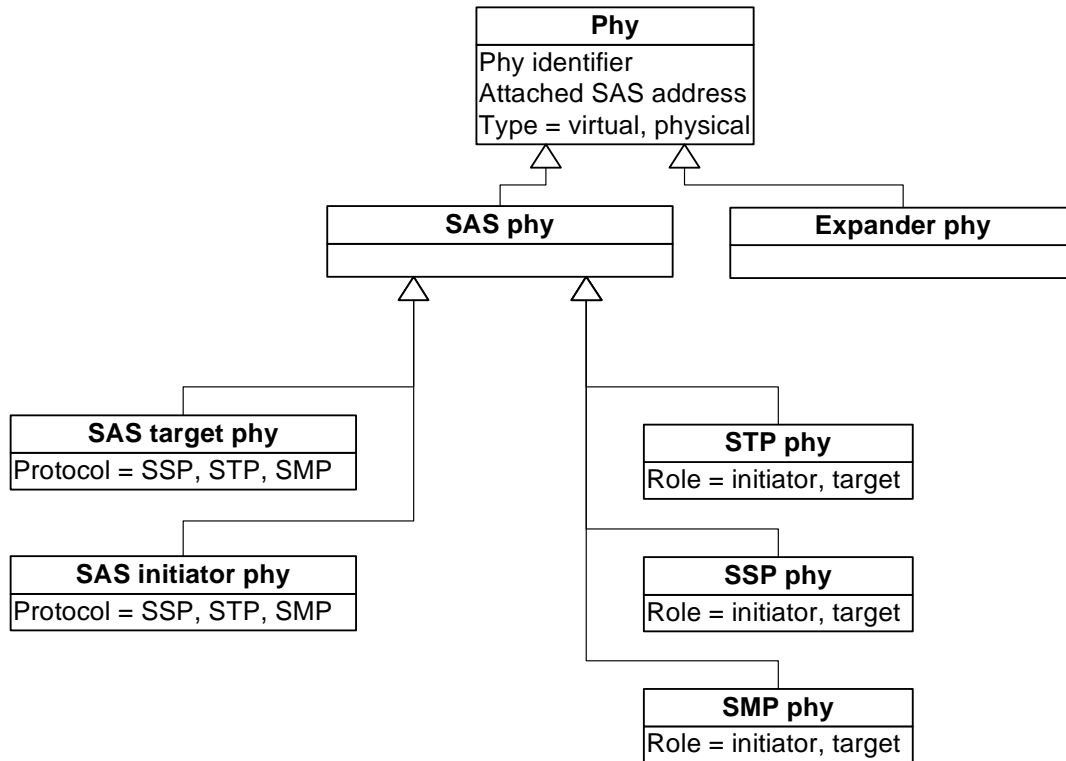
4.1.2 Physical links and phys

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Figure 7 expands the phy class showing the relationships between the following classes:

    a)   phy;
    b)   SAS phy;
    c)   SAS phy;

d) SAS initiator phy;
e) SAS target phy;
f) SSP phy;
g) STP phy;
h) SMP phy; and
i) expander phy.

SATA phys are also referenced in this standard but are defined by SATA (see ATA/ATAPI-7 V3).

Figure 7 — Phy classes

Figure 8 shows the objects that are instances of the:

a) SAS phy class (i.e., SSP initiator phy, SSP target phy, virtual SSP target phy, virtual SSP initiator phy, STP initiator phy, STP target phy, virtual STP target phy, virtual STP initiator phy, SMP initiator phy, SMP target phy, virtual SMP target phy, and virtual SMP virtual initiator phy); and
b) expander phy class (i.e., expander phy and virtual expander phy).

The objects of the SAS phy class shown in figure 8 are only valid and unchangeable during a connection. A different object may be used on a different connection.

