

Embedded Components (eCo) Suite

Embedded Systems Development Made Easy



Introduction

The Software Communications Architecture (SCA) is a Component Based Development (CBD) architecture for the development of Heterogeneous Embedded Distributed Systems (HEDS).

Initially created for the U.S. DoD's Joint Tactical Radio Systems (JTRS) program for tactical software defined radios (SDR), the SCA is now an open international standard that has benefited from the use and input of public and private organizations around the world.

The SCA allows embedded applications to be portable across different hardware platforms. The SCA facilitates post-manufacturing system updates and upgrades, minimizes development risk, and greatly simplifies development cycles by promoting software reuse.

Hundreds of thousands of SCA-based military radios have been deployed to battlefields. Thanks to its proven track record, SCA is now being considered in different domains such as radar, electronic signals intelligence and warfare, test and instrumentation, and robotics.

Speed Up

Speed up your SDR development and reduce risk. Adopt the eCo Suite to leverage the VIAVI experience and expertise in SCA development, certification, as well as professional services including training, technical support, and consulting.

The eCo Suite is a comprehensive Integrated Development Environment (IDE) for Heterogeneous Embedded Distributed Systems (HEDS). This VIAVI solution embraces the concepts of Component-Based Development (CBD) and Model-Driven Engineering (MDE).

The eCo Suite allows developers to model, create, deploy and test software components that run in real time and are independent from the underlying operating environment. It simplifies architectural design, reduces development costs and time to market, optimizes software performance, and improves overall system quality.

The Embedded Components (eCo) Suite



Customers worldwide have benefited from the expertise of VIAVI engineers in developing embedded systems using the SCA. With years of experience obtained by starting with the implementation of the SCA Reference Implementation and the SCARI Software Suite, in use in government and industry organizations around the world, the new eCo Suite for SCA 4.1 takes advantage of technological breakthroughs of the last decade.

The eCo Suite Is Composed Of Five Main Products

eCo Hub

The eCo Hub which implements the SCA 4.1 Core Framework (CF), resides above the operating system on the target platform and is responsible for the deployment and configuration of SCA Devices and Applications. It supports the largest combination of operating systems, object request brokers, and processors. Not being subject to ITAR restrictions, eCo Hub is based on the knowledge and optimization techniques acquired with the former SCARI CF that runs in thousands of battlefield deployed radios from different international radio manufacturers.

Features

- SCA 4.1 Full Profile
- Boot time optimization
- Small footprint
- Support for all major OS/RTOS
- Support for ORBexpress RT
- Support complete backward compatibility with SCA 2.2.2
- Not ITAR restricted

eCo Architect

eCo Architect is an Eclipse-based development tool that allows you to create, validate, and debug SCA software components and applications. It utilizes a visual modeling language that allows developers to unambiguously graphically express every concept of the SCA. It generates behavioral and structural source code that builds for all supported operating environments. It also provides a Zero-Merge functionality to simplify business logic insertion.

Features

- Zero-merge SCA behavioral and structural code generation
- Real-time validation and re-factoring
- Generates source code that builds for multiple operating environments without regenerating
- Unambiguous graphical modeling

eCo Inspector

eCo Inspector is an Eclipse-based run-time monitoring tool that lets developers install and control SCA applications as well as visualize the structure of the running software. It enables easy deployment of software on various processors or in various cores of the same processor; co-locate different signal processing components on the same/different processor core or within the same process space without having to recompile/build your application source code. With eCo Inspector, developers can also graphically visualize data being exchanged between processing components of an application. The VIAVI eCo Inspector is an essential tool for debugging and testing during SCA development.

