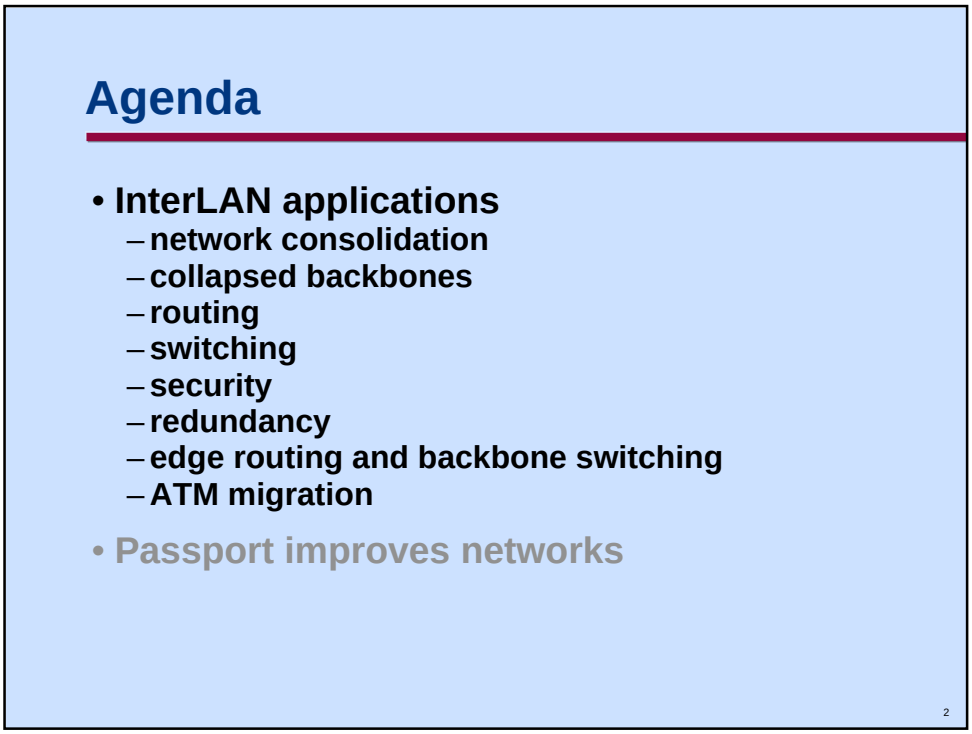
This workshop was designed for network engineers, architects, and managers. It will show that Passport interLAN switching can be used to improve real-world networks. Passport interLAN switching is the TCP/IP and IPX routing and switching product for WANs and LANs. Passport interLAN switching includes security, X.25 and frame relay DTEs, and network and backbone consolidation features.

The objectives of this session are to explain Passport interLAN switching from a customer perspective and to provide clear real-world examples of how Passport interLAN switching can be used to improve networks today and evolve to tomorrow's technology.

About the presenter:

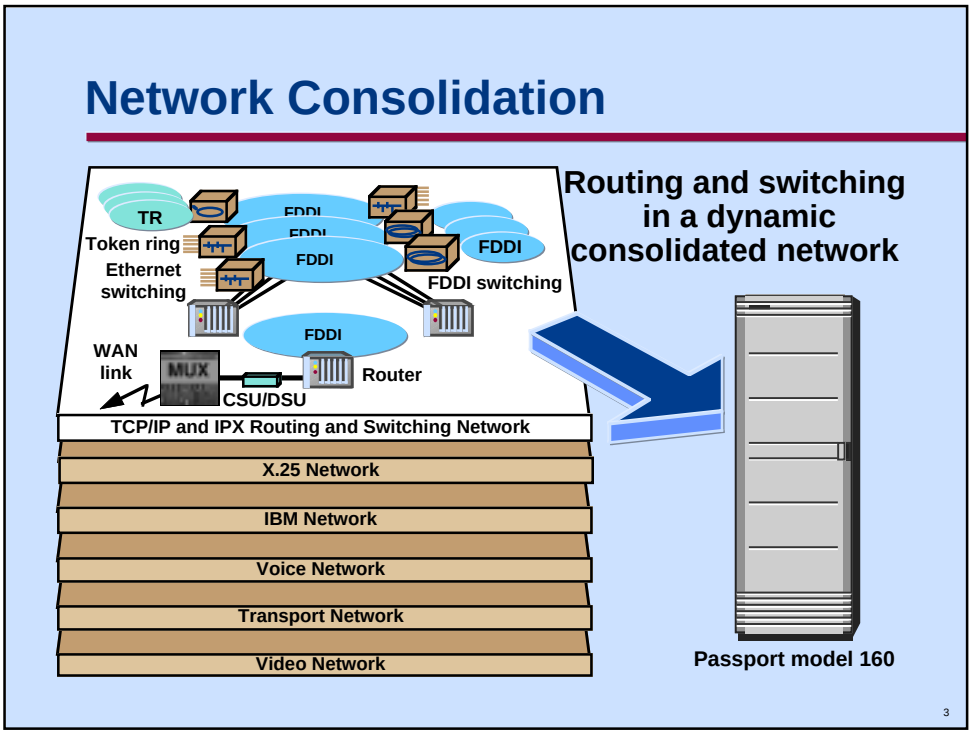
Rob Tomkins started his career with Nortel Technology (formerly Bell-Northern Research) in January 1991. Since early 1992, Robert has been working in the Information Technology (IT) and Global Enterprise Services (GES) LAN and WAN engineering groups. He held various analytical, network engineering, technology specialist, and project management roles to maintain, expand and improve Nortel's internal networks—sometimes with Magellan products. Robert has recently been involved in ethernet switching hub selection, Passport interLAN switching certification and deployment, and ATM product evaluations. He engineered the migration of over 40 routers to OSPF and developed a plan to migrate the remaining 300 Nortel routers to OSPF. He was responsible for the routers in the Ottawa metropolitan area network for two years and was one of the key router experts in the Nortel corporate network for over three years.

In January 1996, Robert became the Passport InterLAN switching product manager. He brings to his current job a wide range of Internet Protocol (IP) and Appletalk network experience, a broad understanding of the current data communications market, and a customer oriented view.



This workshop builds on the *Magellan LAN Interconnection Products for the Enterprise* workshop. For further information on Passport's interLAN switching, please pick up a copy of the *InterLAN Switching* white paper, or visit the following inform events:

- *InterLAN Switching* demonstration
- *InterLAN Switching* whiteboard clinic
- *Passport Update* workshop
- *Nortel's Internal ATM Network: A Customer Perspective* workshop



Most medium to large corporations have six or more distinct networks to manage. Each network requires considerable capital and operational investments.

