

Enhancement of Network and System Management Using Virtual Reality

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Abstract

This paper presents CyberNet, a framework designed to study how virtual worlds may enhance network management, in particular with the use of metaphors. The framework allows to collect and structure information into services before visualizing these services.

Nowadays, network management is a difficult and attention-demanding task, since a network manager has to monitor very complex networks made of thousand manageable components (Systems, Devices, Network, Application). With traditional management systems, we find many proprietary frameworks, support of SNMP, DMI, CMIP and other protocols and standards but there is no common foundation, no consistent view. Instead, managers need a tool that gives a synthetic view of the network status. He should be able to view all the data that are related to that specific aspect of the network (Topology, Connection, NFS, DBMS, Mail, etc.). This is defined as a service-oriented approach. Service is a functionally oriented view of network entities.

We believe that the visualization of services in 3D virtual world can bring a synthetic understanding of the states and tendencies of complex network systems. 3D worlds offer a lot of possibilities and thus, large amount of information can be visualized in a single view instead of opening many windows. This is possible because 3D worlds can make the most of the human perception. Objects in 3D can have a lot of visual parameters (e.g. color, texture, movement, shape, etc.), and each of these visual parameters can display an information. In addition, there are a lot of possibilities in spatial layout, which is generally used to show relationships between objects. Animation can also convey information. Furthermore, new kinds of user interaction give more facilities to explore data and manage the density of information.

In CyberNet, we provide a framework in order to build services and visualize them in 3D metaphoric worlds using a simple Web browser. The framework is based on three main layers (figure 1): the data collection layer (collect data from devices), the core layer (structure data to define services) and the visualization layer (map

services onto 3D visual metaphors).

Traditional collecting techniques (e.g. SNMP) require the manager to pull the data from the collecting agents in the network. They are not suited to our needs since they would largely increase the network bandwidth, requiring that the data be pulled at extremely short intervals in order to present a real-time visualization to the user. In order to reduce the generated traffic, we have developed distributed agents located on or near the observed devices that collect, structure and push information to its subscribers.

In order to describe a service out of the raw data, we define an Information Model that structures the collected data. Collecting agents structure raw data into entities (e.g. process, router, workstation). Relations are groups of entities defined through filtering on attributes of entities of the same type. A service is a structure of entities and relations and is a tree. Each node of the tree contains a relation and builds others nodes according to the entities of this relation.

The visualization layer is in charge of building a 3D interactive metaphoric world from a service. Metaphors are defined inside this layer and can be applied to any service. It allows the user to select the best metaphor for the service he wants to visualize.

The CyberNet framework use Java, CORBA and VRML.

Figure 2 and 3 show the same information, the topological view of the Eurecom Institute network, using traditional tools (figure 2) and with a cone tree metaphor where visual parameters (color, size, transparency, etc.) display information.

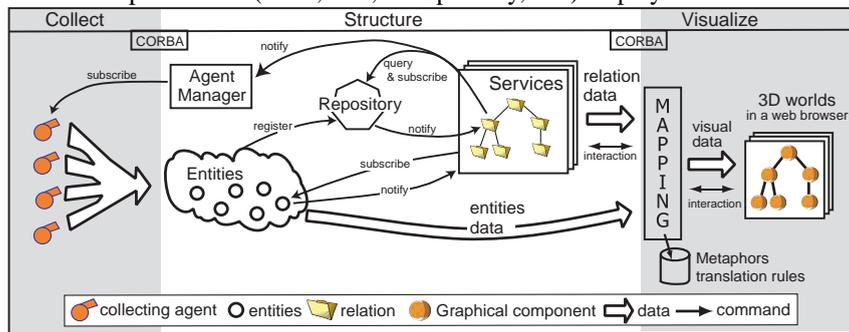


Figure 1 : overview of the CyberNet framework.

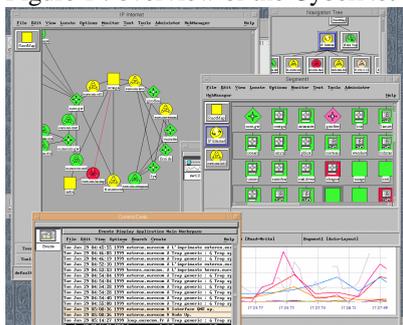


Figure 2

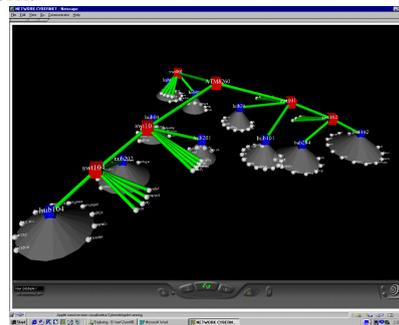


Figure 3