Ascend

Carrier Opportunities With The New Public Network

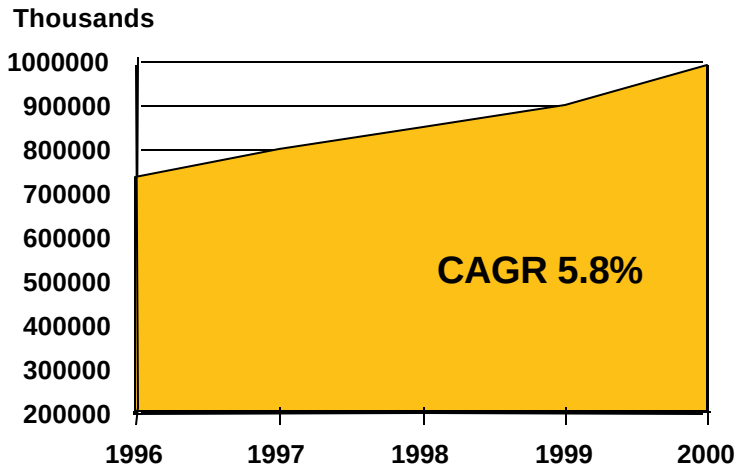
Ascend Communications

ASCEND

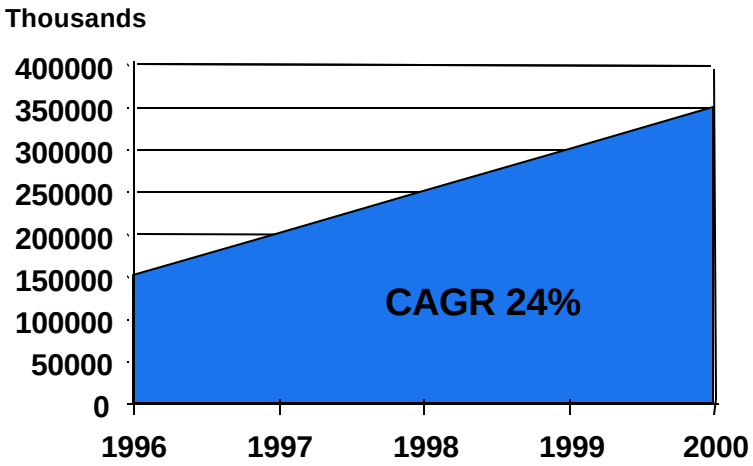
Ascend's Carrier Mission

Bringing Internet Innovation to Carrier Class Solutions In Order To Build The New Public Network

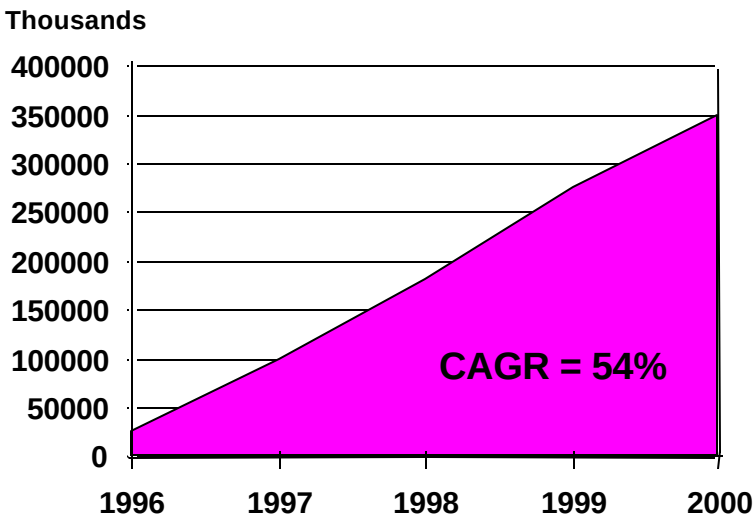
Telecommunications Growth Rates



World- Wide PSTN Subscribers

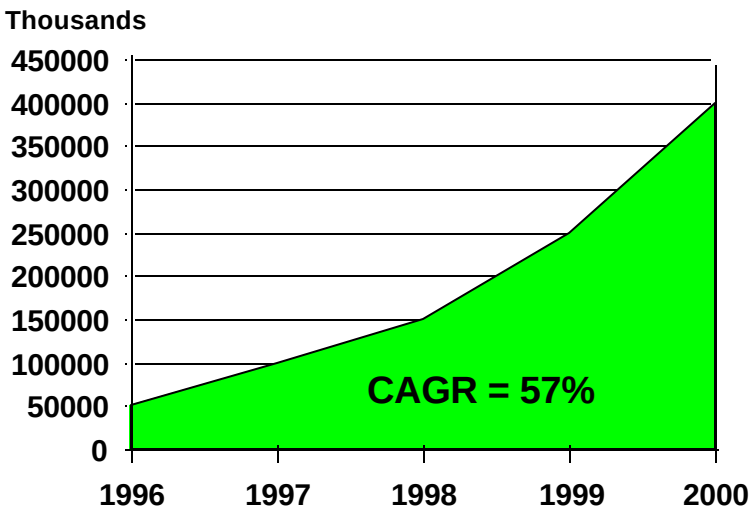


World- Wide Mobile Subscribers



World-Wide Internet Subscribers

Source: IDC

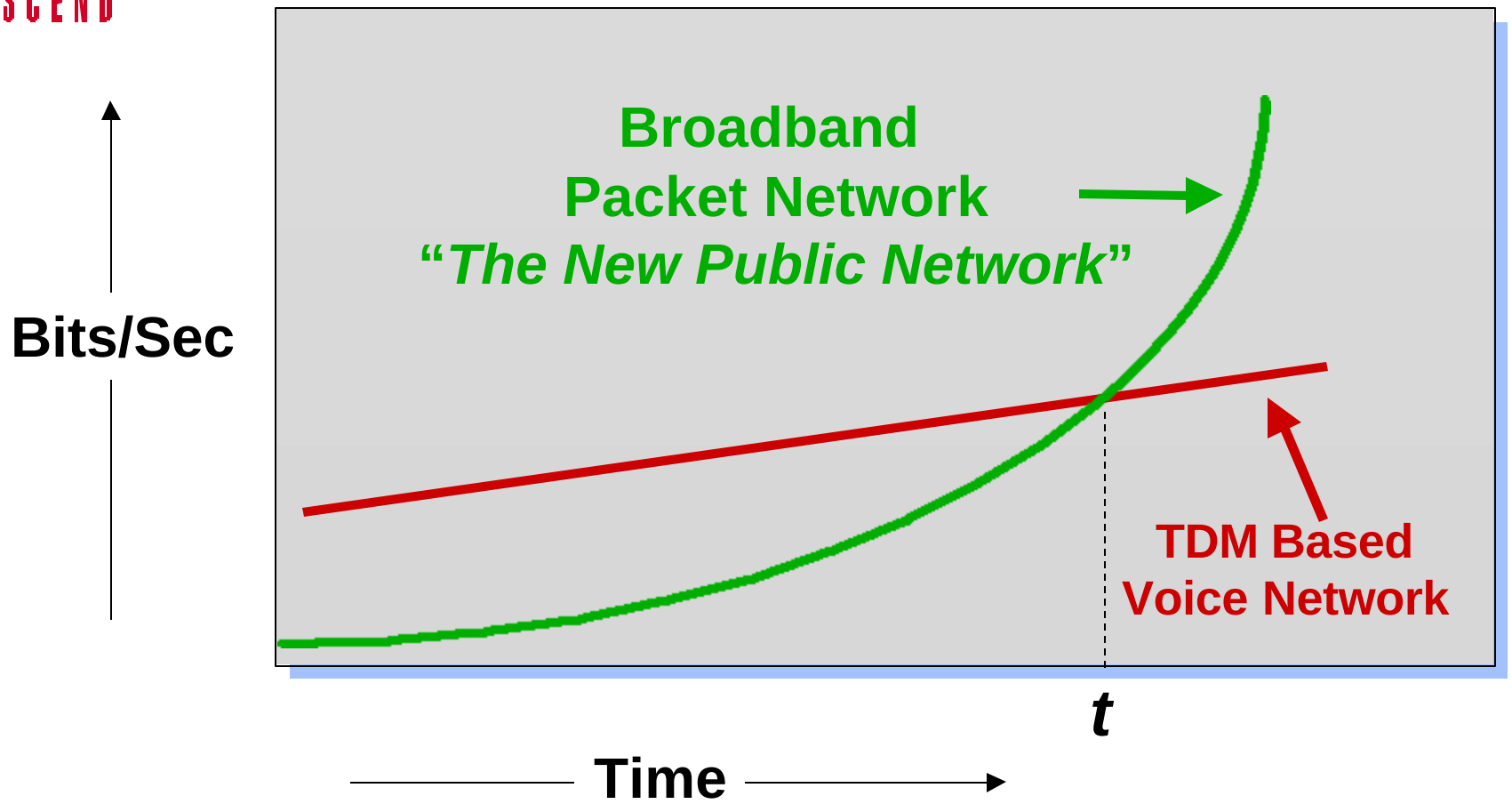


World-Wide ATM/FR ports

Global Data Networking Is Exploding

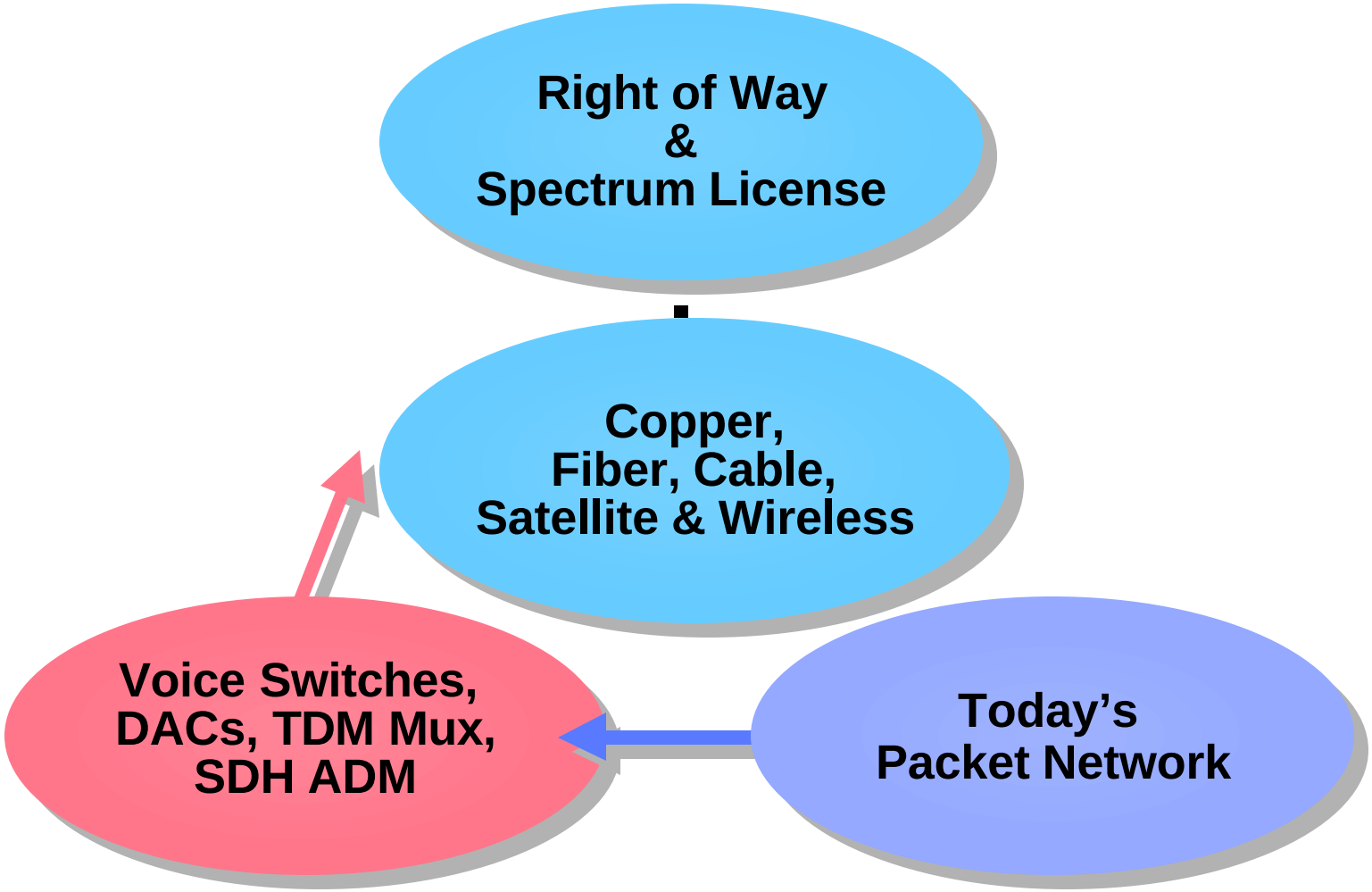
- **Data networks are now a key Service for providers**
- **Private Networks cannot economically deliver:**
  - the reach
  - the connection breadth
  - the bandwidth
- **Companies will look to Service Providers to deliver network infrastructure and services**
  - Standards-based
  - Ubiquitous -- global and seamless
  - Highly reliable
  - Secure
  - Leading edge - to accommodate new applications
  - Economically priced

