

Overview of Fast Token Ring (FasTR)

Token Ring over ATM

White Paper

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Abstract

This paper describes the Fast Token Ring (FasTR) solution for the 2216, 3746 with a Multiaccess Enclosure, 8270 Model 800, and the 8260 (using an 8272 blade) product platforms.

FasTR is a software configurable option on the 2216 and the MSS Client Universal Feature Card (UFC). It is designed to alleviate the 16 Mbps bottleneck for Token Ring network attachment to a mainframe (via a 3746/2216). FasTR uses existing 2216 and 827x/8260 products to provide a 155 Mbps connection from the mainframe to the backbone Token Ring network.

FasTR allows a customer to install an ATM-ready 155 Mbps-class link in a Token Ring-only network, *without* worrying about installing and managing an ATM network infrastructure. It couldn't be easier; the network continues to be Token Ring, and server access performance increases significantly.

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Fast Token Ring (FasTR)

Introduction

Fast Token Ring (FasTR) is a software configurable option on the 2216 Nways Multi-access Connector and the Multiprotocol Switched Services (MSS) Client Universal Feature Card (UFC). It is designed to alleviate the 16Mbps bottleneck for Token Ring network attachment to a mainframe (via a 3746/2216). Currently there is no IBM Token Ring solution for speeds higher than 16 Mbps. FasTR uses existing 2216 and 827x/8260 products to provide a 155 Mbps connection from the mainframe to the backbone Token Ring network. The 2216 may be channel-attached to a System/390 or may be "under the covers" of the new 3746 with a Multiaccess Enclosure (MAE) product available in mid-1998.

FasTR allows a customer to install an Asynchronous Transfer Mode (ATM)-ready 155 Mbps-class link in a Token Ring-only network, *without* worrying about installing and managing an ATM network infrastructure. It couldn't be easier; the network continues to be Token Ring, and server access performance increases significantly.

FasTR Overview

FasTR configures a 155 Mbps ATM connection to look and behave like a Token Ring link. FasTR is designed to:

- Offer configuration and setup equivalent to that for a Token Ring adapter
- Require no (or minimal) ATM knowledge
- Require no changes to Token Ring applications or protocol stacks
- Provide at least 100 Mbps connectivity for Token Ring frames for server attachment

FasTR is based on existing ATM hardware. The ATM adapters in the 2216 and 827x (via the MSS Client UFC subsystem) will run with modified device drivers and configuration tools to enable a customer with no working knowledge of ATM or ATM switches to use the FasTR function. Token Ring frames are encapsulated in ATM Adaptation Layer 5 (AAL5) frames and transported between the 2216 and the 827x/8260.
A more detailed description of the encapsulation scheme can be found in the *Encapsulation Scheme for FasTR* section later in this paper.

A FasTR link will typically be a direct connection with no ATM switch involved in the path. A customer may use ATM switches configured with Permanent Virtual Circuits (PVCs) for the FasTR path; however, this approach defeats the purpose of FasTR, namely for the customer to use ATM without having to deal with its complexities.

As illustrated in Figure 2: Example Network with FasTR Connections, FasTR offers higher bandwidth where it is needed (at the server) *and* offers investment protection for later migration to ATM in the backbone.

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Product Platforms Supporting FasTR

The FasTR solution is offered on the 2216, 3746 Models 900 and 950 with a Multiaccess Enclosure (MAE), 8270 Model 800, and the 8260 (using an 8272 blade) product platforms. As stated earlier, the FasTR solution relies heavily on existing ATM hardware, with modified device driver and other system software providing the Token Ring operation.

- The 2216 and the 3746 Multiaccess Enclosure ATM adapter cards are used "as is."
- The MSS Client UFC provides the FasTR function for the 8270 and 8260 switches. The processor on the MSS Client UFC will handle the FasTR functions; no base 827x or 8260 switch changes are necessary.

