RED HAT SUMMIT

Best Practices for Working with Data in a Microservices Architecture

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Red Hat

MSA has many benefits

- Freedom to independently develop and deploy services
- Better fault isolation
- Code for different services can be written in different languages
- Continuous integration and continuous delivery
- Easy to understand and modify
- Organized around business capabilities
- Easy to scale and re-use
- Work well with containers

But what about the data?

Martin Fowler: Decentralized Data Management where each microservice encapsulates its own data

Problems with a data store per microservice:

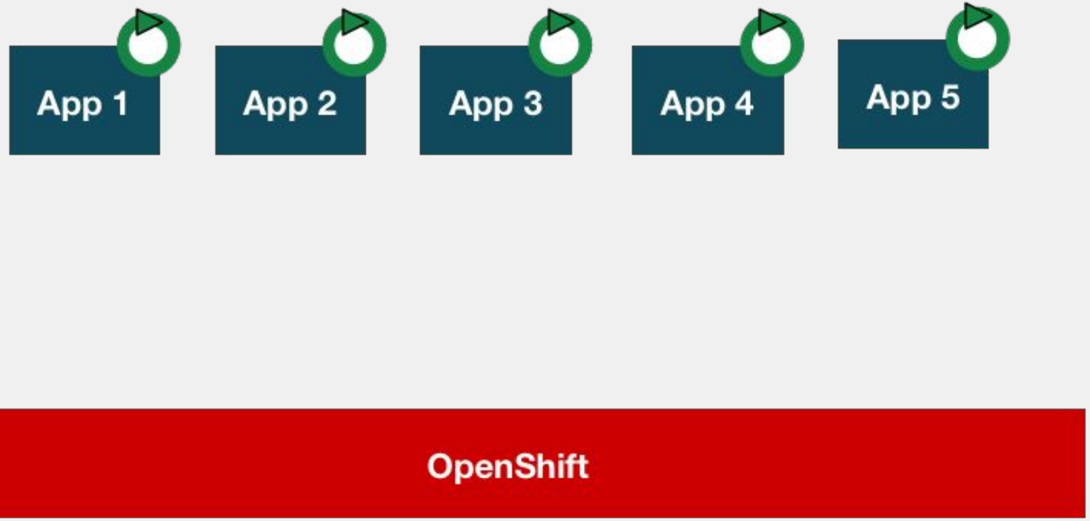
- Not enough ROI for breaking up existing databases and data warehouses
- Copying data can lead to inconsistency
- Security issues around access control
- Difficult to keep a consistent view of data across microservices

