

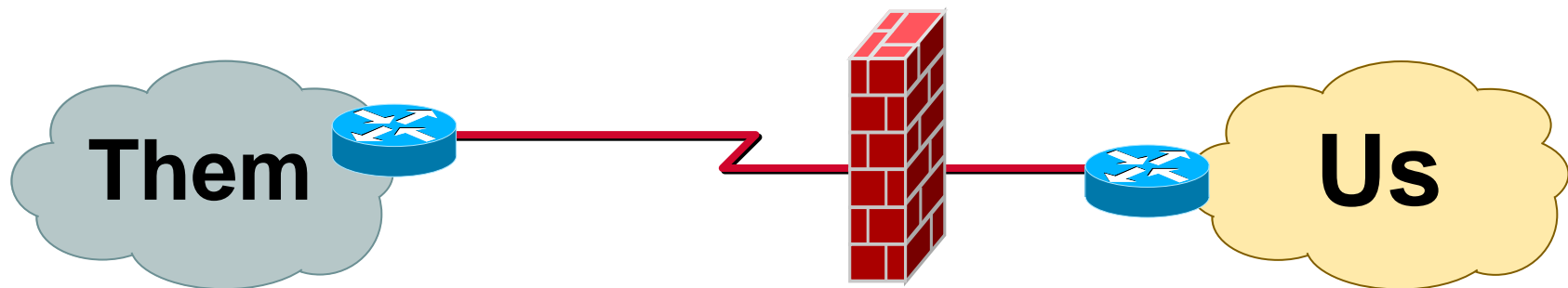


Dedicated Internet Access



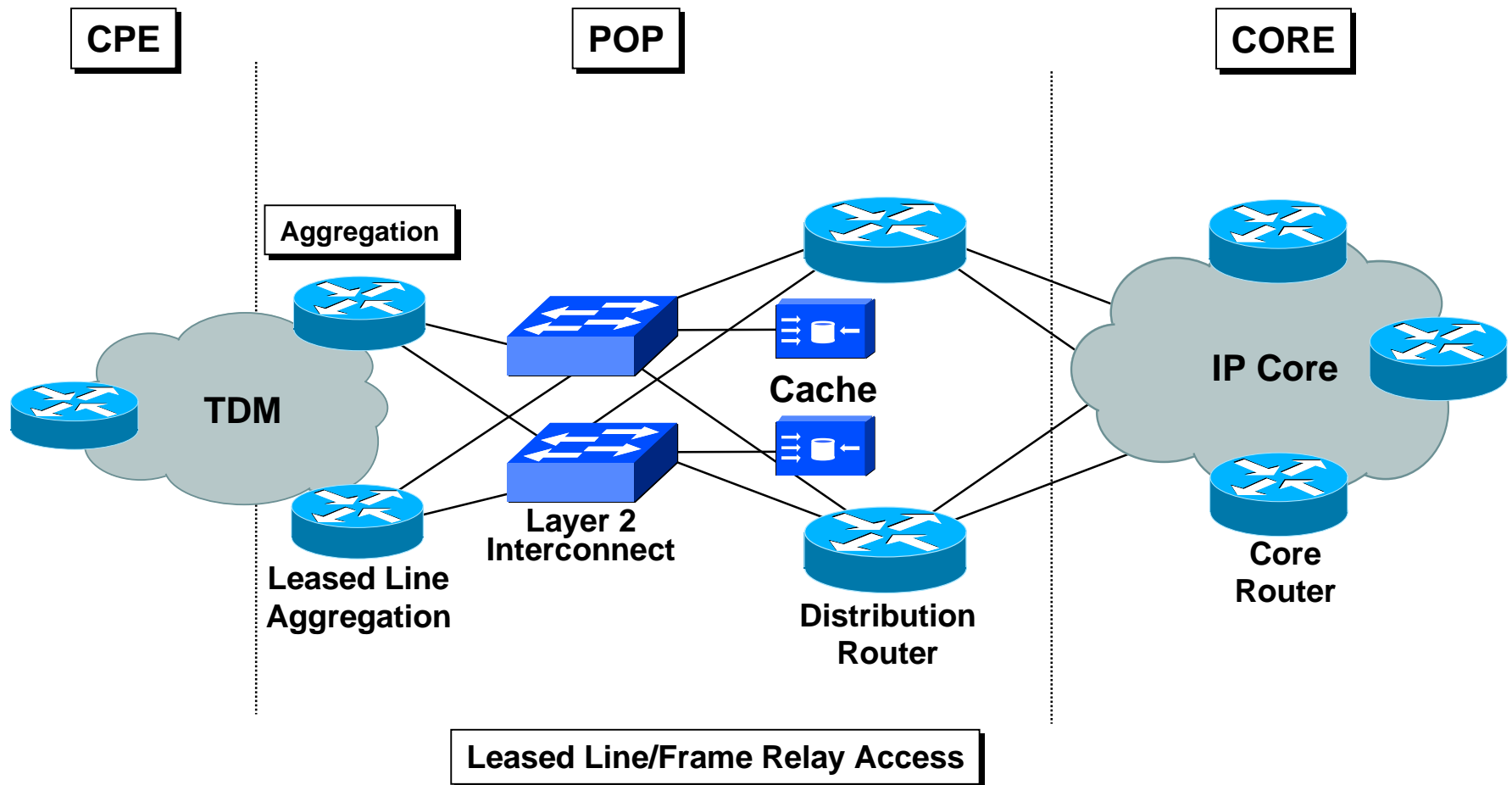
Customers

- Define “us” or “them”
- A domain (us.com, them.gov)?
- An autonomous system?
- Administrative boundaries and controls



