

To: T10 Technical Committee
 From: Tim Hoglund, LSI Logic (tim.hoglund@lsil.com)
 Date: [February 9, 2006](#)
 Subject: T10/06-048r2 SAS-2 zoning enhancements

Deleted: January 26, 2006

Revision Information

- Revision 0 Initial
- Revision 1 Incorporated feedback based on January 9, 2006 SAS Protocol Working Group discussions
 - remove management and broadcast references
 - updated usage model diagram for bridge device (Figure 5)
 - added example diagram (Figure 6)
 - update Table 2 and clarify how source group is determined as a function of the routing attribute of the receiving phy
- [Revision 2 incorporated feedback based on January 26, 2006 SAS2 Supervisor Configuration conference call](#)
 - [remove Access Zone Management from this proposal](#)
 - [remove references to CONFIGURE/REPORT ZONE PERMISSION functions](#)
 - [remove references to CONFIGURE/REPORT ZONE ROUTE TABLE functions](#)
 - [added - all phys within an expander port have same zoning properties](#)
 - [added - ZONE ADDRESS RESOLVED bit to per zone phy information](#)

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References

[SAS2r02](#) Serial Attached SCSI - 2 (SAS-2)
 T10/06-~~019r3~~ SAS-2 zoning
 T10/06-029r2 SAS-2 Expander Configuration Supervisor and SMP CHANGE Request

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Introduction

Reference document T10/06-019 provides a baseline view of zoning functionality for a SAS service delivery subsystem. However, the proposed view of zoning is not sufficiently broad to encompass expected usage models for the SAS-2 market timeframe.

This proposal seeks to define zoning methods for SAS-2 which satisfy expected usage models by building on certain aspects of the method proposed by T10/06-019.

T10/06-019 defines zone groups and a zone permission table to establish access permission (whether a connection is allowed between source zone group and a destination zone group). Zone groups and the zone permission table provide a good method of providing zoning functionality and this proposal uses them as the basis for SAS-2 zoning methods.

In order to satisfy a broader scope of usage models, the primary difference between this proposal and T10/06-019 is how source group assignment is determined. Whereas T10/06-019 assigns zone groups based solely on a phy attribute, this proposal allows the source zone group to be determined via a zone route table lookup. Within this proposal, phy-resolved source zone group mapping shall mean the method provided by T10/06-019 and address-resolved source zone group mapping shall mean the enhanced method offered by this proposal.

Usage model discussion – establish required scope of SAS-2 zoning

Usage model 1: Traffic segregation as illustrated by Figure 1.

