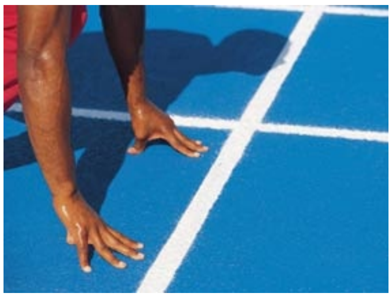
~~maXbox~~

maXbox Starter 39



Start with GEO Maps

1.1 Go with OpenStreetMap

Today we run through GEO Maps coding.
To find a street nowadays is easy; open a browser and search for.
One of the questions that comes up when encoding those coordinates is how they can be useful in a script with for example in maXbox:

```
OpenMapX('cathedral cologne');
OpenMapX('50.94134 6.95813'); //string!
```

With a GPS or navigation: The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather conditions. But you need a map to visualize.

☝ Each GPS satellite continuously broadcasts a navigation message at a rate of 50 bits per second. A message takes 750 seconds to complete!
Such a record does have as minimum navi information:

```
procedure GPSRecord
begin
 writeln('time,date,latitude,longitude,altitude,nsat,speed,course');
end
```

This isn't very different from a normal weather station clock, isn't it? Now we define our map search to get the map in your standard browser. We use the mapquest API from:

http://open.mapquestapi.com/nominatim/

The following example demonstrates a simple map search request for “Cathedral Cologne“ using the Nominatim quest. Only three parameters are being requested (menu: `View\GEO Map View`):

1. format - Output format being called. [html/json/xml]
2. json_callback - Callback function used to display results below.
3. q - Query string being searched for.

We set first a const in the script to send the request:

```
Const
   AMAPFILENAME2= 'maxmapfile.html';

UrlMapQuestAPICode2='http://open.mapquestapi.com/nominatim/v1/search
.php?format=%s&json_callback=renderBasicSearchNarrative&q=%s';
```

How are these 3 arguments linked together:

- `format=%s`
- `json_callback=renderBasicSearchNarrative`
- `q=%s`

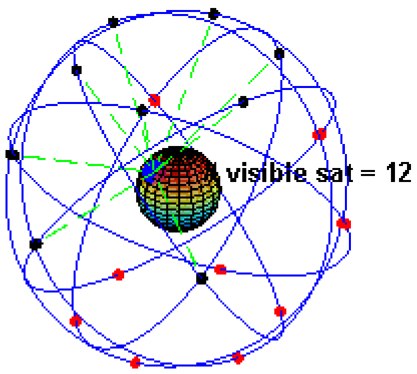
You'll notice that the json_callback parameter is already set. The format and the query string indeed is up to you. We use a html format to prepare open a browser with the map, se here's the call:

```
 if GetMAPX('html',ExePath+'cologne2mapX.html','cathedral cologne')
      then writeln('Cologne Map found');
```

By the way: Most of GPS and data formats is found by the NMEA.
The NMEA is the National Marine Electronics Association. It is to be a worldwide, self-sustaining organization committed to enhancing the technology and safety of electronics used in marine applications and you see also a standard for GPS data formats.

How it works: The GPS satellites transmit signals to a GPS receiver. These receivers passively receive those signals; they do not transmit and require a clear view of the sky, so they can only be used effectively outdoors, or from time to time in trains or gadgets;-).

```
Type
  TReceive_Func = TGPS.SerialRxChar(Sender: TObject);
```



Lets back to our easy call

```
      GetMAPX('html',ExePath+'cologne2mapX.html','cathedral cologne')
      OpenMap('ubs ag burgdorf');
```

You also find a procedure with same meaning

```
      GetGeoMAP('html',ExePath+AMAPFILENAME2,'dom cologne')
```

Note: in both cases, this code is assuming D2007 or earlier as maXbox follows. In D2009 and later, String is Unicode now, so you need to know the Encoding of the `TStream` contents ahead of time in order for the bytes to be interpretted as, or converted to, Unicode correctly.
Otherwise, you would have to change to operate on AnsiString or the new RawByteString instead.

