U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND – C5ISR CENTER

C5ISR/EW Modular Open Suite of Standards (CMOSS) Overview

Jason Dirner

Lead Electronics Engineer

AFC CCDC C5ISR Center I2WD CO2 ITA

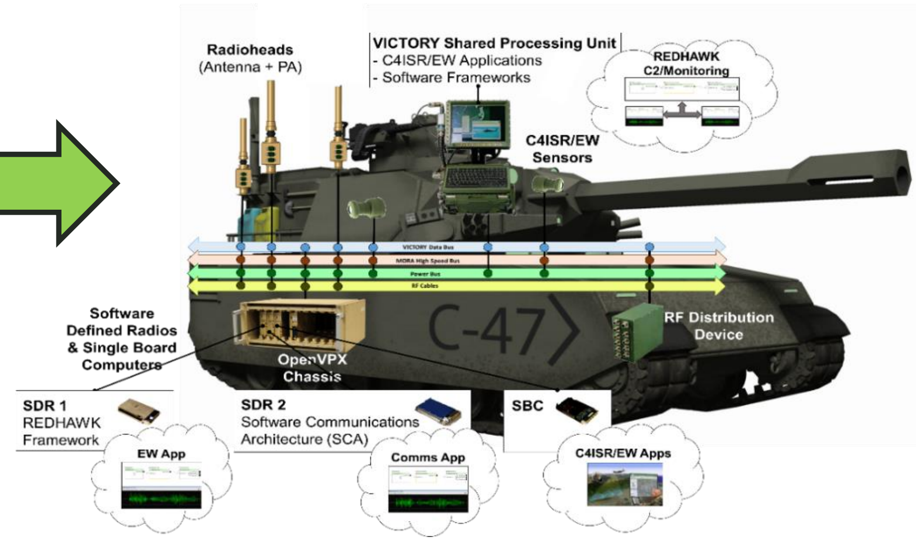
15 SEP 2020

CMOSS OVERVIEW

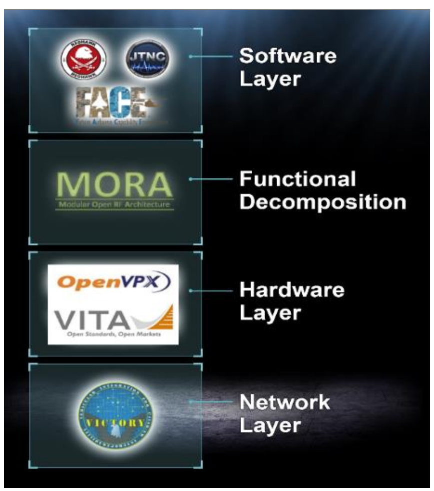
Why Converge?

CMOSS

CMOSS Architecture



C5ISR/EW Modular Open Suite of Standards (CMOSS)



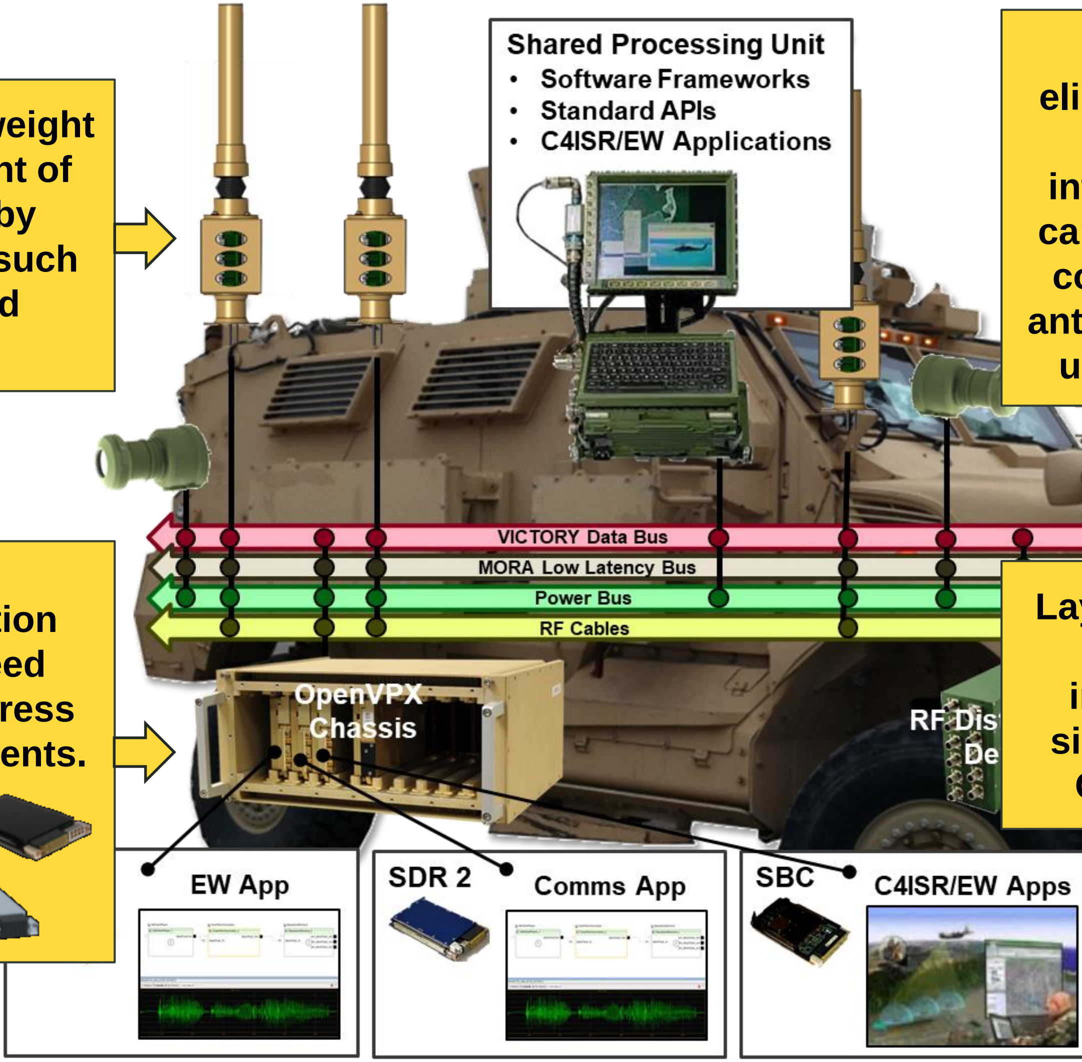
- CMOSS is a suite of standards to support the reduction of the size, weight and power of C5ISR and EW systems while increasing the flexibility and adaptability of these systems
  - Universal A-Kit – Project Managers field capabilities as cards into a common chassis
  - Pooled radio resources such as antennas and amplifiers for Communications, Electronic Warfare (EW), and Signals Intelligence (SIGINT) systems
  - Shared processing resources such as computers and displays
  - Shared data services such as Position, Navigation, and Time (PNT)
  - Foundation for enhanced interoperability and simultaneity between C5ISR systems
  - Reduced life cycle cost through increased competition, smaller logistics tails with common sparing, and upgrading to the latest hardware as parts are replaced
  - Rapid insertion of new technology/capability

Army, Air Force, and Navy collaborate under the SOSA Consortium to develop a holistic open architecture that leverages existing standards, maximizes economies of scale, and provides the flexibility to rapidly insert the latest capabilities to achieve Future Force Modernization.

