Android
-
komunikácia

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- **Retrofit Rest API**
- http(s) GET, POST
  - static Google Maps V2,
- **formáty json (gson) a xml**

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, ...
  - používamie http protokol - 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,
    - *AsyncTask*
    - *corutina*
    - *Retrofit async-callback*
  - autorizácia (Basic Authorization)

REST API
- nie je protokol
- nie je štandard
- je klient-server **stateless** architektúra nad HTTP
- json, xml, html...

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 – REST API, JSON parser (com.google.gson,
  alternatíva: org.json.JSON)
  - LocationApi.org príklad už bol minule
  - Google Directions – získanie cesty-navigácie od služby Google

Retrofit

(bolo v Cvičení-A)

DefaultHttpClient

extends AbstractHttpClient

java.lang.Object
↳org.apache.http.impl.client.AbstractHttpClient
↳org.apache.http.impl.client.DefaultHttpClient

This class was deprecated in API level 22.
Please use `openConnection()` instead. Please visit this webpage for further details.

- Retrofit je REST klient pre Android
- zjednodušuje download & upload JSON (cez HTTP GET/POST)
- používa napr. Gson, resp. SimpleXML, tikXML converter
- build.gradle treba doplniť o


```
implementation 'com.squareup.retrofit2:retrofit:2.6.2'
implementation 'com.squareup.retrofit2:converter-gson:2.6.2'
```

- data class zodpovedajúci JSONu (mapovanie na json tagy):

```
data class Stat (
    @SerializedName("name")       /* -> */  val countryName: String?,
    @SerializedName("capital")    /* -> */  val capital: String?,
    @SerializedName("flagPNG")    /* -> */  val flag: String?,
    @SerializedName("latlng")     /* -> */  val latlng: Array<Float>?,
    @SerializedName("borders")    /* -> */  val borders: List<String>?,
    @SerializedName("alpha3Code") /* -> */  val code: String?
)
```

- REST API pre Retrofit

```
interface StatInterface {
    @GET("vlajky/staty.json")
    suspend fun get(): Response<List<Stat>>
}
```

https://dai.fmph.uniba.sk/courses/VMA/vlajky/staty.json

CoroutineRetrofit

Coroutines+MVVM+Retrofit

(model)

https://dai.fmph.uniba.sk/courses/VMA/vlajky/staty.json

```
data class Stat(
    @SerializedName("name")        /* -> */  val countryName: String?,
    @SerializedName("capital")     /* -> */  val capital: String?,
    @SerializedName("flagPNG")     /* -> */  val flag: String?,
    @SerializedName("latlng")      /* -> */  val latlng: Array<Float>?,
    @SerializedName("borders")     /* -> */  val borders: List<String>?,
    @SerializedName("alpha3Code") /* -> */  val code: String?
)
```

```
/*
  {
    "alpha2Code": "SK",
    "alpha3Code": "SVK",
    "altSpellings": [
      "SK",
      "Slovak Republic",
      "Slovensk\u00e1 republika"
    ],
    "area": 49037,
    "borders": [
      "AUT",
      "CZE",
      "HUN",
      "POL",
      "UKR"
    ],
    "callingCodes": [
      "421"
    ],
    "capital": "Bratislava",
    "currencies": [
      {
        "code": "EUR",
        "name": "Euro",
        "symbol": "\u20ac"
      }
    ],
    "demonym": "Slovak",
        "flagPNG":
 "https://dai.fmph.uniba.sk/courses/VMA/vlajky/svk.png",
```

```
    "gini": 26.0,
    "languages": [
      {
        "iso639_1": "sk",
        "iso639_2": "slk",
        "name": "Slovak",
        "nativeName": "sloven\u010dina"
      }
    ],
    "latlng": [
      48.66666666,
      19.5
    ],
    "name": "Slovakia",
    "nativeName": "Slovensko",
    "numericCode": "703",
    "population": 5426252,
    "region": "Europe",
    "regionalBlocs": [
      {
        "acronym": "EU",
        "name": "European Union"
      }
    ],
    "subregion": "Eastern Europe",
    "timezones": [
      "UTC+01:00"
    ],
```

Coroutines+MVVM+Retrofit

(REST API - model)

```
interface StatInterface {
    @GET("vlajky/staty.json")
    suspend fun get(): Response<List<Stat>>
}

object StatService {
    private val BASE_URL = "httpS://dai.fmph.uniba.sk/courses/VMA/"

    fun get(): StatInterface =
        Retrofit.Builder()
                .baseUrl(BASE_URL)
                .addConverterFactory(GsonConverterFactory.create())
                .build()
                .create(StatInterface::class.java)
    }
}
```

https://dai.fmph.uniba.sk/courses/VMA/vlajky/staty.json

461 kB/ 250x~200kB.png

Coroutines+MVVM+Retrofit

(viewmodel)

```
class ListViewModel: ViewModel() {
    val service = StatService.get()
    lateinit var job: Job
    val staty = MutableLiveData<List<Stat>>()

    fun fetch() {
        job = CoroutineScope(Dispatchers.IO)
            .launch {
               val response = service.get()  // : Response<List<Stat>>
               withContext(Dispatchers.Main) {
                   if (response.isSuccessful)
                        staty.value = response.body()
                   else
                       Log.d("MODEL", "Error: ${response.message()}")
    }      }  }
    override fun onCleared() {
        super.onCleared()
        job.cancel()
}   }
```

Coroutines+MVVM+Retrofit

(view)

```
class MainActivity : AppCompatActivity() {
    lateinit var viewModel: ListViewModel
    private val listAdapter = ListAdapter(arrayListOf())
    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        setContentView(R.layout.activity_main)
        viewModel = ViewModelProviders.of(this).get(ListViewModel::class.java)
        viewModel.fetch()
        listview.apply {
            layoutManager = LinearLayoutManager(context)
            adapter = listAdapter
        }
        observeViewModel()
    }
    fun observeViewModel() {
        viewModel.staty.observe(this, Observer { staty ->
            staty?.let {                                    // if staty != null …
                countriesList.visibility = View.VISIBLE
                listAdapter.updateCountries(it)
            }
        })
} }
```

```
Glide.with(this)
     .load(IMAGE_URL)
     .into(imageView)
```

Glide

(knižnica na sťahovanie obrázkov)

- List adaptér používa Glide na čítanie obrázkov z URL
- https://medium.com/@vlonjatgashi/using-glide-with-kotlin-5e345b557547
- build.gradle:

```
apply plugin: 'kotlin-kapt' // kotlin anotation processing tool

dependencies {
   implementation 'com.github.bumptech.glide:glide:4.4.0`
   kapt 'com.github.bumptech.glide:compiler:4.4.0'
}
```

- kód:

```
import com.bumptech.glide.Glide

val options=RequestOptions().error(R.mipmap.ic_launcher_round)
Glide.with(this)
    .setDefaultRequestOptions(options)
    .load(country.flag)
    .into(imageView)
```

