



**Driving Lower Cost
and Faster Capability
Deployment**

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Presentation Overview



- Why are we here?
 - Some of the key challenging problems.
- How can we meet these challenges?
 - SDR technology and standardization.
 - Software Communications Architecture (SCA).
 - Realizing “true” International SCA Standards via the WinnF Coordination Model.
 - Application of Software Product Line (SPL) Techniques for SCA Solutions.
- Where do we go from here?
 - Conclusions.



The Challenging Problems



- Interoperability
 - Incompatible equipment and frequency bands.
 - Lack of cooperative agreements.
 - Lack of training.
 - Institutional control and culture.
- Latency and cost of technology insertion.
- Information Assurance (IA) and security for sovereign and coalition operations.
- Operational complexity.

Interoperability is a fundamental issue, but other aspects are also critically important.



SDR Technology and Standardization

Benefits of Open SDR Standards



- Enabler for interoperability, procurement clarity.
- Platform knowledge sharing.
 - Reduce costs and risks associated with innovation through the collective brainpower and investment of:
 - Industry (defense, public safety and commercial providers)
 - Governments worldwide
 - Academia (i.e., Virginia Tech, Karlsruhe, Stevens Institute)
- Facilitates software reuse.
 - Reducing development costs and product time-to-market.
 - **Build less software, reuse proven existing applications.**
- Market competitiveness.
 - Facilitates technology insertion, third-party participation.
- Development and integration of advanced applications.
 - I.e., situation awareness, dynamic spectrum allocation

What Makes a Standard Open?



- Not proprietary.
- Readily available, published specifications.
 - Includes all elements of the standard (i.e., APIs).
 - Change management (i.e., backwards compatibility).
 - Promotes development / availability of tools suites.
- Formal, accessible, affordable and timely test, evaluation and certification process.
 - One or more certified (validated) implementations providing proof that the standard can be implemented.
- Extensibility, ability to evolve with future demands.
- Broad acceptance across industry, Government and relevant user space.

U.S. DoD Key SDR Objectives



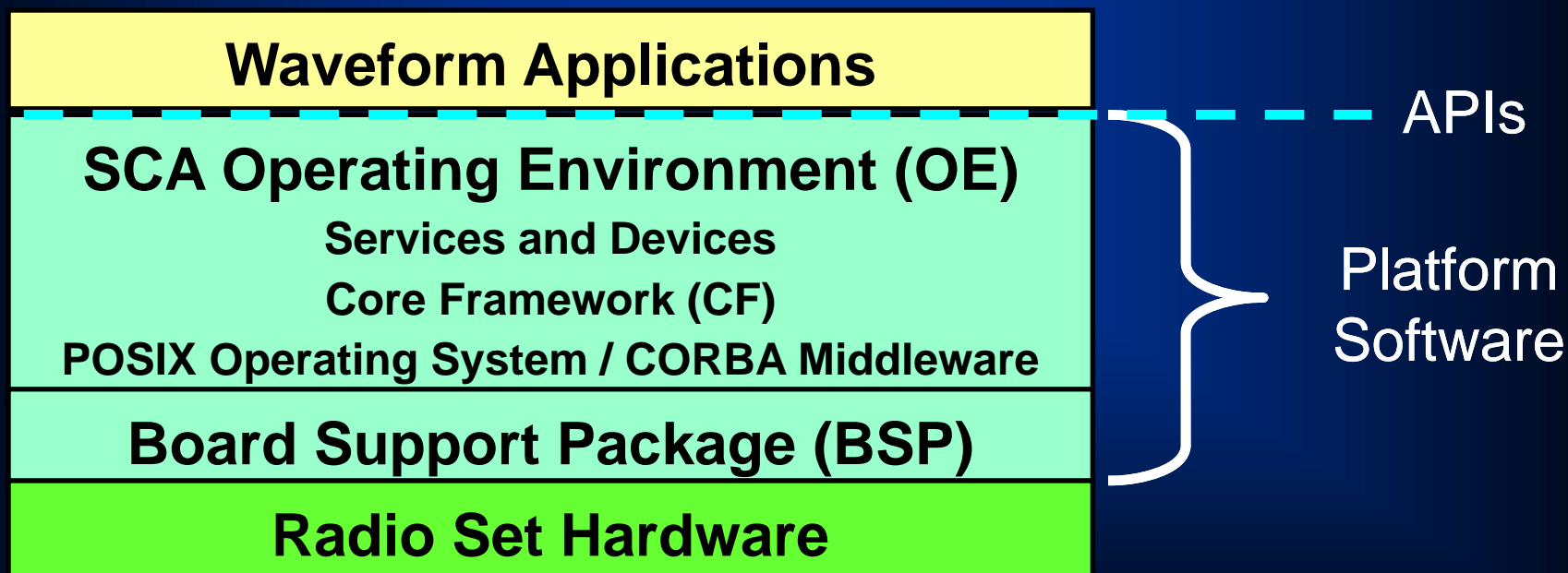
- Enable programmable radios to load waveforms, run applications, be networked into an integrated system.
 - Programmability preserves HW investment
 - Reduces cost and time-to-market for SW based capabilities.
- Procurement clarity – setting & meeting expectations.
- Software reuse and waveform portability.
 - Ensuring interoperability among all JTRS products, including across different radio form factors and missions.
 - Provide needed communications capabilities while reducing the time-to-market, maintaining overall system affordability.

