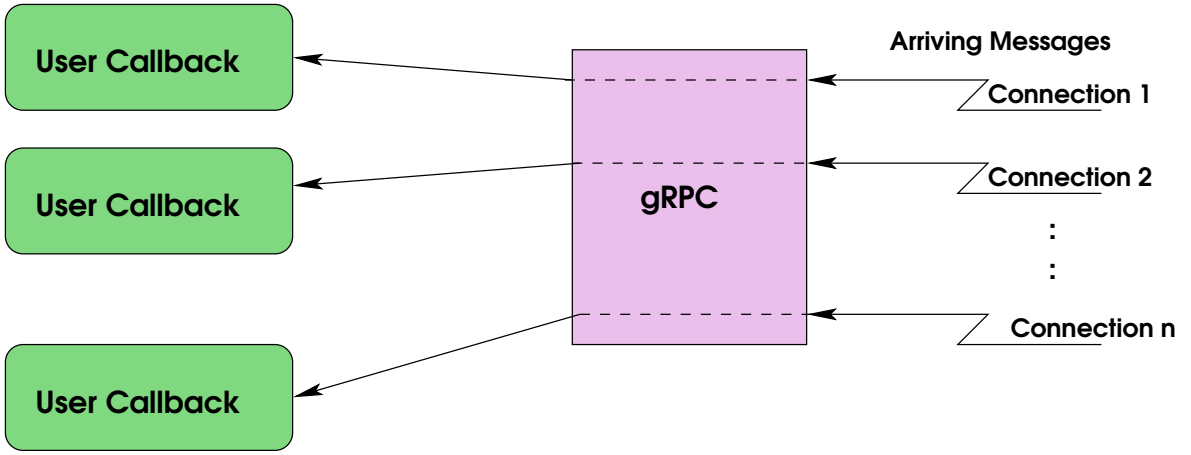
Suitability of gRPC for RMR Communications

24 June 2010

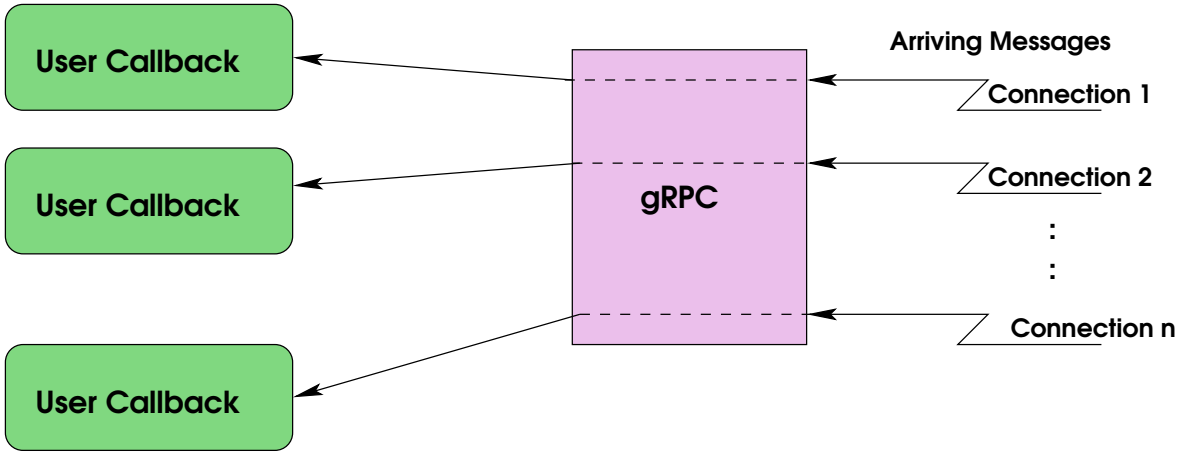
gRPC Functional Overview



Features:

- Callback oriented
- One callback function invoked per connection
- Callbacks can execute concurrently
- Complete messages are passed; no construction at the receiver

gRPC Functional Overview (continued)