Features

- Install, control, and debug applications
- Introspect SCA systems
- Graphical representation of deployed SCA components
- Full control over deployed components
- Use device assignments to deploy components
- Use core affinities to deploy components

eCo DSP Toolbox

eCo DSP Toolbox provides a library of digital signal processing components that allow developers to quickly start creating SCA applications with minimal writing of source code. eCo DSP Toolbox includes common signal processing algorithms of wireless systems such as Codecs, Filters, Modems, and Interleavers already implemented as SCA components.

eCo SCA Devices

eCo SCA Devices provide SCA implementations of platform hardware Devices and Services for APIs associated with the SCA standards for wireless systems produced by the JTRS/JTNC program and Wireless Innovation Forum (e.g., Audio, Vocoder, Ethernet, Serial, GPS, Security, Timing, Transceiver).

eCo Hub

Built from the ground up for embedded platforms, the eCo Hub is the fourth-generation Core Framework implemented by the VIAVI team. It was designed for optimum boot time performance, and implements the Full Profile of the SCA 4.1 specification with support for nearly all Units of Functionality.

VIAVI eCo Hub is the ideal software deployment and configuration engine for R&D and industry organizations that want to take advantage of the modern advanced features of embedded systems. eCo Hub is the only commercial Core Framework that supports complete backward compatibility with the former SCA 2.2.2 standard. This allows you to continue to capitalize on your previous investment made in the SCA and to proceed with a seamless migration at your own pace.

Built on the know-how and experience gathered with the battle-proven commercial off-the-shelf (COTS) SCARI GT product for SCA 2.2.2, including lessons learned from the JTRS-tested SCARI-Open Core Framework, and interactions with leading industry and R&D labs, the eCo Hub is a complete and robust solution for your present and future development.

It is available pre-integrated with generic COTS SCA platforms, ready to be used for development. As its SCARI GT predecessor for SCA 2.2.2, the Eco Hub Core Framework aims to be the most widely adopted commercial SCA 4.1 Core Framework. eCo Hub represents another milestone in the VIAVI SCA development solution. Not being subject to ITAR restrictions, the eCo Hub is available for licensing worldwide.

Operating Environments

Designed with portability in mind, and like its SCARI GT predecessor, the eCo Hub is available for many operating environments: INTEGRITY, VxWorks, different desktop Linux distributions, and new portable platforms such as Android. eCo Hub can also be ported to other operating systems with single or multiple address spaces, with or without a dynamic loader. It is also available for several processor families such as x86, PPC, and ARM.

eCo Hub supports several different ORBs including ORBexpress RT, which is the most widely used real-time, secure, and high-performance ORB used in military radio platforms. The VIAVI team also has the required expertise to add support for any new operating environment.

PORTABLE



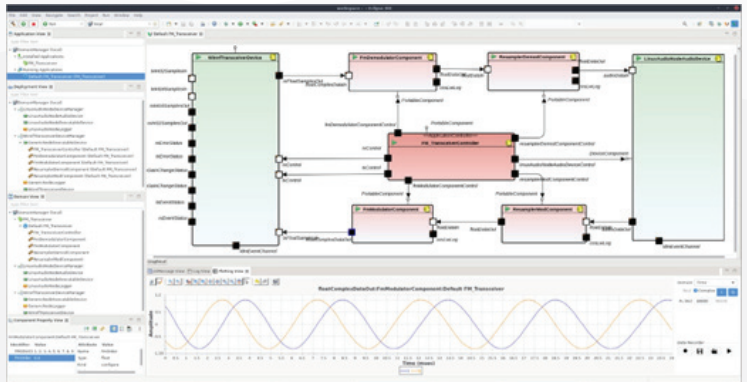
Abstract the operating environment to increase source code portability

High-Speed Core Framework

eCo Hub provides an implementation of SCA 4.1 Full Profile with support for nearly all Units of Functionality. It implements exceptional real-time features to minimize the boot time of an SCA system. The eCo Hub even allows SCA node and application components to be dynamically collocated in a single address space, which is significant for accelerating the boot sequence of a node.

Debugging Support

eCo Hub is provided in two binary forms: Release and Tracer. The Release version is compact and ready for embedded deployment. The Tracer version is instrumental in debugging code that produces several levels of tracing messages that can be selectively turned on or off. eCo Hub can also save the logging messages to a file which are produced before a Log service becomes available. This feature makes a difference when debugging early-crash problems.



