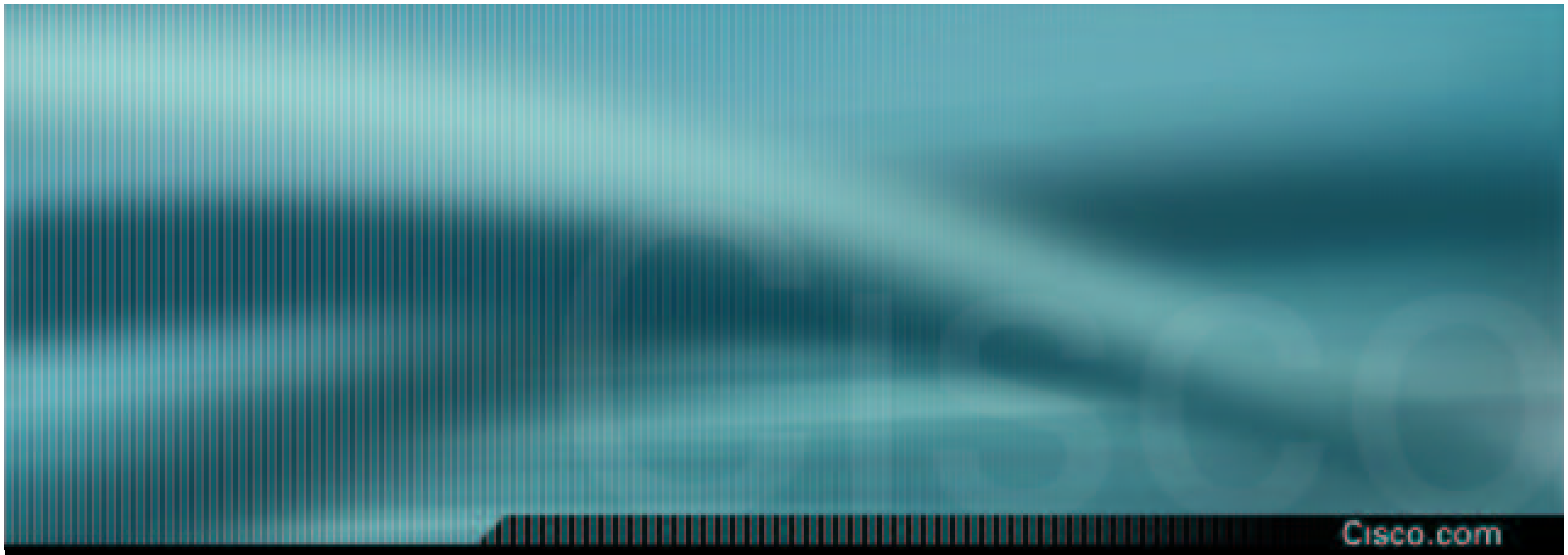

Cisco Systems



NEW WORLD NETWORKS AND TECHNOLOGY TRENDS

Max Tremp

Systems Engineer Manager – Service Providers Mexico

Cisco Systems

mtremp@cisco.com

Agenda

- 2 different “Internets”
- Advances in technology
- Future developments
- Final thoughts

Agenda

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- 2 different “Internets”
- Advances in technology
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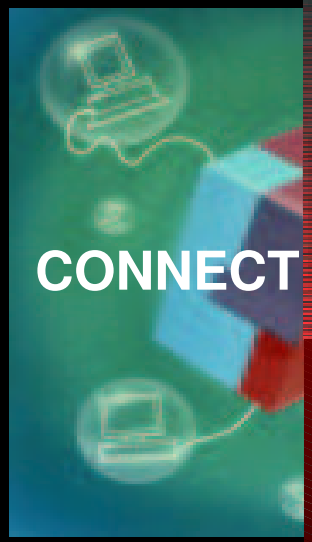
- Final thoughts

The Internet

- Not only it's not lost, it's exactly the other way around
- Number of Internet users will increase from 400 million this year to 900 million by 2004
- Bandwidth at the core of the Internet is doubling every 6 months
- Broadband penetration in the World is ~ 3%
- Investment in e-business is increasing by 25% annually
- It's just that companies need to take the Internet seriously!

Sources: IDC, TeleChoice and Strategis Group, 2000

The Internet has Changed Networking…



***To** Intelligent & Distributed Network Architecture*

- User Awareness
- Content & Application Routing
- Operational Automation
- Network Services
  - Qos, Multicast, Routing
  - Content mgmt, security
  - Addressability, tunneling
  - traffic engineering,etc

Bridging,
Switching,

A trustee w
ASS
trustee users

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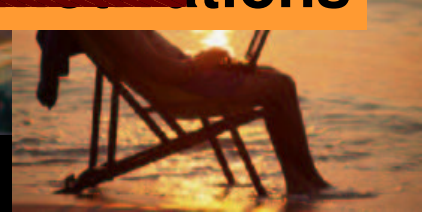

Agenda

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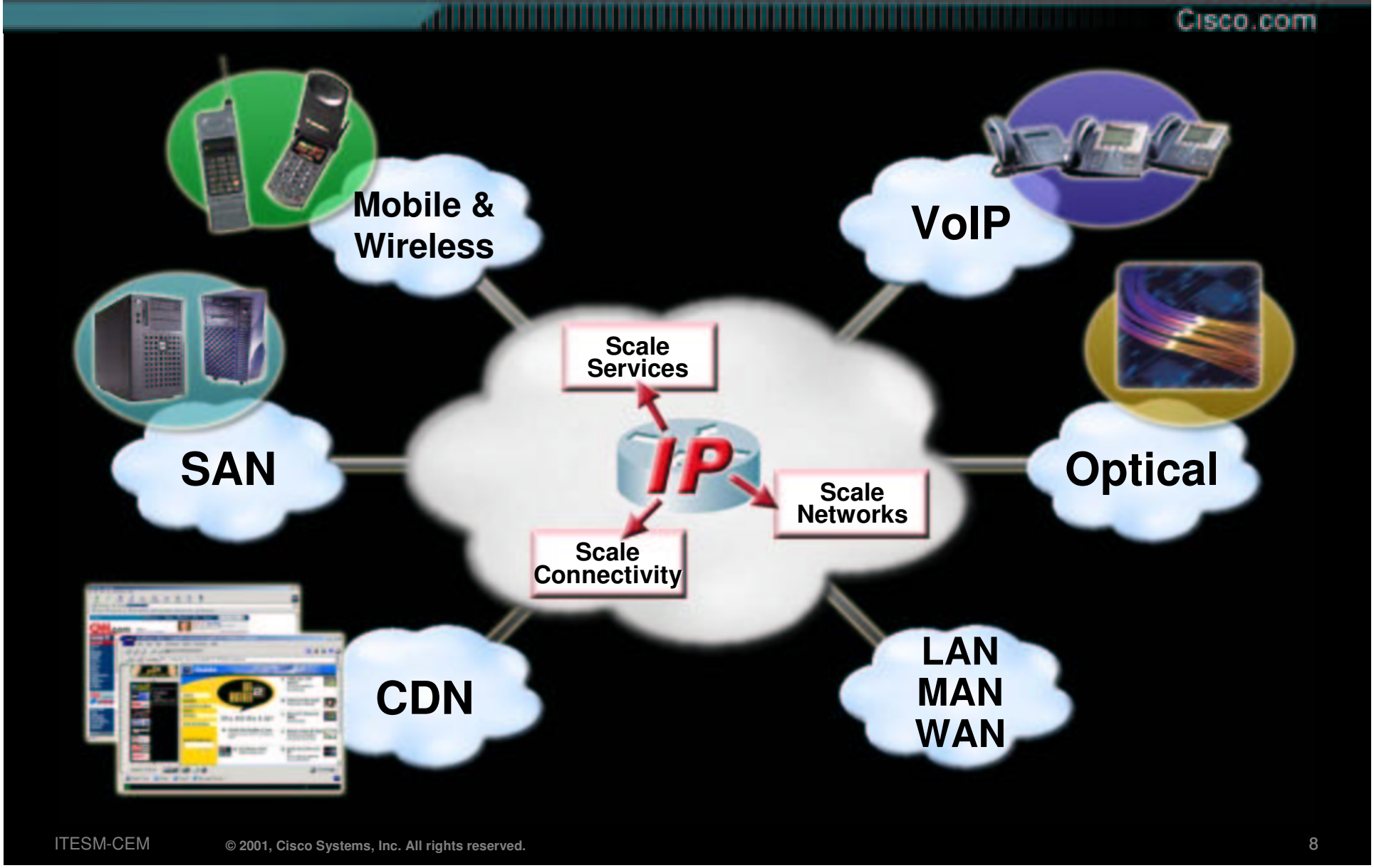
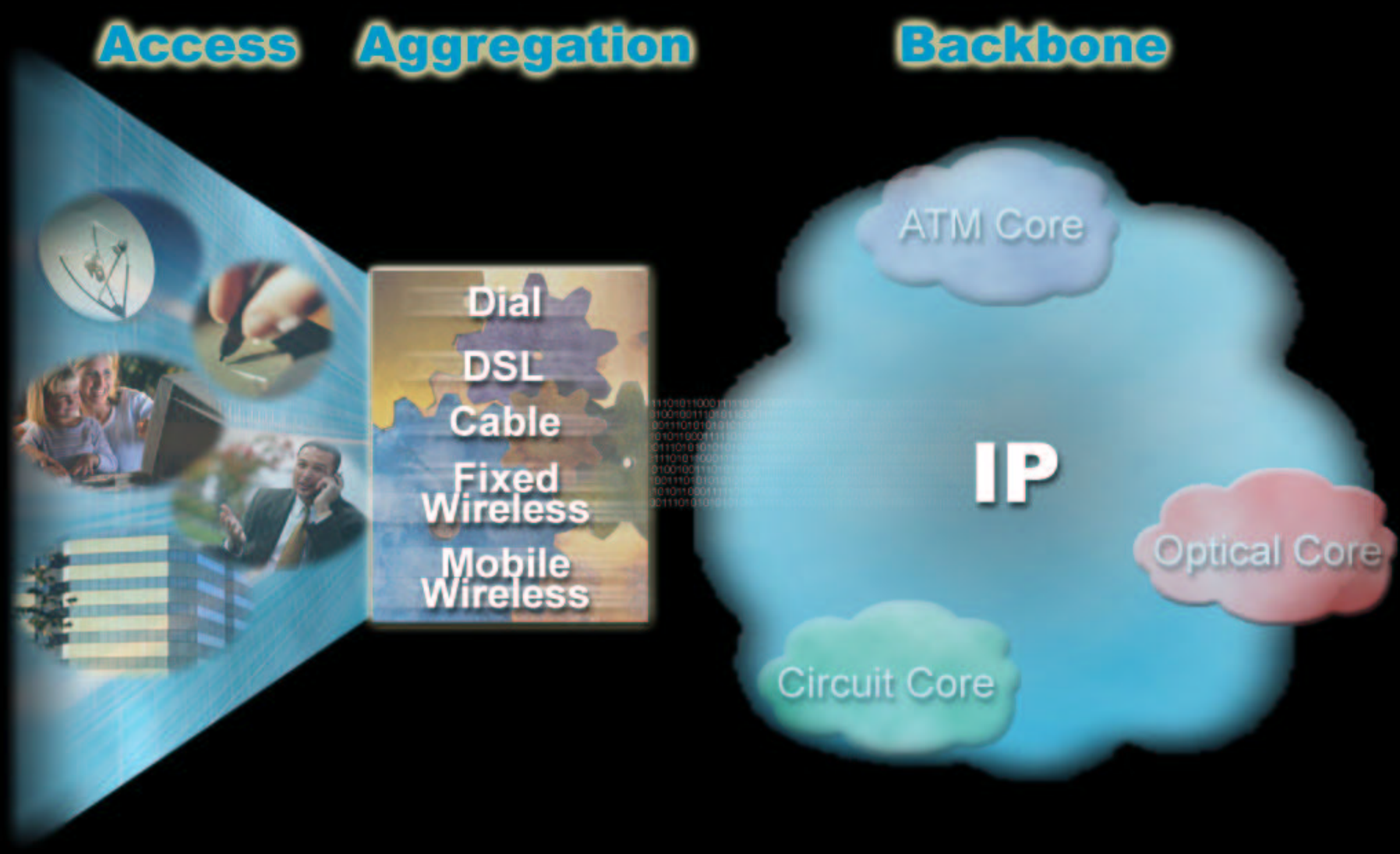
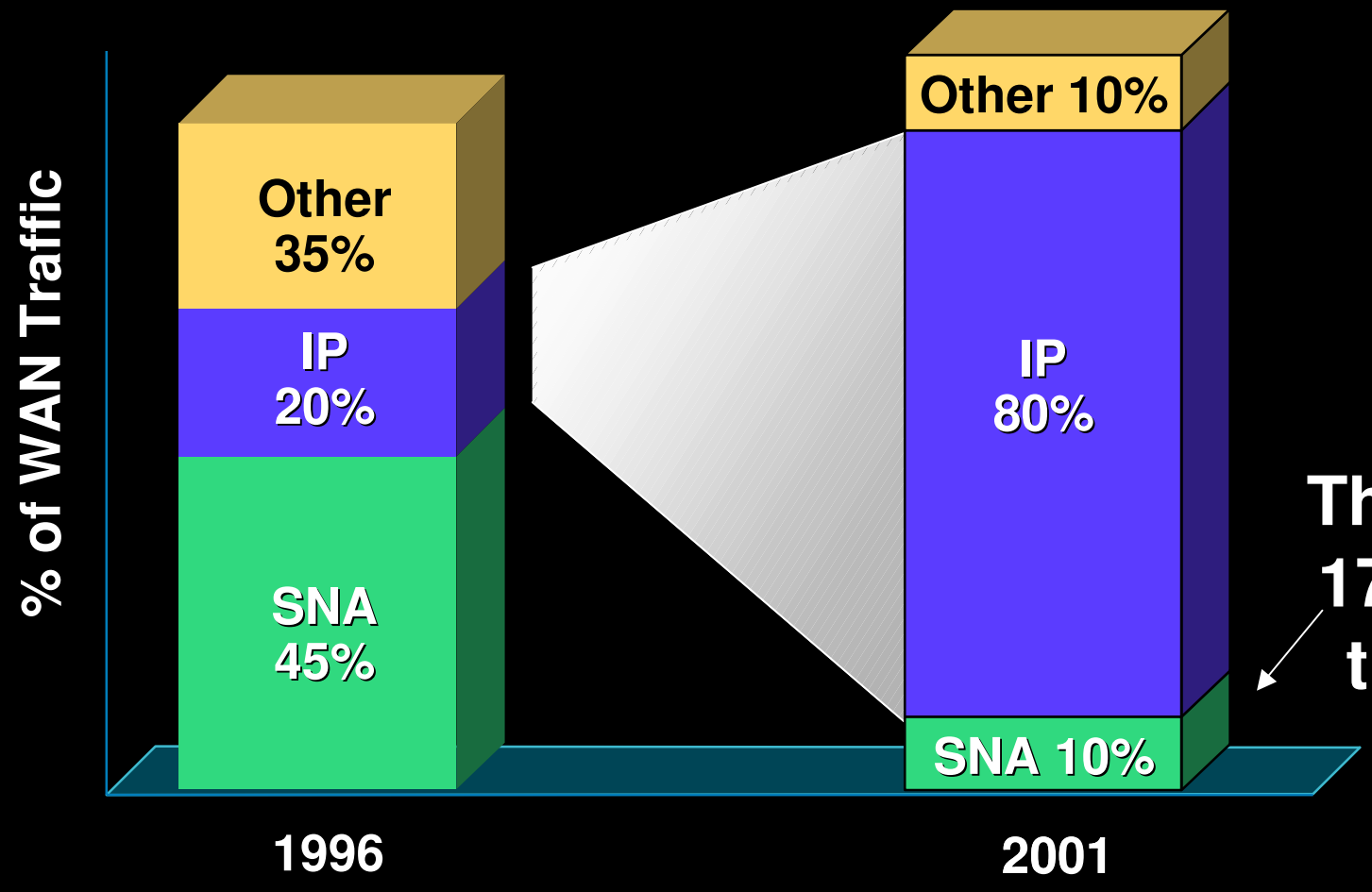
IP, The Invisible Glue – Disruptive Technology



