



Techno-economic regulatory framework to support CR/DSA

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Outline

- What is COST-TERRA?
- Do regulators need help with CR regulation?
- Regulatory view on promises and challenges of CR
- How we and others could help regulators?

What is COST-TERRA?

- COST = European **CO**operation in **Science** and **Technology**
- COST is an European body to promote international networking for R&D and standardisation
- COST Action IC0905 TERRA “ *Techno-Economic Regulatory framework for Radio spectrum Access for Cognitive Radio/Software Defined Radio*”
- Membership: researchers and practitioners from 16 European countries (as of 2010.11)

In other words...

- COST-TERRA is

*independent Think-Tank with broadly open participation
from academia, industry and regulators*

- Our general aim is

*to bring together technical and economic experts for
spearheading a regulatory break-through for European
development of CR*

COST-TERRA time span

- May 2010 – May 2014
- Two distinct phases:
 - Pre-WRC-2012 – defining the stage and trying to build material that might be useful to progress WRC deliberations, influencing a European Common Proposal for AI 1.19
 - Post-WRC-2012 – completing analysis taking note of WRC decisions on the issue of CR (if any). Input to other regulatory meetings/activities, including assisting in defining the agenda for the next WRC

Do regulators need help?

- Always
- Who generates the input?
 - Industry/market driven
 - CR is still not consumable - there are no really knowledgeable and engaged promoters
 - Academia is good at generating forward-looking ideas but tend to shy away from direct interaction.
- thus our vision – a Think-Tank with mixed participation

CR expectations

- Permanent solution for overcoming the nominal shortage of spectrum
- Streamlined spectrum management processes: regulator becomes *ex post* market overseer rather than having to take a difficult *ex ante* decision on which aspiring technology is worth getting spectrum and which not
- Users get new services with better QoS
- Improved and softly expandable service coverage
- Smart interference avoidance through adaptive learning and self-healing mechanisms of CR

CR regulatory challenges

- The definition of true CR – with cognition and learning?
- Keeping pace with evolving markets
- Alleviating interference concerns
- Appropriate type-approval mechanism, security concerns:
 - how to ensure CR radios behave properly?
 - how to ensure CR radios do not encroach on each other e.g. by unfairly claiming/hoarding spectrum?
- Charging for spectrum use (in licensed bands)?
- Avoiding new “junk bands” like the current 2.4 GHz
- Distorting competition by providing “free” services of similar nature as those for which operators paid big money: 2G/3G, BWA/WiMAX/LTE/LTE+?

How to address the challenges

- Resolving critical challenges will require “thinking outside the box”
- The basic regulatory tool-box is not likely to change dramatically, still relying on premises of:
 - light licensing (like current WSD regulation)
 - licence exempt with “good neighbour” rules
 - self-certified type approval for radio apparatus, etc.
- However the solution to CR challenges might require tweaking or combining the above tools in innovative ways



Creating markets & ecosystems

- Technical capabilities
 - DSA, suitable form factors, power usage
- Products/services
 - Use cases, business models, application development
- Regulatory support
 - Spectrum
 - Innovation zones with early-adopters & test users
 - Licencing
 - Commons
 - Private commons
 - Light licensing – Dutch and Irish examples
 - Incentive auctions
 - More...

Socio-economic impact

- Why it is important:
 - legal obligation in some cases
 - A good modern practice of public management
- Making CR consumable
- Three inter-related domains of Policy, Technology and Market,
 - Exceptional opportunity for policy makers to lead the development by providing catalyst measures

Some examples

- Automated, on -demand means
 - addresses charging, interference and other concerns
- Secondary trading akin to a stock exchange:
 - addresses charging, user rights management, etc.
- Combination of licence-exempt and light-licensing regimes depending on type of device, type of services:
 - allows targeted elimination of concerns for most critical components
 - Trade, lease, combine, fragment, revoke, time-share,

Current view on CR

- The CR represents particularly challenging task for regulators
- CR has many edges to it:
 - bears significant promises for regulators and users at large, yet
 - has even more challenges hampering practical implementation, and moreover
 - would provide a disruptive change to the entire basis for spectrum management operations
- Worst of all: there appear to be no true CR champions in either manufacturing or business camps. Do we have chicken-and-egg situation between CR policy and business solutions?

Most urgent tasks in our view

- Cataloguing and categorising CR Use Cases:
 - bridging “technical system configuration” and “business cases” scenario planning
- Considering impact of CR Licensing Schemes:
 - how the choice of licensing regime impacts scenarios?
- Co-existence issues:
 - innovative techniques in PHY to improve co-existence
 - “good-neighbour” protocol strategies, etc., etc.
- Urgency to feed back some of early findings into:
 - regulatory processes (incl. ongoing WSD regulation)
 - ITU WRC-2012 preparatory processes

How to help?

