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SOSA™

Sensor Open Systems Architecture

The Sensor Open Systems Architecture (SOSA™) in a Nutshell

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THE Open GROUP

The SOSA Approach*

The SOSA Consortium is a C4ISR-focused technical and business collaborative effort…

- Who: The Air Force, Navy, Army, other government agencies, and industry
- What: To develop a unified technical Open Systems Architecture standard for **radar, EO/IR, SIGINT, EW, and Communications** – and the supporting business model
- Why: To improve sub-system, system, and platform affordability, re-configurability, upgradability, and hardware/software/firmware re-use
- How: By developing an OSA via modular decomposition (defining functions and behaviors) and associated interfaces (including physical, protocol, and data structure) between the modules

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* Based on abstract of "Sensor Open System Architecture (SOSA) Evolution for Collaborative Standards Development," SPIE Open Architecture/Open Business Model Net-Centric Systems and Defense Transformation 2017

SOSA Consortium Member Organizations

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Sponsor Level

Air Force LCMC
Lockheed Martin
NAVAIR
Raytheon
Rockwell Collins
US Army PEO Aviation

Principal Level

BAE Systems, Inc.
GE Aviation Systems
General Dynamics Mission Systems
Harris Corporation
Leonardo DRS
U.S. Army RDECOM CERDEC I2WD
UTC Aerospace Systems

Associate Level

Abaco, Annapolis Micro Systems, Inc, Behlman Electronics, Inc., Crossfield Technology, Curtiss-Wright, Delta Information Systems, DRTI, Elma, Gore, Herrick Technology Laboratories, Inc., iRF Solutions, Joint Technical Networking Center, KEYW Corporation, Kontron America, L3 Technologies, Inc., Leidos, Mercury Systems, Meritec, North Atlantic Industries, Inc., Northrop Grumman, OAR Corporation, Pentek, Inc., QubeStation, Inc., Rantec Power Systems, Inc., Real-Time Innovations, Samtec, Selex Galileo Inc, SimVentions, Southwest Research Institute, Spectranetix, Inc., Technology Service Corporation, Telephonics, Tucson Embedded Systems, VTS, Inc.

Outline

- SOSA Fundamentals
- SOSA Consortium
- Foundational Methodology
- SOSA Consortium Products

SOSA Fundamentals

Architecture vs. Design

Modules

Interfaces

- Architecture: “The fundamental organization of a system embodied in its <u>components</u>, their <u>relationships</u> to each other and to the environment, and the principles guiding its design and evolution*”

- Design: The result of transforming requirements into specified characteristics or into the specification of a product process or system** –
  – An <u>instantiation</u> of the architecture here can be multiple designs that conform to the same architecture

The SOSA Consortium is developing an <u>architecture</u>, not a design

* From ISO/IEC 42010 - IEEE Std 1471-2000 "Systems and software engineering — Recommended practice for architectural description of software-intensive systems

** Based on ISO 9000:2005 – “Plain English Definitions”

What an OSA "Looks Like"

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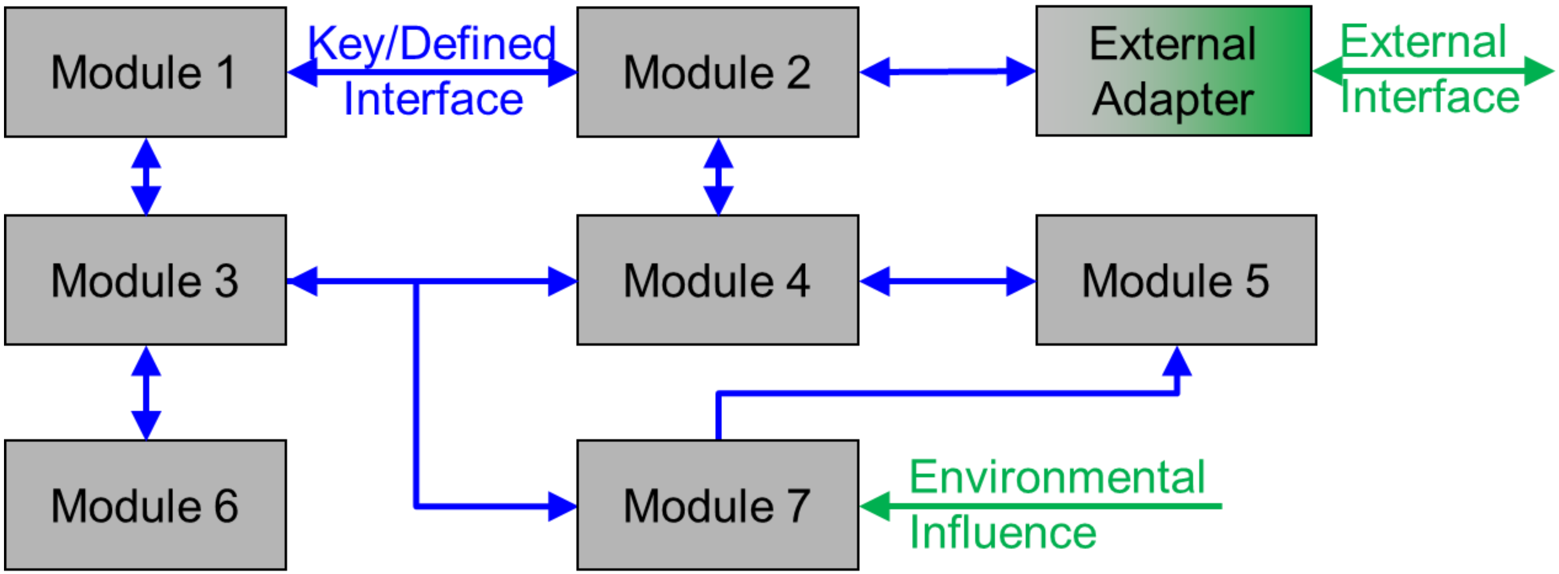
- Modules (can be physical or logical – or a combination):
  - Activities/functions and behaviors
  - Physical properties



- Interfaces: Physical or logical "touch points"
  - Information exchange, protocols, data content, data format
  - Mechanical connections

SOSA Technical Architecture is a Modular Open Systems Architecture

- Modular:
  - Has encapsulated functionality and behaviors, with well-defined interfaces
  - Tightly integrated modules, loosely coupled with others

- Open:
  1. Widely-available, published definitions **← Necessary but not sufficient**
  2. Consensus-based ("interested parties" can shape it) and has a governance process to enables stakeholders to influence and effect the development and evolution
  3. Has conformance/compliance validation process

Gray Box Concept: The OSA defines <u>what</u> the box does and the interfaces between boxes, but NOT <u>how</u> it does it (the IP is inside the box)

Anticipated SOSA Benefits

- Faster/more efficient and more cost-effective
  – Acquisition — without sacrificing capability
  – Systems integration
  – Technology transition
- Improved Lifecycle and supportability
  – Tech insertion (new capability)
  – Commonality and reuse of components
  – Tech insertion (obsolescence)
- Interoperability
  – Between OSA-based systems
  – Within deployed Product Families

CV-1 for the SOSA Consortium: Overview

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Business/acquisition practices and a technical environment for sensors and C4ISR payloads that foster **innovation**, industry **engagement**, **competition**, and allow for **rapid fielding** of cost-effective capabilities and platform mission reconfiguration while minimizing logistical requirements

<u>Open</u>	<u>Standardized</u>	<u>Harmonized</u>	<u>Aligned</u>	<u>Cost Effective</u>	<u>Adaptable</u>
Vendor- and platform-agnostic open modular reference architecture and business model	Software, hardware, and electrical-mechanical module interface standards	Leverage existing and emerging open standards	Consistent with DoD acquisition policy guidance	Affordable C4ISR systems including lifecycle costs	Rapidly responsive to changing user requirements

<u>Key</u>
- Vision
- Goals
- Capabilities

CV-1 for the SOSA Consortium: Part 1 of 6

Business/acquisition practices and a technical environment for sensors and C4ISR payloads that foster innovation, industry engagement, competition, and allow for rapid fielding of cost-effective capabilities and platform mission reconfiguration while minimizing logistical requirements

- <u>Open</u>: Vendor- and platform-agnostic open modular reference architecture and business model
- <u>Standardized</u>: Software, hardware, and electrical-mechanical module interface standards
- <u>Harmonized</u>: Leverage existing and emerging open standards
- <u>Aligned</u>: Consistent with DoD acquisition policy guidance
- <u>Cost Effective</u>: Affordable C4ISR systems including lifecycle costs
- <u>Adaptable</u>: Rapidly responsive to changing user requirements

a) Development of an open systems reference architecture through a consensus-driven process
b) Development of a business model that accounts for government acquisition (e.g., affordability and innovation) and industry interests (e.g., protection of IP and market opportunities)
c) Widespread adoption of the above

<u>Key</u>
Vision
Goals
Capabilities

CV-1 for the SOSA Consortium: Part 2 of 6

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Business/acquisition practices and a technical environment for sensors and C4ISR payloads that foster innovation, industry engagement, competition, and allow for rapid fielding of cost-effective capabilities and platform mission reconfiguration while minimizing logistical requirements

