ESSOR : proven SCA-based SDR Architecture & Waveform methodology

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Presenter: Eric NICOLLET, Thales

WInnComm US 2018
14-15 Nov 2018, Melbourne FL

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Agenda

- What is ESSOR?
- ESSOR Architecture
- ESSOR Waveform Methodology
- Conclusions
- NB: see presentation "*Update on recent ESSOR activities*" in session TS8 by CDR Topi Tuukkanen (Finland MoD) for up-to-date information related to ESSOR activities

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1 What is ESSOR?

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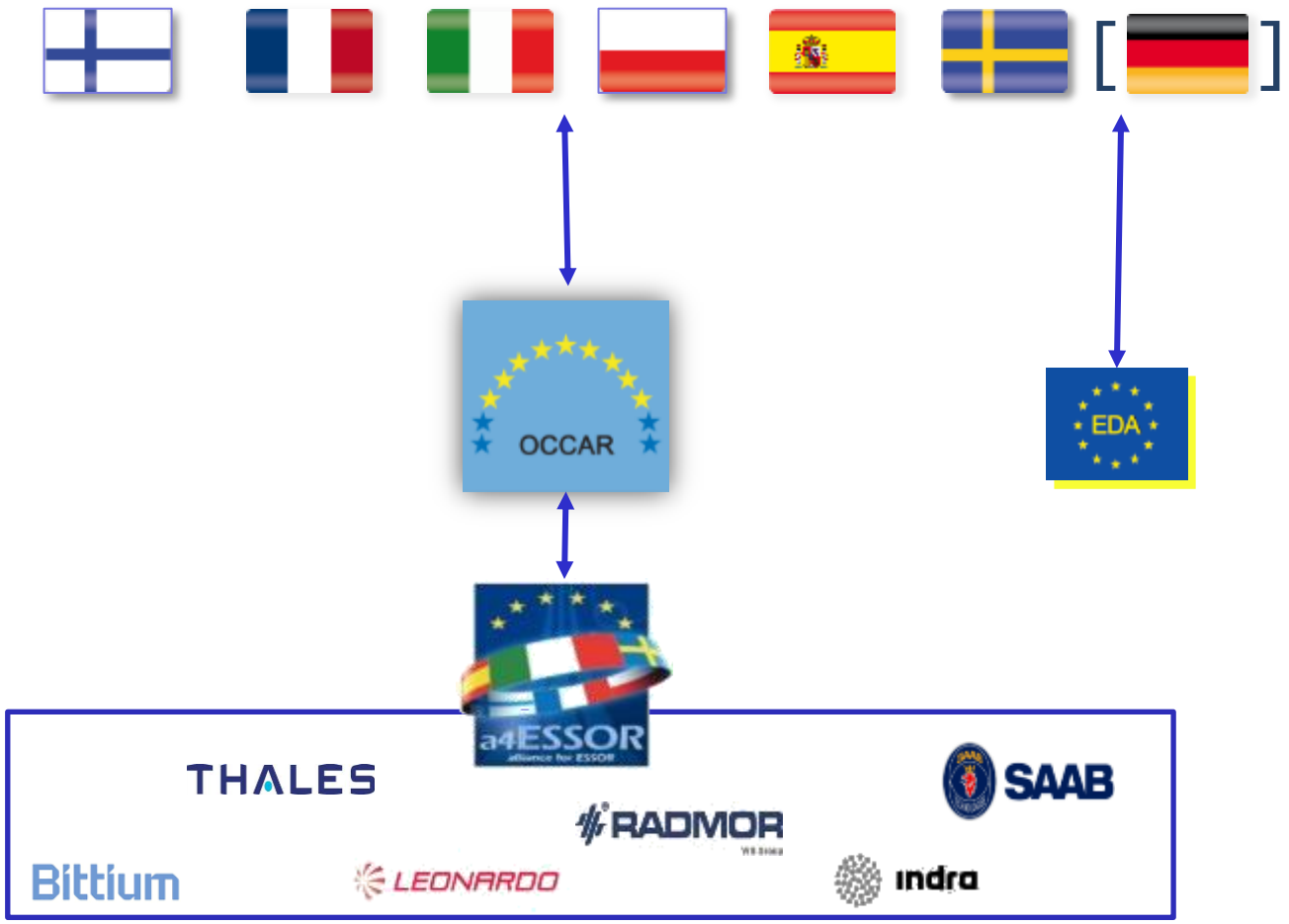
ESSOR is a multinational programme



