



# *Modular Software Frameworks Overview*

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# Topics

- Our Organization
- JTNC Core Functions
- What is the Software Communications Architecture (SCA)?
- How is SCA used?
- SCA Benefits
- Benefits of Modular Software Frameworks



# Chartered Mission and Vision

## Chartered Mission

***To ensure interoperable, secure, and affordable waveform and wireless communications by recommending standards, conducting compliance and certification analysis in accordance with DoD policies, and maintaining a DoD Waveform Information Repository (IR)***

## Chartered Vision

***Interoperable, secure, and affordable waveforms and wireless communications in support of Service, Multi-Service and Coalition forces***

***JTNC Vision and Mission Approved by DAE in the 20 January 2014 Charter, Revalidated Charter, 29 March 2016***



# JTNC Core Functions

- **DoD Waveform Standards and Software Communications Architecture (SCA)**
  - Provides a validated open systems reference architecture that separates waveform/network manager from the radio set
  - Permits common waveform software to be deployed across multiple vendor's radio sets
- **DoD Waveform IR Management & Configuration Control**
  - Provides a cyber-hardened, DoD-wide waveform library and controlled access for waveforms and associated network managers, operating environment software, models, architectural standards and Application Program Interfaces (APIs)
  - Protects and distributes artifacts based on legal agreements between government and software developers
- **Technical Analysis of DoD Waveform IR products**
  - Compliance: preliminary characterizations regarding meeting gov't standards for interoperability and security. Assessments facilitate preparation for participation in Service-level test events
  - Certification: comprehensive characterization of Waveform IR products as to whether they meet DoD standards and policies for interoperable and secure joint tactical networking
- **Technical Advisor to JTNC Board of Directors (BoD)**
  - Provide subject matter expertise on waveforms and wireless communications as requested or identified in support of DoD, the Services, Program Offices and stakeholders
  - Support the various DoD agencies overseeing the protection of critical technologies of wireless communications exported under commercial and/or Foreign Military Sales (FMS) and licenses



