Serverless Architecture

Software Architecture

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Oxymoron 1. Serverless

Logic running on someone else's server.

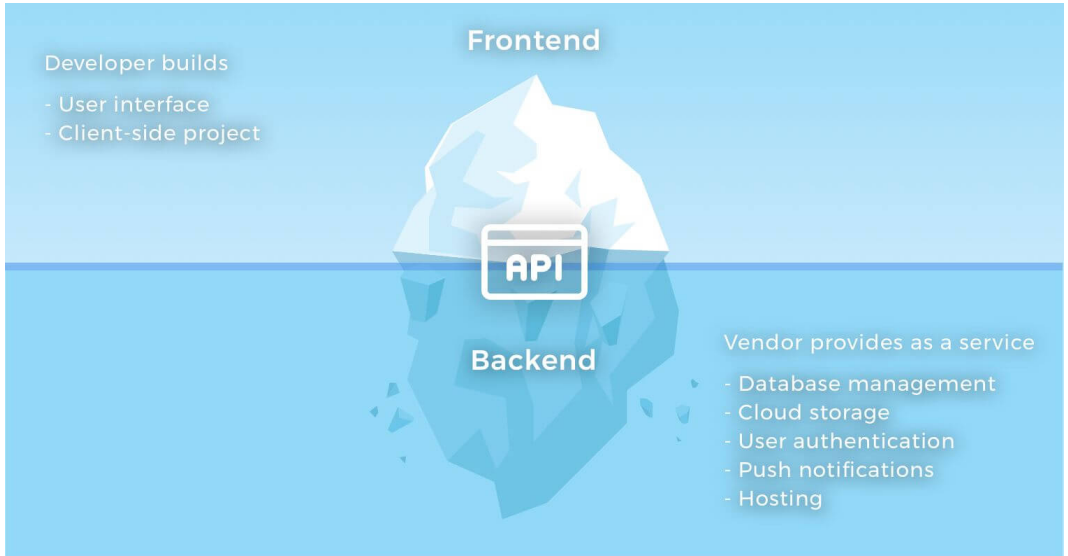
Developers can focus on logic, not infrastructure to deliver it.

Definition 1. Backend as a Service (BaaS)

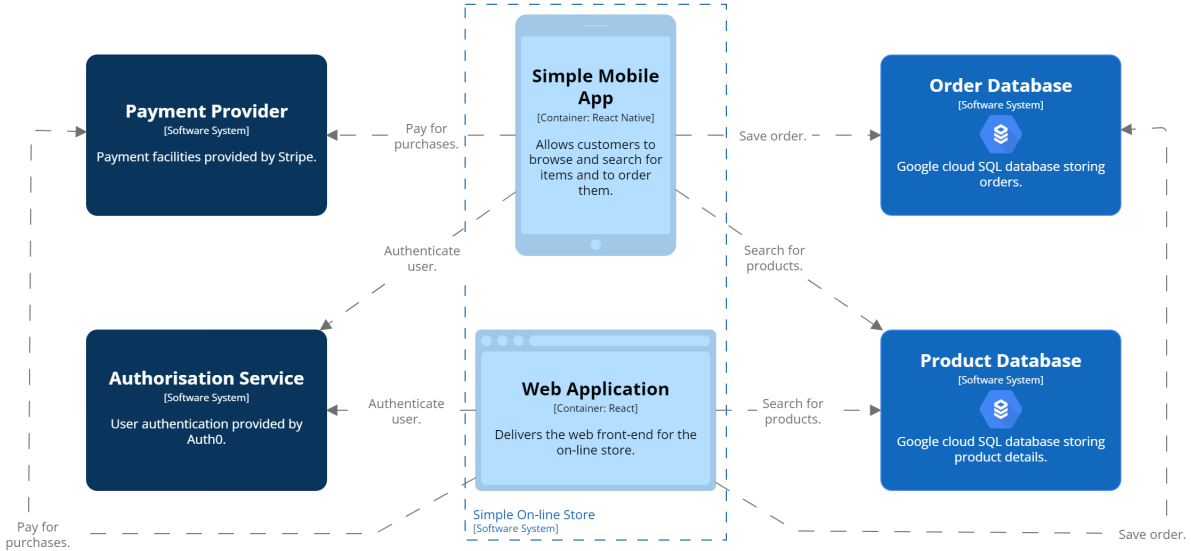
Cloud-hosted applications or services that deliver functionality used by an application front-end.

