Ascend

Ascend @ The Heart Of The Internet

Ascend Communications, Inc
October 1997

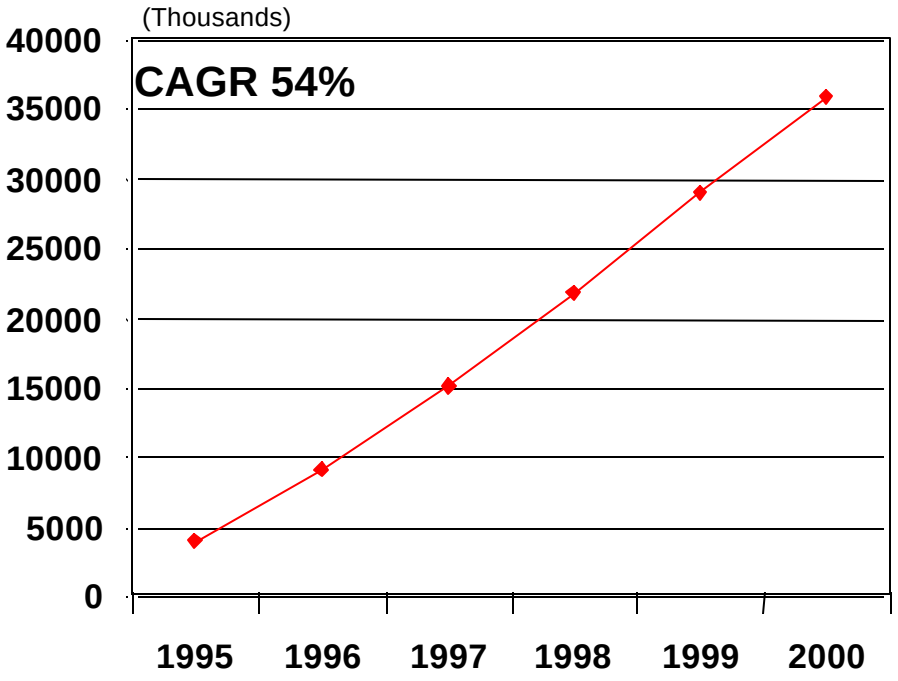
ASCEND

Ascend's Internet Mission

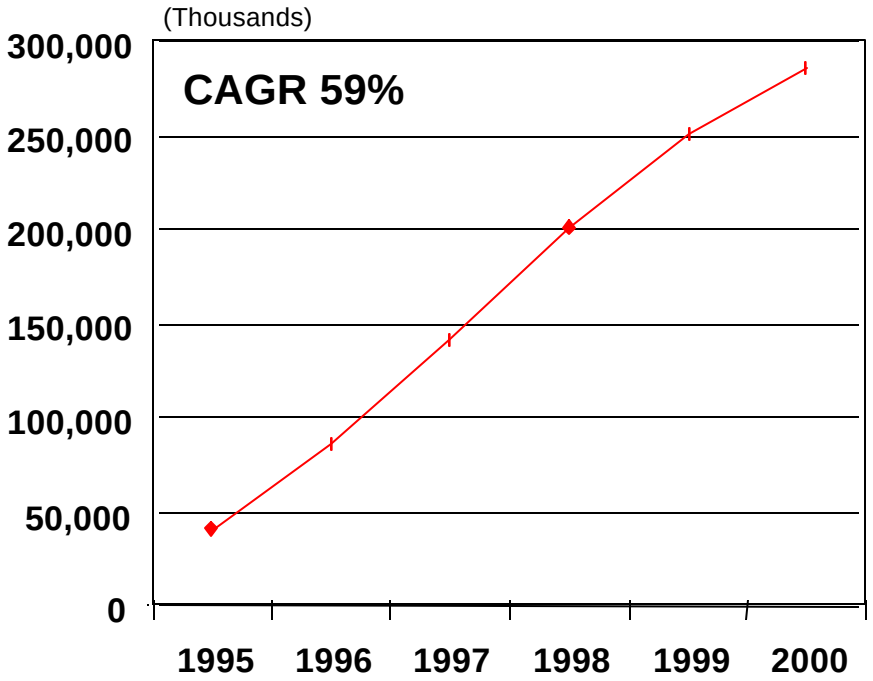
Bringing Business Class Solutions with the Next Generation Internet

The Internet - Just Keeps Growing

Number of Internet Users



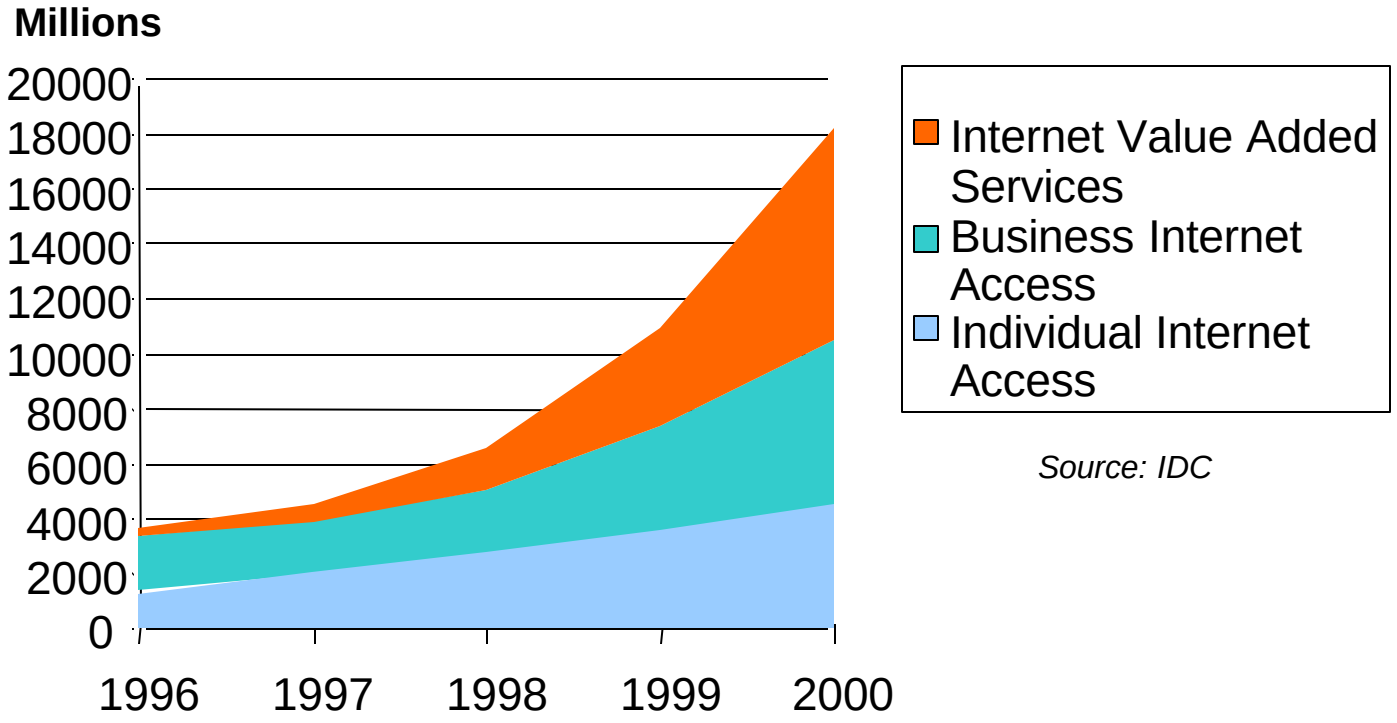
Number of Internet Devices



Source : IDC

The size and number of users of the Internet is projected to continue significant growth well into the next century

World-Wide Internet Market Revenues

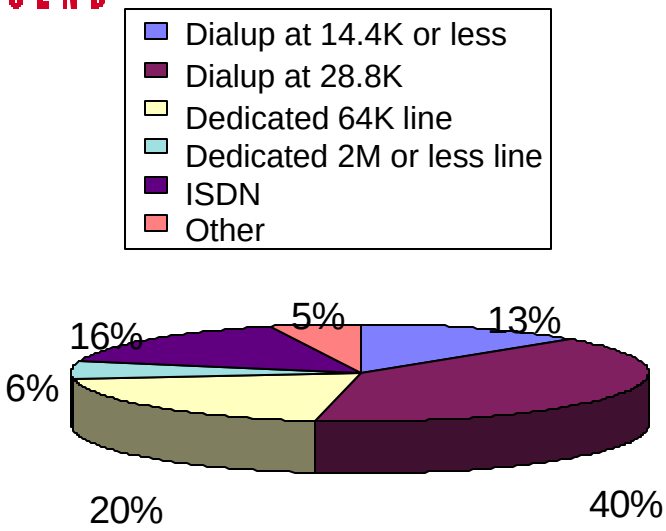


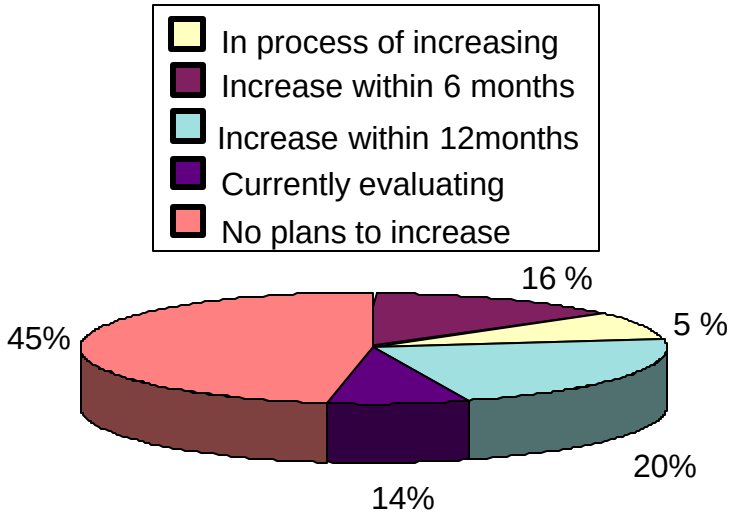
Source: IDC

- **Individual Internet Access represents a $1 B opportunity in 1996, growing to over $3 B in 2000**
- **Business Internet and Internet Value Added Services represent a $2.2B opportunity in 1996, growing to $14.6 B in 2000**

Business Internet applications will be the significant revenue opportunity within the $18B Internet market in 2000