1.1.1 The Dark side of the Code

Obviously the most important device required for this software to work, is the map from the internet provider *OpenStreetMap*. All browser devices with a Java Script ECMA compatible connection are supported.
The Java Script code which sends the request and displays the result can be viewed here as an XML output for example:

Test mX4 Ref: XML, JSON, HTML

```
<reversegeocode timestamp="Thu, 12 Sep 14 20:52:32 +0000" attribution="Data
© OpenStreetMap contributors, ODbL 1.0.
http://www.openstreetmap.org/copyright"
querystring="format=html&json_callback=renderExampleThreeResults&lat=47.039
7826&lon=7.62914761277888"><result place_id="15120759" osm_type="node"
osm_id="1378799522" ref="UBS AG" lat="47.0398676" lon="7.6291424">UBS AG,
Bahnhofstrasse, Oberstadt, Burgdorf, Verwaltungskreis Emmental,
Verwaltungsregion Emmental-Oberaargau, Bern, 3414,
Switzerland</result><addressparts><atm>UBS
AG</atm><road>Bahnhofstrasse</road><neighbourhood>Oberstadt</neighbourhood>
<town>Burgdorf</town><county>Verwaltungskreis
Emmental</county><state_district>Verwaltungsregion Emmental-
Oberaargau</state_district><state>Bern</state><postcode>3414</postcode><cou
ntry>Switzerland</country><country_code>ch</country_code>
</addressparts></reversegeocode>
```

From the result let's go back to the code behind.
As you already know the tool is split up into the toolbar across the top, the editor or code part in the centre and the output window at the bottom. Change that in the menu /view at our own style.

☝ Before this starter code will work you will need to download maXbox from a website. You'll get it from `http://www.softwareschule.ch/maxbox.htm` . Once the download has finished, unzip the file, making sure that you preserve the folder structure as it is. Test it with **F9** / F2 or press Compile and you should hear a test sound. So far so good now we'll open the examples:
`509_GEOMap3.txt`

If you can't find the two files try also direct as a file
http://www.softwareschule.ch/examples/509_GEOMap3.txt

Now let's take a look at the code of this app. One of our first line is creating the object `mapStream` and the encoded URL we use first methods to configure our `HTTPGet()` calling Port and IP of the *mapquest* API with the help of `HTTPEncode`. The object makes a bind connection with the Active method by passing an encoded URL with a memory stream:

```
procedure GetMapScript(C_form,apath: string; const Data:string);
var encURL: string;
    mapStream: TMemoryStream;
begin
  encURL:= Format(UrlMapQuestAPICode2, [c_form,HTTPEncode(Data)]);
  mapStream:= TMemoryStream.create;
  try
    HttpGet(EncURL, mapStream);    //WinInet
    mapStream.Position:= 0;
    mapStream.Savetofile(apath)
    OpenDoc(apath);
  finally
    mapStream.Free;
  end;
end;
```

The `OpenDoc()` procedure is used to get a browser open, you remember the call above:

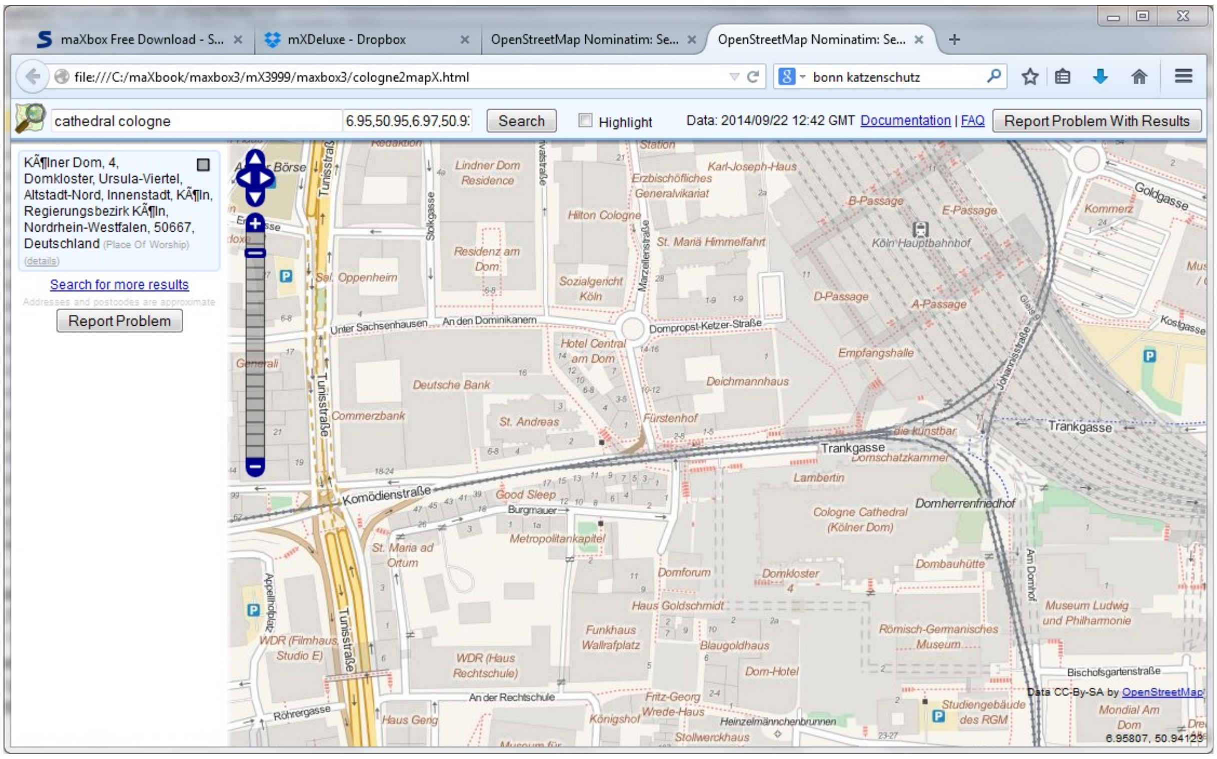
```
  GetMAPScript('html',ExePath+'cologne2mapX.html',
                                'cathedral cologne')
```

As we decode this with Format like above:

- `format=html`
- `json_callback=renderBasicSearchNarrative`
- `q=cathedral cologne`

And this is how another function with download works:

```
function GetMapXScript(C_form,apath: string; const Data: string): boolean;
var encodedURL: string;
begin
  encodedURL:= Format(UrlMapQuestAPICode2,[c_form,HTTPEncode(Data)]);
  try
   //instead HttpGet(EncodedURL, mapStream);  //WinInet
  Result:= UrlDownloadToFile(Nil,PChar(encodedURL),PChar(apath),0,Nil)= 0;
    OpenDoc(apath);
  finally
    encodedURL:= '';
  end;
end;
```


maXbox Free Download - S...
mXDeluxe - Dropbox
OpenStreetMap Nominatim: Se...
OpenStreetMap Nominatim: Se...
file:///C:/maXbook/maxbox3/mX3999/maxbox3/cologne2mapX.html
bonn katzenschutz
cathedral cologne
6.95,50.95,6.97,50.9:
Search
Highlight
Data: 2014/09/22 12:42 GMT Documentation | FAQ
Report Problem With Results
KÃ¶lner Dom, 4, Domkloster, Ursula-Viertel, Altstadt-Nord, Innenstadt, KÃ¶ln, Regierungsbezirk KÃ¶ln, Nordrhein-Westfalen, 50667, Deutschland (Place Of Worship)
(details)
Search for more results
Addresses and postcodes are approximate
Report Problem
Cologne Cathedral (Kölner Dom)
Köln Hauptbahnhof
Trankgasse
Domkloster
Römisch-Germanisches Museum
Museum Ludwig und Philharmonie
Data CC-By-SA by OpenStreetMap
6.95807, 50.94123

