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)

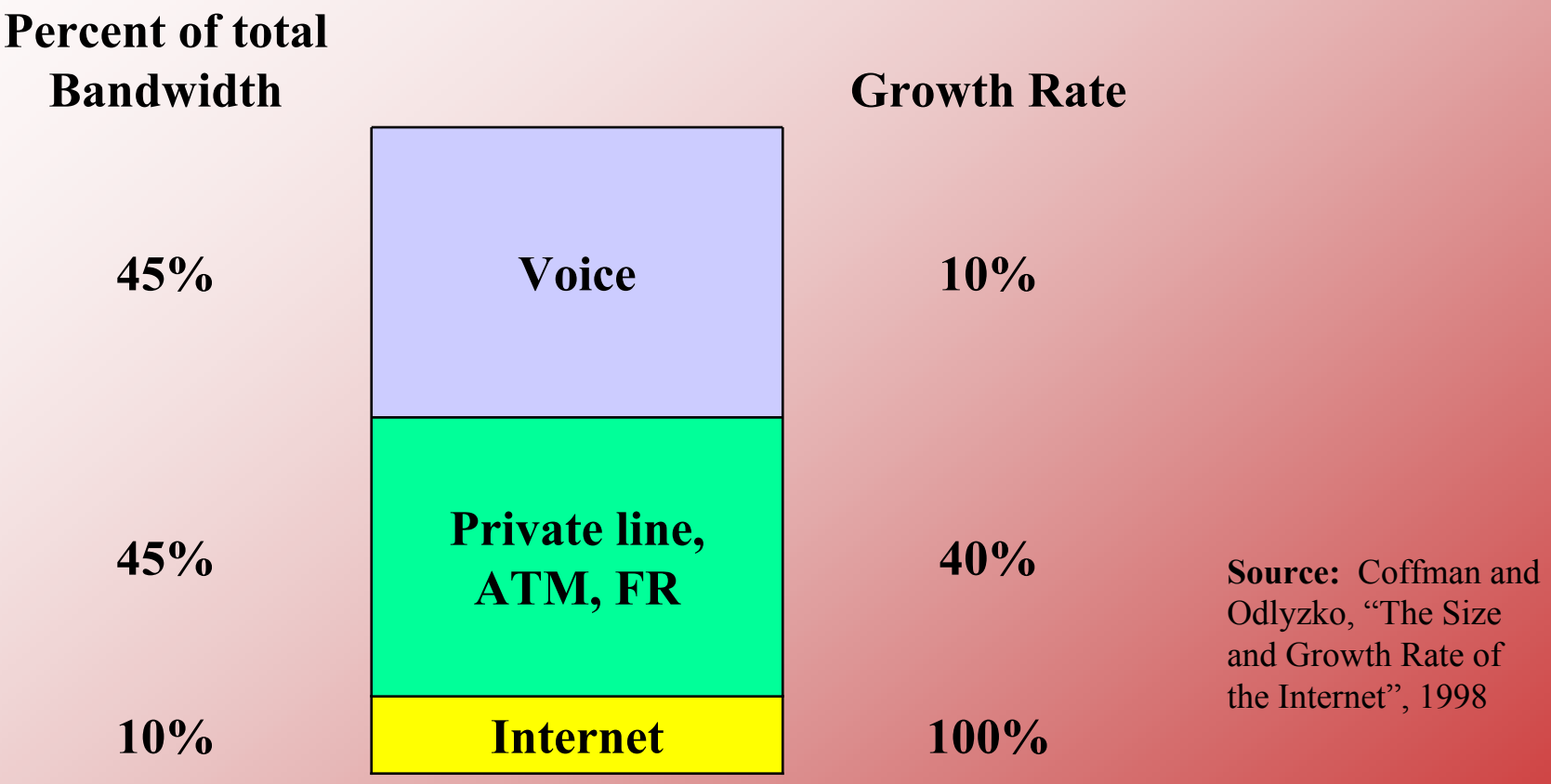
- Long distance fiber deployment: fiber miles growth of 5x
- Transmission capacity: DWDM advances of 100x
- Cumulative fiber capacity growth of around 500x
- Actual demand growth: around 4x