Aggregation



The IP Wave



AND!
This Slice is
17% Bigger
than 1996

Source: Gartner Group

Some Examples of Disruption

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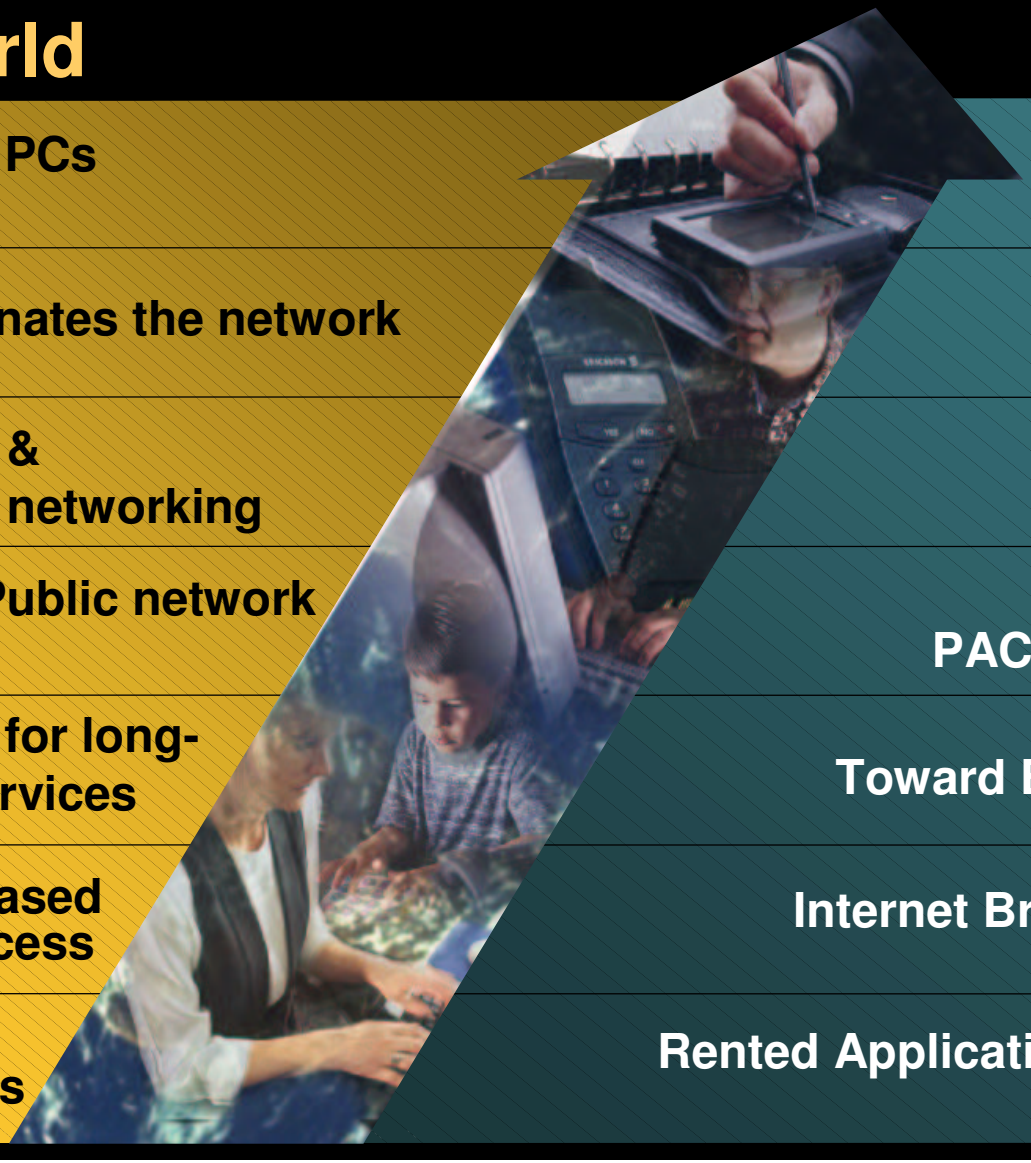
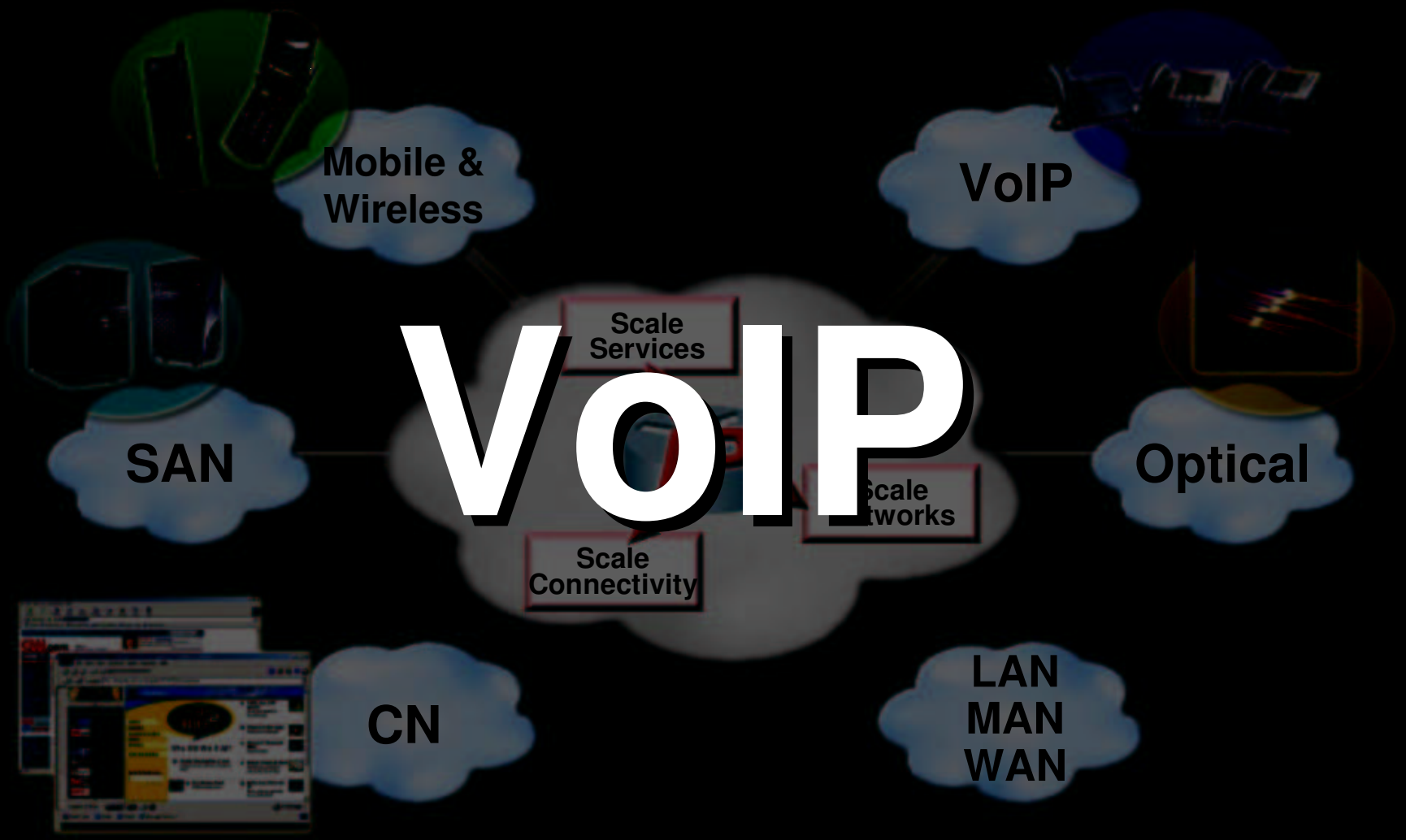
Old World	Internet World
Telephone, PCs and TVs	Multifunctional devices with network interfaces
Voice dominates the network	Now Data, later multimedia dominates
Proprietary & specialized networking	Totally open and interoperable networks
Internet & Public network separate	A global network of PACKET-based NETWORKS
High tariffs for long-distance services	Toward Bundled/Services model
Dial and Leased Internet Access	Internet Broadband Access & VPN
Owned Applications	Rented Applications & Services to ASPs



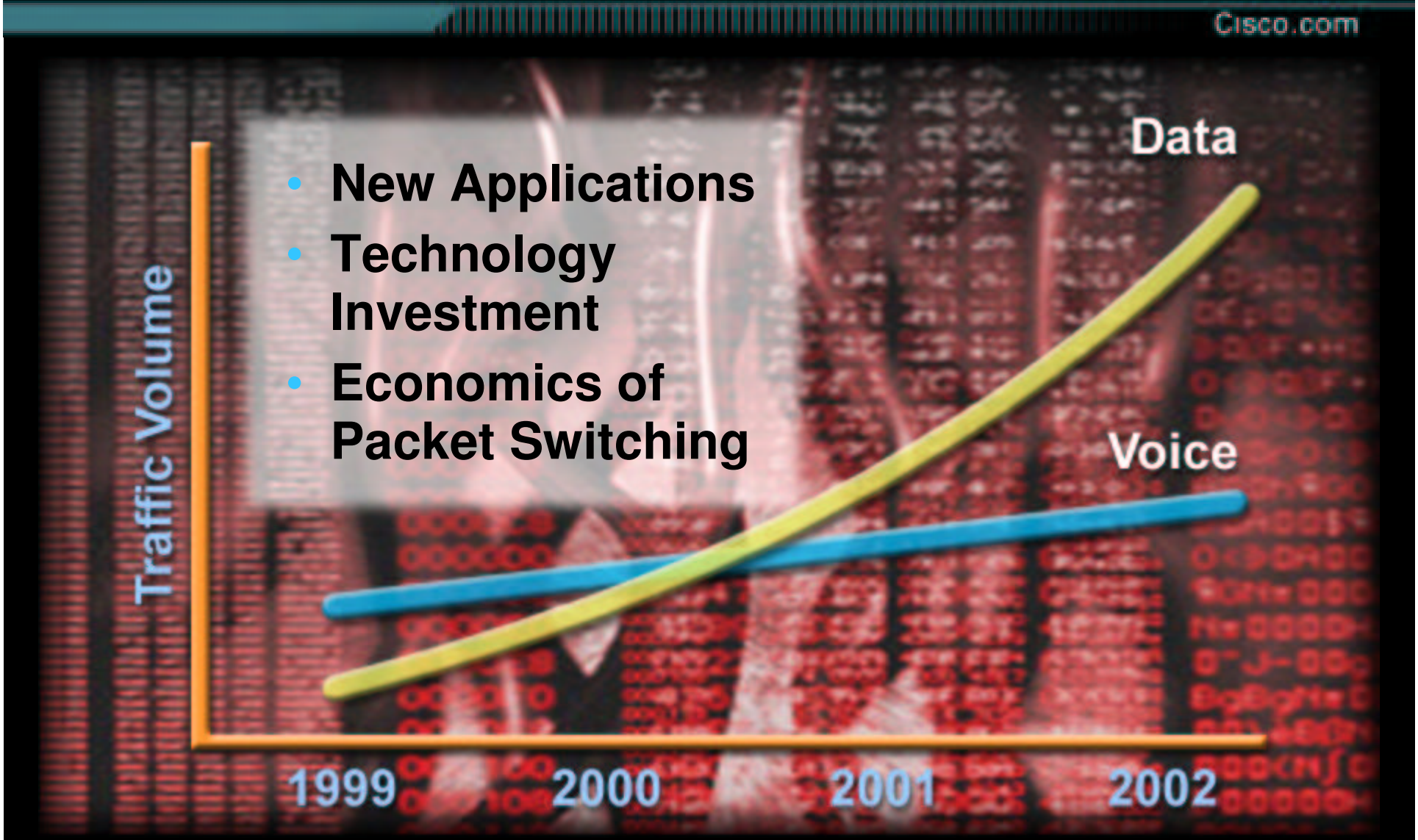


Data/Voice/Video *Conversion*

DATA/VOICE/VIDEO PACKET IP

- Voice and Video *converting* to packet
- Enables new applications
- Telecom and Datacom
  - Enterprise WAN, Networked PBX
  - Service Providers
- Entertainment, information and educational video