Business Internet Want High Speeds
- 40% Want ISDN

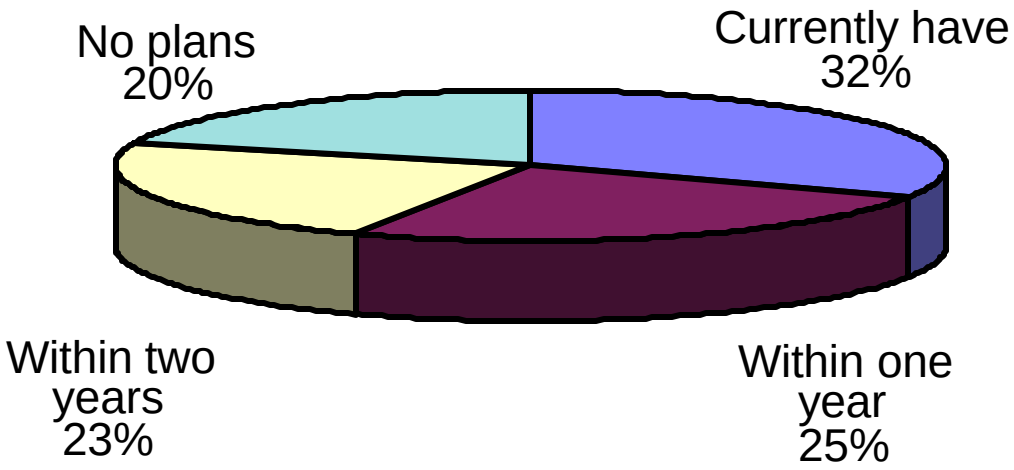




- **51% of Enterprise's have Internet Access**
- **Enterprise Internet applications growing well beyond e-mail**
- **Access rates increasing rapidly (56 K, ISDN, leased lines)**
- **Business users now looking for Business Class network solutions**
- **Internet as a WAN extension (for branch office interconnection)**
- **Security main issue to accelerated deployment**

Source: IDC WAN Manager Survey 1997

Internet Impact On Enterprise Networks



- **Intranet is a private network that uses web technology as a mechanism to share information.**
- **Intranet plans well advanced**
- **Very strong in Retail and Finance sectors**
- **E-mail and access to corporate information key drivers**

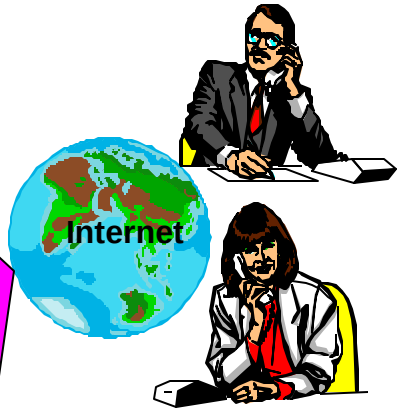
Source: IDC WAN Manager Survey 1997

Internet / Intranet A Business Tool

Branch Offices

Intranet

Internet Commerce



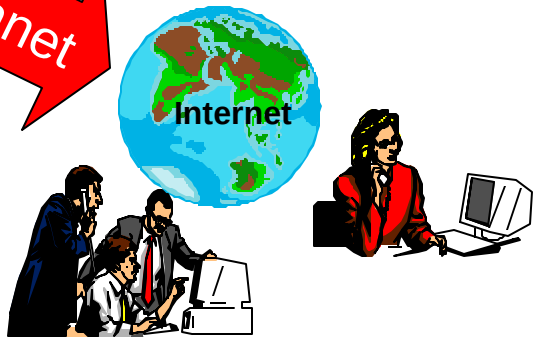
Customers

Mobile & Teleworkers

Intranet

Internet Utility

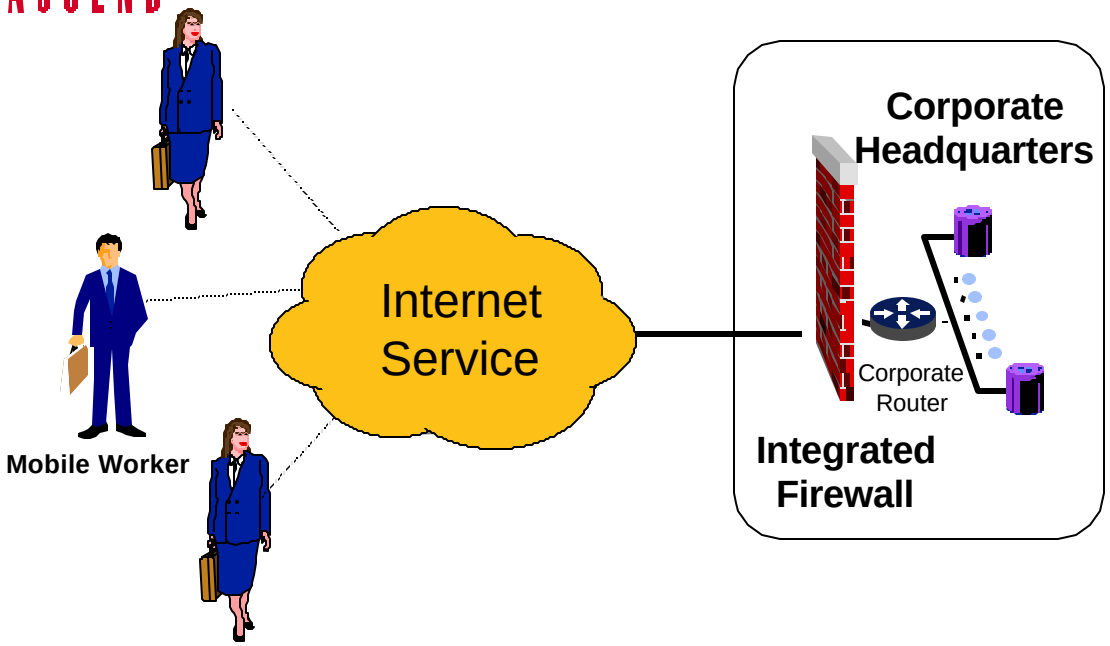
Extranet

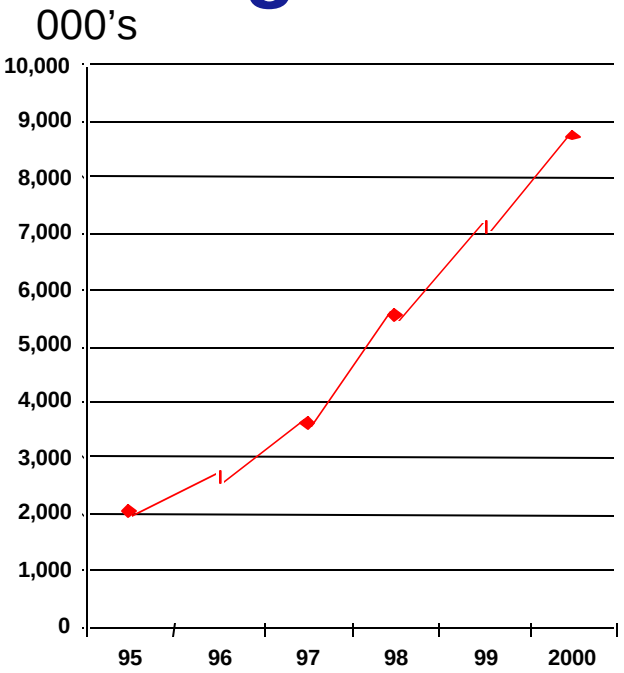


Internet WWW

Supplier, Partners and Customers

Growth Of Mobile Working



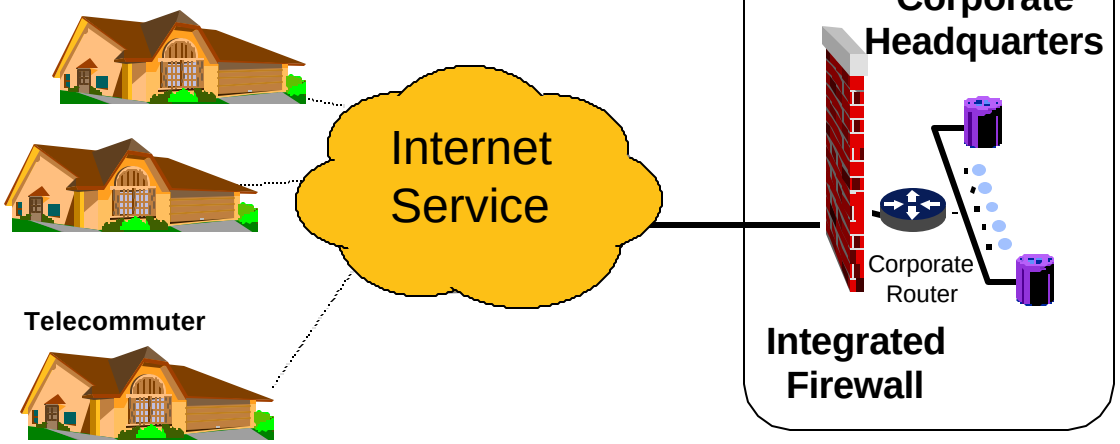


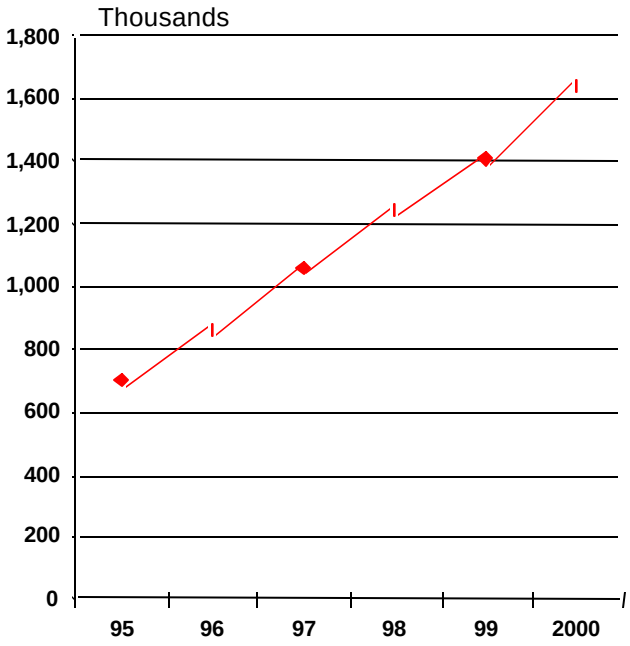
Number of Mobile Workers

- **Mobile workers are employees who regularly work outside their office or even have no permanent working location**
- **Outsourcing of this network requirement offers significant revenue opportunity for ISPs**
- **Security is critical issue in networking design**

