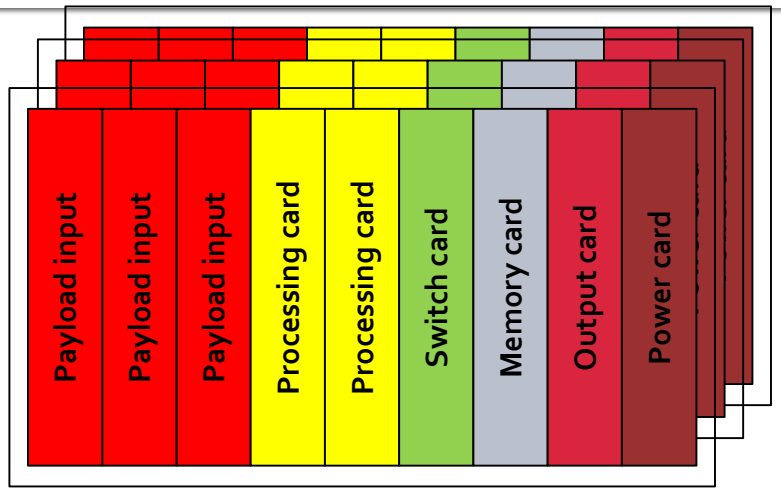
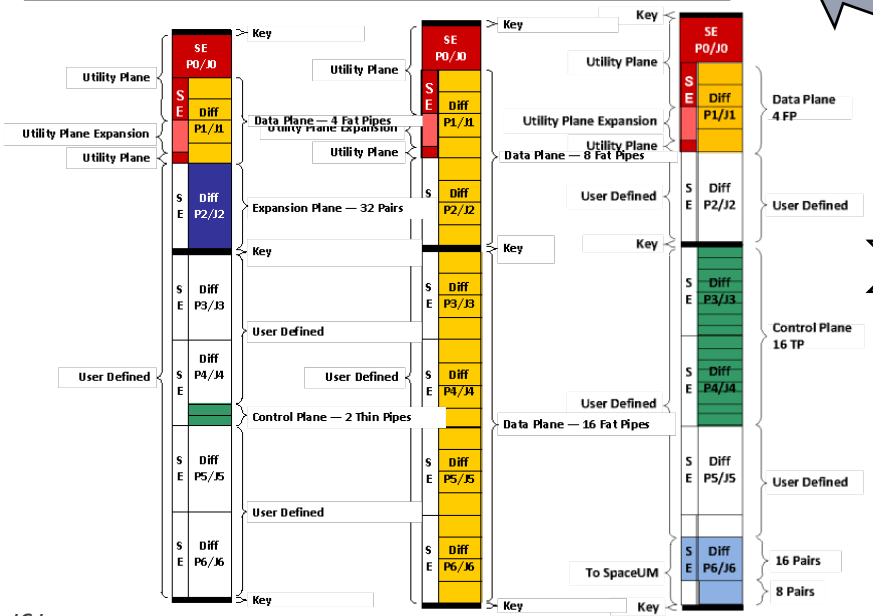
01/20/2015

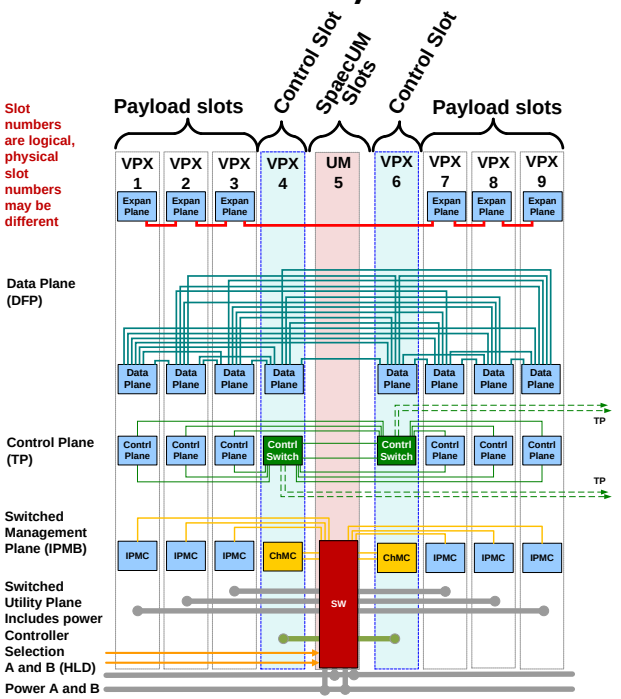
Update on SpaceVPX (VITA 78)

Putting it All Together For SpaceVPX





SATCOM System



Bottom Line, Up Front

What is wrong with just using legacy space electronics?

