

2nd Work Sheet Internet Measurement SS 08

General Information

This assignments covers the analysis of network simulations of HTTP and FTP traffic. The simulations were run using ns2¹. ns2 is an event based simulator and can be configured to generate event traces that contain information on a selected set of events. These trace files can then be used to analyze the behavior of the simulated network traffic.

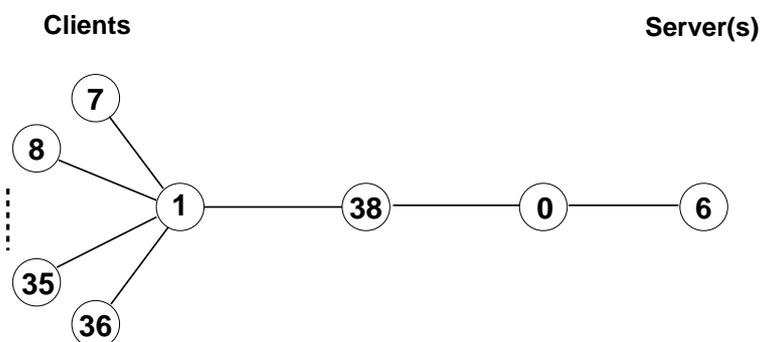


Figure 1: Simulation Topology

- On the lecture's webpage (in section 'Homework') you will find two files in compressed format, `web.out.gz` and `inf.out.gz`, that contain traces of HTTP and FTP traffic simulations, respectively. The trace files are in a customized format described at the end of the assignment sheet².
- The simulations run using the topology shown in figure 1. In this case, the traces contain events from all nodes in the topology, so that the same packet generates an entire series of events.
- Several of the questions are about TCP connections. As there will be several active TCP connections at the same time, events that are caused by the same connection have to be grouped together. There is some programming to extract the relevant information from the traces. Hint: use node/port and link information to identify individual connections.

Question 1: Duration of TCP connections

- Using the simulation trace files, compute both the duration and the number of bytes transferred of every TCP connection you find. Hint: Use the TCP control packets sent during connection setup and teardown to compute the duration of a TCP connection.
- Plot the relative distributions of the number of packets, bytes as well as the duration for every TCP connection. Use logarithmic scales for your plots³.
- Compute the mean and the median of the above distributions.

¹NS2: <http://www.isi.edu/nsnam/ns/>

²<http://www.net.t-labs.tu-berlin.de/~joerg/nsweb/>

³in R: `plot(..., log="xy")`

Question 2: Temporal Distribution of Packet Events

- Generate plots for each of the FTP and the HTTP traffic showing the number of packets arrived and for the number of packets dropped arriving at node 38 from node 0 per time intervals of {10ms, 100ms, 1s} (this amounts to a total of $2 \times 2 \times 3 = 12$ plots). The x-axes of these plots should show time a interval index and the y-axes should show per-time interval counts.
- Explain where the temporal distributions come from, both for the number of arrived and for the number of dropped packets per time interval.
- Explain why the temporal distributions of FTP and HTTP traffic are different from each other.
- Explain why these effects aren't usually as pronounced in real traffic as they are visible in the simulations.

Data Format of extended NS2 Traces: Each node in a NS2 simulation generates a trace line for every action performed on a packet. These trace lines have the following syntax:

```
<time> <event> <len> <from> <to> <link> <seq> <ack> <flags1> <flags2>
```

where the meaning of these fields are:

<time>: timestamp for an action in secondes since start of simulation
<event>: r , if a packet has been received by a node
+, if a packet is placed in the output queue of a node
-, if a packet is taken from the output queue and being sent to the next node
 d , if a packet is dropped (due to a full output queue)
<len>: size of a packet in bytes
<from>: source node and port number of a packet
<to>: target node and port number of a packet
<link>: A link, specified by two adjacend nodes;
for r the event related to the second node, with + and - on the first node
<seq>: the sequence number of a TCP packet
<ack>: the acknowledgement number of a TCP packet
<flags1>: the TCP flags of a packet in hex-coded binary format
<flags2>: the TCP flags of a packet in clear text (SYN, FIN, ACK, PSH)

Submission Details:

Due Date: June 4th 2008, 10:00 c.t. (just before the lecture) In paper form (i.e., print out the plots; print or write down values like mean). We might also offer "digital submission". If we do, you will find more information on the homepage.

Note: during the next tutorial session (June 11th) we will again present a reference solution of the work sheet.