WEB SERVICES

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Solutions

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Module agenda

1. Intro to business to business communication

2. Give an example why and when we need to exchange data between systems (Expedia, weather on BBC and Yahoo, using ATM machine from different banks)

3. Explain structure of web services

4. Give definition of web services

5. Two types of web services

6. REST (JSON format using as an example how to store books)

7. SOAP (XML format using as an example how to store books. WSDL with structure explanation)

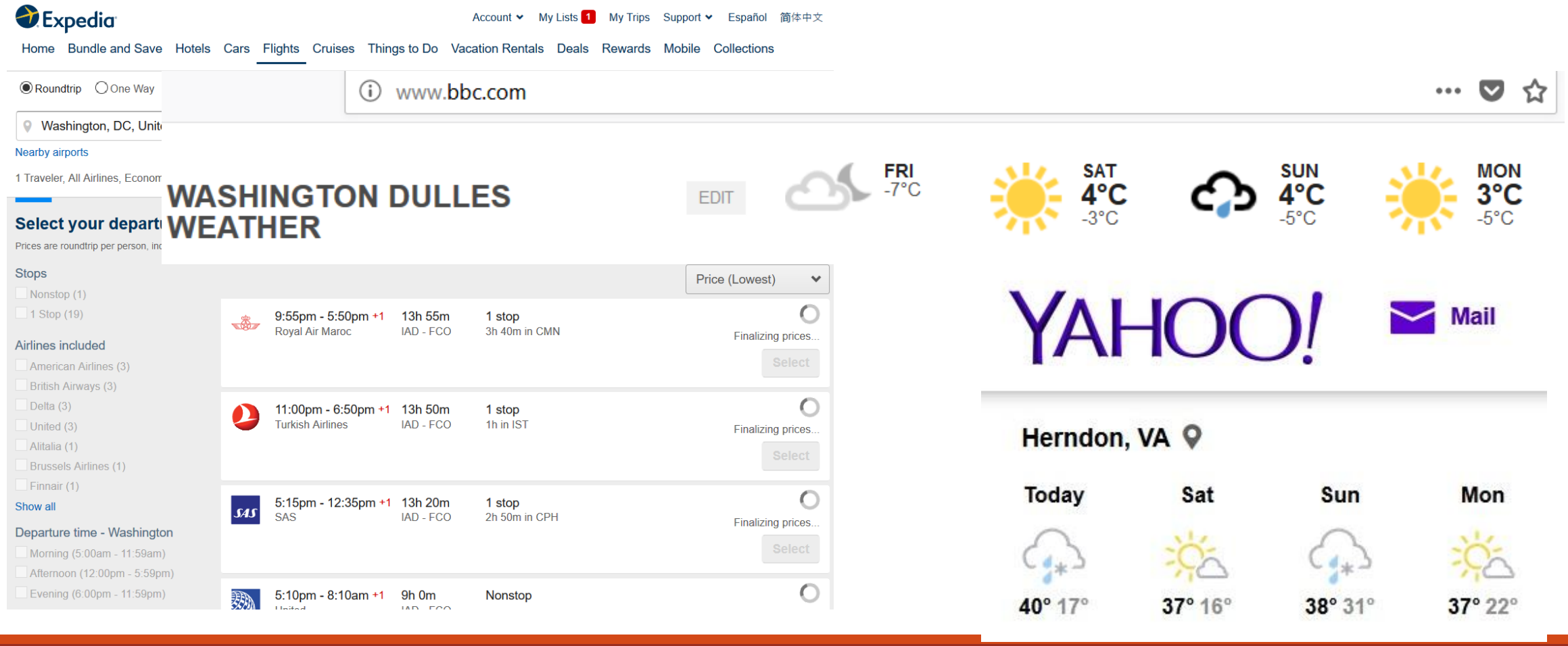
8. Difference between two types of web services (*) Synchronous and asynchronous web services

9. What to test in web services (format, structure, data, performance, security)

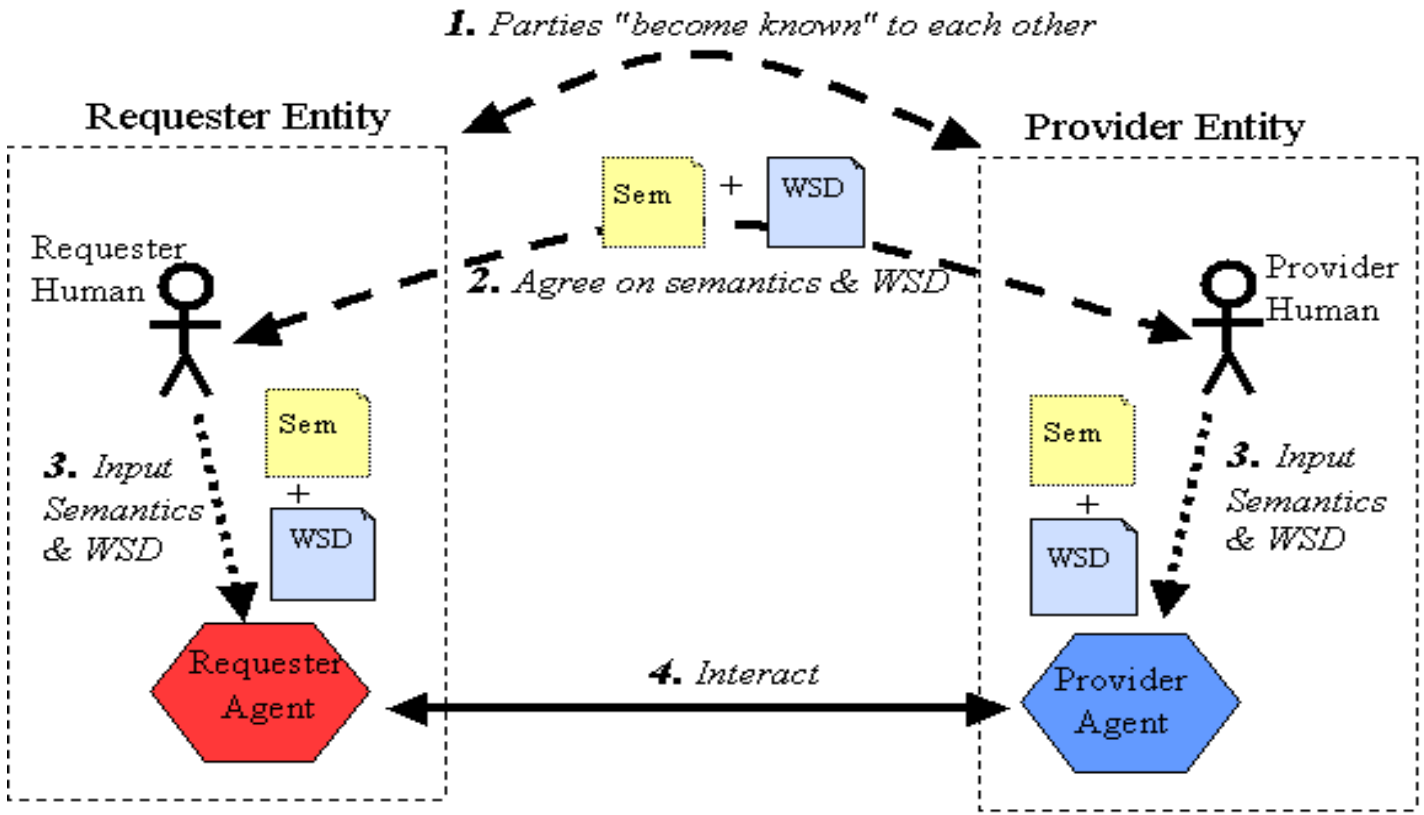
10. Tools to test web services: Postman for REST, SoapUI for both.

