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Highway to Hell or Stairway to Cloud?

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ABOUT ME

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WE BRING FASHION TO PEOPLE IN 17 COUNTRIES

17 markets

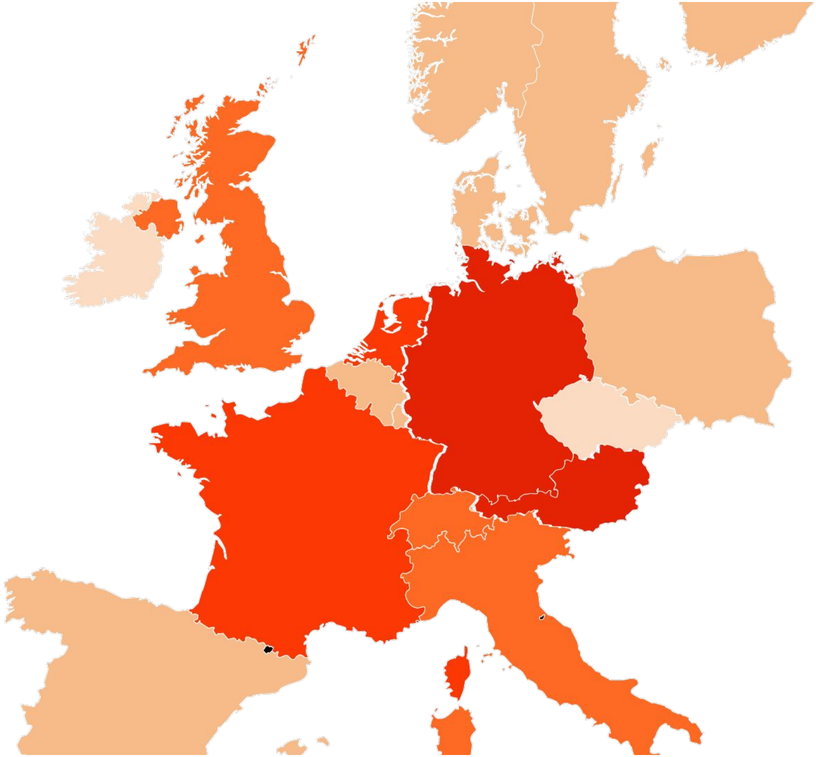
7 fulfillment centers

23 million active customers

4.5 billion € net sales 2017

200 million visits per month

15,000 employees in Europe



FACTS & FIGURES

> 300 databases

on premise

> 650 clusters

in the Cloud (AWS)

AGENDA

About the old setup

Choosing your cloud options

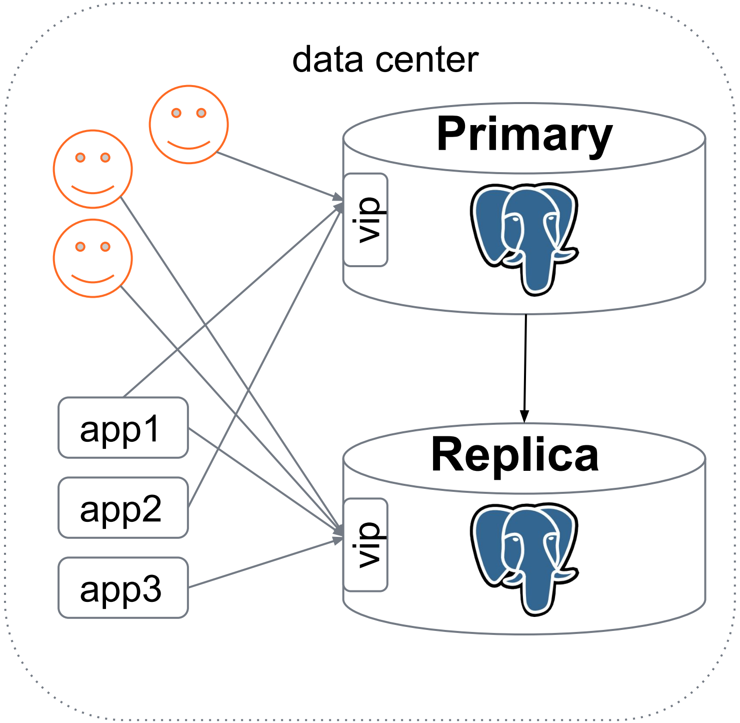
Retain access & make it secure

Data migration & switchover

Backup & recovery

Conclusions

The old setup



- Provisioned in 2015
- DELL PowerEdge R730xd
- 2 * Intel Xeon E5-2667v3 (16 cores)
- 256 GB RAM
- 14 * 1.5 TB SSD in raid10 (10.5 TB)
- Network: 2 * 10 GBit/s
- PostgreSQL 9.6

Under the hood

- 3000 tables
  - two tables per event
    - Hot data (last 10 days)
    - Archived data
  - No primary/unique keys!
- About 100 millions inserts/day
- Size (before the migration): 10 TB
- Avg growth 2 TB per year

Free space: 500 GB

Upgrade or migrate?

Migrate it!

- Minimize costs (cloud isn’t cheap)
- How to switch back to the data center if something goes wrong?
- How to retain access through the old connection url?
- Make it secure
- Minimal downtime

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Candidates

- Amazon Aurora
- DIY
    - i3 instances
    - EBS backed instances
        - gp2
        - io1

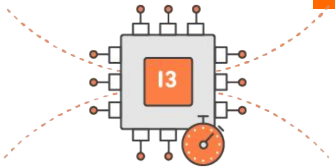
Amazon Aurora

PROS

- AWS promise decent performance
- Storage auto-scaling
  - All instances are sharing the same storage!
- Price for storage is the same as for gp2 EBS, **$0.119**/GB-month

CONS

- $0.22 per 1 million I/O requests.
- **plproxy** extension is not available



i3 instances

PROS

- Local NVMe volumes:
  - low latency
  - high bandwidth and throughput
- Low storage price
- 488 GB RAM

CONS

- Ephemeral volumes
  - Minimum 3 instances for HA
- The biggest instance has “only” 15TB

EBS backed instances (m4/r4)

