

# Some Applications Of Bandwidth Estimation

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# A depressing litany of duds among major recent networking research initiatives:

- ◆ ATM
- ◆ RSVP
- ◆ Smart Markets
- ◆ Active Networks
- ◆ Multicasting
- ◆ Streaming Real Time Multimedia
- ◆ 3G

and (largely encompassing all of these): QoS

All technical successes, but failures in the marketplace

# Telecom crash:

**Technology rose to the challenge posed by unrealistic business plans made in willful ignorance of reality**

## *From year-end 1997 to year-end 2001 (U.S. only)*

- ◆ Long distance fiber deployment: fiber miles growth of 5x
- ◆ Transmission capacity: DWDM advances of 100x
- ◆ Cumulative fiber capacity growth of around 500x
- ◆ Actual demand growth: around 4x

### **Two fundamental mistakes:**

- (i) assume astronomical rate of growth for Internet traffic
- (ii) extrapolate that rate to the entire network

# Bandwidth and growth rates of U.S. long distance networks, year-end 1997

**Percent of total  
Bandwidth**

**Growth Rate**

45%

**Voice**

10%

45%

**Private line,  
ATM, FR**

40%

10%

**Internet**

100%

**Source:** Coffman and Odlyzko, "The Size and Growth Rate of the Internet", 1998

# Internet Growth Hype:

**“... bandwidth ... will be chronically scarce. Capacity actually creates demand in this business...bandwidth-centric names are good values at any price since nobody can predict the true demand caused by growth.”**

