

WTE PROJEKT

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Zadání

1. Navrhněte a vytvořte tematické vrstvy pro data z cvičné databáze `pgis_student` pro schéma `osm`. Pro tento účel byla na serveru josef založena databáze `pgis_osm`.
2. Navrhněte sadu atributových a prostorových dotazů nad databází `pgis_osm` určenou pro výuku PostGIS.
3. Vizualizujte data pomocí UMN Mapserver. Vytvořte MapFile pro službu WFS. Alternativně navrhněte jednoduché uživatelské prostředí.

Navržení tematických vrstev

V databázi `pgis_student` byly vytvořeny následující tematické vrstvy odvozené ze schematu `osm`:

1. *hranice ČR*

```
CREATE TABLE hranice_kk AS
  SELECT id, osm_id, boundary, name, admin_level, way
  FROM osm.planet_osm_line WHERE admin_level = 2;

ALTER TABLE hranice_kk ADD PRIMARY KEY (id);

GRANT SELECT ON hranice_kk TO postgis;
```

2. *obce*

```
CREATE TABLE obce_kk AS
  SELECT * FROM osm.planet_osm_point
  WHERE place='village' OR place='city' OR place='hamlet'
  OR place='town' AND name IS NOT NULL
  ORDER BY name;

ALTER TABLE obce_kk ADD PRIMARY KEY (id);

GRANT SELECT ON obce_kk TO postgis;
```

3. *dálnice*

```
CREATE TABLE dalnice_kk AS
  SELECT * FROM osm.planet_osm_roads
  WHERE highway='motorway' OR highway='motorway-link';

SELECT Populate_Geometry_Columns('public.dalnice_kk'::regclass);

ALTER TABLE dalnice_kk ADD PRIMARY KEY (osm_id);

GRANT ALL ON dalnice_kk TO postgis;
```

4. *železnice*

```
CREATE TABLE zeleznice_kk AS
  SELECT * FROM osm.planet_osm_roads WHERE railway = 'rail';

SELECT Populate_Geometry_Columns('public.zeleznice_kk'::regclass);

ALTER TABLE zeleznice_kk ADD PRIMARY KEY (osm_id);

GRANT ALL ON zeleznice_kk TO postgis;
```

5. *silnice první třídy*

```
CREATE TABLE silnice_1t AS
  SELECT * FROM osm.planet_osm_roads
  WHERE highway = 'primary' OR highway = 'primary_link';

SELECT Populate_Geometry_Columns('public.silnice_1t'::regclass);

ALTER TABLE silnice_1t ADD PRIMARY KEY (osm_id);

GRANT ALL ON silnice_1t TO postgis;
```

6. *silnice druhé a třetí třídy*

```
CREATE TABLE silnice_2t AS
  SELECT * FROM osm.planet_osm_roads
  WHERE highway = 'secondary' OR highway = 'secondary_link'
  OR highway = 'tertiary';

SELECT Populate_Geometry_Columns('public.silnice_2t'::regclass);

ALTER TABLE silnice_2t ADD PRIMARY KEY (osm_id);

GRANT ALL ON silnice_2t TO postgis;
```

7. *řeky a potoky*

```
CREATE TABLE reky_kk AS
  SELECT * FROM osm.planet_osm_line
  WHERE waterway = 'river' OR waterway = 'stream';

SELECT Populate_Geometry_Columns('public.reky_kk'::regclass);

ALTER TABLE reky_kk ADD PRIMARY KEY (osm_id);

GRANT ALL ON reky_kk TO postgis;
```

8. *lesy*

```
CREATE TABLE lesy_kk AS
  SELECT * FROM osm.planet_osm_polygon WHERE landuse='forest';

SELECT Populate_Geometry_Columns('public.lesy_kk'::regclass);

ALTER TABLE lesy_kk ADD PRIMARY KEY (osm_id);

GRANT ALL ON lesy_kk TO postgis;
```