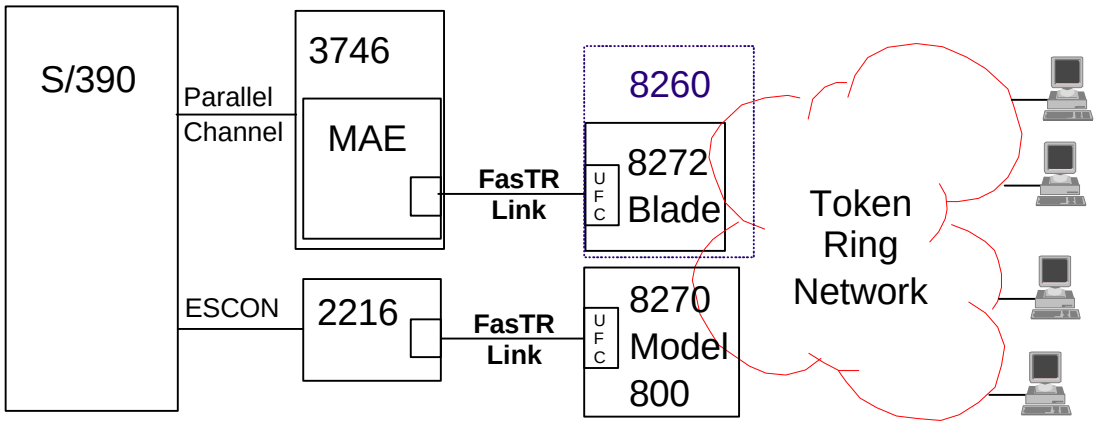


Figure 1: FasTR Product Support

As depicted in Figure 1, the FasTR function enables high-speed connections between:

- a 2216 and an 8270
- a 2216 and an 8260 with an MSS Client UFC installed on an 8272 blade
- 3746 with a Multiaccess Enclosure and an 8270
- 3746 with a Multiaccess Enclosure and an 8260 with an MSS Client UFC installed on an 8272 blade

Though not particularly targeted by this solution, the FasTR function can also be used between:

- a 2216 and another 2216
- an 8270 and another 8270
- an 8260 and another 8260

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Product Configurations

FasTR is a software configurable option on the 2216 and the MSS Client UFC and can be used on the FasTR-capable platforms identified in the following table.

FasTR-Capable Machines	Adapters That Support FasTR	Ordering Information
2216 Nways Multi-access Connector	1-port ATM single-mode fiber adapter	FC 2293, FC 2295
	1-port ATM multimode fiber adapter	FC 2284, FC 2294
3746 with a Multiaccess Enclosure	(supports same adapters as 2216, above)	(same part numbers as 2216, above)
8272 Token-Ring LAN Switch Module for the Nways 8260 Multi-protocol Switching Hub, feature number 6308	MSS Client UFC (single-mode optical fiber)	PN 85H4599
	MSS Client UFC (multimode optical fiber)	PN 85H4596
8270 Token-Ring LAN Switch, Model 800	(supports same adapters as 8272, above)	(same part numbers as 8272, above)

2216

The 2216 supports a maximum of two simultaneous FasTR attachments. The FasTR function can be used with any of the four 2216 ATM Line Interface Cards (LICs).

3746 with a Multiaccess Enclosure

Two FasTR attachments via the 2216 "under the covers" are supported. The adapters are the same as the 2216.

8270 Model 800

On the 8270 Model 800, a maximum of one MSS Client UFC configured as a FasTR link is supported.

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8260

The number of FasTR attachments installed into an 8260 is model dependent. In an 8260 environment, the MSS Client UFC is first installed into a 3-slot 8272 Blade. The 8272 blade is then installed into the 8260 chassis. So as an example, depending on what other features are installed in a 17-slot 8260, from one to five 3-slot 8272 non-integrated blades can be installed.

Example Network with FasTR Connections

The following figure highlights several attachment alternatives for using FasTR in a typical Token Ring network.

