Testing for DR Failover Testing

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About Me

- **Zehua Liu**
  - With Zendesk Singapore since 2015
  - Worked at startups at various stages (Atlassian, mig33, Circos Brand Karma)
  - Leads the tooling team at Zendesk SG
Disaster Recovery Failover Testing

Failing over from the production data centre to the DR data centre
The Parent Problem

- A type of DiRT (Disaster Recovery Testing)
- Part of the BCDR project
  - Business Continuity and Disaster Recovery
- Our focus here
  - Testing lost of the data centre
  - Testing only customer facing features
    ■ Internal tools are excluded
Why conduct DR failover testing

- Compliance - SOC2 Testing twice a year
- Customer Agreements: Advanced Security Add-On
  - Recovery Time Objective - 8 hours
  - Recovery Point Objective - 0 hours
- Test and verify the procedures and documentation
- Identify gaps
- Improve the overall DR process
- Training for Responding Parties
Past attempts of DR failover testing

- Two DR failover testing exercises
  - Four DR failover tests
- Encountered various issues
  - Infrastructure, e.g., database, network
  - Configuration
  - Application, couldn’t handle failure in infrastructure
- Examples of issues
  - Double billing customers
  - iOS app did not work
  - DB replication back to original production was too slow
Can we increase our confidence in DR Failover Testing?
Test the DR environment before failing over
Testing the DR environment

- **Ideal:** automated testing while DR is still in standby mode
  - Run the exact same tests that we run for production
  - Automatically triggered after a change to DR

- **Issues:**
  - Most tests inevitably write data about the test accounts to the DBs in DR
  - Run just the read only tests?

- **The big question:**
  - Should we allow direct write into data stores in DR??
Should we allow direct write into data stores in DR?
● The big question:
  ○ Should we allow direct write into data stores in DR??
● A *trade-off* between risk of production failure and risk of failed DR failover
  ○ writing to DR DB => risk of production failure
  ○ test coverage => risk of failed DR failover
Zendesk Chat Technical Architecture

Static Assets

Cloudflare

Data Centre

Web Servers

Account Service

Live Chat Service

Data API Service

Consul

ElasticSearch

Riak Cluster

Memcached

MySQL

Redis

Mediators

Mediator (US)

Mediator (DE)

Mediator (SG)

Dashboard

Widget

Mobile Apps

Mobile SDK
Zendesk Chat Technical Architecture

Core Services
- Web Servers
- Consul
- ElasticSearch
- Riak Cluster
- Memcached
- MySQL
- Redis

Services
- Account Service
- Live Chat Service
- Data API Service
Data Stores

- MySQL
  - master $\Rightarrow$ slave replication (DR DB as read only slave)
  - Least confident, might cause data corruption, stop replication, etc
- Riak
  - Commercial license with multi-dc sync support
- ElasticSearch
  - Could be rebuilt from source of truth
- Redis: ephemeral data
- Memcached: cold start?
● Good news
  ○ The applications mostly partition data by accounts!
  ○ We could use a dedicated set of test accounts that would never get used on prod
    ■ In theory, these test data is isolated from other customer account data in data stores
    ■ Good to replicate back and forth between DR and production MySQL DBs
Alternatives

- Avoid writing to the real DR DBs?
- Allow writing to only less risky DBs?
- Allow writing to all DBs
**Setup a different set of test data store servers**
- Configure the apps to use them only during test
- Switch back before the actual failover
- Does not test the physical connection
Setup the different set of DBs on the same physical servers as the real ones

- **Naming tricks:**
  - `test_account_db` to mirror account database
  - `test_chat_history` for ES indices, etc
- **Covers the physical connection**

Alternatives - Avoid writing to the real DR DBs?
- Setup the different set of DBs on the same physical servers as the real ones.

Alternatives - Avoid writing to the real DR DBs?

- ElasticSearch
- Memcached
- MySQL
- Redis
- Riak
- Cluster
- Data API Service
- Live Chat Service
- Account Service
- Core Services
- Test DBs
- Consul
- DR DBs
- Use the real ones for all DBs, except MySQL
  - Use a test DB for MySQL
    - MySQL is the most risky one to allow writes
  - Setup the test DB as a writable slave of the DR DB?
• Use all real ones!
  ○ Data in DR DB will have to be eventually replicated back to production DB
  ○ Risks of test data in DR causing conflicts when replicated back to production DB
The big question:
○ Should we allow direct write into data stores in DR??

A *trade-off* between risk of production failure and risk of failed DR failover
○ writing to DR DB => risk of production failure
  ■ Yes, let’s do it!
○ test strategy/coverage => risk of failed DR failover
  ■ ?
More issues:
- Some tables use auto-increment column as primary key
- Insertion into those tables in DR ⇒ replication conflicts

Solutions:
- Play with auto_increment_increment and offset
- Avoid insertion into those tables
  - Identify those tables and avoid running tests that create new data in them
  - Luckily there are only a few non-critical ones
More issues:
- Someone might run the excluded tests and create new rows in the auto-increment tables in DR!

Solution:
- Use a different user with restricted permission
- Switch back to a full access user before failover
● DR apps use real DR DBs
  ○ No test DBs in DR
  ○ Same configuration as production
● MySQL master-master replication between prod and DR
● Avoid doing insertion in tables with auto-increment pkey
  ○ Exclude integration tests that do such insertions
  ○ Setup a MySQL user with restricted access
● We could run end-to-end browser tests against DR while it’s in standby mode!
● The **trade-off** between risk of production failure and risk of failed DR failover
  ○ writing to DR DB => **low** risk of production failure
    ■ Replication might fail, but we would know it early
  ○ test strategy/coverage => **low** risk of failed DR failover
    ■ Application on DR might fail in the excluded test cases, but not critical
The Final Proposal - Caveats

- Does not cover all aspects of DR failover readiness
  - Only functional tests
  - A bit of network link testing via MySQL replication
- Adds to the complexity of DR failover
  - More steps to be performed during the failover
● It is possible to test the DR env in standby mode
● It is a trade-off between risk of production failure and risk of failed DR failover
● Avoid using auto-increment keys if multi-DC support is needed
Questions?