Introduction to REST APIs

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COMEM Web Services 2016

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Big Web Services vs REST

What is a Web Service?

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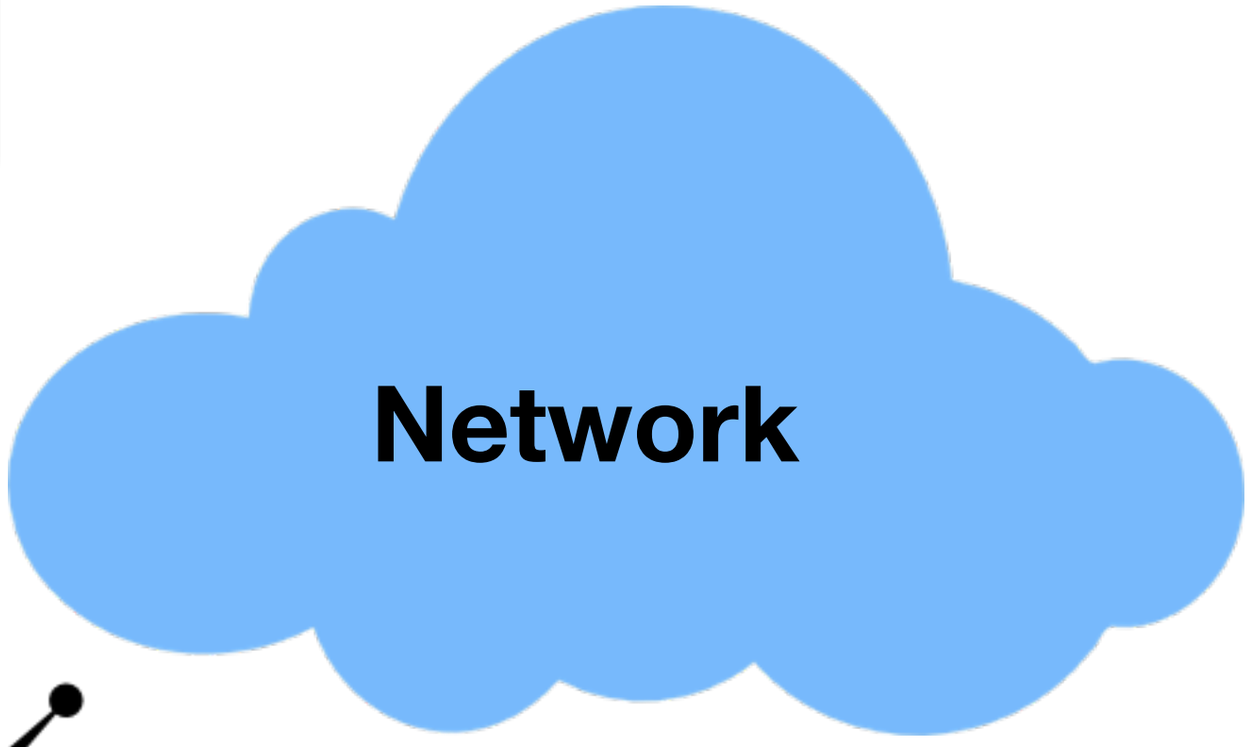

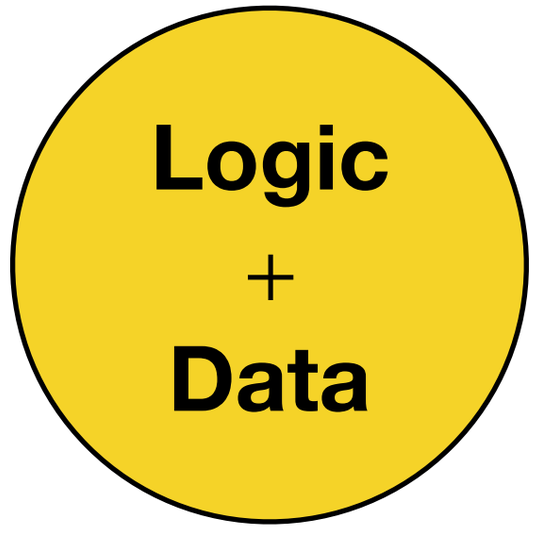

Clients

How do they...

...find each other?

...know what logic can be invoked?

...talk to each other?

