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

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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

The Problem

Can we increase
our confidence in
DR Failover Testing?

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The Answer

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??

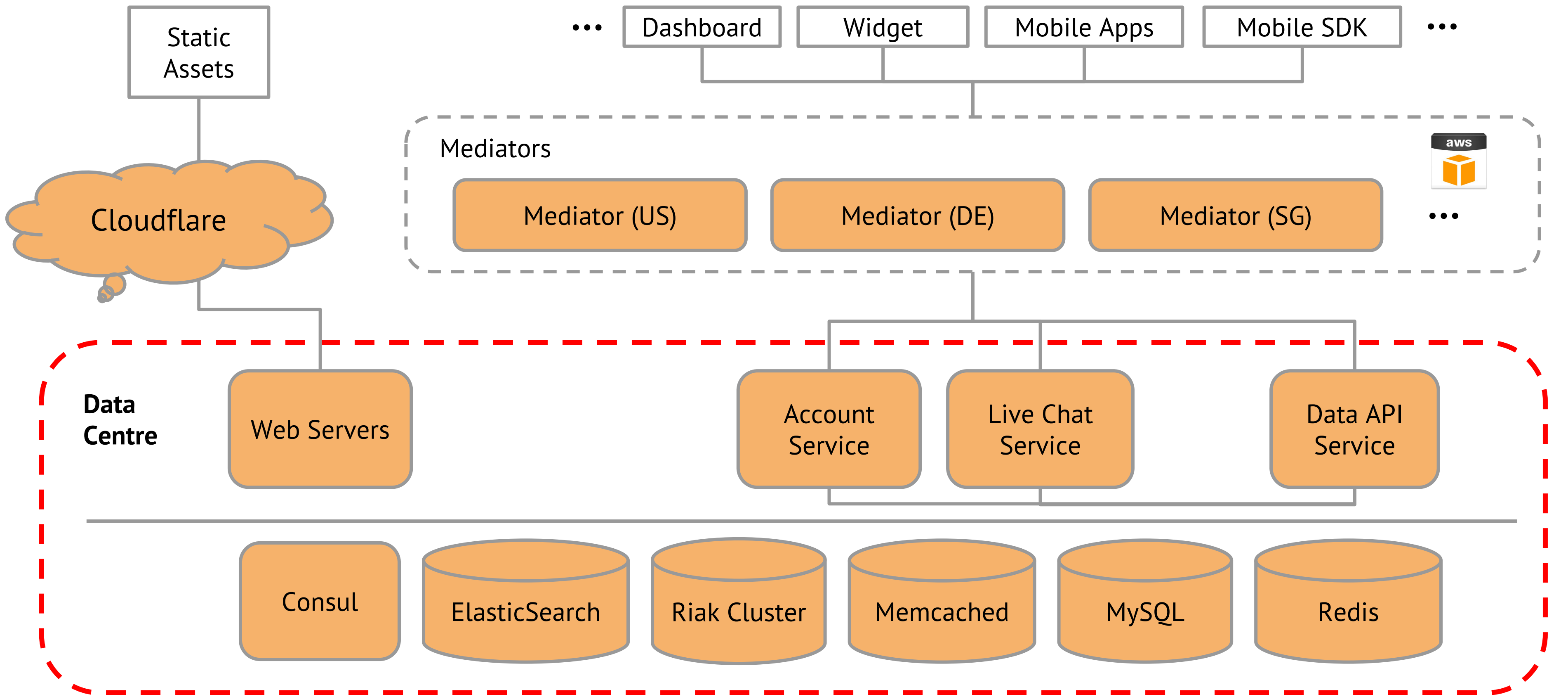
The Big Question

Should we allow direct write into data stores in DR?

