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Next Stop OSI: Transition to DECnet Phase V

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NEXT STOP OSI: TRANSITION TO DECNET PHASE V

Abstract

The worldwide HEP/SPAN DECnet is currently estimated at 20,000 systems worldwide and is providing an essential operational service to large collaborations of researchers, particularly those working in the area of High Energy Physics (HEP) or using the Space Physics Analysis Network (SPAN).

With transition to DECnet phase V, the network will enter the world of OSI. Crucial to its successful integration is the need for European coordination and cooperation in the choices of naming scheme, ISO network addresses and routing domains. Basing a naming scheme on the X.500 recommendations should allow future adoption of standard directory service protocols to be made transparent to the user. Efficient routing within a domain depends on careful selection of network addresses.

Keywords

OSI, DECnet Phase V, Transition, Migration, Naming, Addressing, Routing

Introduction

The European HEP DECnet [1] is a major partner of a worldwide DECnet often referred to as the HEP/SPAN DECnet. The total number of systems with connectivity to this DECnet is currently estimated at 20,000. The network is experiencing rapid growth and is already suffering from a 'node number crisis'. The increased address space of Phase V is crucial to its survival. An added incentive to adopt DECnet Phase V is the potential increased connectivity gained from running OSI protocols.

The transition is at the planning stage and the key issues to be resolved are choice of naming scheme, ISO network address format and routing domains [2]. These decisions require coordination and cooperation both throughout the worldwide DECnet and also with the national research networks. After a brief introduction to the HEP/SPAN DECnet and DECnet Phase V, the main sections of this paper discuss naming, addressing and routing possibilities in Europe, with emphasis on the requirements of the HEP/SPAN DECnet. In particular, the choice of network address can have a strong impact on the volume of routing traffic within a routing domain.

What is the HEP/SPAN DECnet?

The HEP/SPAN DECnet crosses Europe, North America and Japan serving the needs of physicists using the High Energy Physics DECnet (HEP) or the SPace Analysis Network (SPAN). DECnet groups systems into areas and in Europe the countries or organisations managing their own DECnet areas are CERN, France, Germany, Italy, NORDUnet, Spain, Switzerland and the United Kingdom. There are also some systems in Austria, Netherlands and Portugal.

A distinguishing point about the HEP/SPAN DECnet is that it relies on key area routers filtering inter-area traffic by use of the maximum area parameter set to 46. Thus systems numbered in areas 1-46 are reserved for the HEP/SPAN wide area DECnet. The remaining areas, 47-63, are replicated throughout the network and many European countries are using these areas for their National DECnets e.g. the Scandinavian countries (NORDUnet) and Switzerland have large national DECnets using a scheme of this kind. Such techniques have allowed the HEP/SPAN DECnet to evolve beyond the originally intended architectural limits of DECnet Phase IV. Transition to DECnet Phase V is now essential for the future expansion of the network.

What is DECnet Phase V?

DECnet Phase V [3] introduces a number of changes to facilitate the management of very large networks. These include:

- a distributed naming service
- ISO network addressing
- ISO based routing protocols
- CMIP based network management and modular network command language (NCL)

Issues concerning the introduction of the naming service, ISO network addressing and routing are discussed below. The network management aspects are not covered by this paper.

Phase V Naming Scheme

DECnet Phase V provides a distributed naming service for objects such as systems, files, disks, queues and mailboxes. In particular, it will provide system name to address resolution. In order to be compatible with a future multi-vendor OSI network any naming scheme should follow X.500 recommendations. An implementation of Digital's naming service is already in use on DECnet Phase IV by applications such as the distributed file and queue services. Under Phase V it will be used by key applications such as 'set host' (remote login), 'copy' (file transfer) and 'mail' (electronic mail) to retrieve name to address and name to protocol stack information for the specified systems. For the naming scheme to be suitable at the user interface for these popular applications it must meet the following requirements:

- suitable for naming at least systems, files, disks and queues
- compatible with X.500 and TCP/IP naming schemes
- short
- simple to deduce
- simple to administer

The national research networks, through the RARE working group on directories and naming (WG3) have proposed an X.500 naming scheme [4] based on the use of unique organisation names within countries. Objects are named either directly below organisation names or organisational units. Countries are identified by their ISO two letter country codes. Such a scheme offers a practical approach to naming. People tend to identify systems as belonging to a particular organisation so placing these below an organisation name is reasonable from the user perspective. Decisions within a country must eventually be coordinated with their national scheme so a unified HEP/SPAN approach to naming within a country may not be possible.