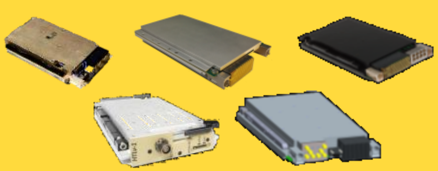
CMOSS ARCHITECTURE

Reduces the size, weight and power footprint of C4ISR systems by sharing hardware such as antennas and amplifiers.

Universal A-Kit eliminates the need for platform specific integration. PMs field capabilities as cards in common chassis and antennas/amplifiers that use existing cabling.



Enables rapid technology insertion using best of breed capabilities to address emerging requirements.

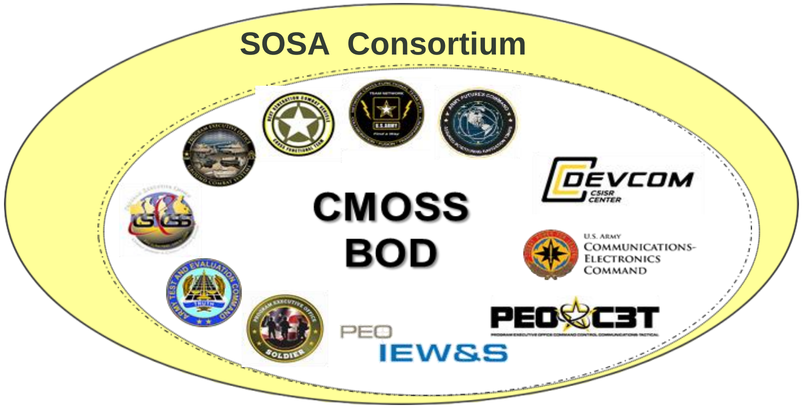


Lays the foundation for enhanced interoperability and simultaneity amongst C4ISR capabilities.

Reduces logistics tails by enabling common sparing. Eliminates the need for “End of Life” buys for a 30+ years sustainment by enabling hardware modernization every 5-10 years.

C5ISR CMOSS STRATEGY

ORGANIZE



EXECUTE

C5ISR Center CMOSS Strategy

Manage	• Manage and mature standards • Educate community • Application to relevant S&T
SIL	• Lab and development architecture • Transition deliverables • Compliance/performance tools and tests
Field Experiment	• Baseline platform architecture • Compliance/performance tests • Tech demonstrations

SYNCHRONIZE

- Multiple C5ISR Center CMOSS prototyping efforts
- Multi-Function Electronic Warfare - Air Large (MFEW-AL)
- Tactical Cyber Equipment - CMOSS Chassis (TCE-CC)
- Terrestrial Layer System (TLS)
- CMOSS Mounted Form Factor Abbreviated - Capability Development Document (CMFF A-CDD)
- N-CFT TEM 4 – CMOSS
- Assured Positioning, Navigation Timing (A-PNT) Prototyping
- PM Tactical Radios (TR) CMOSS SBIRs
- A-PNT Open Innovation Lab (OIL)
- Tri-Service Open Architecture Interoperability Demonstration (TSOA-ID)

JOINT CFT/PEO/S&T GOVERNANCE AND EXECUTION

ENDORSEMENTS AND DIRECTIVES

Tri-Service

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

JAN 7 2019

MEMORANDUM FOR SERVICE ACQUISITION EXECUTIVES AND PROGRAM EXECUTIVE OFFICERS

SUBJECT: Modular Open Systems Approaches for our Weapon Systems is a Warfighting Imperative

Victory in future conflict will in part be determined by our ability to rapidly share information across domains. Sharing information from machine to machine requires common standards.

For the past several years, each of the Services has been developing, demonstrating, and validating common data standards through a cooperative partnership with industry and academia. This work has resulted in the establishment of Open Mission Systems/Universal Command and Control Interface (OMS/UCI), Sensor Open Systems Architecture (SOSA), Future Airborne Capability Environment (FACE) and Vehicular Integration for C4ISR/EW Interoperability (VICTORY) among other standards.

We have reviewed the capabilities of these common standards. We determined the continued implementation of these standards, and further development of Modular Open Systems Approach (MOSA) standards in areas where we lack them is vital to our success. As such, MOSA supporting standards should be included in all requirements, programming and development activities for future weapon system modifications and new start development programs to the maximum extent possible.

In an effort to formalize our approach to MOSA, Service Acquisition Executives will publish specific implementation guidance for our acquisition programs. Additionally, Standardization Executives should continue standards development efforts where we have gaps. Lastly, requirements and programming functions will ensure MOSA is reflected in our requirements and programs to ensure our future weapon systems can communicate and share across domains.

Richard V. Spencer
Secretary of the Navy

Mark T. Esper
Secretary of the Army

Heather Wilson
Secretary of the Air Force

Modular Open Systems Approaches for our Weapon Systems is a Warfighting Imperative

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PM EW&C

DEPARTMENT OF THE ARMY
PROGRAM EXECUTIVE OFFICE
INTELLIGENCE, ELECTRONIC WARFARE AND SENSORS
BUILDING 6002, 6585 SURVEILLANCE LOOP
ABERDEEN PROVING GROUND, MD 21005-1845

SFAE-IEW-EW 26 June 2019

MEMORANDUM FOR RECORD

SUBJECT: Utilization of the Electronic Warfare & Cyber C4ISR/EW Modular Open Suite of Standards (EW&C CMOSS)

1. References:

a. Memorandum, "Modular Open Systems Approach (MOSA) – Tri-Service Memo," OSA, OSN, OSAF, dated 7 January 2019.

b. Document, Project Manager Electronic Warfare & Cyber (PM EW&C), Technical Management Division (TMD), EW&C CMOSS definition, dated 24 June 2019

2. As the Chartered Materiel Developer for Army Electronic Warfare & Cyber Programs of Record as well as Delegated Milestone Decision Authority (MDA) for Operational Need statements: #16-21509, and #17-22579, I approve and direct the use of the EW&C CMOSS for use and integration of all future Project Manager Electronic Warfare & Cyber Systems where applicable.

