CQRS and Event Sourcing

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Agenda

- CQRS - Why? When? How?
  - Sometimes there are choices
  - Sometimes the decision is natural
  - Consequences
- Event Sourcing
  - Again: Why? When? How?
- Eventual consistency

Data Access, "Traditionally"

```
ImportantData editObject;

protected override void OnInit(EventArgs e) {
  editObject = LoadEditObject();
  control.DataSource = editObject;
  control.DataBind();
}

protected void Page_Load(object sender, EventArgs e) {
  if (IsPostBack) {
    MergeEditorChanges(editObject);
    SaveObject(editObject);
  } ...
}
```

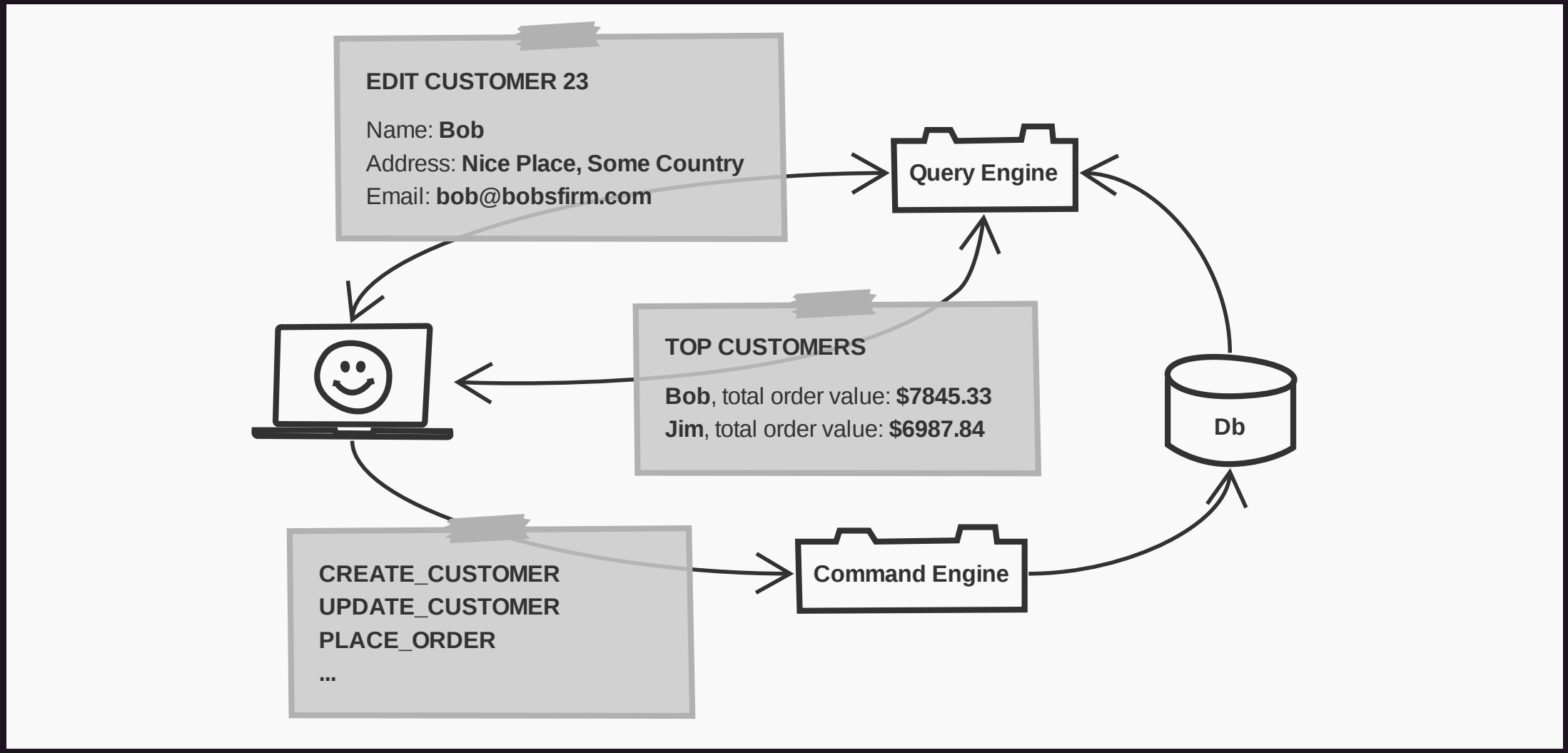
Data Access, "Traditionally"

1. Objects are loaded into memory
2. Data is shown in UI
3. Changes are submitted
4. Loaded objects are modified
5. Local change detection optimizes process of persistence

CQRS — Why?