Dedicated Internet Access

Leased Line/Frame Relay Service Architecture



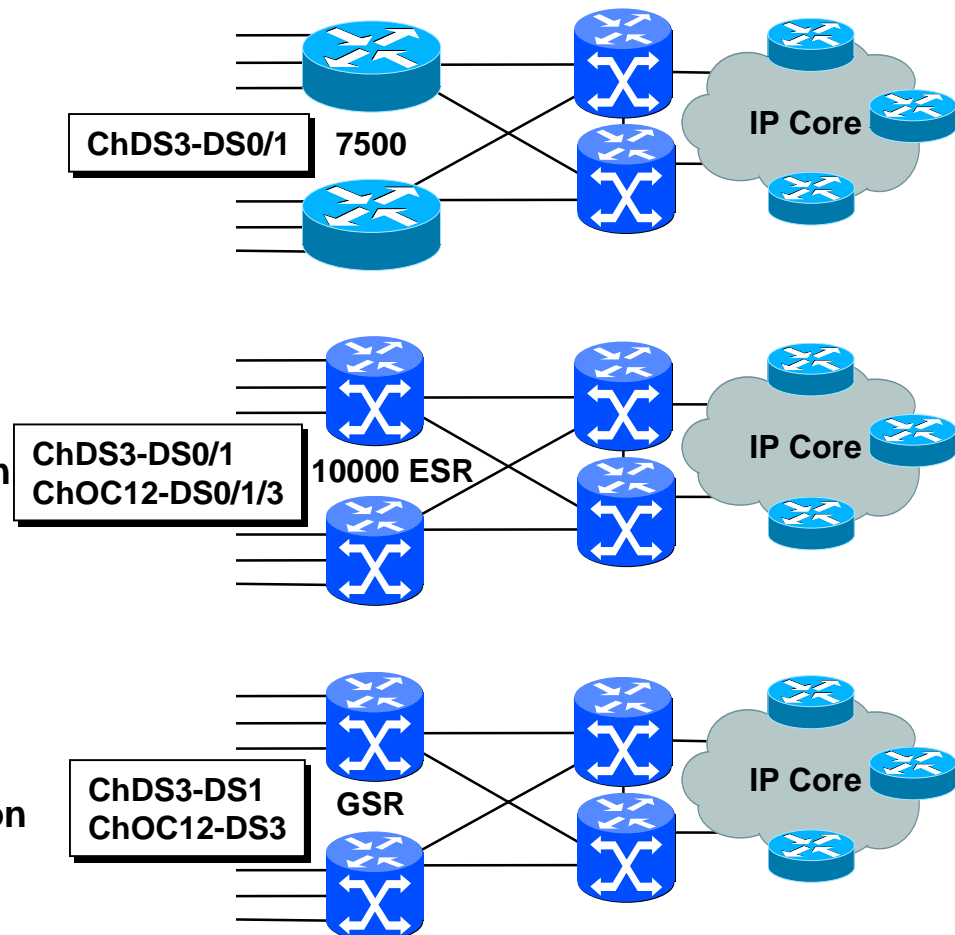
Dedicated Internet Access Aggregation Architectures

POP Characteristics

- Existing POPs
 - Concentration of low speed aggregation
 - Edge features required
-
- Mix of high and low speed aggregation
 - High concentration of low speed aggregation
 - High edge feature content requirement
-
- Mix of high and low speed aggregation
 - High concentration of high speed aggregation
 - Lower edge feature content requirement

