

# **DYNAMIC SPECTRUM USE AND USABILITY**

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# DYNAMIC ?

- New spectrum usages are continuously emerging
  - Yesterday : non-gso satellites, cellular technologies, RLAN...
  - Today : UWB, fixed-mobile convergent systems, combined satellite-terrestrial systems ...
- Spectrum management has to be responsive to usage evolution and technological development
- Spectrum efficiency remains a goal for a scarce resource

# TOOLS FOR ENHANCING DYNAMIC SPECTRUM USE

- Unlicensed equipment and new sharing solutions:
  - New commons bands
  - Underlay systems
  - Cognitive Radio
  - Software Defined Radio
- Introduction of market mechanisms
  - Secondary trading
  - Auctions
  - More flexible authorization conditions : technology neutrality, service neutrality, relaxed technical conditions

# UNDERLAY SOLUTIONS

- Underlaying an application increase spectrum sharing and efficiency
- Underlay solutions have been used for years :
  - Non-GSO satellites to protect GSO orbit
  - RLANs in radar bands
  - Radiomicrophone in TV bands
- Technological development in cognitive radios and UWB will enable further underlay sharing
- However, there are some limitations :
  - Underlay solutions can be perceived as « a regulator dream and a manufacturer nightmare »
  - Many examples where underlay solutions were not proved workable or efficient
  - Underlay application may prevent the evolution of the primary application

# SOFTWARE DEFINED RADIOS

- This is an open radio architecture rather than a regulatory spectrum management solution
- Flexibility is more for the manufacturers and operators : evolution of radio interface, dynamic network reconfiguration, roaming
- “SDR will not obviate the need for harmonized frequency arrangements, nor reduce the need for spectrum policy”
- However, regulation, in particular for placing equipment on the market will have to adapt

# SECONDARY TRADING

- Spectrum trading is a tool to simplify transfer of spectrum rights without or with limited intervention from the NRA
- So far, very low number of transactions in countries having implemented spectrum trading : therefore, no hoarding, no anti-competitive behaviour ...
- Real risk is to act cautiousless in a dogmatic approach just for the sake of fostering secondary trading : *de jure* harmonisation was the basis for GSM success and removal of technical constraints can lead to Nextel nightmare
- Spectrum use is not to be optimized only from economical standpoint, it has to take into account the overall societal value
- Therefore, France will progressively implement secondary trading, including in FWA bands, and learn from experience

# FLEXIBILITY IN AUTHORIZATIONS

- Technology neutrality : general principle in spectrum management which has to be balanced when some level of harmonisation is necessary (e.g. GSM/IMT-2000, DVB-T)
- Electronic communication service neutrality : not trying to limit the nature of the signal (TV, voice, data ...)
- Technical conditions : case-by-case balance to be achieved between risk of interference and risk of undue constraints
- Application/service neutrality : mixed-up between a debate on the RR services definition, the issue of convergence, the “reservation” of portion of spectrum for particular applications and the relation between interference level and application nature

# WAPECS

- WAPECS (Wireless Access Policy for Electronic Communications Services) opinion adopted by the Radio Spectrum Policy Group
- WAPECS is not an “application” to which a band is designated, it is a policy to be applied across all bands
  - more flexibility in the conditions of use of spectrum resources for wireless electronic communications, while maintaining harmonisation where necessary within a coherent and spectrally efficient frequency management scheme
  - to ensure consistency across all authorization for specific applications while markets are overlapping (the real challenge for NRAs !)
  - technology neutrality unless justified
  - ECS neutrality (No frequency band should be reserved for the exclusive use of a particular ECS)

# SPECTRUM MASK

- Usual mistake : “any system A being able to comply with the same mask as system B will not create more interference to adjacent blocks than system B”
- Interference results from many parameters : spectrum mask, receiver characteristics, deployment and antenna characteristics, intermodulation ...
- Spectrum mask concept can only be applied in simple cases or at a price of spectrum efficiency loss or interference rise

