
NATO RTO/IST RTG on SDR: Demonstrating Portability and Interoperability of SCA-based Waveforms

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Outline

- NATO Group & Motivation
- Portability Approach
 - Modifications to Domain Profiles
- Interoperability Approach
 - Demonstration
- Conclusions

NATO RTO/IST-080 RTG-038 on SDR

- NATO RTO/IST RTG on SDR (estd. 2007)
 - Research and Technology Organization (RTO)
 - Information Systems Technology (IST)
 - Research Task Group (RTG)

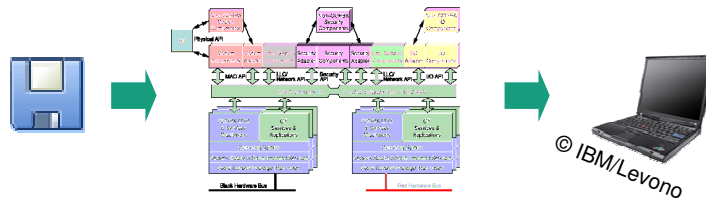
- Main Objectives
 - Share knowledge and experience on SCA/SDR Development
 - Share waveforms and SCA based waveform components

Demonstrate Portability & Interoperability of SCA-based Waveforms

Motivation

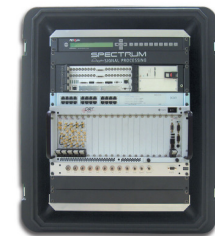
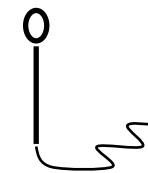
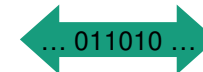
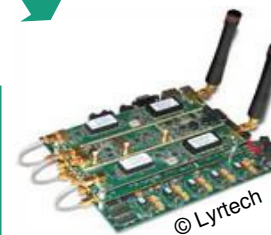
■ Target Workflow

