MFS Datanet, Inc.

Frame Transport Service Description

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1. Introduction

MFS Datanet's (MFS) Frame Transport Service allows customers frame relay access to an ATM network that provides superior connectivity, reliability, scalability of access, and an immediate migration path to higher speed services such as HLI and ATM. Frame Transport was developed as a result of several requests from customers requiring lower speed service (down to 56 Kbps), and to provide the MFS sales force with a low end, entry level service to entice customers down the MFS ATM migration path.

Frame Transport will be available as a standard MFS Service beginning June 1994, and will be available in all MFS cities in the U.S., and U.K., with future geographic availability consistent with all new MFS city introductions.

This document is a summary of Frame Transport features available to customers at MFS's initial launch of the service.

This Frame Transport Service Description should be widely available and distributed to all MFS staff worldwide who are responsible for:

- Customer service, operation, billing and ordering
- Pre and post technical sales support
- Network Communications Consulting
- Product Engineering
- Marketing and Business Development

2. Overview

Frame Transport Service is an important addition to MFS's service portfolio because it offers a widely adopted access technology (frame relay) over the ATM network. It is expected that Frame Transport will be well received by MFS Sales personnel and the market. It will be positioned as a service that provides scalable, high speed access to the ATM network for customers who have made an investment in frame relay technology yet want a reliable and ready migration to ATM technology. It is intended that Sales should not lead an opportunity with Frame Transport Service, but rather, should use Frame Transport as a service migration vehicle to MFS's higher speed, higher value-added services. HLI and higher speed services will continue to be highly promoted in the sales cycle, with Frame Transport offered as a "last alternative" service to obtain good business from well targeted opportunities.

3. Product Positioning

3.1 Business Opportunity

MFS's Frame Transport Service addresses a market with U.S. revenues of $26 million in 1993, projected to grow to $128 million by 1994.[1] Initially frame relay technology was plagued by the market's skepticism about the technology's longevity, its confusing pricing, and poor burst capability. After a two year roller coaster ride and increased market confidence, users now feel comfortable choosing frame relay technology to improve connectivity, reduce cost and improve performance of mission critical applications running over today's enterprise networks.

The number of companies worldwide using frame relay will top 1,410 by the end of 1994 up from just 590 in 1993. According to IDC, the total number of worldwide frame relay ports equaled 3,825 in 1993, and will reach 12,300 in 1994, and hit 63,350 by 1997.

	1992	1993	1994	1995	1996	1997	CAGR (%)
Total # of Customers	190	425	1,025	1,985	3,050	4,525	--
Total # of Ports	1,096	3,825	12,300	23,820	42,700	63,350	125
Total Revenues ($M)	13.1	43.0	135.3	248.9	448.4	636.7	118

Source: International Data Corporation, 1993

It is expected that SNA traffic will play a major role in this growth. Current SNA environments rely almost exclusively on leased 56/64 Kbps lines or T1. IDC has interviewed users planning to migrate wide area SNA support in the next two years and found that 40% chose PVC frame relay as the service of choice.

To MFS's advantage, there is increased discussion in the press over the advent of ATM technology and potential frame relay obsolescence. As a result, users recognize the need for a smooth migration path between frame relay and ATM, which requires carriers to support a transparent protocol conversion that will enable frame relay traffic entering the network to ride across an ATM backbone. While all of the major carriers are implementing plans to transparently interoperate their frame relay networks with an ATM backbone, MFS Datanet is the only provider that can do so today.

3.2 Positioning Objectives

"To fight and conquer in all your battles is not supreme excellence; supreme excellence consists in breaking the enemy's resistance without fighting." Sun Tzu, The Art of War.

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[1] *Johna Till Johnson, "The 1994 Data Comm Market Forecast", Data Communications Magazine, December 1993.*

With this ancient wisdom in mind, Frame Transport will not be positioned as a "me too" frame relay service, but rather as one of a continuum of MFS access services to the ATM network services portfolio.