Valid objects for the expander phy class

Expander phy : Expander phy
Phy identifier
Attached SAS address
Type = physical

Virtual expander phy : Expander phy
Phy identifier
Attached SAS addess
Type = Virtual

Valid objects for the SAS phy class

SSP initiator phy : SAS phy
Phy identifier
Attached SAS address
Type = physical
Role = initiator
Protocol = SSP

SSP target phy : SAS phy
Phy identifier
Attached SAS address
Type = physical
Role = target
Protocol = SSP

STP initiator phy : SAS phy
Phy identifier
Attached SAS address
Type = physical
Role = initiator
Protocol = STP

STP target phy : SAS phy
Phy identifier
Attached SAS address
Type = physical
Role = target
Protocol = STP

SMP initiator phy : SAS phy
Phy identifier
Attached SAS address
Type = physical
Role = initiator
Protocol = SMP

SMP target phy : SAS phy
Phy identifier
Attached SAS address
Type = physical
Role = target
Protocol = SMP

Virtual SMP initiator phy : SAS phy
Phy identifier
Attached SAS address
Type = virtual
Role = initiator
Protocol = SMP

Virtual SMP target phy : SAS phy
Phy identifier
Attached SAS address
Type = virtual
Role = target
Protocol = SMP

Virtual STP initiator phy : SAS phy
Phy identifier
Attached SAS address
Type = virtual
Role = initiator
Protocol = STP

Virtual STP target phy : SAS phy
Phy identifier
Attached SAS address
Type = virtual
Role = target
Protocol = STP

Virtual SSP initiator phy : SAS phy
Phy identifier
Attached SAS address
Type = virtual
Role = initiator
Protocol = SMP

| Virtual SSP target phy : SAS phy |
|---|
| Phy identifier |
| Attached SAS address |
| Type = virtual |
| Role = target |
| Protocol = SSP |

Figure 8 — Phy objects

4.1.3 Ports (narrow ports and wide ports)

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Figure 9 expands the port class and expander class to show the relationships between the following classes:

    a) port;
    b) expander device;
    c) expander port;
    d) SAS port;
    e) SAS target port;
    f) SAS initiator port;
    g) STP port;
    h) SSP port; and
    i) SMP port.
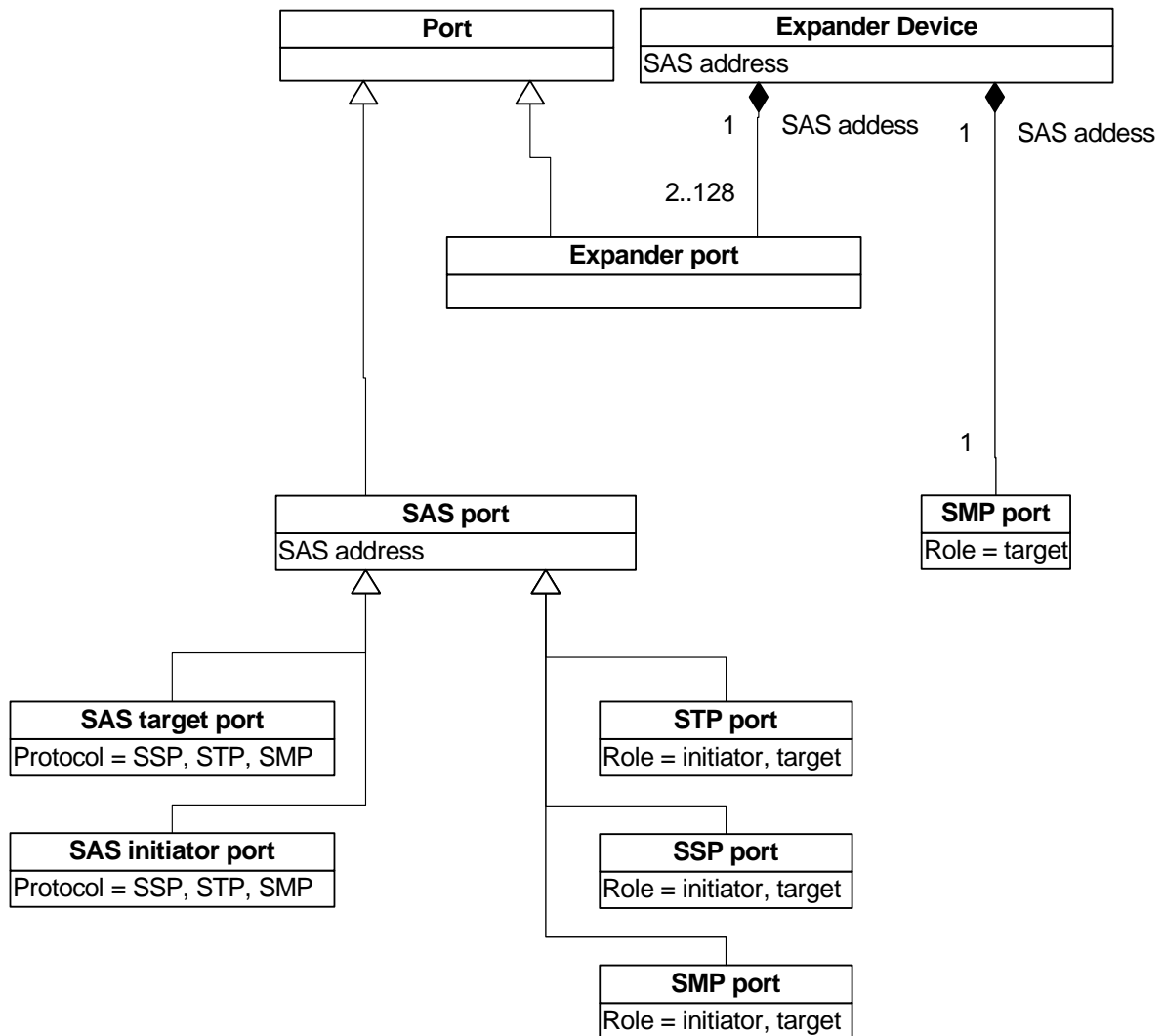
Figure 9 — Port classes