1. SCA-based implementation of STANAG 4285 waveform



3. Demonstrate **interoperability** between the different implementations

2. Demonstrate **portability** onto national SDR platforms

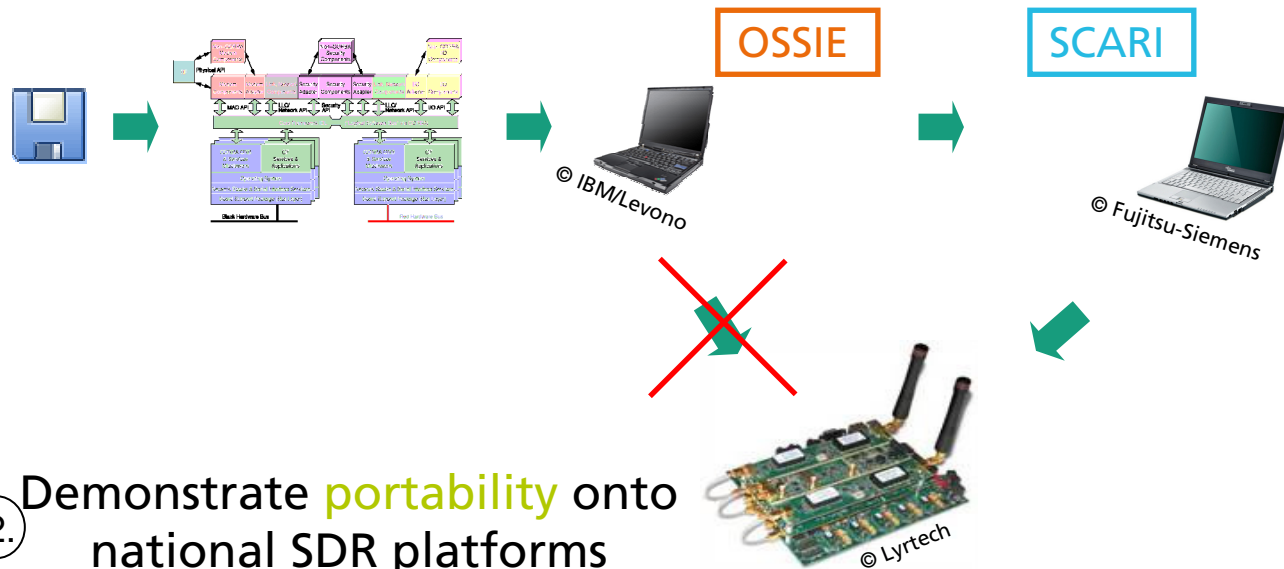


© Spectrum Signal Processing

Motivation

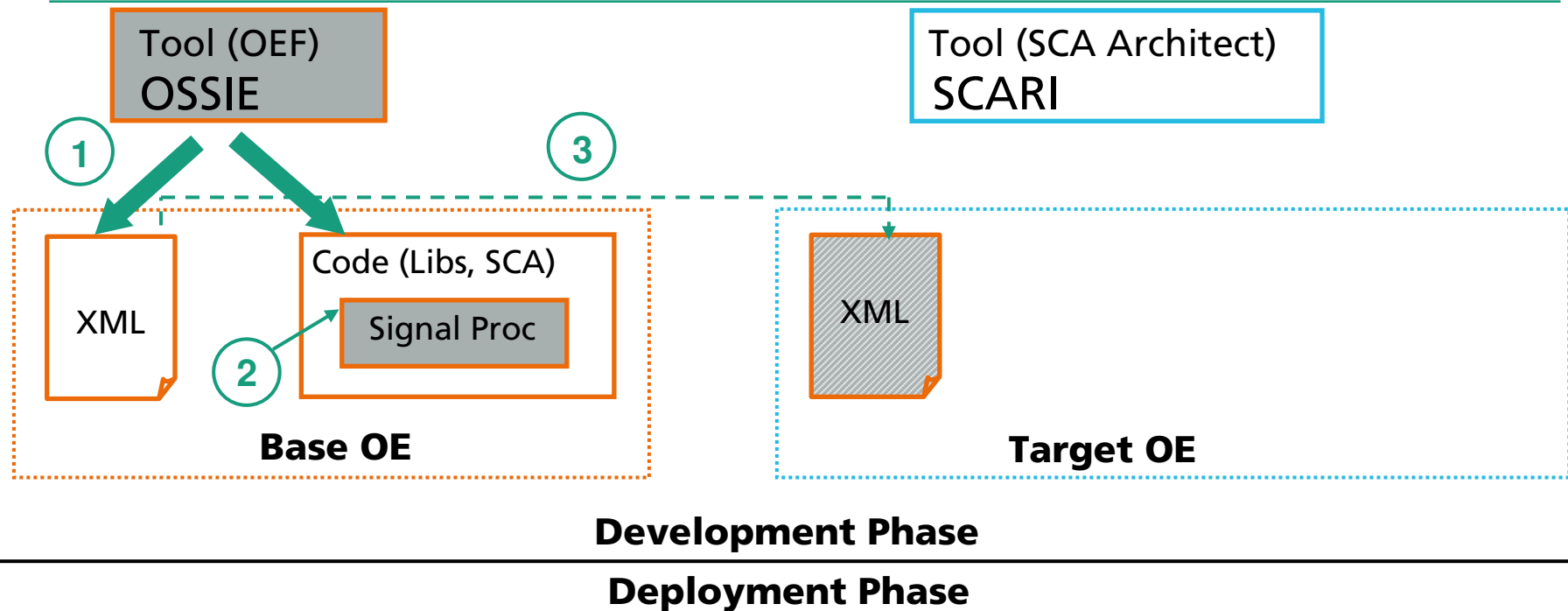
■ Target Workflow

- ## 1. SCA-based implementation of STANAG 4285 waveform



2. Demonstrate **portability** onto national SDR platforms

Portability Approach



Changes needed in Domain Profiles (General)

