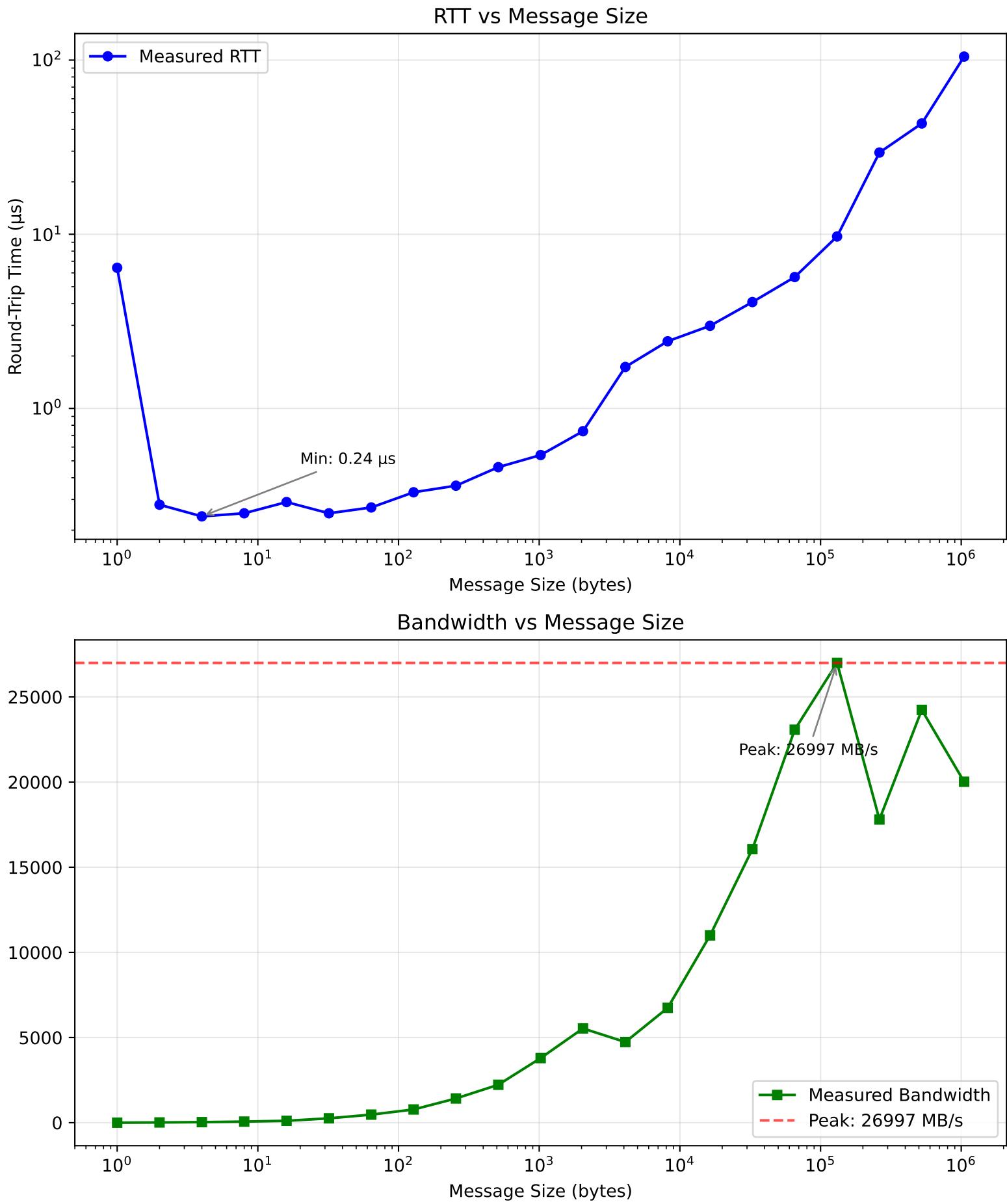


MPI Ping-Pong Results



Results Summary

Parameter	Value	Method
Latency (α)	0.12 μ s	RTT/2 for small messages
Bandwidth (β)	26997 MB/s	Peak observed throughput
Buffer Size	\sim 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 μ s at 4 bytes) and divided by 2 to get one-way latency: 0.12 μ 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, α is latency, β is bandwidth.
With my estimates: $T(n) = 0.12 + n/27000$ (μ 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)