

The Global Internet: Structure and Architecture

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What I'd Like to Talk About

- **Growth in deployment**
- **Key developments**
- **Key uses of technology**

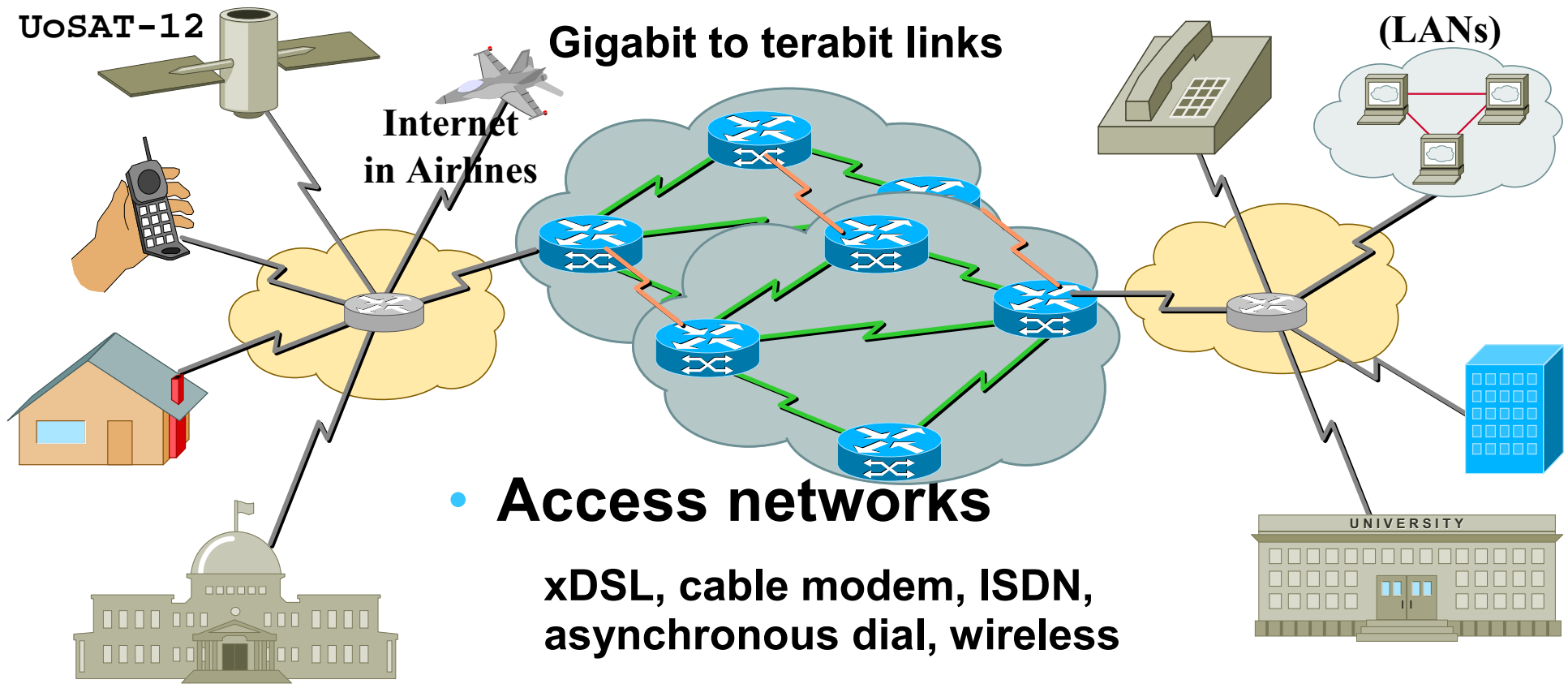


Growth in deployment

Structure of the Internet

- **The optical internet backbone**

