NORTEL
NORTHERN TELECOM

Magellan Frame Relay Market and Product Update

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Agenda

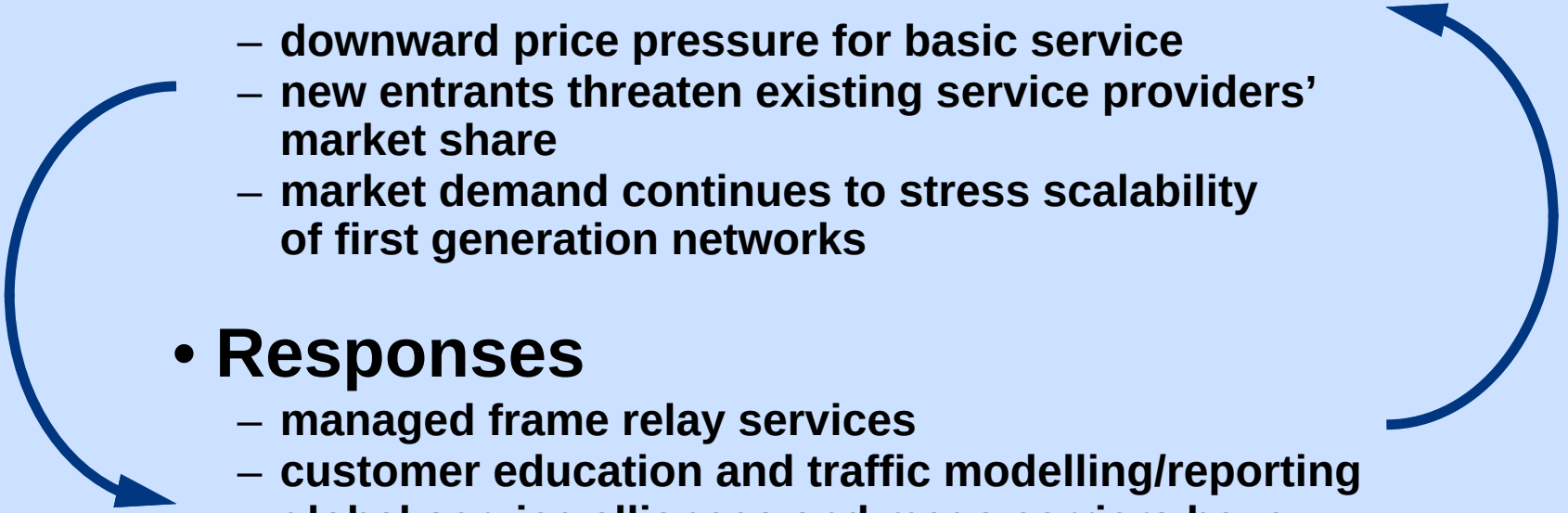
- **Frame Relay Marketplace Updates**
- **Magellan Frame Relay Achievements**
- **Frame Relay Evolution**
- **Summary**

Service Acceptance by End Users

- **Widespread acceptance by users**
  - proven economics, price remains a key buying criteria
  - require consistently dependable service with disaster recovery
  - ease of deployment and maintainability
  - customer service viewed as a differentiator
  - international availability, network-to-network interconnectivity
  - smooth transition to continuously evolving technologies
- **Key drivers in 1995**
  - leased line replacement for dispersed LAN internets
  - SNA applications in a client/server architecture
  - alleviating congestion in large enterprise router networks
- **Comparison shopping for basic service**

Service Providers' Challenges

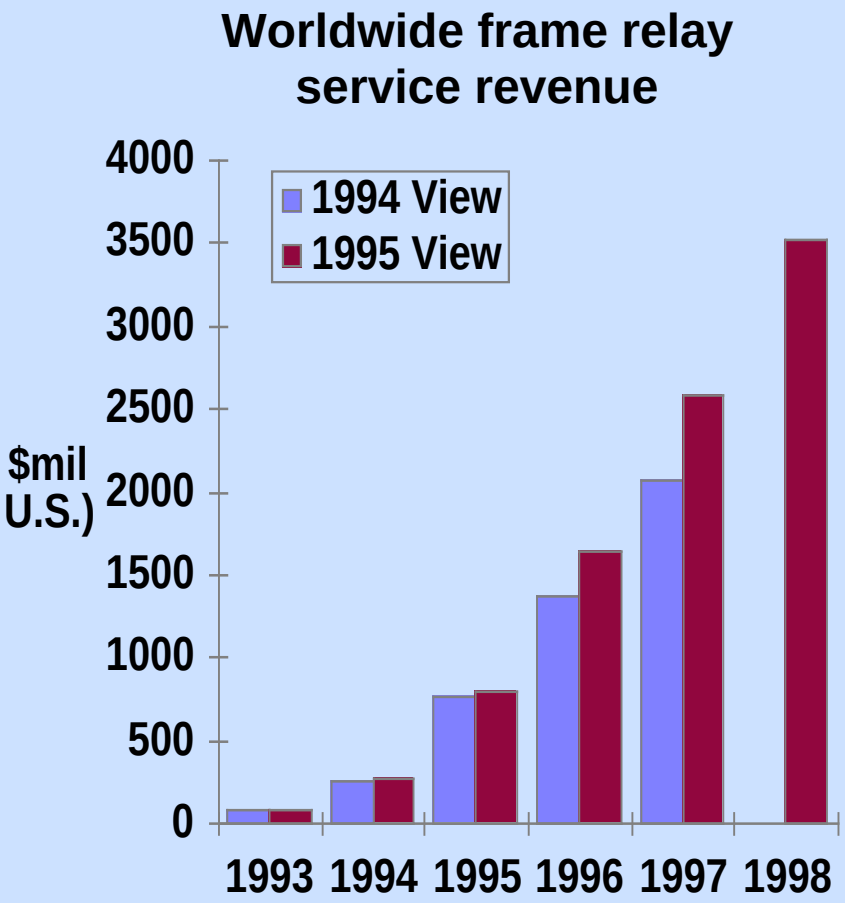
- **Pressures**
  - downward price pressure for basic service
  - new entrants threaten existing service providers' market share
  - market demand continues to stress scalability of first generation networks
- **Responses**
  - managed frame relay services
  - customer education and traffic modelling/reporting
  - global service alliances and mega carriers have emerged for frame relay
  - search for application drivers beyond basic services
  - innovative tariffing packages