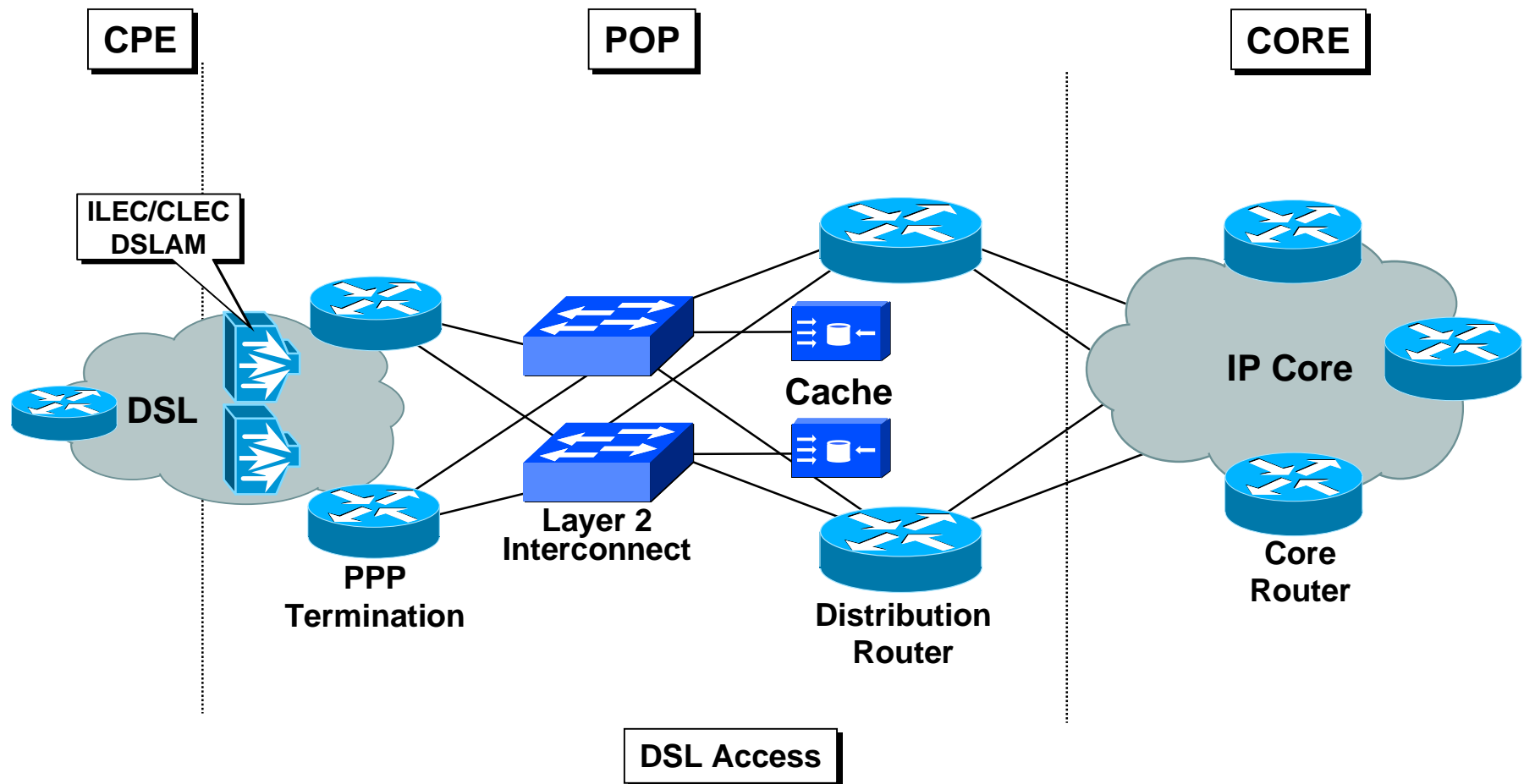
Aggregation

CORE



Dedicated Internet Access

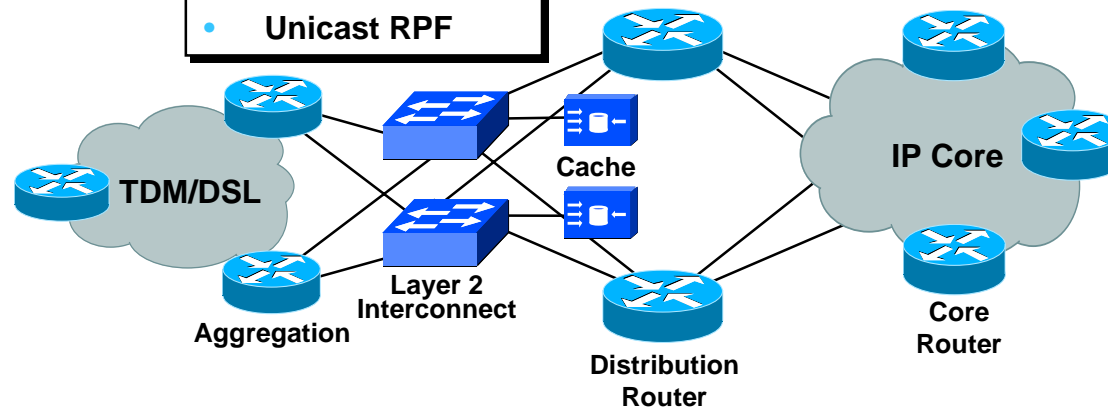
DSL Service Architecture



Dedicated Internet Access

Software Features

CPE Software Features	AGGREGATION Software Features	POP Software Features	CORE Software Features
<ul style="list-style-type: none"> • IGP Support/Static Routing • Traffic Shaping • Congestion Management • HDLC, PPP, Frame Relay, Or ATM Encapsulation 	<ul style="list-style-type: none"> • HDLC, PPP, Frame Relay, ATM Encapsulation • Packet Classification And Policing • QoS Support • IGP Support/BGP Peering • MPLS/Traffic Engineering • Unicast RPF 	<ul style="list-style-type: none"> • Web Caching Via WCCP • IGP Support/BGP Peering • MPLS/Traffic Engineering • QoS Support 	<ul style="list-style-type: none"> • IGP Support/BGP Peering • MPLS/Traffic Engineering • QoS Support



Dedicated Internet Access

Hardware Features

CPE Hardware Features

- Flexible LAN/WAN configurations
- Encryption (3600/7200)

AGGREGATION Hardware Features

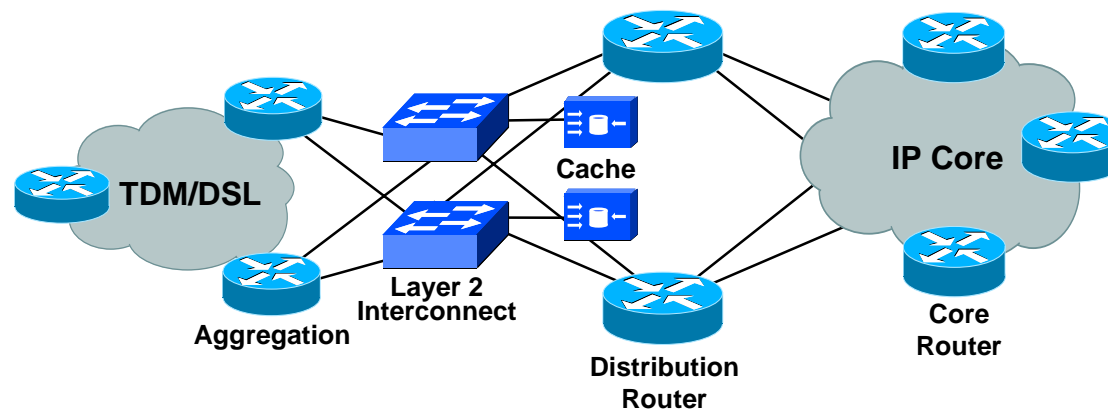
- Channelized Interfaces
- E3, DS-3, OC-3/12 Interfaces
- QoS Support
- NEBS/Redundancy

POP Hardware Features

- QoS Support
- Redundancy/NEBS

CORE Hardware Features

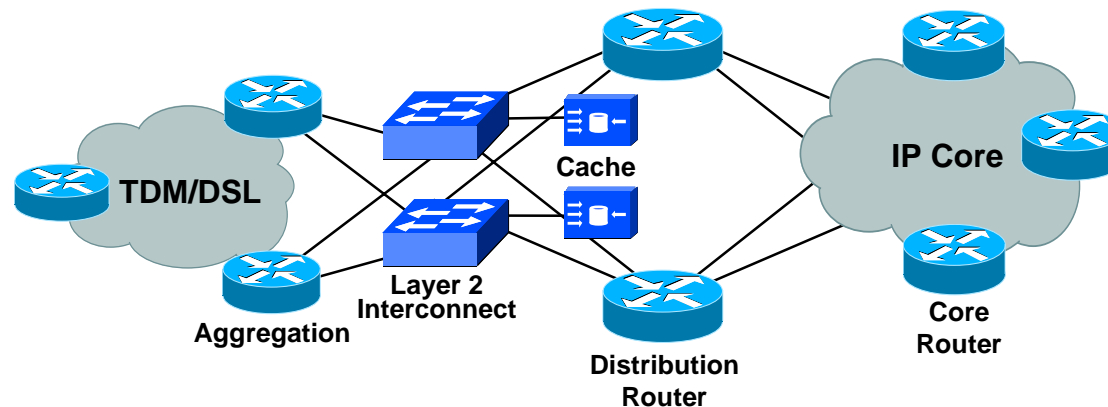
- IGP Support/BGP Peering
- MPLS/Traffic Engineering
- QoS Support