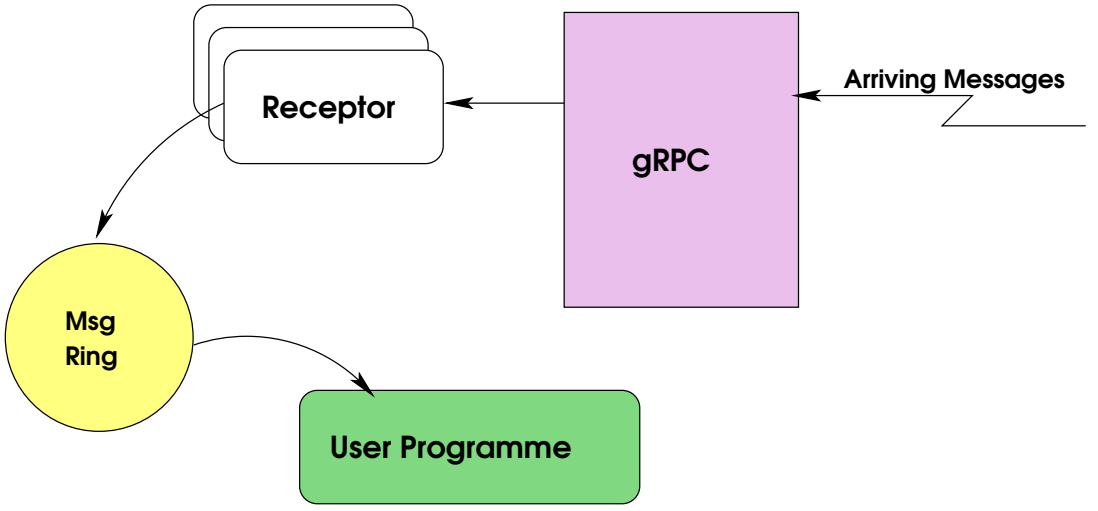


There are 4 *modes* of operation:

- Unary RPC
- Server Streaming
- Client Streaming
- Bidirectional Streaming

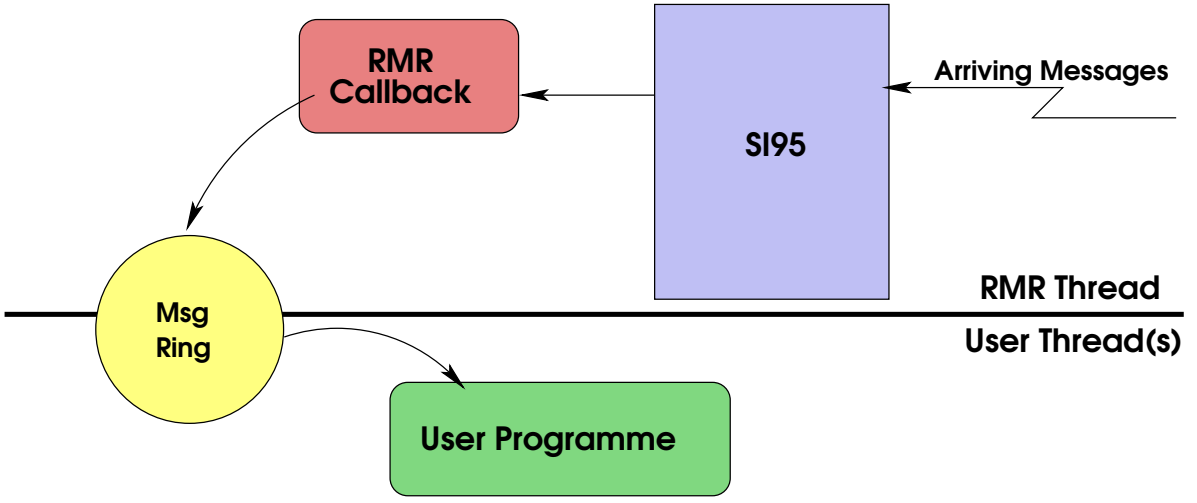
Only **bidirectional streaming** will work.