- Open: Vendor- and platform-agnostic open modular reference architecture and business model
- Standardized: Software, hardware, and electrical-mechanical module interface standards
- Harmonized: Leverage existing and emerging open standards
- Aligned: Consistent with DoD acquisition policy guidance
- Cost Effective: Affordable C4ISR systems including lifecycle costs
- Adaptable: Rapidly responsive to changing user requirements

a) Leverage applicable existing interface definitions and standards
b) Creation of new interface standards only when necessary
c) Use of a consensus-based process

Key
Vision
Goals
Capabilities

CV-1 for the SOSA Consortium: Part 3 of 6

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Business/acquisition practices and a technical environment for sensors and C4ISR payloads that foster innovation, industry engagement, competition, and allow for rapid fielding of cost-effective capabilities and platform mission reconfiguration while minimizing logistical requirements

- Open: Vendor- and platform-agnostic open modular reference architecture and business model
- Standardized: Software, hardware, and electrical-mechanical module interface standards
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- Aligned: Consistent with DoD acquisition policy guidance
- Cost Effective: Affordable C4ISR systems including lifecycle costs
- Adaptable: Rapidly responsive to changing user requirements

a) Selection of subsets of applicable DoD-oriented open standards
b) Selection of subsets of applicable industry/commercial open standards
c) Deconfliction and adaptation of incorporated open standards

Key
Vision
Goals
Capabilities

CV-1 for the SOSA Consortium: Part 4 of 6

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Business/acquisition practices and a technical environment for sensors and C4ISR payloads that foster innovation, industry engagement, competition, and allow for rapid fielding of cost-effective capabilities and platform mission reconfiguration while minimizing logistical requirements

<u>Open</u>: Vendor- and platform-agnostic open modular reference architecture and business model

<u>Standardized</u>: Software, hardware, and electrical-mechanical module interface standards

<u>Harmonized</u>: Leverage existing and emerging open standards

<u>Aligned</u>: Consistent with DoD acquisition policy guidance

<u>Cost Effective</u>: Affordable C4ISR systems including lifecycle costs

<u>Adaptable</u>: Rapidly responsive to changing user requirements

a) SOSA Business Guide written to ensure conformance with government documents for R&D, acquisition, and sustainment activities
b) Business/acquisition model consistent with sustaining the industrial base (e.g., incentives to invest and engage)

<u>Key</u>
Vision
Goals
Capabilities

CV-1 for the SOSA Consortium: Part 5 of 6

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Business/acquisition practices and a technical environment for sensors and C4ISR payloads that foster innovation, industry engagement, competition, and allow for rapid fielding of cost-effective capabilities and platform mission reconfiguration while minimizing logistical requirements

- Open: Vendor- and platform-agnostic open modular reference architecture and business model
- Standardized: Software, hardware, and electrical-mechanical module interface standards
- Harmonized: Leverage existing and emerging open standards
- Aligned: Consistent with DoD acquisition policy guidance
- Cost Effective: Affordable C4ISR systems including lifecycle costs
- Adaptable: Rapidly responsive to changing user requirements

a) SOSA architecture that promotes reuse
b) SOSA architecture that enables the use of COTS/GOTS systems
c) SOSA architecture that supports upgrading elements without the need for redesign
d) SOSA architecture that supports interchangeable parts
e) Business Model that incentivizes widespread industry adoption

Key
Vision
Goals
Capabilities

CV-1 for the SOSA Consortium: Part 6 of 6

Vision: Business/acquisition practices and a technical environment for sensors and C4ISR payloads that foster innovation, industry engagement, competition, and allow for rapid fielding of cost-effective capabilities and platform mission reconfiguration while minimizing logistical requirements

Goals:

- Open: Vendor- and platform-agnostic open modular reference architecture and business model
- Standardized: Software, hardware, and electrical-mechanical module interface standards
- Harmonized: Leverage existing and emerging open standards
- Aligned: Consistent with DoD acquisition policy guidance
- Cost Effective: Affordable C4ISR systems including lifecycle costs
- Adaptable: Rapidly responsive to changing user requirements

Capabilities (Adaptable):

a) Fully-modular, scalable open architecture
b) SOSA architecture that supports rapid modification of existing SOSA systems
c) SOSA architecture that supports ease of multi-INT integration
d) Use of plug-and-play technologies

Key
Vision
Goals
Capabilities

Challenges We Must Address

- Competing interests
- Establishing trust relationships
- Establishing a business/acquisition strategy that balances the interests (and addresses the concerns) of all stakeholders
- Near-term investment and cultural changes needed to realize the long-term benefits of OSA
- Conventional planning and acquisition process not optimized for OSA
- Traditional contracting models assume requirements can be fully defined up front
- COTS standards and products may be ill-suited for many DoD missions

SOSA Consortium

Objective of the SOSA Consortium

Creates a common framework for transitioning sensor systems to an open systems architecture, based on key interfaces and open standards established by industry-government consensus

Business Architecture: Acquisition Model and Conformance Program

Technical Architecture: Reference Architecture in the form of a Technical Standard

SOSA Consortium Organization and Makeup

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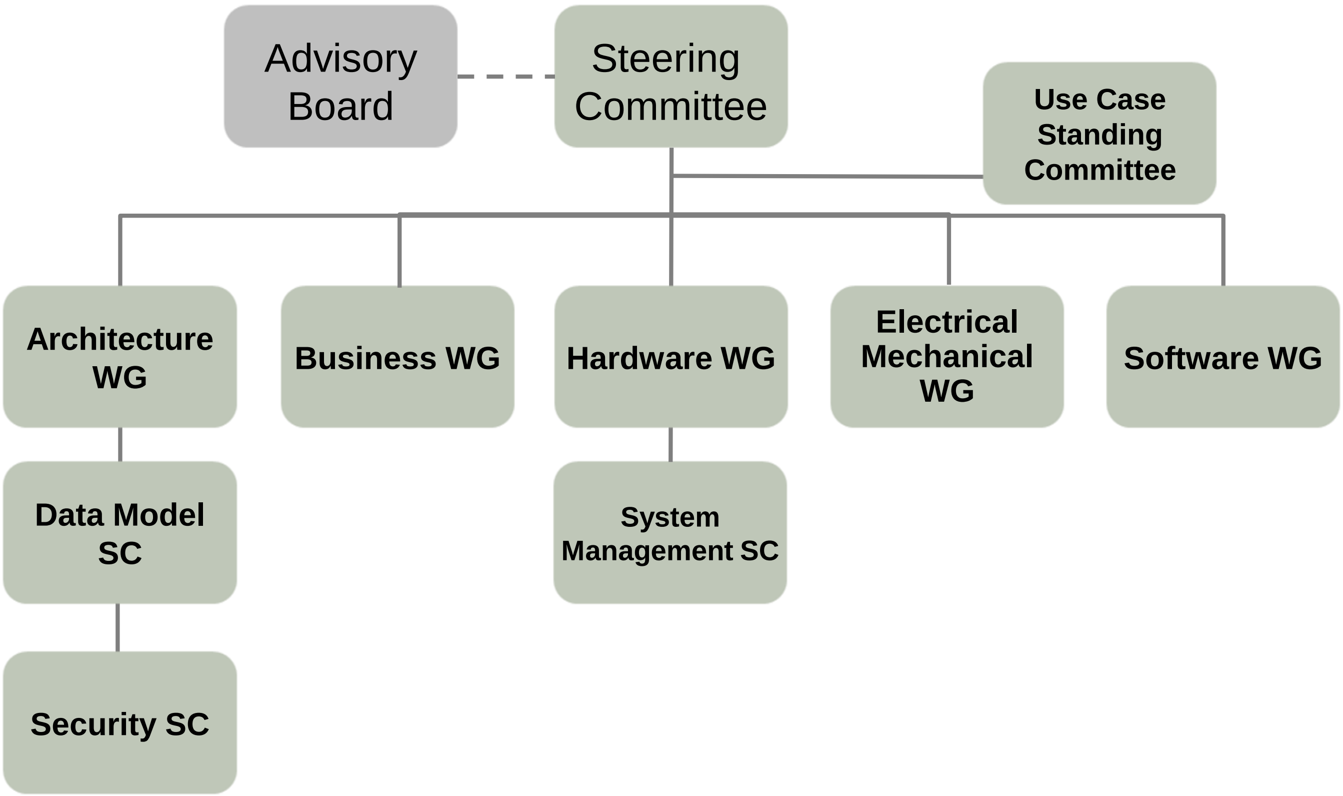

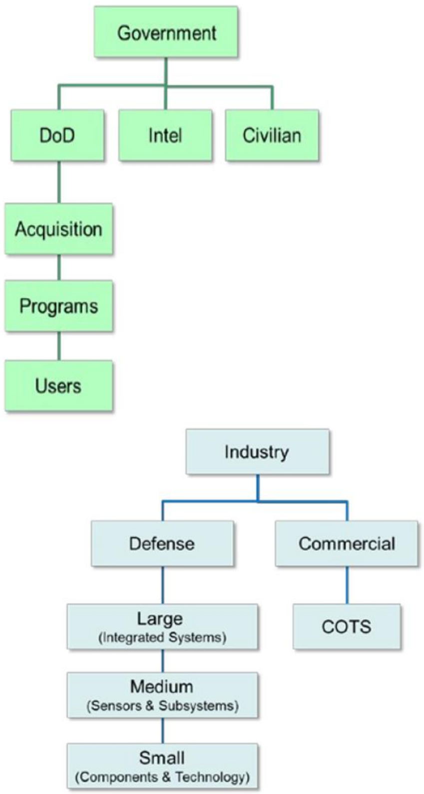

Working Group Leadership

- Business
  - Chair: John Bowling (AFLCMC)
  - Vice-chair: Jason Jundt (GE Aviation)
- Architecture
  - Chair: Steve Davidson (Raytheon)
  - Vice-chair: Paul Clarke (Northrop Grumman)
- Electrical Mechanical
  - Chair: Tim Ibrahim (L3 Sonoma EO)
  - Vice-Chair: George Dalton (KeyW)
- Hardware
  - Chair: Patrick Collier (Harris Corporation)
  - Vice-chair: Jason Dirner (U.S. Army RDECOM CERDEC I2WD)
- Software
  - Chair: Mike Orlovsky (Lockheed Martin)
  - Vice-chair: Michael Moore (support to U.S. Army RDECOM CERDEC I2WD)