This function is shorter than the first one because we use no streams in between. Working with streams in Free Pascal or Delphi you have to include some units to be able to use or code your functions direct in the script as you like:

```
function DownloadFile(SourceFile, DestFile: string): Boolean;
begin
  //TCIPStatus TBindStatus TURLTemplate of URLMon
  try
    Result:=
        UrlDownloadToFile(Nil,PChar(SourceFile),PChar(DestFile),0,Nil)= 0;
  except
    Result:= False;
  end;
end;
```

In maXbox those units and many others are pre-compiled and included on demand. As long as the API is stable we don't have change calls.

```
UrlMapQuestAPICode2='http://open.mapquestapi.com/nominatim/v1/search
.php?format=%s&json_callback=renderBasicSearchNarrative&q=%s';
```

After these steps, we can start with programming the rest of the GEO code called reverse GEO code.

☝ Reverse geocoding is the process of back (reverse) coding of a point location (latitude, longitude) to a readable address or place name. *GeoNames* for ex. offers a wide range of reverse geocoding web services. This permits identification of nearby street addresses, places, stations and/or areal subdivisions such as county, state or country.

1.1.2 Reverse GEO Code

The interesting point is now that we store no data on a file we just use a memory stream to get data direct on the console of maXbox.

Those data can be used with any console or script receiver to make further investigations. This may however vary depending on what data sentence the coordinates find or delivers, for ex. the cathedral at cologne:

```
 writeln(GetMapXGeoReverse('XML','50.94134','6.95813'))
```

or more accurate:

```
GetMapXGeoReverse2('XML',topPath,'50.94133705','6.95812611100766')
then
```

```
<?xml version="1.0" encoding="UTF-8"?>
-<reversegeocode
querystring="format=XML&json_callback=renderExampleThreeResults&lat=50.9413
3705&lon=6.95812611100766" attribution="Data © OpenStreetMap contributors,
ODbL 1.0. http://www.openstreetmap.org/copyright" timestamp="Mon, 22 Sep 14
13:36:43 +0000">
  <result lon="6.95812611100766" lat="50.94133705" ref="Kölner Dom"
    osm_id="4532022" osm_type="way" place_id="40406499">Kölner Dom, 4,
      Domkloster, Ursula-Viertel, Altstadt-Nord, Innenstadt, Köln,
      Regierungsbezirk Köln, Nordrhein-Westfalen, 50667,
      Deutschland</result>-
      <addressparts>
            <place_of_worship>Kölner Dom</place_of_worship>
            <house_number>4</house_number>
            <pedestrian>Domkloster</pedestrian>
            <neighbourhood>Ursula-Viertel</neighbourhood>
            <suburb>Altstadt-Nord</suburb>
            <city_district>Innenstadt</city_district>
            <county>Köln</county>
            <state_district>Regierungsbezirk Köln</state_district>
            <state>Nordrhein-Westfalen</state>
            <postcode>50667</postcode>
            <country>Deutschland</country>
            <country_code>de</country_code>
      </addressparts>
</reversegeocode>
```

Reverse geocoding can be carried out systematically by services which process a coordinate similarly to a geocoding process.
For ex., when a GPS coordinate is entered the street address is interpolated from a range assigned to the road segment in a reference dataset that the point is nearest to.

```
 osm_id="4532022" osm_type="way" place_id="40406499">Kölner Dom, 4,
     Domkloster, Ursula-Viertel, Altstadt-Nord, Innenstadt, Köln,
     Regierungsbezirk Köln, Nordrhein-Westfalen, 50667,
     Deutschland</result>-
```

Each table has a way column containing the geometry for the object in the chosen projection. Two indices are created for each table: one for the way column and one for the osm_id column, see above.
Geometry uses coordinates in the EPSG:900913 AKA G00GlE projection and can be easily used in e.g. OpenLayers based JavaScript.
Now for the code behind the call. We need another *mapquest* API of the get request service:

```
  UrlMapQuestAPI3:= 'http://open.mapquestapi.com/nominatim/v1/reverse.php?
format=%s&json_callback=renderExampleThreeResults&lat=%s&lon=%s';
```

