Directory for Network Management

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Abstract

For efficient network management it is essential that the directory services be used as a source of information for components that are static or quasi-static in nature. The possible uses of such information components are discussed and their potential uses are shown. The corresponding areas where work needs to be done are described.

Introduction

Management basically involves gathering information, processing it in an appropriate manner to derive some conclusions and, carrying out appropriate action based on the inferences. Network managemnent is no exception. The nature of the information utilized by network management can be broadly classified as

- dynamic. The information that (potentially) changes frequently, e.g., the operational status of an interface, the cumulative number of error packets at a particular receiver etc..
- quasi-static. Information that changes - but not with high frequency - i.e. not on an hourly or daily basis. E.g. Network configuration.
- static. Information that changes very infrequently - for example the ip-address of a host, the manager of a network, ...

The X.500 Directory provides an excellent framework for storing and servicing information which is of static or quasi-static nature, in a distributed fashion. Pilot projects employing the directory are already in place. The Paradise project presently spans 35 countries including Japan and covers more than a million entries.

It is clear that the directory services, if properly utilized, could be a repertory of useful information for network management.

Network Information in the Directory

The widening span of computer networking has highlighted the importance of holding and servicing information about the networking infrastructure itself. The growing and active interest in network management [GYM], is severely constrained by the lack of any organized pool of information about the network infrastructure itself. Some attempts have been made, on a piecemeal basis, to provide a larger view of some particular aspect of the network (WHOIS, DNS, .. in the case of the Internet. Presently, there is a movement to explore the possibility of setting up a framework to hold and serve the infrastructural information of a network [ND].

Information about the network infrastructure would cover-

1. the interconnection between the various network elements. It will be possible to represent the Network as a graph where vertices represent objects like gateways/workstations/subnetworks and edges indicate the connections.
2. the properties and functions of the various network elements and the interconnections. In the graph attributes of vertices will represent various properties of the objects e.g. speed, charge, protocol, OS, etc. Functions include services offered by a network element.
3. various name and address related information of the network elements.
4. information about various administrative and management details related to the networks elements.
5. policy related information, part of which may be private while the other part may be made public.

Areas of Usage

Network Maps

A map is very important for management purposes - irrespective of whether the manager is a human being or a application process. Given the configuration information is a straight forward generate 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.

Just as there are several maps of the same geographical domain (political, natural...) one can envisage several views of the same network and its components. A view (called "image" in the remainder) could pertain to a particular protocol suite (IP/OSI/...), an administrative domain or purpose. Using images, several abstractions of the same object is possible.

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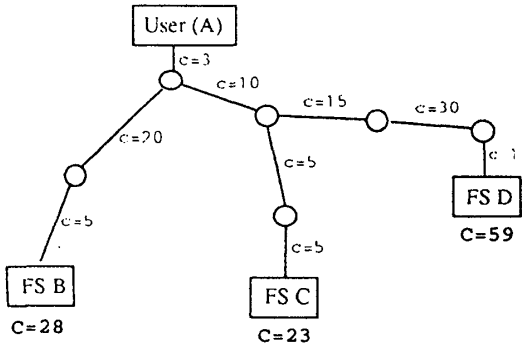
SoftPages[SPP]

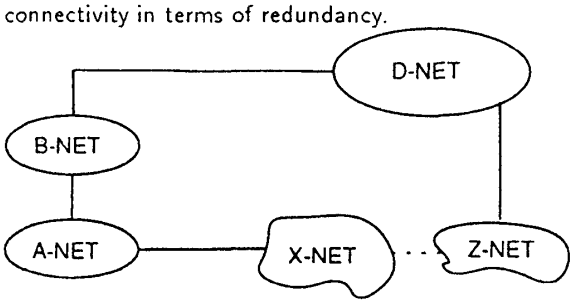
It is desirable to query for files always on filestores that are nearest/cheapest to the users' site. For that purpose, it is necessary to evaluate distance/cost between the users' host and possible servers. Also, it is necessary to search the contents of the servers. For example, a user on host A looking for a certain document should under ideal situation carry out the search in the ordered list of fileservers $[C, B, D]$, the ordering being based on the potential retrieval costs.



The Soft Pages Project [SPP] which implements this algorithm started with the wish to reduce ftp traffic on crowded overseas links and national backbones. The algorithm makes use of the network infrastructure information concerning network configuration, location of servers and their contents, the links and their charges.

Alternate Paths

Given the mesh-type connectivity of networks, it is very important to have a clear picture about the connections; for example, A-net has potential connectivity to D-net via multiple routes. The topological map of the network is useful; to find alternate paths in case of failure, to know the transit policy of the provider on the alternate path, to know the point of contact for the provider. Needless to say the map can be used to detect non-optimal routes and to evaluate the quality of the connectivity in terms of redundancy.



Fault Tolerant Management

In the present management scheme a manager monitors networks thru the manager workstation. Now if the link from the manager workstation to the agent is down or still worse if the link to the managed network is down without alternate means there will be a collapse of network management. Among the alternate means are the following

Use Alternate paths for management traffic

This implies that the management application has control over the networking layer. It uses the network configuration information to decide the next alternative path/router and instructs the networking layer to route its requests/queries accordingly. The intelligent agent at the other end reads the request and sends the reply along the appropriate route.

Use Proxy Agents

This method is a more simpler method but involves the cooperation of a few more agents in the network. For example suppose the the link between management station A and Managed Station B is down. Now, if the link between A and some station C is up, and if there is a link between C and B, then if there is an agent on C which agrees to act as a proxy for the agent on B then the management station can redirect its query to the proxy agent on C.

Conclusion

The success of the scheme to use the directory for management purposes depends heavily on the deployment of the directory in general and on experimentation of the related schema that has been developed into experimental RFCs. Given wide enough experimentation the information of IP-networks in the directory could be routinely looked up for configuration management purposes. The directory service could offer a parallel DNS service. The disjoint *WHOIS* systems could be integrated in the directory. Most important, we envisage that newer , hitherto unthought of, uses of the directory will emerge. That is probably the most challenging and exciting aspect of this exercise.

References

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