FACE™ Master Class

April 28, 2016

IOA 2016
London, England

-Presenters-

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Lockheed Martin Corporation
Chair: FACE Business Working Group

Jeffry A Howington
Rockwell Collins
Vice Chair: Steering Committee

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FACE™ Master Class Agenda

- Introduction
- FACE Coordination With Other Open Architecture Initiatives
- Conformance & Library Overview and Processes
- Break
- Technical Overview

Future Airborne Capability Environment

FACE Steering Committee POCs

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Future Airborne Capability Environment

- The FACE Concept is a government-industry software standard and business strategy:

- The FACE Technical Standard:
  - An open avionics standard of standards to facilitate robust, interoperable, portable and secure avionics capability

- The FACE Business Strategy:
  - Designed to facilitate the acquisition of affordable software systems

FACE Consortium

- Member Composition:
  - Industrial Supply Chain
  - US Army, US Navy, US Air Force
- Voluntary Consensus Based Standards Development Activity:
  - Industrial Supply Chain
  - US Army, US Navy, US Air Force

FACE Consortium Members

FACE™ Future Airborne Capability Environment

Sponsor Level Member Organizations

- Air Force Research Laboratory
- Boeing
- Lockheed Martin
- Rockwell Collins
- US Army PEO Aviation
- US Navy NAVAIR

The FACE Consortium was formed in 2010 by The Open Group

Principal Level Member Organizations

- AeroVironment, Inc.
- BAE Systems
- Elbit Systems of America
- GE Aviation Systems
- General Dynamics
- Green Hills Software
- Harris Corporation
- Honeywell Aerospace
- IBM
- Northrop Grumman
- Raytheon
- Sierra Nevada Corp.
- Sikorsky Aircraft
- Textron Systems
- US Army AMRDEC
- UTC Aerospace Systems
- Wind River

Associate Level Member Organizations

- Abaco Systems
- AdaCore
- Alliant Techsystems Operations, LLC
- Astronautics Corporation of America
- Avalex Technologies
- Avionics Interface Technologies
- Brockwell Technologies
- CALCULEX
- Carnegie Mellon Univ. – Software Engineering Institute
- CERTON Software, Inc.
- CMC Electronics
- Cobham Aerospace Communications
- Concurrent Computer Corporation
- Core Avionics & Industrial Inc.
- Creative Electronic Systems North America
- CTSi
- Curtiss-Wright Defense Solutions
- DDC-I
- DornerWorks
- Draper Laboratory
- Enea Software & Services
- ENSCO Avionics
- Esterel Technologies
- Esterline AVISTA
- Exelis Inc.
- GECO Inc.
- General Atomics
- GrammaTech, Inc.
- Howell Instruments, Inc.
- Intrepid, LLC
- Johns Hopkins Univ. - APL
- Joint Tactical Networking Center
- Kaman Precision Products
- KEYW Corp.
- KIHOMAC
- Kutta Technologies
- L-3 Communications
- LDRA Technology
- Leidos Inc.
- Lynx Software Technologies
- Mercury Systems
- OAR Corporation
- Performance Software
- Physical Optics Corp.
- Presagis USA, Inc.
- PrismTech Corp.
- Pyrrhus Software
- Real-Time Innovations
- Richland Technologies
- SAIC
- Selex Galileo Inc.
- SimVentions
- Southwest Research Institute
- Stauder Technologies
- Support Systems Associates
- Symetrics Industries
- Technology Service Corporation
- TES-SAVI
- Thales USA, Inc.
- Thomas Production Company
- Trideum
- TTTech North America, Inc.
- ULTRAX Aerospace, Inc.
- US Army Electronic Proving Ground
- University of Dayton Research Institute
- Vencore, Inc.
- Verocel
- Vector Software, Inc.
- Zodiac Data Systems

FACE Progress

- Technical Standard 2.1
- Supporting reference documentation
- Business Practices:
  - ✓ Library Administrator Selected
  - ✓ Conformance Program Work Flow Tool Initiated
  - ✓ Change Management Program Operational
- International Participation:
  - Basis for existing process
  - Methods available today:
    - The Open Group Company Review
    - Open Availability to Documents
    - CR/PR Process

International Participation:

- Rationale for Existing Practice
- Methods Available today:
  - The Open Group Company Review
  - Open Availability to Documents
  - CR/PR Process
- Future Outlook

US DoD – Using FACE Approach as Enabler for MOSA Implementations

April 28, 2016

Jeffry A Howington, Rockwell Collins
Steering Committee Vice-Chair

Enabling MOSA

- FACE Standard Intent
  - Fulfill MOSA tenets
  - Meet Better Buying Power MOSA goal

- **Use Modular Open Systems Architecture to stimulate innovation**

- Deliver Key Benefits
  - Reduce life cycle costs
  - Manage obsolescence
  - Speed integration of new capabilities
  - Attract innovation
  - Reduce time to field

Open Architecture Definitions

- Architecture
  - The fundamental organization of a system embodied in its components, their relationships, to each other, and to the environment, and the principles guiding its design and evolution
- Open Standard
  - An Open Standard is a publically available standard, designed and developed with adherence to the key characteristics of due process, consensus, transparency, and balance
- Open Architecture
  - Open Architecture is a type of computer or software architecture designed using open standards and ease the effort associated with adding, modifying, removing, and interchanging components

Key Open Architecture Characteristics

- Provides standardization of key interfaces
- Supports layered architecture principles
- Facilitates abstraction
- Supplies key attributes of:
  - Adaptability (Configurability to meet different requirements)
  - Modularity (Ability to be separated from system)
  - Portability (Transportability between systems)
  - Scalability (Ability to scale with needs)
  - Interoperability (Effective information exchange)
- Other key system attributes desirable in an Open Architecture environment
  - Security
  - Safety

Enabling Cost Reduction

- Implementation underway
  - US Army
  - US Navy
  - US Air Force
  - Industry

Importance of Coordination

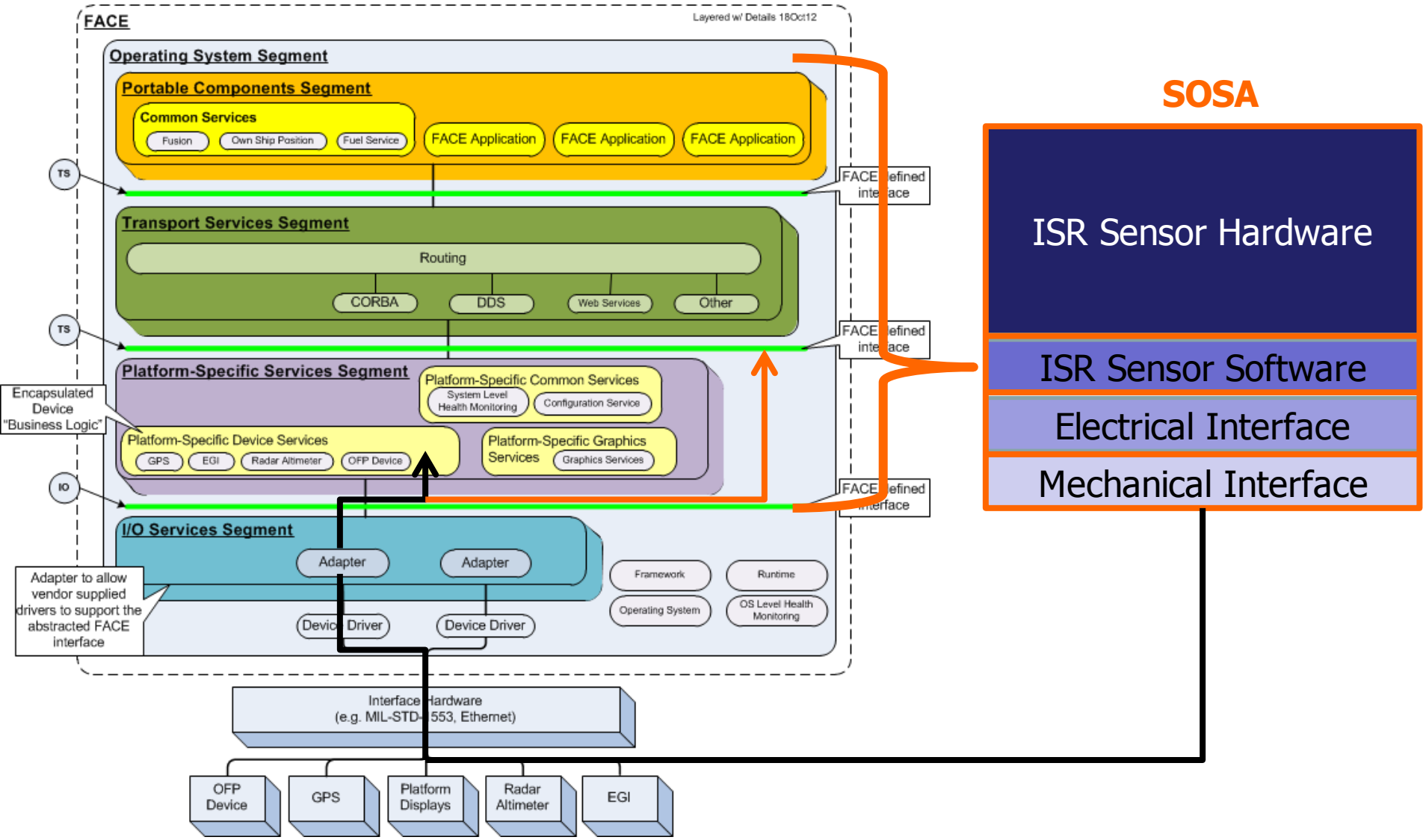
- Software expense drives avionics cost
  - Similar trend in other technologies
  - Makes up 80%+ of capability
- The FACE technical approach for cost reduction
  - Layered abstracted architecture and data model
  - Enable software reuse across multiple aircraft
- Other software architecture standards available
  - Can burden software developers (which standard should they use?)
  - Risks undoing the beneficial intent

Coordination Activities

- Actively seeking coordination and alignment
  - UAS Control Segment (SAE AS-4UCS)
  - Joint Tactical Networking Center (JTNC)
  - Sensor Open Systems Architecture (SOSA)

- Alignment Scope
  - Interface Definitions
  - Data Models
  - Conformance Process (including Repositories)
  - Solution Domain Scope

FACE/SOSA Aligned Architecture

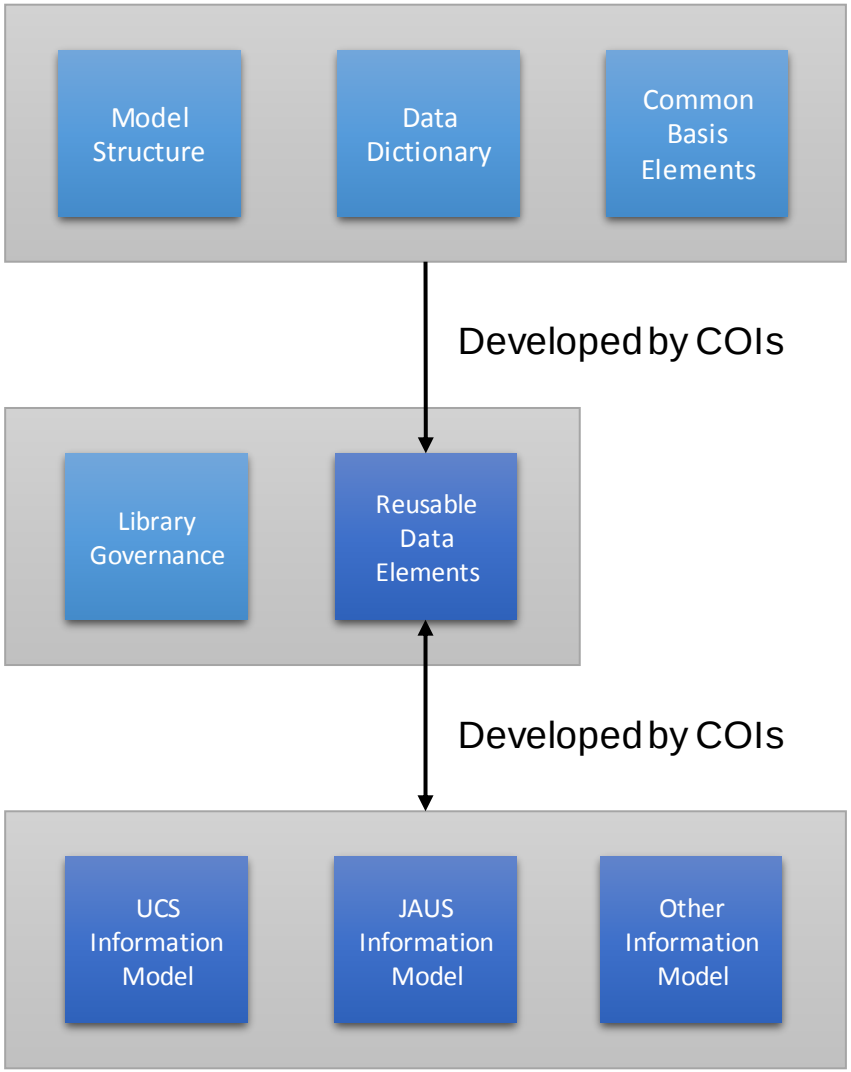


Data Architecture Framework Concept

Core Standard

Library of data architecture elements

Conformant data architectures

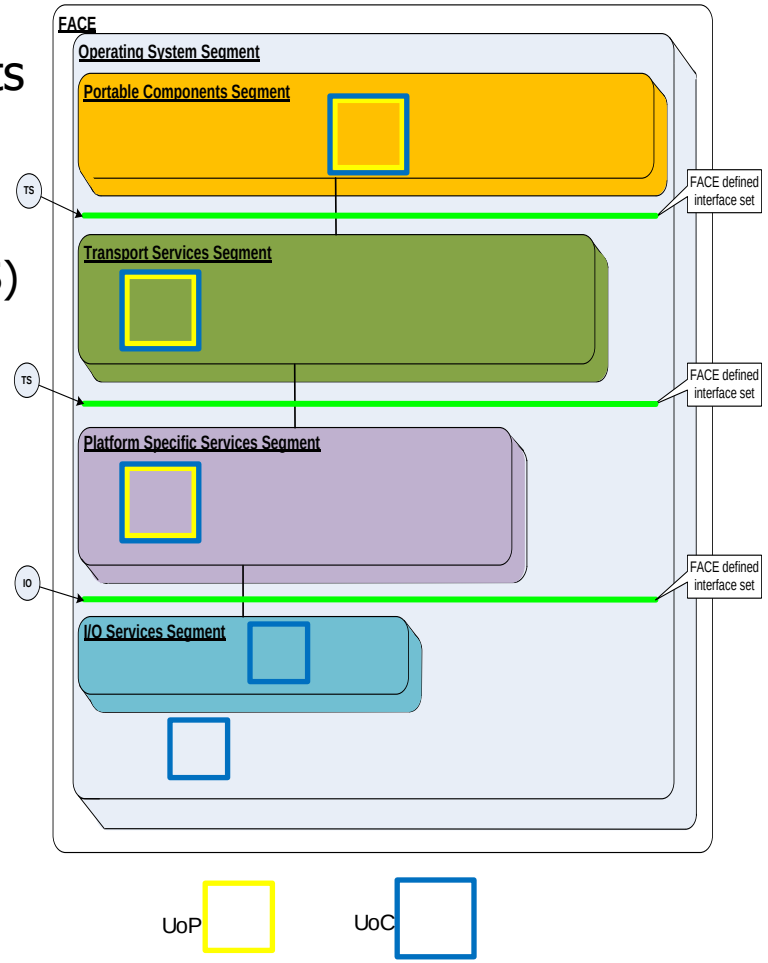


Conformance and Library Process

David Boyett
US Army AMRDEC
Vice Chair: FACE Business Working Group
April 28, 2016

FACE Building Blocks

- A Unit of Portability (UoP) is …
  - Items that fit completely within one of the top three FACE Architecture segments
    - Portable Component Segment (PCS)
    - Transport Services Segment (TSS)
    - Platform Specific Services Segment (PSSS)
- A Unit of Conformance (UoC) is
  - Items that fit completely within one of the five FACE Architecture segments
    - PCS (also a UoP)
    - TSS (also a UoP)
    - PSSS (also a UoP)
    - I/O Services Segment (IOS) (not UoP)
    - Operating System Segment (OSS) (not UoP)



What is FACE Conformance?

- FACE Conformance
  - An assessment of a Software Item, known as a Unit of Conformance (UoC), to the applicable Conformance Requirements contained in the FACE Technical Standard
- Applicable Requirements
  - are determined based on the segment and profile selected in the design of the particular UoC
- Verification of Conformance
  - is conducted utilizing automated test tools and inspection of design and test documents
- Conformance Verification Matrix (CVM)
  - The specific requirements, method of verification, and associated verification evidence is detailed in the CVM

What can be Certified as FACE Conformant?

- Certification is for Units of Conformance (UoC) or UoC Packages
- There is
  - No "compliance"
    - Software is either "certified conformant" or not
  - No FACE certification for entire systems
    - Systems can be comprised completely of Certified UoCs or a mix of Certified UoCs and other software
  - No FACE certification for independent libraries, runtimes, frameworks
    - These can be included in a certification of a larger set

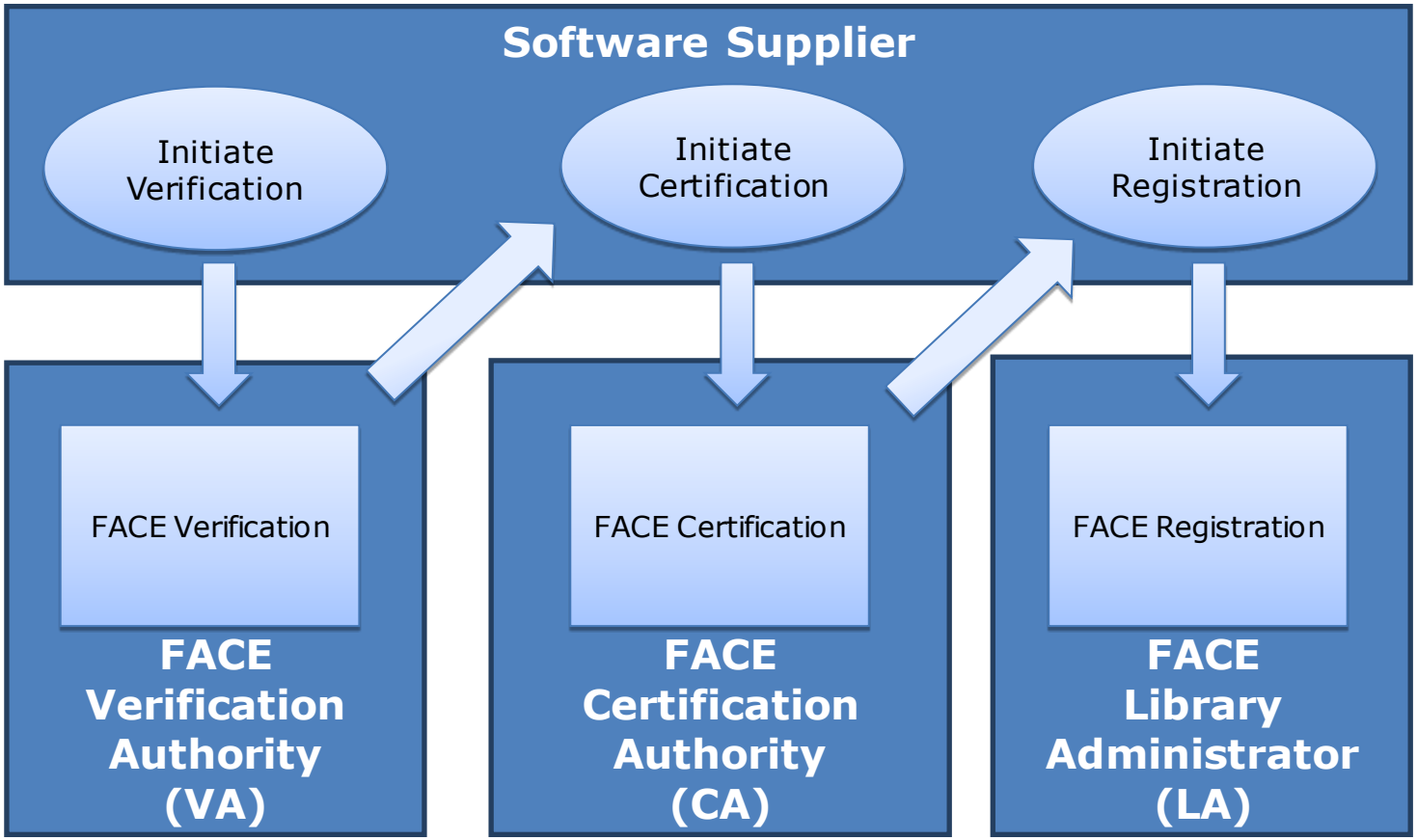
Driving Factors

- Certification is for UoCs or UoC Packages
  - An assessment of a Software item, known as a Unit of Conformance (UoC), to the applicable Conformance Requirements contained in the specified FACE Technical Standard Edition
  - Determined based on the Technical Standard Edition, segment and profile selected in the design of the particular UoC
  - Recompiling to a different target does not cause a loss of FACE Certification

Driving Factors

- No Functional or Performance Testing
  - Interfaces are tested
  - Other Verification Evidence is inspected (evaluated)
  - Functional Testing is assumed as part of other development processes and is not required for FACE Conformance
- Not Plug-n-Play
  - Various levels of integration will likely be required for porting (reuse of software)

Conformance Program and Processes



Conformance Processes

- **FACE Verification**
  - The process of determining the conformance of an implementation to specification requirements. Verification is handled through an entity known as a Verification Authority (VA), a technical expert on the FACE Technical Standard and Verification process and approved by the FACE Consortium Steering Committee

- **FACE Certification**
  - The process of applying for a FACE Conformance Certificate once verification has successfully been completed. Certification is processed through the FACE Certification Authority (CA)

- **FACE Registration**
  - The process of listing FACE Certified UoCs in a public listing of FACE Certified UoCs known as the FACE Registry. The FACE Registry is accessed from the FACE Landing Page

*The FACE Landing Page can be accessed at http://opengroup.org/face

Roles

- **Software Supplier**
  - Anyone providing software (UoC) to be certified. This may include the original software developer, an integrator, or another entity wishing to certify software developed from another party.

- **FACE Verification Authority (VA)**
  - One of several organizations approved by the FACE Consortium to evaluate software against the FACE Technical Standard. The VA is an expert on the FACE technical standard and verification process. The VA conducts or witnesses conduct of the For-the-Record Test, utilizing an approved Conformance Test Tool, and inspects the Verification Evidence.

