Android - komunikácia

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- **triedy z org.apache.***
  - **http(s) GET, POST, cookies**
  - **Static Google Maps V2,**
- **formáty json (gson) a xml**
  - **Google Directions,**
- **cloudove riešenia/úložiská - Firebase**
  - **autentifikácia na Facebook – prémia**

MFF Keška, 48.151901 17.068422

AndreaS

- "I invented the term 'Object-Oriented', and I can tell you I did not have C++ in mind." - Alan Kay

MFF Keška, 48.151901 17.068422

TatianaG

- "Beware of bugs in the above code; I have only proved it correct, not tried it." - Donald E. Knuth.

MFF Keška, 48.151901 17.068422

PeterT

- Most software today is very much like an Egyptian pyramid with millions of bricks piled on top of each other, with no structural integrity, but just done by brute force and thousands of slaves.” - Alan Kay

TomášM

- "Measuring programming progress by lines of code is like measuring aircraft building progress by weight.„ - Bill Gates

Aký klient...

dnes to bude viac o org.apache ako o androide

http://hc.apache.org/httpcomponents-client-ga/tutorial/html/

Klient koho, resp. kto je server ?

- server je len náš (ale nepoužívame http protokol na komunikáciu s ním):
  - môže to byť aj socket-socket komunikácia, ale vyvoláva to veľa otáznikov …
    ako napr. bezpečnosť, robustnosť, multi-vlákno pre obsluhu viacerých klientov, ...
  - priamy prístup do databázy, napr. cez jdbc, iný komunikačný protokol
- server nie je náš, ale máme tam neadminovský účet (davinci.fmph.uniba):
  - najčastejšie provider poskytne rozhrania (okrem webservera/Apache) php, mysql, ...
  - najčastejšie, jediný otvorený port je http/https,
  - najčastejšie vznikne tzv. AMP riešenie (Apache-MySql-Php/Perl/Python) – minulá dekáda
- server vôbec nie je náš
  - môžeme odtiaľ čítať,
  - resp. máme špeciálne API na prístup k dátam (Parse fy.Facebook, Firebase fy.Google)

Čo so ním chceme robiť (so serverom):

- download všeobecne prístupných, resp. zaheslovaných dát,
- upload (malé resp. veľké dáta)
- run/exec (RPC – Remote Procedure Call)

Obsah prednášky

Download:

- HTTP GET – primárne chceme dotiahnúť (veľké) dáta zo servera
  - malé dáta – *všetko jedno* ...
    príklad: select/update mojej gps pozície (lat, long) z databázy na serveri
  - veľké dáta – potrebujeme *extra vlákno*, aby sa nehryzla apka, tzv. *AsyncTask*
  - autorizácia (Basic Authorization)

Upload – primárne chceme poslať (veľké dáta na server)

- HTTP POST
  - veľké dáta (max. veľkosť HTTP GET requestu ~8kB, podľa http web-servera)
    problém, ak chceme uploadovať napr. snímka z kamery, video, ...

Interpretované dáta:

- Bitmapa - Google Static Maps – príde statická bitmapa
- JSON - JSON parser (com.google.gson, alternatíva: org.json.JSON)
  - LocationApi.org príklad sľúbený z predminulej prednášky
  - Google Directions – získanie cesty-navigácie od služby Google
- XML – SAXParser, alternatíva: org.w3c.dom

http://dai.fmph.uniba.sk/courses/VMA/
http://dai.fmph.uniba.sk/courses/VMA/ISLAND.JPG
http://dai.fmph.uniba.sk/courses/VMA/ISLAND2.JPG
http://dai.fmph.uniba.sk/courses/VMA/android/03Http/KOZA.JPG
http://dai.fmph.uniba.sk/~borovan/rosnicka/

HttpClient - GET

Zobrazí obsah nejakej URI (Uniform Resource Identifier)

```
val uri= URI("http://dai.fmph.uniba.sk/courses/VMA/index.php")
```

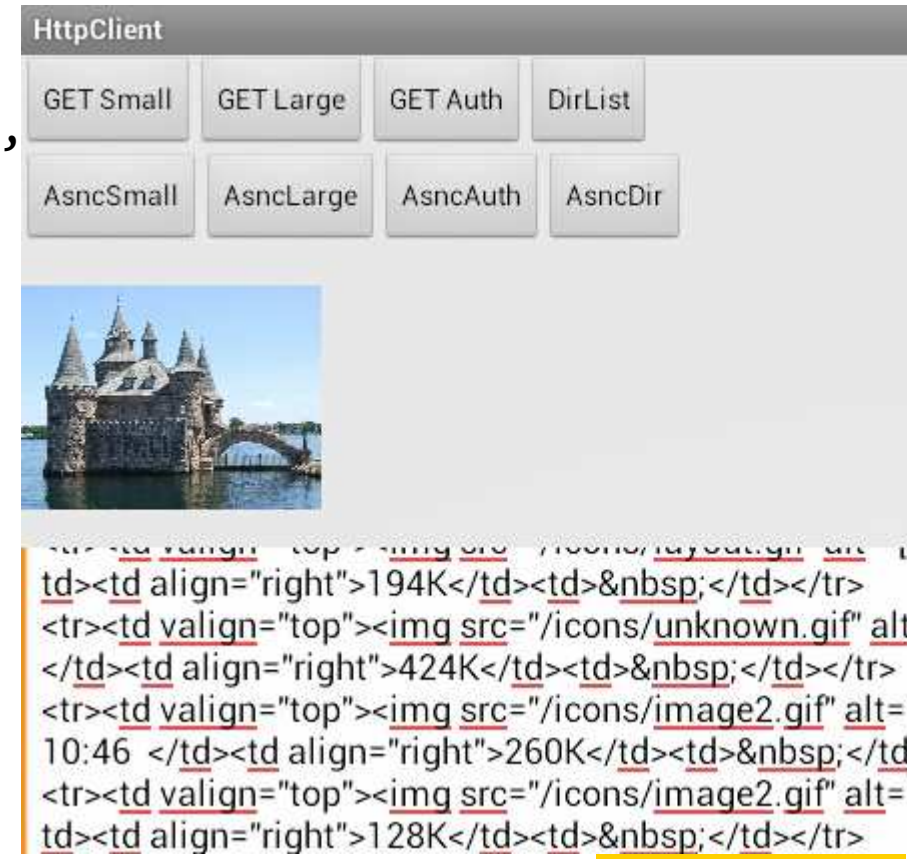
Ilustrujte triedy:

- `HttpClient, DefaultHttpClient,`
- `HttpGet`
- `HttpResponse`

- prečíta obsah ako `InputStream` z `HttpResponse`
- zobrazí ako textový súbor a zobrazí v `EditText`

Problémy:

- ak je súbor veľký, "hryzne" sa hlavné vlákno aplikácie
- ak je zaheslovaný



Project:HttpGet.zip

```
org.apache.http.HttpResponse
org.apache.http.client.methods.HttpGet
org.apache.http.impl.client.DefaultHttpClient
```

HttpClient - GET

```
val httpget = HttpGet()
httpget.uri = URI("http://dai.fmph.uniba.sk/courses/VMA/")
val response = httpClient.execute(httpget)
```

```
val br = BufferedReader(InputStreamReader(
                                response.entity.content))
val result = StringBuilder()    //!!! val result:String = ""
while (true) {
    val line = br.readLine() ?: break
    result.append(line + "\n")  //!!!result += line;
}
return result.toString()
```

Project:HttpGet.zip

```
org.apache.http.auth.AuthScope
org.apache.http.auth.UsernamePasswordCredentials
org.apache.http.client.CredentialsProvider
org.apache.http.impl.client.BasicCredentialsProvider
```

3 Problémy

- **Autorizácia** `// Basic Authorization,alternatíva:Digest (MD5)`

```
val credentialProvider = BasicCredentialsProvider()
credentialProvider.setCredentials(      // AuthScope("ip", 443)
    AuthScope(AuthScope.ANY_HOST, AuthScope.ANY_PORT),
    UsernamePasswordCredentials("java","vaja"))  //login,pass
httpClient.credentialsProvider = credentialProvider
```

- **Interpretácia dát** – obrázky

```
inputStream = httpresponse.entity.content
try {
    bitmap = BitmapFactory.decodeStream(inputStream, .., options); }
```

- veľké obrázky => BitmapFactory OutOfMemory
- **riešenie BitmapFactory.Options.inSampleSize = 4**

```
val options = BitmapFactory.Options()
options.inSampleSize = 4
options.inJustDecodeBounds = false
```

inSampleSize = 4 returns an image that is 1/4 the width/height of the original, and 1/16 the number of pixels

Project:HttpGet.zip

```
org.apache.http.auth.AuthScope
org.apache.http.auth.UsernamePasswordCredentials
org.apache.http.client.CredentialsProvider
org.apache.http.impl.client.BasicCredentialsProvider
```

3 Problémy

- **Čakanie, dlhotrvajúce operácie**, ktoré blokujú hlavné vlákno
  - ak sa aktivita neozýva > 5sec (lebo pracuje), automaticky sa stopne, …
  - riešenie (extra vlákno): **`AsyncTask (deprecated), Kotlin-corutiny`**

- **Aplikácia sama detekuje network operáciu v hlavnom vlákne**
  - a padne na chybe

- **Alebo jej to zakážete, ale problém ste nevyriešili**
  - nastavením thread policy (network oprácia však bude trvať rovnako dlho)

```
val policy = StrictMode.ThreadPolicy.Builder()
                       .detectAll()
                       .penaltyLog()
                       .build()
StrictMode.setThreadPolicy(policy)
```