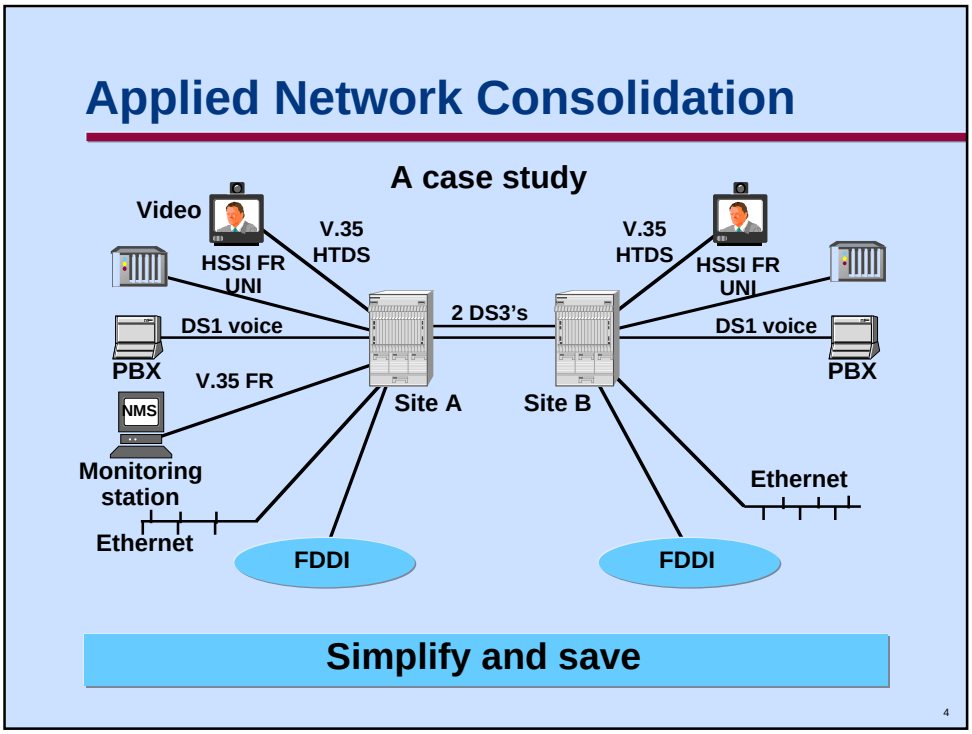
Nortel Magellan's strategy is to consolidate those networks into one network. A key component of the Nortel Magellan consolidation strategy is Passport.

Magellan Passport has the power to dynamically consolidate all your networks into one network with integrated network management for cost savings. This includes the following types of networks:

- LAN/WAN via interLAN switching
- ATM
- Frame relay
- Video via bit transparent service
- Voice
- IBM services
- X.25/DPN-100 networking

InterLAN switching's role in Passport is to provide:

- IP and IPX routing
- Switching and bridging for token ring, ethernet, FDDI, and serial media
- Full security and filtering features
- Access to public WAN services via frame relay, the Point-to-Point Protocol (PPP), and X.25



The above slide is based on a real-world customer's use of Passport.

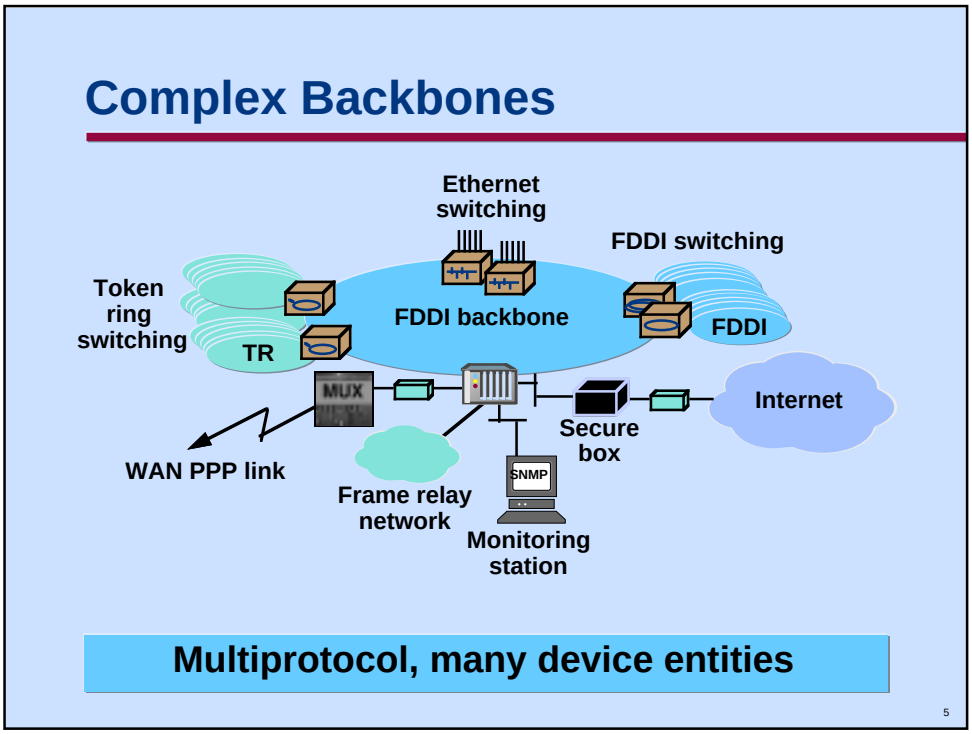
The customer has the following five main services to deliver:

- Voice
- Video
- FDDI and ethernet LAN interconnection
- Network monitoring
- Frame relay UNI

Without the Passport, this network would require one DS1 for each video stream, many DS1s for the frame relay, one DS1 for voice, and a full DS3 for the LAN data.

When Passport is integrated into the network:

All five services can traverse the same Passport trunks, like the DS3 above. The customer consolidates four different networks into one. **This simplifies monitoring and saves money.**



Demands on today's backbones are complex.

User expectations:

Today's users expect access to everything, and higher bandwidth for all. Most backbones are expected to facilitate the following:

- High bandwidth servers via switched networks
- Routing to the corporate wide area network
- Switch-to-switch connectivity
- Routing to a secured Internet connection

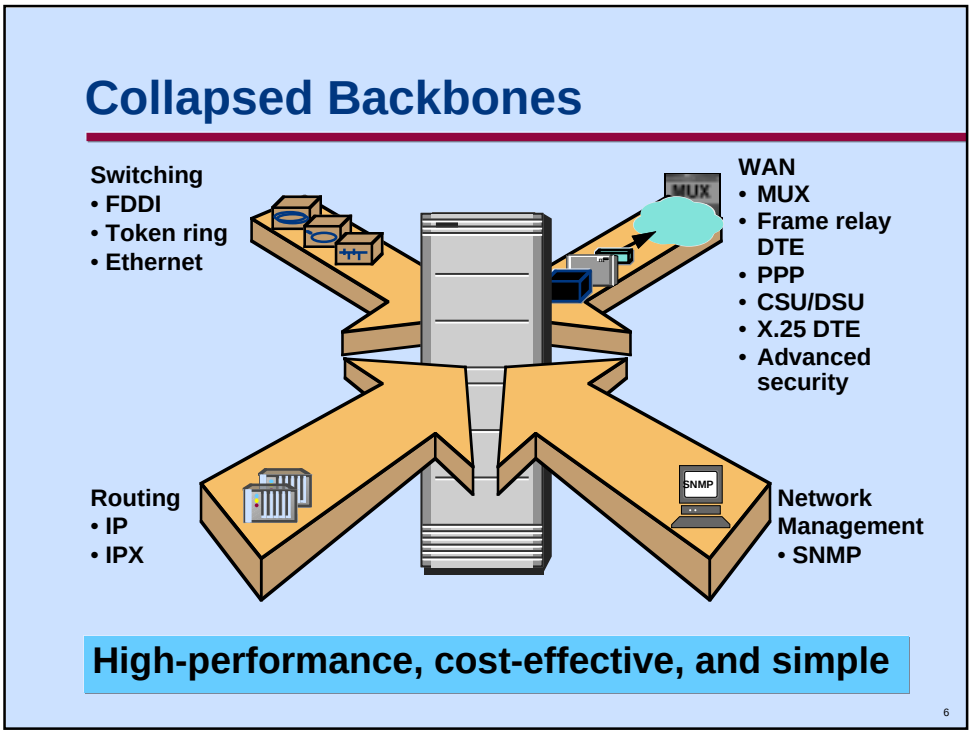
Network management:

Users expect backbones to be up and functional for 24 hours, seven days a week, every week. This means every device and the backbone itself must be monitored and managed by a networking management station.

