# Mobile app development – week 10

Android components

    Services (cont.)

RESTful interfaces in Android

Android components

    Content Providers

Second mandatory assignment

Exercises

## Course evaluation: THIS WEEK

Jan Leschly, CEO /
Tennis pro (ATP 10)
If you are not counting points,
you are just warming up

## Changes to the schedule

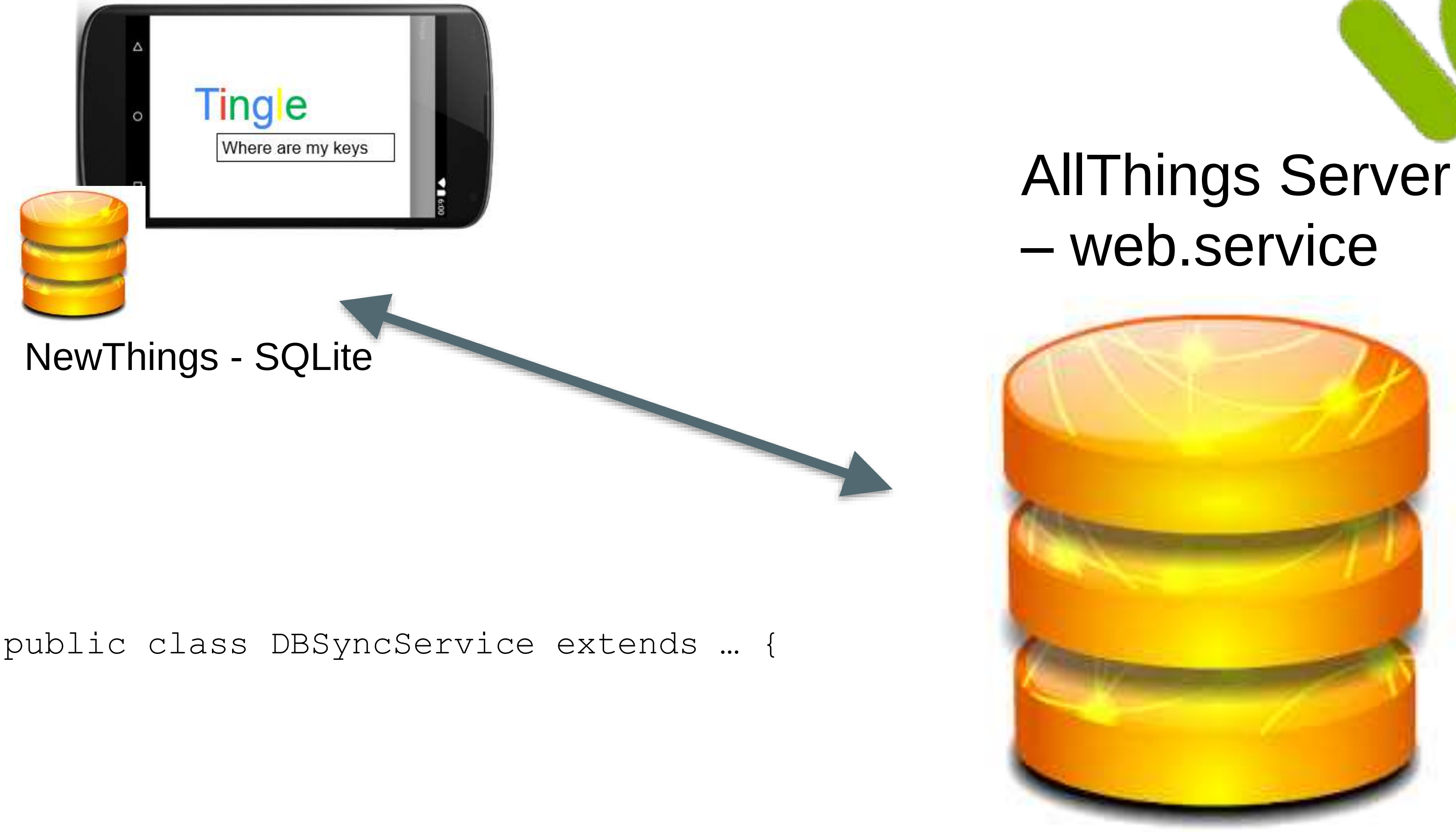
**No lecture** on April 20, but

exercises from 17 - 21

**Extra exercises** from April 13 to 27

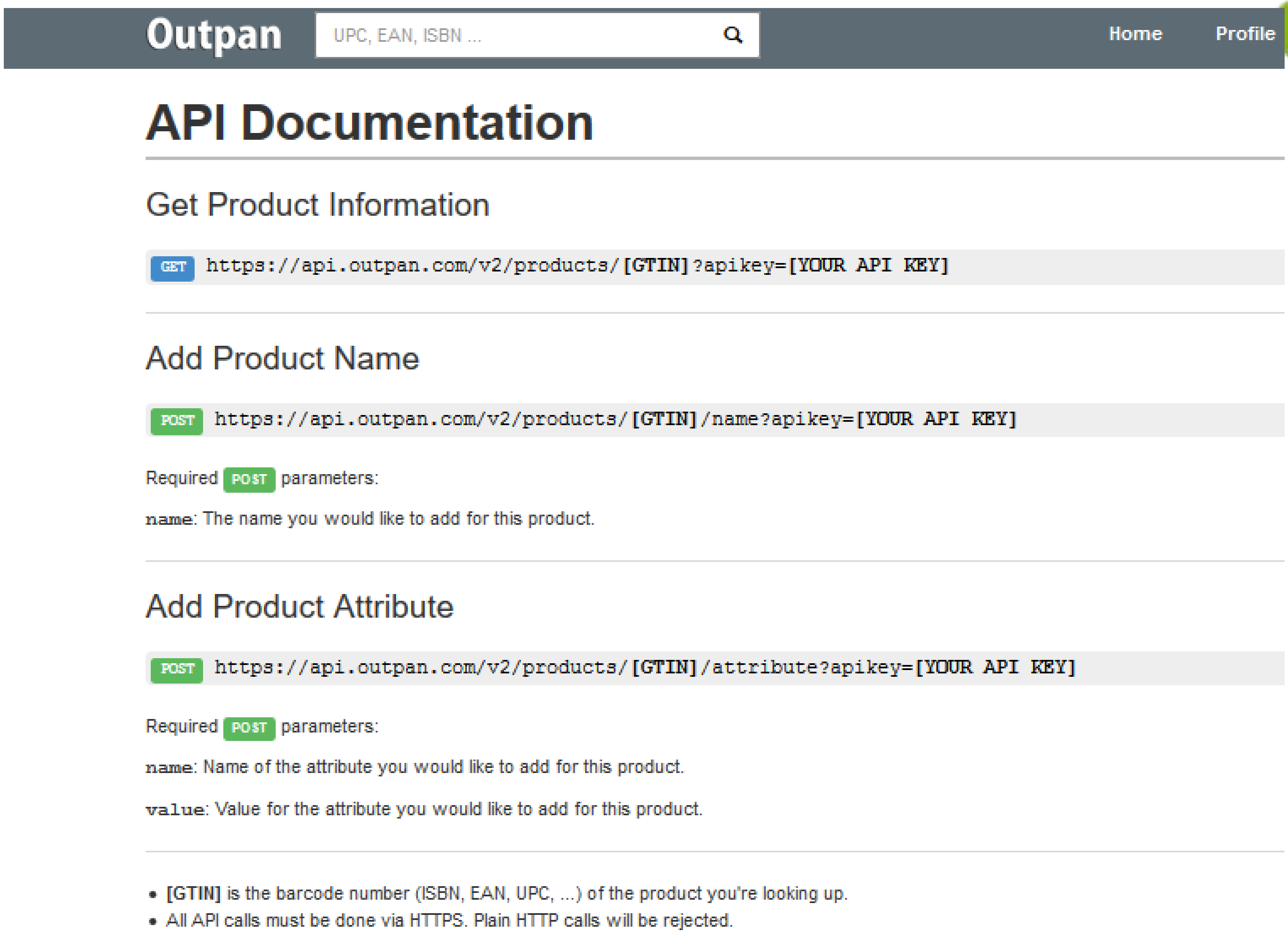
details in worplanW1112

## Synchronization service



```
public class DBSyncService extends … {



  }
```

# Web-service example: Outpan



Outpan | UPC, EAN, ISBN ... | Home | Profile

## API Documentation

### Get Product Information

GET `https://api.outpan.com/v2/products/[GTIN]?apikey=[YOUR API KEY]`

### Add Product Name

POST `https://api.outpan.com/v2/products/[GTIN]/name?apikey=[YOUR API KEY]`

Required POST parameters:

`name`: The name you would like to add for this product.

### Add Product Attribute

POST `https://api.outpan.com/v2/products/[GTIN]/attribute?apikey=[YOUR API KEY]`

Required POST parameters:

`name`: Name of the attribute you would like to add for this product.

