Begin your search for a Token Ring/ATM switch by defining your needs.

Token Ring switching, in conjunction with a high-speed ATM backbone, offers a viable migration strategy that preserves existing investment in Token Ring equipment and extends the life of Token Ring local area networks (LANs) well into the future.

Selecting a Token Ring/ATM Backbone Switch

As businesses increasingly rely on their enterprise networks for mission-critical applications, backbone bandwidth requirements are spiraling and many companies are recognizing the need for a scalable high-speed backbone. Unlike 10BASE-T Ethernet, which has a seamless 100 Mbps upgrade path, there is no natural equivalent for Token Ring. Therefore, in the case of Token Ring enterprise networks, integration with any high-speed backbone technology is a challenge. Compensating for the complexity of integration, Asynchronous Transfer Mode (ATM) offers a number of advantages over other high-speed alternatives, not the least of which is unprecedented scalability.

Three common scenarios drive the need for high-capacity Token Ring switches in the backbone. First, current bridge-laden Token Ring backbones are becoming overloaded to the point where end-to-end latency rises unacceptably and available bandwidth can no longer effectively support the growing number of users. Second, in networks built around routers, this same high usage results in a constant need for more ports, compounding the already high cost of deploying and managing these routers. In addition, during peak utilization the heavily populated routers often exhibit severe performance degradation.

As users face the likely prospect of implementing bandwidth-hogging applications such as videoconferencing and multimedia, as well as the need for high-speed server connections, Token Ring/ATM switches that provide many times the capacity of a bridged backbone at a substantially lower cost than routers become an attractive high-speed migration choice.

Caveat Emptor

In any of these situations, if an appropriate device is selected, Token Ring switches can cost-effectively boost overall network performance. In the highly bridged network, for example, a Token Ring switch that provides easy scalability to large numbers of ports over an ATM backbone can significantly reduce end-to-end delays, increase total throughput, and offer unprecedented levels of scalability. As a result, networks that were previously limited in the types of services they could offer can now run even the most bandwidth-intensive applications.

Similarly, networks that rely on routers for network segmentation can implement a backbone Token Ring switch to provide a growth path alternative that features better performance and a much lower cost per port. By combining both routers and Token Ring switches in such a network, each device can be optimized for its respective environment: routers for wide area connectivity and routing between different LAN types and switches for bridging multiple Token Ring segments.

Be forewarned, however, that not all Token Ring switches can handle the high-capacity, high-speed, and rapid growth requirements of a large-scale enterprise network. Note, too, that just because any given switch appears to score well in a performance test in isolation (a free-standing switch), true performance can only be measured by evaluating total throughput in an actual network scenario. One reason for this is because in actual operation, switches must deal with a mixture of broadcast, multicast, and unicast traffic, each of which may be processed in a different manner. This mix of traffic types, along with a distribution of different frame sizes, is virtually impossible to emulate in test environments. Furthermore, as soon as multiple switches are involved, new elements are introduced into the network that can affect overall performance.

As a result, these needs — and the switch features that address these needs — must be identified before making a product selection. Unfortunately, and all too often, companies rely on media pundits and vendors to assist them in making this determination. Instead, we suggest that your search for an effective Token Ring switch begin by defining your specific requirements and the capabilities that will be needed to meet those requirements. Next, obtain objective information regarding switching technologies and the features that are possible with those technologies.

Obtaining Objective Information

One good source of information is other companies with similar networking requirements that have already begun deploying switches. These can be identified by talking to peers and utilizing Internet discussion groups, or by requesting a list of reference accounts from Token Ring switch vendors.

Another information source is the Alliance for Strategic Token Ring Advancement and Leadership (ASTRAL), an association established to support Token Ring users and help them prepare for the future of high-demand networking. A complete listing of ASTRAL publications can be obtained by contacting Drusie Demopoulos at Bay Networks at (800) ATM-LANS, (408) 486-2511, or info@centillion.com, or by contacting ASTRAL directly at http://www.astral.org.

Since ATM is fast proliferating as a backbone technology, it will also be useful to review the publications and tutorials of the ATM Forum. Again, copies can be obtained from Drusie Demopoulos at Bay Networks or directly from the ATM Forum at (415) 949-6700, info@atmforum.com, or http://www.atmforum.com.

For information on the involvement of any given vendor in the Token Ring hub and switching industry, consult The Dell 'Oro Group, a consultancy that reports on Token Ring market shares, which can be reached at (415) 233-2300 or tam@delloro.com.

Armed with this background information, begin your product search by considering two fundamental Token Ring switch features: scalability and fault tolerance.

Scalability

Scalability should be a key concern because networks seem to always expand and bandwidth requirements continually increase. To meet the growing demand for bandwidth, heavily used segments will gradually become microsegmented. As a result, a Token Ring switch must be able to linearly scale to large numbers of ports while having the full capacity to support throughput rates consistent with ATM backbone technology.