I. Legacy space systems are often point solutions
II. Re-use is not a priority
III. Don't have the full range of redundancy options (dual-string, M-of-N, etc.) built-in given the particular application and its needs.
IV. Internal interfaces are often proprietary and application specific
V. Modules are not designed to inter-operate at either hardware or software level

Why SpaceVPX?

Today with no SpaceVPX Standard	*Future with a SpaceVPX Standard*
• Tightly coupled, proprietary integration schemes - changes costly and risky	• Open Systems architecture guidelines, and Open Standards result in loose coupling between SW and HW
• Hardware reuse appear less attractive when cost is dominated by non-recurring engineering	• SpaceVPX reduces risk and cost tied to re-integration of compliant interfaces - reuse more attractive and affordable
• The prime contractor has a central role for the life of the system, which limits flexibility and options, and stifles competition	• Industry consensus interfaces; more vendor based options from a broader market; more regular sustained competition

What is SpaceVPX?

Was created to bridge the VPX standards to the space market.

- SpaceVPX addresses both interoperability (as OpenVPX does) and space application needs (not in OpenVPX).
- SpaceVPX defines Payload, Switch, Controller, and Backplane module profiles to meet needs of space applications
- SpaceVPX adds features to the Utility Plane for fault tolerance
  - Point-to-point not bussed to tolerate faults: failure on module does not affect entire system.
  - Space Utility Module added to provide dual-redundant source for Utility Plane implementations.
- SpaceVPX defines use of SpaceWire for Control Plane over Ethernet (OpenVPX preferred solution).

Designed to promote standard components, interoperability, accelerated development and deployment for the Space market

SpaceVPX Fault Tolerance

The goal of SpaceVPX is to achieve an acceptable level of fault tolerance while maintaining reasonable compatibility with OpenVPX components, including connector pin assignments. For the purposes of fault tolerance, a module is considered the minimum redundancy element. The Utility Plane, Management Plane, and Control Plane are all distributed redundantly and in star topologies to provide fault tolerance.

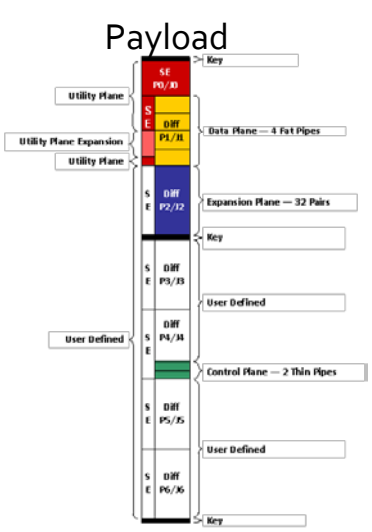
For Space applications, the major fault tolerance requirements are listed below:

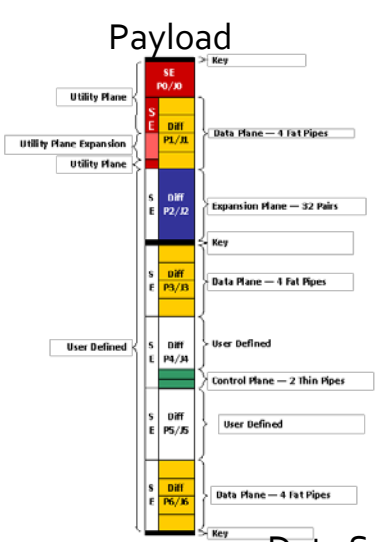
- Dual-redundant power distribution (bussed) (**Section 3.2.1**) where each distribution is supplied from an independent power source.
- Dual-redundant management distribution (point-to-point cross-strapped) where each distribution is supplied from an independent management controller to a SpaceUM module that selects between the A and B management controllers for distribution to each of the slots controlled by the SpaceUM module.
- Card-level serial management (**Section 3.4.3**)
- Card-level reset control
- Card-level power control
- Timing/synchronization/clocks, Matched length, low-skew differential (**Section 3.4.2**)
- Fault tolerant Utility Plane selection (bussed) (**Section 3.3**)
- Dual-redundant Data planes (point-to-point cross-strapped)
- Dual-Redundant Control planes (point-to-point cross-strapped) (**Section 3.2.3**)
- VITA 78 infrastructure allows for fully managed FRUs and for dumb FRUs

