

Networks and Growth

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Yahoo! Research

Networks Critical to Growth

- Mail
- Roads
- Canals, trains
- Telegraph
- Radio
- Telephony
- Electric grid
- Television
- Internet

- All of these involve connecting people
- Transport of goods, people, power and information
- Improve gains from specialization

Government Role

- Governments have played large role
- Theoretical
 - High fixed costs: natural monopoly
 - Substantial external effects
 - Multiple equilibria
 - Rights-of-way and holdup
- Transport and communication similar
 - Both facilitate exploitation of scale economies

Economic Growth

- Education
 - Printing press enabled mass education
 - Expensive, requiring skilled human teachers
- Entry
 - Much innovation from entrants
 - Cannibalization
 - Price competition
 - Major growth engine
 - Transition economy evidence

Facilitating Entry

- Varied set of skills needed
- Entrants often lack many
- Incumbents can build internal
 - Entrants rely on market provision
- Smoothly functioning, competitive supply markets facilitate entry
- Information critical input
 - Market conditions, demand

Facilitating Entry, Continued

- Communications have become a critical facilitator of entry
 - Internet-based businesses
 - Reaching customers, marketing
 - Providing service and support
 - Tracking competition

Providing Network Goods

- Public
- Private
- Publically-subsidized private provision
 - Auctions
- Often optimal to purchase from private sector
 - Foster competition
- Antitrust policy

Removing Entry Barriers

- Rights-of-way
- Multi-sourcing
- Antitrust
- Unbundling

Market Design

- Design rules of the game to further social goals
 - Encourage entry, unbundling
- 1996 Mexican Telecom auctions
- Apply to design of government regulation

Principles of Exchange Design

- Expressive easy
- Strategically simple
- Iterative
- Information
- Transparency
- Exchange neutrality
- Exchange earnings
- Mushing
- Price steps
- Tools
- Economics as an engineering discipline