From Brownfield Database to Greenfield Microservice

Emmanuel Bernard

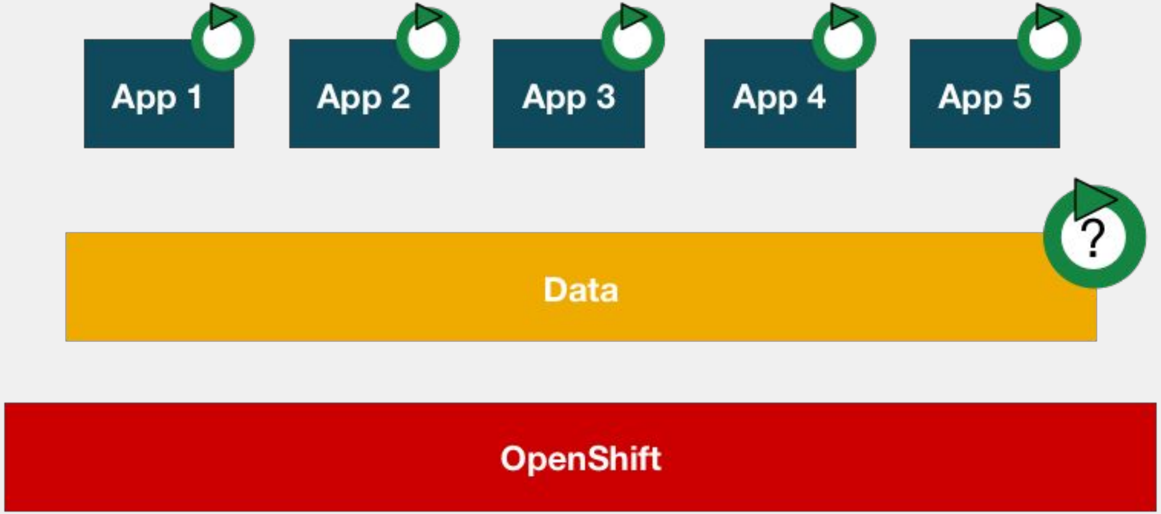
Monolith to microservices

From app velocity



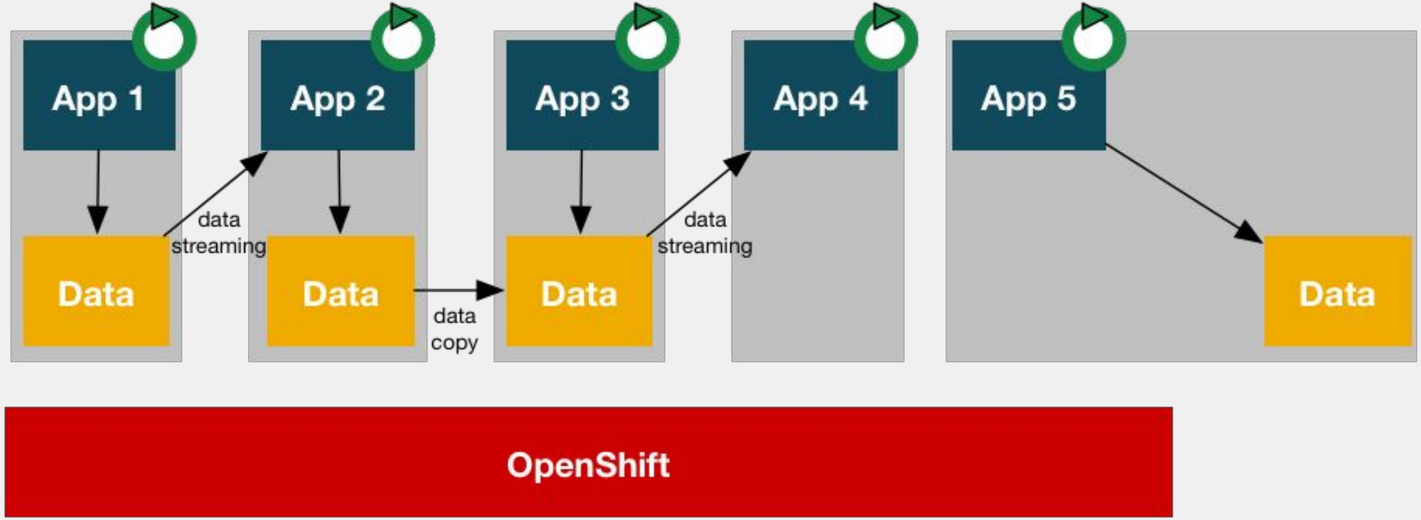
Monolith to microservices

To data velocity

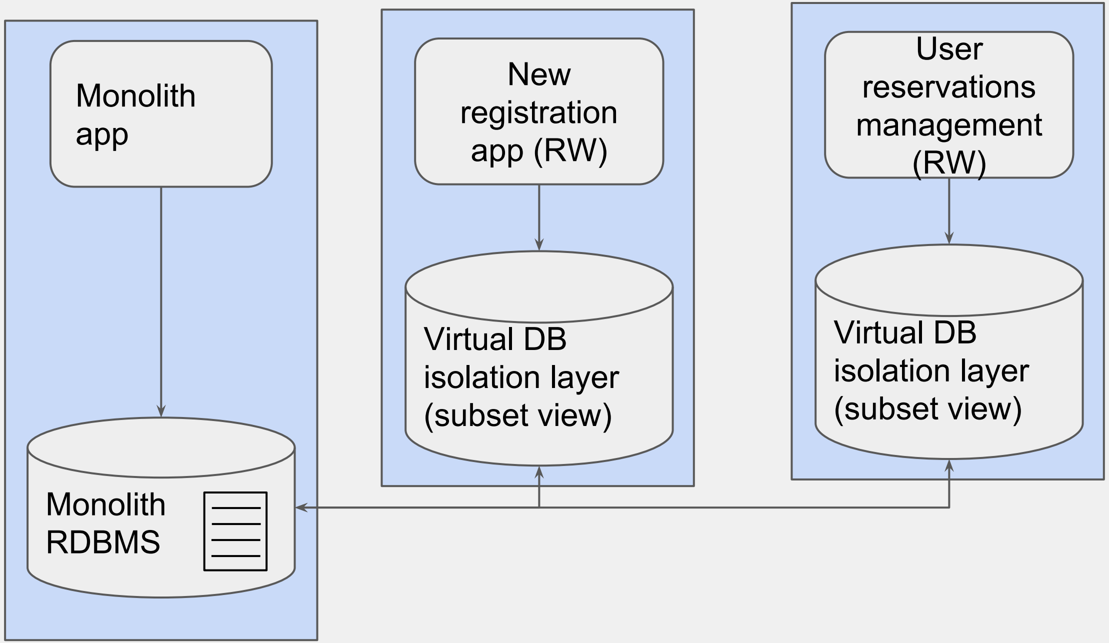


Big bang approach

What about the brownfield app?



One step at a time


Monolith app
Monolith RDBMS
New registration app (RW)
Virtual DB isolation layer (subset view)
User reservations management (RW)
Virtual DB isolation layer (subset view)

Benefits

Of data virtualization

Data remains centralized

- Monolith still works