Backward Compatible

eCo Hub goes beyond supporting the Application Backward Compatible - Unit of Functionality of SCA 4.1, which allows SCA 2.2.2 applications to be deployed. eCo Hub also supports applications made of a mixture of SCA 2.2.2 and SCA 4.1 components. This feature allows you to convert your existing applications by doing a step-by-step migration and test your changes as you go. Moreover, eCo Hub also supports backward compatibility at the platform level by supporting the launching of a complete SCA 2.2.2 node, or a node made of a mixture of SCA 2.2.2 and SCA 4.1 Devices and Services.

Partnerships

The VIAVI SCA Team has a “Best in Breed” philosophy. By dealing with all the key industry and government players, the VIAVI Team ensures that its products are open and compliant. The VIAVI Team simply does not believe in vendor lock-in solutions. Instead, it partners and works closely with many industry and government players. Fruitful partnerships allow VIAVI to provide a wide range of domain-specific expertise.

MODEL DRIVEN



Generate source code from models and assemble applications using intuitive drag-and-drop functionality

Support and Consulting Services

The VIAVI SCA Engineering Services Team is dedicated to providing you with the support needed for the design and implementation of your SCA-based projects. Building on our eCo Suite, which is the most complete commercial integrated development environment for SCA 4.1-based products, we can accompany you in every step of your development process. From the initial training in the SCA development concepts and techniques to the final system integration, the VIAVI Team can assist you at every stage. Contact us to learn more.

eCo Architect

The VIAMI eCo Architect is the component-based development tool of the eCo Suite. It covers the complete development life cycle including modeling and validation of components, full behavioral generation of SCA-compliant C++ source code, real-time model validation, as well as creating component assembly into applications or nodes.

eCo Architect is provided as a plug-in for the universally adopted, platform-independent, Eclipse Integrated Development Environment (IDE). Embedded system developers will benefit from a well-known interface, making it easy to navigate between the different development phases of their projects.

Reusable Modeling Elements

No need to repeat every step when creating components. eCo Architect lets you create reusable component properties and ports, easing your way into SCA component creation. This feature is also extremely useful when applying design modifications to many components. A modification in one place is automatically reflected everywhere – a precious time-saving feature.

Real-Time Model Validation

The real-time model validation feature of eCo Architect eliminates time-consuming retrofits to correct early errors, thereby greatly accelerating the creation of SCA components. In-depth experience and expertise with the SCA have provided eCo Architect with the largest set of validation rules in the industry.

Importing and Refactoring

eCo Architect can also be used to model and validate pre-existing SCA domain profiles. Its powerful import capabilities will import and repair legacy domain profiles. eCo Architect's unique re-factoring feature can also automatically correct errors by offering developers several suggested fixes.

Unambiguous Modeling

eCo Architect's superior modeling capabilities allow unambiguous graphical representations of assemblies, capturing containment relationships between deployed components and their target – a key concept to enable the graphical representation of all types of indirect connections and host collocation relationships. eCo Architect's modeling capabilities provide a deterministic graphical representation of assemblies.

Zero-Merge Code Generation

eCo Architect generates fully functional SCA components using C++/POSIX/CORBA that can be built and used in applications without writing a single line of code. Being template-based, eCo Architect could be tailored to support other programming languages or code conventions. eCo Architect breaks new ground by introducing “zero-merge” code generation capabilities. Developers specialize in the behavior of a component, instead of modifying it.

Developers can at last remodel existing components, and regenerate code without having to merge two versions of the source code.

SCA 2.2.2 to SCA 4.1 Migration

eCo Architect provides the unavoidable capability to help transition applications and nodes from SCA 2.2.2 to SCA 4.1. Whether it is to migrate a complete assembly or a single component, eCo Architect can convert existing models to comply with the new standard and refactor source code that has been generated with the VIAVI SCARI Software Suite’s SCA Architect tool for SCA 2.2.2.