Data/Voice/Video Drivers



- New Applications
- Technology Investment
- Economics of Packet Switching

- Internet Broadcasting

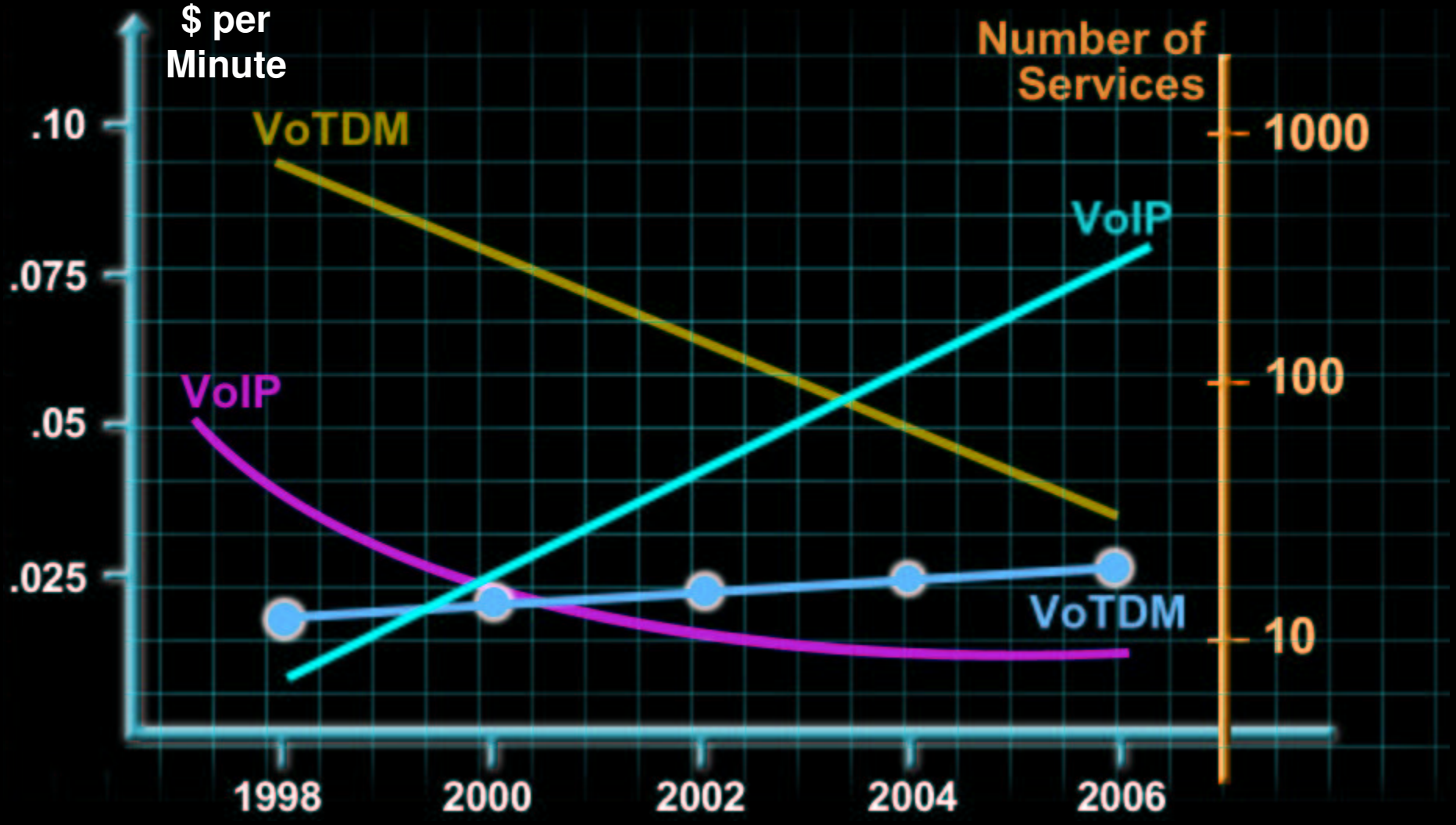
Paradigm of the Past

- **Network Architecture - VHF/PSTN**
- **Programming Environment - Proprietary**
- **Device - TV+ Phone**
- **User Environment - Separated**
- **Interactivity - Low / Slow**
- **Market approacch - Broadband**

Paradigm of the Future

- **Network Architecture - Head-End distribution Managed Services**
- **Programming Environment - IP/Standards**
- **Device - all IP ready**
- **User Environment - Adaptive**
- **Interactivity - Online/Rtime**
- **Market approach - Broadband - Individual & Community**

Implications of Internet Telephony



Doug Ahn, CEO of dialpad.com, demonstrates the use of the free long-distance service on the Internet.

PHOTOS BY PENNY DE LOS SANTOS — MERCURY NEWS

'I don't think this is going to affect us immediately. It's a niche product and you have to have a computer.'

— Ritch Blasi, AT&T spokesman

Making a call from a PC to a phone

Using Internet technologies, dialpad.com has begun offering free long distance calls in the U.S. through its Web site. To use the service, you need a Windows 95 or newer computer with a microphone, a speaker or headphones, and an Internet connection. Here's how it works:

1. The call starts from your PC and travels to your Internet service provider.
2. The ISP sends it to a server owned by dialpad.com.
3. The dialpad.com server contacts the GTE network.
4. The call enters GTE's IP network, which carries it across the country.
5. The call leaves the GTE network and is passed on to a local telephone network.
6. The local phone network delivers the call to its final destination.

Source: GTE Internetworking

REID BROWN AND CHRIS O'BRIEN — MERCURY NEWS

0¢ PER MINUTE

Long-distance calls can be made for free with PC, new service

BY CHRIS O'BRIEN
Mercury News Staff Writer

If you've been wondering just how cheap long-distance calls can get, here's your answer: free.

San Jose-based dialpad.com has launched a service that allows anyone with a PC to make free long-distance calls through its Web site. Just sign up, plug in your headphones and microphone, and call any phone in the United States.

Don't throw out your old telephone just yet, though.

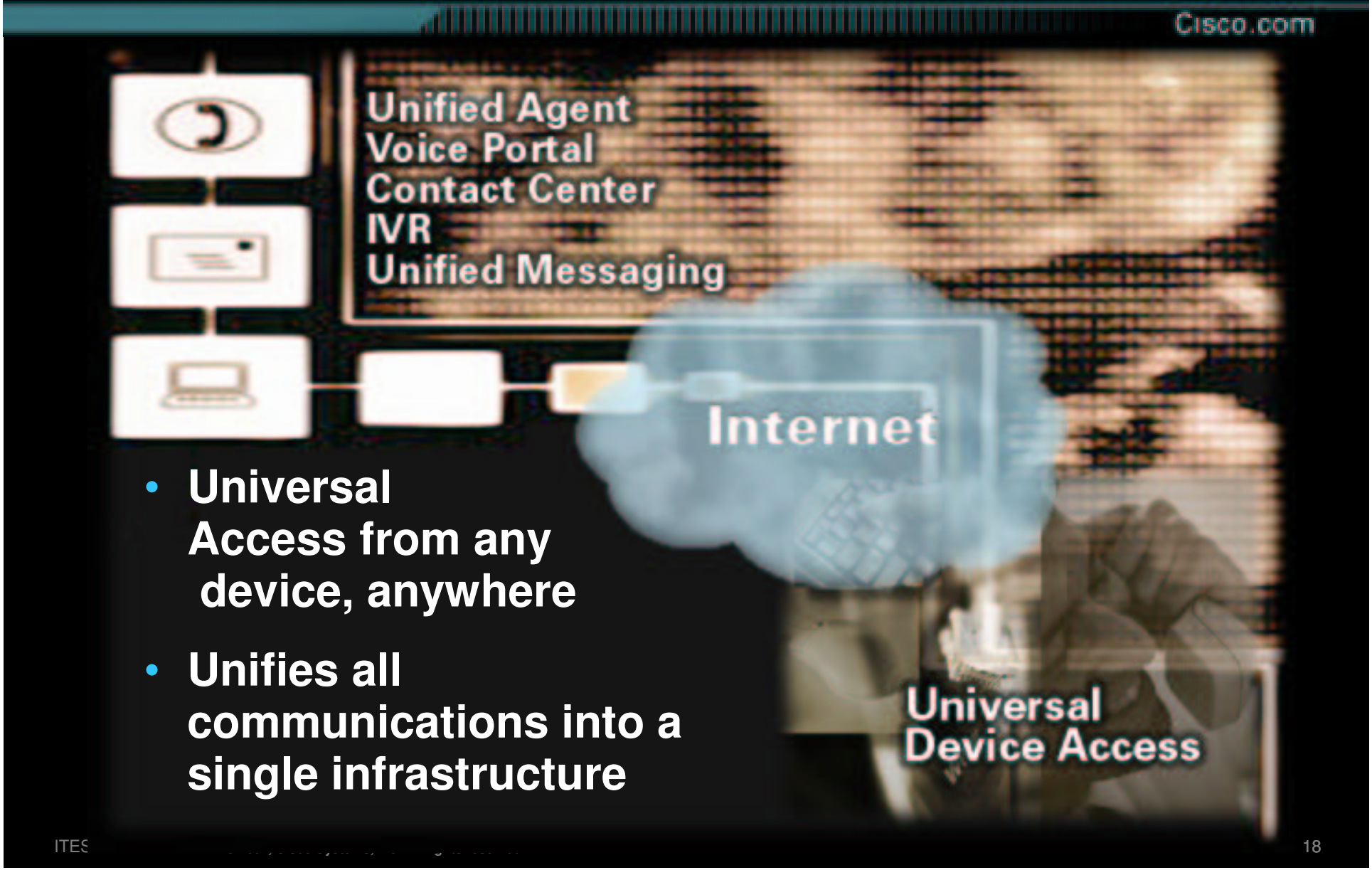
Don't throw out your old telephone just yet, though. The reliability and quality of dialpad.com doesn't match the traditional telephone system. A typical call on dialpad.com sounds like an analog cellular phone call and heavy traffic can sometimes make it tough to place a call. Still, the service is so cheap and easy to use, it

Dialpad.com allows calls to be placed from a computer directly to a regular telephone.

The big long-distance carriers aren't exactly quaking in their boots, and analysts say dialpad.com won't trigger any immediate drops in long-distance prices, which have already plunged to as little as five cents per minute for high-volume callers. But they do agree that dialpad.com provides a glimpse into the not-too-distant future where Internet technologies will make phone calls so cheap they'll be given away for free as part of packages of other communications services.

"We used to go to [illegible]

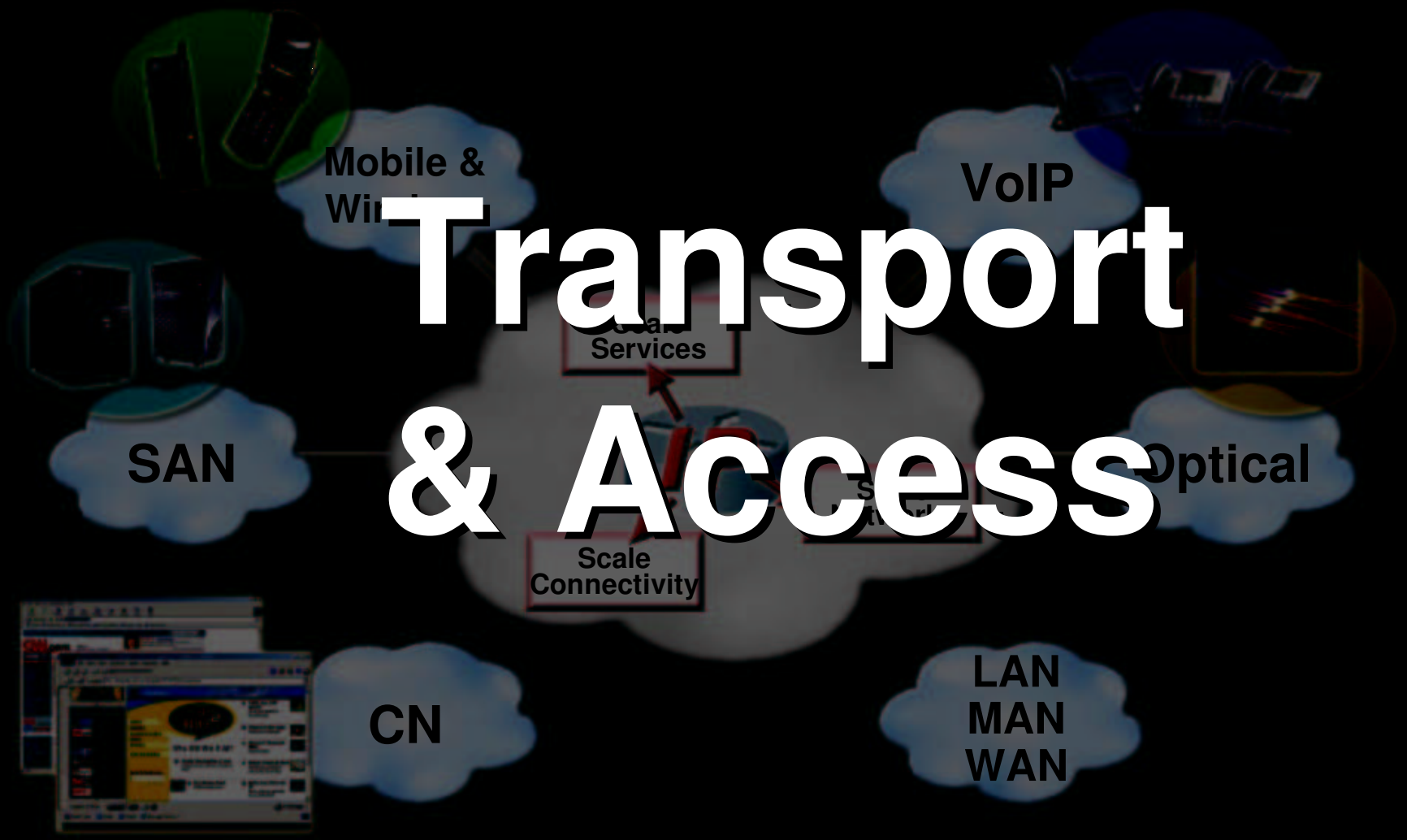
Unified Communications



- **Universal Access from any device, anywhere**
- **Unifies all communications into a single infrastructure**

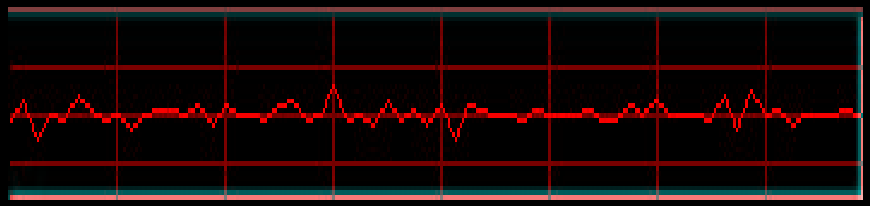
Personal Network Assistant

If it's my wife, call me everywhere! Otherwise I'll sleep with the dog !!