Microservice only seeing the subset it is supposed to

- Clear boundaries ; Avoid dependency abuse
- Read / write

Step by step evolution preparing for the future

- Virtually choking the monolith before the coup de grace
- Data lineage

Data security

Controlling who uses which data set

More microservices, more demands on your data sources

- Who uses what?

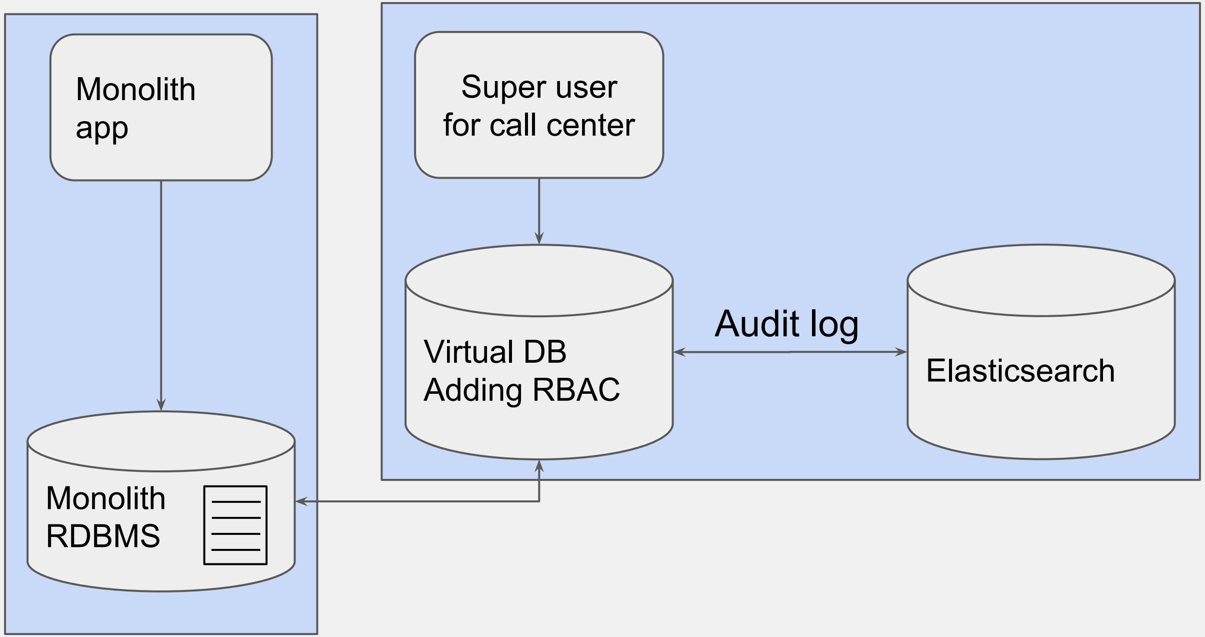
Regulatory constraints

Many aspects of securitization including

- Restrict access to a subset of the data
- Anonymize data
- Restrict who has access to specific data
- Audit and know who has see what