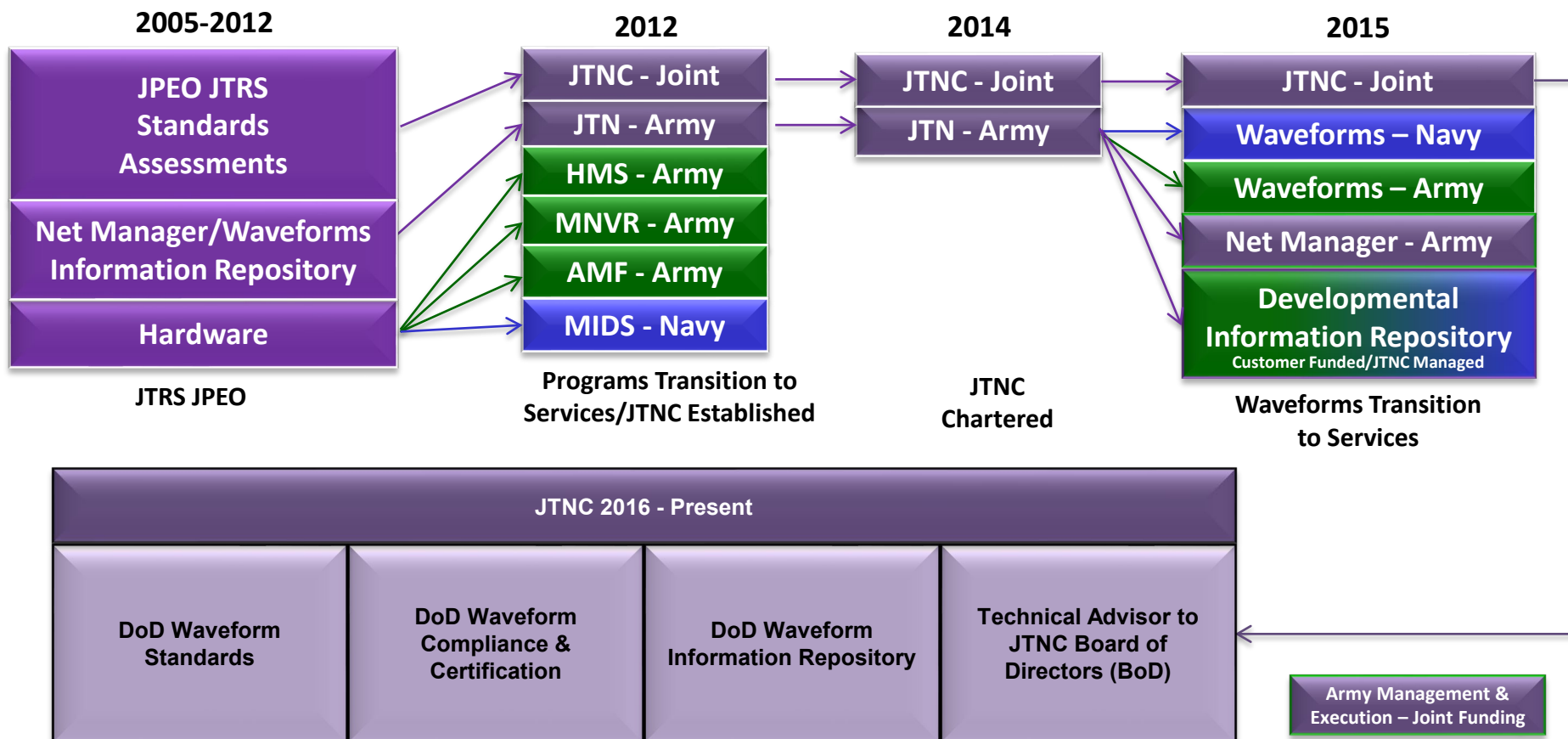
# Why JTNC Open Standards?

- JTNC Standards promote software reuse, improve security, integration and interoperability and reduce redundant development efforts, vendor lock and time to field
- JTNC Standards define a common and open software architecture and interfaces which enable a DoD software product line
- Waveform applications are designed to the technical standard
  - JTNC Standards allow hardware and operating system independent, capability-based applications to be used by multiple platforms
- JTNC Standards ease development and integration efforts of waveform application software, reduce barriers to entry and promoting competition among multiple vendors

***JTNC Standards promote competition,  
reduce costs and improve performance***



# Evolution of the Joint Tactical Networking Center (JTNC)







# What is the SCA?

- SCA (Software Communications Architecture) is a specification that defines a **software architectural framework** for management, control, and configuration of a **Software Defined Radio (SDR)** waveform application --but is not limited to SDRs!
- SCA defines a software infrastructure for the management, control, and configuration of an SDR
  - It does not mandate any specific architecture design or software implementation of the radio system hardware or waveform application
- SCA 4.1 is the Mandated standard listed in the Defense Information Technology Standards Registry (DISR)
- Although not considered part of the SCA, associated with the Framework are 17 standard APIs used in conjunction with the SCA



# What is the SCA? (cont.)

- The main purpose of the SCA standard is to define the Operating Environment (OE), which is referred to as the Core Framework (CF)
- The Core Framework implements the following:
  - Core Management
  - Deployment
  - Configuration and Control
- The Core Framework has a Physical “view” and a logical view
  - Physical: high level management of the physical devices in the radio system
  - Logical: high level management for waveform applications and other services