Foundational Methodology

Following an Enterprise Architecture Approach

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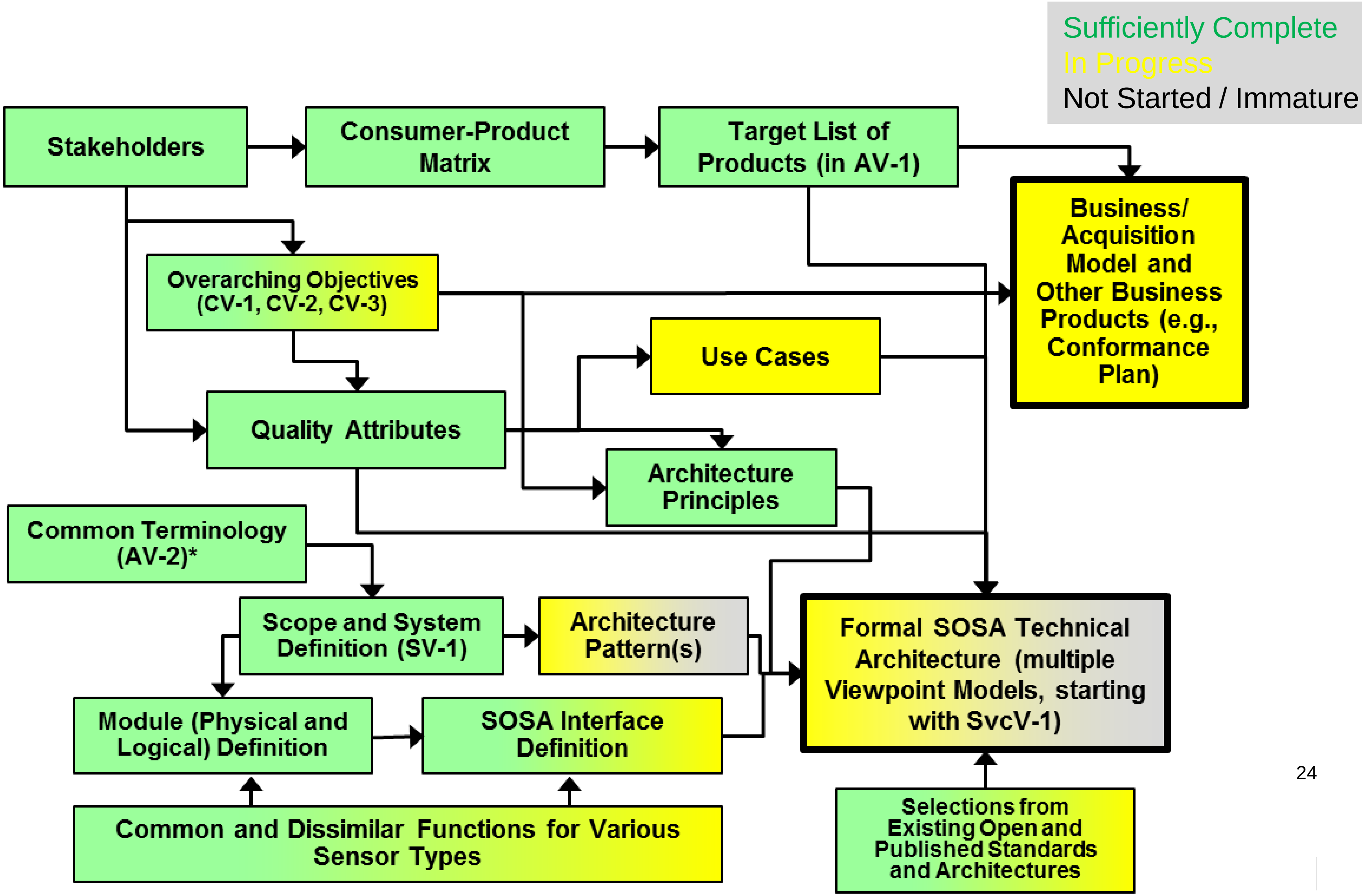
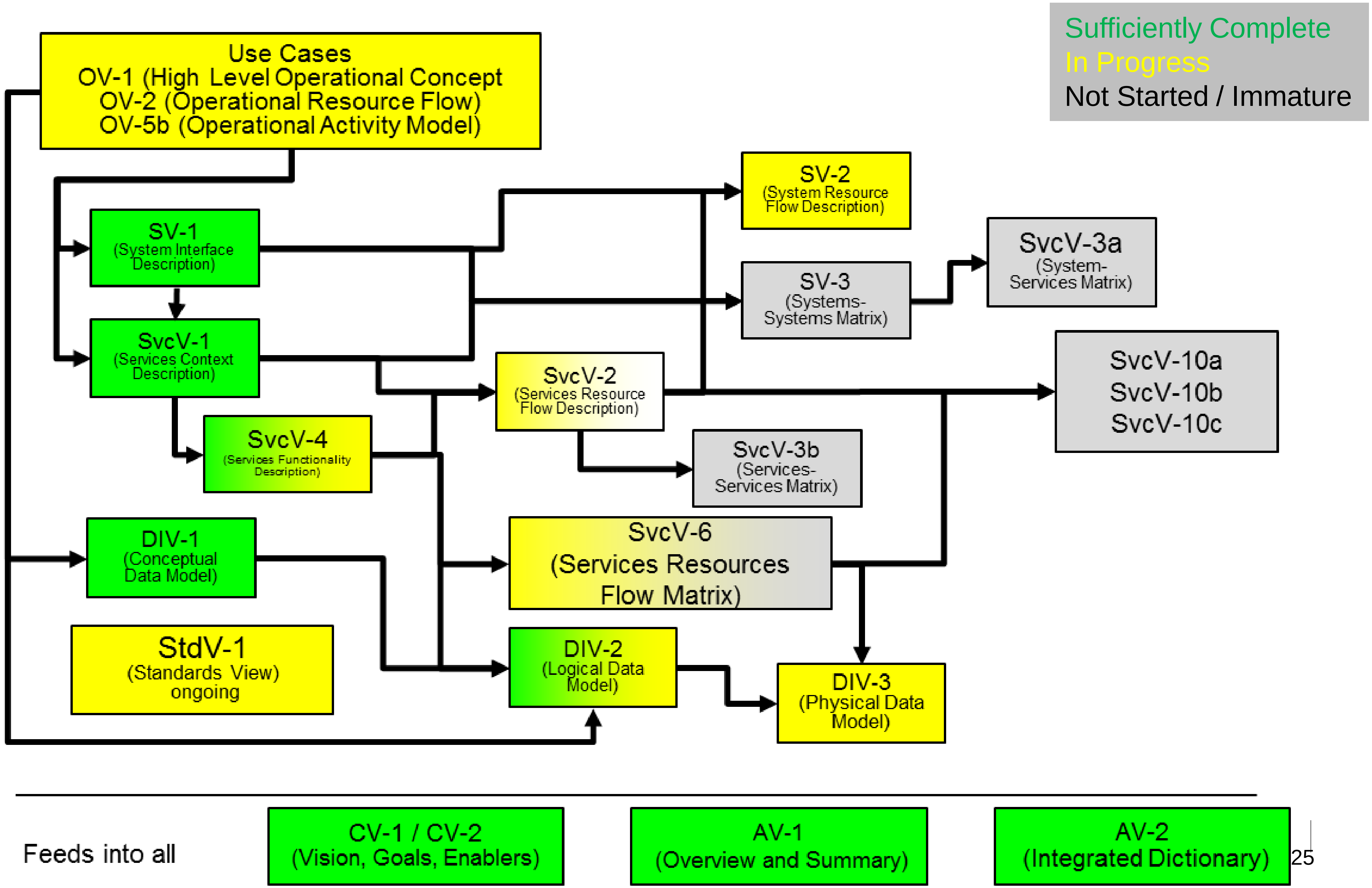
- Driven by business needs
  - Balancing concerns of the government and industry
- Top-down, fundamentals basis
  - Based on agreed-upon drivers grounded in how the Business and Technical Architectures will be used
- Following DoD MOSA guidance
  1. Widely available and published
  2. Consensus-based in creation and governance
  3. Verification process to ensure correct interpretation of the Technical Standard

SOSA Process Flow: Color Coded



SOSA Technical Architecture Artifact Roadmap



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SOSA Quality Attributes (1 of 2)

