Tendências em Redes Metropolitanas

Foco : Ethernet/Acesso

Renier Edward Souza
SE Manager – South America

Setembro/2003

Agenda

- Introduction
- Metro Evolution
  - Ethernet Services over SONET Model
  - Ethernet Services, Ethernet Transport Model
- Metro Solutions and Services
  - How it works
  - Topologies
  - Vlan Translation
  - Point to Point Connection
- Case Studies
- Conclusions

Market Innovation

	1990	1997	2003
Innovation	Complexity **CPU-based multiprotocol routers**	Simplicity **ASIC-based Layer 3 switching**	Flexibility **Seamless access infrastructure and programmable core**
Context	**Large number of LAN technologies** (e.g., FDDI, Ethernet, token ring, IPX…)	**Ethernet and IP win the protocol battle**	**Convergence: new devices and applications** (e.g., wireless, SANs, VoIP…)

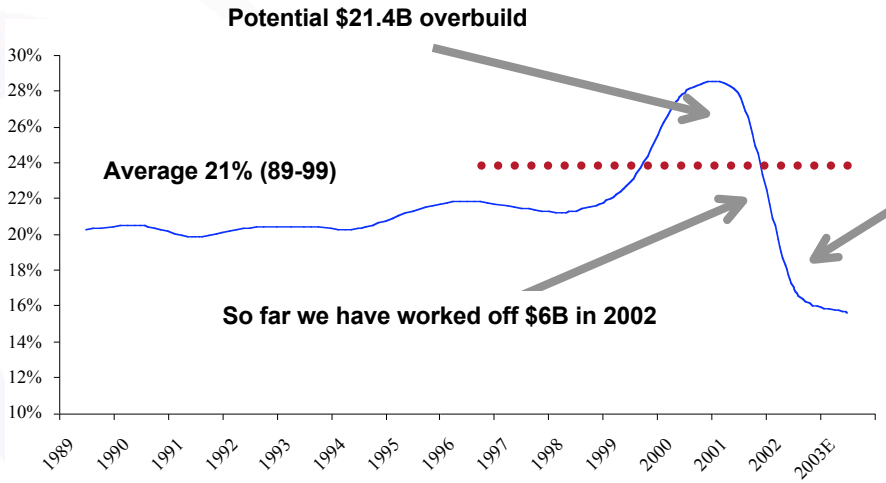
Necessidade de Banda

Versus

Disponibilidade de Investimentos

Global Capital Expenditure Outlook for Carriers

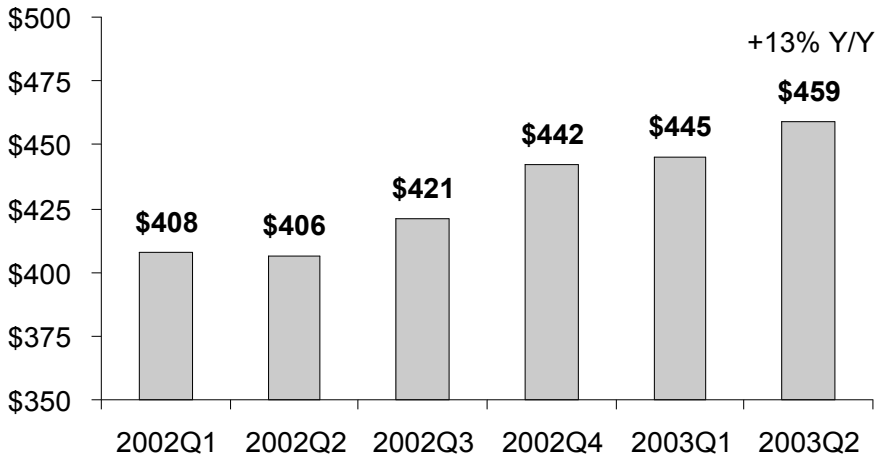
North American RBOCs (~18-20% of wireline capex)



- At Capex down 9% in 2003, $7B in overbuild remaining. AND. . . . .
- Flat 2004 Capex and we finally finish off the overbuild by year end 2004.
- Could mean no growth until 2005

- Expect US RBOC revenue to decline by 2% in 2003 and flat in 2004.
- Worldwide declines will be similar. Driven mainly by price competition.
- Should see some International activity.
- Residential Broadband the brightest spot, new subs growing at 25-30% per year.

AT&T IP Services Revenue

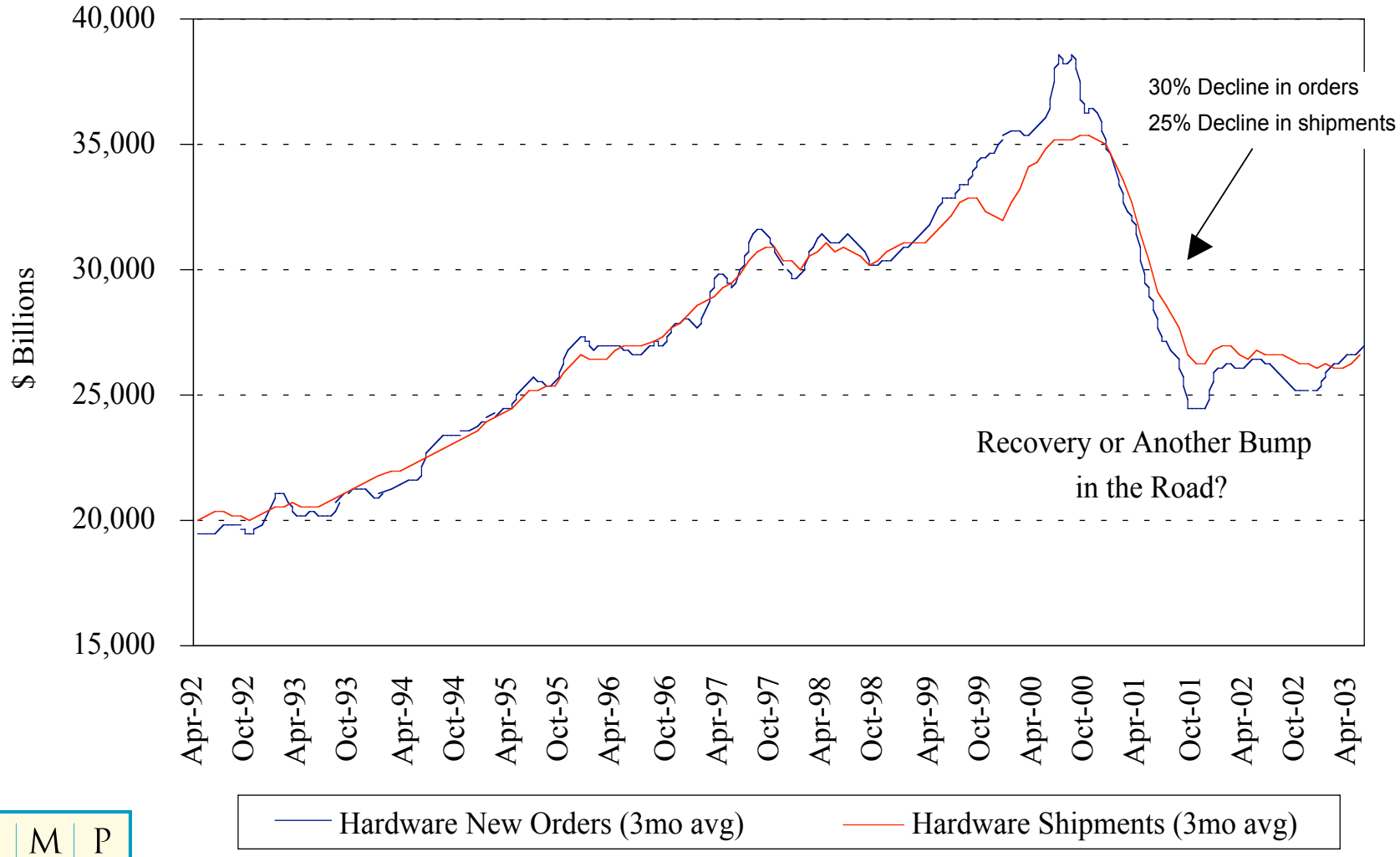


Global Capex down 10-15% in 2003 and Flattish in 2004

Source: JMP Securities, US Census Bureau

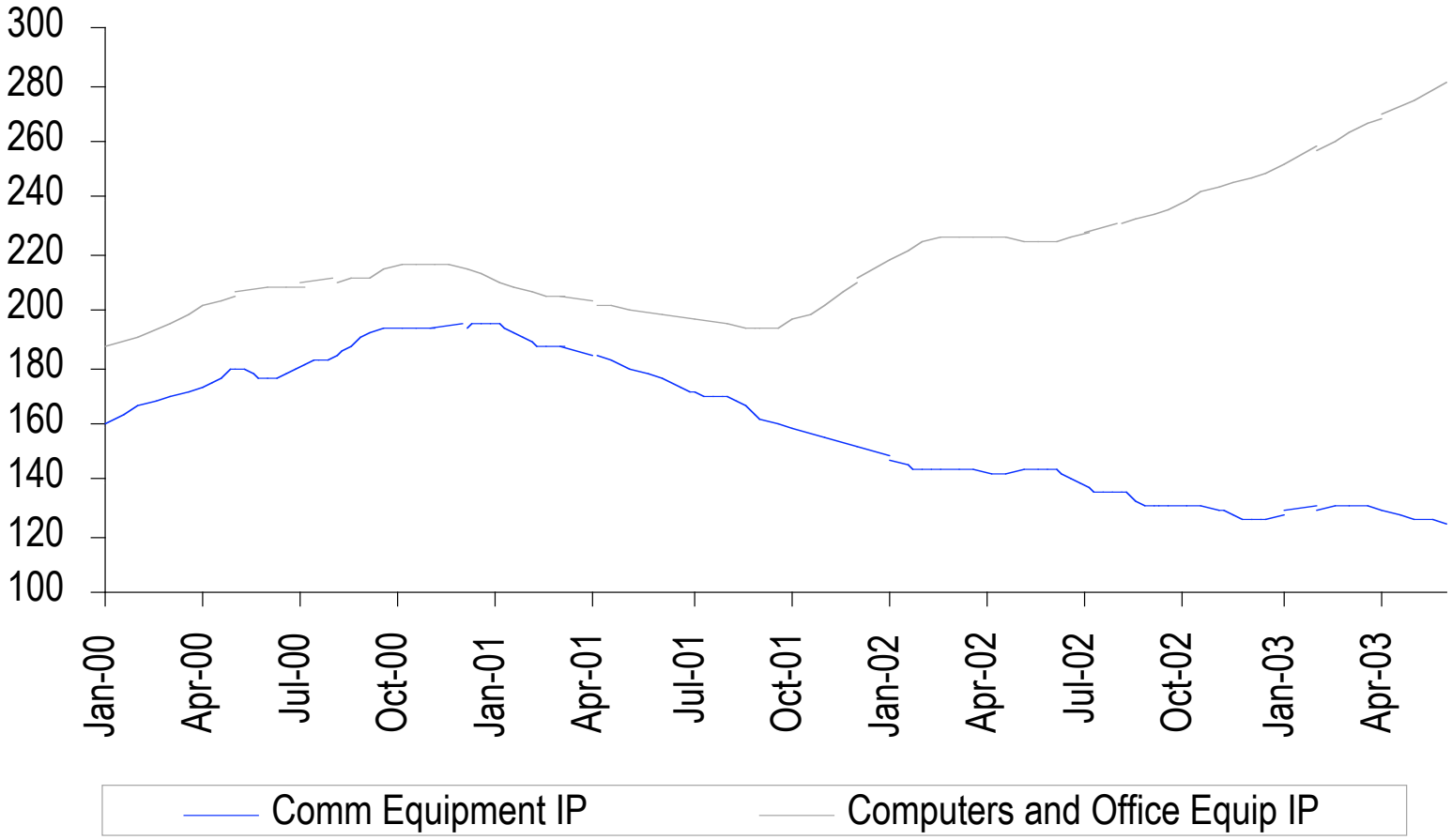
Source: Factset, First Call, JMP Securities

Trends in US Technology Hardware



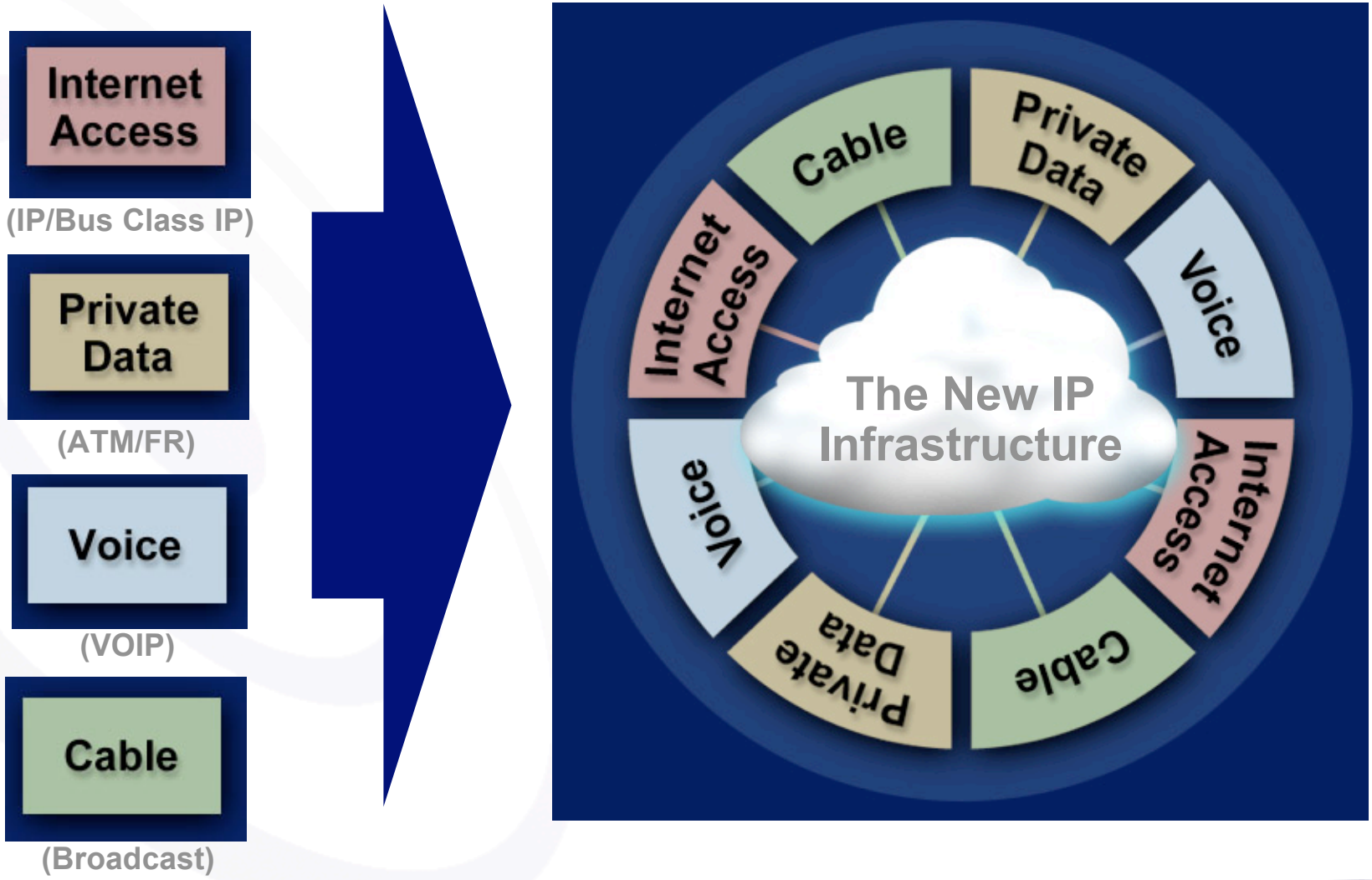
Source: JMP Securities, US Census Bureau

