

Introduction to Web Services

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Web Services

- Definition...

- ... any service that is available over the **Internet**
- ... uses a standardized **XML** messaging system
- ... it is **not tied to** one operating system or programming language

(E. Cerami, 2005)

Web Services

- HTTP
 - Internet transfer protocol
- XML
 - Communication language
- Coupling {HTTP + XML}
 - allows the Internet to act as a communication network between applications
 - ... not just a service for sharing web applications

Web Services

- Significance...
 - **Interoperability...**
 - between applications, which were developed independently
- Web services **standards** ...
 - {XML-RCP, UDDI, WSDL, SOAP ...}
 - Independent of ...
 - Programming languages
 - Operating systems
 - Platforms

Web Services

- Lately, **REST** is dominant
 - Representational State Transfer (REST) has gained widespread acceptance across the Web
 - ... as a simpler alternative to SOAP- and WSDL-based Web services.

Web Services

- REST ...
 - asks developers to use **HTTP methods** explicitly and in a way that's consistent with the protocol definition.
 - To create a resource on the server, use POST.
 - To retrieve a resource, use GET.
 - To change the state of a resource or to update it, use PUT.
 - To remove or delete a resource, use DELETE.

Web Services

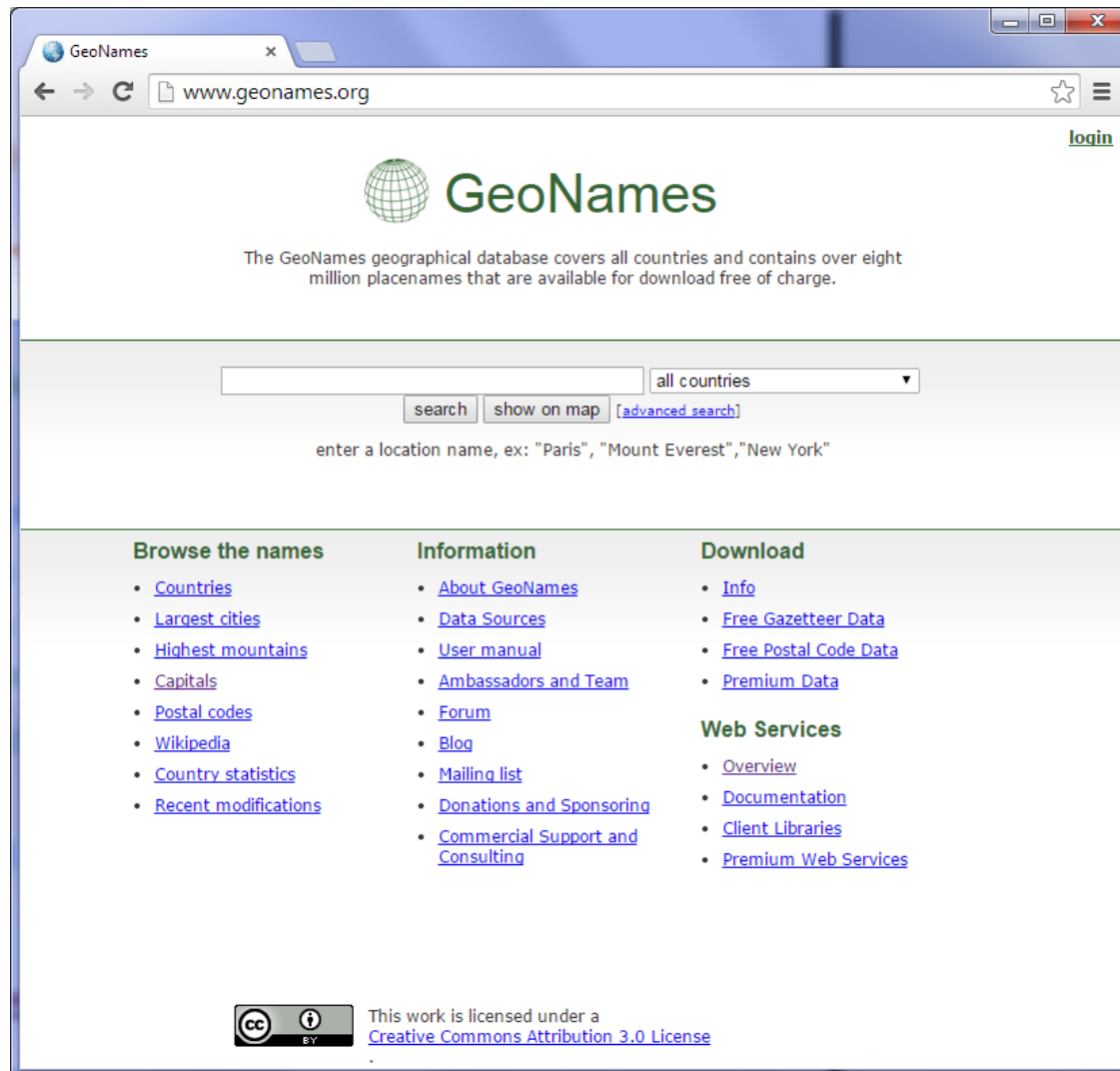
- **Clean and Unclean URLs**

Unclean URL	Clean URL
<code>http://example.com/index.php?page=foo</code>	<code>http://example.com/foo</code>
<code>http://example.com/index.php?page=consulting/marketing</code>	<code>http://example.com/consulting/marketing</code>
<code>http://example.com/products?category=2&pid=25</code>	<code>http://example.com/products/2/25</code>
<code>http://example.com/cgi-bin/feed.cgi?feed=news&frm=rss</code>	<code>http://example.com/news.rss</code>
<code>http://example.com/services/index.jsp?category=legal&id=patents</code>	<code>http://example.com/services/legal/patents</code>
<code>http://example.com/kb/index.php?cat=8&id=41</code>	<code>http://example.com/kb/8/41</code>
<code>http://example.com/index.php?mod=profiles&id=193</code>	<code>http://example.com/profiles/193</code>

- Unclean:
 - URLs contain a **query string** [e.g., `action=delete&id=91`]
- Clean:
 - URLs contain only the **path** of the resource

GeoNames Web Service

<http://www.geonames.org/>

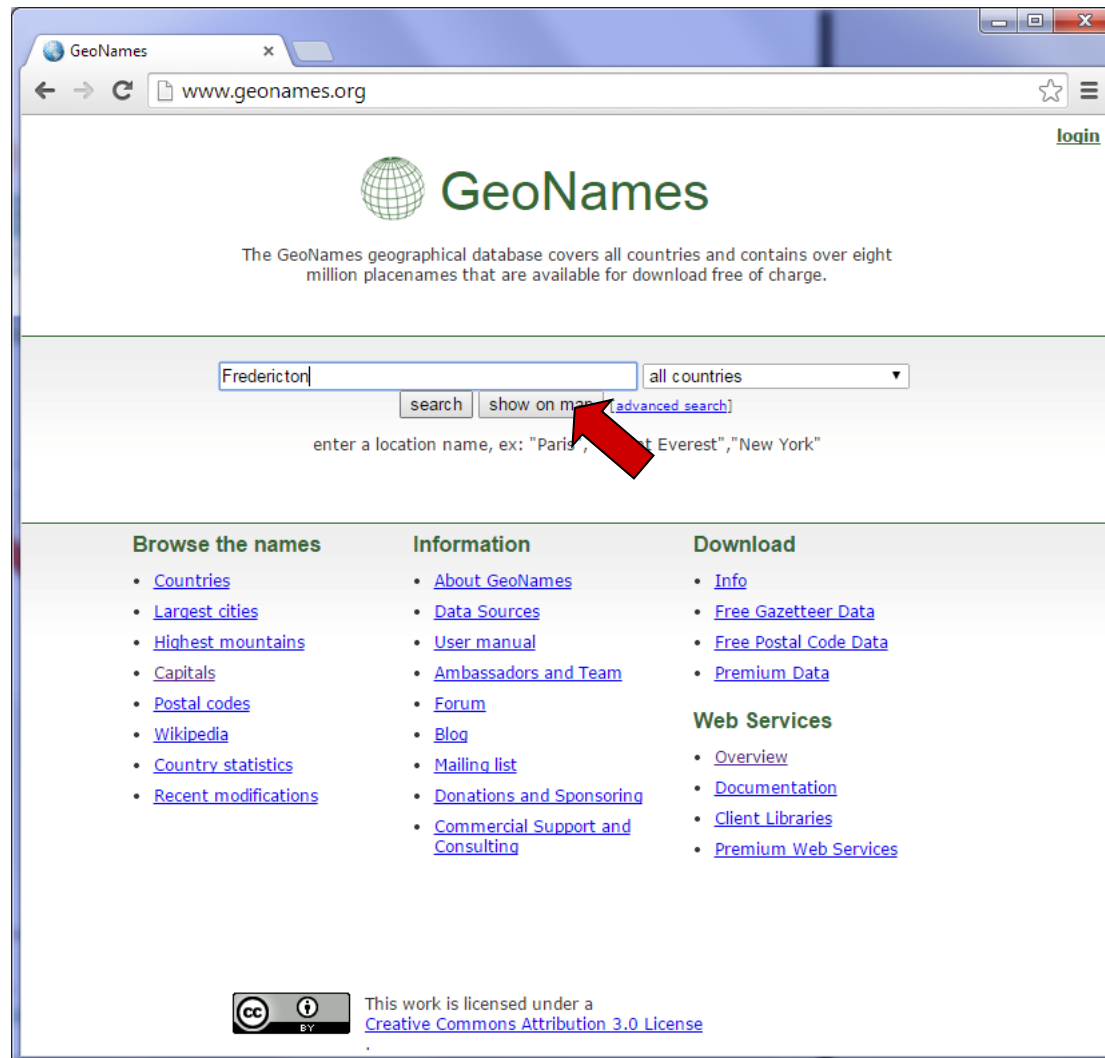


GeoNames Web Service

- The GeoNames database ...
 - is available for download free of charge
 - It contains ...
 - over 8 million geographical names
 - consists of 6.5 million unique features
 - whereof 2.2 million populated places and
 - 1.8 million alternate names.
 - All features are categorized ...
 - into 9 feature classes
 - further subcategorized into 645 feature codes

