



## Optical Enterprise Networking

**Theresa Caragol**

**Senior Manager, Optical Enterprise Market  
Development**

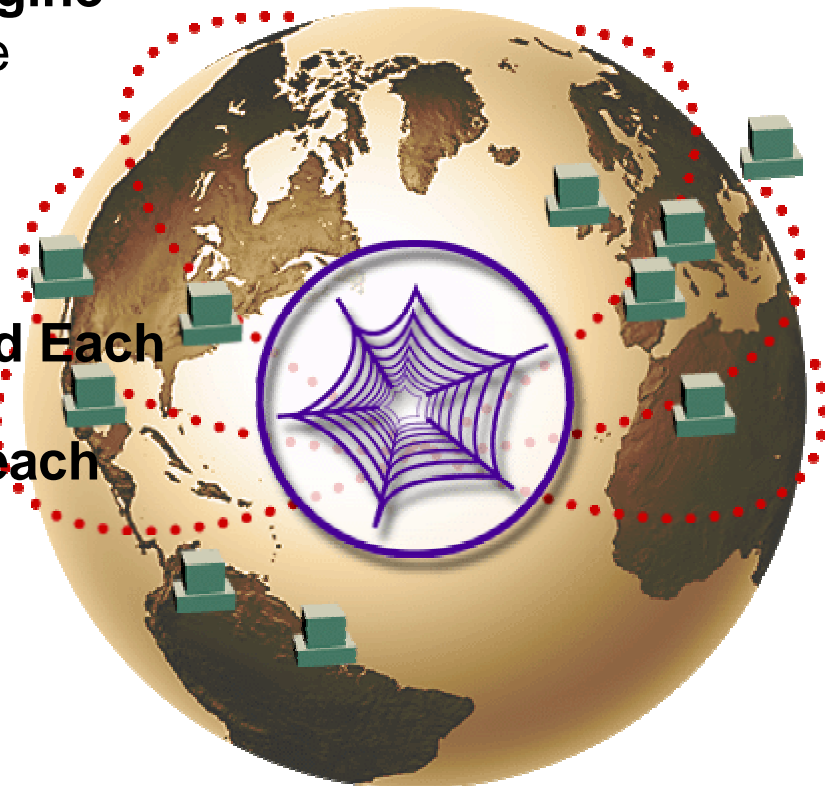
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# Agenda

- **Optical Internet**
- **Enterprise Networks Evolution**
- **Applications**
- **Case Studies**

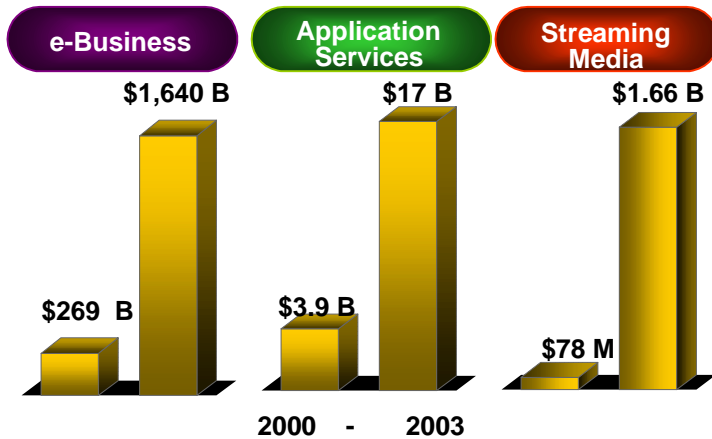
# What do You Want the Internet to Be?

- **Already Many Things to Many People**
  - 60% of Teens prefer being On Line to TV and Telephone
- **Clearly Can be A Major Economic Engine**
  - e-Business = Operations, Knowledge Management, and e-Commerce
- **Far Reaching Social Impact**
- **Information Age**
  - **1.5 Exabytes of Information Shared Each Year**
  - **93% of the information produced each year is stored digitally!**
  - **Not How Is It Stored, But How Is It Accessed?**



# Drivers for Metro Change

IT network usage is evolving



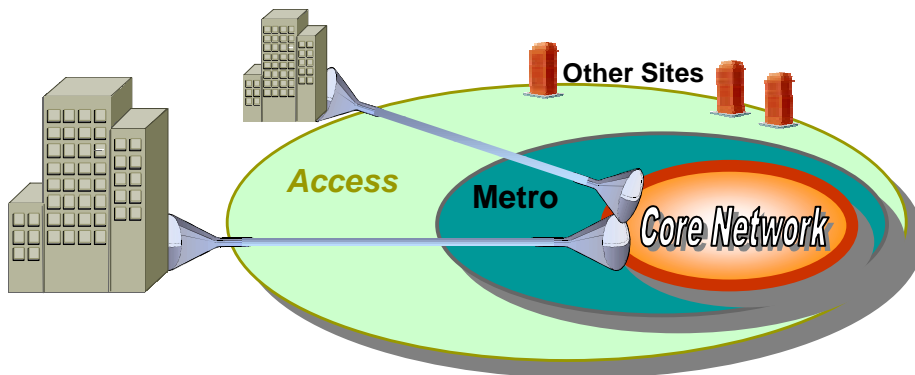
Traffic is changing

Voice → Data

80% Internal → 80% External

Source: IDC - September 2000, Internet Research Group - February 2000

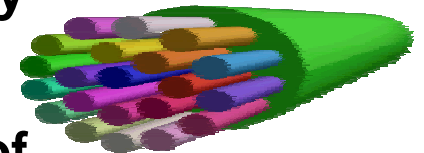
Current access technologies do not meet the challenges



NORTEL NETWORKS

Fiber situation is improving

- +1.5M metropolitan fiber miles in North America
- 10,000 business buildings already fiber connected
- Rapid ramp-up of fiberized cities



Managed Optical Services - 3



# Enterprise Networks Evolution

NORTEL NETWORKS CONFIDENTIAL - SPECIAL HANDLING

# Enterprise Requirements Evolving

## *Legacy:*

### **Fast Ethernet**

100 Mbps

PC

### **ESCON**

16-200 Mbps

Mainframe

### **SCSI**

640 Mbps

Server

### **SONET OC-3**

155 Mbps

Voice and Legacy Data



## *Evolving:*

### **Gigabit Ethernet**

1 Gbps

### **FICON**

1 Gbps

### **Fibre Channel**

1 Gbps

### **SONET OC-12**

622 Mbps

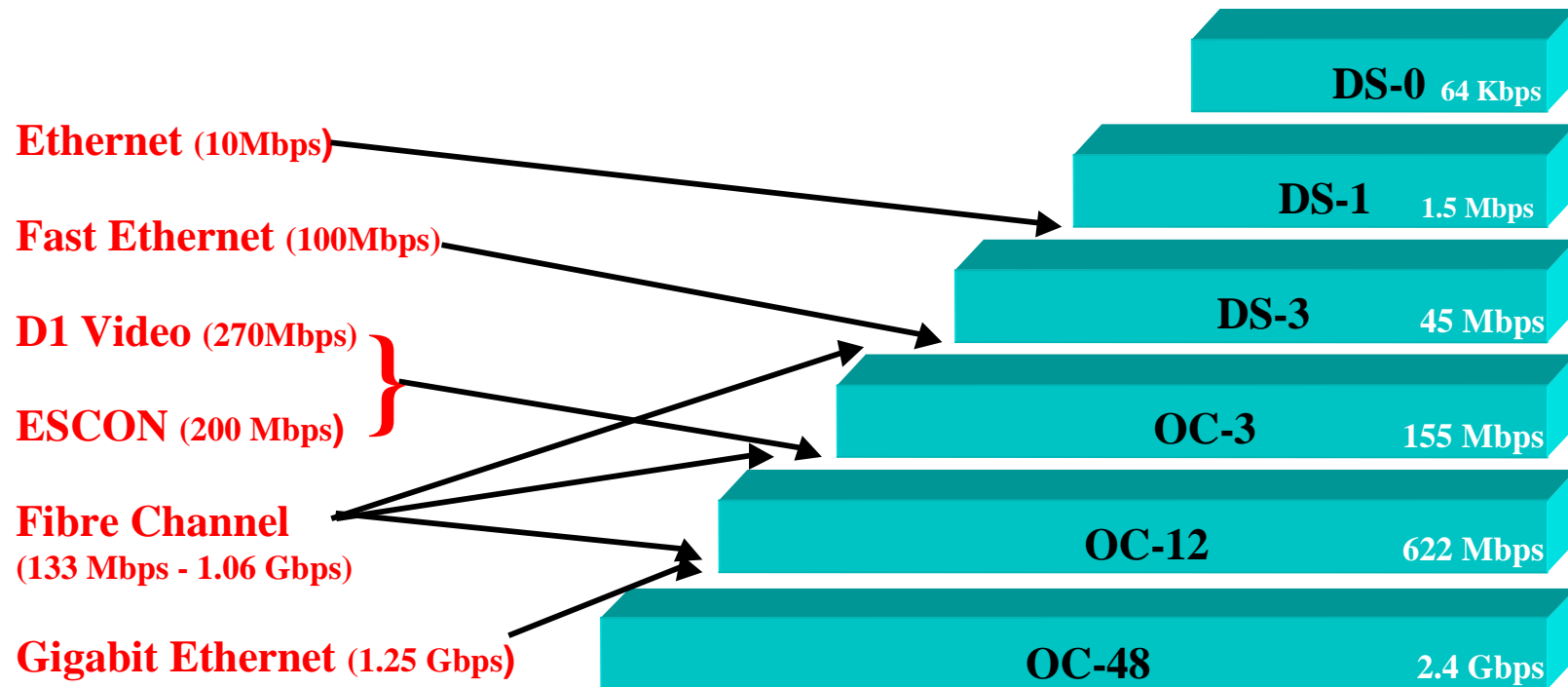
Video Transport

**What about the transport utilization mix ?**

# How to accommodate other needs

Other Needs

Networking Levels today



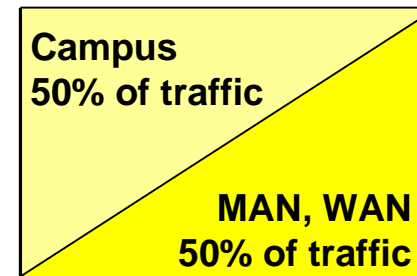
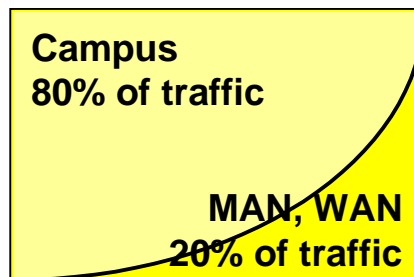
**Translation into TDM typically required**

# ... Demands a High Performance Architecture

- Copper
- Mbps
- Best efforts IP
- Low performance
- High \$\$\$/bit
- Proprietary
- Employees only