Remote services in Java (RMI)

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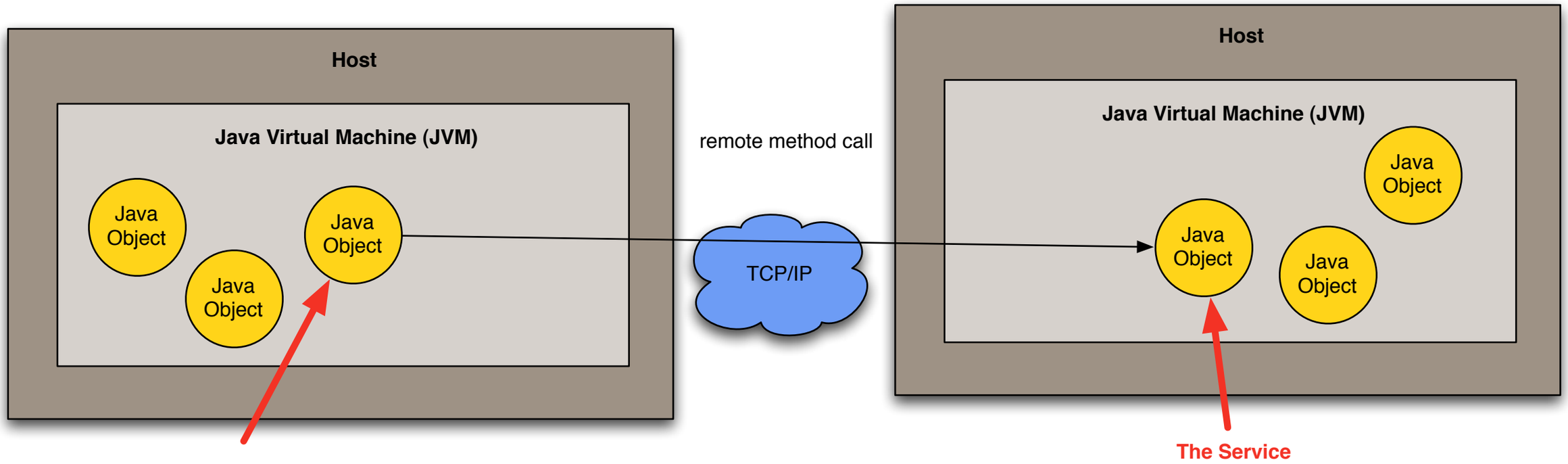


```
public class ClockClient

}
```

générer du XML (SOAP) ?

ouvrir un socket?

parser du XML (réponse SOAP)

?

ClockClient.java

```
public interface ClockService {

  public String getTime();
}
```

ClockService.java

```
public class ClockServiceImp
  implements ClockService {

}
```

générer du XML (SOAP) ?

écouter sur un socket?

parser du XML (SOAP)

?

ClockServiceImpl.java

Remote services in Java (RMI)

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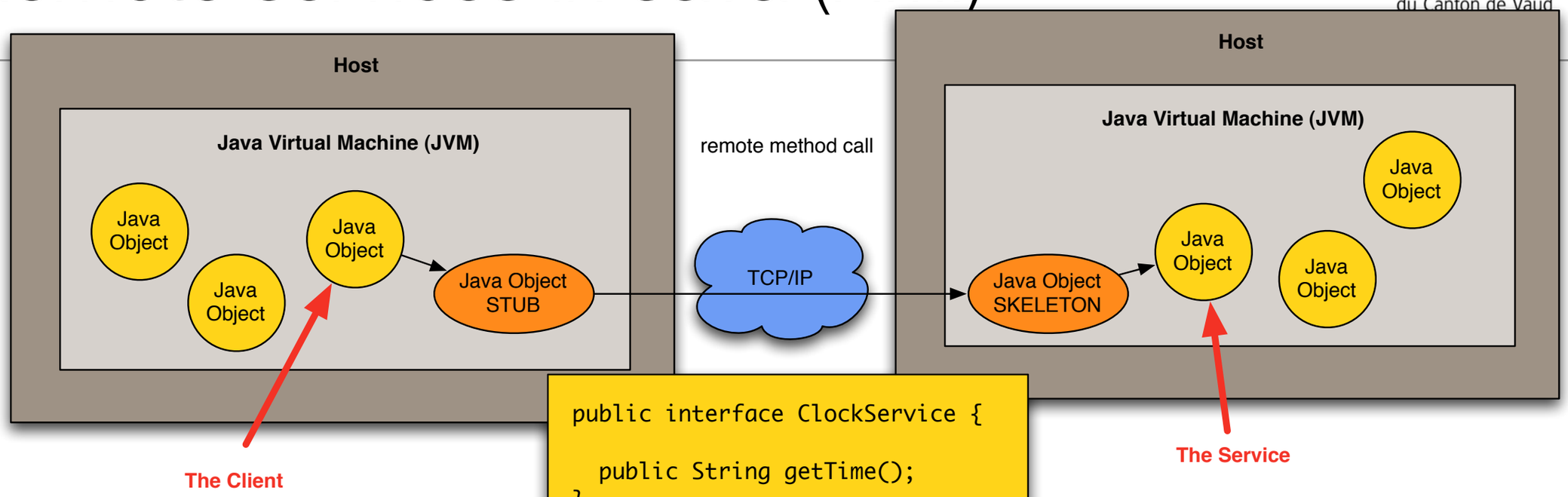


```
public interface ClockService {

  public String getTime();
}
```