11. Create test cases and assertions. As examples use get country by country code for REST and Medicare for SOAP

Examples why and when we need to exchange data between systems



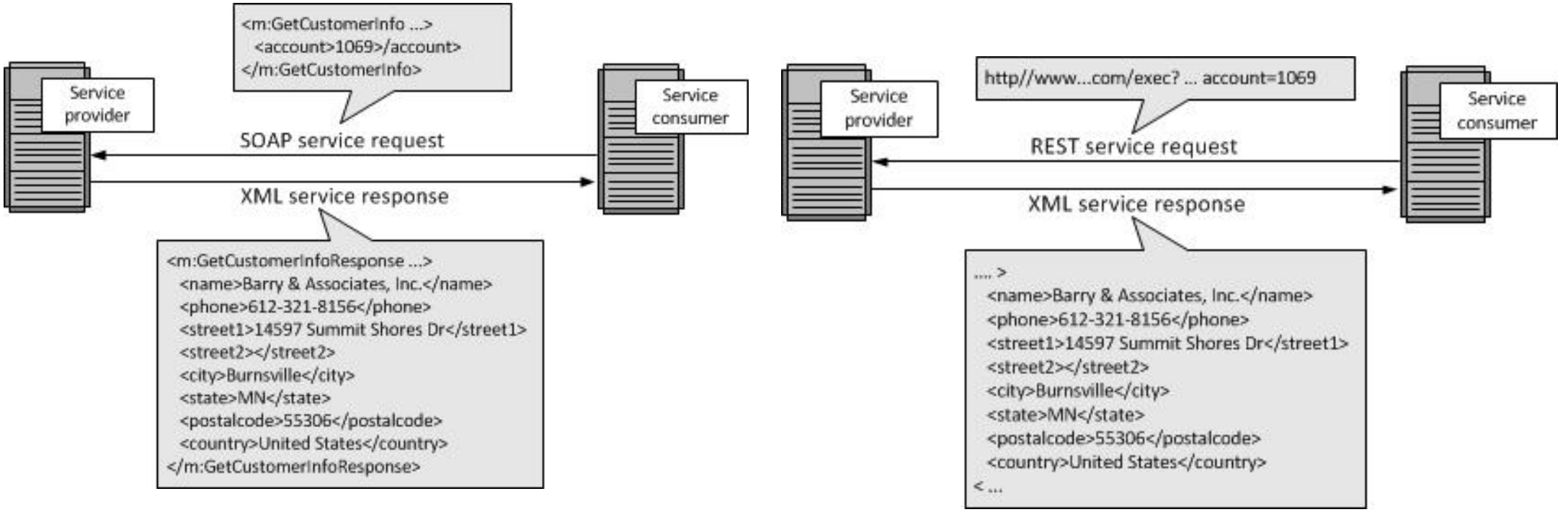
Intro to business to business communication



