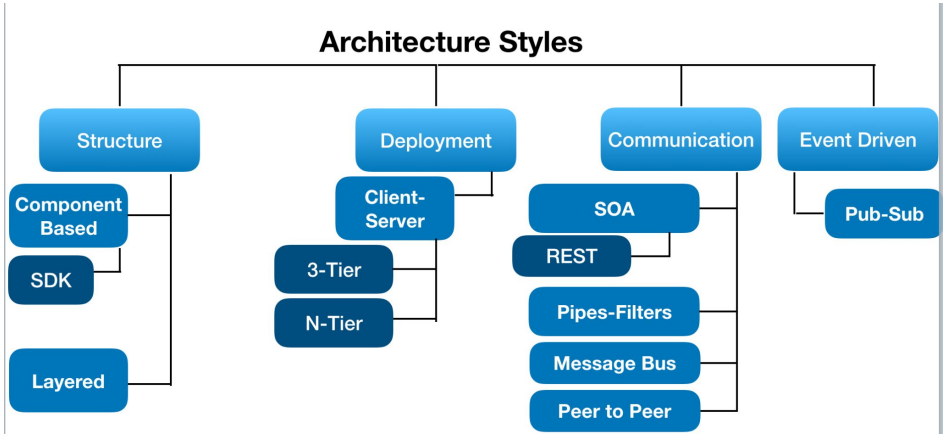
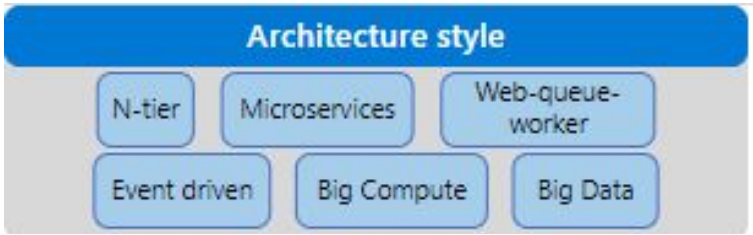
Connectors and Components

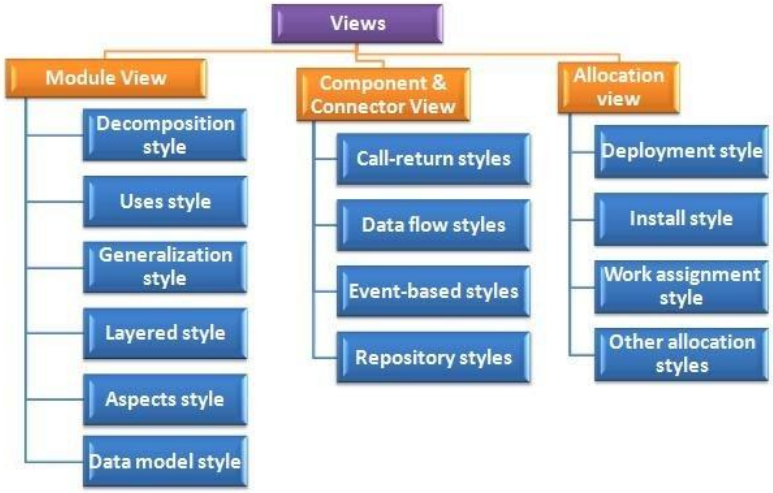
Estilos arquitectónicos

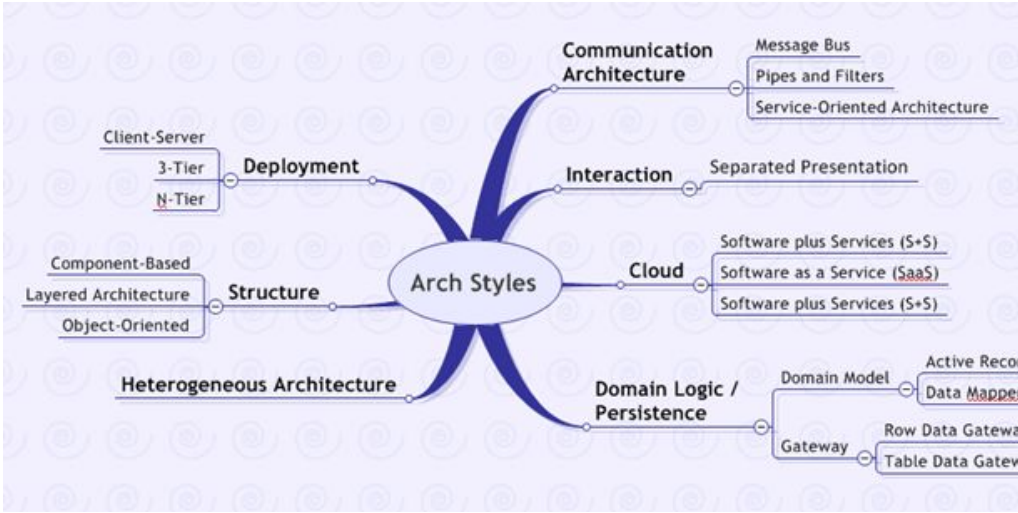
- Un estilo describe una clase de arquitectura o piezas de la misma
- Un «estilo» de arquitectura es un conjunto de decisiones de diseño arquitectural que son aplicables en un contexto de desarrollo específico, restringen las decisiones de diseño de un sistema a ese contexto y plantean como objetivo ciertas cualidades para el sistema resultante.
- An architectural style defines: a family of systems in terms of a pattern of structural organization; a vocabulary of components and connectors, with constraints on how they can be combined.
- Architectural styles are reusable 'packages' of design decisions and constraints that are applied to an architecture to induce chosen desirable qualities.

Estilos arquitectónicos

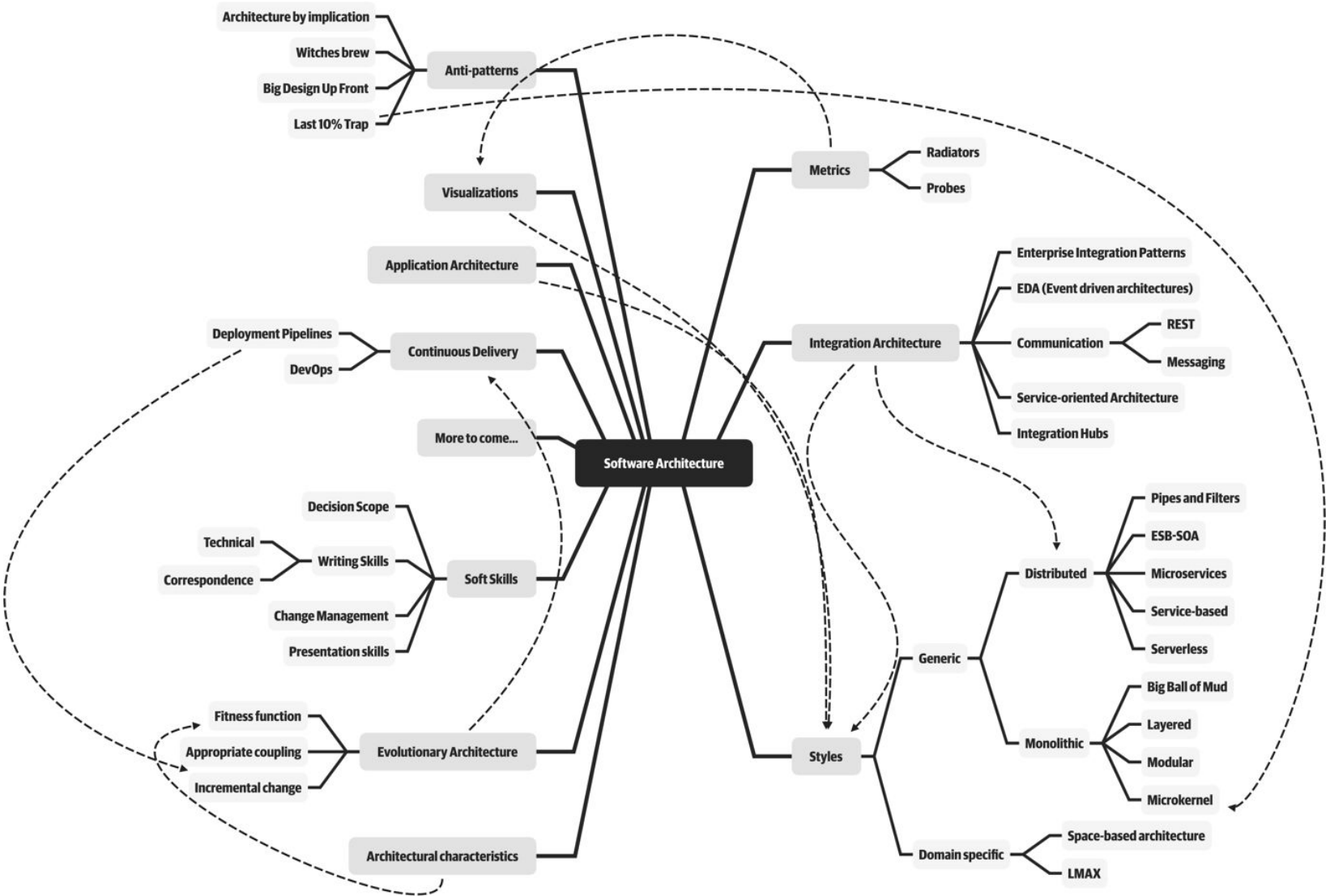




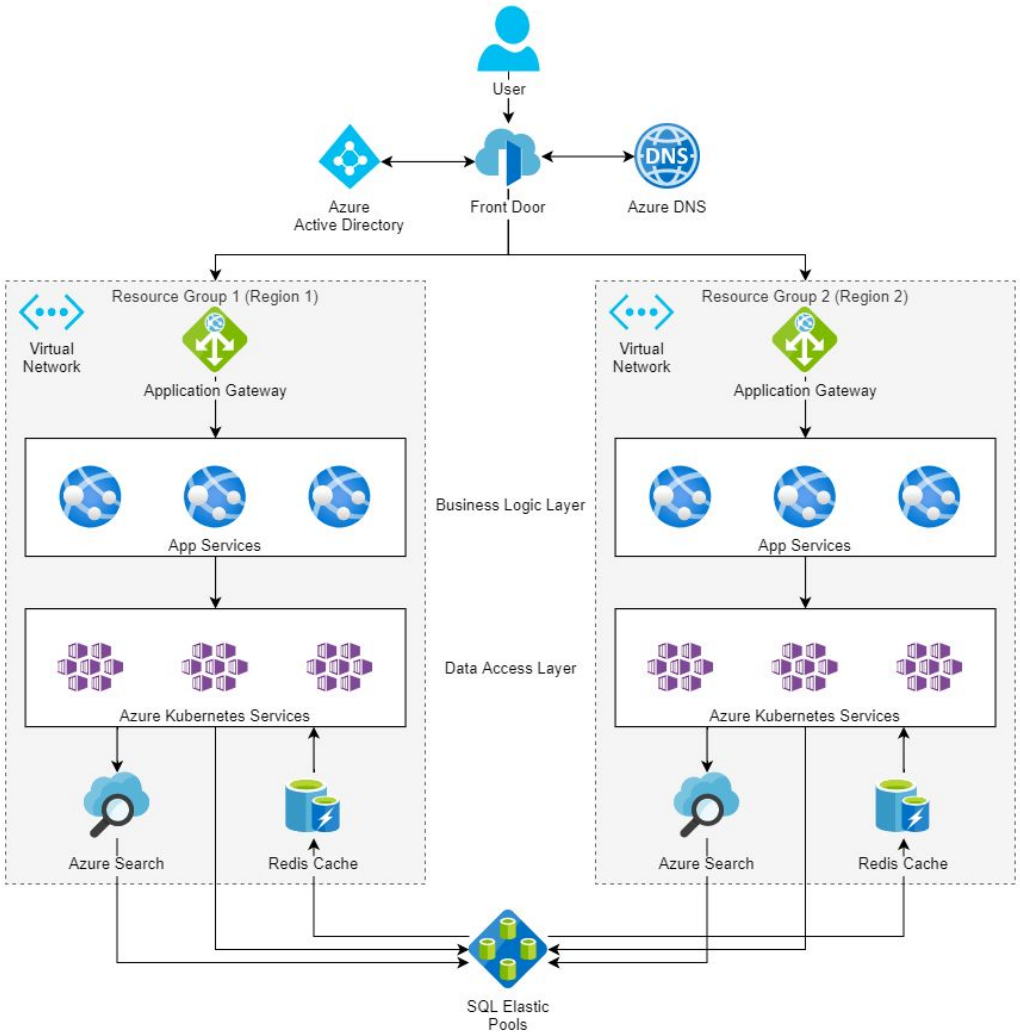




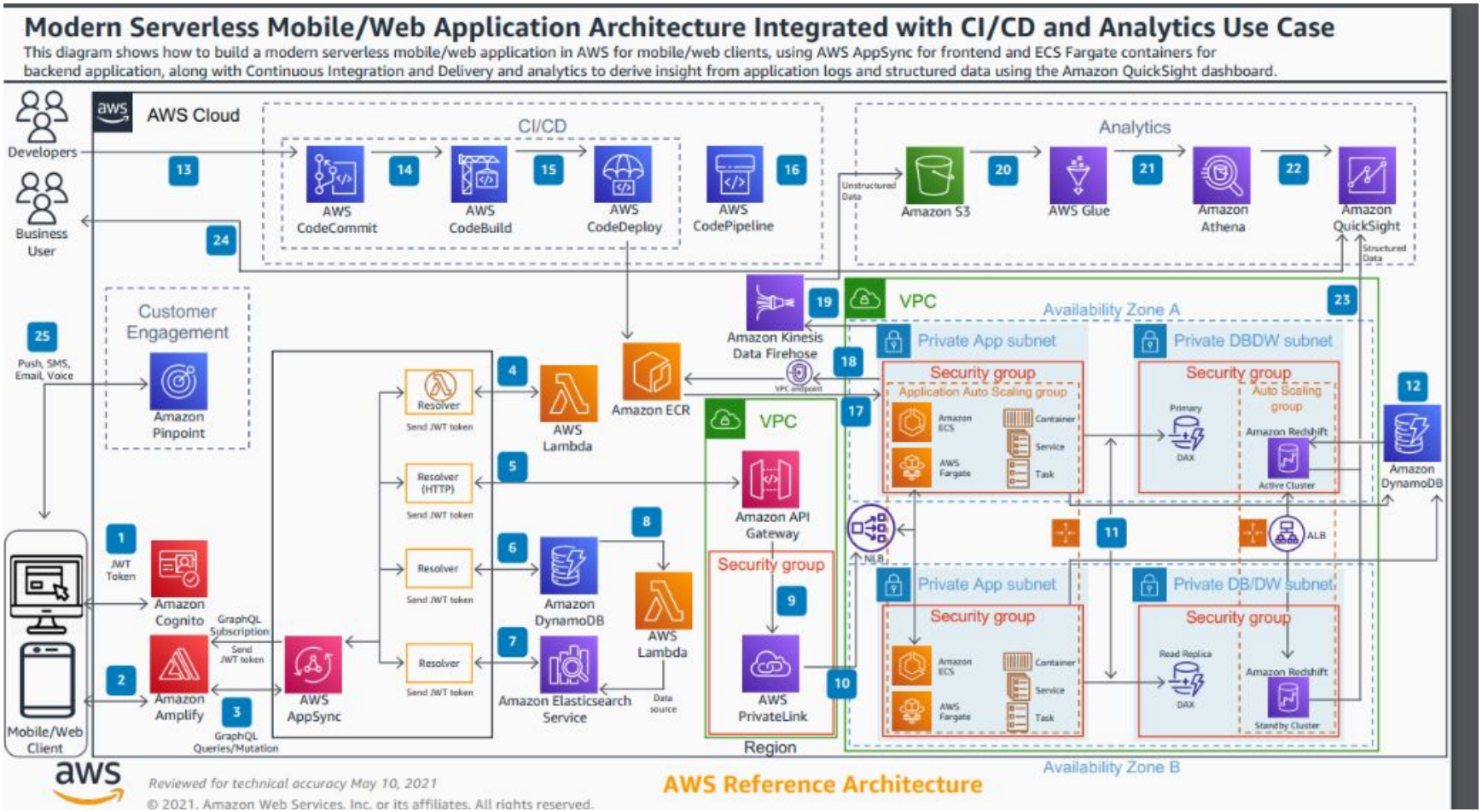
Estilos arquitectónicos - Arquitecto software