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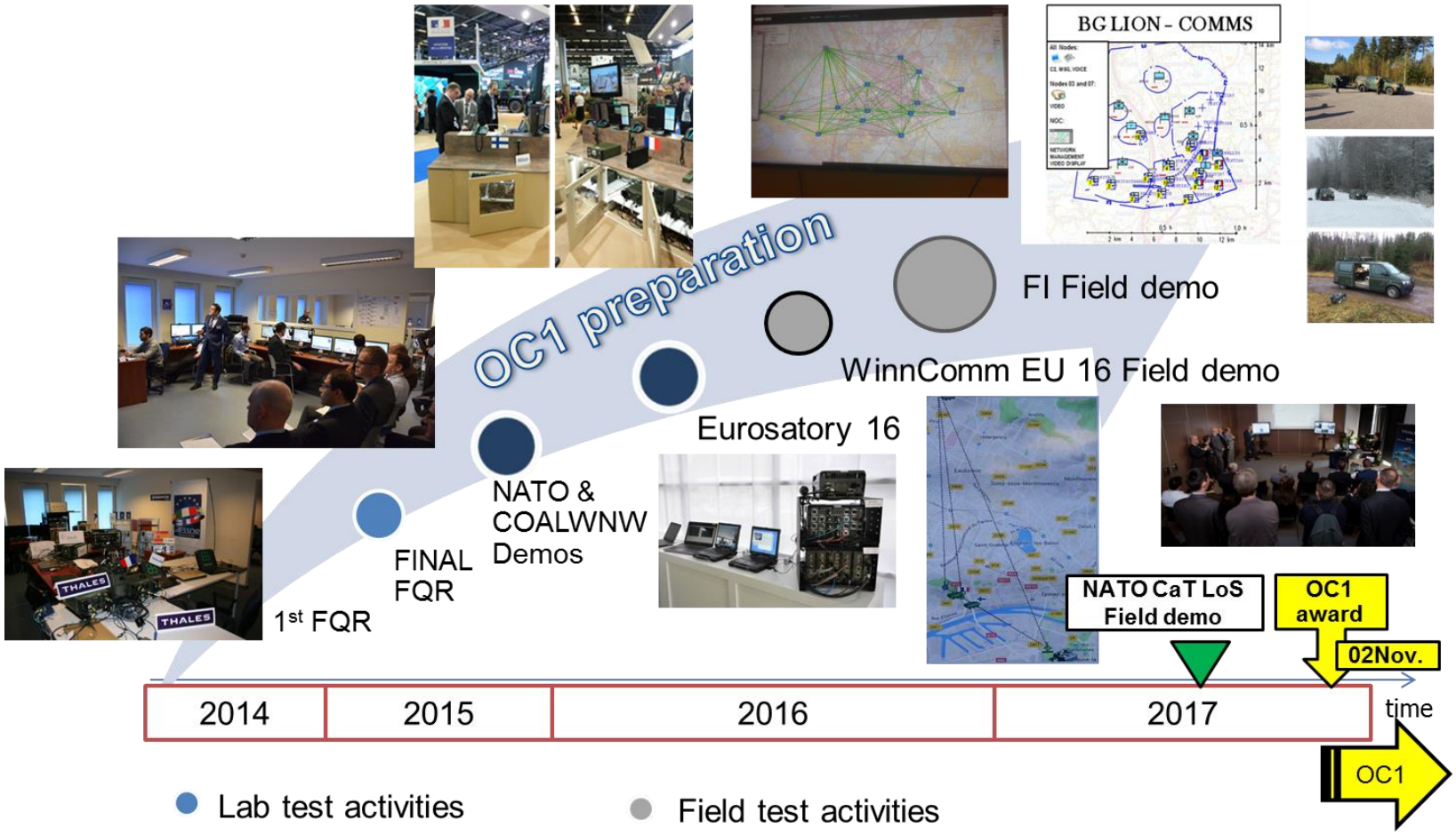
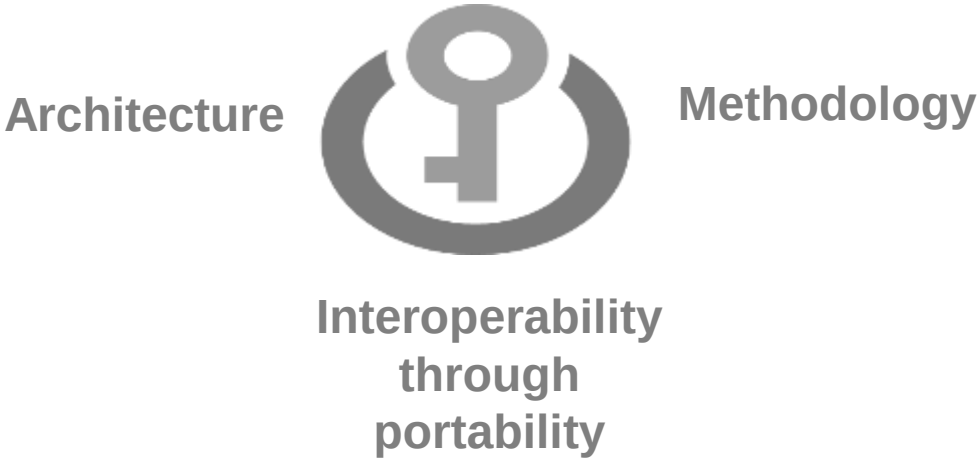
ESSOR Phase 1 is a won challenge

