Presented by

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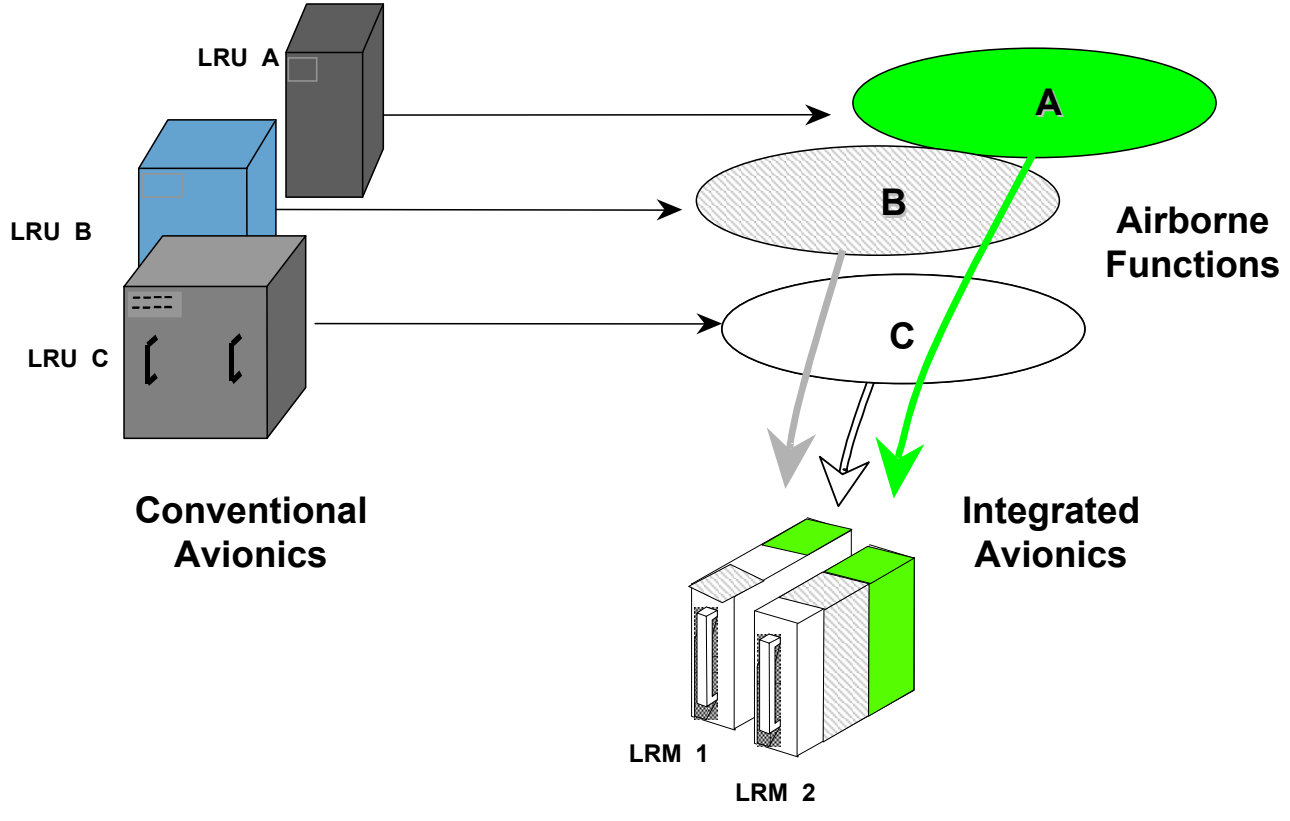
Processes and Methods for Integrated Modular Avionics

Presentation at USA - EU Workshop
Paris, July 7th 2005

Integrated Modular Avionics (IMA)