CoroutineGlide

Glide

(spracovanie obrázku)

```
Glide.with(this)
     .load(IMAGE_URL)
     .into(imageView)
```

jednoduché demo:

```
CoroutineScope(Dispatchers.Main).launch {
    Glide.with(this@MainActivity)
        .asBitmap()
        .error(R.mipmap.ic_launcher_round)
        .load(IMAGE_URL)
        .into(object : CustomTarget<Bitmap>() {
            override fun onResourceReady(
                resource: Bitmap,
                transition: Transition<in Bitmap>? ) {
              val filteredBitmap = toBlackAndWhite(resource)
              progressBar.visibility = View.GONE
              imageView.setImageBitmap(filteredBitmap)
              imageView.visibility = View.VISIBLE
            }
            override fun onLoadCleared(placeholder: Drawable?) { }
        })
}
```

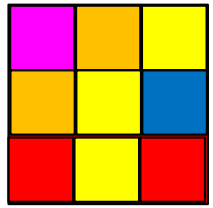
CoroutineGlide

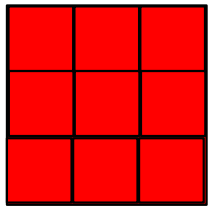
Pixelizácia

úloha z cvičenia A

Implementácia bez väčšej logiky, celý štvorec má farbu bodu v dolnom spodnom rožku štvorca – vylepšovať je čo...

```
fun pixelize(pixelSize : Int, source: Bitmap):
        Bitmap {
    val w = source.width
    val h = source.height
    val bitmapOut = Bitmap.createBitmap(w, h, Bitmap.Config.RGB_565)
    (0 until h step pixelSize).forEach { y->
        (0 until w step pixelSize).forEach { x->
            val color = source.getColor(x, y).toArgb()
            (0 until pixelSize).forEach { dx->
                (0 until pixelSize).forEach { dy ->
                    val xx = Math.max(0, x - dx)
                    val yy = Math.max(0, y - dy)
                    bitmapOut.setPixel(xx,yy, color)
                }
            }
        }
    }
    return bitmapOut
```





https://eu1.unwiredlabs.com/v2/process.php

```
{
    "token": "95b2941777892d",
    "mcc": 231,
    "mnc": 2,
    "cells": [{
        "lac": 1,
        "cid": 31441
    }],
    "address": 1
}
```

```
{
    "status": "ok",
    "balance": 97,
    "lat": 48.14875,
    "lon": 17.06679,
    "accuracy": 837,
    "address": "Botanická, Švédske domky, Bratislava, Karlova Ves, Bratislava, Region of Bratislava, 841 04, Slovakia"
}
```

GSM-Retrofit

GSM lokalizácia - z cvičenia B

mcc,mnc,
lac,cid

unwiredlabs LocationAPI

latitude
longitude

V prednáške o polohe sme narazili na problem ako GSM súradnice (mcc,mnc,lac,cid) prekožiť do latitude-longitude volaním externého servisu

- potrebujeme mu (process.php) poslať,prečítať json-dáta, cez HTTP-POST
  - ak zavrhneme riešenie, že "*lepíme reťazce" do JSON a vyhľadávame v ňom podstringy*, ...
  - riešenie založené na json knižnici **`android.util.JsonReader/JsonWriter`** (ukážeme si)
  - riešenie založené na Gson knižnici (konvertuje json do objektu cez Java reflection model)
  - Gson converter priamo v Retrofit
- nesmieme to robiť v hlavnom vlákne, lebo to môže trvať...
  - riešenie pomocou AsyncTask (old-school – môžete nájsť v MyGSMLocation.zip)
  - riešenie pomocou coroutin (new-wave)

ako z JSON-vzorky dát to vyrobiť Kotlin Class ?

- podporuje to priamo AS plugin
  Json to Kotlin Class

```
data class GSMRequest(
    val address: Int,
    val cells: List<Cell>,
    val mcc: Int,
    val mnc: Int,
    val token: String)
```

```
data class Cell(
    val cid: Int,
    val lac: Int)
```

```
data class GSMResponse(
    val accuracy: Int,
    val address: String,
    val balance: Int,
    val lat: Double,
    val lon: Double,
    val status: String
)
```

GSMRetrofit

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 dostanete kľúč (token),
- 95b2941777892d (keď toto čítate, ešte platí ☺)

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
```

```
val request = GSMRequest(
    token = "95b2941777892d",
    mcc = mcc,
    mnc = mnc,
    cells = listOf(Cell(lac = lac, cid = cid)),
    address = 1
)
```

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

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 – corutina
- 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

GSM-Retrofit

https://eu1.unwiredlabs.com/v2/process.php

```
{
    "token": "95b2941777892d",
    "mcc": 231,
    "mnc": 2,
    "cells": [{
        "lac": 1,
        "cid": 31441
    }],
    "address": 1
}
```

GSMRequest

```
{
    "status": "ok",
    "balance": 97,
    "lat": 48.14875,
    "lon": 17.06679,
    "accuracy": 837,
    "address": "Botanická,
Švédske domky, Bratislava,
Karlova Ves, Bratislava,
Region of Bratislava, 841 04,
Slovakia"
}
```

GSMResponse

- JSON to Kotlin Class
- build.gradle

```
implementation 'com.google.code.gson:gson:2.8.5’
implementation 'com.squareup.retrofit2:retrofit:2.6.2'
implementation 'com.squareup.retrofit2:converter-gson:2.6.2’
```

- toto si dáme vygenerovať pluginom JSON to Kotlin Class

ak interné mená zodpovedajú JSON tagom, tak neriešime `@SerializedName`

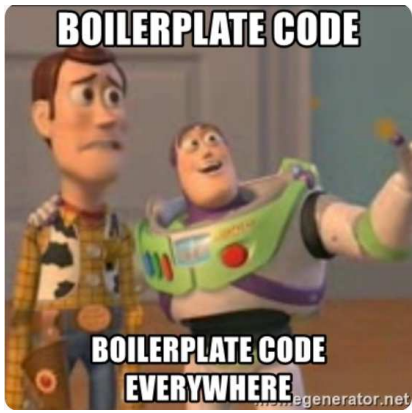
```
data class Cell(
    val cid: Int,
    val lac: Int
)
```

```
data class GSMRequest(
    val address: Int,
    val cells:   List<Cell>,
    val mcc:     Int,
    val mnc:     Int,
    val token:   String
)
```

```
data class GSMResponse(
    val accuracy: Int,
    val address:  String,
    val balance:  Int,
    val lat:      Double,
    val lon:      Double,
    val status:   String
)
```

GSMRetrofit

process.php



Rest API

retrofit callback

```
interface RestApiInterface {
    @Headers("Content-Type: application/json")
    @POST("process.php")
    fun gsm2latlong(@Body gsmRequest: GSMRequest): Call<GSMResponse>
}
```

```
class RestApiService {
  suspend
  fun gsm2latlong(gsmRequest: GSMRequest, onResult: (GSMResponse?) -> Unit){
    val retrofit = ServiceBuilder.get()
    retrofit.gsm2latlong(gsmRequest).enqueue(
      object : Callback<GSMResponse> {
        override fun onFailure(call: Call<GSMResponse>, t: Throwable) {
          onResult(null)                                          null
        }
        override fun onResponse(call: Call<GSMResponse>,
                                response: Response<GSMResponse>) {
          val resp = response.body()
          onResult(resp)                                          !=null
 }   } ) } }
```

GSMRetrofit

https://eu1.unwiredlabs.com/v2/

Service Builder