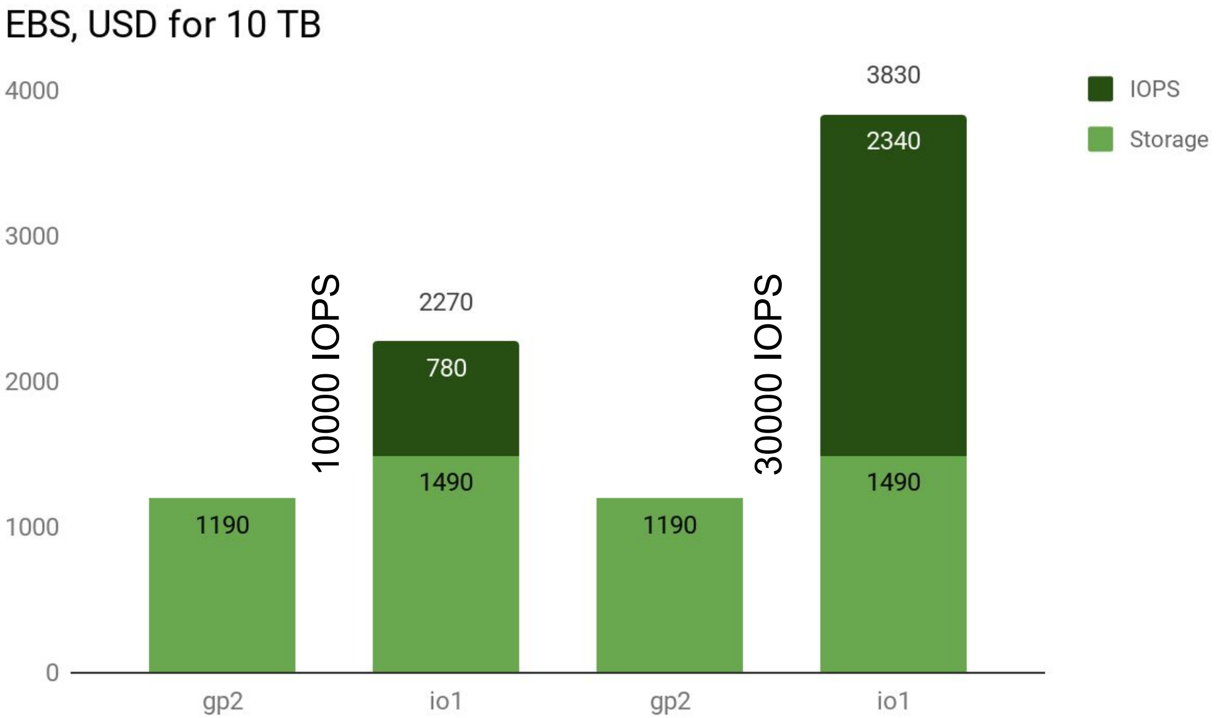
PROS

- Data on EBS survives instance restart
- Easy to scale up or down
- Makes it possible to run only two instances

CONS

- I/O latencies
- Limited IOPS and bandwidth per volume:
    - **gp2**: 160 MB/s, 10000 IOPS
    - **io1**: 500 MB/s, 32000 IOPS
- Price per GB (comparing with i3)

gp2 vs io1



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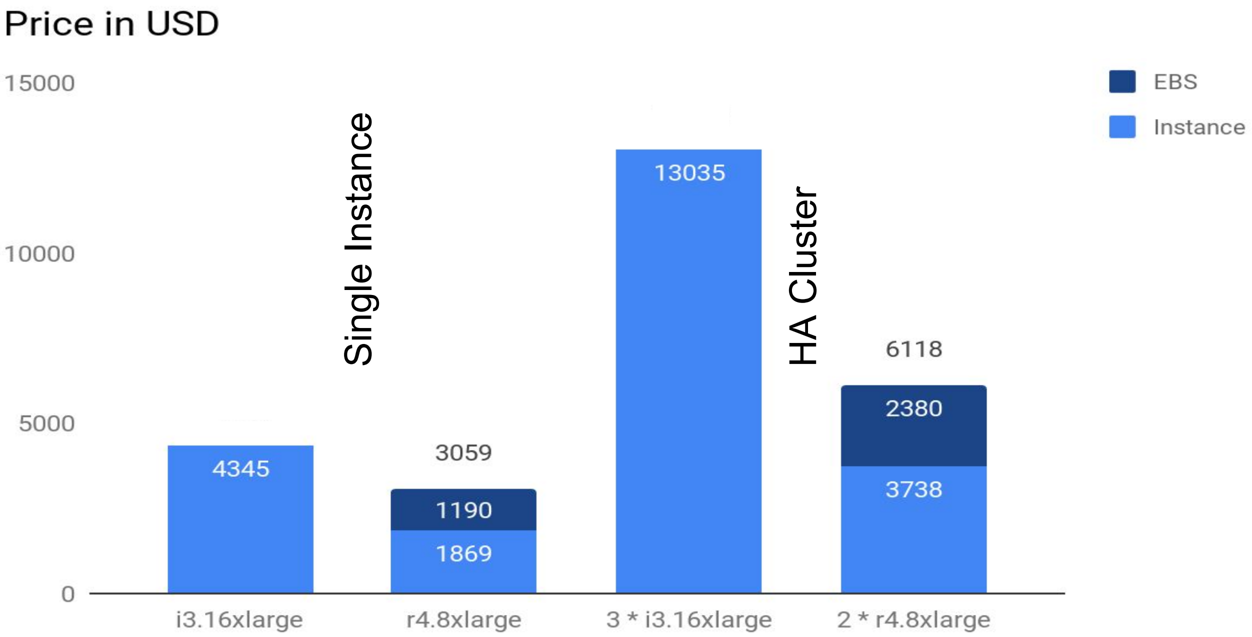
Do benchmarks

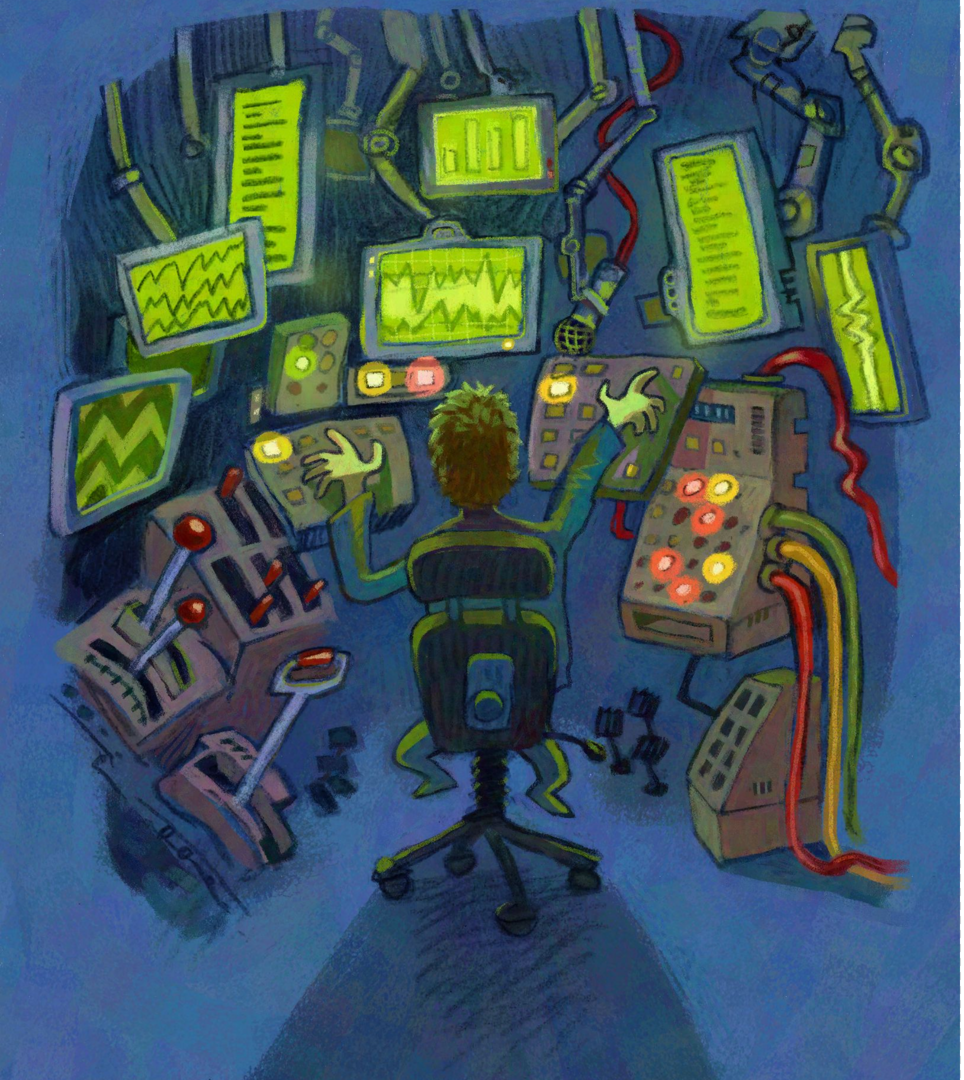
- Cloud makes it very easy to conduct experiments
- Apply the load similar to production
    - Ideally, replicate production workload
- Use **Spot** instances to make it cheaper