ClockService.java

```
public class ClockClient

  private ClockService service;

...

  public String showTime() {
    System.out.println("It is " +
      service.getTime());
  }
}
```

ClockClient.java

```
public class ClockServiceStub
  implements ClockService {

  public String getTime() {
    ... bla bla... SOCKET ...
    XML... bla bla bla... SOAP ...
    bla bla OUTPUTSTREAM... bla bla
    INPUTSTREAM....

    return time;
}
```

ClockServiceStub.java

```
public class ClockServiceSkeleton {

  private ClockService realService;

  private void setup() { ... }
  private void listen() { ... }
  private void processCall {
    realService.getTime();
  }
}
```

ClockServiceSkeleton.java

```
public class ClockServiceImpl
  implements ClockService {

  public String getTime() {
    return new java.util.Date();
  }
}
```

ClockServiceImpl.java

Generated automatically by special tools!

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The “Big” Web Services Approach

Big Web Services

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- **Approach**
  - Services are often designed and developed with a **RPC style** (even if Document-Oriented Services are possible).
- **Core Standards**
  - Simple Object Access Protocol (**SOAP**)
  - Web Services Description Language (**WSDL**)
- **Benefits**
  - **Very rich protocol stack** (support for security, transactions, reliable transfer, etc.)
- **Problem**
  - **Very rich protocol stack** (complexity, verbosity, incompatibility issues, theoretical human readability, etc.)