Figure 10 shows the objects that are instances of the:

    a) SAS port class (i.e., SSP initiator port, STP initiator port, SMP initiator port, SSP target port, STP target port, SMP target port); and
    b) expander port class (i.e., expander port).

The objects of the SAS port class shown in figure 10 are only valid and unchangeable during a connection. A different object may be used on a different connection.

Valid objects for the SAS port class

Valid objects for the expander port class

SSP initiator port : SAS port
SAS address
Role = initiator
Protocol = SSP

SSP target port : SAS port
SAS address
Role = target
Protocol = SSP

Expander port : Expander port
SAS address

STP initiator port : SAS port
SAS address
Role = initiator
Protocol = STP

STP target port : SAS port
SAS address
Role = target
Protocol = STP

SMP initiator port : SAS port
SAS address
Role = initiator
Protocol = SMP

SMP target port : SAS port
SAS address
Role = target
Protocol = SMP

Figure 10 — Port objects

4.1.4 SAS devices

4.1.5 Expander devices (edge expander devices and fanout expander devices)
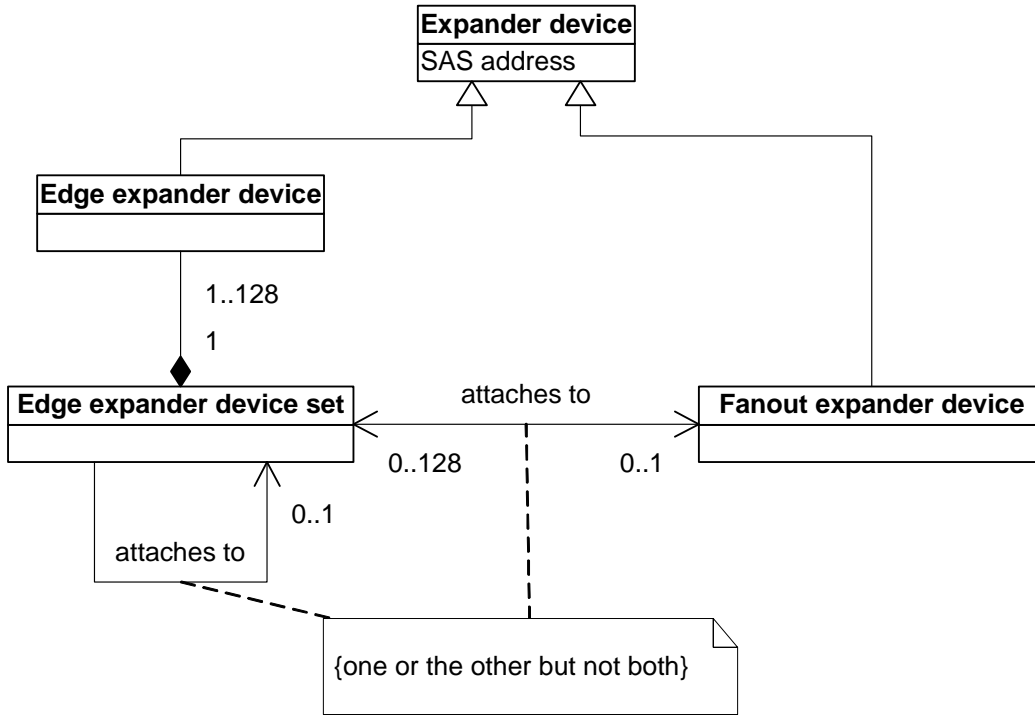
...

Figure 11 shows the expander device classes.