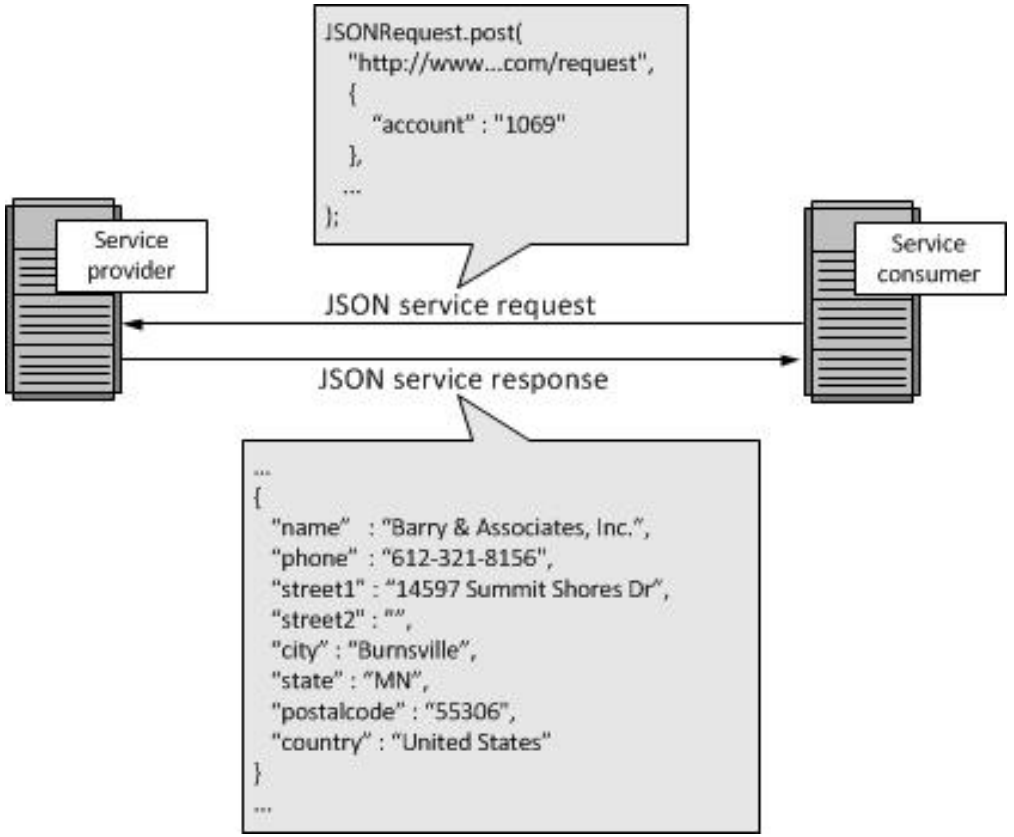
Give definition of web services

- The term *Web services* describes a standardized way of integrating Web-based applications using the XML, SOAP, WSDL standards over an Internet protocol backbone.
- XML is used to tag the data, SOAP is used to transfer the data, WSDL is used for describing the services available and UDDI is used for listing what services are available.
- Used primarily as a means for businesses to communicate with each other and with clients, Web services allow organizations to communicate data without intimate knowledge of each other's IT systems behind the firewall.
- Unlike traditional client/server models, such as a Web server/Web page system, Web services do not provide the user with a GUI. Web services instead share business logic, data and processes through a programmatic interface across a network. The applications interface, not the users.
- Web services allow different applications from different sources to communicate with each other without time-consuming custom coding, and because all communication is in XML, Web services are not tied to any one operating system or programming language.
- For example, Java can talk with Perl, Windows applications can talk with UNIX applications.

Two types of web services



REST


JSONRequest.post(
"http://www...com/request",
{
"account" : "1069"
},
...
);
Service provider
Service consumer
JSON service request
JSON service response
...
{
"name" : "Barry & Associates, Inc.",
"phone" : "612-321-8156",
"street1" : "14597 Summit Shores Dr",
"street2" : "",
"city" : "Burnsville",
"state" : "MN",
"postalcode" : "55306",
"country" : "United States"
}
...

