

# Standards for SDR; a Canadian Perspective

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# Overview

- **Overview of the Canadian market**
- **CRC's Perspective on SDR**
- **The SCA and it's ecosystem**
- **The SCA; What's next?**
- **Conclusion**

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# Canadian Market

- **Canada is 2<sup>nd</sup> largest country**
  - 219<sup>th</sup> for population density
  - Population: 33 million
- **Need for communications**
  - Canada was unified by the railway
  - Solidified by satellites
  - Telecommunications is crucial
- **Canadian internal market remains small**
  - USA population: 302 million
  - USA: 1 426 700 military personnel, 1 259 000 reserve
  - Canada: 62 000 military personnel, 22 000 reserve



# Canadian Industry

- **Canadian industry must create products that are applicable to commercial and military markets**
  - Can't rely on multi-billion projects like the US JTRS program
- **Must use/create international standards and Commercial Off The Shelf (COTS) products**
  - Can't afford expensive one-of-a-kind systems
  - Provides access to international markets
  - Allows cost reduction through increased volume



# CRC's Perspective on SDR

- **There are many standards for embedded systems hardware**
  - PCI, PCI-X, cPCI, RapidIO, VME, PMC, XMC, PC/104, JTAG, USB, etc.
  - Provides a market to smaller players
- **The complexity of embedded systems is on a constant rise**
  - More software is used to address the complexity
  - In many cases, the cost of software is greater than the cost of hardware
  - The goal with SDR is to increase the amount of functionality implemented in software
  - Ironically, there is almost no standards in the embedded software industry



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# CRC's Perspective on SDR

- **In 1999, Defence R&D Canada (DRDC) became interested in Software Defined Radios**
- **The CRC decided to evaluate the SCA standard**
  - The US was about to launch the multi-billion Joint Tactical Radio Systems (JTRS) program
  - The architecture seemed generic enough to meet the requirements of our SDR prototype
- **Developed a FM LoS SDR prototype using SCAv0.3**
  - Used a dual TI DSP board from Spectrum Signal Processing
  - Resulted in several change proposals submitted to the Modular Software-programmable Radio Consortium (MSRC)
  - The MSRC integrated the proposals into SCAv1.0



# CRC's Perspective on SDR

- **SCAv0.3 LoS FM SDR prototype (2000)**



# CRC's Perspective on SDR

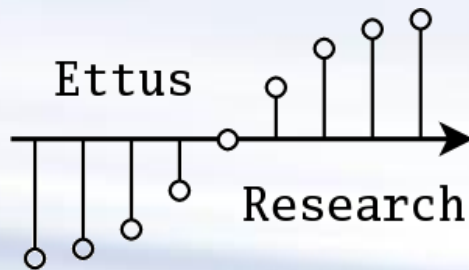
- **Conclusions of the prototyping project**
  - The SCA can be implemented
  - The SCA is in fact a Component -based Design architecture for embedded systems
    - Similar to Enterprise Java Beans and .Net
  - The SCA is not specific to SDR or to military applications
  - The SCA specification can be influenced
    - CRC has successfully influenced every release of the specification: from version 0.3 to version 2.2.2
    - Submitted over 25 official change proposals
  - The SCA is unique and at the forefront of embedded software development

# CRC's Perspective on SDR

- **Since the SCA specification is publicly available, the Canadian industry can play a role in the SDR market**
- **The SCA has been demonstrated to work on very large and very small platforms:**
  - Universal Software Radio Peripheral (USRP): Gnu Radio RF front end
  - Gumstix : Tiny single board computer
  - Thales JTRS Enhance MBITR (JEM): Handheld military radio
  - Harris Falcon III: Handheld military radio
  - Ultra Electronics TCS HCLOS™: Backbone networking radio

# CRC's Perspective on SDR

- **Universal Software Radio Peripheral (USRP): Gnu Radio RF front end**
  - Commercial RF Device with 4 channels
  - CRC developed an SCA AM/FM radio with USRP