When Interoperable SDR seemed to be just theory, ESSOR made it happen



Main Outcomes of ESSOR Phase 1

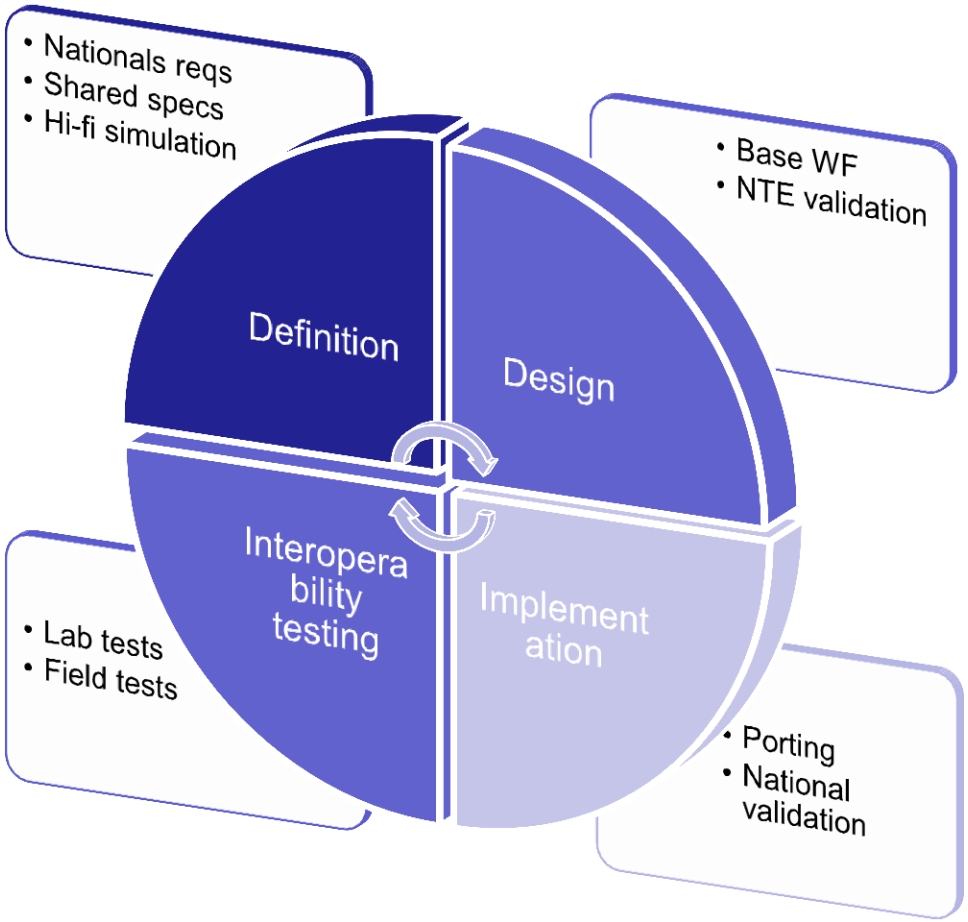
- ESSOR Architecture: a common SCA-based SDR architecture shared by the Participating States
- ESSOR WF Methodology: a common approach for interoperability thanks to waveform portability
- ESSOR HDRWF: a wideband waveform with advanced communication characteristics



