The SCA originated with the JTRS primarily to support SDR waveform portability for a new family of SDR tactical radios for the US military. The Software Defined Radio Forum (SDRF) assisted the JTRS Joint Program Office (JPO) in developing this open framework for SDRs, beginning with version 0.9 to the current version 3.0 (see jtrs.army.mil/sections/technicalinformation/sset_technical_sca.html) with its associated Application Program Interface (API), Specialized Hardware and Security Supplements. The Specialized Hardware Supplement is the main addition to SCA 3.0, which includes other improvements such as the elimination of reference counting and security supplement enhancements.

As the SDRF continues to support development of the SCA, it has sponsored the development of both an Open Source Reference Implementation (OSRI) for an SCA-compliant Core Framework (CF) as well as a compliant waveform based on FM3TR. The CF, based on a hybrid Java and C implementation, is available to SDRF members. An FM3TR waveform project is expected for completion later this year; in addition, the SDRF has developed requirements, use cases, Requests For Information (RFI), and Requests For Proposal (RFP). Typically, these technical products are voted and approved by the SDRF, then transferred via formal liaisons to other organizations such as the JTRS JPO and the Object Management Group (OMG), an object-oriented software standards organization.

For the last three years, SCA evolution has taken a parallel commercialization path in the Software Based Communications Domain Task Force (sbc.omg.org) within the OMG. In this forum, the domain-independent portions of the SCA, the bulk of the SCA, such as Lightweight Logging, Lightweight Services, Lightweight CORBA Component Model, Smart Antennae API, Digital Intermediate Frequency API, Deployment and Configuration of Components, and several Security Specifications, are in various phases of the standardization process as separate specifications. Development of these separate specifications allows commercial participation in related tooling and infrastructure.

Future SCA revisions should decrease in size and complexity as these OMG domain-independent specifications are completed and used as SCA references. This trend has already begun as the Lightweight Logging API was removed from the SCA, referencing the completed OMG version.
The OMG strives for SCA compatibility with its own software radio domain-specific version. Synchronization of OMG software radio specification improvements with the SCA has been achieved through liaisons and OMG member participation in the JTRS SCA Technical Advisory Group (TAG) revision process.

**Existing SCA divisions**

To simplify the categorization of changes, the SCA can be thought of in terms of current work and divisions as depicted in Figure 1. The current SCA 3.0 infrastructure manages the hardware radio components deployment by configuring devices and making sure they are ready, providing a standard store for configuration files, machine state, user attributes, and functional software, and offering a waveform structure, control, and binding framework for heterogeneous processors.

While not specifically addressing a waveform API, the SCA API supplement is given to support the portability of applications and interchangeability of devices; there is a specialization of the API derived from Cluster 1, a large SCA-compliant JTRS program. The current SCA assumes services that are provided by CORBA, for example, event and time services, and adds a logging service.

A standard method to access security functions such as encryption, authentication, transmission security (TRANSEC), and nonrepudiation, is specified in an SCA Security Supplement. Because of the nature of this technology, specializations exist for each JTRS program. In addition, there exists a parallel Air Force/NSA Multiple Independent Levels of Security (MILS) effort to combine the best of FAA DO-178B Common Criteria’s security technologies, so as to provision secure services to embedded real-time, high-assurance platforms.

Parallel OMG standards plans and initiatives for the security functions and specifications are depicted in the OMG SCA Security Roadmap in Figure 2. A Specialized Hardware Specification SCA Supplement, available for SCA 3.0, specifies how to improve portability of software for processing elements other than general-purpose processors, including a Hardware Abstraction Layer (HAL) for deploying on heterogeneous processors.

**Forecasted SCA divisions**

Using the same divisions previously identified in Figures 1 and 2, Figure 3 shows a potential SCA evolution with possible choices. SCA changes occur through a Change Proposals (CPs) process and are reviewed though a Technical Advisory Group (TAG) and Change Control Board process. For instance, SCA 3.1 already

---

**Figure 1**

**Figure 3**

**Figure 2**
completed in draft form, includes CP289, detailing a Component Portability Specification (note CP289 was not accepted yet).

At this date, the OMG version of the Software Radio Specification is in the Finalization Task Force stage. This specification contains only the radio domain and waveform API portions of the specification, with the component model separated into different specifications that describe both the Deployment and Configuration of Components and Lightweight CORBA Component Model currently in the Revision Task Force stage. The SDRF is making additional progress with a new Waveform API contracted research and development project expected to begin in September, partially based on an OMG Software Radio Specification Waveform API Subset document. For the present, synchronization of the OMG and JTRS versions of the Software Radio specifications has been through OMG member participation in the JTRS CP process.

There are two new device-related specifications in process. The first is a Smart Antennae API Specification, with parallel efforts in both the SDRF and OMG. The second is an OMG Digital Intermediate Frequency (DIF) API Specification providing a standard API between tuners and the computer(s) hosting the rest of the software radio logic. This DIF specification is the software analog of the hardware standard driven through the digitalIF.org standards group.

As previously mentioned, the OMG Lightweight Logging Specification has been finalized, serving as an SCA reference. The closest services specification to finalization is the OMG Lightweight Services Specification, offering a further reduction in SCA complexity.