Manage growing complexity of interoperability with leaner budgets

Software Communications Architecture



- Developed by the U.S. DoD as part of JTRS Program.
- Open architecture framework that defines a set of rules and protocols for SDR platforms.
- CBD technology provides “Interchangeable SW parts”.
- APIs facilitate waveform portability across radio sets.



SCA and Military SDR Evolution

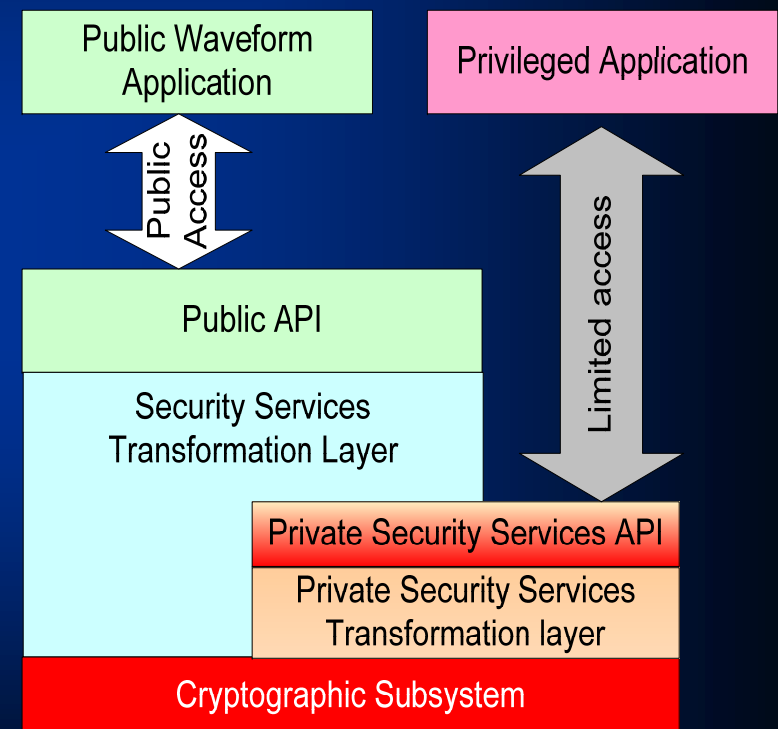


- U.S. DoD “Enterprise Business Model”
 - JTRS products built on common standards and specifications, DoD and commercial standards.
 - “Open source” type environment with GPR.
 - Information Repository (IR) of verified reference model implementations (base waveforms), artifacts, T&E results.
 - Formal Change Management (CM) controlled by US DoD.
 - SCA Specification 4.0 released in March-2012.
- Radio product platforms developed with SCA compliant Operating Environments, standard APIs.
- Waveform application reference implementations are ported onto radio product platforms.
 - Ported implementations (target waveforms) stored in IR.



- Wireless Innovation Forum (WInnF)
 - Elevates SCA activities to Committee level
 - Defines “Coordination Model” for SCA Standards.
 - International Radio Security Services API.
- EDA proposes “Three Category Approach” for API standardization; WInnF votes approval of approach.
 1. International open standard, unlimited distribution.
 2. Multi-national interests (i.e., coalitions), limited distribution.
 3. Specific national interest (i.e., national security), controlled.
- ESSOR program adopts of SCA v2.2.2 baseline.
 - Developing candidate set of extensions and new capabilities.
- Other national programs; Academia; Commercial tools.

- Key considerations in waveform porting.
 - Required IA and security capabilities, including connection to open networks and policy based re-configurability.
 - Waveform applications partitioning across security boundaries.
- Multi-surface model concept:
 - Facilitates open standardization and protected interests.
 - Transformation layer can uniquely and securely alter information format and content.
 - Private APIs (national or coalition) exposed only where applicable.
 - **WinnF IRSS API solution.**