Approach

A reusable control piece: data firewall



Benefits

Common technology between apps and databases

A la carte restriction capabilities

- Controlled by a different team

Transparent to the microservice app development

Reusable solution across all microservices

Demo part 1
Hotel Reservations and Check-in

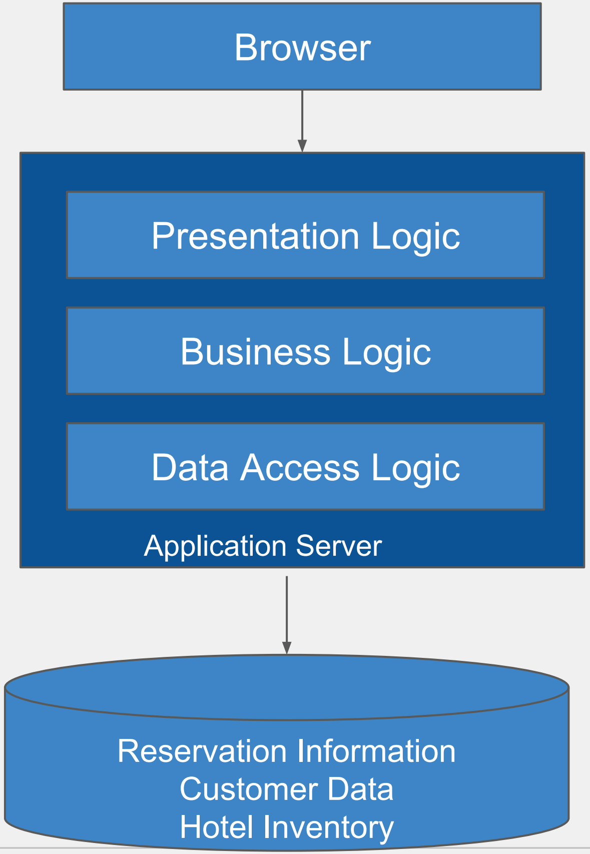
Kim Palko

Original Hotel Booking Application

Three-Tier Architecture

Single Application, Single Database

- Booking reservations
- Customer rewards
- Hotel room inventory

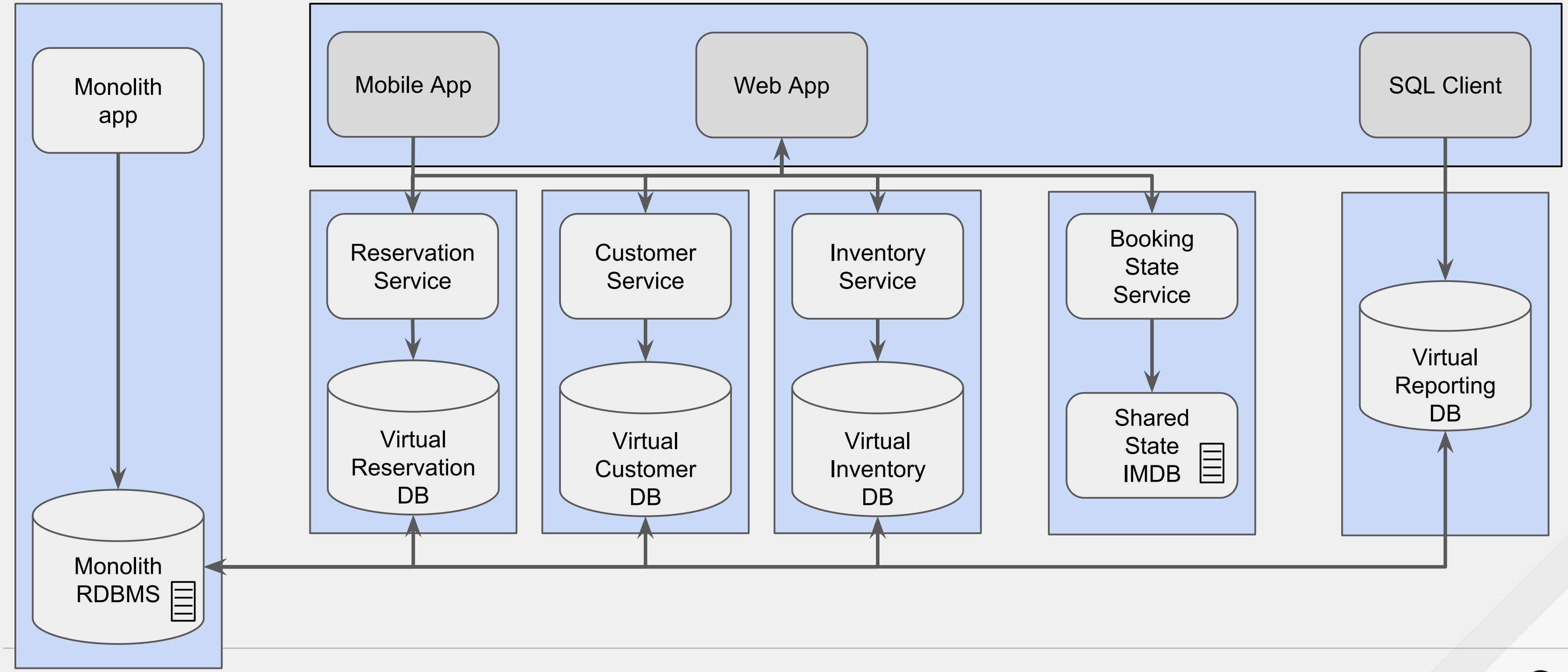


Problem: New functionality requirements with tight deadlines

- Mobile check-in
- Keyless entry
- GDPR privacy regulations

- Teams need to work independently and in-parallel
- Architecture needs to be open to post-relational technology
- GDPR:
  - Need to restrict access to a subset of data
  - Anonymize data (no PII)
  - Audit who has had access to what data

