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ITRE WORKSHOP

Towards an efficient exploitation of spectrum in the EU: technical, social, cultural and economic perspectives

Date: 1st April 2008, 15.00 – 18.00

Venue: European Parliament - Brussels - Room ASP 5G2

Draft Programme

15:00 Welcome and opening – Rapporteur MEP Catherine Trautmann

Part 1: The international radio regulations: which margin of manouvre does the EU have to introduce reforms?

15:10 Presentation by **Mike Goddard**
CEPT Representative and International Radio Regulatory Expert

- How should EU harmonisation be pursued to comply with ITU frequency plans? Are the mandates to CEPT sufficient to ensure compliance? What reforms could be introduced to improve flexibility while ensuring compliance?
- To what extent is the principle of technology and service neutrality compatible with frequency planning? In which bands could this approach be workable?
- Is spectrum trading a solution to improve aflexible usage of spectrum?

15:25 Debate: questions and answers session

Part 2: Spectrum optimisation: managing interference in a digital context

15:55 Presentation by **Jochen Mezger**
Institute für Rundfunktechnik

- What means 'harmful interference' in a digital context? How should interference be handled in a digital world? What can digital technologies offer to combat interference?
- How to plan spectrum to avoid interference while maximising usage? Are bands more suitable for certain type of services? Is clustering of services a viable solution for maximising the benefits of the digital dividend?

16:10 Debate: questions and answers session

Part 3: Economic regulation of spectrum

16:40 Presentation by **Gerard Pogorel**
Professor of Economics and Management at TELECOM ParisTech

- How to assign spectrum in an economic and social efficent way? How to assess the cost/benefit of alternative uses of spectrum?
- Under which conditions is the market better placed (technology and service neutrality) to drive spectrum allocation? When does spectrum harmonisation make more economic and social sense?
- How to develop an efficient and flexible spectrum market? Are spectrum trading and review of authorisations appropriate means?
- What are the advantages and drabacks of individual licences vs general authorisations? What are the prospects for licence-exempt spectrum on a non-interference basis?

16:55 Debate: questions and answers session

Part 4: An enhanced EU coordination role in spectrum?

17:25 Contribution by the panellists and debate

- How to regulate spectrum-based pan-European services?
- Should the Commission grant EU authorisations or define common authorisations procedures?
- Should the EU speak with one voice in international spectrum organisations?

Conclusions

17: 40 Closing remarks – Rapporteur MEP Catherine Trautmann

Organised by the Policy Department A and the ITRE Secretariat, in partnership with ETEPS.

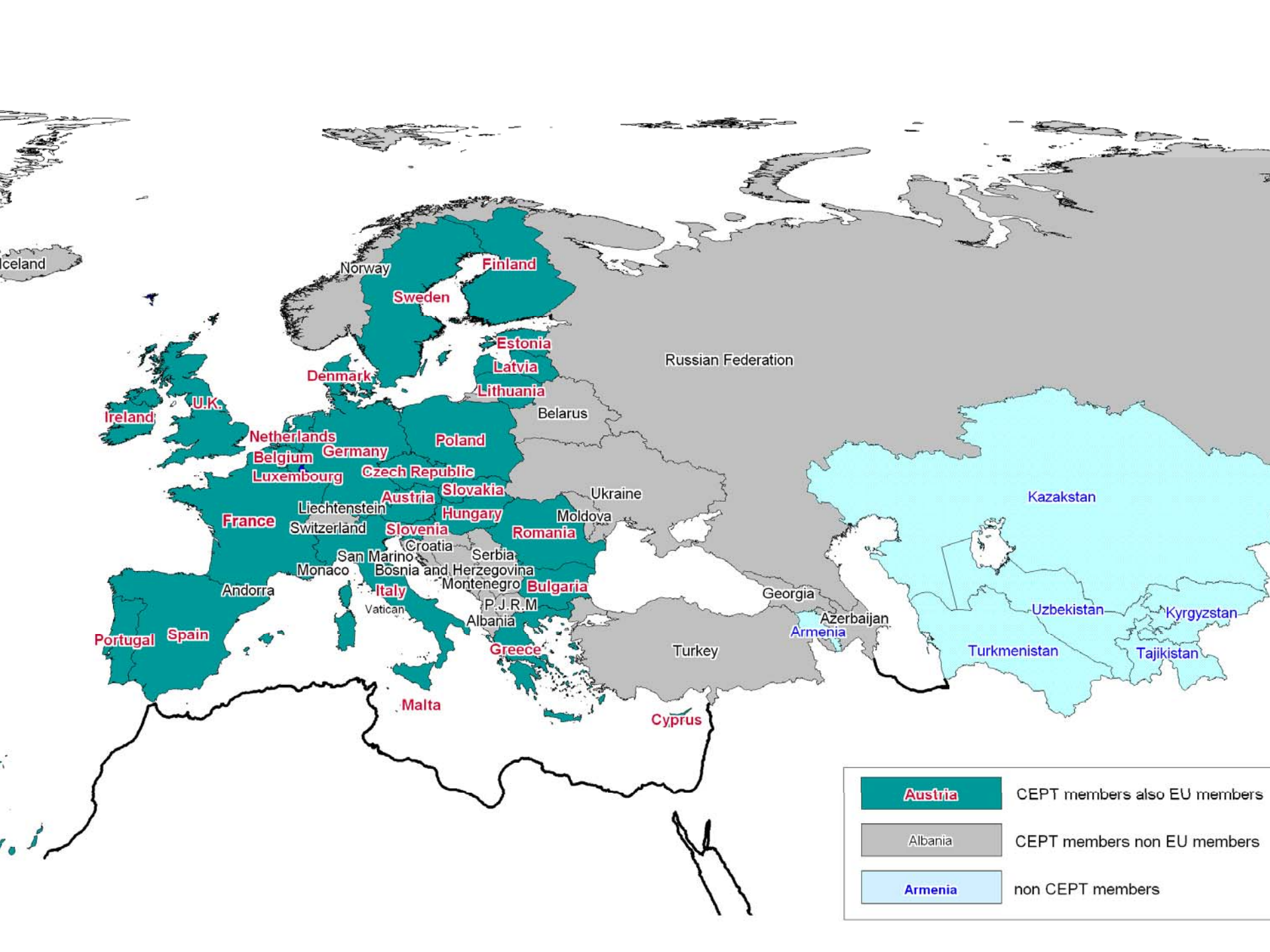
International radio regulatory framework