Data Traffic Will Soon Overtake Voice

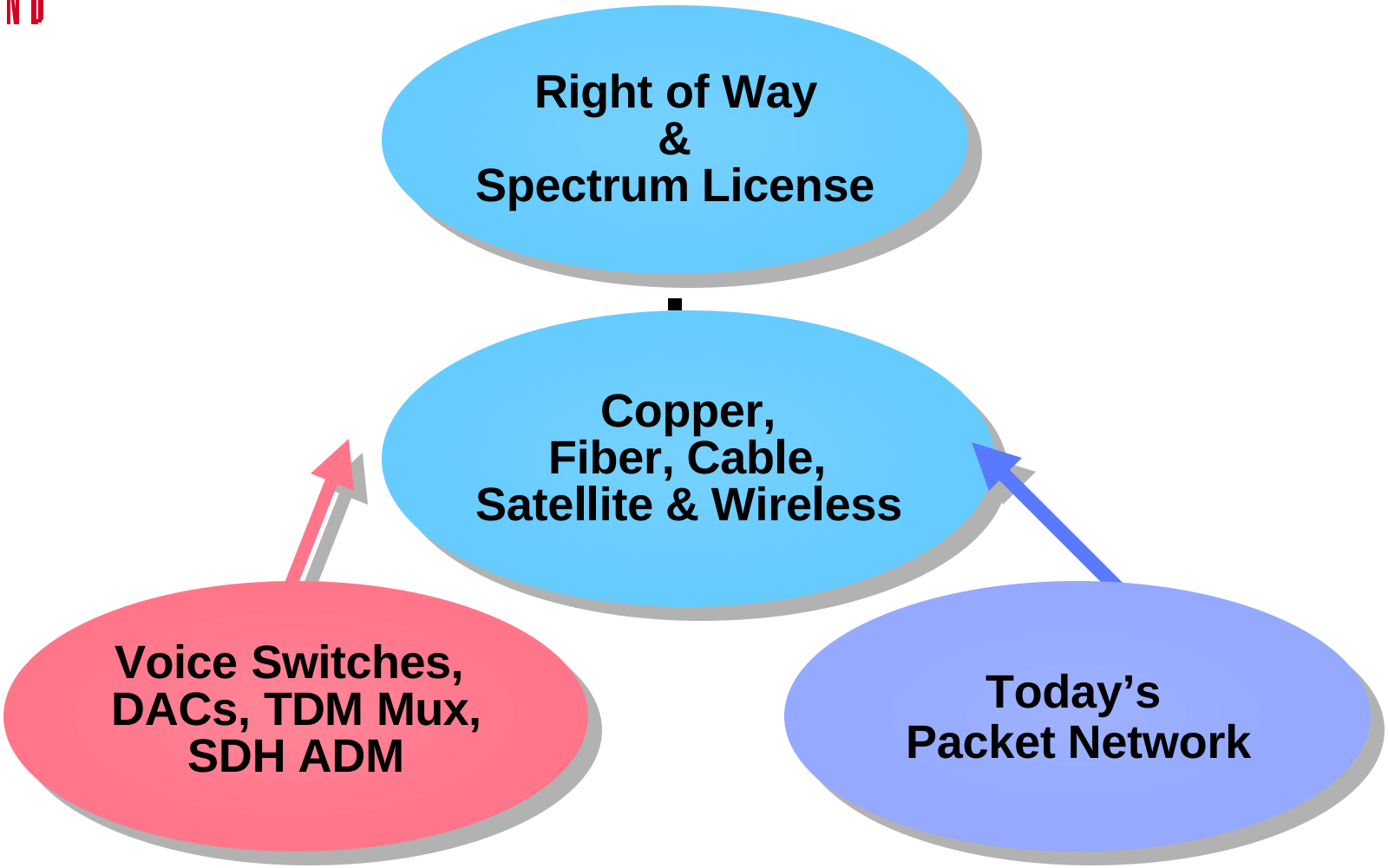


Cerf's prediction for *t* : Data Traffic will overtake Voice traffic in MCI network before 2000