Gigabit to terabit links



- **Access networks**

**xDSL, cable modem, ISDN,
asynchronous dial, wireless**

**20,000 *instantaneous* sessions
per GBPS backbone bandwidth**

What Internet technologies accomplish together

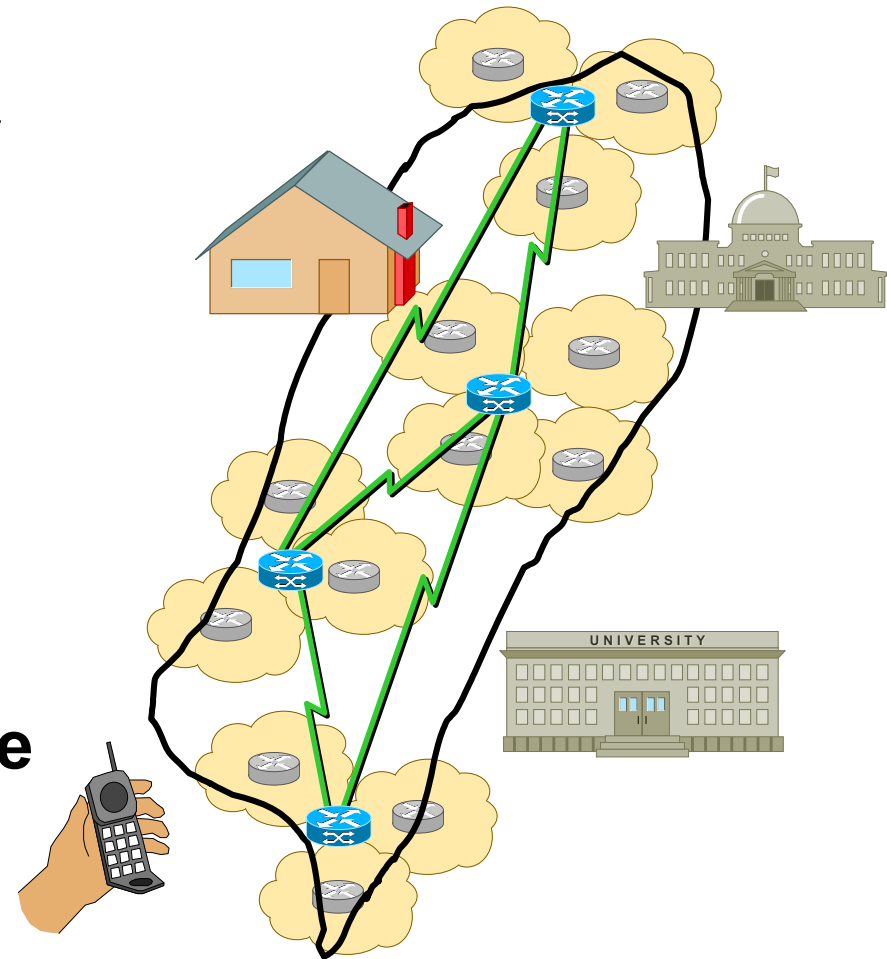
- **Backbone Connectivity**

Connects cities

Links universities

- **Access technologies**

