combined **strength**

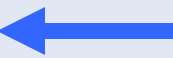# Wireless Innovation Forum
Implementing a Generic Front Panel

November 30, **2010**
Presentation by: **Serge Harnois**
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

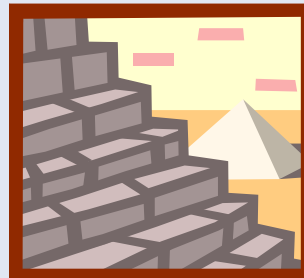- Application deployment mechanism in order to launch and teardown applications

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How to use it ?

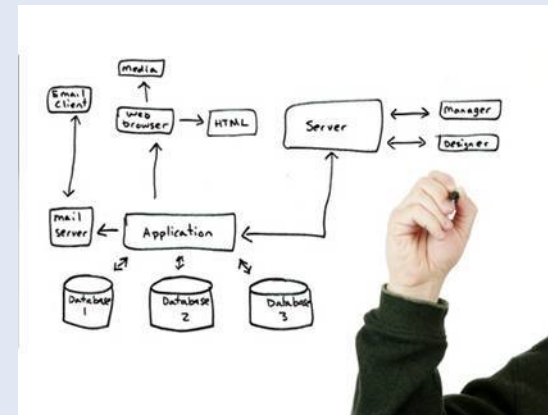- In the context of control and monitor applications

  – Which kind of interface to use for HMI?

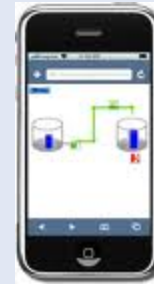 – How application has to be structure?

  – Is there design pattern or best practice that can be use?

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Understand control and monitor application requirements

- Example of control and monitor application

    - Web pages
    - PC application
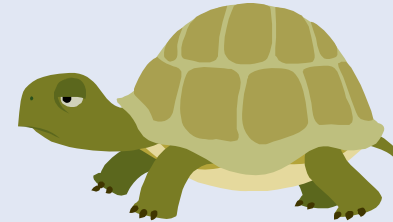   - Keypad and Display
    - Intelligent Handset
    - Etc...

- 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 provides 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 refresh.

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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*

PropertySet
API

```
Radio Control &        ←—————→   Application 1
Monitoring tool
                      ←—————→   Application 2
PropertySet
API
```
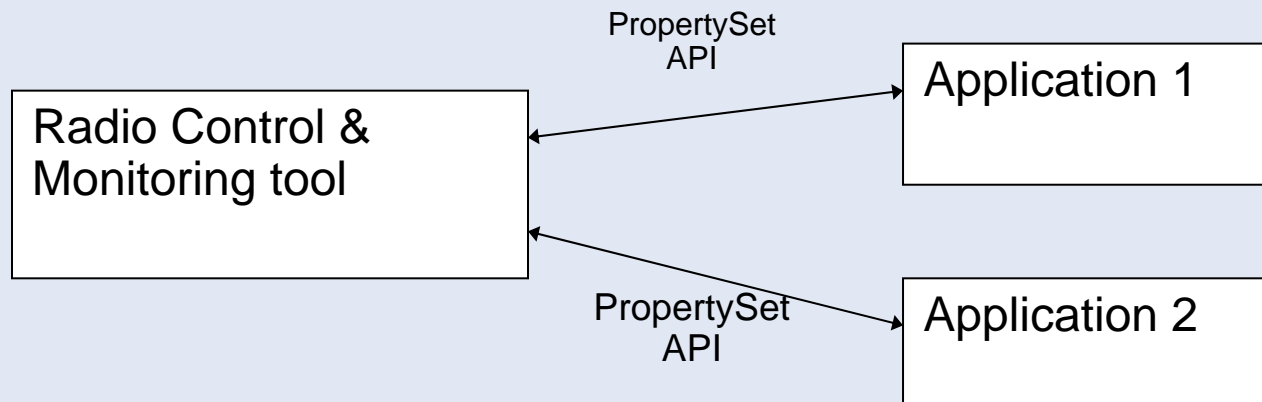
Event Channel API is adapted for HMI

