Microservices & Nanoservices with Java

Eberhard Wolff
Fellow, innoQ
@ewolff

Eberhard Wolff

Microservices

Grundlagen flexibler Softwarearchitekturen

dpunkt.verlag

http://microservices-buch.de/

Microservices

Flexible Software Architectures

Eberhard Wolff

http://microservices-book.com/

Eberhard Wolff

Microservices Primer

A Short Overview

FREE!!!!

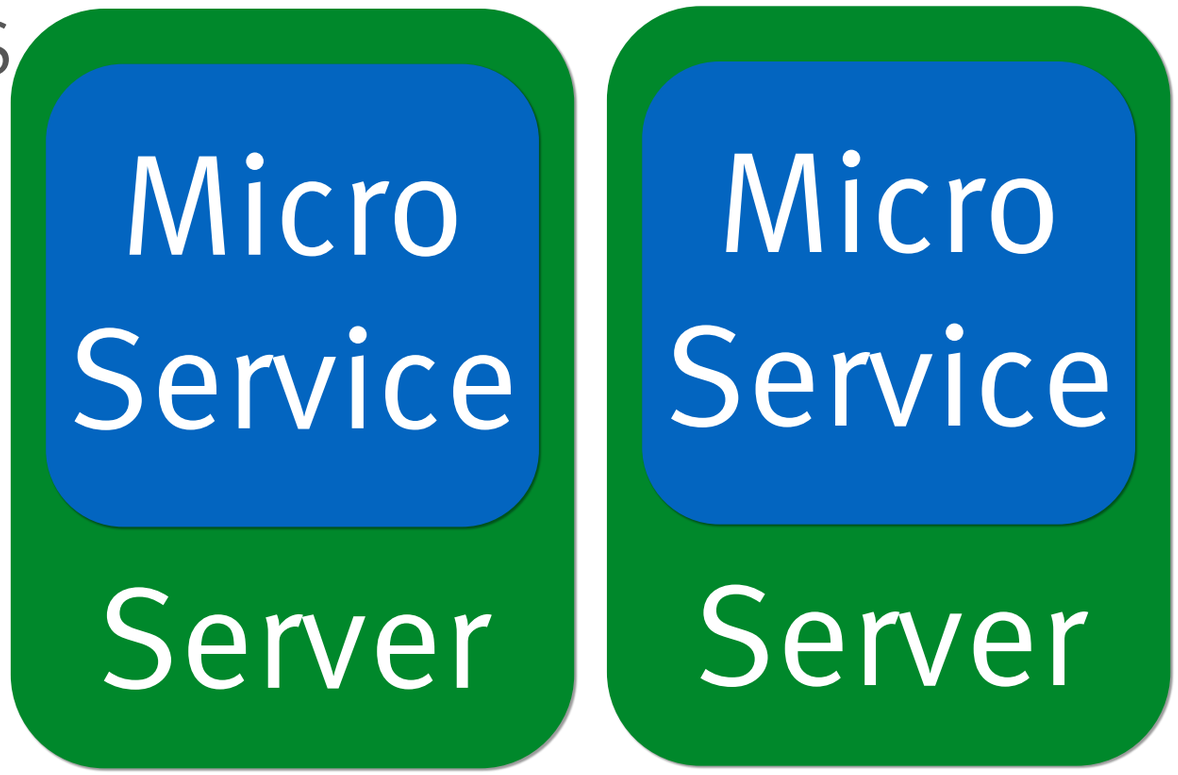
innoQ

http://microservices-book.com/primer.html

Microservice Definition

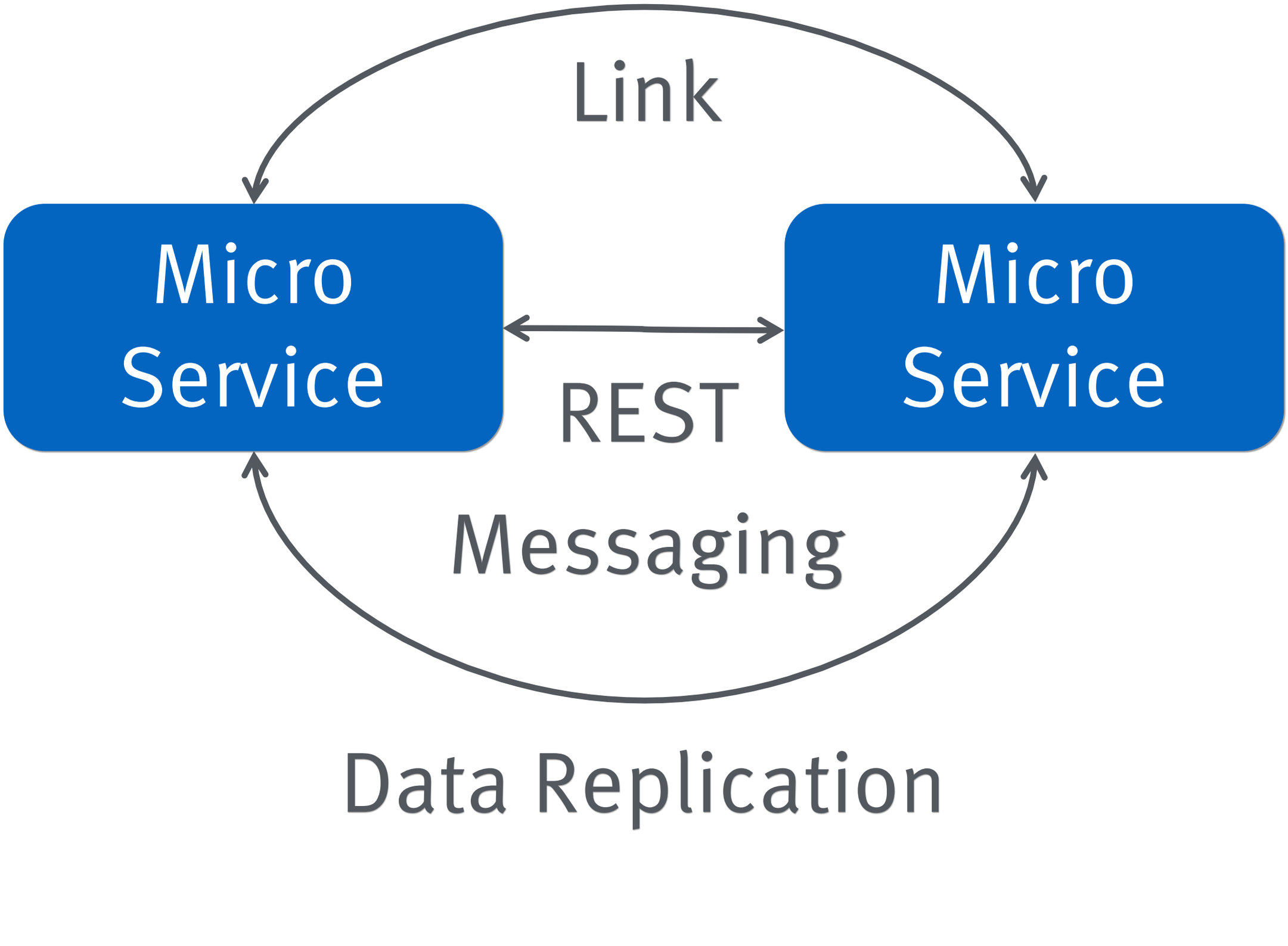
Microservices: Definition

- Independent deployment units
- Separate VM / process
- Any technology
- Any infrastructure