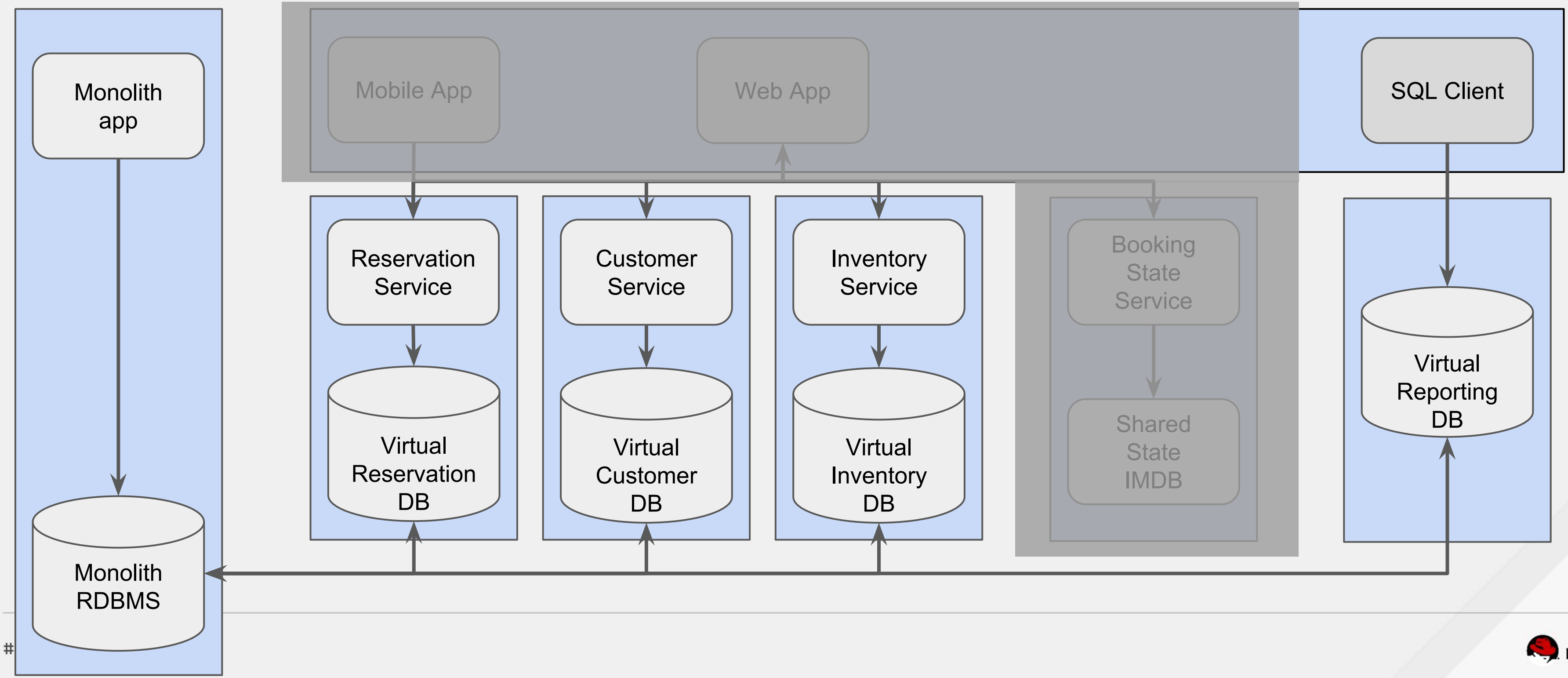
Demo Architecture: Functional



Demo part 1

Madou Coulibaly

Solution: Move to microservices architecture
Break up the monolithic database virtually



Demonstrated benefits

Data remains centralized

- Original application continues to work
- Faster time to production vs physically breaking up database
- Data can be migrated over time if necessary
- Can easily augment centralized database with new data sources
- Developers and Operations get along with each other

Security

- Restrict access to subset of the data (by design or by roles)
- Anonymize the data

Sharing state in a stateless app world

Emmanuel Bernard

The challenge of state

Microservices need to scale out (up and down): very elastic

- Scaling state in the app?
- State scaling or compute scaling?

Deploying new version (A/B or canary) with no disruption

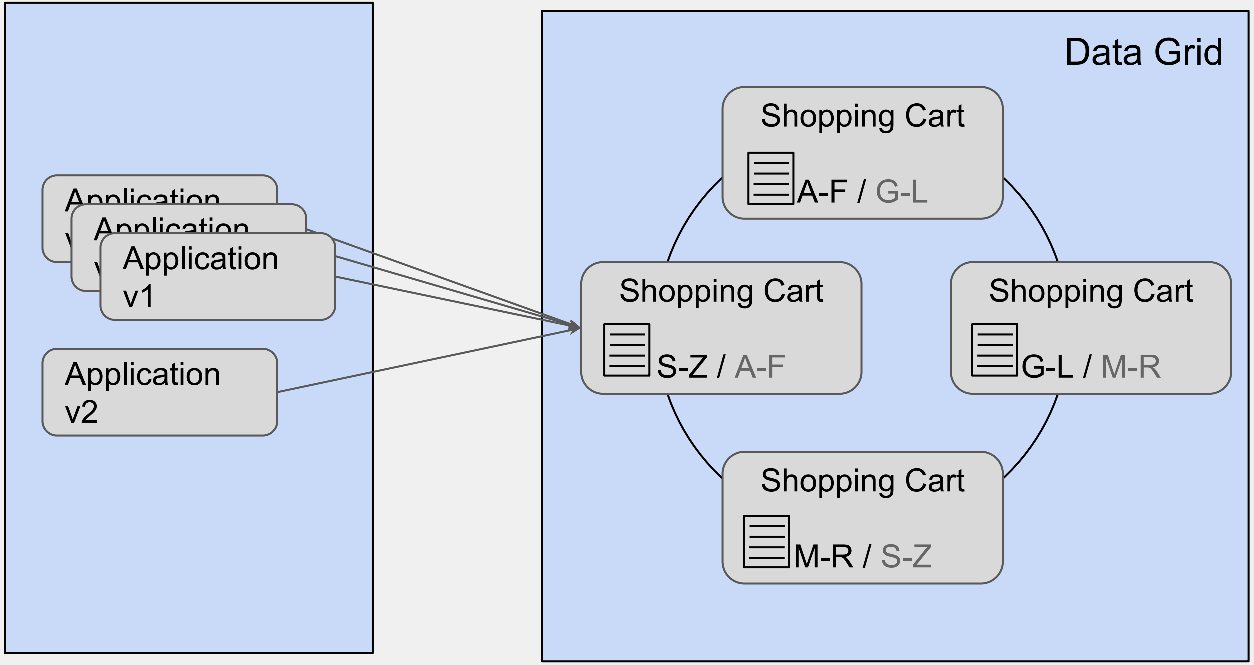
- State?

