Bringing the “App Store” to Embedded Computing Systems

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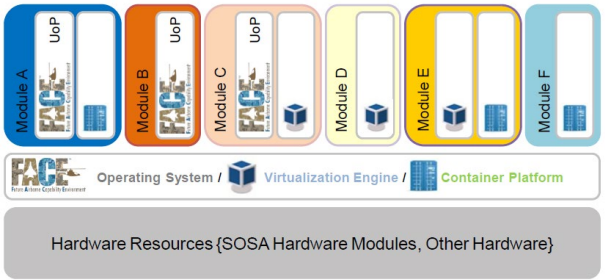
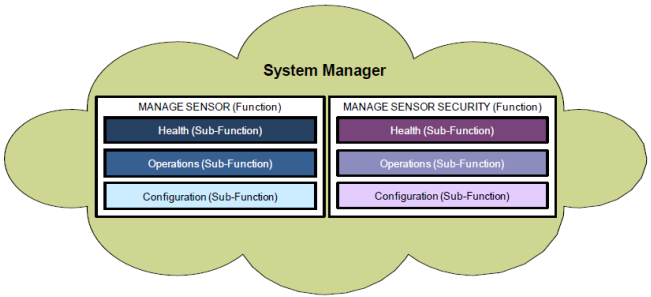
How SOSA is defining the software framework for deployed applications to make this a reality.



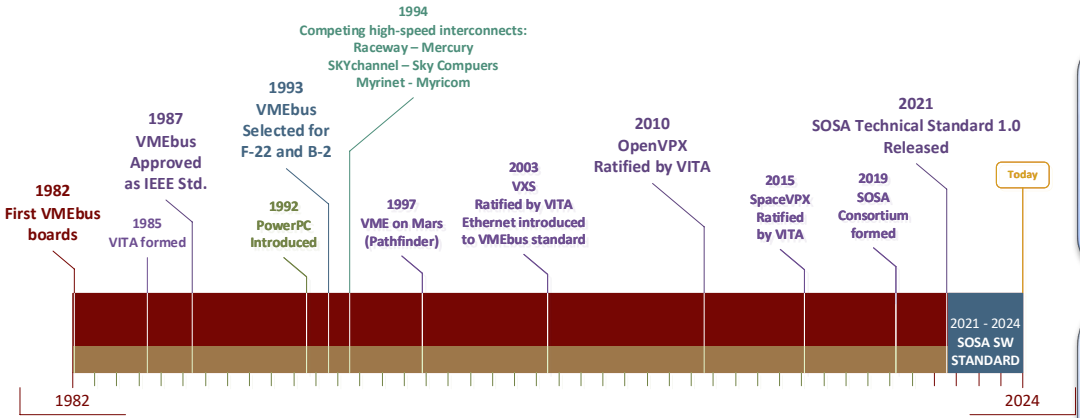
David Tetley
Director, Embedded Solutions