As you can see it's a PHP server side service:

```
encodedURL:
      http://open.mapquestapi.com/nominatim/v1/reverse.php?
```

The function maps a stream to a string and is similar to above, except we don't save a file, but you can save the stream as an XML or Json file:

```
  mapstream.savetofile(apath) and OpenDoc(apath);
```

```
function GetMapXGeoReverse2(C_form,apath: string; const lat,long:
                                                       string):boolean;
 var encodedURL, UrlMapQuestAPI, bufstr: string;
    mapStream: TMemoryStream;
 begin
  UrlMapQuestAPI:= 'http://open.mapquestapi.com/nominatim/v1/reverse.php?
format=%s&json_callback=renderExampleThreeResults&lat=%s&lon=%s';
  encodedURL:= Format(UrlMapQuestAPI,[c_form, lat, long]);
   mapStream:= TMemoryStream.create;
   try
     HttpGet(EncodedURL, mapStream);  {WinInet}
     mapStream.Position:= 0;
     writeln('stream size: '+inttostr(mapstream.size)); //mapStream.memory;
     bufstr:= StreamToString(mapstream);
     writeln('stream back: '+bufstr)
   finally
     encodedURL:= '';
     mapStream.Free;
  end;
end;
```

Two ways to map a stream to a string:
1. Read the available Size of the TStream, allocate a String of that length, and then Read() the TStream contents into the String:

```
function StreamToString2(Stream: TStream): String;
var
  len: Integer;
begin
  len:= Stream.Size - Stream.Position;
  SetLength(Result, len);
  if len > 0 then Stream.ReadBuffer(Result, len);
    writeln('test - buffer read check!')
end;
```

2. Create an intermediate TStringStream, CopyFrom() the TStream to the TStringStream, and then read the TStringStream.DataString property:

```
{code:maXbox}
 function StreamToString3(Stream: TStream): String;
 begin
    with TStringStream.Create('') do
    try
      CopyFrom(Stream, Stream.Size-Stream.Position);
      Result:= DataString;
    finally
      Free;
    end;
 end;
```

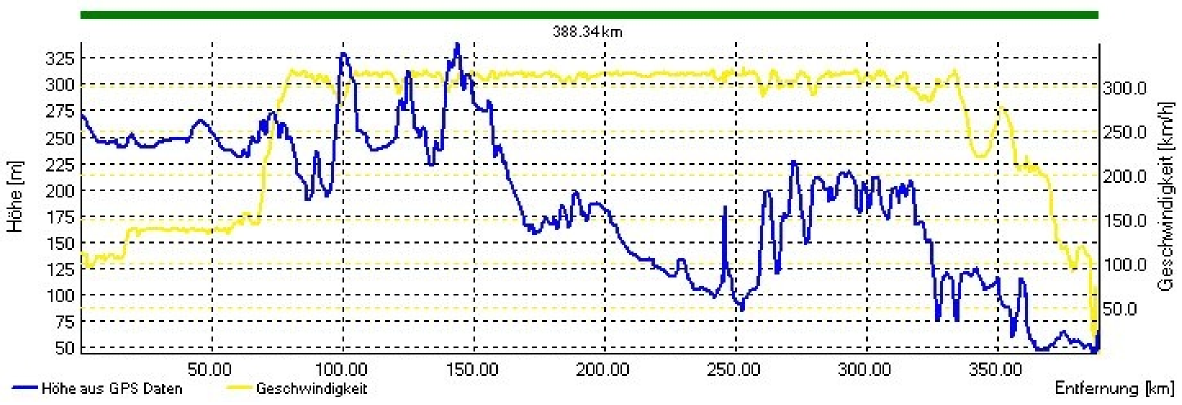
☝ `TMemoryStream` and `TFileStream` are both decendants of `TStream` and they work exactly the same way.

The problem I mostly found is that if we write one stream to another, we have to reset the origins before using it again like
`(MS.Seek(0,soFromBeginning);.`

Another point is to direct test a pair of coordinates. You can also convert coordinates (lat and long) to a map on the internet (Appendix).
http://www.gps-coordinates.net/

You can find the address corresponding to GPS coordinates or latitude, longitude and address of any point on OpenStreetMap.