Roles

- **FACE Certification Authority (CA)**
  - The FACE Certification Authority is the singular organization approved by the FACE Consortium that can provide a FACE Conformance Certificate
- **FACE Library Administrator (LA)**
  - The FACE Library Administrator manages a listing of FACE Certified UoCs known as the FACE Registry
- **FACE Trademark Licensor**
  - The FACE Trademark Licensor issues the FACE Conformance Certification Trademark for Certified Units of Conformance and Certified Unit of Conformance Packages

FACE Library

- Provides the infrastructure to enable the development and discovery of FACE UoCs
- The FACE Library is the primary source of information on:
  - FACE Consortium activities
  - Developing to the FACE Technical Standard
  - How to get a FACE UoC verified and certified
  - Searching for existing FACE certified UoCs
  - Advice on how to acquire FACE certified UoCs
  - Reporting problems with FACE products

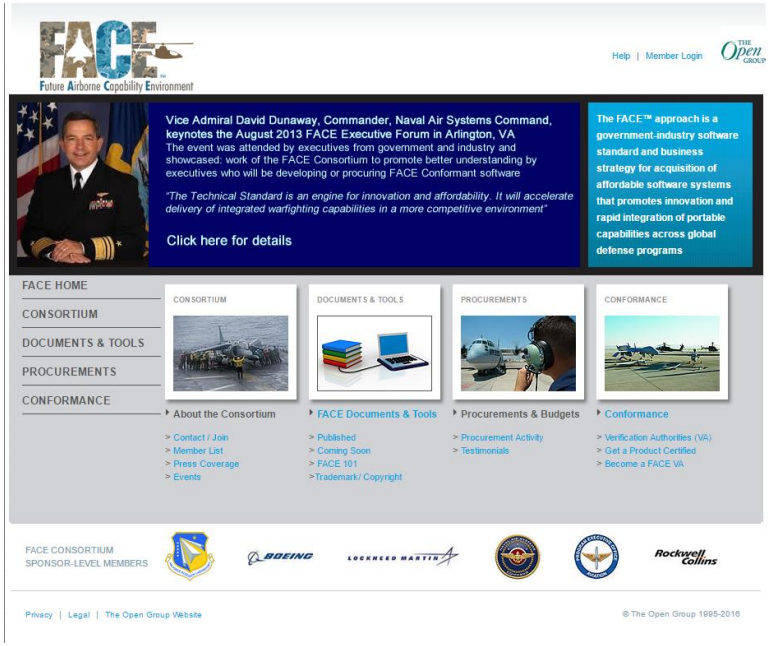
Conformance Preparation

FACE Conformance Tab

FACE Landing Page

FACE Reference Repository

Software Supplier



Supplier Obtains References and Tools

- FACE Technical Standard
- Reference Implementation Guide (RIG)
- Automated Tools, SDK, ITK
- Conformance Certification Users Guide
- Conformance Policy
- Verification Matrix
- Matrix Users Guide (MUG)
- Conformance Test Suite

Conformance Preparation

- Supplier Selects a Verification Authority (VA)
  - List of Approved VAs from the Landing Page
  - Meets supplier needs
    - Not limited to Internal Verification
    - Willing to perform verification for the UoC's applicable FACE Architecture segment, e.g., Operating System

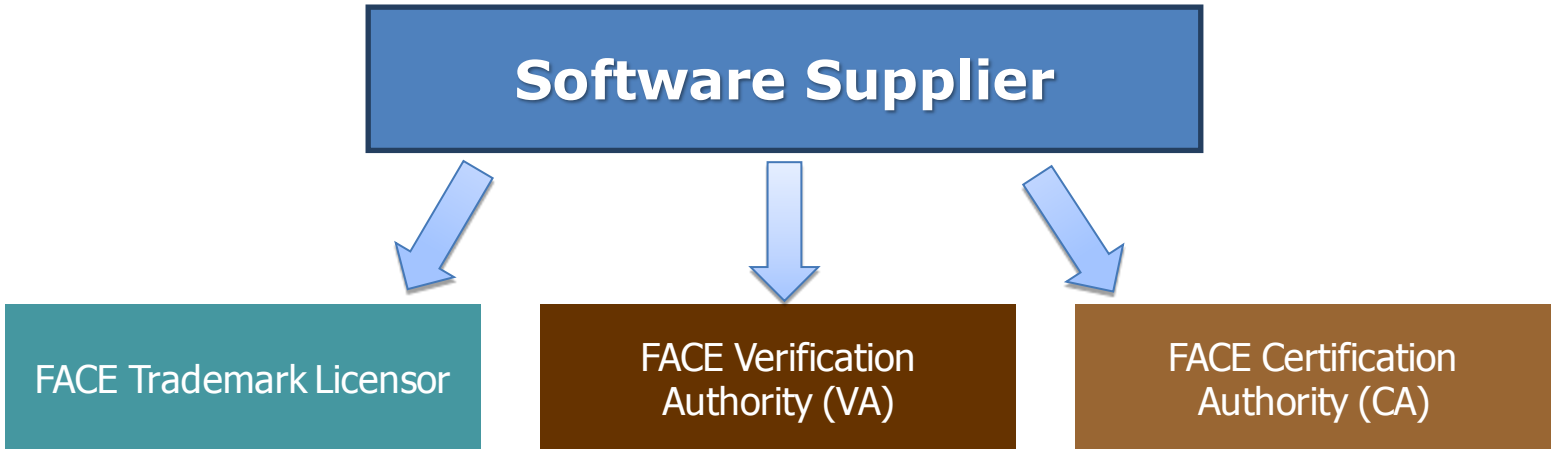
- Current Approved VAs
  - Army VA at AMRDEC (SED ASIF Lab)
  - NAVAIR 5.4.3.7 V & V Branch
  - Tucson Embedded Systems (TES SAVi)
  - More to come in the future…

Conformance Preparation

- Supplier provides Verification Evidence
  - A trace of the FACE requirements to specific documents supporting the requirements
  - Required for all items in the Tech Standard identified as needing inspection in the Conformance Verification Matrix (CVM) including applicable conditional requirements

Verification Needed (Y or N)	FACE Segment	Technical Standard for the FACE Reference Architecture Edition 1.0	Verification Method	Conformance Artifacts (DID or equivalent)	SW Supplier Artifact Cross-Reference	Verification Notes	Conditional Reqs
N		**3.5.6 PSS Segment Requirements**					
Y	PSSS	9. All communication with the IOSS shall go through the I/O Services Interface.	Test	Test Suite			
Y	PSSS	10. Messages communicated through the I/O Services Interface shall be in the format defined in Section D.11.	Inspection	SDD			
Y	PSSS	11. All components of the PSSS shall use the interface defined in Section 3.11, Section 3.12, or Section 3.13 to access the functions provided by the OSS.	Test Inspection	Test Suite SAD SDD		Inspection is only of Java frameworks or Ada run-times.	

Conformance Preparation

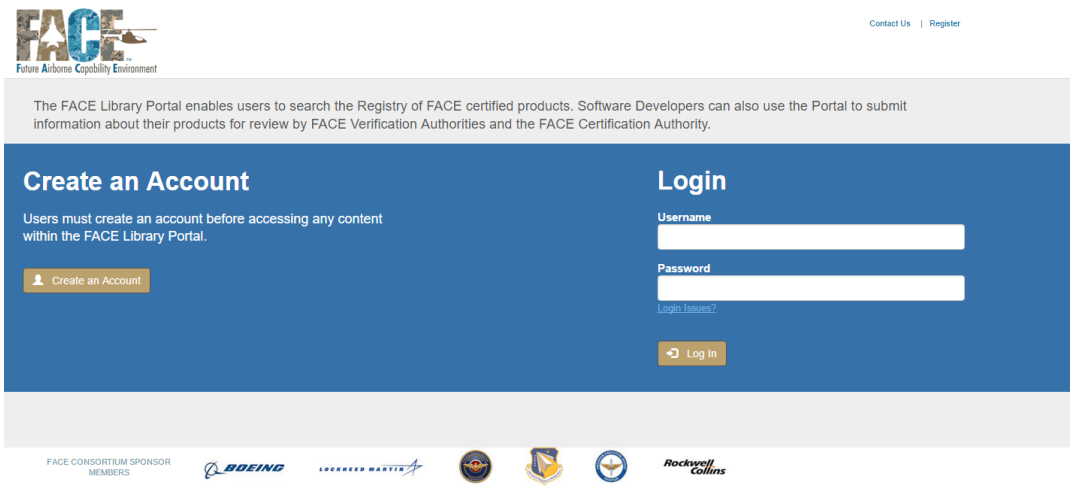


Supplier Establishes Legal Agreements

1. Conformance Certification Trademark License Agreement with TM Licensor
2. Verification Agreement with Selected VA
3. Certification Agreement with CA

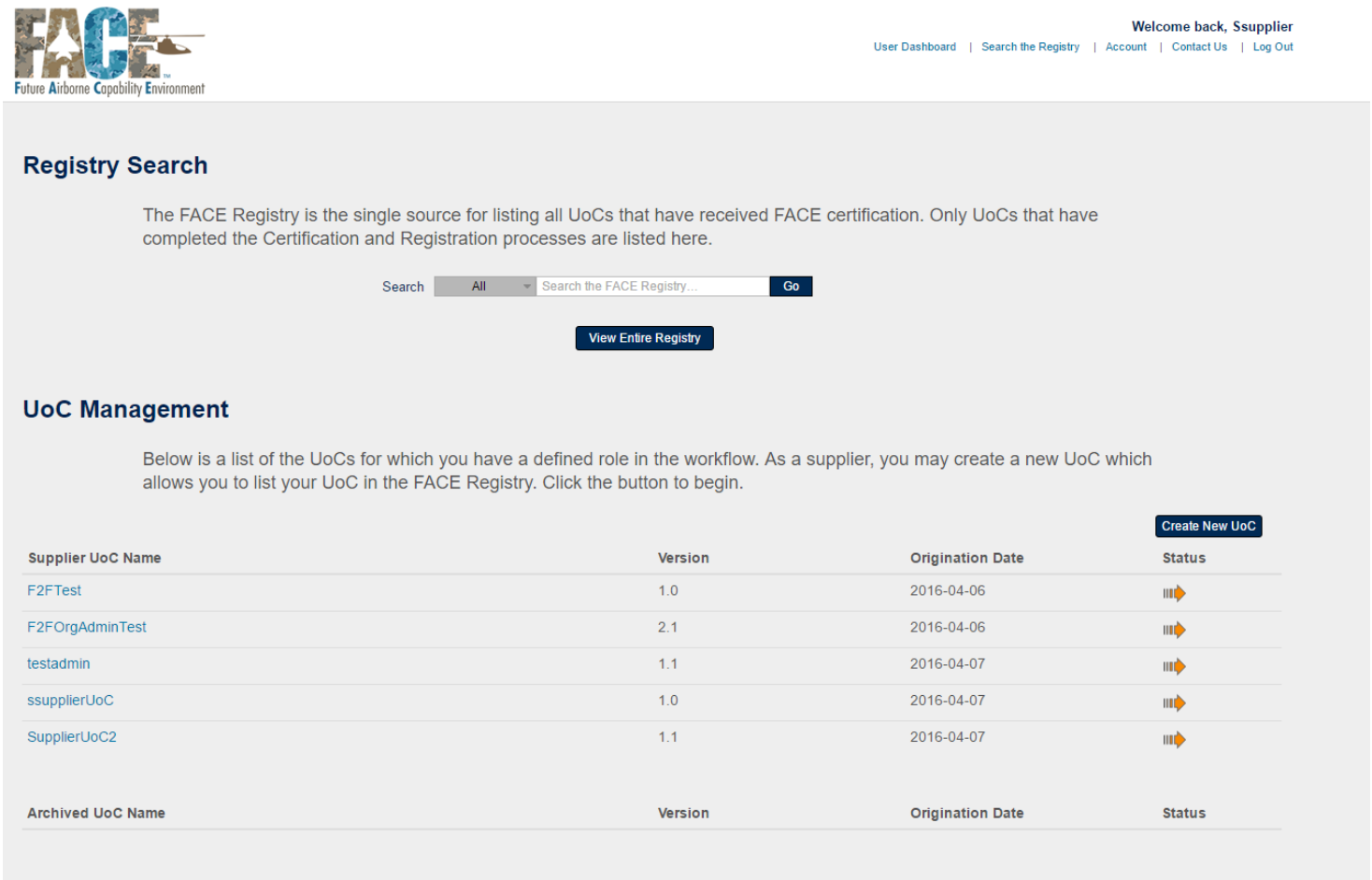
Conformance Workflow Tool

- Provides the infrastructure to support the centralized FACE certification and registration process
- Login required
- Individual or Organizational accounts available
- Manage progress of UoCs through Conformance program
- Browse and search the FACE registry

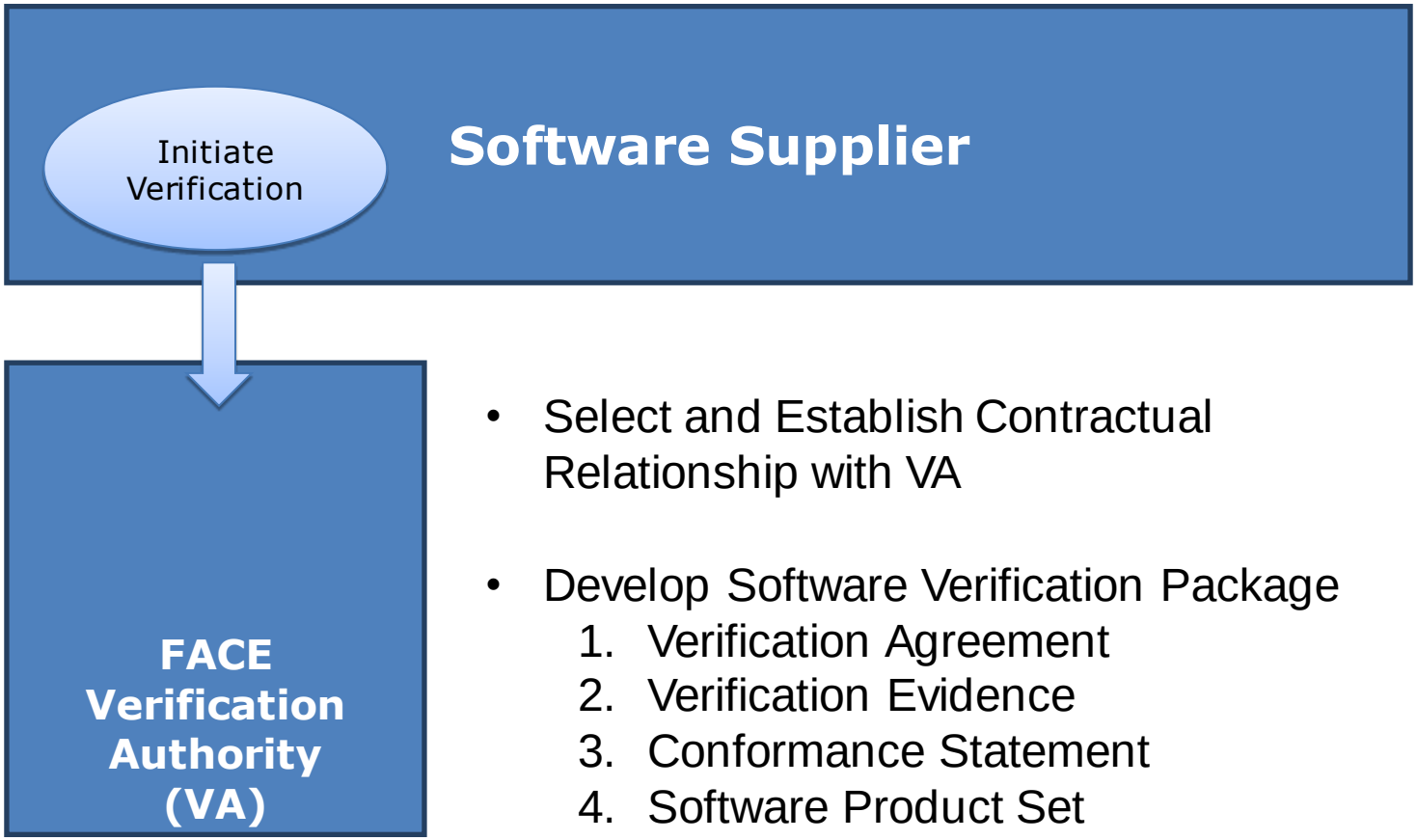


https://www.facesoftware.org

Conformance Workflow Tool Dashboard



Conformance Verification Process



- Select and Establish Contractual Relationship with VA
- Develop Software Verification Package
  1. Verification Agreement
  2. Verification Evidence
  3. Conformance Statement
  4. Software Product Set

Software Verification Package

- Verification Agreement
  - Defines the conformance verification services to be provided by the VA
  - Defines acceptance by the Software Supplier to provide the required verification evidence and Software Product Set

- Verification Evidence
  - Supporting verification documentation submitted by the Software Supplier to provide evidence of FACE Conformance to the applicable conformance requirements of the Technical Standard that are not directly tested by the Test Suite.
  - The verification evidence is organized to correlate with the specific conformance requirements and verification approach contained in the applicable segment of the Conformance Verification Matrix

Software Verification Package (cont.)

Conformance Statement

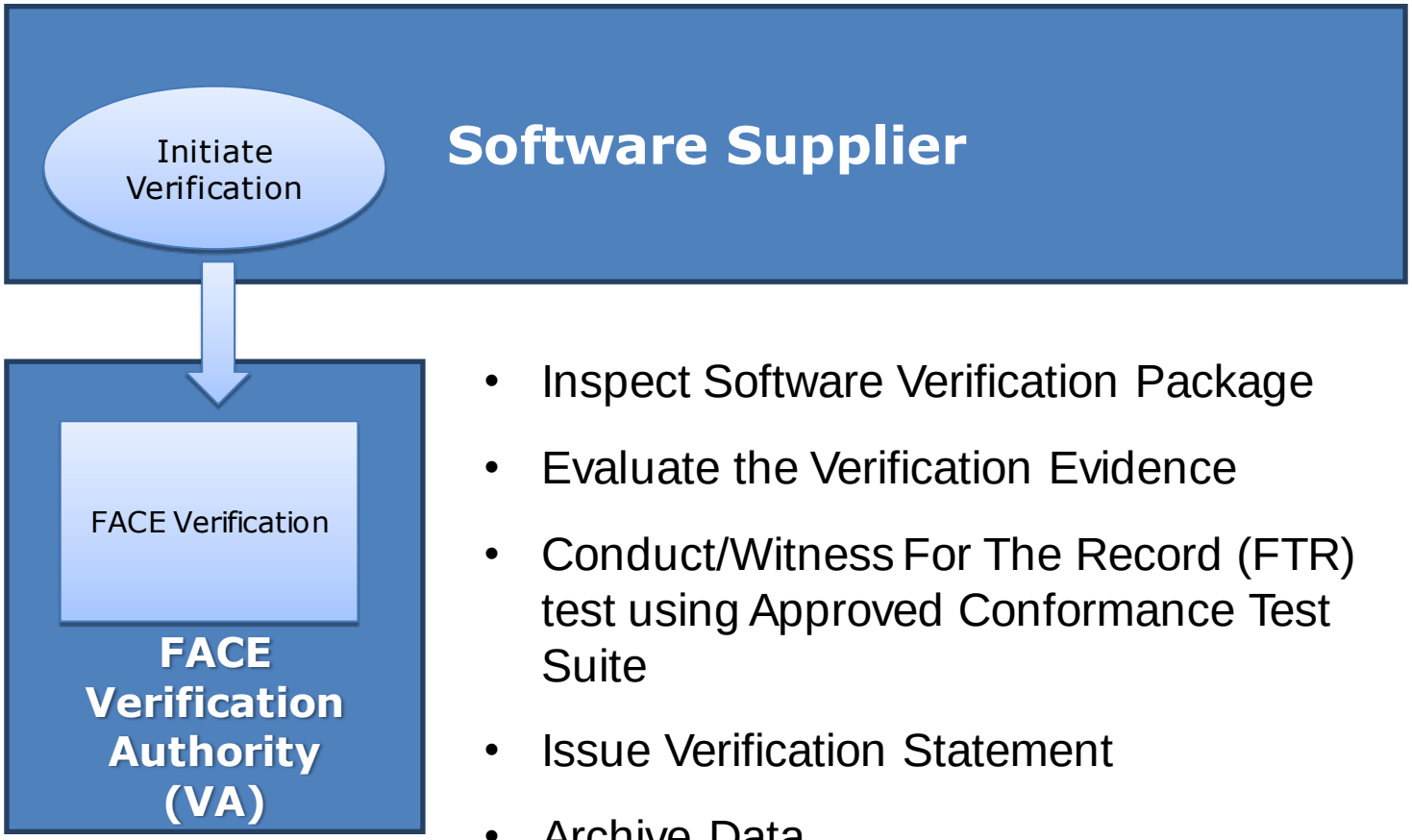
- Software Supplier's response to a standard questionnaire, tailored to the appropriate Segment of the Technical Standard, structured to obtain precise identification of the software product and conformance evidence.
- The Conformance Statement includes:
  - Software product description documentation to uniquely identify and configuration manage the Software product through the conformance process.
  - The Conformance Statement identifies:
    1. The specific edition of the Technical Standard
    2. The applicable set of conformance requirements
    3. The Conformance Verification Matrix version
    4. The version of Conformance Test Suite used for verification

Software Verification Package (cont.)

- Software Product Set
  - Contains the software deliverables that are required for executing the software product using the FACE Conformance Test Suite.