`value`: Value for the attribute you would like to add for this product.

- [GTIN] is the barcode number (ISBN, EAN, UPC, ...) of the product you're looking up.
- All API calls must be done via HTTPS. Plain HTTP calls will be rejected.

## Web services

Exploiting HTTP (ment for browsing) for data exchange:

- SOAP-based services

  XML-based, strongly typed
  => tight coupling of server and client

- REST-based (“RESTful”) services

  Text (URL), JSON (XML), not typed, simple to implement widely used

https://www.soapui.org/testing-dojo/world-of-api-testing/soap-vs--rest-challenges.html

http://blog.smartbear.com/apis/understanding-soap-and-rest-basics/#_ga=1.24995194.1380490897.1460355635

# REST using HTTP protocol in Android (GET)

GET requests do not contain a body and should be idempotent. Parameters are sent in the request line e.g.

https://www.outpan.com/view_product.php?barcode=7311310025250

Listing 23.3 Basic networking code (FlickrFetchr.java)

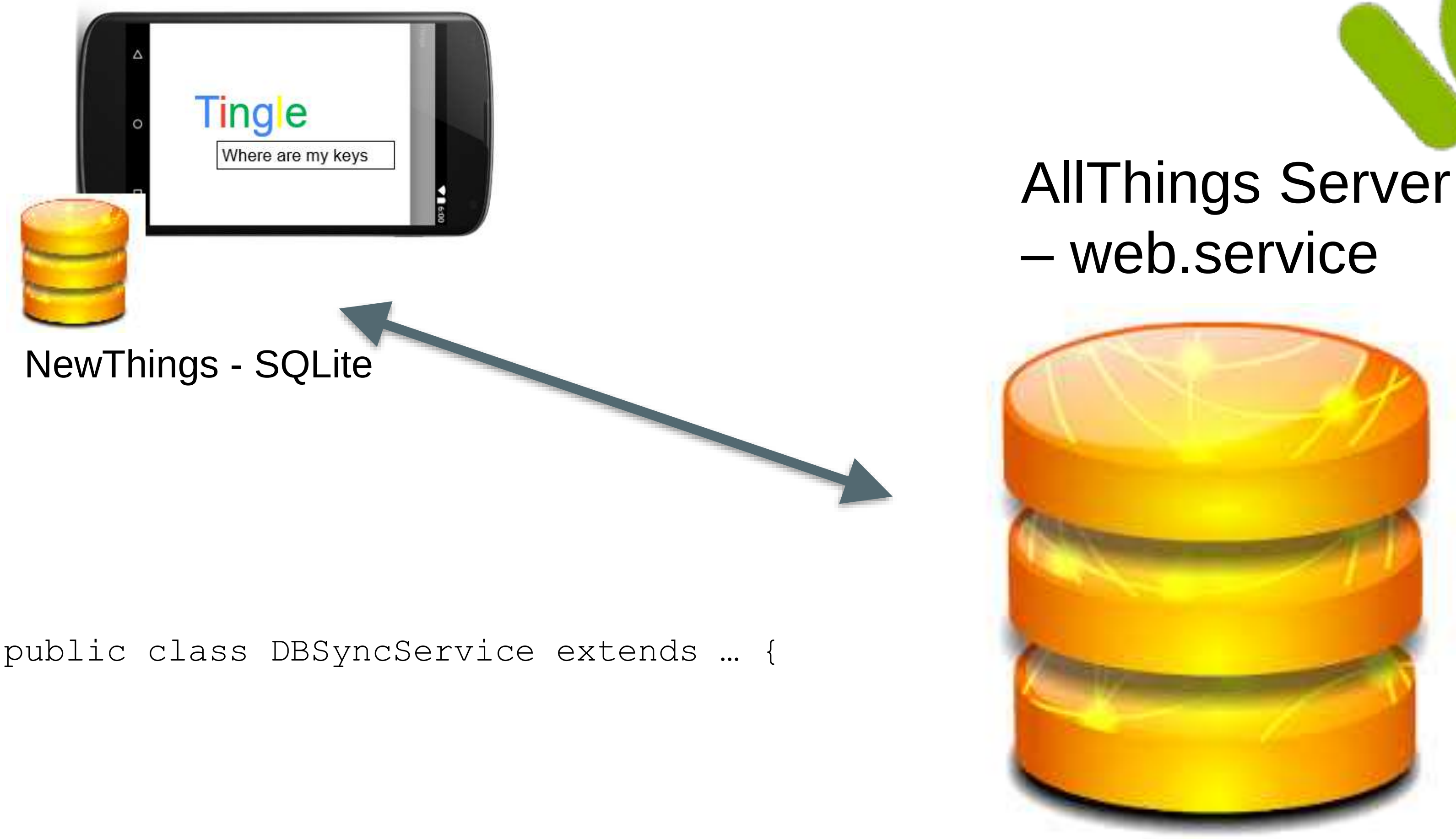
```
public class FlickrFetchr {
  public byte[] getUrlBytes(String urlSpec) throws IOException
   {
  URL url = new URL(urlSpec);
  HttpURLConnection connection =
   (HttpURLConnection)url.openConnection();
  try {
       ByteArrayOutputStream out = new ByteArrayOutputStream();
       InputStream in = connection.getInputStream();
            …
       return out.toByteArray();
  } finally { connection.disconnect(); }
  }    …
}
```