Connect businesses and communities to backbone



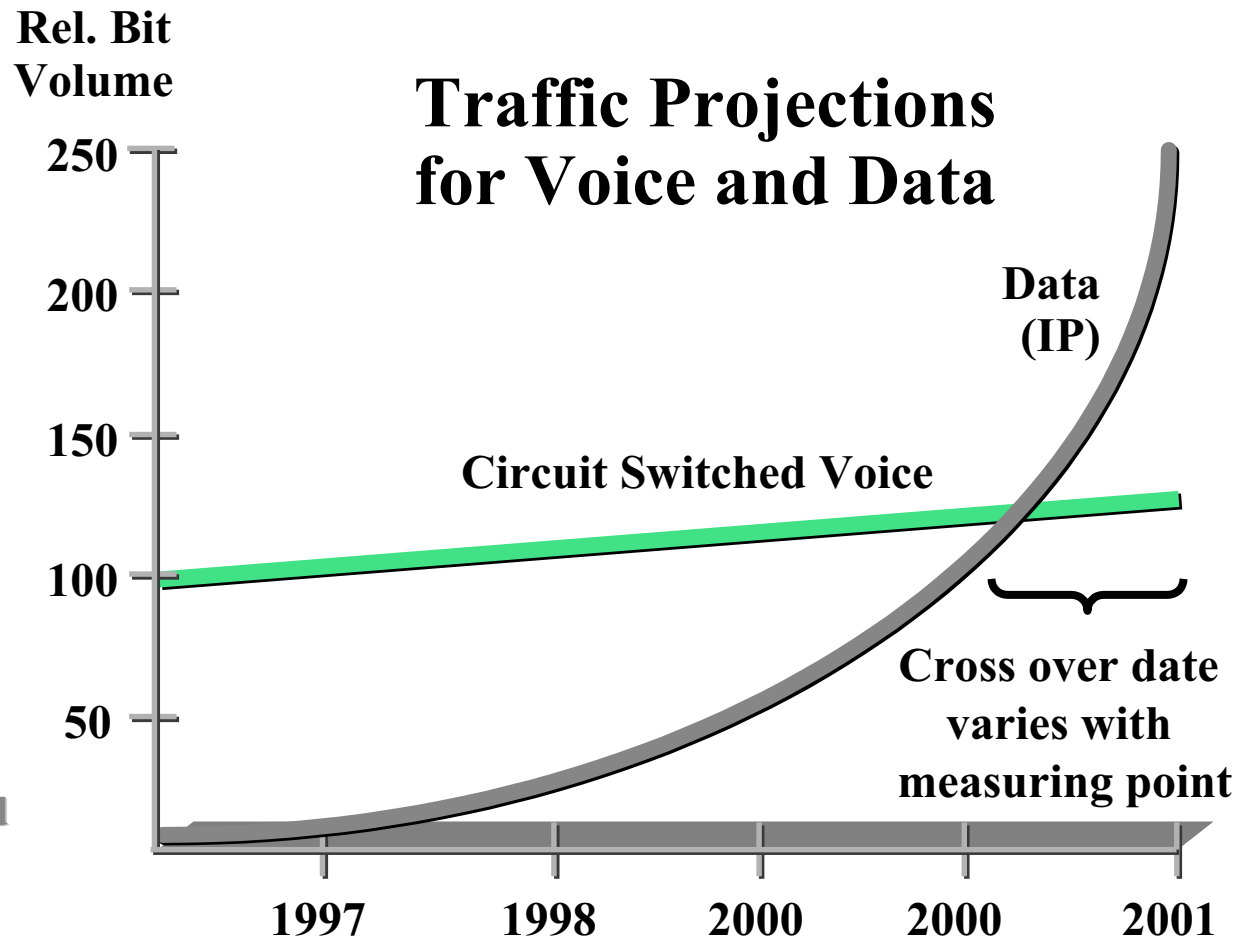
Growth of IP Traffic

- Email
- Information search/access
- Subscription services/“push”
- Conferencing/multimedia
- Video/imaging

“From 2000 on, 80% of Service Provider Profits Will Be Derived from IP-Based Services.”

Source: CIMI Corp.

