

The Many Paradoxes of Broadband

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Broadband (and telecommunications in general) is full of paradoxes, puzzles, and mistaken beliefs

- **What is broadband?**
- **Can we afford it?**
- **Do we want it?**
- **What will we do with it?**
- **Should government make it a national priority?**

In spite of the crash, there is money to be made in telecom:

Qwest yellow pages, sold for \$7 billion:

annual revenues \$1.6 billion

margin 63%

free cash flow \$0.5 billion

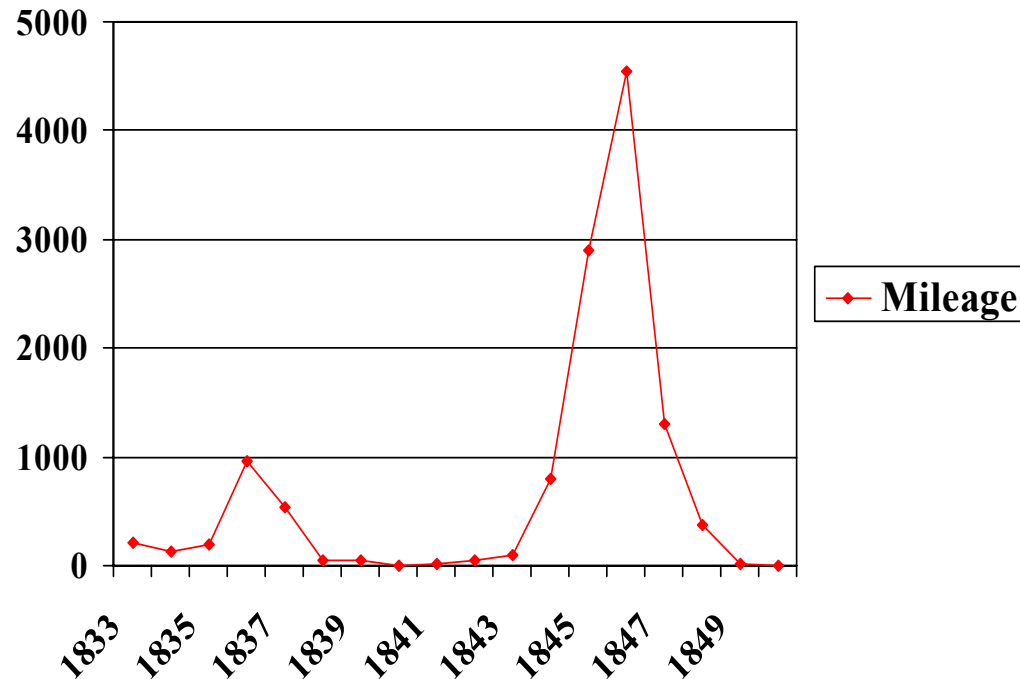
Hence a low-tech business, with seemingly low barriers to entry, can be surprisingly profitable.

Another financial puzzle:

Why did Wall Street applaud AT&T spending \$100 billion to purchase cable TV networks, but got dismayed at spending \$10 billion to upgrade then?

The cost of bringing fiber to each home and business in the U.S. would have been far lower than money misinvested in the bubble

Long history of technology leading to overinvestment and crashes



Railways authorized by British Parliament (not necessarily built)

What is broadband?

FCC definition of broadband:

**connections with speed exceeding 200 Kb/s
in at least one direction**

**Under the official definition, we all have broadband
connectivity courtesy of snail mail!**

**CD-ROMs via USPS deliver more data at same cost
as a 1 Mb/s connection running at full capacity.**

What matters most in communications:

- **volume**
 - **transaction time**
 - **reach**
-

also:

- **isochronicity**
- **price**

Broadband vs. narrowband: How are people voting with their pocketbooks?

U.S. data for December, 2001

broadband lines	12.8M
cell phones	128.4M

Narrowband mobility beats stationary broadband 10:1, even though prices are comparable

Deployment is not the big issue. Adoption rates matter far more

Adoption rates suggest broadband beats cell telephony in attractiveness

U.S. Broadband Lines

Dec. 1999	2.8M
Dec. 2000	7.1M
Dec. 2001	12.8M
Dec. 2002	20.0M (est.)

