



Open Architectures and Frameworks: Where does the SCA fit?

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What is so unique about the SCA?

▪ The Software Communications Architecture (SCA):

- Provides an Architecture for the development of **Software Defined Systems (SDS)**
- Clearly defines the **boundary between software applications and physical hardware**
- Facilitates the **portability, interoperability** and **configurability** of the software and hardware components used in Software Defined Systems
- Unparallel support for **Heterogeneous Embedded Distributed Systems (HEDS)**

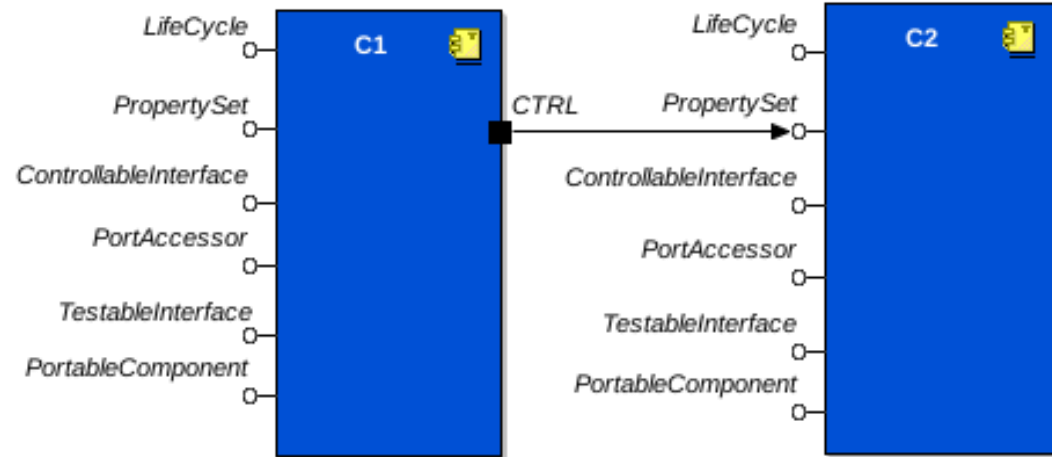
▪ The SCA is not an architecture specifically designed for Software Defined Radios (SDRs)

- SCA is used to create **Software Components** that can be **deployed on** any type of SDS
- SCA is like **Android for** Heterogeneous Embedded Distributed Systems (**HEDS**)
 - Apps can be made of several components that need to run on different processors inside the SDS

What is so unique about the SCA?

- **Plain SCA components are not domain-specific**

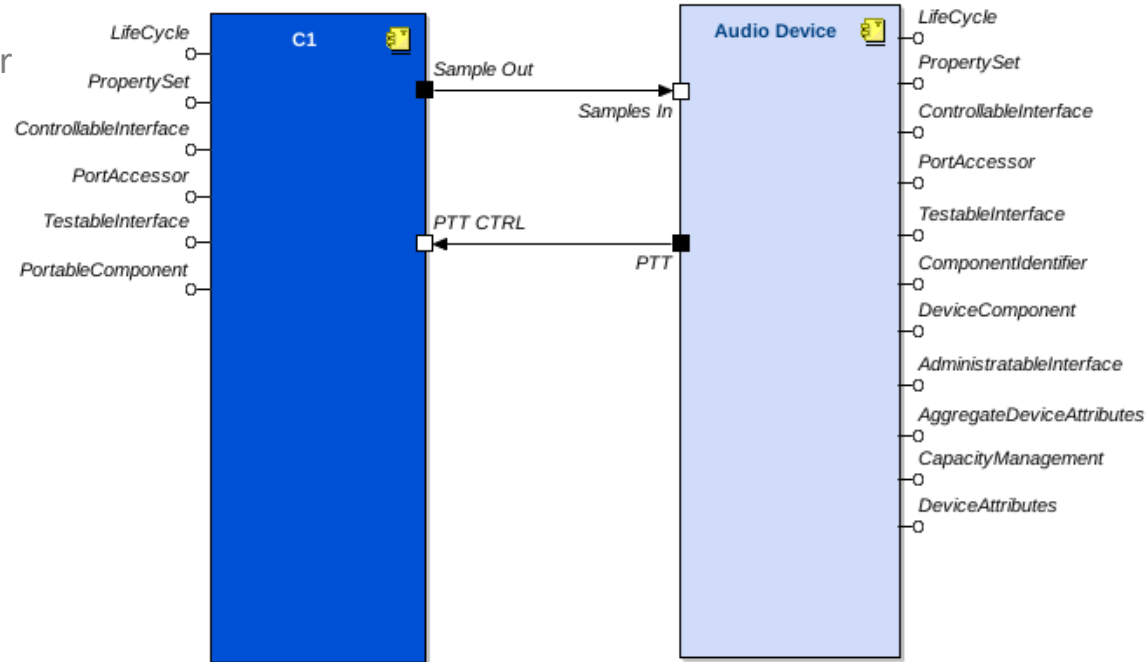
- SCA components are software components that must implement a **basic set of component interfaces** to support how software components are **combined** into assemblies, **installed**, **deployed**, **instantiated**, **started/stopped**, **configured**, **tested**, **described**, **discovered** and more
- All of the above is accomplished **without access to the source code** and **without** being **specific** to processor, an **operating system**, **program space mapping**, **communications bus**, or the **location of execution**



What is so unique about the SCA?

