Cloud-Hydra:
A Cloud Native
Multi-Cloud Defensive
Load Balancing
!Framework

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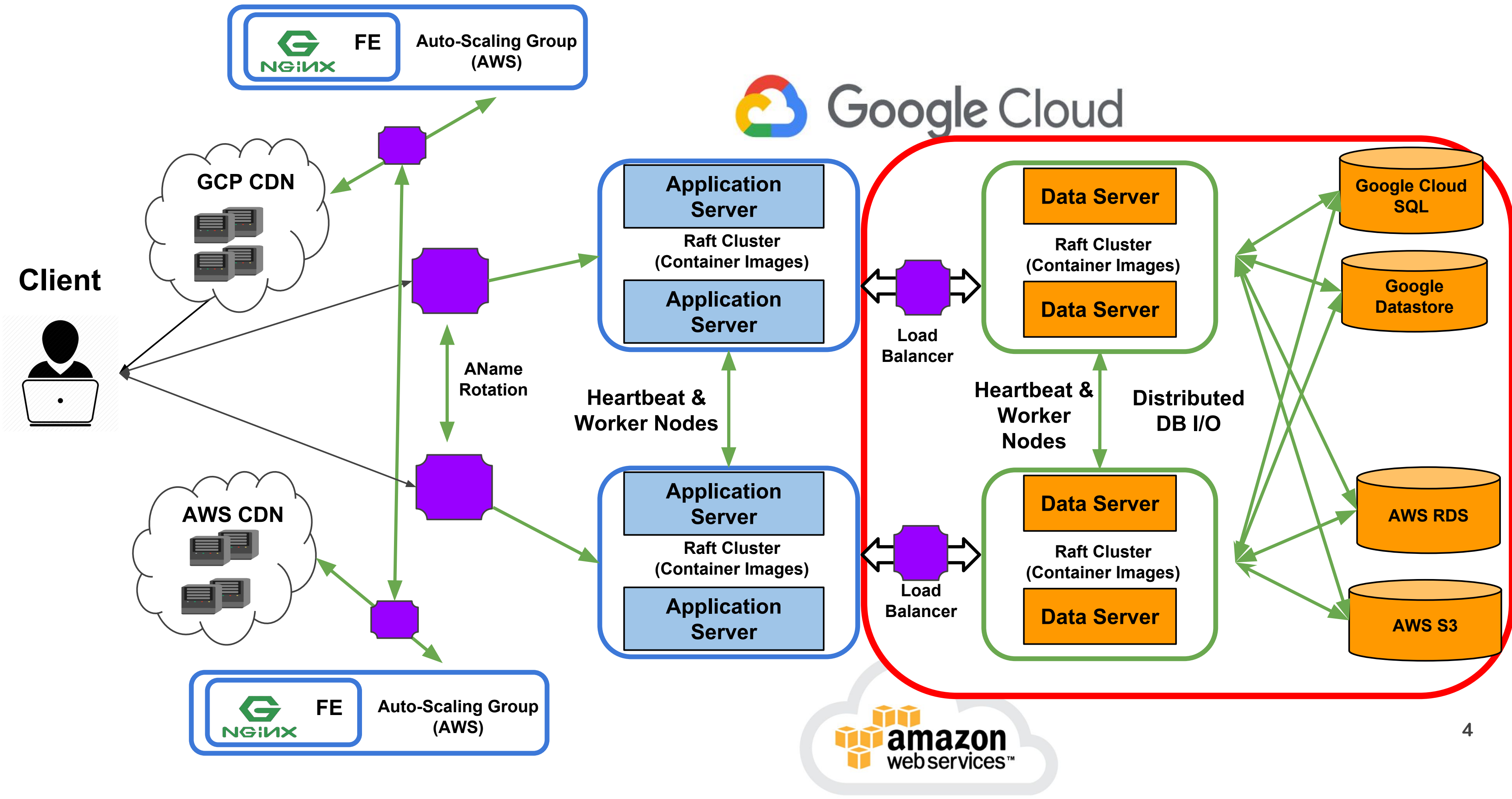
SPRINT 3