Name	Description
Interoperability	The ability of the system to provide data/information to – and accept the same from – other systems, and to use the data/information so exchanged to enable them to operate effectively together. In the context of SOSA, this QA refers to the ability of SOSA-based systems to be able to exchange information during operation, and (possibly with adaptation) be able to interoperate with non-SOSA-based systems
Securability	The property of a system such that its design renders it largely protected/inviolable against acts designed to (or which may) impair its effectiveness, and prevents unauthorized persons or systems from having access to data/information contained therein. In the context of SOSA, this QA ensures that the fundamental architecture is one that has minimal attack surfaces and effective authentication enforcement, and SOSA-based systems can be designed so that they can adapt to an evolving threat environment.
Modularity	The degree to which a system or element is composed of individually distinct physical and functional units that are loosely coupled with well-defined interface boundaries. In the context of SOSA, this QA enforces the establishment of well-defined, well-understood, standardized system modules that can be created and tested individually for function and conformance.
Compatibility	The ability of a system to coexist with other systems without conflict or impairment, or be integrated or used with another system of its type. In the context of SOSA, this QA refers to the ability of SOSA-based systems to be used or integrated with non-SOSA-systems, or with systems designed with earlier versions of the SOSA standard (backwards compatible).
Portability	An attribute that describes the reuse of existing hardware or software elements (as opposed to the creation of new) when moving hardware or software elements from one environment (physical or computing) to another. In the context of SOSA, this QA refers to the ability of SOSA-based hardware and software to be used, without modification, in other SOSA-based environments (e.g., different operational domains, different systems, and different sensor modalities), but does not necessarily imply the porting to vastly different physical environments (e.g., operating temperature, shock, vibration – which are design, not architectural, features)

SOSA Quality Attributes (2 of 2)

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Name	Description
Plug-and-playability	The capability of a system to recognize that a hardware component has been introduced and subsequently use it without the need for manual device configuration or operator intervention (e.g., USB devices) In the context of SOSA, this QA refers to the ability of a SOSA-based system to recognize the introduction of SOSA-based modules, and through a protocol exchange, to understand and use the capabilities and services that the module offers.
Upgradeability	The ability of a system to be improved, enhanced, or evolved without fundamental physical, logical, or architectural changes. In the context of SOSA, this QA refers to the ability of a SOSA-based system to have specific system, hardware, or software elements replaced with more modern or more capable elements without significant change to the rest of the system
Scalability: Sensor Multiplicity	The capability of a system to cope and perform well under an increased or expanding workload or increased demands, and to function well when there is a change in scope or environment – and still meet the mission needs. In the context of SOSA, this QA refers to the ability of the SOSA architecture to accommodate a multiplicity of sensors, constrained only by design-specific limitations.
Scalability: Platform Size	The capability of a system to cope and perform well under an increased or expanding workload, increased demands, and to function well when there is a change in scope of environment and still meet the mission needs. In the context of SOSA, this QA refers to the ability of the SOSA architecture to be applied to platforms that range from the small (e.g., Class I UAS) to large surveillance aircraft – and possibly even spacecraft
Resiliency	The ability of a system to continue or return to normal operations in the event of some disruption, natural or man-made, inadvertent or deliberate, and to be effective with graceful and detectable degradation of function. In the context of SOSA, this QA refers to the ability of SOSA-based systems to be able to maintain operations while under “duress” caused by physical damage, electronic interference, or cybersecurity attack.

SOSA Architecture Principle's Names

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<u>Business-oriented</u>

1. The SOSA business and technical architectures is vendor agnostic
2. SOSA Consortium Products are provided royalty-free
3. SOSA Products and Processes Protect the Intellectual Property of Vendors

<u>Technically-oriented</u>

4. SOSA Standard is Extensible and Evolvable
5. SOSA Architecture Maximally Leverages/Incorporates Existing Industry and Government Standards
6. Resilience (including Cybersecurity) is Enabled by the Architecture
7. SOSA Architecture is Agnostic with Respect to Host Platform
8. SOSA is Agnostic with Respect to Processing Environment
9. Every SOSA Module has Defined Logical Interfaces
10. Every SOSA Hardware Element has Defined Physical Interfaces
11. SOSA Architecture Accommodates Simple through Complicated Systems
12. SOSA Architecture Accommodates Small through Large Systems
13. Modularity is fundamental to SOSA – Physical and Logical
14. Interchangeability is Fundamental to SOSA
15. Reuse is fundamental to SOSA

<u>Each Architecture Principle:</u>

- Statement/Description
- Rationale
- Implications for SOSA

Architecture Principles:
SOSA Example (three of the fifteen shown)

Name	#1 The SOSA business and technical architectures is vendor agnostic
Statement	The modules and interfaces that make up the SOSA technical architecture and standard, and the processes and practices that make up the SOSA business/procurement architecture, is equally beneficial to all vendors, offering no inherent advantage or disadvantage to any one company or business sector.
Rationale	The first Goal of SOSA is "Open: Vendor- and platform-agnostic open modular reference architecture and business model," and as such, the SOSA business and technical architecture supports a "level playing field" to ensure business fairness, and that the best technical solution, regardless of vendor source, can be incorporated into systems based on the SOSA technical architecture.
Implications	The business architecture of SOSA ensures that there are no barriers for stakeholder participation in the development or use of the SOSA architecture. This includes making material available, eliminating financial barriers (or ensuring that they are minimal). The acquisition model is one that enables all qualified vendors to participate. The technical architecture incorporates standards that favor no particular vendor by … able standards for which all qualified vendors have equivalent

Name	#14 Interchangeability is Fundamental to SOSA
Statement	Modules making up SOSA systems are able to be replaced by equivalent modules regardless of the source. Moreover it would be possible to interchange one (entire) SOSA system with another SOSA system (provided it does not violate physical/environmental requirements).
Rationale	The goals of the SOSA effort include openness (platform and vendor-agnostic) and rapid response. The Quality Attributes include plug-and-playability and upgradability. Essential to these objectives is the need to be able to interchange SOSA modules to achieve goals, such as using module replacement to upgrade a sensor or modify it because of a changing mission need. This will result in a more robust marketplace where subsystem upgrades become more commonplace as the ease of modular upgrades become apparent.
Implications	Interfaces are very well defined and yet contain a high degree of flexibility. Module-unique interface technologies should be avoided in favor of those that are broadly-applicable. Interface definitions are superset definitions; they include all the functionality/capability that a SOSA module or system is anticipated to include. The architecture defines a default behavior for situations where all functions supported in the interface are not implemented.

Name	# 7 SOSA Architecture is agnostic with respect to host platform
Statement	The SOSA Architecture and Standard applies to a wide range of host platforms (e.g., aircraft, ground vehicle, ship), and makes no assumption regarding the type of vehicle or installation it is resident in or upon
Rationale	Conformance and adherence to this principle engenders hardware and software interoperability and reuse across multiple platforms and multiple mission types. Enabling and maximizing reuse lowers overall development costs and operational costs over the lifetime of any particular program.
Implications	The development of the SOSA Technical Standard takes into account a wide range of physical and environmental conditions, and so it specifies, for example, a range of standards-based connector types appropriate for the variety of environments. This may have implications on plug-and-playability, and so it is important that one type of interface (for one environment) easily be adapted (through interface conversion and/or software shim) to another. This enables, for example, a small-vehicle sensor to be leveraged for a large platform.

Architecture Approach: Maximize Commonality

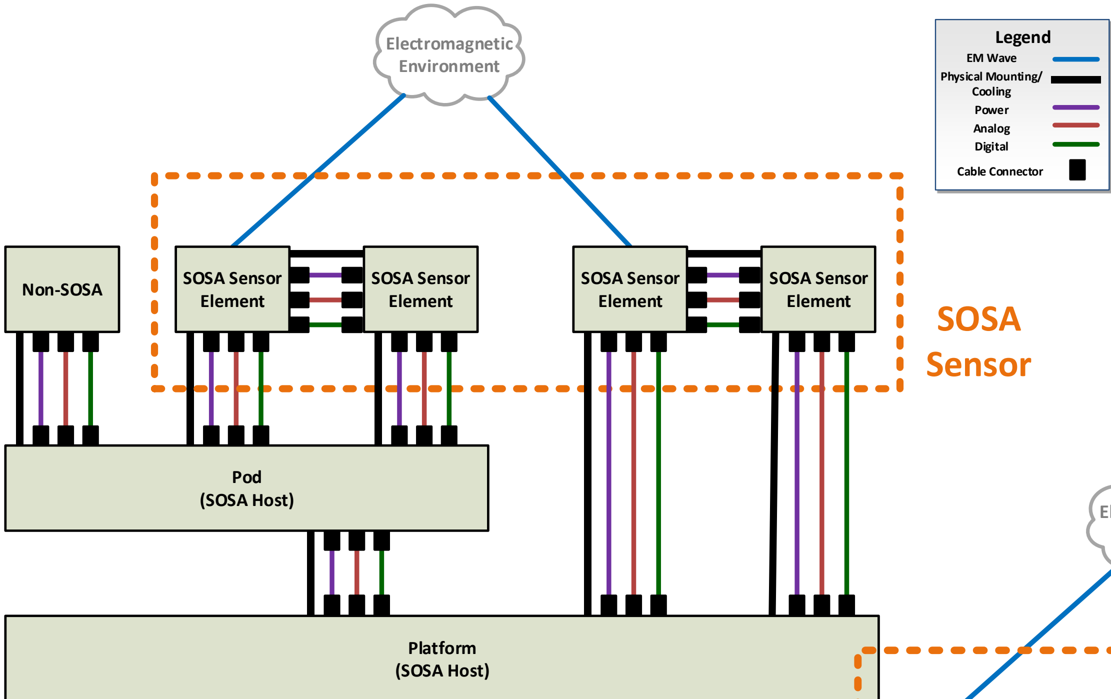
- Create a <u>superset</u> reference architecture that can be used for the full range of target sensor systems
  - Not all sensors have to incorporate every module (e.g., processing *<u>may</u>* be done in a large sensor, or off-board for a small sensor)
- Leverage commonality between sensor types as much as the physics will permit
  - E.g., image geo-registration for SAR and EO/IR images
  - E.g., apertures different and no REX, for EO/IR

