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DECNIS Frame Relay

A technical specification of the DECNIS Frame Relay implementation

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Abstract

This document provides a technical specification of the DECNIS Frame Relay implementation. It provides information to help Digital re-sellers, account teams and support personnel answer customer questions.

The technical information in this document is based on the original DECNIS Frame Relay specification document written by Debbie Tayler of the DECNIS engineering development team.

Introduction

The DECNIS software supports connections over Frame Relay data links as specified in the Frame Relay Specification jointly developed by Digital Equipment Corporation, StrataCom Inc, Northern Telecom, and Cisco Systems Inc.

Multiple virtual circuits can be multiplexed over a single Frame Relay link using the Data Link Control Identifier (DLCI) field of the Frame Relay LAPD header. ANSI-D, CCITT, and LMI control procedures are supported

The DECNIS V2.3 software supports remote bridging and routing of IP, IPX, DECnet, OSI and AppleTalk protocols over Frame Relay data links using Point-to-Point Protocol (PPP) encapsulation within the Frame Relay frame. Frame Relay is only supported on the DEC WANcontroller 622 network interface card.

Conformance to Standards

The DECNIS Frame Relay implementation conforms to the following standards:

- Frame Relay Specification with Extensions document V1.0 (LMI), September 1990
- Frame Relay Forum's (FRF) User-Network Interface (UNI) agreement
- ANSI T1.617 *DSS1 - Signalling Specification for Frame Relay Bearer Service* (including the PVC management procedures specified in Annex D)
- ANSI T1.618 *DSS1 - Core Aspects of Frame Protocol for use with Frame Relay Bearer Service*
- CCITT Q.922 *ISDN Data Link Layer Specification for Frame Mode Bearer Services*
- CCITT Q.933 *ISDN Signalling Specification for Frame Mode Bearer Services* (including the PVC management procedures specified in Annex A)

Physical Layer Specification

The physical User-Network Interface (UNI) is provided on the DECNIS by the DEC WANcontroller W622 card. The recommended physical layer interface is CCITT standard V.35 with suitable clocking and:

- Electrical characteristics according to CCITT V.35 and V.28
- Connector and pin assignments according to ISO 2983
- Interchange circuit definitions according to CCITT V.24

Frame Relay Frame Structure

The format for DECNIS Frame Relay frames are outlined in the following diagram.

8	7	6	5	4	3	2	1	Octet
0	1	1	1	1	1	1	0	1
DLCI (high order)						C/R	EA	2
DLCI (low order)				FECN	BECN	DE	EA	3
Frame Relay Info Field								4 to n
FCS (1st octet)								n-2
FCS (2nd octet)								n-1
0	1	1	1	1	1	1	0	n

DECNIS Frame Relay frames have the following characteristics:

- Flag Sequence; all frames start and end with the flag sequence consisting of one 0 bit followed by six contiguous 1 bits and one 0 bit.
- Address field; a two octet address field is supported - see next section.
- Frame Relay Information Field; a by default a 1600 byte information field is supported. This may be increased up to 4500 bytes if the network can accommodate the larger frames.
- Transparency; as defined in CCITT Q.921, the contents of frames to be transmitted are examined and modified, by the insertion of a 0 bit after all sequences of five contiguous bits, to ensure that a flag or an abort sequence is not simulated within the frame. Similarly the contents of received frames are examined and modified, by the removal of any 0 bit that directly follows five contiguous 1 bits.

- Frame Check Sequence; as defined in CCITT Q.921 the FCS field is a 16 bit sequence.

Format Convention

The following format conventions apply:

- Numbering convention; bits are grouped into octets. The bits of an octet are shown horizontally and numbered 1 to 8. Multiple octets are shown vertically and numbered 1 to n.

- Order of bit transmission; octets are transmitted in ascending numerical order. Inside an octet bit 1 is the first bit to be transmitted.