Performance:

Because of growth and new applications, backbones often double their throughput in approximately a year. This is expected to continue as more and more multimedia applications are cost-effective and useful. Multimedia applications will increase the broadcast to unicast traffic ratio and require most users to be connected to the backbone by at least switched ethernet to improve throughput.

FDDI can be too slow for a network backbone.



Passport interLAN switching consolidates one or more network backbones into a single Passport.

InterLAN switching functions as **combinations** of the following network elements:

- Router
- FDDI switch
- Token ring switch
- Ethernet switch
- DPN-100 gateway
- Frame relay router
- CSU/DSU
- MUX
- Security box

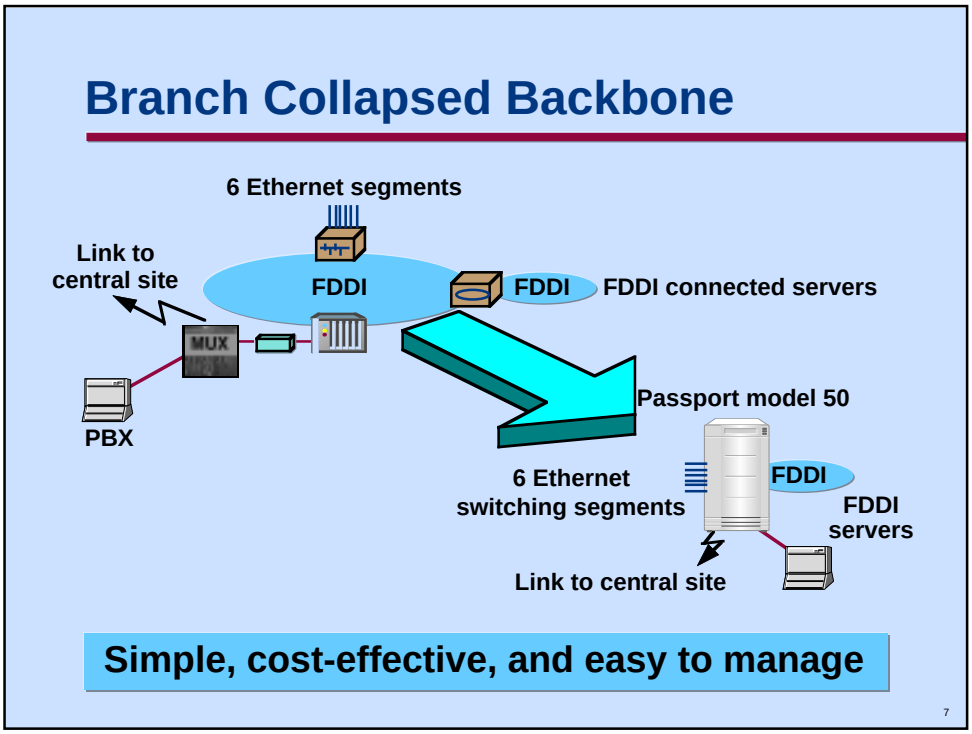
Network Management:

Consolidation makes the network and the network topology simple. All the devices listed above are no longer required. Only one network management platform is required to manage the collapsed backbone.

Performance:

Consolidating a backbone with Passport raises the throughput of the backbone to the **1.6 Gbit/s** throughput that the Passport bus offers. Our backplane is **sixteen times faster than an FDDI backbone.**

Passport results in cost savings, reduced management—and users get the performance they need.



The above branch scenario shows how a Passport model 50 can simplify a 10 to 150 user branch.

Initially, the network engineer, in the example above, has six devices (plus the ethernet hubs) to manage:

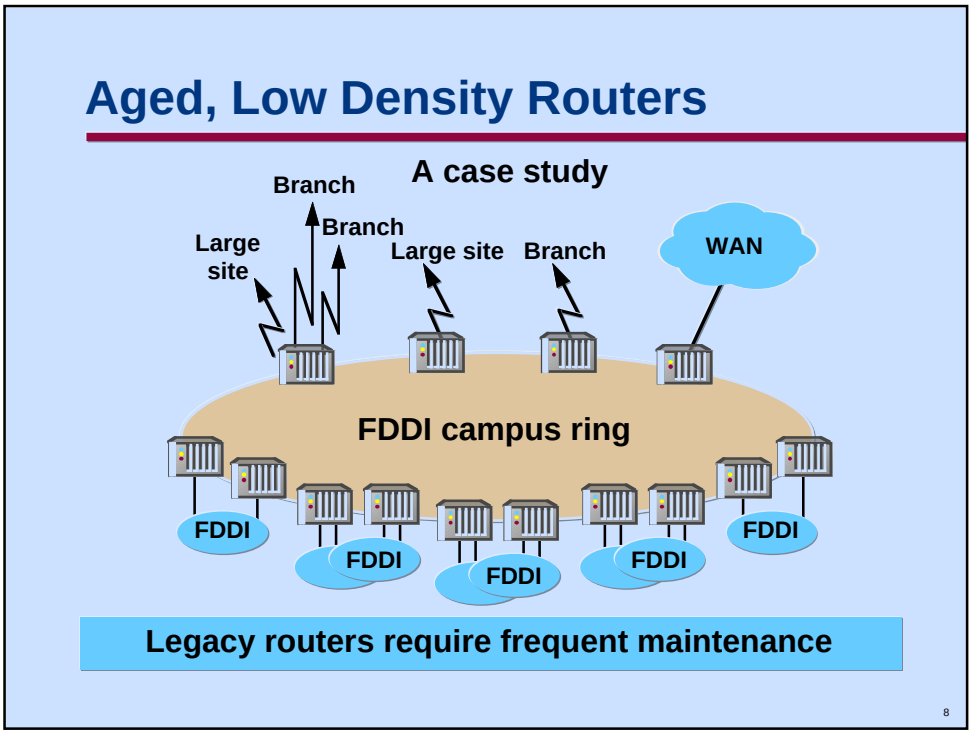
- 1 ethernet switch; and
- 1 FDDI switch; and
- 1 router; and
- 1 CSU/DSU; and
- 1 MUX; and
- 1 PBX

There could be approximately five different vendors to work with in the initial scenario. Each vendor often has its own network monitoring software to use.

When Passport is installed:

- It replaces everything except the PBX and the ethernet hubs
- The network can be supported by one or two vendors

A single Passport model 160 can similarly simplify a collapsed backbone for a 100 to 2,000 user scenario.



Many corporations have large, but aging router networks.