```
object ServiceBuilder {
    private val client = OkHttpClient.Builder().build()

    suspend
    fun get(): RestApiInterface =
        Retrofit.Builder()
        .baseUrl("httpS://eu1.unwiredlabs.com/v2/")
        .addConverterFactory(GsonConverterFactory.create())
        .client(client)
        .build()
        .create(RestApiInterface::class.java)
}
```

Volanie - bez corutiny

```
data class Cell(
    val cid: Int,
    val lac: Int
)
```

```
data class GSMRequest(
    val address: Int,
    val cells:   List<Cell>,
    val mcc:     Int,
    val mnc:     Int,
    val token:   String
)
```

```
class RestApiService {
  suspend
  fun gsm2latlong(gsmRequest: GSMRequest,
                  onResult: (GSMResponse?) -> Unit)
```

```
val request = GSMRequest(
    token = "95b2941777892d",
    mcc = mcc,
    mnc = mnc,
    cells = listOf(Cell(lac = lac, cid = cid)),
    address = 1
)

    val apiService = RestApiService()
    val response = apiService.gsm2latlong(request) {
      response ->          // toto je onResult
        if (response != null) {
            Log.d(TAG, "${response.lat}, ${response.lon}")
            latTV.text = response.lat.toString()
            longTV.text = response.lon.toString()
        } else
            Log.d(TAG, "response is null")
      }
```

```
data class GSMResponse(
    val accuracy: Int,
    val address:  String,
    val balance:  Int,
    val lat:      Double,
    val lon:      Double,
    val status:   String
)
```

GSMRetrofit

Volanie – s corutinou

```
class RestApiService {
  suspend
  fun gsm2latlong(gsmRequest: GSMRequest,
                  onResult: (GSMResponse?) -> Unit)
```

```
val request = GSMRequest(
    token = "95b2941777892d",
    mcc = mcc,
    mnc = mnc,
    cells = listOf(Cell(lac = lac, cid = cid)),
    address = 1
)
CoroutineScope(Dispatchers.IO).launch {
    val apiService = RestApiService()
    val response = apiService.gsm2latlong(request) {
      response ->                  // toto je onResult
        if (response != null) {
            Log.d(TAG, "${response.lat}, ${response.lon}")
            latTV.text = response.lat.toString()
            longTV.text = response.lon.toString()
        } else
            Log.d(TAG, "response is null")
      }
}
```

GUI len ako Dispatchers.Main

```
val request = GSMRequest(
    token = "95b2941777892d",
    mcc = mcc,
    mnc = mnc,
    cells = listOf(Cell(lac = lac, cid = cid)),
    address = 1
)
CoroutineScope(Dispatchers.IO).launch {
    val apiService = RestApiService()
    val response = apiService.gsm2latlong(request) {
      response ->                    // toto je onResult
        if (response != null) {
            Log.d(TAG, "${response.lat}, ${response.lon}")
            CoroutineScope(Dispatchers.Main).launch {
                latTV.text = response.lat.toString()
                longTV.text = response.lon.toString()
            }
        } else
            Log.d(TAG, "response is null")
}   }
```

WifiLocation

(úloha z cvičenia-A presunutá do cvičenia-B)

V skratke: TelephonyManager nahraď WifiManagerom a uprav jsony

AP-mac address

latitude
longitude

Projekt GSMRetrofit získava od TelephonyManagera informácie polohe vo forme štvorice cid, lac, mcc, mnc. Prerobte tento projekt tak, aby ste zisťovali informáciu o polohe od WifiManagera (nahraďte Telephony za Wifi Managera, kód sme mali pred 2 týždňami). Vyrobte zodpovedajúci json, ktorý obsahuje mac-adresu, napr. najsilenjšieho access pointu. Tento json otočte cez uvedený servis, a získajte tak polohu zariadenia. Keď tu budete testovať, overte si, napr. ručne, že MAC-ADDRESS ...šeho access-pointu je v databáze. Inak nebudete dostávať priaznivú odpoveď, a ...da ani polohu. Keď si takéto APčko najdete, urobte drobné video o funkčnosti vašej appky, aby sme pri hodnotení nemuseli hľadať vhodný Access point. Ak také APčko nevidíte, asi úloha nie je vhodná pre vás.

V projekte musíte zameniť TelephonyManagera za WifiManagera, predefinovať data class zodpovedajúci GSMRequestu na niečo ako WifiRequest, a vygenerovať si vlastný API-key u služby https://eu1.unwiredlabs.com/v2/process.php.

Vytvorenie (malého) JSON objektu

knižnica JsonWriter/JsonReader

```
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

knižnica JsonWriter/JsonReader

```
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 = "";          }
```