Michael Goddard

On behalf of CEPT

CEPT

- European Conference of Postal and Telecommunications Administrations
- 48 members (*Albania, Andorra, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, The Former Yugoslav Republic of Macedonia, Turkey, Ukraine, United Kingdom, Vatican.*)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Bulgaria
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Italy
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Georgia
Azerbaijan
Armenia
Uzbekistan
Kyrgyzstan
Portugal
Spain
Greece
Turkey
Turkmenistan
Tajikistan
Malta
Cyprus
Austria
CEPT members also EU members
Albania
CEPT members non EU members
Armenia
non CEPT members

Electronic Communications Committee (ECC) of CEPT

The mission of the Electronic Communications Committee (ECC)

- consider and develop common electronic communications regulatory policies in a European context, taking account of European and international legislation and regulations;
- forward plan and harmonise within Europe the efficient use of the radio spectrum, satellite orbits and numbering resources, so as to satisfy requirements of users and industry;
- promote the interest of Europe on a world-wide basis in the preparations for ITU fora;
- encourage deregulation and liberalisation;
- foster the process of free circulation of radiocommunication equipment to support the development of an open and competitive market.

Recent activities

- Coordinated preparation for ITU Regional Radio Conference to plan for digital broadcasting (conference initiated by European countries)
- Coordination for ITU World Radio Conference
- Responses to EU Radio Spectrum Committee mandates, e.g. on WAPECS (spectrum flexibility), Digital dividend, UWB (ultra wideband), 2.6 GHz, (BWA) Broadband Wireless Access, etc…
- Revision of CEPT Agreement on “L-band” spectrum to facilitate different uses
- Specific issues of common interest in CEPT, e.g. interference to radio astronomy from mobile-satellite systems, free circulation decisions, etc

ITU/Europe

- ITU sets global framework through International Radio Regulations (RRs - an international treaty)
- RRs govern relationship between countries – there is considerable freedom at national/regional level (reinforced in ITU Constitution)
- RRs do not generally specify frequency use in detail – for example allocations are made to the “Mobile” service, with no distinction between civil and defence applications, public or private systems, and no specific technology identified
- Many frequency allocations provide flexibility by providing for more than one radio service (eg Fixed and Mobile)
- At all ITU conferences since 1992, EU Member States have entered a declaration stating that they will only implement the RRs insofar as they are consistent with EU treaties.

ITU/Europe – planned bands

- Some frequency bands are specified in more detail through *a priori* frequency plans (eg for digital television broadcasting at the Geneva 2006 Regional Radio Conference)
- But even then there is freedom to operate systems with other technical characteristics
- At the GE-06 broadcasting planning conference, all EU countries (and many others) signed a declaration to extend this flexibility
- However, once plans have been adopted, there is limited scope for significant changes – this has implications for harmonising digital dividend spectrum

ITU/Europe - Summary

- The international framework provides a considerable degree of flexibility for action at European level – particularly for terrestrial communication services (fixed, mobile, broadcasting) in the most valuable frequency range
- Constraints are more severe for other services – e.g. satellite services, aeronautical and and maritime communications and navigation (radar)
- The next ITU World Radio Conference will consider the issue of further flexibility at the global level (based on CEPT proposal)
- CEPT will always take account of the ITU dimension in their responses to EC mandates
- Hence European spectrum decisions are consistent with ITU regulations

Technology and service neutrality

- CEPT is moving progressively in the direction of technology and service neutrality
- Based on the principles adopted by the EU Radio Spectrum Policy Group (WAPECS Opinion), CEPT is developing technical criteria on a technology and to some extent service/application-neutral basis for specific important frequency bands
- Challenge is to maximise flexibility while retaining sufficient control to minimise interference risks and cross-border issues
- The application of these principles is more straightforward in “new” frequency allocations, e.g.:
  - “3G expansion band” at 2.6 GHz
  - Broadband wireless band at 3.4 GHz
  - Digital dividend spectrum

Spectrum Trading

- Spectrum trading by itself does not necessarily improve flexibility in spectrum use
- It should however ease access to the spectrum and lead to more intensive (hence more valuable) use of the spectrum
- Increased flexibility will be provided if the licences to be traded are technology and service neutral, or if licence conditions can be relaxed (liberalisation)
- Would also promote innovation and competition

Conclusions

- ITU framework does not in general constrain move to flexibility in Europe
- CEPT has embraced technology neutrality and is progressively moving towards application/service neutrality
- CEPT effectively prepares for ITU conferences and represents a much wider Europe than the EU
- But is more needed in terms of policy direction?

Questions?

Die Kostenträger finden Sie auch auf der Homepage unter den Favoriten.

We design the future
- with you and for you!

Spectrum Optimisation: Managing Interference in a Digital Context

Jochen Mezger
General Manager
Program Distribution

Interference – is this really an issue?

Incoming call awaiting

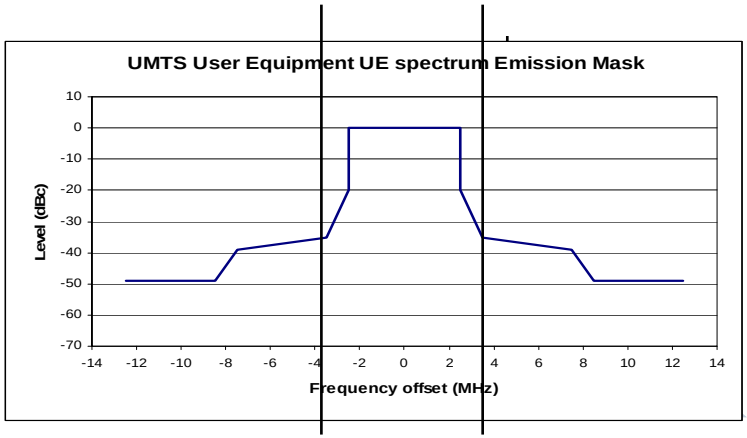
Bip bip … bip bip

In an FM radio, you can hear an incoming call, before your cell phone is ringing

Mobile Transmitters in the home area of DVB-T receivers make DVB-T reception impossible

What is the issue about Interference?

