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# Strong Consistency with High Performance in a Primary Key database

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*HPTS GONG SHOW, October, 2017*

# Legal statement

**This discussion of new product features is *not* intended to describe a system which Aerospike will make available.**

**It represents current research.**

# TL;DR

**Practical Multi-Million TPS temporal database**

**With Strong Consistency**

**Based on existing real, deployed technology**

**Give up *Availability*, not Performance ( P in CAP is *not* performance )**

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# Who am I ?

**I'm Brian Bulkowski, and I'm addicted to building infrastructure**

**I founded Aerospike in 2008 to bring modern systems approachs to databases**

**We have a scheme for**

**high performance transactions**

**Which requires a little background….**

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# History of Aerospike

- **Solve “internet scale” data**
  - Multi-core, multi-server, clustering & HA
  - Allows competition with Google, Amazon, etc
  - Use *Flash*, software only, “cloud-enabled”
- **2008 ~ 2009 - Prototype**
  - Proved 100K TPS+ per server, distribution mechanism
  - DRAM only, no persistence ( cache )
- **2010 ~ 2012 - Flash, Adtech, and Lies**
  - Claimed ACID prematurely
  - Funded by boutique VC firms ( Alsop/Louie, Tim Draper )
  - Key-value stores working at 100k+++ read / writes over Flash
  - Avg 0.3 ms, 95% < 1ms, 99% < 5ms
  - 80-ish paying customers

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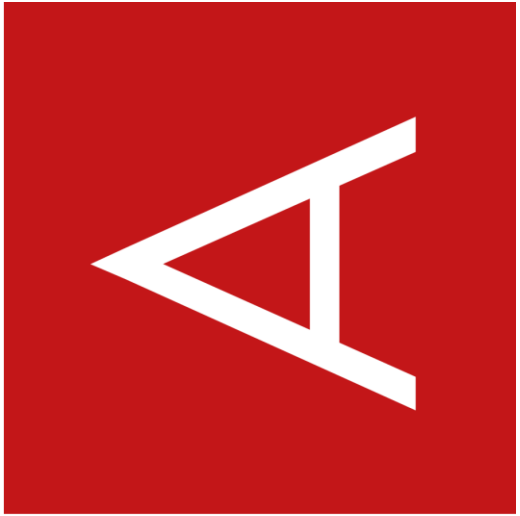
# History of Aerospike

- **2013 ~ 2015 – Open source, queries, data structures**
  - Funding by major VC firms ( NEA )
  - Added query, in-database compute, lists / maps
  - telco ( data-oriented routing )
  - fraud detection in real time
    ( behavioral analytics involving money )
  - One retail brokerage

- **2016 ~ 2017 – The road to strong constancy**
  - Promised to stop lying ( HPTS 2016, thanks Kyle )
  - Tired of hearing “what about split brain”



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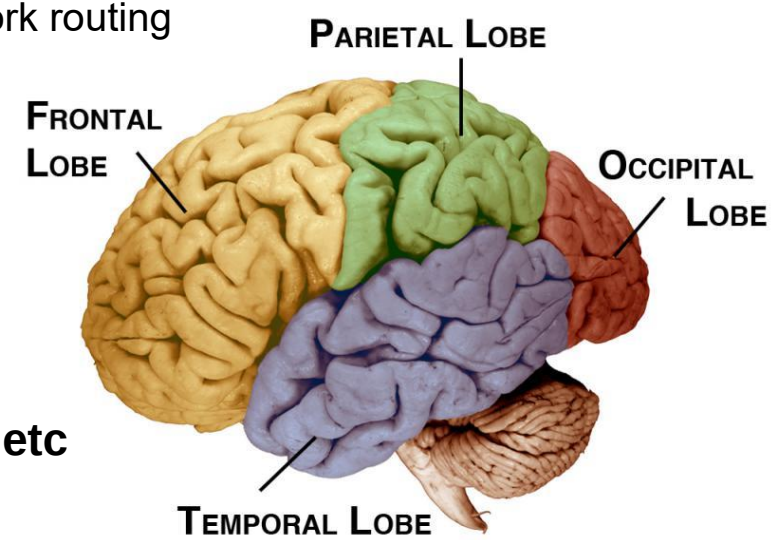
# Why do people use Aerospike?

