Wireless Innovation Forum
Implementing a Generic Front Panel

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Location: Washington
Agenda

• Introduction

• Relevant SCA APIs for HMI development

• Proposed design patterns and best practices

• Virtual Front Panel project

• Conclusion
SCA well defined areas

- Cross platform communication infra-structure with CORBA

- Variety of components with their characteristics
  - Devices
  - Resources
  - Services

- Set of standard application programming interfaces (APIs) to exchange information between components
  - PropertySet
  - TestableObject
  - LifeCycle
  - PortSupplier

- Application deployment mechanism in order to launch and teardown applications
How to use it?

- In the context of control and monitor applications
  - Which kind of interface to use for HMI?
  - How application has to be structure?
  - Is there design pattern or best practice that can be use?
Understand control and monitor application requirements

• Example of control and monitor application
  - Web pages
  - PC application
  - Keypad and Display
  - Intelligent Handset
  - Etc...

• What do they have in common
  - They have dynamic content
  - They are initiating actions
  - They need to be refresh
Understand control and monitor application requirements

- Radio control and monitoring does not impose tight requirements for speed because human reaction time is relatively slow

- The interface should easily provide a suitable way to expose an understandable interface for each possible kind of platform and waveform application

- HMIs are not very useful if the data displayed is out of date or if the user needs to refresh it manually, so there is also a need for data to be refreshed.
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SCA Interfaces adapted for HMI

- Two Apis can fulfill all those requirements:
  - PropertySet
    - An API like PropertySet can be used as an interface between any generic or specific tool and SCA applications
    - It is not the most efficient way to exchange information in term of speed but it is in term of visibility of your applications features and characteristics
  - Event Channels
    - Another SCA standard API can be used to fulfill this aspect of the tool design; the Event Channel is perfectly adapted for this kind of requirement
PropertySet API is adapted for HMI

- The PropertySet interface provides two functions
  - “query” in order to get property value
  - “configure” to modify property value

- This interface allows to configure and query properties of all types, i.e:
  - simple
    - integers
    - strings
    - floating points
    - Etc...
  - sequences of simples
  - structure of simple
  - sequence of structures
PropertySet API is adapted for HMI (cont’d)

• Properties are readable and understandable
  – The combination of the name, type, and description allow properties to talk for themselves

• Properties are described in the SCA Application metadata (XML files)

• A Control and Monitoring tool can be developed in no time with properties attached to dynamic elements
PropertySet API is adapted for HMI (cont’d)

• The following figure shows how simple a HMI can be integrated to an SCA design with the PropertySet interface

• No need to define specific Interface Definition Language (IDL)

• The entire mechanic is already present in the SCA standard interface part of the Core Framework
Event Channel API is adapted for HMI

- The Multiple Input Multiple Output (MIMO) structure of an event channel allows more than one application to broadcast information intended to be refreshed by any listener on the event channel.

- It also allows more than one listener, in that case HMIs and generic control and monitoring tools, to receive this information and update their display if needed.
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Design practical approaches

- Assembly Controller of an SCA application is always the only entry point of the application.
Design practical approaches

- The design pattern called “PROXY” is used at the property level to publish some platform or application attributes to external applications.
Design practical approaches

- Each public property of the application should generate an event with its name and value each time the property is modified.
Overall approach
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Virtual Front Panel Project

- Allows remote control of a radio unit (AN/GRC-245 HCLOS) using the same interface
- Virtual Panel is hosted on a computer and behaves exactly like the physical front panel
- Virtual Panel can be used in combination with the physical front panel
Virtual Front Panel Project (cont’d)

SCA Architecture enables a quick development approach

• The project was an R&D exploration project.
  • The time allocated was only one month
  • The main goal was to create a remote MMI
  • There was very little time for integration
  • There was only two developers on the project
    • One developer at CRC: GUI portion
    • One developer at Ultra: Radio portion

The Use of Standard API reduces the time of integration and facilitates information transfer
Virtual Front Panel Project (cont’d)

Development Approach

- Needed a simple and efficient way to interface between:
  - The two teams → Specification
  - The two portion of the system → SCA standard APIs

- Needed to be able to quickly build a simulation environment
  - CRC needed to simulate the radio MMI hardware
Virtual Front Panel Project (cont’d)
Architectural Approach

- What was already available in the existent architecture:
  - Information required by the Front Panel was already available via the SCA waveform Application
  - This information was available via a list of SCA properties and can be accessed via SCA standard API PropertySet
Virtual Front Panel Project (cont’d)

Architectural Approach

• What was missing?
  • An event channel, in order to refresh the Virtual Panel
  • On each relevant property modification, the generation of an event has been added.

Using a Standard Event Channel to notify the Virtual Panel reduces the use of processing resources that can be made available for more useful features.
Virtual Front Panel Project (cont’d)

Interface Specification

• Ultra only had to prepare a very short specification document to describe what needed to be done by CRC.

• The outline of the specification was as follows:
  – SCOPE
    • Briefly summarized the project scope and context

  – PHYSICAL FRONT PANEL
    • Described all front panel zones which are animated
    • Describe the MMI capabilities and sub-components

  – APPLICATION PROGRAMMING INTERFACES (APIs)
    • Front Panel Event Channel section
    • SCA Application port section
Virtual Front Panel Project (cont’d)

Application Programming Interfaces (APIs)

• Information that needs to be displayed will be sent on an Event Channel
  – Describes the format of the different events generated

• Information regarding SCA properties available on the SCA Waveform Application
  – Provides the SCA standard XML description of the properties. This accelerated the development of simulation components by CRC
  – Describes the possible values for each property
  – Describes the behavior of the virtual panel for each property value
Virtual Front Panel Project (cont’d)
From the Management Point of View

• Development of the Virtual Panel done in about 3 weeks.

• Development was done separately.

• No source code was exchanged during development.

• Time of integration was less than a day
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Conclusion

- PropertySet and Event Channel are two SCA Standard API adapted to interface with HMI

- Three design patterns and best practices can speed-up HMI development when applied to Radio SCA Design
  - Property proxy on sub-component information
  - Assembly Controller used as a gateway for application information
  - Event broadcast on Assembly Controller property modification

- SCA standard APIs speed-up development time and reduce integration time
Virtual Front Panel Demonstration at Exhibit (CRC boot)
Questions