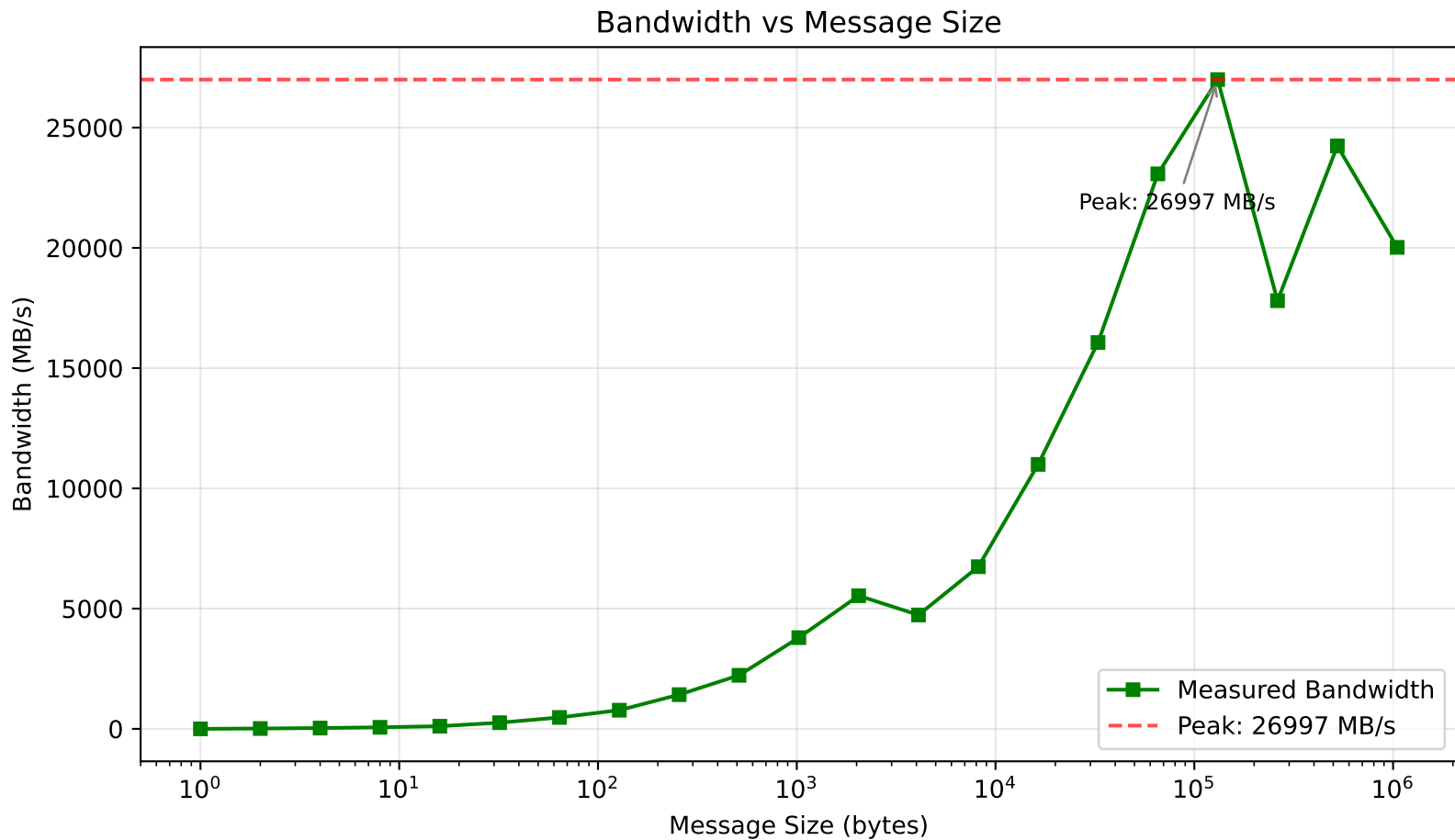
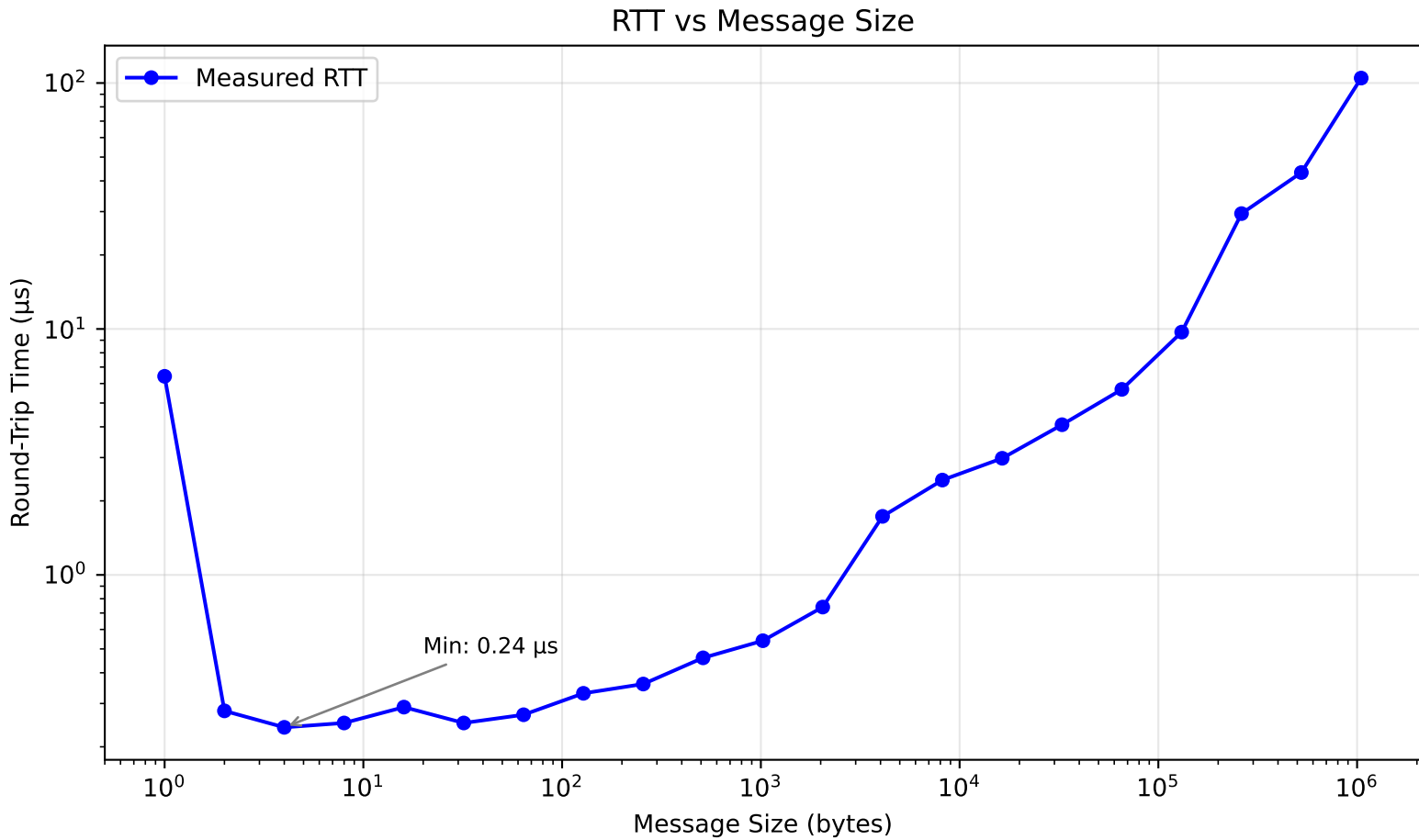