3.3 Key Features & Benefits

Frame Transport Service provides frame relay connectivity over MFS's high speed national fiber optic ATM network. Unlike traditional frame relay services, which limit access to speeds from 56 Kpbs to 1.544 Mbps, MFS's Frame Transport will accommodate scalable access and hub speeds ranging from 56 Kbps to significantly higher speeds of 6 Mbps. In addition, Frame Transport provides a smooth, easy and investment free migration path to ATM as user applications and traffic requirements expand.

The key features of Frame Transport include:

Features	*Benefits*
➢ Frame relay over a T3 trunking, 45 Mbps, ATM backbone ATM network	➢ *An smooth, easy and investment free migration path to ATM* ➢ *Increased flexibility to access ATM network at high speeds using frame relay technology* ➢ *Scalable high speed access and aggregate to hub at 56 Kbps to 6Mb* ➢ *CCITT and ANSI standards based* ➢ *Superior congestion management capabilities* ➢ *Lower latency compared to other networks* ➢ *Network performance equivalent to leased lines at a fraction of the cost* ➢ *Extends the life of legacy systems*
➢ Superior Customer Service & Support Capabilities	➢ *24 hour, 7 day a week network management and customer service* ➢ *Faster service delivery intervals than any other frame service provider*
➢ Global reach using fiber optics	➢ *1900 points of presence* ➢ *Coupled long distance & local service*
➢ Superior Network Management	➢ *Alternate routing and redundancy* ➢ *Multi-vendor, multi-protocol support*
➢ Simple, flexible pricing options	➢

4. Service Description

The service elements discussed here are standard features of MFS's Frame Transport Service that will be introduced in June 1994. Variations from these standard features may be managed through Product Engineering, Operations and Business Development as major customer-specific opportunities warrant.

4.1 Service Platform

In terms of frame relay services, there are a limited number of technical features carriers can use to competitively distinguish their services. This is because four of the seven leading carriers have implemented frame relay using the same central office-based switch---Stratacom's IPX. MFS's Frame Transport Service will use the Cascade 6000 and 9000 B-STDX Frame Relay switches at the network edges with the current backbone based on a the a Newbridge 36150 ATM and GDC APEX ATM switches.

There are several inherent advantages to MFS's network platform over carriers using Stratacom's IPX-BPX platform. These advantages include lower latency, technology investment protection and an immediate migration path towards multimedia communications applications requiring ATM. Overall, MFS's Frame Transport Service and network platform will provide customers with increased functionality and performance at a lower costs.

MFSs backbone transmission is implemented using fiber optic, DS3 backbone trunking with 2 Mb cells per second throughput, compared to competing providers with backbone transmission implementing DS1 backbone trunking with 24 - 53 K cells per second throughput.

The chart below describes the platforms implemented by competing frame relay providers:

Platform	MCI HyperStream	AT&T Interspan	Sprint Frame Relay	Wiltel Wilpak
Gateway & Backbone Switch	Wellfleet BCN with SMDS support; Siemans EWSM/QPS cell switches	Stratacom IPX-32; SMDS supported by AT&T BNS-2000	Sprint TP 4900 fast packet switch; frame relay & X.25 support	Stratacom IPS
Backbone Transmission	T-3 backbone trunking w/53 byte cells	T-1 backbone trunking w/24 byte cells	T-1 backbone trunking w/variable length cells	T-1 backbone trunking w/24 byte cells
Platform Management	SNMP standards based net mgmt	Stratacom StrataView	Proprietary Sprint TP 5000 series mgmt system	Stratacom StrataView

Backbone Routing Scheme	OSPF	RIP	RIP	RIP

4.2 Geographic Availability

Using Frame Transport, customers gain access to MFS'S ATM network through an access connection currently available globally in 1900 points of presence in the following 20 cities:

- **Albany**
- **Atlanta**
- **Baltimore**
- **Boston**
- **Buffalo**
- **Chicago**
- **Dallas**
- **Hartford**
- **Houston**
- **London, U.K.**
- **Los Angeles**
- **Minneapolis**
- **New York**
- **Northern New Jersey**
- **Philadelphia**
- **Pittsburgh**
- **Rochester**
- **San Francisco**
- **San Jose**
- **Washington, DC**
- **Wilmington**