Trends Inside Hardware: Computers vs. Communications



Source: JMP Securities, US Census Bureau

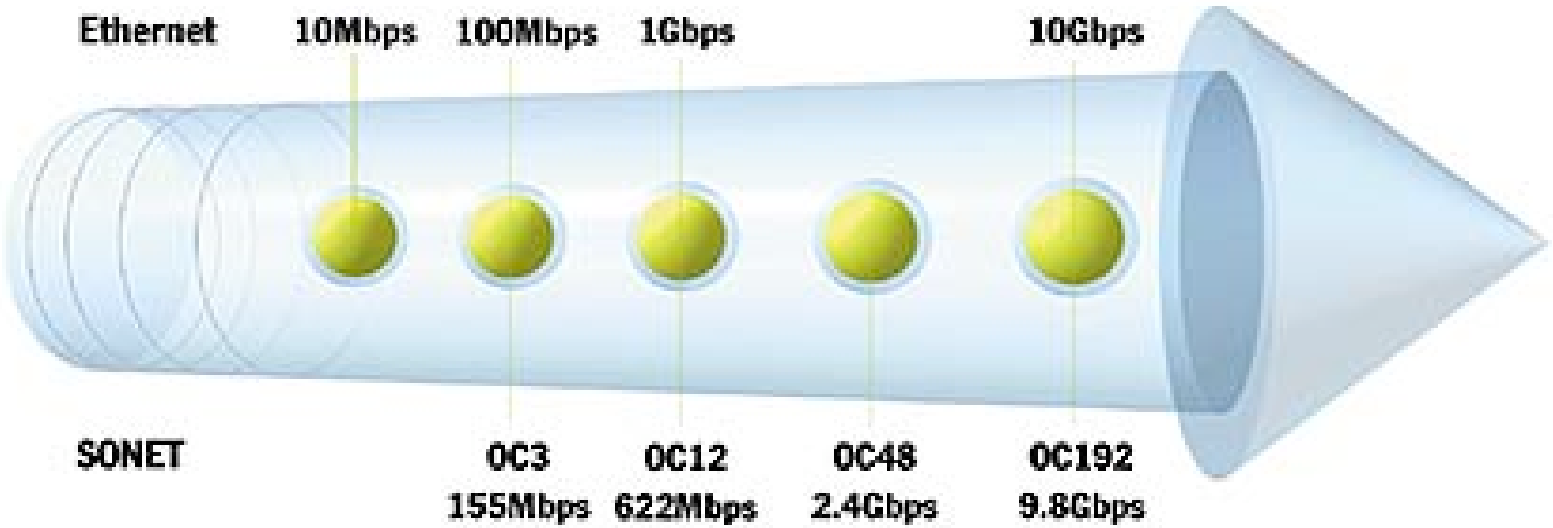
Network Issues & Trends



SDH/ATM x Ethernet
in Metro Networks

Talking about Simplicity ...

SONNET vs. Ethernet

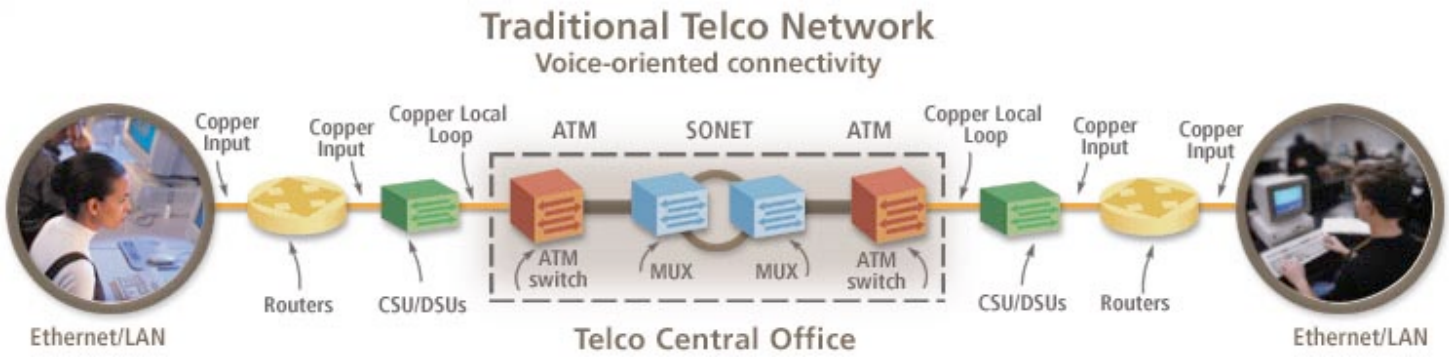


Ethernet Economic Advantage

	Equipment $/Mbps	BW mgmt & Provisioning	Annual Maint Upgrades	BW on Demand
IP/ATM/SONET	$8-40k	$5k	$750-$3750	Hard
IP/SONET	$6-35k	$5k	$750-$3750	Hard
IP/Ethernet	$1-3k	$1k	$150-450	Easy
GigE Advantage	8:1 - 13:1	5:1	5:1 – 8:1	Easy

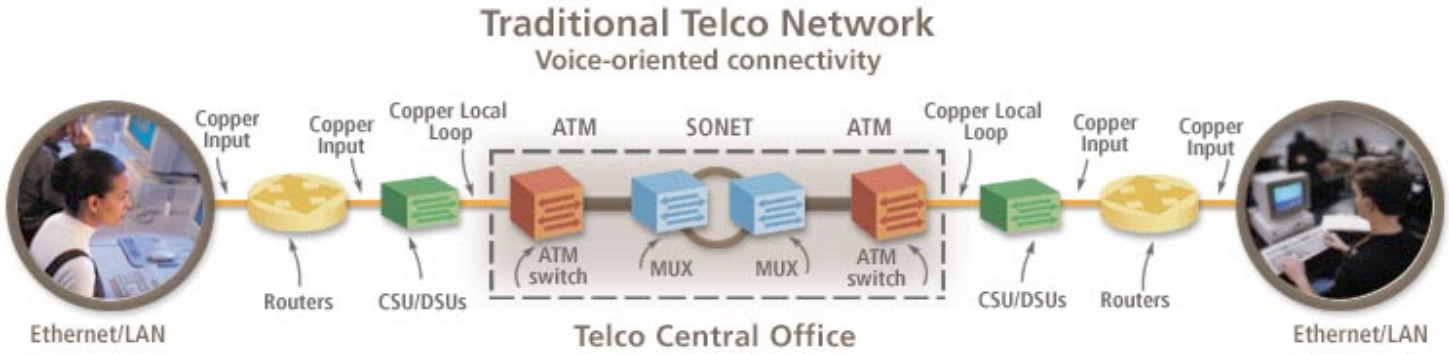
Source: Yipes, Dell 'Oro, Yankee Group, Extreme Networks, Juniper Networks
Assumes a regional network with five hubs and 10 rings

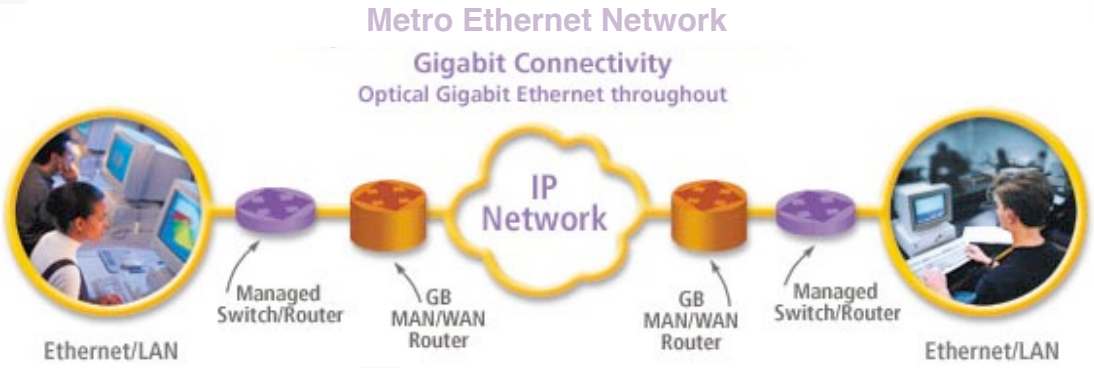
SDH/ATM Big Networks for Data – Regional Optical Networks



Public Ethernet Networks

Designed for data services





Ethernet Services Marketing
Metro Market Evolution

Trends in Metro Ethernet Networks

Early ’90s

Late ’90s

Mid ’00s

Metro Area Networks
= Leased Line Services
over SONET/SDH

Advent of Ethernet
Metro Networks

Ethernet Services provided
over Advanced Ethernet
- Asia, Japan, Europe

Ethernet Services provided
over SONET
- North America

The Metro has Evolved

- Market has split into two spaces
  - Ethernet over SONET (EoS)
    - US/EMEA/Australia - ILECs/PTTs, IXCs
    - Using Ethernet to market excess capacity of SONET networks
    - Layer 3 Services are primary offering
    - Attempt to extend life of recently upgraded infrastructure
  - Ethernet over Ethernet
    - Japan/Asia/Northern Europe – CLECs as well as incumbents
    - Layer 2/3 access providers First and second-tier ISPs
    - Municipal carriers, utilities, schools, government – Private MANs
      - Extending LANs with Ethernet campus and metro network extensions
      - Trying to solve similar issues as service providers - but at lower cost points, using familiar technology
- Understanding this evolution and our position will keep us viable and a leader in the market

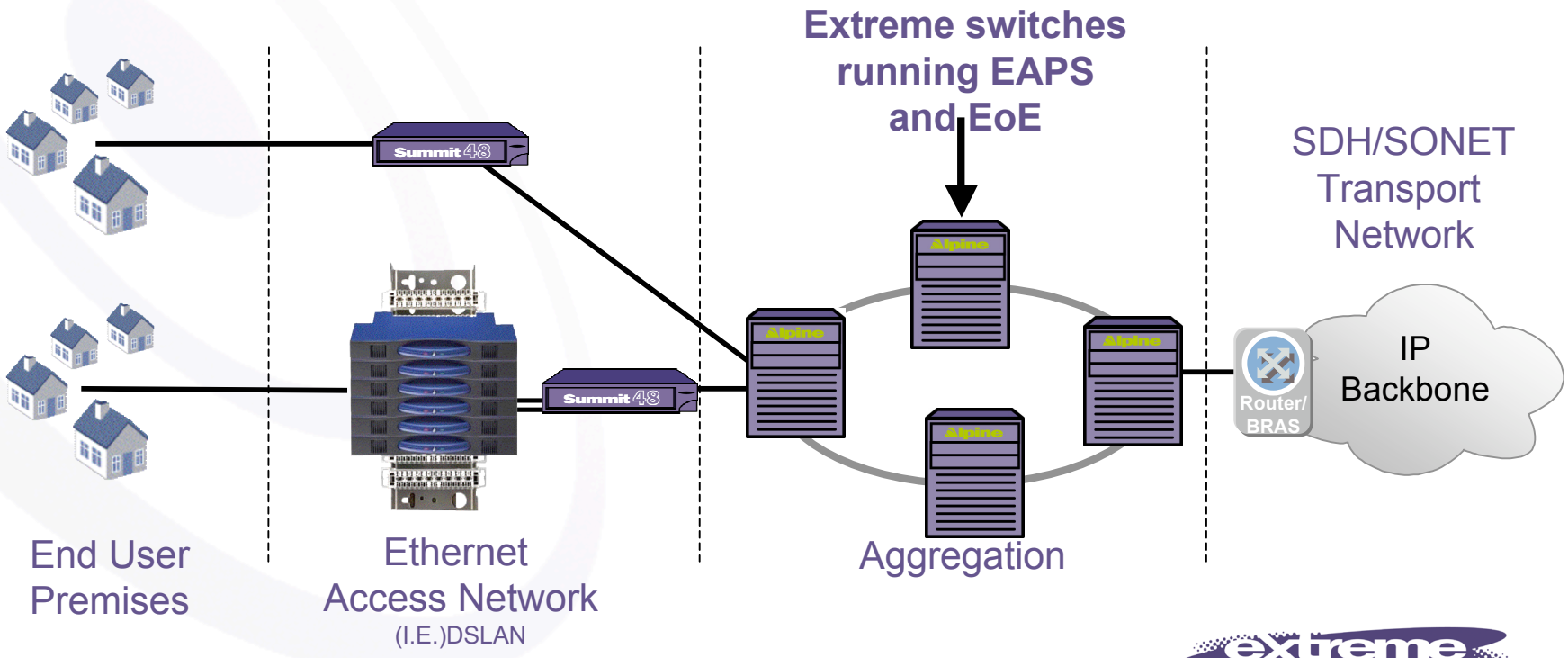
Ethernet over SONET

- Ethernet services over legacy transport is not really Ethernet at all
  - Providers lose the cost and simplicity advantages
  - Subscribers have to deal with inefficient encapsulation and slow protocol translations
  - Ethernet over SONET/SDH – mismatched planes, bandwidth increments – a 10 MB service requires a T3/E3 transport !
  - Providers using the Ethernet “brand” to attract new business
- Ethernet services over SONET is like building a motorcycle out of a car

≠

Success in the EoS model

- Provide integration, testing and knowledge to offer total solution
- VoIP transport



