

Wireless Technology, Spectrum Policy and Rural Network Development

Presentation by
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27 February 2003

Introduction

- Purpose
- Outline
 - Introduction
 - Background
 - Wireless Technology
 - Developments in Spectrum Management
 - Applications in Rural Access
- Introductory Note on Network Architectures

Background

- Nature and Importance of the Spectrum Resource
- Basic Steps in Spectrum Management
 - Allocation
 - Service Rules
 - Assignment
 - Enforcement

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Background

- Pressures on the Resource
 - More users, more uses, greater bandwidths
 - Traditional solutions to spectrum congestion
 - Reallocation
 - Move higher in frequency
 - Increased sharing
 - Improved technology
 - More spectrally efficient technologies (bits/second/Hertz)
 - More frequency reuse
 - Compression

Background

- Challenges to the Current System in the Face of Increasing Demand
 - Excessive rigidity
 - Administrative scarcity
 - Barriers to sharing
 - Voluntary
 - In-voluntary
 - Barriers to other welfare enhancing transactions
- A Note on Spectrum Auctions

Wireless Technology

- Prior Technical Constraints
- Recent Advances
 - Software Defined Radios
 - Adaptive antennas
 - Space-time processing
 - Interference cancellation
 - Space division multiplexing
 - Ad hoc networks
 - “Intelligence at the edge”

Wireless Technology

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Spectrum Management

- Challenges
 - Reducing rigidities in current system
 - Taking advantages of advanced technologies
 - Vision of a more flexible future
- Competing Approaches/Models
 - Property rights model
 - Commons model
 - Command and control/engineering model

Spectrum Management

- Property Rights Model
 - Clearer definition of rights conveyed by license
 - Technical and service flexibility
 - Facilitating private transactions
 - Secondary markets (short and long term leasing)
 - Disaggregation and partitioning
 - Voluntary sharing

Spectrum Management

- Property Rights Model (Cont'd)
 - Interference Temperature Concept
 - Defining interference temperature
 - Underlays below maximum interference temperature
 - Voluntary negotiations to exceed maximum interference temperature
 - Simultaneous private – government auctions

Spectrum Management

- Property Rights Model (Cont'd)
 - Benefits claimed
 - Traditional advantages of decentralized, competitive markets in the allocation and use of scarce resources
 - More specifically, greater flexibility and increased innovation, faster responses to changes in demand and technological developments
 - In short, greater economic yield from the available spectrum

Spectrum Management

- Property Rights Model (Cont'd)
 - Challenges of property rights model
 - Sufficient spectrum available to establish viable market?
 - Spectrum has different degrees of substitutability
 - Sufficient number of buyers and sellers?
 - Strategic behavior by existing licensees
 - Fragmentation in terms of standards

Spectrum Management

- Spectrum Commons Model
 - Notion of a spectrum commons
 - Past examples of spectrum commons
 - Recent success of unlicensed devices/systems/services – e.g., 802.11/HiperLAN

Spectrum Management

- Spectrum Commons Model (Cont'd)
 - The “Myth of Scarcity”
 - Advocates
 - Basis
 - Range/Reuse (Utilizing Techniques Described Earlier)
 - Amount of Spectrum
 - Systems That Scale with Additional Users

Spectrum Management

- Spectrum Commons Model (Cont'd)
 - Benefits Claimed
 - Open, non-proprietary, decentralized platform with intelligence at the edge (internet model)
 - No “gatekeepers”
 - Promotes innovation
 - Scalable, each additional user contributes capacity

Spectrum Management

- Spectrum Commons Model (Cont'd)
 - Challenges
 - Restrictive rules regarding protocols at physical layer
 - Enforcement – avoiding the tragedy of the commons
 - Latency?
- Command and Control/Engineering Model

Spectrum Management

- Applications in Rural Access
 - Spectrum as a policy tool for promoting access
 - Previous experience
 - Technical approaches
 - Cellular technology (e.g., GSM)
 - Wireless Local Loop (e.g., DECT and proprietary) and broadband (e.g., LMDS)
 - Wireless LAN-based (e.g., 802.11b/HiperLAN and extensions)
 - Anecdotes and assessment

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