Source: IDC European Remote Access Survey 1997

Growth Of Teleworking



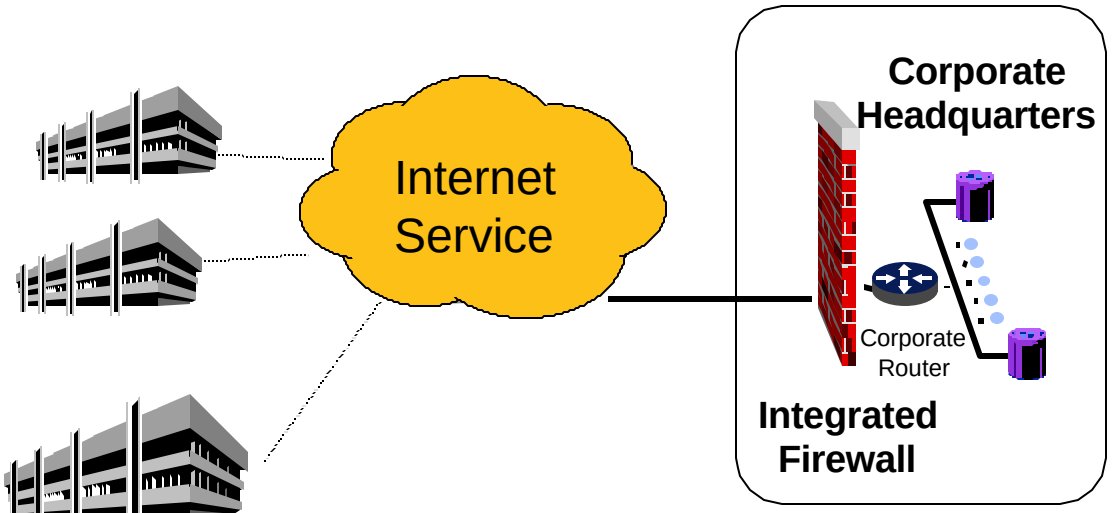


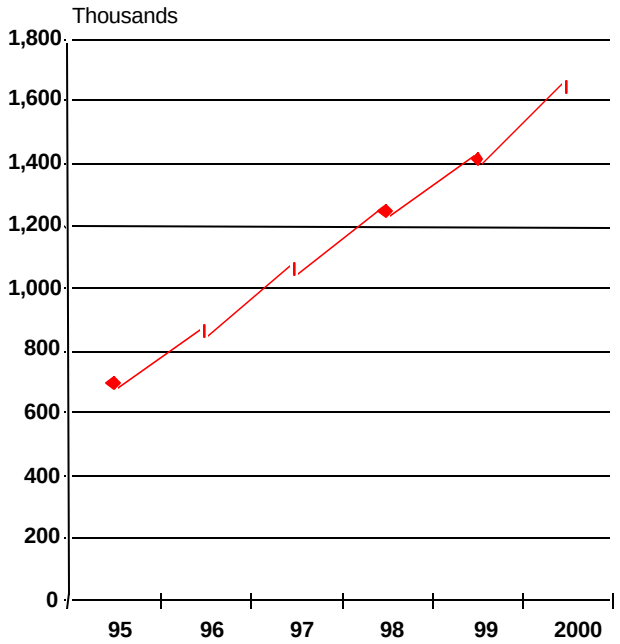
Number of Teleworkers

- **Teleworkers are employees who regularly work outside their office but their location is not mobile**
- **Outsourcing of this network requirement offers significant revenue opportunity for ISPs**
- **Security is critical issue in networking design**

Source: IDC European Remote Access Survey 1997

Growth Of Branch Office Connectivity





Number of Branch Offices

- **Branch office workers have access to same tools and information as those at corporate HQ, e.g. database access**
- **Branch office may be as small as two PCs or as large as an office with multiple LANs**
- **Connections mainly to their Enterprise backbone via ISDN, ISDN/Frame Relay, or Frame Relay**

Source: IDC European Remote Access Survey 1997

Internet Market Environment Summary

- **Exponential Growth Rate World-Wide**
  - 120 million subscribers today, 350 million in 3 years
  - Ever increasing dial access numbers & speeds
  - Increasing leased line access speeds
  - Backbone bandwidth doubles every 6 months
- **Increasing Importance to Business**
  - Intranet phenomenon
  - Teleworking/Mobile working outsourcing
  - Willing to pay for a premium service
- **New Applications and Customer want Quality of Service**

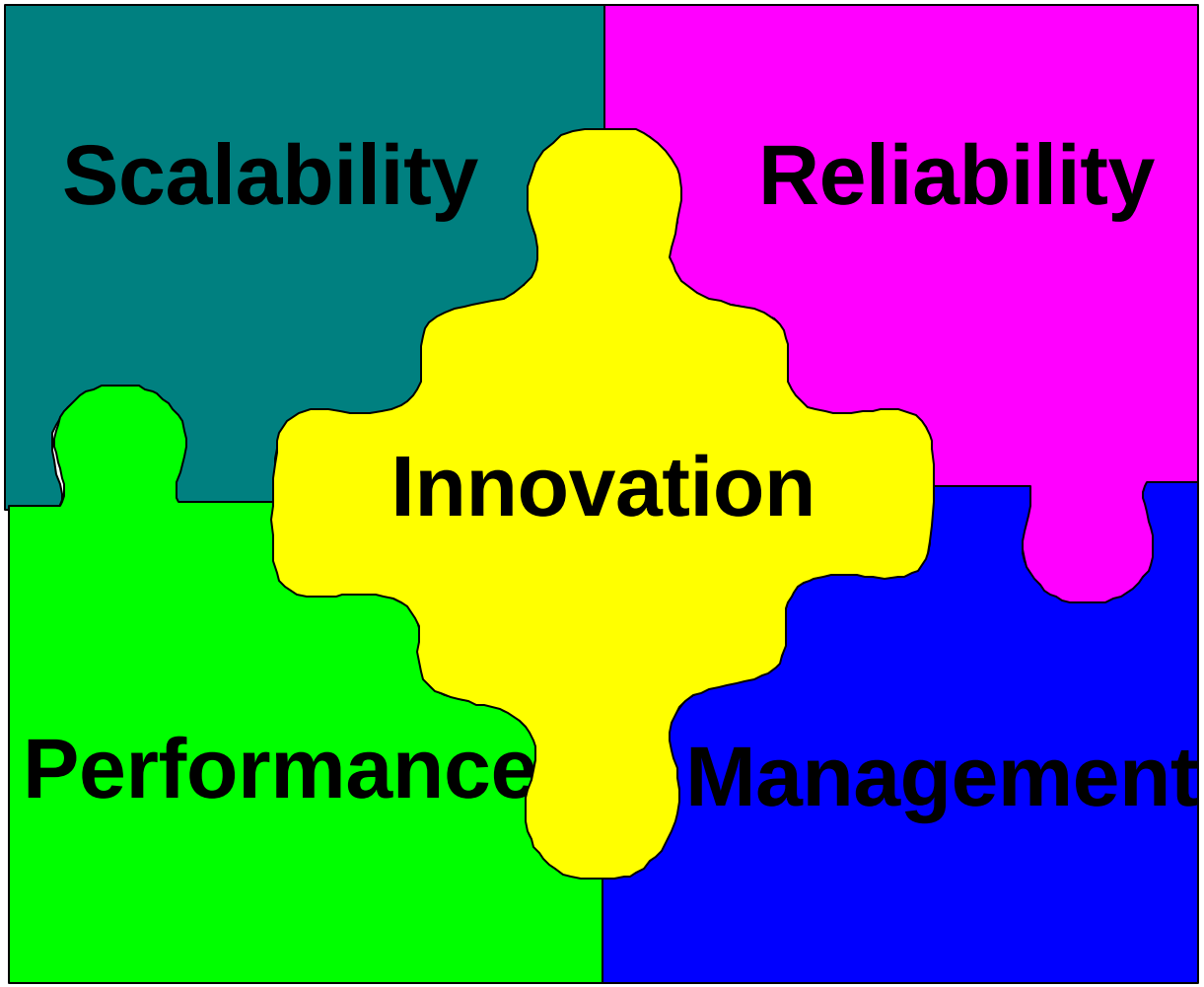
Key Business Challenges For ISPs

- **Managing increased user demand**
  - Number of Users
  - Requirement for increased speed
- **Introduce and Market Quality of Service as differentiation in intensively competitive environment**
  - Business Class Network
- **Identifying and offering value added services**
  - Mobile/Teleworker Outsourcing
  - Virtual Private Networking (Intranets/Extranets)
  - Voice, Fax & Video over the Internet
- **Lower operations costs**
  - Maximize use of high cost International bandwidth

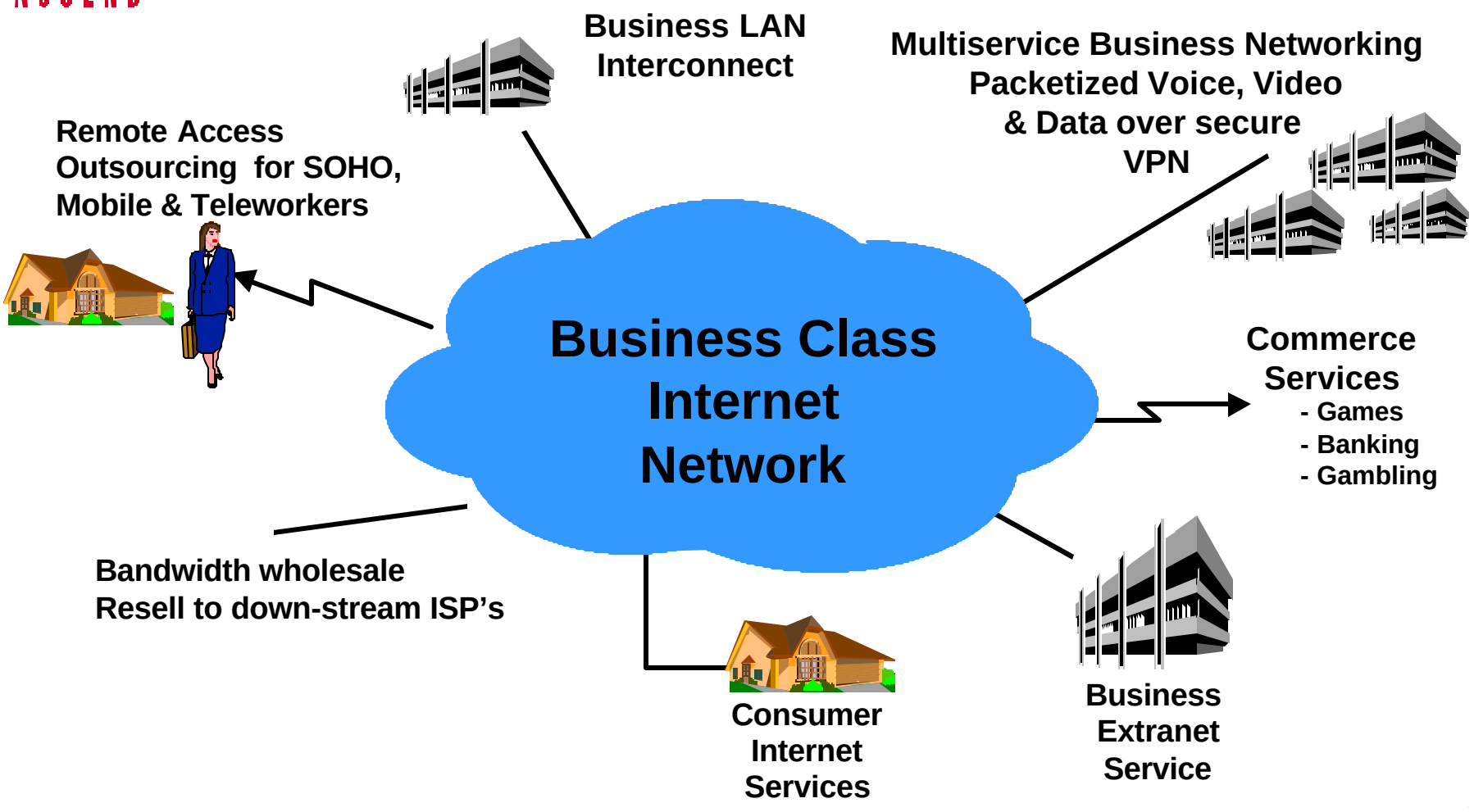
Technical Issues Facing ISPs

- **Network and Service reliability for business Applications**
  - Business Class Network
- **Scalability of Access and Backbone**
  - Backbone capacity & routing table size
  - Port densities
  - Access rates
- **Implement network wide security management systems**
- **Maintaining and improving performance as traffic increases**
  - Prevent International link saturation with low value traffic
- **Implementing Virtual Private Networking**

