AADL-Modelling of Plug&Play Weapon System Architecture

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• Introduction
• Notational Issues and Modelling Approach
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• Conclusion
Military Aircraft

Introduction – Aircraft/Store

Aircraft

AS

Mission Store

MSI
Introduction – Aircraft/Carriage Store/Store

Aircraft

Carriage Store

Mission Store

Miniature Mission Stores
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Graphical Notation - Components

Software
- Data
- Thread
- Process

Platform
- Device
- Memory
- Processor
- Bus

Composite
- System
Graphical Notation - Features

Ports
- Data Port
- Event Port
- Event Data Port

Subprograms

Connections
- Immediate
- Delayed
- Client / Server

<name>
Modelling Approach

- The PnP technical architecture defines several protocol layers which provide the means for network transparent control and communication between the aircraft and the weapon systems.

- A concise system model should reflect this generic hierarchical layered communication infrastructure and not put any constraints on the actual physical architecture of the aircraft/weapon system.

- Modelling approach suggested in this presentation is based on abstract buses (protocols) and abstract processors (virtual machines) which are currently developed as part of the AADL.
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Dynamic connectivity, i.e. air data link used for communication with weapon after release
Can be modelled in terms of modes (omitted in graphics)
Physical Architecture (cont’d)

A/C Platform

- Avionics Bus (e.g. 1553)
- Comms IF Computer
- Mission Computer
- Store Mgmt System
- Carriage Store
- Store Bus
- Store #1 (Weapon)
- Store #n (Weapon)
- Air Data Link (e.g. Link16)
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Functional Architecture

- Communication between system functions is based on abstract store control protocol which provides API.
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Store Control Protocol

Store Control Protocol <abstract>

refined to

Store Control Protocol <refined>

Store Communication Protocol <abstract>

Store Communication API
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Store Communication Protocol

Store Communication Protocol <abstract>

refined to

Store Communication Protocol <pre-launch>

Store Comms FSM

LL Store Comms Protocol <1553>

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Store Communication Protocol (cont’d)

Store Communication Protocol <abstract>

refined to

Store Communication Protocol <post-launch>

LL Store Comms Protocol <link16>
Abstract Physical Architecture

Communication services are provided as subprogram features via:

- **LL Store Comms API (1)**: Messages via avionics bus.
- **LL Store Comms API (2)**: Messages via air data link.

**Message Router**
Transparent routing of all store communication messages between avionics & weapon bus.
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A/C Functions

Store Control Protocol

Store Comms Protocol

Store Communication Protocol

Comms IF Computer
Mission Computer
Store Mgmt System
Cartage Store

Avionics Bus (e.g. 1553)
Store Bus

Store #1 (Weapon)
Store #n (Weapon)

SDFile
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Open Modelling Issues

- **I01**: The hierarchical refinement of protocols into systems requires a generic specification of protocol layers which is unfolded at instantiation time (e.g. see VHDL generics)
- **I02**: The system boundaries of the presented model show the layered architecture of the distributed system, however, an “integration” perspective might be desirable where the system boundaries reflect the borders of the physical systems
- **I03**: The graphical representation of binding between layers requires an huge amount of arrows. This could be reduced by means of a deployment view.
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Open Modelling Issues – Integration Perspective

Syntactically incorrect AADL specification!

Potentially a tool issue rather than a language aspect
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Conclusion

- This presentation showed a first approach of a PnP system architecture which focuses on the layered approach taken by the PnP technical architecture
- Modelling was based on the notion of abstract buses (protocols) and abstract processors (virtual machines)
- The approach allows for the explicit specification of all network transparent APIs, i.e. the store control API and the store communication API