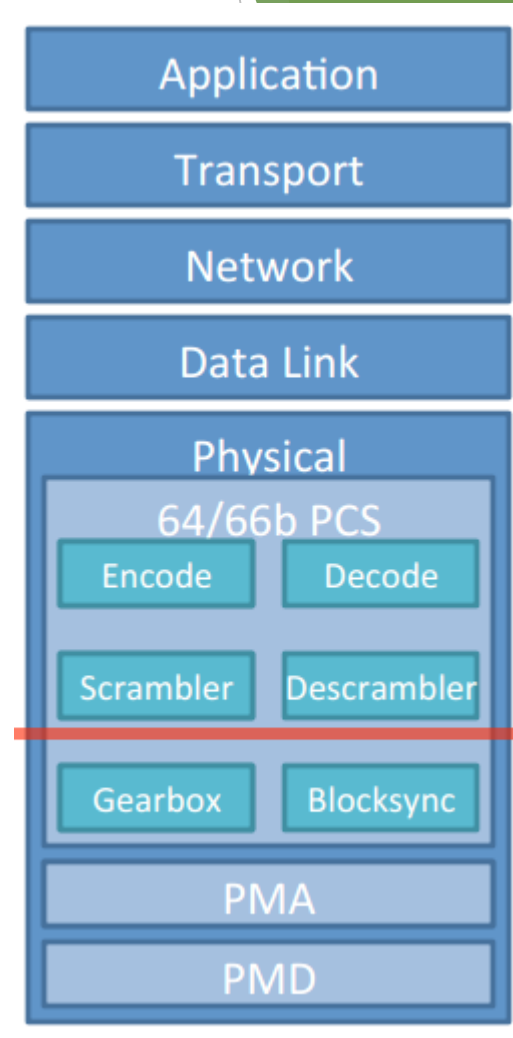


TCP over SoNIC

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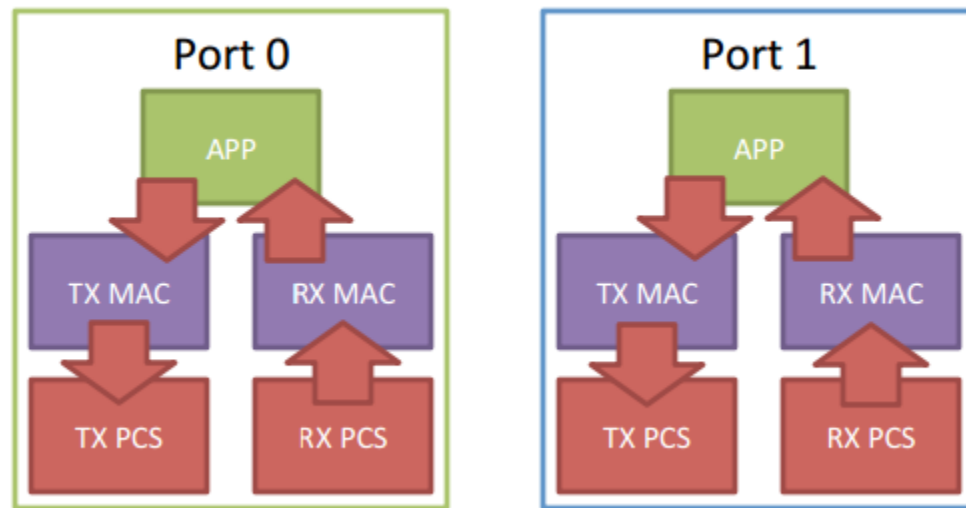
SoNIC Overview