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

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

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.`

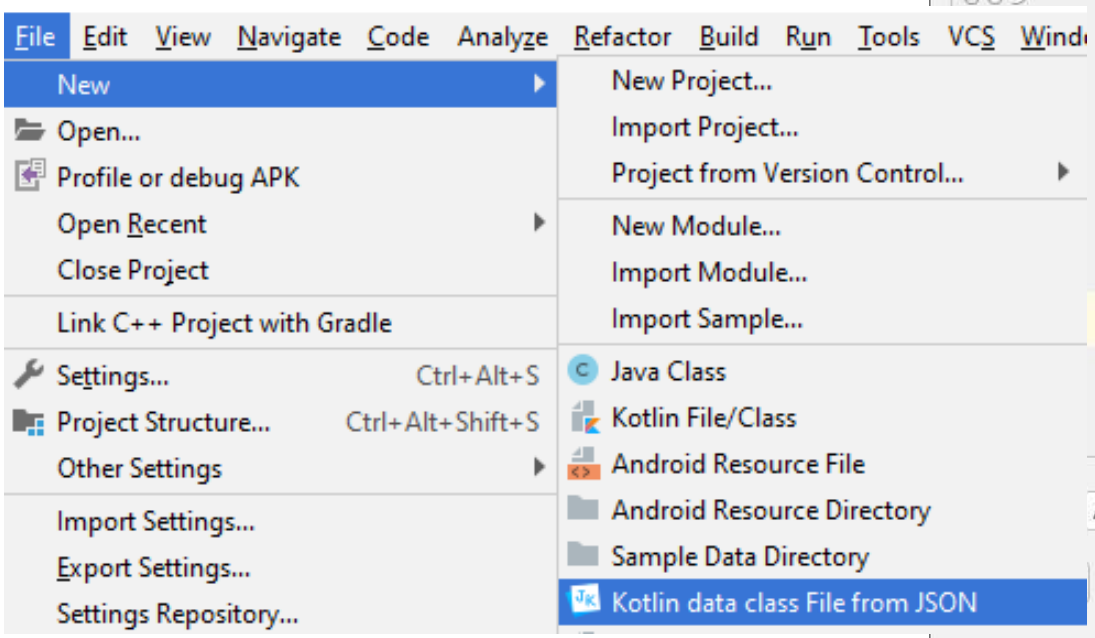
`com.google.gson`

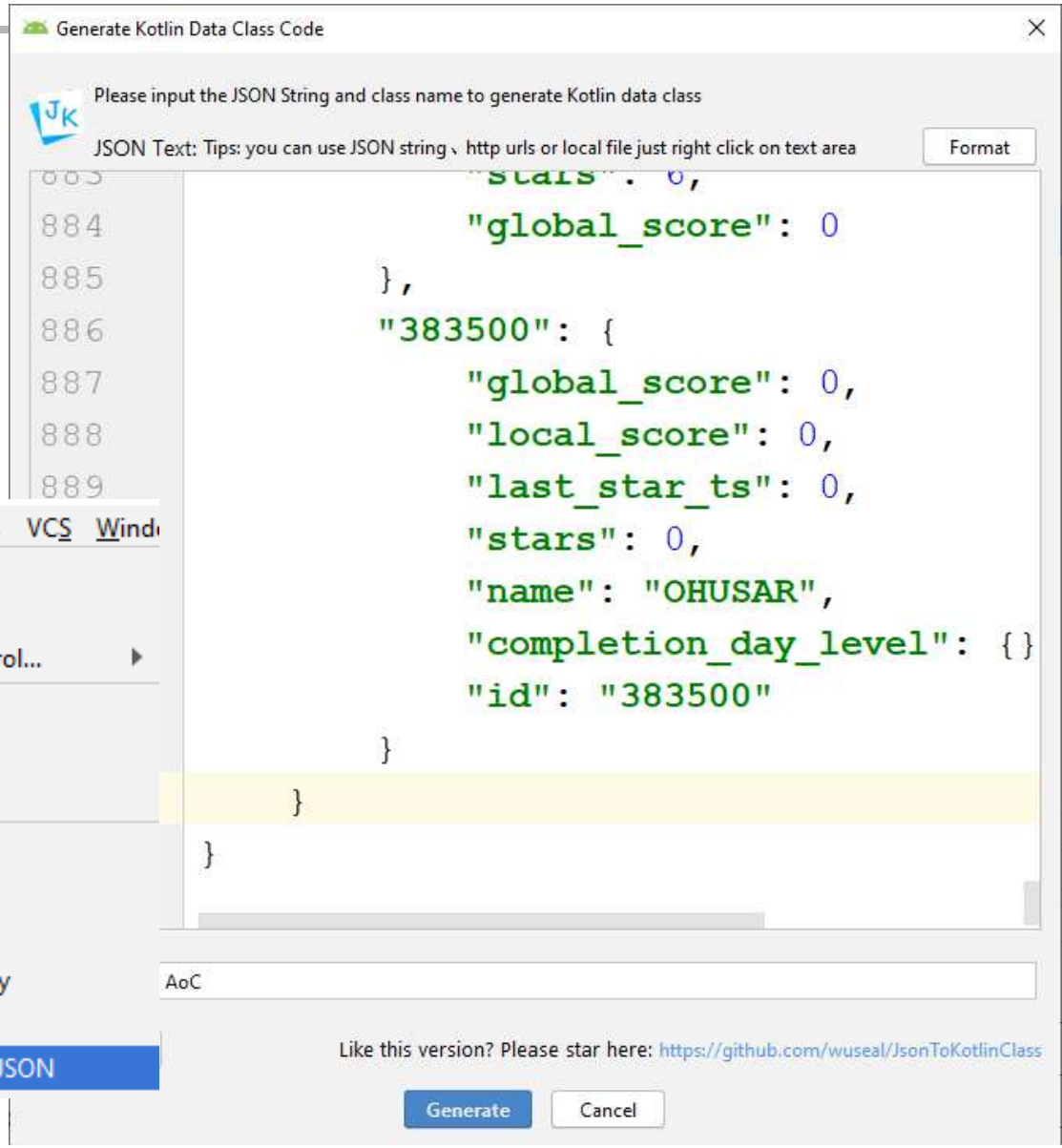
Zdroj: http://www.huffingtonpost.com/2012/06/17/mc-escher-birthday_n_1591432.html

Plugin JSON to Kotlin Class

- z daného JSON vytvorí definíciu Kotlin tried

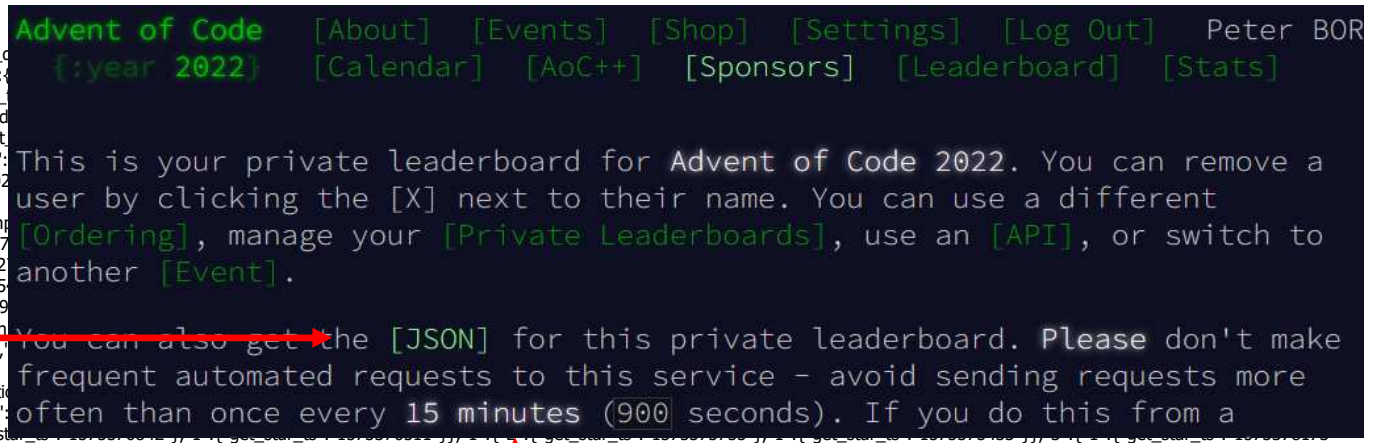
- potom stačí zavolať fromJson prekonvertuje vám json-string do dátovej štruktúry





Kde zohnať zaujímavý json

(JSON je vraj čitateľnejší ako xml)



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":"1575185453"},"1":{"get_star_ts":"1575184775"}},"2":{"2":{"get_star_ts":"15752
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s":"1575265098"}}},"id":"635829","name":"Jozef Kubík","last_star_ts":"1575350619
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al_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_s
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obal_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"},
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al_score":0,"last_star_ts":"1575351770","name":"Peter BOROVANSKY"},"133724":{"stars":4,"local_score":104,"last_star_ts":"1575328931","name":"Alexka
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Knor","stars":0},"253915":{"last_star_ts":"1575311956","name":"Michal
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019"}

Alternatívne domáca úloha

pre AoC pozitívnych

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

Vašou úlohou je v aplikácii prečítať tento JSON a interpterovať.

