The ESSOR Programme:

Status and way to Standardisation

European **S**ecure **SO**ftware defined **R**adio

SDR'11 WinnComm

Washington DC, 29 November – 2 December 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. Way to Standardisation
8. The future
9. 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

European Secure SOftware-defined Radio

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

www.occar-ea.org/programme/ESSOR

questions-essor@occar.int

Participating States expectations

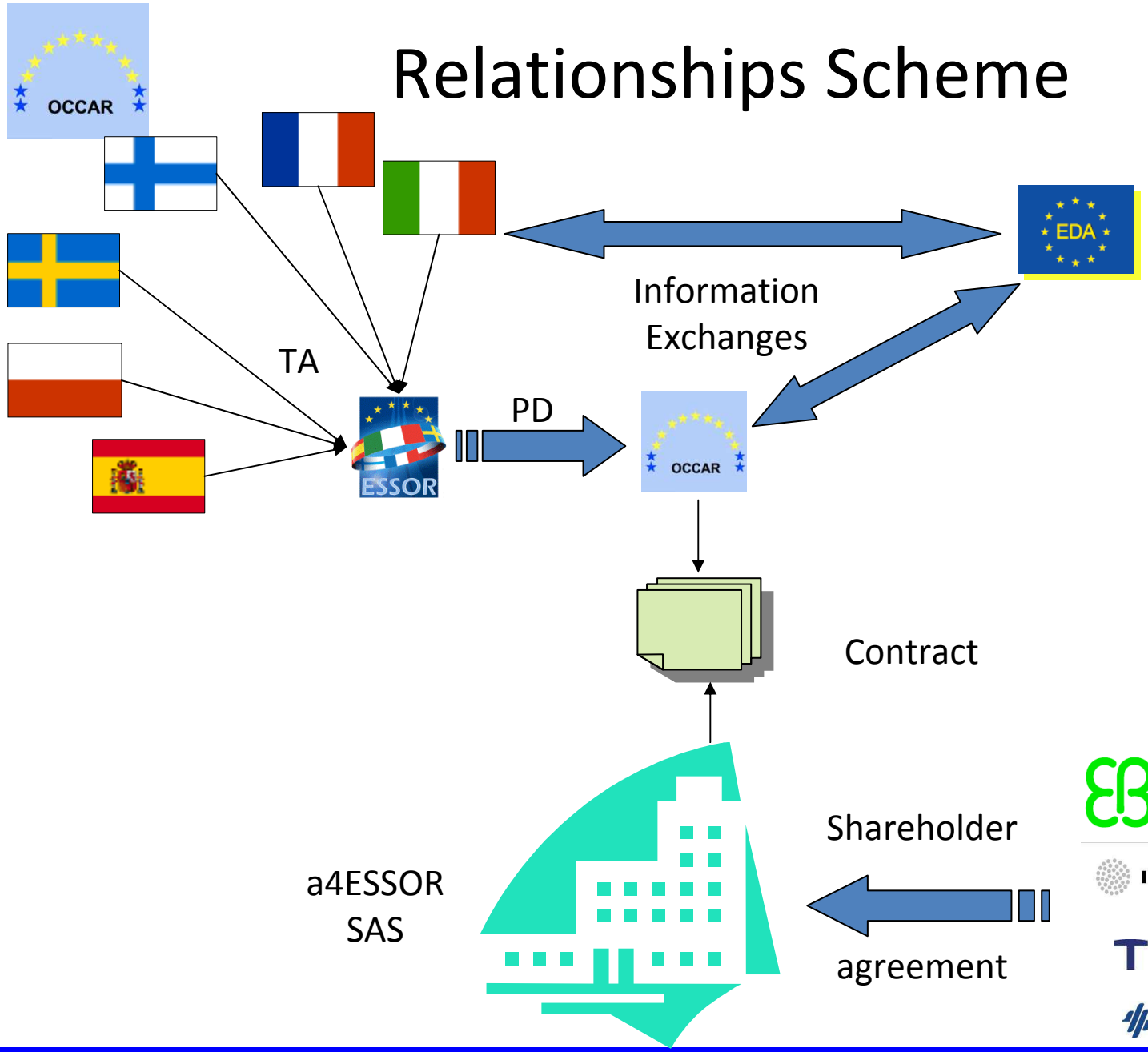
- **To improve interoperability** between EU Members States, the USA and NATO, and public safety/homeland security communication systems by the means of:
  - Deployment of SDR concepts, architecture and technologies
  - Deployment of common Information Security Architecture
  - Definition and validation 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



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, the **ESSOR Architecture**:
  - Referential system & secure architecture shared at European level.
- Elaboration and validation of a **coalition secure networking waveform,** the **HDR WF:**
  - First multinational HDR waveform designed for secure interoperability in terrestrial operations.