# REST using HTTP protocol in Android (POST)

POST requests may contain data in the body - even large amounts of binary data. Parameters are sent in the body.

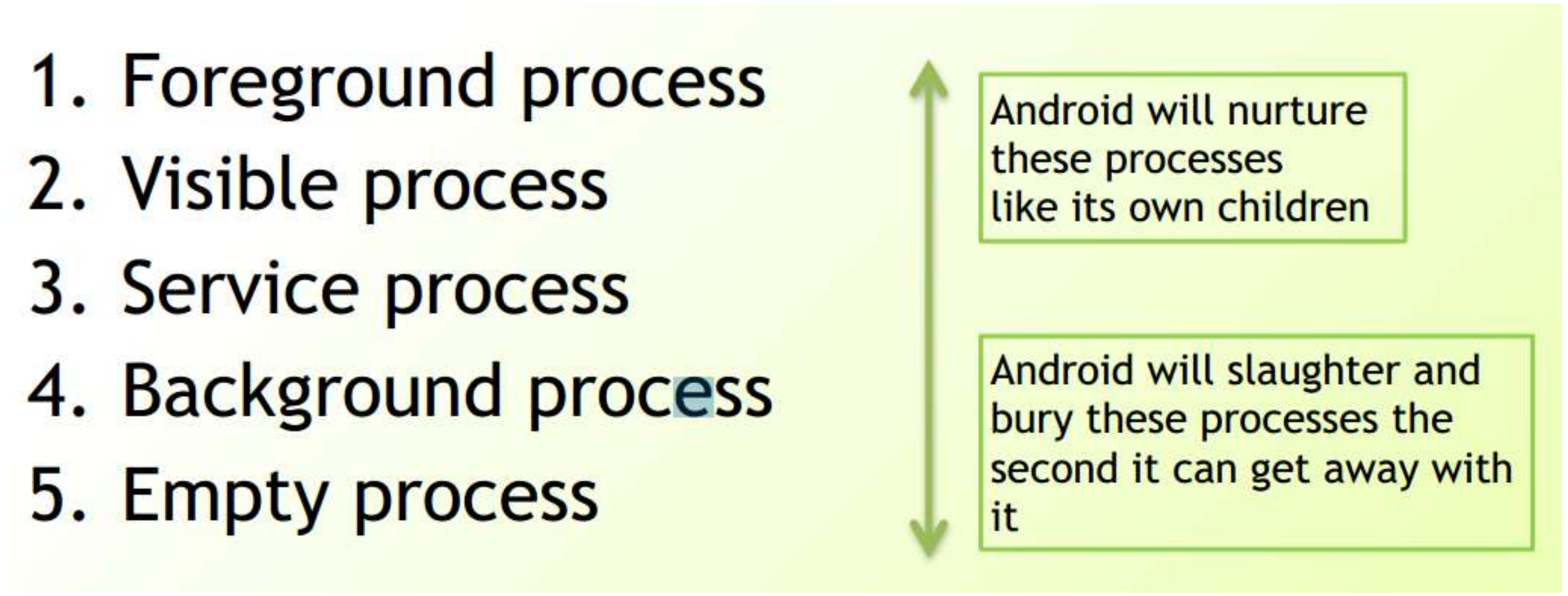
```
URL url = new URL(resource);
URLConnection connection = url.openConnection();

((HttpURLConnection)connection).setRequestMethod("POST");

OutputStream outputStream = connection.getOutputStream();
PrintWriter writer = new PrintWriter(outputStream);
writer.write(queryString);
writer.flush();
writer.close();

InputStream inputStream = connection.getInputStream();
BufferedReader reader = new BufferedReader(
    new InputStreamReader(inputStream));

String result = reader.readLine();
```

