Auto Scaling of Key Value stores

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Outline

1. Abstract
2. Introduction
3. Experiments
4. Current Picture
5. Further works

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- Collect statistics for different queries on different scaling configurations and try to find possible bottlenecks in the system.
- Providing an auto-scaling solution for key value stores.

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- Mostly In-memory - extremely fast compared to traditional DBs.

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- Several load balancing schemes are used in horizontal scaling.

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- Why AutoScaling?
  - To prevent overprovisioning.

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- Master-slave asynchronous replication.
- Transaction, expiration time (BigTable).

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- After cluster meet, every node contains node - hash slot mapping.

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- Same basic mechanism can be used in order to rebalance the cluster, add or remove nodes.
- Moving hash slots through Cluster Bus.
- No down time - with the help of MOVED Error.

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- On receiving a request:
    - Return the value if serves that hash slot.
    - MOVED error, if not served.
- MOVED error response also contain IP:PORT of node serving that hash slot.
- Still is an overhead.

Partitioning

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- Examples: Jedis, Twemproxy, Redis Cluster.

Twemproxy

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- Stats monitoring port.

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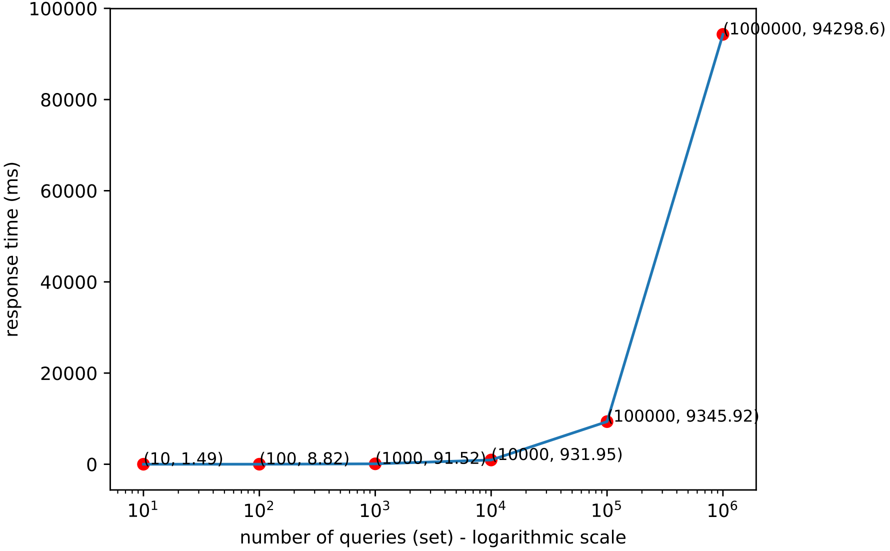
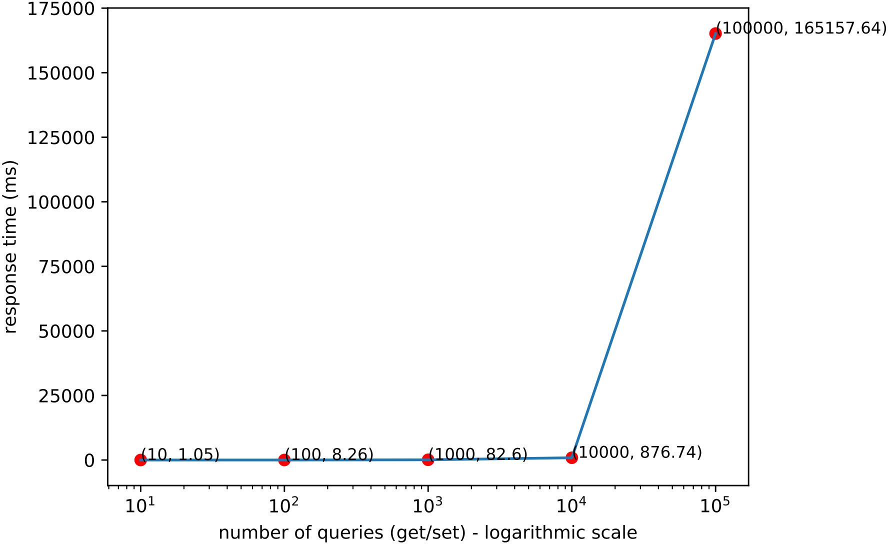
- Tests based on get/set commands.
- Resource limitation enforced using Docker.