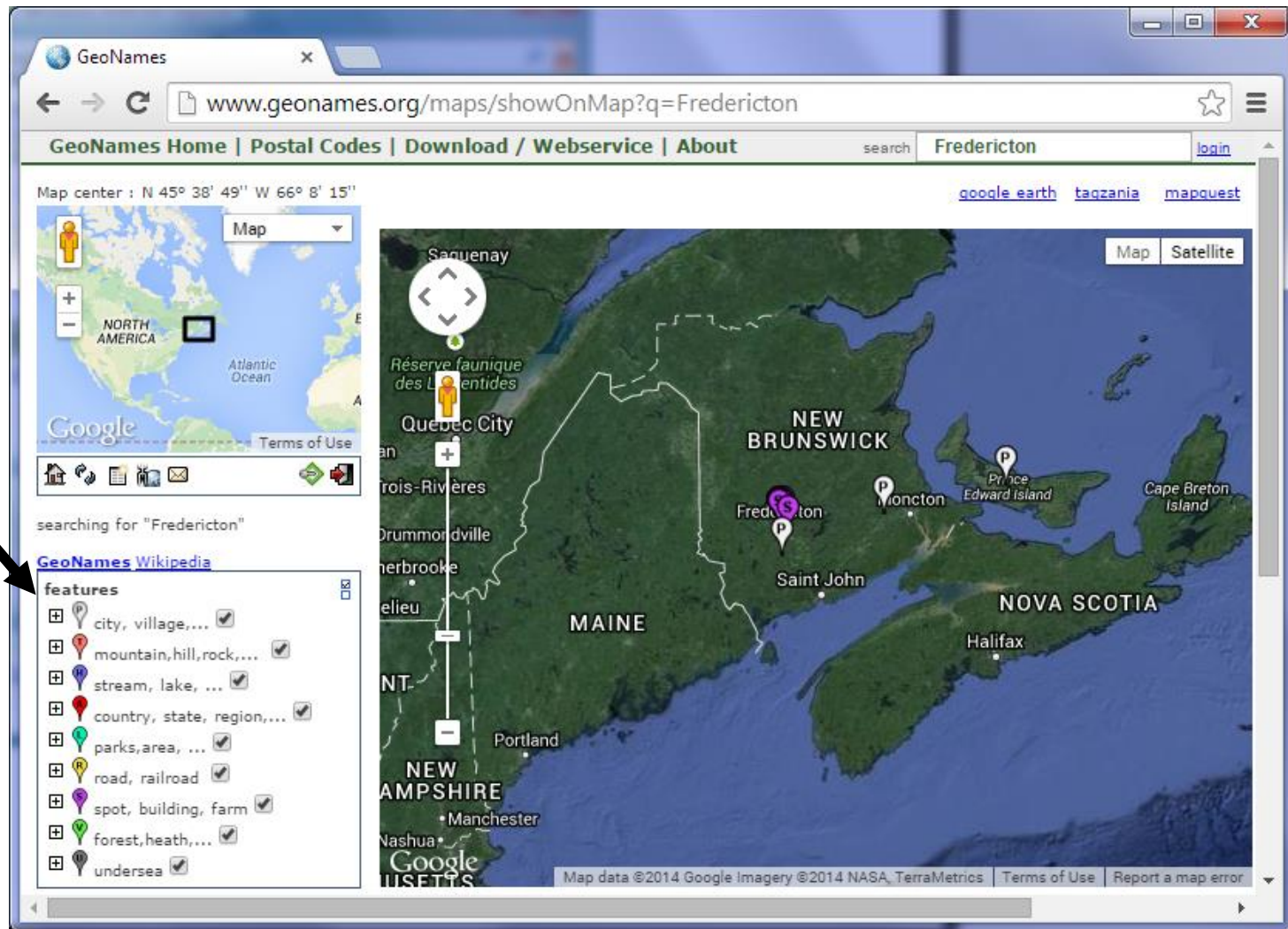
GeoNames Web Service

<http://www.geonames.org/>



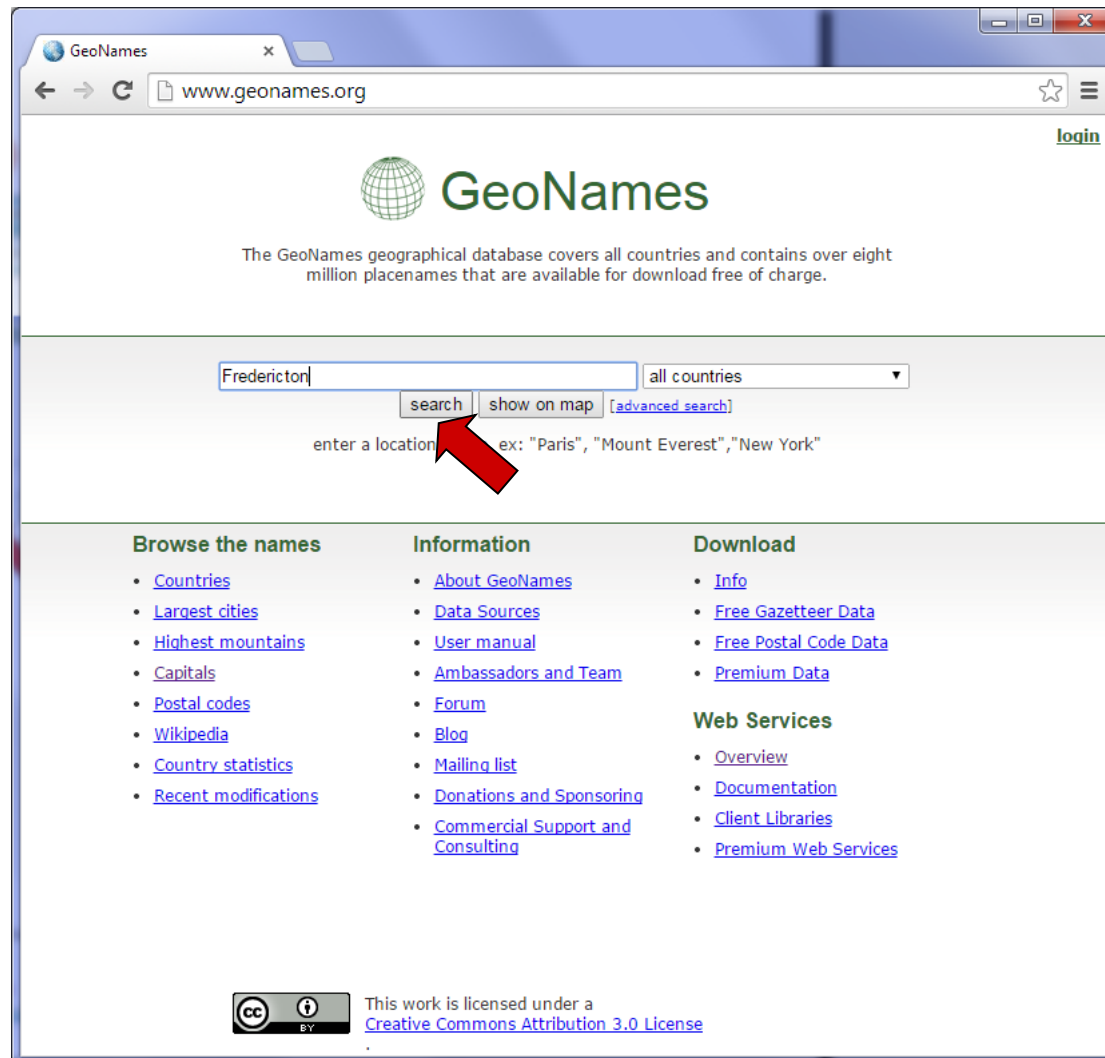
GeoNames Web Service

The 9
categories



GeoNames Web Service

<http://www.geonames.org/>



GeoNames Web Service

The screenshot shows a web browser window titled 'GeoNames Fulltextsearch'. The address bar displays the URL `www.geonames.org/search.html?q=Fredericton&country=`. The page header includes navigation links: 'GeoNames Home', 'Postal Codes', 'Download', 'Webservice', and 'About'. A search bar contains the text 'Fredericton', and a dropdown menu is set to 'all countries'. Below the search bar are buttons for 'search', 'show on map', and a link to 'advanced search'. The search results section indicates '14 records found for "Fredericton"'. A table lists the results, with the first entry, 'Fredericton', highlighted in green and pointed to by a red arrow. The table has columns for Name, Country, Feature class, Latitude, and Longitude.

Name	Country	Feature class	Latitude	Longitude
1 Fredericton Fredericopolis, Fredericton, Frederikton, Frederiktonas, Frederiktono, Frederiktun, Gorad, Frehdehryktan, P...	Canada , New Brunswick	seat of a first-order administrative division population 52,337	N 45° 56' 43"	W 66°
2 Fredericton International Airport Aéroport international de Fredericton, Aéroport international de Fredericton, CYFC, Fredericton Interna...	Canada , New Brunswick Sunbury	airport elevation 20m	N 45° 52' 12"	W 66°
3 Fredericton Junction XFC	Canada , New Brunswick	populated place	N 45° 39' 37"	W 66°
4 Fredericton Frederikton, Фредериктон	Canada , Prince Edward Island	populated locality	N 46° 22' 0"	W 63°
5 Fredericton Road	Canada , New Brunswick	populated place	N 46° 4' 4"	W 65°
6 Delta Fredericton Hotel	Canada , New Brunswick	hotel	N 45° 57' 48"	W 66°



GeoNames Web Service

The screenshot shows the GeoNames web service interface. The main map displays the Fredericton area, including parts of New Brunswick, Maine, and Nova Scotia. A sidebar on the left shows search results for "Fredericton". Below the map, a table lists various features with their names, countries, features, and distances from the center.

Name	country	feature	km to center
1 Fredericton	Canada	seat of a first-order administrative division	507.64 km
2 Fredericton International Airport	Canada	airport	501.92 km
3 Fredericton Junction	Canada	populated place	518.17 km
4 Fredericton	Canada	populated locality	266.81 km
5 Fredericton Road	Canada	populated place	398.36 km
6 Delta Fredericton Hotel	Canada	hotel	506.82 km
7 CASTLETON SUITES FREDERICTON	Canada	hotel	505.73 km
8 Amsterdam Inn Fredericton	Canada	hotel	509.55 km
9 Lakeview Inn Fredericton	Canada	hotel	508.97 km
10 Ramada Hotel Fredericton NB	Canada	hotel	504.44 km
11 Fredericton Inn	Canada	hotel	507.82 km
12 Wandlyn Inn Fredricton	Canada	hotel	508.34 km
13 Comfort Inn Fredricton	Canada	hotel	502.36 km
14 The City Motel	Canada	hotel	507.54 km

Export: csv

The screenshot shows the GeoNames export page. The URL is www.geonames.org/export/tmp/geonames52541.csv. The table below contains the exported data.

GeoNameId	Name	Country	Latitude	Longitude
5957776	Fredericton	CA	45.94541	-66.66558
6301455	Fredericton International Airport	CA	45.86999	-66.53217
5957777	Fredericton Junction	CA	45.66043	-66.61387
5957775	Fredericton	CA	46.36683	-63.432
5957778	Fredericton Road	CA	46.06777	-65.17112
6478714	Delta Fredericton Hotel	CA	45.9635	-66.6658
6462894	CASTLETON SUITES FREDERICTON	CA	45.9336	-66.6305
6523837	Amsterdam Inn Fredericton	CA	45.9466	-66.6936
6516600	Lakeview Inn Fredericton	CA	45.9506	-66.6879
6487531	Ramada Hotel Fredericton NB	CA	45.9499	-66.623
6500457	Fredericton Inn	CA	45.935	-66.6612
6515592	Wandlyn Inn Fredricton	CA	45.9444	-66.6749
6474812	Comfort Inn Fredricton	CA	45.96	-66.6
6498078	The City Motel	CA	45.9375	-66.6589

GeoNames Web Service

The image shows two overlapping browser windows. The background window displays the main GeoNames website (www.geonames.org) with a search bar containing 'Frederickton' and a list of navigation links. The foreground window shows the 'GeoNames WebServices overview' page, which contains a table of available web services and their supported output formats. A red arrow points from the 'cities' service row in the table to the 'Overview' link in the 'Web Services' section of the main website. A green arrow points from the bottom right of the main website towards the bottom right of the slide.

GeoNames
The GeoNames geographical database covers all countries and contains over 10 million placenames that are available for download free of charge.

Frederickton | all countries
search show on map [advanced search]
enter a location name, ex: "Paris", "Mount Everest", "New York"

Browse the names

- [Countries](#)
- [Largest cities](#)
- [Highest mountains](#)
- [Capitals](#)
- [Postal codes](#)
- [Wikipedia](#)
- [Country statistics](#)
- [Recent modifications](#)

Information

- [About GeoNames](#)
- [Data Sources](#)
- [User manual](#)
- [Ambassadors and Team](#)
- [Forum](#)
- [Blog](#)
- [Mailing list](#)
- [Donations and Sponsoring](#)
- [Commercial Support and Consulting](#)

Download

- [Info](#)
- [Free Gazetteer Data](#)
- [Free Postal Code Data](#)
- [Premium Data](#)

Web Services

- [Overview](#)
- [Documentation](#)
- [Client Libraries](#)
- [Premium Web Services](#)

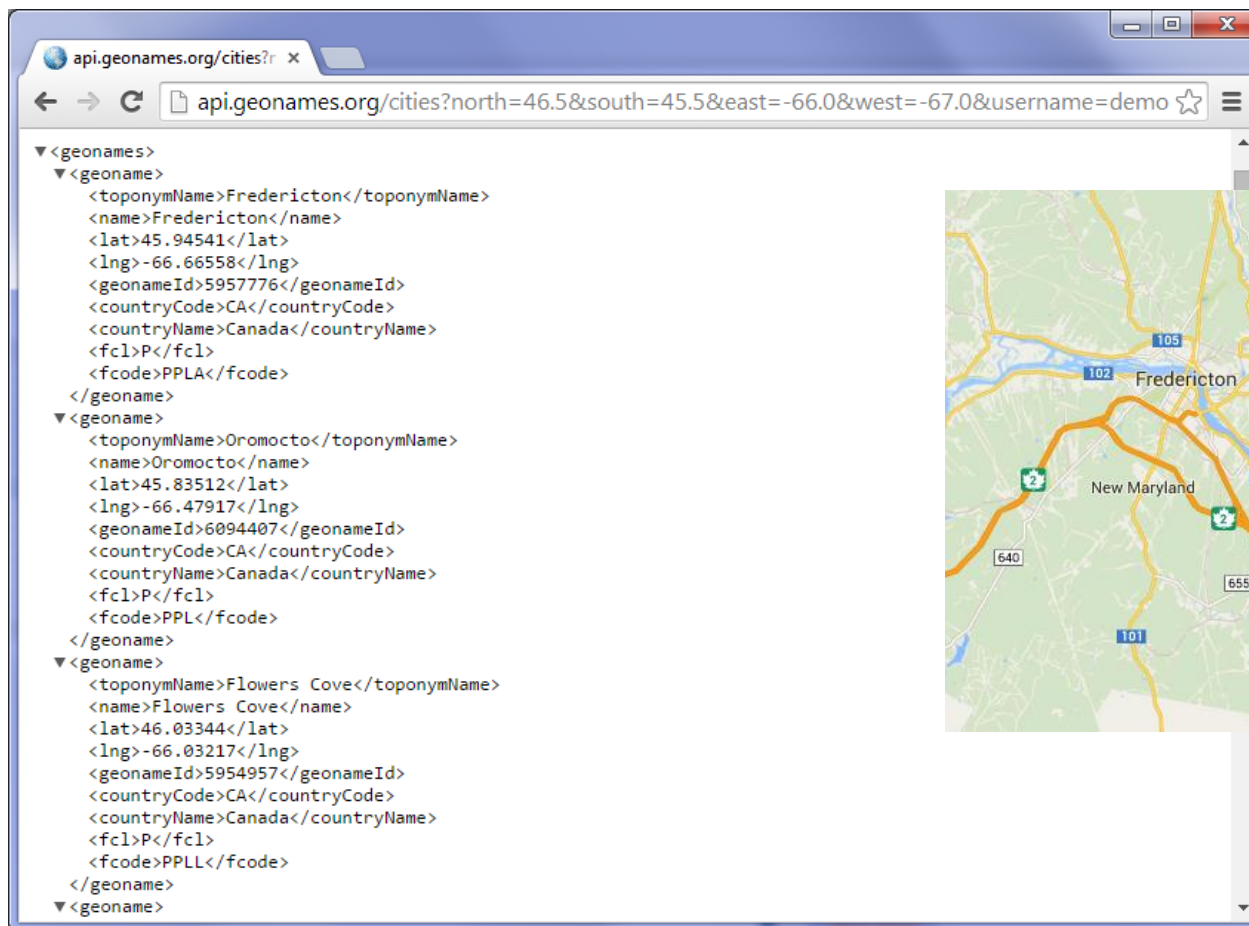
GeoNames WebServices overview

WebService	XML	JSON	RDF	CSV	TXT	RSS	KML
1 children	XML	JSON					
2 cities	XML	JSON					
3 countryCode	XML	JSON			TXT		
4 countryInfo	XML	JSON		CSV			
5 countrySubdivision	XML	JSON					
6 earthquakes		JSON					
7 findNearby	XML	JSON					
8 findNearbyPlaceName	XML	JSON					