SOSA Consortium Products

Important SOSA Terms to Understand

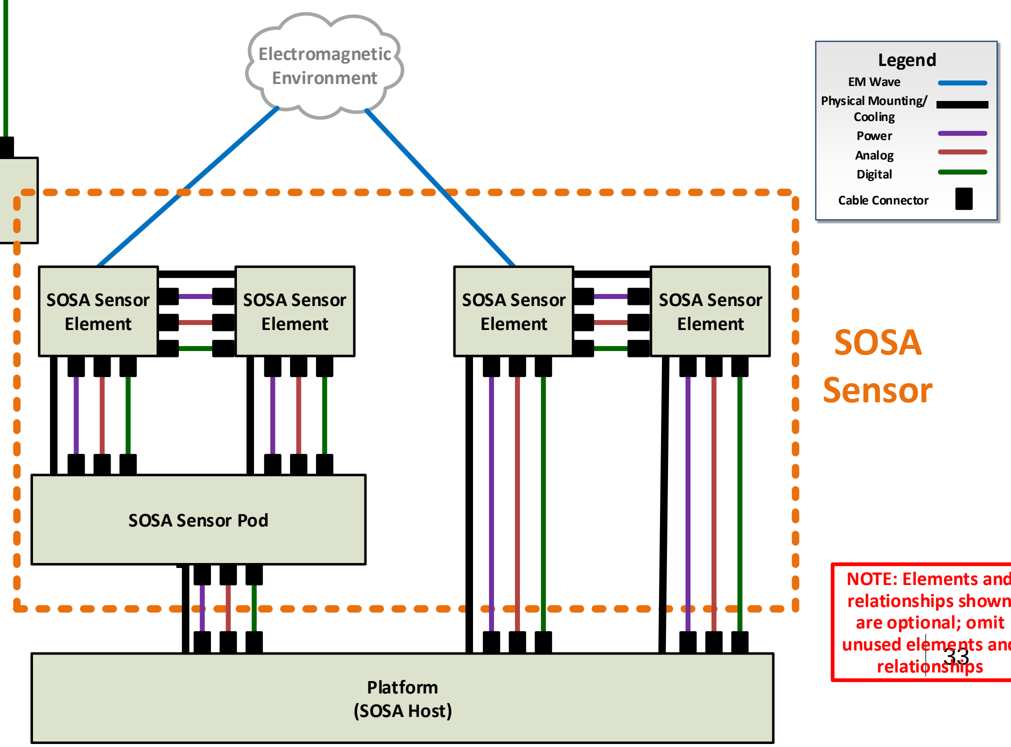
- **Interface**: The region (physical or logical) where two systems or elements meet and interact
- **Sensor**: A device or system that actively or passively detects the physical properties of another entity and produces quantitative data that will be subsequently processed or used (e.g., radar, sonar, IR focal plane, seismometer, etc.) and consist of one or more SOSA Sensor Elements mounted within or on the same platform
- **Hardware Element**: An all-encompassing term for hardware that is incorporated into a SOSA sensor
- **Plug-In Card:** Term for any hardware element that is a circuit card that plugs into a backplane
- **SOSA Plug-In Card:** Any Plug-in Card that <u>conforms to a SOSA slot profile</u>
- **Software Component**: A unit of software that is incorporated into a SOSA sensor
- **SOSA Module**: A combination of Hardware Elements and/or Software Components can be instantiated in a way that <u>conforms to the complete definition</u> (functionality, behavior, and interfaces) of the SOSA Modules as defined in the SOSA Technical Standard (SvcV-1 and SvcV-4)

SV-1 (Systems Interface Description*)



Nominal Case

Sensor Pod Case



* Several pages of descriptive text omitted here for brevity

SOSA Module Definition Process

- Identified functions performed within radar, EO/IR, SIGINT, EW, and communications systems
- Aggregated these functions into logical groups, SOSA Modules, based on the following criteria:
  1. Severable (can be separated and used elsewhere) – based on business needs, timing requirements, or other drivers
  2. Has minimal complexity interfaces (minimum interdependencies)
  3. Can operate as stand-alone or be operated via function/process/system manger (that can operate it as stand-alone)
  4. Is independently testable
  5. Does not expose IP
  6. Facilitates competitive procurement
  7. Encapsulates rapid change
- For each function within a SOSA Module, we identified
  – What is required for input (not provided by another function inside that SOSA Module) ,and
  – What it produced for an output that is used outside the SOSA Module

The SOSA Technical Standard specifies what the modules do, but not how they do it (IP and innovation are preserved)

SOSA Modules' Definition

- ID Number: Numerical designator: Major-point-minor
- Name: Succinct label
- Description: Paragraph that explains the encapsulated functionality
- Function List: List of functions contained within the SOSA Module
- Inputs: List of data items and controls that are ingested by the Module (in certain cases, their sources)
- Outputs: List of data items that are produced by the SOSA Module (in certain cases, their destinations)

The SOSA Modules (Textual)

SOSA Sensor Management

1.1: System Manager

1.2: Task Manager

Transmission/Reception:

2.1: Receive Aperture/ Transducer/ Camera

2.2: Transmit Aperture/ Transducer/ Laser

2.3: Conditioner-Receiver-Exciter

Process Signals/Targets

3.1: Signal/Object Detector and Extractor

3.2: Signal/Object Characterizer

3.3: Image Pre-Processor

3.4: Tracker

Analyze/Exploit

4.1: External Data Ingestor

4.2: Encoded Data Extractor

4.3: Situation Assessor

4.4: Impact Assessor and Responder

4.6: Storage/Retrieval Manager

Convey

5.1: Reporting Services

Support System Operation

6.1: Security Services

6.2: Encryptor/Decryptor

6.3: Guard/Cross-Domain Service

6.4: Network Subsystem

6.5: Calibration Service

6.6: Nav. Data Service

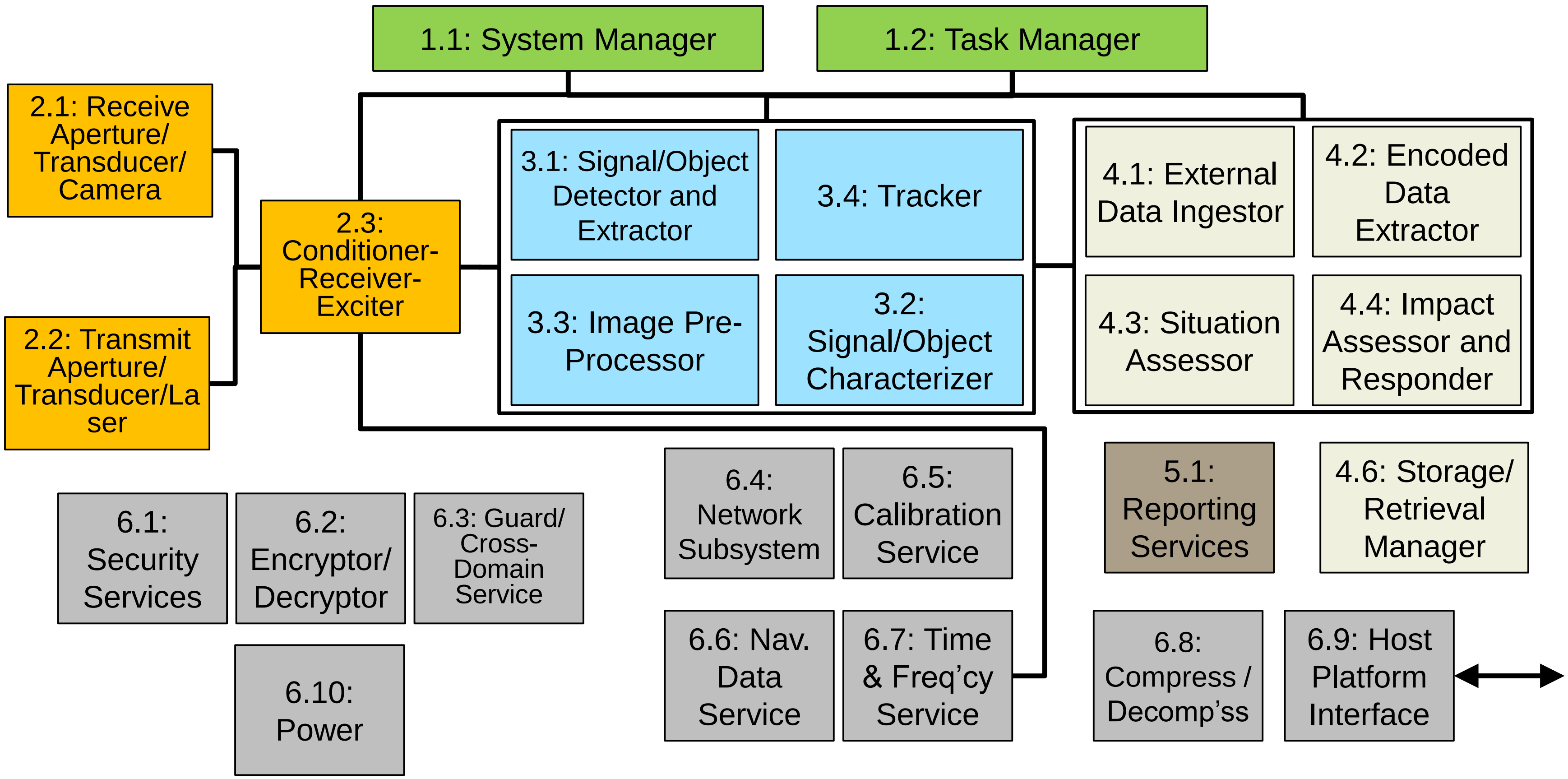
6.7: Time & Frequency Service

6.8: Compressor/ Decompressor

6.9: Host Platform Interface

6.10: Power

The SOSA Modules (Graphical part of SvcV-1)



