MultiRead Operations in RAMCloud
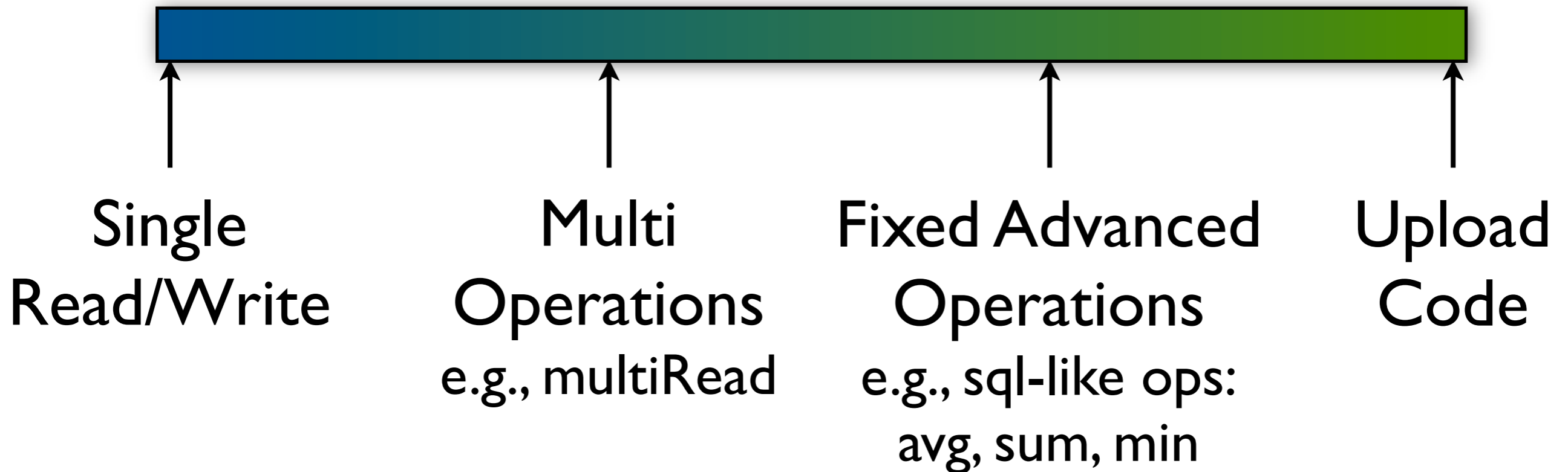
Ankita Kejriwal

