MongoDB I/O Access Patterns are under the Microscope
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I. Context

- MongoDB is a document-based NoSQL database
- NoSQL databases store semi-structured and/or unstructured data
- We need to create indexes to optimize querying data
- Based on certain industry reports, MongoDB takes unjustified time to create indexes over a pre-stored data
- Benchmarks report high-level results in general, they also use synthetic data (≠ in-production data)

II. Objectives

- Investigation on creating indexes by MongoDB
- Introducing new experimental methods that could go beyond benchmarking high-level results

III. Experimental settings

- A data set of 20 million doc. is created; about 71 GB
- Experiments are performed on Grid’5000 testbed
- Ubuntu 14.04, Linux 4.9.13
- Tests are performed on one HDD per machine
- MongoDB V3.4, replicas are disabled, hash sharding, sharding on _id,
- MongoDB storage engine (WT) stores each collection on a separate file

IV. Performance results

- It is a recent dynamic tracing technique in Linux
- It could connect to all Linux data sources
- Very negligible overhead (4 ns per syscall)
- Fits with systems in production

An eBPF tool is built to evaluate the I/O access patterns:

- A generic tool, could be used by other systems
- It traces all I/O requests
- It reports offsets, request latencies & data size
- Its results could be filtered by accessed files

V. extended Berkeley Packet Filter (eBPF)

VI. I/O access patterns using eBPF

- A performance study on MongoDB I/O access pattern is done
- A generic eBPF tool for testing I/O access patterns is developed
- A new experimental method to go beyond benchmarking results is introduced

VII. Conclusion

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