



# Nordiasoft

## The Enduring Myths of the Software Communications Architecture (SCA)

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**Myth #5: SCA is too Expensive**

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**Conclusion**

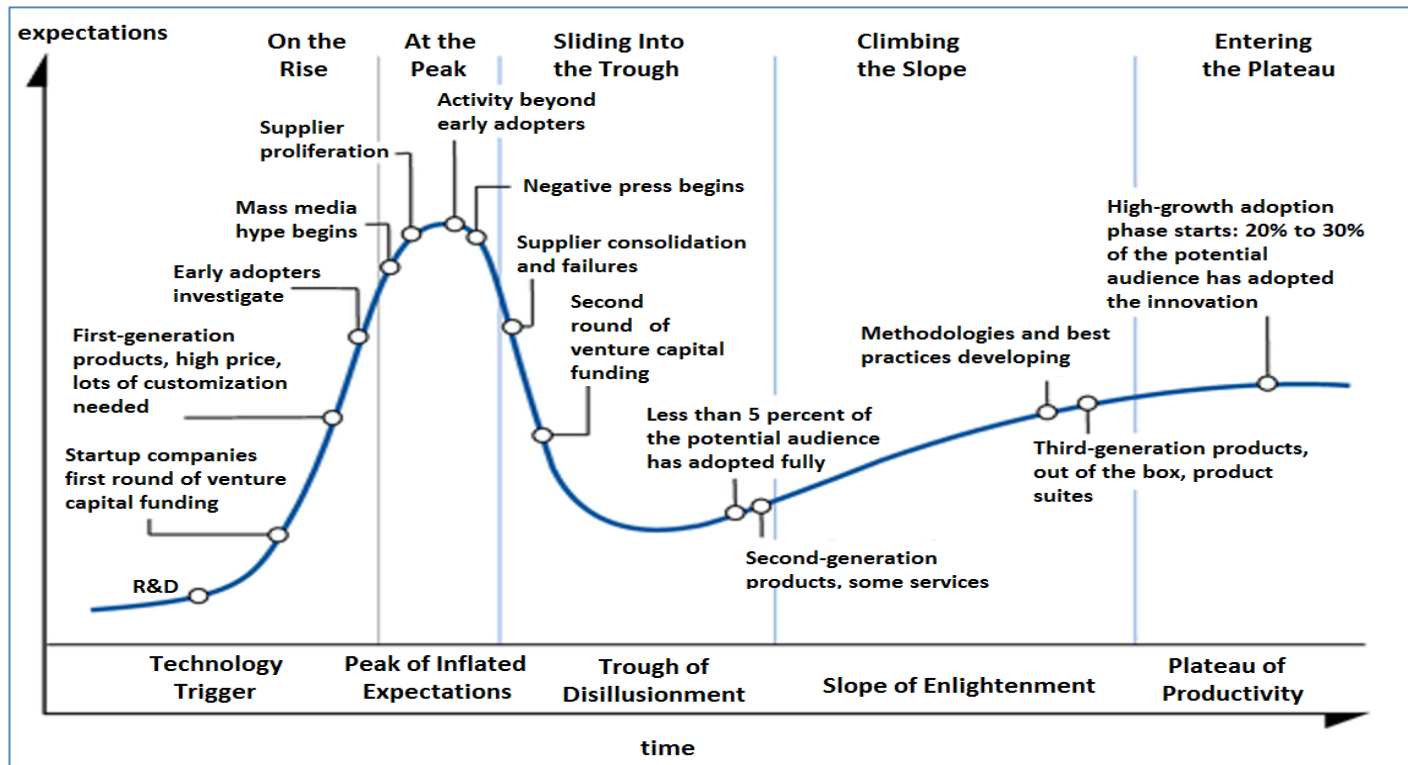
# Introduction

- **First major SDR project was SpeakEasy in 1991**
  - Goal: implement 10 different waveforms on the same equipment
  - First large-scale use of processors to perform most of the signal processing
    - 3 years of development
    - Involved several hundred processors and filled the back of a truck
- **SpeakEasy could not take advantage of the faster processors and the reason was the software**
  - Moore's law provides doubling of speed every 18 months
  - Could not divide the number of processors by 4
- **The JTRS program was influenced by the lessons learned from SpeakEasy**
  - SCA was designed to provide platform-independence for the software