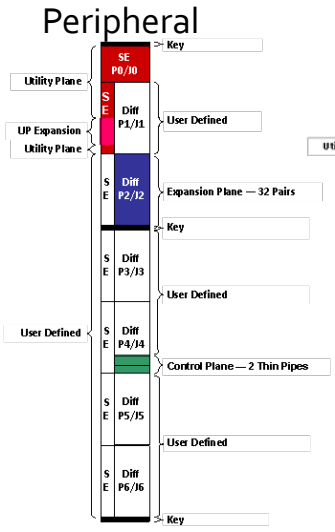
SpaceVPX Benefits to Customers and Vendors

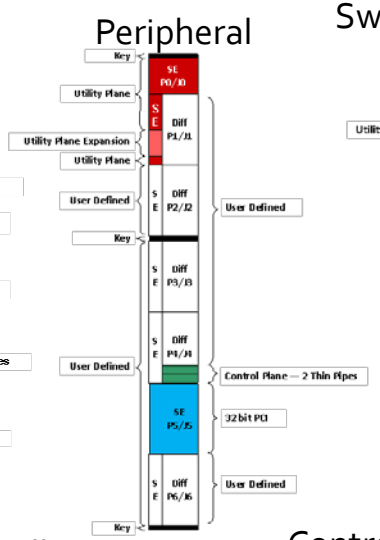
- Promotes interoperability and vendor choice
- Provides specific design profiles that vendors can design to and integrators can specify as requirements
- Reduces integration issues resulting in faster development & deployment time
- Higher board volumes produces Economies of scale
- Industry leading bandwidth and density
- Higher velocity of technology upgrades
- Will support higher backplane signaling speeds as technology matures