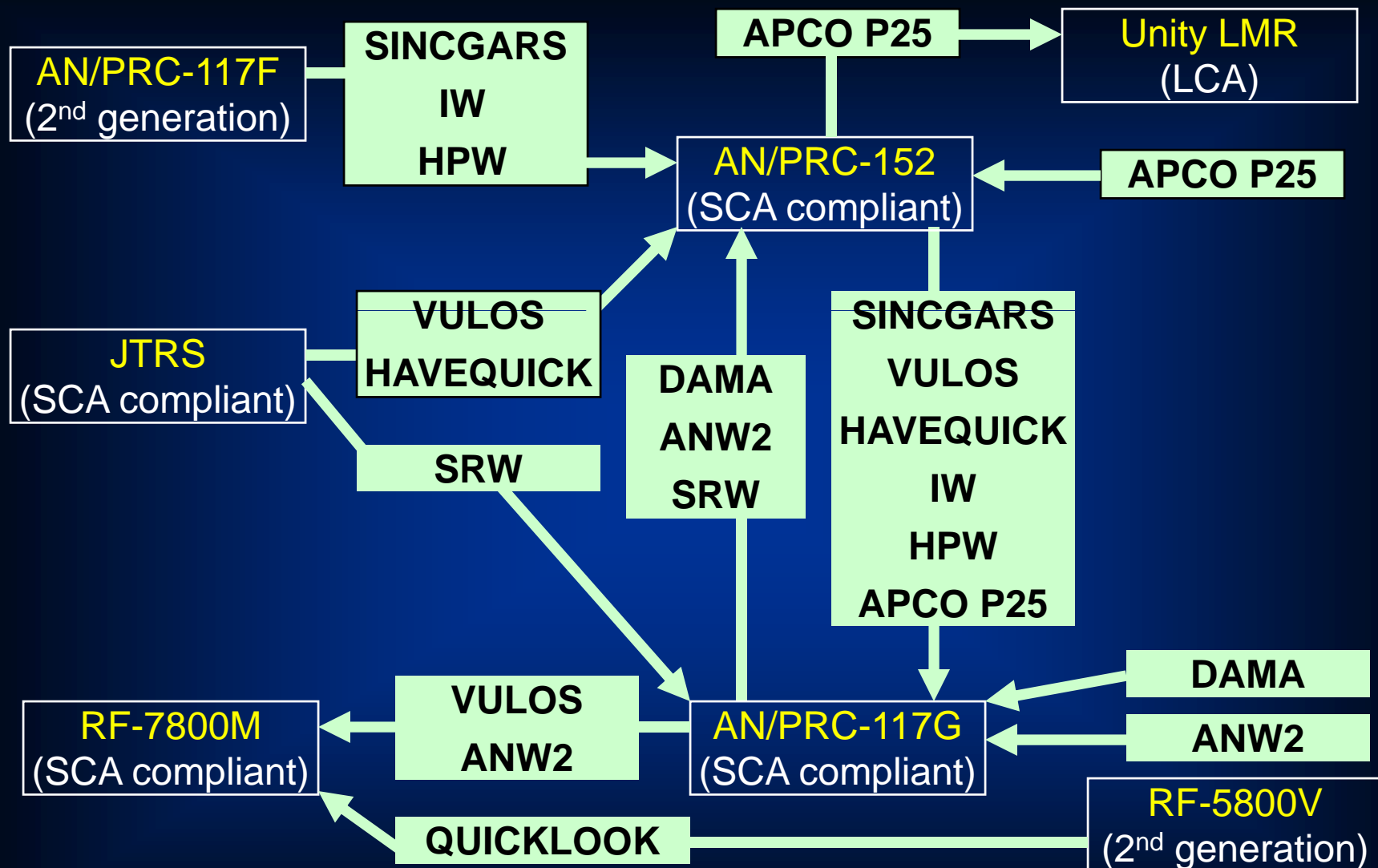
- What is it?
 - “Transformation” of an existing waveform software application so the resulting waveform software will execute properly on a new platform.
- **Facilitated by basic principles of the SCA.**
- Key Considerations
 - Development is complex.
 - Waveforms extend throughout radio to system level.
 - Waveform processing is distributed:
 - Multi-processors, multiple processes, multiple processing threads on a single processor.
 - Requires application of real-time design concepts.
 - Integral with communications security considerations.