- 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

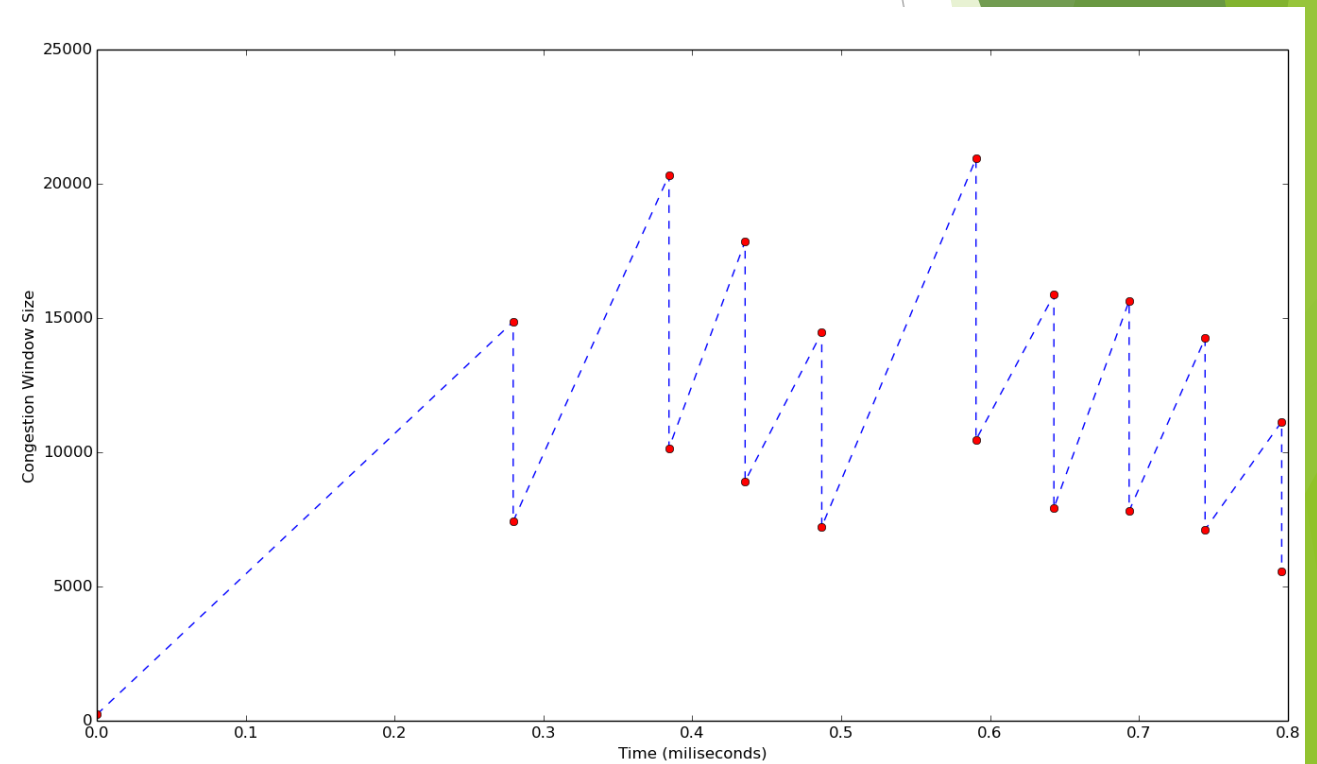
- Implementation of Transmission Control Protocol (TCP) layer on top of SoNIC
- TCP state machine for tracking connection state
- Separate Tx and Rx threads for packet and acknowledgement handling
- Synchronization between Rx and Tx threads