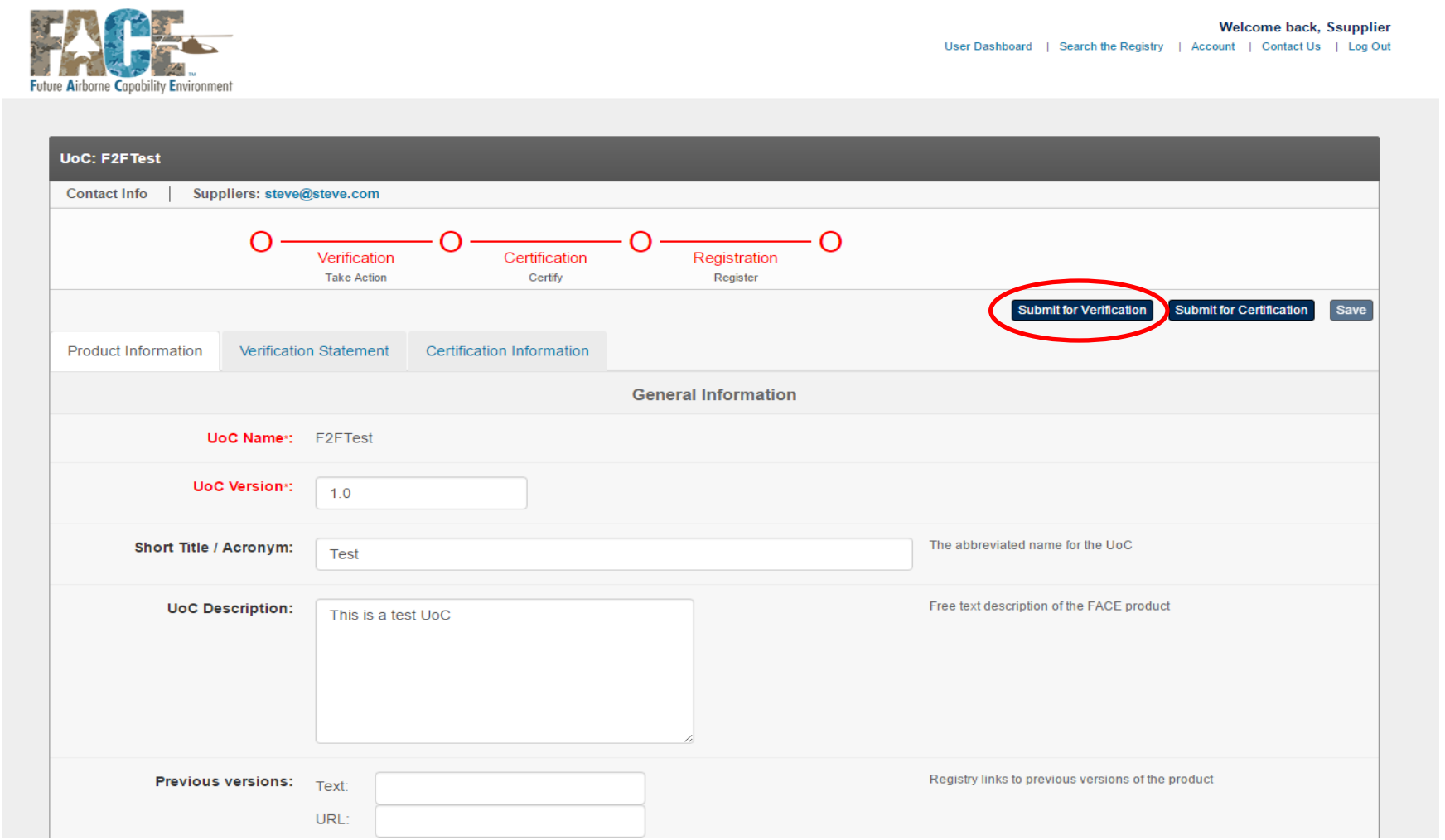
  - The Software Product Set includes:
    1. The software product
    2. Associated information for set-up of interfacing segments
    3. Minimum computer operating environment requirements

Conformance Verification by VA

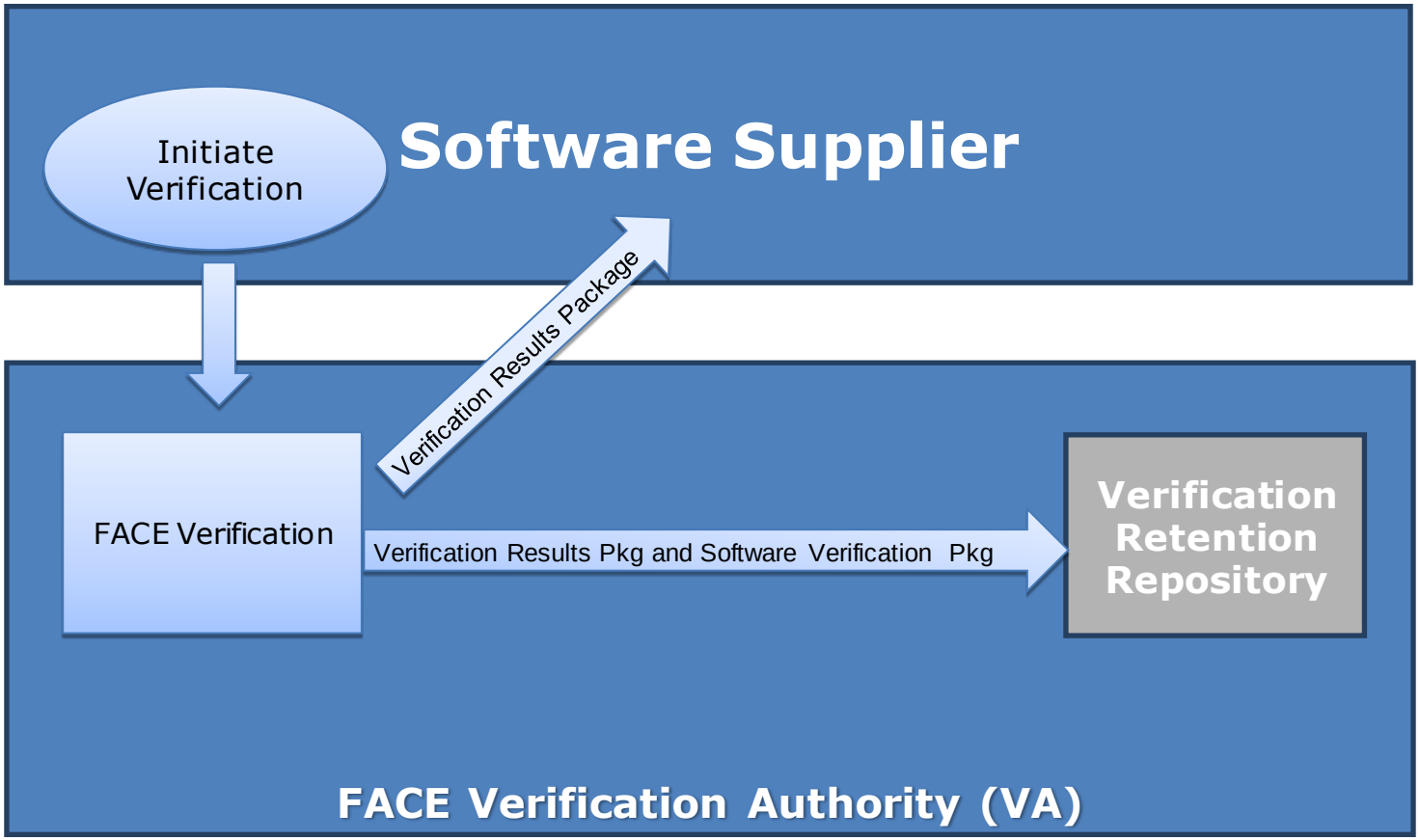


- Inspect Software Verification Package
- Evaluate the Verification Evidence
- Conduct/Witness For The Record (FTR) test using Approved Conformance Test Suite
- Issue Verification Statement
- Archive Data

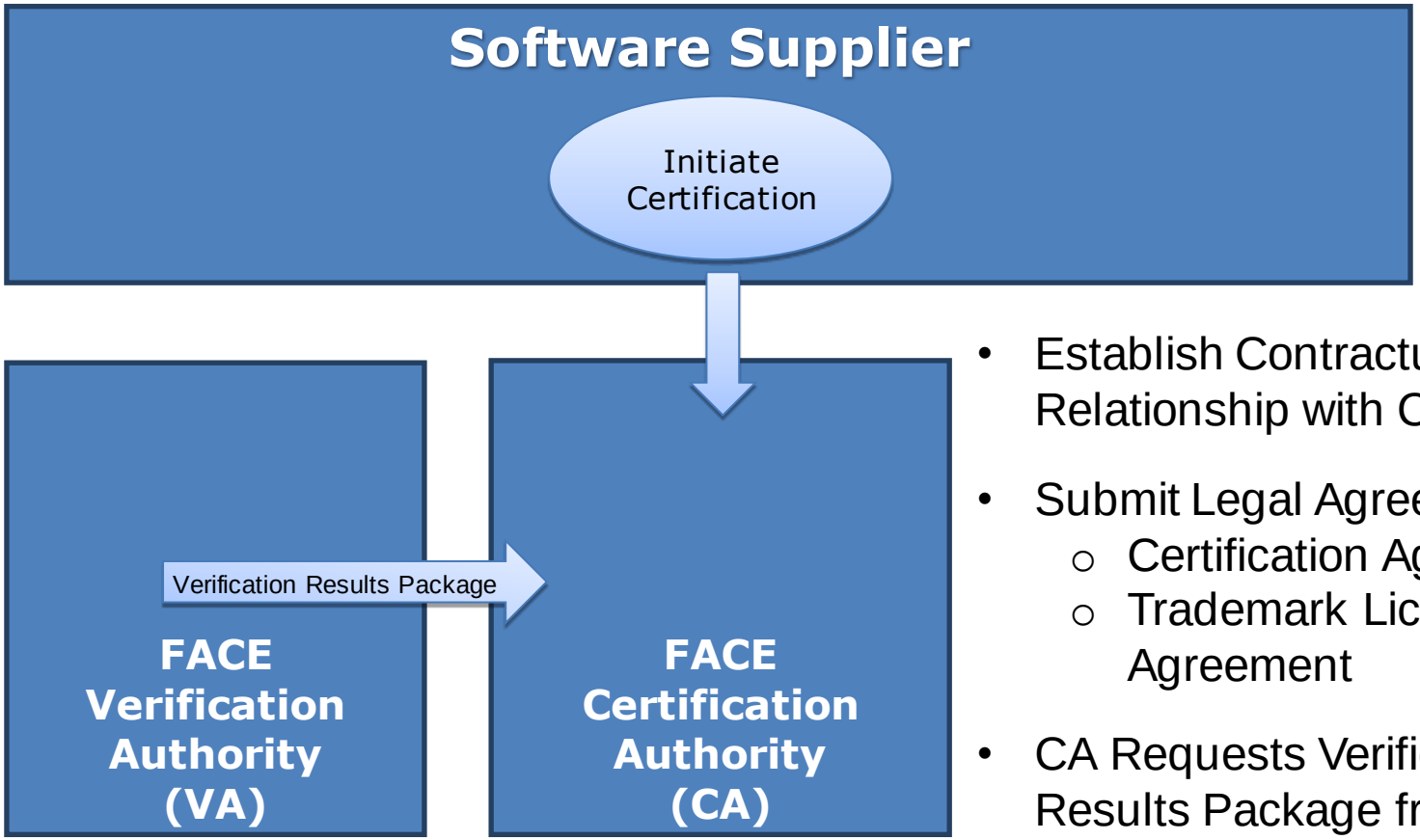
UoC Verification Metadata



Conformance Verification Process

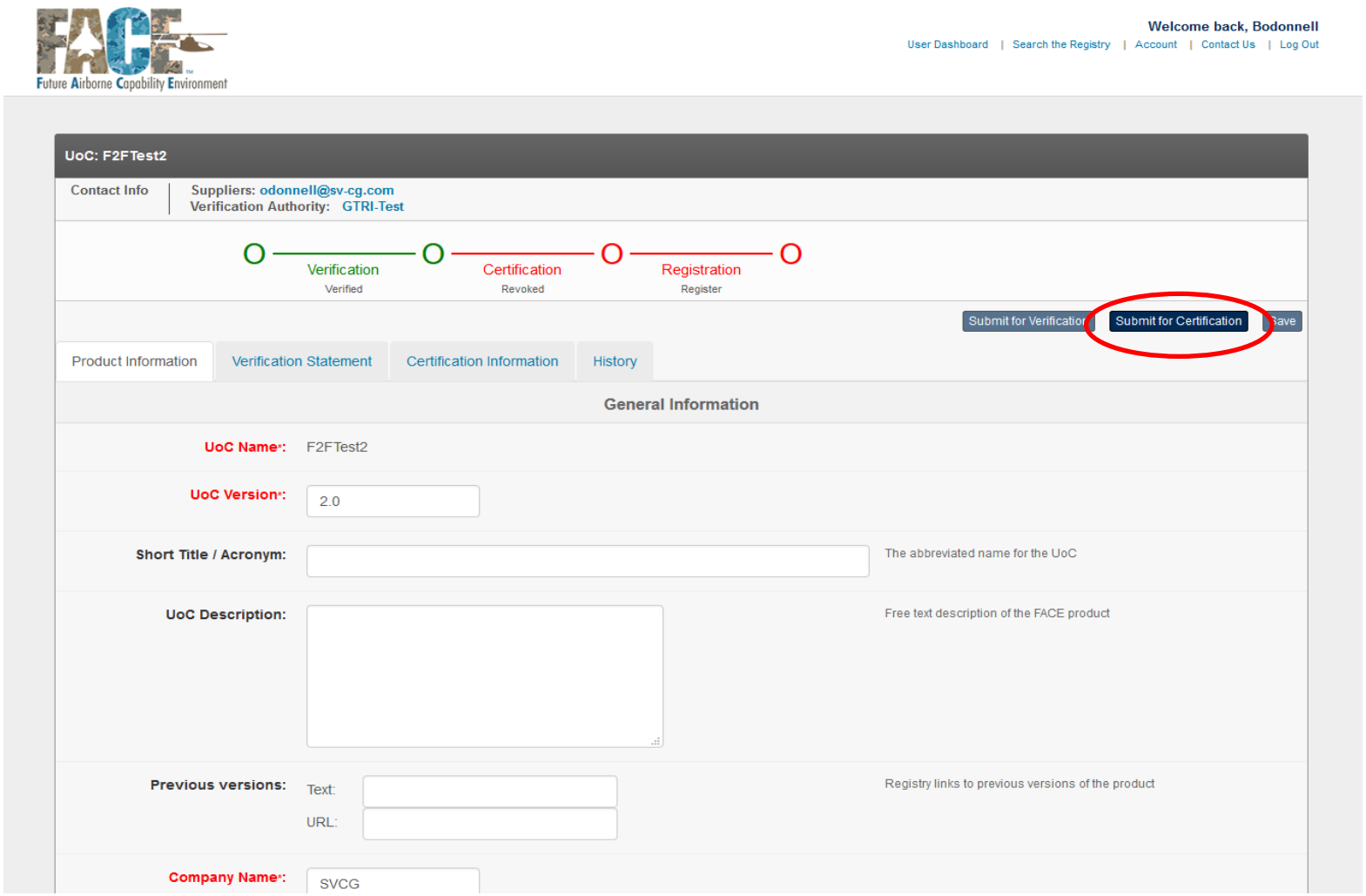


Conformance Certification Process

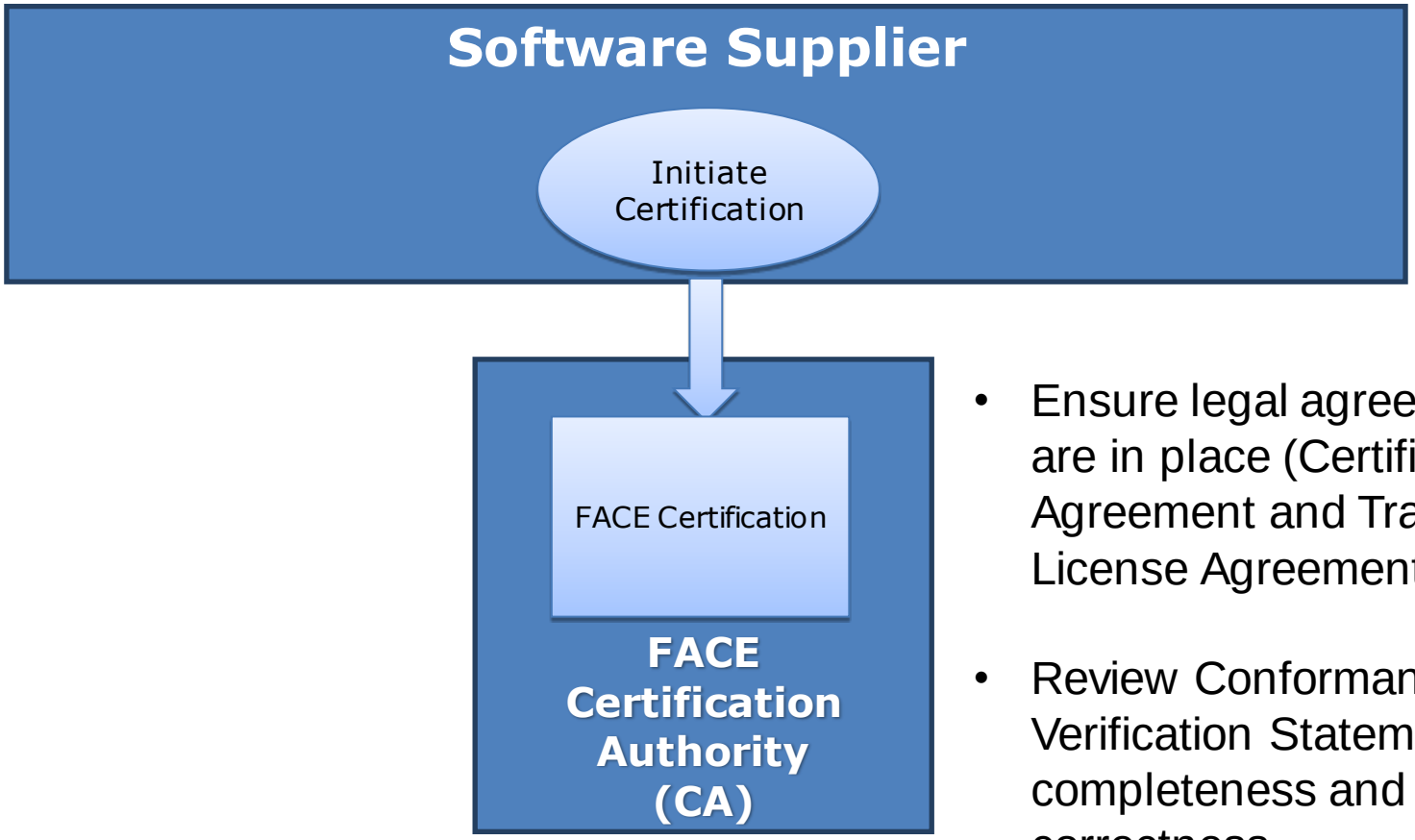


- Establish Contractual Relationship with CA
- Submit Legal Agreements
  - Certification Agreement
  - Trademark License Agreement
- CA Requests Verification Results Package from VA