Estilos arquitectónicos



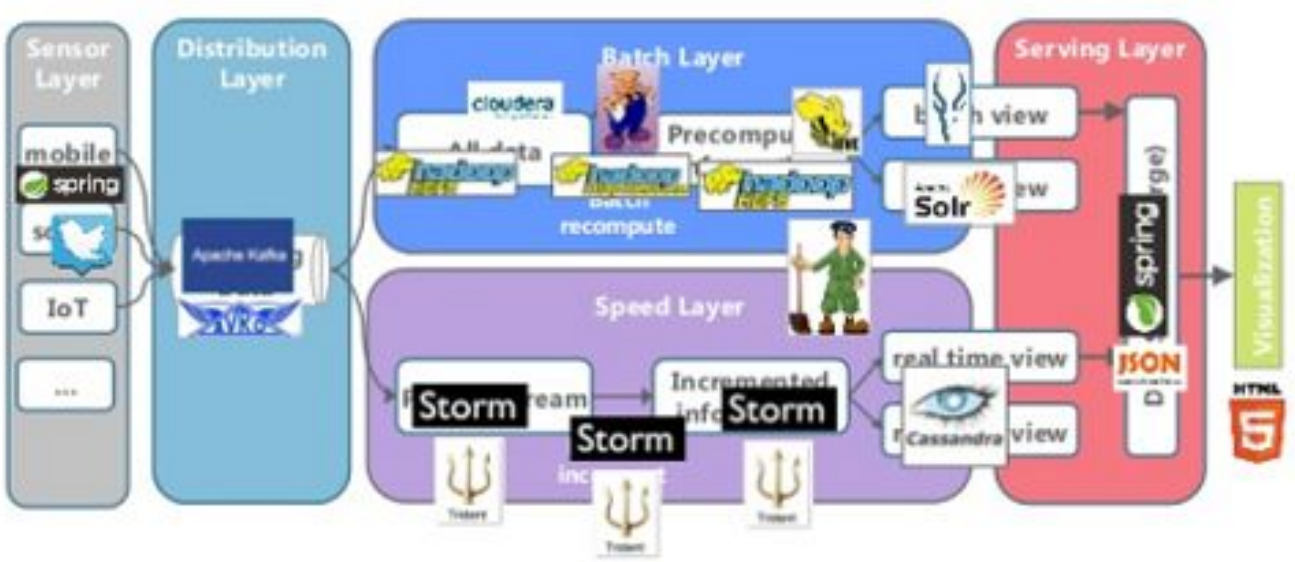
Estilos arquitectónicos



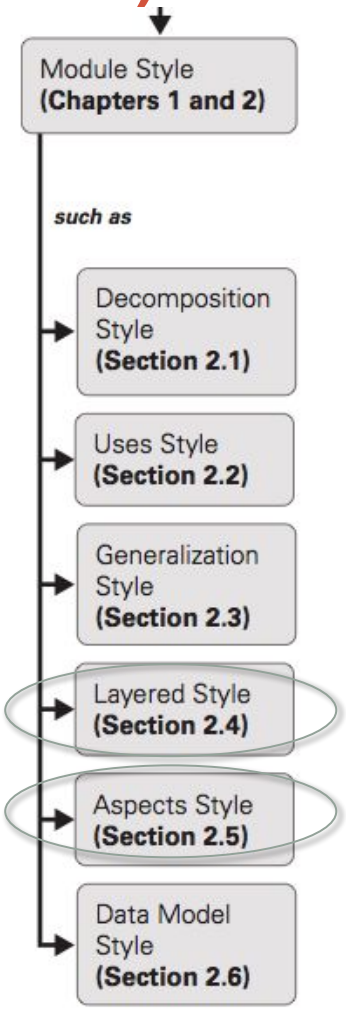
Estilos arquitectónicos

- Lambda Architecture

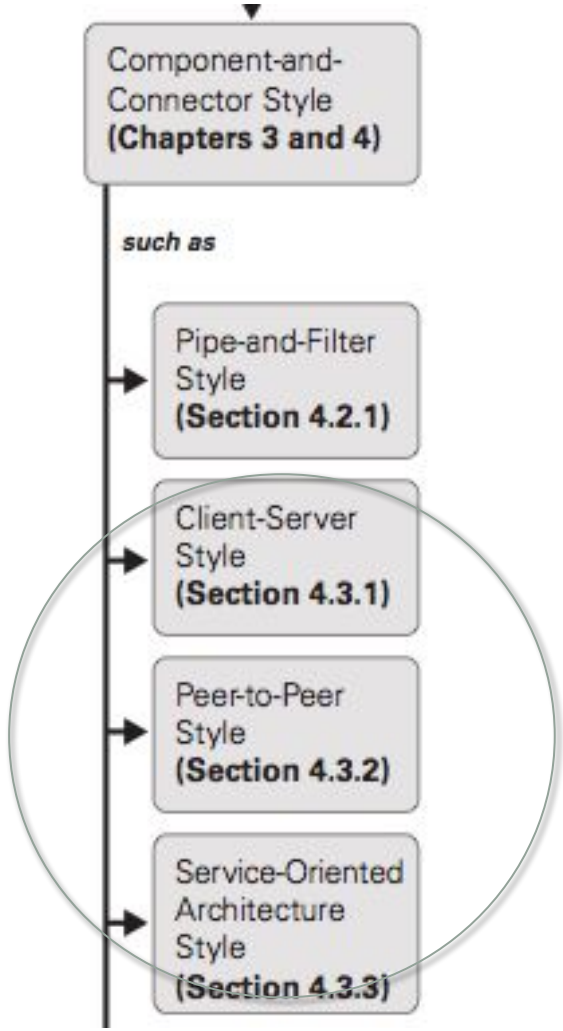
Open Source Frameworks for implementing a Lambda Architecture



Estilos arquitectónicos (vistos en cursos anteriores)