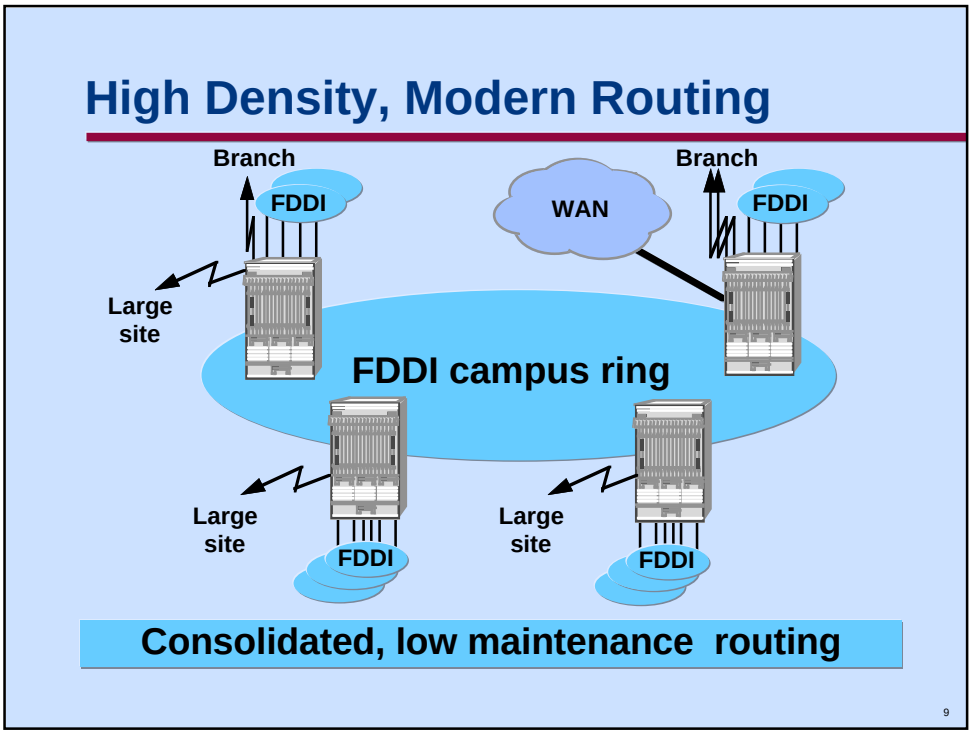
The above diagram is based on a real-world Nortel situation.

The diagram above has been simplified. The actual network has MUXes, the CSU/DSUs, the switching hubs, the multiport bridges, or the intelligent hubs in place. There are CSU/DSUs attached to each serial and HSSI link. Most of the time, these CSU/DSUs are connected via MUXes. There are also 16 ethernet subnets connected to this campus.

The routers involved are 0-8 port DS1, 0-1 HSSI links, 1-3 FDDI port systems with six ethernet ports each. Each router has almost no redundancy. Two or three years ago, these routers were state-of-the-art. For a campus ring this large, these routers are considered to be low-density. All but one of these routers are now considered to be obsolete by the industry because they are architecturally limited, have low port densities, and are unable to provide services like ATM. These routers can no longer be purchased.

The view of the routers alone contain 14 different routers to manage, configure, monitor, upgrade, etc.

The campus ring is one of the most critical and most heavily used parts of the network.



The solution is to use Passports to replace the aged routers to:

- Provide redundancy to improve reliability and save money
- Improve the port density to consolidate equipment for simplicity and cost savings
- Provide for growth
- Eliminate the CSU/DSU requirements for simplicity and cost savings
- Eliminate the MUX requirements for simplicity and cost savings

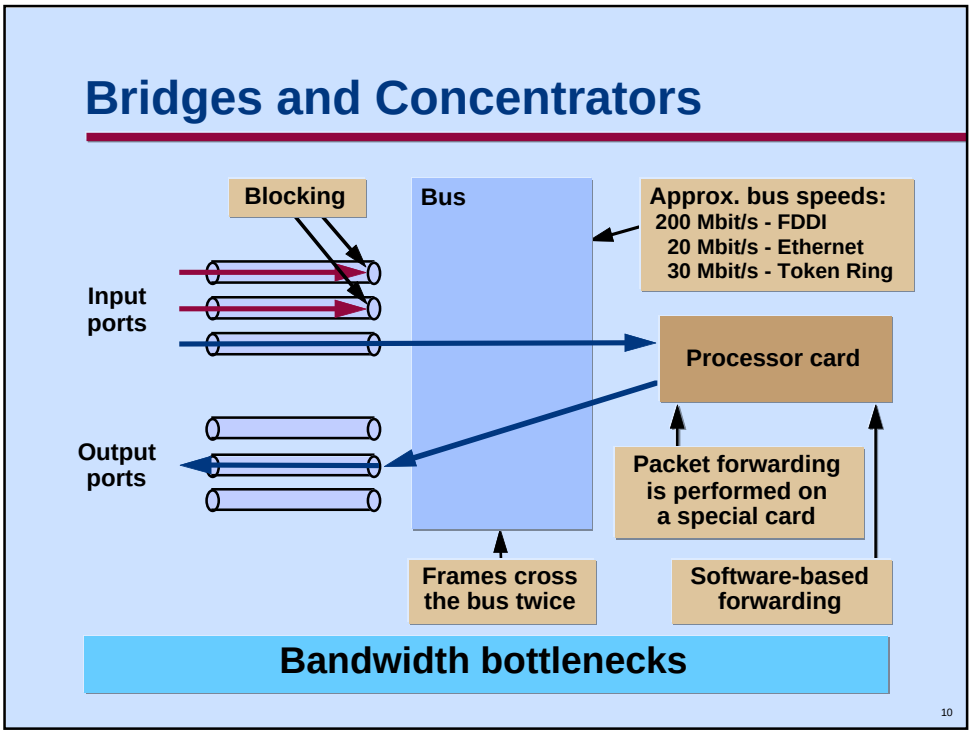
The solution was to deploy four Passports. A three chassis solution would have been sufficient, except that there were concerns about cable length and growth requirements.

In addition to providing room for growth, the 22 blank slots could be used today for:

- FDDI switching
- Ethernet switching
- Token ring switching
- ATM migration
- Network consolidation

The CSU/DSU function of the Passport will free up existing CSU/DSUs for deployment.

With Passport, customers add cards, not routers, to accommodate growth.



Bridges and concentrators were designed to connect LANs of similar media together and segregate intraLAN unicast traffic. This provides connectivity and minimizes the traffic impact.

This was a solid strategy for the time, but now applications are becoming more:

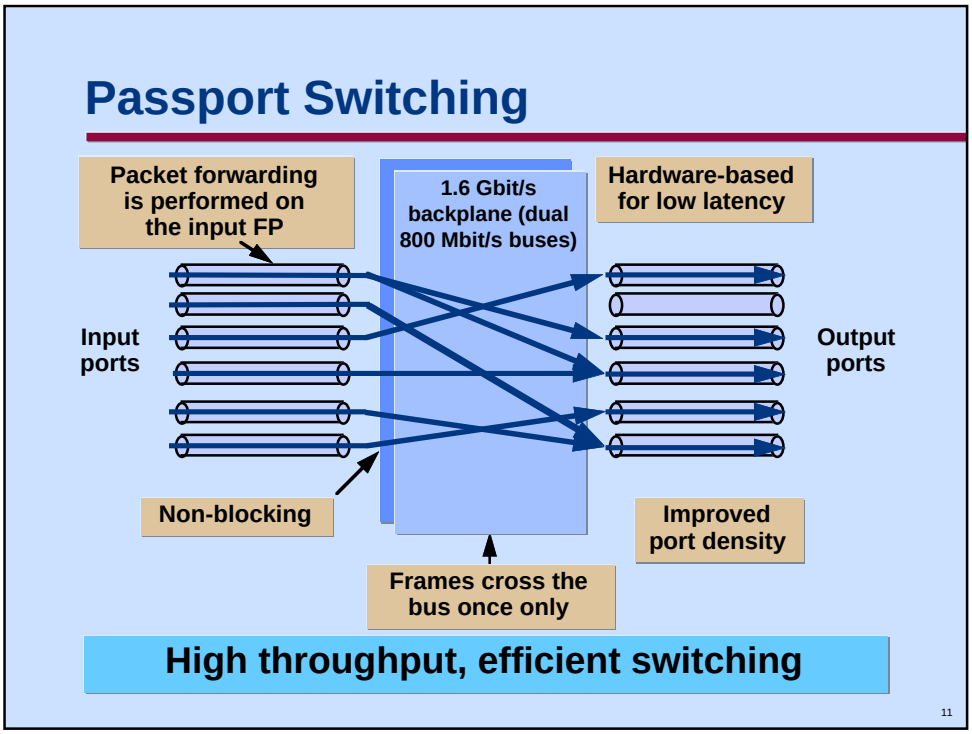
- Window based
- Visual and image based
- Client-server based

