U.S. ARMY CORPS OF ENGINEERS
DISTRICT CONNECTIVITY
FTS2000

The Corps of Engineers' Financial Management System (CEFMS), as well as other applications are driving the requirements for inter-office communications for networking multiple resident, area, and project offices below the District office levels. In defining a suitable architecture, it is critical to evaluate existing communication needs in addition to future requirements, systems, and applications that may evolve.

To that end, the information provided in the attachments describes various feasible alternatives under FTS2000 to fulfill these needs. Despite the similarities in applications across the Districts, there are also differences that exist that may make one service more viable than others when evaluating the optimal data network configuration for each District.

The services discussed in these packages are -- Dedicated Transmission Service, Packet Switched Service, Frame Relay Service, Dial-up, and Remote Site Network Connectivity.
Specific attachments include:

- o Summary description of each data networking alternative
- o Matrix highlighting the services and their characteristics
- o FTS2000 access methods
- o FTS2000 order intervals
- o Pricing examples for Dedicated Transmission and Frame Relay Services
- o AT&T account team contacts by Division and District
- o In some cases, a more detailed briefing package is available on FTS2000 services, see briefing package index

A pricing example is provided for illustrative purposes only comparing Dedicated Transmission and Frame Relay service in a "meshed" configuration for one District office. Multiple variables such as distance, time of day, usage, access areas, committed information rates, etc., make any attempt to include pricing for each service convoluted and of limited use in evaluating an appropriate service. Under the terms of the FTS2000 contract, AT&T account team representatives are available to meet with District offices to discuss these services in greater detail and will provide technical support in evaluating individual requirements and design and price feasible alternatives.

Points of contact for more detailed information on the services discussed in this package, or the briefing package are:

- o Dale Winstead HQUSACE-IM (202) 761-1676
- o AT&T Account Executive Team (see attached)

FTS2000
DATA NETWORKING ALTERNATIVES SUMMARIES

DEDICATED TRANSMISSION SERVICE (DTS)

FTS2000's Dedicated Transmission Service provides a solution for transmitting large volumes of data or voice calls over dedicated facilities on a continual basis between two locations.

There are a variety of service options including Dedicated Analog lines at 4.8 and 9.6 kbps, Dedicated Digital Service providing synchronous transmission at 9.6, 56 and 64 kbps and Dedicated T1 and T45 service offering high speed bulk data transfer.

Offered on a fixed monthly charge, the service is available for your agency's use exclusively 24 hours a day. Regardless of usage volumes, the pricing remains the same which may be an advantage for budgetary purposes over other usage-sensitive alternatives. The fixed cost may be ideal for locations requiring continual data transmission, the general assumption being at least 6 hours per day.

Disadvantages of DTS over other alternatives such as Frame Relay is the lack of traffic information which can provide usage data for an agency to make informed decisions on sizing. DTS is also distance sensitive. Generally, the greater the distance between the end points of the circuit, the greater the cost. In addition, the ability to operate in a meshed environment, with full office-to-office connectivity, is unavailable without additional dedicated facilities being installed between each location. Each point-to-point circuit requires separate terminations at each end, adding to the investment in equipment.

THE BRIEFING PACKAGE FOR DTS IS AVAILABLE UPON REQUEST FROM POC

PACKET SWITCHED SERVICE (PSS)

FTS2000's PSS is a cost-effective and reliable data transmission option to link geographically dispersed locations having a variety of software, speeds, terminal equipment and protocols. Ideal for sites having "bursty", rather than continuous traffic, the service transmits information in "packets" which are routed through the network and then reassembled at the destination.

This technology consists of multiple virtual circuits instead of dedicated resulting in increased utilization and decreased costs. PSS employs a variety of access options including dial-up and dedicated access up to 9.6 kbps.

Although the maximum speed for PSS is 56 kbps the overhead required will probably result in 32 kbps throughput at best. While it is a viable solution for a starting point, its advantages may be offset by low speeds and limited throughput.

FRAME RELAY

FTS2000's Frame Relay service or Enhanced Packet Switched Service (EPSS) is ideally suited for file transfer, imaging, graphics, electronic mail, CAD/CAM as well as other emerging applications. Frame relay service is an evolutionary service from the existing X.25 packet switched protocol, offering higher throughput and lower delay in data transmissions.

Pricing consists of three elements - access, port, and CIR or permanent virtual connections.

With access methods ranging from 56 kbps to T1.5 service, frame relay's key advantage is its ability to "burst" traffic above the committed information rate (CIR) when needed. In a nutshell, what this means to an agency is the capability to transmit data traffic at higher speeds without paying the cost of dedicated service on a continual basis.

One of the advantages of frame relay service is its' ability to operate efficiently in a fully "meshed" environment, permitting office to office communication with a single termination at each site. The added equipment expense and potential bottlenecks of dedicated circuits between each and every location is eliminated. Requiring only a single interface at the District office, or hub, frame relay offers a cost effective alternative to dedicated private line services.