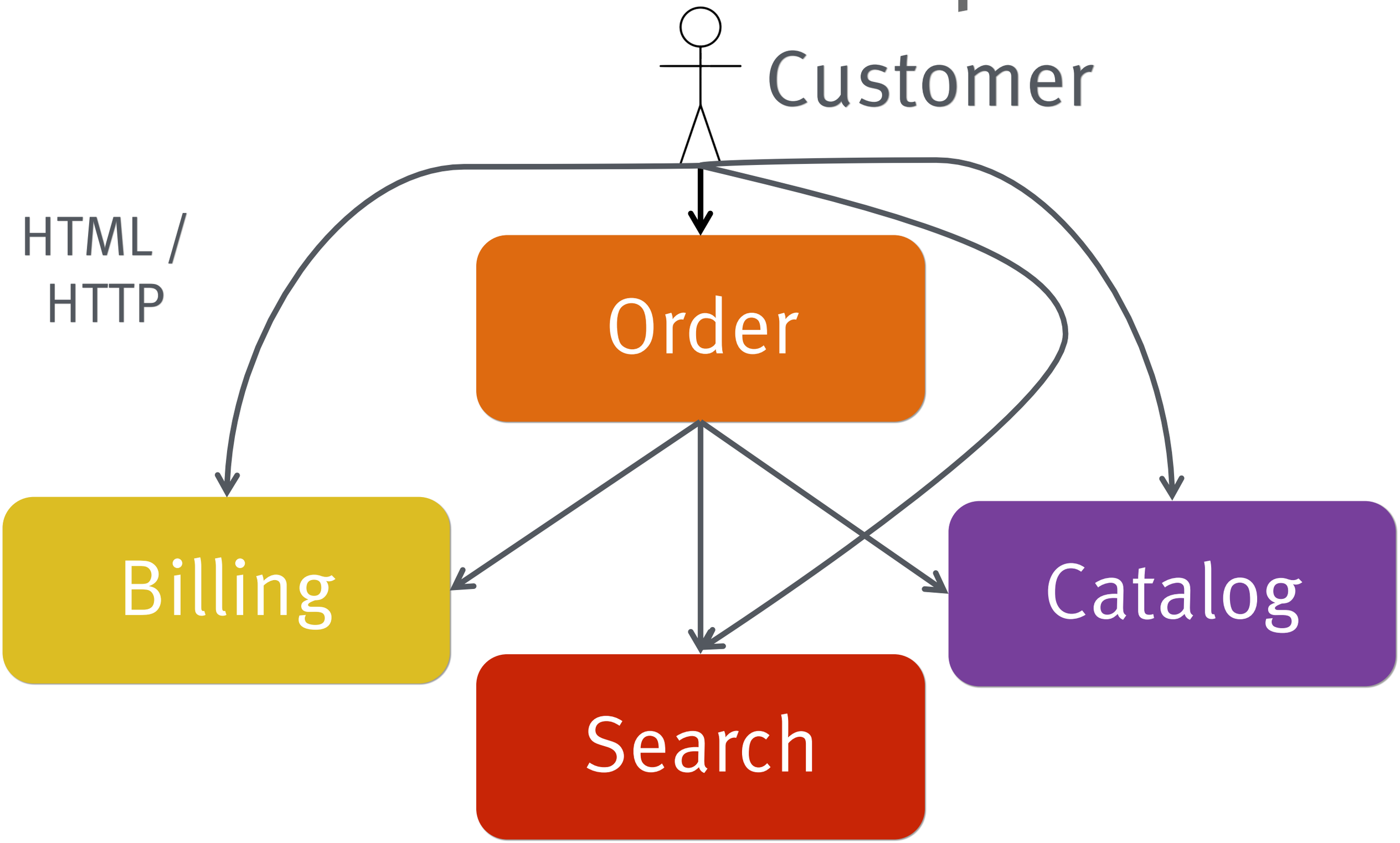


Microservices= Independent Deployment Units

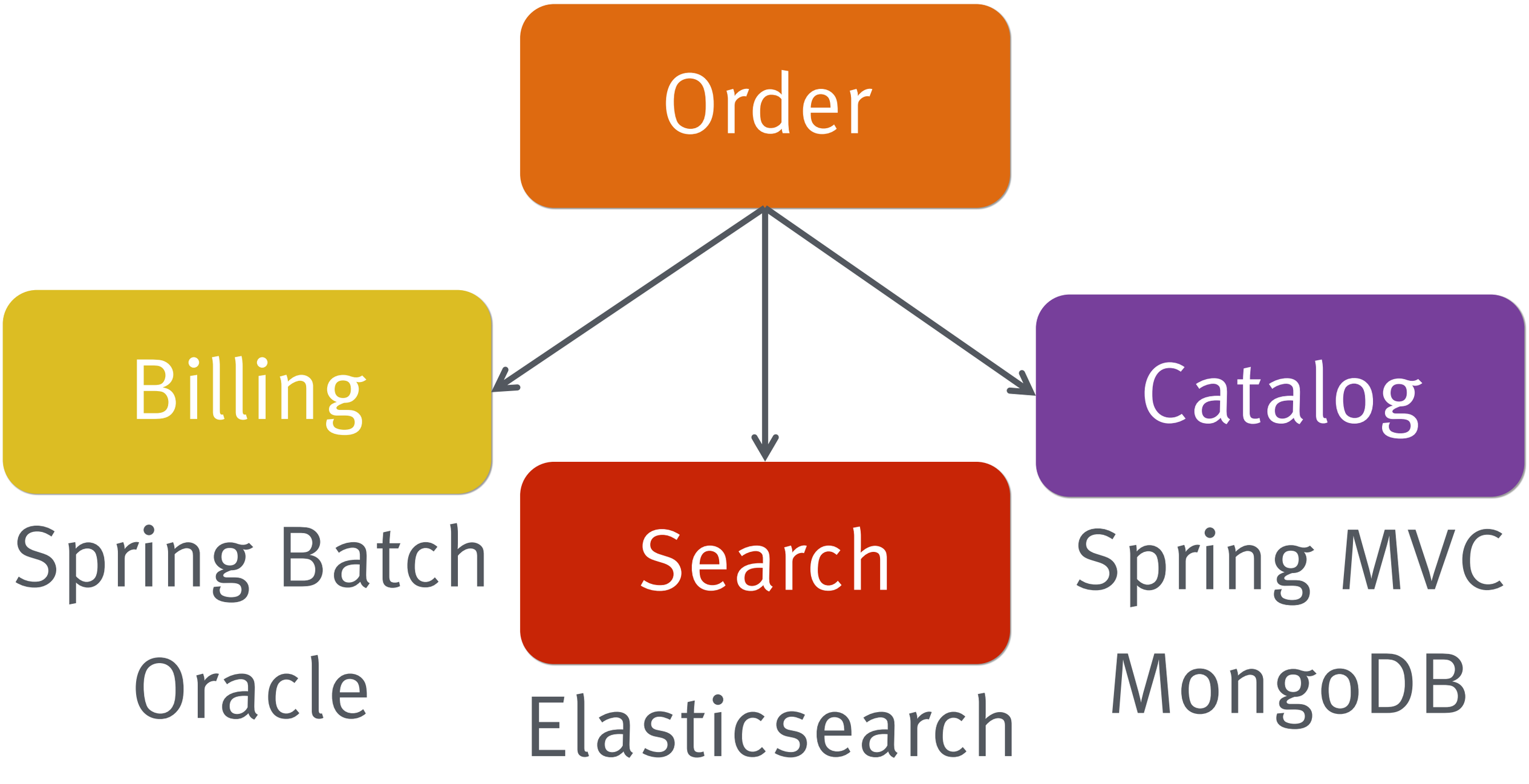
Components Collaborate



Online Shop



Online Shop


Order
Billing
Spring Batch
Oracle
Search
Elasticsearch
Catalog
Spring MVC
MongoDB

Microservices Stack

Docker

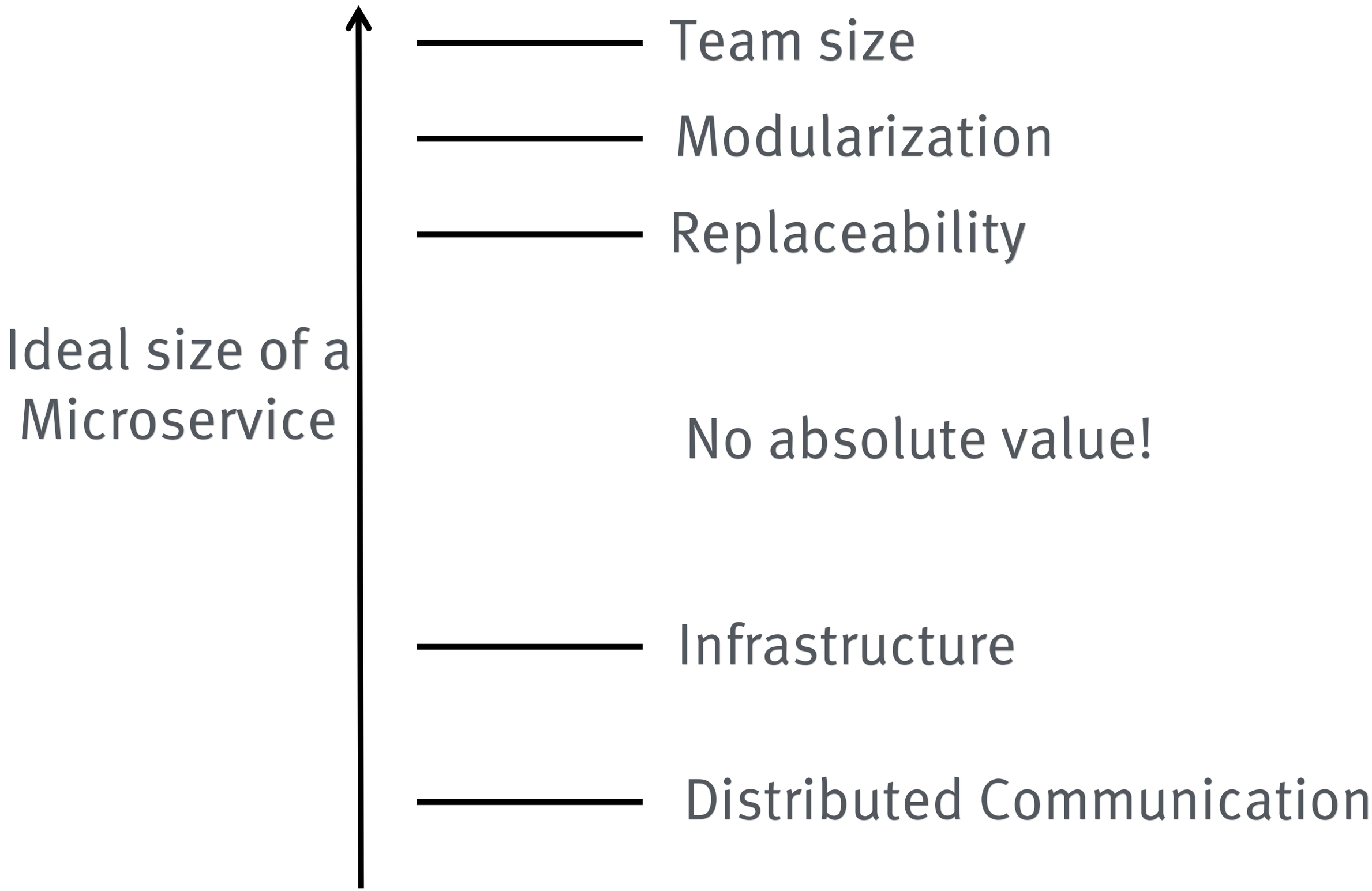
- Linux (soon Windows)
- Shared kernel
- Filesystem just stores diffs
- Extremely light weight
- Can run in cluster (e.g. Kubernetes, Mesosphere etc)

Spring Boot

- One build file
- One Java class
- = REST service + embedded Tomcat
- Deploy: One Java Fat JARs
- Alternatives: Dropwizard, Wildfly Swarm...
- https://github.com/ewolff/spring-boot-demos

Microservice = Fat JAR + Java EE *programming model* possible!