**-- Jack Grubman, April 1988**

**“Over the past five years, Internet usage has doubled every three months.”**

**-- Kevin Boyne, UUNET COO, Sept. 2000**

**“If you are not scared, you do not understand”**

**-- Mike O'Dell, UUNET Chief Scientist, May 2000**

# Blatant implausibilities in Internet bubble stories

Mike O'Dell, May 2000

<http://stanford-online.stanford.edu/optic/main.html>

Audio presentation: claimed consistent 10x annual growth

Slides: domestic UUNET network: growth only 7x

mid – 1997      5,281 OC12-miles

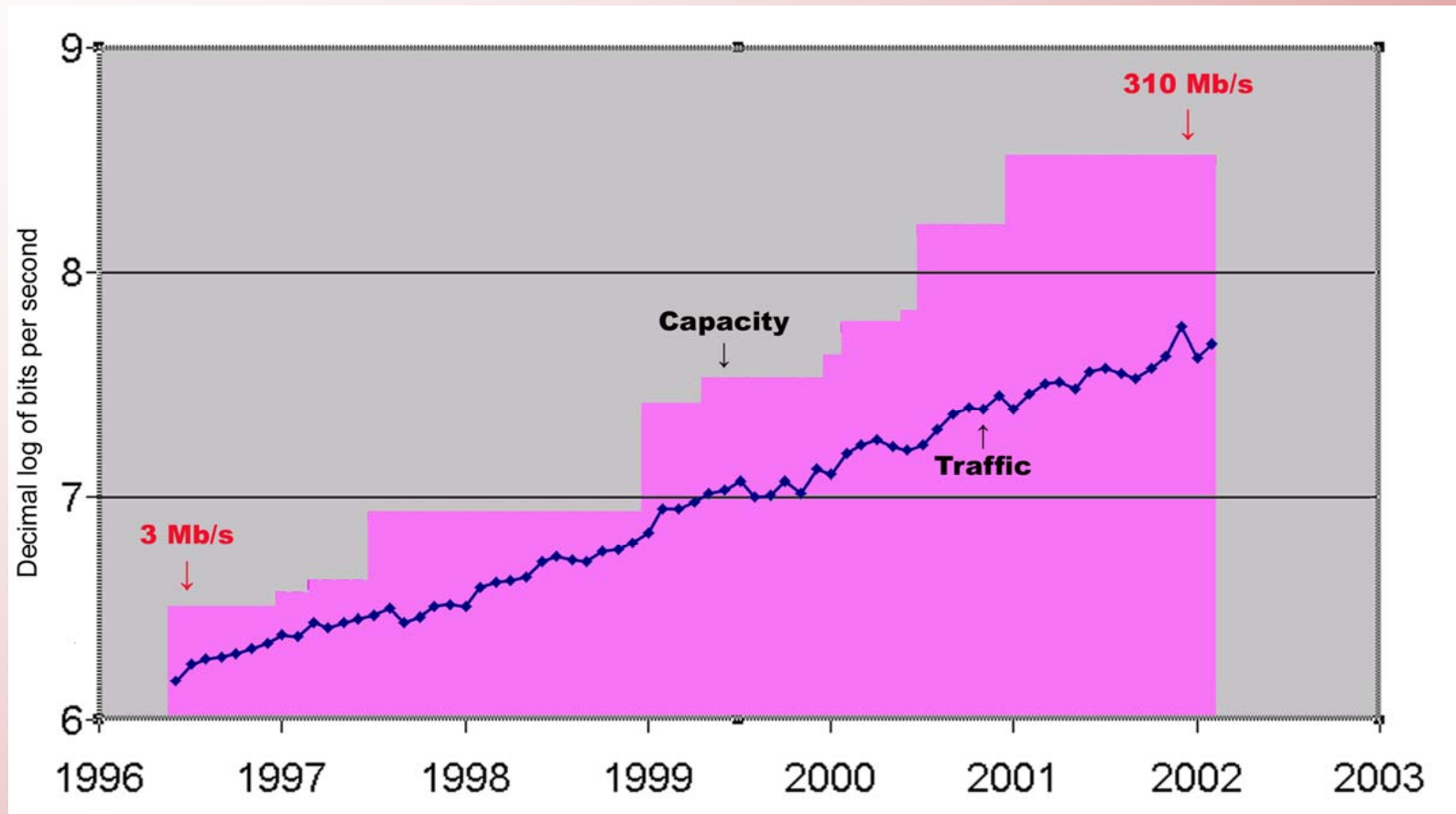
mid – 1998      38,485

mid – 1999      268,794

Extrapolating back to mid-1994 using 10x annual rate:

→ 5 OC12-miles  $\approx$  2,000 T1-miles      ??????

# *SWITCH traffic and capacity across the Atlantic*





**To assure health of the networking industry and research enterprise, need better information about:**

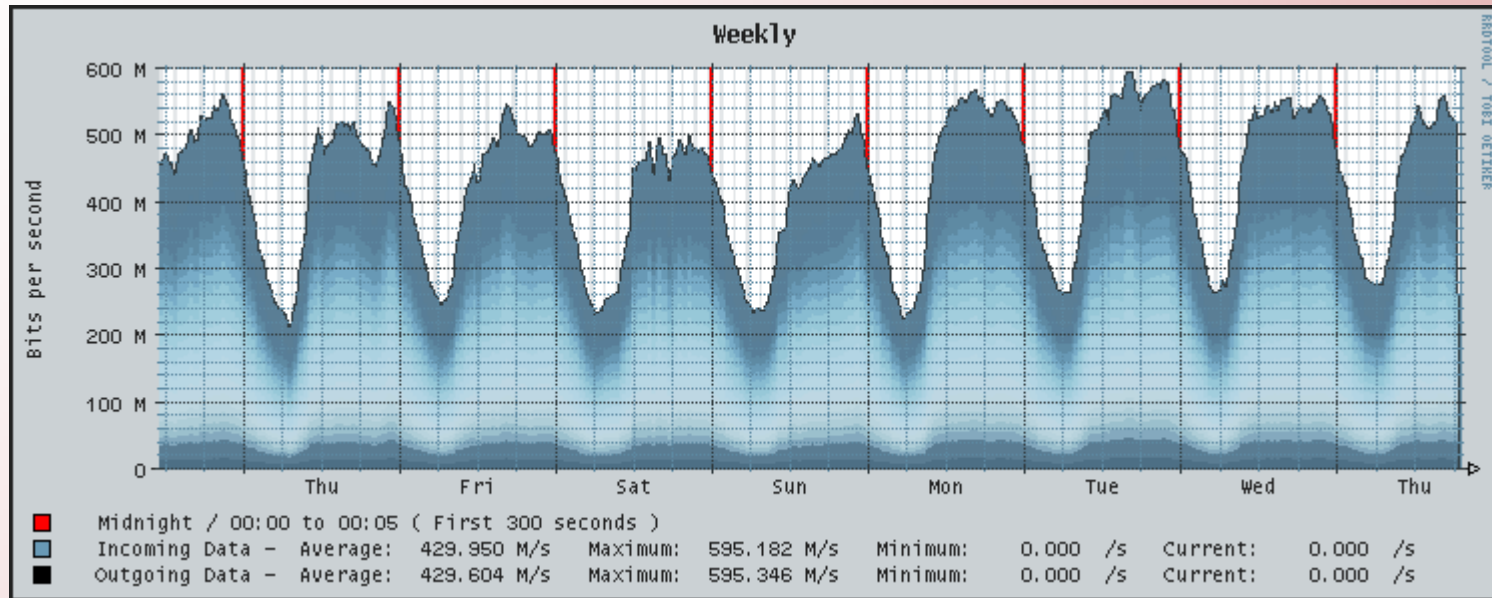
1. Capacity
2. Traffic
3. Applications mix

The more information can be inferred from external observations, the more likely carriers will be to open up.

# Current effort at the Digital Technology Center:

- ◆ Collection and analysis of publicly accessible MRTG and RRD graphs
- ◆ “Reverse engineering” of graphs to get underlying data

# Reverse engineering of TORIX graphs:



2003-12-04-18:02:38 xxxxxx 600.0  
2003-12-04-17:44:10 xxxxxx 600.0  
2003-12-04-17:25:43 519.0 xxxxxx  
2003-12-04-17:07:15 516.0 600.0  
2003-12-04-16:48:47 525.0 528.0  
2003-12-04-16:30:20 525.0 600.0  
2003-12-04-16:11:52 534.0 549.0  
2003-12-04-15:53:24 549.0 600.0  
2003-12-04-15:34:56 555.0 558.0

## **Conclusion:**

**Indirect measurements of network capacity and utilization extremely desirable to build a healthy industry and research establishment.**