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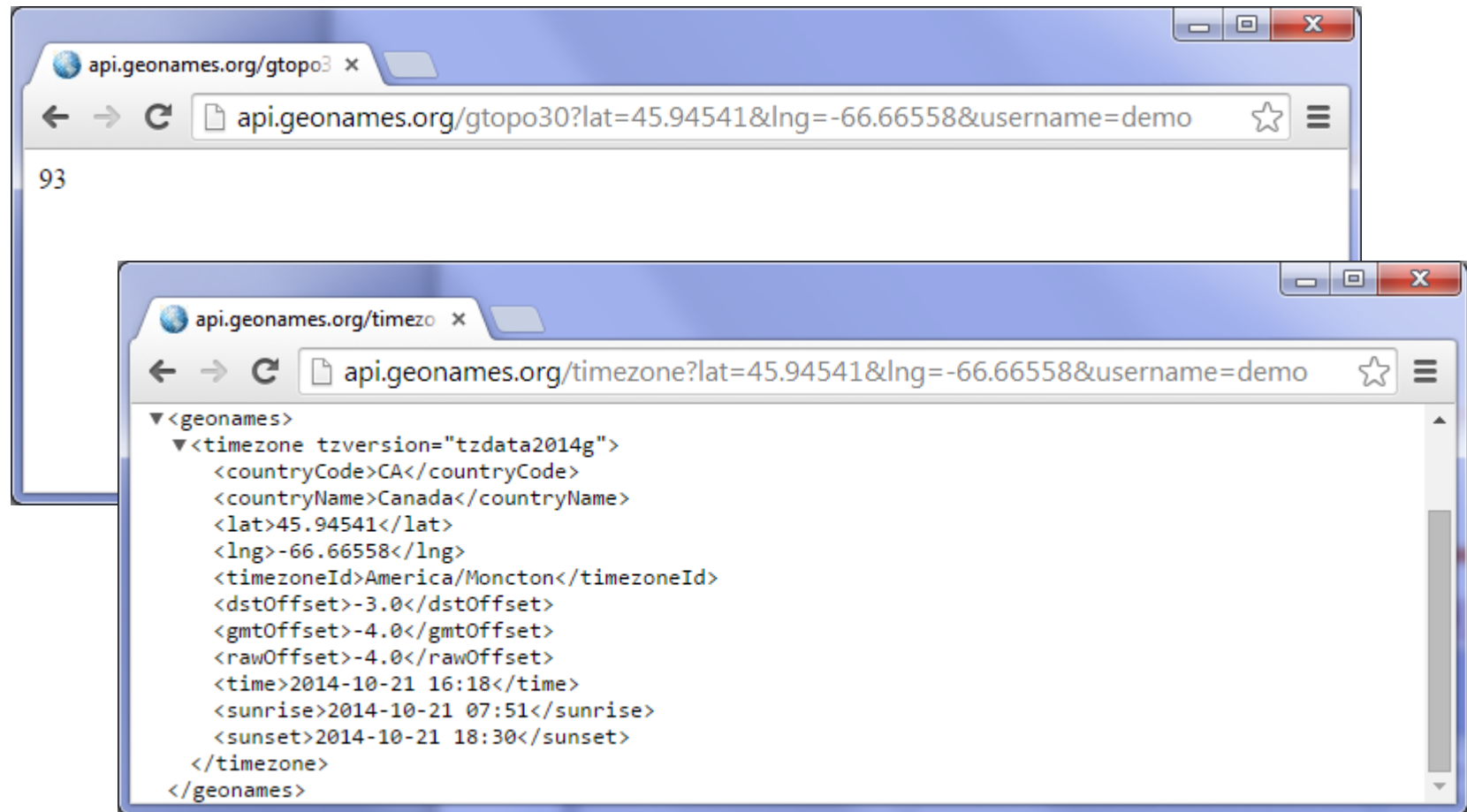
GeoNames Web Service

<http://api.geonames.org/cities?north=46.5&south=45.5&east=-66.0&west=-67.0&username=gge5403>



GeoNames Web Service

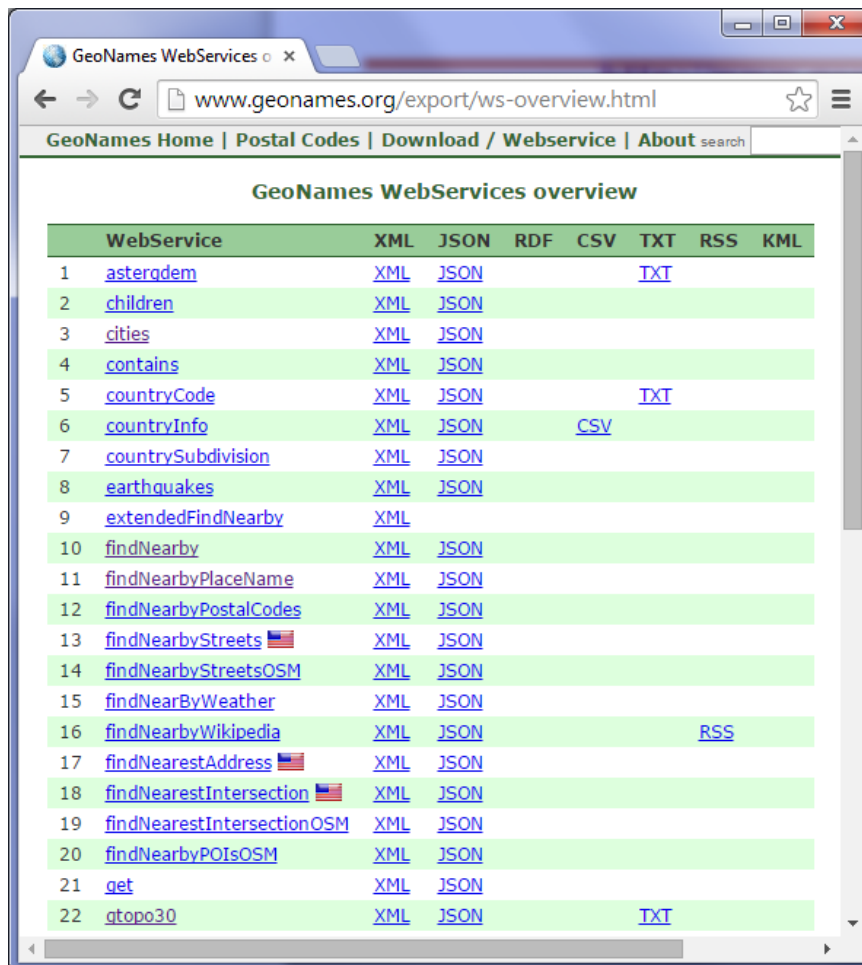
<http://api.geonames.org/gtopo30?lat=45.94541&lng=-66.66558&username=gge5403>






<http://api.geonames.org/timezone?lat=45.94541&lng=-66.66558&username=gge5403>

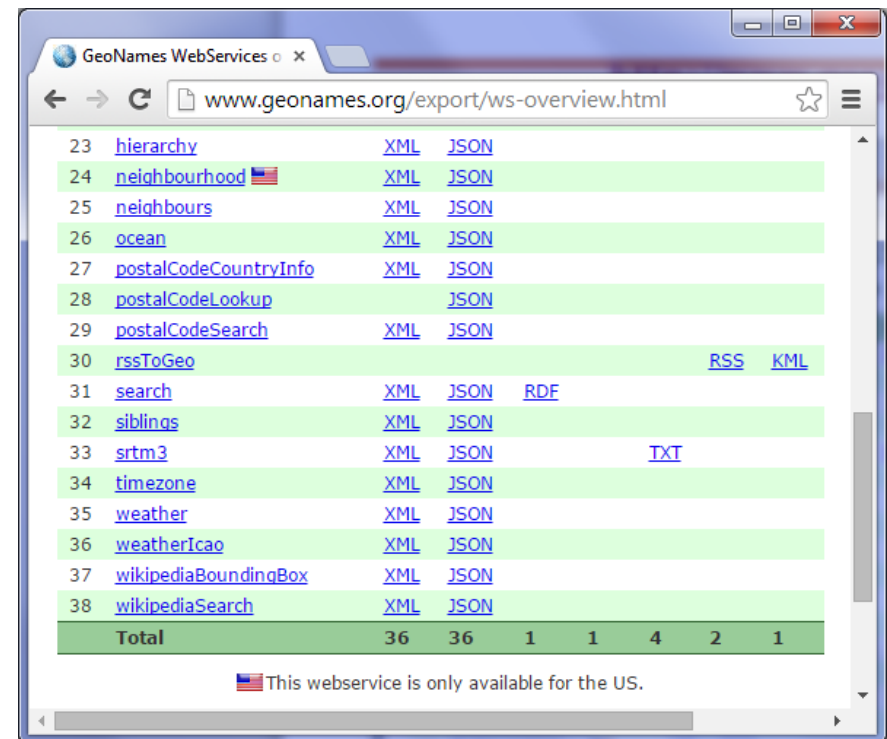
GeoNames Web Service

<http://www.geonames.org/export/ws-overview.html>





GeoNames WebServices overview

WebService	XML	JSON	RDF	CSV	TXT	RSS	KML
1 asterqdem	XML	JSON			TXT		
2 children	XML	JSON					
3 cities	XML	JSON					
4 contains	XML	JSON					
5 countryCode	XML	JSON			TXT		
6 countryInfo	XML	JSON		CSV			
7 countrySubdivision	XML	JSON					
8 earthquakes	XML	JSON					
9 extendedFindNearby	XML						
10 findNearby	XML	JSON					
11 findNearbyPlaceName	XML	JSON					
12 findNearbyPostalCodes	XML	JSON					
13 findNearbyStreets 	XML	JSON					
14 findNearbyStreetsOSM	XML	JSON					
15 findNearByWeather	XML	JSON					
16 findNearbyWikipedia	XML	JSON				RSS	
17 findNearestAddress 	XML	JSON					
18 findNearestIntersection 	XML	JSON					
19 findNearestIntersectionOSM	XML	JSON					
20 findNearbyPOIsOSM	XML	JSON					
21 get	XML	JSON					
22 qtopo30	XML	JSON			TXT		



GeoNames WebServices overview

23 hierarchy	XML	JSON					
24 neighbourhood 	XML	JSON					
25 neighbours	XML	JSON					
26 ocean	XML	JSON					
27 postalCodeCountryInfo	XML	JSON					
28 postalCodeLookup		JSON					
29 postalCodeSearch	XML	JSON					
30 rssToGeo						RSS	KML
31 search	XML	JSON	RDF				
32 siblings	XML	JSON					
33 srtm3	XML	JSON			TXT		
34 timezone	XML	JSON					
35 weather	XML	JSON					
36 weatherIcao	XML	JSON					
37 wikipediaBoundingBox	XML	JSON					
38 wikipediaSearch	XML	JSON					
Total	36	36	1	1	4	2	1

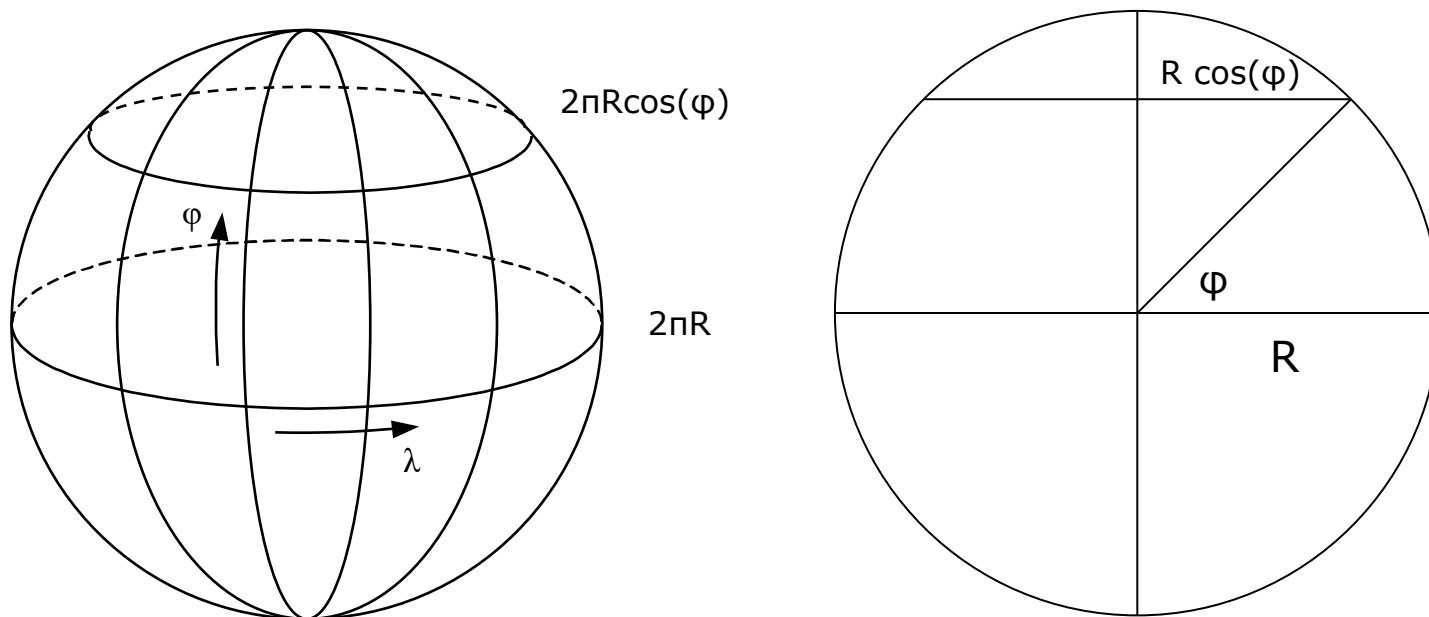
 This webservice is only available for the US.