Source: Multiple IXC Projections





Key Developments Enabling the Internet to Grow

There is nothing so constant in the Internet as innovation and change

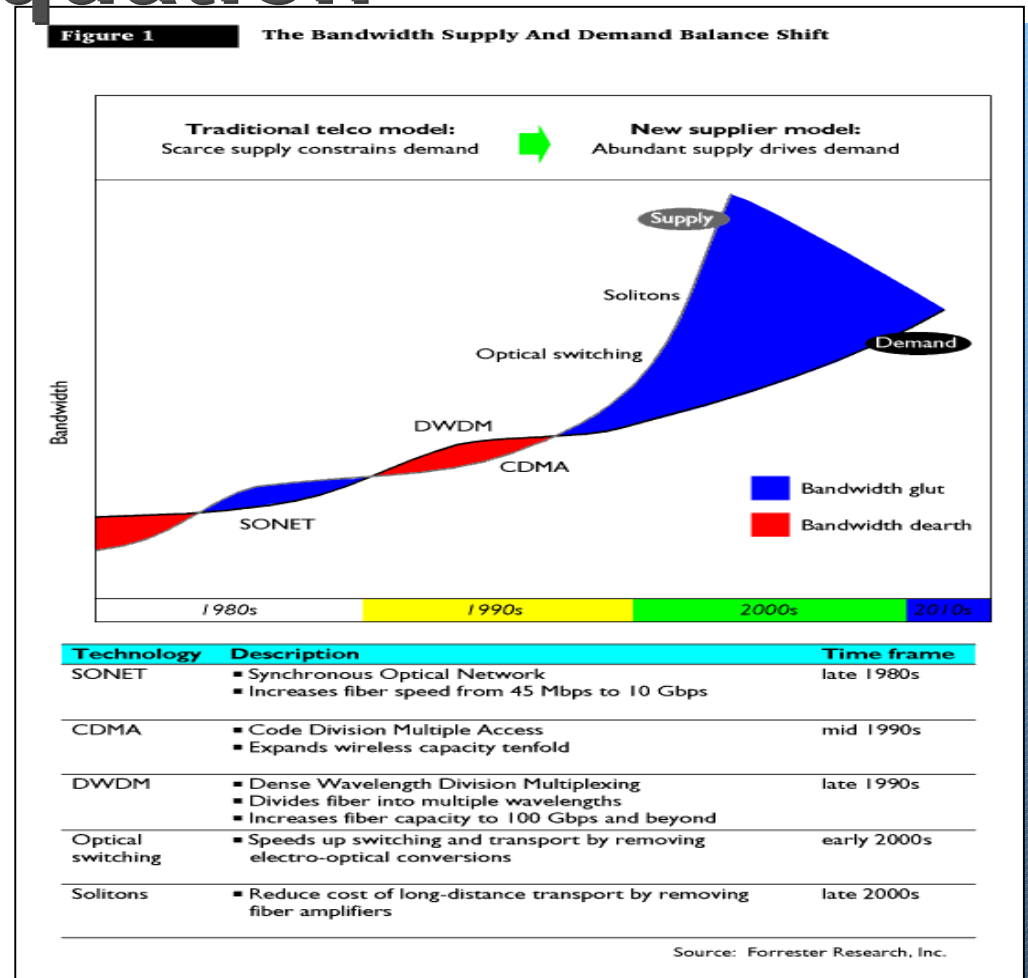
Bandwidth Supply-demand Equation

“An emerging combination of new technologies, and new service suppliers will create a long-lasting abundance of bandwidth permanently altering telecom’s supply-demand equation.”

Source: Forrester Dec97.

“The potential capacity between major [European] cities will rise one-thousand fold over the next three years”

Source: Yankee Group 08/98



DWDM as a Backbone Technology

- **High bandwidth core**
 - Each color is a data stream**
 - Each data stream is megabits to gigabits**
- **Connects many access networks**
 - Too expensive for access links**
 - Can connect access networks**

Large Core Bandwidth Will Enable...

