MERCURY SYSTEMS

VITA 100.20: SECURING THE MANAGEABILITY OF NEXT GENERATION (VITA100.0-BASED) MISSION CRITICAL DISTRIBUTED PROCESSING SYSTEMS

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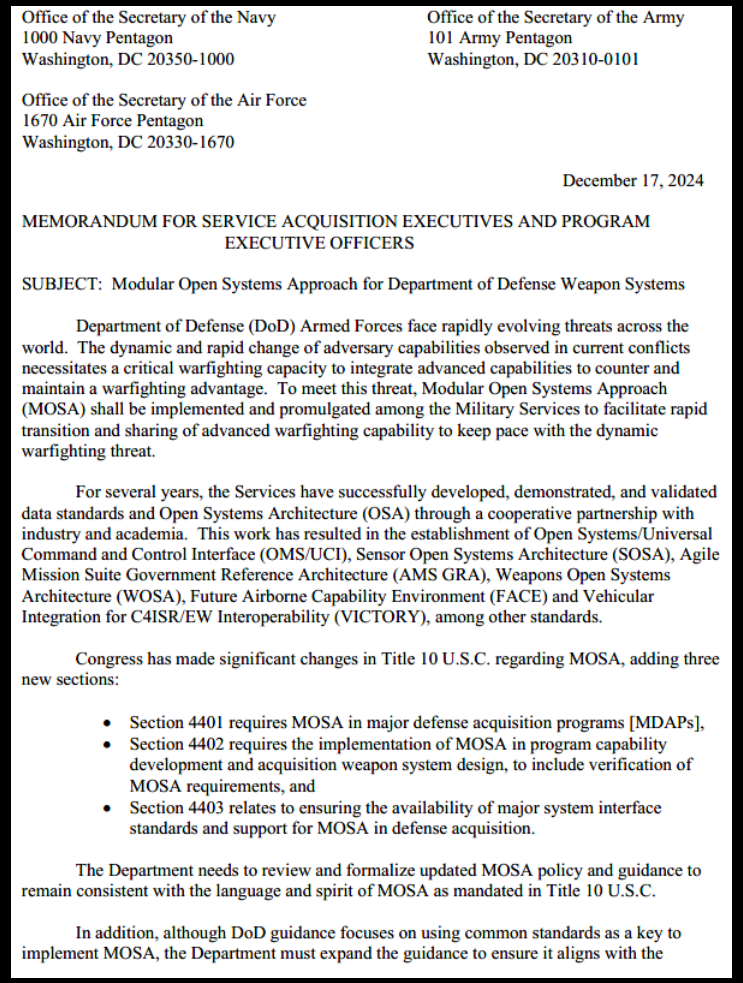
Outline

- The MOSA Directive and VSO Answer
- Commercial Industry Standardized System Management for Processing Systems
- Current VSO Standardized System Management for Embedded Processing Systems (EPS)
- VITA 100.20 – The Future VSO Standardized System Management for EPS

Recent DoD Tri-Service Reaffirmation of MOSA (December 2024)

1. Employing a modular design

2. Designating modular interfaces



Office of the Secretary of the Navy
1000 Navy Pentagon
Washington, DC 20350-1000

Office of the Secretary of the Army
101 Army Pentagon
Washington, DC 20310-0101

Office of the Secretary of the Air Force
1670 Air Force Pentagon
Washington, DC 20330-1670

December 17, 2024

MEMORANDUM FOR SERVICE ACQUISITION EXECUTIVES AND PROGRAM EXECUTIVE OFFICERS

SUBJECT: Modular Open Systems Approach for Department of Defense Weapon Systems

Department of Defense (DoD) Armed Forces face rapidly evolving threats across the world. The dynamic and rapid change of adversary capabilities observed in current conflicts necessitates a critical warfighting capacity to integrate advanced capabilities to counter and maintain a warfighting advantage. To meet this threat, Modular Open Systems Approach (MOSA) shall be implemented and promulgated among the Military Services to facilitate rapid transition and sharing of advanced warfighting capability to keep pace with the dynamic warfighting threat.