Transmitters emit signals for physical reasons outside the intended frequency range (band) regardless of transmission technology



Emission level depends on implementation

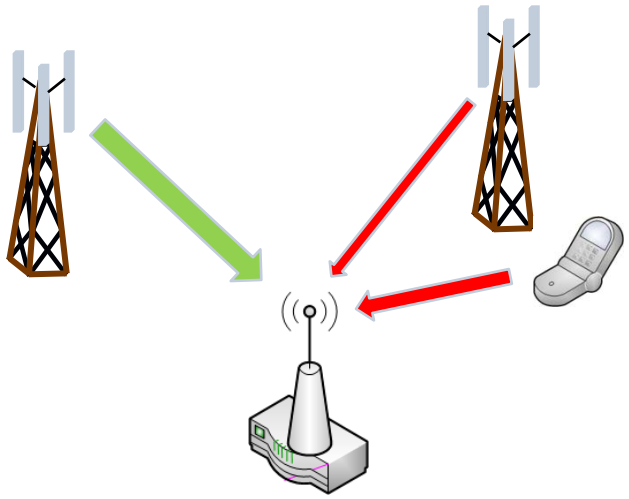
- groundlevel broadcast transmitters suppress out-of band emissions almost to the physically possible minimum
- mass market products (mobile phones) trade-off suppression level with production cost

→ out-of-band emission typically significantly higher compared to broadcasters transmitters (in relation to the transmitted power)

→ interference level highest in adjacent channels, but do not ignore harmonics!

→ Mobiles appear in large volumes in small areas

The Impact of Interference in Digital Networks



powersum of all interferers below a threshold
→ no degradation of service quality

powersum of all interferers exceeds threshold
→ immediate interruption of service

User expectations
- broadcast services show no interruption at all
- interruption of communication services is accepted to a certain extend

Options to counter Interference

ONLY by careful frequency management and network planning

- Within a technology (DVB-T/H or UMTS)
  → account for interference levels of transmitters of same technology
- From other technologies
  → international definition of maximum tolerable interferer levels
  → introduction of guard bands to keep technologies as much apart as possible
- Guidelines for receiver manufacturers for adjacent channel immunity

Technology-neutral harmonization can not solve the problems of interference

Adjacent channel interference – Can separating bands help out?

Sometimes a „reasonable“ guard band is sufficient
when it can be practically implemented without loosing efficiency
„**DVB-H in GSM-Handsets should be below channel 55“**

Sometimes a reasonable guard band is **not** suffcient
increase distance between victim receiver and interferer
GSM near a speaker

Sometimes a reasonable guard band is **no**t sufficient
increase distance between victim receiver and interferer is **not** suffcient
switch off the interferer!
GSM in Planes
UMTS Uplink on cable networks?

The case „UMTS Uplink Interferer on DVB-T Portable Indoor“ has still to be precisely determined!

Different subbands for Mobile TV and fixed TV Why segregate what belongs together?

- DVB-H/ MEDIAFLO have the same physical structure as DVB-T
  - There is no need for a sub band

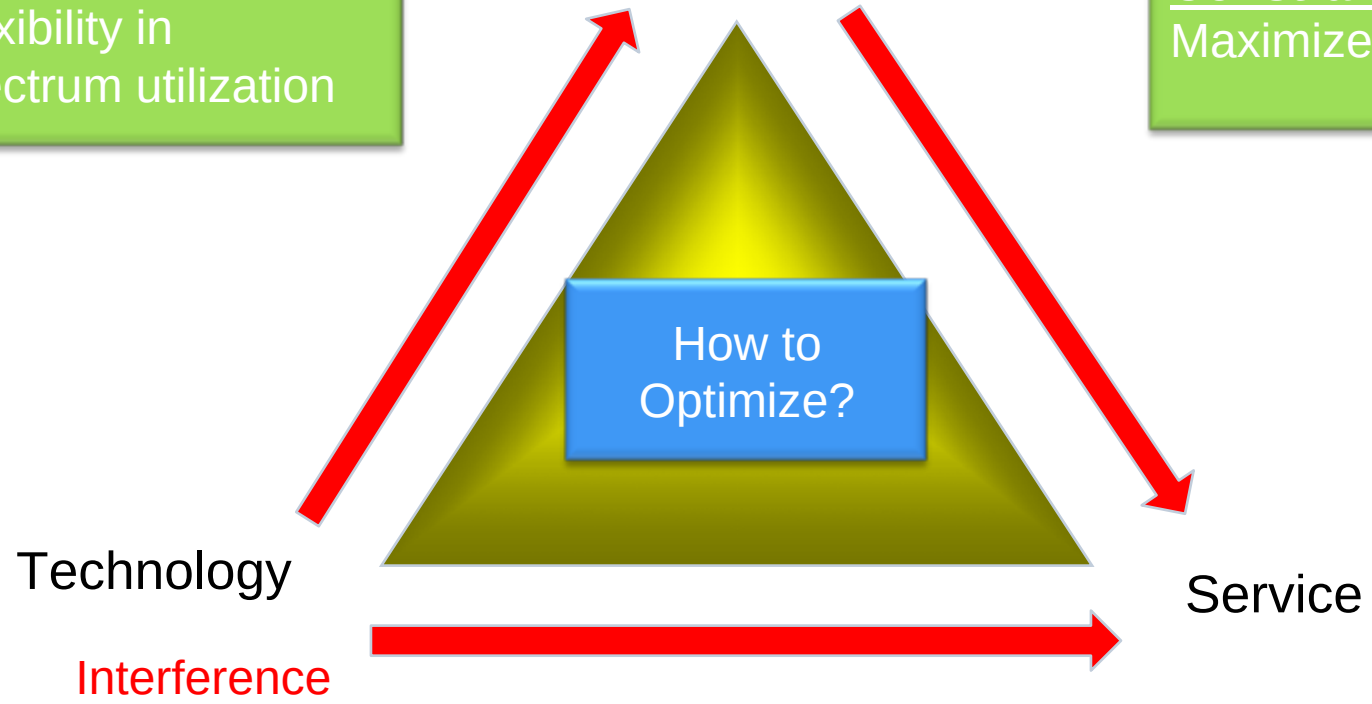
- Subband is only beneficial before a roll out
  - Should we wait until 2012?
  - DVB-H roll out is happening or has already happened (I, F,D,FIN,A,B)
- Different markets have different needs for mobile TV/ DTTV
  - What is the optimal bandwidth?
- Convergence between portable/Fixed TV and mobile TV is already reality
  - portable media players with DVB-T
  - USB sticks
  - New UMTS/DVB-T appear on the Market (e.g. TwinTV or LG or VODAFONE)