■ Hard Coded File Paths

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE softpkg SYSTEM "../dtd/softpkg.dtd">
<!--Created with OSSIE WaveDev-->
<!--Powered by Python-->
<softpkg id="DCE:eda4420a-fc2c-11dd-ac86-000bcd0a50e1"
name="ST_Transmitter" type="sca_compliant">
  <title/>
  <description>
  </description>
  <author>
    <name>OSSIE Project</name>
    <company>Mobile and Portable Radio Research Group</company>
    <webpage>http://www.mprg.org</webpage>
  </author>
  <propertyfile type="PRF">
    <localfile name="xml/ST_Transmitter/ST_Transmitter.prf.xml"/>
  </propertyfile>
  <descriptor>
    <localfile name="xml/ST_Transmitter/ST_Transmitter.scd.xml"/>
  </descriptor>
  <implementation aepcompliance="aep_compliant"
fc2c-11dd-a37c-000bcd0a50e1">
    <description>Description</description>
    <code type="Executable">
      <localfile name="bin/ST_Transmitter"/>
    </code>
    <processor name="x86"/>
  </implementation>
</softpkg>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE softpkg SYSTEM "dtd/softpkg.2.2.dtd">
<!--Created with OSSIE WaveDev-->
<!--Powered by Python-->
<softpkg id="DCE:eda4420a-fc2c-11dd-ac86-000bcd0a50e1"
name="ST_Transmitter" type="sca_compliant">
  <title/>
  <description>
  </description>
  <author>
    <name>OSSIE Project</name>
    <company>Mobile and Portable Radio Research Group</company>
    <webpage>http://www.mprg.org</webpage>
  </author>
  <propertyfile type="PRF">
    <localfile name="ST_Transmitter.prf.xml"/>
  </propertyfile>
  <descriptor>
    <localfile name="ST_Transmitter.scd.xml"/>
  </descriptor>
  <implementation aepcompliance="aep_compliant" id="DCE:edaf01ae-
fc2c-11dd-a37c-000bcd0a50e1">
    <description>Description</description>
    <code type="Executable">
      <localfile name="ST_Transmitter"/>
    </code>
    <processor name="x86"/>
  </implementation>
</softpkg>
```

Changes needed in Domain Profiles (Properties Descriptor)

■ Replacing elements based on SCA Schema

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE properties SYSTEM "dtd/properties.2.2.dtd">
<!--Created with OSSIE WaveDev-->
<!--Powered by Python-->
<properties>
  <simple id="DCE:dd57f964-fc2c-11dd-a97d-000bcd0a50e1"
mode="readonly" name="Psk" type="short">
    <value>2</value>
    <description>
</description>
    <kind kindtype="configure"/>
  </simple>
</properties>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE properties SYSTEM "dtd/properties.2.2.dtd">
<!--Created with OSSIE WaveDev-->
<!--Powered by Python-->
<properties>
  <simple id="DCE:dd57f964-fc2c-11dd-a97d-000bcd0a50e1"
mode="readonly" name="Psk" type="short">
    <description>
</description>
    <value>2</value>
    <kind kindtype="configure"/>
  </simple>
</properties>
```


Changes needed in Domain Profiles (Software Component Descriptor)