Project:HttpGet.zip

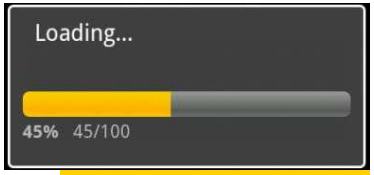
AsyncTask

android.os.AsyncTask

AsyncTask<String, Integer, String>

je zložitá generická trieda

```
varargs params = pole vstupných parametrov
progress = hodnota progresu, pre ProgressDialog
result = typ výsledku

val ast = object : AsyncTask<String, Integer, String>() {
   override fun doInBackground(varargs String params?):String {
        var count = 0;
        var result = StringBuilder()
        try {
           httpClient = DefaultHttpClient()
           val uri = URI(params[0])      // moje http://....
           val httpresponse = httpClient.execute(httpget)
           val br = BufferedReader(InputStreamReader(
                        httpresponse.entity.content))
           while (true) {
                var line = br.readLine()?:break
                result.append(line + "\n")
                publishProgress(count++)
           } catch (e : Exception) { ... }
           return result.toString()
```



Project:HttpGet.zip

```
AsyncTask<String, Integer, String>
AsyncTask<String, Integer, Bitmap>
```

AsyncTask

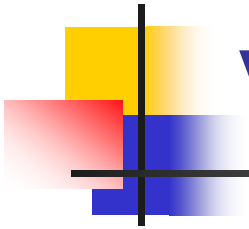
Bežia v GUI vlákne

```
    override fun onPostExecute(result: String) {
      edtxt.append(result) // edtxt je nahradený parametrom kam
      pd.dismiss()
    }

    override fun onPreExecute() {
      pd = ProgressDialog(this@MyHttpClient)
      pd.setProgressStyle(ProgressDialog.STYLE_SPINNER)
      pd.max = 100
      pd.show()
    }
    override fun onProgressUpdate(vararg values: Int?) {
      pd.incrementProgressBy(values[0]?:0)
} ___________________________________ tu končí definícia AsyncTasku
ast.execute("http://dai.fmph.uniba.sk/courses/VMA/index.php")
```

v kóde najdete:

- `fun HttpGetAsyncString(uristr: String, kam: EditText)`
  implementuje `AsyncTask<String, Integer, String>`
- `fun HttpGetAsyncBitmap(uristr: String, kam: ImageView)`
  implementuje `AsyncTask<String, Integer, Bitmap>`

Project:HttpGet.zip



varargs sú v Jave tri bodky ...

```
method(params : String[]) {}
   sa volá takto
method(arrayOf("first", "second"));

Kotlin:
method(vararg params : String) {}  // variabilný počet Stringov
Java:
method(String... params) {}
   sa volá takto
method("first", "second");
```

ale je to len syntax sugar, verzia s varargs/`...` sa skompiluje ako pole []

```
override fun onProgressUpdate(vararg values: Int?) {
   pd.incrementProgressBy(values[0]?:0)
}
```

Static Google Maps

(život pred Google Maps API...)

Google Maps poskytujú API pre download statickej mapy, príklad.
http://maps.googleapis.com//maps/api/staticmap?center=48.152177,17.07153&zoom=15&size=500x500&maptype=mobile&markers=48.152177,17.07153,ref/&key=AIzaSyCUU5[redacted]eYuihYGL8&sensor=false&

Povinné polia v HTTP Requeste:

- center – stred mapy,
  napr. "48.152177,17.07153", resp. "Mlynska dolina, Bratislava"
- zoom – 0..21
- size – veľkosť obrázku
- formát – PNG (default), jpg, gif, …
- key (25kAccess/day ☺) si vygenerujete tu: https://console.developers.google.com/apis/

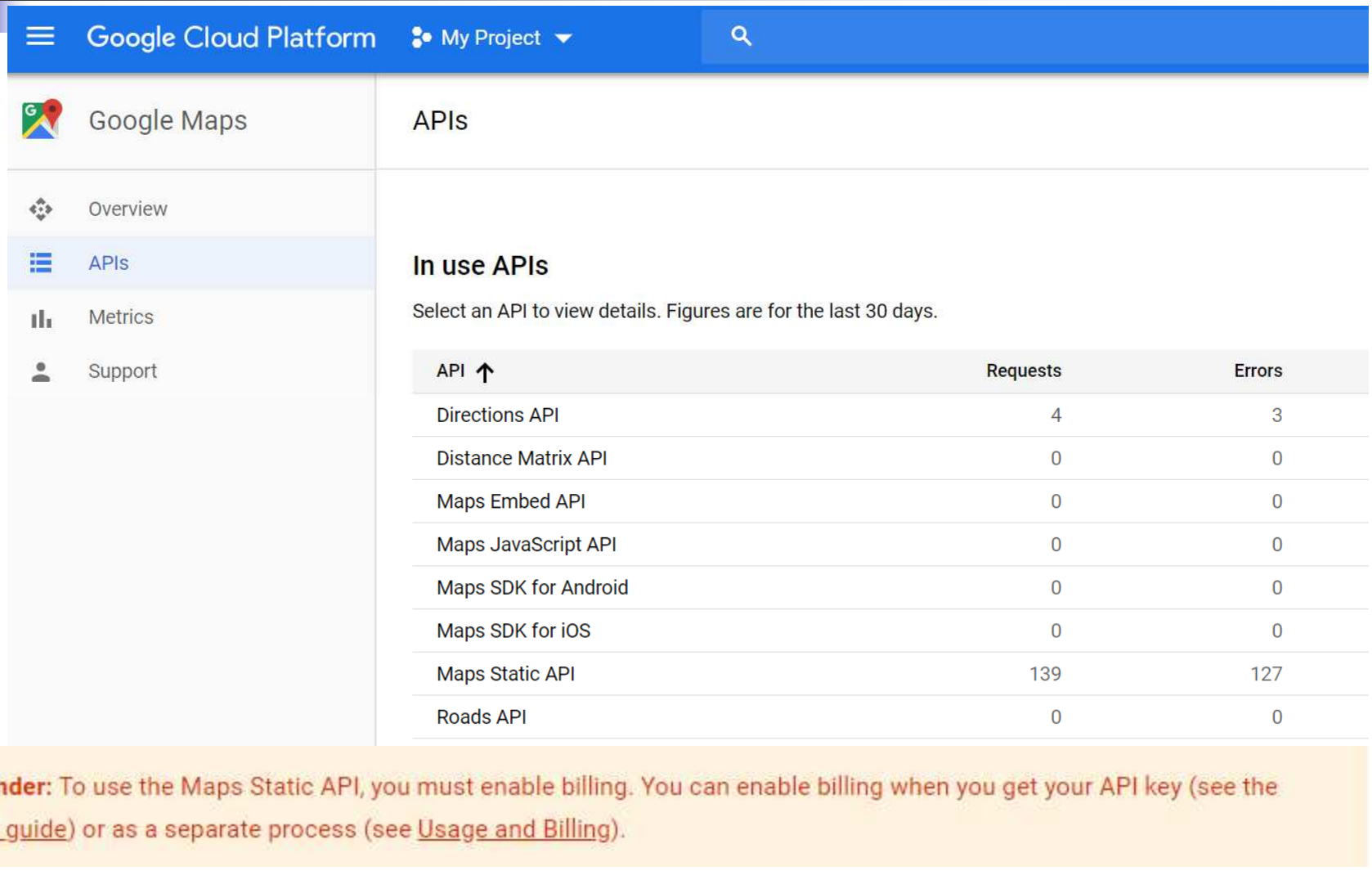
https://developers.google.com/maps/documentation/staticmaps/
https://developers.google.com/maps/documentation/maps-static/get-api-key

iné, nepovinné polia:

- markers,
- path, …

Project:HttpGETStaticMap.zip

Google Platform Console



Disclaimer statement

(tento kurz neberie žiadnu zodpovednosť za straty na vašich účtoch)

Requests per Day (QPD) limits have ended, effective June 11, 2018

For Existing Customers:

- If you are an existing customer (using the Google Maps Platform before June 11, 2018), you were billed under the previous plan until July 16, 2018.
- **Note:** Starting on June 11, 2018, Google began to roll out the removal of the default QPD limits on existing billing accounts. This process may take up to six weeks.
- If you rely on the default QPD limits to help you manage your cost of use, we recommend you **set your own daily limits** in the Google Cloud Platform Console, to override the default QPD limits set by Google. This will ensure that your preferred QPD limits remain in place.

For New Customers:

- If you are a new customer (using the Google Maps Platform starting on or after June 11, 2018), you were billed under the previous plan until July 16, 2018.
- **Note:** New customers began receiving unlimited QPD starting on June 11, 2018.
- To help you manage your cost of use, you can **set your own QPD limits** in the Google Cloud Platform Console.

Static Maps API v2

(V2 Upgrade Guide)

Tiež prišlo **API V2 Static Maps**

- https://developers.google.com/maps/documentation/staticmaps/upgrade

Static map creator:

- vygeneruje request http://staticmapmaker.com/ , len si pridajte API Key:
- http://maps.google.com/maps/api/staticmap?center=48.160020,17.075810&zoom=13&markers=mlynska+dolina, bratislava&size=400x400&sensor=TRUE_OR_FALSE

```
org.apache.http.NameValuePair;
org.apache.http.message.BasicNameValuePair;
```