Dedicated Internet Access

Product Options

Cisco CPE Product Options	Cisco AGGREGATION Product Options	Cisco POP Product Options	Cisco CORE Product Options
<ul style="list-style-type: none"> • 675 • 1600 • 1720 • 2600 • 3600 • 7200 	<ul style="list-style-type: none"> • 2600 • 3600 • 6400 • 7200 • 7500 • MGX 8850 • 10000 • Cat 6000 OSR 	<ul style="list-style-type: none"> • 2600 • 3600 • Catalyst 6000 • 7200 • 7500 • GSR • MGX 8220 • UCP 	<ul style="list-style-type: none"> • 3600 • 7200 • 7500 • GSR • BPX 8650 • MGX 8850

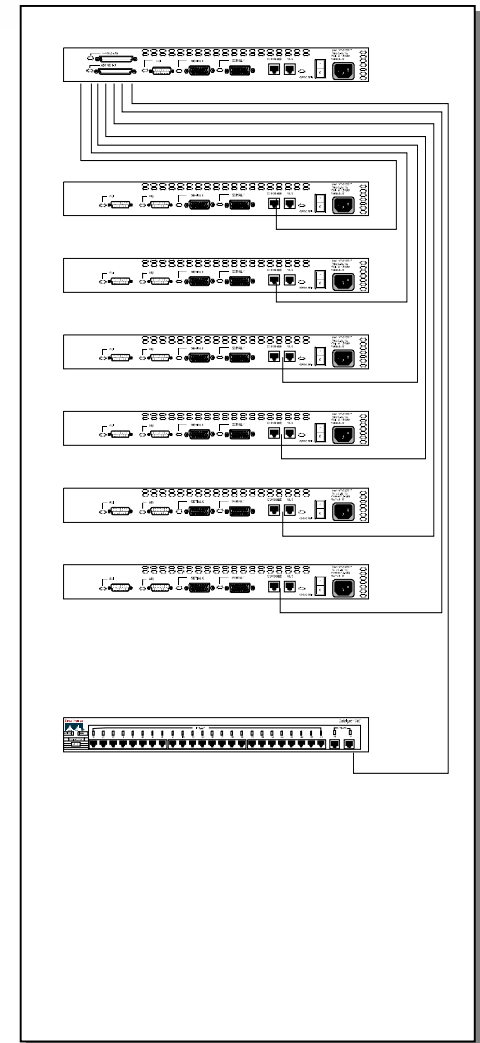


A man in a white shirt and tie is holding a large, curved cable against a blue background. The cable is arched over him, and he is looking up at it. The background has some faint, abstract lines.

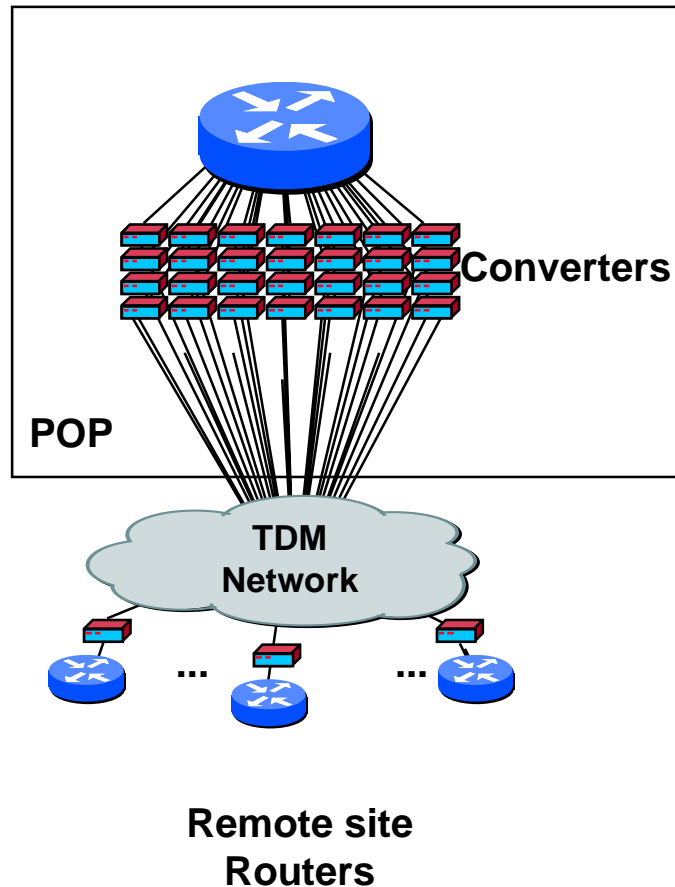
Scaling Lease Line POPs

Stack and Rack

- **Model for scaling lease line growth based on revenue growth.**
- **Get a Cisco 2522 (2 high speed serial & 8 low speed serial)**
 - ✓ Fill up 6 ports, taking in the revenue, use the revenue to buy the next 2522.
 - ✓ Keep on stacking ...

