Microservice Resiliency

From Front to Back End

QCon São Paulo, 2017

Lance Ball, Senior Software Engineer, Red Hat

Who am I?

Senior Software Engineer, Red Hat

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RED HAT® JBOSS® MIDDLEWARE

redhat.

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project:odd

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node JS®

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µ Service

> “ software applications as suites of independently deployable services

https://martinfowler.com/articles/microservices.html

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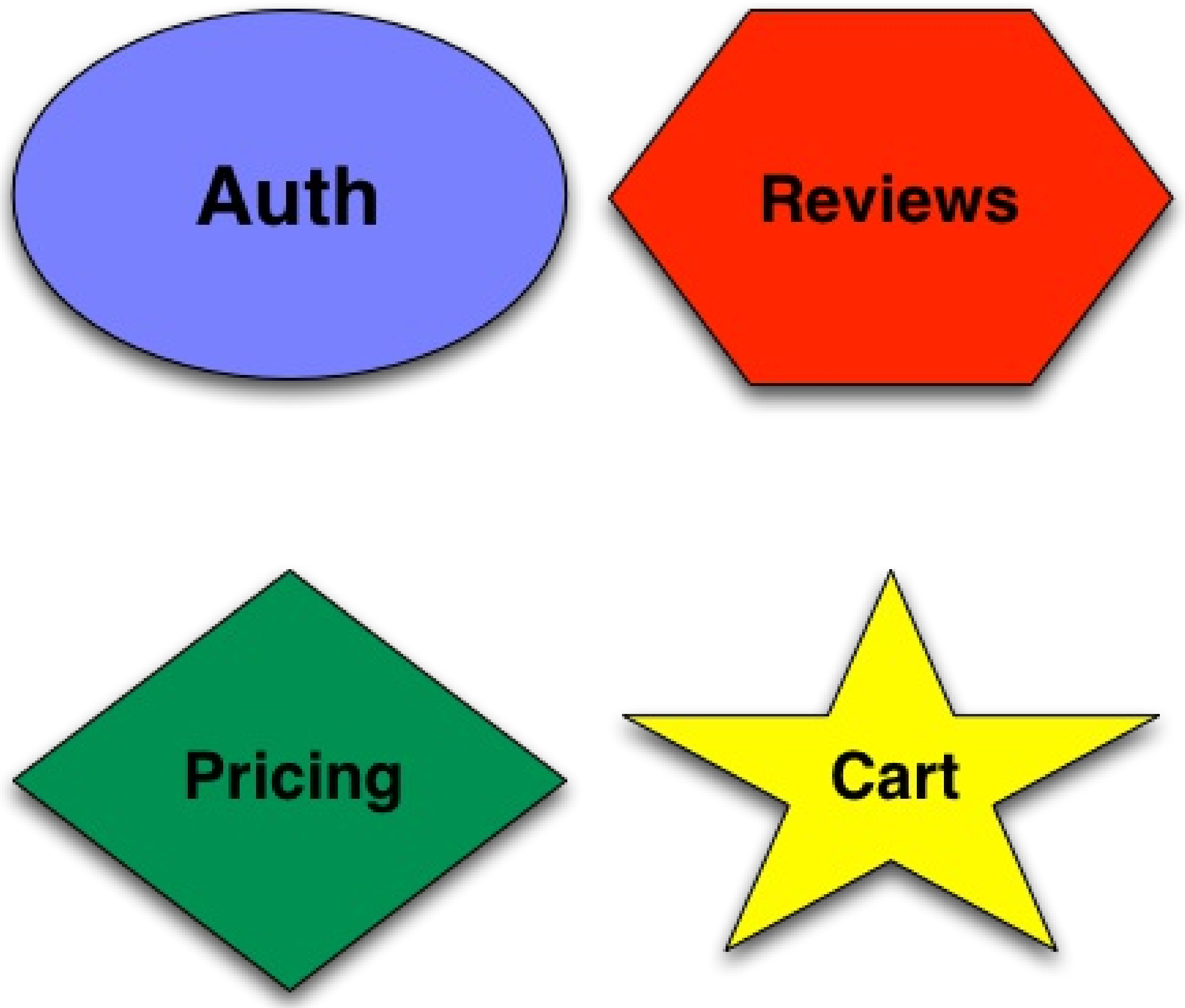
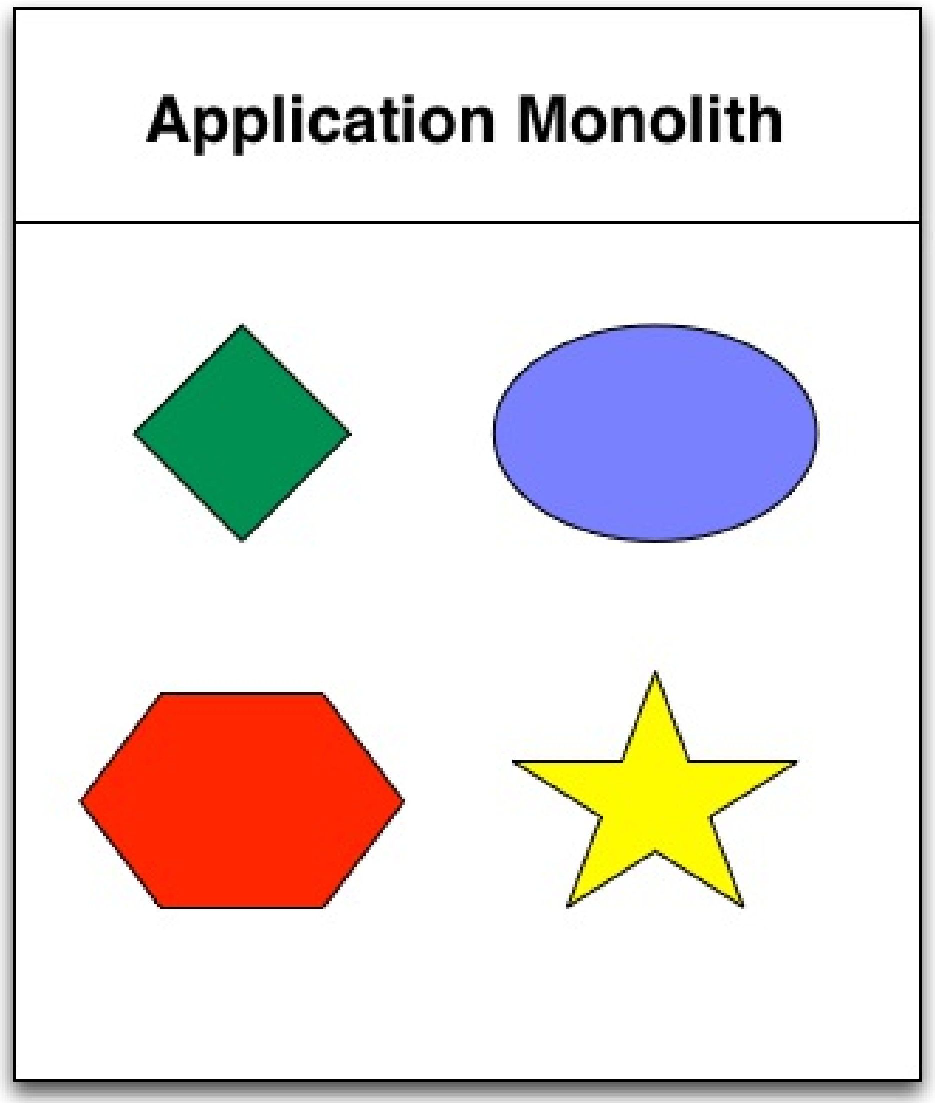
But what does this mean?!

