

DECnet to TCP/IP

Evaluating your network environment prior to migration



viewpoint: network assessment



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Introduction

Many IT environments that contain an OpenVMS component rely heavily on the DECnet network protocol. However, the non-proprietary TCP/IP suite of networking protocols, with its strength in interoperability between heterogeneous environments, ease of use, and rich set of services, is the accepted protocol for internet communications.

Consequently, IT managers and network system architects for DECnet environments are faced with increasing requirements for TCP/IP support. This document presents background information and recommendations to consider when evaluating, planning, and deploying a migration of some or all of your DECnet network environment to a TCP/IP-based solution.

Comparing Protocols

The following sections briefly describe the DECnet and TCP/IP protocols and highlight their features, similarities, and differences.

Features of DECnet

First released in 1975 by Digital Equipment Corporation, DECnet is a relatively old network protocol in computer terms. Now maintained by EDS and distributed by Hewlett-Packard Corporation (HP), the protocol currently exists in two variants: DECnet Phase IV and DECnet Phase V (known as DECnet-Plus). The features of each variant are described below.

DECnet Phase IV

The first version of DECnet, Phase IV has proved to be an incredibly stable and reliable networking platform. Highlights of Phase IV include:

- **16-bit addressing**, which was considered large at the time, but by today's standards, is now very limited addressing space.
- **Easy management via Network Control Program (NCP)** using a fairly simple command-line interface.
- **Closely coupled with the OpenVMS operating system**, especially with file services provided by Record Management Services (RMS).
- **Access by customer-written applications** via RMS services, language file services, and the QIO interface.

DECnet-Plus

DECnet-Plus represents a major enhancement of the Phase IV implementation and, in many areas, is a complete revision. Highlights of DECnet-Plus include:

- **Expanded addressing space** allowing a virtually unlimited number of systems.

- **Management via Network Control Language (NCL)**, which provides a more carefully designed architecture, but unfortunately includes a much more complex interface.
- **Backwards compatibility** with Phase IV.
- **Support for new ISO protocol standards** in addition to the existing Network Services Protocol (NSP) used by Phase IV.
- **Support for using TCP/IP** as the networking backbone protocol using RFC1859.

Features of TCP/IP

TCP/IP started in 1969 as a research project funded by the Defense Advanced Research Projects Agency (DARPA). It evolved throughout the 1970s as a design for a host-to-host communications protocol with an emphasis on interconnectivity and interoperability.

In 1983, the basic TCP/IP protocols were adopted as a Military Standard, and Bolt, Beranek, and Newman (BBN) was funded by DARPA to implement TCP/IP into Berkeley (BSD) UNIX.

Over time, the initial specification evolved to formally encompass a suite of protocols based on several separate, interdependent protocols: Transmission Control Protocol (TCP), User Datagram Protocol (UDP), and Internet Protocol (IP) being among the most prevalent. Today, TCP/IP is the most widely-deployed suite of communications protocols in existence.

To meet the increased demand for unique hosts, IP has evolved into two main variants: Internet Protocol Version 4 (IPv4) and Internet Protocol Version 6 (IPv6). The main difference between the variants is in the area of address space.

IPv4 allows a 32-bit addressing space, while the new IPv6 extends the addressing space to 128-bits.

TCP/IP in a DECnet Environment

In general, DECnet and TCP/IP offer the same basic network services to applications and the operating system, with differences occurring mainly in the file system area.

Due to its late introduction into the OpenVMS environment, TCP/IP was not initially as well coupled with the operating system as DECnet Phase IV. During this time, a number of third-party TCP/IP products for OpenVMS became available, as well as DIGITAL's LIBUCX and later TCP/IP Services offerings which ran next to DECnet Phase IV.

With DECnet-Plus came closer incorporation with TCP/IP. Specifically, DECnet-Plus implements its upper layers as separate towers that share integrated network functions up to the Transport layer. This allows DECnet Phase IV, DECnet Phase V, OSI, and TCP/IP applications and services to interoperate through Open Networking standards.