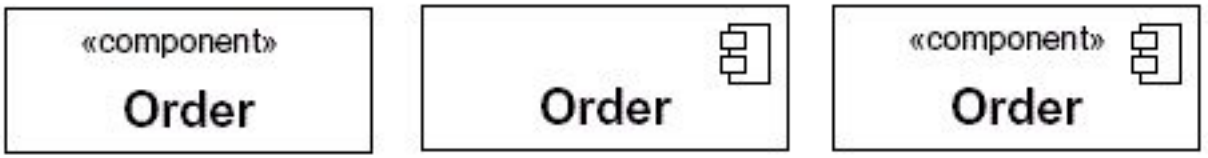


Estilos arquitectónicos

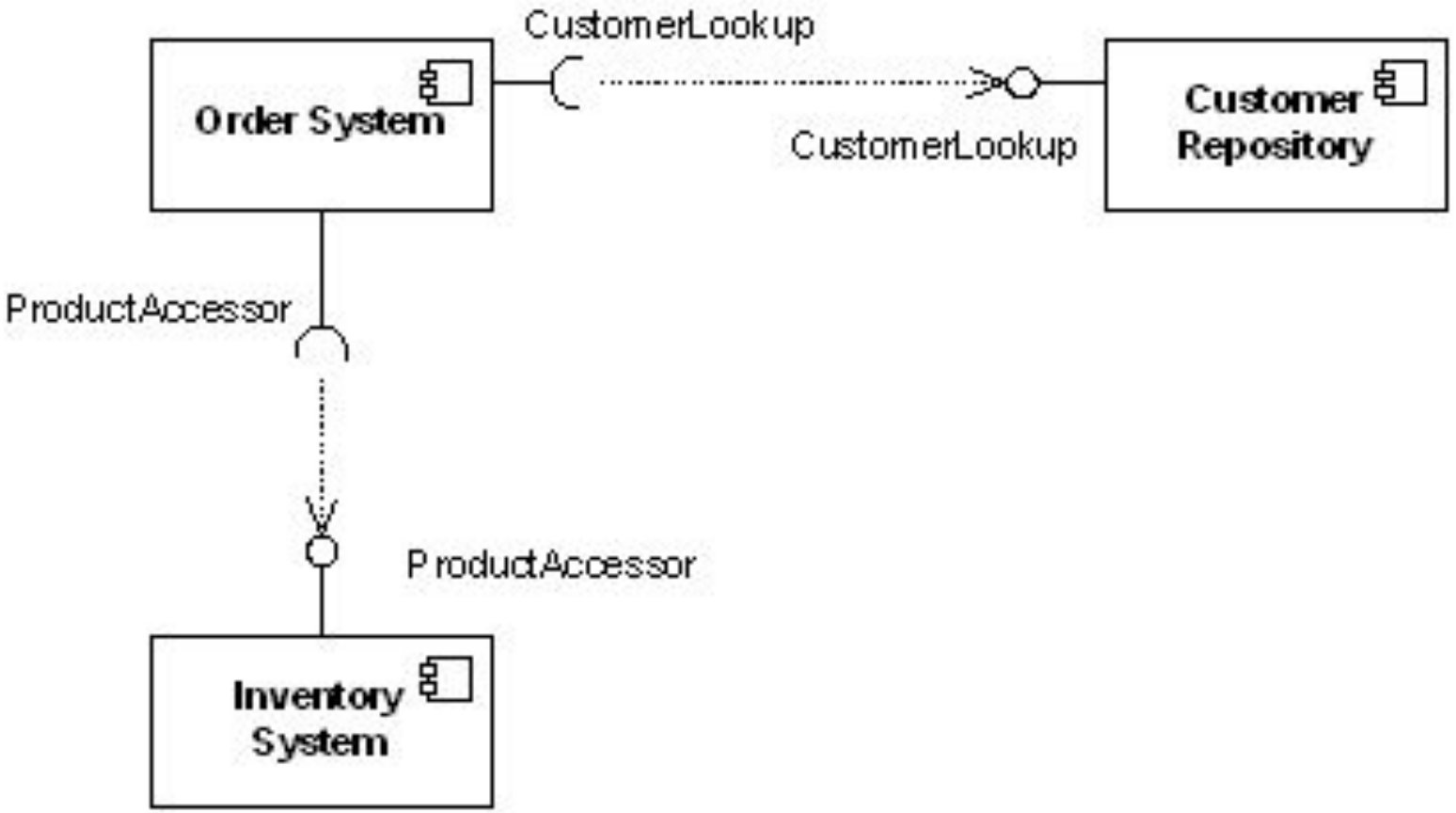


Call-return

Componentes y conectores

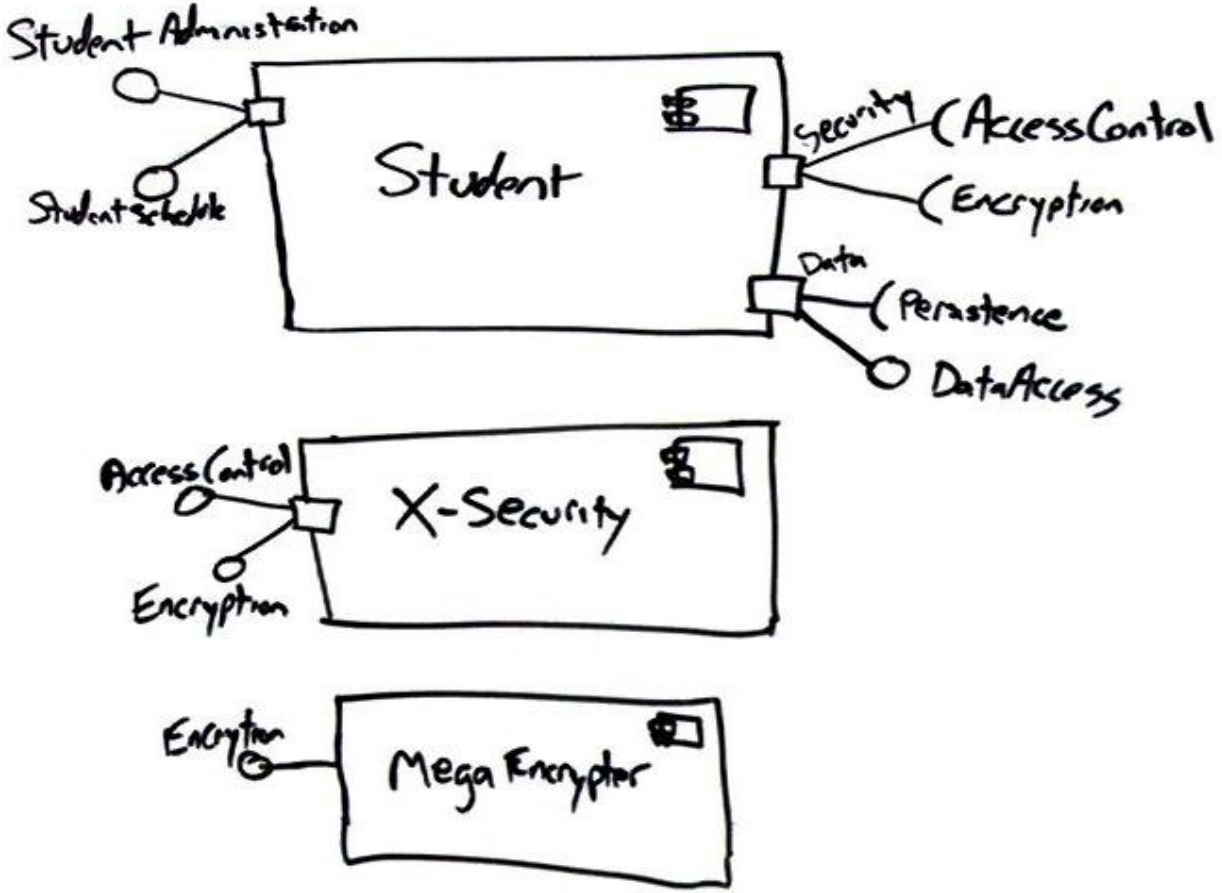


Componentes y Conectores



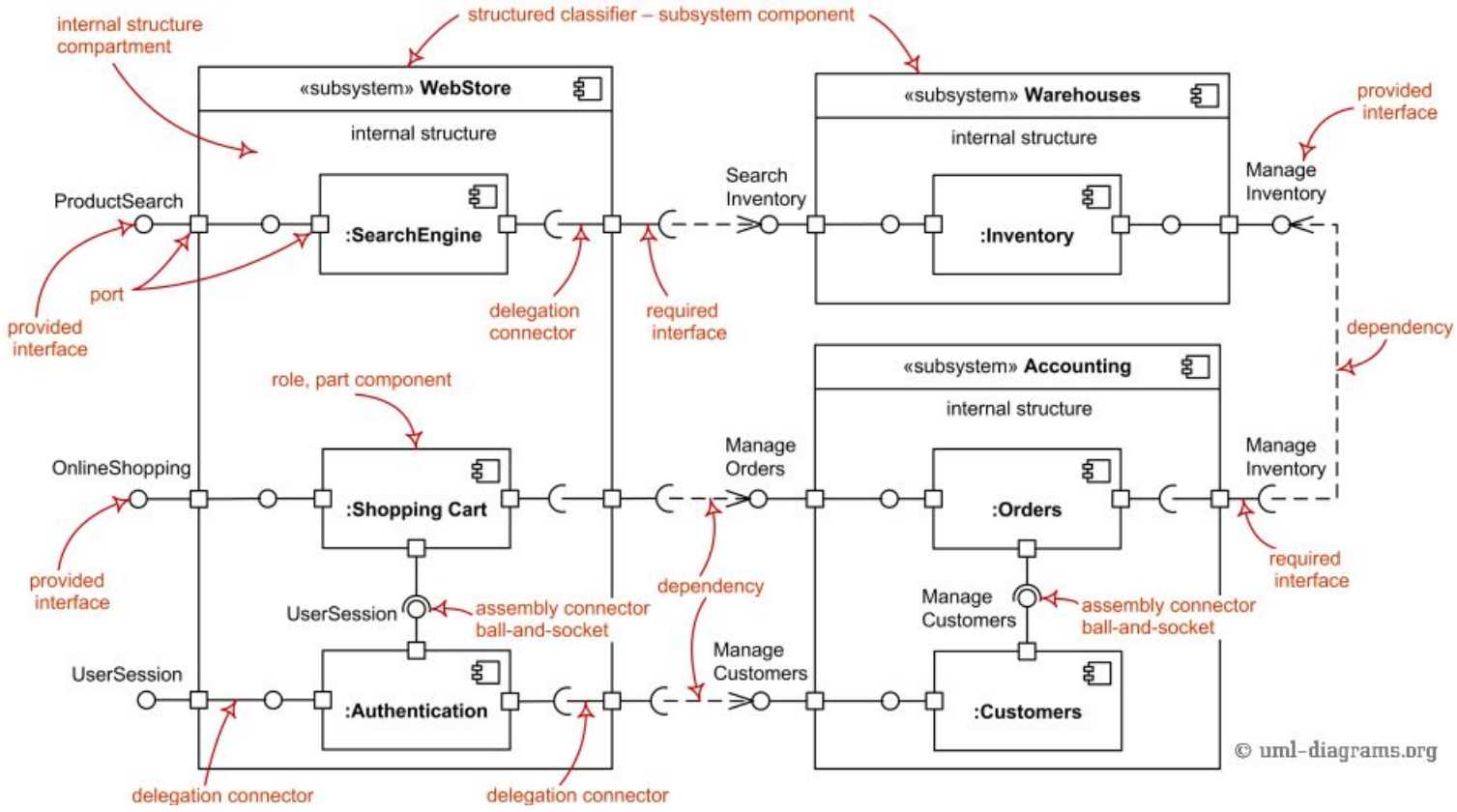
Componentes y Conectores

- Interfaces y Puertos

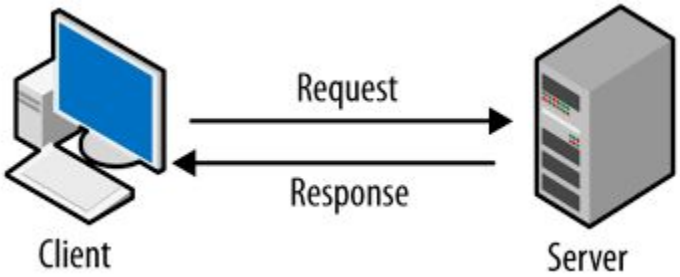


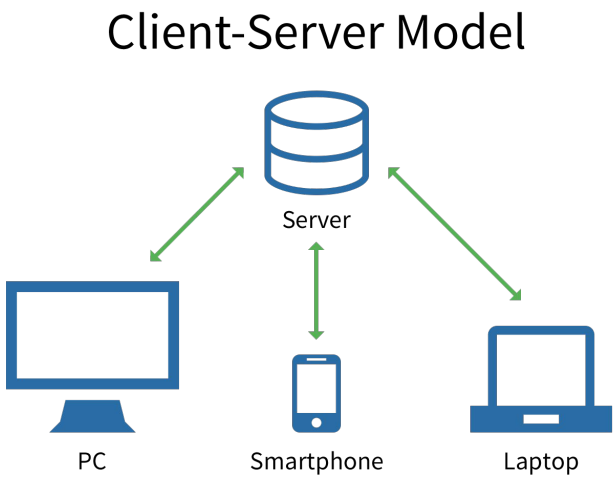
Componentes y Conectores

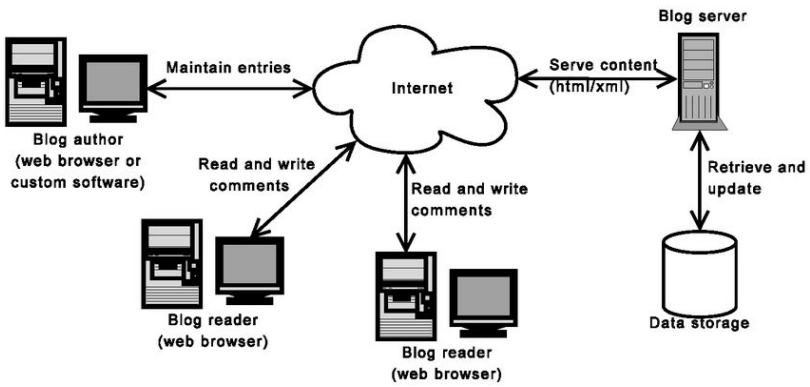
- Representación

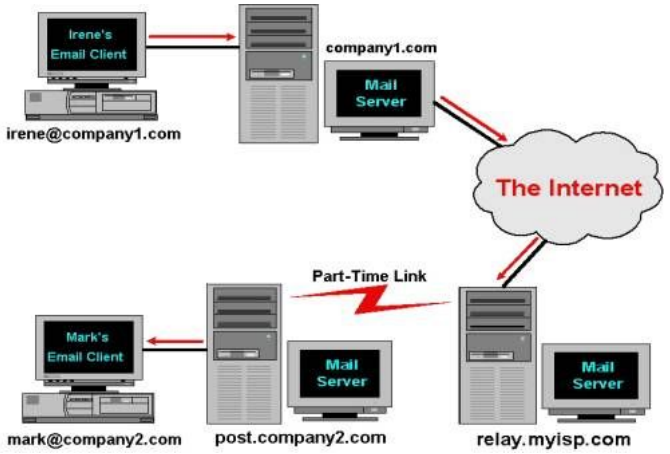


Ejemplos - estilo cliente/servidor aplicado.





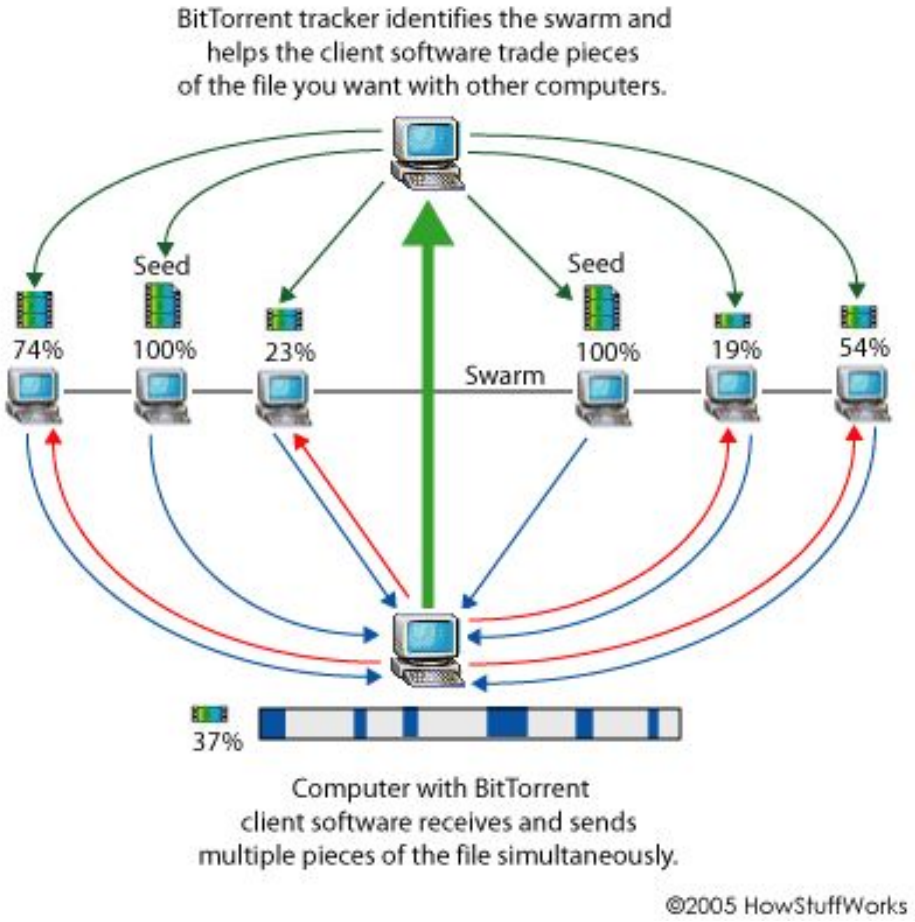




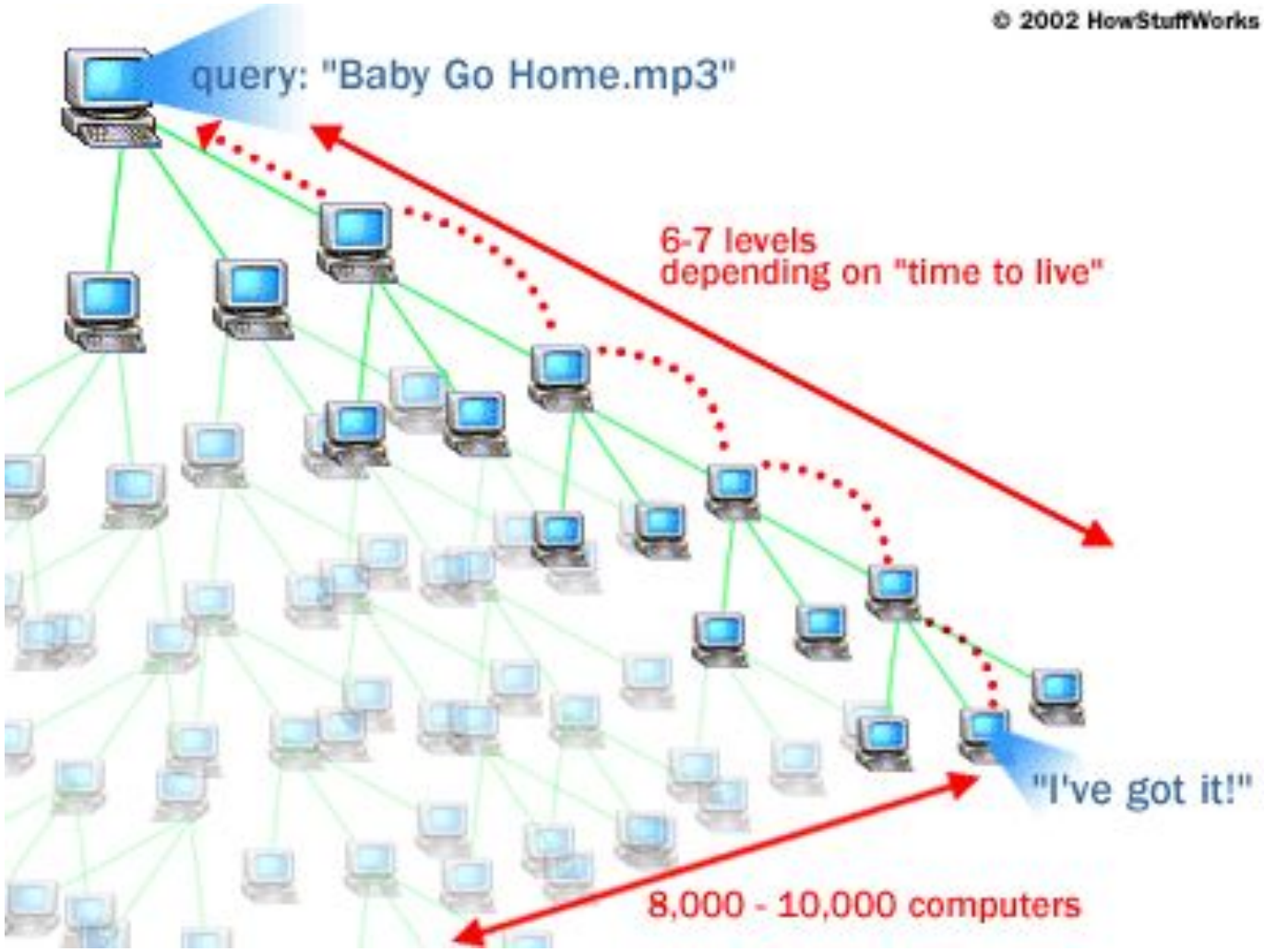
Continuamos la próxima semana!

Estilos arquitectónicos

P2P (Punto a punto)



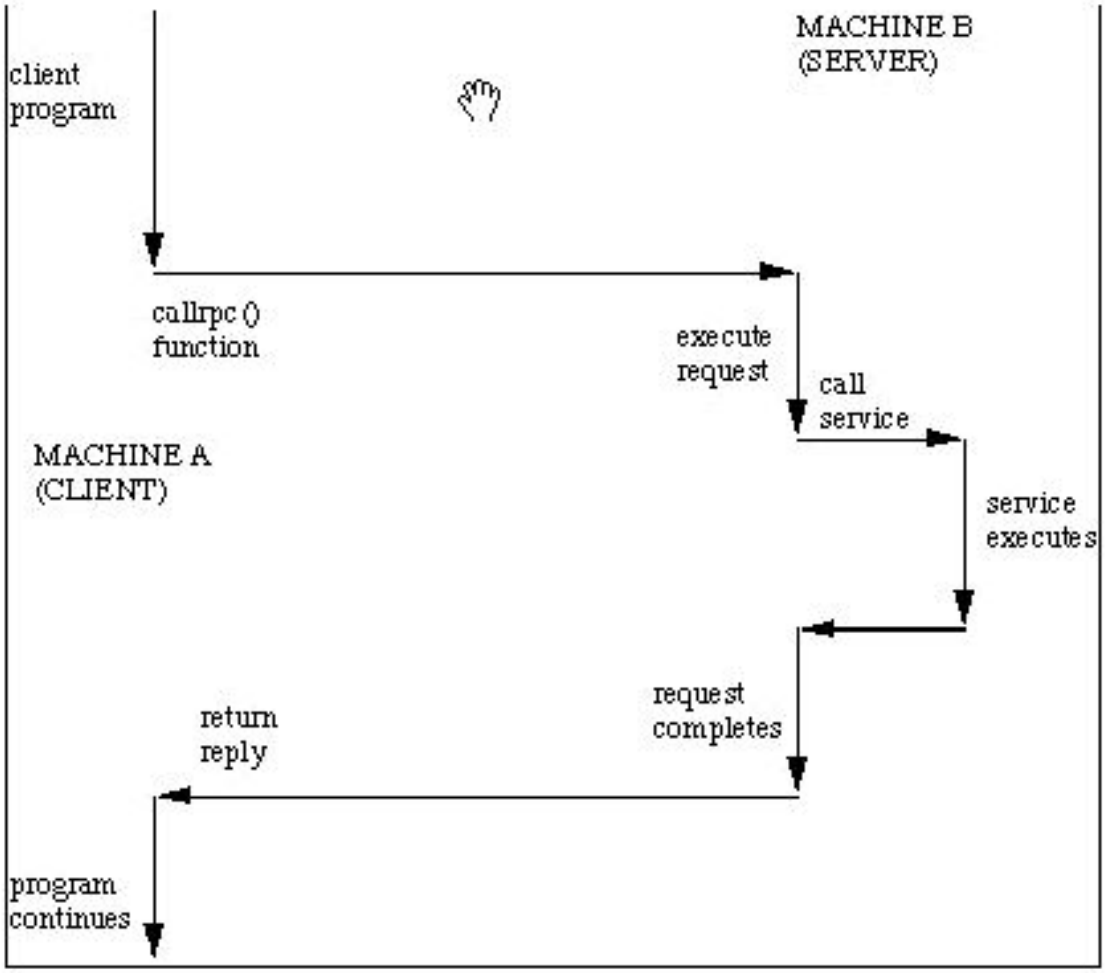
Gnutella


© 2002 HowStuffWorks
query: "Baby Go Home.mp3"
6-7 levels
depending on "time to live"
"I've got it!"
8,000 - 10,000 computers

Alternativas de implementación.

- Bajo nivel:
  - Sockets + protocolos propios.
- Alto nivel:
  - RPC (Remote Procedure Call)
  - ROI (Remote Object Invocation)

RPC



http://www.cs.cf.ac.uk/Dave/C/node33.html

RPC

```
int
rpc_call (char *host /* Name of server host */,
    u_long prognum /* Server program number */,
    u_long versnum /* Server version number */,
    xdrproc_t inproc /* XDR filter to encode arg */,
    char *in /* Pointer to argument */,
    xdr_proc_t outproc /* Filter to decode result */,
    char *out /* Address to store result */,
    char *nettype /* For transport selection */);
```

RPC

```
#include <stdio.h>
#include <utmp.h>
#include <rpc/rpc.h>
#include <rpcsvc/rusers.h>

/* a program that calls the RUSERSPROG
* RPC program
*/

main(int argc, char **argv)

{
   unsigned long nusers;
   enum clnt_stat cs;
   if (argc != 2) {
     fprintf(stderr, "usage: rusers hostname\n");
     exit(1);
    }

   if( cs = rpc_call(argv[1], RUSERSPROG,
          RUSERSVERS, RUSERSPROC_NUM, xdr_void,
          (char *)0, xdr_u_long, (char *)&nusers,
          "visible") != RPC_SUCCESS ) {
              clnt_perrno(cs);
              exit(1);
            }

   fprintf(stderr, "%d users on %s\n", nusers, argv[1] );
   exit(0);
}
```

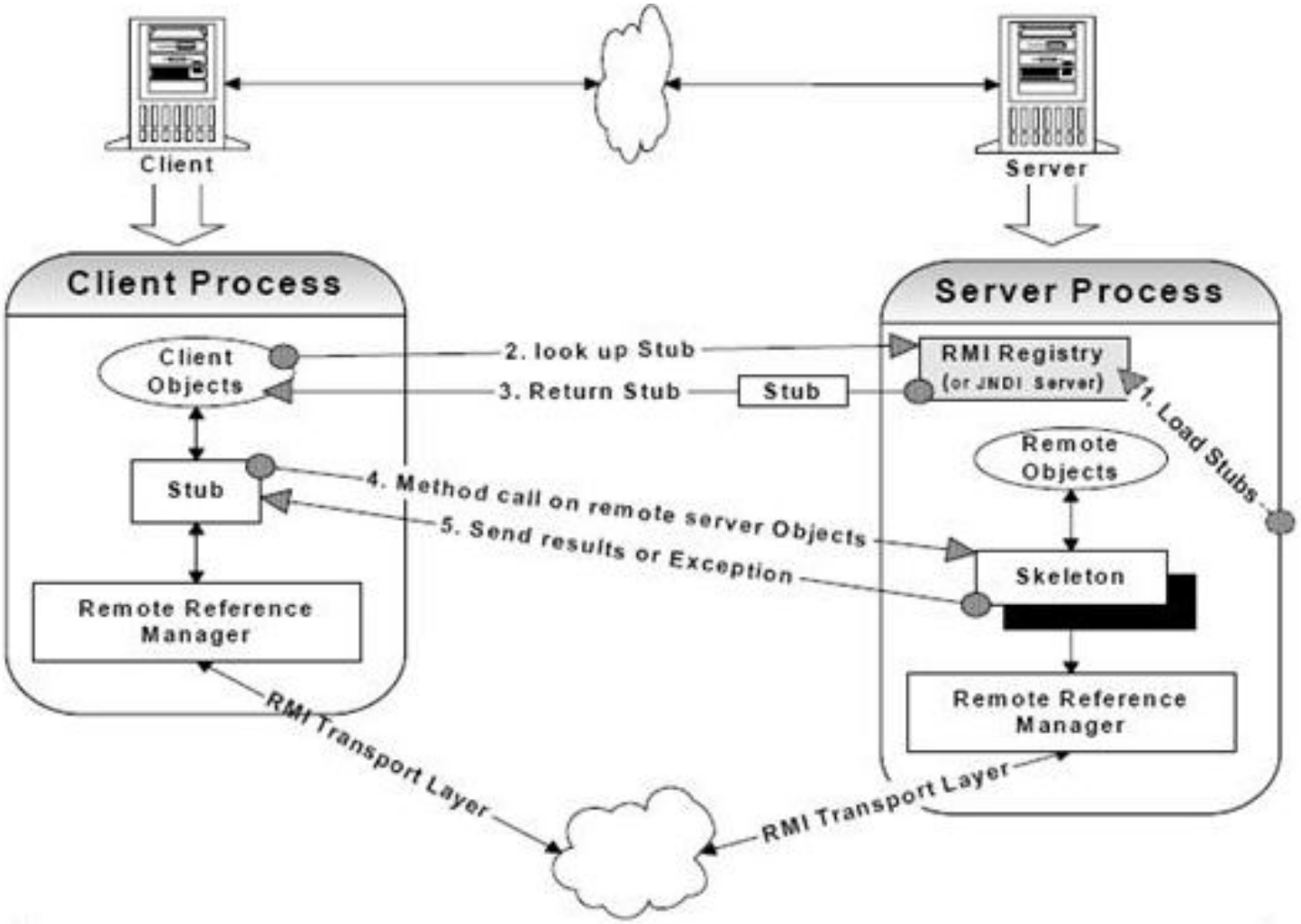
Remote Object Invocation

- Java RMI (Remote Method Invocation)
- .NET Remoting / DCOM.