Contract overview (3/4)

- **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

ESSOR Programme

Contract overview (4/4)

2010

ESSOR Architecture definition

High Fidelity Simulations

HDR WF Specification

2010

WF Specification Elaboration

Design Methodology

2011

HDR Base WF

Base WF Development

ESSOR ARCHITECTURE (APIs & OPERATING ENVIRONMENT)

Native Test Environment

Base WF Porting

ESSOR AL(*) ... ESSOR AL(*) ... ESSOR AL(*)

6 NC different SDR Platforms updated to ESSOR Architecture

2012

HDR Target WF

HDR Target WF

HDR Target WF

2011

ESSOR AL(*) ... ESSOR AL(*) ... ESSOR AL(*)

HDRWF ported on 6 NC SDR Platforms updated to ESSOR Architecture

2013

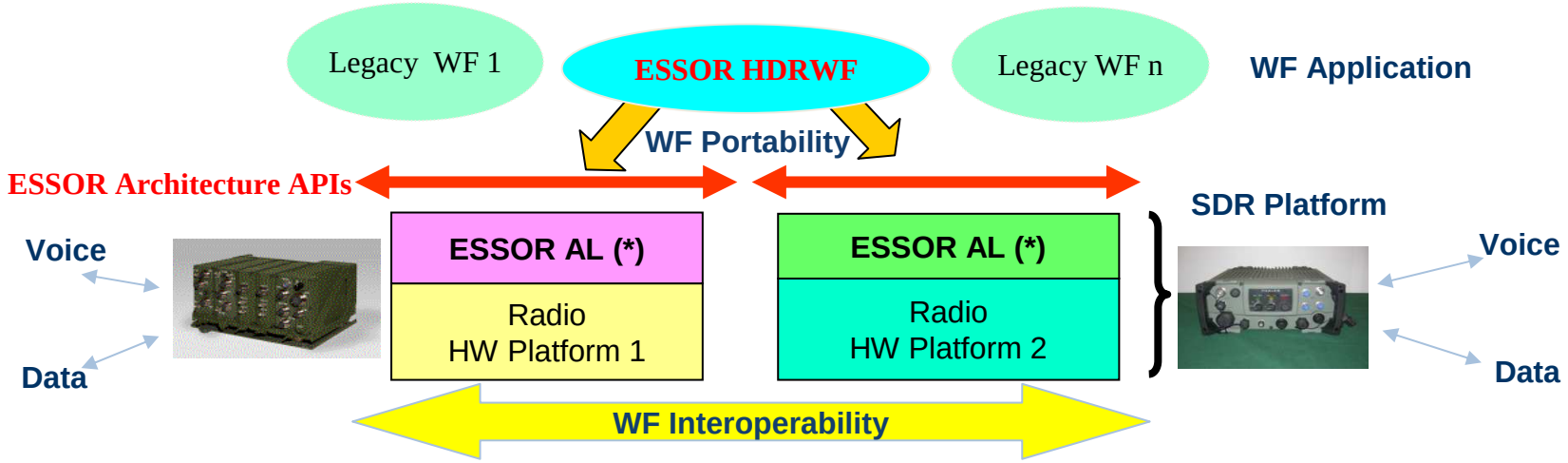
Multinational Validation

(*) AL: Abstraction Layer and APIs

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 the ESSOR Architecture in order to facilitate WF Portability amongst the six different National SDR Platforms.