What's in an application?

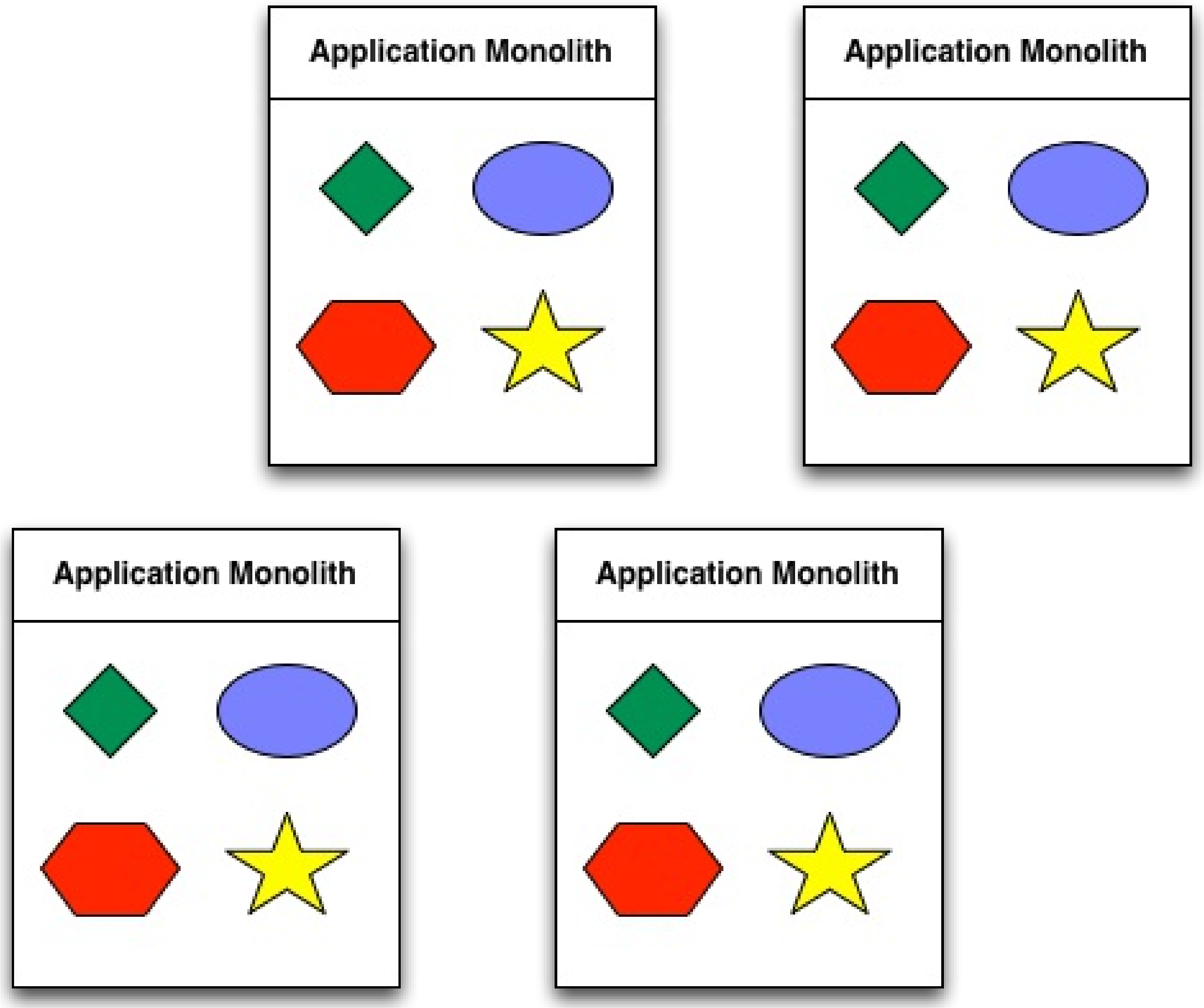
Stuff



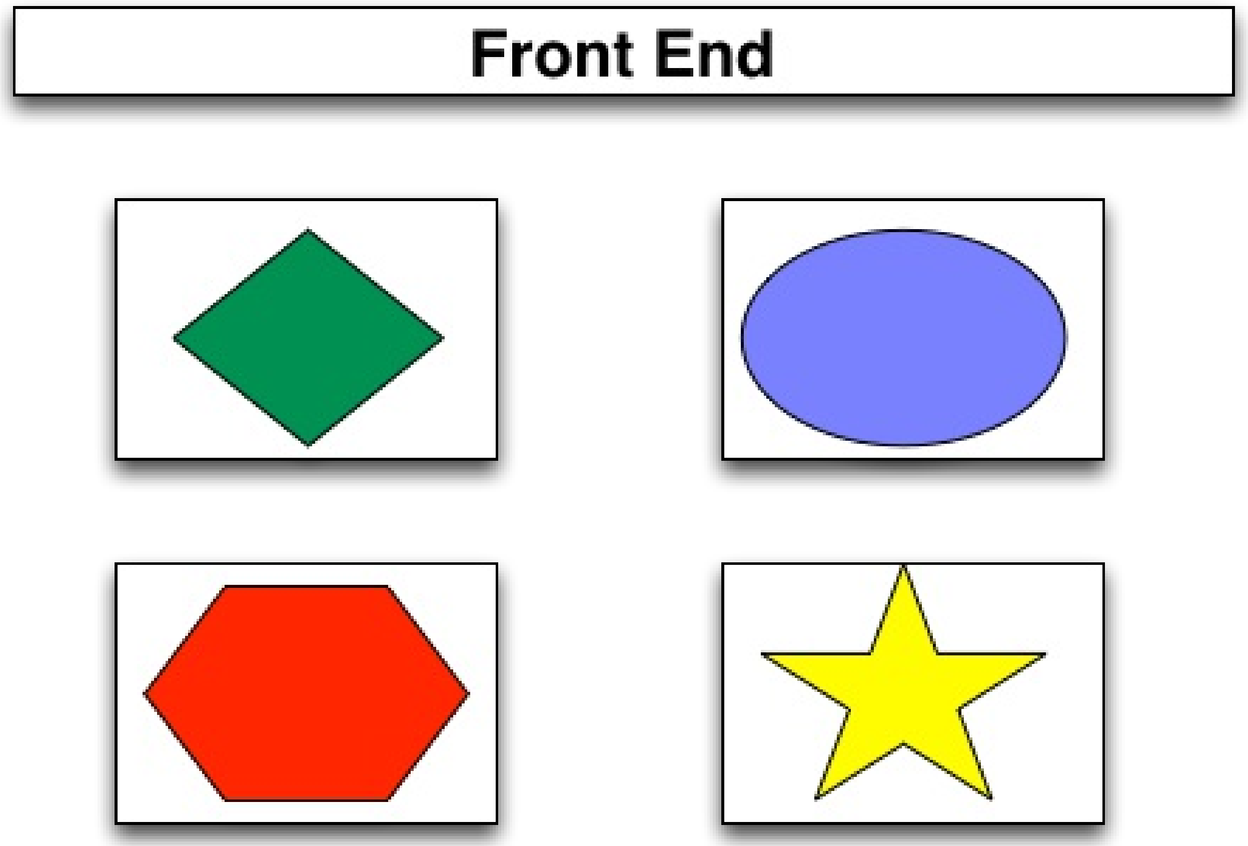
Monolithic application



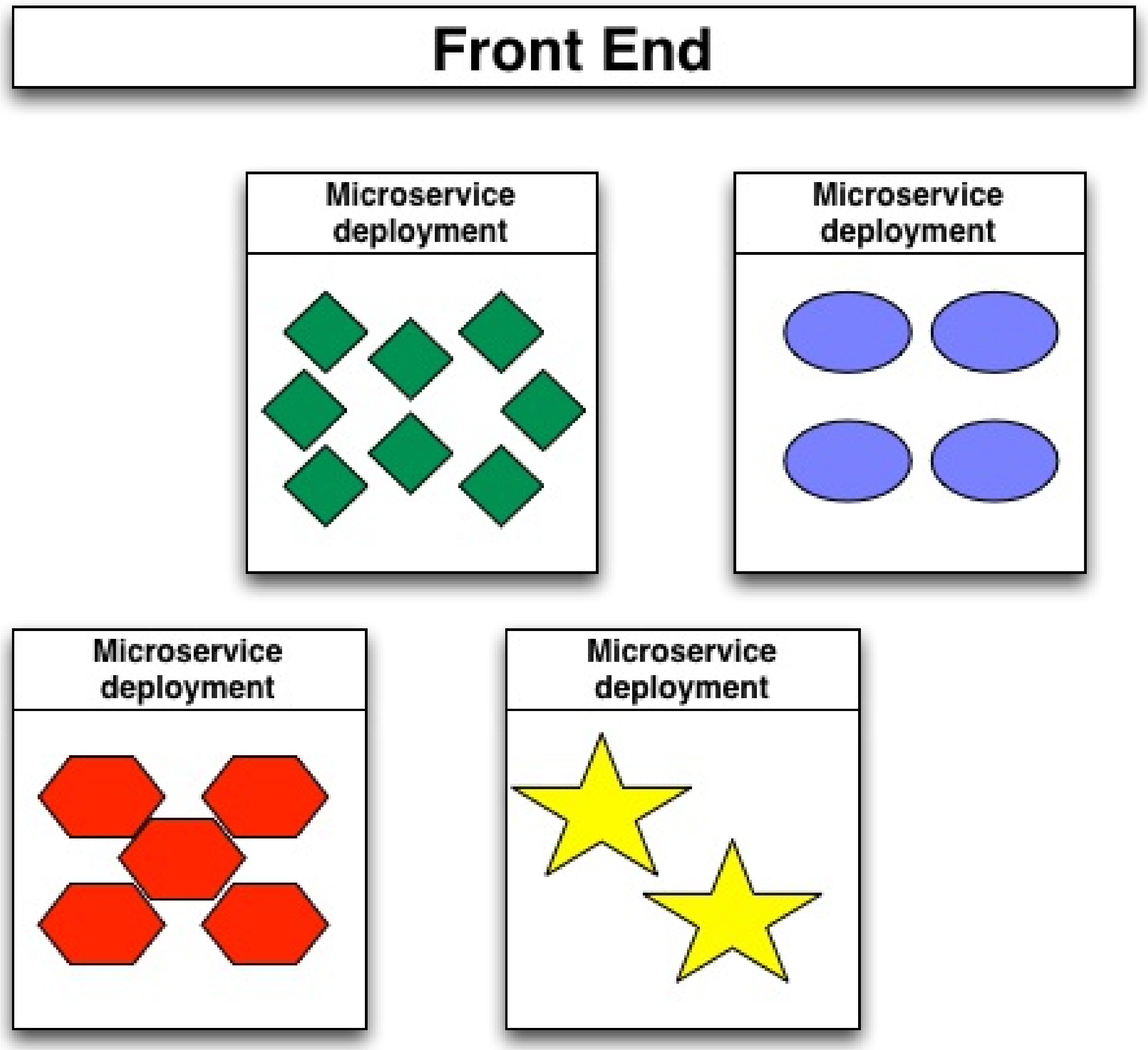
Scaling a monolith



Microservice application

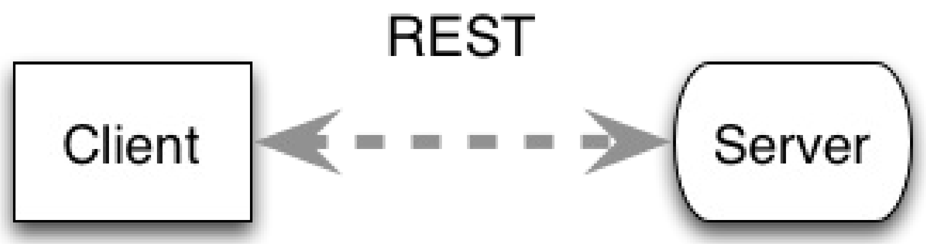


Scaled microservices

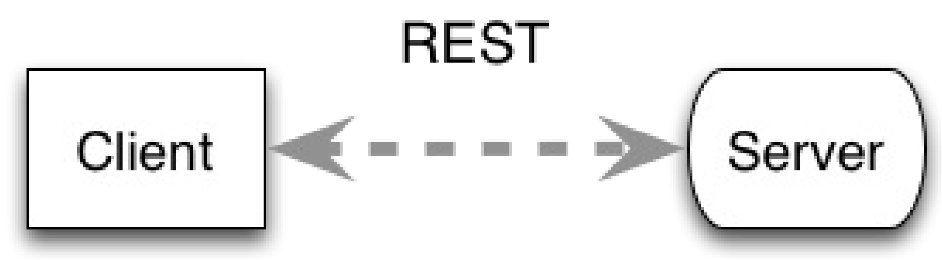


Wait... isn't this the UX track?