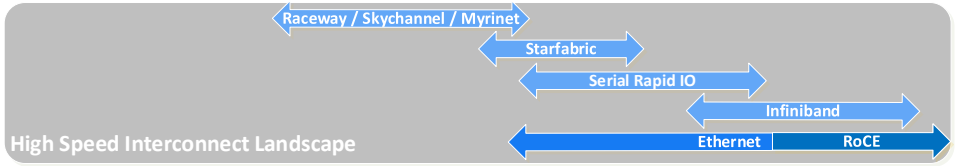
Embedded Tech Trends, January 2025

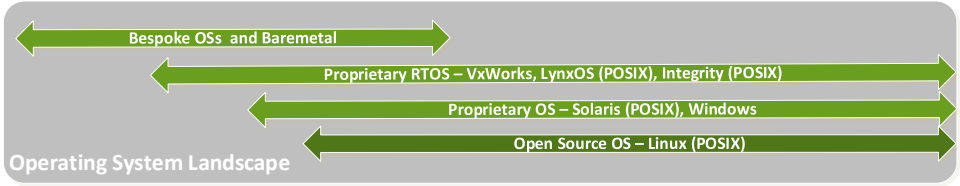


Embedded Computer Systems Built on Open Standards

Historical Timeline of VME and VPX







“Wild West” of software architectures pre-2010

Post 2010

HPEC architectures began to converge with those in commercial world

OpenVPX did not solve the interoperability problem

The Advent of SOSA

Defining the HW Infrastructure for the “Plug and Play” Concept

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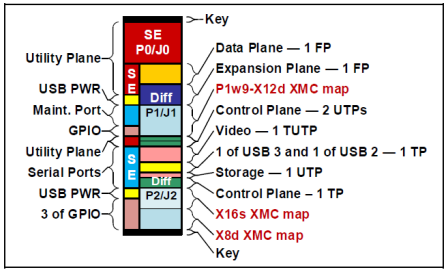
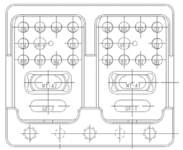
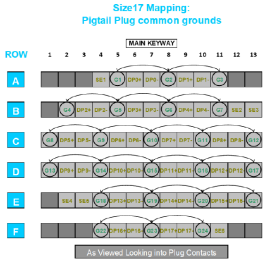
Hardware

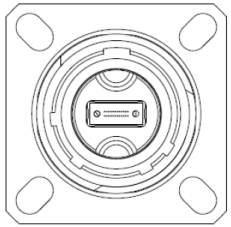
- **Plug-In Card (PIC):**
  - Limiting slot profiles
  - Standardizing mechanicals, cooling and power distribution
  - Standardizing maintenance ports
  - Tightly defining RF and optical connectors
  - Tightly defining interconnect protocols

- **Chassis / Backplane:**
  - Tightly defining backplane requirements
  - Defining clock topology
  - Tightly defining connector types
  - Chassis management definition









The Advent of SOSA

Defining the SW Infrastructure for Interoperability and Portability

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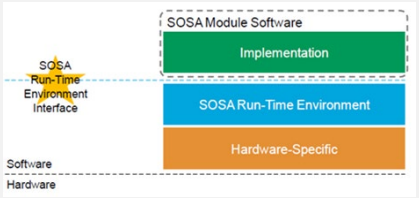
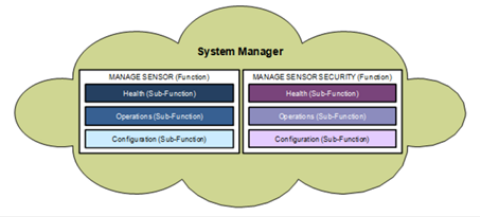
RTE (Run-Time Environment) profiles:

- FACE OSS (Operating System Segment)
- Container
- Virtual Machine



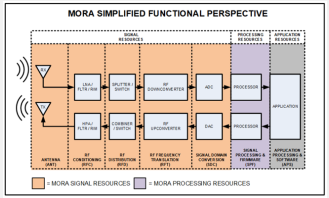
System and Task Management:

- **System Manager:** Responsible for management of SOSA Modules and Infrastructure.
- **Task Manager:** Responsible for coordinating all mission operations



Inter-module Interactions:

- **E.g.: MORA (Modular Open Radio Architecture):** Adopted for RF Signal Layer Modules