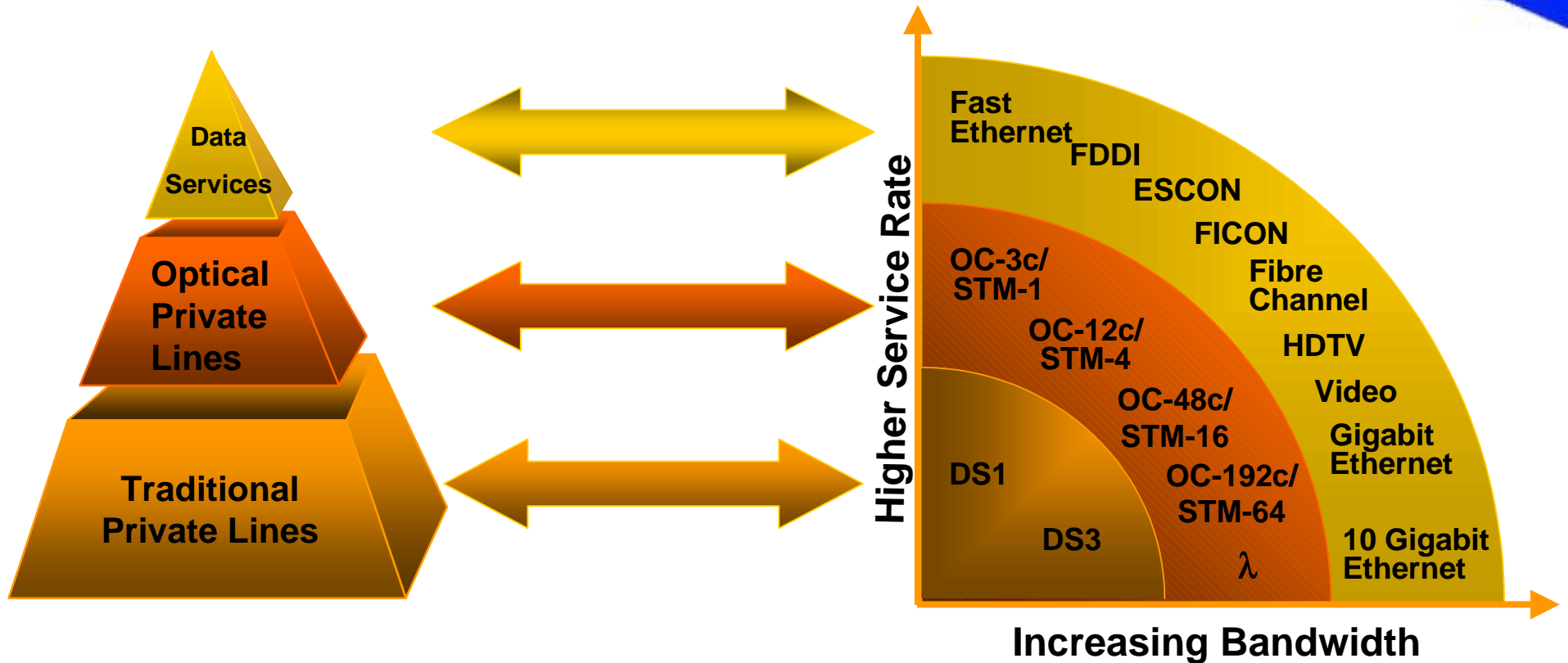


- Optical
- Gb/s and Tb/s
- Prioritized IP
- High performance
- Low \$/bit
- Open
- Employees, customers, partners, suppliers





# A Fast-Paced Industry Changing Service Needs



**Bandwidth Needs Are Rising and Service Choices  
Are Multiplying**



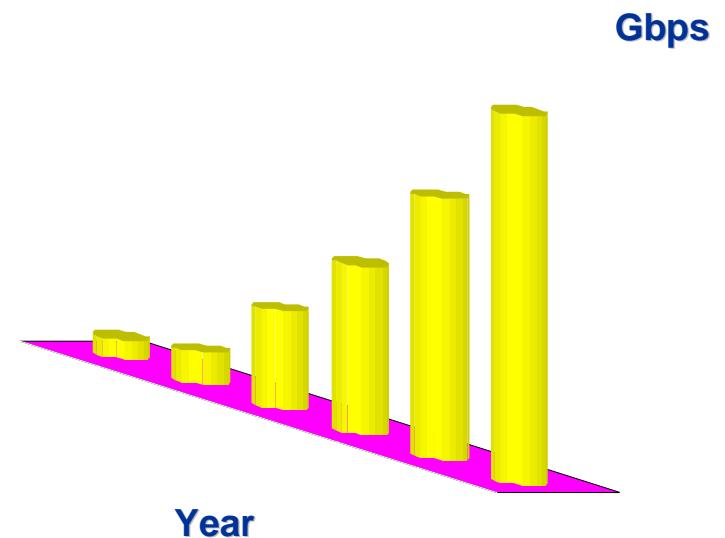
Data Optimized SONET/SDH & Open DWDM are all needed

# A Fast-Paced Industry

## Market Drivers

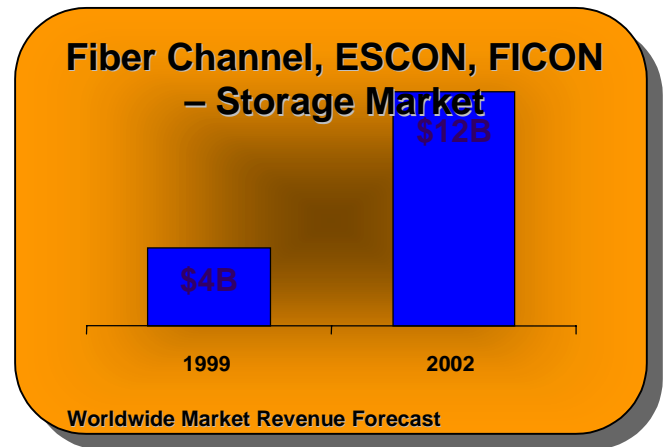
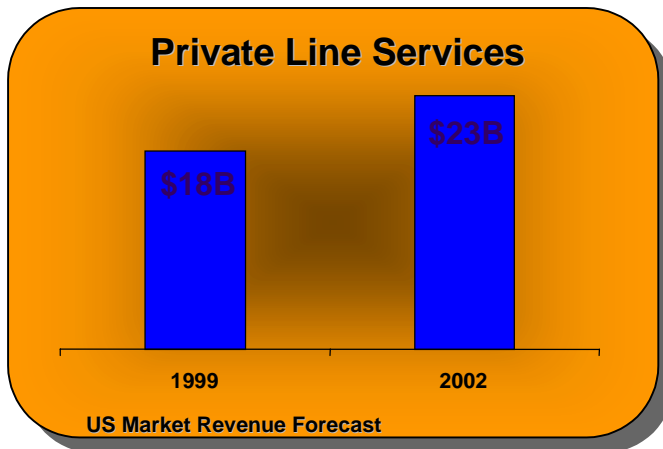
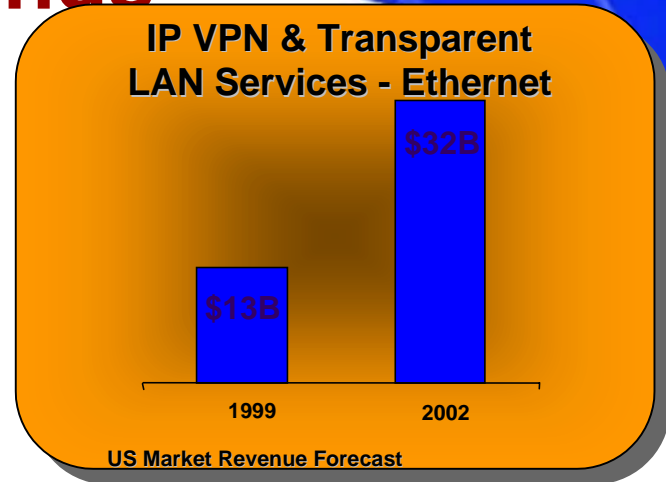
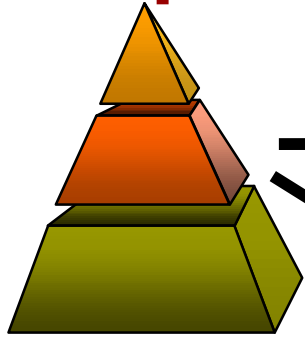
- Enterprise bandwidth needs continue to grow
- Trend is to outsource **EVERYTHING**
- Increase in capabilities and decrease in cost of Metro Optical equipment
- New entrants into industry

### Global Bandwidth Demand\*



*\*Source: Morgan Stanley Dean Witter: Global Bandwidth Demand Estimates, Exhibit 13, March, 2000*

# Enterprise Technology Trends

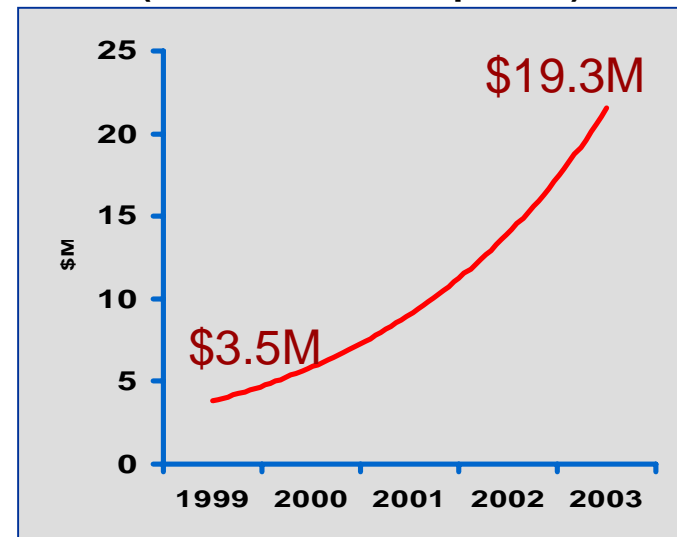


# Bandwidth Explosion in the Enterprise

- Storage Area Networking
- Business Continuity
- e-Business

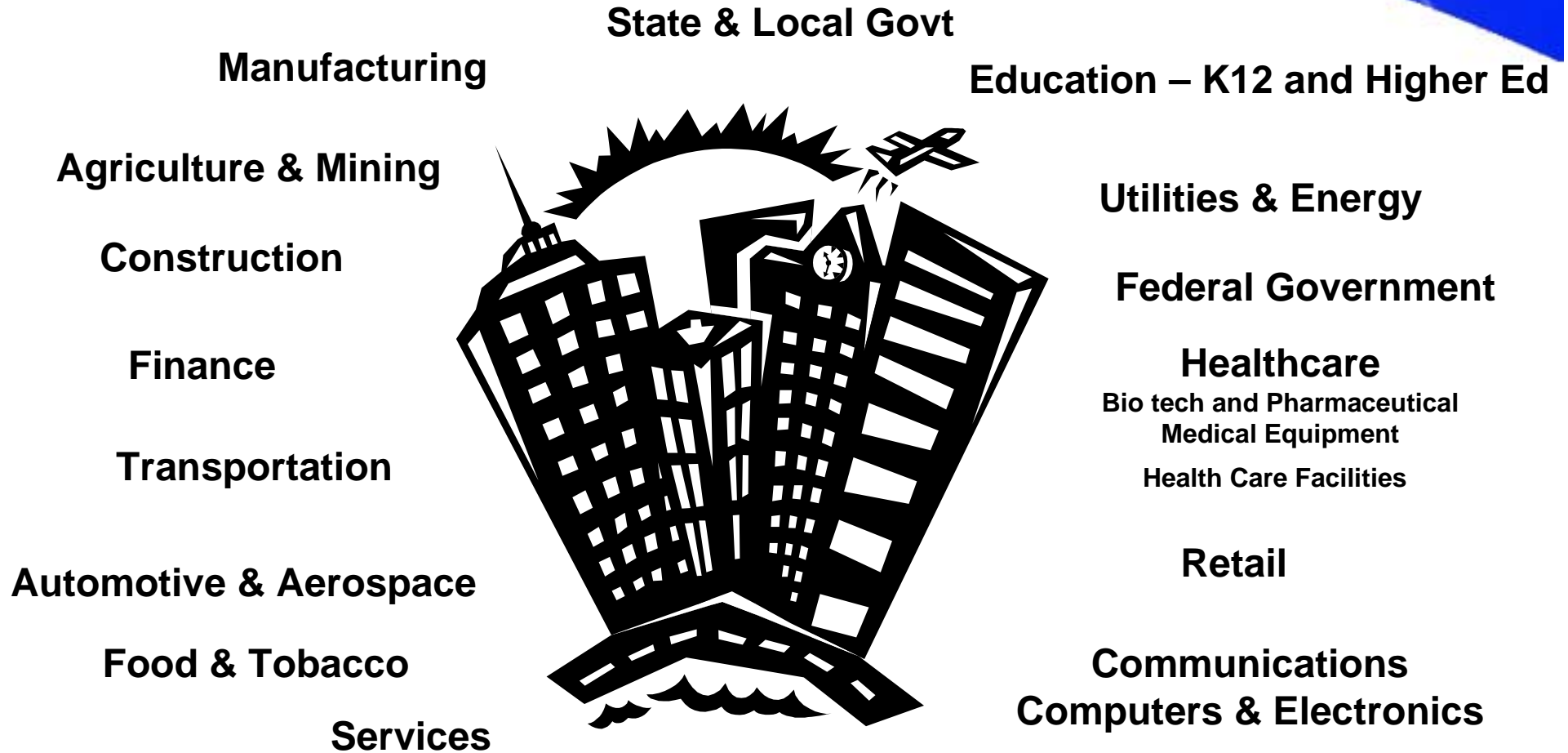
**Nortel is driving  
Optical Internet Economics  
into the MAN**