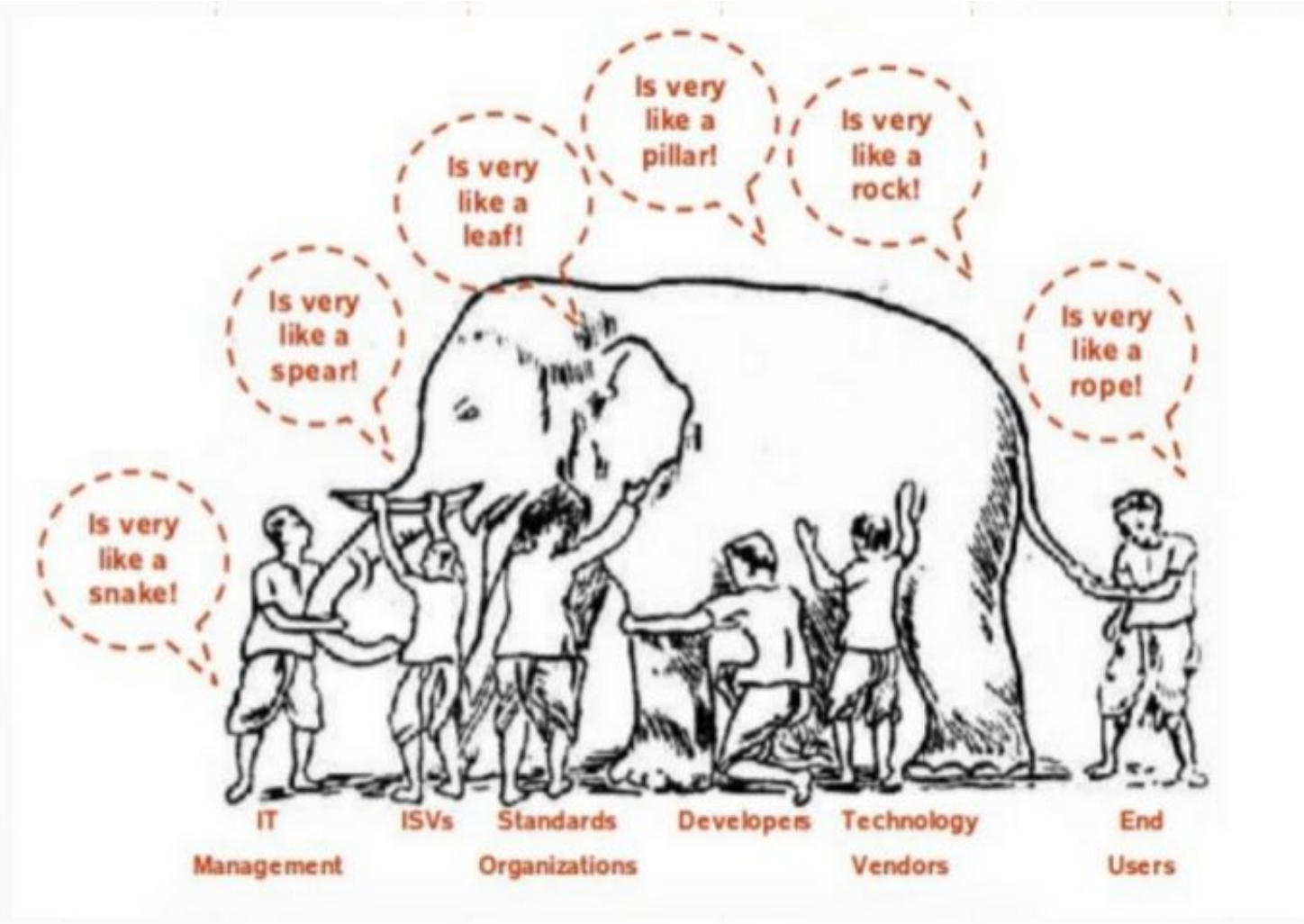
RPC vs Remote Object Invocation

RPC	R O I
Abstracción a nivel procedural (procedimiento remoto)	Abstracción a nivel de objeto (objetos remotos).
Soportado por múltiples plataformas.	Protocolos propietarios => no compatible con otras plataformas.
Complejidad para el envío de parámetros y respuestas: alta.	Complejidad para el envío de parámetros y respuestas: muy baja
No hay noción de estado.	Se tienen referencias a objetos remotos exactamente iguales con el mismo comportamiento de los objetos locales.

RMI


Client
Server
Client Process
Server Process
Client Objects
2. look up Stub
3. Return Stub
Stub
RMI Registry
(or JNDI Server)
1. Load Stubs
Remote Objects
Stub
4. Method call on remote server Objects
5. Send results or Exception
Skeleton
Remote Reference Manager
Remote Reference Manager
RMI Transport Layer
RMI Transport Layer

SOA


Is very like a pillar!
Is very like a rock!
Is very like a leaf!
Is very like a spear!
Is very like a rope!
Is very like a snake!
IT Management
ISVs
Standards Organizations
Developers
Technology Vendors
End Users

SOA (architectural style)

- *Service-oriented architecture (SOA) is a paradigm where software components are created with concise interfaces, and each component performs a discrete set of related functions. With its well-defined interface and contract for usage, each component, provides a service to other software components.*

SOA vs Cliente/Servidor – P2P

Cliente/Servidor

- Lógica principalmente en el cliente.
- Clientes 'gordos' y únicos.
- Lenguaje: 3GL/4GL

SOA

- Lógica: principio de abstracción.
- Bajo acoplamiento, sin estado: clientes simples.
- Lenguaje: estándares independientes de cualquier plataforma.

SOA

- Principios
  - Bajo acoplamiento de los servicios
  - Abstracción de servicios
  - Autonomía de los servicios
  - Ausencia del concepto de estado en los servicios.
  - Facilidad de descubrimiento
  - Compatibilidad con estándares

Bajo acoplamiento

Within the service-orientation design paradigm, **service loose coupling** is a design principle[1] that is applied to the services[2] in order to ensure that the service contract is not tightly coupled to the service consumers and to the underlying service logic and implementation. This results in service contracts that could be freely evolved without affecting either the service consumers or the service implementation.[3]

Abstracción

Service abstraction is a design principle that is applied within the service-orientation design paradigm so that the information published in a service contract is limited to what is required to effectively utilize the service[1] The service contract should not contain any superfluous information that is not required for its invocation. Also that the information should be limited to the serviced contract (technical contract and the SLA) only, no other document or medium should be made available to the service consumers other than the service contract that contains additional service related information.

Autonomía

Service autonomy is a design principle that is applied within the service-orientation design paradigm, to provide services with improved independence from their execution environments.[1] This results in greater reliability, since services can operate with less dependence on resources over which there is little or no control.

Ausencia de estado

Service statelessness is a design principle that is applied within the service-orientation design paradigm, in order to design scalable services by separating them from their state data whenever possible.[1] This results in reduction of the resources consumed by a service as the actual state data management is delegated to an external component or to an architectural extension. By reducing resource consumption, the service can handle more requests in a reliable manner.[2]

Facilidad de descubrimiento (metadatos)

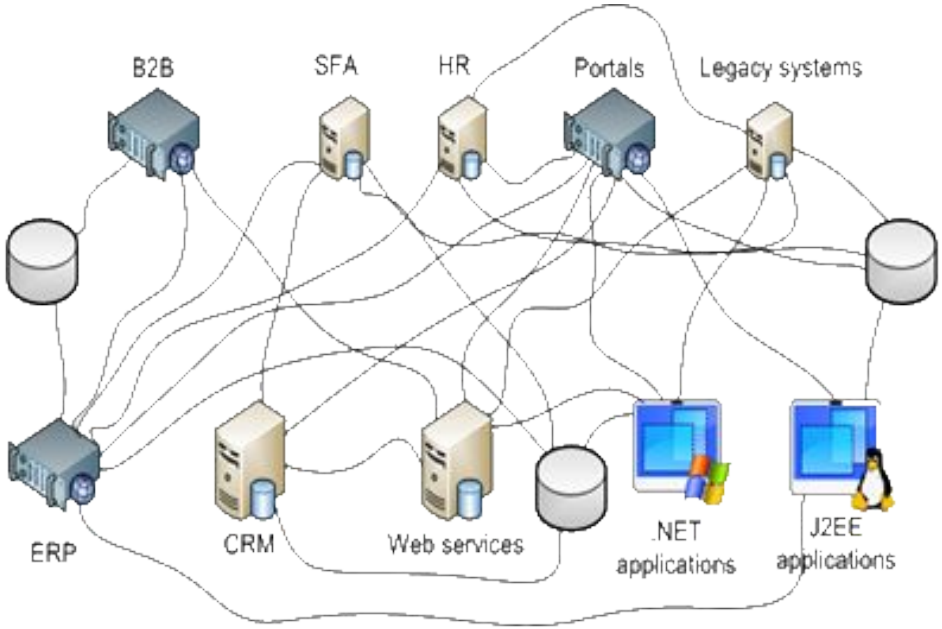
Discoverability is the ability of something, especially a piece of content or information, to be found. Discoverability is a concern in library and information science, many aspects of digital media, software and web development, and in marketing, since a thing cannot be used if people cannot find it or don't understand what it's for. Metadata, or "information about information," such as a book's title, a product's description, or a website's keywords, affects how discoverable something is. Organizing information by putting it into alphabetical order or including it in a search engine is an example of how to improve discoverability. Discoverability is related to, but different from, accessibility and usability, other qualities that affect the usefulness of a piece of information.

SOA – Service Oriented Architecture

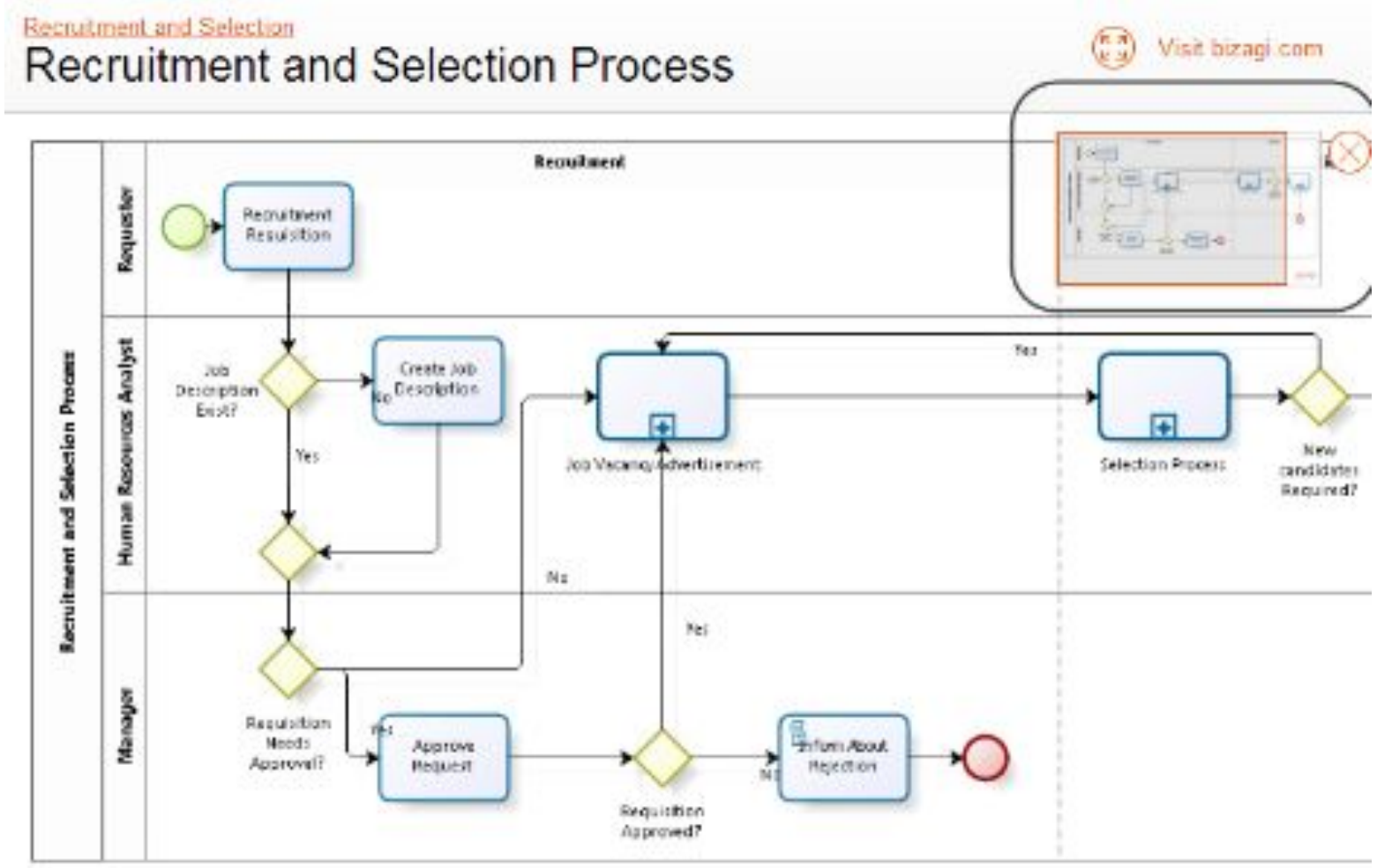
- Estilo arquitectónico
- Enfocado a sistemas distribuidos

SOA e Integración

- ESB – Bus de servicios



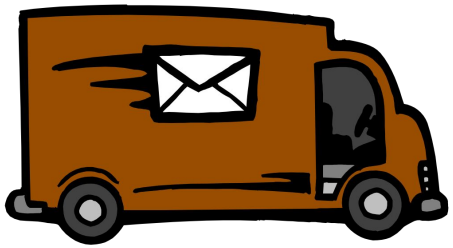
SOA y Procesos de Negocio Automatizados



SOA – HTTP-based protocol:SOAP

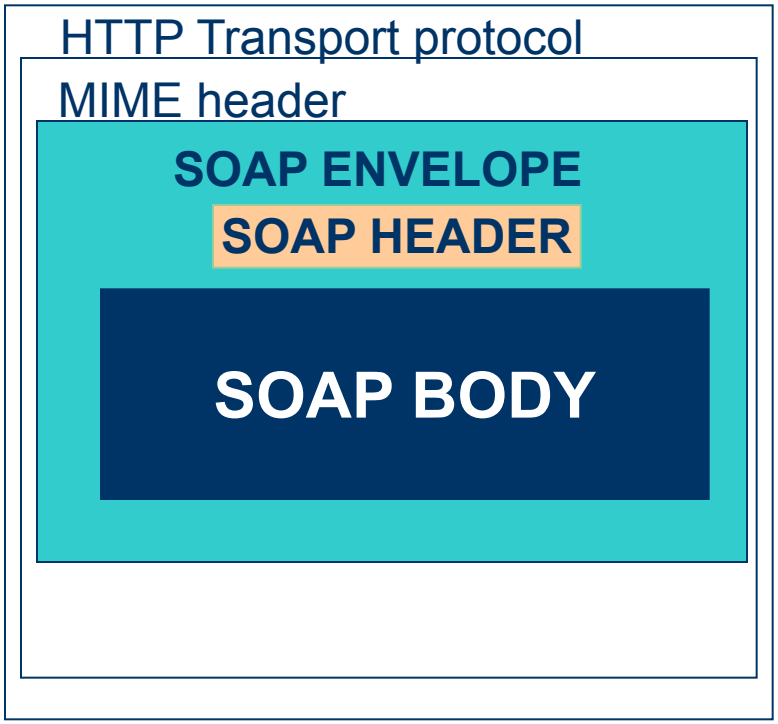
Simple Object Access Protocol

- SOAP: ‘sobre’ estándar para el envío de mensajes sobre HTTP.
- SOAP: protocolo para transferir dichos mensajes entre aplicaciones distribuidas.