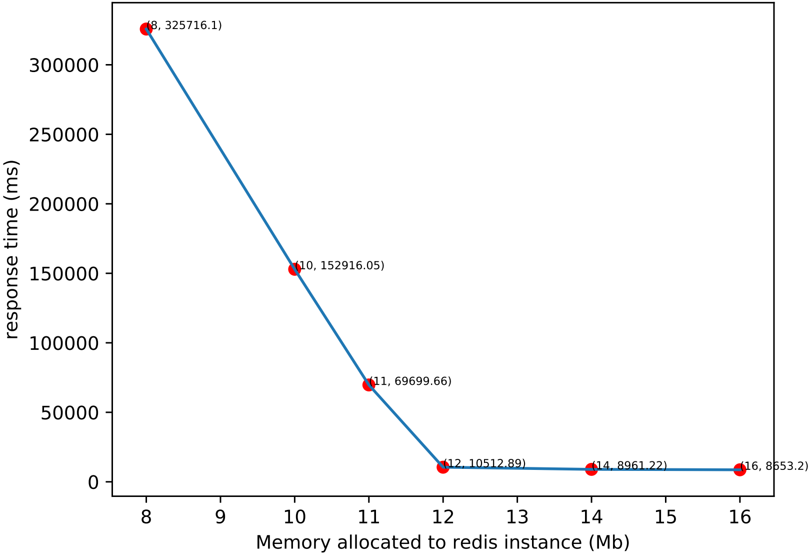
Single redis instance, with no memory/cpu restriction

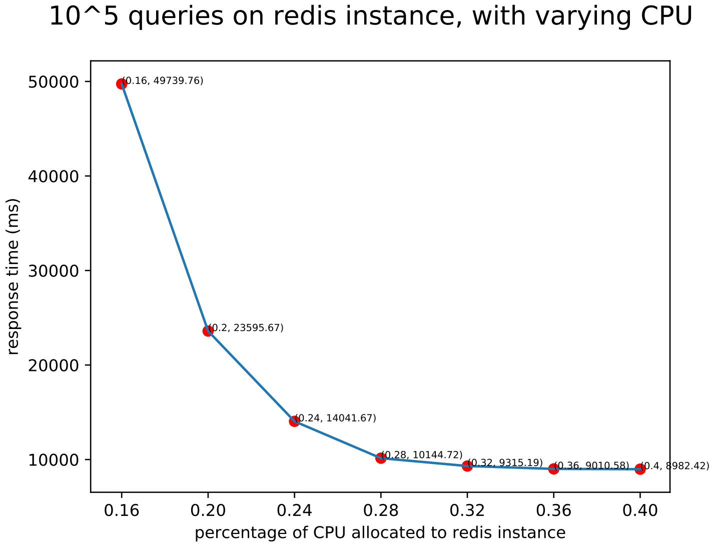


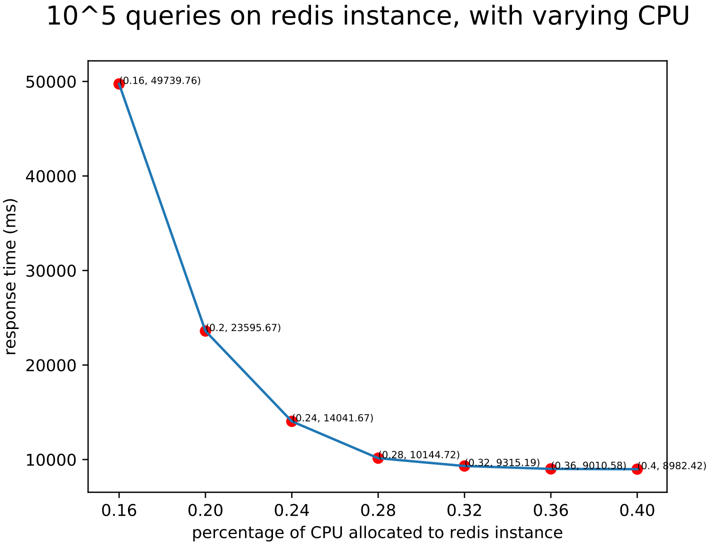
Single redis instance, with max main memory = 10Mb