Flexibility and Maximum Efficiency ….
…. in the Context of Interference

Goal:
Flexibility in spectrum utilization

Spectrum planning

Constraint:
Maximize efficiency



Service-Neutrality

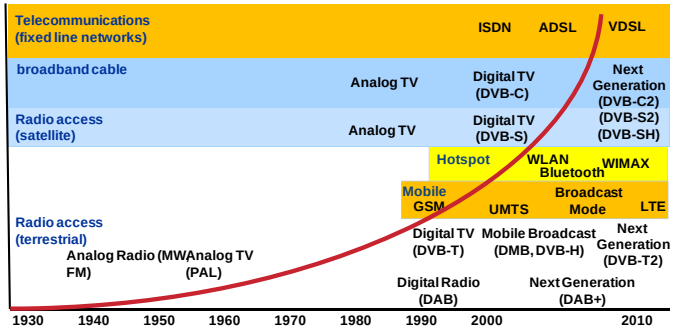
Network technology gets more and more independent of services

- UMTS → communications network
  - integrates high speed data downlink (HSDPA) and broadcast mode (MBMS)
- WIMAX → HotSpot technology (wireless DSL), bidirectional communications
  - supports mobility and in principle also broadcast

BUT

- All wireless networks of today are designed for a particular service
  - despite MBMS MNOs eye on DVB-H
- For economical reasons
  - design constraints (e.g. coverage) are fundamentally different between a broadcast and a communications network
  - design constraints differ from country to country (topology, population density and population spread, constitutional requirements, etc.) (mobile networks are designed independently for each nation)