Changing Requirements

- **High-speed frame relay**
  - **fractional T1 1995 revenue in U.S. exceeded revenue for low-speed ports**
  - **high-speed frame relay revenue growing to 58% of total revenue by 1998**
  - **T3 frame relay access to address concentration in large enterprise networks**
- **Multimedia desktop applications fueling high bandwidth requirements**
- **Emerging real-time multimedia applications**
- **FRADs driving demand beyond LAN interconnect**
- **SVCs are now in play**
- **Frame relay over ATM backbones deployed**

Market Growth



Source: Vertical Systems Group

- Growth outpaces aggressive forecasts
- 1994 to 1998 CAGR > 90%
- 1995 U.S. growth driven by 248% increase in fraction T1 services
- U.S. service revenue passed $0.5 billion in 1995
- European/Asian service revenue will pass $ 0.5 billion in 1996 (107% growth over 1995)

Standards - Current Status

- **Base technology standardization complete and largely implemented**
  - **UNI/NNI PVC (FRF.1 and FRF.2)**
  - **multiprotocol interconnect (FRF.3)**
  - **SVC at the UNI (FRF.4)**
  - **ATM PVC network interworking (FRF.5)**
  - **ATM PVC service interworking (FRF.8)**
- **The focus now shifts to value added solution of business problems**
  - **increased importance of the Market Development and Education (MD&E) committee (Nortel-chaired)**
  - **maintain positive momentum in the market using MD&E**

Standards Evolution

- **SVC enhancements (Nortel editor in ITU-T)**
  - **security (via CUG)**
  - **class of service signaling**
- **Data compression**
- **Voice carriage**
- **NNI enhancements (Nortel editor in ITU-T)**
  - **SVCs, SPVCs**
- **Switched access to frame relay**
- **FR-ATM SVC interworking**

Value-added solutions to business problems

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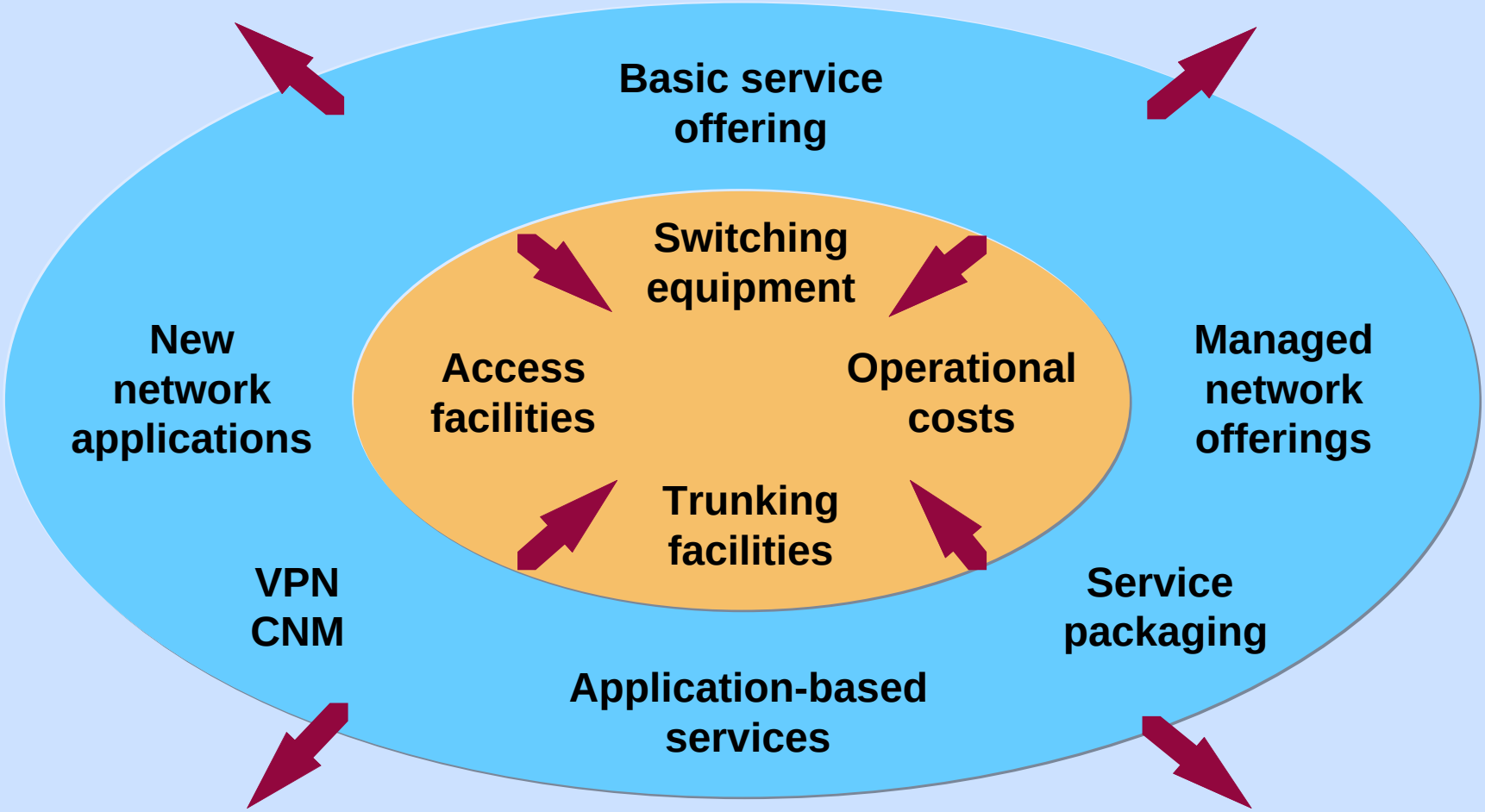
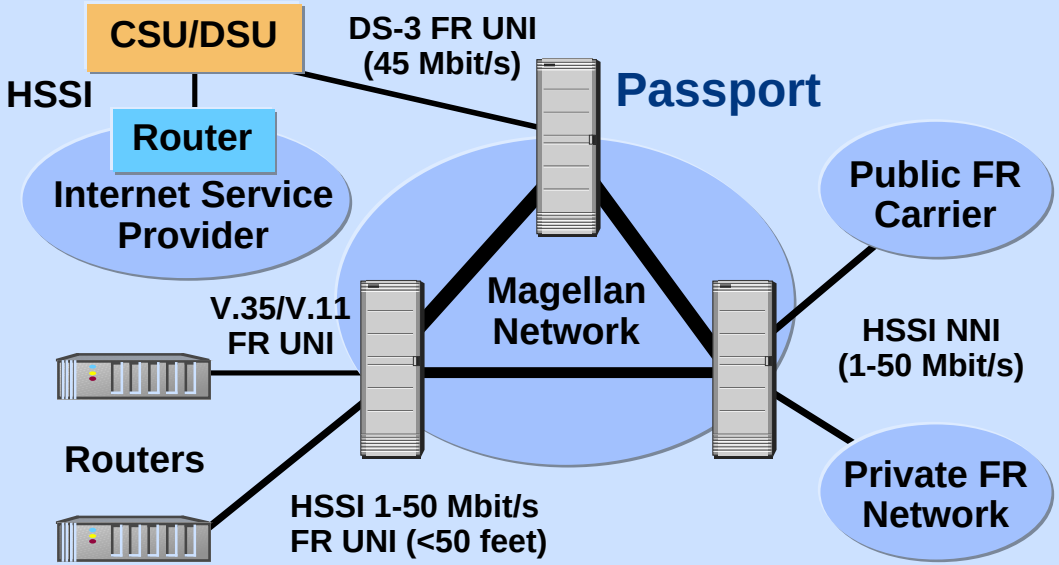
Revenue Growth and Life-cycle Cost for Next Generation Frame Relay Networks



