Guide to

Gigabit IP

Switching

madge

The way forward
for Token Ring
Networking

The Multimedia Potential of IP

The demands placed on enterprise networks are changing fast. The use of IP for classic data traffic is well established, but the use of IP as a dynamic networking protocol for multimedia traffic, including voice and video, is the area of true potential.

The successful deployment of IP-based converged data, voice and video networks will enable organizations to not only reduce connection costs of local and global communications, but will also serve to simplify networks, and improve the effectiveness and competitiveness of their business.

Scaling LANs to Gigabit Speeds

The challenge for network administrators is two-fold: accommodate the anticipated growth in client-server traffic and inter-workgroup communications, and maximize the return on investment in installed equipment and cabling. To relieve network bottlenecks, both Token Ring and Ethernet LANs can already be scaled to 100Mbps speeds, often using existing LAN cabling.

The introduction of Gigabit IP switching achieves the next step. It provides a common high-speed Layer 3 backbone for LAN workgroup traffic, irrespective of Layer 2 protocol. This is due to the fact that IP switches are 'LAN-agnostic' and are designed to process and switch IP frames. They rely upon the relevant Token Ring or Ethernet workgroup edge device to provide any necessary frame translation or reformatting.

This means that network managers can plan for a Gigabit future, whilst continuing to grow the population and complexity of both Token Ring and Ethernet desktop and workgroup applications.

The bottom line for Token Ring users is that Gigabit IP switching provides the long-term way forward for:

- Converged backbones
- Gigabit transport for Token Ring
- Effective integration with Ethernet
- Applications-aware switching

What is Gigabit IP?

Gigabit IP technology itself is the result of the combination of traditional LAN (IEEE802) and emerging Internet (IETF) standards. These standards focus on network and traffic control in an end-to-end switched IP network:

- Layer 3 routing (RIP, OSPF, etc.)
- Active flow control (802.1x)
- Spanning tree (802.1d)
- Link aggregation (802.1ad)
- Virtual LANs (802.1Q)
- Frame priority (802.1p)
- Dynamic packet filtering (IGMP)
- Network management (RMON, SNMP and MIB support)

The physical connection of departmental and workgroup networks into a Gigabit IP backbone is normally provided via direct Gigabit speed uplinks from data center or wiring closet switches.

Most organizations prefer the electrical immunity, security and distance benefits of fiber cabling; Gigabit fiber uplinks are designed to the IEEE802.3z standard, the physical layer specification for 1000Mbps over fiber. For shorter cable distances, Gigabit copper connections conform to IEEE802.3ab. Gigabit IP is therefore an open standards-based network architecture, which can be implemented by the combination of standards-compliant products from multiple vendors.

Gigabit IP Today

To date, the current generation of Gigabit switches have been used to address the urgent need for incremental backbone bandwidth in networks dominated by Ethernet end-stations and workgroups. Conversely, the same pressing need for backbone bandwidth at Gigabit speeds simply does not yet exist in the majority of Token Ring-based networks.

Thanks to the advanced capabilities and intelligence of the Token Ring protocol, shared 16/4Mbps connections still dominate the active, stable and efficient Token Ring installed base (75% of all new connections in 1999. Source: Instat).

Furthermore, since 1998, networks with demanding levels of backbone traffic have been able to take advantage of the IEEE802.5t standard for 100Mbps Token Ring as a simple, yet very effective bandwidth upgrade.

Gigabit IP Tomorrow

However, with the increased adoption of auto-sensing 100/16/4 adapters and the availability of low-cost Token Ring desktop switching products, switches have outsold traditional shared Token Ring media since the end of 2000 (source: Instat).

This will further increase the need for greater backbone switch port densities to support high-speed downlinks from a fast growing population of fully switched Token Ring workgroups.

For this reason, Madge.connect has defined the principle applications for next generation IP backbone switches to be:

- High-speed interconnection of Token Ring workgroups
- Multilayer backbone access to Ethernet-based resources

network convergence

The rise of the Internet Protocol

The Internet and global communications are changing the face of business-to-business relationships. The Internet Protocol (IP) provides a common communications language that can be used to facilitate the integration of diverse systems, processes and applications across a common network infrastructure.