An RMR-like Setup



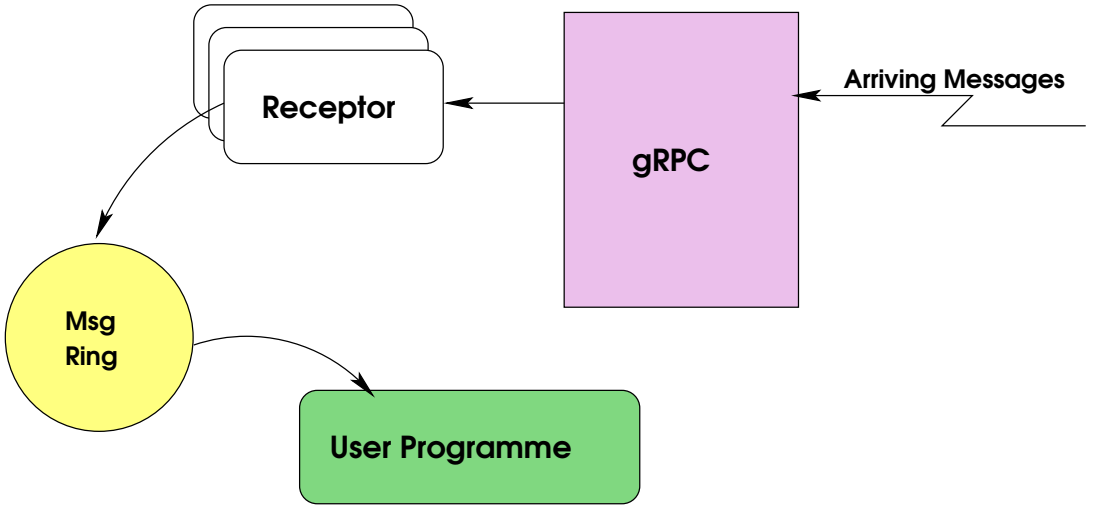
- One service/one callback type: Receptor (white)
- Concurrently executing Receptors; one for each connection
- Single stream for user programme to manage
- Extra buffer copy needed to pass message via ring

RMR/SI95 Comparison



- Single RMR thread; one callback (red)
- Extra copy **NOT** needed to pass message via ring
- Callback must reconstruct large messages

Measurement Point



- Rate and latency measured in the Receptor
- Initial experiments with and without ring insertion
- Single connection/single Receptor

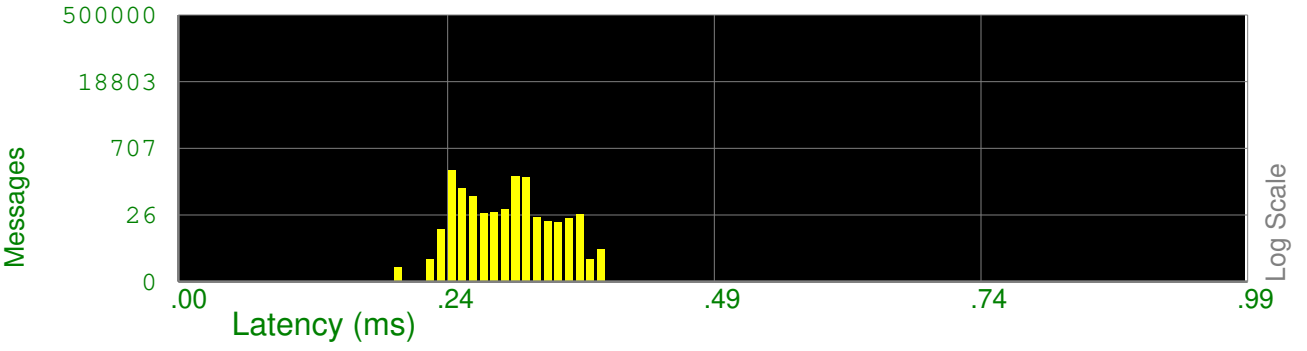
Throughput Results

Transport	Messages	Elapsed	Rate
gRPC	3,000,000	85.4 sec	35K msg/sec
NNG	1,000,000	19.3 sec	52K msg/sec [10]
RMR/NNG	1,000,000	missing	38K msg/sec [10]
RMR/SI95	10,000,000	43.5 sec	230K msg/sec