ESSOR HDRWF in a nutshell

ESSOR HDRWF
A secure interoperable wideband waveform

- UHF band
- Up to 1 Mbps data rate
- Frequency Hopping
- 1.25 MHz bandwidth
- IP data
- Network synchronization with or without GNSS



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2. ESSOR Architecture

Details available in ESSOR article at Dec 2010 WInnF Technical Conference

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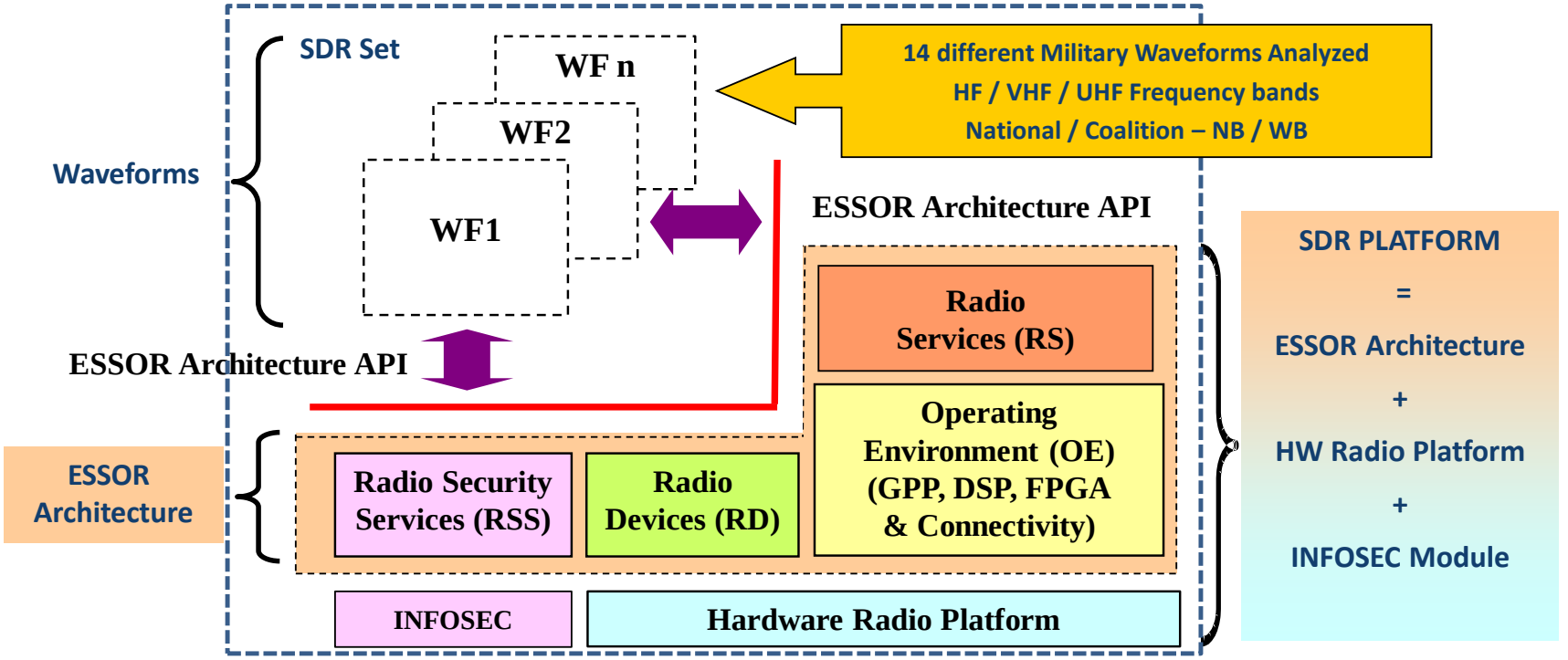
ESSOR Architecture Overview