In Europe the Domain Name Scheme [5] is already used by TCP/IP based applications for naming systems and in many cases there is a direct correspondence with the X.500 proposal. For DECnet Phase V, it seems appropriate to adopt an X.500 based scheme. Where this does not directly correspond to an existing TCP/IP scheme, soft links (an aliasing mechanism) can be used to allow parallel use of both schemes during transition.

The use of an X.500 based scheme requiring unique organisation names within countries has one major problem. In many countries "Naming Authorities" have not (yet) been defined and initially HEP/SPAN together with the national networks may need to play this role. In the case of international organisations, such as CERN, the RARE naming scheme foresees the possibility of omitting the country code. Use of this option would require a naming authority for international organisations to be defined.

There is also a problem with the syntax required by Digital's naming service. This will be of the form `.country_code.org_name.system` (for example `.ch.cern.system`). The ordering of terms is completely reversed from the Domain Name Scheme already used by TCP/IP utilities and the RFC 822 based mail systems common in the research environment. This will no doubt cause justifiable confusion and dissatisfaction amongst our user community.

ISO Network Addressing

During the transition period to DECnet Phase V many end systems will be running DECnet Phase IV software. For Phase IV systems to continue to communicate with Phase V systems across OSI routers a constraint is placed on the OSI network address structure. It is therefore likely that initially systems will use network addresses compatible with HEP/SPAN communication. As national networks start to grow in many countries it may be more appropriate for systems to use nationally allocated addresses. The requirement for compatibility with both Phase IV and national addressing schemes could be helped by the possibility foreseen in the standards for systems to be associated with more than one area address. The area address refers to all but the last 7 octets of the network address.

However, with the expected growth of the network and the possibly dramatic increase in the number of areas exchanging routing data, it seems reasonable to consider breaking the network into a number of routing domains.

Until progress is made in the standardisation of inter-domain routing, no routing data can pass between routing domains; the only possibility is the use of static tables. Static routing has two major disadvantages:

- Static tables can be difficult to set up and maintain
- Availability of a link which is two or more hops away cannot be learnt. This can prohibit the use of possible alternative routes.

Provided the availability status of static routes is propagated through its own routing domain, it is still possible to perform some minimal re-routing. Since there are relatively few links across the Atlantic it would be feasible to consider Europe as one routing domain separated from the USA by static routing tables. At least the end points of the transatlantic links on each side of the ocean should be part of the same routing domain to allow fully functional re-routing.

Within Europe it is not necessary for every country to join a common routing domain. Countries with relatively few international links may prefer to form national routing domains. Unfortunately there is no way for physics laboratories to straddle the border between their National Routing Domain and the HEP Routing Domain. Either the National Network must agree to form part of a European wide Routing Domain or the HEP site must decide which routing domain to join. For efficient and manageable routing in Europe we will require routing domains that cross at least some country boundaries. The minimal set of countries should include those with transatlantic links. Sites willing to act as transit routing centres must be established and these sites joined in a common European Routing Domain. Longer term there is a clear need for a dynamic Inter-Domain Routing Protocol to ease the situation for those sitting on the border between their National Network and their Discipline oriented network. In the short term we need European cooperation to get OSI routing established in a manageable fashion.

Summary

The transition of the HEP/SPAN DECnet into the world of OSI will be an evolving process requiring practical decision making and European cooperation [9]. The key issues at the planning stage concern choices of naming scheme, network addressing format and routing domains. Factors affecting these choices are summarised below.

- DECnet Phase V provides a distributed naming service for objects such as systems, files, disks, queues and mailboxes. In particular, it will provide system name to address resolution. Choosing a naming scheme compatible with X.500 should allow future adoption of standard protocols to be made transparently. A scheme describing objects within organisations (where an organisation could be a research laboratory or university) seems appropriate for our environment. Placing organisation names below two letter country codes brings the naming to a national level where conflicts are more easily resolved. For this X.500 based naming scheme to be a success we urgently need Naming Authorities in each country to ensure unique organisation names.
- The choice of ISO network address needs careful consideration. Initially, many systems will require addresses that allow communication with Phase IV nodes. As transition to Phase V evolves into a multi-vendor OSI environment, nationally allocated addresses may be more appropriate. However, since the IS-IS protocol (DP 10589) applies area routing to all but the last 7 octets of the address, allocating different values in the preceding octets will place systems

in different areas. This can potentially result in inefficient routing between systems and an explosion of unnecessary areas with the consequent increase in the volume of routing traffic throughout the whole routing domain.

- The HEP/SPAN network will require a routing domain that crosses country boundaries. Sites acting as transit routing centres need to dynamically exchange routing data to make efficient use of alternative routes. More than a minor use of static routing tables may cause an unacceptable management overhead. As the OSI network grows the need for a dynamic Inter-Domain Routing Protocol will become increasingly important. Unfortunately, standardisation in this area is still at an early stage.

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