SOSA Run-Time Environment

Defining the SW Infrastructure for interoperability and portability

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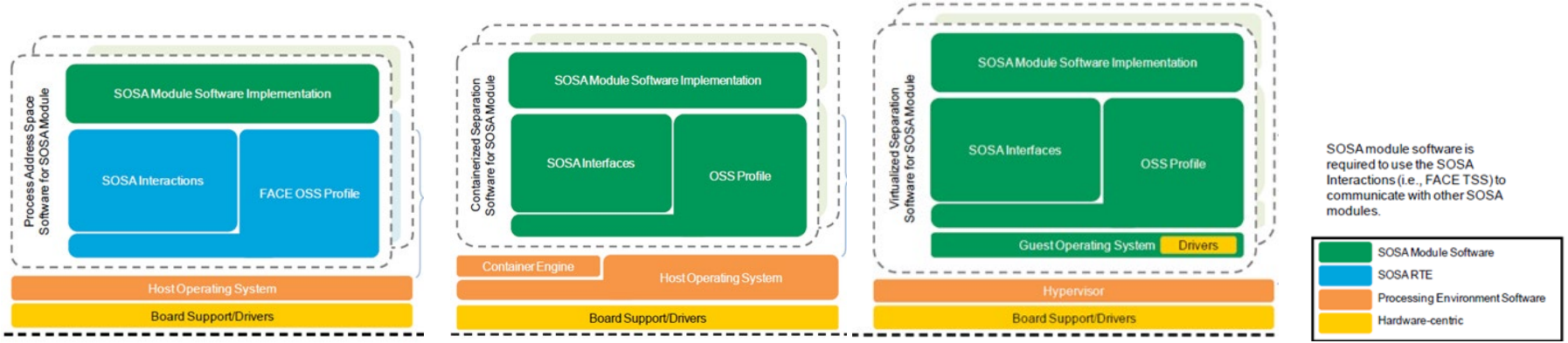

FACE OSS RTE

Container RTE

Virtual Machine RTE
(Type 1 "Bare Metal" Hypervisor shown)

These RTE profiles define constraints and dictate the interfaces that application developers must adhere to in the creation highly portable SOSA modules.

Defined Run-time Environments lay foundation for the "App Store" concept.

SOSA System Management

Overview

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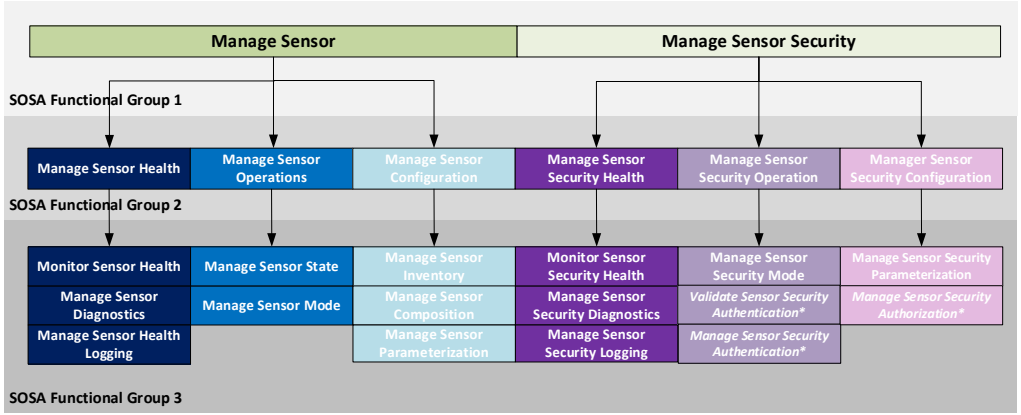
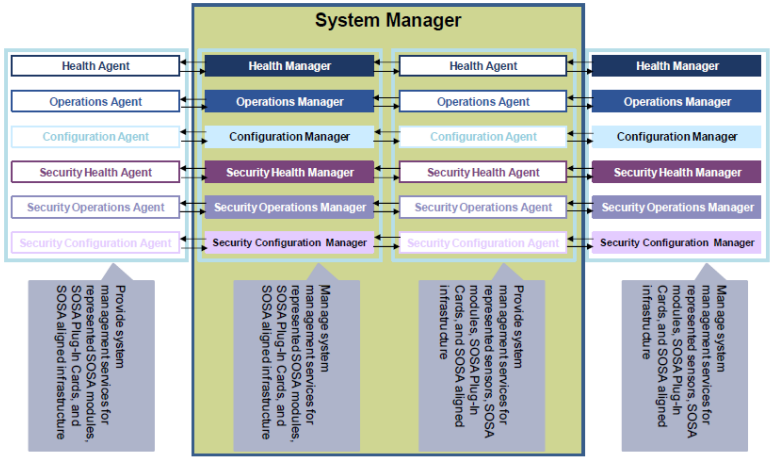
Standardizes the management of the health, operation and configuration of the platform and its security.