UoC Certification metadata

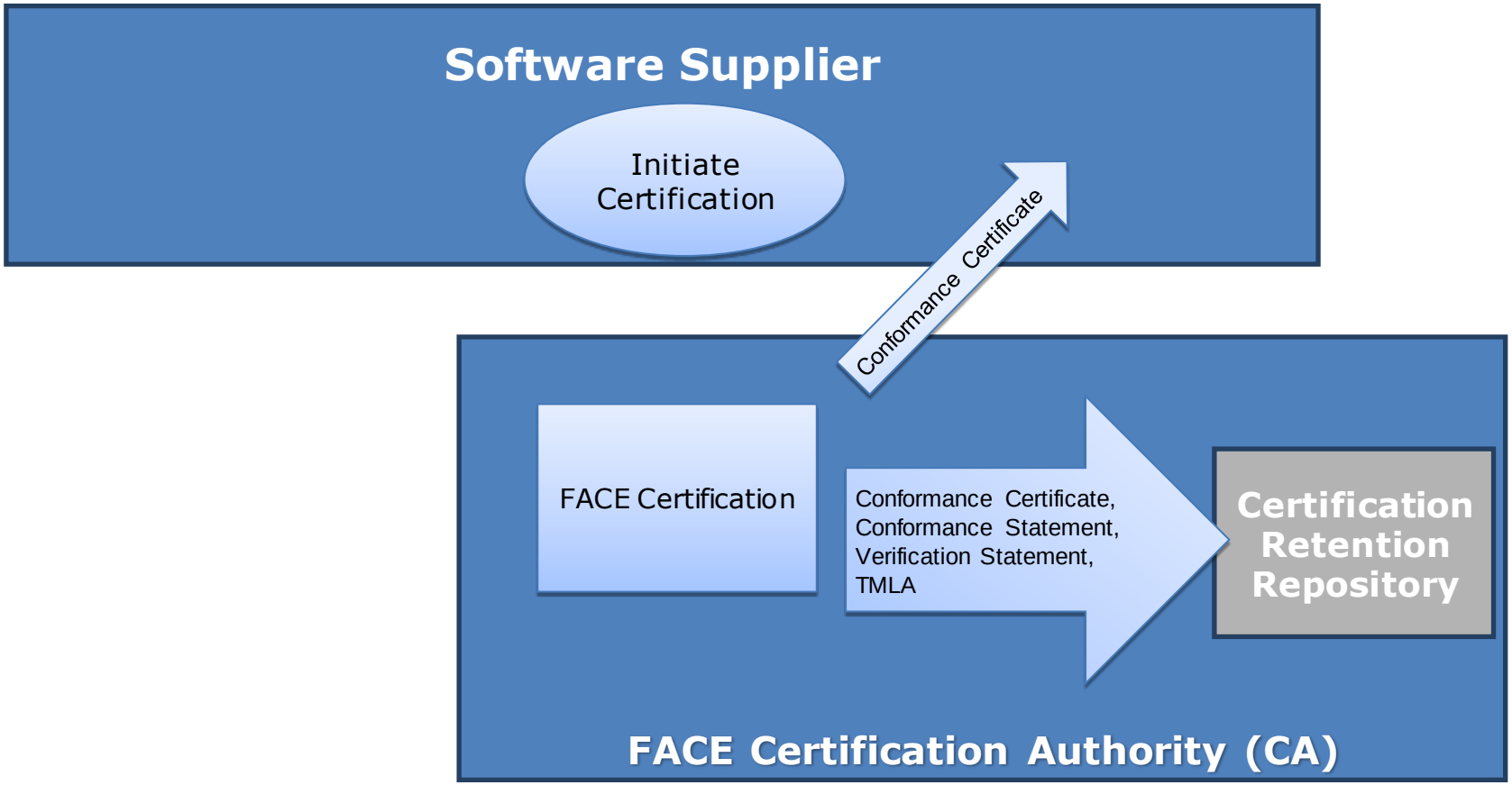


Conformance Certification

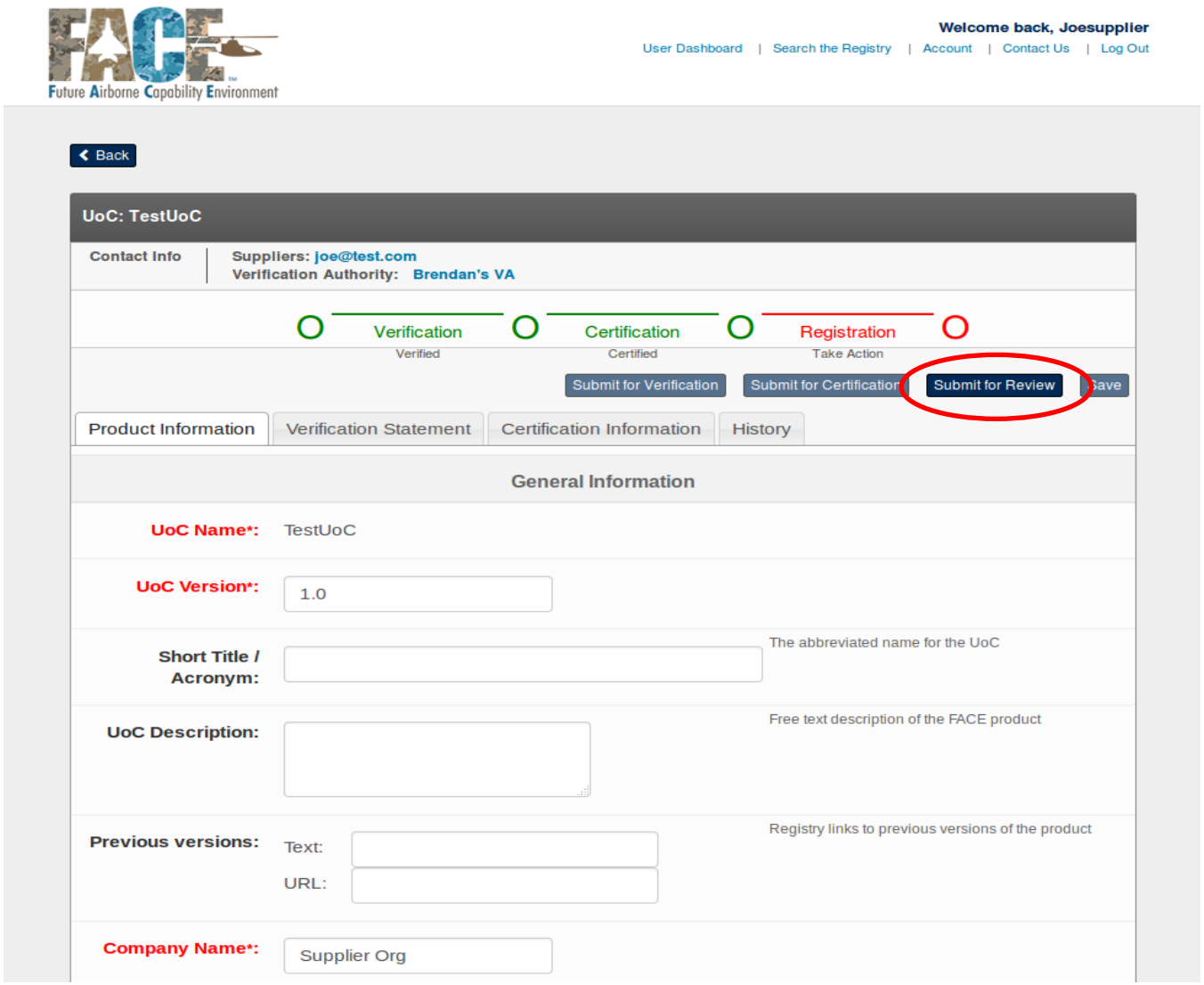


- Ensure legal agreements are in place (Certification Agreement and Trade Mark License Agreement (TMLA))
- Review Conformance and Verification Statements for completeness and correctness

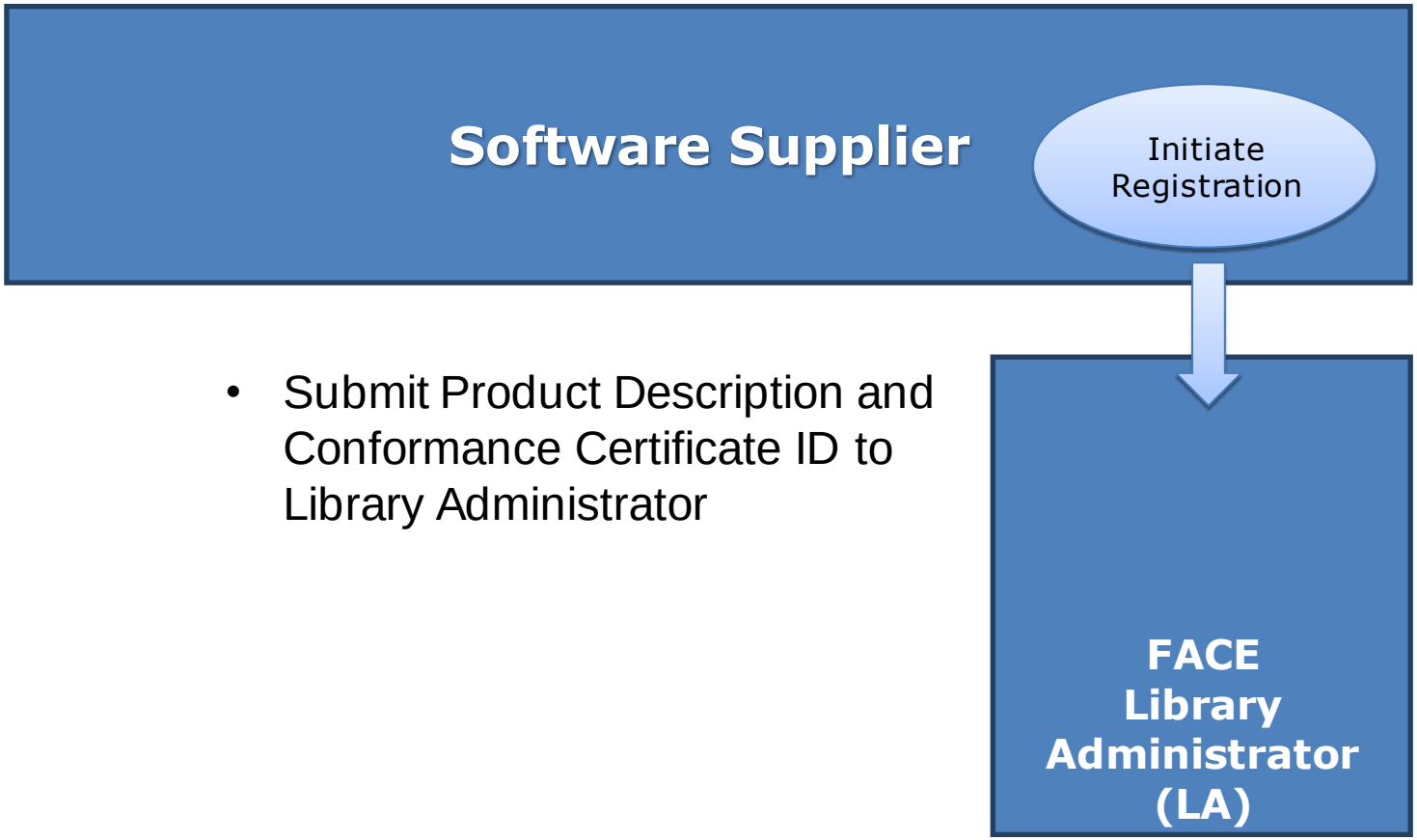
Conformance Certification



UoC Registration Metadata

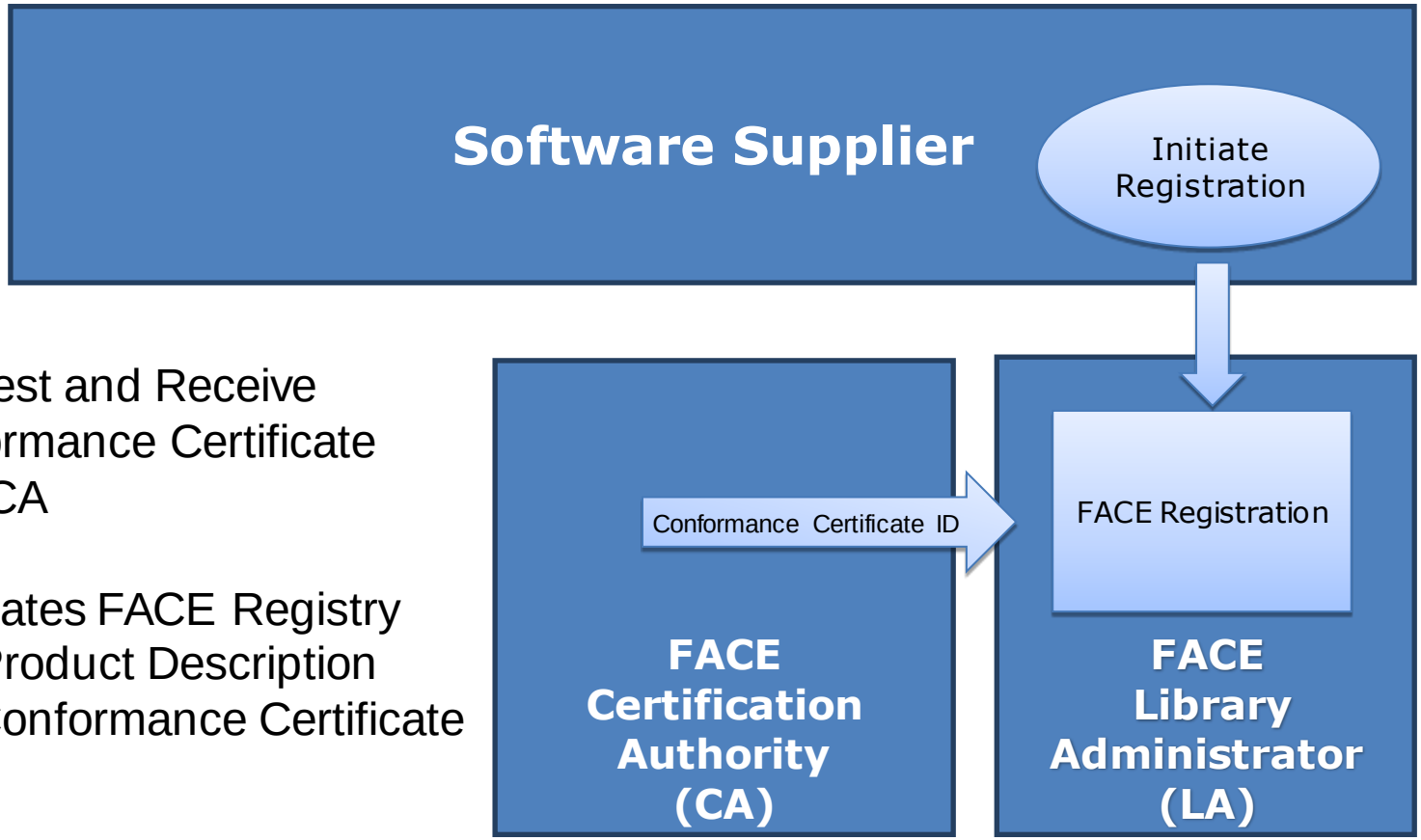


FACE Registration Process



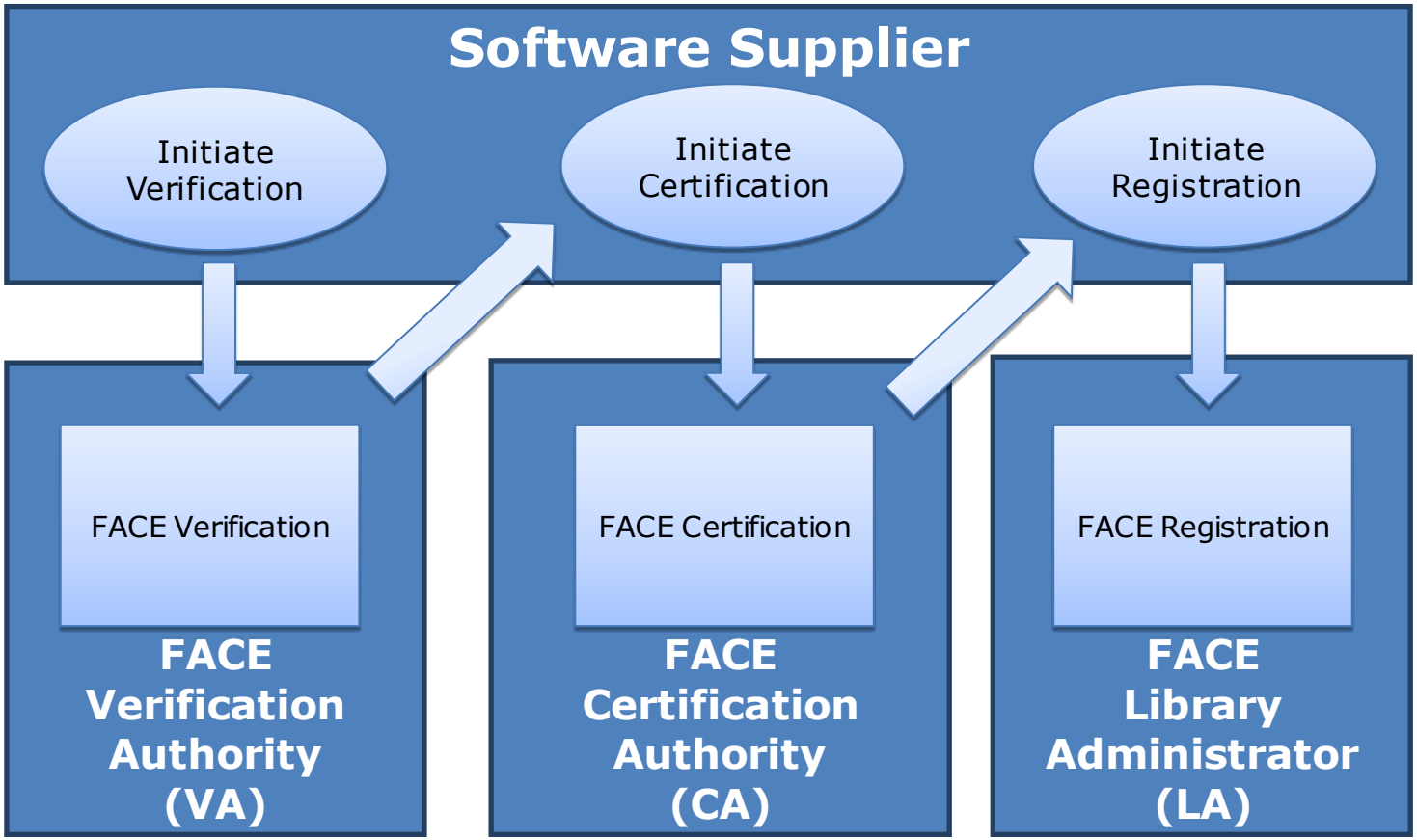
- Submit Product Description and Conformance Certificate ID to Library Administrator

FACE Registration Process

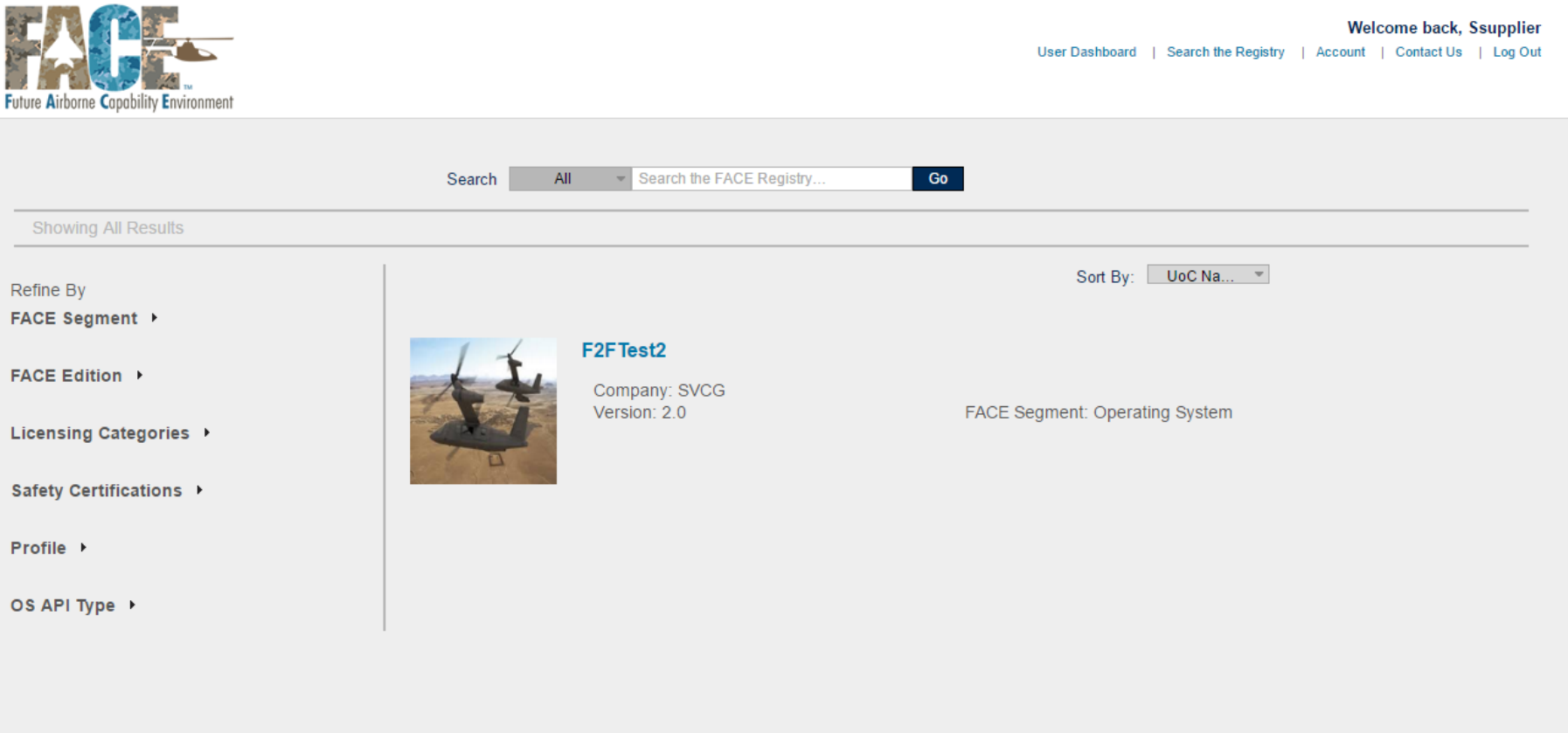


- Request and Receive Conformance Certificate from CA
- Populates FACE Registry with Product Description and Conformance Certificate

Conformance Program and Processes



UoC in the FACE Registry



Key FACE Conformance References

- Technical Standard
  - Requirements for the FACE Architecture
- Conformance Verification Matrix
  - Guidance and Verification Methods
- Conformance Policy
  - Policy for Certification of UoCs
- Conformance Certification Guide
  - Guidance on the Policy and Program

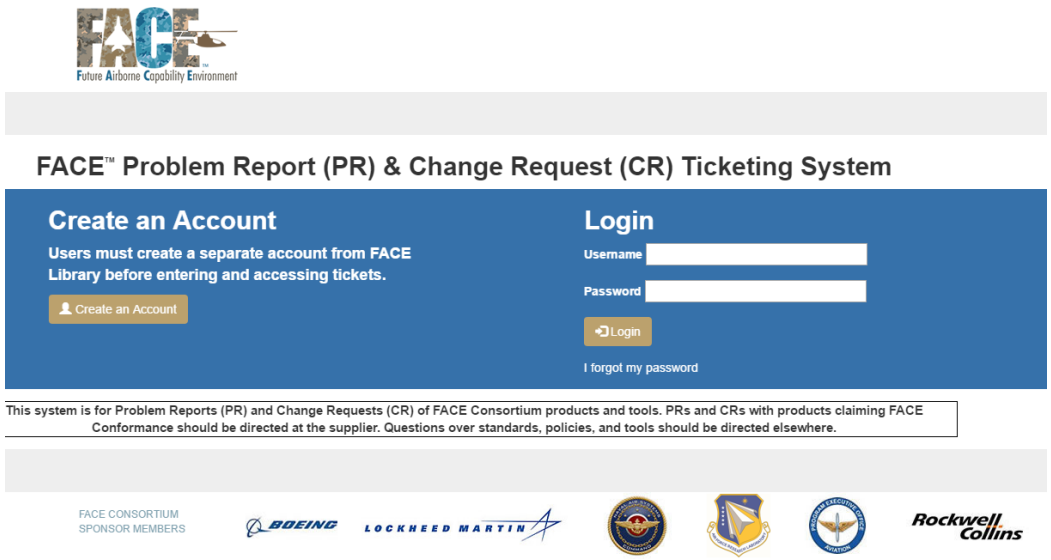
*Please visit http://opengroup.org/face/information for the most recent published documentation

Problem Reporting and Change Request

David Boyett
US Army AMRDEC
Vice Chair: FACE Business Working Group
April 28, 2016

