

# Top 10 Most Wanted Wireless Innovations

WinnComm-2014

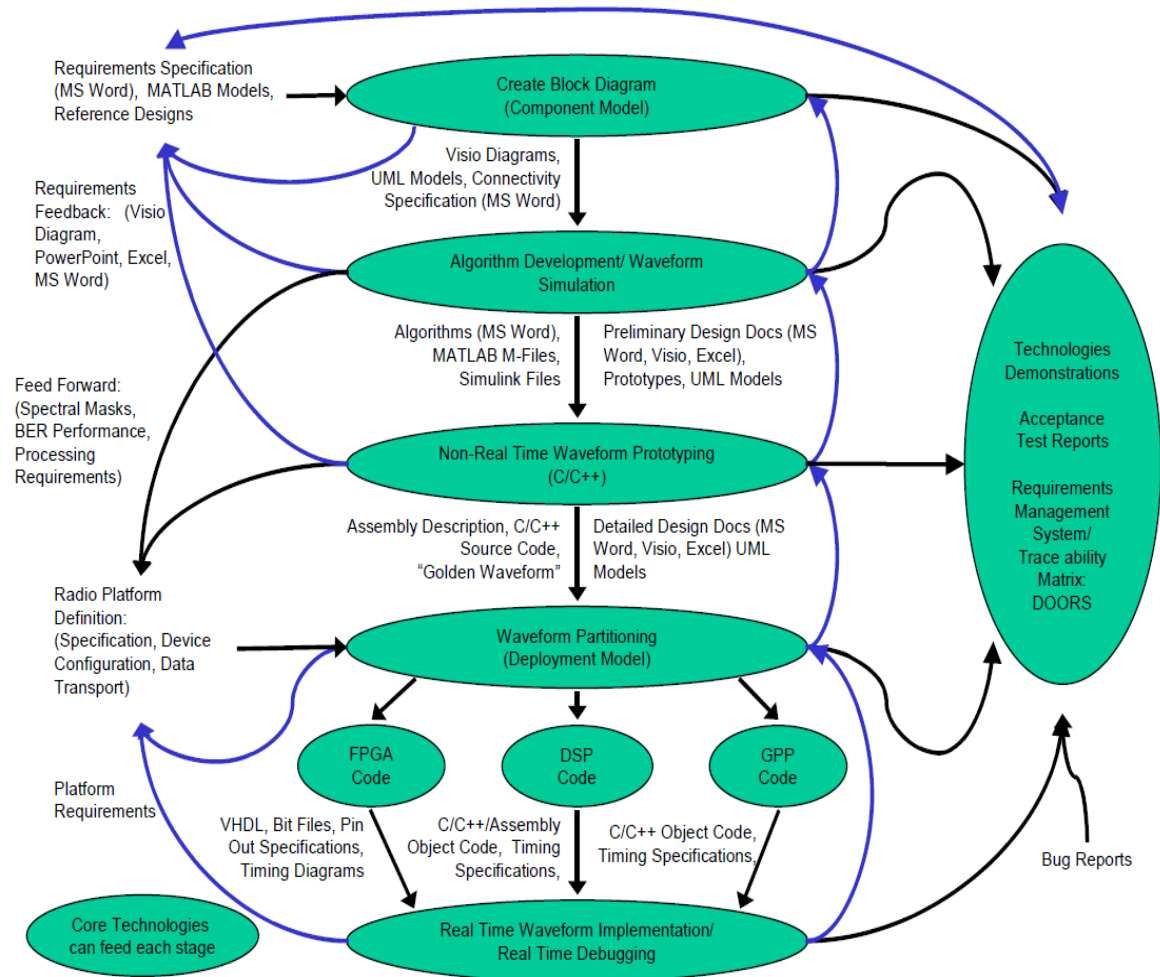
# What is a Most Wanted Wireless Innovation?

***...innovations, either **technical, business or regulatory**, that if realized, would address various shortcomings in existing wireless communications from the point of view of the different stakeholders in the wireless industry value-chain...***

Source:

[http://data.memberclicks.com/site/sdf/SDR\\_Forum\\_2010\\_to\\_2014\\_Strat\\_Plan.pdf](http://data.memberclicks.com/site/sdf/SDR_Forum_2010_to_2014_Strat_Plan.pdf)

# Techniques for Efficient Software Porting Between Heterogeneous Platforms and Generic Development Tools for Heterogeneous Processors

