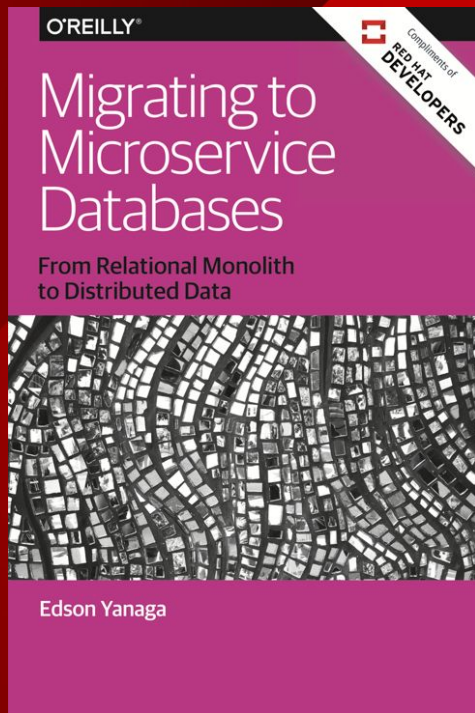




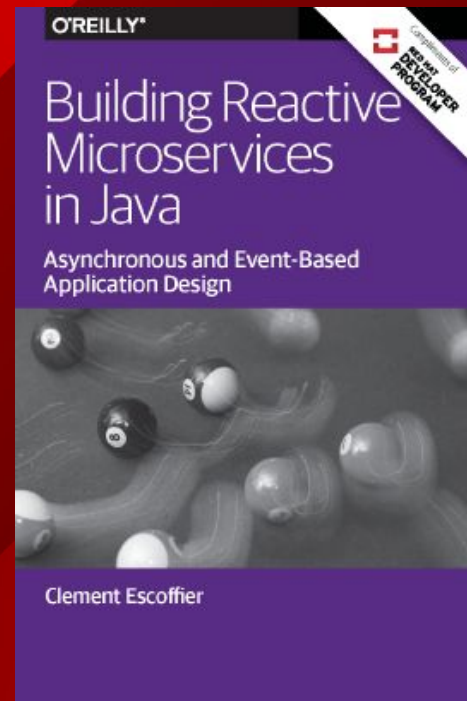
MICROSERVICES DATA PATTERNS: CQRS AND EVENT SOURCING

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





<http://developers.redhat.com/promotions/migrating-to-microservice-databases>



<https://developers.redhat.com/promotions/building-reactive-microservices-in-java>

Code is easy,
State is hard

How was data
managed 10 years ago

<Entity>

<Entity>



@Entity

<Entity>



@Entity



POJOs as an
(Anemic) Domain Model

Event Sourcing

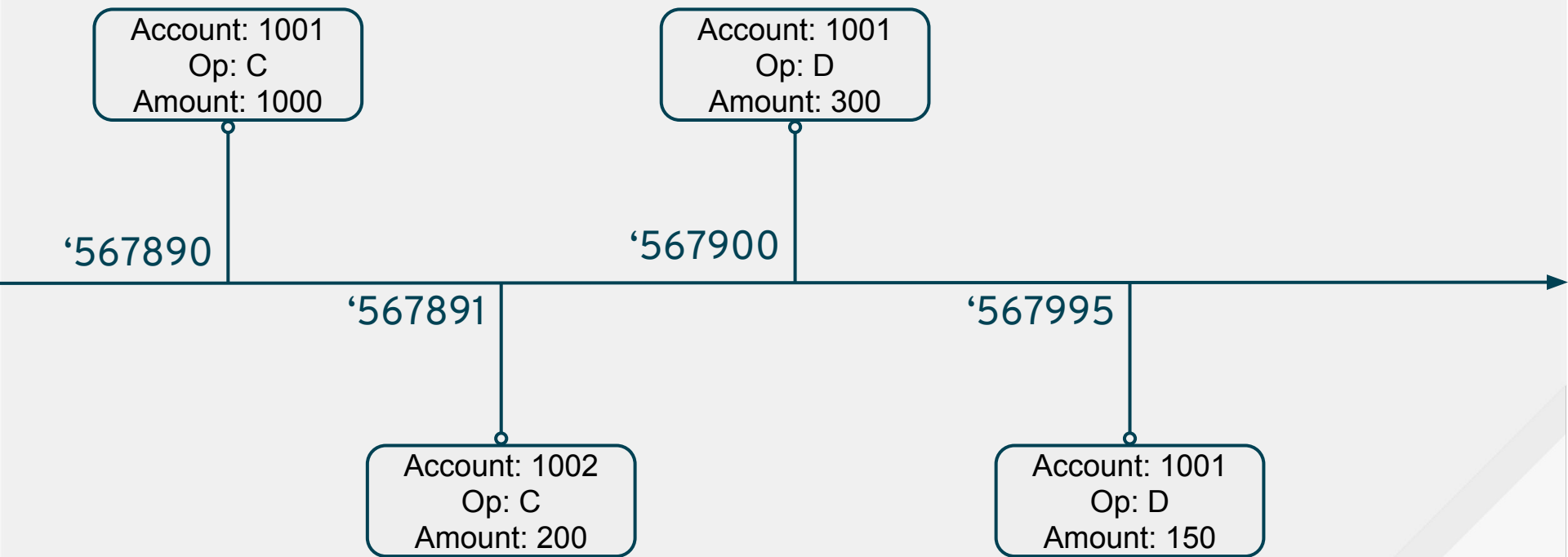
Account

ID	CUSTOMER_ID	BALANCE
1001	990	1000
1002	991	0
1003	991	-500
1004	992	300

Transactions

ID	ACCOUNT_ID	TIMESTAMP	OP	BALANCE
1	1001	1234567890	C	1000
2	1002	1234567891	C	200
3	1001	1234567900	D	300
4	1001	1234567995	D	150