An Example Web Service

- Built in **php** (accesses postgis)
- **Operations and parameters** passed through the URL (unclean URL) to the server
- The server performs the operations (**processing**) and sends the results back to the client

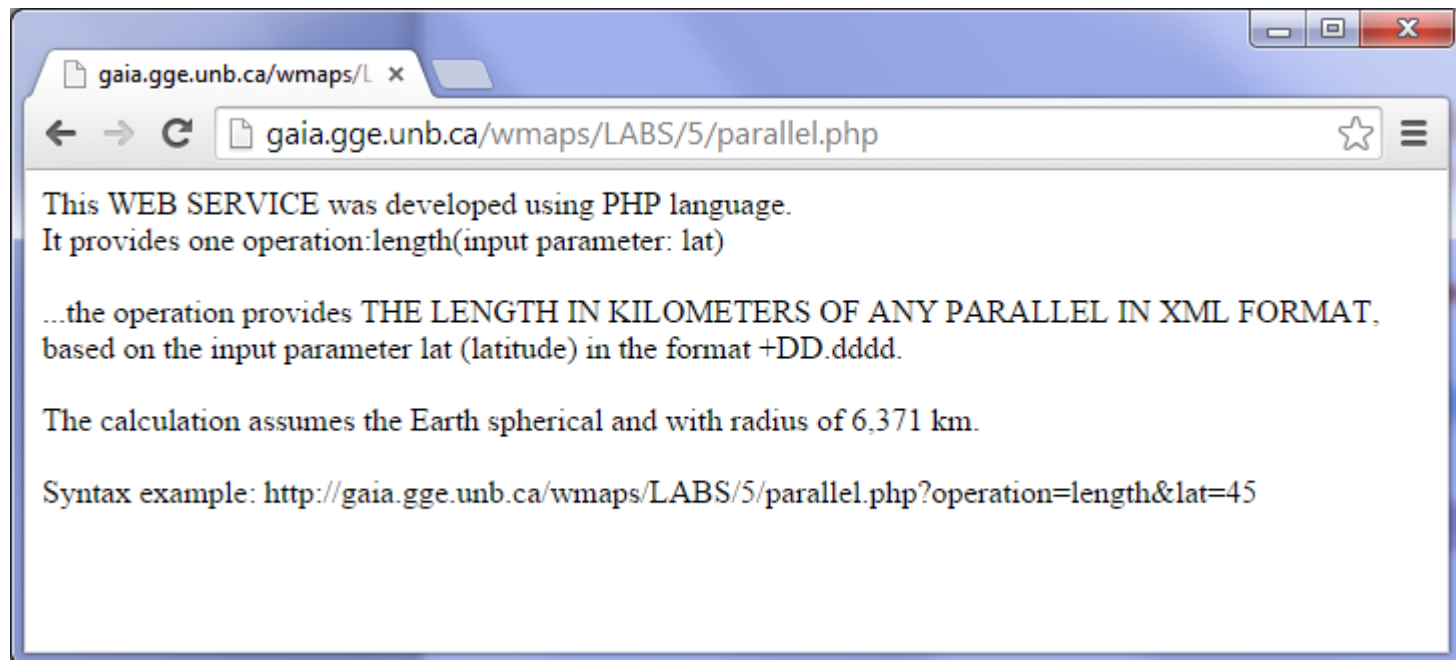
An Example Web Service

- Compute the length of a parallel
 - Assumption: spherical Earth



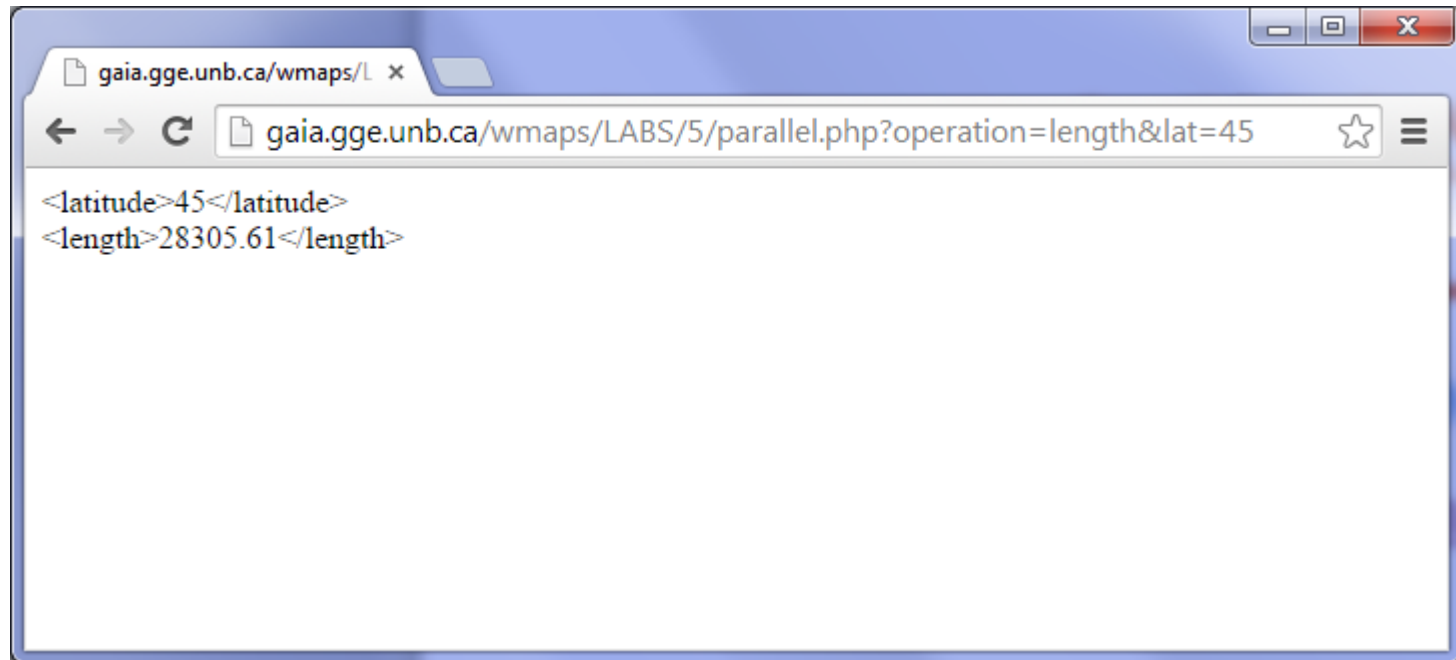
An Example Web Service

- Compute the length of a parallel
 - <http://gaia.gge.unb.ca:8080/gge5403/labs/3/parallel.php>

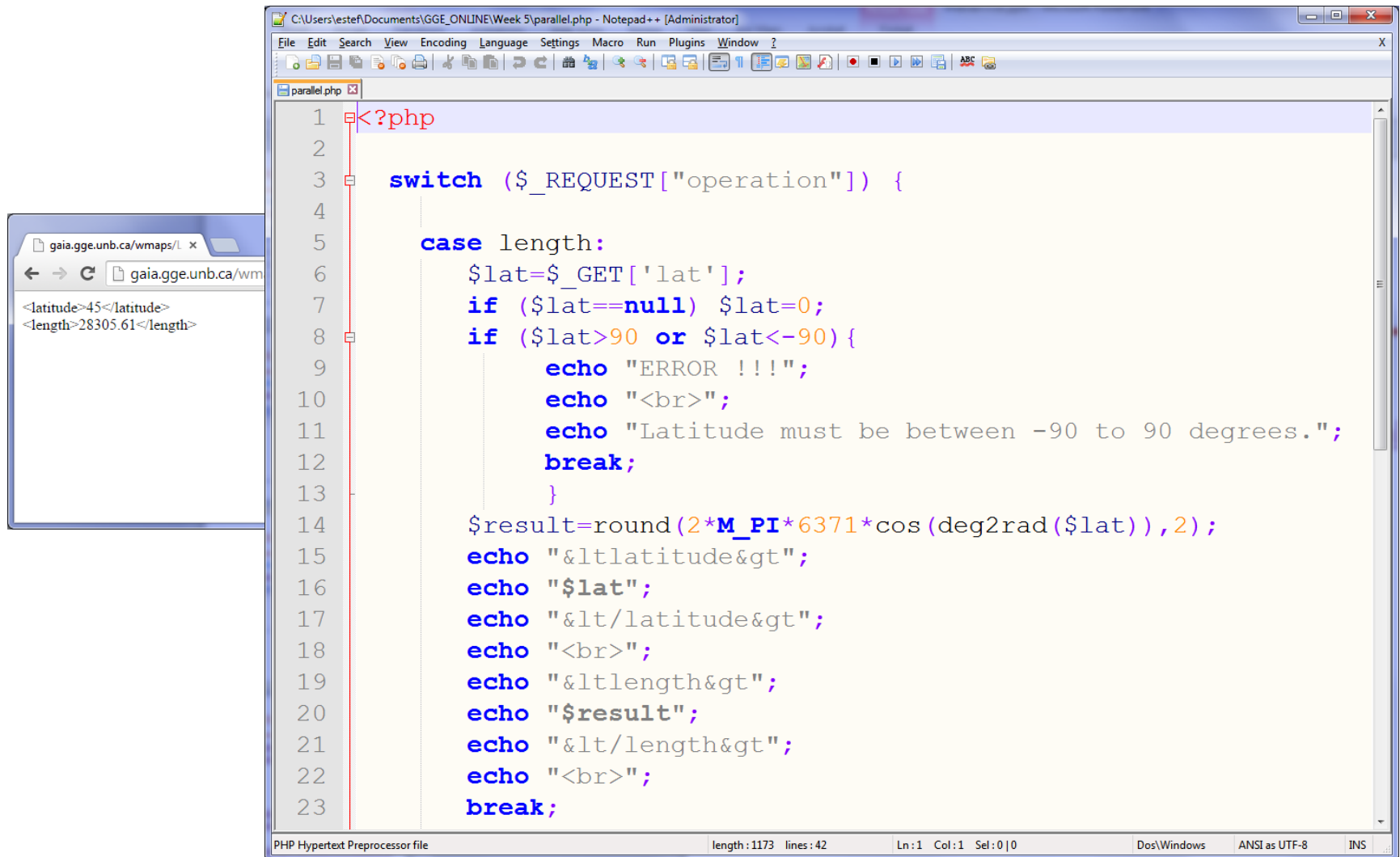


An Example Web Service

- Compute the length of a parallel



An Example Web Service

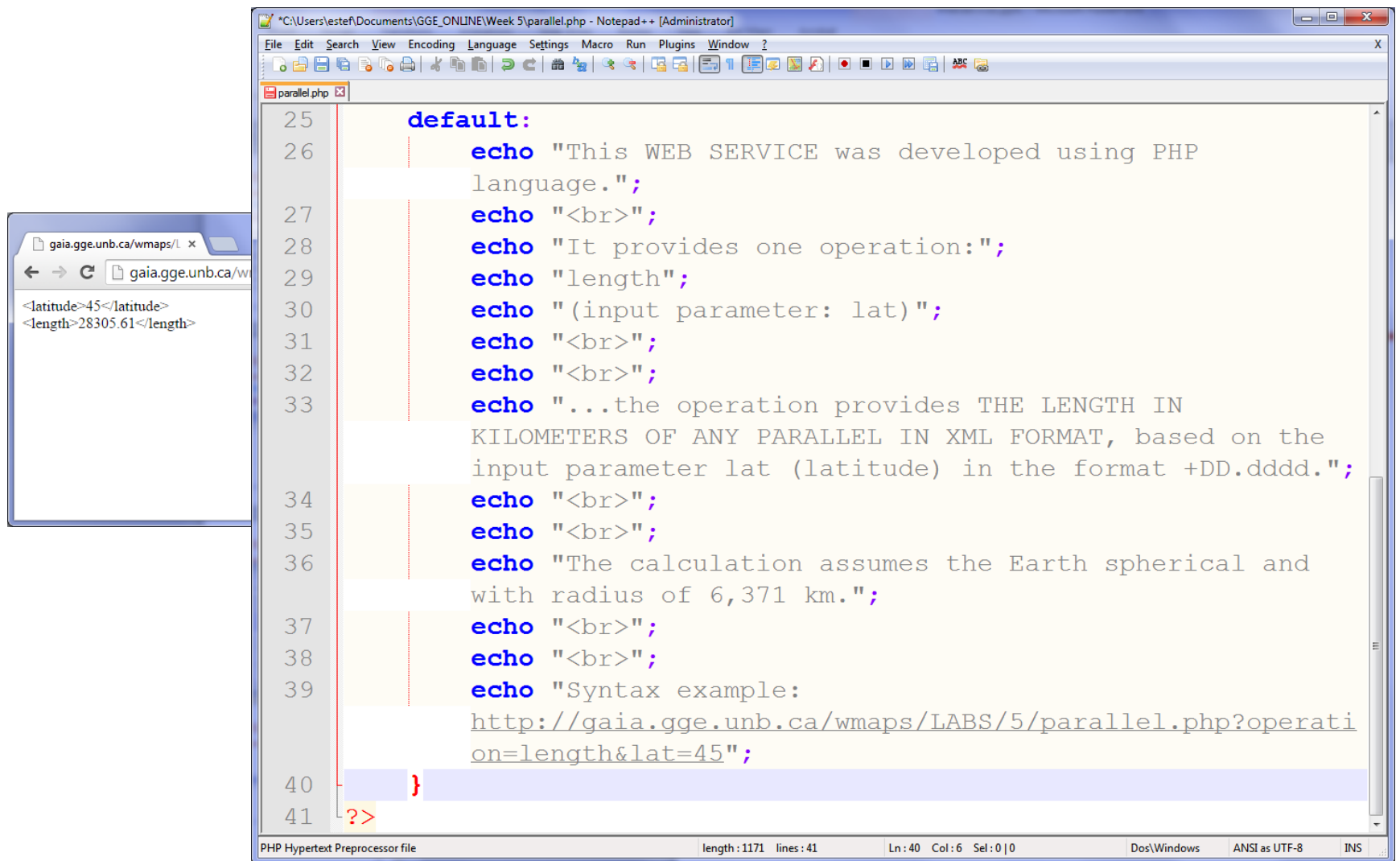


The image shows a web browser window on the left and a Notepad++ editor window on the right. The browser window displays the output of a web service call to `gaia.gge.unb.ca/wmaps/L`, showing XML-like output: `<latitude>45</latitude>` and `<length>28305.61</length>`. The Notepad++ editor shows the PHP script `parallel.php` which implements a web service. The script uses a `switch` statement to handle the `$_REQUEST["operation"]`. In the `length` case, it retrieves the `lat` parameter, validates it (must be between -90 and 90 degrees), and calculates a result using the formula `round(2 * M_PI * 6371 * cos(deg2rad($lat)), 2)`. The output is formatted as XML using `echo` statements.

```
1 <?php
2
3 switch ($_REQUEST["operation"]) {
4
5     case length:
6         $lat=$_GET['lat'];
7         if ($lat==null) $lat=0;
8         if ($lat>90 or $lat<-90){
9             echo "ERROR !!!";
10            echo "<br>";
11            echo "Latitude must be between -90 to 90 degrees.";
12            break;
13        }
14        $result=round(2*M_PI*6371*cos(deg2rad($lat)),2);
15        echo "&lt;latitude&gt";
16        echo "$lat";
17        echo "&lt;/latitude&gt";
18        echo "<br>";
19        echo "&lt;length&gt";
20        echo "$result";
21        echo "&lt;/length&gt";
22        echo "<br>";
23        break;
```

PHP Hypertext Preprocessor file length:1173 lines:42 Ln:1 Col:1 Sel:0|0 Dos\Windows ANSI as UTF-8 INS

An Example Web Service



The image shows a web browser window on the left and a Notepad++ editor window on the right. The browser window displays the output of a web service call, showing XML data for latitude and length. The Notepad++ editor shows the PHP script that generates this output.

