ESSOR

European Secure Software defined Radio

EC workshop on "SDR and CR standardization and certification"

JRC - ISPRA, 17-18 November 2011
Agenda

1. ESSOR Programme strategic aim
2. Participating States
3. Status of the ESSOR Programme
4. ESSOR Contract
5. ESSOR Perspectives on SDR
6. Status of Activities
7. The future
8. Conclusions
1. ESSOR Programme strategic aim
Strategic aim

- The aim of the ESSOR Programme is to provide the basis for development and production of Software Defined Radio (SDR) products in Europe to meet the requirement for fielding such equipment in Europe within the timeframe of 2011-2015 (depending on National SDR Programmes roadmaps).

Focus on SDR technology

European initiative to improve know how

Security considered as a key topic
Expected Main Outcomes

The ESSOR Programme will provide a common architecture, shared by the Participating States, that defines the framework for the development of radio platform software and associated security elements.

This architecture is key to interoperability, portability and will promote the development of SDR equipment in Europe.

Interoperability and Portability will be tested through the development of a waveform with advanced communication characteristics, the HDR WF.
2. Participating States
Participating States

ESSOR

- Finland
- France
- Italy
- Poland
- Spain
- Sweden

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Participating States expectations

- **To improve interoperability** between EU Members States, the USA and NATO, and public safety/homeland security communication systems by the means of:
  - Deployment of SDR concepts, architecture and technologies
  - Deployment of common Information Security Architecture
  - Definition and validation of new coalition waveforms (WF) to be used in future Network Enabling Capability (NEC) operations

- **To master SDR architectures and technologies in Europe** in order to:
  - Facilitate WF (Waveform) portability between different SDR products
  - Facilitate the future development of new generations of SDR products
  - Maintain a competitive offer in Europe

- **To leverage on current National/Multinational investments** and optimise future European developments in these domains.
3. Status of the ESSOR Programme
Integration phase

ESSOR is an **EDA Ad hoc Category B Programme** (Decision of the EDA Steering Board on 26 February 2007).

Decision to **integrate the ESSOR Programme into OCCAR** made by the OCCAR Board of Supervisors (OCCAR BoS) on **5 June 2007**.

**Technical Arrangement** (TA) to the European Research Grouping Arrangement No 1 to the EUROPA Memorandum of Understanding related to ESSOR signed on **18 December 2008**.

On **18 December 2008**, the representatives of the Participating States (ES, FI, FR, IT, PL, SE, SE) signed the ESSOR Programme Decision:
- OCCAR-EA became officially the Contracting Authority for the ESSOR Programme.

Contract **No. ESSOR.09.DEV.001** signed on **19 December 2008** between the OCCAR-EA Director and the a4ESSOR President after several rounds of negotiation between the Govt Negotiation Team (OCCAR-EA + PS) and the 6 selected Industry National Champions.

Contract activities started on **1 January 2009** (T0).
Relationships Scheme

ESSOR Programme

OCCAR

Information Exchanges

EDA

PD

TA

Contract

Shareholder agreement

a4ESSOR SAS

OCCAR Organisation for Joint Armament Co-operation

a4ESSOR SAS Alliance for ESSOR

17-18/11/2011

ISPRA – EC Workshop

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4. ESSOR Contract
ESSOR Industries

- **a4ESSOR SAS** Joint Venture is the **Prime Contractor**.

- Shareholder Agreement between the six following Main sub-contractors:
  - **Elektrobit** (Finland);
  - **Thales Communications & Security** (France);
  - **Selex Elsag** (Italy);
  - **Radmor** (Poland);
  - **Indra** (Spain); and
  - **Saab** (Sweden).
Contract overview (1/4)

- The contract will use **national radio Platforms (PTF)** as the basis for the application of the ESSOR Architecture onto which the HDR Base WF will be ported. The results will be **6 national target HDR WF** developed from a common HDR Base WF running on 6 different national radio PTF **with a common ESSOR architecture**. The radios will be **interoperable** when using the HDR WF.

