Distributed Systems I

Software Architecture

Brae Webb

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@mathiasverraes

There are only two hard problems in distributed systems:
2. Exactly-once delivery
1. Guaranteed order of messages
2. Exactly-once delivery

Going forward

Investigating architectures that are *distributed*.

Distributed Systems Series

Distributed I *Reliability* and *scalability* of *stateless* systems.

Distributed II *Complexities* of *stateful* systems.

Distributed III *Hard problems* in distributed systems.

What are the benefits?

- Improved *reliability*.
- Improved *scalability*.
- Improved *latency*.

What are the drawbacks?

- Increased *complexity*.
- Increased *attack vector*.
- Increased *latency*.
- Introduce *consistency* problems.

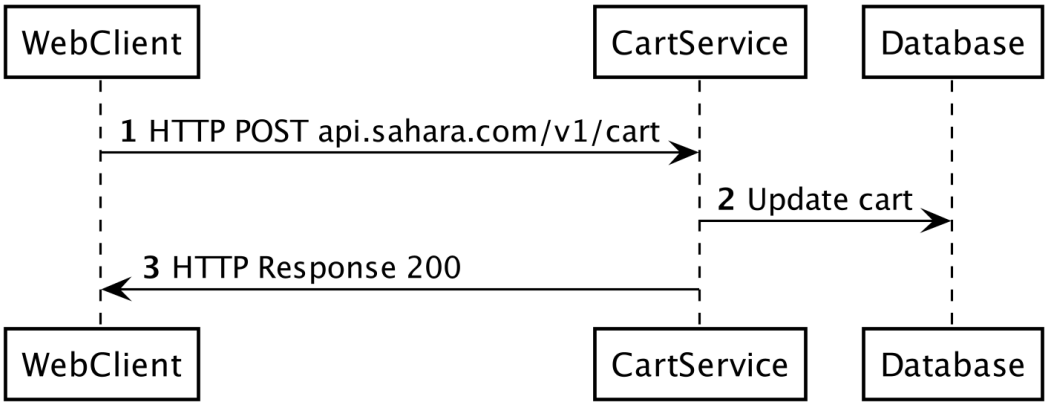
§ *Fallacies*

A few reasons for complexity

The Fallacies of *Distributed Computing*.

