Future Web Services
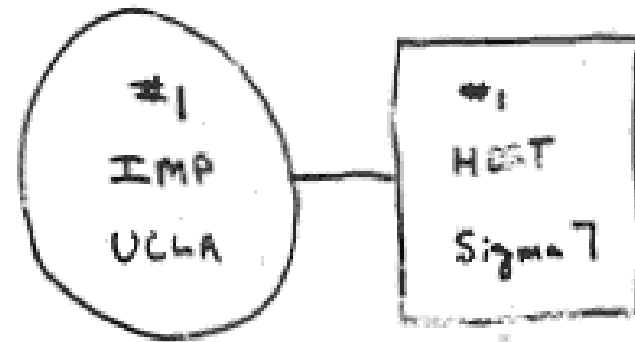
Andy Poggio
Packet Systems Group
Systems Products
Sun Microsystems

Networking

- Past
- Present
- Future

ArpaNode

FIGURE 6.1 Drawing of September 1969 (Courtesy of Alex McKenzie)

- ◆ Advantages:
  - ◆ no congestion
  - ◆ no viruses
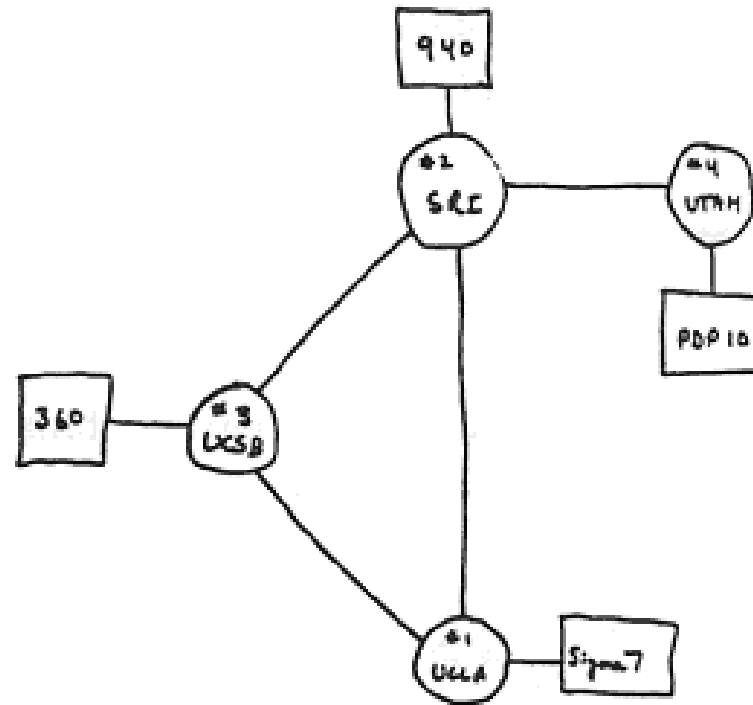 - ◆ no denial of service
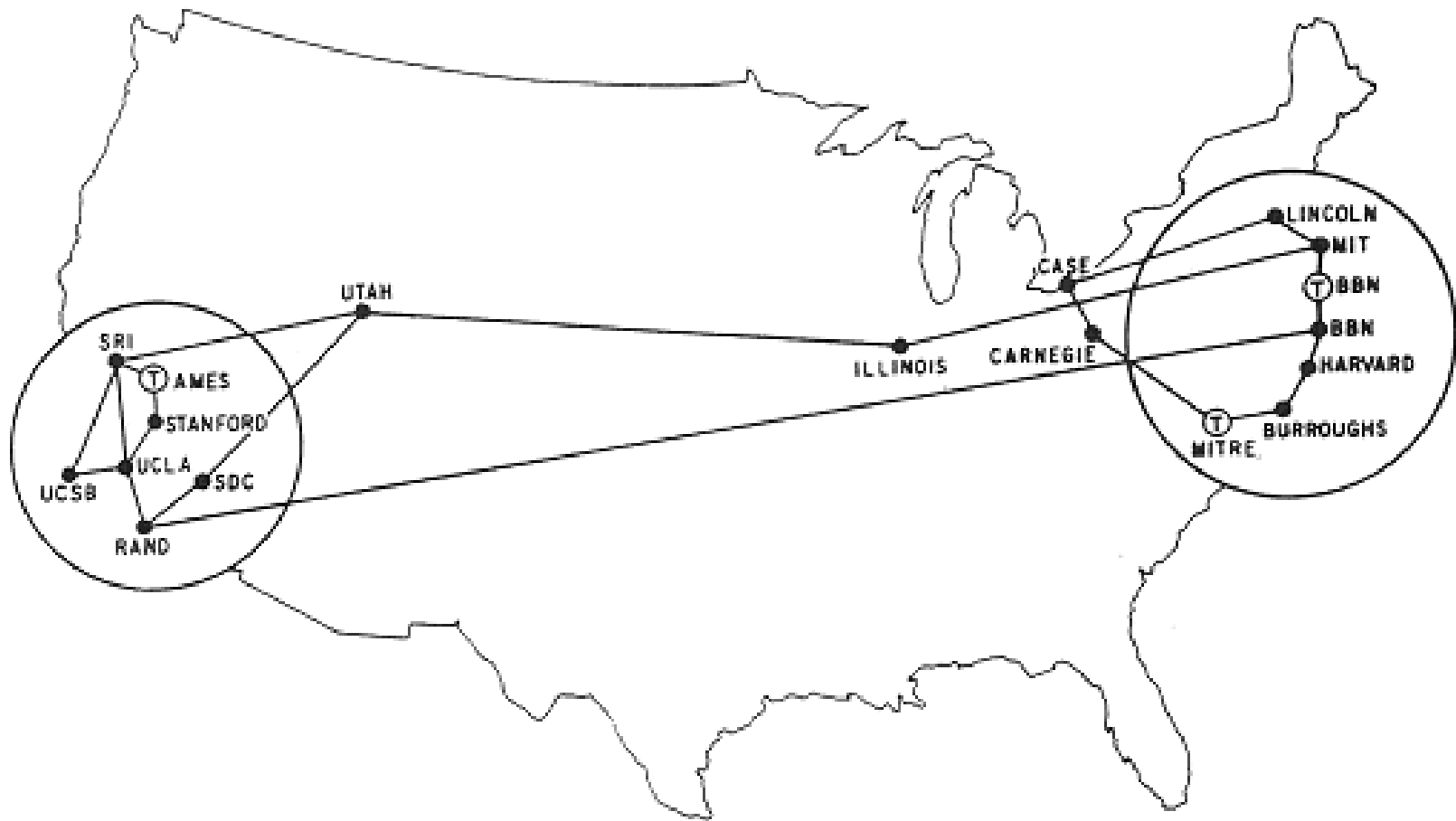- ◆ Disadvantages:
  - ◆ Metcalfe's law

