XML Processing and Web Services

Chapter 19

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Fundamentals of Web Development

Chapter 19

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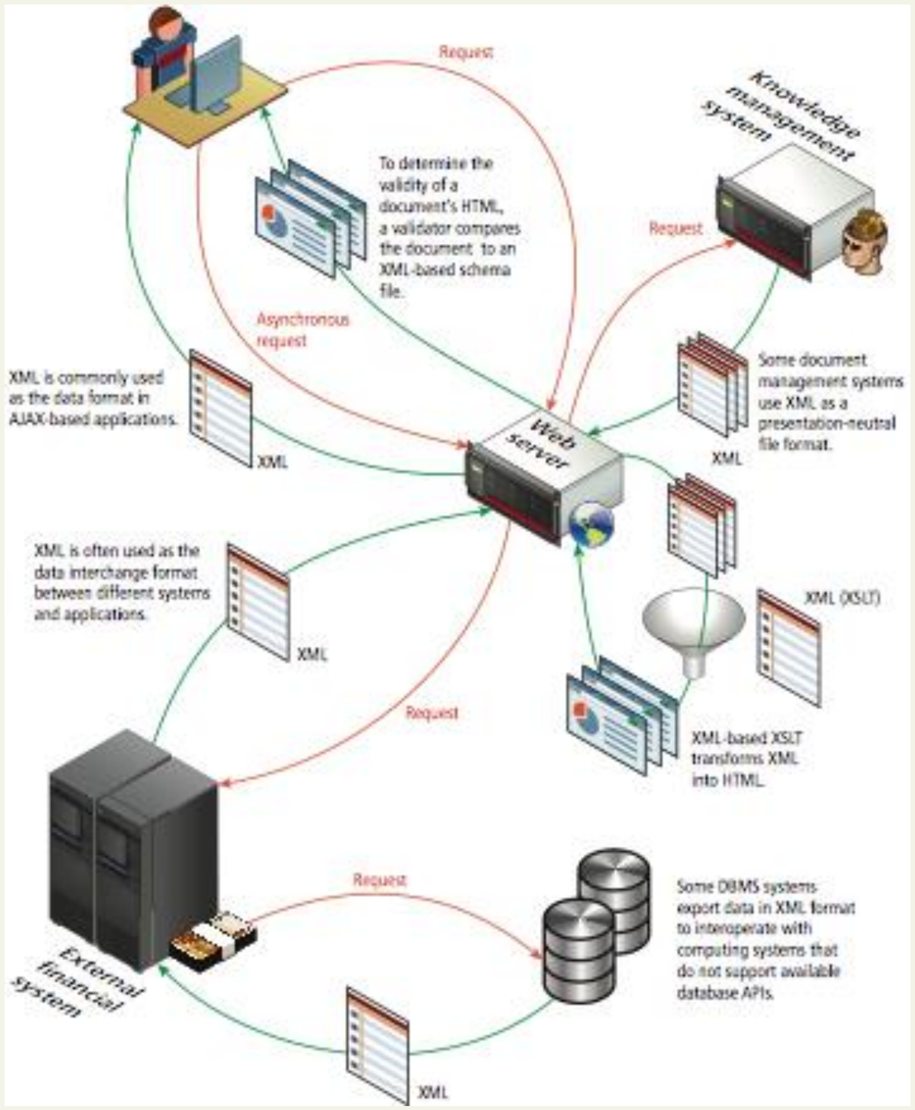
XML Overview

- Recall XML is a markup language, but unlike HTML, XML can be used to mark up any type of data
- One key benefit of XML data is that as plain text, it can be read and transferred between applications and different operating systems
- XML is used on the web server to communicate asynchronously with the browser
- used as a data interchange format for moving information between systems

XML Overview


Request
Knowledge management system
To determine the validity of a document's HTML, a validator compares the document to an XML-based schema file.
Request
Asynchronous request
XML is commonly used as the data format in AJAX-based applications.
XML
Web server
Some document management systems use XML as a presentation-neutral file format.
XML
XML is often used as the data interchange format between different systems and applications.
XML
XML (XSLT)
Request
XML-based XSLT transforms XML into HTML.
Request
Some DBMS systems export data in XML format to interoperate with computing systems that do not support available database APIs.
External financial system
XML

XML Overview

Well-Formed XML

- Element names are composed of any of the valid characters
- Element names can’t start with a number.
- There must be a single-root element.
- All elements must have a closing element (or be self-closing).
- Elements must be properly nested.
- Elements can contain attributes.
- Attribute values must always be within quotes.
- Element and attribute names are case sensitive.

XML Overview

Well-Formed XML Simplified Example

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<art>
		<painting id="290">
				<title>Balcony</title>
				<artist>
						<name>Manet</name>
						<nationality>France</nationality>
				</artist>
				<year>1868</year>
				<medium>Oil on canvas</medium>
		</painting>
</art>
```

XML Overview

Valid XML

A valid XML document is one that is well formed and whose element and content conform to the rules of either its document type definition (DTD) or its schema

- DTDs tell the XML parser which elements and attributes to expect in the document as well as the order and nesting of those elements
- A DTD can be defined within an XML document or within an external file.

XML Overview

Example Document Type Definition (DTD)

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE art [
<!ELEMENT art (painting*)>
<!ELEMENT painting (title,artist,year,medium)>
<!ATTLIST painting id CDATA #REQUIRED>
<!ELEMENT title (#PCDATA)>
<!ELEMENT artist (name,nationality)>
<!ELEMENT name (#PCDATA)>
<!ELEMENT nationality (#PCDATA)>
<!ELEMENT year (#PCDATA)>
<!ELEMENT medium (#PCDATA)>
]>
<art>
...
</art>
```

Chapter 19

XML Processing

XML Processing in JavaScript

- The in-memory approach , which involves reading the entire XML file into memory
- The event or pull approach , which lets you pull in just a few elements or lines at a time

XML Processing

XML Processing in JavaScript

```
if (window.XMLHttpRequest) {
        // code for IE7+, Firefox, Chrome, Opera, Safari
        var xmlhttp = new XMLHttpRequest()
}
else {
        // code for old versions of IE (optional)
        var xmlhttp = new ActiveXObject("Microsoft.XMLHTTP");
}
// load the external XML file
xmlhttp.open("GET","art.xml",false);
xmlhttp.send();
var xmlDoc = xmlhttp.responseXML;
// now extract a node list of all <painting> elements
var paintings = xmlDoc.getElementsByTagName("painting");
```

XML Processing

XML Processing in jQuery

```
var art = '<?xml version="1.0" encoding="ISO-8859-1"?>';

art += '<art><painting id="290"><title>Balcony ... </art>';

// use jQuery parseXML() function to create the DOM object

var xmlDoc = $.parseXML(art);

// convert DOM object to jQuery object

var xml = $(xmlDoc);

// find all the painting elements

var paintings = xml.find("painting"); //…
```