Transactions are events



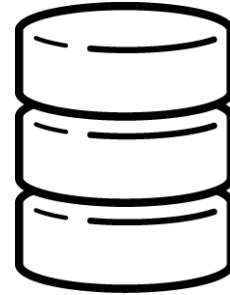
Command-Query Separation

“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);
```

write

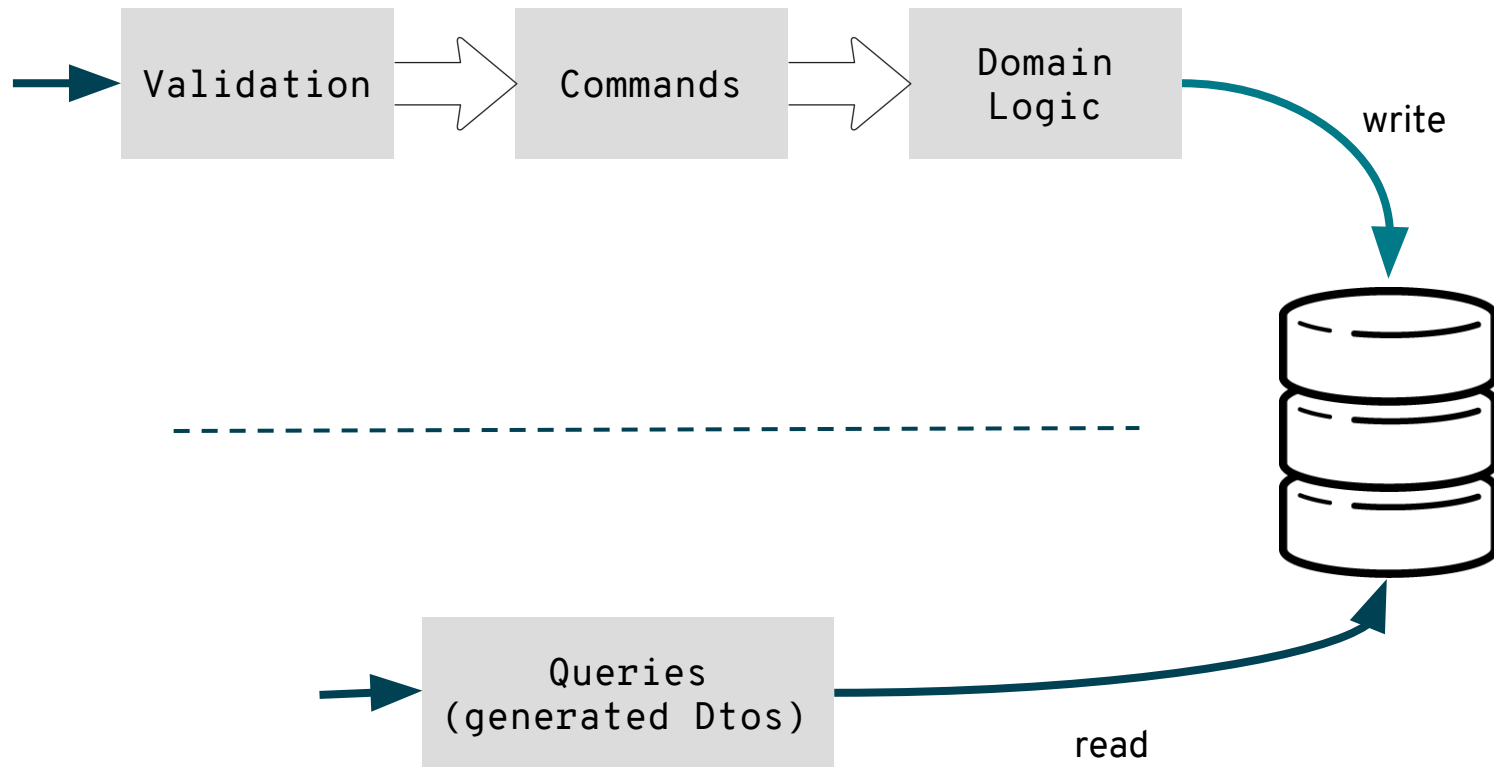


Read API