The Big Question
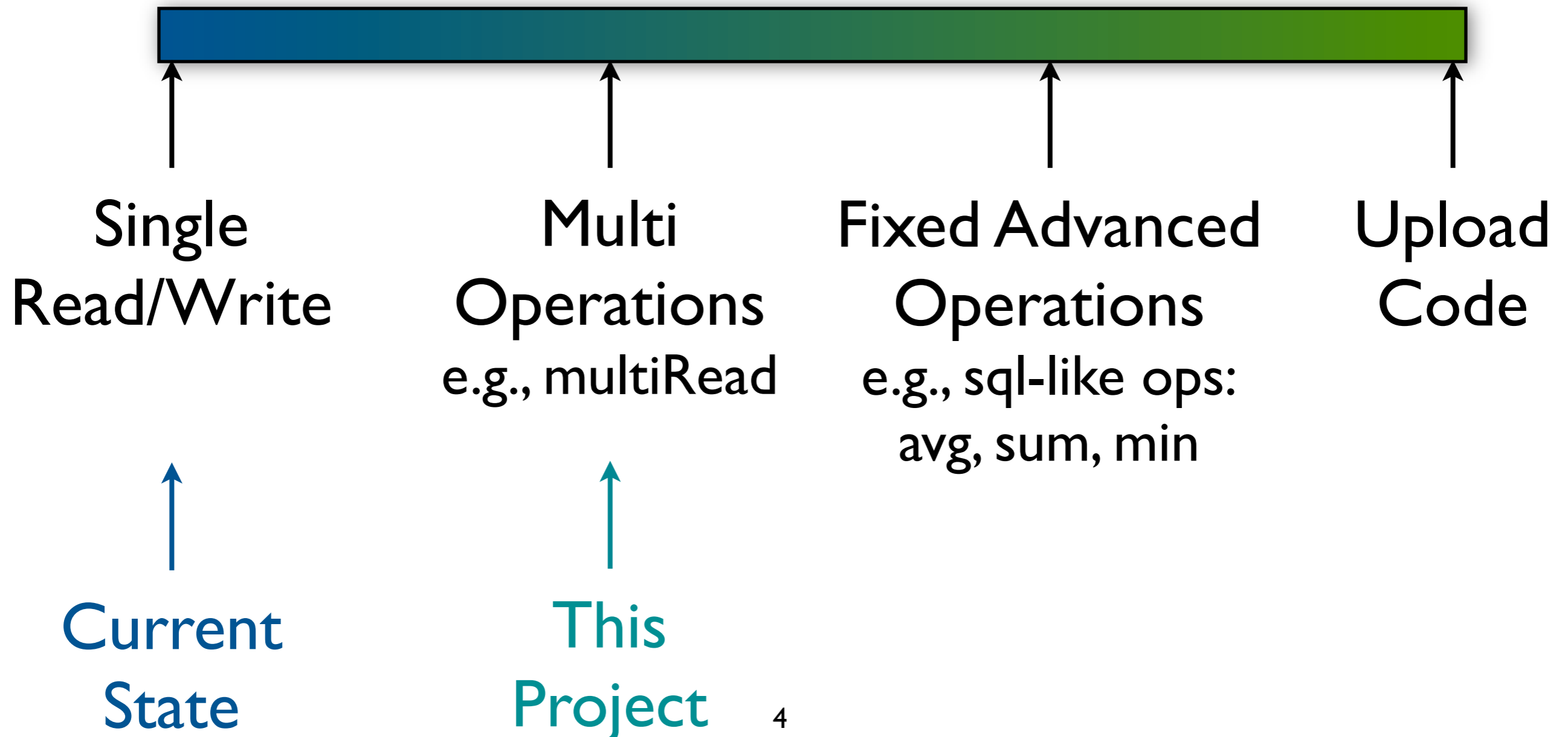
What is the ideal distribution of work between the client and the server?

Single
Read/Write

Multi
Operations
e.g., multiRead

Fixed Advanced
Operations
e.g., sql-like ops:
avg, sum, min

Upload
Code

Design Considerations

- Low level operations (Read-Write):

  - Arbitrary computations are possible

  - Simplifies server implementation

- Higher level operations:

  - Fewer RPCs exchanged => lower latency

  - Less network bandwidth

- Issues with higher level operations:

  - Need data locality

  - Potential security implications (with uploading code)