- **Large edge bandwidth**

xDSL to home and business

Cable modem to home

Wireless

IP mobility - handsets

Fixed wireless

Wireless LANs

Wider use in small applications

Wireless Technologies

- **Low bandwidth**

IEEE 802.11b LANs: 11 MBPS

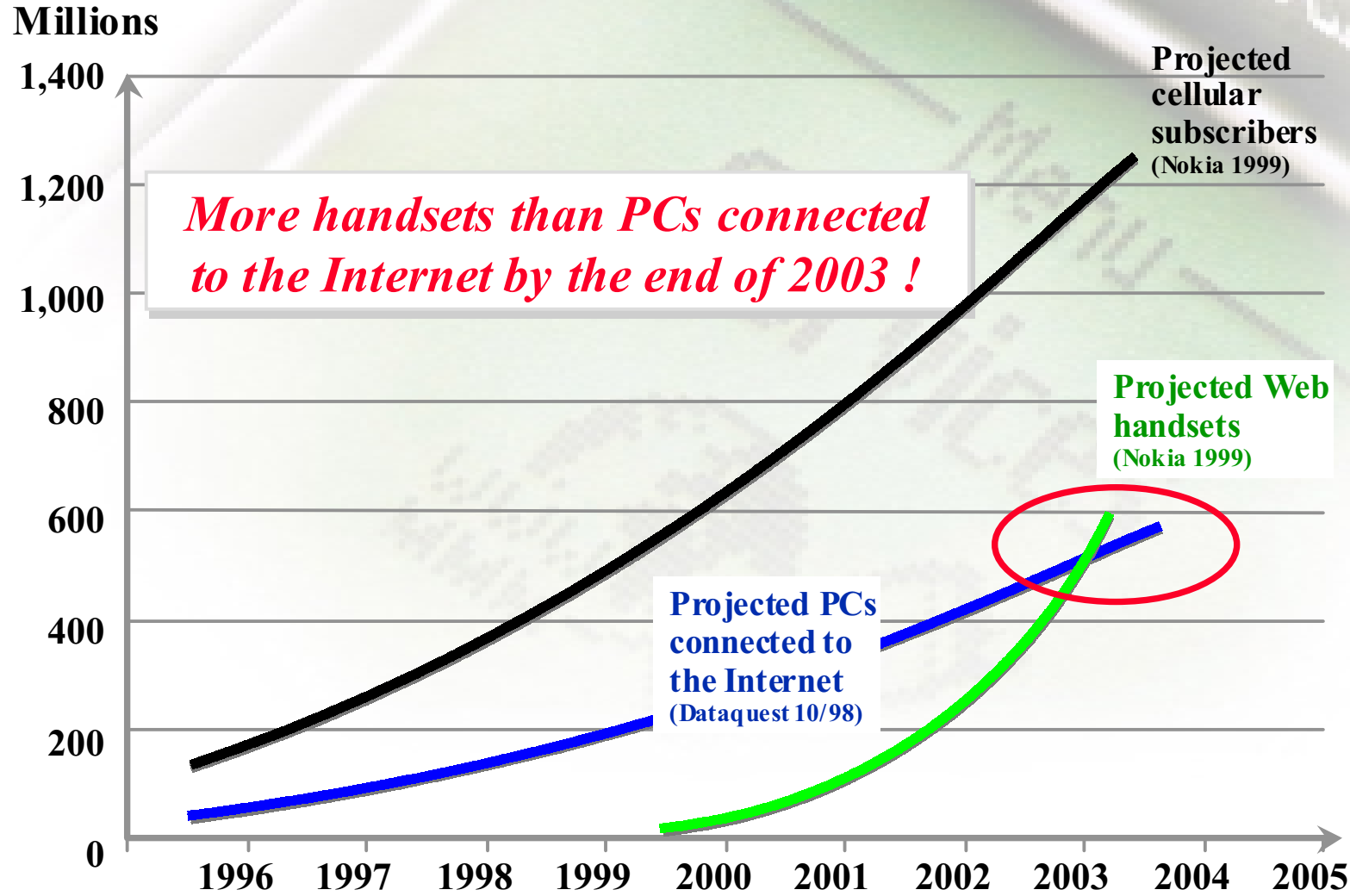
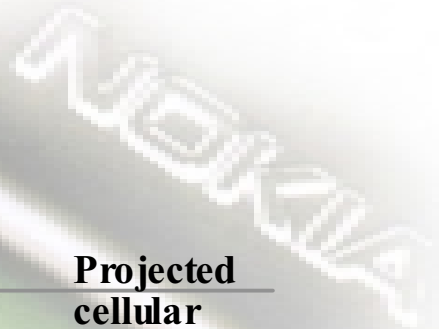
3GPP UTRAN: 2 MBPS among hundreds