■ Additional Interfaces

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE softwarecomponent SYSTEM "dtd/softwarecomponent.2.2.dtd">
<!--Created with OSSIE WaveDev-->
<!--Powered by Python-->
<softwarecomponent>
  <corbaversion>2.2</corbaversion>
  <componentrepid repid="IDL:CF/Resource:1.0"/>
  <componenttype>resource</componenttype>
  <componentfeatures>
    <supportsinterface repid="IDL:CF/Resource:1.0"
      supportsname="Resource"/>
    <supportsinterface repid="IDL:CF/LifeCycle:1.0"
      supportsname="LifeCycle"/>
    <supportsinterface repid="IDL:CF/PortSupplier:1.0"
      supportsname="PortSupplier"/>
    <supportsinterface repid="IDL:CF/PropertySet:1.0"
      supportsname="PropertySet"/>
    <supportsinterface repid="IDL:CF/TestableObject:1.0"
      supportsname="TestableObject"/>
    <ports>
      <uses repid="IDL:PushPorts/ShortSeqConsumer:1.0"
        usesname="ShortOut">
        <porttype type="data"/>
      </uses>
    </ports>
  </componentfeatures>
  <interfaces>
    <interface name="Resource" repid="IDL:CF/Resource:1.0">
      <inheritsinterface repid="IDL:CF/LifeCycle:1.0"/>
      <inheritsinterface repid="IDL:CF/PortSupplier:1.0"/>
      <inheritsinterface repid="IDL:CF/PropertySet:1.0"/>
      <inheritsinterface repid="IDL:CF/TestableObject:1.0"/>
    </interface>
    <interface name="ShortSeqConsumer"
      repid="IDL:PushPorts/ShortSeqConsumer:1.0"/>
  </interfaces>
</softwarecomponent>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE softwarecomponent SYSTEM "dtd/softwarecomponent.2.2.dtd">
<!--Created with OSSIE WaveDev-->
<!--Powered by Python-->
<softwarecomponent>
  <corbaversion>2.2</corbaversion>
  <componentrepid repid="IDL:CF/Resource:1.0"/>
  <componenttype>resource</componenttype>
  <componentfeatures>
    <supportsinterface repid="IDL:CF/Resource:1.0"
      supportsname="Resource"/>
    <supportsinterface repid="IDL:CF/LifeCycle:1.0"
      supportsname="LifeCycle"/>
    <supportsinterface repid="IDL:CF/PortSupplier:1.0"
      supportsname="PortSupplier"/>
    <supportsinterface repid="IDL:CF/PropertySet:1.0"
      supportsname="PropertySet"/>
    <supportsinterface repid="IDL:CF/TestableObject:1.0"
      supportsname="TestableObject"/>
    <ports>
      <uses repid="IDL:PushPorts/ShortSeqConsumer:1.0"
        usesname="ShortOut">
        <porttype type="data"/>
      </uses>
    </ports>
  </componentfeatures>
  <interfaces>
    <interface name="Resource" repid="IDL:CF/Resource:1.0">
      <inheritsinterface repid="IDL:CF/LifeCycle:1.0"/>
      <inheritsinterface repid="IDL:CF/PortSupplier:1.0"/>
      <inheritsinterface repid="IDL:CF/PropertySet:1.0"/>
      <inheritsinterface repid="IDL:CF/TestableObject:1.0"/>
    </interface>
    <interface name="LifeCycle" repid="IDL:CF/LifeCycle:1.0"/>
    <interface name="TestableObject"
      repid="IDL:CF/TestableObject:1.0"/>
    <interface name="PropertySet" repid="IDL:CF/PropertySet:1.0"/>
    <interface name="PortSupplier"
      repid="IDL:CF/PortSupplier:1.0"/>
    <interface name="ShortSeqConsumer"
      repid="IDL:PushPorts/ShortSeqConsumer:1.0"/>
  </interfaces>
</softwarecomponent>
```

Changes needed in Domain Profiles (Software Package Descriptor)

- Replacing elements based on SCA Schema
- Addition of necessary elements

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE softpkg SYSTEM "dtd/softpkg.2.2.dtd">
<!--Created with OSSIE WaveDev-->
<!--Powered by Python-->
<softpkg id="DCE:eda4420a-fc2c-11dd-ac86-000bcd0a50e1"
name="ST_Transmitter" type="sca_compliant">
  <title/>
  <description/>
  </description>
  <author>
    <name>OSSIE Project</name>
    <company>Mobile and Portable Radio Research Group</company>
    <webpage>http://www.mprg.org</webpage>
  </author>
  <propertyfile type="PRF">
    <localfile name="ST_Transmitter.prf.xml"/>
  </propertyfile>
  <descriptor>
    <localfile name="ST_Transmitter.scd.xml"/>
  </descriptor>
  <implementation aepcompliance="aep_compliant" id="DCE:edaf01ae-
fc2c-11dd-a37c-000bcd0a50e1">
    <description>Description</description>
    <code type="Executable">
      <localfile name="ST_Transmitter"/>
    </code>
    <processor name="x86"/>
  </implementation>
</softpkg>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE softpkg SYSTEM "dtd/softpkg.2.2.dtd">
<!--Created with OSSIE WaveDev-->
<!--Powered by Python-->
<softpkg id="DCE:eda4420a-fc2c-11dd-ac86-000bcd0a50e1"
name="ST_Transmitter" type="sca_compliant">
  <title/>
  <author>
    <name>OSSIE Project</name>
    <company>Mobile and Portable Radio Research Group</company>
    <webpage>http://www.mprg.org</webpage>
  </author>
  <description/>
  </description>
  <propertyfile type="PRF">
    <localfile name="ST_Transmitter.prf.xml"/>
  </propertyfile>
  <descriptor>
    <localfile name="ST_Transmitter.scd.xml"/>
  </descriptor>
  <implementation aepcompliance="aep_compliant" id="DCE:edaf01ae-
fc2c-11dd-a37c-000bcd0a50e1">
    <description>Description</description>
    <code type="Executable">
      <localfile name="ST_Transmitter"/>
    </code>
    <os name="Linux"/>
    <processor name="x86"/>
  </implementation>
</softpkg>
```