The chart below compares the number of POPs and nodes of competing providers:[2]

Service Provider	Number of U.S. POPs	Total Number of U.S. Nodes	Number of Int'l POPs	Total Number of Int'l Nodes
AT&T	Available throughout	200	16 in Europe, Pac Rim & Australia available 1Q '94	90
BT	22	22	5-U.K. 9-Continental Europe 4-Asia/Pacific	18
MCI	390+	NA	16	NA
Sprint	350+	41	Canada, Australia, U.K. 8- Continental Europe 2- Asia/Pacific	16
Wiltel	150	1,000	London & Frankfurt in 1994	thru other carriers

4.3 Access Interface Options

MFSs Frame Transport Service will accommodate numerous interface specification and speeds, including:

I/O Modules	*Port Speeds*
V.35, X.21, RS 449	up to 6 Mbps
Unchannelized T1/E1	1.544/2.05 Mbps
Channelized T1/E1	24 or 30 56/64 Kbps channels

[2] *Broadband Networking News, "Carriers Put Stock In Frame Relay", February 8, 1994, pg. 4.*

4.4 Customer Premise Equipment

How is this Different from

MFS will offer a LAN Bridge/Router as an option, bundled with Frame Transport service, when the customer does not supply a router. Currently, Wellfleet is the only router certified for connection to the MFS ATM network. In the case of an MFS supplied router, MFS will maintain and manage the router.

If the customer supplies a router, bridge or frame relay access device (FRAD) MFS will not manage and maintain the router, and the demarcation point for Frame Transport will be a V.35 or serial line interface.

4.5 Port Speeds

Currently, over 80% of frame relay ports remain at 56 Kbps, although an increasing number of sites are being connected via the middle speed range between 56 Kbps and T1.[3] The reason users are connecting at these lower speeds to frame relay networks results from the fact that users are limited to access aggregates of up to T1 speeds offered by traditional frame relay service providers. Alternatively, MFS will provide a significant advantage to customers by allowing access aggregates up to 6 Mbps.

MFS's Frame Transport Service will offer the widest, and scalable range of port speeds available in the market. Frame Transport will allow port speeds to be assigned to access circuits enabling PVCs to be defined at the following speeds:

- 56 Kbps
- 128 Kbps
- 256 Kbps
- 512 Kbps
- 1.544 Mbps
- 3 Mbps
- 4.5 Mbps
- 6 Mbps

4.6 Bandwidth Allocation

Customer supplied routers will be connected via Frame Transport to the ATM backbone by Permanent Virtual Circuits (PVCs). The total throughput on an access link will be determined by the bandwidth/speed of that line, while data rates through each individual PVC can vary. An access link may support a number of PVCs each with varying bandwidth requirements. Each PVC is associated with a "Committed Information Rate" (CIR) which defines the maximum sustainable throughput, and can access the PVC at any rate within specific bounds. Key parameters for provisioning a PVC are CIR and allowable oversubscription and are discussed below.

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[3] *Caroline J. Michel, "Wide Area Frame Relay Services: A 1992-1997 Reassessment", IDC, March 1993.*

4.6.1 Committed Information Rate

Committed Information Rate (CIR) is the rate that the network agrees to transfer data under normal conditions. CIR is derived by calculating the total data in a burst and dividing it by the duration.

Many users opt for exchanging their right to use a fixed amount of bandwidth for lower prices. This choice gives users an For example, users can take advantage of bursting capabilies selecting a CIR of zero, knowing that enough capacity will exist on the network to send bursts of data at rates as high as their frame relay access port's rate.

Customers usually select higher speed CIRs for their primary network routes, lower speed CIRs for medium routes, and zero for smaller locations and routes with sporadic usage. Naturally, zero CIR costs less than any other CIR. Frame Transport will offer the following CIR options:

- Zero
- Increments of 64 Kbps up to T1
- Port Speed

4.6.2 Committed Burst Rate

Committed burst rate is the maximum rate at which the network will accept data under normal conditions. When data arrives at a rate above the CIR but below the committed burst rate will be marked as "Discard Eligible" (DE).