Figure 11 — Expander device classes

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4.1.6 Service delivery subsystem

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4.1.7 Domains

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4.1.8 Expander device topologies

4.1.8.1 Expander device topology overview

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4.1.8.2 Edge expander device set

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4.1.8.3 Expander device topologies

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4.1.9 Pathways

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4.1.10 Connections

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4.2 Names and identifiers

4.2.1 Names and identifiers overview

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4.2.2 SAS addresses

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4.2.3 Hashed SAS address

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4.2.4 Device names

4.2.5 Port names

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4.2.6 Port identifiers

...

4.2.7 Phy identifiers

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4.3 State machines

4.3.1 State machine overview

Figure 12 shows the state machines for SAS devices, their relationships to each other and to the SAS device, SAS port, and SAS phy.
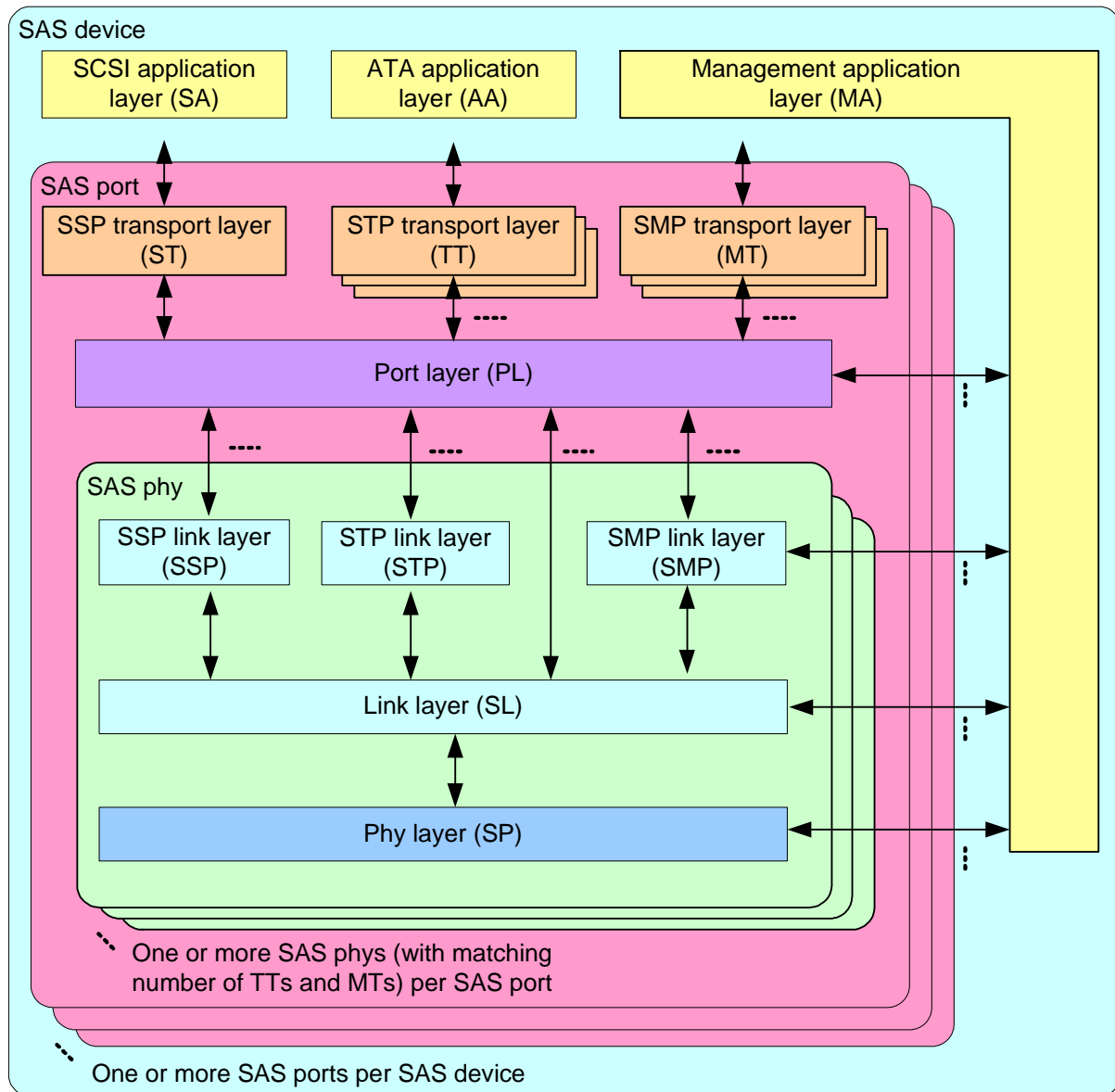
Figure 12 — State machines for SAS devices

