Consistency in the Cloud II

Consistency v. Latency in Geo-Replicated Systems

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Paper 1: Li et al.

Title

Source

Authors

Date

Overview

Theorem

Every finite distributive lattice can be embedded in a boolean lattice.

Overview

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Theorem

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Proof.

Use join-irreducible elements. □

Example 2

Example 2

- a local maximum, or

Example 2

- a local maximum, or
- a local minimum, or

Example 2

- a local maximum, or
- a local minimum, or
- an inflection point.

Paper 2: Lloyd et al.

Stronger Semantics for Low-Latency Geo-Replicated Storage

Proceedings of the 10th USENIX Symposium on Networked Systems Design and Implementation (NSDI13)

Wyatt Lloyd, Michael J. Freedman, Michael Kaminsky, and David G. Andersen

April 2013

Main Idea

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- Causal Consistency Instead of Eventual Consistency (causal is stronger)
- We require low latency
- Extend previous systems: Cassandra and COPS

Contributions

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- Eiger
  - Low Latency
  - High throughput (slightly lower than Cassandra)
  - Causal Consistency (rather than eventual as in Cassandra)

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Background

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- Cassandra
  - Eventual Consistency

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- Cassandra
  - Eventual Consistency
- COPS

Consistency - Causal versus Eventual

Consistency - Causal versus Eventual

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Column Family Data Model

Column Family Data Model

- p1

Column Family Data Model

- p1
- p2

Column Family Data Model

- p1
- p2
- p3

Eiger

Eiger

- p1

Eiger

- p1
- p2

Eiger

- p1
- p2
- p3

Evaluation

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- Versus Cassandra
  - Within 7% of throughput Using Facebook-like data
    - Ops/sec
    - Keys/sec
    - Columns/sec

Evaluation

- Versus Cassandra
  - Within 7% of throughput Using Facebook-like data
    - Ops/sec
    - Keys/sec
    - Columns/sec
- Versus COPS
  - Both have low latency
  - Eiger has slightly higher latency due to 2nd round indirection
  - Only Eiger has write transactions
  - Eiger has less overhead because it tracks only one-hop dependencies

Follow Up Research

Follow Up Research

- Mahajan et al. showed that Causal Consistency strongest that guarantees low latency.

Ideas for Future Research

Ideas for Future Research

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Bibliography

- **Stronger Semantics for Low-Latency Geo-Replicated Storage**, *Proceedings of the 10th USENIX Symposium on Networked Systems Design and Implementation (NSDI13)*, Wyatt Lloyd, Michael J. Freedman, Michael Kaminsky, and David G. Andersen, April 2013
- **Out in the Open: The Abandoned Facebook Tech That Now Helps Power Apple**, *www.wired.com* , Klint Finley, Aug. 4, 2014
- **A Short Primer on Causal Consistency**, *;login: The Usenix Magazine Volume 38, Number 4*, Wyatt Lloyd, Michael J. Freedman, Michael Kaminsky, and David G. Andersen, , August 2013