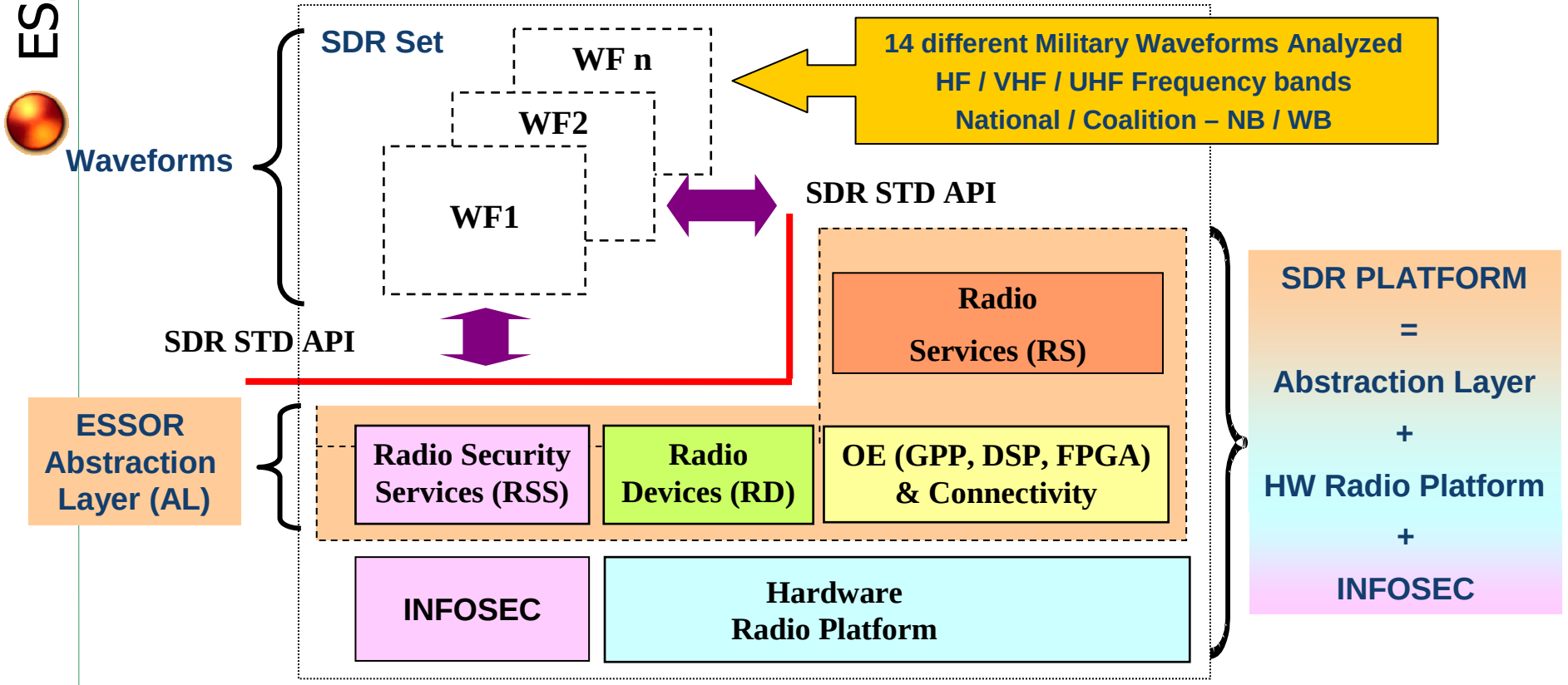
(*) AL: Abstraction Layer and APIs

Goals of ESSOR Architecture

- ESSOR Participating States (PS) and Industries have recognized for 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 Architecture is to extend the public part of the SCA in order to facilitate 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 future SDR Architecture Standardisation.

ESSOR Architecture – Main Parts

- ESSOR Architecture defines APIs between WFs and SDR Platform (composed of HW Radio Platform + INFOSEC + Abstraction Layer), addressing Operating Environment (OE), RD, RS and RSS elements.
  - These elements are the core of an SDR Standardization approach



ESSOR Architecture Extensions

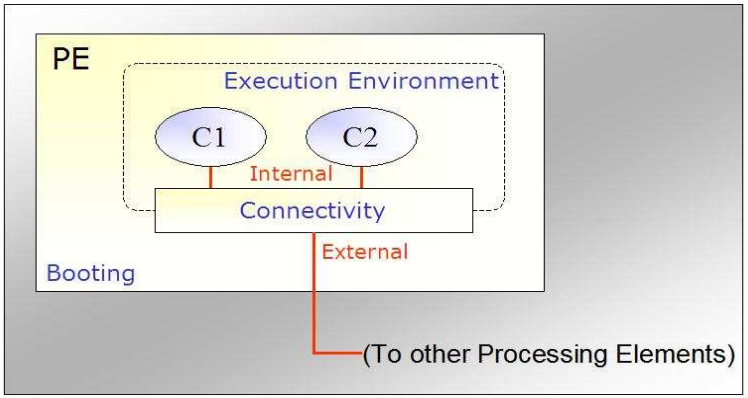
- ESSOR Architecture extends the following specifications
  - JTRS SCA 2.2.2 and API Release 1.0.3
  - WINNF Transceiver APIs

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

(*) 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

ESSOR RD API (*)	Reference JTRS API	Considered WINNF API
Audio	AudioPortDevice API VocoderService API	-
Discrete	-	-
Serial	SerialPortDevice API	-
Ethernet	EthernetDevice API	-
GNSS	GpsDevice API	-
Transceiver	MHAL RF Chain Coordinator API Extension to MHAL API	WINNF Transceiver Facility Spec (including WINNF inputs)
Power amplifier		

(*) 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

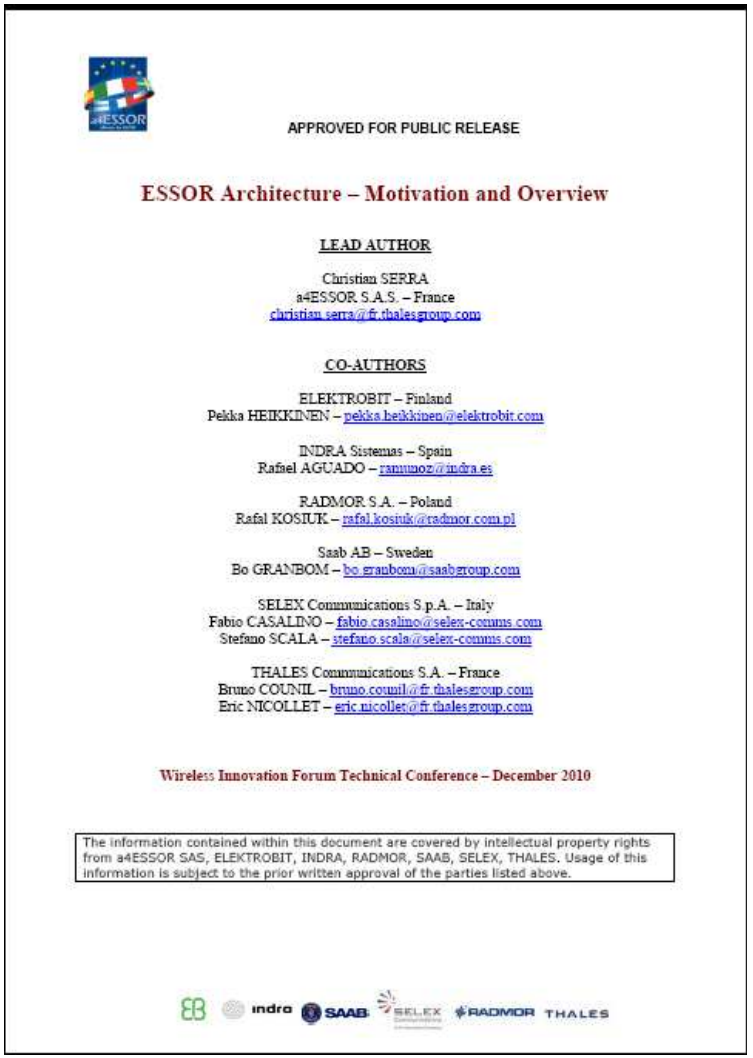
ESSOR RS API (*)	Reference JTRS API	Considered SDRF API
Configuration	-	-
SNMP	-	-
Fault Management	-	-
HMI Service	-	-
Retransmission	-	-
IP Routing	-	-
Vocoder Service	JTRS VocoderService API	-
Time Management	JTRS TimingService API	-