ArpaNet

THE ARPA NETWORK

DEC 1969

4 NODES
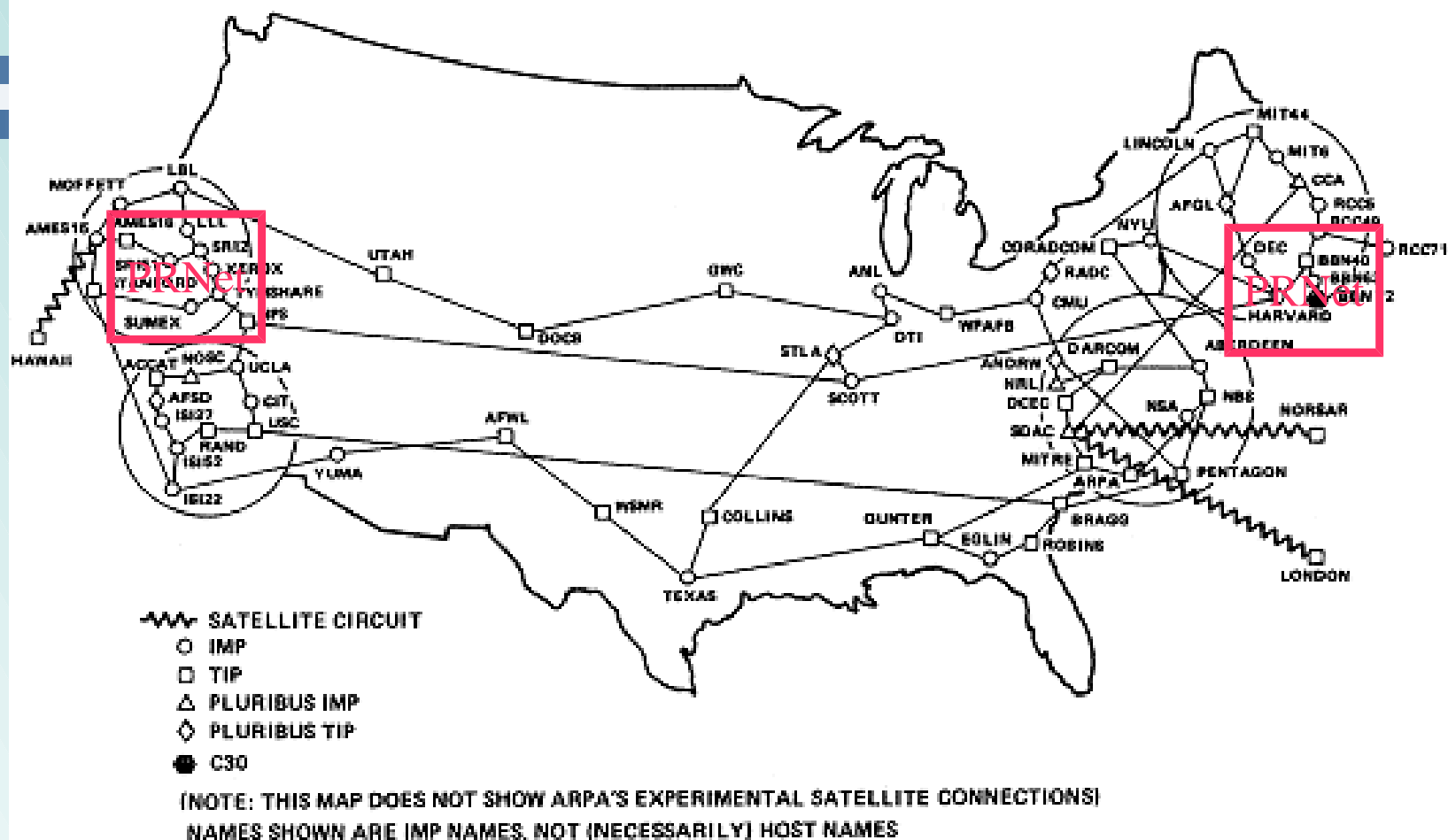
FIGURE 6.2 Drawing of 4 Node Network
(Courtesy of Alex McKenzie)
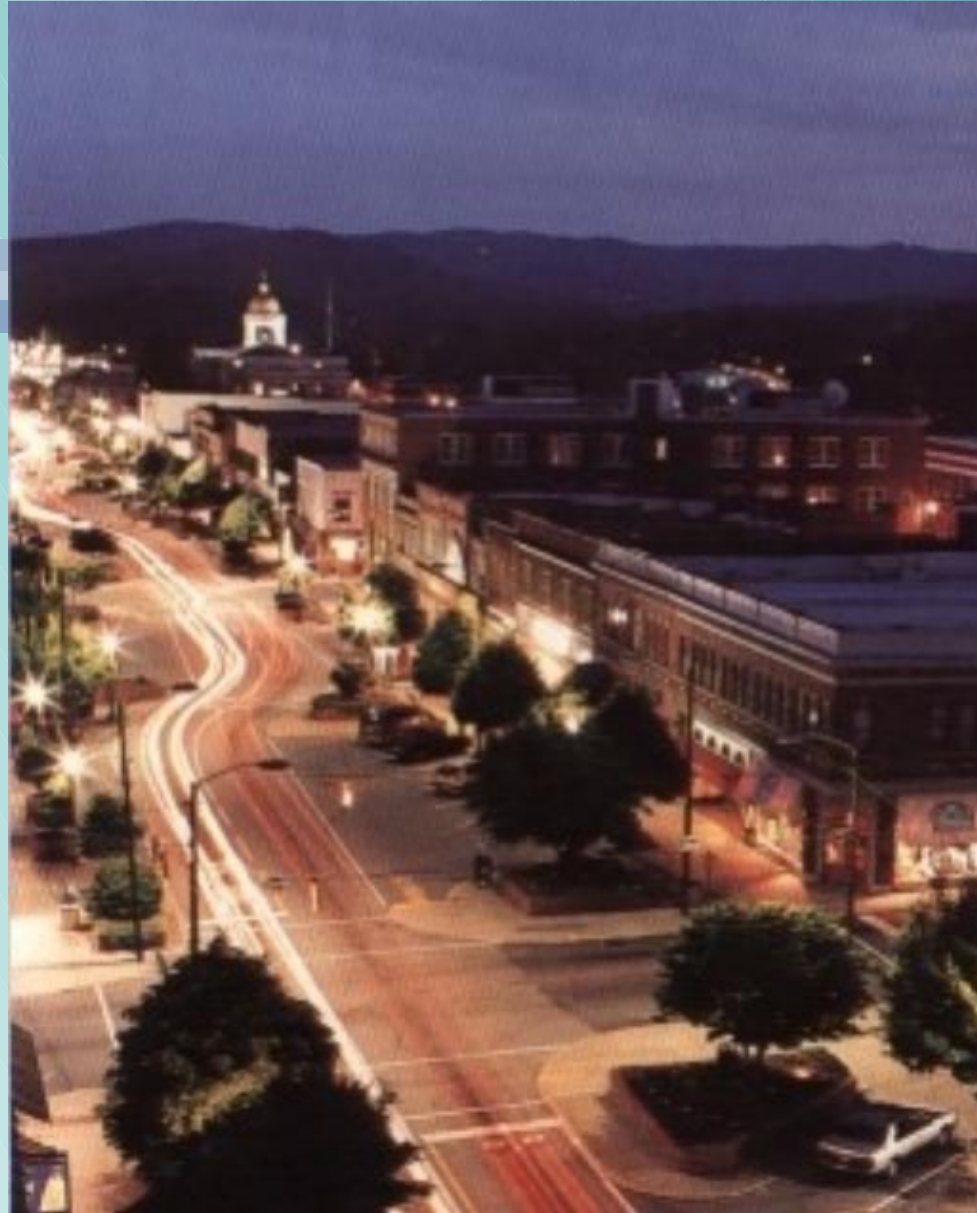
ArpaNet – Both Coasts