U.S. Cell Phones

Dec. 1989	3.5M
Dec. 1990	5.3M
Dec. 1991	7.6M
Dec. 1992	11.0M
Dec. 1993	16.0M
Dec. 1994	24.1M

- Thus broadband growth in three years equals that of cell phones in five years
 —→ cannot ignore technology adoption rates
- Internet time is a dangerous myth

Is telecommunications a natural monopoly?

But somehow we have multiple networks:

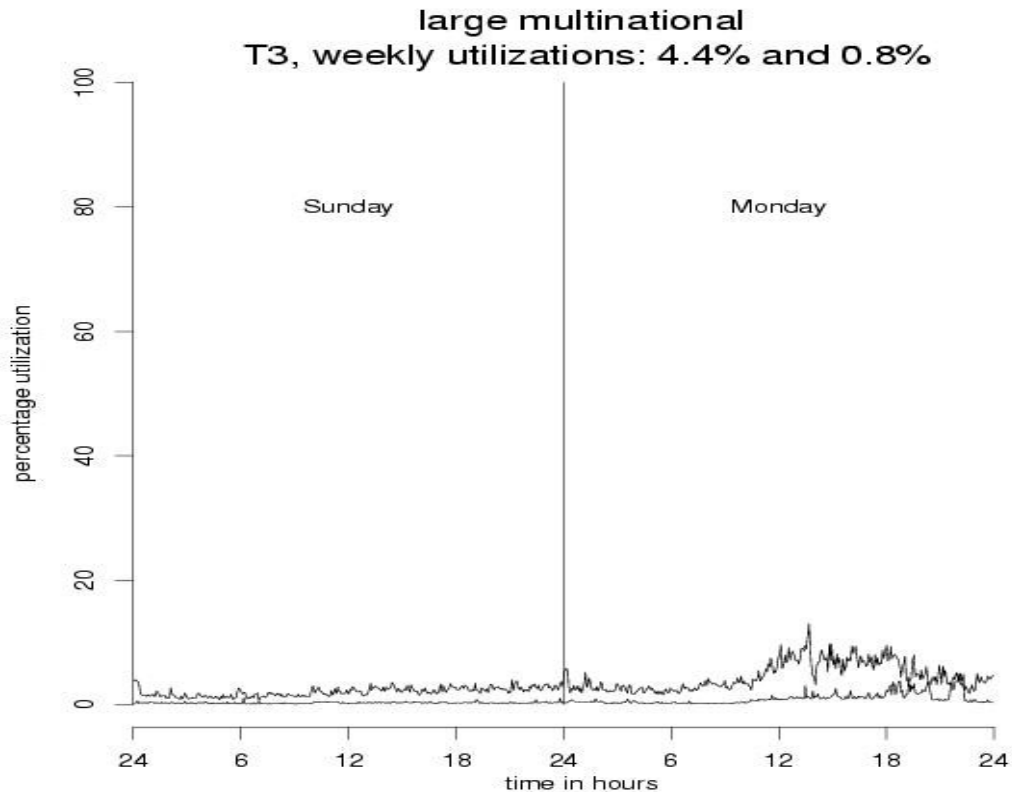
- **wireless phone**
- **cable TV**
- **satellite broadcast**
- **plus, several cell phone companies**

How to spur adoption of broadband?