```
Optional<P> find(K id);  
Cursor<P> all();
```

read

Command-Query Responsibility Segregation (CQRS)



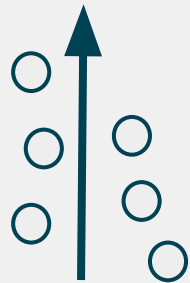
CQRS & Event Sourcing

Account & Transactions

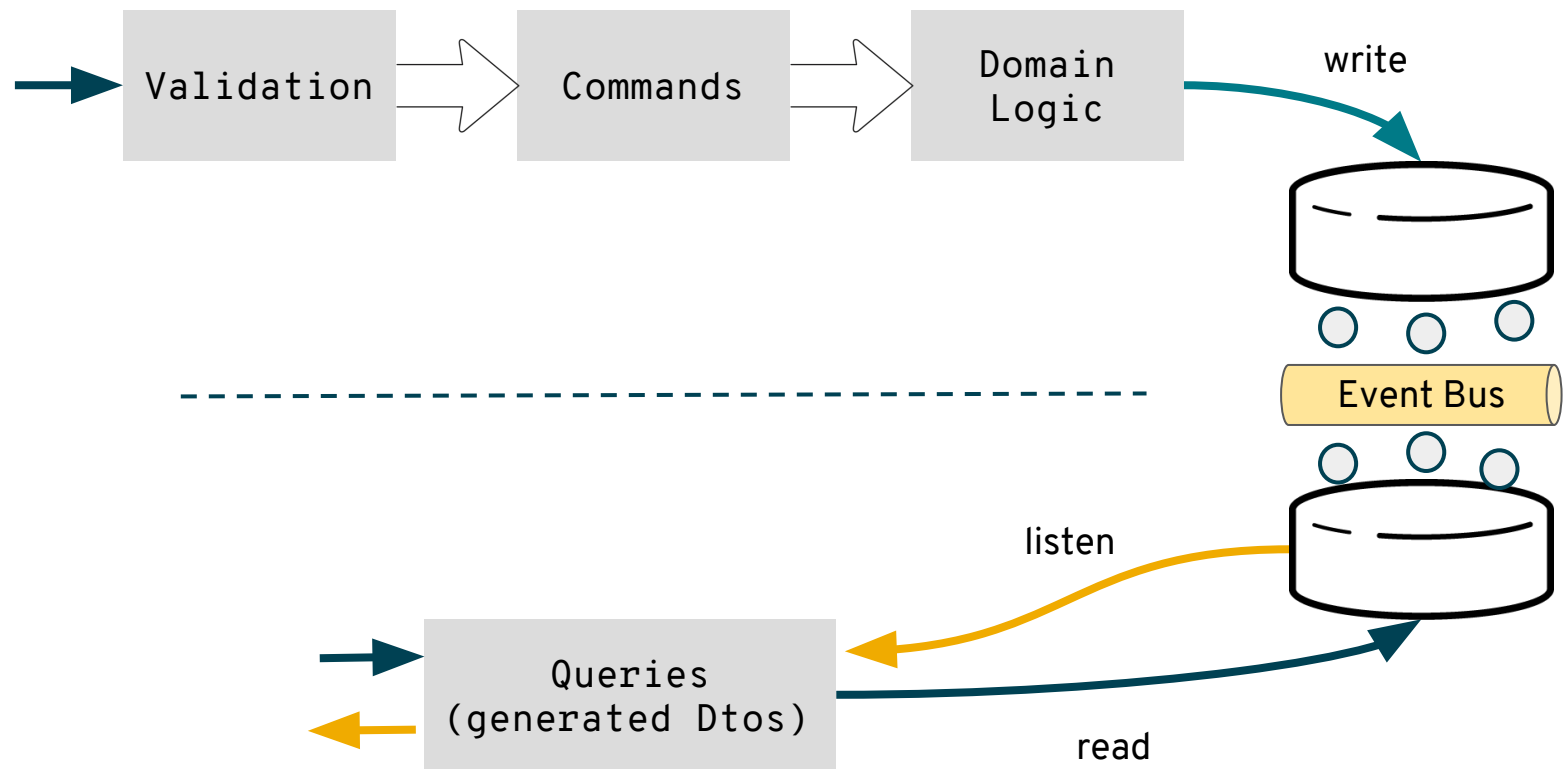
ID	CUSTOMER_ID	BALANCE
1001	990	1000
1002	991	0
1003	991	-500

ID	ACCOUNT_ID	TIMESTAMP	OP	BALANCE
1	1001	1234567890	C	1000
2	1002	1234567891	C	200