It’s all about the money (and risks)



The cloud setup

- r4.8xlarge
  - 32 vCPU cores
  - 244 GB RAM
  - 37500 IOPS
  - 875 MB/s
- 20 TB EBS gp2
  - 6 * 3333 GB, raid 0



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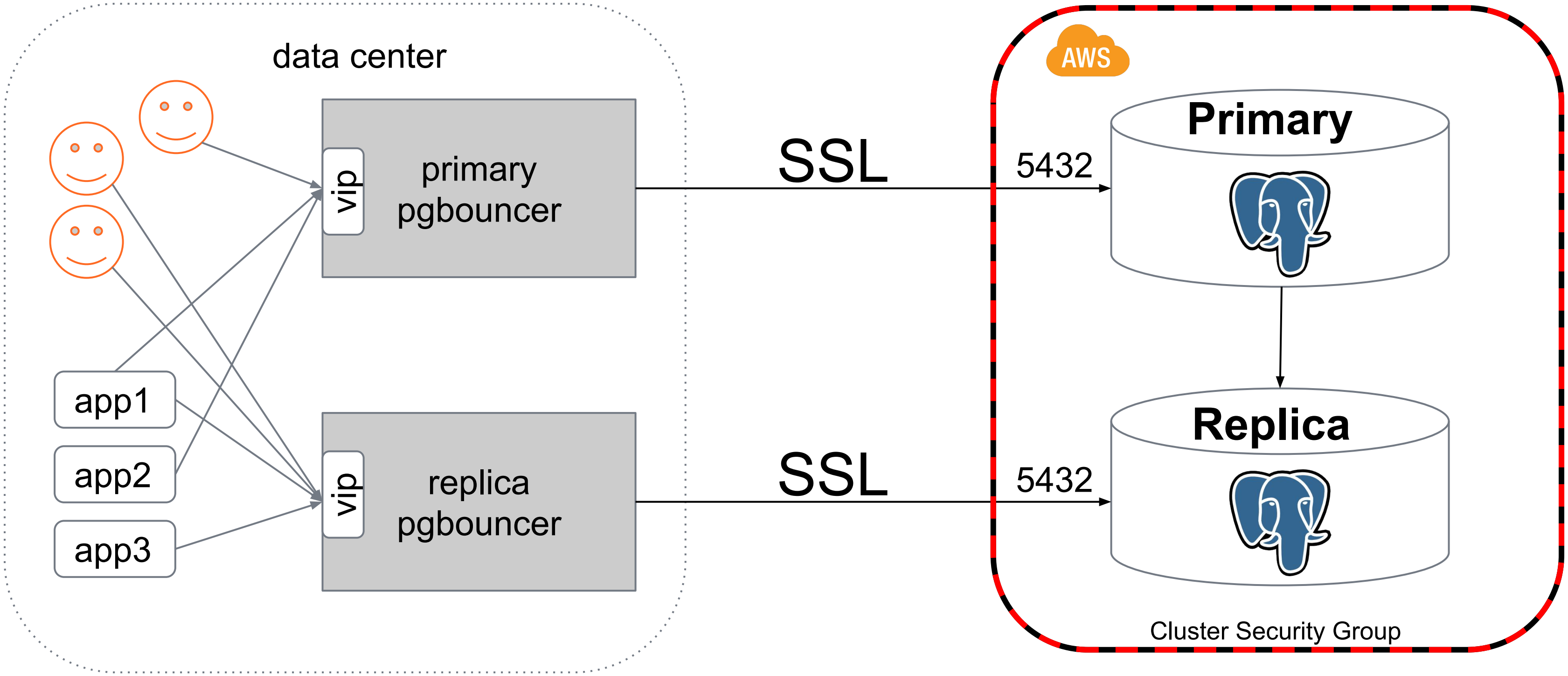
How to retain access via old conn_url?

- Possible options:
  - DNS
  - “Proxy” (iptables/HAProxy/pgbouncer)
- Think about security:
  - Internet traffic **MUST** be encrypted!
  - Some of the legacy applications are not using **SSL**
    - Nobody wants to fix legacy code :(
  - How to protect from Man-in-the-Middle attack?

Pgbouncer to the rescue



Make it secure

- Setup **CA**
- Generate server and client keys
- Sign server and client certs with the **CA** private key
- Postgres must validate the client certificate from pgbouncer
- Pgbouncer must validate the Postgres server certificate

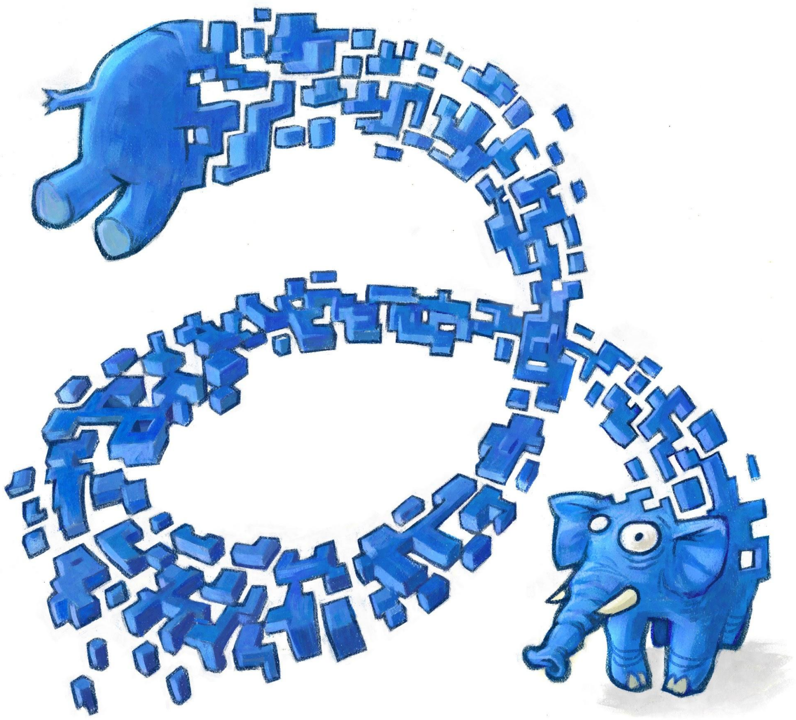
Postgres configuration

- postgresql.conf
  - ssl_cert_file = ‘server.crt’
  - ssl_key_file = ‘server.key’
  - ssl_ca_file = ‘**ca.crt**’
- pg_hba.conf
  - hostssl   all all A.B.C.D/32 md5 **clientcert=1**
  - hostnossl all all A.B.C.D/32 reject

data center public ip

Pgbouncer configuration

- Configure pgbouncer (in the data center)
    - pool_mode = session
    - auth_file = users.conf
    - auth_query = “SELECT * FROM pgbouncer.user_lookup($1)”
    - server_tls_sslmode = verify-ca
    - server_tls_ca_file = **ca.crt**
    - server_tls_cert_file = client.crt
    - server_tls_key_file = client.key



