MICROSERVICES DATA PATTERNS: CQRS AND EVENT SOURCING

Edson Yanaga, Director of Developer Experience, Red Hat
Clement Escoffier, Principal Software Engineer, Red Hat
Code is easy,

**State** is hard
How was data managed 10 years ago
<Entity>
POJOs as an Anemic Domain Model
Event Sourcing
<table>
<thead>
<tr>
<th>ID</th>
<th>CUSTOMER_ID</th>
<th>BALANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001</td>
<td>990</td>
<td>1000</td>
</tr>
<tr>
<td>1002</td>
<td>991</td>
<td>0</td>
</tr>
<tr>
<td>1003</td>
<td>991</td>
<td>-500</td>
</tr>
<tr>
<td>1004</td>
<td>992</td>
<td>300</td>
</tr>
</tbody>
</table>
# Transactions

<table>
<thead>
<tr>
<th>ID</th>
<th>ACCOUNT_ID</th>
<th>TIMESTAMP</th>
<th>OP</th>
<th>BALANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1001</td>
<td>1234567890</td>
<td>C</td>
<td>1000</td>
</tr>
<tr>
<td>2</td>
<td>1002</td>
<td>1234567891</td>
<td>C</td>
<td>200</td>
</tr>
<tr>
<td>3</td>
<td>1001</td>
<td>1234567900</td>
<td>D</td>
<td>300</td>
</tr>
<tr>
<td>4</td>
<td>1001</td>
<td>1234567995</td>
<td>D</td>
<td>150</td>
</tr>
</tbody>
</table>
Transactions are events

Account: 1001
Op: C
Amount: 1000

Account: 1001
Op: D
Amount: 300

Account: 1002
Op: C
Amount: 200

Account: 1001
Op: D
Amount: 150
Command-Query Separation

“Asking a question should not change the answer”
(Bertrand Meyer)
Write API

void insert(K key, P record);
void delete(K key);
void update(K key, P record);

Read API

Optional<P> find(K id);
Cursor<P> all();
Command-Query Responsibility Segregation (CQRS)
Validation -> Commands -> Domain Logic

Queries (generated Dtos) -> Database

write -> Database

Database -> Domain Logic

Domain Logic -> Commands

read -> Database
CQRS & Event Sourcing
## Account & Transactions

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**Read Model**
- **Account**

**Write Model**
- **Transaction**
Validation \rightarrow Commands \rightarrow Domain Logic

\textbf{Queries (generated Dtoms)} \leftarrow \textbf{read}

\textbf{Event Bus}

\textbf{write} \rightarrow \textbf{listen}
Why CQRS?
Performances
Distribution
Availability
Integration
Analytics
Choosing the right technology

- Latency
- Size
- Staleness
- Ownership
- Security
- Type?
Reactive Event Sourcing
Canonical Source of Information
Write Data Store

Read Data Store

Propagation of changes

Read Data Store

Graph or visualization showing data flow and propagation of changes.
Sequence of events form a **data stream**
Data Stream is the realm of Reactive

Reactive programming - compose async and event-driven applications using observable streams

Reactive Streams - async and non-blocking back-pressure protocol
Consuming data streams

stream
    .map(Message::body)
    .map(json -> "Patient: " +
            json.getString("patient") + "\n" +
            json.getString("alert")
    )
    .flatMapCompletable(this::sendTextMessage)
    .subscribe();
Canonical Source of Information
Write Data Store

debezium

Read Data Store

Propagation of changes

Read Data Store
https://github.com/cescoffier/reactive-event-sourcing-demo
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facebook.com/redhatinc
twitter.com/RedHat
youtube.com/user/RedHatVideos
INSERT DIVIDER COPY
CLICK TO ADD TITLE
Click to add subtitle

Insert paragraph of copy here. Do not exceed 40 words.

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THANK YOU

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linkedin.com/company/red-hat
facebook.com/redhatinc
twitter.com/RedHat
youtube.com/user/RedHatVideos
When creating charts, graphs, and tables use the corporate and secondary color palettes with no more than one accent color.
ICONS

Red Hat icons use simplicity to explain complex ideas and key concepts. Icons can be used alone, with a polished fill, or on a round button.

To download, visit: http://brand.redhat.com/elements/icons.
TIMELINE

Use these elements when creating a timeline. Copy and paste these graphics to your slide before changing the size and content of the elements.
CHART ELEMENTS

Use these elements when creating charts. Copy and paste these graphics to your slide before changing the size and content of the elements.

Primary box, resize as needed

Insert text

Secondary box, resize as needed

Insert text

Secondary box, resize as needed

Insert text

Secondary box, resize as needed

Insert text

Dotted line

Solid line

Arrow line

Large arrow, resize as needed

Plus sign, resize as needed
TABLES

Using the table tool in Google Slides, you can create basic tables for your presentation. Make sure to use only corporate and secondary colors.

Sample chart template

<table>
<thead>
<tr>
<th>VALUE</th>
<th>VALUE</th>
<th>VALUE</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
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CODE SNIPPET

When referencing code snippets, use the template below. Resize the snippet box to the appropriate size for your text.

Type code snippet here
PRESENTATION TITLE SHOULD NOT EXCEED TWO LINES

Subheading goes here

Presenter
Presenter’s title
Date
# AGENDA

Date and/or title of event

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00AM–9:00AM</td>
<td>NAME OF TOPIC</td>
</tr>
<tr>
<td>8:00AM–9:00AM</td>
<td>NAME OF TOPIC</td>
</tr>
<tr>
<td>8:00AM–9:00AM</td>
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</tr>
</tbody>
</table>
CLICK TO ADD TITLE
CLICK TO ADD TITLE
Click to add subtitle

Insert paragraph of copy here. Do not exceed 40 words.

- Bullet
- Bullet
- Bullet
INSERT DESIGNATOR, IF NEEDED

50

CLICK TO ADD TITLE
Click to add subtitle

Insert paragraph of copy here. Do not exceed 40 words.

- Bullet
- Bullet
- Bullet

INSERT GRAPHIC HERE
Insert paragraph of copy here. Do not exceed 40 words.

- Bullet
- Bullet
- Bullet
CLICK TO ADD TITLE
Click to add subtitle

COLUMN HEADING
ALL CAPS, TWO LINES AT MOST

Click to insert text

COLUMN HEADING
ALL CAPS, TWO LINES AT MOST

Click to insert text
Click to add title

Click to add subtitle

COLUMN HEADING, ALL CAPS
Click to add text

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Click to add text

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<td>Click to insert copy</td>
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</table>
Click to add subtitle

Insert paragraph of copy here and logos in box to the right.

- Bullet
- Bullet
- Bullet
Insert paragraph of copy here and logos in box to the right.

- Bullet
- Bullet
- Bullet
“Insert customer quote”

OPTIONAL HEADLINE

Insert customer summary. Include product software. Do not exceed 40 words.
“Click to add quote”

ATTRIBUTION
Title
Company

“Click to add quote”

ATTRIBUTION
Title
Company
Click to add subtitle
“Click to add quote”

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CLICK TO ADD TITLE
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THANK YOU

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youtube.com/user/RedHatVideos
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twitter.com/RedHat
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twitter.com/RedHat
youtube.com/user/RedHatVideos
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linkedin.com/company/red-hat
youtube.com/user/RedHatVideos
facebook.com/redhatinc
twitter.com/RedHat