Harris Waveform Porting Experience

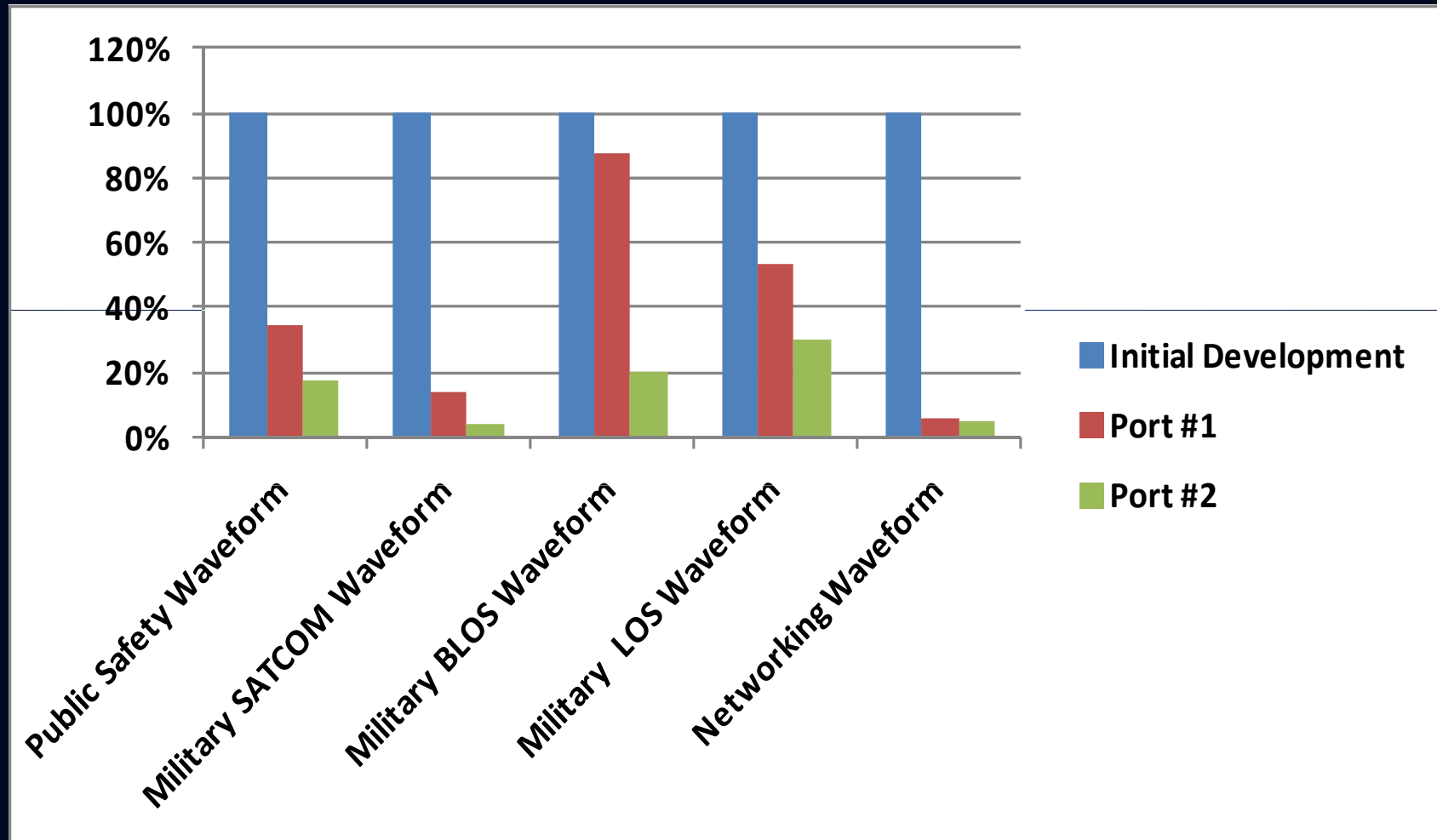


- 2nd generation waveforms (SINCGARS, HPW, IW)
- Third party waveforms (APCO P25, DAMA)
- IP based networking waveforms (ANW2, SRW)
- Information Repository waveforms (HQ, VULOS)
- Multiple platform domains
 - Man-Pack, Hand-Held, Small Form Factor
 - Multi-channel vehicular, shipboard, airborne
 - LMR
 - Other.
- Multiple products, including various hardware architectures and frameworks.

