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Roadmap for a Modular Multi Domain Avionic Architecture

Florence

Living doc
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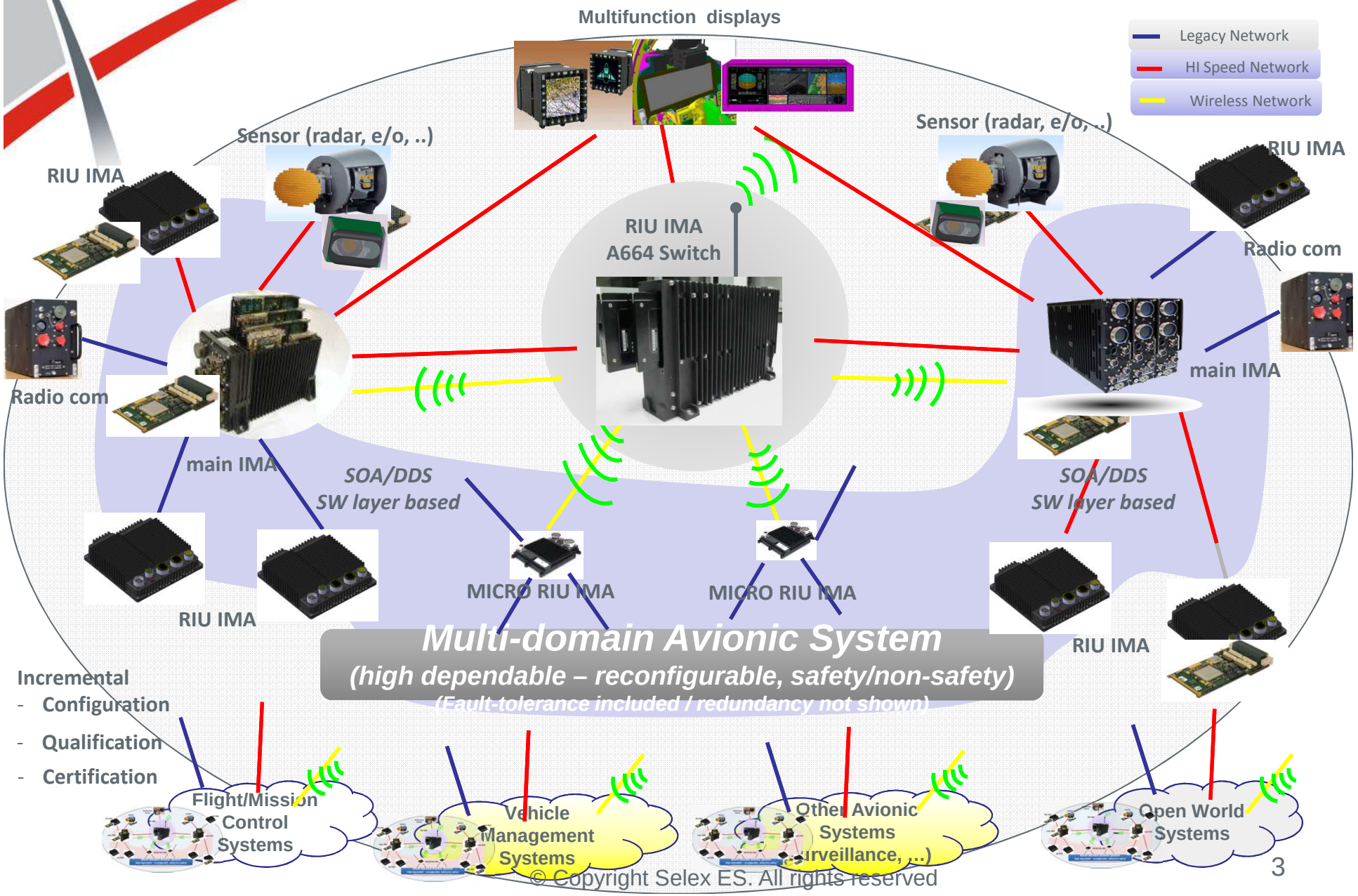
A HW-SW infrastructure for a Multi Domain Avionic Architecture for all different avionics application (including connection with the open world)

The main objective is to validate the concept of the new Avionics architecture ready to be used for all different avionics platform (from High Performance to High Critical), from an “IMA system of computers” to an “IMA computer system” (or IMA Systems of Systems): i.e., to extend the Distributed IMA concept to all aircraft domains, from the Open World domain to the wide range of aircraft electronics domain including the connection/interface with the main avionic sensors (i.e., radar, e/o, communication, …). Moreover, this will result in:

- Wide use of open systems architecture that will become a reference for the future projects;
- Extensible interoperable avionics solutions for a broad class of aeronautic platforms to optimally meet or exceed requirements while managing the logistics of development, deployment, and maintenance of avionics in a cost effective way

Multi domain avionic system



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Avionics Drivers- 1

- Integration of Avionics + flight control and airplane system
- More generic processor & SW based functionality
- Huge increase in functional integration (software size and complexity)
- Shift techniques for isoaltion/independence
  - Traditionally, redundant features were completely isolated – now they communicate with each other
  - High/Low criticality functions traditionally physically isolated from each other – now share computing and data bus resources
- Mix of new and reused (“legacy”) software
- Increase dependence on Commercial Off The Shelf (COTS) hardware and software

Avionics Drivers- 2

- Provide extensible interoperable avionics solutions for a broad class of aeronautic platforms to optimally meet or exceed requirements while managing the logistics of development, deployment, and maintenance of avionics in a cost effective way.

- Resource limitations (Mass, volume)
  - Need to leverage approaches that optimize “system performance”

- Performance (Data rates, autonomy, docking)
  - Need to increase flexibility, portability and improve services

- Safety
  - Need to improve reliability & add redundancy

- Affordability/Cost saving
  - Need to increase interoperability, manage complexity, extend commonality, reduce mission & repair/maintenance cost

- Evolving Architecture/Point Designs
  - Flexible, scalable, extensible, adaptable, reusable & opportunity for design variation to accommodate multi-use avionics

AVIONIC EMERGING REQUIREMENTS

- Dependable systems are increasingly affected by security threats.
- Systems with mixed criticalities (timing and safety-critical) applications are powered by the multi/many-core computing systems where they share resources among critical and non-critical applications.
- Dynamic mapping and load balancing under safety and time constraints become crucial as well as the management of the parallelism continues to be an issue.

Challenges:

- virtualisation in the embedded world while staying predictable,
- networking of the embedded world with the cloud,
- multi-parameter/domains (Megaflops/Watt, cost, timing, safety, green) optimisation.
- security is becoming a key issue in embedded systems which are connected to the Internet or the Cloud
- adaptive computation to assure Quality of Service
- incremental qualification/certification