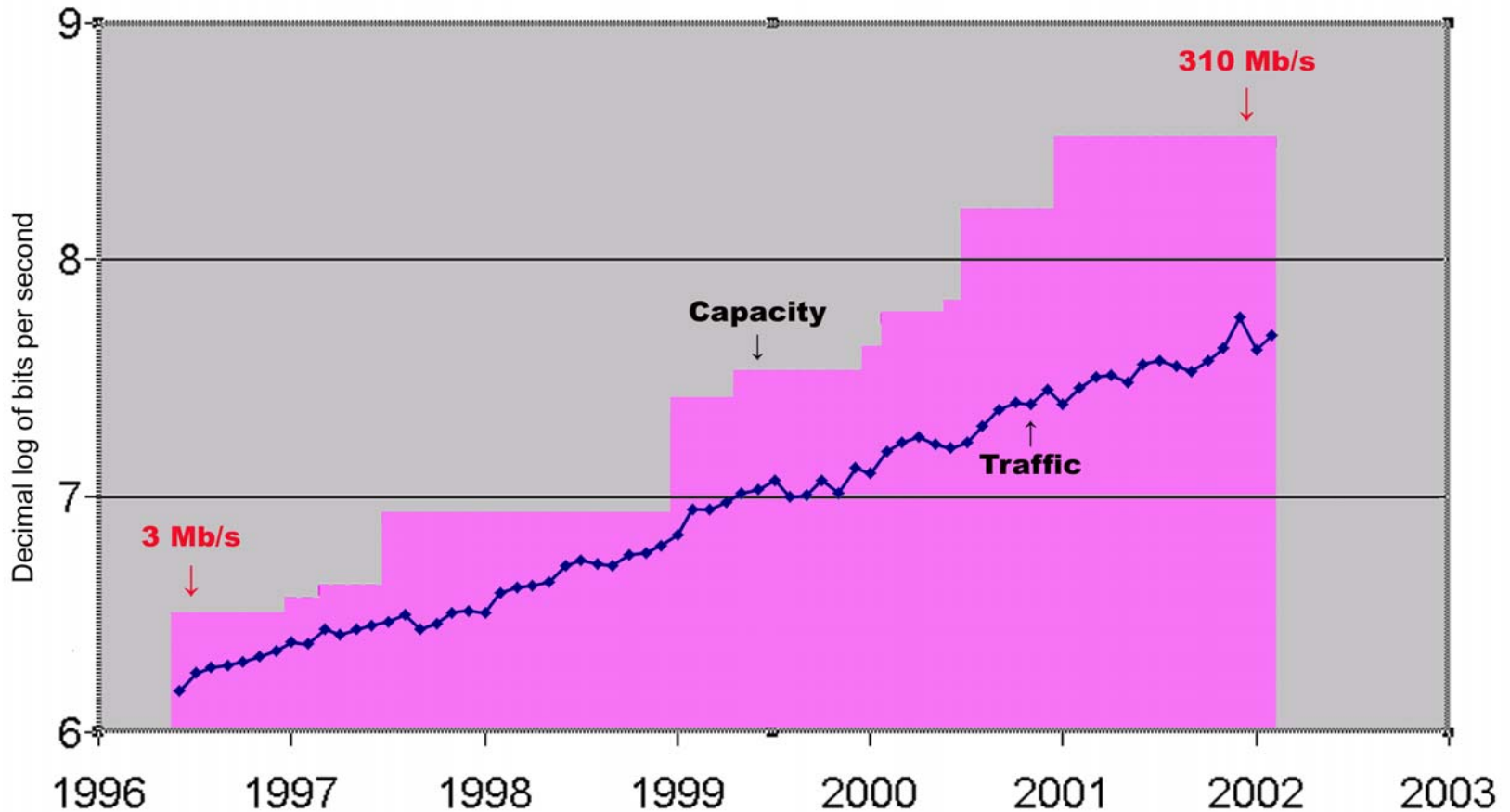
**An impractical but likely effective method:
make music free on the internet**