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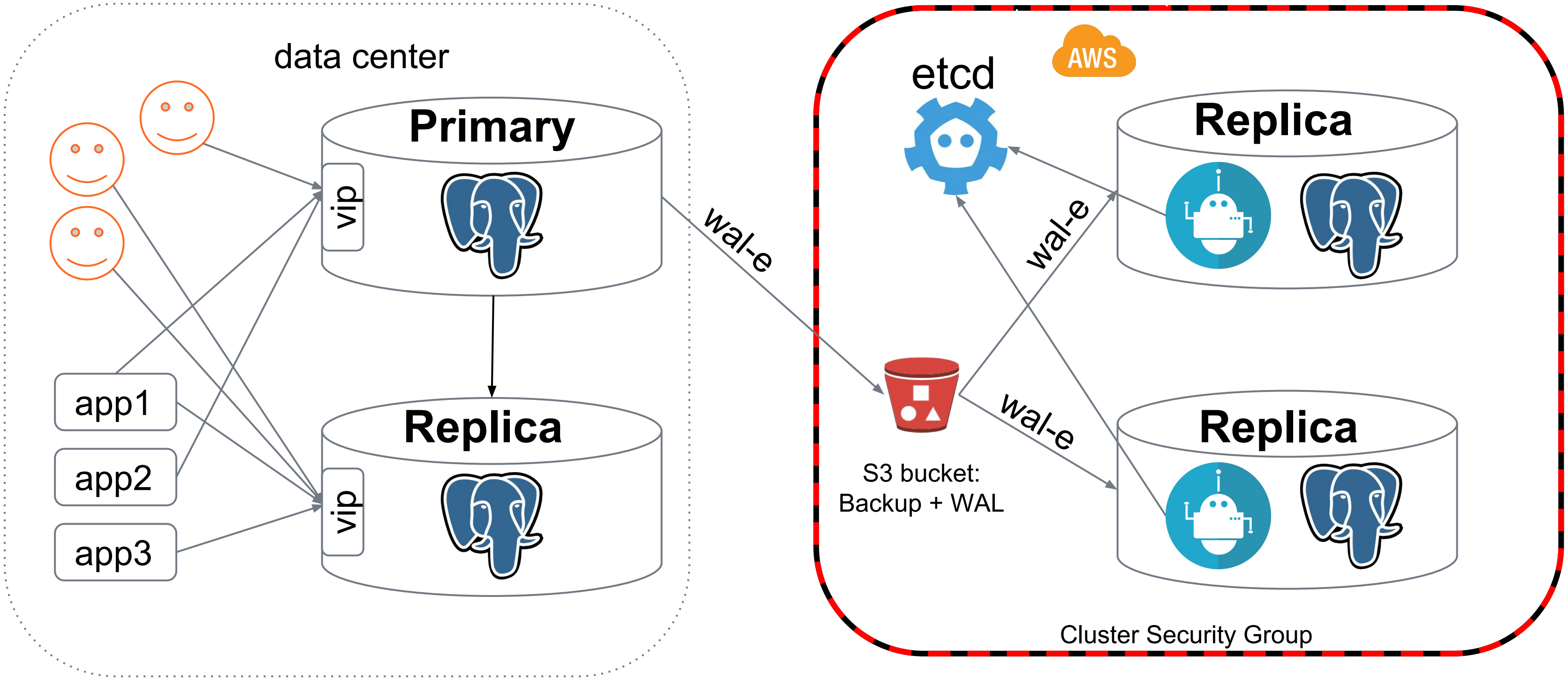
Possible options

- pg_basebackup + physical replication
    - via VPN?
    - via SSH tunnel?

- S3 compatible backup tool
    - WAL-E
    - pgBackRest
    - WAL-G

Keep it Simple



Migration statistics

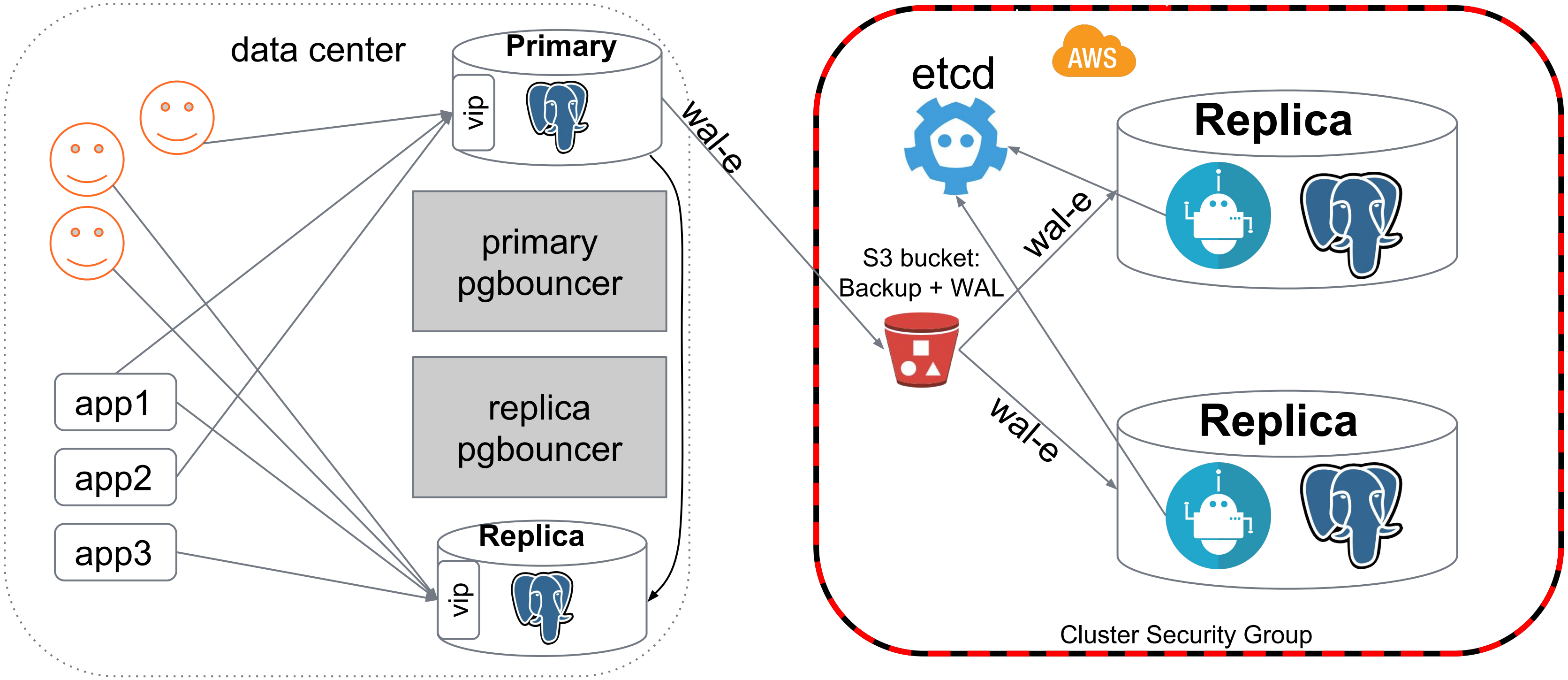
“wal-e backup-push” in the DC:	12 hours
“wal-e backup-fetch” on AWS:	9 hours
Replay accumulated WAL:	4 hours