MAP 4   September 1971

ARPANET GEOGRAPHIC MAP, OCTOBER 1980

Ipv4 Addresses circa 1980

- 32 bits total

- 8 bits for network number –– plenty

- 24 bits for host number –– could run out

- "Predictions are hard to make, especially about the future" – Vint Cerf

Where?

ebay.com
cnet.com
1–800–flowers.com
download.com
etrade.com
webvan.com
amazon.com

Post–Mainstreet Era

- What can't real mainstreet provide?

- Anytime

- Anywhere

- "The 6+ Webs" – Bill Joy

Near Web

- Nearby high resolution display/mouse/kbd
- Personalized News
  - multimedia
  - on demand
- Education
  - Any medium – text, graphics, 3D, video, audio
  - Interactive / simulation – angular momentum
  - Draw from information sources worldwide

Near Web

- ◆ References – traditional

  - ◆ Alexander, Steve, and Ralph Droms. *DHCP Options and BOOTP Vendor Extensions*. RFC 2132. March 1997.

- ◆ References – web

  - ◆ www.planetit.com/techcenters/docs...

Far Web

- TV/appliance with remote control

- Entertainment on demand

- Targeted advertising

  - Can be unobtrusive and valuable

- Anyone is a source

  - publisher/broadcaster/service provider

  - content / service

  - infrastructure (server+connection)

Voice Web

- ◆ Voice–dominated communication
- ◆ JavaCar with voice control of:
  - ◆ Wireless modem
  - ◆ GPS
  - ◆ Miniserver with in–car network
  - ◆ Digital dashboard

E-commerce Web

- ◆ Computer-to-computer

- ◆ Auctions – forward and reverse (eWanted)

- ◆ Dynamic pricing

  - ◆ price-conscious pays low price

  - ◆ service/warranty/shipping advantages pay more

Device Web

- Device to device

- NonPC devices will dominate in the future

  - With cell phones, NTT Docomo is becoming Japan's biggest ISP

  - First Internet radio has been demonstrated

  - Internet settop boxes (cable, WebTV, etc.)

  - Electronic picture frames using SS memory available; Internet connection soon

Device Web

- Agents
  - Everyone needs a staff
  - Personal news
  - Reverse auctions
  - Global distributed processing – SETI
  - Move/Run anywhere with IP/Java

Here Web

- Personal, portable computing+communication
- Digital assets anywhere
    - Own CD, access MP3 via website (myMP3)
    - Same with files, DVDs, etc.
    - On demand access+ownership

Here Web

- Creating an environment

- Where would you rather be?

  - Taken from "Snow Crash" by Neal Stephenson

Here Web

- 20x30 storage locker in a U–Stor–It
    - concrete floor with rollup steel door
    - cinder block and cargo pallet furniture
    - thrifty but sanitary bathroom facilities located next–door

Here Web

- The Street, 65K kilometers around

- Neighborhoods filled with Frank Lloyd Wright and Victorian house designs

- A black pyramid the size of several football fields

- Beautiful people, wild−looking abstracts, tornadoes of gyrating light

Here Web

- Universe creators
- Live in Versailles, The Forbidden City, Kauai
- Be in places you can't go:
  - Fusion ignition of a new star
  - Shockwave of a supernova
- For the price of a software upgrade
- *But the real world always comes first!*