Browser Window (gaia.gge.unb.ca/wmaps/L):

```
<latitude>45</latitude>
<length>28305.61</length>
```

Notepad++ Editor (parallel.php):

```
25  default:
26      echo "This WEB SERVICE was developed using PHP
27      language.";
28      echo "<br>";
29      echo "It provides one operation:";
30      echo "length";
31      echo "(input parameter: lat)";
32      echo "<br>";
33      echo "<br>";
34      echo "...the operation provides THE LENGTH IN
35      KILOMETERS OF ANY PARALLEL IN XML FORMAT, based on the
36      input parameter lat (latitude) in the format +DD.dddd.";
37      echo "<br>";
38      echo "<br>";
39      echo "The calculation assumes the Earth spherical and
40      with radius of 6,371 km.";
41      echo "<br>";
42      echo "Syntax example:
43      http://gaia.gge.unb.ca/wmaps/LABS/5/parallel.php?operati
44      on=length&lat=45";
45  }
```

PHP Hypertext Preprocessor file | length: 1171 | lines: 41 | Ln: 40 | Col: 6 | Sel: 0 | 0 | Dos\Windows | ANSI as UTF-8 | INS

An Example Web Service

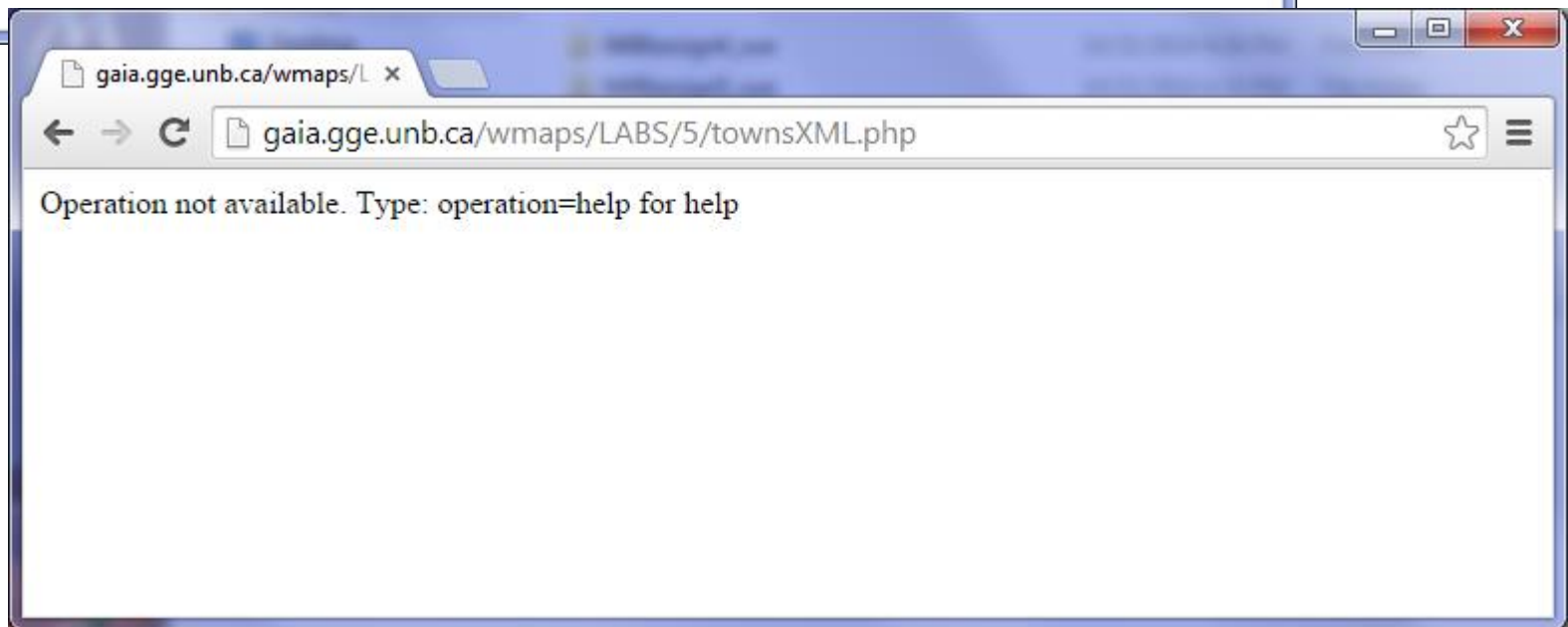
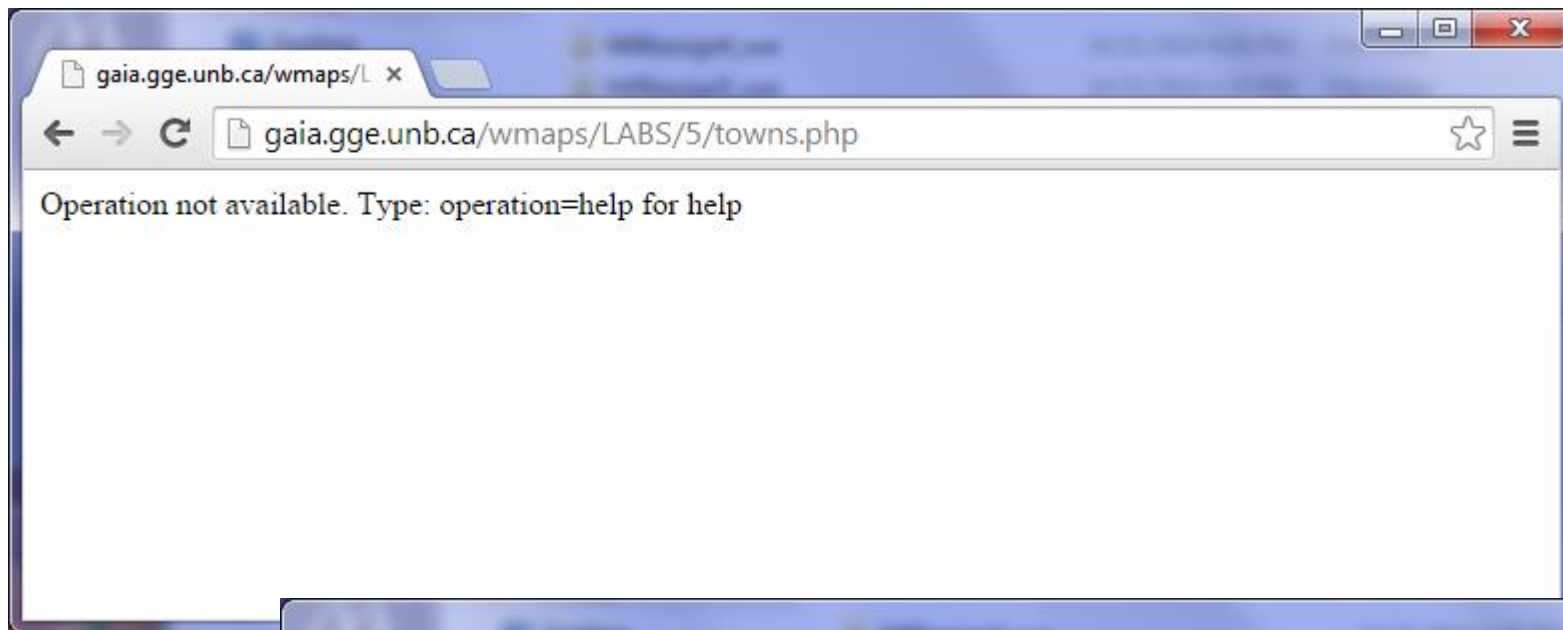
*These services are
unavailable*

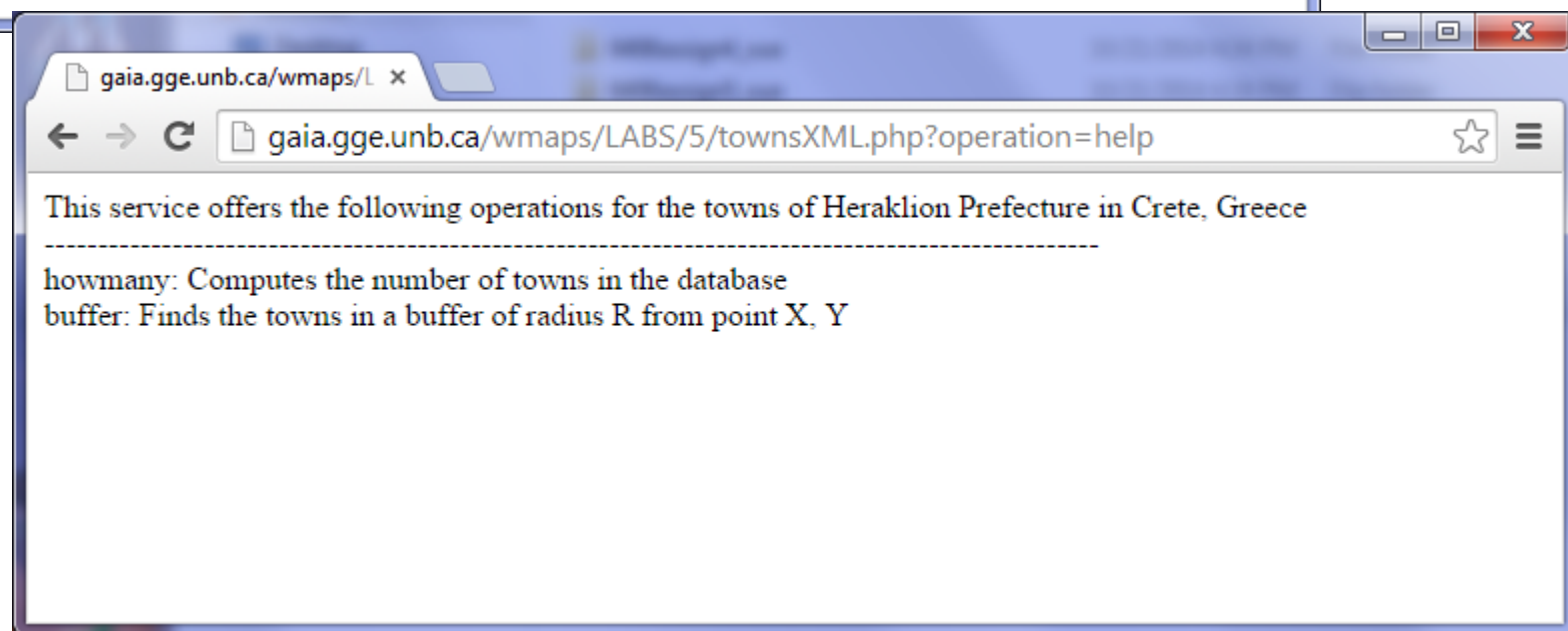
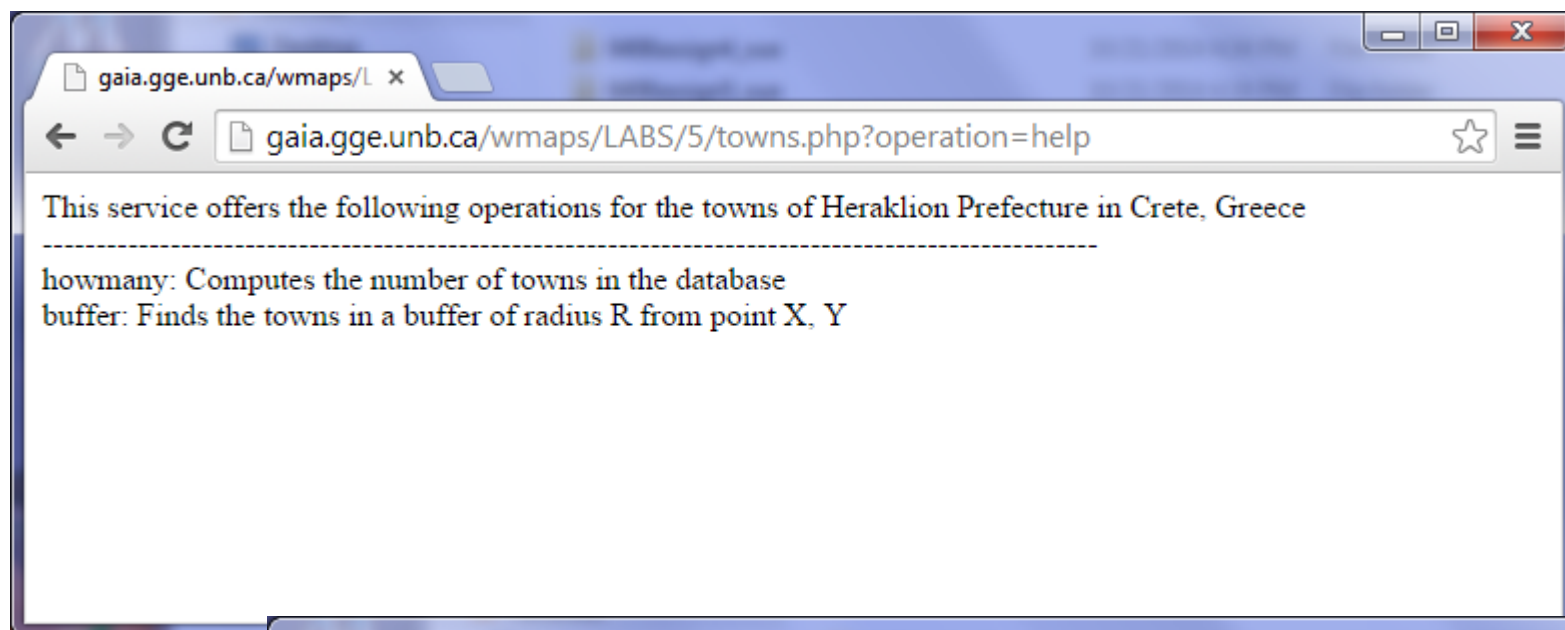
- <http://gaia.gge.unb.ca/wmaps/LABS/5/towns.php>
- <http://gaia.gge.unb.ca/wmaps/LABS/5/towns.php?operation=help>
- <http://gaia.gge.unb.ca/wmaps/LABS/5/towns.php?operation=howmany>
- <http://gaia.gge.unb.ca/wmaps/LABS/5/towns.php?operation=buffer>
- <http://gaia.gge.unb.ca/wmaps/LABS/5/towns.php?operation=buffer&R=10000>
- <http://gaia.gge.unb.ca/wmaps/LABS/5/towns.php?operation=buffer&R=5000&X=593000&Y=3918500>