Documenting the SOSA Modules

Extract from the SvcV-1

	beamforming, focus control, and filtering.
2.3 Conditioner-Receiver-Exciter	The Conditioner-Receiver-Exciter may perform receive functions, transmit functions, or both. The receive side may include space-time adaptive processing (STAP), low-noise amplification (with gain control), amplitude limiting, band-pass filtering, frequency translation, application of calibration corrections, channelization, image formation, tagging with metadata, RF signal distribution, data framing , and datacube formation (for hyperspectral). The transmit side may include amplification (with gain control), amplitude limiting, frequency translation, waveform conversion (analog to digital, digital to analog), waveform generation, RF signal distribution, calibration, and adaptation to spectrum use.
3.1 Signal/Object Detector and Extractor	The Signal/Target Detector and Extractor is responsible for detecting electromagnetic signals or physical objects among the noise and other signals and objects in the environment (e.g., clutter or interference). This module extracts a detected signal, detected object, or image chip for downstream processing. Techniques to perform this may include clutter suppression and extraction of scintillation/decorrelation information, interference suppression, the use of constant false alarm rate techniques, coherent and non-coherent integration, image enhancement (including edge detection and sharpening), and employment of gating logic to manage and balance search volume returns with existing object tracks.
3.2 Signal/Object Characterizer	The Signal/Object Characterizer is designed to make measurements on images, signals and physical objects to determine attributes, properties, categories, classes, types, or identification — all with confidence estimates.
3.3 Image Pre-Processor	The Image Pre-Processor module prepares the image for final use and processing. For SAR, this module forms images from sensed RF data. This module also registers images to maps and other images.
3.4 Tracker	The Tracker Module correlates detections and tracks over time, forming new or updated tracks. It is responsible for all track management functions and producing track reports. The core functionality of the Tracker is data association, track initiation, track drop, track update, state and covariance estimation, and split track handling. Estimation of relative position or location (geolocation), when feasible, is also included in this function.
4.1 External Data Ingestor	The External Data Ingestor is responsible for ingesting data from other SOSA sensors, as well as sensors that don't conform to the SOSA Technical Standard (converting from non-Conformant format to Conformant format as needed), and distributes ingested data to other SOSA modules.
4.2 Encoded Data Extractor	The Encoded Data Extractor is applicable to SIGINT, communications, and EW. It is responsible for demodulating and extracting message content (communications and EW), extracting internals (SIGINT and EW) and human language processing (SIGINT).

Extract from the SvcV-4

Module	**Mode**	**Functions (and Prior Modules)**	**Input (See Table 3 for Definition)**	**Output (See Table 3 for Definition)**
6.5 Calibration Service	ALL	Intake the injected test signal Collect output of either cal test points or main Disable modules not under test Note: Do not preclude the design option to have the data source and processing be internal to the sensor (not needing external injection).	Injected test signal = RF Signal, or Image/Video Stream, or Demodulated Signal Calibration Command Safety Interlock	Electromagnetic Source Command Calibration Result(s)
6.6 Nav Data Service	ALL	Ingest platform/sensor location and orientation (if available) Blend internal and external spatial data (if available) Distribute platform/sensor location and orientation	Navigation Data (external source – option, since could be internally generated) Settings	Navigation Data
6.7 Time & Frequency Service	ALL	Ingest time from external source (if available) Blend internal and external time data Generate time internally (design-dependent) Provide time to internal function (as a timing signal/clock or time message) Provide local oscillator/frequency reference	Time Reference (external source)	Time Reference Frequency Reference
6.8 Compressor/ Decompressor	ALL	Compression Decompression Codec functions [non-specific]	Compression Command Compressed Data Compression Metadata Decompression Command Decompressed Data Decompression Metadata	Compressed Data Compression Metadata Decompressed Data Decompression Metadata

Module-to-Module Interfaces: Top-Down Approach

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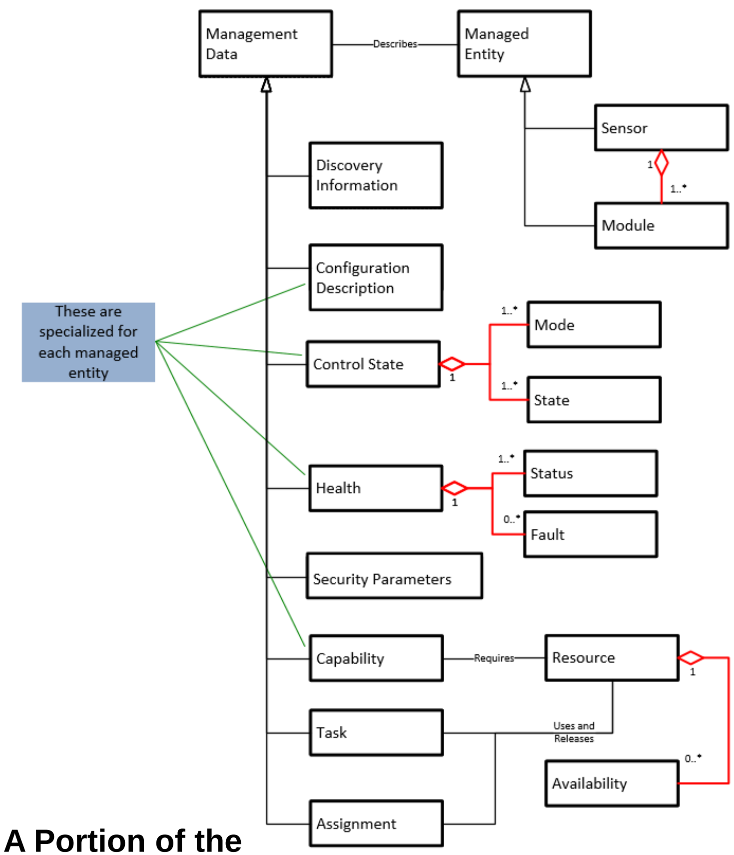
- Data Model defines the information content flowing between SOSA Modules
  - DIV-1 Conceptual Data Model
    - Overall data scheme
  - DIV-2 Logical Data Model
    - What is contained in data elements
  - DIV-3 Physical Data Model
    - How data elements are represented
- Interaction Categories define how the data is exchanged
  - E.g., Pub-Sub, Request-Response, etc.
- Messages define how those data items are conveyed



