Axon Server Benchmarks
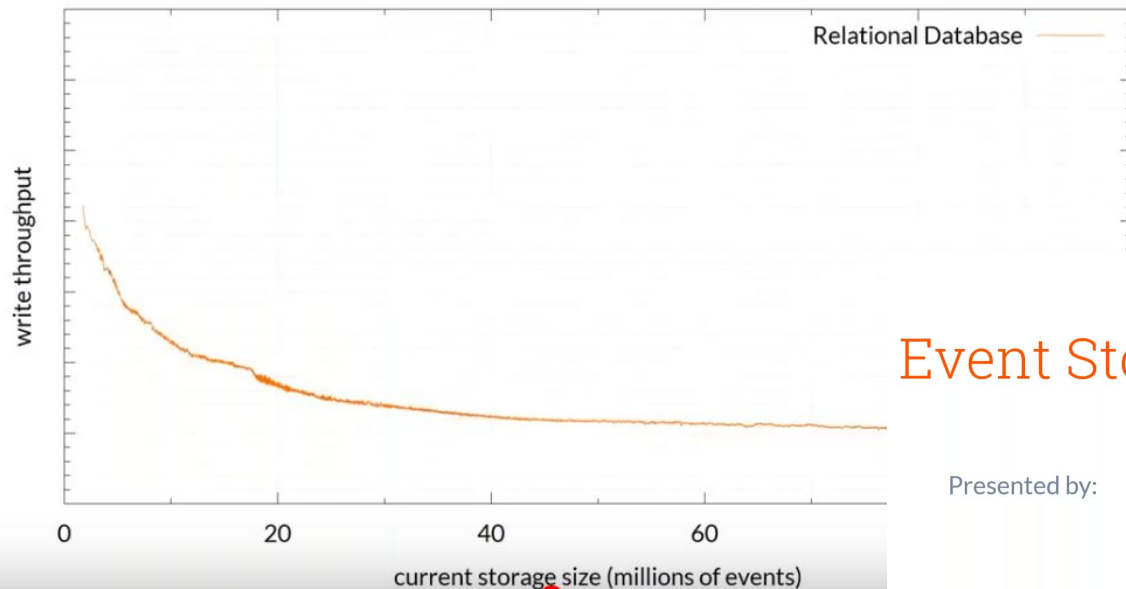
Marco Amann | digital frontiers

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Motivation

- Talk by Allard

- Is it really this bad?

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Metrics

Throughput

Single Producer
Multiple Producers
Stability over time

Storage space

(Latency)

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Contestants

Axon Server

Postgres

Mongodb

Machines

Small Virtual Server	Beefy Virtual Server	Bare Metal Server	Dev Machine
14€/month	59€/month	> 1300€/month	N.A.
Shared	Shared	Dedicated	Dedicated
4 Cores 8 GB RAM 160 GB SSD	16 Cores 32 GB RAM 300 GB SSD	80 Cores 256 GB RAM 2x 3.4 TB NVME	24 Cores 32 GB RAM 1x 256 GB M2 SSD
			Completely different system