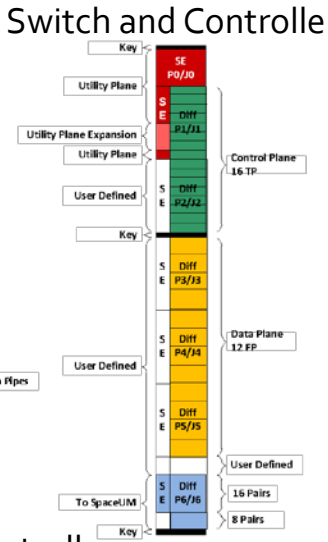
6U Slot Profiles

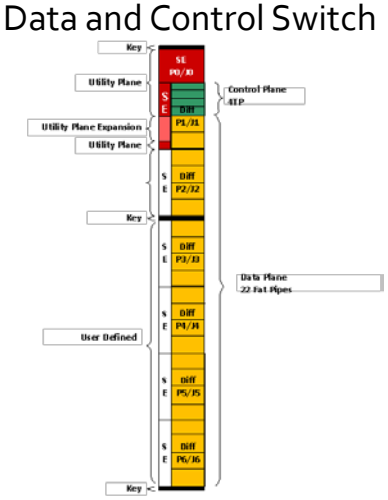


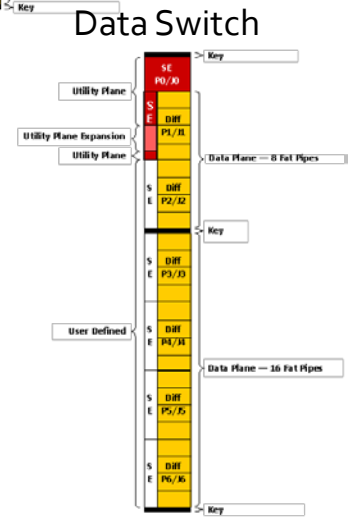


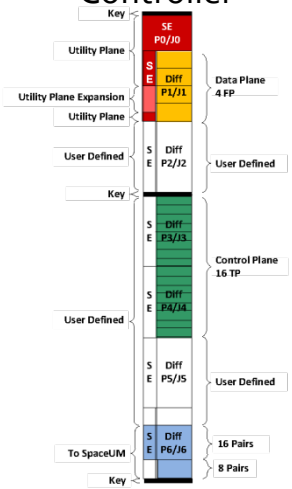


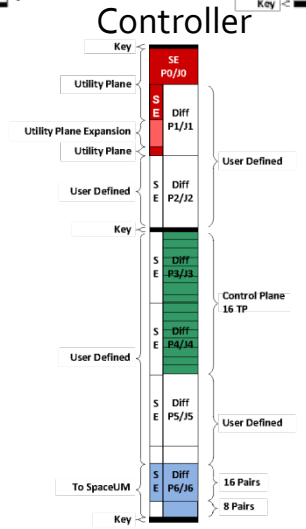






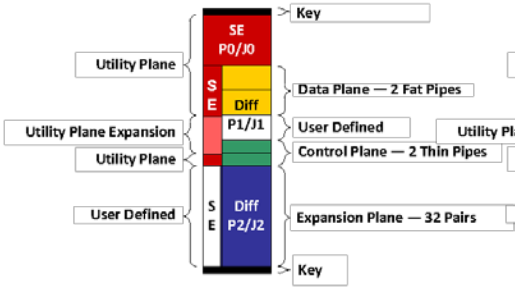




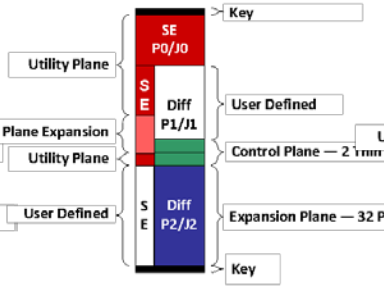


3U Slot Profiles

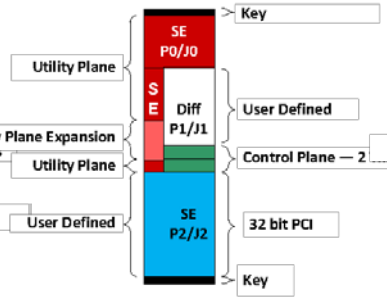
Payload



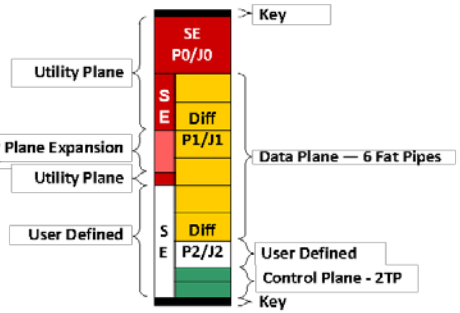
Payload



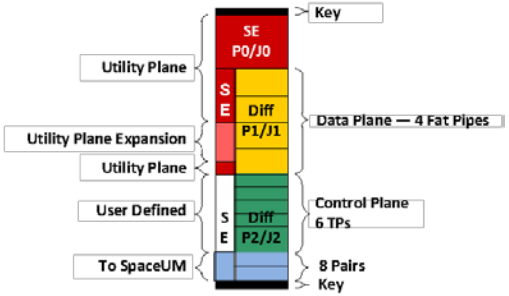
Peripheral



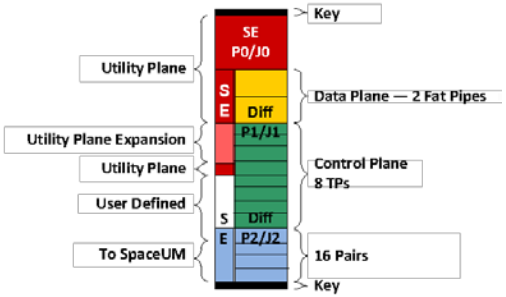
Switch or Mesh Slot



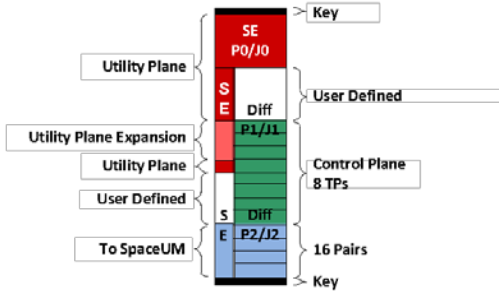
Switch and Controller



Controller



Controller



Payload Slot Profile (switched)