# Synchronization service



```
public class DBSyncService extends … {



  }
```

# Process states for an Android app



1. Foreground process
2. Visible process
3. Service process
4. Background process
5. Empty process

↕

Android will nurture these processes like its own children

Android will slaughter and bury these processes the second it can get away with it

## Synchronization service

### Introduce a syncButton

```
syncButton.setOnClickListener(new View.OnClickListener() {
  @Override public void onClick(View view) {
    Intent i= DBSyncService.newIntent(getActivity());
    getActivity.startservice(i);
  }
});
```

```
public class DBSyncService extends IntentService {

      @Override
      public void onHandleIntent(Intent i){
       …
      }
  }
```

# ThingsDB

```
public class ThingsDB {
  private static ThingsDB sThingsDB;

  private Context mContext;
  private SQLiteDatabase mDatabase;

  public static ThingsDB get(Context context) {
    if (sThingsDB == null) sThingsDB= new ThingsDB(context);
    return sThingsDB;
  }

  public void addThing(Thing thing) {
    …
  }
  public void deleteThing(ThingID id) {
    …
  }
  public void Sync() {
    …
  }
….
```

## Things to consider

User pressing Sync button several times

Network failure while syncing

User adding/deleting while syncing

…

# ThingsDB shared synchronized singleton ?

```
public class ThingsDB {
  private static ThingsDB sThingsDB;

  private Context mContext;
  private SQLiteDatabase mDatabase;

  public static synchronized ThingsDB get(Context context) {
    if (sThingsDB == null) sThingsDB= new ThingsDB(context);
    return sThingsDB;
  }

  public void synchronized addThing(Thing thing) {
    …
  }
  public void synchronized deleteThing(ThingID id) {
    …
  }
  public void synchronized Sync() {
    …
  }
…
}
```

# Android components

- Activities
- Services
- Broadcast Receivers
- Content Providers

An Android app consists of one or more components that all run in the same (Linux) process – separated from other processes/apps.

http://developer.android.com/guide/components/fundamentals.html

## Services

- runs in the background,
  often while no activity in the app is active

- roughly an activity without a UI.

- run on the *main* thread, *not* in a worker thread.

```
public class MyService extends Service {
  @Override
  public void onCreate() { … }
    …
  @Override
  public int onStartCommand(Intent intent, int flags, int startId) {
    …
    return …;
  }
 …  more @Override
}
```

## Basic service functionality

- needs to be started by another component `startService // stopService` providing an intent

- a service can also call `stopSelf`

```
 startService(intent);    -------→   onCreate()


                                 -------→  onStartservice(intent)
```

# Implementing a service

A service must be registered in the manifest:

```
<service android:name= ".MyService">
```

`onCreate` and `onDestroy` lifecycle methods (optional)

`onStartCommand`

onStartCommand returns an integer value that dictates what should happen in case the service is killed by Android after the method has returned:

- START_NOT_STICKY: the service is *not* re-created, unless there are pending intents to deliver.
- START_STICKY: the service is re-created, and onStartCommand is called with a null intent (unless there are intents to deliver).
- START_REDELIVER_INTENT: the service is re-created, and onStartCommand is called with the last intent delivered.

## Service example

```
public class InternalService extends Service {


  @Override
  public int onStartCommand(Intent intent, int flags, int startId) {

    Toast.makeText(getBaseContext(), "Running internal service.",
                   Toast.LENGTH_SHORT).show();

    return Service.START_NOT_STICKY;
    }
}
```

More complete example:

http://codetheory.in/understanding-android-started-bound-services/

## BREAK

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If you are not counting points,
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**Remember to do the course evaluation**

## Service binding

Instead of starting and stopping the service manually, components can *bind* to it.

Communication between components and the service is done through a custom interface, making a far richer data exchange with the service possible.

When all components bound to a service have been unbound, the service is destroyed.

Implement the `onBind` method in your service (instead of `onStartCommand`) to return the object your service communicates through.

If you do not want your service to support binding, then just let onBind return null.