10^5 queries on redis instance, with varying main memory

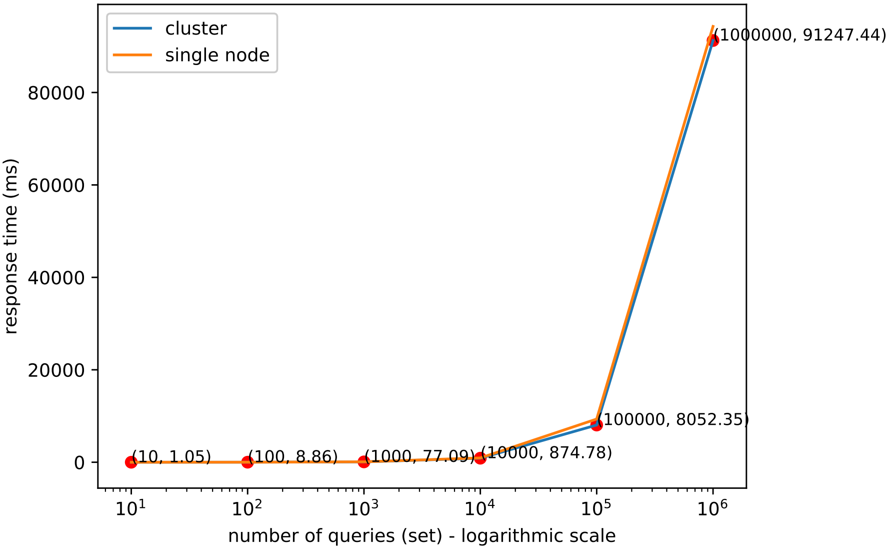



10^5 queries on redis instance, with varying CPU
response time (ms)
50000
40000
30000
20000
10000
0.16
0.20
0.24
0.28
0.32
0.36
0.40
percentage of CPU allocated to redis instance
(0.16, 49739.76)
(0.2, 23595.67)
(0.24, 14041.67)
(0.28, 10144.72)
(0.32, 9315.19)
(0.36, 9010.58)
(0.4, 8982.42)

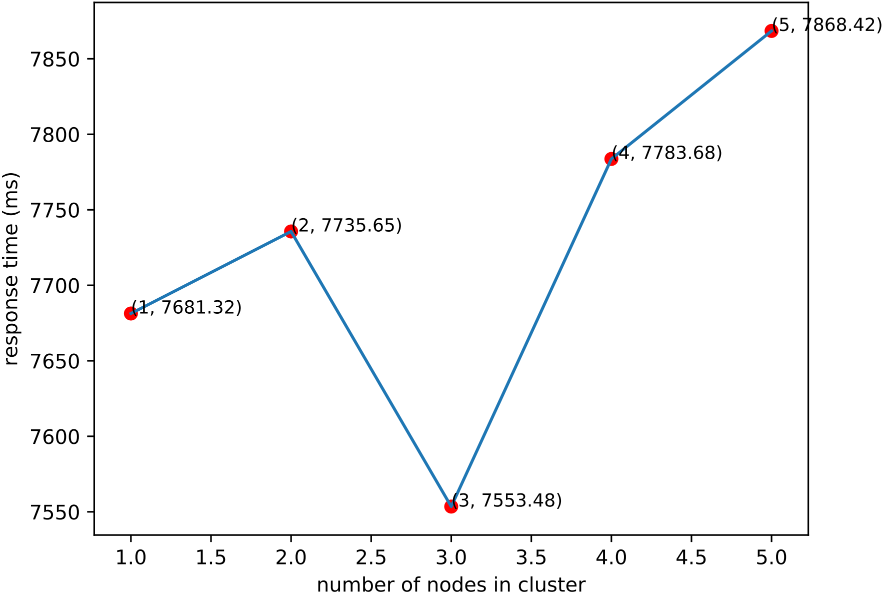


- fractional CPUs?