- Front-end may be a SPA or mobile app.
- Back-end provides sophisticated functionality (e.g. database, machine learning, location services, authentication, ...).
- Front-end ties back-end services together to deliver the application's functionality.

BaaS Iceberg *[Brunko, 2019]*



BaaS Example



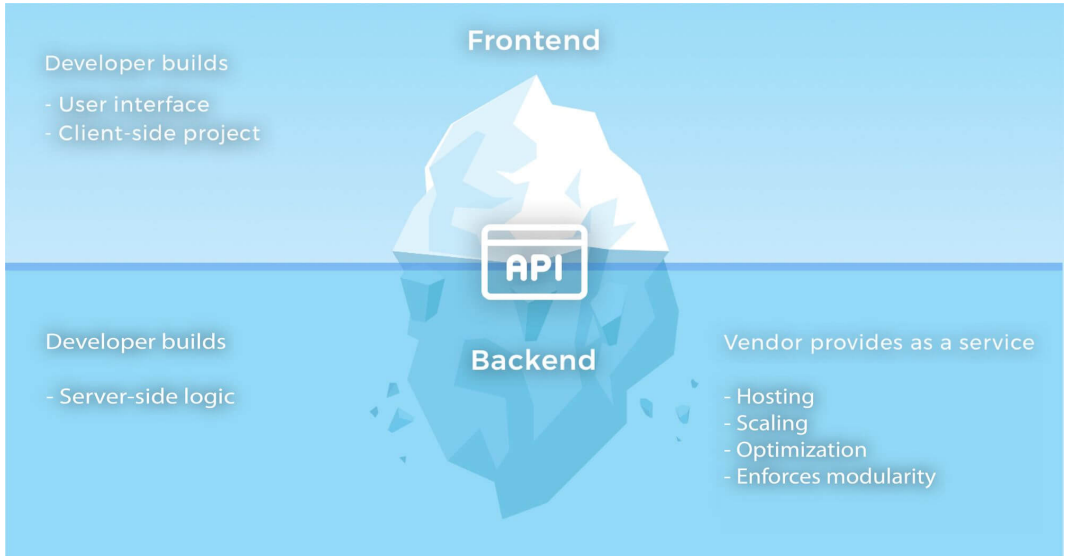
- Example of simple system with back-end functionality delivered entirely via BaaS.
- Feature-rich front-ends coordinate behaviour delivered by BaaS.
- Consequence: Front-ends are tightly coupled to BaaS.
- Consequence: Front-ends are have both UI and functional behaviour logic.
- Front-end could have a layered design, though many SPAs don't.

Definition 2. Functions as a Service (FaaS)

Application logic that is triggered by an event and runs in a transient, stateless compute node.

- Node may only exist for duration of function call.
- Server infrastructure (e.g. type of node, lifespan, scaling, ...) are managed by hosting provider.
- e.g. AWS Lambda, Google App Engine, Azure Automation, ...