The deployment of a ubiquitous managed IP network brings enormous benefits to business. By converging applications towards a common protocol, the overheads and costs associated with the maintenance of widespread network resources can be reduced.

The use of IP for building and campus-based local area networks also permits more tightly-coupled integration of external Internet network services with both locally and remotely administered private network resources.

benefits of Gigabit IP for Token Ring Users

Benefits of Gigabit IP for Token Ring Users

Token Ring backbones today, whether based on native Token Ring at 4/16/100Mbps or using Token Ring LAN Emulation over ATM, support some of the world's largest local area network infrastructures. They provide high reliability, high availability access to network services and resources to widely dispersed user communities.

As applications converge upon IP as the common network interface protocol, so must the backbone evolve to embrace the changing characteristics of data traffic flows and the integration of multimedia communication across the LAN infrastructure.

Gigabit IP is not just a quick fix solution to backbone bandwidth. It represents the definitive and logical long-term evolution for Token Ring backbones by:

- Extending installed networks to Gigabit speeds
- Embracing the new wave of real-time IP applications
- Integrating Token Ring and Ethernet

Applications-aware Networking

In the brave new wired world, very few new network applications are being written without IP in mind. In this context, the underlying LAN topology that is used to deliver and exchange applications data and multimedia content becomes irrelevant.

The Layer 2 LAN protocol provides the base physical and data link connectivity between devices. Token Ring is in fact an excellent LAN topology for IP-oriented applications, based on its longstanding superior flexibility and sensitivity to priority data flows.

It is this applications-awareness that ensures that installed Token Ring end-stations can continue to integrate seamlessly with network designs enabled for real-time voice, video and data. Certainly, there is no applications-driven benefit to be derived from the replacement of Token Ring stations by another technology.

Capacity for the Future

The current generation of Token Ring backbone devices allows organizations to build robust collapsed backbone networks, supporting many thousands of both switched and shared 16/4 Token Ring end-stations.

Gigabit IP switching takes Token Ring to the next level. Providing almost limitless backbone scalability, it ensures that the required high speed port density is available to support significantly increased uplink/downlink connectivity, as Token Ring workgroups evolve from 16/4 to 100/16/4 desktop access speeds.

Dynamic Traffic Control

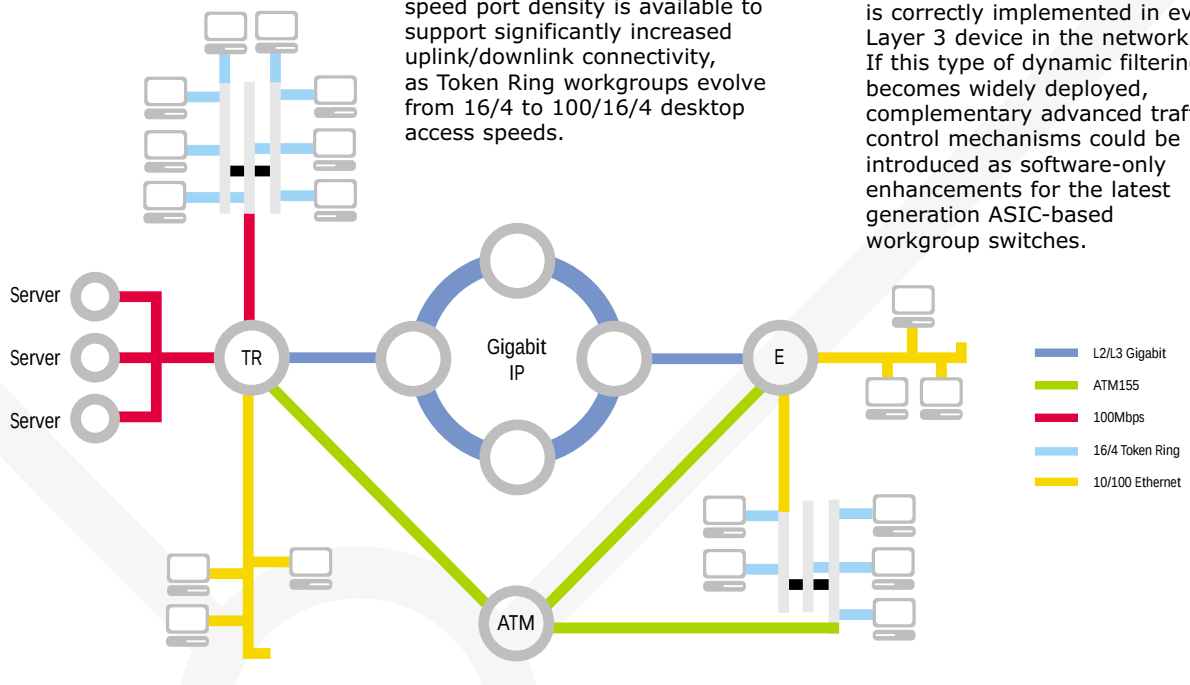
The majority of Token Ring installations are configured to switch where they can (at Layer 2) and route where they must (at Layer 3). This is due to the efficiency of the Token Ring protocol and effectiveness of advanced Layer 2 traffic control mechanisms (e.g. automatic broadcast suppression) that exist in certain switching products, avoiding recourse to external Layer 3 devices. However, Gigabit-class multi-layer switches include dynamic traffic control mechanisms that are designed to address the more complex needs of next generation multicast/broadcast applications, such as streamed intranet-based multimedia content.