XML Processing

XML Processing in PHP

- The DOM extension
- SimpleXML extension,
- XML parse
- XMLReader
- Combining XMLReader and SimpleXML

XML Processing

SimpleXML

```
<?php
$filename = 'art.xml';
if (file_exists($filename)) {
        $art = simplexml_load_file($filename);
        // access a single element
        $painting = $art->painting[0];
        echo '<h2>' . $painting->title . '</h2>';
```

XML Processing

XPath with SImpleXML

```
$art = simplexml_load_file($filename);

$titles = $art->xpath('/art/painting/title');

foreach ($titles as $t) {

        echo $t . '<br/>';

}

$names = $art->xpath('/art/painting[year>1800]/artist/name');

foreach ($names as $n) {

        echo $n . '<br/>';

}
```

XML Processing

XMLReader

```
$filename = 'art.xml';
if (file_exists($filename)) {
      // create and open the reader
      $reader = new XMLReader();
      $reader->open($filename);
      // loop through the XML file
      while ( $reader->read() ) {
            //…
```

XML Processing

Combining XMLReader with SimpleXML

```
//…
while($reader->read()) {
        $nodeName = $reader->name;
        if ($reader->nodeType == XMLREADER::ELEMENT
                && $nodeName =='painting') {
                // create a SimpleXML object from the current painting node
                $doc = new DOMDocument('1.0', 'UTF-8');
                $painting = simplexml_import_dom($doc->importNode(
                                                $reader->expand(),true));
                // now have a single painting
                echo '<h2>' . $painting->title . '</h2>';
                echo '<p>By ' . $painting->artist->name . '</p>';
        }
}
```

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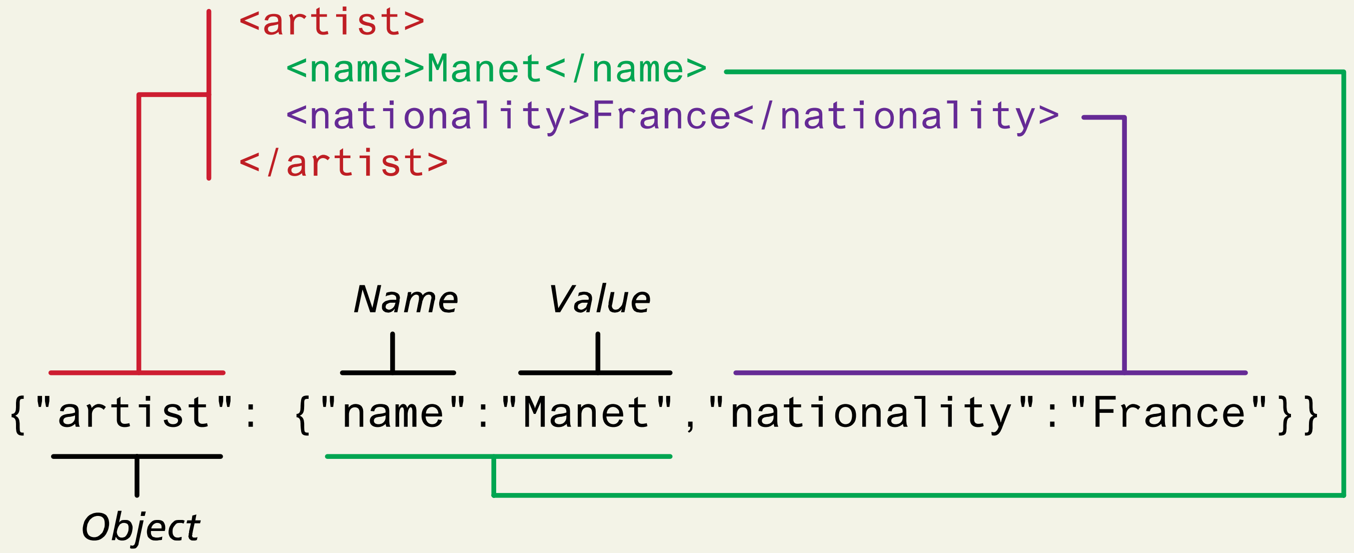
JSON

Sample JSON



```
<artist>
  <name>Manet</name>
  <nationality>France</nationality>
</artist>
```

```
{"artist": {"name":"Manet","nationality":"France"}}
```

JSON

Using JSON in Javascript

```
var text = '{"artist": {"name":"Manet","nationality":"France"}}';

var a = JSON.parse(text);

alert(a.artist.nationality);
```

JSON

Using JSON in PHP

```
<?php
// convert JSON string into PHP object
$text = '{"artist": {"name":"Manet","nationality":"France"}}';
$anObject = json_decode($text);
// check for parse errors
if (json_last_error() == JSON_ERROR_NONE) {
        echo $anObject->artist->nationality;
}
?>
```