Implementation of TCP over UDP

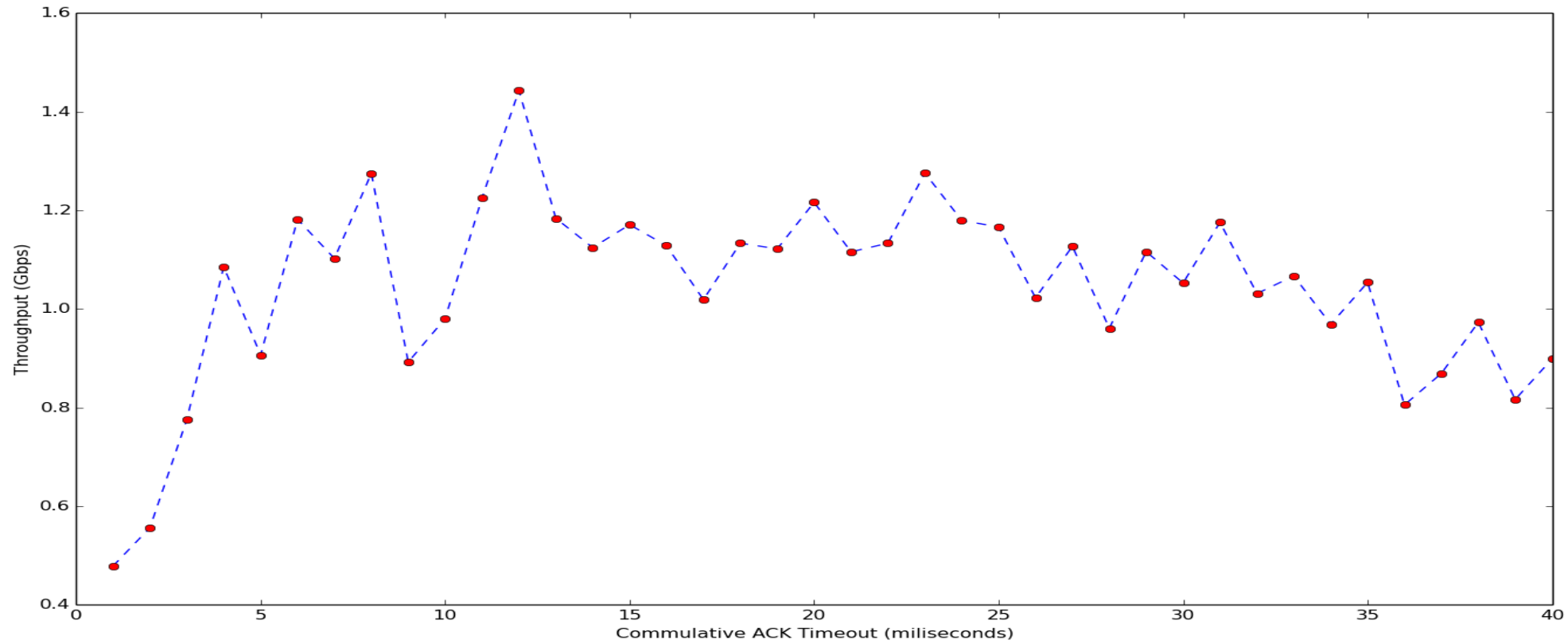
Congestion Window Size vs Time

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



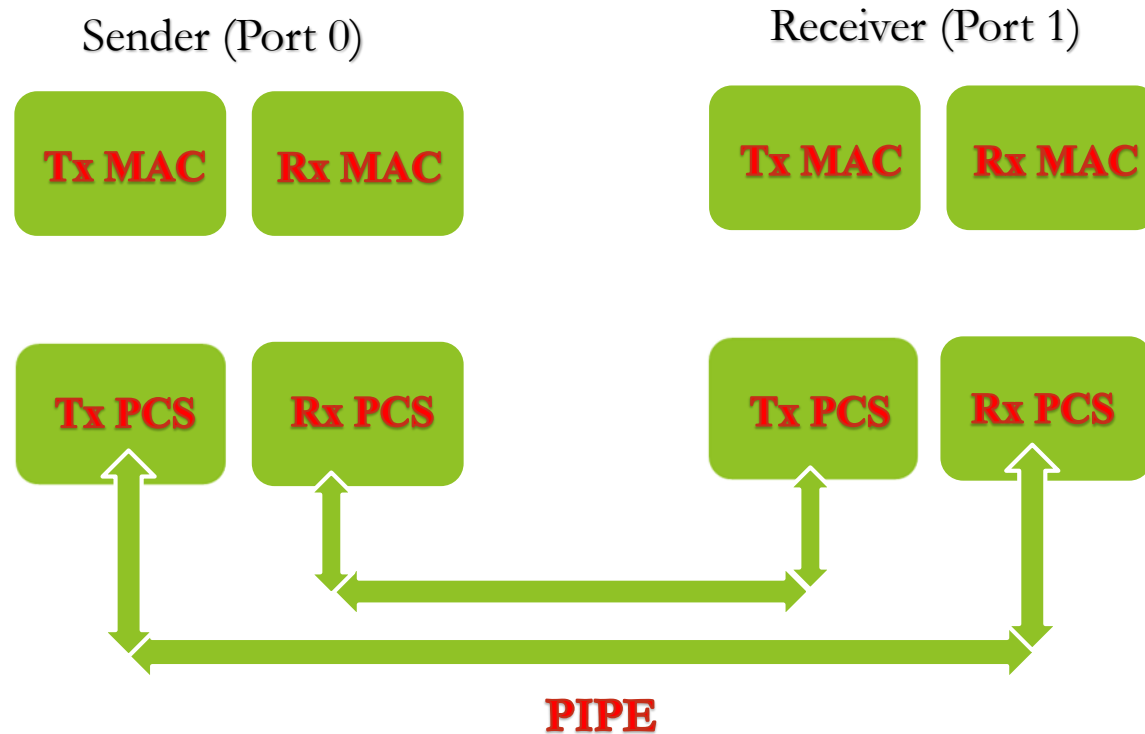