3	1001	1234567900	D	300

Read Model
Account



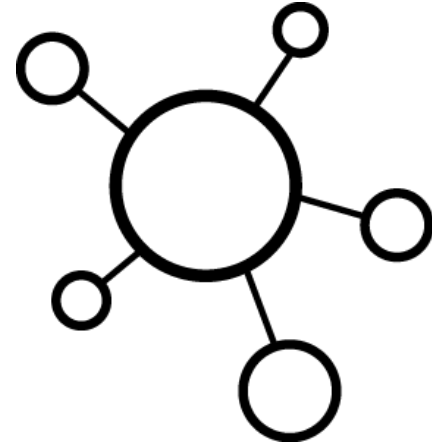
Write Model
Transaction

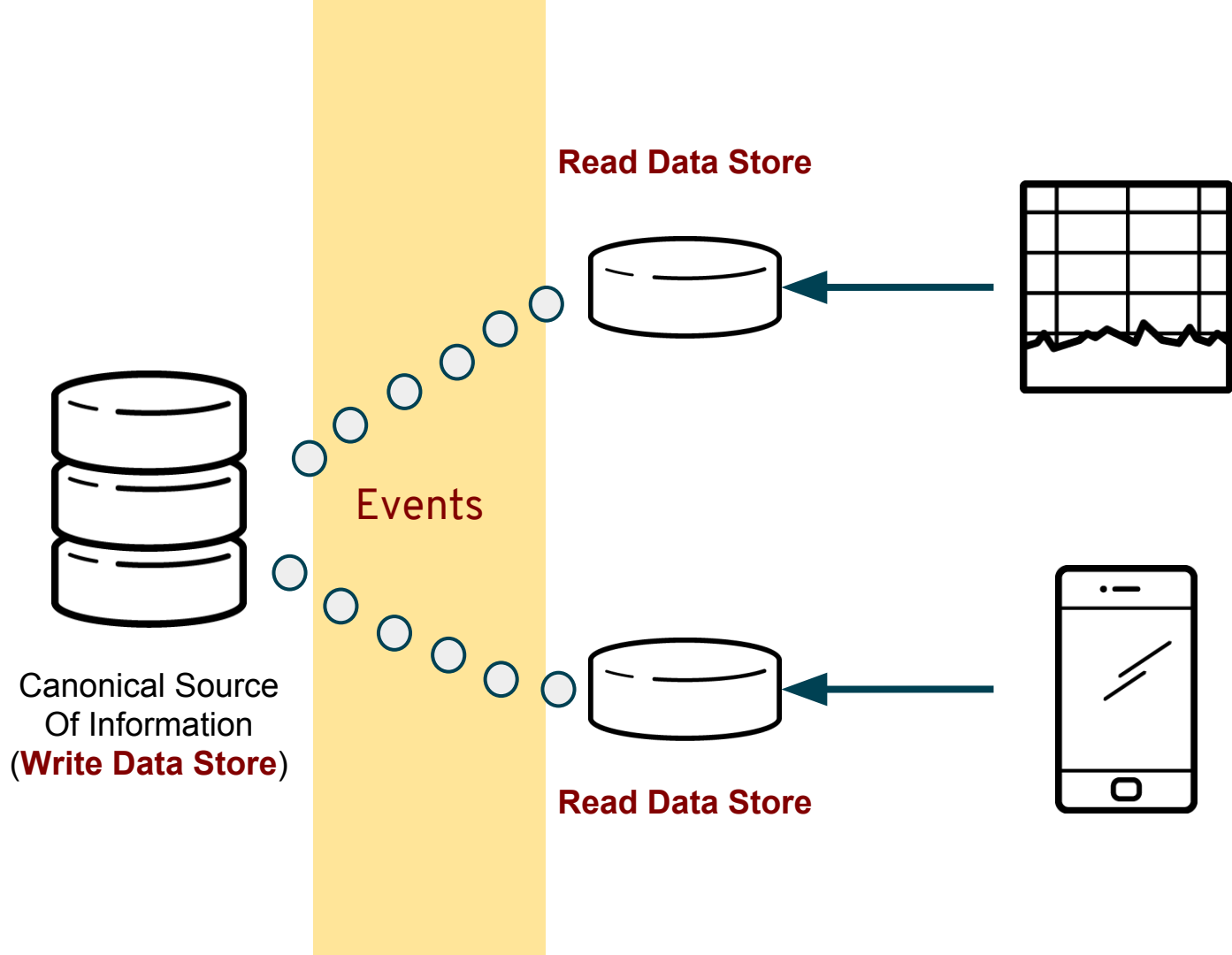


Why CQRS?

Performances

Distribution
Availability
Integration
Analytics





Choosing the right technology

Latency

Infinispan

Size

Staleness



Ownership

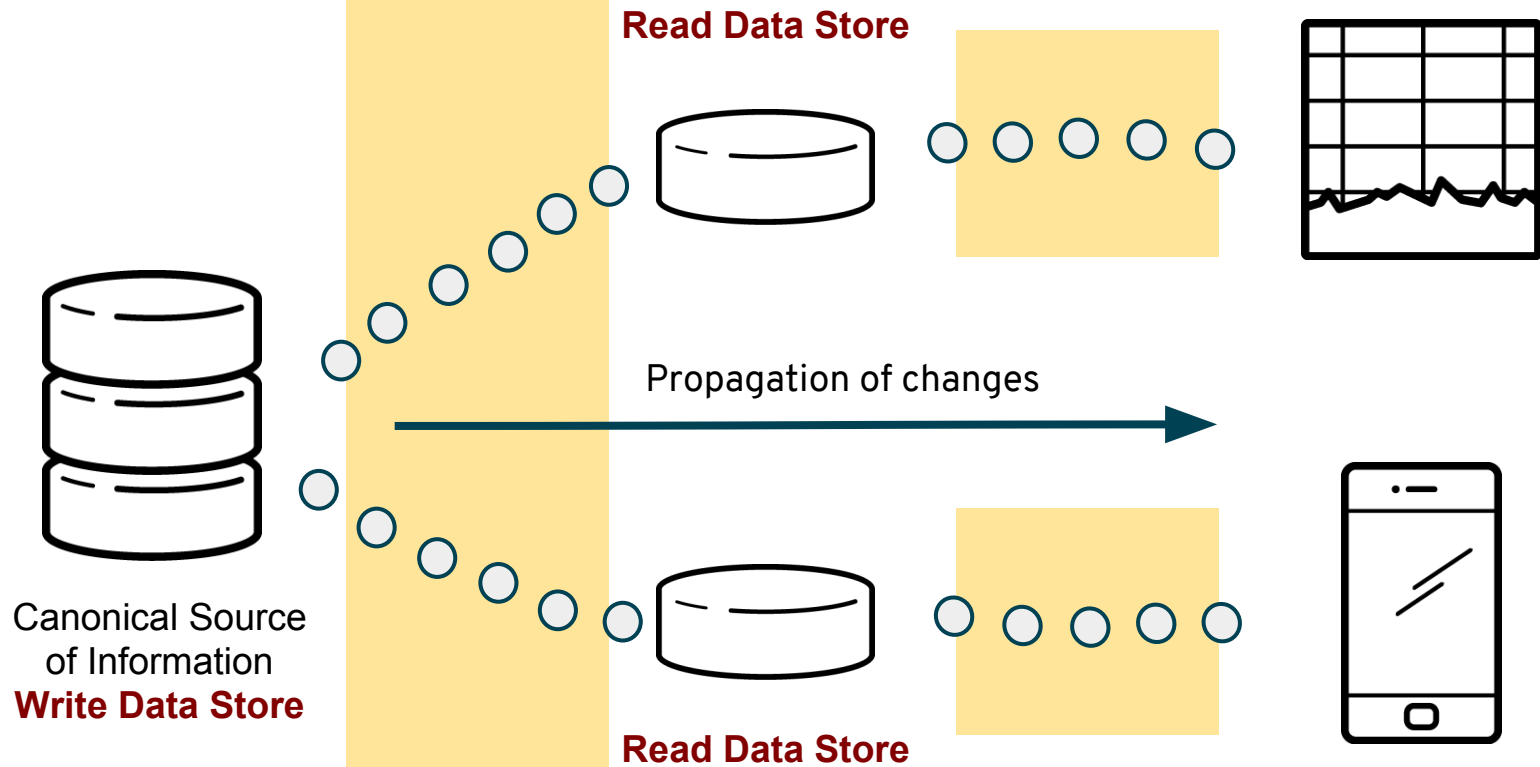
Security