Ako vygenerovať httpRequest s parametrami

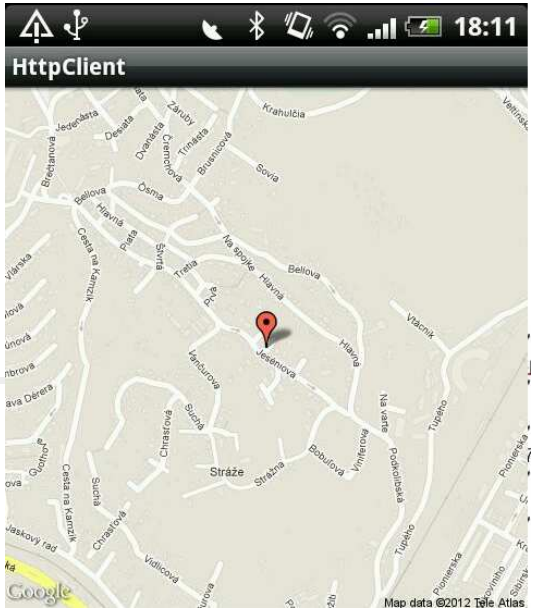
```
onLocationChanged:48.14909957693445:17.05740296875271
onLocationChanged:48.14915053663316:17.057799709349354
onLocationChanged:48.14888578996695:17.0580995579689
onLocationChanged:48.14924186425896:17.057917318866394
onLocationChanged:48.14889891484486:17.05771144101115
Location:48.14889891484486:17.05771144101115
http://maps.googleapis.com/maps/api/staticmap?center=48.1488989
1484486%2C17.05771144101115&zoom=15&size=480x480&maptype
=mobile&markers=48.14889891484486%2C17.05771144101115&key
=AIzaSyC3yLT-5cHoknBR0kR-F7xnuPJzTlakc3E&sensor=false
```

```
val httpClient = DefaultHttpClient()
var url = staticGoogleMap
if (!url.endsWith("?")) url += "?"
val httpParams = mutableListOf<NameValuePair>()
val latlngString = "${loc.latitude},${loc.longitude}"
    httpParams.add(BasicNameValuePair("center", latlngString))
    httpParams.add(BasicNameValuePair("zoom", "15"))
    httpParams.add(BasicNameValuePair("size", "480x480"))
    httpParams.add(BasicNameValuePair("markers", latlngString))
    httpParams.add(BasicNameValuePair("key", "AIzaS******YGL8"))
url += URLEncodedUtils.format(httpParams, "utf-8")
val httpget = HttpGet()
httpget.uri = URI(url)
val httpresponse = httpClient.execute(httpget)
val inputStream = httpresponse.entity.content
result = BitmapFactory.decodeStream(inputStream)
```

Project:HttpGETStaticMap.zip

urlEncoding: http://www.w3schools.com/tags/ref_urlencode.asp

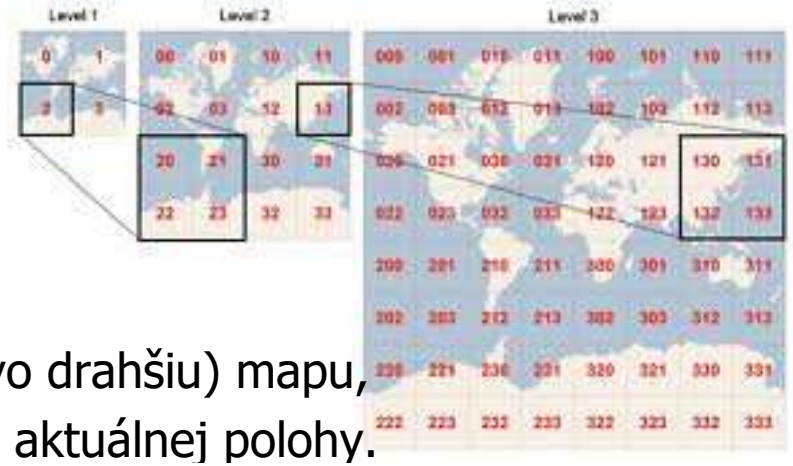
Ako často generovať
(prekonané, ak použijete G-Maps V2)



- „lacný“ trik:

```
var lastTime = 0L      // len každých 10 sek.
fun onLocationChanged(Location arg0) {
  if (arg0.getTime() - lastTime > 10000) {
     updateLocation(arg0)
     lastTime = arg0.getTime() }
```

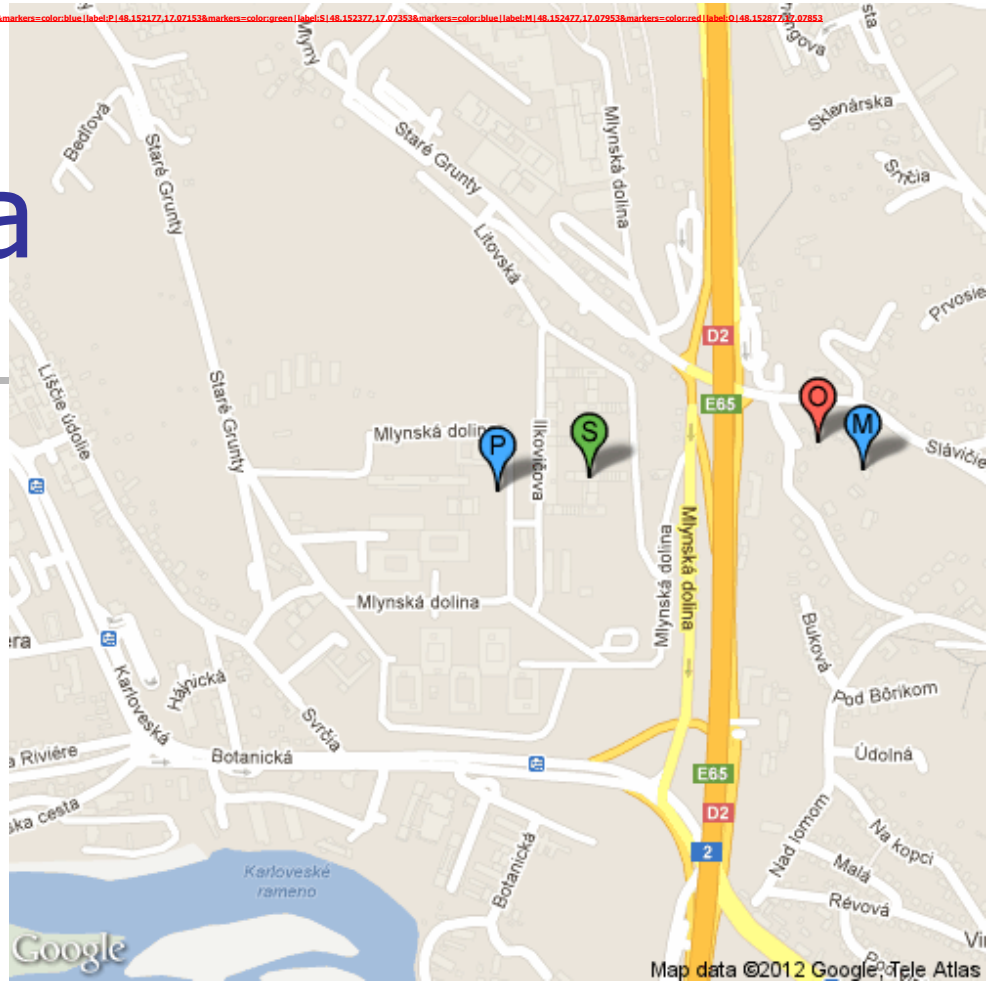
- kým je poloha *"rozumne"* vo mapovom výreze (tile), tak len prekreslujeme pozíciu (napr. balónik) lokálne na bitmape, neposielame nový map-request
- keď už sa blížime "veľmi" k okraju, dáme nový mapový request
- časti mapy (tiles), ktoré sme už dotiahli a momentálne nepotrebujeme, si pamätáme na karte,
- veľkosť výrezu zvolíme tak, aby jeho dotiahnutie nenarušilo dynamiku UI
- alternatíva: vypýtam si väčšiu (ale časovo drahšiu) mapu, v ktorej potom „scrollujem“ mojej podľa aktuálnej polohy.



http://maps.googleapis.com/maps/api/staticmap?center=48.152177,17.07153&zoom=15&size=500x500&maptype=mobile&key=AIzaSyC3yLT-5cHoknBR0kR-F7xnuPJxTIakc3E&sensor=false&markers=color:blue|label:P|48.152177,17.07153&markers=color:green|label:S|48.152377,17.07353&markers=color:blue|label:M|48.152477,17.07953&markers=color:red|label:O|48.152877,17.07853

Domáca úloha

(kamaráti na mape)



- napíšte aplikáciu, ktorá po zapnutí uploaduje súradnice užívateľa (lat,long) na server pomocou priloženého php scriptu.
- tabuľka obsahuje `ID, DateTime, Latitude, Longitude,`
- zobrazte posledné záznamy všetkých aktívnych (max.60 min. starý záznam) užívateľov na statickej mape farebne odlíšených markermi s iniciálkou

maps.googleapis.com/maps/api/staticmap?center=48.152177,17.07153&zoom=15&size=500x500&maptype=mobile&key=AIzaSyCUU53EADiCbbSzFreLbD_FzEeYuihYGL8&sensor=false&markers=color:blue|label:P|48.152177,17.07153&markers=color:green|label:S|48.152377,17.07353&markers=color:blue|label:M|48.152477,17.07953&markers=color:red|label:O|48.152877,17.07853

Project:HttpGETStaticMap.zip

Potrebné detaily k DÚ

http://dai.fmph.uniba.sk/courses/VMA/android/php/PositionUpdate.php?name=Peter&lat=48.152177&long=17.07153

```
<?php
$dbhost = 'kempelen.ii.fmph.uniba.sk';
$dbuser = 'androids';
$dbpass = 'HotelDiamantDunakility';
$conn = mysql_connect($dbhost, $dbuser, $dbpass);
if(! $conn )
   die('Could not connect: ' . mysql_error());
$sql = "insert into myfriends (name, time, lati, longi) values ('".
   $_GET['name']."', NOW(),".$_GET['lat'].",".$_GET['long'].");";
mysql_select_db('androids');
$retval = mysql_query( $sql, $conn );
if(! $retval )
   die('Could not update data: ' . mysql_error());
echo "Insert successfull\n";
mysql_close($conn);
?>
```

http://kempelen.ii.fmph.uniba.sk/phpmyadmi

Potrebné detaily k DÚ

http://dai.fmph.uniba.sk/courses/VMA/android/php/PositionSelect.php

```
<?php
...
$sql = "select * from myfriends where time > DATE_SUB( now() ,
                INTERVAL 1 DAY);";
mysql_select_db('androids');
$retval = mysql_query( $sql, $conn );
if(! $retval ) {
  die('Could not select data: ' . mysql_error());
}
$rows = array();
while($r = mysql_fetch_assoc($retval)) {
    $rows[] = $r;
}
print json_encode($rows);
mysql_close($conn);
?>
```

http://kempelen.ii.fmph.uniba.sk/phpmyadmin/


```
[
{"name":"Peter","time":"2012-11-28
15:41:50","lati":"48.3443","longi":"17.2322"},
{"name":"Peter","time":"2012-11-28
19:27:20","lati":"48.1522","longi":"17.0715"},
{"name":"Silvia","time":"2012-11-28
19:27:42","lati":"48.1522","longi":"17.0415"},
{"name":"Peter","time":"2012-11-28
19:28:44","lati":"48.1522","longi":"17.0715"}
]
```

