

# Business Panel: (Academic) Economist Perspective on Spectrum Sharing

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*"Defining the roadmap for communications  
and its impact on adjacent industries."*

# Need to focus on demand for shared spectrum

- Spectrum reform: from C&C → Markets
  - Allocation determined Top down v. Bottom up
  - Market sharing....many (potential) models
  - (C&C: mobile operators wrt their licensed spectrum → consumers)
- Markets have 2-sides
  - Supply: additional spectrum for new allocations?
    - Spectrum hoarding (future needs)
    - Market power (foreclosure of new technologies)
  - Demand: what business wants to use shared spectrum??
    - *(Any business if quality-price trade-off is appropriate...)*
    - BUT, more help so policymakers can see the beef would be nice...
- What is the “good” being traded? Property rights..
  - Right to access (obligation to share)
  - Right to interference protection (obligation to tolerate)

# Willingness/ability to pay for interference protection?

User/Use ...

Interference Protection Rights Needed

	Weak	Strong
High	Unlicensed	C&C, subsidized licensed
Low	Licensed/Unlicensed ??	Licensed

Smart radio systems:  
Greater interference robustness  
More sharing options

Market success:  
More congestion  
Fast innovation

Off-diagonal cases more common? Weak/low or Strong/high

- ❑ Dynamic shared spectrum options
- ❑ Multiple, complementary regulatory options

# Business models for spectrum sharing

*Spectrum access regime*  $\Leftrightarrow$  *Technical Design & Use*

\* Quality: predictability availability, interference protection

\* CAPEX & OPEX (includes cost of acquiring spectrum)

	Non-Cooperative	Cooperative
	Permission of primary user not needed. No explicit coordination. Other signals look like noise.	Permission of primary user needed. Explicit coordination. Other signals recognizable.
Primary Sharing	Unlicensed, e.g., WiFi, Bluetooth  Secondary markets (trading licenses)	Secondary markets, e.g., leasing  <i>Bandwidth Manager (real-time)</i> <i>Closed commons</i>
Secondary Sharing	Easements: -- underlay, e.g. UWB -- overlay, e.g., TV White space (LBT)	<i>Cooperative Mesh</i>

# DSA: more flexible sharing models for future

## Spectrum Markets

Time scale	Real-time $\leftrightarrow$ Special events/emergency $\leftrightarrow$ Investment
What traded	Primary or secondary rights
Administered	Private (NYSE) or Public (T-bill auctions)

Cooperative (contracts) and non-cooperative (easements) sharing between primary and secondary users

What spectrum?

- White space access to broadcast spectrum (location/time)
- Low-power underlays (UWB)
- Preemptible spectrum (govt./public safety sharing)
- etc.

# Need multiplicity of regulatory frameworks

- ❑ Need innovation, but reform happens only slowly. Partially for good reasons (protection of legacy systems, regulatory commitment); and partially for bad reasons (inability to overcome logjams, regulatory inertia)
- ❑ Different models, different economics
  - Strong/weak interference protection
  - Cooperative/non-cooperative sharing models
  - Open v. partially open v. closed access models
  - Predictable v. unpredictable spectrum access needs (burstiness)
- ❑ Examples
  - Opportunistic mobile broadband (upload pictures, download media)
  - Better-than-contracted video
  - Maybe-never access, but when I need it...
  - ????

Thanks

Questions/comments?

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