Service Lifecycle

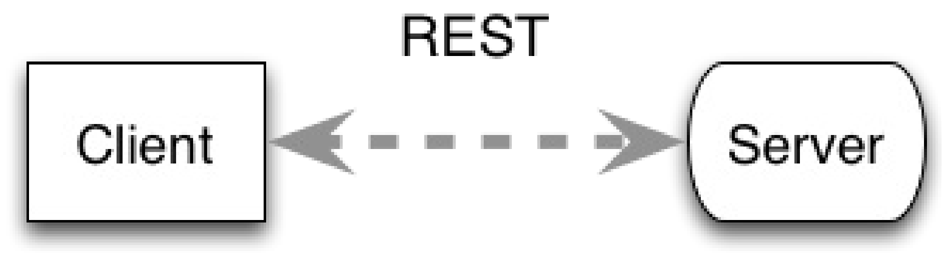


Service Lifecycle



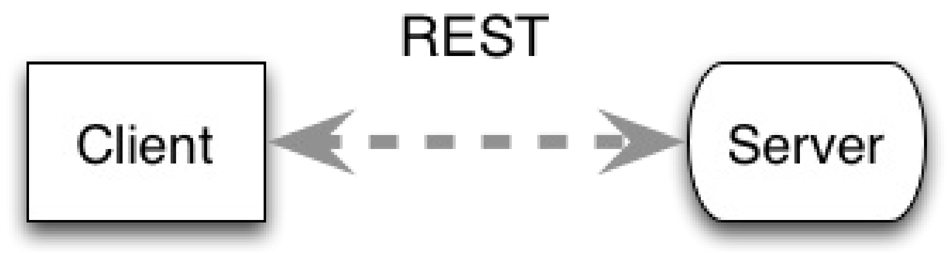
➥ Client makes a request

Service Lifecycle



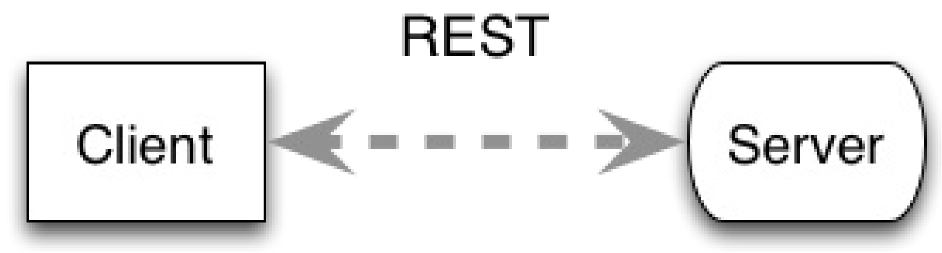
- Client makes a request
- Server provides a response

Service Lifecycle



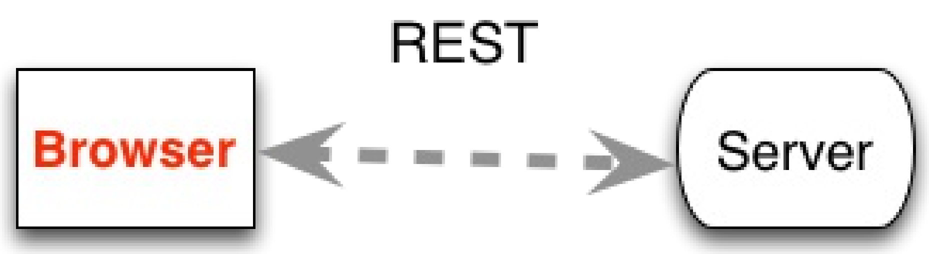
- Client makes a request