- **Low infrastructure cost**

Relatively easy to install

Easy access technology to deploy

Mobile Internet Outlook



Digital Subscriber Line

- **xDSL takes megabits to home/office**
Deliver Internet, audio, and video
Perhaps reuse existing wiring
Rate inversely proportional to distance from central office

Cable Modem

- **Use Cable TV service as network**
Bus topology shared among many homes
Statistical bandwidth of megabits

Large Core Bandwidth Will Enable...

- **Bandwidth-hungry applications**

Electronic “mail order” shopping and other commerce

Music delivery

Medical imaging

Wide-scale teleconferencing

Remote learning, remote presence

Your idea here...



So where is the Internet going?

“As for the future, your task is not to foresee, but to enable it.”

Antoine de Saint-Exupéry

Business opportunities and issues

- **Opportunities:**

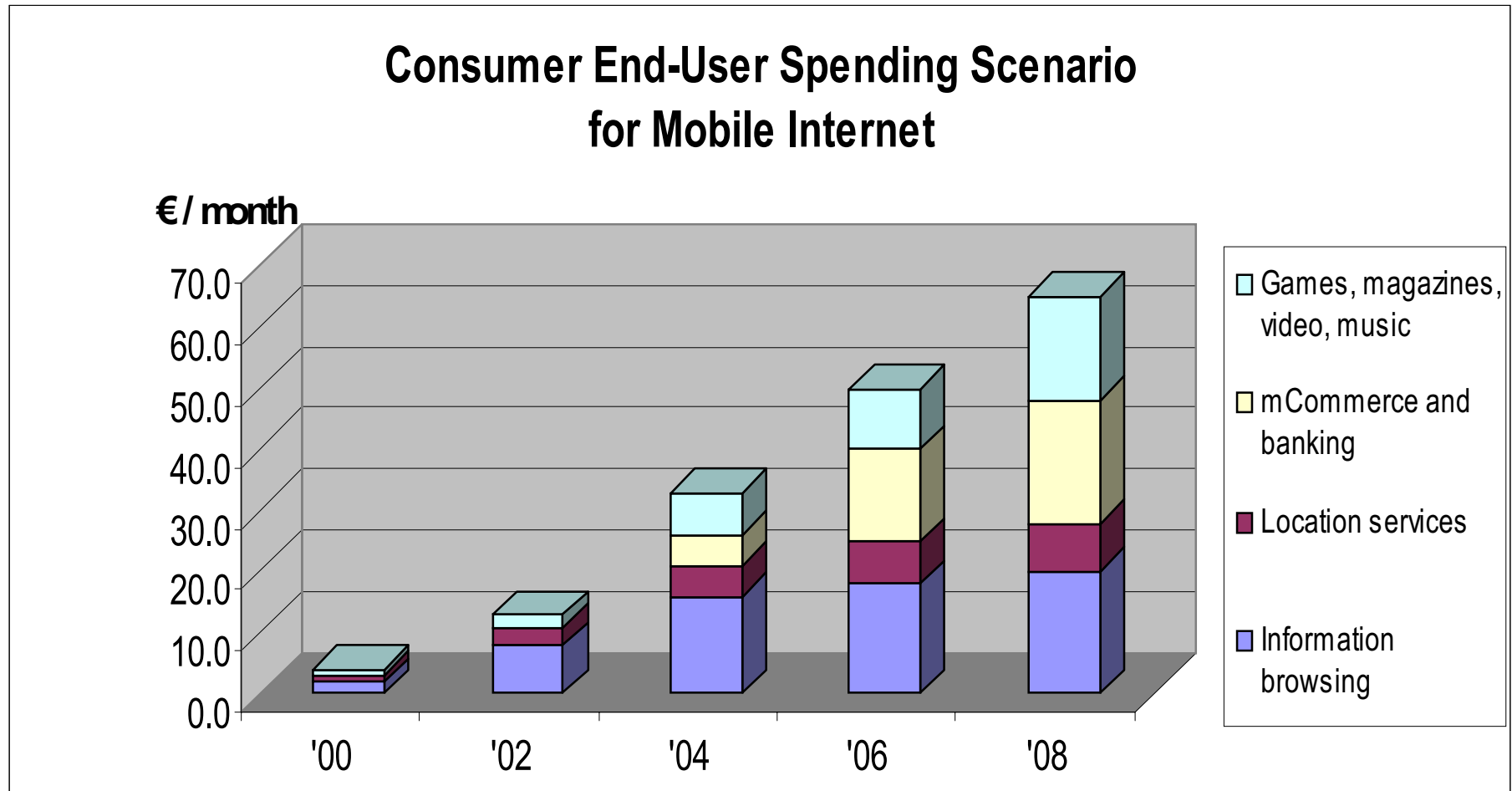
Internet can promote communication

Business can become easier

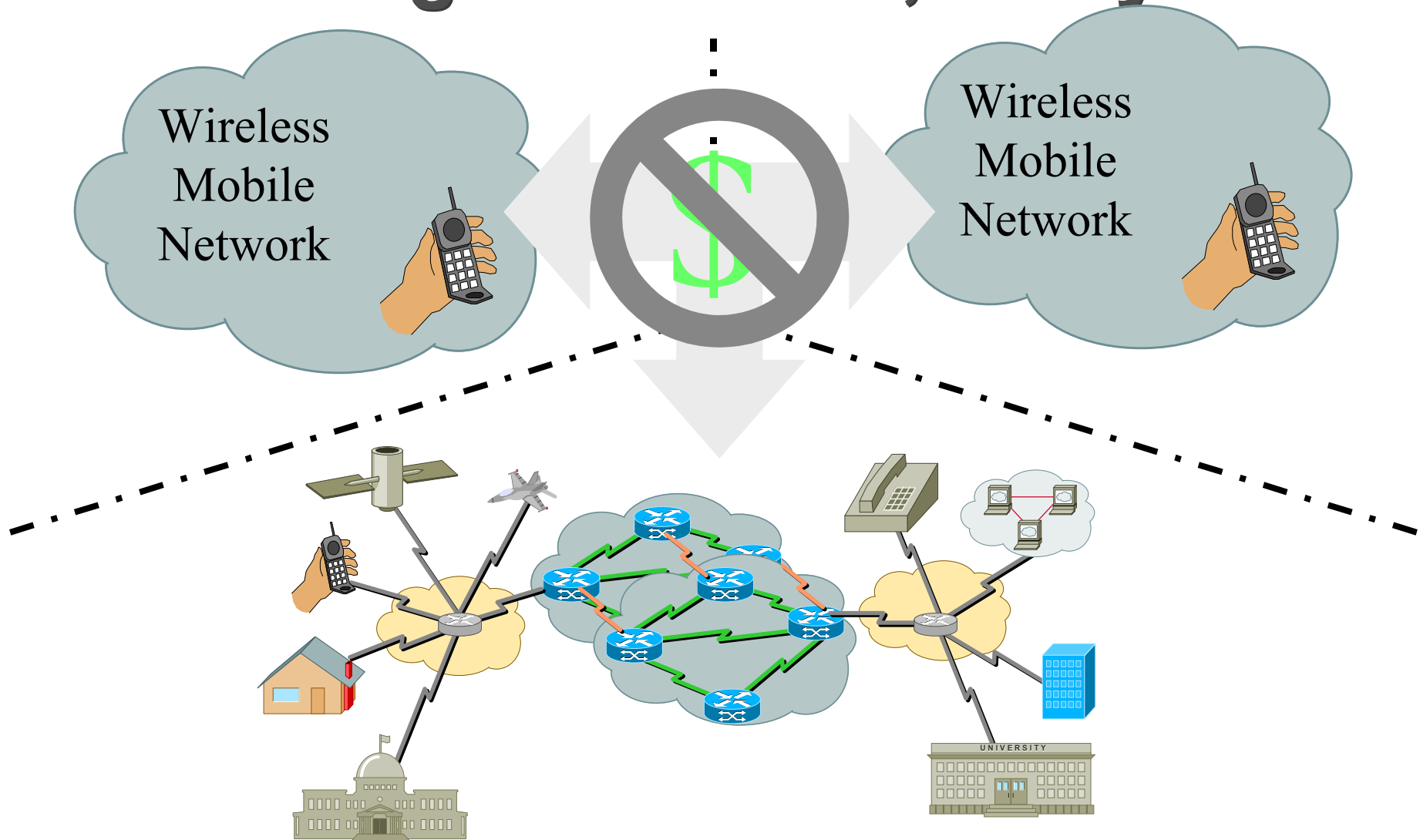
- **Issues:**

Poor business models and bad policies can hamper Internet usefulness

New applications for the Internet



Proprietary and exclusive designs can hurt, badly