Identical Hardware & Kernel Software used for different

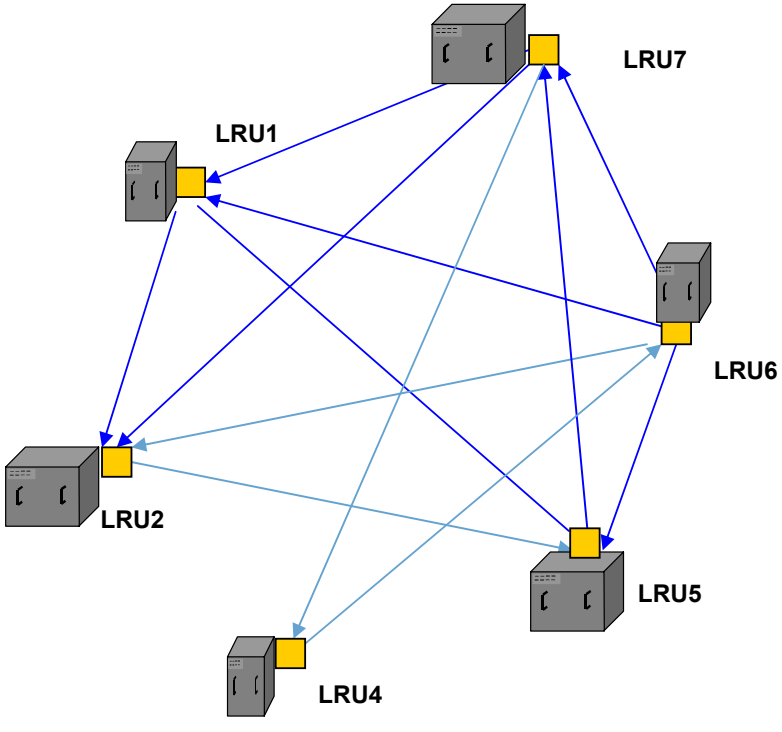
Airborne Functions in Flight Control & Utility Functions

Targeted IMA Advantages

- Reduction of Weight / Volume / Power consumption of the Avionics
- Reduction of material stocks within Airline Maintenance Centers
- Reduction of cost for Versions-Upgrades (core HW & SW)
- Reduction of cost for functional enhancements
- Reduction of cost through the emerging market of open standards