In this way, Token Ring customers can continue to deploy classic Layer 2 switching for workgroup and departmental networking, whilst establishing a solid foundation for the future.

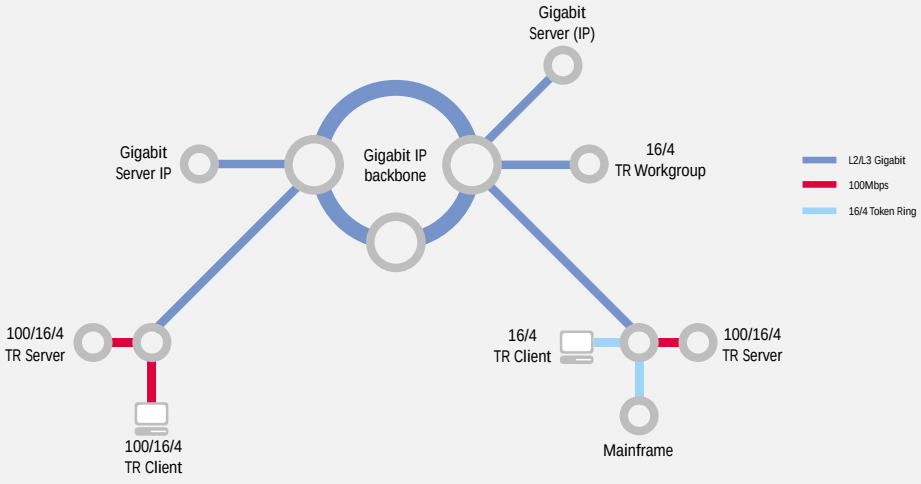
Contrary to popular myth, Token Ring workgroups are seldom stressed by uni-cast, broadcast or multi-cast data streams. The applications-awareness of the protocol and the effective Layer 2 IP-zoning options of the latest Token Ring switches ensure that traditional data-only applications can co-exist with new delay-sensitive, bandwidth hungry multicast applications.

Ultimately, the usefulness of targeted filtering using the emerging IGMP and GMRP specifications is limited, unless the relevant filtering support is correctly implemented in every Layer 3 device in the network. If this type of dynamic filtering becomes widely deployed, complementary advanced traffic control mechanisms could be introduced as software-only enhancements for the latest generation ASIC-based workgroup switches.

Backbone Product Roadmap



Madge-powered Gigabit Backbone



Multi-vendor Compatibility

The beauty of Gigabit IP networking is that there is already a general consensus in the networking industry that applications are converging upon IP for network transport and the IEEE802 standards for physical layer and data link access.