- Server provides a response
- Often using HTTP transport

Service Lifecycle



- Client makes a request
- Server provides a response
- Often using HTTP transport
- Often with JSON data format

In the Browser



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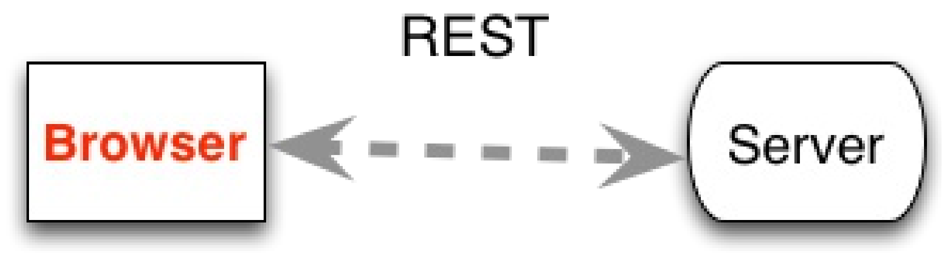
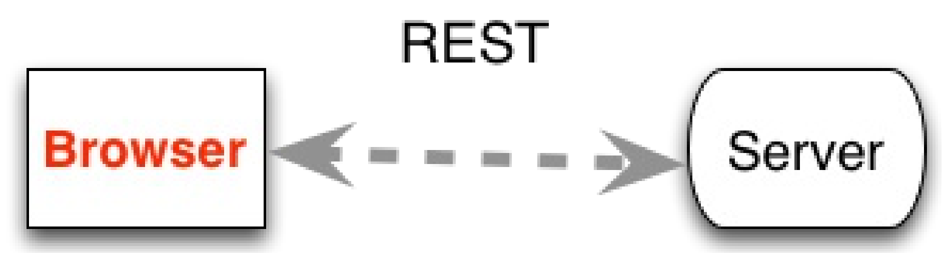