books.json

Raw


```
{
  "books": [
    {
      "isbn": "9781593275846",
      "title": "Eloquent JavaScript, Second Edition",
      "subtitle": "A Modern Introduction to Programming",
      "author": "Marijn Haverbeke",
      "published": "2014-12-14T00:00:00.000Z",
      "publisher": "No Starch Press",
      "pages": 472,
      "description": "JavaScript lies at the heart of almost every modern web application, from social apps to the newest browser-based gam
      "website": "http://eloquentjavascript.net/"
    },
    {
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      "title": "Learning JavaScript Design Patterns",
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      "published": "2012-07-01T00:00:00.000Z",
      "publisher": "O'Reilly Media",
      "pages": 254,
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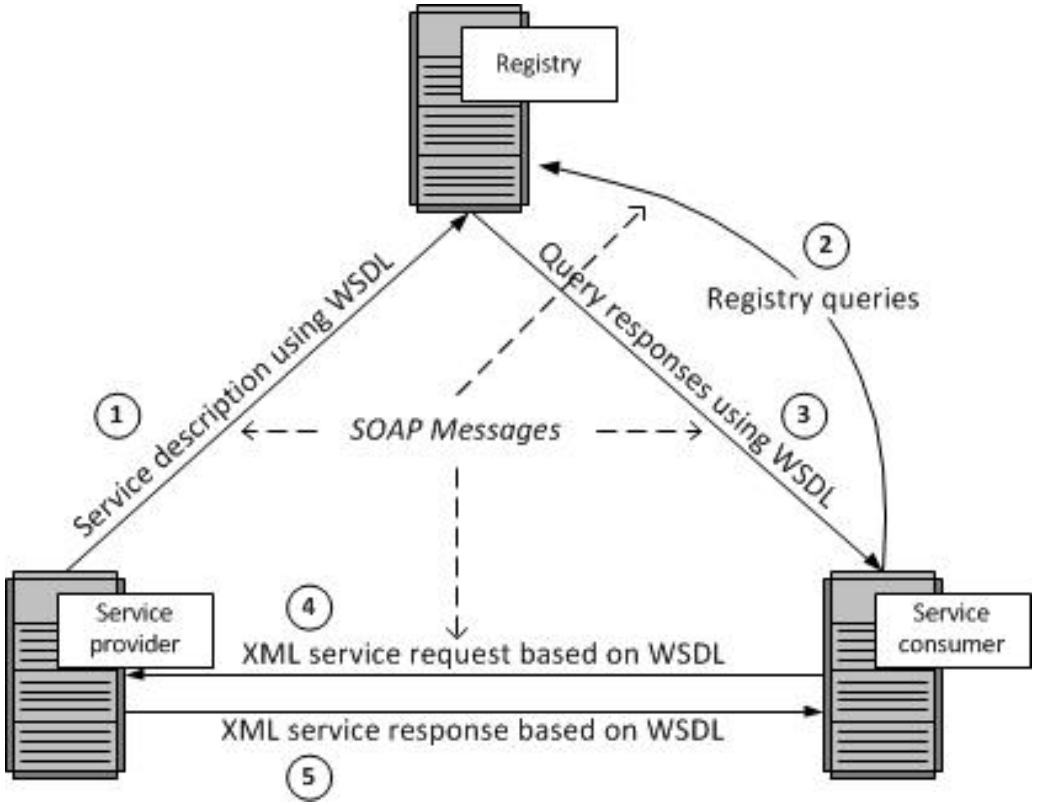
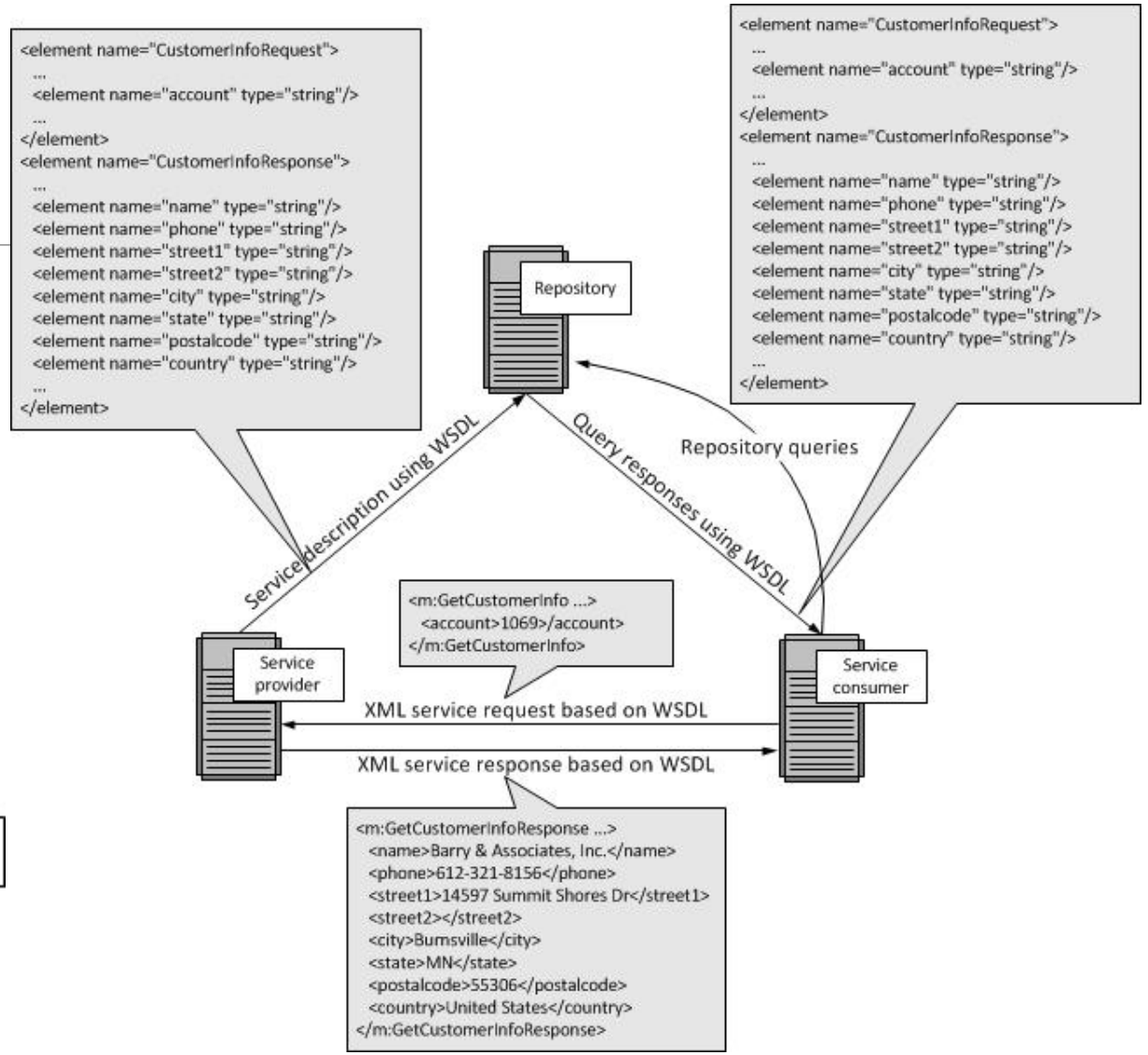
SOAP


Registry
Service description using WSDL
Query responses using WSDL
Registry queries
SOAP Messages
Service provider
Service consumer
XML service request based on WSDL
XML service response based on WSDL
1
2
3
4
5


<element name="CustomerInfoRequest">
...
<element name="account" type="string"/>
...
</element>
<element name="CustomerInfoResponse">
...
<element name="name" type="string"/>
<element name="phone" type="string"/>
<element name="street1" type="string"/>
<element name="street2" type="string"/>
<element name="city" type="string"/>
<element name="state" type="string"/>
<element name="postalcode" type="string"/>
<element name="country" type="string"/>
...
</element>
Repository
Service description using WSDL
Query responses using WSDL
Repository queries
<m:GetCustomerInfo ...>
<account>1069</account>
</m:GetCustomerInfo>
Service provider
Service consumer
XML service request based on WSDL
XML service response based on WSDL
<m:GetCustomerInfoResponse ...>
<name>Barry & Associates, Inc.</name>
<phone>612-321-8156</phone>
<street1>14597 Summit Shores Dr</street1>
<street2></street2>
<city>Burnsville</city>
<state>MN</state>
<postalcode>55306</postalcode>
<country>United States</country>
</m:GetCustomerInfoResponse>

XML format

XML

```xml
<?xml version="1.0"?>
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   <book id="bk101">
      <author>Gambardella, Matthew</author>
      <title>XML Developer's Guide</title>
      <genre>Computer</genre>
      <price>44.95</price>
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      <description>An in-depth look at creating applications
      with XML.</description>
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      <genre>Fantasy</genre>
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      foundation for a new society.</description>
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```
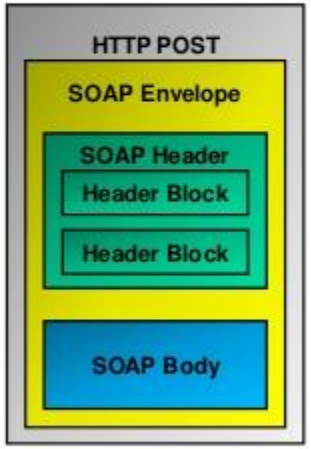

SOAP (WSDL with structure explanation)

SOAP - WSDL - UDDI

4. SOAP (4/12)

SOAP message exchange mechanism (3/5):
SOAP defines a generic structure of an abstract message.
Elements of a SOAP message:



SOAP Envelope:
The envelope (=root element of SOAP message) is a
for the optional SOAP header and the mandatory
SOAP body element.