HttpClient – POST

Ak potrebujem uploadovať väčšie dáta (napríklad fotku), použijeme POST

- vytvoríme aplikáciu, ktorá zosníma obrázok z kamery,
- zobrazí na display, kde ju môžeme pomenovať,
- pomocou HTTP-POST pošleme na server
- tam ju pomocou malého php-scriptu ukladáme do „galérie" (adresára),

http://dai.fmph.uniba.sk/courses/VMA/galeria/

```
<?php
$base=$_REQUEST['image'];
$iname=$_REQUEST['iname'];
if ($iname != "") {
  $binary=base64_decode($base);  // dekóduje z MIME base64
  $file = fopen($iname.'.jpg', 'wb');
  fwrite($file, $binary);
  fclose($file);
  echo "... OK ...";
} else
  echo "... NULL NAME ...";
?>
```

ShotUploaderPhp=
"http://dai.fmph.uniba.sk/courses/VMA/galeria/upload.php"

Project:HttpPOST.zip

HttpClient - POST

Encode
Decode
Base64

HttpPostAsyncBitmap vytvorí AsyncTask<String, Integer, Boolean>

```
val baos = ByteArrayOutputStream()
// Bitmap.CompressFormat.PNG, Bitmap.CompressFormat.WEBP, 90%
bmp.compress(Bitmap.CompressFormat.JPEG, 90, baos)  // fotka je v baos
val img_string = Base64.encodeBytes(baos.toByteArray())
val variableValue = mutableListOf<NameValuePair>()
   variableValue.add(BasicNameValuePair("image", img_string))   //fotka
   variableValue.add(BasicNameValuePair("iname", params[0]))    // meno
try {
   val httpclient = DefaultHttpClient()
   val httppost = HttpPost("http://dai.fmph.uniba.sk/courses/VMA/galeria/upload.php")
   httppost.entity = UrlEncodedFormEntity(variableValue)
   val response = httpclient.execute(httppost)
   Log.d("HttpClient",response.statusLine().toString())
   . . .
```

upload

Project:HttpPOST.zip

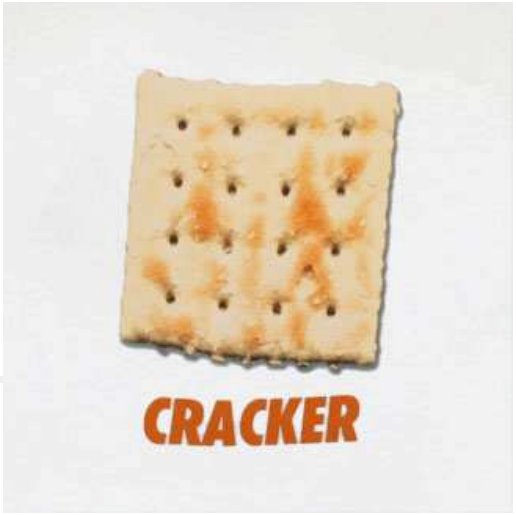
Ako odfotiť

```
override fun onClick(v: View) {
   if (v.id == R.id.btnShot)
      startActivityForResult(
                  Intent(MediaStore.ACTION_IMAGE_CAPTURE),
                  IMAGE_CAPTURE_RESULT)
   if (v.id == R.id.btnUpload)
      HttpPostAsyncBitmap(edtPictureName.text.toString(), bmp)

---------------------------------------

override fun onActivityResult(requestCode:Int, resultCode:Int,
                              data: Intent) {
                                 // fotka prída ako časť intentu data
   if (requestCode==IMAGE_CAPTURE_RESULT && resultCode==RESULT_OK){
       val bundle = data.extras // extrahovanie bitmapy
       bmp = bundle["data"] as Bitmap
       val iview = findViewById(R.id.imageView) as ImageView
       iview.setImageBitmap(bmp) // zobrazenie bitmapy
   }
}
```

Project:HttpPOST.zip

Prémia

(len krátko-trvajúca)



Napíšte malú jednoúčelovú androidovskú aplikáciu,
hoc aj bez GUI,..., ale ktorá z adresára
http://dai.fmph.uniba.sk/courses/VMA/android/crackme/

- zmažte súbor crack.me
- vytvorí tam súbor VašeMeno.VašePriezvisko (kvôli bodom za prémiu), ktorý ale obsahuje vašu hackerskú prezývku, teda žiaden php-kód...
- všetky stopy (napr. pomocné súbory) po sebe upracte.

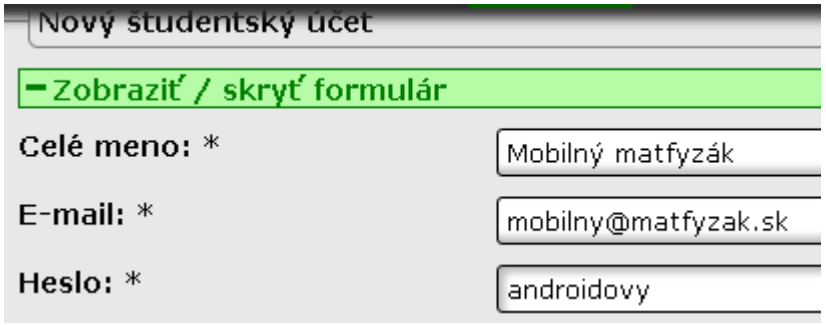
Poznámka: zvyšok webu prosím nechajte tak ☺

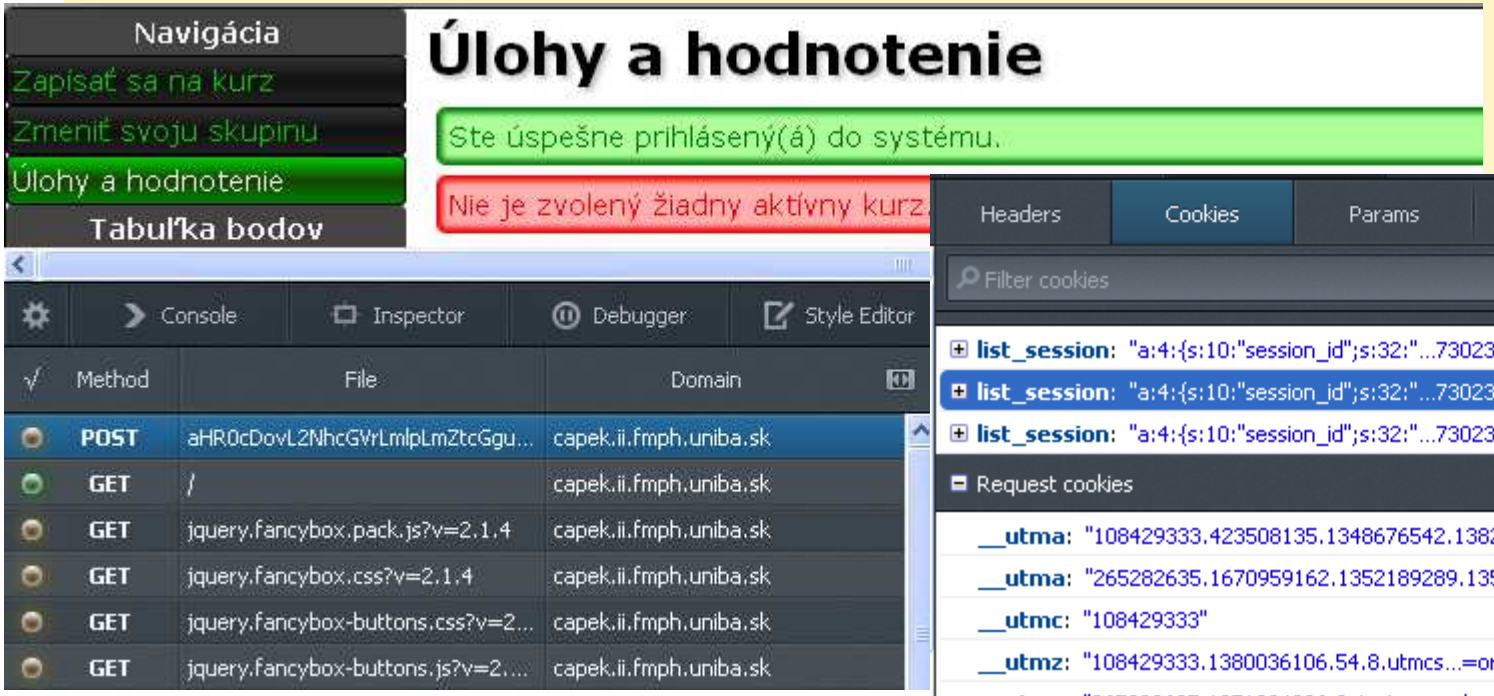
Deadline: čím skôr...
bodovanie 3 body (zlato), 2 (striebro), 1.5 (bronz), 1 (za účasť)

Project:Crackmi.zip

Cookies

Pokúsime sa prihlásiť do LISTu a zapamätať si vytvorenie cookies, obsahujúce session-id. Otvoríme si Developer Tools (FF) a pozeráme, čo sa deje, aké requesty-responsy chodia...