Type?

VERT.X



Reactive Event Sourcing



**Sequence of events
form a data stream**

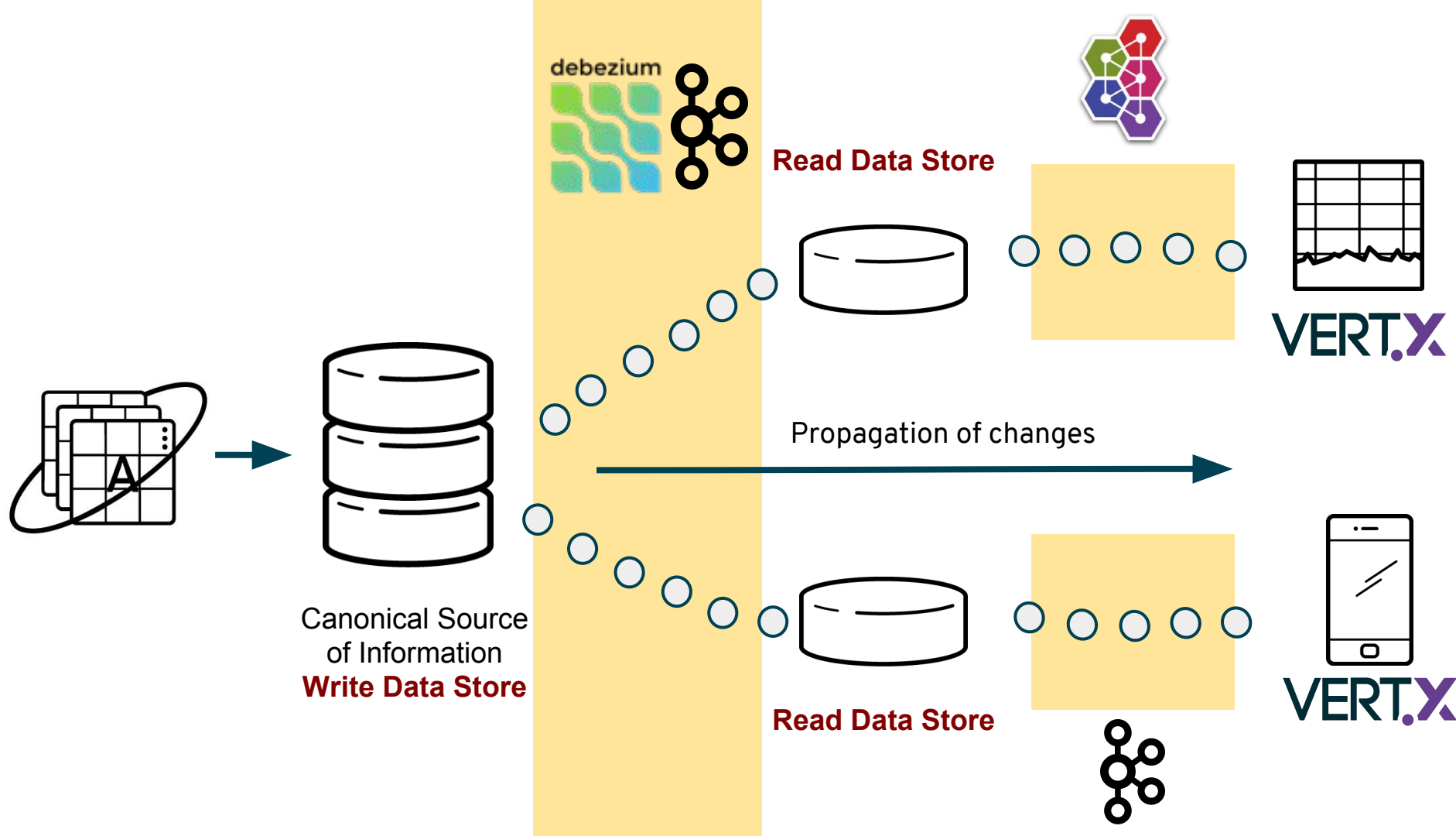
Data Stream is the realm of **Reactive**

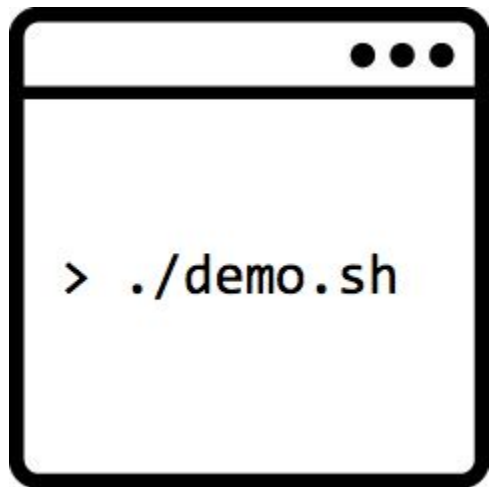
Reactive programming - compose async and event-driven applications using *observable streams*

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();
```