- 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
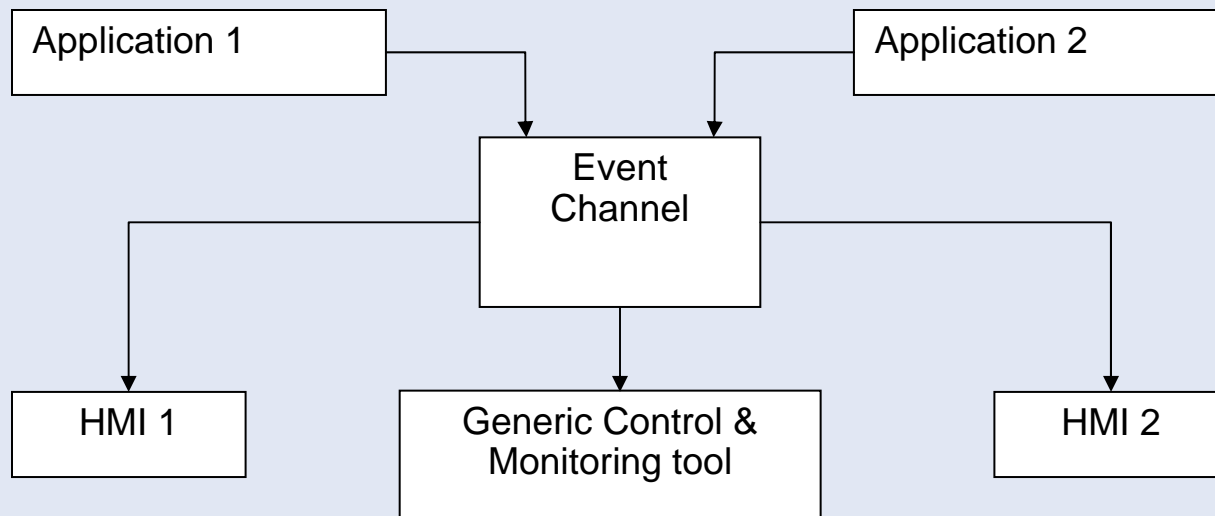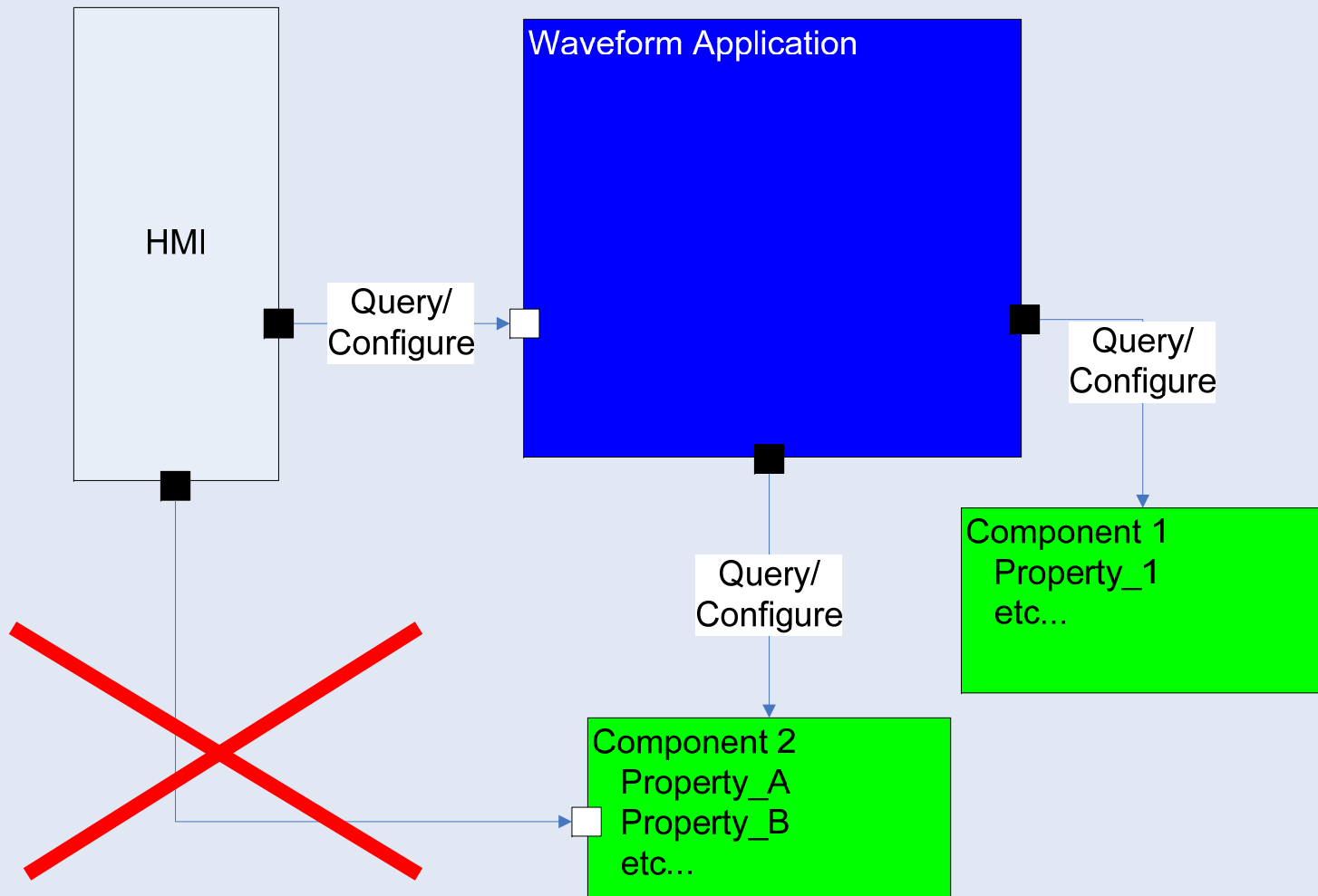
| Application 1 | | Application 2 |