2 Encls
1. Tri-Service Memo, 7 JAN 19
2. EW&C CMOSS, 24 JUN 19

KEVIN E. FINCH
Colonel, AC/FA
Project Manager, Electronic Warfare & Cyber

Utilization of Electronic Warfare & Cyber C4ISR/EW Modular Open Suite of Standards (EW&C CMOSS)

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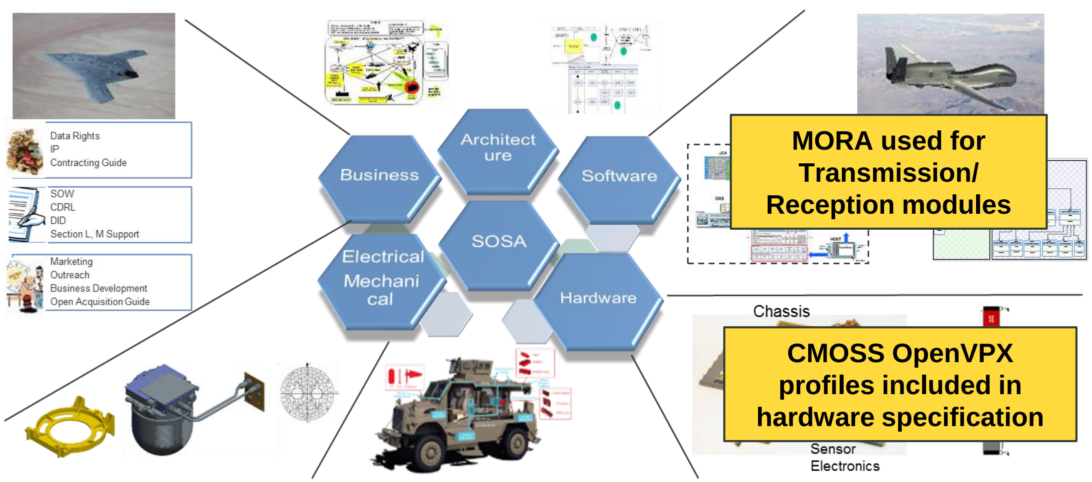
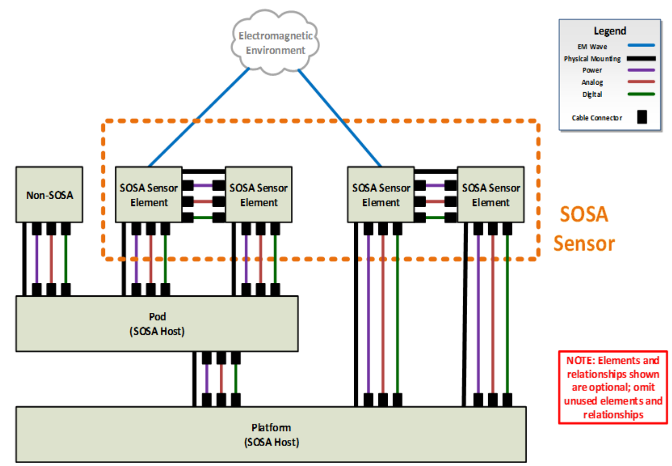
ON-GOING CMOSS EFFORTS

- **Programs of Record**
  - Product Lead Electronic Attack (PdL EA) Multi-Function Electronic Warfare Air Large (MFEW-AL) Electronic Attack / Electronic Warfare Support pod on a Gray Eagle unmanned aircraft system
  - Product Manager Information Warfare (PdM IW) Tactical Cyber Equipment - CMOSS Chassis (TCE-CC) manpack chassis and Bionic Commando Cyber-Electromagnetic Activities (CEMA) card
  - Product Manager Terrestrial Spectrum Warfare (PdM TSW) Terrestrial Layer System (TLS) SIGNT, EW, and Cyber-enabling integrated solution
- **Requirements**
  - CMOSS Mounted Form Factor (CMFF) Abbreviated – Capability Development Document (A-CDD) for a CMOSS chassis including cards for PNT, Mission Command, Communications, and EW
- **Prototype Efforts**
  - TSM and USRP radio cards
  - CMOSS-capable cryptographic subsystem (CSS) via RESCUE
  - Proof of concept of JBC-P/MMC hosted on a single board computer (SBC)
  - Multiple CMOSS-based Mounted Assured PNT System (MAPS) prototypes
  - CMOSS-based Tactical SIGINT (TSIG) system integrated into Stryker platform
  - Small Business Innovation Research (SBIR) efforts for Radioheads and SDR cards
  - Digital / analog Radiohead prototyping

SENSOR OPEN SYSTEMS ARCHITECTURE™ (SOSA) CONSORTIUM

- Initiated by AFLCMC at Wright-Patterson Air Force Base, OH
  - Working group under the FACE Consortium formed in November 2015
  - Independent Open Group consortium stood up in November 2017
  - Air Force, Army, Navy, and industry participation with 100 member organizations
- SOSA™ Consortium enables Government and Industry to collaboratively developed open standards for use across the C5ISR community
  - Accelerate the development of affordable, agile, and composable sensor systems
  - Enable common components for Radar, SIGINT, EW, Communications, and EO/IR sensors
  - SOSA™ Technical Standard defines architecture modules with well defined open interfaces
  - SOSA™ Business Guide, Contracting Guide, and Conformance Plan facilitate future acquisitions





CMOSS is aligned with the SOSA™ Technical Standard

SOSA CONSORTIUM MEMBERS & CMOSS RELATIONSHIP

SOSA™ Sponsors

- Air Force Life Cycle Management Center
- Collins Aerospace
- Joint Tactical Networking Center
- Lockheed Martin
- NAVAIR
- U.S. Army CCDC C5ISR Center
- U.S. Army PEO Aviation
- U.S. Army Project Manager Electronic Warfare and Cyber

SOSA™ Principals

- BAE Systems, Inc.
- Elbit Systems of America
- FLIR Systems, Inc.
- GE Aviation Systems
- General Dynamics
- L3Harris
- Mercury Systems
- Northrop Grumman
- Physical Optics Corporation
- Raytheon
- Sierra Nevada Corporation
- SRC Inc.

SOSA™ Consortium - Brings together DoD, industry, and academia under a *rigorous consensus based approach* for standards development. SOSA Leverages CMOSS development. The consortium has 100 members. US Army CMOSS developers serve in many key roles within the consortium.

CMOSS - Standards developed and maintained by the US Army to support Army procurements which *respond to program office* schedules and needs. We strive to maintain alignment between CMOSS and the SOSA™ Technical Standard.

