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14th Global Symposium for Regulators
Capitalizing on the potential of the digital world

New Frontiers in Spectrum Licensing

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The views expressed in this presentation are those of the author and do not necessarily reflect the opinions of the ITU or its Membership.

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Overview

- Finding more spectrum for wireless broadband
- The evolution of spectrum licensing
- Sharing: gaining more access to “less” spectrum
- Technology enablers
- Licensing experimentation
- International and national exploration and implementation

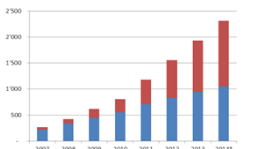
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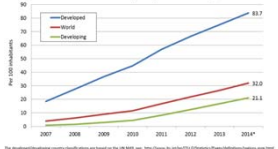
Regulators under Pressure

- ITU-R WP 5D generated an estimate of 1.34 GHz up to 1.96 GHz of total spectrum for IMT
- Broadband’s “sweet spot” is under 6 GHz
 - AI 1.1 at WRC-15 is examining IMT & RLAN options


Growth of active mobile-broadband subscriptions (millions)



Active mobile-broadband subscriptions per 100 inhabitants, 2007-2014



Note: * Estimates
Source: ITU World Telecommunication /ICT Indicators database

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Traditional Models of Spectrum Licensing

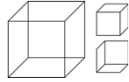
- Administrative Licensing
 - Typically for public sector or when there are not too many applicants for available spectrum
- Flexible Rights of Use
 - Commercial licenses, often by auction, and increasingly service/technology neutral and flexible
- License-exempt
 - Pioneered for RLANs (Wi-Fi), low-power & short range devices

PRAGMATISM RULES!



Spectrum Sharing

- A legacy of analogies:
 - Spectrum = land
 - Spectrum = a "cube"
 - Spectrum = a glass full of ice
- These analogies are simplistic
- It's about technology and physics:
 - Transmitter power levels, duty cycles
 - Antenna & main beam directionality
 - Receiver robustness, filters & masks, etc.



Sharing Techniques

- Frequency-based sharing
 - Re-channelization & guard bands
 - Spectrum trading, disaggregation, band managers (in limited numbers of countries)
 - Re-farming
- Time-based sharing
 - Using duty cycles or night/day alternation
- Geographic-based sharing
 - Exclusion zones
- Regulators use licensing to:
 - Set technical requirements, limit interference



Technology Sharing Enablers

- Small cells (pico, femto, micro)
- Smart Antenna systems -- MIMO
- Database systems
- Dynamic Spectrum Access (Sensing)
 - Dynamic Frequency Selection (DFS)
 - Employed in limited bands
 - Cognitive Radio Systems (CRS) –
 - Only in research stage
 - Technical barriers remain to any deployment



Experiments in Licensing

- Blurring lines between licensed and license-exempt
- Operator data offloading
- TV white spaces
- Licensed shared access (LSA)
- Satellite auxiliary terrestrial component (ATC)



Dorse



Many experiments involve hybrids of traditional licensing approaches



International & National Exploration

- Studies in ITU-R Study Groups
 - WP 5A (land mobile) – CRS reports
 - WP 1B (spectrum management) – DSA report
 - Preparation for WRC-15
- TVWS trials
 - Kenya, South Africa
- Regulatory experimentation
 - US, UK, Canada

TVWS and DSA are not allocations; systems must comply with international rules and national regulations in the bands where they operate.



Where Do We Go from Here?

- Exploration is ongoing
 - Technological – CRS, database + sensing combinations
 - Regulatory – Enforcement is a big issue
- How widespread are these new techniques?
 - Not all bands or economies may need them
- Can they succeed in granting access to new users without interference?
 - Complexity grows in sharing with mobile, radio-astronomy, radars
- Can national licensing frameworks be adapted?
 - Can access rights be balanced – what about “squatters’ rights”?



Thank You!

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