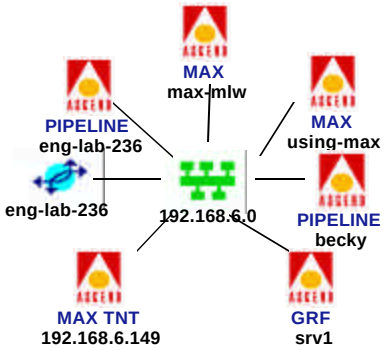
Internet Business Class Service Must Provide:



INNOVATION: Multiple Services On One Network



MANAGEMENT : Network, Service and Security

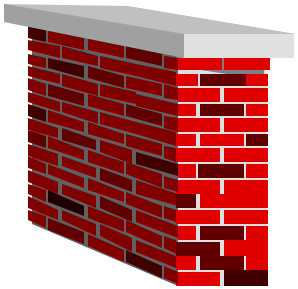


Navis Access delivers mission-critical tools in all key management areas

- Discovery and mapping
- Remote access
- Java-based Configuration
- Fault
- Performance
- Security and Accounting

Access Control delivers

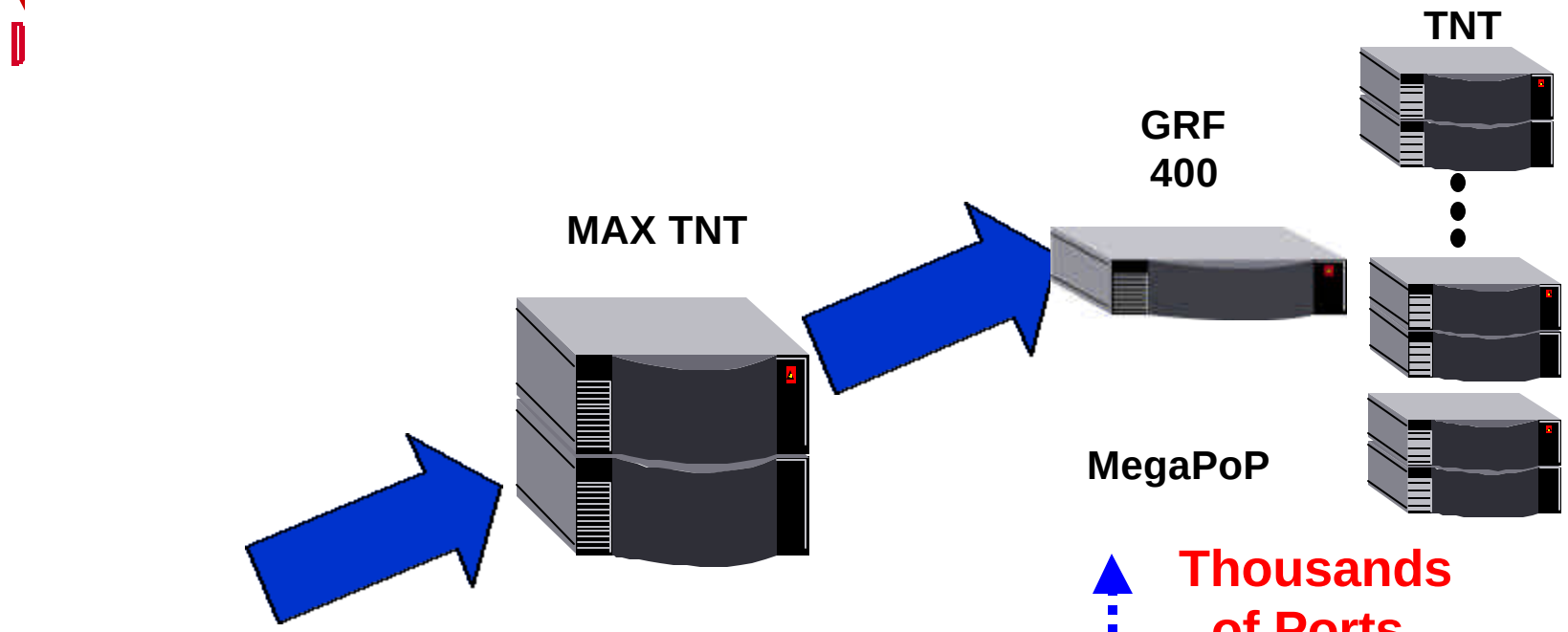
- User identification
- User authentication
- User authorization
- Intranet and Virtual Private Network
  - Proxy-RADIUS
- Resource management
- Accounting



Secure Access delivers

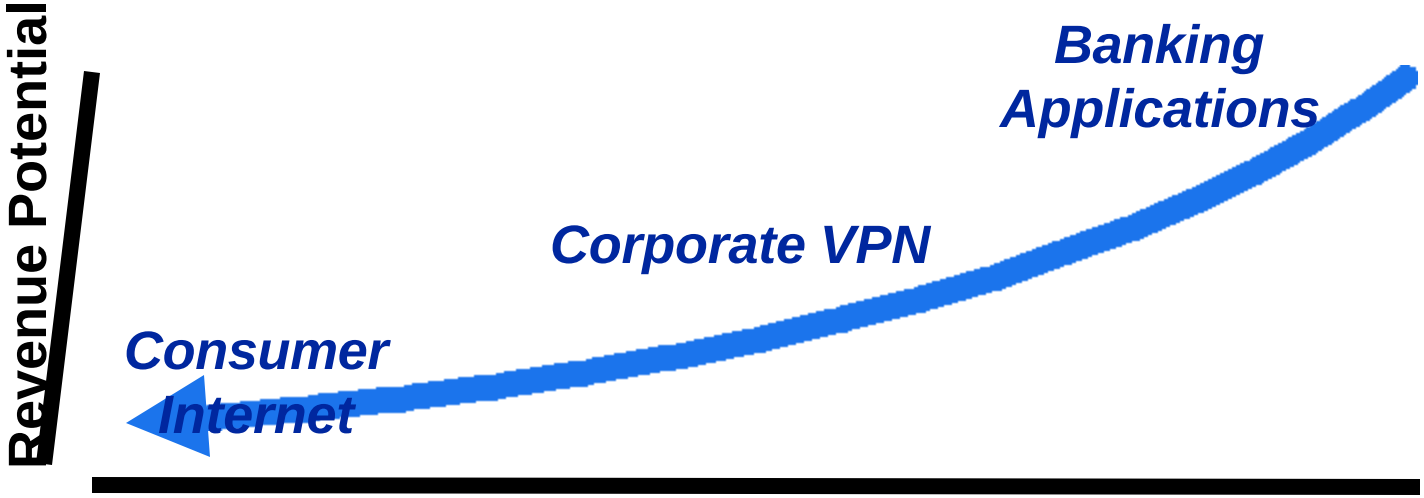
- Central and local Firewalls. Secure Access Manager provides configuration of firewalls from a central site
- ISPs can sell/lease Pipelines and offer firewall protection to corporate customers as a value-added product
- ISPs can enhance their virtual private network offering to corporate clients

SCALABILITY : Network Solution That Grows With Your Business



Integrated solution with Common Features, Management and Services

RELIABILITY : User Class Of Service



Phone Number	Customer	Price	InDial	Authentication	WAN QoS
262 1000	Bank	High	5:1	Encryption	CIR =64K
262 1050	Corporate	Medium	10:1	Token Based	CIR = 16K
262 1100	ISP	Low	40:1	Downstream	CIR=0

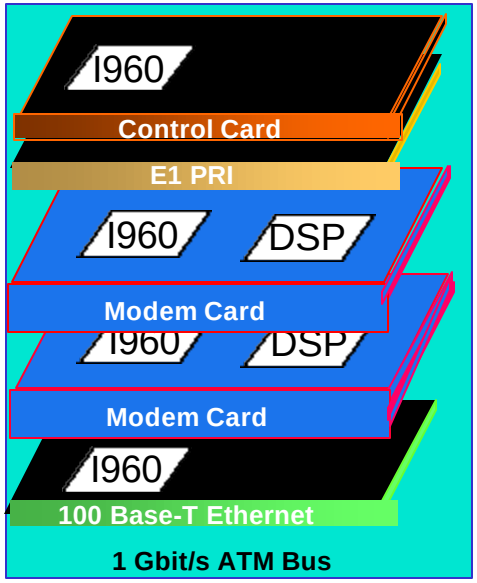
Quality of Service can be provided within both the dial and core network, for example :

Probability of getting a modem in a modem pool

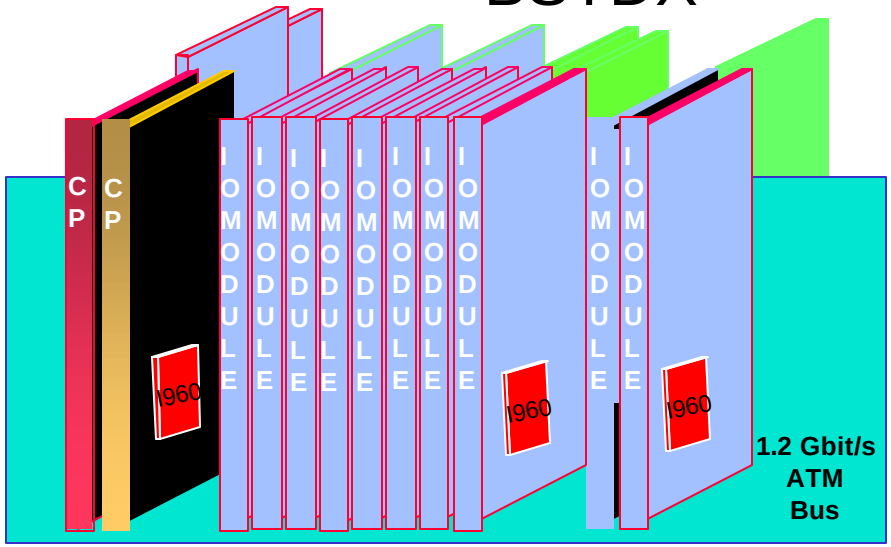
Commitment to backbone bandwidth and Priority