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Application

"Producer" → CommandGateway → CommandHandler

CommandHandler → Event → magic → EventStore → Disk
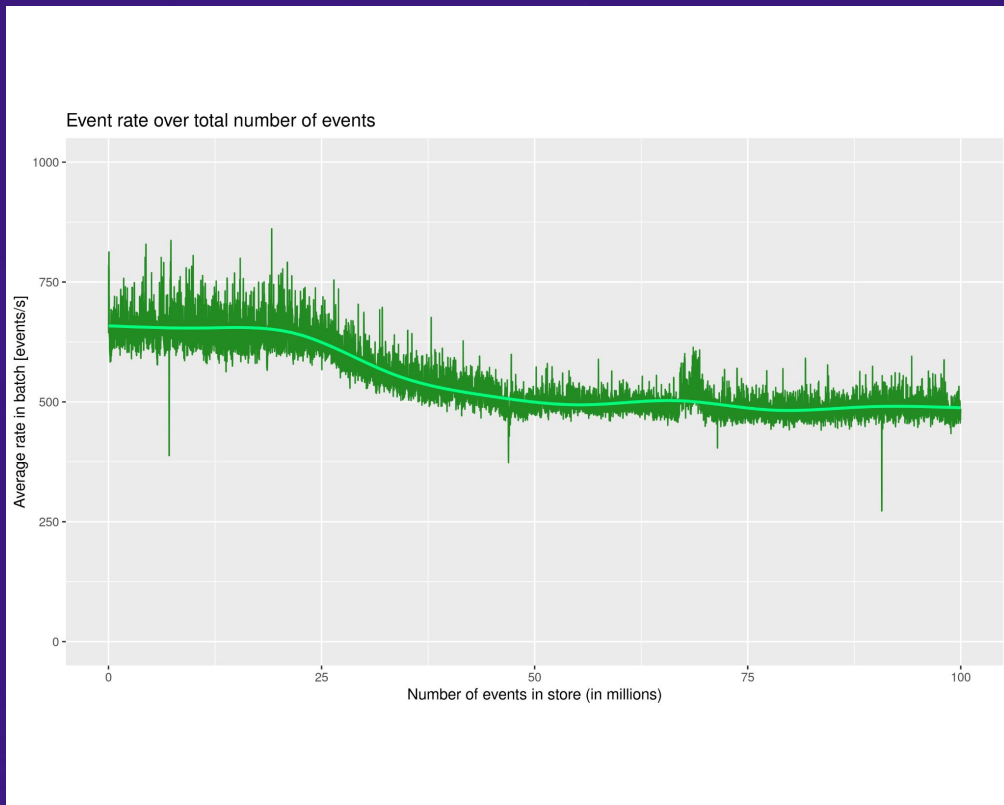
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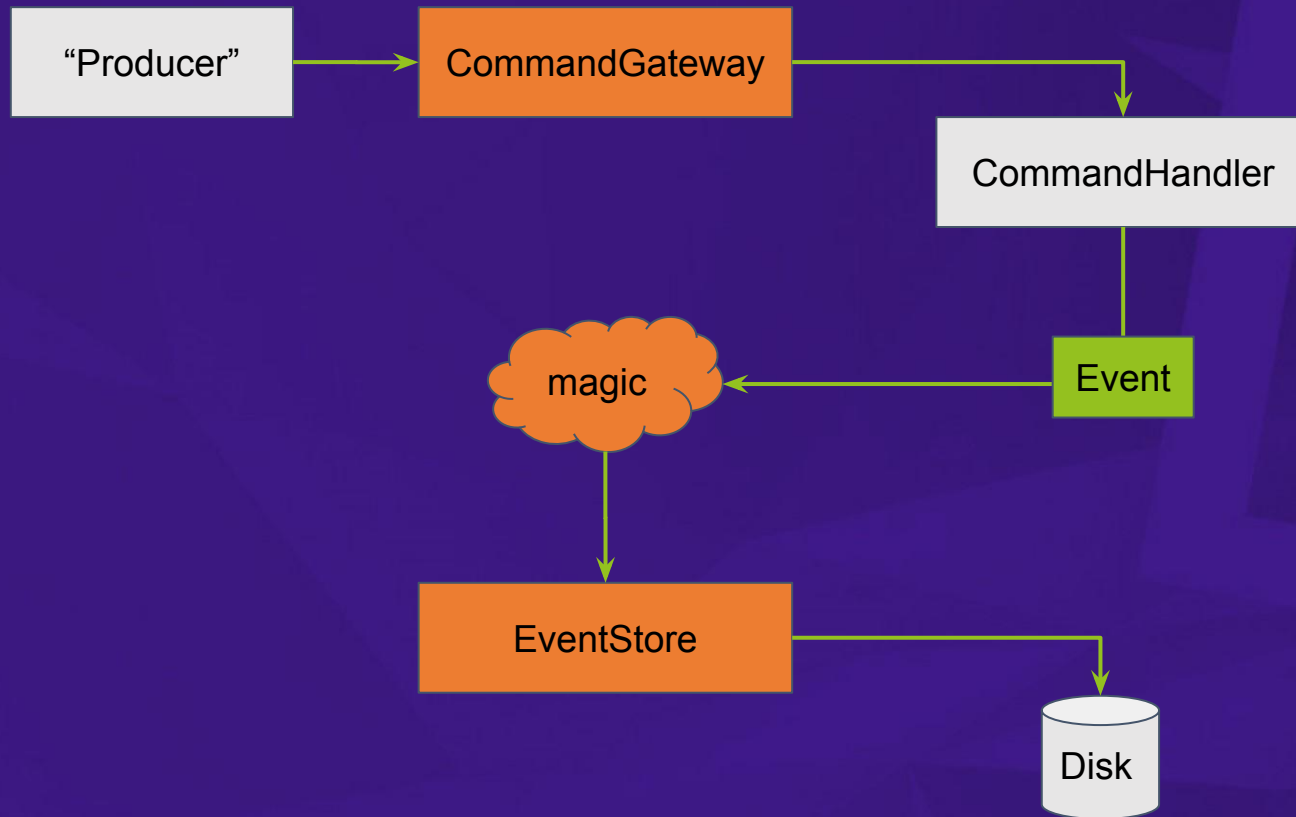
One or more producers?

Can we produce another command without
knowing if the current one failed?

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Stability

All these benchmarks ran on the small virtual server

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Postgres

Event rate over total number of events

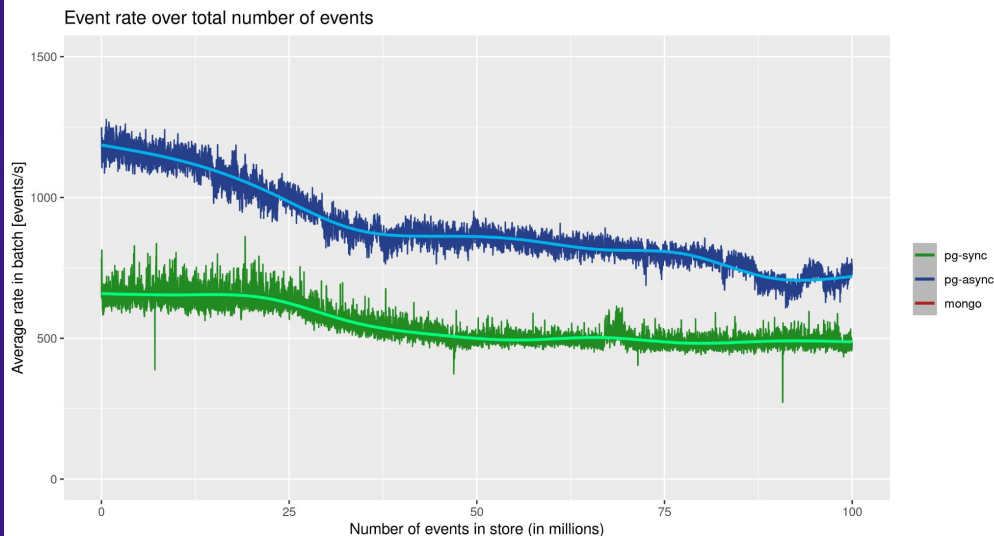100 Million Events (about 2 days)