Figure 13 shows the state machines for expander devices, their relationships to each other and to the expander device, expander port, and expander phy. Expander function state machines are not defined in this standard, but the interface to the expander function is defined in 4.6.6.
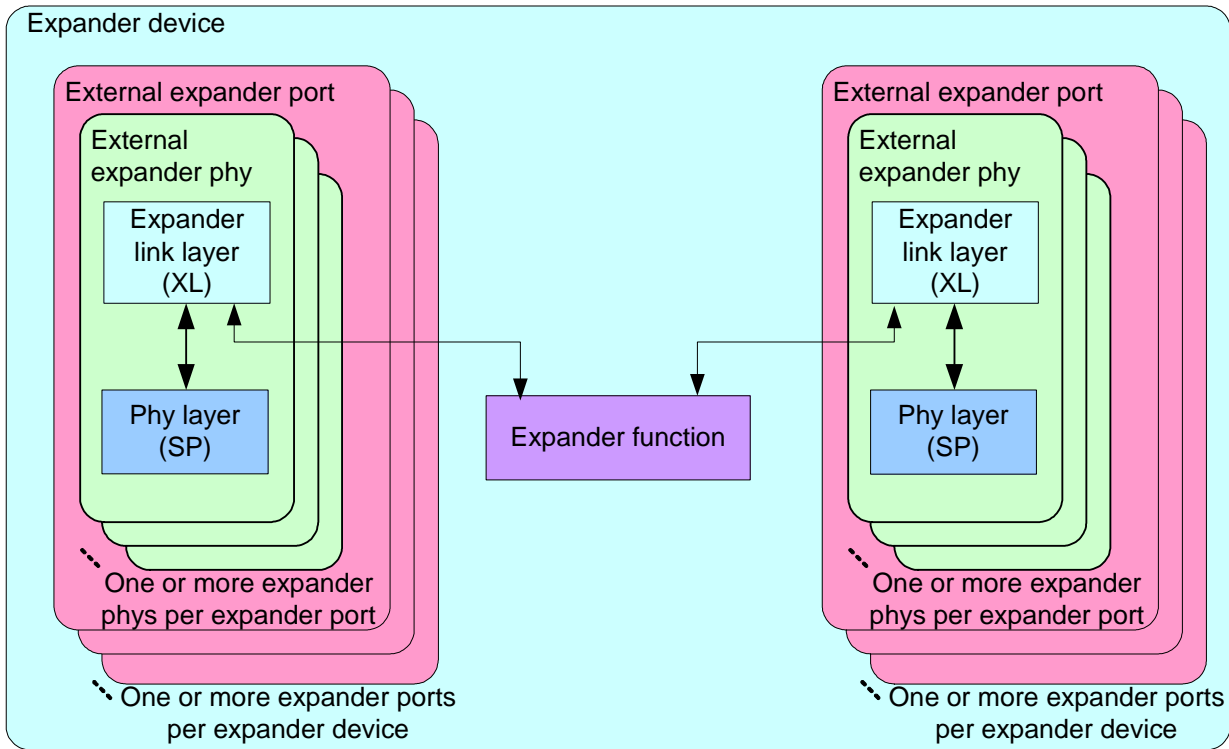

Figure 13 — State machines for expander devices

Annex I contains a list of messages between state machines.