Testing the DR environment

- 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



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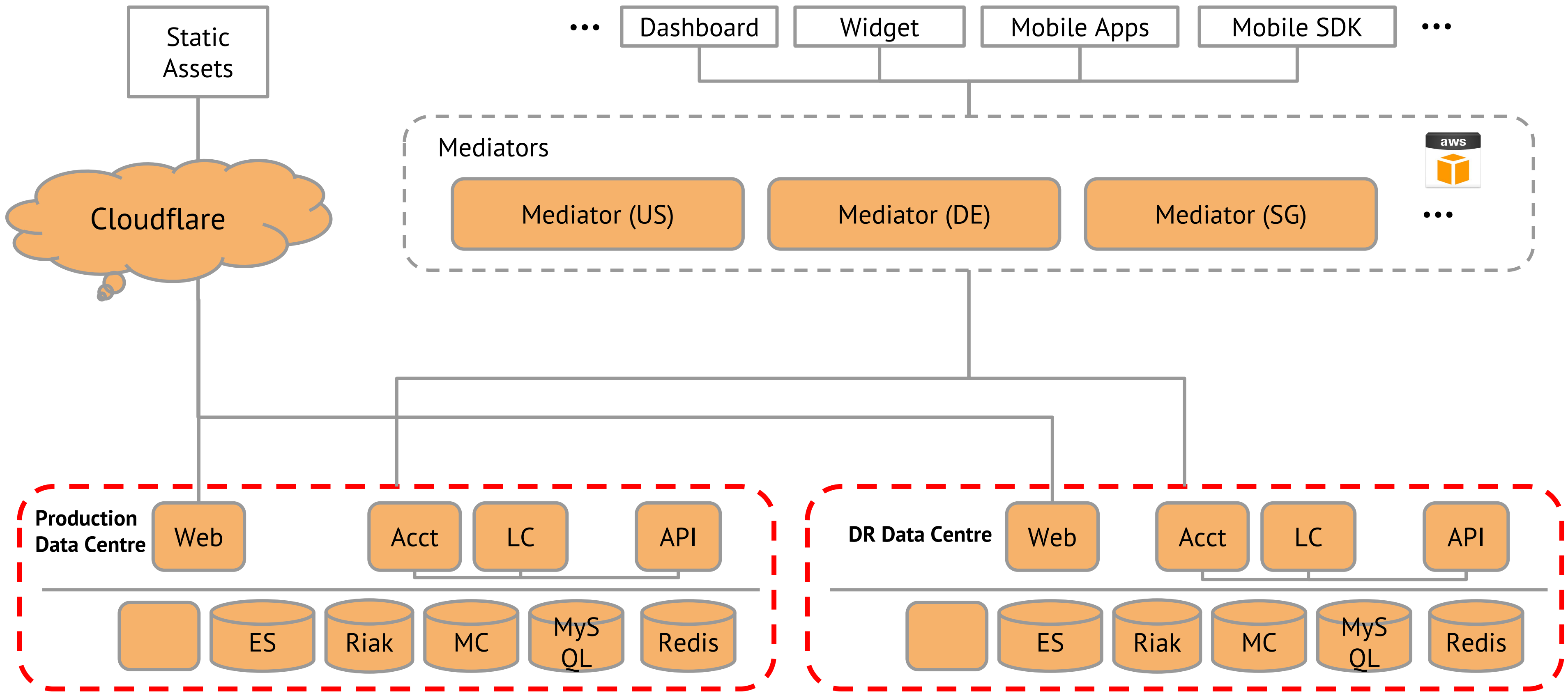
DR Failover