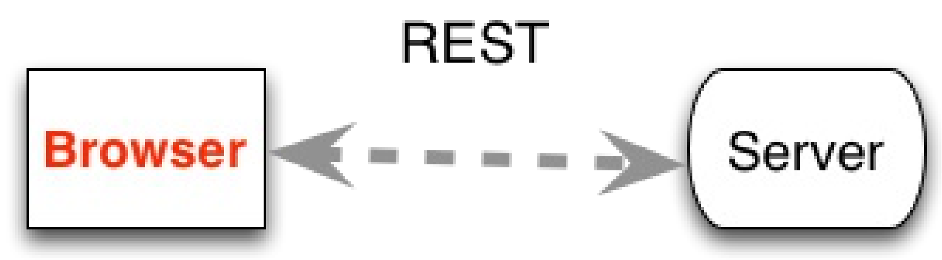
- XMLHttpRequest

In the Browser



- XMLHttpRequest
- JQuery

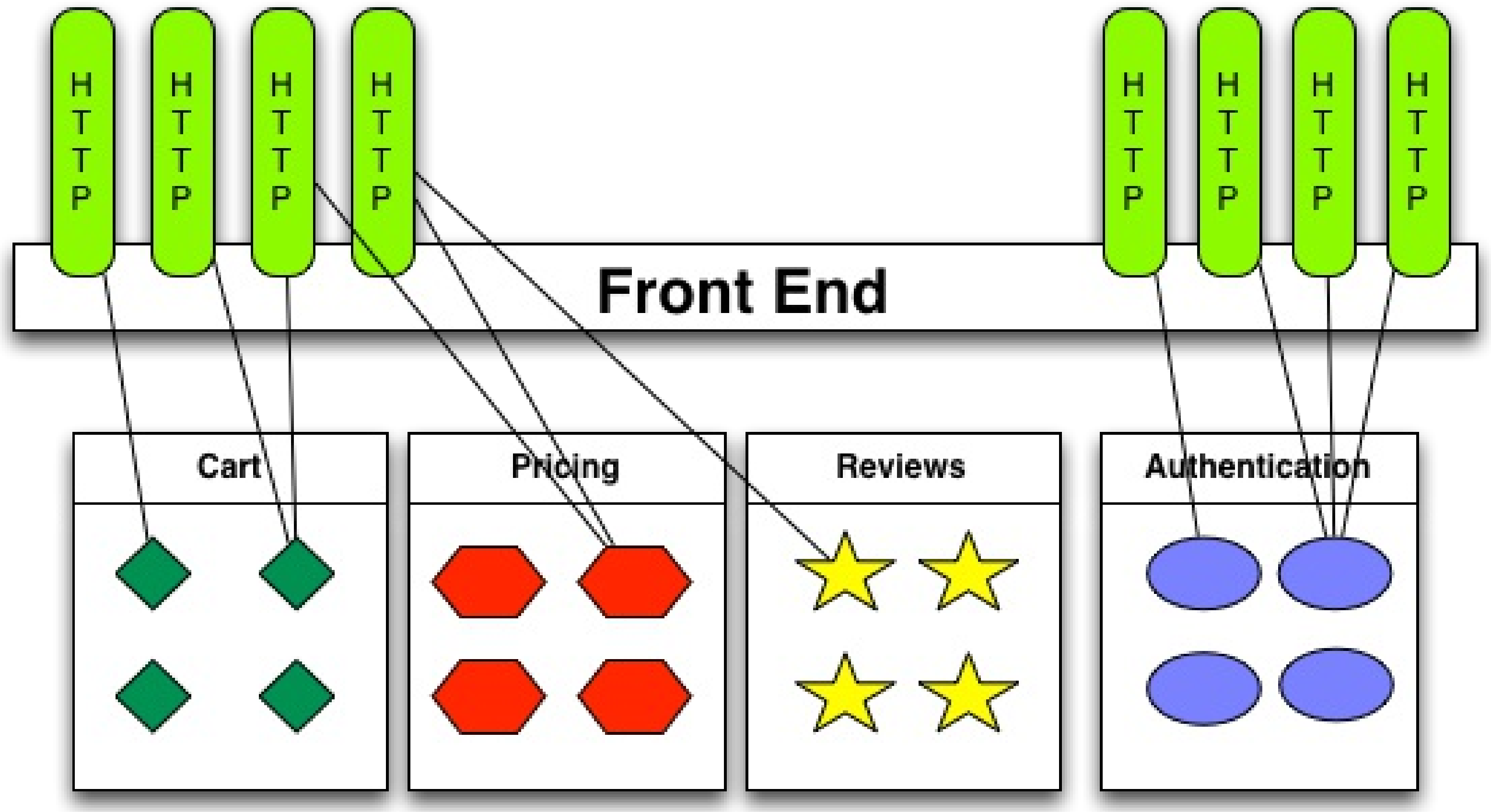
In the Browser



- XMLHttpRequest
- JQuery
- AJAX

Microservice Requests

(simplified)