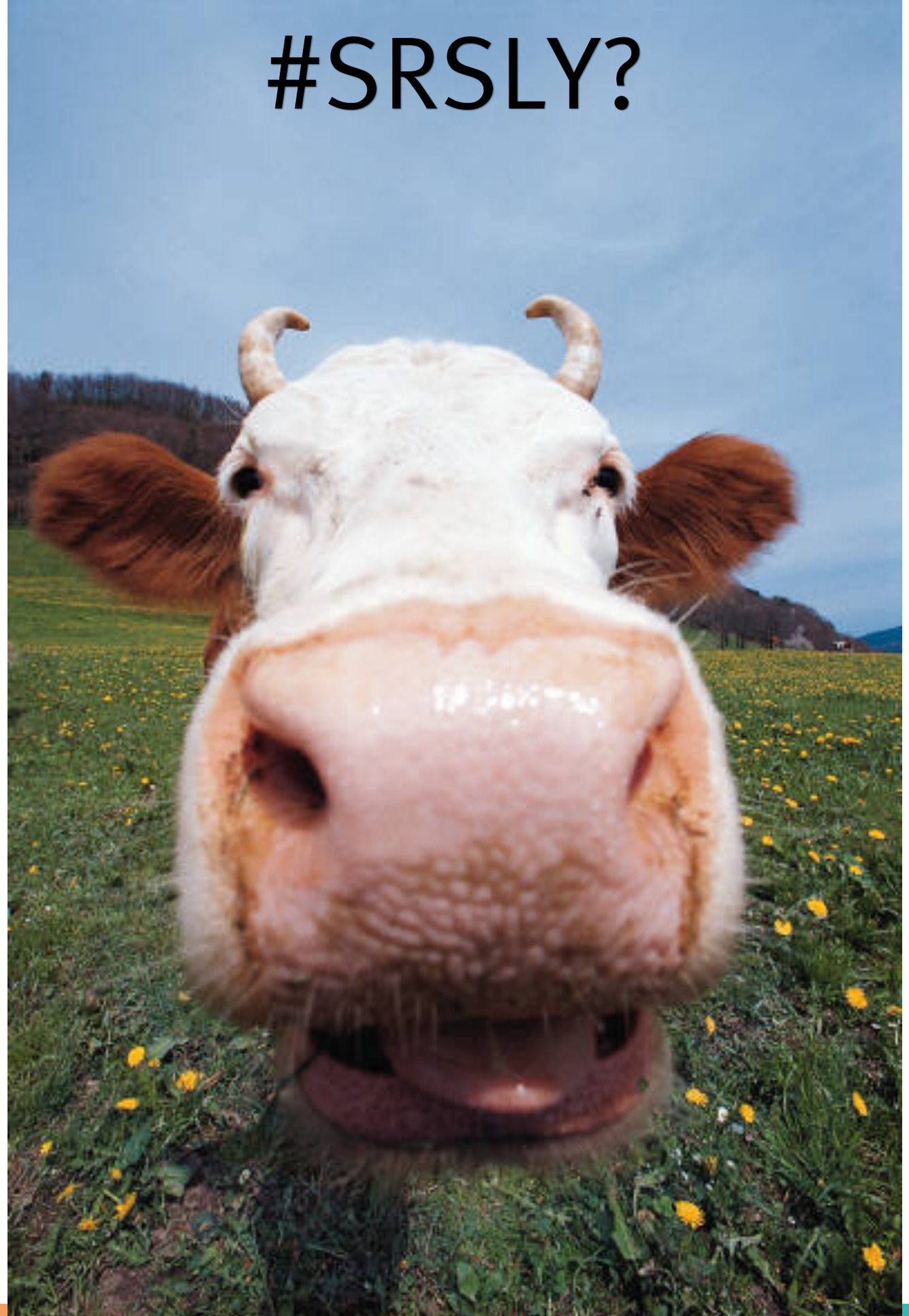
Microservice Size



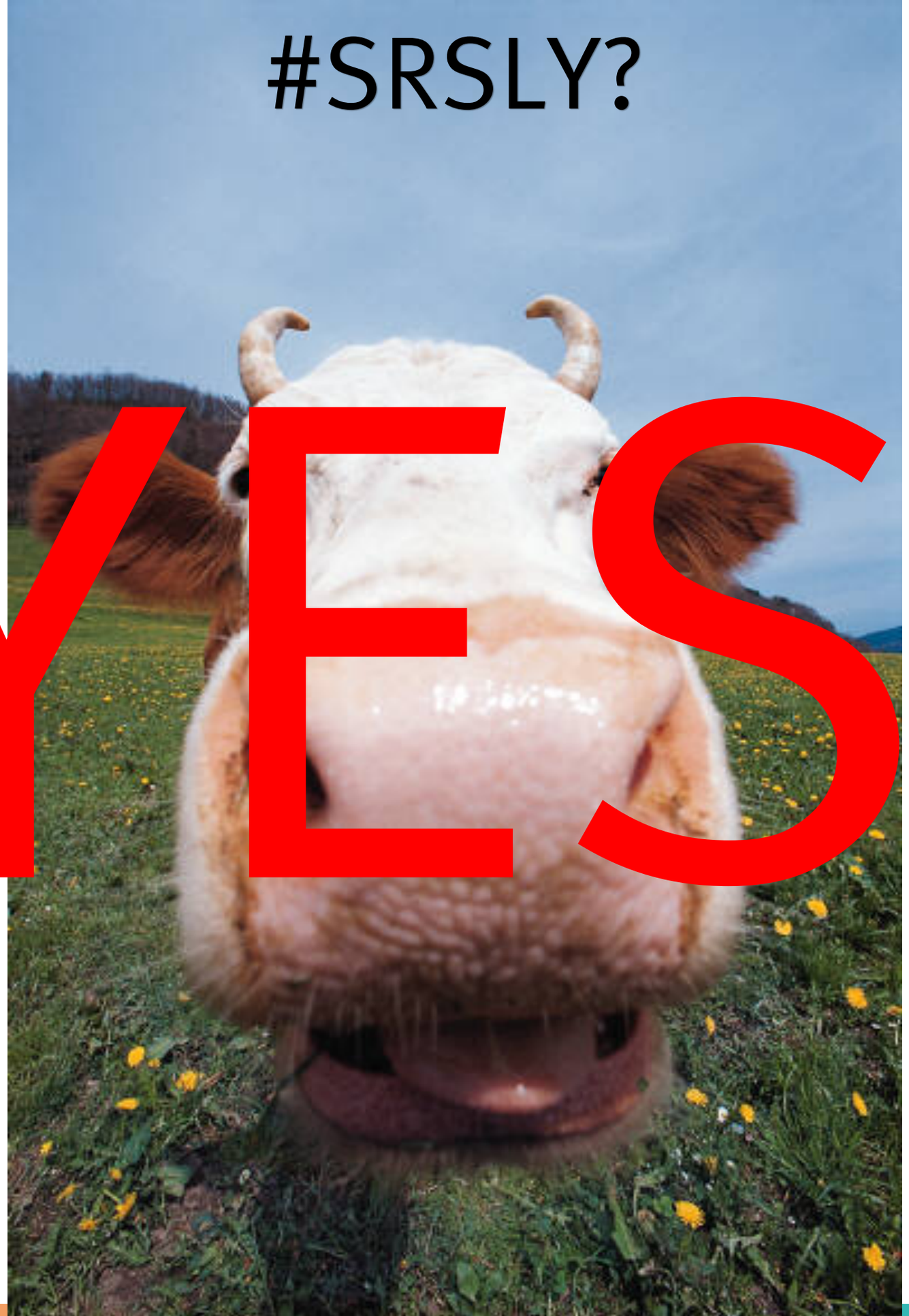
Nanoservices

Nanoservices?

#SRSLY?



#SRSLY?