replication lag in such setup is usually about a few seconds and determined by amount of write activity on the primary.

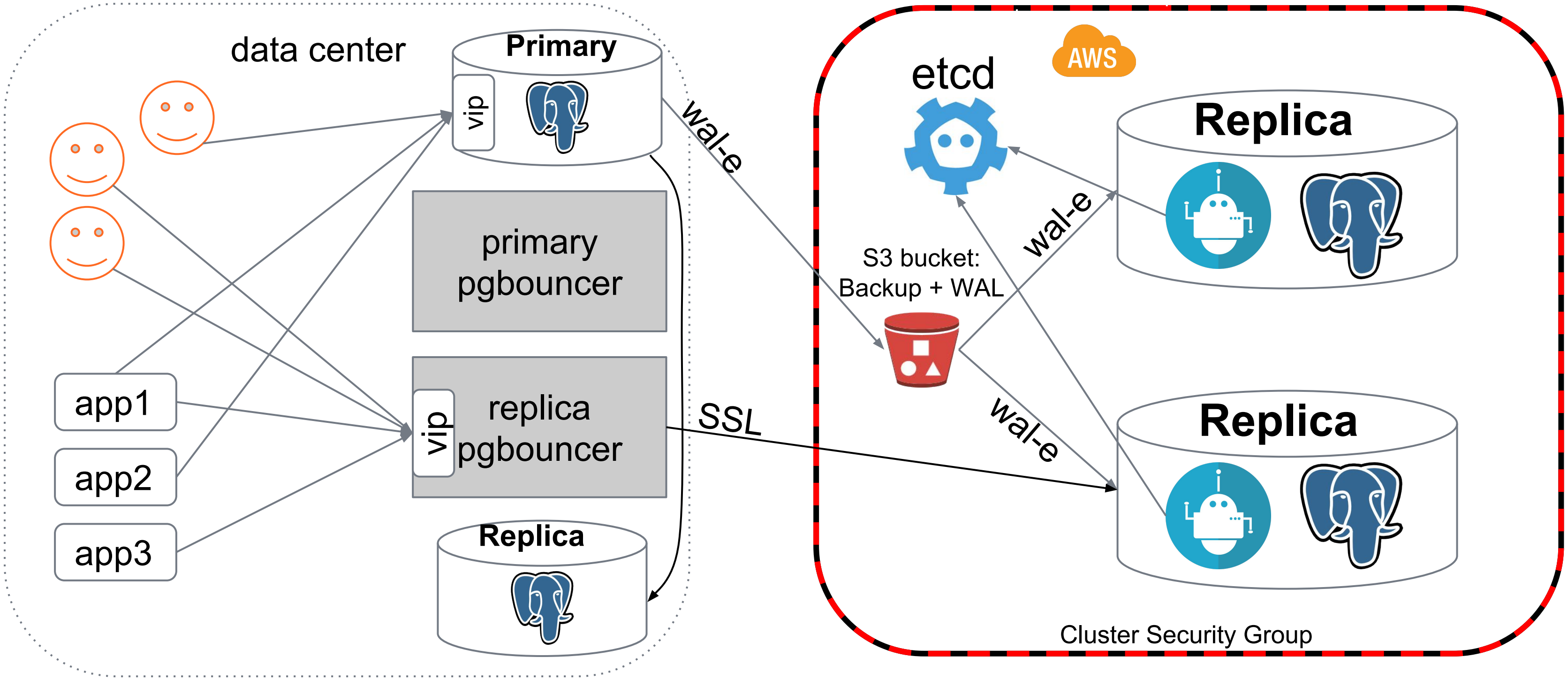
Switchover plan

1. Shutdown the main application writing into DB
2. Move the replica **virtual ip** to the pgbouncer host
3. Shutdown the replica in the data center
4. Move the primary **virtual IP** to the pgbouncer host
5. Shutdown the primary in the data center
6. Promote replica in the Cloud
7. Start the main application
8. Start replicas in the data center with the new recovery.conf