Operational Complexity

Microservices Visualized

https://twitter.com/ThePracticalDev/status/845285541528719360

Problems

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- Timeouts

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- Network saturation

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- Programmer error

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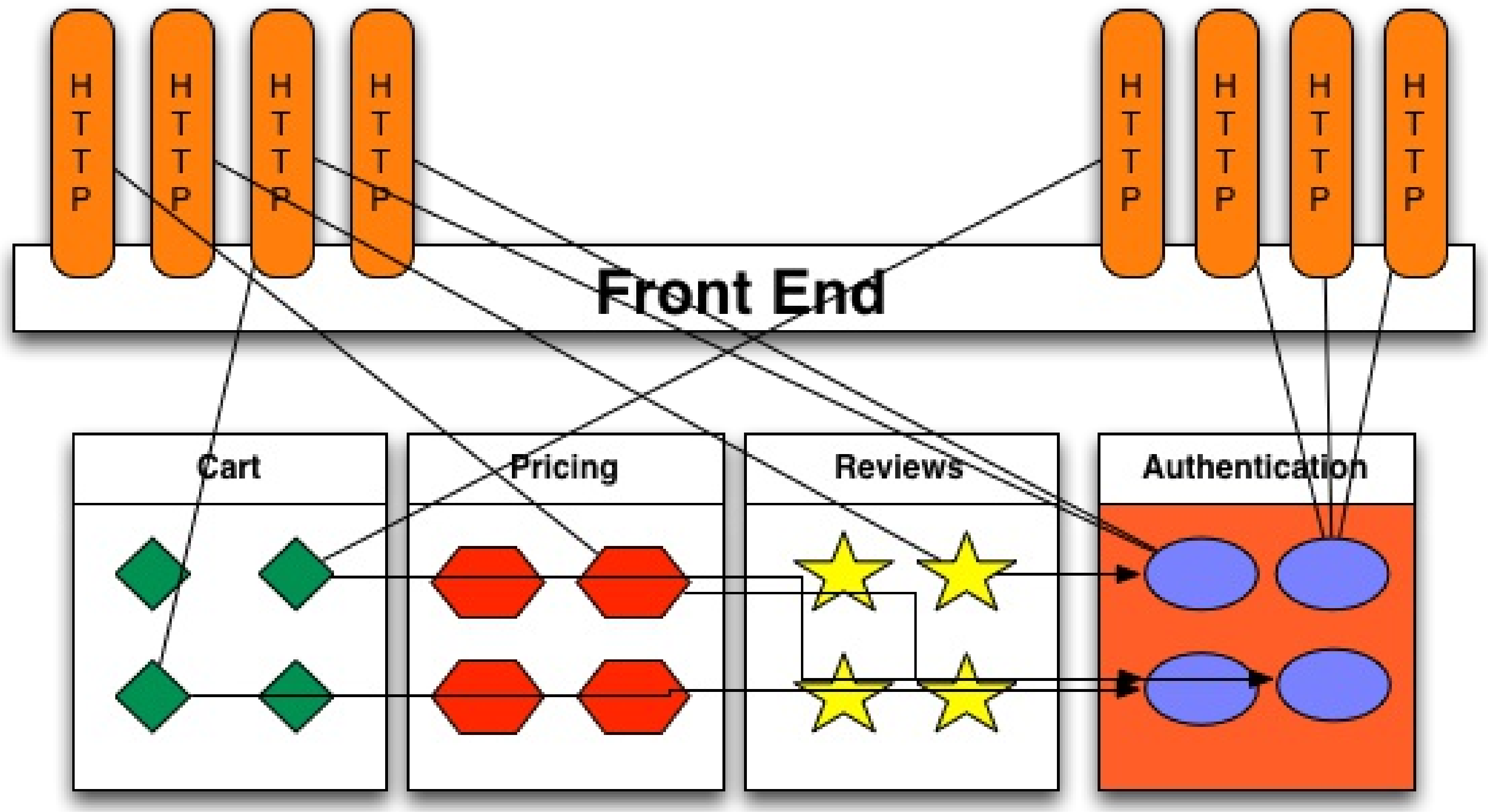
- Transitive dependencies

Cascading failures



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How to deal with all this

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- Limit single points of failure
- Shed load when possible
- Provide fallback behavior
- Optimize failure discovery