IMA Concept - LRU / LRM based Architecture

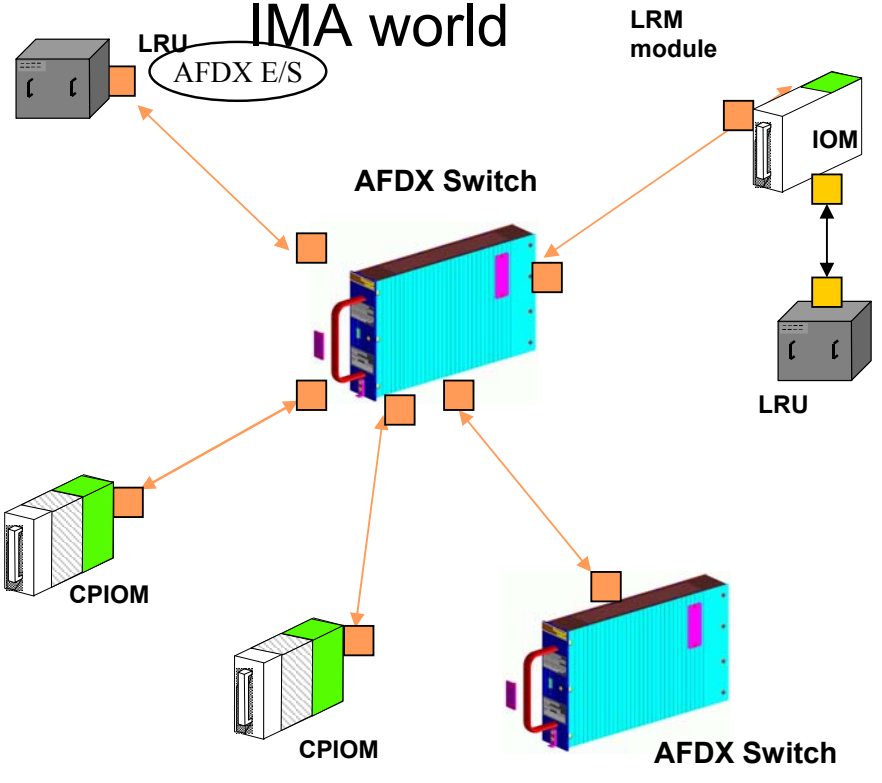
ARINC 429 world



ARINC 429 interface ARINC 429 link

1 new link = 1 new cable

IMA world

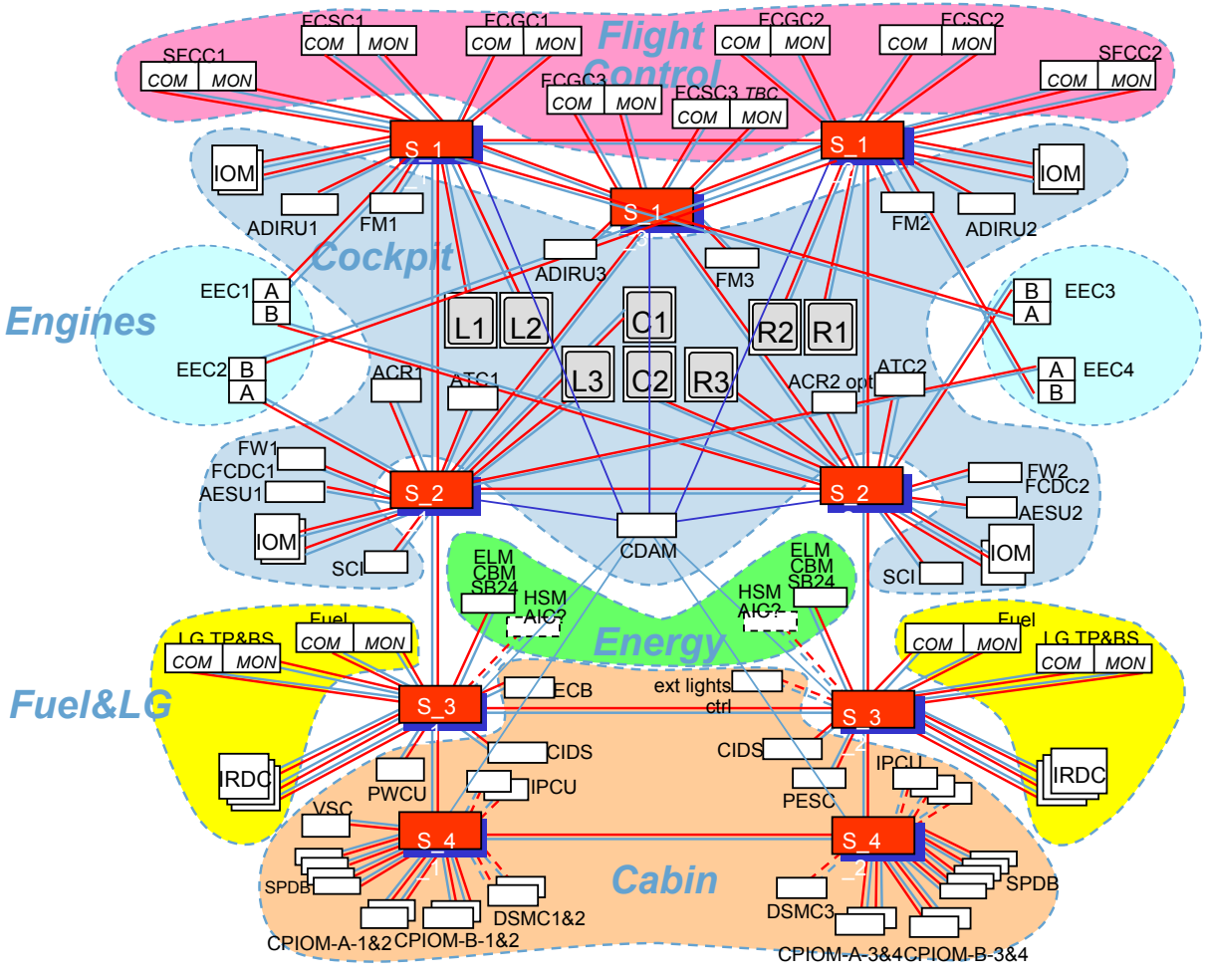


AFDX interface AFDX link

