



Evaluating SCA 4.1 features in action

– Lessons and Metrics –

WinnComm 2015

Workshop 5C: Evaluation, Analysis and Prototype of SCA 4.1 Results

- ❖ **Who is Nordiasoft?**
- ❖ **What is SCAv4?**
- ❖ **SCAv4 Key New Features**
- ❖ **Lessons learned with SCAv2.2.2**
- ❖ **Some Metrics**
- ❖ **SCAv4.1 Change Proposals for New Features**

Who is NordiaSoft ?



- ❖ **NordiaSoft offers Products and Services for the development of SCA platforms**
 - SCARI Software Suite: most popular IDE for SCA
 - SCARI GT: Core Framework deployed in thousands of fielded SCA Radios
 - Services: Consulting and training. We can make your platform SCA compliant
- ❖ **Our team: over 80 years of combined SCA experience**
- ❖ **Office: Gatineau, Québec, Canada**
- ❖ **Products: licensed to over 50 organizations in 16 countries**
 - Americas, Europe, Middle-east, and Asia
 - Thousands of radios deployed to the battlefield



What is SCAv4 ?

- ❖ **SCAv4.1 is a draft release of SCAv4 [code name SCA Next] that is expected to be implementable**

- ❖ **SCAv4.0 is the first draft release of the specification since SCAv2.2.2 that includes a number of new features**
 - Changes come from years of experience implementing SCAv2.2.2
 - New features to allow developers to implement light-weight components
 - New features to enable shorter booting sequences – improved boot time
 - New features to minimize footprint requirements

- ❖ **Ultimately, SCAv4 broadens applicability of SCA beyond U.S. military Software Defined Radios**

SCAv4 Key New Features

❖ **SCAv4 is backwards compatible to SCAv2.2.2**

- Launch SCAv2.2.2 applications on a SCAv4.1 platform
- Launch SCAv2.2.2 application components as part of SCAv4.1 applications**

❖ **SCAv4 supports varying levels of granularity for components**

- Components can implement only the standard interfaces that are required
- Ex: a component with no properties doesn't have to implement the PropertySet interface
- This can help reduce footprint requirements
- This can also help address some IA requirements

SCAv4 Key New Features

- ❖ **SCAv4 now uses a new registration interface: push vs pull**
 - SCAv2.2.2 was mostly implemented by letting key components pull the information they needed
 - SCAv4 is focused on allowing components to provide more information at registration to avoid pulling
 - This feature can save several interactions and avoid reparsing of some XML information
 - The anticipated result is a faster boot sequence
- ❖ **SCAv4 also add support for the push approach to establish connections between components**
 - Components can register all their ports during registration
 - Connections can be established in bulk
 - The anticipated result is a shorter connection sequence

SCAv4 Key New Features

- ❖ **SCAv4 now supports the concept of factories for Device/service components**
 - SCAv2.2.2 only supported factories for application components
 - SCAv4 generalizes the Factory concepts to both node and application components
 - The feature can save tremendous amount of memory
 - The feature can also drastically accelerate communications between components with good real time ORBs

Lessons learned with SCAv2.2.2

❖ SCARI GT is Nordiasoft's SCA Core Framework

- It has been deployed by different radio manufacturers, on radios of varying sizes, and on thousands of radios deployed world wide

❖ Boot Time is Paramount

- SCARI GT has been optimized with several features to accelerate the SCA boot sequence. Over the years, several features have been implemented
- What was recognized as a common problem for many radios is the poor performances of the file systems.
- Anything that prevents the unnecessary parsing of XML files leads to great performance improvements.
- Push registration is one trick SCARI GT uses to avoid reading files

Lessons learned with SCAv2.2.2

❖ **Flexibility for Address Space configurations is essential**

- SCARI GT and SCA Architect offer several features to allow developer to make last minute changes for address space configurations
- Running many application components into a single address space can provide significant footprint savings and speed improvement
- SCA Architect can automatically generate a ResourceFactory from any application components
- SCA Architect can automatically change a component from being linked into a stand-alone Executable into a Shared Library
- SCARI GT's ExecutableDevice provides an ExecutableDevice that can run components as processes or as threads

Lessons learned with SCAv2.2.2

- ❖ **Connections have not been a major performance issue**
 - The speed at which an SCA Core Framework can establish connections between components has not been a major performance issue amongst Nordiasoft customers
 - Experiments with real radios have led to data collection that did not expose performance issues
 - SCARI GT uses a caching approach to establish connections

- ❖ **Connections could be more of an issue on an RTOS with a partition scheduler**
 - Establishing a one-way connections between components hosted in different partitions could have to wait for two full rounds of scheduling
 - But there is a simple design pattern to avoid this issue with SCAv2.2.2

Some Metrics

❖ Boot Time is Paramount

- SCARI GT offers the possibility of performing push registration in one single call which can save up to 19 CORBA calls per registering Device
 - Some of the calls have to do with reading XML from a remote and slow embedded file system

Test Scenarios	Standard Registration	One call Registration	Improvement
Linux Desktop, 1 Device	0.56 sec	0.19 sec	~ 66%
Linux Desktop, 4 Devices	1.53 sec	0.24 sec	~ 84%
LynxOS PPC405GPr, 1 Device	0.86 sec	0.13 sec	~ 85%
LynxOS PPC405GPr, 4 Devices	2.33 sec	0.22 sec	~ 91%

❖ SCAv4.1 Push registration will allow similar performance gains

Some Metrics

❖ Flexibility for Address Space configurations is essential

- SCARI GT and SCA Architect offer several features to allow developer to make last minute changes for address space configurations

Average Round Trip Time in usec for PPC405GPr (400MHz) running INTEGRITY RTOS and ORBexpress	Double Sequence		Octet Sequence	
	1024	2048	1024	2048
using TCP/IP	3334	7272	1428	1767
using INTCONN	2215	4728	1042	1273
using direct method invocation thanks to a ResourceFactory that yielded 40% smaller footprint	244	492	155	231

❖ SCAv4.1 ComponentFactory will allow similar performance gains for both application assemblies and node assemblies

❖ Flexibility for Address Space configurations is essential

- SCARI GT and SCA Architect offer several features to allow developer to make last minute changes for address space configurations

Average Round Trip Time in usec for Intel i7-4770 (3.4GHz) running Linux and ORBexpress	Average Packet Round Trip Time for 1024 doubles
Using TCP/IP running as separate executables	815
using direct method invocation thanks to a ResourceFactory	31

❖ SCAv4.1 ComponentFactory will allow similar performance gains for both application assemblies and node assemblies

SCAv4.1 Change Proposals for New Features



❖ Core Affinity

- Would allow applications to benefit from Multi Core processors
- Could define a Core Affinity for an SCA Component to be launched
- Offers performance optimization

❖ Process Assignment

- Would allow developers to define within which process a component must be launched
- Would allow dynamic creation of processes to run host specific components
- Offers performance optimization

❖ Ultimately, SCAv4 broadens applicability of SCA beyond U.S. military Software Defined Radios

– The End –