Changes needed in Domain Profiles (Software Assembly Descriptor)

■ Replacing the order of “usesport” and “providesport” elements

```
<connections>
  <connectinterface id="DCE:d9d5ad62-fc2d-11dd-b97a-000bcd0a50e1">
    (A) <providesport>
      <providesidentifier>DoubleIn</providesidentifier>
      <findby>
        <namingservice name="ST_Receiver1"/>
      </findby>
    </providesport>
    (B) <usesport>
      <usesidentifier>DoubleOut</usesidentifier>
      <findby>
        <namingservice name="ST_Transmitter1"/>
      </findby>
    </usesport>
  </connectinterface>
</connections>
```

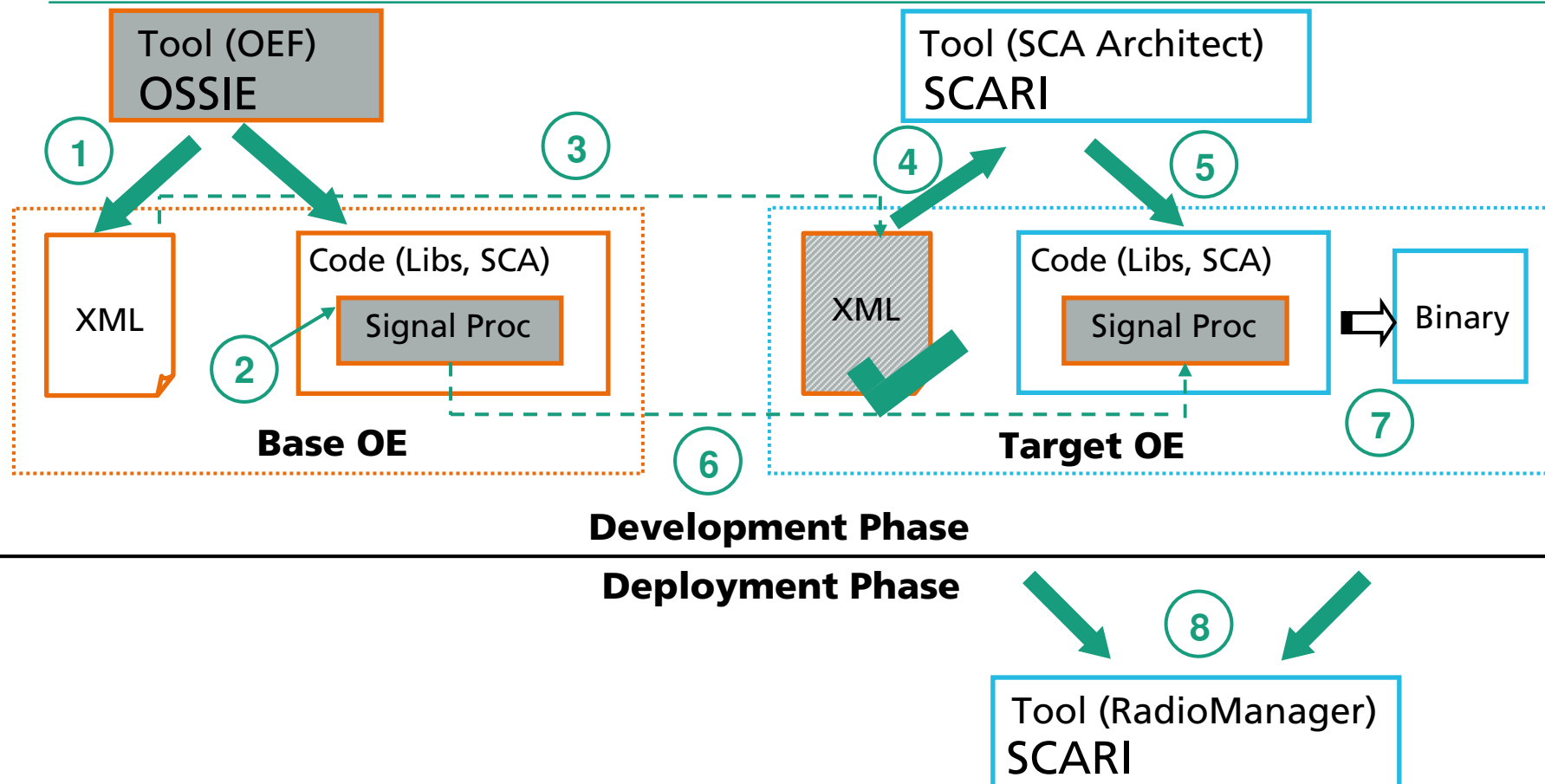
```
<connections>
  <connectinterface id="DCE:d9d5ad62-fc2d-11dd-b97a-000bcd0a50e1">
    (B) <usesport>
      <usesidentifier>DoubleOut</usesidentifier>
      <findby>
        <namingservice name="ST_Transmitter1"/>
      </findby>
    </usesport>
    (A) <providesport>
      <providesidentifier>DoubleIn</providesidentifier>
      <findby>
        <namingservice name="ST_Receiver1"/>
      </findby>
    </providesport>
  </connectinterface>
</connections>
```