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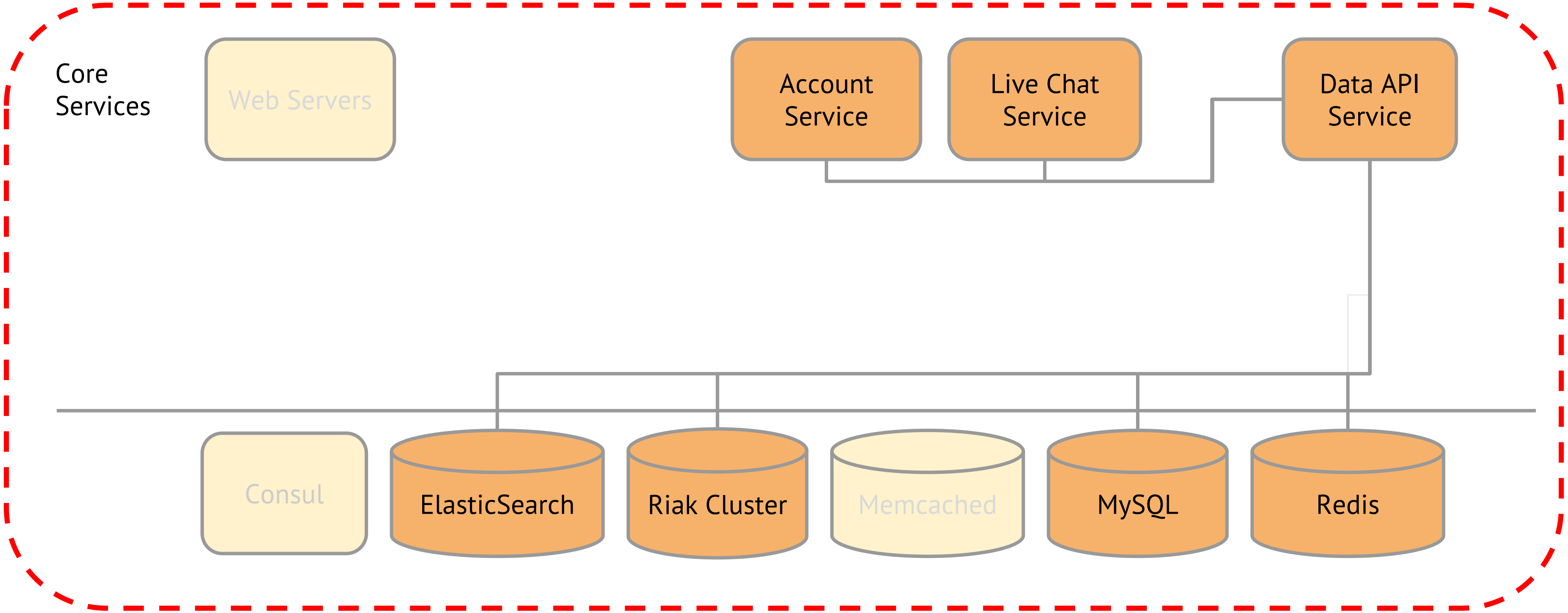
Zendesk Chat Technical Architecture



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Data Stores

- MySQL
  - master ⇒ 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?

The Approach

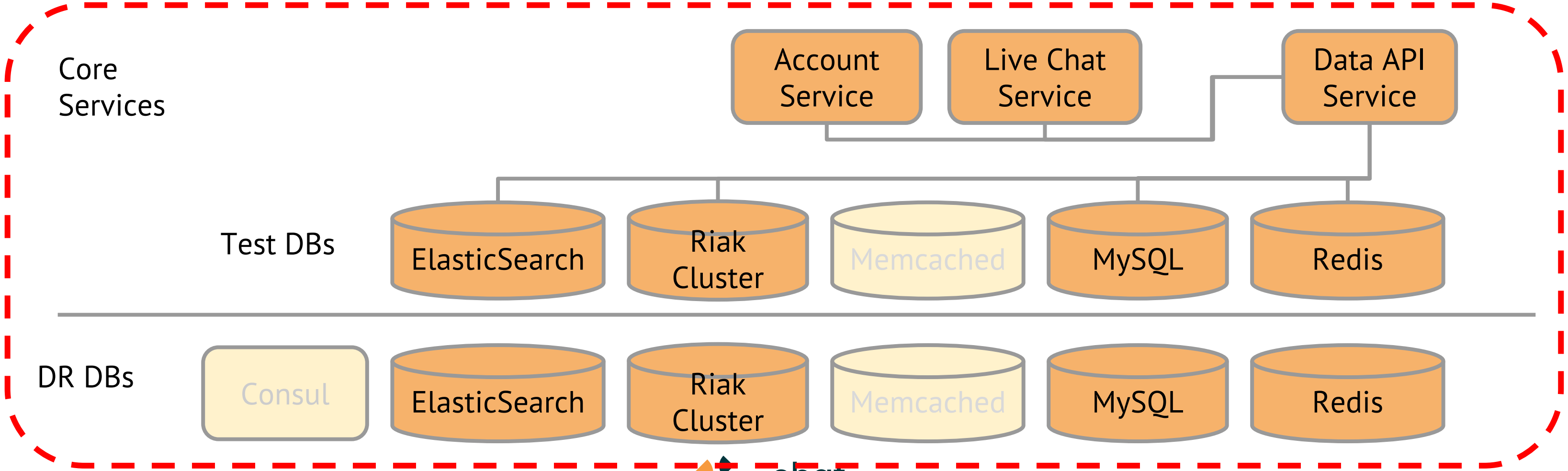
- Good news
  - The applications mostly partition data by accounts!
  - We could use a dedicated set of test accounts that would never get used on prod
    - In theory, these test data is isolated from other customer account data in data stores
    - Good to replicate back and forth between DR and production MySQL DBs