Building the Future

- "The best way to predict the future is to build it" – Alan Kay

- Network infrastructure

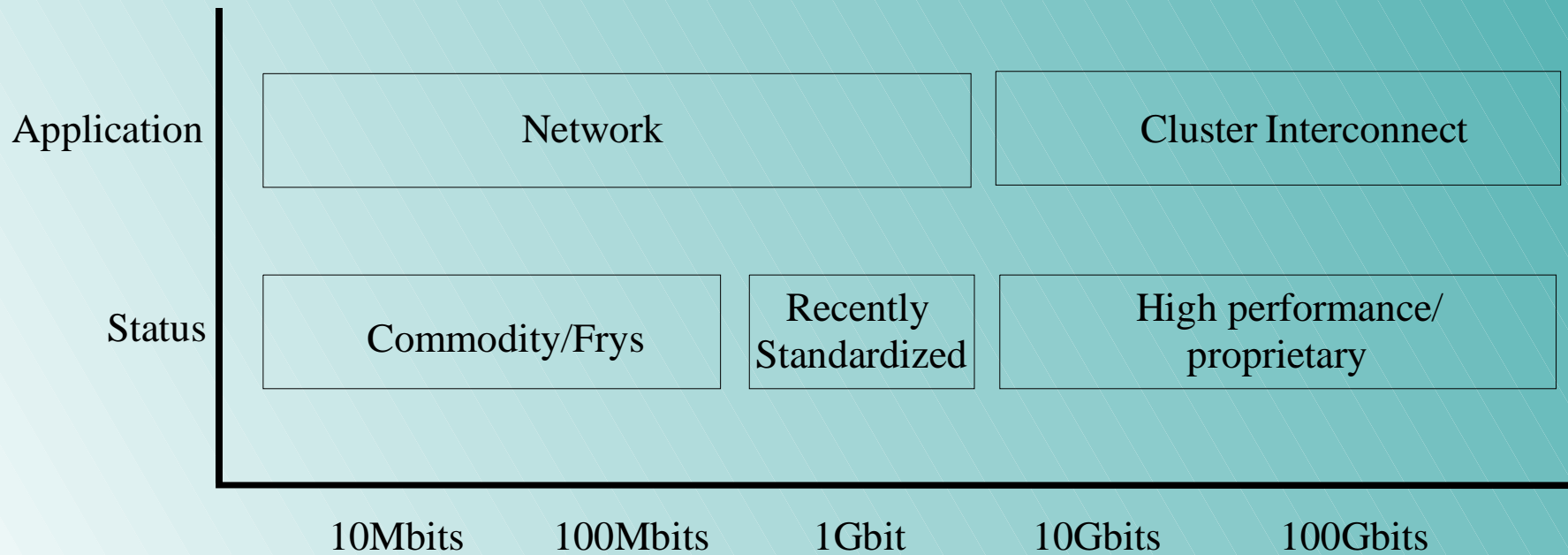- Computer architecture

- Server room architecture

Ipv6

- Expanded address space

- Simpler autoconfiguration with global+local address components

- Better support for authentication and encryption

- Mobility – moved node can ask router for forwarding

IPv6

- Primary motivation is address space

- About 1 billion IPv4 addresses remain

- Successful reuse: DHCP, NAT and private address ranges

- IPv6 adoption slow for much of the world

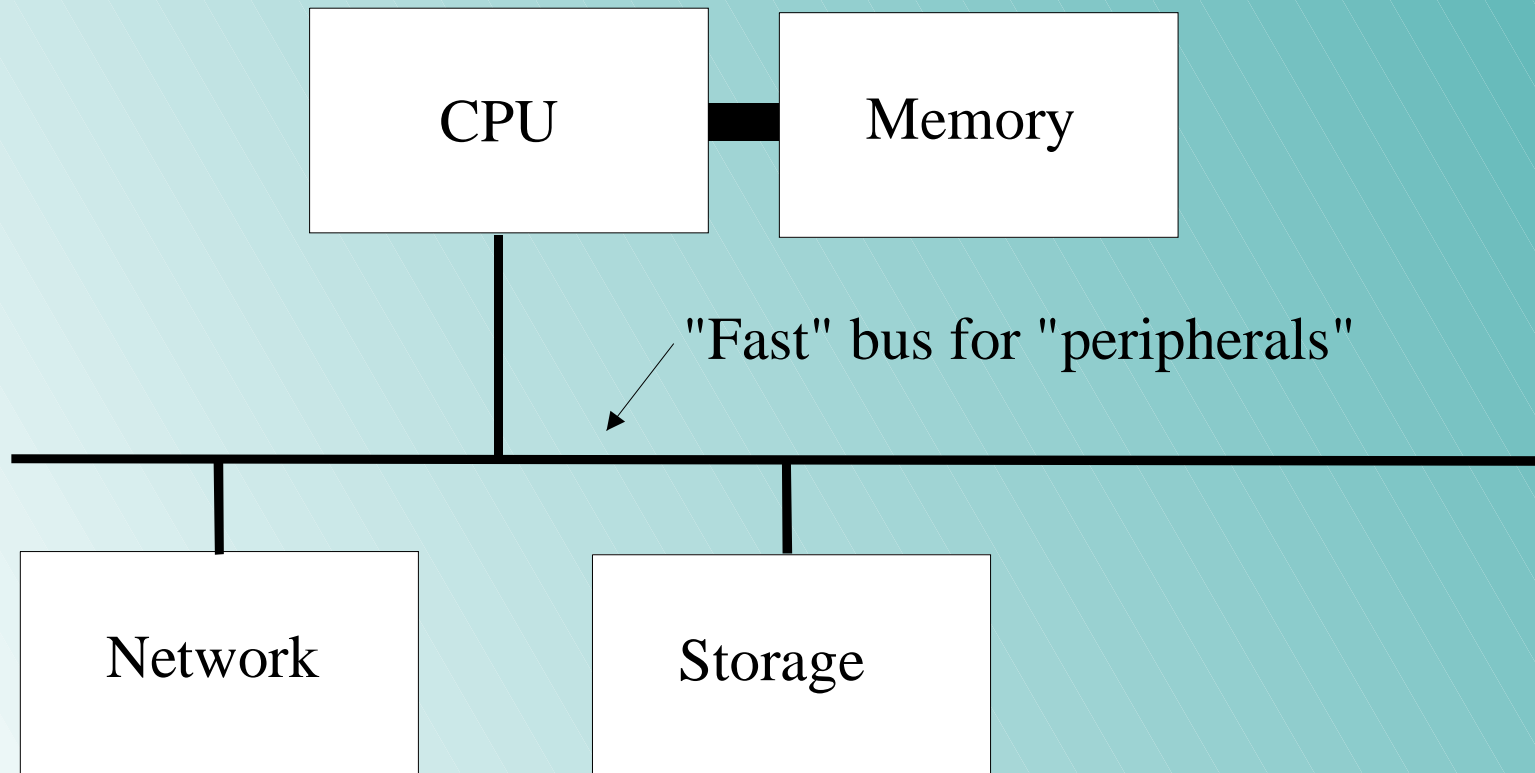- There will always be IPv4 on the Internet