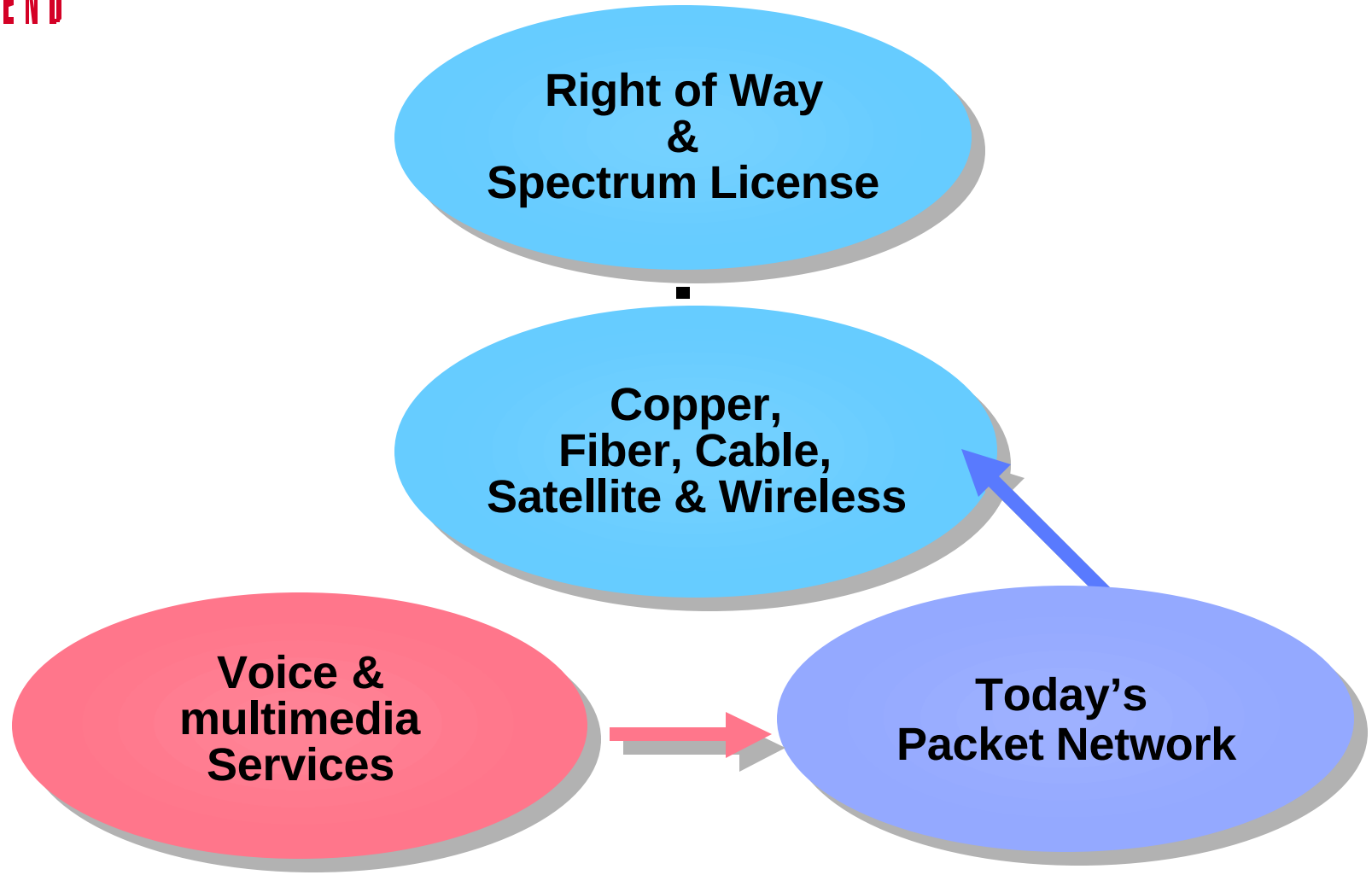
Traditional Carrier Networks



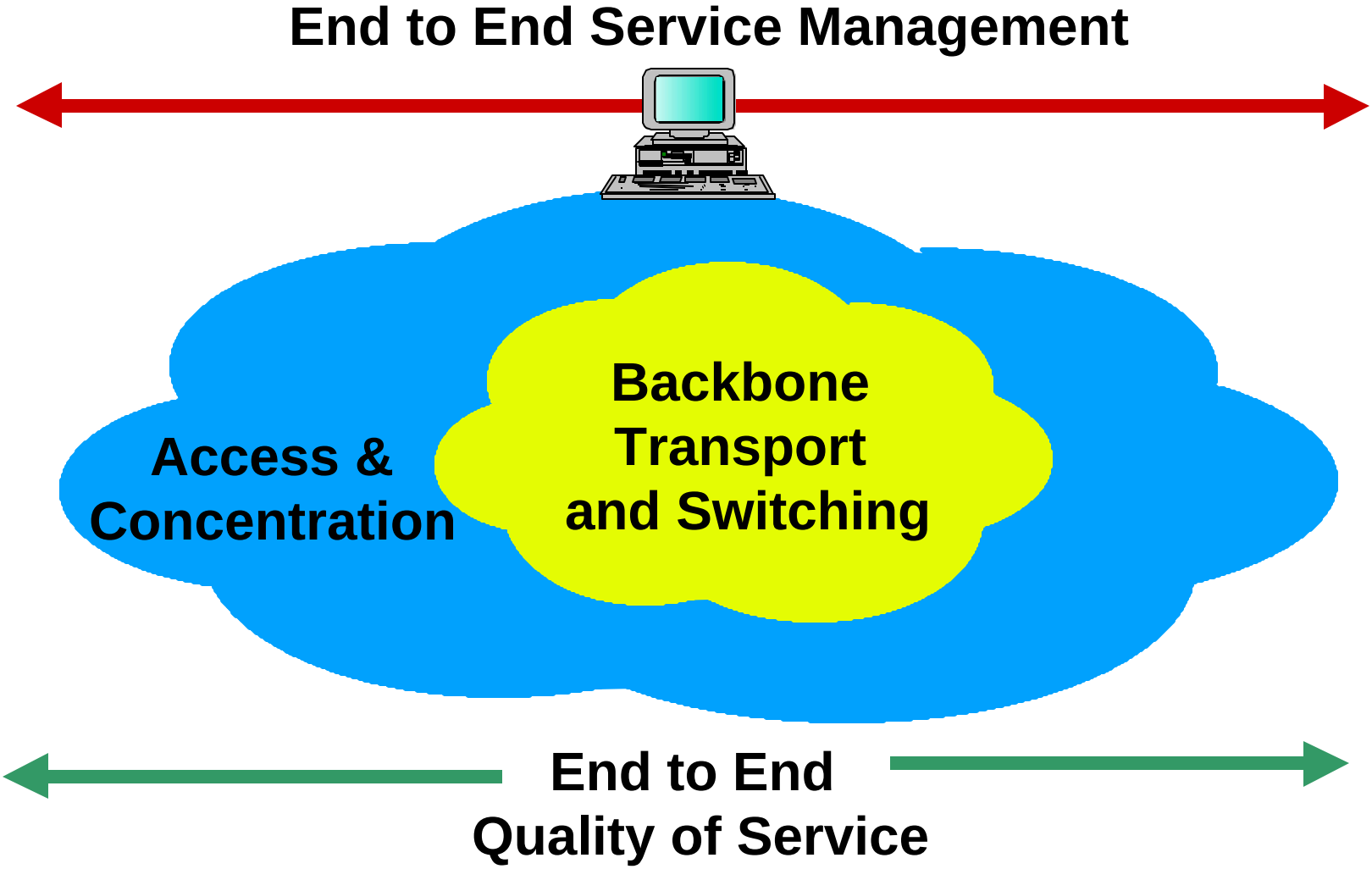
Today's Carrier Networks



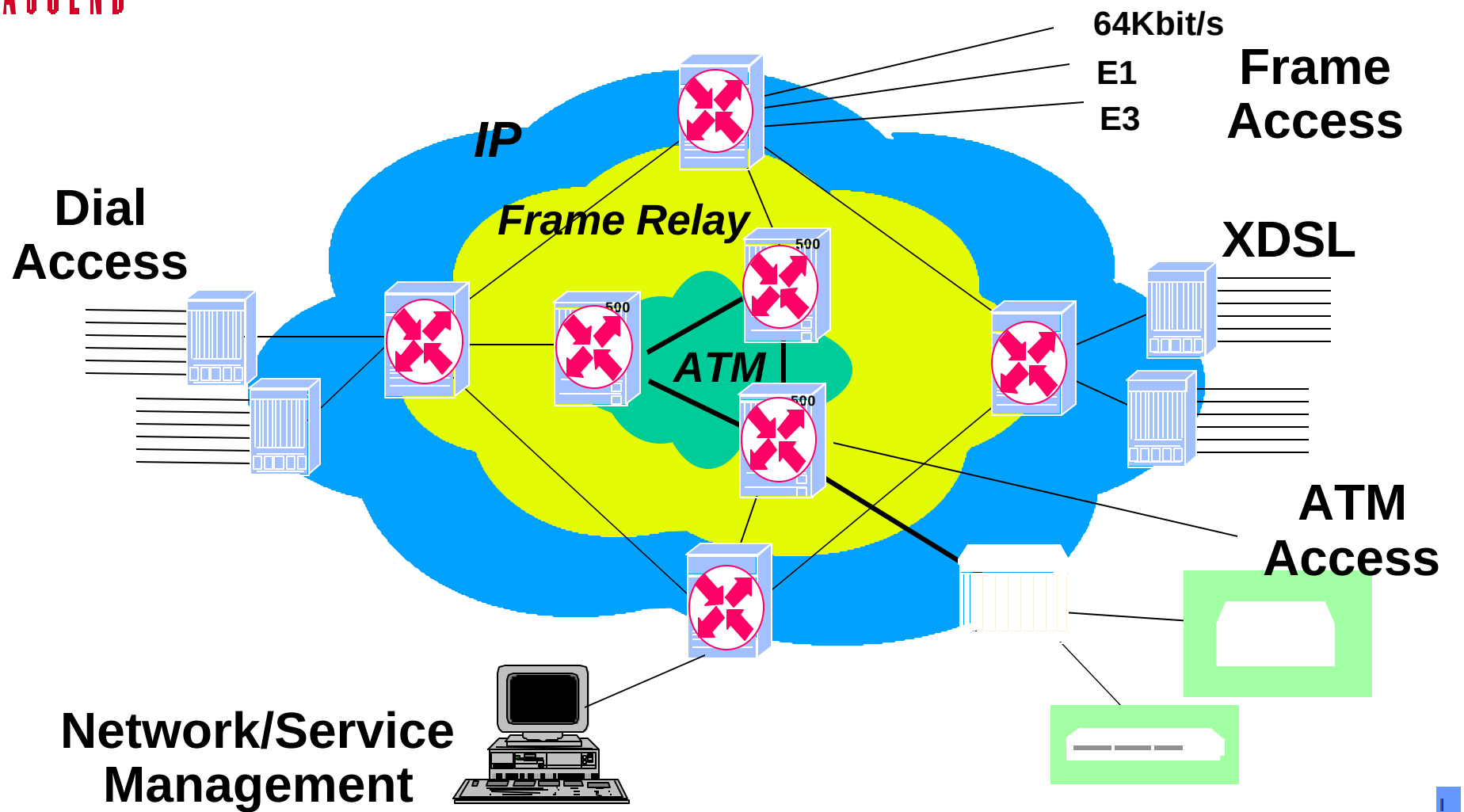
The Future - New Public Network



Components Of The New Public Network

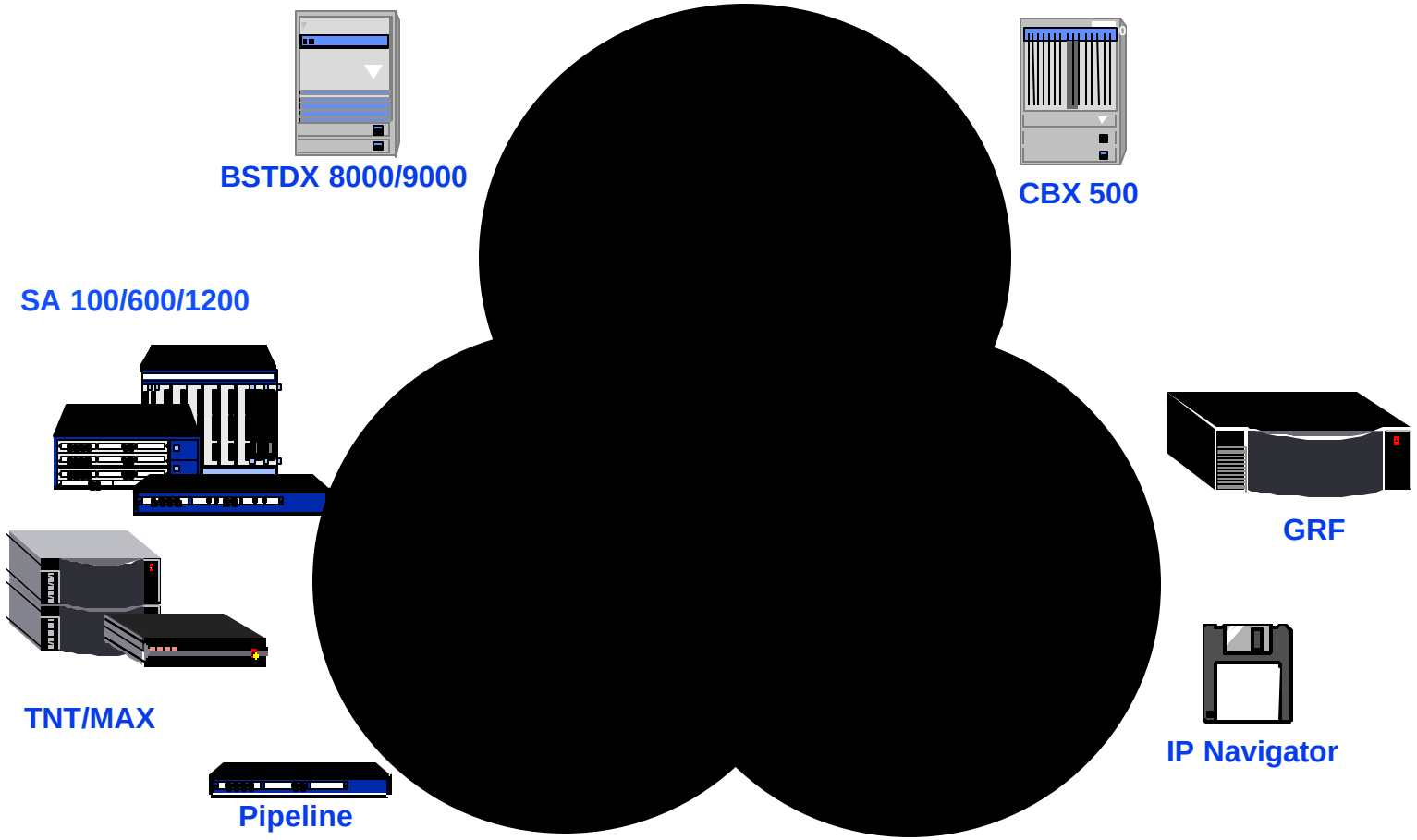


The New Public Network Infrastructure



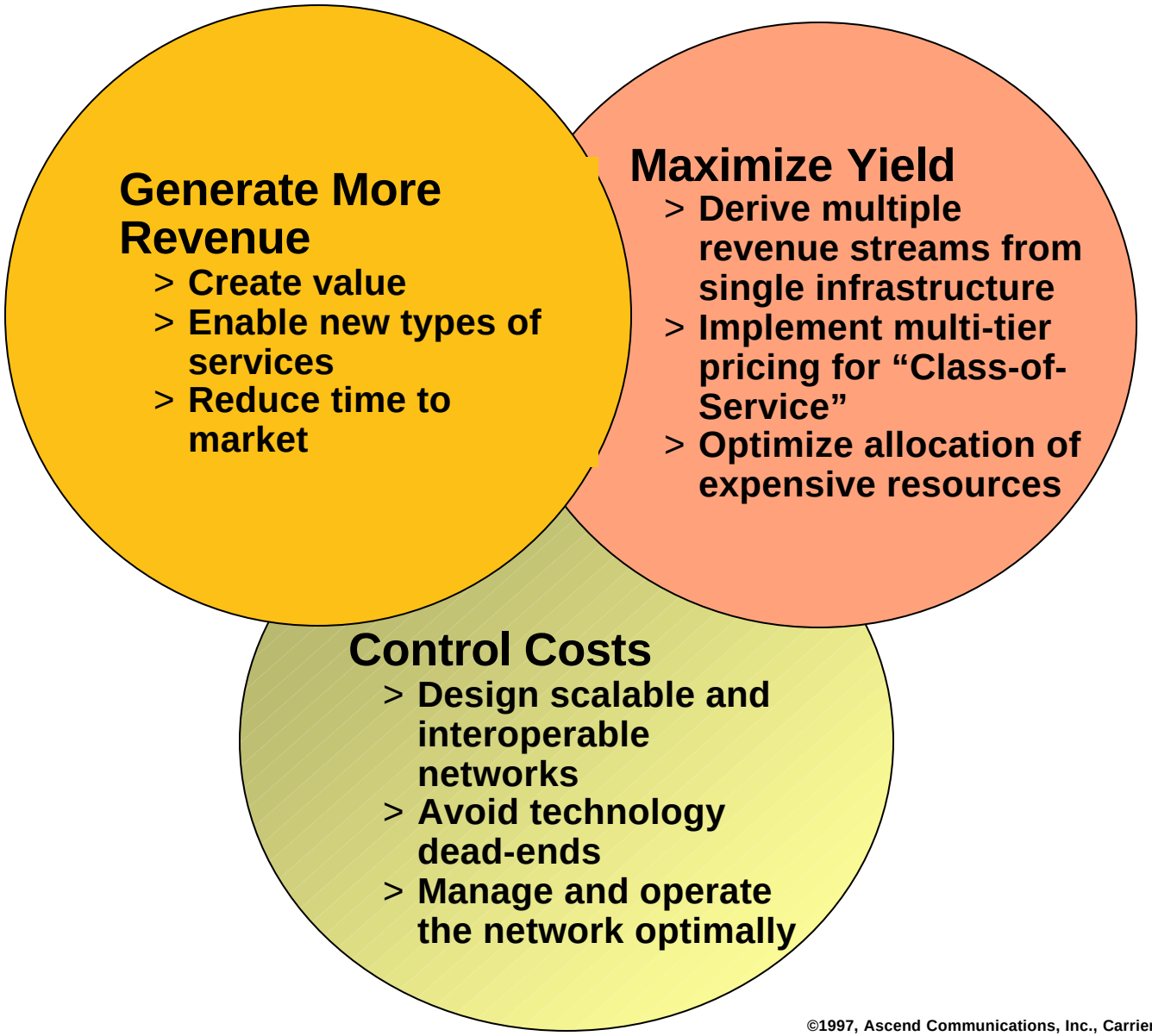
Characteristics Of The New Public Network

Service Management

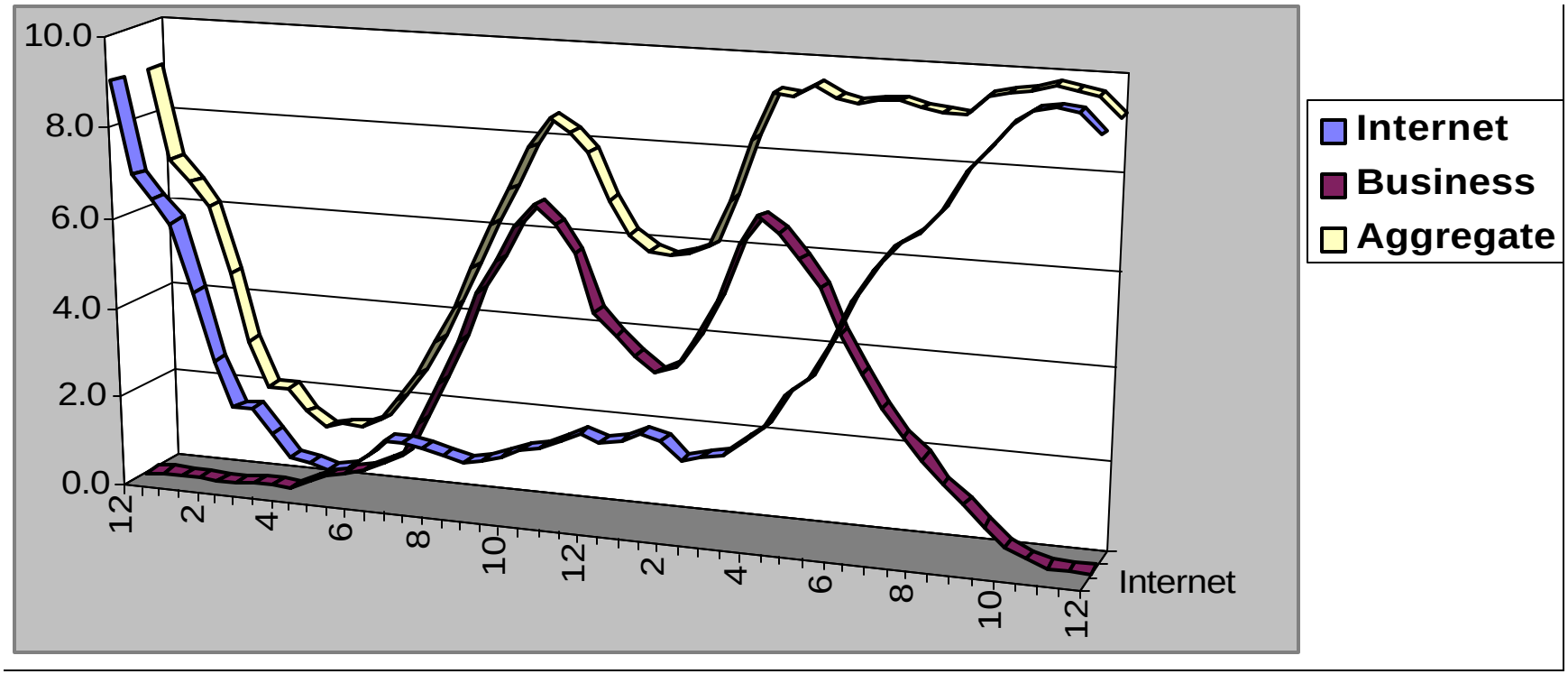


End-to-end QoS Management

The Network Is The Business



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

Selling "Class of Service"

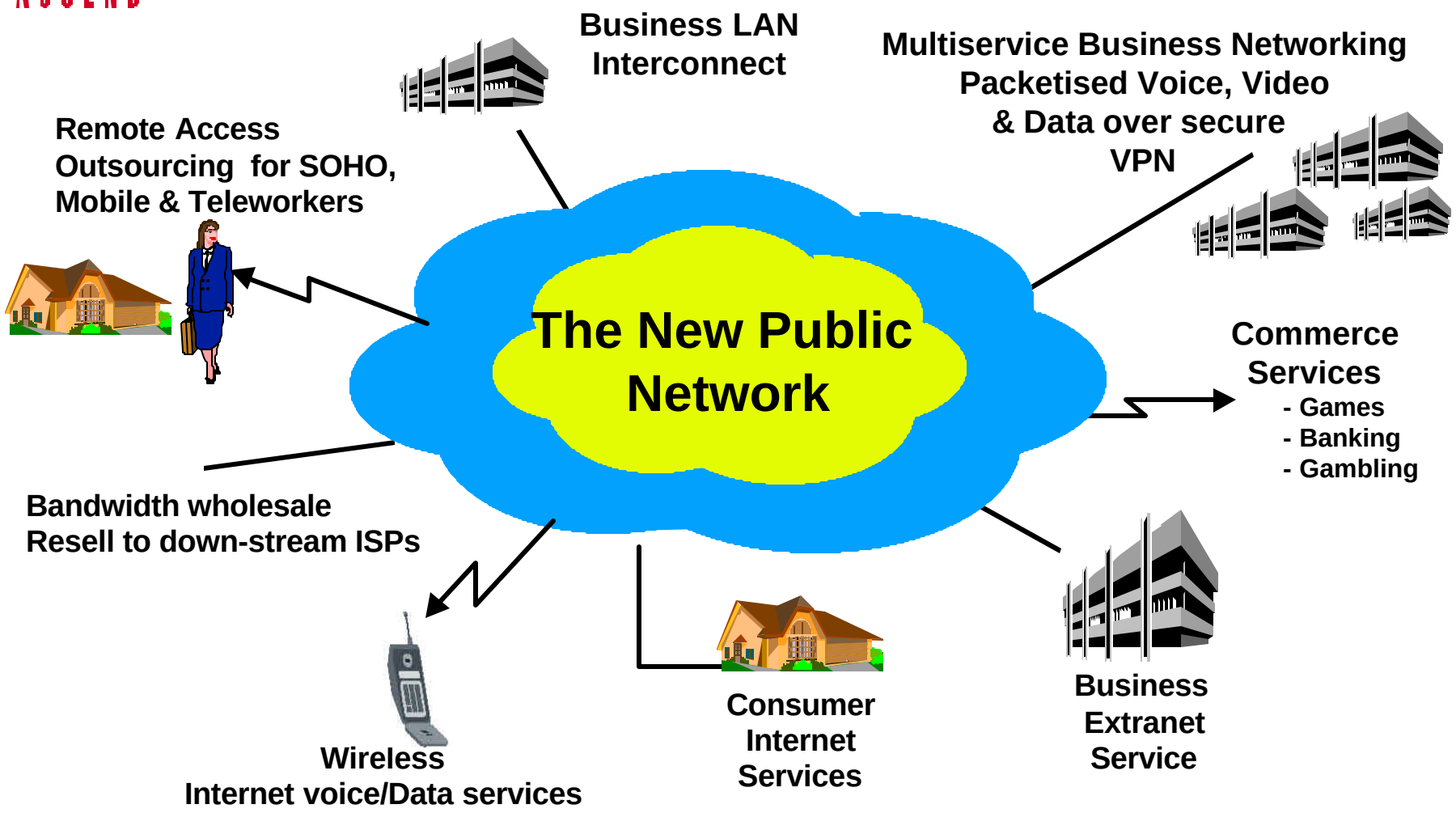
Phone Number	Customer	Price	InDial	Authentication	WAN QoS
262 1000	Bank	High	5:1	Encryption	CIR =64K
262 1050	Corporate	Medium	10:1	Token Based	CIR = 16K
262 1100	ISP	Low	40:1	Downstream	CIR=0

