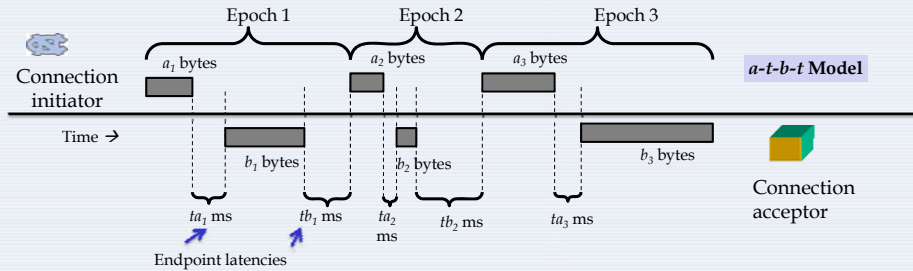




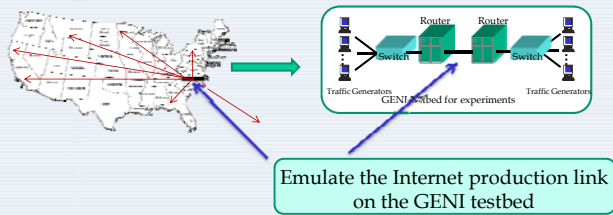
## Modeling Application Workloads

We model application workloads in two dimensions: size and time. Consider an application exchange between two TCP endpoints that transfers a total of  $X$  bytes in one direction and  $Y$  bytes in the opposite direction over the duration of the connection. The  $a-t-b-t$  model, shown below, includes every request-response exchange within the connection in both size and time dimensions.



## Emulating Network Paths

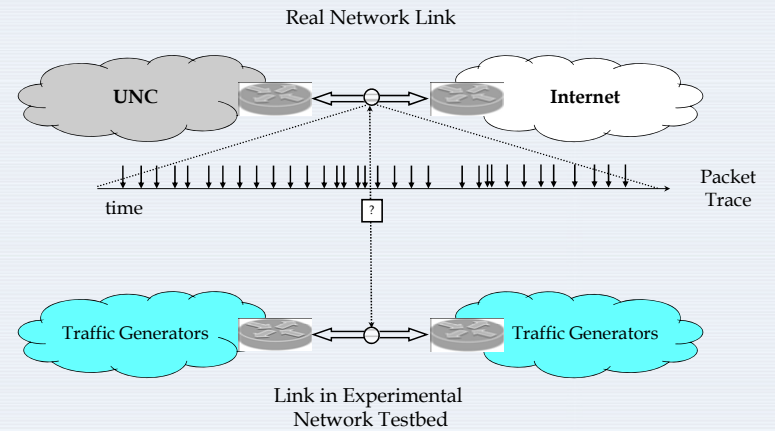
We experimented with several different methods of emulating RTTs in our experiments. We can emulate a single path with the same latency for all TCP connections. Or we can emulate multiple paths that represents a distribution of the minimum RTTs measured for each connection by analyzing the TCP/IP header traces.



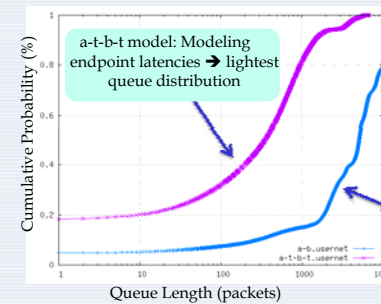
Emulate the round trip times as:

- Single path
- Multiple paths

## Traffic Generation



## Why does this matter?



- Same traffic input
- Same path characteristics
- Different application models
- *Very different queuing dynamics at the router!*

a-b model: > 1,000 packets in the queue 80% of the time

The a-b model does not emulate end-point latencies