            The PPP DECnet Phase IV Control Protocol (DNCP)

Status of this Memo

Abstract

   The Point-to-Point Protocol (PPP) [1] provides a standard method of
   encapsulating Network Layer protocol information over point-to-point
   links. PPP also defines an extensible Link Control Protocol, and
   proposes a family of Network Control Protocols (NCPs) for
   establishing and configuring different network-layer protocols.

   This document defines the NCP for establishing and configuring
   Digital's DNA Phase IV Routing protocol (DECnet Phase IV) over PPP.
   This document applies only to DNA Phase IV Routing messages (both
   data and control), and not to other DNA Phase IV protocols (MOP, LAT,
   etc.).

1. Introduction

   There are two basic approaches to running the DNA Phase IV Routing
   protocol over a serial line:

   1. The approached that several router vendors have taken which is to
      treat the serial link as an Ethernet, using the same data and
      control messages an Ethernet would use.

   2. The approach defined by Digital, which uses DDCMP and slightly
      different control messages.

   This document will define a method that uses the first approach.

2. Overview Of Phase IV DNA Protocols

    The Phase IV DNA protocols which act as data link clients are:

        o   DNA Phase IV Routing
            The Phase IV Digital Network Architecture (DNA) Routing
            protocol is a network layer protocol providing services similar
            to that of DoD IP. It routes messages in Phase IV DECnet
            networks and manages the packet flow. The complete definition
            of the DNA Phase IV Routing protocol can be found in [2].

        o   DNA System Console
            The Digital Network Architecture (DNA) System Console protocol
            is a maintenance protocol providing low level access to a
            system for the functions of:

              . Identify processor
              . Read data link counters
              . Boot system
              . Console carrier (a general purpose i/o channel)

            The complete definition of the DNA System Console protocol can
            be found in [3].

        o   Digital Customer Use
            The Digital Customer Use protocol type is a value reserved for
            use by Digital customers. It allocates a type for private use
            which will not conflict with Digital or other vendor protocols.

        o   DNA Diagnostics
            The Digital Network Architecture (DNA) Diagnostics protocol
            type is reserved to allow diagnostic software communications in
            parallel with other data link clients.

        o   DNA Naming Service (DNS)
            The Digital Network Architecture Naming Service (DNS) provides
            a distributed naming service. It allows clients to register
            named objects and to bind a set of attributes to the objects in
            a distributed database.

        o   DNA Time Service (DTS)
            The Digital Network Architecture Time Service (DTS) is a
            protocol providing global clock synchronization in a
            distributed environment.

        o   DNA Load/Dump
            The Digital Network Architecture (DNA) Load/Dump protocol is a
            maintenance protocol for copying the contents of processor

        memory to or from a remote system. For example, a system
        manager can load an operating system into an unattended, remote
        system. The complete definition of the Phase IV DNA Load/Dump
        protocol can be found in [3].

     o DNA Experimental Use
        The Digital Network Architecture (DNA) Experimental Use
        protocol type allows Digital experimental protocols to share a
        data link with other data link clients. It is for use by
        Digital Equipment Corporation only.

     o DNA Communications Test
        The Digital Network Architecture (DNA) Communications Test
        protocol is a maintenance protocol for testing the data link
        communications path. The complete definition of the DNA
        Communications Test protocol can be found in [3].

     o Digital Protocol X1
        The Digital X1 protocol is a network layer protocol currently
        private to Digital.

   This document defines the NCP for establishing and configuring
   Digital's DNA Phase IV Routing protocol (DECnet Phase IV) over PPP.
   This document applies only to DNA Phase IV Routing messages (both
   data and control), and not to other DNA Phase IV protocols (MOP, LAT,
   etc.).

3. A PPP Network Control Protocol for DNA Phase IV Routing

   The DNA Phase IV Routing Control Protocol (DNCP) is responsible for
   configuring, enabling, and disabling the DNA Phase IV Routing
   protocol modules on both ends of the point-to-point link. DNCP uses
   the same packet exchange mechanism as the Link Control Protocol
   (LCP). DNCP packets may not be exchanged until PPP has reached the
   Network-Layer Protocol phase. DNCP packets received before this
   phase is reached should be silently discarded.

   The DNA Phase IV Routing Control Protocol is exactly the same as the
   Link Control Protocol [1] with the following exceptions:

   Frame Modifications

      The packet may utilize any modifications to the basic frame format
      which have been negotiated during the Link Establishment phase.

   Data Link Layer Protocol Field

      Exactly one DNCP packet is encapsulated in the Information field

of a PPP Data Link Layer frame where the Protocol field indicates
type hex 8027 (DNA Phase IV Control Protocol).

Code field

   Only Codes 1 through 7 (Configure-Request, Configure-Ack,
   Configure-Nak, Configure-Reject, Terminate-Request, Terminate-Ack
   and Code-Reject) are used. Other Codes should be treated as
   unrecognized and should result in Code-Rejects.