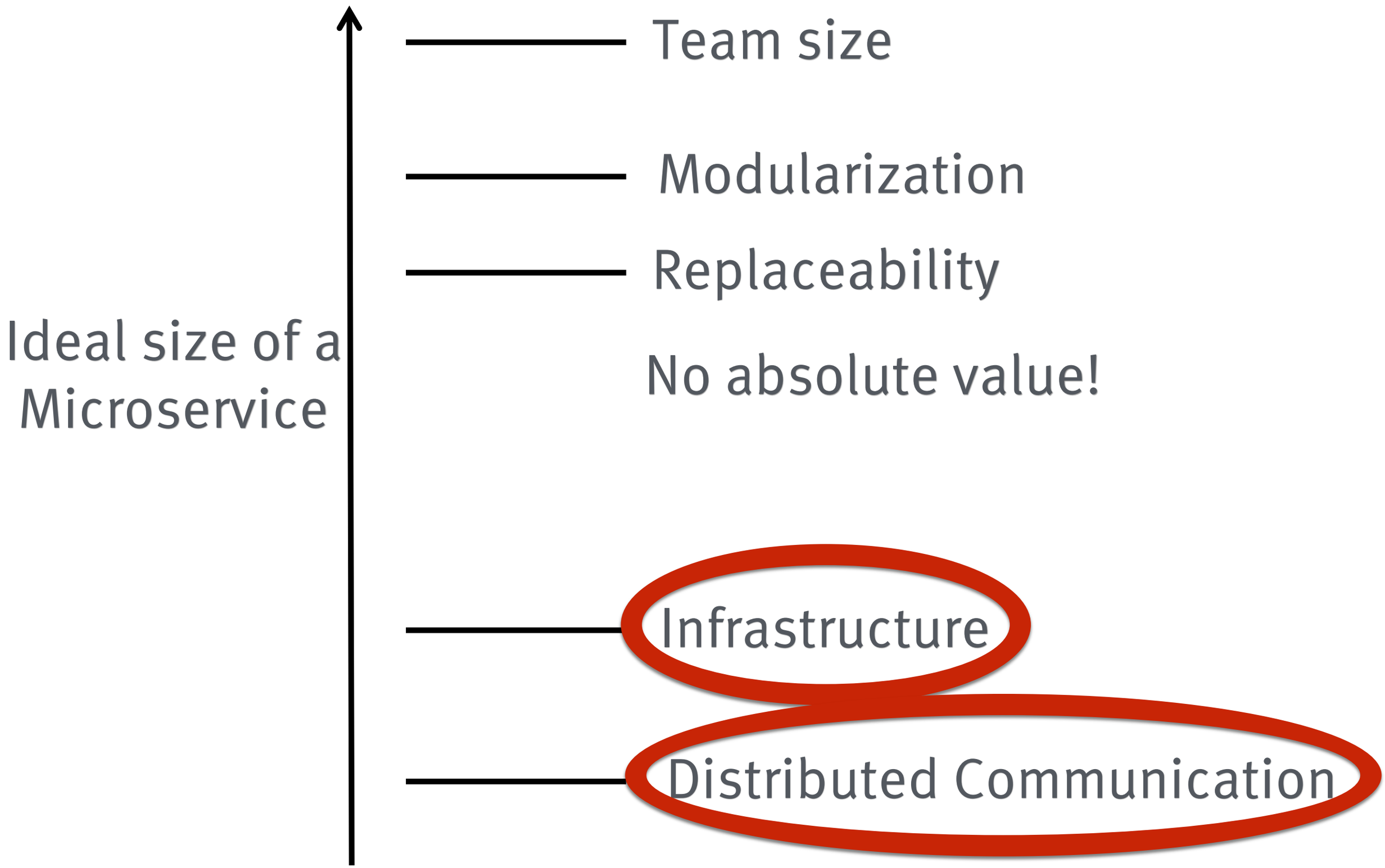
YES!

Nanoservices!= Microservices

Nanoservices‹

Microservices

Microservice Size



Microservices= Independent Deployment Units

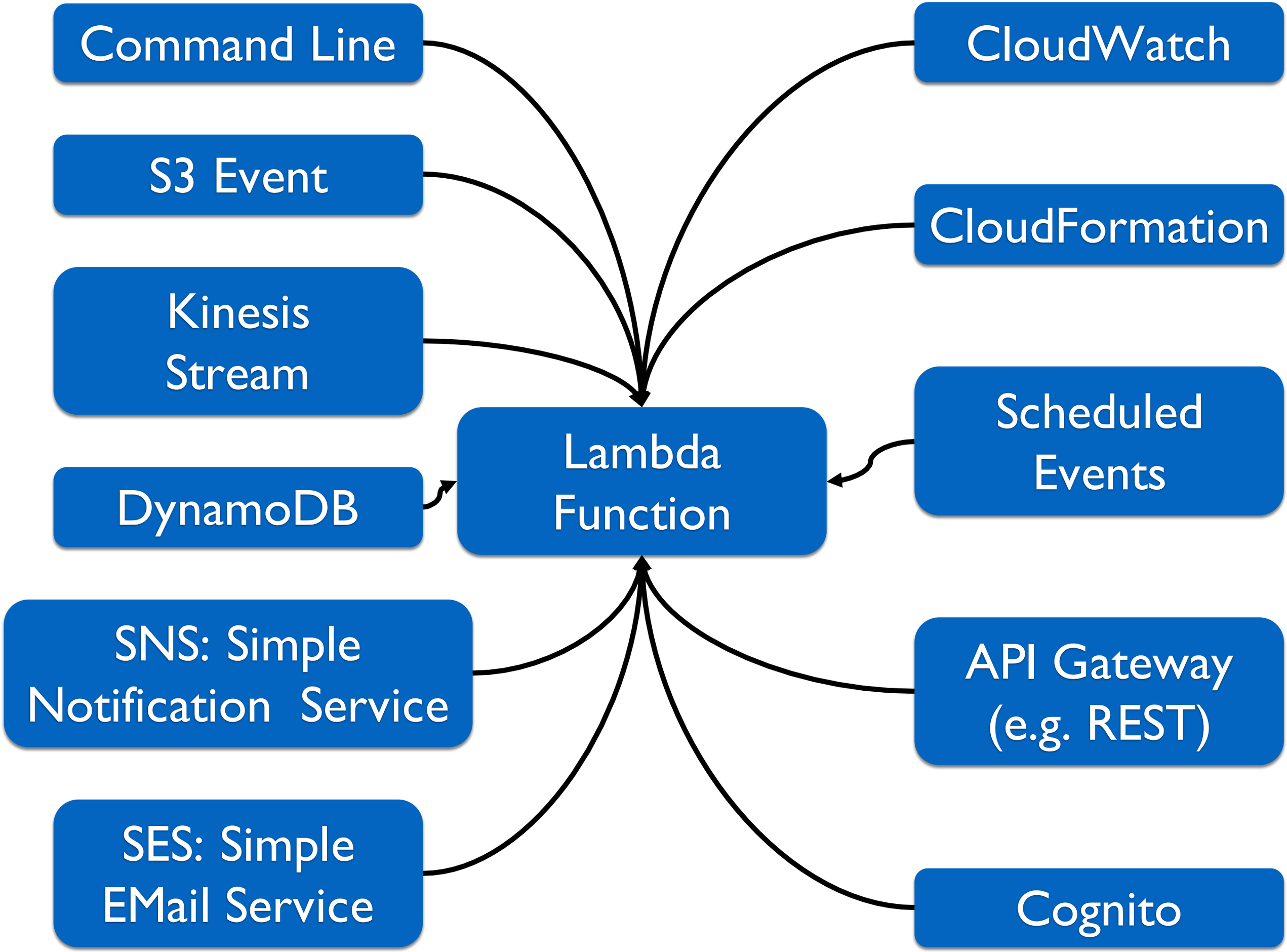
Nanoservices= Independent Deployment Units

Nanoservices use more light weight technologies

Amazon Lambda

Amazon Lambda

- Service in the Amazon Cloud
- Allows you to install individual *functions*
- Java, JavaScript, Python


Command Line
S3 Event
Kinesis Stream
DynamoDB
CloudWatch
CloudFormation
Scheduled Events
Lambda Function
SNS: Simple Notification Service
SES: Simple EMail Service
API Gateway (e.g. REST)
Cognito

Amazon Lambda adds
e.g. trigger to
DynamoDB.