These application architectures require networks to be able to:

- Service more network traffic
- Service more multicast and broadcast traffic
- Provide low latency
- Provide better network management

Bridges and concentrators are not adequate to provide the required network performance. They often have packet blocking, software-based processing, low bus speeds, and require the packets to cross the bus more than once. This increases latency, and reduces the throughput of the device.

Note that the above slide depicts only one bridge architecture. Bridge architectures may vary.

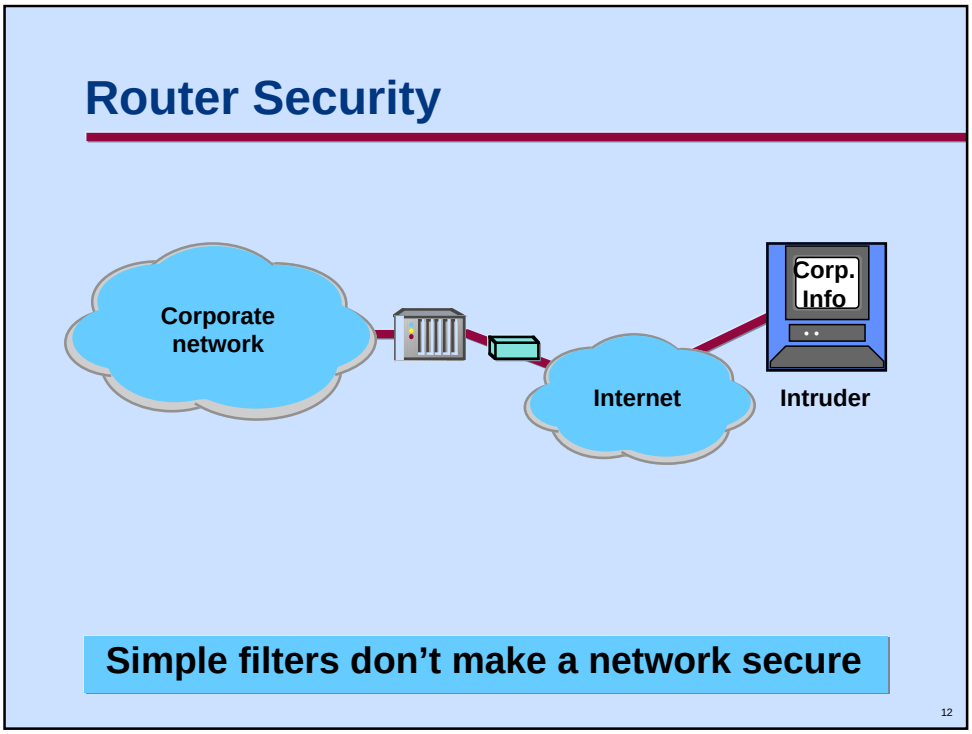


Passport switching provides:

- **Distributed architecture**
  - Passport's architecture and ingress processing only require packets to cross the bus once instead of two or three times
  - Passport's architecture does not have a switching card to potentially bottleneck traffic
  - Results in increased throughput and fewer dropped or delayed packet
- **High speed backplane**
  - 1.6 Gigabit backplane
  - Results in increased throughput and fewer dropped or delayed packets
- **Reliability**
- **Features add flexibility**
  - Routing
  - Network consolidation
  - Collapsed backbone
  - Variety of interfaces
  - Domain bridging (VLANs)
- **High port density**
  - Consolidates the network for simplicity

As a result, the customer network:

- handles **more network traffic;**
- handles **more broadcast traffic;**
- provides **low latency;** and
- improves **network management.**

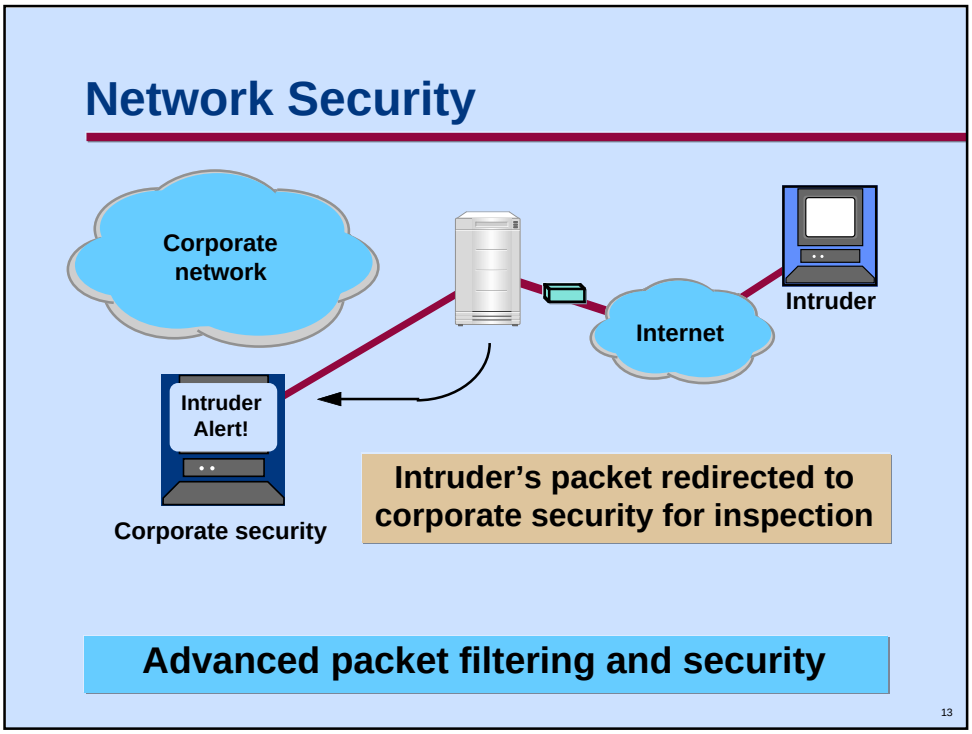


Many networks are based on simple access filters and are not very secure.

Persistent hackers can continuously attack a customer's access routers through automated programs. These programs could:

- Attempt to access the router via passwords
- Attempt to find router ports which will allow application information through to the corporate network
- Attempt to find what corporate host IP addresses can be directly accessed from the Internet. If it finds a host, or groups of them, it will try to break into them
- Attempt to spoof different IP addresses to see if the corporation will allow access to them

Simple filters may be inadequate to handle these security attempts. Simple filters just drop packets and do not inform network managers about the invalid attempts to access the corporate network. The intruder can make as many attempts as are needed until a hole in corporate security is found. This leaves the network available for intruders to perform espionage and information vandalism.



