Virtual Leased lines:
Applications will always be king!

Keith Falter

Global Enterprise Markets Director

AT&T Business

How did all this get started?
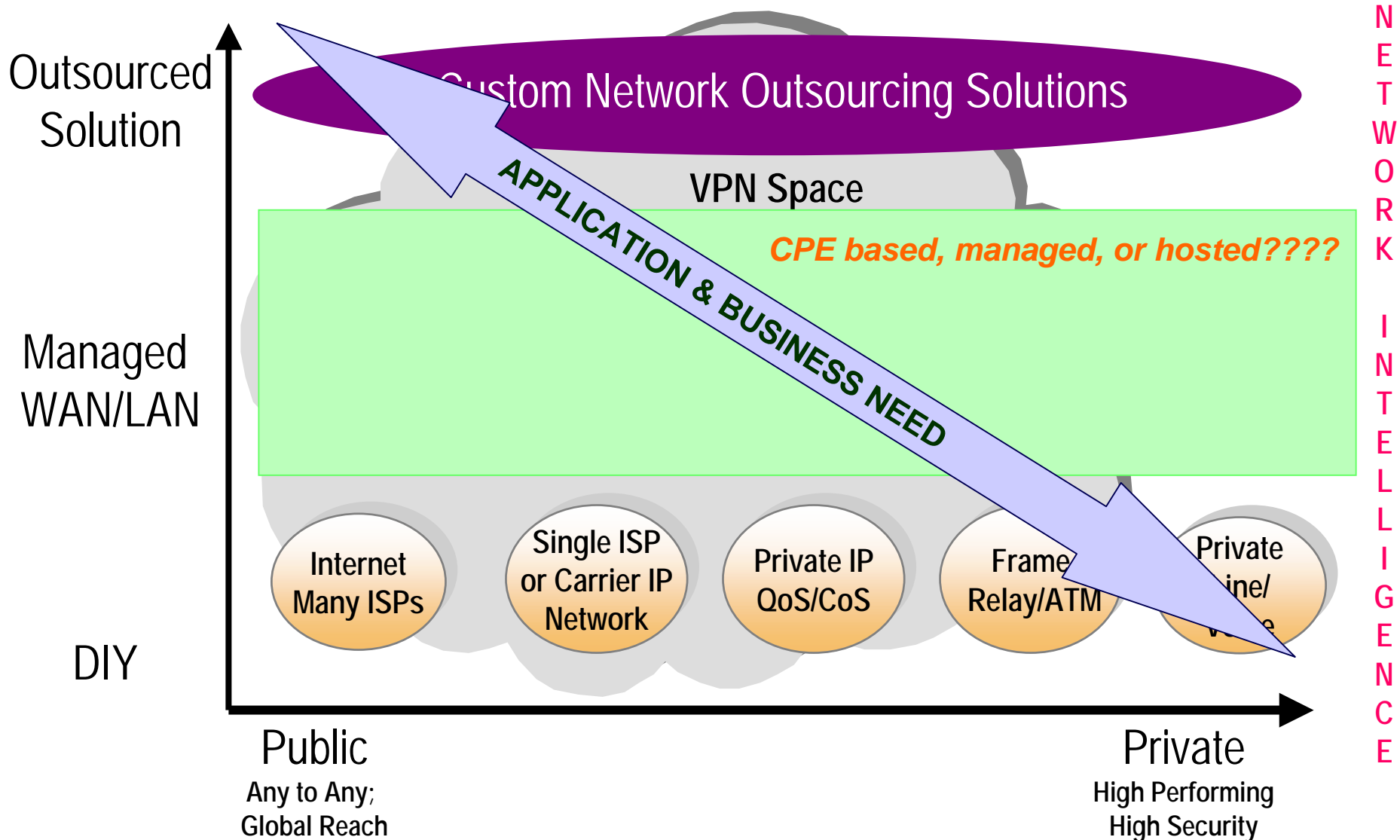
Is There Any Substance Behind the Network Growth Numbers?

Number of US Employees Online

43.8 million
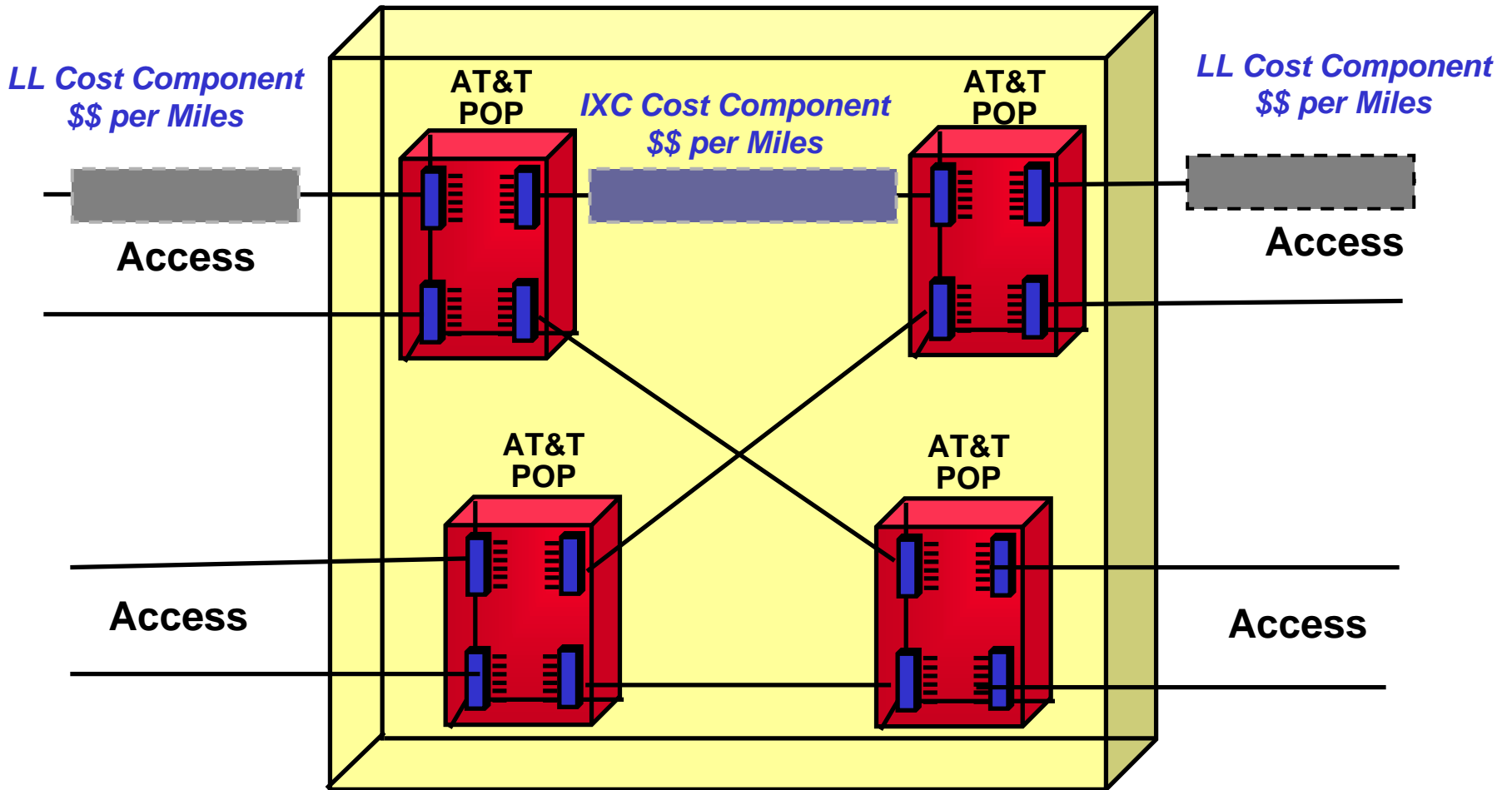not ONLINE

89 million
ONLINE

What are we doing on-line?