Event Channel

| HMI 1 | Generic Control & Monitoring tool | HMI 2 |

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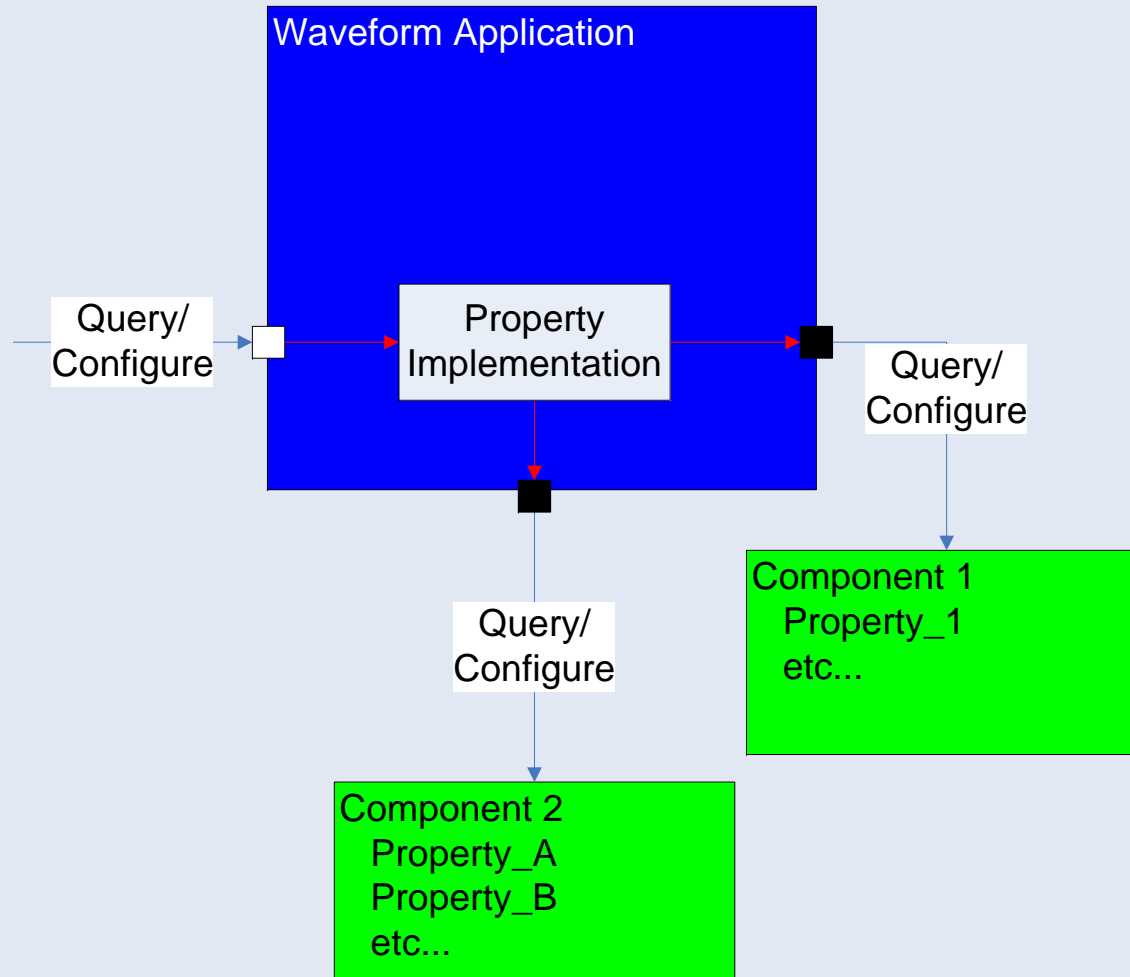
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Design practical approaches