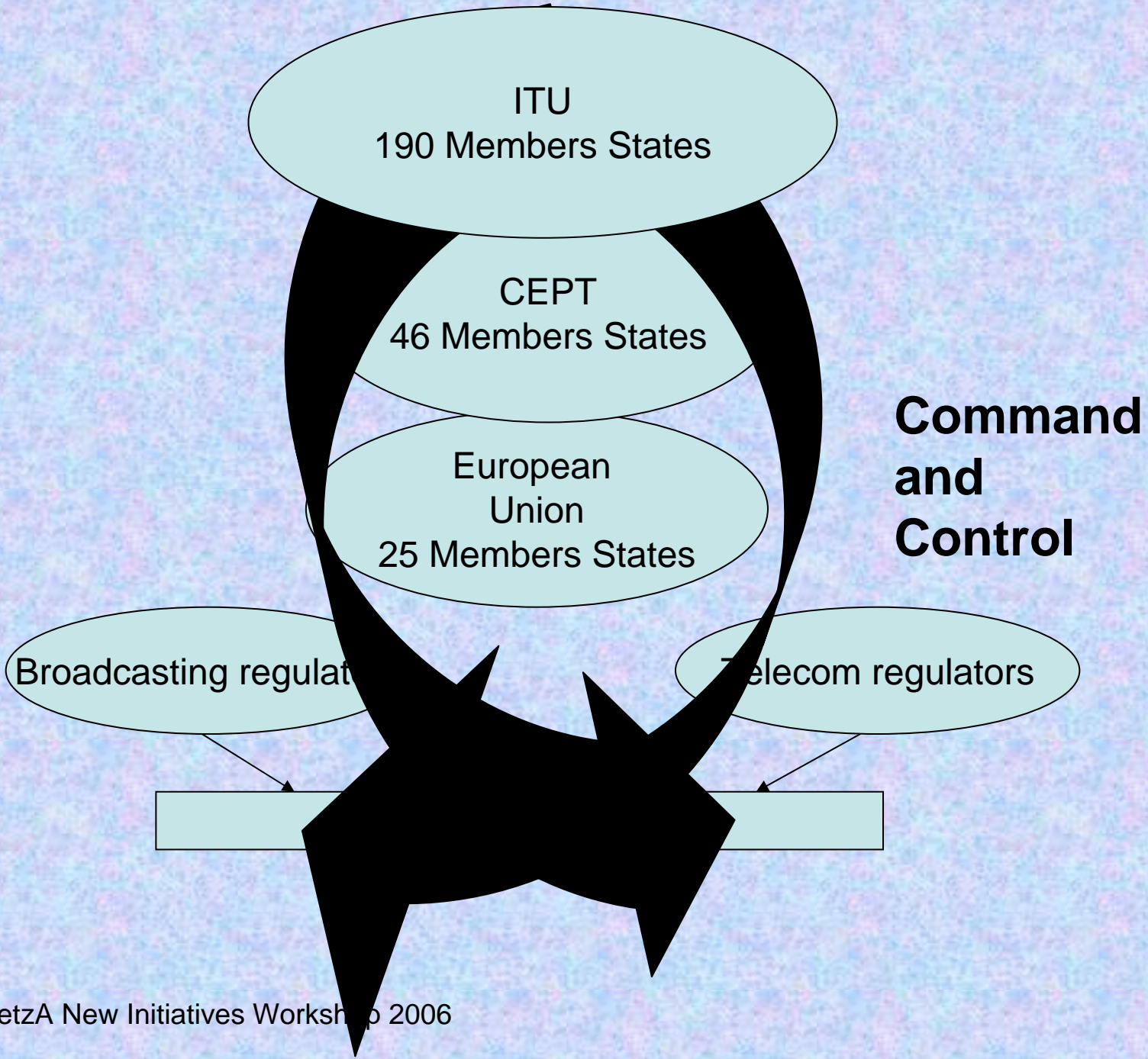
# SPECTRUM USAGE RIGHTS

- Current OFCOM consultation : very detailed and globalizing technical analysis
- Attempt to generalize technical conditions for limiting interference : in-band, out-of-band and neighbouring areas
- Leaving possibility for negotiations : similar to existing situation in GSM or FWA bands
- However :
  - Complex to define and to apply
  - Conditions will be based on assumed characteristics of interfering and interfered systems