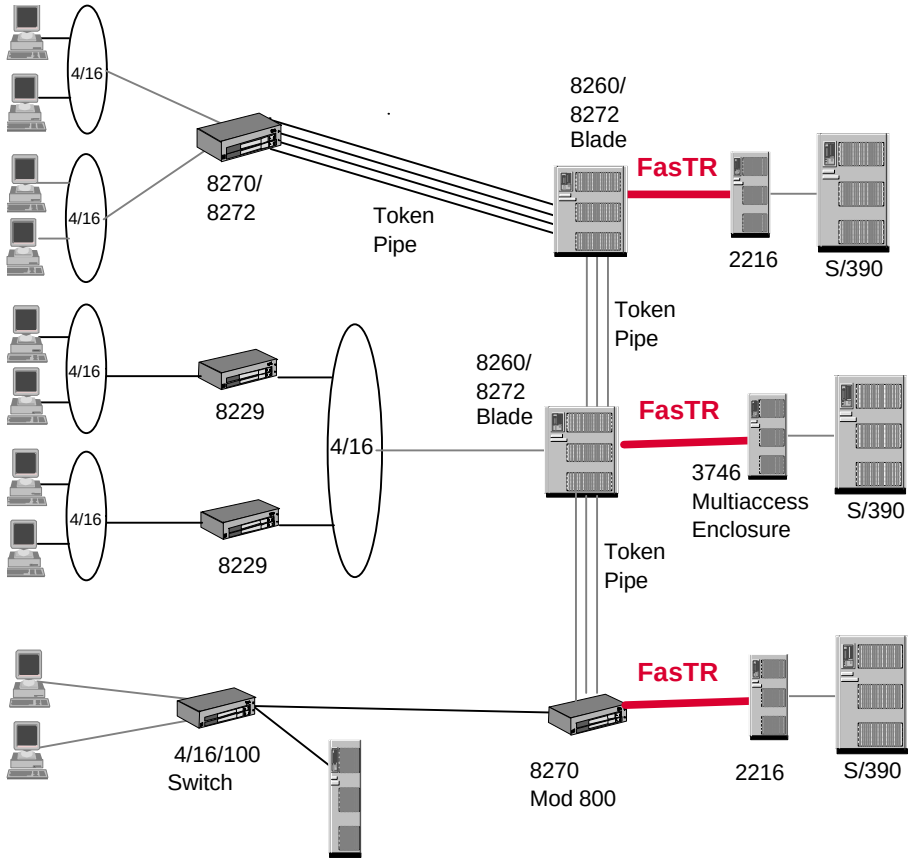


Figure 2: Example Network with FasTR Connections

Physical Media and Protocols Supported by FasTR Links

FasTR supports a variety of media and protocols. FasTR supports two forms of traffic forwarding: source route bridging and layer 3 routing of both IP and APPN. When operating in source route bridging mode, any layer 3 protocol can be used.

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As depicted in the following table, the 2216 can be configured to route IP or APPN traffic (layer 3) and the MSS CLIENT UFC can be configured to route IP traffic.

Both single-mode and multimode fiber media are supported by the 2216 and the MSS Client UFC.

Support		**2216**	**MSS Client UFC**
Layer 3 Routing	*IP*	*YES*	*YES*
	APPN	*YES*	*NO*
Layer 2	*Source Route Bridging*	*YES*	*YES*
Physical Layer	*Multimode Fiber*	*YES*	*YES*
	Single-mode Fiber	*YES*	*YES*

Configuring a FasTR Link

FasTR on the 2216 and MSS Client can be configured using either the "Talk 6" command line interface or by using the Configuration Tool. The FasTR configuration is essentially identical to the Token Ring configuration. The only difference is that for FasTR, the default "speed" and "media" values cannot be altered: they are fixed at 155 Mbps and fiber. All other parameters, such as "packet size," "source-routing enabled," "physical-address," "rif-timer value," can be configured as if this were a Token Ring link.

Performance Measurements

Using 4000 byte packets, preliminary performance testing has measured the FasTR link at greater than 3400 Token Ring packets/second. This corresponds to a throughput of over 108 Mbps for Token Ring traffic.

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Encapsulation Scheme for FasTR

Figure 3 depicts the encapsulation scheme for a FasTR frame. In both the 2216 and the MSS Client UFC, the ATM device driver (DD) is surrounded by a Token Ring shell. The Token Ring shell makes the ATM Link "look" like a Token Ring device driver to the rest of the system software. The Token Ring shell uses pre-configured ATM initialization and setup parameters. This removes the complexity of having to configure the ATM subsystem. The customer simply configures the link as if it were a Token Ring connection.