- ESSOR Architecture extends the published part of JTRS Standards (SCA 2.2.2 and API 1.0.3) and the WInnF Transceiver Facility V1
- For WF Portability, maximising compatibility with JTRS Standards and complementing with lightweight DSP & FPGA OE, RD, RS and RSS



SDR Standards Evolution (1/2)

- ESSOR Community contributed to SCA 4.1
  - Application Environment Profiles (AEPs)
  - Interface Definition Language (IDL) (U)Lw profiles

- ESSOR Community appreciates the SCA 4.1 development through WInnF
  - Backwards compatibility with SCA 2.2.2, enabling re-use of WF developments
  - Integration of significant contributions from ESSOR
  - Normative reference to WInnF “PIM IDL Profiles” standard

SDR Standards Evolution (2/2)

- ESSOR Community appreciates WInnF Transceiver Facility V2
  - ESSOR Transceiver APIs released to WINNF CC SCA

- ESSOR Community is considering evaluating the impact of WInnF Specifications and SCA 4.1 for future enhancements of the ESSOR Architecture
  - With the goal to maintain the compatibility with the SCA

Publication of ESSOR Architecture

- The ESSOR OC1 programme will enable to make the Unclassified parts of the ESSOR Architecture “Releasable to the Public”, focusing on:
  - Radio Devices (RD)
  - Radio Services (RS)
- The publication preparatory activities are on-going
- Planning to have data package ready for publication in the hands of the Participating States in first half of 2019

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Relationship OCCAR-WInnF

- OCCAR-WInnF agreement (“MoU”) for the exchange of information in order to support the harmonization of the Software Communication Architecture (SCA) standards at international level is in place since beginning of 2016
- ESSOR Transceiver API was released to WInnF “Transceiver Next” project
- ESSOR supports current WInnF “Harmonized Time Service” project, for international harmonization on essential complements to Transceiver Facility
  - ESSOR Timing Service API can be released to WInnF “Harmonized Time Service” project depending on work agenda and agreement on the licensing terms

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3. ESSOR Methodology for WF Portability