■ Removing double colons

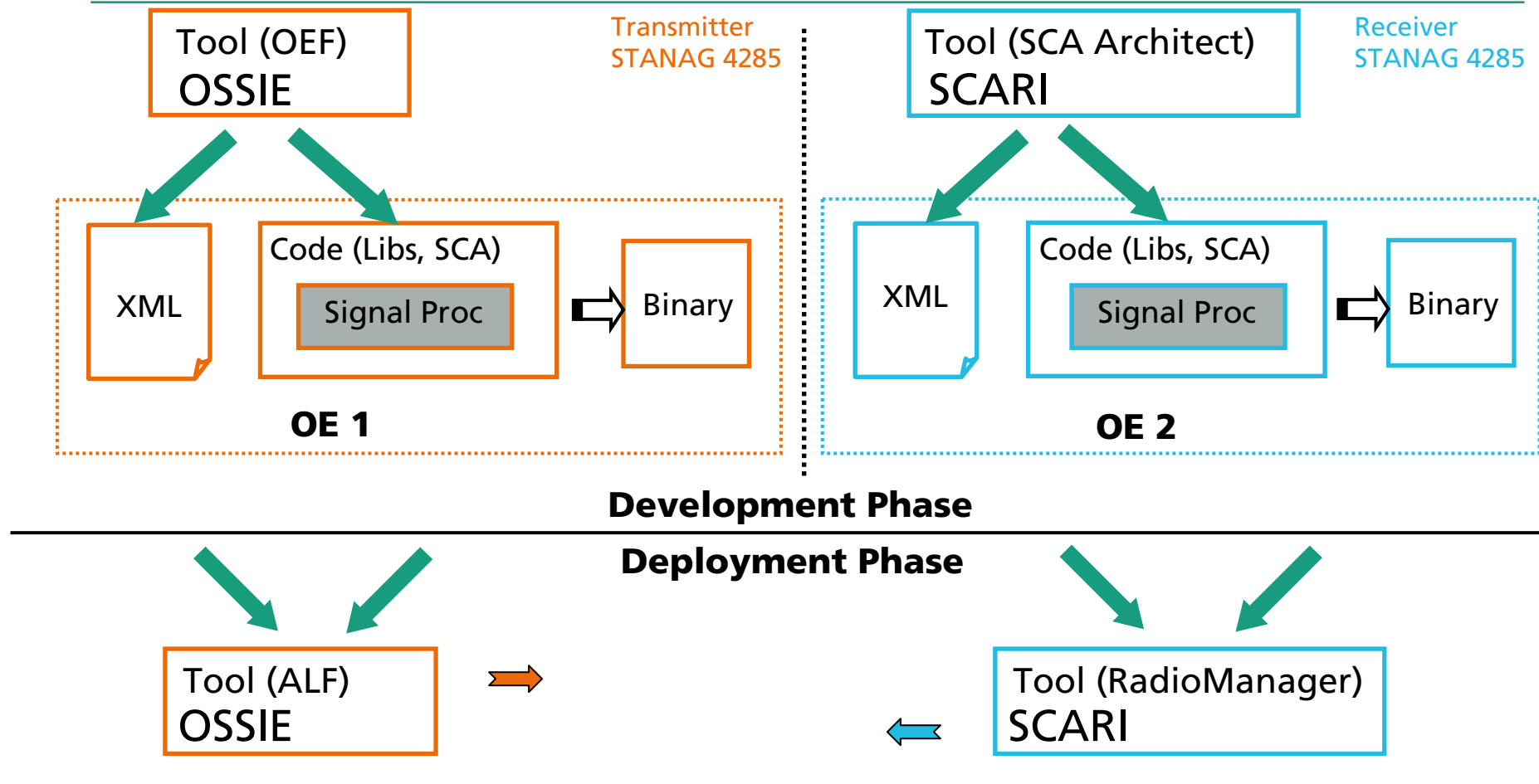
```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE softwareassembly SYSTEM "dtd/softwareas...
<!-- Created with OSSIE WaveDev-->
<!-- Powered by Python-->
<softwareassembly id="DCE:d9ce644e-fc2d-11dd-b9d3-000bcd0a50e1"
name="OSSIE::ST_Wave">
  <componentfiles>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE softwareassembly SYSTEM "dtd/softwareassembly.2.2.dtd">
<!-- Created with OSSIE WaveDev-->
<!-- Powered by Python-->
<softwareassembly id="DCE:d9ce644e-fc2d-11dd-b9d3-000bcd0a50e1"
name="OSSIE|ST_Wave">
  <componentfiles>
```