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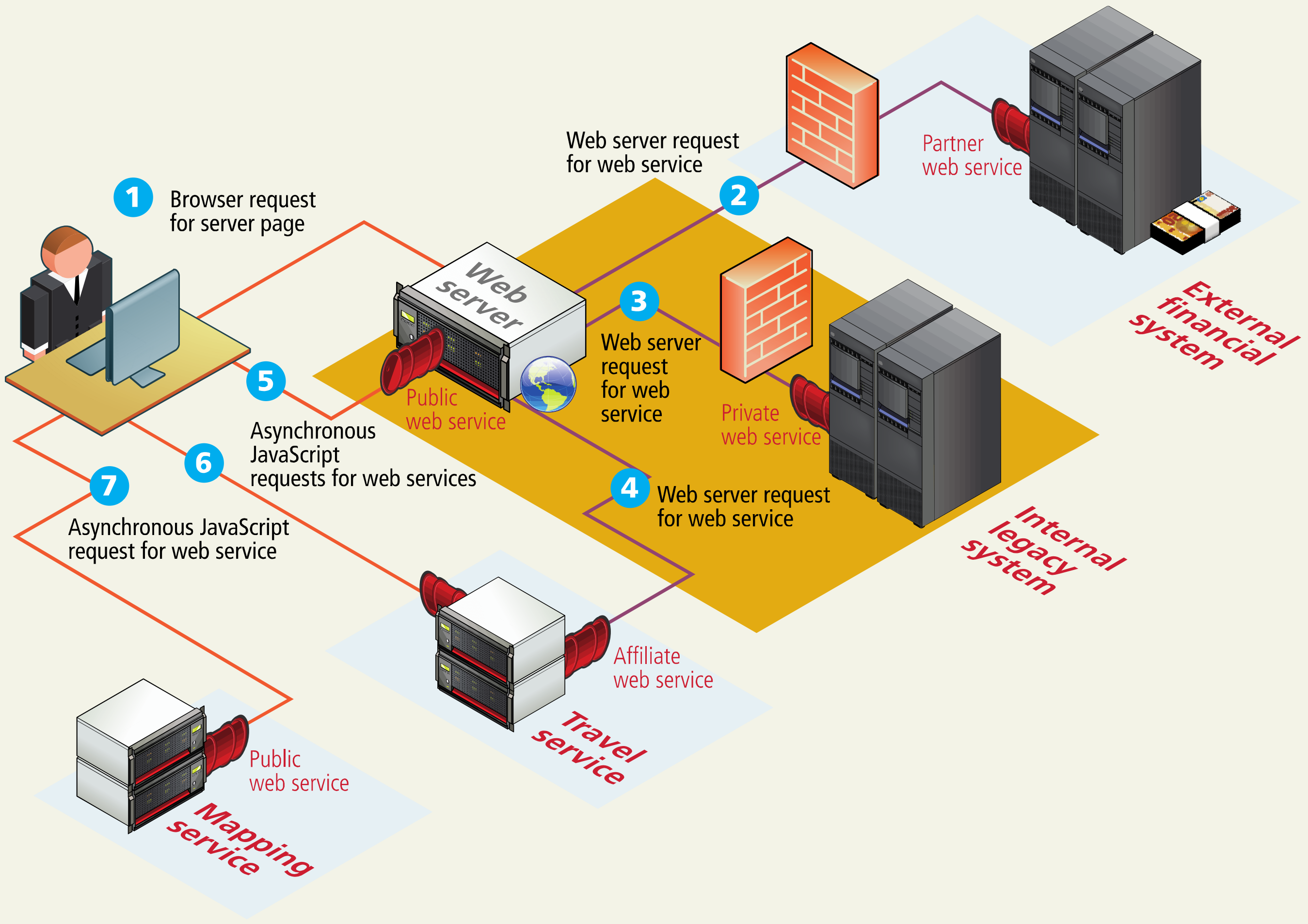
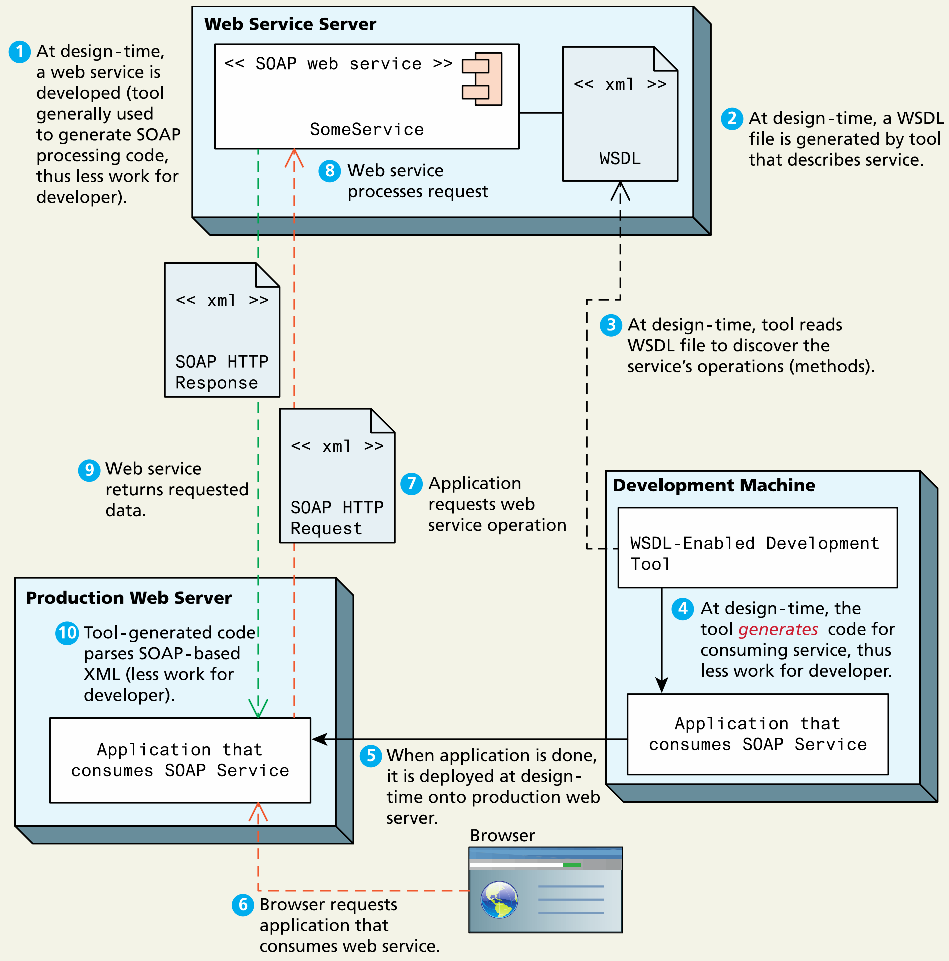
Overview of Web Services


1
Browser request for server page
Web server request for web service
2
Partner web service
External financial system
Web server
3
Web server request for web service
Public web service
Private web service
5
Asynchronous JavaScript requests for web services
6
7
Asynchronous JavaScript request for web service
4
Web server request for web service
Internal legacy system
Affiliate web service
Travel service
Public web service
Mapping service