Web Services Standards Overview

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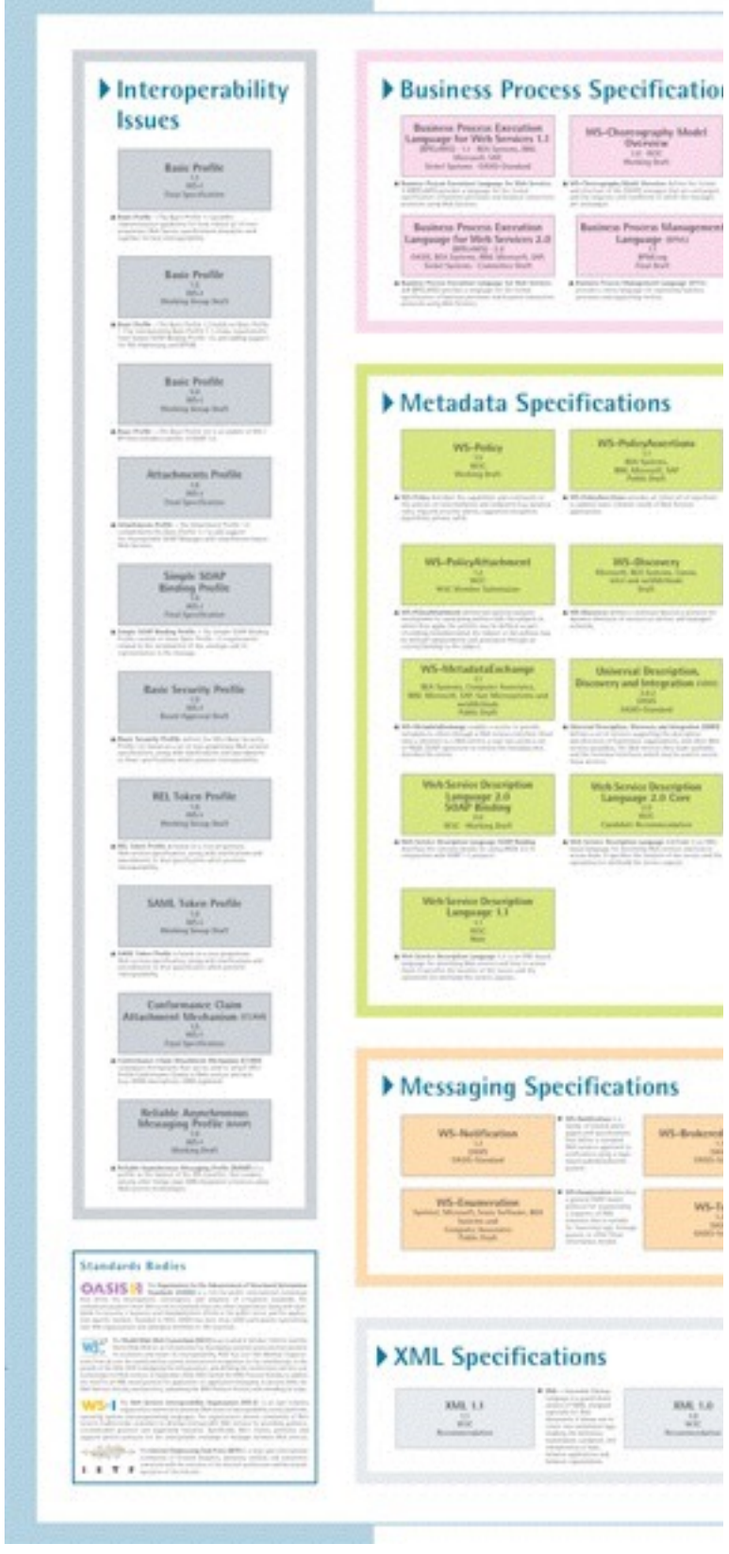
http://www.innoq.com/soa/ws-standards/poster/
http://www.innoq.com/soa/ws-standards/

Web Services Standards Overview



Enterprise Platforms (Java EE, .NET, etc.) hide some of the complexity.

```
@Stateless
@WebService
public class Demo implements DemoLocal {

  @Override
  public String getTime() {
    return new Date().toString();
  }

  @Override
  public long computeSum(long v1, long v2) {
    return v1 + v2;
  }

}
```

Adding a **@WebService** annotation does the magic. The application server takes care of all the gory details: generation of the WSDL interface, marshalling/unmarshalling of the SOAP messages. Still...

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The REST Approach

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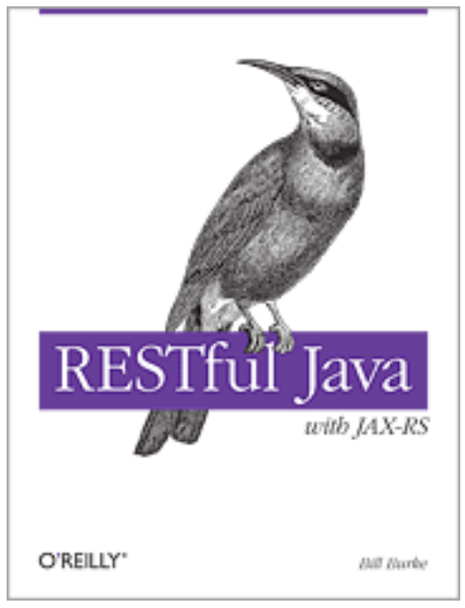
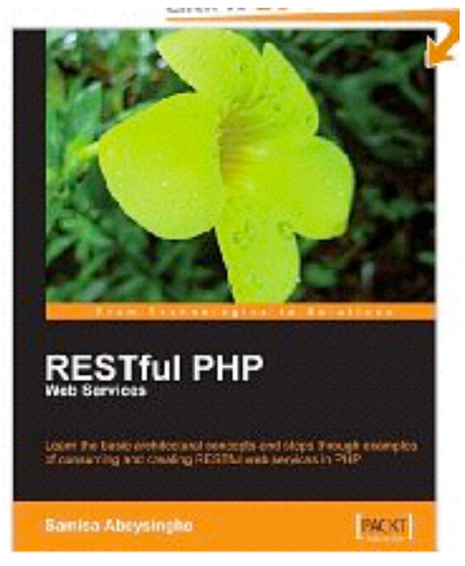
RESTful Web Services





The REST Architectural Style

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- REST: **REpresentational State Transfer**
- REST is an **architectural style** for building distributed systems.
- REST has been introduced in **Roy Fielding's Ph.D. thesis** (Roy Fielding has been a contributor to the HTTP specification, to the apache server, to the apache community).
- The WWW is **one example** for a distributed system that exhibits the characteristics of a REST architecture.