Which state

- Basket, last articles seen, HTTP session etc

Approach

There is a service for that

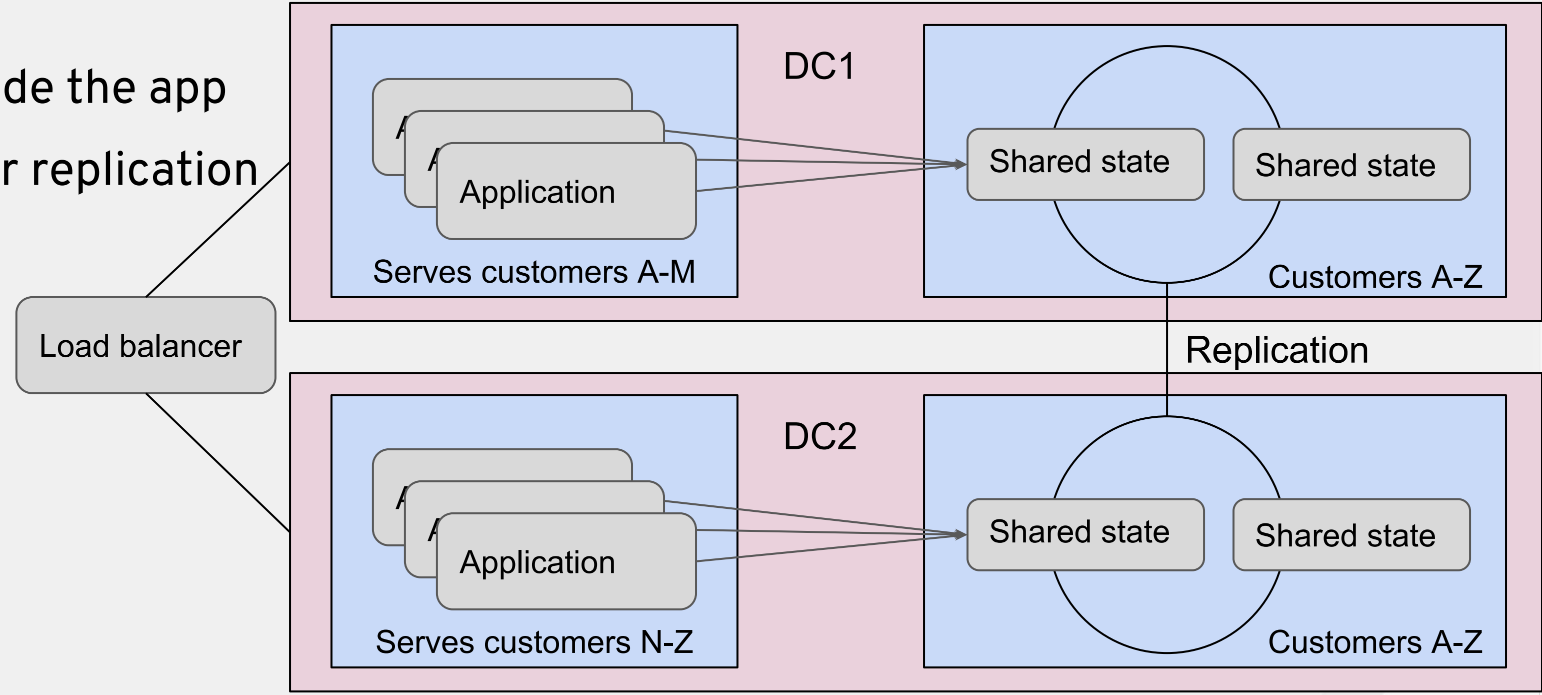


Benefits

Low latency

Complexity outside the app

Cross data center replication



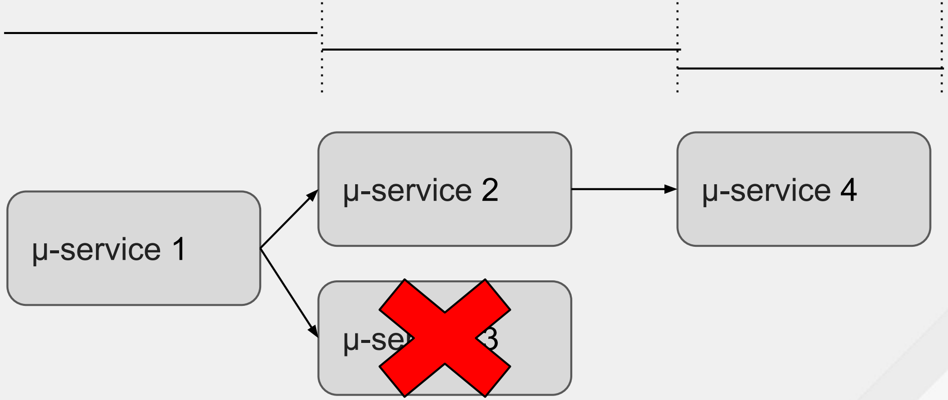
Caching

One service to fail them all

Cluster of microservices with dependencies

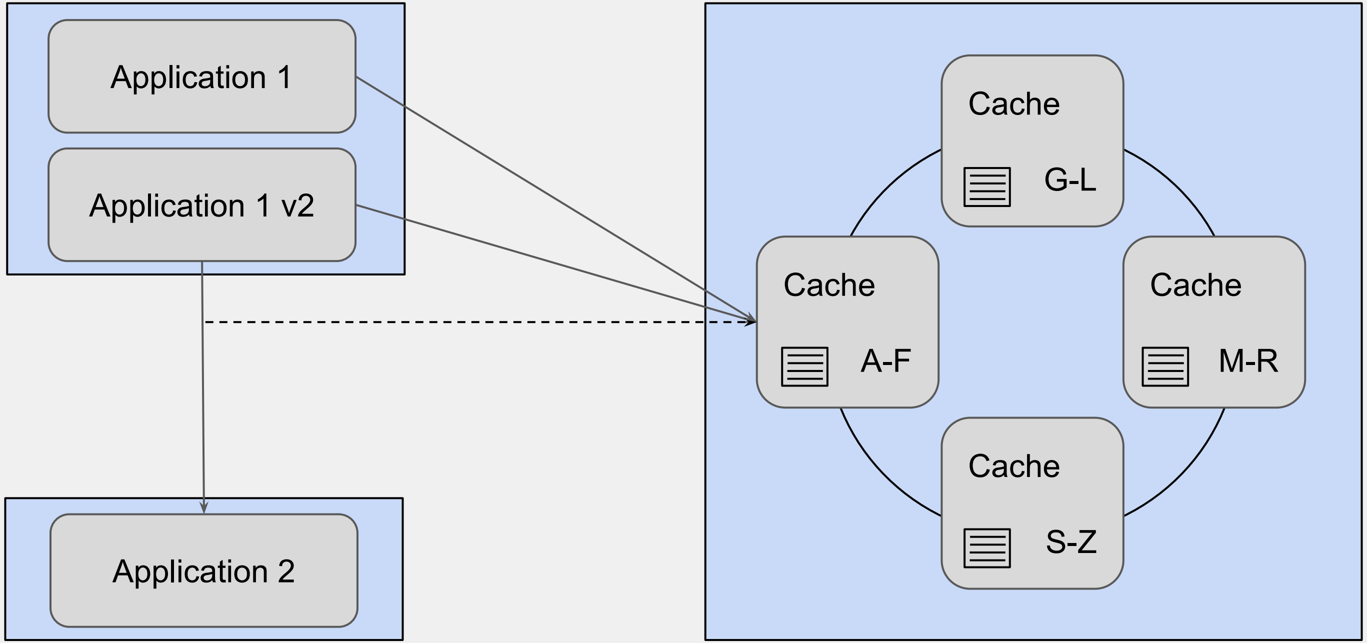
- Latency accumulation

What if one goes down



Approach

There is a service for that



Benefits

Externalize infrastructure

- Simpler
- Better hit/miss ratio

Differentiated lifecycle and scaling

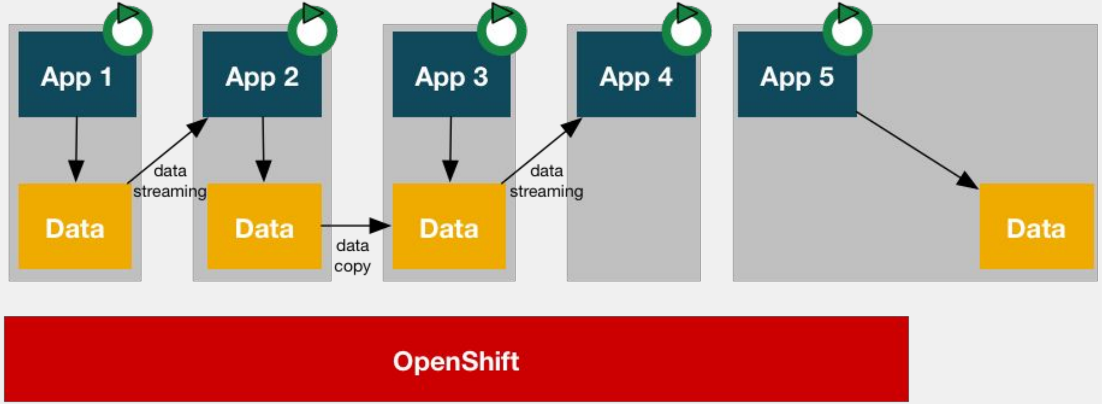
A/B or canary testing without performance drop