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

Probability of getting a modem in a modem pool

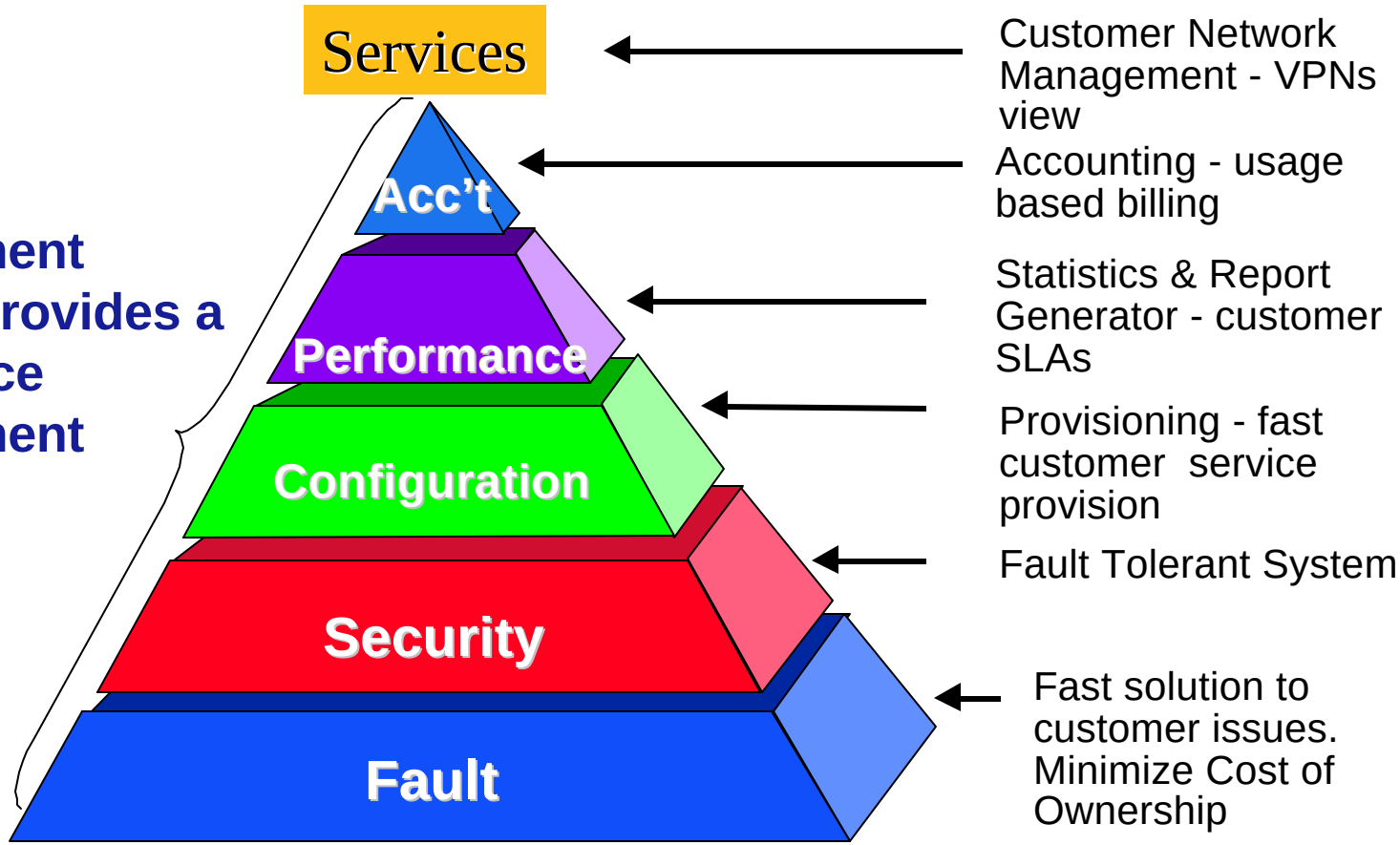
Commitment to backbone bandwidth and Priority

Multiple Services On One Network Infrastructure



Service Management Function

Ascend Management System provides a full Service Management solution

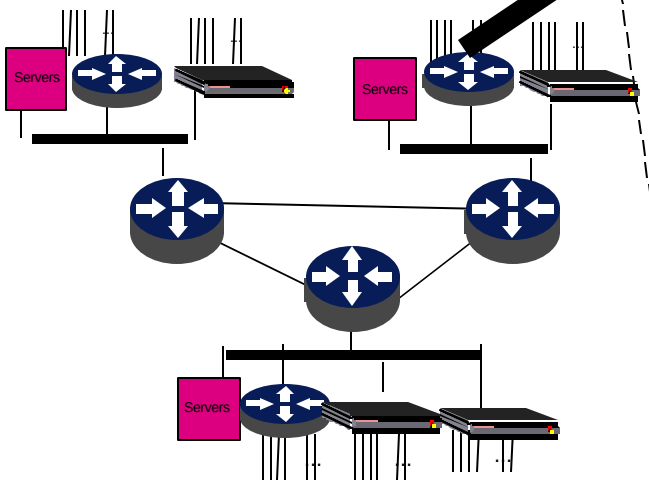


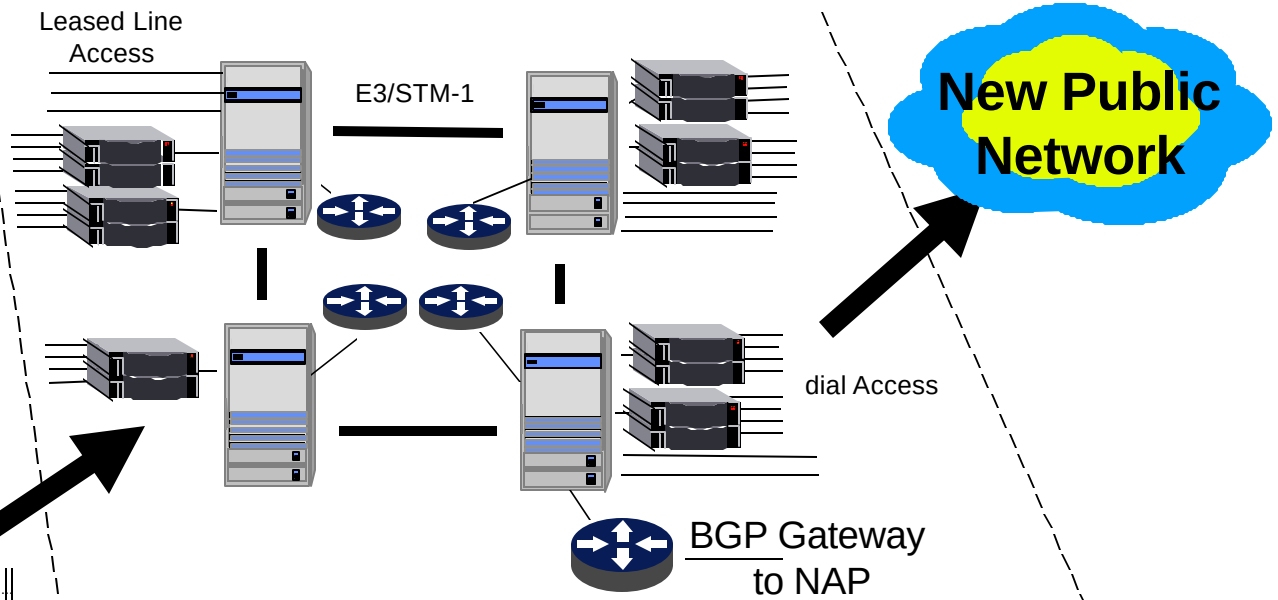
OSI Model for Network Management

Evolution To The New Public Network

1st Generation

- All router backbone
- Leased line access via router ports
- No Quality of service
- Massive Congestion





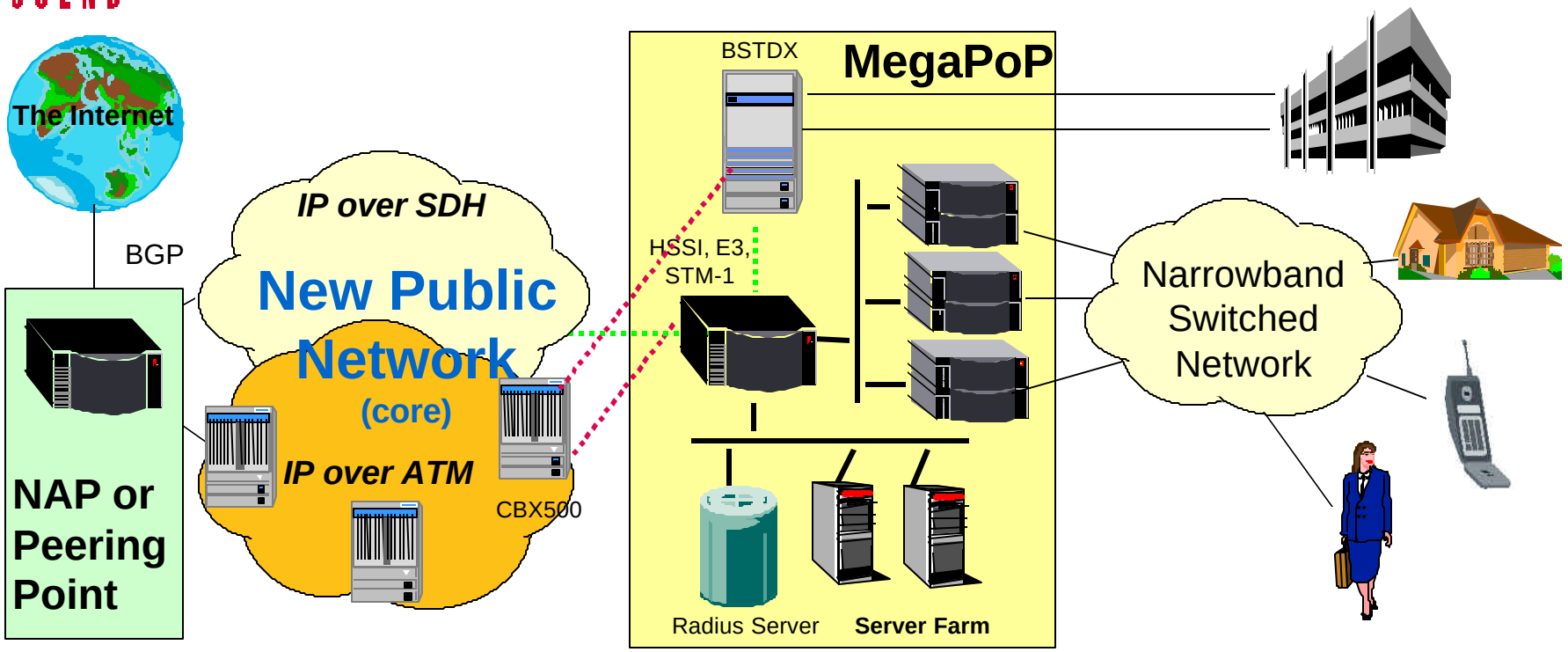
2nd Generation

- Introduction of Switch backbone of Frame Relay and/or ATM
- Switches add network resilience and some some Quality of Service
- Leased line access via switch ports. Carrier Class Remote Access servers added
- Routers used as route servers & NAP gateways. Current router technology again becoming bottleneck

Today's Issues Facing Internet Services

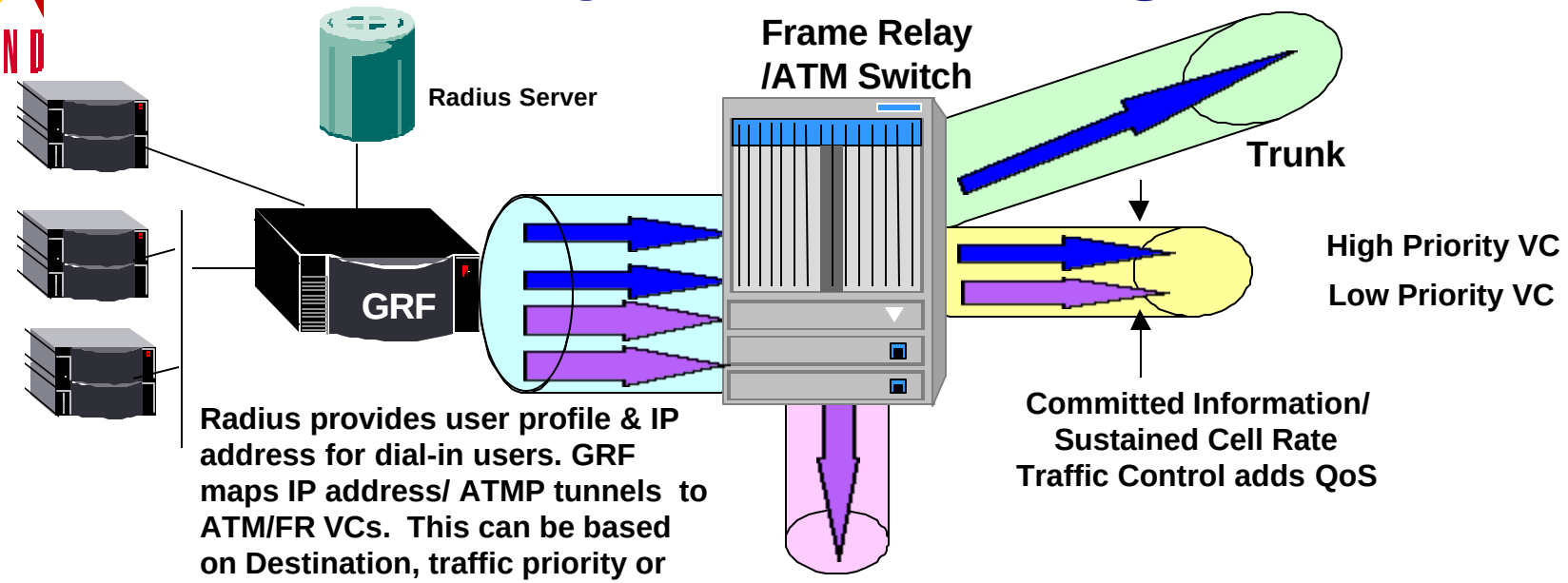
- **Scalability of Access and Backbone**
  - Backbone capacity & routing table size
  - Port densities
  - Access rates
  - Network and Service Reliability (Carrier Class with QoS)
- **Adding New Services & Applications**
  - Virtual Private Networks
  - Outsourced Intranets/Extranets
  - Mobile Internet Users
  - Voice/Video over the Internet