**Average Storage Spending  
per Enterprise  
(Global 2500 Companies)**



**\$50 Billion by 2003 !!!!  
Must have Connectivity**

# Enterprise Vertical Market Opportunities

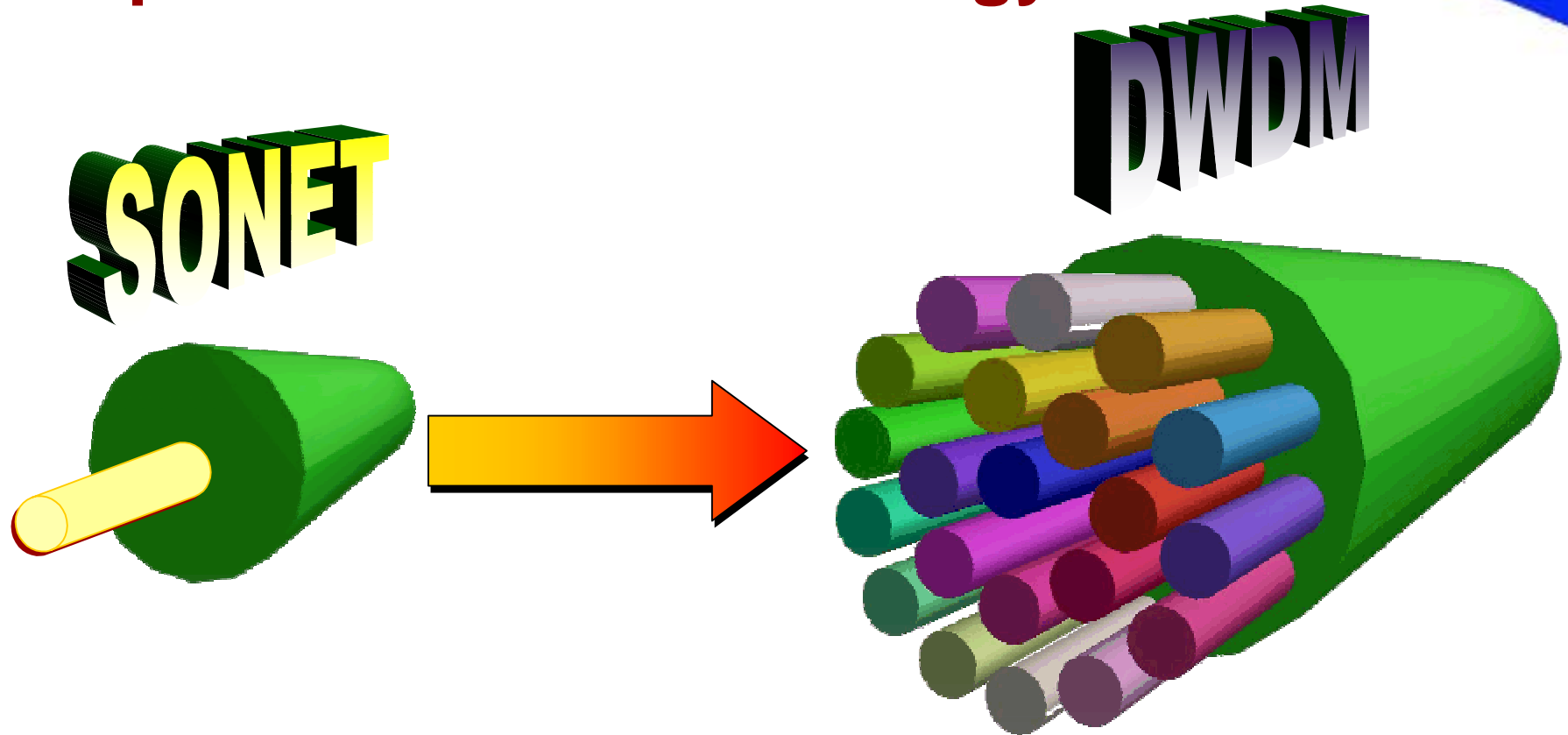


**Optical Opportunity Exists In Each of These Vertical Markets**



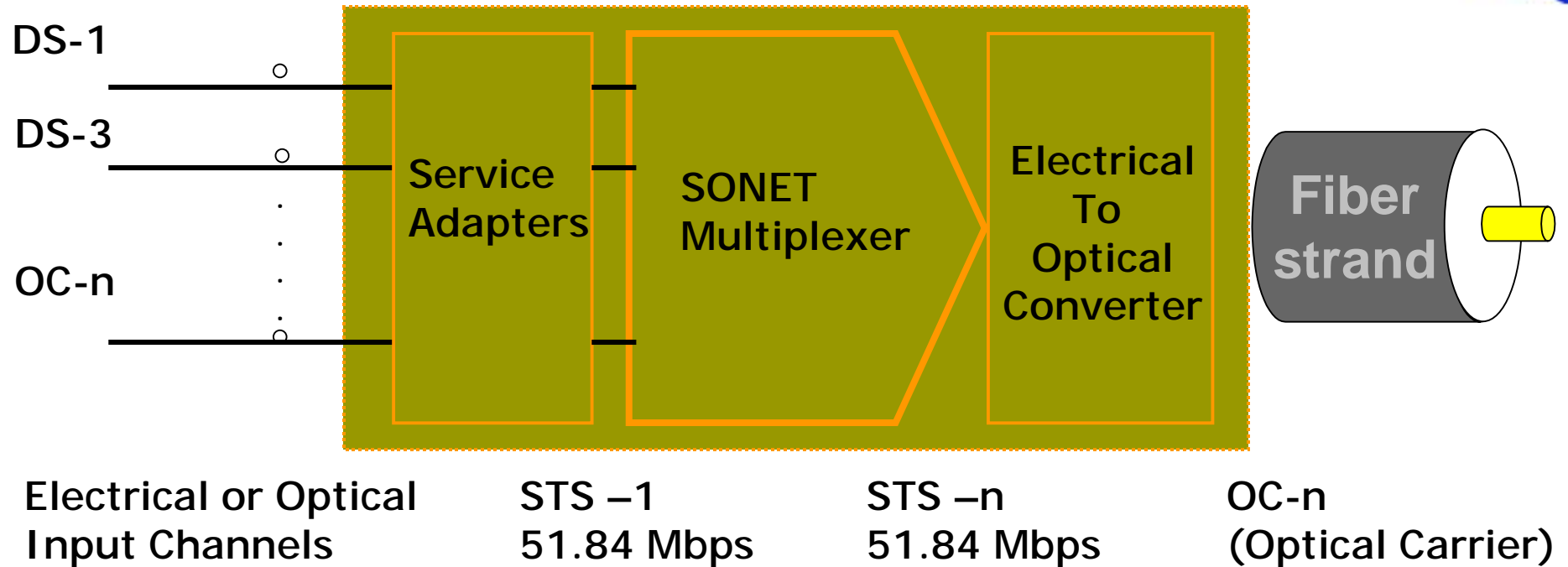
# **SONET and DWDM Technology**

# Optical Internet Technology



# SONET Multiplexing Defined

SONET = Synchronous Optical Network

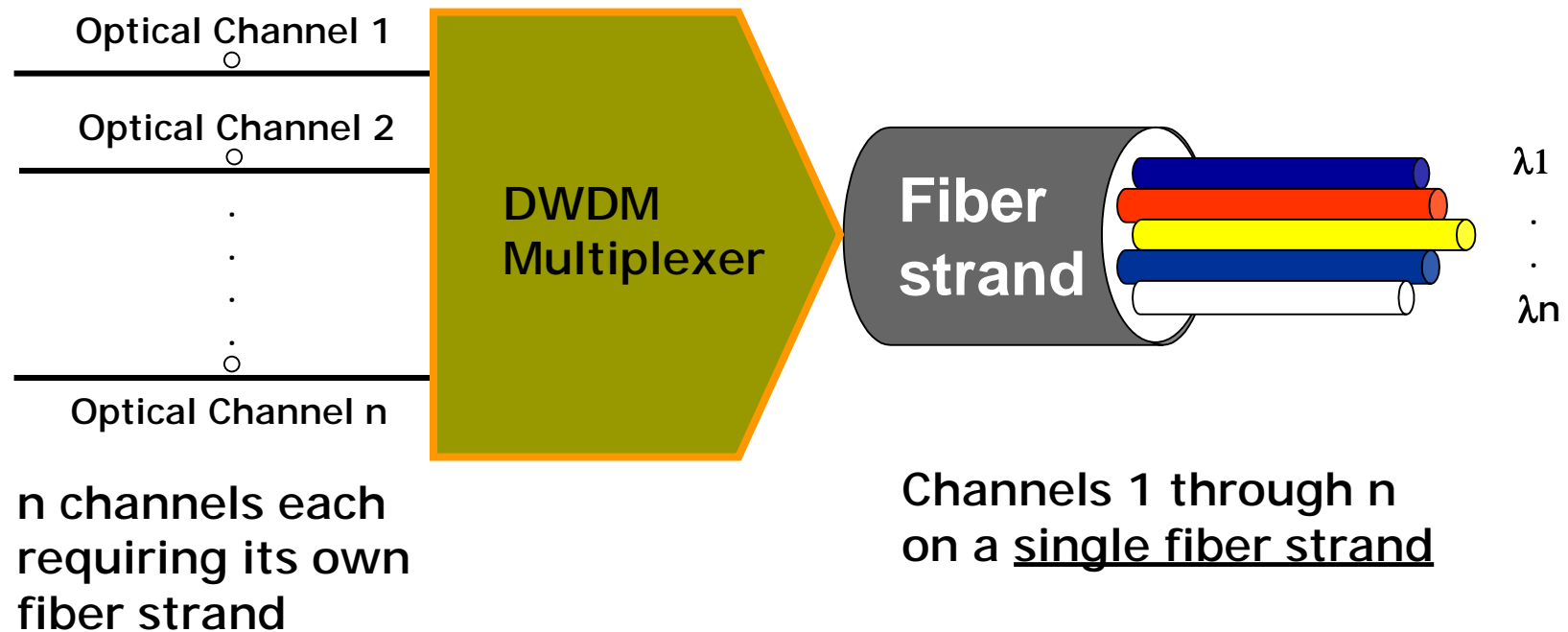


- Multiplexing of many electrical or optical signals to one higher order optical signal
- Bellcore initiated ANSI Standard for Transport