Possibility I

- Data-In Module
- Data-Out Module

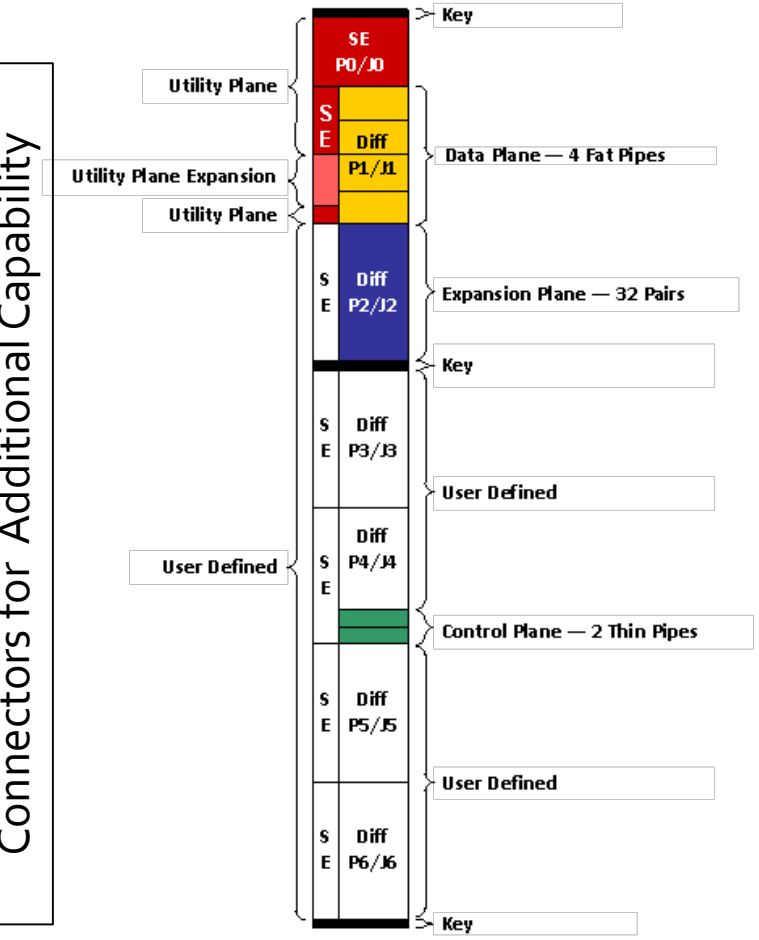
Possibility II

- Data-In Module
- Processing Module
- Data-Out Module

Possibility III

- Data-In Module
- Processing Module
- Storage Module

Utilize User Defined Pins and Top of Card Connectors for Additional Capability



Any Combination of Payload Functions is Possible

SpaceVPX Update (Where are We?)

- SpaceVPX was approved via VSO Public Review on the **7th of December**, 2014.

- Multiple vendors have adopted the SpaceVPX specification.
- Prototype products available Q3 or Q4 of 2015.

- **Adoption of SpaceVPX by multiple large programs.**

- Engagement with **multiple NASA Centers** – evaluations underway for adoption with both 6U and 3U formats.

- **Engaged the European Space Agency at the 22nd SpaceWire Working Group meeting.**

- Interest from ESA and multiple ESA Tier I and Tier II vendors.
- **SpaceVPX under evaluation by Thales Alenia Space**

Air Force OSA Efforts

Brief Introduction to a small OSA effort called Sensor Open Systems Architecture (SOSA)

Problem Statement

- Majority of current ISR systems have been designed to **meet a specific mission scenario**.
- Little consideration given to alternate mission scenarios using a number of different sensor packages going after a more diverse set of targets.
- Sensor payloads have been custom designed rather than a preferred multi-use platform/payload system.
- Vendor-lock and data rights issues have stifled competition, limited innovation, and resulted in overall higher life-cycle program costs.