The SOSA Standard represents both governmental and industry organizations with 100 members

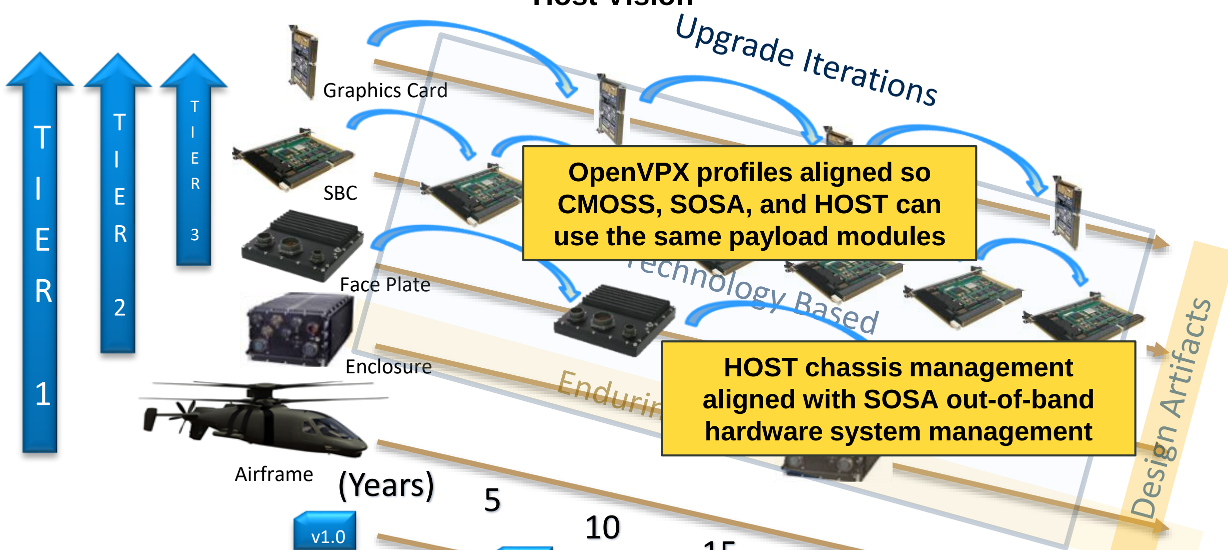
SOSA™ Associates

- Abaco Systems
- Acromag, Inc.
- Aegis Power Systems
- Aitech Defense Systems, Inc.
- Ampro ADLINK Technology, Inc.
- Anduril Industries, Inc.
- Annapolis Micro Systems, Inc.
- Behlman Electronics, Inc.
- Bliley Technologies
- CACI International, Inc.
- Cobham Advanced Electronic Solutions Inc.
- Concurrent Technologies
- CoreAVI
- COTSWORKS, LLC
- CRFS, Inc.
- Critical Frequency Design
- Crossfield Technology
- Curtiss-Wright Defense Solutions
- Dawn VME Products
- Delta Information Systems
- DornerWorks
- DRS Signal Solutions
- DRTI
- EIZO Rugged Solutions, Inc.
- Elma Electronic Inc.
- Epiq Solutions
- FEI-Elcom Tech, Inc.
- Freedom Power Systems, Inc.
- Georgia Tech Research Institute
- GORE
- Great River Technology, Inc.
- Herrick Technology Laboratories, Inc.
- Interface Concept Inc.
- iRF Solutions
- Jovian Software Consulting LLC
- KEYW Corporation
- Kontron America
- LCR Embedded Systems, Inc.
- Lead Dog Technologies, LLC
- Leidos
- LGS Innovations
- Mellanox Federal Systems
- Meritec
- Micro Focus (US), Inc.
- Midwest Microwave Solutions Inc
- Milpower Source
- Motorola Solutions
- New Wave Design and Verification, LLC
- North Atlantic Industries, Inc.
- OAR Corporation
- Orion Technologies, LLC
- Orolia Defense & Security, LLC
- Pacific Star Communications, Inc.
- PCI Systems Inc.
- Pentek, Inc.
- Perspecta Labs Inc.
- QRC Technologies, LLC
- RADA Technologies, LLC (RADA USA)
- Rantec Power Systems, Inc.
- Real-Time Innovations
- Reflex Photonics Corp.
- Riverside Research
- RTD Embedded Technologies, Inc.
- Samtec
- Selex Galileo Inc.
- SimVentions
- Skayl LLC
- SMART Embedded Computing, Inc.
- Southwest Research Institute
- Spectranetix, Inc.
- SR Technologies, Inc.
- Star Lab Corp
- SV Microwave
- TE Connectivity
- Telephonics
- Tucson Embedded Systems
- University of Dayton Research Institute
- VITA
- VTS, Inc.
- Wolf Advanced Technology Inc.

HARDWARE OPEN SYSTEMS TECHNOLOGIES (HOST)

- Initiated by US Navy's Naval Air Systems Command (NAVAIR) at Patuxent River, MD in 2014
- Specification methodology for state-of-the-art embedded systems development and acquisition
  - Compilation of established industry standards such as OpenVPX and IPMI
  - Flexibility to add new Tier 2 standards for other technologies
  - Initial focus on airborne mission processing
- Focused on establishing interoperability and interchangeability at the module level

Host Vision



- Tier 1: Universal requirements that apply to all HOST components
- Tier 2: Technology specific requirements (e.g., OpenVPX)
- Tier 3: Module level requirements used to create component registry

HOST chassis management augments CMOSS network layer interoperability to provide enhanced system management

SUMMARY

- Built upon open standards, CMOSS enables the soldier for the next fight while providing significant cost savings during the procurement and sustainment phases of the life-cycle
- Multiple CMOSS efforts are on-going providing EW, SIGINT, Comms, and Cyber capabilities
- CMOSS is being aligned with the SOSA™ Consortium with Army, Air Force, and Navy participation
- The CMOSS specifications can be obtained from:
  - VICTORY (https://www.victory-standards.org/index.php/publicly-available-documents)
  - MORA (https://www.victory-standards.org/index.php/publicly-available-documents)
  - OpenVPX (http://www.vita.com)
  - REDHAWK (https://redhawksdr.github.io/Documentation)
  - SCA (http://www.public.navy.mil/jtnc)
  - FACE (http://www.opengroup.org/face)
  - SOSA (http://www.opengroup.org/sosa)

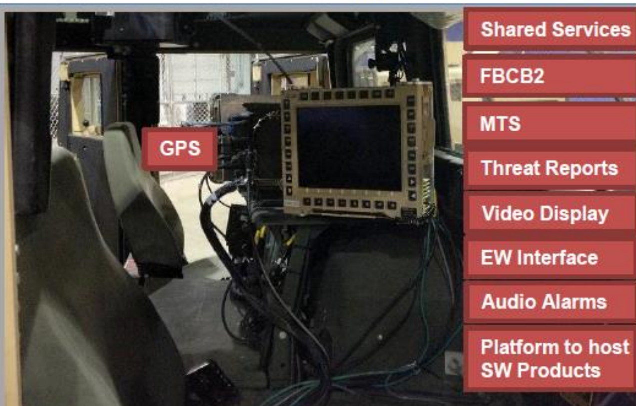
TECHNICAL OVERVIEW

VEHICULAR INTEGRATION FOR C4ISR/EW INTEROPERABILITY (VICTORY)