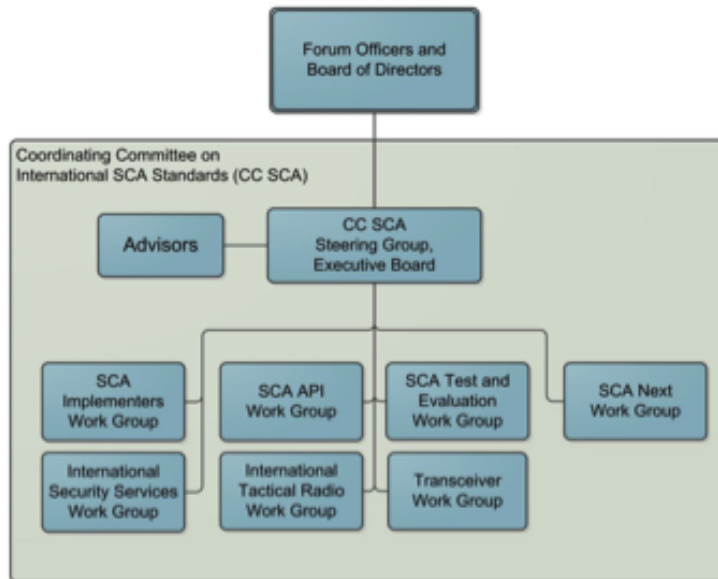


Source: <http://groups.winforum.org/d/do/1566>

# Innovation #1 Forum Activities

## Structure for Coordinating Committee on International SCA Standards

17 April 2013



### AEPs Improvements for SCA 4.1

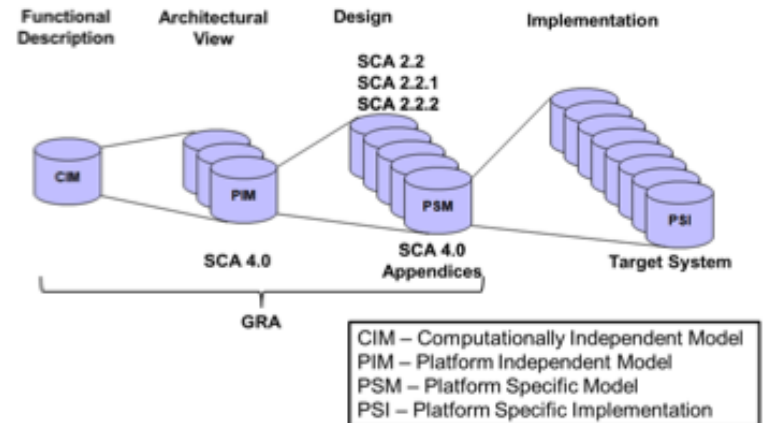
Document [PD\\_SCA\\_2013\\_003](#)

### IDL Profiles Improvements for SCA 4.1

Document [PD\\_SCA\\_2013\\_002](#)

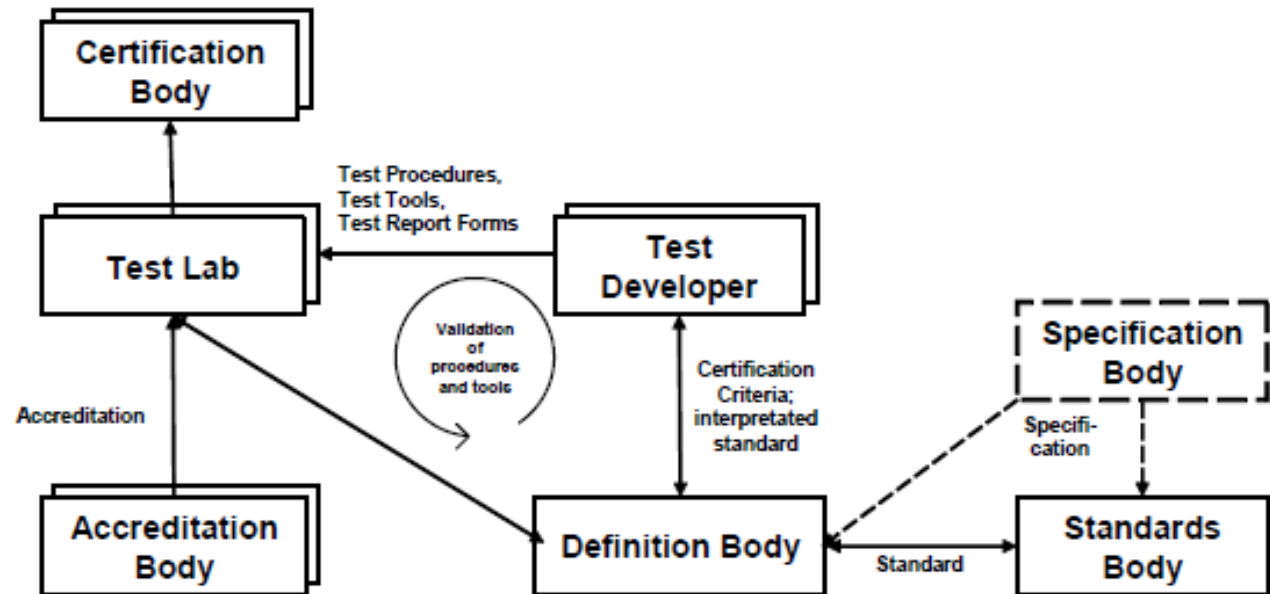
## Integrated Communications System Modeling (ICSM) Group

[PAC-2012-002](#)



**ICSM:** Develop and integrated systems model for communications systems that can be used as a foundation for software-based communications systems across a variety of domains, hardware types and applications. This model is developed using a SysML/UML tool to represent and capture the architecture aspects of the communications system model.

## Innovation #2: Certification Process for Third Party Waveform Software



Source: <http://groups.winnforum.org/d/do/1559>

# Innovation #2 Forum Activities



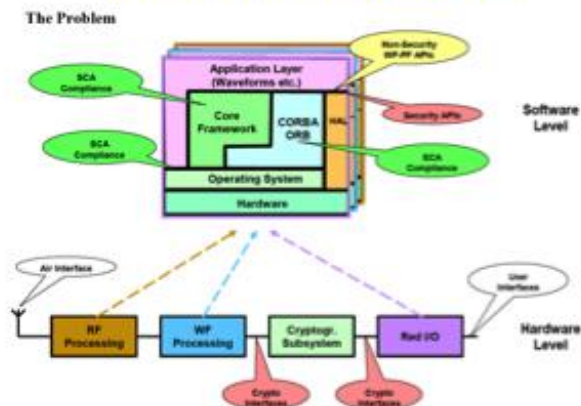
JTEL is the US government "Evaluation Lab" that evaluates platforms and waveforms for SCA compliance - including AEP compliance.



