



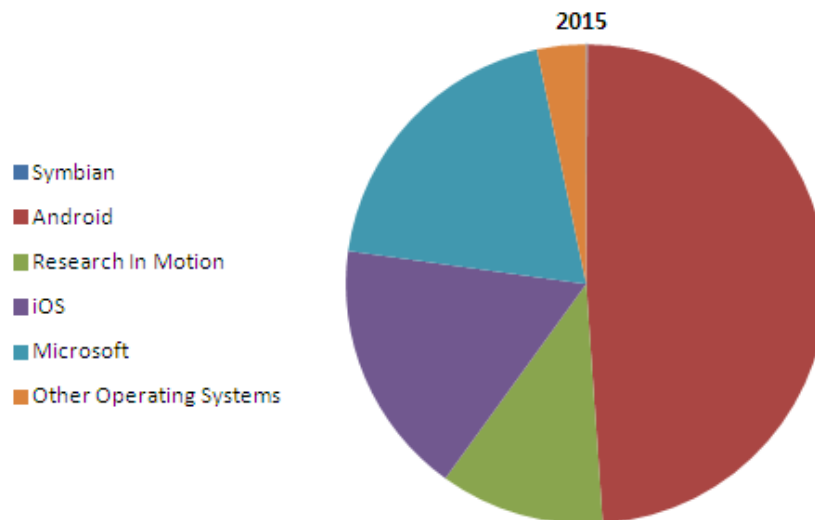
ANDROID

ellipsis
integration services and more ...

▶ www.ellipsis.co.il

Smartphone market share

Gartner predicts that Apple's iOS will remain the second biggest platform worldwide through 2014 despite its share decreasing slightly after 2011. Android will become the most popular OS in 2011 and account for 49% of the market by 2015. Microsoft will claim third place in 2013, behind Android and Apple.



Smartphone market share (cont.)

OS	2010	2011	2012	2015
Symbian	37.60%	19.20%	5.20%	0.10%
Android	22.70%	38.50%	49.20%	48.80%
Research In Motion	16%	13.40%	12.60%	11.10%
iOS	15.70%	19.40%	18.90%	17.20%
Microsoft	4.20%	5.60%	10.80%	19.50%
Other Operating Systems	3.80%	3.90%	3.40%	3.30%
Total Market (Thousands of Units)	296,647	467,701	630,476	1,104,898

Source: Gartner (April 2011)