<https://github.com/cescoffier/reactive-event-sourcing-demo>

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

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BRAND COLORS

Use ONLY the colors outlined below in your presentation.

CORPORATE

PMS 1797 2 98 85 2 204 0 0 #CC0000	PMS 1805 2 98 85 22 163 0 0 #A30000	PMS 1815 2 98 85 42 130 0 0 #820000	RICH BLACK 60 40 40 100 0 0 0 #000000	WHITE 0 0 0 0 255 255 255 #FFFFFF
--	---	---	---	---

SECONDARY

PMS 3035 100 25 18 72 0 65 83 #004153	PMS 2975 35 0 6 0 163 219 232 #A3DBE8	DARK GRAY 0 0 0 85 76 76 76 #4C4C4C	LIGHT GRAY 0 0 0 15 220 220 220 #DCDCDC
---	---	---	---

ACCENT (Use these colors sparingly.)

PMS 2685 92 100 0 10 59 0 131 #3B0083	PMS 130 0 30 100 0 240 171 0 #F0AB00	PMS 7474 98 7 30 30 0 122 135 #007A87	PMS 306 79 0 6 5 0 185 228 #00B9E4	PMS 375 47 0 94 0 146 212 0 #92D400
---	--	---	--	---

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.



BASIC



POLISHED



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.

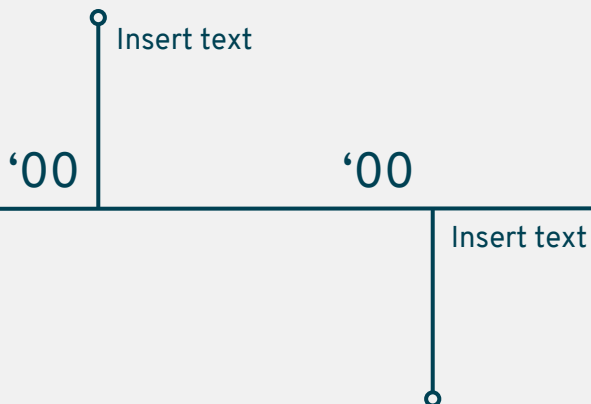


CHART ELEMENTS

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



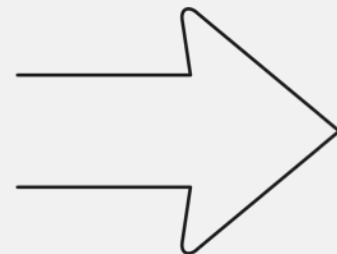
Solid line



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

VALUE	VALUE	VALUE	VALUE
value	value	value	value
value	value	value	value
value	value	value	value

Sample chart template

VALUE	VALUE	VALUE	VALUE
value	value	value	value
value	value	value	value
value	value	value	value

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



PRESENTATION TITLE SHOULD NOT EXCEED TWO LINES

Subheading goes here

Presenter
Presenter's title
Date



PRESENTATION TITLE SHOULD NOT EXCEED TWO LINES

Subheading goes here

Presenter
Presenter's title
Date

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INSERT DIVIDER COPY

AGENDA

Date and/or title of event

8:00AM–9:00AM

NAME OF TOPIC

8:00AM–9:00AM

NAME OF TOPIC

8:00AM–9:00AM

NAME OF TOPIC

8:00AM–9:00AM

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NAME OF TOPIC

8:00AM–9:00AM

NAME OF TOPIC

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COLUMN HEADING
ALL CAPS, TWO LINES AT MOST