Harris Platforms and Waveforms



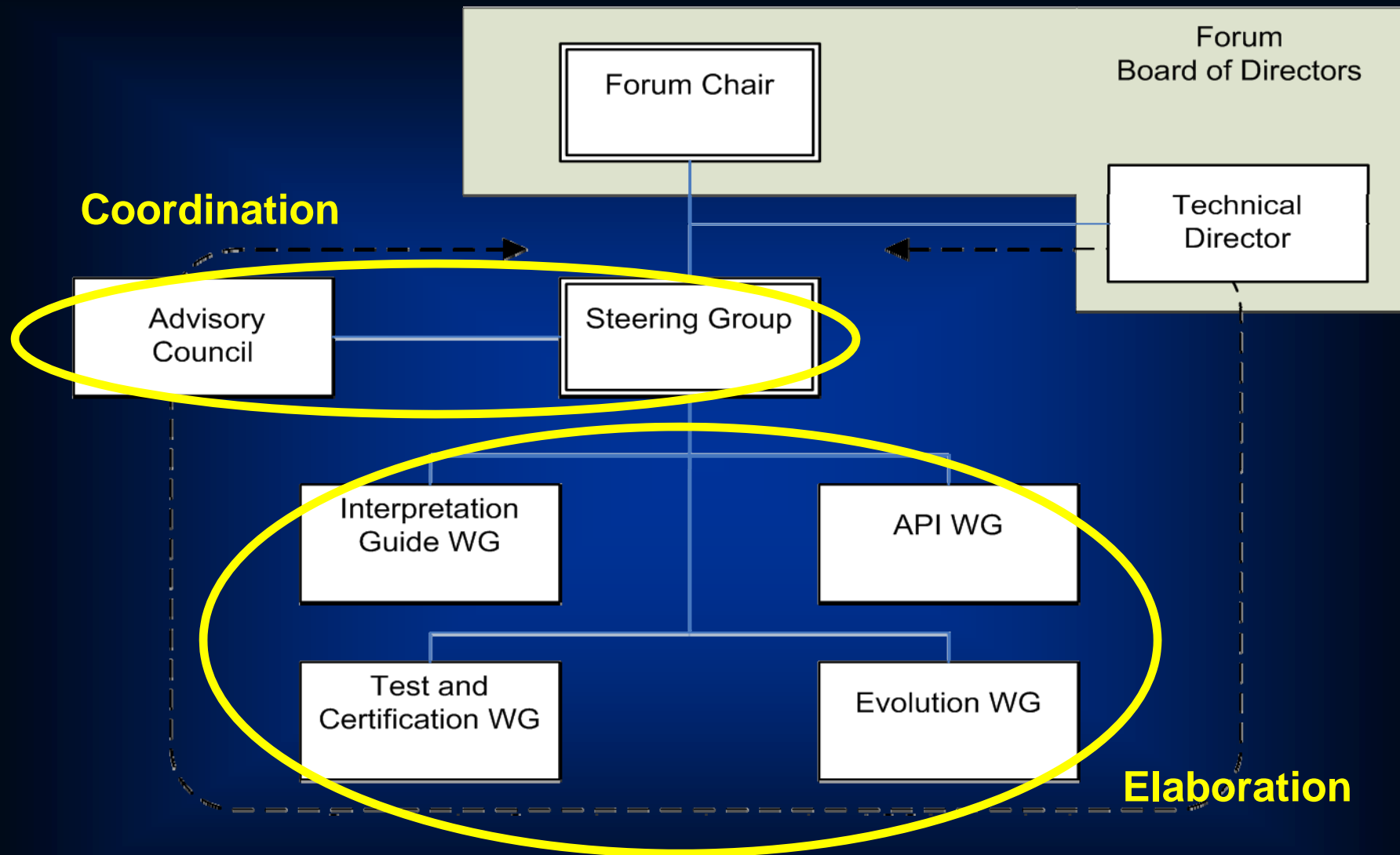
Waveform Porting Examples





**Realizing “true” International SCA Standards
via the WinnF Coordination Model**

Coordinating Committee Structure

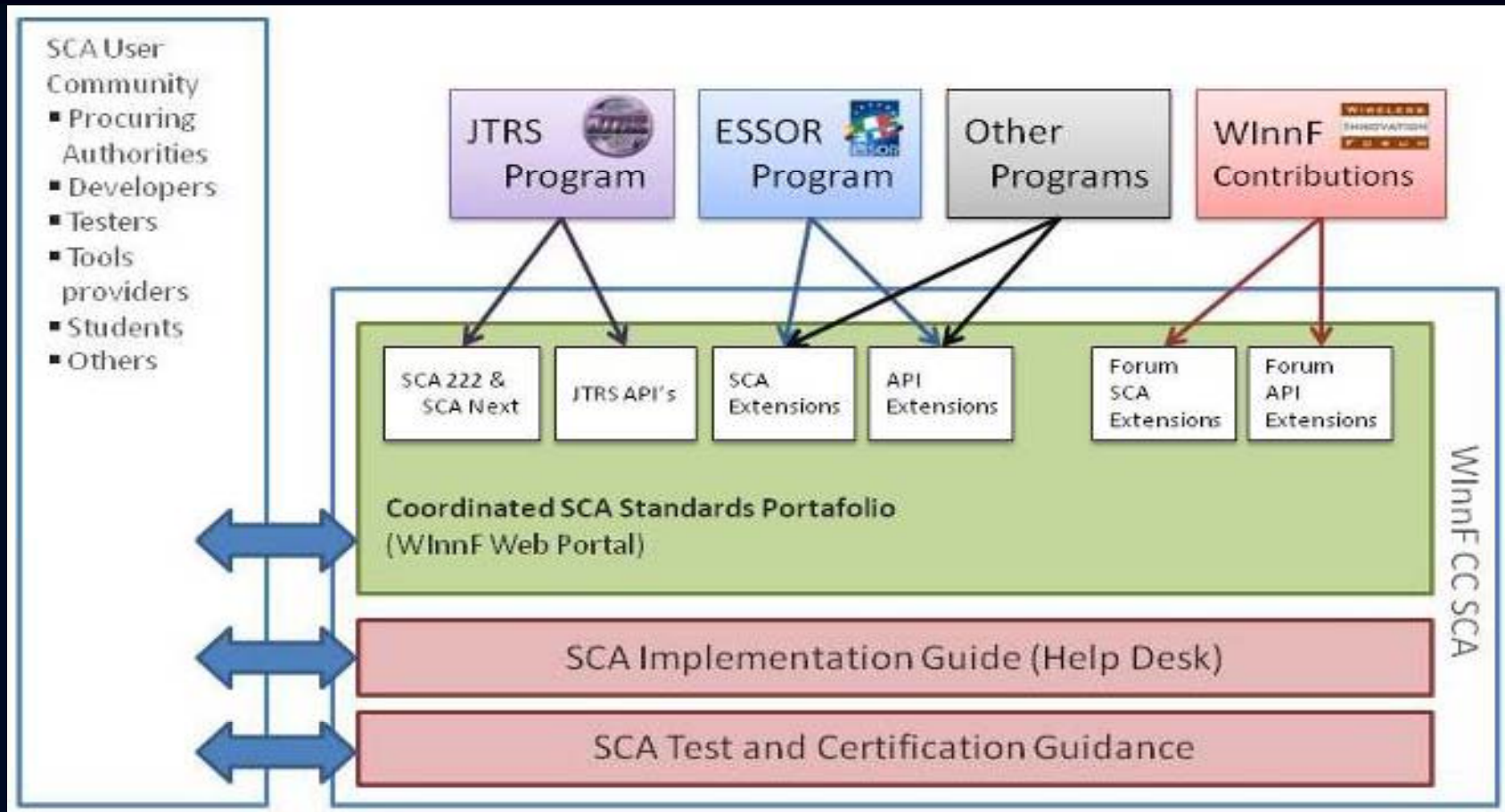


Coordination Model Key Objectives



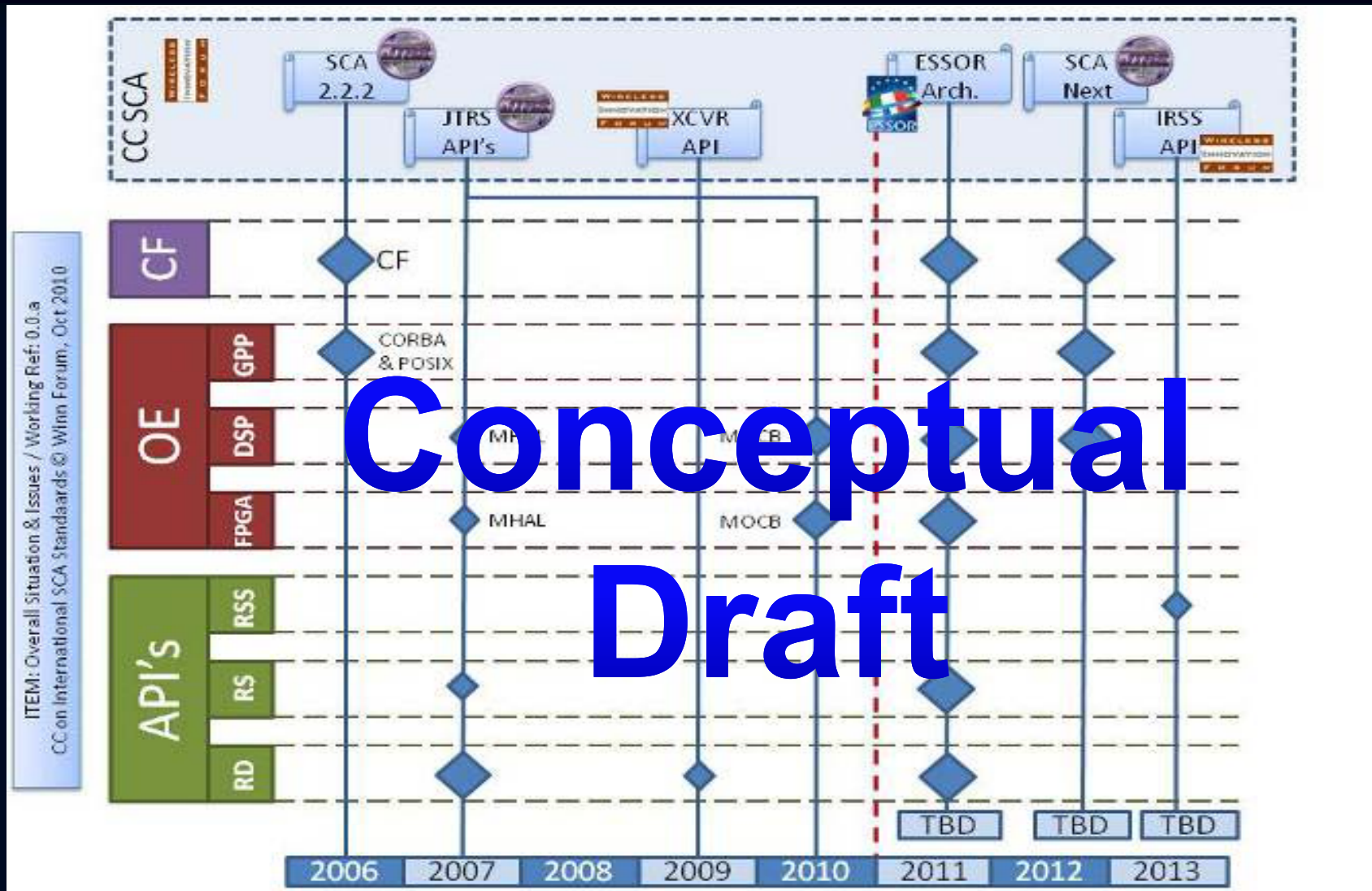
- **Harmonization**: Support technical collaboration across various organizations in order to harmonize SCA specifications worldwide, as much as possible.
- **Roadmaps**: In partnership with relevant stakeholders, define, maintain and publish technical roadmaps for evolution of SCA specifications.
- **Distribution**: Provide a central authority for collecting and distributing publically released specifications from various organizations worldwide.
- **Support**: Provide guidance and help to procurement authorities, implementers and testers to ensure consistent interpretation specifications.