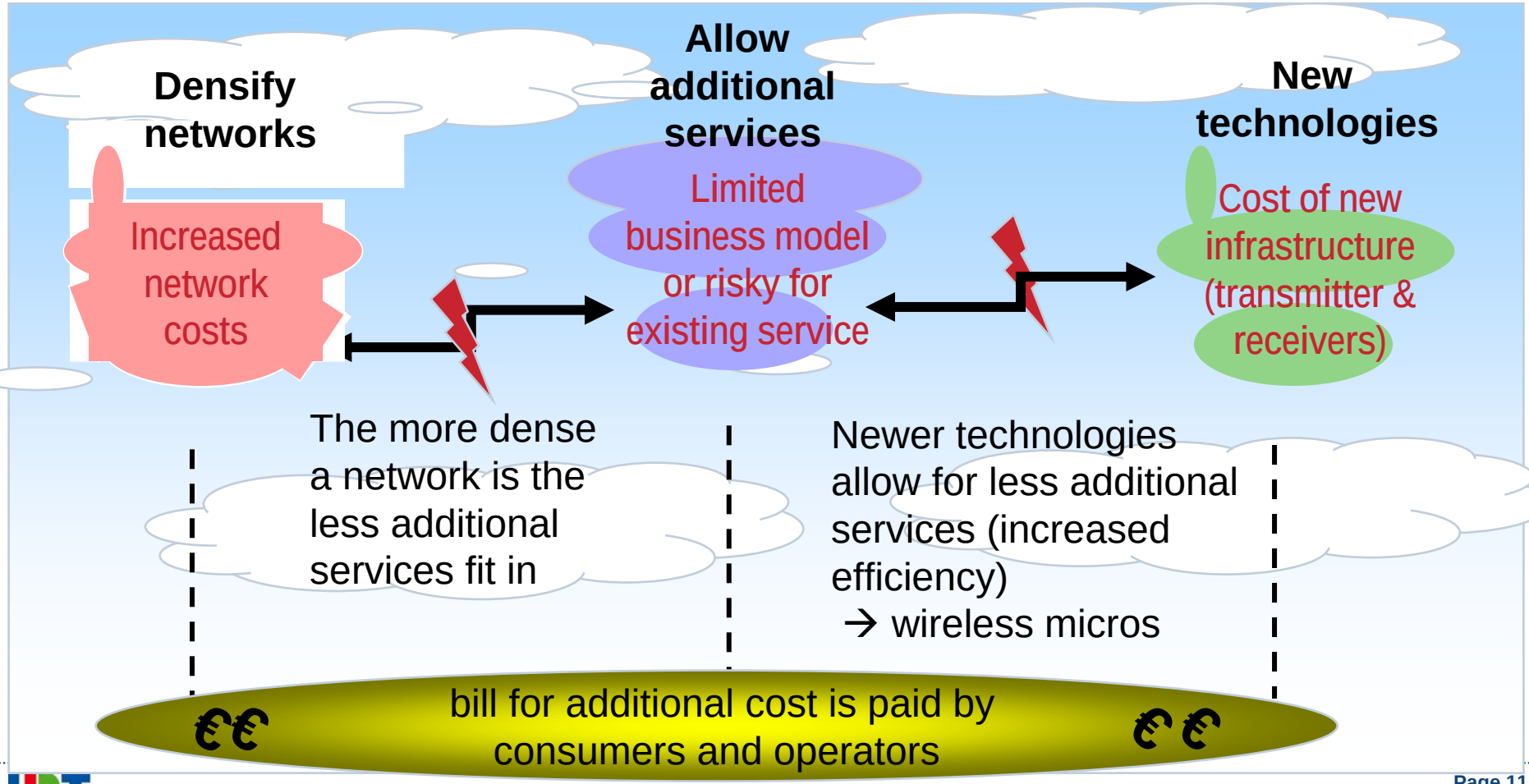
Technology-Neutrality



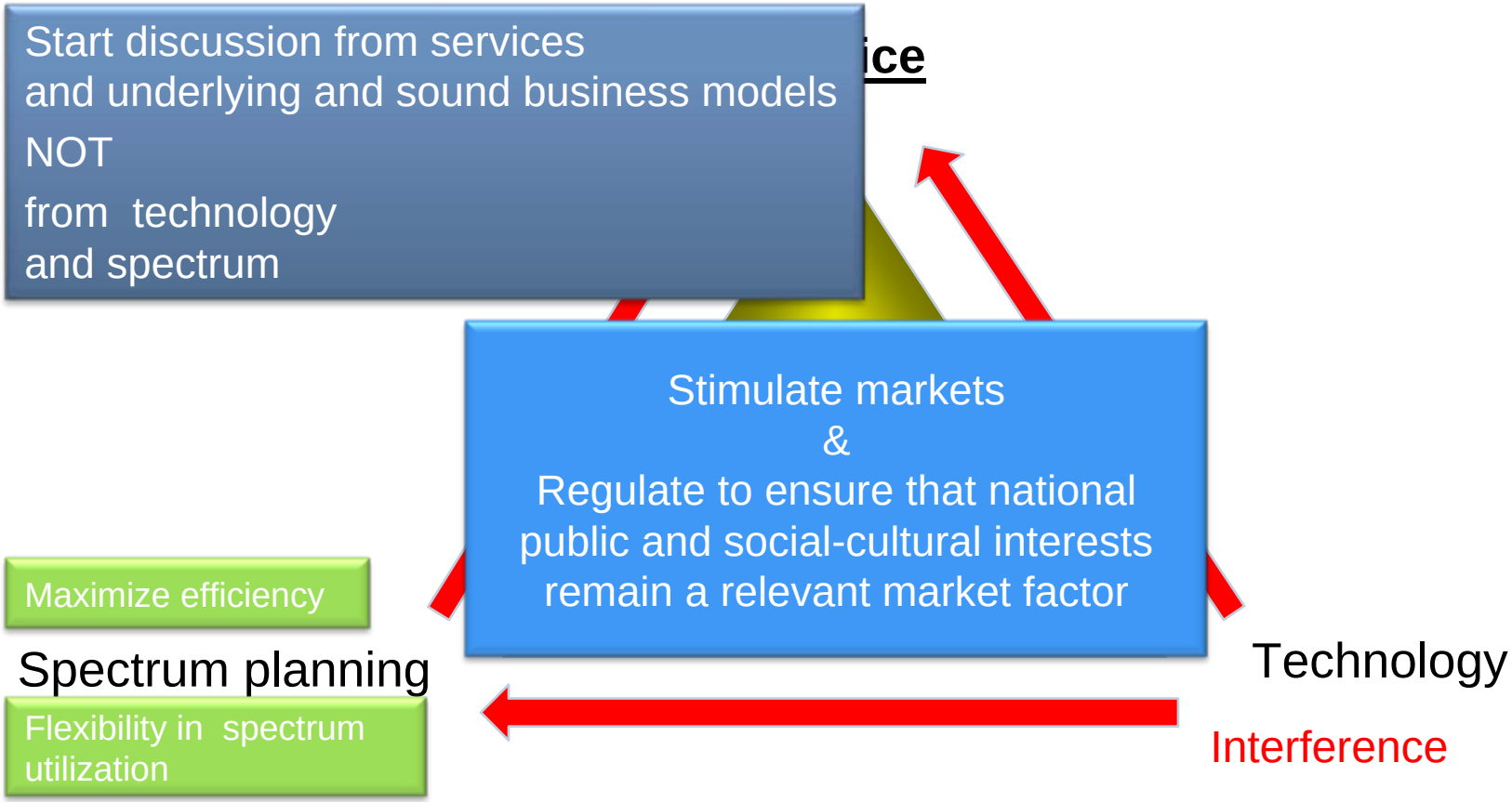
- Technology develops rapidly
  - much faster than at the advent of GSM 1990
  - no one can foresee the options in 5 years
- Established infrastructure is operational for a very long time (GSM beyond 2020)
  (problem of huge amounts of legacy devices in the market)
- Technology is selected such, that a <u>business model</u> can optimally be implemented (maximize profit)
  - Business models have to be driven by **services** accepted by the consumer

<u>Attention:</u>
Public services and socio-cultural services follow different rules
→ Serve everybody, no profit, cultural diversity

Increasing Spectrum Efficiency versus Flexibility



Flexibility and Maximum Efficiency ….
…. will always be a trade-off and costs money



Consequences of EU-Wide-Clustering in the UHF as a binding decision

Harmonization allows higher efficiency due
- Less constraints and specifications
- Simplified frequency planning and interference management

Amount of resources for the applications **frozen** both in time and the whole EU:
- each country has to fit his requirement and needs in the sub band plan
- future evolution in technology is complicated to implement (no flexibility in time)

- Harmonization should be compliant with aims outside EU to facilitate export, economies of scale and coordination
- CEPT / ITU (WRCs) are the best tools for this!
- Wouldn‘t be a **recommendation instead of a binding decision** be the „**perfect“ compromise**?

? How to generate the sub-bands with minimal impact on GE06 for all countries? ?

Conclusions

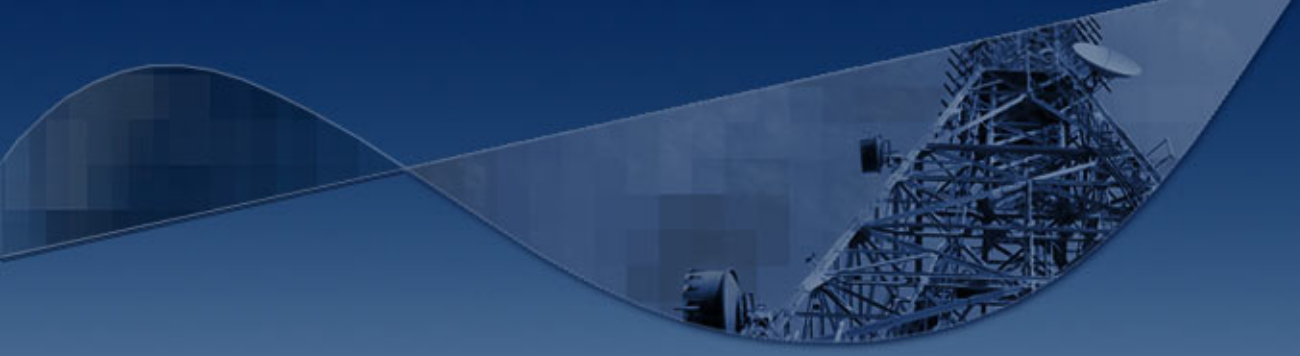
Interference is a physical effect spectrum planning and management has to account for

Consumer expectations make broadcast services most sensitive to interference → service interruption

Increase of flexibility and maximize efficiency is always a trade-off and will cost money

stimulate competition in the market for the sake of compelling and economical attractive services to all European citizens.

ensure that national public and socio-cultural interests remain a relevant market factor



Thank you for your attention!