Hope you did already work with the Starter 34 on GPS topics:
http://sourceforge.net/p/maxbox/wikimax/main/
At least we see a picture over a distance of 388 km. This image below is my sight of a track: the yellow line is the speed and the blue one marks the altitude point.



☝ **Almanac** data is data that describes the orbital courses of the satellites. Every satellite will broadcast almanac data for EVERY satellite. Your GPS receiver uses this data to determine which satellites it expects to see in the local sky; then it can determine which satellites it should track.

1.2 GPS and Arduino Conclusion

I would also recommend the book "Arduino Cookbook" by Michael Margolis. Here are a few ideas of more complicated projects that I have seen made with an Arduino.

- A box that will only open when it is at a certain location in the world (It connects a GPS to the Arduino. Search on "Reverse Geo-cache" to see some examples.)
- Or a controller for a 3D printer to print out the landscape the GPS or `OpenMAPX()` has just scanned!

Feedback @
max@kleiner.com
Literature: Kleiner et al., Patterns konkret, 2003, Software & Support

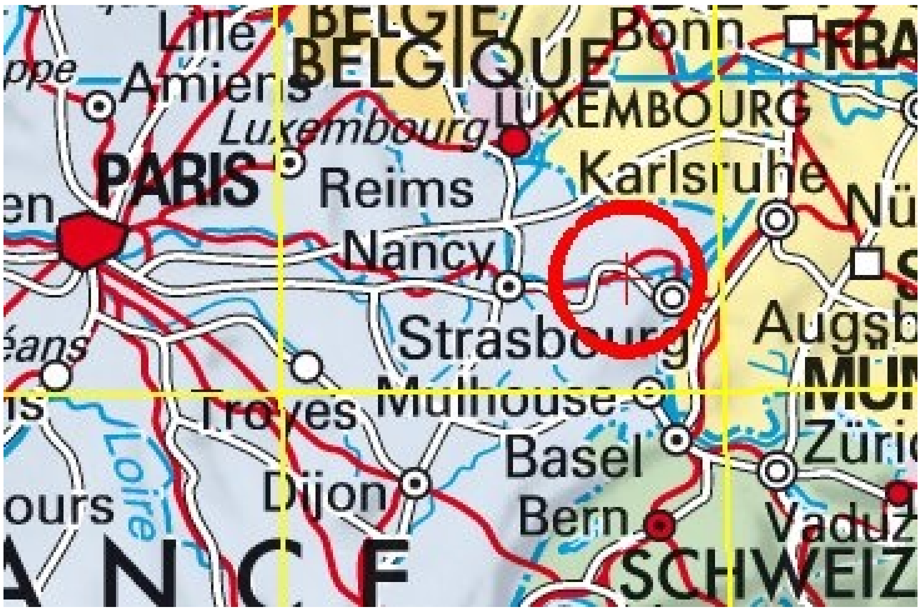
http://en.wikipedia.org/wiki/Reverse_geocoding
http://www.kleiner.ch/kleiner/gpsmax.htm
http://www.softwareschule.ch/examples/475_GPS_mX2.txt

Stream Ref:

http://embarcadero.newsgroups.archived.at/public.delphi.vcl.components.using/200907/0907292775.html

• Arduino Example.
http://www.softwareschule.ch/download/Arduino_C_2014_6_basta_box.pdf
http://sourceforge.net/projects/maxbox