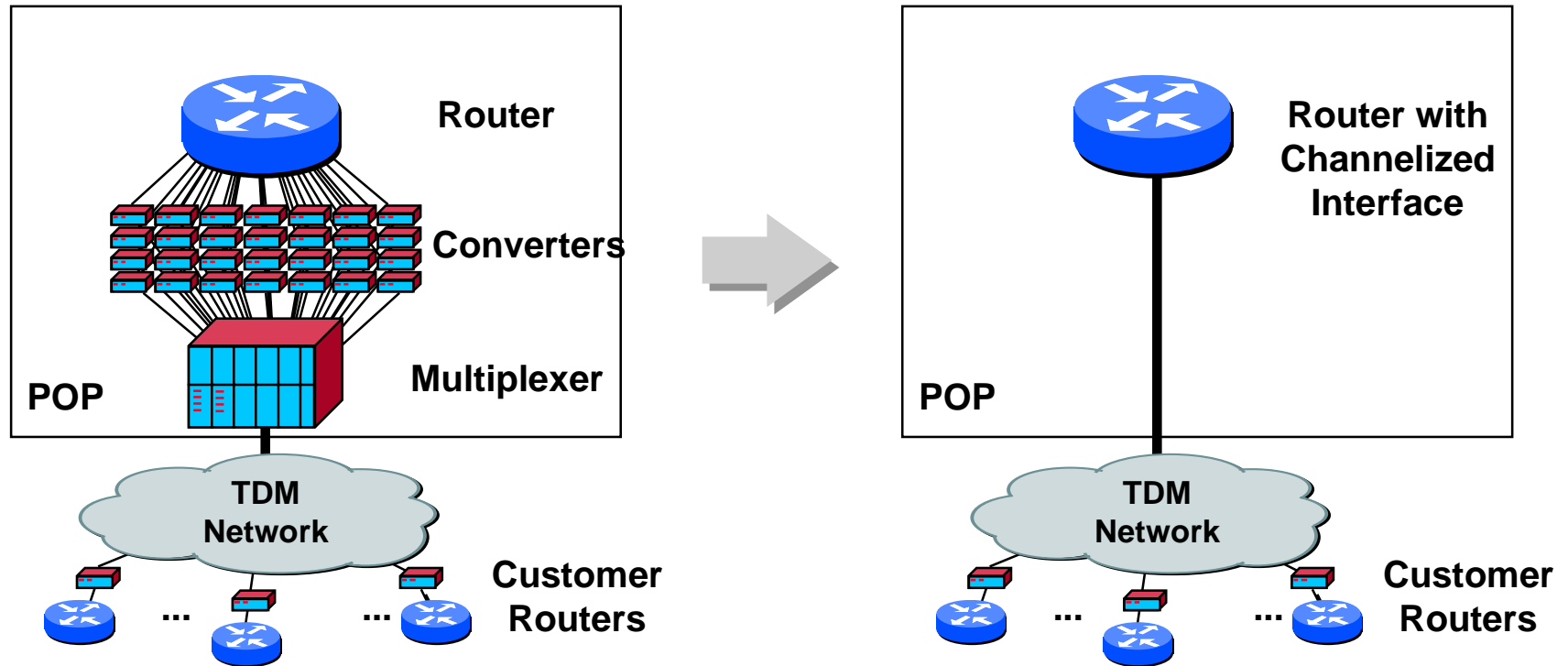


Problem: Growth

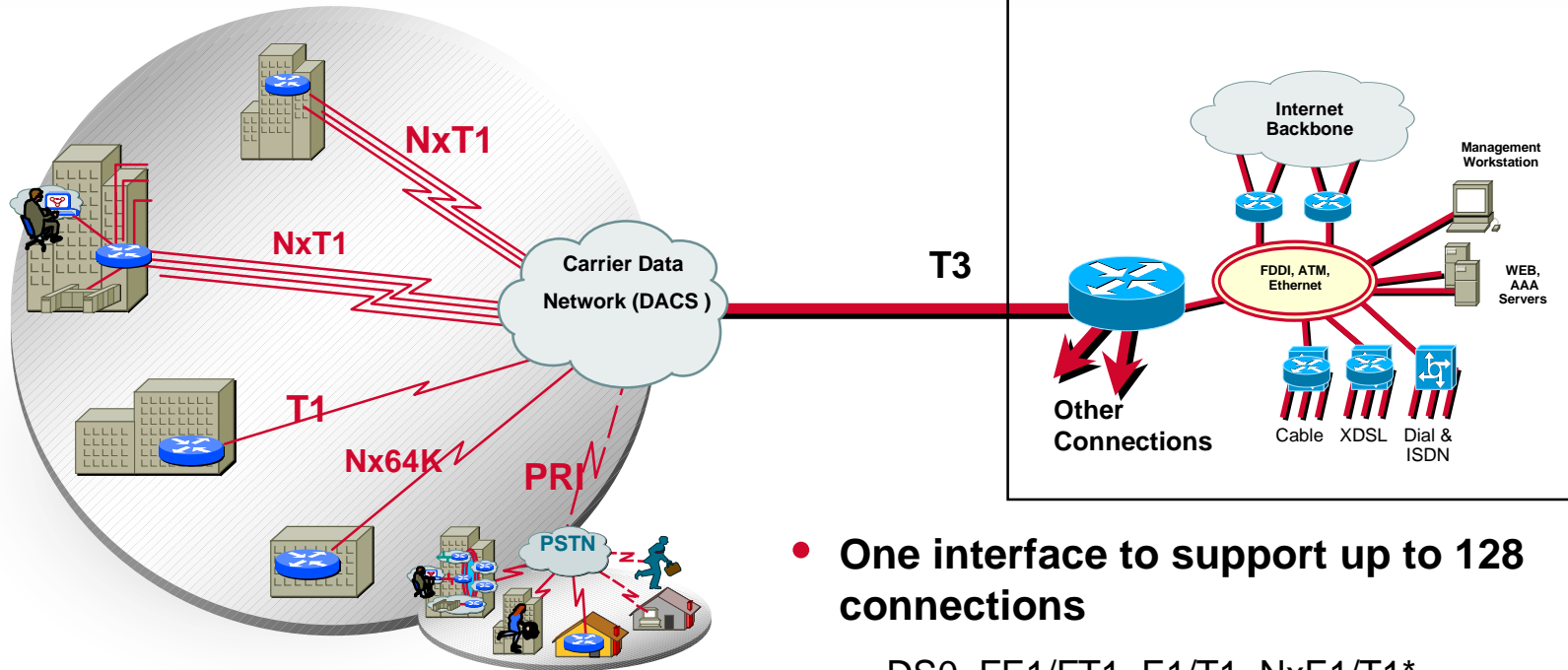


- Rack Space
- Provisioning of new customers
- Cabling Complexity
- Management of converters
- Cost
- Uplink bottleneck
 - ✓ Bandwidth
 - ✓ Number of uplinks
- Port density limits
 - ✓ Low router slot utilization
- Difficult Service management
- Problematic QoS
- Configuration inflexibility

Channelized Interface Solutions



Multi-Level Channelization



CPE Solutions:

Cisco 17X0, 26x0, 36x0, 4x00, 7x00

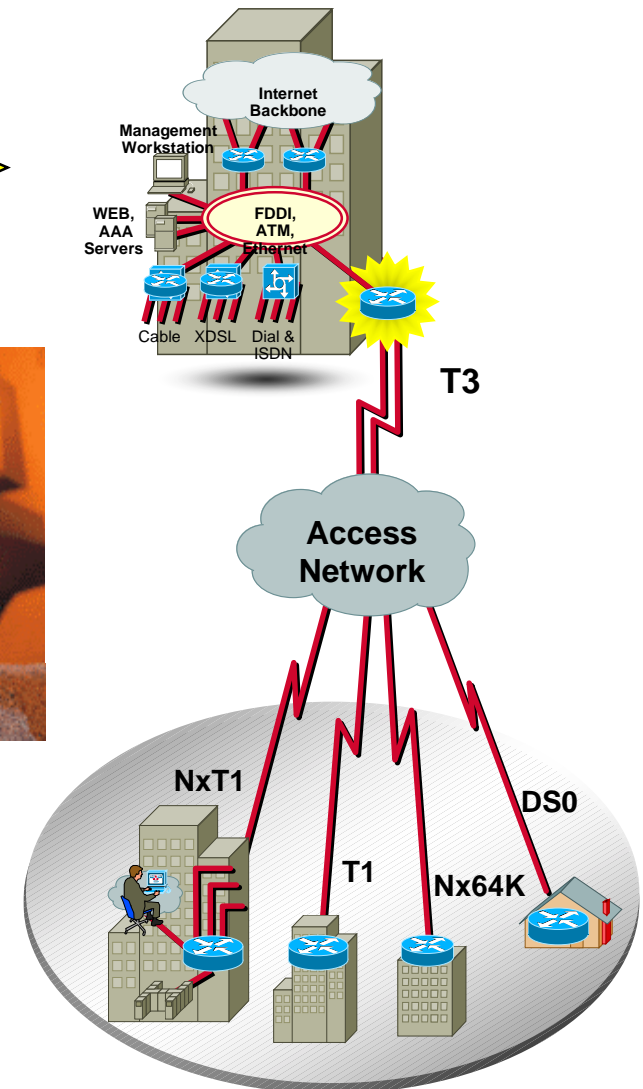
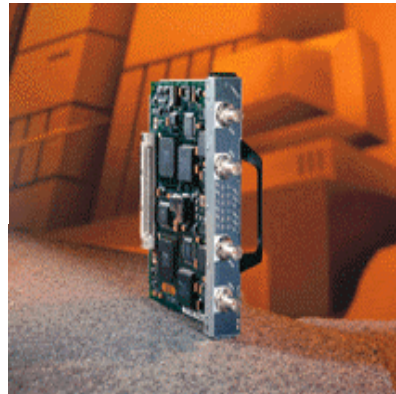
- One interface to support up to 128 connections

DS0, FE1/FT1, E1/T1, Nx E1/T1*,
subrate E3/T3, E3/T3

- Flexible provisioning
- Minimum number of cards
- Single point of management

1 & 2 Port Multichannel T3

- **Full range of connectivity on one interface**
 - ✓ DS0, NxDS0, FT1, T1, NxT1, subrate DS3, full rate DS3
 - ✓ 28 T1s per T3
 - ✓ 16 E1s per E3
 - ✓ Up to 128 connections per T3
- **Full interoperability**
 - ✓ Digital Link, Larscom, Kentrox simultaneous subrate and scrambling support
- **Direct termination**
 - ✓ Built in T3/E3 Line interface
- **Single wide PA for Cisco 7500 and 7200**
- **Cisco IOS 12.0T, 12.0S**



How Telcos can Leverage Lease Line Aggregation

- **If Telcos know that ISPs are going to have a lot of lease lines coming to one location, then proactive planning will keep the Telco's cost down.**
 - ✓ **Co-Locate the DACS (Digital Access and Cross-connect System) with the ISP's Operations Center.**



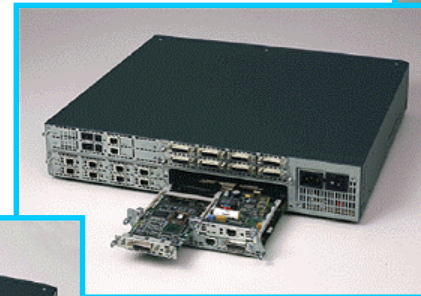
Dedicated Internet Access Technologies and Products

Low End Lease Line Aggregation

- **Maximum investment protection, scalability, and flexibility**
 - ✓ Five major platform groups
 - Over 70 shared NMs, WAN interface cards, voice interface cards, and AIMs
- **Broadest multiservice capability in the industry**
 - ✓ Data, voice, video, dial, VPN, and ATM edge integration



Cisco 3660



Cisco 3640

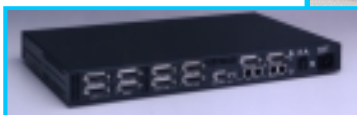


Cisco 3620

Cisco 2600



Cisco 2622



**Over 500,000
Units Sold!**

Cisco 2522 - Low Cost Lease Line Aggregation

- **1 Ethernet (AUI/10BT)**
- **2 High-speed synchronous serial**
- **1 ISDN BRI S/T interface**
- **8 Low-speed (115.2 kpps) asynchronous/synchronous serial (5-in-1)**



Modular Access Router Family

- 50–70 kpps fast switching
 - 3–4 kpps process switching
 - Four network module slots
-
- 25–40 kpps fast switching
 - 1.5–2 kpps process switching
 - Two network module slots
-
- 12–25 kpps fast switching
 - LAN interfaces integrated
 - One network module slot

Versatility
Integration
Performance



Cisco 2600 Series: Versatility, Integration, Power



- Data, voice, dial, and VPN access
- Field-upgradable interfaces shared with Cisco 1600, 1700, and 3600 series
- Ethernet, Fast Ethernet, Token Ring, and mixed-LAN models
- Full Cisco IOS software support

Cisco 3660

- **Higher performance**
100 to 120 kpps
(Cisco 3640: 50 to 70 kpps)
- **Higher density: six slots**
- **Higher level of integration**
One or two Fast Ethernet ports
Two Advanced Integration Module (AIM) slots
Console port, aux port, dual PCMCIA card slots, dry contact closure
- **Higher availability**
Dual power (dual AC, dual DC, or AC and DC)
Hot-swap like-like network modules
Hot-swap power supplies