Principles of a REST Architecture

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- The state of the application is captured in a **set of resources**
  - Users, photos, comments, tags, albums, etc.
- Every resource is **identified with a standard format** (e.g. URL)
- Every resource can have **several representations**
- There is one **unique interface for interacting** with resources (e.g. HTTP methods)

References

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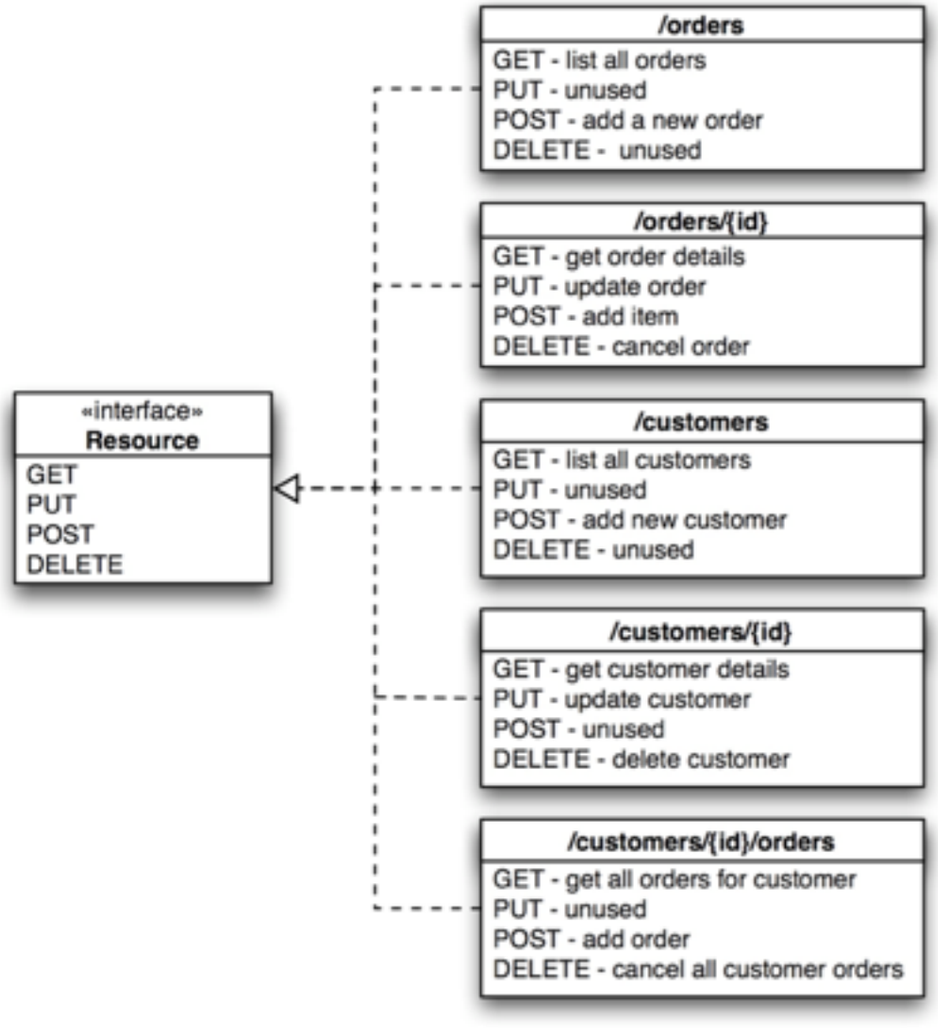
- Very good article, with presentation of key concepts and illustrative examples:
  - http://www.infoq.com/articles/rest-introduction
- Suggestions for the design of “pragmatic APIs”
  - http://www.vinaysahni.com/best-practices-for-a-pragmatic-restful-api



HTTP is a protocol for interacting with "**resources**"

What is a “**Resource**”

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- At first glance, one could think that a “resource” is a file on a web server:
  - an HTML document, an XML document, a PNG document
- That fits the vision of the “static content” web
- But of course, the web is now more than a huge library of hypermedia documents:
  - through the web, we interact with services and a lot of the content is dynamic.
  - more and more, through the web we interact with physical objects (machines, sensors, actuators)
  - We need a more generic definition for resources!