Details available in ESSOR presentation at Mar 2014 WInnComm summit

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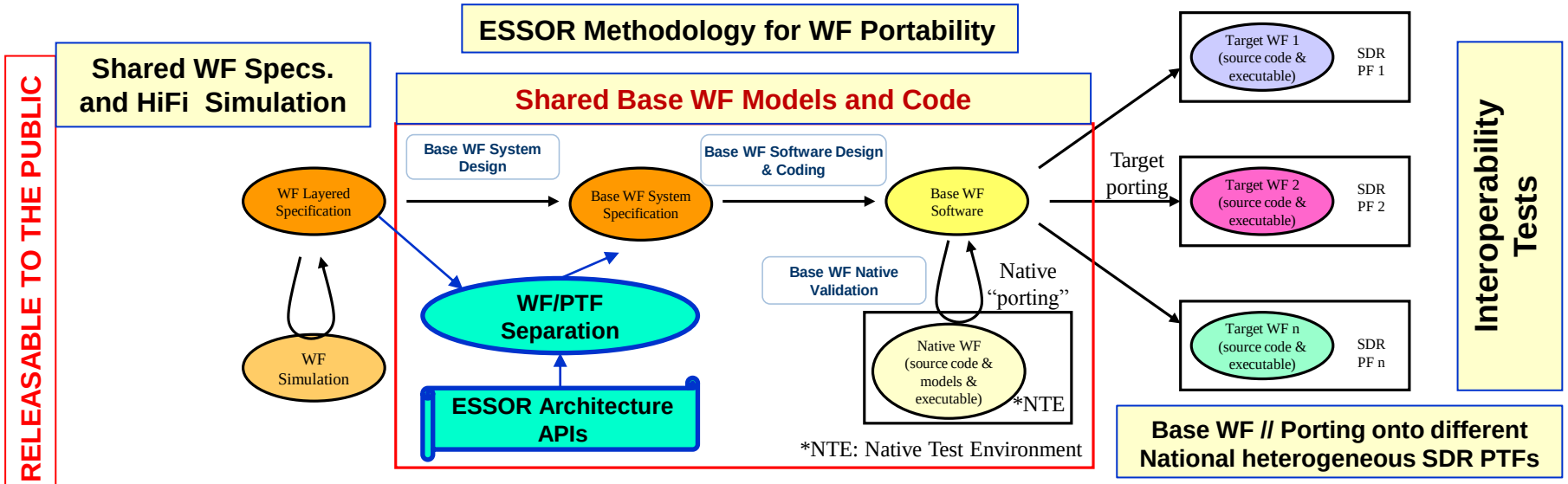
ESSOR Methodology for WF Portability

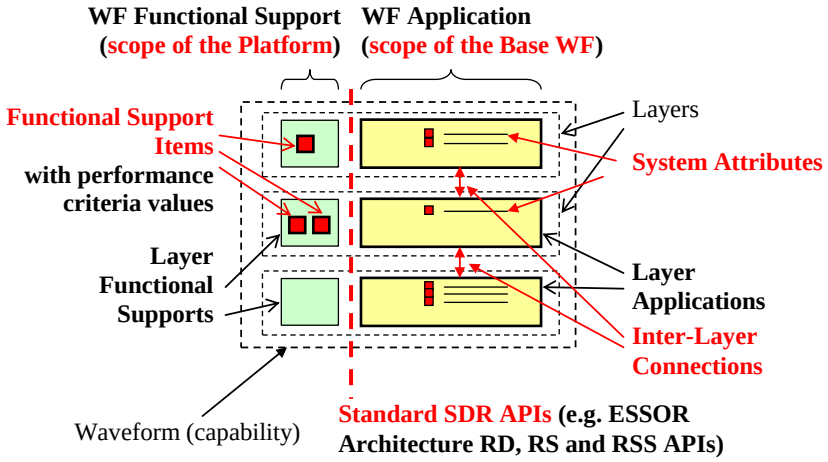
- WF Specifications and High Fidelity Simulations
- **Base WF Models and "Golden Source"**
  - WF / PTF Separation sets the Base WF & "Golden Source" scope
  - Differentiate Portable Base WF from Optimized Ported Target WF
  - Base WF enables WF Portability across different OE choices, as possible connectivity choices increases (e.g. CORBA, MHAL, …)
  - Base WF Modularity for addressing the diversity of Target PTF
- Base WF Porting on national target SDR PTF
- Interoperability validation among PTFs

Base WF dev in 4 Steps
- Base WF System Design
- Base WF Software Design
- Base WF Software Coding
- Base WF Native Validation