SOAP Header:
The SOAP header may carry control information whi
not application payload.
Such information is organized in header blocks, eacl
its individual XML namespace defining the schema.
The SOAP header is extensible, i.e. arbitrary namesp
a particular way of message processing can be "wov
the header.

SOAP Body:
The SOAP body carries the actual application inform
encoded as an XML document. The schema of the bc
defined by a WSDL document.

WSDL File (Four Elements)

```
<definitions>

<types>
  data type definitions.....
</types>

<message>
  definition of the data being communicated
</message>

<portType>
  set of operations.....
</portType>

<binding>
  protocol and data format specification....
</binding>

</definitions>
```

Types: XML data types for all input and output messages in the service

Message: Defines the input & output parameters for each operation

PortType: Operations (functions) offered by the web service

Binding: Defines protocol and data format for each port type

SOAP (WSDL with structure explanation)

Difference between two types of web services

#	SOAP	REST
1	A XML-based message protocol	An architectural style protocol
2	Uses WSDL for communication between consumer and provider	Uses XML or JSON to send and receive data
3	Invokes services by calling RPC method	Simply calls services via URL path
4	Does not return human readable result	Result is readable which is just plain XML or JSON
5	Transfer is over HTTP. Also uses other protocols such as SMTP, FTP, etc.	Transfer is over HTTP only
6	JavaScript can call SOAP, but it is difficult to implement	Easy to call from JavaScript
7	Performance is not great compared to REST	Performance is much better compared to SOAP - less CPU intensive, leaner code etc.

Difference between two types of web services

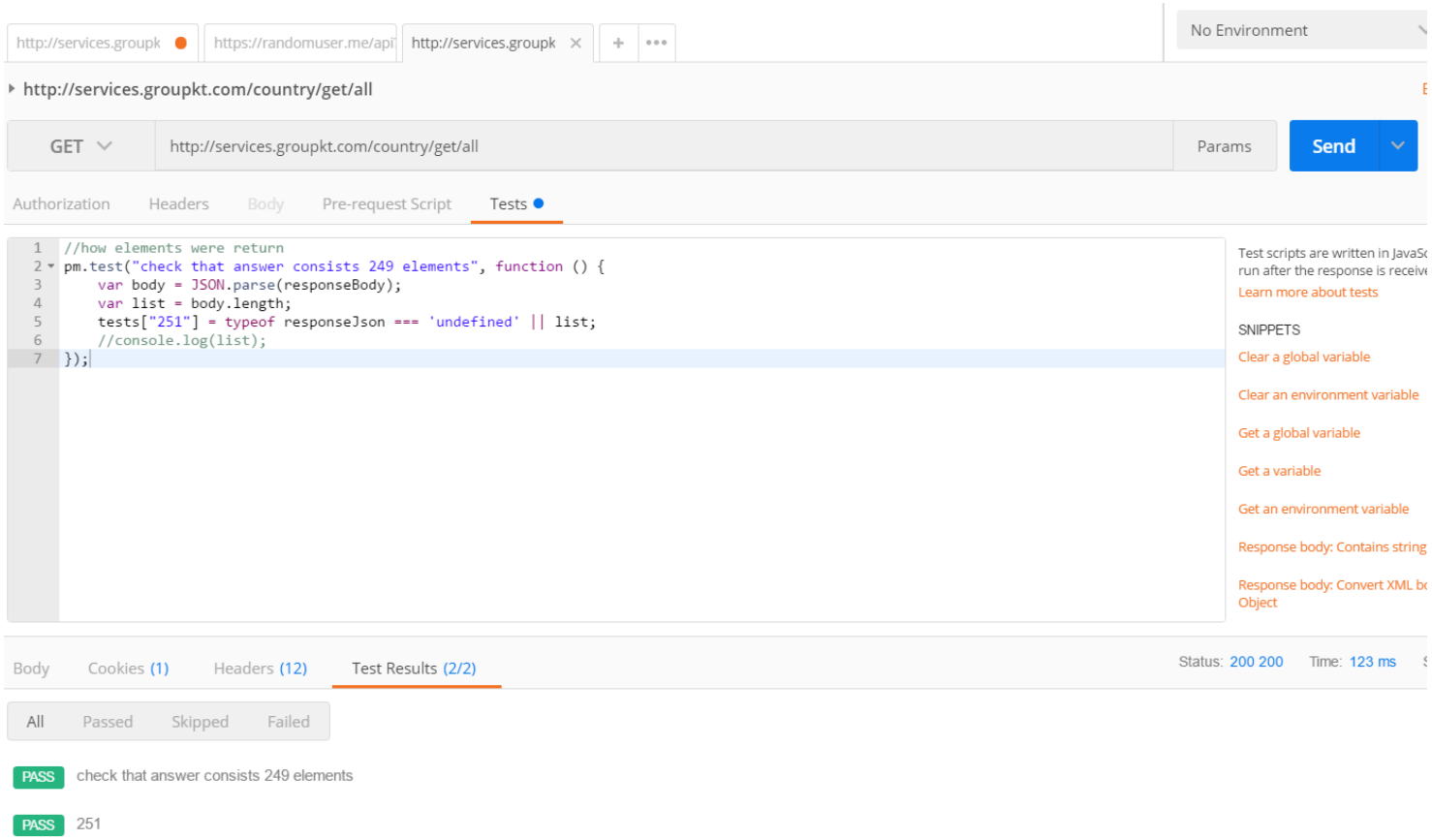
	SOAP	REST
Acronyme	Simple Object Access Protocol	REpresentational State Transfer
Architecture	SOA based architecture that use middleware interoperability.	Architecture style protocol designed for web based communication assuming only point to point communication.
Message Format	XML inside a SOAP Envelope	XML
In business logic	Uses services interfaces to expose the business logic.	Uses URI to expose business logic.
Standards	Defines standards to be strictly followed.	Does not define too much standards like SOAP.
Communication	Use WSDL for communication between consumer and provider.	Uses XML or JSON to send and receive data.
Transport	Transfer is over HTTP, Also uses other protocols such as SMTP, FTP, MIME, JMS, HHTP, etc.	Transfer is over HTTP only.
JavaScript calls	JavaScript can call SOPA but it is difficult to implement.	Easy to call from Javascript.
Security	SOAP defines its own security.	RESTful web services inherits security measures from the underlying transport.
Payload	Payload must support SOAP schema.	Payload can be of any format.
Error Handling	Doesn't support error handling.	Has built-in error handling.
External Calls	Invokes services by calling RPC method.	Simply calls services via URL path.