For several years, the Services have successfully developed, demonstrated, and validated data standards and Open Systems Architecture (OSA) through a cooperative partnership with industry and academia. This work has resulted in the establishment of Open Systems/Universal Command and Control Interface (OMS/UCI), Sensor Open Systems Architecture (SOSA), Agile Mission Suite Government Reference Architecture (AMS GRA), Weapons Open Systems Architecture (WOSA), Future Airborne Capability Environment (FACE) and Vehicular Integration for C4ISR/EW Interoperability (VICTORY), among other standards.

Congress has made significant changes in Title 10 U.S.C. regarding MOSA, adding three new sections:

- Section 4401 requires MOSA in major defense acquisition programs [MDAPs],
- Section 4402 requires the implementation of MOSA in program capability development and acquisition weapon system design, to include verification of MOSA requirements, and
- Section 4403 relates to ensuring the availability of major system interface standards and support for MOSA in defense acquisition.

The Department needs to review and formalize updated MOSA policy and guidance to remain consistent with the language and spirit of MOSA as mandated in Title 10 U.S.C.

In addition, although DoD guidance focuses on using common standards as a key to implement MOSA, the Department must expand the guidance to ensure it aligns with the evolving statutory language. We direct all DoD acquisition officers commit to all five MOSA pillars: (1) employing a modular design, (2) designating modular interfaces, (3) leveraging consensus-based open standards, (4) establishing enabling environments, and (5) certifying conformance.

MOSA guidance must include the appropriate verification method and timing within the acquisition program's development to ensure MOSA conformance. Each Service Acquisition Executive (SAE) will ensure MOSA is implemented to the extent practical and will review MOSA compliance with their MDAPs at Systems Engineering Technical Reviews (SETRs), Gate Reviews, and Program Reviews. For MDAPs, MOSA may be addressed at Milestone Reviews as part of Independent Technical Risk Assessments, as appropriate. These MOSA reviews will address how the program has implemented or will implement the five pillars of MOSA. Within 60 days of this memorandum, each SAE will identify and report to their respective Service Secretary on any MOSA architecture that is currently shared between two or more Services; this report will also identify operational military imperative capabilities that can be or are being jointly developed and transitioned. Within 120 days, each SAE will publish their Service MOSA implementation guidance as required by the memo "Modular Open Systems Approaches for Our Warfighting Systems Is a Warfighting Imperative," dated January 7, 2019.

Carlos Del Toro
Secretary of the Navy

Christine Wormuth
Secretary of the Army

Frank Kendall III
Secretary of the Air Force

3. Leveraging consensus-based open standards

5. Certifying conformance

4. Establishing enabling environments

- Reaffirms the importance of MOSA and the Leverage of Consensus-Based Open Standards
- Increases the messaging to specifically call out the four other tenets of a Modular Open System Approach

Distributed Processing Systems: A Common MOSA Realization, Enabled by the VITA Standards Organization

- A distributed processing system is a computer implementation that utilizes computational resources across multiple, physically separate computation nodes via messaging protocols to achieve a common, shared goal..
- VITA standards such as VITA 65 (OpenVPX) and VITA 100 enable distributed processing systems.

MOSA Tenet	VITA65/VITA100 Realization Example
1. Employing a modular design	A set of distinctively defined circuit card assemblies (CCAs) based on function (e.g., Payload and Switch Modules)
2. Designating modular interfaces	Profiles define pin assignments on Module connectors that enable communication between Modules.
3. Leveraging consensus-based open standards	Requirements map open-standards based protocols onto the requirements-based pin assignments e.g, Ethernet
4. Establishing enabling environments	VITA Standards Organization (VSO) provides the infrastructure to develop and maintain open standards.
5. Certifying conformance	Each requirements has an associated list of acceptible verification methods to be used to show compliance.