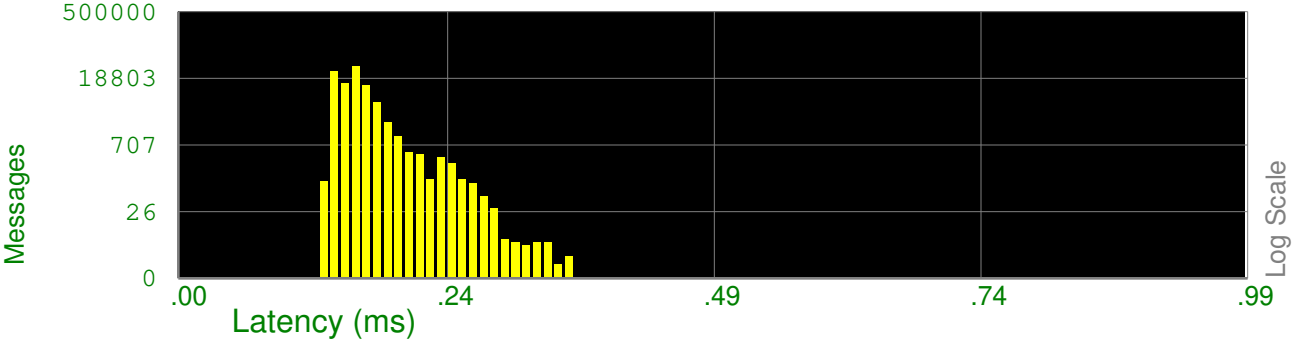
For gRPC:

- Rate for 4K messages averaged about 31K msg/sec
- Rate for 20 byte messages averaged about 41K msg/sec
- MTU varied between 9K and 1500 bytes without affecting the throughput

Latency

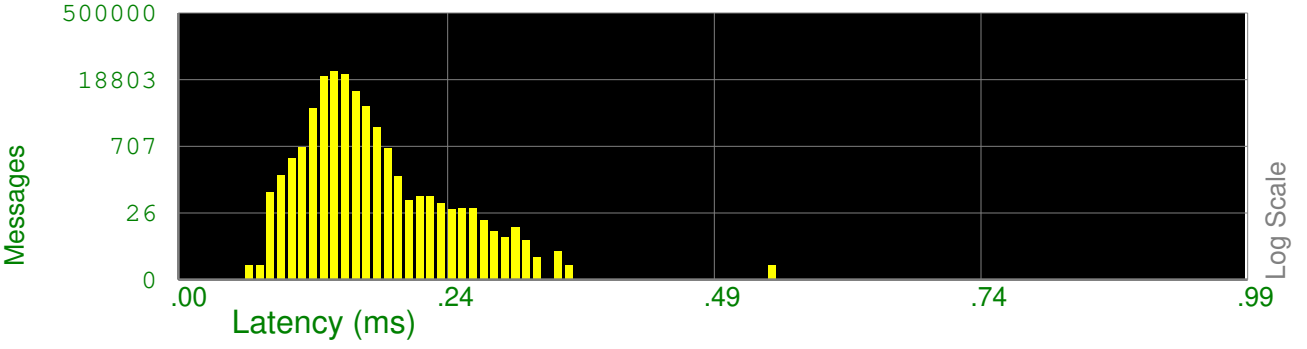


1000 messages at 100 messages/second.

