Mobile Broadband Growth, Spectrum Scarcity, and Sustainable Competition

John Chapin

john.chapin@ieee.org

William Lehr

wlehr@mit.edu

Research Laboratory of Electronics
Computer Science and Artificial Intelligence Laboratory

Massachusetts Institute of Technology

Key Points

Spectrum scarcity threatens competition in mobile broadband

Shared small cell infrastructure can preserve competition

  Synergistic with increased spectrum sharing

One way to get there

  Offload providers that sell network component access to mobile
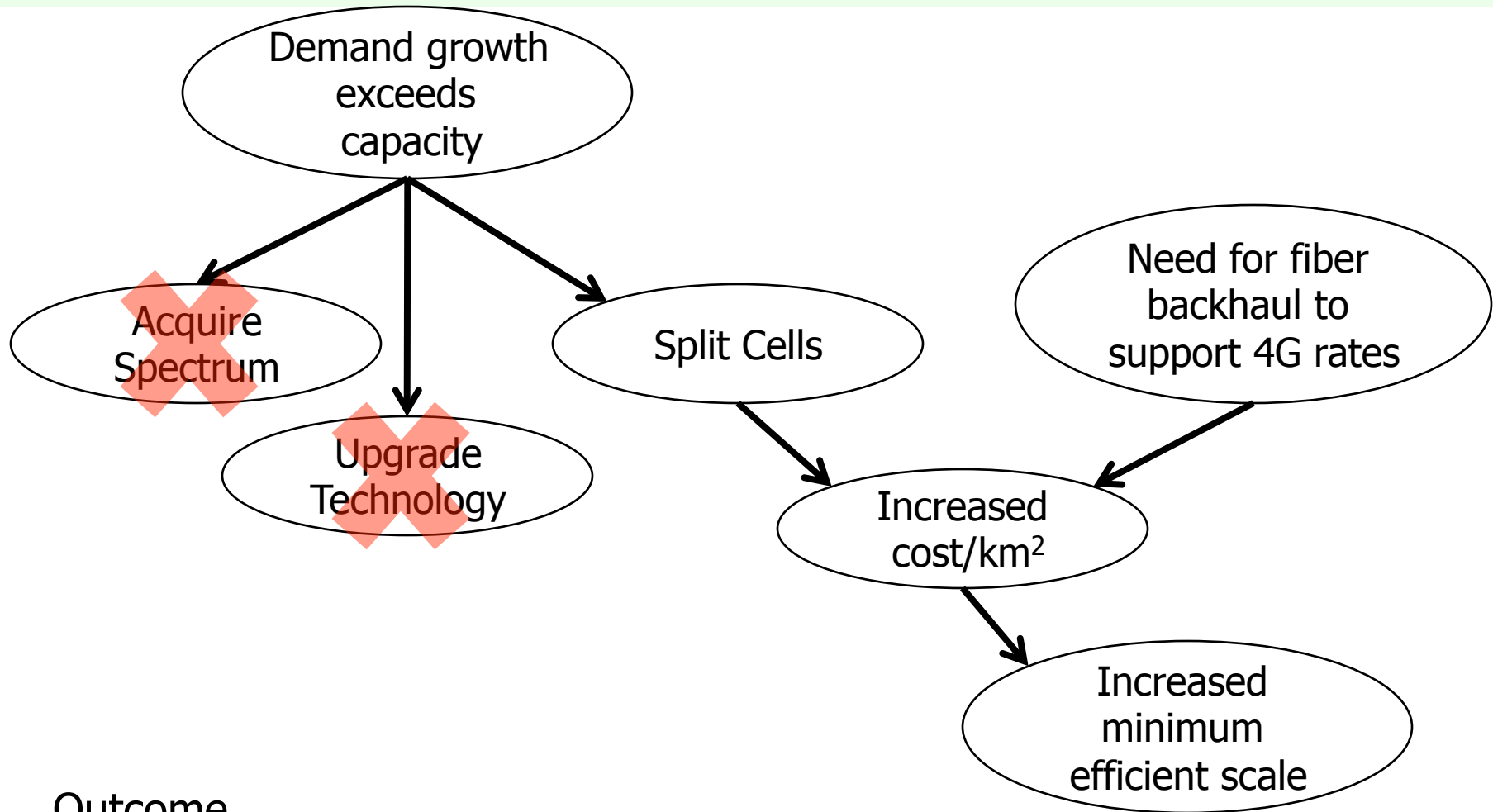   broadband providers