Fallacy #1

The network is reliable.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CartService
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1 HTTP POST api.sahara.com/v1/cart
2 Update cart
3 HTTP Response 200
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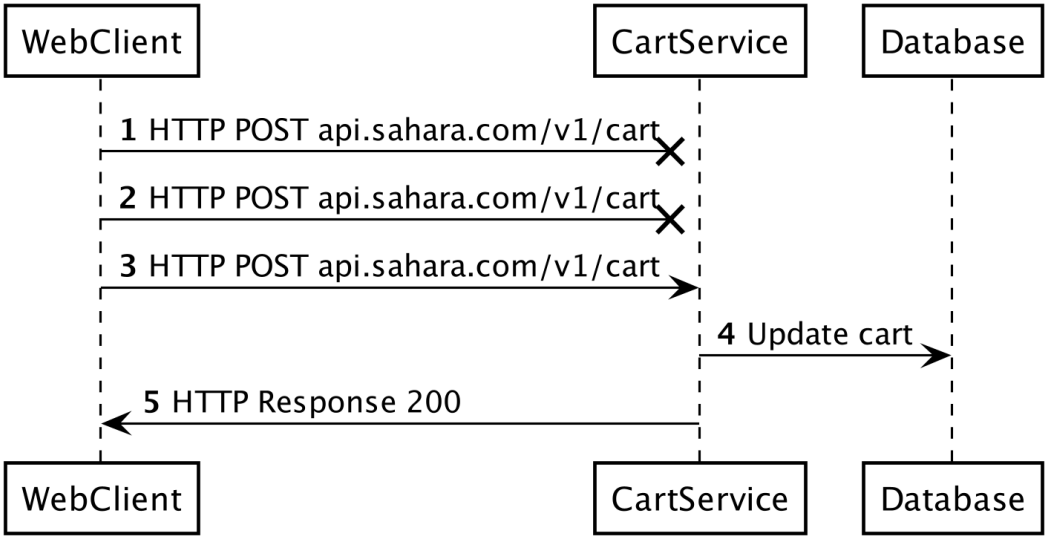
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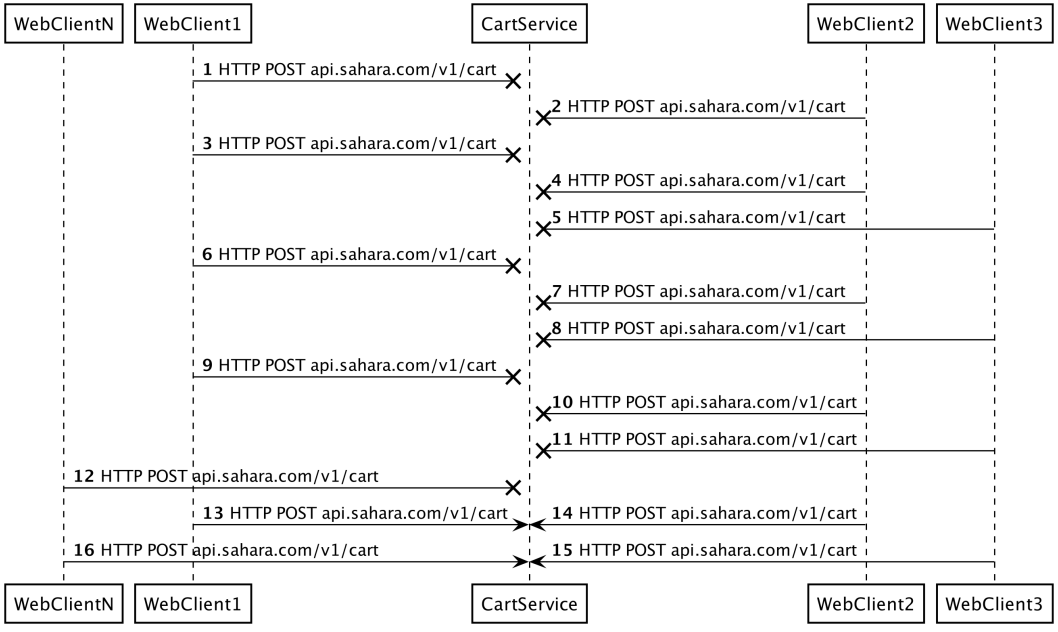
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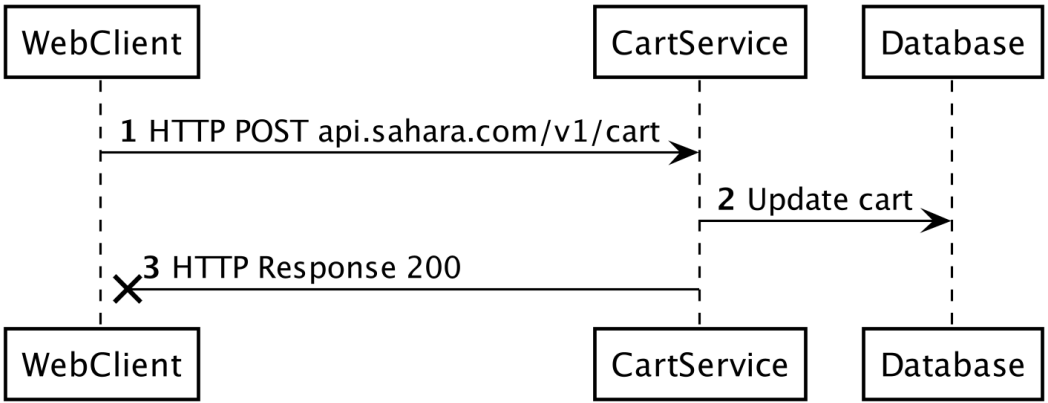