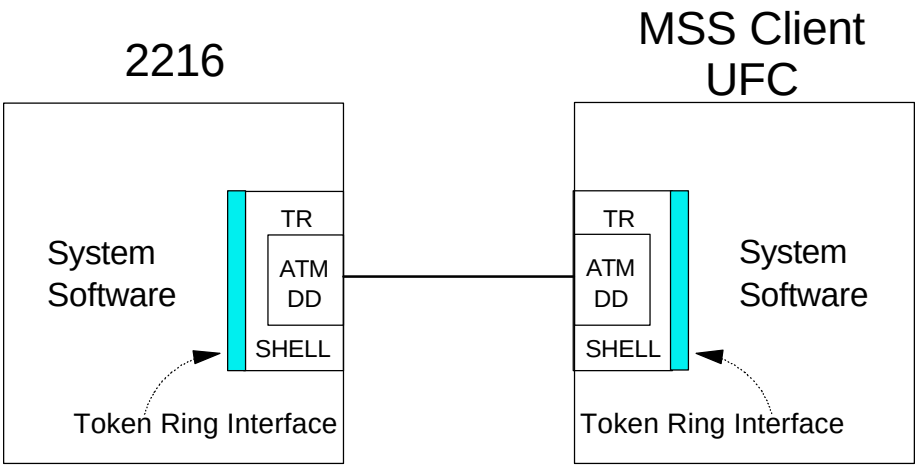


Figure 3: Encapsulation Scheme

FasTR Frame Formats

FasTR encapsulates the Token Ring Media Access Control (MAC) frame over an ATM AAL5 connection. The AAL5 Cyclic Redundancy Check (CRC) in the AAL5 trailer ensures the integrity of the Token Ring data as it is transported over the ATM link.

Virtual Circuit Used by FasTR

Rather than require the customer to dynamically select a PVC circuit while FasTR is being configured, FasTR automatically uses hardcoded VPI/VCI values: VPI=0 and VCI=32.

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High-Availability Scenarios Using FasTR

In addition to providing higher bandwidth attachment to the Sysplex, FasTR can be used to satisfy typical high-availability scenarios by providing redundant paths and duplicate MAC addresses. The following figures highlight how this can be done.

As indicated in the section on *Product Configurations,* the 2216 supports up to two simultaneous FasTR attachments. To support high availability scenarios such as the ones identified in this section, each of these attachments can have the same MAC address.

The first scenario, depicted in Figure 4 and Figure 5, shows a typical configuration where a single 374x is connected to two different backbone rings. The 374x uses the same Token Ring MAC address on both rings. To incorporate FasTR into this solution, the two backbone rings are replaced by two 8272 blades installed into an 8260 (Figure 4) or two 8270s (Figure 5), and the 374x is upgraded to a 3746 with a Multiaccess Enclosure. The FasTR connections are then configured with the same MAC addresses on the 2216 under the covers of the 3746 with a Multiaccess Enclosure. This configuration provides increased bandwidth to the System/390 as well as maintaining dual paths for high-availability purposes.

The second scenario, depicted in Figure 6, shows a dual host configuration where full redundancy of the System/390, front-end processor (374x), and network connections is required. Figure 7 shows this configuration using FasTR links and replacing the backbone rings and bridges with switches.