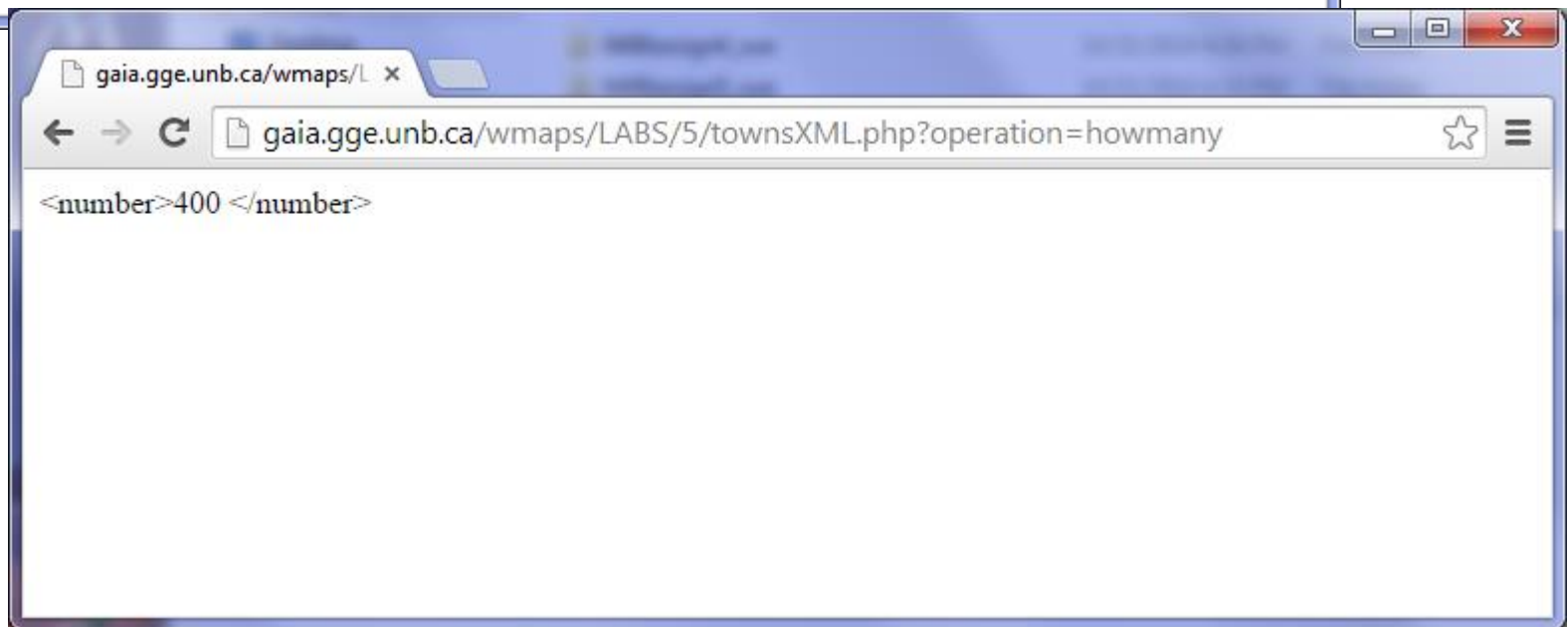
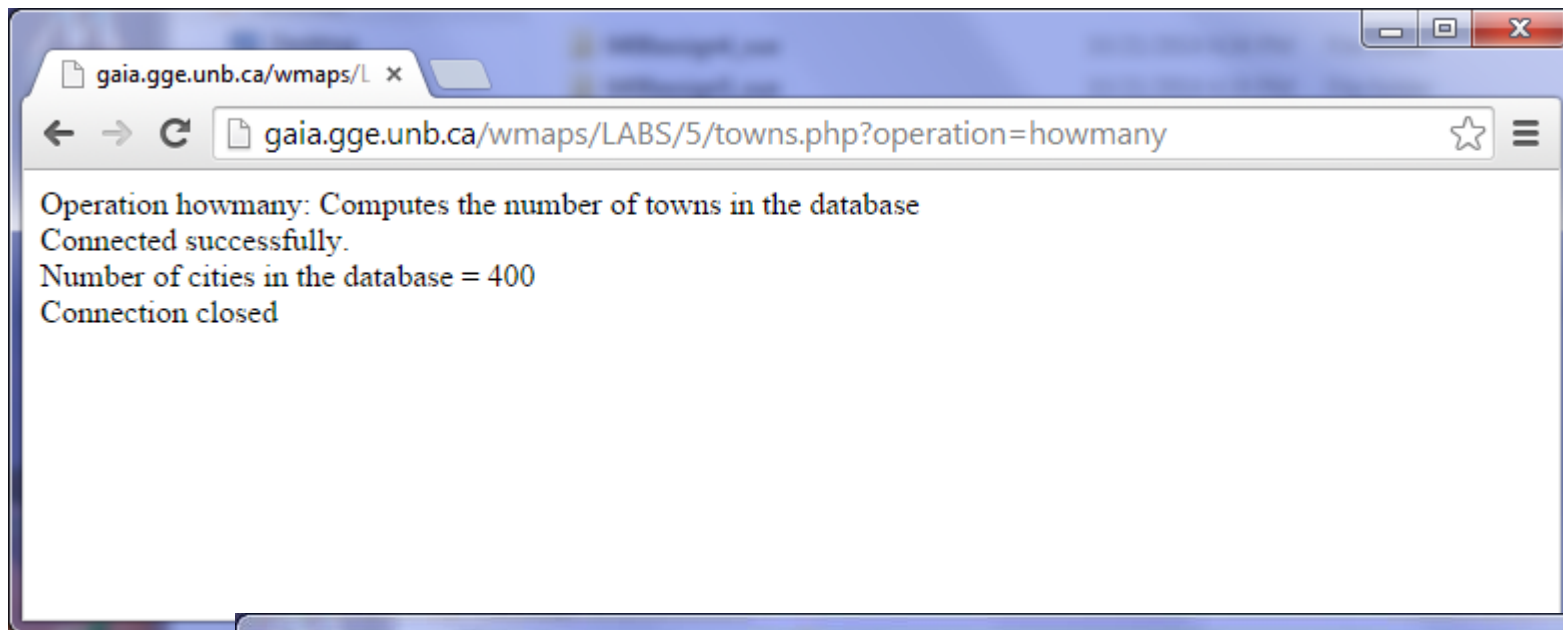
An Example Web Service (XML)

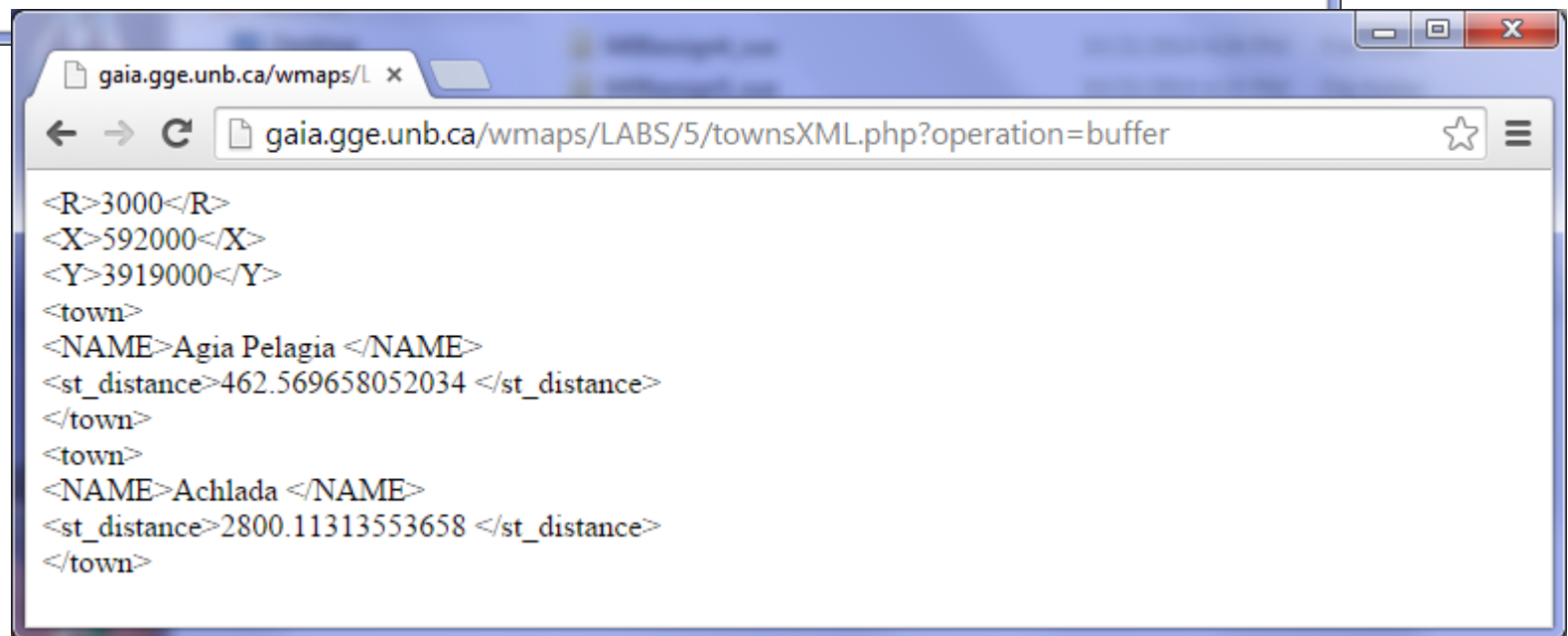
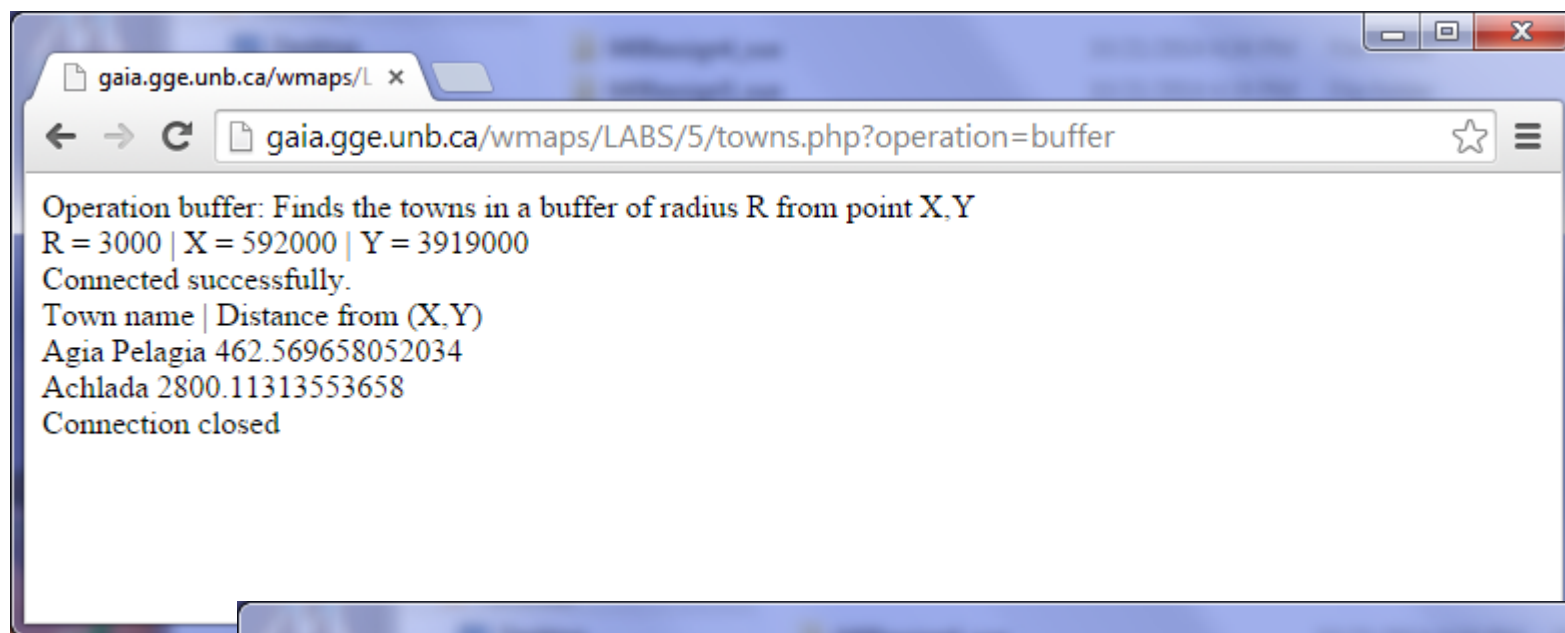
*These services are
unavailable*