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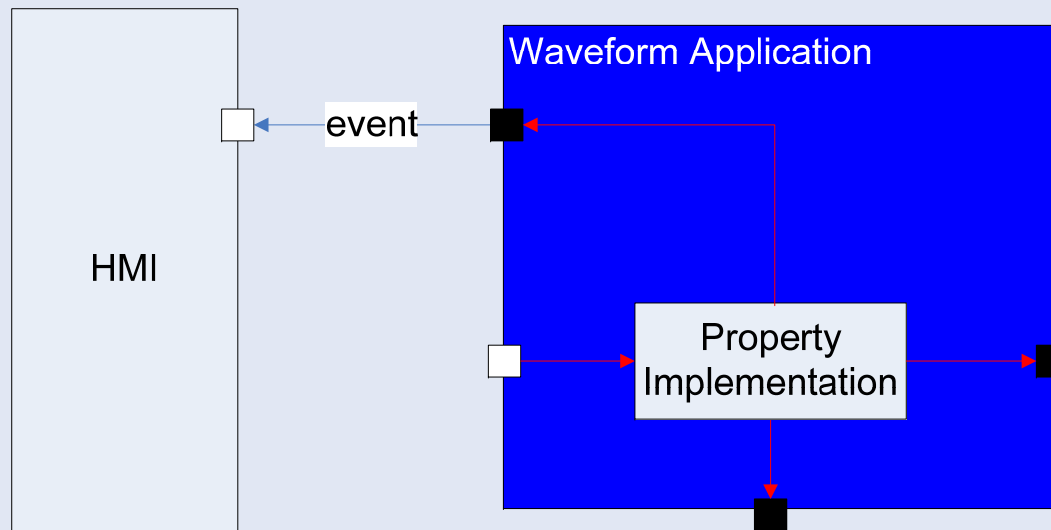
Design practical approaches

