Open Standards – A prerequisite to configure a satellite data handling system

ADCSS 2020

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DEFENCE AND SPACE

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TESO Avionics Team

AIRBUS

*"Where **open standards** exist, **innovation** is driven; disruptive technologies emerge. Things become **more valuable**, **smarter** and **easier to use**. This pattern has been shown time and time again in almost every industry on the planet. The examples are endless. Open standards foster a **broad selection of products and vendors** for end users to choose from. This competition is what drives innovation. More importantly, open standards allow small and medium-sized companies to compete. **Disruptive technologies** often emerge from such companies that are agile enough **to innovate** based on open standards. At the end of the day, the **end user wins** by not being locked into one large company's method of doing business."*

What others say …

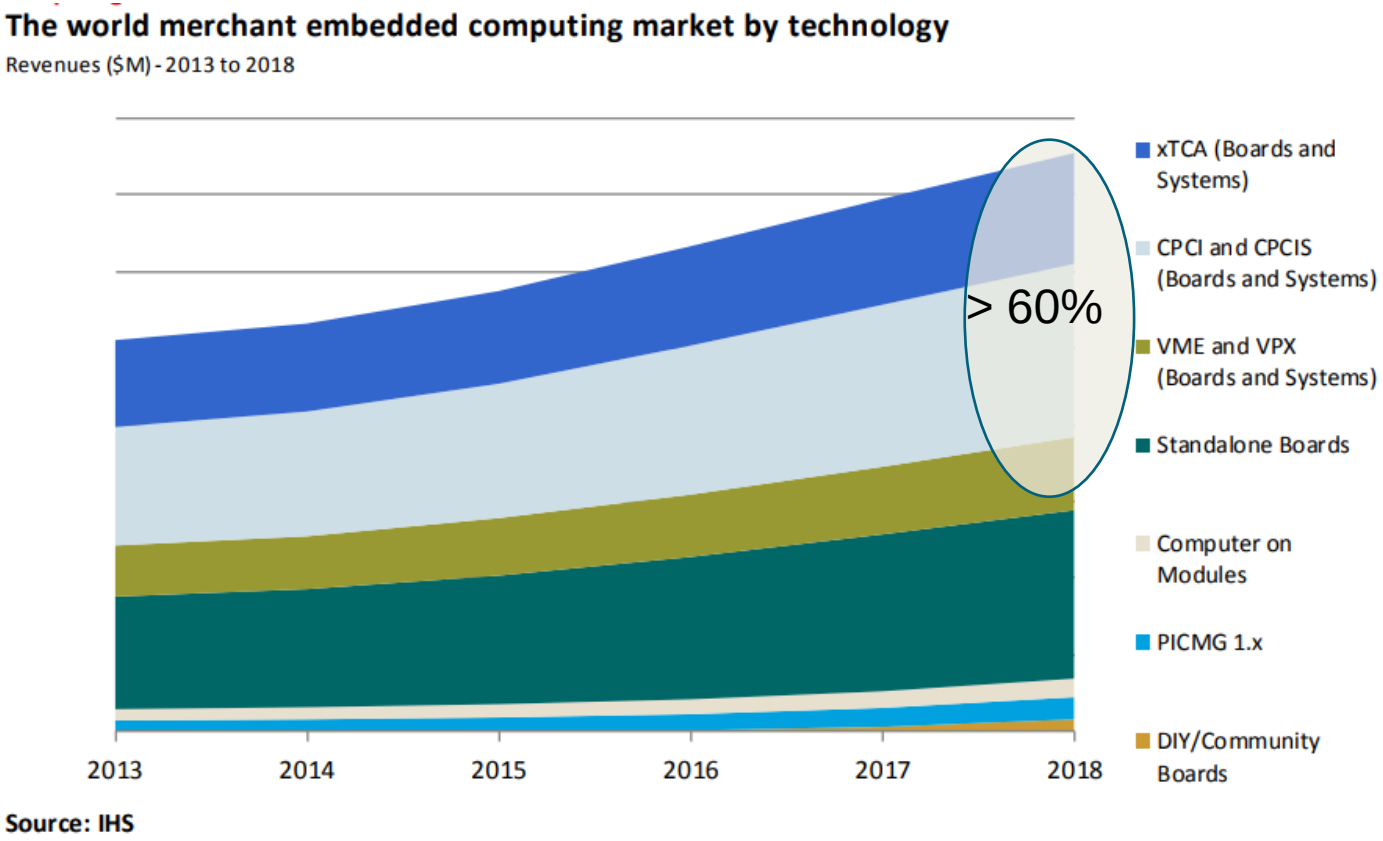
May 10th, 2017,
Michael Bowne,
Executive director,
PI North America

AIRBUS

What exactely is an open standard?

