Introduction round table

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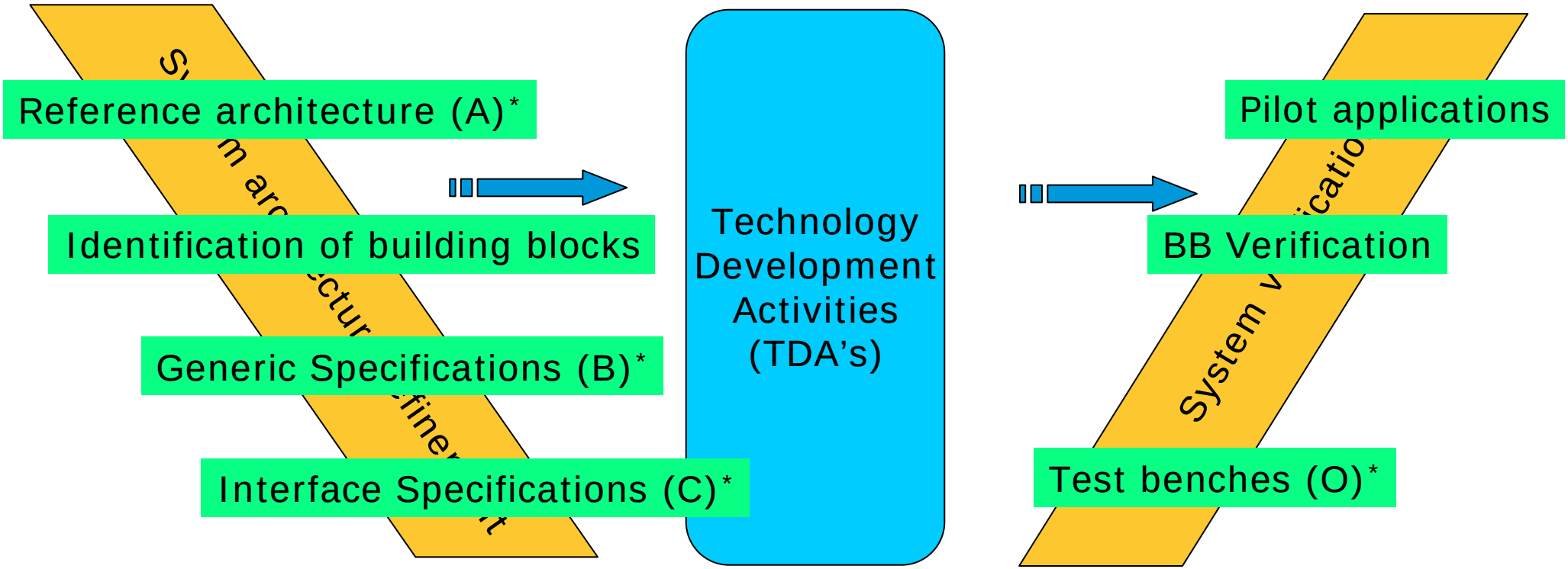
Kjeld Hjortnaes

From Concept towards implementation, mapping to R&D programme



*) refer to the defined AIM's of the Embedded Avionics Systems dossiers

From Concept to implementation mapping to R&D programme

Reference

tions

Identifi

TDA's - examples –

Architecture
- Cordet prototype
  - Avionics system reference architecture consolidation
  - Modelling of system architecture in AADL

Execution Platform
- IMA for Space

SOIS prototyping
- Remote Terminal Bus Component & Reusable HDSW
- PUS mapping on PUS services.

Terms used

- **Architecture**:
  IEEE Std 1471: "The fundamental organization of a system embodied in its components, their relationship to each other, and to the environment, and the principles guiding its design and evolution"

- **Standards:** Refers to an established norm or requirement issued by a recognised standardisation organisation (as ECSS, CCSDS or similar)

- **Reference Architecture**: An abstract representation of an architecture allowing to identify BBs and interfaces. The reference architecture is an agreed basis and a template solution for a particular domain, known and used by various stakeholders.