This convergence has led to increased end-user choice in the number of available, compatible and interoperable networking devices that can be deployed today. Not only does this provide network managers with assurance of a future-proof open network design, it also allows any installed base investment in Layer 2 Token Ring, Ethernet and ATM technologies to be preserved.

Legacy Protocol Support

The relentless rise of IP traffic in today's networks presents the challenge of how to maintain support for legacy applications, based on simpler Layer 2 non-routable protocols, such as LLC and Netbios (e.g. 3270 emulation). Such applications are particularly prevalent in those Token Ring networks that were originally implemented as part of the IBM System Networking Architecture.

Organizations may wrongly feel that it is Token Ring and these associated applications that are holding them back from fully embracing the IP wired world.

As described above, Token Ring is in fact an ideal underlying Layer 2 architecture for IP networks, thanks to its robustness and applications-sensitivity. The real challenge is to provide a Gigabit IP switching solution that is capable of transporting non-routable or simply non-IP traffic (e.g. IPX).

This is where Gigabit-enabled Token Ring workgroup devices play a key role at the departmental/wiring-closet level. These incorporate advanced frame translation/ switching technology that provides multi-protocol access from Token Ring into a switched Gigabit IP backbone:

- IP frames are switched and routed across the Gigabit backbone at Layer 3
- Non-IP frames are switched and transported across the Gigabit backbone at Layer 2

Leverage Installed Cabling

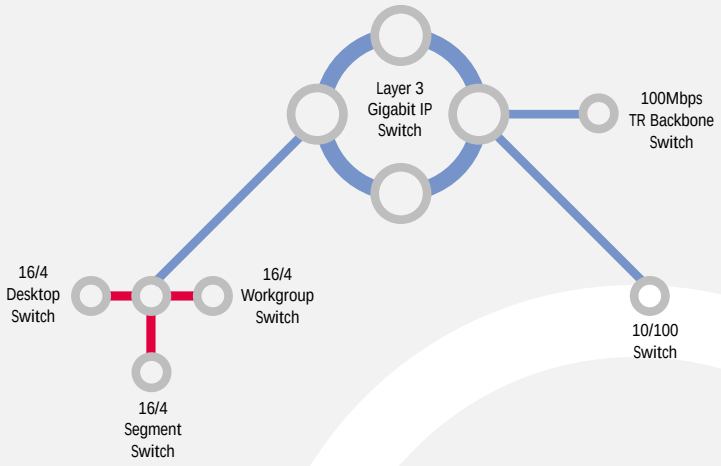
At the same time as Token Ring-based organizations are reviewing application and protocol support, they are also looking at how their installed cabling infrastructure is positioned to support their on-going needs. Classic shielded cabling (notably IBM Type 1 and variants) still dominates the loyal installed Token Ring base. In spite of its apparent inflexibility, compared to its unshielded counterpart, Type 1 provides excellent immunity from electrical interference, is more robust and supports significantly longer lobe lengths. Moreover, the continued viability of Type 1 has been further assured by the full support accorded in the IEEE802.5t standard for 100Mbps Token Ring operation.
In spite of the apparent benefits of evolving to a wall-to-wall, floor-to-floor UTP structured cabling system to serve both PBX and LAN connections, the associated cost and potential business disruption often makes this impractical to implement.

The good news is that Token Ring workgroups, based on 16/4Mbps can already evolve to 100Mbps backbone speeds using the Smart DeskStream desktop Token Ring switches across Type 1. Better still, the Smart Ringswitch 100/16/4 workgroup switches will provide native Token Ring full-duplex access speeds to 100Mbps to the Desktop switches, with the optional Gigabit uplink capability for direct connection to a multi-layer Gigabit backbone.
In this way, Type 1 based Token Ring workgroups can be directly integrated with the core network and seamlessly interconnect with other workgroups, irrespective of Layer 2 protocol.