PERFORMANCE : Removal Of Bottlenecks

TNT

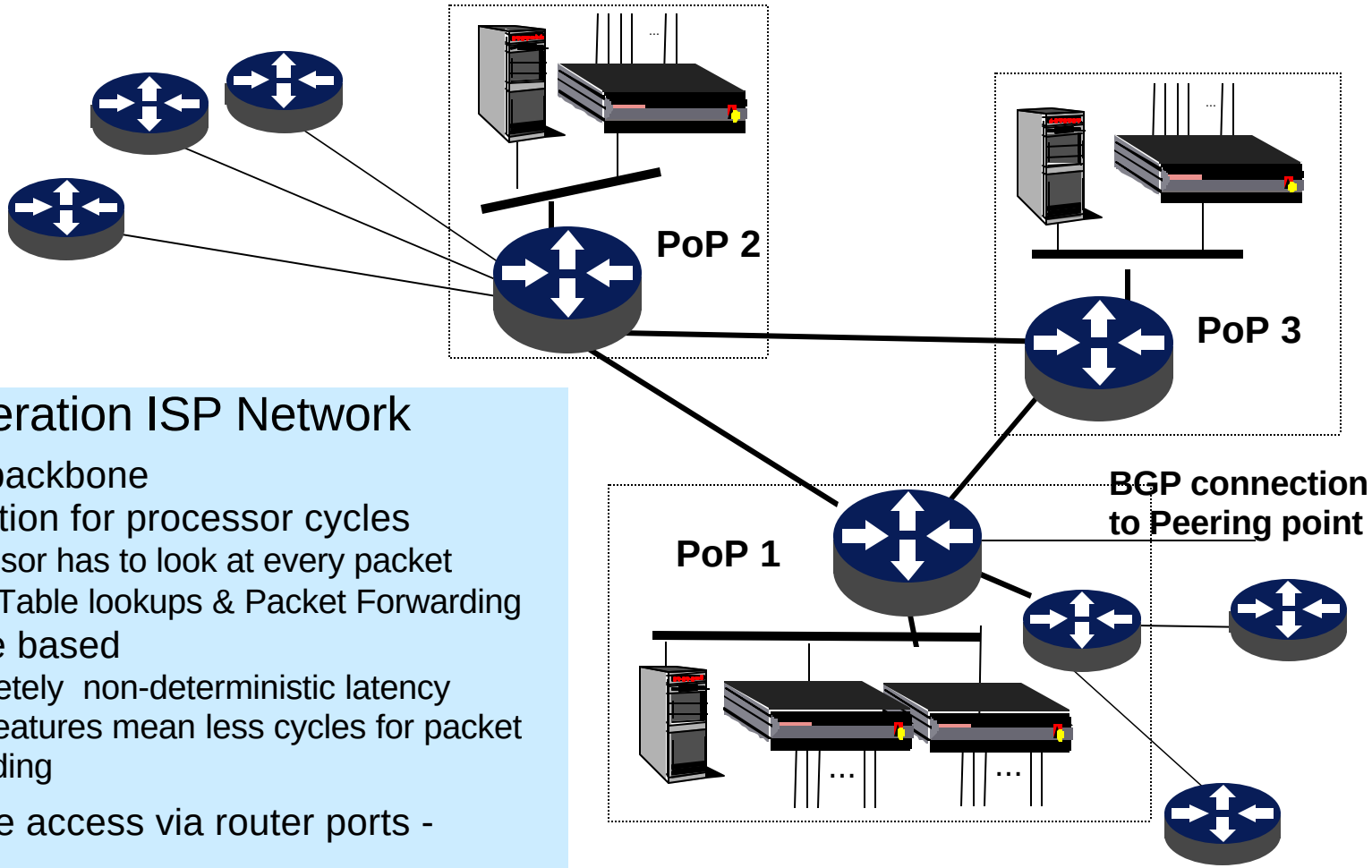


BSTDX



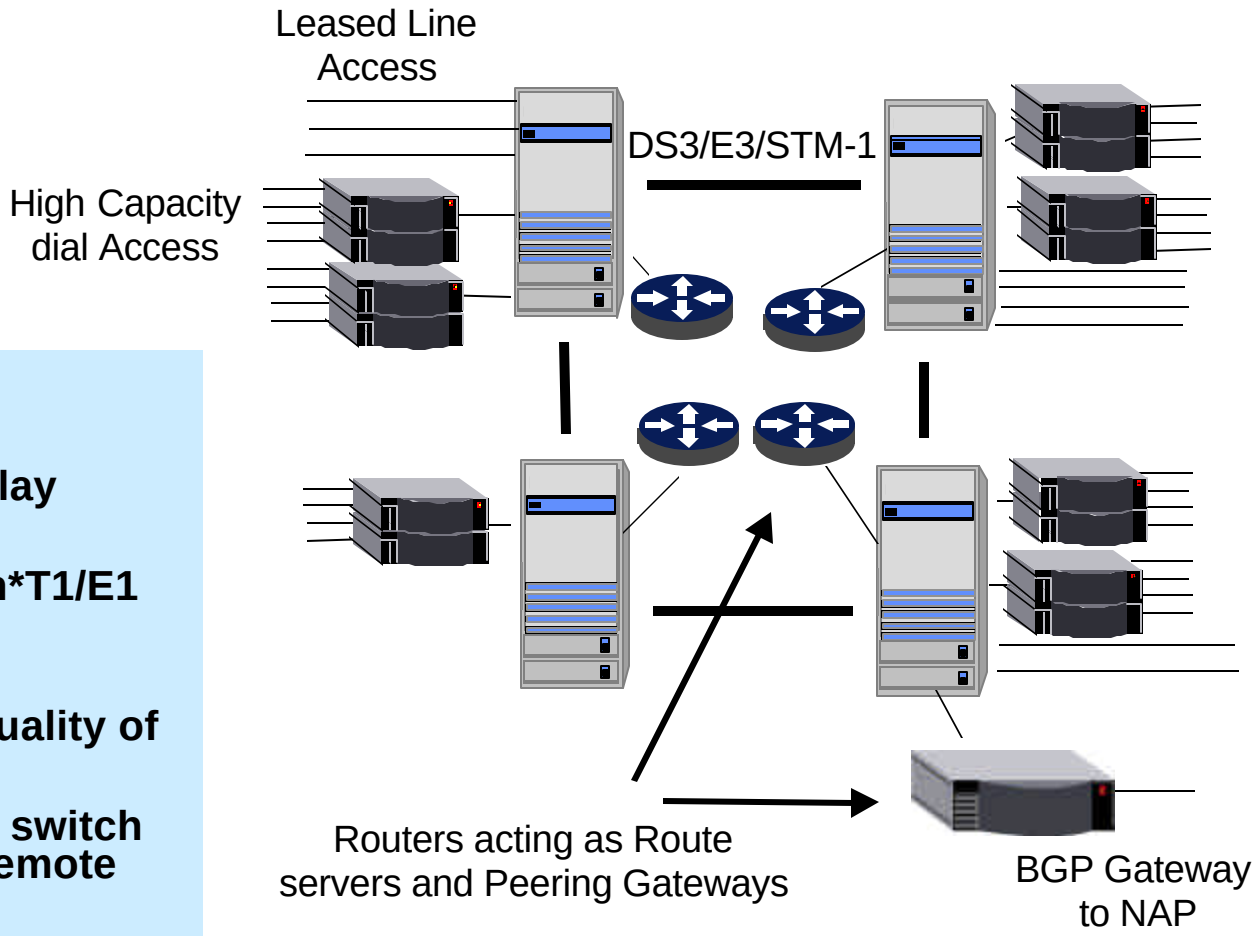
- **The TNT/BSTDX/GRF are modular products with dedicated processing on each line card**
  - Add more users add more processing power
- **Solution provides access performance from 1.2Kbit/s to 155Mbit/s**
- **Solution provides backbone performance from 64 Kbit/s to 622 Mbit/s**
- **Ascend IP switching solution provides the best packet throughput in the industry today**
  - 2.8 million pps

First Generation Internet Backbones



- 1st Generation ISP Network
  - All router backbone
    - Competition for processor cycles
      - Processor has to look at every packet
      - Route Table lookups & Packet Forwarding
    - Software based
      - Completely non-deterministic latency
      - More features mean less cycles for packet forwarding
  - Leased line access via router ports - expensive
  - Latency at every hop - No Quality of service
  - Massive Congestion
  - Limited route table size

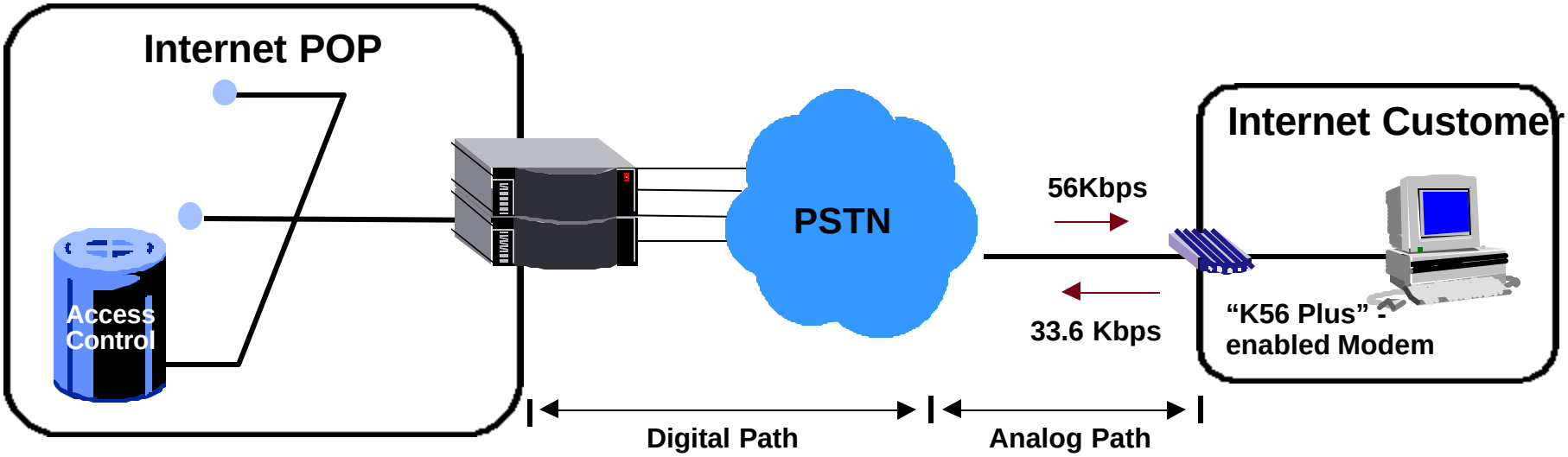
Adding Scalability, Resilience And Quality Of Service



2nd Generation

- Introduction of Switch backbone of Frame Relay and/or ATM
- Backbone bandwidth n*T1/E1 to 155 Mbit/s
- Switches add network resilience and some Quality of Service
- Leased line access via switch ports. High capacity Remote Access servers added
- Routers used as route servers & Peering gateways. Current router technology again becoming bottleneck