Transport & Access

Analog.com



28Kbps-56Kbs…!%$@#!^

80% of the Internet Access is still Analog/leased transmission. like 20 years ago…

Scaling the Internet – The Bandwidth Tsunami

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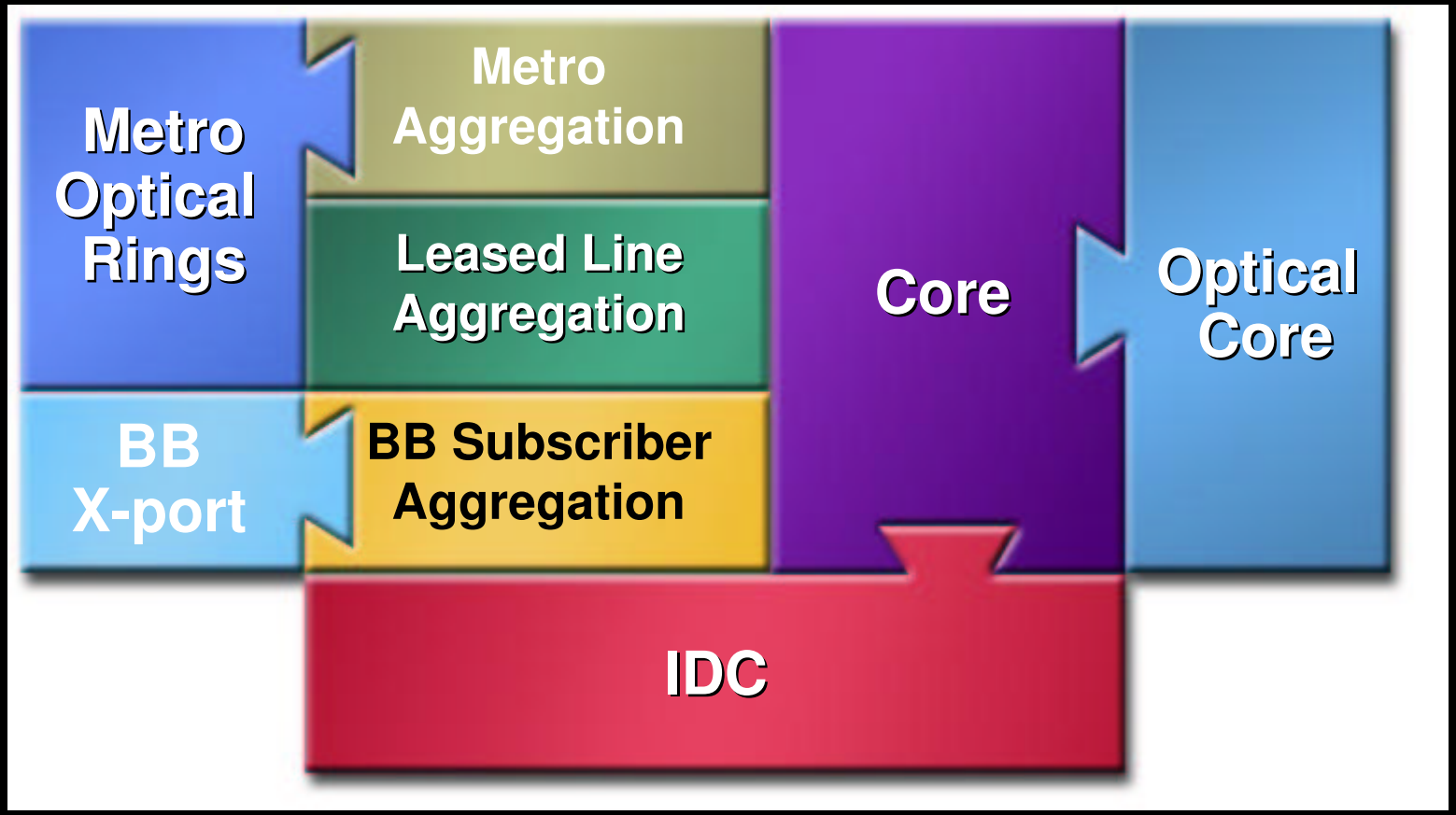
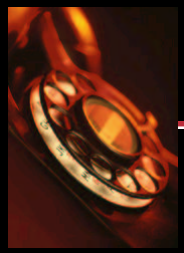


Last Miles

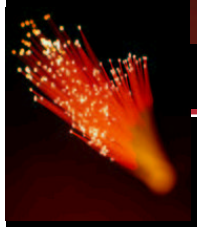
Wireless

Cable



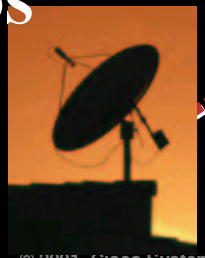
Dial

Leased



Fiber/

POS



Satellite

/fixed

- Managed Services
  (VPN,hosting, video, webcaching,etc)
- Service Reach
- Mass market provisioning & services level automation/mgmt
- Consumer services
- Business Services
- Interoperability
- Standards

Optical Networking

Bandwidth

- Wavelength proliferation
- From 2.5G to 10G to 40G
- Dramatic improvements

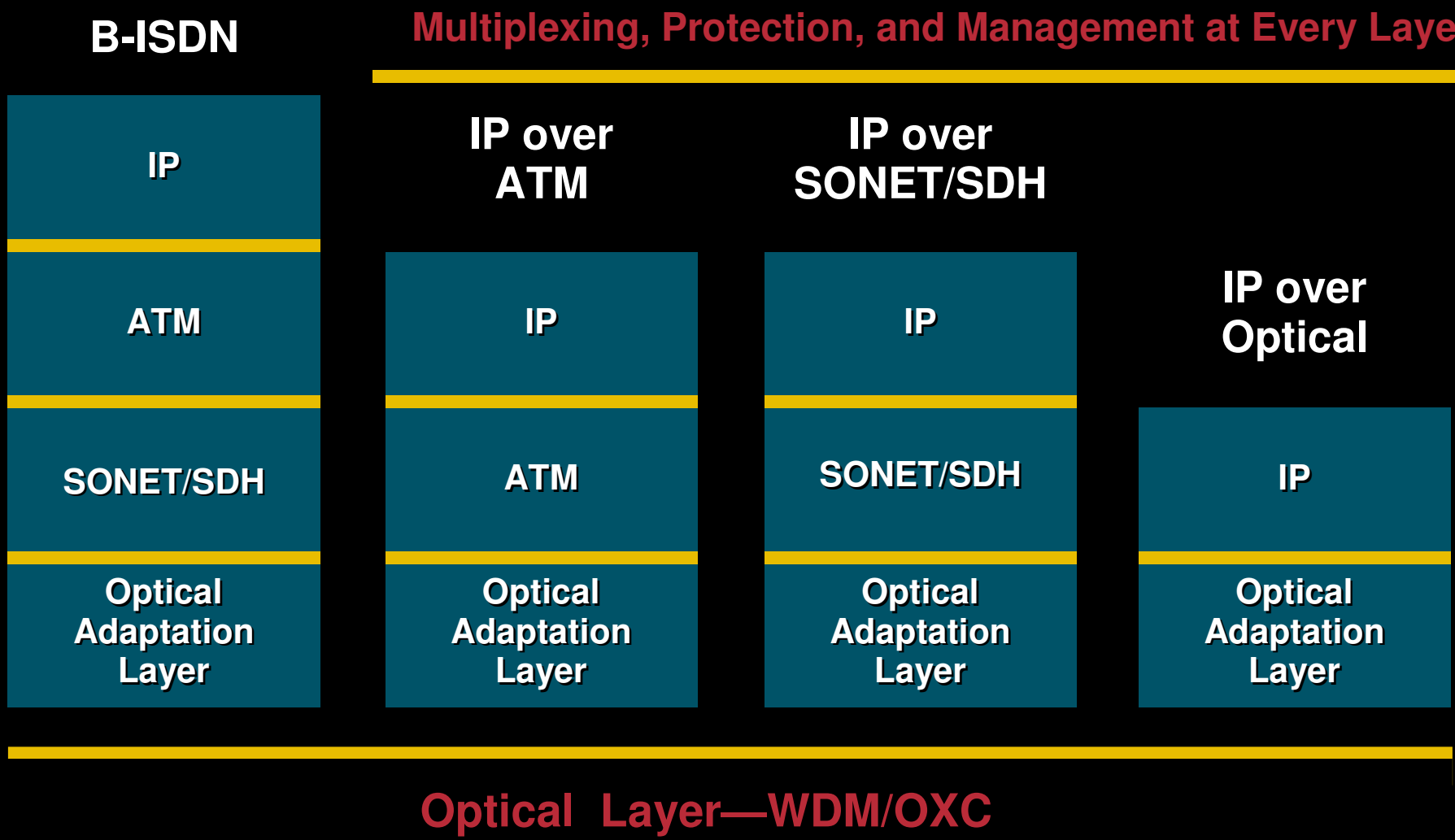
IP Optimized

- Controlling optics with IP
- Eliminating multiplexing layers

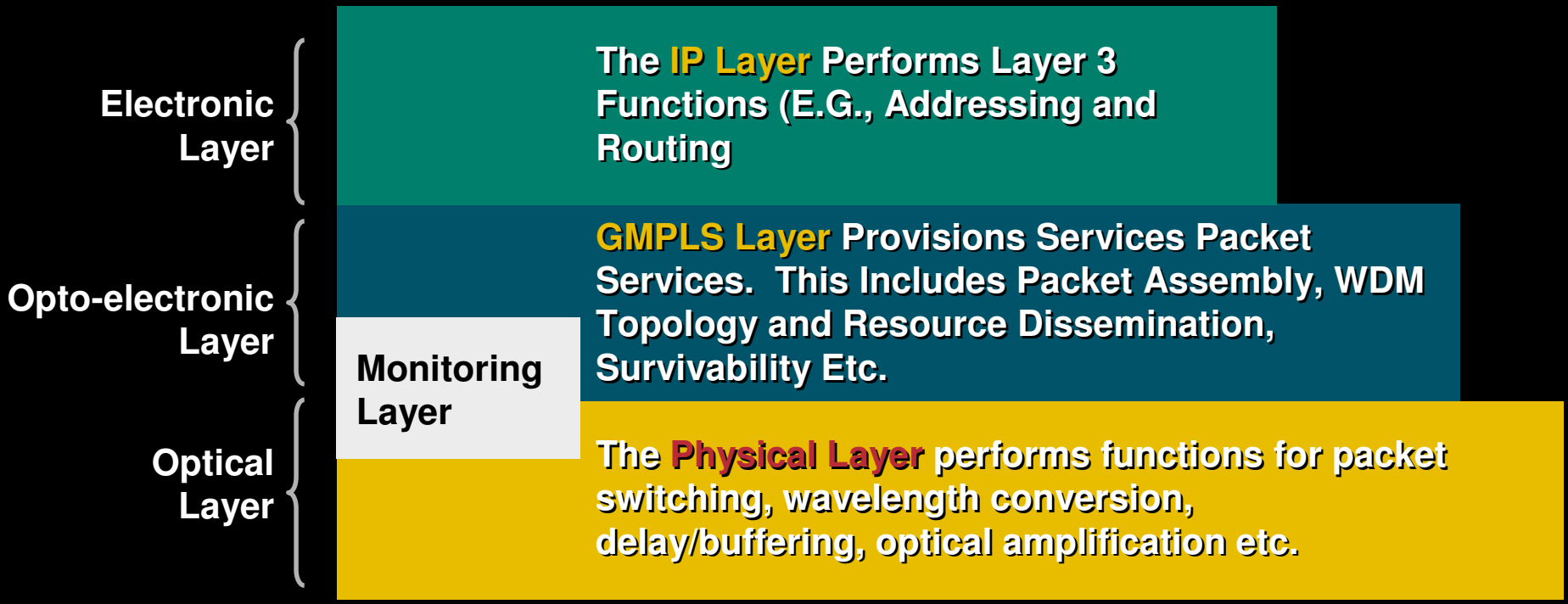
Segmentation

- Storage
- Metro/Ethernet
- Long and ultra long haul
- Legacy traffic

Architectural Layering



IP-over-WDM Architecture



Monitoring and Detection: This May of May Not Use Data Framing (E.G., For Control Channel)

Direct Lambda (λ) Labeling, MPLS-Based Approach

The Role of DWDM

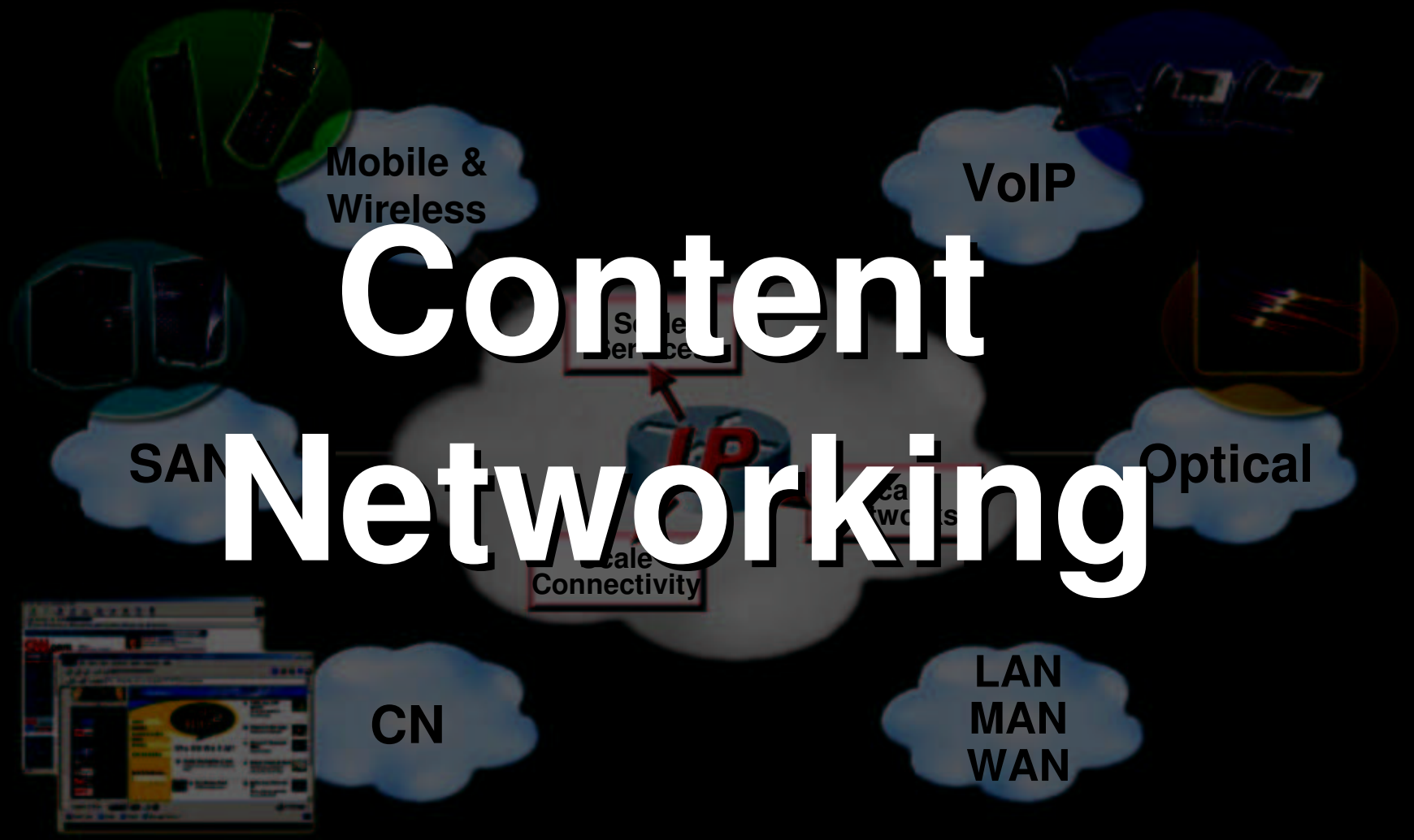
- Uses Wavelengths as virtual fiber
- Point-to-point connectivity
- Increased bits/fiber, reduced cost/bit
- No optical *networking*