Revenue/port - loaded cost/port = Profit

High-speed Frame Relay



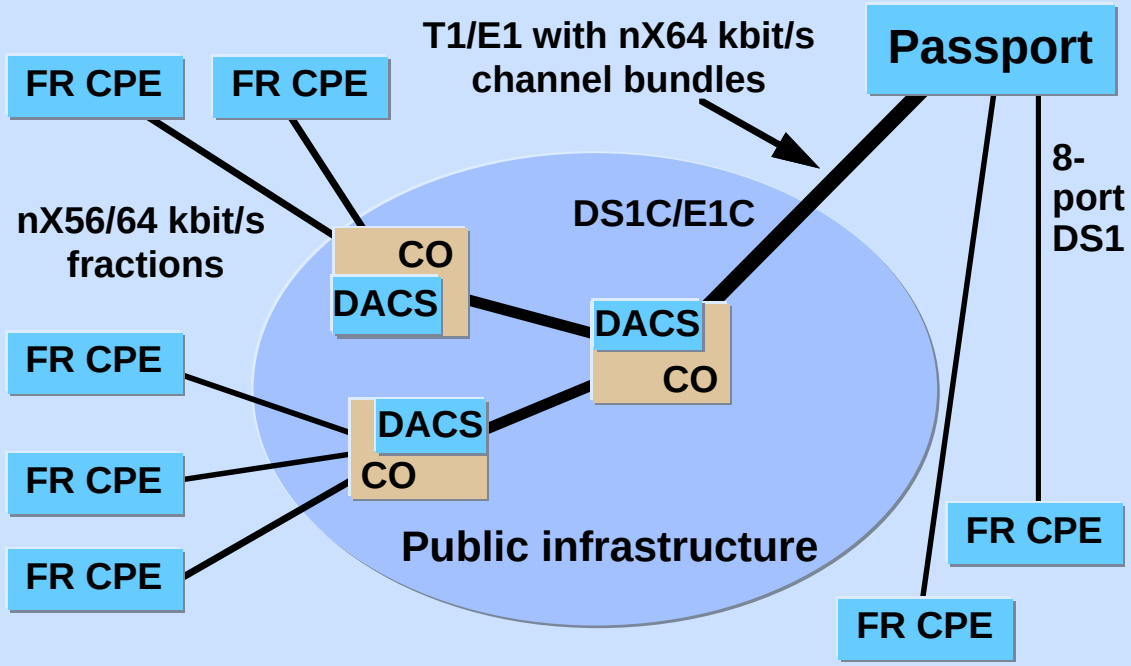
- FR UNI connectivity
- Multi-carrier networking
- Private NNI

- HSSI - up to 50 Mbit/s
- DS-3 - 45 Mbit/s
- V.11 - up to 8.4Mbit/s
- V.35 - up to 4 Mbit/s
- E3 Capable - 34 Mbit/s

- CIR/EIR up to line speed

- Differentiate service in the market as a leader
- Capture niche market segments and solutions
- Consolidate traffic in high-speed backbone
- Opportunity for consolidating Internet traffic
- Smooth migration to high-speed ATM when ready

Fanout Improvements



- 4-port E1C/DS1C
  - –up to 124/96 channels
  - –fractions available with non-contiguous timeslots
  - –>1200 FR ports/shelf
- 8-port DS-1
  - –full T1/Fraction
  - –up to 112 DS1s/shelf

- Utilize 4-port DS1C/E1C for high-density, low-speed connectivity
- Reduce shelf space, transmission equipment and per-port costs
- Utilize 8-port DS1 interface for full DS1 or high speed DS1 fractions
- Address growth in DS1 FR access

High-performance System

Access performance ...