Surviving the temporary loss of one microservice

- Common requests

Maturing your data microservices approach
CQRS, event sourcing and more

Microservices
Data islands



Full isolation between microservices islands

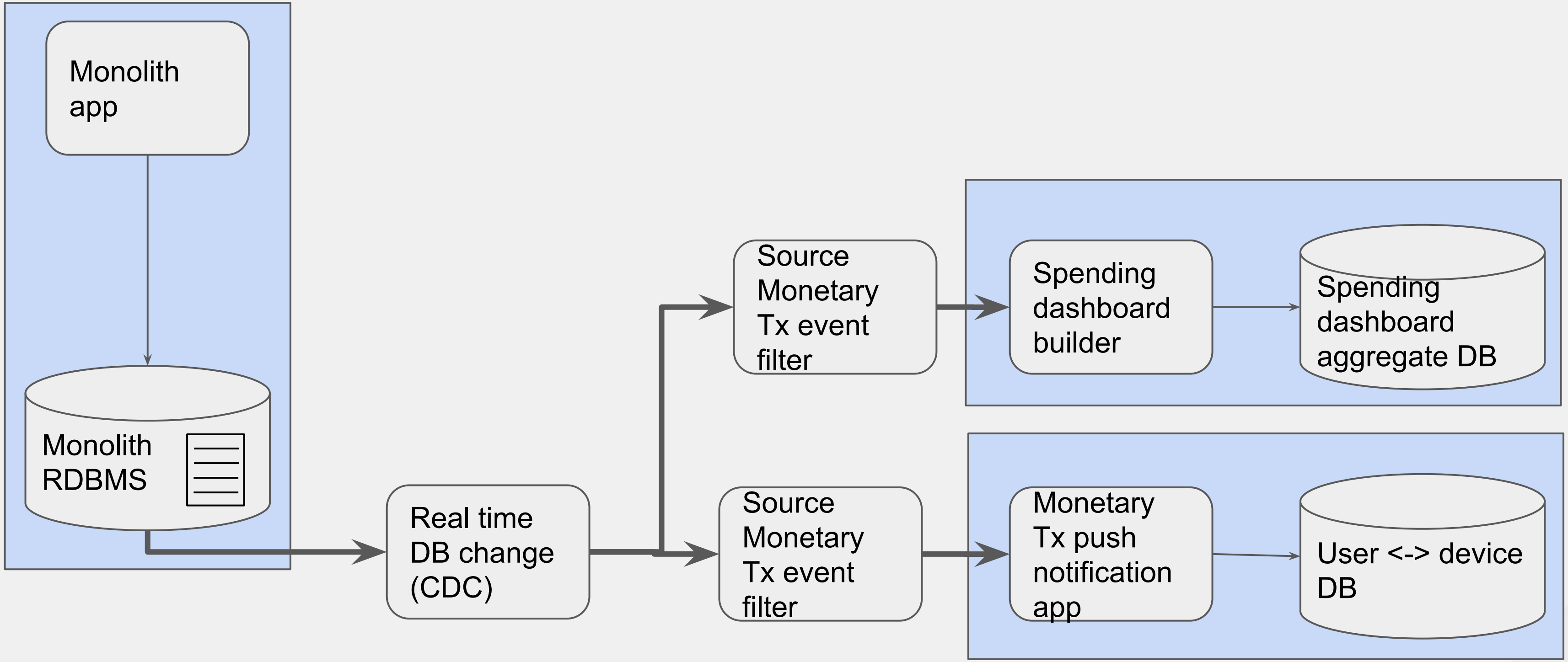
- Hard to achieve

Adding new services off the same data stream

Scaling different parts independently

- Give flexibility to change (data) tech
- CQRS

Change data capture to the rescue


Monolith app
Monolith RDBMS
Real time DB change (CDC)
Source Monetary Tx event filter
Spending dashboard builder
Spending dashboard aggregate DB
Source Monetary Tx event filter
Monetary Tx push notification app
User <-> device DB

Benefits

Of Change Data Capture
Of CQRS

CDC decorrelates the existing database from later consumption by new systems

Lower the load on the database

No update cost on exist apps consuming the database

Opens up “real time” doors

Demo part 2
Hotel Reservations and Check-in

Kim Palko

Problem: Need to share the booking state

Need to share booking state while customer is searching for a room

- Select one room (state that needs to be shared across room inventory)
- Then go to the Customer Service to do credit card checking
- then the Reservation Service to create the reservation

Assure that all the microservices are stateless

Every step across the application will be stored in a Data Grid and saved

The state can be shared across Web and Mobile UI’s

Problem: Need to test new functionality with limited availability before rolling out globally

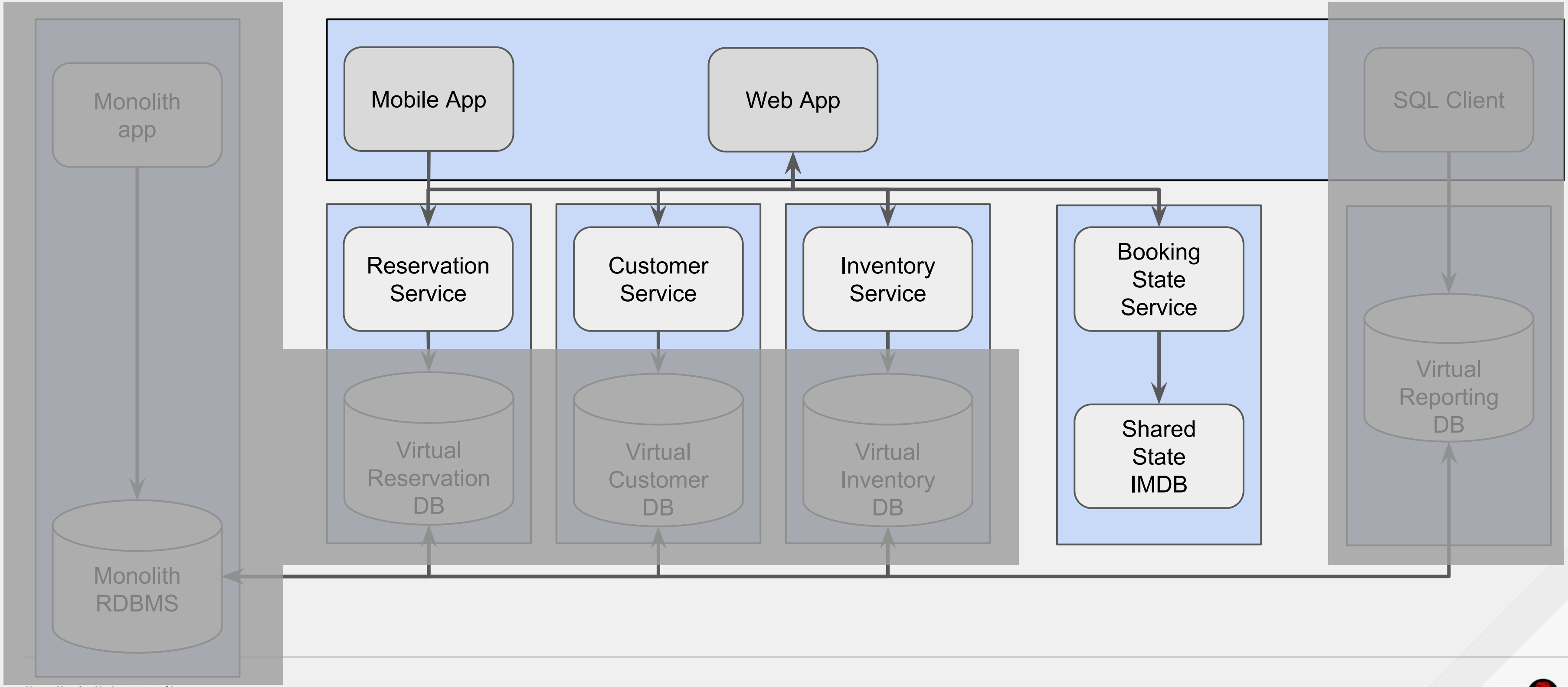
A/B Testing

- Highlight rooms with a living area
  - Change button color and add an icon
- 2 different versions of the application:
  - one showing the new screen and one without
  - Part of customers have the new screen
- After one week trial, make a decision which version to keep in production