The management information reports available with this service will provide overall usage and performance measurements as well as specific traffic data such as spikes, retransmissions and errors. These valuable reports allow an agency to manage their network and make educated decisions on sizing and bandwidth requirements.

It is important to note that frame relay is distance insensitive. The cost of transmitting the same data across town or across the country is no different.

Some key enhancements to FTS2000's frame relay service include dial-up access at speeds ranging from 19.2 to 28.8 kbps (a critical advantage for the Corps of Engineers' District office applications), Internet connectivity and disaster recovery applications.

THE BRIEFING PACKAGE FOR FRAME RELAY IS AVAILABLE UPON REQUEST FROM POC

DIAL-UP SERVICE

Dial-up service options under FTS2000 include access utilizing Switched Voice Service (SVS), Virtual On-Net (VON), or Switched Data Service (SDS). SVS and VON service will permit transmission of voice and analog data up to 9.6 kbps while SDS handles traffic at 56 or 64 kbps on a point-to-point basis between on-net locations.

Dial-up or switched service provides a cost-effective method for data transmission where traffic does not justify a dedicated connection. Charges for FTS2000 switched services are usage sensitive based on time of day and the distance between access areas.

Applications often used for SDS include intermittent bulk data transfer (i.e. payroll, graphics), back-up for peak time overflow from DTS facilities, video conferencing and disaster recovery.

REMOTE SITE NETWORK CONNECTIVITY (RSNC)

RSNC allows locations to access the FTS2000 network where no Local Exchange Company (LEC) facilities exist or are technically insufficient to meet agency requirements. With RSNC, remote locations can access SVS, DTS and PSS.

RSNC provides a low cost fully digital network solution for low capacity telephone service. Using VSAT (Very Small Aperture Terminal) satellite technology and interfaces to the FTS2000 terrestrial network, RSNC can support simultaneous two-way data and voice applications.

The VSAT dishes are available in 1.2, 1.8 and 2.4 meters and can be ordered for permanent (fixed) installation or fly-away (portable) mode. Configurations for both Star (hub/remote) and Mesh (hubless) are included under the FTS2000 contract.

Basic price elements include Feature Initiation Charges (non-recurring) for the VSAT unit, associated equipment and host interface and monthly recurring charges for the space segment (network services) and maintenance. A thorough technical design and site surveys based on an agency's or location's specific requirements are needed to develop a feasible configuration and pricing.

Specifically, RSNC is ideally suited for areas having permanent physically diverse access requirements for FTS2000 (i.e. river, mountaintops), emergency communications and portable backup for natural disasters (i.e. hurricanes). The key disadvantage of limited bandwidth (currently 128 kbps) is offset by its unique niche-oriented applications.

THE BRIEFING PACKAGE FOR RSNC IS AVAILABLE UPON REQUEST FROM POC

FTS2000 ACCESS METHODS

All of the FTS2000 data networking options discussed can be ordered as single services with access provided for each circuit. To achieve greater efficiency, realize significant economic savings and migrate to future technologies, there are alternative access methods under the FTS2000 contract that may benefit the Corps of Engineers. These methodologies are SDIS and ISDN.

SDIS (Switched Digital Integrated Service)

SDIS integrates voice, data , video and imaging by means of digital connectivity to network users. The basic premise of SDIS is that all services at an on-net location are aggregated through one or more T1 facilities. Key benefits include improved transmission due to digital access and reduced costs. Economic savings are achieved as the usage is aggregated to take advantage of higher volume bands thereby reducing the cost per minute. Dedicated services that are not usage sensitive also receive the economic benefit, typically with a reduction in the monthly recurring charge for the service.

ISDN (Integrated Services Digital Network)

ISDN is an evolutionary step beyond the SDIS access method. Key benefits include more efficient utilization of available bandwidth, faster call set-up and processing time. With ISDN, bandwidth is selected on a call-by-call basis. The ability to dynamically allocate bandwidth provides maximum flexibility for different applications. In addition to the aggregated cost savings of SDIS, ISDN features also include station level billing and calling party number identification.

FTS2000 SERVICE ORDER INTERVALS

In general, the FTS2000 contract stipulates that switched services will be provisioned within 90 calendar days and dedicated services, with the exception of T45 service, will be provisioned within 120 calendar days. Order intervals begin with the receipt in the Agency Support Delivery Center (ASDC) of an accurate order; intervals for "projects" are negotiated on an individual case basis. On average, the current provisioning interval by service is as follows:

SERVICE	APPROXIMATE INTERVAL IN BUSINESS DAYS
VON	19
VON BRI	19
T1.5	35
ISDN PRI	42
9.6 ANALOG	25
9.6 DIGITAL	35
56 Kbps	30
FRACTIONAL T1	45
T45	ICB (Individual Case Basis)
800 BASIC	9
800 ADVANCED	22
FRAME RELAY	ICB (Individual Case Basis)
PACKET DEDICATED	100
PACKET DIAL-UP	10
FEDERAL CARD	15