Category	Value
	3%
Sales	9%
	21%
Cust. Svc.	21%
	30%
E-Mail	51%

0%   20%   40%   60%
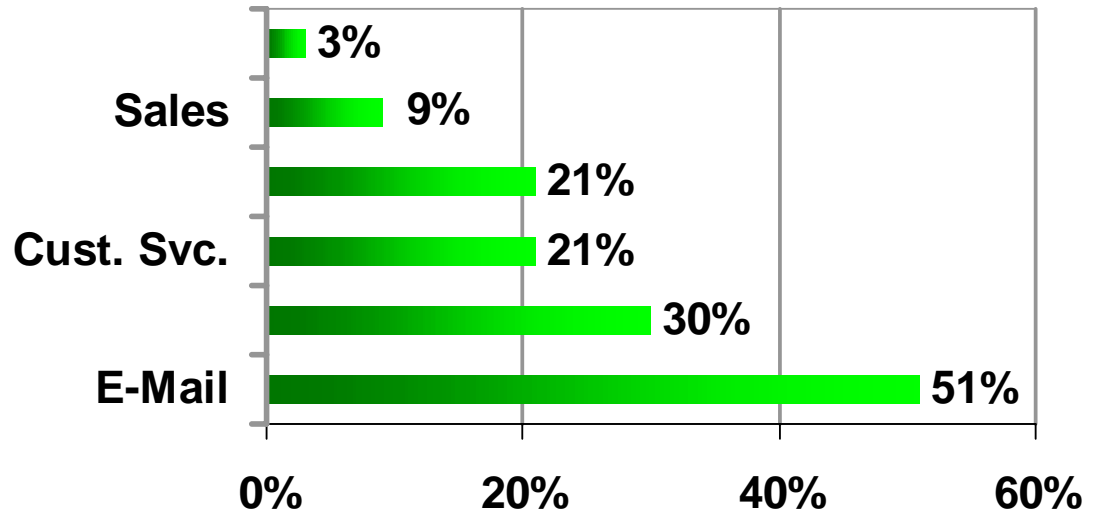
Private Line Network
Pay for _miles_ 24X7 and the maximum bandwidth is always there.
Point to Point and Multi-Point can expensive

**LL Cost Component
$$ per Miles**

**AT&T
POP**

**IXC Cost Component
$$ per Miles**

**AT&T
POP**

**LL Cost Component
$$ per Miles**

Access

Access

**AT&T
POP**

**AT&T
POP**

Access

Access

AT&T Frame Relay Network

Pay for _CIR_, operate over 90% of the time at _port_ speed, and "meshing" sites is simplified!