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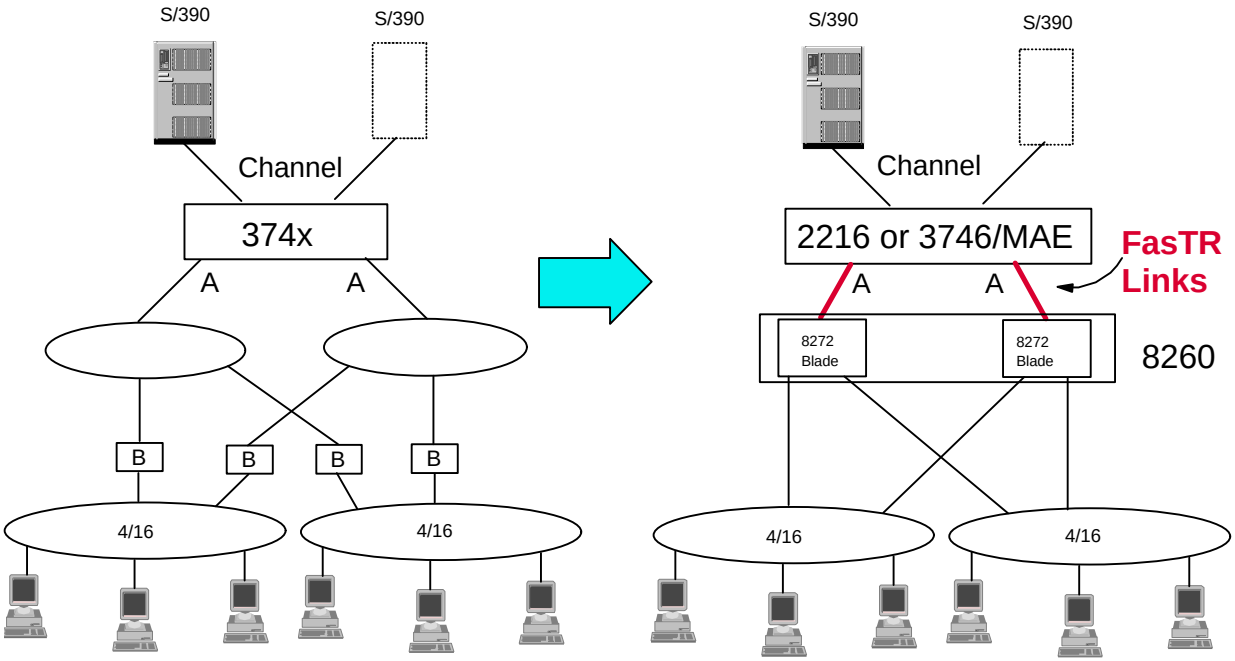