9. ubytování

```
CREATE TABLE ubytovani_kk AS
  SELECT * FROM osm.planet_osm_polygon
  WHERE tourism = 'camp-size' OR tourism = 'hostel' OR tourism =
    'hotel'
  OR tourism = 'motel' OR tourism = 'guest_house' ORDER BY name;

ALTER TABLE ubytovani_kk ADD PRIMARY KEY (osm_id);

GRANT SELECT ON ubytovani_kk TO postgis;
```

Tyto tematické vrstvy byly převedeny do databáze `pgis_osm` jednoduchým skriptem:

```
#!/bin/bash
```

```
for tabulka in dalnice_kk zeleznice_kk silnice_1t silnice_2t reky_kk
  hranice_kk obce_kk ubytovani_kk lesy_kk; do
  pg_dump pgis_student -t $tabulka >> osm.sql
done

psql pgis_osm < osm.sql
```

Navržení atributových a prostorových dotazů

V databázi pgis_osm byly navrženy následující dotazy:

- *délky toků:*

```
SELECT (sum(ST_Length(way))/1000)::int AS lubina_km
FROM reky_kk WHERE name = 'Lubina' GROUP BY name;
```

```
lubina_km
-----
      34
```

```
SELECT (sum(ST_Length(way))/1000)::int AS vltava_km
FROM reky_kk WHERE name = 'Vltava' GROUP BY name;
```

```
vltava_km
-----
      519
```

```
SELECT (sum(ST_Length(way))/1000)::int AS labe_km
FROM reky_kk WHERE name = 'Labe' GROUP BY name;
```

```
labe_km
-----
      569
```

```
SELECT (sum(ST_Length(way))/1000)::int AS morava_km
FROM reky_kk WHERE name = 'Morava' GROUP BY name;
```

```
morava_km
-----
      383
```

```
SELECT (sum(ST_Length(way))/1000)::int AS berounka_km
FROM reky_kk WHERE name = 'Berounka' GROUP BY name;
```

```
berounka_km
-----
      217
```

- počet km dálnic

```
SELECT (sum(ST.Length(way))/1000)::int AS dalnice_km
FROM dalnice_kk GROUP BY highway;
```

```
dalnice_km
-----
          3259
```

- ubytování v blízkosti řeky Lubina v km

```
SELECT name,
       ST.Distance((SELECT way FROM reky_kk
                    WHERE name = 'Lubina' ORDER BY Length(way)
                    DESC LIMIT 10), way)/1000 AS vzdalenost
FROM ubytovani ORDER BY vzdalenost LIMIT 10;
```

name	vzdalenost
Motorest Jehlan	1.11427200236292
Hotel Olympia	4.18716562439279
Hotel Stadion	4.5234399935007
TIR	39.195295584866
Nová radnice	49.7843559424788
Motel Jerry	92.689226048914
Chata na Červenohorském sedle	130.791583652168
Continental	186.643599417988
Hotel Motorsport	204.501642561511
Atom	260.595440885878

- vzdálenost Praha – Příbor¹

```
SELECT name, (ST.Distance((SELECT way
                           FROM obce WHERE name = 'Příbor'),
                          (SELECT way FROM obce WHERE name = 'Praha'))/1e3)::int
FROM obce WHERE name = 'Příbor';
```

```
name | int4
-----+-----
Příbor | 422
```

¹balík lstring nepodporuje diakritiku, a proto je v dotazu uvedeno město Příbor bez diakrity