The New Market

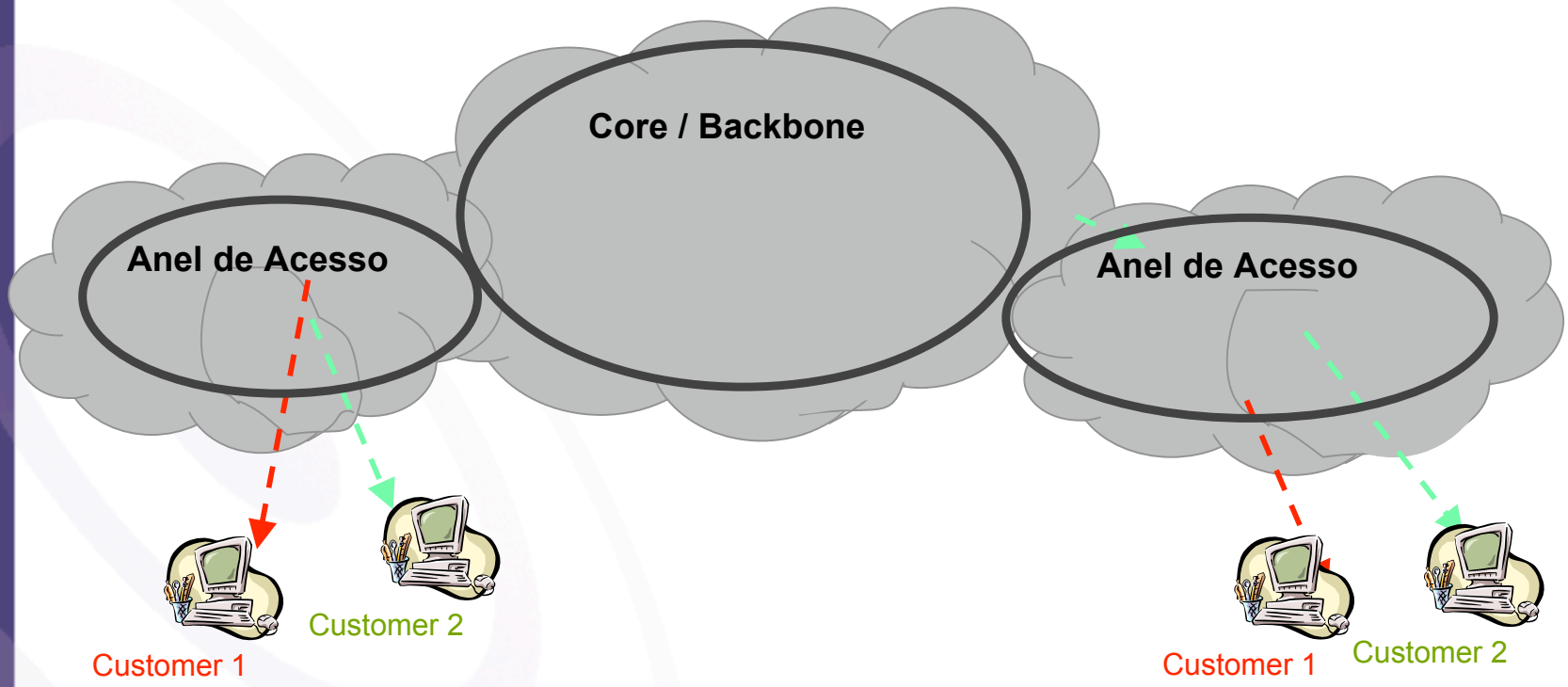
Ethernet over Ethernet

- First recognized in Japan, Asia and EMEA
  - Ethernet over Ethernet – services over transport
  - Metro architecture that does not necessarily travel around a single city
  - May span a campus, a town, a state or a country
  - May not require Layer 3
- Requires some of the features needed in the ILEC Metro
  - Resiliency, scalability, security – and typical Ethernet services
- Cost sensitive, Ethernet feature-oriented, dense port counts
- Customer base may include universities, city governments, school districts, first and second tier ISP, and high volume Layer 2 access providers

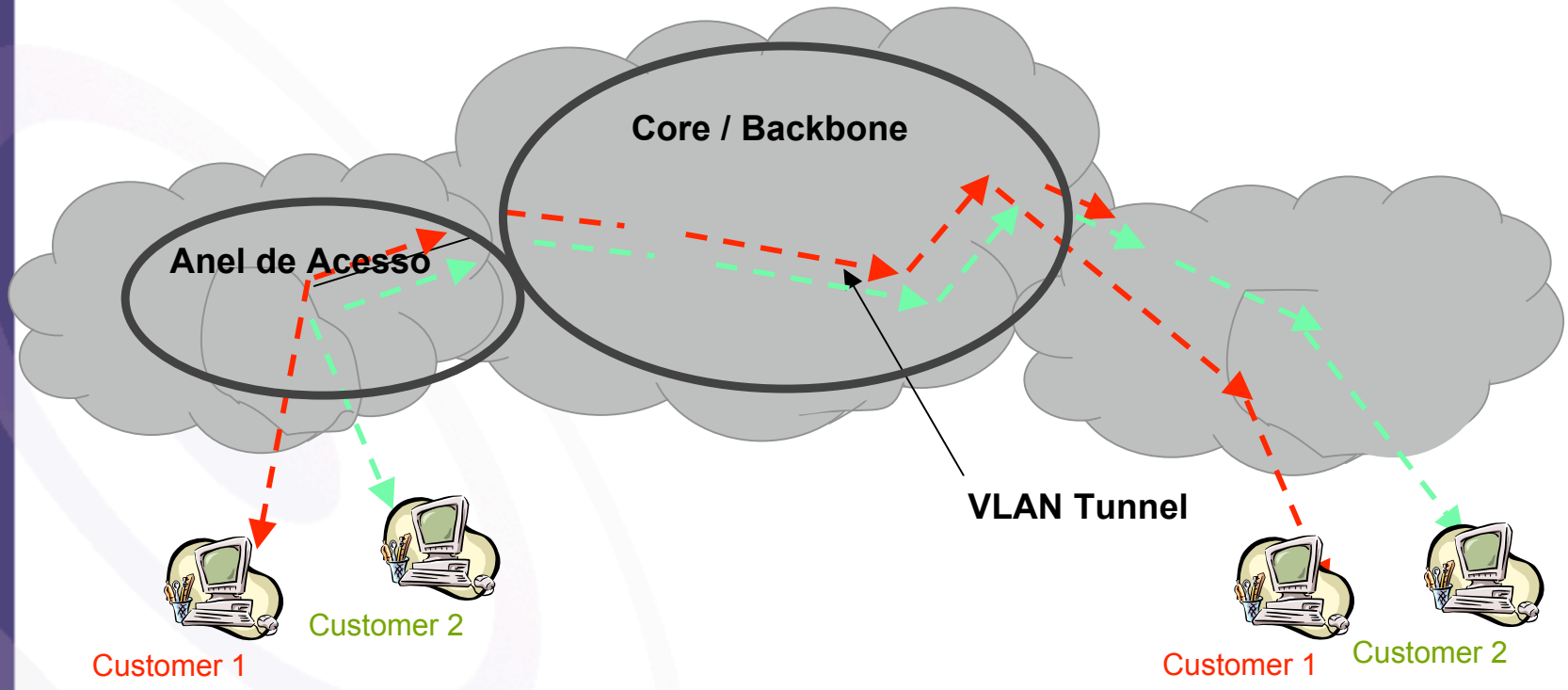
Metro solutions and Services

- Internet Access (L3 Access)
- Point to Point Connection

Terminologia



Point to Point connection



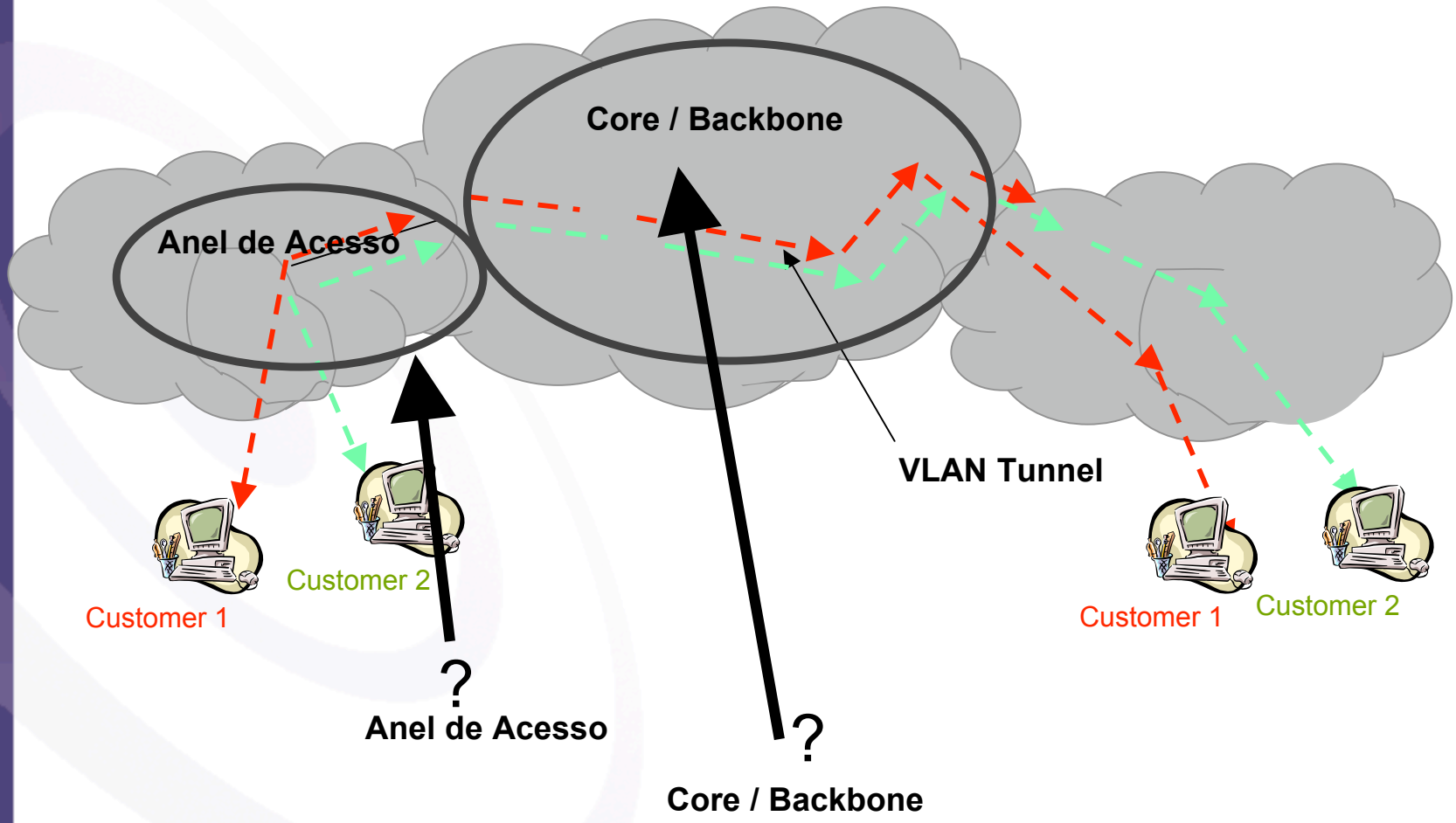
Solução : Manter o mais “simples” possível.

A tecnologia Ethernet teve de evoluir !

Necessidades Básicas :

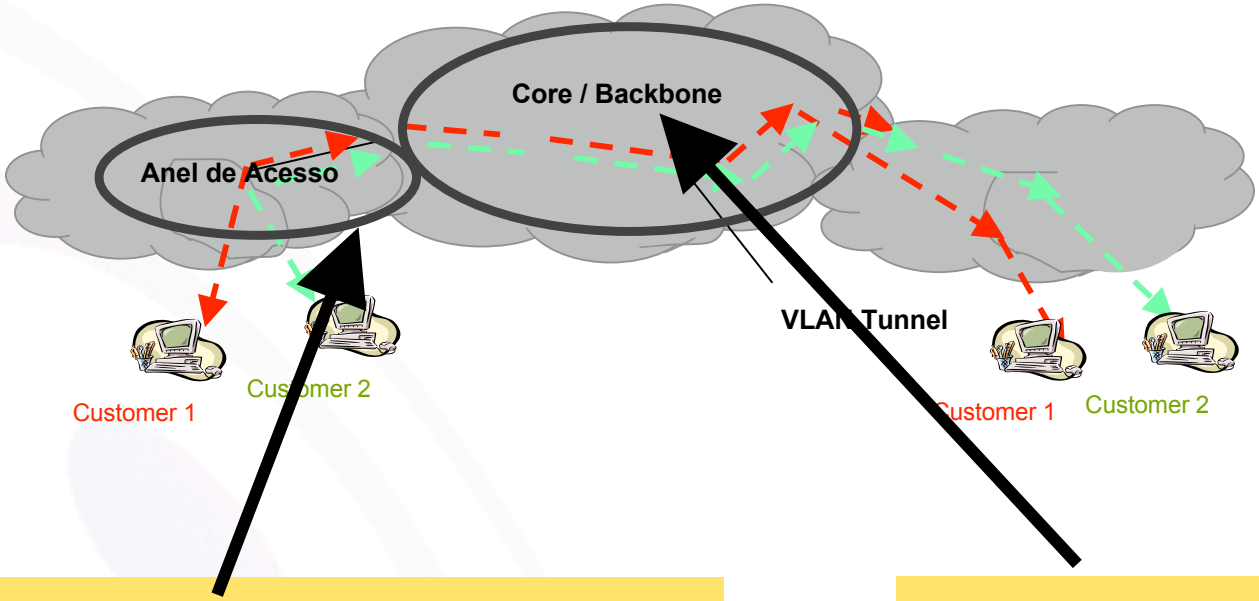
* Tunelamento (VPN, MPLS, etc)
* Failover (STP, EAPS, etc)
* Escalonamento

MPLS / VPLS : Onde ?



RESPOSTA : Simplicidade e Custo competitivo !!!!!!

Mantendo a Simplicidade...