System Manager Function Groups
SOSA Table 6.1.1-1



System Manager Architecture & Interactions



SOSA System Management

Landscape of Interactions as Defined by SOSA Rules as per Section 6.2

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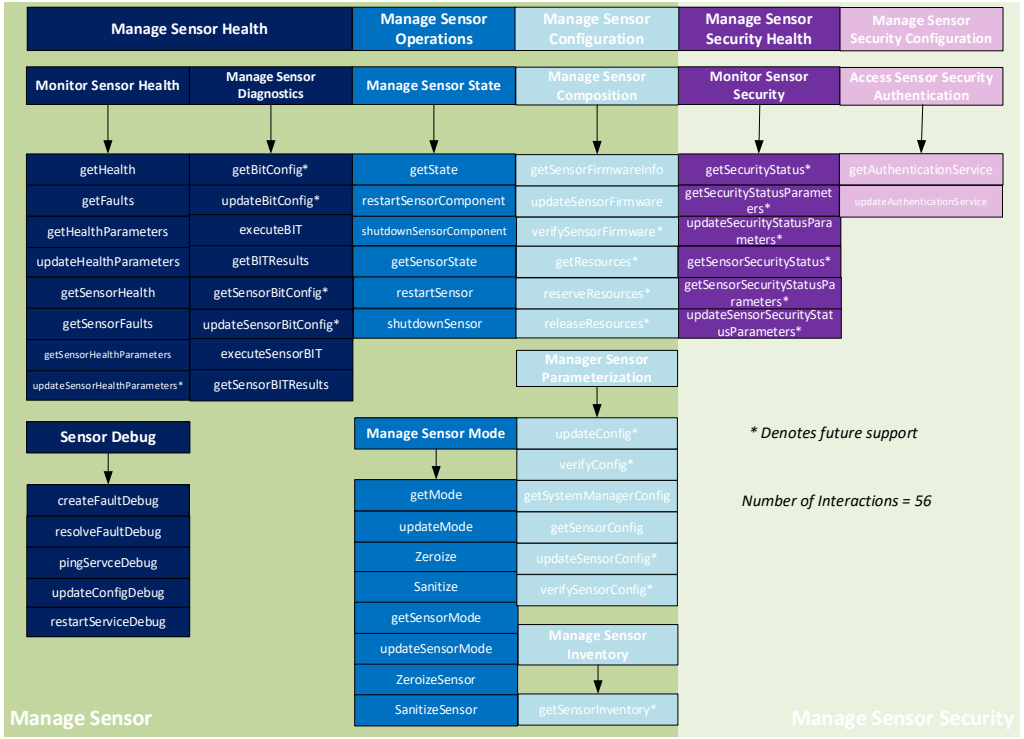
SOSA System Manager Defined Interactions per Element

SOSA Element	Number of In-Band Interactions
Generic Module	24
System Manager	56
Chassis Manager	35
Security Services	47
PIC	51
RTE	63
TOTAL	**276**

System Manager In-Band System Management Interactions
Snapshot 2 SOSA Rules 6.2.5-1 and 6.2.5-2