What to test in web services

- FORMAT
- STRUCTURE
- DATA
- PERFORMANCE
- SECURITY

Tools to test web services: Postman for REST, SoapUI for both.

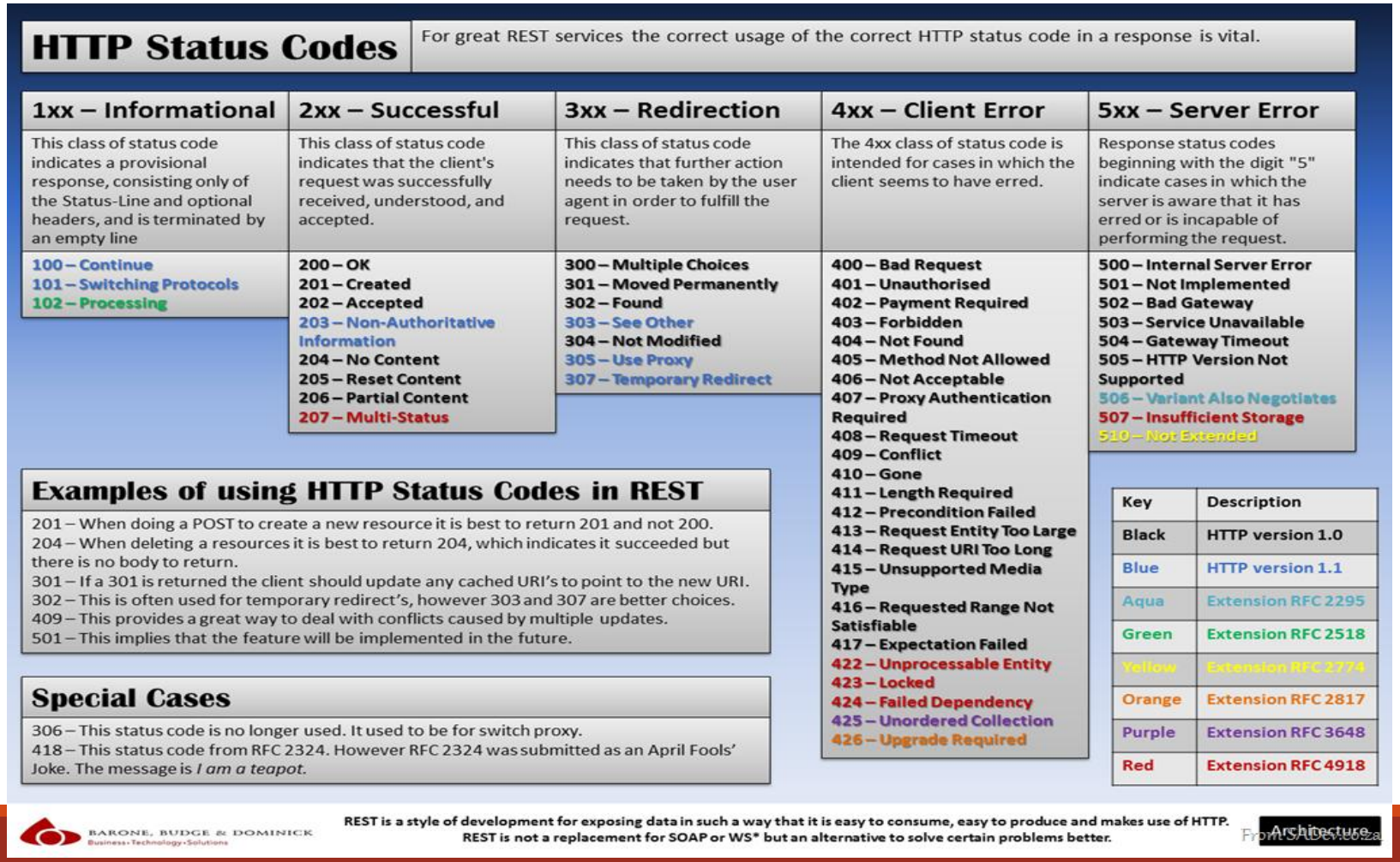
Create test cases and assertions. As examples use get country by country code for REST



