



# **Emulating WAN Impairments For Multiple Client-Server Applications**

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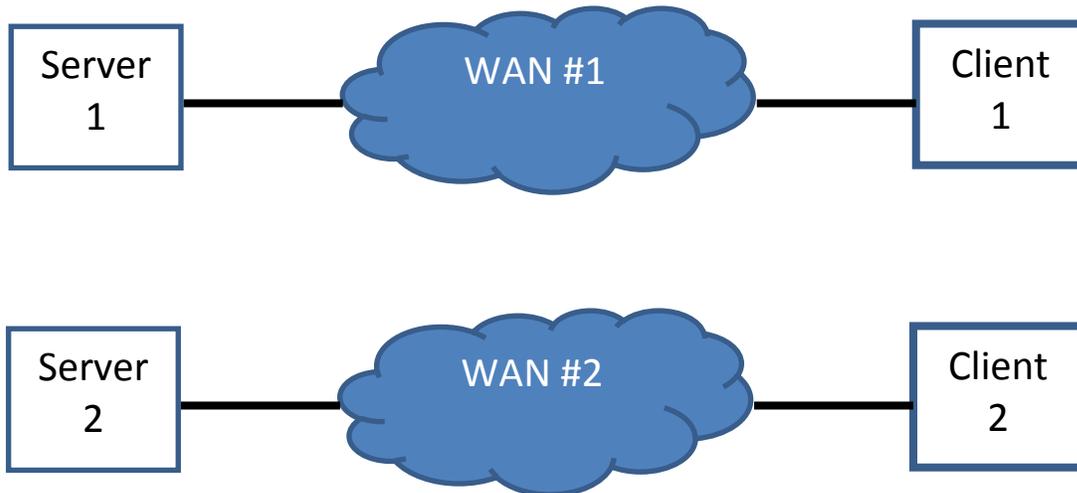
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## Background

Typically users want to have the most flexibility and receive the most value when using their test equipment. To truly emulate a more complex network than a dedicated link between two devices requires an emulator that's capable to aggregate and separate traffic. An example is provided to demonstrate how a user can achieve greater value by using less emulator ports for some basic network applications.

## Two Client-Server Example

Below is an example of two simple network configurations (Figure 1). Each network configuration is comprised of a server, a client, and a WAN. Each server and client has limited bandwidth, delay, and loss specified in their respective WAN (Table 1).

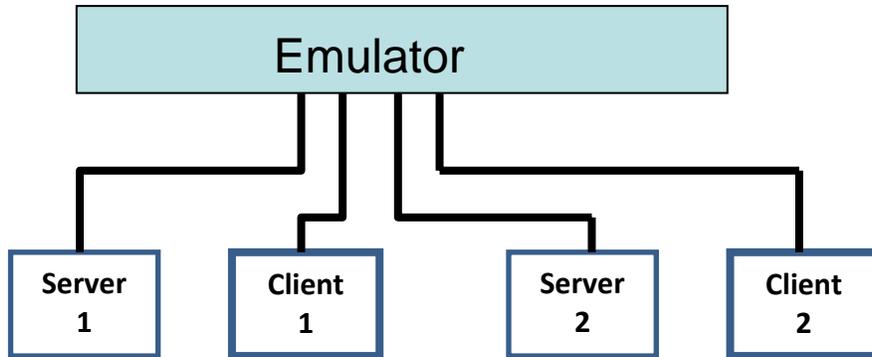


**Figure 1. – Two Client-Server Example**

	WAN #1	WAN #2
Delay	100 ms	180 ms
Packet Loss	2 %	1.2 %
Bandwidth Limit	1.5 Mbps	45 Mbps