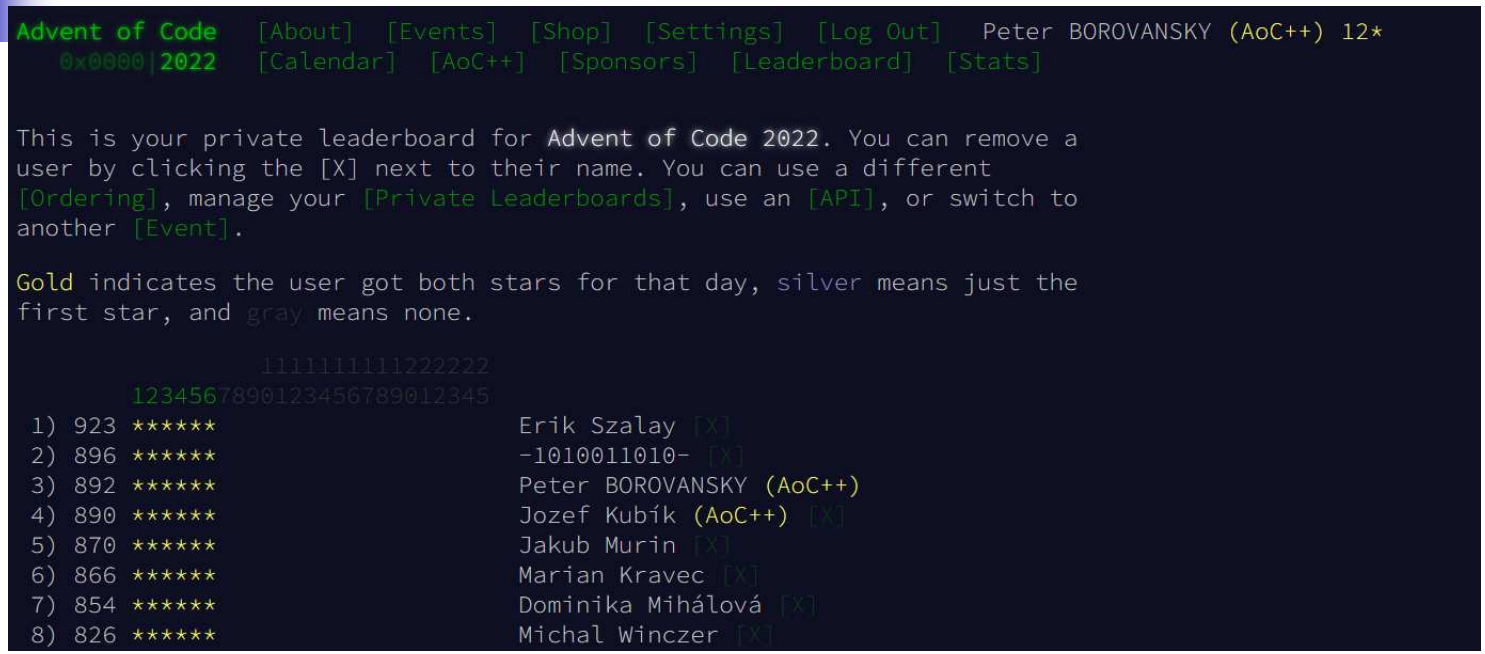
Čo sa chápe pod interpretáciou:
•v master view zobrazíte v jednom riadku ListView mená (ID ak name=null) s počtom hviezd,

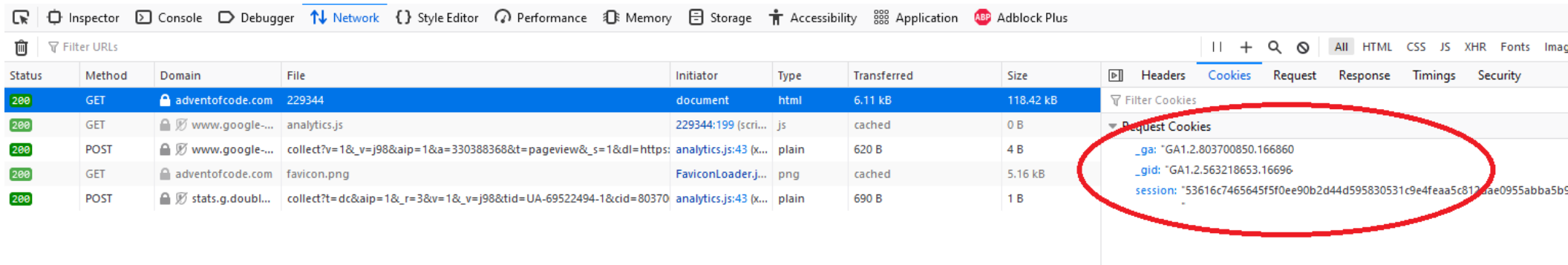
•po klinutí na konkrétny riadok (hráča) sa zobrazí detail view, ktorý obsahuje dni a časy, kedy tento hráč vyriešil ktorú úlohu. JSON obsahuje timestampy vo formate long (napr. 1575234400), tie samozrejme preveďte na čitateľný Date-Time formát. Pre jednoduchosť, dni sú dni adventu 1..25 a úlohy sú v každom dni len 2, teda 1..2.

•kvôli autorizácii musíte pochopiť cookies _gid, _ga – viac na konci prezentácie
•cookies získate po autentifikácii (prihlásení napr. cez google/hithub account)
•Cookies vylovíte v developer tools vašeho obľúbeného browsera
•tie následne použijete v kóde, ktorý dotťahuje json
•rozparsujete json a vymaľujete do aplikácie

AoC cookies

ako poznať, že ich mám





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/

Retrofit Download Image

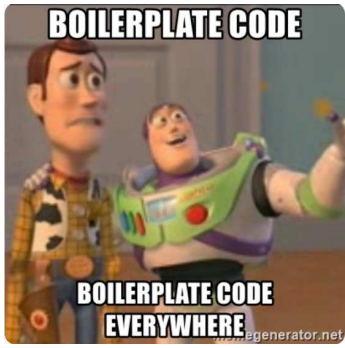

```
interface RetrofitInterface {
    @GET
    fun getImage(@Url url: String): Call<ResponseBody?>
}
```

```
val retrofit = Retrofit.Builder()
                .baseUrl("https://dai.fmph.uniba.sk/courses/VMA/")
                .build()
val retrofitInterface = retrofit.create(
                                        RetrofitInterface::class.java)
val request = retrofitInterface.getImage("ISLAND2.JPG")
try {
    val body: ResponseBody? = request.execute().body()
    downloadImage(body)
} catch (e : IOException) {
    e.printStackTrace()
    Toast.makeText(applicationContext, e.message,
                                        Toast.LENGTH_SHORT).show()
}
```

Project:RetrofitDownloadImage.zip

Retrofit Autentifikácia

Basic Authentification




```
class BasicAuthInterceptor(username:String, password:String): Interceptor {
    private var credentials: String = Credentials.basic(username, password)

    override fun intercept(chain: Interceptor.Chain): okhttp3.Response {
        var request = chain.request()
        request = request.newBuilder()
                         .header("Authorization", credentials).build()
        return chain.proceed(request)
    }
}
```

OkHttpClient je implementácia HTTP & HTTP/2 klienta, umožňuje nám pridávať interceptory, napr. na autentifikáciu

```
val okclient = OkHttpClient.Builder()
    .addInterceptor(BasicAuthInterceptor("java", "vaja"))
    .build()
val retrofit = Retrofit.Builder()
    .baseUrl("http://dai.fmph.uniba.sk/courses/VMA/")
    .client(okclient)
    .build()
val retrofitInterface = retrofit.create(RetrofitInterface::class.java)
val request = retrofitInterface.getImage("ISLAND2.JPG")
```