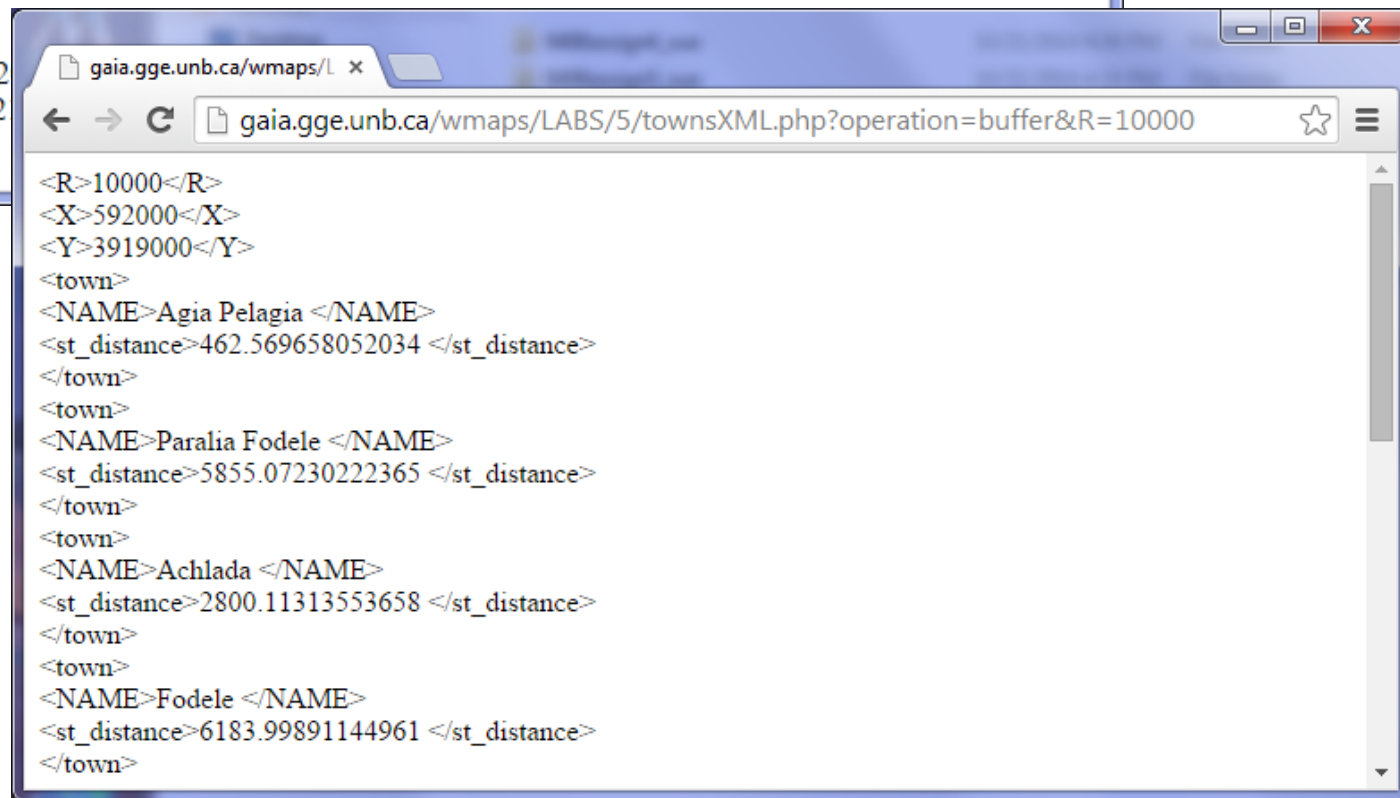
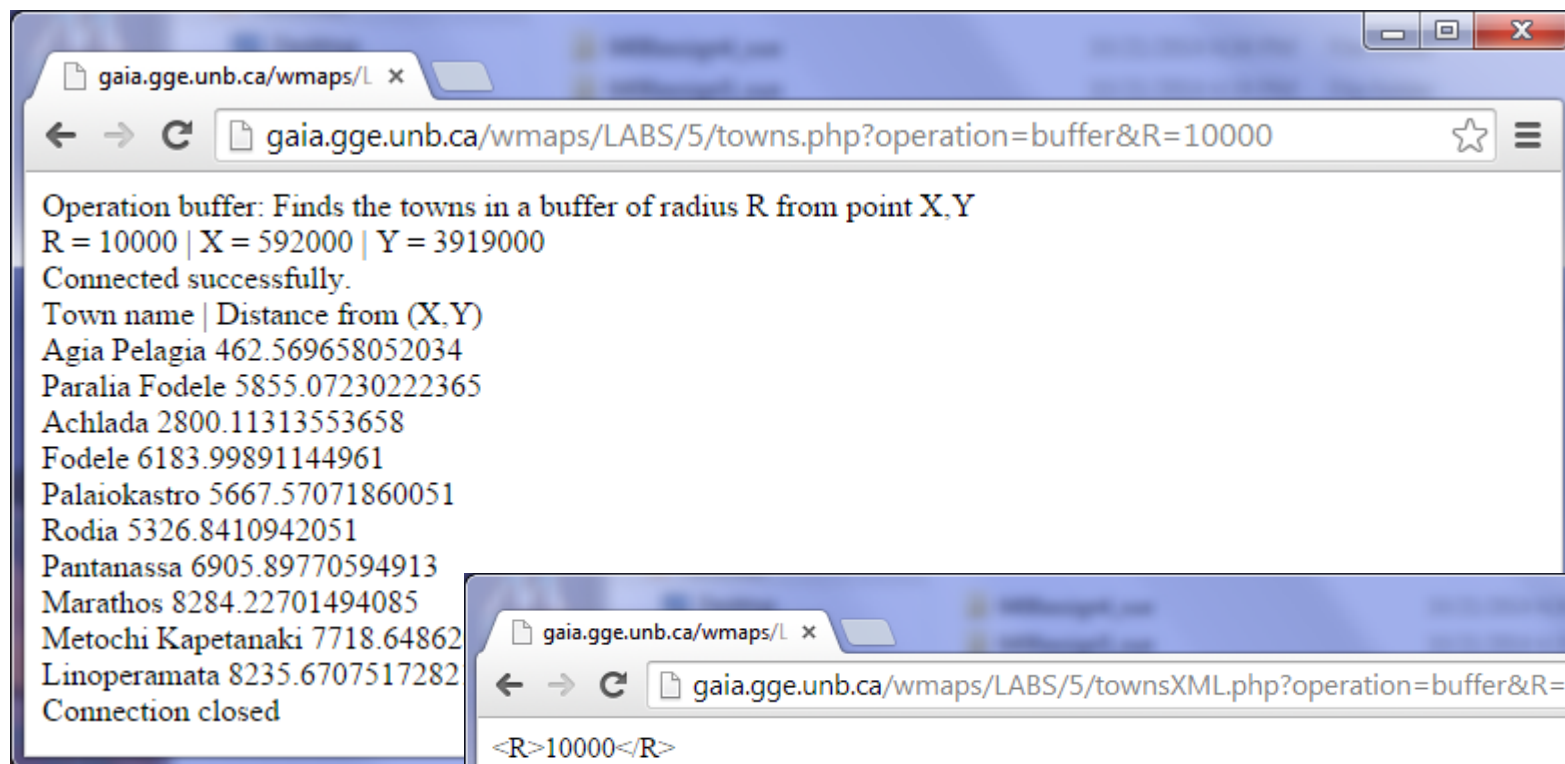
- <http://gaia.gge.unb.ca/wmaps/LABS/5/townsXML.php>
- <http://gaia.gge.unb.ca/wmaps/LABS/5/townsXML.php?operation=help>
- <http://gaia.gge.unb.ca/wmaps/LABS/5/townsXML.php?operation=howmany>
- <http://gaia.gge.unb.ca/wmaps/LABS/5/townsXML.php?operation=buffer>
- <http://gaia.gge.unb.ca/wmaps/LABS/5/townsXML.php?operation=buffer&R=10000>
- <http://gaia.gge.unb.ca/wmaps/LABS/5/townsXML.php?operation=buffer&R=5000&X=593000&Y=3918500>

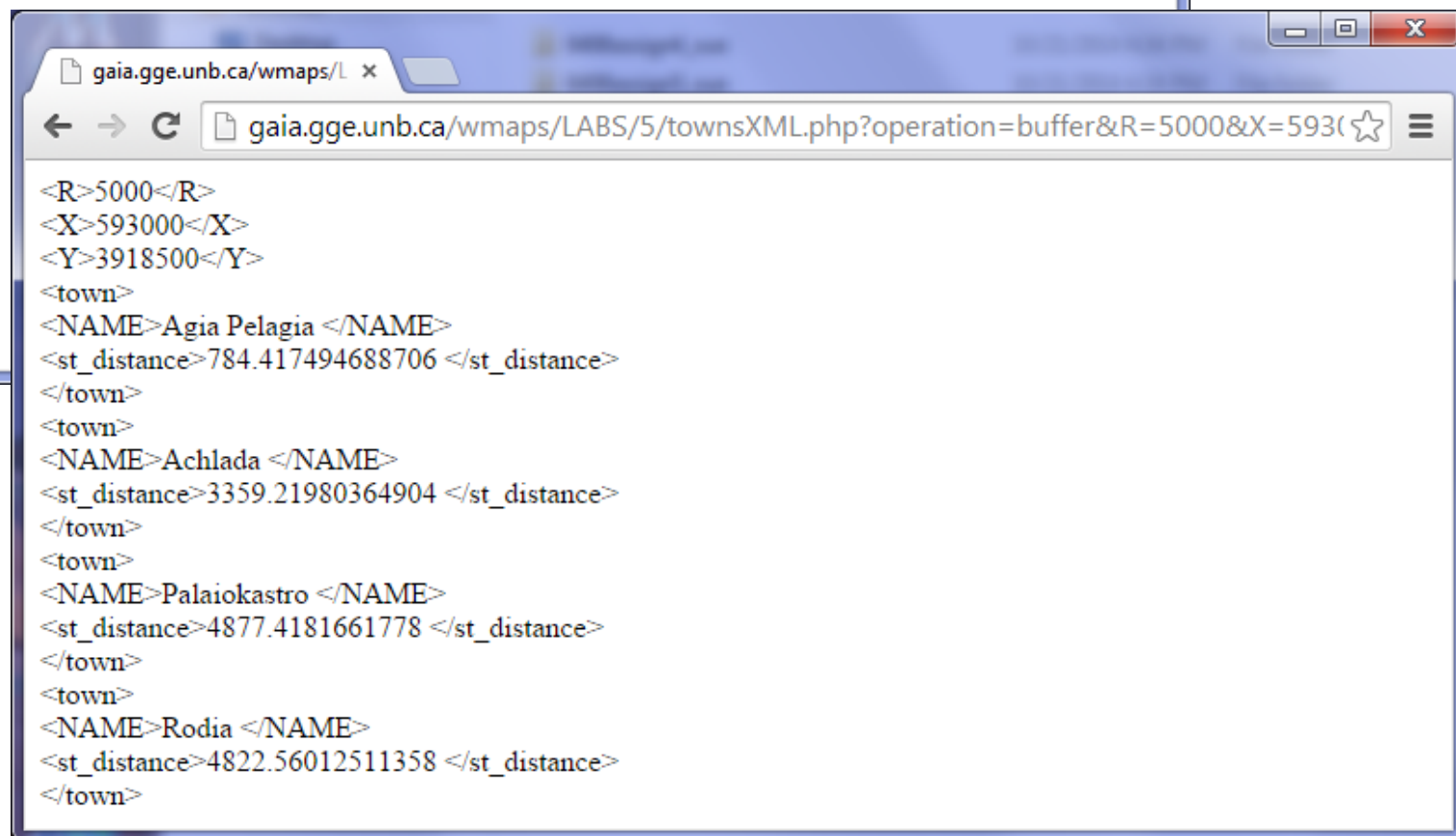
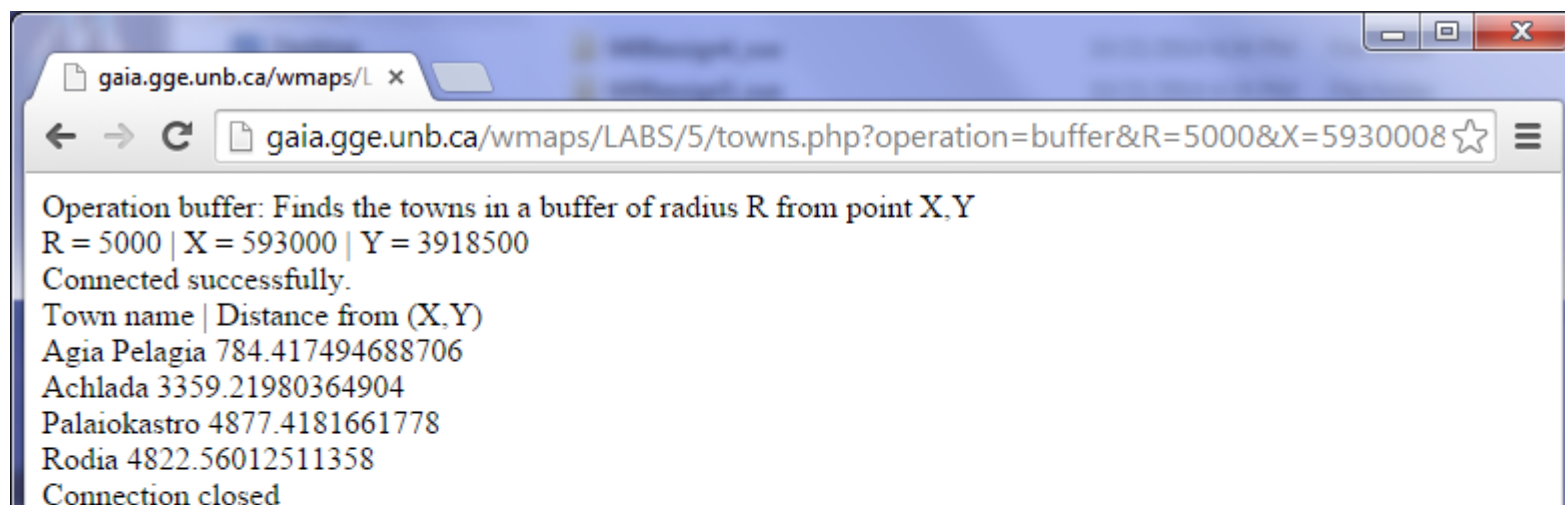