Figure 4: High-Availability Single-Host Scenario Using an 8260

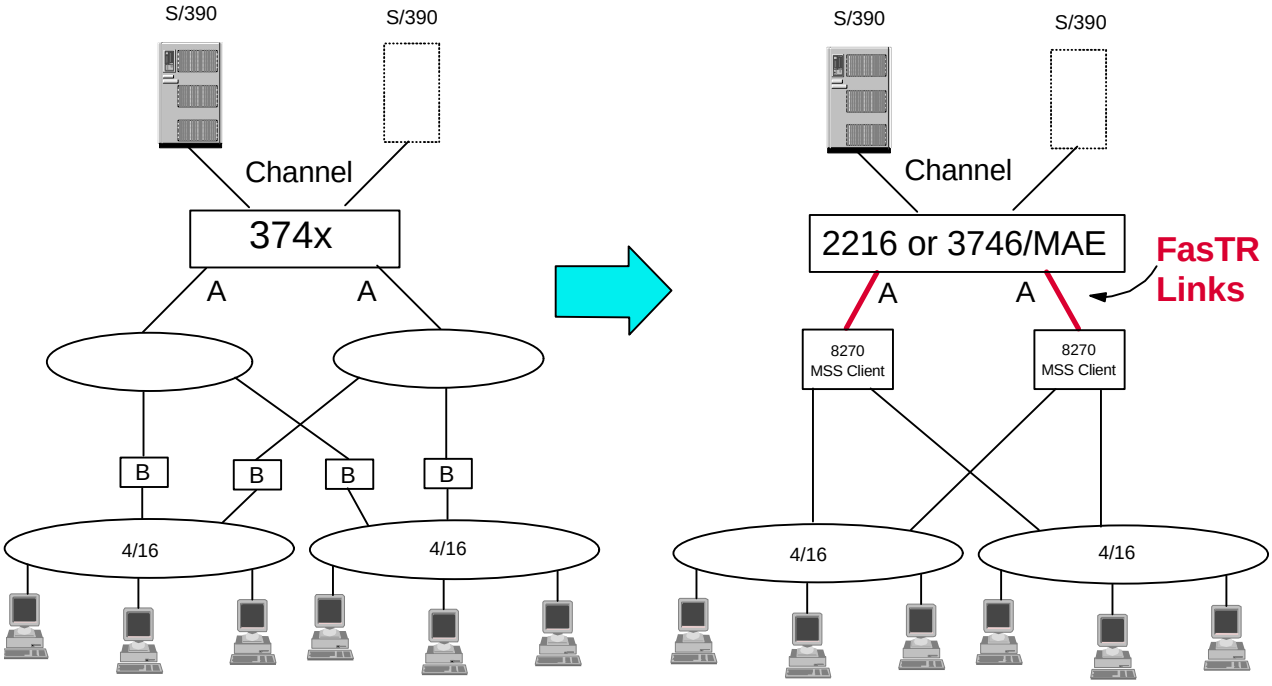


Figure 5: High-Availability Single-Host Scenario Using 8270s

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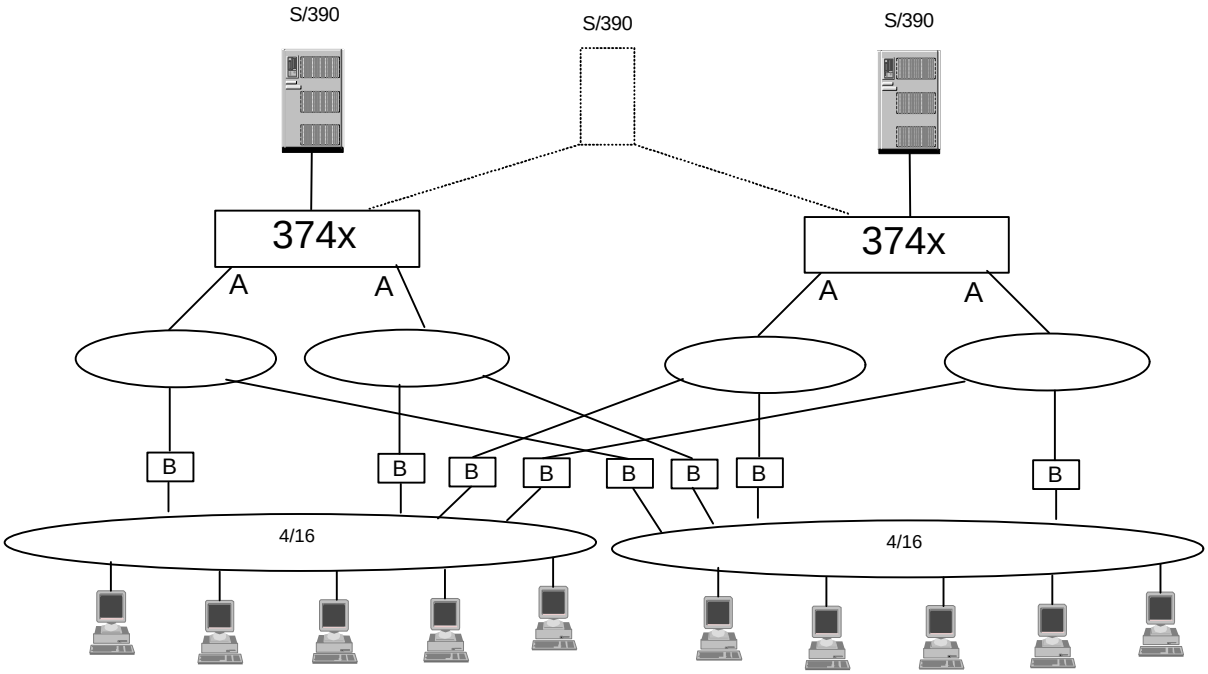