Android Market Growth



GROWTH

Most popular time to download

SUN

9:00

PM

Least popular time to download

MON

4:00

AM

People from 190 countries download apps every day

10 BILLION

downloads... and counting!
December

6 BILLION

July

4.5 BILLION

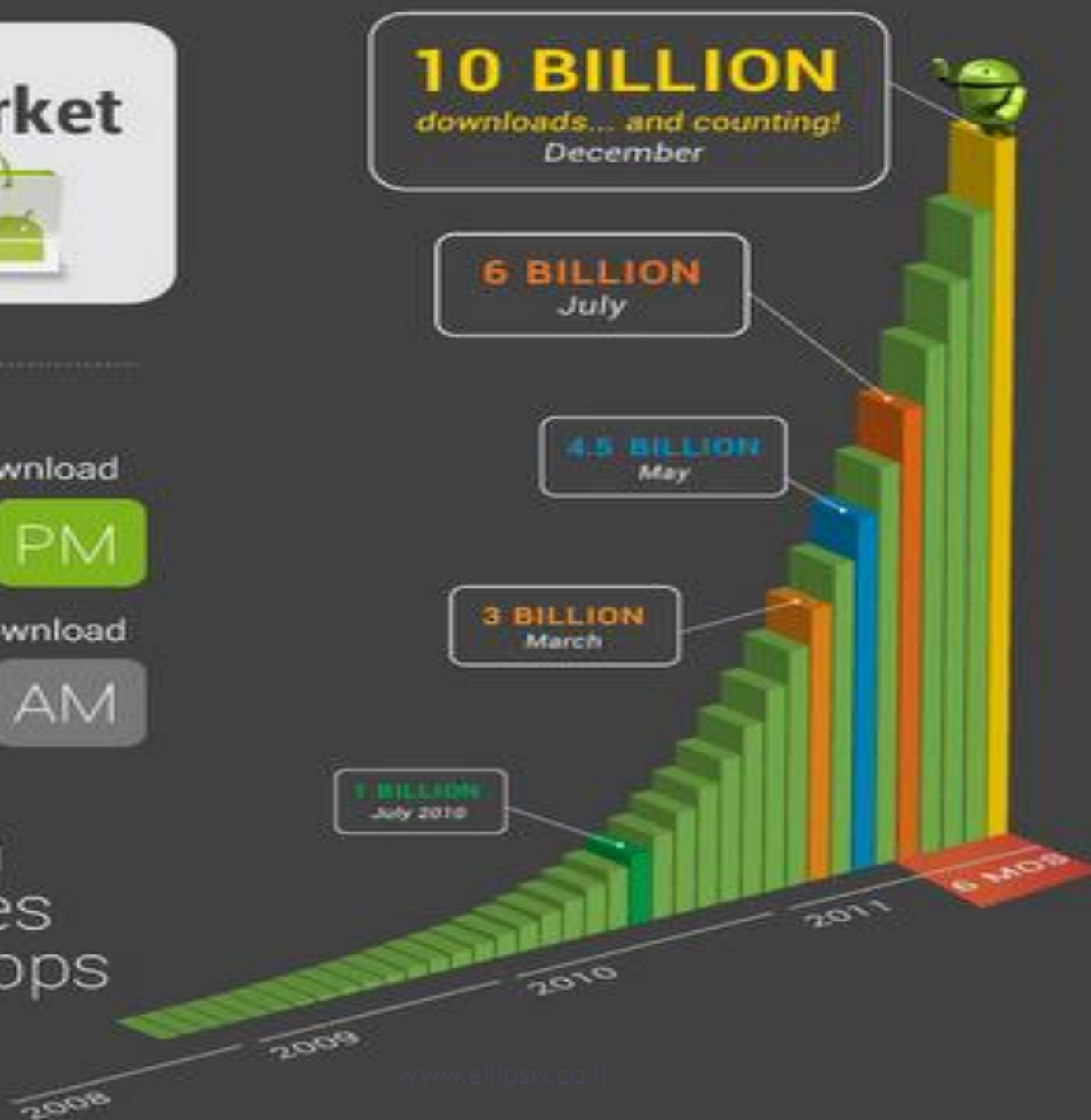
May

3 BILLION

March

1 BILLION

July 2010



Top 10 Most App-crazed Countries

(Downloads Per Capita)



1. South Korea



2. Hong Kong



3. Taiwan



4. United States



5. Singapore



6. Sweden



7. Israel



8. Denmark



9. Netherlands



10. Norway

Top 10 Categories

GAMES

- 39.25% Arcade
- 22.08% Brain
- 17.68% Casual
- 7.31% Cards
- 7.27% Racing
- 6.41% Sports Games



ENTERTAINMENT

TOOLS

COMMUNICATION

PRODUCTIVITY

PERSONALIZATION

MUSIC & AUDIO

SOCIAL

MEDIA & VIDEO

TRAVEL & LOCAL



Arcade & Action

Angry Birds

"RovioMobileLtd."

Free
50,000,000 - 100,000,000

4.58



Tools

Google Search

"GoogleInc."

Free
50,000,000 - 100,000,000

4.55



Tools

Adobe Flash Player 11

"AdobeSystems"

Free
50,000,000 - 100,000,000

4.37



Communication

Gmail

"GoogleInc."