- Many organization, consortiums and institutes,
- Relevant for our business
  - CCSDS
  - ECSS
  - IEEE
  - VITA
  - PICMG (PCI Industrial Computer Manufac

- Open standards are based on five principles
  - Cooperation
  - Adherence to principles
  - Collective empowerment
  - Availablity
  - Voluntary adoption



What is ADHA (Advanced Data Handling Architecture)?

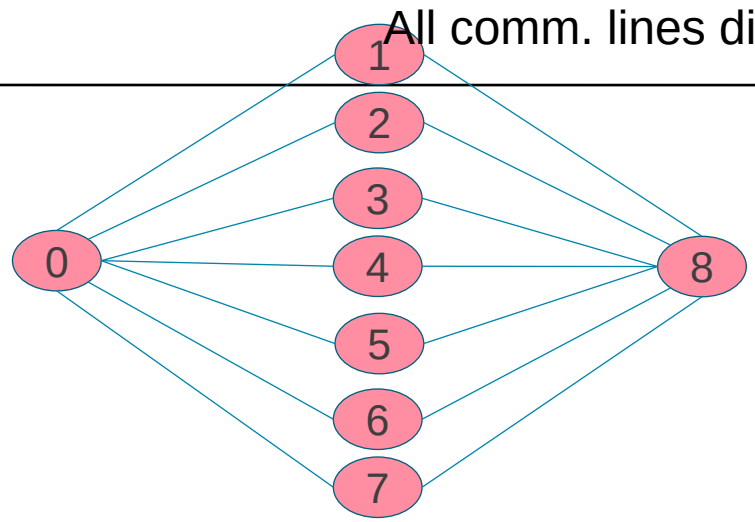
- ESTEC initative to foster modularity in space avionics