IP + Optical

Putting the network in optical networking

- DWDM transmission
- Mesh topology
- End-to-end provisioning

- Wavelength switching granularity
- Open protocols



Content Networking

Traditional Web Growth

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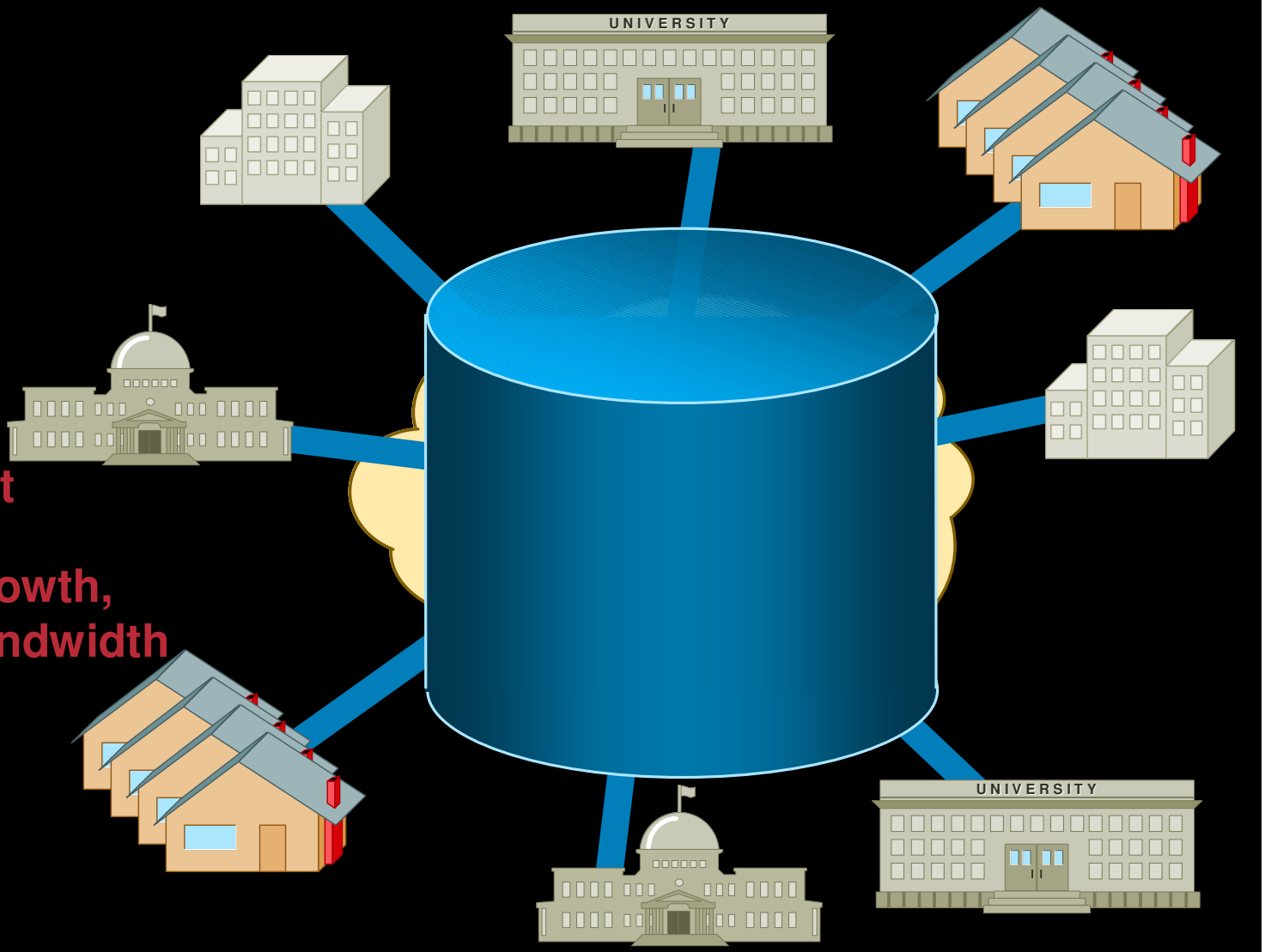
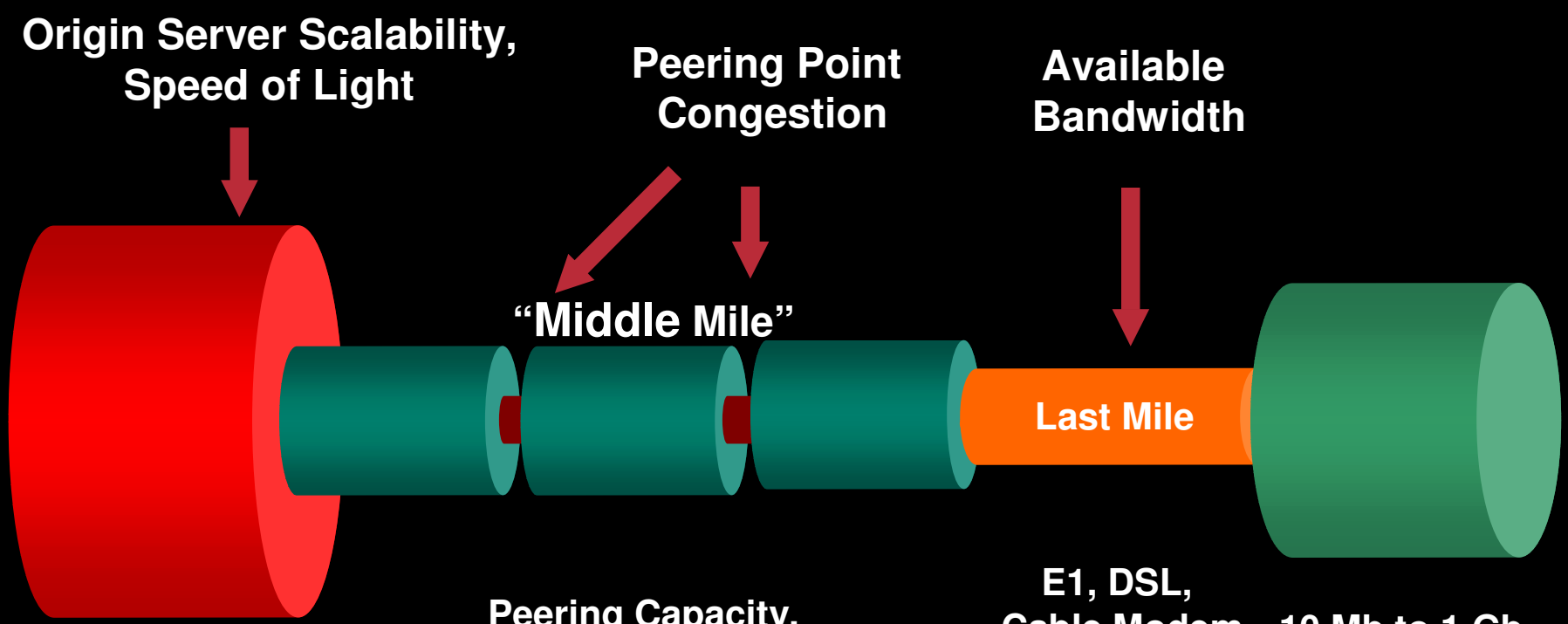
Web Sites
Are Centralized

Web Grows:
More Users
Richer Content

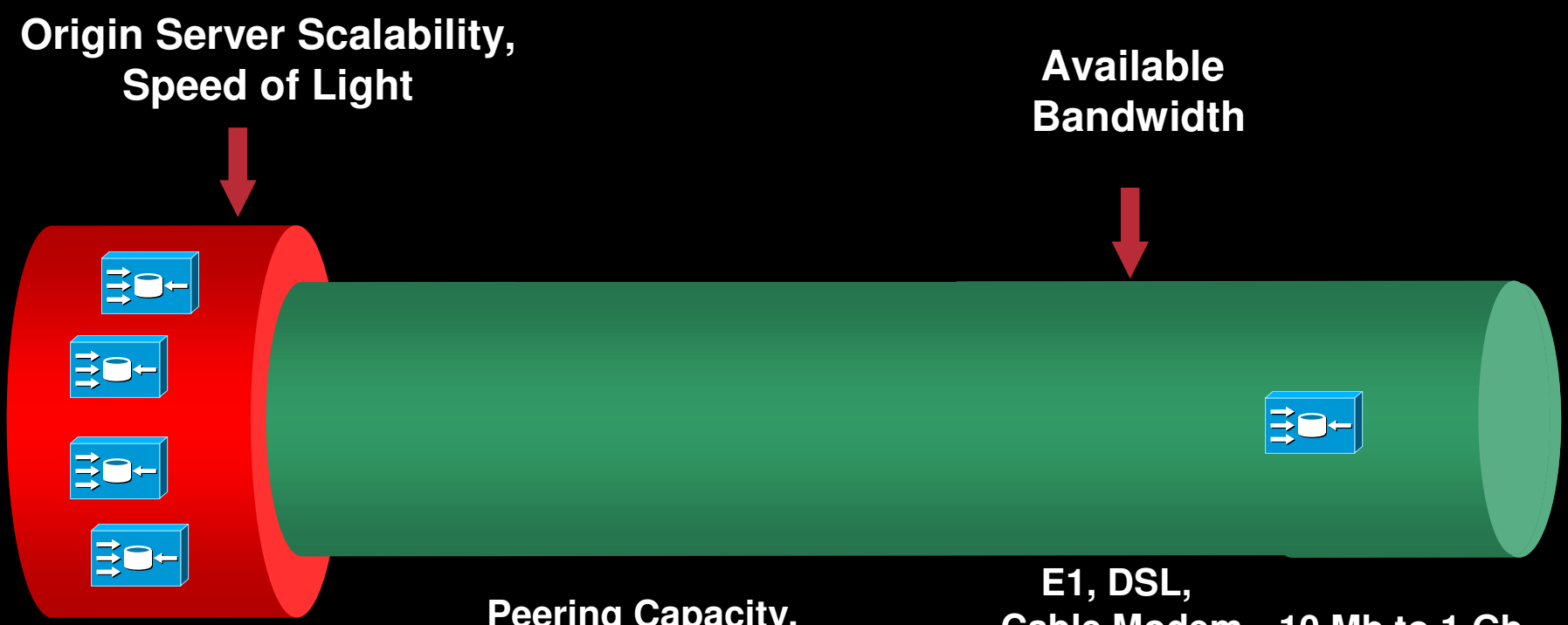
To Manage Growth,
Server and Bandwidth
Are Added