LAN Bandwidth

Application	Network		Cluster Interconnect	
Status	Commodity/Frys	Recently Standardized	High performance/ proprietary	
	10Mbits	100Mbits	1Gbit	10Gbits	100Gbits

Network Infrastructure

- Wireless versus <u>Wired</u>

- <u>QoS</u> versus <u>Overprovision</u>

- Electrical versus <u>Optical (crayons)</u>

- Last mile

  - ADSL

  - cable modem
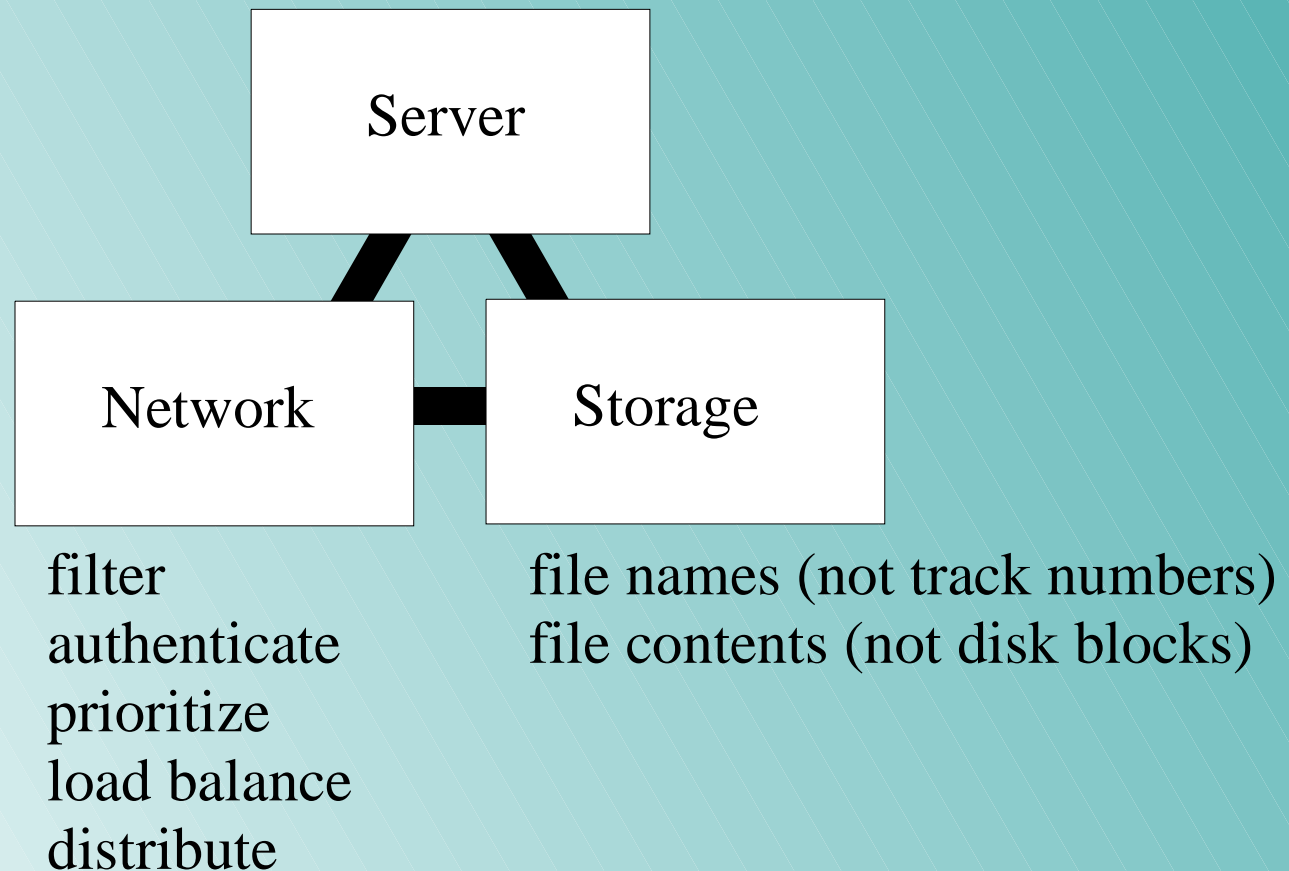
  - satellite

  - <u>fiber to the home (FTTH)</u>

Chip Architecture

- Electrical / Si for another decade

- Quantum effects count at .02 microns

- New approach needed then:

  - optical
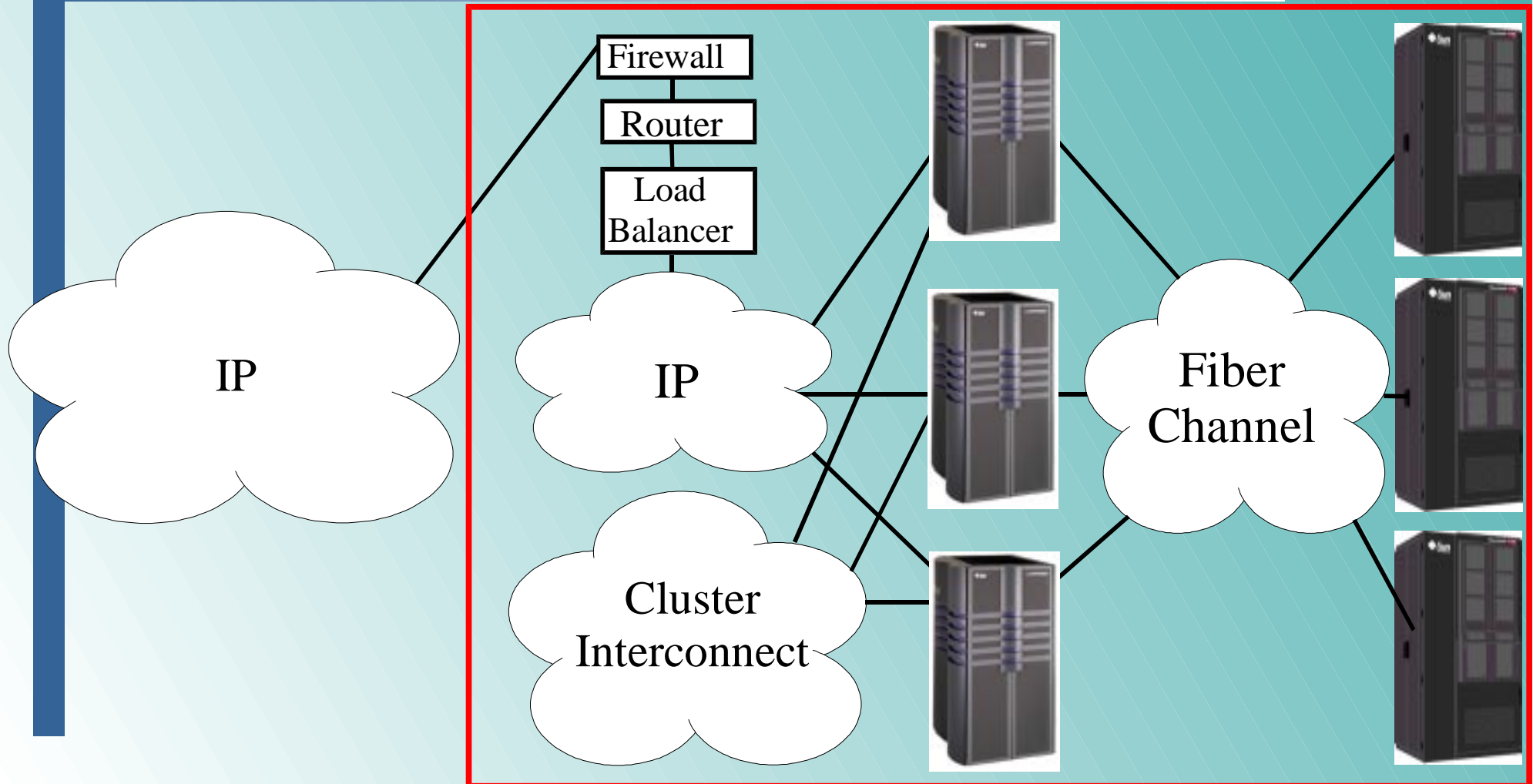
  - organic

  - quantum

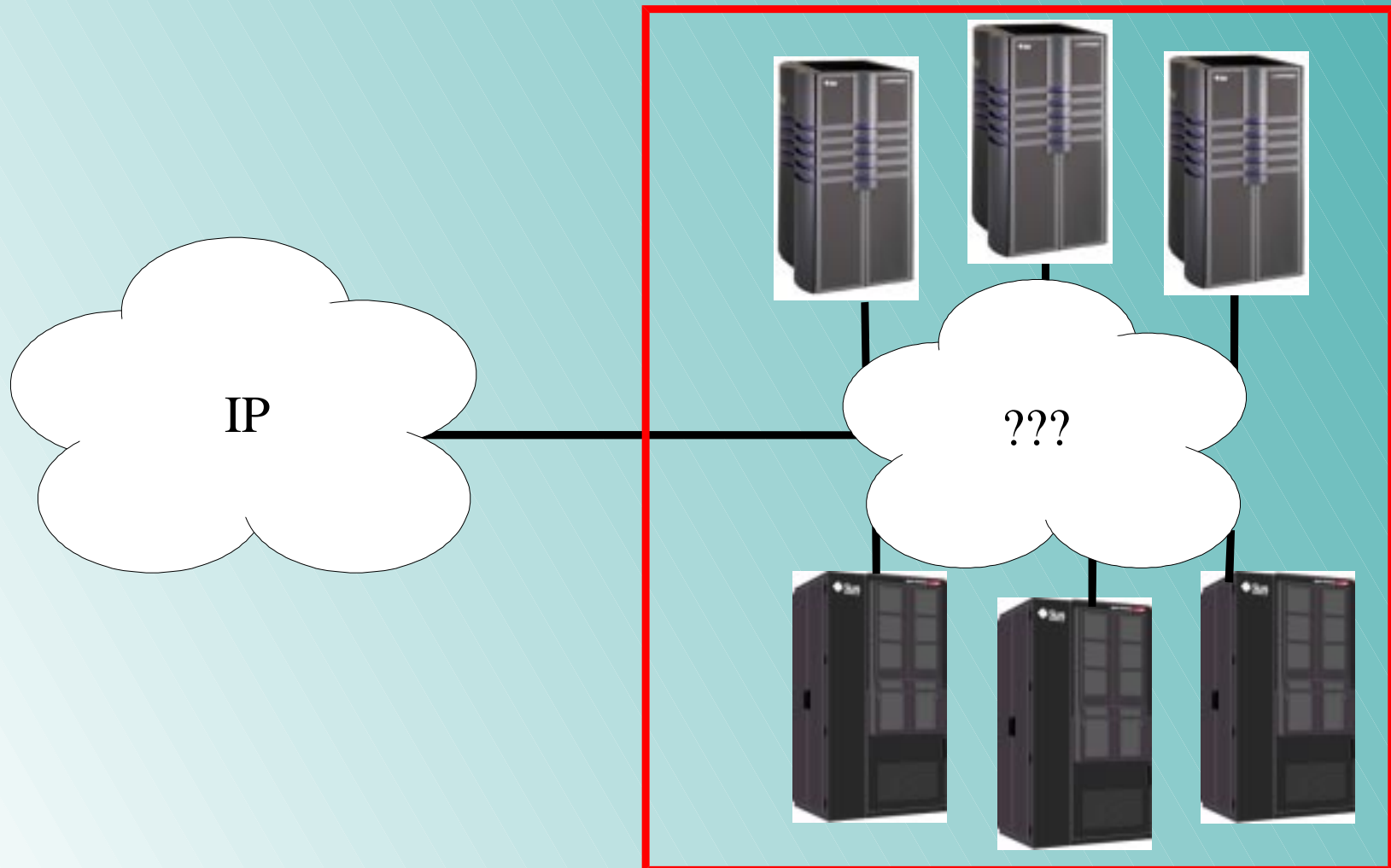 - computational fog (VR)

Traditional Computer Architecture

CPU — Memory

Network

Storage

"Fast" bus for "peripherals"

Future Computer Architecture

Server

Network Storage

filter
authenticate
prioritize
load balance
distribute

file names (not track numbers)
file contents (not disk blocks)