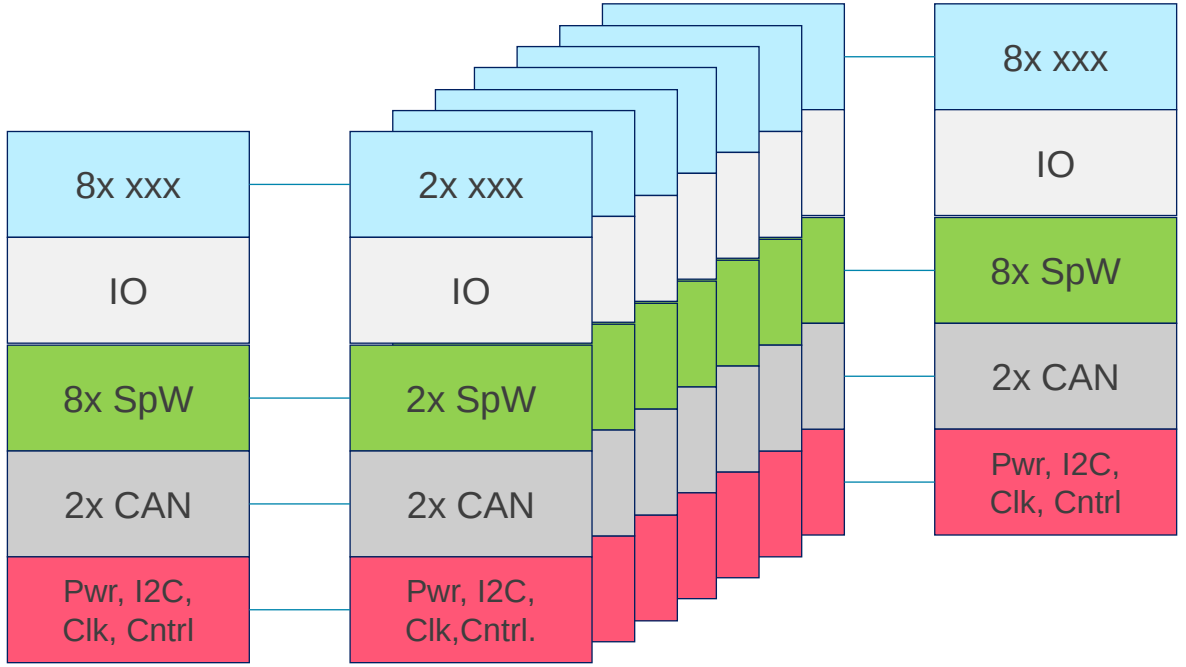
  Two consortiums: TAS and Ruag/Airbus

  Two Standards: spaceVPX and CPCI Serial Space

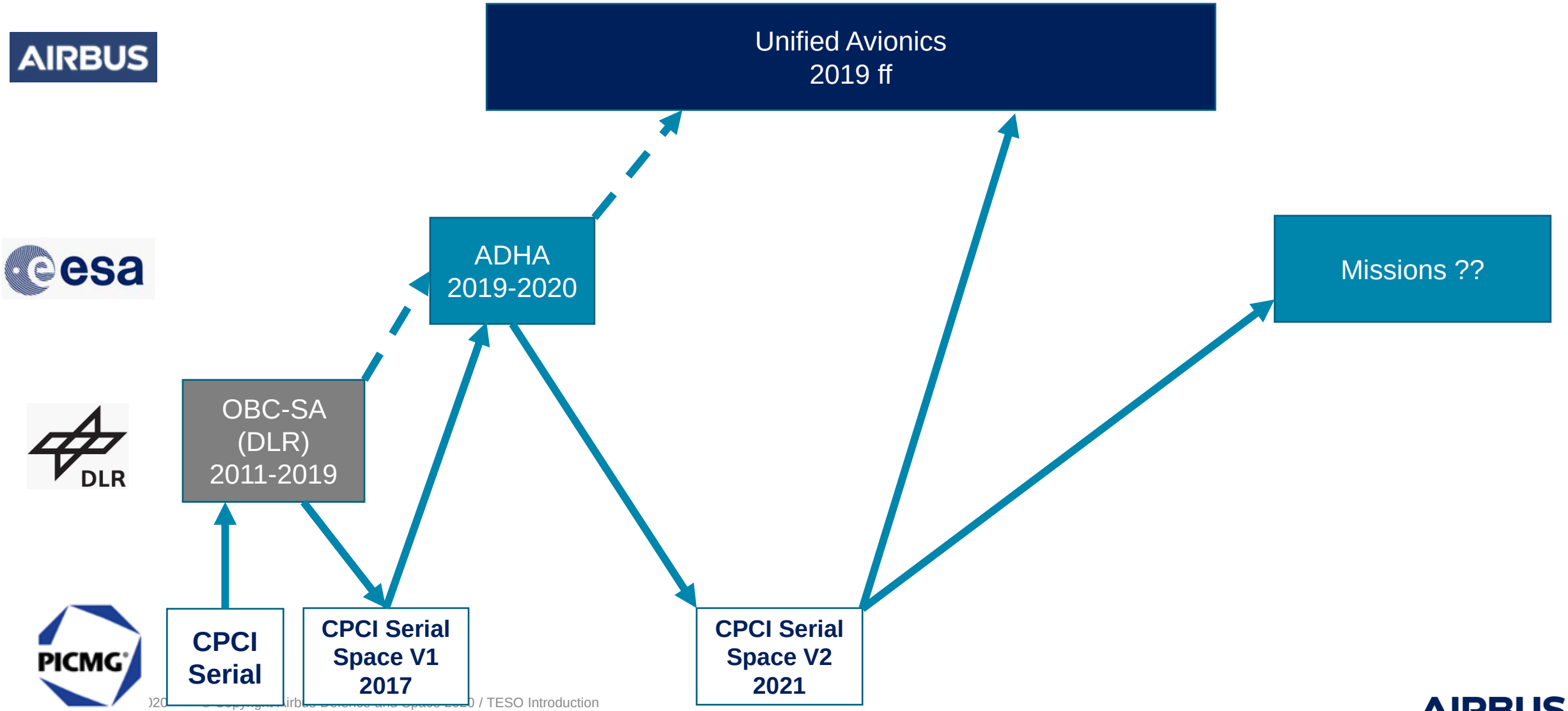
What is CPCI Serial Space?