(*) 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" Wireless Innovation Forum Technical Conference – December 2010**
- Available from Winnf website:
  - http://groups.winnforum.org/d/do/3824



APPROVED FOR PUBLIC RELEASE

ESSOR Architecture – Motivation and Overview

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Wireless Innovation Forum Technical Conference – December 2010

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Contributions to SCA Next Initiative

- During the SCA Next roll out in August 2010, Industries were invited to provide contributions in a number of areas for JTRS consideration
- Contributions 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 SCA Next, focusing on very lightweight environments, maximizing the compatibility between the two specifications.

Both have been provided to JTRS for integration into final SCA Next Specs

ESSOR Architecture Implementation

- The ESSOR Architecture is currently being 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.
- Lessons learned from these implementations will provide feedback on the ESSOR Architecture definition.
- Acceptance Reviews of these implementations have already started between Industry and the Contracting Authority (OCCAR-EA).

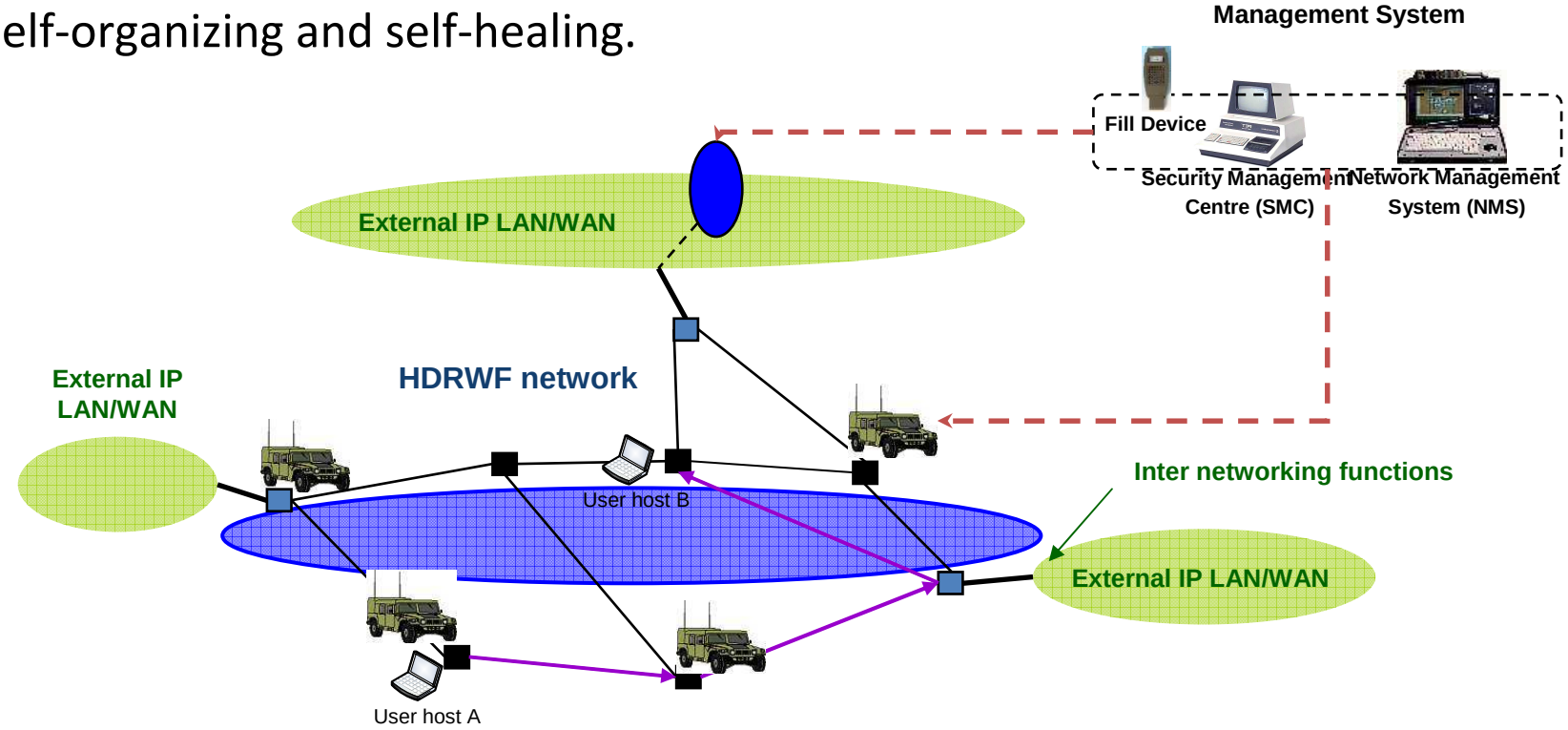
Publication of ESSOR Architecture

- 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)