Overview of Web Services

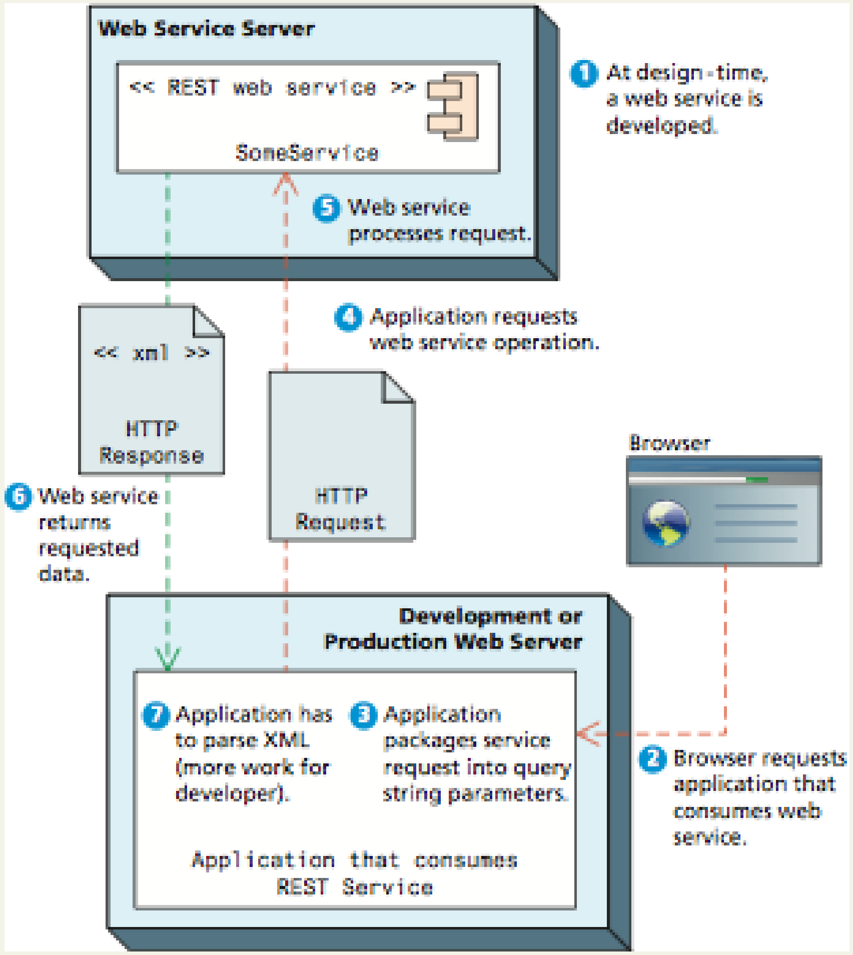
SOAP Services



Web Service Server
<< SOAP web service >>
SomeService
<< xml >>
WSDL
1 At design-time, a web service is developed (tool generally used to generate SOAP processing code, thus less work for developer).
2 At design-time, a WSDL file is generated by tool that describes service.
8 Web service processes request
<< xml >>
SOAP HTTP Response
3 At design-time, tool reads WSDL file to discover the service's operations (methods).
<< xml >>
SOAP HTTP Request
9 Web service returns requested data.
7 Application requests web service operation
Development Machine
WSDL-Enabled Development Tool
4 At design-time, the tool *generates* code for consuming service, thus less work for developer.
Application that consumes SOAP Service
Production Web Server
10 Tool-generated code parses SOAP-based XML (less work for developer).
Application that consumes SOAP Service
5 When application is done, it is deployed at design-time onto production web server.
Browser
6 Browser requests application that consumes web service.

Overview of Web Services

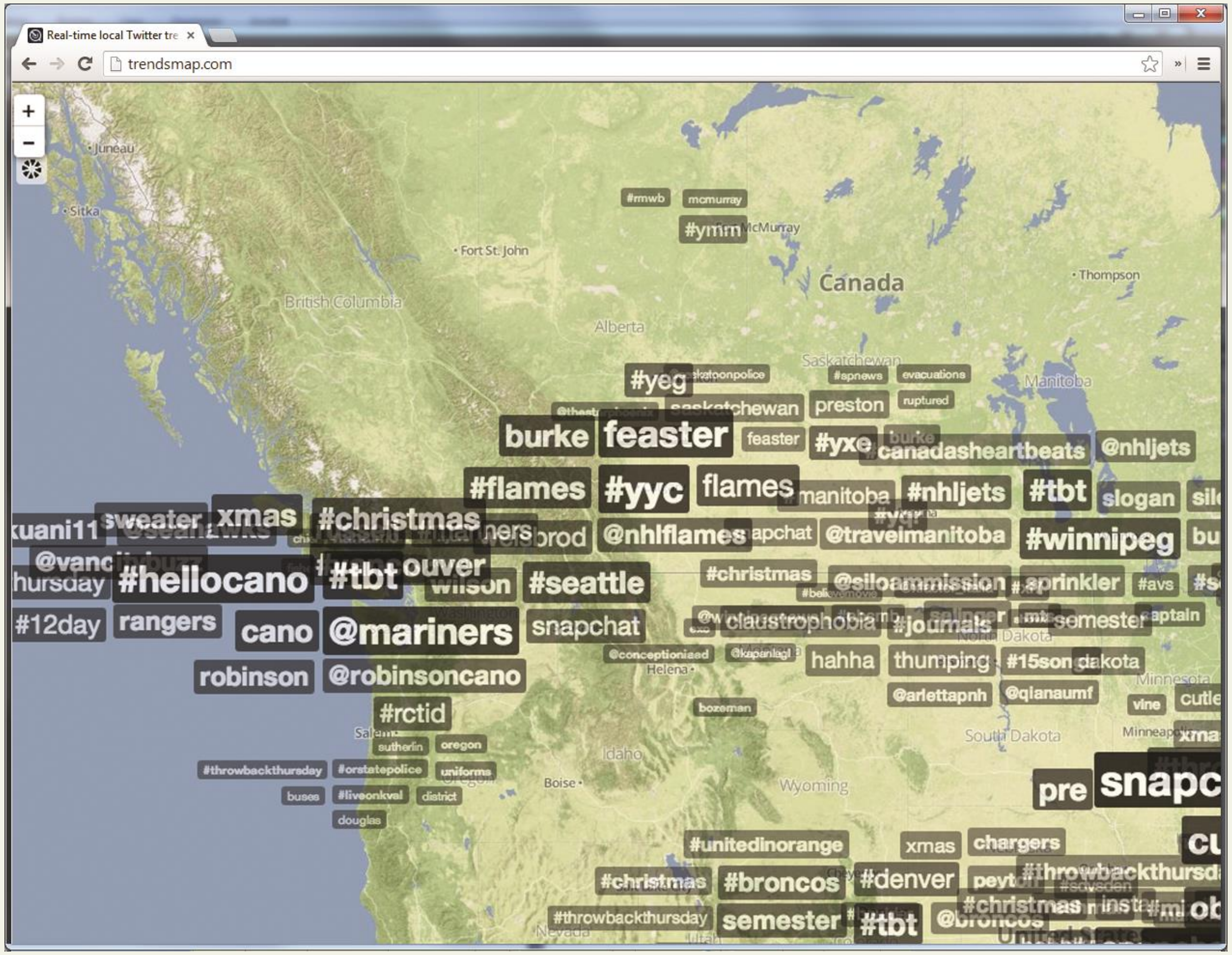
REST Services



Web Service Server
<< REST web service >>
SomeService
1 At design-time, a web service is developed.
5 Web service processes request.
4 Application requests web service operation.
<< xml >>
HTTP Response
HTTP Request
Browser
6 Web service returns requested data.
Development or Production Web Server
7 Application has to parse XML (more work for developer).
3 Application packages service request into query string parameters.
2 Browser requests application that consumes web service.
Application that consumes REST Service

Overview of Web Services

An Example Web Service



Overview of Web Services

Identifying and Authenticating Service Requests

- Identity. Each web service request must identify who is making the request.
- Authentication. Each web service request must provide additional evidence that they are who they say they are.

