



CONSTRUISONS **ENSEMBLE**
LA DÉFENSE DE DEMAIN

International Tactical Radio Workshop

Coalition Interoperability

French views

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SDR expectations

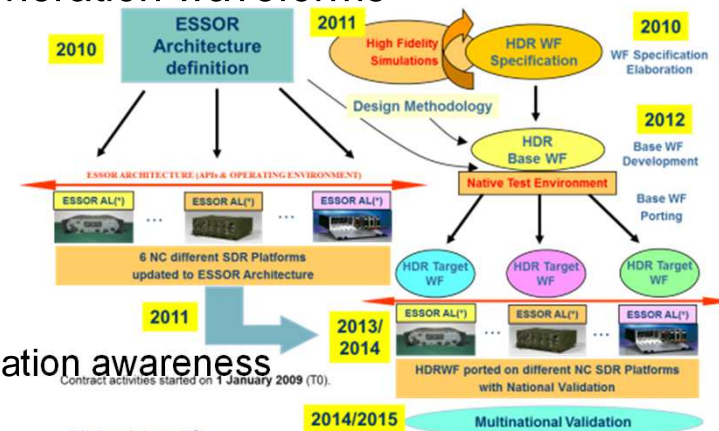
SDR, radio seems to be as simple as a PC (almost...)



- Emerging SDR technology created expectations both relative to the perspectives of portability and capabilities for the new generation radios
- Standardization activities first gave the priority to portability (SCA, APIs), which shall pave the way to the desired benefits of SDR
 - Interoperability
 - Flexibility
 - New Services
- The expectations on the three topics have still to be more precisely defined

From Software Architecture to Waveforms

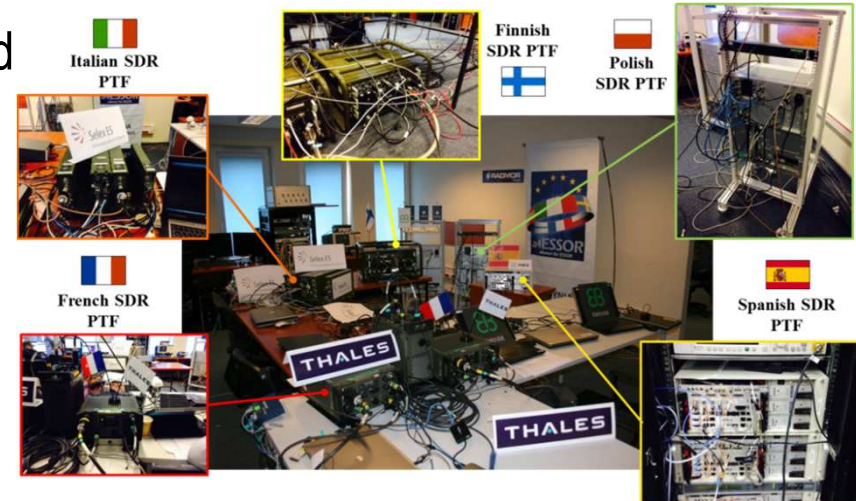
- Portability allows a common source code to be shared, mitigating acquisition costs, encouraging Nations to cooperate on new generation waveforms
- Underlying intentions could as well be
 - to share investments needed for new capacities
 - Larger networks
 - Ad hoc : Self organizing, mobile networks
 - Wideband
 - Increase of throughput and lower latencies
 - Allow the transmission of video, tactical situation awareness
 - to establish a common coalition waveform standard
- ESSOR has proven the success of this approach, defining common products
 - ESSOR Architecture extends the JTRS SCA 2.2.2, APIs Release 1.0.3 and WINNF Transceiver APIs
 - ESSOR Base WF
- It has to be noted that ESSOR products have been built on the basis of
 - Existing available standards
 - Experience from the 6 national champions (former advanced studies)
 - Understanding of 6 Nations of what capabilities / challenges would be expected in the near future



ESSOR motto

“interoperability through portability”

- The ESSOR base waveform has been ported onto the different **ESSOR-Architecture-compliant national SDR platforms**.
- The success of Interoperability Qualification Testing Events demonstrate that the interoperability in military radio-communications is achievable through the software defined radio (SDR) technology.
 - Interoperability has been achieved among 5 different national SDR platforms from 5 different vendors/nations:
 - 2 operational radios (FRA and ITA), 1 operational prototype (FIN), 2 lab demonstrators (ESP and POL).
- **Each nation can use its own national SDR radio equipment** and interoperability is achieved through the usage of a common waveform application.