# Introduction

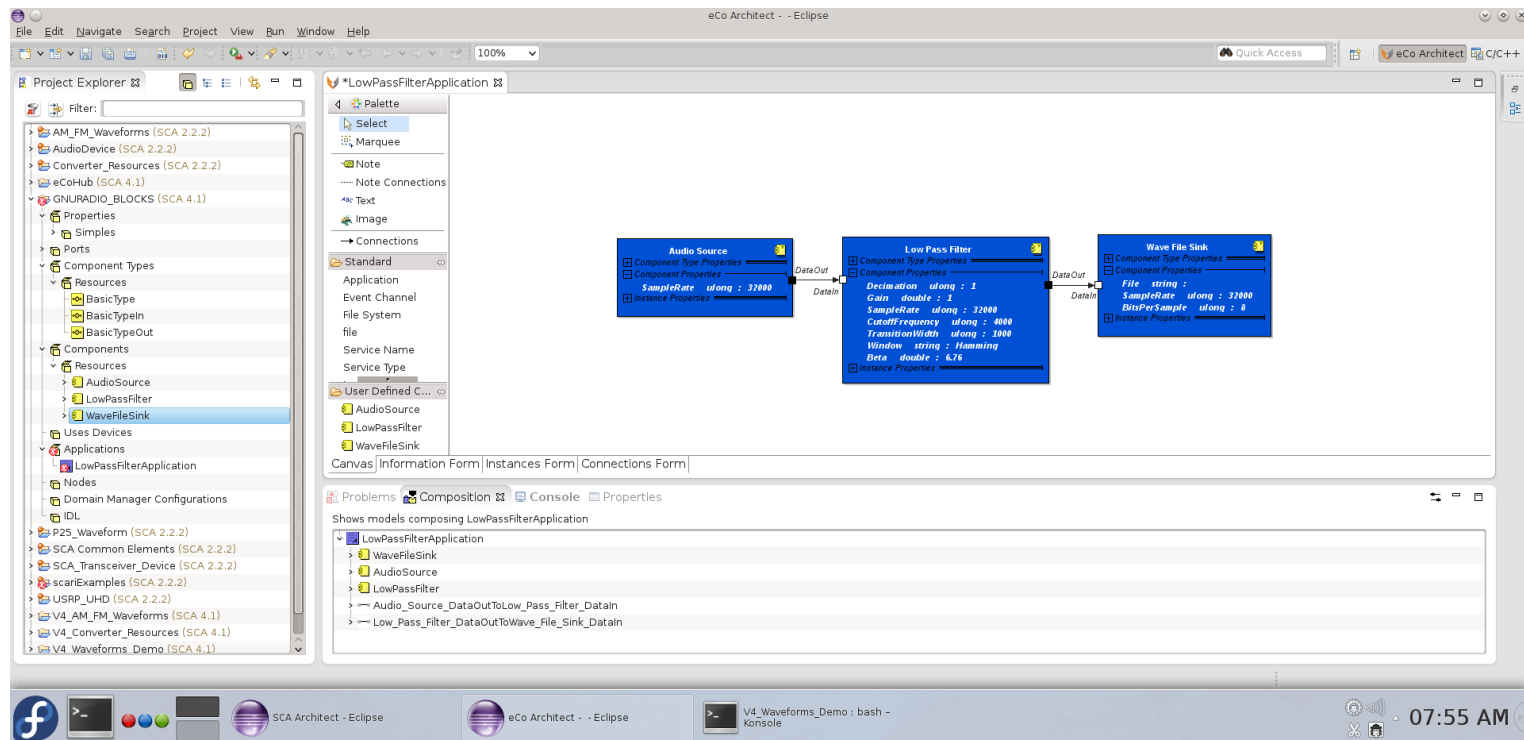
## ▪ The Joint Tactical Radio System (JTRS) Program

- Was very disruptive; changed system concept and acquisition process
- SCA went through different phases of adoption (see Gartner Hype Cycle)