Topology/resource partitioning in the manner of VLAN/VSAN

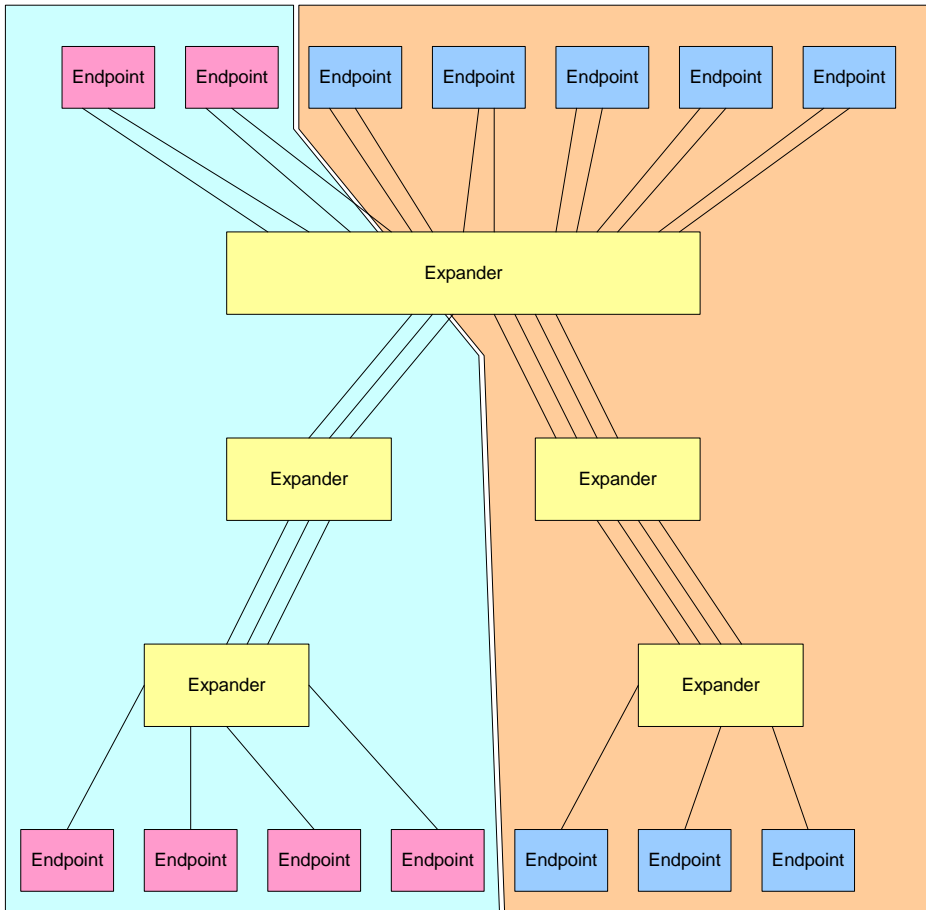


Figure 1: Traffic Segregation

Either phy-resolved or address-resolved source zone group mapping can satisfy the traffic segregation usage model.

However, phy-resolved source zone group mapping cannot differentiate traffic when non-zoned expanders are present within the topology.

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Usage model 2: Access control as illustrated by Figure 2.

Allow control of which hosts can access which devices.

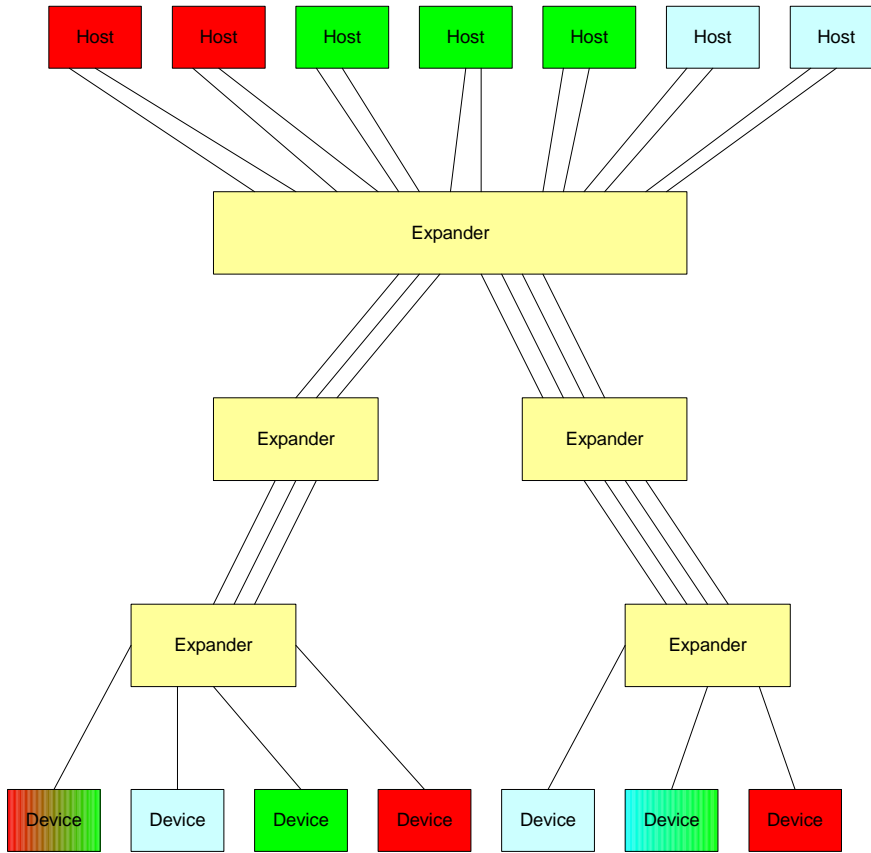


Figure 2: Access control

Either phy-resolved or address-resolved source zone group mapping can satisfy the Access control usage model.

However, phy-resolved source zone group mapping cannot provide full access control when non-zoned expanders are present within the topology.

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Usage model 3: Device sharing as illustrated by Figure 3.
Hosts sharing access to devices to not allowed to see or interfere with each other.

