Directory User Interface for Network Maps

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Abstract

X500 directory contains information about networks and their elements. A user interface to show the entries and create network maps is proposed. The mechanics of creating a comprehensive map, containing the network hierarchy, elements and their connections for any level of detail is outlined. Applications of this map, such as routing paths from any node to the rest of the network, intelligent ways to poll the elements of the network etc. are discussed.

1 Introduction

In recent times, networks have grown in size, making it impossible for network adminstrators to remember the details of the network without external aid. Further, it is also necessary, in the era of international networking, to provide a pool from which the network maps can be drawn with accuracy, from any point of the globe. X.500 directory provides such a service [GYM]. In this paper, we give details of our proposal to use this directory to create maps, and conversely, to use maps created by the user to update the directory.

2 Requirements

The major requirements for creating maps and directory entries is that the entries be comprehensive, and complete in terms of connections to other entries. While this is not a problem while creating entries at the lowest level, at higher levels, the connections, which take place at the lowest level, may not always be clearly known. It is necesary that the algorithm to create maps be able to find this out. The absolute basic requirements for these algorithms is explained.

2.1 Requirements for Creating Maps

Creating maps consists of translating the information found in the X.500 directory into the various network elements, complete with connections, onto a flat map. Unless the gateways are spelt out at each level, the connections for the various levels will not be complete.

Item type	Mandatory details
Network	Name, type, gateways
Node	Name
Port	Name, connection, IP counterpart name

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The gateways defined in the network entries give the connections; the network type is required for geometry purposes. The connections in the port entry gives the connected node or network, while the IP counterpart name leads to the IP addresses, which are required for polling.

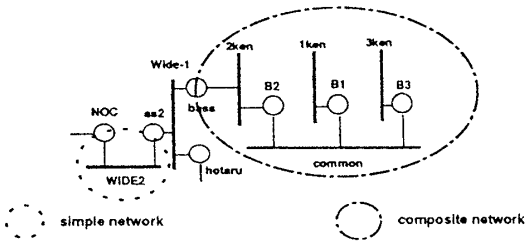
The other details make the map more complete, but are not absolutely essential for creating the basic map.

2.2 Requirements for Updating

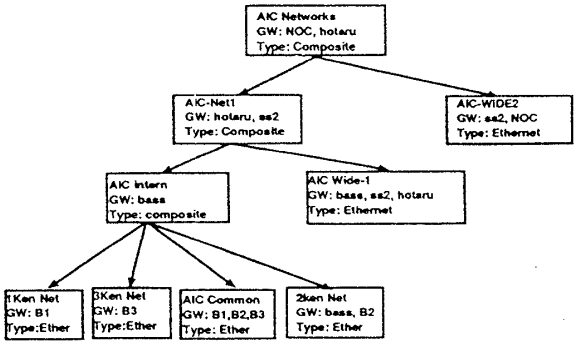
Updating the X.500 directory using the map is the reverse process of creating the map. In this case, the user *draws* a map specifying the details of the elements, and asks for X.500 update. The main requirement in this case is to tell the update utility about the hierarchy of the tree, the map being flat. In case the leaf elements are not being updated, it is necessary to specify the gateways of the parent elements, so that the map subsequently drawn with the updated information can be complete with connections.

3 Organisation in Directory

Physical picture of a network:



Modelling in the Directory:



For representing networks in the Directory we use the following hierarchical model. A network is the media for

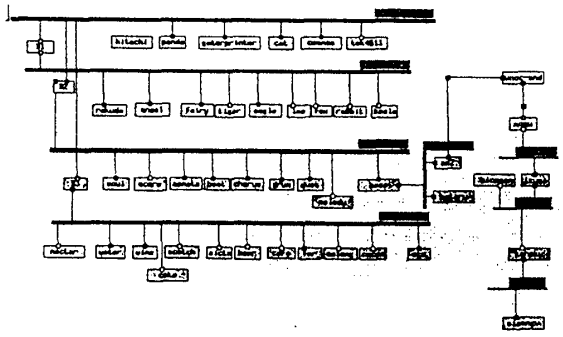
transmitting information with zero or more network elements each having at least one network interface on the media. The media may be a line (physical circuit/virtual circuit), a coaxial-cable, or a collection of interconnected networks. The model allows a hierarchy of subnetworks. Network elements with multiple interfaces may act as *external gateways* to the attached network and to networks higher up in the hierarchy. Thus, a gateway may be the external gateway of several networks which are either interconnected or have a hierarchical relationship. A network may be *simple* consisting of zero or more network elements or *composite* consisting of several subnetworks. Examples of simple networks are ethernets, Optical fiber/copper cables, free space, ...

Using the above model it is a straight forward procedure to draw the topological graph of the network where the vertices represent the components of the network and edges indicate the connections. For visual representation the graph may be translated to a more "physical" illustration.

4 Implementation

The implementation is in two parts, the first part being creating the map from the directory, and the second part being updating the directory from the map. The user interface is based on X windows; the user is provided with a point-and-select graphical utility to create the map and update the directory. Facilities to create nodes, networks, interfaces etc. are provided, as well as the facility to modify existing elements. The X.500 directory is updated using LDAP libraries.

The first part, namely, creating the map, has been successfully implemented. Given below is the map created from the X.500 directory for the Tohoku region. The map for AIC Systems Laboratories has been given in detail, and for the other regions, only the important nodes.



The second part is being implemented, and initial tests have been successfully done.

5 Conclusion

As part of an effort to cope with the rapidly changing communications scene and the explosive growth in communication networks, the need for a framework to hold the infrastructural and service related information about communication networks has been emphasised. The use of such a *map* is manifold. A Pilot based on this idea, presently covering the Japanese Internet, is in operation. Future plans involve extending the pilot to the International arena to cover other countries/NICs. The network model adopted in the Pilot for representing a communication network with all its related details and descriptions in the Directory, is described. Experience with problems and strategies for bootstrapping, operation and maintenance of the Pilot are discussed. A new genre of applications based on this proposal are coming up and their current status is reviewed.

References

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