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**ETS**

# Course Profile

## Frame Relay in the Enterprise Network

**ETS356**

**Duration:**

2 days

**Objectives**

**D**escribe the basic concepts of Frame Relay and the Frame Relay Standards.

**E**xplain packet switching and X.25 and its relationship with Frame Relay.

**D**escribe typical Frame Relay networks and applications and discuss practical implications of using Frame Relay.

**D**escribe Voice over Frame Relay.

**D**escribe how Frame Relay interoperates with other networks.

**Who should attend:**

Technical specialists, support personnel, network administrators, consultants and communication specialists who need an introduction to Frame Relay services and technology.

**Prerequisites:**

A good understanding of data communications obtained by attending a course such as Introduction to Data Communications (ETS325).

**Follow-on courses:**

Further courses on related networking systems such as ATM (ETS345). This course also acts as a solid foundation for some elements of Internetworking with Bridges, Switches and Routers (ETS329).

**Course style:**

The course is presented as a mixture of teaching sessions and discussions relating to practical experiences.



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### Key contents:

What is Frame Relay?	Standards
Principles of Packet Switching	Commercial Considerations
Physical Level Specifications	ISDN
Frame Relay Protocol	HDLC
Traffic Management	FRADs
Using Frame Relay	Voice over Frame Relay and Video
Frame Relay and ATM	Encapsulation
DLCI	ATM
ATM Interfaces	Migration to ATM
Signalling	PVC
Network Management	SVC
LAPB	LAPF
ITU	ANSI
Frame Relay Forum	UNI
Queuing Delays	NNI
TI.606, TI.617, TI.618	Data Compression
Committed Information Rate	Burst Rate
CPE	Equipment Manufacturers
Cisco	Newbridge
Nortel	Ascend
Sentient	Internet Access
International Connectivity	Multicast
Routing	OSI



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### Detailed contents:

#### Overview

Evolution of Networking through 70's, 80's and 90's

Evolution of Data Applications

Network Types

Overview of WANs

- Leased/Private Lines
- Circuit Switching
- X.25 Packet Switching
- ATM
- SMDS
- Frame Relay

#### Overview of Network Based Applications

Overview of Packet Switching

X.25 Packet Switching

X.25 Recommendations

X.25 Levels

X.25 Mechanical and Electrical Characteristics

Interchange Circuits

Phases of Operation

LAPB

- Major Functions
- Protocol
- Fields
- Frame Types

X.25 Packet Level Protocol and Structures

General Format Identifier

Logical Channel Group Numbering, PVCs, SVCs



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### Detailed contents continued:

Overview of Network Based Applications (continued)

Logical Channel Types and Numbering

- PVC
- SVC

X.25 Call Set-up

X.25 Data Transfer

X.25 Call Clearing

Triple X

X.25 Limitations

Frame Relay Concepts

Faster Packet Switched Networks

Frame Relay Features

Frame Relay and ISDN

Frame Relay Data Transmission Service

Non ISDN Frame Relay Standards and X.25

Terms and Definitions

- UNI
- NNI
- VC
- PVC
- SSVC
- CIR

Frame Relay and OSI

Frame Relay Technical Framework

- The Role of the CPE
- The User to Network Interface
- The Network to Network Interface

LAPF

- Frame Format



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## Frame Relay in the Enterprise Network

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### Detailed contents continued:

#### Frame Relay Concepts (continued)

- Protocol Identifier
- Throughput, Congestion and Committed Information Rate (CIR)
- Congestion Control
- Local Management Interface (LMI)
- Managing PVCs
- IP over Frame Relay
  - Inverse ARP
- Frame Relay SVCs
- Frame Switching

#### Frame Relay Standardisation

##### Frame Relay Organisations

- ITU
- ANSI
- FRF

##### Frame Relay Standards

- UNI, FRF-1
- NNI, FRF-2
- Data Link Core Layer Aspects
- PVC Management

##### Frame Relay Standards - ANSI

- T1.606
- T1.617
- T1.618

##### Frame Relay Forum Terms of Reference and Goals

##### Frame Relay Forum Implementation Agreements

- Multiprotocol Encapsulation
- Frame Relay /ATM Interworking
- Customer Network Management
- Multicast



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## Frame Relay in the Enterprise Network

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### Detailed contents continued:

#### Frame Relay Standardisation (continued)

- Voice over Frame Relay (VoFR)
- Data Compression

PVC

Switching Virtual Circuits

Signalling

Multiprotocol Aspects

#### Physical Connectivity and Performance Issues

Low - Medium Speeds

Medium - High Speeds

Other Interfaces

Time Division Multiplexing (TDM)

TDM and Bandwidth

Statistical Multiplexing

Queuing Delays

Frame Relay Switching

Performance Issues

- Subscription
- Traffic Mix and Patterns
- DLCI Capacity
- Broadcast Analysis
- Traffic Management

#### Frame Relay Networks

Users View of Network

Private Networks

Public Networks

Understanding Public Frame Relay Services

Access Alternatives Offer Flexibility



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## Frame Relay in the Enterprise Network

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### Detailed contents continued:

#### Frame Relay Networks (continued)

Network Management  
Internet Access  
International Connectivity  
Managed Network Services  
Migration to ATM  
Mixed Networks

#### Frame Relay Applications and Products

Leading Frame Relay Applications  
Frame Relay for LAN or Client/Server  
Frame Relay Solution for SNA  
Frame Relay Solution for LAN and SNA  
Frame Relay Topologies

- Full mesh
- Partial Mesh
- Star
- Point to Point

Routing Updates - Problems  
Traffic Types - Protocols  
Frame Relay for Voice  
VoFR Statistics  
VoFR Standards  
Private Voice Networks  
Private VoFR Networks  
Integrated Voice and Data Frame Relay Networks  
VoFR Goals  
Effective Utilisation of Low Bit Rate Frame Relay  
Data Fragmentation



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### Detailed contents continued:

Frame Relay Applications and Products (continued)

Frame Relay Products for Networks and Customer Premises Equipment

- Ascend
- Newbridge
- Cisco
- Nortel
- Telematics
- Sentient

Cell Relay and Frame Relay

B-ISDN and ATM

Services and Applications

How does ATM Work?

ATM Control

ATM Networks

ATM Interfaces

Examples of Public ATM Networks

Migration Path to ATM

Frame Relay Complements other Technologies



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This information is provided in good faith to represent the typical contents of the course material. The course will change as required to keep pace with technology changes and learning styles, as a result the exact contents may differ from those specified here. The benefit of instructor led training is that it will evolve to suit the needs of any specific class, therefore no warranty is given that any specific course will cover the subjects outlined here to any implied level of detail.

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