For example, assuming a licensed TCP/IP product that supports the PATHWORKS Internet Protocol (PWIP) interface is installed; standard DECnet applications can run in an IP routing environment (DECnet over TCP/IP).

Assessing the Network Topology

When considering migration from one network protocol to another, customers need to assess how these differences may impact their environment at the network backbone and application layers. Each layer may be based on an interleaved set of protocols. Therefore, application layers should not be evaluated in isolation from the each other. Concurrent application and network migration is critical for success.

Evaluating the Network Backbone

Networks are usually complex and frequently use multiple protocols (the two most common protocols being TCP/IP and NETBIOS). For networks consisting of a single or small number of segments, bridging of non-routable protocols is generally not detrimental. However, in environments where the network topology is more complex, bridging of non-routable protocols becomes much more problematic. Router cost and complexity increases in relation to the number of protocols supported. *In these situations, customers may want to restrict the number of protocols spanning routers to a single standard protocol.*

For example, with a combined DECnet Phase IV and TCP/IP network, some systems may need DECnet addresses only, TCP/IP addresses only, or both. Managing two disjoint addressing spaces can easily become twice as difficult as managing one.

In order to appropriately assess an application environment, an evaluation of each application's level of dependency on the DECnet protocol must be performed. Once it is determined which, if any, applications require modification based on their dependencies, a determination is made as to the level of effort involved in modifying those applications. This, in turn, influences the choice of migration strategies for the application: either to a pure TCP/IP environment, or to a DECnet-Plus environment that uses DECnet over IP.

EDS has found that the typical network migration strategy can be generally categorized as migration from either a DECnet-only environment to TCP/IP, or from a mixed-protocol environment to TCP/IP. The following sections detail points learned about each migration strategy.

Moving from a DECnet-only Environment to TCP/IP

The easiest way to migrate from a DECnet-only environment to a TCP/IP-only environment is to:

1. First, move to a mixed DECnet-and-TCP/IP environment. This provides the least disruption and allows applications to run in parallel during the migration process.
2. Then, transition to a TCP/IP-only backbone.

Note that this type of a migration strategy involves certain considerations.

For example, customers will need to weigh the complexity of maintaining two address spaces against the cost of development and additional testing associated with a conversion to TCP/IP-only backbone.

Moving from a Mixed-Protocol Environment to TCP/IP

The majority of work in a mixed-protocol environment involves addressing the dependency of applications on DECnet and other non-TCP/IP protocols.

In a test configuration, the resulting application changes are then verified by selectively blocking the non-TCP/IP protocols. Upon validation of basic functionality, detailed regression and performance testing is then conducted on the various applications across a range of test and production scenarios.

Evaluating the Application Environment

Each customer's application migration requirements are unique. Some customers will not be inclined to make intrusive changes to their applications, thus eliminating complete migration to TCP/IP.

Some customers may be willing to make changes to their applications, but will need to weigh the cost of those changes against the cost associated with migrating to an entirely different application that is not dependent on DECnet.

Moving Applications to TCP/IP

Whether or not an application can be completely converted to TCP/IP depends largely on the application, and on how much effort or money the customer is willing to invest. It should be noted that, for many customers, making any type of change to an existing application, even trivial, might involve considerable expense and effort.

Applications need to be evaluated on a case-by-case basis to determine whether they can be completely converted. Some of the initial considerations to take into account are:

- Is the source code available for the application?
- Is a development environment for the application in which it can be compiled and linked in-place on-site with up-to-date licenses?
- If so, how up-to-date is this development environment?
- Does the application use protocol dependent I/O routines?
- Does the application use RMS services or other utilities?

Customers may only be able to migrate a DECnet-dependent application completely to TCP/IP if they modify the application so that it uses the TCP/IP QIO interface or some other programming interface supplied by TCP/IP, such as sockets. If this is not a viable choice, then the use of DECnet over IP with DECnet-Plus should be considered.