Most carriers implement CIR/Burst parameters (called 'rate enforcement") to help deal with congestion on their networks. Most carriers need this because their frame relay network utilize a T1 backbone.

By comparison, MFS has a T3 ATM backbone, where the frame relay switch acts as a concentration point. The relative capacity of this medium far exceeds the capacity of typical frame relay access. This is an important feature of MFS's Frame Transport service because it has the ability to dynamically support sustained rates up to the access port speed.

4.6.3 Oversubscription

(BJ/ Dan, could you guys write up a description of oversubscription?)

4.6.4 Alternative Routing

(BJ/ Dan, could you guys write up a description of redundancy?)

4.7 Congestion Management & Control

These parameters described above, CIR and Burst rate, are set for every virtual circuit. Frames flowing across a virtual circuit (VC) are marked for discard if between the CIR and the burst rate, and discarded if over the committed burst rate. CIR frames are discarded only if there is a catastrophe in the network (i.e., link failure), while discard eligible frames are discarded if there is any congestion on the network.

Most carriers implement CIR/Burst parameters (called "rate enforcement") to help deal with congestion on their networks. Most frame relay carriers are concerned with congestion on their networks because most utilize a T1 backbone. MFS, on the other hand, utilizes a T3 ATM backbone, where the frame relay switch acts as a concentration point. The CIR is often set to the rate of the incoming customer link, allowing the customer to transfer data at full rate without having these frames marked for discard. Since the backbone runs at 45 Mbps, there is not the same problem of congestion as with a T1 backbone.

Congestion may occur on a customer access line. If several virtual circuits pass over a single access line the total traffic from the network to the access line may exceed the capacity of the line. This may be acceptable when the customer is certain that not all of the virtual circuits will be active at the same time. In those cases that the customer wishes to manage the access bit rate more closely, MFS Datanet will establish CIRs for the virtual circuits on a given access line that insure a minimum capacity for each circuit and a burst at a higher level. MFS can also offer higher speed connectivity through Frame Transport up to 6 Mbps.

4.7.1 FECN, BECN & DE

FECN/BECN/DE: These stand for "Forward Explicit Congestion Notification", "Backward Explicit Congestion Notification", and "Discard Eligible". These are flags that are set in a frame by a frame relay switch. If FECN is set, it indicates that the frame has passed through a switch experiencing congestion in the direction the frame is traveling. BECN is similar, except it means the frame has passed through a switch experiencing congestion in the opposite direction to which the frame is traveling. FECN and BECN tell the devices transmitting the frames onto the network (i.e. customer premise bridge/router) to reduce their load on the network. The discard eligibility (DE) bit, when set, will indicate that a frame is a potential candidate for discard.

FECN and BECN are supported by the MFS network to signal to destination and source that congestion is occurring in the network or on an access line.

The chart below describes this congestion management features implemented by competing frame relay providers:

Service Provider	*FECN & BECN Utilized?*	*DE Bit Utilized?*	*Data Buffered or Discarded with Congestion*
AT&T	Yes	No	Uses a closed-loop algorithm to monitor spare capacity; therefore does not allow
BT	Yes	No	Engineered to avoid congestion. If it occurs, data is buffered within the IPX Nodes
MCI	Yes	Yes	Yes, but discarded when buffers are filled
Sprint	Yes	Yes	Buffered
Wiltel	Yes	Yes, only for data above CIR	Buffered

4.7.2 Latency

MFS Frame Transport users will benefit from very low network latency because frames will be transported over MFS's ATM network. In a frame relay network like those used by competing providers, variable length packets require switching in both hardware and software. The software switched devices used in frame relay networks rely on processor speed and the efficiency of the switching software, and therefore, do not readily scale to high speeds.