SOAP: Envelope

- Mensaje SOAP:
  - An `Envelope`
  - A `Header` (optional)
  - A `Body`



SOAP: Envelope

```
<?xml version='1.0'
   encoding='UTF-8'?>
  <SOAP-ENV:Envelope
  xmlns:SOAP_ENV="http://schemas.xmlsoap.org/soap/envelope/"
      xmlns:xsi="http://www.w3c.org/1999/XMLSchema-instance"
      xmlns:xsd="http://www.w3c.org/1999/XMLSchema">
          <SOAP-ENV:Header>

          </SOAP-ENV:Header


          <SOAP_ENV:Body>


          </SOAP-ENV:Body
          >

  </SOAP-ENV:Envelope>
```

SOAP: Request envelope

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<SOAP:Envelope xmlns:SOAP="http://schemas.xmlsoap.org/soap/envelope/">
  <SOAP:Body>
    <qk:query xmlns:qk="http://www.sosnoski.com/quakes">
      <qk:min-date>2001-07-25T19:58:24.918</qk:min-date>
      <qk:max-date>2001-09-01T16:00:59.4</qk:max-date>
      <qk:min-long>134.90671</qk:min-long>
      <qk:max-long>178.3323</qk:max-long>
      <qk:min-lat>-47.337864</qk:min-lat>
      <qk:max-lat>-18.00817</qk:max-lat>
    </qk:query>
  </SOAP:Body>
</SOAP:Envelope>
```

SOAP: response envelope

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<SOAP:Envelope xmlns:SOAP="http://schemas.xmlsoap.org/soap/envelope/">
  <SOAP:Body>
    <qk:results xmlns:qk="http://www.sosnoski.com/quakes" count="1">
      <qk:result-set>
        <qk:area-name>Vanuatu Islands</qk:area-name>
        <qk:regions count="1">
          <qk:regions>
            <qk:region ident="rgn189" index="189">LOYALTY ISLANDS REGION</qk:region>
          </qk:regions>
        </qk:regions>
        <qk:quakes count="3">
          <qk:quakes>
            <qk:quake time="2001-08-10T15:05:12" millis="1300" latitude="-22.217" longitude="170.571" de
            <qk:quake time="2001-08-10T20:02:50" millis="4500" latitude="-22.262" longitude="170.506" de
            <qk:quake time="2001-08-30T08:12:27" millis="2400" latitude="-22.928" longitude="169.787" de
          </qk:quakes>
        </qk:quakes>
      </qk:result-set>
    </qk:results>
  </SOAP:Body>
</SOAP:Envelope>
```

Servicios Web

- Servicio remoto accesible a través de SOAP.
- Descrito por un documento WSDL.
- Sin estado (acorde con principios SOA).

Web Services - WSDL

- A WSDL document is an XML document

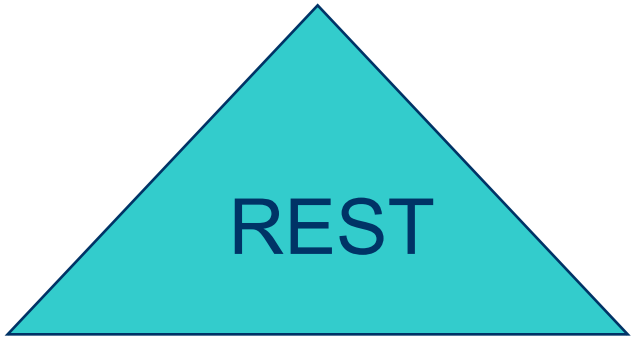
```
<?xml version="1.0" encoding="UTF-8"?>
<definitions>
   <types>
    <!- define the types here using XML Schema  →
   </types>
   <message>
    <!- XML messages the web service uses are defined here  →
   </message>
   <portType>
    <!- define the input and output parameters here  -→
   </portType>
   <binding>
    <!- define the network protocol here  →
   </binding>
   <service>
    <!- location of the service  →
   </service>
</definitions>
```

REST

- Estilo arquitectónico (no es un protocolo ni una herramienta) para la interoperabilidad. No es una tecnología ni un producto.
- Manejo explícito de HTTP.

REST – Elementos

Nouns (Resources)
i.e., http://example.com/employees/12345



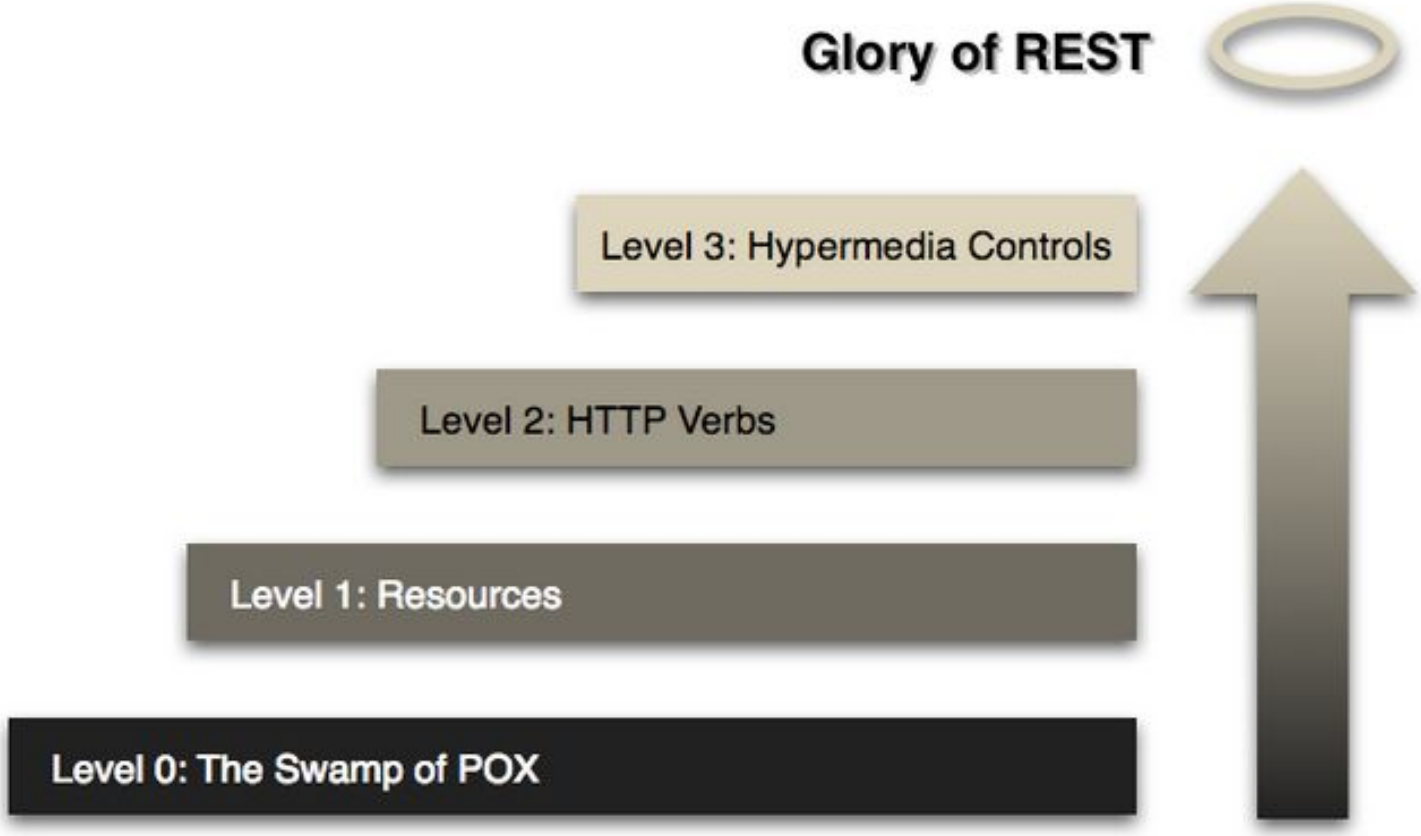
Verbs
i.e., GET

Representations
i.e., XML

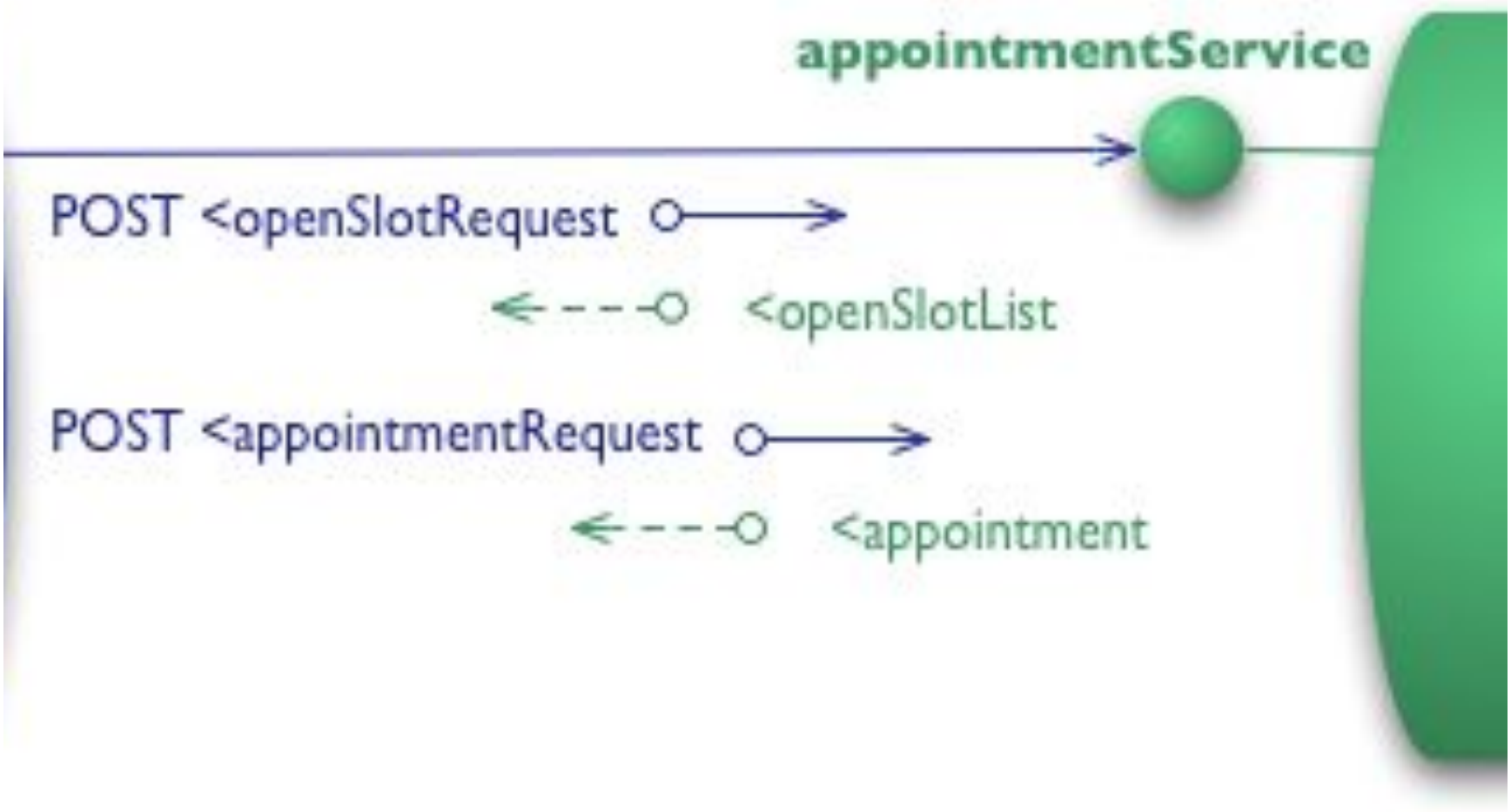
REST (Representaciones)

- XML
- JSON
- …
- [Mime-types]

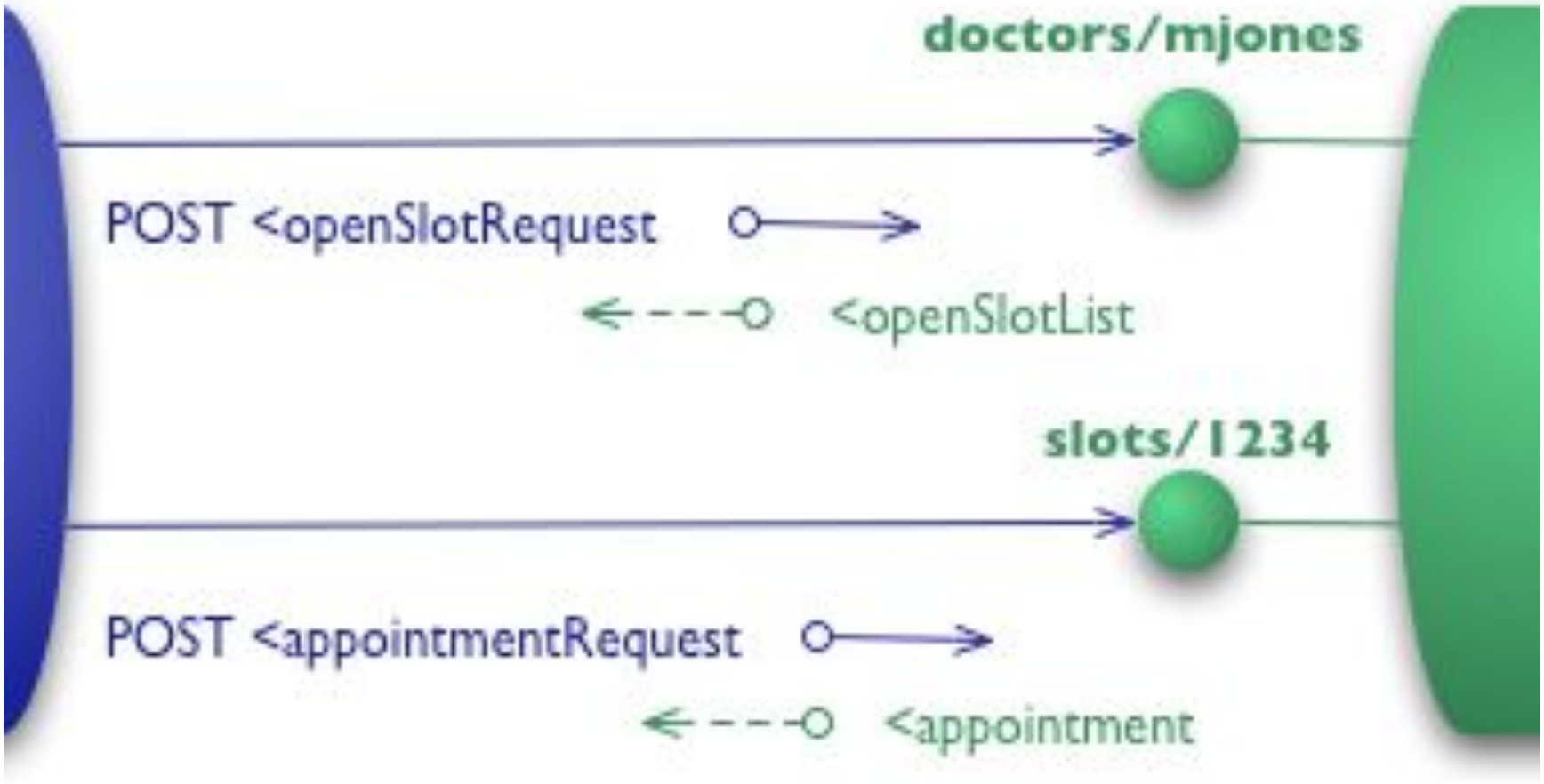
Niveles de madurez REST



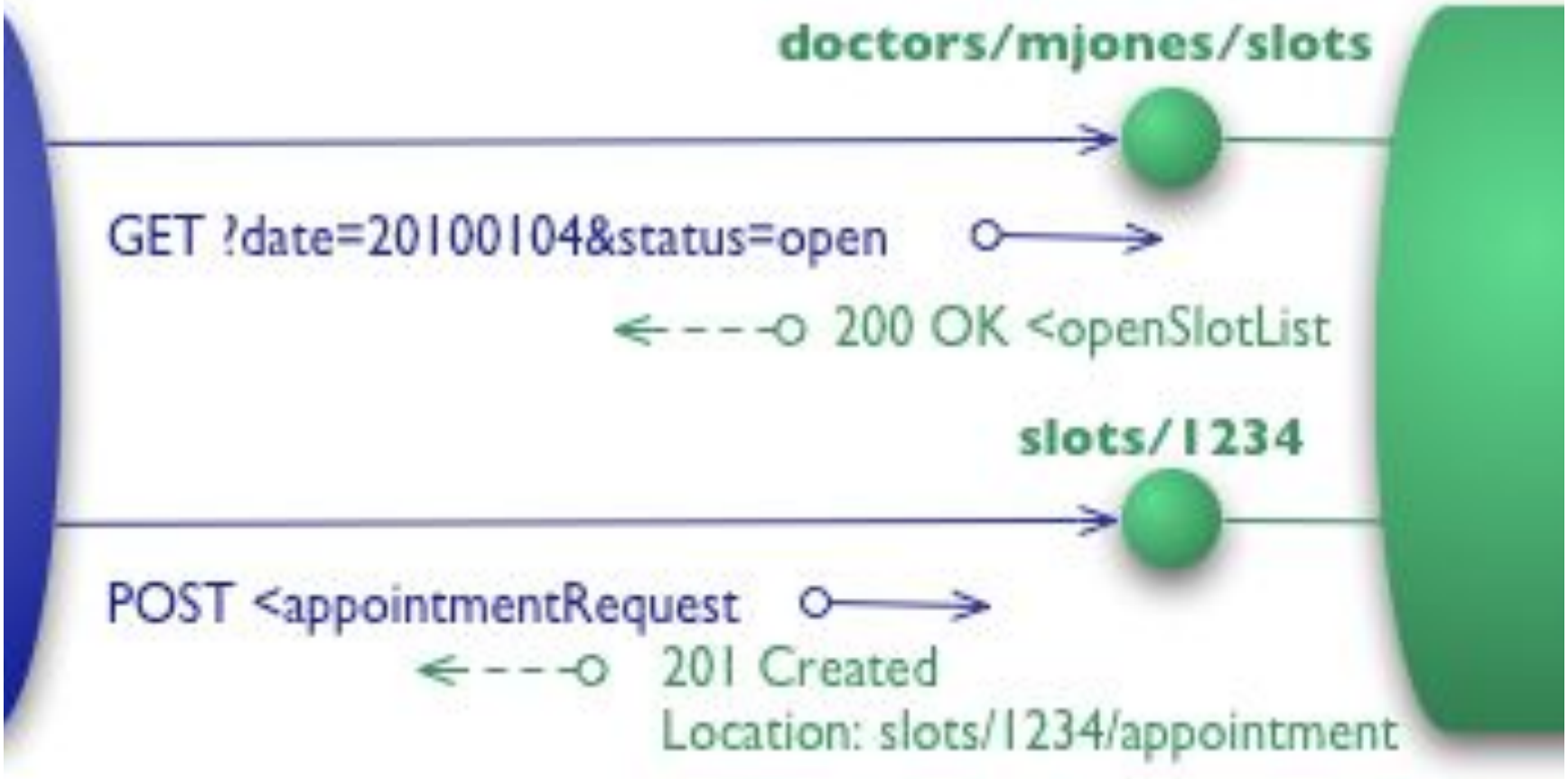
Nivel 0


appointmentService
POST <openSlotRequest
<openSlotList
POST <appointmentRequest
<appointment