## European Secure Software Radio Programme (ESSOR)

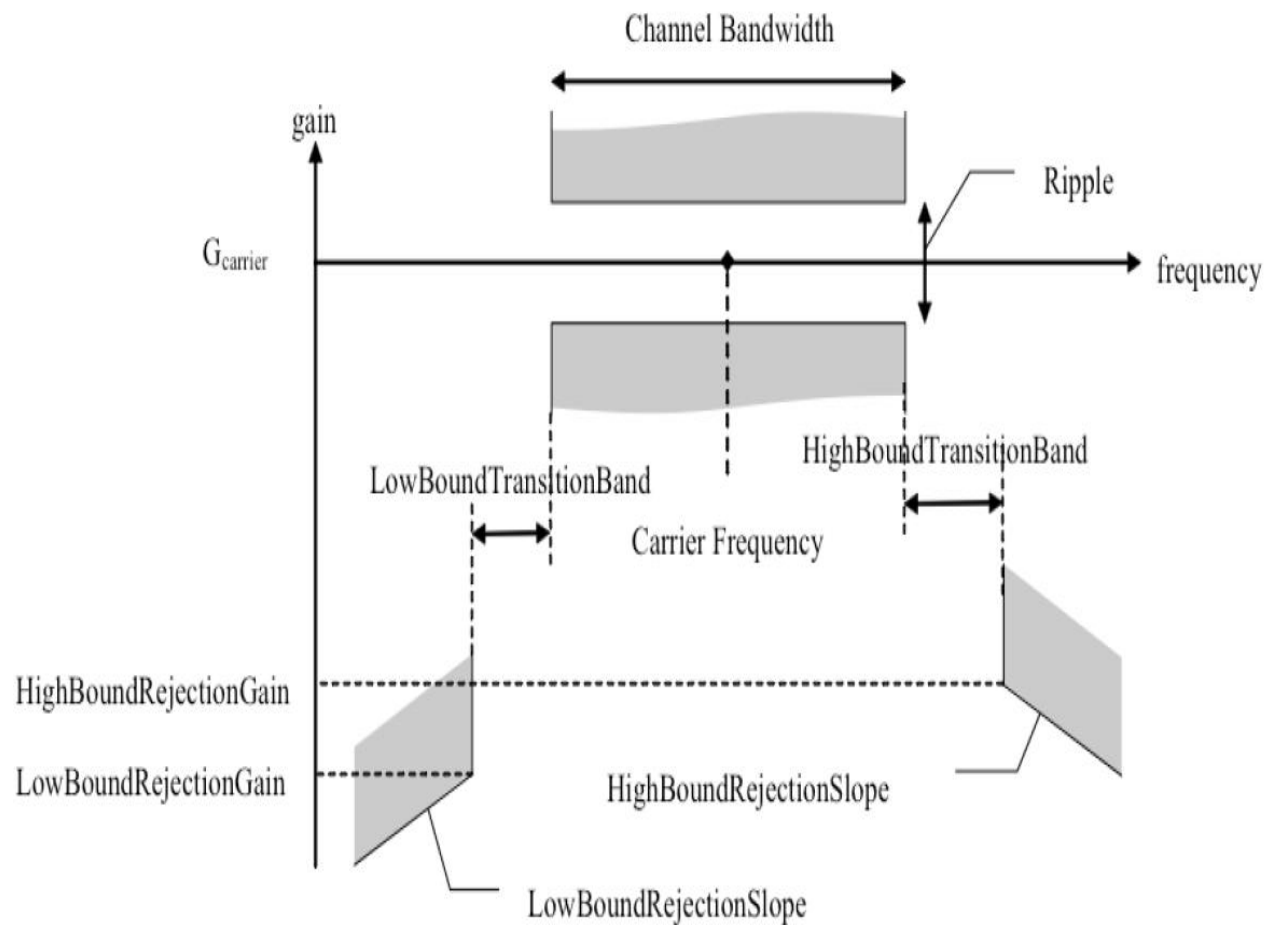
The main scope of this project is to provide architecture of Software Defined Radio (SDR) for military purposes and a military High Data Waveform (HDR WF) compliant with such architecture, thus offering the normative referential required for development and production of software radios in Europe. In addition, the project will deliver guidelines which are related to the validation and verification of waveform portability and platform re-configurability, setting up a common security basis to increase interoperability between European Forces.

## SCA T&E WG, ITR SIG SCA Certification Guide #2 WINNF-10-P-0012-V1.0.0

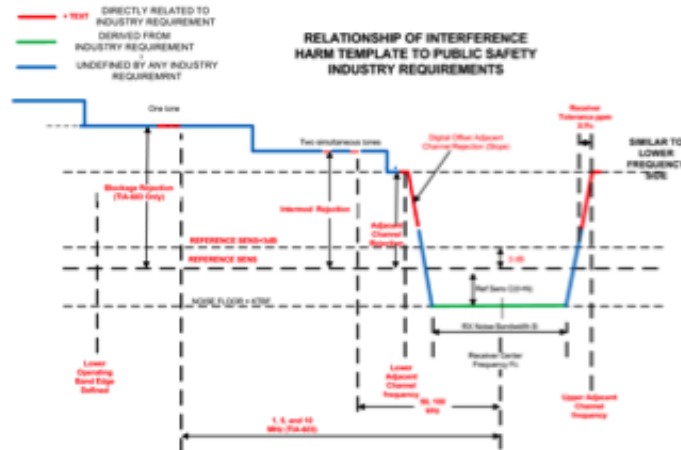




## Innovation #3: Receiver Specifications



**Receiver Performance Guidelines  
and Evaluation Criteria Task Group**  
**PAC-2012-004**



- Reference Sensitivity is signal level where a min received signal quality is achieved (usually 5% BER or 12 dB SINAD)
- Ref Sens = Noise Floor + C/N ref
- C/N ref varies with modulation (values in TSB-88)
- Noise Floor = KTB
- B = RX Filter Noise Bandwidth Chosen to balance Adj Ch Rejection vs Sensitivity