Release 3 improves frame relay performance

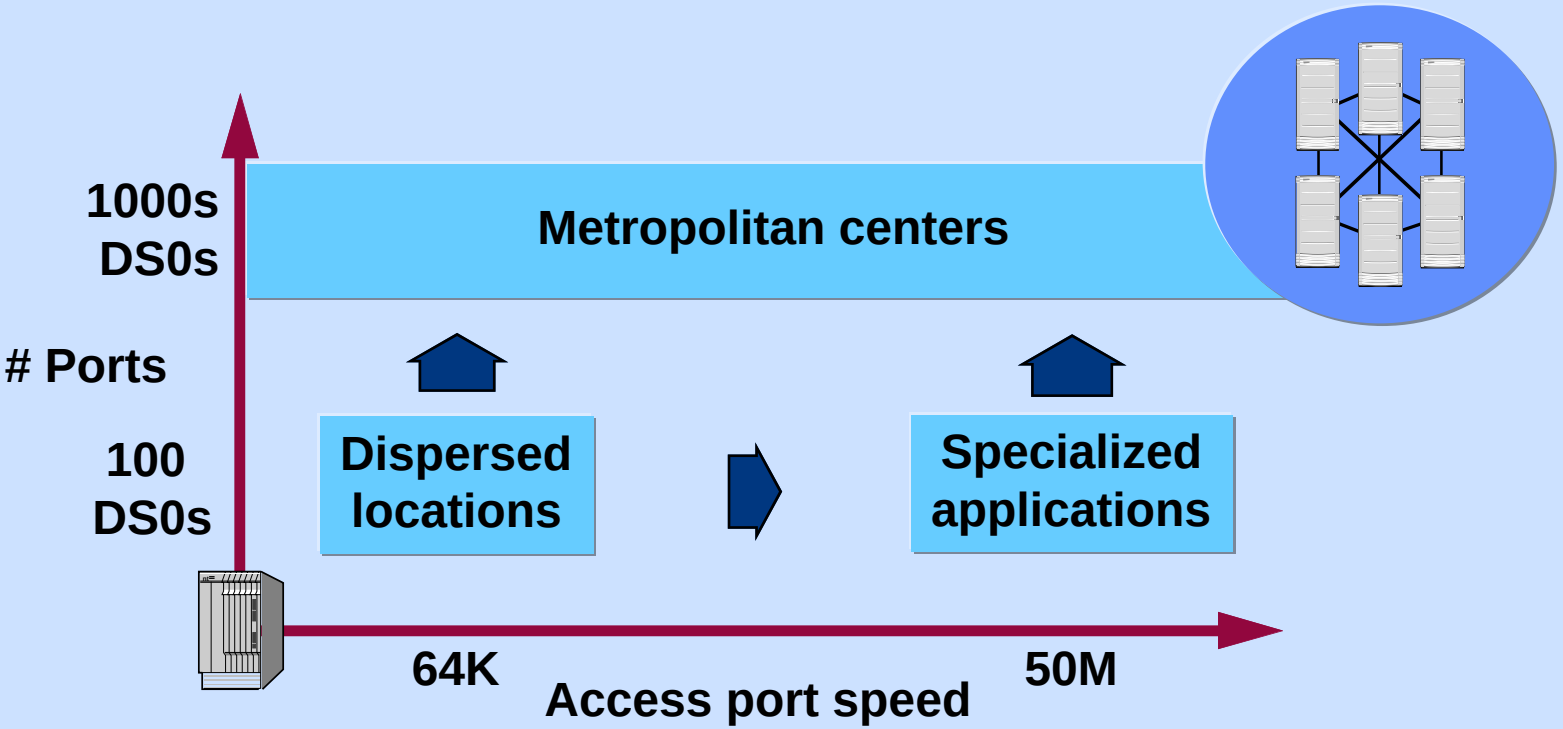
- Up to 100% performance improvement in FR throughput
- Leverage high-speed interfaces for FR UNI/NNI applications
- Take advantage of improved fanout
- Smooth migration for users needing increased bandwidth

... in concert with trunk performance

- 80% performance improvement Rel. 3 DS3/E3 frame/cell trunk
- Up to 14 DS3/E3 trunk functional processors per shelf
- 3-port ATM OC-3/STM-1 trunks available

Cost/performance improvements without hardware upgrade, further leveraging your investment

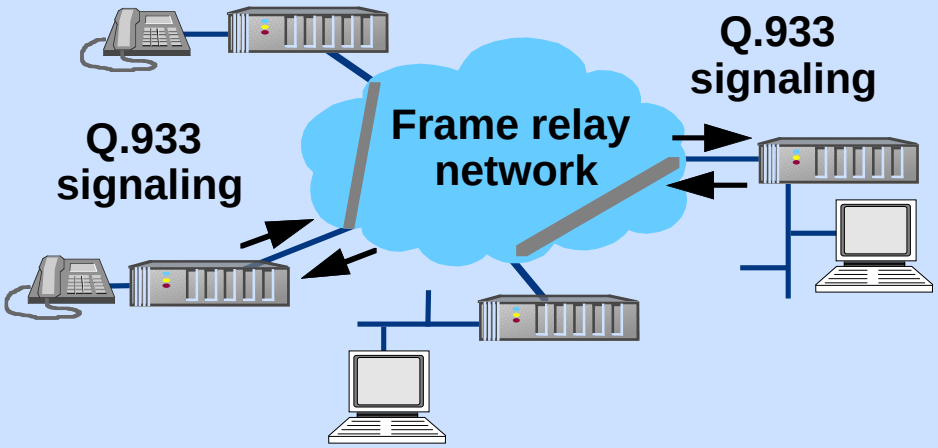
Next Generation Scalability



- Cost-effective deployment with a single, high-performance platform
- Smooth migration to higher speeds using the same platform
- Independently migrate users to higher speeds as demanded by users
- Demand for higher speed constantly moving upward

Frame Relay SVCs

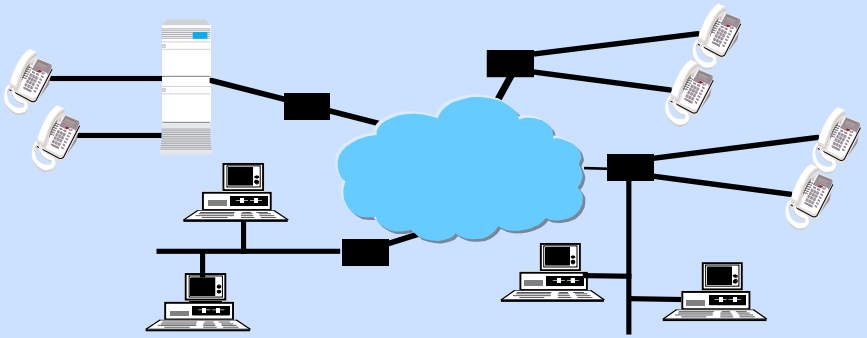
INDUSTRY FIRST
Comnet
Jan'96



- Compliant with FRF.4,
- ITU- Q.933 and Q.922
- Integrated egress accounting
- Distributed architecture