- **BACKPLANE STANDART (maintained by PICMG)**
  - **2 System Slots**
  - **Up to 7 Peripheral Slots**
  - **Full mesh (or Dual star) for *SpFi, ETH, TSN*, …**
  - **Dual Star architecture for *SpaceWire***
  - ***CAN bus (nom. + red.)***
  - ***I2C* for board monitoring**
  - **Clock signals**
  - **Control signals for individual slot monitoring and control**
  - **Power (nom.+red.): +12V, +5V, (+28V)**





Some History …



Modularity and open standards in Software

- Aeronautics
  - **Integrated Modular Architecture (IMA)**
    - **Reduced Size, Weight and Power:** Resources are shared between multiple applications instead of having their separate but duplicated resources, costs are lower.
    - **Competitiveness:** IMA separated applications from the hardware. Before IMA, vendors supplied both hardware and software together. With IMA, hardware can be bought alone and software can be developed according to the requirements.
    - **Portability and Reuse:** Standardized modules can be reused thanks to flexibility provided by IMA.
    - **Easier Modification:** Since applications are moved from separate modules to central shared processing unit, it is easier to modify the application compared to asking modifications from the vendors.

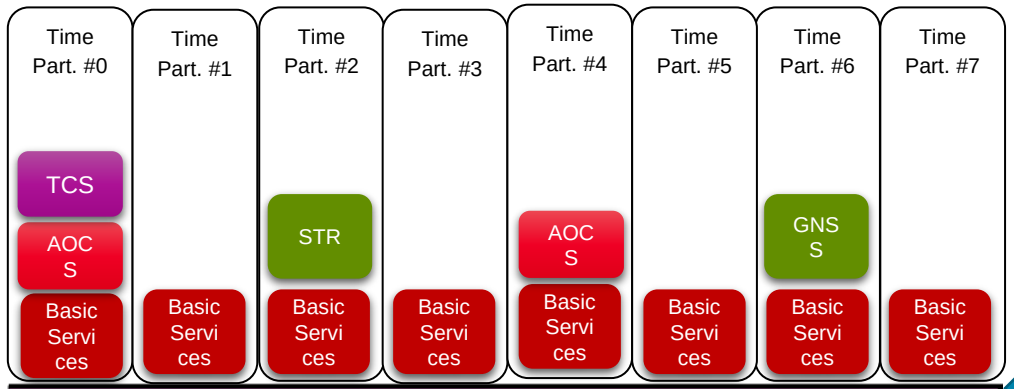
… but **requirements on processing power are higher ➔ Multicore !!!**

Modularity and open standards in Software

- **ARINC (Aeronautical Radio Incorporated) Industry Activities develops open standards for avionics**
  - ARINC 653 is a software specification for space and time partitioning in safety-critical avionics
    - **Ap**plication/**Ex**ecutive interface (APEX) is defined as a set of software interfaces that an ARINC 653 compliant operating system must provide to avionics application developers.
      - **Partition Management Module:** Provides means for modifying the operation mode of partitions.
        - Spatial Partitioning
        - Temporal Partitioning
        - Communication between partitions
          - Queuing ports
          - Sampling ports
      - **Process Management Module:** Each partition can have multiple processes which can be periodic or aperiodic. ARINC 653 partitions are analogous to Windows/Unix processes and ARINC 653 processes are analogous to Windows/Unix threads. Process Management Module provides process scheduling. Each process can be in **Waiting**, **Ready** or **Running** State.
      - **Time Manager Module:** Time is unique and independent of partition execution. This module provides services like reading time, wait/timeout services for processes, increasing time budget of a process with a hard real time deadline. Together with process management module, they guarantee timely execution of processes in a partition.

Modularity and Open Standards in Software

Apps



Applic. Backplane

space Application Execution Platform (*space***APEX**)

Subject to standarization

OS Portability

Operating System Abstraction Layer (OSAL)

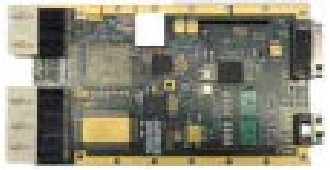
Mixed criticality

Simple scheduler OR Time and Space Partitioning Kernel
(e.g. xTratum, PikeOS, VxWorks653, …)