- **Temporal “Edge” uses**
  - Internally immutable, “update” to an application
  - “Analytics” like ad pricing, fraud detection, network routing
  - Behavioral suggest Availability over Consistent
- **Extreme Insert & Ingest**
  - 50% write rate common
- **Lower latency than DynamoDB, BigTable, etc**
- **Works great with Flash / NAND**
  - Beyond “In Memory Databases”

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# From AdTech Outward







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# Extreme Data Integrity Required

- **“Enterprises” demand strong consistency**
  - “System of Record” needs higher performance
- **“System of Record” with cache is broken**
  - “System of Engagement” is a fast SoR
- **“Data services” in enterprise need speed**
  - Architects understand they are fighting Amazon
  - “Stateless” apps need *more* database
- **Aerospike provides speed**


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# Thus, Strong Consistency

- **Performance**
  - 1M++ TPS *per server* over Flash ; 10M++ DRAM / Batch
- **Mixed read / write workload**
  - Extreme insert rates
- **“Fairly” high availability**
  - Allow “n-1” replica failure with “no” availability hit
- **“Local”**
  - < 10ms network latency
- **Durability**
  - Disk-buffered currently, adding based on customer demand ( Flash )

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# Scheme – combine known techniques

- **Single Master**
  - Requires high quality cluster management ( * )
- **Writes: synchronous**
  - ***Aerospike already does it***
- **Reads: Single-master ( “session” ) vs All ( “linearize” )**
  - Linearize only needs to check other servers
  - Per-read transaction choice
  - Stale reads in case of client accessing server about to leave cluster
- **Lamport Clock**

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# Only One Master

- **Rule 1**
  - If a sub-cluster has all of the known masters and replicas, CONTINUE PROCESSING
- **Rule 2**
  - If a ***majority sub-cluster*** has data (master or replica), CONTINUE PROCESSING ( promote, replicate )
- **Rule 3 ( tie-breaker )**
  - If an equal sub-cluster, and had a master of the data, CONTINUE PROCESSING ( replicate )
- **If none of the above, NO reads and writes ( retain data for fast resync )**

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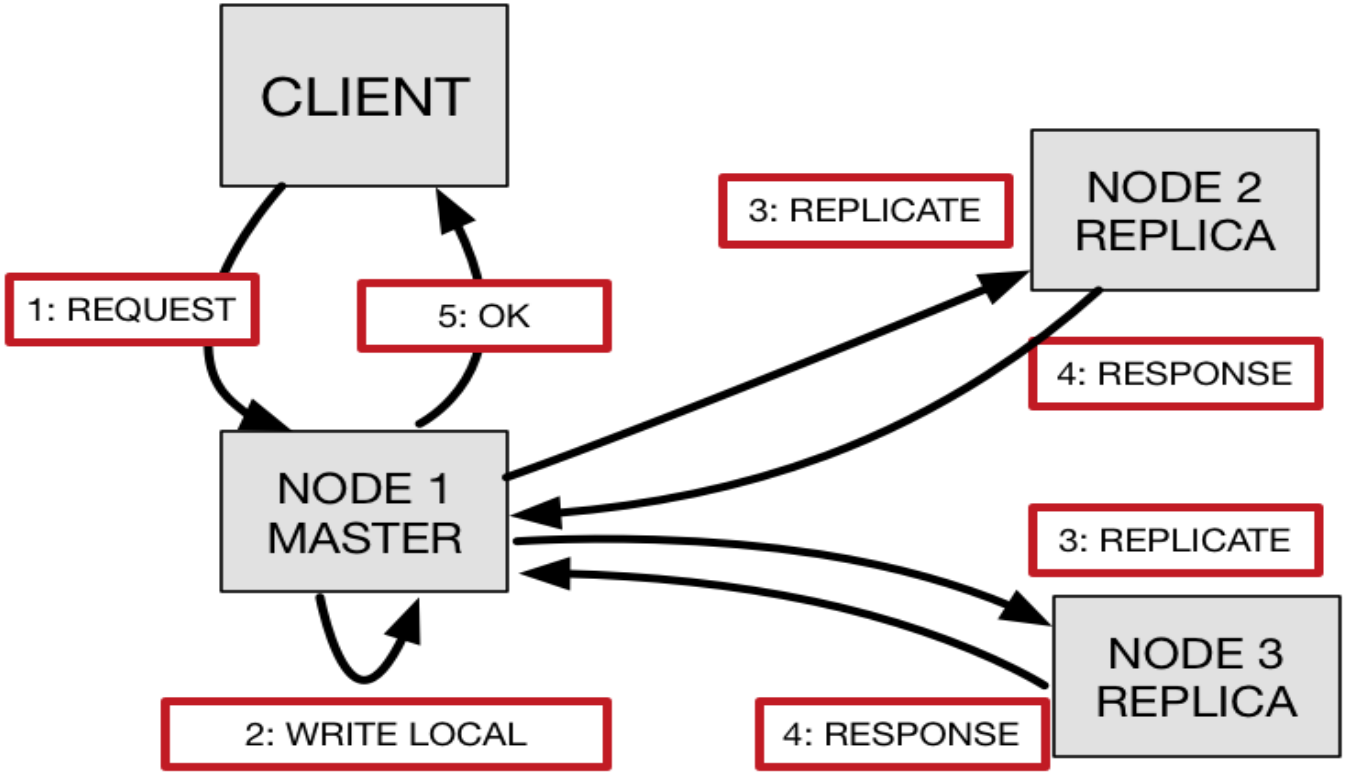
# Writes



# Thank You

*Questions?*

Talk to me about
Storage Class Memory,
The Future of Infrastructure

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