Opportunity for Modularized Software

Building Blocks for SOSA Compliance

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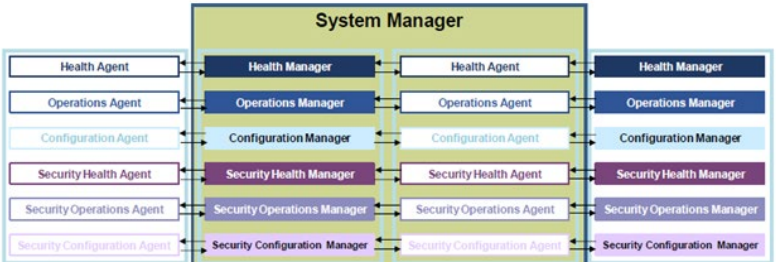
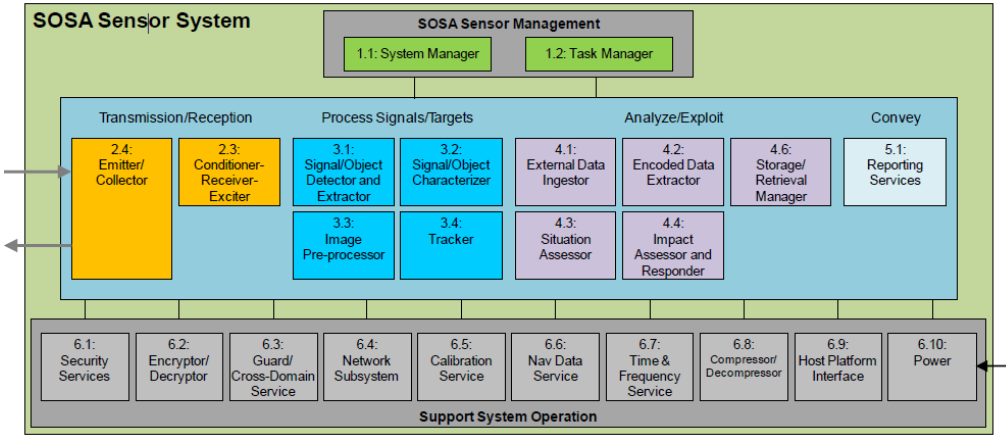


System Manager Components:

- **Agents (Servers):**
  Performs system management service for managed sensor or sensor component
- **Managers and User Interfaces (Clients):**
  Management of one or more subfunction agents.
  (Issues requests, acquires responses, publishes information for subscribers, and observing event notifications.)



Other Opportunities:

- Task Manager Module
- Services to Support System Operations
- Other sub-functions in support of modules

Case Study: US Army & CMOSS

Why is This Important?

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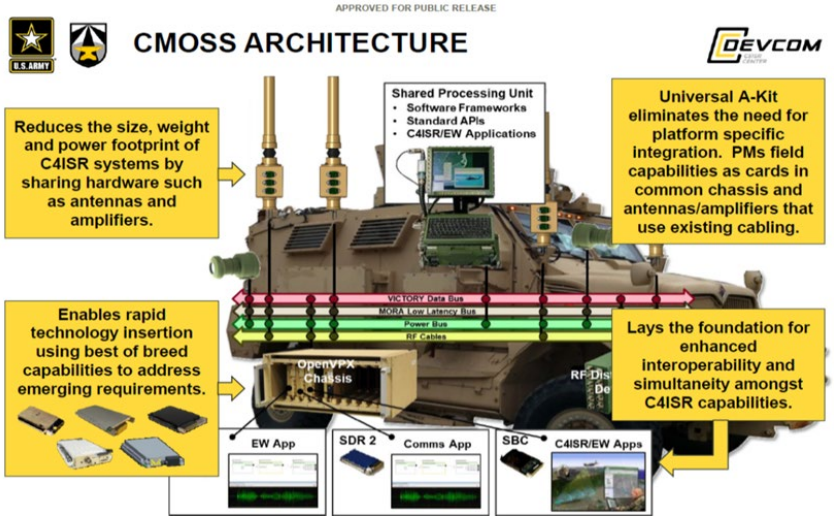
C5ISR/EW Modular Open Suite of Standards