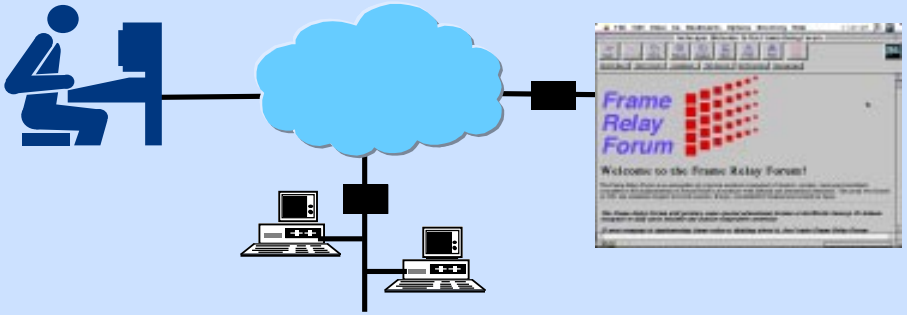
- **Expand addressable market with new applications**
- **Enhancing benefits to the end user**
  - connection and duration based on need
  - better utilization of bandwidth (compared to PVCs)
  - allows easy adaptation to office growth
- **Reduced administrative costs for service provider**
  - provisioning minimized
  - no processing of adds/changes/delete
  - quicker service activation

Applications to Drive SVCs



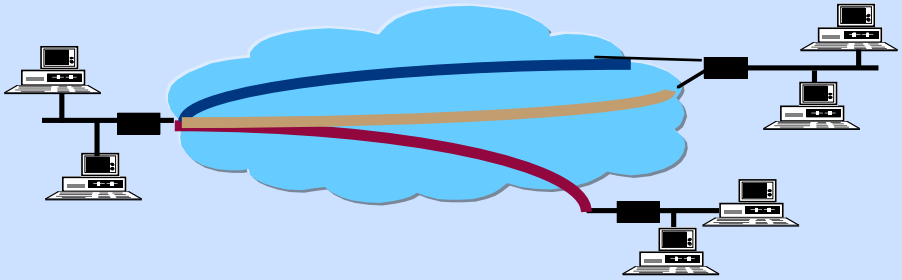
Voice over frame relay

- Simplified ubiquitous access
- Duration as required
- Rapidly gaining acceptance



Highly meshed public and private Internet and remote LAN access

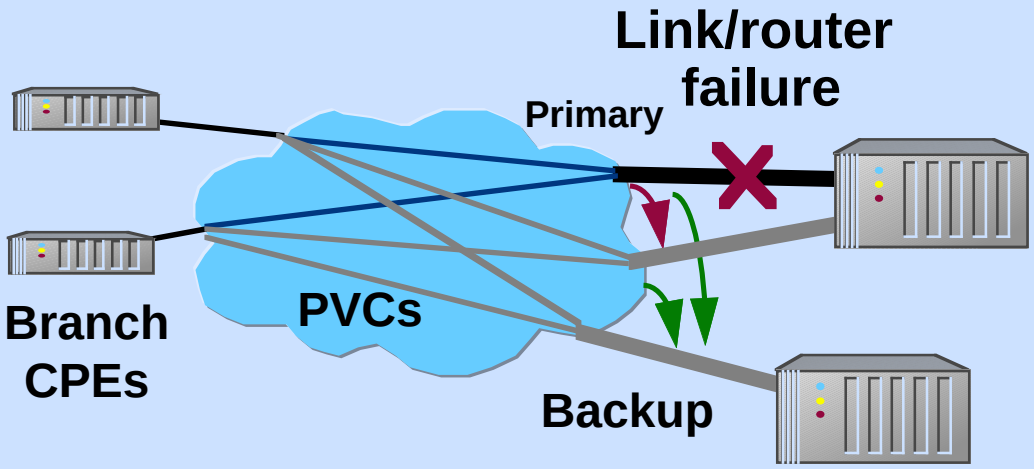
- Flexibility to multiple users growing rapidly
- Simplified value added extensions for content providers



Disaster recovery

- Cost savings through sharing
- Simplicity for wide-scale use
- Flexible recovery options

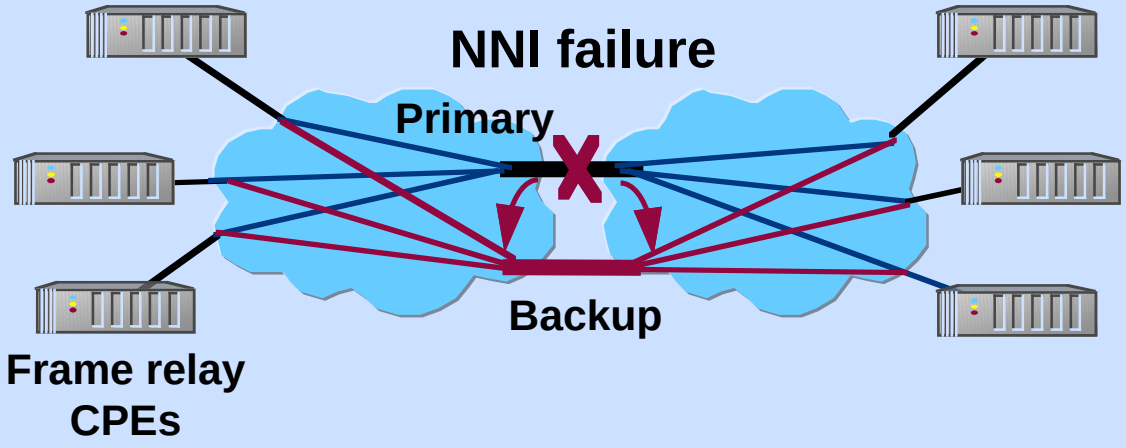
Resilient Frame Relay UNI



- All PVCs are automatically established to the backup service
- Switchover in seconds
- Multiple backups
- Manual/automatic capability

- Offer disaster recovery services as a premium service for PVC clients
- Fully transparent to branch site routers
- Resilient to multiple failure modes
- No resources consumed in network by backup paths, until in use