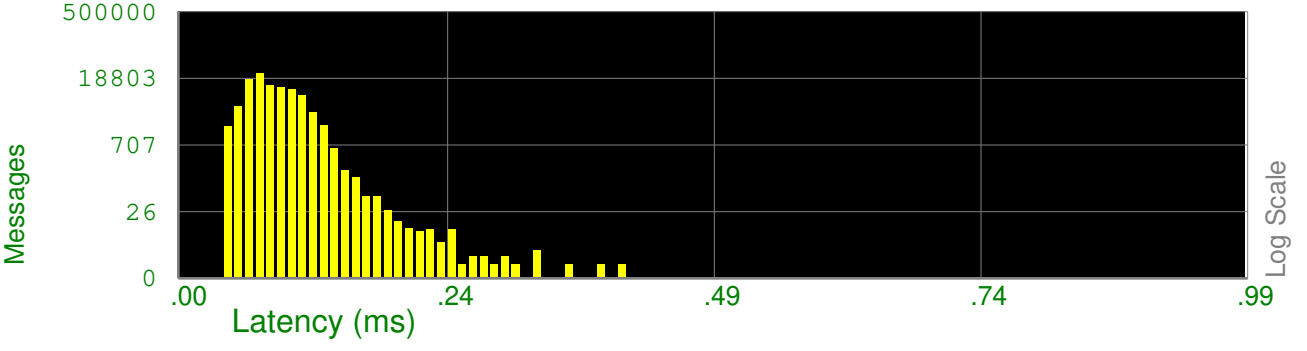


100,000 messages at 850 messages/second.

Latency (continued)

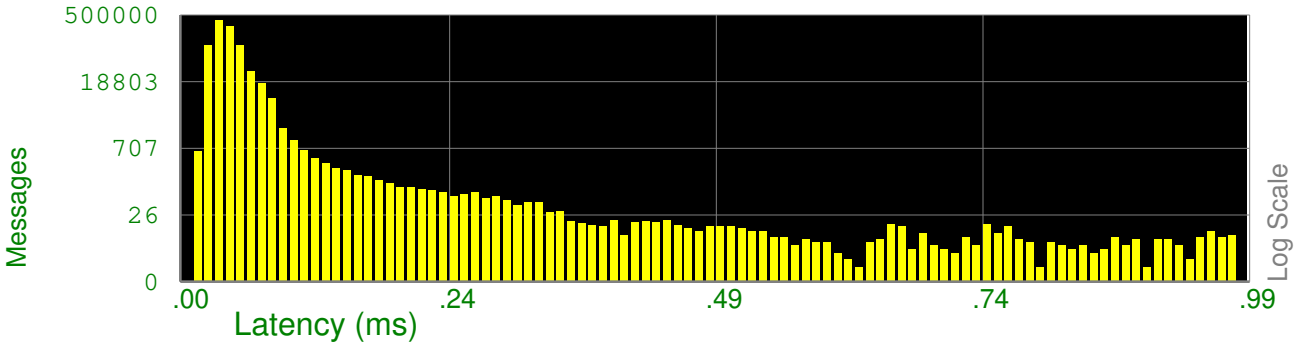


100,000 messages at 4000 messages/second.



100,000 messages at 8500 messages/second.

Latency (continued)

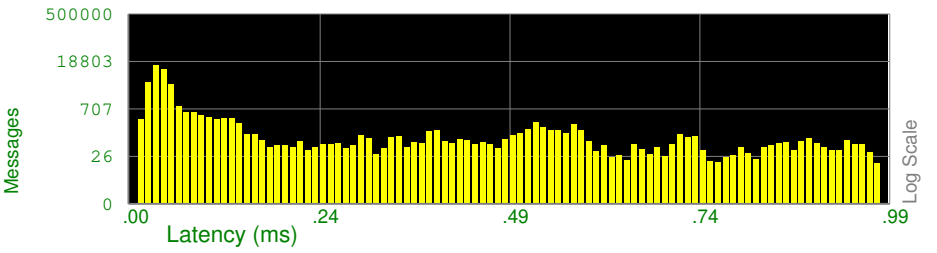


1,000,000 messages at 39K messages/second.

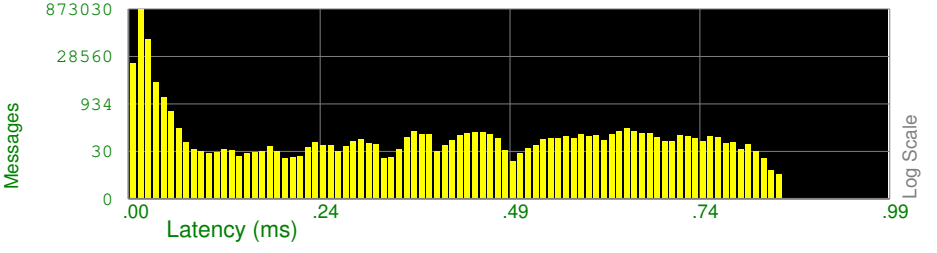
Minimum:	0.03 ms
Maximum:	>1.0 ms
50th percentile:	0.05 ms
95th percentile:	0.09 ms
99th percentile:	>1.0 ms

