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How to Thrive on REST/ WebSocket-based Microservices

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Introduction

Why are we doing this?

- Proof of concept
  - Micro is the new black
  - Very small runtime can deliver key functionality
- JAX-RS (Jersey) + WebSocket (Tyrus)
- Java SE 8 adoption
- Reactive APIs

What's already there?

- Vert.x
- Dropwizard
  - Jetty, Jersey, Jackson, …
  - No WebSocket
- Glassfish / Payara
  - JAX-RS, WebSocket, Servlet, JSF, BV, CDI, …
  - ~60MB

QUESTION
Typical production deployment in my company is:

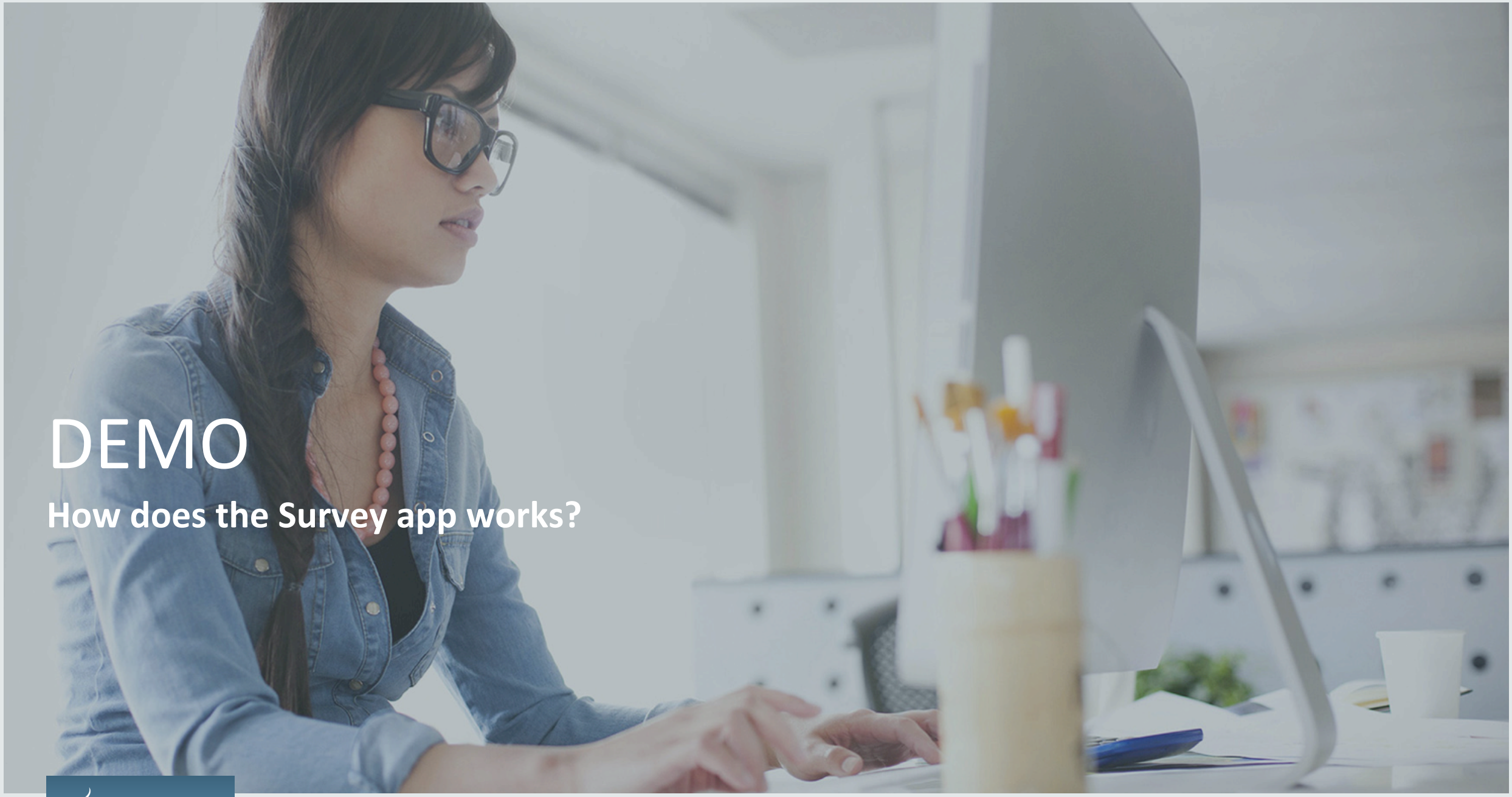
A. Micro-service (small containers, dynamic up/down scaling)

B. Monolithic application (big containers, static resources, active/passive backup)

C. Combination of previous

Sample application

- Simple poll
  - Jersey MVC
- Results are updated based on new votes
  - WebSocket connection (could be SSE..)
- Simple filtering (websocket based)
  - Interactive part of the app
  - WebSocket are more efficient to use



DEMO

How does the Survey app works?

QUESTION
Which Java framework do you use in production?

A. Java EE 6+

B. Spring

C. Java EE 5 (and older) + Java SE

D. Something else, text us what!

DEMO

+CDI

QUESTION
Do you use WebSocket in production?

- **A** Yes.
- **B** Not yet, but we plan to.
- **C** No (we don’t need bi-directional communication).
- **D** No (we use something else).