Project:RetrofitDownloadImage.zip

Retrofit Download Image

Save response body to file

```
private fun downloadImage(body: ResponseBody?) {
    var count = 0
    val data = ByteArray(1024 * 4)
    val fileSize = body?.contentLength()
    val inputStream = BufferedInputStream(body?.byteStream(), 1024 * 8)
    val outputFile = File(Environment
        .getExternalStoragePublicDirectory(Environment.DIRECTORY_DOWNLOADS),
        "downloaded.jpg")
    val outputStream = FileOutputStream(outputFile)
    var total = 0L
    var downloadComplete = false
    while (inputStream.read(data).also({ count = it }) != -1) {
       total += count.toLong()
       val progress = ((total*100).toDouble()/(fileSize?:100).toDouble()).toInt()
       updateNotification(progress)
       outputStream.write(data, 0, count)
       downloadComplete = true
    }
    onDownloadComplete(downloadComplete)
    outputStream.flush()
    outputStream.close()
    inputStream.close()
}
```

```
Android-10
<application
   android:requestLegacyExternalStorage="true"
```

Project:RetrofitDownloadImage.zip

Retrofit Download Image

Load image from downloaded file

```
val file = File(Environment.getExternalStoragePublicDirectory(
                Environment.DIRECTORY_DOWNLOADS)
                .getPath() + File.separator.toString() +
                "downloaded.jpg")
Picasso.get().load(file).into(imgView)


implementation 'com.squareup.picasso:picasso:2.71828'
```

```
Android-10
<application
   android:requestLegacyExternalStorage="true"
```

Project:RetrofitDownloadImage.zip

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=AIzaSyCUU 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:

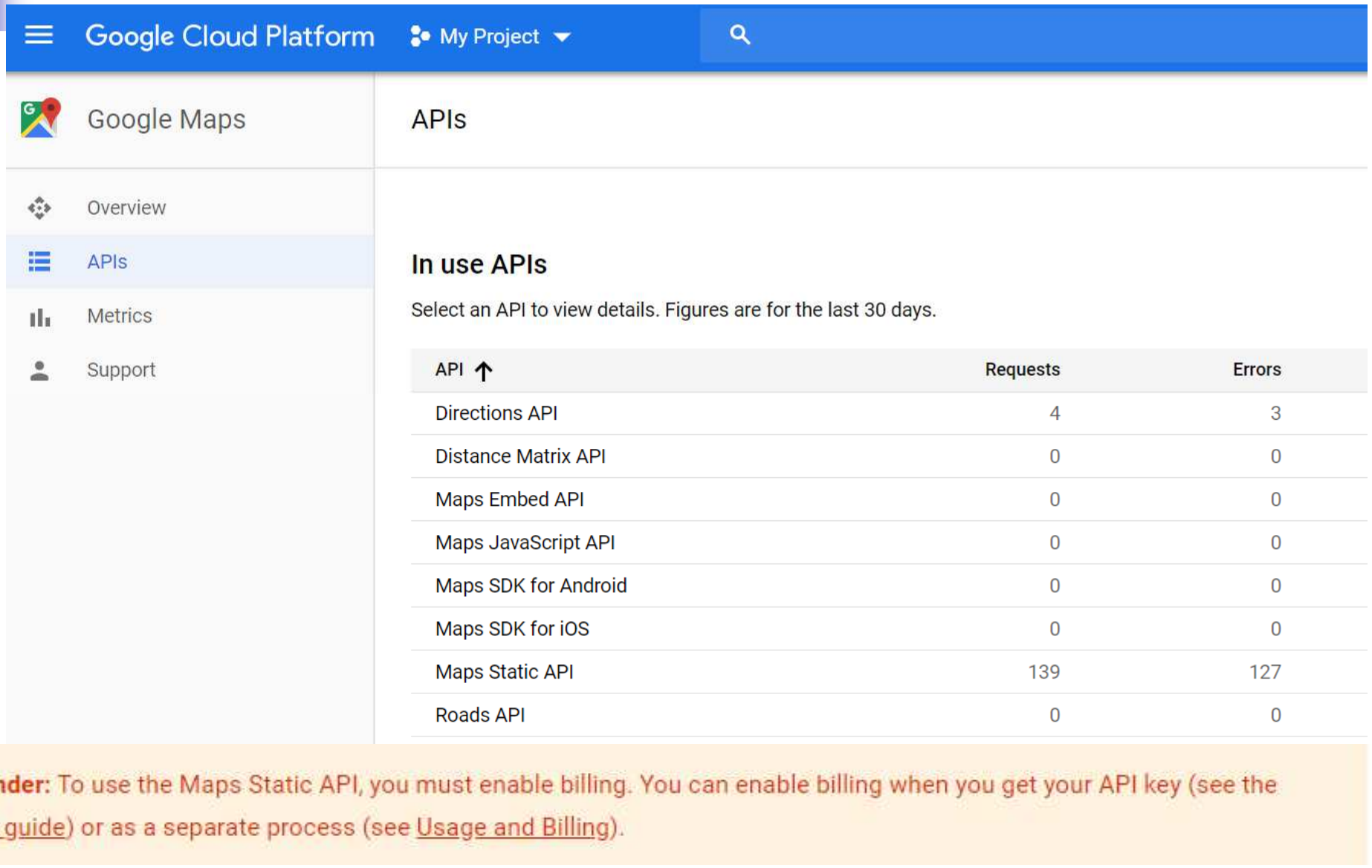
- markers,
- path, …

Alternatíva

http://maps.googleapis.com/maps/api/staticmap?size=230x200&path=weight:3|color:blue|geodesic:true|Brisbane,Australia|Hong%20Kong|Moscow,Russia|London,UK|Reyjavik,Iceland|New%20York,USA|San%20Francisco,USA&key=AIzaSyCUU53EADiCbbSzFreLbD_FzEeYuihYGL8

https://www.journaldev.com/10392/google-static-maps-android#google-static-maps-android-code

Google Cloud 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.

Pricing

Maps Static API
Google

OVERVIEW | PRICING | DOCUMENTATION | SUPPORT

Category: Maps

Service name: static-maps-backend.go

About Google

Google's mission is to organize the world's information and make it universally accessible and useful. Through products and platforms like Search, Maps, Gmail, Android, Google Play, Chrome and YouTube, Google plays a meaningful role in the daily lives of billions of people.

Pricing

Flexible pricing that scale to fit your needs. Plus, get USD200.00 in free usage for Maps, Routes, and Places every month.