# DWDM Defined

DWDM = Dense Wave Division Multiplexing

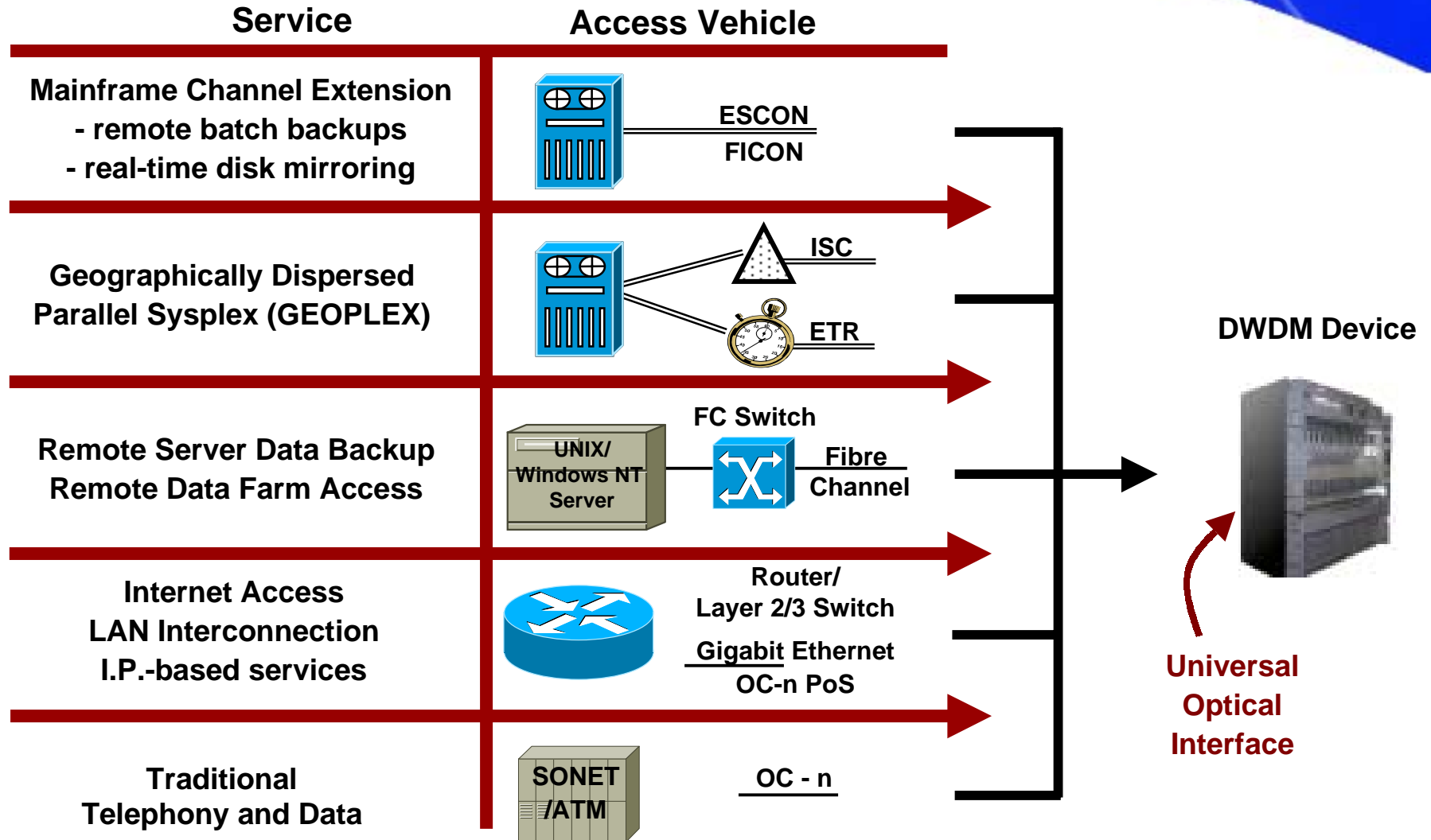


- Multiplexing of many optical, digital channels onto single fiber
- Technology initially commercialized in long-haul networks
  - relief from fiber exhaust