- Field mapping convention; when a field is contained in a single octet the lowest bit number of the field represents the lowest order value. When a field spans more than one octet the order of bit values progressively decreases as the octet number increases within each octet. The lowest bit number represents the lowest order value. The 2 octet FCS is the only exception; where bit 1 of the first octet is the high-order bit and bit 8 of the second octet is the low order bit.

- Invalid frame; Invalid frames are discarded. An invalid frame is one that is:
  - not properly bounded by two flags
  - has fewer than 5 octets
  - doesn't consist of an integral number of octets prior to zero bit insertion or following zero bit extraction
  - contains a frame check sequence error
  - has EA bit in octet 2 set to 1
  - has EA bit in octet 3 set to 0
  - has DLCI not supported by receiver

- Frame abort; on the receipt of seven or more contiguous 1 bits.

Address Field Format and Procedures

8	7	6	5	4	3	2	1	Octet
	DLCI	(high	order)			C/R	EA	1
	DLCI	(low	order)	FECN	BECN	DE	EA	2

The DECNIS implementation includes support for a two octet address field as shown in the above diagram. Two octets is the minimum and default length.

The following procedures are adhered to:

- Address field extension bit (EA); all frames have the EA bit set to 0 in the first octet of the address and the EA bit set to 1 in the second octet of the address field.

- Command/response bit (C/R); is not used by DECNIS and is set to 0 on transmission.

- Discard eligibility (DE); is not used by DECNIS and is set to 0 on transmission.

- Forward explicit congestion notification (FECN); is mapped by the DECNIS onto the DECnet/OSI Phase V congestion bit and is set to 0 on transmission.

- Backward explicit congestion notification (BECN); is not used by DECNIS and is set to 0 on transmission.

- Data link connection identifier (DLCI); is used to identify the logical channel, multiplexed within the physical channel, with which the frame is associated. Valid DLCI values are identified to the DECNIS by the network device via the PVC management procedures. The DECNIS only supports the following 10 bit DLCI values:

  - 0 for in-channel signalling

  - 16-1007 for permanent virtual connections

  - 1023 for in-channel layer management

PVC Management Procedures

The DECNIS fully supports all the mandatory PVC procedures specified in:

- ANSI T1.617 Annex D

- CCITT Q.933 Annex A

- Frame Relay Specification with Extensions V1.0 (LMI)

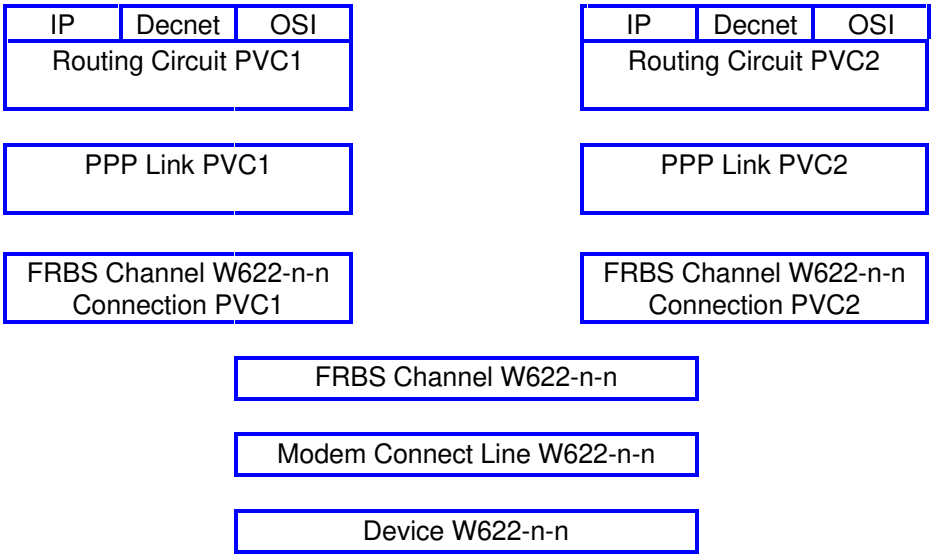
The DECNIS requests the status of PVCs and verifies link integrity by the periodic transmission of Status Enquiry messages. These messages contains Report Type and Keep Alive information elements. The DECNIS expects to receive Status messages in response from the network device. Status messages may contain multiple PVC Status Information elements. In addition the DECNIS is capable of receiving and processing asynchronous Status up- dates from the network device. The DECNIS supports the following system parameters:

- T391; the Link Integrity verification timer identifies the polling interval between Status Enquiry message transmissions.
- N391; Full Status Polling counter indicates how often a full status should be requested from the network.
- N392; Error Threshold indicates the number of errors that make up a service affecting condition.
- N393; Monitored Event count indicates the window in which to count errors.

A maximum number of 32 PVCs can be supported per physical channel. However due to the overhead involved in keeping counters on a per PVC basis currently only the aggregate counters for the physical channel are maintained.

Management

To support two Frame Relay PVCs the following entities need to be configured:



The Frame Relay functionality is represented in the DECNIS by the FRBS management entity. The FRBS entity has a sub-entity CHANNEL which identifies the physical access channel, which in turn has CONNECTION sub-entities which represent the individual, logical connections or PVCs in the network. NCL can be used to manipulate these entities.

A FRBS CHANNEL entity has the following characteristics:

- SPECIFICATION = ANSI-D, CCITT or JOINT; this attribute is specified on the CREATE and indicates to which Frame Specification the channel will adhere. The default is Joint (the LMI specification).

- POLLING INTERVAL = 5-30; Timer T391 the link integrity verification timer (in seconds). Defaults to 10.

- FULL ENQUIRY INTERVAL = 1-255; Counter N391 controls how often a Full Status is requested from the network. Default is 6.

- ERROR THRESHOLD = 1-10; Counter N392 controls the number of errors that make up a service affecting condition. Default is 3.

- MONITORED EVENTS = 1-10; Counter N393 controls the number of events that make up a reasonable interval. Default is 4.

- MAXIMUM DATA SIZE = 1-65535; maximum buffer size that can be transmitted and received. Default is 1600 bytes.

- PHYSICAL LINE; the Modem Connect Line over which Frame Relay will operate.

A FRBS CHANNEL CONNECTION entity has just one characteristic:

- PREFERRED DLCI = 16-1007 : the DLCI assigned to the PVC in the network over which the connection will run. The default 0 will allow the Connection to be dynamically assigned a DLCI by the network.

The DECNIS Configuration utility provides support to configure a DECNIS to run Frame Relay.

DECNIS Frame Relay Configuration Guidelines

Frame Relay is only supported on the DEC WANcontroller 622 interface card. This is a dual port, high speed synchronous interface card supporting synchronous line speeds from 9.6 Kbit/s up to 2 Mbits/s. The DEC WANcontroller 622 supports the following electrical interfaces using separate adapter cables to provide the appropriate interchange circuits:

- V.36/V.11 (RS449/RS442)
- V.35
- CCITT X.21 (leased line)
- British Telecom Kilostream/Megastream

A maximum of 32 Frame Relay PVCs can be configured per DEC WANcontroller 622 physical interface. The maximum number of Frame Relay PVCs that can be configured per DECNIS system is limited by the number of available DEC WANcontoller 622 interfaces and the maximum number or router adjacenies configured for the DECNIS system.

The maximum number of Frame Relay PVCs that can be configured for remote bridging is limited to 15 per DECNIS system. This is due to the DECNIS architecture bridge port limit of 15.

Public Frame Relay Networks

The DECNIS Frame Relay implementation has been tested and is known to be compatible with the following public Frame Relay networks:

- AT&T Interspan Frame Relay Service
- British Telecom GNS Frame Relay service
- Sprint Frame Relay Network Service

Frame Relay Switches

The DECNIS Frame Relay implementation has been tested and is known to be compatible with the following Frame Relay switches:

- StrataCom IPX 16/32 running V5.2 software or later

- Cascade Communications Corporation STDX 3000 and 6000 running V2.0.1 software or later

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