HDRWF System Overview

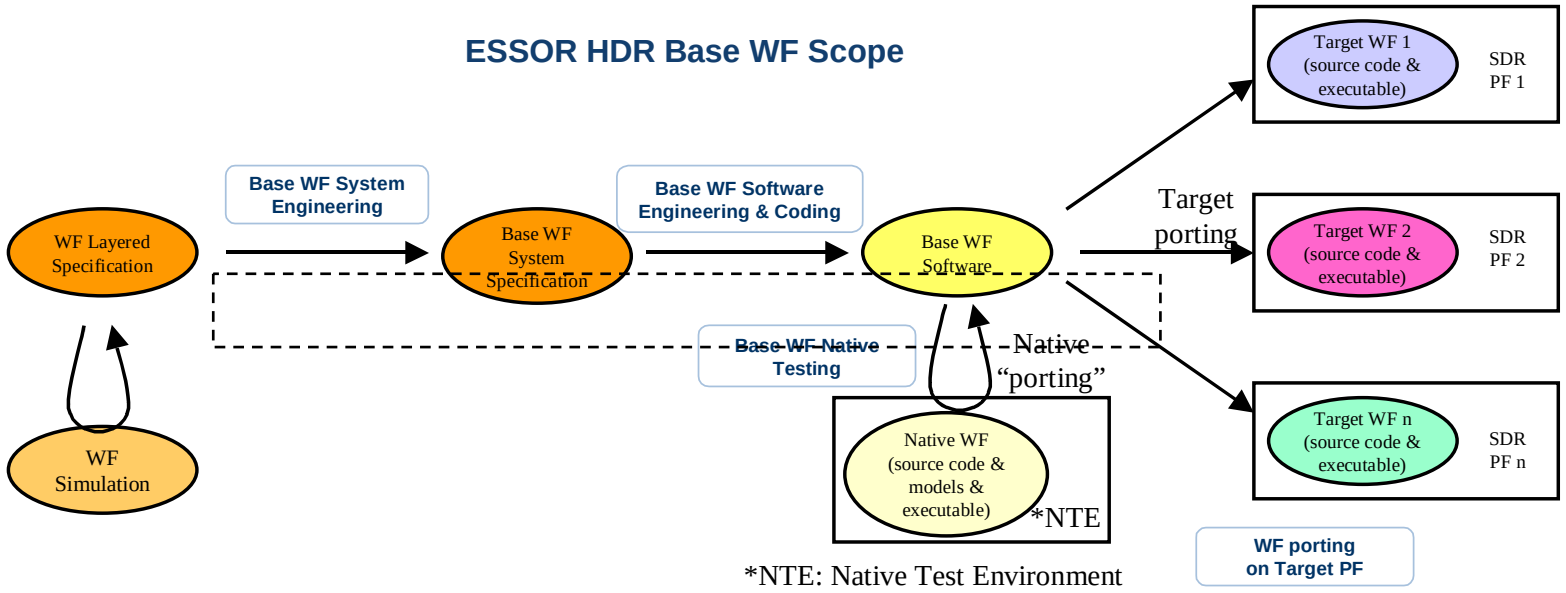
- The HDRWF network is a high data-rate multi-hop mobile ad hoc network, self-organizing and self-healing.



- Network nodes act as source Transmitter, destination Receiver or Relay node.
- Network nodes can be connected to IP external networks through inter-networking functions.