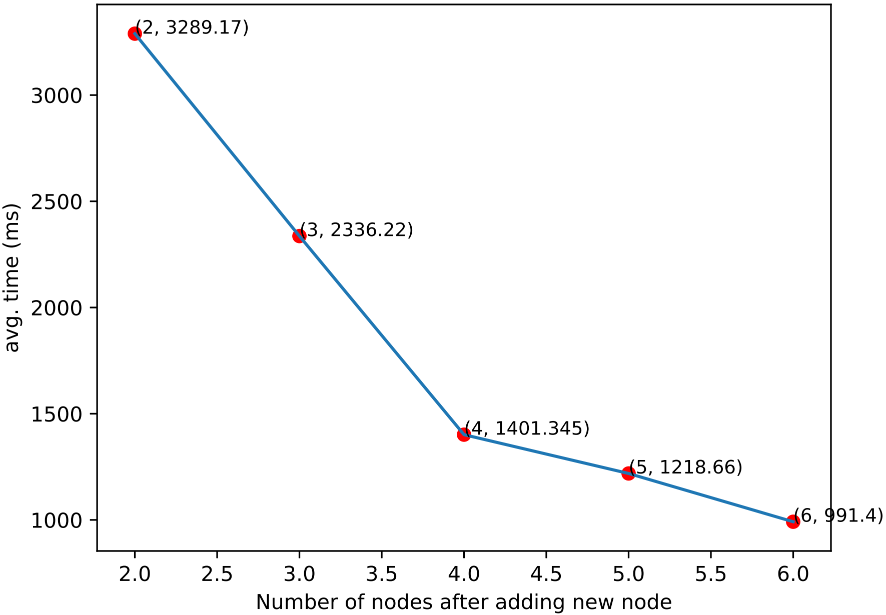
Single redis instance, compared with 6 Node cluster



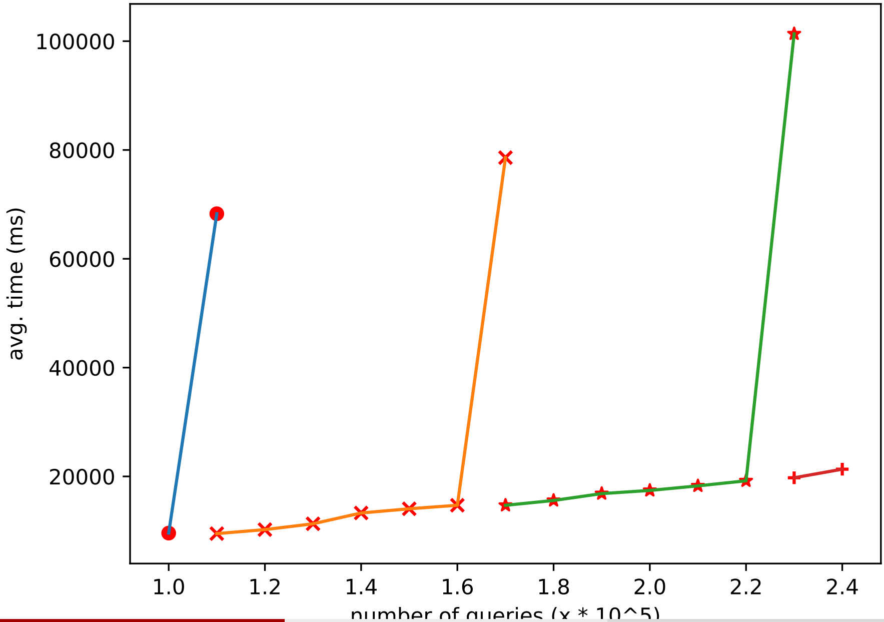
10^5 queries on different node configurations



10^5 keys present, setup time for adding new node



Varying queries and number of nodes



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- Features used: startup time, resource utilization factor, etc.

Static metric based approach

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  - Elapsed time since last instance launched >= provisioning_interval
- Single Instance Binding Autoscaler.
  - Multiple requests to autoscale triggered by the same unschedulable pod may be invoked.

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- Precise performance models can be automatically learned for distributed stream processing systems that can predict the execution performance of a job even before deployment.
- These models can be used to optimally schedule logically specified jobs onto available physical hardware.
- These models and the derived execution schedules can be refined online to dynamically adapt to unpredictable changes in the runtime environment or auto-scale with variations in job load.

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- Add a service on top of Twemproxy to apply scaling logic (based on statistics received from Twem).
- Test some state of the art machine learning algorithms like Meta learning, Siamese nets, etc.

Thank You!