Lessons Learned from Distributed Systems and Applied to Modern Storage Platforms

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Co-inventor Amazon Dynamo

Goals

- Key value store as foundation
- Solved availability problem.
- Designed to run across data centers
- Designed to run on off the shelf commodity hardware.

What needed improvement

- Design requiring client to resolve version conflicts
- Design didn't take into account operational issues
- Handling data corruption, disk failures etc.

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Inventor Apache Cassandra

Goals

- Storage of choice for Facebook Inbox Search.

- Designed to ingest data at insane rates.

- Support range queries via an ordered partition

What needed improvement

- Better than Dynamo from an operational perspective

- Only supported Eventual Consistency

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The convergence of data center trends in 2011

- Virtualization was becoming all pervasive

- Enterprises were adopting a true cloud mentality

- Commodity hardware was coming much further along, even then 10 years ago

- Flash and high-capacity HDDs were arriving

- 10/40 GigE networks were becoming ubiquitous

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Why do all these trends matter?

Conclusion 1:
Storage had reached a point where it was a distributed systems problem to solve

Conclusion 2:

There had been no fundamental innovation in storage for 10 years

Conclusion 3:

The move to cloud and commoditization signaled enterprise readiness and skill set to adopt a new storage approach

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7 Design goals for modern, scalable storage

- Scale-out seamlessly with x86 or ARM
- Consolidate all protocols in one platform
- Support hyper-converged and hyper-scale
- Run agnostic to any hypervisor, container, or OS
- Provide hybrid-aware DR, across any public cloud
- Provision storage with unprecedented flexibility and speed
- Make enterprise-grade storage features fundamental primitives

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3 Reasons why a distributed systems is needed for massively scalable storage

Reason 1: Data protection

Data protection in massive virtualized/cloud environments sucks

Value of distributed system	Example
• Self-healing clusters • Multi-site replication • No more forklift upgrades or data migration	• Fortune 50 bank • Hyperscale configuration for VMware environment • Complex 4-city, 2-region DR failover schema

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Reason 2: Data locality

Data locality for big data
(and Hadoop in particular) is a myth

Value of distributed system	Example
• Single data platform to handle multiple distros • Gain data efficiency across multiple data sets • Ability to virtualize big data	• Same Fortune 50 bank • Bare metal Linux environment with HDFS • Virtualize the various flavors of NoSQL solutions.

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Reason 3: Backup

Backup is dead . . .
at least for massive data sets

Value of distributed system

- Eliminates need for separate backup infrastructure

- Hybrid cluster adds cloud tier

- Incremental scale & no more growing maintenance costs

Example

- $10B mining company

- Backup costs untenable

- Commodity disk-to-cluster better than traditional backup infrastructure

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Thank you!

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