PostgreSQL in Production

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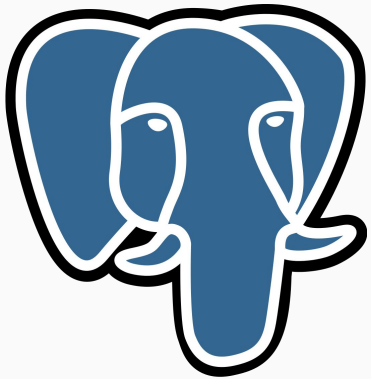
About Yammer

- Founded 2008
- Enterprise Social Network
- Acquired 2012 by Microsoft
- Typical workloads:
  - Micro services & Rails monolith
  - 90% “real-time” - web queries
  - Batch workloads runs off mostly non-production env
  - Many service-to-service dependencies
  - Large varieties of data stores

Yammer loves PostgreSQL

- Reliability and stability
- Rich feature sets (data types, extensions, replication, etc.)
- Great libraries/clients for all major languages
- Awesome community and toolings

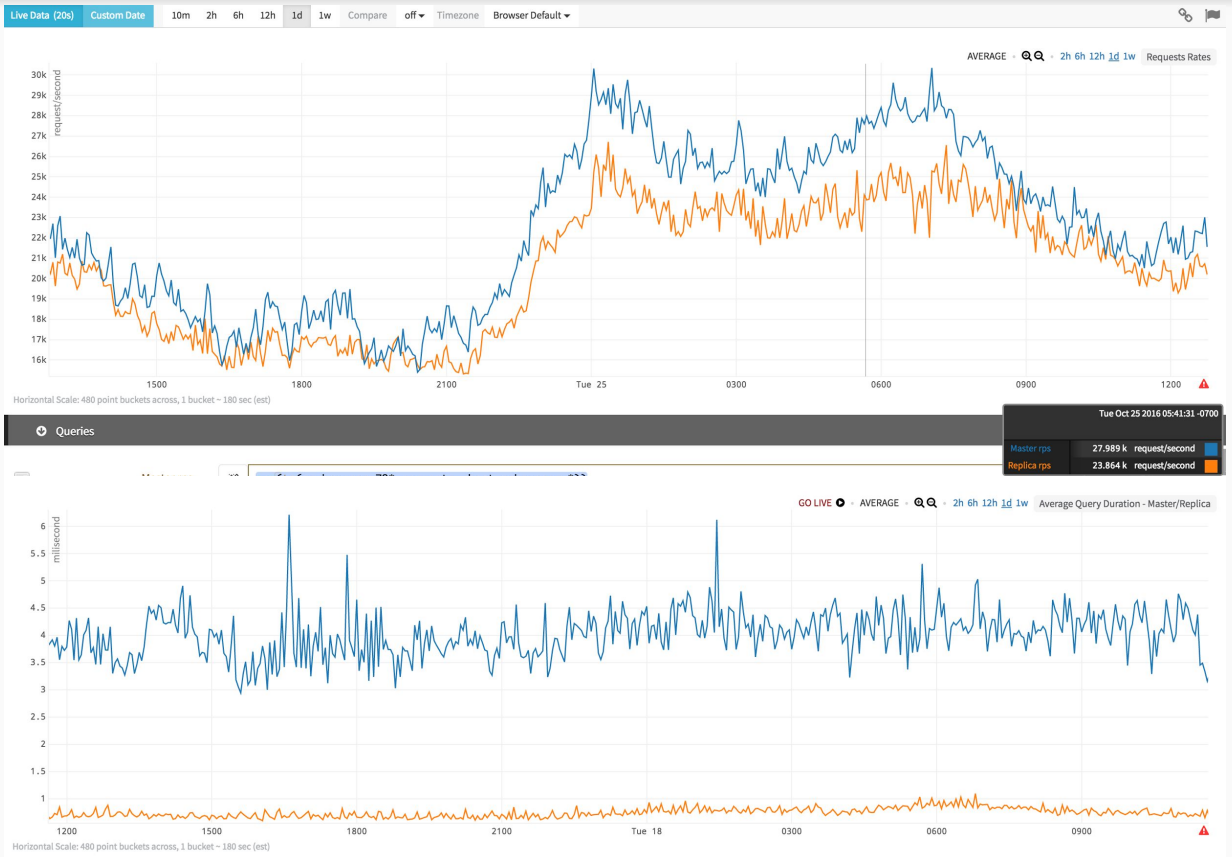



PostgreSQL in Production

- 14 PostgreSQL clusters in Production (4-8 nodes/cluster, 2 DCs)
- Asynchronous cascading replication
- Use replica read whenever timeline consistency is accepted
- Peak ~30k RPS for masters (reads + writes) + ~25k RPS for replicas
- Runs on Fusion IOs, no SAN
- Disaster Recovery replicas for non-realtime production traffic and all analytics workload
- Configuration management using Puppet, assisted by bouncie, an in-house tool

