

SpaceWire Plug and Play Updates

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SpW PnP Update

- Presentation made at 2006 MAPLD SpW Seminar
- White paper posted on SpaceWire web-site
- Group bi-weekly telecons
 - Interested in participating contact:
 - Glenn Rakow Glenn.P.Rakow@nasa.gov
- Recent work
 - Identify PnP packet types
 - Interrogation
 - Request
 - Response
 - Notification Message
 - Configuration
 - Request
 - Grant
 - Write
 - Read
 - » Request
 - » Response

SpW PnP Summary

- Product of SpW PnP WG will be to develop specification of necessary hardware features required in support upper layer (software) PnP implementations
 - Network mapping
 - Notification Message
 - Attachment/Detachment
 - Housekeeping functions
 - In support of
 - Network Mapping
 - Notification Message
- Supports different PnP approaches at upper layer
- Scheme requires
 - Assignment of Protocol ID
 - Requires use of Router ID
- Implemented in router configuration (0) port
- Compatible with legacy SpaceWire nodes

SpW PnP Issue

- Network mapping
 - Interrogation packet is used to gather information to map network
 - Targeted to configuration 0 port of router
 - <0><254><Protocol ID><cargo>
 - Interrogation packet recipient's type is not known, could be:
 - Router
 - Node
 - Another Host
 - Leading zero in front of packet not defined by Protocol ID documentation for
 - Node
 - Host
- Would like to define behavior for leading zero when not router

SpW PnP Next Steps

- Request SpaceWire working group participation for SpaceWire PnP definition
- Assignment of Protocol ID

Backup - Why PnP?

- PnP Framework
 - Allowing data providers (hardware or software) to
 - Register as a data provider
 - Describe capabilities and controls
 - Allowing applications software to
 - Identify sources of needed data
 - Description, format, accuracy, calibration, etc
 - Subscribe for data delivery
- PnP important to Responsive Space
 - Nodes have built-in intelligence to support rapid integration
 - Systems are built as self-organizing assemblies, based on this built-in intelligence

Backup - Hardware Support for PnP

- Don't reinvent the wheel
 - Borrow PnP features from other protocols for incorporation into SpaceWire PnP
 - USB - Provides device attachment / detachment messages to host
 - Leverage group's collective experience
- Two key *hardware* functions identified
 - Change in network status
 - Node attaches or detaches from network
 - Network Mapping
 - Provide hardware hooks to facilitate network mapping
- Host software implementation is not addressed

Backup - Definitions

- Detachment – a link becomes inactive (unrelated to error conditions) after some period of activity
- Attachment – a link becomes active after some period of inactivity unrelated to error conditions
- Node – an addressable network entity that is not a router
- Host node – a node that is the destination for notification packets
- Subnet – a separable collection of internally connected routers and nodes

Backup - Requirements

- The SpaceWire network shall recognize the attachment/detachment of nodes/subnets as a notification event
- The SpaceWire network shall distribute a notification packet to selected host nodes upon recognition of a notification event
- The SpaceWire network shall distribute notification packets with best effort
- The notification packet shall identify the type of notification event (attachment or detachment)
- The notification packet shall identify the attached/detached port

Backup - Assumptions

- The concept should support path addressing and the various forms of logical addressing
- The concept can require modification of router designs, but not endpoint designs
- The concept should be SpaceWire friendly
 - Minimize the reservation of route identifiers
 - Minimize notification packet size
- Notification should be inactive in un-initialized SpaceWire networks