The Big Question

Single
Read/Write

Multi
Operations
e.g., multiRead

Fixed Advanced
Operations
e.g., sql-like ops:
avg, sum, min

Upload
Code

Current
State

This
Project

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Motivation

- Batch multiple requests to a single master in one multiRead RPC

- Parallelize requests to multiple masters

multiRead API

Array of
{table Id, object Id}
for each object
to be read

→ multiRead →

For each object:
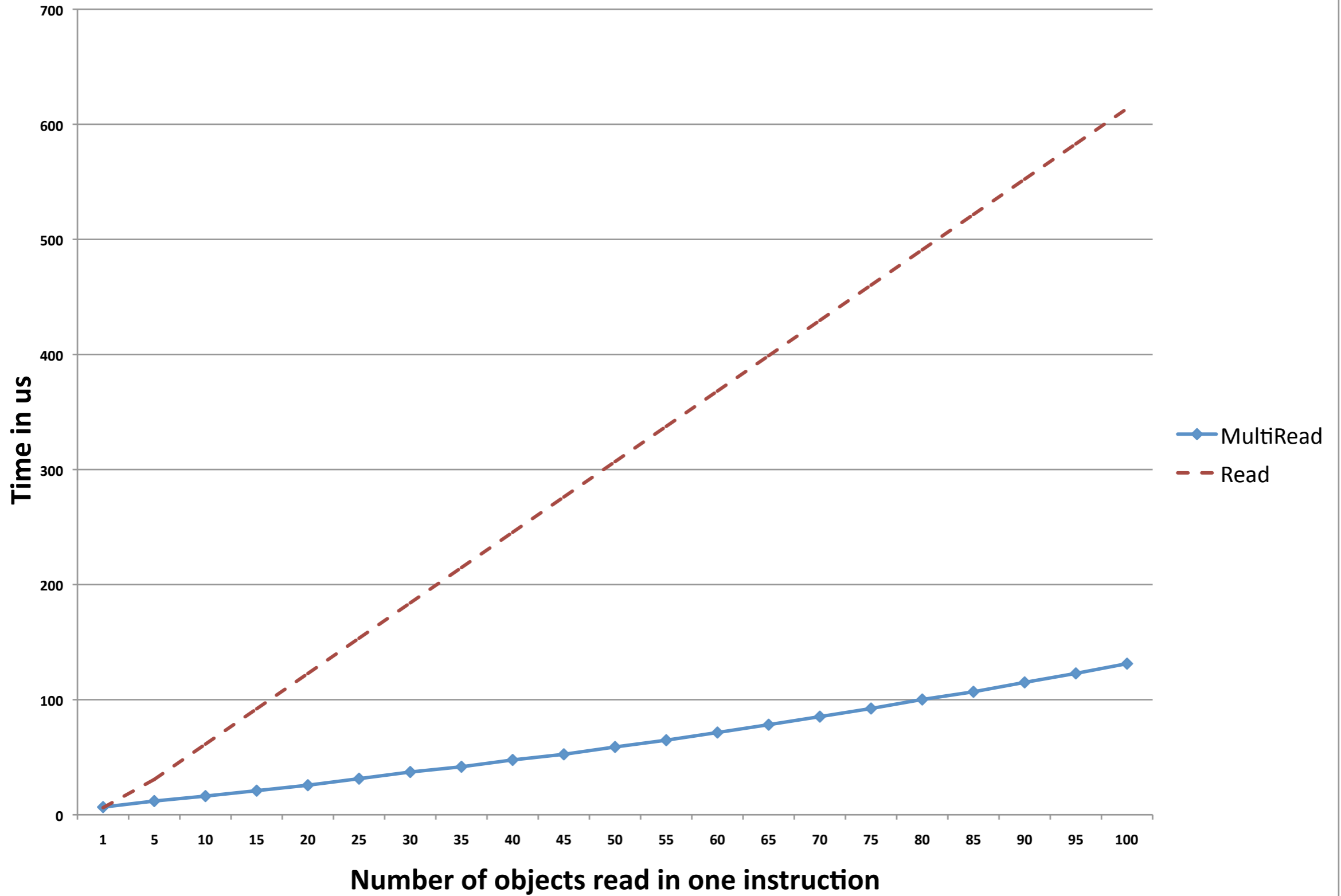{value, version,
status}