Micro-services

- Simple, small, decoupled standalone “applications”
  - They don’t do (and provide) anything else than they should
  - Easy to develop and test
- Fast startup time, Fault tolerant
  - Dynamic scaling
  - Cattle vs Pet

<<Placeholder>>

<<Placeholder>>

- Grizzly
  - HTTP container
- HK2
  - Dependency Injection
- Tyrus
  - WebSocket RI
- Jersey
  - JAX-RS RI

DEMO

<<Placeholder>>

QUESTION
Executable JAR size (<<Placeholder>> + poll app) is:

A ~100 MB

B ~50 MB

C ~20 MB

D ~10 MB

E ~5 MB

Summary

- Glassfish
  - Footprint: >200 M
  - Startup time: ~10 s
- Jetty + Weld
  - Footprint: ~28 M
  - Startup time: ~5 s
- <<Placeholder>>
  - Footprint: ~11 M
  - Startup time: ~1s

What do we miss?

Java 8 + Reactive APIs

- Lots of new features in Java 8
- Frameworks slowly up-taking new APIs
- Optional, Lambdas, Streams, …

- Reactive APIs are very handy when you are accessing more services
  - You don't need to wait (block) for the answer
  - Processing hooked to "response(s) received"

QUESTION
Java version in production:

- **A** Java 5 (and older)
- **B** Java 6
- **C** Java 7
- **D** Java 8
- **E** Java 9 (for cutting-edge enthusiasts)

Optional in Jersey

- Server
  - Incoming entities
  - Return values (Outgoing entities)
  - @*Param values
- Client
  - Outgoing entities

Optional in Jersey

```
@GET
@Path("results")
@Template(name = "/survey-results")
public SurveyResults results(@QueryParam("name") final Optional<String> name,
                             @QueryParam("thank") final Optional<String> thank) {
    final String message = name.map(str ->
                format(format: "Thank you, %s, for participating in this survey.", str))
            .map(Optional::ofNullable)
            .orElseGet(() -> thank)
            .orElse("Thank you!");

    return surveyService.surveyResults(id)
            .message(message);
}
```

Optional in Jersey

```
ClientBuilder.newClient()
        .target("http://localhost:8080")
        .request()
        .post(Entity.text(Optional.of(42)));
```

Reactive Client API in Jersey/JAX-RS 2.1

- Utilize the reactive programming model when using Jersey/JAX-RS Client
- Already in Jersey
  - Java 8 – CompletionStage
  - RxJava
  - Guava
- Will be in JAX-RS 2.1

Reactive Client API – Jersey & RxJava

```
RxObservable.newClient().target("http://localhost:8080/destination/visited")
        .request()
        // Reactive invoker.
        .rx()
        // Return a list of destinations.
        .get(new GenericType<List<Destination>>() {})
        // Handle Errors.
        .onErrorReturn(throwable -> Collections.emptyList())
        // Flat the list of destinations.
        .flatMap(Observable::from);
```

Reactive Client API – JAX-RS 2.1 & CompletionStage

```
CompletionStage<List<String>> cs = ClientBuilder.newClient()
        .target("remote/forecast/{destination}")
        .resolveTemplate("destination", "mars")
        .request()
        .rx()
        .get(new GenericType<List<String>>() {});

cs.thenAccept(System.out::println);
```

Programmatic Resources in Jersey

```
new ResourceConfig()
        .registerResources(Resource.builder().path("/")
                .addChildResource("ping").addMethod("GET").handledBy(inflector -> "pong").parent()
                .addChildResource("pong").addMethod("GET").handledBy(inflector -> "ping").parent()
                .build());
```

Lambdas in Tyrus

- Endpoint is just a set of lambda functions
  - @OnOpen, @OnMessage, @OnError, @OnClose
  - WebSocket API already has programmatic version in the specification – see javax.websocket.Endpoint
- It can be applied to server side as well
  - Annotation way is often preferred for server-side deployment
  - Easier to read + integrate with other frameworks (DI, ..)

Lambdas in Tyrus

```
webSocketContainer.connectToServer(new Endpoint() {
    @Override
    public void onOpen(Session session, EndpointConfig config) {
        session.addMessageHandler(String.class, new Whole<String>() {
            @Override
            public void onMessage(String message) {
            }
        });
    }

    @Override
    public void onClose(Session session, CloseReason closeReason) {
    }

    @Override
    public void onError(Session session, Throwable thr) {
    }
}, URI.create("ws://localhost:8025/sample-echo/echo"));
```

Lambdas in Tyrus

```
final WebSocketContainer.SessionBuilder sessionBuilder =
        webSocketContainer.sessionBuilder()
        .path(URI.create("ws://localhost:8025/sample-echo/echo"))
        .messageHandler(String.class, this::onMessage)
        .onOpen(this::onOpen)
        .onError(this::onError)
        .onClose(this::onClose);

sessionBuilder.connect();
```

Lambdas in Tyrus

```
final WebSocketContainer.SessionBuilder sessionBuilder =
        webSocketContainer.sessionBuilder()
        .path(URI.create("ws://localhost:8025/sample-echo/echo"))
        .messageHandler(String.class, this::onMessage)
        .onOpen(this::onOpen)
        .onError(this::onError)
        .onClose(this::onClose);

sessionBuilder.connect();
```

```
var websocket = new WebSocket(window.wsUrl("/sample-btc-xchange/market"));
websocket.onopen = function () {...};
websocket.onmessage = function (evt) {...};
websocket.onclose = function () {...};
websocket.onerror = function () {...};
```

Streams in Tyrus

- Stream processing is another bigger and more notable feature of the Java 8
- MessageHanders (in general - any event handler) can be modeled as endless stream
  - there are some issues with “terminators”, but that could be solved - terminator would unregister current “message handler”; push vs pull..
  - streams can easily: filter, map (encode/decode)

```
session.processMessages(String.class, stream -> stream
        .filter(s -> s.startsWith("prefix"))
        .forEach(System.out::println)
);
```

Contacts

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Github repo: https://github.com/pavelbucek/placeholder

- Jersey – http://jersey.java.net
- Tyrus – http://tyrus.java.net

Q & A

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