The role for policy

  Prevent cartelization

  Leverage public assets

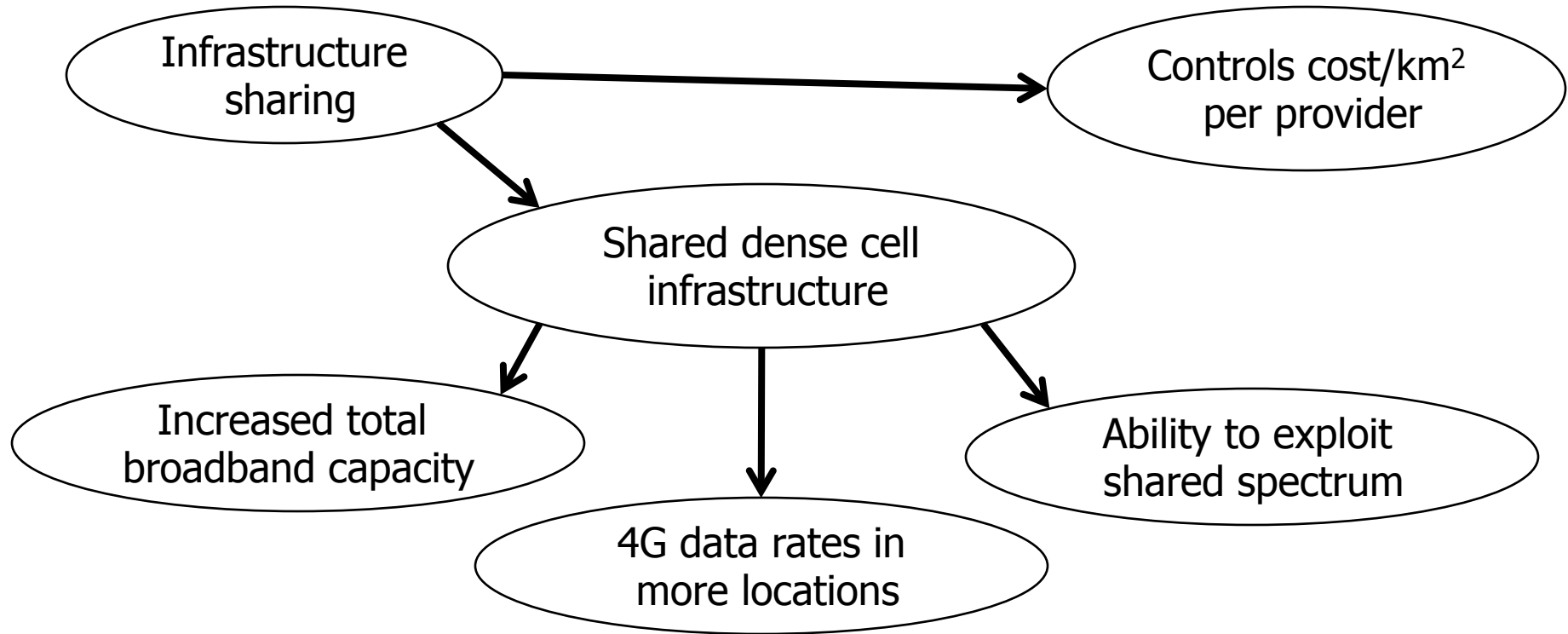 Preserve openness to technology innovation and new entrants

Spectrum scarcity threatens competition

Outcome

2 high-grade mobile broadband providers in major markets
1 or 0 in smaller markets, including suburban areas

An alternative broadband future

Infrastructure sharing → Controls cost/km^2 per provider

Infrastructure sharing → Shared dense cell infrastructure

Shared dense cell infrastructure → Increased total broadband capacity

Shared dense cell infrastructure → 4G data rates in more locations

Shared dense cell infrastructure → Ability to exploit shared spectrum

Linchpin is to amortize dense cell costs across multiple providers

Key questions:

How to get infrastructure sharing?

How to prevent cartelization?