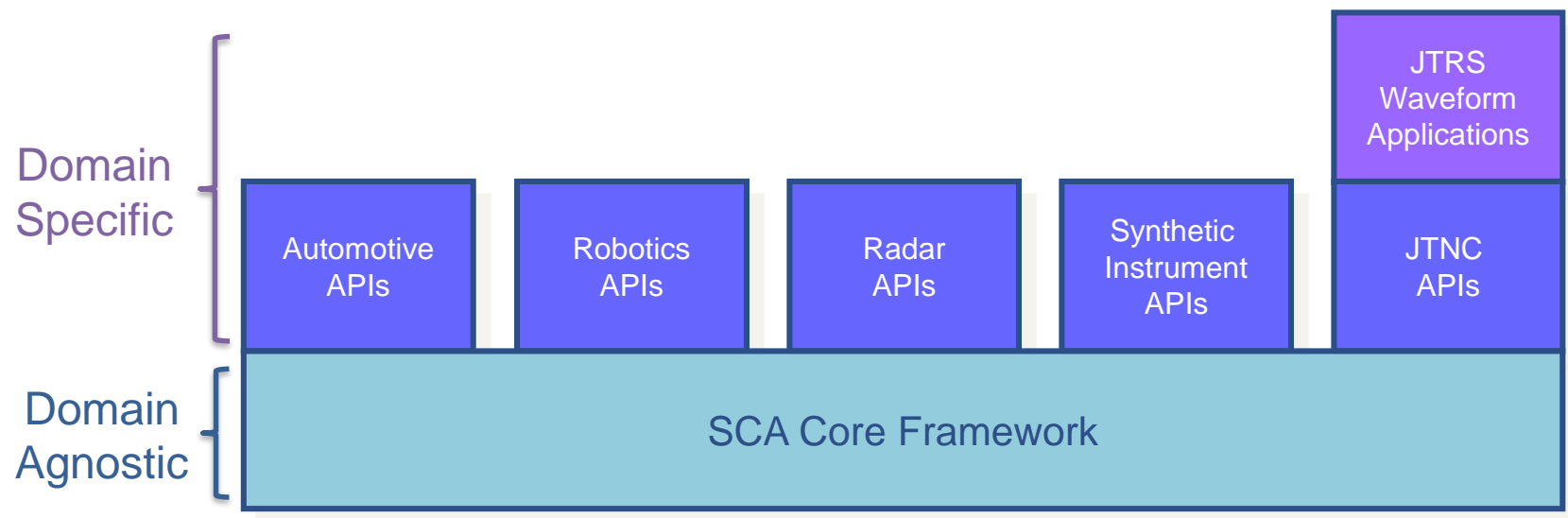
# Myth #1: SCA is for Military Radios

- **Indeed, the SCA originates from a Military Radio program**
  - But great care was taken to keep the SCA domain-agnostic
- **SCA is in fact a component-based architecture**