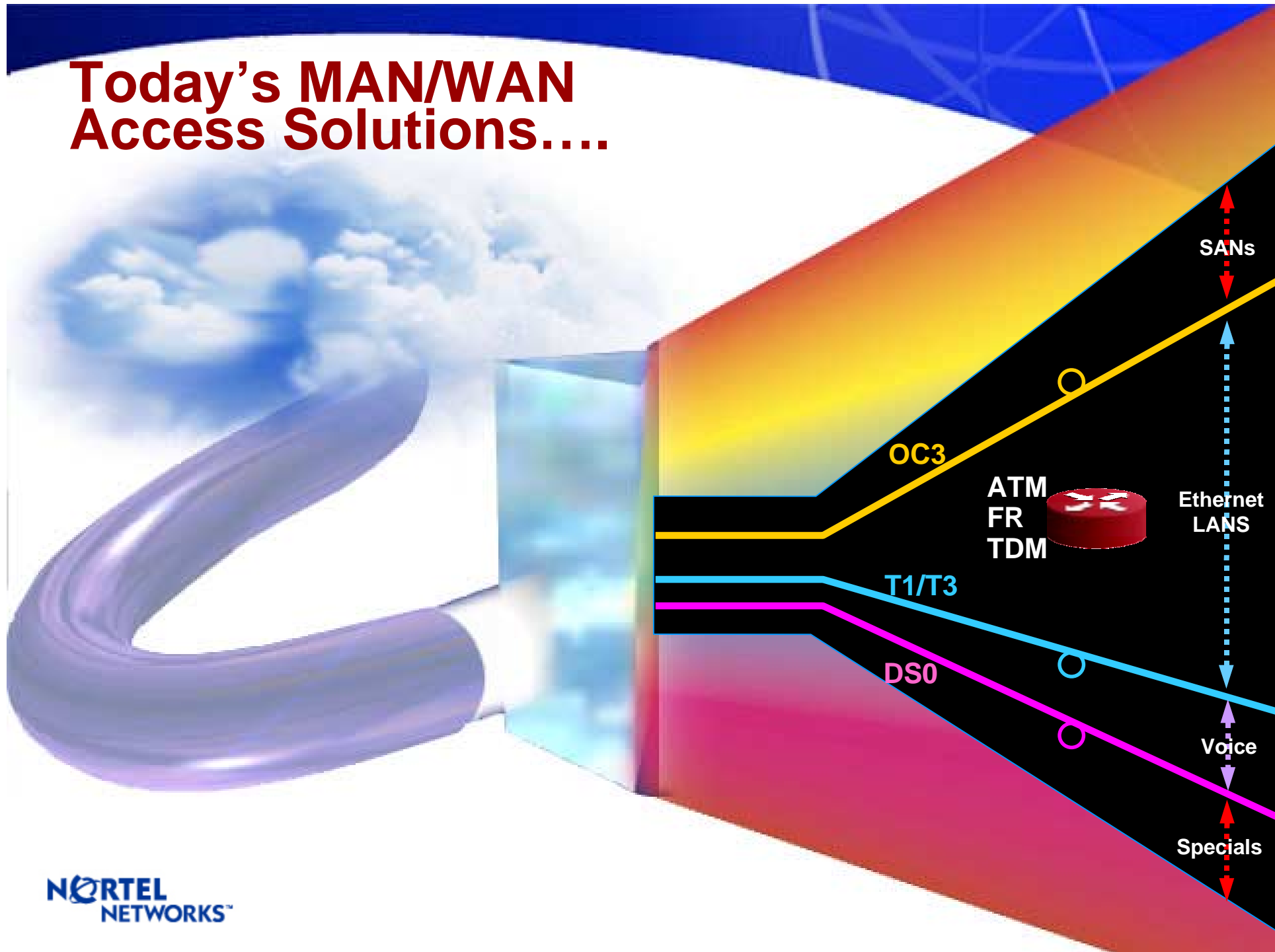


# Enterprise Applications

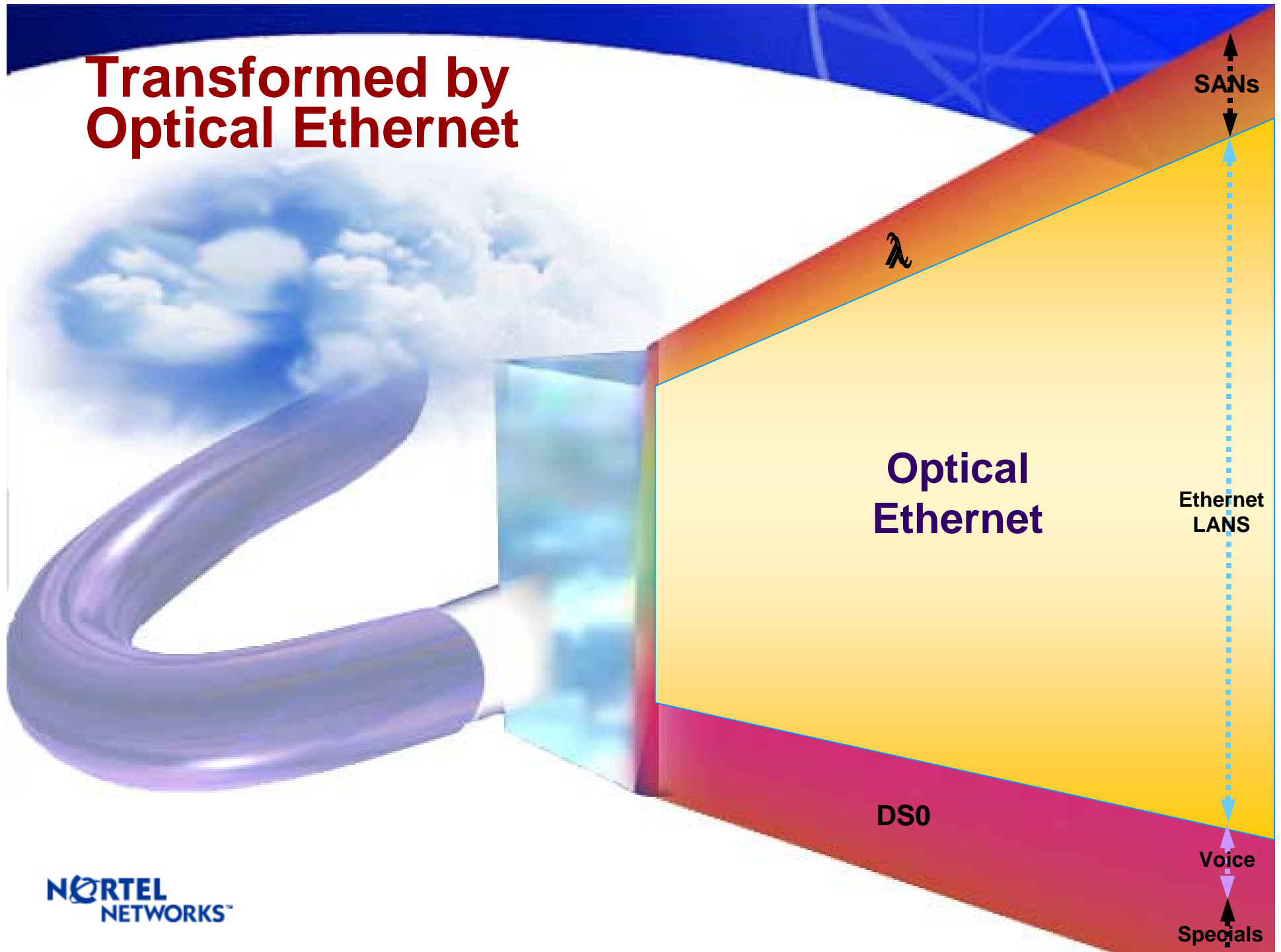
# Enterprise MAN Environment



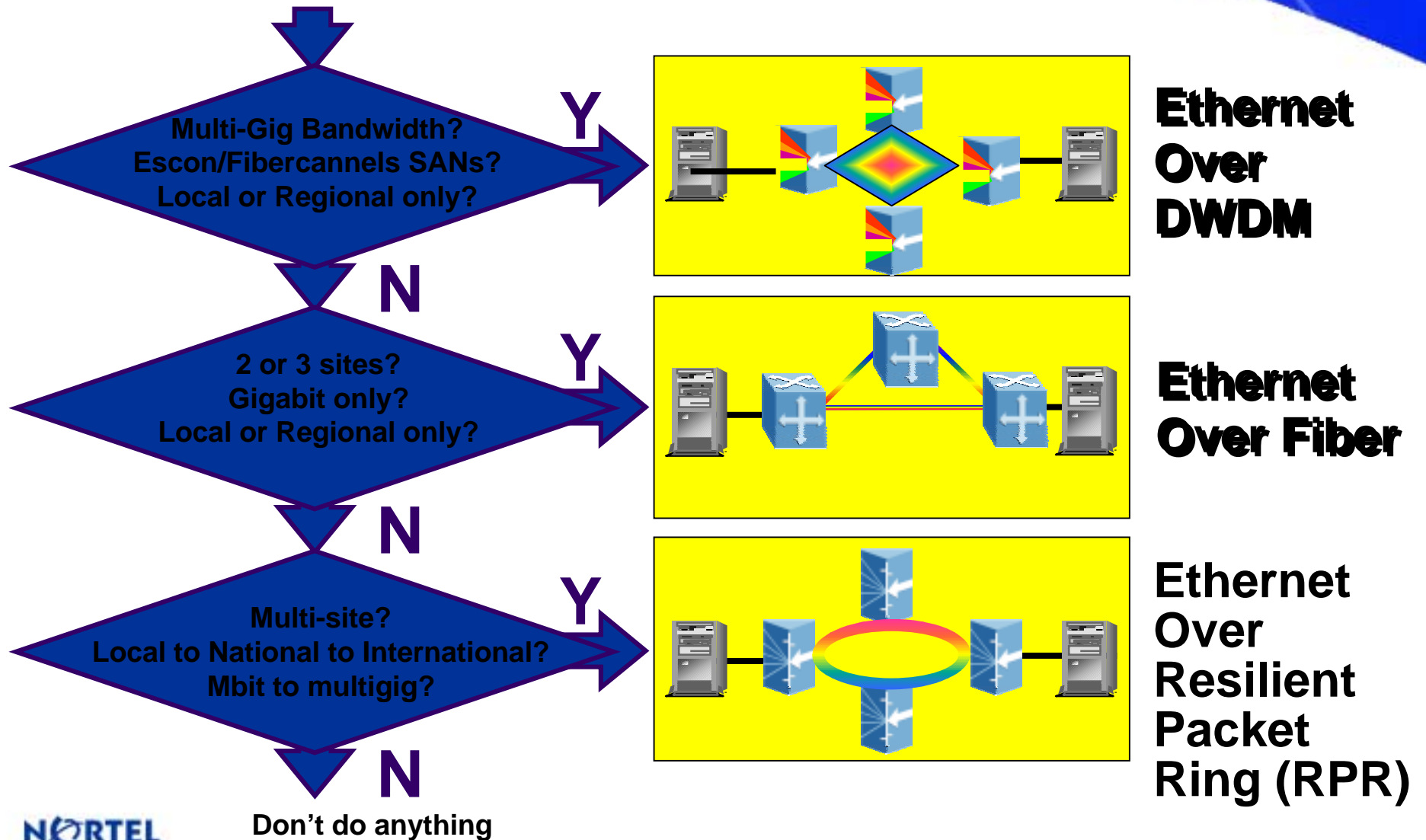
# Today's MAN/WAN Access Solutions....



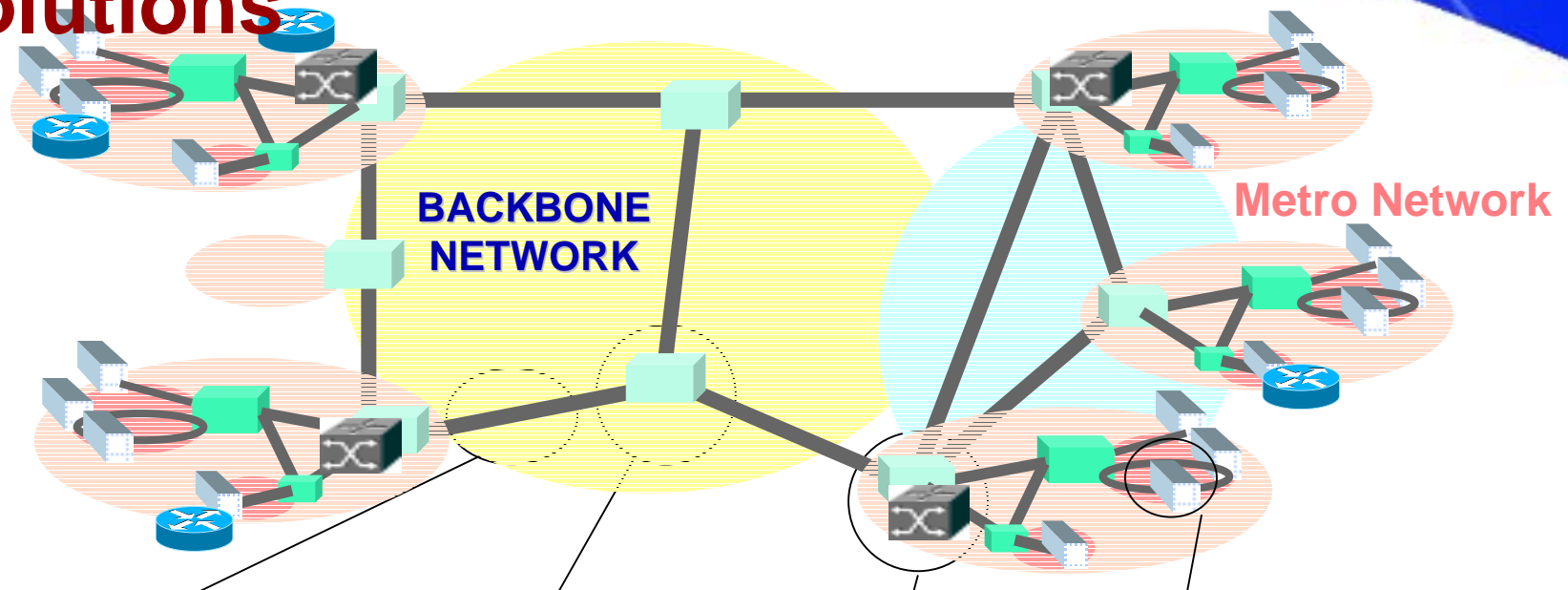
# Transformed by Optical Ethernet



# How is Optical Ethernet Deployed?



# Nortel Networks OPTera Solutions



## OPTera Long Haul

- optical layer management
- reach / performance
- adaptive to line conditions

## OPTera Connect

- connection management
- “route /  $\lambda$  topology”
- transparent
- L-0/L-1 protection and restoration
  - (mesh - ring)

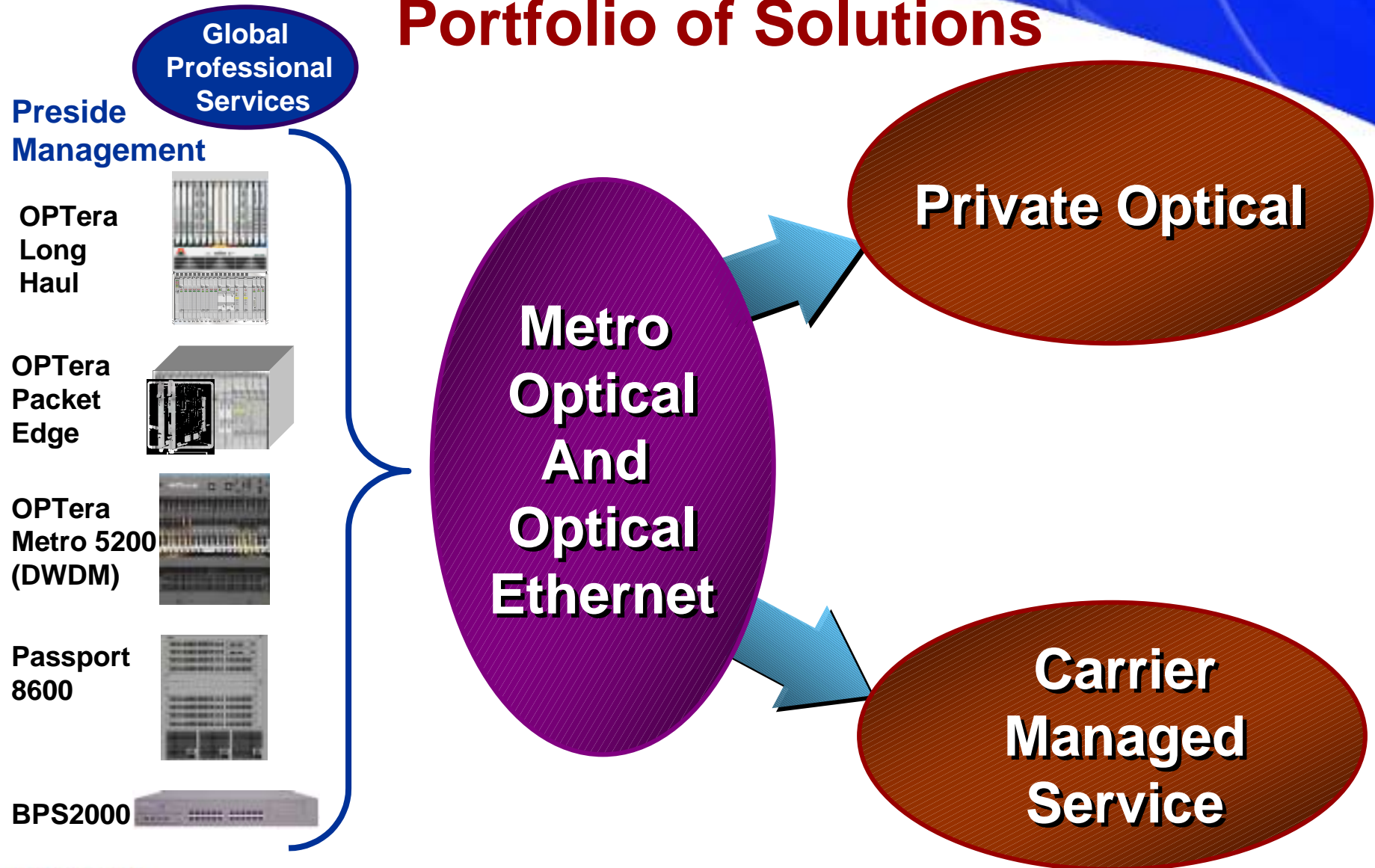
## OPTera Metro

- cost effective optical edge
- service velocity
- transparency
- managed  $\lambda$  demarcation
- QoS / SLA's

