

AI+X: Report 2

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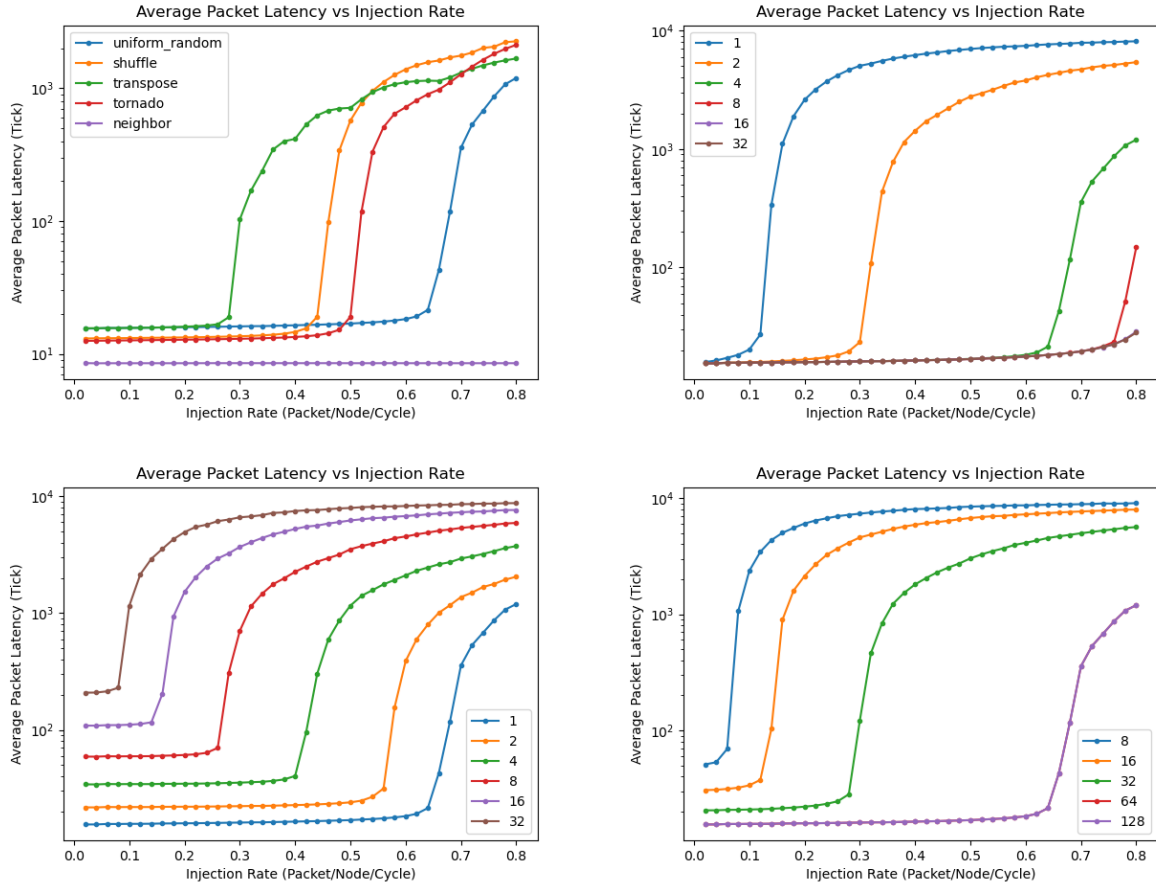


Figure 1: Average Packet Latency vs. Injection Rate under different configurations

Task 1&2

By running the shell script in appendix, we generated the four figures above.

- **SYNTHETIC TRAFFIC:** As figure 1 shows, when the injection rate is low, the average packet latency is dominated by the network latency, which is highly correlated to the average hops.