#### Innovation #4:

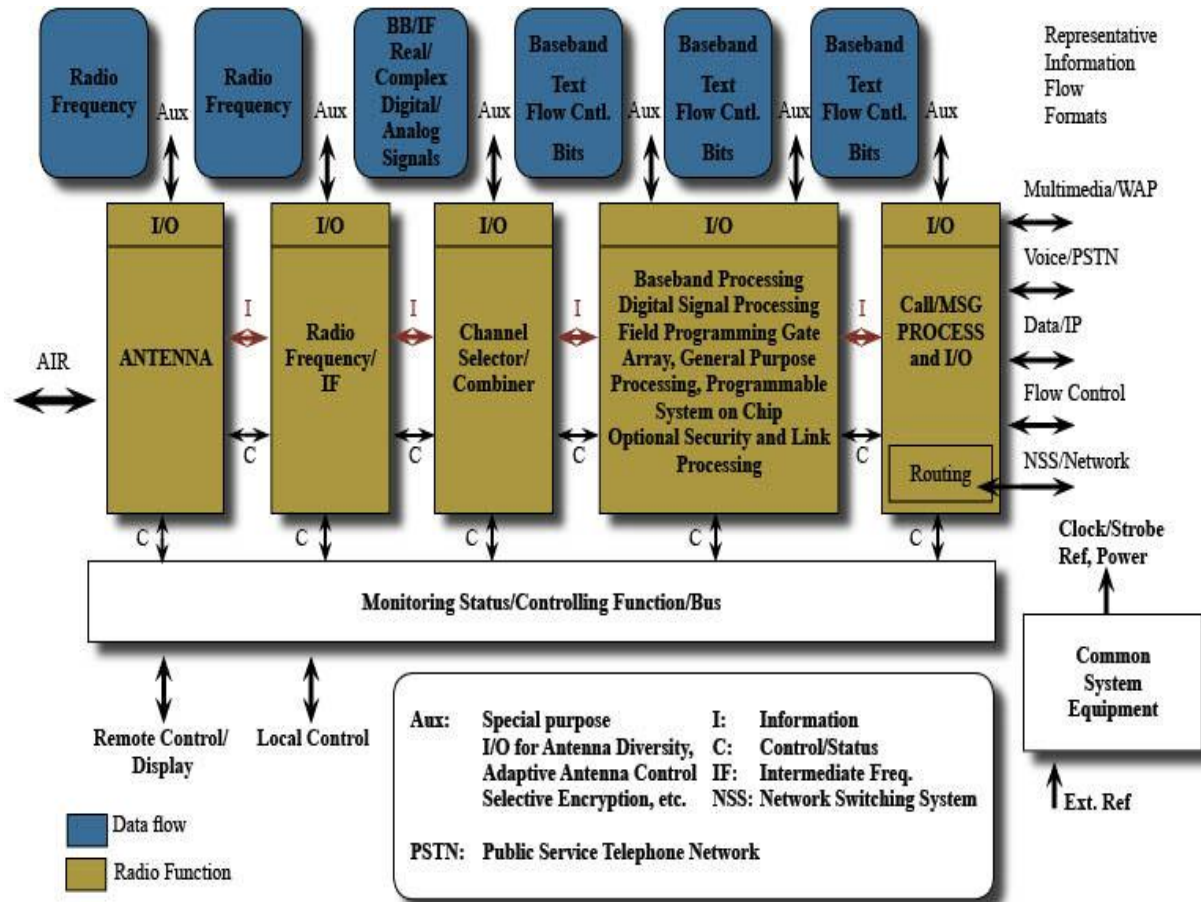
Low Cost Wide Spectral  
Range RF Front-End  
(Multi-octave Contiguous)  
(Tx,Rx)

#### Innovation #5:

Techniques to Minimize  
Power Amplifier Spectral  
Regrowth in Non-  
contiguous Spectral  
Environment

#### Innovation #6

Increase Communications  
Time on Battery Charge  
by an Order of Magnitude

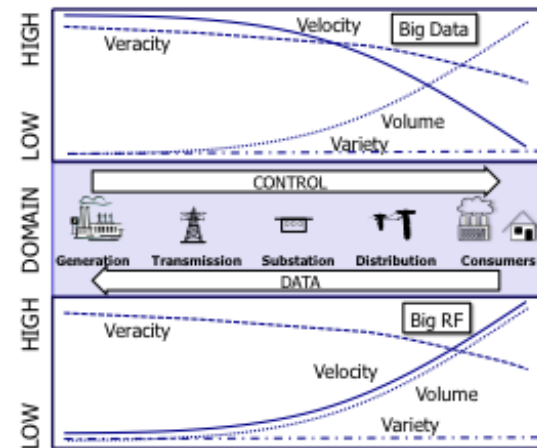


Source: <http://groups.winnforum.org/d/do/1574>

# Innovation #4,5,6 Forum Activities

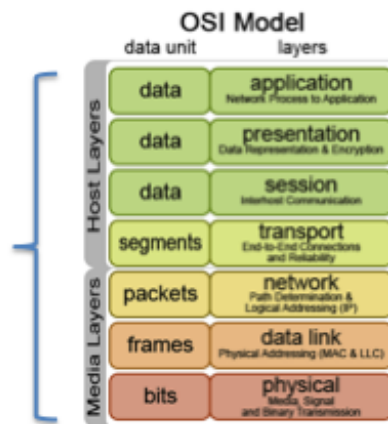


Shared context lowers EpNB (Energy Per Network Bit) and improves energy/information ratio