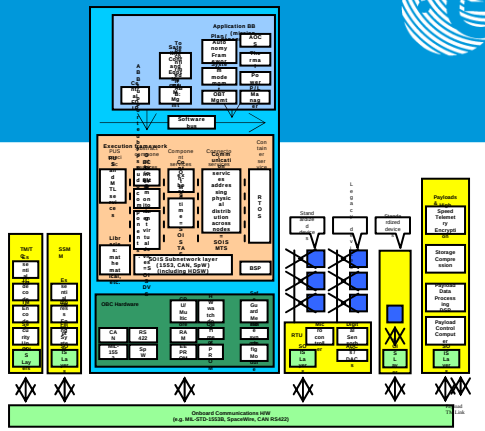
- **Avionics System Topology** : Representation of a reference architecture with modules/units/interconnects depicted in a representative manner: e.g. box/unit level, centralised or decentralised with redundancy and cross- strapping

- **Generic specification / item**: specification/item that covers an extended domain of applications, (may be applicable after tailoring).
  - Generic specifications are functional spec's and may includes constraints as applicable standards, interface requirements and performance requirements

- **Canonical specification / item**: specification/item based on a generic specification (may be tailored) that respects SAVOIR rules/recommendations.

Terms used - software

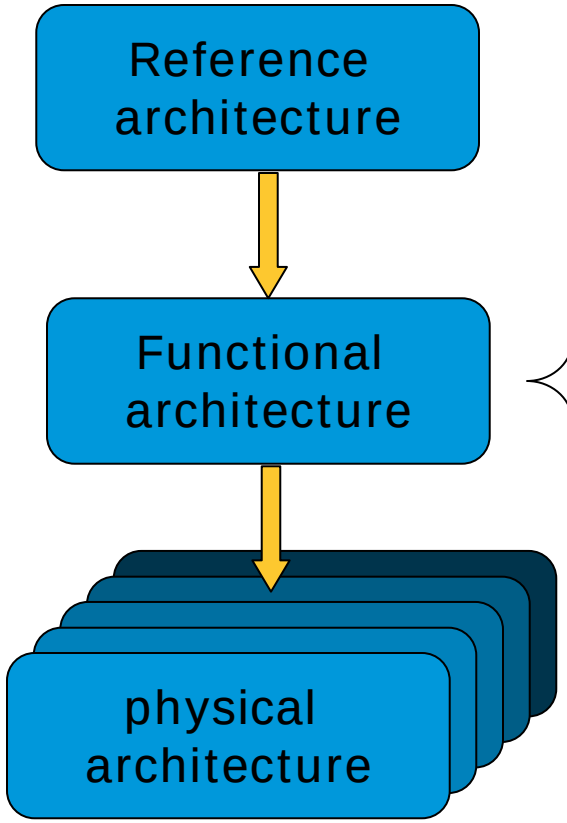
- **Software reference architecture**
  A set of architectural design principles and a mapping of the usual functions implemented by the software onto the components and the execution platform.



- **Functional architecture**
  Focus is on the system functionalities to be implemented and on the relation to their environment
- A functional architecture is built, independently from the issues brought by the integration on an execution platform. ----------▸ Set of generic spec's

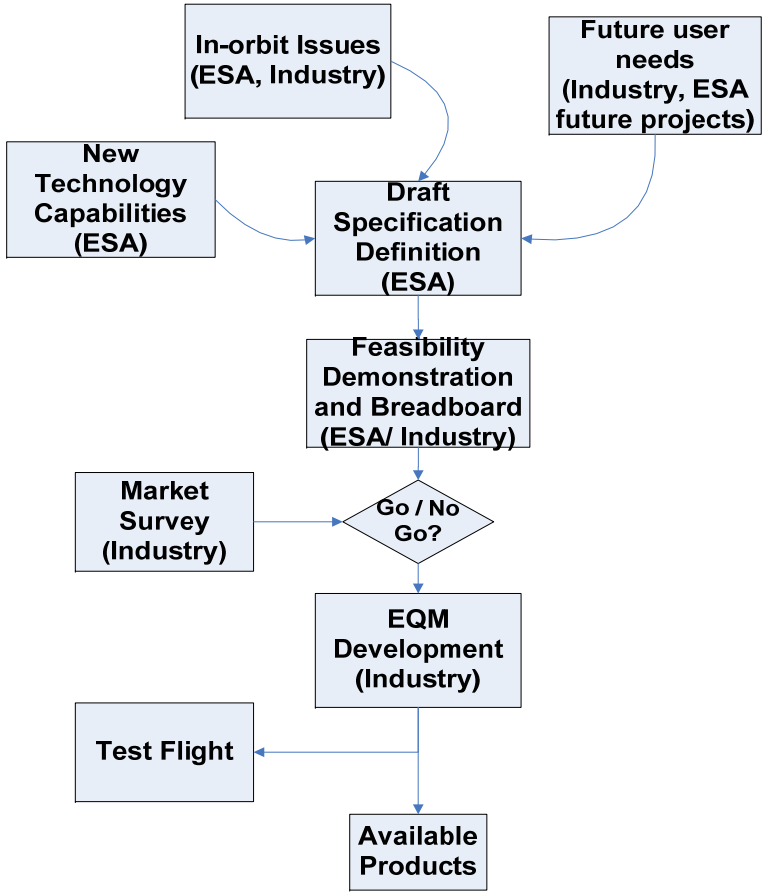
- **Physical architecture**
  The Physical architecture describes the processing nodes of the system (i.e. on-board computer), sensors and actuators, the network topology (buses/point-to-point links/serial lines) that interconnects them and the communication protocol used by the physical communication layers. ----------▸ Products – Building blocks