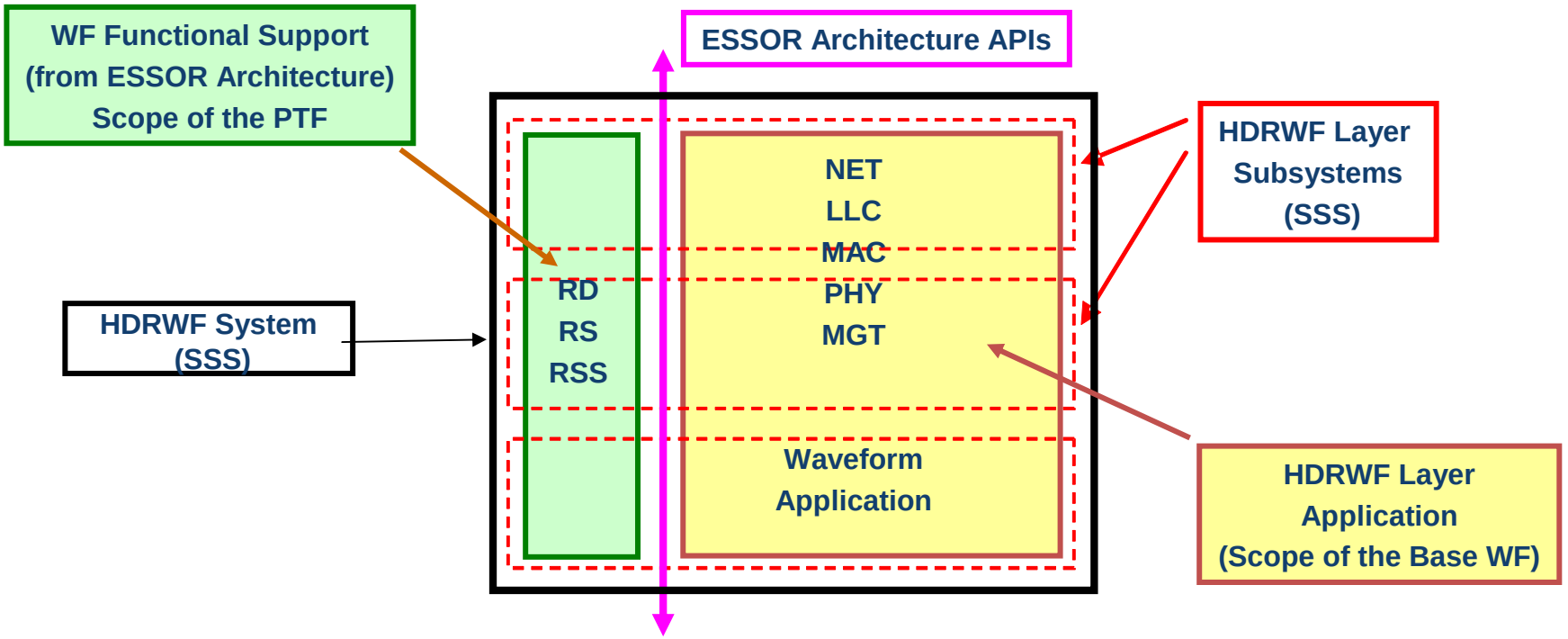
ESSOR HDR Base WF

- 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



ESSOR HDR Base WF / PTF Partitioning

- 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

- **ESSOR Architecture Preliminary Design Review (PDR) held in July/Sept 2010**.

- **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 completed for some National implementations

7. Way to Standardisation

Standardisation Strategy

- A Standardisation Strategy for the ESSOR Architecture and its Implementation Plan have been elaborated by the ESSOR Participating States and OCCAR-EA.
- This strategy is composed of 4 tracks executed in parallel in a timeframe still under discussion.
  - Track 1: Understand the international expectations for Secure Software Defined Radio (SSDR) Architecture Standard (AS)
  - Track 2: Consolidate internally within the ESSOR community the ESSOR Architecture aiming at becoming a de facto ESSOR standard (ESSOR PS only) and respond to international expectations w.r.t. publication
  - Track 3: Create a European Community for SSDR based on ESSOR
  - Track 4: Create and promote an international standard defined by European Nations and US

Standardisation Strategy

- **Track 1: Understand the international expectations for SSDR Architecture standard (AS)**
  - Start discussing with US at Government level: a specific exchange agreement (MIEA) is in place between the 6 ESSOR Nations and the US. This allows direct discussions between ESSOR PS and US JTRS JPEO. First meeting was held in June 2011.
  - Establish an ESSOR Nations position on Standardisation: Ongoing
  - Assess the ESSOR Architecture implementation activities: Ongoing (Acceptance Reviews performed on some platforms).
  - Establish with US a Programme of Work which could include:
    - Present to US JTRS JPEO the proposed ESSOR position on standardisation
    - Exchange lessons learned with the JTRS JPEO through MIEA
    - Define key elements of common SSDR Standardisation Strategy
    - Produce a roadmap for standardisation between MIEA Nations
  - Assess the ESSOR HDR WF porting activities

Standardisation Strategy

- **<u>Track 2</u>: Consolidate internally within the ESSOR community the ESSOR Architecture aiming at becoming a de facto ESSOR standard (ESSOR PS only) and respond to international expectations w.r.t. publication**
  - Finalise the Standardisation Strategy for ESSOR Architecture: Ongoing
  - Consolidate the standardisation plan internally within ESSOR Nations: Ongoing
  - Elaborate the required document set for standardisation of the ESSOR Architecture
    - Initial Draft Document Set: Ongoing - release of ESSOR Architecture information planned in 2012 (see previous slides on ESSOR Architecture)
    - Final Draft Document Set: To be produced after the porting of the WF and under conditions to be established

Standardisation Strategy

- **Track 3: Create a European Community for SSDR based on ESSOR**
  - Exchange of vision and strategy with potential future partners: Ongoing through EDA
  - Stimulate common European interest in sharing the same technologies: Under discussion with European Commission/EDA as a result of their initiative about standardisation of military/public safety Architecture (see specific slides)
  - Define a common position within Europe on Standardisation

Track 3: EC/EDA initiative

- Public Safety has similar issues of interoperability, reconfigurability and compatibility with legacy systems.
- Joint operations between Public Safety and Military organizations are common for large natural disasters (e.g. earthquake and flooding).
- SDR technologies have been investigated by European governments, industry, institutions and the European Commission in various projects in the Commercial, Public Safety and Military domains.
- ETSI has started in 2008 a Technical Committee for Reconfigurable Radio Systems including SDR technology and Cognitive Radio (CR) technology.

Workshop on

“Software Defined Radio and Cognitive Radio standardization”

DG JRC facilities, Ispra, Italy
November 17 & 18, 2011

The purpose of this workshop is to identify the main steps needed to drive the development and use of SDR and CR technologies in Europe, including the elements of a future standardization mandate as well as related regulatory and certification issues.
The final outcome of the workshop will be a roadmap to that purpose.

Jointly organized by DG ENTR, EDA and DG JRC
with the support of ETSI

Track 3: EC/EDA initiative

- The European Commission has a plan to prepare a standardisation mandate involving ETSI
- The mandate should include 2 phases
  - Phase 1 - preparation:
    - Convergence between ESSOR and SVFuA
    - Possible convergence between EU and US
    - Road-map for international standardization
  - Phase 2 – implementation of the standardization
- Potential Stakeholders (including the ESSOR Participating States) have to confirm their interest.