Static cabling configuration
1 new link = AFDX switch configuration table update

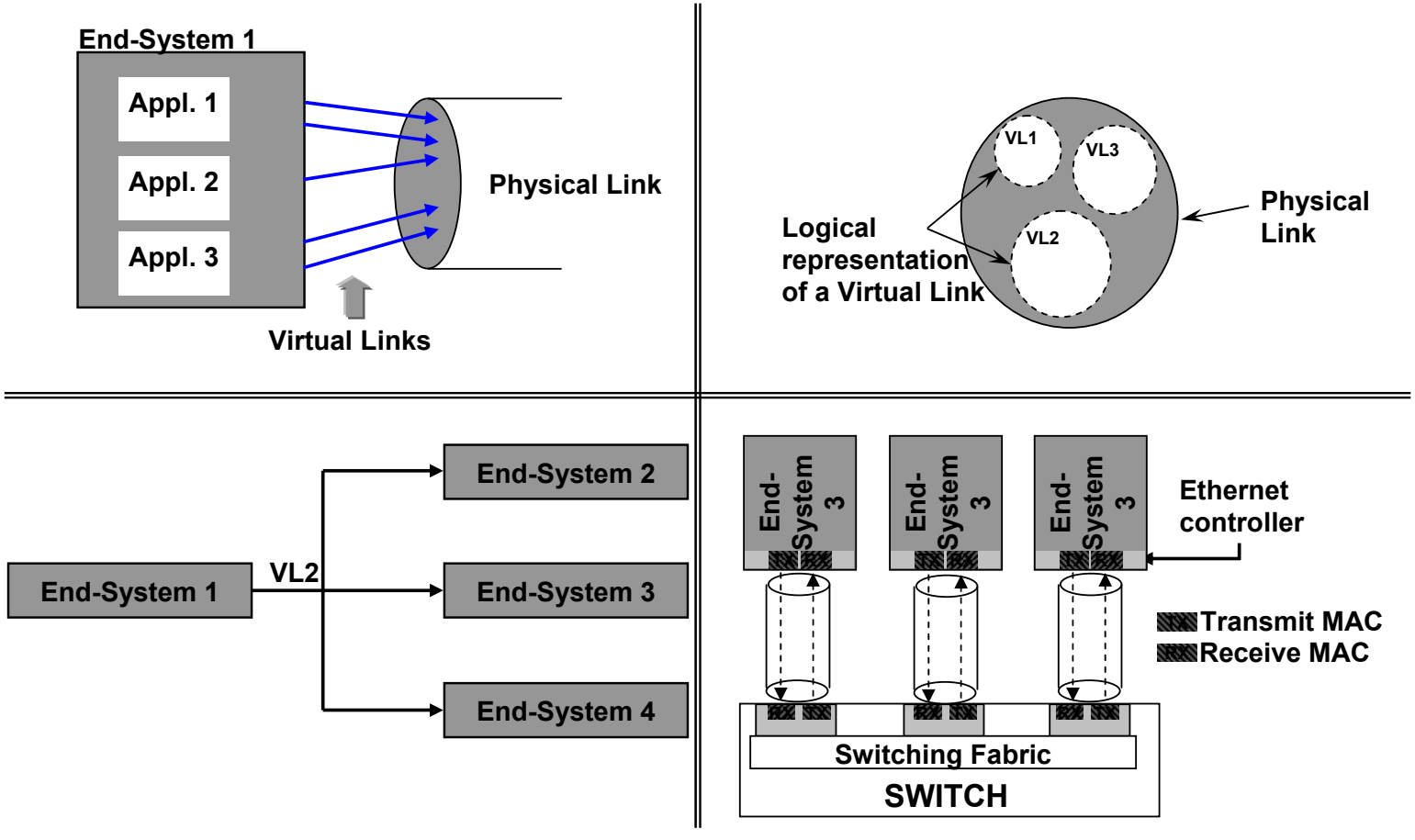
ADCN Network Architecture - Functional Domains

WARNING: old obsolete architecture for functional domain description only!