Cisco 3660 Mechanical Design

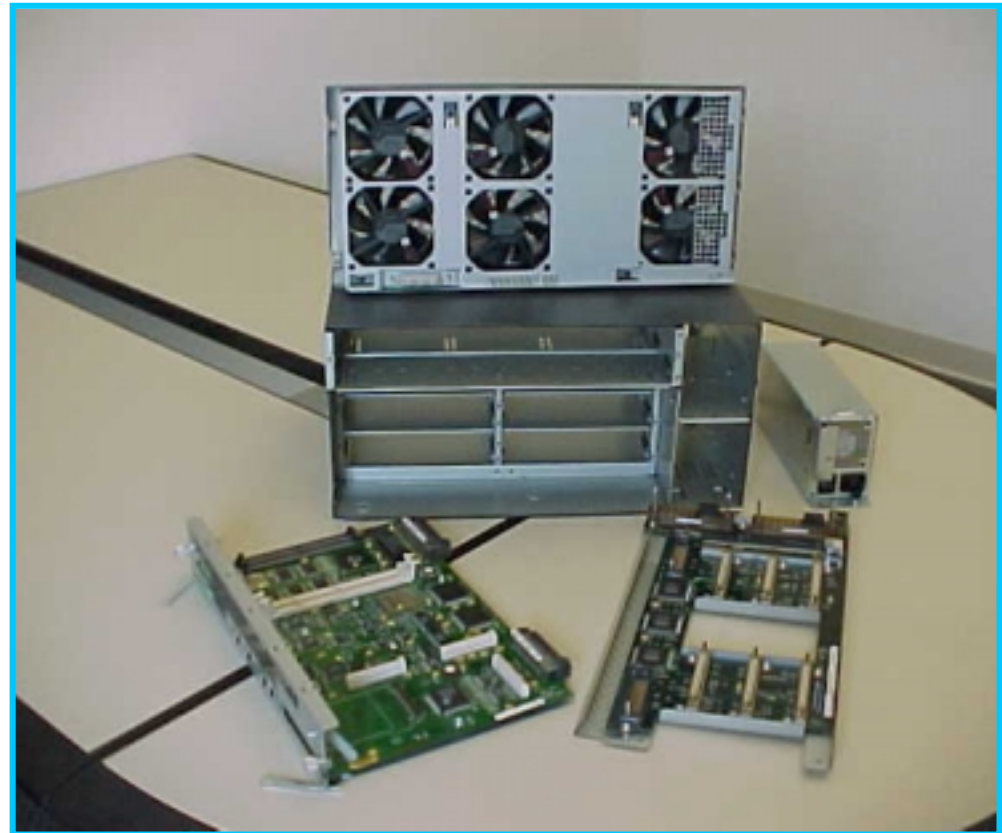
- Designed for mission- critical applications
- Designed for maximum uptime
- Designed for easier serviceability
- All components are field replaceable

Motherboard

Backplane

Fan tray

Power supply



Cisco 7200

LAN

- 1 Fast Ethernet (TX/FX)
- 2 Fast Ethernet (TX/FX)
- 4 and 8 Ethernet (10BaseT)
- 5 Ethernet (10BaseFL)
- 4 Token Ring (HDX/FDX)
- 1 FDDI (HDX and FDX)
- 1 100VG
- 1 ATM OC-3
- EtherSwitch (12E/2FE)
- Gigabit Ethernet**

WAN

- 4 and 8 Serial
- 4 E1 G.703
- 1 and 2 HSSI
- 4 and 8 BRI
- 1 ATM-CES
- 1 ATM (DS-3/E3)
- DPT-OC12**
- 1 Multichannel T3/E3
- 1 Channelized T3
- 4 and 8 Multichannel T1/E1
- 2 PRI/Channelized T1/E1
- 1 Packet-over-SONET
- 1 Channel (ESCON, Parallel)
- 1 and 2 T3/E3 with Integrated CSU/DSU

Multiservice

- Digital Voice Port
- Adapters
- ATM IMA



L3 Services

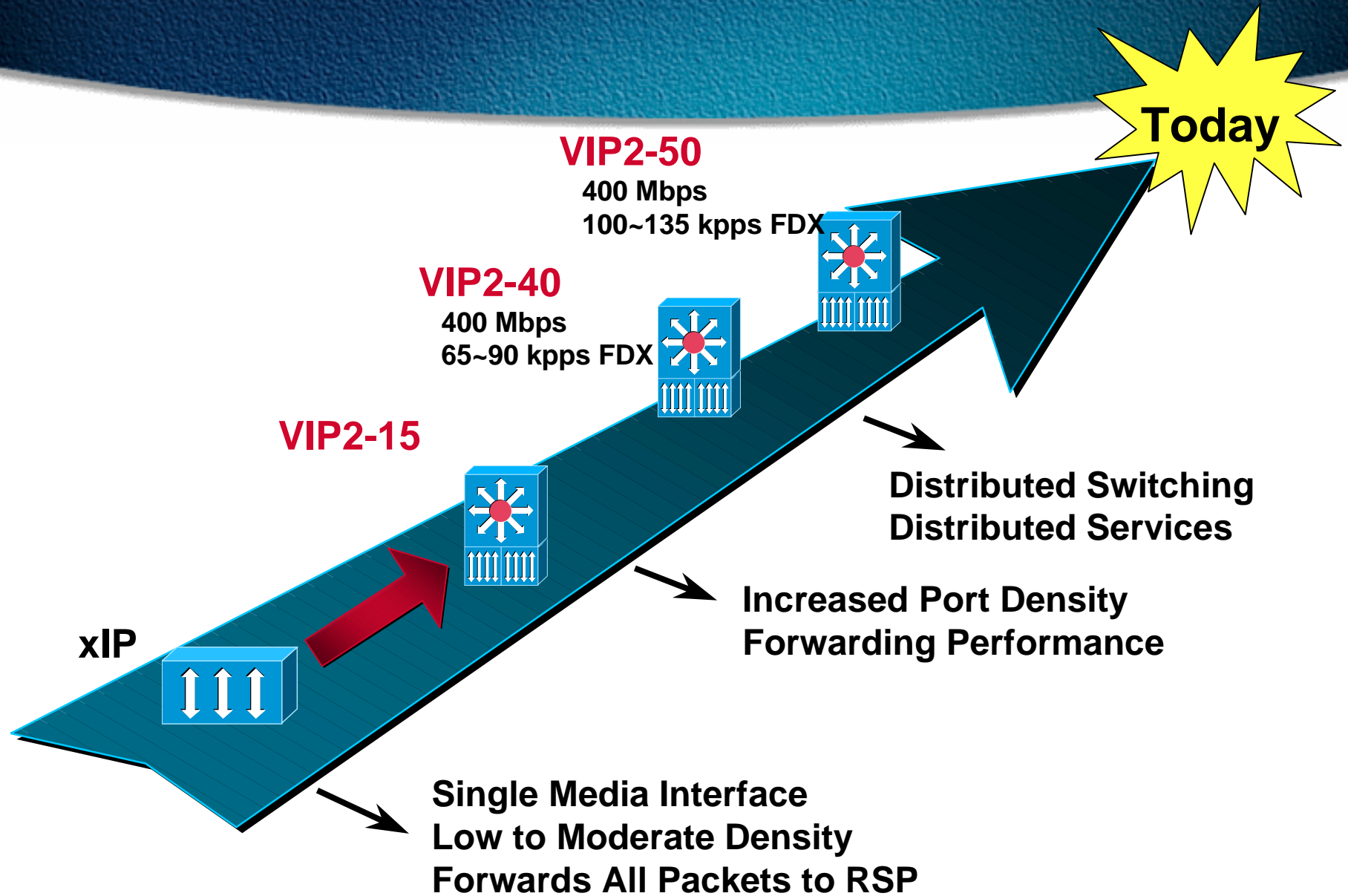
- Integrated Service Adapter**
- Compression
- Encryption