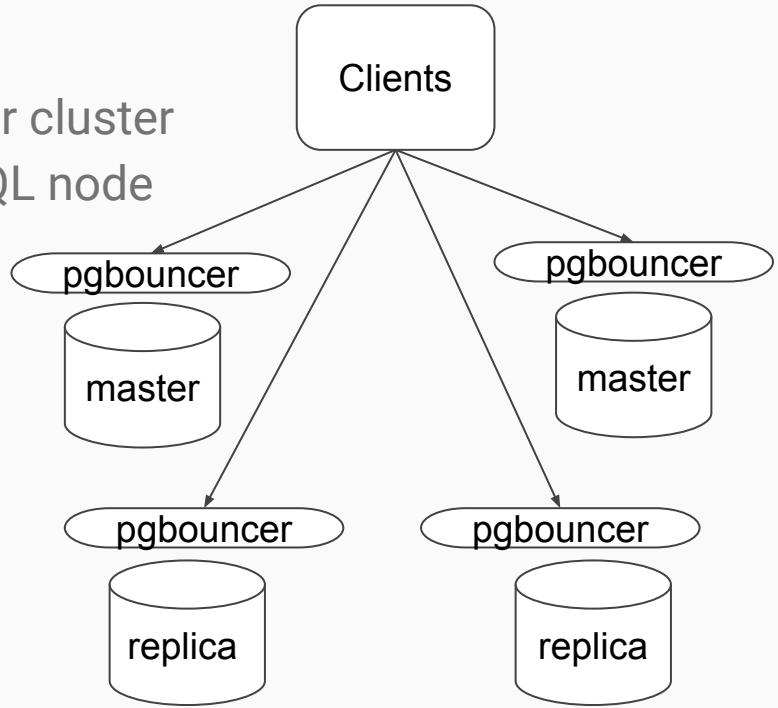
PostgreSQL Traffic

- 100% E2E TLS
- AES SHA256 at rest
- 1.2 Gbps peak egress

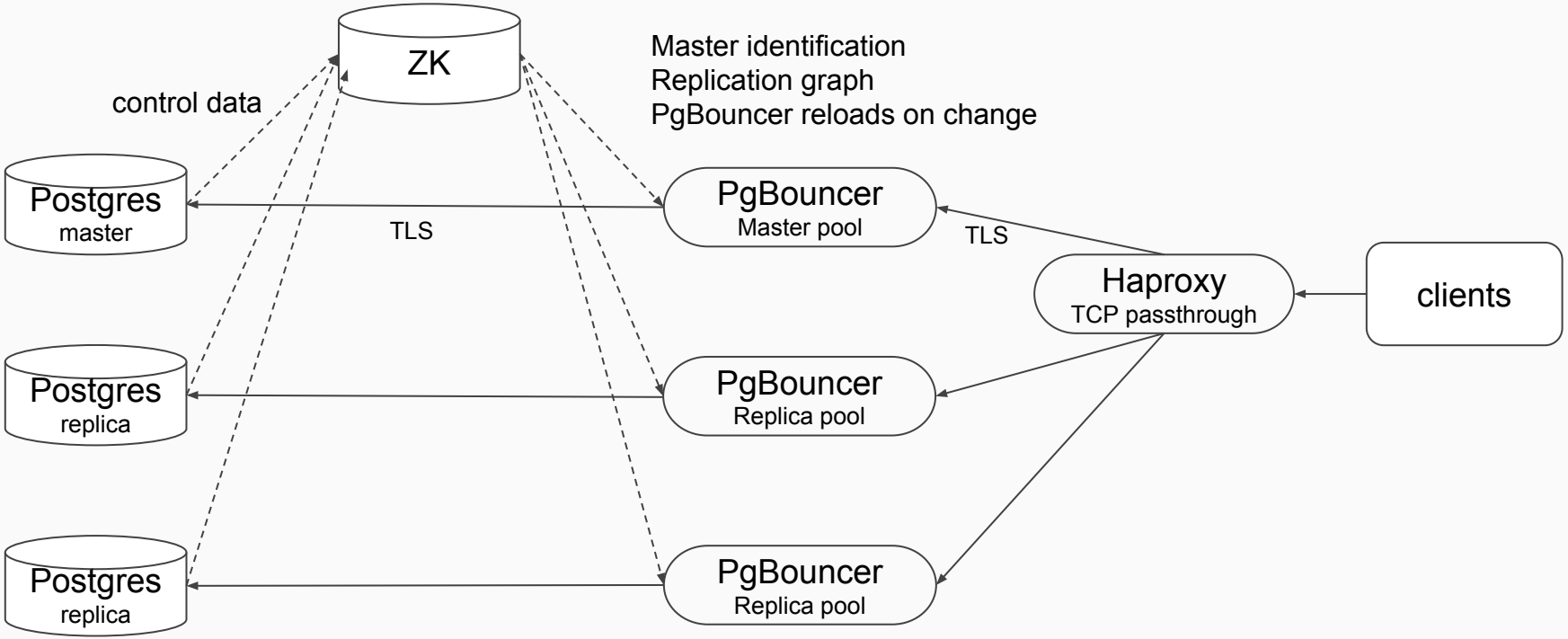


Once Upon A Time ...

- Service Discovery was not a thing
- Diverged/customized configuration per cluster
- Dummy pgbouncer on each PostgreSQL node
- Clients aware of all nodes
- Losing track of cluster memberships
- Replication management is an art
- Astronomical MTTR
- Ganglia-backed metrics system