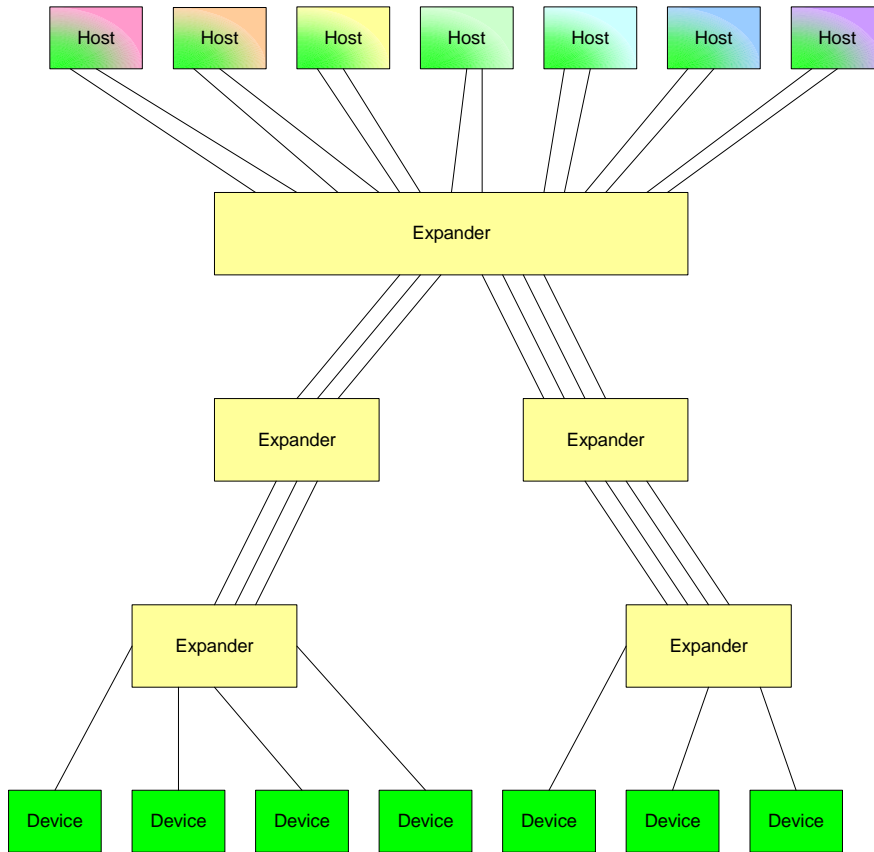


Figure 3: Device sharing

Either phy-resolved or address-resolved source zone group mapping can satisfy the Device sharing usage model.

Usage model 4: Non-zoned JBODs as illustrated by Figure 4.

Adding zoned root expanders that resolve source group information from a SAS address allows complete zoning functionality to be realized without changes to the JBODs.

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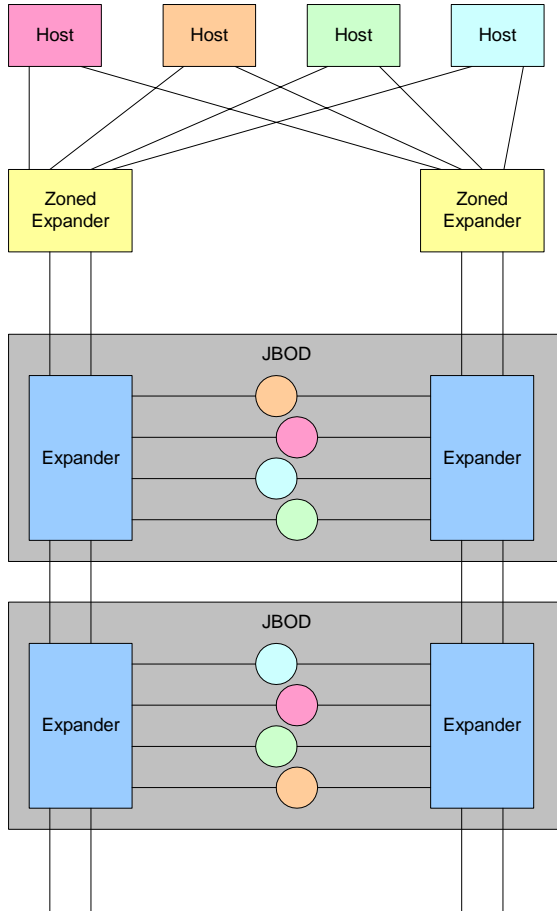


Figure 4: Non-zoned JBODs

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This usage model cannot be realized with the phy-resolved source zone group mapping.