Figure 6: High-Availability Dual-Host Configuration

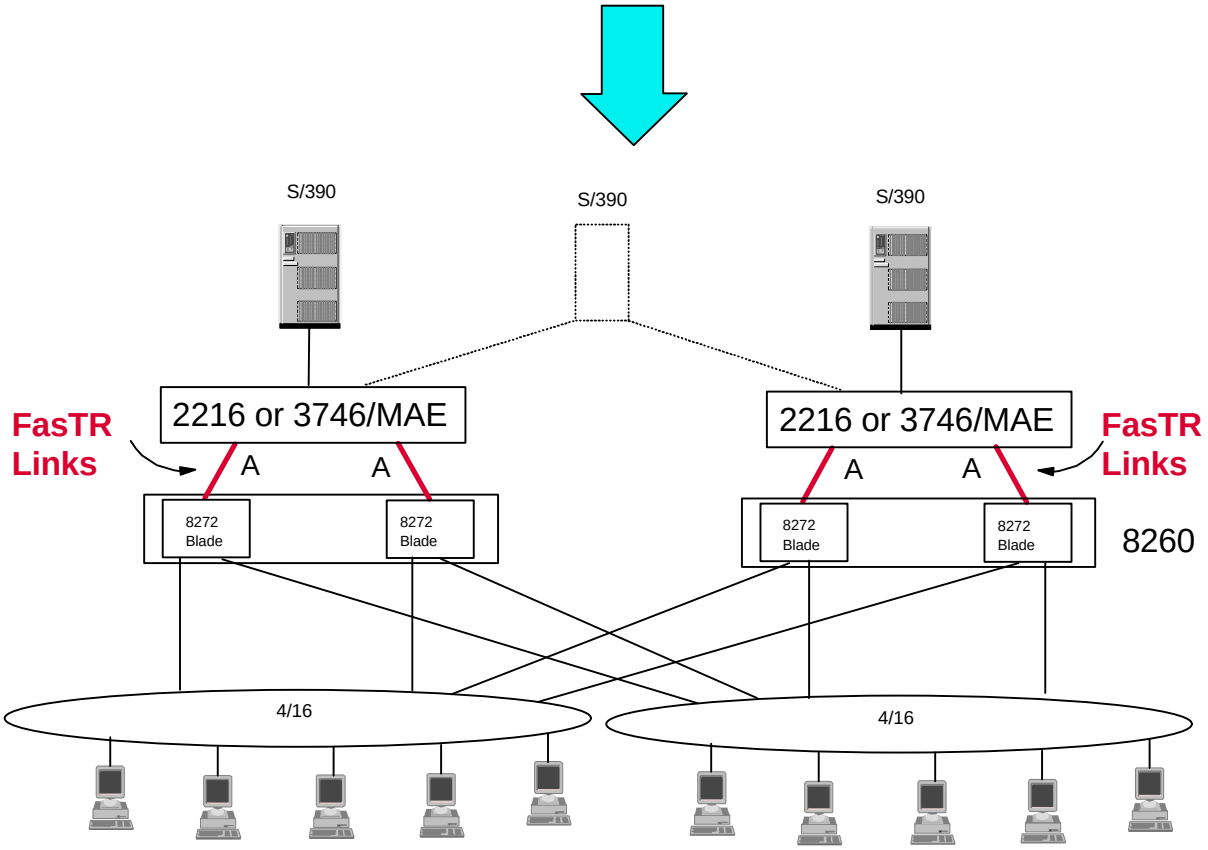


Figure 7: High-Availability Dual-Host Configuration with FasTR

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Strategic Positioning of FasTR

FasTR is designed to complement the Token Ring Migration Strategy defined in the IBM White Paper "Token Ring Migration" by Robert Love and Jeffrey Lynch. FasTR is a targeted solution that can be deployed today to solve bandwidth problems to key shared resources such as System/390 servers.

FasTR augments Step 2 of the typical migration strategy highlighted in the "Token Ring Migration" white paper. This typical migration strategy with FasTR included is:

1. **Exploit switching and workgroup segmentation.**
    - Collapse the upper-tier backbone into a backbone switch and provide dedicated ports for key resources.
    - Replace the mid-tier rings with switches, directly attaching servers to the ports as appropriate.
    - Micro-segment heavily used workgroup rings increasing port utilization of mid-tier switches.

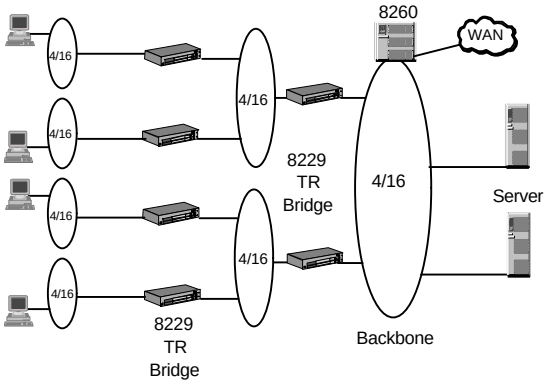
2. **Migrate key shared resources to high-speed connections via TokenPipe, FasTR, or Multi-Link Token Ring, depending on strategic requirements.**

3. **Move to High-Speed 100 Mbps Token Ring.**
    - Install client and server adapters and run them in 4/16 Mbps mode until ready to exploit 100 Mbps.
    - Upgrade the infrastructure. Continue to exploit switching and workgroup segmentation by incorporating 100 Mbps backbone links, and provide dedicated ports for key resources.
    - Selectively upgrade power users and servers to direct-attached connections of 100 Mbps High-Speed Token Ring. Phase out the concentrators, as more bandwidth is required to the end-stations, replacing them with 4/16 switches with high-speed up-links for the bulk of end-user station attachments.