LL Cost Component
$$ per Miles

Access

AT&T POP

PVC Cost Component
per _minimum_ bandwidth

AT&T POP
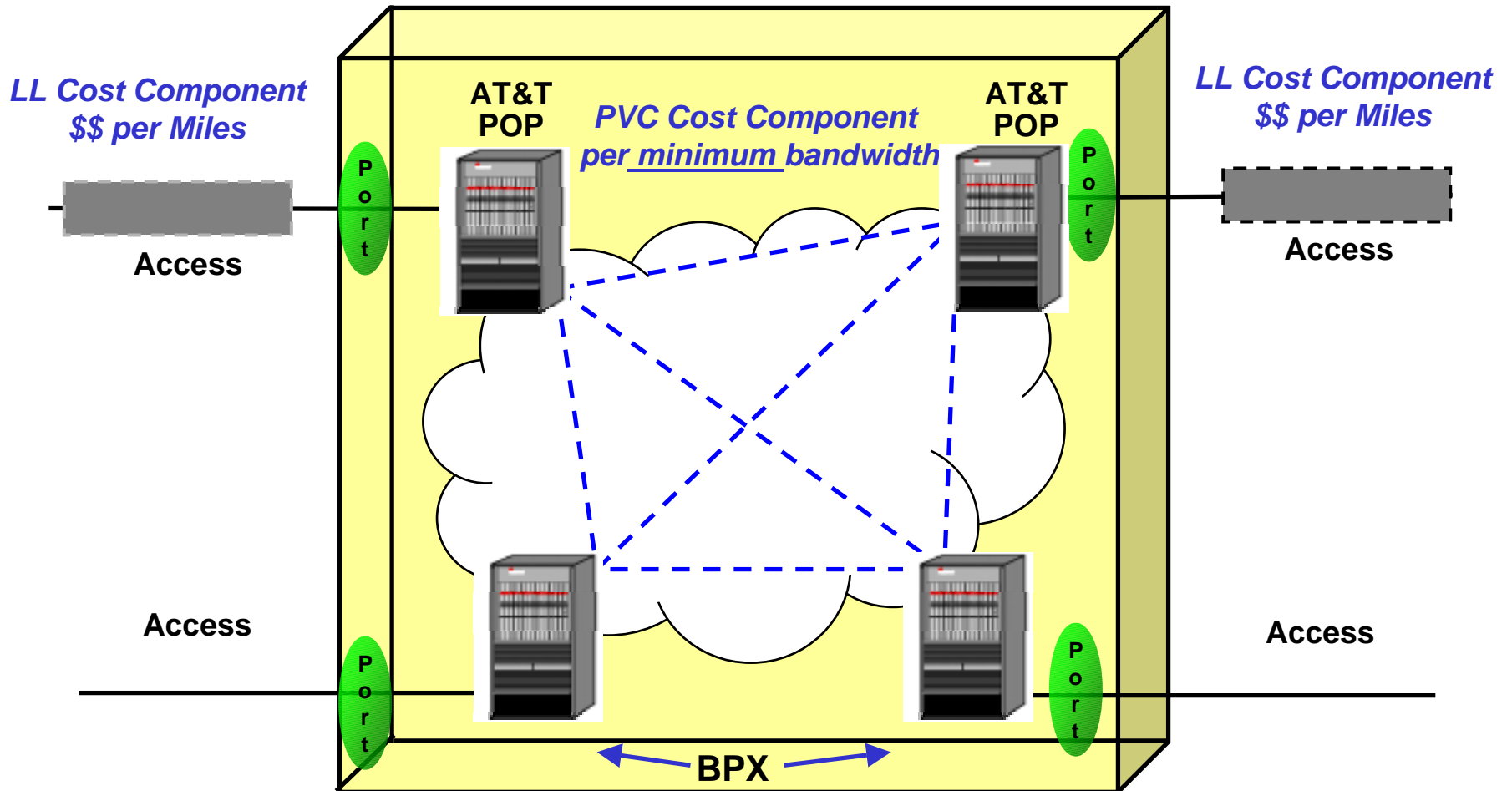
LL Cost Component
$$ per Miles

Access

Port

Access

Port

Access

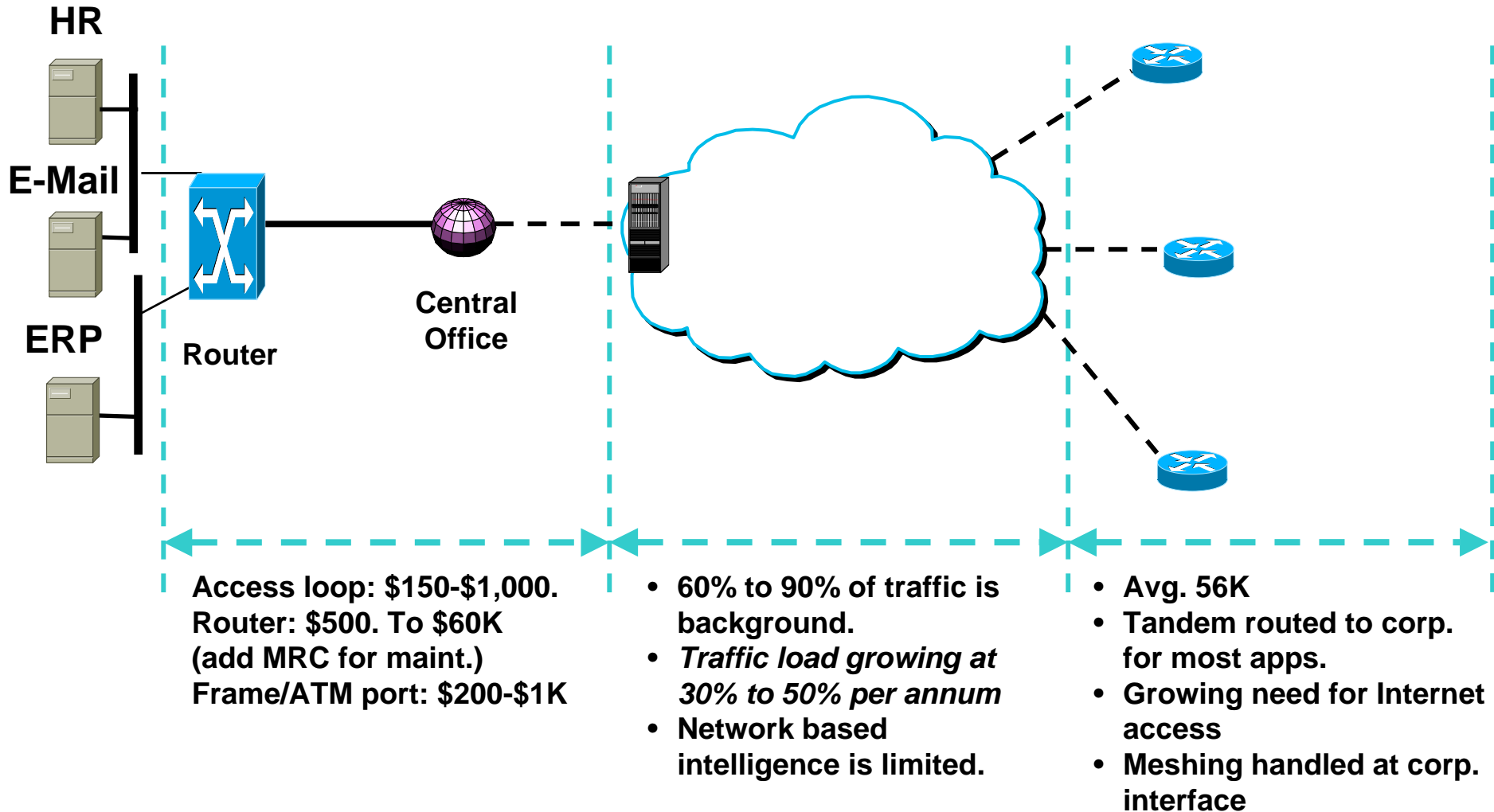**Port**

Port

BPX

No-one in Particulars Network
Pay $19.95 per month, want private line security and performance (or at least pretty close), want anyone regardless of how they get on the network to be able to communicate with me. That is…if I want them to…

Any old Internet Service Provider (ISP)
AT&T
MCI/Worldcom
Sprint
Qwest
RBOC
ETC…..

Building the network for the application and business need: *Realities of what the customer is dealing with today!*

HR

E-Mail

ERP

Router

Central Office

Access loop: $150-$1,000. Router: $500. To $60K (add MRC for maint.) Frame/ATM port: $200-$1K

- **60% to 90% of traffic is background.**
- ***Traffic load growing at 30% to 50% per annum***
- **Network based intelligence is limited.**

- **Avg. 56K**
- **Tandem routed to corp. for most apps.**
- **Growing need for Internet access**
- **Meshing handled at corp. interface**

Frame Relay / ATM VPNs Will Grow

Data traffic is increasing by an average of 30 percent to 50 percent per year for most enterprises.

Therefore, many enterprises are considering replacing their data networks (most of which are frame relay networks in the United States) with what they are told are lower-cost IP VPNs.

While most realize that the majority of current IP VPNs do not measure up to the quality of frame relay or ATM, they are willing to accept lower-quality technology if they can get a lower price.

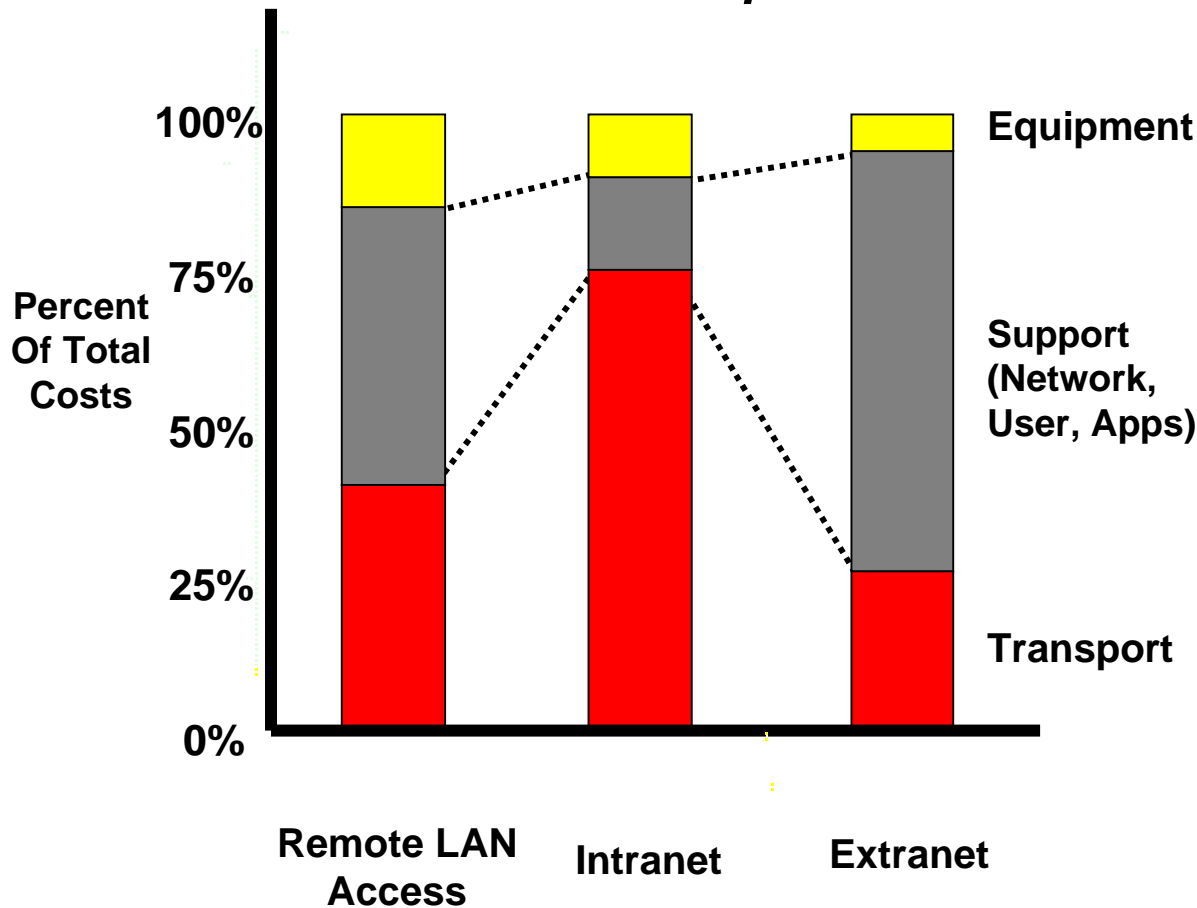*The truth, however, is that IP VPNs are not less expensive when total costs are considered.*

Gartner Group – Strategic Analysis Report
November 28, 2000

All VPNs are Not the Same

Cost Chain Comparison

Percent Of Total Costs

Equipment

Support (Network, User, Apps)

Transport

Remote LAN Access / Intranet / Extranet

Today, the monthly rates for connections are usually about the same between frame relay and IP VPNs; for the latter, however, administration costs are typically five times higher than those of frame relay.

