

IP Network Designer: Interface for IP Network Simulation

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Abstract

In this demonstration, we present IP Network Designer: interfaces for IP network simulation. The IP Network Designer consists of two subsystems: The IP Network Design Workbench and a 3D simulator.

IP Network Design Workbench is intended to support a collaborative design and simulation of an IP network by a group of network designers and their customers. This system is based on a tangible user interface platform called "Sensetable" and allows users to directly manipulate network topologies. Users can control parameters of nodes and links using physical pucks on the sensing table and simultaneously see the simulation results projected onto the table.

3D simulator provides a 3D view of simulation results. Users can see traffic packets flow as if they are inside the network. This system allows users to understand network behavior intuitively.

Keywords: Tangible User Interfaces, network simulation, network design, 3D

1. IP Network Design Workbench

IP Network Design Workbench is intended to support a collaborative design by a group of network experts and their customers. The goal of this system is to make simulation tools more accessible for people who have little network knowledge, so that they too can join the network design process. This system allows users to directly manipulate network topologies, control parameters of links and nodes (e.g., servers, clients, and routers) using physical pucks on a sensing table, and simultaneously see simulation results (e.g., service performance, link utilization, network running cost, traffic flow, etc.) projected onto the table and an LCD display in real-time.



Figure 1. IP Network Design Workbench in use

2. 3D simulator

3D simulator provides a 3D view of simulation results. This system projects the behavior of packets inside a network as movement of 3D spheres using a 3D immersive viewing system. Users can see traffic packets' flow as if they are inside the network, move anywhere in the network using a joystick, and pursue any particular packet. This system allows users to understand network behavior intuitively.

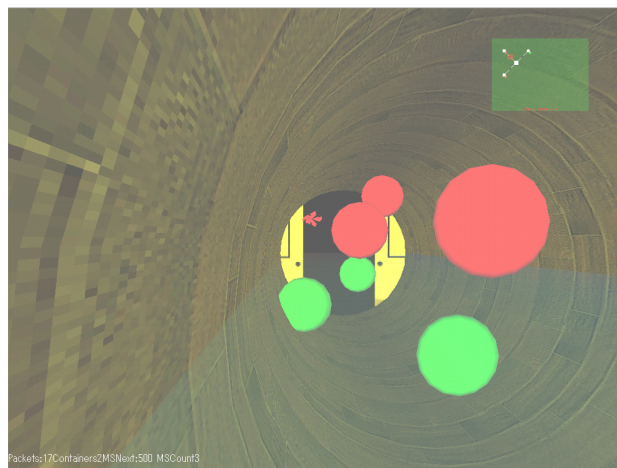


Figure 2. 3D view of simulation results

3. System architecture

IP Network Design Workbench consists of a sensing table, ten “pucks” for manipulation, a video projector and three computers. Figure 3 shows the architecture of the *IP Network Design Workbench*.

A video projector projects a network topology onto the surface of Sensetable. The Sensetable, originally developed by Tangible Media Group in the MIT Media Lab, is one of several TUI platforms, that can wirelessly detect locations and orientations of physical pucks on a sensing table. A puck has two LC tags to detect its rotation and its location. It has a button on its surface and button-press events are also detectable. The status of the pucks is handled by a computer connected to the Sensetable and then sent to the simulation engine. Simulation results are projected as an animation directly onto the table. In addition, the charts of simulation results are monitored on an LCD display.

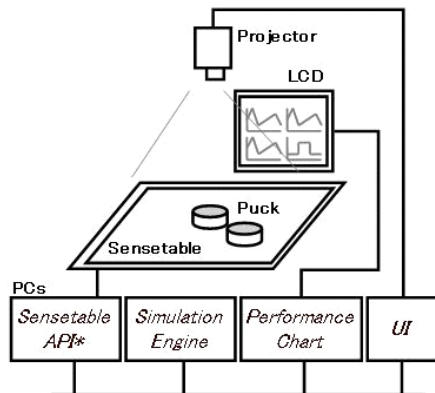


Figure 3. system architecture of IP Network Design Workbench

Figure 4 shows the system architecture of *3D simulator*. A joystick is used as an input device and a 3D immersive viewing system is used as a display.

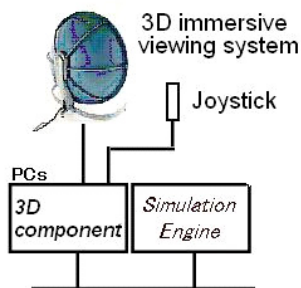


Figure 4. system architecture of 3D simulator

4. Demonstration scenario

A network designer is designing an IP network for a customer who wants to introduce a new streaming service on the existing network system currently used for e-mail, HTTP and Voice over IP (VoIP). The network designer adds a streaming server and some clients to the network simulation model on the table using physical pucks in front of the customer’s eyes.

When the designer starts the simulation, simulation results are projected as an animation and they can see the performance of this model IP network degrades. The designer and the customer will adjust the simulation parameters and see the results of real-time simulation. The designer increases the bandwidth of a link in order to improve network performance. Though the customer understands that the model would meet performance requirements, she points out that its cost would be expensive and suggests changing the bandwidth of another link.

Refining the network model and its parameters directly and repeatedly, they finally find the solution to keep the balance between performance and cost.

Next to the *IP Network Design Workbench*, there is a *3D simulator*. The customer enters one of the links and sees which service’s packets are using the link. She also learns how traffic packets which are generated at one client reach to the server and then return to the client, giving her a better understanding of network architecture and behavior.

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