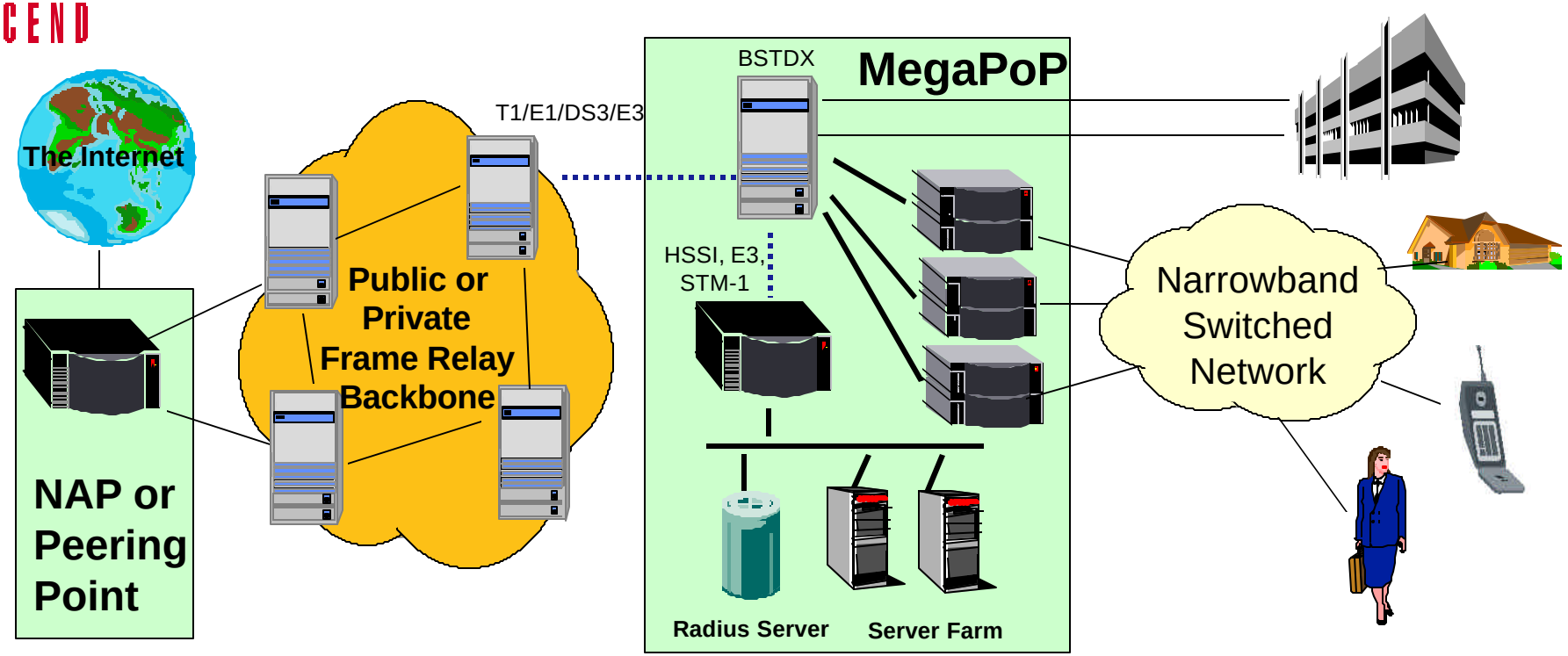
Adding High Speed Dial Access



56K Modem technology

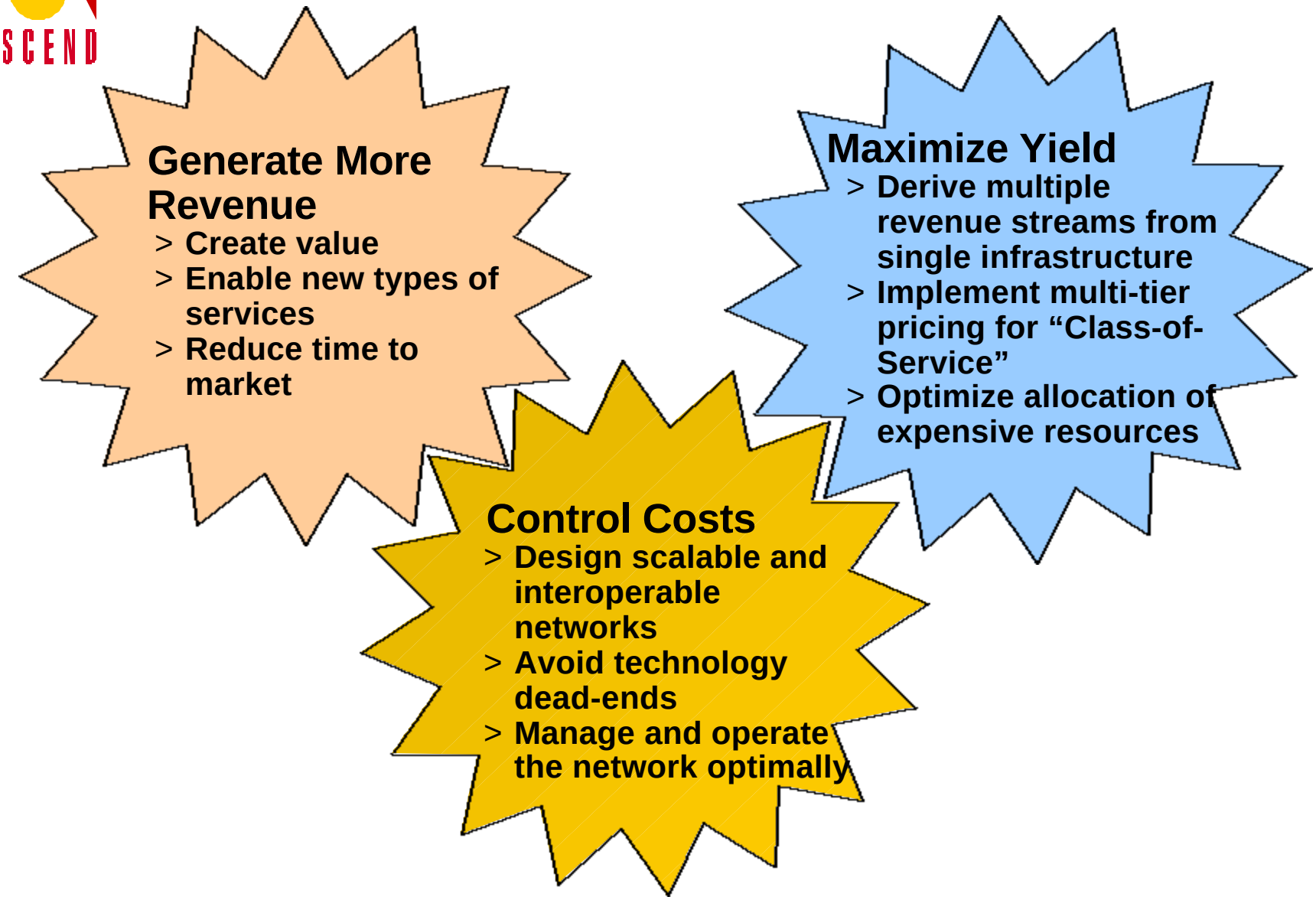
- Provides significant speed increase over PSTN access
- K56Flex technology from Rockwell & Lucent
  - 400 companies announced support
  - Now shipping in considerable numbers (over 2 million ports shipped to date)
- Available on both Max and TNT
- Upgrade to ITU-T standard as software reload

High Capacity Internet Backbone And Access

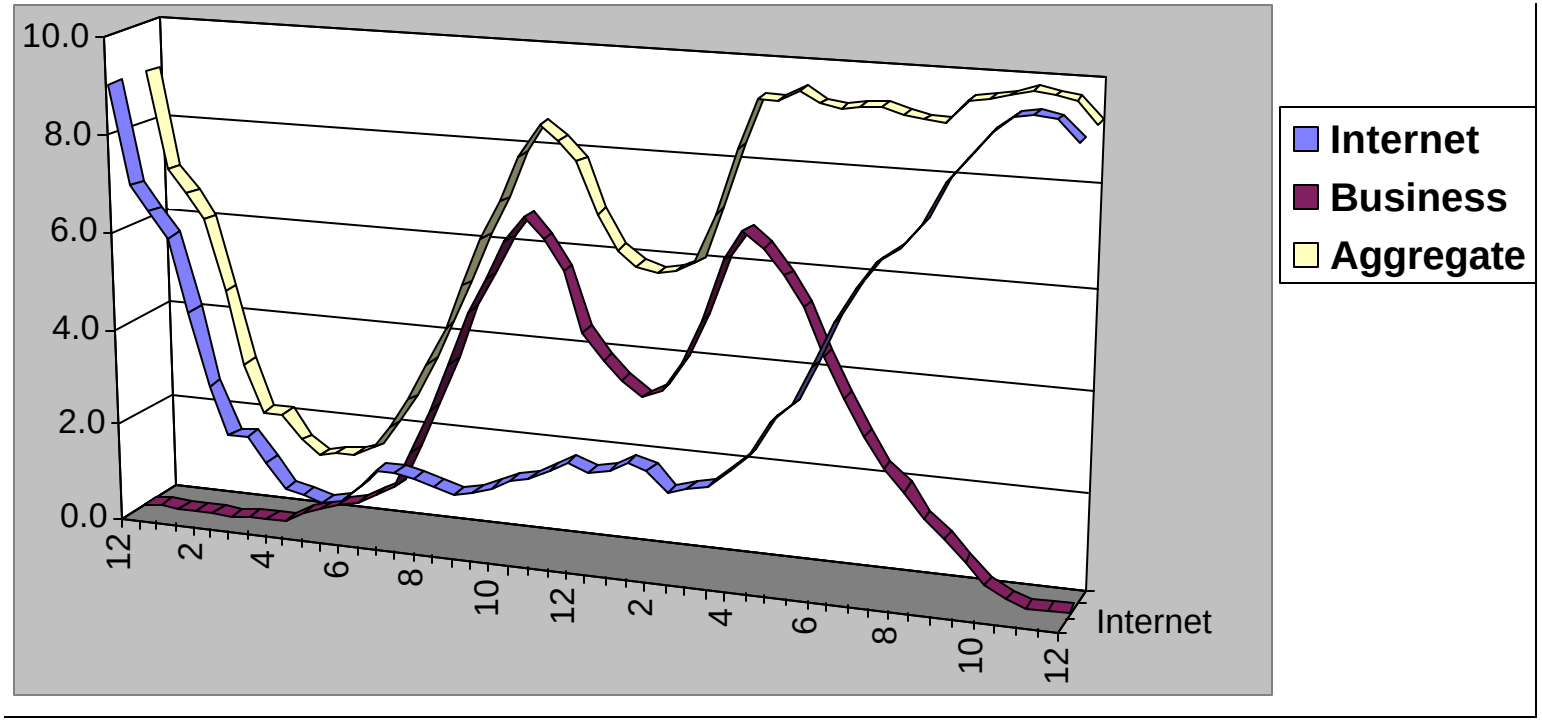


- **High Capacity Internet Backbone Provides**
  - High capacity Access Servers provide thousands of dial/ISDN ports
  - High speed leased line access via Frame Relay switches
  - High speed IP switching via Gigabit IP switches. Distributed and hardware assisted route table lookup to solve router table size issues
  - Wide Area transmission with Frame Relay or IP over SDH

Business Model For A Successful ISP

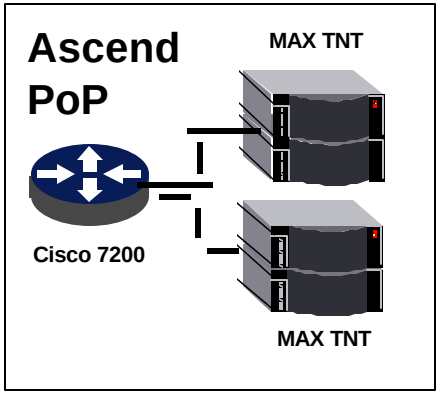


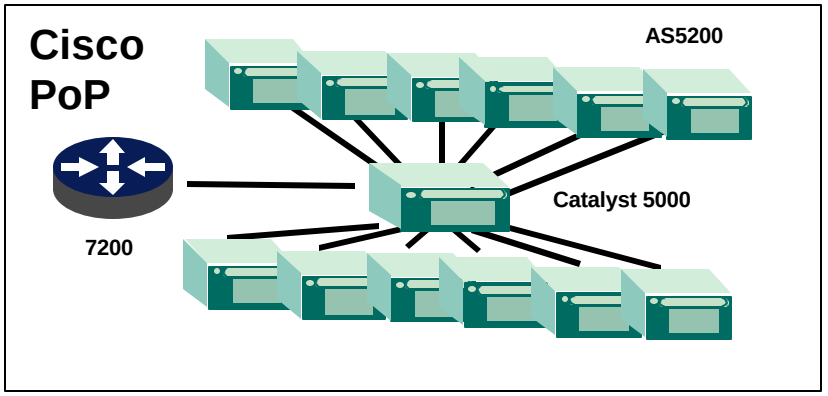
Maximize Network Yield



- Resell the same network for different applications
- Business traffic profile differ to general Internet profile
- Network engineered for evening peak Internet demand so reuse capacity during the day for Intranet and Extranets