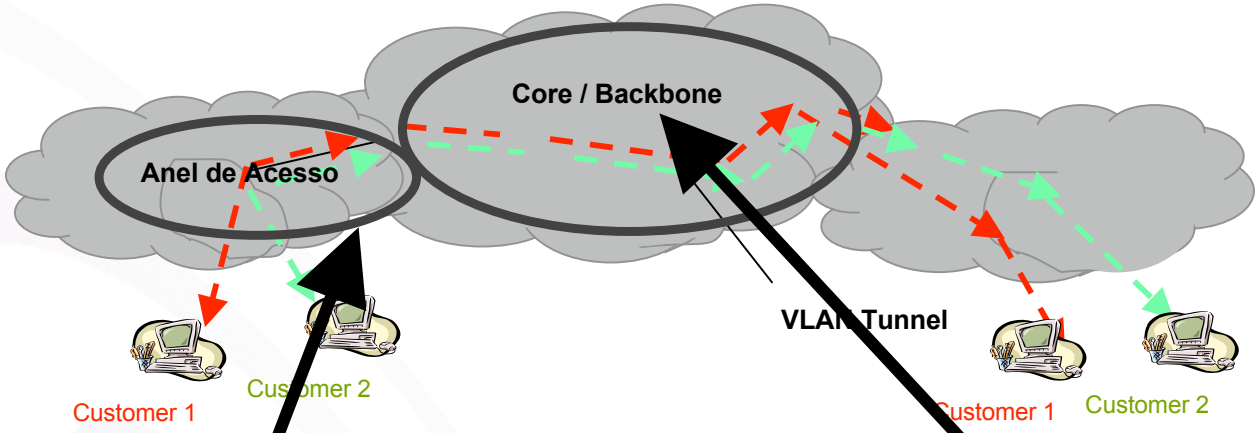
Anel de Acesso

* Tunelamento (801.1Q)
* Failover (STP, EAPS)
* Escalonamento (Q in Q , Vlan Translation)

* Tunelamento (VPN, MPLS/VPLS)
* Failover (MPLS , EAPS)
* Escalonamento (MPLS)

RESPOSTA : Simplicidade e Custo competitivo !!!!!!

O que é EAPS - RFC 3619??



Anel de Acesso

* Tunelamento (VMC)
* Failover (STP, **EAPS**)
* Escalonamento (Cisco, Vlan Translation)

* Tunelamento (VPLS/MPLS)
* Failover (MPLS , **EAPS**)
* Escalonamento (MPLS)

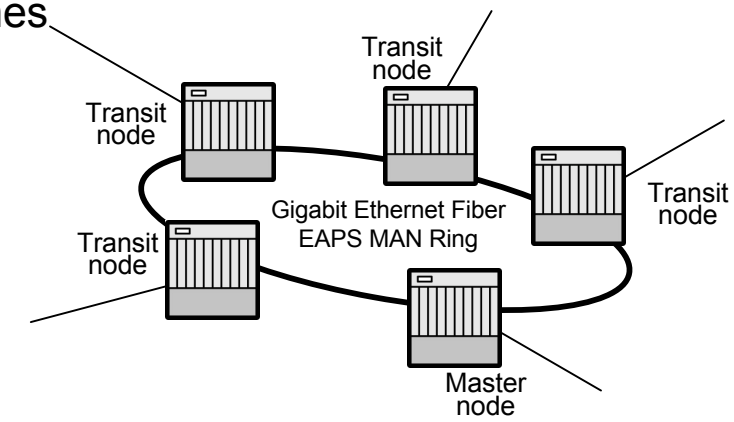
Necessidades : * Tunelamento

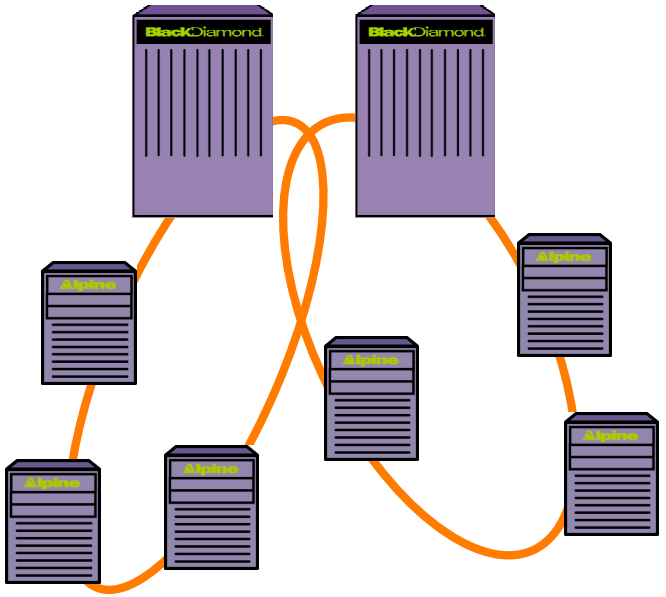
* Failover

* Escalonamento

EAPS - RFC 3619

- EAPS: Fast protection switching to Layer 2 switches interconnected in an Ethernet ring topology
- Faster than Fast STP in a ring:
  - < 50 Milliseconds
- Traffic can flow in both directions on the ring.
- Recovery should be approx 1 second
- Works specifically in a ring topology
- No set limit on number of switches in a ring
- Can run separate instances in separate rings. A VLAN can span multiple rings
- The topology and primary and backup path per VLAN are pre-defined for the switch
  - Upon failure traffic is redirected and appropriate forwarding databases are flushed.
  - Will want a provisioning tool for all the configuration information required

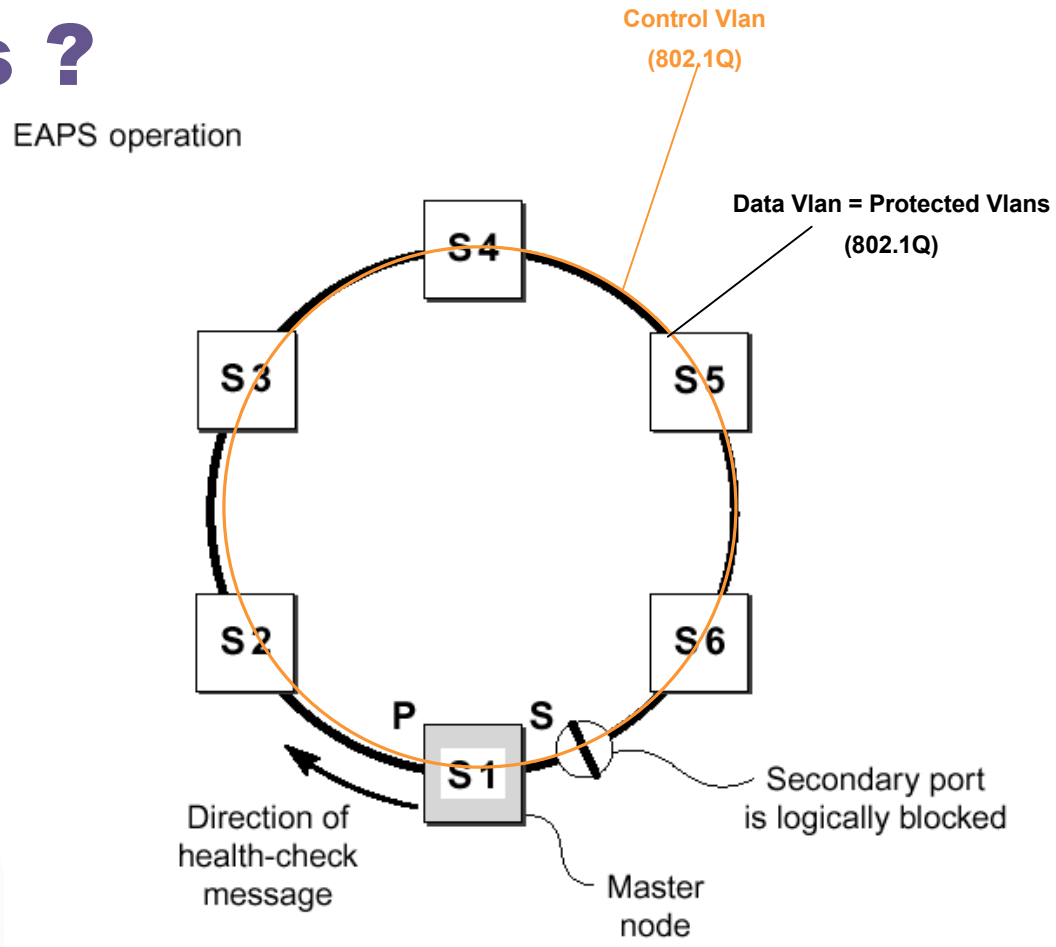




How it works ?

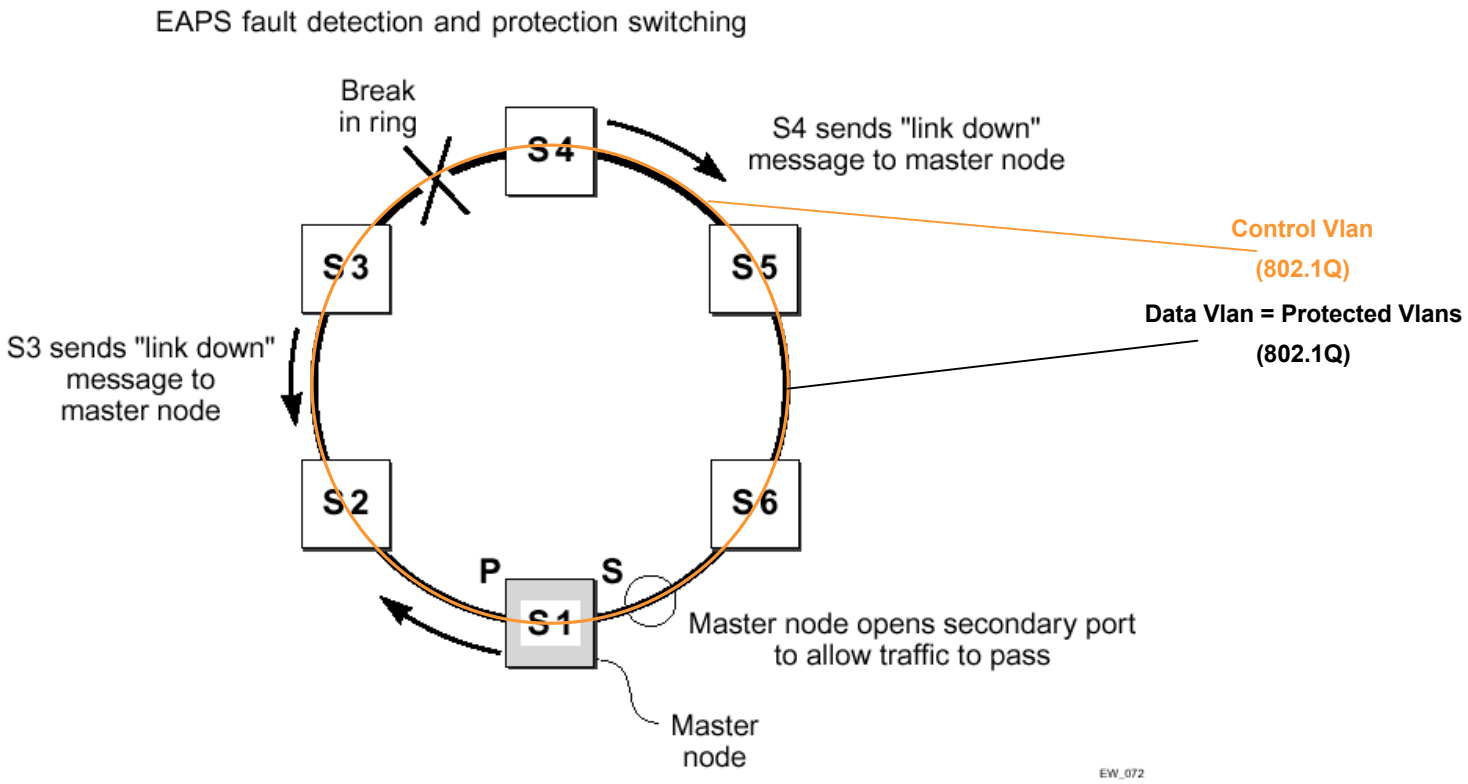
Key Components:

- Domain
- Master Node
- Transit Node
- Primary Port
- Secondary Port
- Control VLAN
- Data VLAN



If the ring is complete, the master node logically blocks all data traffic in the transmit and receive directions on the secondary port to prevent a loop. If the master node detects a break in the ring, it unblocks its secondary port and allows data traffic to be transmitted and received through it.

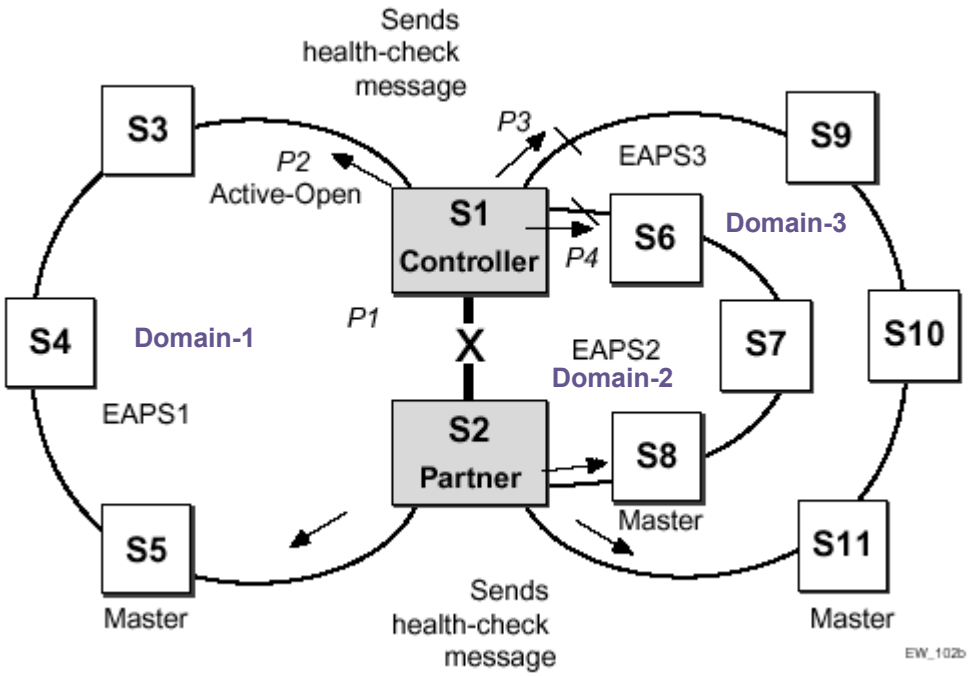
How failover works ?