Averages of batches (1000 events each)

Executed on the small virtual server

Postgres: Sync vs Async
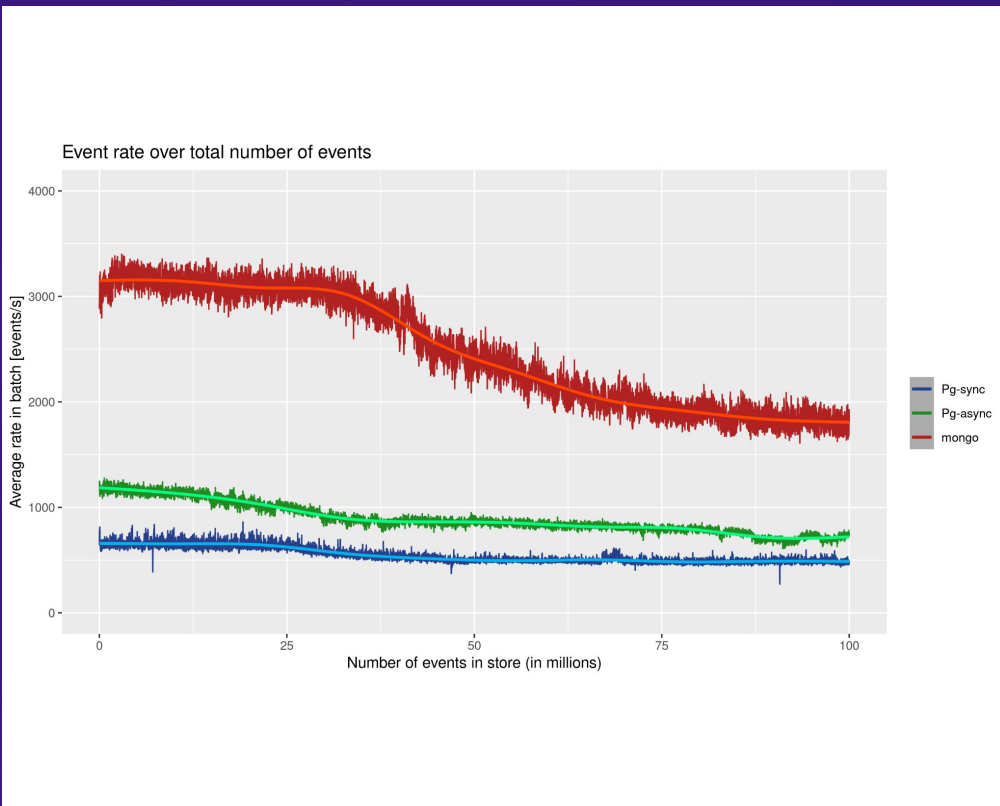

Event rate over total number of events

Async: disabled f sync

Executed on the small virtual server

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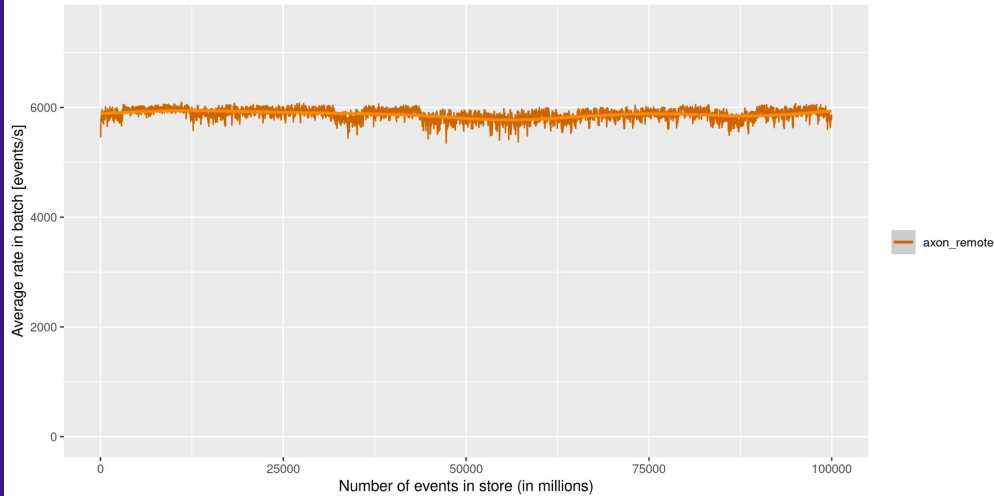
Postgres vs Mongo

Event rate over total number of events

Mongo was much faster on remote machine.