Results

Throughput vs Cumulative ACK



➤ Best throughput ~1.4-1.5Gbps

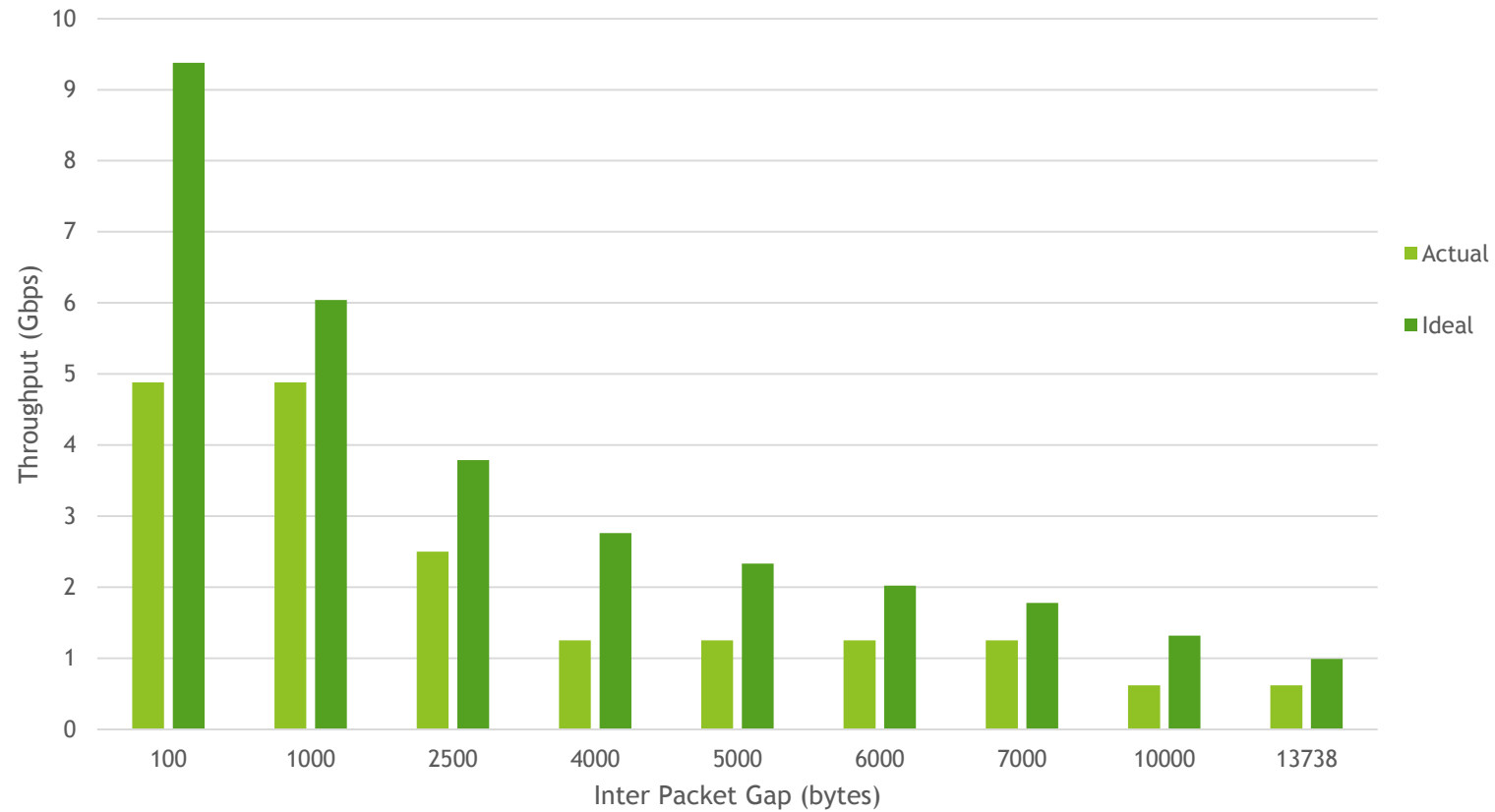
TCP over SoNIC in User Space



