Network Discovery Protocols Status

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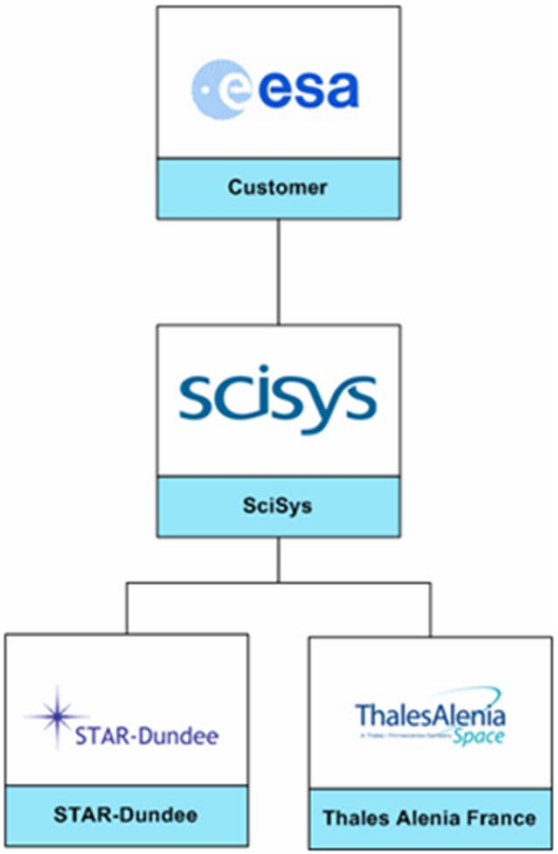
Agenda

- Activity overview
- Requirements approach
- Requirements overview
- Protocol approach
- Protocol status

Activity Scope

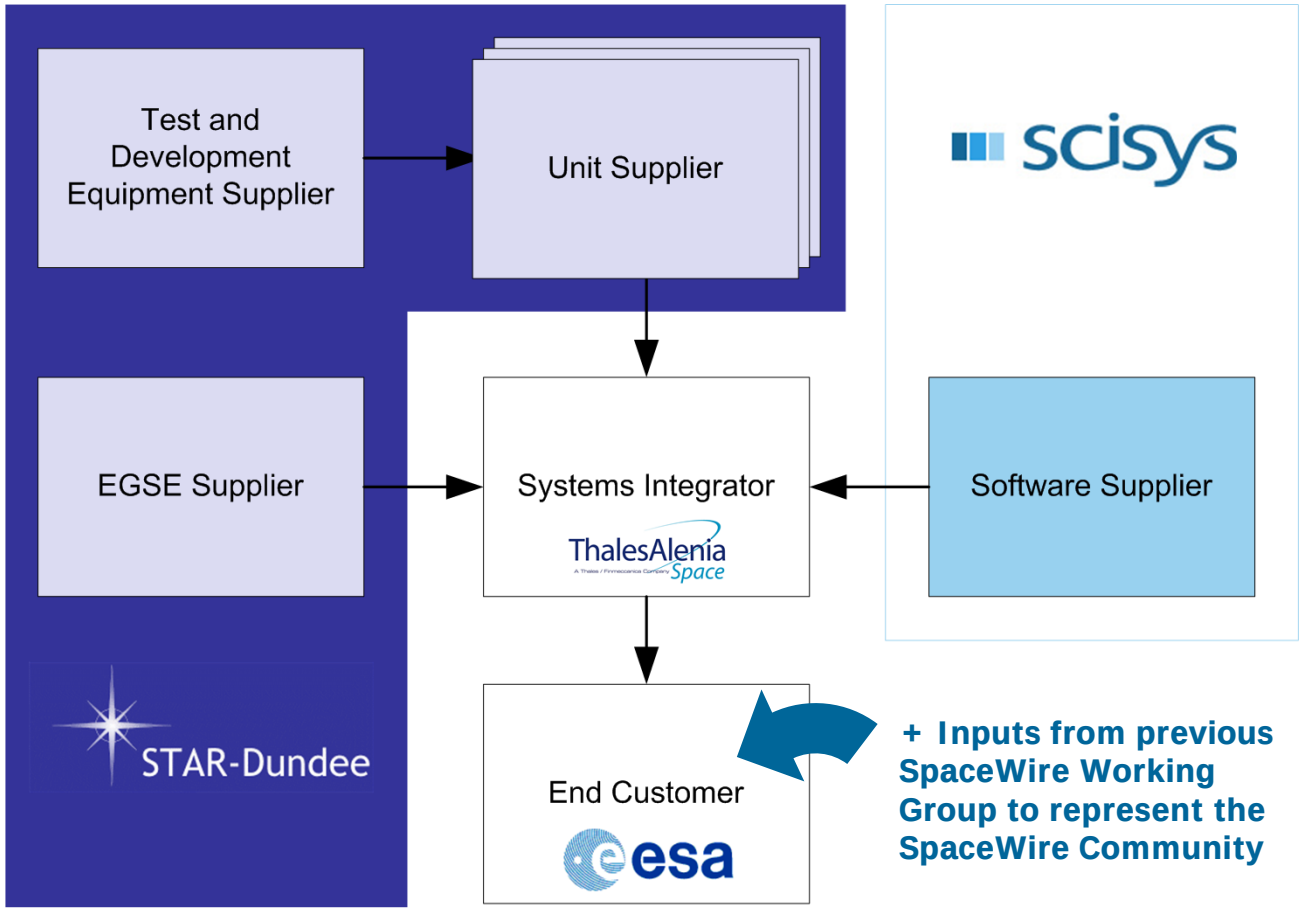
- There is currently no standard SpaceWire protocol for
  - The discovery or confirmation of presence of devices
  - The management of standard aspects of a SpaceWire network
- The ESA Network Discovery Protocols activity aims to develop, validate and demonstrate a suitable protocol
- Promote interoperability and reuse
- Project goals
  - Gather requirements for a SpaceWire plug-and play protocol;
  - Design and specify a SpaceWire plug-and play protocol;
  - Develop an implementation of the protocol encompassing hardware and software;
  - Provide a test bench, for validation of the protocol;
  - Provide a demonstrator to permit demonstration of protocol features.

