

Infrastructure – the next tsunami

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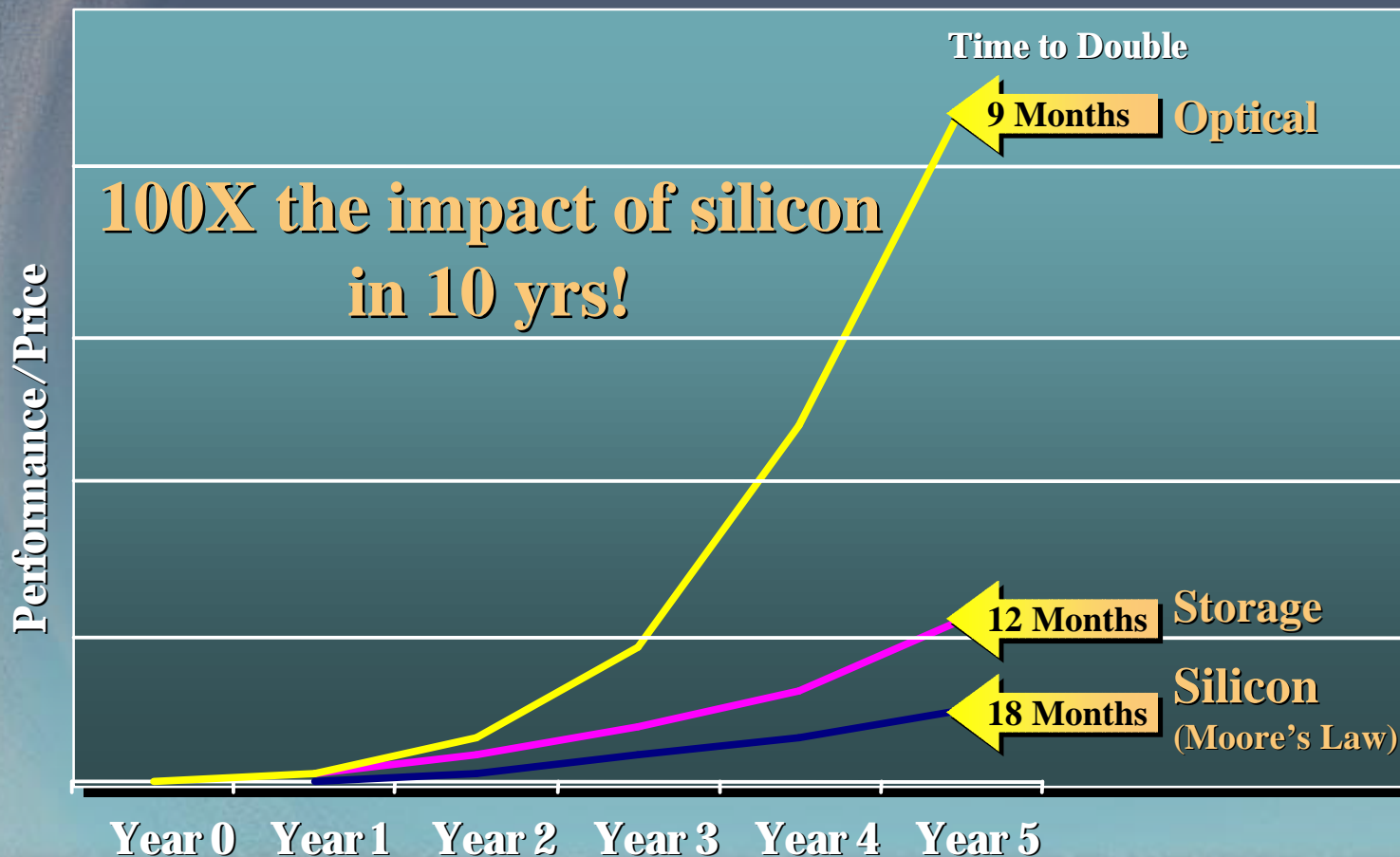
July, 2000

... We Can't Predict What Will Happen

“Nobody knew early in 1921 where radio was really headed. Everything about broadcasting was uncertain. For my own part I expected that since it was a form of telephony, and since we were in the business of furnishing wires for telephony, we were sure to be involved in broadcasting somehow.”