Portability Approach



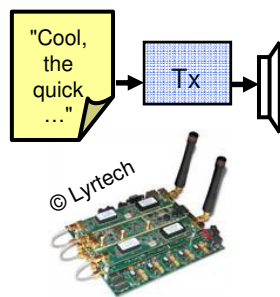
Interoperability Approach



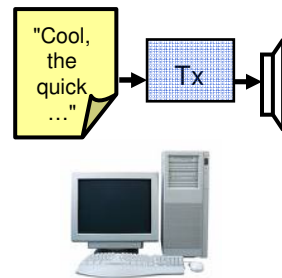
Interoperability Test Setups

TRANSMITTER

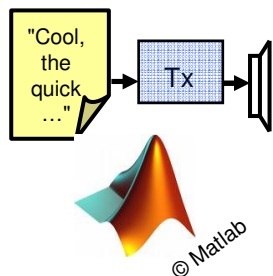
Non- SCA-based
C-Code (Lyrtech)



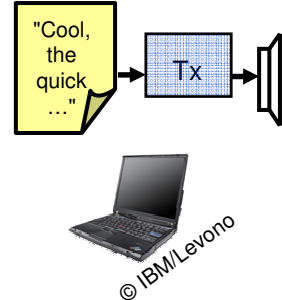
SCA-based
C-Code (SCARI)



Non- SCA-based
C-Code (Matlab)

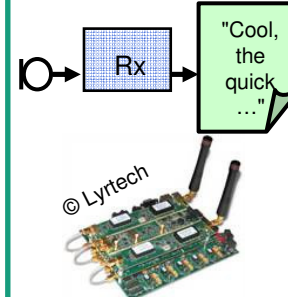


SCA-based
C-Code (OSSIE)

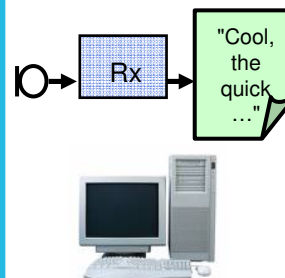


RECEIVER

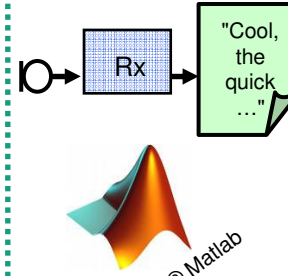
Non- SCA-based
C-Code (Lyrtech)



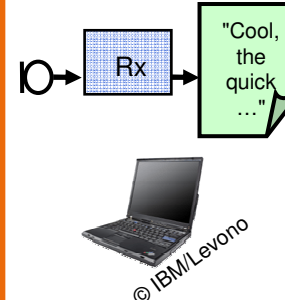
SCA-based
C-Code (SCARI)