# Myth #1: SCA is for Military Radios

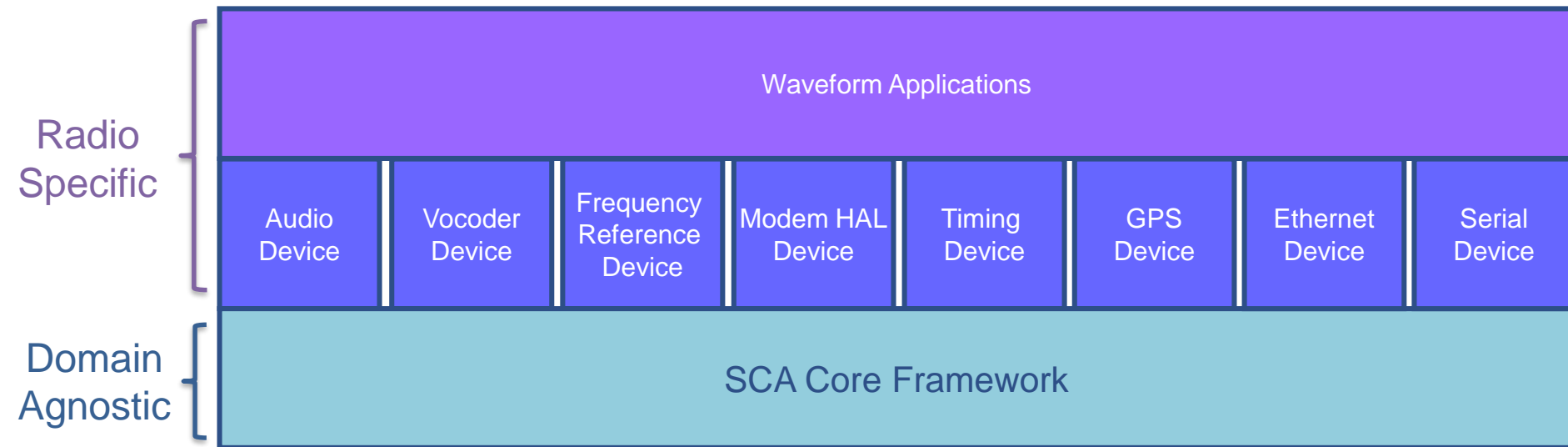
- **The SCA specification does not provide domain-specific APIs**
  - SCA Core Framework APIs cover basic deployment APIs
    - Device, LoadableDevice, ExecutableDevice, File, FileSystem, Log, etc.
  - SCA components have ports via which domain-specific APIs are used/provided
  - Applications use Device components which implement a set of Domain-Specific APIs