Circuit Breaker

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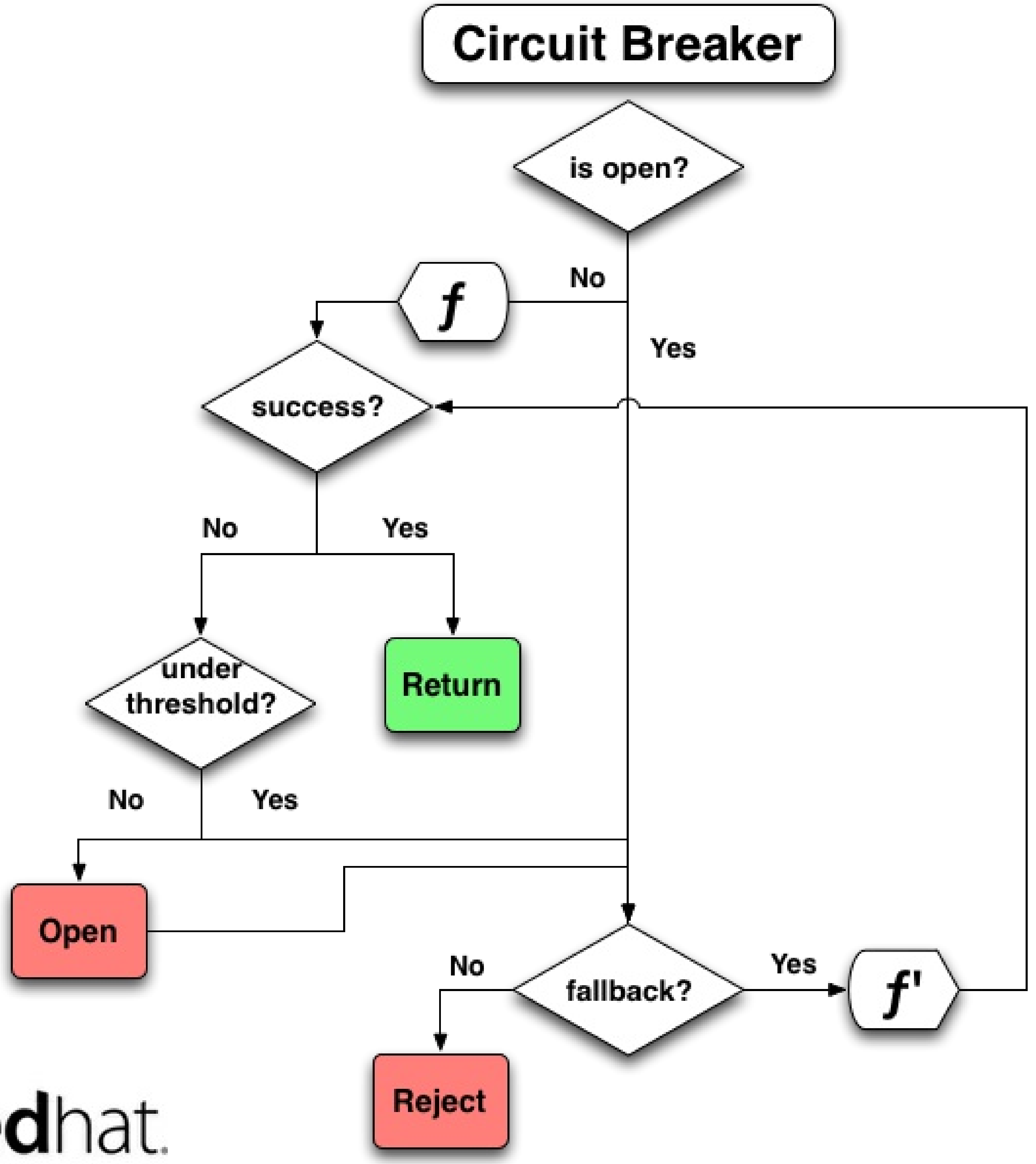
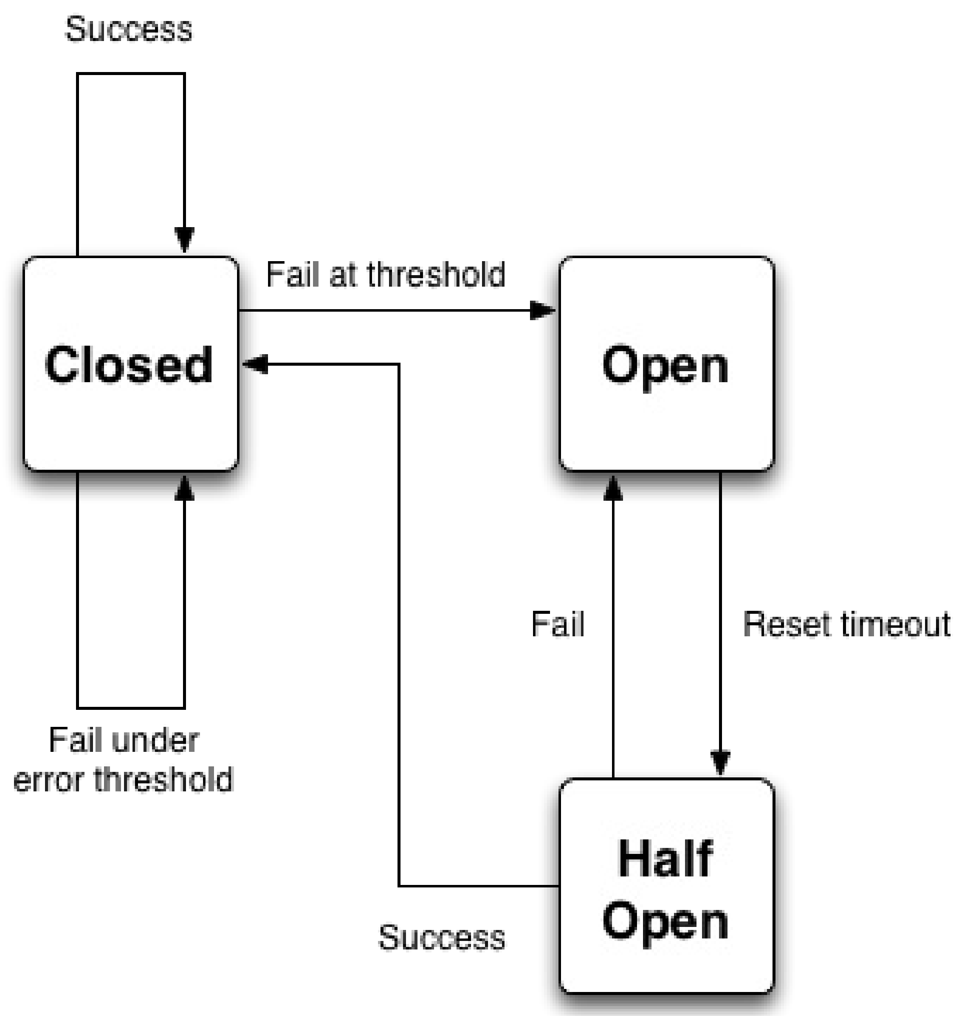
- Calls that could fail are wrapped
- Circuit opens at a failure threshold
- Further calls short circuit for a while
- Later, circuit tries again and trips immediately if there is failure


Circuit Breaker
is open?
No
f
Yes
success?
No
Yes
under threshold?
Return
No
Yes
Open
No
fallback?
Yes
f'
Reject

Circuit State



Async operation that could fail

```
// Use JQuery to get cart info
$.get('http://mystore.com/cart')
  .then((json) => {
    // update the UI with JSON data
  })
  .catch((e) => {
    // oops something went wrong
   console.error(e);
  })
```

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Shed load when possible

Aside - Promsies

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   console.error(e);
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```

Circuit Breaker Example

```
// Use JQuery's ajax wrapper and circuit breaker
// defaults for failure threshold, timing, etc.
const circuit = circuitBreaker($.get);

circuit.fire('http://nodejs.org/dist/index.json')
  .then((json) => {
    // update the UI with JSON data
  })
  // on failure, just log to console
  .catch(console.error);
```

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  .catch(console.error);
```

Promises vs. Callbacks

```javascript
// Wrap Node.js' fs.readFile as a promise-returning function
const readFile = circuitBreaker.promisify(fs.readFile);

const circuit = circuitBreaker(readFile, options);

circuit.fire('./package.json', 'utf-8')
  .then(console.log)
  .catch(console.error);
```

Circuit Breaker Fallback

Provides default behavior in case of error

```
circuit.fallback((file) => `Sorry, I can't read ${file}`);

// Fallback function is still a success case
circuit.fire('./package.jsob')
  .then((data) => console.log(`package.json: \n${data}`))
  .catch((err) => console.error(`ERR: ${err}`));
```

Circuit Breaker Fallback

Provides default behavior in case of error

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// Fallback function is still a success case
circuit.fire('./package.jsob')
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```

Caching

Always returns the same value

```
const now = circuitBreaker(Date, { cache: true });
```

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```
const now = circuitBreaker(Date, { cache: true });

circuit.fire().then(console.log);
// Mon Apr 10 2017 12:10:26 GMT-0400 (EDT)
circuit.fire().then(console.log);
// Mon Apr 10 2017 12:10:26 GMT-0400 (EDT)
circuit.fire().then(console.log);
// Mon Apr 10 2017 12:10:26 GMT-0400 (EDT)
```

When is this useful?