Exponential backoff

```
retry = True
do:
    status = service.request()

    if status != SUCCESS:
        wait(2 ** retries)
    else:
        retry = False
while (retry and retries < MAX_RETIRES)
```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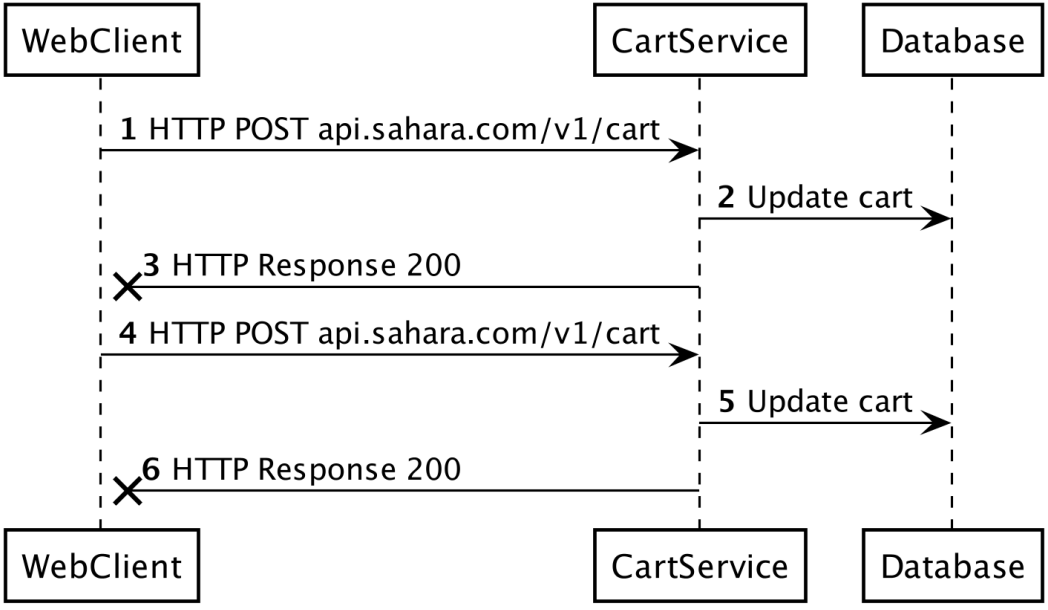
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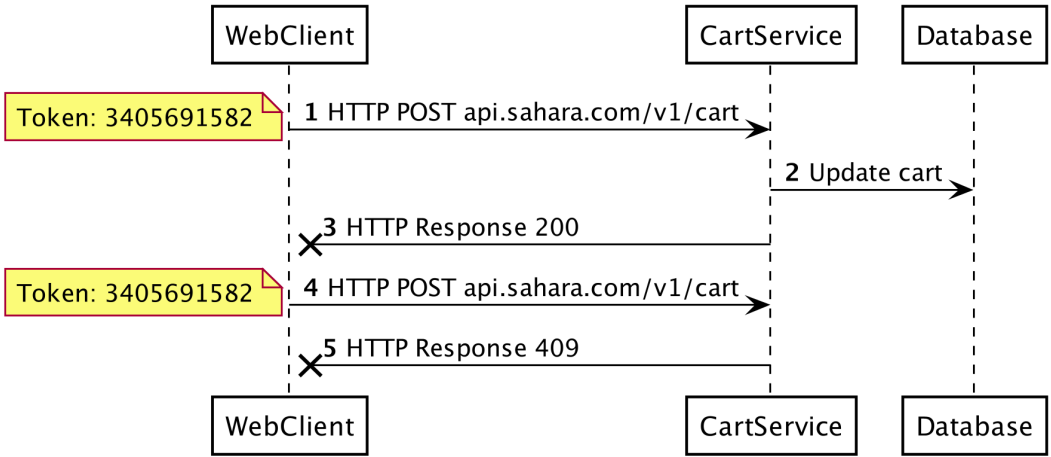
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Fallacy #2