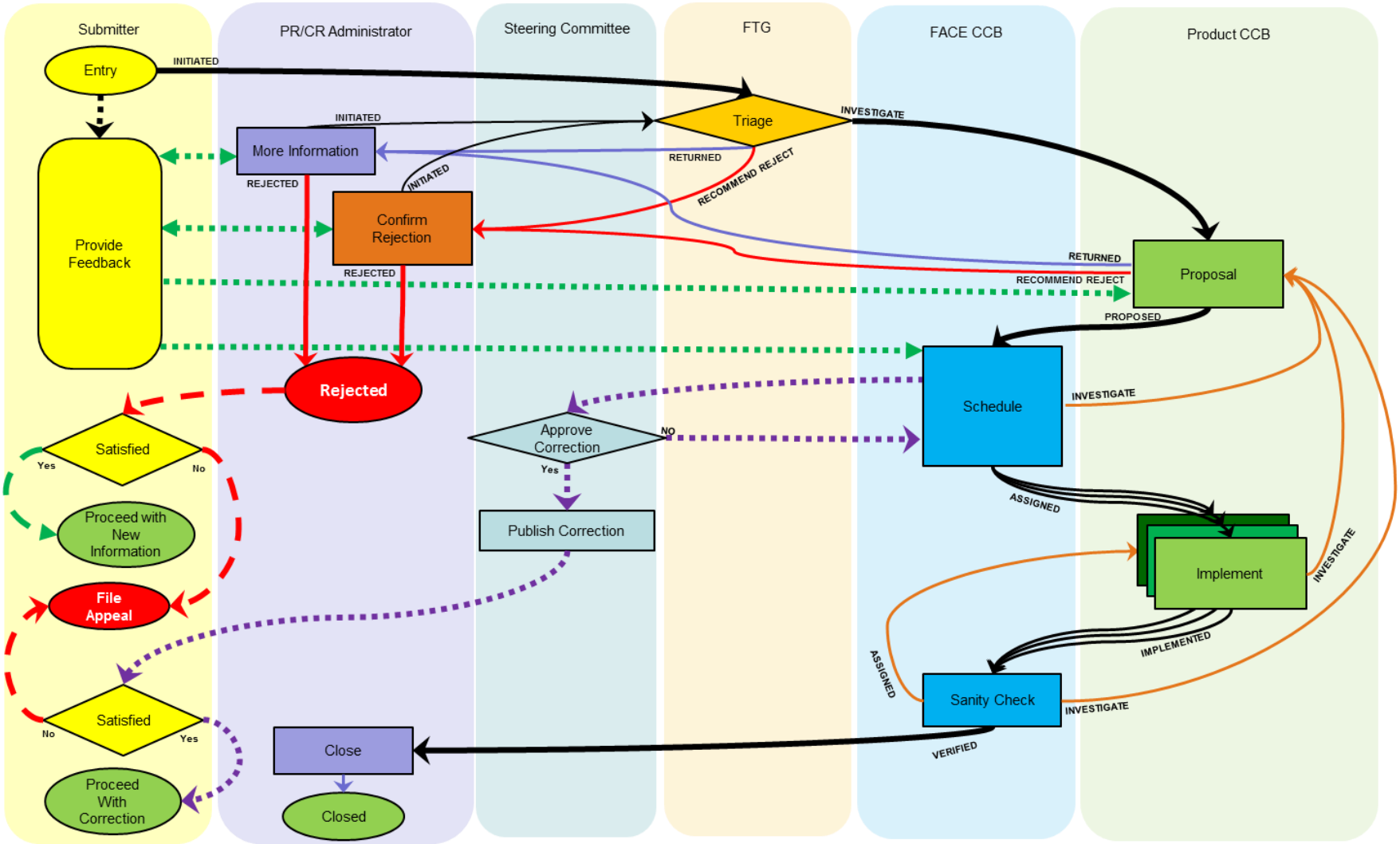
Problem Reporting and Change Requests

- The FACE Consortium has developed a comprehensive PR/CR process
- Problems can be communicated via the FACE Landing Page
- FAQs are available on the FACE Landing Page
- Focus is on users who are not members of the FACE Consortium, including international users
- A tool has been developed to capture and track PRs/CRs to resolution

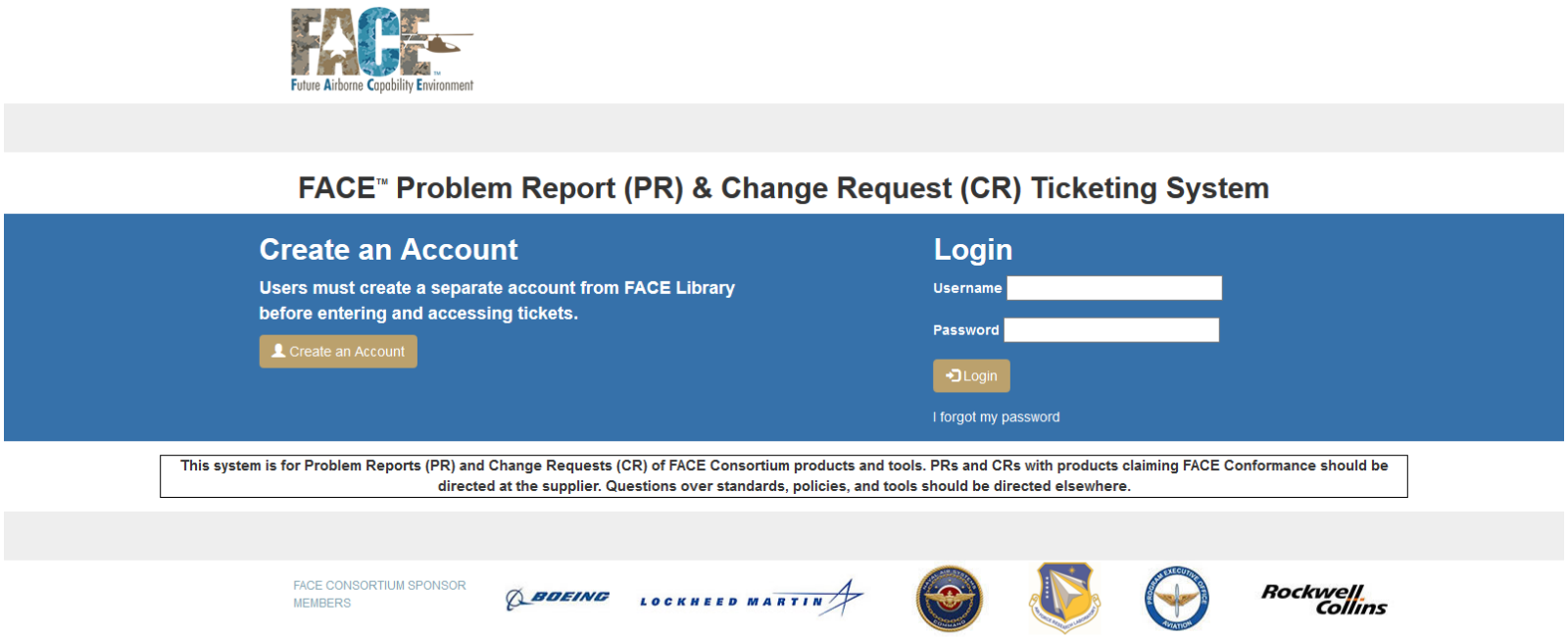


https://ticketing.facesoftware.org

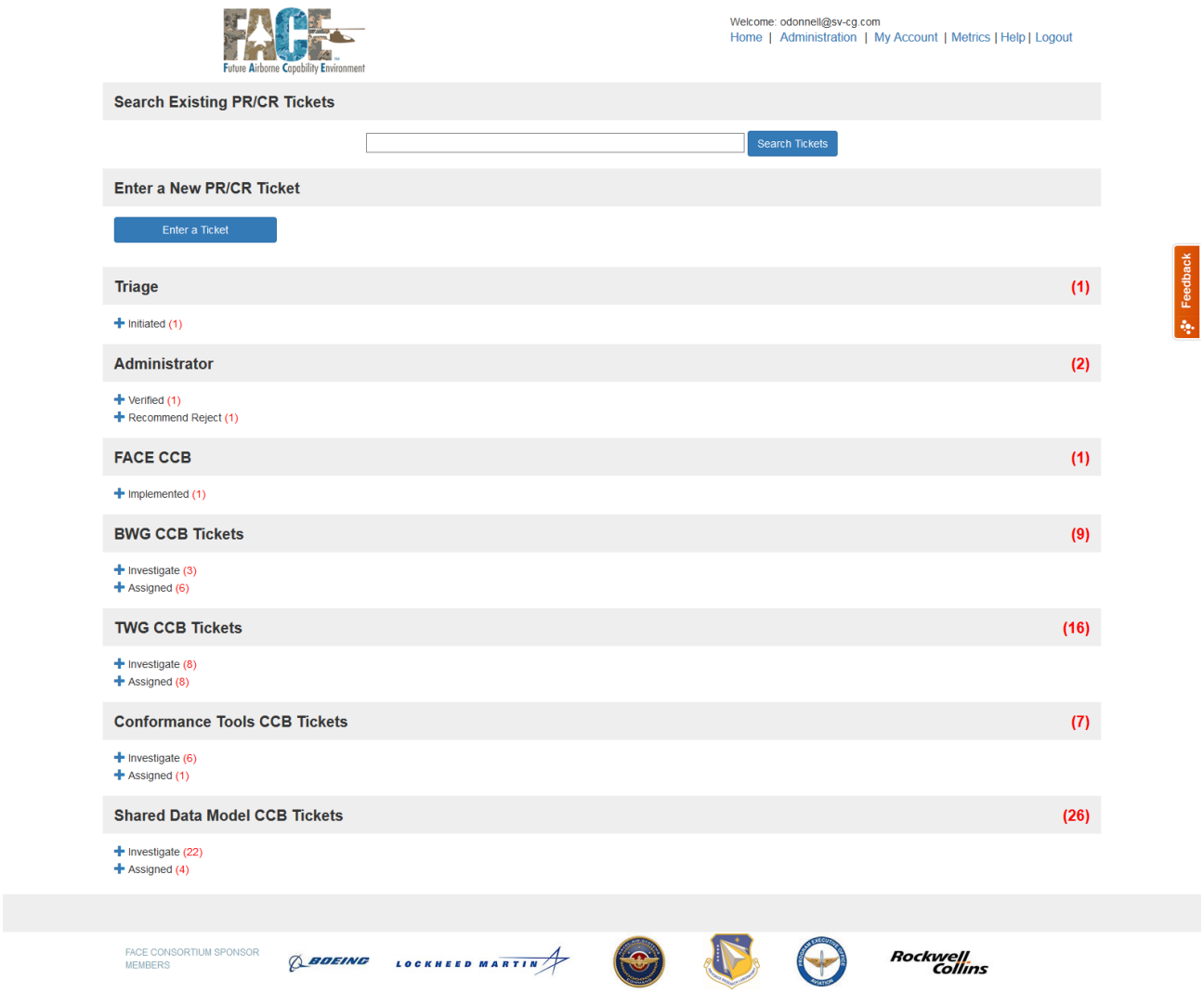
PR/CR Process



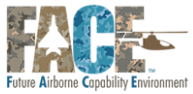
Create an account / login



User Dashboard



View all PR/CR tickets



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FACE PR/CR Ticket Search

Keyword: Search Tickets

Export Tickets to Excel

Refine By

Keyword Fields

- ☑ Ticket Title
- ☑ Description
- ☑ Proposal
- ☑ Resolution
- ☑ Notes

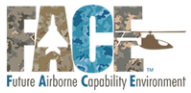
Ticket State
Criticality
Priority
Product
Product State

ID	Topic	Version	Consortium Title	Status	Priority
14	Library Requirements	2.0	Remove Digital Signature	Closed	
15	Library Requirements	2.0	Product Repository - Only FACE Certified Products	Closed	
16	Conformance Authorities Plan		Assign VA ID on Verification Statements	Implemented	Low
17	FACE Technical Standard	2.0	TSS API message_size parameter "in out"	Investigate	Low
18	FACE Technical Standard	2.1	Duplicate of 20	Rejected	
19	FACE Technical Standard	2.1	How MessagePorts would be used from a UoP to create connections revealed discreapancies	Assigned	Low
20	FACE Technical Standard	2.1	Add Software Communications Architecture (SCA) as a framework	Assigned	Low
21	FACE Technical Standard	2.1	SCA as a framework	Rejected	
22	FACE Technical Standard	2.1	Add NTPv4 (RFC-5905)	Rejected	Medium
23	FACE Technical Standard	2.0	Coordinate conversions are missing, or hidden in Frames of Reference	Investigate	
24	FACE Technical Standard	2.1	Figure 27 should be consistent with figure 46	Rejected	Low
25	FACE Technical Standard	2.1	Duplicate of 24	Rejected	
26	FACE Technical Standard	2.1	Add new services from ARINC 653 Part 2-2: HM Extensions & Queuing Port List Services	Assigned	Low
27	FACE Technical Standard	2.1	Clarify Platform-Specific Graphics Services restriction for Security Profile	Rejected	Low

Feedback

THE Open GROUP

Filter all tickets by state



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FACE PR/CR Ticket Search

Keyword: Search Tickets

Refine By

Keyword Fields

- ☑ Ticket Title
- ☑ Description
- ☑ Proposal
- ☑ Resolution
- ☑ Notes

Ticket State

- ☐ Initiated
- ☐ Returned
- ☐ Recommend Reject
- ☐ Investigate
- ☐ On Hold
- ☐ Proposed
- ☐ Assigned
- ☐ Implemented
- ☐ Verified
- ☑ Closed
- ☐ Rejected

Criticality

Priority

Product

- ☐ FACE Business Guide
- ☐ FACE Technical Standard
- ☐ Library Requirements
- ☐ FACE Shared Data Model
- ☐ DM Governance Plan
- ☐ Library Administration Plan

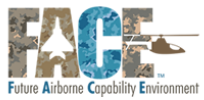
Export Tickets to Excel

ID	Topic	Version	Consortium Title	Status	Priority
14	Library Requirements	2.0	Remove Digital Signature	Closed	
15	Library Requirements	2.0	Product Repository - Only FACE Certified Products	Closed	
48	Conformance Authorities Plan		duplicate of 16	Closed	
78	FACE Shared Data Model	2.1	FACE 2.1 Shared Data Model removal of elements	Closed	Medium

Feedback

THE Open GROUP

Submit a Problem Report / Change Request



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Create a FACE PR/CR Ticket

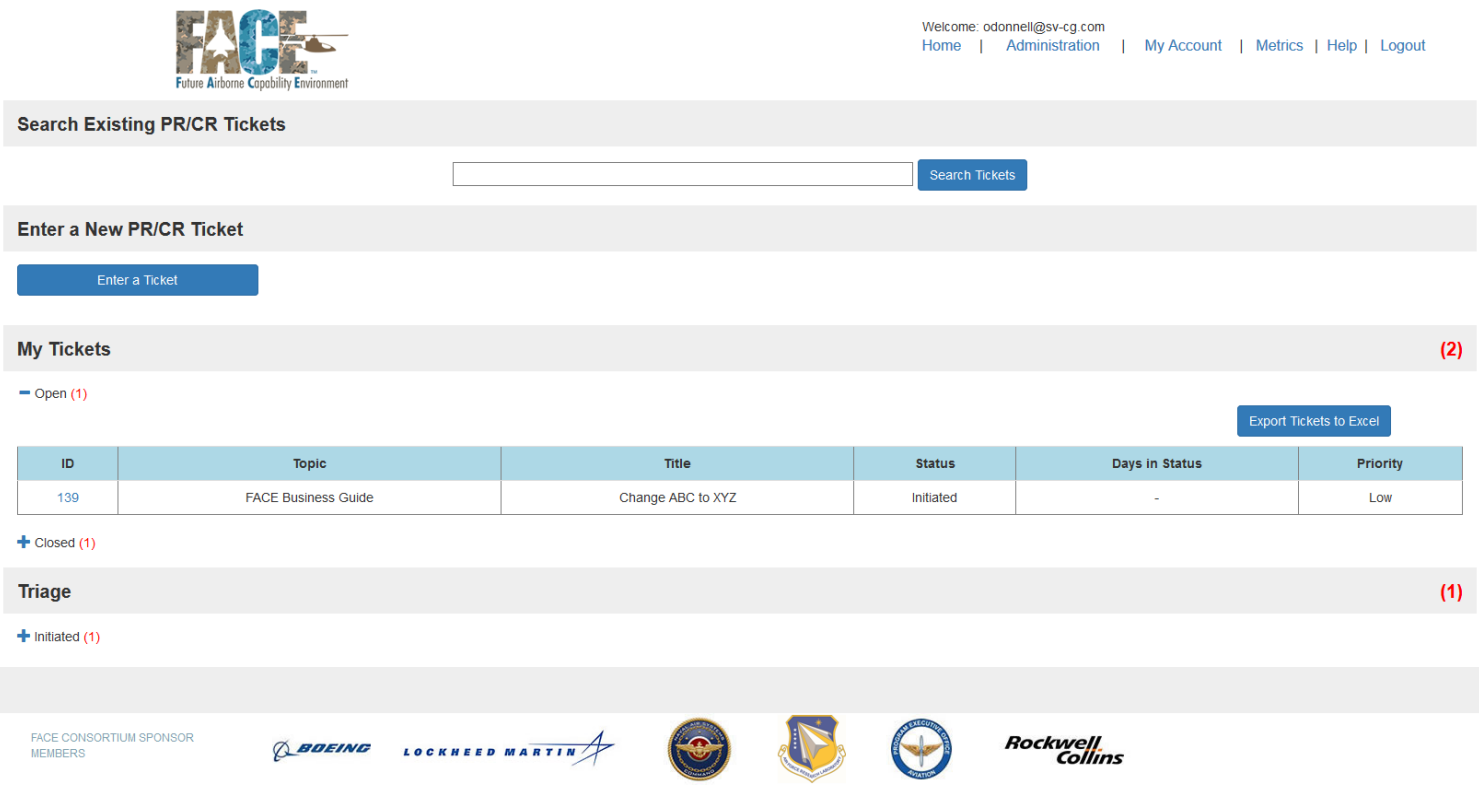
Information entered in Issues within this system is visible to the general public. Intellectual Property, confidential, or classified information should not be posted here. The FACE Consortium and the manager of this tool accepts no liability over the release of information through this system.

FACE Consortium Product	FACE Business Guide
Product Version	1.1
Comment Type	Editorial
Submitter Priority	Low
Location	
Submitter Title	
Submitter Description	
Submitter Proposed Resolution	
Certification Need	Yes
ITAR Data Exists	
Add Attachment	Choose File No file chosen

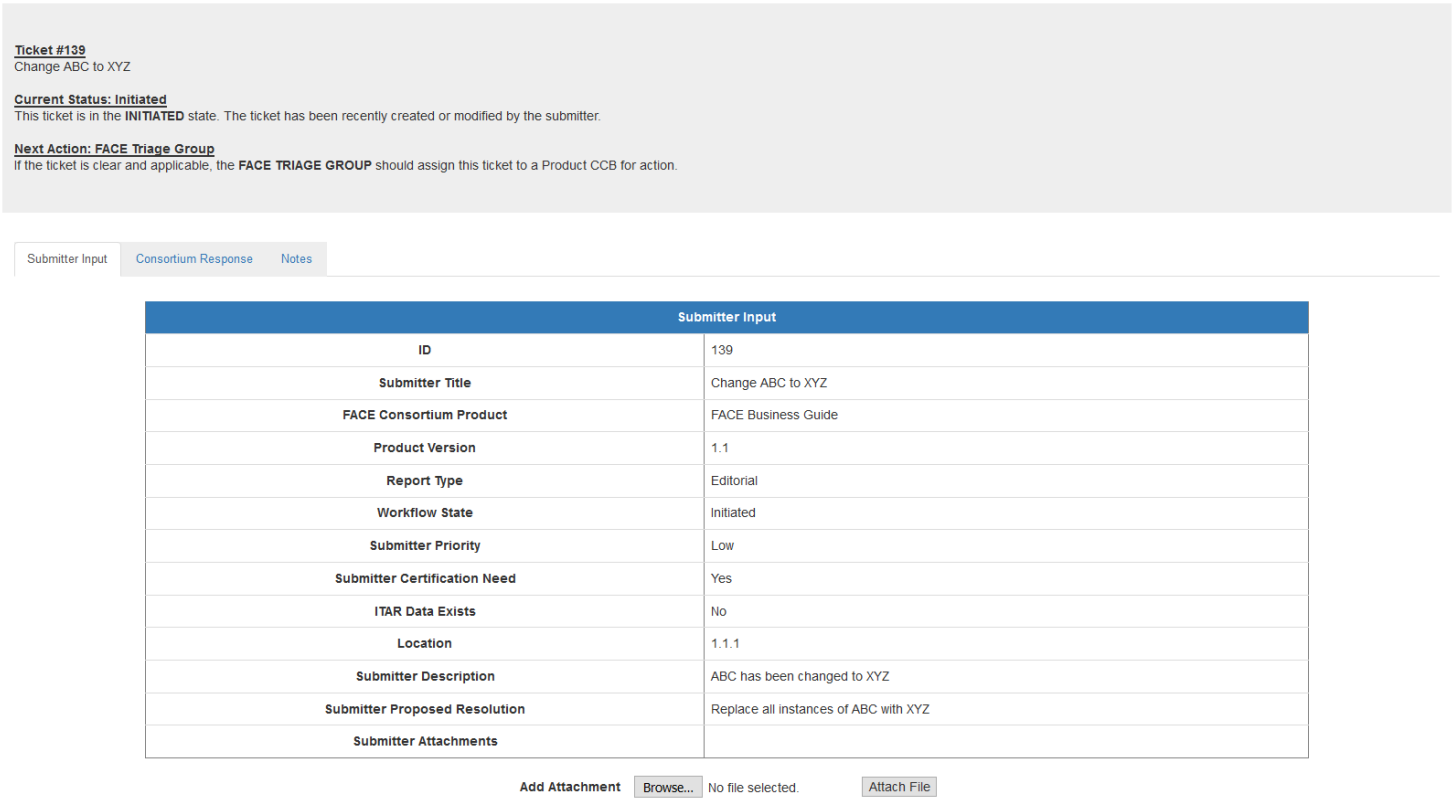
Enter New Ticket

Information entered in Issues within this system is visible to the general public. Intellectual Property, confidential, or classified information should not be posted here. The FACE Consortium and the manager of this tool accepts no liability over the release of information through this system.

View all submitted tickets in user dashboard



View details of submitted ticket



Ticket #139
Change ABC to XYZ

Current Status: Initiated
This ticket is in the **INITIATED** state. The ticket has been recently created or modified by the submitter.

Next Action: FACE Triage Group
If the ticket is clear and applicable, the **FACE TRIAGE GROUP** should assign this ticket to a Product CCB for action.

Submitter Input | Consortium Response | Notes

Submitter Input	
ID	139
Submitter Title	Change ABC to XYZ
FACE Consortium Product	FACE Business Guide
Product Version	1.1
Report Type	Editorial
Workflow State	Initiated
Submitter Priority	Low
Submitter Certification Need	Yes
ITAR Data Exists	No
Location	1.1.1
Submitter Description	ABC has been changed to XYZ
Submitter Proposed Resolution	Replace all instances of ABC with XYZ
Submitter Attachments	

Add Attachment Browse... No file selected. Attach File

Feedback

View consortium response to submitted ticket

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Ticket #139
Change ABC to XYZ

Current Status: Initiated
This ticket is in the **INITIATED** state. The ticket has been recently created or modified by the submitter.

Next Action: FACE Triage Group
If the ticket is clear and applicable, the **FACE TRIAGE GROUP** should assign this ticket to a Product CCB for action.

