TCP over SoNIC

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SoNIC Overview

- Implementation of physical and data link layer in software
- Real-time access to network stack
- Real-time traffic monitoring
- Fine-grained control on Inter packet delay
- Commodity processor and field-programmable gate array (FPGA) board
Project Overview

- Implementation of Transmission Control Protocol (TCP) layer on top of SoNIC
- TCP state machine for tracking connection state
- Separate Tx and Rx threads for packet and acknowledgement handling
- Synchronization between Rx and Tx threads
Implementation of TCP over UDP

- TCP state machine
- Cumulative ACK
- Congestion Control
  - Go-Back-N
  - Additive Increase Exponential Decrease
Results

Throughput vs Cumulative ACK

- Best throughput ~1.4-1.5Gbps
A new mode to spawn 4 TCP handler threads
User Space Pipe between Tx PCS and Rx PCS of Sender and Receiver and vice versa
Results

Throughput vs Inter Packet Gap

- Actual
- Ideal

Throughput (Gbps)

Inter Packet Gap (bytes)
Results

Throughput vs Ethernet Frame Size
A new mode to spawn 4 TCP handler threads

For loopback Port 0 is directly connected to Port 1
Results

Throughput vs. Inter Packet Gap - loopback

Throughput (Gbps)

Inter Packet Gap (bytes)

- Actual
- Ideal

Throughput (Gbps)

100 1000 2500 4000 5000 6000 7000 10000 13738
Results

Through vs. Ethernet Frame Size - loopback
Results

Throughput vs. Inter Packet Gap - Across SoNIC

Throughput (Gbps)

Inter Packet Gap (bytes)

100 1000 2500 4000 5000 6000 7000 10000

Actual

Ideal
Results

Throughput vs. Ethernet Frame Size - Across SoNIC
Future Work

- Fast Re-Transmit
  - Packet Buffering
  - Loss Detection using 3-Duplicate ACKs
- Slow Start
DEMO
Q & A
References

- TCP RFC https://www.ietf.org/rfc/rfc793.txt
- SoNIC http://fireless.cs.cornell.edu/sonic/