Click to insert text



INSERT GRAPHIC HERE

COLUMN HEADING
ALL CAPS, TWO LINES AT MOST

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**COLUMN HEADING
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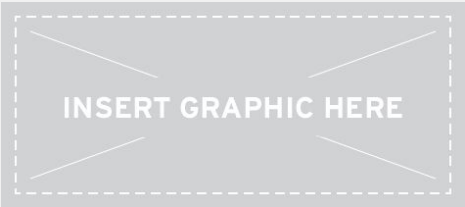
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ALL CAPS**

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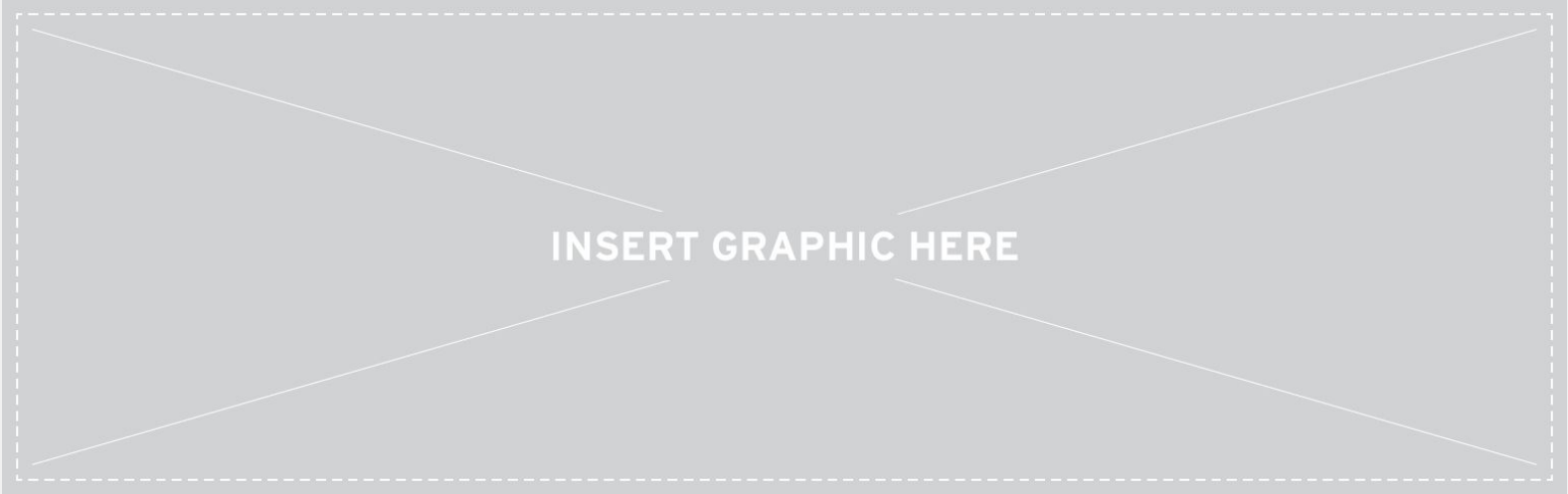
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ALL CAPS**

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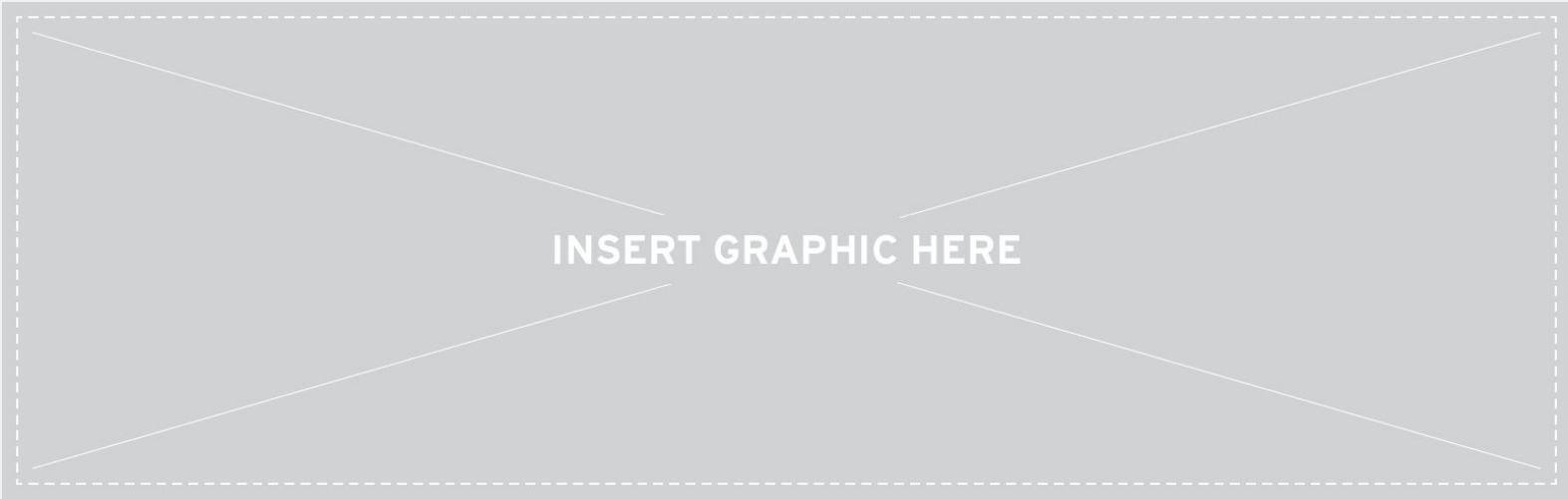
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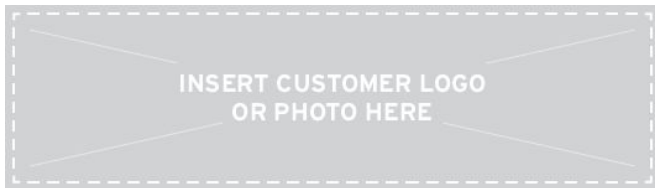