Traditional Approach

"Bolt On" Mission Equipment Integration

VICTORY Approach



VICTORY Data Bus enables interoperability across C4ISR/EW and platform systems

Adds a network data bus to vehicles

- Specifies "on-the-wire" network-based interfaces for discovery, management, health publishing, and data exchange
- Provides shared hardware and user interface hardware
- Provides shared services including time synchronization, position, orientation, and direction of travel
- Supports IA requirements and "defense in depth" security designs

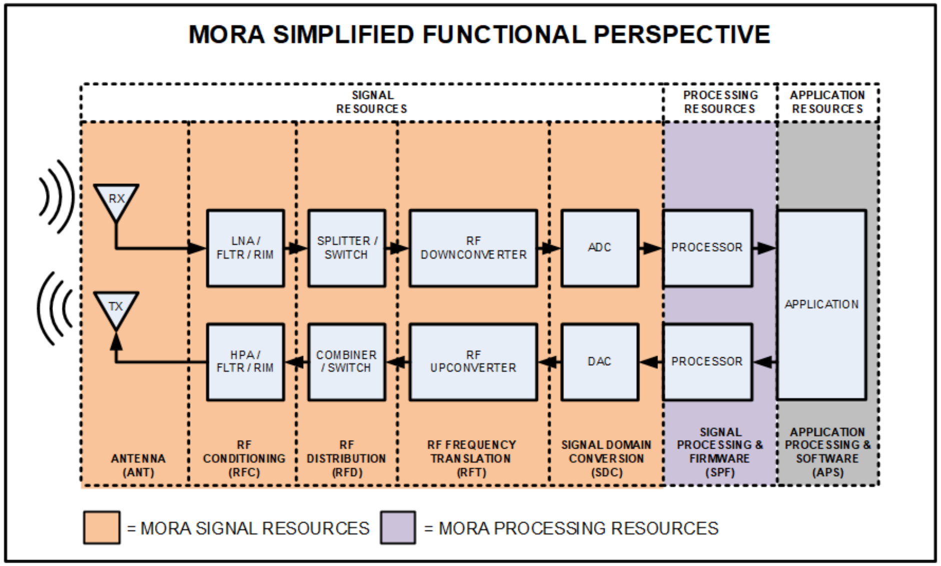
VICTORY leverages the following commercial technologies:

- SOAP-based web services and Simple Network Management Protocol (SNMP) for management
- Syslog over UDP and SNMP for health publishing
- VICTORY Data Messages (VDMs) for data distribution
  - XML application layer payload encapsulated in a VDM-specific binary header
  - Multicast UDP provides a simple publish/subscribe paradigm
- Zero Configuration Networking (Zeroconf) for node and service discovery

VICTORY enables interoperability across C4ISR, EW, and platform systems on Army ground vehicles. Technical approach is applicable to air, sea, and subsurface platforms.

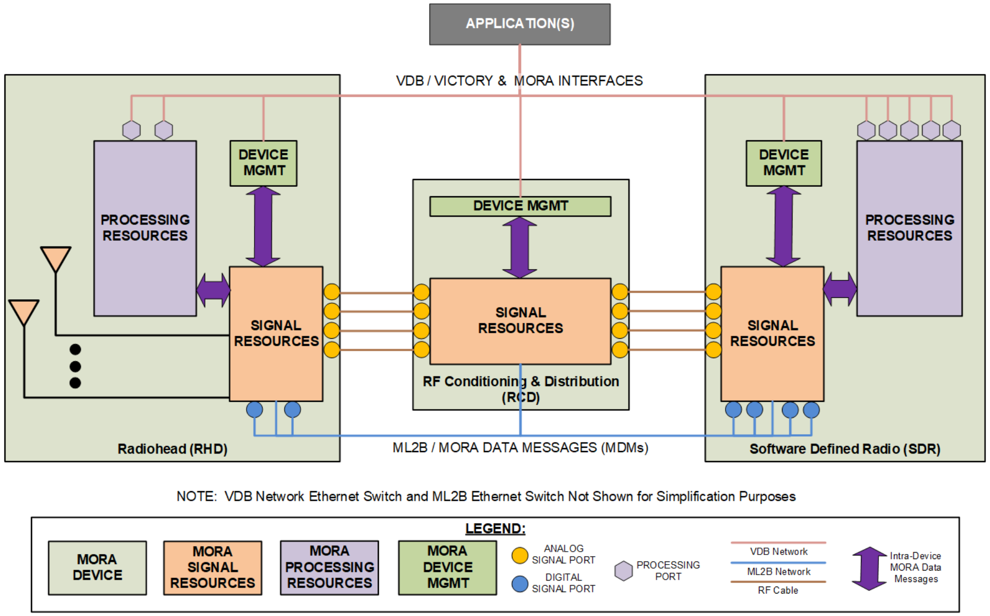
MODULAR OPEN RF ARCHITECTURE (MORA) OVERVIEW

- MORA integrates VICTORY and VITA Radio Transport (VITA 49.2) to standardize access and control of the RF chain
- Decomposes the RF chain into the following signal resources:
  - Antennas (antenna elements / arrays)
  - RF Conditioning (e.g., LNAs, filters and HPAs)
  - RF Distribution (e.g., RF switches)
  - RF Frequency Translation (e.g., tuners and up converters)
  - Signal Domain Conversion (e.g., ADCs and DACs)



MODULAR OPEN RF ARCHITECTURE (MORA) RESOURCE MANAGEMENT

- Resource management occurs over different physical links than control and data due to performance and security considerations
- Discovery and allocation occur in non real-time (milliseconds or seconds) over the VICTORY Data Bus (VDB)
  - Leverages SOAP-based web services with MORA defined WSDLs and schemas
  - Inherits the IA controls and attribute-based access control (ABAC) framework provided by VICTORY
  - Priority-based resource reservation restricts control to a single entity at a given time
  - Data can be subscribed to by multiple entities
  - Interfaces enable but do not prescribe implementation of the resource manager itself