System Management Importance in Distributed Systems

- Facilitates adaptability
  - Increasing/Reducing system element (e.g., module) count/type
  - Replace system element (e.g., module) type with an alternate system element type
  - Relocating system elements to/from one subsystem/platform to an alternate one
  - Improving system infrastructure (e.g., increased and/or alternate power, thermal, and/or network capabilities)
- Eases performance optimization
  - System element inventory and allocation
  - System element monitoring (e.g., power consumption, throughput, temperature)
- Enables resiliency
  - Supervision of redundant system elements
  - Maintains system element(s) availability
  - Eases system element prognostics
- Improves operational efficiency
  - Facilitates automation of activities (e.g., out-of-the-box configuration/provisioning)
  - Centralized event/response collection and decision making
- Supports system security
  - Confidentiality, Integrity, Authenticity
  - Authorization and access control
  - Surveillance, response, and auditing support

FCAPS – The Original OSI Network Management Model and Genesis of Modern System Management Architectures

FCAPS FAST FACTS

- Established in the 1980s
- Developed by the International Standards Organization (ISO)
- Created alongside the ISO Open Systems Interconnect (OSI) networking model
- Intended to drive protocol development for management of networks
- Lead to development of multiple management protocols e.g., Simple Network Management Protocol (SNMP)
- Overcome recently by a consolidated, model: FAB (Fulfillment, Assurance, Billing)

FCAPS FIVE AREAS OF FOCUS

- **F**ault Management
- **C**onfiguration Management
- **A**ccounting Management
- **P**erformance Management
- **S**ecurity Management

IPMI – The Intelligent Platform Management Interface and Bedrock Implementation Framework for Systems Infrastructure Management

IPMI FAST FACTS

- Developed in the late 1990s
- Created an implementation framework for autonomous out-of-band (OOB) management of host processing systems, without the need for OS-based agents, via a central resource
- Highly adopted by the computer/server and network supplier industries
- Extensible via OEM messages
- Standard updates halted in mid 2010's[1]

IPMI KEY FUNCTIONALITY

- Remote management
- Inventory management
- Configuration management
- Health management
- Diagnostic management
- Recovery management

Note 1: Intent was to halt updates of a low-level infrastructure interface standard, referenced by many high-level management standards, in favor of documenting needed updates in the higher-level system management standards e.g., Redfish.

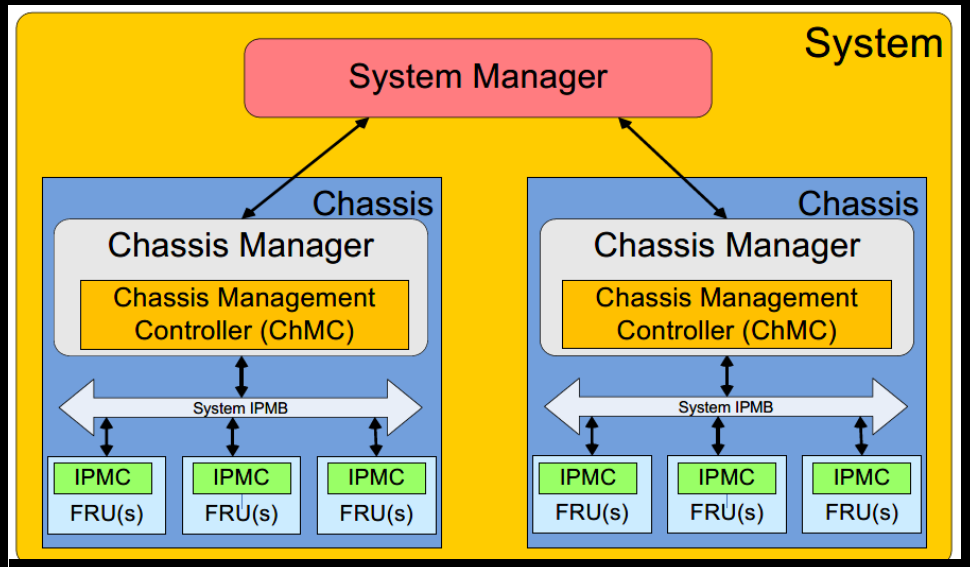
VITA 46.11 – System Management on VPX and Game Changing Technology in Modern OpenVPX Platforms/Subsystems

VITA 46.11 FAST FACTS

- Developed in the early 2010s with VITA 65
- Defines an open standards-based architecture and implementation framework that supports autonomous OOB system management of VPX-based system platforms' hardware infrastructure
  - Intended to significantly reduce system integrators' effort to implement systems management
  - Addresses common user needs for hardware infrastructure management in OpenVPX platforms
  - Addressed FRU and Chassis management levels
  - Functionality enabled in Tiers
  - Does not address management of software
- Guided by modified FCAPs areas
- Leveraged the IPMI specification
- Leveraged the AdvancedTCA® standard
- Updated in 2022 to add Tier 3 functionality.