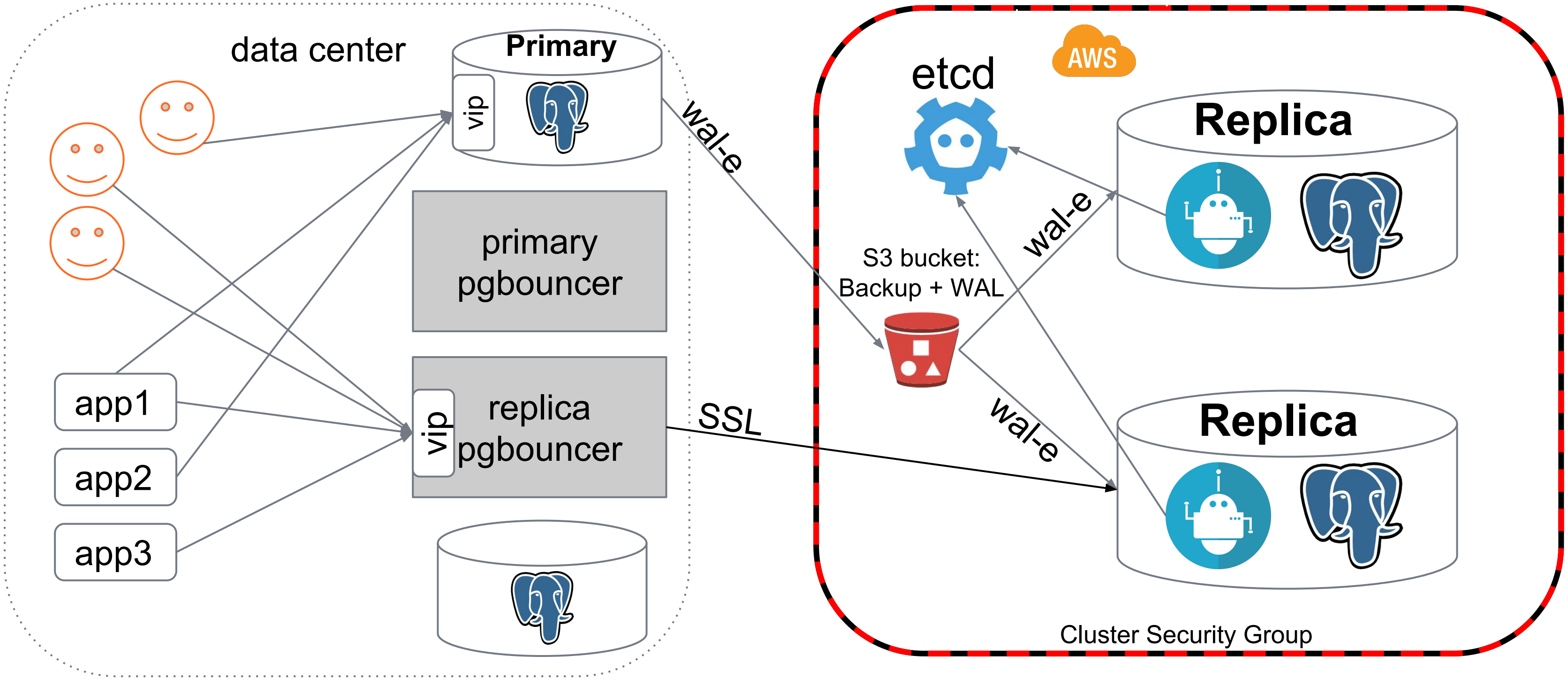
Before the switchover



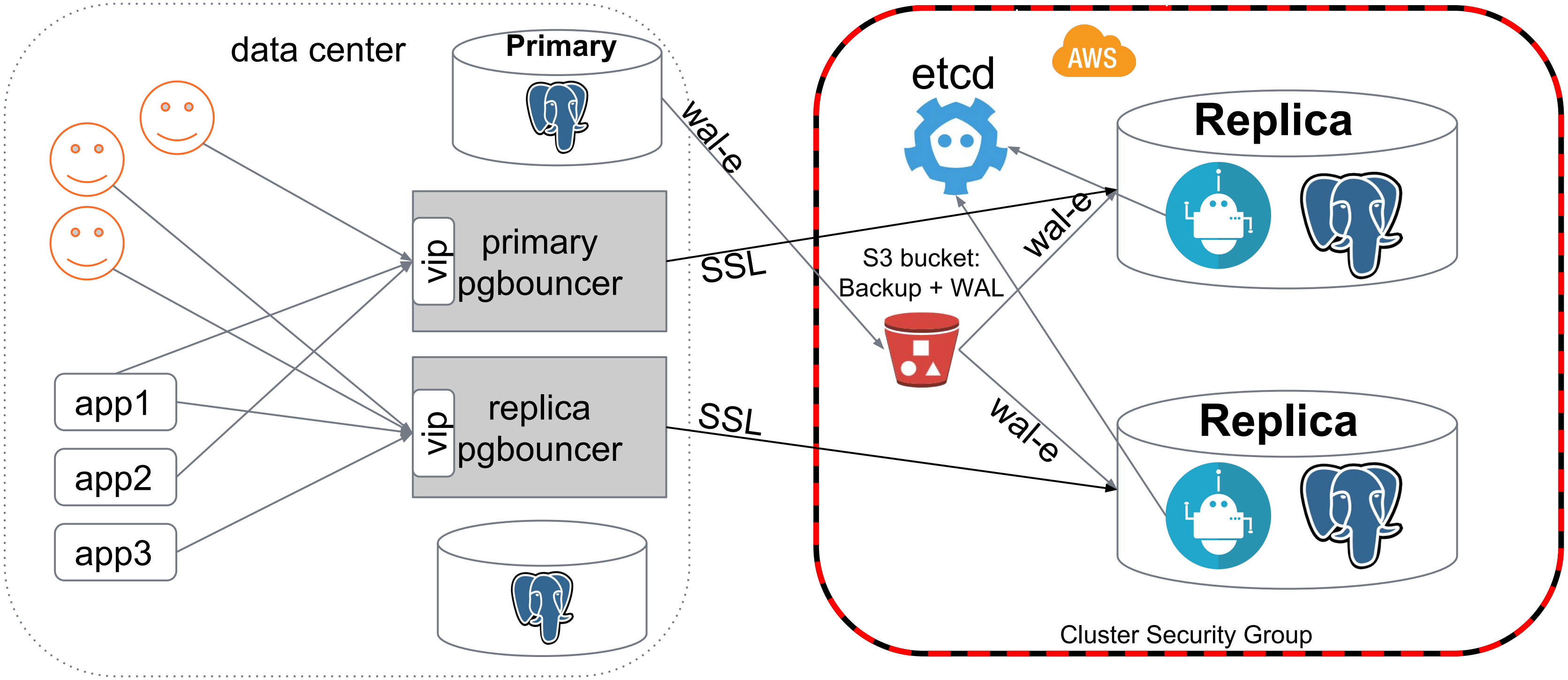
Move the replica VIP



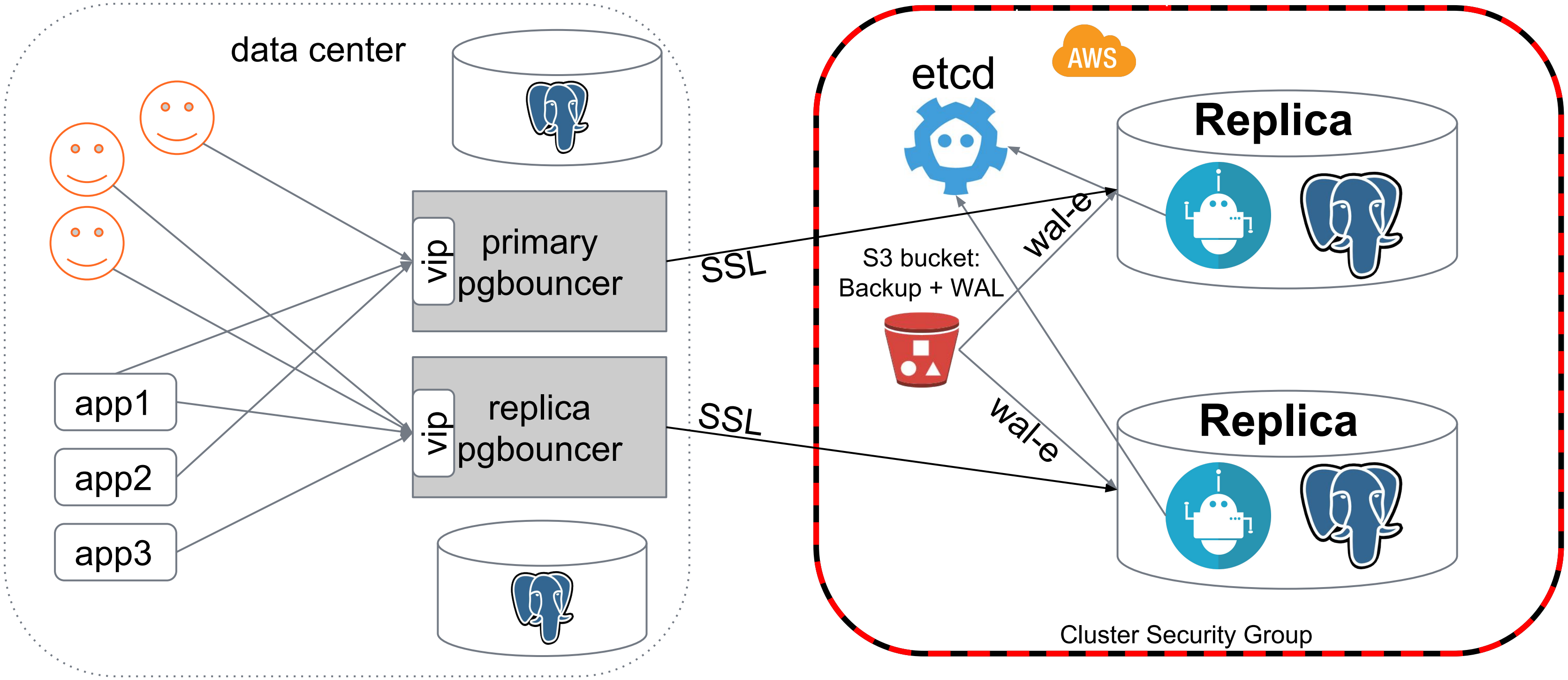
Shutdown the replica



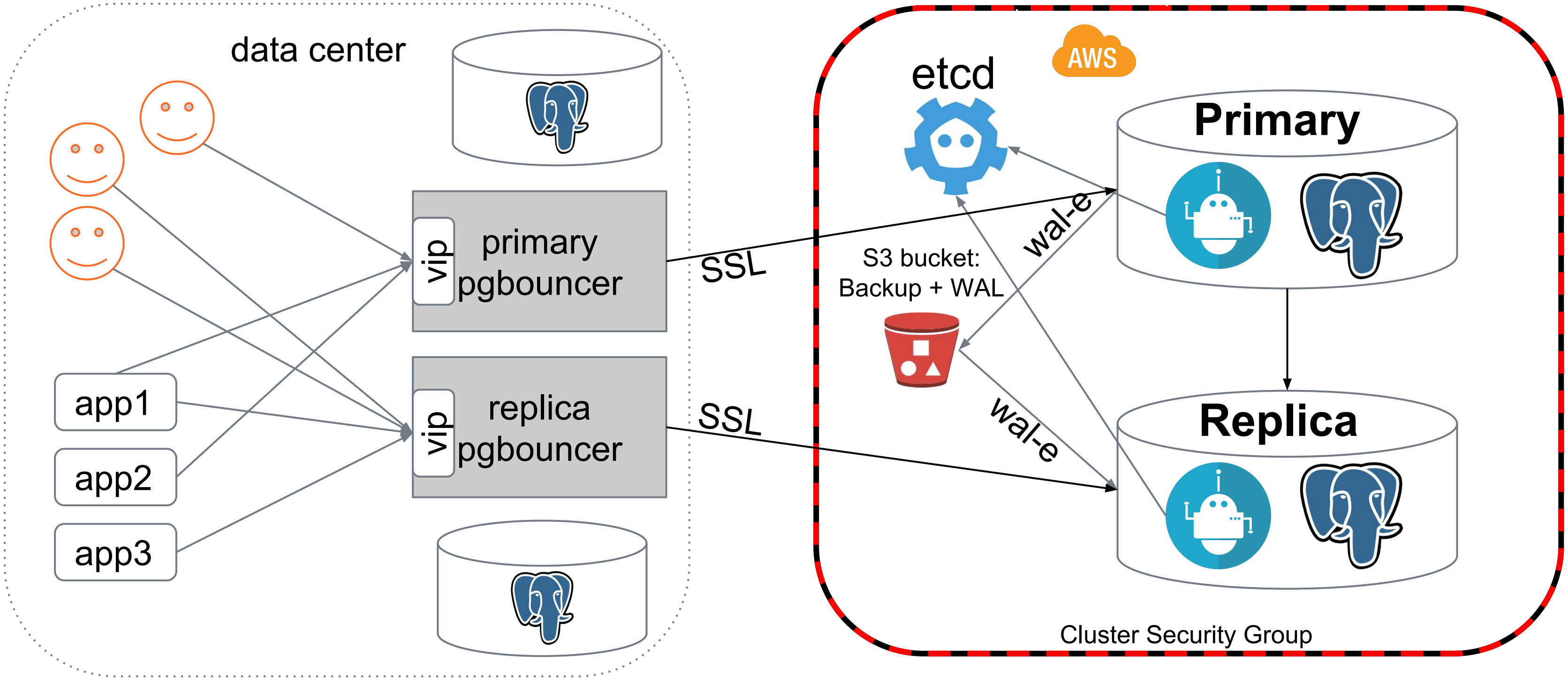
Move the primary VIP



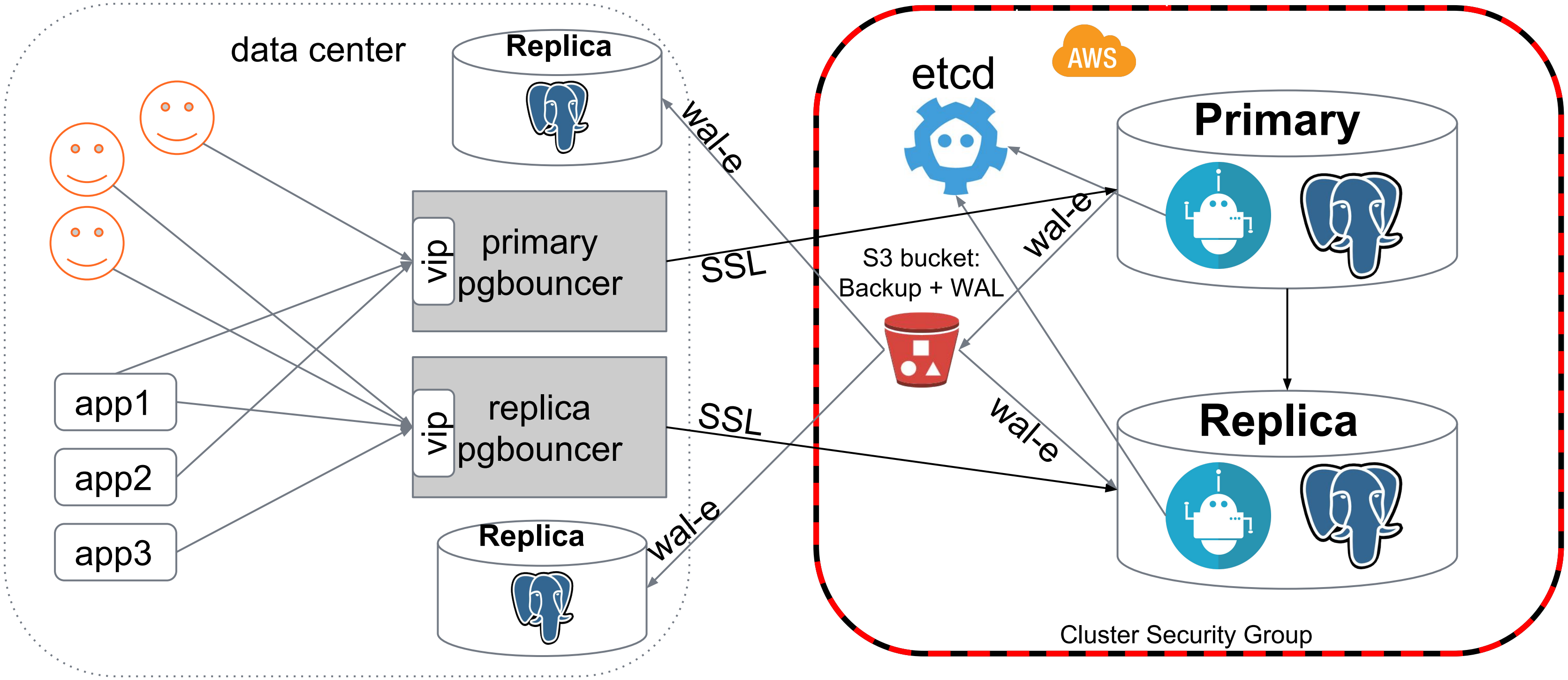
Shutdown the primary



Promote the replica on AWS



Start replicas in the data center



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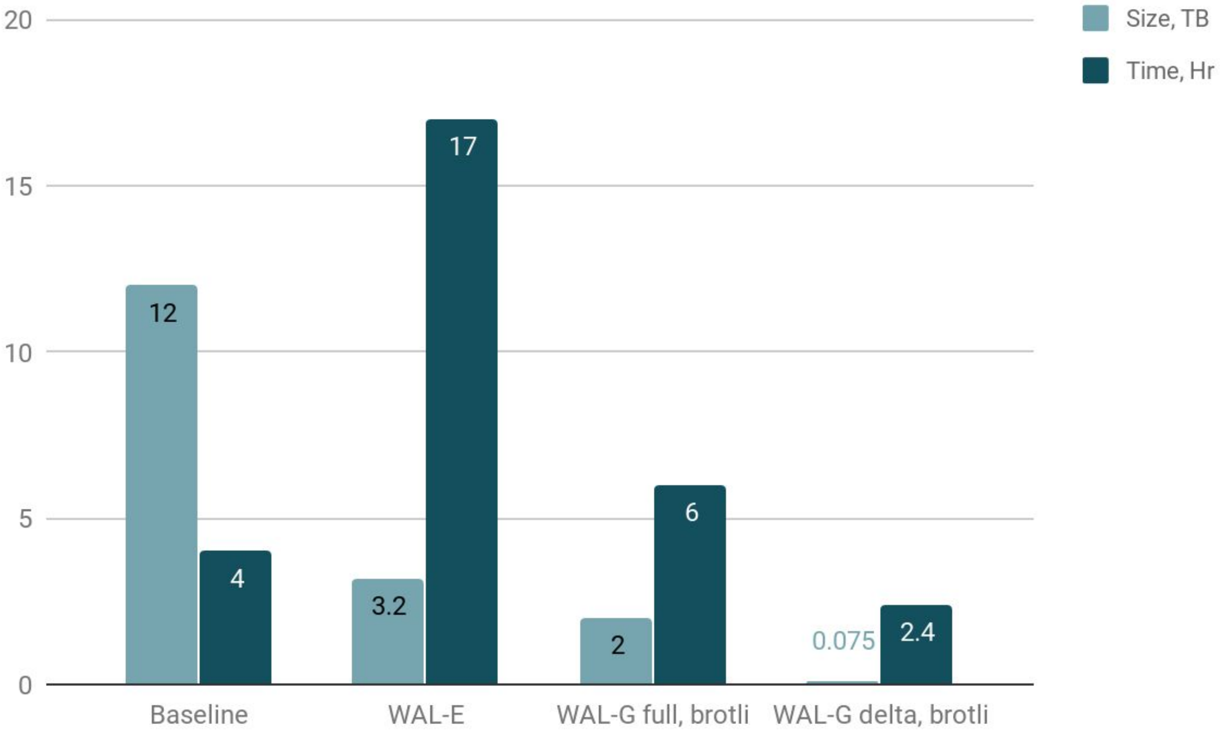