# Myth #1: SCA is for Military Radios

## • The JTRS Radio-specific APIs

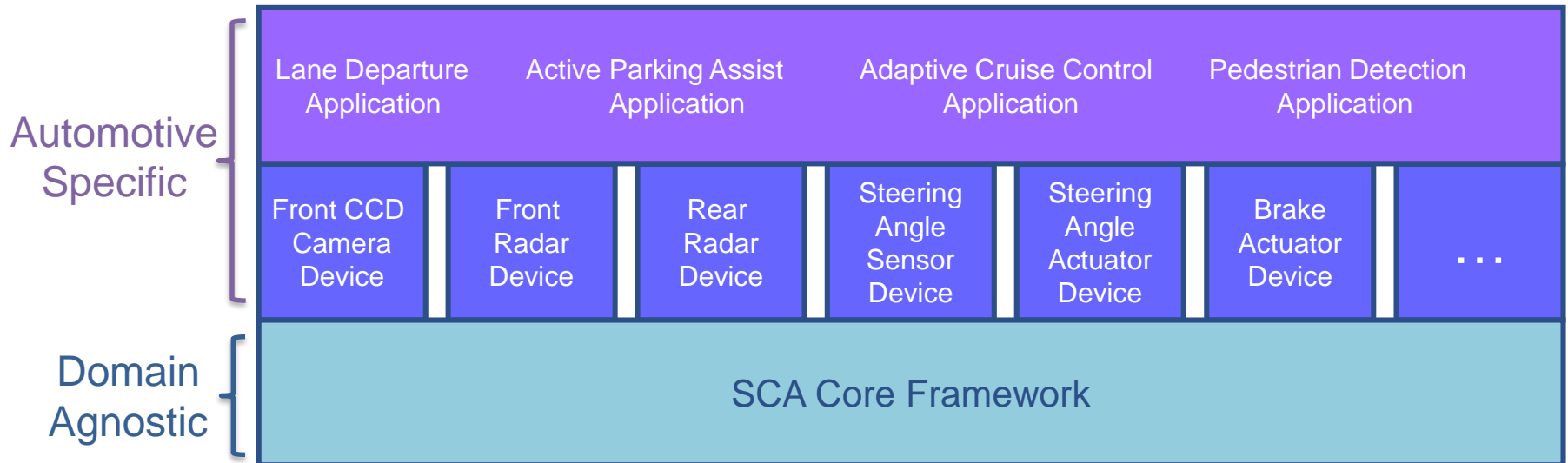
- Now called the JTNC APIs



# Myth #1: SCA is for Military Radios

## ▪ SCA could be used with automotive domain-specific APIs

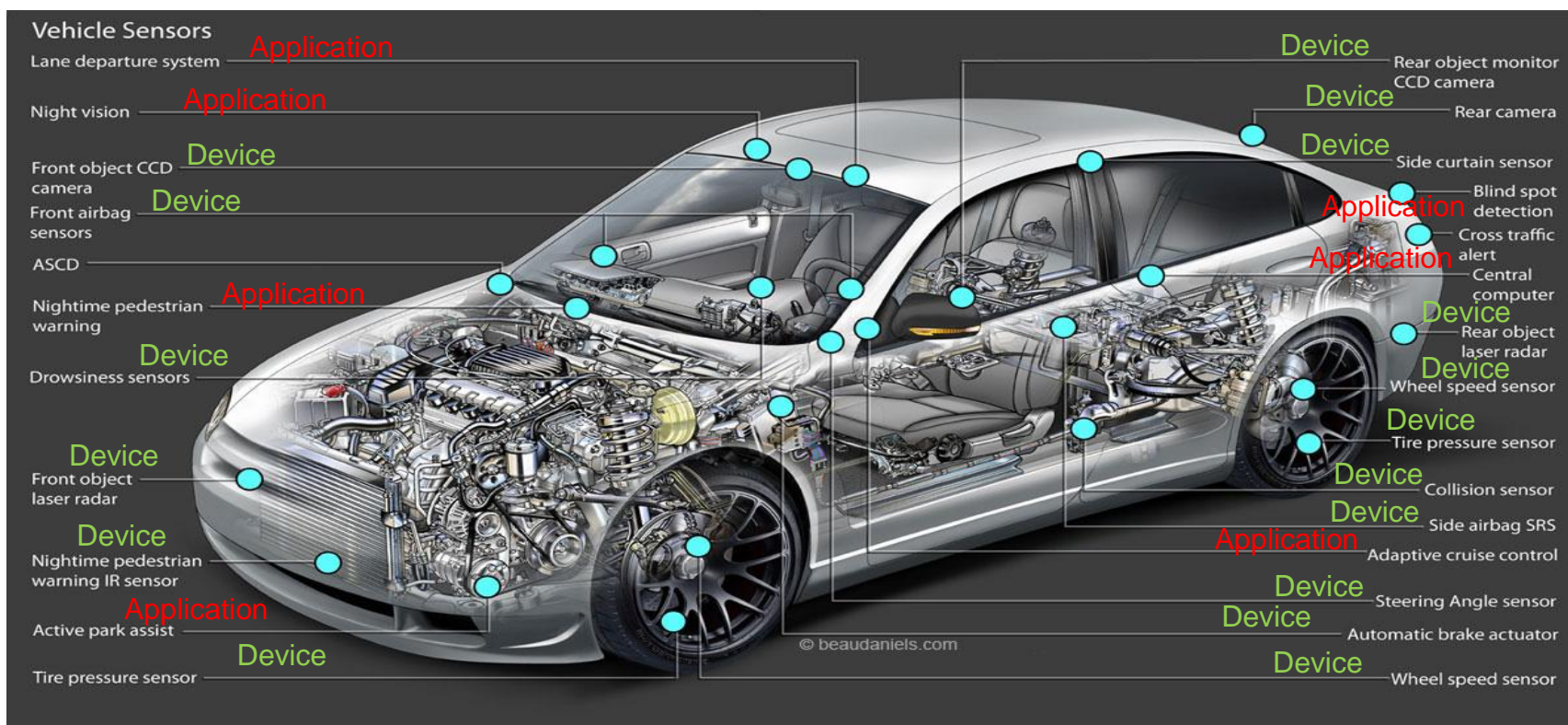
- Applications: Lane departure system, active park assist, adaptive cruise control, cross-traffic alert, rain-activated wipers, etc.