VITA 46.11 KEY FUNCTIONALITY

- Inventory management
- Sensor management
- Configuration management
- Diagnostic and Recovery management
- Security management (with VITA46.11-2022 update)



Note: Image from VITA46.11 Standard

VITA 100.20 – System Management for VITA 100
Revolutionary Management Functionality for a Revolutionary Standard

VITA 100.20 FACTS AND OBJECTIVES[1]

- Developing in the late 2020s with VITA 100
- Creating a net-centric implementation framework for both OOB management of host processing systems, without the need for OS-based agents, via a central resource and in-band (IB) implementation framework for operating environment(OE)-aware and/or application-aware management
- Interoperability with VITA46.11 and VITA 65
- Additional state/mode definition to support common user needs e.g., offline maintenance
- Guided by modified FCAPs areas
- Guided by DMTF Redfish e.g., RESTful interfaces

VITA 100.20 PLANNED KEY FUNCTIONALITY

- Inventory management
- Sensor management
- Configuration management
- Diagnostic and Recovery management
- Security management
- Network management

Note 1: Solidification of objectives will be a high priority once the VITA 100.20 working group is officially kick-offed and meeting regularly.

VITA 100.20 – Revolutionary Standards Creation Processes Plans: User Needs, Conformance, and MBSE

FOCUS ON USER NEEDS

- Plan to prioritize VITA100.20 content and workflows to address user needs
- Plan to capture use needs in both requirement and use case forms, as appropriate
- Plan to avoid creation of requirements with no traceability to a documented user need.

GUIDED BY CONFORMANCE

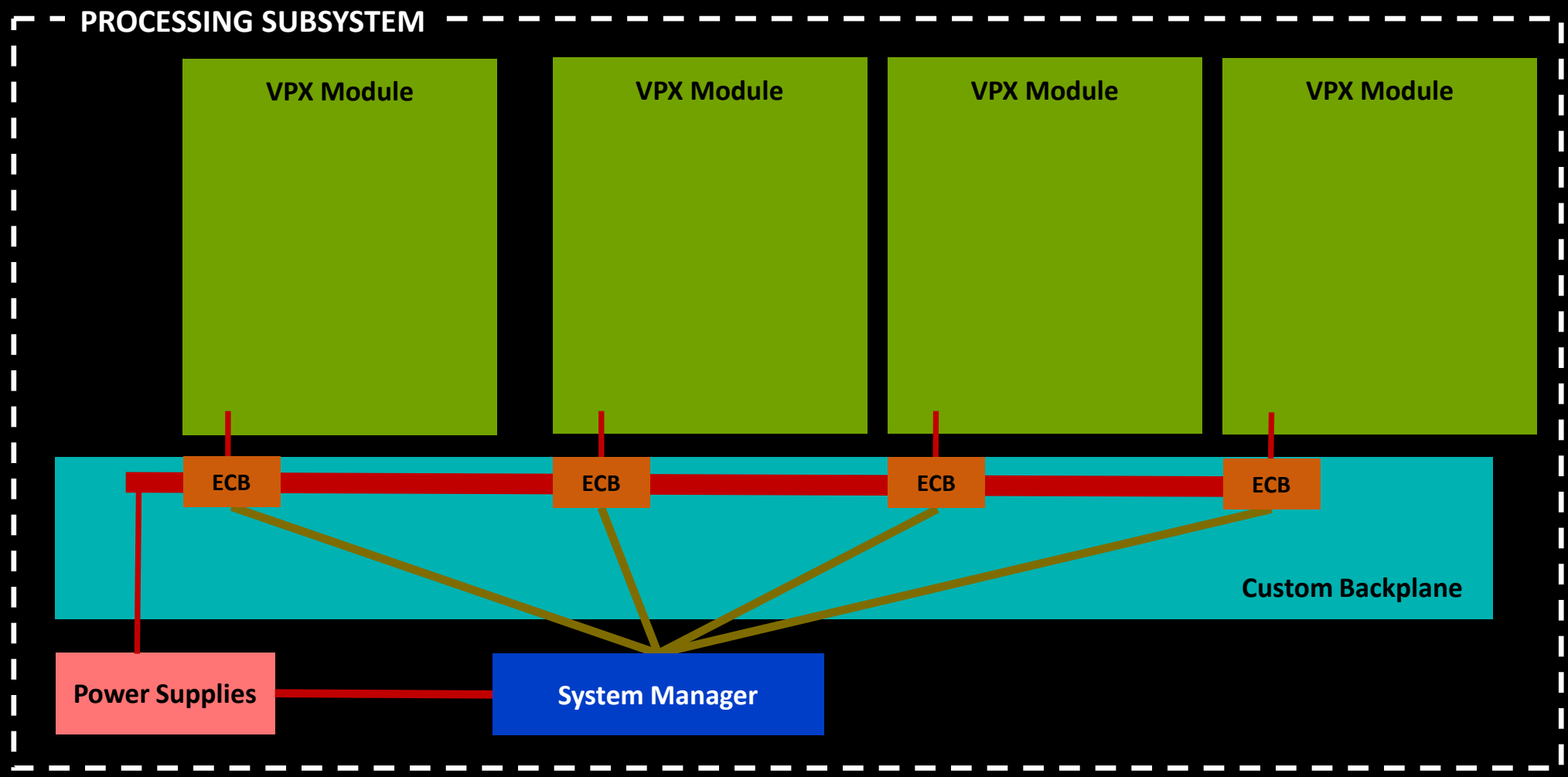
- Plan to list acceptible conformance methods for requirements
- Plan to shape requirements such that conformance testing is realizable
- Plan to optimize conformance testing to be expedient, effective, and economical
- Plan to align conformance methodology with emerging MBSE and DevSecOps principles, as possible