Vizualizace dat pomocí UMN Mapserveru a OpenLayers

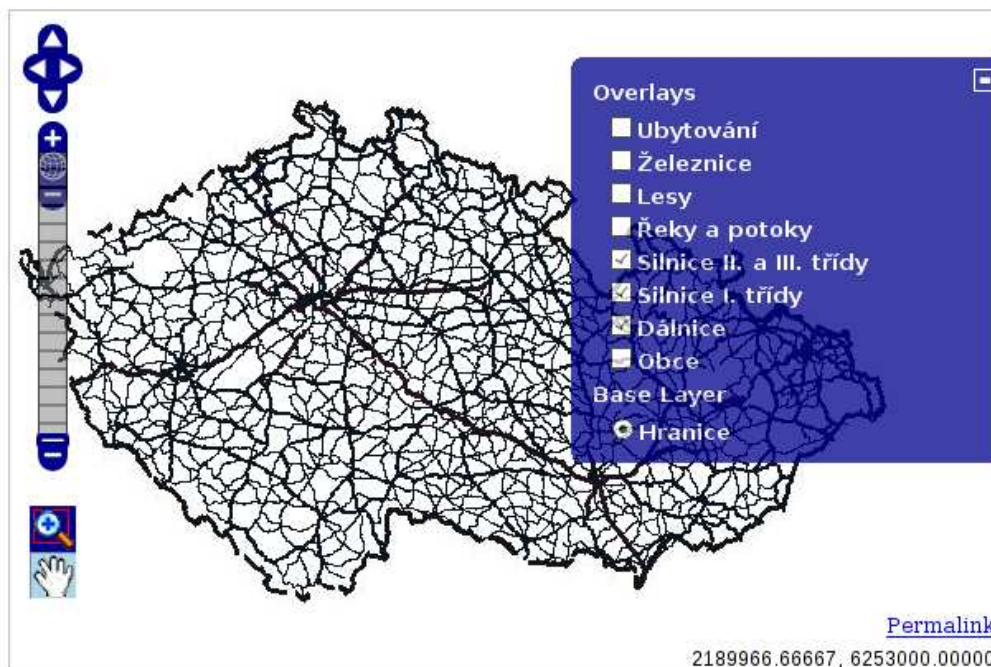
Byl vytvořen soubor `mapfile.map`, viz. Přílohy, který obsahuje základní konfiguraci pro zobrazení dat pomocí UMN Mapserveru. Tento soubor poskytuje jak služby WMS, tak i služby WFS a je dostupný ke stažení na <http://josef.fsv.cvut.cz/~kitzbkri/mapfiles/mapfile.map>.

Pomocí příkazu `getCapabilities` lze jednoduše zjistit, která data poskytuje a to následujícím způsobem:

```
http://josef.fsv.cvut.cz/cgi-bin/mapserv?map=/var/www/user/kitzbkri/mapfiles/mapfile.map&service=WMS&request=getCapabilities
```

```
http://josef.fsv.cvut.cz/cgi-bin/mapserv?map=/var/www/user/kitzbkri/mapfiles/mapfile.map&service=WFS&request=getCapabilities
```

Pro zobrazení odvozených tematických vrstev byla vybrána javaskriptová API knihovna *OpenLayers*. Základní vrstva, neboli Base Layer, zobrazuje hranice území ČR. Pomocí tzv. Overlays vrstev lze zobrazit ostatní tematické vrstvy jako jsou Obce, Dálnice, Řeky a potoky, Silnice I. třídy, Silnice II. a III. třídy, Lesy, ... více na <http://josef.fsv.cvut.cz/~kitzbkri/postgis.html>.



Obrázek 1: Ukázka zobrazení dat pomocí openlayers

Data jsou zobrazena v Mercatorově zobrazení pomocí WMS služby poskytované UMN Mapserverem na serveru Josef, knihovny OpenLayers a jednoduchého HTML kódu:

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
" http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
<meta http-equiv="content-type" content="text/html; charset=utf-8" />
<title>Postgis a OpenLayers</title>
<link href="style.css" rel="stylesheet" type="text/css" media="screen" />
<script src="OpenLayers/OpenLayers.js" type="text/javascript"></script>
<script defer="defer" type="text/javascript">
var map;
function init(){
var options = {
projection: new OpenLayers.Projection("EPSG:900913"),
units: "meters",
maxResolution: "auto",
maxExtent: new OpenLayers.Bounds(1340000, 6400000, 2200000, 6450000)
};

map = new OpenLayers.Map('map', options);