Complete Standards Eco-System



Leverages and preserves program investment, economies of scale for cost and time

SCA Technical Roadmaps

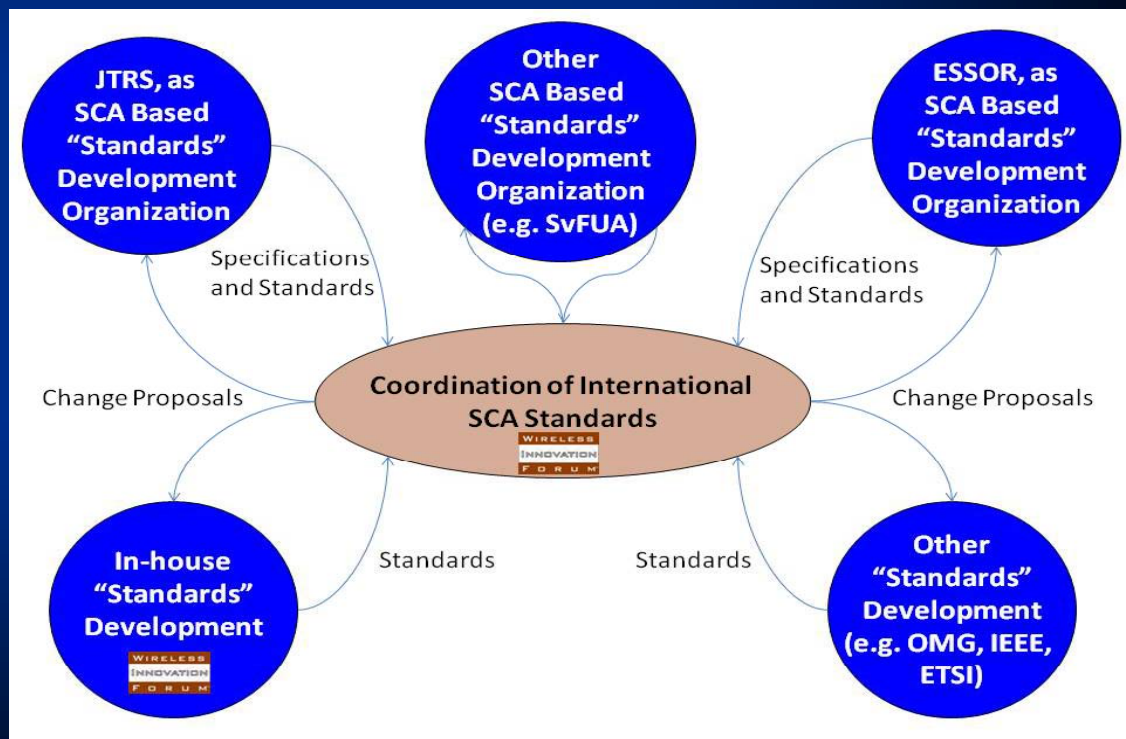


Conceptual
Draft

Coordination Model Relationships



- WinnF is the ONLY worldwide organization with necessary capabilities to realize coordination value.
 - WinnF represents 100's of staff-years of military defense communications with specific SCA experience.
 - Established relationships with all key stakeholders, including Gov't representatives on Advisory Council.