MODULAR OPEN RF ARCHITECTURE (MORA) CONTROL AND DATA

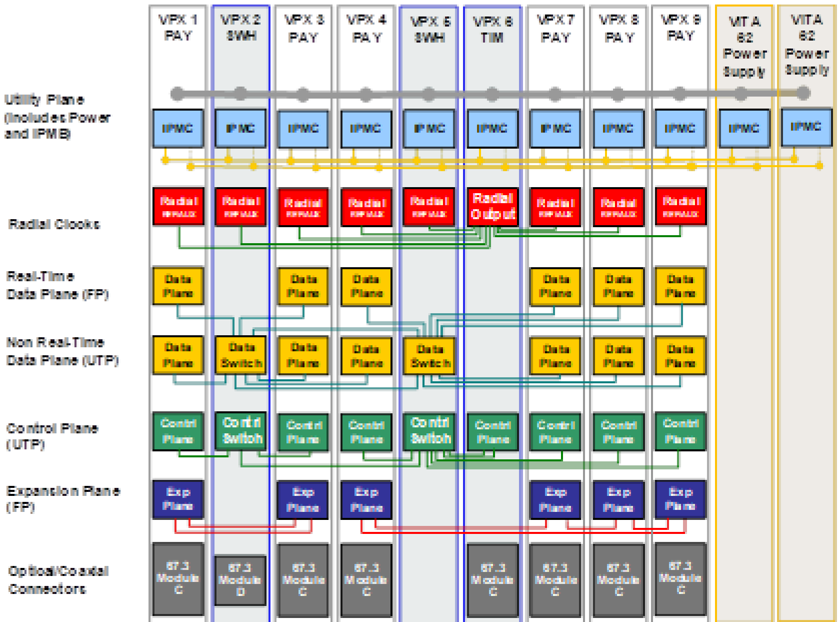
- RF control and data distribution occur in real-time (microseconds) over the MORA Low Latency Bus (ML2B)
- MORA Data Message (MDM) binary header encapsulates VITA 49.2
  - Enables ACK-based reliable delivery over UDP without degrading performance
  - Data and context messages use multicast for one-to-many distribution
  - Different Ethernet and IP service classes defined for control and data packets
- MORA necks down VITA 49.2 to ensure interoperability
  - Limits packet types that are supported
  - Identifies required fields
  - Limits field options such as timestamp and data format
  - Defines the Discrete I/O field to replace discrete signals

Bit	CIF 0 (VITA 49.0) *Legacy Fields, CIF enables*	CIF 1 (VITA 49.2) *Spatial, Signal, Spectral, I/O, Ctl*	CIF 2 (VITA 49.2) *Identifiers (tags)*	CIF 3 (VITA 49.2) *Temporal, Environmental*	CIF 7 (VITA 49.2) *Attributes*
31	Context Field Change Indicator	Phase	Bind	Timestamp Details	Current Value
30	Reference Point Identifier	Polarization	Cited SID	Timestamp Skew	Average Value
29	Bandwidth	3-D Pointing Vector	Sibling(s) SID	*Reserved*	Median Value
28	IF Reference Frequency	3-D Pointing Vector Structure	Parent(s) SID	*Reserved*	Standard Deviation
27	RF Reference Frequency	Spatial Scan Type	Child(ren) SID	Rise Time	Max Value
26	RF Reference Frequency Offset	Spatial Reference Type	Cited Message ID	Fall Time	Min Value
25	IF Band Offset	Beamwidth	Controllee ID	Offset Time	Precision
24	Reference Level	Range (Distance)	Controllee UUID	Pulse Width	Accuracy
23	Gain	*Reserved*	Controller ID	Period	1st Derivative (Velocity)
22	Over-range Count	*Reserved*	Controller UUID	Duration	2nd Derivative (Acceleration)
21	Sample Rate	*Reserved*	Information Source	Dwell	3rd Derivative
20	Timestamp Adjustment	Eb/No BER	Track ID	Jitter	Probability
19	Timestamp Calibration Time	Threshold	Country Code	*Reserved*	Belief
18	Temperature	Compression Point	Operator	*Reserved*	*Reserved*
17	Device Identifier	2nd and Third-Order Intercept Points	Platform Class	Age	*Reserved*
16	State/Event Indicators	SNR/Noise Figure	Platform Instance	Shelf Life	*Reserved*
15	Signal Data Packet Payload Format	Aux Frequency	Platform Display	*Reserved*	*Reserved*
14	Formatted GPS	Aux Gain	EMS Device Class	*Reserved*	*Reserved*
13	Formatted INS	Aux Bandwidth	EMS Device Type	*Reserved*	*Reserved*
12	ECEF Ephemeris	*Reserved*	EMS Device Instance	*Reserved*	*Reserved*
11	Relative Ephemeris	Array of CIFS	Modulation Class	*Reserved*	*Reserved*
10	Ephemeris Ref ID	Spectrum	Modulation Type	*Reserved*	*Reserved*
9	GPS ASCII	Sector Scan/Step	Function ID	*Reserved*	*Reserved*
8	Context Association Lists	*Reserved*	Mode ID	*Reserved*	*Reserved*
7	Field Attributes Enable	Index List	Event ID	Air Temperature	*Reserved*
6	*Reserved for CIF expansion*	Discrete I/O (32-bit)	Function Priority ID	Sea/Ground Temperature	*Reserved*
5	*Reserved for CIF expansion*	Discrete I/O (64-bit)	Communication Priority ID	Humidity	*Reserved*
4	*Reserved for CIF expansion*	Health Status	RF Footprint	Barometric Pressure	*Reserved*
3	CIF 3 Enable	V49 Spec Compliance	RF Footprint Range	Sea and Swell State	*Reserved*
2	CIF 2 Enable	Version and Build Code	*Reserved*	Tropospheric State	*Reserved*
1	CIF 1 Enable	Buffer Status	*Reserved*	Network ID	*Reserved*
0	*Reserved*	*Reserved*	*Reserved*	*Reserved*	*Reserved*

Allowed VITA 49.2 Context/Command Indicator Fields (CIF)

DOD OPENVPX PROFILES

Example Backplane



Supports DoD-specific concerns including:

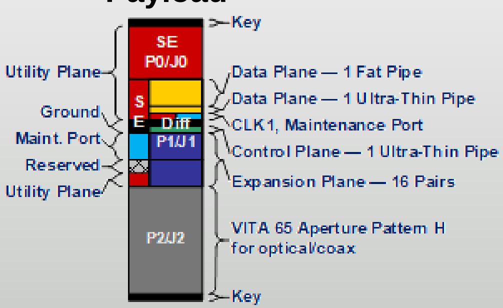
- Connectivity for the VICTORY Data Bus (Control Plane) and MORA Low Latency Bus (Real-Time Data Plane)
- Radial clock distribution for phase coherent operation
- Blind-mate optical and coaxial connectors for two-level maintenance

Maximizes interoperability by:

- Specifying a single slot profile for each type of card (e.g., Payload, Radial Clock, etc.)
- Limiting protocols to a single technology family
  - Ethernet for Control and Data Planes
  - PCIe for Expansion Plane
- Limiting the use of user-defined pins