4.3.2 Transmit data path

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4.3.3 State machines and SAS device, SAS port, and SAS phy objects

Figure 14 shows which state machines are contained within the SAS device, SAS port, and SAS phy classes.
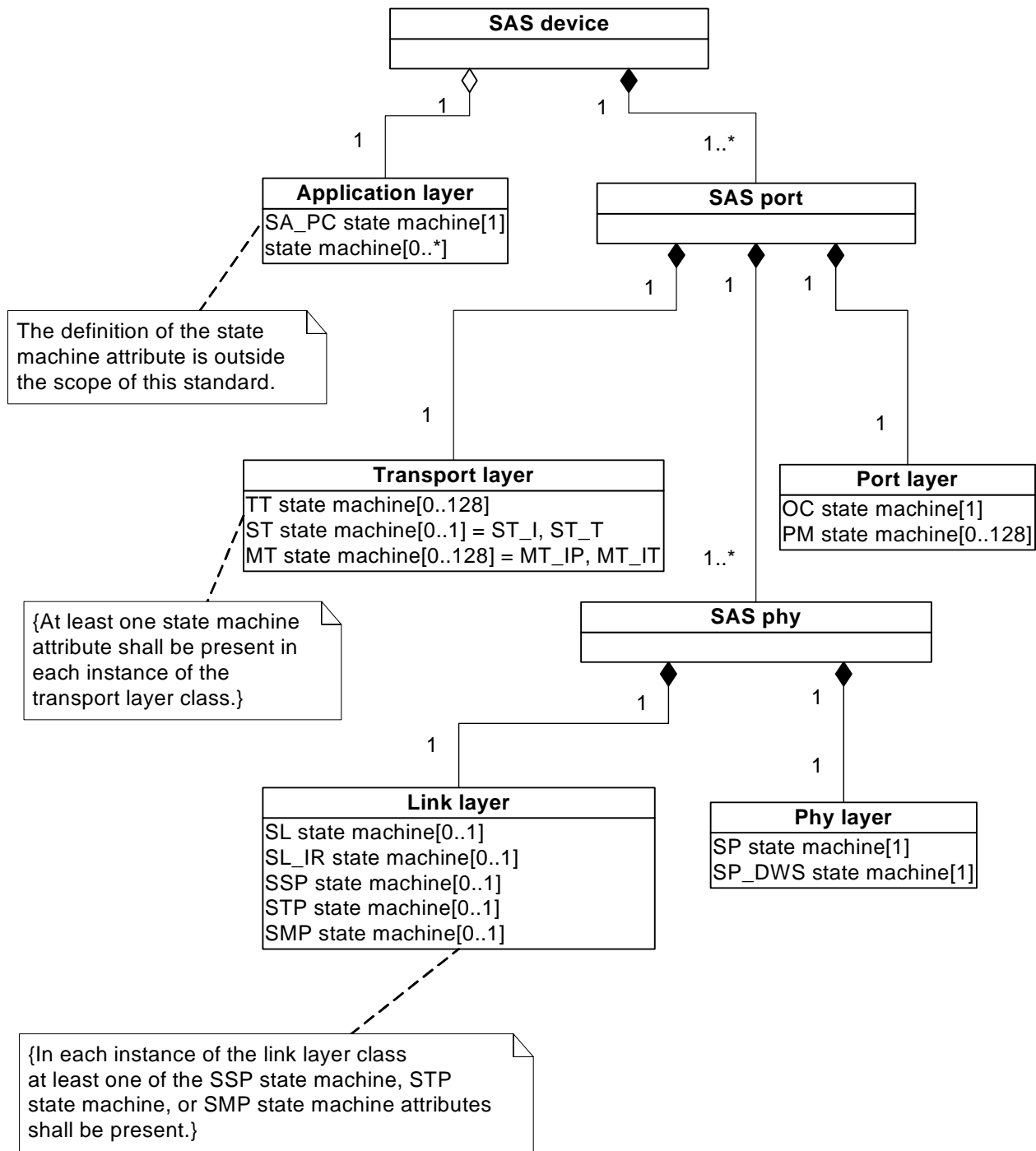

SAS device

1

1

Application layer
SA_PC state machine[1] state machine[0..*]

The definition of the state machine attribute is outside the scope of this standard.