## OPTera Packet

- Terabit IP / MPLS switching
- L-2 protection and restoration

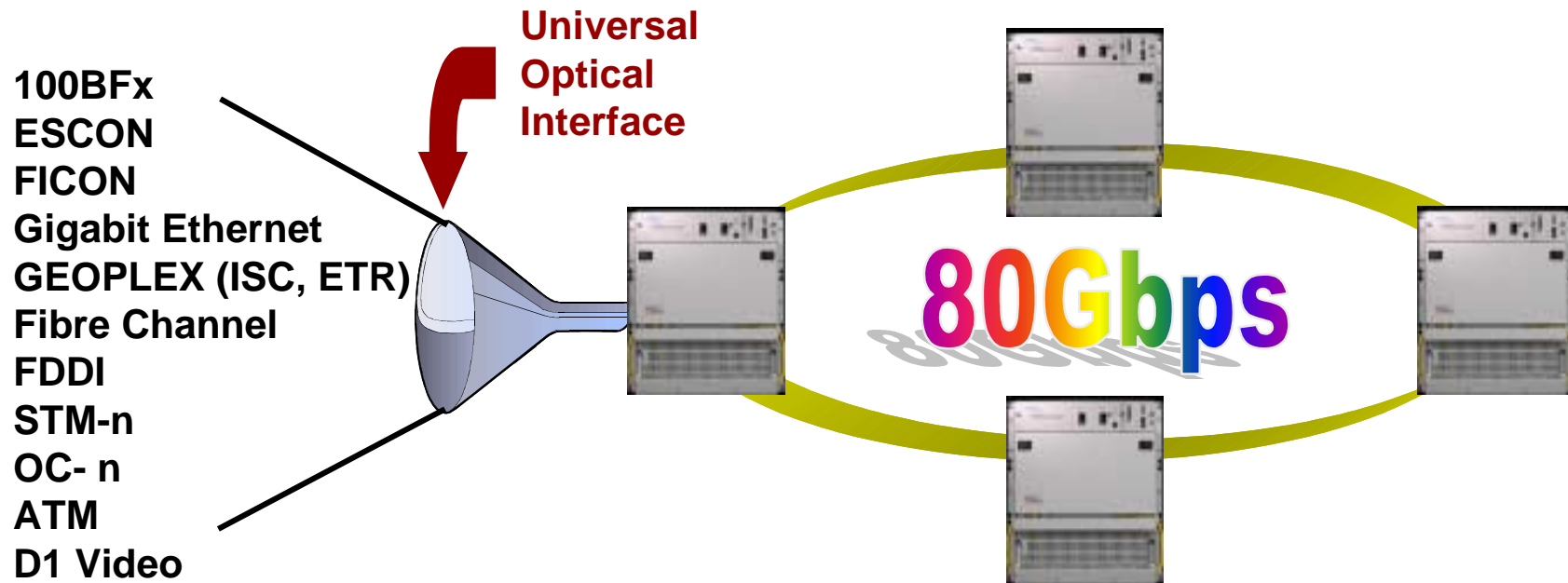
# Metro Optical and Optical Ethernet - A Portfolio of Solutions



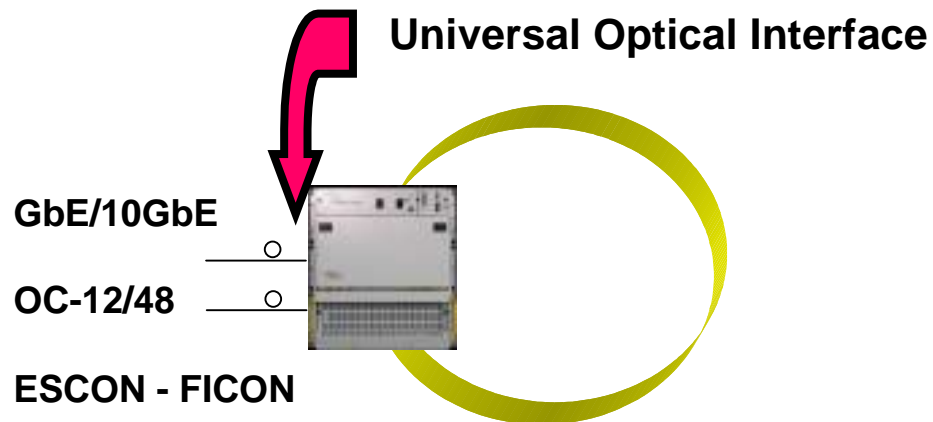


# OPTera Metro Benefits

<b>Low Start Up Cost</b>  High Capacity 32 $\lambda$	<b>Multi Service</b>  Universal Optical Interface	<b>Survivable Services</b>  Self-healing Ring	<b>OPEN Management</b>  Smart Optics	<b>Forecast Tolerant Networks™</b>  Network enabled business growth
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# Forecast Tolerant Networking™



- No field dispatch
- No ring upgrade

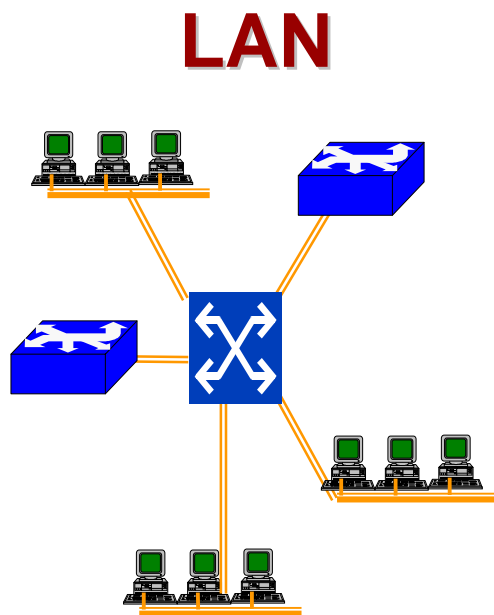


Need to upgrade to  
more bandwidth or  
another protocol

Point  
&  
Click

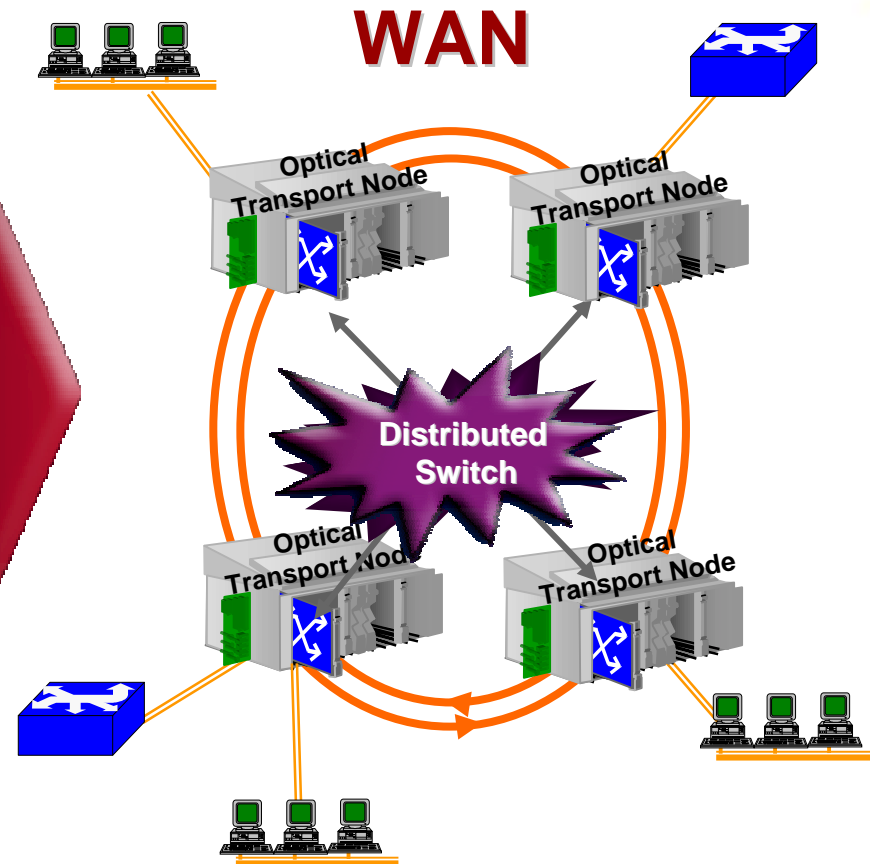
**DONE !**

# Packet Edge Transport



- Low Cost
- Simplicity
- Universality

LAN in the WAN Paradigm



- Low Cost
  - Simplicity
  - Universality
- +
- Scalability
  - Reach
  - Robustness



# Case Studies

# Case Study

## Current environment

- **Three sites connected about 25 miles apart**
  - Primary Data Center A doing backup to Data Center B using 8 ESCON channels
  - Data Center B mirroring the data at Data Center C using SRDF over ESCON
- **Site A currently connected to Site B with 8 T3 connections**
- **Site B connected to Site C with 8 T3 connections**

## Future requirements

- **4 additional ESCON channels between Sites A & B**
- **Fibre Channel (FC) connection between Sites B & C**

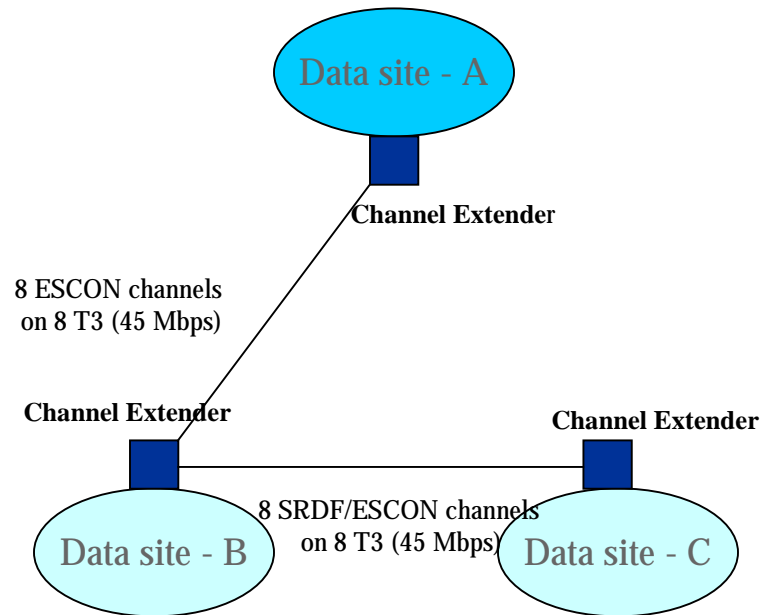
## Assumptions

### Network Solution with T3 Connections (45 Mbps)

- Cost per dedicated T3 per month for two locations 25 miles apart = \$7600
- Cost per month for 3 locations = \$122,000 (2\*8\*7600)
- Cost of 3 Channel Extender boxes per month = \$10,000
- 1 OPTera Metro cost 175.33K including dark fiber installation.
- Recurring cost of leasing fiber for 100 miles @ \$350/mile = \$35,000/mo
- Incremental Cost of OPTera Metro for additional 4 ESCON & 1 FC per month = \$13,000

**Note:** Fixed H/W cost are to be spread over 3 year term for per month cost.

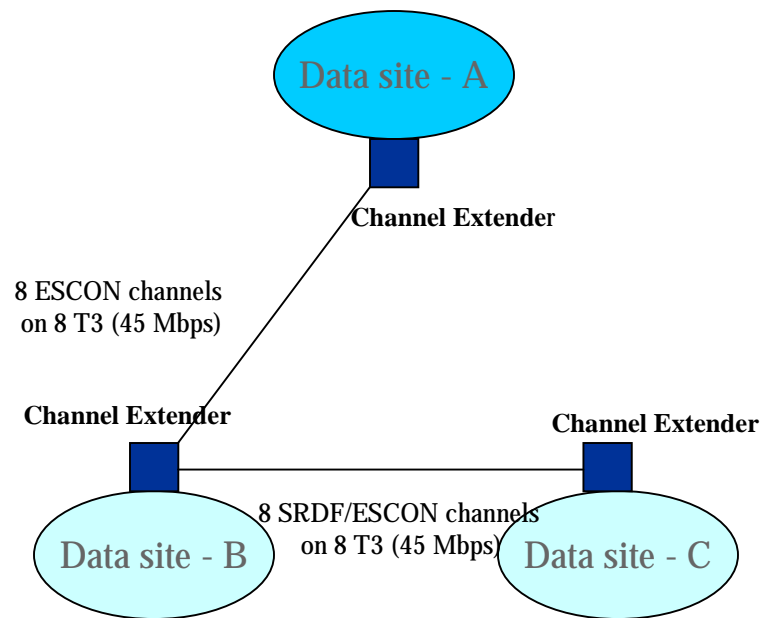
### T3 Based Solution Site Map (Existing)



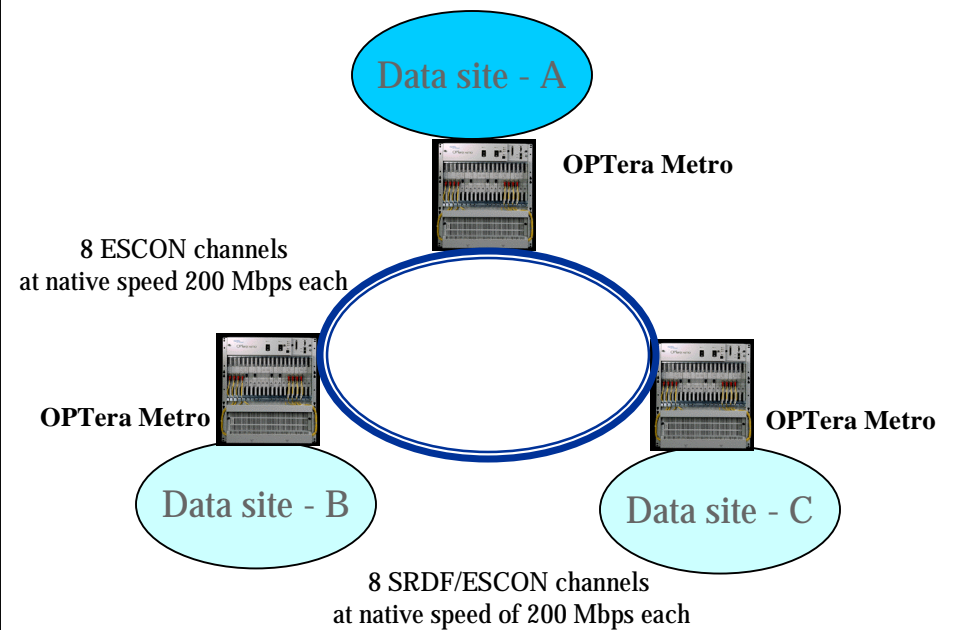
1. Determine cost per month for existing network.
2. Determine cost per month for a proposed network.
3. Determine incremental cost for additional Esccon channels.