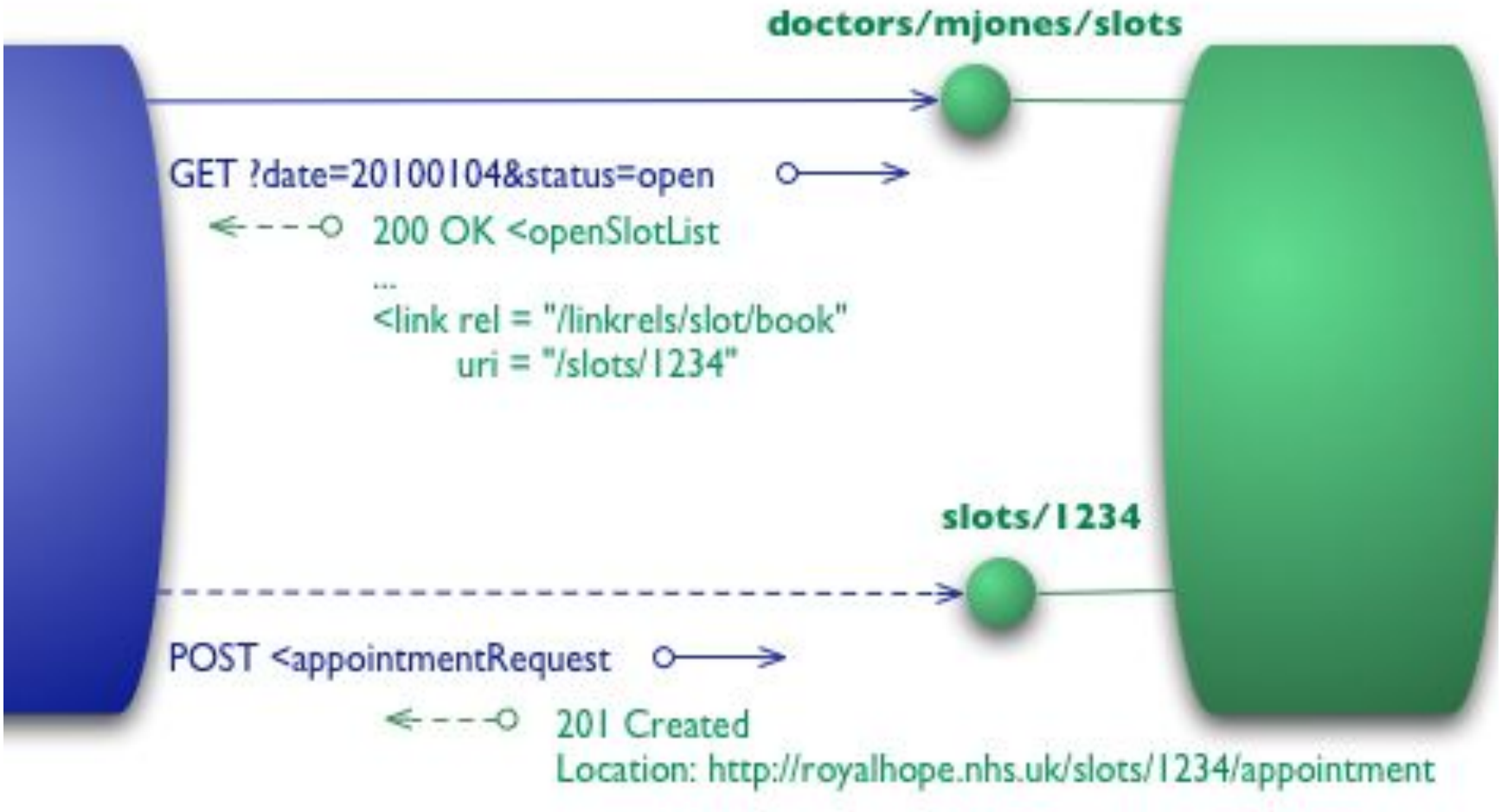
Nivel 1


doctors/mjones
POST <openSlotRequest
<openSlotList
slots/1234
POST <appointmentRequest
<appointment

Nivel 2

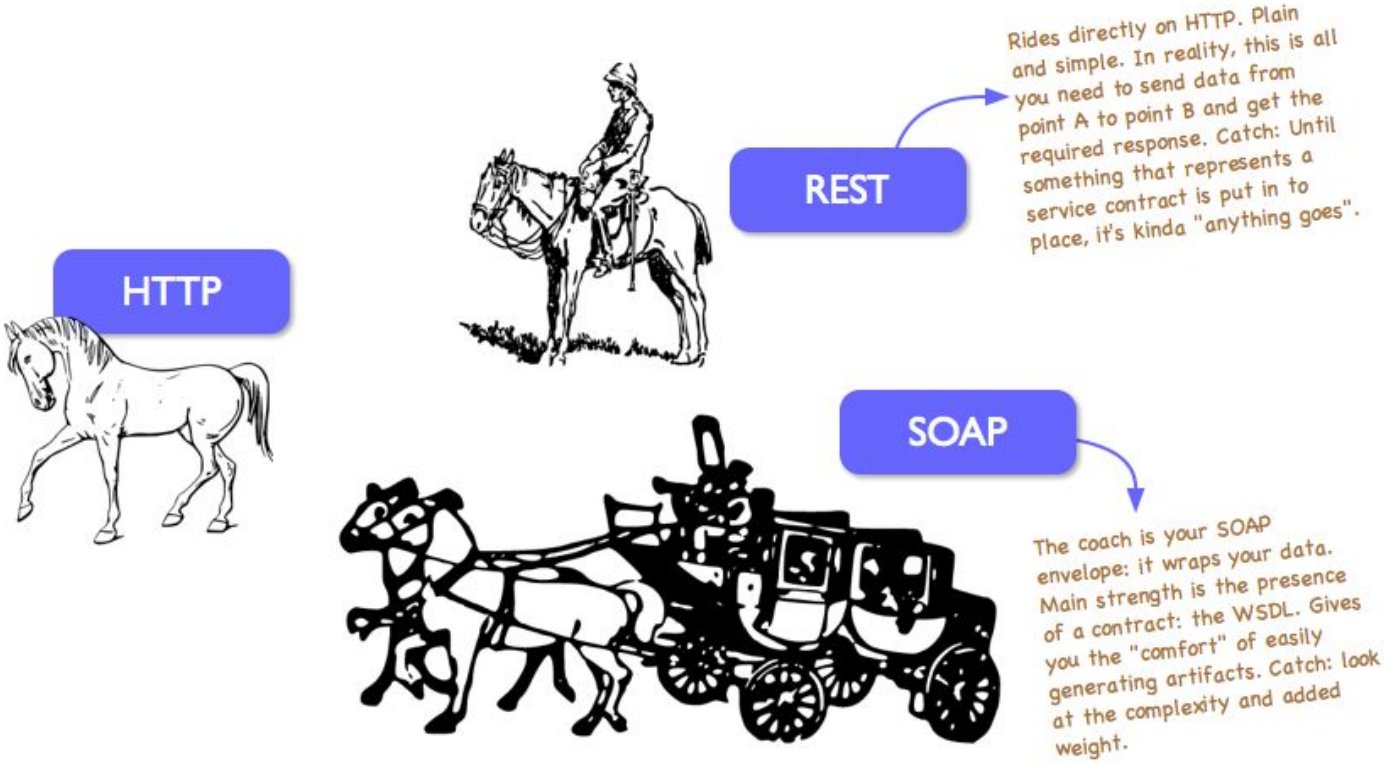

doctors/mjones/slots
GET ?date=20100104&status=open
200 OK <openSlotList
slots/1234
POST <appointmentRequest
201 Created
Location: slots/1234/appointment

Nivel 3


doctors/mjones/slots
GET ?date=20100104&status=open
200 OK <openSlotList
...
<link rel = "/linkrels/slot/book"
uri = "/slots/1234"
slots/1234
POST <appointmentRequest
201 Created
Location: http://royalhope.nhs.uk/slots/1234/appointment

SOAP vs REST

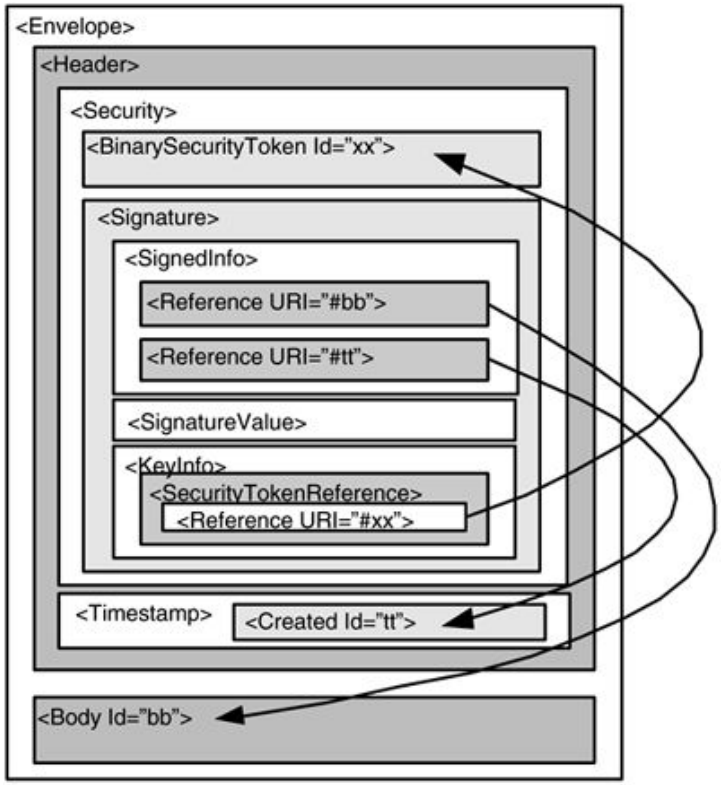
- Tamaño de las peticiones

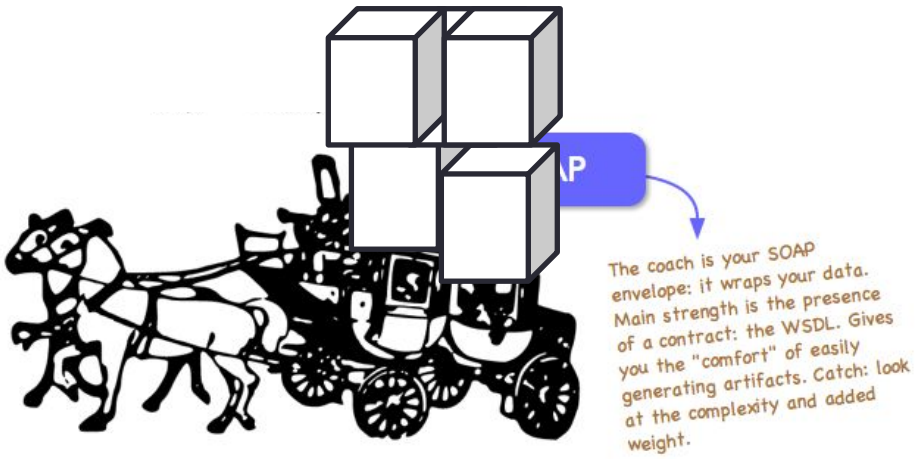


http://mudassirshahzad.com/soap-vs-restful-for-mobile-services-which-one-to-use/

SOAP vs REST

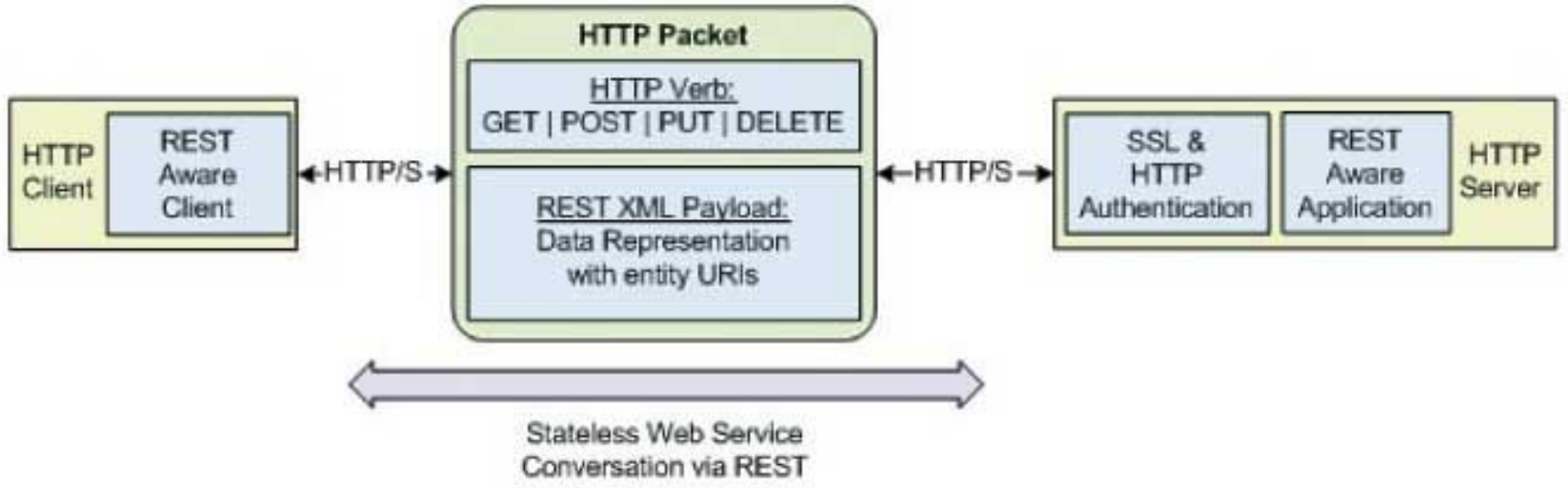
- Seguridad. SOAP: SSL+HTTPS + WS-Security





SOAP vs REST

- Seguridad REST: SSL+HTTPS



SOA y REST?

- SOA: Servicios
- REST: Recursos…. ROA?