• SCA has been designed to be extended with domain-specific interfaces

- The SCA standardizes the way components can **provide** any number of domain-specific interfaces via the concept of **provides ports**
- The SCA standardizes the way components can **use** any number of domain-specific interfaces via the concept of **uses ports**
- **Connections** are only a way to exchange references to port implementations





SCA used in the SDR Domain

▪ The SCA + JTNC/ESSOR APIs + WinnF APIs to build SDRs

- Add standard interfaces on top of SCA for services typically used in SDRs

JTNC APIs	
Audio	Speaker, microphone, tones, push-to-talk
Vocoder	Voice encoding/decoding with a number of standard algorithms
GPS	Position, velocity, and time (PVT) data in Latitude/Longitude and MGRS format
Timing	Getting access to time and saving application time
Serial	Reading/writing serial of various formats with different modes of synchronization
Ethernet	Reading/writing ethernet frames for network links
MHAL	Communications with devices like DSPs and FPGAs. Commands to control an RF Chain.

WinnF APIs	
Radio Security	Security services for platforms with 1 or 2 security domains: encryption/decryption, key management, digital signatures, authentication, etc.
Transceiver	Hardware-agnostic services to transmit / receive signals from one to many antennas
<i>more</i>

ESSOR APIs	
GNSS	Position, velocity, and time (PVT) data
Transceiver	Hardware-agnostic services to transmit / receive signals from one to many antennas
<i>more</i>	...

Comparing the SCA with other Architectures



SCA Characteristics [1/5]

• Is an Open Architecture

- SCA specification documents are public and change proposals can be submitted by members of the Wireless Innovation Forum



SCA Characteristics [2/5]

▪ Is Mature

- The version 1.0 of the specification was introduced in 2000, the latest version is 4.1 which was published in 2015
- Hundreds of change proposals, thousands of hours of development, used by organizations in many countries, over 30 major organizations involved in maturing the specification, over 500,000 fielded radios worldwide
- Non-disruptive evolution of the SCA specification: SCAv4.1 is backwards compatible to SCAv2.2.2

▪ Is Extensible to Specific Domains

- SCA is designed to allow domain-specific extensions that do not require modifications to the Core Specification
- SCA is already used in the military radio domain worldwide. It is also used in radar and in electronic warfare. SCA could easily be used for other domains

SCA Characteristics [3/5]

▪ Is Scalable to different Operating Environments

- SCA components can run on resource-constrained platforms as well as resource-rich platforms without changing source code

▪ Enables Portable Applications

- SCA defines a clear boundary between software and hardware which makes application software portable to different operating environments
- SCA is platform agnostic because it does not rely on a specific operating system, programming language, processor, or bus technology

▪ Enables Reusable Components

- SCA defines a level of granularity that allows components to be made reusable across different applications
- SCA defines composition APIs that allow developers to plug-and-play components unknown to each other

SCA Characteristics [4/5]

- **Provides Interoperability**

- SCA Components are interoperable within a set of domain-specific interfaces

- **Enables Post-Manufacturing upgrades/updates**

- SCA defines how applications can be added to a fielded product

- **Enables 3rd Party Technology Insertion**

- SCA is modular, adding new applications does not require access to the source code of existing software. Thus, it does not require a new build of the existing software to add new applications

- **Protects Intellectual Property**

- SCA Components interact with each other using late binding which does not require any source code to be shared

SCA Characteristics [5/5]

▪ **Minimizes Obsolescence**

- With portability, reusability, backwards-compatibility, platform independence, post-manufacturing upgrades, and technology insertion, the SCA allows existing SCA software to run on new platforms

▪ **Shorter time-to-market**

- With portability, reuse, and 3rd party technology insertion, products can be developed faster

▪ **Lower Implementation Costs**

- With portability, reuse, interoperability, and the minimizing of obsolescence, SCA helps keep implementation costs

▪ **Increases Competition**

- SCA is open, modular, and supports interoperability which serves to increase competition which can lead to more innovation and lower acquisition costs



Comparing the SCA to other Architectures

Architecture Characteristics	SCA	FACE	RedHawk	EOA	LAVOSAR	AUTOSAR	More ...
Open	Yes						
Mature	Yes						
Extendible to Specific Domains	Yes						
Scalable to different operating environments	Yes						
Portable Applications	Yes						
Reusable Software Components	Yes						
Interoperable Software Components	Yes						
Post Manufacturing Upgrades	Yes						
3 rd Party Technology Insertion	Yes						
Intellectual Property Protection	Yes						
More ...	?						

Moving Forward with the SCA and Domain-Specific interfaces



Vehicular Domain

▪ Can the SCA be used to build software for vehicles?