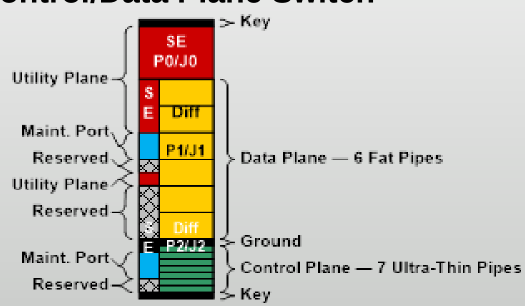
Slot Profiles

Payload



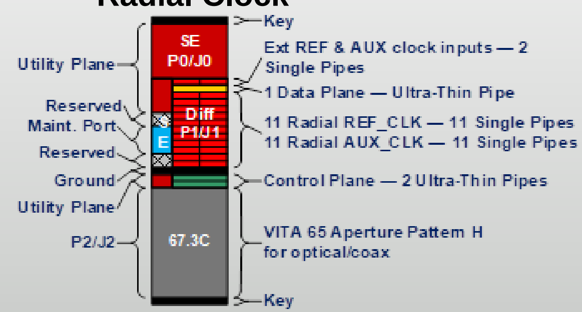
RF and Computing
SLT3-PAY-1F1U1S1S1U1U2F1H-14.6.11-0/4

Control/Data Plane Switch



SLT3-SWH-6F1U7U-14.4.14
SLT3-SWH-4F1U7U1J-14.8.7-n

Radial Clock

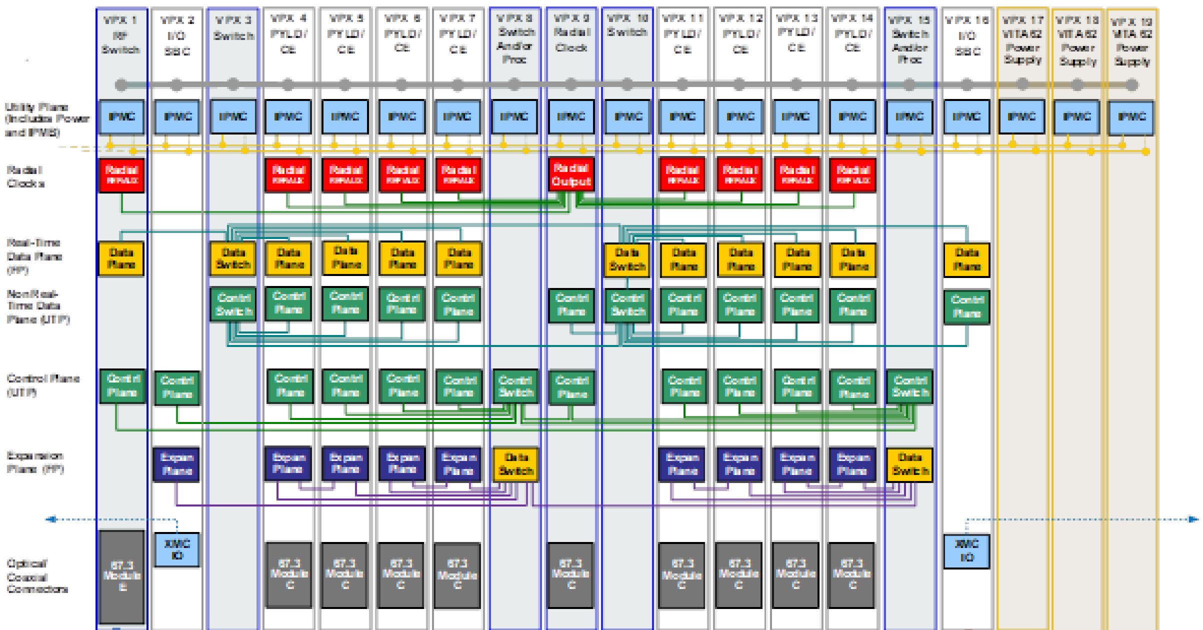


Position, Navigation, and Timing
SLT3x-TIM-2S1U22S1U2U1H-14.9.2-1

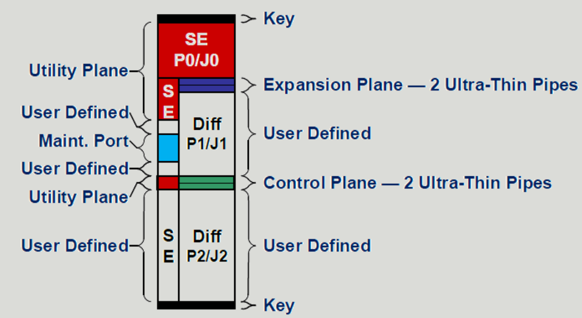
Refer to SOSA™ Technical Standard for additional details

DOD OPENVPX PROFILES

Example Backplane



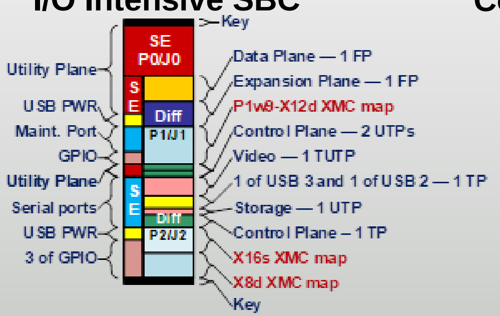
External I/O



Platform Specific I/O
SLT3-PAY-2U2U-14.2.17

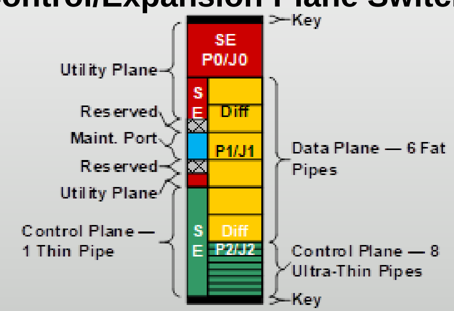
Slot Profiles

I/O Intensive SBC



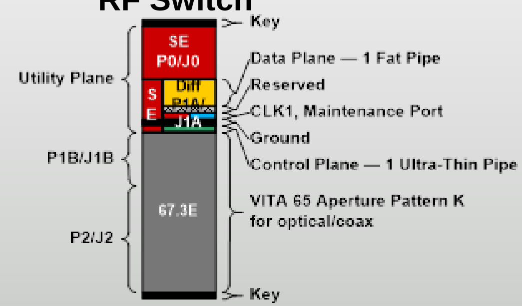
Platform I/O
SLT3-PAY-1F1F2U1TU1T1U1T-14.2.16