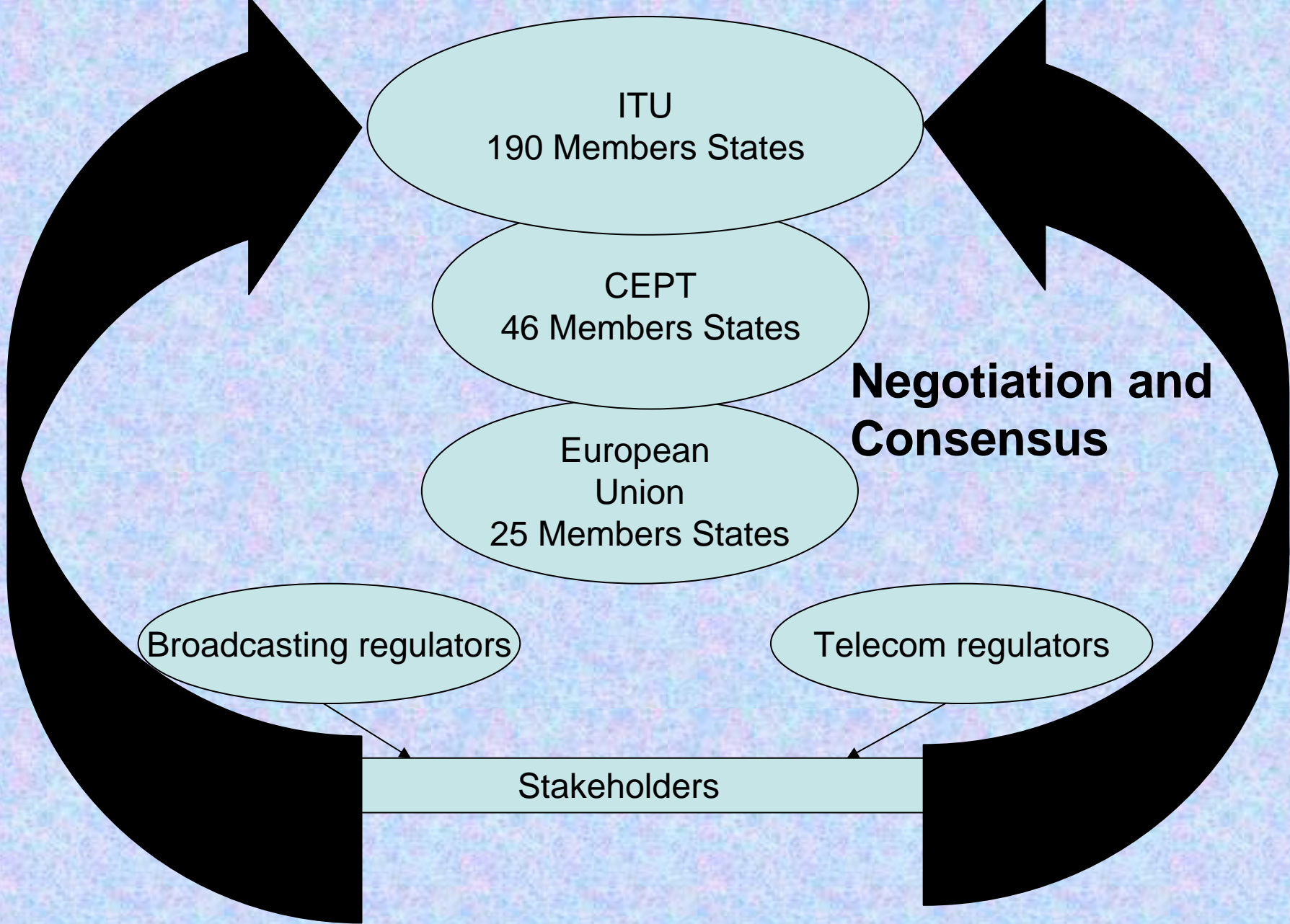
# INTERNATIONAL AGREEMENTS

- ITU, CEPT, EU, Bilateral, in decreasing level of geographical size and of technical details
- First goal is to ensure the absence of interference between countries :
  - International coverage : satellite, HF, high power transmitters, aeronautical, maritime ...
  - Cross-border coordination
  - Difficulty to control placing to the market and use
- Second goal is harmonisation
  - Global market and economies of scale
  - Roaming and worldwide services
  - Increasing competition on terminals and services

# **One perception of spectrum management**



**And another one**



# CONCLUSION

- What is at stake is not the spectrum management model, but rather the way to accommodate emerging technologies and meet users demand
- « Command and control » is not a solution
- Top-down flexibility may discourage innovation and lead in some cases to interference nightmare scenarios and loss of spectrum efficiency
- Permanent negotiation and consensus is the right flexible model to adapt to dynamic evolution of spectrum usage