# Solution

## T3 Based Solution (Existing) **Site Map**



## OPTera Metro Solution (Proposed)



Note: All connections are completely redundant via diverse routing protection scheme

# Solution

## Cost Comparison Network Solution with (Year 1) T3Connections (45 Mbps)

- Cost per dedicated T3 per month for two locations 25 miles apart = \$7600\*
- Cost per month for 3 locations = \$122,000 (2\*8\*7600)
- Cost of 3 Channel Extender boxes per month = \$10,000\*\*\*

## OPTera Metro 5200 Solution Up to 10 Gbps

- Total cost of OPTera solution at 3 locations = \$526,000\*\*
- Recurring cost of leasing fiber for 100 miles @ \$350/mile = \$35,000

### Total Cost of Solution per Month

**\$132,000**

**\$50,000**

**Payback in about 6 Months!!**

\*\* 3 OPTera Metros = \$476,000 approx; Dark fiber installation charges at 3 locations = \$50,000; Total Fixed cost = \$526,000

\*\*\* Fixed costs spread over 3 years; Channel Extender boxes assumed to be \$120K each



# Solution

## Cost Comparison Network Solution with T3 (45 Mbps)

- Incremental Cost of T3 for additional 4 ESCON & 1 FC for 2 sites per month = \$38,000
- Incremental Cost of 3 Channel extenders per month = \$10,000

## OPTera Metro 5200 Solution

- Incremental Cost of OPTera Metro for additional 4 ESCON & 1 FC per month = \$13,000\*\*

### Total Cost of Solution per Month

\$180,000

\$63,000

- **OPTera Metro Solution offers Substantial Savings**
- **Savings Escalate as Transport Needs Grow (Higher Bandwidth, Different Traffic Types)**
- **Transport at Native Speeds**

\*\*\* Fixed costs spread over 3 years

# Local Government Case Study

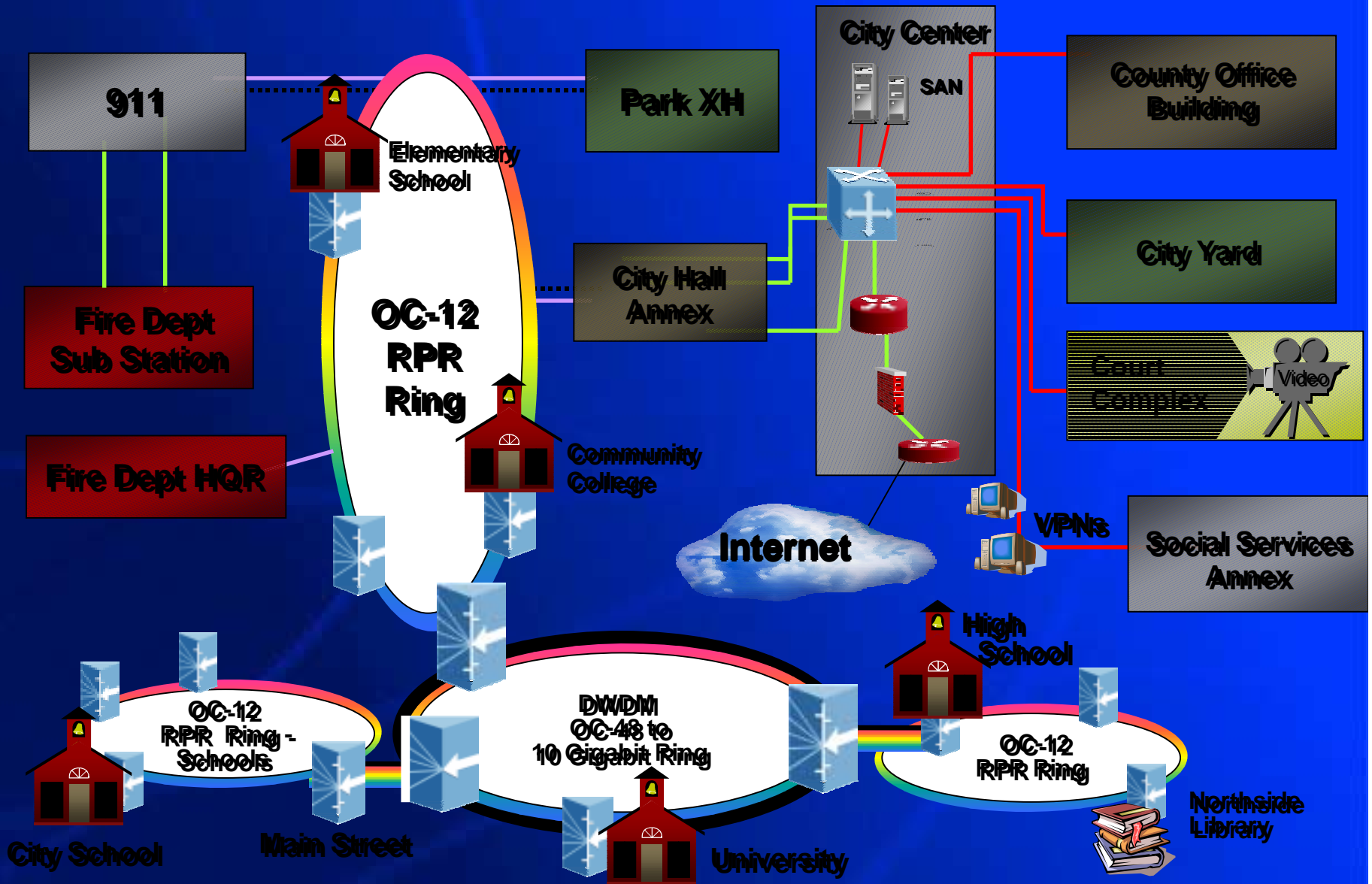
## *Goal*

- Create an environment where citizens can meet, communicate, interact and form as a community in entirely new ways

## *Challenges*

- Interoperate with city's existing ATM network
- Support data, voice, and multimedia services
- Scalability, flexibility, reliability
- Single universal interface
- Future viability

# Case Study - OE Network Implementation



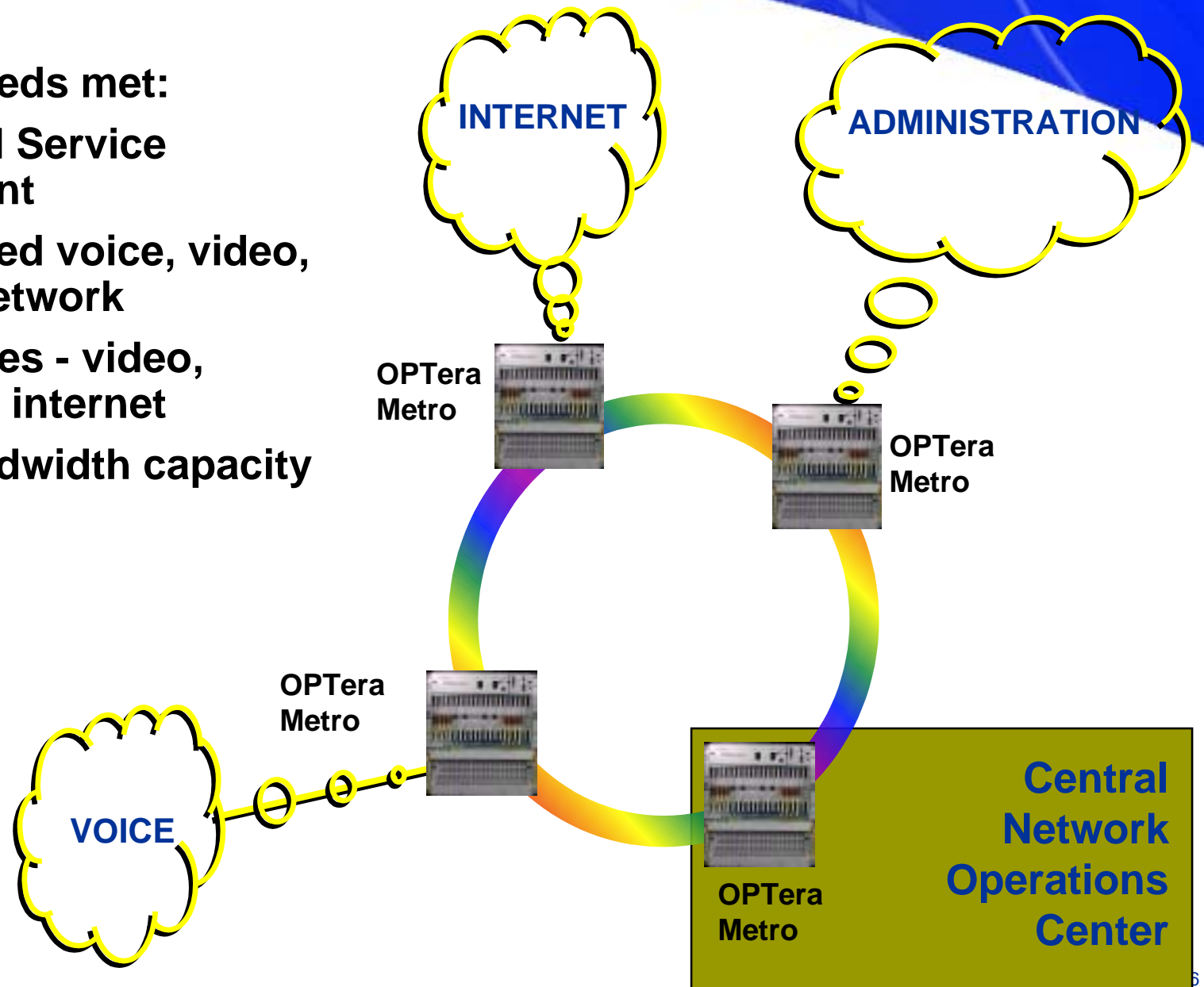
# Case Study - Optical Ethernet Benefits

- **Linking government, business, and citizens together, locally, regionally, and globally**
- **Scalable connectivity for varying site requirements**
  - 10 BaseT
  - 100 BaseT
  - GigE
- **Reliability and survivability sufficient to support 911 services**
- **Flexibility to adapt to changes in network access as well as growth**
- **Creating a city that is an “in demand” place to live**