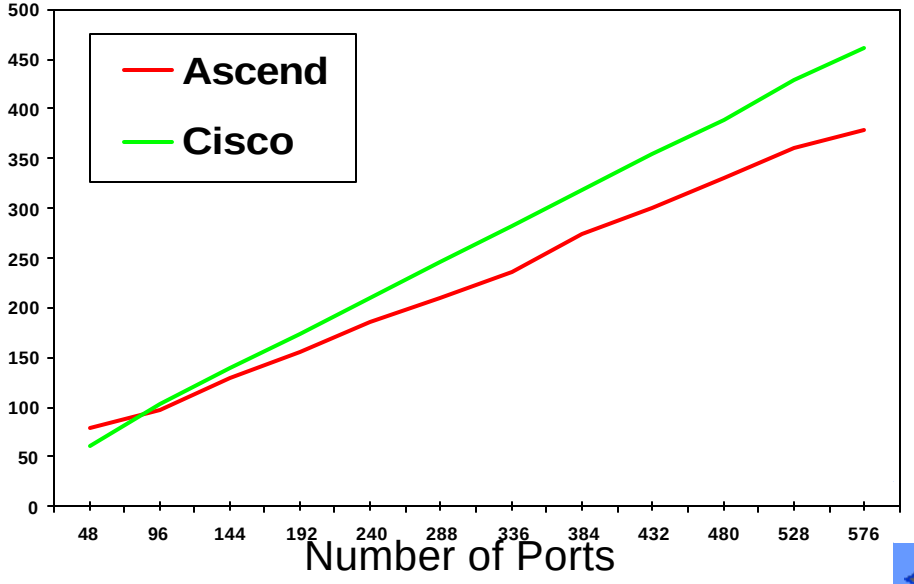
True Network Cost Is Not Just The "Cost Per Port"



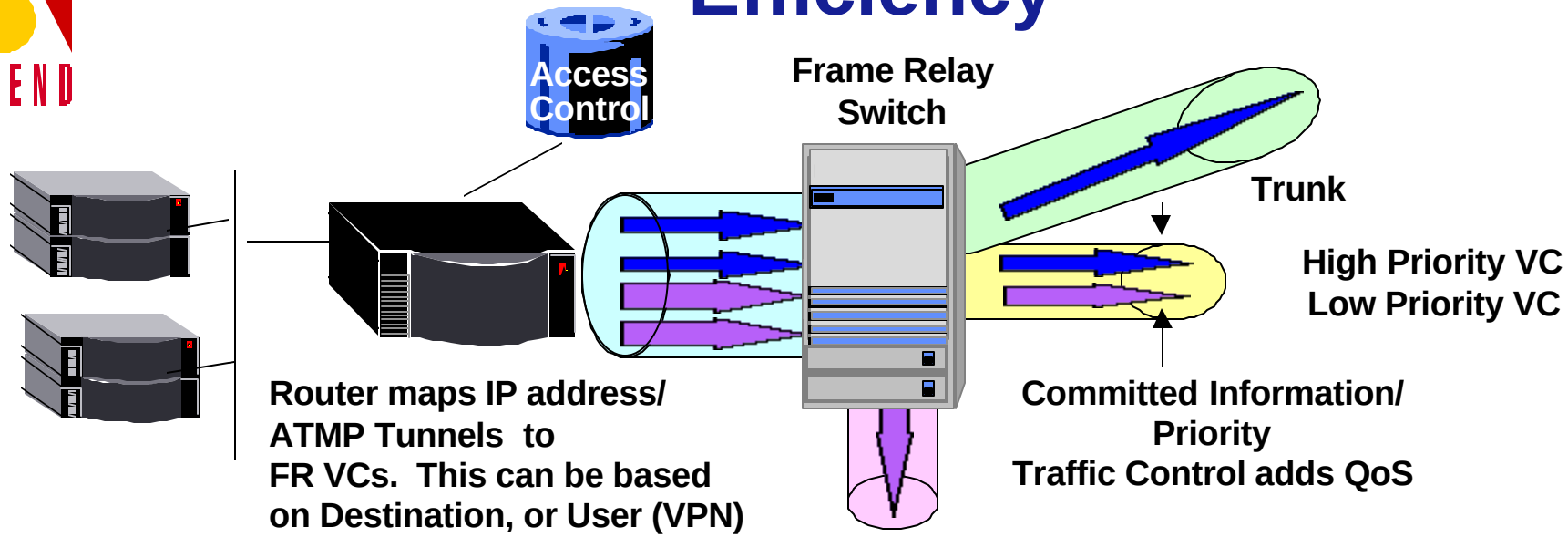


- **Cost Of Ownership**
  - Extra Space
  - Extra power
  - Extra spare
  - Configuration/Management
- **Space = money**
- **Power = money**
- **Spares = money**
- **Additional points of failure = less reliable system**

List Price US$

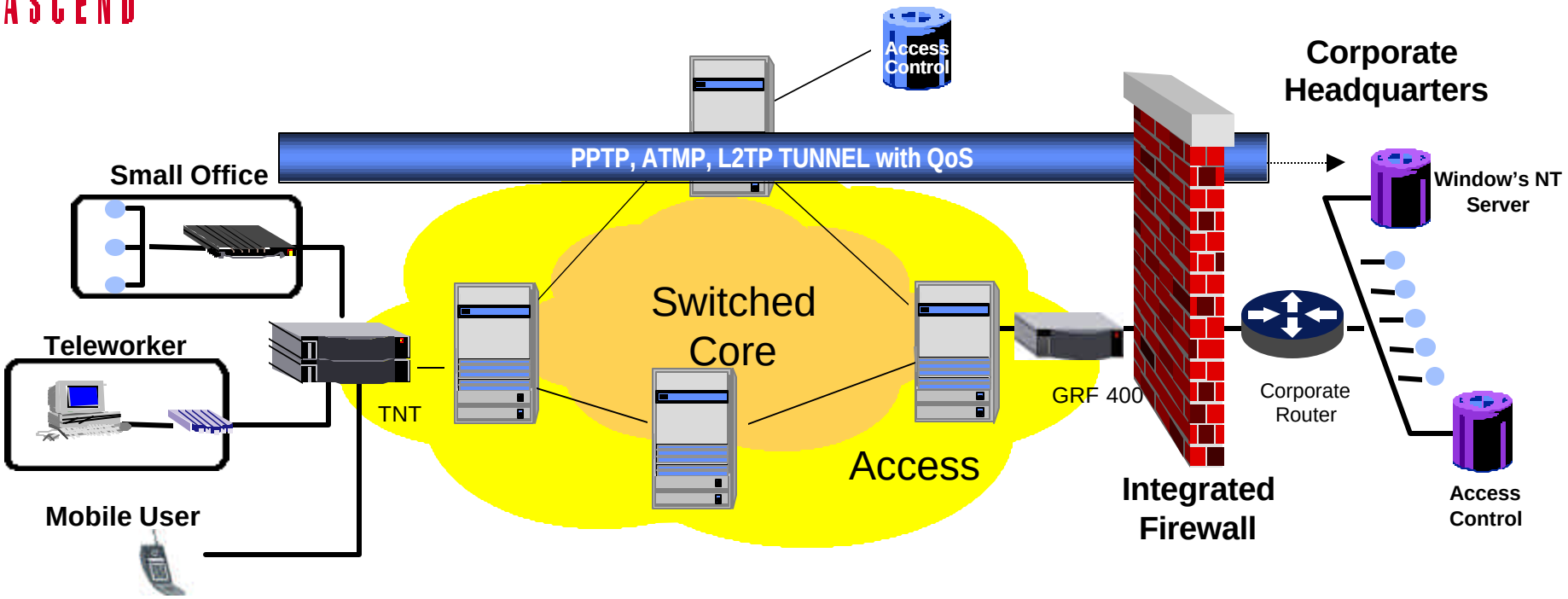


Switch Network Improves Backbone Efficiency



- **Switch based networks support over subscription of backbone trunks**
  - More bandwidth means less cost
  - Typical Internet Service Provider:
    3 - 8:1 on T1/E1 Links
    5 - 10:1 on DS3/E3 Links
- **Customer QoS objective maintained at minimal bandwidth cost**
  - Priority given to high value traffic. Particularly important on expensive International links
- **IP networks can only guarantee customer QoS objectives when:**
  - Backbone bandwidth pool the sum of subscriber port access rates