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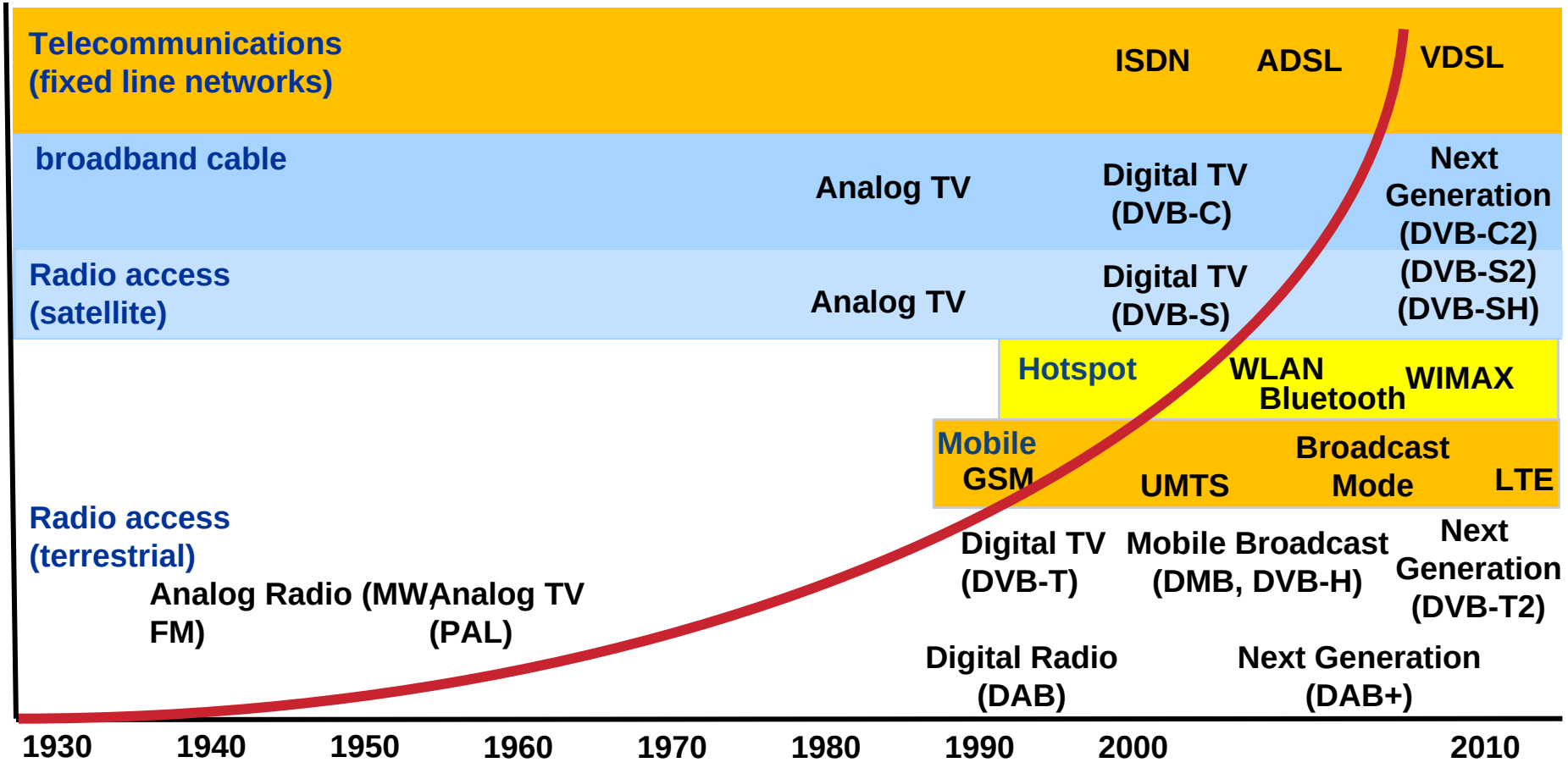
Digital Distribution Links in Europe



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ITRE WORKSHOP

Towards an efficient exploitation of spectrum in the EU: technical, social, cultural and economic perspectives

European Parliament - Brussels

April 1st, 2008

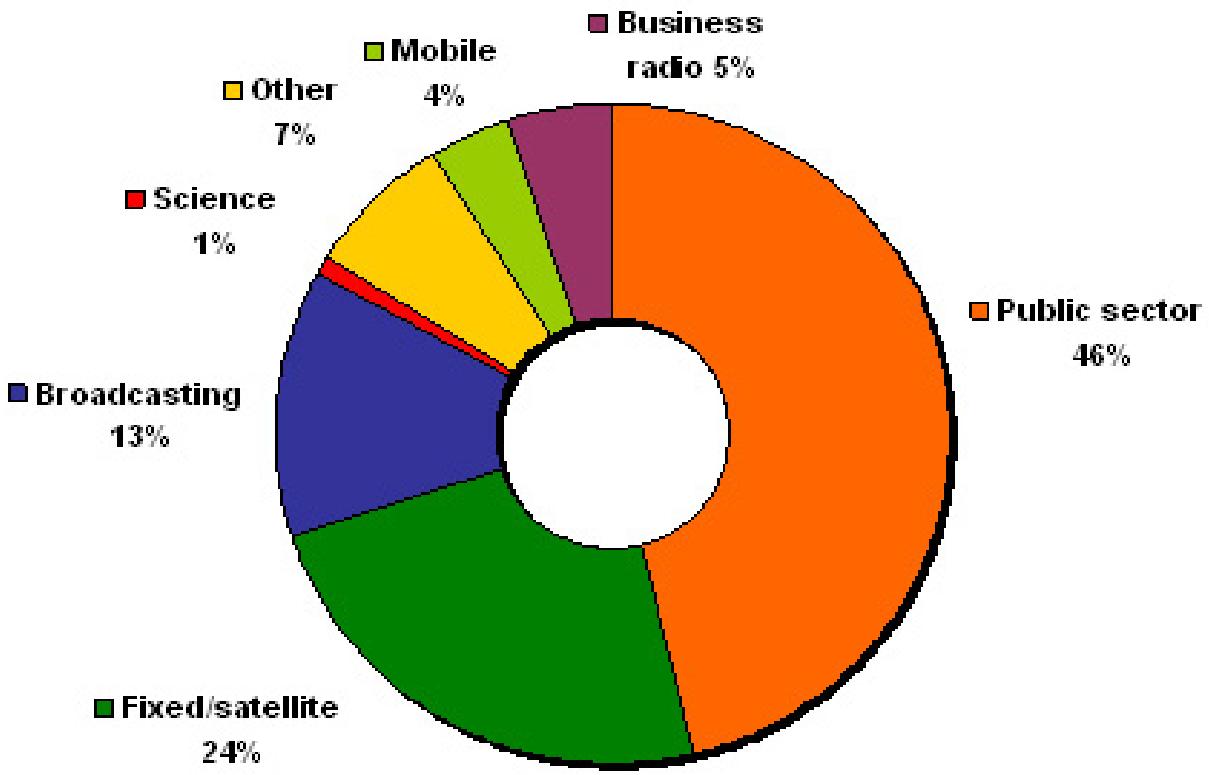
Part 3 : Economic regulation of Spectrum:

« Matching Wireless Clusters with Spectrum Regulation Regimes »

Gérard POGOREL
Professor of Economics
TELECOM ParisTech

1. How to assign spectrum in an economic and social efficient way? How to assess the cost/benefit of alternative uses of spectrum?