On the dev machine, async-pg and mongo were equally fast.
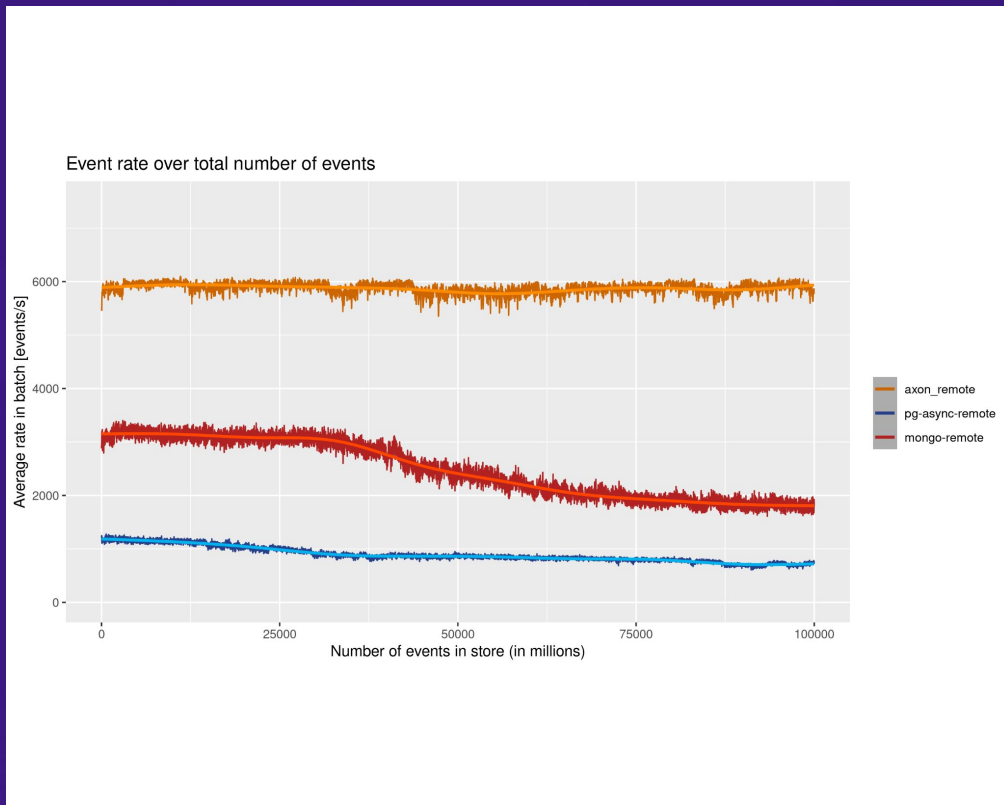
Executed on the small virtual server

Axon

Nearly no decrease!

Event rate over total number of events

Executed on the small virtual server

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Axon vs Mongo vs Postgres

Event rate over total number of events

Axon shows nearly no decrease over time.

Axon is much faster than postgres with a **single** producer (see slide 23).
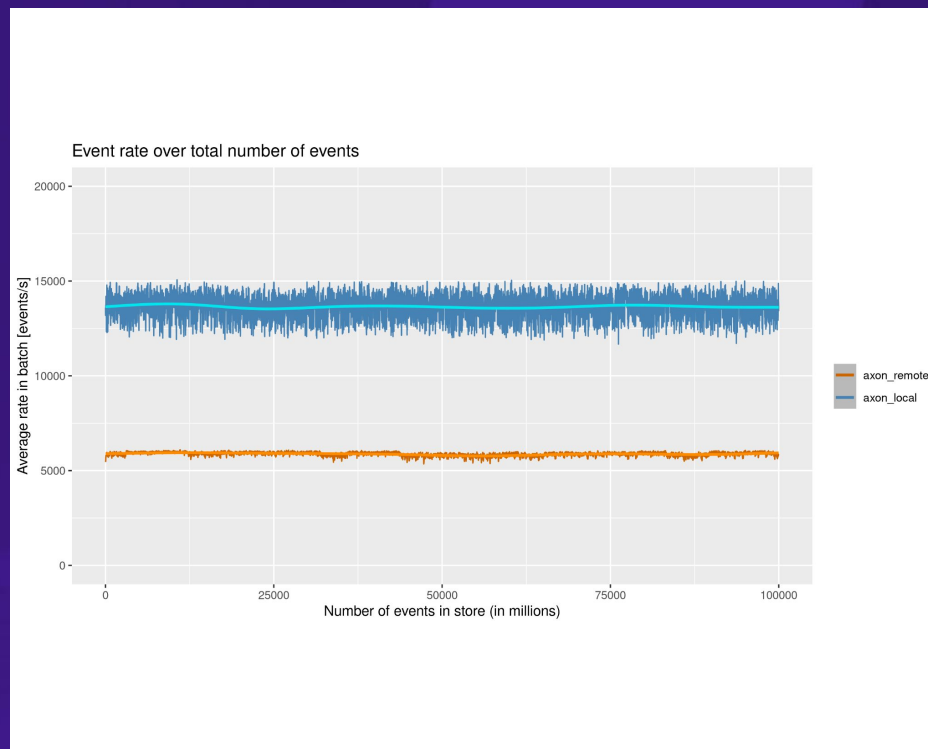
Executed on the small virtual server

Axon on better Hardware

Axon can make use of faster hardware.