- **Common products** (ESSOR Architecture and HDR Base WF) are developed and funded as a common activity.
  - Based on a collaborative model amongst 6 companies working as a joint team

- **Non-common products** (the modified PTF and Target HDR WF) are developed for, and funded by, every single PS.
Contract overview (2/4)

- Elaboration and validation of a joint **secure architecture for SDR**, based on the SCA:
  - Referential system & secure architecture shared at European level.

- Elaboration and validation of a **coalition secure networking waveform**:
  - First multinational HDR waveform designed for secure interoperability in terrestrial operations.

- Option for specification of certification tools.
Common activities
- ESSOR architecture
- HDR WF specification
- HDR Base WF development
- Multinational validation

Non Common Activities
- ESSOR architecture implementation on national PTF
- HDR Target WF implementation on national PTF
5. ESSOR Perspectives on SDR
ESSOR Perspectives on SDR

- ESSOR Program addresses the following topics
  - Definition and development of a new High Data Rate WF (HDRWF) for Ad-Hoc mobile network for Land Applications in order to achieve Interoperability between the coalition forces.
  - Definition of an SDR Architecture in order to facilitate WF Portability amongst the six different National SDR Platforms.
Goals on SDR Architecture

- ESSOR Participating States (PS) and Industries have recognized since a long time the outstanding benefit of the SCA as a de facto Procurement Specification / Standard for SDR in Military Business.

- The goal of the ESSOR Program is to extend the public part of the SCA in order to achieve WF Portability amongst the ESSOR Participating States, maximising the compatibility with the open parts of the SCA.

- Under ESSOR Participating States control, the goal of the ESSOR Program is also to make public these SCA extensions in order to achieve further SDR Standardisation.
In order to achieve WF Portability, SDR Architecture shall address Std APIs definition between WFs and SDR Platform (composed of HW Radio Platform + INFOSEC + Abstraction Layer)

- Extending Operating Environment (OE), RD, RS APIs and defining RSS APIs are the main ESSOR Program efforts
ESSOR Architecture Extensions

ESSOR Architecture extends the following specifications:
- JTRS SCA 2.2.2 and API Release 1.0.3
- WINNF Transceiver APIs

<table>
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<th>ESSOR Architecture Functional Elements</th>
<th>Existing Published Specifications Referenced</th>
<th>ESSOR Architecture Efforts</th>
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<tr>
<td>OE (Execution Environment)</td>
<td>SCA 2.2.2 GPP (CF, OS)</td>
<td>Extensions for DSP &amp; FPGA OE</td>
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<tr>
<td>Connectivity</td>
<td>SCA 2.2.2 CORBA on GPP</td>
<td>Extensions for: CORBA on DSP/FPGA MHAL DSP /FPGA</td>
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<td>Radio Devices (RD)</td>
<td>Published JTRS RD APIs</td>
<td>RD Extensions</td>
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<td>WINNF Transceiver APIs</td>
<td>Transceiver Extensions</td>
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<td>Radio Services (RS)</td>
<td>Published JTRS RS APIs</td>
<td>RS Extensions</td>
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<tr>
<td>Radio Security Services (RSS)</td>
<td>SCA Security Supplement for Information Only (*)</td>
<td>Defining High Level ESSOR Security Architecture and RSS API</td>
</tr>
</tbody>
</table>

(*) SCA Security Supplement not more supported by SCA 2.2.2 release
OE for DSP & FPGA

- ESSOR Architecture defines system components related to Operating Environments (OE) for different types of processing units, typically used for data signal processing (DSP, FPGA), and provides a specification for such environments, taking into account currently available technologies.