	TIER 1	TIER 2
Static Maps	USD2.00 /1K requests	USD1.60 /1K requests

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

Retrofit request s parametrami

```
@GET
fun getStaticMap(@Url url: String,
                 @Query("center")  lstlng : String,
                 @Query("zoom")    zoom : String,
                 @Query("size")    size : String,
                 @Query("markers") markers : String,
                 @Query("key")     key : String): Call<ResponseBody?>
```

```
val retrofit = Retrofit.Builder()
        .baseUrl("https://maps.google.com/")
        ...
val request = retrofitInterface.getStaticMap(
                        "maps/api/staticmap",
                        "48.160020,17.075810",
                        "13",
                        "480x480",
                        "48.160020,17.075810",
                        "AIzaS********************EeYuihYGL8"
                    )
```

https://howtodoinjava.com/retrofit2/query-path-parameters/

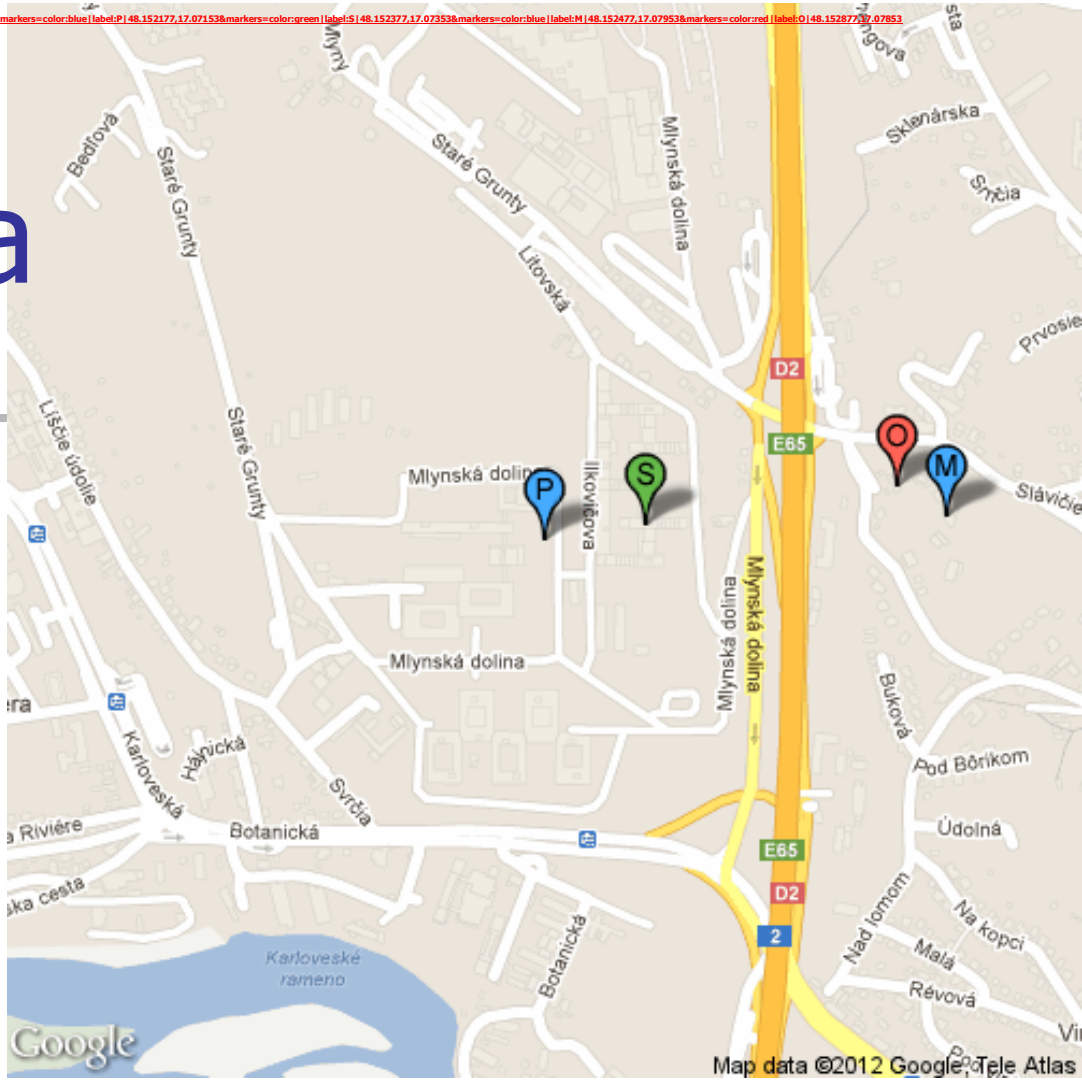
Project:RetrofitDownloadImage.zip

http://maps.googleapis.com/maps/api/staticmap?center=48.152177,17.07153&zoom=15&size=500x500&maptype=mobile&key=AIzaSyC3yLT-5cHoknBR0kR-F7xnuPJzTIakc3E&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
- GMAPs alebo Static GMAPs



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

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.dai.fmph.uniba.sk';
$dbuser = 'androids';
$dbpass = 'HotelDiamantDunakility';
$conn = mysqli_connect($dbhost, $dbuser, $dbpass, $dbuser);
if(! $conn ) {
  die('Could not connect: ' . mysqli_connect_error());
}
$sql = "insert into myfriends (name, time, lati, longi) values
   ('".$_GET['name']."', NOW() ,".$_GET['lat'].",".$_GET['long'].");";
$retval = mysqli_query( $conn, $sql );
if(! $retval ) {
  die('Could not update data: ' . mysqli_error());
}
echo "Insert successfull\n";
mysqli_close($conn);
?>
```

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

Potrebné detaily k DÚ

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

```
<?php
...
$sql = "select * from myfriends where time > now() - INTERVAL 1 DAY;";
$retval = mysqli_query( $conn, $sql );
if(! $retval ) {
  die('Could not select data: ' . mysqli_error());
}
$rows = array();
while($r = mysqli_fetch_assoc($retval)) {
    $rows[] = $r;
}
print json_encode($rows);
mysqli_close($conn);
?>
```

```
[
{"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"}
]
```

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

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),

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

HttpClient – POST

RetrofitServiceObject

```
interface RetrofitInterface {
    @FormUrlEncoded
    @POST("galeria/upload.php")
    suspend fun post(@Query("iname") iname: String,
                     @Field("image") image: String)
}
val okHttpClientInterceptor: OkHttpClient = OkHttpClient.Builder()
    .addInterceptor(BasicAuthInterceptor("java", "vaja"))
    .build()
object RetrofitServiceObject {
    private val BASE_URL = "httpS://dai.fmph.uniba.sk/courses/VMA/"
    fun post(): RetrofitInterface {
        return Retrofit.Builder()
            .baseUrl(BASE_URL)
            .addConverterFactory(GsonConverterFactory.create())
            .client(okHttpClientInterceptor)
            .build()
            .create(RetrofitInterface::class.java)
    }
}
```

Project: RetrofitUpload.zip

HttpClient - POST

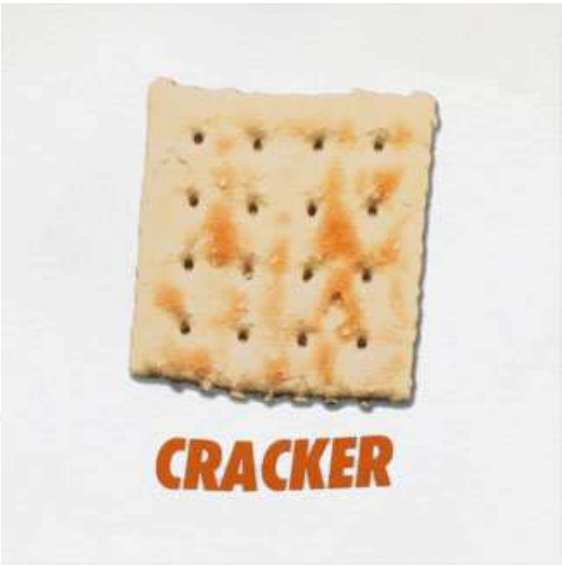
Encode
Decode
Base64