Interesting Issues in Implementation

- Error handling

  - Individual read requests can fail

- RPC Packet Overflow

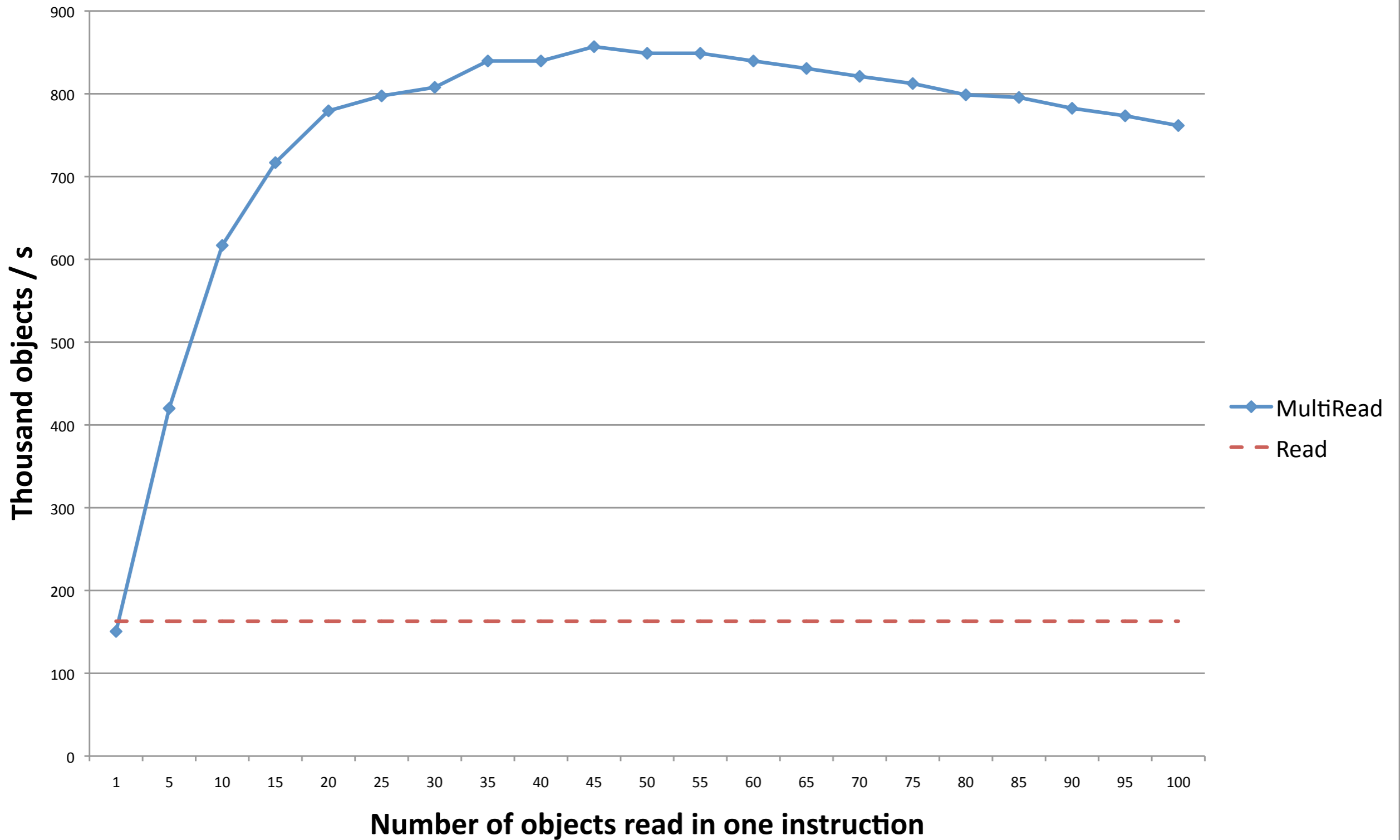 - Possible Solution: Client sends another request for remaining objects