Distributed shared context minimizes transmission of unnecessary data

**Innovation #6**  
Opportunities exist at all layers of the OSI Stack

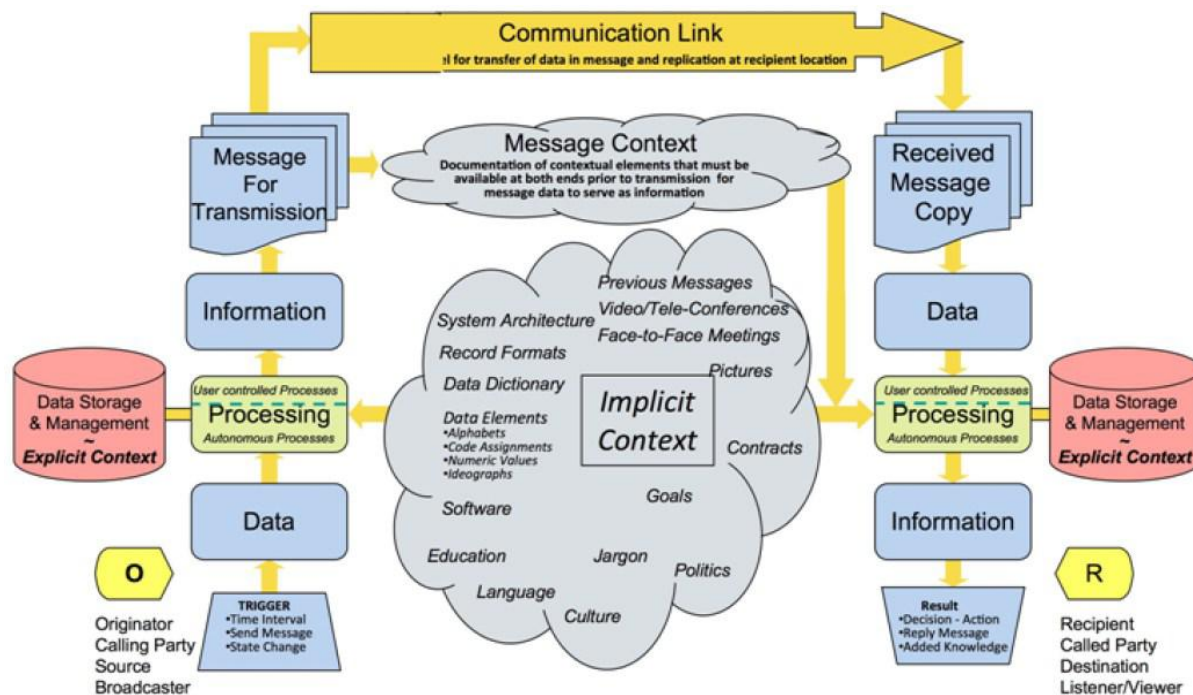


## Innovation #4 & #5

Primary opportunities in the Physical layer.

- Development of linear wide band components
- Improved filter technology
- Dynamic characterization and cancelation of non-linear behavior
- Use of orthogonal frequency's and codes
- Application of power control based on QoS

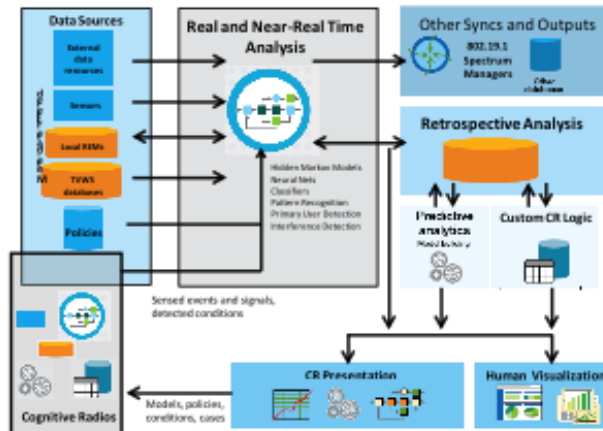
## Innovation #7 (NEW): Context Aware Cognitive Radio



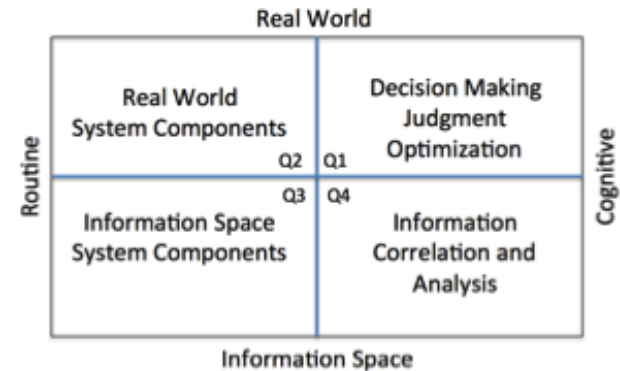
Source: <http://groups.winnforum.org/d/do/5689>