Non- SCA-based
C-Code (Matlab)

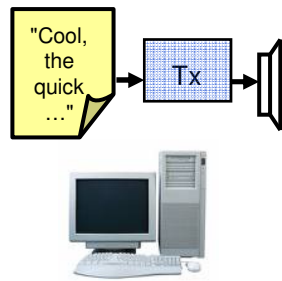


SCA-based
C-Code (OSSIE)

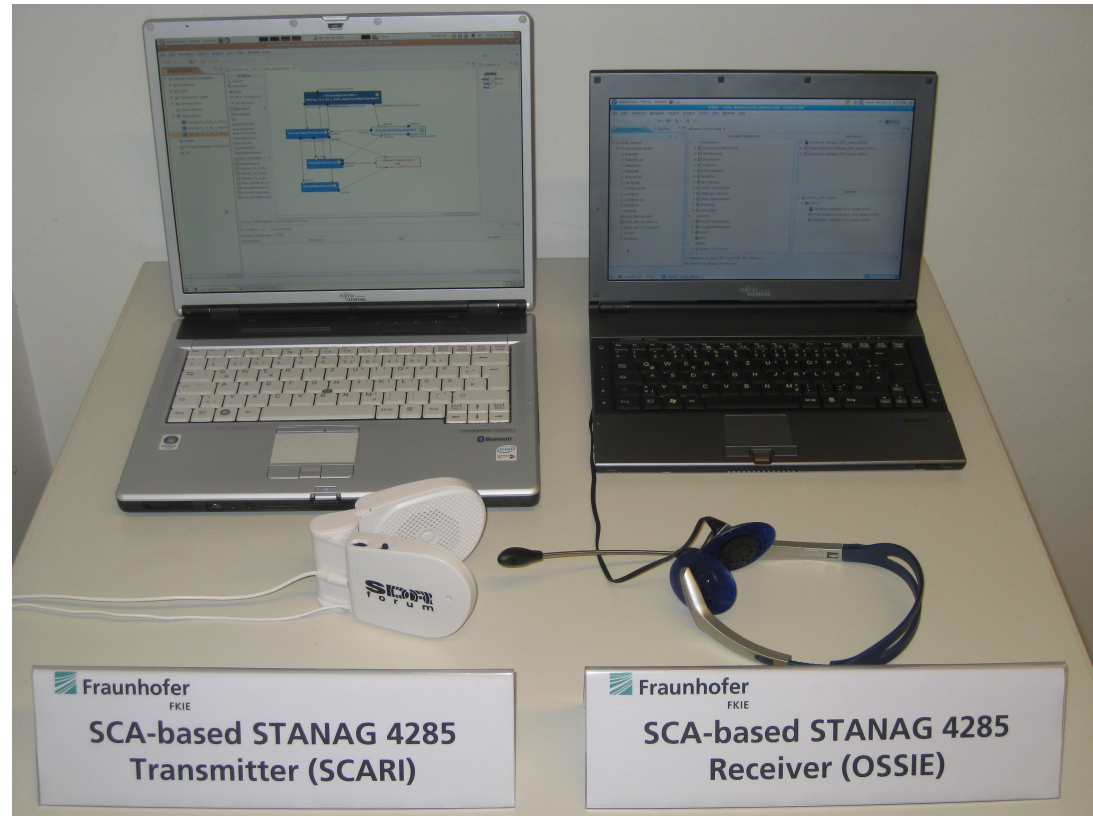
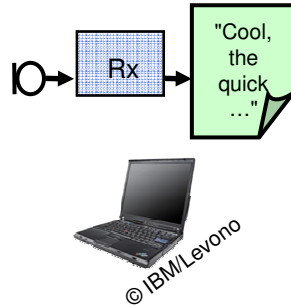


Demonstration

SCA-based C-Code (SCARI)



SCA-based C-Code (OSSIE)



Conclusions

- RTG Portability Interoperability
 - STANAG 4285 as example waveform

- Porting from one OE (OSSIE) to (SCARI)
 - Changes in XML domain profiles required
 - Code cannot be used directly

- Interoperability between both implementations
 - Live Demonstration in the IF signal (audio spectrum)