High Capacity Internet Backbone & Access Over The New Public Network



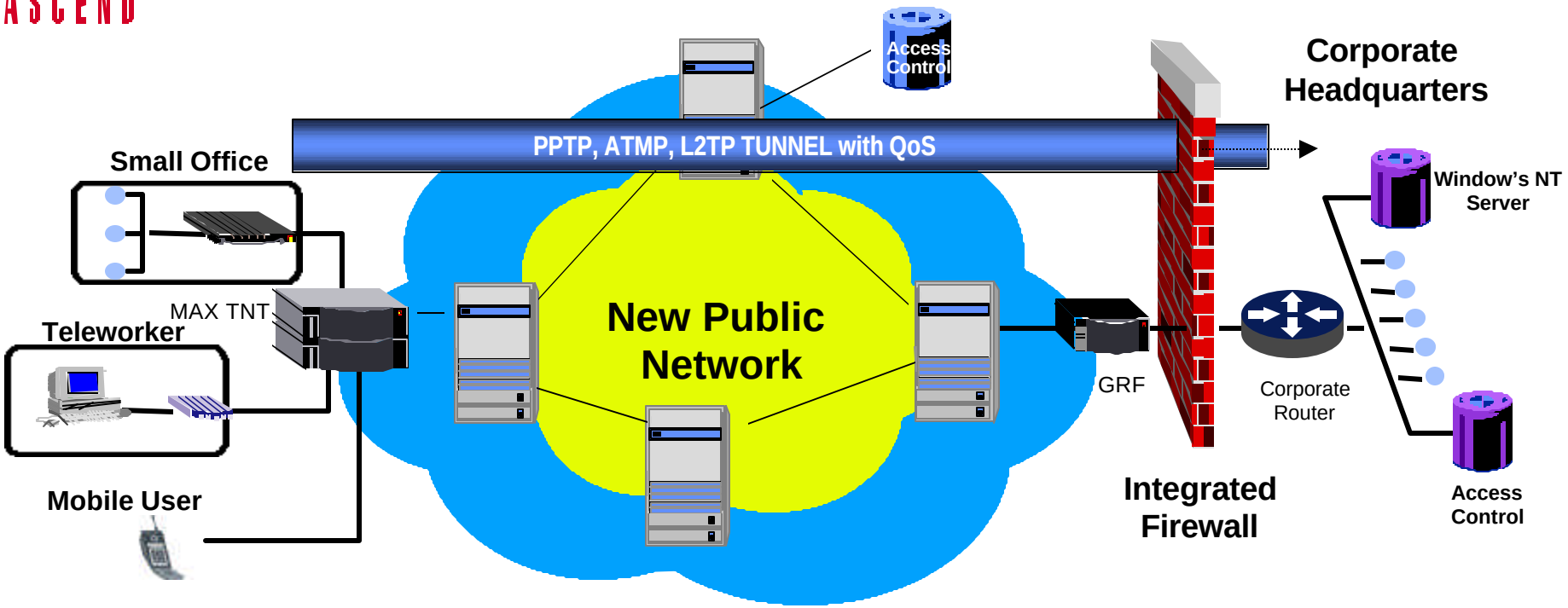
- **Internet Backbone Provides**
  - High capacity Access Servers provide thousands of dial/ISDN ports
  - High speed leased line access via Frame Relay switches
  - High speed IP switching via Gigabit Router
  - Wide Area transmission with Packet over SDH or ATM at STM1/STM4
  - Local cashing of Web Pages

Adding QoS And Resilience With Layer 2 Switching



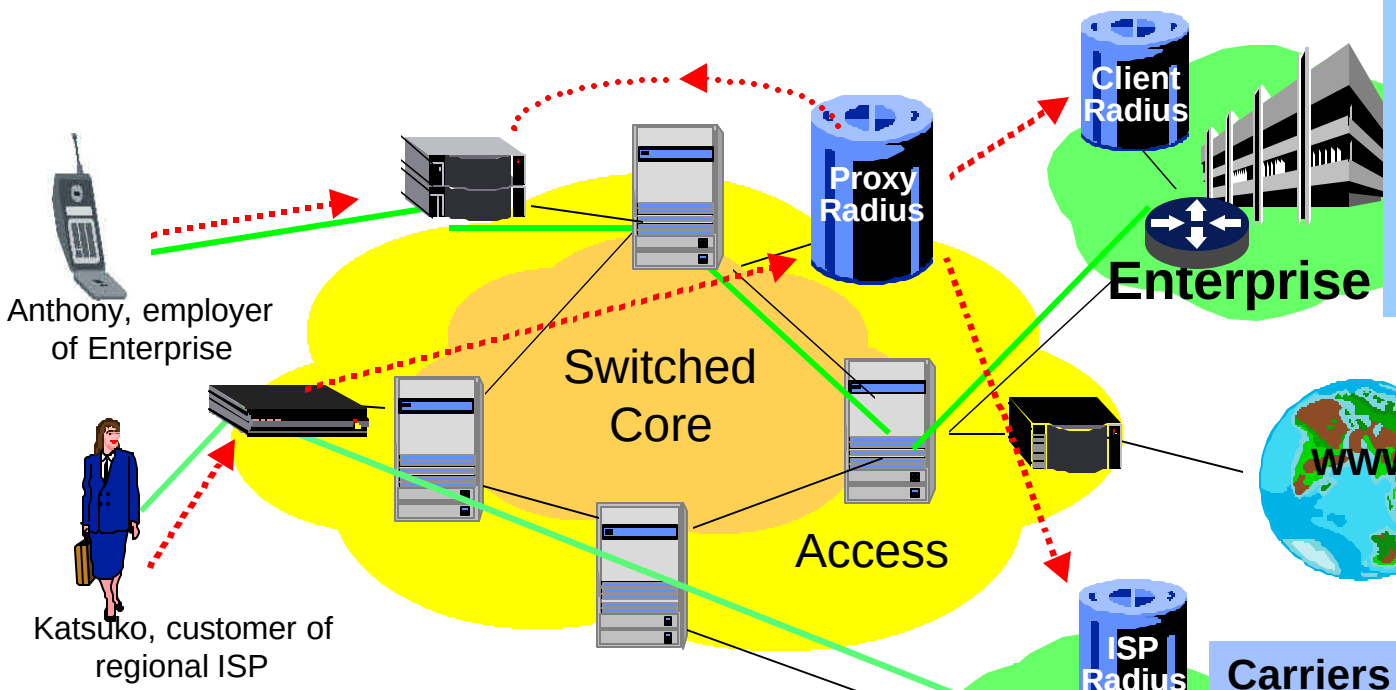
- Both ATM and Frame Relay provide connection-oriented network service that manages bandwidth
- Both can support a variety of Quality of Service parameters
- Network cut-through achieved using direct Virtual connections between routing points.
- Customer QoS objective maintained at minimal bandwidth cost

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.

Virtual Private Intranets and Extranets



Enterprise Intranet:

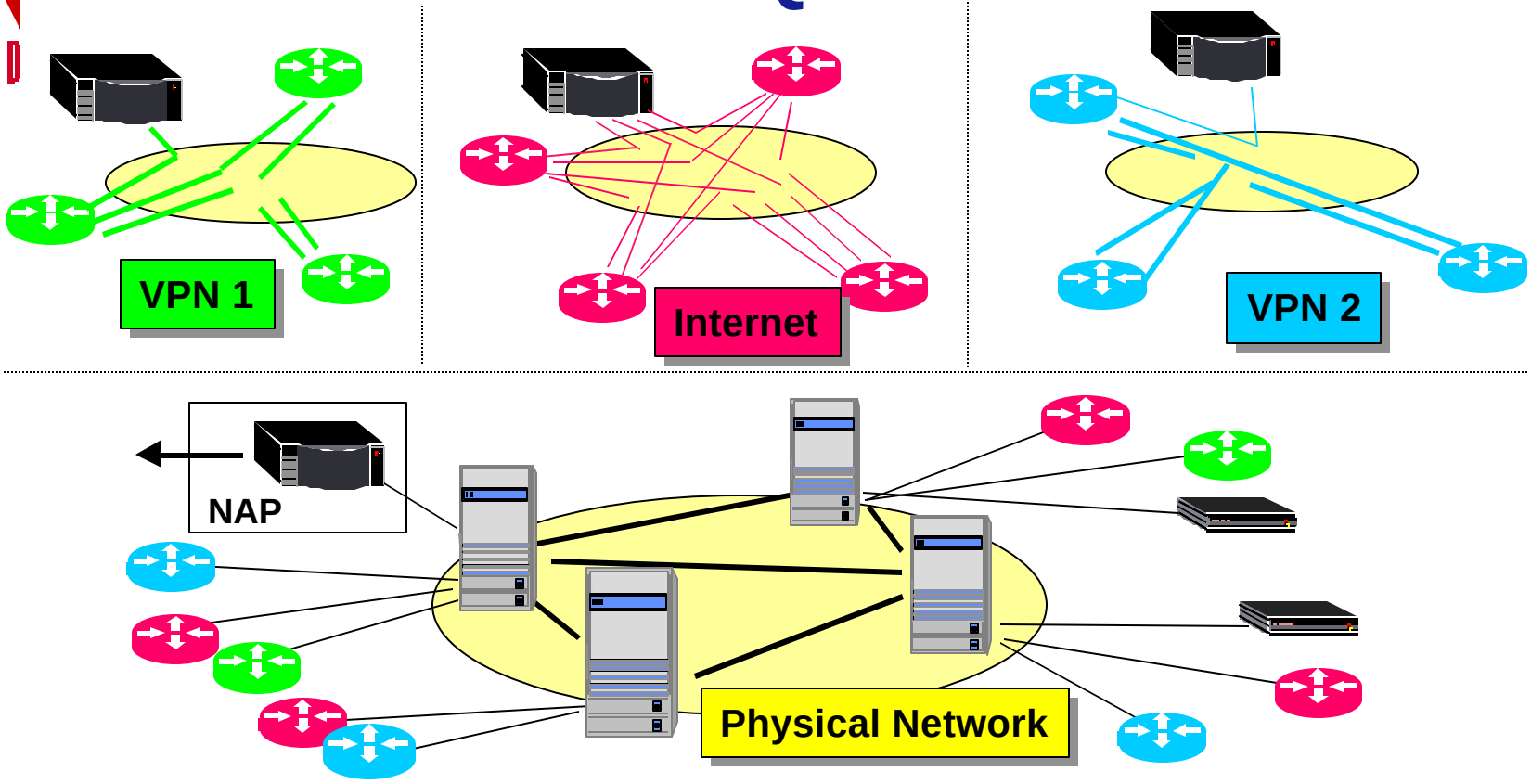
- Scale ports on demand
- Avoid long distance charges
- Let Carriers worry about equipment
- Fix monthly charges

Carriers sell excess capacity:

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

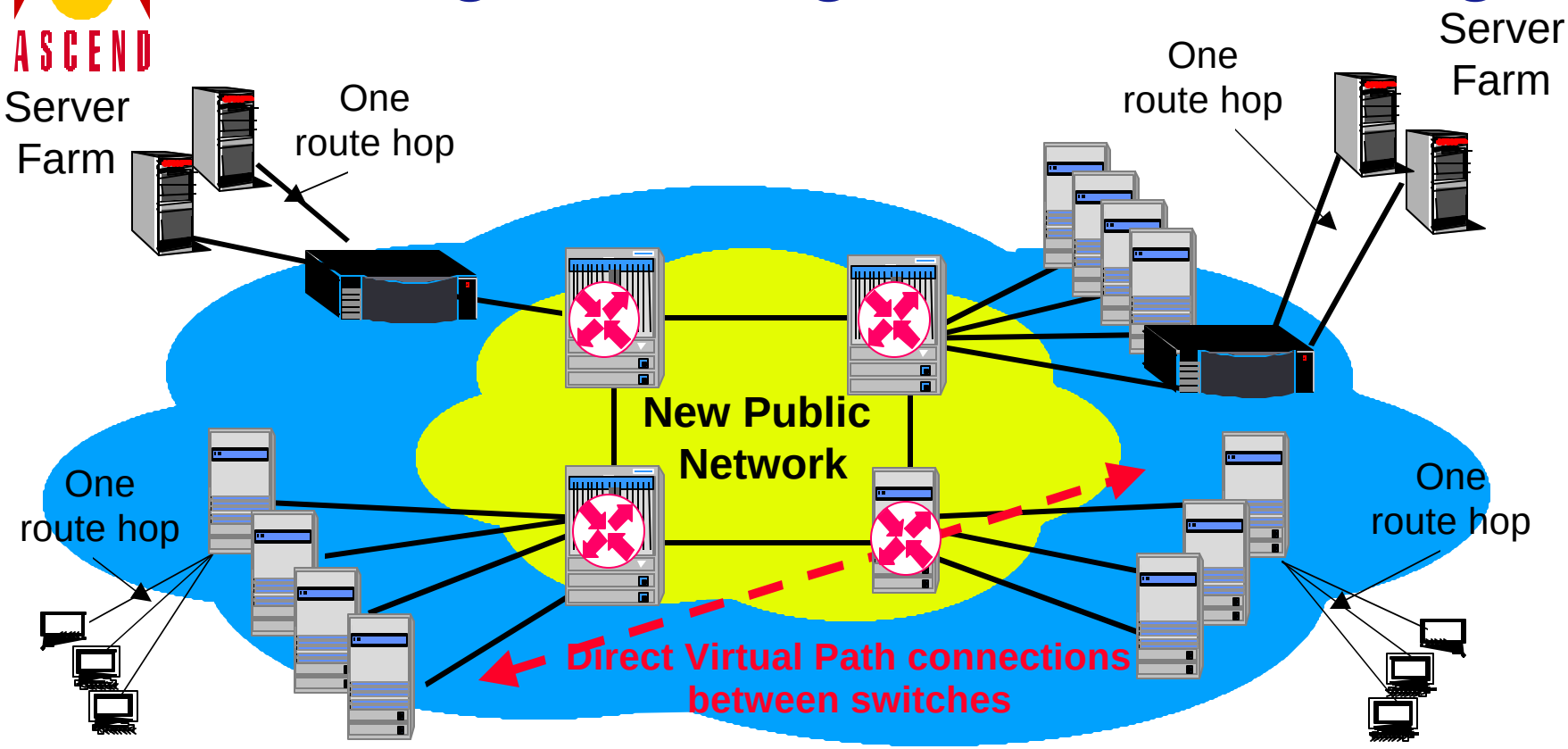
- **Common access for Enterprise Intranets and Virtual Internets**
- **Proxy RADIUS server determines network destination of user**
- **Local RADIUS server managed within client network**

Virtual Connections Provide VPN With QoS



- Level 2 Virtual Connections used to segment general Internet traffic from corporate Intranets Overlay networks
- All routers are now only one hop apart (lower latency) and Level 2 connections add provide Quality of Service commitments
- Number of VC's can become large as number of PoPs increases introducing long-term scalability issues.