A master node detects a ring fault in either of two ways:

- Polling response
- Trap message sent by a transit node

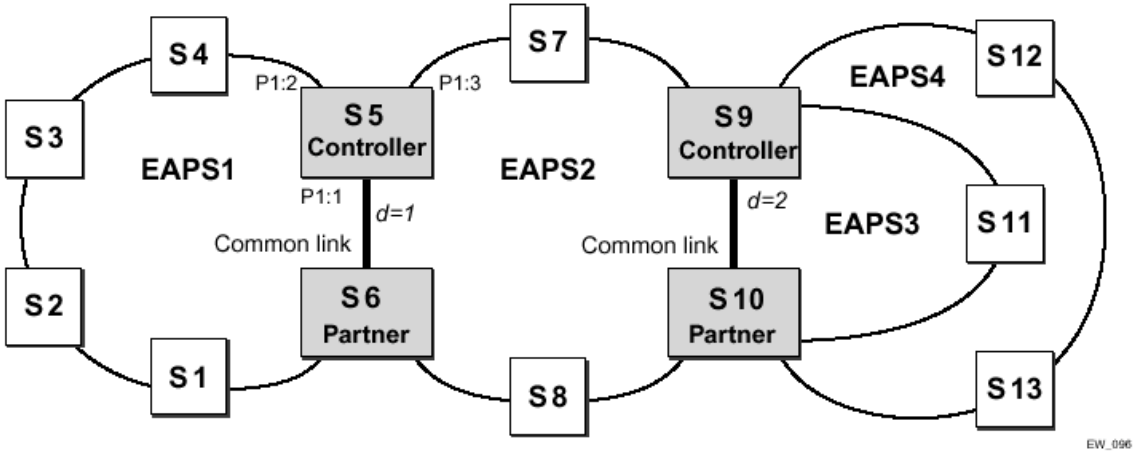
Domínios de EAPS

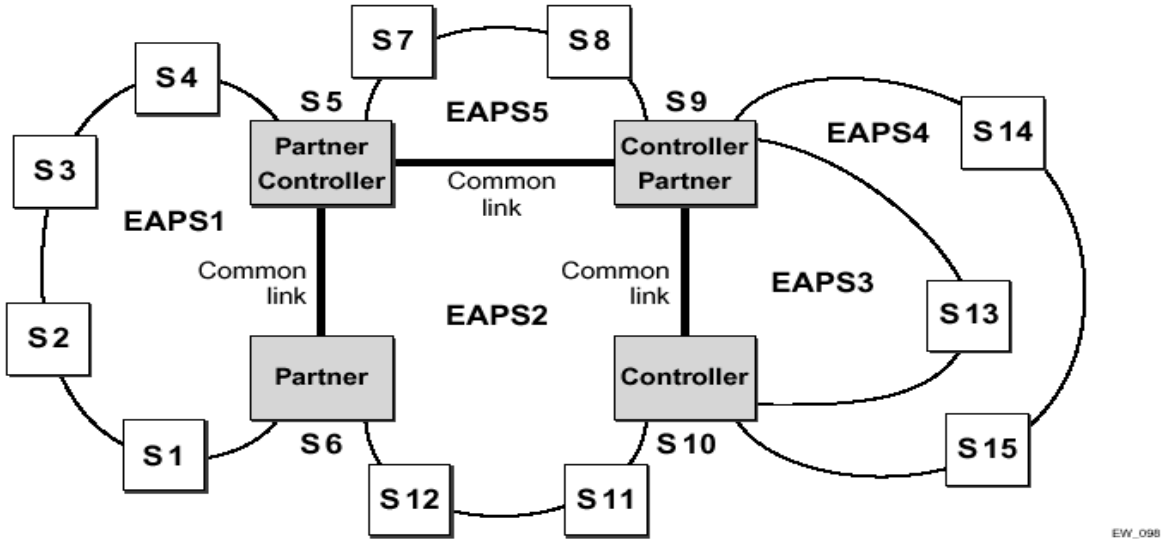


The physical link between two nodes in a multiple EAPS domain state is the *common link*.

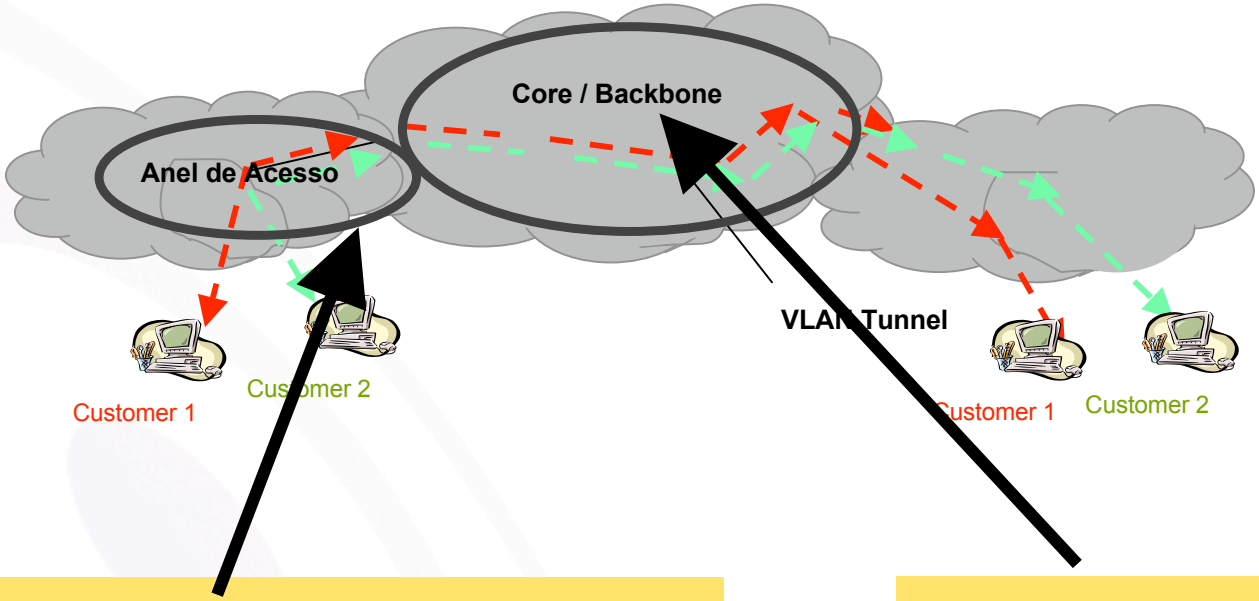
Each node is configured with a shared port to another node in an EAPS domain to create the common link. To prevent a superloop from occurring if the common link between the multiple EAPS domains fails, the switches on either end of the common link must be configured as *controller* and a *partner*.

Exemplos de Topologias





Mantendo a Simplicidade...



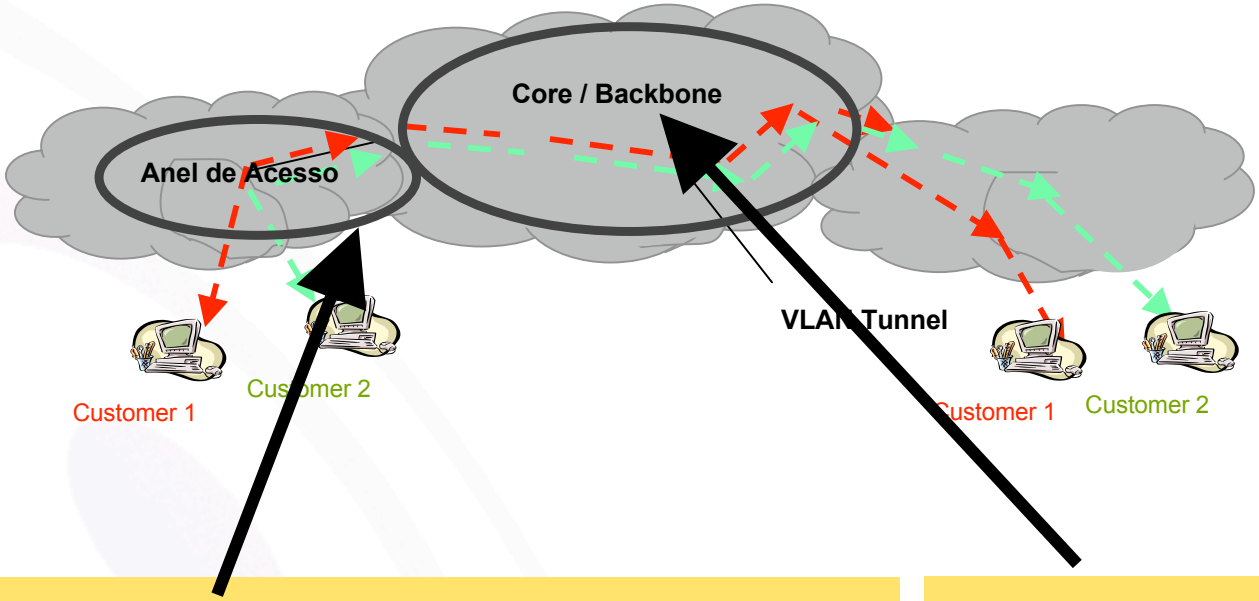
Anel de Acesso

* Tunelamento (801.1Q)
* Failover (STP, EAPS)
* Escalonamento (Q in Q , Vlan Translation)

* Tunelamento (VPN, MPLS/VPLS)
* Failover (MPLS , EAPS)
* Escalonamento (MPLS)

RESPOSTA : Simplicidade e Custo competitivo !!!!!!

O que é VLAN Translation ??



Anel de Acesso

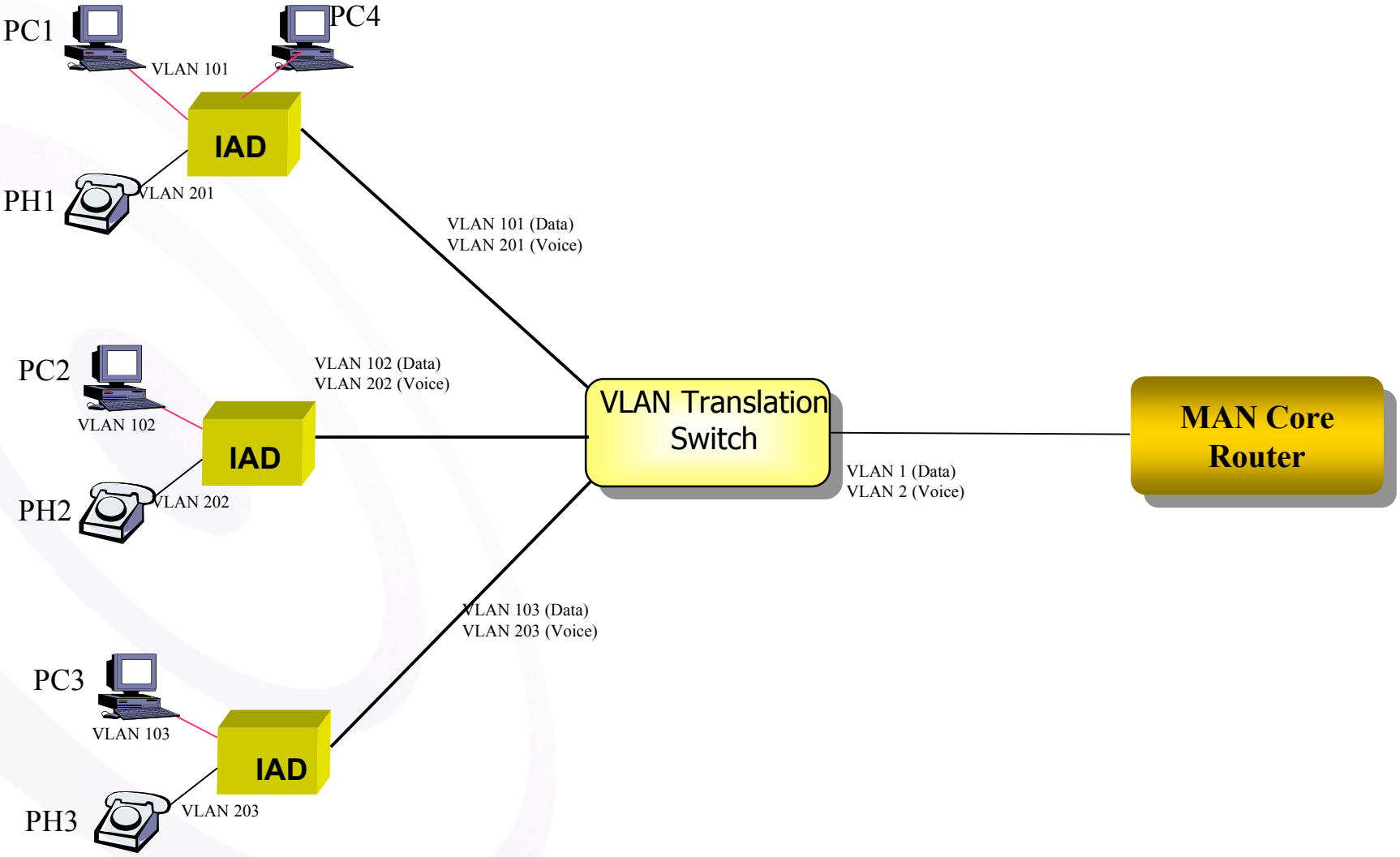
* Tunelamento (801.1Q)
* Failover (STP, EAPS)
* Escalonamento (Q in Q , **Vlan Translation**)