- **Open**: Vendor & platform agnostic, MOSA conformance
- **Standardized**: Software, Hardware, Mechanical
- **Harmonized**: Leverage existing and emerging open standards
- **Aligned:** In concert with ongoing service objectives
- **Adaptable**: Rapidly responsive to user change requirements
- **Cost Effective**: Affordable



CMFF (CMOSS Mounted Form Factor Standard)

- Dictates alignment with **SOSA** and **MORA**

Example: CMFF Hosted SDR

How the SOSA Software Modules Map to Hardware Infrastructure

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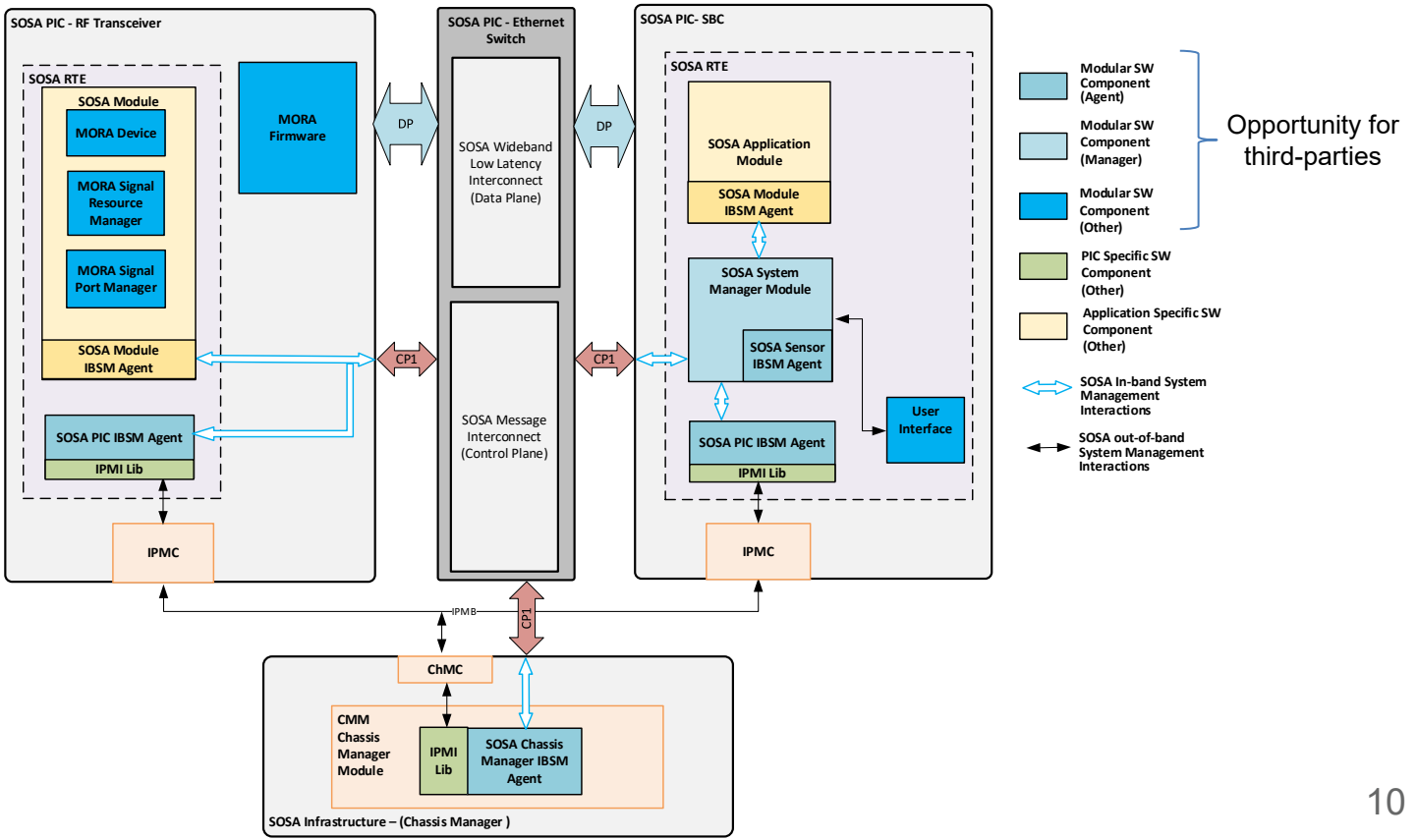