## Example of Binding

```
public class MyService extends Service {

    private IBinder myBinder = new MyBinder();
    public MyService() {      }
    @Override
    public void onCreate() { …    }

    @Override
    public IBinder onBind(Intent intent) { return myBinder; }
    @Override
    public boolean onUnbind(Intent intent) {return false;    }

    public class MyBinder extends Binder {
        MyService getService() { return MyService.this; }
    }
    // Methods used by the binding client components

    public void methodOne() { // Some code...   }

    public void methodTwo() { // Some code...   }

}
```

http://codetheory.in/understanding-android-started-bound-services/

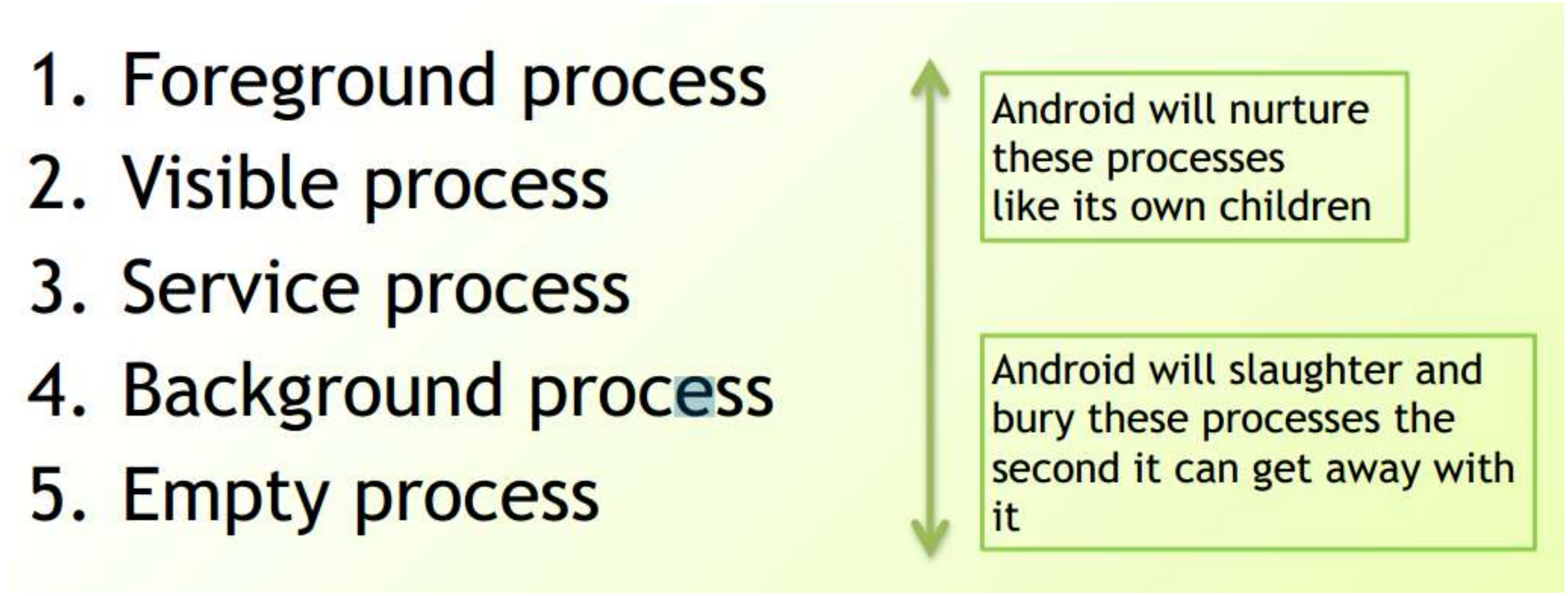
## Intent service (reminder)

To use an intent service, extend the *IntentService* class instead of the Service class, and implement the *onHandleIntent* method instead of *onStartCommand*.

Provides an easy way of creating a service that:

- Creates a worker thread
- Provides a queue that executes intents sent to it on the worker thread one at a time
- Shuts down the service when the last intent has been processed

# Process states for an Android app



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Android will nurture these processes like its own children

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## Foreground services

A service can forced into "foreground" state

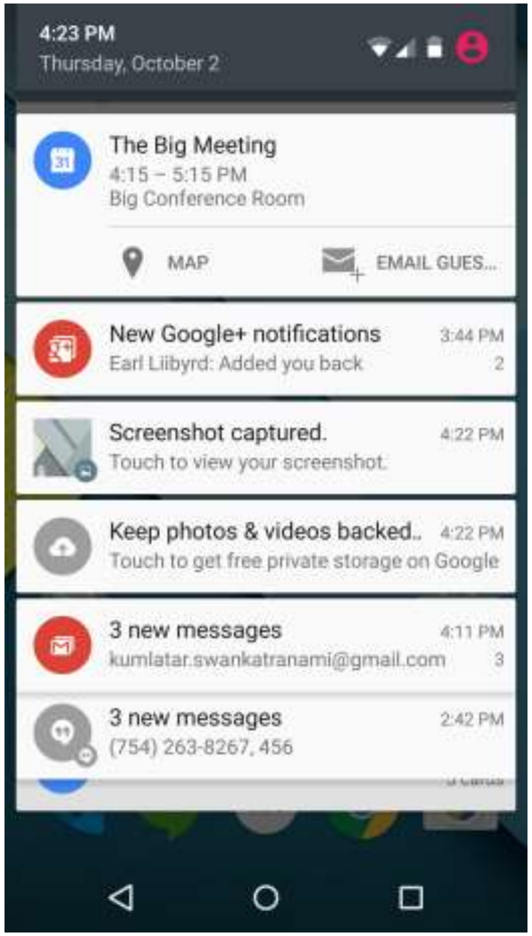
This means that the service has a higher priority and is less likely to be shut down

