Workshop in Communication Networks
Exercise 2

Keren Sfez - 342768264
Oz Matlaw - 329603674

Assignment Goal:

The goal of this assignment was to measure the point-to-point (unidirectional) throughput using the Verbs API in a C application. The throughput was measured by sending messages from the client to the server using RDMA WRITE and receiving control messages from the server to the client using IBV_WR_SEND.

Warm-Up Phase:

In our warm-up phase, we conducted 5000 iterations to allow the system to reach a stable state before collecting actual performance measurements. The warm-up phase played a crucial role in ensuring that the system had sufficient time to stabilize, minimizing any transient effects that could impact the accuracy of the measurements. By performing a substantial number of iterations, we provided ample opportunity for the system's resources to be properly allocated, caches to be populated, and adaptive mechanisms to settle into an optimal state. This approach allowed us to obtain more reliable and representative performance measurements during the subsequent data collection phase.

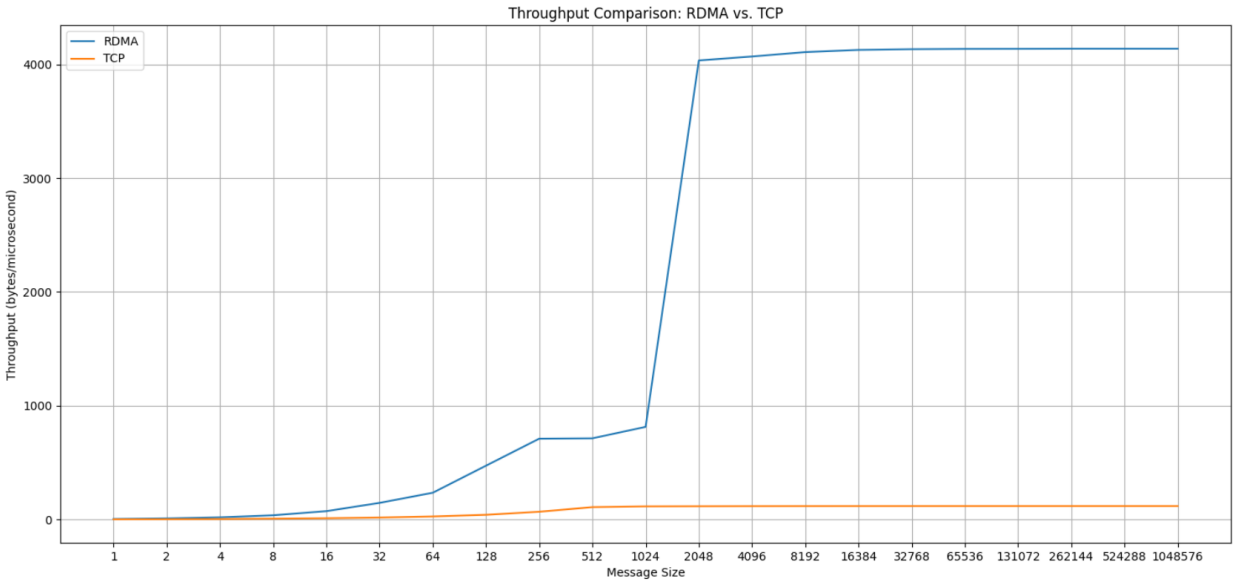
Chosen Parameters:

For the measurements, the following parameters were chosen:

- rx_depth: 6000
- tx_depth: 6000
- Number of iterations in Warm-up phase: 5000
- Number of total iterations: 60000

Results:

1	3.772636	bytes/microseconds
2	9.017810	bytes/microseconds
4	18.170806	bytes/microseconds
8	36.330609	bytes/microseconds
16	72.617247	bytes/microseconds
32	145.355439	bytes/microseconds
64	234.546787	bytes/microseconds
128	472.411884	bytes/microseconds
256	709.829475	bytes/microseconds
512	712.926433	bytes/microseconds
1024	813.764056	bytes/microseconds
2048	4035.467980	bytes/microseconds
4096	4070.289339	bytes/microseconds
8192	4108.874473	bytes/microseconds
16384	4128.078611	bytes/microseconds
32768	4134.389529	bytes/microseconds
65536	4137.069029	bytes/microseconds
131072	4137.682845	bytes/microseconds
262144	4138.684495	bytes/microseconds
524288	4138.662715	bytes/microseconds
1048576	4138.676055	bytes/microseconds



At smaller message sizes (e.g., 1-16 bytes), the throughput is relatively low but starts to increase significantly from 32 bytes onward. This suggests that the overhead associated with smaller message sizes becomes more prominent, impacting the overall throughput.
From 32 bytes to 1024 bytes, the throughput continues to rise steadily. However, beyond 1024 bytes, the rate of improvement slows down, indicating a potential bottleneck or limitation in the system.
Overall, the numbers demonstrate the efficiency of RDMA communication, with higher throughput achieved for larger message sizes, highlighting the advantages of low-latency, high-bandwidth data transfer provided by RDMA technology.

Impact of Other Parameters:

Choosing different parameters, such as varying the depth, warm-up duration, or iterations, could lead to different results. For example, reducing the depth may result in lower throughput due to increased contention and overhead. Shortening the warm-up phase might introduce measurement artifacts and inaccuracies. Adjusting the number of iterations can affect the stability and statistical significance of the results. Careful consideration of these parameters is crucial to ensure accurate measurements.

Improvement from TCP to RDMA:

The comparison between TCP and RDMA throughput measurements highlights the substantial improvement achieved by RDMA over TCP for point-to-point communication. In the case of TCP, the throughput remains relatively low and stable across all message sizes, ranging from 0.770891 bytes/microsecond to 117.229 bytes/microsecond. The low throughput of TCP can be attributed to the overhead and limitations imposed by the TCP protocol, including additional processing, buffering, and congestion control mechanisms.
On the other hand, RDMA demonstrates significantly higher throughput across the entire range of message sizes. Starting from 3.772636 bytes/microsecond for a 1-byte message, the throughput consistently increases as the message size grows. This improvement is attributed to the direct data transfer capabilities of RDMA, which bypasses many of the overheads associated with TCP. As a result, RDMA achieves throughput values ranging from 9.017810 bytes/microsecond to 4138.676055 bytes/microsecond for different message sizes.