What is SOSA?

- Collaborative organic, self-directed, cross directorate effort with participation from AFRL/RI, RV, RW, RX, RY, and AFLCMC OSA Group.

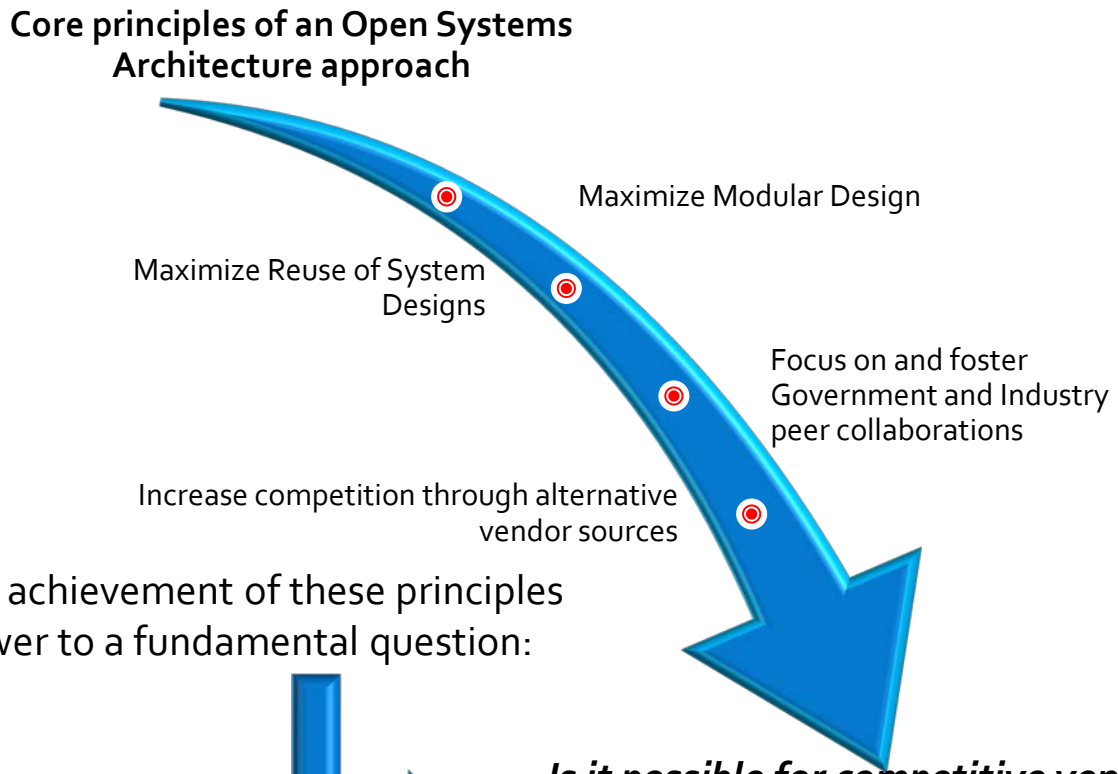
Focused on…

- Develop an effective Sensor Open Systems Architecture (SOSA) for use across the ISR community to include Air Force, DoD, and other governmental agencies; to **maximize platform and system affordability, re-configurability, performance, and re-use.**

- The intended outcome is to redirect industry's business model away from stove-piped point solutions to a more open systems design which will engender competition and lower costs while encouraging more rapid innovation.

- The long term goal is to also influence the commercial industry into standardizing their varied open approaches.

SOSA Architecture Approach



Affirmation and achievement of these principles requires an answer to a fundamental question:

Is it possible for competitive vendors to interoperate or provide support for a piece of a system, based on open standards and published interfaces for that system type?

SOSA Capabilities

Capability

- Develop is an open systems, agile, multi-INT, platform agnostic ISR payload architecture which will serve as an enabler for future ISR systems and associated upgrades.

SOSA

- Support both hardware and software components. Of particular interest is an architecture that both handles the demanding data requirements of ISR and accommodates future upgrades.

Each component

- Designed to be loosely coupled to promote competitive acquisition with minimal re-work.