Usage model 5 Bridge or Virtual Devices as illustrated by Figure 5.
Providing the ability to properly differentiate zoning information on behalf of bridged devices, e.g. Fibre Channel to SAS Bridge Device presenting itself as a non-zoning expander with virtual devices.

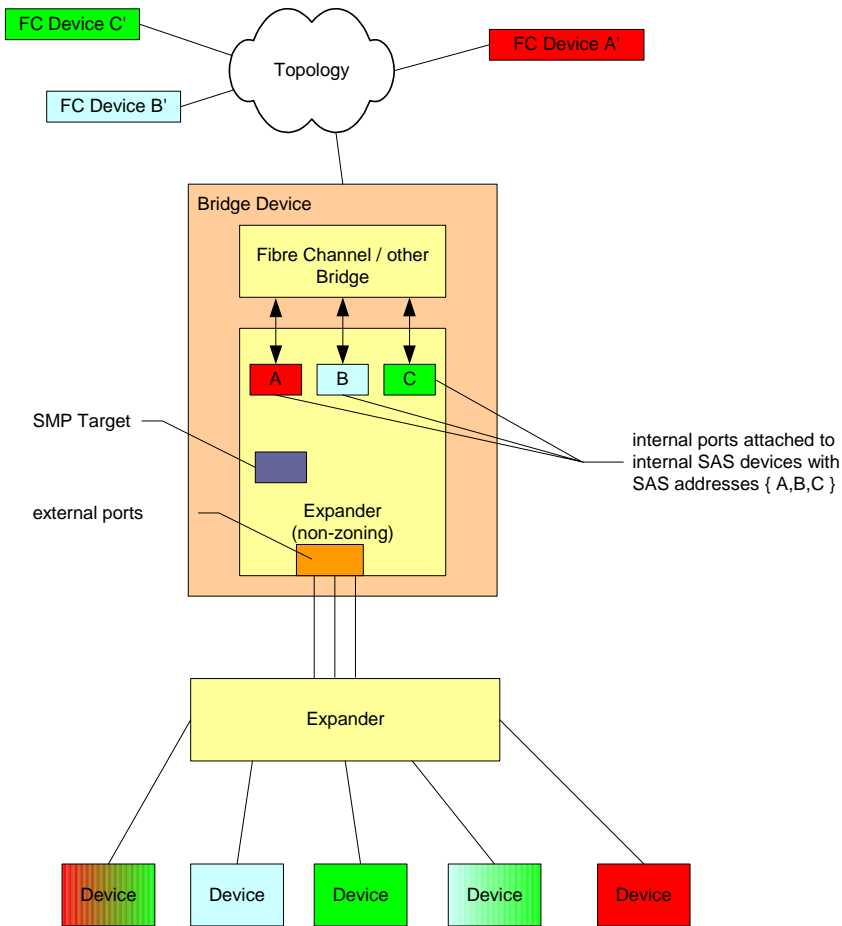


Figure 5: Bridged devices

This usage model cannot be realized with the phy-resolved source zone group mapping.

Address-resolved source zone group mapping example

Figure 6 shows how Address resolved source zone group mapping satisfies the requirements of Usage model 4 Non-zoned JBODs.