Appendix

```

1  #!/bin/bash
2
3  NUM_CPUS=64
4  SIM_CYCLES=10000
5
6  echo > network_stats.txt
7
8  for SYNTH in uniform_random shuffle transpose tornado neighbor
9  do
10     echo "SYNTHETIC TRAFFIC: $SYNTH" >> network_stats.txt
11     for INJ_RATE in 0.02 0.04 0.06 0.08 0.10 0.12 0.14 0.16 0.18 0.20 0.22 0.24 0.26
12         0.28 0.30 0.32 0.34 0.36 0.38 0.40 0.42 0.44 0.46 0.48 0.50 0.52 0.54 0.56 0.58
13         0.60 0.62 0.64 0.66 0.68 0.70 0.72 0.74 0.76 0.78 0.80
14     do
15         ./build/NULL/gem5.opt \
16         configs/example/garnet_synth_traffic.py \
17         --network=garnet --num-cpus=$NUM_CPUS --num-dirs=64 \
18         --topology=Mesh_XY --mesh-rows=8 \
19         --inj-vnet=0 --synthetic=$SYNTH \
20         --sim-cycles=$SIM_CYCLES --injectionrate=$INJ_RATE
21         INJ_TOT=$(grep -Eo "packets_injected::total\s*[0-9.]*" m5out/stats.txt |
22             grep -Eo "[0-9.]*")
23         RECV_TOT=$(grep -Eo "packets_received::total\s*[0-9.]*" m5out/stats.txt |
24             grep -Eo "[0-9.]*")
25         RECV_RATE=$(echo "scale=6;$RECV_TOT/$NUM_CPUS/$SIM_CYCLES" | bc)
26         AVG_PKT_QUEUE_LATENCY=$(grep -Eo "average_packet_queueing_latency\s*[0-9.]*"
27             m5out/stats.txt | grep -Eo "[0-9.]*")
28         AVG_PKT_NETWK_LATENCY=$(grep -Eo "average_packet_network_latency\s*[0-9.]*"
29             m5out/stats.txt | grep -Eo "[0-9.]*")
30         AVG_PKT_LATENCY=$(grep -Eo "average_packet_latency\s*[0-9.]*" m5out/stats.
31             txt | grep -Eo "[0-9.]*")
32         AVG_HOPS=$(grep -Eo "average_hops\s*[0-9.]*" m5out/stats.txt | grep -Eo "
33             [0-9.]*")
34         echo "[$INJ_RATE, $INJ_TOT, $RECV_TOT, $RECV_RATE, $AVG_PKT_QUEUE_LATENCY,
35             $AVG_PKT_NETWK_LATENCY, $AVG_PKT_LATENCY, $AVG_HOPS]" >> network_stats.
36             txt
37     done
38     echo >> network_stats.txt
39 done
40
41 python3 plot.py
42
43 echo > network_stats.txt
44
45 for VCS_PER_VNET in 1 2 4 8 16 32