S3 compatible backup tools

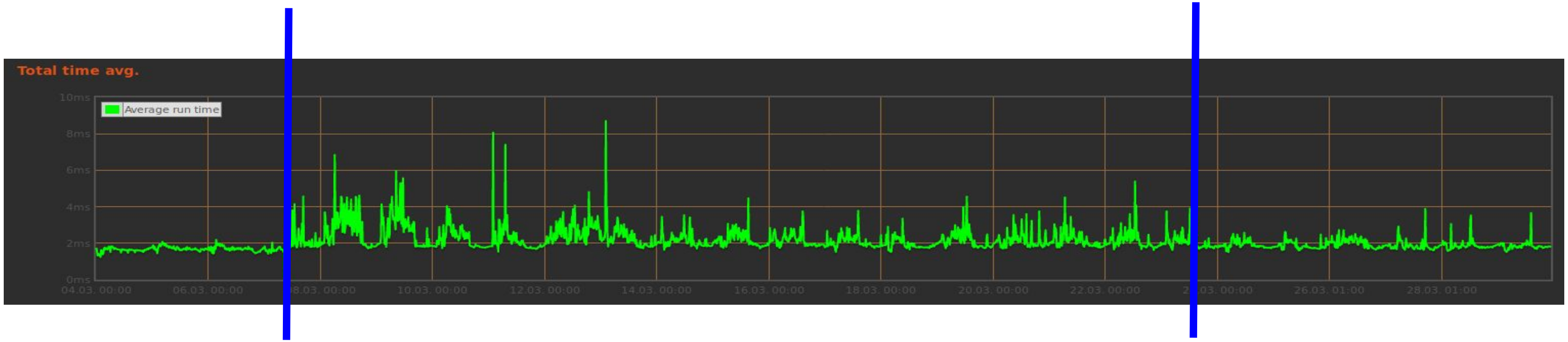
- **WAL-E** is our primary backup tool in the cloud
  - is too slow on big volumes of data :(
  - can’t take basebackup from the replica :(
- **pgBackRest**
  - incremental & differential backups
  - can’t use AWS instance profile credentials :(
- **WAL-G**
  - delta backups
  - configurable compression methods: **lz4**, **lzma**, ~~**zstd**~~, **brotli**
  - backward compatible with **WAL-E**

WAL-E vs WAL-G on r4.8xlarge



After the migration

Keep an eye on monitoring!!!



Switchover

synchronous_commit = ‘off’

Links

- Patroni: https://github.com/zalando/patroni
- WAL-E: https://github.com/wal-e/wal-e/
- WAL-G: https://github.com/wal-g/wal-g/
- pgBackRest: https://pgbackrest.org/
- pgbouncer: https://pgbouncer.github.io/
- Easy Amazon EC2 Instance Comparison: EC2instances.info

Thank you!