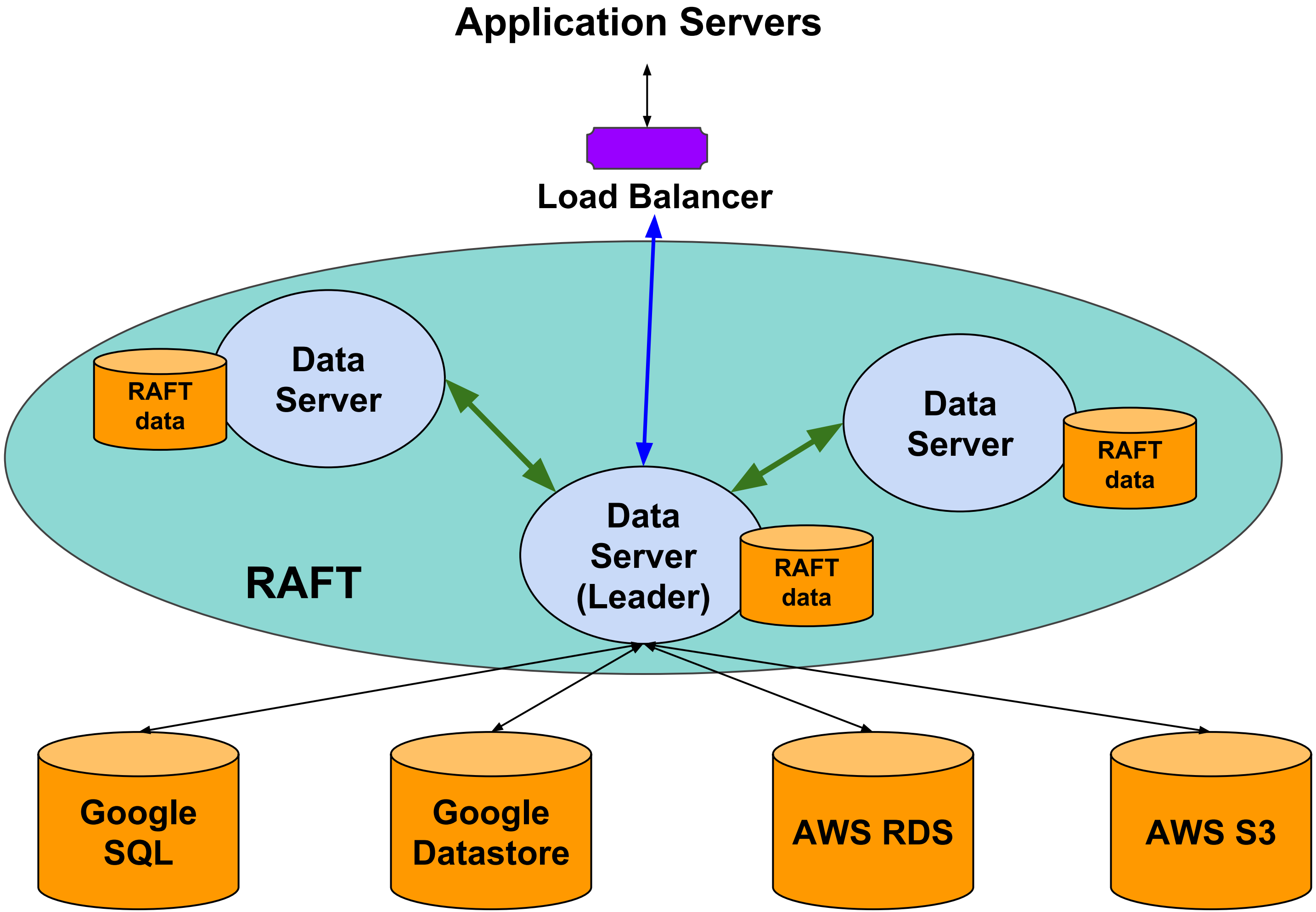
Sprint History

- **Sprint 1- Built fullstack web app in GCP and AWS**
  - Compute Engine
  - Managed Instance Groups (with Docker Images)
  - Nginx front end server + CDNs
- **Sprint 2 - Unified Data Layer**
  - Raft consensus
  - New leader election
  - Distributed Raft log
  - Cross-cloud consensus, single cloud load balancing