MBSE AS A TOOL

- Plan MBSE to be the authoritative source of truth (ASOT) for the standard.
- Plan to capture user needs, requirements, conformance methods, etc. within a VITA 100.20 model
- Plan to enable requirements tracing within the model from user need to requirement to conformance methodology
- Plan to autogenerate VITA 100.20 tables and textual content as possible

Common Use Case – Power Management – VITA 46 Subsystem

- User needs to have individual input power enable and/or disable control per VPX module.
- Wants to be able to set and get the power enable start for each module.
- Implementation requires a custom backplane with power switches w/control interfaces
- System manager is part of the physical subsystem



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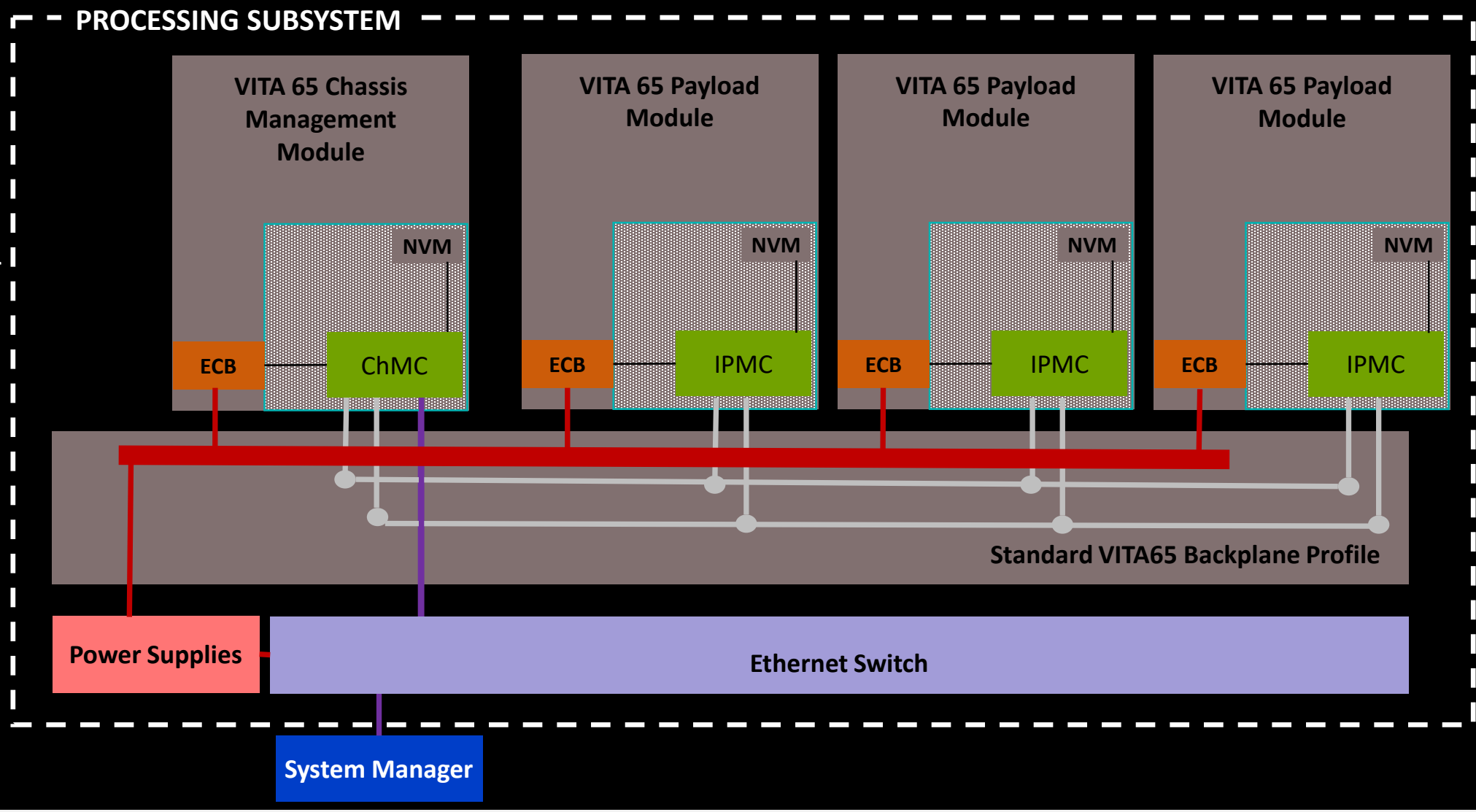
Common Use Case – Power Management – VITA 65 Subsystem

- VITA 46.11 IPMCs control Payload Power on each VITA 65 module
- VITA 46.11 ChMC communicates with the System Manager over an open-standard Ethernet interface and to the module IPMCs over an open-standard IPMB
- Implementation can leverage a standard backplane
- System manager can be remote from or local to the physical system