# Innovation #7 Forum Activities

## Big Data Tools for Big RF Solutions

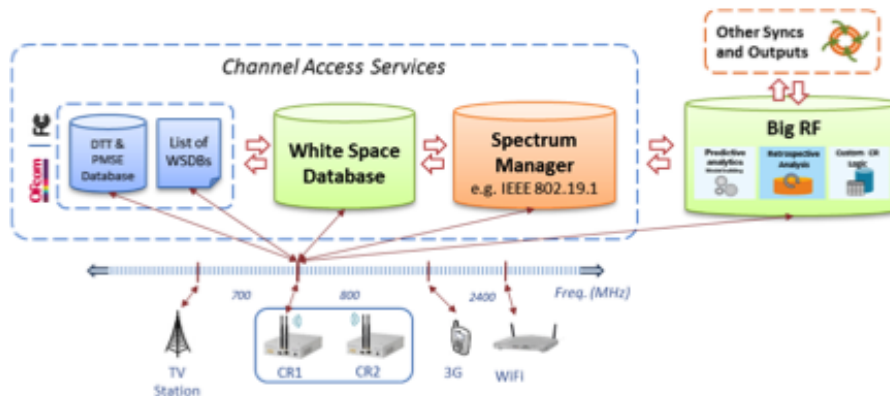


## Wireless Information System Descriptive Model (WISDM).



## Information Process Architecture (IPA) v3: Context Aware Cognitive Radio

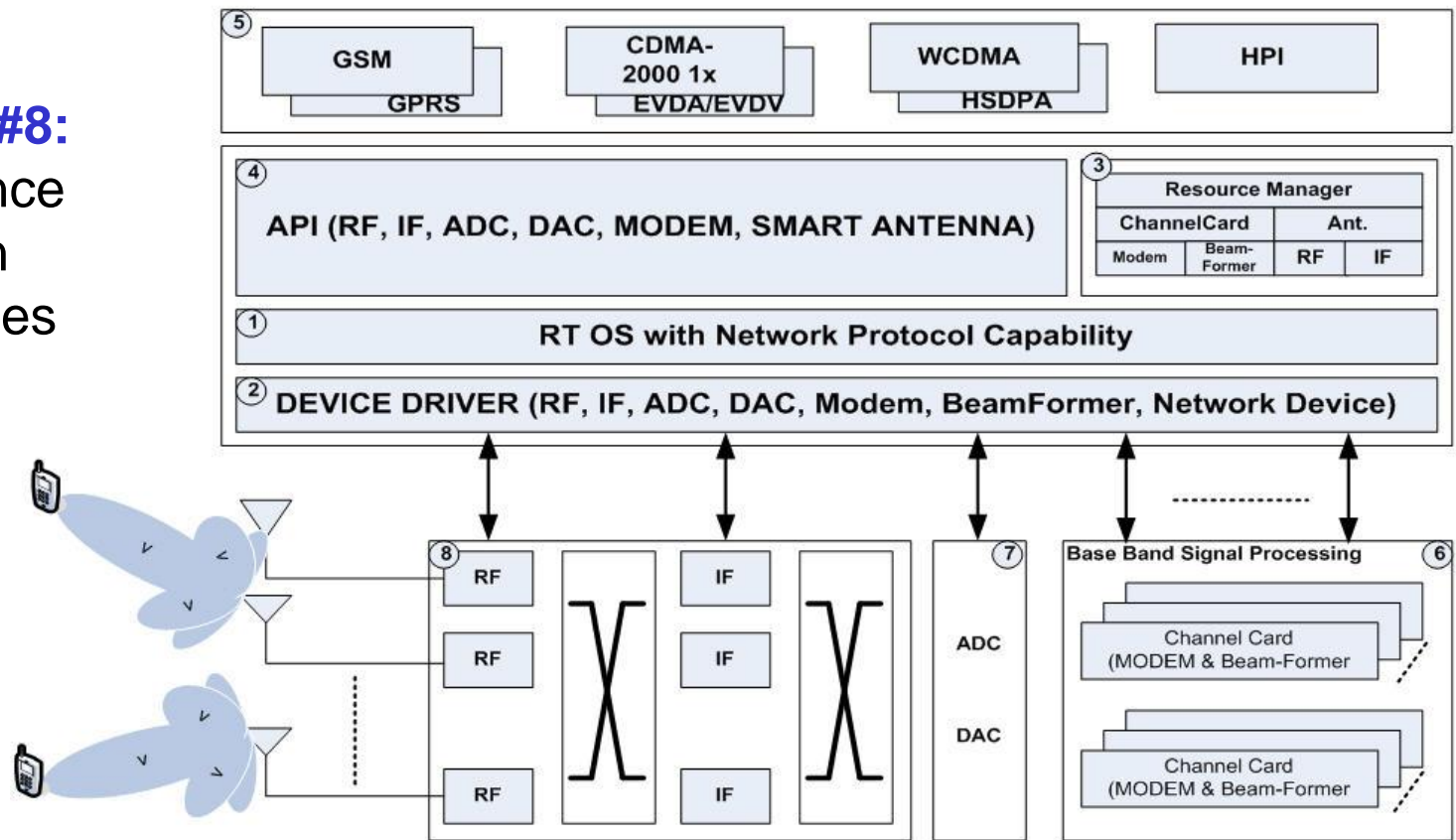
PAC-2013-001



## Big RF in White Space Database Ecosystem

Big RF can provide real time intelligence to improve the performance of channel access services provided by white space database providers and spectrum managers and to the decisions of individual cognitive radios

## Innovation #8: Interference Mitigation Techniques



Source: <http://groups.winnforum.org/d/do/1555>



# Innovation #8 Forum Activities

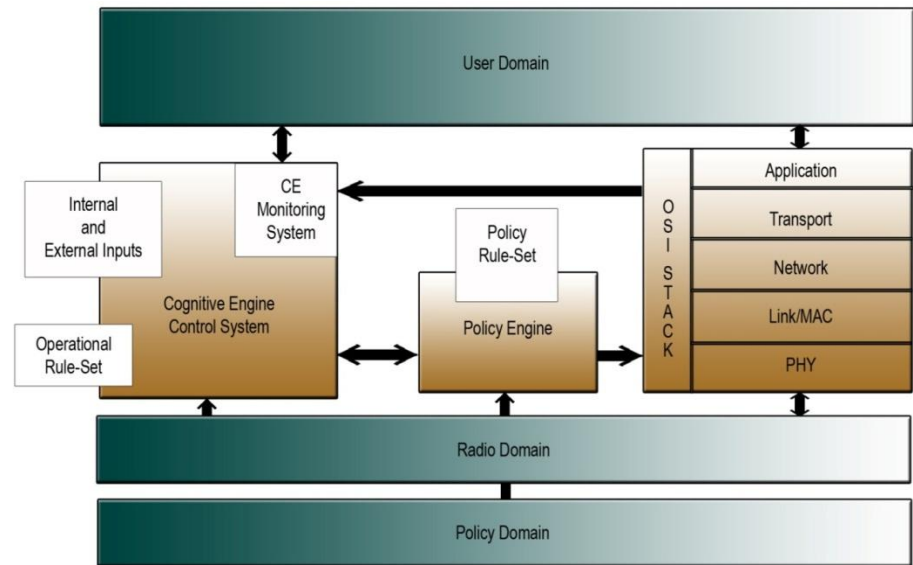
## Key Focus of Proceedings and Workshops

### Sample Titles of Proceedings and workshops in the WinnF Library

- Strategies for Pushing Software Radio Closer to the Antenna
- An Efficient Digital Pre-Distortion Filter For Ultra-Wideband QAM Modems
- Interference Mitigation using Adaptive Polarization
- A Tunable Wideband RF Front-End for SDR
- IF and Baseband Signal Processing
- Implementation of an ASIP based SDR platform for MIMO OFDM transceivers
- Antenna and Transceiver Architectures
- Tutorial for Fundamental Hardware System Design for SDR System
- A Cognitive Radio with Multi-antenna Interference
- ANALOG-TO-DIGITAL Conversion – The bottleneck for Software Defined Radio Frontends
- Single-Configurable Chip Solution for Digital-Front End with Supporting Multiple Standards
- RF Sampling Software Defined Radio for HF Band
- Cascade Linear Phase Recursive Half-Band Filters Implement the Most Efficient Digital Down-converter
- Reconfigurable Continuous-Time Delta-Sigma Analog-to-Digital Converters
- An Analysis of Active Interference Cancellation for Wideband OFDM System from Multi-band
- Improving MIMO Sphere Detection Through Antenna Detection Order Scheduling
- Adaptive Antenna Array to Improve Cognitive Radio Performance
- The ADCs of SDR
- RF System Aspects for SDR - A Tutorial