Process for creating Building Block Spec's



- Conceptual – abstract
- Generic functional Spec's (building block)'
  - Has no design requirements
  - May have constraints (non-functional req) as
    - -performance,
    - -interface req,
    - -applicable standards
- Interface spec's
- Product's (Building Blocks)

AOCS generic sensors: what next to improve the current approach?



Current devt flow

- Get users feedback also on AIT and operability issues?
- Develop more interface requirements already at this early stage? (although design-dependant)
- Assess also future efficiency within a Reference Avionics and identify improvements?
- Check and confirm I/F requirements with AOCS primes?
- Develop/validate a HiFi mathematical model to be delivered with the unit?
- Support enhancements, e.g. compatibility with (new) standards

Areas for improvement?

AOCS standards (E60 branch): what next to improve the current situation?

- **Star sensor terminology and performance specification** (ECSS E-ST-60-20C Rev 1):
  - Published mid 2008 but very limited feedback
  - No constraining clause regarding outputs, e.g.:

    A sensor with autonomous attitude determination shall have the minimum outputs:

    - the relative orientation of the defined sensor reference frame with respect to the defined inertial reference frame;

    NOTE: The relative orientation is usually expressed in the form of a normalized attitude quaternion

→ Make it applicable! Get users feedback and update propositions

→ Prepare accurate output requirements for Rev 2 (consensus to be found between stakeholders)

- **Satellite AOCS requirements** (ECSS E-ST-60-30C)
  - One objective is to streamline customer requirements to avoid unjustified design requirements which would prevent efficient re-use of qualified AOCS
  - Challenge: populate a structured document with elements which can be reused either to prepare a high level document (ESA ITT SRD), or a more detailed spec (industry spec)
  - Public Review expected early 2011