- 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

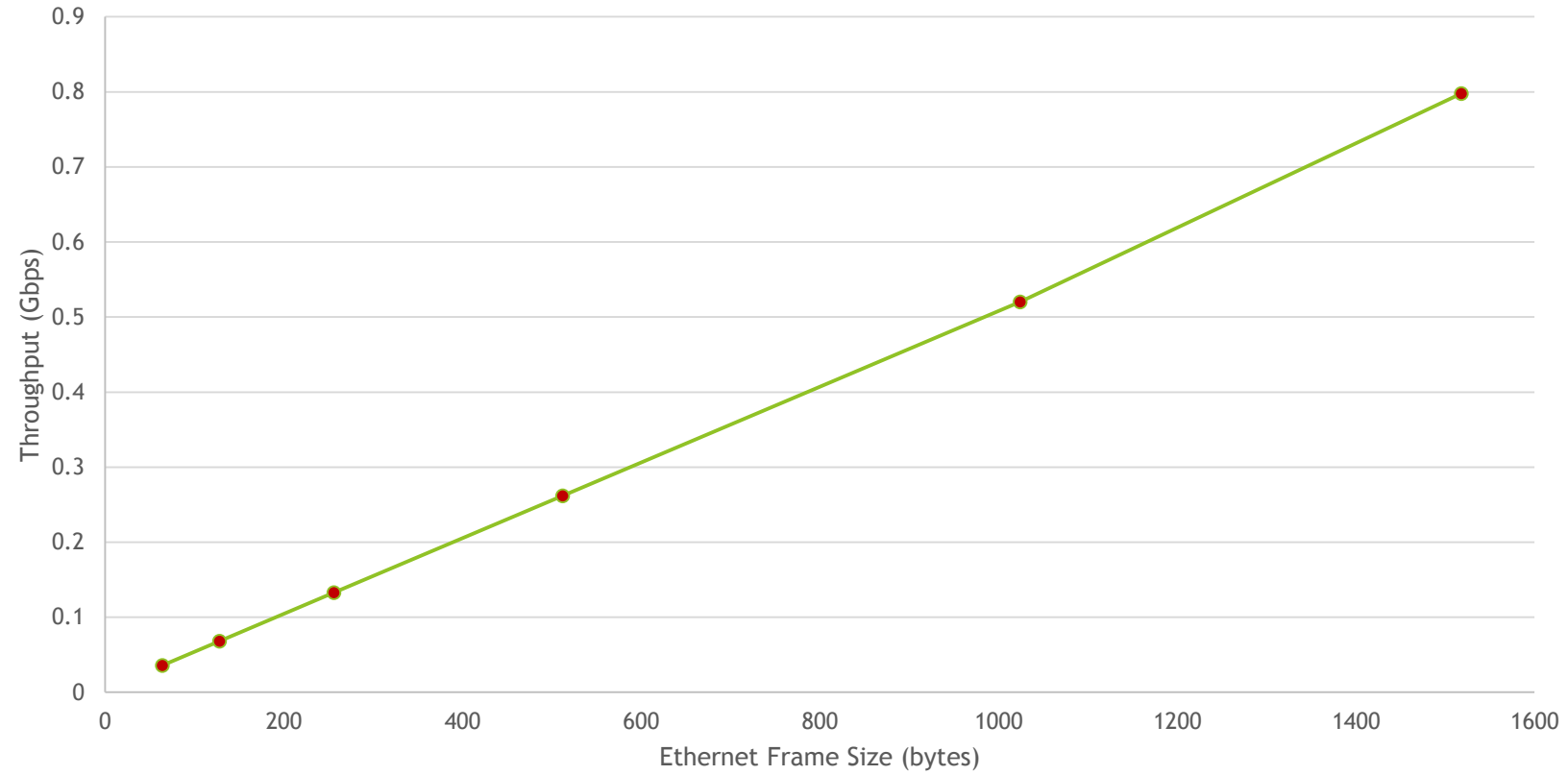
Results

Throughput vs Inter Packet Gap

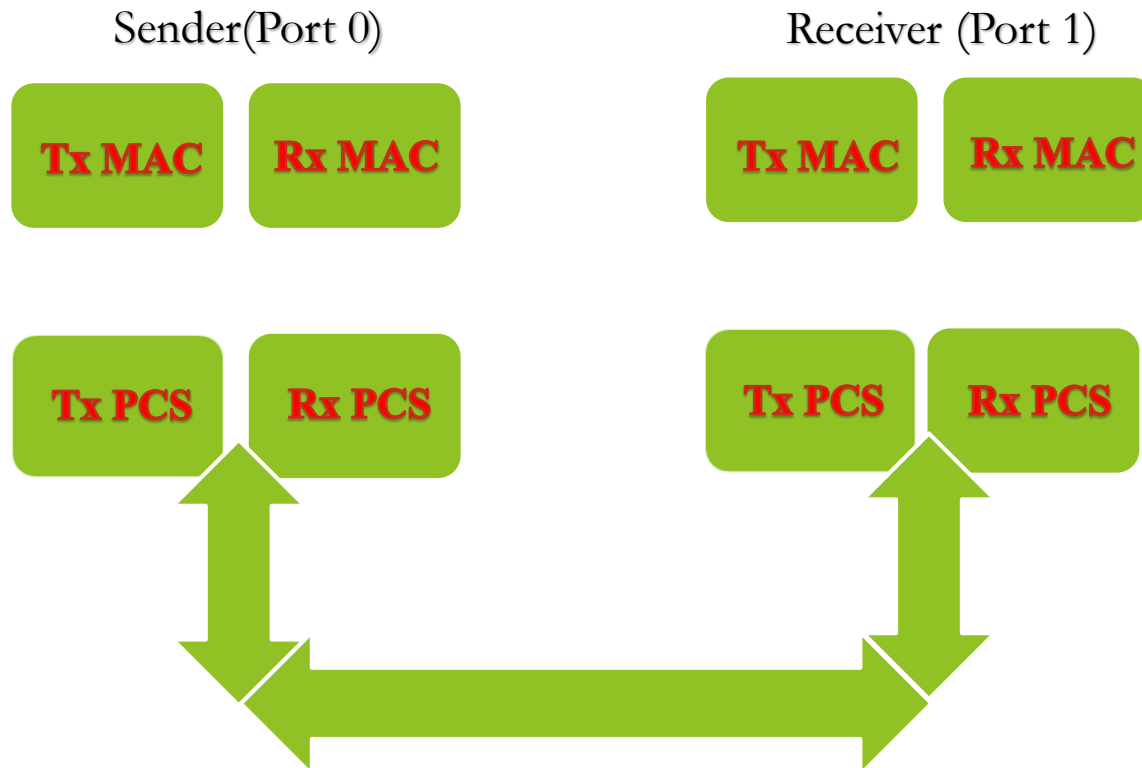


Results

Throughput vs Ethernet Frame Size