# Clear Creek Independent School District

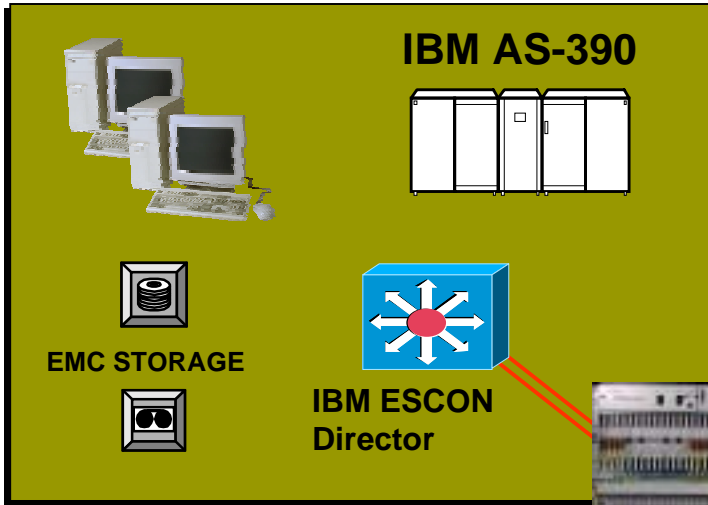
## Customer needs met:

- **Centralized Service Management**
- **Consolidated voice, video, and data network**
- **New services - video, high speed internet**
- **Future bandwidth capacity**

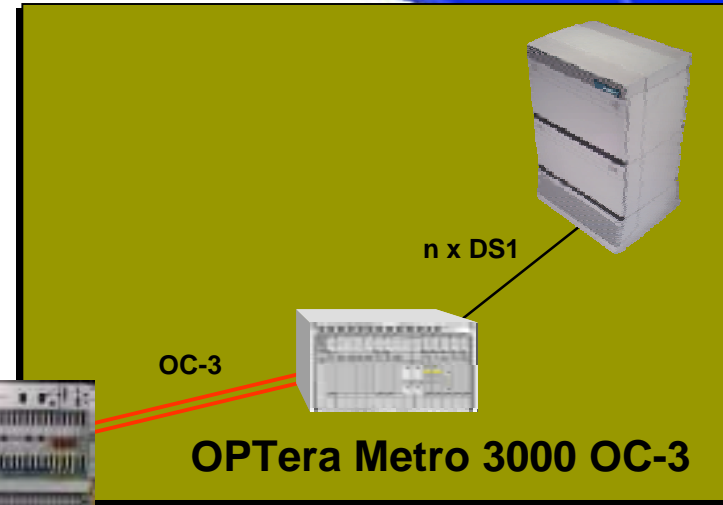


# Global Financial Firm

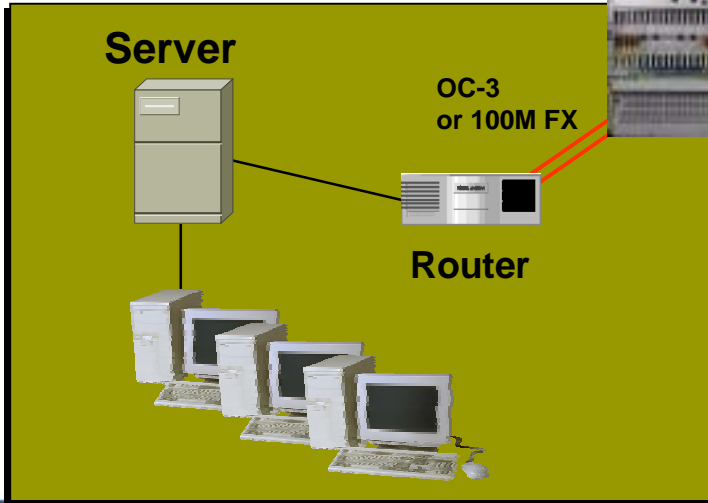
## ESCON



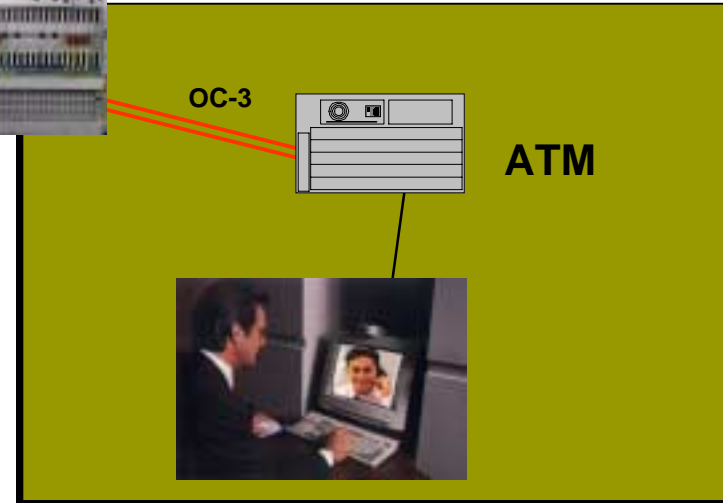
## VOICE



## FAST ETHERNET



## VIDEO



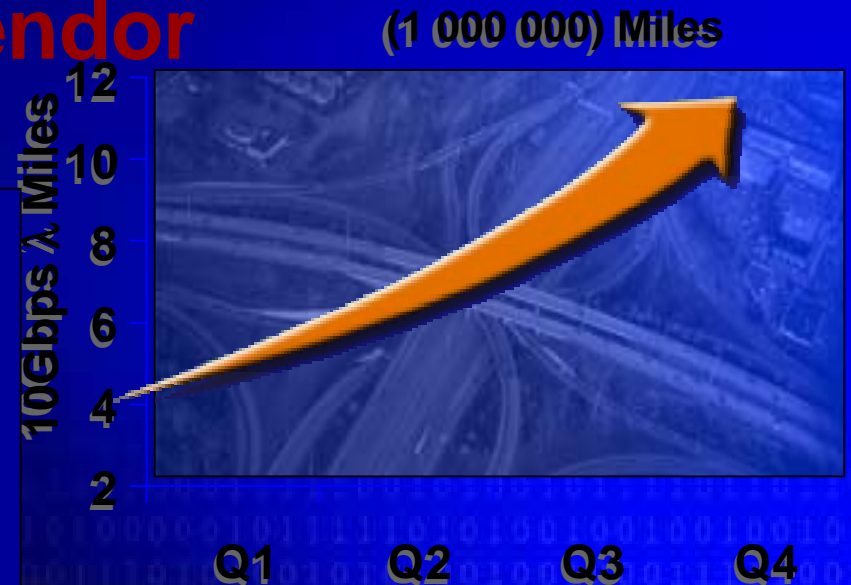
# OPTera is Best of Breed Worldwide\*

	1999	1Q'00	2Q'00	
<b>Optical – Total</b>	<b>30%</b>	<b>37%</b>	<b>43%</b>	<b>#1 – Nortel extends lead</b>
<b>SONET / SDH</b>	<b>29%</b>	<b>33%</b>	<b>38%</b>	<b>#1 – Nortel increases lead</b>
<b>DWDM</b>	<b>33%</b>	<b>45%</b>	<b>54%</b>	<b>#1 – Nortel expands lead</b>

\* Dell'Oro Group Report 2Q'00

# Nortel – The Optical Vendor of Choice

- 42 of 58 North American & Pan European Network wins - last 4 yrs
- 75% of North American Internet Traffic
- >50% of European Internet traffic





# The Power of Nortel Networks Research

## R&D Investment

- **\$2.9 billion per year**
- **Over 80 percent of R&D invested in IP**
- **Optical R&D scientists: 4650**
- **Optical PhD's: 201**
- **Over 23,000 years cumulative experience**
- **Nortel Networks Optical patents: 432**  
**Optical patents pending: 377**
- **Research Focus – Customer Solutions**

# OPTera Metro Wins Blue Ribbon from Network World/University of West Va.

## Enterprise optical boxes see the light

*Nortel's OPTera Metro 5200 tops the list of DWDM gear tested.*

By JEFFREY FRITZ  
Network World, 04/02/01

“Nortel's OPTera Metro 5200 earned the Network World Blue Ribbon Award, because it offered more features, was more resilient and had enhanced management over its competitors.”

# Nortel Standards Activities

- **Optical and Network Standards Development**
  - IEEE 802.3 – 10Gbps! - Chair
  - Optical Interop Forum (OIF) – Board Position
  - ITU-T Study Study Group 15 – Chair
  - ANSI T1X1 Participant
- **Associations**
  - Storage Networking Association (SNA)
  - Fiber Channel Association (FCA)
- **Storage Standards**
  - FibreAlliance
  - Common Information Model (CIM)

# Industry's First Optical Certification and Skills Verification

## Architect

- Able to analyze and resolve challenging internetworking environments
- Multi-discipline (optical, wireless, etc.) solutions oriented
- Target audience: Senior individuals

2002

## Expert

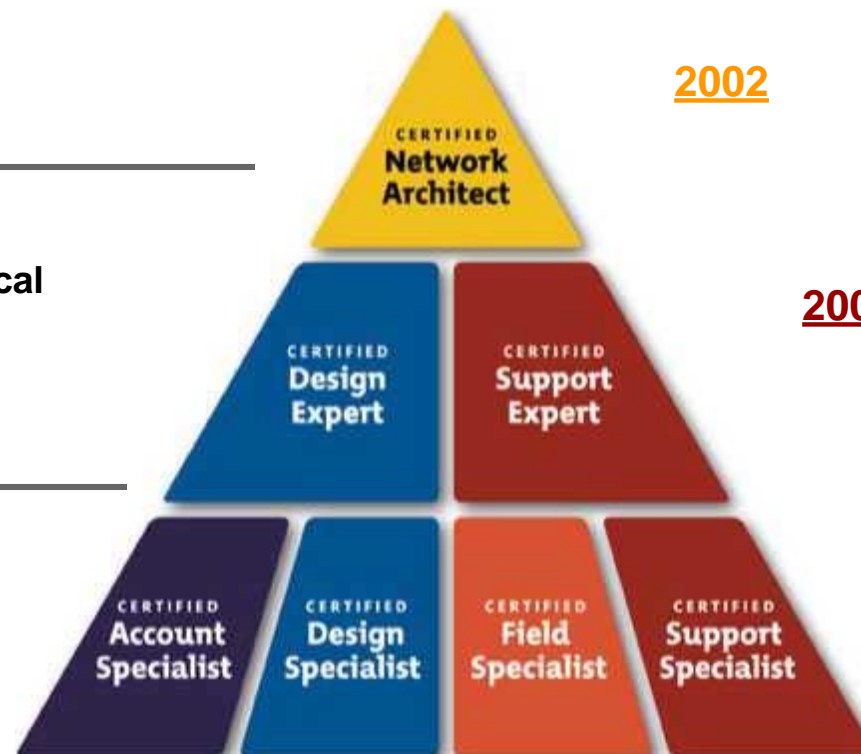
- Able to design and optimize customer optical networks
- An in-depth knowledge of solution sets
- Target audience: Intermediate and Senior individuals

2002

## Specialist

- Basic level of technical proficiency to sell and install Nortel Optical solutions
- Able to support or design "in service" Optical solutions
- Target audience: Entry-level and Intermediate Individuals

2001



# How Do I Apply This Kind of Technology Today?

1. Analysis of Your Situation

2. Evaluation of Alternatives

3. Use of resources

a. Consulting

b. Architectural alternatives

c. Fiber / Managed Service Availability

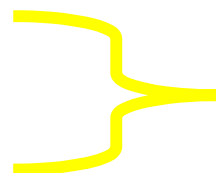
d. Engineering

e. Private vs. Managed Network Selection

f. Engineering

g. Installation

h. Maintenance and Monitoring



Business -- ratios

Networks / costs

Transport / costs

**4. Nortel Networks and Hewlett Packard Will Assist Every Step of the Way!**