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



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

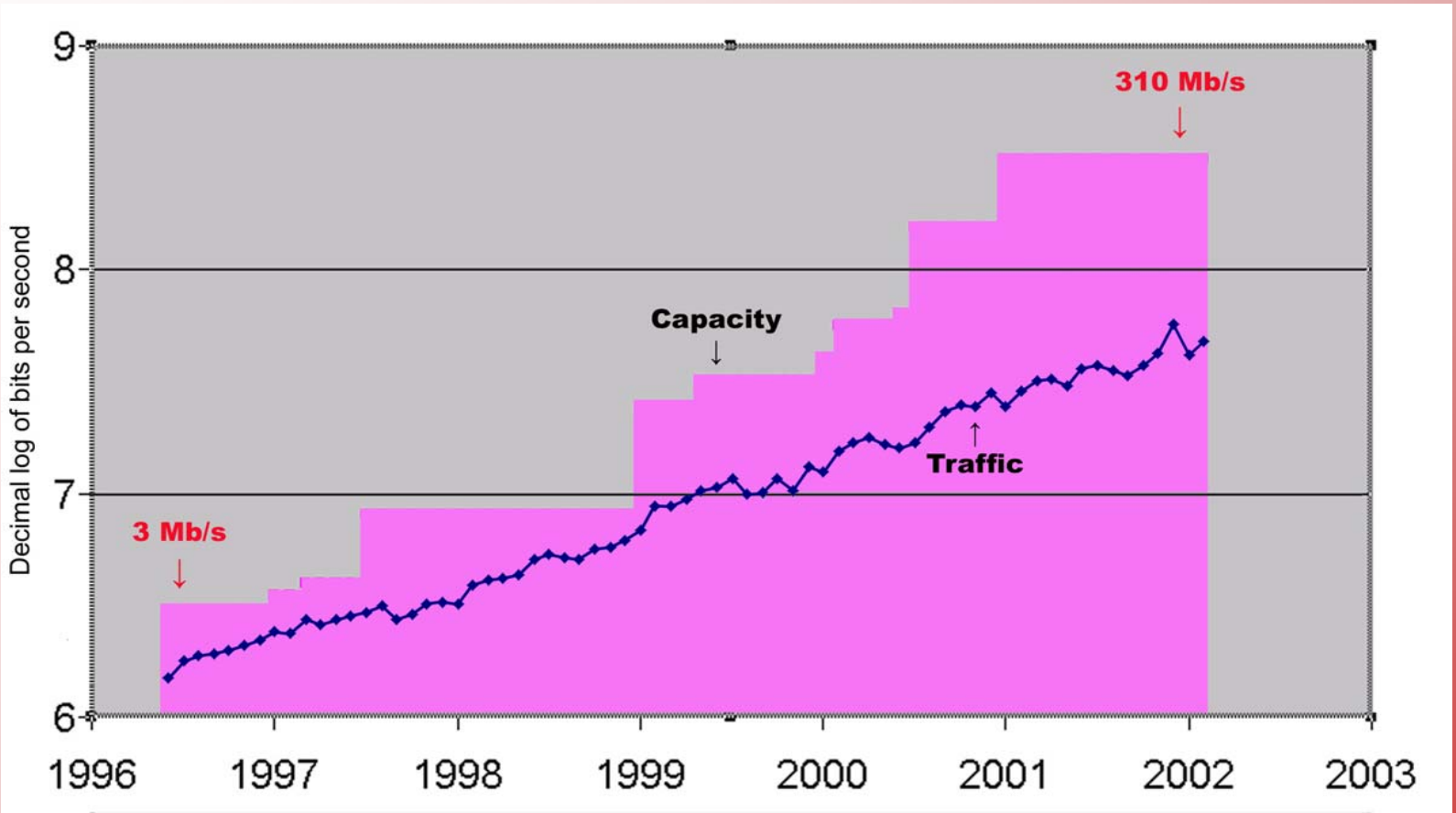
Slides: domestic UUNET network: growth only 7x

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 ≈ 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:

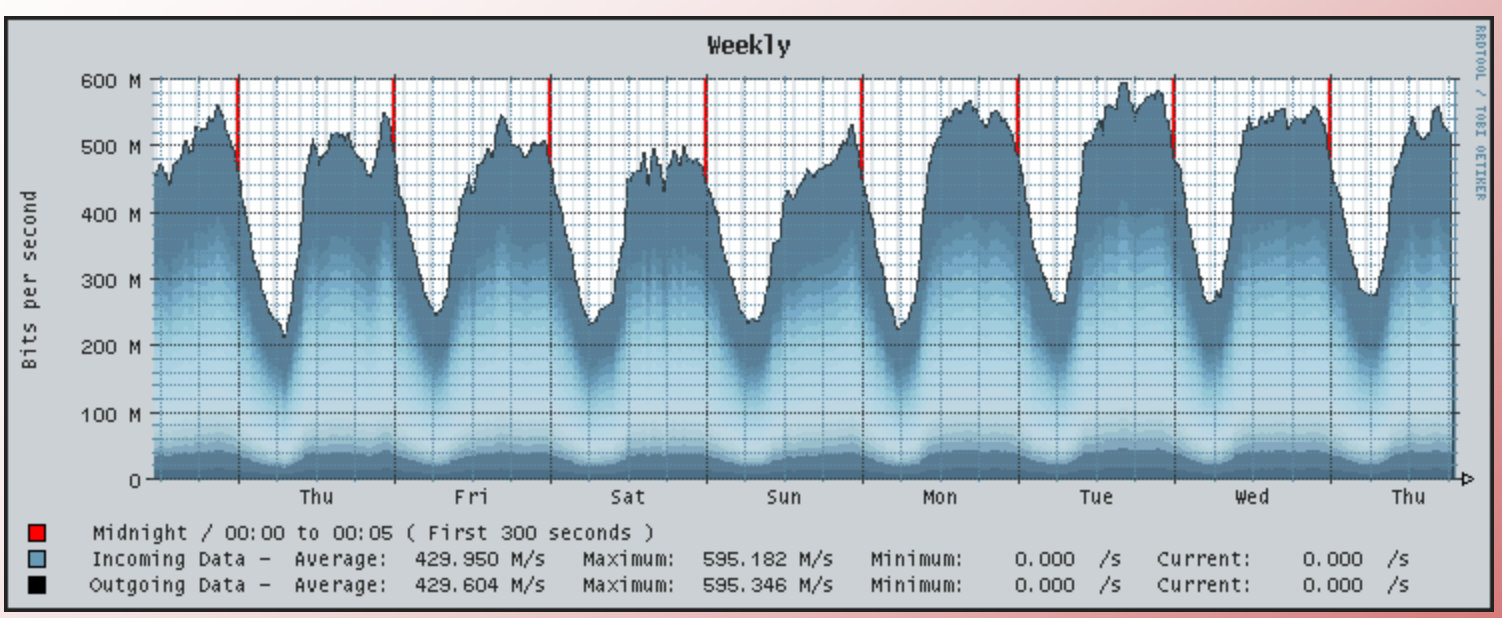
1. Capacity
2. Traffic
3. Applications mix

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 xxxxx 600.0
2003-12-04-17:44:10 xxxxx 600.0
2003-12-04-17:25:43 519.0 xxxxx
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.