```
val byteArrayOutputStream = ByteArrayOutputStream()
bitmap.compress(Bitmap.CompressFormat.JPEG, 90,
                byteArrayOutputStream)
val encodedPhoto: String = Base64.encodeToString(
                byteArrayOutputStream.toByteArray(),
                Base64.DEFAULT)

val service = RetrofitServiceObject

CoroutineScope(Dispatchers.IO).launch {
    service.post().post(filename, encodedPhoto)
    withContext(Dispatchers.Main) {
         makeToast(...)
    }
}
```

Project: RetrofitUpload.zip

Prémia

(len krátko-trvajúca)



Napíšte malú jednoúčelovú androidovskú aplikáciu,
hoc aj bez GUI,..., ale ktorá z adresára
https://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

Advent of Code

https://adventofcode.com/

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

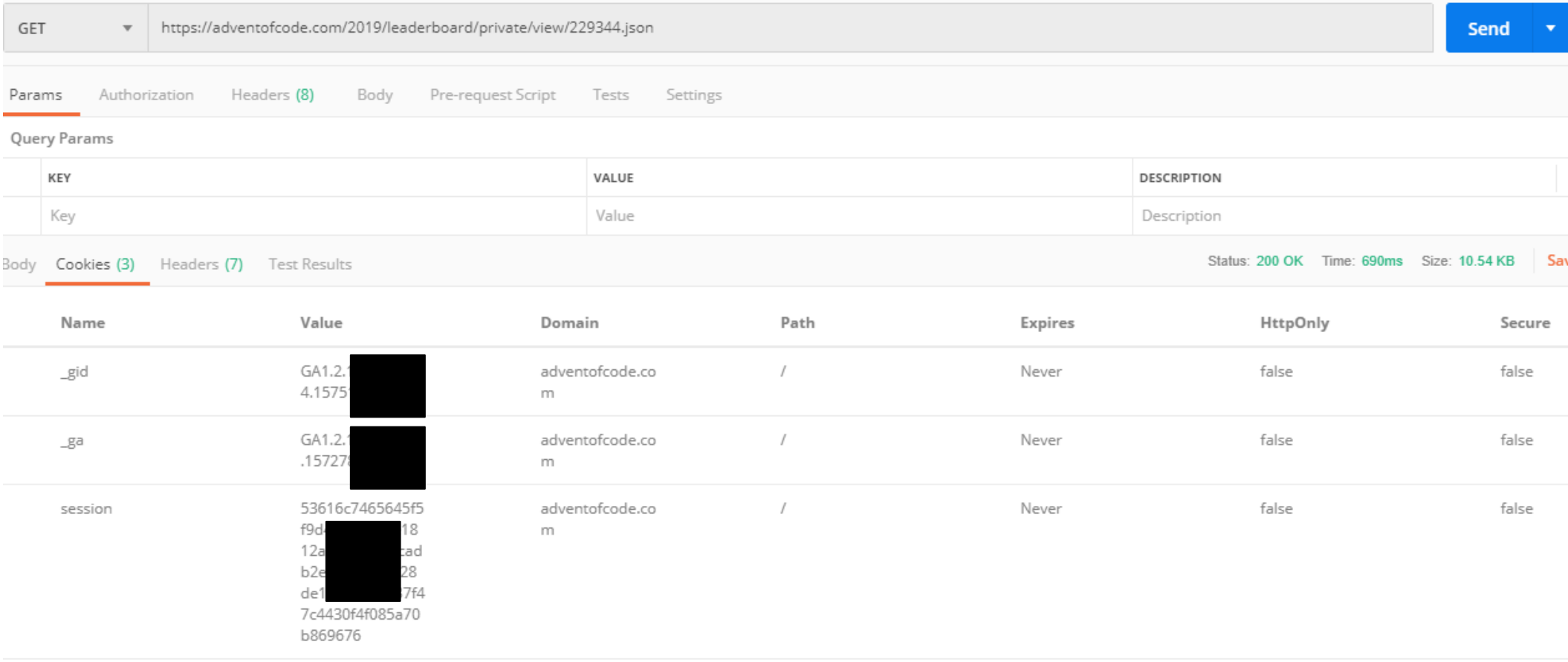
Name	Value	Domain
_gid	GA1.2. 4.1575 [redacted]	adventofcode.com
_ga	GA1.2. .15727 [redacted]	adventofcode.com
session	53616c7465645f5 f9d4157c5dffe18 1 [redacted] ad b 8 d 7f4 7 70 b869676	adventofcode.com


```
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



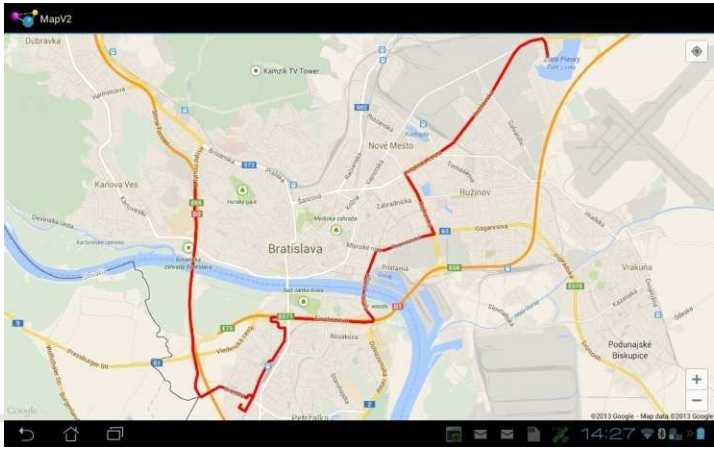
Cookie store

```
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

GoogleDirections

(ako ide matfyzák na pláž)



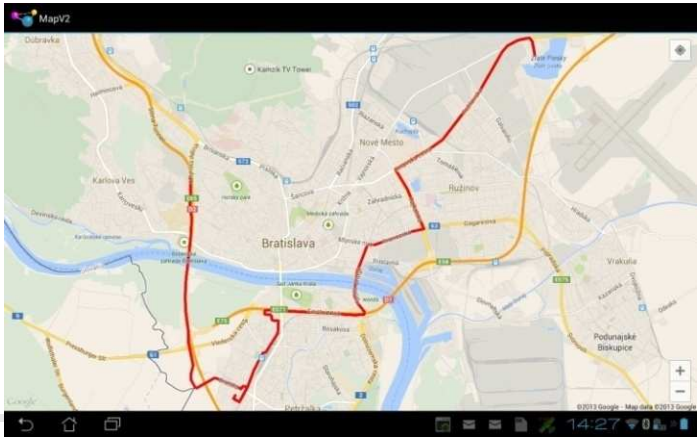
- https://developers.google.com/maps/documentation/directions/

```
val startLocation = "Mlynska dolina, Bratislava"
                                .replace(" ", "+")
val endLocation = "Zlate piesky, Bratislava"
                                .replace(" ", "+")
val via = "AGEM, Kopcianska, Bratislava|
       Alza, Prievozska, Bratislava".replace(" ", "+")
val 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]MM
            \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"
}
```

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

decodePoly Prémia

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