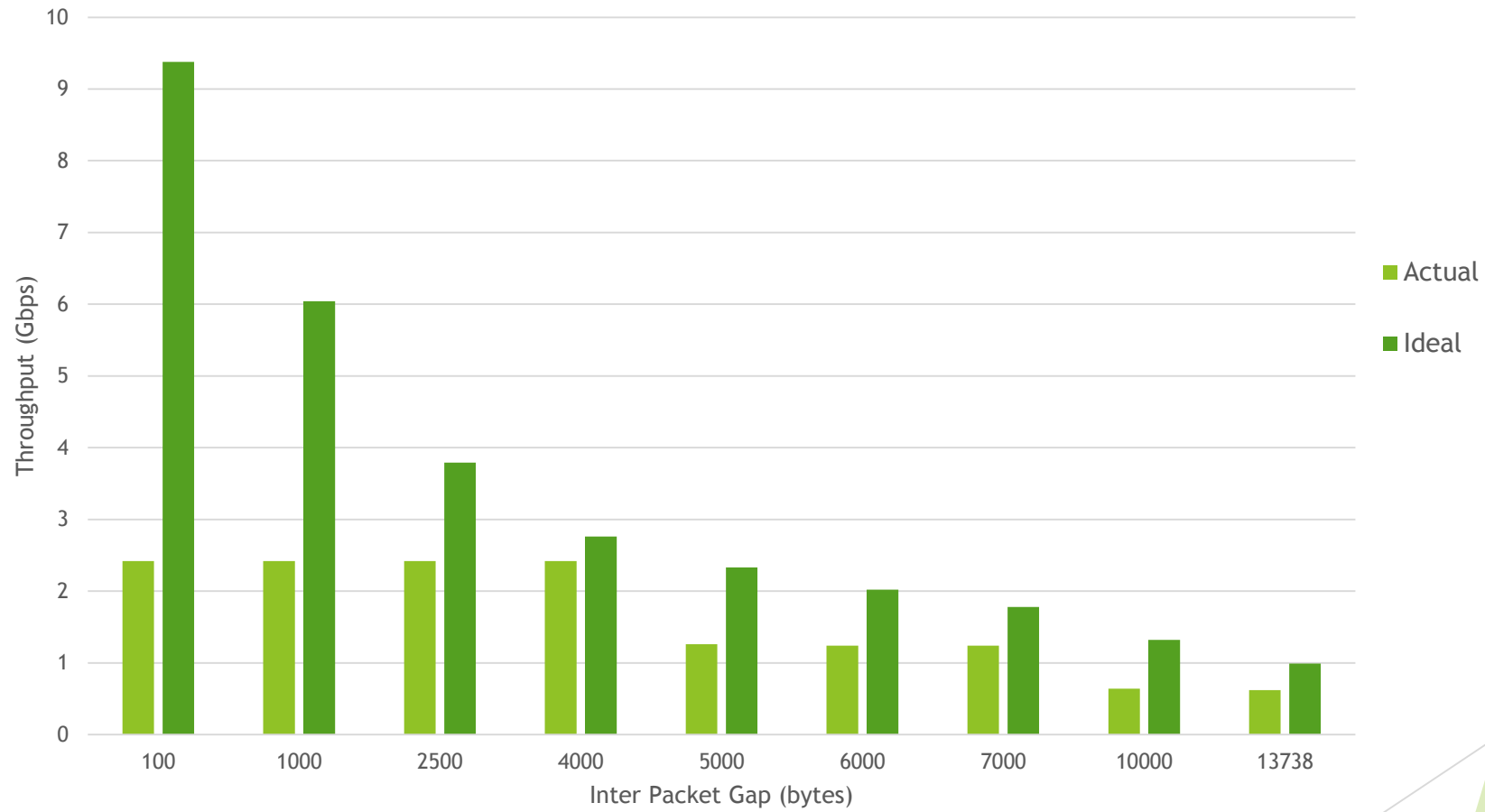
TCP over SoNIC in Kernel Space



- A new mode to spawn 4 TCP handler threads
- For loopback Port 0 is directly connected to Port 1