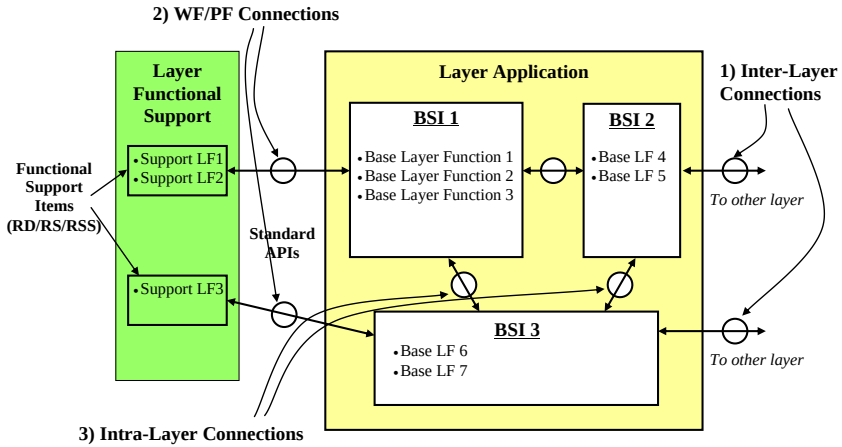


Step 1 – Base WF System Design

1.1 WF/PF Separation



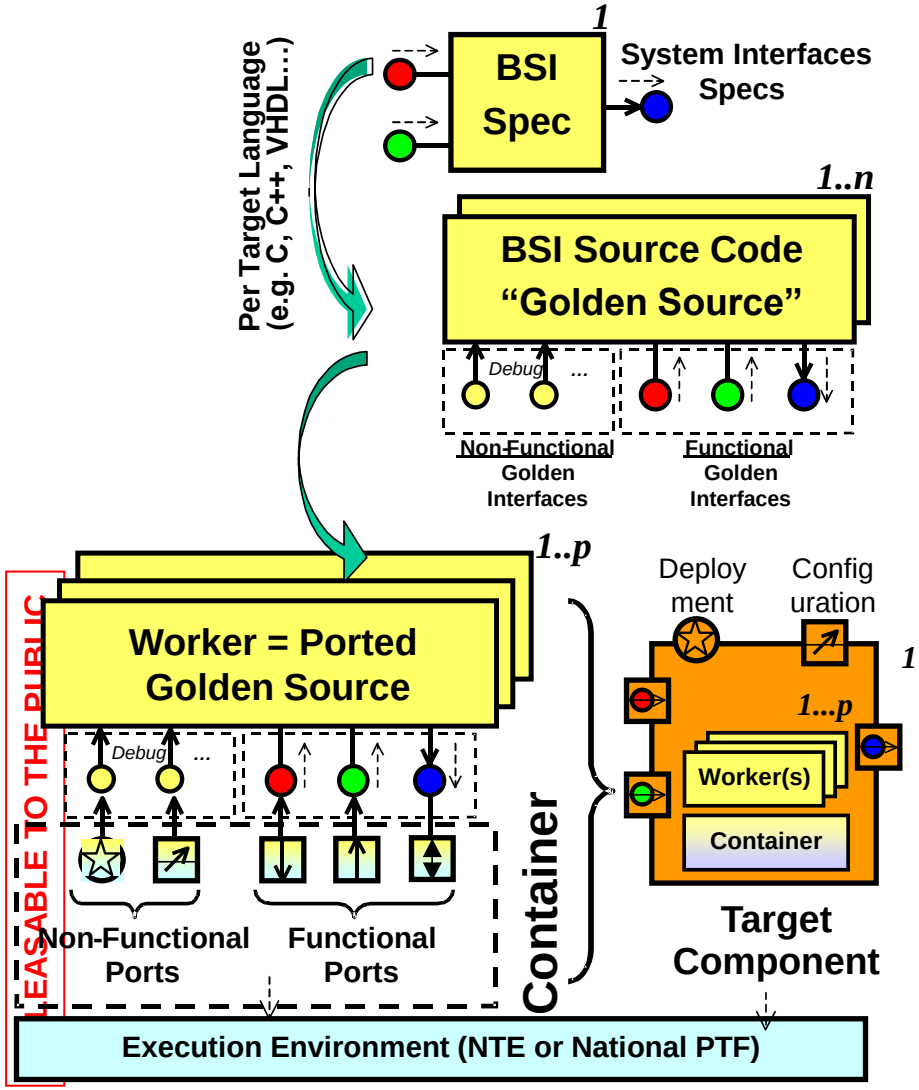
1.2 Base WF Partitioning



1.3 Base WF Mapping

- Target programming language(s) choice for BSI implementation
- Several languages can be needed for a given BSI, e.g. C and VHDL (“dual BSIs”)
- As many developments as chose languages
- The previous steps ensure overall consistency