An enterprise with as few as 25 sites on an IP VPN network will require at least one full-time employee to manage the network. By comparison, managing a 25-site frame relay network would take only 20 percent of one employees time.

Gartner Group – Strategic Analysis Report November 28, 2000

Private IP VPNs "The Best of Both Worlds"

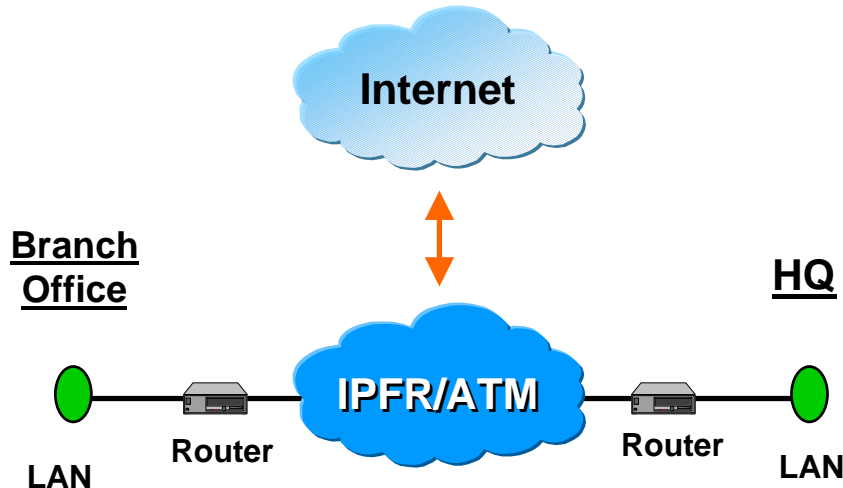|	Frame Relay	Internet-Based VPN	Private IP VPN
Any-to-Any Connectivity	Expensive, Difficult	Yes	Yes
QoS and CoS	Yes	No	Yes
Reliability	High	Med	High
Simple Routing	No	Yes	Yes
Disaster Recovery	Manual	Automatic	Automatic
Private IP Addresses	Yes	Tunneled	Yes
Latency/Throughput	Low/High	Variable	Low/High
Secure	Yes	Edge	Yes
Administrative/ Engineering Costs	Low	High	Low

Network Based / Edge Based VPN Comparison

Security

Private IP (IPFR/ATM VPN)

Network is private:
- **Not exposed to Internet - no premises firewall required**
- **Not exposed to other customers – separated using layer 2 physical/logical security**

Internet

IPFR/ATM

Branch Office

HQ

LAN — **Router** ——— **Router** — **LAN**

No encryption required since packets can't be viewed by other users
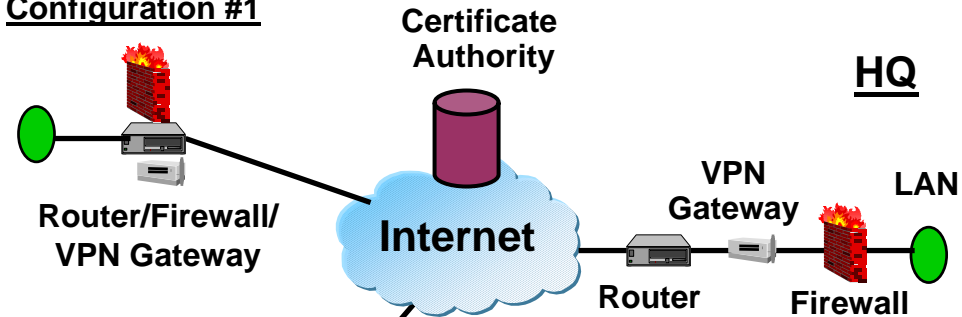
Public IP (Site to Site VPN)

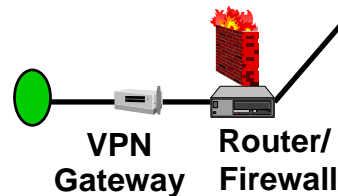**Stateful firewall required at remote site and HQ site**
- **Intrusion detection must be managed**
- **Whether or not firewall can be integrated with the router or VPN gateway functions depends on number of connections to be supported.**

Branch Office

Configuration #1

Certificate Authority

HQ

Router/Firewall/ VPN Gateway

Internet

VPN Gateway

LAN

Router

Firewall

Configuration #2

VPN Gateway

Router/ Firewall

VPN gateway for tunneling and encryption utilized at remote site and HQ.
- **Certificate authority or shared secret used for tunnel authentication.**

Network Based / Edge Based VPN Comparison

Ease of Use - CPE Administration

Private IP (IPFR/ATM VPN)

Network Routing Table
Customer VPN 100

Destination	Next Hop
A.B.C.D	DLCI #1
A.B.C.E	
	DLCI #1
A.B.C.F	DLCI #1
A.B.C.G	DLCI #1

Network Routing Table
Customer VPN 200

Destination	Next Hop
A.B.C.D	DLCI #1
A.B.C.E	
	DLCI #1
A.B.C.F	DLCI #1

IPFR/ATM

Router   **Router**

Adding a new site only requires router changes at that site
- **Same layer 2 DLCI as other sites**
- **Network automatically learns about new address via BGP and shows it available to other sites**

Public IP (Site to Site VPN)