Free
50,000,000 - 100,000,000

4.47



Arcade & Action

Robo Defense

"LupisLabsSoftware"

US\$2.99

500,000 - 1,000,000

4.80



Music & Audio

PowerAMP Full Version Unlocker

"MaxMP(MSRLimited)"

US\$4.99

500,000 - 1,000,000

4.76



Brain & Puzzle

Cut the Rope

ZeptoLab

US\$0.99

500,000 - 1,000,000

4.65



Arcade & Action

Doodle Jump

GameHouse

US\$0.99

500,000 - 1,000,000

4.38



Arcade & Action

Fruit Ninja

"HalfbrickStudios"

US\$1.26

500,000 - 1,000,000

4.43

Android OS

- ▶ Android is an operating system for mobile devices such as smartphones and tablet computers. It is developed by the Open Handset Alliance led by Google.
- ▶ The Open Handset Alliance is a group of 84 technology and mobile companies who have come together to develop open standards for mobile devices.
- ▶ Google purchased the initial developer of the software, Android Inc., on August 17, 2005.

Android Hardware

- ▶ The main hardware platform for Android is the ARM architecture (Acorn RISC Machine).

There is support for x86 from the Android-x86 project, and Google TV uses a special x86 version of Android.

- ▶ The first commercially available phone to run Android was the HTC Dream, released on 22 October 2008.

In early 2010 Google collaborated with HTC to launch its flagship Android device, the Nexus One.

Android Apps

- ▶ As of October 2011 there were more than 300,000 apps available for Android, and the estimated number of applications downloaded from the Android Market as of December 2011 exceeded 10 billion.
- ▶ Apps can be downloaded from third-party sites or through online stores such as Android Market.
- ▶ Google has announced that in Q3 2011, the total number of Android activations had surpassed 190 million.

The increase was boosted by sales of lower Android smart phone prices from Chinese and Indian manufacturers.

Linux & Dalvik Virtual Machine

- ▶ Android consists of a kernel based on the Linux kernel, with middleware, libraries and APIs written in C.
- ▶ The compiled Java code transformed into Dalvik Executable (.dex) format, a format that is optimized for efficient storage and memory-mappable execution.
- ▶ Dalvik was originally written by Dan Bornstein, who named it after the fishing village of Dalvík in Iceland, where some of his ancestors lived.

System Architecture



Platform Versions

Platform	Codename	API Level	Distribution
Android 1.5	Cupcake	3	0.8%
Android 1.6	Donut	4	1.3%
Android 2.1	Eclair	7	9.6%
Android 2.2	Froyo	8	35.3%
Android 2.3	Gingerbread	9	0.5%
Android 2.3.2			
Android 2.3.3		10	50.1%
Android 2.3.7			
Android 3.0	Honeycomb	11	0.1%
Android 3.1		12	1.1%
Android 3.2		13	1.2%
Android 4.0	Ice Cream Sandwich	14	0%
Android 4.0.3		15	0%

Security Model

- ▶ The Android operating system is a multi-user Linux system in which each application is a different user.
- ▶ Each process has its own Dalvik VM, so an application's code runs in isolation from other applications.
- ▶ By default, android prevents apps from reading and writing the user's private data such as contacts or emails, performing network access, and so on...
- ▶ Apps that need to access the network or perform other sensitive operations must first obtain permission to do so. Permissions required by an app are declared in the app's manifest file.

Security Model (cont.)