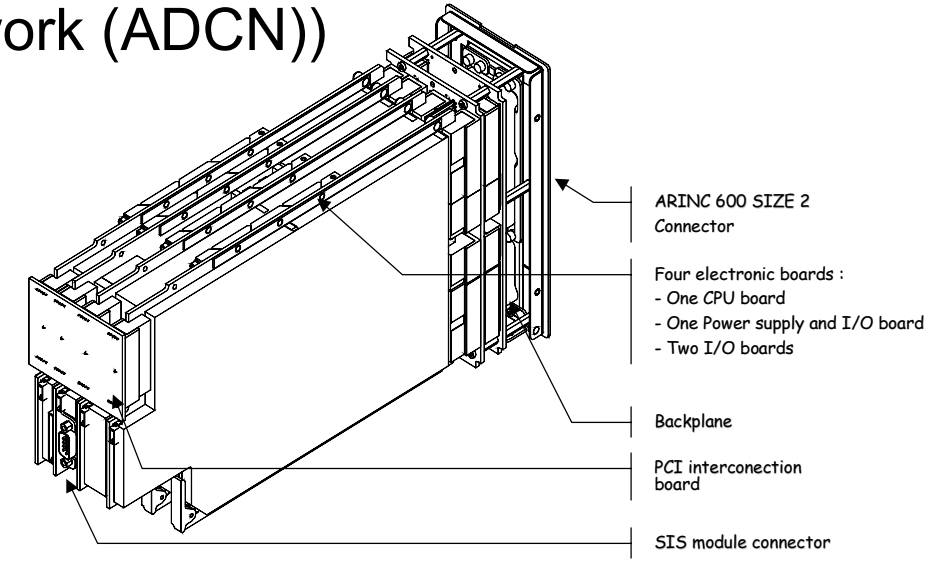
Flow Separation Concept

The Virtual Link Concept

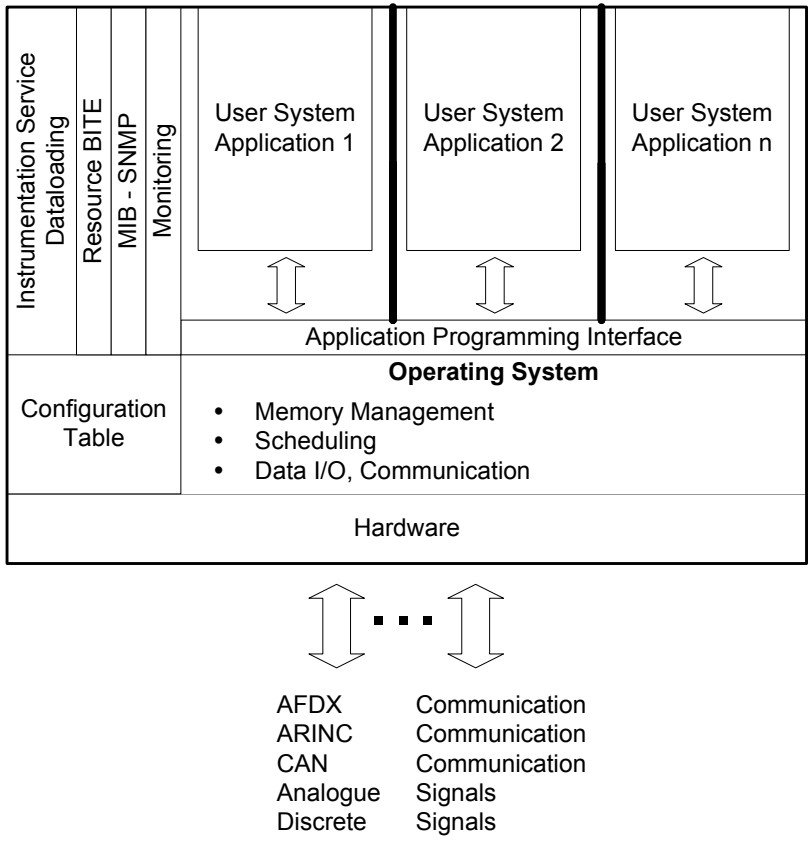


LRM / CPIOM Hardware

- ARINC 600, 3 MCU
- Approximately 4 kg
- Powered by 28VDC (some on ESS bus)
- ARINC 600 conn., 368 pins + 2 QUADRAX
- Hardware pin programming identifies domain, location, side, aircraft (MAC and IP addressing on Aircraft Data Communication Network (ADCN))