Configuration Management

eCo Architect pioneers model-level configuration management. Developers no longer have to manually track each individual artifact of a model element. It allows developers to save model elements directly to a repository. Developers don’t have to save incoherent versions of those models. This feature radically simplifies configuration management.

Shared Projects

eCo Architect provides a way to reuse common modeling elements without having to duplicate them. eCo Architect supports the Eclipse concept of shared projects. Rather than duplicating a modeling element, developers can reference projects containing shared elements. After all, “Reuse” is one of the core SCA philosophies.

Multiple Development and Operating Environment Support

eCo Architect supports multiple development and operating environments by providing the possibility to define different sets (or versions) of toolchains, libraries, paths, and ORBs for a component by using different definitions of build specifications, IDL profiles, macros, environment variables, and system variables. This makes it possible to not only support different environments, but also allows developers to share models that use a build specification that can be customized for their specific requirements without affecting the configuration management. eCo Architect can also generate different build artifacts, such as make files or cmake files, according to the developer preference. Both, make and cmake files are fully integrated with the popular C/C++ Development Tools (CDT) Eclipse’s plug-in.





eCo Inspector

The VIAVI eCo Inspector offers a runtime view of the SCA system design. This introspection tool provides multiple views which allow developers to visualize the software structure of any SCA compliant platform. Using tree views and block diagrams, engineers and developers can see where each application component is running. It also represents the relationships between application and platform components.

Multiple Domain Control

eCo Inspector can connect to more than one platform or domain simultaneously. Engineers can control several systems within the same tool, which facilitates debugging of systems with more than one domain (e.g., a radio with Red and Black Domains). eCo Inspector is to the SCA what a debugger is to source code. In fact, the eCo Inspector can be connected to any embedded SCA platform, just like source code debuggers.

Installing and Controlling Applications

eCo Inspector comes with a built-in application installer to copy the required artifacts into the file system of an SCA platform. The tool can also instantiate, configure, start, stop, terminate, and uninstall applications.

eCo Inspector provides a generic property browser that can render every type of SCA property and can change values dynamically or in batch mode.

Influence Deployment

eCo Inspector can be used to deploy any application component to a specific processor using device assignments. It can also be used to assign application components to specific processor cores via the new core affinity feature of SCAv4.1. It can assign different application components to specific devices, an essential feature to assess performance.

Plotting

eCo Inspector includes real-time, peak and average value plotting capabilities that allows visualization in three types of graphs: Time Domain (time/amplitude), Frequency Domain (frequency/magnitude), and Constellation (phase/quadrature).

Interface with VIAVI Signal Workshop

eCo Inspector allows for further introspection of a waveform performance, by routing its data to/from the industry's gold standard for signal analysis and generation. An ideal complement to eCo Inspector, VIAVI Signal Workshop is a fully integrated software suite designed to assist in finding and/or solving the toughest RF communications signal quality, spectral monitoring, interference, and environmental RF issues. It allows for the capture of RF signals over the air to monitor and analyze the spectral environment. It also allows the creation of synthetic waveforms, the generation of signals, and the measurement of performance of your wireless system. Or to simply measure the performance of your own RF system.

Debugging Features

In real-time, eCo Inspector introspects the platform and reports the status of every component, by refreshing the views and block diagrams when needed. Any new application being added, device failing, or connection broken will be shown, providing valuable information to the integrators and testers to resolve issues.

eCo Inspector can be used to test applications under different conditions. It can be used to lock/unlock specific device components to create different deployment scenarios. eCo Inspector can shut down a complete node or individual components. It can even do so, while applications are running to analyze the impact on the system. In short, eCo Inspector provides full control over the life cycle of any SCA component.

Extended Introspection

eCo Inspector provides different types of views for displaying the deployed software components and related information. The Domain View, Application View, and Deployment View use a tree-like structure, where each node represents a component. The block diagram view uses a block for each deployed component. eCo Inspector can even show which components have been deployed onto other components and graphically displays how components have been inter-connected.



eCo DSP Toolbox

eCo DSP Toolbox provides a library of digital signal processing algorithms implemented as SCA components that are commonly used in wireless communications systems. It provides invaluable functionality to kick-start waveform development. Below is a list of components offered with the eCo DSP Toolbox which is regularly updated.