Latency is zero.

Network Statistics

Home to UQ

Home to us-east-1

EC2 to EC2

Network Statistics

Home to UQ 20.025ms

Home to us-east-1

EC2 to EC2

Network Statistics

Home to UQ 20.025ms

Home to us-east-1 249.296ms

EC2 to EC2

Network Statistics

Home to UQ	20.025ms
Home to us-east-1	249.296ms
EC2 to EC2	0.662ms

Fallacy #3

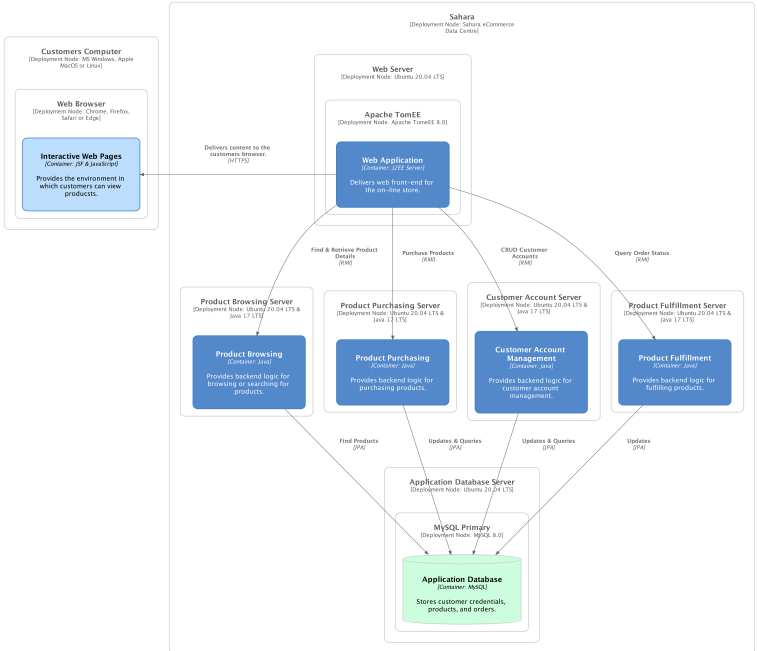
Bandwidth is infinite.

Definition 1. Stamp Coupling

Components which share a composite data structure.

Fallacy #4

The network is secure.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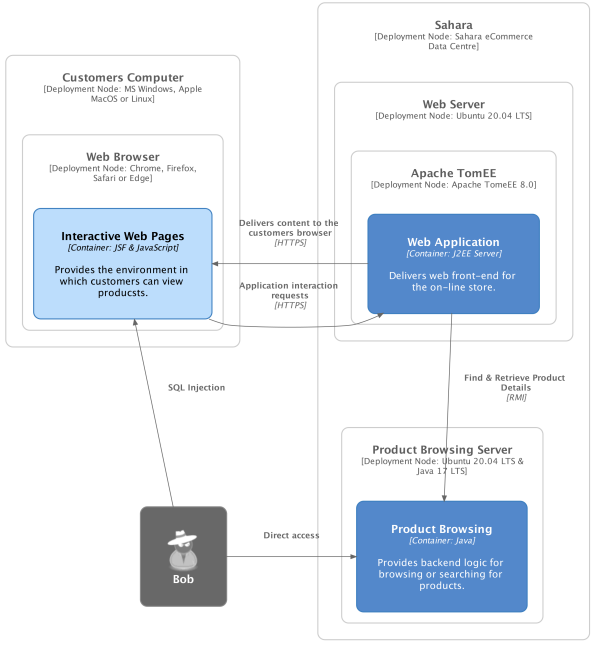
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Fallacy #5

The topology never changes.

Fallacy #6

There is only one administrator.

