Bagger: Massive Log Management on PostgreSQL

Chris Travers and Felix Wischke

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About Adjust

Adjust is an mobile advertisement attribution company, focusing on transparency and fairness. Our attribution service is the basis of our analytic offerings. (Offer to give a 30 sec intro to what we do.)

We are also a big user of PostgreSQL, mostly on analytic workloads.

About The Authors

Chris Travers (Speaking) serves as Head of Database at Adjust. He has been a software developer and PostgreSQL user for over twenty years.

Felix Wischke is a platform engineer and one of the maintainers of Bagger. He is an expert on Linux, databases, and system programming.

Section 1

Why Bagger?

Our Needs

- Debug log for operations and support
- Reconcile data customers ask about
- Locate bad data sent to us
- Generalized application debug log
- Short-term storage

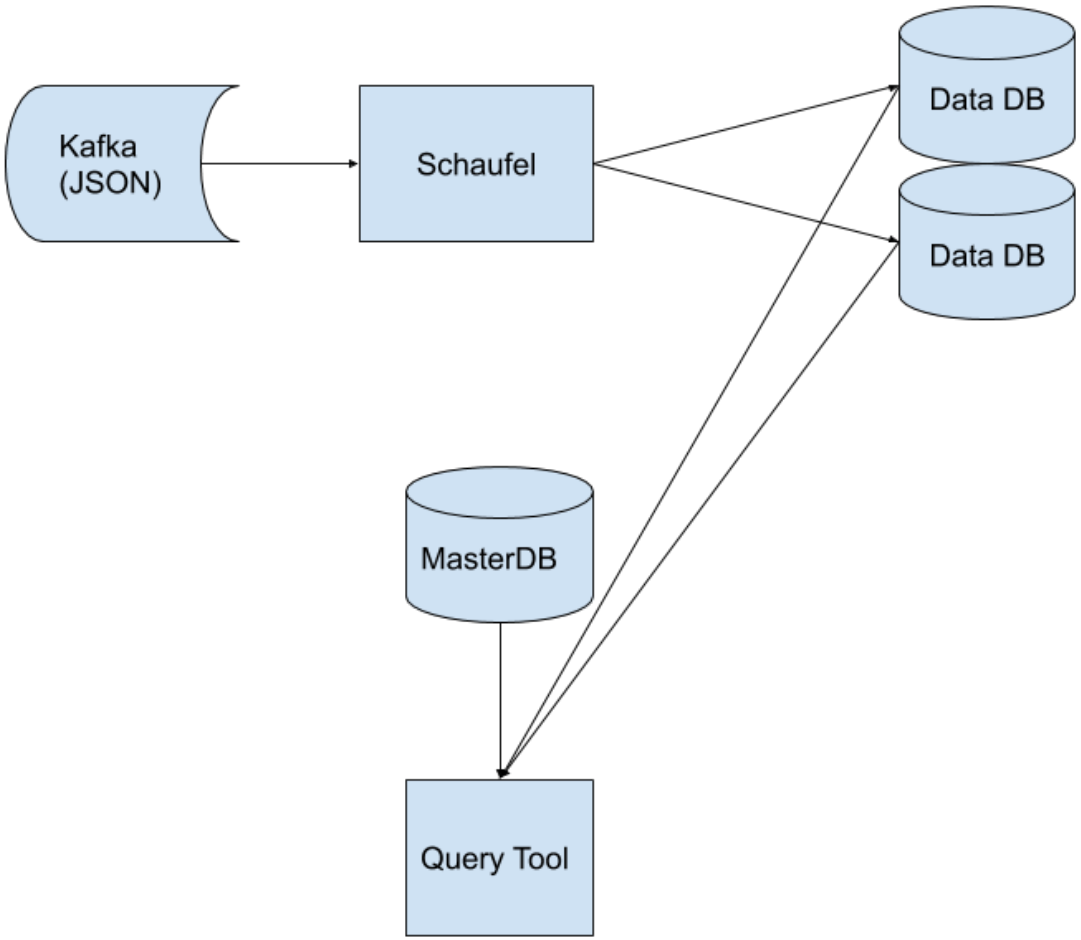
Previous System

- Elastic Search Cluster
- Over 1PB data
- Hard to manage
- Easy to crash

Section 2

Bagger's Structure

Overall Architecture



Master Databases Role

- Tracks data nodes
- Tracks usable partitions on each node
- Used to build queries by the query tool
- Used to configure Schaufel