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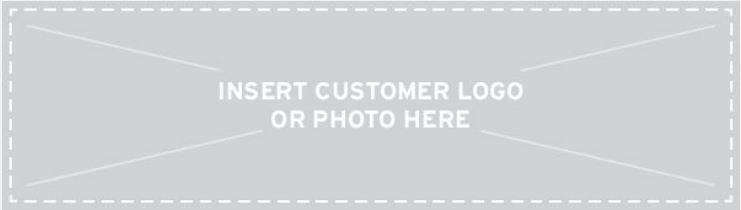
Click to add subtitle



“Insert customer quote”

OPTIONAL HEADLINE

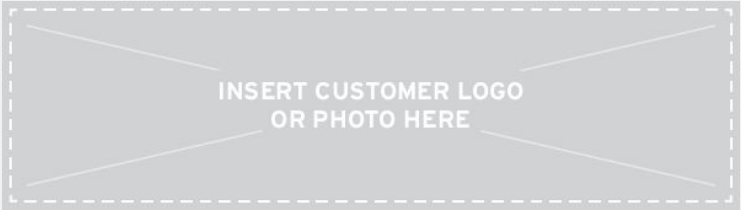
Insert customer summary. Include product software. Do not exceed 40 words.



INSERT CUSTOMER LOGO
OR PHOTO HERE

“Click to add quote”

ATTRIBUTION
Title
Company



INSERT CUSTOMER LOGO
OR PHOTO HERE

“Click to add quote”

ATTRIBUTION
Title
Company

CLICK TO ADD TITLE

Click to add subtitle

INSERT CUSTOMER LOGO
OR PHOTO HERE

“Click to add quote”

ATTRIBUTION
Title
Company

INSERT CUSTOMER LOGO
OR PHOTO HERE

“Click to add quote”

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ATTRIBUTION
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ATTRIBUTION
Title
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“Click to add quote”

ATTRIBUTION
Title
Company

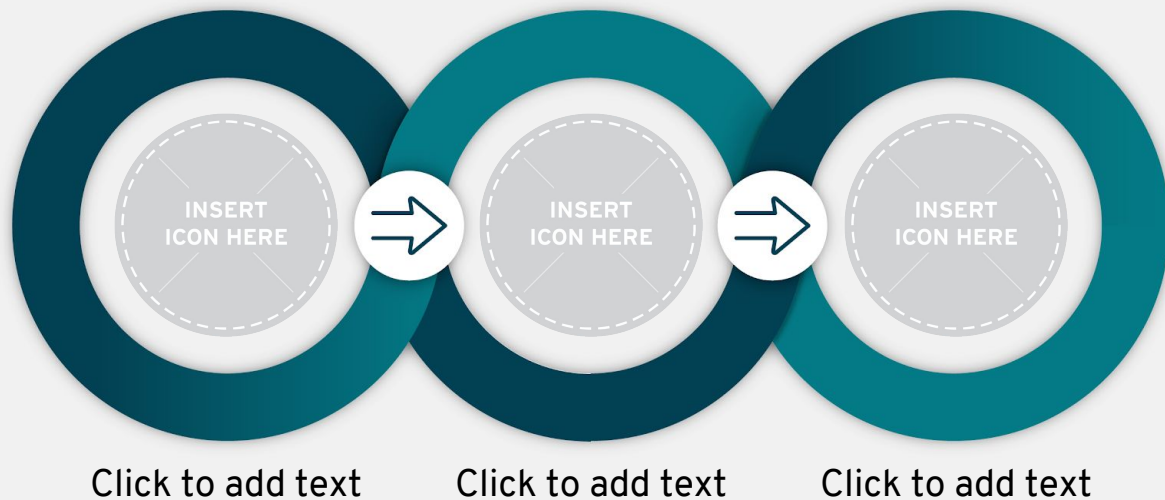
INSERT CUSTOMER LOGO
OR PHOTO HERE

“Click to add quote”

ATTRIBUTION
Title
Company

CLICK TO ADD TITLE

Click to add subtitle



CLICK TO ADD TITLE

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