# Myth #1: SCA is for Military Radios

## ▪ SCA could be used with automotive domain-specific APIs



## Myth #2: SCA is too Large

- **The high-tech world we live in is completely transforming the way business is conducted**
  - The short cycle between products requires technology-insertion capabilities to address obsolescence
  - Manufacturers are moving from hardware-centric solutions to software-centric solutions
    - Software-Defined Radio (SDR)
    - Synthetic Instruments
    - Software-Defined Car
    - Software-Defined Networking (SDN)
    - Software-Defined Data Center (SDDC)
  - The general trend is referred to as Software-Defined Everything (SDx) or Software-Defined System (SDS)

## Myth #2: SCA is too Large

- **SDR was the first wave of SDS in the 1990s**
  - Radio systems contained little software and provided little memory
  - First JTRS radios prototypes were built on existing platforms which provided very little memory. That's the origin of this myth
  
- **The SCA can be used with a small amount of memory**
  - Nordiasoft customers have platforms that require less than 32 megs of RAM for complete system.
  - That includes: a real time operating system kernel, a TCP/IP networking layer, a flash file system, a POSIX layer, the drivers and SCA platform components for the speakers, the microphone, the transceiver, the GPP, the DSP, the FPGA, the Nordiasoft SCA Core Framework, the ORBexpress RT CORBA stack from OIS, and an SCA application made of 3 components

## Myth #3: SCA is too Slow

- **This myth implies that using the SCA to implement a software-defined radio is a barrier to real time performances**
- **JTRS SCA radio prototypes were built during the early phases of the program**
  - Many publications/presentations during early days of the JTRS program



# Myth #3: SCA is too Slow

- **Harris published measurements comparing their legacy AN/PRC-117F radio with their first JTRS prototype called JMTR**

	AN/PRC-117F (C) legacy radio	1st iteration JMTR radio (2001)	2nd iteration JMTR radio (2004)	3rd iteration JMTR radio (2005)
Power up to Application	1x	8x	1.6x	Meet field requirement
Application switch time	1x	16x	2.3x	Meet field requirement
Parameter change time	1x	4x	2x	Meet field requirement
Rx/Tx turnaround time	1x	3x	1.75x	Meet field requirement

- **Today's SCA radio platforms use modern hardware and have been designed with SDR in mind**
  - Over 500 thousand SCA radios have been manufactured worldwide

## Myth #4: CORBA is too Slow

### ▪ Comparing Apples and Oranges

- CORBA performances are often compared with the performances of TCP/IP Sockets or with messaging layers ZeroMQ and such
- TCP/IP alone cannot be used to build heterogeneous embedded and distributed systems (HEDS)
- Developers are often unaware of alternate transports or in-process optimizations

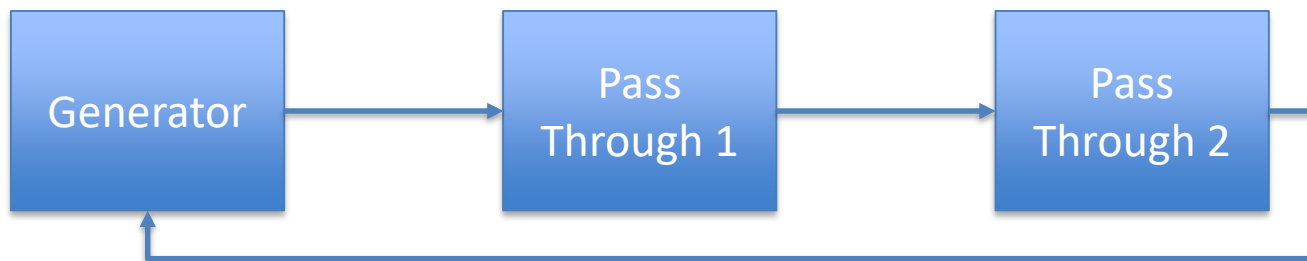
### ▪ CORBA can transparently use alternate transports

- CORBA over shared memory, CORBA over PCI/VME/RapidIO, etc.
- No need to change any business logic
- Provides huge performance improvements