Hardware portability

Architecture and platform support package

Multicore Processor ADHA Compliant



GR740 or GR712

NG Ultra

DAHLIA

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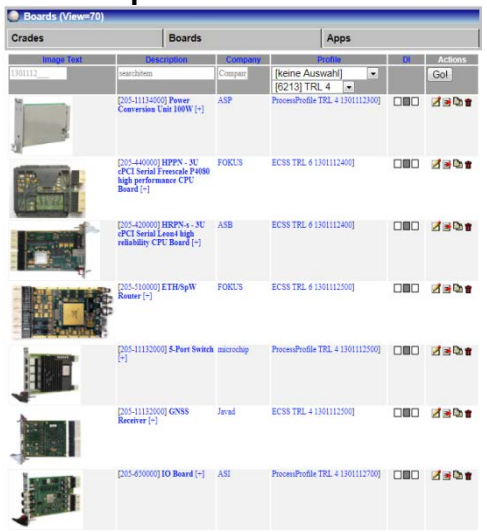
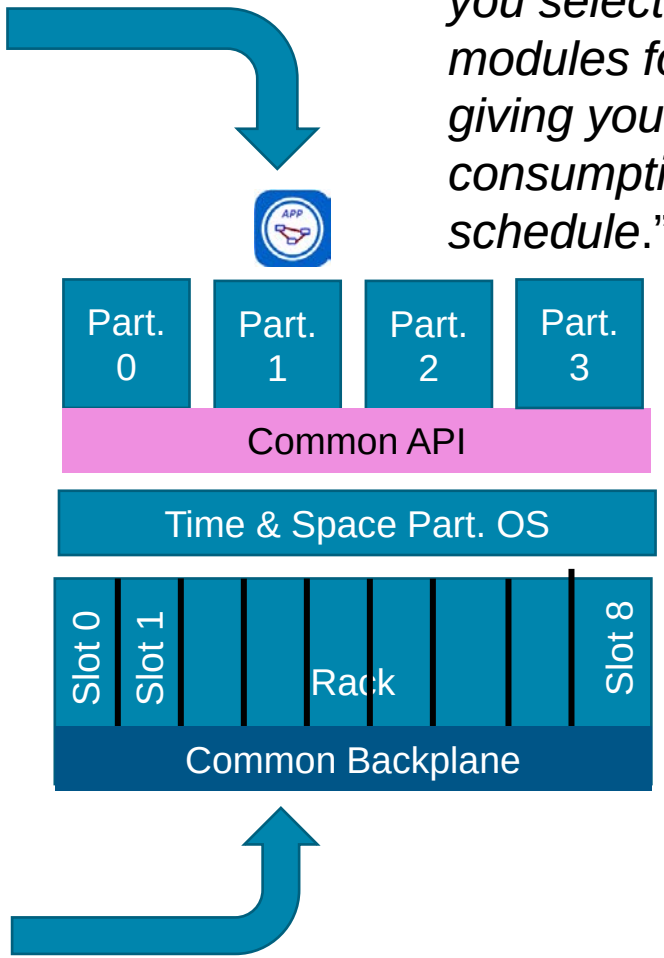
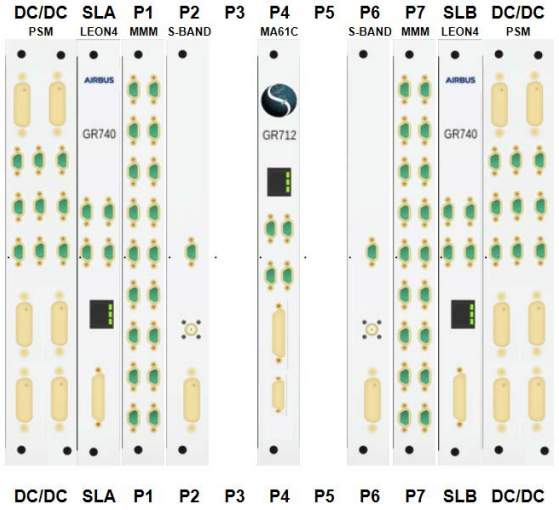
"Say goodbye to endless requirement loops and unpredictable pricing. Thanks to open standards, our configurator lets you select the right combination of modules for your test equipment, while giving you real-time feedback on power consumption, mass, volume, price and schedule."

App Store

Component Store







Test Equipment

http://www.omac4s.org

What others say …

Feb 10th, 2020,
Ran Qedar,
CEO,
SPiN GmbH,
Darmstadt

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Thank you …

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