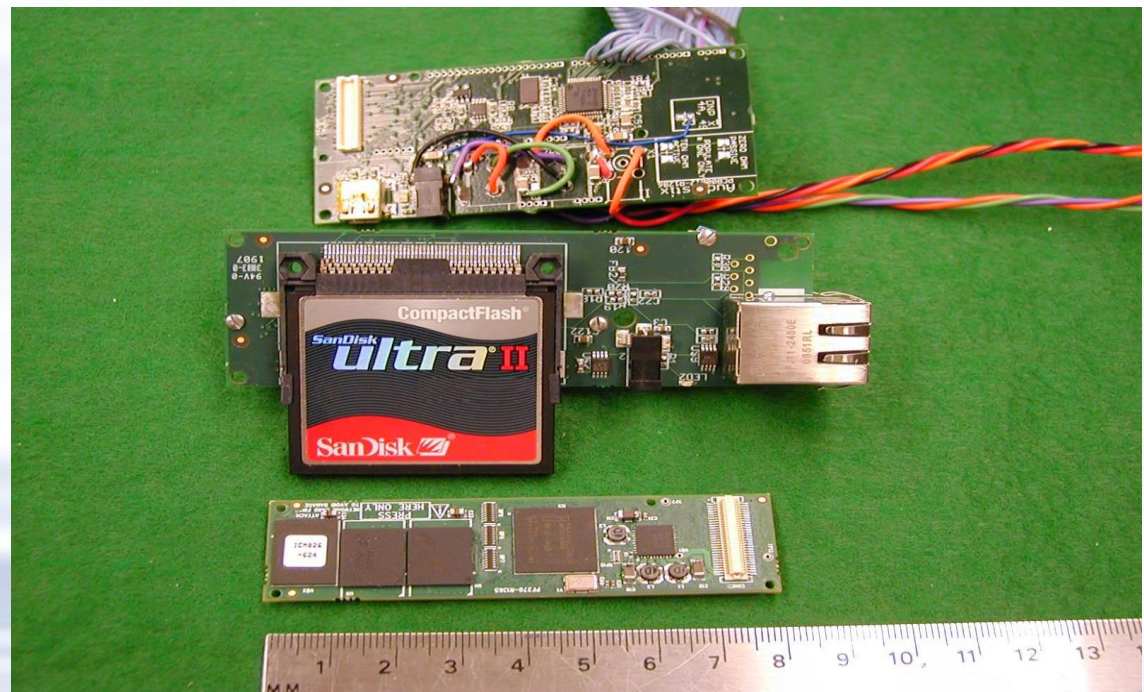




# CRC's Perspective on SDR

- **Gumstix :**

- CRC used a Gumstix™ Audio Pack to implement an SCA FM radio (XScale processor)
- Audio Pack: 1.5 cm high, 3cm wide, 10cm long.



# CRC's Perspective on SDR

- **Thales JTRS Enhance MBITR (JEM):**
  - AN/PRC-148 SCA handheld military radio
  - Retrofitted with a DSP (TBC)

THALES





# CRC's Perspective on SDR

- **Harris Falcon III:**
  - AN/PRC-152 SCA handheld military radio
  - SCA certified without waivers

The Harris logo features the word "HARRIS" in a bold, black, sans-serif font. A red diagonal line starts from the bottom left of the letter 'A' and extends upwards and to the right, crossing through the letter.

# CRC's Perspective on SDR

- **Ultra Electronics TCS HCLOS™: Networking radio**
  - AN/GRC-245 HCLOS™ military radio



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# The SCA

- **The SCA helps standardize some aspects of the software:**
  - How the software can be configured, started, stopped
  - How software gets installed and launched
- **The SCA makes application software more portable**
  - The use of Portable Operating System Interfaces (POSIX)
  - The use of CORBA as a middleware



# The SCA Ecosystem

- **The SCA has fostered an ecosystem of COTS products and services for radio manufacturers**
  - SCA Core Frameworks
    - Application deployment and configuration
    - Basic Device functionality
  - Code generation tools
    - Translate models into source code: Model Driven Development
  - Runtime monitoring tools
    - Install, launch, and debug applications
    - View log messages and events
  - Waveform application software
    - Implementation of standards: TETRA, APCO-P25, 3G, etc.



# The SCA Ecosystem

- **Canadian providers of COTS SCA solutions for radio manufacturers:**
  - **The Communications Research Centre Canada:**
    - COTS SCA Software Suite
  - **Spectrum Signal Processing by Vecima**
    - First COTS SCA platform
  - **ISR Technologies:**
    - First COTS platform with FPGA partial reconfiguration
  - **Lyrtech Signal Processing:**
    - First COTS platform with CORBA on FPGA and DSP
  - **Zeligsoft:**
    - Provides COTS modeling tools
- **Canadian Radio Manufacturer - Ultra Electronics TCS:**
  - Deployed the first military SCA radio that relies on a COTS SCA Core Framework (US Army, WIN-T)



# The SCA Ecosystem

- **Other providers of COTS SCA solutions for radio manufacturers:**
  - **United States:**
    - Pentek – COTS SCA boards
    - PrismTech – COTS SCA Software Suite
    - Harris – COTS SCA Core Framework
  - **Australia:**
    - Etherstack – Waveform applications (ex: TETRA, APCO-P25)