Amazon Lambda

+ API Gateway

= REST services.

```
public class Main {


 public String myHandler(int myCount,
  Context context) {
    LambdaLogger logger = context.getLogger();
    logger.log("received : " + myCount);
    return "Hi"+myCount;
  }
}
```

Deploy

java-lambda-demo — -bash — 77×19

/Users/wolff/aws-lambda/java-lambda-demo — -bash

```
[wolff@TeraMacBook:~/aws-lambda/java-lambda-demo]\
> aws lambda create-function \
>  --function-name hello_java \
>  --role arn:aws:iam::142613406848:role/executionrole \
>  --runtime java8 \
>  --handler com.ewolff.aws_demo.Main::myHandler \
>  --zip-file fileb://target/original-java_lambda_demo-1.0-SNAPSHOT.jar
```

Deploy

java-lambda-demo — -bash — 77×19

/Users/wolff/aws-lambda/java-lambda-demo — -bash

```
>   --runtime java8 \
>   --handler com.ewolff.aws_demo.Main::myHandler \
>   --zip-file fileb://target/original-java_lambda_demo-1.0-SNAPSHOT.jar
{
    "CodeSha256": "n3Wek1RpCE5//o9IpbHC3/LWoOlZyBzpS0/Zj6w+OyE=",
    "FunctionName": "hello_java",
    "CodeSize": 2647,
    "MemorySize": 128,
    "FunctionArn": "arn:aws:lambda:eu-west-1:142613406848:function:hello_java
",
    "Version": "$LATEST",
    "Role": "arn:aws:iam::142613406848:role/executionrole",
    "Timeout": 3,
    "LastModified": "2016-03-04T15:42:54.126+0000",
    "Handler": "com.ewolff.aws_demo.Main::myHandler",
    "Runtime": "java8",
    "Description": ""
}
[wolff@TeraMacBook:~/aws-lambda/java-lambda-demo]
```

Invoke

java-lambda-demo — -bash — 77×19

/Users/wolff/aws-lambda/java-lambda-demo — -bash

```
[wolff@TeraMacBook:~/aws-lambda/java-lambda-demo]aws lambda invoke \
>      --function-name hello_java \
>      --payload '42' \
>      outputfile.txt
{
    "StatusCode": 200
}
[wolff@TeraMacBook:~/aws-lambda/java-lambda-demo]more outputfile.txt
"Hi42"
[wolff@TeraMacBook:~/aws-lambda/java-lambda-demo]
```

Lambda Management Cons ×

Eberhard

https://eu-west-1.console.aws.amazon.com/lambda/home?region=eu-west-1#/functions/hello_ja...

AWS | Services | Edit | Eberhard Wolff | Ireland | Support

Lambda > Functions > hello_java

ARN - arn:aws:lambda:eu-west-1:142613406848:function:hello_java

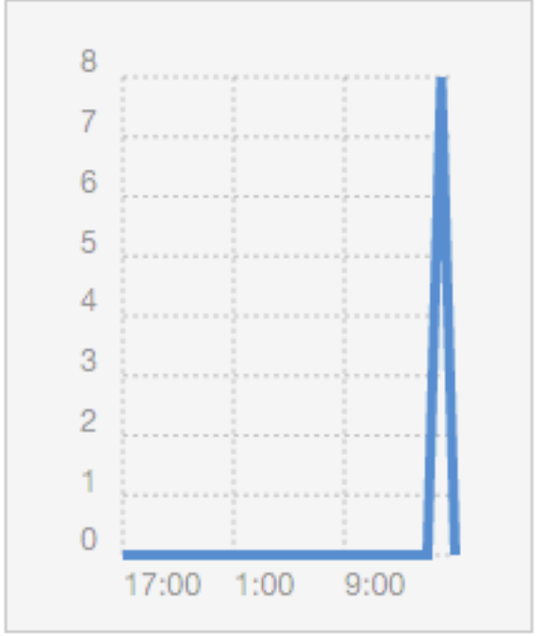
Test | Actions

Code | Configuration | Event sources | API endpoints | Monitoring

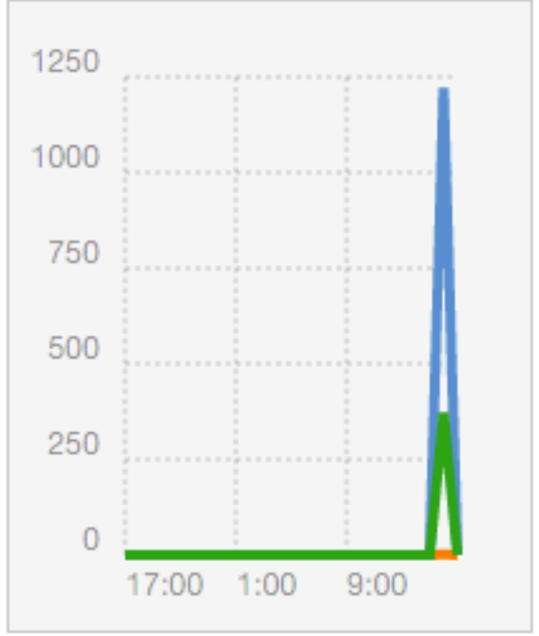
CloudWatch metrics at a glance (last 24 hours)