Desarrollo de APIs REST - Python


```python
from flask import abort

@app.route('/todo/api/v1.0/tasks/<int:task_id>', methods=['GET'])
def get_task(task_id):
    task = [task for task in tasks if task['id'] == task_id]
    if len(task) == 0:
        abort(404)
    return jsonify({'task': task[0]})
```

Desarrollo de APIs REST – Node.js

```
//File: controllers/tvshows.js
var mongoose = require('mongoose');
var TVShow  = mongoose.model('TVShow');

//GET - Return all tvshows in the DB
exports.findAllTVShows = function(req, res) {
  TVShow.find(function(err, tvshows) {
    if(err) res.send(500, err.message);

    console.log('GET /tvshows')
    res.status(200).jsonp(tvshows);
  });
};
```

```
//GET - Return a TVShow with specified ID
exports.findById = function(req, res) {
  TVShow.findById(req.params.id, function(err, tvshow) {
    if(err) return res.send(500. err.message);

    console.log('GET /tvshow/' + req.params.id);
    res.status(200).jsonp(tvshow);
  });
};
```

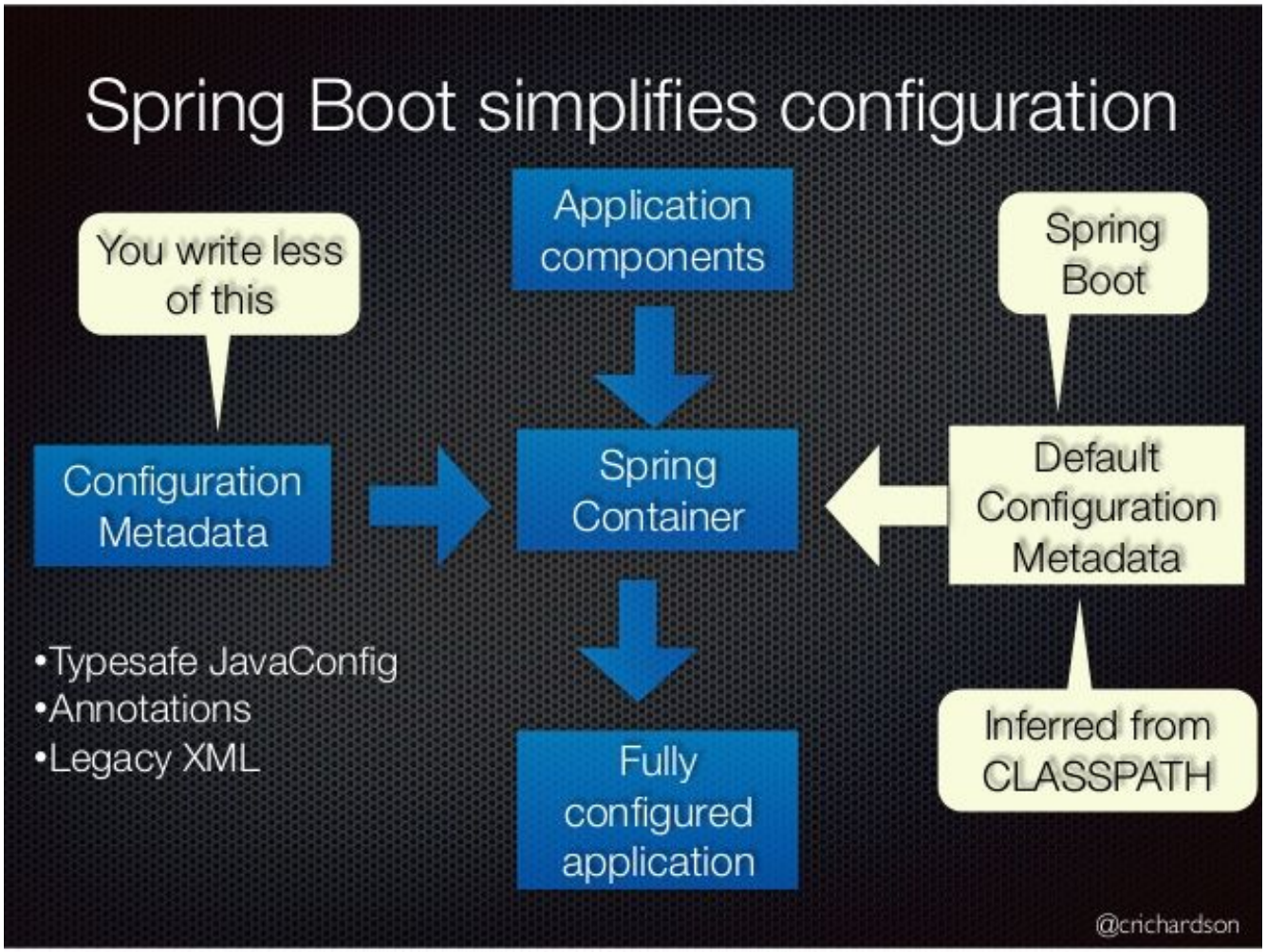
Spring-MVC


```
@RestController
public class GreetingController {

    private static final String template = "Hello, %s!";
    private final AtomicLong counter = new AtomicLong();

    @RequestMapping("/greeting")
    public Greeting greeting(@RequestParam(value="name", defaultValue="World")
        return new Greeting(counter.incrementAndGet(),
                            String.format(template, name));
    }
}
```

Spring-boot


Spring Boot simplifies configuration
You write less of this
Application components
Spring Boot
Configuration Metadata
Spring Container
Default Configuration Metadata
•Typesafe JavaConfig
•Annotations
•Legacy XML
Fully configured application
Inferred from CLASSPATH
@crichardson

Facilidad de descubrimiento (metadatos)

SOAP

- WSDL

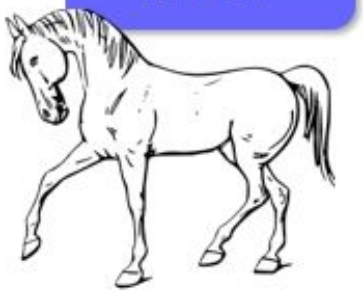
```
<wsdl:definitions name="MyCustomerTestService" targetNamespace="http://www.webservicetest.net">
  <wsdl:types>
    <xs:schema targetNamespace="http://www.webservicetest.net" elementFormDefault="qualified">
      <xs:simpleType name="CustomerId"></xs:simpleType>
      <xs:complexType name="Customer"></xs:complexType>
      <xs:complexType name="Address"></xs:complexType>
    </xs:schema>
  </wsdl:types>
  <wsdl:message name="getCustomerDataRequest">
    <wsdl:part name="CustomerRequest" type="tns:CustomerId"/>
  </wsdl:message>
  <wsdl:message name="getCustomerDataResponse">
    <wsdl:part name="CustomerResponse" type="tns:Customer"/>
  </wsdl:message>
  <wsdl:portType name="CustomerData">
    <wsdl:operation name="getCustomerData">
      <wsdl:input message="tns:getCustomerDataRequest"/>
      <wsdl:output message="tns:getCustomerDataResponse"/>
    </wsdl:operation>
  </wsdl:portType>
  <wsdl:binding name="CustomerSOAPBinding" type="tns:CustomerData">
    <soap:binding style="document" transport="http://schemas.xmlsoap.org/soap/http"/>
    <wsdl:operation name="getCustomerData">
      <soap:operation soapAction="" style="document"/>
      <wsdl:input>
        <soap:body use="literal"/>
      </wsdl:input>
      <wsdl:output>
        <soap:body use="literal"/>
      </wsdl:output>
    </wsdl:operation>
  </wsdl:binding>
  <wsdl:service name="CustomerService">
    <wsdl:port name="CustomerSOAPPort" binding="tns:CustomerSOAPBinding">
      <soap:address location="No Target Adress"/>
    </wsdl:port>
  </wsdl:service>
</wsdl:definitions>
```

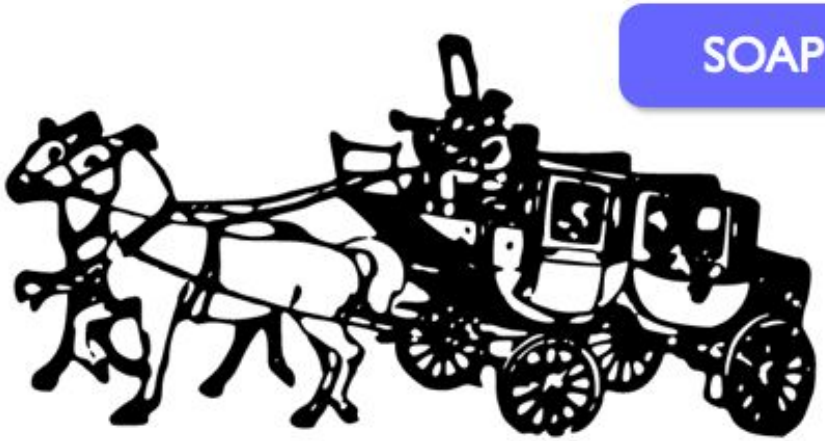
REST

- RAML

```
#%RAML 1.0
title: New API
mediaType: [ application/json, application/xml ]
types:
  Person:
  Another:
/list:
  get:
    responses:
      200:
        body: Person[]
/send:
  post:
    body:
      application/json:
        type: Another
```

Compatibilidad con estándares





Compatibilidad con estándares

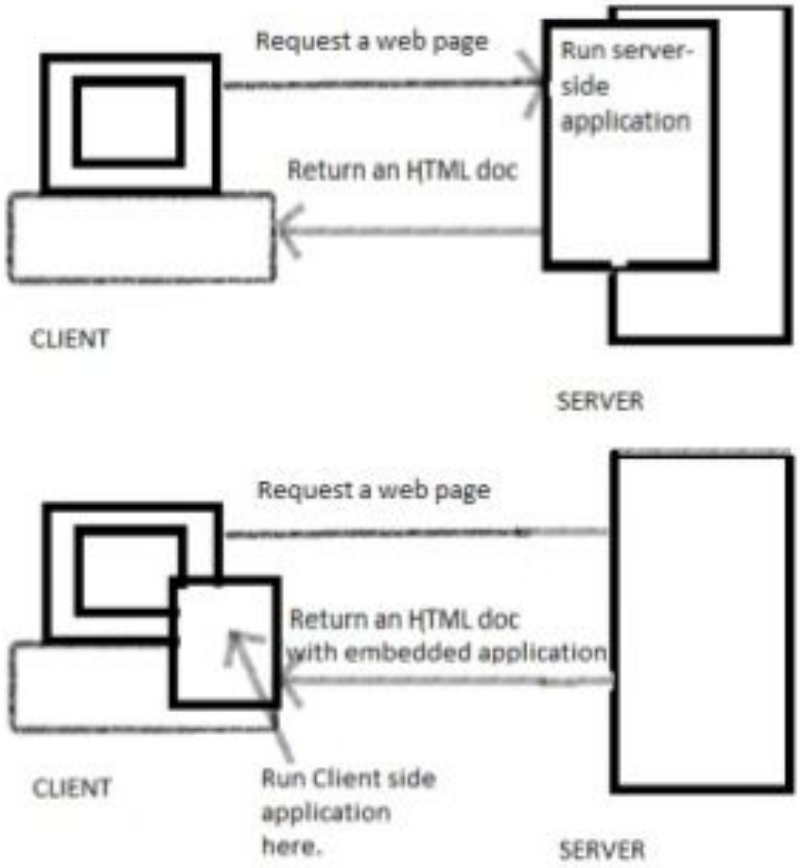
- Clientes SOAP/REST: HTTP

Mejores prácticas – APIs REST

- Recursos, no funciones (Sustantivos, no verbos)
- Las peticiones GET NUNCA deben alterar estados.
- Recursos (sustantivos) en plural.
- Usar sub-recursos a manera de relaciones.
- Parámetros GET para: filtrado, ordenamiento, selección de campos y paginación.
- Versionamiento de APIs.
- Manejar errores con códigos HTTP.
- HATEOAS - Hypermedia as the Engine of Application State

Continuamos la próxima semana!

Clientes ‘gruesos’ vs ‘delgados’



Thin Client

- All processing on server
- Round tripping to server
- Delays…

Rich Client

- Complex, dynamic
- Feature-rich UI
- Access local resources

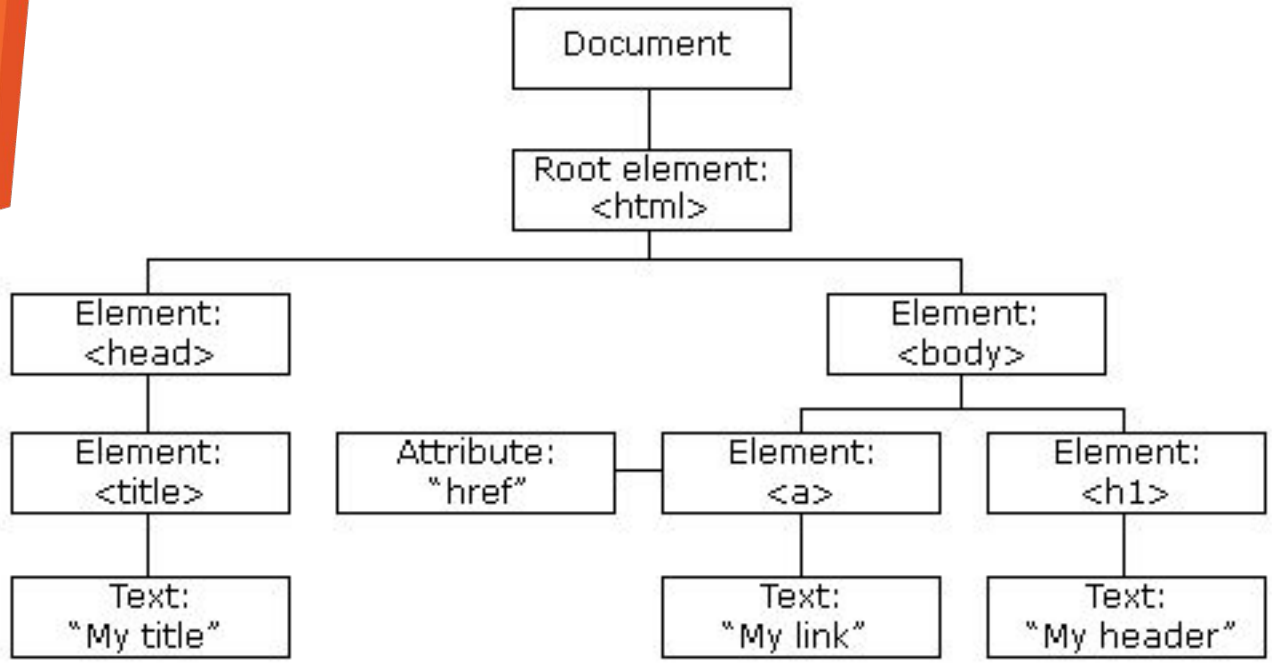
Java ORACLE

Clientes ‘gruesos’ + Servicios

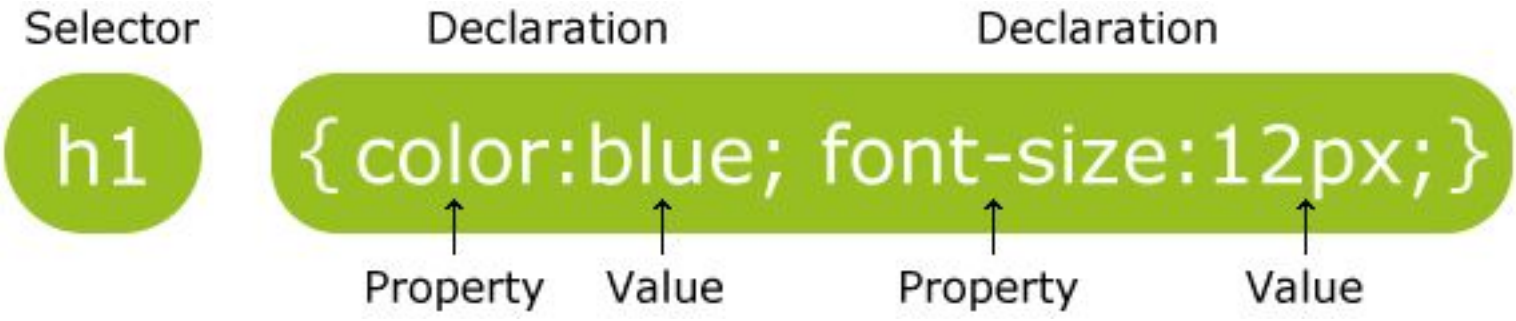
- Diferencias en consumo de recursos?
- Perspectivas en:
  - IAAS?
  - PAAS?

Clientes ‘gruesos’ Web

DOM – Document Object Model



CSS – Cascade Style Sheets

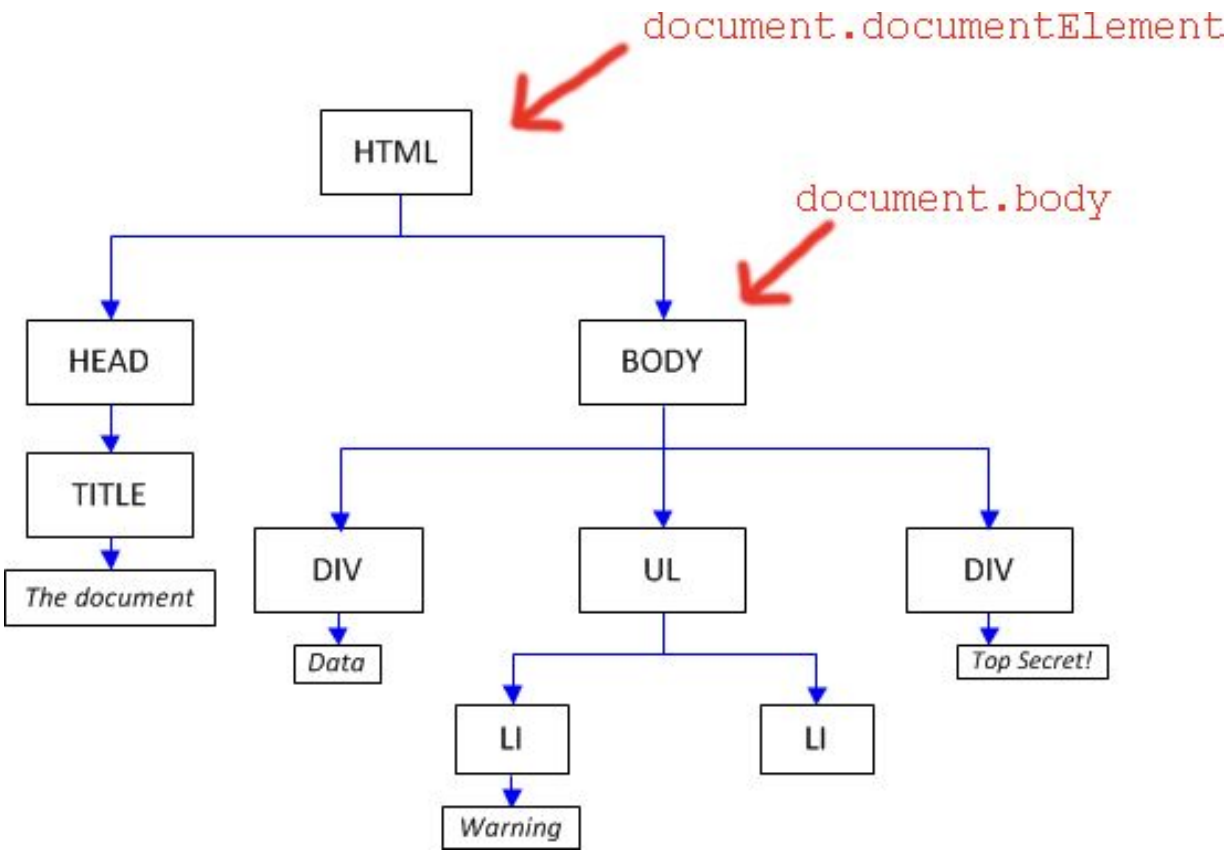


CSS Selectors

Selector	Role
p{ }	Tag selector, **all p tags**
#para{ }	Id para (***unique***)
.para1{ }	Class para1 (***multiple***)
p.para{ }	P tag with class para
P .para{}	P with child having class para
div p{}	p tag having parent div.
*{}	All tags{ **Universal Selector**}
h1, h3, h5{}	Only h1, h3 and h5 (***grouping***)
.para a{ }	A with parent para class
body{}	Parent of all tags