Bouncie - The PgBouncer Cluster



Bouncie


```
"1bf4b27b4a705dc7f537c9ef53b40a47": {
  "badnodes": [],
  "dbs": [
    "files",
    "aces"
  ],
  "master": "filesdb-1.az3.[redacted]",
  "regions": {
    "centralus": [
      "filesdb-1.az1.[redacted]",
      "filesdb-1.az3.[redacted]"
    ],
    "eastus": [
      "filesdb-1.az2.[redacted]",
      "filesdb-1.az3.[redacted]"
    ]
  },
  "replications": [
    [
      "filesdb-1.az3.[redacted]",
      "filesdb-1.az1.[redacted]"
    ],
    [
      "filesdb-1.az3.[redacted]",
      "filesdb-1.az2.[redacted]"
    ],
    [
      "filesdb-1.az1.[redacted]",
      "filesdb-1.az3.[redacted]"
    ]
  ],
  "xlag": {
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    "filesdb-1.az2.[redacted]": 0.198438,
    "filesdb-1.az3.[redacted]": 0.275565,
    "filesdb-1.az3.[redacted]": 0
  }
},
```
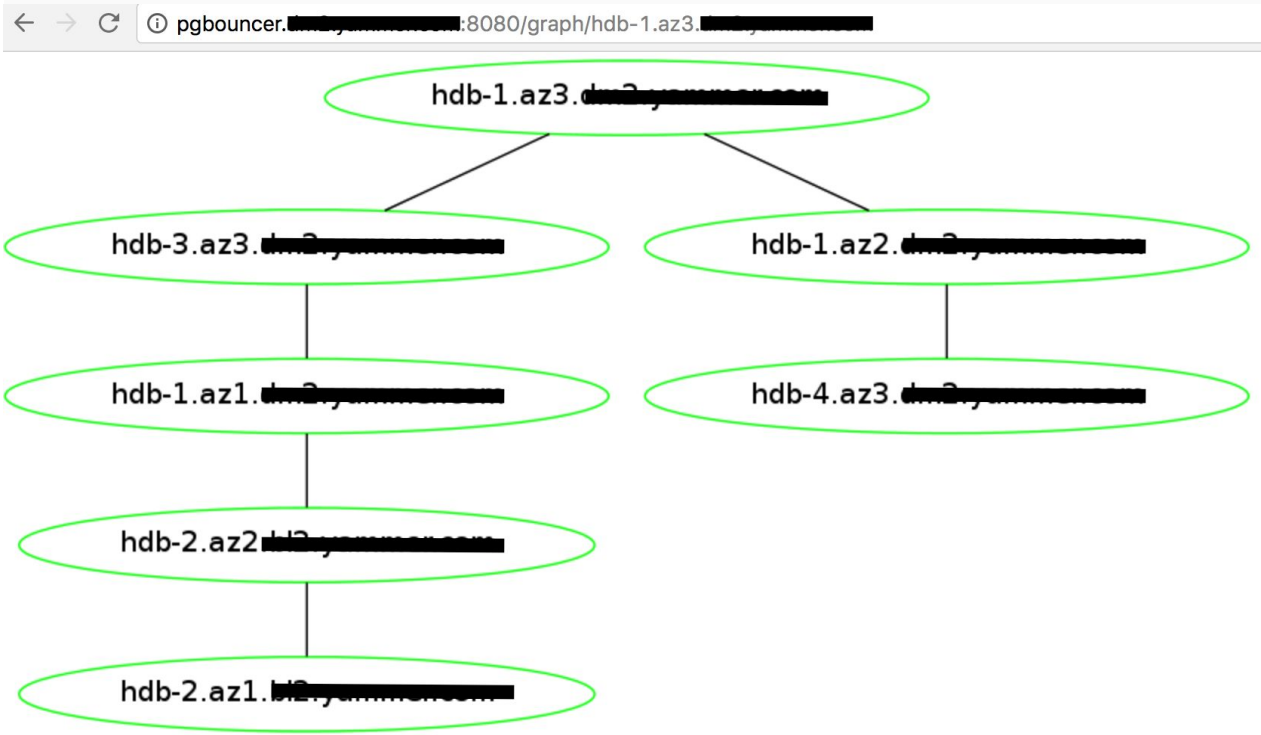




Scaling, Partitioning and Sharding

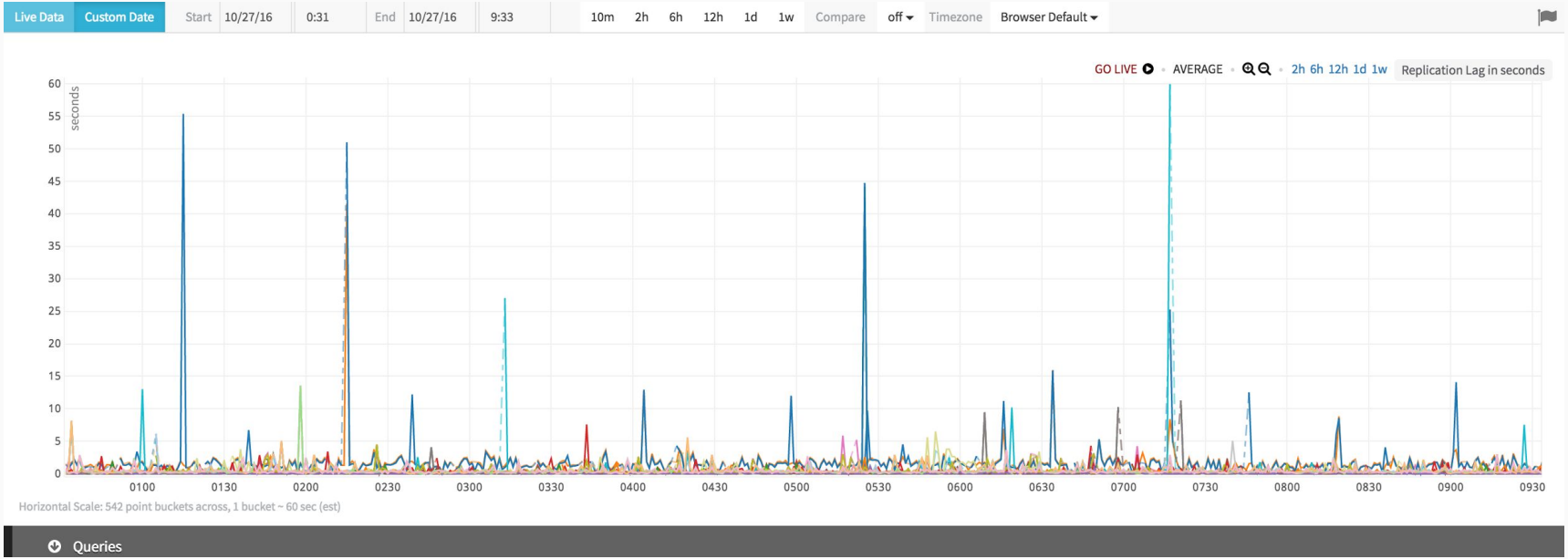
- Master is SPOF for write
  - Know the limits (RPS, IO, storage)
  - Avoid synchronous whenever possible (instead write to a queue)
- Do not let a single cluster grow too big
  - IO/Storage constraint
  - Expensive maintenance
  - Slow replica rebuild
- Vertical partitioning may create more SPOFs
  - Availability ↘, MTBF ↗
  - Compound latency on critical path
- Keep it simple! (no crazy joins, layers of subqueries, views, etc.)
- “Sharding is hard”