- Because *loading data for visualization* doesn't have the same requirements as *persisting data*
- Because one *loading process* can be *different* from another
- Because one *persistence process* can be *different* from another
- Because we can save time in *page cycle* environments
- Because separate execution paths are *easier to test and maintain*

CQRS


EDIT CUSTOMER 23
Name: Bob
Address: Nice Place, Some Country
Email: bob@bobsfirm.com
Query Engine
TOP CUSTOMERS
Bob, total order value: $7845.33
Jim, total order value: $6987.84
Db
CREATE_CUSTOMER
UPDATE_CUSTOMER
PLACE_ORDER
...
Command Engine

CQRS — When?

- Almost *anytime*!
- Typical doubts:
  - Pure client app — do I benefit?
  - More complex structure == more complicated maintenance work?
  - But what about ORM?
- Reality:
  - Structural advantages *benefit any architecture*
  - *Complex != complicated*, complex systems can have simple parts
  - Maybe we don't always need ORM...

CQRS — How?

- *Separate execution paths* for data reading and writing
- Consider modeling *changes as commands*
- Consider *efficient data models* to support business operations

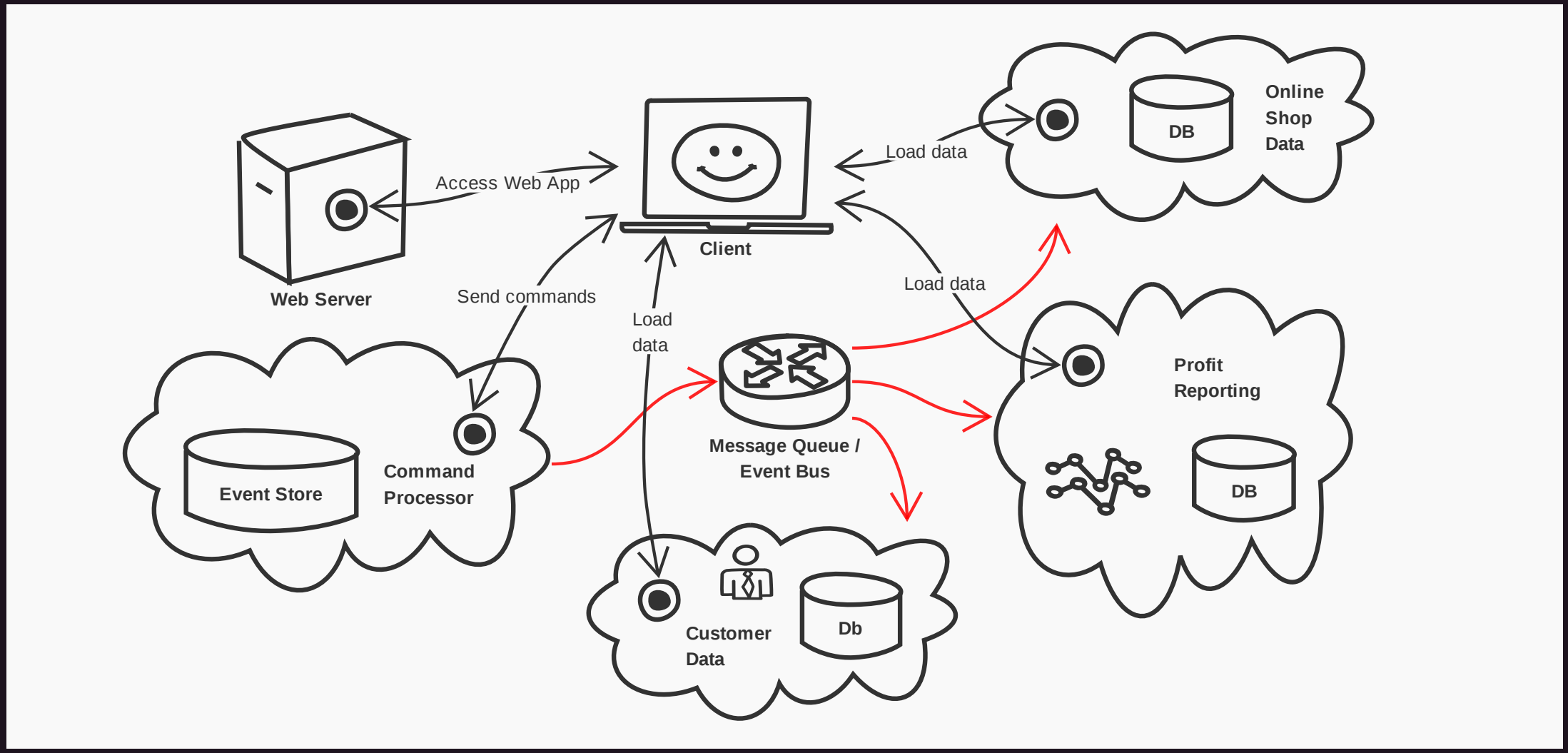
Event Sourcing

- Starting from *command* idea
  - Primarily *persist events*, instead of data
  - *Append-only* event log
  - *Derive entity state* at any time, for any point in time
- Entities/Aggregates/domain objects
- Optimizations: snapshots, projections, (persistent) read models

Event Sourcing — Why?