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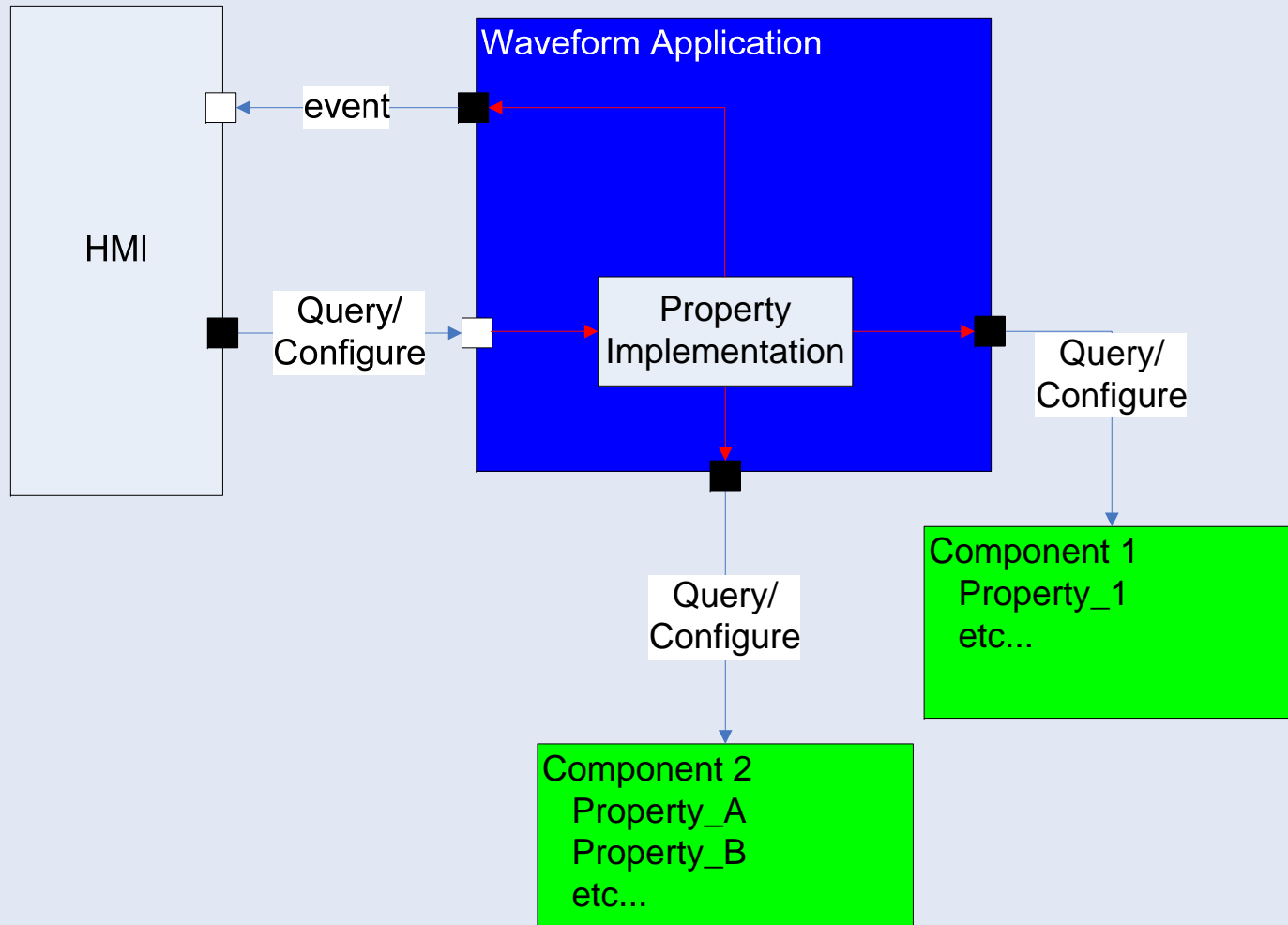
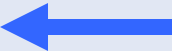# Design practical approaches

- 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

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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