Manifest File

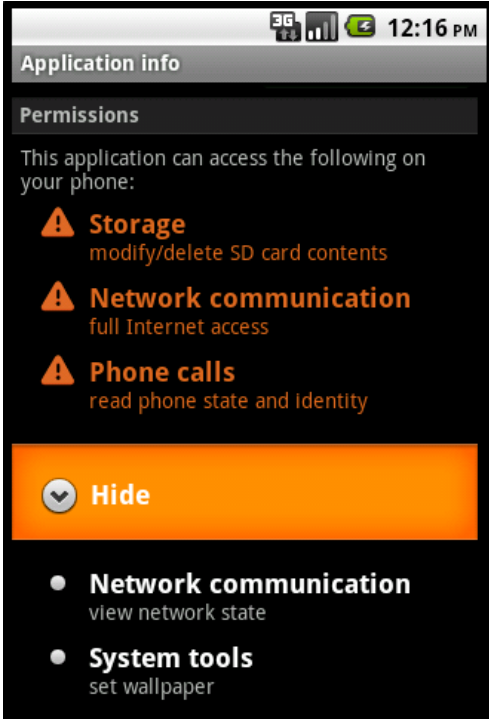
```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.android.demo.notepad"
    android:versionCode="1"
    android:versionName="1.0" >

    <uses-sdk android:minSdkVersion="15" />

    <uses-permission android:name="android.permission.INTERNET" />

    <application android:icon="@drawable/ic_launcher" android:label="@string/app_name" >
        <activity android:name=".Notepad" android:label="@string/app_name" >
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
        <activity android:name=".NoteEdit" />
    </application>

</manifest>
```



The screenshot shows the 'Application info' screen for an application. At the top, there are status bar icons for 3G, signal strength, battery, and the time 12:16 PM. The screen is divided into sections: 'Application info', 'Permissions', and a 'Hide' button. Under 'Permissions', it lists three permissions with warning icons: 'Storage' (modify/delete SD card contents), 'Network communication' (full Internet access), and 'Phone calls' (read phone state and Identity). Below the 'Hide' button, there are two more permissions listed with circular icons: 'Network communication' (view network state) and 'System tools' (set wallpaper).

Application Architecture

- ▶ Application architecture is based upon components that communicate with each other by using intents that are described by a manifest and that are stored in an application package.
- ▶ Android application consists of one or more activities, services, content providers, and broadcast receivers.

Application Architecture (cont.)

- ▶ **Intents** are messages that describe operations to perform.
- ▶ An **activity** is a component that presents a user interface.
- ▶ A **service** is a component that runs in the background to perform long-running operations or to perform work for remote processes.
- ▶ A **content provider** is a component that makes a specific set of an app's data available to other apps.
- ▶ A **broadcast receiver** is a component that responds to system-wide broadcast announcements.

Application Architecture (cont.)

- ▶ The **manifest file** is an XML file that each application must define, to describe the application's package name, version, and components .
- ▶ Each Android application is compiled and packaged in a single file that includes all of the application's code (.dex files), resources, assets, and manifest file.

The **application package** file can have any name but *must* use the .apk extension.

String Resources

- ▶ XML file saved at `res/values/strings.xml`:

```
<?xml version="1.0" encoding="utf-8"?>
<resources>
    <string name="hello">Hello!</string>
</resources>
```

- ▶ This layout XML applies a string to a View:

```
<TextView android:layout_width="fill_parent"
          android:layout_height="wrap_content" android:text="@string/hello" />
```

- ▶ This application code retrieves a string:

```
String string = getString(R.string.hello);
```

Android Localization Service:

<http://crowdin.net/page/android-localization>

Publishing on Android Market

- ▶ Your application must be signed with a cryptographic private key whose validity period ends after 22 October 2033.
- ▶ Your application must define both an `android:versionCode` and an `android:versionName` attribute in the `<manifest>` element of its manifest file.
- ▶ Your application must define both an `android:icon` and an `android:label` attribute in the `<application>` element of its manifest file.

Software Development Tools & Demo

- ▶ Android SDK

<http://developer.android.com/sdk/index.html>

<http://developer.android.com/sdk/installing.html>

- ▶ Eclipse IDE - "Eclipse Classic"