Anatomy of a Network



The #1 Barrier for e-Business Applications: Bandwidth Bottlenecks



Content Delivery Networks

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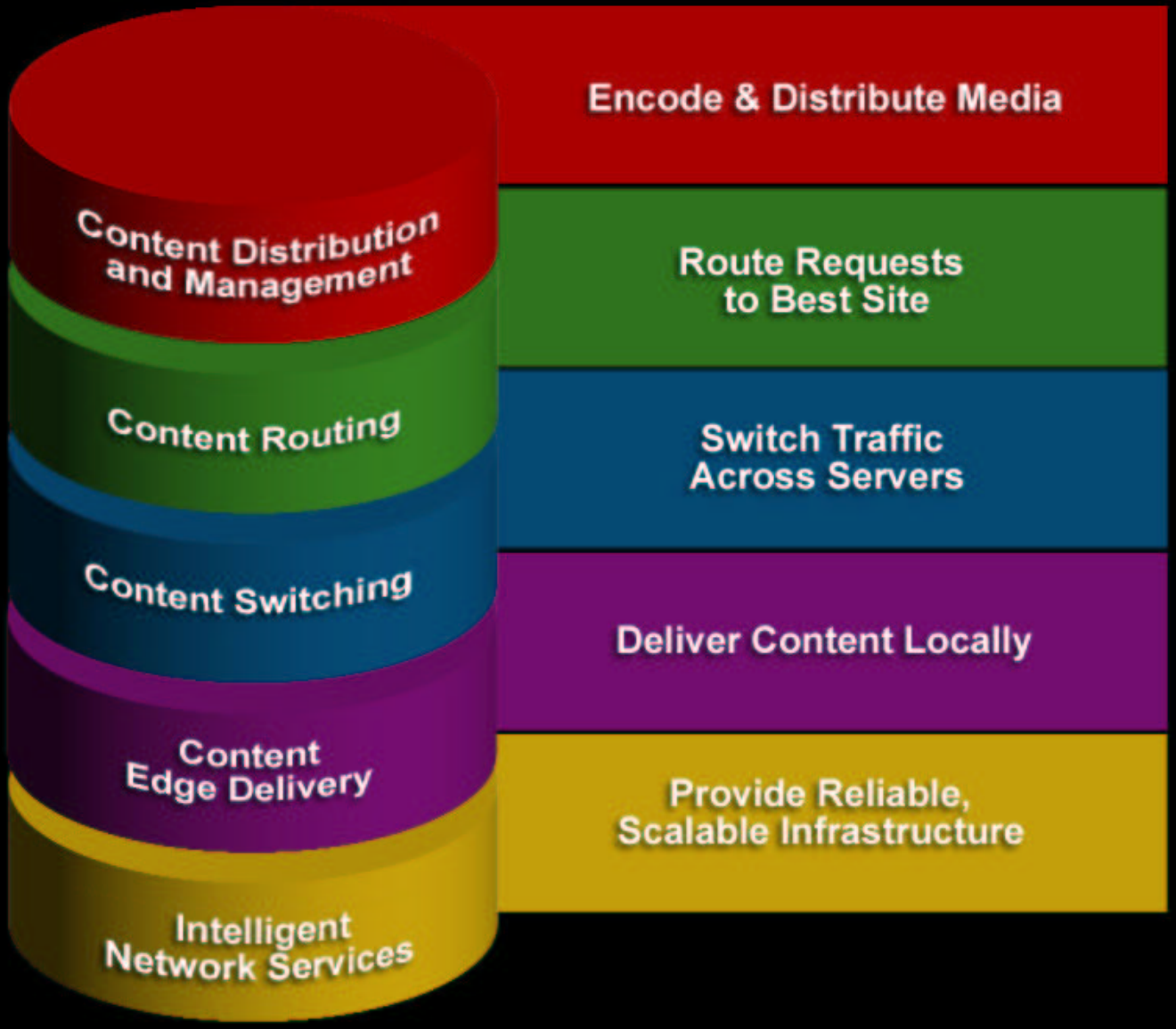
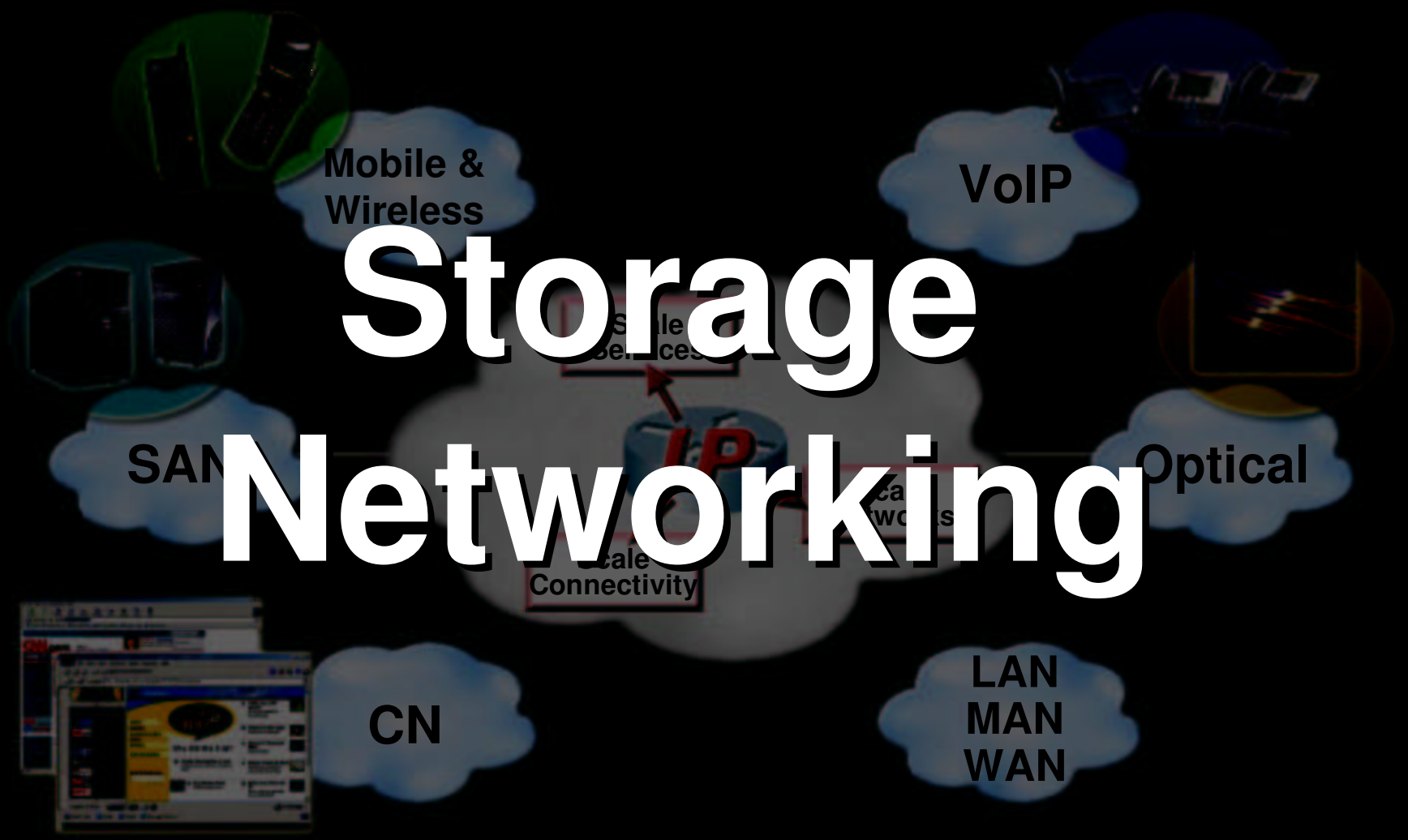
Five key Elements

Bypass Bottlenecks

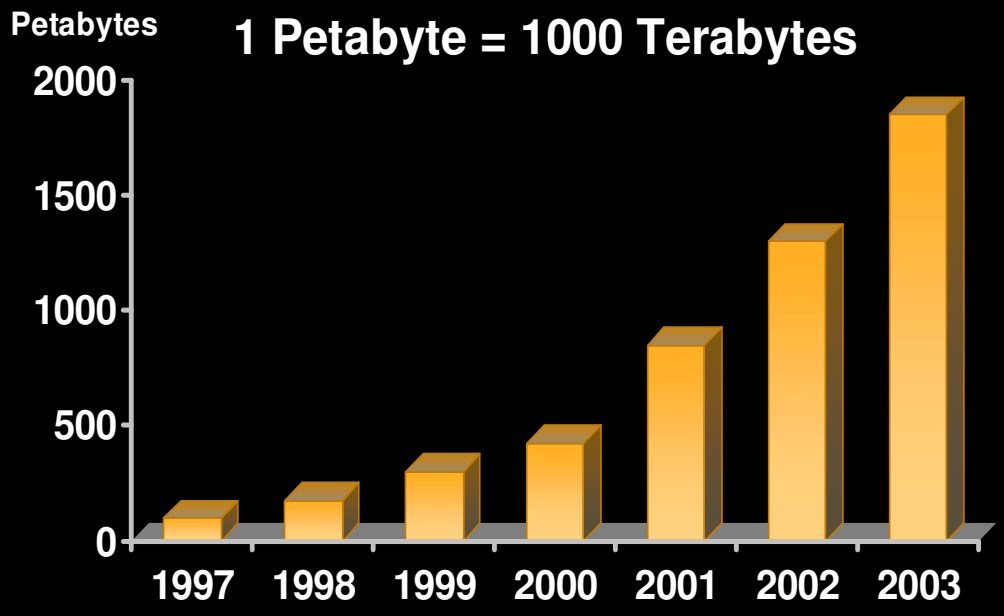




Storage Networking

Key Drivers

- Exponential growth in storage
- Velocity of information accumulation
- Acceleration of higher bandwidth networking technologies
- Externalization of storage network
- Shortage of IT staff, ever increasing management costs



Source: International Data Corporation

Key Drivers

- Exponential growth in storage
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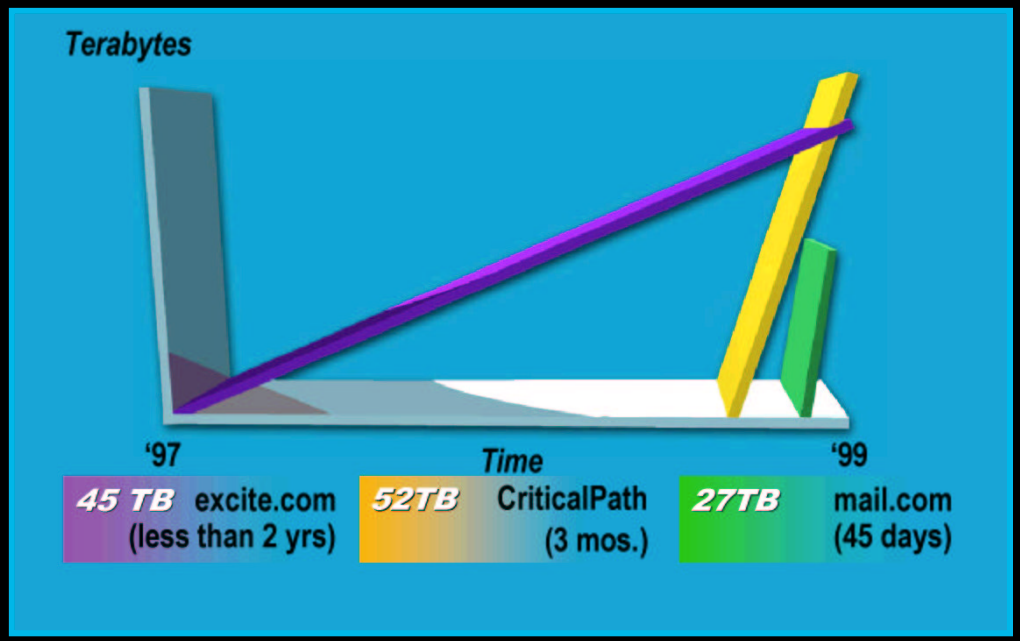

Source: EMC Corporation

Key Drivers

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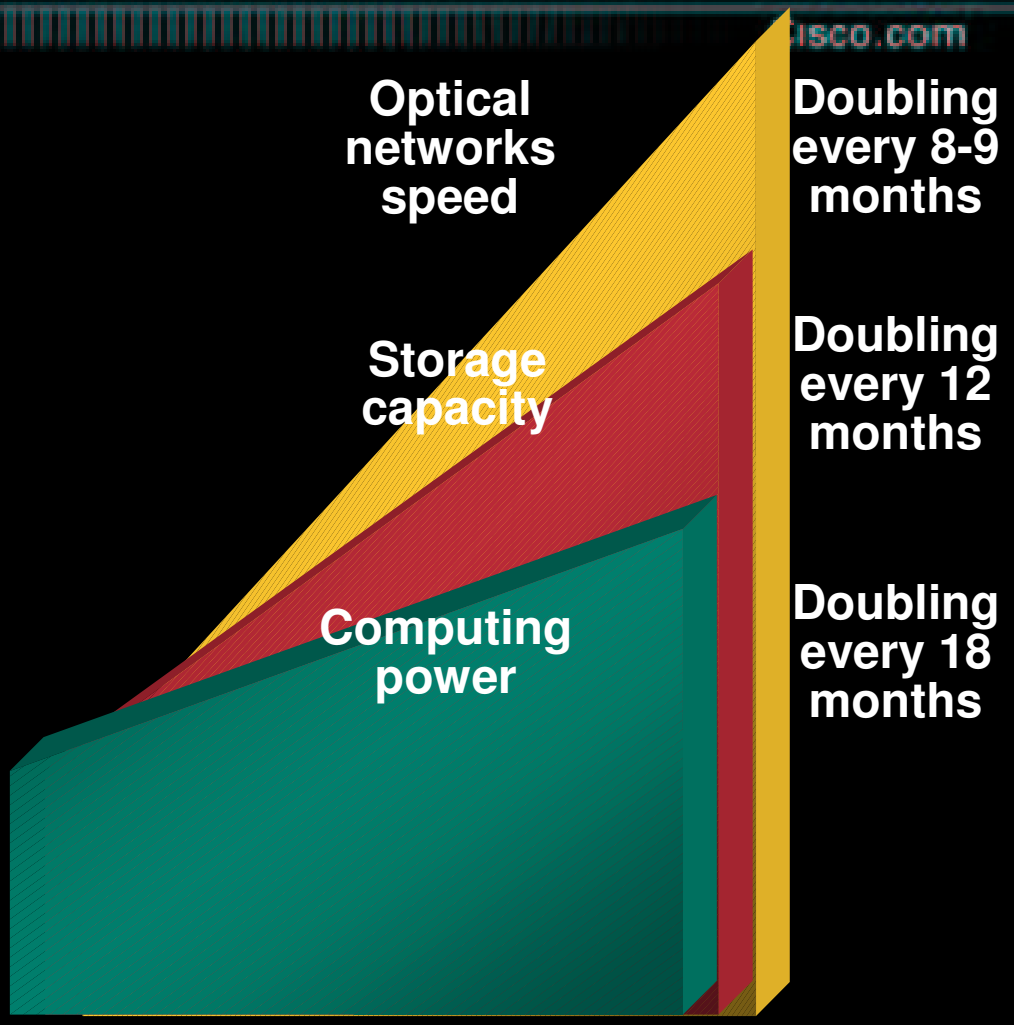

Source: Storage Networking Industry Association

Key Drivers

Most Storage Will Be Networked by 2005

- Exponential growth in storage
- Velocity of information accumulation
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- Externalization of storage on the network
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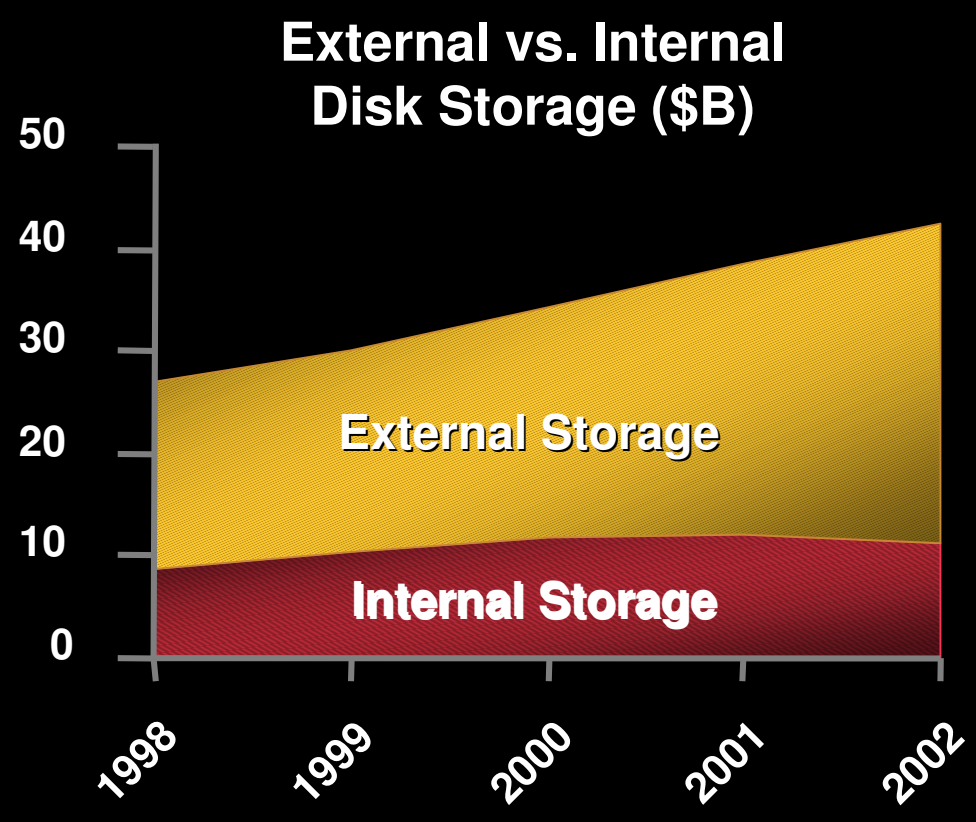

Source: International Data Corporation

Key Drivers

Price-per-Gigabyte Decreasing 40% per Year But...