Consortium



- SciSys prime
- Partnered with
  - Thales Alenia Space, France (Cannes)
  - STAR-Dundee

Requirements Stakeholders



Requirements Gathering

- Requirements gathered from each stakeholder representative
- Requirements collated
  - Expected this to be an additive process
- Requirements categorised
  - Mandatory and extended
- Categories relate to the ability of this activity to
  - Address the requirement fully in the protocol
  - Validate the requirement

Requirements Documentation

- Requirements gathered from consortium with limited interaction
- Intended to elicit user requirements
- Only information given to consortium was the “Terms of Reference”
- Requirements from consortium have been documented “as-is” with no modification by SciSys

Requirements Collation

- Collation intended to be a purely additive process
- i.e. no loss of requirements
- This was more difficult than expected
- No contradictory requirements, however…
- Requirements with significant overlap had to be combined for consistency
- The reasoning behind the requirement had to be understood to permit combination
- Minor adjustments had to be made to requirements e.g.

Requirements: The Expected

- Many of the requirements were exactly as expected
  - Based on a long history of working with PnP/Network Management
- Unique identification of devices
- Configuration of SpaceWire-related features
- Support for the features of nodes and routers

Plug-and-Play Standardisation

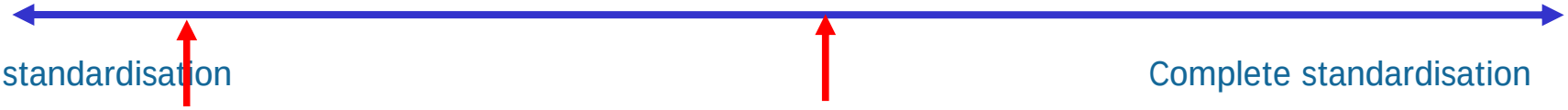
- Spectrum of possible approaches to devices:

No standardisation — Complete standardisation

- No device standardisation
  - Requires custom support for existing devices
  - Devices described by standard device features
  - Standard device driver interface
  - Drivers may be qualified once
  - Permits use of devices by standard hardware
    - Assumes all device accesses come from software
  - Software must be re-qualified every time
  - Hardware must be rewritten each time

Approaches to Plug-and-Play

- Spectrum of possible approaches to devices:



- Identification of devices based on vendor/product IDs only
- Device driver needed for all devices
  - Even simple routers...
  - Or simple nodes

- Identification of devices
- Plus support for standard SpaceWire features
- Defined mechanisms for vendor-specific additions

Requirements: The Unexpected

- TAS-F took an interesting position on the spectrum of approaches to PnP
  - Expect the protocol to provide only network discovery
  - No network or device management
  - All interaction with devices beyond identification requires a driver
- All other consortium members (+ESA) did not take this position
  - Other positions much more similar
- STAR-Dundee required support for many features only present in the SpW-10X or STAR

Requirements: The Unusual...

- Most requirements have some coverage from three or four (all) stakeholders
- Some requirements have coverage only from SciSys and ESA
- Specifically:
  - Ownership and proxies
  - Data sources and data sinks

Approach to Protocol

- RMAP-based
  - Get/set or read/write operations
  - RMW based on compare and exchange
- Support for a spectrum of implementations
- The entire PnP target address space must be implemented
  - Does not imply that the corresponding function must be implemented
  - Fields corresponding to an unimplemented feature should read as zero
  - Reserved fields should read as zero

Spectrum Position

- Should the protocol
  - Attempt to cover the most useful features in a generic way which will cover most implementations?
- Or
  - Steer clear of any features that have many possible implementations and leave these vendor specific?
- Examples:
  - Router watchdog time out
  - Router arbitration

What about Partial Implementations?

- Do not want to impose the inclusion of SpaceWire features on implementers of targets
  - e.g. do not want the inclusion of PnP support to force the implementation of SpaceWire functions
- However, do not want there to be a large number of implementation options
  - Makes compatibility difficult
- Suggest the use of a small number of **profiles**
  - Target profile support can be easily determined by an initiator
  - Profiles can be used to cover the Level 1/Level

Continuous vs. Discrete Functions

- Where feature implementation options are discrete this is easy
  - Either the feature is implemented or it is not
- Harder when there is a wide range of options
  - e.g. possible link speeds
- The target can respond by choosing the nearest valid option to the requested selection
  - Difficult to determine what is actually valid without trial-and-error
- How important is this?
- Is this most appropriately dealt with using an

Protocol Documentation Approach

- Interfaces
  - Service interface to user (“top”)
  - Protocol interface (“bottom”)
- Actions
  - Event driven
  - May include protocol state machine
- Must be defined for
  - Initiators/targets
  - Active/passive nodes
  - Control/peripheral nodes
- Will be delivered as a draft ECSS standard

Conclusions

- Requirements gathered according to stakeholder-based strategy
- Good coverage of problem
- Interestingly divergent requirements
- Now into protocol detail
  - Many decisions to be taken on a “micro” level
  - Useful to have opinions from the wider community
- Expect draft protocol to be completed by end of May
- Next activity phase: test bench and