Virtual Private Network Access

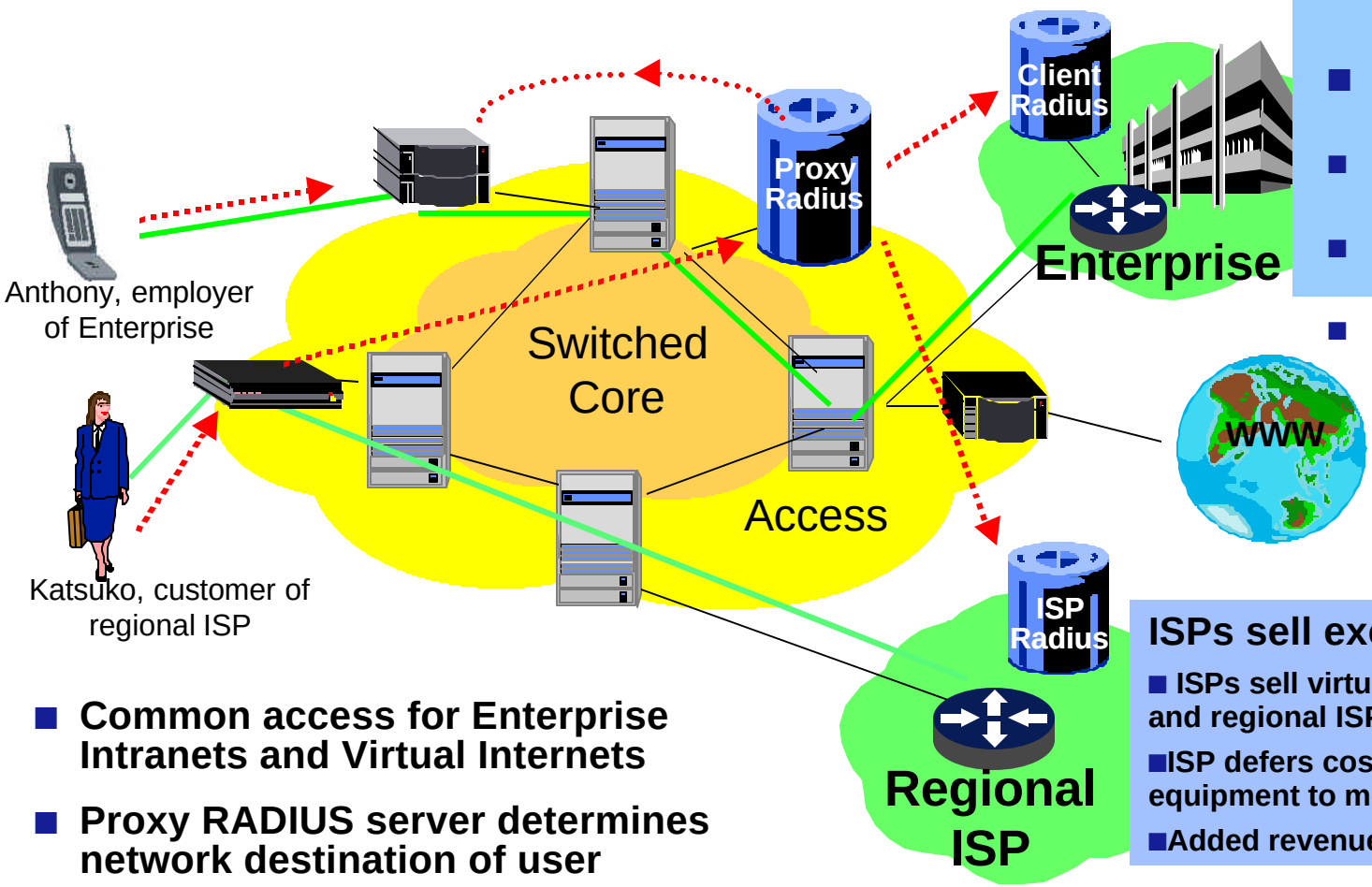


- **VPN Provides**
  - Secure connections from users to corporate network with Quality of Service
  - Require security options based on user authentication (radius) and Firewalls
  - Tunnelling used not routing
    - Use standards as defined : PPTP, ATMP, L2TP
  - Offers Virtual Private Intranets off a common infrastructure as public Internet.

Security - Access Control

- Comprehensive network-wide security management solution
- Fully compliant with the de facto industry standard – RADIUS
- Authentication, authorization and accounting for analog and digital users
- Scales for small to large implementations
- Facilitates enhanced VPN & Intranet service offerings
- Centralized and/or distributed management of users

Virtual Private Intranets and Extranets



Enterprise Intranet:

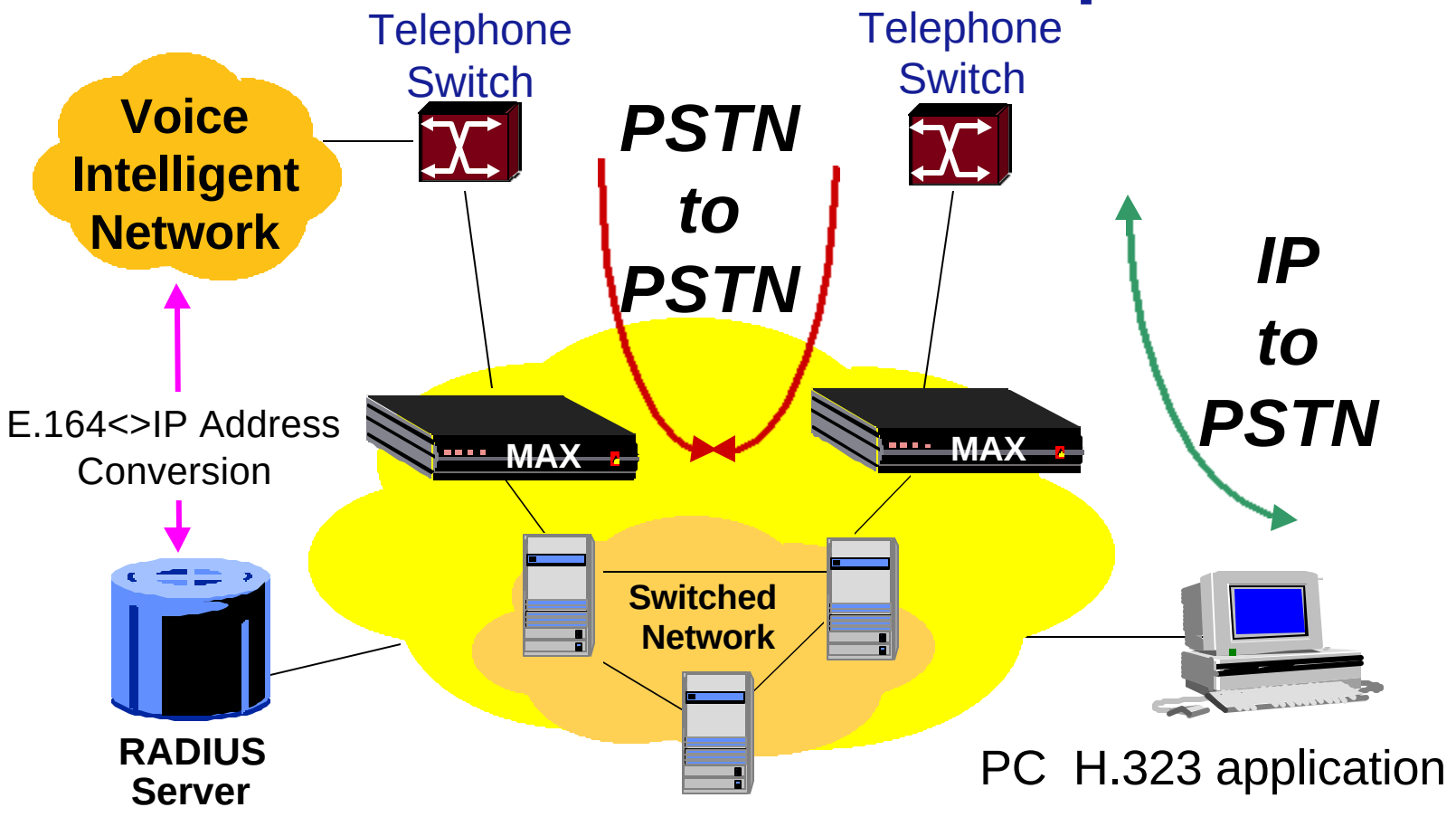
- Scale ports on demand
- Avoid long distance charges
- Let Carriers worry about equipment
- Fix monthly charges

ISPs sell excess capacity:

- ISPs sell virtual PoPs to small and regional ISPs
- ISP defers cost of deploying equipment to monthly charge
- Added revenue stream for ISP

- **Common access for Enterprise Intranets and Virtual Internets**
- **Proxy RADIUS server determines network destination of user**
- **Local RADIUS server managed within client network**

Voice Over IP - H.323 Encapsulation

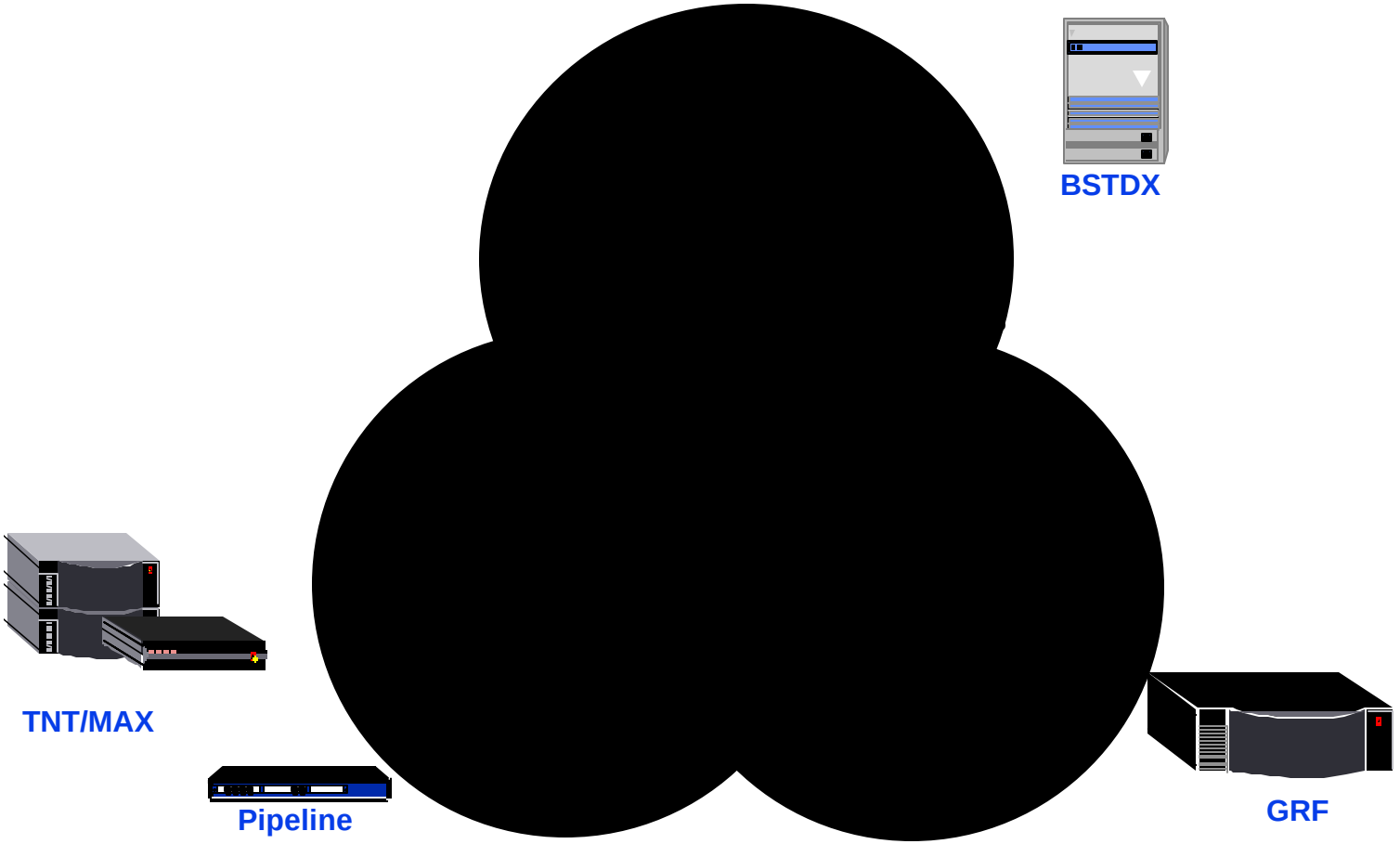


Implications of Internet Voice

- Significant interest by end users in application, if successful will be significant revenue stream
- Quality of voice improving consistently, many aggressive ISPs have plans to launch service
- Critical service launch issue is integration of connection control in PSTN and VoIP

Scalable Business Class Solution for ISPs

Service Management



End-to-end QoS Management

Ascend @ The Heart Of The Internet

- **A solution that scales to support the projected increases in users, access speeds and applications**
- **A solution that provides Quality of Service as differentiation in intensively competitive environment**
  - Business Class Network
- **A solution that offering value added services opportunities**
  - Mobile/Teleworker Outsourcing
  - Virtual Private Networking (Intranets/Extranets)
  - Voice over the Internet
- **A solution that controls and lower operations costs**