- Exponential growth in storage
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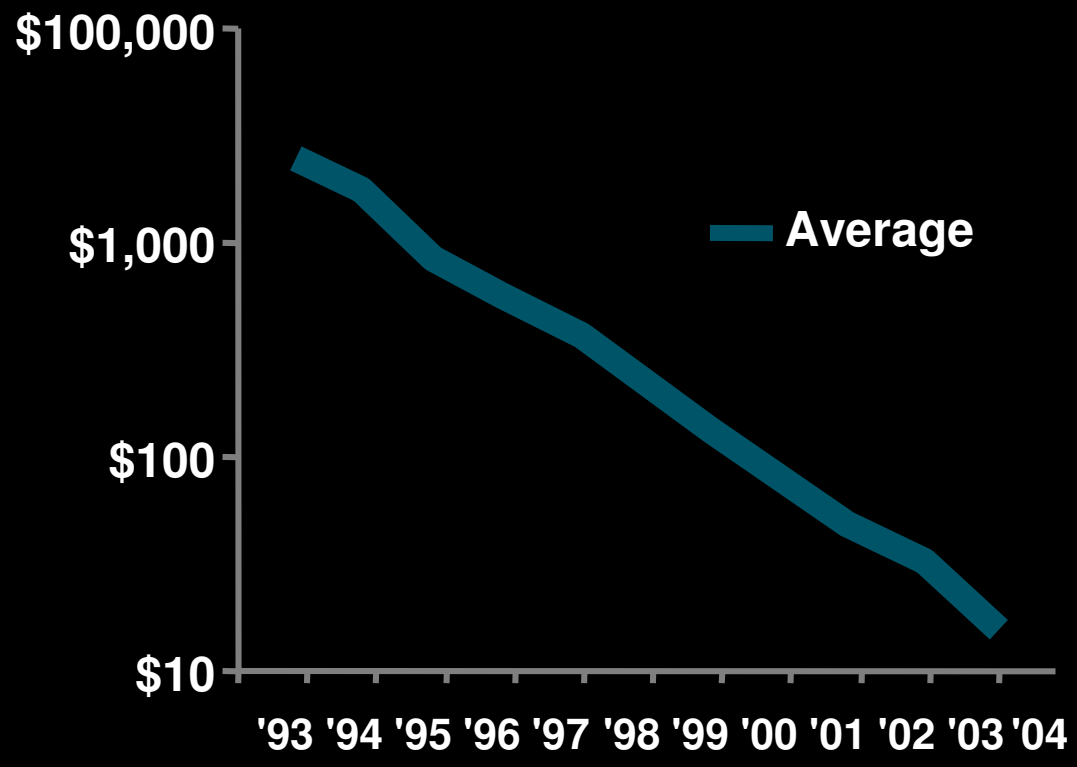

Source: International Data Corporation

Key Drivers

Nearly 1 Million Open IT Jobs

- Exponential growth in storage
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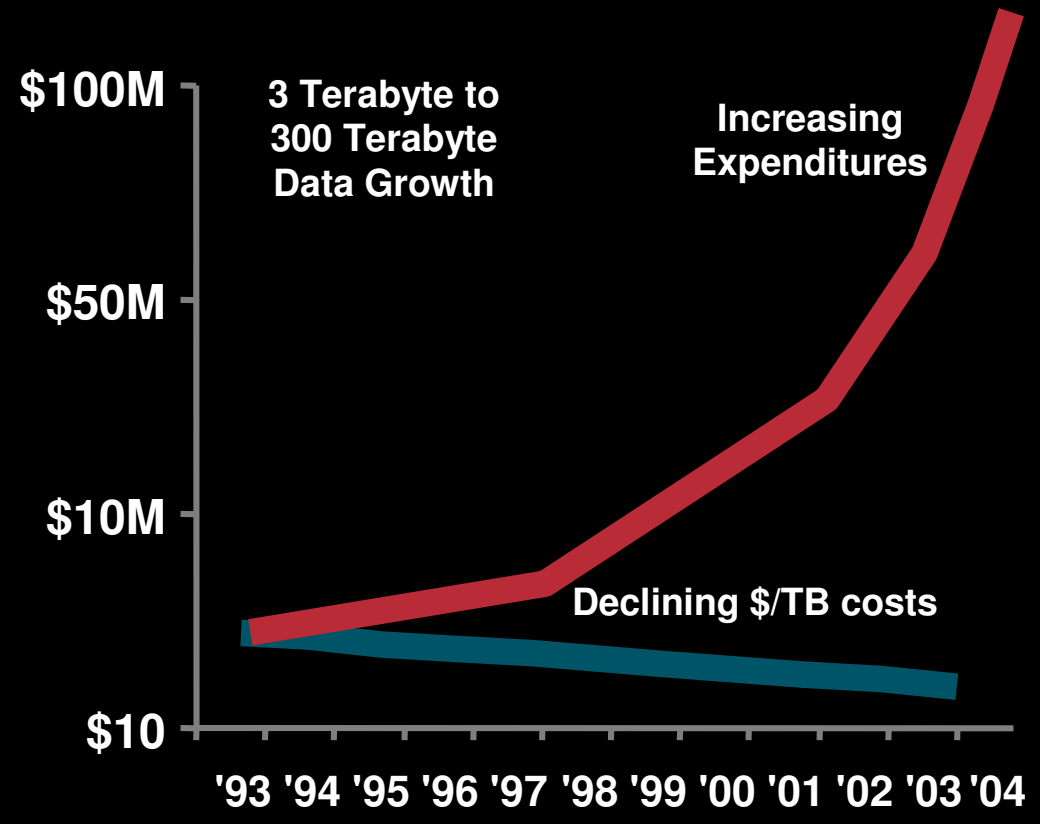
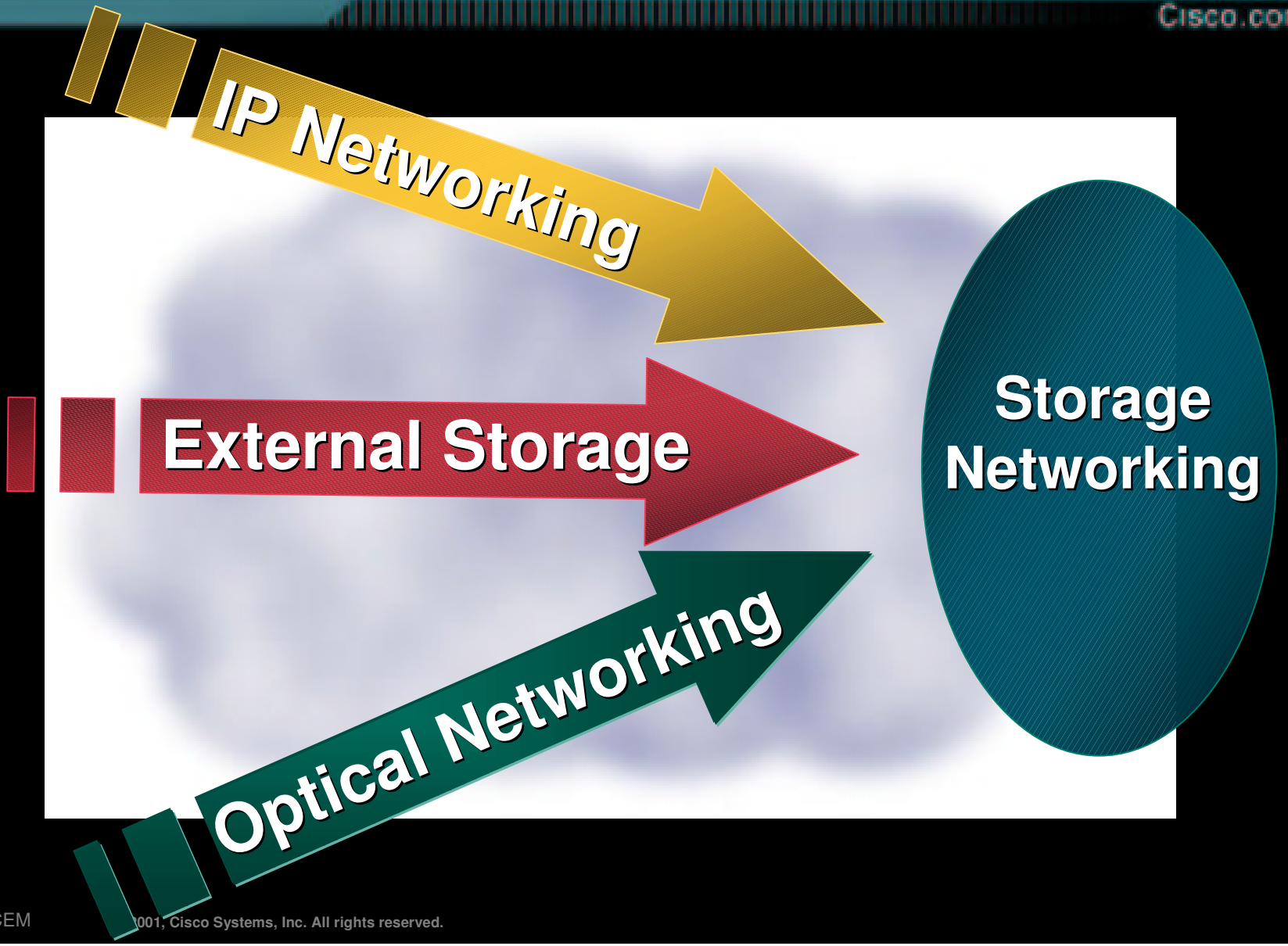
- Acceleration of higher bandwidth networking technologies
- Externalization of storage on the network
- Shortage of IT staff, ever increasing management costs



Source: IDC, Meta Group, Gartner Research, ITAA

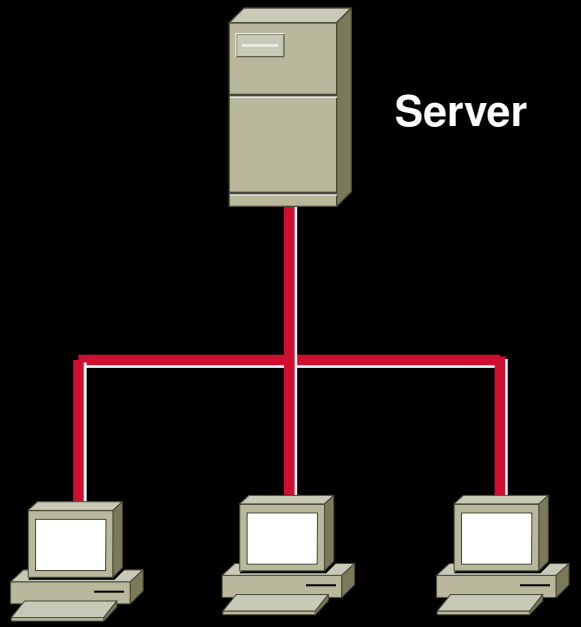
Storage and Network Convergence



Network Storage: Generation I

- All storage resides in servers
- Storage sharing creates CPU overhead
- Network burdened with disk I/O traffic
- Limited scalability and low performance

Internal Server-Based Storage



Generation II: SAN and NAS

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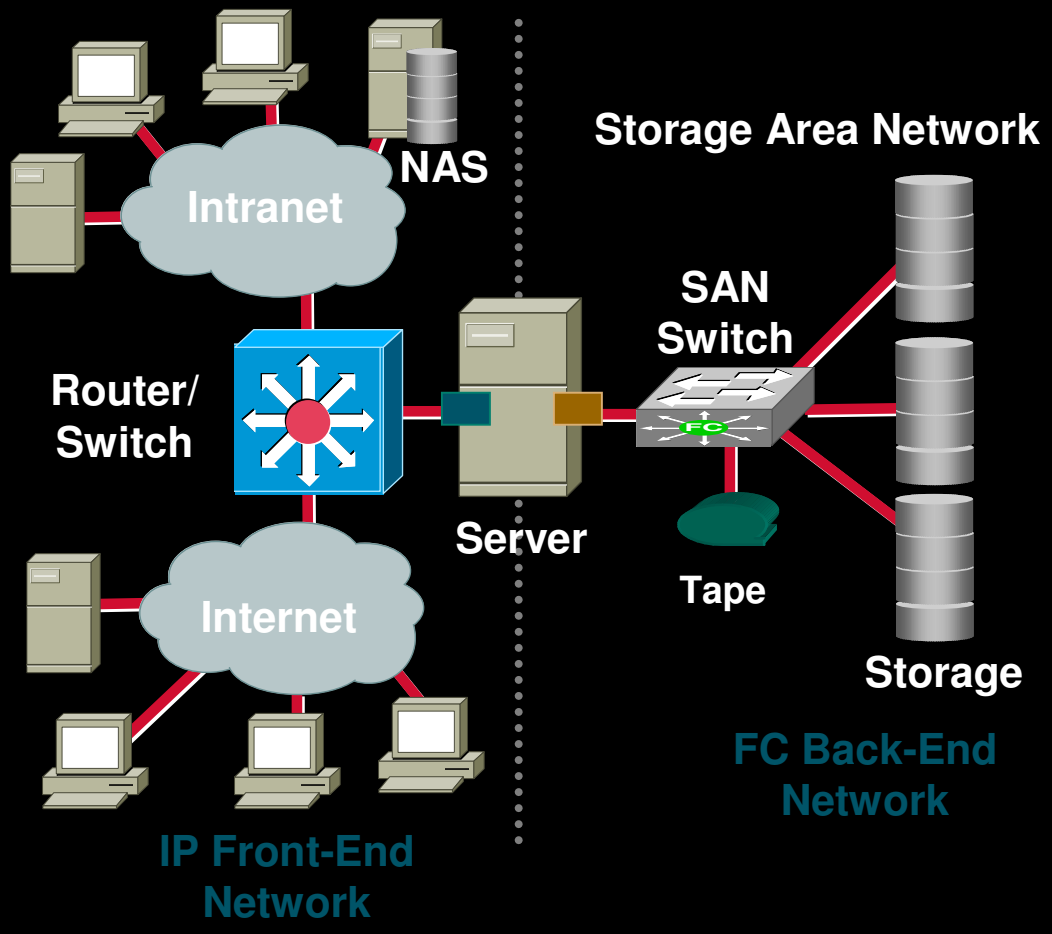
SANs Create Two Separate Networks