View logs in CloudWatch

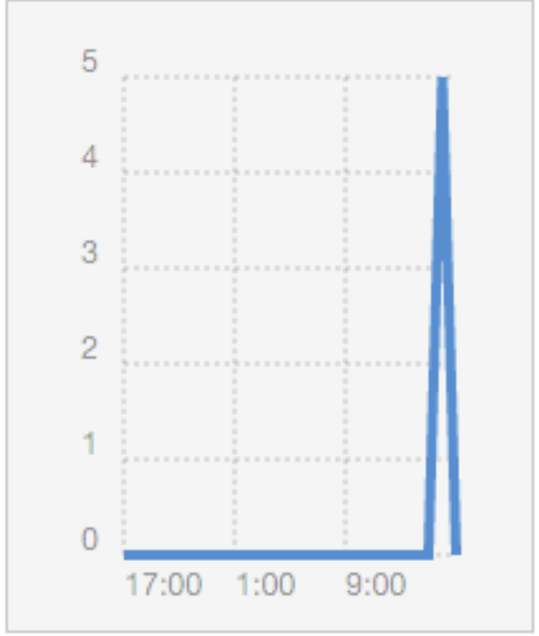
Invocations



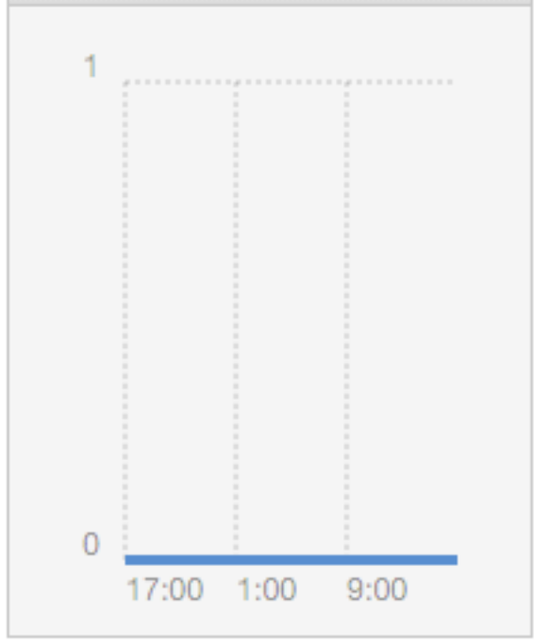
Duration



Errors



Throttles



Other monitoring information

Last modified date 2016-03-04T15:30:03.351+0000

CloudWatch Management

Eberhard

https://eu-west-1.console.aws.amazon.com/cloudwatch/ho...

AWS | Services | Edit | Eberhard Wol

CloudWatch
Dashboards NEW
Alarms
ALARM 0
INSUFFICIENT 0
OK 0
Billing
Events NEW
Rules
Logs
Metrics
Selected Metrics
Lambda

Log Groups > Streams for /aws/lambda/hello_java > Events for

2016/03/04/[$LATEST]ac34651...

Filter: Search for events

Date/Time:

2016/03/04 15 : 30 : 55 UTC (GMT)

Event Data

```
START RequestId: 161291fa-e21e-11e5-b188-9f9119a08dce
Version: $LATEST
received : 42
END RequestId: 161291fa-e21e-11e5-b188-9f9119a08dce
REPORT RequestId: 161291fa-e21e-11e5-b188-9f9119a08dce
Duration: 238.81 ms Billed Duration: 300 ms Memory Size: 128
MB Max Memory Used: 28 MB
```

Feedback | English | Privacy Policy | Terms of Use

Amazon Lambda vs. PaaS

- Commercial model: Pay-per-call
- Fine grained (e.g. database trigger, HTTP GET)
- First million requests FREE!
- Can edit Python / JavaScript function in the browser

Amazon Lambda

- Can add any other Amazon Service to complete the system
- i.e. Beanstalk PaaS, EC2 IaaS ...
- Or databased (DynamoDB, RDS...)

OSGi

OSGi: Bundles

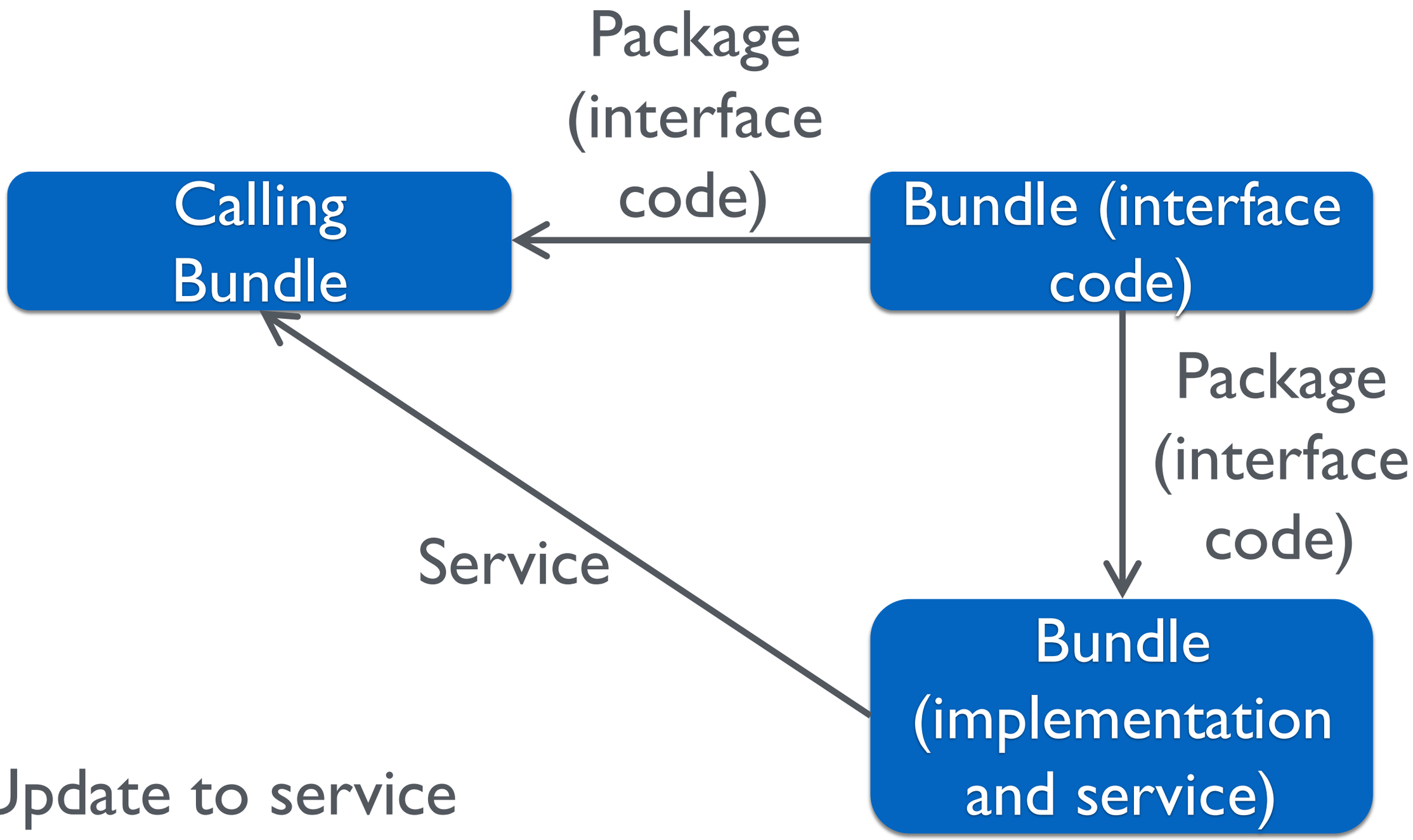
- Partition system into – "bundles”
- Bundles can be installed, started, stopped, uninstalled and updated
- ...at runtime