This *requires* that the service shows a notification so the user is aware of the foreground service

Use the methods *startForeground* and *stopForeground* in the service to toggle foreground status

# Notifications (1)

”persistent toast”



4:23 PM
Thursday, October 2

The Big Meeting
4:15 – 5:15 PM
Big Conference Room

New Google+ notifications 3:44 PM
Earl Liibyrd: Added you back 2

Screenshot captured. 4:22 PM
Touch to view your screenshot.

Keep photos & videos backed.. 4:22 PM
Touch to get free private storage on Google

3 new messages 4:11 PM
kumlatar.swankatranami@gmail.com 3

3 new messages 2:42 PM
(754) 263-8267, 456

## Notifications (1)

From listing 26.17 (textbook)

```
Notification notification = new NotificationCompat.Builder(this)
    .setTicker(resources.getString(R.string.new_pictures_title))
    .setSmallIcon(android.R.drawable.ic_menu_report_image)
    .setContentTitle(resources.getString(R.string.new_pictures_title))
    .setContentText(resources.getString(R.string.new_pictures_text))
    .setContentIntent(pi)
    .setAutoCancel(true)
    .build();

NotificationManagerCompat notificationManager =
                               NotificationManagerCompat.from(this);
notificationManager.notify(0, notification);
```

# Notifications (1)

From listing 26.17 (textbook)

```
Notification notification = new NotificationCompat.Builder(this)
    .setTicker(resources.getString(R.string.new_pictures_title))
    .setSmallIcon(android.R.drawable.ic_menu_report_image)
    .setContentTitle(resources.getString(R.string.new_pictures_title))
    .setContentText(resources.getString(R.string.new_pictures_text))
    .setContentIntent(pi)
    .setAutoCancel(true)
    .build();

NotificationManagerCompat notificationManager =
                               NotificationManagerCompat.from(this);
notificationManager.notify(0, notification);
```

## Pending intents

```
PendingIntent pendingIntent;
```

- used to fire an intent after the app is gone - which, for instance, is the case with notifications.

- wrapper around a “normal” intent. It:

- is tied to the context that created it and
- has permission to execute the contained intent as if the original app did it, even if the app has been killed by the Android system.

# Alarm manager

A system service that can be set up to fire a pending intent (and thus reach an Android component) at a given time or interval.

```
public final static int FIVE_SECONDS = 5 * 1000;
private AlarmManager alarmManager;
private PendingIntent pendingIntent;

@Override
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);

    alarmManager = (AlarmManager) getSystemService(ALARM_SERVICE);

    Intent intent = new Intent(this, AlarmReceiver.class);
    pendingIntent = PendingIntent.getBroadcast(this, 0, intent, 0);

    alarmManager.set(AlarmManager.RTC_WAKEUP, System.currentTimeMillis() +
        FIVE_SECONDS, pendingIntent);
}
```