Current Server Room

Future Server Room

IP

???
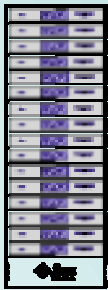
InfiniBand Technology

- Fast interconnect technology

- Designed for:

  - high bandwidth

  - low error rate

  - low latency environments

- Memory (RDMA), not network, semantics

InfiniBand Technology

- Basic rate (x1) is 2 Gbits
  - x4 is 8 Gbits
  - x12 is 24 Gbits
- Replace PCI, cluster interconnect
- Server room communication standard
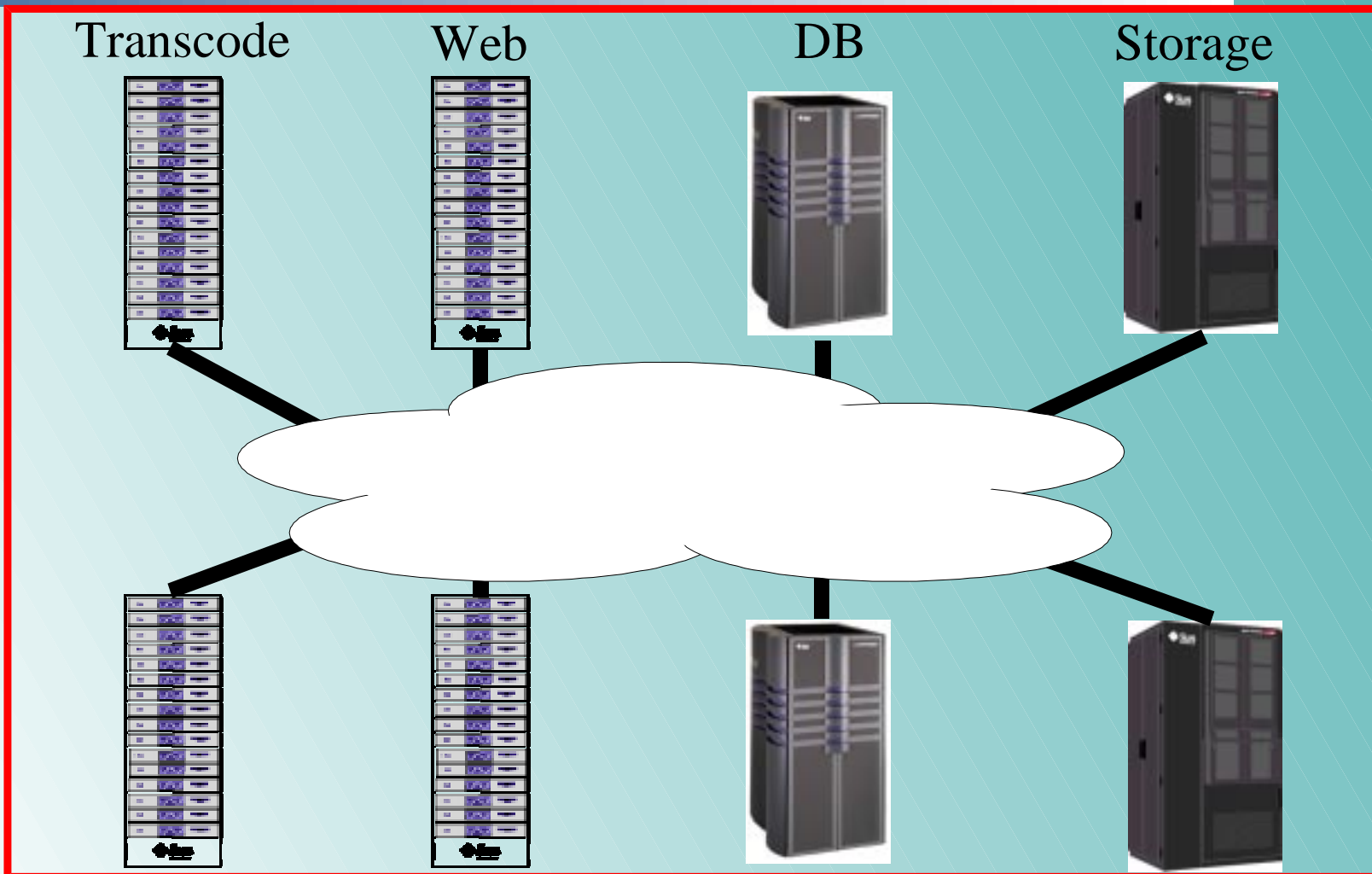- Broad industry commitment