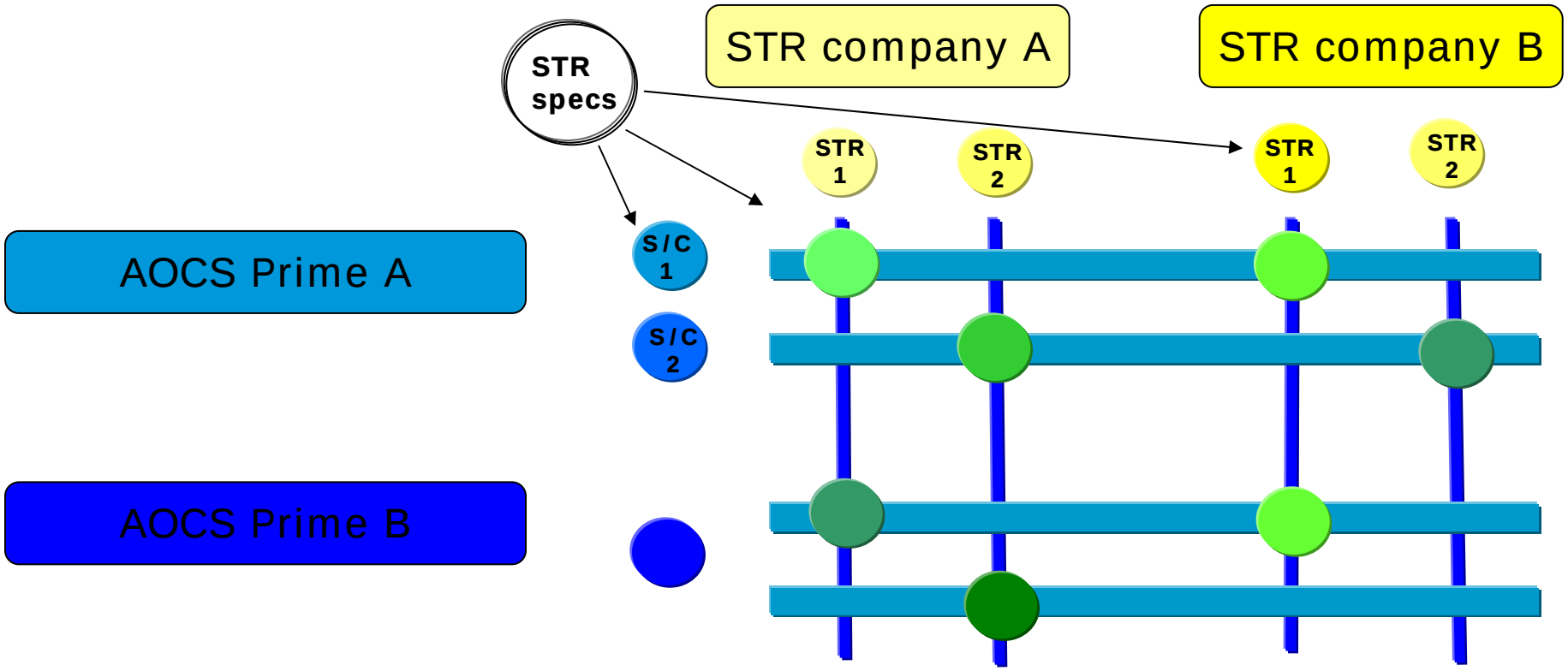
→ Generic functional spec widely shared by ESA projects and industry

→ Strong participation from industry (incl. Ops and SW)

Current situation

Areas for improvement?

Harmonisation of Star Tracker specifications?



- Motivation from AOCS primes and STR manufacturers to harmonise specifications?
- Which process (mapping, streamlining,by whom? …)
- Which reduced set of specs: functional as designed, physical as built?

What's next

1. We now have now a satellite **reference architectures**
   - Do we need more architecture (and if so which).

2. Is the Generic functional spec's the right strategy to prepare for **products**
   - Does it kill innovation
   - Does it fulfil the paradigm
     - **Collaborate on standardisation compete on implementation.**
   - What does it take to get to **products**
     - TDA's
     - Prototypes
     - **Verification** process
     - have we identified all the steps required to reach **the right TRL**
   - How much
     - **minimum Spec** – that may be augmented by the supplier or the project
     - **maximum spec** – that are tailored down for the project

What's next

1. Requirements should include a **normative** part
   and a requirement **justification** (in free text)
   - Should the requirements be captured in **DOORS** to secure version control / a single repository / traceability**.**

Process proposal for Generic Functional Spec's / Interface Spec's

- A BB Spec can be composed of several generic functional spec's
  - Depending on the level of integration that is selected.

- A) Generated by ESA
  - ESA generate internally the draft generic functional spec's.
  - Reviewed by a limited number of persons from D/TEC and Projects.
  - Reviewed by a SAG nominated WG (Industry, agencies, ESA)

- B) Generated by an industrial activity under specification of ESA
  - Reviewed by a limited number of persons from D/TEC and Projects.
  - Reviewed by a SAG nominated WG (Industry, agencies, ESA)

- Published under ECSS (Handbook or Technical Memorandum)

What's next – prove the process by a quick win.

4. **Quick win's – Prove by example**
   - Identify an "obvious" set of BB's (one HW & one SW) and take them through the full process
     - Generic functional spec's
     - Interface requirements Spec's
     - Generate a canonical product spec compliant to the SAVOIR architecture.
     - Execute the required TDA's
     - Prototype the and verify the product.
   - assess
     - the process (can it be simplified, is it robust, …)
     - Demonstrate the potential of Generic functional Spec's
     - What it takes to bring the BB to the required TRL level