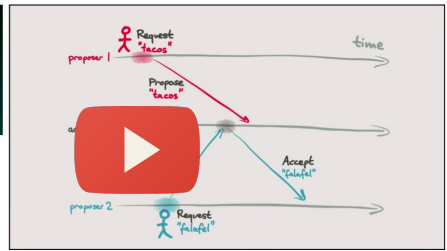
Fallacy #7

Transport cost is zero.

Remember

Distributed systems are *hard*.
The choice to use them should be *well considered*.

When you need to, maybe prove it?



strangeloop

Sept 13-14, 2019

thestrangeloop.com

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https://youtube.com/watch?v=7w4KC6i9Yac

Or, more realistically,

Use existing algorithms and software.

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Distributed I *Reliability* and *scalability* of *stateless* systems.

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Stateless vs. Stateful Systems

Stateless Does *not* utilize *persistent data*.

Stateful Does utilize *persistent data*.

Question

What makes software *reliable*?

Definition 2. Reliable Software

Continues to work, even when things go wrong.

Definition 3. Fault

Something goes wrong.

Death, taxes, and computer system failure are all inevitable to some degree.
Plan for the event.

- Howard and LeBlanc

Reliable software is

Fault *tolerant*.

Problem

Individual computers fail *all the time*

Solution

Spread the risk of faults over *multiple computers*, or, *nodes*.

Spreading Risk

If you have software that works with *just one* computer, spreading the software over *two* computers *halves* the risk that your software will fail.

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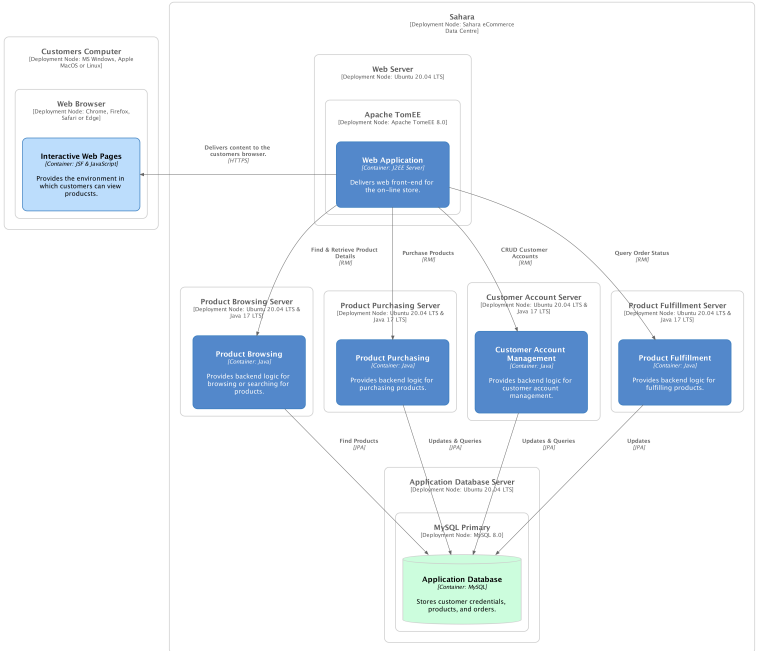
Adding *100* computers reduces the cuts the risk by *100*.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Question

Who has used *auto-scaling*?

Auto-scaling terminology

Auto-scaling group A *collection of instances* managed by auto-scaling.

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Minimum/Maximum Capacity *Hard limits* on the minimal and maximum amount of instances.