Investment must be balanced

- **Network consists of backbone and access**

Backbone: gigabits to connect many people

Access: flexibility to allow them to easily attach to and use the network

- **Investment and planning is necessary for both**

What Internet technologies accomplish together

- **Backbone Connectivity**

Connects cities

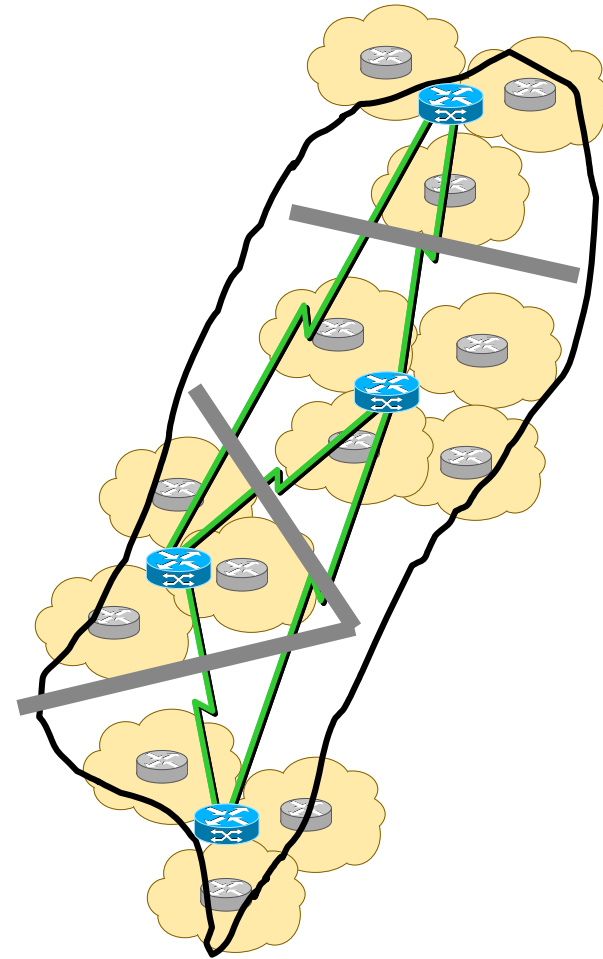
Links universities

High speed

- **Access technologies**

Connect businesses and communities to backbone

Make Internet accessible



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