Step 2 & 3 – Base WF Software Design & Coding



BSI Golden Source(s)

Instantiate the **functional requirements**

Independent from Configuration and Deployment (SCA CF) and Connectivity (CORBA, MHAL)

1 per dev language - Practically : 1 or 2 ("duals")

Coding rules derived from JSF program

Target components

Worker(s) is the **ported BSIs Golden Source**

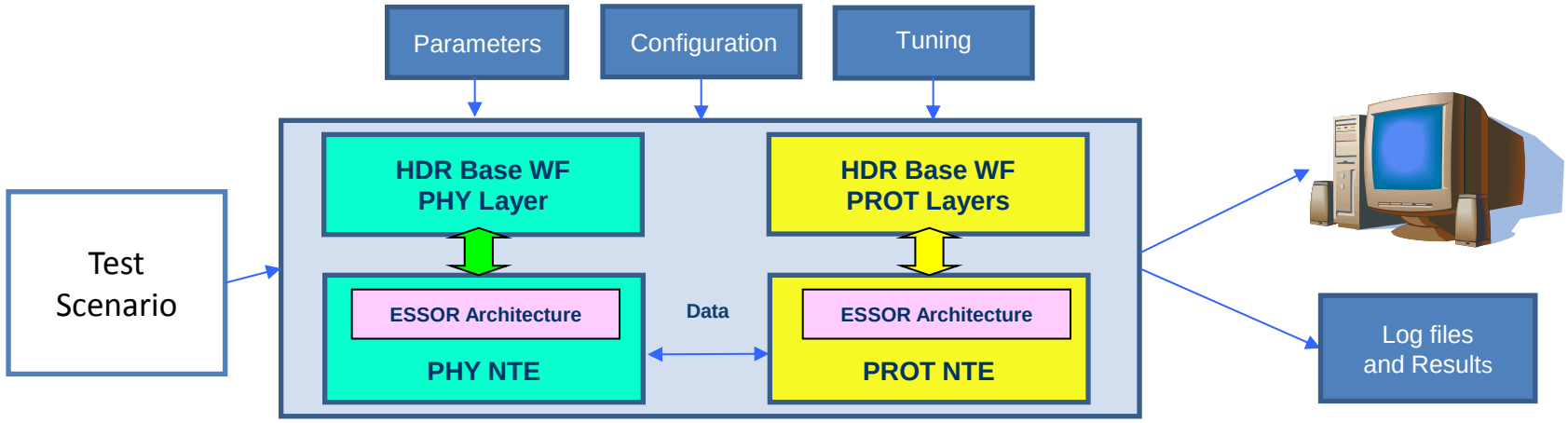
Possible porting optimisation (e.g. usage of dedicated libraries or hardware accelerators)

Container supports Worker(s) operation based on the available Execution Environment

Container code generation encouraged by IDL characterization of the BSI interfaces and standard-compliant Execution Environments (e.g. CORBA)

Step 4 – Base WF Native Validation on NTE

- Native Test Environment (NTE): a generic, platform independent, functional, test framework for Base WF Golden Sources validation
  - Progressive functional validation
  - Creation, execution and monitoring of test cases
  - Record of the simulation scenarios allowing replication
- Composed of interconnected PROT NTE and PHY NTE
- Based on ESSOR Architecture APIs for the emulated components: SCA 2.2.2 CF, OS, Connectivity (CORBA / MHAL), RD, RS, RSS



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4. Conclusions

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Conclusions

- ESSOR Phase 1 achieved field interoperability with ESSOR HDRWF between different nations
  - A world's first
- ESSOR SDR Architecture and WF Methodology were essential enablers of this success
- ESSOR SDR Architecture
  - Based on published JTRS standards (SCA 2.2.2 and APIs)
  - Contributed to WInnF (for SCA 4.1, Transceiver Facility V2 and Time Service Facility)
- ESSOR WF Methodology leveraged JTRS concepts of waveform repository and portability
- **ESSOR Phase 1 proved the value of SCA-based standard SDR Architectures and Base WF portability**

END OF THE PRESENTATION

Thank you for your attention

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