- Events describe what the system was asked to do, any *technical consequences of an event are not set in stone*. Fantastic for long-term maintenance!
- Clean, extensible and scalable structure supports *strict separations of concerns*
- Event Storming — very practical planning method

CQRS and Event Sourcing



Event Sourcing — When?

- Tempting pattern for many applications, but with structural consequences (complexity)
- Very "clean complexity"
- *In real-world well structured service based apps generally a good recommendation*
- In-process, in full-fat clients? Possible...

Event Sourcing — How?

- Easy part: *receive commands*
- Raising domain events across service boundaries requires *communication infrastructure*
- Persisting events and possibly read models requires a *persistence layer*
- Structural maintenance of *aggregates and projections* is a bit fiddly, especially in typed languages
- Recommended: *use libraries existing for all platforms*

DEMO

Eventual Consistency

> Consistency is over-rated (Greg Young, Mr CQRS)

- General issue in distributed systems - CAP theorem
- Eventual consistency exists in the real world. Starbucks?
- How eventual are things in your system?
- Business logic needs to deal with issues resulting from eventual consistency
  - Compensation
  - Special programming tactics
  - Check this out: http://queue.acm.org/detail.cfm?id=2462076

CAP Theorem

Two Out of Three Ain't Bad

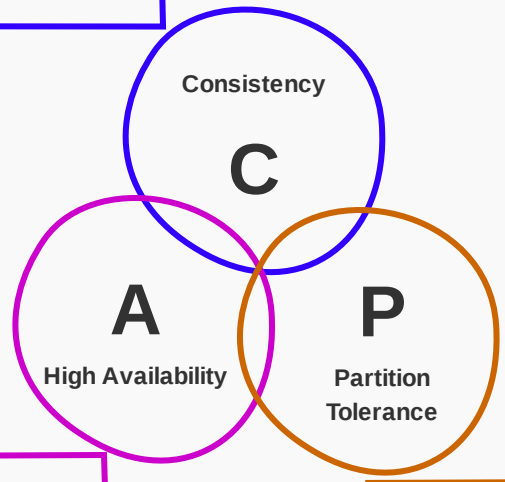
James Richard Steinman, 1977

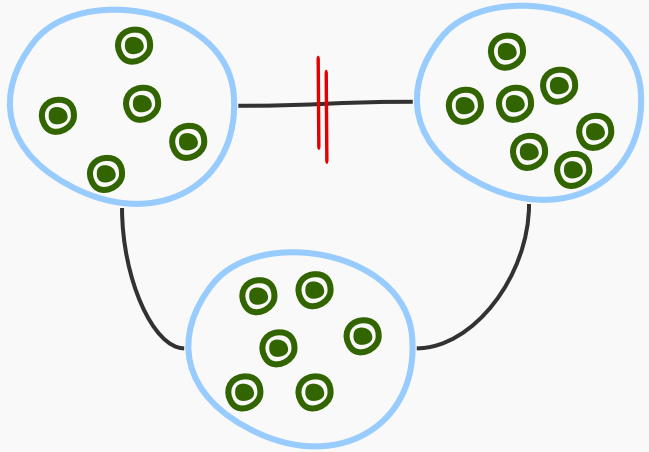
Every read receives latest data or an error

CAP Theorem:

Only two out of the three (C/A/P) guarantees can be provided simultaneously by a distributed data store.

Eric Brewer, 1998





Requests always receive a successful response

System remains operational in spite of network failures

Typical basic RDBMS: **CA** -- Typical cache-style DB: **CP** -- Eventual Consistency: **AP**
Honorary mention: MongoDB supports ACID guarantees (CP)

Sources

- This presentation:
  - https://oliversturm.github.io/cqrs-event-sourcing
  - PDF download: https://oliversturm.github.io/cqrs-event-sourcing/slides.pdf
- Demo code:
  - https://github.com/oliversturm/one-day-fullstack-complete

Thank You

Please feel free to contact me about the content anytime.

Check out reSolve: https://reimagined.github.io/resolve/

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