Goals of Sprint 3

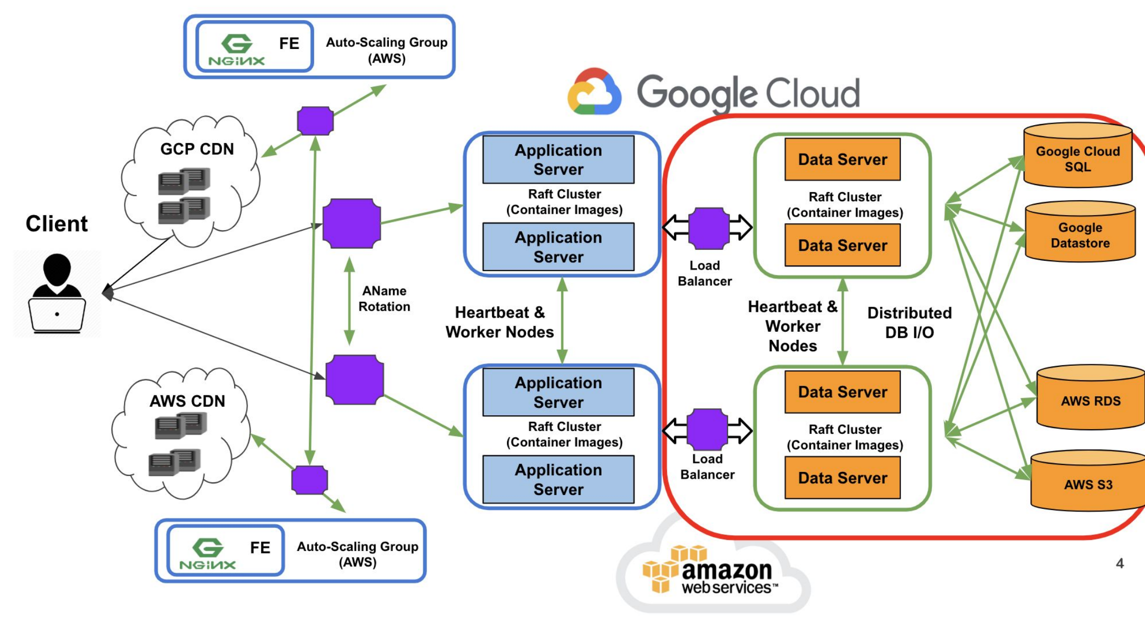
- Still focused on the data layer
- Leader Forwarding
- Round-Robin load balancing per cloud
- DB Recovery
- Multi-Cloud DB communication


FE
Auto-Scaling Group (AWS)
GCP CDN
Client
Google Cloud
Application Server
Raft Cluster (Container Images)
Application Server
AName Rotation
Heartbeat & Worker Nodes
Application Server
Raft Cluster (Container Images)
Application Server
AWS CDN
FE
Auto-Scaling Group (AWS)
Load Balancer
Load Balancer
Data Server
Raft Cluster (Container Images)
Data Server
Heartbeat & Worker Nodes
Distributed DB I/O
Data Server
Raft Cluster (Container Images)
Data Server
Google Cloud SQL
Google Datastore
AWS RDS
AWS S3
amazon web services™


Application Servers
Load Balancer
Data Server
RAFT data
Data Server
RAFT data
Data Server (Leader)
RAFT data
RAFT
Google SQL
Google Datastore
AWS RDS
AWS S3

Single Cloud Load Balancing

- Nginx as a proxy and load balancer
- Round robin requests between servers within each cloud
- Multi cloud consensus for state agreement for the entire cluster



Leader Forwarding

- Leader of the cluster handles writes
- Any node can service reads
- Only the leader can propose a new value to the cluster
- Values are only committed upon consensus
- When a node receives a write request, it checks itself for leadership
    - If it is the leader, it will initiate consensus, write the query to the log, and execute the query
    - If it is not, it will find the leader’s IP via Raft cluster configuration and send the body of the request to the leader