<http://www.eclipse.org/downloads/>

- ▶ ADT Plugin for Eclipse

<http://developer.android.com/sdk/eclipse-adt.html>

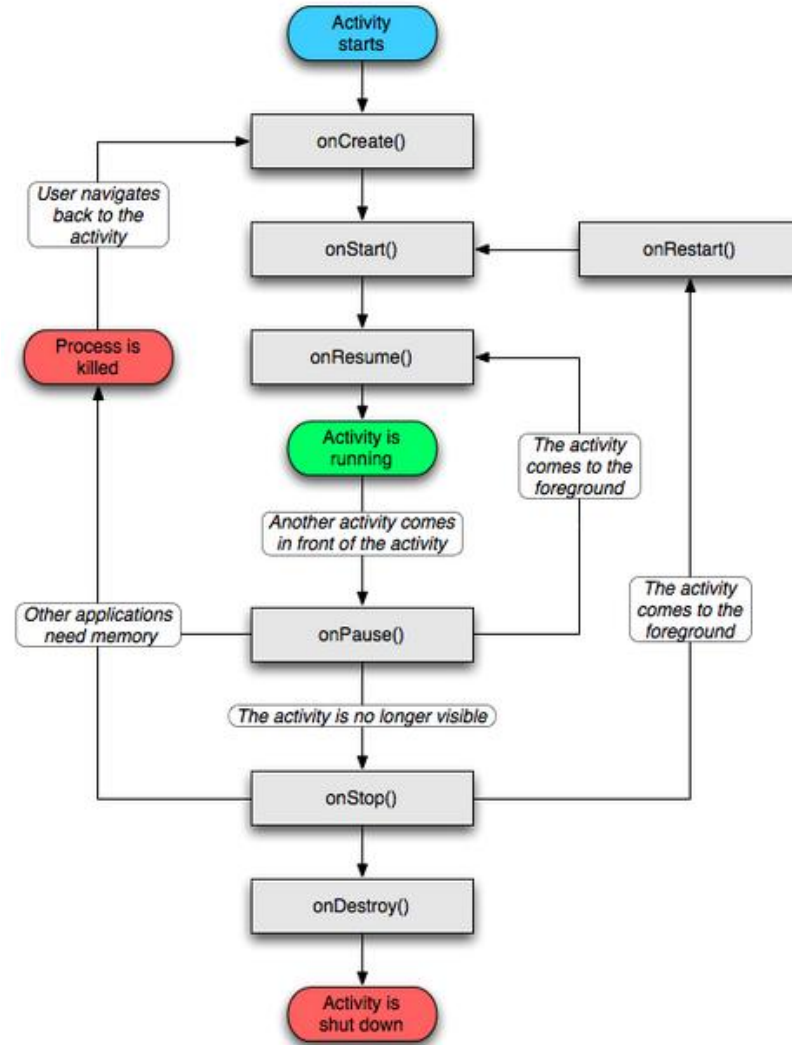
- ▶ Notepad Tutorial (Demo)

<https://developer.android.com/resources/tutorials/notepad/index.html>



Appendix

Activity Lifecycle



Android Debug Bridge

- ▶ You can find the adb tool in `<sdk>/platform-tools/`

```
% adb pull <remote> <local>
```

```
% adb push <local> <remote>
```

```
% adb install <path_to_apk>
```

```
% adb shell ls /system/bin
```

```
% adb shell
```

```
# sqlite3 /data/data/com.android.demo.notepad/databases/data.db
```

```
sqlite> .header ON
```

```
sqlite> .mode column
```

```
sqlite> SELECT * FROM notes;
```

<u>id</u>	<u>title</u>	<u>body</u>
1	asdf	aaaaaaaaa

Performance Tips

- ▶ Don't do work that you don't need to do.
- ▶ Don't allocate memory if you can avoid it.
- ▶ Before you start optimizing, make sure you have a problem.
- ▶ Avoid using floating-point.
- ▶ Avoid Internal getters/setters.
- ▶ Prefer Static over Virtual.
- ▶ Use Static Final for Constants.

<http://developer.android.com/guide/practices/design/performance.html>

Resources

- ▶ Android Developers

<http://developer.android.com/index.html>

- ▶ Android Developers Blog

<http://android-developers.blogspot.com/>

- ▶ Android Training

<https://developer.android.com/training/index.html>

- ▶ StackOverflow

<http://stackoverflow.com/questions/tagged/android>