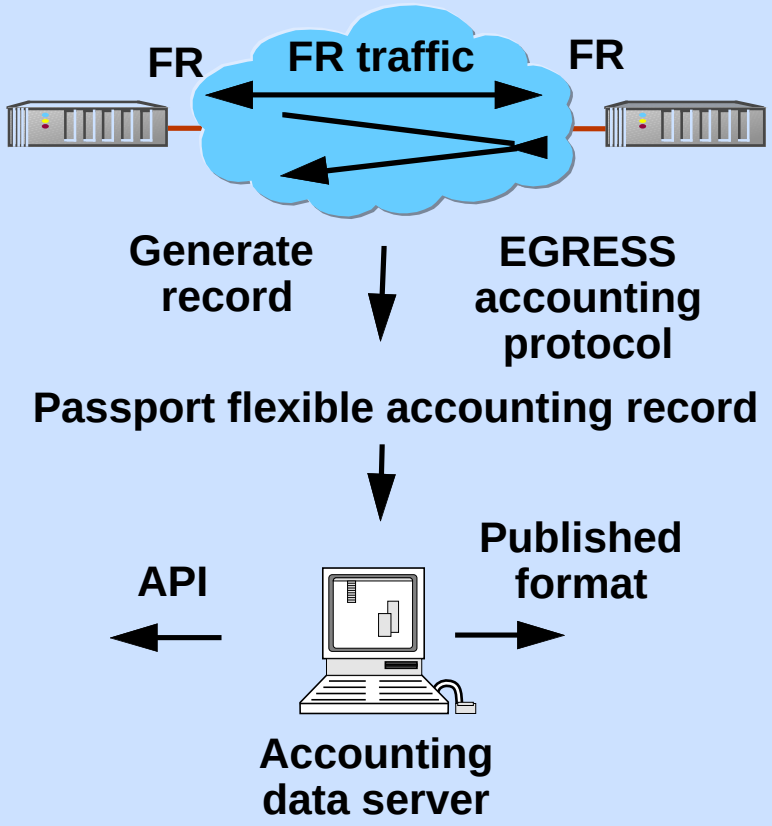
Resilient Frame Relay NNI



- All PVCs are automatically established to the backup service
- Switchover in seconds
- Multiple backups
- Manual/automatic capability

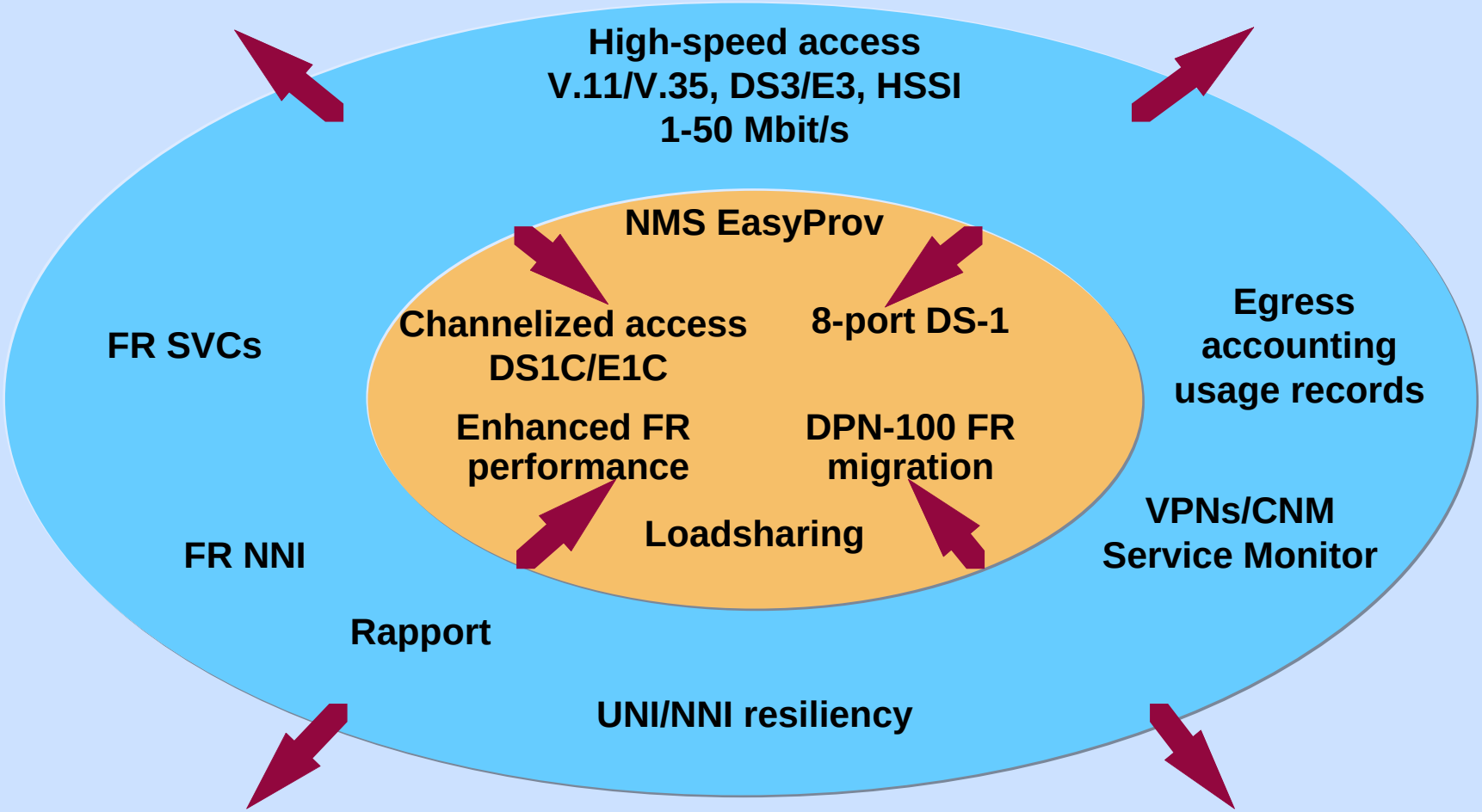
- Improve end-to-end availability of user PVCs
- Suitable in both multi-carrier and private NNI environments
- Not dependent on standards development
- No proprietary extensions required
- Can be automatic or tuned to be manual

Service and Network Management Accounting Capabilities



- **Service differentiation**
  - flat rate or usage-based billing
  - customized reporting capability
  - VPN/CNM identification
- **Cost-efficient, reliable and scalable**
  - single record egress accounting
  - no external end-to-end matching
- **QoS performance management**
  - service level verification
  - select monitored period
  - measure frame/byte stats/PVC
  - basis for re-engineering network
  - peak water mark monitoring
  - proactive selling opportunity
- **Available for PVCs and SVCs**

Improving the Profitability Equation



Reducing life-cycle costs and generating new service opportunities for the next generation

Magellan Frame Relay Success

- Passport frame relay deployed in every region
- More than 30 Magellan frame relay service providers
  - >100 % growth in Magellan frame relay service providers
- Frame relay software delivered to more than 75 Passport customers
- Approximately half of enterprise customers use Magellan frame relay