1

1..*

SAS port

1   1   1

1

1

Transport layer
TT state machine[0..128] ST state machine[0..1] = ST_I, ST_T MT state machine[0..128] = MT_IP, MT_IT

Port layer
OC state machine[1] PM state machine[0..128]

{At least one state machine attribute shall be present in each instance of the transport layer class.}

1..*

SAS phy

1

1

1

1

Link layer
SL state machine[0..1] SL_IR state machine[0..1] SSP state machine[0..1] STP state machine[0..1] SMP state machine[0..1]

Phy layer
SP state machine[1] SP_DWS state machine[1]

{In each instance of the link layer class at least one of the SSP state machine, STP state machine, or SMP state machine attributes shall be present.}

Figure 14 — State machine and SAS device, SAS port, and SAS phy classes

Figure 15 shows which state machines are contained within the expander device, expander port, and expander phy classes.
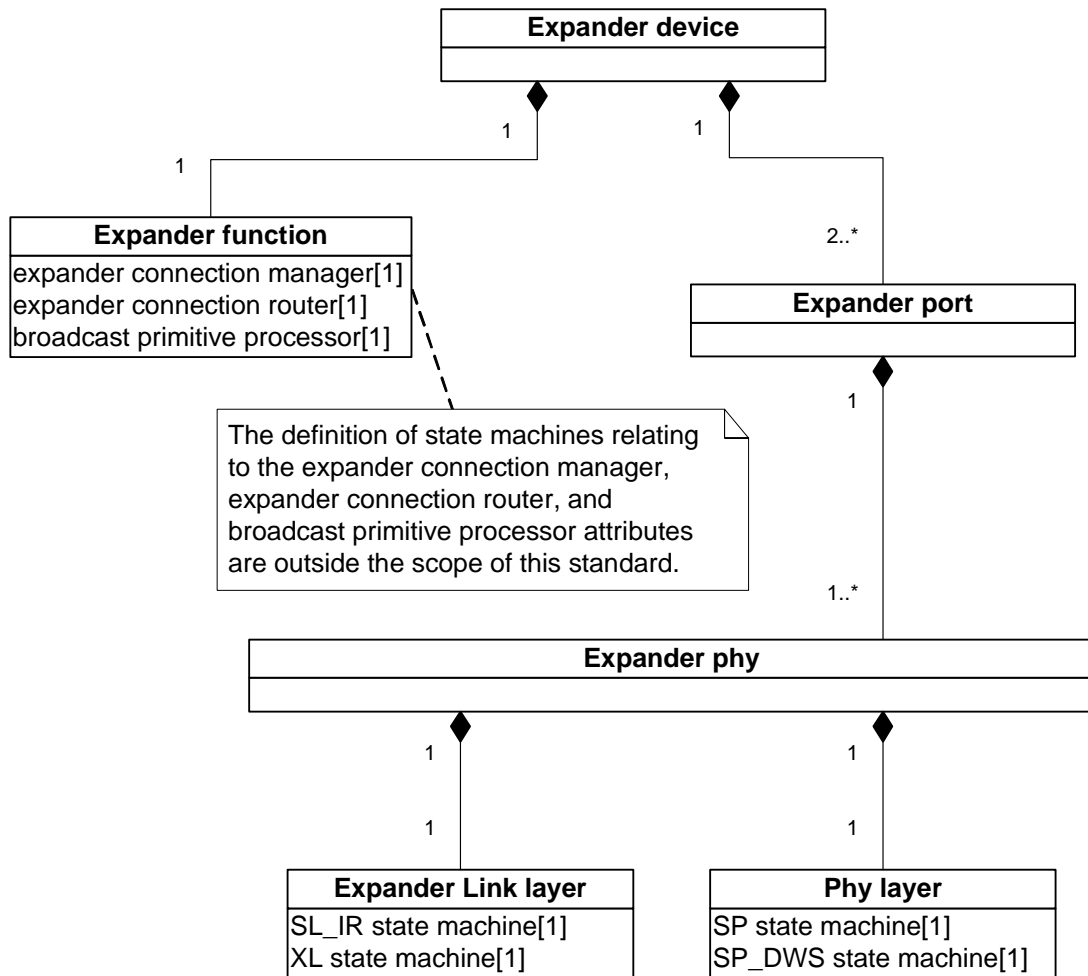

Figure 15 — State machine and expander device, expander port, and expander phy classes