Mexican Microwave Auctions

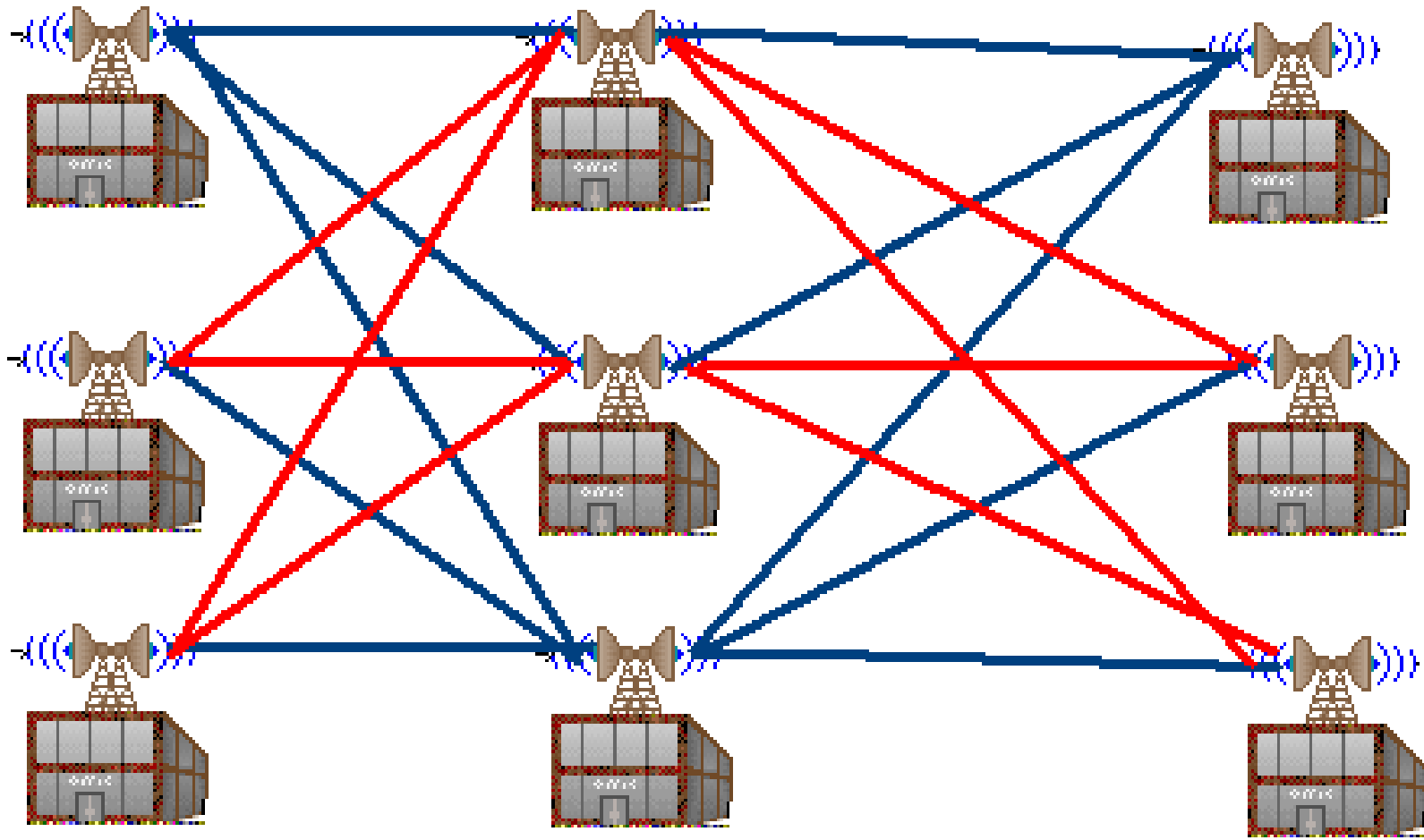
- Problem: gridlock
- Concerns
 - Lack of spectrum
 - Monopolization
 - New Technology
 - Complicated feasible set
 - No pricing of scarce resource
 - Requirement to auction
 - How to price 1,000,000 unique goods?

What Are Microwaves?