var hranice = new OpenLayers.Layer.WMS( "Hranice",
"http://josef.fsv.cvut.cz/cgi-bin/mapserv?",
{map: '/var/www/user/kitzbkri/mapfiles/mapfile.map',
layers: 'hranice',
maxExtent: new OpenLayers.Bounds(1340000, 6400000, 2200000, 6450000),
isBaseLayer: true}
);
var obce = new OpenLayers.Layer.WMS( "Obce",
"http://josef.fsv.cvut.cz/cgi-bin/mapserv?",
{map: '/var/www/user/kitzbkri/mapfiles/mapfile.map',
layers: 'obce',
transparent: 'true',
maxExtent: new OpenLayers.Bounds(1340000, 6400000, 2200000, 6450000)},
{visibility: 'true'}
);
var lesy = new OpenLayers.Layer.WMS( "Lesy",
"http://josef.fsv.cvut.cz/cgi-bin/mapserv?",
{map: '/var/www/user/kitzbkri/mapfiles/mapfile.map',
layers: 'lesy',
transparent: 'true',
maxExtent: new OpenLayers.Bounds(1340000, 6400000, 2200000, 6450000)},
{visibility: false}
);
var zeleznice = new OpenLayers.Layer.WMS( "Zeleznice",
"http://josef.fsv.cvut.cz/cgi-bin/mapserv?",
{map: '/var/www/user/kitzbkri/mapfiles/mapfile.map',
layers: 'zeleznice',
transparent: 'true',
maxExtent: new OpenLayers.Bounds(1340000, 6400000, 2200000, 6450000)},
{visibility: false}
);
var dalnice = new OpenLayers.Layer.WMS( "Dalnice",
"http://josef.fsv.cvut.cz/cgi-bin/mapserv?",
{map: '/var/www/user/kitzbkri/mapfiles/mapfile.map',
layers: 'dalnice',
```



```

        transparent: 'true',
        maxExtent: new OpenLayers.Bounds(1340000, 6400000, 2200000, 6450000)},
        {visibility: false}
    );

    var silnice1t = new OpenLayers.Layer.WMS( "Silnice_I._tridy",
    "http://josef.fsv.cvut.cz/cgi-bin/mapserv?",
    {map: '/var/www/user/kitzbkri/mapfiles/mapfile.map',
    layers: 'silnice1t',
    transparent: 'true',
    maxExtent: new OpenLayers.Bounds(1340000, 6400000, 2200000, 6450000)},
    {visibility: false}
    );

    var silnice2t = new OpenLayers.Layer.WMS( "Silnice_II._a_III._tridy",
    "http://josef.fsv.cvut.cz/cgi-bin/mapserv?",
    {map: '/var/www/user/kitzbkri/mapfiles/mapfile.map',
    layers: 'silnice2t',
    transparent: 'true',
    maxExtent: new OpenLayers.Bounds(1340000, 6400000, 2200000, 6450000)},
    {visibility: false}
    );

    var reky = new OpenLayers.Layer.WMS( "Reky_a_potoky",
    "http://josef.fsv.cvut.cz/cgi-bin/mapserv?",
    {map: '/var/www/user/kitzbkri/mapfiles/mapfile.map',
    layers: 'reky',
    transparent: 'true',
    maxExtent: new OpenLayers.Bounds(1340000, 6400000, 2200000, 6450000)},
    {visibility: false}
    );

    var ubytovani = new OpenLayers.Layer.WMS( "Ubytovani",
    "http://josef.fsv.cvut.cz/cgi-bin/mapserv?",
    {map: '/var/www/user/kitzbkri/mapfiles/mapfile.map',
    layers: 'ubytovani',
    transparent: 'true',
    maxExtent: new OpenLayers.Bounds(1340000, 6400000, 2200000, 6450000)},
    {visibility: false}
    );

    map.addLayers([hranice]);
    map.addLayers([obce, dalnice, silnice1t, silnice2t]);
    map.addLayers([reky, lesy, zeleznice, ubytovani]);

    map.addControl(new OpenLayers.Control.PanZoomBar());
    map.addControl(new OpenLayers.Control.MouseToolbar());
    map.addControl(new OpenLayers.Control.LayerSwitcher({'ascending': false}));
    map.addControl(new OpenLayers.Control.Permalink('permalink'));
    map.addControl(new OpenLayers.Control.MousePosition());
    // map.addControl(new OpenLayers.Control.OverviewMap());
    map.addControl(new OpenLayers.Control.KeyboardDefaults());

    map.zoomToMaxExtent();
}
</script>
<style type="text/css">
#map{
float: center;
background-color: #FFFFFF;
width: 600px;
height: 400px;

```

