Simulation Analysis

This section discusses the results of the hot-potato routing simulation.

The hot-potato routing algorithm described above guarantees an expected O(N) delivery and injection time where N is the diameter of the network. The simulation was designed to test these guarantees over a variety of conditions.

Graph 1 and 2 display the results of the system simulated under four different loads and 32 different network diameters. The loads are represented as a percentage of the total number of LPs (routers) that will have an associated packet injection application. Each packet injection application injects packets at a rate of one packet per time step. The network diameters used in the simulated configurations range from 8 to 256.

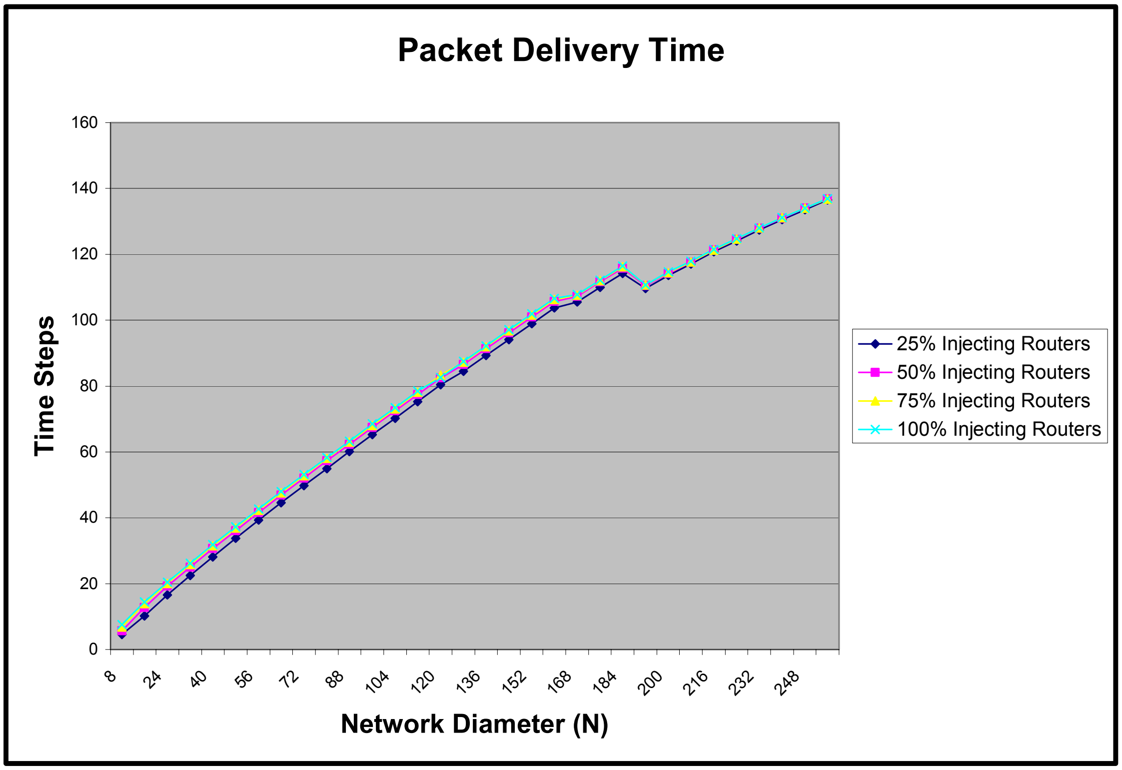
Graph 1 shows the average packet delivery time with respect to the network size.

You can see from the graph that the average delivery time increases approximately linearly with respect to N. The packet injection rate has a very limited effect on the packet delivery rate. One notable feature of the results is the change in trajectory of the graph at approximately N = 188. This change is caused by the probabilistic packet state changing rules. In a larger network, a greater percentage of packets have changed to higher states. This change in state comes with a change in how the packet is routed and consequently makes the algorithm perform slightly better.

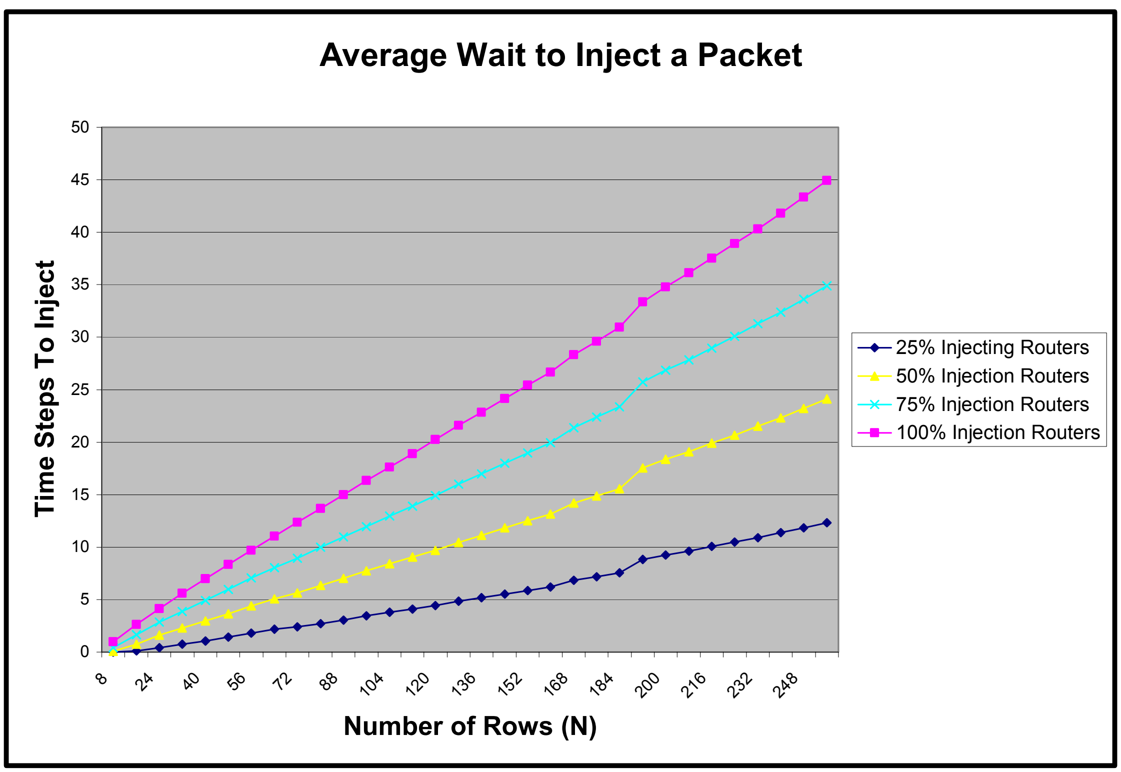
Another statistic of interest is how long a packet waits to be injected into the network. Graph 2 shows the average number of time-steps a packet waits to be injected.

You can see from the graph that the average packet injection waiting time increases approximately linearly with N within each injection configuration. However, it is obvious that the injection rate (determined by the number of injection applications) has a significant impact on the injection wait.

The injection of packets is ultimately controlled by the network mechanics. The injection rate is limited because a packet can only be injected when there is a free link at that router. A link becomes free when a packet is delivered to a router. A router will have a free link if it is the final destination of a packet that is delivered to it. A router will also have a free link if it does not receive a packet from one of its adjacent routers at that time step. Therefore, it appears that the average injection rate is linear with respect to N and is bounded by the delivery rate.



Graph 1: Packet Delivery Time



Graph 2: Average Wait to Inject a Packet