FTS2000 56K POINT-TO-POINT PRICING
ALL SITES INTER-CONNECTED

ORIG AREA CODE	ORIG ACCESS METHOD	TERM AREA CODE	TERM ACCESS METHOD	CIRCUIT SPEED	TOTAL RECURRING CHARGES	ORIG-END (1-TIME) CHARGES	TERM-END (1-TIME) CHARGES	TOTAL (1-TIME) CHARGES
540-629	SDIS-T1.5	704-271	SDIS-T1.5	56K	$110	$1,470	$1,470	$2,940
540-629	SDIS-T1.5	804-738	SDIS-T1.5	56K	$109	$0	$1,470	$1,470
540-629	SDIS-T1.5	919-542	SDIS-T1.5	56K	$110	$0	$1,470	$1,470
540-629	SDIS-T1.5	910-251	SDIS-T1.5	56K	$112	$0	$1,470	$1,470
704-271	SDIS-T1.5	804-738	SDIS-T1.5	56K	$114	$0	$0	$0
704-271	SDIS-T1.5	919-542	SDIS-T1.5	56K	$112	$0	$0	$0
704-271	SDIS-T1.5	910-251	SDIS-T1.5	56K	$112	$0	$0	$0
804-738	SDIS-T1.5	919-542	SDIS-T1.5	56K	$110	$0	$0	$0
804-738	SDIS-T1.5	910-251	SDIS-T1.5	56K	$112	$0	$0	$0
919-542	SDIS-T1.5	910-251	SDIS-T1.5	56K	$107	$0	$0	$0
TOTALS					**$1108**	$1470	$5,880	**$7,350**
ORIG = Originating								
TERM = Terminating								
DI56 = Digital 56K Access Line								
SDIS-T1.5 = Switched Digital Integrated Service								
CSU/DSU CHARGES ARE INCLUDED IN PRICING								
SERVICE AVAILABILITY IS DETERMINED UPON SUBMISSION OF AN ORDER.								
THIS PRICING REPRESENTS COST ESTIMATES. ACTUAL CHARGES MAY VARY.								

FRAME RELAY PRICING ESTIMATES

AREA CODE	ACCESS RATE	ACCESS TYPE	ACCESS MRC	ACCESS NRC	PORT SPEED	PORT MRC	PORT NRC	PVC #	PVC CIR	PVC/CIR NRC	CIR MRC	TOTAL NRC	TOTAL MRC
540-629	56K	DI56	$301	$753	56K	$170	$444	10	16K	$370	$740		
704-271	56K	DI56	$288	$753	56K	$170	$444						
804-738	56K	DI56	$301	$753	56K	$170	$444						
919-542	56K	DI56	$441	$753	56K	$170	$444						
910-251	56K	DI56	$228	$753	56K	$170	$444						
								10					
TOTALS			$1,559	$3765		$850	$2,220			$370	$740	**$6,355**	**$3,149**
MRC = Monthly Recurring Charges													
NRC = Non-recurring Charges													
PVC = Permanent Virtual Circuit													
CIR = Committed Information Rate													
DI56 = Digital 56K Access Line													
SERVICE AVAILABILITY IS DETERMINED UPON ORDER SUBMISSION.													
PRICING REPRESENTS COST ESTIMATES.													

SPREAD SPECTRUM

Spread spectrum technology is NOT used with services under the FTS2000 contract. Typical applications for this technology include wireless and radio communications.

In addition to bandwidth, wireless communications requires resistance to interference. However, traditional "narrowband" radio transmission is highly prone to interference. For example, two FM radio stations broadcasting at the same frequency would "jam" each other. The FCC was originally established to regulate the assignment and use of frequencies precisely because of this inherent tendency to interfere.

Originally developed for military applications, **spread spectrum** techniques literally spread radio signals over a much wider bandwidth than that used by narrowband transmission. As a result, spread spectrum offers an inherently greater ability to resist interference than does narrowband communications.

There are two major spread spectrum techniques in common use today: **direct sequence** and **frequency hopping**. In **direct sequence spread spectrum** a digital signal is multiplied by a sequence of pseudo-random phase changes. These changes of phase are termed the *Chip Sequence* and measured by the chip rate in chips per second (Cps). When received, the original signal is recovered by comparing it to a locally generated replica of the chip sequence. Any interference that is encountered is spread over a broad spectrum and then further minimized through filtering.

In **frequency hopping spread spectrum** a narrowband signal is transmitted at one frequency for a brief period of time and then shifts *(hops*) to a new frequency based on a pseudo-random *hopping pattern*. All frequency hopping spread spectrum devices are synchronized to the same pattern and hop to the new frequency together. Although frequency hopping can temporarily avoid interference sources, it is essentially a narrowband technique and suffers from the same drawbacks.

Of the two techniques, direct sequence is usually preferred for applications requiring **high throughput, extended range and superior resistance to interference.**

3/2/98		
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