HDR Base WF has been ported
on 5 different National SDR PTFs
where ESSOR Architecture is implemented

Multinational Labs
Interoperability:

Finalized



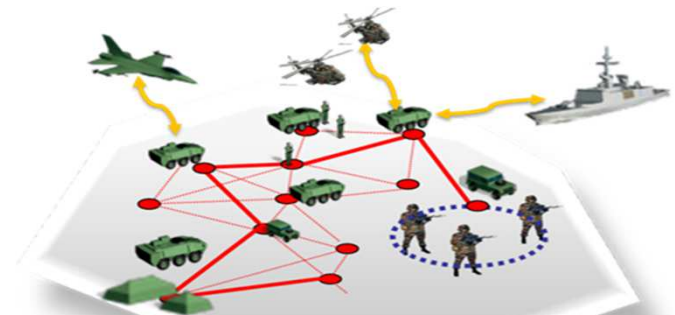
ESSOR HDR WF Key Features

- High Data Rate: up to 1 Mbps at Radio Link
- UHF: 225-400 MHz (extensible), ~1,25 MHz bandwidth, Frequency-Hopping
- Designed to support up to 200 nodes per Network
- Ad-Hoc: Mobility management of the nodes and communication on the move. Dynamic adaptation to the environment (Propagation, Node Density, Traffic, Advantaged Nodes, ...)
- Synchronization: With / Without GNSS, taking advantage of the GNSS when available (Mixed configuration)
- Radio Silence Capable
- Secure: Red / Black – Embedded COMSEC / NETSEC / TRANSEC / OTAR/D/Z
- Compatible with standard IP applications: QoS driven approach – Unicast / Optimized Multicast / Broadcast traffic
- Voice Capable: VoIP; Voice CNR Push To Talk (PTT)
- Support Local or Remote Management and Supervision

How far are interoperability issues solved ?

- MANET WFs solve technical issues regarding the radio changing environment
 - maintenance of connexity
 - power / rate adaptivity
 - routing, retransmission
- Sovereignty needs (National network / Coalition network) have to be considered
- Operational domains (land / aero / navy) can lead to specific waveforms
- User communities pertain with specific views on the ideal functioning points
 - Real Time / Voice / Data profile
 - Reactivity / Number of users
 - Availability

Best usage of allocated spectrum resource according to configuration parameters



Different expectations lead to at least different configurations / parameterization

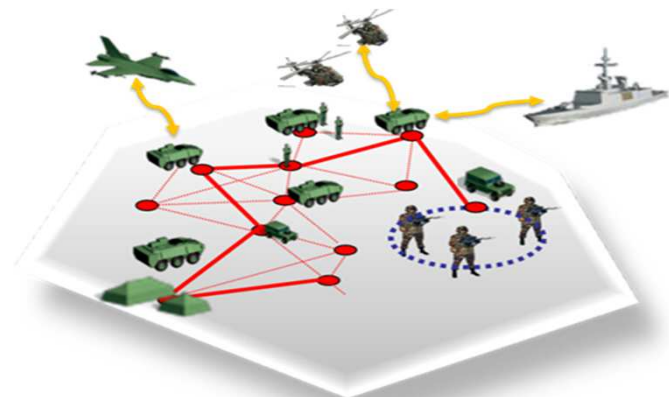


Expectations can hardly be fulfilled with only one radio network, breaking interoperability if no other solution is being developed

Operational expectations (1)

New Services and networking

- Network centric operations
 - Command chain continuity from PC to elementary unit
 - Secure end-to-end data and voice transmission for C4I
 - End-to-end delivery: optimized routing over heterogeneous radio network
 - Quality of service enforcement (SLA) for data transmission
 - End- to-end Latency control consistent with the operational constraints
- New Services
 - Geographical services: blue force tracking - geo-conferences
 - Integrated applications: alerts dissemination and free text messages



Higher layer routing/network interfaces

Core Services to be supported by new generation WFs

Interoperability between integrated applications & C4I

Operational expectations (2)

Flexibility & Robustness

- Mobility has to be ensured for weeks / months
 - Networks / User communities have to be able to move freely, while not interfering
 - Spatial separation cannot be seen as a prerequisite to plan the deployment
- Flexibility / Reconfiguration
 - Adaptation to the mission of one network shall be possible without impacts on other units
- Availability / Capacity
 - Splitting the resource (spectrum) between user communities might affect capacity, but should not impact robustness
 - Efficient techniques for sharing the spectrum shall be implemented and might require cooperation between different radio networks



Mobility / reconfiguration

Robustness & Scalability

Operational expectations (3)

« Transition path »

- During the transition period users expects « SDR » to open access to new services
 - Enhanced BFT
 - Extended connexity
 - Ability of using new generation C4I
- Uncompatibility between legacy and new systems might slow down the transition
- A smooth transition requires an homogeneous interface at service / networking layers
 - Use an abstraction layer
 - Upgrade legacy radios