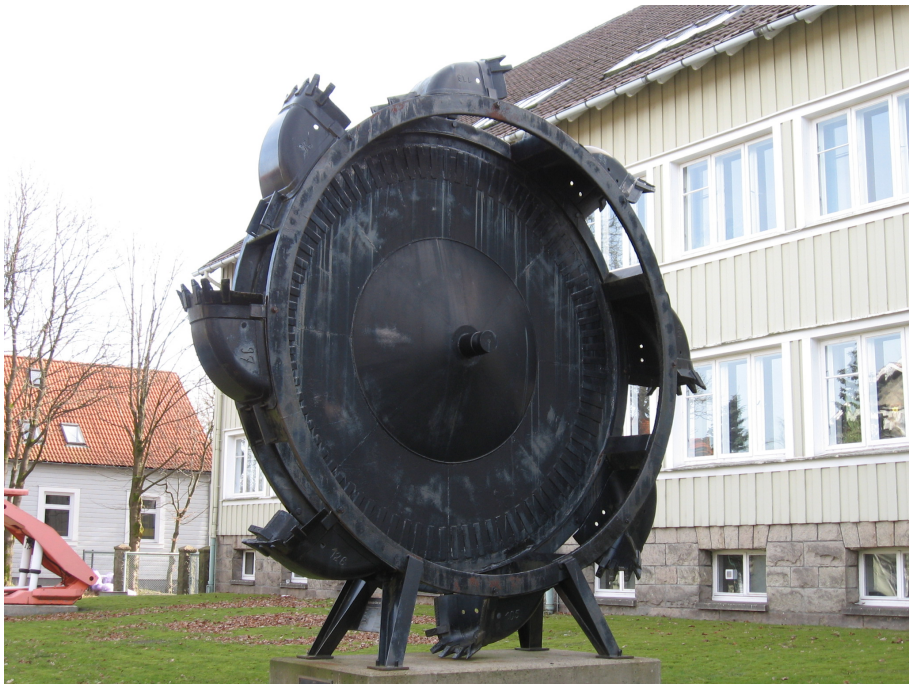
Structure of Master Database

- Backends (id, host, port, state, prefix/namespace)
- Partitions (id, name, master_id, slave_id, stats)
- Generations (id, map)

Structure of Data Nodes

- Each data node has 8-10 PG instances, each with own disks
- Using ZFS for data storage in order to optimize insert throughput
- Each schema contains a table with a single "data" JSONB column
- Each PG instance has two data schemas, a primary and a mirror
- Schaufel writes two instances, one primary and one mirror

Section 3



Schaufel

Image credit user NetNet on Wikipedia

Overview and Purpose

- High performance, parallel "shovel" for data
- Intended as a way to move data in/out of Kafka and other queues.
- Basically a giant swiss-army knife for data transfer
- `https://www.github.com/adjust/schaufel`

Basic Capabilities

- Parallel, multi-threaded
- Supports reading from Kafka, Redis queues, files
- Supports writing to Kafka, Redis queues, and PostgreSQL
- But schema, table, column names are hardcoded for Pg

Current Development

- Support configurable database schemas by "unwrapping" JSON
- Want other features? Get involved!
- `https://www.github.com/adjust/schaufel`

Section 4

PostgreSQL Issues

Partitioning/Inheritance Limits

- Currently have around 200k tables per data instance
- Initially were children of two parent tables
- Querying parent table took 15 minutes to **plan**
- Solution: Precalculate child tables and query them.

Indexing Limits

- Don't want to index whole jsonb for space reasons
- Want to index more than 32 sub-fields
- Have to patch PostgreSQL to use (change MAX_INDEX_KEYS)
- This has to be fixed before all of our tooling can be fully released.

COW File System Caveats

- Fragmentation from autovacuum
- Turn off autovacuum globally but what about catalogs
- Excels in linear writes but most reads become random

Section 5

Towards a Full Release

Of Server Orchestration Tools

Production Prototype Problem

- Requires patched PostgreSQL
- Not super-easy to run yet
- Not very efficient in space yet
- Autovacuum turned off globally instead of on data tables
- Catalog access is SLOW

Generalization Problem

- Too much dependence on our internal use case
- Need configuration for things like indexes
- Question of backwards compatibility

Section 6

Stats and Conclusions

Current Stats

- 80 servers
- Four full racks of servers
- 740x8TB HDD
- Approx 17.5PB raw data.
- 30 days of data

Lessons Learned

- Don't turn of autovacuum globally
- Be careful with ZFS and PostgreSQL
- PostgreSQL is awesome.

Thanks for Coming

Thanks for coming! Feel free to reach out after in the hallways etc.

Chris Travers
mailto:chris.travers@adjust.com

Felix Wischke
mailto:felix.wischke@adjust.com