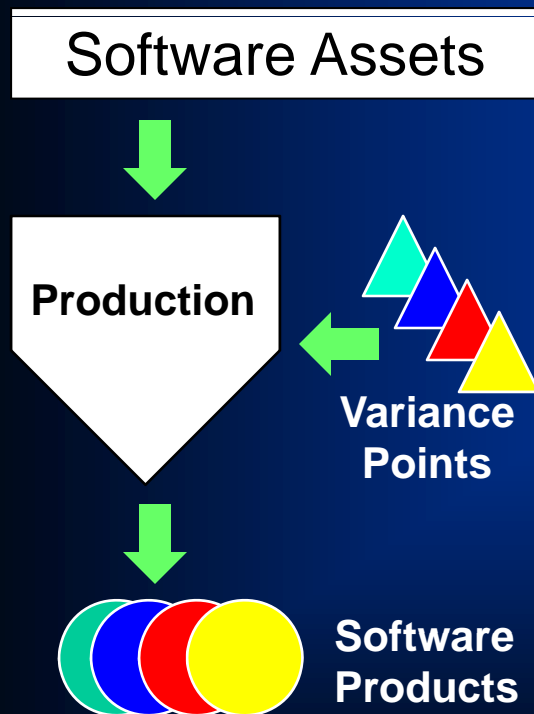


Application of Software Product Line Techniques for SCA Solutions

Software Product Line Techniques



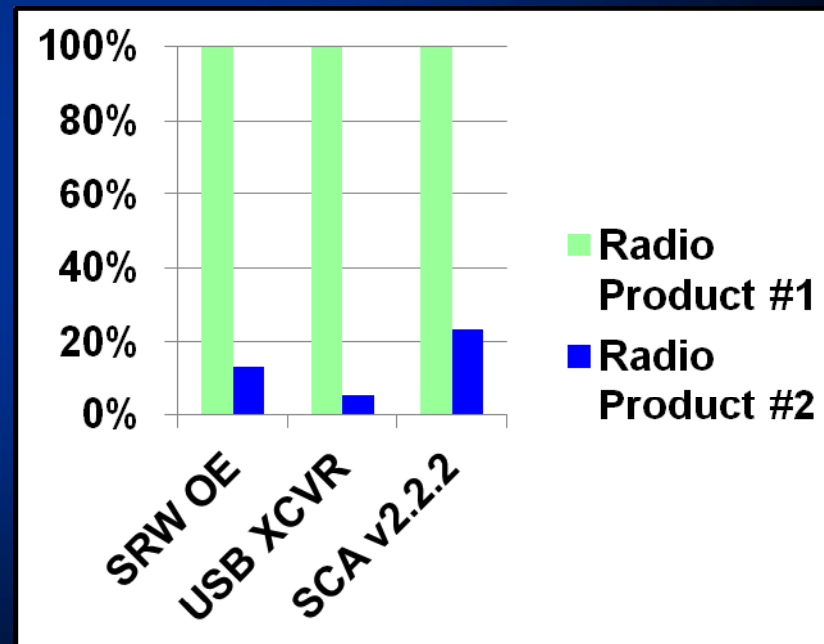
- Software Product Line (SPL): A portfolio of similar software systems developed from a common set of shared assets in a prescribed way (i.e., common means of production). **[SW PLATFORMING]**



Falcon III® OE SPL Examples



- Capabilities added (includes technology insertion)
 - OE updates to support SRW V1.01.1C.
 - USB transceiver updates.
 - SCA v2.2.2 compliance updates.
- Observations
 - Radio Product #2 main focus = build, testing and verification.
 - SCA v2.2.2 costs higher to include JTeL preparation and support (with travel).



Where do we go from here?



Conclusions

Conclusions (1 of 2)



- Interoperability, development cost, time-to-market, security are critical issues facing military communications stakeholders.
 - Being addressed today through SCA enabled technologies.
- The JTRS SCA provides a foundation to mitigate interoperability, cost and time-to-market challenges.
 - Standardization provides path to assured compliance.
 - Architectural separation through defined Applications Programmer Interfaces (APIs) facilitates cost effective waveform application porting.
 - Enterprise business model facilitates reuse.

Conclusions (2 of 2)



- WinnF Coordination model extends these benefits past the U.S. DoD into the global space.
 - Provides full eco-system of support across portfolio of SCA specifications; preserves and leverages investment.
 - World-wide organization with sufficient breadth of experience in military defense communications and SCA.
 - IRSS API framework supports three category approach with a standardized security solution.
- Software Product Line (SPL) techniques
 - Can be applied to families of SCA based products to drive down development costs and reduce time-to-market (capability deployment).
 - Software Platforming supports rapid technology insertion.

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