```

        border: thin solid silver;
    }
</style>
</head>
<body onload="init()">
  <div id="map"></div>
</body>
</html>

```

Přílohy

MAP

```

NAME          "Open Street Maps"
STATUS        ON
EXTENT        1340000 6400000 2200000 6450000
SIZE          520 360
UNITS         meters
IMAGECOLOR    255 255 255
IMAGETYPE     PNG

```

```
# SHAPEPATH /home/kitzbkri/mapfiles/
```

OUTPUTFORMAT

```

NAME          png
DRIVER        "GD/PNG"
MIMETYPE      "image/png"
IMAGEMODE     RGBA
EXTENSION     "png"
END

```

WEB

```

TEMPLATE      "/home/kitzbkri/public_html/postgis.html"
IMAGEPATH     "/var/tmp/ms_tmp/"
IMAGEURL      "/tmp/"

```

METADATA

```

"wms_title"          "Josef WMS server"
# "wms_onlineresource" "http://josef.fsv.cvut.cz/cgi-bin/mapserv?map=/var/www/user/kitzbkri/mapf
"wms_srs"            "EPSG:900913"
"wms_abstract"       "Testovací WMS server na josef.fsv.cvut.cz"
"wms_encoding"       "UTF-8"
"wms_server_version" "1.1.0"
"wms_contactelectronicmailaddress" "martin.landa@fsv.cvut.cz"
"wms_contactperson" "Martin Landa"
"wms_contactorganization" "CVUT v Praze, Fakulta stavebni"
"wms_contactvoicetelephone" "+420 224 354 644"

```

```
"wfs_title"          "Josef WFS server"
```

```

# "wfs_onlineresource" "http://josef.fsv.cvut.cz/cgi-bin/mapserv?
"wfs_srs"            "EPSG:900913"
"wfs_abstract"       "Testovací WMS server na josef.fsv.cvut.cz"
"wfs_encoding"       "UTF-8"
# "wfs_server_version" "1.1.0"
"wfs_contactelectronicmailaddress" "martin.landa@fsv.cvut.cz"
"wfs_contactperson" "Martin Landa"
"wfs_contactorganization" "CVUT v Praze, Fakulta stavebni"
"wfs_contactvoicetelephone" "+420 224 354 644"

```

```
END
```

```
END
```

```

PROJECTION
'init=epsg:900913'
END

LAYER
NAME                hranice
METADATA
  "wms_title"       "hranice"
  "wms_srs"         "EPSG:900913"

  "wfs_title"       "hranice"
  "gml_featureid"   "hranice"
  "gml_include_items" "all"
END
CONNECTIONTYPE postgis
CONNECTION          "user=postgis password=postgis1 dbname=pgis_osm host=localhost port=5432"
DATA                "way FROM public.hranice_kk USING SRID=900913"
STATUS              OFF
TYPE                LINE
DUMP                TRUE

CLASS
NAME                "hranice"
STYLE
  COLOR             18 20 18
  WIDTH             3
END
END

LAYER
NAME                obce
METADATA
  "wms_title"       "obce"
  "wms_srs"         "EPSG:900913"

  "wfs_title"       "obce"
  "gml_featureid"   "obce"
  "gml_include_items" "all"
END
CONNECTIONTYPE postgis
CONNECTION          "user=postgis password=postgis1 dbname=pgis_osm host=localhost port=5432"
DATA                "way FROM public.obce_kk USING SRID=900913"
STATUS              OFF
TYPE                POINT
DUMP                TRUE

CLASS
NAME                "obce"
STYLE
  COLOR             20 20 22
  SIZE              16
END
END

LAYER
NAME                ubytovani
METADATA
  "wms_title"       "ubytovani"
  "wms_srs"         "EPSG:900913"

```

```

        "wfs_title"          "ubytovani"
        "gml_featureid"     "ubytovani"
        "gml_include_items" "all"
    END
    CONNECTIONTYPE postgis
    CONNECTION "user=postgis password=postgis1 dbname=pgis_osm host=localhost port=5432"
    DATA "way FROM public.ubytovani_kk USING SRID=900913"
    STATUS OFF
    TYPE POLYGON
    DUMP TRUE