Backup - General Approach

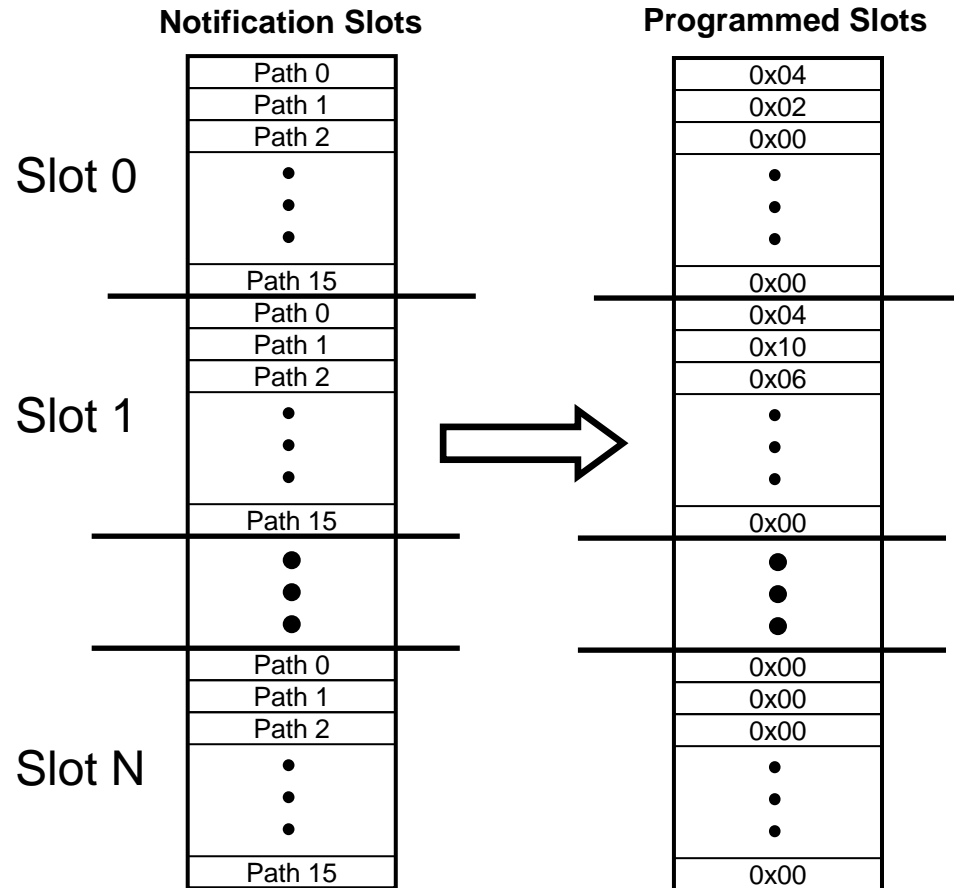
- Router is aware of the status of its own ports
- Router generates and sends notification messages to hosts after detecting an attachment or detachment
- Utilize Protocol ID implementation for these messages

Backup - Proposed Solution

- Reserve N *slots* in the router for return path addresses to hosts
 - Logical or physical routes are supported
- A host's return path is written to one slot
- An attachment/detachment event triggers the router to send notification messages to all valid slots
- Assign each router a unique ID to incorporate into the notification packet

Backup - Slot Usage

- Initialize all slot table values to zero on power up
 - Invalid slots have 0x00 as first entry
 - For valid slots, 0x00 marks last valid path
- Logical or path addressing supported
- Slot size can be tailored by the router designer
 - Both number of paths & number of slots are independent



Memory Size is
16*N by 8

Slide text from Patrick McGuirk, Micro-RDC

Backup - Slot Considerations

- Memory storage for slot table is user-defineable
 - RMAP and PNP Protocol *can* co-exist for slot & Router ID housekeeping
 - Map PNP parameters to RMAP memory space
 - Must support PNP messaging

	Notification Slots				Memory Mapped Address
	P3	P2	P1	P0	
Slot 0	P3	P2	P1	P0	0xC00
	P7	P6	P5	P4	0xC04
Slot 1	P3	P2	P1	P0	0xC08
	P7	P6	P5	P4	0xC0C
Slot 2	P3	P2	P1	P0	0xC10
	P7	P6	P5	P4	0xC14
Slot 3	P3	P2	P1	P0	0xC18
	P7	P6	P5	P4	0xC1C

Memory Size is 8 by 32

Memory mapping to an address space is optional

Backup - Attachment Event

- Green node triggers event notification packet to host nodes
- But how do the Host nodes know where the packet came from?