Alternatives

- Avoid writing to the real DR DBs?
- Allow writing to only less risky DBs?
- Allow writing to all DBs

Alternatives - Avoid writing to the real DR 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



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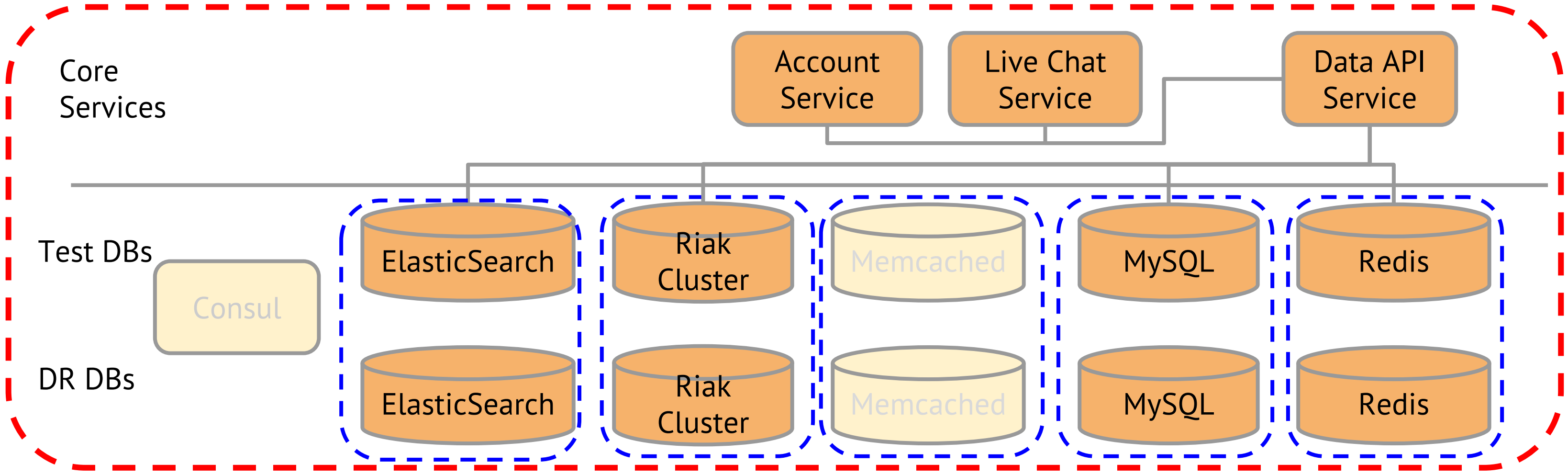
Alternatives - Avoid writing to the real DR DBs?