API Keys

https://dev.virtualearth.net/REST/v1/Locations?o=json&query=British%20Museum,+Great+Russell+Street,+London,+WC1B+3DG,+UK&key=**[BING API KEY HERE]**

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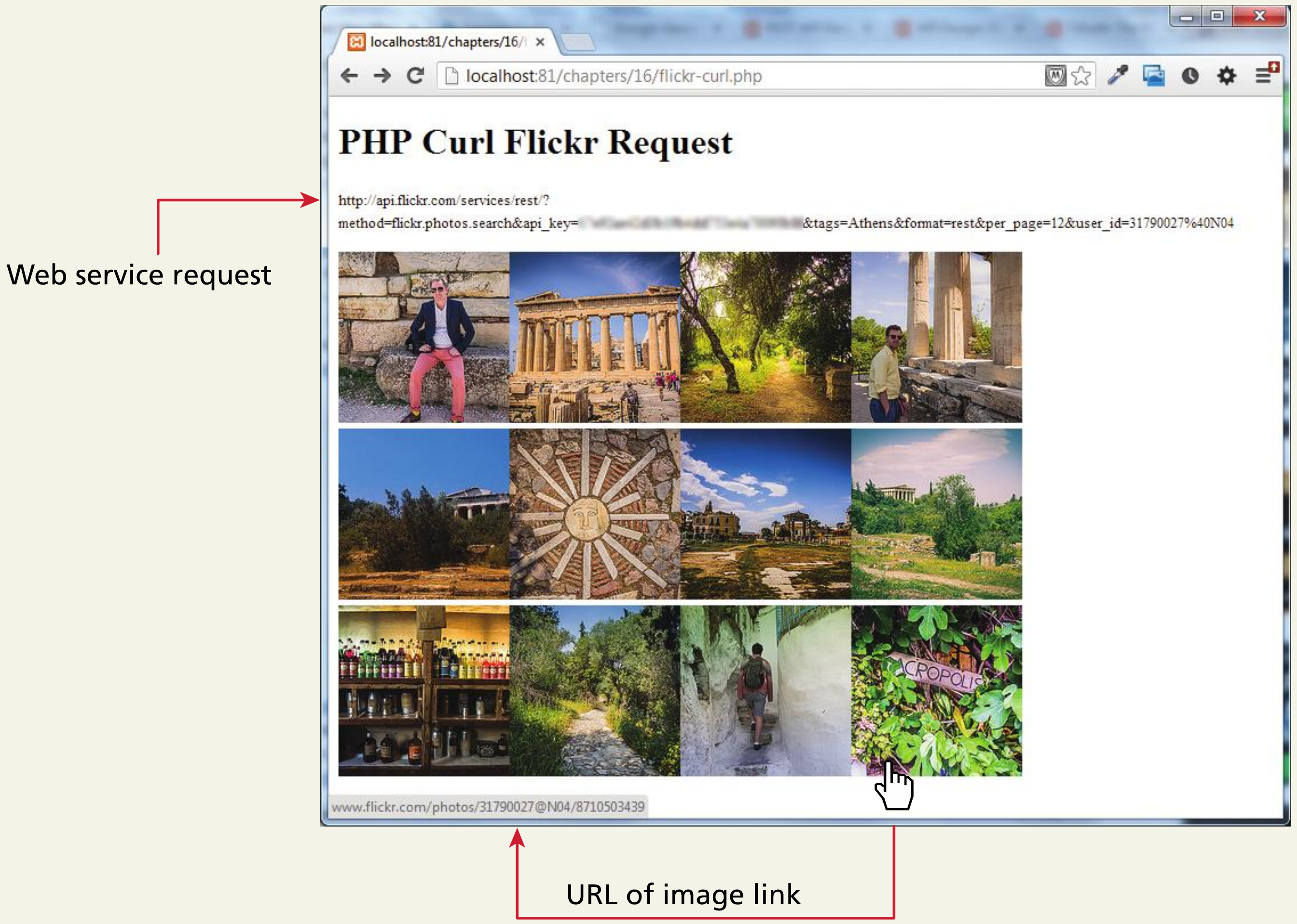
Consuming Web Services in PHP

Consuming an XML Web Service



localhost:81/chapters/16/flickr-curl.php

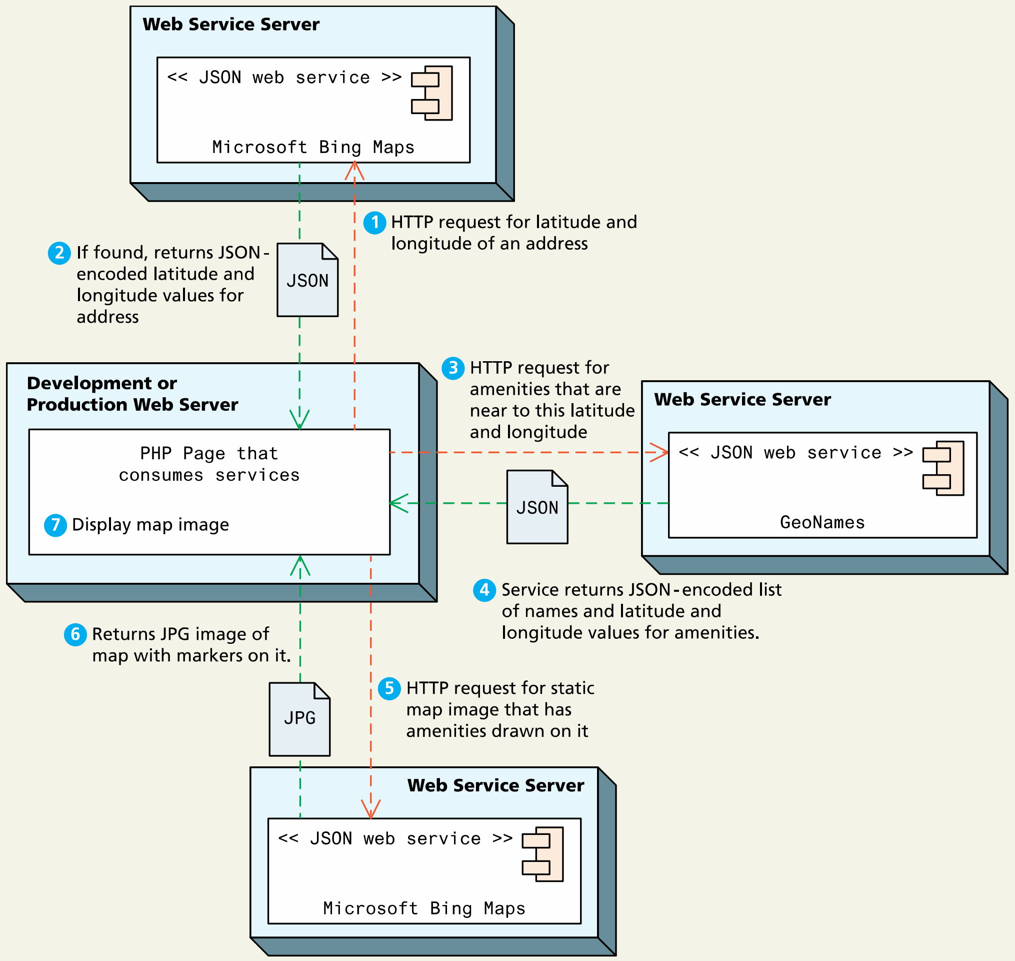
PHP Curl Flickr Request

```
http://api.flickr.com/services/rest/?
method=flickr.photos.search&api_key=[redacted]&tags=Athens&format=rest&per_page=12&user_id=31790027%40N04
```

```
www.flickr.com/photos/31790027@N04/8710503439
```