Branch Office

Other Sites

VPN Gateway

Internet

LAN

1

N

LAN

Router/ Firewall

$$\text{Possible Connections} = N^2 / 2$$
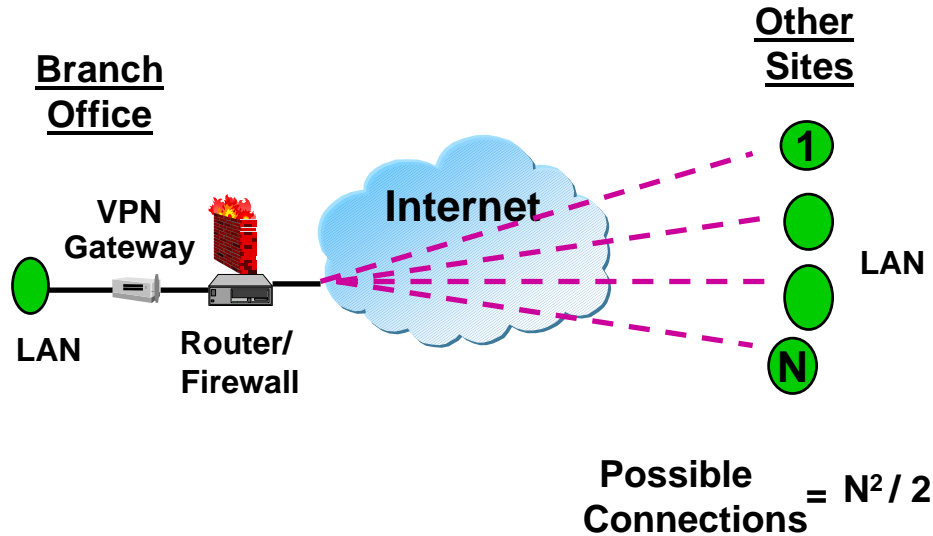
Adding a new site requires that all VPN gateways and firewalls be updated to recognize new site.
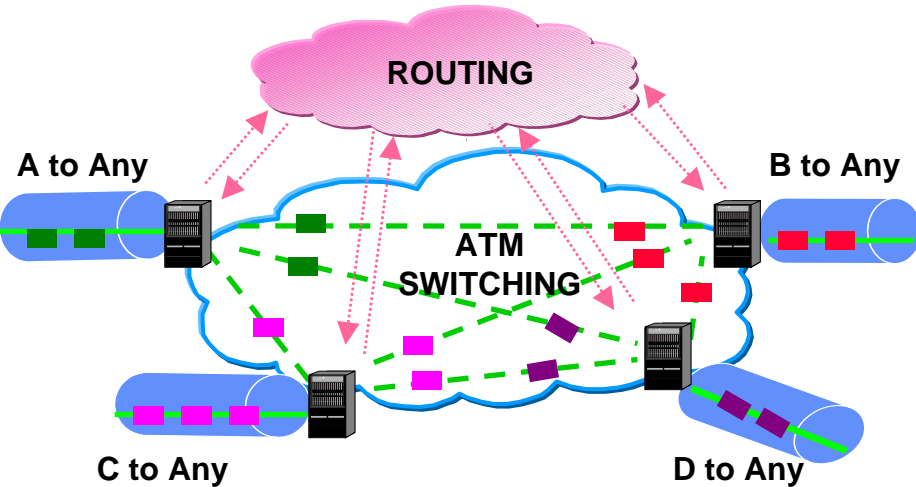- **New site must be configured to recognize all other possible connections (e.g. key pair combinations if using digital certificates).**

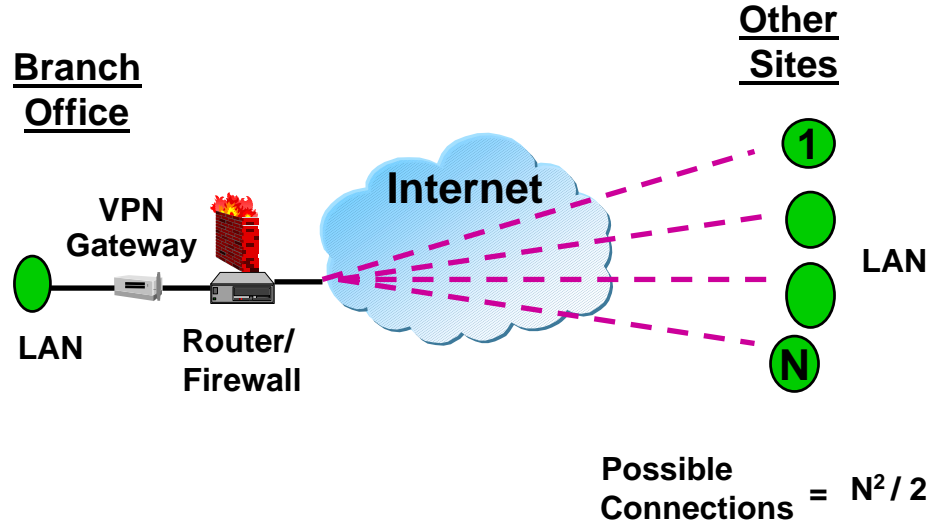# Network Based / Edge Based VPN Comparison

Connectivity

Private IP (IPFR/ATM VPN)

Any-to-any connectivity provided via single connection into MPLS core
- Packets routed at edge of network and switched in core for optimal performance.

Public IP (Site to Site VPN)

Possible Connections $= N^2 / 2$

Any-to-any connectivity possible through configurations of proper key pair combinations in each VPN gateway
- Configuration requires similar complexity in terms of defining possible connections as building full mesh PVC network with frame relay

Network Based / Edge Based VPN Comparison

Performance

Private IP (IPFR/ATM VPN)

Throughput
- **MPLS core allows for provider guaranteed network performance**
- **CIR guarantees desired level of throughput for each connection. 0K CIR is equivalent to site to site VPN performance.**
- **No overhead from tunneling and encryption**

Branch Office   **HQ**

LAN — Router — **IPFR/ATM** — Router — LAN

Latency & Jitter
- **Latency almost same as frame relay / ATM and guaranteed for each connection**
- **Network based CoS available 3Q01**

Public IP (Site to Site VPN)

Throughput
- **Performance not guaranteed**
- **IP header tax from tunneling and encryption (15% to 25%)**

Branch Office   **HQ**

VPN Gateway   VPN Gateway

LAN — VPN Gateway — Router/Firewall — **Internet** — Router — Firewall — LAN

Latency & Jitter
- **Latency is a function of congestion and NAPs**
- **No network based CoS**
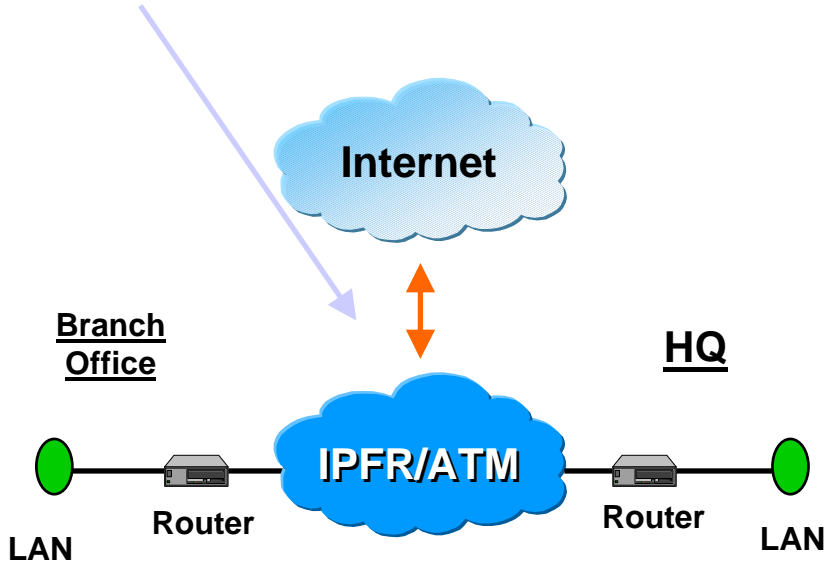 - **Premises router queuing only**