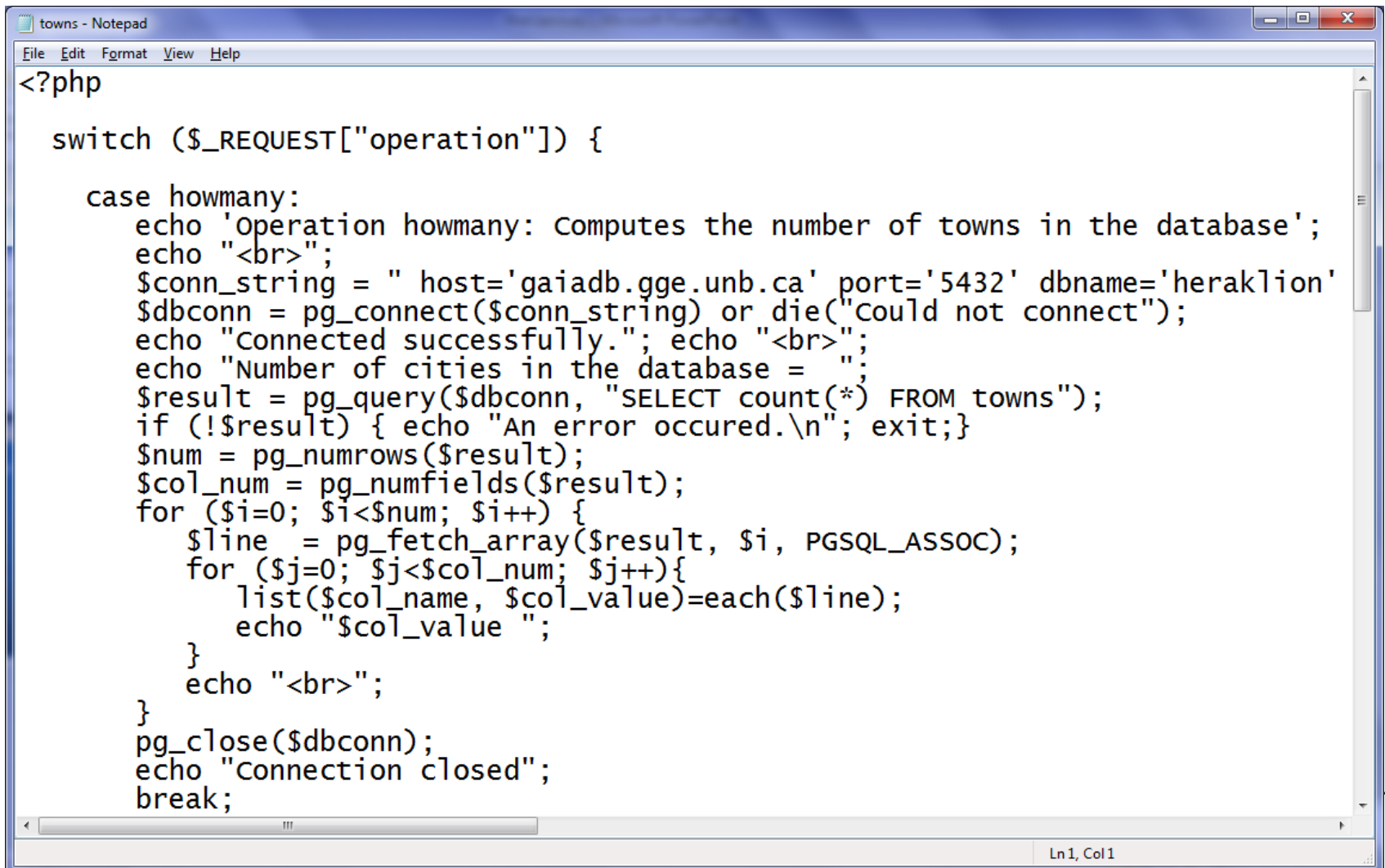








php code



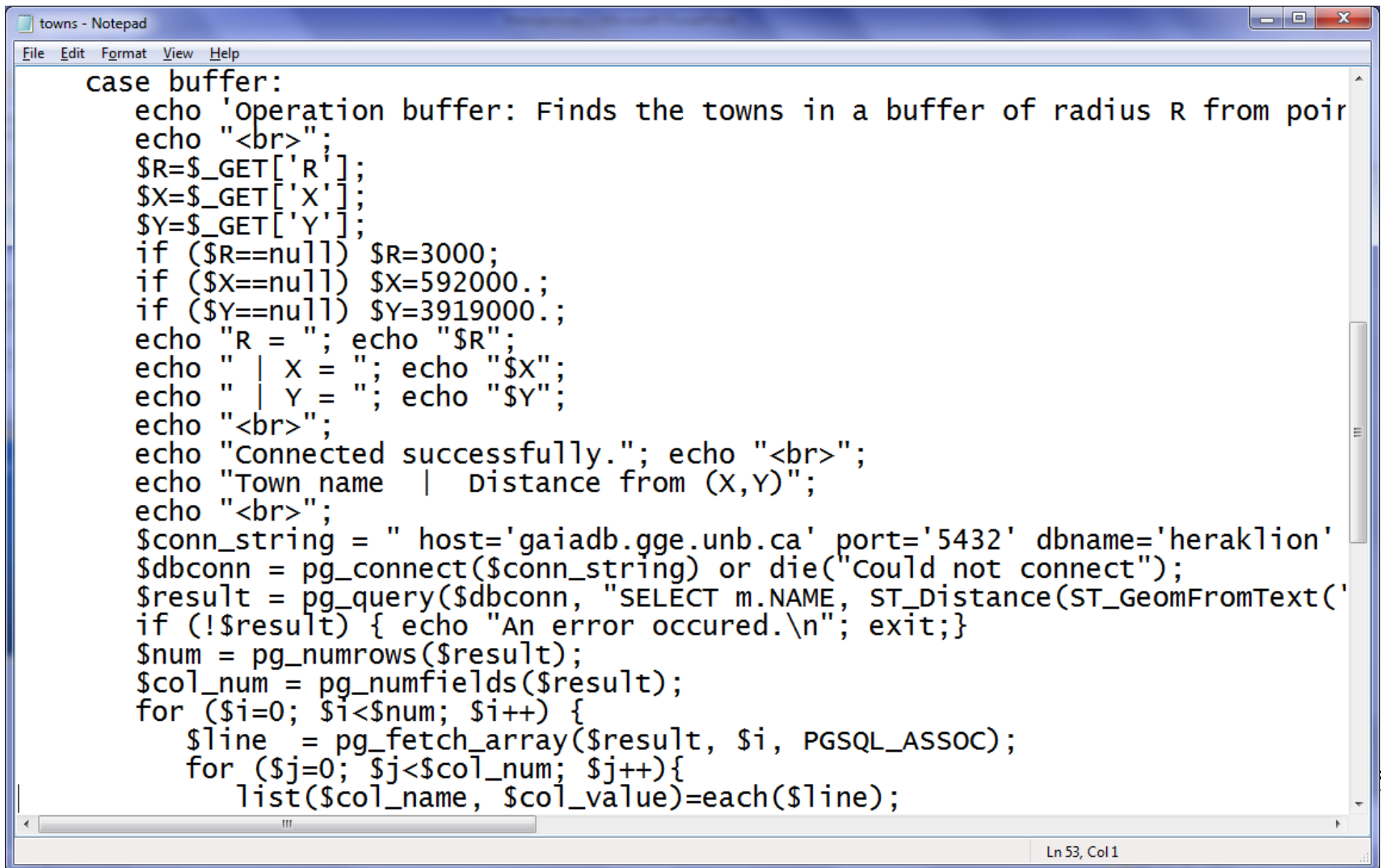
```
<?php

switch ($_REQUEST["operation"]) {

    case howmany:
        echo 'operation howmany: Computes the number of towns in the database';
        echo "<br>";
        $conn_string = " host='gaiadb.gge.unb.ca' port='5432' dbname='heraklion'";
        $dbconn = pg_connect($conn_string) or die("Could not connect");
        echo "Connected successfully."; echo "<br>";
        echo "Number of cities in the database = ";
        $result = pg_query($dbconn, "SELECT count(*) FROM towns");
        if (!$result) { echo "An error occured.\n"; exit;}
        $num = pg_numrows($result);
        $col_num = pg_numfields($result);
        for ($i=0; $i<$num; $i++) {
            $line = pg_fetch_array($result, $i, PGSQL_ASSOC);
            for ($j=0; $j<$col_num; $j++){
                list($col_name, $col_value)=each($line);
                echo "$col_value ";
            }
            echo "<br>";
        }
        pg_close($dbconn);
        echo "Connection closed";
        break;
```

Ln1, Col1

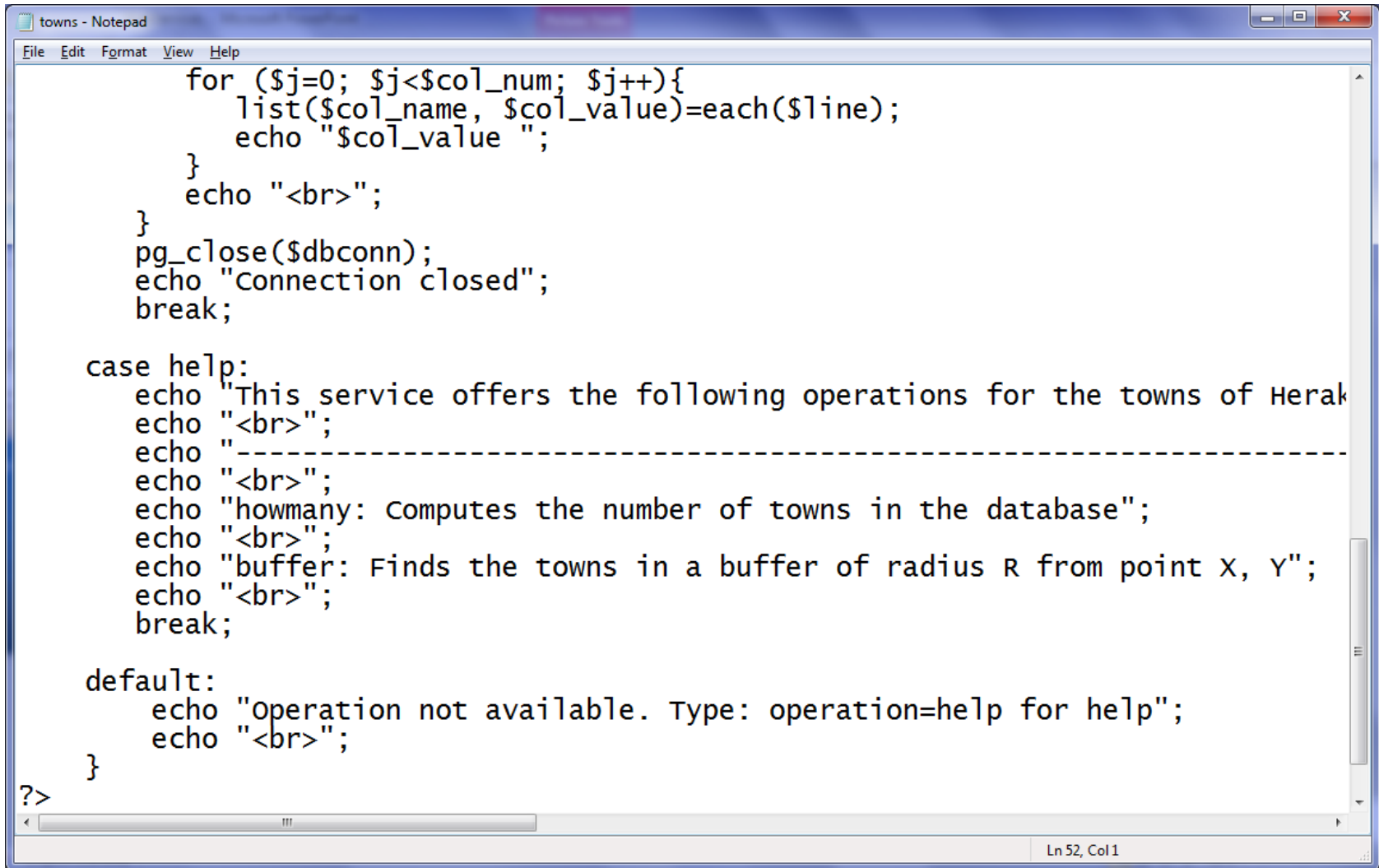
php code



```
case buffer:
    echo 'Operation buffer: Finds the towns in a buffer of radius R from pair';
    echo "<br>";
    $R=$_GET['R'];
    $X=$_GET['X'];
    $Y=$_GET['Y'];
    if ($R==null) $R=3000;
    if ($X==null) $X=592000.;
    if ($Y==null) $Y=3919000.;
    echo "R = "; echo "$R";
    echo " | X = "; echo "$X";
    echo " | Y = "; echo "$Y";
    echo "<br>";
    echo "Connected successfully."; echo "<br>";
    echo "Town name | Distance from (X,Y)";
    echo "<br>";
    $conn_string = " host='gaiadb.gge.unb.ca' port='5432' dbname='heraklion'";
    $dbconn = pg_connect($conn_string) or die("Could not connect");
    $result = pg_query($dbconn, "SELECT m.NAME, ST_Distance(ST_GeomFromText('"));
    if (!$result) { echo "An error occurred.\n"; exit;}
    $num = pg_numrows($result);
    $col_num = pg_numfields($result);
    for ($i=0; $i<$num; $i++) {
        $line = pg_fetch_array($result, $i, PGSQL_ASSOC);
        for ($j=0; $j<$col_num; $j++){
            list($col_name, $col_value)=each($line);
```

Ln 53, Col 1

php code



```
towns - Notepad
File Edit Format View Help
    for ($j=0; $j<$col_num; $j++){
        list($col_name, $col_value)=each($line);
        echo "$col_value ";
    }
    echo "<br>";
}
pg_close($dbconn);
echo "Connection closed";
break;

case help:
    echo "This service offers the following operations for the towns of Herak";
    echo "<br>";
    echo "-----";
    echo "<br>";
    echo "howmany: Computes the number of towns in the database";
    echo "<br>";
    echo "buffer: Finds the towns in a buffer of radius R from point X, Y";
    echo "<br>";
    break;

default:
    echo "operation not available. Type: operation=help for help";
    echo "<br>";
}

?>
```

Ln 52, Col 1

An Example Web Service

*These services are
unavailable*

The Code:

http://gaia.gge.unb.ca/wmaps/LABS/5/text_parallel.txt

http://gaia.gge.unb.ca/wmaps/LABS/5/text_towns.txt

http://gaia.gge.unb.ca/wmaps/LABS/5/text_townsXML.txt