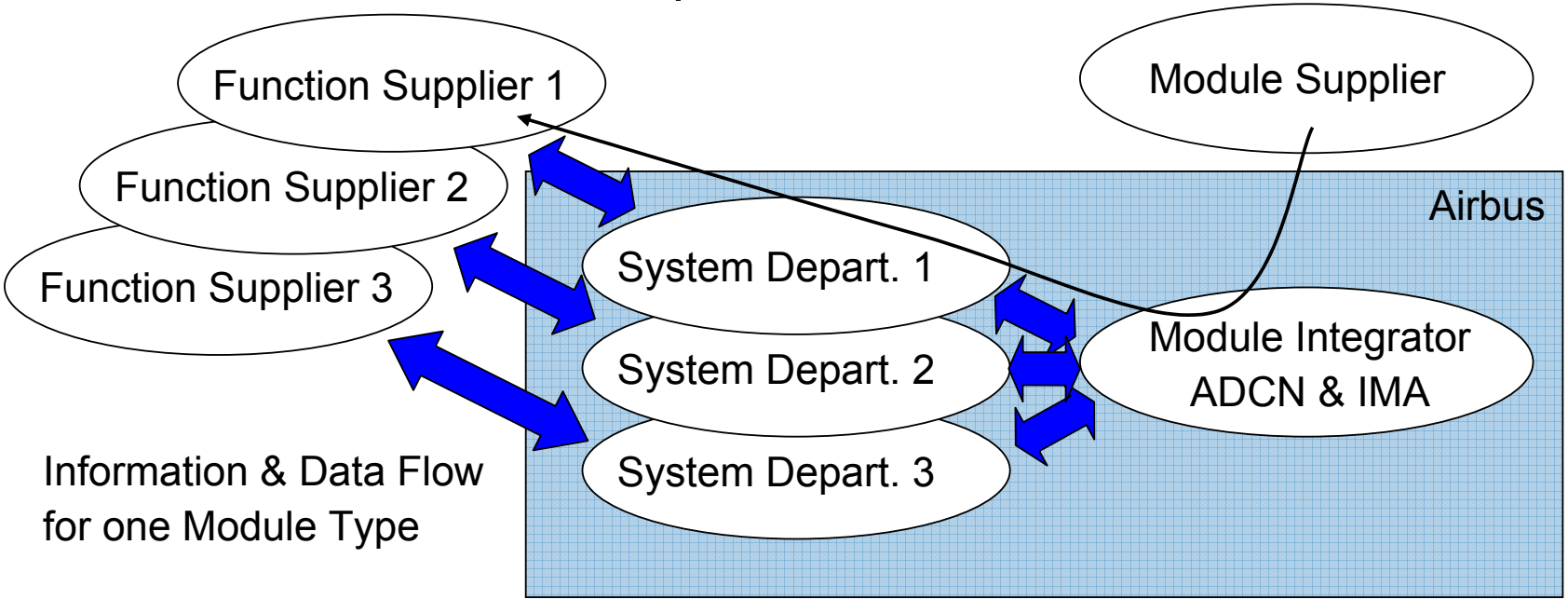


Building blocks of an Integrated CPIOM



IMA Configuration Process Aspects

- Classification of Configuration Parameter (Module, Global, Local).
- Hardware/OS specific configuration parameter.
- Manual assignment of resources supported by databases.
- Automated tool-chain to produce the load.