Types of infrastructure sharing – both desirable

Network Sharing

Shared subsystem is a full network

Provider leases capacity
(megabits/sec over the air)

Today: roaming

Desirable type: offloading

Mobile remains registered on home
network

Only some traffic offloaded to
shared network

Component Sharing

Shared subsystem < a network

Provider uses shared
components in its network

Today: shared towers

**Desirable type: antenna
sharing**

Avoid competition problems due
to siting restrictions

Reduce social costs

For smallest cell sizes:
distributed antenna system

Small cells enable spectrum sharing

Spectrum sharing is essential under congestion

Sharing between mobile broadband providers   Efficiency

Sharing with other services   Spectrum access

"Hotzones" approach – separate infrastructure – is too costly
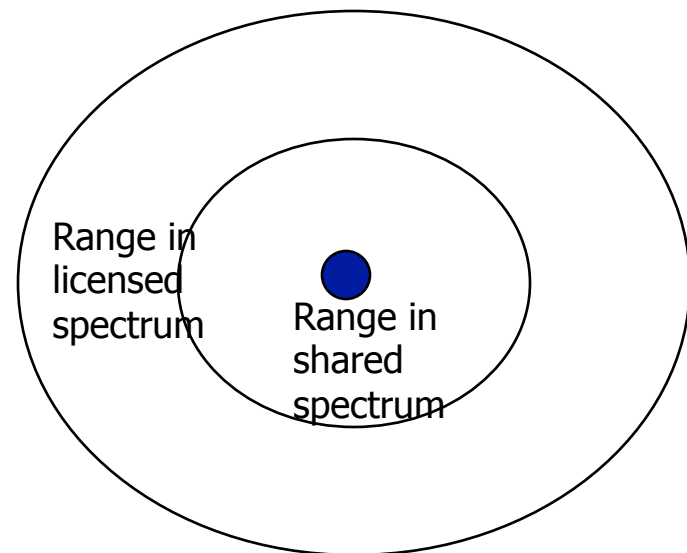
Small cells are a key enabler

Low power ➔ Tunable RF components available

Low power ➔ Access to more spectrum

Small diameter ➔ More users within range of shared spectrum

Critical to improve ROI for spectrum sharing capability

The denser the cells, the more spectrum sharing is possible.

Range in licensed spectrum

Range in shared spectrum

Structure for sharing infrastructure and spectrum

One attractive structure:

An offload provider   (offload = only handles some types of traffic) operating largely in shared spectrum

who leases infrastructure components to mobile broadband providers

who use those components to support networks in licensed spectrum

with the offload service and licensed broadband services sharing a distributed antenna system in the densest areas.

Paths to get there:

Partnership of tower company and local wireline service provider

Evolution from local government public safety or last-mile network

Role for policy

The policy challenge

Shared infrastructure/spectrum => bottleneck => open access

Lower small cell infrastructure costs

Lower spectrum access costs

Promote competition => lower entry barriers, more innovation, choice

Minimize regulatory distortions => as light-handed reg as possible

Future will be heterogeneous, change incremental

Continued use of dedicated infrastructure/spectrum, but *also* shared

As much facilities-based competition as feasible

Promote sharing and investment in

Dense neighborhood fiber for backhaul

Spectrum sharing (technology, business models, ...)

Small cell infrastructure

National and Local Policies

National

    Spectrum reform : expand spectrum access opportunities

        - including for shared access spectrum (dedicated and secondary)

    Promote commercialization of innovative radio technology

        - testbeds, operational experiments, R&D funding

    Harmonize/rationalize rules for deploying local infrastructure

        - access to conduit, rights of way, pole attachment, etc.

Local

    Finance fiber/dense-cell infrastructure (community bonds)

    Leverage public assets (schools, govt buildings)

    Anchor tenant (public safety)

    Municipal utility (where it works)

    Public/private partnerships

Summary

Spectrum scarcity threatens competition in mobile broadband

Shared small cell infrastructure can preserve competition

    Synergistic with increased spectrum sharing

One way to get there

    Offload providers that sell network component access to mobile broadband providers

The role for policy

    Prevent cartelization

    Leverage public assets

    Preserve openness to technology innovation and new entrants

Thanks for your attention!	John Chapin john.chapin@ieee.org	William Lehr wlehr@mit.edu

Traffic splitting and spectrum sharing

Delay-intolerant

    Voice

    Gaming

    Video-conferencing

Delay-sensitive

    Text messages

    Operations when user is waiting

    Streaming video

Delay-tolerant

    Unattended file transfer

    Telemetry

Shared but dedicated to broadband

    Reallocation must be rapid to decorrelate demand peaks

    Cellular standards (e.g. LTE) don't work, WiFi is suboptimal

Other licensed spectrum

    Access guarantees on a case-by-case basis (if cooperative)

Fully unlicensed spectrum

    Unpredictable access