    CLASS
        NAME "ubytovani"
        STYLE
            COLOR 250 120 132
            WIDTH 2
        END
    END
END

LAYER
    NAME zeleznice
    METADATA
        "wms_title" "zeleznice"
        "wms_srs" "EPSG:900913"

        "wfs_title" "zeleznice"
        "gml_featureid" "zeleznice"
        "gml_include_items" "all"
    END
    CONNECTIONTYPE postgis
    CONNECTION "user=postgis password=postgis1 dbname=pgis_osm host=localhost port=5432"
    DATA "way FROM public.zeleznice_kk"
    STATUS OFF
    TYPE LINE
    DUMP TRUE

    CLASS
        NAME "zeleznice"
        STYLE
            COLOR 32 120 32
            WIDTH 2
        END
    END
END

LAYER
    NAME dalnice
    METADATA
        "wms_title" "dalnice"
        "wms_srs" "EPSG:900913"

        "wfs_title" "dalnice"
        "gml_featureid" "dalnice"
        "gml_include_items" "all"
    END
END

CONNECTIONTYPE postgis
CONNECTION "user=postgis password=postgis1 dbname=pgis_osm host=localhost port=5432"
DATA "way FROM public.dalnice_kk"
STATUS OFF
TYPE LINE

```

```

DUMP TRUE
CLASS
  NAME "dalnice"
  STYLE
    COLOR 40 20 30
    WIDTH 3
  END
END
END

LAYER
  NAME silnice1t
  METADATA
    "wms_title" "silnice prvni tridy"
    "wms_srs" "EPSG:900913"

    "wfs_title" "silnice1t"
    "gml_featureid" "silnice1t"
    "gml_include_items" "all"
  END
  DUMP TRUE
  CONNECTIONTYPE postgis
  CONNECTION "user=postgis password=postgis1 dbname=pgis_osm host=localhost port=5432"
  DATA "way FROM public.silnice_1t"
  STATUS OFF
  TYPE LINE

  CLASS
    NAME "silnice prvni tridy"
    STYLE
      COLOR 10 20 30
      WIDTH 2
    END
  END
END

LAYER
  NAME silnice2t
  METADATA
    "wms_title" "silnice druhe tridy"
    "wms_srs" "EPSG:900913"
    "wfs_title" "silnice2t"
    "gml_featureid" "silnice2t"
    "gml_include_items" "all"
  END
  DUMP TRUE
  CONNECTIONTYPE postgis
  CONNECTION "user=postgis password=postgis1 dbname=pgis_osm host=localhost port=5432"
  DATA "way FROM public.silnice_2t"
  STATUS OFF
  TYPE LINE

  CLASS
    NAME "silnice druhe tridy"
    STYLE
      COLOR 10 20 30
      WIDTH 1
    END
  END
END

LAYER

```

```

NAME                reky
METADATA
  "wms_title"       "reky"
  "wms_srs"         "EPSG:900913"
  "wfs_title"       "reky"
  "gml_featureid"  "reky"
  "gml_include_items" "all"
END
CONNECTIONTYPE postgis
CONNECTION          "user=postgis password=postgis1 dbname=pgis_osm host=localhost port=5432"
DATA                "way FROM public.reky_kk"
STATUS              OFF
TYPE                LINE
DUMP                TRUE
CLASS
  NAME              "reky"
  STYLE
    COLOR           50 50 255
    WIDTH           2
  END
END
END
LAYER
NAME                lesy
METADATA
  "wms_title"       "lesy"
  "wms_srs"         "EPSG:900913"
  "wfs_title"       "lesy"
  "gml_featureid"  "lesy"
  "gml_include_items" "all"
END
DUMP                TRUE

CONNECTIONTYPE postgis
CONNECTION          "user=postgis password=postgis1 dbname=pgis_osm host=localhost port=5432"
DATA                "way FROM public.lesy_kk"
STATUS              OFF
TYPE                POLYGON

CLASS
  NAME              "lesy"
  STYLE
    COLOR           10 155 100
    WIDTH           3
  END
END
END
END

```