Let's see how the others keep up!

But first: storage
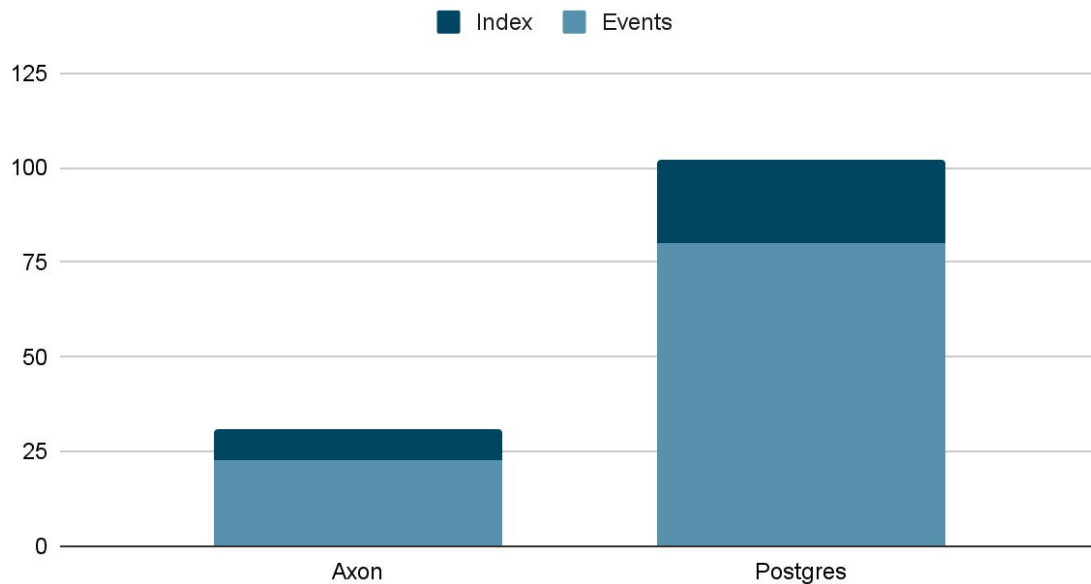
Storage

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Storage size

Note:
- Small Events
- No tuning for space

Postgres storage cleanup (VACUUM FULL) did never complete
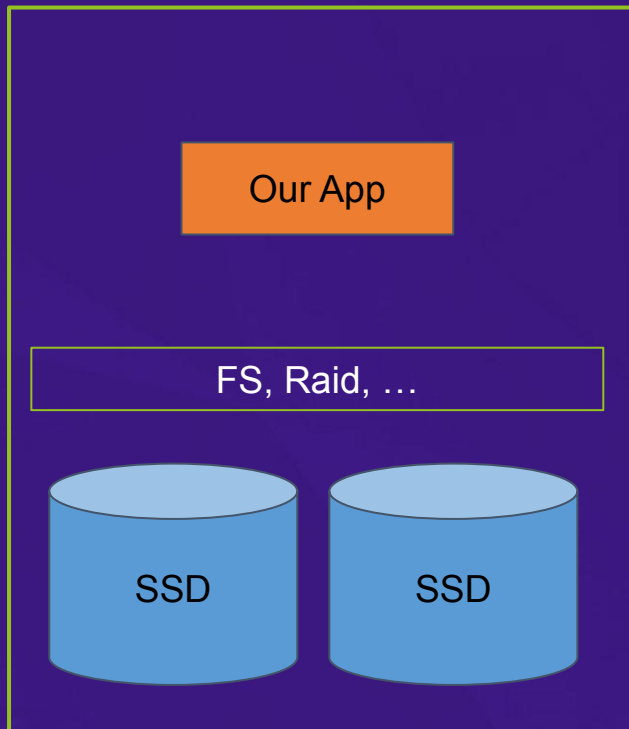
Storage (GB) for 100 million events