Timeouts

   DNCP packets may not be exchanged until PPP has reached the
   Network-Layer Protocol phase. An implementation should be
   prepared to wait for Authentication and Link Quality Determination
   to finish before timing out waiting for a Configure-Ack or other
   response. It is suggested that an implementation give up only
   after user intervention or a configurable amount of time.

Configuration Option Types

   DNCP has no Configuration Options.

4.   Sending DNA Phase IV Routing Packets
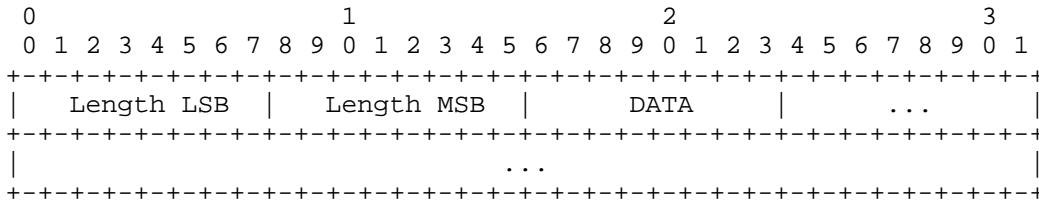
   Before any DNA Phase IV Routing packets may be communicated, PPP must
   reach the Network-Layer Protocol phase, and the DNA Phase IV Routing
   Control Protocol must reach the Opened state.

   Exactly one octet-count field and one DNA Phase IV Routing packet are
   encapsulated in the information field of a PPP Data Link Layer frame
   where the Protocol field indicates type hex 0027 (DNA Phase IV
   Routing). The octet-count contains a count of the number of octets
   in the DNA Phase IV Routing packet. It is two octets in length
   itself, and is stored in VAX byte ordering, to be more consistent
   with DNA Phase IV Routing over Ethernet (i.e. least significant byte
   first). It is needed to disambiguate optional padding octets from
   real information.

   The maximum length of an DNA Phase IV Routing packet transmitted over
   a PPP link is the same as the maximum length of the Information field
   of a PPP data link layer frame minus 2 octets (for the Length field).

   The format of the packets themselves is the same as the format used
   over Ethernet, without the Ethernet header, Pad, and FCS fields.

   A summary of the information field is shown below. The fields are
   transmitted from left to right.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Length LSB  |    Length MSB  |     DATA       |     ...      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                              ...                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Length LSB

   Least significant byte of length field

Length MSG

   Most significant byte of length field

DATA

   DNA Phase IV Routing data, as specified in [2]

5. General Considerations

   When a topology change in the network occurs, DNA Phase IV Routing
   nodes immediately propagate changes via Level 1 and Level 2 Routing
   messages, with a 1 second minimum delay between updates. DNA Phase
   IV Routing nodes also periodically retransmit the complete Level 1
   and Level 2 distance vectors to guard against data corruption in host
   memory, and (in the case of Ethernet) loss of packets due to media
   errors. Because Digital's serial links run a protocol that
   guarantees delivery of packets (DDCMP), the recommended default
   retransmit time is long (600 seconds), whereas for Ethernet, where
   packet delivery is not guaranteed, the recommended default is short
   (10 seconds), as documented in [2]. To achieve convergence of routes
   within a satisfactory time, the interval between updates should be
   based upon the error rate of underlying data link. As such, it is
   recommended that the time between routing updates be user
   configurable per PPP interface.

   The Hello timer and Listen timer should be set according to the
   recommendations for broadcast links (15 and 45 seconds,
   respectively).

   Routers are not required to send routing updates if the remote node
   connected via the PPP link is an endnode. Endnodes are required to
   discard all routing updates received over a PPP link. The type of a
   node (endnode versus routing) can be determined from the hello
   messages received from it.

References

   [1] Simpson, W., "The Point-to-Point Protocol (PPP)", RFC 1331,
       Daydreamer, May 1992.

   [2] Digital Equipment Corporation, "DNA Routing Layer Functional
       Specification", Version 2.0.0, Order No. AA-X435A-TK.

   [3] Digital Equipment Corporation, "DNA Maintenance Operations
       Functional Specification", Version 3.0.0, Order No. AA-X436A-TK.

Acknowledgments

   Some of the text in this document is taken from previous documents
   produced by the Point-to-Point Protocol Working Group of the Internet
   Engineering Task Force (IETF).

   The author wishes to thank Jim Muchow (Network Systems Corporation),
   and Arthur Harvey (Digital Equipment Corporation) for their input to
   this memo.

Security Considerations

   Security issues are not discussed in this memo.

Chair's Address

   The working group can be contacted via the current chair:

   Brian Lloyd
   Lloyd & Associates
   3420 Sudbury Road
   Cameron Park, California 95682

   Phone: (916) 676-1147
   EMail: brian@lloyd.com

Author's Address

   Questions about this memo can also be directed to the author:

   Steven J. Senum
   Network Systems Corporation
   7600 Boone Avenue North
   Minneapolis, Minnesota 55428

   Phone: (612) 424-4888
   EMail: sjs@network.com