What we really want

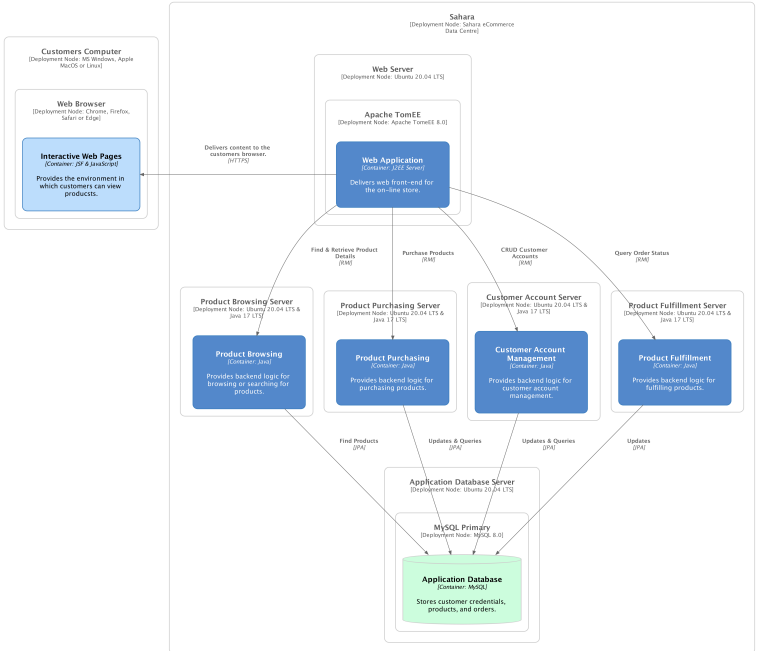
Desired Capacity Amount of *healthy* instances we want to have in an auto-scaling group.

Health check

Mechanism to determine whether an instance is *healthy*.