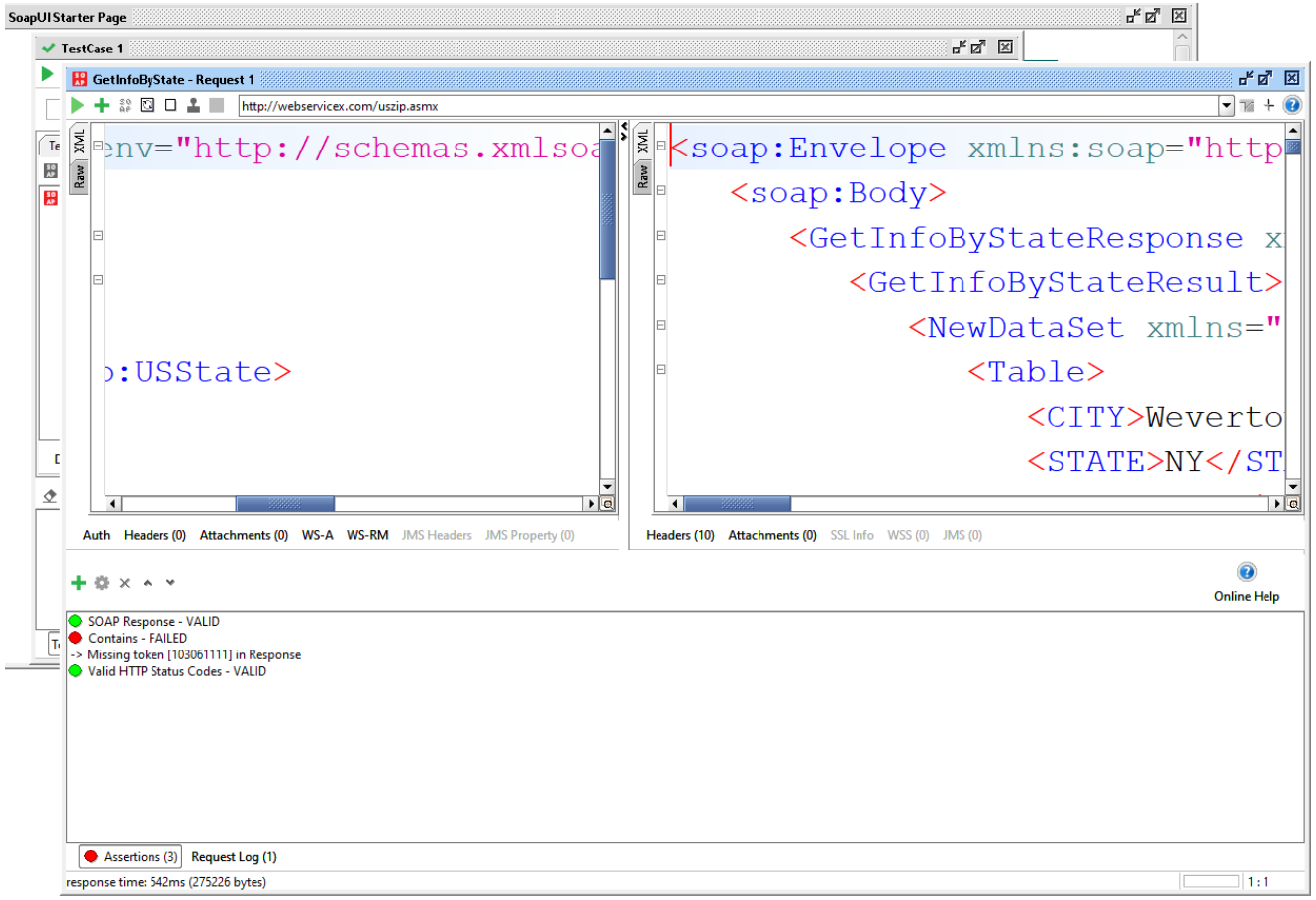
HTTP Methods for RESTful Services

HTTP Verb	CRUD	Entire Collection (e.g. /customers)	Specific Item (e.g. /customers/{id})
POST	Create	201 (Created), 'Location' header with link to /customers/{id} containing new ID.	404 (Not Found), 409 (Conflict) if resource already exists..
GET	Read	200 (OK), list of customers. Use pagination, sorting and filtering to navigate big lists.	200 (OK), single customer. 404 (Not Found), if ID not found or invalid.
PUT	Update/Replace	405 (Method Not Allowed), unless you want to update/replace every resource in the entire collection.	200 (OK) or 204 (No Content). 404 (Not Found), if ID not found or invalid.
PATCH	Update/Modify	405 (Method Not Allowed), unless you want to modify the collection itself.	200 (OK) or 204 (No Content). 404 (Not Found), if ID not found or invalid.
DELETE	Delete	405 (Method Not Allowed), unless you want to delete the whole collection—not often desirable.	200 (OK). 404 (Not Found), if ID not found or invalid.