Alternatively, in an ATM network, ATM cells are switched in hardware only, which makes switching fast and scaleable to high speeds. This translates to a great benefit to MFS Frame Transport users, because the very low latency of ATM switches (2-10 microseconds) means higher throughput at higher speeds.

4.8 Performance and Quality of Service Targets

MFS provides national network monitoring and control from its Network Control Center headquarters in San Jose, CA with a dedicated staff of highly qualified network technicians, 24 hours/day, 7 days/week. The network control center operates current industry software and hardware platforms to capture real time network events, alarms and statistical data, thus providing customers with a high level of network performance and availability. The chart below describes MFS performance and QOS targets for Frame Transport service:

Network Performance Measure	QOS Targets
Overall Availability	99.96%
MTTR	1.5 Hours
MTBF	1 in 8 months

4.9 Standards Supported

MFS's Frame Transport service conforms to the following standards:

CCITT Reference	ANSI Reference	Description
I.233	T1.606	Frame relay architecture framework
Q.922	T1.618	Core aspects of frame protocol for Frame Relay service
I.555	NA	Frame relay bearer service internetworking specifications
I.365.1	NA	Frame relay service specific convergence sublayer
I.370	T1.606	Congestion management
Annex A Q.933	Annex D T1.617	PVC management procedures/LMI processing
I.363	NA	ATM adaptation layer specification

4.10 Service & Support

4.10.1 Service Management

A Frame Transport customer may choose either a "unbundled" or 'bundled" service from MFS. With the "unbundled" service, the customer provides a router and MFS will:

- manage PVC changes (including changes to CIR, addition/deletion of PVCs)
- manage the provision and maintenance of the access link
- manage and monitor all aspects of service up to the V.35 point of demarcation.

With the "bundled" Frame Transport service option, MFS will provide a Wellfleet router as part of the service. MFS will also:

- provision, install and maintain the routers,
- provide software upgrades as necessary
- manage router configurations and monitoring
- manage PVC changes (including changes to CIR, addition/deletion of PVCs)
- manage the provision and maintenance of the access link.

4.10.2 Demarcation Point (Ted this section needs help!!)

not so when we provide the route. →

The demarcation point for Frame Transport will Be either a V.35 interface for customer supplied routers and FRADs. MFS Datanet will be responsible for all MFS service and equipment, including installations, maintenance and spares up to the V.35 demarcation point.

4.10.3 Service Delivery Lead Times

MFS Frame Transport Service delivery lead time will be the fastest in the market, allowing customers to order and implement the service as fast as 20 days.

The delivery lead times outlined in the chart below define the following set of activities prior to hand-off to the customer:

- order/contract acceptance
- access circuit lead time (including installation & delivery)
- router lead time (including delivery & configuration)
- end-to-end circuit and LAN interconnection testing

MFS will provide the following delivery lead times for Frame Transport Service:

Geography	New Access/PVCs	Modify/New PVCs
On-Net[1]	20 days	1day
On-Net[2]	30 days	1day
On-Net[3]	60 days	1day
Off-Net	36 days	1day

[1]new access/PVCs on-net
[2]new access/PVCs in London
[3]new access/PVCs in Albany, Baltimore, Buffalo, Hartford, N. NJ, Pittsburgh, Rochester, St. Louis, Tampa, and Wilmington.

The chart below describes service delivery intervals of competing frame relay providers:

Carrier	New Access/PVCs	New/Modify PVCs
MCI	34 days	1 day
AT&T	36 days	NA
Sprint	60 days	7 day
Wiltel	60 days	1 day

4.10.4 Installation

Network Installation and project related activity for Frame Transport will be coordinated between network and field operations based on service requirements, purchased services

and or modification to existing equipment and services. As part of the provisioning process, MFS will conduct site surveys of user locations to develop data required for installation and service. Pre-coordination with the customer's technical staff will ascertain information needed to properly configure the applications, and interfaces to be supported. At the same time, connectivity options will be selected and required characteristics will be determined.

