Motivation for Flow-Level Traffic Generation

- Emulation and simulation environments require tools for reproducible creation of a range of test conditions similar to those experienced in the live Internet.
- Existing tools (e.g., SURGE, iperf, specialized hardware like Spirent AX/4000) for creating background traffic cannot recreate the rich variety of packet streams observed in the Internet.

Harpoon Features and Benefits

Harpoon is unique in that it:
- scalably generates statistically representative network traffic at the IP flow level;
- is application-independent;
- recreates temporal volume (byte, packet, flow) characteristics of live traces;
- recreates spatial characteristics (source and destination IP address frequencies);
- self-configures (IMC ’04 submission) from Netflow logs or packet traces – there is no parametric estimation required.

Validation of the Model and Tool

Figures show capability of Harpoon to recreate file size, inter-connection time, and spatial distributions given as input. Steps visible in test environment inter-connection times are caused by a coarse-grained operating system scheduler.

Harpoon, with the addition of the Harpoon client, testbed used in experiments to compare packet-oriented traffic generator (AX/4000) with Harpoon.

Comparison with Packet-Oriented Traffic Generators

We ran experiments based on RFCs 2544 and 2889 to compare loads placed upon a Cisco 6500 using Harpoon and a Spirent AX/4000, a high-performance, precise packet-oriented traffic generator.
- Two different load levels of 600Mbps and 900Mbps were used by first generating load with Harpoon, then matching average load using AX/4000.
- Configured Harpoon and the AX/4000 to generate traffic over a full class-B network, and used four different routing table sizes at the 6500.
- Used three packet size configurations and four burst size configurations at the AX/4000.
- Comparisons considered average forwarding rate at the 6500, switching fabric utilization, and packet loss rates.

Major findings:
- Forwarding rates with Harpoon are much more variable than for AX/4000, especially at higher loads.
- Extreme conditions generated by AX/4000 (e.g., only using 40 byte packets) do not generate the kinds of variability in forwarding rates and switching fabric utilization produced by Harpoon.

Architecture of Harpoon

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