DOM Traversing

- Document Object

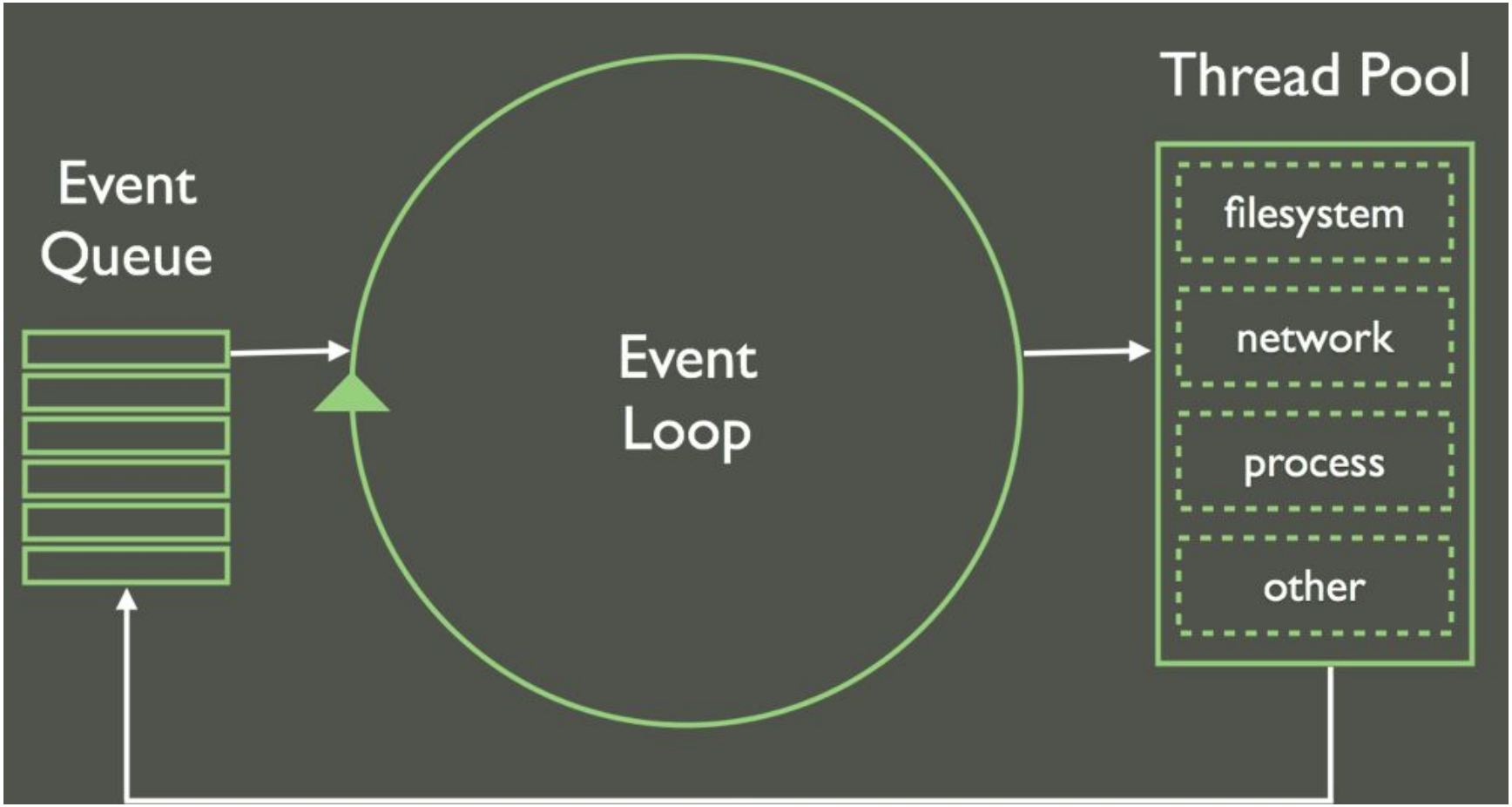


JavaScript – Client/Server (REST API)


```
function UserAction() {
    var xhttp = new XMLHttpRequest();
    xhttp.open("POST", "Your Rest URL Here", false);
    xhttp.setRequestHeader("Content-type", "application/json");
    xhttp.send();
    var response = JSON.parse(xhttp.responseText);
}
```

```
<button type="submit" onclick="UserAction()">Search</button>
```

Javascript – fp - callbacks



JavaScript – Client/Server (REST API)

- Defecto?

```
<button type="submit" onclick="UserAction()">Search</button>
```

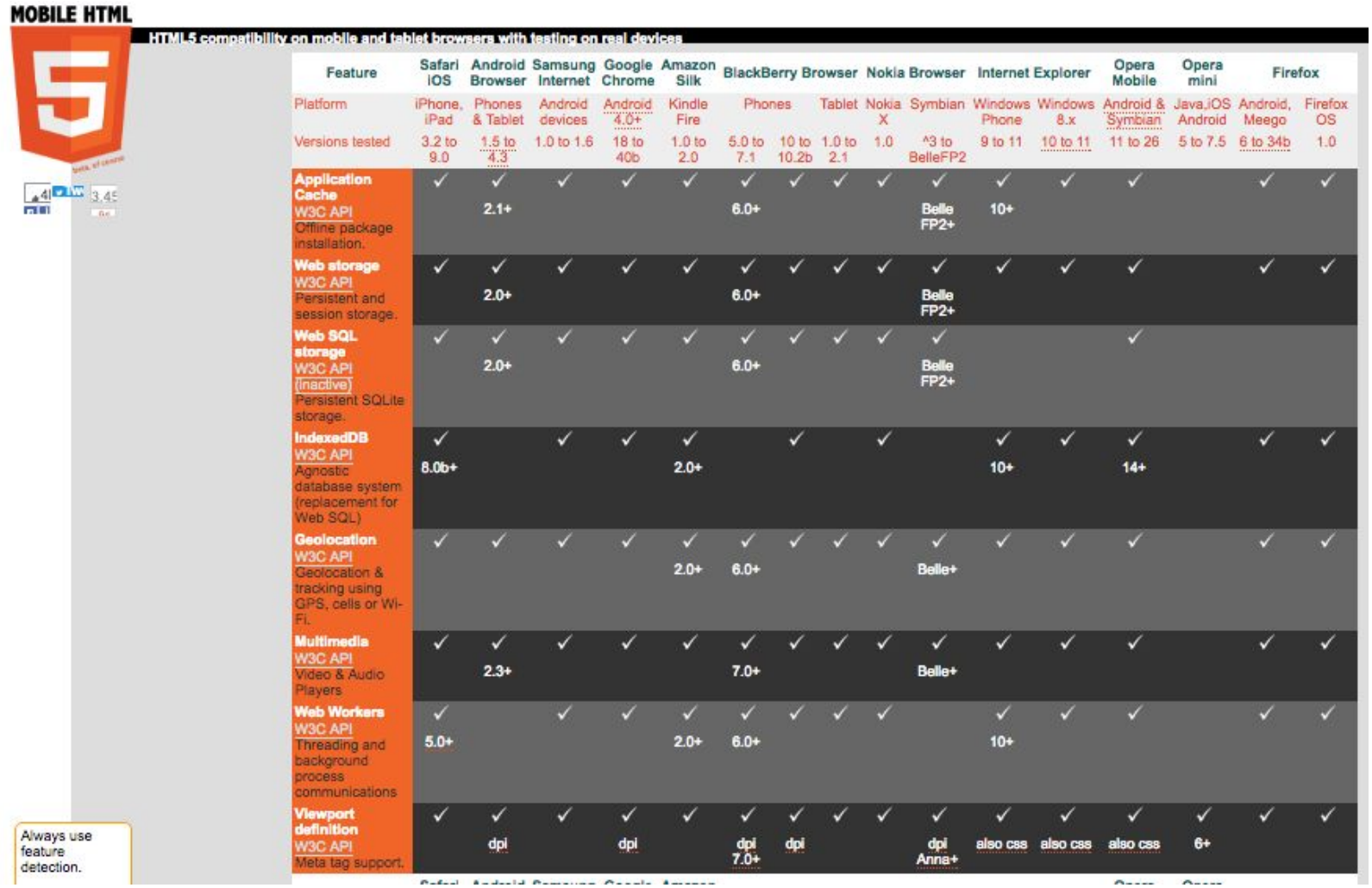
```
function UserAction() {
    var xhttp = new XMLHttpRequest();
    xhttp.open("POST", "Your Rest URL Here", false);
    xhttp.setRequestHeader("Content-type", "application/json");
    xhttp.send();
    var response = JSON.parse(xhttp.responseText);
}
```


```
<button type="submit" onclick="UserAction()">Search</button>
```

JavaScript - CallBacks

```
var xmlhttp=new XMLHttpRequest();
xmlhttp.open("POST", 'http://forexplay.net/ajax/quotes.php');
xmlhttp.onreadystatechange = function() {
    if (xmlhttp.readyState == XMLHttpRequest.DONE) {
        if(xmlhttp.status == 200){
            console.log('Response: ' + xmlhttp.responseText );
        }else{
            console.log('Error: ' + xmlhttp.statusText )
        }
    }
}
xmlhttp.send(data);
```

JavaScript Implementations (browsers)



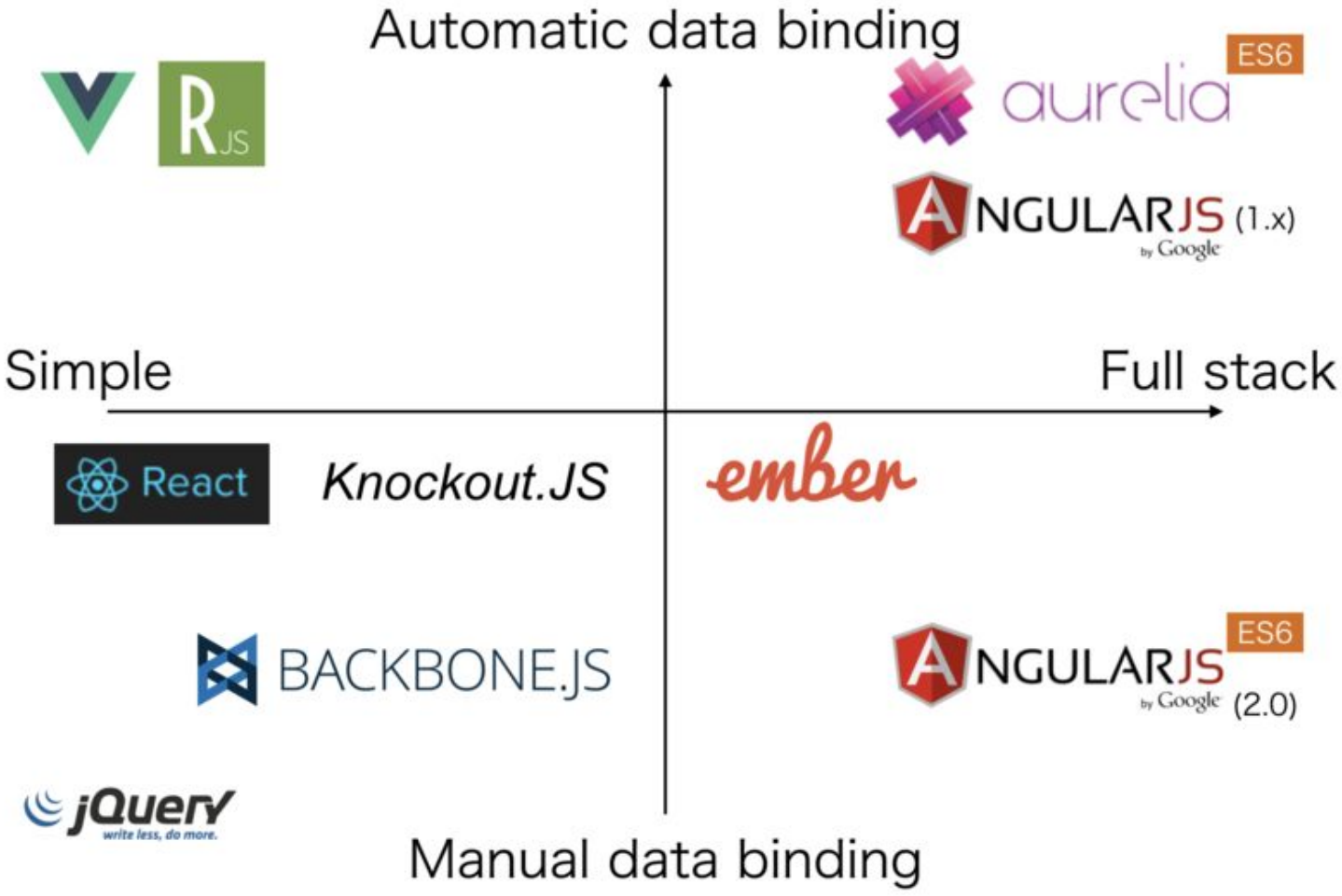
MOBILE HTML

HTML 5 compatibility on mobile and tablet browsers with testing on real devices

Feature	Safari iOS	Android Browser	Samsung Internet	Google Chrome	Amazon Silk	BlackBerry Browser			Nokia Browser		Internet Explorer		Opera Mobile	Opera mini	Firefox	
Platform	iPhone, iPad	Phones & Tablet	Android devices	Android 4.0+	Kindle Fire	Phones		Tablet	Nokia X	Symbian	Windows Phone	Windows 8.x	Android & Symbian	Java iOS Android	Android, Meego	Firefox OS
Versions tested	3.2 to 9.0	1.5 to 4.3	1.0 to 1.6	18 to 40b	1.0 to 2.0	5.0 to 7.1	10 to 10.2b	1.0 to 2.1	1.0	^3 to BelleFP2	9 to 11	10 to 11	11 to 26	5 to 7.5	6 to 34b	1.0
Application Cache W3C API Offline package installation.	✓	✓ 2.1+	✓	✓	✓	✓ 6.0+	✓	✓	✓	✓ Belle FP2+	✓ 10+	✓	✓		✓	✓
Web storage W3C API Persistent and session storage.	✓	✓ 2.0+	✓	✓	✓	✓ 6.0+	✓	✓	✓	✓ Belle FP2+	✓	✓	✓		✓	✓
Web SQL storage W3C API (inactive) Persistent SQLite storage.	✓	✓ 2.0+	✓	✓	✓	✓ 6.0+	✓	✓	✓	✓ Belle FP2+			✓			
IndexedDB W3C API Agnostic database system (replacement for Web SQL)	✓ 8.0b+		✓	✓	✓ 2.0+		✓		✓		✓ 10+	✓	✓ 14+		✓	✓
Geolocation W3C API Geolocation & tracking using GPS, cells or Wi-Fi.	✓	✓	✓	✓	✓ 2.0+	✓ 6.0+	✓	✓	✓	✓ Belle+	✓	✓	✓		✓	✓
Multimedia W3C API Video & Audio Players	✓	✓ 2.3+	✓	✓	✓	✓ 7.0+	✓	✓	✓	✓ Belle+	✓	✓	✓		✓	✓
Web Workers W3C API Threading and background process communications	✓ 5.0+		✓	✓	✓ 2.0+	✓ 6.0+	✓	✓	✓		✓ 10+	✓	✓		✓	✓
Viewport definition W3C API Meta tag support.	✓	✓ dpi	✓	✓ dpi	✓	✓ dpi 7.0+	✓ dpi	✓	✓	✓ dpi Anna+	✓ also css	✓ also css	✓ also css	✓ 6+	✓	✓

Always use feature detection.

JavaScript Frameworks



JavaScript – Callbacks

- Escenario:
  - Se quiere agregar un ítem a un pedido, y una vez hecho esto recalcular y actualizar el valor mostrado en la vista:
  - Operaciones:
    - $.POST('/pedidos/23/items', {nombre:"papas",precio:2332})
    - $.GET('/pedidos/23/total',….)
    - actualizarVista(valor)

JavaScript – callback hell

```
a(function (resultsFromA) {
  b(resultsFromA, function (resultsFromB) {
    c(resultsFromB, function (resultsFromC) {
      d(resultsFromC, function (resultsFromD) {
        e(resultsFromD, function (resultsFromE) {
          f(resultsFromE, function (resultsFromF) {
            console.log(resultsFromF);
          })
        })
      })
    })
  })
});
```

Promesas JavaScript

- Promesa: objeto javascript que representa un valor ‘eventual’ (existirá en el futuro).
- Como alternativa a los ’callbacks’, los métodos pueden retornar de forma inmediata una promesa.
- Una promesa puede ser:
  - Cumplida
  - Rechazada (por un error)
  - Pendiente (no cumplida aún).

Promesas JavaScript

- Toda promesa tienen una función '.then()' asociada que acepta:
  - La función que se realizará cuando se cumpla.
  - La función que se realizará cuando haya un error.
- Cada promesa retorna una promesa.

```
hacerConPromesa()
.then(function (value) {
  // handle success here
}, function (error) {
  // handle error here
});
```