Network Management and Configuration using RMAP

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Introduction

- **SpaceWire device interoperability**
  - Need a standard method for device configuration
- **Proposal to use RMAP**
  - Implications
- **Provide support for "standard" features**
- **Summary**

Relationship with Plug-and-Play

- Very strong overlap
- Particularly in the last few weeks
- This paper documents our perspective
- Starting point:
  - Configuration space and use of RMAP from UoD router
- Indebted to SpaceWire PnP working party

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Interoperability

- Methods for managing and configuring networks are vendor specific
- Useful to have a standard way to handle the common features of SpaceWire devices
- Permit greater level of interoperability
- Potential for network and device discovery

Interoperability Use Cases

- **Test and Development Equipment**
  - Promote ease of use
- **Ground Equipment**
  - Standard methods for integration and test
- **Flight Equipment**
  - Software and hardware reuse

Standardise a Protocol

- Configuring routers
- Configuring the state of links
- Checking the status of links
- Interrogating nodes

RMAP as a Standard Protocol

- Network Management and Configuration operations are largely get/set
- RMAP provides basic read/write operations
- RMAP is flexible, fully featured and relatively lightweight
- Read/write commands operate on 40-bit address field with no further semantics
- "Address" field can therefore be interpretted in any way

Interpretation of Address Field

- Split the address field into three parameters
  - Command
  - Index
  - Byte
- Top two bytes are unused

Protocol Identifier

- RMAP is being given specific semantics
- Not appropriate to use RMAP protocol ID
- Need to use new protocol ID
- No clear way to identify RMAP is being used
- Need consistent way to address configuration space of both routers and nodes
- Nodes must also support leading zero
  - Will be discussed elsewhere

Specifying a Return Address

- Read and acknowledged write require return address
- Not known if querying a router through an unknown link
- RMAP packet always has source logical address field
- If this is zero, the port of the request is added to the return address

"Standard" SpaceWire Tasks

- Interrogating and indentifying devices
- Link status monitoring
- Link state and speed configuration
- Router arbitration control
- Routing table configuration

Device Information

- Vendor ID
- Product ID
- Device class
- Device version
- Device type: node/router
- Number of ports
- Maximum write packet size
- Device identifier
  - Network unique
  - May be read-only or read/write
- Bit map of active ports
  - Ports in the run state

Link Status/Link Information

- **Link errors:**
  - Disconnect
  - Parity
  - Escape
  - Transmit credit
  - Receive credit
  - Character sequence
- **Maximum supported speed**

Link State

- **Configure link state:**
  - Idle
  - Start
  - Auto-start
  - Disable

- **Set link speed**
  - Device chooses nearest supported speed

Router Arbitration

- Resolves competition for output port
- Standard suggests a number of different approaches to arbitration
  - E.g. round-robin, random, fixed
- Also permit priority-based routing
  - Logical address
  - Arrival port
- Permit valid combinations, applied in order:
  - Logical address
  - Arrival port
  - Arbitration method (round-robin, etc.)

Routing Table

- **Assigns ports to addresses**
- **Multiple assignments gives:**
  - Alternatives (Group Adaptive Routing)
  - Multiple forwarding (Packet Distribution) (except to arrival port)
- **Permits GAR/PD on path addresses**
- **Set priority associated with address**

Summary

- **Interoperability**
  - Ease of use
  - Better testing facilities
  - Promotes hardware and software reuse
- **Standard protocol**
- **RMAP-based**
  - Simple semantics of RMAP can be extended
  - New protocol ID should be used
- **Support the "standard" features of SpaceWire**
- **Features are optional, just provides access to existing hardware facilties**

The Future

- Work closely with the SpaceWire plug-and-play group
- Work closely with CCSDS plug-and-play group
- Continue to develop facilities
- Simulation and testing