Storage

Latency and Throughput

For EventStores, storage throughput is no concern in most cases.
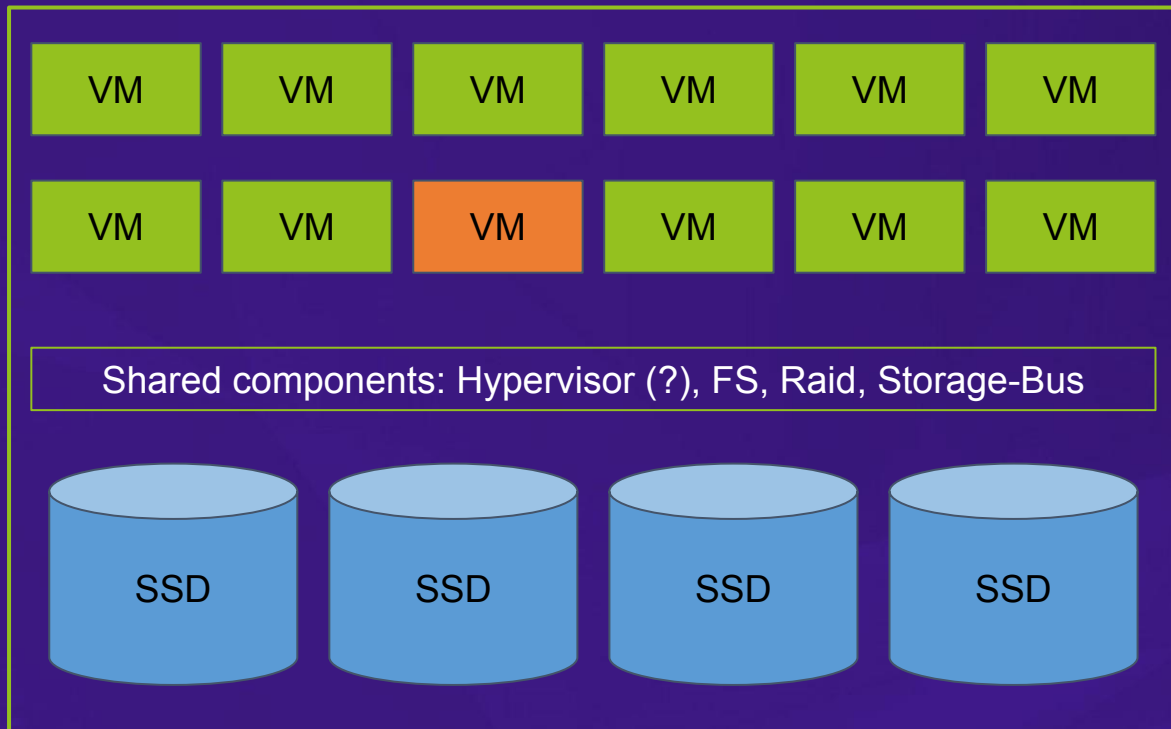
Latency:
- Read
- Write
- Sync

Storage

Our App

FS, Raid, …

SSD

SSD

Dedicated Server
- Fast
- Stable performance
- Prohibitively expensive
  - Often better conditions with 1y-5y contracts

Storage

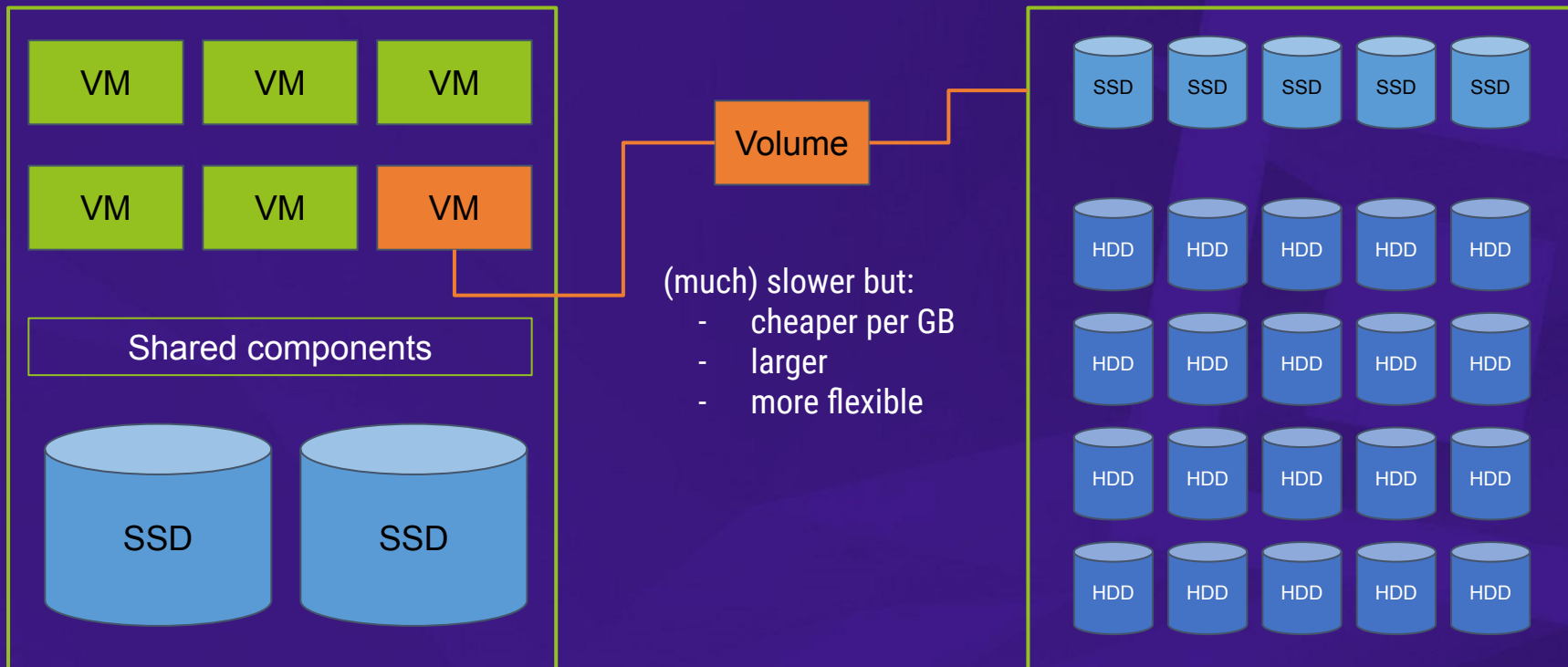|					
VM	VM	VM	VM	VM	VM
VM	VM	VM	VM	VM	VM