Control/Expansion Plane Switch



Ethernet and PCIe
SLT3-SWH-6F8U-14.4.15

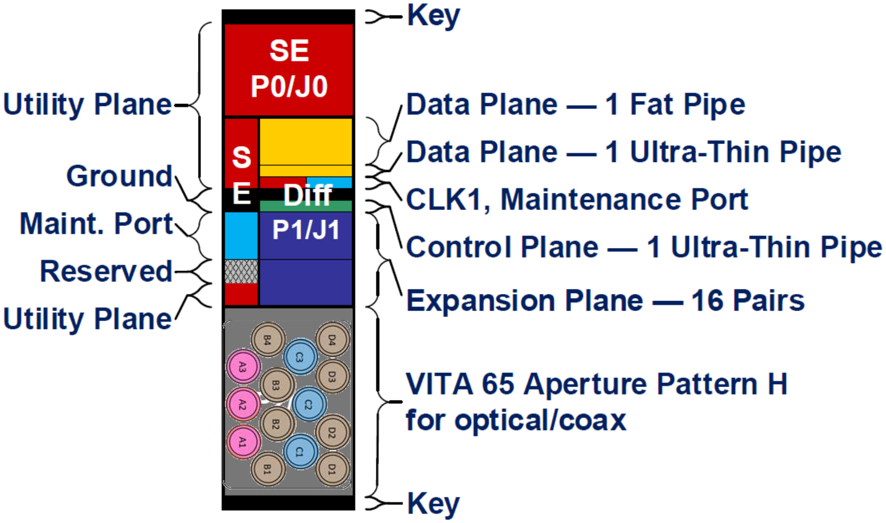
RF Switch



Analog RF Distribution
SLT3-SWH-1F1S1S1U1U1K-14.8.8-n

Refer to SOSA™ Technical Standard for additional details

PAYLOAD SLOT PROFILE SLT3-PAY-1F1U1S1S1U1U2F1H-14.6.11-4



- VITA 67.3 Module C provides coax and/or fiber over the backplane
  - 14 coax connections using SMPM pins
  - Coaxial pin assignment is as follows:

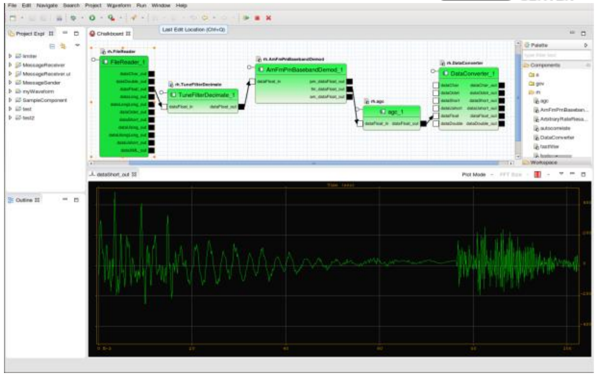
Module Type	Channel 67.3C SMPM Designation							
	1	2	3	4	5	6	7	8
1 Channel Module	B1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 Channel Module	B1	B4	N/A	N/A	N/A	N/A	N/A	N/A
3 Channel Module	B1	B4	D1	N/A	N/A	N/A	N/A	N/A
4 Channel Module	B1	B4	D1	D4	N/A	N/A	N/A	N/A
5 Channel Module	B1	B4	D1	D4	B2	N/A	N/A	N/A
6 Channel Module	B1	B4	D1	D4	B2	B3	N/A	N/A
7 Channel Module	B1	B4	D1	D4	B2	B3	D2	N/A
8 Channel Module	B1	B4	D1	D4	B2	B3	D2	D3

  - 6 user-defined pins for coherent operation across payloads (e.g., local oscillator distribution)
  - Future support for optical interfaces using high density MT ferrules

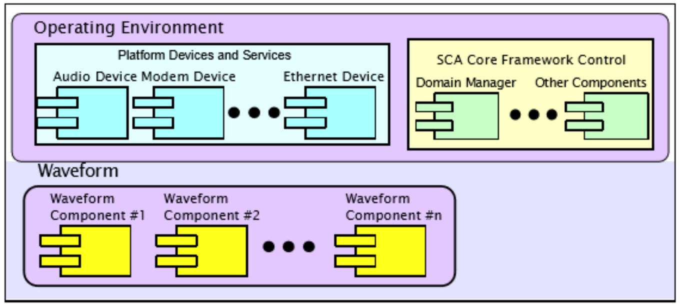
- Control Plane (1 Ultra-Thin Pipe)
  - Ethernet
  - Routed over backplane in star topology using switch card
  - Monitoring/management over the VICTORY Data Bus
- Real-Time (RT) Data Plane (1 Fat Pipe)
  - Ethernet
  - Routed over backplane in star topology using switch card
  - Real-time control over the MORA Low Latency Bus
- Non Real-Time (NRT) Data Plane (1 Ultra-Thin Pipe)
  - Ethernet
  - Routed over backplane in star topology using switch card
  - Non real-time control over the MORA Low Latency Bus
- Expansion Plane (2 Fat Pipes)
  - EP00 – EP03: PCIe
  - EP04 – EP07: PCIe / User Defined
  - Routed over backplane in ring or star topology
  - Supports tight coupling of adjacent cards
- Maintenance Port provides console for use during board maintenance
- Radial clocks terminated on plug-in module
  - 1 PPS AUX_CLK
  - 100 MHz REF_CLK
- Data Plane separated from Control Plane by an unused Ultra-Thin Pipe (GND)
- Only uses 12V, 3.3V_AUX, and VBAT to maximize portability

SOFTWARE FRAMEWORKS

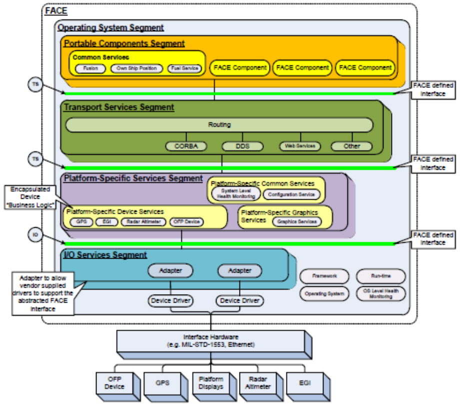
- Enable portability of software applications across hardware platforms
- Appropriate software framework is dependent on mission area
  - REDHAWK: Free and Open Source Software (FOSS) Software Defined Radio (SDR) framework
  - Software Communications Architecture (SCA): Developed by JTNC for Comms applications
  - Future Airborne Capability Environment (FACE): Developed by NAVAIR PMA-209 for avionics applications
- Software frameworks can be integrated with network layer to maximize reuse and leverage existing capabilities
  - MORA REDHAWK Device
  - VICTORY Platform-Specific Services Segment (PSSS) within FACE



REDHAWK IDE (from REDHAWK website)



Composition of a SCA System (from SCA Specification V4.1)



Architecture Segments Example (from FACE Technical Standard 2.1)