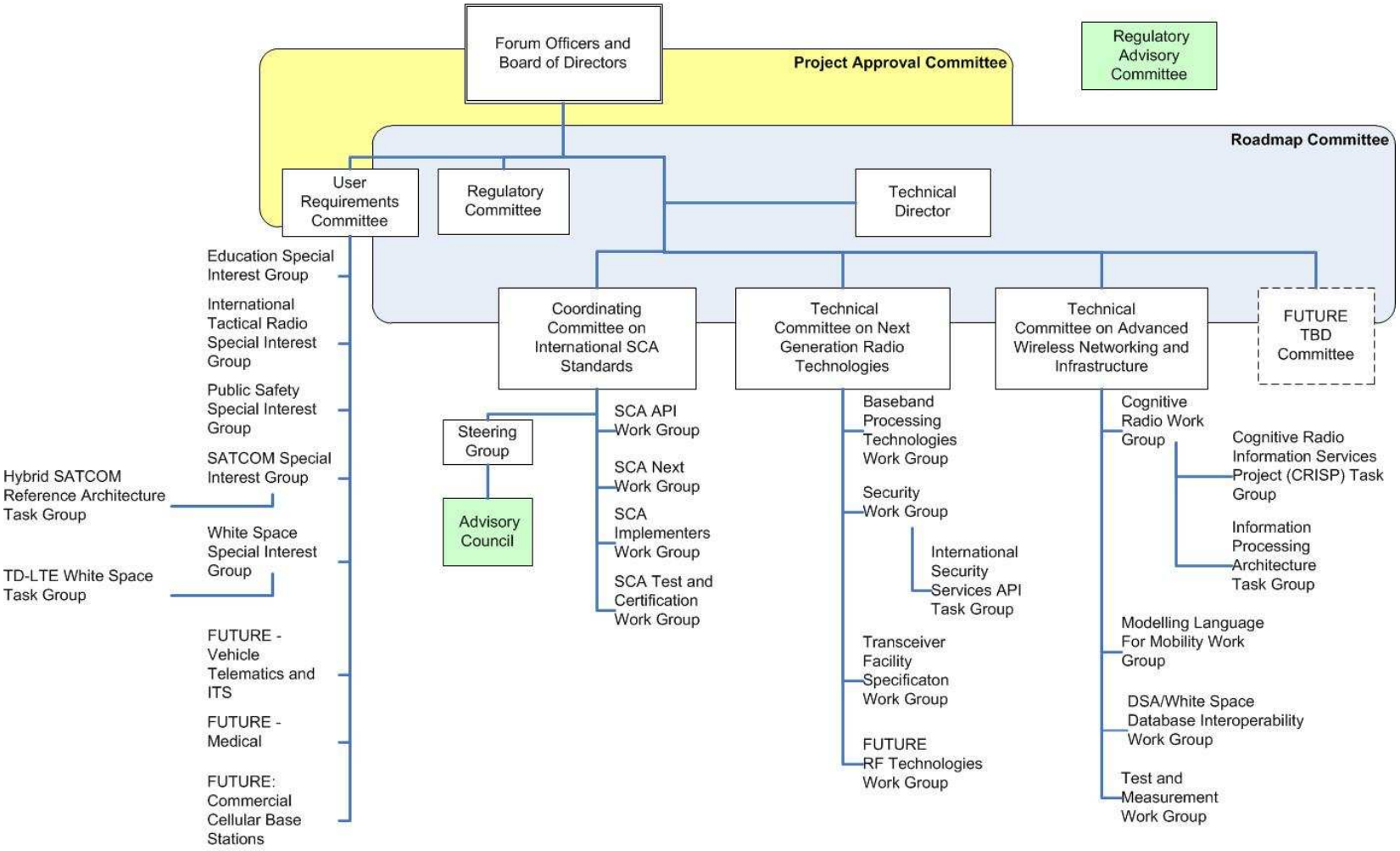
Standardisation Strategy

- **Track 4: Create and promote an international standard defined by European Nations and US**
  - Define a robust configuration management strategy for an International Standard: making use of the WINNF initiative - WInnF Coordination Model for International SCA Standards (see specific slides)
  - Plan for a progressive/incremental elaboration and release of the Architecture Standard
  - Elaborate the detailed specifications to be released
  - Release of the first increment of SSDR Architecture Standard

Track 4: Winnf Initiative

- The following slides have been extracted from a presentation made by Eric NICOLLET, THALES, Co-chair of WInnF Coordinating Committee on International SCA Standards during the IQPC SDR Europe conference held in Amsterdam at the end of October 2011:
  - "The WInnF Coordination Model for International SCA Standards"