Core / Backbone

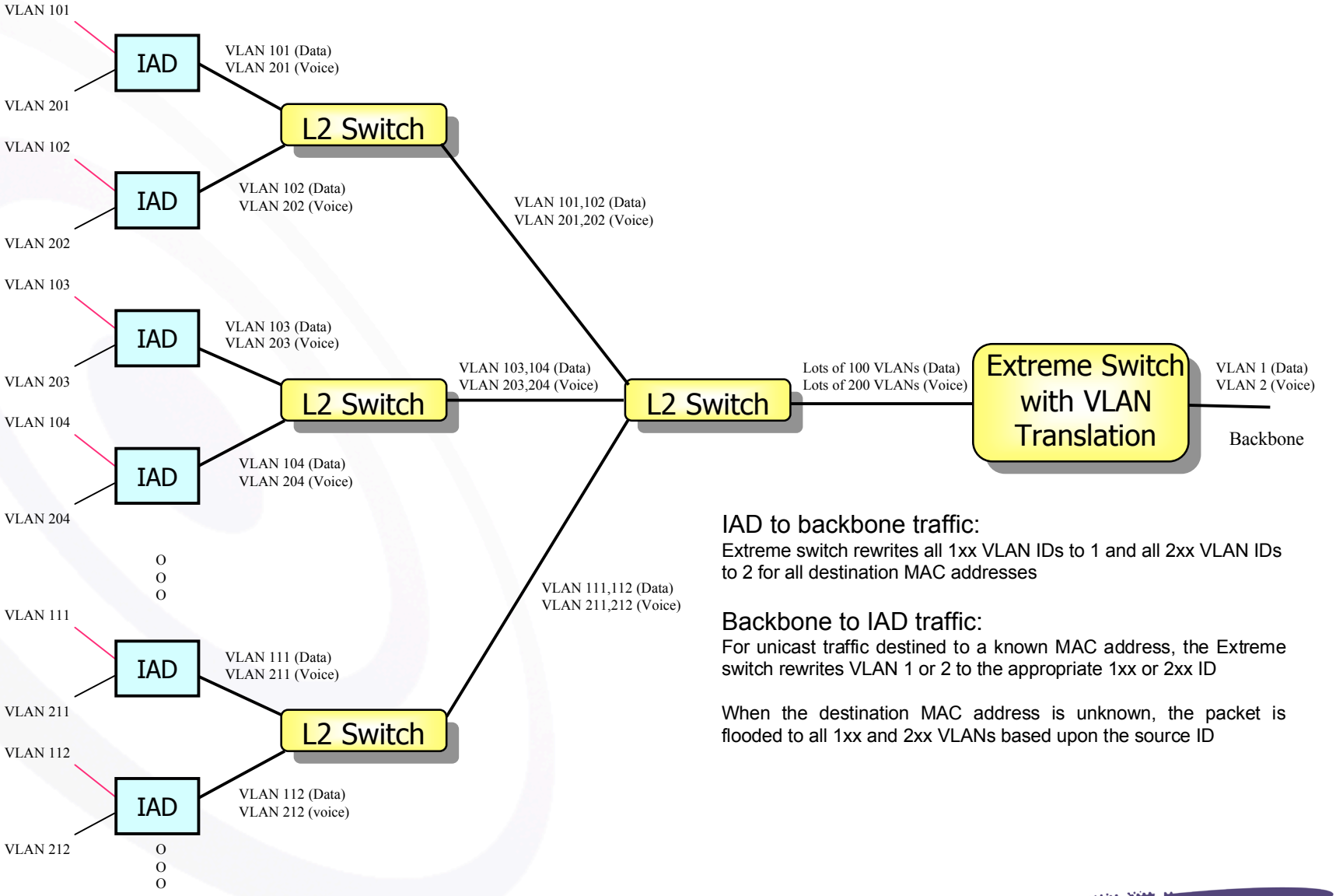
* Tunelamento (VPN, MPLS/VPLS)
* Failover (MPLS , EAPS)
* Escalonamento (MPLS)

Necessidades : * Tunelamento
* Failover
* Escalonamento

VLAN Translation



VLAN Translation



IAD to backbone traffic:

Extreme switch rewrites all 1xx VLAN IDs to 1 and all 2xx VLAN IDs to 2 for all destination MAC addresses

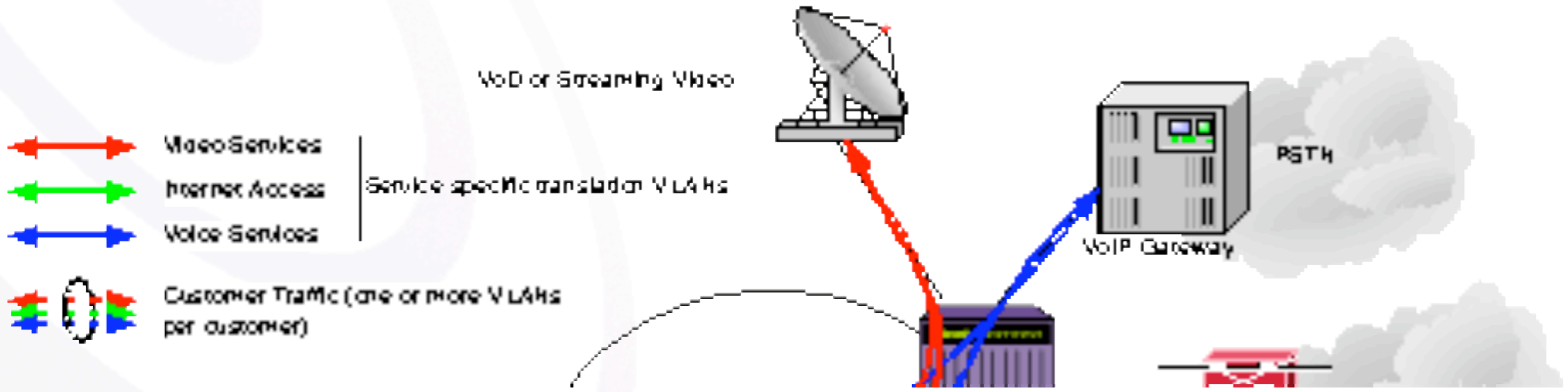
Backbone to IAD traffic:

For unicast traffic destined to a known MAC address, the Extreme switch rewrites VLAN 1 or 2 to the appropriate 1xx or 2xx ID

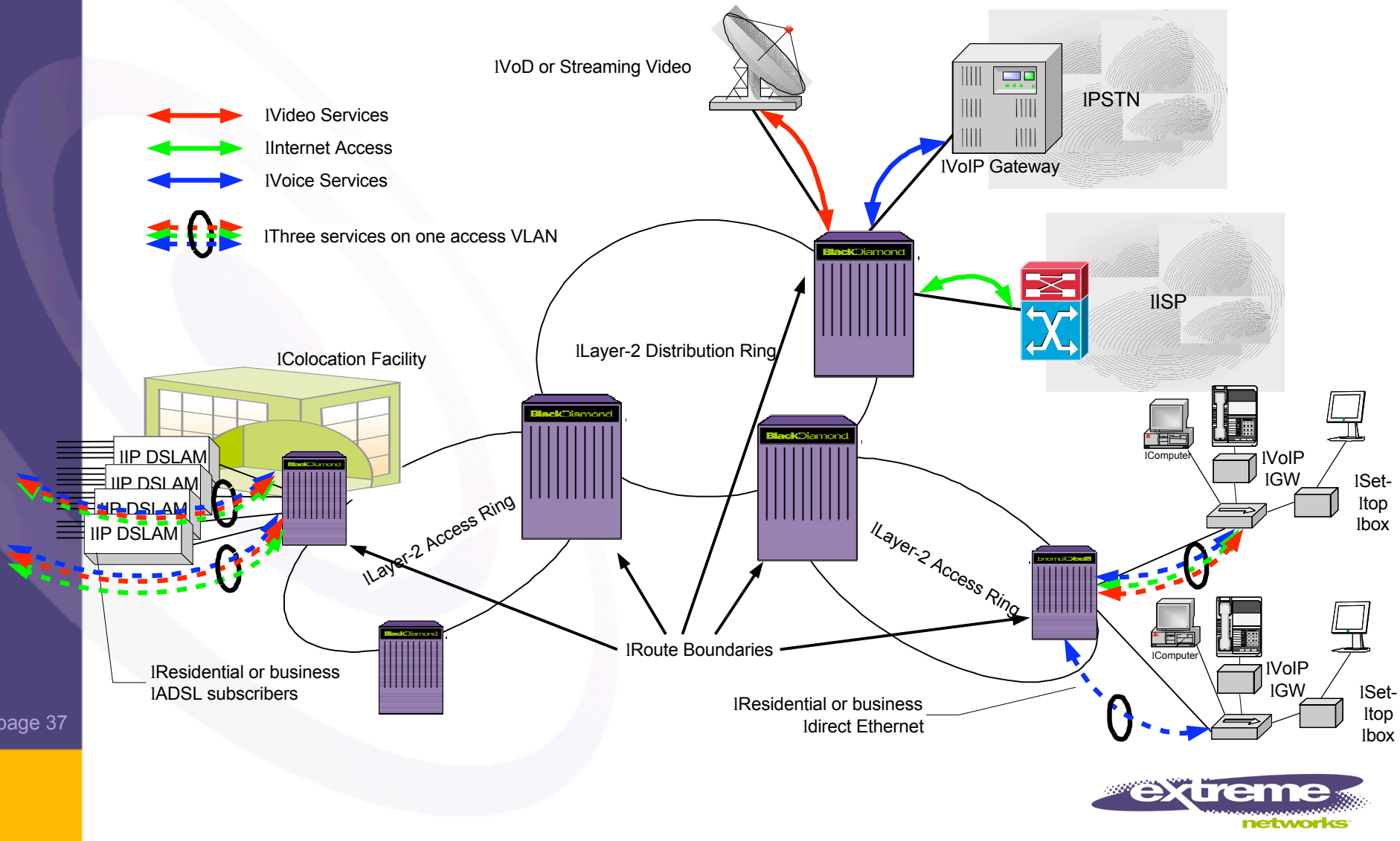
When the destination MAC address is unknown, the packet is flooded to all 1xx and 2xx VLANs based upon the source ID

Wholesale Residential Internet Access With Vlan Translation

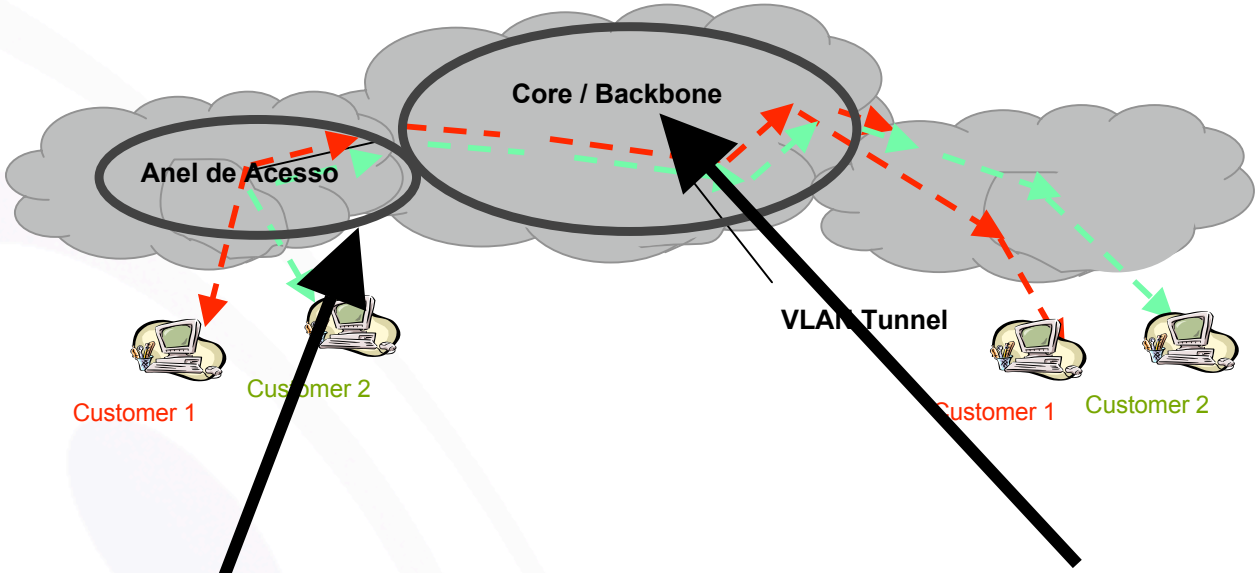
Converged Services—Wholesale Model with Vlan Translation



Converged Services—Layer 3 Model



O que é vMAN ??



Anel de Acesso

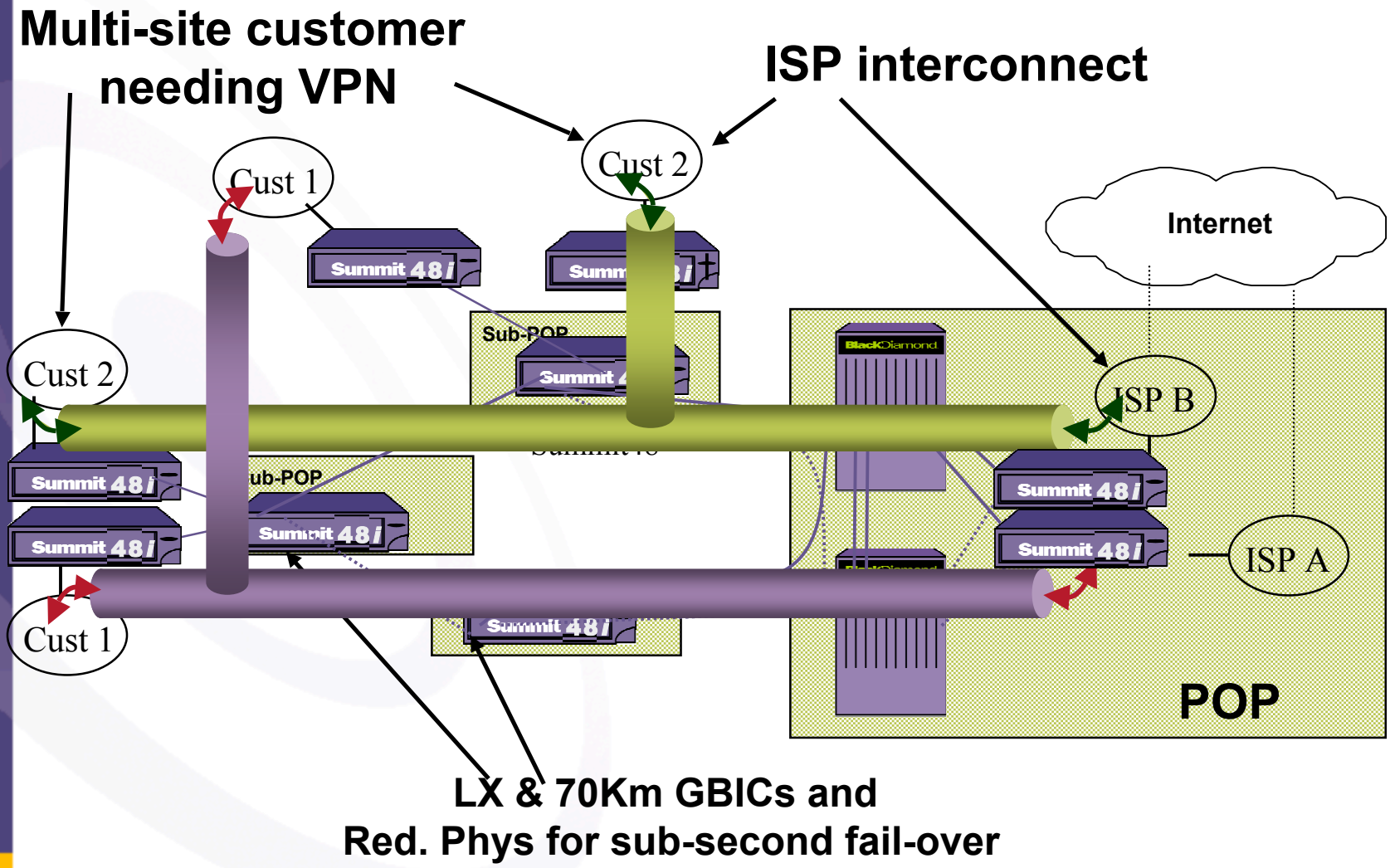
* Tunelamento (802.1Q)
* Failover (STP, [illegible])
* Escalonamento (Q in Q , Vlan Translation)