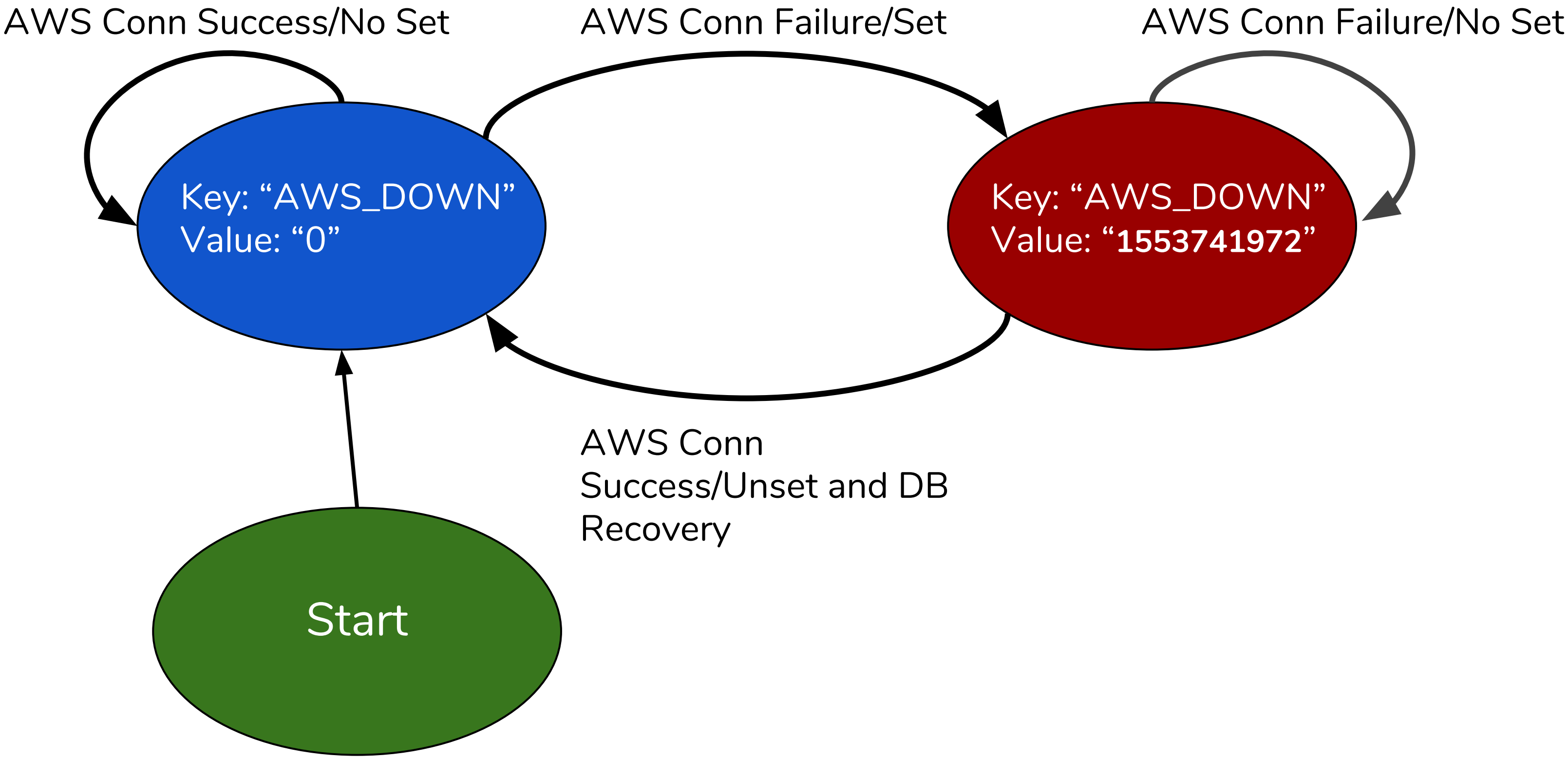
Multi-Cloud Database I/O

- The database servers will read from a pseudo random database that is healthy
- If read encounters unhealthy DB, it will notify leader and read from a healthy DB
- On writes, the dao servers will write to all the DBs
- if one or all the dbs are down, beside the instructions, the db down state will be written to the raft log as well

Database Forwarding

- Detecting down databases
- Detecting databases that have come back from the dead
  - Use raft log for recovery
- If a non leader node detects a database state change, notify the leader
  - Only the leader can propose changes to the raft log / update db state
- Internal Timestamps -- need to switch to external source

Database Forwarding



AWS Conn Success/No Set

AWS Conn Failure/Set

AWS Conn Failure/No Set

Key: “AWS_DOWN”
Value: “0”

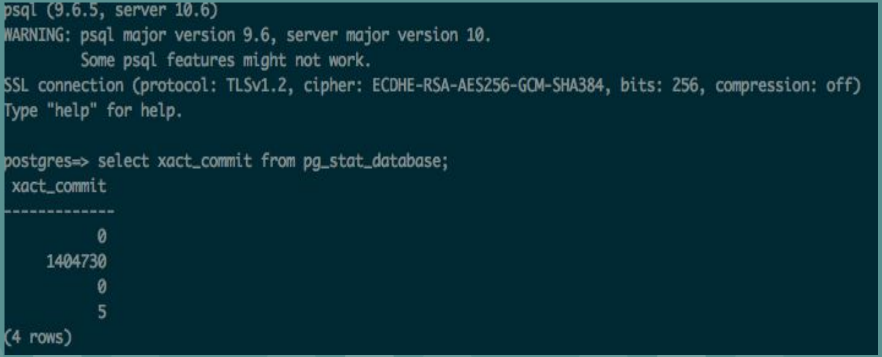
Key: “AWS_DOWN”
Value: “**1553741972**”