– Walter Gifford, future President of AT&T, 1921

Expected Innovation Rates of Optics, Storage, and Electronics



Oil Fueled The Industrial Revolution.

Will Bandwidth Fuel The New Economy?

- Content, personalization, community (Excite, Yahoo)
- E-commerce (Amazon, Cisco)
- Extranets (Auto Exchange, Asera)
- Intranets (Netscape, Microsoft)
- Application outsourcing services (Corio, Qwest)
- Extended bandwidth & services (Broadband Office, Concentric)
- Video & audio (Real Networks, Replay TV)
- Operating system dial tone (Qwest/Microsoft, Storage Networks)
- Unwritten: Machine to machine web (“silicon cockroaches”)

... and the Best Surprises (Like Napster, Corio & BBO) Yet to Come!

The Environment

- Hyper efficiency or Adam Smith II
- Hyper speed
- Winner take all economy
- Value add transparency
- Risk as a requirement?
- Change as a process
- Technology as a driver
- Diseconomy of scale
- Technostructure & Infostructure

CIO's Issues

- The problem of legacy - systems, people,...
- Skills shortage
- Re-engineering the enterprise for technology based competition/strategy
- Intranets & extranets among islands of information/systems
- Dynamic information architecture vs. static databases (“enterprise models”)
- Real time corporation & future of software

Network Operators Issues

- The problem of legacy - systems, people,...
- Skills shortage
- Re-engineering the evolvability & obsolescence
- Enabling value added services & external service operators
- Growth
- Interoperability across networks

New Networks, New Possibilities

- Internet scale data centers
- High bandwidth (really!) last mile
- Total bandwidth exploding
- Connectivity - “evernet”, “everyplace”, “everydevice”
- Applications over IP
- ASP’s

New Networks, New Goals

- **Complexity thru federation NOT integration**
- **Adaptability & evolvability**
- **Configurability NOT customization**
- **Modularity – “micro” open systems model**
- **Personalization**
- **Application interoperability, unified UI**
- **Dramatically new management systems**

New Areas for Innovation

- **Network – Telecom equipment & Services**
- **“Extranet information architecture”**
- **Virtual computer**
- **Network services - “decomposing”
the computer**
- **Services Infrastructure**

New Areas -Telecom Equipment

- **Hot Boxes & Hotter Software**
 - Optical backbone (Corvis)
 - Metro glue (ONI, Zaffire, Cerent)
 - Renovation – Cerent/Cisco
 - IP routing (Juniper)
 - IP based value added services (Redback)
 - VOIP switches
- **New Systems**
 - VOIP –services, voice processing, signaling
 - More packet processing software
 - Optical hot boxes
 - Management systems (Abatis, Sigma)

New Areas - Telecom Services

- **Bit market – scale, IP everywhere (Qwest)**
- **VOIP + voice services**
- **IP Network Based Services – processing power (VPN's, COS, ...)**
- **VAR Services on IP networks (Smartpipes, Akamai)**
- **Services Management services (Coreon, Abatis)**

The Infrastructure Stack

Asera Inktomi Smart Pipes Marimba ISS Verisign
Resonate Corio Jamcracker LoudCloud Zambeel
LogicTier Storage Networks

IP services

WebMethods Active Tibco BEA
Veritas MSFT Bow Street Oracle Apache

IP Software

Sun Cisco Dell IBM HP Compaq
Network Appliance EMC Intel Seagate

IP Components

Exodus Qwest Level 3 Akamai, Onfiber, iBeam,
CacheFlow, Digital Island Coreon Cosine InterVu

Network
Services

Qwest Level 3 Williams, MCI Comm ATT
BroadBand Office Sprint Rythms Covad Concentric

Access
Providers

Juniper, Cisco, ONI, Sycamore, Cerent, Nortel,
Lucent, Copper Mtn, Redback, Zaffire, Ciena

Network
Components

New Area: “Ibase” for the Enterprise

The Real Time Information Architecture

- Multi-architecture architectures
- Messaging paradigms
- Heterogeneous databases
- Metadata
- Entitlement: authentication, authorization...
- Inter-enterprise MIS, diverse environments
- Translation
- EAI
- Connectivity- speeds, modes, devices
- Coherency of information

Case Study: Asera “IBASE”

- Architecture for multi-architecture integration
- Unification of the UI - “personal portal”
- Universal, application independent “entitlement system”
- Messaging, EAI, translation...
- Configurable and personalized
- Not quite flexible “business object modeling”
- Not quite the work flow and rules engine
- “Real-time” enablement

Mission: Ciscoize and Dellize the rest

Architecture Connecting Architectures...