Consuming Web Services in PHP

Consuming a JSON Web Service



Web Service Server
<< JSON web service >>
Microsoft Bing Maps
1 HTTP request for latitude and longitude of an address
2 If found, returns JSON-encoded latitude and longitude values for address
JSON
Development or Production Web Server
PHP Page that consumes services
7 Display map image
3 HTTP request for amenities that are near to this latitude and longitude
Web Service Server
<< JSON web service >>
GeoNames
JSON
4 Service returns JSON-encoded list of names and latitude and longitude values for amenities.
6 Returns JPG image of map with markers on it.
JPG
5 HTTP request for static map image that has amenities drawn on it
Web Service Server
<< JSON web service >>
Microsoft Bing Maps

Consuming Web Services in PHP

Consuming a JSON Web Service

URL of service request for static road map image

Zoom level (between 1 and 21)

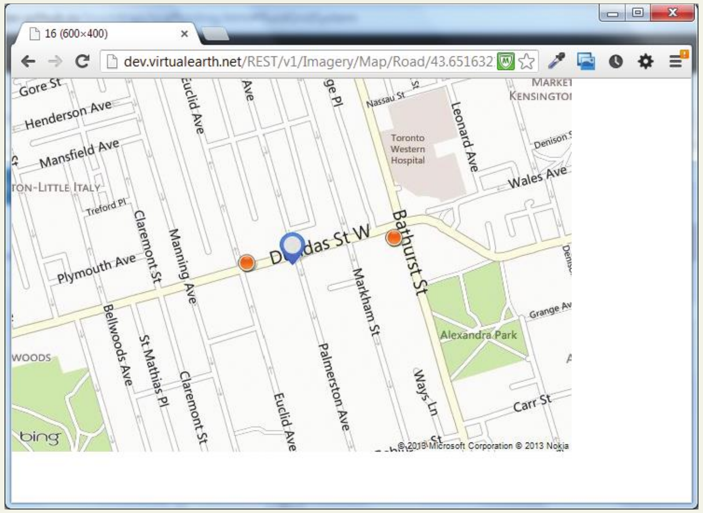
```
http://dev.virtualearth.net/REST/v1/Imagery/Map/Road/43.65163,-79.40853/16?
key=[your api key]
&mapSize=600,400
&pp=43.65163,-79.40853;66;
&pp=43.65208,-79.40618;34;
&pp=43.65166,-79.40958;34;
```

Location (latitude and longitude) of center of map

Width and height of map in pixels

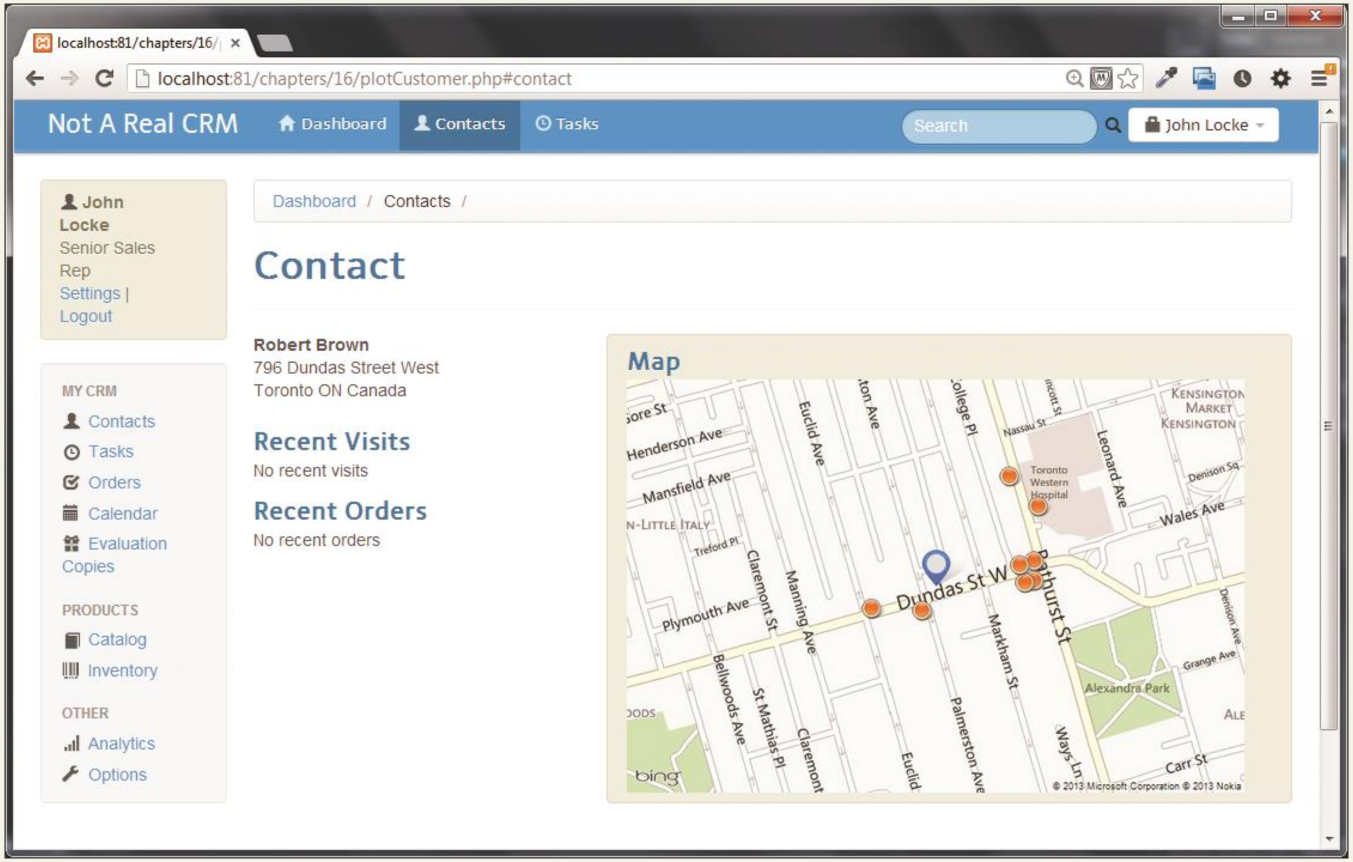
Location of marker (marker 66 = blue circle)