Advent of Code

https://adventofcode.com/

- Json URI
- https://adventofcode.com/2019/leaderboard/private/view/229344.json
- Ale chce to vypátrať cookies od servera

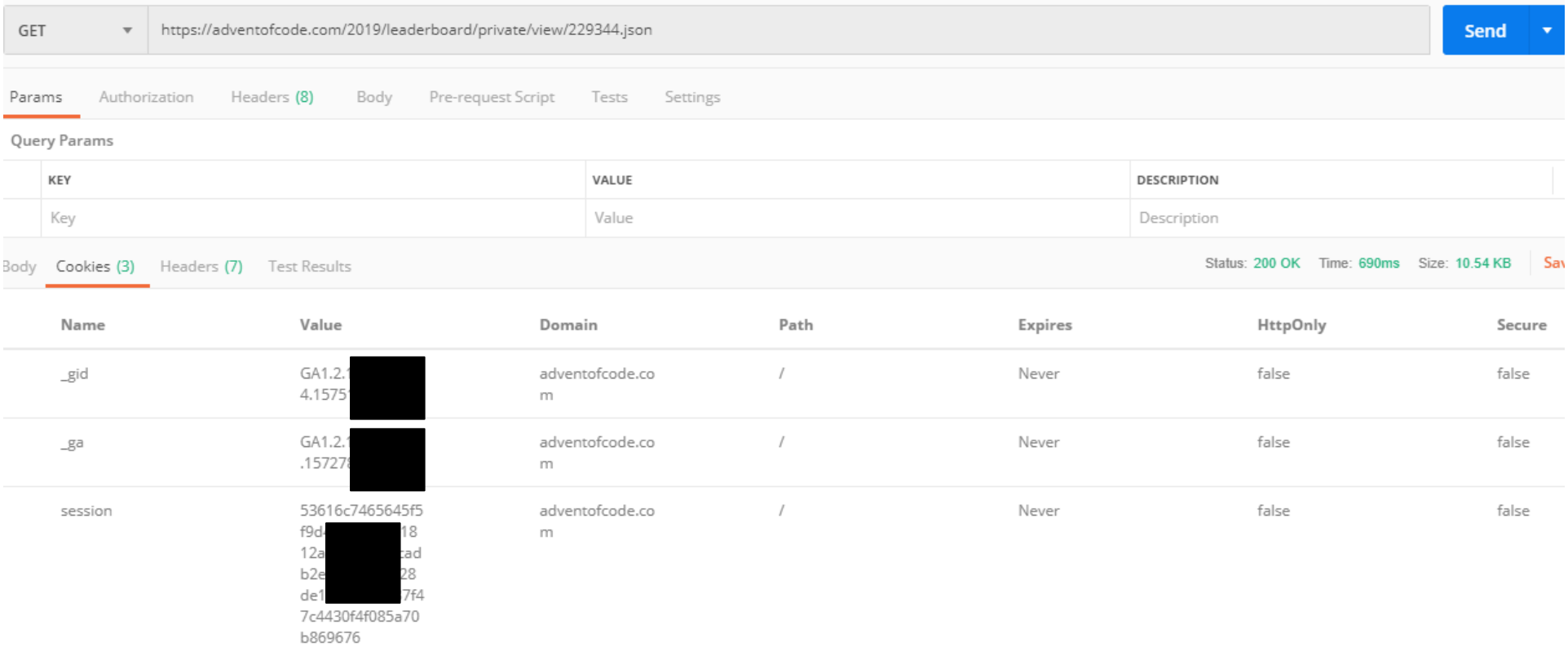
Name	Value	Domain
_gid	GA1.2. 4.1575 [redacted]	adventofcode.com
_ga	GA1.2. .15727 [redacted]	adventofcode.com
session	53616c7465645f5 f9d4157c5dffe18 1 [redacted] ad b 8 d 7f4 7 0 b869676	adventofcode.com

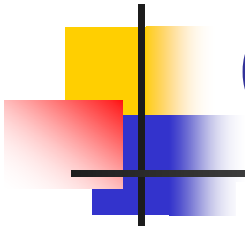

```
229344:
  local_score:        325
  id:                 "229344"
  stars:              8
  completion_day_level:
    1:
      1:
        get_star_ts:  "1575176691"
      2:
        get_star_ts:  "1575177020"
    2:
      1:
        get_star_ts:  "1575264081"
      2:
        get_star_ts:  "1575264839"
    3:
      1:
        get_star_ts:  "1575350735"
      2:
        get_star_ts:  "1575351770"
    4:
      1:
        get_star_ts:  "1575436158"
      2:
        get_star_ts:  "1575440183"
  global_score:       0
  last_star_ts:       "1575440183"
  name:               "Peter BOROVANSKY"
```

Advent of Code

https://adventofcode.com/

- Softvér tretích strán - Postman





Cookie store

```
val cookieStore = BasicCookieStore()
val bc1 = BasicClientCookie("_gid", "GA1.2.126736...")
bc1.domain = "adventofcode.com"
bc1.path = "/“       bc1.isSecure = false
cookieStore.addCookie(bc1)

val bc2 = BasicClientCookie("_ga", "GA1.2.11794137...")
bc2.domain = "adventofcode.com"
bc2.path = "/“       bc2.isSecure = false
cookieStore.addCookie(bc2)

val bc3 = BasicClientCookie("session", "53616c7...")
bc3.domain = "adventofcode.com"
bc3.path = "/“       bc3.isSecure = false
cookieStore.addCookie(bc3)

val ctx = BasicHttpContext()
ctx.setAttribute(ClientContext.COOKIE_STORE,cookieStore)

val httpresponse = httpClient.execute(httpget, ctx)
```

Project:HttpAoC.zip

JSON

(JSON je vraj čitateľnejší ako xml)