Significant Magellan frame relay momentum in 1995

Thank You

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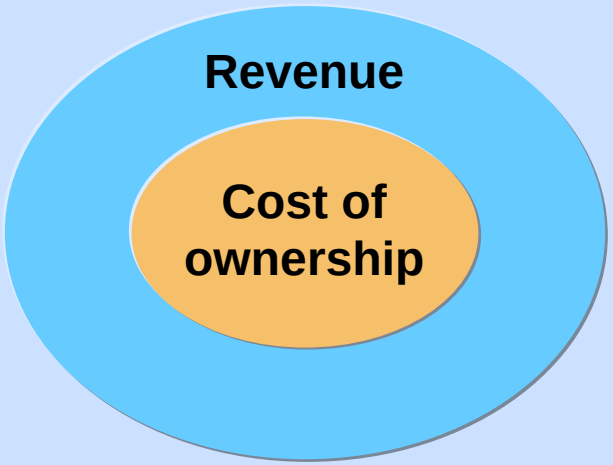
Evolving the Next Generation Networks

- New frame relay revenue and application opportunities
- Addressing cost of ownership
- Smooth transition to new technology
- Operational and availability improvements
- Scalability and growth planning
- Market introduction and development assistance



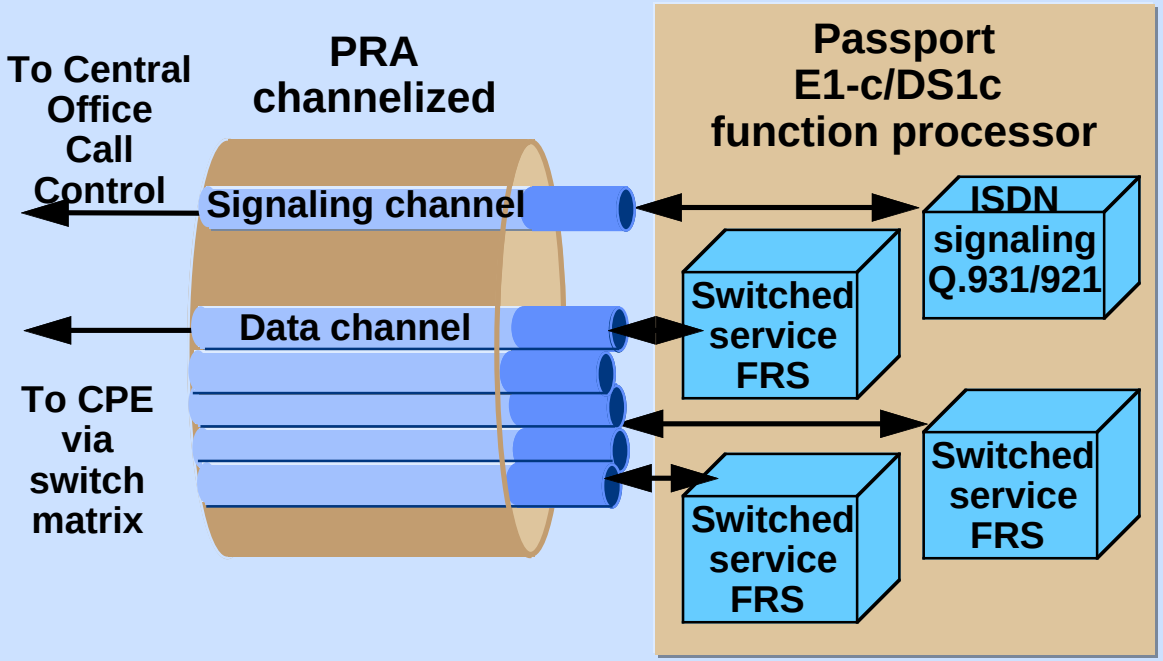
Partnering with our customers for mutual success

Switched Virtual Circuits

- **Security enhancements**
  - **support of closed user groups**
- **Traffic class signaling**
  - **support of multimedia services**
- **Co-existence with switched access**
  - **extending the reach**
  - **true ‘plug and play’**
- **Other network services**
  - **redirection**
  - **hunt groups**

Enhancing the product and maintaining our lead

Switched Access

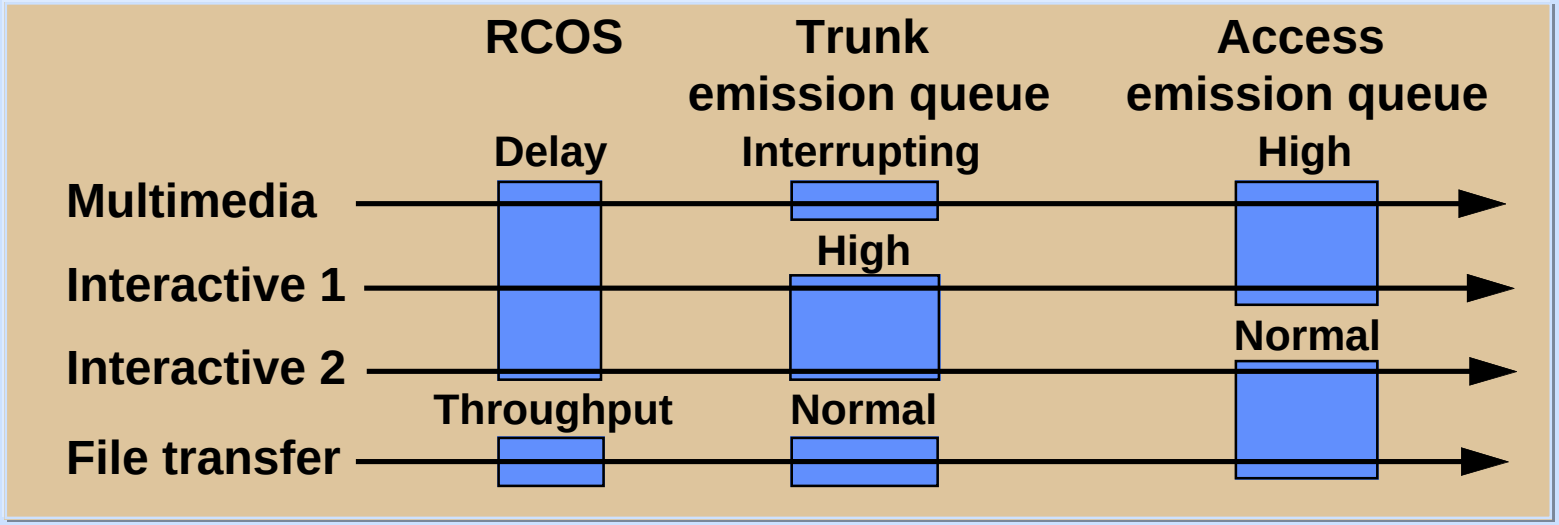


- ISDN & switched-56 access
  - ubiquitous
  - reduced cost
  - increased resiliency
  - rapid turn up time
- Service types
  - occasional access
  - permanent access
  - disaster recovery