Location of other markers (amenities) with marker 34 = orange circle



Consuming Web Services in PHP

Consuming a JSON Web Service



Contact

Robert Brown
796 Dundas Street West
Toronto ON Canada

Recent Visits
No recent visits

Recent Orders
No recent orders

Chapter 19

Creating Web Services

Creating a JSON Web Service

- Consider the URL and format of requests
- Tell the browser to expect JSON rather than HTML
  - Header('Content-Type: application/json');
- Use json_encode() to format.
- Implement *JsonSerializable*

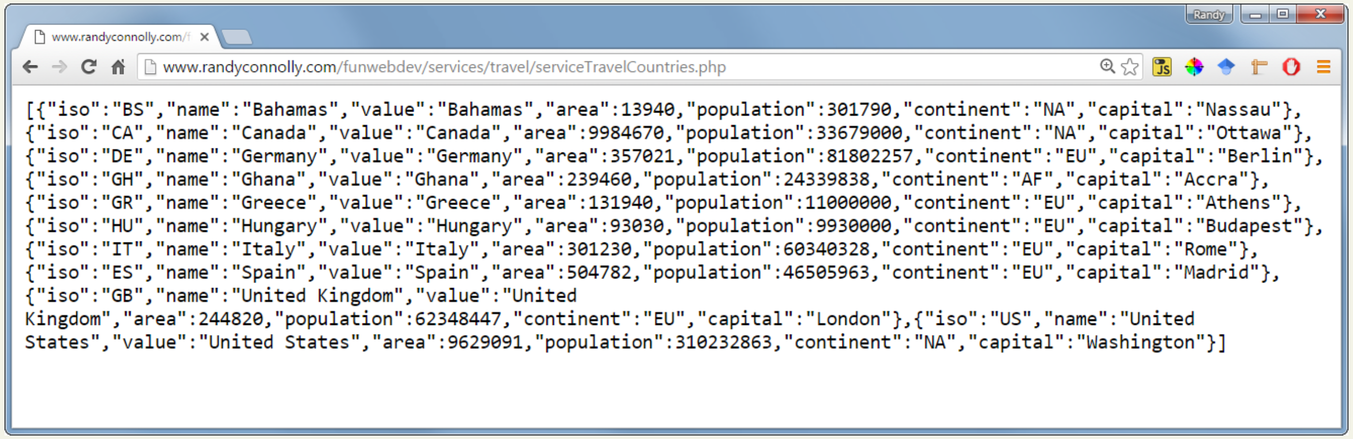
Creating Web Services

Creating a JSON Web Service

```
class Country extends DomainObject **implements JsonSerializable**
{
...
        /*
        This method is called by the json_encode() function that is part of PHP
        */
        public function jsonSerialize() {
            return ['iso' => $this->ISO,
                'name' => $this->CountryName,
                'value' => $this->CountryName,
                'area' => $this->Area,
                'population' => $this->Population,
                'continent' => $this->Continent,
                'capital' => $this->Capital
            ]; }
}
```

Creating Web Services

Creating a JSON Web Service


www.randyconnolly.com/
www.randyconnolly.com/funwebdev/services/travel/serviceTravelCountries.php
Randy

```
[{"iso":"BS","name":"Bahamas","value":"Bahamas","area":13940,"population":301790,"continent":"NA","capital":"Nassau"},
{"iso":"CA","name":"Canada","value":"Canada","area":9984670,"population":33679000,"continent":"NA","capital":"Ottawa"},
{"iso":"DE","name":"Germany","value":"Germany","area":357021,"population":81802257,"continent":"EU","capital":"Berlin"},
{"iso":"GH","name":"Ghana","value":"Ghana","area":239460,"population":24339838,"continent":"AF","capital":"Accra"},
{"iso":"GR","name":"Greece","value":"Greece","area":131940,"population":11000000,"continent":"EU","capital":"Athens"},
{"iso":"HU","name":"Hungary","value":"Hungary","area":93030,"population":9930000,"continent":"EU","capital":"Budapest"},
{"iso":"IT","name":"Italy","value":"Italy","area":301230,"population":60340328,"continent":"EU","capital":"Rome"},
{"iso":"ES","name":"Spain","value":"Spain","area":504782,"population":46505963,"continent":"EU","capital":"Madrid"},
{"iso":"GB","name":"United Kingdom","value":"United
Kingdom","area":244820,"population":62348447,"continent":"EU","capital":"London"},{"iso":"US","name":"United
States","value":"United States","area":9629091,"population":310232863,"continent":"NA","capital":"Washington"}]
```