The Tale of Caching

- Increasing reliance on caching layer (req hit rate > 90%)
  - ~400k RPS mcrouter/memcached at peak
- Inconsistency, invalidation problems
- mcrouter comes to rescue with
  - Memcached hardware failures
  - Cold cache, cross-DC cache replication
- Troubleshooting the cache is hard
  - Hot keys
  - Eviction
  - Sometimes involving TCP packet analysis
- **Rely more on replica reads instead of cache!**

Replication lag!

- pg_current_xlog_location() - pg_last_xlog_replay_location() = lag in bytes
- Lag in bytes/WAL rate ⟶ time value



Keeping PostgreSQL Happy

- Set statement_timeout on client side!
  - Most clients just walk away after timeout on their end
- Consider a watchdog service to kill long running SELECT queries
  - This saved us numerous times
- Lower lock_timeout to get out of bad locking situation quickly
- Control pool_size on PgBouncers/clients
- Tune timeouts on pgbouncer
  - Server_lifetime
  - Idle_transaction_timeout
- Separate disks/partitions for data, xlog and logs

Backups & Maintenance

- PITR is a must have
  - Barman (https://github.com/2ndquadrant-it/barman)
  - Wal-E (https://github.com/wal-e/wal-e)
  - Monitor your backup system
  - Exercise recovery runbook regularly (implement continuous recovery test)
- Logging & analysis
  - Pgbadger for offline query analysis (https://github.com/dalibo/pgbadger)
  - Pg_hero (https://github.com/ankane/pghero)
  - PgBouncer log to ELK for auth error detection
- Table compaction, reindexing
  - Pgcompact (https://github.com/grayhemp/pgtoolkit#pgcompact)
  - Extremely resource-intensive and risky process
- Upgrade :)

Metrics and Dashboards

The Road to Azure

- 99.99% SLA
- Automation, automation and automation
  - Provisioning of VMs, VM rotation
  - Replica failover by moving attached disks to healthy, standby VMs
  - Master failover TBD
- Bouncie improvements
  - Removing DNS dependency
  - Real-time update
  - Graceful failover/rotation
- Hashicorp Vault integration for credentials rotation
- Celling, data locality, multi-region replicas
- Patroni has a lot of potential! (https://github.com/zalando/patroni)

We are Hiring!

Come join us, we have openings in both San Francisco and Redmond!

- https://medium.com/yammer-engineering
- Our stack
  - Linux
  - Mesos, Marathon, Docker, Hashicorp Vault
  - PostgreSQL, HBase, ElasticSearch
  - Azure
- Contacts: cnguyen@yammer-inc.com

QUESTIONS?