Benchmarking

- multiRead and read

- multiple 100B objects

- random object Ids

- one table, one master

Latency - Multiple Objects on 1 Master

Time in us (y-axis): 0, 100, 200, 300, 400, 500, 600, 700

Number of objects read in one instruction (x-axis): 1, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100
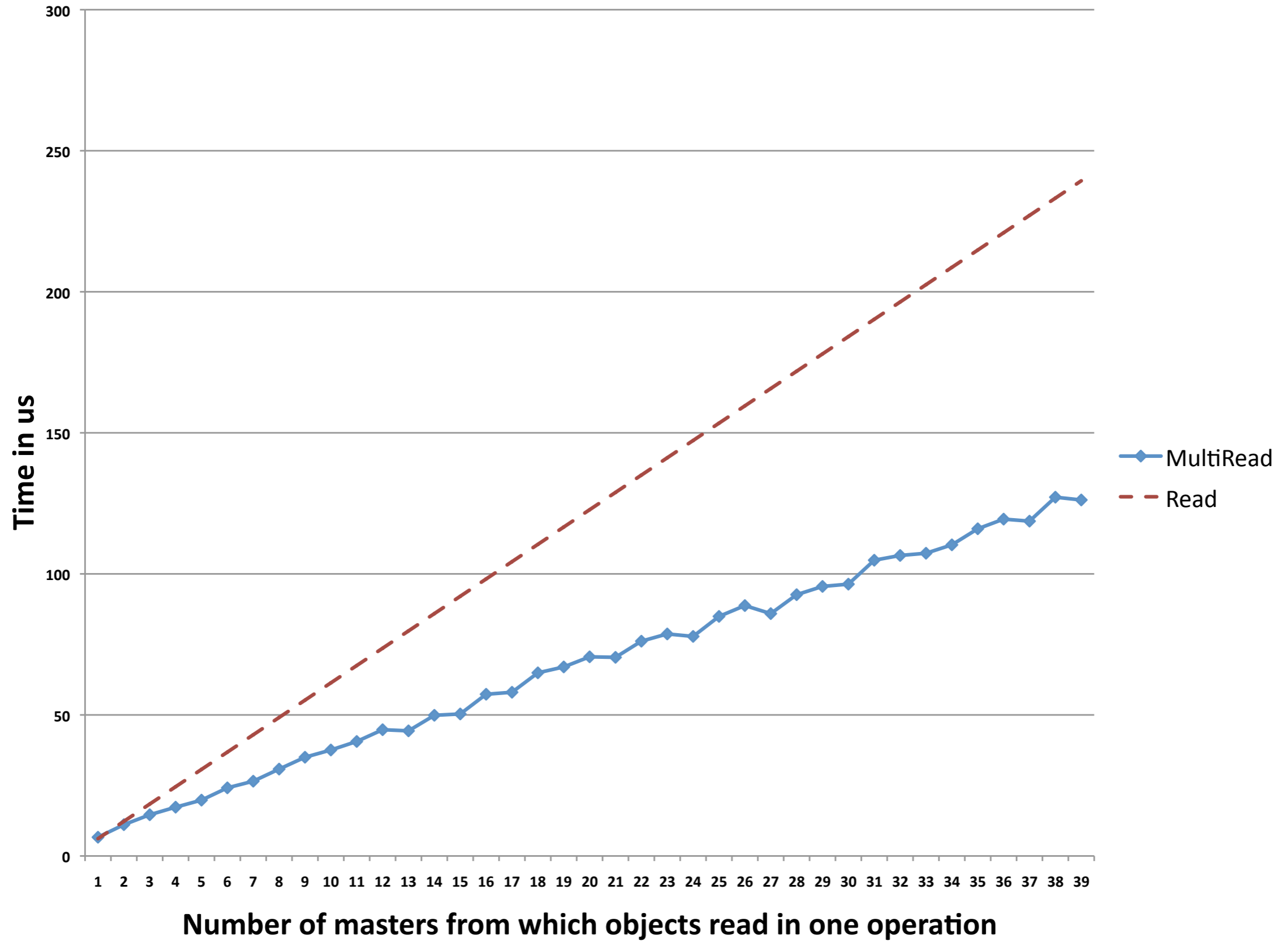
Legend: MultiRead, Read
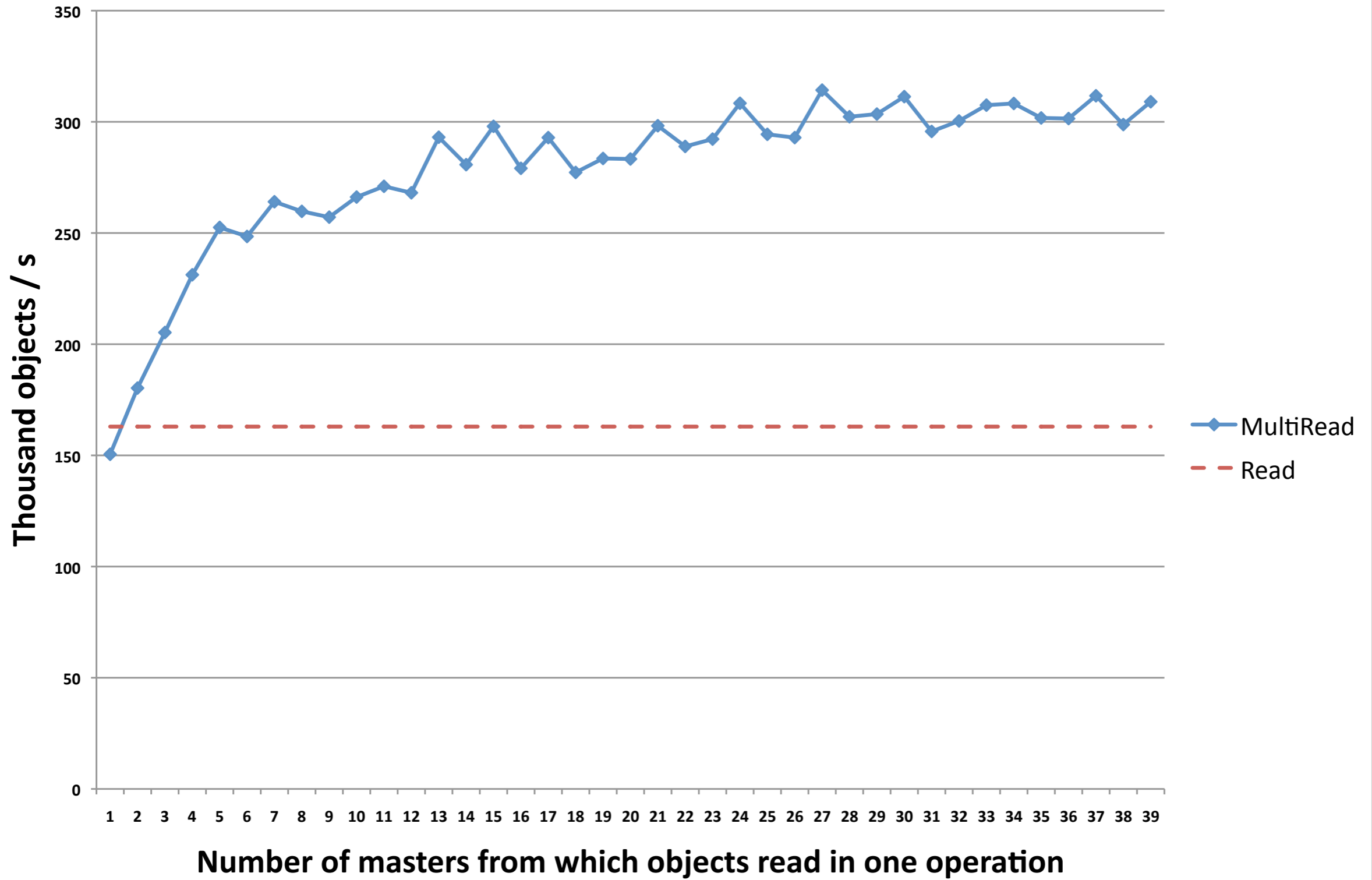
Throughput - Multiple Objects on 1 Master

Benchmarking

- multiRead and read

- multiple tables, multiple masters

- one 100B object on each master

Latency - 1 Object on each Master

Throughput - 1 Object on each Master

Summary & Future Work

- Summary:

    - Batched requests to 1 server: up to 5.2x speedup over read

    - Parallel requests to multiple servers: up to 1.9x speedup over read

- Future Work:

    - MultiRead - Understanding what limits performance and whether it can be improved; RPC Overflow; More benchmarks; Optimizations

    - Design, Implementation and Benchmarking of MultiWrite and other advanced operations

Questions?