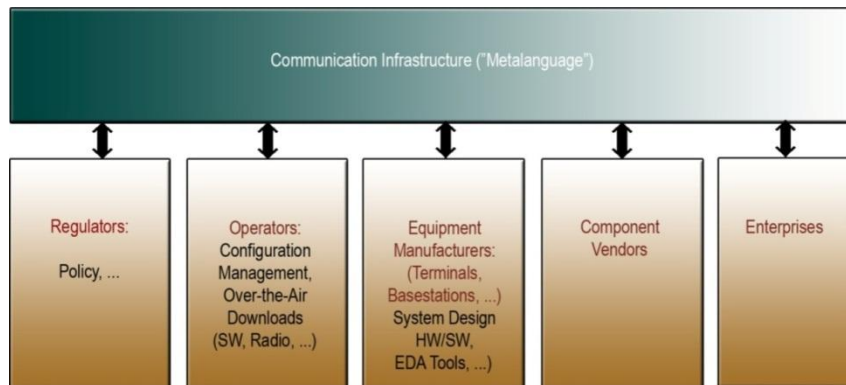


## Innovation #9: Standardize computer interpretable policy language for cognitive radio



Wireless Innovation Forum Cognitive Radio Concept  
Architecture

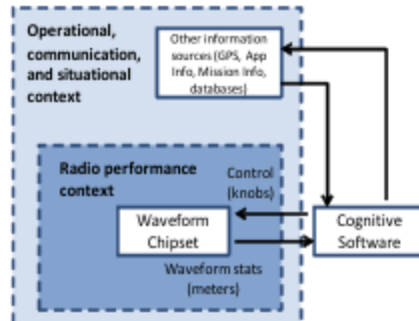
Source: <http://groups.winnforum.org/d/do/1563>



Source: <http://groups.winnforum.org/d/do/1562>

# Innovation #9 Forum Activities

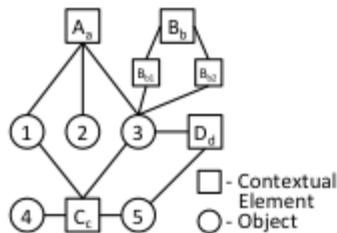
## The Role of Context in Cognitive Systems



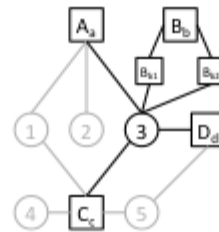
**A Context-Aware Cognitive Radio incorporates sources of information beyond what is available to a baseband chipset.**

## WinnF - Modeling Language for Mobility (MLM)

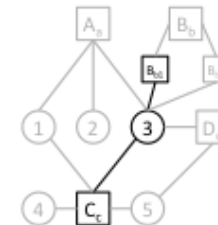
Supporting IEEE 1900.5 Working Group (WG) on Policy Language and Architectures for Managing Cognitive Radio for Dynamic Spectrum Access Applications. Defining a vendor-independent set of policy-based control architectures and corresponding policy language requirements for managing the functionality and behavior of dynamic spectrum access networks.



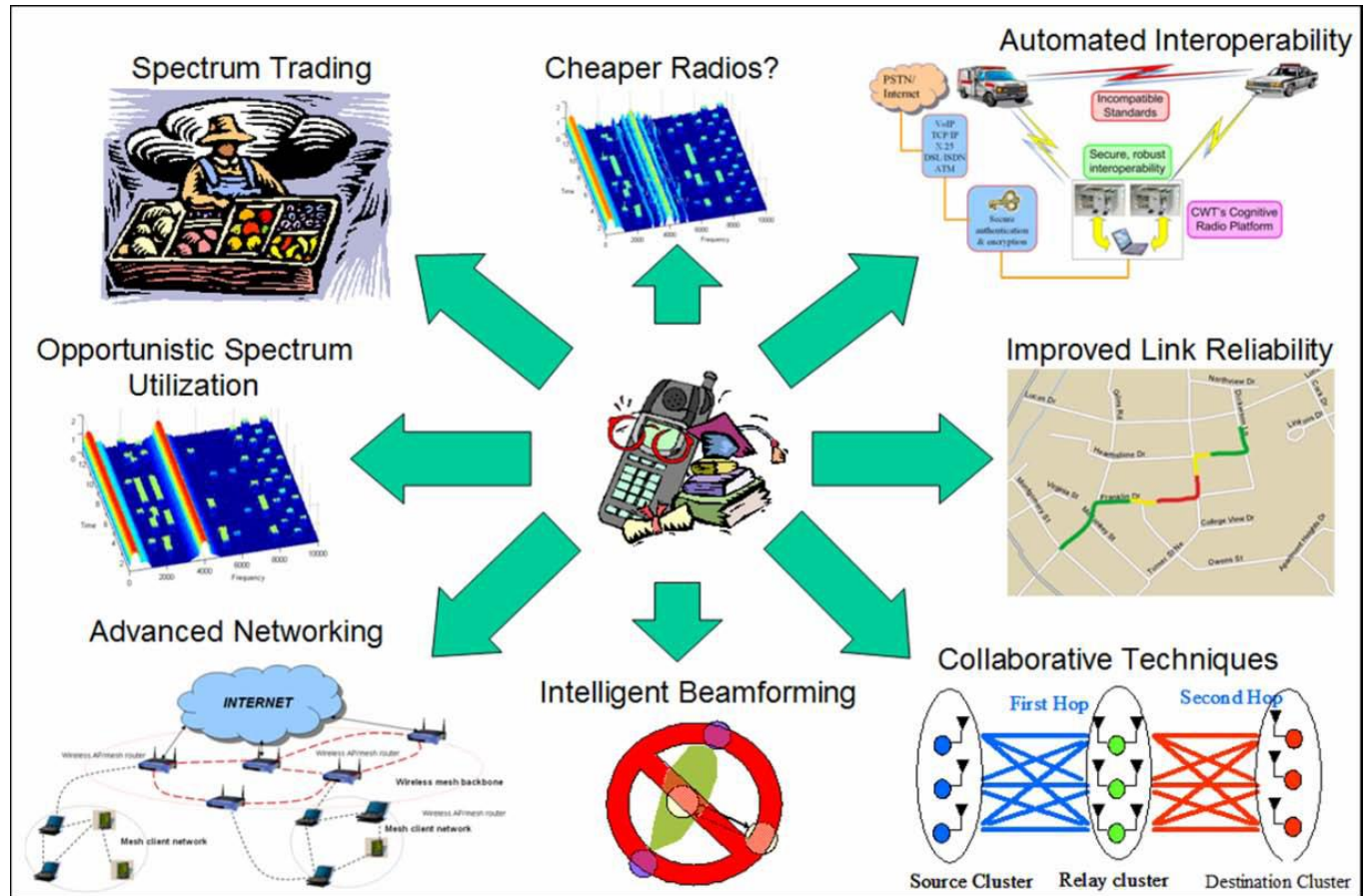
System Contextual Model



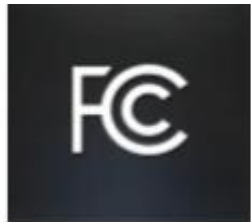
Contextual & Intext Model. Left: The complete context for Object 3 includes six other modeling elements. Right: An intext (perspective) for Object 3 which only depends on two modeling elements



