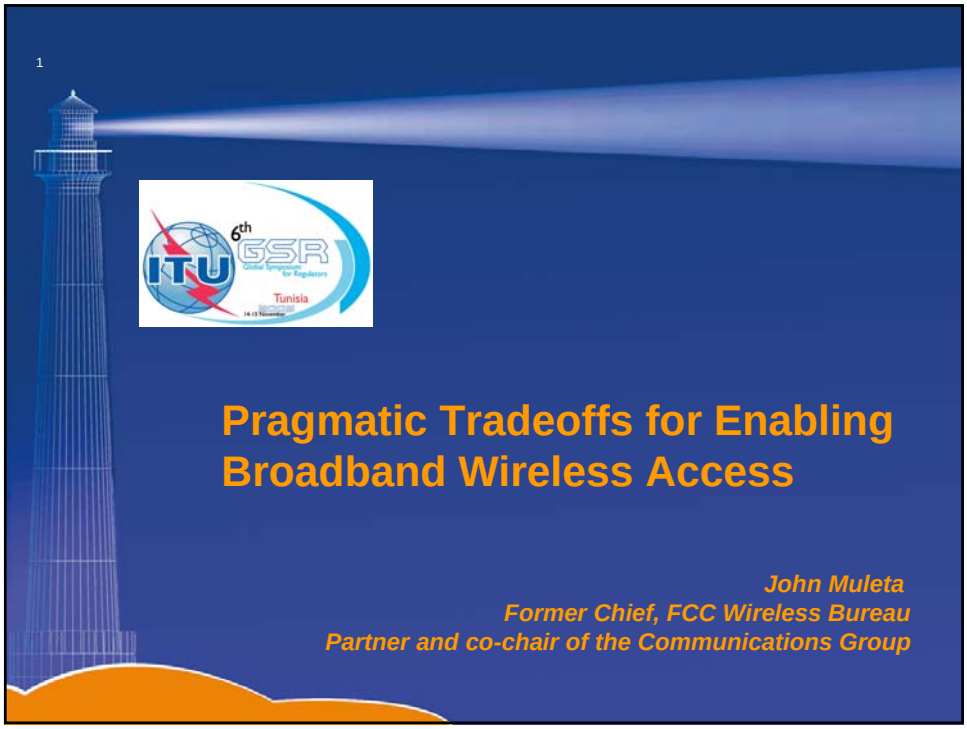

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Regulatory Goals For BWA

- Use spectrum services to increase consumer welfare by enabling "Broadband Everywhere, All the Time"
- Allocate spectrum rights using market mechanisms while avoiding licensees from engaging in uneconomic hoarding of spectrum rights
- Address challenges to the traditional spectrum regulatory models presented by advances in spectrum technology

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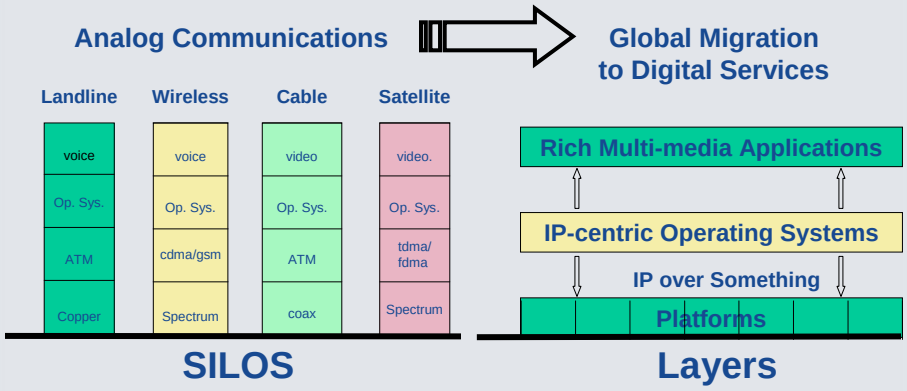
Broadband Wireless will at the Core of Broadband Access As It Provides for Portability and Mobility