Figure 1: Use of UK radio spectrum



Source: Ofcom, 2008

1.b. Differences in rationale among spectrum uses:

Costs are always present

Benefits are not commensurable

First make a distinction between spectrum use categories consistent enough in terms of services for similar rules to apply properly:

Defense, public safety: effectiveness rules apply, i.e. cost minimisation for a determined level of performance to be achieved

Commercial spectrum: efficiency rules (cost-benefit)

Mobile communications: cost-benefit analysis applies under proviso

The case of Broadcasting: can be considered “public”&/or commercial, in reality hybrid

Then, within each spectrum use category, determine the most efficient regime

What management methods do we have?
"standard" 3-mode approach to spectrum management

- FCC Spectrum Task Force 2002
- UK Radio Authority 2002 Report

- Command & Control: administrative management
- Market+ property rights approach
  - Auctions+trading
- Collective use: expanded unlicensed band approach

  - To be combined in varied proportions

This approach has led to:

- Confusion of analytical levels and lack of accuracy in policy definitions
- Ideological oppositions and paralysis of public policy

- Need for a more accurate approach to:
  - define coherent sets of wireless services
  - Assess options
  - apply appropriate management methods to each set
- SPORTVIEWS Research project Results:
  A novel approach to the impact assessment of spectrum management regimes

2. Under which conditions is the market better placed (technology and service neutrality) to drive spectrum allocation? When does spectrum harmonisation make more economic and social sense?

1.c. Four Steps of Spectrum Management Regimes assessment for a specified set of services (cluster)

A. **Allocation of Frequencies to services (Harmonisation?)**
B. **Technology options (Standards?)**
C. **Usage Rights Definition (Exclusive, shared or collective?)**
D. **Assignment Modes (Auctions/Trading, Administrative?)**

Four Steps of Spectrum Management Regimes assessment

STEP 1: Harmonisation vs neutrality of Frequency Allocations?

Harmonisation	Neutrality
• Reduces interferences • Reduces cross-border coordination requirements • Ensures roaming facilities and cross-border mobility • Lower network planning costs and lower prices of devices.	• No inefficiency costs incurred from local or overall suboptimal usage of the resource • Openness to innovation • No administrative costs

Four Steps of Spectrum Management Regimes assessment

STEP 2: Standardisation of terminal an network equipments or technology neutrality?

Standardisation	**Technology Neutrality**
❍Larger production scale =>Lower the costs ❍Adaptive search for best technology time and investment consuming	❍No obstacle to introduction of innovative, unexpected and un-expectable technologies ❍No risk to be stuck with inferior technology

- In total, the trade-off is between, on the plus side, lower costs made possible by economies of scale, on the minus side, potential barriers to entry for innovative new technologies.

Four Steps of Spectrum Management Regimes assessment

Step 3. Usage Rights Definition (Exclusive, shared or collective?)

- Property rights can be:
  - Exclusive (without easements)
  - With easements (Sharing provisions, Overlay -vertical, Underlay – horizontal. Open to DFS, etc.)

- Collective use

Four Steps of Spectrum Management Regimes assessment

STEP 3: Impact assessment of Usage Rights type?

- **Exclusive property rights**

PLUS Side	MINUS Side
❍Fostering efficient use ❍Allowing more actors to have access to the resource ❍With trading, introduce smooth and efficient neutrality	❍Entry barriers in access to non-replicable resources, ❍Fragmentation ❍Hoarding, pre-emption, market dominance, foreclosure of new entrants, in a context of vertical and horizontal integration

Four Dimensions of Spectrum Management Regimes: **STEP 3: Impact assessment of Usage Rights type?**

- **Property rights with easements**

PLUS Side	MINUS Side
Recent advances in low power and dynamic frequency selection (DFS, DySpaN), permitting Sharing, Overlay -vertical, Underlay – horizontal, without harmful interference	Non-clean spectrum. Interferences to be managed

Four Dimensions of Spectrum Management Regimes: **STEP 3: Impact assessment of Usage Rights type?**

Collective use

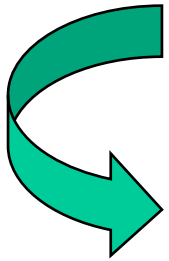
Plus side	*Minus side*
Low entry barriers	
Quickly addresses niche applications	
Certainty of obtaining access	**Technical restrictions and higher risk of interference**
Less demand for licensed spectrum	**Risk that the complexity and cost of devices will be increased**
Innovation (anti-monopoly)	
Public infrastructure	
Freedom of speech/cultural diversity	
Light licensing	
Private commons, Experimental commons	

The EU Study on Collective Use presents an up to date assessment of the extent of this category of usage right.

Four Dimensions of Spectrum Management Regimes: **STEP 3: Impact assessment of Usage Rights type?**

- **Decision-making on Spectrum usage rights**
  - **1/ Maximum extension of collective use**
  - 2/ Technology level: reality and feasibility of “flexible” technologies justifying easements in the property rights category, and collective use
  - 3/ Relevance and institutional acceptability of the property-rights framework

Step 4: Impact assessment of spectrum assignment modes



- **Administrative assignment procedures**
- **Hybrid procedures (mixing financial & social considerations)**
- **Auctions/trading**

Criteria:

- Welfare considerations
- Domestic and international security and policy concerns
- Markets, industry structures, and competition monitoring
- Capturing rents (possibly by maintaining them?)

