

# Wild Wild Web: The Lay of the Land

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## **Argument:**

The Web (in its current form) is a fad.

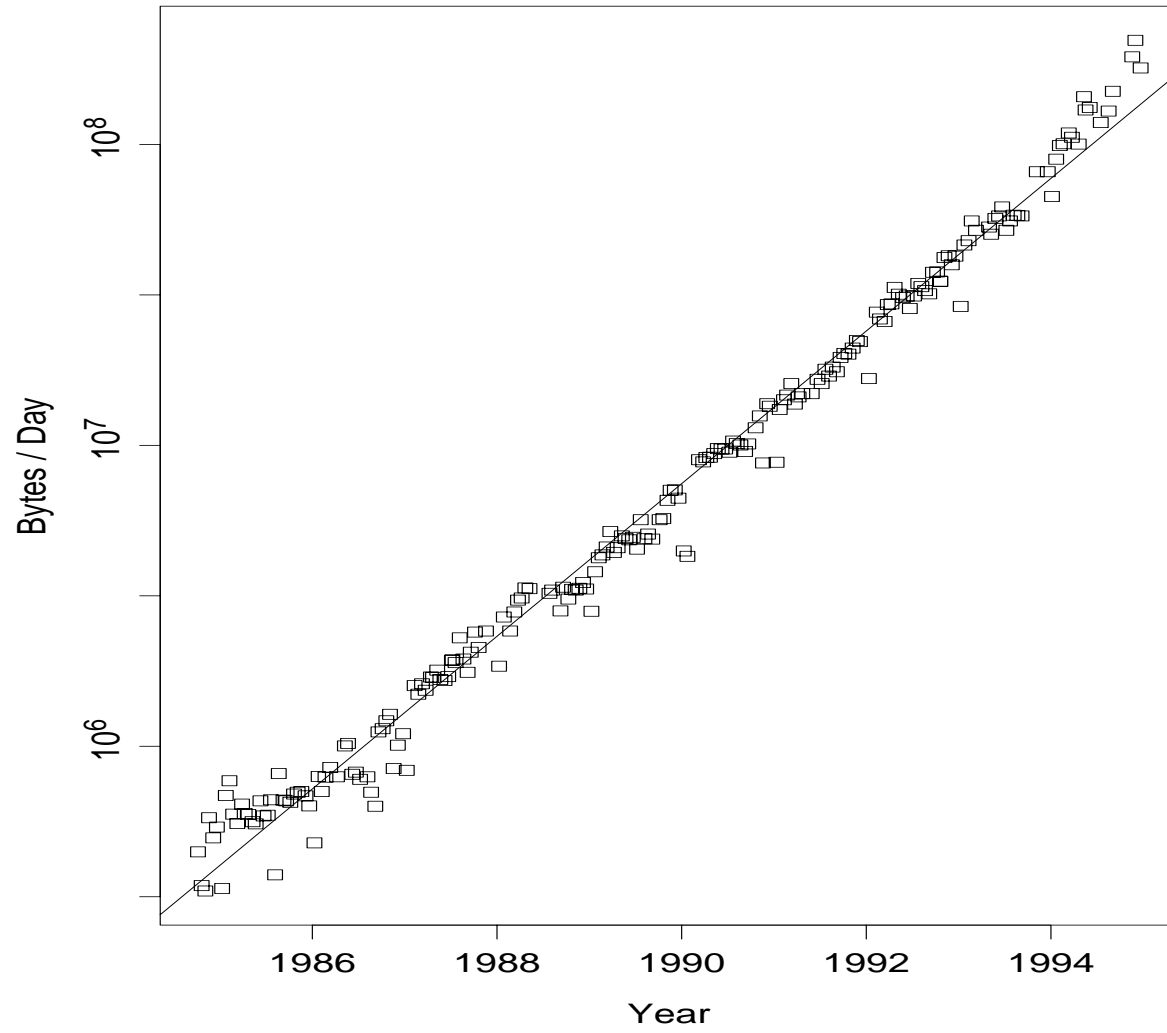
The role of the architecture is to facilitate paradigm shifts.

Beware truly distributed applications.

The gold rush is expensive.

Whither robustness?

# USENET Bulletin Board Traffic Volume



Courtesy of Rick Adams.

## The Internet — diverse wherever you look:

Network grows exponentially: total; per site; per user.