As part of our agreement with **Network Systems Corporation (NSC)**, Nortel has comprehensive, advanced filtering software on Passport interLAN switching. NSC is a world renowned, industry leading, secure router company. Some of the capabilities of the filtering facility include:

Advanced Filtering Facility (AFF) for routing

- Count the number of packets between any source and destination
- Collect user-specified statistics by source and destination
- Permit/restrict connectivity between source and destination
- Take overt or covert actions based on packet content and address
- Perform type of service routing based on packet content

AFF for bridging

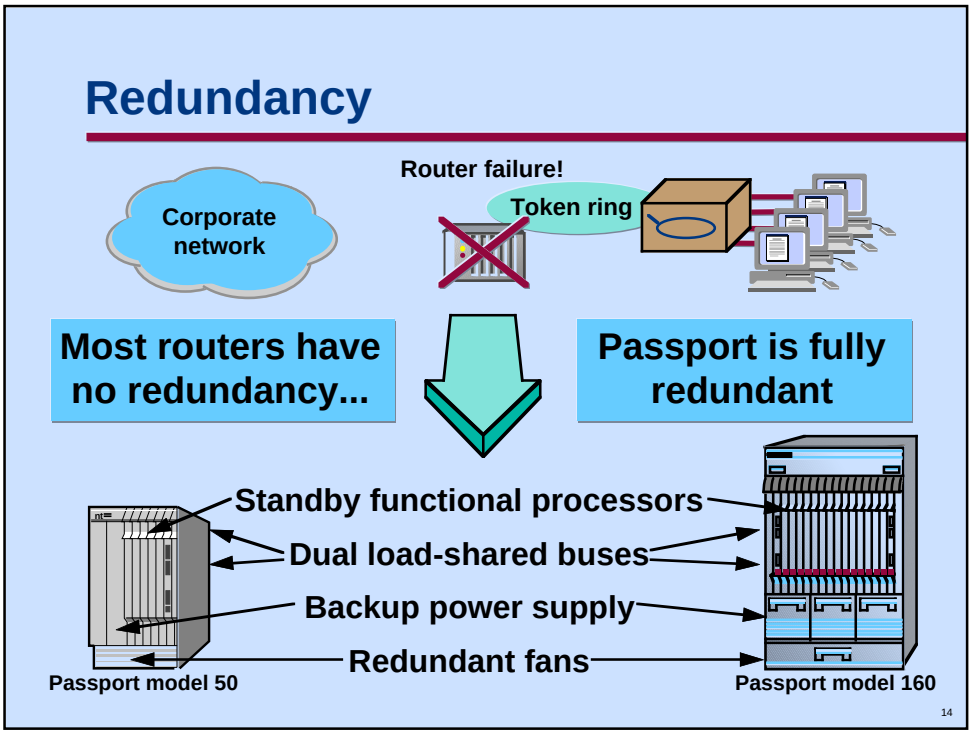
- Selectively bridge packets based on type and content
- Separate bridged traffic into distinct bridging domains
- Disallow broadcasting by port
- Disable learning by port (static tables)
- Perform translational bridging of IPX frames adapting header to next hop media

Architected for performance

- Filter tables loaded on each functional processor (FP) to minimize latency

Meeting stringent military/government security requirements

- Generate and check network layer extended security options per DNSIX
- Generate and check basic security options in IP packet



Router failures cost companies millions of dollars every year. Some customers have router networks that cost over $250,000/hour in lost revenue if a key router fails.

So, Nortel continues to provide **"TELCO" class system redundancy options**.

LAN functional processor sparing provides swift recovery should the primary FP fail *(optional)*

- Redundant FPs are attached to same media
- Redundant FPs share the same Mac address - no proprietary protocols
- When the active FP fails, the standby FP begins accepting packets
- Total outage: 0.1-5.0 seconds.
- Failed FP replaced by new standby FP (hot-swap)

Dual buses provide zero downtime if a bus fails *(standard)*

- Failed bus is no longer used
- The active bus continues to function at 800 Mbit/s

Passport model 160 **control processor (CP) sparing** reduces downtime if the control processor fails (*optional*)

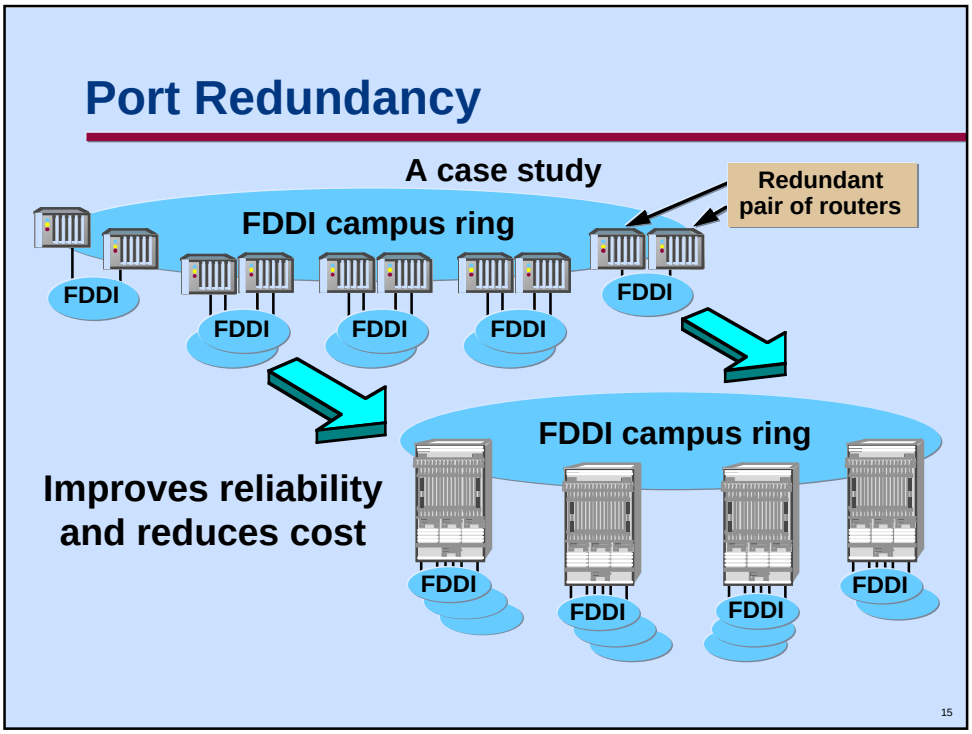
- One CP in slot 0, the other in slot 15
- When the active CP fails, the backup CP takes control

Redundant and load sharing power supplies *(optional)*

- If a power supply fails, the spare takes over - no downtime

Fan redundancy *(standard)*

- Second fan continues to cool the chassis sufficiently after one fan has failed



The above diagram is based on the real-world Nortel internal network (GES) situation.