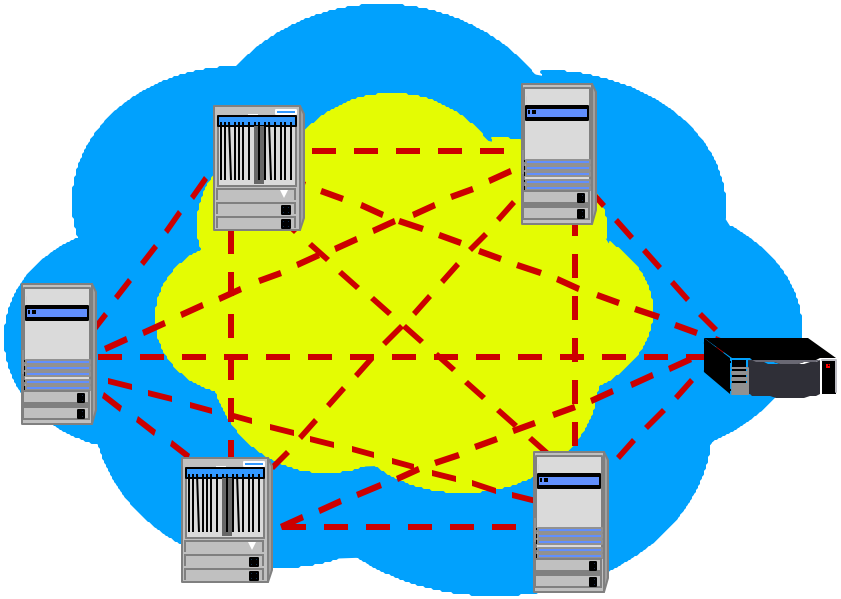
Adding IP Intelligence to Switching



- IP intelligence added to Frame Relay and ATM interfaces on switches. Traffic now routed directly to destination without need to pass through backbone “one arm bandit” routers.
- Scalability for network size, route tables and Virtual connections
- Performance - distributed IP switching with ATM core
- Business Class applications with End-to-End QoS

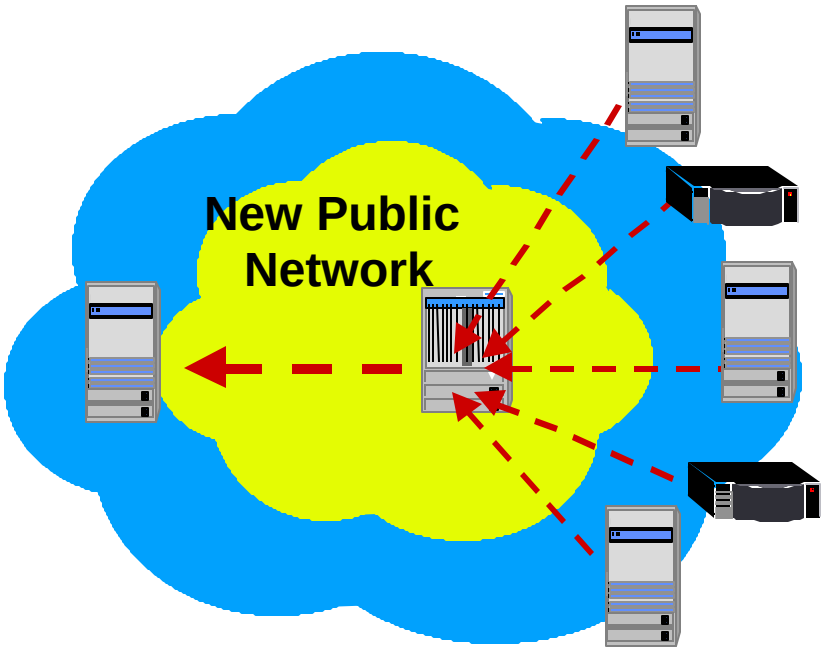
Solving the Scalability Problem

Traditional Switched Backbone



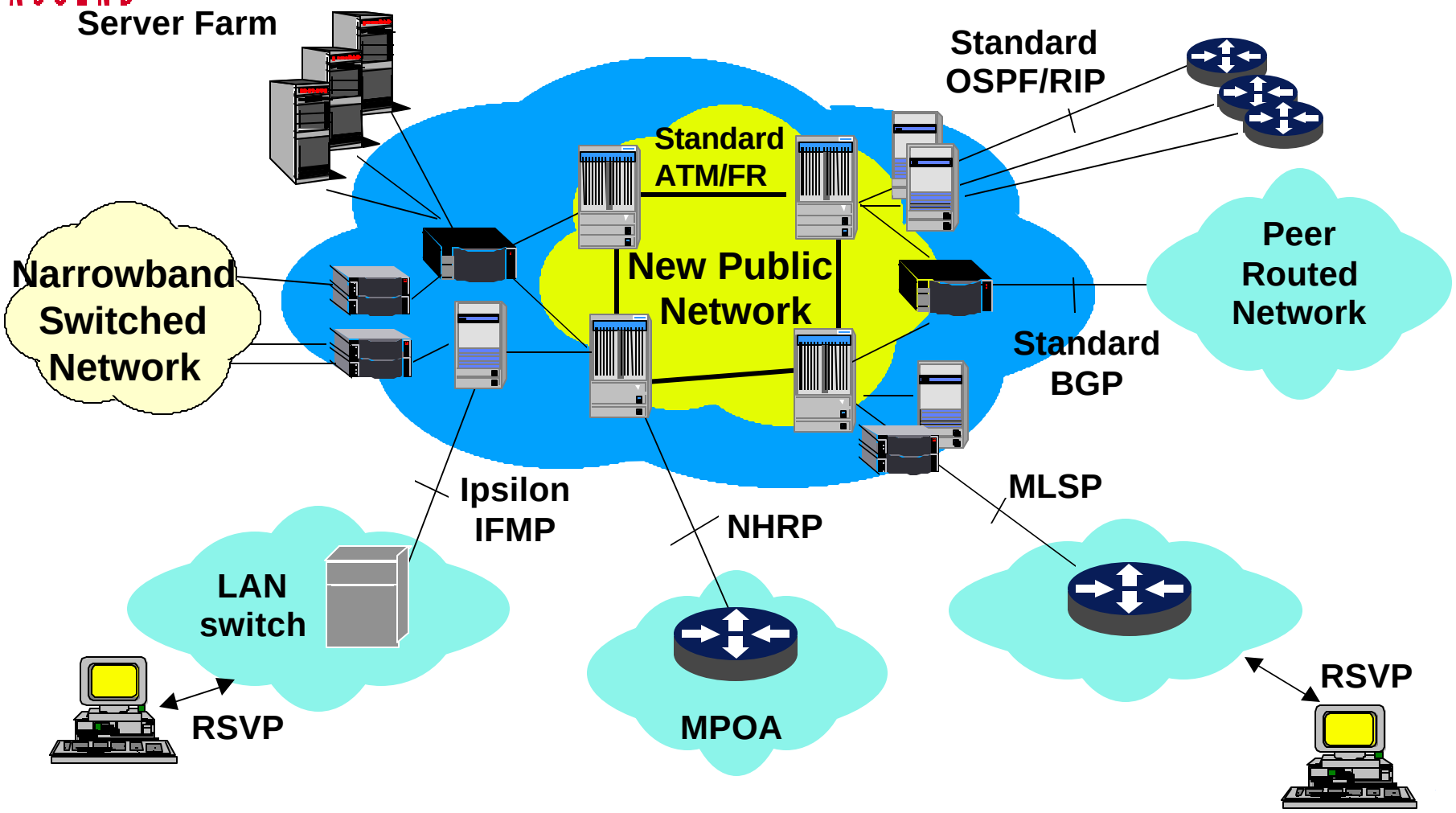
Pre-established connections infeasible due to resultant explosion of required connection paths (N^2)

Ascend's Virtual Network Navigator

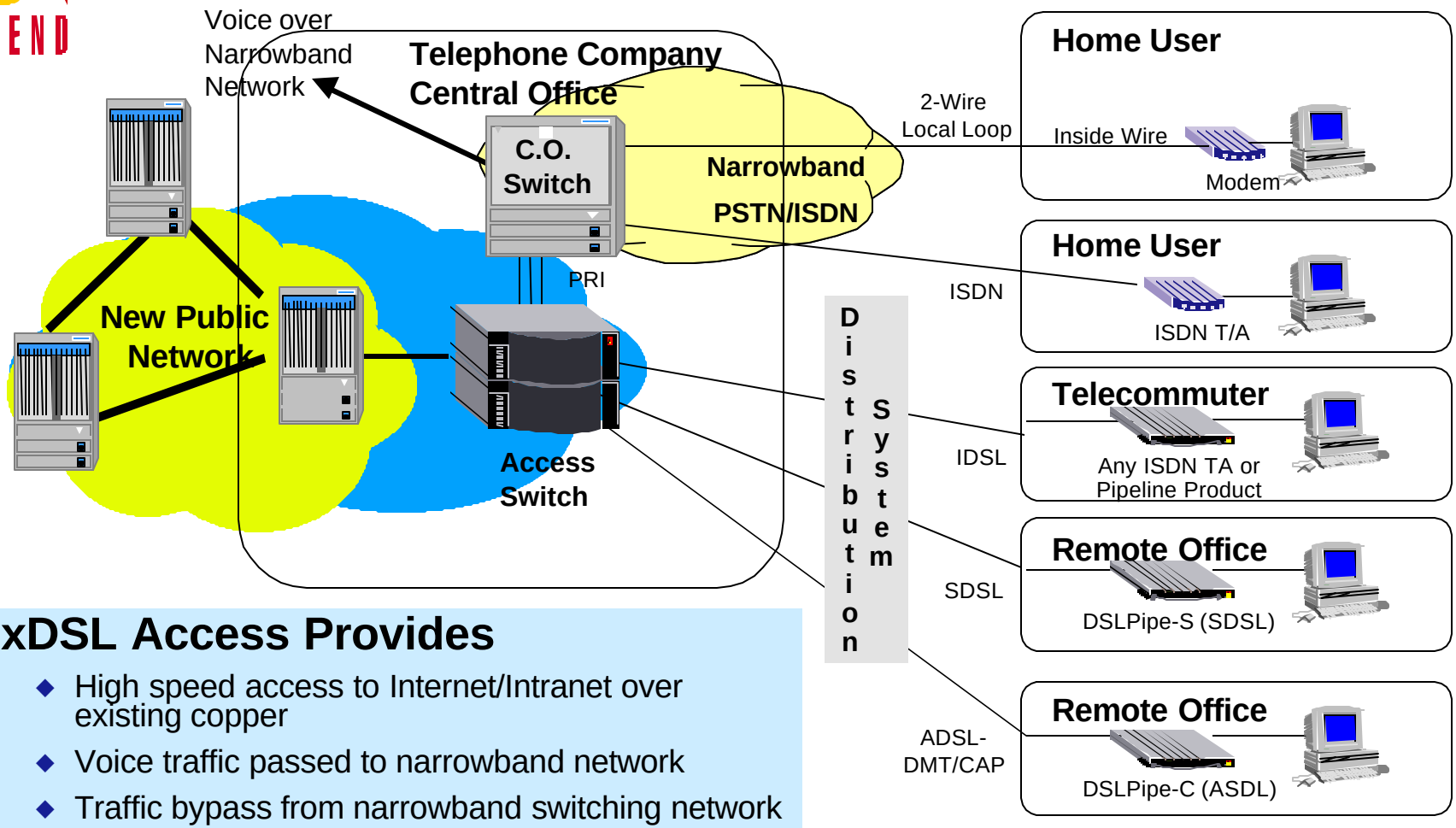


Ascend's patented "MPT" technology solves the N^2 scaling problem, for virtually unlimited scalability