A Portion of the SOSA DIV-1

Interaction Categories and Data Purpose

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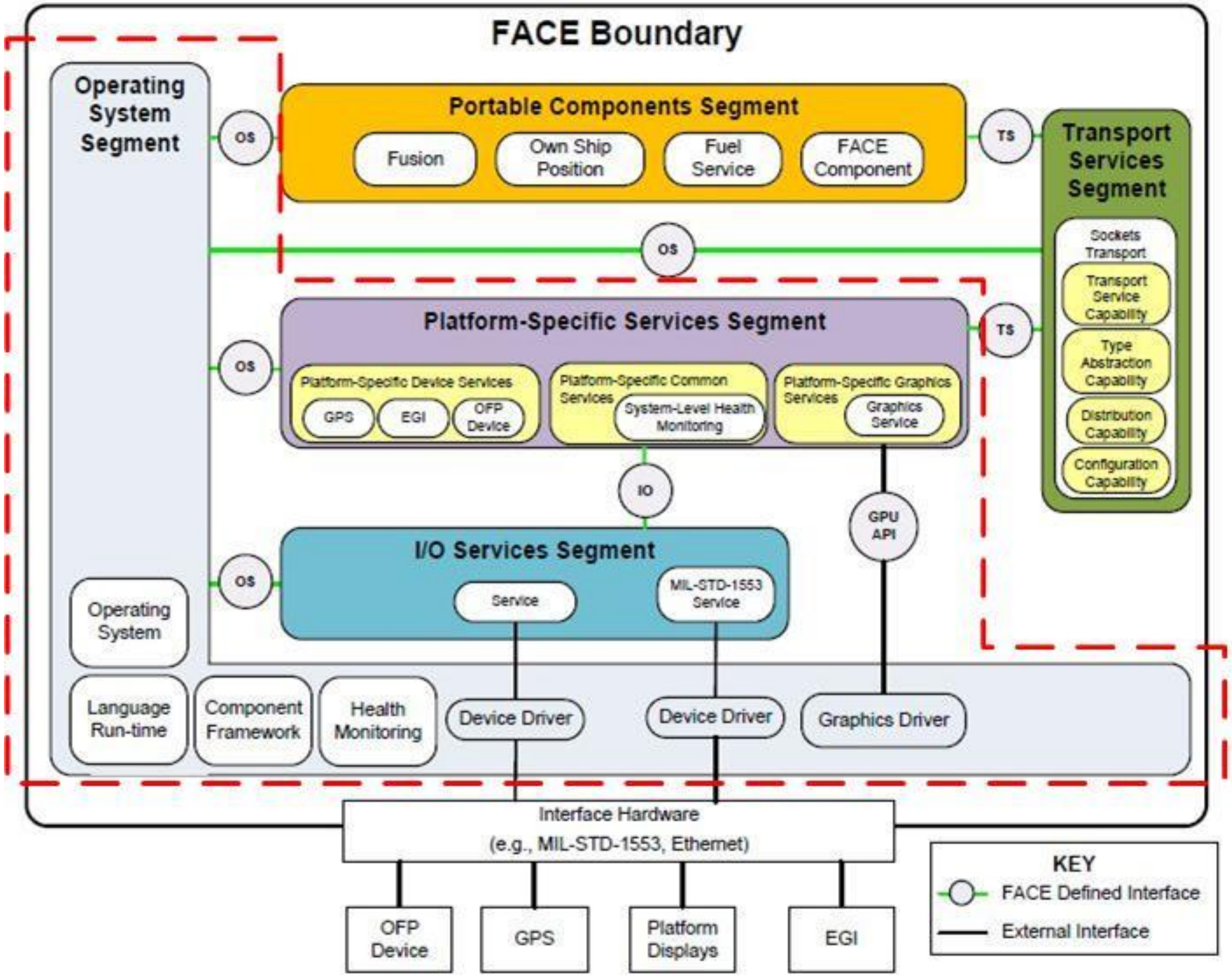
- Analog signal (e.g., RF, DC voltage)
- Request-Response
- Publish-Subscribe
- Bulk transfer (e.g., digital stream)
- Event Notification
- Secure Request-Response

- Mission Data
  - Related to the purpose of the system (e.g., sensing, PED, communications)
- Management Data
  - Related to control of the system

The differentiation of Mission Data and Management Data are reflected in the DIV-1 Conceptual Data Model

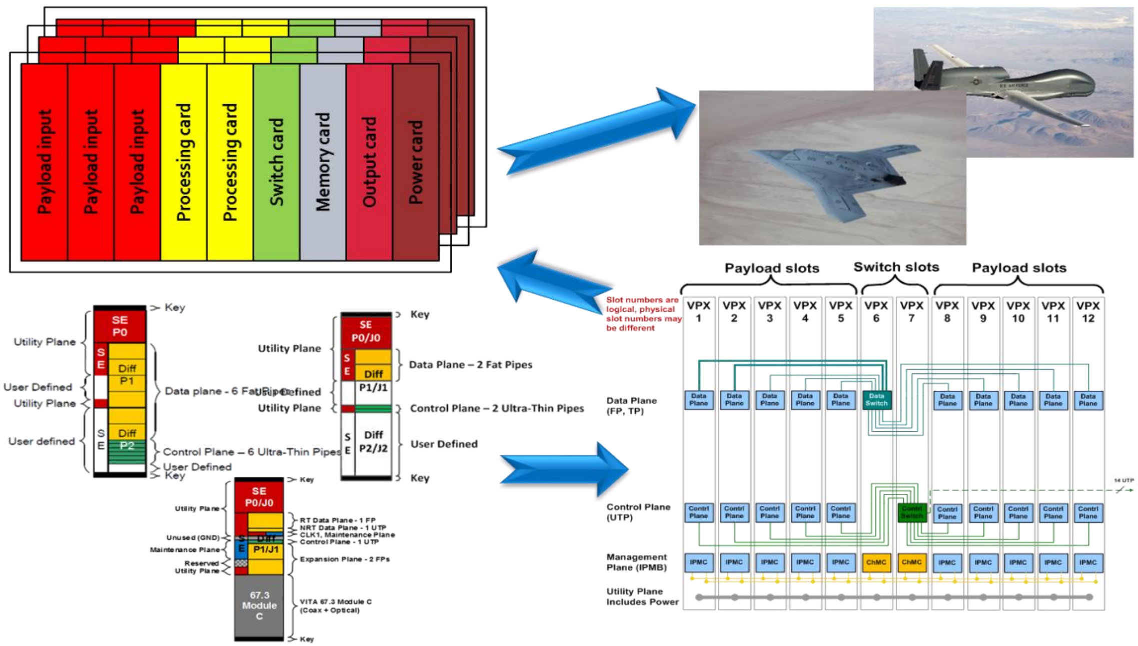
Candidate Software Runtime Environment Interface Based on the FACE™ Technical Architecture



SOSA Software Runtime Environment Interface (REI) <u>may</u> consist of SOSA application software interface to host system for language run time and calls to operating system services as defined by FACE OSS interface, SOSA platform specific software and low level I/O as defined by FACE PSSS and IOSS, SOSA operating system as defined by FACE (Posix, ARINC 653, C, C++, Java, and Ada)

Hardware Approach: "Box Level" Specification

- Applicable to a variety of sensor/avionics platforms
- Hardware Module defined here is an individual card that fits into the box).
- The system is inherently interoperable, compatible with non-Conformant hardware via a set of standard bridge interfaces that are
  - Plug-and-playable
  - Upgradeable (evolvable)
  - Securable
- Compatibility/alignment with
  - VITA standards
  - HOST
  - CMOSS



SOSA Hardware Module Development (Samples)

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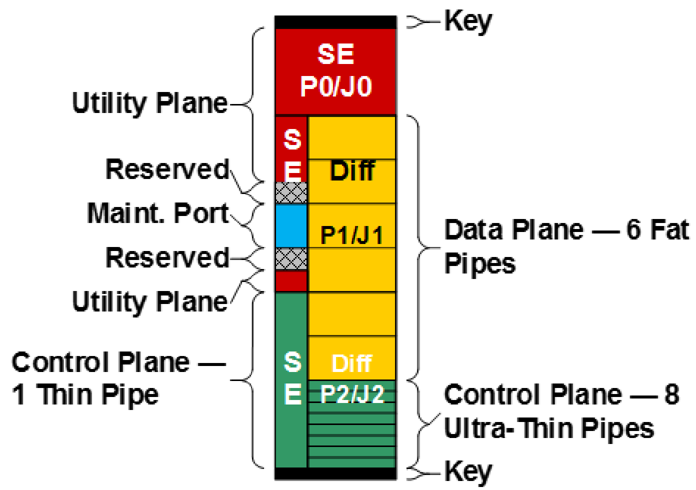
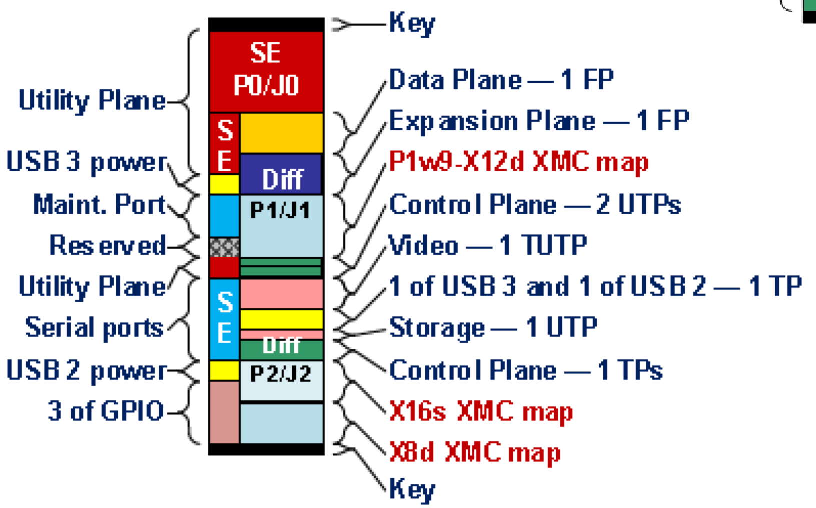
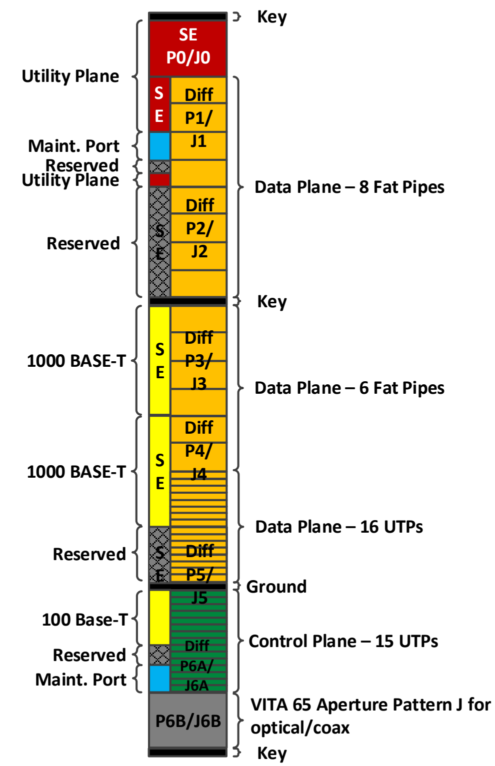
Control/Expansion Plane Switch