A380: 7 Module types; Up to 4 redundant Modules; 22 Physical Modules

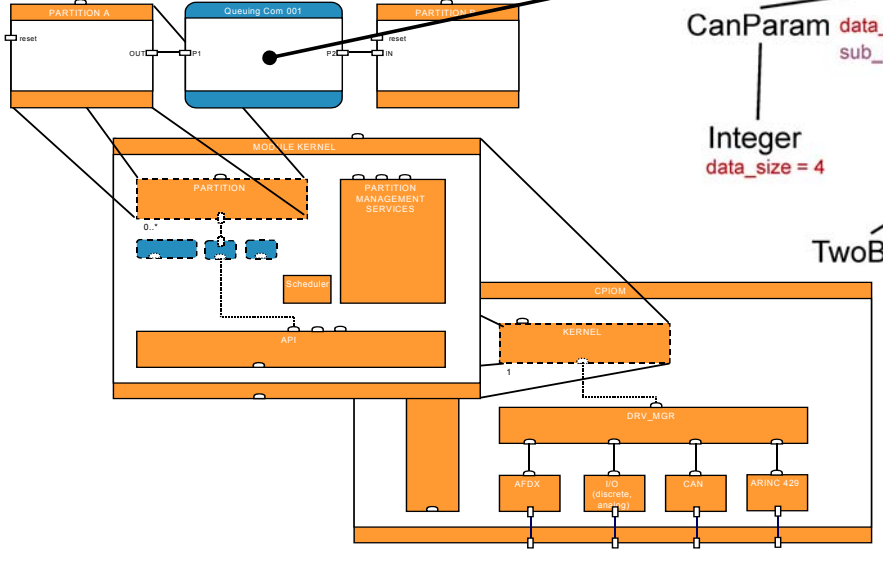


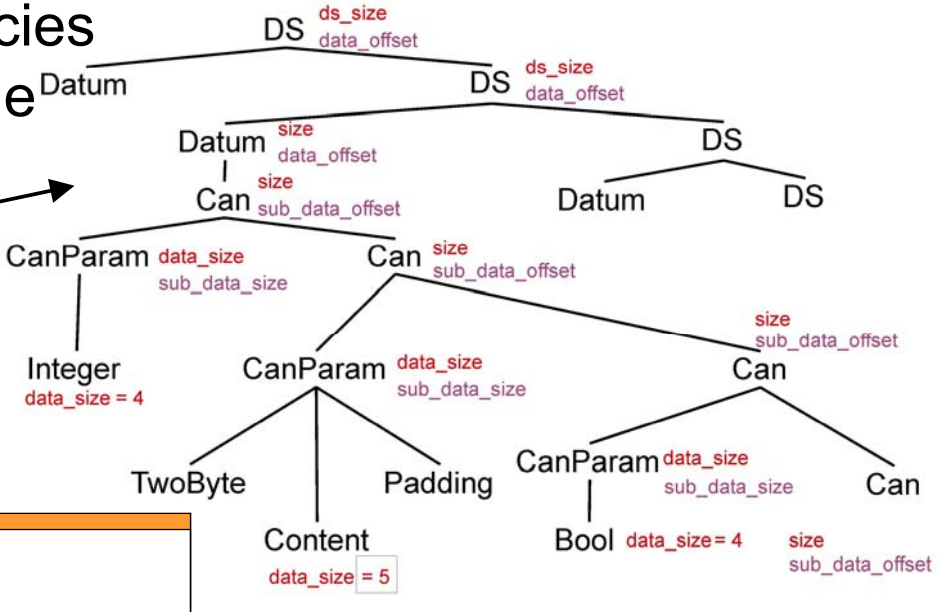
Visions for IMA

Processes & Methods

Configuration based on System Model

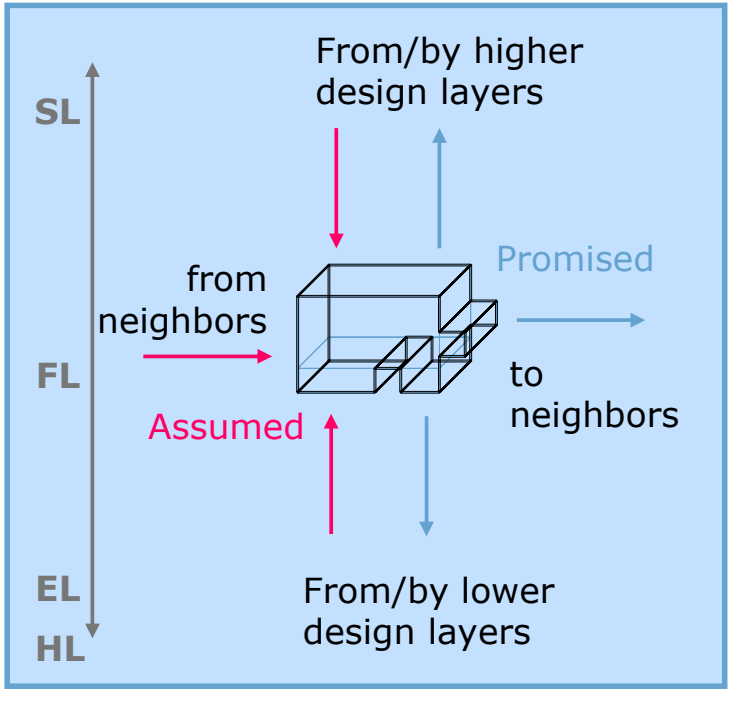
- Configuration bound to System Description Language
- Support of different Layer (e.g. Application, OS, Hardware)
- Decoration of Abstract Syntax Tree with configuration data
- Declaration of dependencies between parameter on the same or adjacent layer.





Component-based System Development

- Concept of building up the system architecture from exchangeable (heterogeneous) components.
- Components are enriched with functional and non-functional aspects as “Heterogeneous Rich Components” (HRC).
- Their characteristics can be assessed on the basis of those aspects.



- Design-space exploration is used to find a semi-optimal mapping of applications to LRMs under multi-dimensional constraints.

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Improvement of the Development Process