Shared components: Hypervisor (?), FS, Raid, Storage-Bus

SSD	SSD	SSD	SSD

Shared Server
- Fast most of the time
- Possibly fluctuating performance
- Cheap
- Limited configurations

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Storage

VM VM VM
VM VM VM

Shared components

SSD SSD

Volume

(much) slower but:
- cheaper per GB
- larger
- more flexible

SSD SSD SSD SSD SSD

HDD HDD HDD HDD HDD
HDD HDD HDD HDD HDD
HDD HDD HDD HDD HDD
HDD HDD HDD HDD HDD
HDD HDD HDD HDD HDD

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Fsync performance

Example: fsync performance

```
Dedicated:    47473.648 ops/sec       21 usecs/op
Volume:         368.807 ops/sec     2711 usecs/op
```

Factor: 129

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Faster Hardware

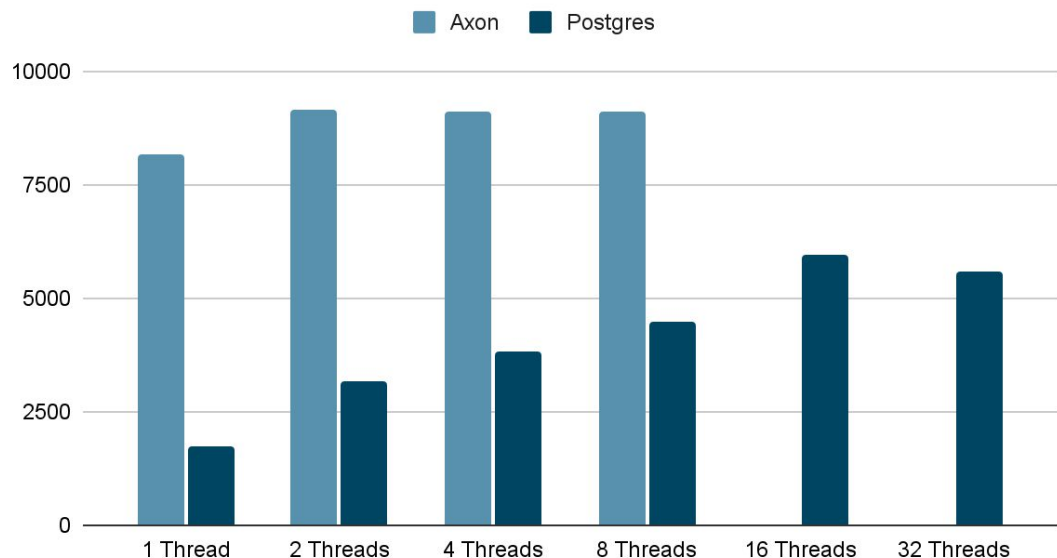All of the following benchmarks ran with 500K events

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Multiple Threads

Increasing threads did not boost axon performance that much, since the CommandBus already allows for async processing.

Multiple threads with PG in Axon Framework has to be done by hand!

Can we allow for parallel/async processing?
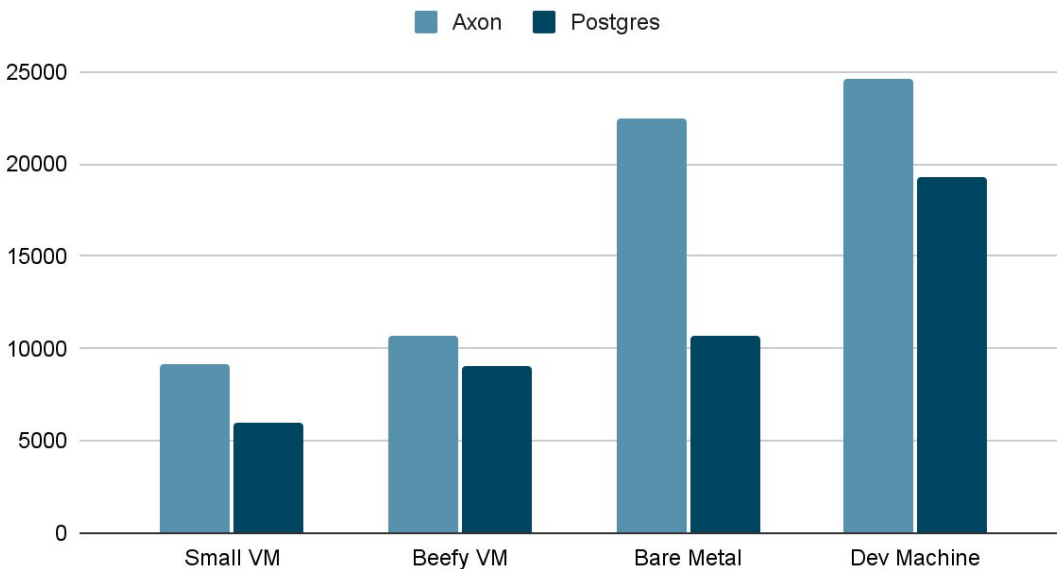

Performance with different Threads

Executed on the large virtual server

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Axon can make use of more/faster RAM and CPU

Maximum Throughput by Server — bar chart comparing Axon and Postgres across Small VM, Beefy VM, Bare Metal, and Dev Machine.