Demo part 2
Hotel Reservations and Check-in

Madou Coulibaly

Solution: Share state with an in-memory data grid



Benefits demonstrated

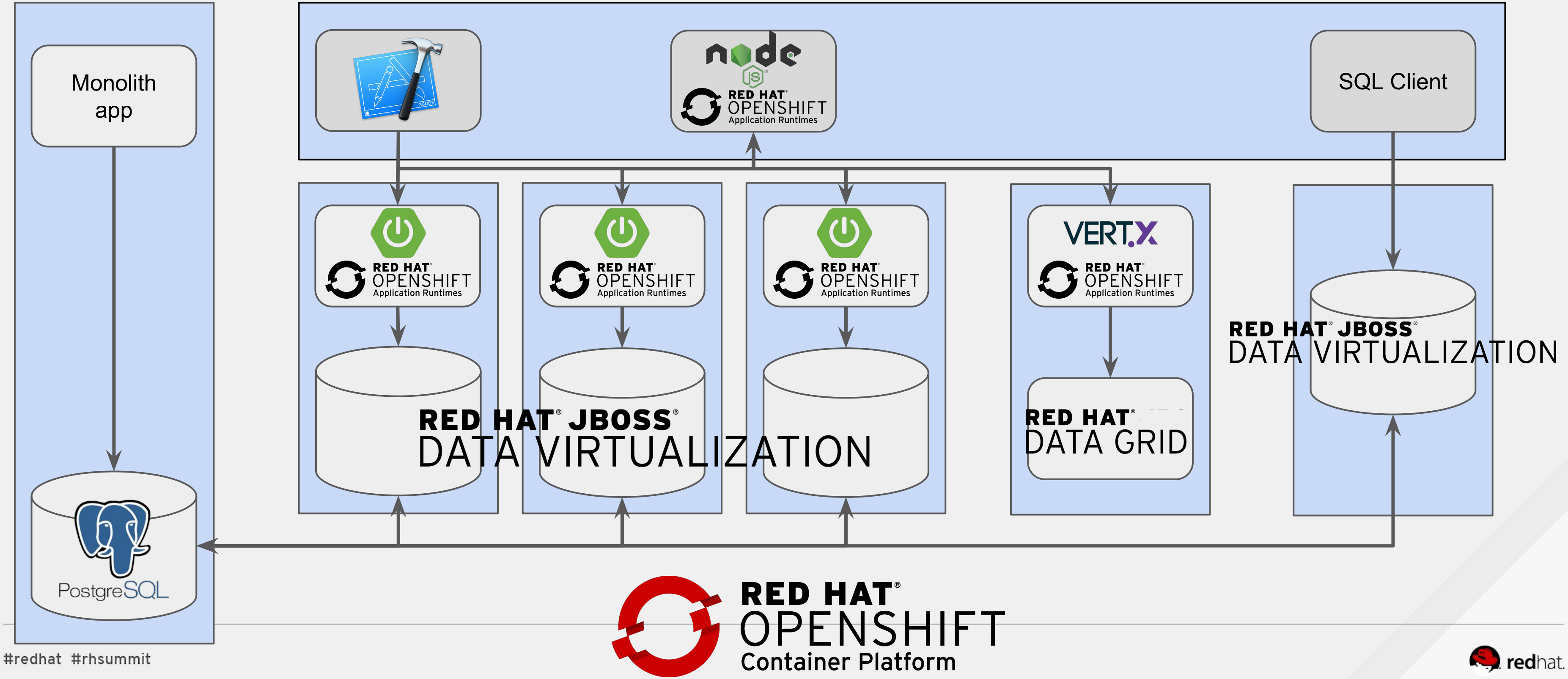
Shared State

- Share booking state across microservices and different UI's
- Reliability of the shared data (distributed)
- Low latency
- Scalability (out and down)

A/B Testing

- Deploying a new version of the application re-using the currently used state
- Upgrading an app with no down time

Demo Architecture: Projects


Monolith app
node JS
RED HAT OPENSHIFT Application Runtimes
SQL Client
RED HAT OPENSHIFT Application Runtimes
RED HAT OPENSHIFT Application Runtimes
RED HAT OPENSHIFT Application Runtimes
VERT.X
RED HAT OPENSHIFT Application Runtimes
RED HAT JBOSS DATA VIRTUALIZATION
RED HAT DATA GRID
RED HAT JBOSS DATA VIRTUALIZATION
PostgreSQL
RED HAT OPENSHIFT Container Platform

Summary

- When moving a monolithic application to a microservices architecture
  - take a pragmatic approach and break up large data sources logically
  - option to move data physically over time
- Architect for security up front
- Delegate data handling to specialized services (i.e. out of the app)
  - Don’t try to implement caching, shared memory, data virtualization etc.
- Red Hat can help you manage data in a MSA, starting where you are today
- Take your microservices evolution as a journey

References

- Re-create this demo yourself
  - https://github.com/mcouliba/hotel-booking
- Free download book:
  - Migrating to Microservice Databases: From Relational Monolith to Distributed Data

    by Edson Yanaga, Red Hat (with Forward by Emmanuel Bernard)

- Blog: "Low Risk Monolith to Microservice Evolution, Part III" by Christian Posta, Red Hat

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