Submitter Input | Consortium Response | Notes

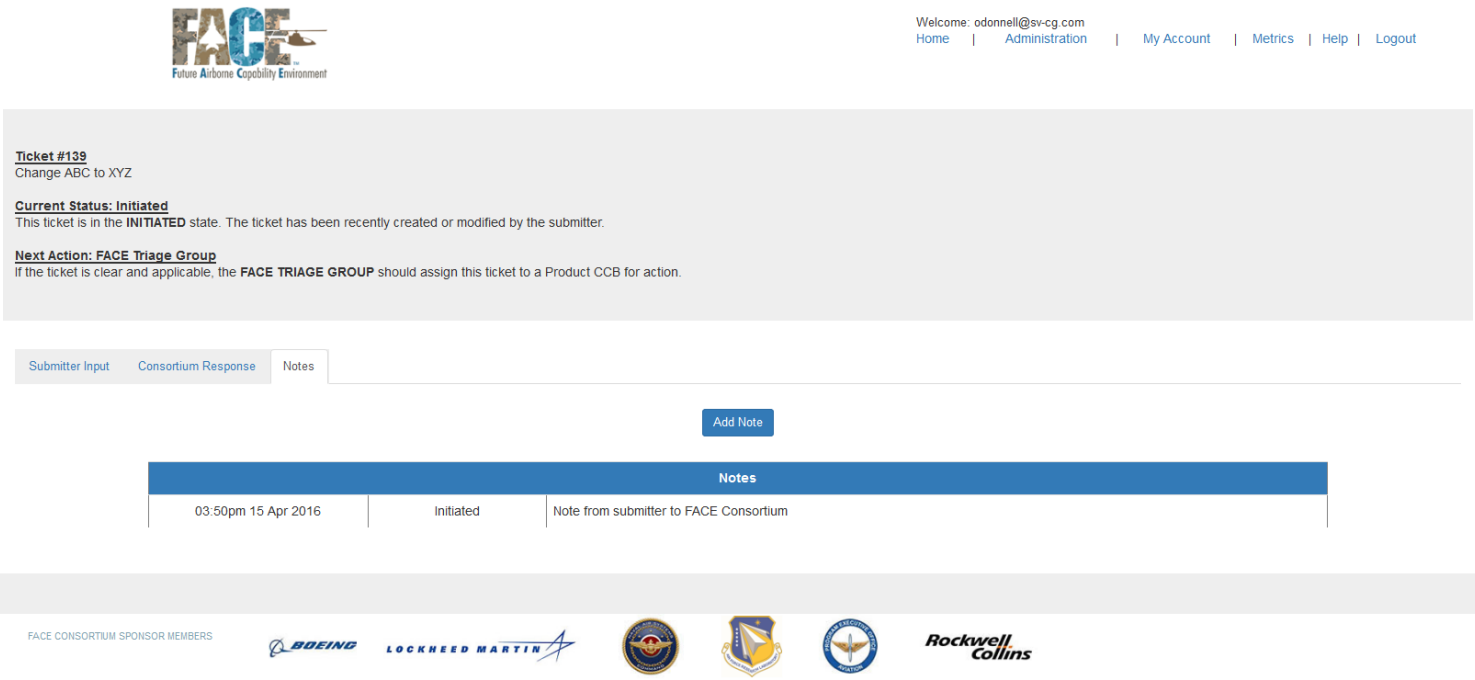
Consortium Response	
Consortium PR/CR Title	Change ABC to XYZ
Consortium Description	ABC has been changed to XYZ
Consortium PR/CR Criticality	
Consortium PR/CR Priority	
Proposal Subcommittee	
Local Impact Only	
Proposed Correction	
Proposed Correction Approved	
Proposed Correction Approved Date	

Feedback

FACE CONSORTIUM SPONSOR MEMBERS

THE Open GROUP

Communicate with FACE Consortium about PR/CR



The FACE Technical Standard

NAVAIR Public Release 2014-088
NAVAIR Public Release 2015-268

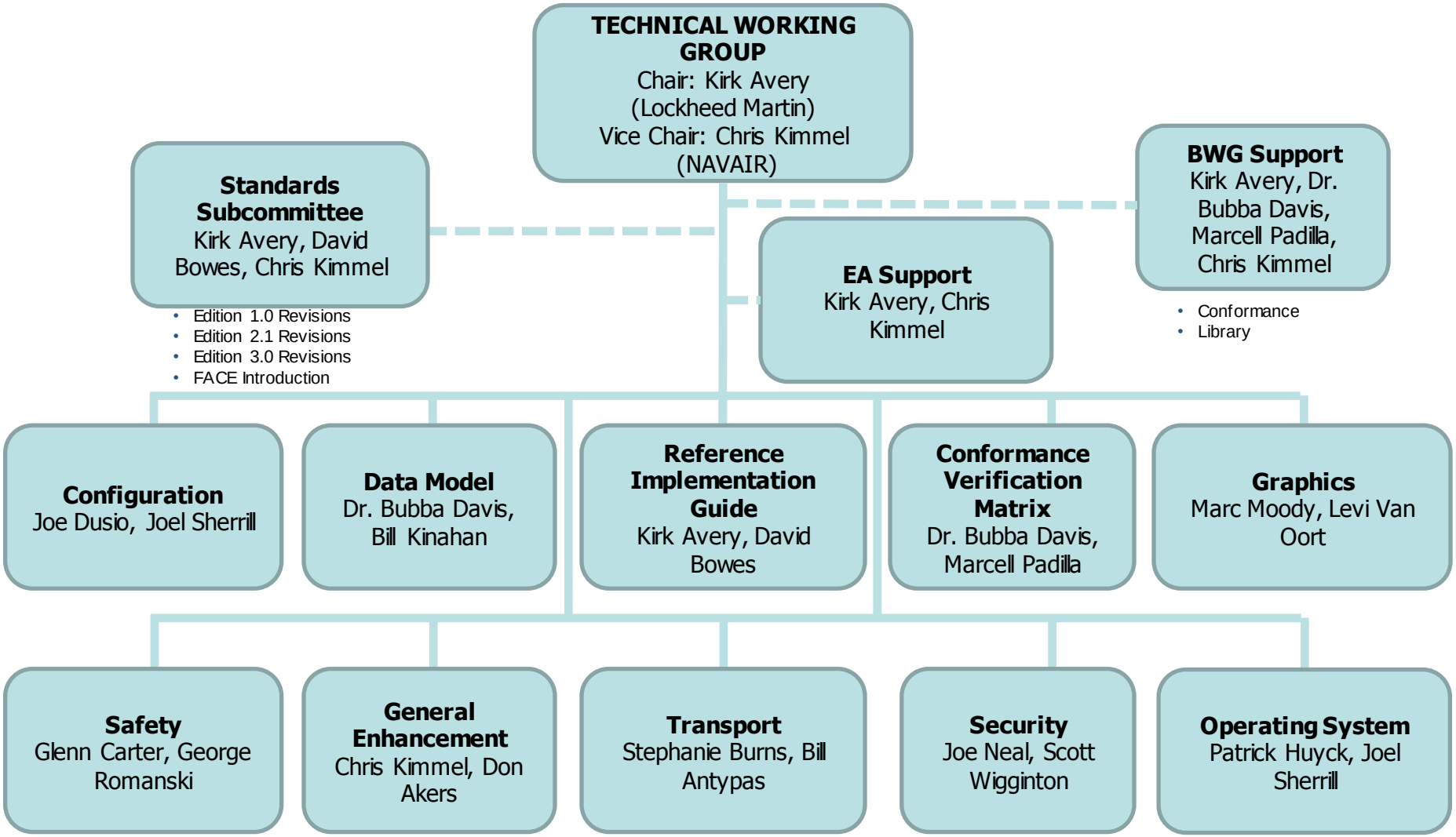
Distribution Statement A
"Approved for public release distribution is unlimited"

Kirk Avery
Technical Working Group Chair
Lockheed Martin Fellow
Lockheed Martin Mission Systems and Training Ship and Aviation Systems

Master Class Overview

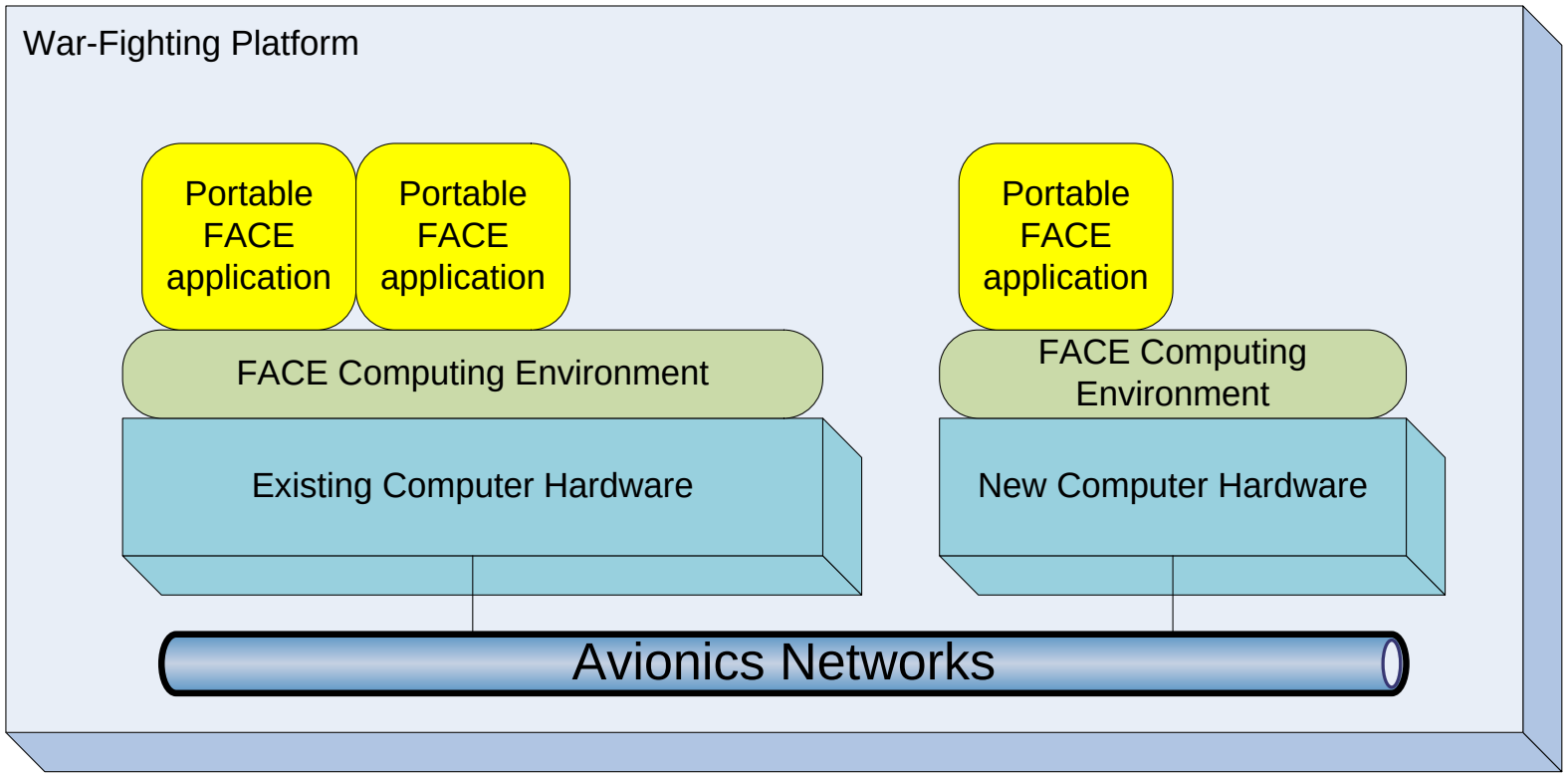
- FACE Technical Standard
  - An in-depth description of the technical reference architecture defined in the FACE Technical Standard
  - Planned enhancements for the FACE Technical Standard
- Future plans for the Data Model Architecture and Shared Data Model

FACE TWG Organization Chart

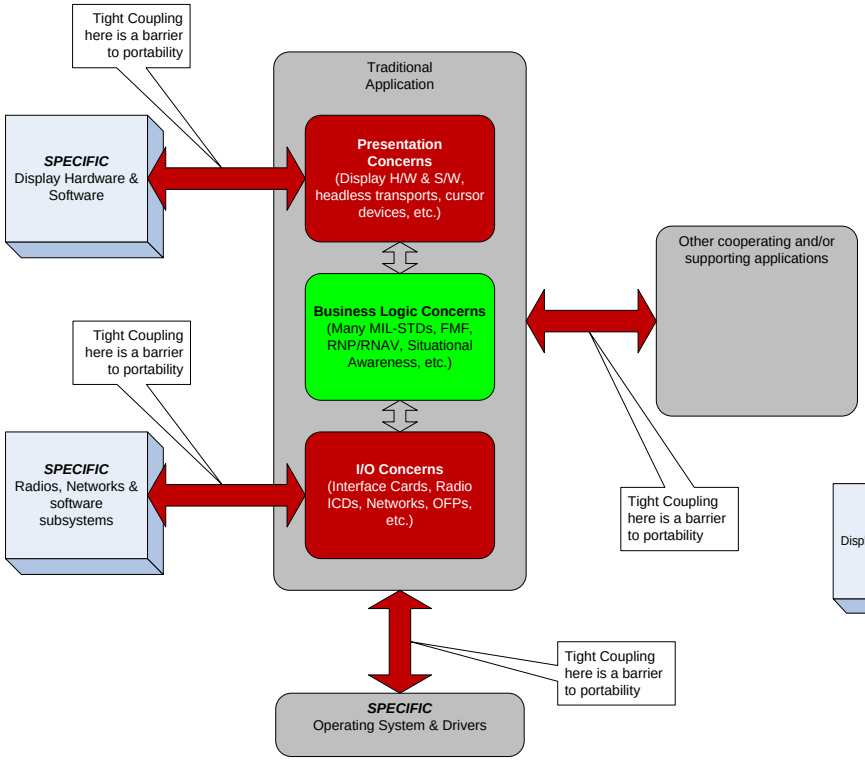


FACE Technical Strategy

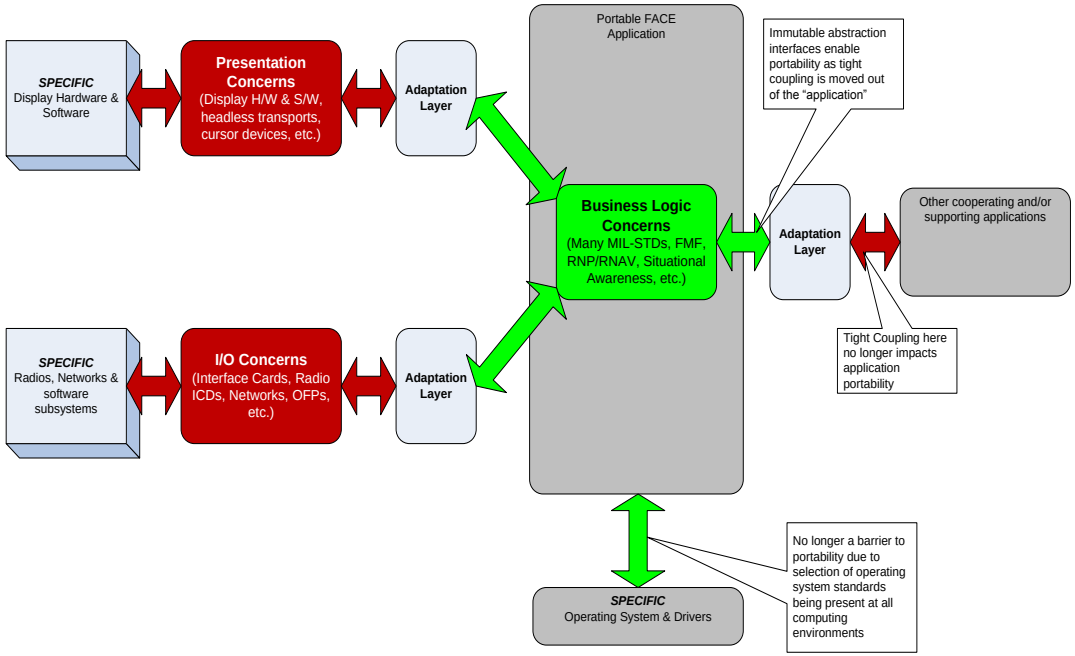
The FACE strategy is to create a software environment on the installed computing hardware of DoD aircraft (a.k.a. platforms) that enables FACE applications to be deployed on different platforms with minimal to no impact to the FACE application.



Eliminates Barriers to Portability



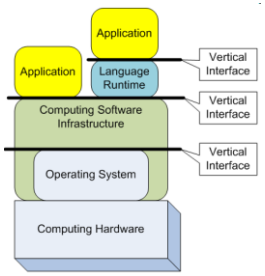
- Truly portable applications require common open standards at multiple layers in the architectures
- Prevents lock-in and improves competition throughout supply chain

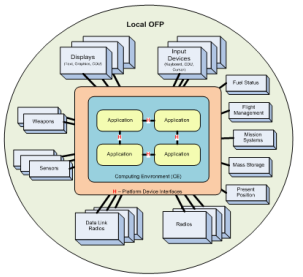


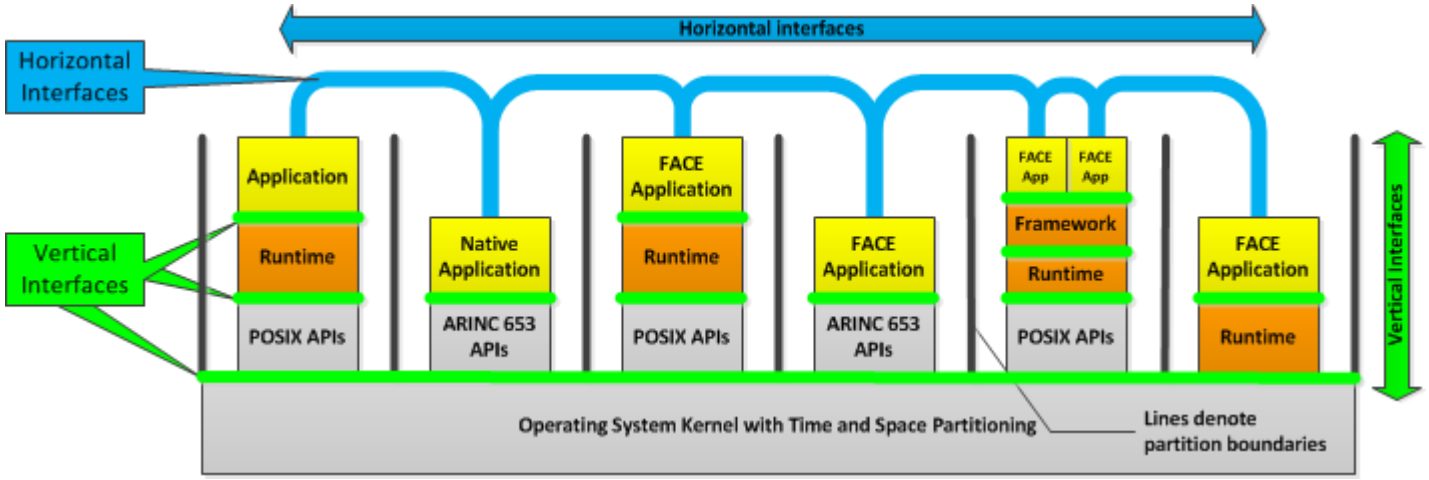
- Uniform application of common open standards across DoD aviation needed to break "Cylinders of Excellence"

What is the FACE Architecture?

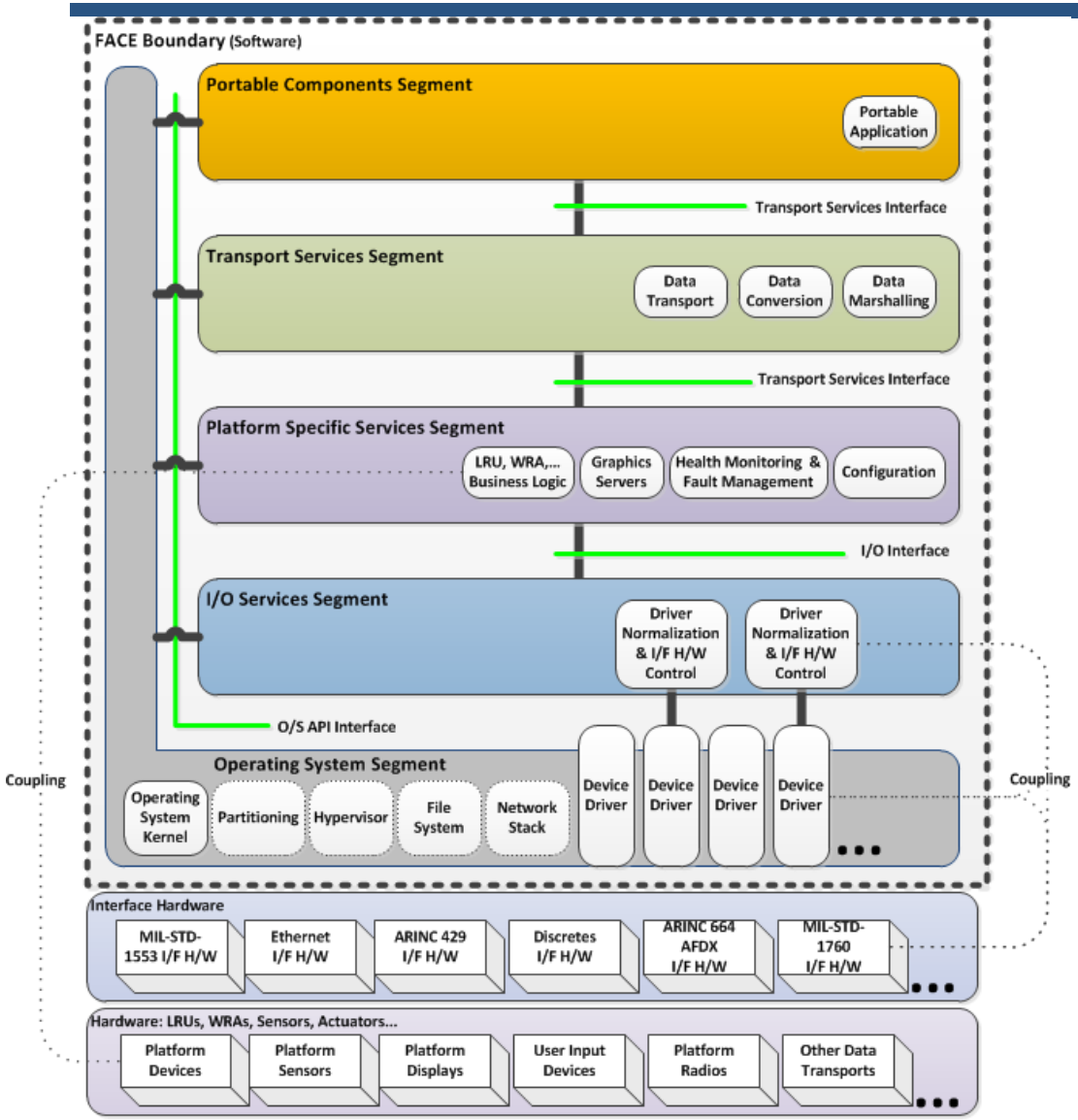
- A software computing environment to enable product lines for military Aviation
- The FACE architecture is comprised of a set of "places" where variance occurs
  - Points of variance are called "Segments"
  - The structure created by connecting these segments together is the beginning of the FACE architecture
- Horizontal and vertical interfaces defined as part of FACE architecture