Core / Backbone

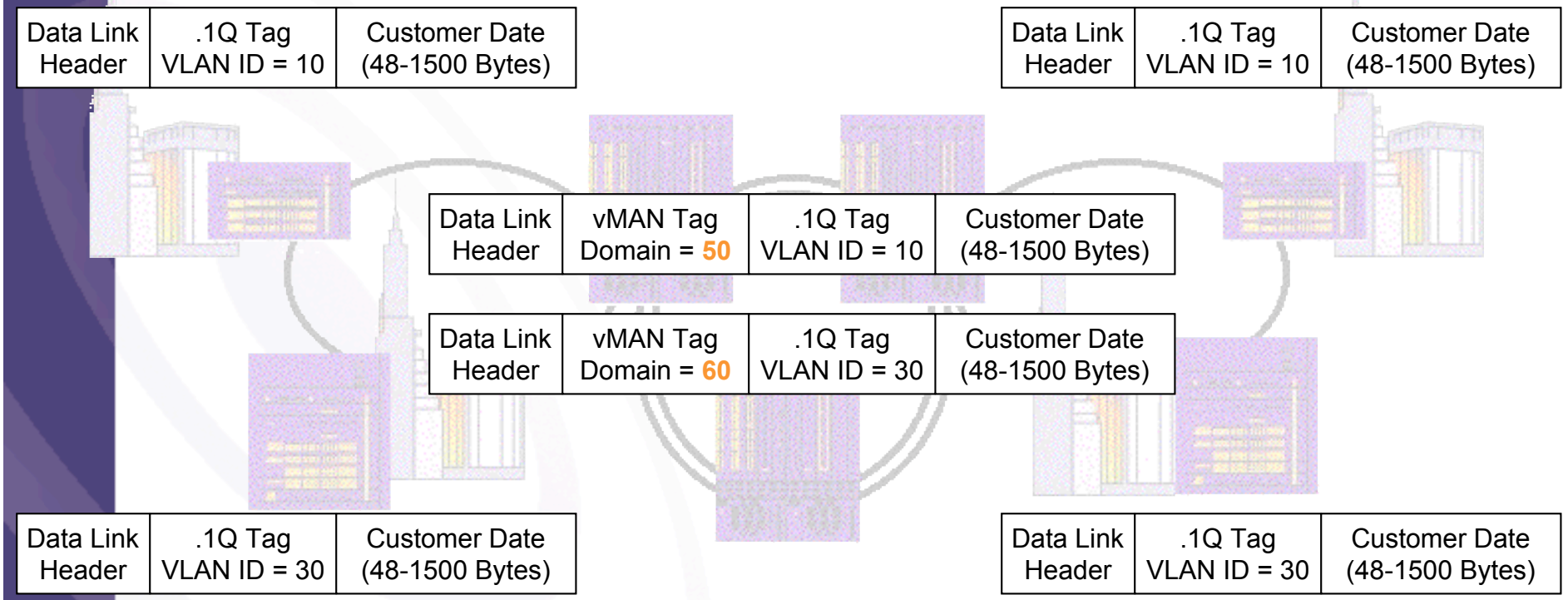
* Tunelamento (VPN, MPLS/VPLS)
* Failover (MPLS , EAPS)
* Escalonamento (MPLS)

Necessidades : * Tunelamento
* Failover
* Escalonamento

Extensions for Scaling: vMANs



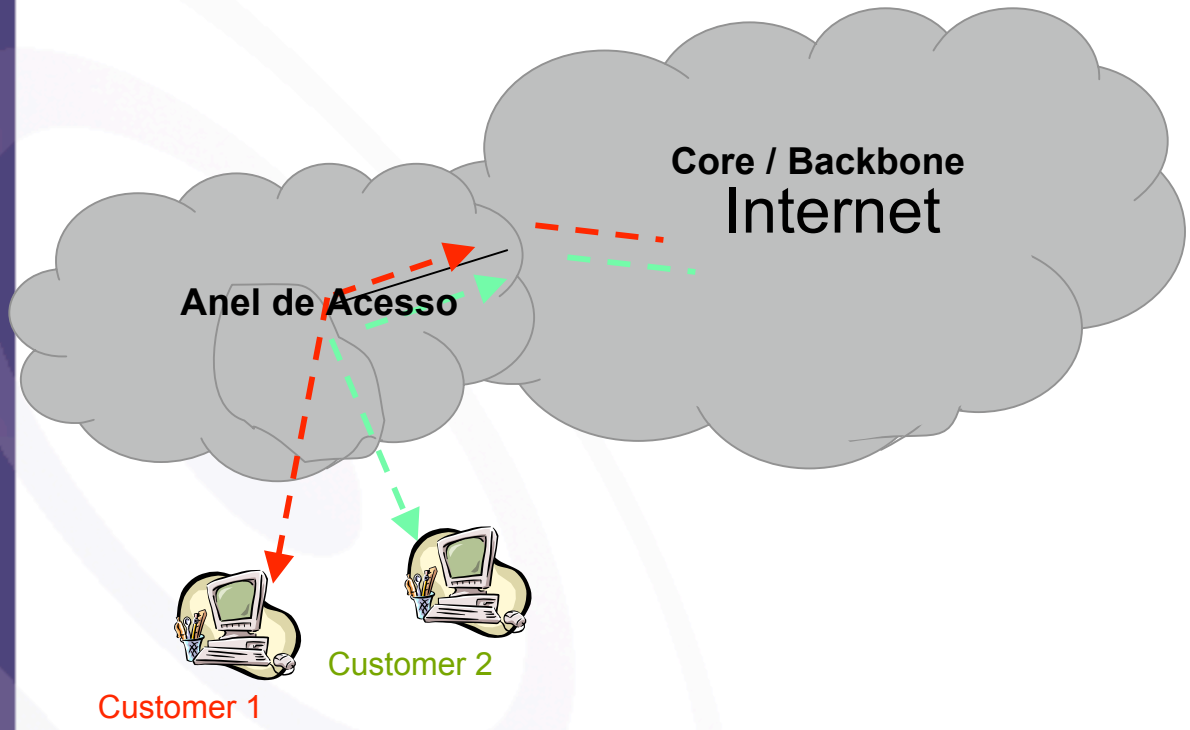
vMANs: Virtual Private Metropolitan Area Networks



Metro solutions and Services

- **Internet Access**
- **Point to Point Connection**

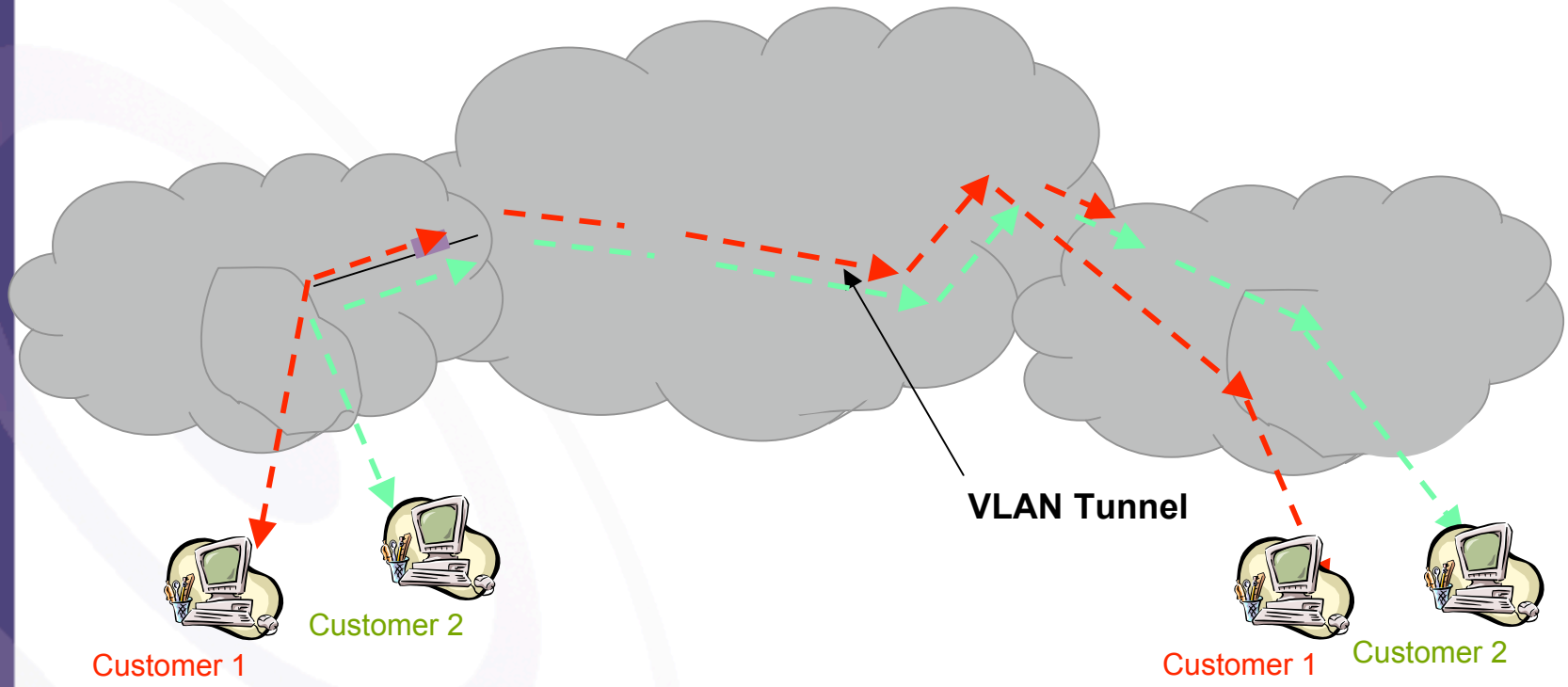
Serviço de Acesso Internet



Metro solutions and Services

- **Internet Access**
- **Point to Point Connection**

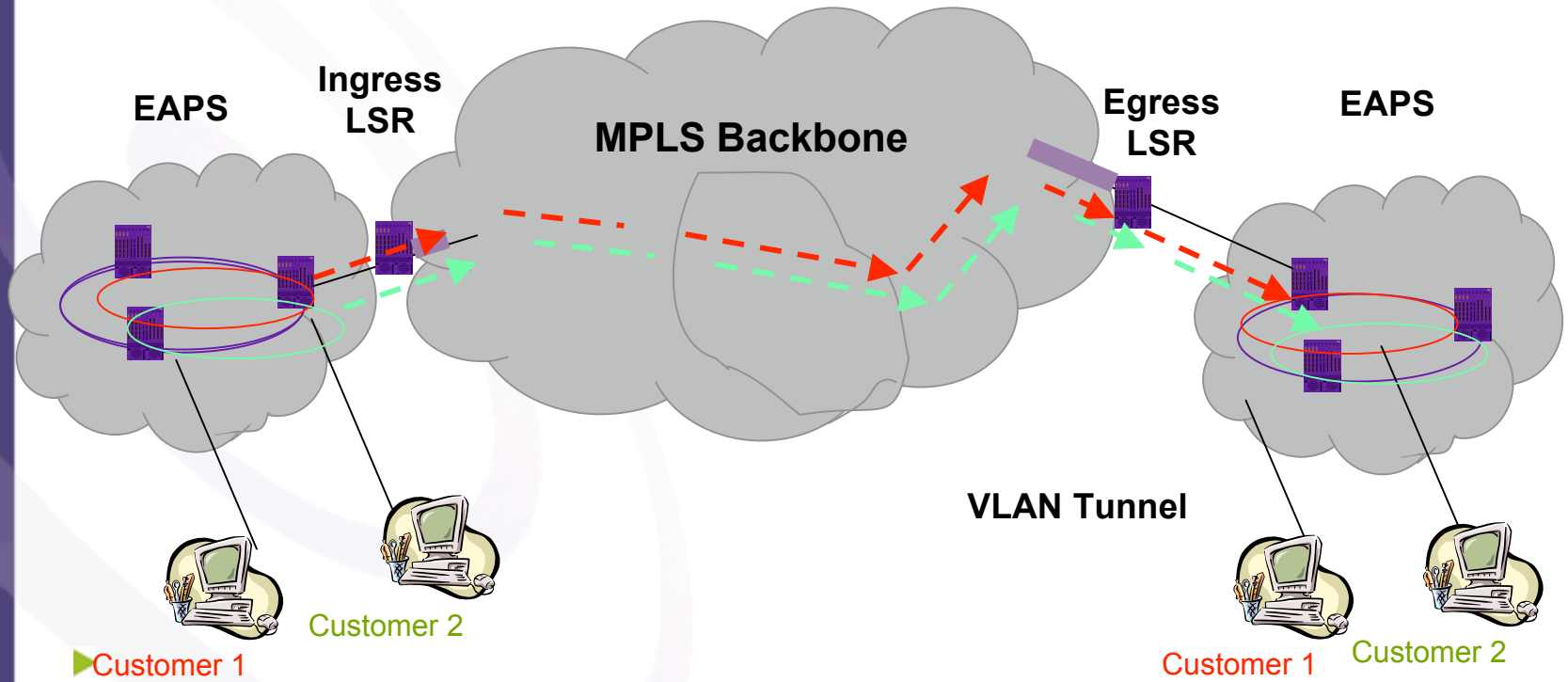
Point to Point connection



Necessidades Básicas :