Demodulators/Modulators

AM Modulator/Demodulator, APSK Modulator/Demodulator, ASK Modulator/Demodulator, DPSK Modulator/Demodulator, FM Modulator/Demodulator, FSK Modulator/Demodulator, GMSK Modulator/Demodulator, PSK Modulator/Demodulator, QAM Modulator/Demodulator

Filters

FIR Decimation Filter, FIR Kaiser Filter, FIR Interpolation Filter, IIR Prototype Filter

Decoders / Encoders

Convolutional FEC Encoder/Decoder, Hamming FEC Encoder/Decoder, Interleaver Encoder/Decoder, Reed- Solomon FEC Encoder/Decoder

Resamplers

MultiStage Resampler, MultiStage Half Resampler, Rational Resampler, Real MultiStage Resampler

Data Generators

BER Meter, Gaussian Generator, PN Sequence Generator, Sine Wave Generator

Receiver

Automatic Gain Control, Carrier Synchronizer, Signal Detector, Sequence Detector

Channels

AWGN, Channel Emulator, Packet Assembler

Other DSP

FFT

Utilities

Float to Double Converter, Symbol Synchronizer

eCo SCA Devices

eCo SCA Devices provide SCA implementations of platform hardware Devices and Services for APIs associated with the SCA standards for wireless systems produced by the JTRS/JTNC program (part of the JTNC Catalog of Public Release Approved Standards version 1.0.1) and Wireless Innovation Forum. SCA 4.1 implementations modeled and code generated with the VIAVI eCo Architect tool are delivered. Native implementations are designed to be decoupled from the SCA and CORBA, to be self-tested, and for easy adaptation to specific platform implementation. UML class and sequence diagrams are also provided to describe the native implementation and its integration within the SCA component. Unit tests and functional tests are also provided.

JTNC Audio Port Device

Supports the JTRS Standard Audio Port Device API version 1.3.4. Supports the Audio Sample Stream extension. Native implementation uses Linux Pulse Audio driver.

JTNC Ethernet Device

Supports the JTRS Standard Ethernet Device API version 1.2.2. Supports the Mode Configuration, Multicast Mode, Promiscuous Mode, Header Configuration and MAC Address extensions. Native implementation uses Sockets and ioctl.

JTNC GPS Device

Supports the JTRS Standard GPS Device API version 2.1.4. Supports the Latitude/Longitude and MGRS extensions. Needs to be specialized for specific GPS driver. Supports a GPS simulator mode.

JTNC Timing Service

Supports the JTRS Standard Timing Service API version 1.4.4. Supports the External Time Reference, Waveform Time, and System Time extensions. Native implementation uses POSIX timers.

JTNC Serial Port Device

Supports the JTRS Standard Serial Port Device API version 2.1.4. Supports the Asynchronous extension. Native implementation uses termios on Linux.

JTNC Vocoder Service

Supports the JTRS Standard Vocoder Service API version 1.3.3. Supports the Vocoder Audio Stream, Speex, and AMBE codec extensions. Native implementation supports Speex on Linux and AMBE using a DVSI USB- 3000 dongle on Linux.

JTNC MHAL Device

Supports the JTRS Standard MHAL Device API version 3.0. Supports the MHAL GPP API, MHAL DSP API, and MHAL RF Chain Coordinator extensions. RF Chain Coordinator commands can be implemented by the Device or delegated to a Transceiver Device through a special interface. Native implementation needs to be further specialized for specific transports.

WInnF Transceiver Device API

Supports the WInnF Transceiver Facility PIM Specification version 2.1.1. Supports the Immediate and Absolute Creation of Burst Control.

WInnF International Radio Security Services (IRSS) API

Supports the WInnF IRSS API version 2.0.0. Supports the Bypass service with Infosec Transec Channel. Needs to be adapted for a specific crypto subsystem.



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