## Myth #4: CORBA is too Slow

### ▪ Speed Comparison Experiment

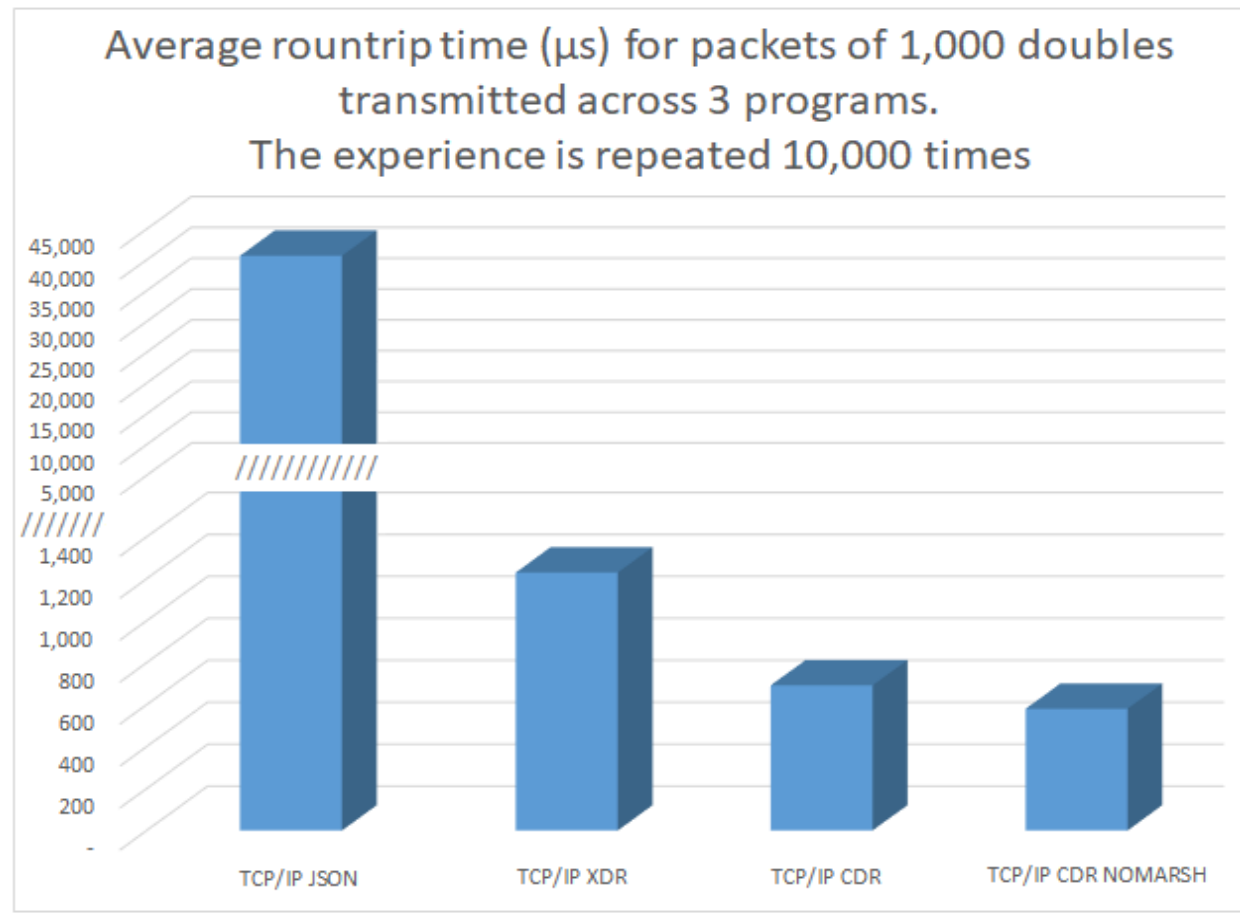
- Generator program transmits 1000 doubles and uses a timestamp to measure how long it takes before the 1000 doubles loop back
- The experiment is repeated 10,000 times using a FreeScale i.MX6 Quad SABRE Automotive board that comes with an ARM<sup>®</sup> CORTEX<sup>®</sup>-A9 Quad Core processor with auto scaling of the clock up to 1 GHz, running Linux kernel version 3.14 with 2 Gigs of RAM.