{"owner_id":"229344","members":{"633850":{"stars":2,"id":"633850","completion_day_level":{"1":{"1":{"get_star_ts":"1575177325"},"2":{"get_star_ts":"1575232476"}}},"local_score":64,"name":null,"last_star_ts":"1575232476","global_score":0},"50608":{"id":"50608","completion_day_level":{"2":{"1":{"get_star_ts":"1575323440"},"2":{"get_star_ts":"1575324582"}},"1":{"2":{"get_star_ts":"1575234400"},"1":{"get_star_ts":"1575233779"}}},"local_score":99,"name":null,"last_star_ts":"1575324582","global_score":0,"stars":4},"387689":{"completion_day_level":{},"id":"387689","last_star_ts":0,"global_score":0,"name":"beowulf11","local_score":0,"stars":0},"284148":{"local_score":116,"name":"Jana Lachova","last_star_ts":"1575317389","global_score":0,"id":"284148","completion_day_level":{"1":{"1":{"get_star_ts":"1575190775"},"2":{"get_star_ts":"1575191559"}},"2":{"1":{"get_star_ts":"1575316384"},"2":{"get_star_ts":"1575317389"}}},"stars":4},"289473":{"stars":0,"completion_day_level":{},"id":"289473","global_score":0,"last_star_ts":0,"name":"Michal Vido","local_score":0},"381890":{"completion_day_level":{},"id":"381890","last_star_ts":0,"name":"Ján Kľuka","global_score":0,"local_score":0,"stars":0},"133669":{"stars":6,"local_score":160,"last_star_ts":"1575400260","global_score":0,"name":"Zoltan Onody","id":"133669","completion_day_level":{"2":{"2":{"get_star_ts":"1575333802"},"1":{"get_star_ts":"1575331323"}},"1":{"1":{"get_star_ts":"1575202384"},"2":{"get_star_ts":"1575204753"}},"3":{"1":{"get_star_ts":"1575394347"},"2":{"get_star_ts":"1575400260"}}}},"440747":{"name":"Ivan Martynovskyi","last_star_ts":"1575401728","global_score":0,"local_score":177,"completion_day_level":{"2":{"2":{"get_star_ts":"1575310108"},"1":{"get_star_ts":"1575308668"}},"1":{"2":{"get_star_ts":"1575188229"},"1":{"get_star_ts":"1575187596"}},"3":{"2":{"get_star_ts":"1575401728"},"1":{"get_star_ts":"1575400101"}}},"id":"440747","stars":6},"374071":{"stars":6,"id":"374071","completion_day_level":{"3":{"2":{"get_star_ts":"1575376678"},"1":{"get_star_ts":"1575375301"}},"1":{"2":{"get_star_ts":"1575185453"},"1":{"get_star_ts":"1575184775"}},"2":{"2":{"get_star_ts":"1575271779"},"1":{"get_star_ts":"1575271476"}}},"local_score":202,"global_score":0,"last_star_ts":"1575376678","name":"Gyorgy Tomcsanyi"},"635829":{"completion_day_level":{"3":{"1":{"get_star_ts":"1575350543"},"2":{"get_star_ts":"1575350619"}},"1":{"2":{"get_star_ts":"1575176838"},"1":{"get_star_ts":"1575176482"}},"2":{"2":{"get_star_ts":"1575265176"},"1":{"get_star_ts":"1575265098"}}},"id":"635829","name":"Jozef Kubík","last_star_ts":"1575350619","global_score":15,"local_score":246,"stars":6},"425420":{"stars":6,"name":"Peter Gergel","last_star_ts":"1575359599","global_score":0,"local_score":210,"completion_day_level":{"3":{"2":{"get_star_ts":"1575359599"},"1":{"get_star_ts":"1575358938"}},"2":{"1":{"get_star_ts":"1575274108"},"2":{"get_star_ts":"1575274499"}},"1":{"1":{"get_star_ts":"1575184467"},"2":{"get_star_ts":"1575184888"}}},"id":"425420"},"383500":{"stars":0,"last_star_ts":0,"name":"OHUSAR","global_score":0,"local_score":0,"completion_day_level":{},"id":"383500"},"432600":{"completion_day_level":{},"id":"432600","last_star_ts":0,"name":"Maroš Malý","global_score":0,"local_score":0,"stars":0},"205219":{"id":"205219","completion_day_level":{},"local_score":0,"last_star_ts":0,"global_score":0,"name":"yoyko","stars":0},"413457":{"stars":0,"name":"kkikus","last_star_ts":0,"global_score":0,"local_score":0,"completion_day_level":{},"id":"413457"},"398095":{"last_star_ts":0,"name":"Samuel Wendl","global_score":0,"local_score":0,"completion_day_level":{},"id":"398095","stars":0},"387446":{"stars":6,"last_star_ts":"1575379220","name":"F Kerak","global_score":0,"local_score":143,"completion_day_level":{"2":{"2":{"get_star_ts":"1575376842"},"1":{"get_star_ts":"1575376511"}},"1":{"2":{"get_star_ts":"1575375755"},"1":{"get_star_ts":"1575375433"}},"3":{"1":{"get_star_ts":"1575378173"},"2":{"get_star_ts":"1575379220"}}},"id":"387446"},"382973":{"completion_day_level":{},"id":"382973","last_star_ts":0,"name":"Boris Silný","global_score":0,"local_score":0,"stars":0},"633816":{"stars":6,"completion_day_level":{"3":{"2":{"get_star_ts":"1575355116"},"1":{"get_star_ts":"1575353986"}},"2":{"1":{"get_star_ts":"1575264967"},"2":{"get_star_ts":"1575265404"}},"1":{"2":{"get_star_ts":"1575177501"},"1":{"get_star_ts":"1575177229"}}},"id":"633816","last_star_ts":"1575355116","global_score":0,"name":null,"local_score":230},"357988":{"last_star_ts":"1575384913","name":null,"global_score":0,"local_score":181,"completion_day_level":{"1":{"2":{"get_star_ts":"1575192085"},"1":{"get_star_ts":"1575191610"}},"2":{"2":{"get_star_ts":"1575280368"},"1":{"get_star_ts":"1575279807"}},"3":{"2":{"get_star_ts":"1575384913"},"1":{"get_star_ts":"1575384157"}}},"id":"357988","stars":6},"442294":{"stars":0,"local_score":0,"last_star_ts":0,"name":"mrkvost","global_score":0,"id":"442294","completion_day_level":{}},"257369":{"local_score":0,"last_star_ts":0,"global_score":0,"name":"Frantisek Drabecky","id":"257369","completion_day_level":{},"stars":0},"727545":{"completion_day_level":{},"id":"727545","last_star_ts":0,"global_score":0,"name":null,"local_score":0,"stars":0},"406017":{"id":"406017","completion_day_level":{"2":{"1":{"get_star_ts":"1575264301"},"2":{"get_star_ts":"1575264561"}},"1":{"1":{"get_star_ts":"1575176687"},"2":{"get_star_ts":"1575177031"}},"3":{"2":{"get_star_ts":"1575350314"},"1":{"get_star_ts":"1575349931"}}},"local_score":249,"global_score":0,"last_star_ts":"1575350314","name":"Erik Szalay","stars":6},"633833":{"stars":0,"id":"633833","completion_day_level":{},"local_score":0,"global_score":0,"last_star_ts":0,"name":null},"49729":{"stars":0,"completion_day_level":{},"id":"49729","name":"Seluwin","last_star_ts":0,"global_score":0,"local_score":0},"452327":{"stars":4,"local_score":89,"global_score":0,"last_star_ts":"1575359071","name":"Andrea Spišáková","id":"452327","completion_day_level":{"2":{"1":{"get_star_ts":"1575318972"},"2":{"get_star_ts":"1575359071"}},"1":{"2":{"get_star_ts":"1575316042"},"1":{"get_star_ts":"1575315442"}}}},"382474":{"completion_day_level":{"3":{"1":{"get_star_ts":"1575367655"},"2":{"get_star_ts":"1575380238"}},"2":{"1":{"get_star_ts":"1575296554"},"2":{"get_star_ts":"1575297391"}},"1":{"2":{"get_star_ts":"1575294741"},"1":{"get_star_ts":"1575290505"}}},"id":"382474","last_star_ts":"1575380238","global_score":0,"name":"linda Jurkasova","local_score":170,"stars":6},"230440":{"local_score":196,"last_star_ts":"1575355079","name":"Tomáš Bočinec","global_score":0,"id":"230440","completion_day_level":{"3":{"2":{"get_star_ts":"1575355079"},"1":{"get_star_ts":"1575355063"}},"1":{"1":{"get_star_ts":"1575222029"},"2":{"get_star_ts":"1575222656"}},"2":{"2":{"get_star_ts":"1575275021"},"1":{"get_star_ts":"1575274812"}}},"stars":6},"241618":{"id":"241618","completion_day_level":{"2":{"1":{"get_star_ts":"1575272186"},"2":{"get_star_ts":"1575279106"}},"1":{"1":{"1":{"get_star_ts":"1575184259"},"2":{"get_star_ts":"1575184876"}},"3":{"1":{"get_star_ts":"1575369676"},"2":{"get_star_ts":"1575375683"}}}},"local_score":207,"last_star_ts":"1575375683","global_score":0,"name":null,"stars":6},"289854":{"last_star_ts":"1575375697","global_score":0,"name":"Miki Hermann","local_score":206,"completion_day_level":{"2":{"2":{"get_star_ts":"1575267648"},"1":{"get_star_ts":"1575265752"}},"1":{"2":{"get_star_ts":"1575185929"},"1":{"get_star_ts":"1575185448"}},"3":{"1":{"get_star_ts":"1575369838"},"2":{"get_star_ts":"1575375697"}}},"id":"289854","stars":6},"677144":{"local_score":196,"last_star_ts":"1575367533","name":"Vsetky Borufky","global_score":0,"id":"677144","completion_day_level":{"3":{"2":{"get_star_ts":"1575367533"},"1":{"get_star_ts":"1575357449"}},"1":{"2":{"get_star_ts":"1575241741"},"1":{"get_star_ts":"1575241062"}},"2":{"1":{"get_star_ts":"1575264300"},"2":{"get_star_ts":"1575267832"}}},"stars":6},"340516":{"stars":6,"id":"340516","completion_day_level":{"3":{"1":{"get_star_ts":"1575351837"},"2":{"get_star_ts":"1575376586"}},"2":{"1":{"get_star_ts":"1575263547"},"2":{"get_star_ts":"1575263974"}},"1":{"2":{"get_star_ts":"1575182013"},"1":{"get_star_ts":"1575181806"}}}},"local_score":233,"last_star_ts":"1575376586","name":"Lukáš Gajdošech","global_score":0},"440518":{"last_star_ts":0,"global_score":0,"name":"Marek Stachera","local_score":0,"completion_day_level":{},"id":"440518","stars":0},"394723":{"local_score":0,"last_star_ts":0,"global_score":0,"name":null,"id":"394723","completion_day_level":{},"stars":0},"229344":{"stars":6,"id":"229344","completion_day_level":{"3":{"2":{"2":{"get_star_ts":"1575351770"},"1":{"get_star_ts":"1575350735"}},"1":{"1":{"get_star_ts":"1575176691"},"2":{"get_star_ts":"1575177020"}},"2":{"2":{"get_star_ts":"1575264839"},"1":{"get_star_ts":"1575264081"}}},"local_score":245,"global_score":0,"last_star_ts":"1575351770","name":"Peter BOROVANSKY"},"133724":{"stars":4,"local_score":104,"last_star_ts":"1575328931","name":"Alexka Nyitraiová","global_score":0,"id":"133724","completion_day_level":{"1":{"1":{"get_star_ts":"1575210606"},"2":{"get_star_ts":"1575211974"}},"2":{"2":{"get_star_ts":"1575328931"},"1":{"get_star_ts":"1575327359"}}}},"644573":{"id":"644573","completion_day_level":{"1":{"1":{"get_star_ts":"1575176824"},"2":{"get_star_ts":"1575177172"}},"2":{"1":{"get_star_ts":"1575263803"},"2":{"get_star_ts":"1575264338"}},"3":{"2":{"get_star_ts":"1575351620"},"1":{"get_star_ts":"1575351021"}}},"local_score":245,"last_star_ts":"1575351620","name":"vidosuba","global_score":0,"stars":6},"541831":{"id":"541831","completion_day_level":{},"local_score":0,"global_score":0,"last_star_ts":0,"name":"Michal Knor","stars":0},"253915":{"last_star_ts":"1575311956","name":"Michal Winczer","global_score":0,"local_score":100,"completion_day_level":{"2":{"2":{"get_star_ts":"1575311956"},"1":{"get_star_ts":"1575311450"}},"1":{"2":{"get_star_ts":"1575307940"},"1":{"get_star_ts":"1575307081"}}},"id":"253915","stars":4},"387557":{"stars":0,"id":"387557","completion_day_level":{},"local_score":0,"global_score":0,"last_star_ts":0,"name":"dobrakmato"},"414606":{"id":"414606","completion_day_level":{},"local_score":0,"name":null,"last_star_ts":0,"global_score":0,"stars":0},"668371":{"last_star_ts":"1575318359","name":"Matej Magat","global_score":0,"local_score":106,"completion_day_level":{"2":{"1":{"get_star_ts":"1575315504"},"2":{"get_star_ts":"1575318359"}},"1":{"2":{"get_star_ts":"1575229904"},"1":{"get_star_ts":"1575228543"}}},"id":"668371","stars":4}},"event":"2019"}

Výmena dát so serverom

Už sme videli výmenu dát klient-server

- cez parametre GET/POST requestu,
- cez obsah POST requestu,
- cez cookies

ešte uvidíme:

- cez JSON objekt
  - **`pomocou org.json.*`**
  - **`pomocou com.google.gson.*`**
- cez xml formát
  - **`pomocou org.xml.sax.*;`**
  - ~~pomocou DOM ste (asi) to robili na Prog – Java2~~ **`http://dai.fmph.uniba.sk/courses/java2/sl/xml.pdf`**

LocationAPI.org

```
D/MyGSMLocation(19361): gsm cid: 396517
D/MyGSMLocation(19361): gsm lac: 1001
D/MyGSMLocation(19361): operator:23102
D/MyGSMLocation(19361): network: 23102
D/MyGSMLocation(19361): mcc: 231
D/MyGSMLocation(19361): mnc: 2
```

- zaregistrujete sa napr. na 7-dňový trial, max. 50 requests/day
- dostanete kľúč (token), 95b2941777892d (keď toto čítate, asi už neplatí ☹
- skúste 95b2941777892d (7.dec 2017).

