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#### Radio Spectrum Management and Ubiquitous Network Societies

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### Radio technologies an Integral Element of Ubiquitous Network Societies

- Mobility
- Wireless



1-Premises of prevalent Spectrum Management principles

- Spectrum scarce
- Administered Allocation and Assignment (AAA) needed to prevent signal interference
- O Public Domain
- Market-Based Extension of Property Rights (ExPR)
- Special conditions to preserve Diversity of Opinions/Cultures (DOC)



### 1-1 Origins of Perceived Scarcity

#### • 30 years ago

 most of the used part of the radio frequency spectrum was reserved for radio and television broadcasting, military purposes and a few professional long-distance civilian links.

#### O The radio technology boom

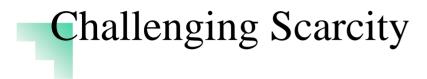
- The progress made in electronics and microprocessors in the last 10 years: a whole new range of products and services made available to the general public:
  - Satellite broadcasting of television and radio programs with digital technology adding increasing quality and choice.
  - Mobile phones, for the main part using GSM technology
  - In the future, satellites will be used for these purposes, which will be of particular benefit to increasingly mobile populations.



# Challenging Scarcity: present spectrum usage

- The real spectrum usage picture
  - The Carnegie-Mellon experiment
  - **The US Survey**
  - ➡ Europe ?





#### • SPECTRALIA Table



### 1-2 Challenging the AAA process

- Marginal challenge
  - Improving the quality of emitters and receivers
- ... or Radical challenge
  - Will
    - market mechanisms

or

- future radio technologies
- make AAA useless ?



# 1-3 Challenging the public domain nature of the frequency spectrum

- Radical Destruction: The full property rights challenge
  - Auctioning off the spectrum
  - privatisation big bang
  - Sunset of regulators
- Radical Extension: The advent of the Commons for
  - Innovation (anti-monopoly)
  - Public infrastructure
  - Freedom of speech/cultural diversity
- Marginal Change: Public Domain often considered of fundamental nature



Preserving some kind of State pre-eminence

## 1-4 Challenging the DOC: Diversity of Opinions/Cultures Framework

- Diversity of Opinions/Cultures
  - Freedom of speech/diversity
  - Government control
  - ...the one providing a rationale for the other
- Convergence and Relevant Market ?
  - Broadcasters only
  - Or: All media, including new
- Financial implications for the media/bradcasting industry



#### Responses: 2-1 market-oriented

- Anything goes: Can market mechanisms foster an efficiency revolution in spectrum usage?
- Auctions
  - **USA PCS 93**
  - Countries in Europe: the UMTS auctions
- The auctions bubble: what bubble? true believers never doubt



# Responses: 2-2 The advent of 802.11x

• The unlicensed band (s)

- The "Commons" Challenge to property
  - ➡ IPRs
  - Spectrum



## 

- New technologies and management methods might change thoroughly the way we look at future spectrum usage:
  - Spectrum trading and clearing (re-allocation)
  - Software defined radio allowing agile radio: dynamic (vs. static) allocation of the spectrum
  - Mesh networks
  - Frequency sharing and hopping
  - Frequency on demand
  - Optimisation of non-permanent uses
  - Increased component (emitter and receiver) resilience and tolerance to interference
- How much flexibility is allowed?



3- What way to the Bright ...

- Omni-Body
- Multi-Service
- Pluri-Network
- A-Topic
- UBIQUITOUS

#### ...Future



# 3-1 Radio Spectrum and market mechanisms: the uneasy alliance

- Let's have the market deal with inefficiencies
- BUT:
  - Solution ⇒ Is it consistent with competitive policy
  - Residual Differences among platforms regulations



#### Caveat about the Competitive Policy Viewpoint

- 1. Competition Economics have their doubts, shortcomings and ambiguities
- 2. They do not prevent having to make heroic assumptions and assessments about future technology and business developments and outcomes
- 3. It combines with already complex issues regarding the whole IT sector, as we can see the multiplicity of actors involved:
  - Public Services
  - Tlc operators and vendors
  - Broadcasters
  - but also actors inventing or reinventing themselves out of contiguous territories (like component suppliers-WIMAX)



#### Risks associated with granting PR?

- High Entry barriers to non-replicable resources: Foreclosure of new entrants
- O Possible market dominance associated with vertical or horizontal integration: can it be controlled?
- Are we creating a potentially harmful situation with no remedies?



# 3-2 Mixing the 3 basic models of spectrum management

- AAA : Administered Allocation/Assignment
- Second Second

#### Through Primary+Secondary markets

Commons: expanded unlicensed band approach



#### The spectrum policy mix ahead:

- A systemic analysis:
- Harmonised
- Flexibility
- ... For Innovation



- Governments: regulators vs cash-strapped budgets
  - The regulatory arm is not always keen on ExPR
  - ➡ If only because, in the end, it makes it redundant
  - The techies sympathise with the unlicensed prowess



- Governments: under the influence of budget needs
  - Welfare considerations
  - Domestic and Int'l Security Concerns
  - Preserving National or regional Champions: to a certain degree
  - Capturing the rents (possibly by maintaining them?)



- Public services
  - Careful but well-inclined to accept spectrum management evolutions



- Broadcasters: free spectrum!
  - ➡ Freedom of speech, diversity of opinions/cultures, argument
  - Strong political clout



- Telecom Operators
  - Have accepted to pay "market" prices in exchange for rentgenerating licences





• What territorial extent the mixed regulatory framework (s)



### Strong International Component

• Caveat: Radio spectrum management is, by its nature, an international affair



#### What paths ahead?

The Harmonised Flexibility Mix

- AAA : Administered Allocation/Assignment
- ExPR: Extension of property rights

Through Primary+Secondary markets

• Commons: expanded unlicensed band approach



#### Future Radio technologies diffusion rate

	Scenario 1	Scenario 2
Scenarios and strategies for the decade ahead	Advent of flexible use technologies	No significant diff. In trend with present technology mix
ExPR Strategy	LOW	MEDIUM
Policy-Mix Strategy	HIGH	MEDIUM



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#### Risk of regulatory inconsistencies

Is a policy mixing the 3 Regimes sustainable?

- Potential competition between Wireless services of all sorts in the various frequency bands benefiting from diverse (paying or not paying) conditions
- 2. Potential competition between Wireless services of all sorts and services in the same market(s) provided on other platform
- 3. UMTS vs. WiFi (orWIMAX)



# Questions for You... Variables and uncertainty areas

- Networks: Feasibility and timeframe of future radio technologies
- Services: scale and scope of marketable services
- Spectrum management methods: Optimality and Actors strategies





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