Auto-scaling

An example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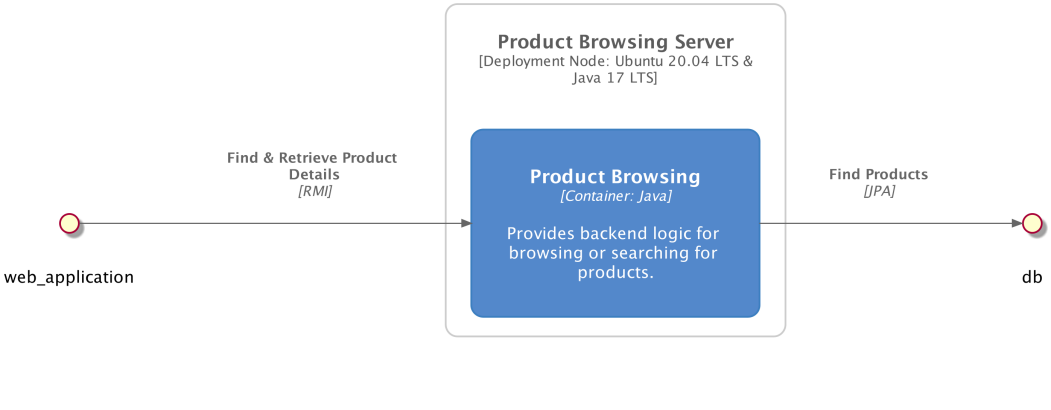
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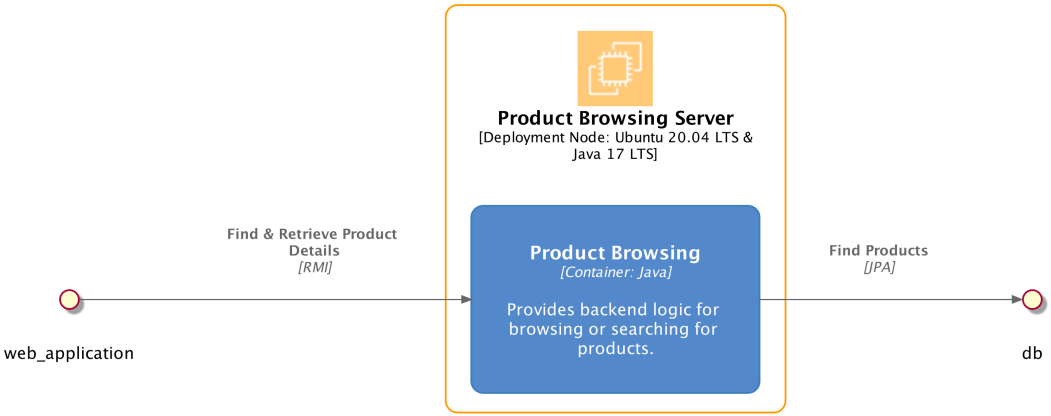
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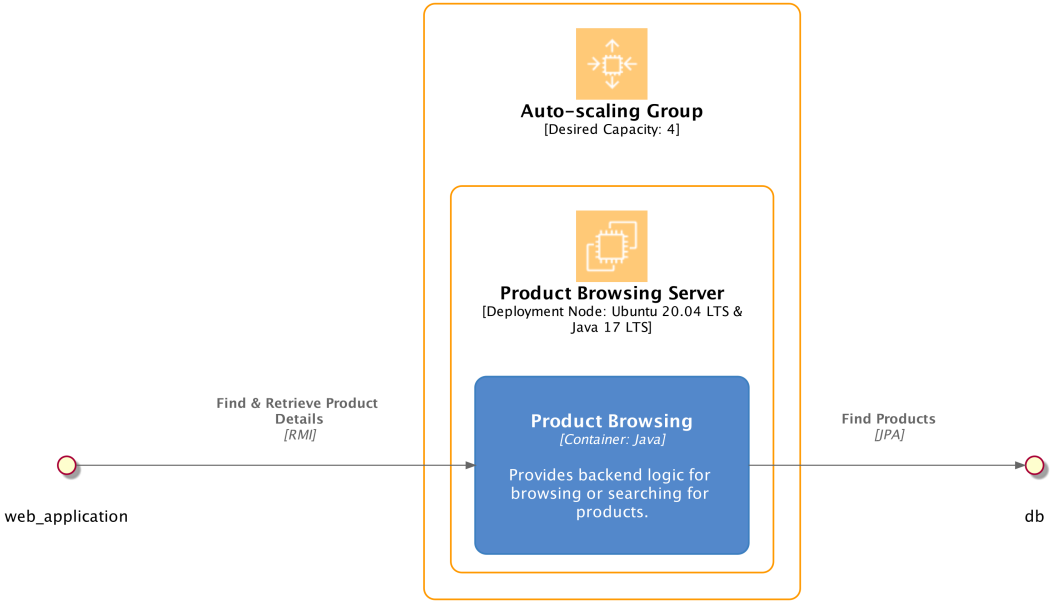
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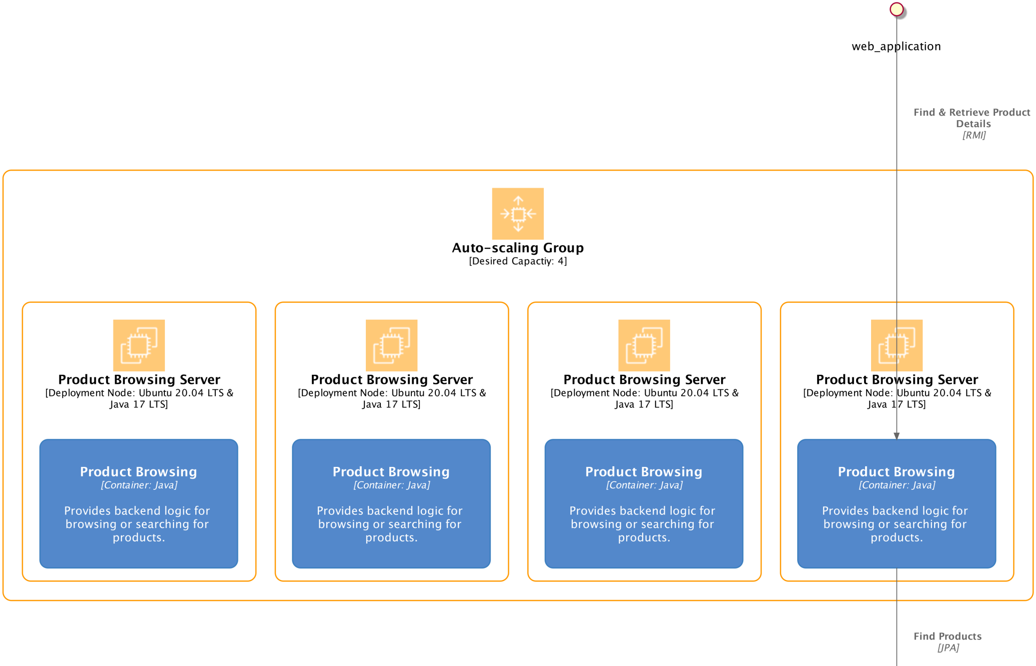
