

Introduction

The level of traffic generated by a highly interactive online network applications can easily exceed the capability of a host network. Most solutions to this problem involve caching of data to enable faster delivery of static data content such as web pages; however, caching technologies are not adequate to ensure the delivery of non-cacheable dynamic real time modeling and simulation data. Our solution for dynamic data is to intelligently route data between distributed network servers.

Cybernet has developed a patent pending, HLA-based, distributed network server technology for the real-time data transfer of dynamic network content. By using our Real Time Intelligent Routing technology, host networks are protected from data overload typically experienced with networking high data content applications. Real-time on-line applications that can benefit from Real Time Intelligent Routing include:

- | | |
|---|---|
| <input type="radio"/> Networked modeling and simulation | <input type="radio"/> Internet-based training |
| <input type="radio"/> Battlefield communication | <input type="radio"/> Chat rooms |
| <input type="radio"/> Cooperative planning | <input type="radio"/> Video Teleconferencing |

The majority of web traffic is composed of one-to-one or one-to-many interactions. However, the proliferation of online communities for simulation, entertainment, and communication, -- both military and civilian -- has shown that there is a growing demand for a more interactive experience on the Internet. Handling the demand for bandwidth intensive interaction on the Internet requires a novel approach to increase performance and provide a better quality of service to the end users.

Cybernet's Real Time Intelligent Routing Technology, called OpenSkies, meets this need. Our technology delivers increased performance where there are multiple users performing simultaneous interactions in real-time. In the commercial space, Cybernet is focused on bringing this technology to the online gaming business, however, our routing techniques can be applied to a wide range of bandwidth intensive applications. By providing intelligent routing capabilities that service non-cacheable requests across the Internet, we can provide a faster and better quality of service to the end user in many-to-many interactions.

Cybernet's technology takes the concept of caching to the next level. Caching distributes content across the Internet to reduce load on a web server, but does nothing to diminish the bandwidth required by applications generating dynamic data. In contrast, our intelligent routing technology reduces the proliferation of real-time traffic across the backbone by selectively transferring only the information needed by the client. In the case of interactive gaming or simulations, data transfer between all users creates an N2 problem of data transfer across the Internet. By creating a distributed network running our intelligent routing software, we can remove much of the redundancy and reduce the bandwidth load by 25% to 90%.

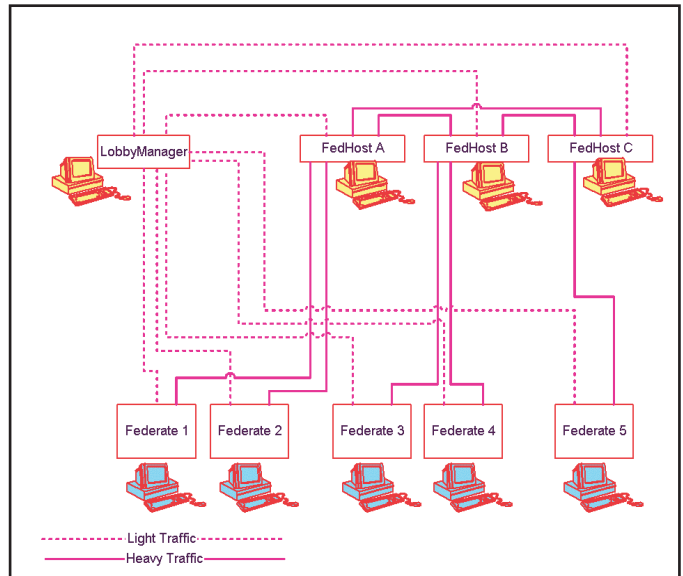


Figure 1: Openskies Network Topology

Intelligent routing is made possible by the use of culling rules which control data flow through the network backbone. Culling rules simply eliminate transmission of data that the client does not necessarily need, resulting in a significant reduction in required bandwidth. Interactive TV is an example of where data culling is effective. Interactive TV systems provide the ability to watch a sporting event from multiple cameras. Typically, each of these video streams are placed on the network in parallel, and the user chooses which stream to watch at the client end of the connection.

Our culling technology determines which streams the user is actually watching, restricting the unwatched video streams nearest the source and routing only the desired video streams for delivery to the client. In an example where there are 10 different camera angles and the user is only watching one, we can reduce the bandwidth load by 90%. Openskies also reduces the bandwidth from the client by performing the required routing on external servers. A client who is currently visible from 20 other clients need only send one update rather than being burdened by having to send 20 of them. This is especially important for those players with slower Internet connections.

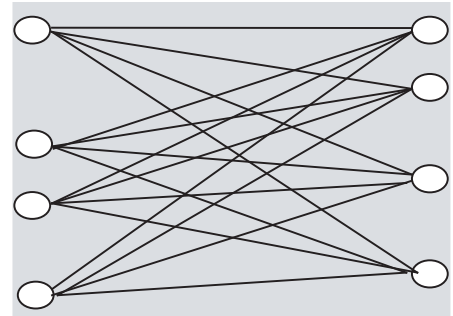


Figure 2: Number of Connections for a typical online, 8-client application

Technology

The OpenSkies Real Time Intelligent Routing technology uses a software-based system running across a distributed server network. The clients (called federates) connect to one of the distributed servers (called FedHosts). These FedHosts then act as traffic cops, acting in concert to route the data where it needs to go. With culling properly implemented, each FedHost is primarily busy servicing its assigned clients so the number of clients that can be handled by the system scales linearly with the number of supporting FedHosts. Developers are able to implement their own culling modules, which can take advantage of the attributes of a specific application and its requirements. Some examples are culling by radio frequency, culling by viewing angle, culling by distance, and culling by rank or security clearance. Since the developer is able to code his/her culling module using standard C++, the rules can be arbitrarily simple or complex.

Linear scaling is the key to managing network bandwidth. As clients are added, more distributed servers (FedHosts) can be added to the network. Ultimately, the connection backbone will saturates, but saturation can be avoided by partitioning the backbone connectivity so each segment has the bandwidth to support its connected client load.

The application interface for using the Openskies technology is based on the High Level Architecture (HLA) specification. HLA is based on decades of research by the U.S. military, who have been the predominant researcher in multiplayer simulations for the past 20 years. By adapting this architecture, we have created a patented distributed server system that not only supports massive multiplayer games, but will, in addition, allow us to meet the bandwidth needs of many DoD-related, multi-participant interactions such as battlefield communication, teleconferencing, modeling and simulation.

View the Openskies website at www.Openskies.net.