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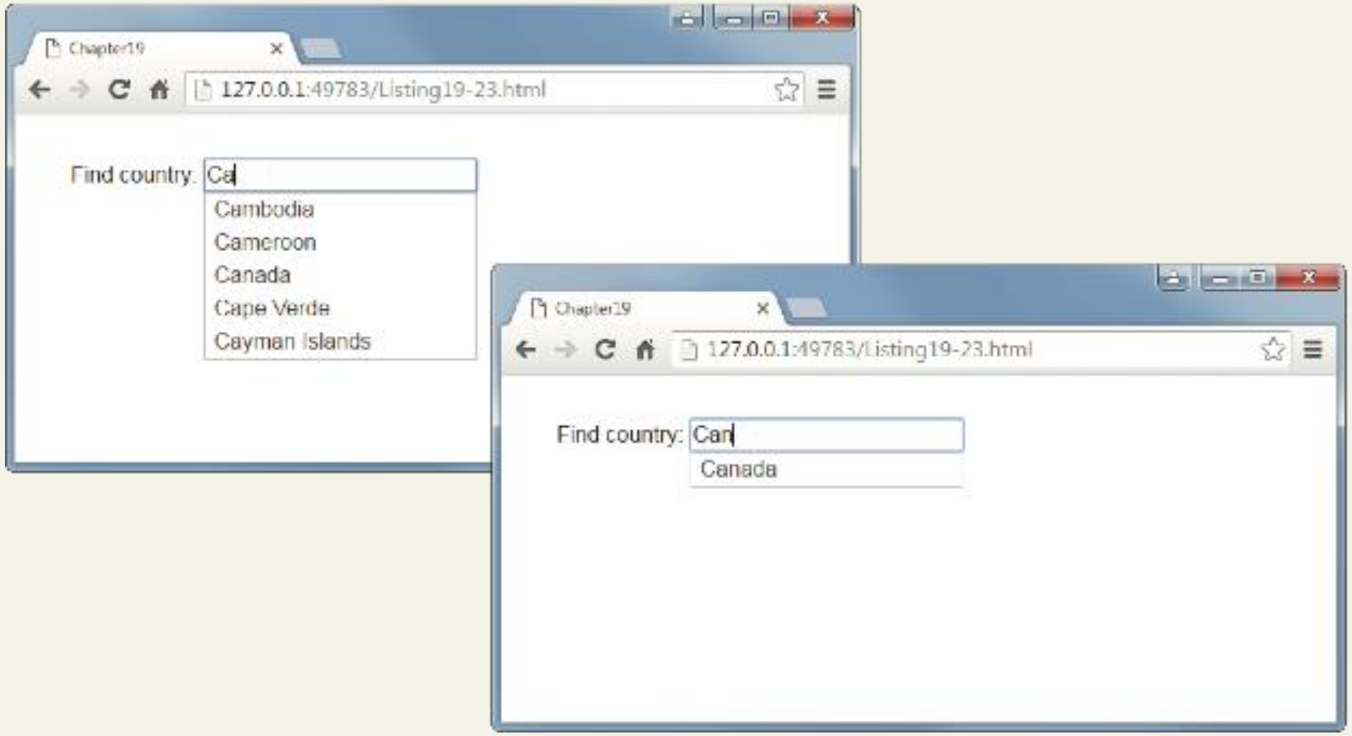
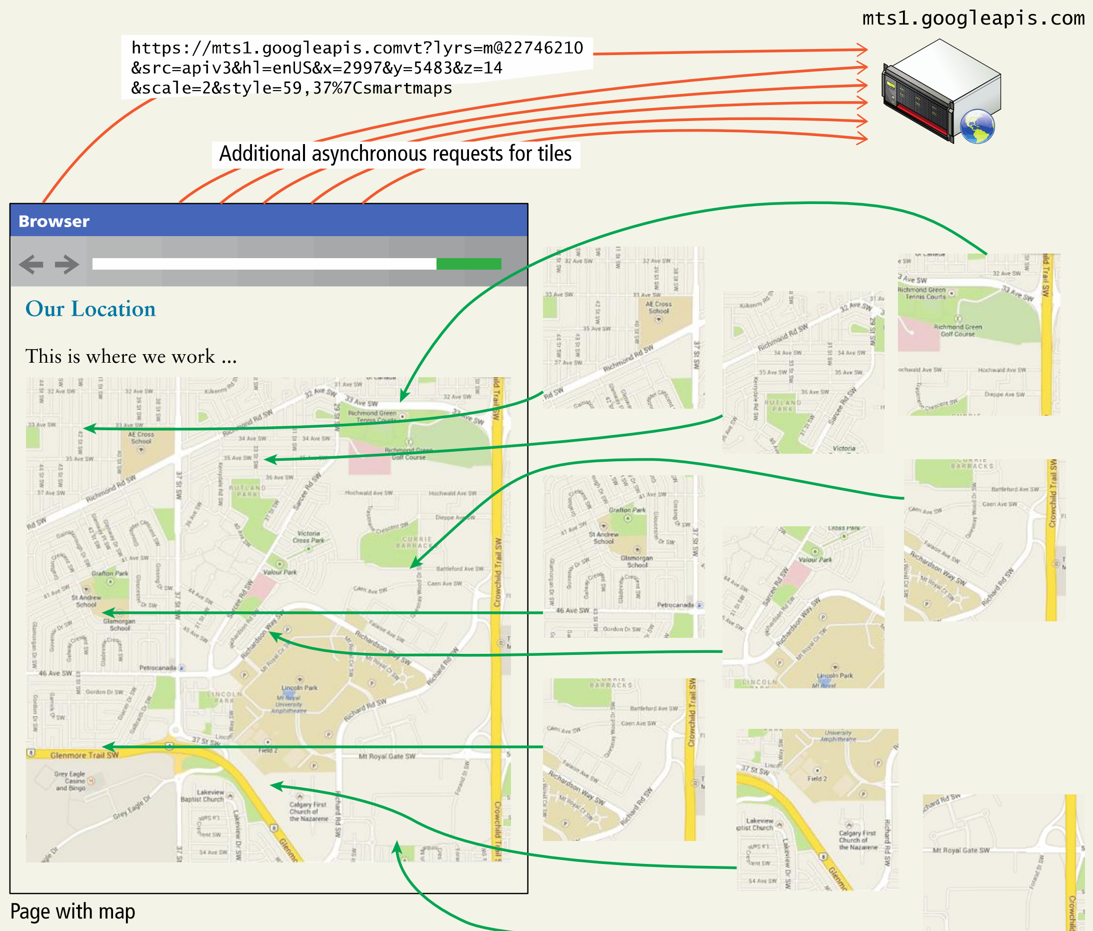
Interacting Asynchronously with Web Services

Consuming Your Own Service



Interacting Asynchronously with Web Services

Using Google Maps


mts1.googleapis.com
https://mts1.googleapis.comvt?lyrs=m@22746210&src=apiv3&hl=enUS&x=2997&y=5483&z=14&scale=2&style=59,37%7Csmartmaps
Additional asynchronous requests for tiles
Browser
Our Location
This is where we work ...
Page with map

Interacting Asynchronously with Web Services

Using Google Maps

```
<script type='text/javascript'
src='https://maps.googleapis.com/maps/api/js?key=yourkey'></script>

<style>
/* map element needs a styled size otherwise it doesn't appear at all */
#map {
height: 500px;
width: 600px
}
</style>
```

Interacting Asynchronously with Web Services

Using Google Maps

```
<script>
        $(function() {
        // hard-coded latitude and longitude for demonstration purposes
        var ourLatLong = {lat: 51.011179 , lng: -114.132866 };
        var ourMap = new google.maps.Map(document.getElementById('map'),
{
                center: ourLatLong,
                scrollwheel: false,
                zoom: 14
                });
});
</script>
</head>
<body>
        <h2>Our Location</h2>
        <h3>This is where we work ... </h3>
        <div id="map"></div>
</body>
</html>
```

Chapter 19

Summary

Key Terms

authentication	REST	valid XML
DOM extension	reverse geocoding	web services
event or pull approach	root element	well-formed XML
geocoding	service	XML declaration
identity	service-oriented	XML parser
in-memory approach	architecture	XMLReader
JSON	service-oriented	XPath
mashup	computing	XSLT
Node	SimpleXML	

Summary

Questions?