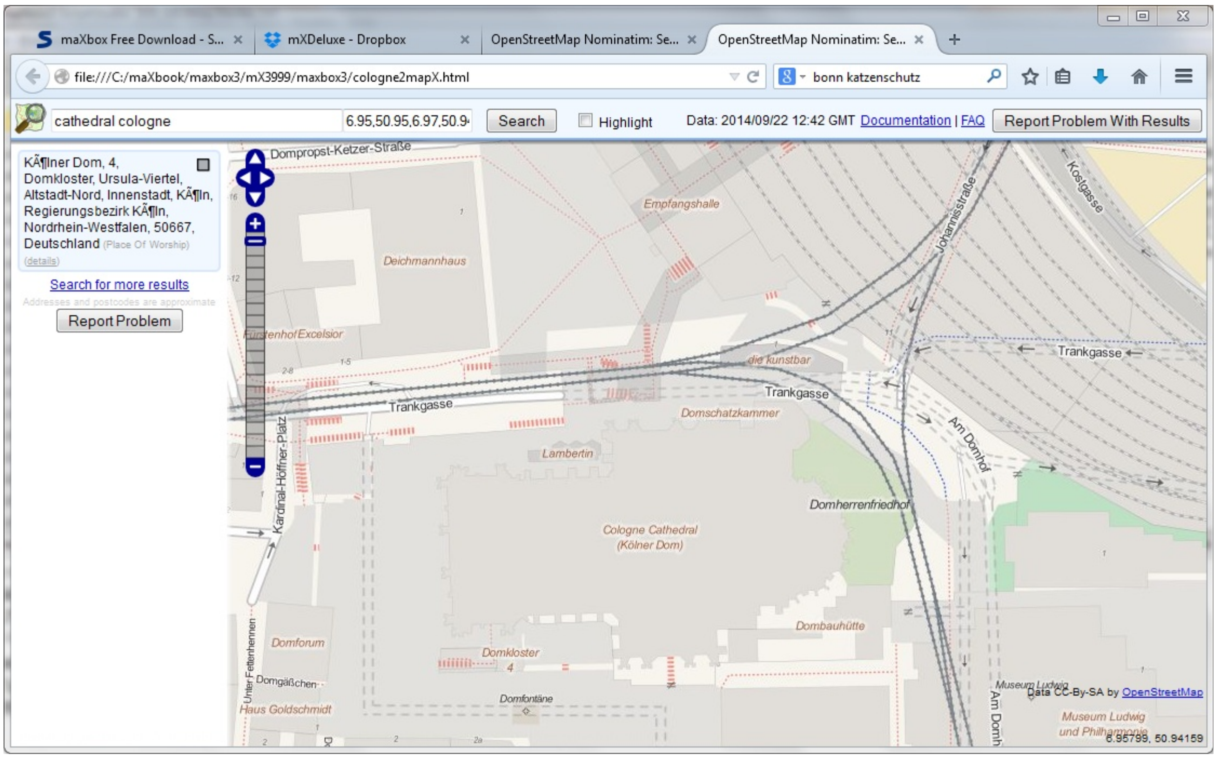
1.3 Appendix Map Study



[maXmap](#)

DD (decimal degrees)*
Latitude 48.725447N (48.656280963566495)
Longitude 7.143274E (6.991813648492098)
1 Rue du Canal, 57405 Guntzviller, France
Latitude : 48.725447 | **Longitude :** 7.143274 **Altitude :** 287 meters

`Here another map search zoom of OpenMAPX:`


maXbox Free Download - S... | mXDeluxe - Dropbox | OpenStreetMap Nominatim: Se... | OpenStreetMap Nominatim: Se...

file:///C:/maXbook/maxbox3/mX3999/maxbox3/cologne2mapX.html

bonn katzenschutz

cathedral cologne | 6.95,50.95,6.97,50.9 | Search | Highlight | Data: 2014/09/22 12:42 GMT Documentation | FAQ | Report Problem With Results

KÃ¶lner Dom, 4, Domkloster, Ursula-Viertel, Altstadt-Nord, Innenstadt, KÃ¶ln, Regierungsbezirk KÃ¶ln, Nordrhein-Westfalen, 50667, Deutschland (Place Of Worship)
(details)

Search for more results

Addresses and postcodes are approximate

Report Problem

Data CC-By-SA by OpenStreetMap

6.95799, 50.94159

RTClock: Arduino by Silvia Rothen http://www.ecotronics.ch/ecotron/arduinocheatsheet.htm