Insert new services as soon as possible





CONTACT Needs & Challenges

- **2 major operational challenges**

- **Organizational context**

- Joint
 - Multinational
 - Civilian security actors

- **Operation digitalization**

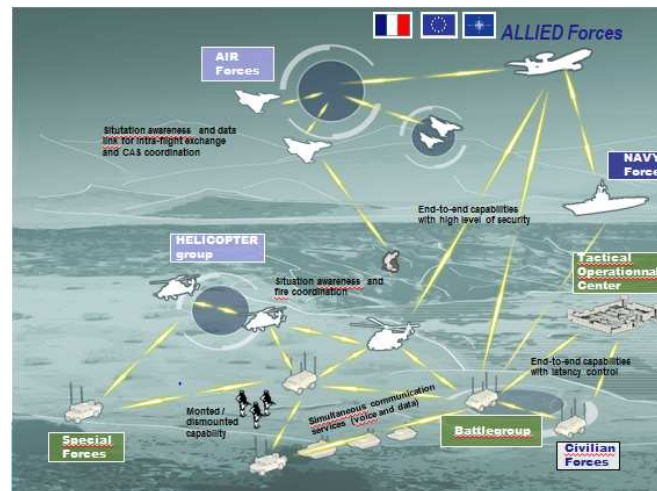
- To share quickly the same operational picture
 - To speed up the rhythm of decision making
 - To improve coordination

- **Programmatic challenge**

- Smooth migration
 - Economical optimization

- **Technical challenges**

- High data rates
 - Secured communications & transmission
 - Large number of nodes
 - Nodes moving differently
 - Various elongations to deal with
 - Optimization of frequency resource



CONTACT Programme Roadmap



2009 2011 2013 2016 2019 2022 2025

DEPORT

- ◆ CONTACT System Definition
- ◆ Advanced studies and Technology



X-CONTACT

Vehicle



SV0 : Experimental system version

- ◆ First CONTACT services
- ◆ Tactical Communication Node
- ◆ PR4G interoperability

SV1 : Key products and tri- service technology

- ◆ Full CONTACT services: IP Interface, combat voice messaging, position report
- ◆ Multi-band Tactical Communication Node
- ◆ Mounted/Dismounted
- ◆ Helicopters



NCT-t Vehicle

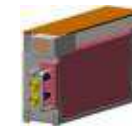
ERS-a Helos

ERS-p handheld

SV2 : 3D Extension & GA-Coordination

- ◆ Man-Pack
- ◆ Ground-Air Coordination
- ◆ Intra-flight
- ◆ WF enhancements
- ◆ System improvements

ERS-a
Fighter



ERS-m
Manpack



SV3 : 3D Extension RVT , MIDS, Naval

- ◆ RVT / Video streaming
- ◆ ERS-MIDS
- ◆ NCT-n (naval radio)
- ◆ HF network connection
- ◆ WFs enhancements
- ◆ Future HF land radio
- ◆ Future soldier radio

RVT



ERS-MIDS



MINISTÈRE
DE LA DÉFENSE

DGA

Perspectives

Coalition needs and CONOPS

- ESSOR
 - demonstrated « interoperability through portability »,
 - offers a common, flexible, extendable WF and the **first step** towards coalition interoperability
- CONOPS for the emerging technologies have still to be consolidated, however
 - Different views exist on required interoperability points
 - Networking seems to be a common requirement
 - Coalition interoperability at the tactical level needs taking account of the potential operational context for each nation
 - a nation which sends a company might see interoperability at the lowest level as a prerequisite in supporting successful participation
 - for a wider participation interoperability points could be at battalion level
 - Availability and performance will keep being a driver
 - Each user community might require the network being instantiated in their own radio to offer optimized performance for their own need
 - Nations might use coalition networks for their national traffic, or require a separate sovereign network

A good WF candidate for the coalition shall be able to cover wide range of needs inside the same deployment

Perspectives

National Programme and further standardization

- CONTACT: Joint Digital Tactical and Theatre Communications program
 - New generation of tactical communications in support of network-centric war fighting operations, it includes the development of a full Radio products family based on the ESSOR Architecture and covers the full range of expectations from operational users
 - ESSOR is used both as a reference for the software architecture and for national UHF WF
 - CONTACT WFs adress new services like BFT, latency controled trafic, geographical data exchange in addition to simultaneous voice & data transmission and are designed to operate inside the same network
 - CONTACT is designed to allow the a large number of end users in the same network (up to 2000 nodes for 2D+ network, up to 100 nodes for 3D network)
- Building a system on available standards, Architecture & Waveforms makes it easier to interoperate and achieve the best global performance
- To get the most benefits of SDR technologies it appears that wider needs have to be adressed on a coordinated manner
 - Integrated applications (BFT ...)
 - Spectrum sharing techniques between different radio networks to allow scalability and robustness
 - Seamless networking between optimized radio networks
 - Security (Interoperable encryption)

Contact info: Advisors from DGA at WINNF Advisory Council (updated)

- Invited Advisors :

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