Network Based / Edge Based VPN Comparison

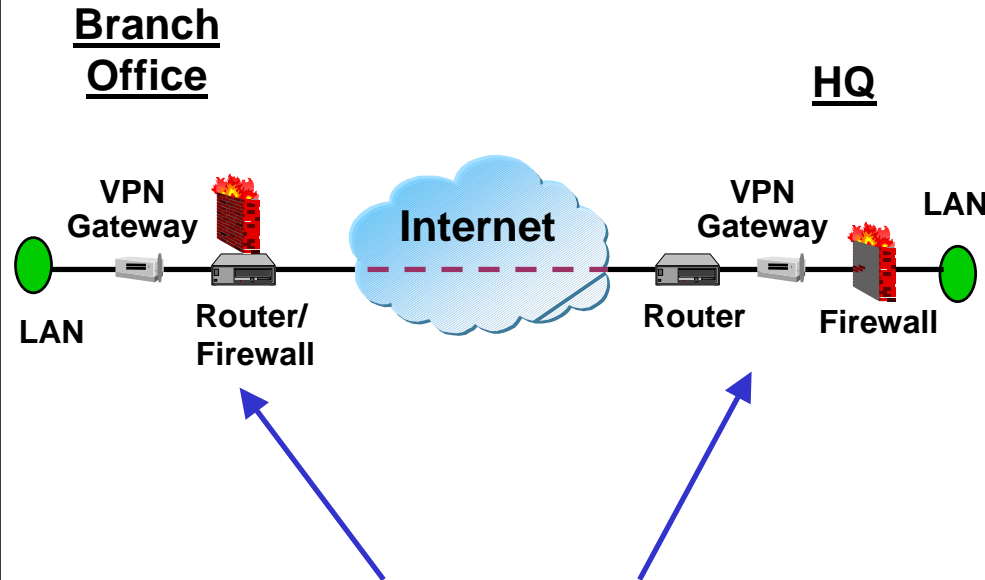## *Reliability*

Private IP (IPFR/ATM VPN)

Network is private so not exposed to security attacks from the Internet, which can degrade performance or cause a site to fail

Public IP (Site to Site VPN)

External factors are a reliability variable
- **Sites exposed to security attacks from the Internet.**

Branch Office

Internet

HQ

Branch Office

LAN

Router

IPFR/ATM

Router

LAN

VPN Gateway

LAN

Router/ Firewall

Internet

Router

VPN Gateway

LAN

HQ

Firewall

Extra boxes on premises create more points of failure and more complex troubleshooting.
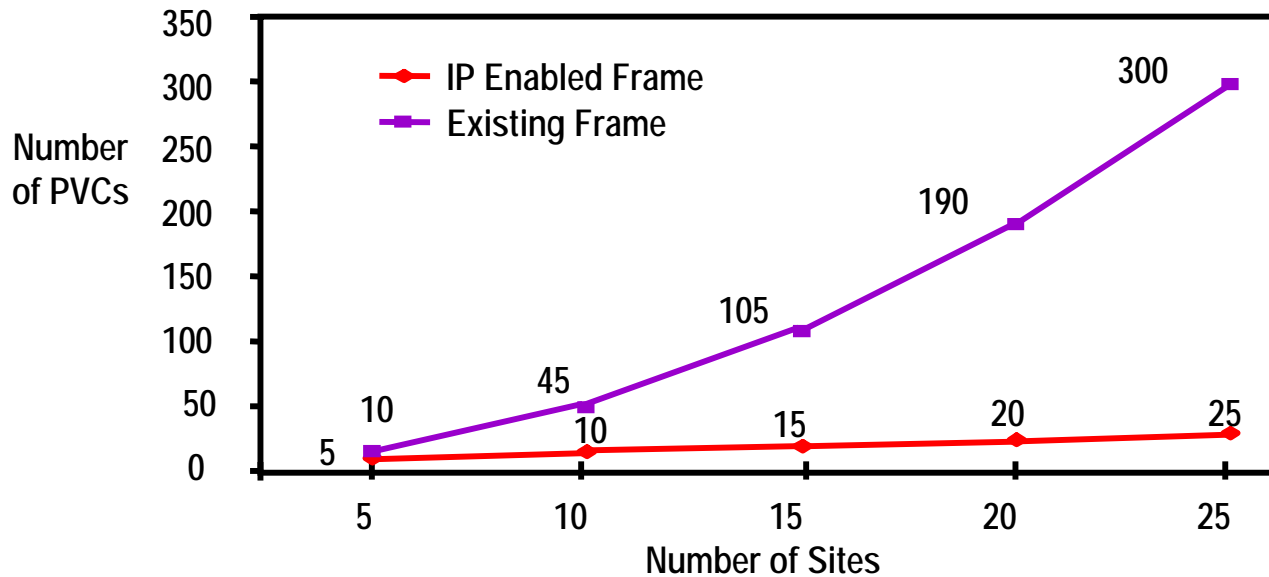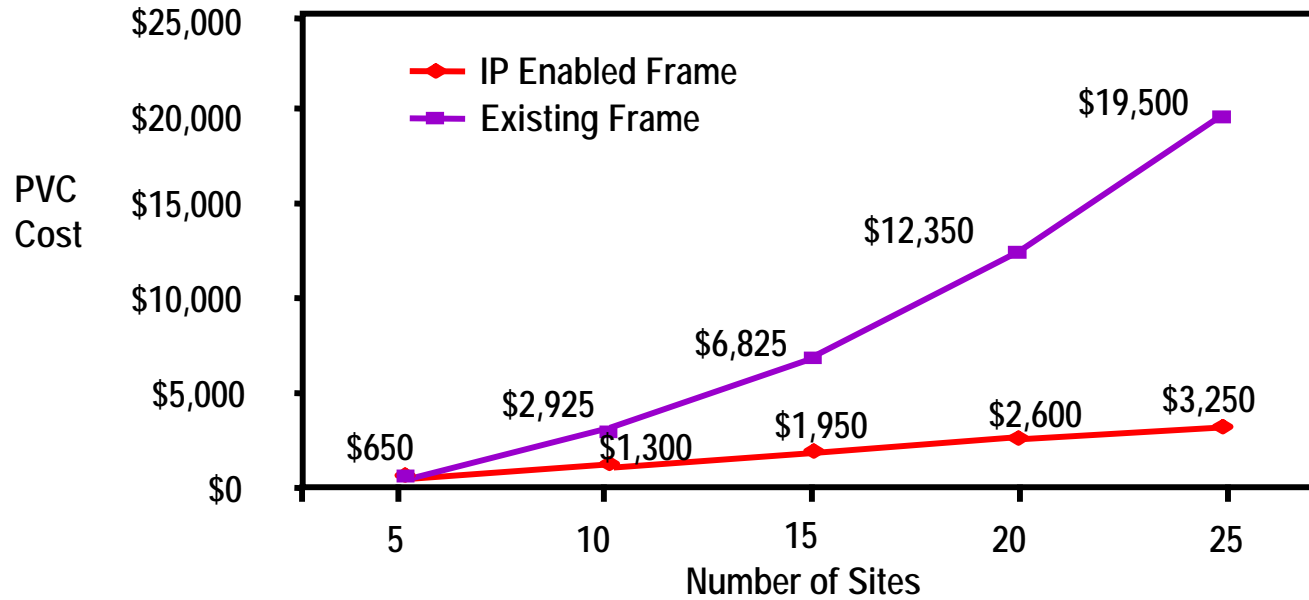
Building the network for the application and business need: Investments to protect and new users with fast pipes.