- Operating Environments are namely composed of:
  - Execution Environment:
    - Deployment of Waveform Components on Processing Elements (PE)
    - AEP (Application Environment Profile) for DSP
  - Connectivity:
    - Logical Interconnection of deployed components, wherever located (for mutual interaction purposes)
    - Access to RD / RS by co-located WF components
OE for DSP & FPGA

- ESSOR Architecture considers two approaches for Connectivity on DSP and FPGA: CORBA and MHAL
  - Both are issued from SCA achievements
  - The choice of Connectivity is a SDR Platform provider decision

- Specific profiles are being defined for usage of CORBA in DSP and FPGA environments

- The JTRS MHAL specification is being extended to support additional capabilities (OS tasks synchronization, etc...)

- ESSOR Architecture identifies relationships between DSP, FPGA OEs and GPP OE

**ESSOR Architecture is scalable, fitting with different classes of processing and connectivity environments**
## ESSOR Radio Devices API

<table>
<thead>
<tr>
<th>ESSOR RD API (*)</th>
<th>Reference JTRS API</th>
<th>Considered WINNF API</th>
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<td>Audio</td>
<td>AudioPortDevice API</td>
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<tr>
<td></td>
<td>VocoderService API</td>
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<tr>
<td>Discrete</td>
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<td>-</td>
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<tr>
<td>Serial</td>
<td>SerialPortDevice API</td>
<td>-</td>
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<tr>
<td>Ethernet</td>
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<td>GpsDevice API</td>
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</tr>
<tr>
<td>Transceiver</td>
<td>MHAL RF Chain Coordinator API Extension to MHAL API</td>
<td>WINNF Transceiver Facility Spec (including WINNF inputs)</td>
</tr>
<tr>
<td>Power amplifier</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(*) Elaborating ESSOR RD API takes into account also ESSOR Industries & ESSOR PS Background Information

For RD APIs, ESSOR mainly extends JTRS and WINNF RD APIs
ESSOR Radio Service API

<table>
<thead>
<tr>
<th>ESSOR RS API (*)</th>
<th>Reference JTRS API</th>
<th>Considered WINNF API</th>
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<tr>
<td>Configuration</td>
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<td>SNMP</td>
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<td>Fault Management</td>
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<td>HMI Service</td>
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<td>Retransmission</td>
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<tr>
<td>IP Routing</td>
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<tr>
<td>Vocoder Service</td>
<td>JTRS VocoderService API</td>
<td>-</td>
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<tr>
<td>Time Management</td>
<td>JTRS TimingService API</td>
<td>-</td>
</tr>
</tbody>
</table>

(*) Elaborating ESSOR RS API takes into account also ESSOR Industries & ESSOR PS Background Information

For RS APIs, ESSOR mainly uses as foundations the ESSOR Industries & PS Background Information
ESSOR Architecture Description

More details about ESSOR Architecture can be found into the following publication:

- “ESSOR Architecture – Motivation and Overview”

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a4ESSOR contributions to the SCA Next Initiative

- At the SCA Next roll out (August 2010) Industries were invited to provide contributions in a number of areas through the WINNF SCA-Next WG for JTRS consideration.

- The contributions were to be made via the WINNF “ad hoc” SCA-Next WG, a technical group mandated to channelize to JTRS proposals and optimization of the current draft specification.

- a4ESSOR, duly authorized by ESSOR Nations, released some ESSOR information to the WINNF SCA-Next WG in the scope of the proposed areas, aiming, as much as possible, to align/harmonize the contents of both specifications in such areas.

- Based on those inputs, two contributions to JTRS SCA Next have been prepared by SCA Next WG and voted within WINNF Membership (www.wirelessinnovation.org):
  - AEP profile – WINNF-11-R-0005
  - UltraLw corba profile - WINNF-11-R-0007

- These contributions aim to complement the SCA Next, focusing on very lightweight environments, maximizing the compatibility between the two specifications.