- SCA provides a software framework which is not the case with VICTORY, MORA, or NGVA. Can we define interfaces that will enable OEMs to implement SCA applications that interact with the rest of the system?

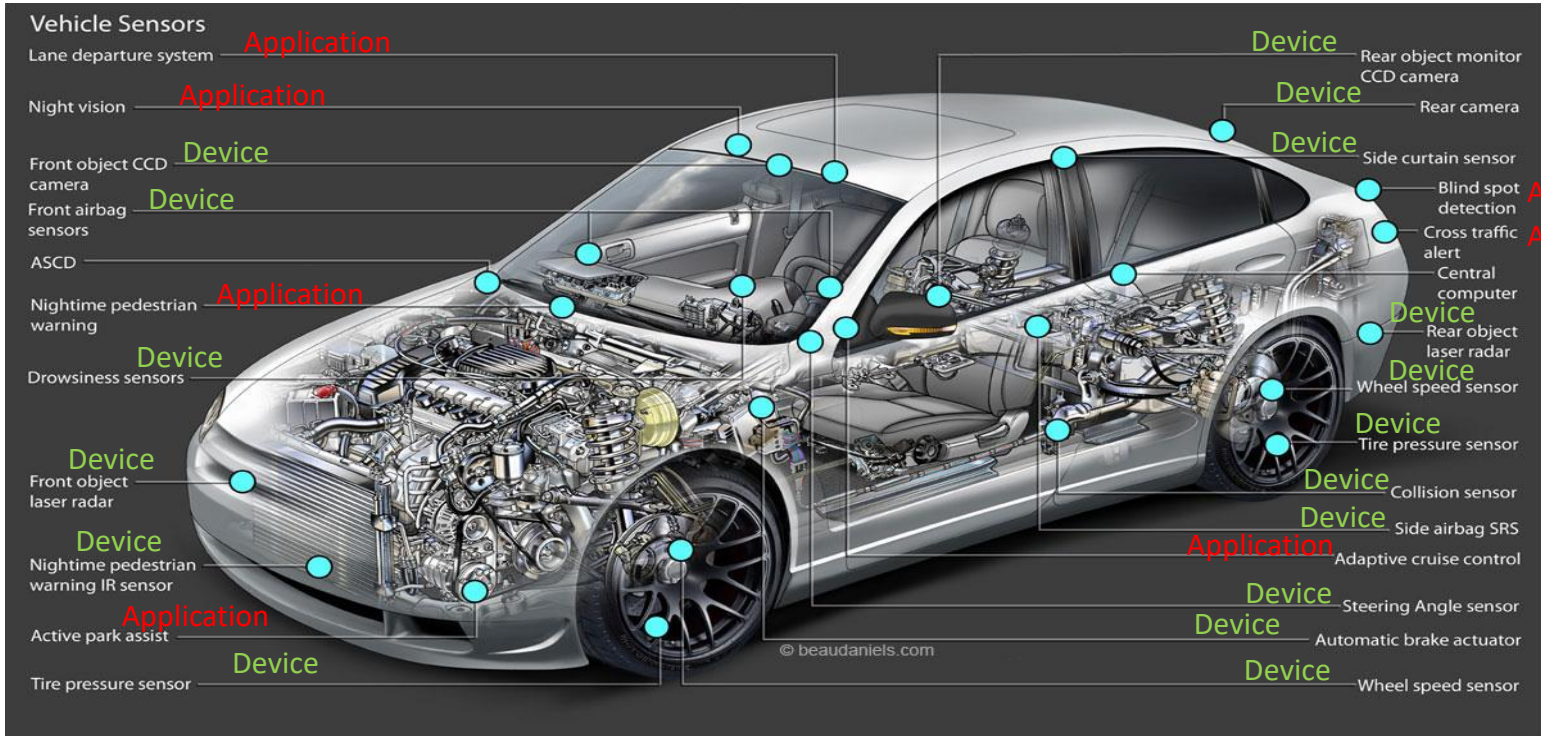
Architecture	Application Framework
Software Communications Architecture (SCA)	Yes
The Future Airborne Capability Environment (FACE)	Yes
The Vehicle Integration for C4ISR/EW Interoperability (VICTORY)	No
Modular Open Radio Frequency Architecture (MORA)	No
NATO Ground Vehicle Architecture (NGVA)	No

Vehicular Domain

- **WinnF standard for interoperability between VICTORY and SCA. Define Interfaces for:**
 - Network Radio
 - Electronic Warfare System, RF Spectrum Sensor, RF Signal Detector, RF Signal Generator, and more

- **WinnF standard for interoperability between VICTORY and NGVA. Define Interfaces for:**
 - NGVA currently does not contain explicit support for Radios
 - Tactical Effector, Tactical Sensor, and more

Vehicular Domain



Domains closely related to SDR

- **What is so unique about the EW domain?**

- Are waveform applications fundamentally different regarding the operating environment?
- Is the WInnF Transceiver standard adequate for EW?

- **What is so unique about the Radar domain?**

- Software-Defined Radar seems to be the new way of doing, can the SCA help?
- Is the WInnF Transceiver standard adequate for EW?



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