FaaS Iceberg *[Brunko, 2019]*



FaaS Example

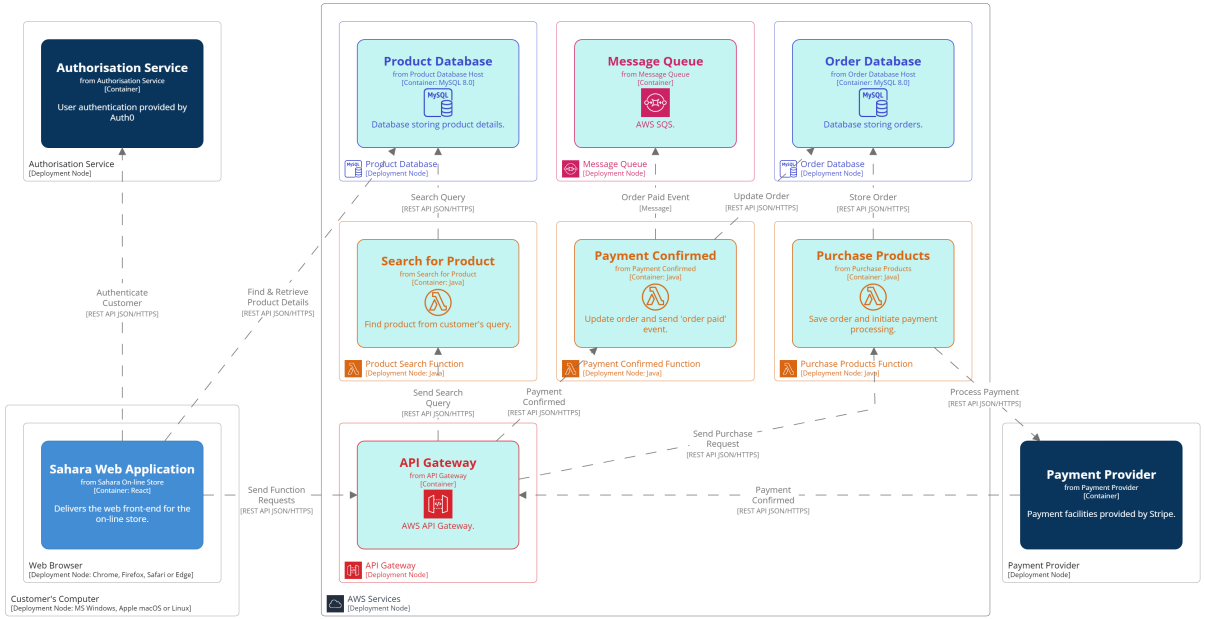
- Example of simple system with back-end functionality delivered entirely by FaaS.
- Feature-rich front-ends coordinate behaviour delivered by FaaS.
- Front-ends invoke functions via an API.
- API Gateway provides some separation between front-end and functions.
- May allow a bit more separation between UI and logic.

Definition 3. Serverless Architecture

Software system delivering functionality through BaaS or FaaS.

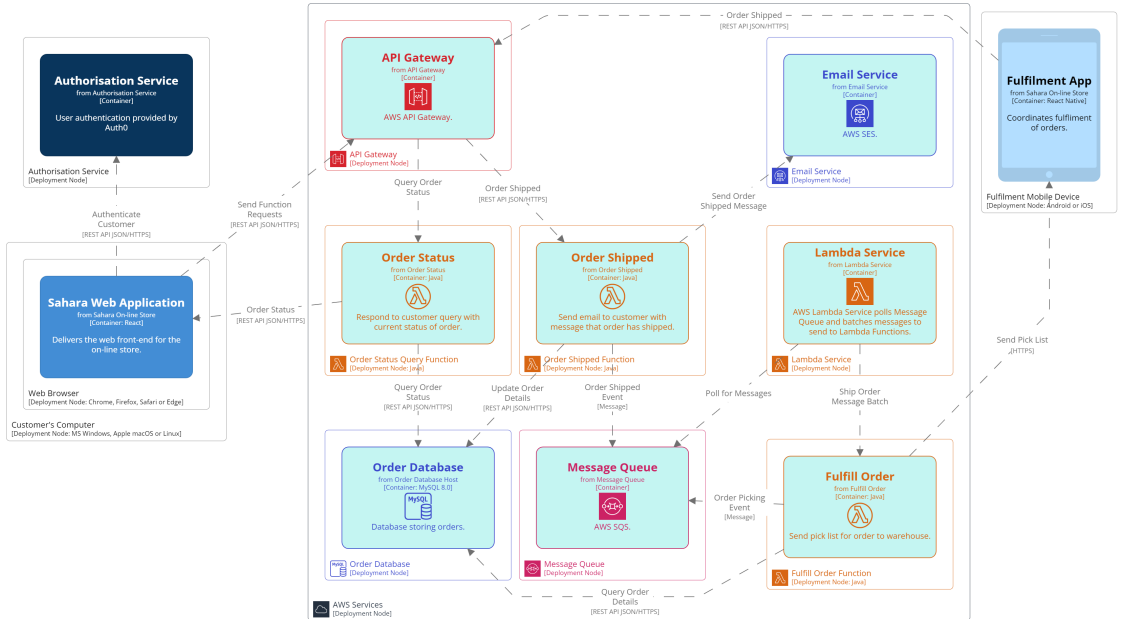
- Many people focus on FaaS when considering Serverless.
- Some simple Single Page Web Apps (SPA) coordinate.
- Front-end ties back-end services together to deliver the application's functionality.