For the Radio System

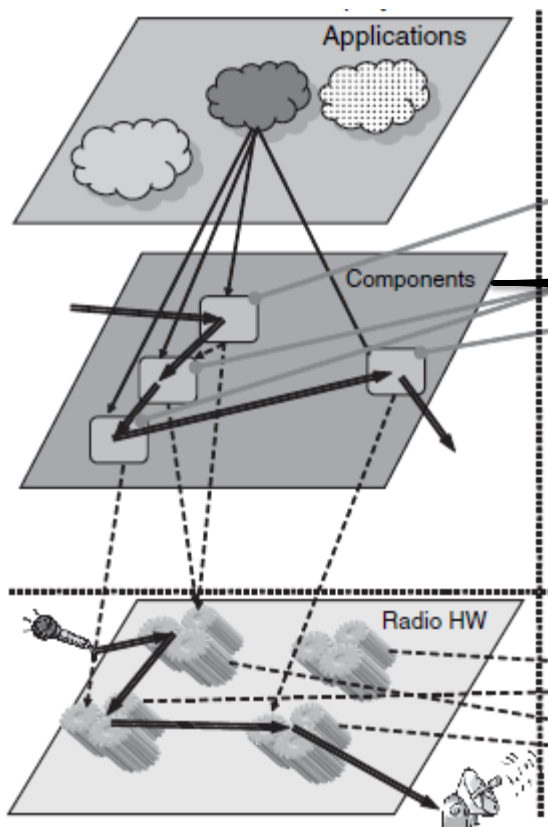






# Example of SCA Usage (for a Radio Transceiver)

## Waveform Deployment



**Example:**

## Component Design

### 1. Transmitter

- a. Randomizer
- b. Convolutional Encoder
- c. Interleaver
- d. BPSK Symbol Mapper
- e. QPSK Symbol Mapper
- f. 16-QAM Symbol Mapper
- g. 64-QAM Symbol Mapper
- h. Insert Guard Subcarriers
- i. Insert Pilot Tone and DC Null Subcarriers
- j. Inverse Fast Fourier Transform (IFFT)
- k. Insert Cyclic Prefix

### 2. Receiver

- a. De-randomizer
- b. Convolutional Decoder
- c. De-interleaver
- d. BPSK Symbol De-mapper
- e. QPSK Symbol De-mapper
- f. 16-QAM Symbol De-mapper
- g. 64-QAM Symbol De-mapper
- h. Remove Guard Subcarriers
- i. Remove Pilot Tone and DC Null Subcarriers
- j. Fast Fourier Transform (FFT)
- k. Remove Cyclic Prefix



# SCA Benefits

- **SCA enables reusable components**  
**In these two specific ways:**
  - The SCA defines a common set of interfaces for basic deployment, configuration, and control of applications
  - The JTNC APIs described on the website are intended to promote reusability of waveform software components through common waveform interfaces
- **SCA enables easier insertion of new technology**
  - SCA specifies interfaces for deployment, configuration, and control, and monitoring of hardware and software within the SCA system, so new technology can be inserted with less cost and impact



# SCA Usage

- Available since 2012, the Spectra DTP4700 is a SCA development platform that comes in a Linux based platform complete with the SCA 2.2.2 compliant Spectra Core Framework



- OSSIE: Open-Source SCA Implementation – Embedded

## OSSIE

SCA-Based Open Source Software Defined Radio

SDR infrastructure software, rapid prototyping tools, educational resources, and demo applications for students, researchers, and developers

- The AN/PRC-148 JE, an evolution of the AN/PRC-148 MBITR, is a small, light, and power-efficient, tactical handheld radio
- It covers the 30-512 MHz frequency range
- The AN/PRC-148 JEM operates on a Software Communications Architecture (SCA)-compliant platform





# Benefits of Modular Software Frameworks

- Modular Software Frameworks Benefits
  - Anti-vendor lock
  - Greater access to innovation
  - Interchangeable components simplifies upgrades & potential security updates
  - Standard interfaces promote interoperability

Components



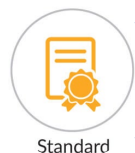
Modular & Interchangeable  
Distinct functionality  
Self-contained

Interfaces



Key boundary between components  
Change and configuration managed

Standards



Widely supported  
Maintained by consensus organization  
Specifies operational and performance requirements



*Questions?*