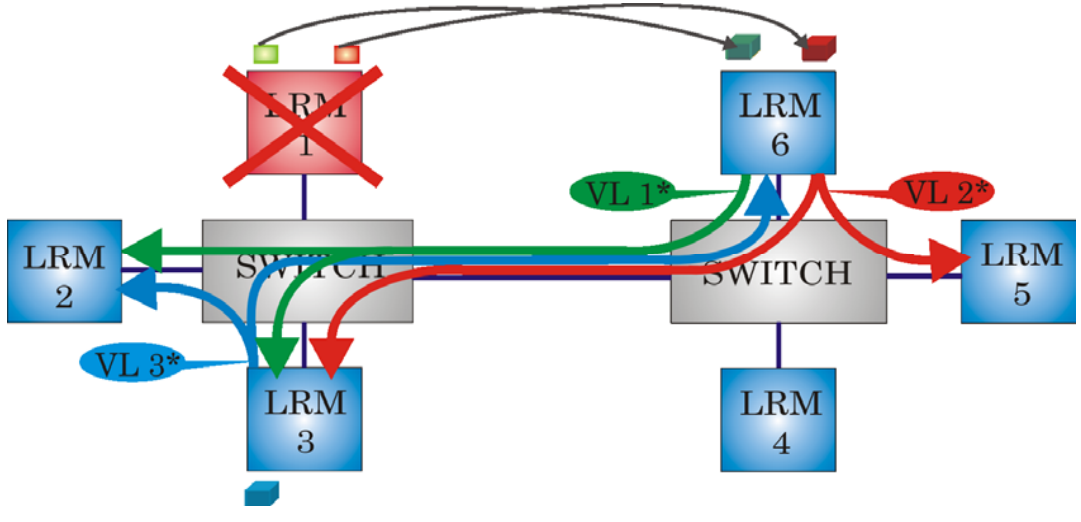
- Ubiquitous seamless model-based design access
  - hiding heterogeneity and semantic diversity of representations and methods, and
  - providing a design-centric access to all design activities.

- During all design phases, process steps must be guided by an estimation how far overall requirements (e.g. safety, costs) are fulfilled. This “speculative” design can be based on HRC analysis methods.

- High flexibility and robustness with respect to late changes and overlapping design activities.

From Structural to Analytical Redundancy

- Identical Hardware & Kernel Software is the prerequisite for a flexible allocation (reconfiguration) of applications.
- The amount of Structural Redundancy (and thus number of LRM) can be reduced by the use of Analytical Redundancy.
- Analytical Redundancy requests design-space exploration with safety constraints.
- The Analytical Redundancy has to respect certification aspects.



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