What is a “**Resource**”?

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- A resource is "something" that can be named and uniquely identified:
  - Example 1: an article published in the "24 heures" newspaper
  - Example 2: the collection of articles published in the sport section of the newspaper
  - Example 3: a person’s resume
  - Example 4: the current price of the Nestlé stock quote
  - Example 5: the vending machine in the school hallway
  - Example 6: the list of grades of the student Jean Dupont
- URL (Uniform Resource Locator) is a mechanism for identifying resources
  - Exemple 1: http://www.24heures.ch/vaud/vaud/2008/08/04/trente-etudiants-partent-rencontre-patrons
  - Exemple 2: http://www.24heures.ch/articles/sport
  - Exemple 5: http://www.smart-machines.ch/customers/heig/machines/8272

Resource vs. **Representation**

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- A "resource" can be something intangible (stock quote) or tangible (vending machine)
- The HTTP protocol supports the exchange of data between a client and a server.
- Hence, what is exchanged between a client and a server is **not** the resource. It is a **representation** of a resource.
- Different representations of the same resource can be generated:
  - HTML representation
  - XML representation
  - PNG representation
  - WAV representation

Resource vs. **Representation**

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HTTP provides the **content negotiation** mechanisms.

```
GET /books HTTP/1.1
Accept: application/json
```

```
HTTP/1.1 200 OK
Content-Type: application/json

[
  { "title": "Fahrenheit 451" }
]
```

```
GET /article/game-of-thrones HTTP/1.1
Accept: */*
```

```
HTTP/1.1 200 OK
Content-Type: text/html

<html>
  <head>
    <title>Game of Thrones</title>
  </head>
  <body>Awesome show!</body>
</html>
```

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The ~~toys~~ tools we will use

Languages, Platforms, Communities

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Client

Server

Languages, Platforms, Communities

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JavaScript End to End

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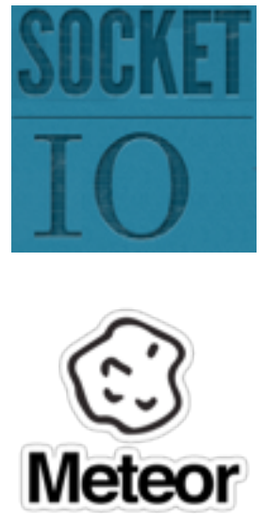
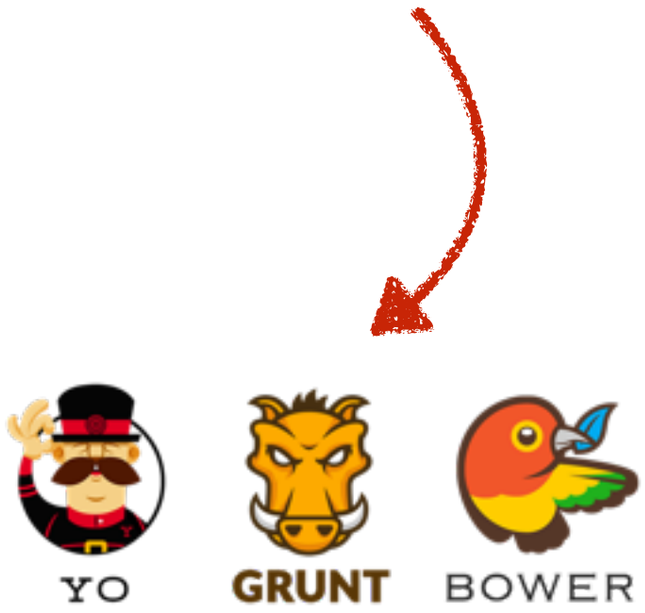


Client

Server

Use this to create and build the project



Use this to implement `/api/endpoints`

express
web application
framework for
node

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Use this to store data

mongoose

Use this interact with mongoDB

Use this because it's cool

ECMAScript 6 is on its way (but not for us)

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http://es6-features.org/