RMR Latency; A Quick Comparison

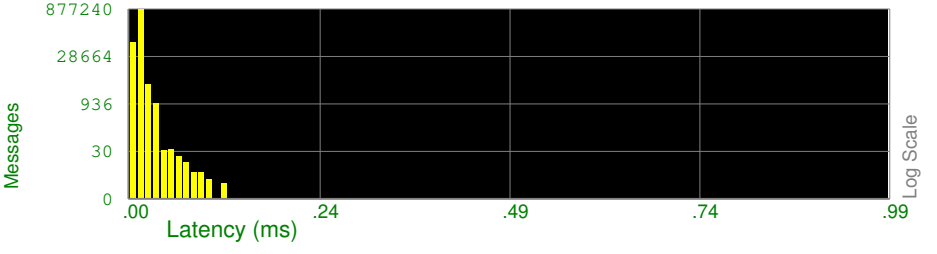
Rcv Rate: ~300K msg/sec
Nagle's: ON
Pinned: Neither
99.5/99.9: >1.0ms



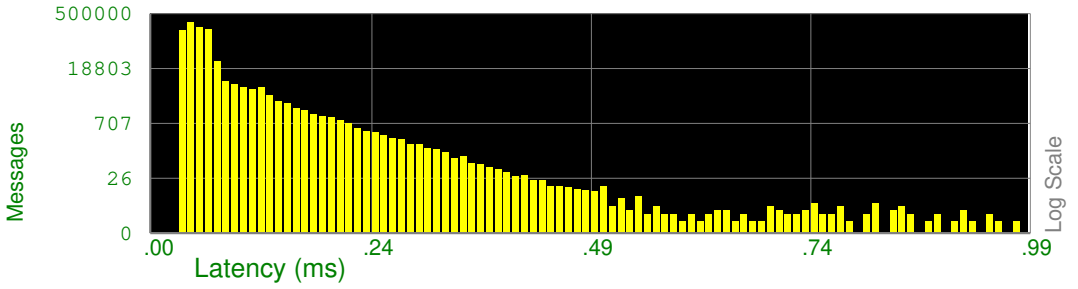
Rcv Rate: ~112K msg/sec
Nagle's: OFF
Pinned: Neither
99.5/99.9: 0.07 / 0.69 ms



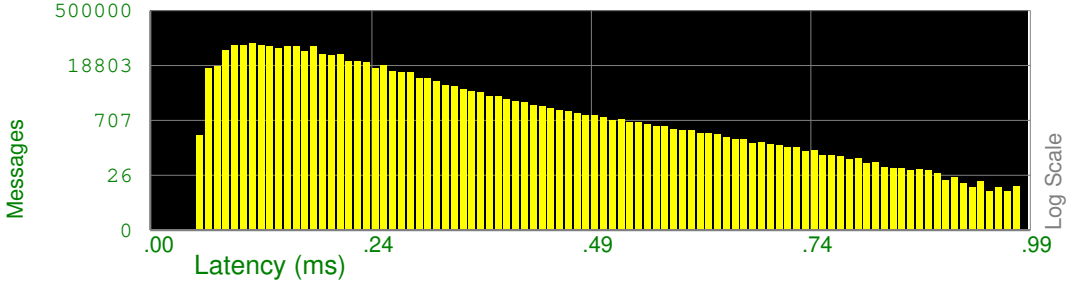
Rcv Rate: ~136K msg/sec
Nagle's: OFF
Pinned: Receiver
99.9: 0.04 ms



Pinning gRPC Processes



Unpinned gRPC Receiver



Pinned gRPC Receiver

- Reduced 99th percentile latency from 0.87ms to 0.52ms
- Did not eliminate the tail

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