* Tunelamento (VPN, MPLS, etc)
* Failover
* Escalonamento

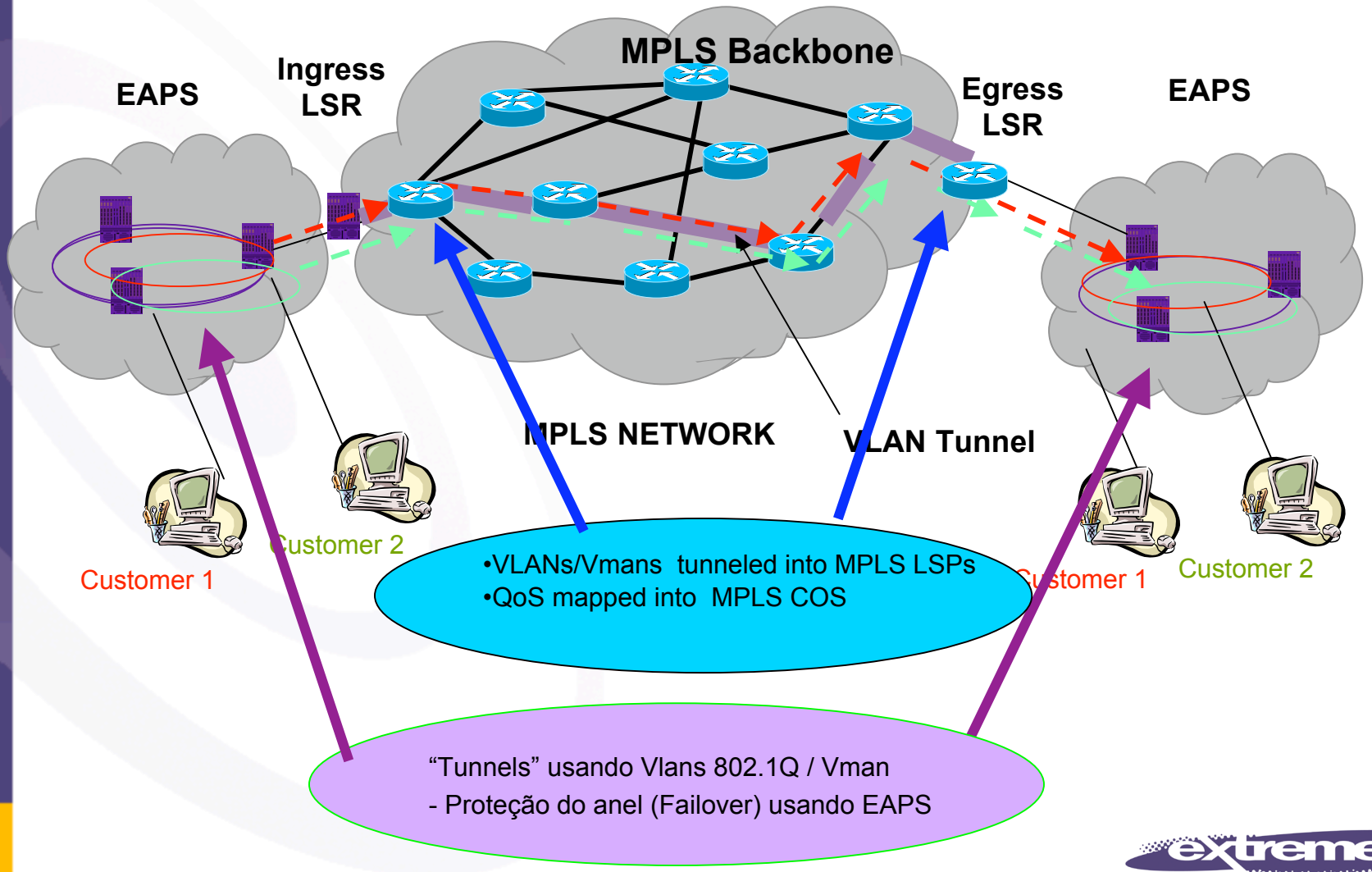
Extending L2 VPNs over the WAN



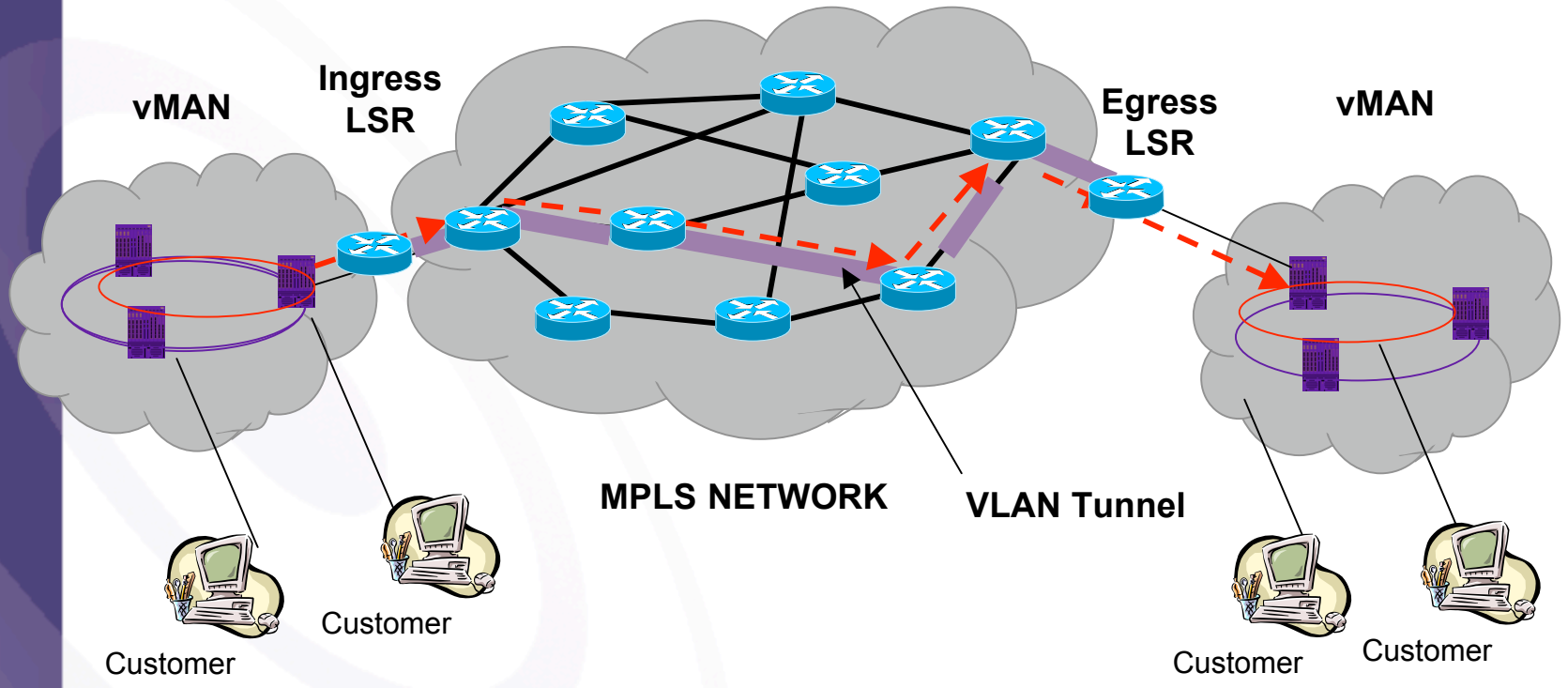
- VLANs tunneled into MPLS LSPs
- QoS mapped into MPLS COS

Black Diamond / Alpine / Summits

Metro Solution



Extending L2 VPNs over the WAN



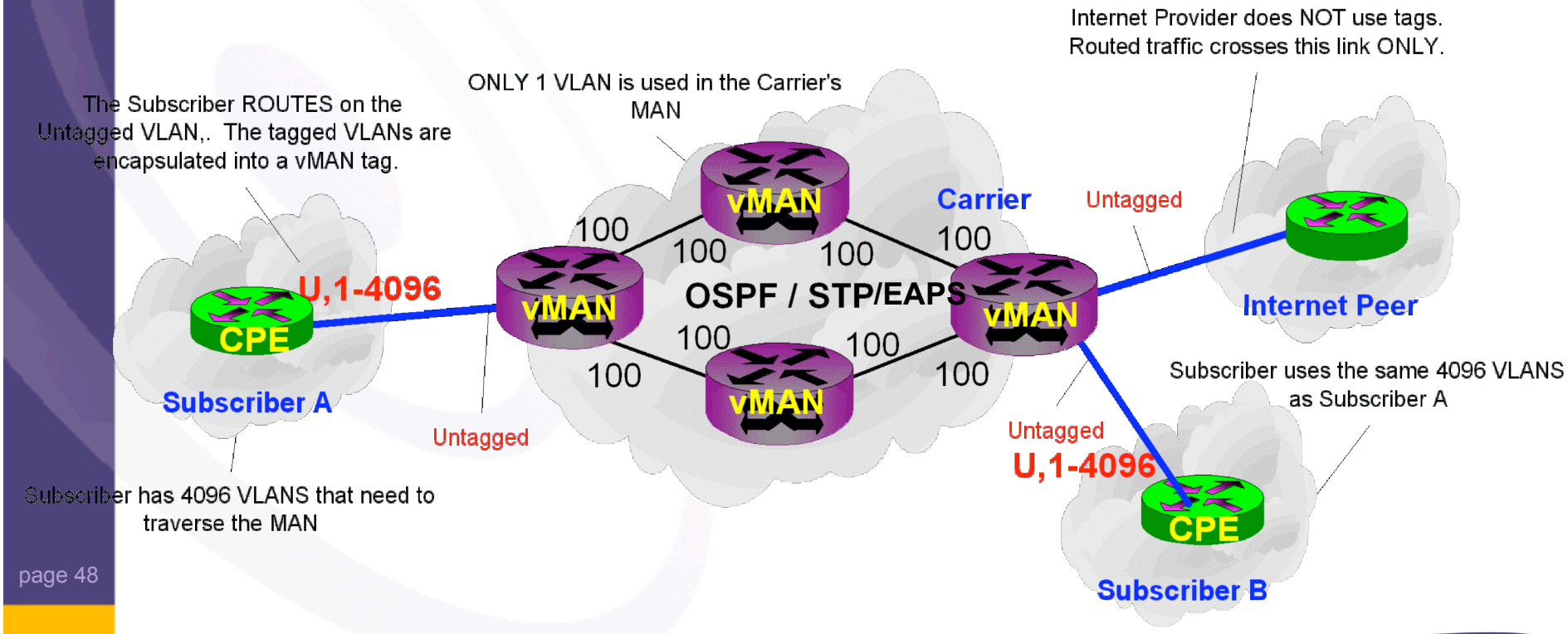
- VLANs tunneled to HVPLS
- QoS mapped into MPLS COS

Juniper M20/M40

Black Diamond/Alpine/Summit I

MAN with Layer 2 and 3 utilizing OSPF/STP/vMAN

- Layer-2 and Layer-3 Service on the same physical port
- Subscriber needs a device capable of routing an untagged vlan while supporting tagged traffic for TLS

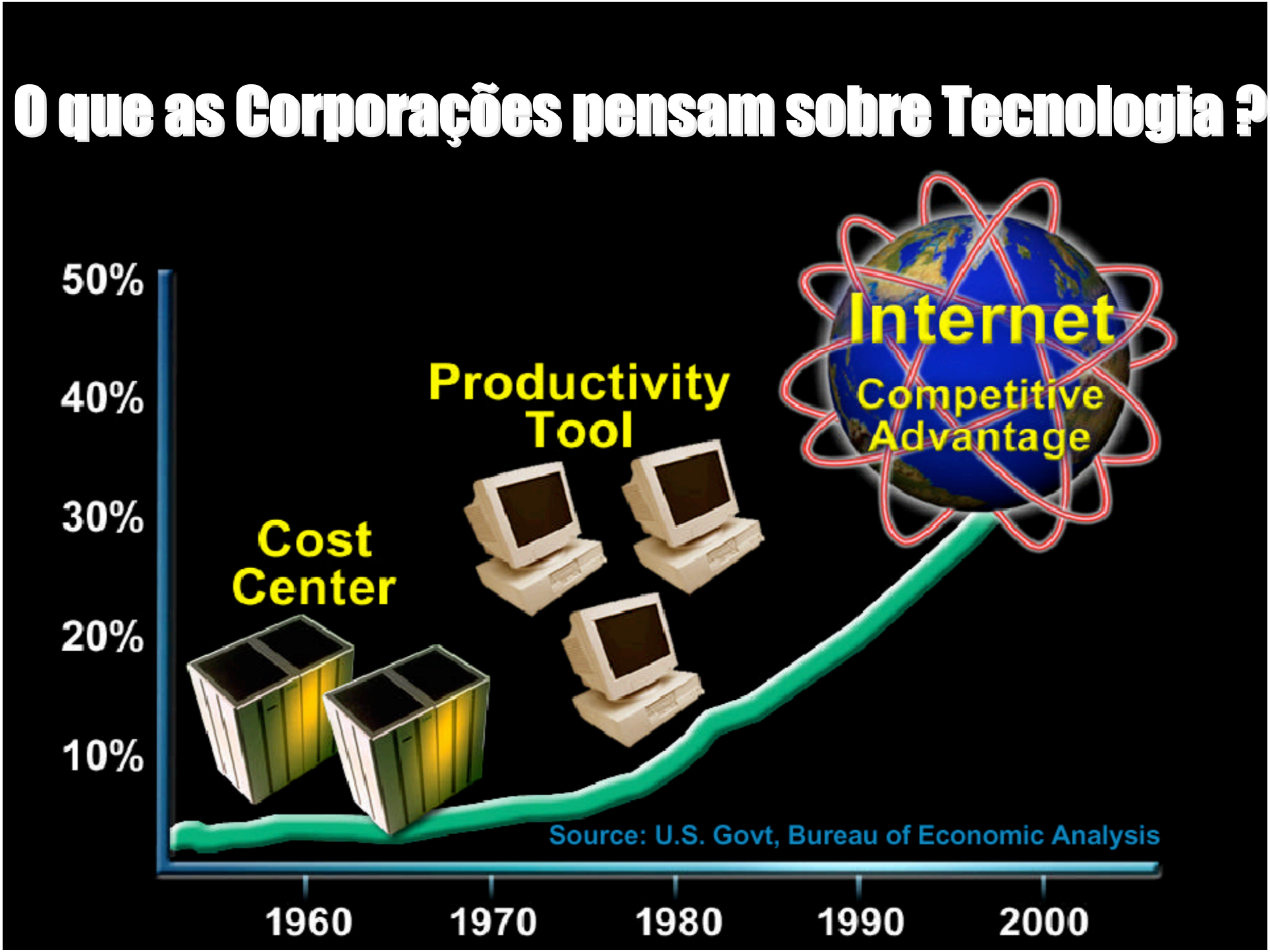


Conclusions

- Trends in Local Area Networks
  - Cycling back to a multi-technology, multi-protocol environment requiring very flexible, feature rich switches in the network core.
- Trends in Metro Ethernet Networks
  - Extending Ethernet and L2/L3 switching to enable very large scale, resilient, secure delivery of Ethernet services
- Standards
  - The vast majority of all Ethernet related standards activity is focused on the demands of Metro Ethernet Networking


Quem é o cliente ??

O que as Corporações pensam sobre Tecnologia ?



Ou uma grande dor de Cabeça !

Muito Obrigado !!!!!!

Renier Edward Souza
SE Manager
Rsouza@extremenetworks.com