- Pre-Gigabit Ethernet bandwidth assumptions
- Two different networks
- Limited Interoperability
- Isolated "SAN Islands"
- Minimal storage security



The Vision for Next Generation Storage Networking

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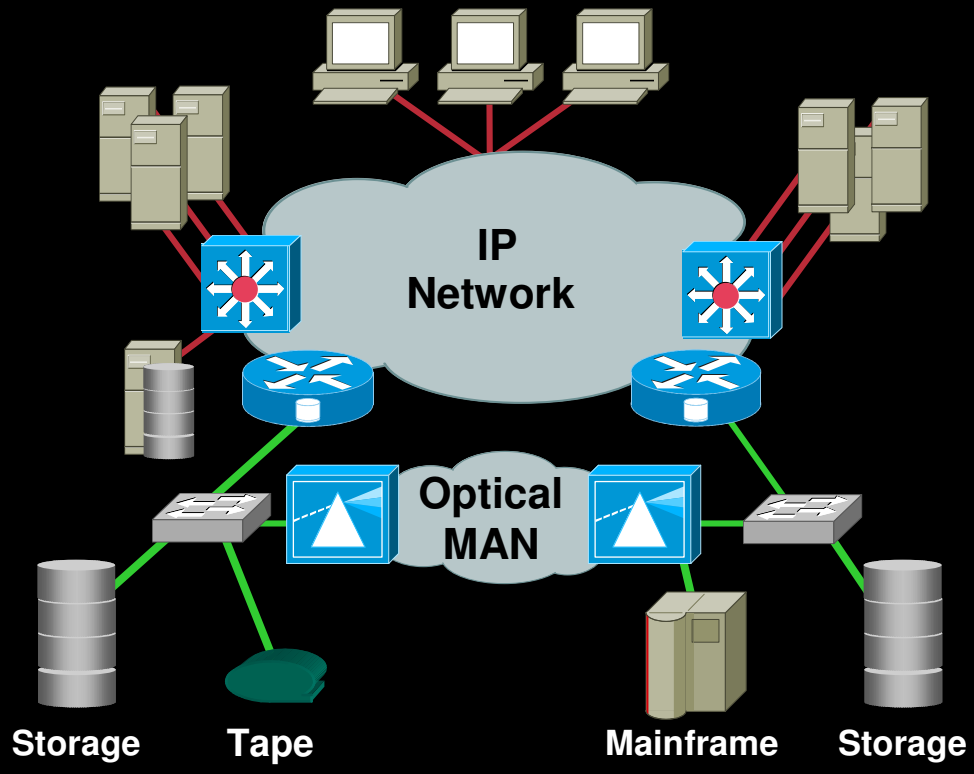
Universal Access to Data and Storage

Network Storage Pool

- Utilizes best features of SAN and NAS
- Leverages capabilities of intelligent IP and optical network infrastructure
- Cost-effective scalability for e-business



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Chasing the Tornado

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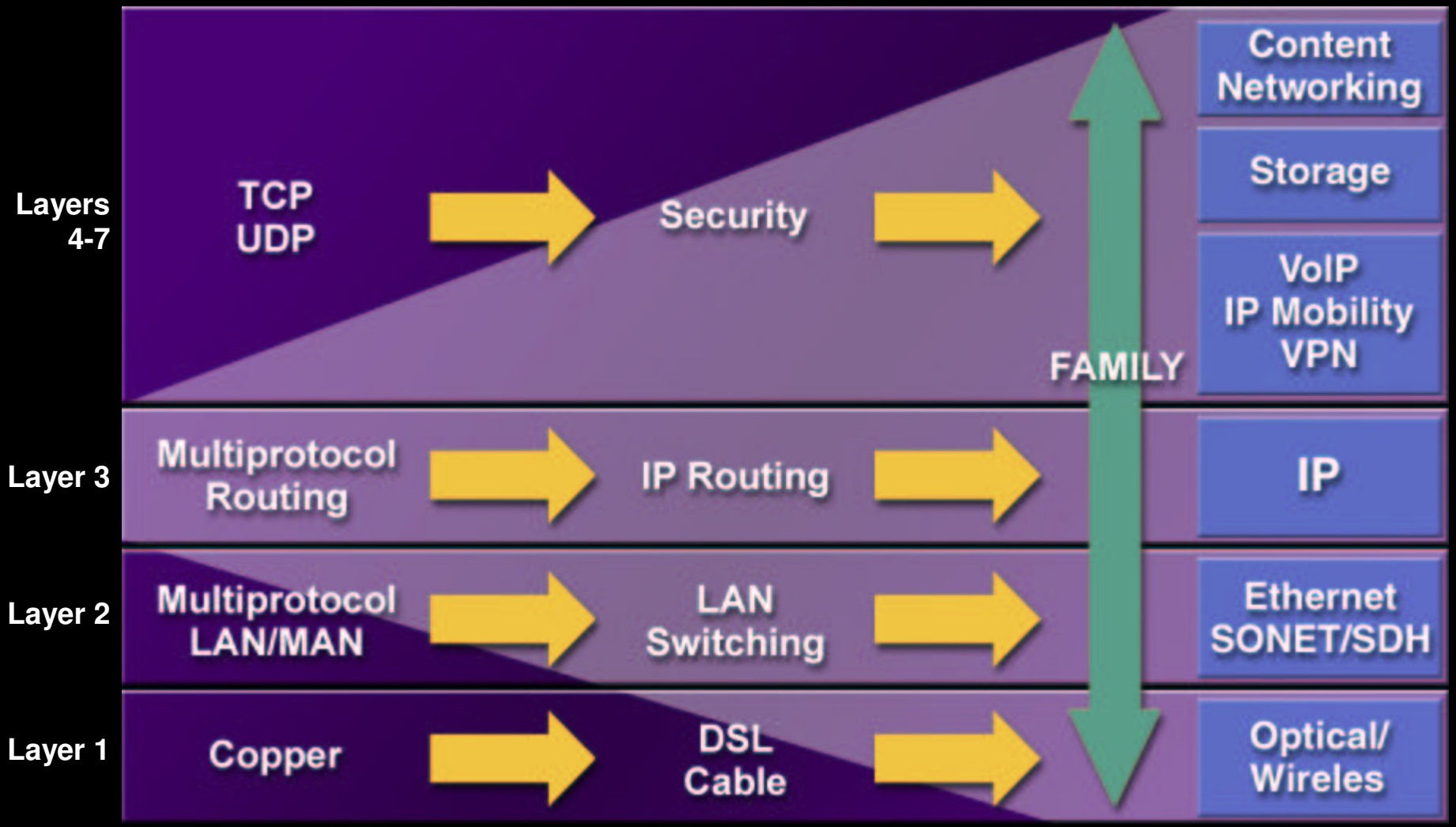

Research Programs

- Electronic Persistence
- Ubiquitous Computing
- Instant Messaging
- Mobile, wireless & nomadic access
- Personal Locator Servic

- Optics, DWDM, Switched DWDM
- L3 restoration
- Lambda switching
- Metropolitan
- Mirrors & Lasers

- DIFFSERV, MPLS, QoS
- Web Caching, ORBs
- Routing/Congestion Control
- Active Routing
- Micronets

(Directories, Policy Servers)

- Network Management (Agent-based, Smart Nets)
- Security, Multicast
- SOHO services

- Network Processor
- Optics manufacturing
- H/W Simulation tools
- ASICS and beyond

Agenda

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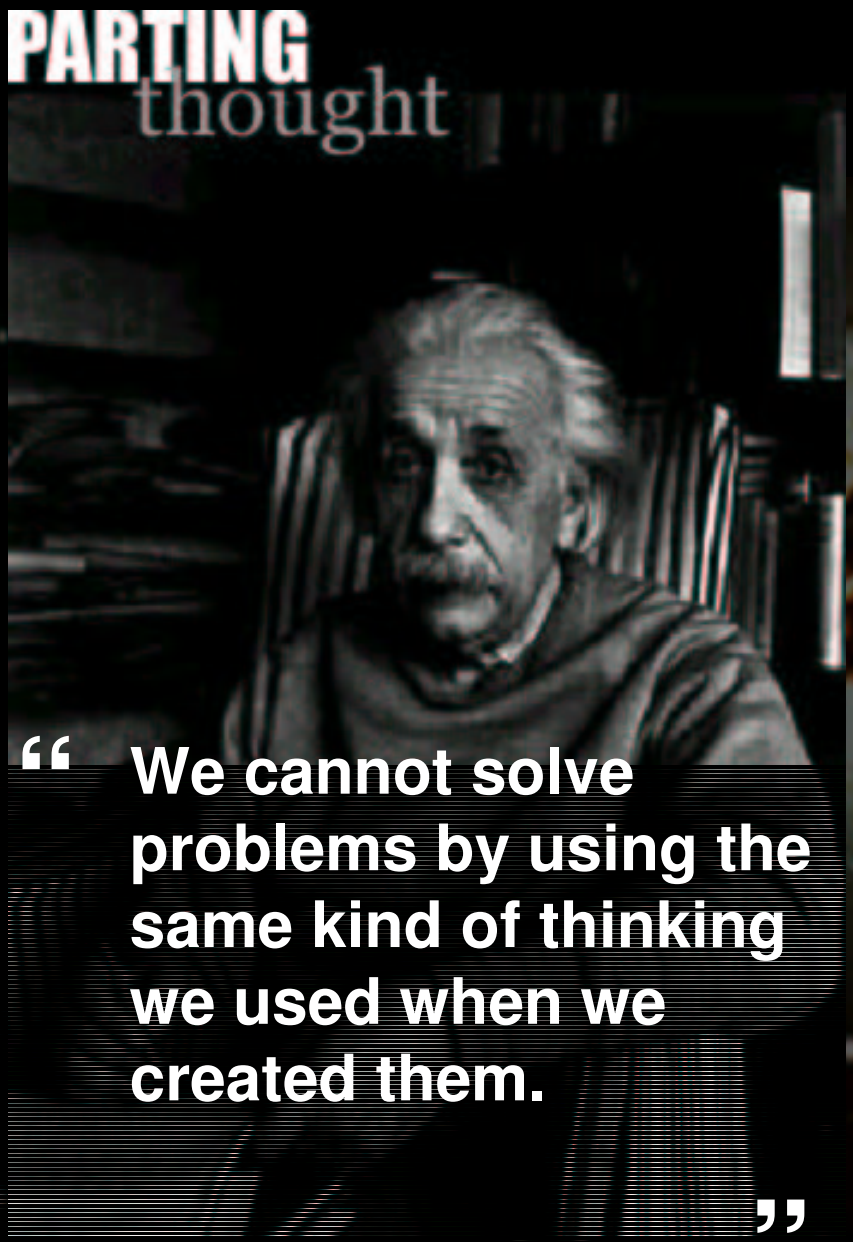
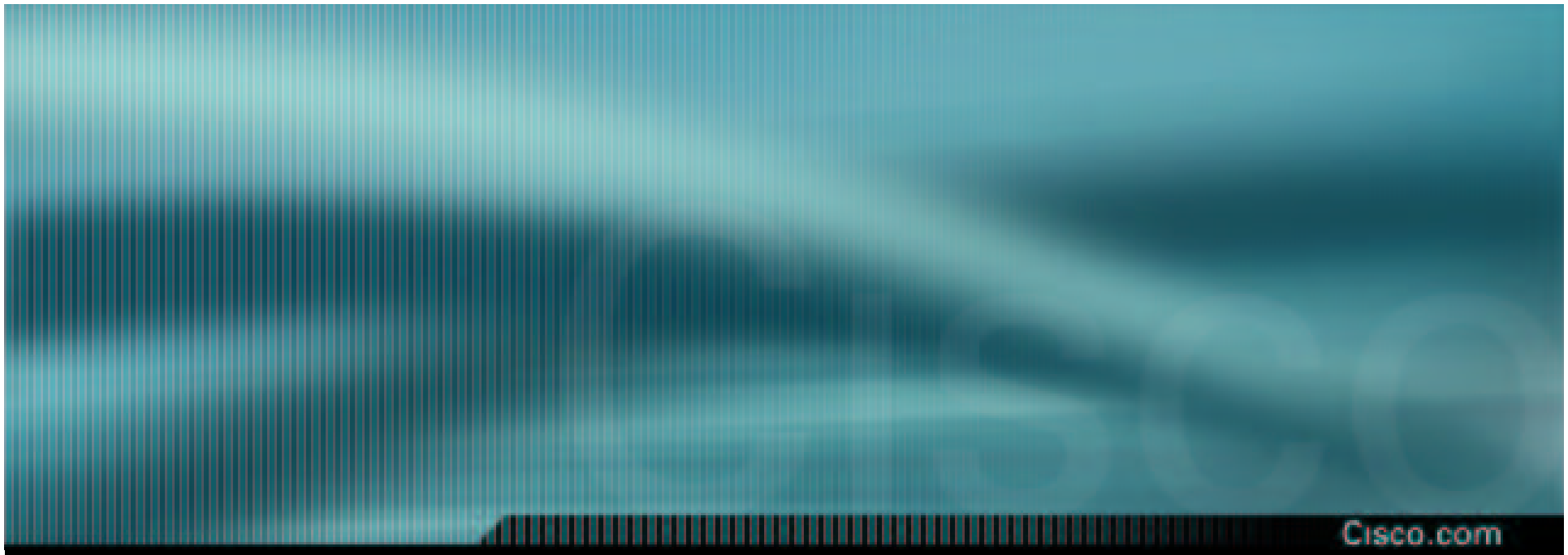
- Reality Check : A look @ Today's market
- 2 different "Internets"
- Advances in technology
- Future developments
- Final thoughts


PARTING
thought
“ We cannot solve problems by using the same kind of thinking we used when we created them.
”



Gracias

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