http://locationapi.org/site/page?view=apiv2

LocationAPI.org

API v2 Documentation

1. Usage
2. Test it out
3. Request body
4. Response body
5. Example Script - PHP
6. Example Script - Python

Usage

Requests are sent using POST to the following url:

```
http://locationapi.org/v2/process.php
```

Request: 1 cell | 3 cells | 7 cells

```
{
    "token": "1445573628",
    "mcc": 231,
    "mnc": 2,
    "cells": [{
        "cid": 396517,
        "lac": 1001,
        "signal": -60,
        "tA": 13
    }]
}
```

Response:

```
{
    "status": "ok",
    "balance": 45,
    "lat": 48.16802,
    "lon": 17.11049,
    "accuracy": 1063,
    "message": "Accuracy is in BETA!"
}
```

Project:MyGSMLocation.zip

LocationAPI z aplikácie

- potrebujeme urobiť http-POST request na http://locationapi.org/v2/process.php
- keďže to niečo trvá, nesmieme to robiť v hlavnom vlákne – AsyncTask
- do tela dotazu (requestu) potrebujeme zakódovať (cellID, lac, mcc, mnc + môj token) hoc jednoduchý, ale predsa-len JSON objekt
- z tela odpovede (responsu) potrebujeme dekódovať hoc jednoduchý, ale JSON objekt, t.j. prečítať latitude-longitude

Request: 1 cell | 3 cells | 7 cells

```
{
    "token": "1445573628",
    "mcc": 231,
    "mnc": 2,
    "cells": [{
        "cid": 396517,
        "lac": 1001,
        "signal": -60,
        "tA": 13
    }]
}
```

Response:

```
{
    "status": "ok",
    "balance": 45,
    "lat": 48.16802,
    "lon": 17.11049,
    "accuracy": 1063,
    "message": "Accuracy is in BETA!"
}
```

Project:MyGSMLocation.zip

Vytvorenie (malého) JSON objektu

(pre GET LocationAPI)

```
import android.util.JsonWriter
```

```
val sw = StringWriter()
val jw = JsonWriter(sw)
try {
   jw.beginObject()  -- {
     jw.name("token").value(token_locationAPIORG)
     jw.name("mcc").value(mcc)
     jw.name("mnc").value(mnc)
     jw.name("cells")
     jw.beginArray()    -- [
        .beginObject() -- {
                jw.name("cid").value(cid)
                jw.name("lac").value(lac)
                jw.name("signal").value(-60)
                jw.name("tA").value(13)
jw.endObject().endArray().endObject().close() -- } ] }
```

Request: 1 cell | 3 cells | 7 cells

```
{
    "token": "1445573628",
    "mcc": 231,
    "mnc": 2,
    "cells": [{
        "cid": 396517,
        "lac": 1001,
        "signal": -60,
        "tA": 13
    }]
}
```

Project:MyGSMLocation.zip

Dekódovanie (malého) JSON

```
import android.util.JsonReader
```

```
val sr = StringReader(result)
val jr = JsonReader(sr)
jr.beginObject() -- {
   jr.nextName() -- skip: “status”
   jr.nextString()    -- skip: “ok”
   jr.nextName() -- skip: “balance”
   jr.nextInt()  -- skip: 45

   jr.nextName() -- skip: “lat”
   lat = jr.nextDouble()
   jr.nextName() -- skip: “lon”
   lng = jr.nextDouble()
   jr.nextName()  -- skip: “accuracy”
   accur = jr.nextInt()
```

Response:


```
{
    "status": "ok",
    "balance": 45,
    "lat": 48.16802,
    "lon": 17.11049,
    "accuracy": 1063,
    "message": "Accuracy is in BETA!"
}
```


Project:MyGSMLocation.zip

GSON
(fromJson)

```
{
 "id": "1547257485",
 "name": "Peter Borovansky",
 "first_name": "Peter",
 "last_name": "Borovansky",
 "link":"http://www.facebook.com/
          peter.borovansky",
 "username": "peter.borovansky",
 "gender": "male",
 "locale": "cs_CZ"
}
```

Idea: k JSON objektu definujeme zodpovedajúcu (1:1) java triedu

Obmedzenia (viac https://github.com/google/gson/blob/master/UserGuide.md):

- mená JSON tagov sa musia zhodovať s java menami polí v triede

```
class FBHeader {
   public String id = "";
   public String name = "";
   public String first_name = "";
   public String last_name = "";
   public String link = "";
   public String username = "";
   public String gender = "";
   public String locale = "";          }

Gson gson = new GsonBuilder().create();
FBHeader header = gson.fromJson(jsonstring, FBHeader.class);
```

```
import com.google.gson
```

FB Friends

(fromJson)

```
{ "data":
          [ { "name": "Zuzka B…", "id": "582749468" },
            { "name": "Lubica K…", "id": "583024903" },
            { "name": "Barbora F…", "id": "632007063" },
          ],
  "paging": { "next":"https://graph.facebook.com/15...}
```

```
class FBFriends {  // dvojica
   public FBPairs[] data = null;
   public FBPaging paging = null; }
class FBPairs {    // dvojica
   public String name = "";
   public String id = ""; }
class FBPaging {   // singleton
   public String next = ""; }
```

```
import com.google.gson
```

```
Gson gson = new GsonBuilder().create();
FBFriends friends = gson.fromJson(result, FBFriends.class);
if (friends != null) {
   if (friends.data != null)
        for (int i = 0; i < friends.data.length; i++)
           if (friends.data[i] != null)
                tv.append(friends.data[i].name + ",");
}
```

GSON – ako to funguje ?

Reflexivita

Ukázali sme

- `fromJson (do Javy)`

ale analogicky funguje

- `toJson (z Javy)`

`org.json`

`vs.`

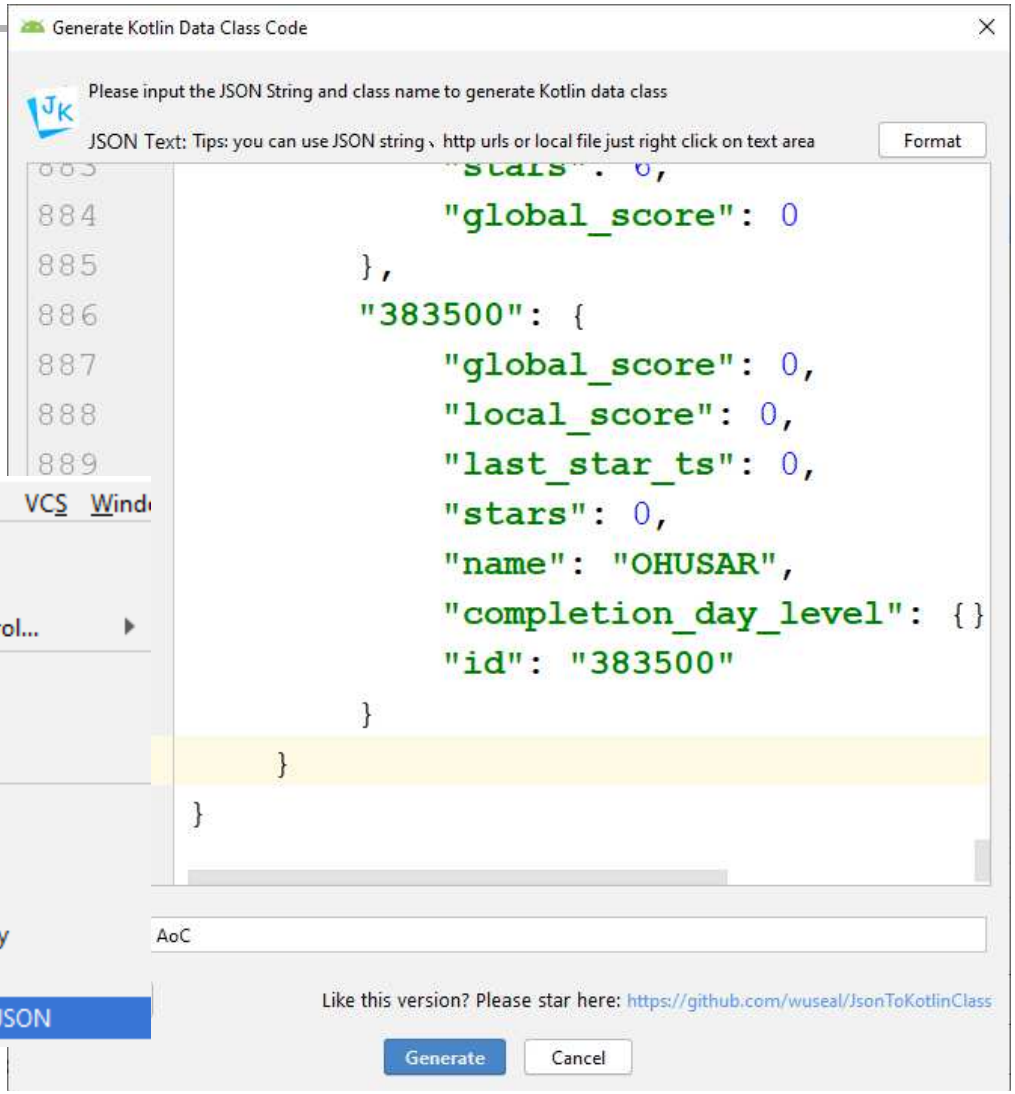
`com.google.gson`

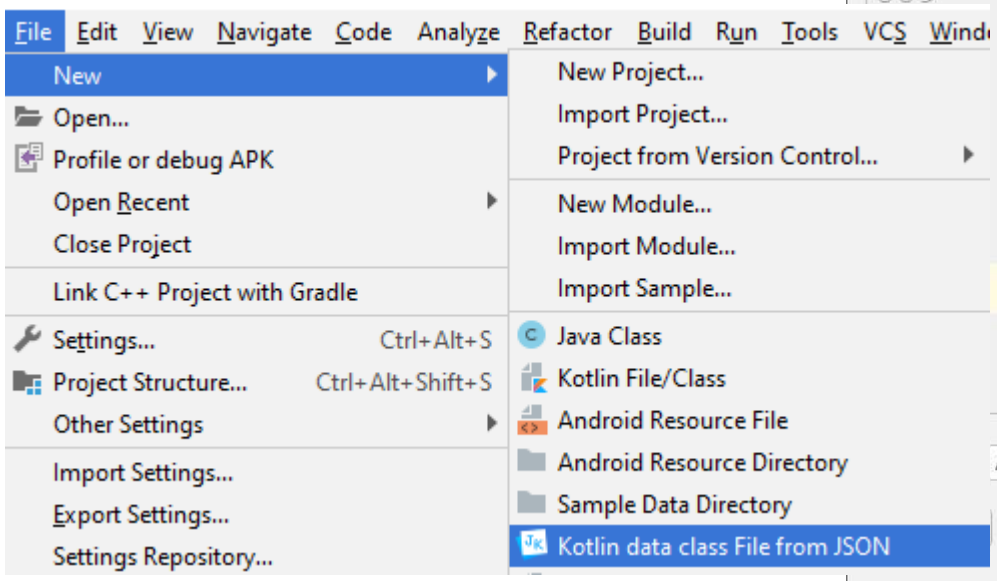
Zdroj: http://www.huffingtonpost.com/2012/06/17/mc-escher-birthday_n_1591432.html