Annual telecom revenues:	\$300 billion
Annual recorded music sales:	\$15 billion

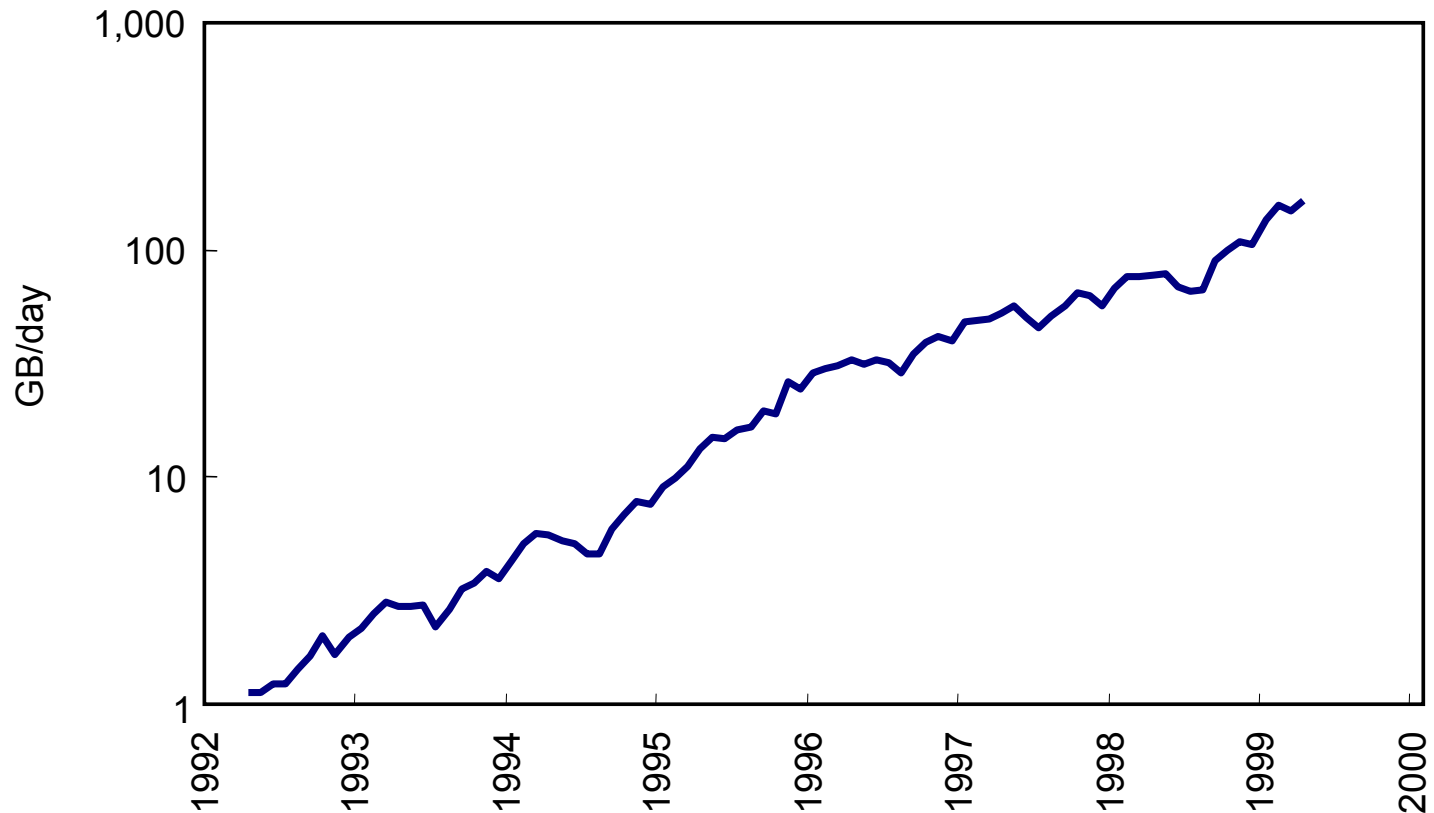
Typical enterprise traffic profile: Demolishes myth of insatiable demand for bandwidth and many (implicit) assumptions about nature of traffic



***SWITCH traffic and capacity across the Atlantic:
Illustrates “Moore’s Law” for data traffic (steady growth even
in absence of bottlenecks)***



Traffic between the University of Minnesota and the Internet



Carriers are looking for new services, but have a dismal record. Dominant source of innovation: Users

Internet “killer apps,” not a single one invented by carriers:

E-mail

WWW

Browser

Napster

The role of the Internet is to provide connectivity, not services!

The Internet succeeded by accident. Email, its “killer app,” was not among the original design criteria:

The popularity of email was not foreseen by the ARPANET's planners. Roberts had not included electronic mail in the original blueprint for the network. In fact, in 1967 he had called the ability to send messages between users “not an important motivation for a network of scientific computers” Why then was the popularity of email such a surprise? One answer is that it represented a radical shift in the ARPANET's identity and purpose. The rationale for building the network had focused on providing access to computers rather than to people.

J. Abbate, *Inventing the Internet*

Conclusion (inspired by a sign at a computing center help desk)

We are sorry that we have not been able to solve all of your problems, and we realize that you are about as confused now as when you came to us for help. However, we hope that you are now confused on a higher level of understanding than before.

For more data and speculations, see the papers and presentations at:

<http://www.dtc.umn.edu/~odlyzko>