- Via PRA, based on channelized FP
- Rapid generation of regional ISDN variants
- Distributed protocol processing for scalability

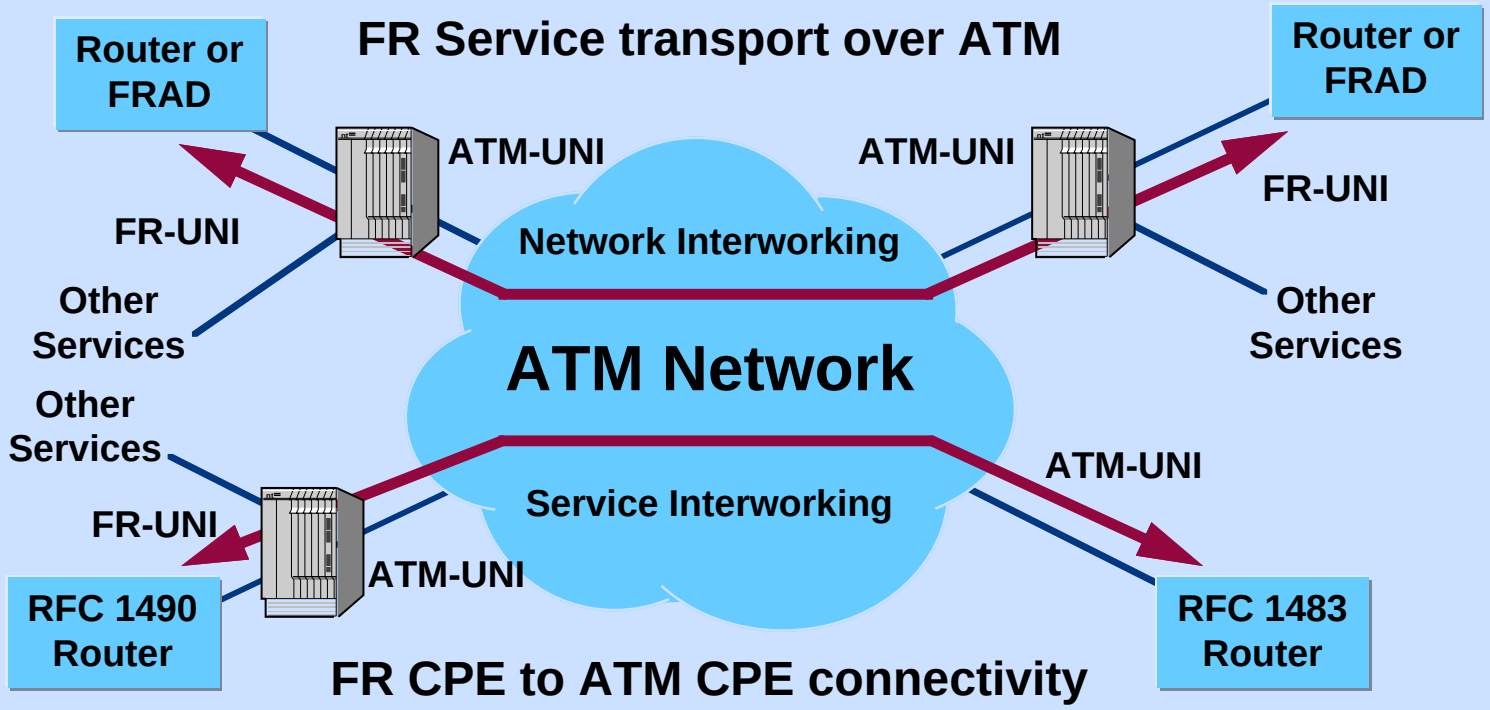
Multimedia Traffic Class

- **Reduce delay and delay variance for real-time multimedia applications (eg. voice, video, etc.) over frame relay**



- **Select traffic class on a per PVC basis**
  - **independently define urgency, importance and reliability**
  - **urgency determines trunk emission priority, routing class of service and emission priority at egress access link**
  - **multimedia class of service utilizes Magellan interrupting trunk queues for priority delivery**

ATM Interworking



- Logical trunking provides network interworking
- Service interworking translates RFC1490/RFC1483 encapsulation for end-to-end CPE connectivity

Continuing evolution

- **Improving operations**
  - **frame relay trace on Passport**
  - **PVC loopback**
  - **PVC alarming**
- **CP redundancy for Passport model 50**
  - **low-end model suitable with even higher reliability**
- **Hitless CP**
  - **continuously improving user availability**
- **Continued performance enhancements**
  - **initially targeting channelized cards for performance improvements**
- **Continue evolution of high-density interfaces**
  - **DS3 channelized interface**
  - **enhanced European interfaces**
- **NNI evolution**
  - **SPVCs consistent with standards evolution**

Evolution Beyond the Platform

- **Facilitate growth of new and existing frame relay networks**
  - **iterative network design for new and growing networks**
  - **leverage Magellan's comprehensive congestion management and robust routing system**
  - **engineer with multiple traffic classes**
  - **engineer NNI for immediate deployment**
- **Assist in the introduction of frame relay services**
  - **Frame Relay Service Development Guide**

Related sessions

Frame Relay Service Strategies	**John Casadante** **Chairperson, Frame Relay Forum MD&E Committee**
Frame Relay Engineering	**Todd Biggs** **Senior Network Engineer**

Summary

- **Rapid market growth continuing through 1998**
  - **opportunities for both service providers and enterprises**
  - **gap between North American and rest of world markets is narrowing with explosive global growth**
- **Nortel focus on customer profitability**
  - **addressing cost of ownership and value-added revenue opportunities**
- **Significant customer base established**
  - **commitment to evolution and growth through partnering with our customers**

Thank you for choosing Magellan frame relay