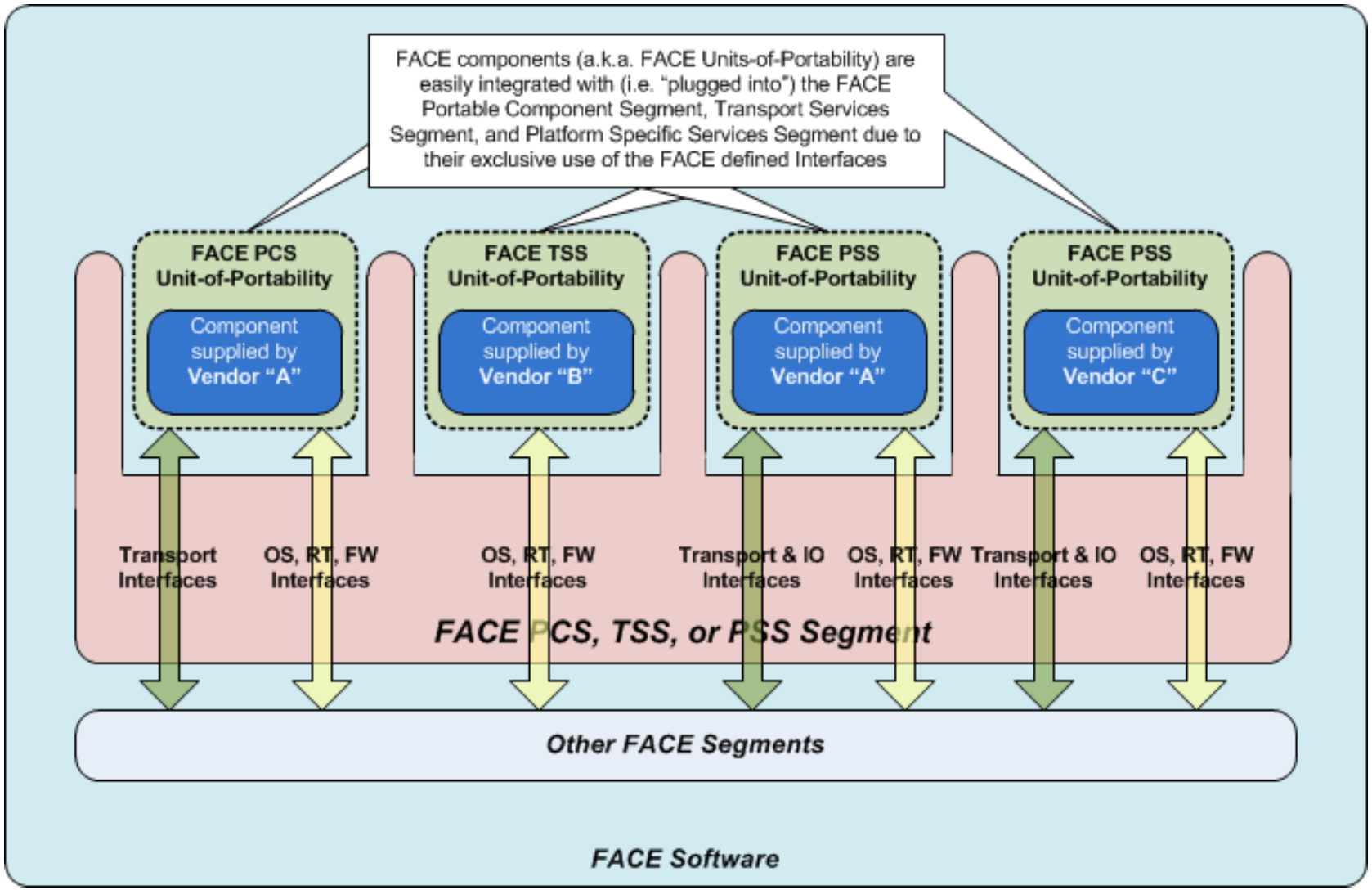


FACE Architectural Segments

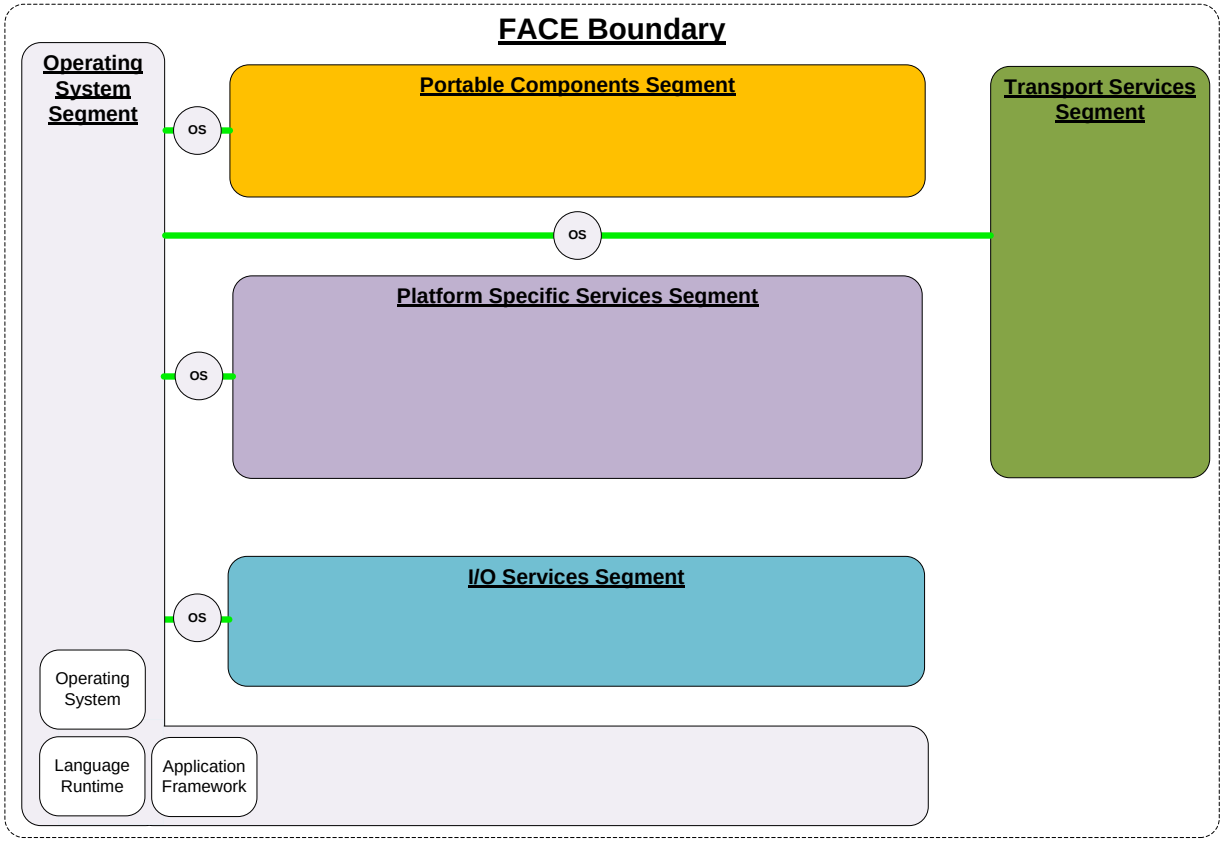


- **FACE Portable Components Segment**
  - Portable Applications
  - Portable Common Services
- **Transport Services Segment**
- **Platform Specific Services Segment**
  - Platform Device Services
  - Platform Common Services
  - Graphics Services
- **I/O Services Segment**
- **Drivers**
- **Operating System Segment**

Standardization and Constraint on UoP Interfaces

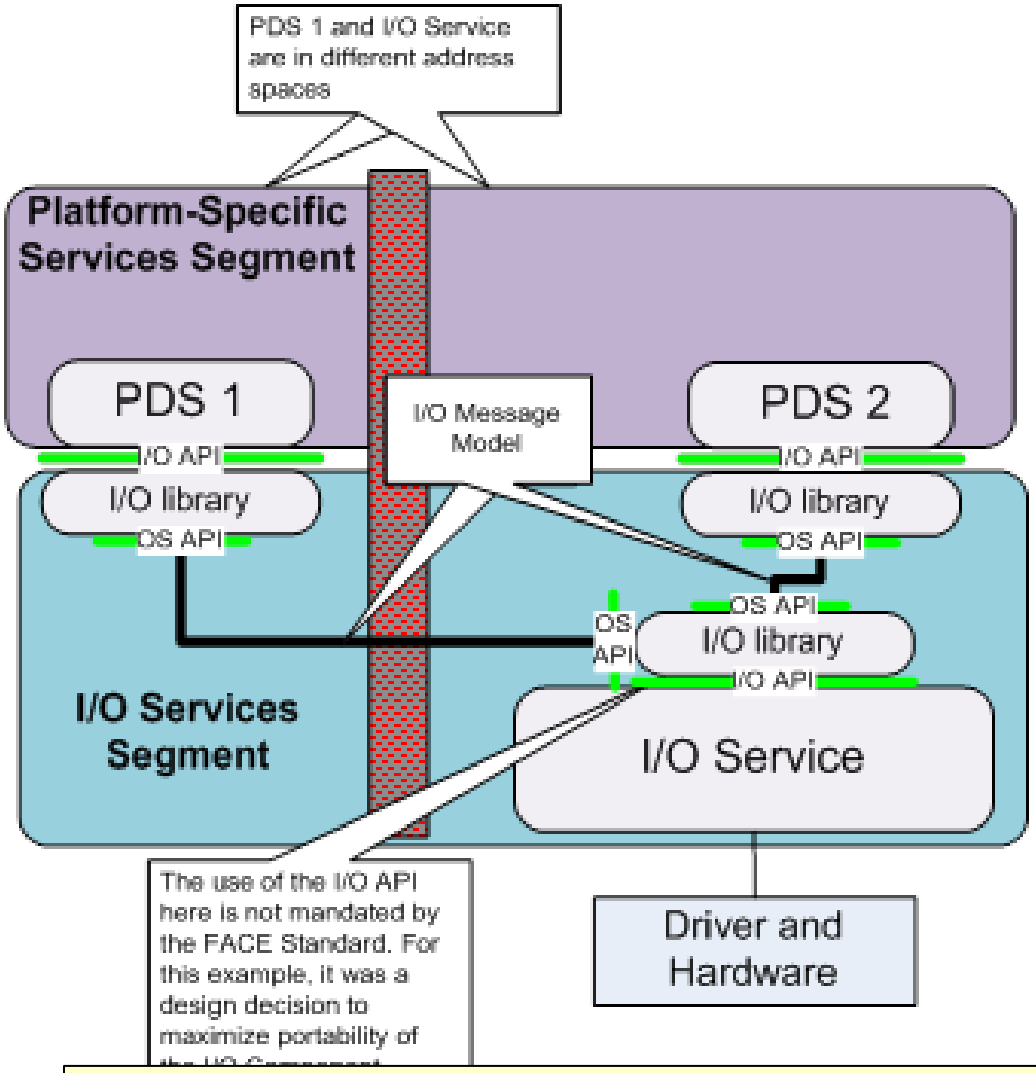


Operating System Segment



- **Operating System Segment**
  - Governed by:
    - POSIX
    - ARINC 653
  - Profiles:
    - General Purpose
    - Safety
    - Security
  - Language Runtimes
  - Application Frameworks

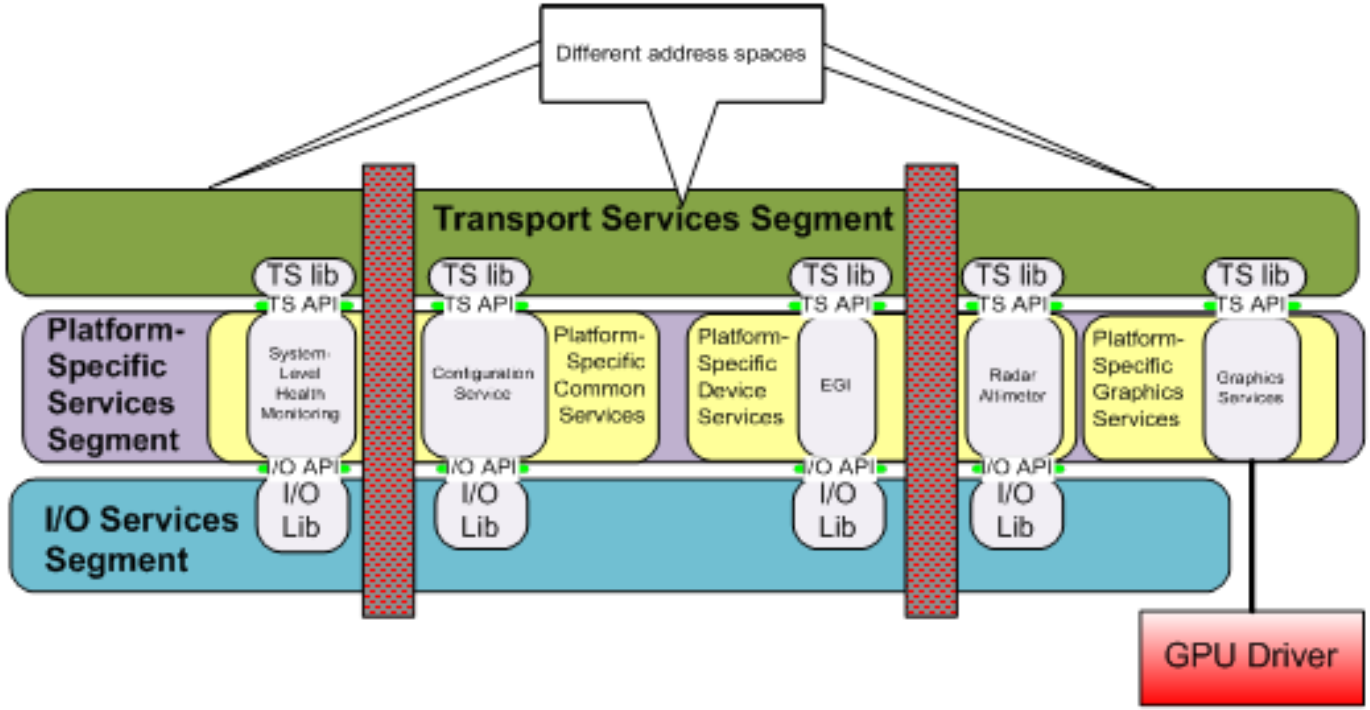
IO Services Segment



- The PDS packs data and sends over the IO API
- Data is sent between I/O Libraries over the OS API using the IOMM
- The I/O Service reads and writes data to the device drivers
- The I/O Service sends received data to the I/O library
- Data is sent between I/O Libraries over the OS API using the IOMM
- The PDS extracts the data from the message payload received over the IO API

Note: For more information on this and other example Implementations, refer to FACE Reference Implementation Guide

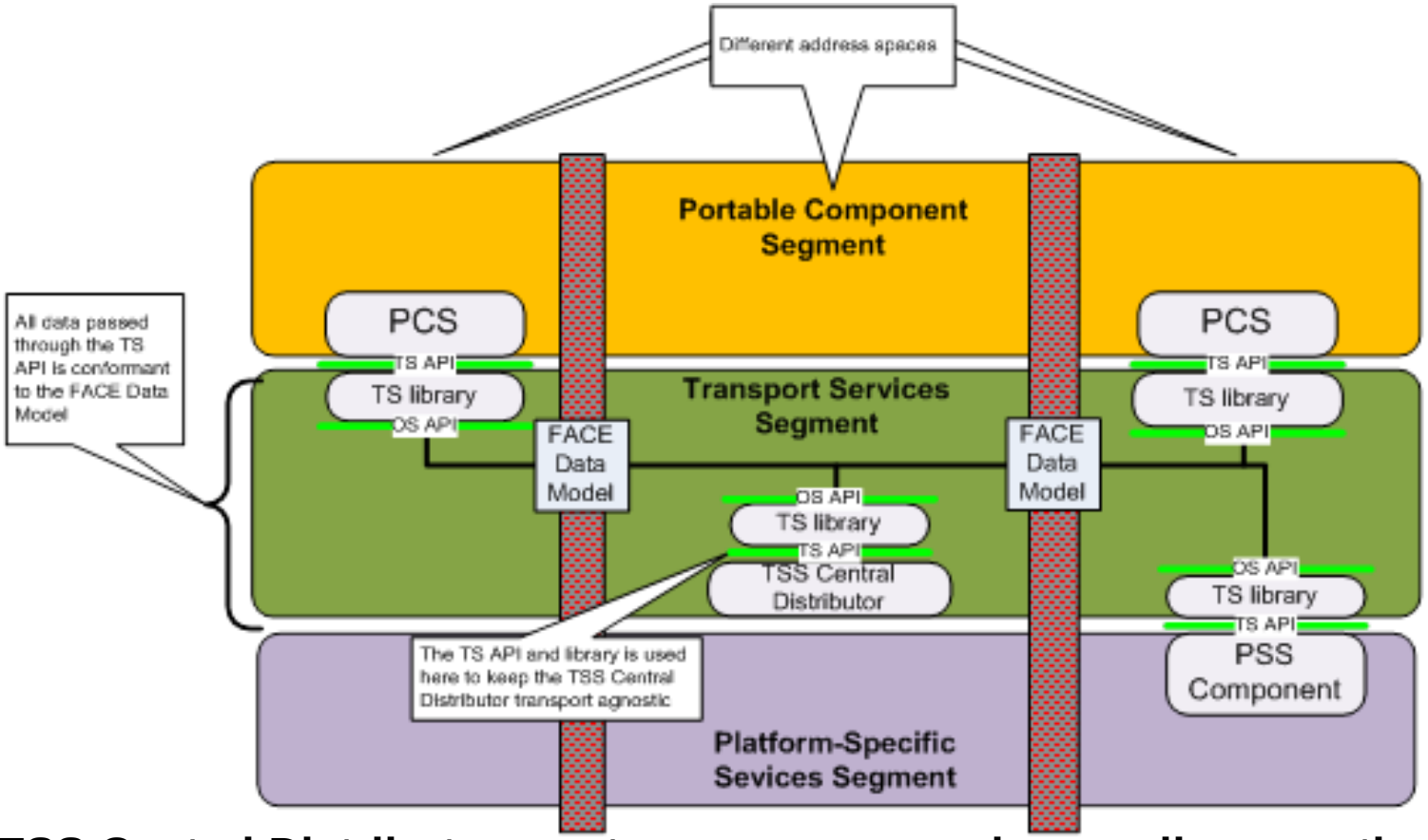
Platform Specific Services Segment



- **PSSS components can use the I/O Interface to communicate with the IOSS**
- **PSSS components may communicate directly with the GPU driver**
- **PSSS components use the TS Interface to communicate with the TSS**
  - The TS Interface provides communication between PSSS and PCS components
  - PSSS components can act as software abstractions by converting I/O Interface data to the FACE Data Model for use in the TSS

Note: For more information on this and other example Implementations, refer to FACE Reference Implementation Guide

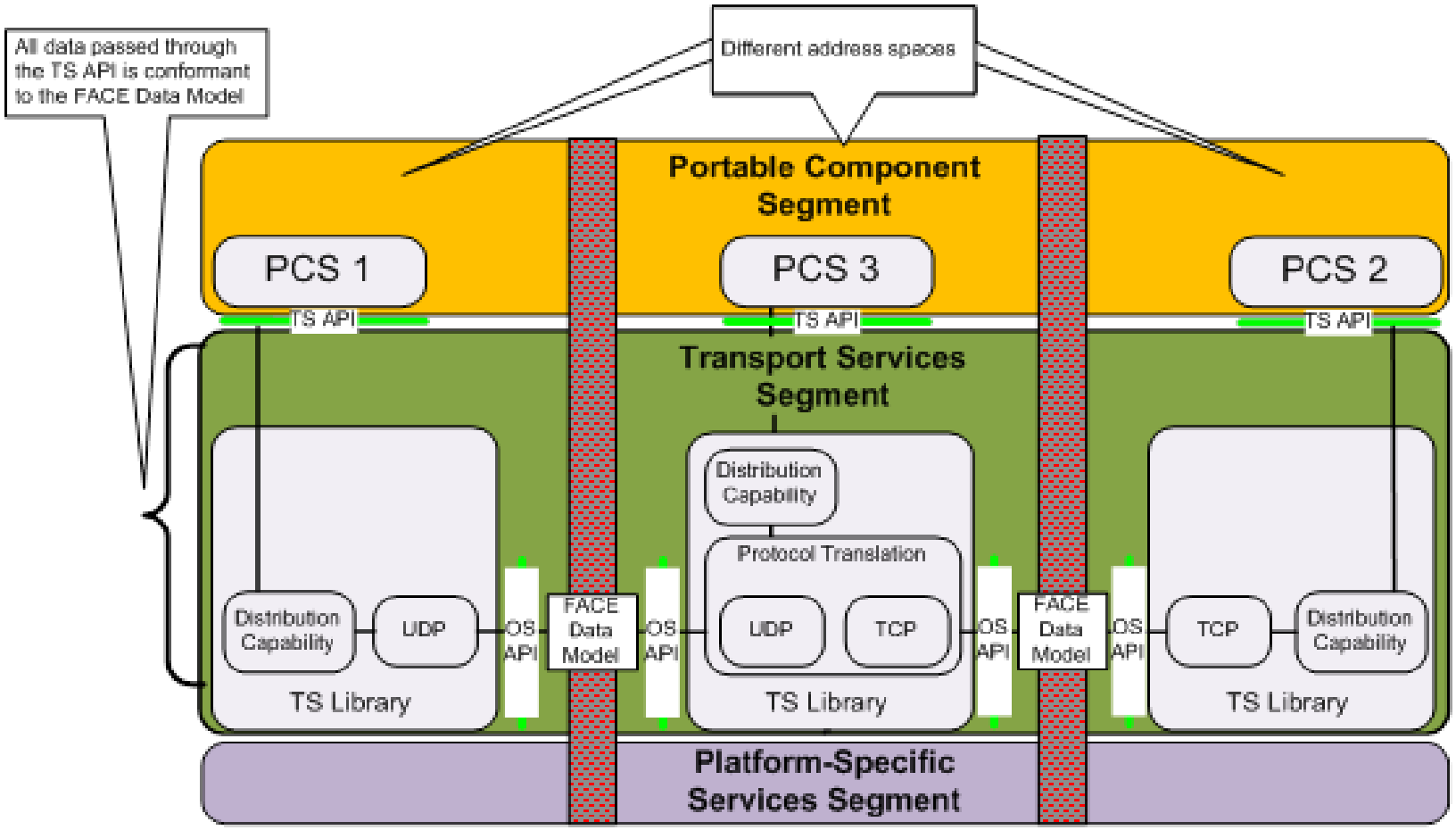
Transport Services Segment Centralized Distributor