AserA



New Area: “Virtual Computer”

A Computer Distributed Over the Internet

- Networks of computers as the “Virtual Computer”
- Scalability of hardware - add & delete
- Self management
- Geographic distribution
- Load balancing, caching, COS, ... services
- Resilience
- “Network operating system”
 - SETI, Napster, Routers

Case Study: Router Networks

- Behave as “one” machine
- System self-adjusts to “node” failures
- Capacity can be added/deleted - “self organizing”
- Geographically disbursed
- Managed failure modes

New Areas: Network Services

The “Decomposed” Computer Architecture

- Storage services
- Database services
- Web servers/HTTP servers
- TCP/IP session servers
- Application servers
- Composite services
 - Replication
 - Load balancing
 - Distribution

New Areas: Network Services

- System Services
 - Storage/translators (Oracle IFS)
 - Network desktop (iPlanet Webtop)
 - Synchronization
- Personal Services (Microsoft net initiatives)
 - Network identity & directory
 - Search
 - Proxy services
 - Notification & Messaging
 - Personalization
 - XML Store
 - Dynamic Delivery
 - Data, workflow, rules engines

Case Study: Zambeel

...distributed data services



A Different View of Services ...

... Finally the Network IS the Computer

Network Services 1 - Applications

- **ASP's - Corio & Asera**
- **Loudcloud / Logic Tier**
- **Storage Networks Inc**
- **Broad band channels – Broad Band Office, Inc.**
- **Oracle IFS**

Network Services 2 - Services

- Caching (Akamai)
- Content routing
- Storage (SNI)
- Authentication & entitlement (Oblix)
- Security (Verisign)
- Agents
- Workflow & rules engines
- Virus & intrusion detection
- OMAP (Abatis)

Network Services 3 – The Network Is the Computer

- **Directory services**
- **HTTP services**
- **NFS & CIFS services**
- **TCP/IP Session services**
- **Database services**
- **Messaging & notification**
- **Proxy & agent services**
- **Pattern detection**

Network Services 4 - Distributed Systems

- **Distributed computers – Centratta**
- **WebOS – single image view of machines + new apps**
 - Proxy services
 - Search (infrasearch, ...)
 - Caching (Akamai)
 - Directory, entitlement & security
 - Mobile “translators”
 - Virus detection
 - Load Balancing
 - Content routing
 - Spam

Other...

- **Remote Services – multi-trillion global market**
- **Collaboration – Firedrop**
- **Re-engineering databases**
 - Data vs. majority of human information online
 - Metadata
 - QOS, reliability vs cost vs. access time
 - Distribution & federated databases
 - Scalability: size, concurrent users ...
 - Security, entitlement, billing
 - Trillions of gizmos, billions of clients, millions of servers
 - Adaptable, no knobs operation

Economics

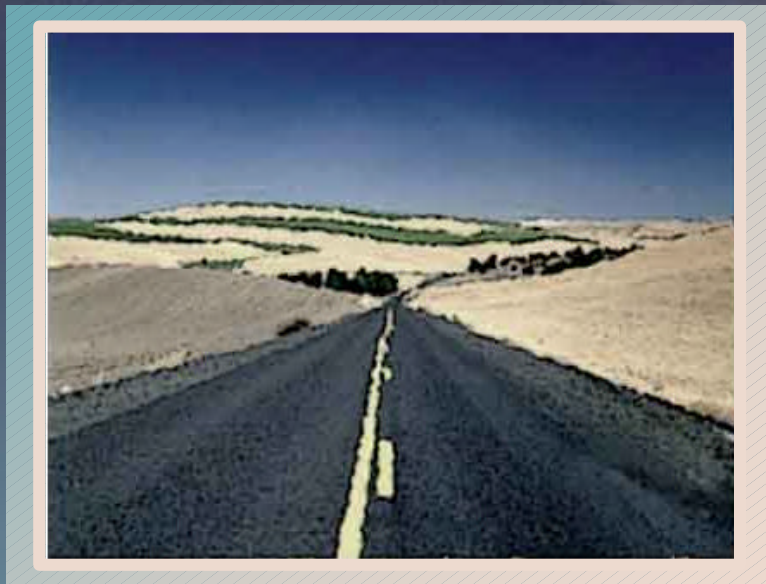
- The relative cost of computing and human attention has changed
- The cost of “failure” is increasing exponentially
- This new economics requires that computer systems be autoeverything: autoinstalling automanaging, autohealing, and autoprogramming
- Computers can augment human intelligence by analyzing and summarizing data, by organizing it, by intelligently answering direct questions and by informing people when interesting things happen