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Spectrum Best Practices Lead to Affordable and Rapid BWA Deployment

- Harmonizing spectrum allocation on a global basis to increase economies of scale at product and the service layers and reduce cost to the end-user.
- Fostering the use of standards based technology to increase economies of scale that reduce cost to the end-user.
- Allocating spectrum and developing technical rules that encourage adjacent spectrum users to have compatible technical characteristics as a way of limiting interference and maximize use of spectrum ("good neighbor" policies)
- For shared spectrum bands, encourage or mandate technical standards fostering cooperative systems designed to reduce harmful interference
- Develop efficient and transparent licensing rules and processes that allow for restructuring of incumbent spectrum bands in order to implement harmonization goals.

Spectrum Availability

- Ready availability of spectrum matching BWA needs (good propagation characteristics); ease of transfer from incumbent use and users

Equipment Scale and Affordability

- Scale of Equipment (both base transmitters and consumer equipment) manufacturing allows for BWA affordability

Service Delivery and Management

- Service rules foster use of standards service applications like Internet Protocol (IP) services allowing for scale at the applications

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Current BWA Standards, Technologies, and Frequencies

Technology	Standard	Usage	Throughput	Range	Frequency
UWB	IEEE 802.15	Personal Area Network	110-480 Mbps	Up to 30 feet	4 GHz to 10 GHz
WiFi and HiperLAN 2	IEEE 802.11 & ETSI Standard	Radio Local Area Networks unified with other wireless apps like CDMA and UMTS	Up to 54 Mbps	Up to 300 feet	900 MHz 2.4 GHz 5-5.8 GHz
WiMax	IEEE 802.16d and 802.16e	Radio Metro Area network (fixed and mobile)	Up to 75 Mbp/s on 20 MHz Channels and up to 30 Mbp/s for mobility	4-6 miles for fixed and 1-3 miles for mobility	2.1, 2.3, 2.5-2.6, and 3.5 GHz
W-CDMA, CDMA2000, etc.	IMT-2000	Cellular/Wireless Wide Area Network	Up to 2 Mbps	1-5 miles	700, 800, 1.7, 1.8, 1.9, 2.1, 2.3, 2.8,

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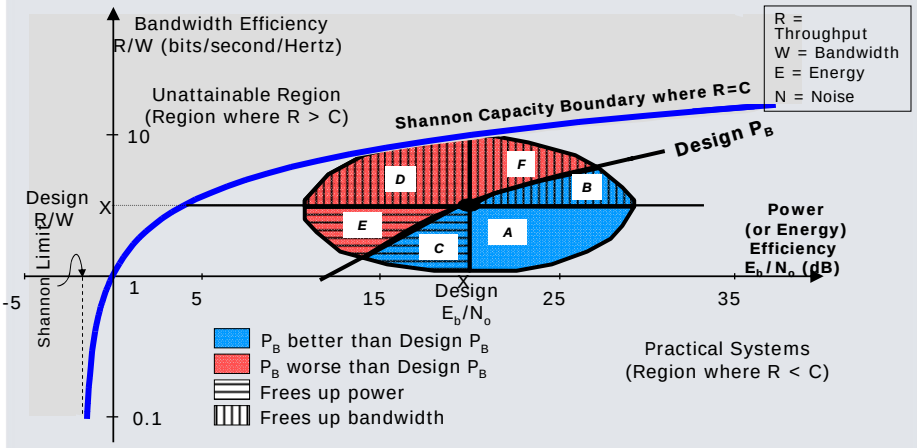
Adding Computing to Radio Breaks Old Regulatory Models



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Current Spectrum Regulatory Models Have Both Benefits and Limits

- **Command and Control Model**
  - Strict operating parameters originally designed for the previous generation of inflexible radio system designs
  - Requires constant intervention from the regulator which could slow innovation and market development
- **Exclusive Model**
  - Exclusive licenses based on geography and spectrum blocks
  - Provides the greatest level of investment certainty
  - Need to provide incentives to encourage build out and avoid spectrum hoarding
- **Unlicensed or License-exempt Model**
  - Benefits driven by standardized equipment and mass manufacturing on a global standard
  - Limitations arise from successful adoption which leads to overcrowding and resulting interference
  - Careful application of power limits and sharing rules should be considered.