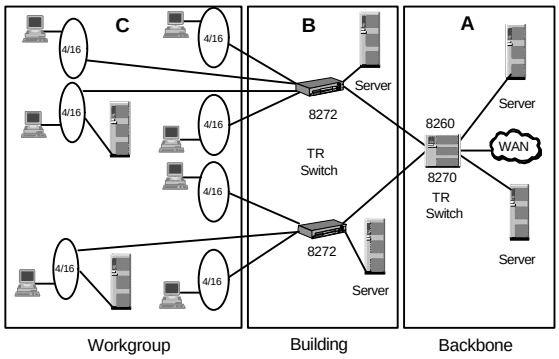
With these key steps in mind, the evolution of a large network is likely to follow the progression shown in Figure 8.

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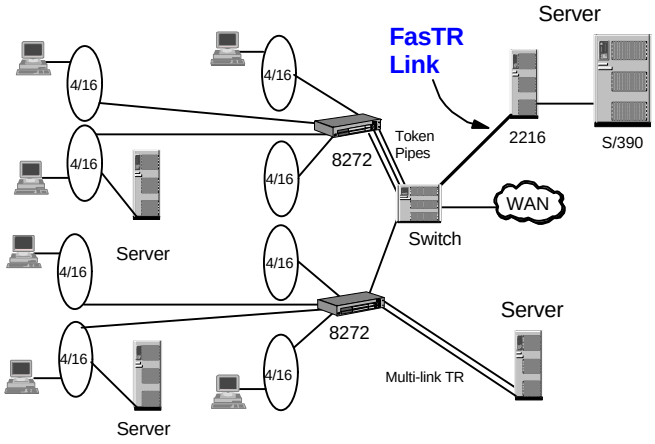
Starting with a Classic Shared Media Token Ring Network



1) Exploit switching and workgroup segmentation.
   a. Collapse the upper tier backbone.
   b. Replace the mid-tier rings with switches.
   c. Micro-segment heavily used workgroup rings.



2) Selectively use TokenPipe, FasTR, and Multi-link Token Ring to relieve current bandwidth constraints and bottlenecks for shared resources.



3) Migrate to High Speed Token Ring.
   a) "Future-proof" client workstations by installing 4/16/100 Mbps adapters.
   b) Upgrade infrastructure and migrate key shared resources (such as backbone links and servers) to higher-speed connections.
   c) Selectively turn on 100 Mbps clients as required.

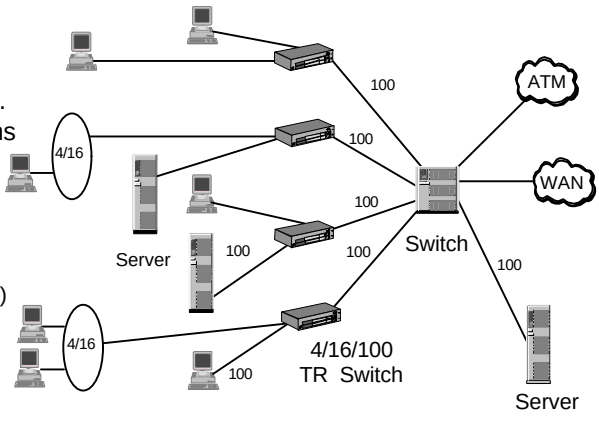


Figure 8: Roadmap of a Typical Migration Scenario

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Summary

When additional network bandwidth is needed for System/390 Server access via the 2216 or 3746, a customer can install an ATM-ready 155 Mbps-class FasTR solution in a Token Ring-only network, *without* worrying about installing and managing an ATM network infrastructure. It couldn't be easier; the network continues to be Token Ring, and server access performance can increase to many times that of 16 Mbps Token Ring.

Finally, if the backbone network is eventually migrated to ATM, the same FasTR hardware can be reused for a native ATM Server connection to the ATM backbone network. Investment in the hardware is protected.

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