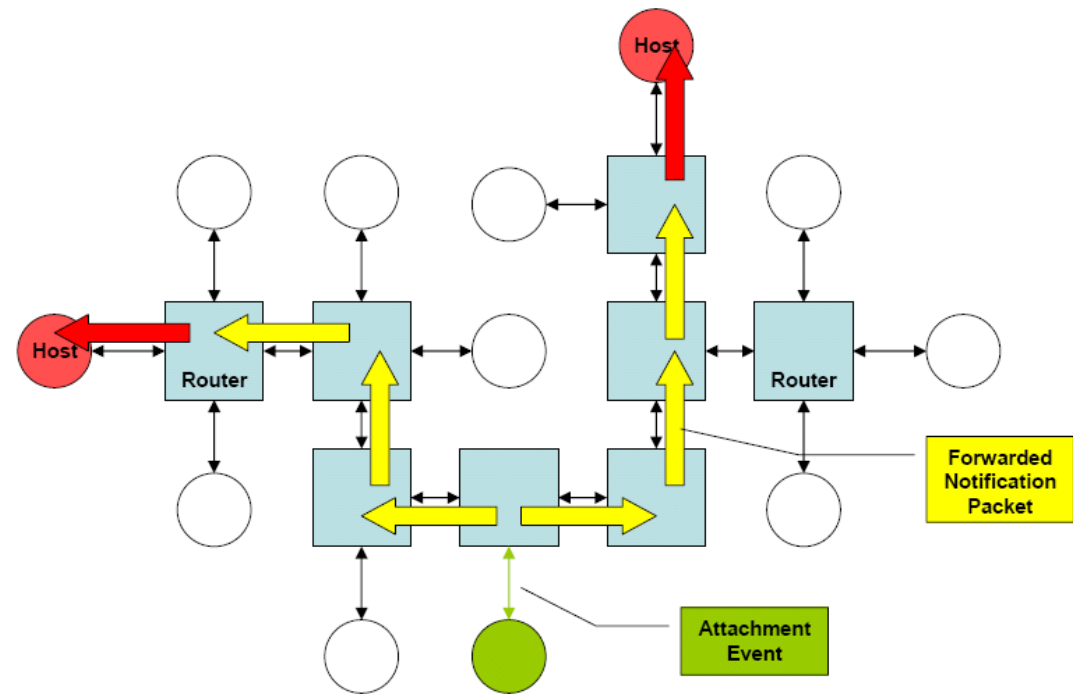
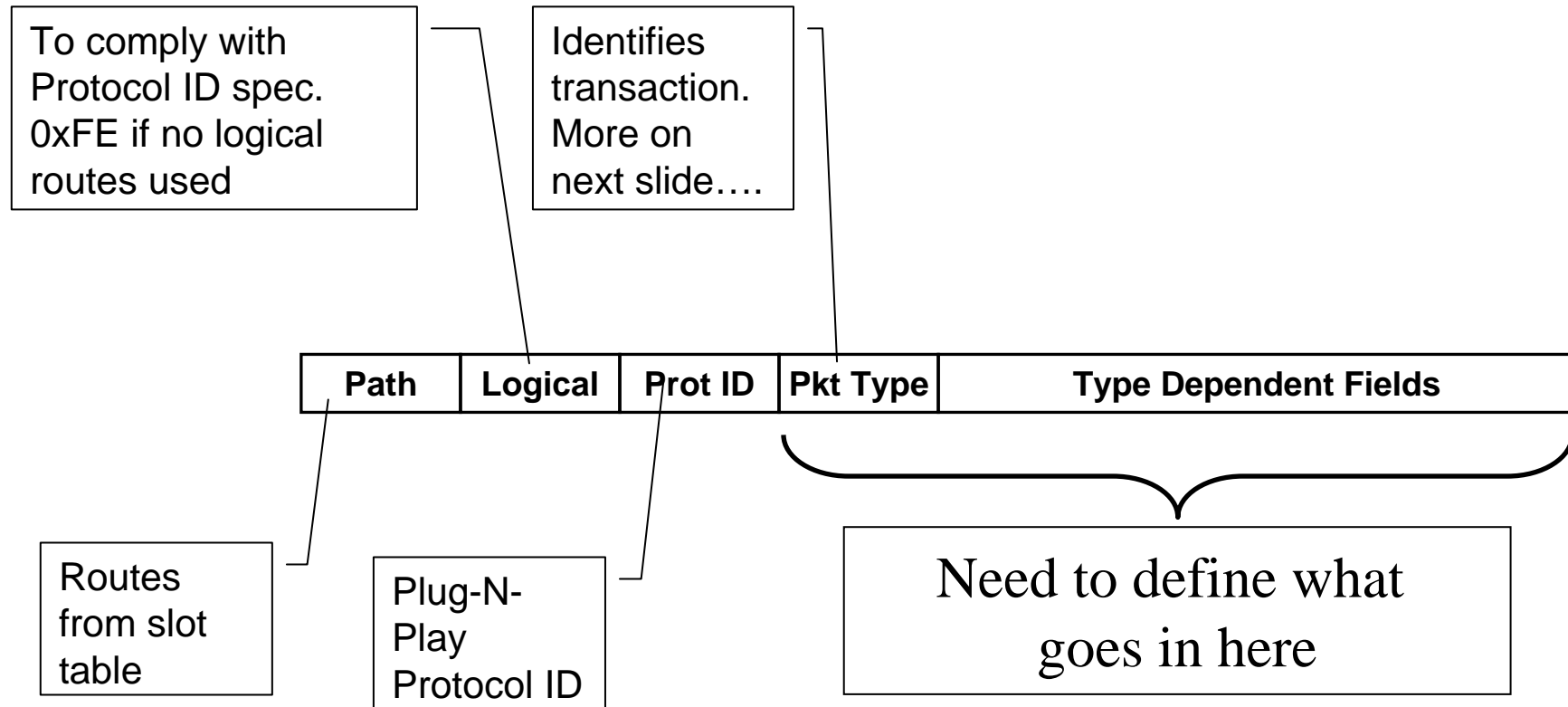


Diagram from Cliff Kimmerly, Honeywell

Backup - Router ID

- A host node receiving an event notification packet must be able to determine where the message originated
- Label each router with a unique ID, which is incorporated into these notification packets
 - Router ID could be ‘hardwired’
- Assumptions
 - There will be a node performing ‘mapping’ functions
 - All host nodes can construct network map or have a method of obtaining a network map

Backup - PnP Packet Structure



Backup –

What should be included in the PnP Protocol?

- Notification Event
 - Indicates which router it came from & which port is affected
- Slot Housekeeping
 - Supports slot writes, slot read request, slot return read
- Router ID Housekeeping
 - Supports Router ID writes, read requests & return reads
- Ping/Query Message
 - Returns status of ports & Router ID
 - *Node* support for this message type
- Programmable detachment inactivity time?
 - Could be used to disable notification messages
- Other types of messages
 - Router diagnostics
 - Router capabilities
 - Router traffic reports

Backup - Limitations

- Very large number of hosts would make this approach not feasible
 - Router storage required for slots
 - If 32 hosts, 16 paths per slot = 512 bytes → Manageable
 - Router needs time to generate messages to all valid slots
 - Could have proxy type host
- Routers must have an ID register
- All hosts must have knowledge of network, or at least have method of obtaining it