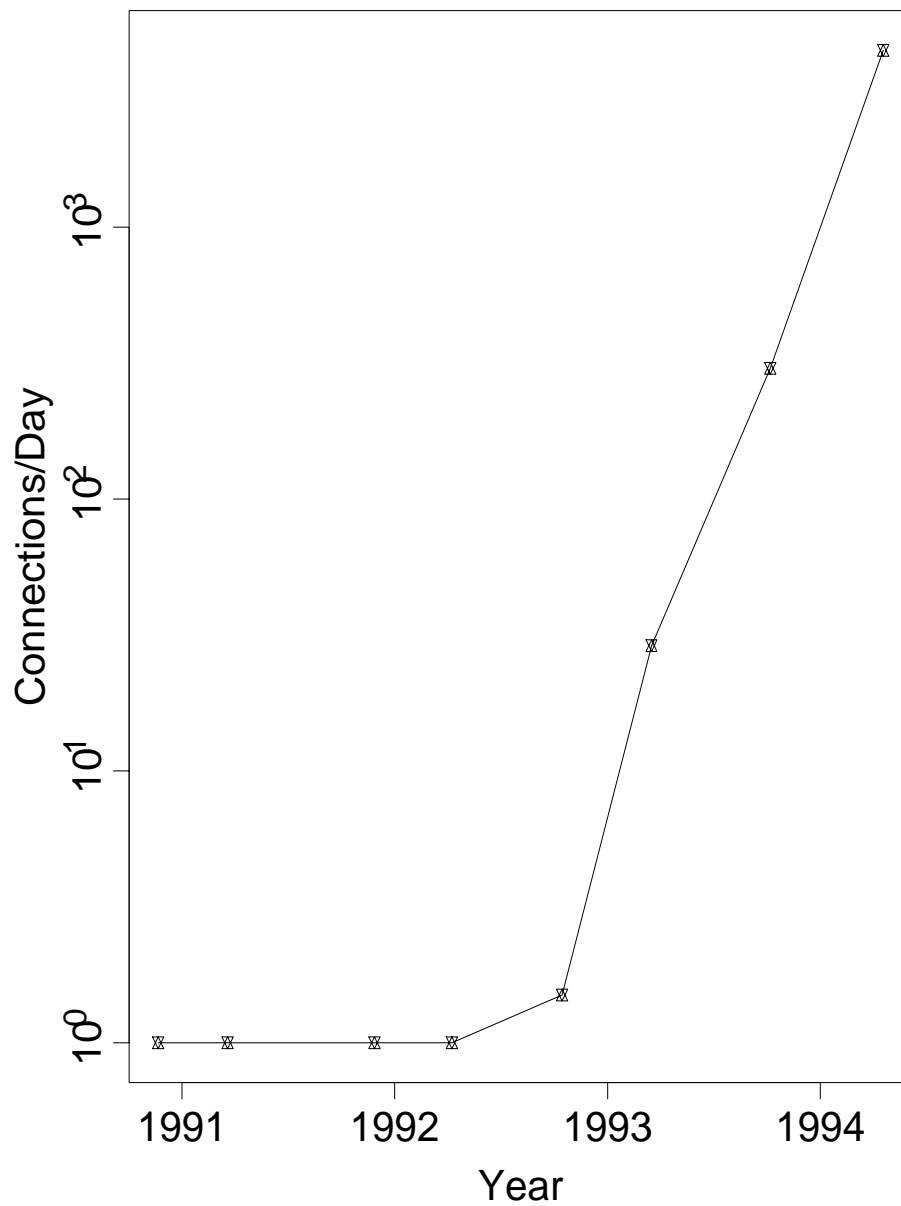
There's no such thing as “typical”: robust statistics fail.

Sizes, durations exhibit infinite variance — immense range!