# Innovation #10: Flexible Regulatory Framework for Temporary, Cooperative and Opportunistic Access



# Innovation #10 Forum Activities



Wireless Innovation Forum Advocacy  
Agenda

Document WINNF-R-12-0007



SSRF A data exchange standard:

- Explains how to pack datasets for transmittal
- Explains how to unpack received datasets
- Performs quality-checking *IF* desired

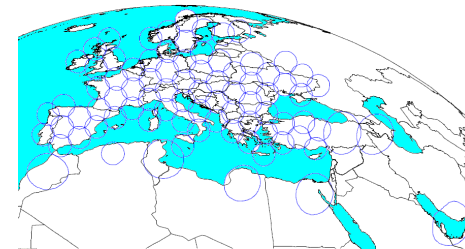


# Project Survey Responses

## What new projects should the forum undertake?

- **Investigate orthogonal frequency and waveforms as an approach to allow spectral reuse in limited frequency bands.**

- Similar concept used by Satellites for frequency reuse. Each “Color” is a region of orthogonal frequency assignment. Ka band satellites use this technique to achieve transponder throughput up to 140GBps
- Similar techniques are being tested for Urban wireless deployments to allow frequency reuse in high density apartments and environments.

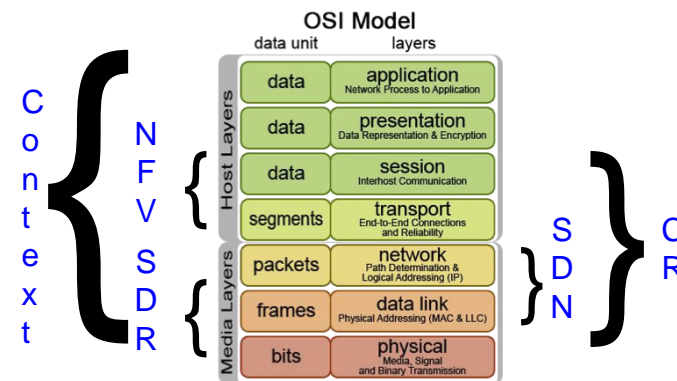


- **Consider project in Software Defined Networking (SDN), as the concept of software virtualization and flexibility moves past the radio to the network.**

- Cognitive Radio spans elements from the physical layer through the session layer of the OSI Model
- Context addresses all elements of a communication architecture
- The Forum seeks to innovate at all levels of the OSI Model

- **Advocate for completely dynamic use of spectrum without any licensing requirements**

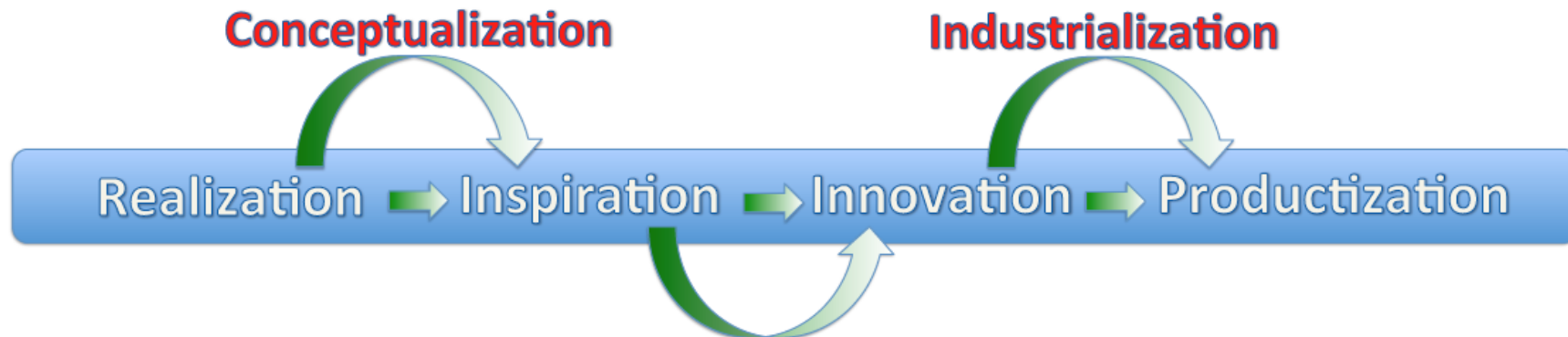
- Might be a difficult position to sell to governments that make Billions of dollars selling and regulating spectrum
- Unlicensed does not mean unregulated and opportunistic use of underutilized spectrum is a position the Forum supports



# Innovation

## Theodore Levitt

“Creativity is thinking up new things, Innovation is doing new things”



**WinnF: Participation in Conferences, WGs and SIGs**

### WinnForum Groups

- CC SCA Advisory Counsel
- CC SCA Steering Group
- Cognitive Radio Work Group
- IDL Profiles Improvements Task Group
- International Tactical Radio SIG
- Modeling Language for Mobility Work Group
- Public Safety SIG
- Receiver Performance Guidelines Project Group
- SCA 4.1 AEPs Improvements Task Group
- SCA 4.1 Backwards Compatibility Work Group
- Spectrum Innovation Committee Starring Group
- Spectrum Sharing Annual Report Work Group
- SSRF Standards Development Project Kickoff
- Test and Evaluation Work Group
- Transceiver API Work Group
- Waveform Portability Task Group