Network Operations will initiate a tracking "Action Request" form which is utilized to communicate all necessary information pertaining to the installation/project activity. Procurement of circuit's in the local or IXC service area's will be managed by the Network Operations Provisioning and Support staff through testing/acceptance of end-to-end connectivity which may also include CSU/DSU components.

MFS will provide a wide spectrum of installation and facilities management of Frame Transport will include the following:

- Engineering of network design
- Configuration management
- Ordering of all network circuits (including local loop)
- Equipment installation up to the V.35
- Network operations including circuit monitoring, troubleshooting, management reporting, etc.

4.10.5 Ordering and Billing

MFS will invoice Frame Transport Service using the same method as HLI Services. MFS will provide an itemized and detailed invoice that will allow customers to perform cost and usage analysis that enables timely and accurate charge-back of usage expenses. Frame Transport customers will be billed monthly, with all recurring, non-recurring and usage-based charges (where applicable) related to MFS Datanet services appearing on the same invoice. In addition, the invoice will reflect charges for the current month as well as any prorated amounts for the previous month.

4.11 Pricing

Pricing for frame relay typically comprises three parts: access line charges, monthly port charge and permanent virtual circuit (PVC) charges. The access line and port charges cover the physical connection to the network, and the PVC charges cover the logical connections between user devices.

Pricing of these elements from the carriers has been very confusing to users. Some carriers bundle the access line with the port charge, and some charge for each separately. Some carriers price PVCs as a major portion of the cost of service, while others price PVCs very low.

Users have found different frame relay offerings difficult to compare, making it nearly impossible to do an apples-to-apples comparison of various service options. In addition, some users still struggle to make the transition from a private-line mentality to a CIR and PVC configuration for their data networks. What users of frame relay services want is simple, easy to understand pricing.

In addition to the features users will enjoy as a result of MFS's ATM network, MFS will offer simple, easy to understand and very competitive pricing to attract new customers to the service. In many cases, MFS Frame Transport pricing will be more attractively priced to users than other provider's pricing.

Because Frame Transport will be a entry-level, "lower-end" service in MFS's ATM network services portfolio, it will be priced lower than HLI services.

Expand Answers on these questions:
How will Frame Transport be priced compared to other providers?
How will the frame transport be price positioned to HLI?

4.11.1 Pricing Schedule

(Jon's Section)

The chart below compares pricing features of competing frame relay service providers.

Feature	AT&T	MCI	Sprint	Wiltel
Fixed	Yes	Yes	Yes	Yes
Zero CIR	No	Yes	Yes	No
Incremental CIR	Yes	Yes	Yes	Yes
Port Speed CIR	Yes	Yes	Yes	Yes
Usage CIR	No	Yes	No	No
Rate Structure	Duplex access Duplex ports Simplex PVCs	Duplex access Duplex ports Simplex PVCs	Fixed price PVC w/CIR, Usage based PVC w/zero CIR, Fixed priced port w/opt. equipment	Fixed priced ports Fixed priced PVCs
Mileage Sensitivity	No	PVC pricing is mileage sensitive	No	No

Optional Items	Extended connectivity (managed routers) bespoke support	CPE, network mgmt.	Managed routers, equipment, bespoke support	Full line of formalized internetwork support under WilPower

4.11.2 Promotional Incentives & Limited Time Offers

(Ideas- final incentives contingent on approved standard pricing)
Any ideas anyone?

- Buy 5 Frame Transport PVCs, receive first 3 HLI free for 3 months
- Installation charges waived when migrating from Frame Transport to HLI or higher speed services

4.11.3 Terms & Conditions

MANAGEMENT CONCURRENCE

Name/Title **Date**

_____ _____

Al Fenn, President

_____ _____

Bill Euske, V.P., Product Engineering

_____ _____

Ken Holcomb, V.P., Operations & Customer Service

_____ _____

Scott Yeager, V.P., Sales & Distribution

_____ _____

Jay Jonekait, V.P., Business Development

_____ _____

Jim Johnson, V.P., Finance & Administration

_____ _____

Bob Barbour, Director, Marketing