  *Both have been considered by JTRS for integration into final SCA Next Specs*
ESSOR Programme

ESSOR Architecture Implementation

- As planned into the ESSOR Programme, the ESSOR Architecture is currently implemented into the 6 different National Platforms

- These distinct implementations allow the porting of the ESSOR HDRWF plus additional WFs according to each Nation request

- These distinct implementations allow to obtain feedback on the ESSOR Architecture definition

- Acceptance Reviews of these implementations have already started between Industry and ESSOR-PD
Publication of ESSOR Architecture

ESSOR-PD / Participating States and ESSOR Industries have agreed to publish progressively in 2012 the Unclassified parts of the ESSOR Architecture.

The publication plan will address successively the following points (detailed content and schedule of the progressive publication is under discussion):

- Conditions for release, including identification of the legal clauses and selection of the appropriate Web-Site
- Radio Devices (RD)
- Radio Services (RS)
- Operating Environment (OE)
The HDRWF network is a high data-rate multi-hop mobile ad hoc network, self-organizing and self-healing.

Network nodes act as source Transmitter, destination Receiver or Relay node.

Network nodes can be connected to IP external networks through inter-networking functions.
ESSOR HDR Base WF

- **ESSOR HDR Base WF main goals**
  - Common HDR WF software code amongst the 6 National Champions
  - Initially ported and validated in a common Native Test Environment to de-risk national porting phase
  - Developed using the ESSOR Architecture APIs
  - Supported by ESSOR Base WF Methodology for Portability

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**Diagram:**
- **WF Layered Specification**
- **WF System Engineering**
- **Base WF System Specification**
- **Base WF Software Engineering & Coding**
- **Base WF Software**
- **Base WF Native Testing**
- **Native Testing**
- **Target Porting**
- **Target WF 1 (source code & executable)**
- **Target WF 2 (source code & executable)**
- **Target WF n (source code & executable)**
- **WF porting on Target PF**

*NTE: Native Test Environment*
The HDRWF system functionalities are partitioned between:
- HDRWF Layer Application – Scope of the Base WF
- The WF Functional Support – Scope of the PTF implementing the selected features of the ESSOR Architecture (with API identification according to RD, RS, RSS)
6. Status of Activities
ESSOR Architecture


Acceptance Review of the draft standard for the ESSOR Architecture held in July/Sept 2010 based on:
- ESSOR Architecture definition document;
- Operating Environment description;
- ESSOR Security Architecture definition document;
- Radio Devices APIs;
- Radio Services APIs;
- Radio Security APIs.

Implementation of the ESSOR Architecture on the National Platforms performed in 2011.
- Acceptance Reviews already started for some National implementations.
7. The Future
The Future

Potential follow on activities:

- SDR Standardization and Certification
- ESSOR Products technical enhancement
  - ESSOR Architecture
  - ESSOR HDRWF
- Support to Operational Deployment
8. Conclusions
Conclusions (1/2)

- The ESSOR Programme is extending the public SCA specification in order to achieve WF Portability amongst the ESSOR Participating States, maximising the compatibility with the SCA 2.2.2.
  - ESSOR Program puts efforts on DSP & FPGA OE (Scalability), RD, RS and Security Architecture (RSS).

- The ESSOR Programme is developing an advanced HDRWF for mobile ad-hoc networking in UHF band
  - ESSOR HDRWF modular Architecture enables Incremental Development
  - ESSOR HDR Base WF will be ported on 6 National Platforms implementing a common ESSOR Architecture standard

- The ESSOR Programme is a successfully running example of joint development between different Nations and Industries in a high cooperative manner.
Conclusions (2/2)

- ESSOR Programme was launched by 6 Participating States in December 2008, Contract activities started 1st January 2009

- High expectations from the Participating States to obtain:
  - A HDR WF Specification Standard
  - An ESSOR Architecture

- The products are aimed at becoming operational

- Release of any information is under OCCAR-EA / ESSOR Participating States control.

- Publication of the Unclassified parts of the ESSOR Architecture is planned to be done progressively in 2012
OCCAR-EA ESSOR PD

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