Plugin JSON to Kotlin Class

- z daného JSON vytvorí definíciu Kotlin tried

- potom stačí zavolať fromJson prekonvertuje vám json-string do dátovej štruktúry





Domáca úloha
AoC

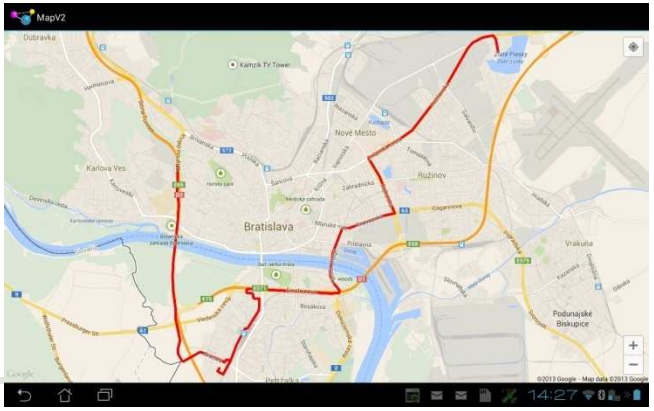
- https://adventofcode.com/
- Leaderboardu 229344-861e5094.

Vašou úlohou je v aplikácii prečítať tento JSON a interpterovať.

Čo sa chápe pod interpretáciou:
•v master view zobrazíte v jednom riadku ListView mená (ID ak name=null) s počtom hviezd,
•po klinutí na konkrétny riadok (hráča) sa zobrazí detail view, ktorý obsahuje dni a časy, kedy tento hráč vyriešil ktorú úlohu. JSON obsahuje timestampy vo formate long (napr. 1575234400), tie samozrejme preveďte na čitateľný Date-Time formát. Pre jednoduchosť, dni sú dni adventu 1..25 a úlohy sú v každom dni len 2, teda 1..2.

GoogleDirections

(ako ide matfyzák na pláž)



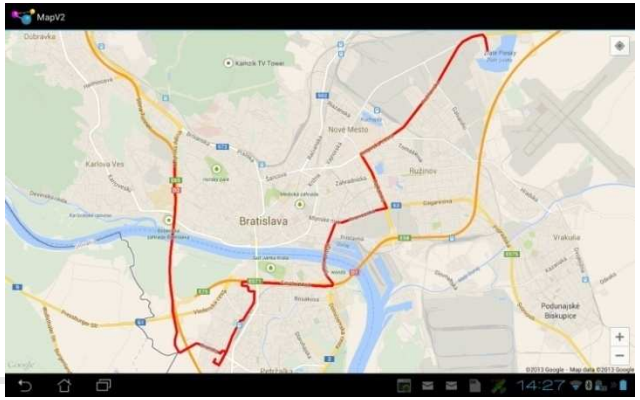
- https://developers.google.com/maps/documentation/directions/

```
String startLocation = "Mlynska dolina, Bratislava"
                                .replace(" ", "+");
String endLocation = "Zlate piesky, Bratislava"
                                .replace(" ", "+");
String via = "AGEM, Kopcianska, Bratislava|
       Alza, Prievozska, Bratislava".replace(" ", "+");
String stringUrl =
   "http://maps.googleapis.com/maps/api/directions/json?"+
        "origin=" + startLocation +
        ",+&destination=" + endLocation +
        ",+&mode=bicycle,&avoid=highways,&waypoints=" +    via
   +
        ",+&sensor=false";
```

Project:GMapDirections.zip

http://maps.googleapis.com/maps/api/directions/json?origin=Mlynska+dolina,+Bratislava,+&destination=Zlate+piesky,+Bratislava,+&mode=bicycle,+&avoid=highways,+&waypoints=AGEM,+Kopcianska,+Bratislava|Alza,+Prievozska,+Bratislava,+&sensor=false

Hľadaná trasa



vo formáte json, resp. xml, na vykreslenie trasy potrebujeme dekódovať „overview_polyline"


```
                  "maneuver" : "keep-right",
                  "polyline" : {
                     "points" : "urbeHyj{gBRAdDm@fGeA"
                  },
                  "start_location" : {
                     "lat" : 48.187468,
                     "lng" : 17.1846087
                  },
                  "travel_mode" : "DRIVING"
               }
            ],
            "via_waypoint" : []
         }
      ],
      "overview_polyline" : {
         "points" :
"cg}dHybfgBvCWbDEpQSn@B`B`@|AV|@Fb@AjAGdCg@lC_@bBQr@OzGH|I
O|BcA|FoAxKkBrASn@?t@Fr@PbDvAlA`@jBF~AQh@Sl@a@zCgCfA}@PUJS
AdA`DfCiCrJsC_CrC~BhCsJaDgCkAeA{AiAuB_BuDqCqE_CiJeEsAk@i@[
Wj@EZKnI_DGCMAEIOIK?MBsCHuGZsQb@s^PmNJ}Lb@yZ
\\oWVsMP{O@oCDwDA]?e@?s@Ca@UgAS]MM[M_@@[JUL{@x@cEpG]p@s@f@
iAmHaEcYoAiIqAcJc@oEaAyLGgAG{@MD]NWJWL}Aj@kAj@uBvAc@
\\CTkCtAgCpAyFtC_CjAgL`G}D|BiFlEkF`FyExDgC~BkCeJiAsDc@gB_C
gB{A_@a@q@}@_AoAk@iAq@uAmAaD}A}GUy@e@}Cc@kDY_DOyBO}FRILQjA
         },
         "summary" : "Route 61",
         "warnings" : [],
         "waypoint_order" : [ 0, 1 ]
```



```
- <DirectionsResponse>
    <status>OK</status>
  - <route>
      <summary>Route 61</summary>
    + <leg></leg>
    + <leg></leg>
    + <leg></leg>
      <copyrights>Map data ©2013 Google</copyrights>
    - <overview_polyline>
      - <points>
            cg}dHybfgBvCWbDEpQSn@B`B`@|AV|@Fb@Aj
            \oWVsMP{O@oCDwDA]?e@?s@Ca@UgAS]Mf
            \CTkCtAgCpAyFtC_CjAgL`G}D|BiFlEkF`FyExDg
        </points>
      </overview_polyline>
      <waypoint_index>0</waypoint_index>
      <waypoint_index>1</waypoint_index>
    + <bounds></bounds>
    </route>
</DirectionsResponse>
```


Project:GMapDirections.zip

http://maps.googleapis.com/maps/api/directions/xml?origin=Mlynska+dolina,+Bratislava,+&destination=Zlate+piesky,+Bratislava,+&mode=bicycle,+&avoid=highways,+&waypoints=AGEM,+Kopcianska,+Bratislava|Alza,+Prievozska,+Bratislava,+&sensor=false

Ako sa dostať k ceste


```
{
  "routes" : [
    {
      "copyrights" : "Map data ©20
      ......
      "overview_polyline" : {
        "points" : "cg}dHybCc@kDY
      },
    }
  ],
  "status" : "OK"
}
```


```
String jsonOutput = response.toString();
JSONObject jsonObject = new JSONObject(jsonOutput);
JSONArray routesArray = // z routes berieme prvú alternatívu
            jsonObject.getJSONArray("routes");
JSONObject route = routesArray.getJSONObject(0);
JSONObject poly = // pod route je uzol overview_polyline
            route.getJSONObject("overview_polyline");
String polyline = poly.getString("points");
decodePoly(polyline);
```

ako dekódovať reťazec na zoznam bodov cesty ???

```
private List<LatLng> decodePoly(String encoded)
```

je mágia mimo rozsahu tejto prednášky

http://stackoverflow.com/questions/15924834/decoding-polyline-with-new-google-maps-api

Project:GMapDirections.zip

Domáca úloha

(Google Direction Navigation)

Vytvorte aplikáciu, ktorá zistí trasu medzi dvoma bodmi pomocou služby Google Directions, prečíta výsledný json/xml a naviguje vás po tejto ceste použitím vášho GPS.

Jadrom aplikácie je dekódovanie a zobrazovanie informácie, ktorú json/xml ponúka. Predpokladá sa, že po čase disciplinovaný vodič dosiahne (s istou presnosťou) miesto, križovatku, kam ho inštrukcia poslala. Vtedy dostane novú inštrukciu, na ďalšie miesto, kam má isť.

Ak nedisciplinovaný vodič neposlúchne radu kam má smerovať od Google Directions, tak to aplikácia nerieši. Teda žiadne „prepočítavam"...

Vašu polohu môžete, ale nemusíte ilustrovať na mapovom podklade.