Cisco 7500 Series

Today

Capabilities	7505 	7507 	7513 	7576 
Routers / Chassis	1	1	1	2
Chassis / Rack	3	2	2	2
Bandwidth	1.0 GB/s	2.0 GB/s	2.0 GB/s	4.0 GB/s
Chassis Slots	5	7	13	13
Interface slots	4	5	11	11
Max. processors*	1	2	2	2
Max. power supplies	1	2	2	2

VIP Family



Multimedia, Multi-Service Connectivity

LAN

- 4 and 8 Ethernet
- 5 Ethernet (10BaseFL)
- 1 Fast Ethernet (TX/FX)
- 2-Port FEIP2
- 1 FDDI (HDX and FDX)
- 4 Token Ring (HDX/FDX)
- 1 100VG
- Fast EtherChannel

NEW!

Gigabit Ethernet

DPT

ATM OC-12

Red
= future

WAN

NEW!

Serial

- 4/8 Serial
- 1/2 HSSI
- 4-Port G703 E1
- JT2
- 2-Port PRI ISDN/
Ch. T1/E1
- Channelized T3IP
- POSIP OC3

T3/E3 PA
POS PA

Multichannel

8-T1/E1/DSX1
CT3/CE3

ATM

OC-3
DS3/E3
IMA

Layer 3 Services

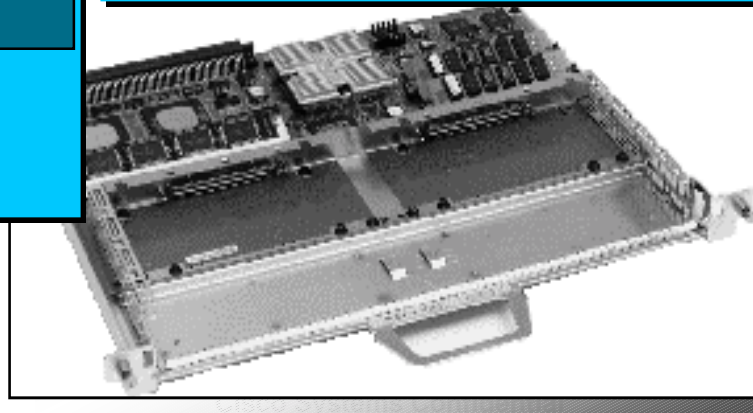
- Compression Adapter
- Encryption Adapter
- Dist. Compression
- Dist. Encryption
- Dist. LANE

NEW!

- Dist. IP QoS
- WRED, CAR, WFQ
- Dist. Multicast
- Dist. NetFlow
- Voice Adapter

ISA

Modular QoS
NBAR Classification



Dedicated Internet Access

Cisco 10000 Edge Services Router

High Performance IP Services

- based on IOS 12.0S
- MPLS
- QoS (WRED, CB-WFQ)
- Access lists
- CAR
- Multicast
- MLPPP
- and more...

Leadership Port Density

- up to 2000 DS1 hardware connections per chassis
- 6000 DS1s hardware connections per rack



High Availability

- Redundant point-to-point backplane connections to every port
- Separate data and control path
- Redundant power and cooling
- Route Processor Redundancy (RPR)
- POS 1:1 APS
- All elements hot swappable

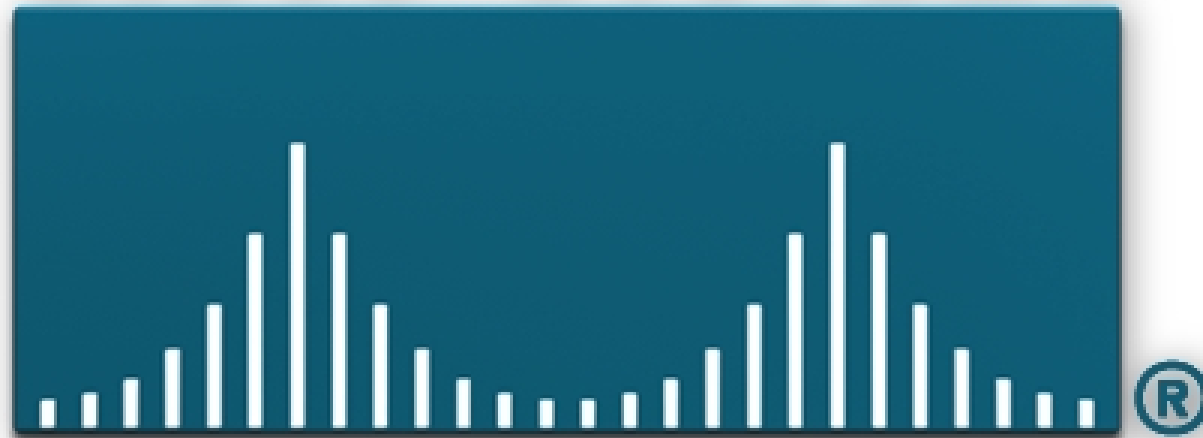
Central Office Packaging

- NEBS Level 3
- redundant AC or DC power
- Front-back airflow
- 12" depth, 21 3/4 height

Summary

- **Stack and Rack works and scales**
- **Channelized links are the best way to scale lease line infrastructure**

CISCO SYSTEMS



EMPOWERING THE
INTERNET GENERATIONSM