Value Propositions for the Future...

- Demand elasticity (currently 3:1 for bandwidth)
- Price Model for the future & derivative product/operations economics
- Federation & configuration vs. integration & customization
- “Autoeverything” in network & software operations
- Skills shortage
- Testing & validation
- Power & size
- New models – business, network, software, device

The Weather Forecast ...

- **Rate of change will accelerate - life will be more complex, busier . . .**
- **Adaptability, agility & momentum will be the key to success!**
- **Innovation, opportunities & entrepreneurship will thrive**
- **Disruption will be the order of the day**
- **Fun, fortunes & failure will be in abundance**



Comments?

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KPCB Telecom Portfolio: Infrastructure

*Backbone
Transport*

IP Core

Regional

Metro

IP Edge

*Broadband
Access*

Enterprise



Corvis

Lightera

Juniper

Cerent

Optical Networks

New Access

Redback/Siara

Cosine

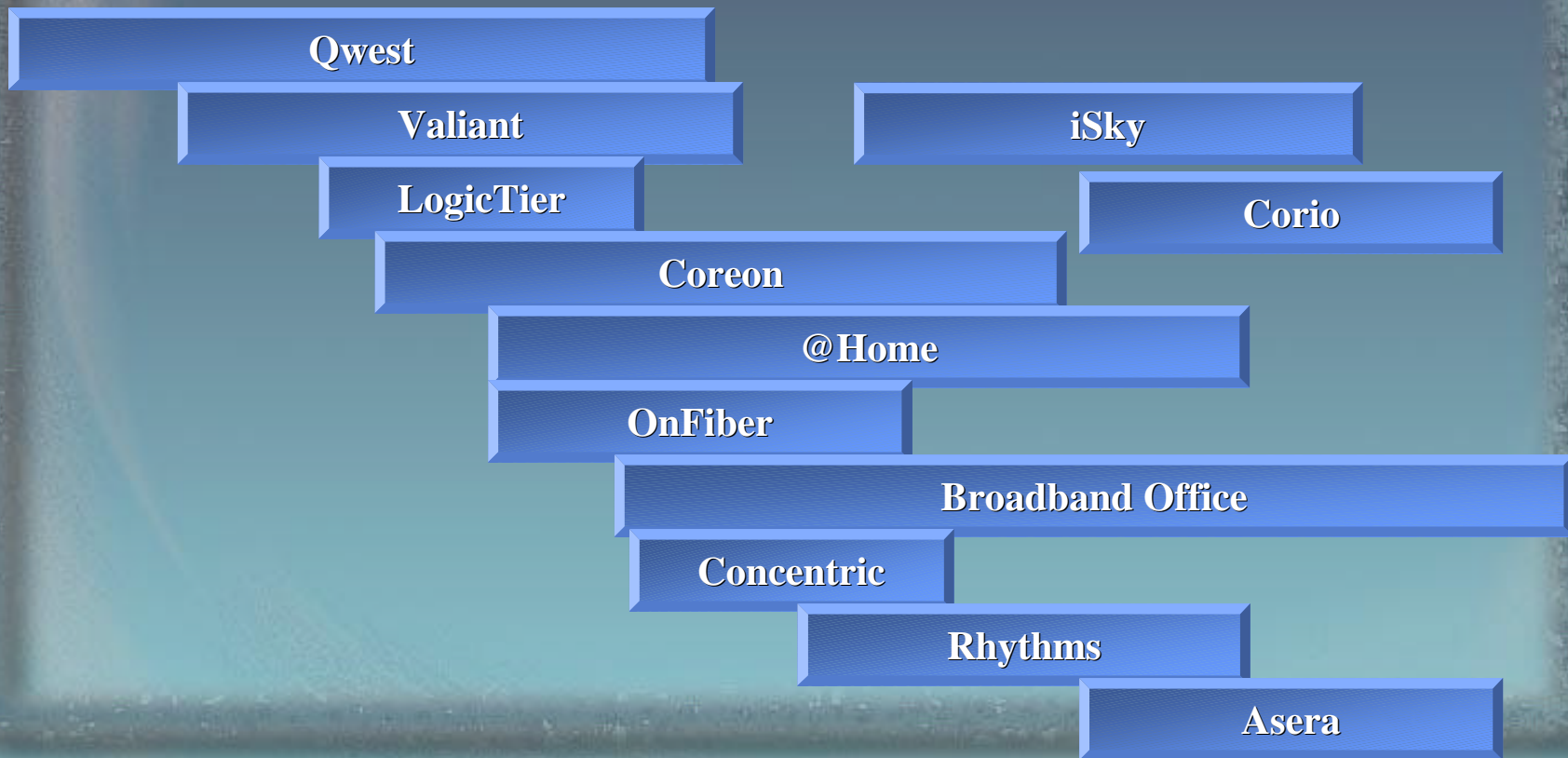
Extreme Networks

Vertical Networks

KPCB Telecom Portfolio: Services

Backbone Transport *IP Core* *Regional* *Metro* *IP Edge* *Broadband Access* *Enterprise*

← *Applications for Service Providers* *Applications for Enterprises* →



Many Companies Will Not Keep Up ...

Leading Computer Vendors (Last Generation)

- IBM
- H-P
- Data General
- DEC
- Sperry
- Univac
- Wang
- Cray



Leading Computer Vendors (Current)

- IBM
- Sun
- Dell
- Compaq
- H-P

Leading Communications Vendors (Current)

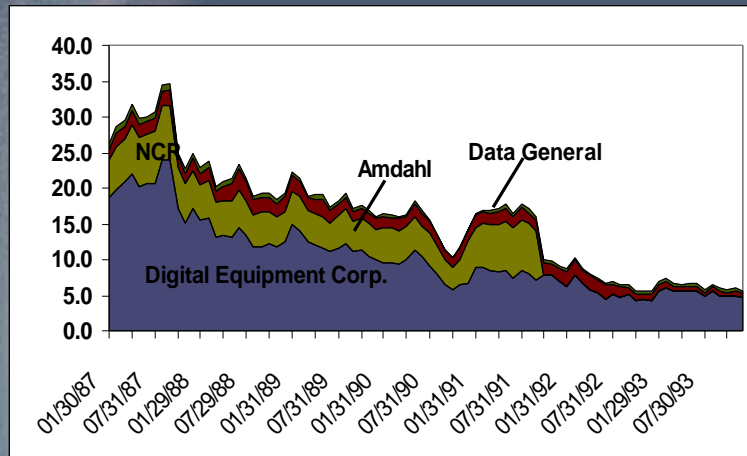
- Lucent
- Nortel
- Cisco
- Tellabs
- Alcatel
- Siemens
- Newbridge
- Ciena



Leading Communications Vendors (Next Generation)