# Myth #4: CORBA is too Slow

## ▪ Speed Comparison Experiment

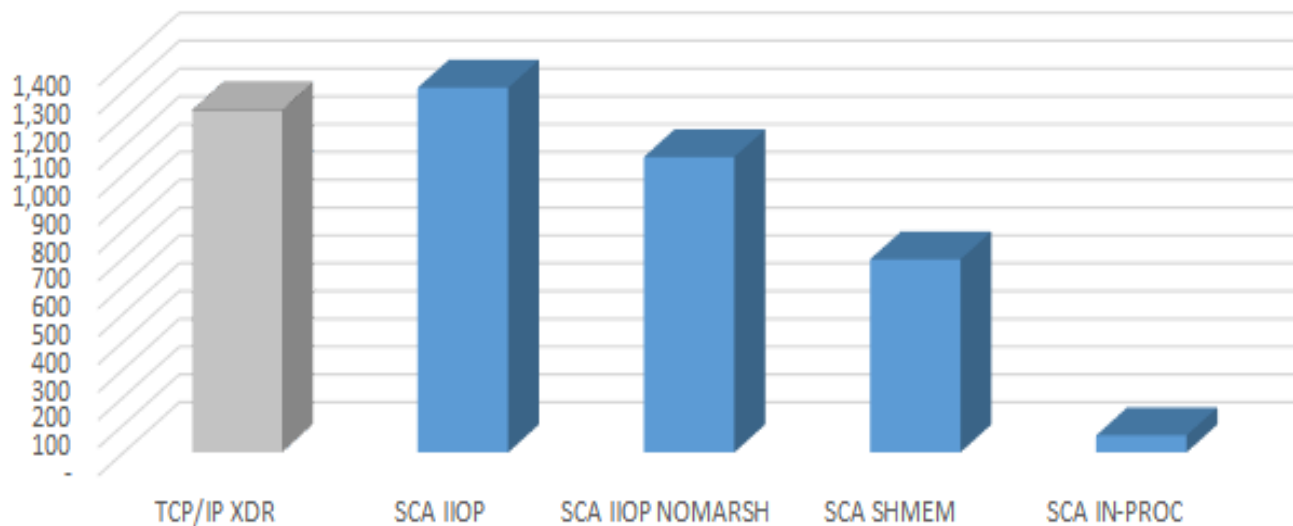




# Myth #4: CORBA is too Slow

## ▪ Speed Comparison Experiment

Average roundtrip time ( $\mu$ s) for packets of 1,000 doubles transmitted across 3 SCA components.  
The experience is repeated 10,000 times



Measurements produced using Embedded Component Suite (eCo) for SCA version 4.1 from NordiaSoft and ORBexpress RT from OIS

SCA version 4.1



eCoSuite

**ORBexpress**

## Myth #4: CORBA is too Slow

### ▪ CORBA has been used to build many types of embedded real-time systems

- aircraft and flight control systems
- airborne early warning systems
- missile defense systems
- weapon systems
- air traffic control systems
- distributed interactive simulation
- automated stock trading systems
- process automation
- process automation
- Etc.

### ▪ What does CORBA bring?

- Handles Endianness
- Procures independence from transport protocols
- Procures independence from programming language
- Provides location transparency
- Procures independence from address space configurations
- Provides a control protocol

## Myth #5: SCA is too Expensive

- **Radio manufacturers have published measurements that indicate using the SCA significantly reduces the porting costs and time-to-market**
- **Need to make a difference between the JTRS program and the SCA technology**
  - The JTRS program did run into costs and delivery issues, but keep in mind this was a very disruptive program
  - The JTRS program had a profound effect on the established ecosystem
    - Waveform Repository and intellectual property rights

## Myth #6: SCA 4.1 Eliminates CORBA

- **SCA 4.1 documents now describe the basic SCA concepts without assuming CORBA**
  - Akin to a Platform-Independent Model (PIM)
- **SCA 4.1 implementation details are described using CORBA**
  - Akin to a Platform-Specific Model (PSM)
  - There are no documents (e.g. PSM) describing alternatives to CORBA
    - So far (4 years), there has been no proposal
- **Reality: CORBA meets all the requirements of the SCA**

# Conclusion

- SCA is deployed in over 500,000 radios and has become a requirement outside the US DoD



## Presentation and References

- **This presentation is available in the “Knowledge Centre” section of the Nordiasoft website**
  - [Nordiasoft.com/knowledge-center/selected-publications/](http://Nordiasoft.com/knowledge-center/selected-publications/)
  - You can download the list of over 60 references used for this presentation

**- The End -**