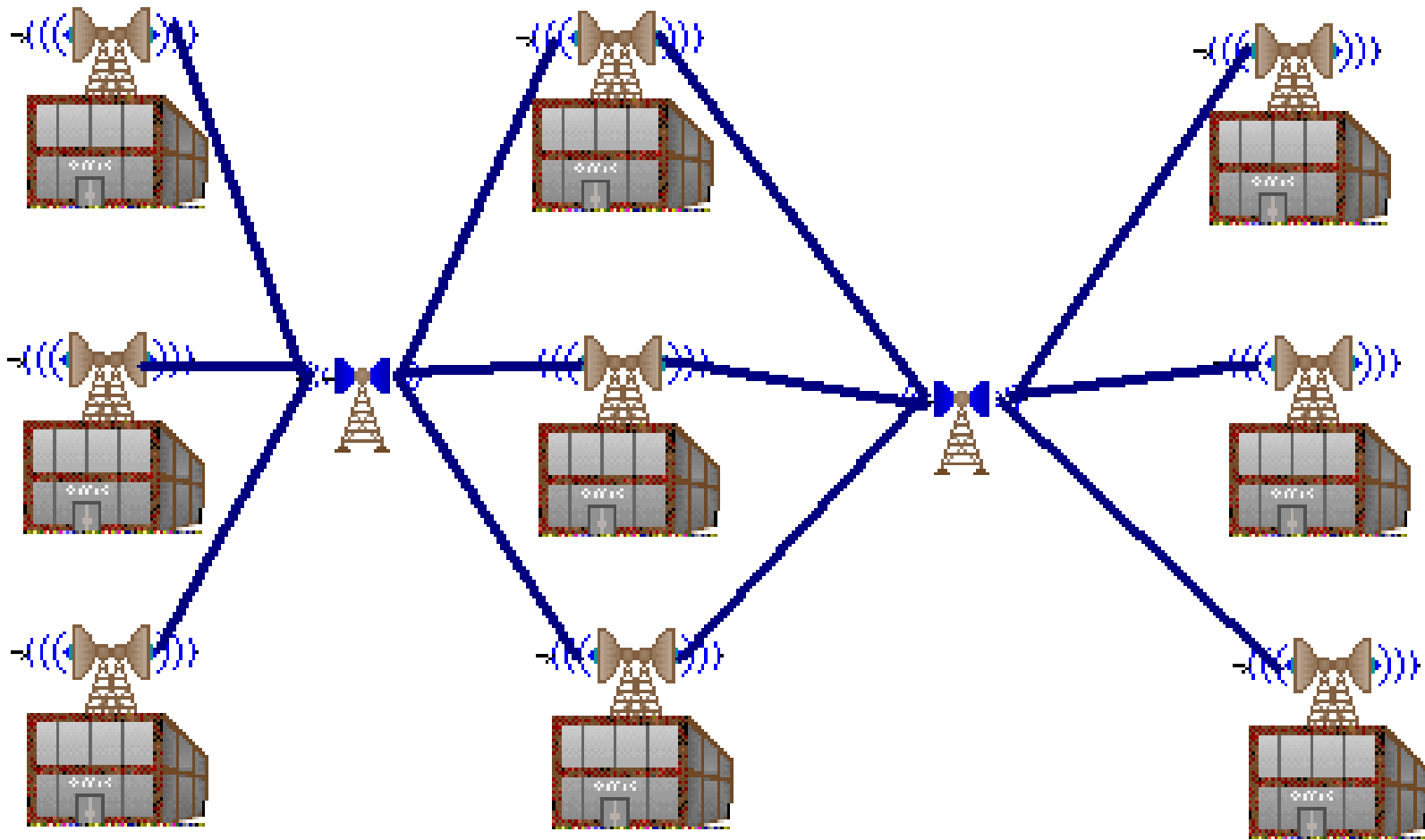
- Microwaves are used for
 - High capacity phone line links
 - Connecting mobile phone towers to the system
 - Line of sight communications
 - Telephone exchange connections
 - Satellite connections
(non-conflicting use)



Point to Point Connections



Point to Multipoint



Solution: Create a Market

- Microwave links are an ideal candidate for deregulation
 - No serious scale economies
 - Sufficient spectrum available to endow many firms
 - Many major users are natural spectrum administrators

Valuations

- Different bands are imperfect substitutes
 - Propagation distance
 - Scatter (size of cone)
 - Volume of data transmission per MHz
- Other substitutes vary
 - Copper wire
 - Fiber optics
 - Satellite link

Licenses Offered

Number of Licenses	Type	Band	Size	Coverage
15	Point to Point	23 GHz	56 MHz	National
10	Point to Point	23 GHz	100 MHz	National
10	Point to Point	15 GHz	56 MHz	National
5 per region	Point to Multipoint	10 GHz	60 MHz	Regional

Auction Design

- Spectrum caps to limit ownership & insure competition in aftermarket
- Ability to create a national footprint using regional licenses
- Round populations to simplify math
 - Squashing

Outcomes

- 14 winners
- Telinor assembled national license
 - all on the same frequency
- Telmex assembled nine regions
 - all but one on the same frequency.

Outcomes, Continued

- The results suggest that spectrum caps were rarely binding.
- Raised US \$100M
- National cheaper than DF
- Market continues to be vibrant

Conclusions

- Keys to growth: education and entry
- Transport and communications are critical infrastructure for development
- Markets are powerful forces
- Outcomes not always satisfactory
- Market design is a new technology for creating good outcomes in markets
- Harness the power of markets yet bend them to accomplish social goals

Conclusions, Soundbite

What running water did for public health, the internet does for the mind. It would be a shame if this revolution in public goods, and the huge increase in worker skills and economic efficiency these public goods promise, was lost for monopoly profits.