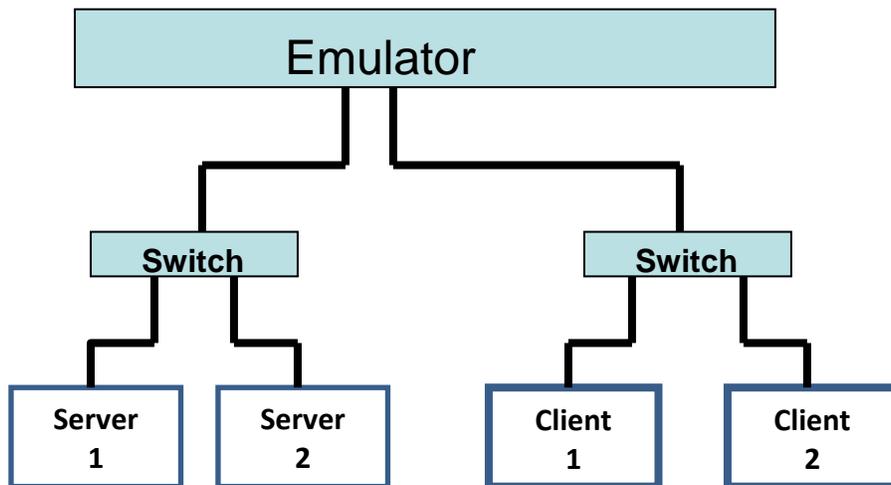
**Table 1 – WAN Impairment**

One way to emulate the two separate networks is to use an emulator with four ports: one port for each server and client (Figure 2). This strategy would lead to much greater costs as more Client-Server pairs are added to the test network.

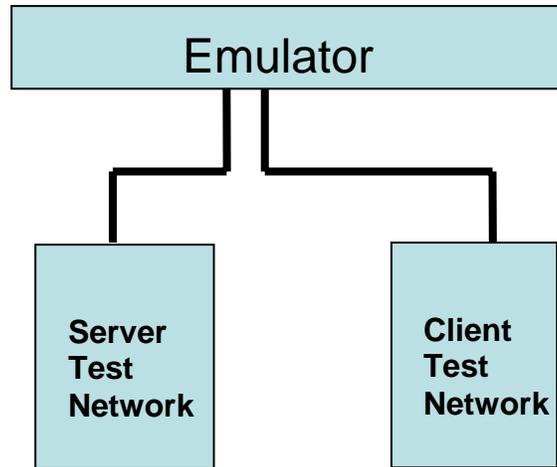


**Figure 2 – Four Port Emulator Configuration**

A better and a more cost effective solution is to have a network switch between the servers and the emulator and a second network switch between the clients and the emulator (Figure 3). In fact, test labs typically have their servers and clients on separate networks and in that case the emulator would be connected into one port of each network (Figure 4).



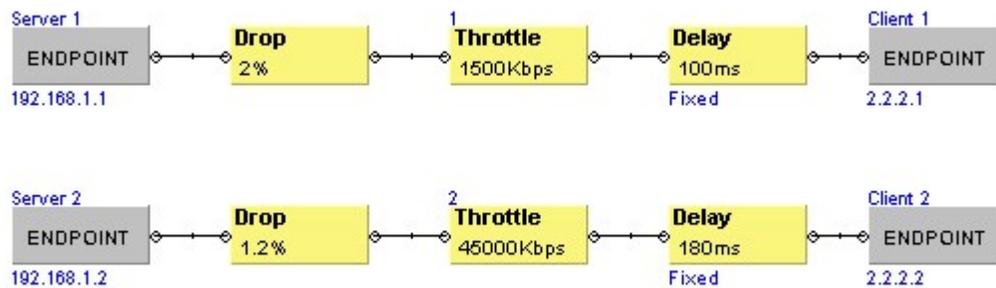
**Figure 3 – Two Port Emulator Configuration**



**Figure 4 – Two Port Emulator Configuration – Test Networks**

Figure 4 demonstrates the potential of a large number of concurrent independent Client-Server test networks.

Following is a GUI network configuration of a PacketStorm emulator for two Client-Server networks. Each network has its independent WAN impairments of packet drop, bandwidth throttle, and delay. The number of Client-Server pairs using the same emulator ports can be expanded to many more such that the aggregate bandwidth is below the maximum bandwidth of the emulator port.



## **Summary**

Even for a simple two client-server network, it's apparent the value of the emulator having filtering and flexibility. It's essential for an emulator to impair packets independently with any set of impairments when using the same emulator ports. As demonstrated above, as more Client-Server networks are added, the value is further magnified to use the same ports. In addition, advanced filtering, dynamic emulation, multiple users, mesh network emulation, and multiple routing modes are some of the other attributes required to accurately emulate real world scenarios.

## About PacketStorm Communications

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PacketStorm Communications, Inc. develops IP Network Emulators that allow users to emulate various IP Network conditions. By developing proprietary hardware and software, PacketStorm has created emulators that can be used to extensively test networking applications that are available today as well as future technologies that have yet to be deployed

PacketStorm is a privately held company founded in 1998 by a team of engineers and managers from the prestigious Bell Laboratories. With extensive backgrounds and experience in both network development and testing, PacketStorm continues to focus on the needs of IP developers and network managers. PacketStorm's world headquarters in New Jersey handles product engineering, marketing, and customer support.

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