Open and Scaleable Architecture



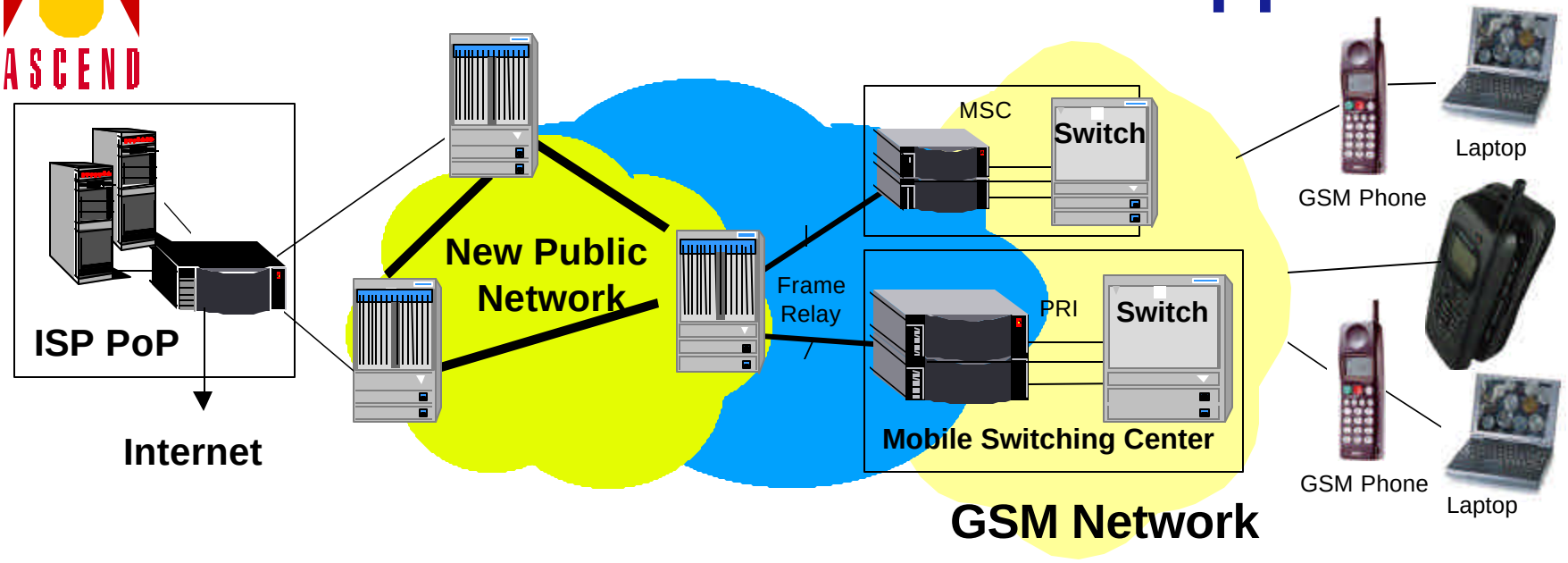
MultiDSL - Very High Speed Access To The New Public Network



xDSL Access Provides

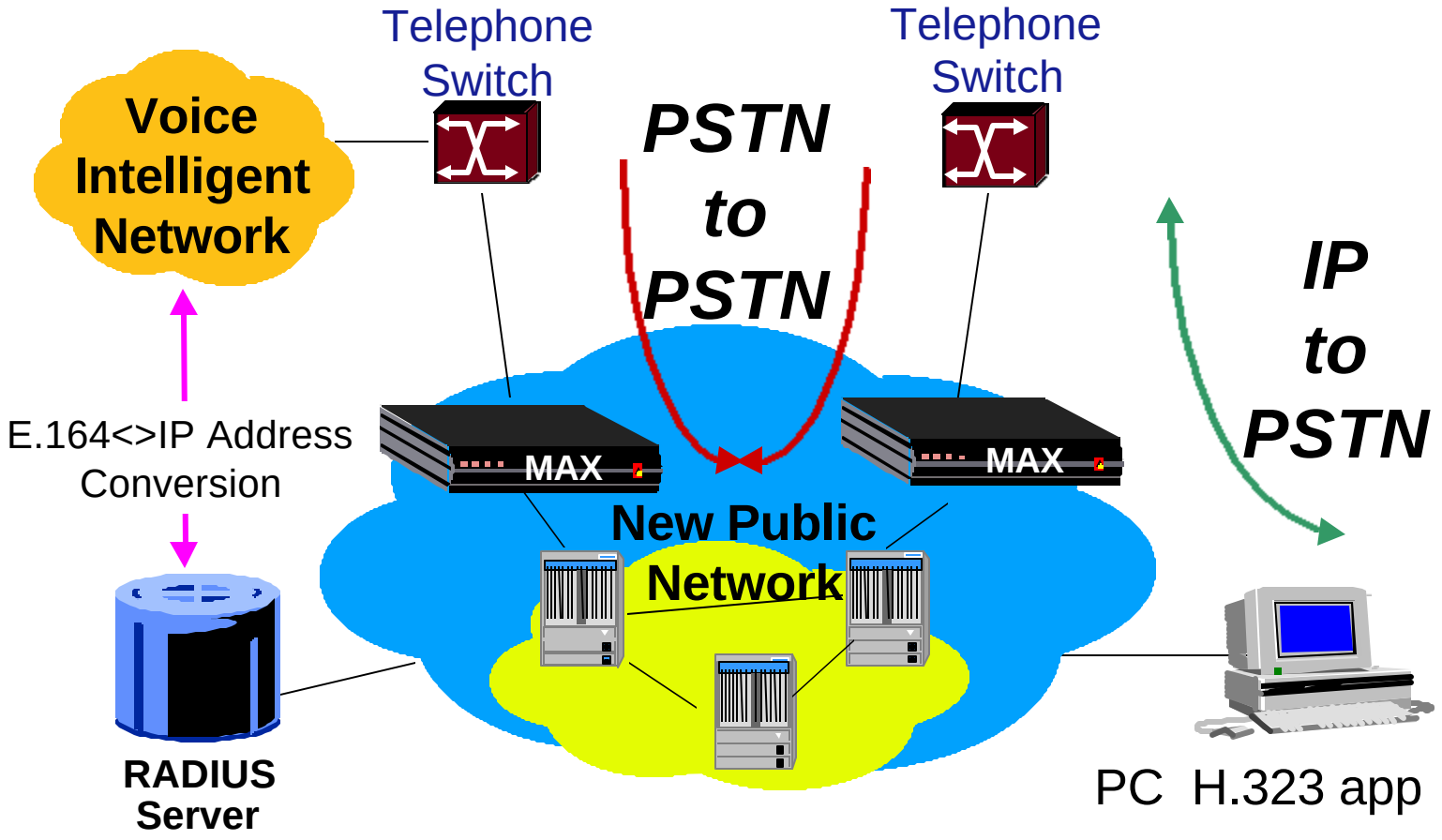
- High speed access to Internet/Intranet over existing copper
- Voice traffic passed to narrowband network
- Traffic bypass from narrowband switching network
- Data traffic off loaded to Packet based network
- Common infrastructure with existing PSTN and ISDN remote access.

Cellular Access Internet Appliances



- **Ascend GSM data access**
  - Significant growth in GSM coverage, portage computers and new mobile communicators.
  - New applications such as digital camera download, electronic checkbooks and Internet Walkmans.
  - Now a major source of usage revenue for providers
  - Ascend MAX supports necessary rate adaptation standards to enable mobile data (V.110)
  - New Public Network allows data traffic to be off loaded from GSM voice network. More efficient transport by packet network.
  - New public Network can also be used to transport Management and account information for the GSM MSC network

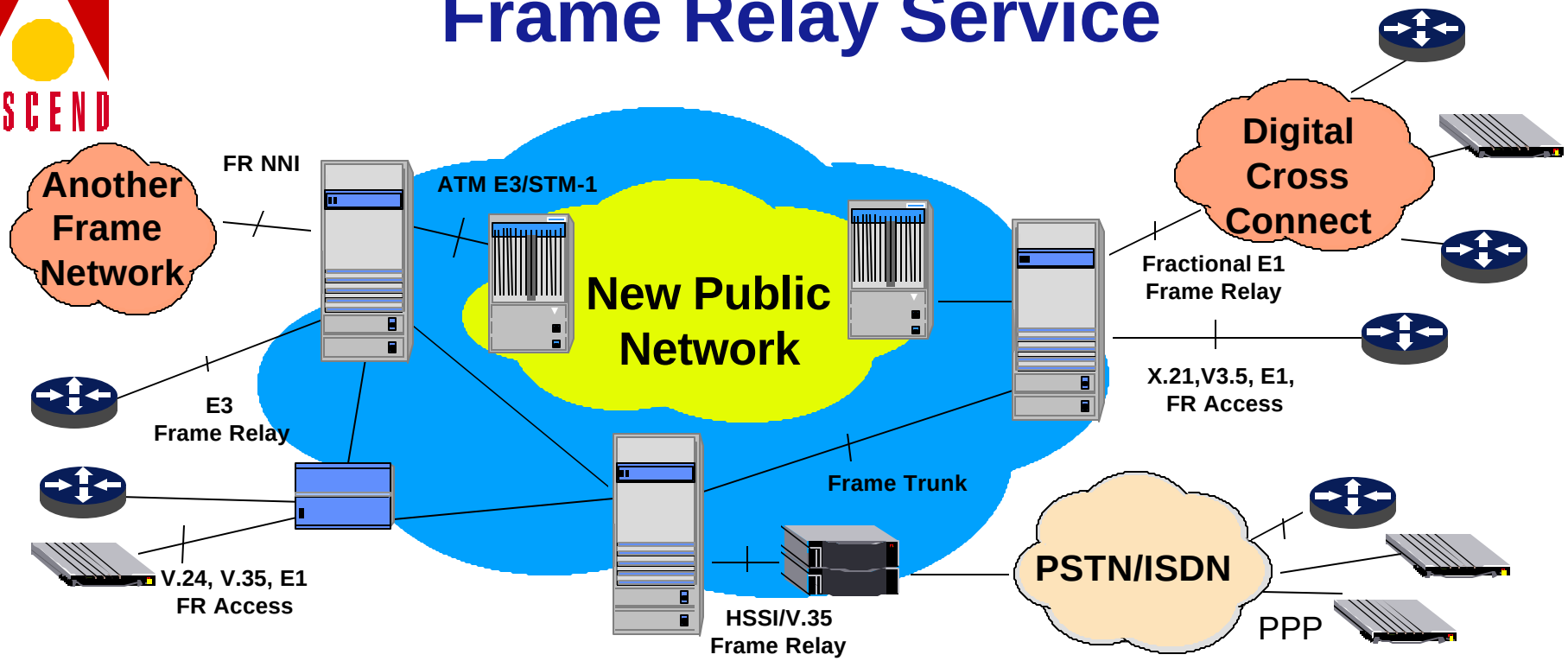
Voice Over IP - H.323 Encapsulation



Implications of Internet Voice

- Significant interest by end users in application, traditional carriers ignore at their own peril
- 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

