Interference Avoidance, Infostations and Economics

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WHAT IS WINLAB?

- Academic Research Unit within E&CE
- Strong ties to CS
- 15 Faculty, 40+ Grad students in a trailer
- 5 to 10 year wireless horizon
- Supported by corporate sponsors and Gov't grants
- Recently added Economists to the mix!!

  $\Rightarrow$ **now looking to influence national spectrum policy**

AN INTERESTING OBSERVATION

- Cellular Voice: 10kb/s, $\$V$/minute
- Cost of 1MB Data: $\approx 13V$
  - 30 minutes of MPEG3 music: 30MB — 390v
  - Syncing a disc: 100MB – 1300v
  - A typical powerpoint presentation: 3MB – 39v
- At 1 or 0.1 cents/minute: carefree use unlikely
- 0.1 cents/minute: voice revenue disappears
- NO difference for 3G wireless because 13v is 13v is 13v.

BOLD CLAIM: Cellular can't carry low (enough) cost data

WIRELESS HARDWARE OF YORE

- Clumsy, Fixed Transceivers
- Expensive Equipment
- Little Wireline Infrastructure

SPECTRUM MANAGEMENT OF YORE

- Central Licensing Authority
- Spectrum Police
- Litigation to protect infrastructure investment

WIRELESS HARDWARE TODAY

- Sophisticated signal processing
- Cheap Transceivers
- Agile Transceivers
- Extensive Wireline Infrastructure

What is spectrum management of tomorrow?

LAY OF THE LAND

- Multiple uses and users
- Unpredictable uses
- Multiple manufacturers and service providers
- Irregular network structures

Standards committees meet at sanitariums

A TYPICAL WIRELESS DREAM

- Develop Hardware – spend money
- Roll Out Infrastructure – spend big money
- Roll Out Service – make $(\text{LOTS})^2$ of money (eventually)

OR NIGHTMARE

- Someone else deploys a noise-bomb application
  - Service dies
  - Investment lost

CATCH 22

- Must buy license to preclude noise-bomb
- No idea what license fee is sustainable *a priori*
- Business fails
  - from lack of license
  - from (ignorantly) high bid for license

THE USUAL SCENARIO

- Massive entry costs require deep pockets
- Entry costs preclude many competitors
- Deep pockets require large stable return
  - Carefully assess market
  - Find least common denominator cash cow

Social Cost: service diversity suffers

TOWARDS A SOLUTION: first, an abstraction

- Spectrum as the “Commons”
- Greediness
- Overuse
- Service Degradation

Make the Commons Bigger!