Maximum throughput of different servers
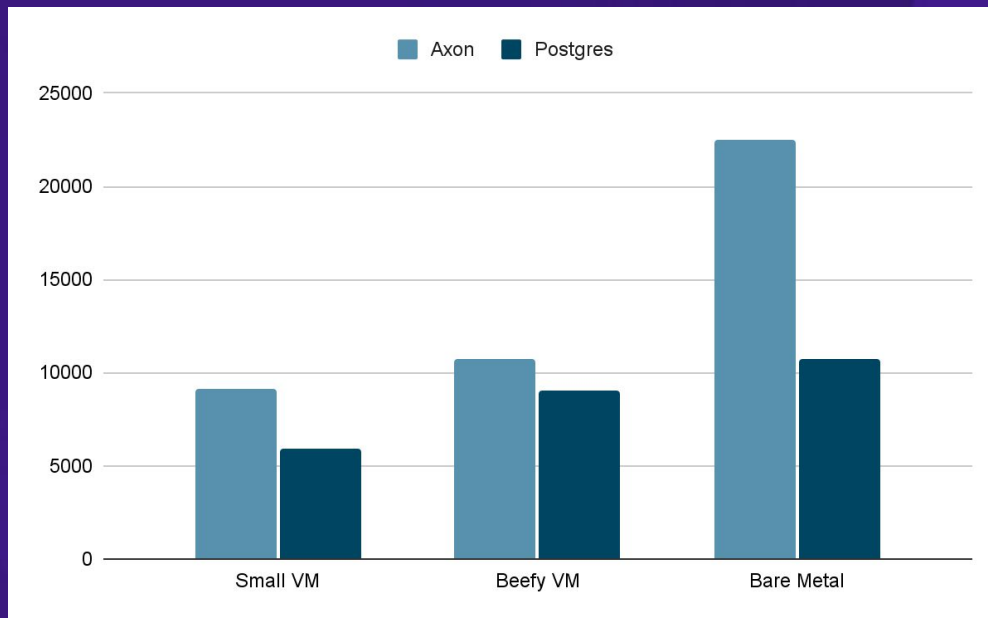
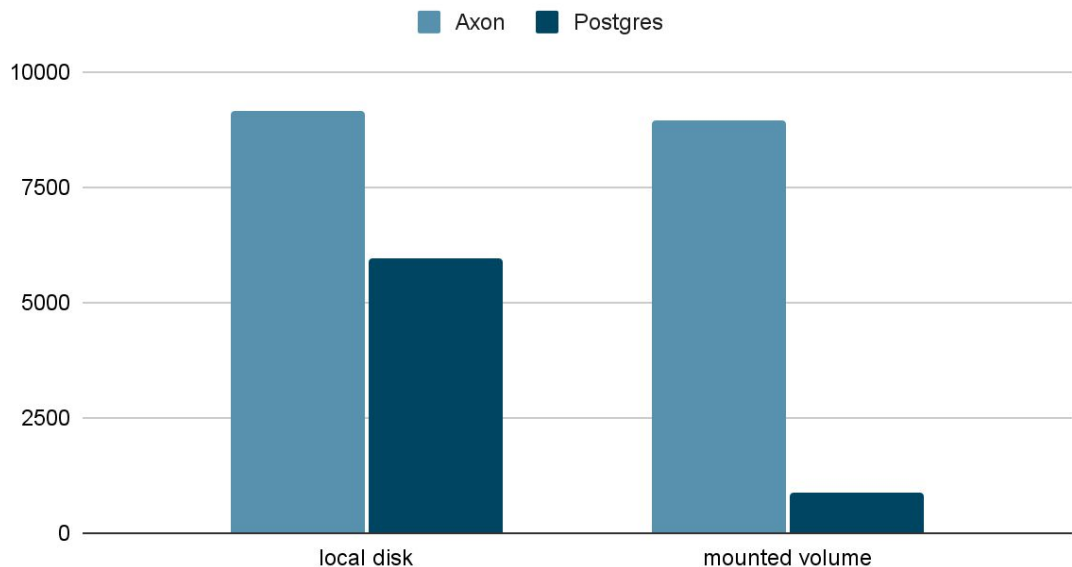14€/month   59€/month   >1300€/month

Impact of slow disks

Axon showed nearly no effect when running on remote storage

Postgres performance was abysmal

Impact of Slow Disk

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Available Storage

With parallel workloads, Axon Server
can run on cheap remote storage volumes

VMs (at Hetzner): Max 960GB local storage
Volumes for 0.0476€ per GB/month, up to 10TB without contract

If you need low-latency (local)
storage, you need to buy larger VMs

VM with 10TB storage at AWS is at least 2100€/month

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Summary

Axon

- Steady performance

- Less impacted by slow storage

- Can make use of more CPU
    - also: requires more CPU and RAM

Postgres

- Axon Framework connector requires many concurrent transactions

- With lots of tuning and on certain hardware, 75% of Axon performance is possible

- Less compact (default) storage representation: roughly x4

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@amann_dev

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What's the main driver of your server costs?

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