Memo From the Pentagon

December 17th 2024

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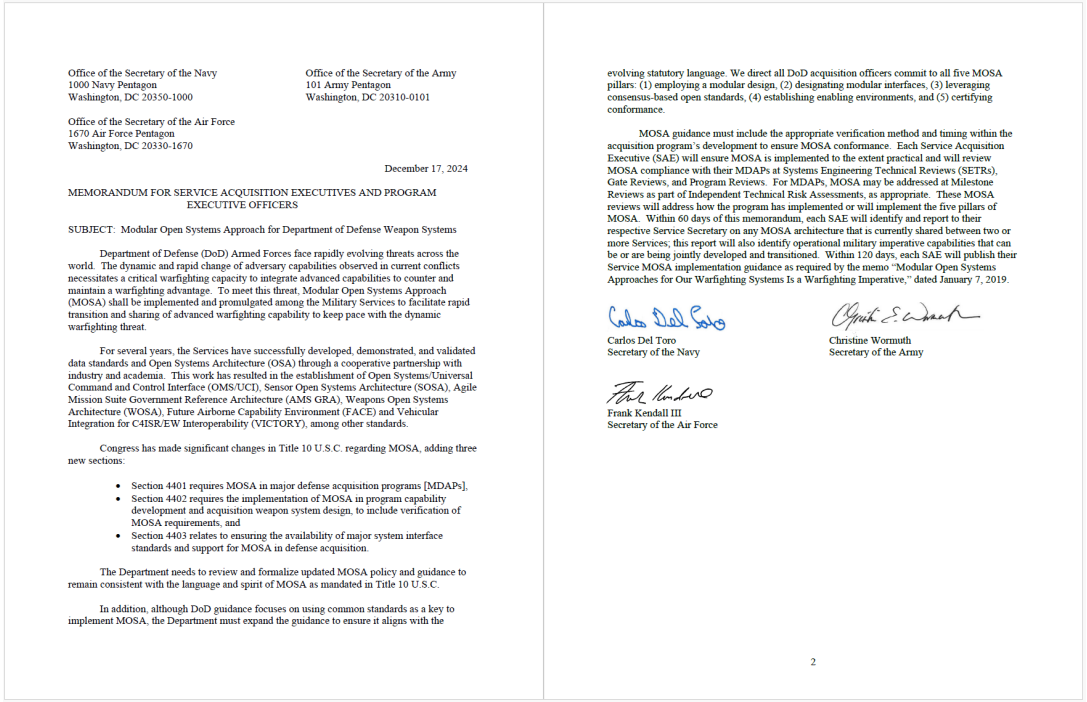
"Modular Open Systems Approach (MOSA) shall be implemented and promulgated among the Military Services"

Signed by Secretaries of the Navy, Army and Air Force



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

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Key Takeaways

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SOSA Standard defines the software platform on which applications must run and how they interact.
It also defines the framework for system management.

The successful implementation of the standard can provide a platform for truly “plug-and-play” applications hence realizing the “App-Store” concept.

Sensor system developers want to focus their SW resources in development on their IP. They do not want to develop SOSA SW infrastructure from scratch.

For widespread adoption, SW alignment with SOSA needs to be affordable and have minimal impact on schedule.

PIC vendors, system integrators and software vendors can provide building blocks that satisfy key elements of the software aspects of the SOSA standard.
Reducing our customers cost and risk will be the key to adoption.

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Thank You!
Questions?

David Tetley

Embedded Tech Trends