Organizational Structure of the WInnF



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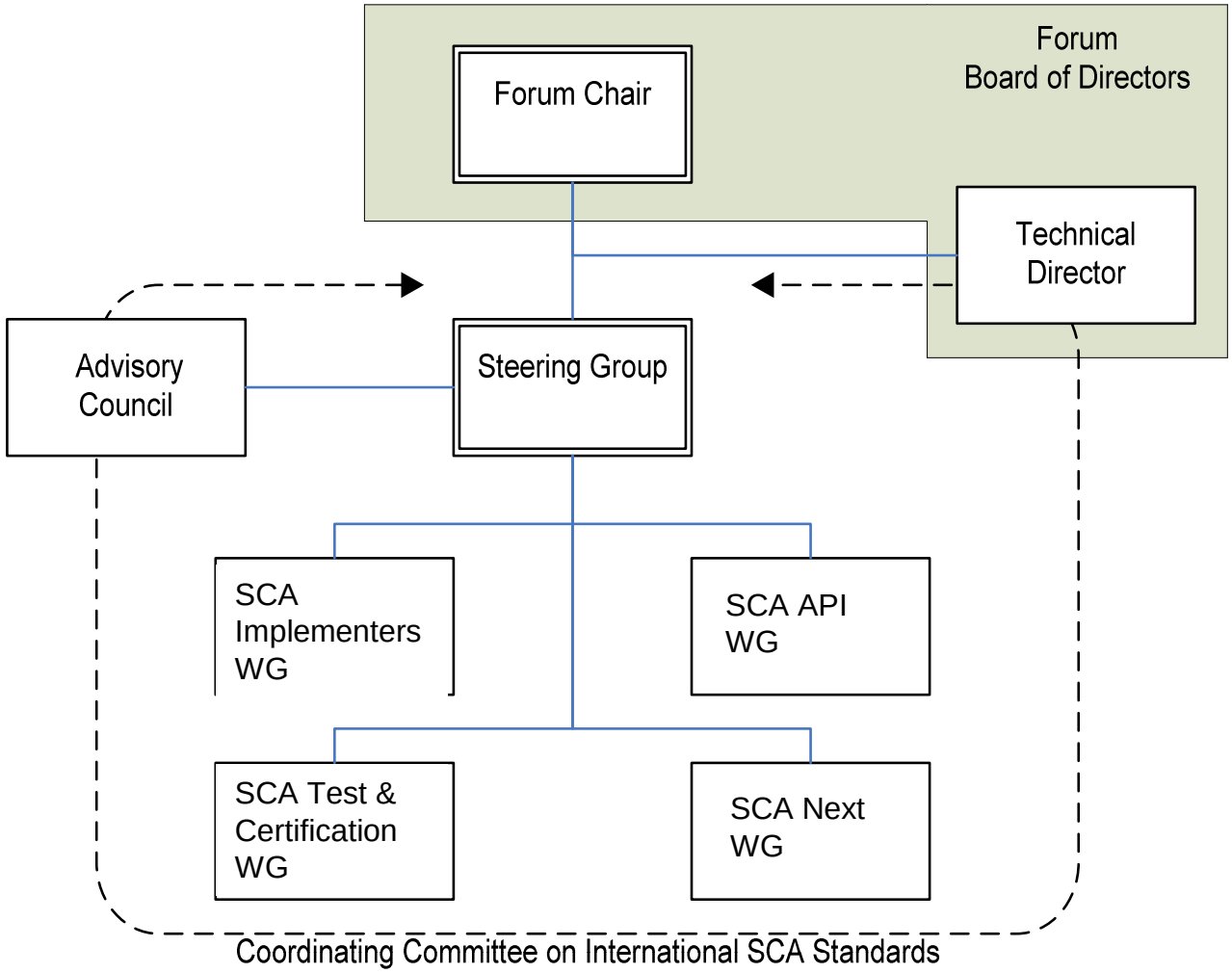
Committee Organization and Purpose



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Steering Group Composition

SG Voting Members

- a4ESSOR
- GDC4S
- Harris
- Indra
- ITT
- Raytheon
- Rohde & Schwarz
- SELEX Elsag
- THALES

Ex-officio members

- Claude Bélisle, WInnF Technical Director
- Steve Bernier, chair of SCA Interpretation WG

WInnF Staff participants

- Lee Pucker, WInnF CEO

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- Rick Barfoot, NATO
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- Sylvain Sermesant, NATO
- Don Stephens, JTRS JPEO
- Carlo Zammariello, EDA

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The Coordination Model

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Document Overview

§1 Introduction incl. Problem Statement

§2 International SCA Standards

- Clarification on what is meant by “International SCA Standards”
- Status of International SCA Standards (e.g. SCA & JTRS APIs, ESSOR Architecture…)

§3 Coordination of International SCA Standards

- WInnF to serve as a Coordinating Body
- Organization through WInnF CC SCA Steering Group and Advisory Council
- Description of typical Coordination activities

§4 Production of International SCA Standards

- Description of typical Production activities
- Current and potential role of WInnF and Partner SDO (ETSI and OMG)

§5 Support to International SCA Standards

- Working Groups and Supporting Actions

Annexes

- Articulation with WInnF Strategy relative to Standards
- Summary of WInnF document process

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Motivation

SDR Standards are multiplying

- For Defense market
  - SCA 2.2.2 / SCA Next
  - ESSOR Architecture
- For other purposes
  - Satcom GRA (Government Reference Architecture)
  - NASA STRS

Risk of global and local inefficiency

Moving towards a harmonized suite of international SCA standards

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The on-going project

Name: "Preparatory Work for Elaboration of Coordinated International SCA Standards Roadmaps"

Providing necessary clarifications wrt

- Standards ownership models
- Topics subject to future Standardisation efforts
- Business model and/or procurement activities implications
- Process for Roadmaps elaboration and distribution

Will set the basis to engage effective elaboration and maintenance of Roadmaps

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Track 4: Winnf initiative

- The ESSOR PS and OCCAR-EA decided to participate to the Advisory Council to understand what could be achieved with regard to the coordination of international SCA Standards between key stakeholders.
- For the time being the ESSOR PS are witnessing actively this initiative and are looking forward to getting real achievements from the on-going project before deciding how this could be pursued further.

8. The Future

The Future

Potential follow on activities:

- **SDR Standardization and Certification**
- **ESSOR Products technical enhancement**
  - ESSOR Architecture
  - ESSOR HDRWF
- **Support to Operational Deployment**

9. 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.
  - 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
- Standardisation Strategy for the ESSOR Architecture has been defined by the ESSOR Participating States

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