Sahara Browse & Order



- Sahara eCommerce example as a serverless app.
- Only browse, search and purchase are shown.
- Point out that it uses both BaaS & FaaS.
- Shopping cart is implemented within the web and mobile app for this architecture.
- Order Scenario 1: Customer checks out their shopping cart in the web or mobile app.
- Order Scenario 2: App calls Purchase Products function via API Gateway.
- Order Scenario 3: Purchase Products stores order in DB and sends a payment request to Payment Provider.
- Order Scenario 4: We provide Payment Provider with API end point to call to report payment result.
- Order Scenario 5: Payment success causes Payment

Sahara Fulfilment



- Sahara eCommerce example as a serverless app.
- Only fulfilment functions are shown.
- Shows Lambda Service polling Queue, demonstrating how Lambda Functions are invoked via events in a message queue.
- Fulfilment Scenario 1: Lambda Service monitors Queue for ‘ship order’ messages.
- Fulfilment Scenario 2: Lambda Service batches groups of ‘ship order’ messages and sends them to Fulfill Order function.
- Fulfilment Scenario 3: Fulfill Order gets order details from DB and sends pick list to Fulfilment App.
- Fulfilment Scenario 4: When order is shipped, Fulfilment App calls Order Shipped function via API Gateway.

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- Reduced cost for dynamic loads
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- Reduced server management
- Easier to run closer to client
  - Launch in same zone as client

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- Front-end accesses database directly
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  - Duplication of logic with multiple front-ends
    - Web, mobile, ...
- No control over server optimisation

- Spoofing messages is an issue for all BaaS services.
- Modern expectations are that almost all systems will have multiple front-ends.
- Duplication of front-end logic is a smaller, but still partial, concern for FaaS.

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    - Some languages worse than others (e.g. Java)
- Proliferation of functions
  - Loss of encapsulation

- Server running function can be killed when function is not running.
- Can occassionally send messages to functions to keep them alive.
- Java has concurrency benefits over other languages.

Question

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- High latency processing
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- Apps with variable load
  - Take advantage of auto-scaling

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When is serverless *not* appropriate?

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- Quick response required
  - Can't wait for FaaS to start
- Compute intensive processing
- Apps with steady load
  - Server-based approaches are cheaper

Self-Study Exercise

- Redesign your scalability assignment to be serverless.
  - What parts of your design would benefit from being serverless?
- Implement your revised design.

Pros & Cons

Extensibility 

Reliability 

Interoperability 

Scalability 

Deployability 

Modularity 

Testability 

Security 

Simplicity 

- Modularity: Deployed functions are naturally modular.
- Modularity: Higher-level abstractions to group deployed functions is difficult.
- Testability: Unit testing FaaS functions is easy.
- Testability: Integration testing is hard.
- Security BaaS: Front-end access database directly. No server-side protection of db.
- Security FaaS: Every function needs its own security policy (e.g. IAM), which is easy to get wrong.

References

[Brunko, 2019] Brunko, P. (2019).
Serverless architecture: When to use this approach and what benefits it gives.
https://apiko.com/blog/serverless-architecture-benefits//.