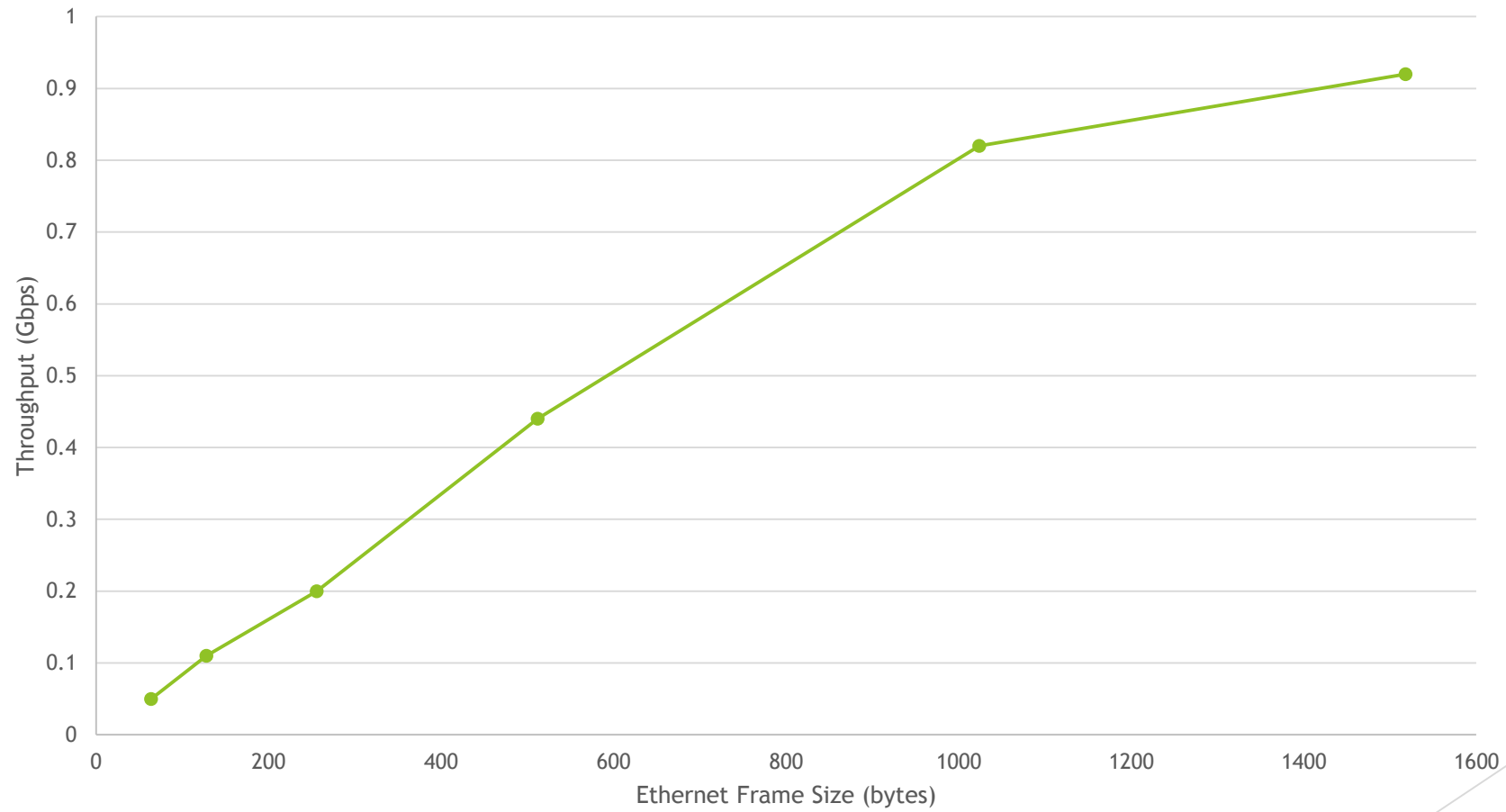
Results

Throughput vs. Inter Packet Gap - loopback



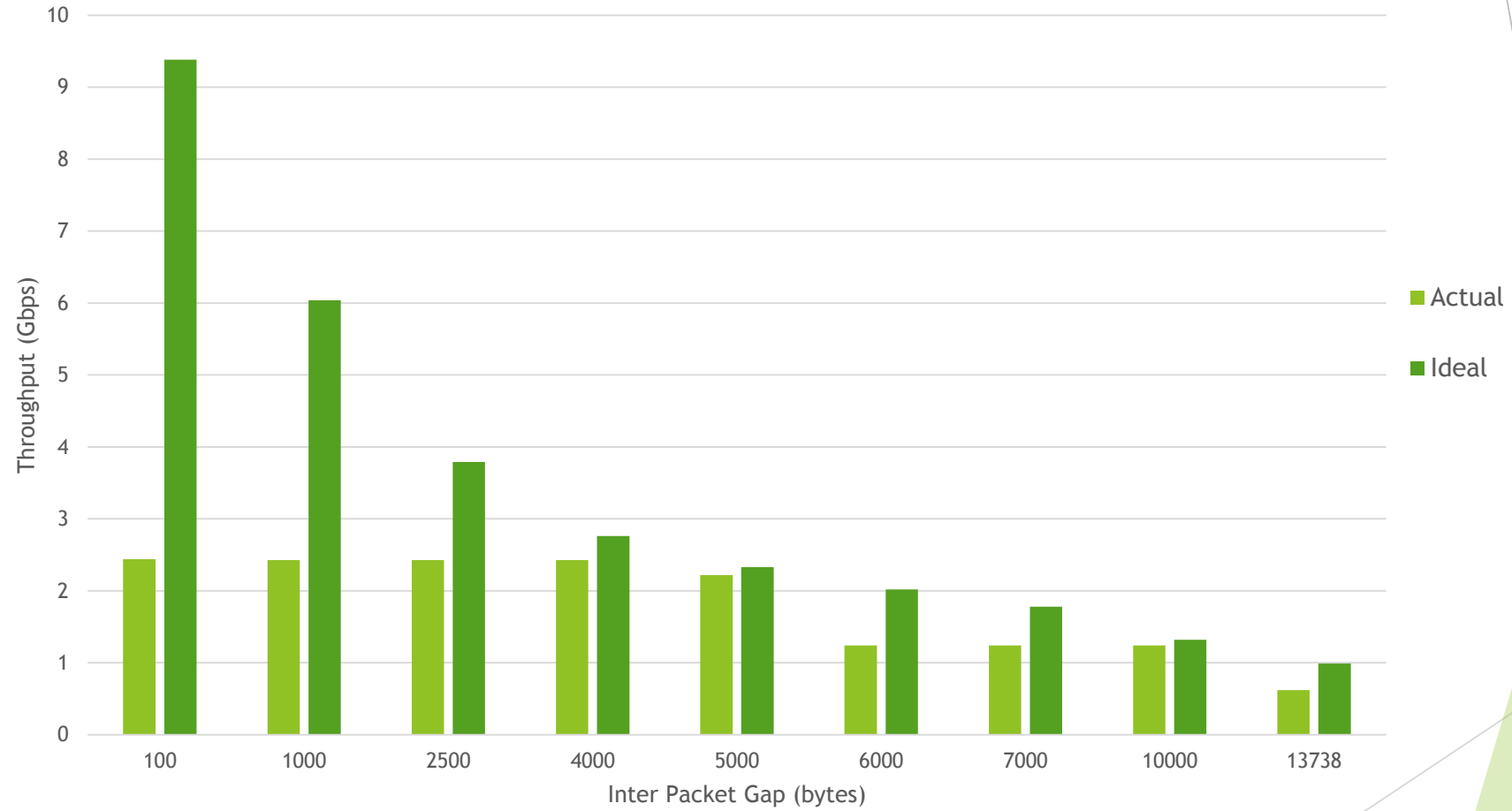
Results

Through vs. Ethernet Frame Size - loopback



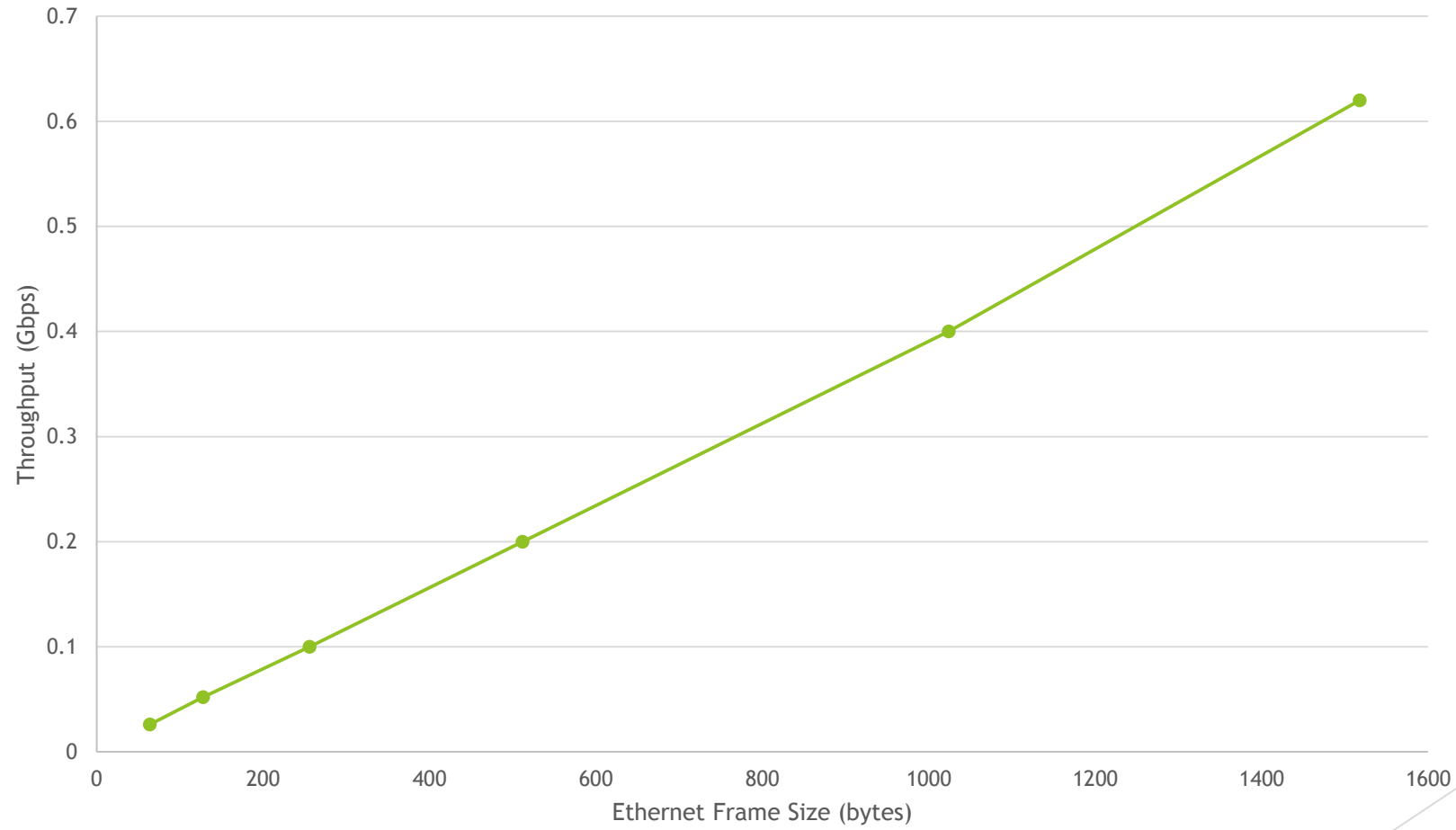
Results

Throughput vs. Inter Packet Gap - Across SoNIC



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/>
- ▶ SoNIC: Precise Real-time Software Access and Control of Wired Networks
http://fireless.cs.cornell.edu/sonic/sonic_nsd2013.pdf
- ▶ PHY Covert Channels: Can you see the Idles?
http://fireless.cs.cornell.edu/publications/chupja_nsd2014.pdf