```

```

36 do
37     echo "VCS PER VNET: $VCS_PER_VNET" >> network_stats.txt
38     for INJ_RATE in 0.02 0.04 0.06 0.08 0.10 0.12 0.14 0.16 0.18 0.20 0.22 0.24 0.26
39         0.28 0.30 0.32 0.34 0.36 0.38 0.40 0.42 0.44 0.46 0.48 0.50 0.52 0.54 0.56 0.58
40         0.60 0.62 0.64 0.66 0.68 0.70 0.72 0.74 0.76 0.78 0.80
41     do
42         ./build/NULL/gem5.opt \
43         configs/example/garnet_synth_traffic.py \
44         --network=garnet --num-cpus=$NUM_CPUS --num-dirs=64 \
45         --topology=Mesh_XY --mesh-rows=8 --vcs-per-vnet=$VCS_PER_VNET\
46         --inj-vnet=0 --synthetic=uniform_random \
47         --sim-cycles=$SIM_CYCLES --injectionrate=$INJ_RATE
48         INJ_TOT=$(grep -Eo "packets_injected::total\s*[0-9.]*" m5out/stats.txt |
49             grep -Eo "[0-9.]*")
50         RECV_TOT=$(grep -Eo "packets_received::total\s*[0-9.]*" m5out/stats.txt |
51             grep -Eo "[0-9.]*")
52         RECV_RATE=$(echo "scale=6;$RECV_TOT/$NUM_CPUS/$SIM_CYCLES" | bc)
53         AVG_PKT_QUEUE_LATENCY=$(grep -Eo "average_packet_queueing_latency\s*[0-9.]*"
54             m5out/stats.txt | grep -Eo "[0-9.]*")
55         AVG_PKT_NETWK_LATENCY=$(grep -Eo "average_packet_network_latency\s*[0-9.]*"
56             m5out/stats.txt | grep -Eo "[0-9.]*")
57         AVG_PKT_LATENCY=$(grep -Eo "average_packet_latency\s*[0-9.]*" m5out/stats.
58             txt | grep -Eo "[0-9.]*")
59         AVG_HOPS=$(grep -Eo "average_hops\s*[0-9.]*" m5out/stats.txt | grep -Eo "
60             [0-9.]*")
61         echo "[$INJ_RATE, $INJ_TOT, $RECV_TOT, $RECV_RATE, $AVG_PKT_QUEUE_LATENCY,
62             $AVG_PKT_NETWK_LATENCY, $AVG_PKT_LATENCY, $AVG_HOPS]" >> network_stats.
63             txt
64     done
65     echo >> network_stats.txt
66 done
67
68 python3 plot.py
69
70 echo > network_stats.txt
71
72 for ROUTER_LATENCY in 1 2 4 8 16 32
73 do
74     echo "ROUTER LATENCY: $ROUTER_LATENCY" >> network_stats.txt
75     for INJ_RATE in 0.02 0.04 0.06 0.08 0.10 0.12 0.14 0.16 0.18 0.20 0.22 0.24 0.26
76         0.28 0.30 0.32 0.34 0.36 0.38 0.40 0.42 0.44 0.46 0.48 0.50 0.52 0.54 0.56 0.58
77         0.60 0.62 0.64 0.66 0.68 0.70 0.72 0.74 0.76 0.78 0.80
78     do
79         ./build/NULL/gem5.opt \
80         configs/example/garnet_synth_traffic.py \
81         --network=garnet --num-cpus=$NUM_CPUS --num-dirs=64 \
82         --topology=Mesh_XY --mesh-rows=8 --router-latency=$ROUTER_LATENCY\
83         --inj-vnet=0 --synthetic=uniform_random \
84         --sim-cycles=$SIM_CYCLES --injectionrate=$INJ_RATE
85         INJ_TOT=$(grep -Eo "packets_injected::total\s*[0-9.]*" m5out/stats.txt |
86             grep -Eo "[0-9.]*")
87         RECV_TOT=$(grep -Eo "packets_received::total\s*[0-9.]*" m5out/stats.txt |

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75         grep -Eo "[0-9.]*")
76     RECV_RATE=$(echo "scale=6;$RECV_TOT/$NUM_CPUS/$SIM_CYCLES" | bc)
77     AVG_PKT_QUEUE_LATENCY=$(grep -Eo "average_packet_queueing_latency\s*[0-9.]*"
78         m5out/stats.txt | grep -Eo "[0-9.]*")
79     AVG_PKT_NETWK_LATENCY=$(grep -Eo "average_packet_network_latency\s*[0-9.]*"
80         m5out/stats.txt | grep -Eo "[0-9.]*")
81     AVG_PKT_LATENCY=$(grep -Eo "average_packet_latency\s*[0-9.]*" m5out/stats.
82         txt | grep -Eo "[0-9.]*")
83     AVG_HOPS=$(grep -Eo "average_hops\s*[0-9.]*" m5out/stats.txt | grep -Eo "
84         [0-9.]*")
85     echo "[$INJ_RATE, $INJ_TOT, $RECV_TOT, $RECV_RATE, $AVG_PKT_QUEUE_LATENCY,
86         $AVG_PKT_NETWK_LATENCY, $AVG_PKT_LATENCY, $AVG_HOPS]" >> network_stats.
87         txt
88 done
89 echo >> network_stats.txt
90 done
91 python3 plot.py
92 echo > network_stats.txt
93 for LINK_WIDTH_BITS in 8 16 32 64 128
94 do
95     echo "LINK WIDTH BITS: $LINK_WIDTH_BITS" >> network_stats.txt
96     for INJ_RATE in 0.02 0.04 0.06 0.08 0.10 0.12 0.14 0.16 0.18 0.20 0.22 0.24 0.26
97         0.28 0.30 0.32 0.34 0.36 0.38 0.40 0.42 0.44 0.46 0.48 0.50 0.52 0.54 0.56 0.58
98         0.60 0.62 0.64 0.66 0.68 0.70 0.72 0.74 0.76 0.78 0.80
99     do
100         ./build/NULL/gem5.opt \
101         configs/example/garnet_synth_traffic.py \
102         --network=garnet --num-cpus=$NUM_CPUS --num-dirs=64 \
103         --topology=Mesh_XY --mesh-rows=8 --link-width-bits=$LINK_WIDTH_BITS\
104         --inj-vnet=0 --synthetic=uniform_random \
105         --sim-cycles=$SIM_CYCLES --injectionrate=$INJ_RATE
106         INJ_TOT=$(grep -Eo "packets_injected::total\s*[0-9.]*" m5out/stats.txt |
107             grep -Eo "[0-9.]*")
108         RECV_TOT=$(grep -Eo "packets_received::total\s*[0-9.]*" m5out/stats.txt |
109             grep -Eo "[0-9.]*")
110         RECV_RATE=$(echo "scale=6;$RECV_TOT/$NUM_CPUS/$SIM_CYCLES" | bc)
111         AVG_PKT_QUEUE_LATENCY=$(grep -Eo "average_packet_queueing_latency\s*[0-9.]*"
112             m5out/stats.txt | grep -Eo "[0-9.]*")
113         AVG_PKT_NETWK_LATENCY=$(grep -Eo "average_packet_network_latency\s*[0-9.]*"
114             m5out/stats.txt | grep -Eo "[0-9.]*")
115         AVG_PKT_LATENCY=$(grep -Eo "average_packet_latency\s*[0-9.]*" m5out/stats.
116             txt | grep -Eo "[0-9.]*")
117         AVG_HOPS=$(grep -Eo "average_hops\s*[0-9.]*" m5out/stats.txt | grep -Eo "
118             [0-9.]*")
119         echo "[$INJ_RATE, $INJ_TOT, $RECV_TOT, $RECV_RATE, $AVG_PKT_QUEUE_LATENCY,
120             $AVG_PKT_NETWK_LATENCY, $AVG_PKT_LATENCY, $AVG_HOPS]" >> network_stats.
121             txt
122     done
123 done
124 echo >> network_stats.txt

```

```
110 done
111
112 python3 plot.py
```