HTTP Status Codes



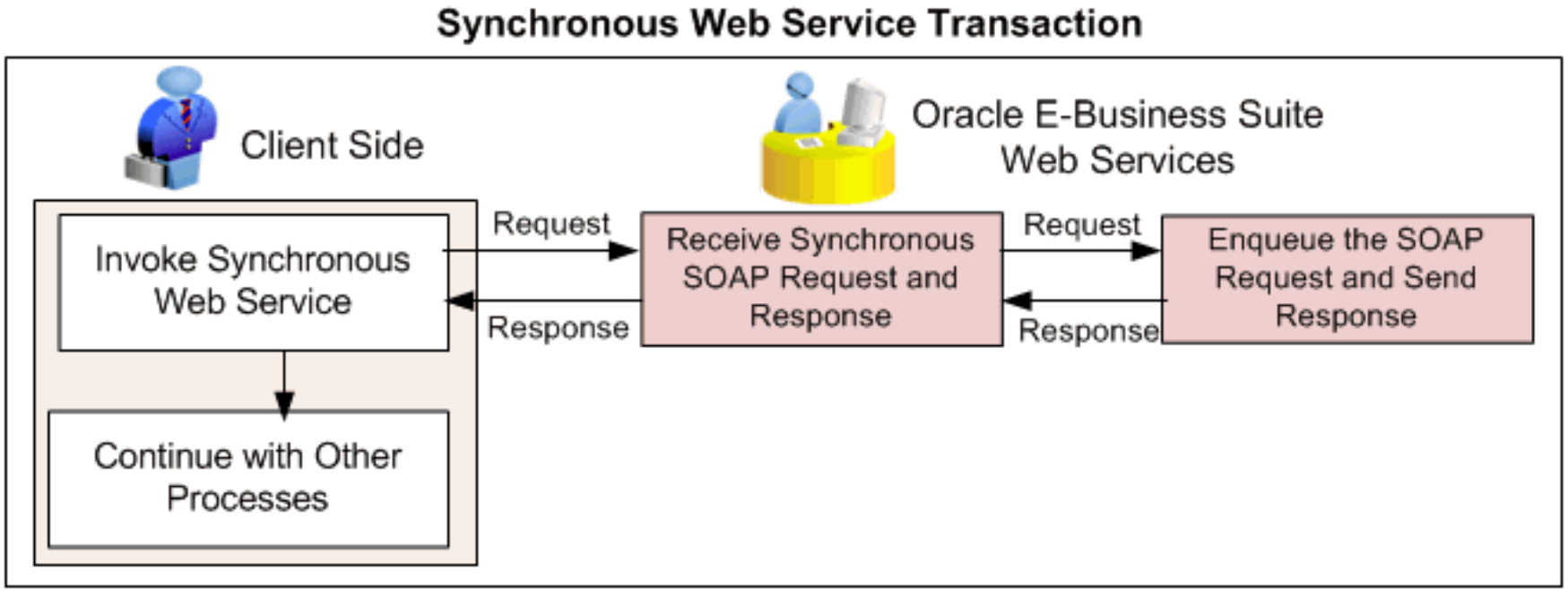
Create test cases and assertions. As examples use Medicare by zip for SOAP



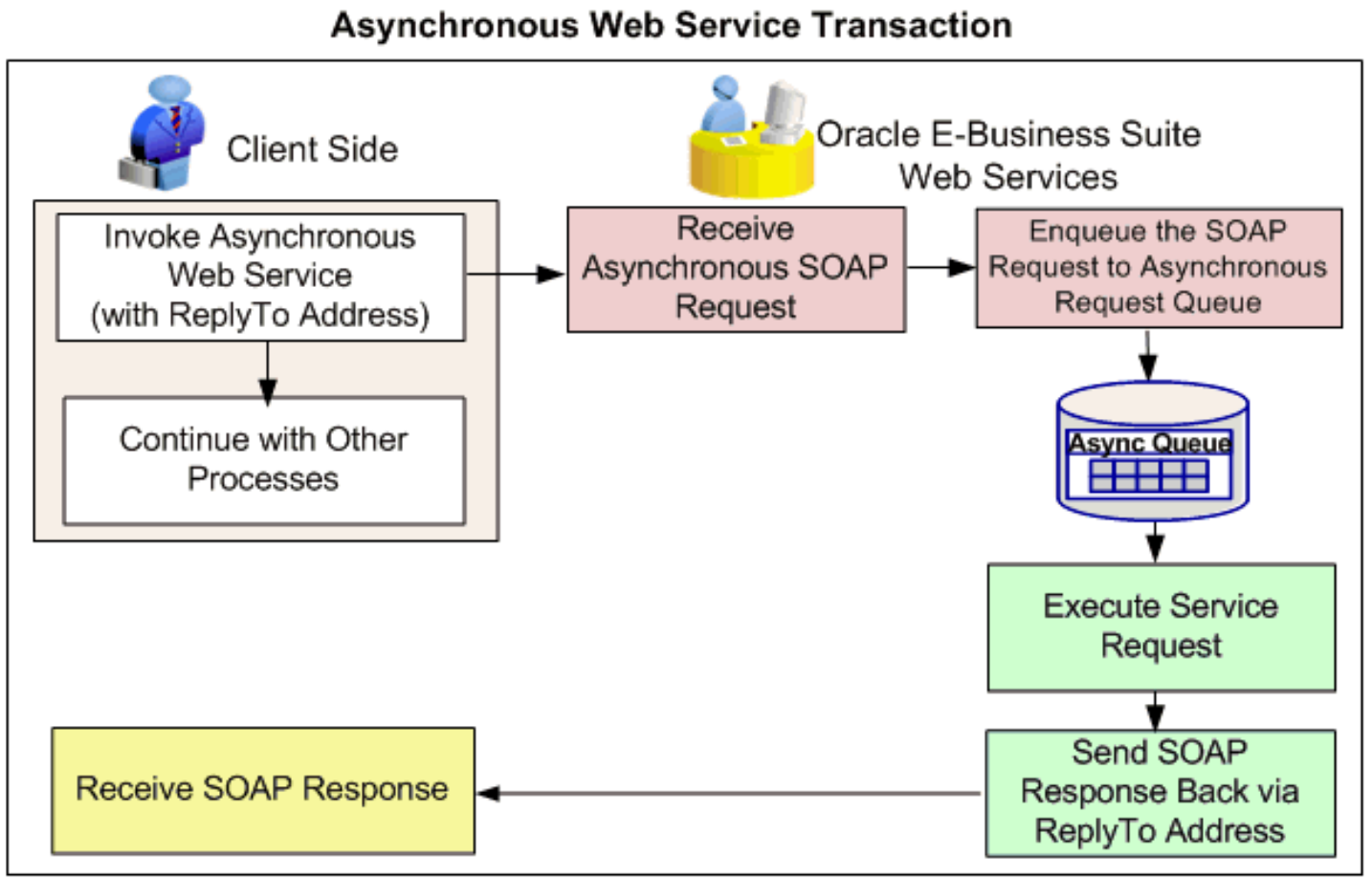
Performance testing with SoapUI

Only demonstration without testing (because we are using third parties web services)

Synchronous web services



Asynchronous web services



Thank you

Questions

Suggestions