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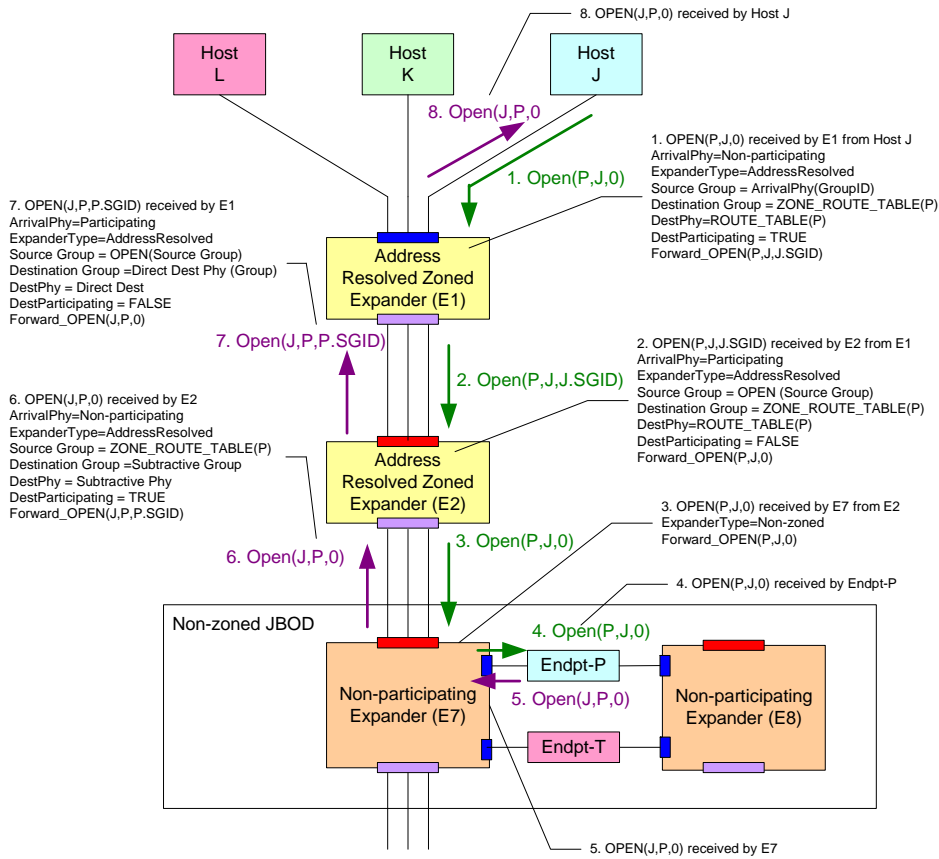


Figure 6: Address-resolved source zone group mapping example

4.6.2 Expander ports

[add the following text to SAS2r02 section 4.6.2]

Each phy in an expander port shall have the same ZONE ADDRESS RESOLVED bit value and ZONE GROUP field value. The DISCOVER function (see 10.4.3.5) shall return the same value in the ZONE ADDRESS RESOLVED and ZONE GROUP fields for each phy in an expander port.

[Changes proposed to T10/06-019]

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4.9.3.2 Zone phy information

[add ZONE ADDRESS RESOLVED bit to set of information supported by each phy]

Each phy of a zoning expander device shall support the following zone phy information fields:

- a) ZONE PARTICIPATING bit;
- b) ZONE ADDRESS RESOLVED bit;
- c) ZONE SUPERVISING PRIORITY field; and
- d) ZONE GROUP field.

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The ZONE PARTICIPATING bit shall be set to one when the phy is attached to a zoning expander device. The ZONE PARTICIPATING bit may be set to one when the phy is attached to a zoning end device. The ZONE PARTICIPATING bit shall be set to zero when the phy is attached to a device that does not support zoning. This indicates the boundary of the ZSDS.

The ZONE ADDRESS RESOLVED bit shall be set to one when the phy is contained within a zoning expander device and is configured to use the Address-resolved source group zoning method as specified in Table 2.

The ZONE ADDRESS RESOLVED bit shall be set to zero when:

- a) the phy is contained within a zoning expander device and is configured to use the Phy-resolved source group method as specified in Table 2; or
- b) the phy is contained within a non-zoning expander device.

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The ZONE SUPERVISING PRIORITY field indicates the active zone supervisor election priority of the device attached to the phy (see [4.9.4.1](#)).

The ZONE GROUP field has a value in the range 0 to 127 that indicates the zone group that contains the phy.

4.9.3.5 Zone Routing

When a zoning expander device receives an OPEN request, the zoning permission table shall check the access permission between the source zone group and the destination zone group. If the zone permission table entry is set to one then access between the phys is allowed and the zoning expander shall continue with the normal ECM arbitration procedure. If the zone permission table entry is set to zero then access is not permitted and the OPEN_REJECT (ZONE VIOLATION) response shall be sent for the OPEN request and the ZONE VIOLATION bit for the source phy shall be set to one.

The zoning expander device uses the rules in [Table 1](#), and [Table 2](#) to check the zone group access permission of the OPEN request.

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[Table 1](#), defines how the source zone group is determined from a received OPEN address frame.

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Table 1 – Source zone group mapping

Within or on boundary of zoned service delivery subsystem	Source zone group mapping			
	Phy-resolved	Address-resolved (route attribute of receiving phy)		
		Direct Attach	Subtractive Routed	Table routed
Within zoned service delivery subsystem (ZONE PARTICIPATING = 1)	Source zone group in OPEN address frame	Source zone group in OPEN address frame	Source zone group in OPEN address frame	Source zone group in OPEN address frame
On boundary of zoned service delivery subsystem (ZONE PARTICIPATING = 0)	Zone group of the receiving phy	Zone group of the receiving phy	Zone group of the receiving phy	Zone group stored in the zone route table for the source SAS address.