Variety of possible spectrum management regimes

Frequency Allocation: Harmonisation Or Not **STEP 1**	**Technologies** **Standardisation or not** **STEP 2**	**Usage rights** **STEP 3**	**Spectrum assignment mode** **STEP 4**	**Spectrum Management Regime #**
Harmonised spectrum (no Service neutrality)	Standardisation (no techno neutrality)	Property rights/- Exclusive	a/Administrative Assignment Procedure/Hybrid b/ Auctions/Trading	**1a Standard Command and Control (CC)** **1b Technology Control/Property rights (PR) Market**
		Property rights/with Easements	a/Administrative Assignment Procedure/Hybrid b/ Auctions/Trading	**2a Mitigated CC with easements** **2b Technical CC+ Mitigated Market**
		Collective use		**3 CC Collective**
Harmonised spectrum (no Service neutrality)	Techno neutrality NO Standardisation	Property rights Exclusive	a/Administrative Assignment Procedure/Hybrid b/ Auctions/Trading	**4a Technology neutrality in CC context** **4b Harmonised neutrality**
		Property rights with. Easements	a/ Administrative Assignment Procedure/Hybrid b/ Auctions/Trading	**5a Controlled neutrality** **5b Harmonised neutrality Plus**
		Collective Use		**6 Standard ŌCommonsÓ Regime**
Service neutrality) NO Harmonisation	Techno neutrality NO Standardisation	Property rights Exclusive	a/Administrative Assignment Procedure/Hybrid b/ Auctions/Trading	**7a Administered Neutrality** **7b Pure market regime: libertarian**
		Property rights with. Easements	a/Administrative Assignment Procedure/Hybrid b/ Auctions/Trading	**8a Technology Neutrality/Administered semi-PR Market** **8b Mitigated Market regime: semi-libertarian**
		Collective Use		**9 California Dream**

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3. How to develop an efficient and flexible spectrum market? Are spectrum trading and review of authorisations appropriate means?

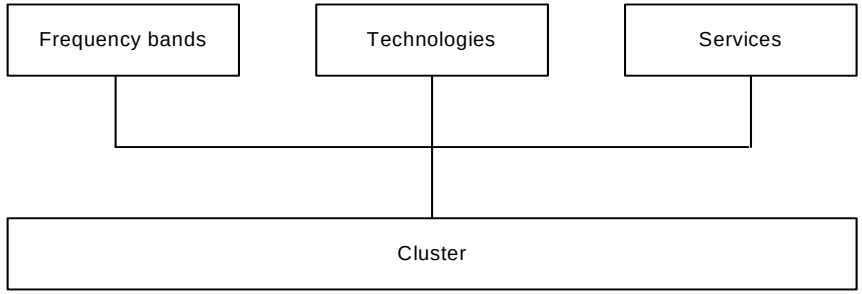
The clusters Approach: Matching Future Radio Frequencies/Technologies/Services

with

Coherent Regimes of Radio Spectrum Management

3.1 Defining wireless clusters

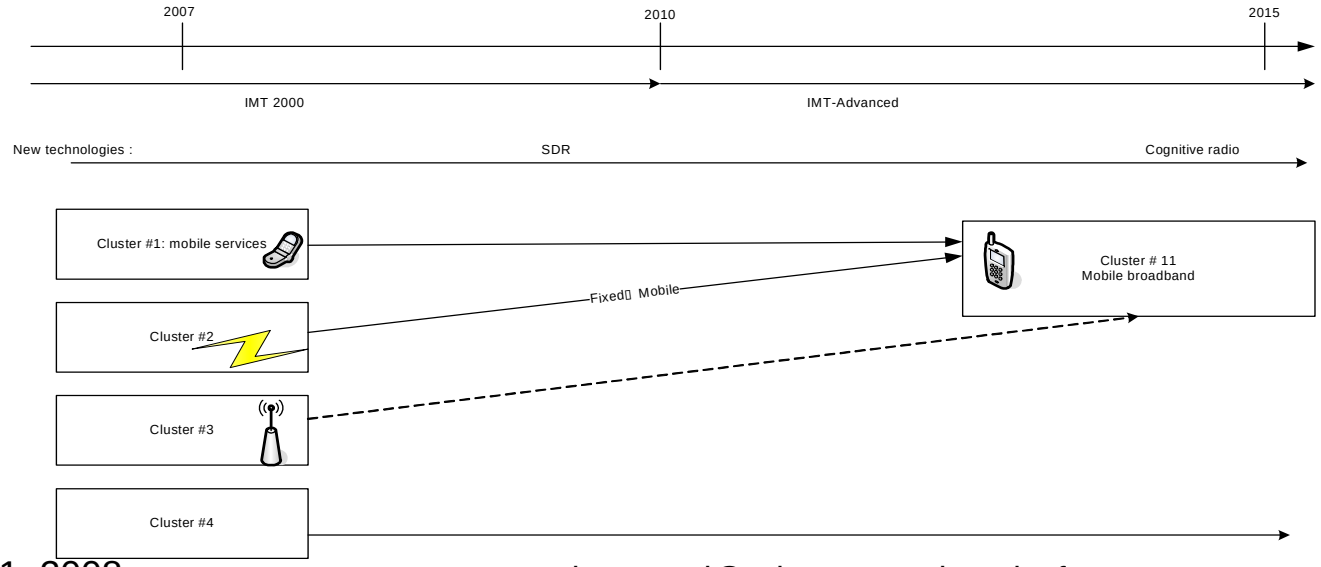
- Given the strong interaction of frequency band, service application, and technology assessment, which constitute the basic foundation of the choice of a spectrum management regime,
- we propose to operate those choices for each “cluster” of consistent and relevant band/service/technology



- The analysis of the spectrum management regimes & transition paths

3.2 Impact Assessment of Alternative Spectrum Management Regimes for wireless clusters

Clusters	Name	Time Frame	Characteristics/Objectives
#1	Mobile & mobile TV	<2012	Global management of mobile services Ensure quality of service in licensed bands
#2	FWA/BWA (Fixed Wireless Access/Broadband Wireless Access)	<2012	Transition from fixed PMP (Point-to-Multipoint) systems to broadband mobile (limited mobility?)
#3	Unlicensed / WLANs	<2015	Collective use – Nomadic access for data and voice
#4	PMR + emergency services		Private Mobile Radio, security applications
#11	Broadband mobile	>2012	FWA (Fixed Wireless Access) becomes mobile and is integrated with Mobile services
#12	Long term	>2015 ?	Introduction of cognitive radio Enable deployment of opportunistic radios



Technological transition must be planned and associated to spectrum management transitions

In a future proof way

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Thank you