# The SCA Ecosystem

- **The existence of an ecosystem of COTS SCA products and services has been instrumental**
  - Organizations feel more confident to make the jump towards the SCA since it is a standard
  - The cost of entering the SCA market is greatly reduced
  - Previous achievements provide risk mitigation
- **Outside the US, CRC is involved with more than 35 organizations using the SCA**
  - Canada, UK, Germany, Italy, Israel, India, Singapore, Korea, China

# The SCA Ecosystem

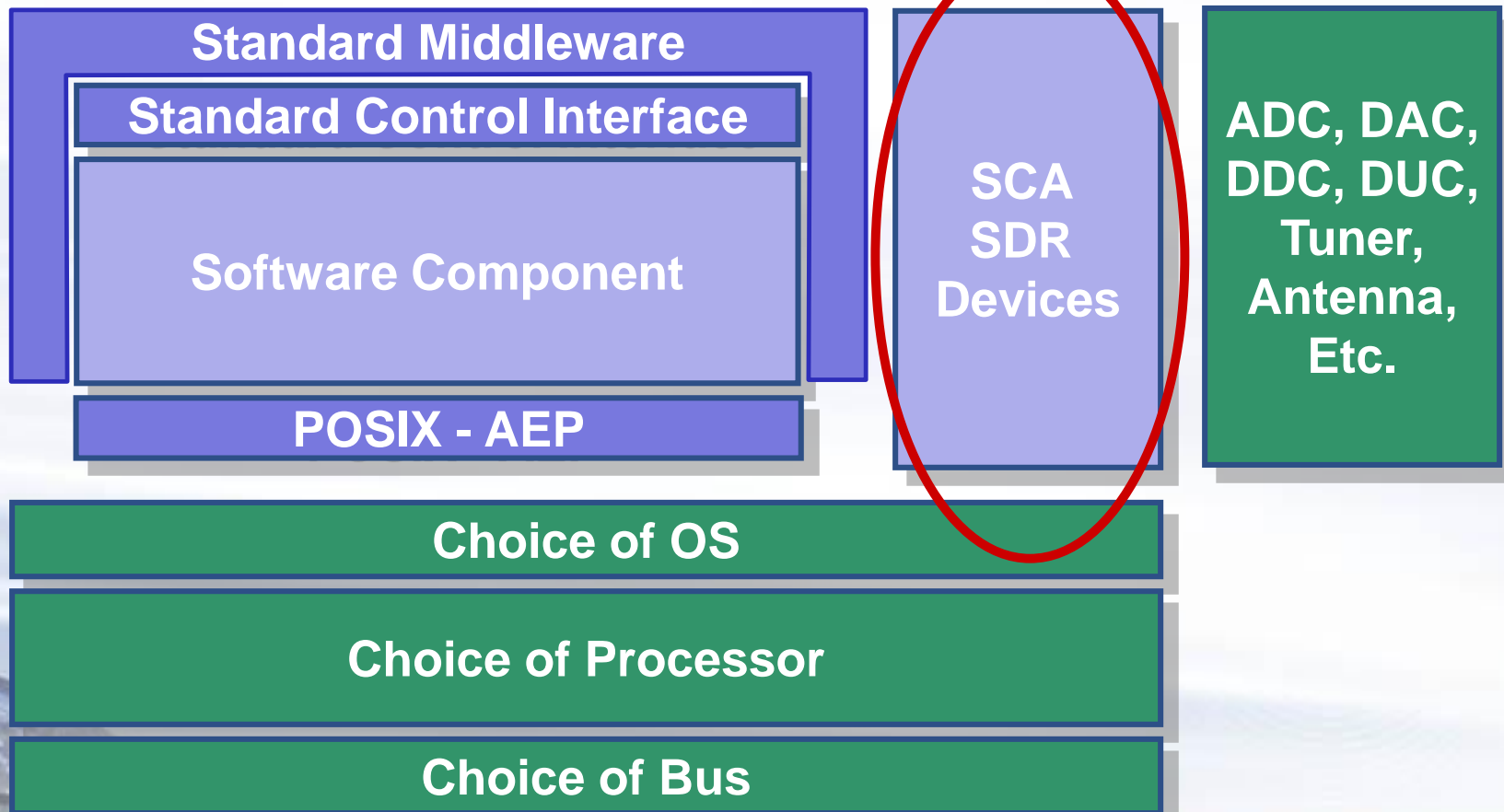
- **COTS SCA products and services are speeding up the development process**
  - Clarity/precision: Development starts at a higher level of abstraction
  - Reuse: High-level abstractions are translated into platform specific artifacts
  - Early visibility: Can quickly create prototypes
  - Greater flexibility: Developers can redesign almost at will
  - Fewer defects: Because of modeling wizards and model translation which greatly reduce manual coding
  - Reduced development cost: Shorter development cycles, time is money!