Note:

Address-resolved source group mapping differs from Phy-resolved source group mapping only when an OPEN address frame is received on the boundary of the zoned service delivery subsystem and the routing attribute of the receiving phy is table routed.

To provide the broadest scope of potential zoning usage models, Address-resolved zoning expanders should not utilize subtractive phys on the boundary of the zoned service delivery subsystem.

[Table 2](#) defines how the destination zone group is determined from a received OPEN address frame.

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Table 2 – Destination zone group mapping

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Expander routing attribute	Destination zone group mapping	
	Phy-resolved	Address-resolved
direct routing	Zone group of the destination phy	Zone group of the destination phy
table routing	Zone group stored in the zone route table for the destination SAS address.	Zone group stored in the zone route table for the destination SAS address.
subtractive routing	Zone group of the subtractive phy.	Zone group of the subtractive phy

10 Application Layer...

10.4.3 SMP functions

10.4.3.1 REPORT GENERAL function

Changes to 06-019r3 and 06-029r2 REPORT GENERAL response – Add an ADDRESS RESOLVED ZONE DEVICE bit to indicate that the device is capable of Address-resolved source group mapping.

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Table 193 defines the response format.

Table 197 - REPORT GENERAL response

Byte\Bit	7	6	5	4	3	2	1	0
	...							
10	ZONE DEVICE	ADDRESS RESOLVED ZONE DEVICE	Reserved			ACTIVE SUPERVISOR CONFIGURABLE ROUTE TABLE	CONFIGURING	CONFIGURABLE ROUTE TABLE
11	ACTIVE ZONE SUPERVISOR PRIORITY Reserved			ZONE SUPERVISING SUPERVISOR PRIORITY				
12	ENCLOSURE LOGICAL IDENTIFIER							
19	ENCLOSURE LOGICAL IDENTIFIER							
20	ENCLOSURE LOGICAL IDENTIFIER							
27	ACTIVE ZONE SUPERVISOR SAS ADDRESS							
	...							

...

The ADDRESS RESOLVED ZONE DEVICE bit shall be set to one if the device supports Address-resolved source zone group mapping (see 4.9.3.5). The ADDRESS RESOLVED ZONE DEVICE bit shall be ignored if the ZONE DEVICE bit is set to zero.

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10.4.3.5 DISCOVER function

Changes to 06-019r3 and 06-029r2 DISCOVER response – Add ZONE ADDRESS RESOLVED bit to indicate that a phy within a zoned device is configured for Address-Resolved Source Group Mapping.

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Table 197 defines the response format.

Table 197 - DISCOVER response

Byte\Bit	7	6	5	4	3	2	1	0	
	...								
33	Reserved				ATTACHED ZONE DEVICE	ATTACHED-ZONE BROADCAST METHOD			Reserved
	...								
48	Reserved		ZONE VIOLATION	ZONE PARTICIPATING	ZONE ADDRESS RESOLVED	ZONE SUPERVISING PRIORITY			Reserved
49	Reserved	ZONE GROUP							
	...								

...

A ZONE ADDRESS RESOLVED bit set to one indicates that the phy within a zoning expander device is configured to use an Address-resolved method as specified in Table 2 to determine the source group for received OPEN address frames.

A ZONE ADDRESS RESOLVED bit set to zero indicates that the phy within a zoning expander device is configured to use a Phy-resolved method as specified in Table 2 to determine the source group for received OPEN address frames.

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10.4.3.13 CONFIGURE PHY ZONE function

Changes to 06-019r3 and 06-029r2 – Add a ZONE ADDRESS RESOLVED bit to configure a phy within a zoned device for Address-Resolved Source Group Mapping.

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Table 18 - Phy zone configuration entry descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved			ZONE PARTICIPATING	ZONE ADDRESS RESOLVED	ZONE SUPERVISING PRIORITY-Reserved		
1	Reserved	ZONE GROUP						

...

A ZONE ADDRESS RESOLVED bit set to one indicates that the phy within a zoning expander device shall use an Address-resolved method as specified in Table 2 to determine the source group for received OPEN address frames.

A ZONE ADDRESS RESOLVED bit set to zero indicates that the phy within a zoning expander device shall use a Phy-resolved method as specified in Table 2 to determine the source group for received OPEN address frames.

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[[zoning management functions removed from this proposal](#)]