Moving Applications to DECnet-Plus (to use DECnet over IP services)

One of the advantages with DECnet-Plus is that it provides relatively transparent access to TCP/IP. DECnet-Plus achieves this using RFC1859, which basically wraps a small amount of protocol information around the packets sent by the application. This enables the remote receiver to reassemble the stream of bytes supplied by TCP/IP into a packet that is subsequently delivered to the cooperating application. In short, DECnet over IP imposes a tunnel for DECnet data via TCP/IP.

Almost every extant DECnet application is a candidate for this type of migration. Exceptions are those that utilize hard-coded numeric addressing or hard-coded DECdns addressing.

The major drawback to DECnet-Plus for many customers is the perceived complexity of the product, especially in comparison with the relative simplicity of DECnet Phase IV. Even though DECnet-Plus has made great progress over the years in reducing the complexity, many customers simply refuse to migrate from Phase IV. For these customers, retaining their DECnet Phase IV core environments while adding select DECnet-Plus nodes and additional TCP/IP capability at the edges of the network can be an attractive strategy.

Additional Considerations When Migrating

The following are some additional areas to consider when performing a DECnet-to-TCP/IP migration:

- **TCP/IP networking training**
This is probably first and foremost area of concern, as there is a possibility that the customer may have limited experience with TCP/IP networking. EDS can evaluate the overall training requirements and can either deliver or help the customer obtain the required training.

- **Network evaluation and assessment**
Understanding the current network topology and evaluating what equipment needs to be upgraded or replaced is key to migration planning. Various routers may need to be upgraded or replaced with newer routers that can handle multiple protocols. EDS can evaluate a customer's network topology, identify and address potential bottlenecks, and help optimize network performance
- **Edges of the network analysis**
EDS can help a customer determine what level of connectivity and throughput is needed to optimize connections to a local intranet, an extranet, and to the outside world of the Internet.
- **Security**
Providing TCP/IP connectivity has important security ramifications that can be handled in a variety of ways, some more secure and cost effective than others.

The EDS Experience

EDS has maintained and supported the HP DECnet family of products (as well as other select HP networking, application development, and transaction processing products) for over ten years. Drawing from our extensive networking solutions implementation background, EDS has the expertise to provide the consulting services to meet your customer's network architecture planning and/or migration needs.

Our services emphasize a collaborative approach in requirements definition, network topology assessment, applications migration assessment, and security and performance analysis. Upon completion of an initial assessment, a variety of consulting engagement models is available. These range from a small-team network strategy advisement, to a complete migration roadmap and deployment including training and follow-on support options.

For more information on how EDS can assist with your network migration strategy, contact us at:

EDS
Hewlett-Packard Unified Agreement
Suite 300
5 Clock Tower Place
Maynard, MA 01754
phone: 781-487-1000
fax: 781-487-1685

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Let's begin the conversation

Corporate Headquarters

United States

5400 Legacy Drive
Plano, Texas 75024
USA
1 800 566 9337

Regional Headquarters

Asia Pacific

Asia Pacific North
33rd Floor, Citibank Tower
Citibank Plaza
3 Garden Road
Central
Hong Kong
852 2867 9888

Asia Pacific South
Level 34, 100 Miller Street
North Sydney
New South Wales 2060
Australia
612 9025 0777

Canada

33 Yonge Street
Toronto, Ontario
M5E 1G4
Canada
1 416 814 4500
1 800 814 9038 (in Canada only)

Europe, Middle East and Africa

4 Roundwood Avenue
Stockley Park
Uxbridge
Middlesex UB11 1BQ
United Kingdom
44 20 8848 8989

Latin America

Avenida Presidente Juscelino
Kubitschek, 1830
5th Floor - Tower 4
04543-900
São Paulo
Brazil
55 11 3707 4100



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