HR

E-Mail

ERP

Router

Central Office

- I need to protect this investment

- Need QoS
- Need Few to Many connectivity

- Smaller offices
- SOHO
- Traveling users
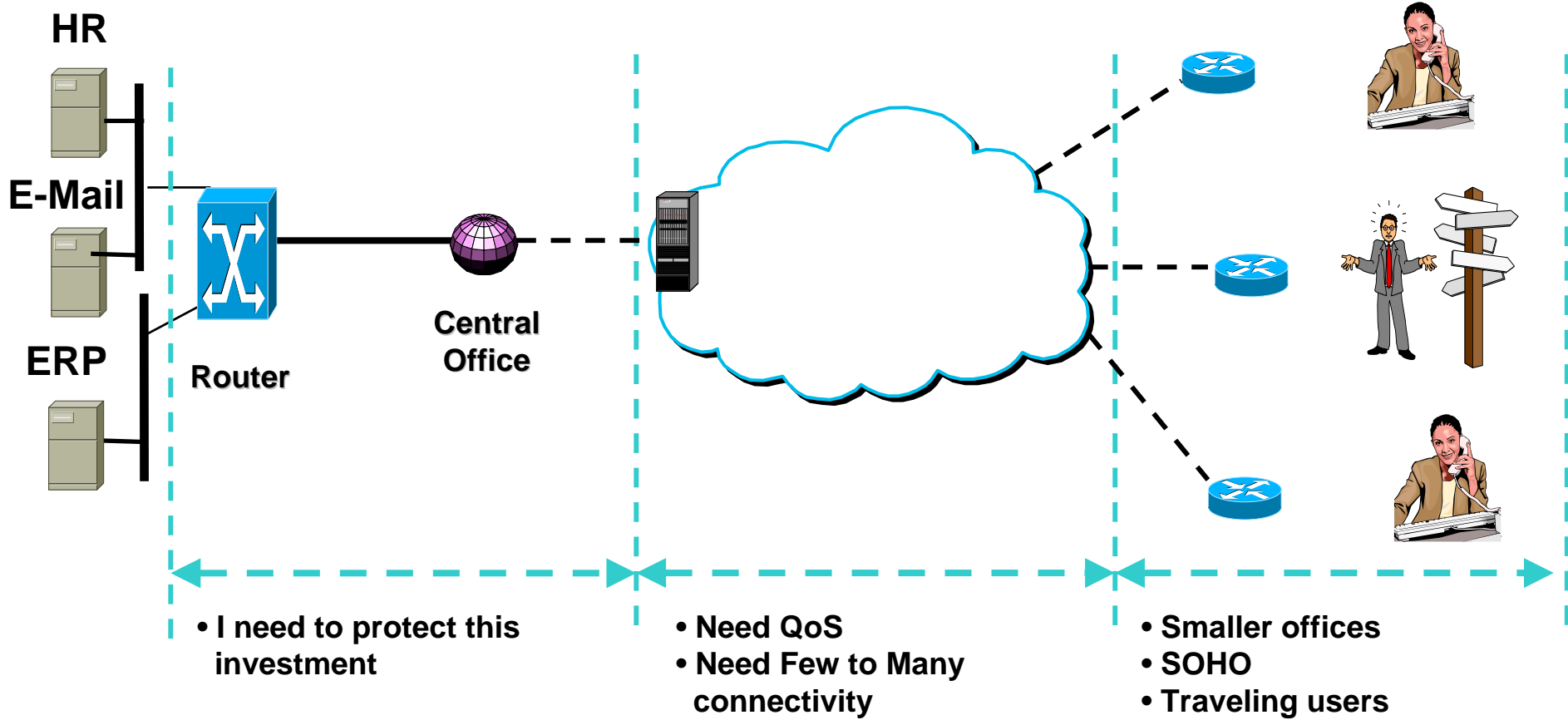
So how do we change the existing network to a VPN? Comparison for Any-to-Any Connectivity

Dynamic meshing, same CPE, same IP addresses, same Port...IP Enabled Frame Relay

Flexibility
• **Less complex, any to any connectivity via single PVC**

ROUTING

Savings
• **Fully meshed 25 port network <1/3 the cost of traditional frame relay!**

B to ANY

B

ATM SWITCHING

A to ANY

Main Site A

C to ANY

C

"Built In" Disaster Recovery

D
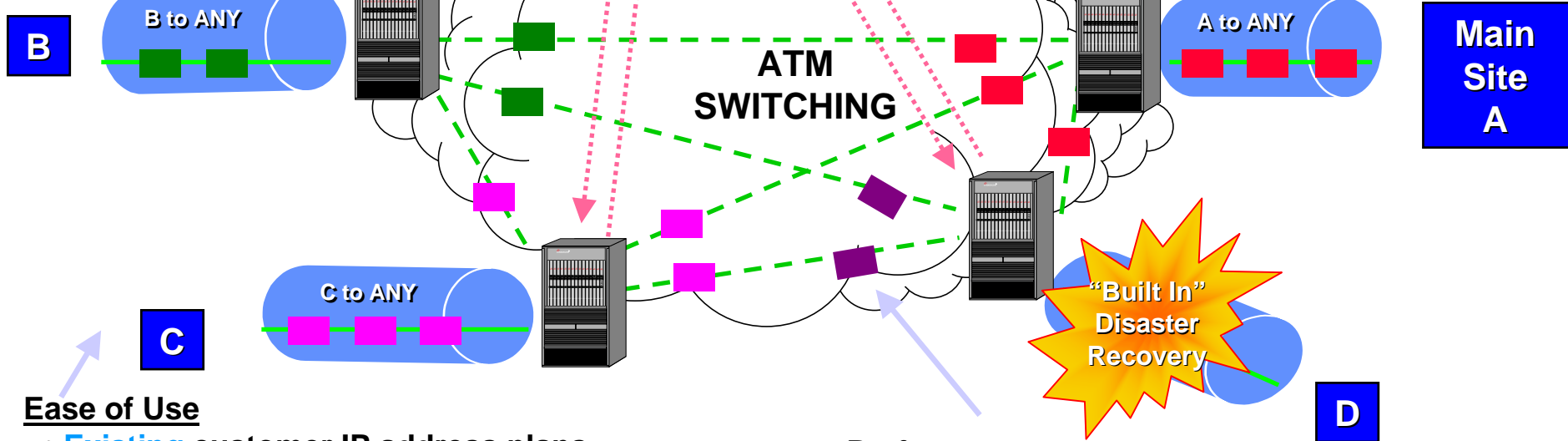
Ease of Use
  • **Existing customer IP address plans supported so no changes needed**
  • **Simpler router configuration because all PVCs to same network address (DLCI) rather than multiple**

Performance
  • **Same throughput and latency characteristics as traditional frame relay**

Security
  • **Same as traditional frame relay**

IP VPNS…ubiquitous mesh but what about end to end QoS? Next steps: IPFR QoS and MPLS serving the application need

Application or CPE marks packets for QoS Type of Service Byte

High: VOIP?

Mission Critical and Standard: Data?

Best Effort: Internet?