- **The TSS Central Distributor creates, manages, and uses all connections necessary to perform message distribution**
- **Each TS Library only communicates with the TS Library associated with the TSS Central Distributor**

Note: For more information on this and other example Implementations, refer to FACE Reference Implementation Guide

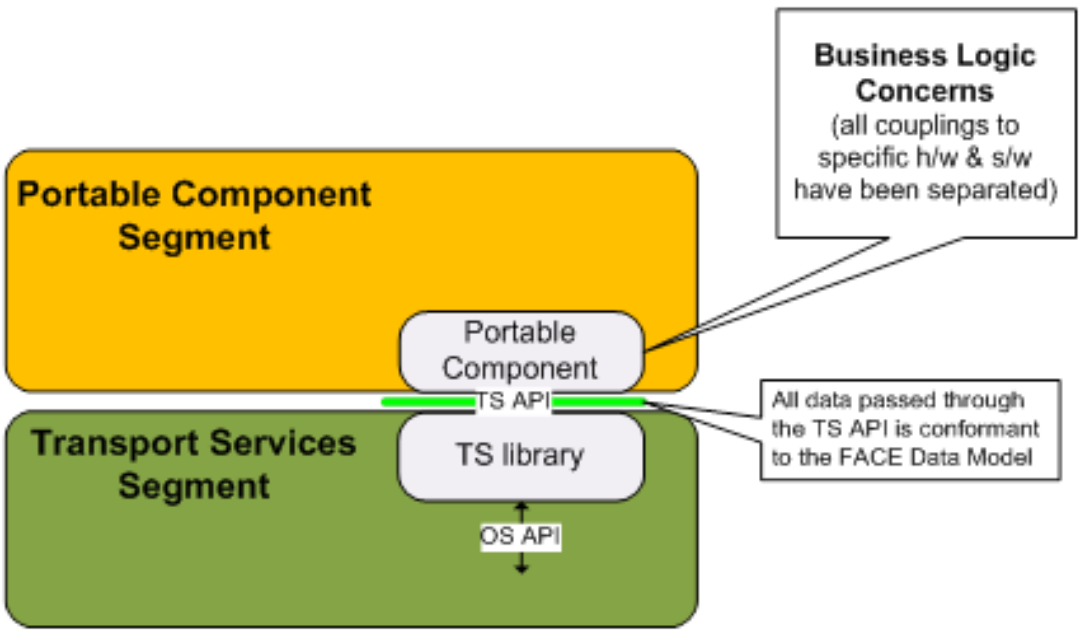
Transport Services Segment Distributed Protocol Translation



- **Example of a distributed implementation between PCS 1, PCS 2, and PCS 3 TS Libraries where PCS 3 exchanges data to/from both PCS 1 and PCS 2**

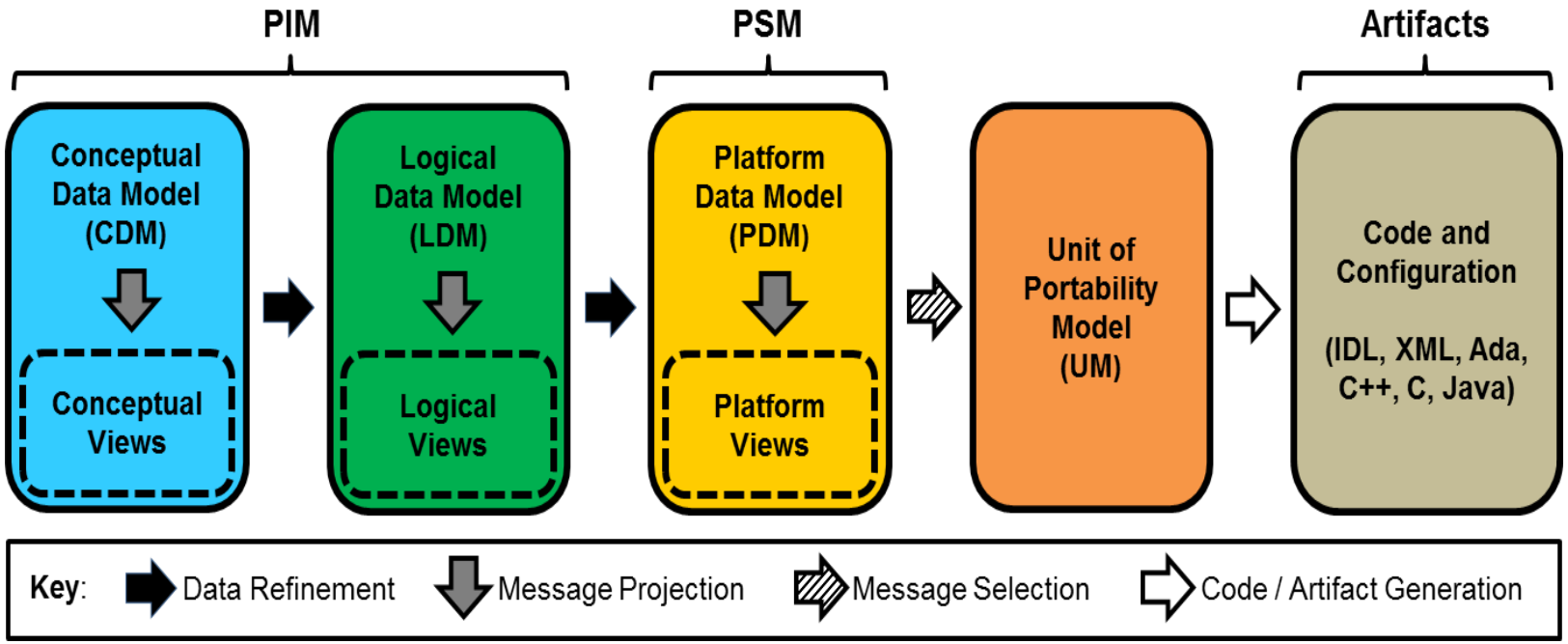
Note: For more information on this and other example Implementations, refer to FACE Reference Implementation Guide

Portable Components Segment



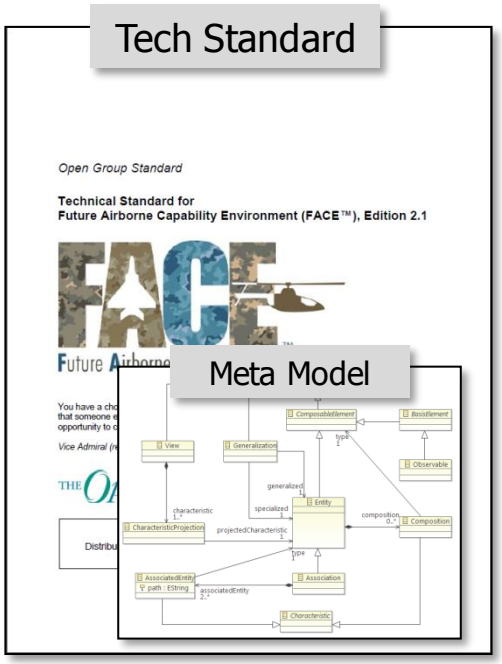
- The PCS is not a deliverable container for software
- The PCS is a logical container for UoPs
- PCS components are entirely independent from other FACE segments
- A PCS UoP contains the business logic decoupled from a specific implementations
- A PCS UoP must use the TS Interface for all communication
- Any data sent over the TS Interface must use the FACE Data Model.

FACE Data Model Architecture

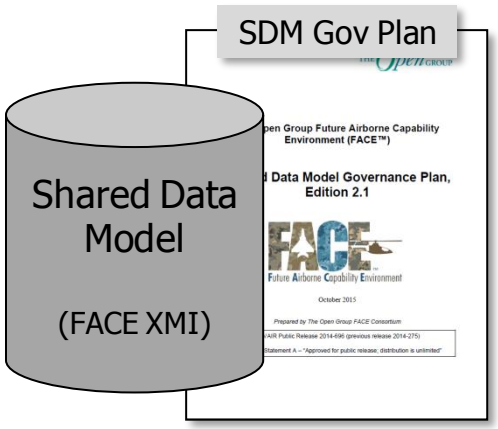


- Three levels to the primary data and message models aligned with ideas from the Object Management Group's (OMG) Model Driven Architecture™
- The addition of the Unit of Portability Model (UM) allows components to be tied to the messages and data elements in the Platform Model
- Supports definition and potentially generation of code and other artifacts

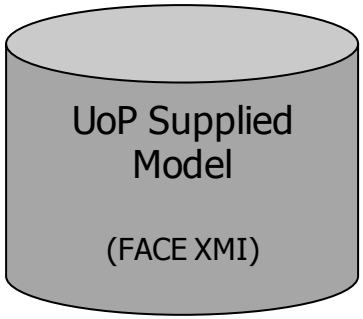
FACE Data Architecture



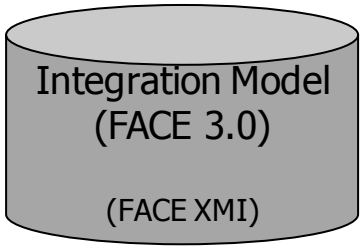
- Meta-Model defines rules for data model construction
- OCL Constraints added for semantic checks



- Defines basis elements enforced across all UoP data models.
- Baseline established by Data Model Subcommittee
- Managed by Data Model CCB according to **Data Model Governance Plan**
  - Defines basis elements to be managed
- Will grow as UoP developers add to it.
- Stored in an XMI file



- Built by UoP Developers
- Must align with SDM
- New basis element items must be added to SDM before conformance can be achieved
- Stored in an XMI file



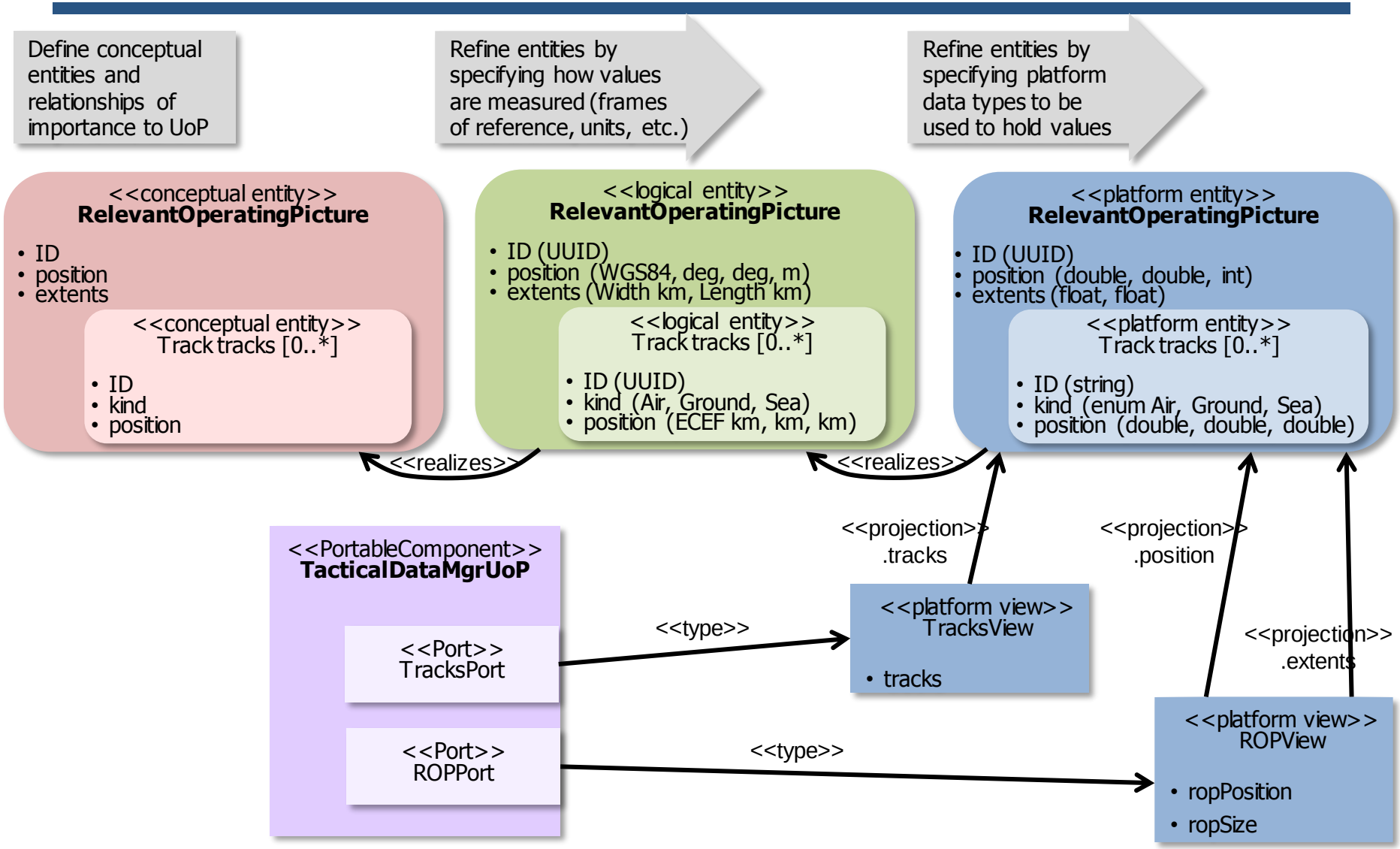
- Built By System Integrators
- Defines interconnectivity between UoPs in a system
- Stored in XMI file

Overview of Model Levels

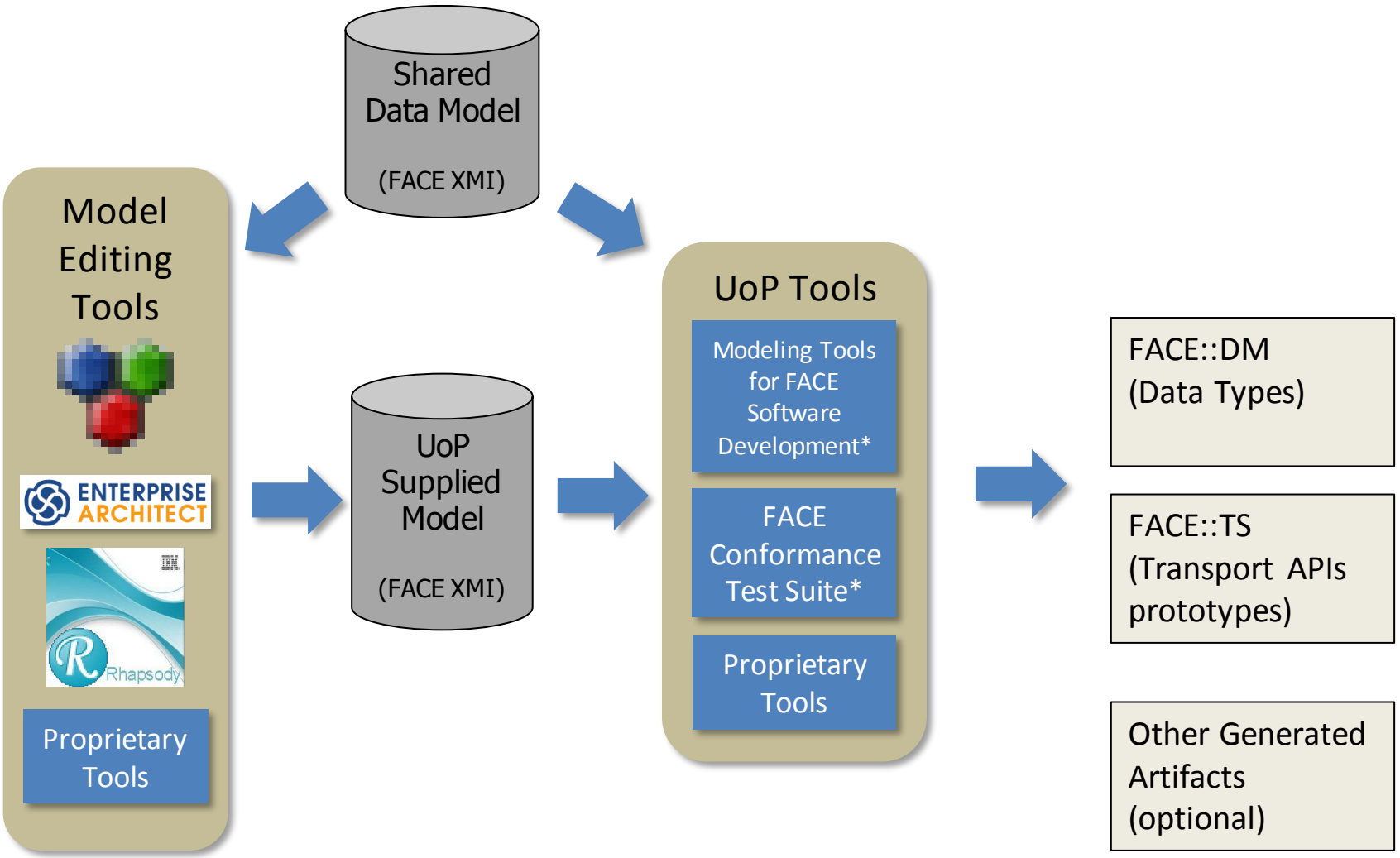
	From Shared Data Model (SDM)	Added In UoP Supplied Model (USM)
Conceptual Model Defines basic ideas and establishes abstract definition of entities	Observables	Entities, Associations
Logical Model Refines entity concepts and describes how observable properties will be measured.	Coordinate System, Coordinate System Axis, Measurement System, Measurement System Axis, Landmarks, Reference Point, Reference Point Part, Units, Value Type	Entities, Associations, Measurements, Measurement Axis
Platform Model Refines logical entities and describes how measurements will be mapped into IDL data types. Adds views to map data into messages.	IDLPrimitiveTypes	Entities, Associations, IDLTypes, Views
UoP Model Defines FACE Component and ports for data exchange.		Platform Specific Component, Portable Component, Port

Note: Not complete list of meta-model elements. For introduction only! See meta model for complete list

Data Model Example



Data Model Tools and Flow



* Available from http://www.opengroup.org/face

FACE Technical Standard Planned Enhancements

- FACE Edition 3.0
  - Refinements from FACE Technical Standard, Edition 2.x
  - OS API Set enhancements
  - Extensions for Multi-Core and Hypervisor
  - Component Framework/Language Runtime integration
  - I/O Service message types enhancements
  - Configuration Services enhancements
  - Data Architecture enhancements
  - System Lifecycle Model definition
  - TSS Interoperability enhancements
  - Graphics Enhancements

FACE Technical Standard (Data Architecture Future Plans)

- The FACE Technical Standard 3.0 has been architected for separation of the FACE Data Architecture sections
  - Allowing for independent governance
  - Facilitate Data Architecture and Shared Data Model evolution
  - Prepare for multi-domain adoption
  - Enable expanded contribution
  - Currently planned for Technical Standard, Edition 3.1

Publicly Available FACE Documentation

- FACE Technical Standard Edition 1.0
  - http://www.opengroup.org/bookstore/catalog/c122.htm
- FACE Technical Standard Edition 1.1
  - https://www2.opengroup.org/ogsys/catalog/C13J
- FACE Technical Standard Edition 2.0
  - www.opengroup.org/bookstore/catalog/c137.htm
- FACE Technical Standard Edition 2.1
  - https://www2.opengroup.org/ogsys/catalog/c145
- FACE Reference Implementation Guide Edition 2.0
  - https://www2.opengroup.org/ogsys/catalog/g142
- FACE Reference Implementation Guide Edition 2.1
  - https://www2.opengroup.org/ogsys/catalog/g162
- FACE Data Model Governance Plan Edition 2.1
  - https://www.opengroup.us/face/documents.php?action=show&dcat=&gdid=16916
- FACE Shared Data Model Edition 2.0
  - https://www.opengroup.us/face/documents.php?action=show&dcat=&gdid=16917
- FACE Shared Data Model Edition 2.1
  - https://www.opengroup.us/face/documents.php?action=show&dcat=31&gdid=17240
- FACE Conformance Policy 1.1
  - https://www2.opengroup.org/ogsys/catalog/X1406
- FACE Conformance Authorities Plan 1.0
  - https://www2.opengroup.org/ogsys/catalog/X1302
- FACE Conformance Statement
  - https://www.opengroup.us/face/documents.php?action=show&dcat=&gdid=16656
- FACE Verification Statement
  - https://www.opengroup.us/face/documents.php?action=show&dcat=&gdid=16719
- FACE Conformance Verification Matrix User's Guide 2.0
  - www.opengroup.org/bookstore/catalog/x1318.htm
- FACE Conformance Verification Matrix Edition 1.1
  - www.opengroup.org/bookstore/catalog/x1318a.htm
- FACE Conformance Verification Matrix Edition 2.0
  - www.opengroup.org/bookstore/catalog/x1318b.htm
- FACE Conformance Verification Matrix Edition 2.1
  - https://www2.opengroup.org/ogsys/catalog/X1412A
- FACE Business Guide, Version 1.1
  - http://www.opengroup.org/bookstore/catalog/g115.htm
- FACE Library Requirements Document Edition 2.2
  - https://www.opengroup.us/face/documents.php?action=show&dcat=&gdid=17212
- FACE Library Implementation Plan 1.0
  - https://www.opengroup.us/face/documents.php?action=show&dcat=&gdid=16438
- FACE Library Administration Plan 1.0
  - https://www.opengroup.us/face/documents.php?action=show&dcat=&gdid=16959
- FACE Conformance Test Suites
  - https://www.opengroup.us/face/documents.php?action=show&dcat=50&gdid=16964
- FACE Contract Guide Version 1.0
  - https://www2.opengroup.org/ogsys/catalog/G145

For Change Requests / Problem Reports please use the following link:
https://mantis-fp.gtri.gatech.edu/

Summary

- FACE is addressing the business concerns that have hampered other OA initiatives
- FACE documentation is being designed through industry and government collaboration
- FACE enables getting capabilities to the Warfighter with reduced schedule and at a lower cost
- FACE Technical Standard requirements are being required by Customers today
- The FACE Technical Standard is being used today across industry product lines