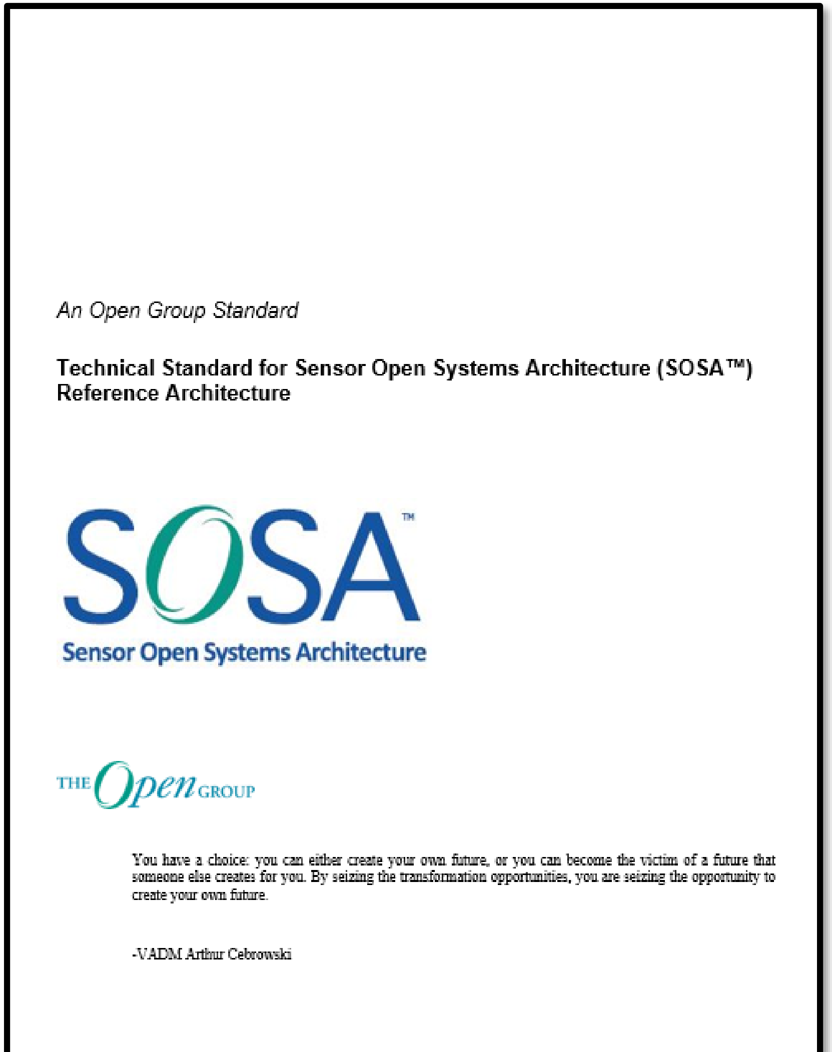
I/O Intensive SBC





6U Red/Black Switch

SOSA (Draft) Technical Standard


An Open Group Standard

Technical Standard for Sensor Open Systems Architecture (SOSA™) Reference Architecture

SOSA™

Sensor Open Systems Architecture

THE Open GROUP

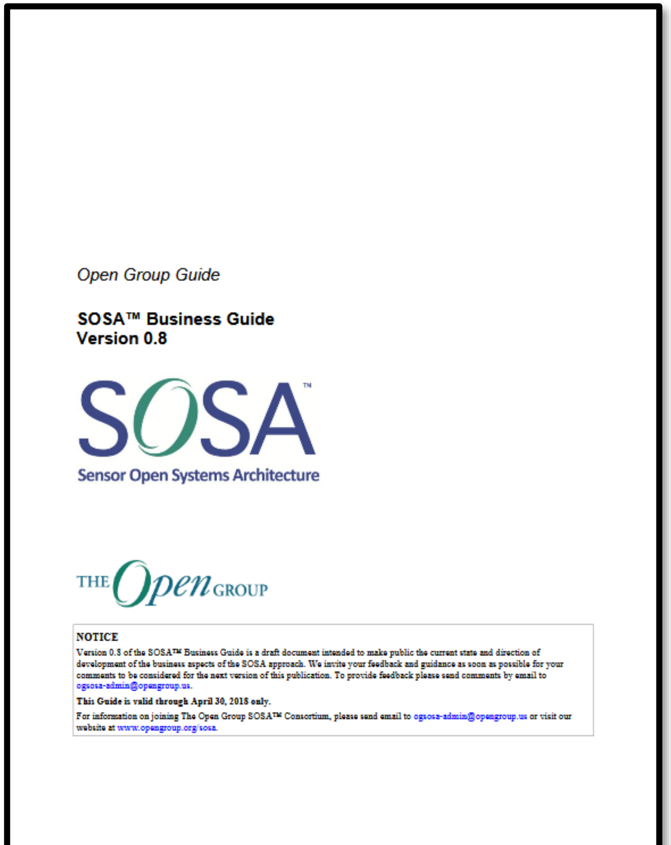
You have a choice: you can either create your own future, or you can become the victim of a future that someone else creates for you. By seizing the transformation opportunities, you are seizing the opportunity to create your own future.

-VADM Arthur Cebrowski

- Documents the SOSA Reference Architecture
- Contains normative and non-normative content
- Major Sections
  - Architecture Overview
  - Architecture Definition
  - SPSA Technical Standard
  - Appendices
    - StdV-1 (Applicable Standards)
    - AV-2 (Integrated Dictionary)
    - Use Cases
    - DIV-2 (Logical Data Model) and Data Dictionary
    - Host Platform / Sensor Connector Details
    - Slot Profiles
    - Backplane Examples

http://opengroup.org/sosa

SOSA Business Guide



Open Group Guide

SOSA™ Business Guide
Version 0.8

SOSA™
Sensor Open Systems Architecture

THE Open GROUP

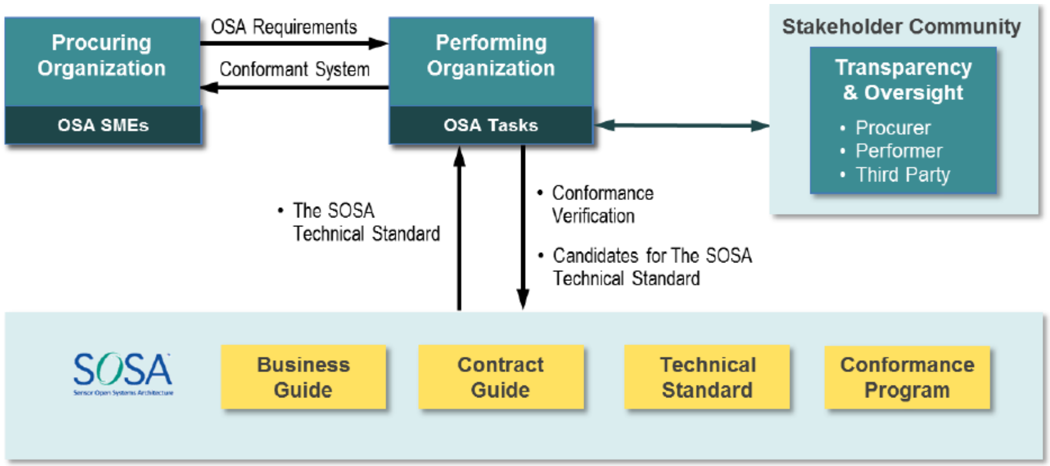
NOTICE

Version 0.8 of the SOSA™ Business Guide is a draft document intended to make public the current state and direction of development of the business aspects of the SOSA approach. We invite your feedback and guidance as soon as possible for your comments to be considered for the next version of this publication. To provide feedback please send comments by email to ogsosa-admin@opengroup.us.

This Guide is valid through April 30, 2018 only.

For information on joining The Open Group SOSA™ Consortium, please send email to ogsosa-admin@opengroup.us or visit our website at www.opengroup.org/sosa.

- Open Systems Architecture principles
- Business Model
- Value proposition for C4ISR open systems architecture
- Overview of the SOSA Technical Standard
- Examples of how the acquisition process is affected by OSA
- Guidance for writing solicitations that include SOSA requirements
- Examples of contracting language relevant to the inclusion of OSA



Key Take-Aways

- The SOSA Consortium is developing a unified modular, open reference architecture – and associated business model – for radar, EO/IR, SIGINT, EW, and communications
  - Following MOSA principles, gray box model to protect IP and encourage innovation
  - Structured, top-down approach: Quality Attributes, Architecture Principles, using DoDAF
- Using a consensus-body approach to balance interests of all parties
  - Five Working Groups: Architecture, Business, Electrical/Mechanical, Hardware, and Software
- Products include the SOSA Technical Standard and the Business Guide
  - Initial "Snapshots" have been released for both

How to Reach Us and Learn More

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http://opengroup.org/sosa

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