- Frequent hits, infrequent change
- E.g. username

```
const username = circuitBreaker(fetchUsername, { cache: true

// periodically clear the cache
setInterval(_ => username.clearCache(), 5000);
```

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Events

Circuit breakers are event emitters

```
  // Update the UI specifically for timeout errors
  circuit.on('timeout',
   () => $(element).prepend(
     mkNode(`${route} is taking too long to respond.`)));
```

Events

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```

- `fire`
- `reject`
- `timeout`
- `success`
- `failure`
- `open`
- `close`
- `halfOpen`
- `fallback`
- `snapshot`

Status

```
// create a 10 sec window with 10 buckets of 1 sec
const circuit = circuitBreaker(asyncFunc, {
   rollingCountTimeout: 10000,
   rollingCountBuckets: 10
});

// status is calculated every time status is accessed
const status = circuit.status

// print the entire statistical window
console.log(status.window);

// print the rolling stats
console.log(status.stats);
```

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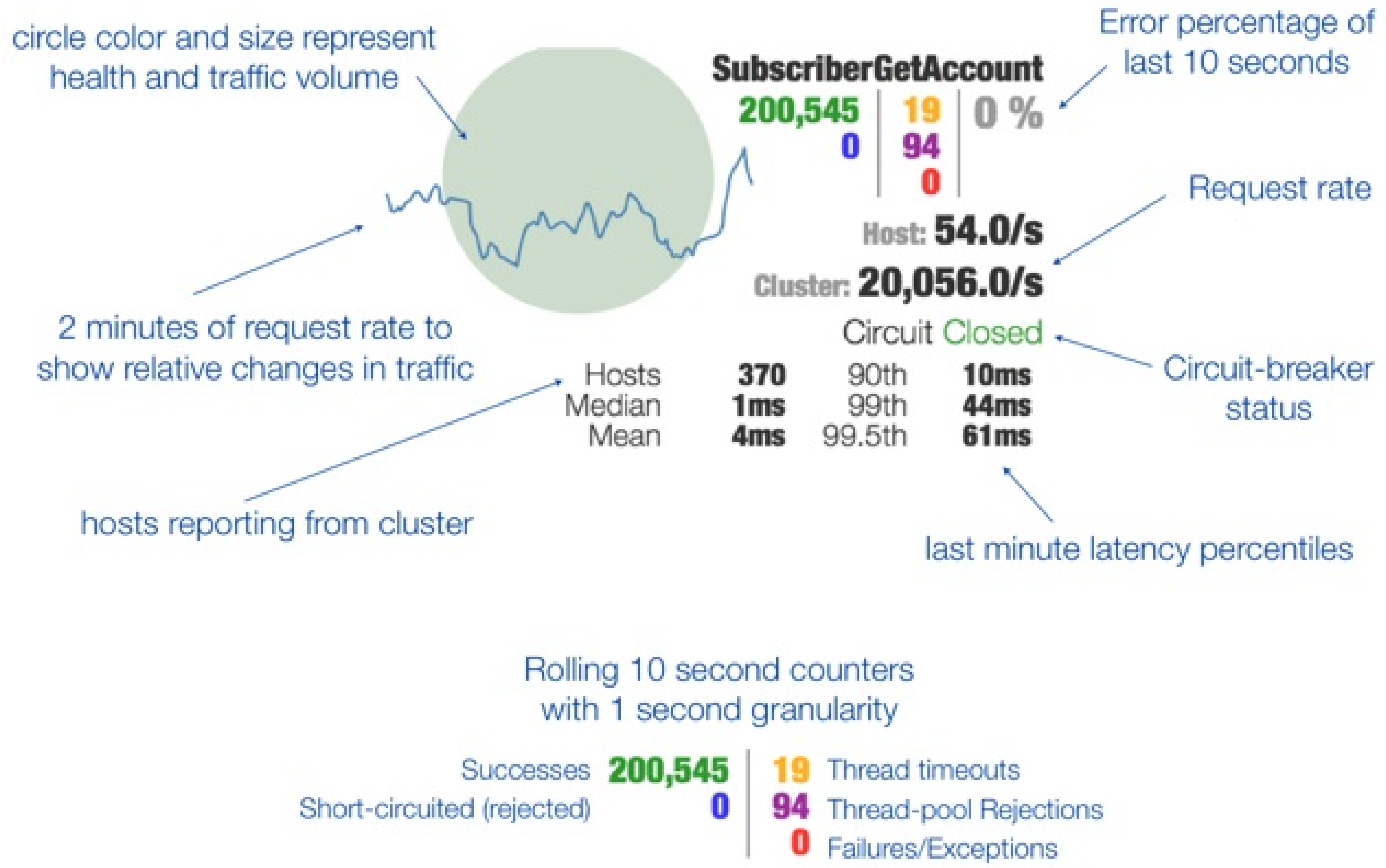
Status

```
// print the rolling stats
console.log(status.stats);

// { failures: 3,
//   fallbacks: 4,
//   successes: 44,
//   rejects: 4,
//   fires: 48,
//   timeouts: 1,
//   cacheHits: 0,
//   cacheMisses: 0 }
```

Dashboard


circle color and size represent health and traffic volume
SubscriberGetAccount
200,545
19
0 %
0
94
0
Error percentage of last 10 seconds
Request rate
Host: 54.0/s
Cluster: 20,056.0/s
2 minutes of request rate to show relative changes in traffic
Circuit Closed
Circuit-breaker status
Hosts 370
Median 1ms
Mean 4ms
90th 10ms
99th 44ms
99.5th 61ms
hosts reporting from cluster
last minute latency percentiles
Rolling 10 second counters with 1 second granularity
Successes 200,545
Short-circuited (rejected) 0
19 Thread timeouts
94 Thread-pool Rejections
0 Failures/Exceptions

http://techblog.netflix.com/2012/12/hystrix-dashboard-and-turbine.html

Demo

Obrigado & Questions

http://lanceball.com/qcon-saopaulo-2017/
https://github.com/lance/qcon-saopaulo-2017
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GitHub - @lance