Embedded Real-Time CORBA Requirements for Software Defined Radios

Byron Tarver
Business Development Manager
byron.tarver@motorola.com
Outline

- SDR Concepts
- CORBA/ORB applicability in SDRs
- Issues
- Uses/ Benefits
- ORB Requirements
Services
- Provides common signal flow and processing

Waveforms
- Use services
- Extend Services

Application

Platform Services

Core Framework
- Middleware to manage raw resources
- Provides mechanisms for writing consistent software objects

Platform

Control
- Manages Radio applications
- Provides services for radio robustness

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SDR Domain Architecture Components Logical Model

Service level APIs support 3rd party applications/waveforms

Multiple frameworks support independence of HW/SW

Waveform/Applications
Services Architecture
Management Architecture
Computational Architecture
Radio Application (HW Independent)

Radio Services

Waveform / Applications

- IDL Interface
  - RF
  - Modem
  - Radio Control
- ASN.1 Interface
- IDL Interface
- IDL Interface
- IDL Interface
- IDL Interface

Object Request Broker / Middleware

- IDL Interface
  - Real Time POSIX Interface

Real Time Operating System A *

Device Driver A

Hardware A

System Fabric

Radio Platform (HW Dependent)

Real Time Operating System N *

Device Driver N

Hardware N

Heterogeneous Processors using Middleware to provide a Homogenous Software System

* A, N are used to indicate any number of heterogeneous OS's and processors may be used
Notional Software Allocation

Software Functions:

- **RF Control**
  - Preselector
  - Synthesizer
  - Gain Set
  - Filter Selection
  - AGC Threshold
  - AGC Time Cons

- **Demodulate/Modulate**
- **Despread/Spread**
- **Decode/Encode**
- **Deinterleave/Interleave**
- **FEC**
- **Tracking Loops**
- **Counters**
- **Sorters**
- **Adaptive Filters**
- **Equalizer**
- **Correlator**
- **FFT**
- **Interference Canceller**
- **Hop Control**
- **Critical Timing**
- **TRANSEC PN Gen**
- **Channel Access Ctrl**
- **Timing Generation**
- **Timing Control**
- **Regenerative Repeat**

- **T/R Control**
  - Frequency
  - Levels
  - BWs
  - Timing Events

- **External Control**
  - Cosite
  - Antenna Position
  - Modes / Paths

- **Radio Configuration**
- **Waveform Selection**
- **Waveform Operation**
- **INFOSEC Control**
- **Networking Control**
- **Loading of S/W**
- **Servicing HD I/O**
- **Exception processing or maintenance**
- **Interface to HMI**
- **SNMP MIB**
- **Ephemeris Updating**

- **Ensure Privacy**
  - (Encrypt/Decrypt)
- **Ensure Authenticity of Commands**
- **Validate Configurations**
- **Validate all Red to Black Information**
- **Manage Key**
  - (Load, Encrypt, Data base, Expiration, Destruction)
- **TRANSEC**
- **Indicator drivers**
- **Crypto Ignition**

Note: Software functions (objects) can reside on most any processor. This distribution is representative of a normal distribution across the radio.

- **Voice Codec**
- **Data Codec**
- **Message Packet Detection**
- **Message Filtering / Formatting**
- **Checksum Validation**
- **Bridge Protocol**
- **Simulcast Multiple Protocols**
- **Identify/Route Packets**
- **Maintain Router Tables**
- **IP Routing**
- **Gateway**
- **Router Bypass**

Radio / User Interface

HMI

Internet-working

Red Side

WIM

Notional Software Allocation
• Support software deployment in hard real-time system
• Real-time configuration across multiple CORBA capable processors executing a single or multiple radio application(s)
• Non-transactional and persistent data flow nature of waveform signal processing applications
• Co-location of Clients and Servers
• Portability to other ORB Environments
Uses/Benefits

- **Deployment**
  - Supports configuration and reconfigurations
  - Supports downloading new software and functionality
  - Object distribution

- **Development**
  - Quick development of new applications
  - Reuse of waveform software from development environment to target with only recompilation.
Required Features and Services

- Multi-lingual support (e.g. ANSI C and C++ …)
- Location Transparency overhead relief for co-located clients and servers
- High Availability and Fault Tolerance
- Deployment Architecture for Hard Real-Time systems
- Modular, micro-kernel architecture allows you to use only what you need (e.g. Pluggable protocols, threading models)
- Portable Object Adaptors (improves multi-vendor portability)
- Services
  - Naming
  - Telecom Log
  - Event
  - Security