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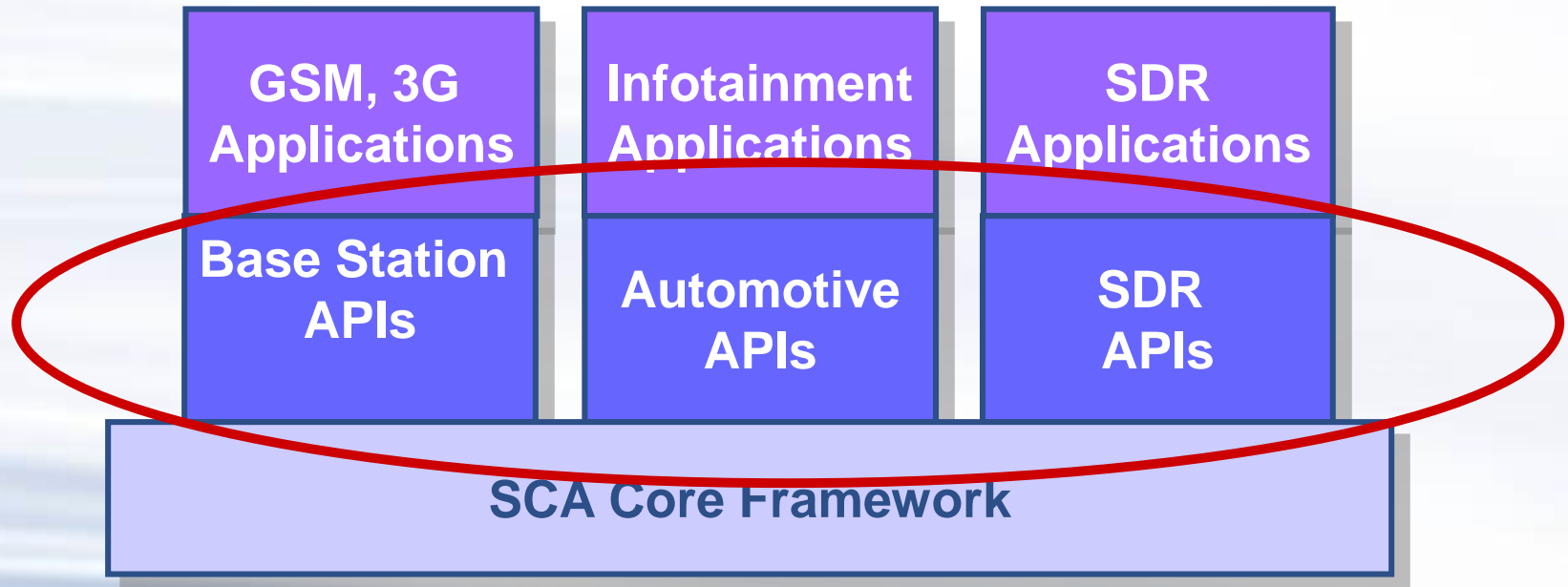
# The SCA: What's Next?

- The SCA community has not been successful at standardizing domain-specific APIs



# The SCA: What's Next?

- **The SCA needs standard domain-specific APIs**





# The SCA: What's Next?

- **Domain-specific APIs would provide a greater level of portability**
  - Porting an application to a similar platform which uses different Radio hardware would not require API changes
- **The SCA working group of the SDR Forum is looking for organizations to participate in an effort to assemble a set of SDR-specific APIs**
  - Will look at several APIs:
    - JTRS newly released APIs
    - Will also look at the OMG Software-Based Communications models for communications equipment
    - Will look the SDRF Smart Antenna APIs
    - Will look at Transceiver APIs from Thales
  - Welcomes more contributions

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# Conclusion

- **Standards are essential to foster a healthy ecosystem around a technology**
  - Lower cost of entry
  - Risk mitigation
- **The SCA is only a start; it is an architecture supplemented with guideline for software development best practices**
  - The SCA is not a military technology
  - The SCA is a Component-based Design architecture for embedded systems
- **The SCA works for small and large military and commercial applications**

# Conclusion

- **The next big step for the SCA community is the development of standard APIs for radio hardware**
  - The SCA Working group of the SDR forum will welcome any contribution

# Questions ?

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