- 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

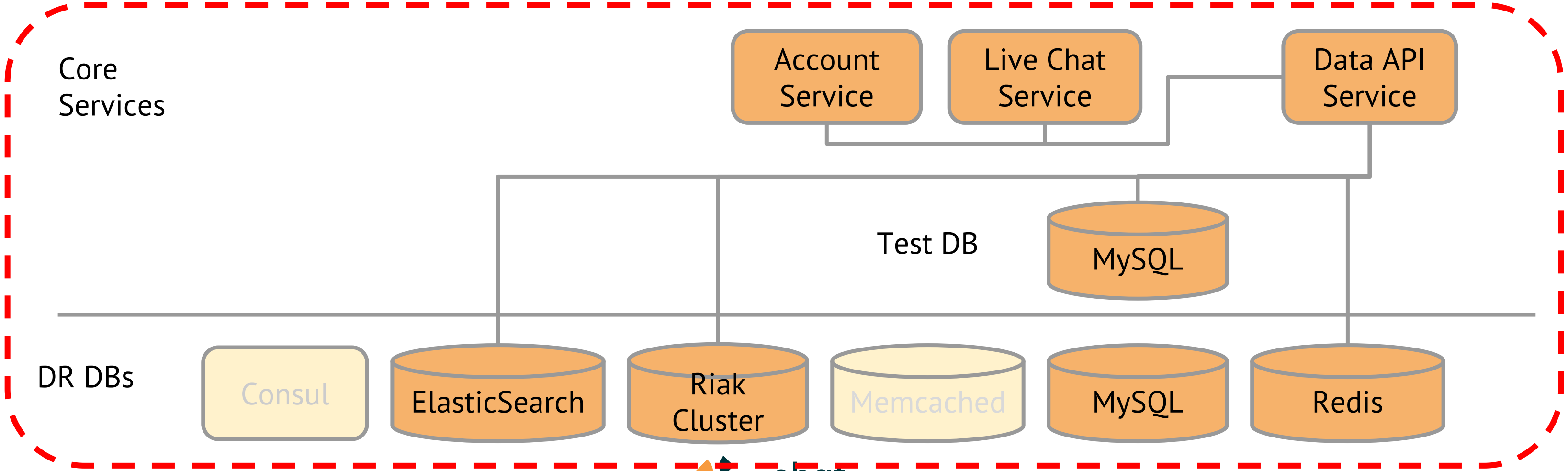
Alternatives - Avoid writing to the real DR DBs?

- Setup the different set of DBs on the same physical servers as the real ones



Alternatives - Allow partial writes

- 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?



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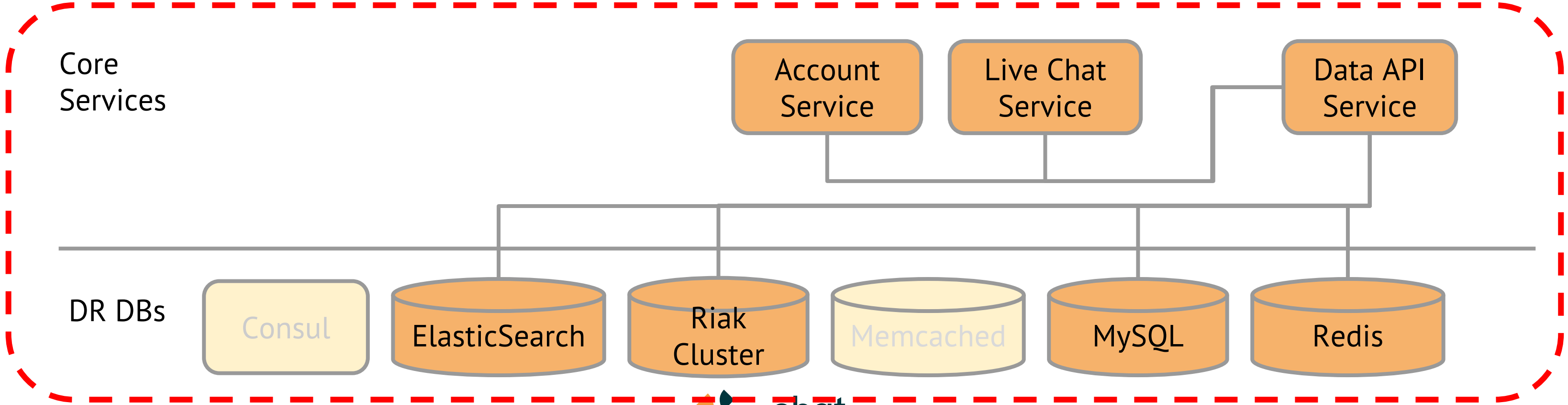
Alternatives - Writing to real DR DBs!

- 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



Testing the DR environment

- 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
    - ?

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The Final Proposal

- 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

The Final Proposal

- 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

The Final Proposal

- 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 Final Proposal

- 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

Conclusion

- 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?