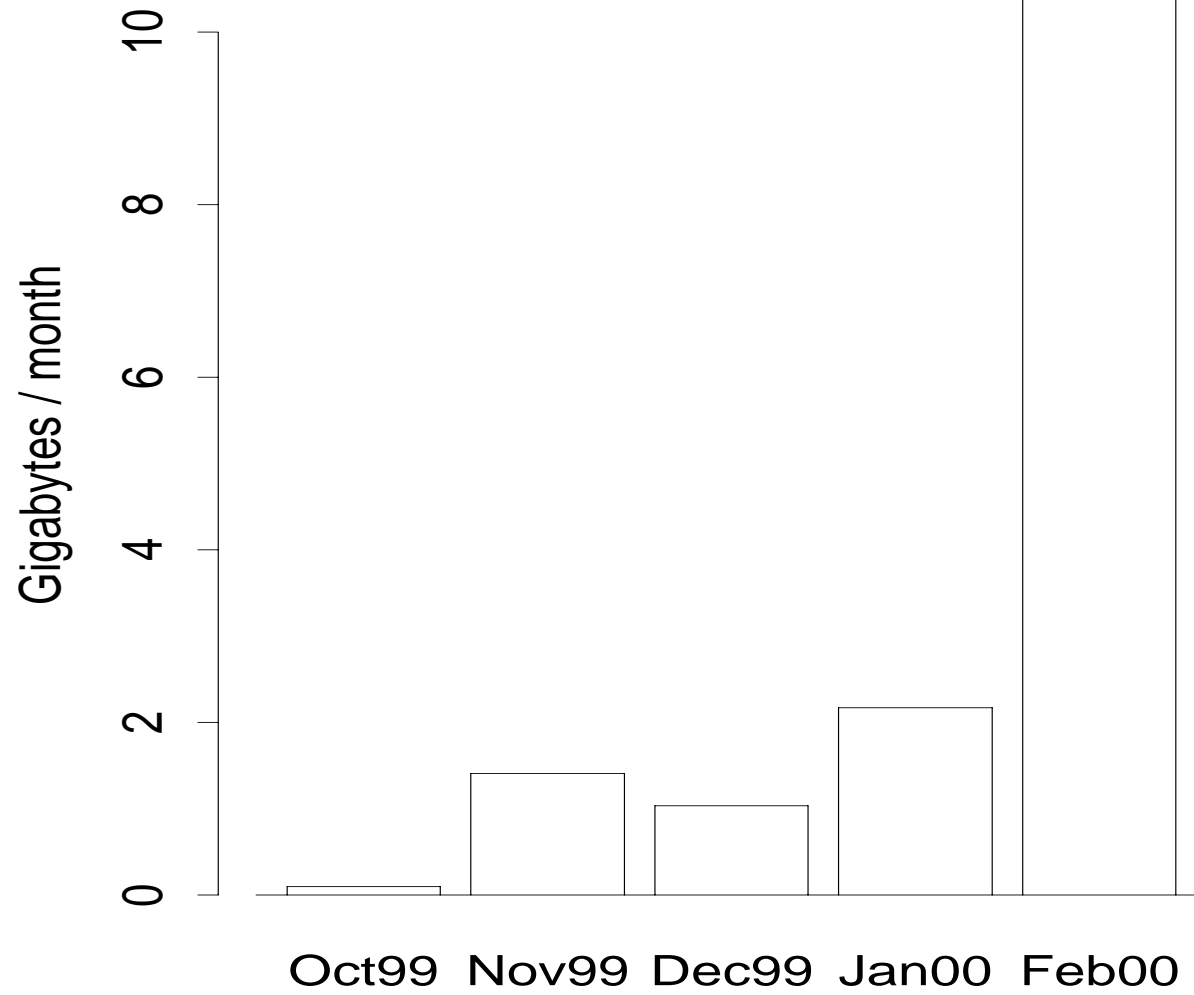
From 100's of msec on up, traffic exhibits a fractal structure.

New applications radically alter the landscape . . .

# Growth of LBNL's WWW Traffic



# One Site's Napster Traffic



## **Paradigm shift: Broadly distributed applications**

With centralized elements:

- Web search engines
- Napster (MP3s; 50% of bytes @ UCSC)
- Imesh (publish your whole PC)
- SETI@Home (15% of packets, UCB)

## **Paradigm shift: Broadly distributed applications, con't**

Without centralized elements:

- Gnutella (open-source Imesh — the arms race is on!)
- Distributed denial of service (could be improved!)
- Content distribution networks
- GRID forum (distributed scientific computing)
- MBone/multicast (enabling technology)

⇒ We're still figuring out the possibilities.



## **The high price of all those IPOs:**

Gold rushes tend to lead to strip mining.

Today's land grab = tomorrow's fences:

Firewalls hardwire limited models of connectivity.

NAT boxes restrict application flexibility.

“Transparent” (interception) proxies redefine service model.

End-to-end security undermined.

Fast routers  $\Rightarrow$  no incremental extensibility (options).

Architectural evolves ad hoc, driven by short-term market forces.

## Whither robustness?

The great success of IP is due not to its efficiency, but its robustness, in the face of: outages, administrative diversity, link technologies, unforeseen applications.

Missing: robustness to attack.

Developing robustness requires a coherent architecture.

Where is the paydirt in that?