SCA Events

SCA Simulation application

SCA Property Configuration
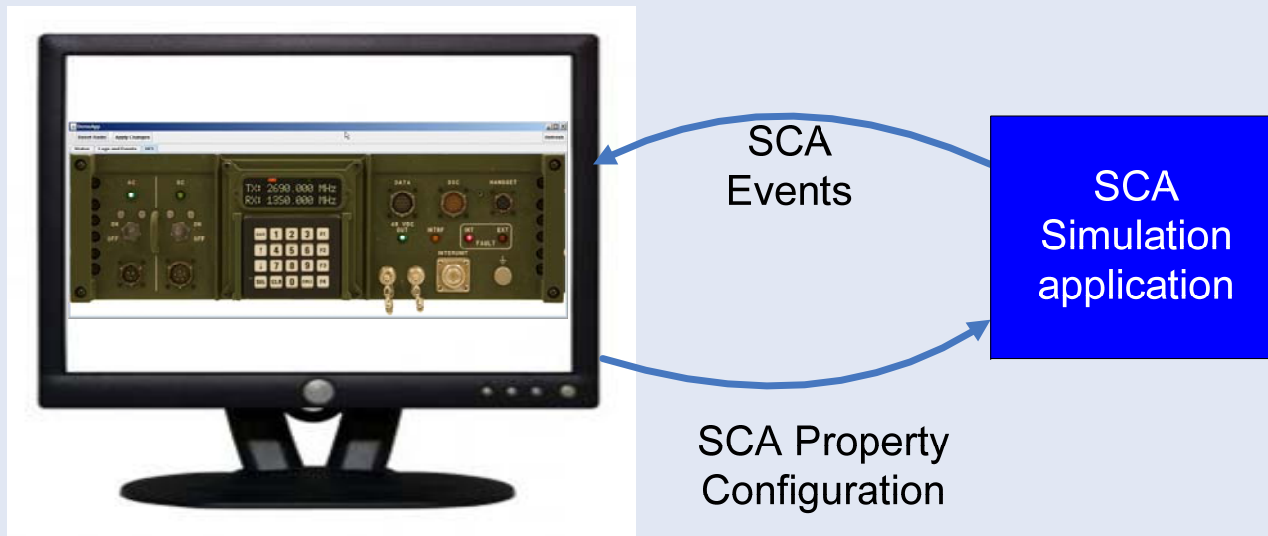
Virtual Front Panel Project (cont'd)

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 ProtertySet
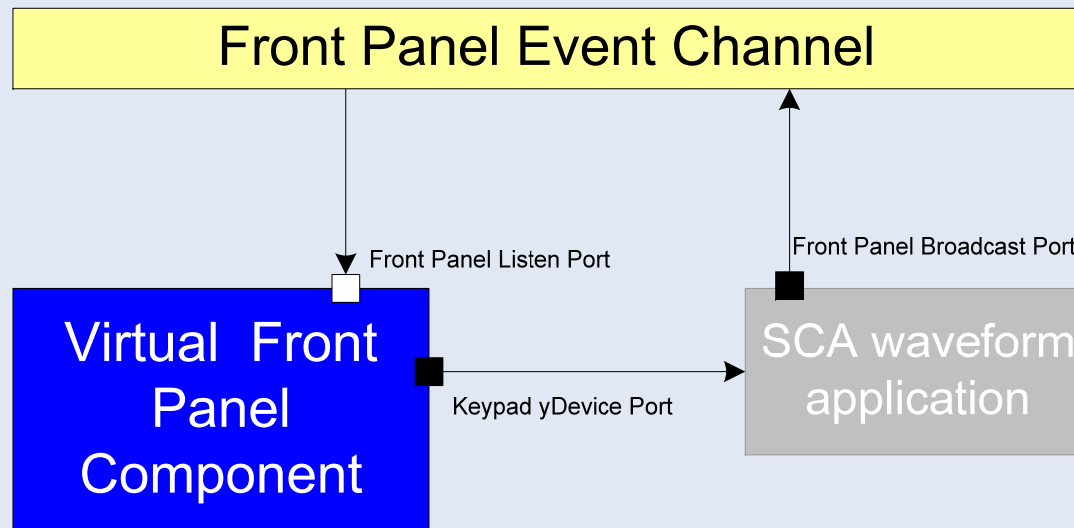
Virtual Front Panel Component → Application Port → SCA waveform application
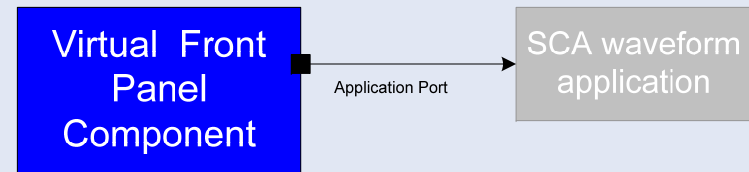
The information is already available in the actual design

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.

Front Panel Event Channel

Front Panel Listen Port

Front Panel Broadcast Port

Virtual Front Panel Component

SCA waveform application

Keypad yDevice Port

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

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Virtual Front Panel Project (cont'd)

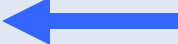## Application Programming Interfaces (APIs)

- **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

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Virtual Front Panel Demonstration at Exhibit (CRC boot)

Questions