The Nortel internet has a policy of redundancy on all critical network resources. The following must be fully redundant or else secondary systems must be purchased to act as a backup:

- Multiport bridges
- Backbone routers
- Serial links (MAN and WAN)

When Passport was added:

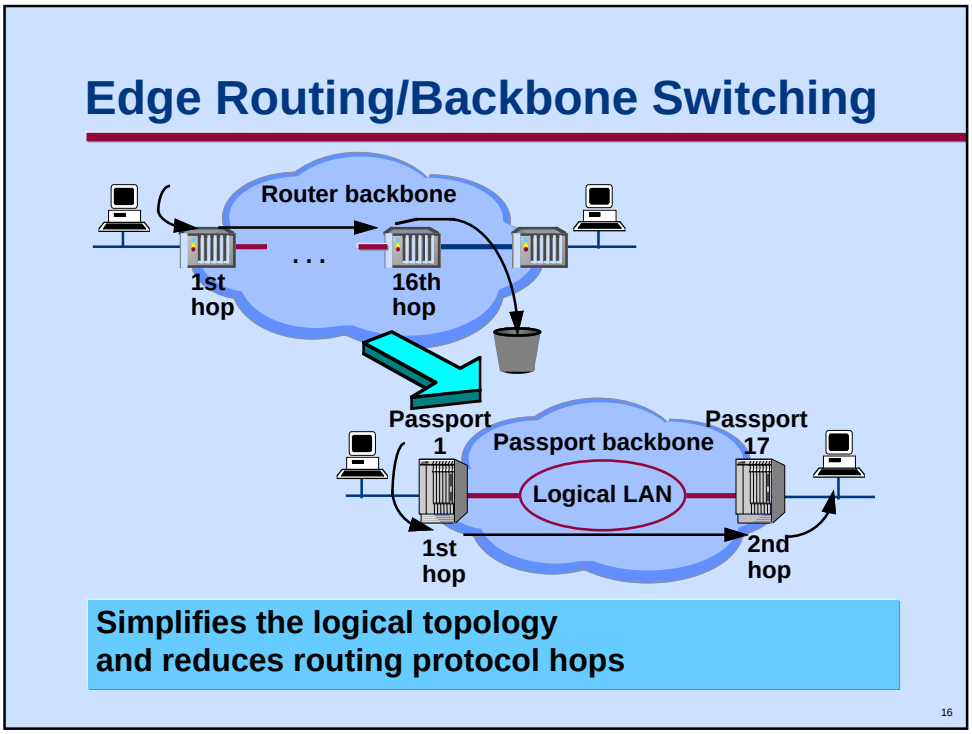
Nortel GES chose to implement redundancy with:

- Redundant ethernet and FDDI functional processors (not required for serial links)
- Redundant control processors
- Redundant and load sharing power supplies

The following features that are provided on every Passport were also used:

- Redundant fans
- Dual buses

The two routers on each subnet are not required, because the Passport is fully redundant. This reduces the cost and the number of devices to be managed.



Most wide area networks are complex with many routes and many routers to manage. This can be very costly for protocols like RIP. Network management in general can be very difficult.

In the situation above, the network engineer initially has difficulties with the large router backbone because RIP packets do not reach their destination because of the 16 hop limit in the RIP packet.

When Passport edge routing via Passport backbone switching is deployed, the backbone appears to be one single subnet - one hop for RIP.

Passport edge routing/backbone switching provides:

High performance

- Single “hop” to peer routers
- Minimal processing in tandem/backbone nodes
- Reduced route table size and processing in access hubs and routers
- Reduced latency backbone

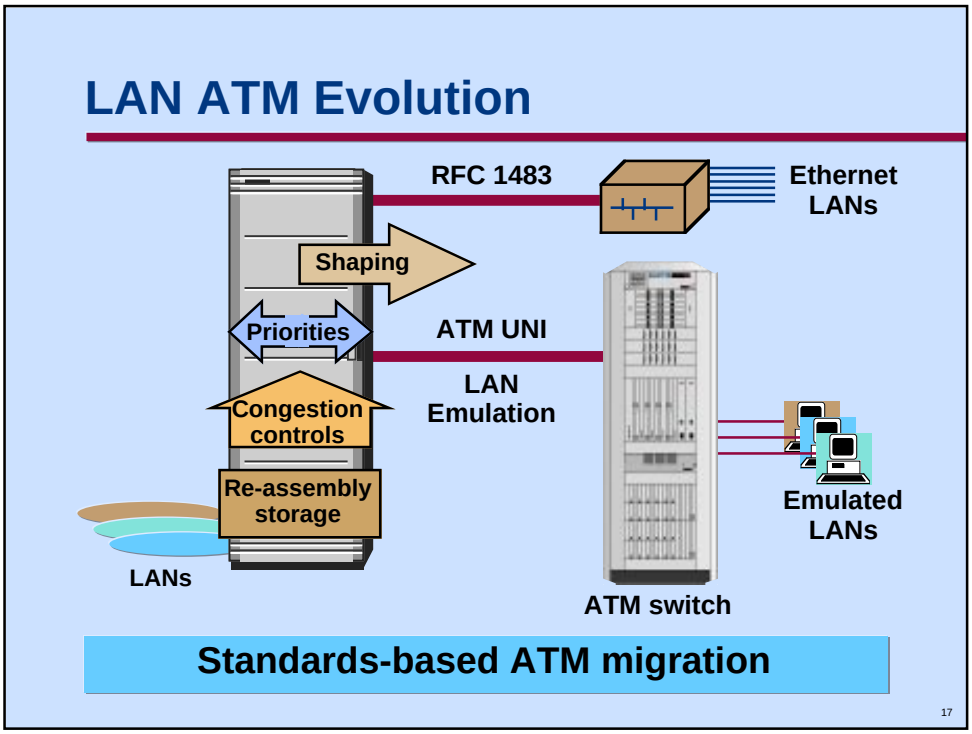
Simplified administration

- Simplified network architecture: backbone appears as logical LAN to peer routers
- Single, intelligent forwarding in the backbone

Reduced overhead

- Logical LAN multicast facility minimizes bridge/router “chatter” across WAN

Edge routing and backbone switching are provided by the Virtual Network System (VNS) component of Passport interLAN switching.



Many customers see ATM as the way of the future. ATM offers high throughput, is able to consolidate all types of traffic on one network, and provides quality of service (QOS) features.

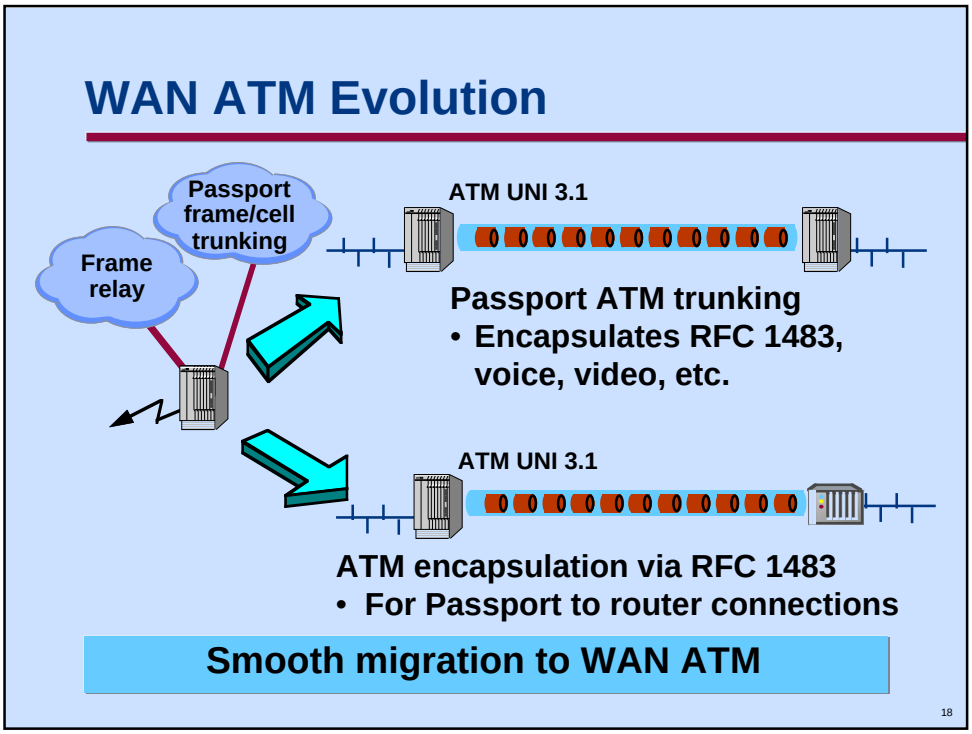
Passport interLAN switching will offer the following ATM LAN standards:

- **Multiprotocol over ATM (RFC 1483)**
- ATM Forum **LAN Emulation (LANE)**
  - Emulated LANs (ELANs) set up based on function, not physical location
  - Simplifies network administration
  - Protects investment in legacy LAN hardware and software
  - Passport ATM switching interconnects desktops and ATM switches
  - Passport layer 2 switching within an ELAN minimizes latency
  - Passport layer 3 switching between ELANs controls intra-workgroup connectivity

Passport will also provide state-of-the-art:

- Congestion control
- Traffic shaping
- Packet re-assembly
- Prioritization

Other standards are also under consideration.

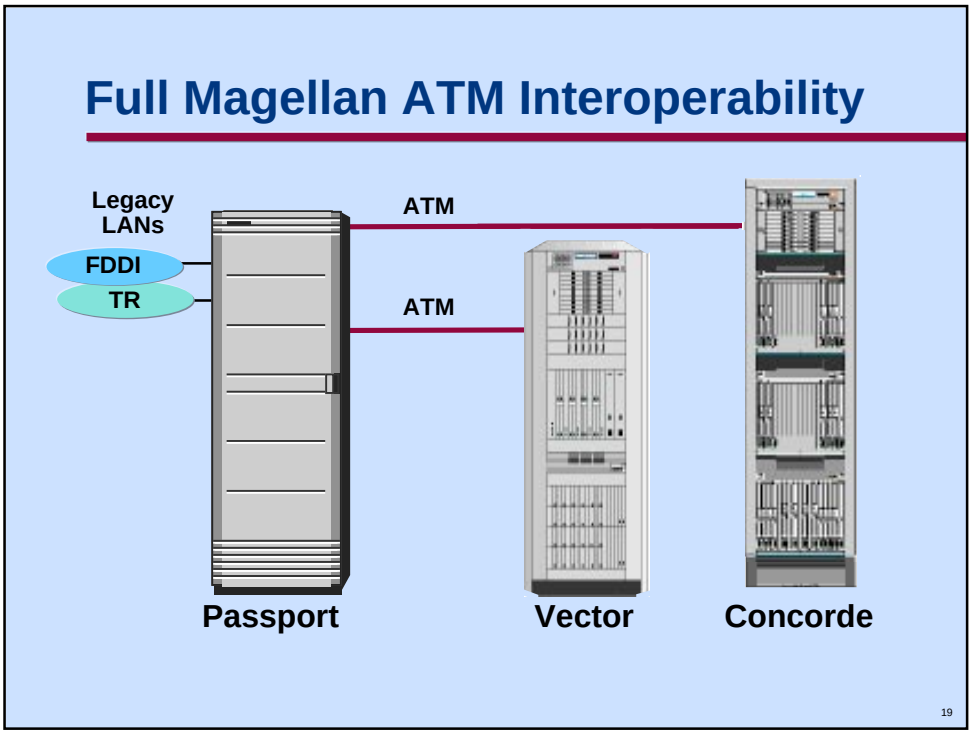


Passport provides a smooth and complete technology evolution path to ATM.

Passport's design allows customers to choose how LAN internet traffic will be carried over the wide area, and provides the maximum flexibility concerning interconnection options both to other Passport nodes or to third-party equipment.

As ATM services become available, customers may choose to interconnect Passport nodes over ATM using Passport ATM trunks to carry multimedia traffic. Passport will support the ATM UNI standard for connection to carrier-based ATM networks, and will interwork, naturally, with Magellan Vector and Concorde for seamless end-to-end ATM service.

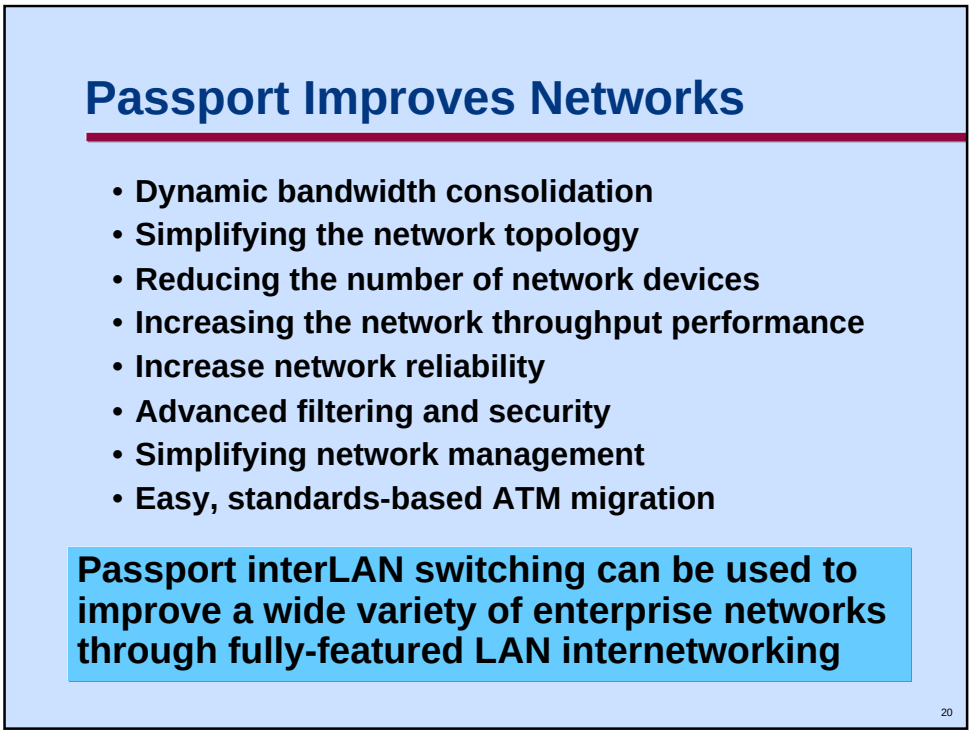
For connection to, and interworking with, third-party routers which have ATM interfaces, Passport interLAN switching will support the industry standard RFC 1483 for multi-protocol encapsulation for routing LAN traffic over ATM.



The Magellan ATM product portfolio:

- **Magellan Passport:** a frame/cell switch designed to facilitate network consolidation in the enterprise and to facilitate the delivery of multiple services by an enterprise or service provider (frame relay, voice, transparent data, LAN internetworking, SNA, and ATM).
- **Magellan Vector:** an ATM public network access or concentration switch that extends the reach and value of the core ATM network toward the user community by providing economical high port density and lower-speed access rates. It may also be deployed as a backbone switch in smaller networking environments.
- **Magellan Concorde:** a high performance, high capacity backbone central office ATM switch for data transport and SONET/SDH integration in large broadband multimedia networks.

Nortel has extensive experience with ATM.



Passport interLAN switching saves capital and operational money, improves performance, reliability, and security, and provides a smooth migration to future technologies.