While all Token Ring switches can be networked to increase port density, there is sharp differentiation in the way this scalability is achieved. Some switches, for example, have a maximum density per switch of just 12 ports. To increase the number of ports beyond this requires the purchase of additional switches and possibly the addition of backbone equipment to interconnect the switches. In fact, with low-density switches it is often necessary to purchase more switches than you might think to achieve required configurations. For example, connecting two 12-port switches back to back over Token Ring may only consume two ports; however, connecting the same two switches over ATM requires 4 ports for the connection. As a result, 22 ports are available by linking two 12-port switches over Token Ring, but only 16 usable LAN ports are left when the switches are ATM connected.

To scale beyond 20 to 24 ports, most vendors rely on some sort of external ATM backbone connection to support the high-bandwidth requirements dictated by the increased number of ports. But again, significant differences exist in the implementation of the ATM network connection.

In the most common approach, a single ATM uplink per switch is provided. In this case, Token Ring switches must be concentrated into a separate ATM switch. Optimized performance and expandability can be obtained, however, with a different switch architecture that fully integrates Token Ring and ATM switching and supports either the concentrated approach with a separate ATM network, or direct connectivity over ATM. With the latter configuration, multiple switches can be meshed together without the need for a separate ATM switch, so costs are lower, efficiency is higher, and management and support overhead are reduced. Furthermore, support for multiple ATM ports on one switch provides the option to upgrade congested servers to high-speed connections. This capability is unavailable with single ATM uplinks.

It is important to note that no matter what type of ATM backbone connection is provided, a Token Ring switch may not necessarily be able to fully utilize the bandwidth provided by the ATM link. If the switch's internal capacity is lower than the ATM connection or inadequate for the aggregate inputs from the LAN ports, the switch itself, rather than the ATM link, becomes the bottleneck. Using ATM purely as a high-speed backbone does not require the complexity of LAN Emulation services. Look for vendors that allow you to use ATM in this way, as well as offer full support for ATM Forum LAN Emulation in the future, so that you can also upgrade servers to ATM when you are ready.

Fault Tolerance

With networks supporting business-critical operations, the need for fault tolerance is obvious. Yet many Token Ring switches do not even offer the most rudimentary protection. Cooling fans and power supplies, for example, are the most likely point of failure in a switch, and so implementing a device that does not feature dual fans or redundant power supplies is courting disaster.

No matter how reliable other switch components may be, failures do occur, so look for switches that offer hot-swap capabilities. By allowing individual components to be removed and replaced without bringing the switch down, hot-swappability minimizes downtime. To further control productivity losses, some switches also feature a distributed architecture that helps contain faults to specific components that can be replaced before the entire switch crashes.

To assess the degree of distribution in the switch architecture, examine the flow of data as it traverses through the switch under a variety of operating conditions. Only by determining the switch components that broadcast, multicast, and unicast frames flow through will you be able to identify potential bottlenecks, single points of failure, how the switch isolates faults, and whether there are any oversubscribed components that may affect scalability.

Fault tolerance is also enhanced in switches that feature a small number of ports per module, with a separate switch engine for each module. This design provides a high degree of port isolation. If the engine is powerful enough and there are adequate buffers, then throughput can be optimized under peak operating conditions that otherwise could precipitate a failure.

While not strictly a fault-tolerance issue, the way in which the switch manages traffic flow can, to a great degree, minimize the number of fault conditions that occur due to bottlenecks. With broadcast and explorer traffic in the network, switches should offer a range of filtering capabilities to control the impact of this bandwidth-eroding traffic.

This objective will be enhanced with switches that also feature broadcast management software to monitor broadcasts and intelligently route traffic based on past patterns. The result: Broadcast traffic finds its destination faster, even while unnecessary frames are prevented from propagating through the network and using bandwidth.

Multiprotocol and VLAN Management

Support for all common bridging methods — source route, transparent, and source route transparent — is essential to ensure easy implementation into almost any network environment. Even within source route bridged environments, the option of configuring IBM or IEEE 802.1d Spanning Tree for provision of redundant paths is important for maintaining compatibility with other network components.

In an effort to centralize management and create a consolidated enterprise network, many companies must support both Token Ring and Ethernet LANs. If confronted with this challenge, favor Token Ring switches that support both protocols in order to streamline overall network management and achieve a faster return on investment than would be possible if separate switches were utilized.

In these scenarios, and others in which a high degree of network segmentation is required, many companies are implementing Virtual LANs (VLANs) that support flexible creation of logical workgroups spanning multiple switches, hubs, and other devices such as ATM-attached servers and routers. This enables users who are located throughout the organization to be treated as though they are on the same segment, greatly reducing the management costs of implementing adds, moves, and changes to the network. If this is the situation in your company, ensure that your Token Ring switch vendor also provides VLAN management software that allows you to achieve these logical workgroups. Also be sure that ATM LAN Emulation software is available as a software upgrade. This is required to facilitate high-speed server integration in the future.

Performance Evaluation: More Than Meets the Eye

With the ability to seamlessly link large numbers of ports directly over an ATM backbone, Token Ring/ATM switches can empower companies to cost-effectively meet their current bandwidth and performance requirements while providing an easy growth path to meet tomorrow's needs. The key is selecting the best-performing switch for your specific environment.

In your search for this switch, always remember that overall performance is a function of end-to-end latency, total throughput, scalability, fault tolerance, and manageability. In short, Token Ring/ATM switch performance cannot be measured and numerically summarized, it can only be meaningfully evaluated in the context of your specific environment.

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