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BWA Can Be Achieved By Providing Maximum Flexibility So Long As Two Absolute Conditions Are Met

Provide Flexibility (provides for efficient use)

- Maximum technical and operational autonomy for licensees
- Rapid transition of spectrum to highest and best uses using market forces as much as possible and with the least amount of intervention

Ensure the Possibility of Competition (provides for effective use)

- Competition should always be encouraged and flexibility should not be used to block new entrants
- True even in underserved areas where economic growth from BWA deployment will eventually enable more demand that competition will fill

Enforce Opportunity Costs of Using Spectrum (provides market and economic discipline to licensees and encourages build-out)

- Auctions
- Secondary Markets (trading)
- Power limits
- Sharing Rules
- Economically viable license areas

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Mauritius BWA Case Study

Processes → Key Findings → Results

- Review and audit current spectrum uses within the country
- Review global harmonization efforts and identify key trends to take advantage of;
- Participate in technical and regulatory forums to refine options and understand economic drivers;
- Issue a consultative paper outlining market and spectrum outlook for BWA; Evaluate options and build a record of the consultative process
- Issued allocation decisions within 6 months

- High demand for spectrum and access from Wireless ISPs
- Existing 2.4 GHz band for unlicensed use was congested
- Additional bands were required to promote BWA for use with both licensed and license exempt approaches
- Identified the bands that are harmonized globally for BWA networks
- Needed both technical rule changes and new service rules for new band to meet harmonization efforts

2.4-2.483 GHz EIRP limited to 20 dBm in accordance with ETSI EN 300 328. All existing operators have been given until January 2005 to 20 dBm limit. All existing operators limited to 23 dBm

2.5-2.690 GHz Band open for both BWA and IMT-2000 – Reserved for Mobile and Nomadic BWA systems. TDD, FDD and Hybrid Satellite terrestrial systems permitted; Spectrum licensing required and 5 MHz channelization; 2010 Transition timeline

3.4 – 3.6 GHz Band open for fixed BWA through license registration process. Power limited to 15 W eirp; compliant with ITU-R Rec. F.1488 (allocation blocks formed from the aggregation of 0.25 MHz frequency slots

5.150-5.350 GHz open for indoor use only. Technical characteristics in compliance with Res. 229 WRC-2003 (**5.4-5.8 GHz** Band held back until radar interference resolved).

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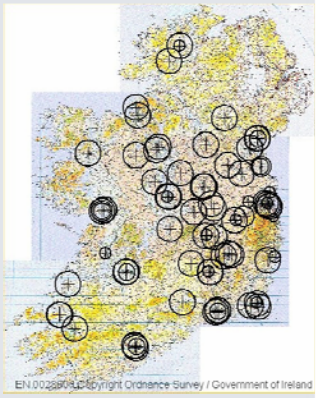
Ireland BWA Case Study

Challenges

- How to enable BWA in rural and underserved areas using fixed microwave systems
- Finding economic incentives for encouraging BWA deployment

Pragmatic Solutions

- Change fixed microwave licenses to 15 km radius with 30 km outer limit for interference purposes; designed to reduce build-out obligations into manageable and economically viable market sizes
- Allow multiple licensees to operate fixed microwave systems through the use of license registration and interference coordination process
- 5.8 GHz band license exempt band allocated with higher power limit (than the EU standard) to increase range and coverage;
- Permit use of point-to-point wireless systems to make more backhaul available for wireless ISP services



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