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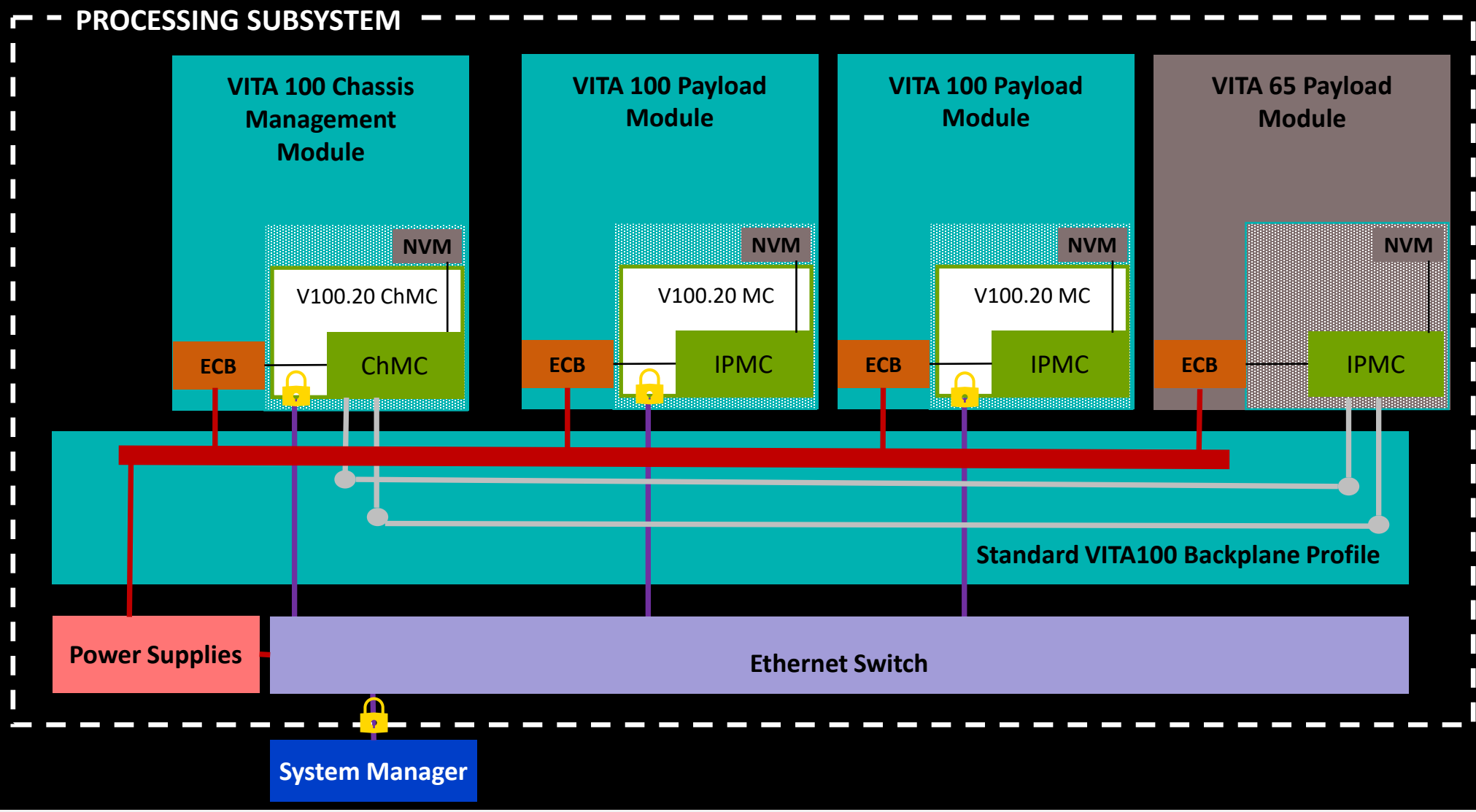
Common Use Case – Power Management – VITA 100 Subsystem

- VITA 100.20 xMCs control Payload Power on each VITA 65 module and can each communicate directly with the System Manager over a secure Ethernet interface
- VITA ChMC communicates with any VITA 65 module IPMC over the IPMB
- Standard backplane
- Remote or local system manager



VITA 100.20 Working Group Formation

Subject Line:	New Working Group Formation to Define System Management for VITA 100
Designation:	VITA 100.20
Project Action:	New
Title of Standard:	System Management for VITA 100
Abstract:	This document defines an architecture and implementation requirements for system management in VITA 100-based systems. It addresses both out-of-band and in-band system management across all operating states and enables system management interoperability within the VITA 100 ecosystem at the Field Replaceable Unit (FRU), chassis, and system levels.
List of Potential Sponsors:	Mercury Systems, Moore Integrity Engineering, TBD
Project intended for ANSI accreditation: Yes or No	Yes
Recommended Day/Time	Decide at upcoming January 2025 F2F in San Antonio

Sponsors: mercury Moore Integrity Engineering

Summary

- The number of solutions implemented upon MOSA-based systems is growing
- The VSO has historically played a large part in the realization of MOSA-based systems with their distributed processing system standards, like VITA65: OpenVPX
- Standardized system management is a key part of distributed processing systems and thus a key part of MOSA-based systems
- As the number of MOSA-based systems, based on VSO standards, continue to grow, the set of common system management user needs grows too
- The VITA 100.20 standard, System Management for VITA 100, working group is forming now to develop the next system management standard in the VSO for the VSO's next generation system standard, VITA 100.

QUESTIONS?

THANK YOU

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