- Join COST-TERRA ☺
- Ramp-up policy research to help regulators to get it done quickly, and to get it right from the first time:
 - cross-disciplinary research
 - innovative business models
- inter-regional cooperation
- consensus seeking between different stake-holders:
 - policy-makers
 - manufacturing
 - businesses in the wireless market (and related ones)

Further Information and Contacts

- A range of up-to-date information on the COST Action IC0905 TERRA is available at its web site:

www.cost-terra.org

- COST IC0905 Contacts:

- Chair: Arturas Medeisis, medeisis@cost-terra.org
- Vice-Chair: Oliver Holland, holland@cost-terra.org
- WG1 Chair: Luca de Nardis, denardis@cost-terra.org
- WG2 Chair: Fernando Velez, velez@cost-terra.org
- WG3 Chair: Keith Nolan, nolan@cost-terra.org



APPENDIX WITH SELECTION OF REFERENCE SLIDES

Track-record of CR rule-making

- So far only White-spaces solution has been maturing – WS is not true CR thus its regulation represents but only partial solution to the challenge
- Fruitless time gap in US since the first WS ruling in 2008, hoping that the second ruling of September 2010 will help restarting the process
- In Europe serious considerations started after WRC-07 and gathered speed only by 2009, so far the focus had been on WSD solution
- Preparations for WRC-2012 AI 1.19 (Res.956): Europe goes for NOC proposal, echoed by CPM report. Possible after-studies...

Conclusions

- CR represents extremely challenging case for policy-makers yet the coordinated research could help in formulating credible regulatory solution
- Once established, the CR regulatory policy might become a catalyst to guide the strategic development of novel CR technologies
- WRC-2012 - plant the seeds for the future through WRC-12 taking relevant resolutions or retaining Res. 956 for the next cycle

Thank you!

- *For more information on COST-TERRA:*

www.cost-terra.org

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What is European Cooperation in Science and Technology (COST)?

- An inter-governmental framework for European cooperation, allowing the coordination of nationally-funded research on a European level
- Primarily European, but also has involvement of countries with which there are reciprocal agreements, as well as other “non-COST” countries considered on an action-by-action basis
- COST, together with EUREKA and the EU framework programmes, is one of the three pillars of joint European research initiatives. These three complementary structures have differing “competence” areas
- The focus of COST is on networking, i.e. providing coordination of national as well as international research initiatives

Project timetable

	2010				2011				WRC 2012	2012				2013/2014			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		Q1	Q2	Q3	Q4				
Kick-off MC meeting		X															
MC meetings			X		X	X		X			X		X		X		X
WG1 meetings			X		X	X		X			X		X				
WG2 meetings			X		X	X		X			X		X		X		
WG3 meetings					X	X		X			X		X		X		
WG4 meetings								X			X		X		X		X
Public workshops						W		W					W				W
Website update		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

COST-TERRA Issues (Fair- 2010)

- Cataloguing and categorising CR Use Cases
- Considering impact of CR Licensing Schemes
- Co-existence issues
- Feeding back some of early ideas/findings

Cataloguing CR use cases

- It is important to catalogue and categorise the various CR Use and Business Cases:
 - different classes of use and business cases:
 - depending on licensing scheme
 - depending on who keeps the infrastructure
 - depending on “who pays” for services/infrastructure maintenance
 - apply tags to categorize use cases
 - seek eventual refinement of CR definition: today multiple definitions exist leading to confusion
- As of today two types of scenario building:
 - technical system configurations (as used in ETSI TC RRS, OneFIT)
 - business development scenarios (as reported by AaltoU)
 - How to map these two to each other?

Impact of Licensing Schemes

- How licensing scheme should interweave into business case and technology modelling:
 - licensed?
 - light-licensed?
 - unlicensed?
- How frequency band access regime come into picture:
 - overlay (“white spaces” concept)?
 - shared dedicated CR bands (ISM bands, commons)?
 - self-managed CR bands?
 - what about “underlay” (UWB-like)? Other innovative combinations?

Co-existence issues

- Mapping needed between ETSI and IEEE coexistence models/approaches?
- Exploring the role of innovative techniques (FBMC, spectrum “sculpting”, else) in physical layer to facilitate co-existence?
- Simultaneous multi-band CR operation?
- Advanced co-existence (e.g. the one employing above methods) modelling in terms of probability of interference estimates?
- Promotion of “self-regulation” / “good-neighbour” protocol concepts?

Feeding back ideas

- Identified feed-back options into various processes:
 - inputs on scenarios and licensing considerations into CEPT WGFM/WGRA CGs as/if/when facilitated by the ECC Liaison officer (K. Buckwitz)
 - inputs to ITU WRC-2012 process may be considered at the next meeting (facilitator M. Bellanger)
 - inputs to WInnF through the ad hoc Task Group (facilitator K. Nolan)
 - providing models/concepts into SEAMCAT development processes – long term objective

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