# MPI Ping-Pong Results



## Results Summary

Parameter	Value	Method
Latency ( $\alpha$ )	0.12 $\mu$ s	RTT/2 for small messages
Bandwidth ( $\beta$ )	26997 MB/s	Peak observed throughput
Buffer Size	~1 KB	Send time increase threshold

### How I Got These Numbers:

Latency: For tiny messages (a few bytes), transfer time is negligible—almost all the time is overhead. I took the smallest RTT I measured (0.24  $\mu$ s at 4 bytes) and divided by 2 to get one-way latency: 0.12  $\mu$ s.

Bandwidth: At larger sizes, data transfer dominates. Peak bandwidth was 27 GB/s at 128 KB. This is way too fast for a network—it means the processes were on the same machine using shared memory.

Buffer Size: MPI buffers small messages so Send() returns immediately. I looked for where send times jumped (around 1-2 KB), indicating the switch from buffered to blocking mode.

### Communication Model:

$$T(n) = \alpha + n/\beta$$

Where  $T(n)$  is transfer time for  $n$  bytes,  $\alpha$  is latency,  $\beta$  is bandwidth.  
With my estimates:  $T(n) = 0.12 + n/27000$  ( $\mu$ s)

### Notes:

- The 120 ns latency and 27 GB/s bandwidth confirm shared-memory communication
- First message (1 byte) was slower due to warmup effects
- Bandwidth peaks at 128 KB then drops slightly for larger messages (cache effects)