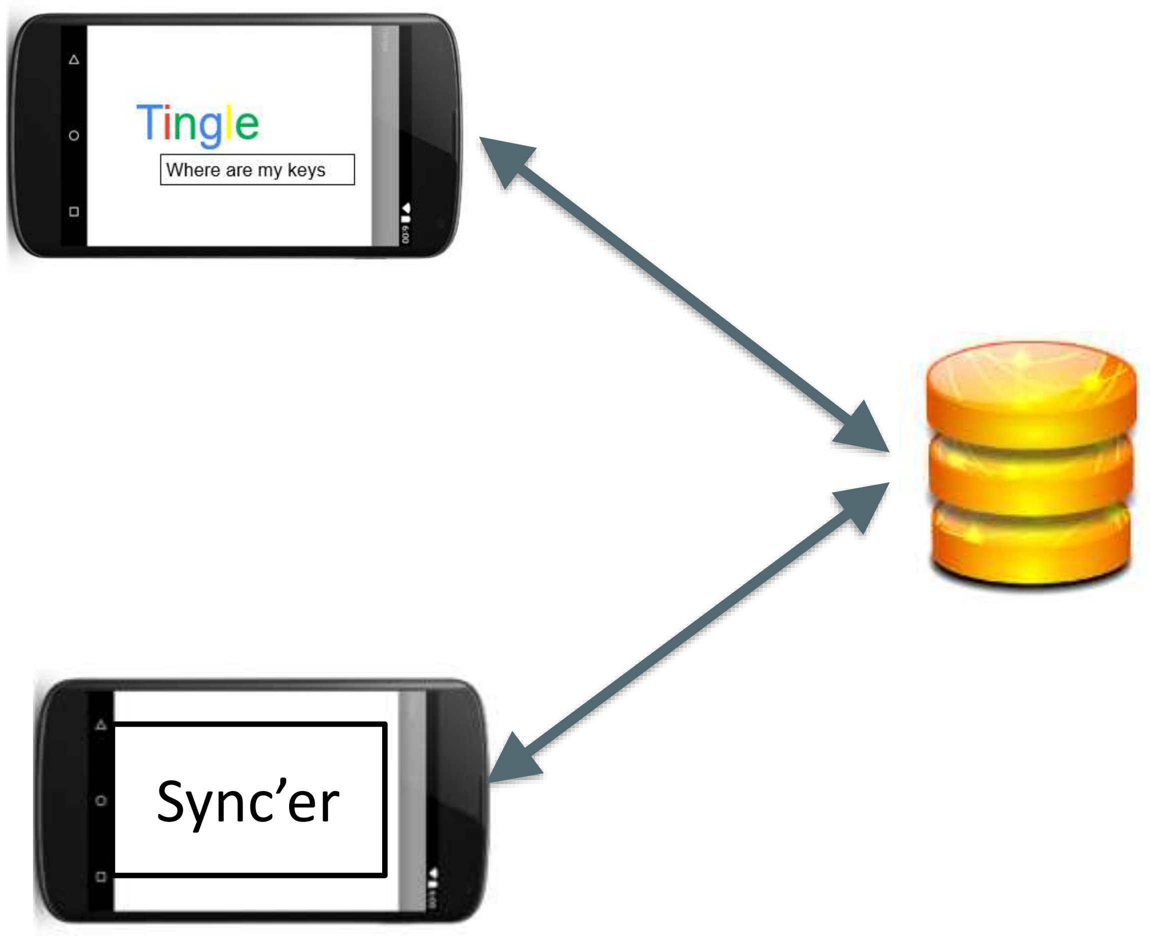
# Android components

- **Activities**
- **Services**
- **Broadcast Receivers**
- **Content Providers**

An Android app consists of one or more components that all run in the same (Linux) process – separated from other processes/apps.

[http://developer.android.com/guide/components/fundamentals.html](http://developer.android.com/guide/components/fundamentals.html)

# Synchronization in a separate app



# Content Providers

allows an app to expose information to other apps

uses concepts/syntax similar to a SQLite database

```
public class ThingProvider extends ContentProvider {

 @Override
 public boolean onCreate() { … }

 @Override
 public Cursor query(…)  { … }

 insert() update() delete()  getType()
}
```

```
<uses-permission android:name="android.permission.READ_USER_DICTIONARY">
```

http://developer.android.com/guide/topics/providers/content-providers.html

## Using a content provider

Know the URI of the provider, e.g.

```
content://com.android.contacts/contacts/lookup
content://user_dictionary/words
content://dk.staunstrups.tingle/database
```

Request permission for using the provider, e.g

```
<uses-permission android:name= "android.permission.READ_USER_DICTIONARY">
```

Query the content resolver

# Content provider example

```
public class MainActivity extends ListActivity {

@Override
protected void onCreate(Bundle savedInstanceState) {
  super.onCreate(savedInstanceState);


  Cursor cursor= getContentResolver().query(Settings.System.CONTENT_URI,
                null, null, null, Settings.System.NAME);


   String[] from = {Settings.System.NAME, Settings.System.VALUE};

   int[] to = {android.R.id.text1, android.R.id.text2};
   SimpleCursorAdapter cursorAdapter= new SimpleCursorAdapter(this,
                  android.R.layout.simple_list_item_2, cursor, from, to, 0
   setListAdapter(cursorAdapter);
 }
}
```

## Second Mandatory Assignment

Any questions?