Queuing essential to assure end to end performance

MPLS Enabled Network

Provider Edge classifies traffic at ingress

Provider Edge prioritize Traffic at Egress
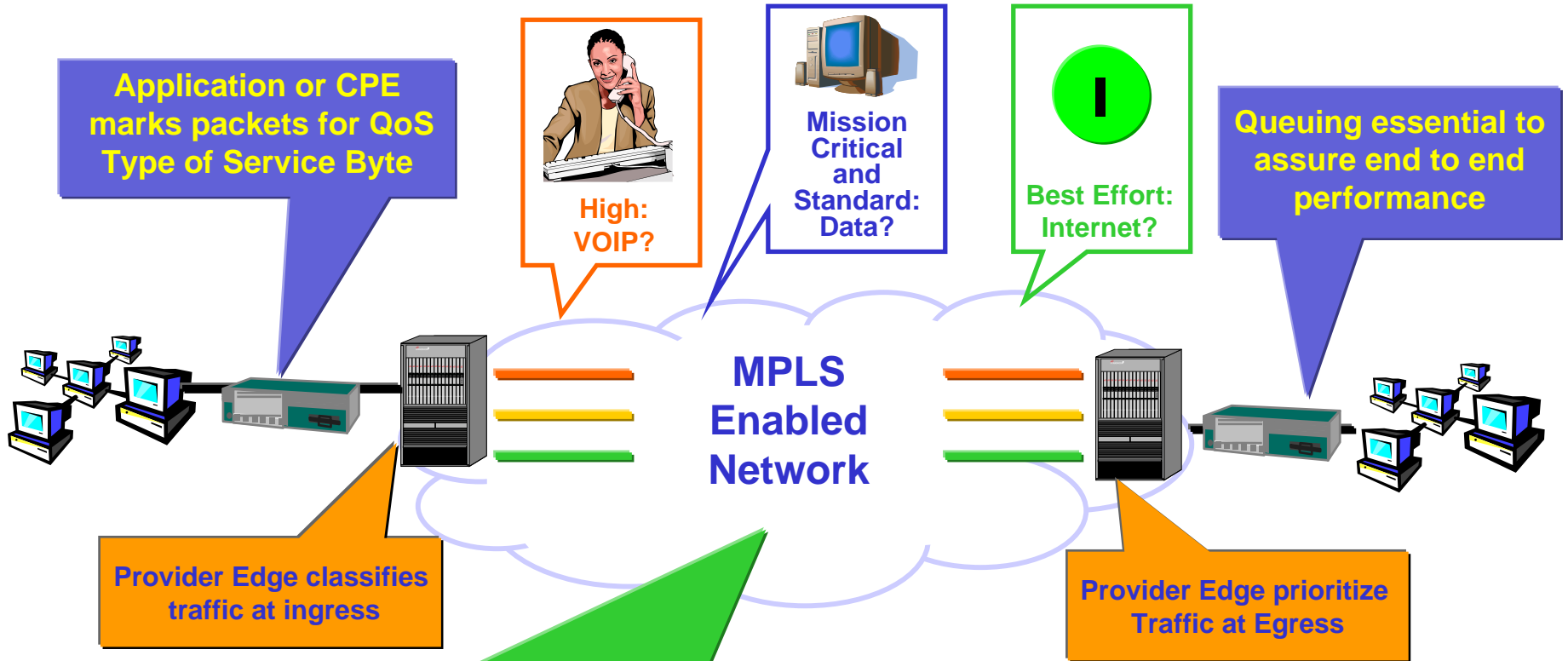
**MPLS Enabled Backbone maps Type of Service /DiffServ markings to MPLS Label
MPLS DiffServ Aware Label Switch Path incorporates QoS requirements
And applies QoS mechanisms to deliver End-to-End QoS**

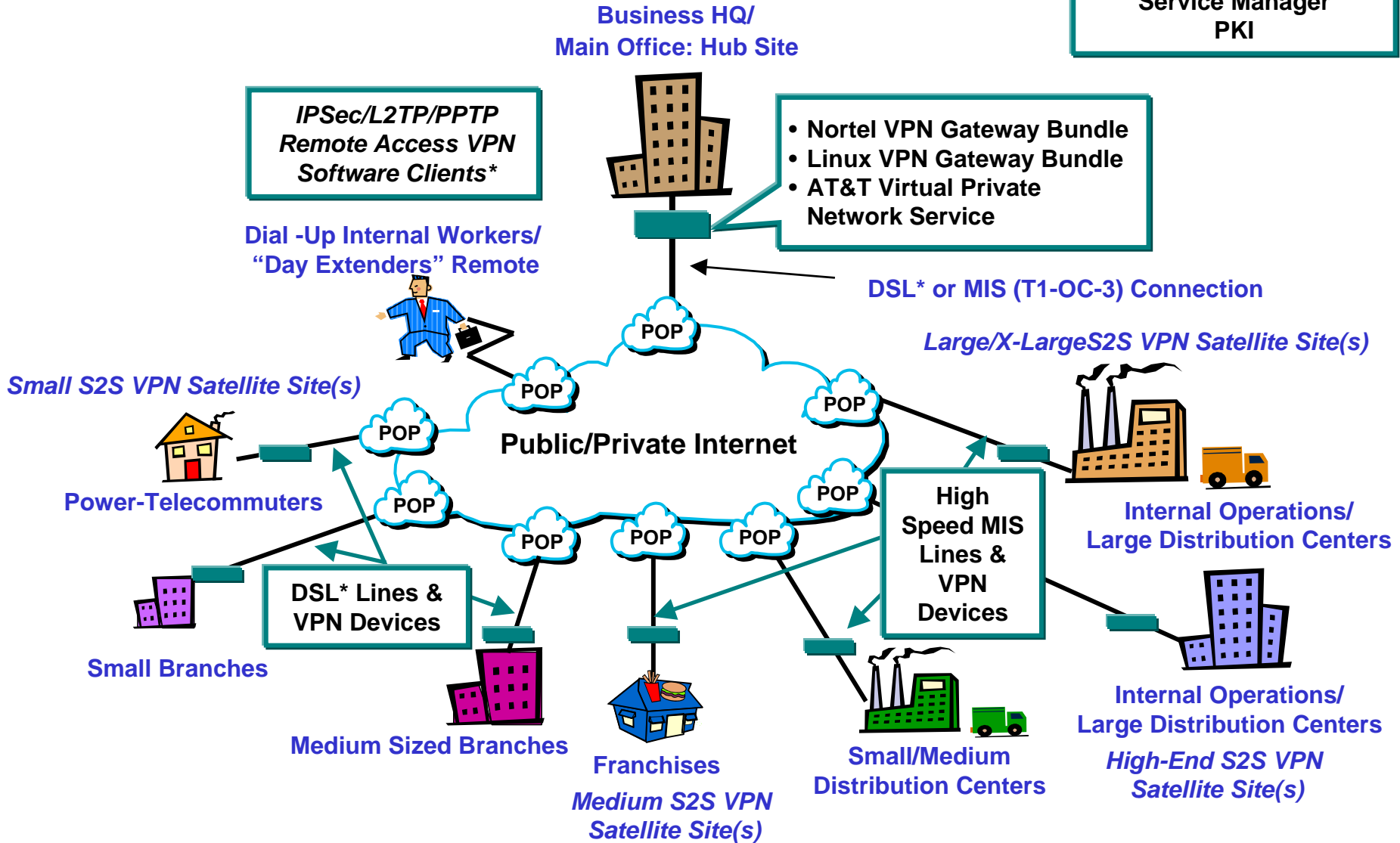# The entire network can be "VPN" or "IP." Are you prepared for the complexity?

AT&T

Authentication Options
Radius
SecureID
Safeword
Service Manager
PKI

Business HQ/ Main Office: Hub Site

*IPSec/L2TP/PPTP Remote Access VPN Software Clients**

- **Nortel VPN Gateway Bundle**
- **Linux VPN Gateway Bundle**
- **AT&T Virtual Private Network Service**

Dial -Up Internal Workers/ "Day Extenders" Remote

DSL* or MIS (T1-OC-3) Connection

POP

Large/X-LargeS2S VPN Satellite Site(s)

Small S2S VPN Satellite Site(s)

POP

POP

POP

Public/Private Internet

POP

POP

Power-Telecommuters

POP

POP

POP

High Speed MIS Lines & VPN Devices

Internal Operations/ Large Distribution Centers

DSL* Lines & VPN Devices

Small Branches

Medium Sized Branches

Franchises

Medium S2S VPN Satellite Site(s)

Small/Medium Distribution Centers

Internal Operations/ Large Distribution Centers

High-End S2S VPN Satellite Site(s)

In summary…………..

IP is a wonderful, unifying language but, as a transport mechanism, it does not answer many of the needs of the application. The low cost "ubiquity" of IP Internet access can potentially lower network costs "if" it fits the needs of the application and the expertise of the staff.

Layer 2 communications can protect your existing investments, feature enhanced IP functionality, and can reduce your network costs. IP VPN connectivity can be added to the existing platform.

Each and every aspect of the business needs analysis to determine the appropriate policy, performance, and security to ensure that the best possible "Virtual Leases Line" is used.

Thank you for your time!