Interactive Networks

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Introduction

It is common to represent computer networks as graphs. Such a graph can reveal interesting network characteristics when it is enriched with real-time network status information such as load, delay, bandwidth and jitter. In this research, our aim is to find visualization and interaction methods that (1) reveal the structure of real-time status information, such as network robustness for example (2) and that allow optimization to these characteristics either by human interaction or by automated adaptation programs.

Interactive Networks

We have built an interactive network visualization and manipulation prototype for our programmable network test bed. The programmable network test bed consists of VMware virtualized computers and networks, FPGA's and commodity servers and is interconnected by a 10 Gbit and gigabit network infrastructure. Our prototype provides control through an innovative graphical input device suitable for collaborative and command-and-control applications to analyse and manage programmable networks.

Visualization and Interaction

The prototype provides three different levels of interaction.

Network overview
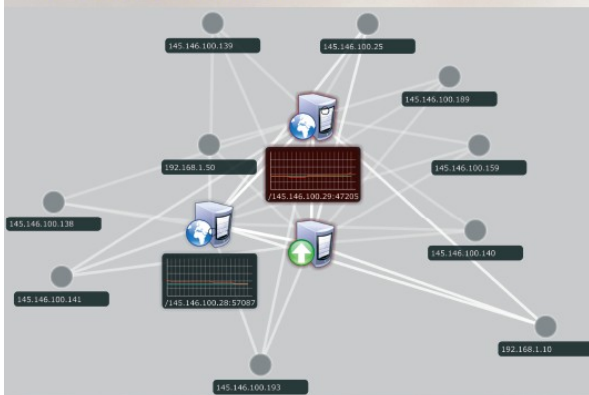
The viewing mode presents an overall representation of the computer network that is discovered at boot time. Various icons represent the function of a known computer node and unknown nodes are shown by their network address. Properties of the computer nodes (such as workload) and their network connections (bandwidth, delay and jitter) are visualized and updated in real-time. In viewing mode users can navigate (i.e. pan, rotate and zoom) through the network by the touch of their fingers.

Route definition

Users can define streams from producers to consumers in the route definition mode. The streams are identified in the network by placing tokens in the IP level traffic. Users can define a path by drawing a line from node to node and the path is allowed to cross a node multiple times. Both point-to-point and multicast paths are supported by the interface.

Stream manipulation

A user can modify stream forwarding of a node by zooming in on the specific node and modify its forwarding graph. For example, a rate limiter can be added to a specific path in the graph to limit its bandwidth usage.

Credits

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