Madge.connect Gigabit IP Strategy

Madge.connect, as the leading supplier of enterprise solutions for Token Ring customers, has defined a clear product and technology roadmap that ensures that the advanced benefits of the Token Ring protocol can be preserved as networks scale to Gigabit speeds. Madge's objective is to provide the best possible switched backbone solutions for customers with a significant installed base of Token Ring workgroups. Unlike complex standalone Gigabit access technologies, the Ringswitch Gigabit Uplink is simple to install with configuration, diagnostics and control capabilities readily available via Madge's popular TrueView device management application. As an integral part of the well-established Smart Ringswitch family, the Gigabit Uplink is optimized for use with Token Ring networks.It includes unique capabilities that are designed to minimize downtime and maximize data throughput, such as: jumbo frame support, RIF caching, SPT loop prevention and VLAN/priority field preservation.

Madge.connect customers can simply add a translational switching Gigabit port to their existing Smart Ringswitch Plus or Express configuration, by installing the module in an available option slot. Non-Madge customers can also benefit from Madge.connect Gigabit integration technology, by complementing their existing equipment with the compact, yet powerful Smart Ringswitch Express. This 16-port switch is available in four variants (16/4 or 100Mbps; copper or fiber) with an option slot, into which the Gigabit Uplink module can be installed.



High Speed Translational Switching

All Gigabit interfaces on Layer 3 IP switches rely upon 802.3 network addressing and frame formatting. To minimize session latency and maximize data throughput, Madge.connect has extending its highly efficient 100Mbps translational switching technology to Gigabit speeds. Through the Gigabit uplink module in the Ringswitch, Madge.connect customers are able to simply implement the necessary frame and protocol translation to allow Token Ring data to traverse a Gigabit IP backbone.

Affordable Switching to the Desktop.

Token Ring desktop switching at 16/4Mbps has now established itself as the perfect technology to replace traditional shared Token Ring hubs. By providing a dedicated full-duplex switched connection to every user, network administrators are able to increase the reliability, speed and performance of the network at a lower cost per port than a shared hub. Furthermore, the deployment of fully switched workgroups allows them to secure their networks for future multimedia, IP and eCommerce needs.

Jumbo Frame Support

To maximize the efficiency of any frame translation and to preserve the larger data payloads associated with Token Ring networks, Madge.connect Gigabit Uplink technology incorporates large frame format support. Independent testing by Silicon Valley Networking Labs (SVNL) in 1999, proved that a switched 16Mbps Token Ring connection can provide sustained performance at a similar level to switched 10/100 Ethernet.
This can be mainly attributed to one of the key differentiators and benefits of the Token Ring protocol, compared to Ethernet. The original 802.5 Token Ring standard, and hence all compliant products, permits the use of variable frame sizes up to 18KB, over 10 times the maximum equivalent for Ethernet (1.5KB). Madge.connect customer research indicates that 4KB frames are the norm in the 15 million installed community of Token Ring stations.

The benefits of using jumbo frames at high data rates are particularly compelling when deployed in server farms. A Gigabit network adapter receiving 1.5KB frames has to process in excess of 65,000 packets per second to operate at 100% efficiency. This overhead has a profound effect on Gigabit server performance. As a result, a number of Gigabit vendors, are proposing the support of larger 802.3 frame sizes for Gigabit networks.

Madge.connect Gigabit technology is designed to be compatible with jumbo frame-capable Gigabit switches. Support for packet translation without fragmentation for jumbo frames up to 8KB, provides the optimum combination of compatibility and performance between Token Ring edge devices and Gigabit IP backbones.

Packet Priority

The original architects of the IEEE802.5 standard anticipated that LANs would one day be carrying a broad spectrum of traffic types. They therefore included a special priority field in the standard Token Ring frame header as a means of delivering Quality of Service (QoS).

Until recently, use of this priority field has been limited to static station-specific traffic prioritization (e.g. a router port takes a higher priority than a user station). With the advent of the latest desktop operating systems, it is now possible for this priority field to be dynamically set on a session-by-session basis using the Network Driver Interface. With this scheme, stations running time-critical applications, such as real-time video conferencing, can be automatically assigned higher priority from source to destination than less time-sensitive applications.

In Gigabit IP networks, the packet priority of an originating Token Ring frame is preserved across the backbone. This further confirms Token Ring as a viable and flexible workgroup technology to support the new wave of multimedia applications.

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