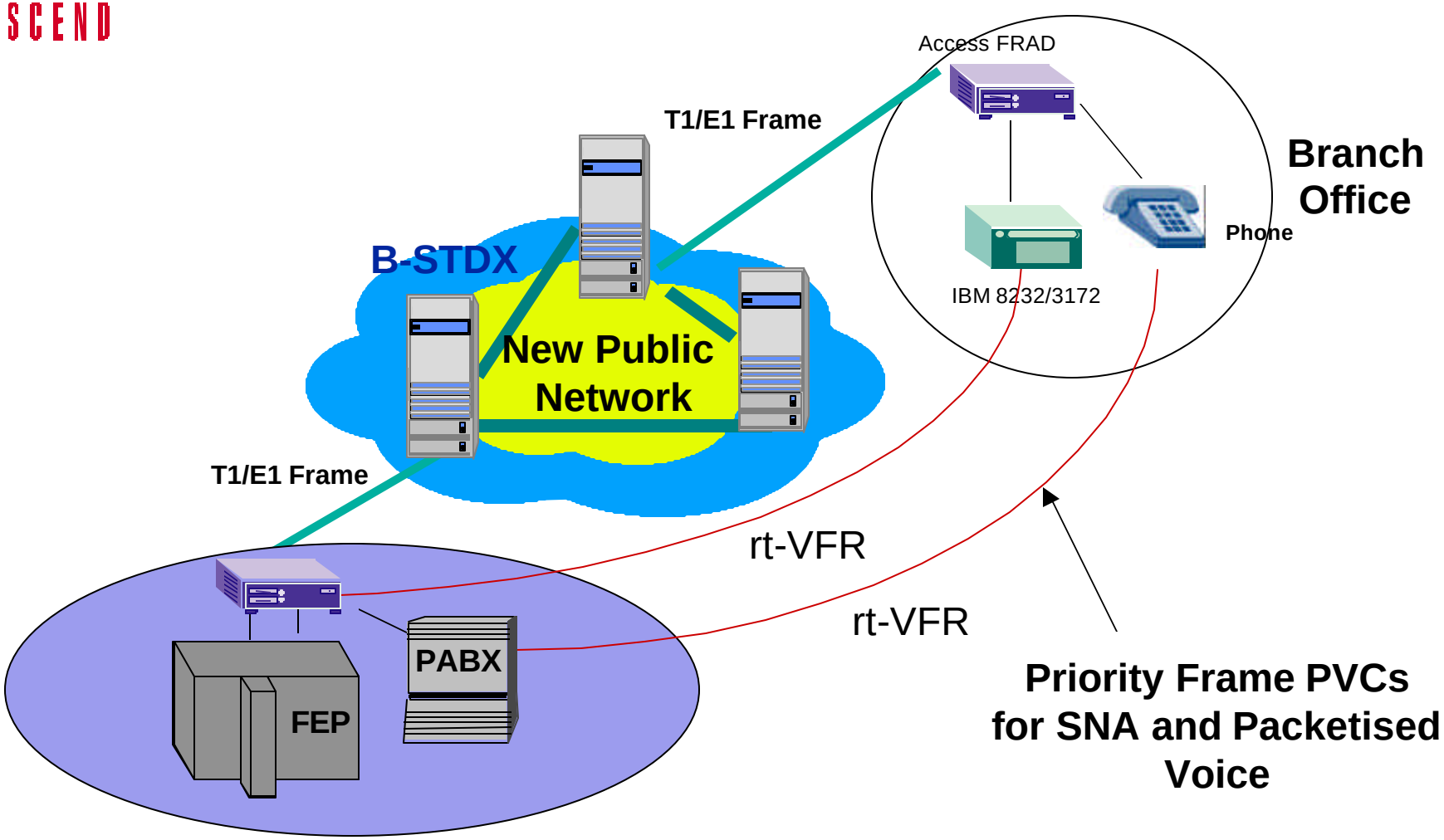
Frame Relay Service



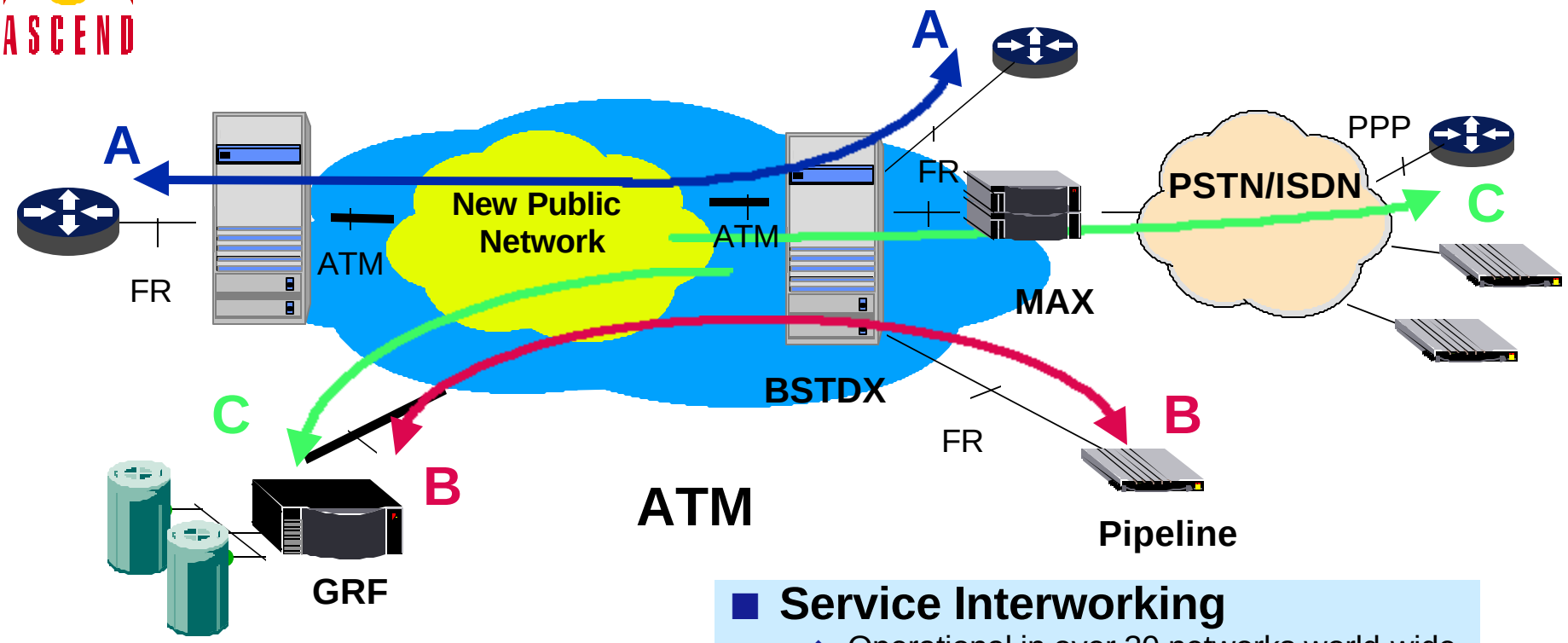
Frame Relay Implementation

- Efficient method of Wide Area communications for LAN to LAN data
- New applications such as SNA and Voice support possible with QoS controls
- Today's networks must be scalable for high port speeds and densities
- Frame Relay and ATM complementary technologies and require interworking
- Frame Relay networks require Dynamic Routing & Rerouting of PVCs of SVCs
- Value features such as Fault Tolerant PVCs, Multicast, and Customer Network Management

Priority Frame - Value-Added SNA and Voice Services



FR/ATM Service Interworking



A **FRF.5 (FR UNI to FR UNI)**

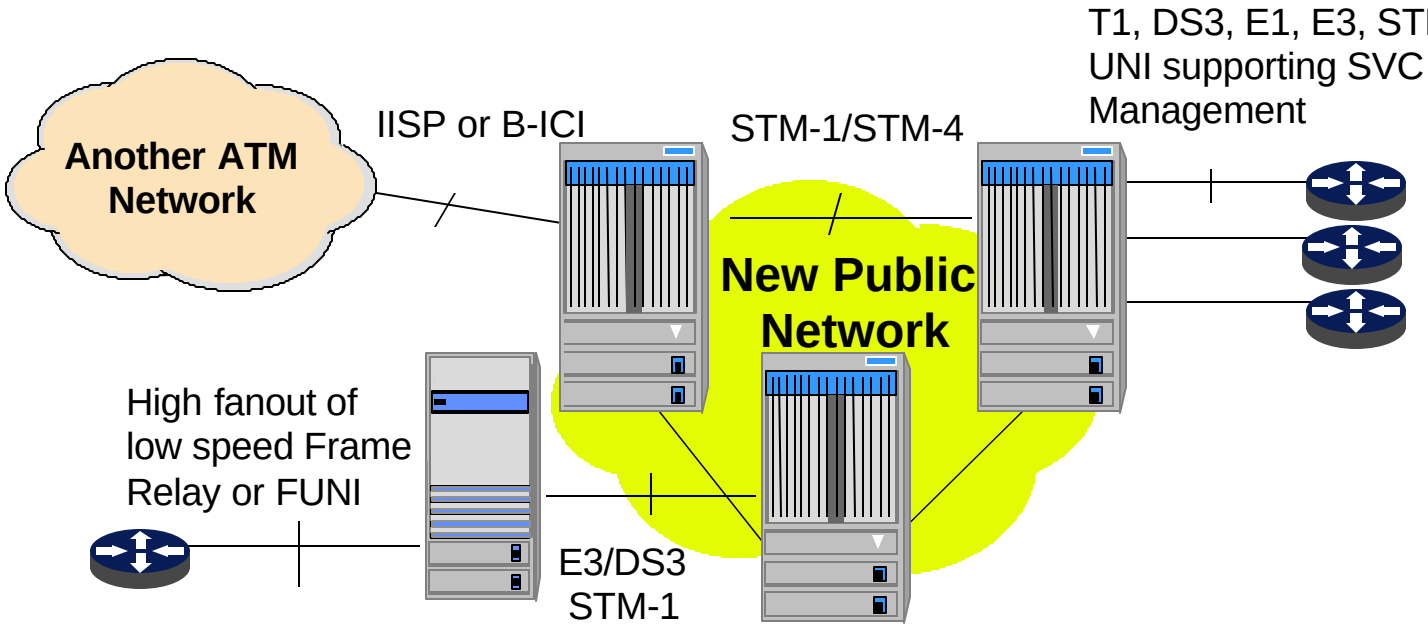
B **FRF.8 (FR UNI to ATM UNI)**

C **FRF.8 (PPP to FR UNI to ATM UNI)**

Service Interworking

- Operational in over 30 networks world-wide
- Full support for FRF.5 and 8
- Traffic parameters mapped automatically according to B-ICI specifications
- RFC 1490 to RFC 1483 Interworking
- FRF.5 used to scale Frame Relay networks
- FRF.8 useful in connecting branch/remote offices to ATM connected headoffices.

Carrier ATM Service



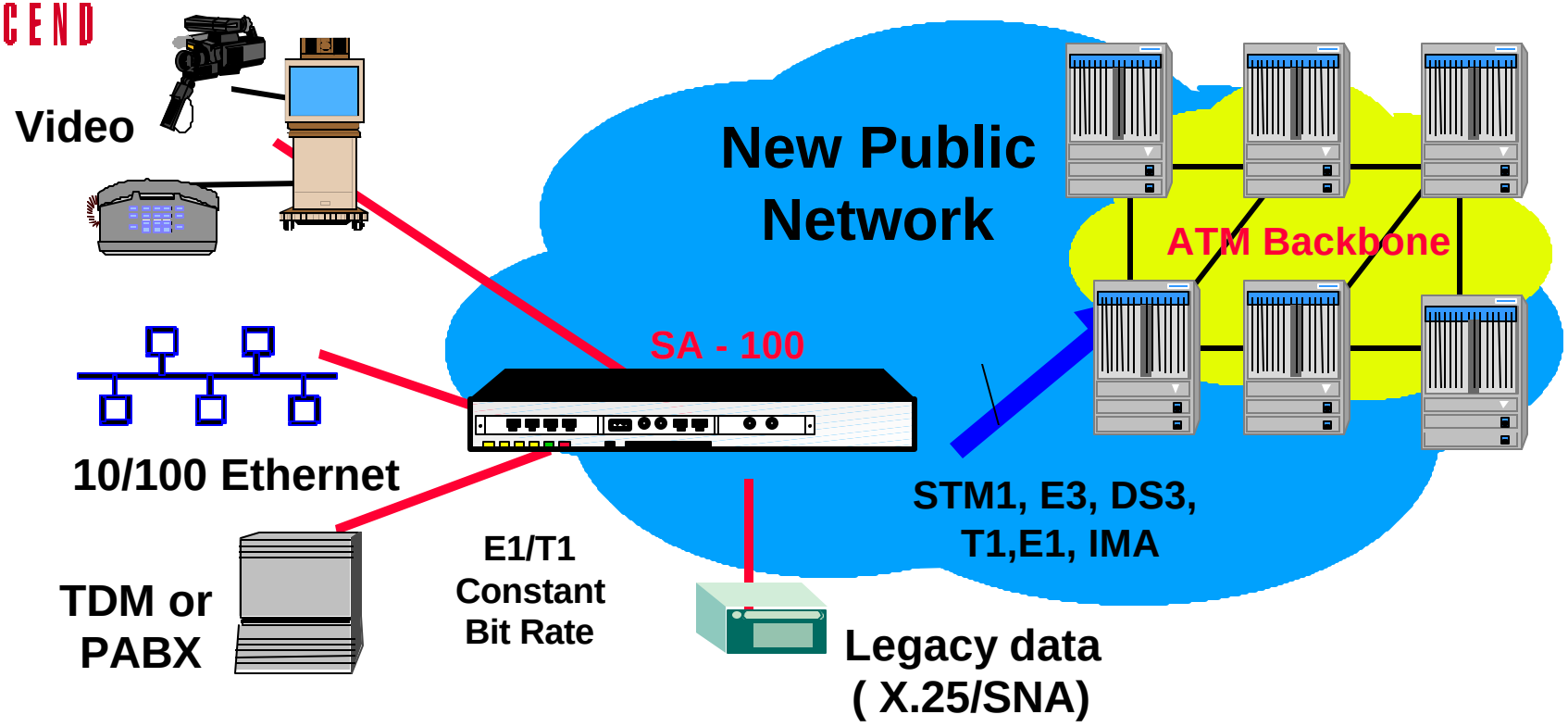
ATM Implementation

- High Speed Wide Area communications for LAN to LAN data
- ATM promises a common transmission method for voice video and data traffic
- Controllable quality of service with statistical bandwidth on demand
- Product ATM networks must be scalable for high port speeds and densities
- ATM and Frame Relay are complementary technologies and require interworking
- ATM networks require Dynamic Routing & Rerouting of PVCs of SVCs
- Value features such as Fault Tolerant PVCs, Multicast, and Customer Network Management

Native ATM Services

- **Demand is growing rapidly**
- **Relative complexity of ATM may cause end-user confusion, stalling acceptance**
  - CBR, rt-VBR, nrt-VBR, ABR, or UBR??
  - PCR, SCR, MBS, BT??
  - CDV, CDVT, CLR??
  - Traffic shaping?? Policing??
  - What is best for my applications?

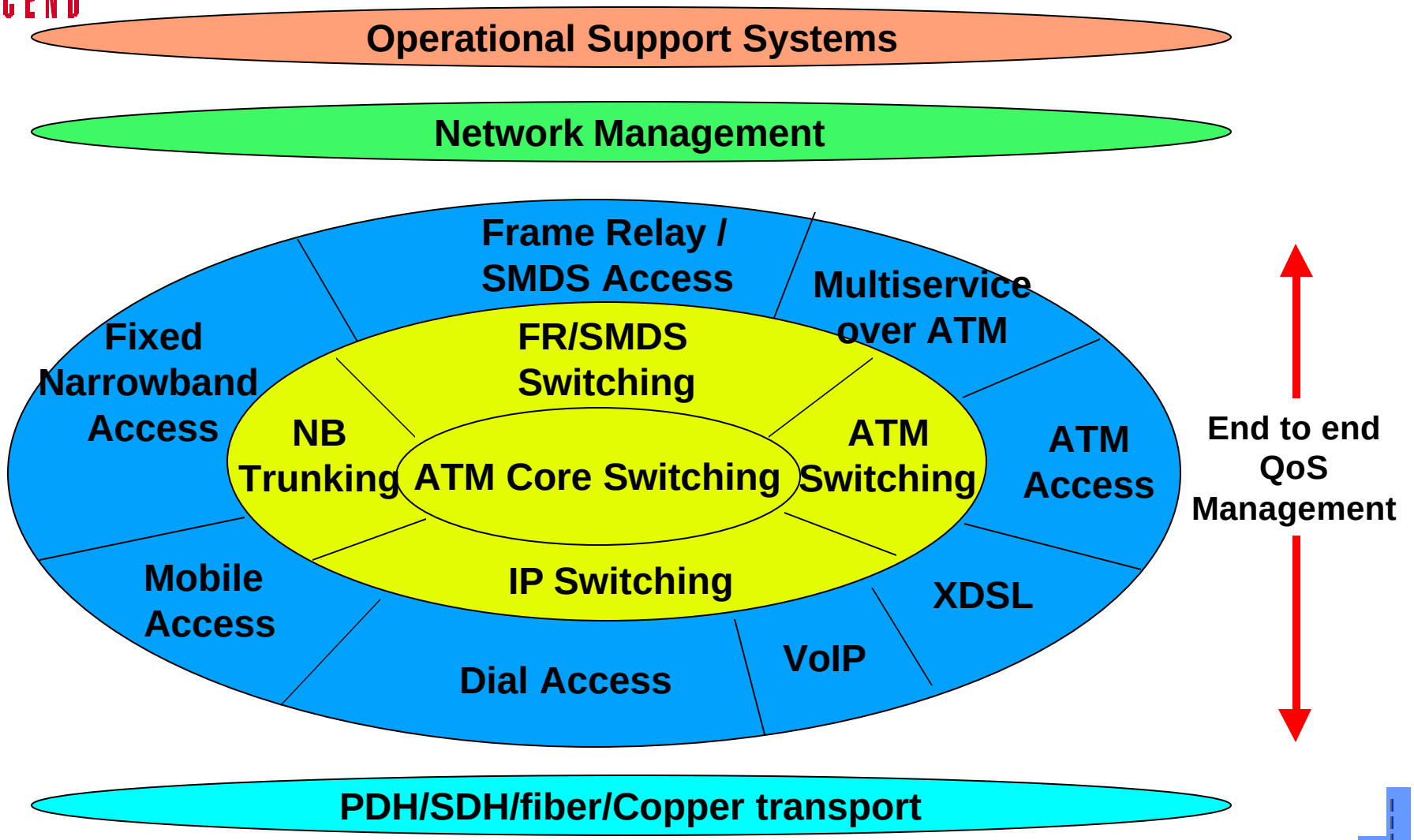
Integrated Business Solutions over the New Public Network



ATM Service Multiplexer Implementation

- Hide ATM complexity whilst deploying Integrated Business solution over ATM
- Lower overall delivery cost for a package of services - extend NPN to the customer premise
- Fulfil ATM promise of a common transmission method for voice video and data traffic
- Controllable quality of service with statistical bandwidth on demand

Total New Public Network Carrier Solution



Summary

- Broadband networks offer Service providers opportunities for additional revenue generating services and reduction in operating costs.
- Ascend Communications offers a comprehensive solution for delivery of advanced multi-service networking.
- Ascend has a clear vision and an evolution path to the New Public Network