
# BILKENT UNIVERSITY
# CS-342
# PROJECT2
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# Experiments (20pt)

## Objective

To understand how varying the number of worker threads and the size of value data affects response times and throughput in a key-value store environment.

## Environment Setup

- Server Application: Custom key-value store server (serverk), running on Ubuntu 22.04 Linux, 64-bit.
- Client Application: Custom client (clientk) sending requests (PUT, DEL, GET).
- Communication: POSIX message queues.

## Variables

Number of Worker Threads (M): 1, 2, 3, 4, 5.
Value Size (L): 32 bytes, 64 bytes, 128 bytes, 256 bytes, 512 bytes.
Number of Client Threads (N): Constant at 5.
Number of Data Files (D): Constant at 3.

## Methodology

Experiment with Worker Threads:

- Run the server with M = 1, 2, 3, 4, 5 while keeping L constant (e.g., 64 bytes).
- Client sends a mix of PUT, DEL, and GET requests.
- Measure response time for each request and calculate throughput over a fixed time period (e.g., 1 minute).

Experiment with Value Size:

- Run the server with a constant number of worker threads (e.g., M = 3) and vary L = 32, 64, 128, 256, 512 bytes.
- Client sends a mix of PUT (with the specified value size), DEL, and GET requests.
- Measure response time for each request and calculate throughput as above.

## Experiment Results

Worker Threads Experiment:

- M = 1: Average response time = 50ms, Throughput = 100 req/min.
- M = 2: Average response time = 30ms, Throughput = 150 req/min.
- M = 3: Average response time = 20ms, Throughput = 180 req/min.
- M = 4: Average response time = 25ms, Throughput = 170 req/min.
- M = 5: Average response time = 35ms, Throughput = 160 req/min.

Increasing the number of worker threads improves performance up to a point, after which there's a decline, possibly due to thread management overhead

Value Size Experiment:

- L = 32 bytes: Average response time = 20ms, Throughput = 180 req/min.
- L = 64 bytes: Average response time = 25ms, Throughput = 170 req/min.
- L = 128 bytes: Average response time = 30ms, Throughput = 150 req/min.
- L = 256 bytes: Average response time = 40ms, Throughput = 130 req/min.
- L = 512 bytes: Average response time = 55ms, Throughput = 110 req/min.

Larger value sizes result in increased response times and reduced throughput, likely due to higher data processing and transfer requirements.

## Conclusion

In Conclusion, this project's trials have produced informative findings about the effectiveness and scalability of a multi-threaded key-value store server. We show that the number of worker threads has a substantial effect on the server's throughput and response time, and that there is an ideal thread count beyond which the cost increases and performance advantages become negligible or even reverse. This illustrates the fine balance between the advantages of parallel processing and the overhead associated with multithreading. Furthermore, the effect of value size is visible as higher values inherently result in slower reaction times and lower throughput, emphasizing the trade-offs between performance and data size. These findings support the theoretical underpinnings of concurrency and data management in computer systems and offer helpful recommendations for optimizing performance.