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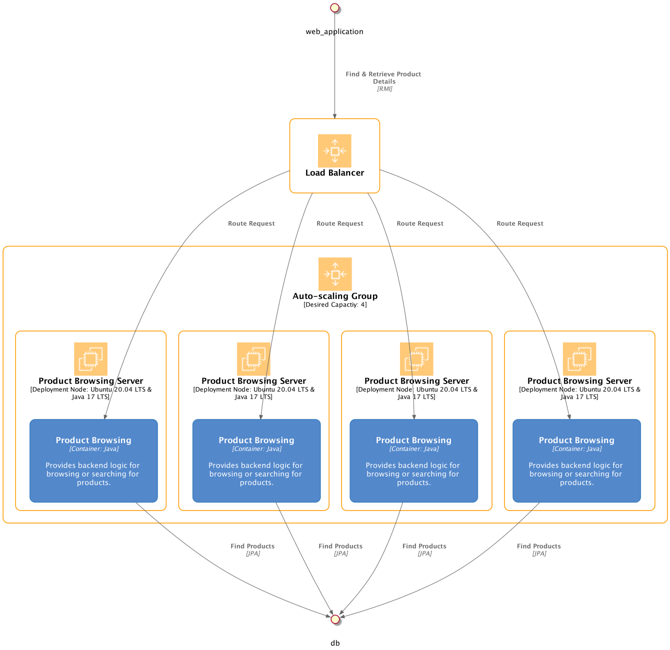
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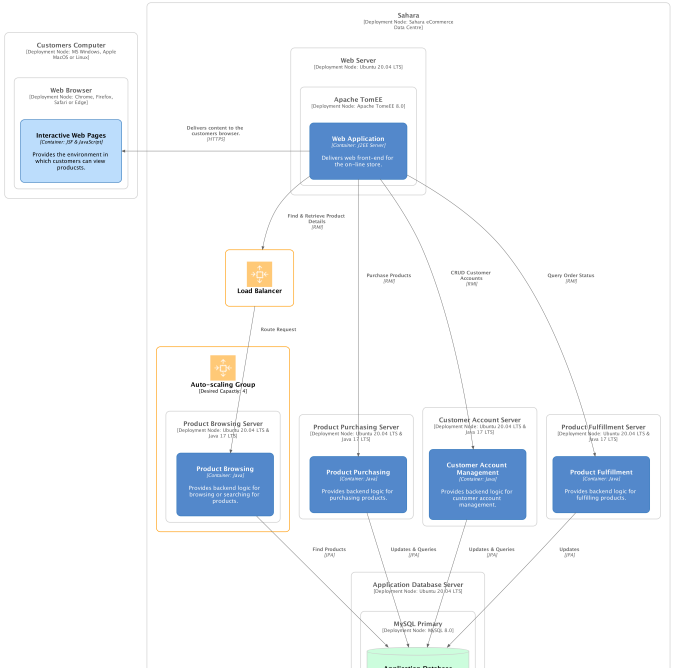
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Scalability

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Scalability Auto-scaling and load balancing allows *individual services to scale*. However, the *database is a bottle-neck*.