AWS Conn Success/Unset and DB Recovery

Start

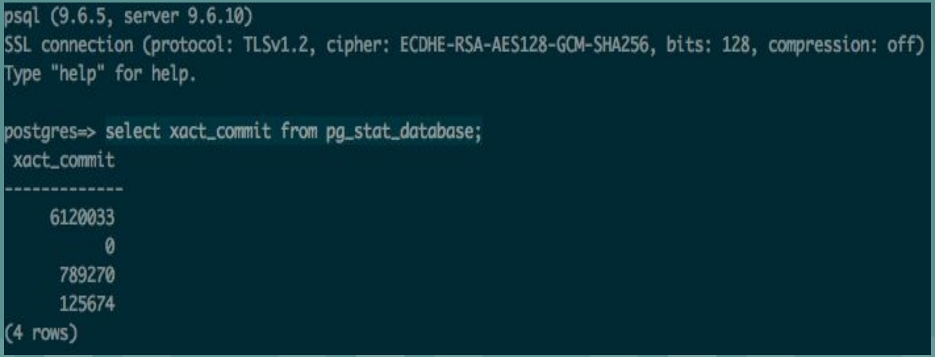
Transaction Counters

- Database versions are not homogenous
- Numbers do not just reflect our own actions since we’re using a DB Service



```
psql (9.6.5, server 10.6)
WARNING: psql major version 9.6, server major version 10.
         Some psql features might not work.
SSL connection (protocol: TLSv1.2, cipher: ECDHE-RSA-AES256-GCM-SHA384, bits: 256, compression: off)
Type "help" for help.

postgres=> select xact_commit from pg_stat_database;
 xact_commit
-------------
           0
     1404730
           0
           5
(4 rows)
```

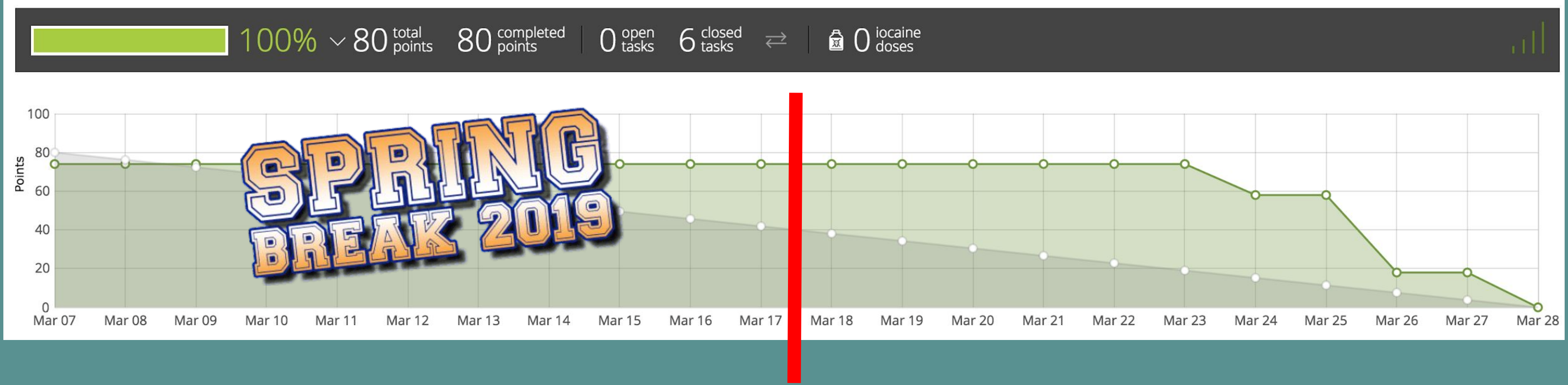


```
psql (9.6.5, server 9.6.10)
SSL connection (protocol: TLSv1.2, cipher: ECDHE-RSA-AES128-GCM-SHA256, bits: 128, compression: off)
Type "help" for help.

postgres=> select xact_commit from pg_stat_database;
 xact_commit
-------------
     6120033
           0
      789270
      125674
(4 rows)
```

DEMO TIME!

Sprint 3 Burndown



MVP / Next Steps

- MVP is finished!
- Fully test database forwarding
- Implement consensus in the application layer
- DNS ANAME rotation for application servers

Thank you!
Questions?