The OMG Security Specification roadmap (refer back to Figure 2) is still in its initial phases; the first two specifications on this roadmap, the Core and Key Management Specifications, are in the initial submission stage. The OMG will standardize on the black, crypto, and red processing described in Figure 4. Common security requirements are combined into this Security Subsystem Core to describe the overlap in one specification. The Secure Audit and Authentication RFPs are complete, with initial submissions in work; the rest of the OMG security submissions in Figure 2 will follow. In the meantime: 1) There are JTRS/NSA planned upgrades to the SCA Security Supplement; and 2) the Joint Program Executive Office (JPEO) is putting together an Information Assurance team to plan upcoming security specification update and implementation testing.

Tuning in the future
If the trend to replace SCA sections with domain-independent portions continues, tool vendor support will increase. In addition, the SCA framework will be smaller, require less testing, and eventually support ultra lightweight deployments in small and low-power consumption devices. The OMG SWRadio domain-specific specification will, in the short term, contribute to the SCA though the JTRS SCA change process. The progression from SCA 3.0 to SCA 3.1 will support true waveform component portability over heterogeneous processors.

Commercial SCA adoption is still hampered by many factors such as tool and predefined component availability. Future integration of SCA and commercial Software Defined basestation specifications holds promise as competing commercial standards and the SCA improve with liaisons and information sharing between groups.

Jeff Smith received his Ph.D. from Northeastern University in computer systems engineering, his MS in engineering management from Southern Methodist University, his MS in computer science from East Texas State University, and his BS in computer systems engineering from the University of Massachusetts. He has a 30-year track record in the acquisition, management, research, and development of advanced development/technology programs and heads a consulting company, Composable Logic, supporting SCA Technica.
He is one of three co-chairs of the OMG Software-Based Communications Task Force and participates with the OMG Ontology working group. His primary expertise is in modeling/formal methods and applied complex systems (multi-sensor fusion or software radio applications).

For more information, contact Jeff at:
Composable Logic
PO Box 3148
Nashua, NH 03061-3148
Tel: 603-566-0124
Fax: 603-222-2098
E-mail: jesmith@ComposableLogic.com
Website: www.ComposableLogic.com

David Murotage received his SB in electrical engineering, SB in English literature and creative writing, SM in electrical engineering and computer science, and a Ph.D. in management of technological innovation from MIT. With more than 30 years of engineering and management experience at the US Army, RCA, GE, Lockheed, and Mercury Computer, he founded SCA Technica, Inc. in 2002. SCA Technica specializes in research and development of high-assurance SDR and CR and developed the High Assurance Wireless Computing System (HAWCS™) for protecting SDR and wireless computers from blended radio and Internet “hacking” attacks. A member of the SDRF board of directors, Murotage chairs its markets committee and is its Technical Committee’s past vice-chair. He is founder and chair of numerous SDR working groups and special interest groups, including the Base Station WG and R & D WG.

For more information, contact David at:
SCA Technica, Inc.
PO Box 3148
Nashua, NH 03061-3148
Tel: 603-321-6536
Fax: 603-222-2098
E-mail: dmurotak@scatechnica.com
Website: www.scatechnica.com

Antonio Martin holds a bachelor’s degree from the University of Maine in computer science and is pursuing a master’s, certified by the Committee on National Security Systems, in computer science with a concentration in security at Boston University. Tony has eight years experience in the fields of biometrics, image processing, scalable distributed database and transaction processing, and network and system security. He is a participant at the OMG SW Radio FTF.

For more information, contact Antonio at:
SCA Technica, Inc.
PO Box 3148
Nashua, NH 03061-3148
Tel: 603-321-5220
Fax: 603-222-2098
E-mail: tony.martin@scatechnica.com
Website: www.scatechnica.com
## CPU Modules

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<th>Model</th>
<th>Intel Celeron™</th>
<th>VIA Eden™</th>
<th>AMD Geode™</th>
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## Dual-Port Memory Options

- 8k 1250
- 650 12
- 1/4 8
- 2 8
- 9 8

## Processor Options

- Intel Celeron™
- VIA Eden™
- AMD Geode™

## CPU Modules

- AT Expansion Bus
- PCI Universal Expansion Bus
- PC/104-Plus PCI Bus Masters
- APIC (add’l PCI interrupts)

## Utility Modules

- 8000 MIPS dspModules™

- COProcessors
- Accelerators

## Speciality I/O

- Pulse width modulator
- Incremental encoder
- Opto-isolated MOSFET
- User defined FPGA

## Frame Grabbers

- Single or multi-channel
- MPEG-2 compression

## Video Controllers

- Analog VGA
- TTL and DVI panel support

## Communication Modules

- Copper or fiber Ethernet
- USB 2.0, Firewire, CAN, serial

## Wireless Telematics

- GSM, GPRS, CDMA
- EDGE, GPRS, SMS
- GPS, Wi-Fi, Bluetooth

## Motion Controllers

- DC motor controllers
- Synchro, resolver, LVDT

## Power Supplies

- 50/75/83/100 Watts
- Wide input range
- UPS backup
- MIL-STD-704/461

## Mass Storage

- 1.8 and 2.5-inch IDE
- CompactFlash and PCMCIA

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