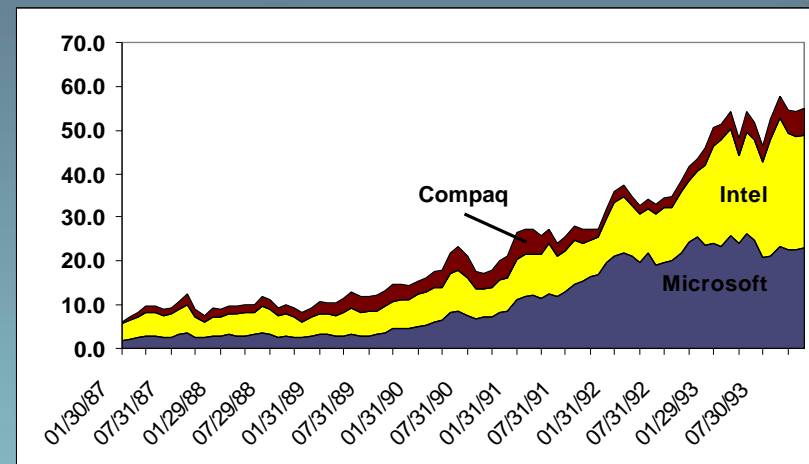
Mainframe to PC Transition



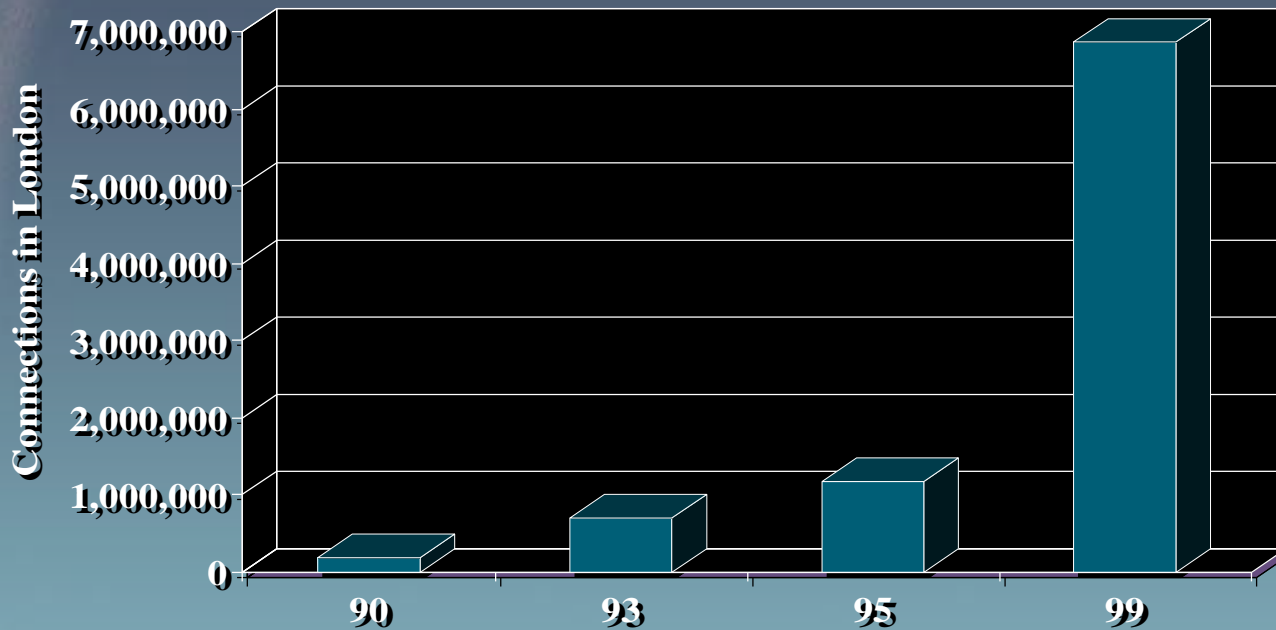
Capital Fled Legacy Systems

New Winners Emerged

This time the stakes
are over \$300B!



New Technology Has A History...



“In 1885, Yale students who were getting ‘more light than they relished’ chopped down an electric pole erected at the corner of the campus...”

Source: When Old Technologies Were New

One Analyst's Explanation:

<u>Time</u>	<u>Platform(s)</u>	<u>Network Operations Model</u>	
1960-1980	Mainframe/ IBM era	10:1 people/machine ratio	<i>Old network management systems were single vendor solutions optimized for cost in rigid five-year preplanned networks.</i>
1970-1990	Minicomputer/ DEC era	1:1 people/machine ratio	
1980-	Workstation/ PC era	1:10 people/machine ratio	
1990-	Enterprise networks/ Cisco era	1:100? people/machine ratio	<i>New network operations systems must be designed for <u>adaptability</u> and <u>change</u> (new equipment, multiple vendors, new service offerings/provisioning).</i>
2000-	Broadband packet networks ?	1:1000? people/machine ratio	

Source: Paul Johnson