OSGi: Code Sharing

- Bundles can export and import packages
- Updating code requires other bundles to start fresh

OSGi: Services

- Bundles can **publish** services… *dynamically!*
- Service = Java Object
- **Service Registry** allows other bundles to **consume** services
- Services come and go at runtime
- Quite easy with OSGi Blueprints or OSGi Declarative Services



Update to service
in running application

(Almost) Independent Deployment Units

Java EE

Java EE

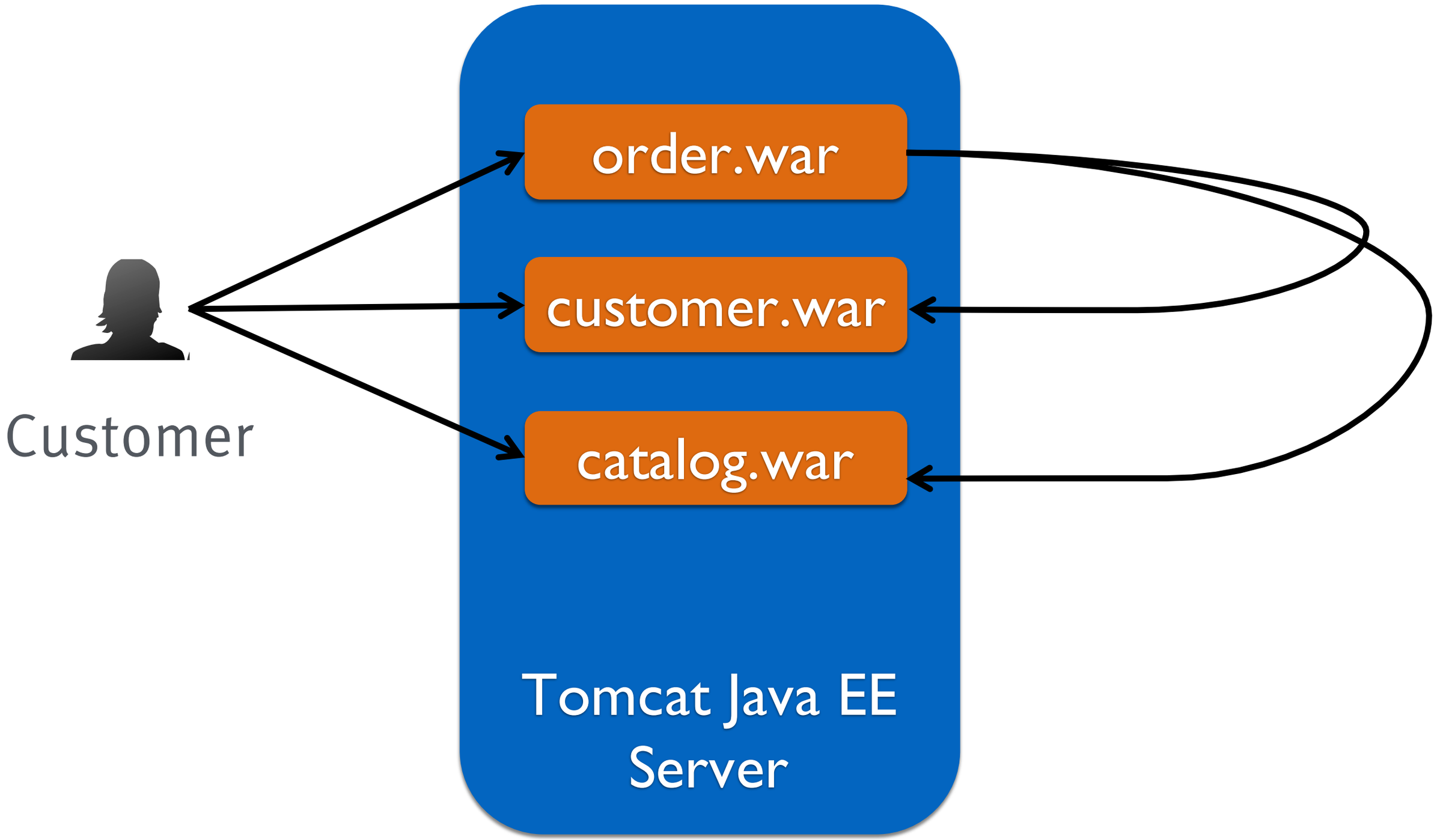
- JARs e.g. for EJBs
- WARs e.g. for web application
- EARs for JARs and WARs
- Completely separated code
- ...unlike OSGi

Java EE

- Relevant: Deployment model
- i.e. application server
- Not programming model

Java EE Nanoservices?

- Local calls not possible
- No shared code e.g. for interfaces


order.war
customer.war
catalog.war
Tomcat Java EE Server
Customer

(Almost) Independent Deployment Units

Comparison

Independent Deployment

- THE feature of Micro-/Nanoservices
- Simplifies to put new features in production
- Docker Fat JAR: ++
- Amazon Lambda: ++
- OSGi: + Restart the whole JVM?
- Java EE: + Restart the whole JVM?

Benefits of Nanoservices

Effort per Service

- How hard is it to create another service?
- All: Create another project/JAR/WAR
- Amazon Lambda: ++
- OSGi: ++
- Java EE: ++
- Docker Fat JAR : - (Docker container etc)

Cost per Service

- Hardware, software cost
- Amazon Lambda: ++
- OSGi: ++
- Java EE: ++
- Docker Fat JAR: -- (need Docker container etc, separat JVM Heap)

Local Communcation

- Call without network stack
- Docker Fat JAR : --
- Amazon Lambda: --
- OSGi: ++
- Java EE: --

Challenges of Nanoservices

Independent Scaling

- Start more instances of a single service
- Docker Fat JAR: ++
- Amazon Lambda: ++
- OSGi: ?
- Java EE: --

Isolation

- CPU / Memory consumption/crash influences other services
- Docker Fat JAR: ++
- Amazon Lambda: ++
- OSGi: --
- Java EE: --

Resilience & Isolation

- Resilience: System can handle crash of other services
- Needs isolation
- Problem for OSGi/Java EE

Technology Freedom

- Using different technologies
- Docker Fat JAR: ++ (whatever)
- Amazon Lambda: + (Java, JavaScript, Python)
- OSGi: -- (Java)
- Java EE: -- (Java)

Conclusion

Nanoservices!= Microservices

Nanoservices‹

Microservices

Conclusion

- Nanoservice technologies compromise
- ...to allow smaller services
- ...to allow local communication
- OSGi and Java EE deployment model don't fully support independent deployment
- ...might therefore not be "true" Nanoservices

Conclusion

- OSGi and Java EE weak concerning
- Independent scaling
- Isolation
- Technology freedom

- Amazon Lambda a lot stronger

Might also consider...

- Vert.x: polyglot, distributed and module concept
- Erlang: support update to running system and processes in other languages

Thank You!

@ewolff

http://microservices-buch.de/

http://microservices-book.com/primer.html

http://aws.amazon.com/lambda/getting-started/