Server Room Strategies

- Farms for replicated content

  - failover to independent node; minimal context

- Big systems/clusters for unique content

  - failover to clustered node; full context

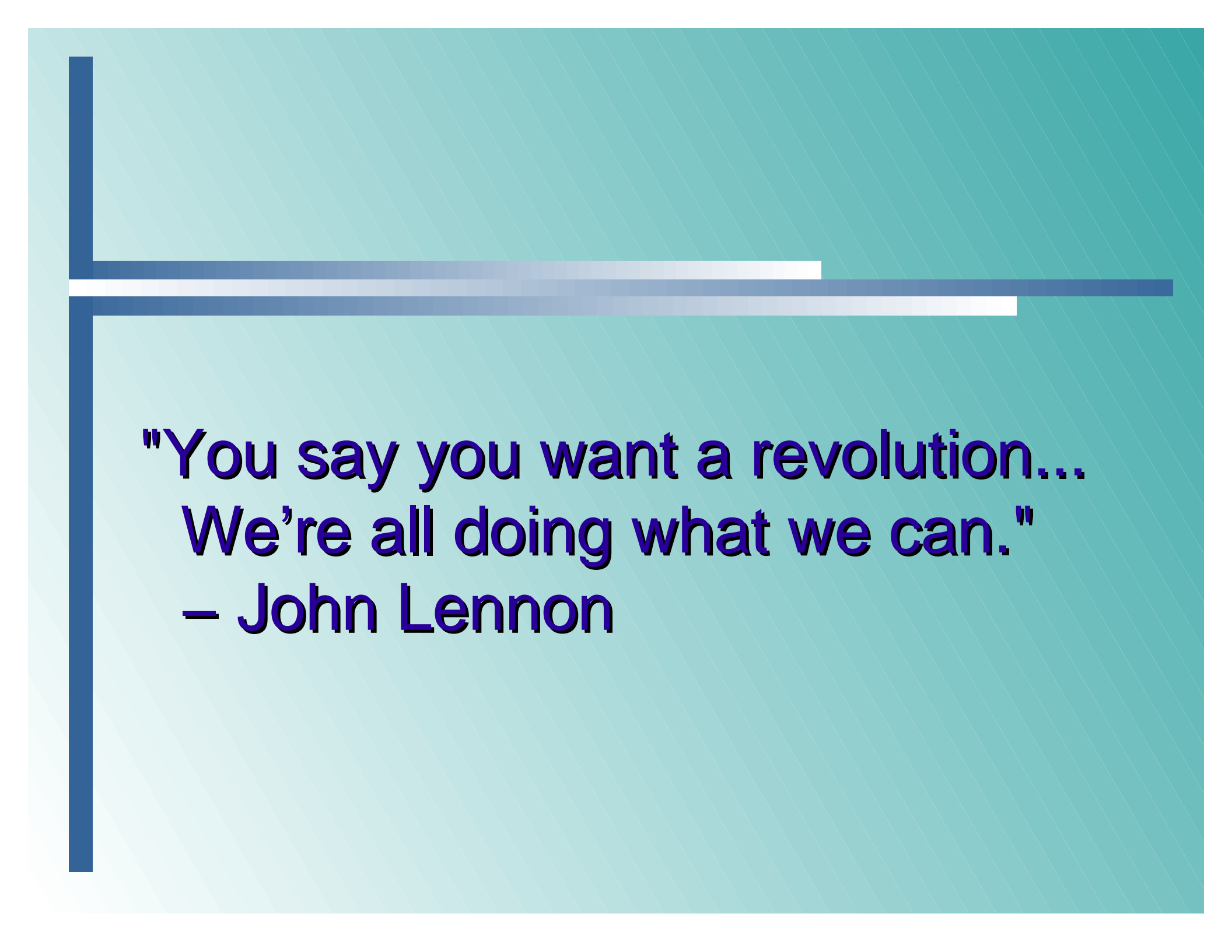- Most server rooms will have both

- Geographic distribution

Current Server Room

Web

DB

Storage

Ethernet

Fiberchannel
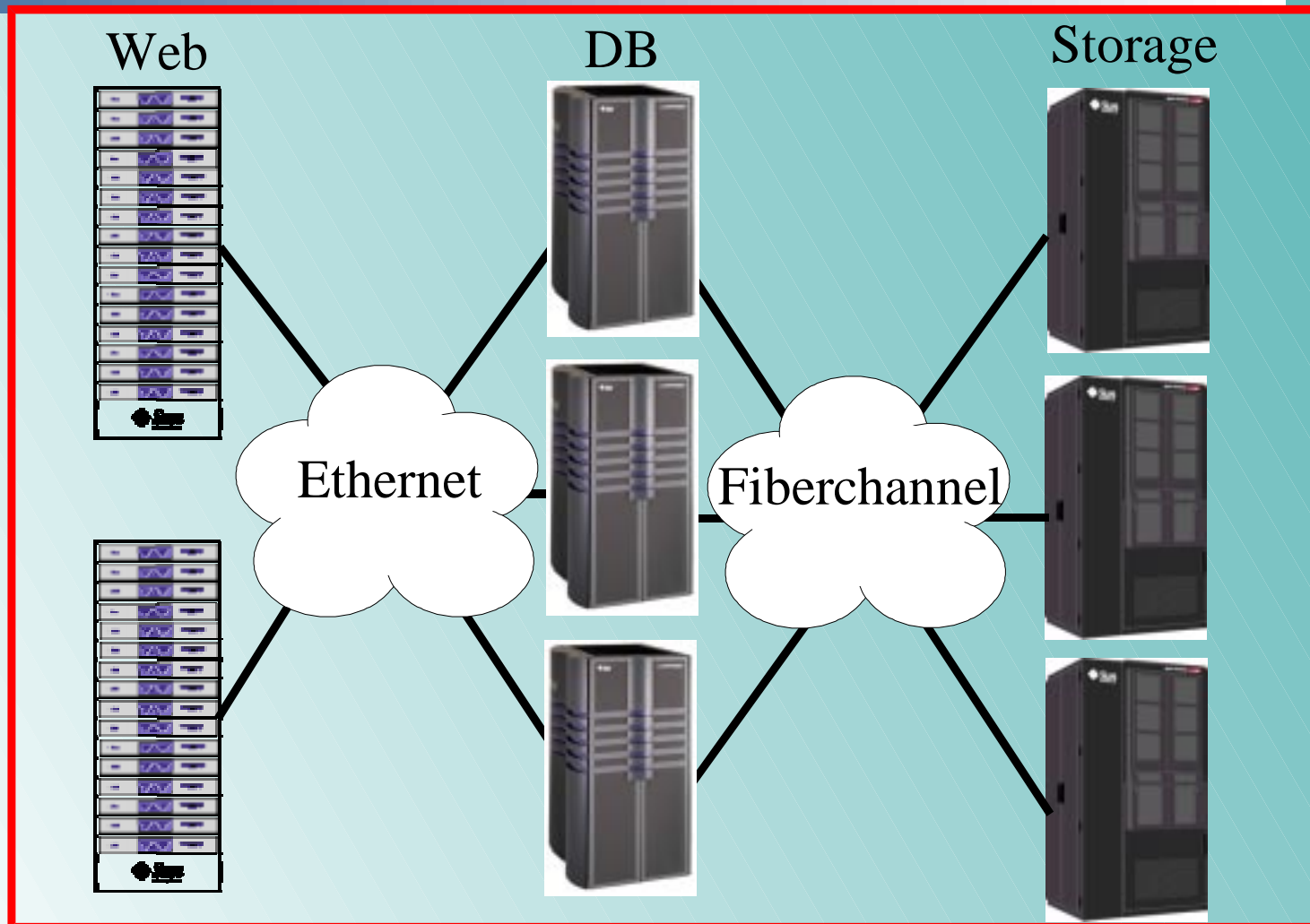
Future Server Room – More Layers

"You say you want a revolution...
We're all doing what we can."
– John Lennon