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Android OS/SDK brief intro

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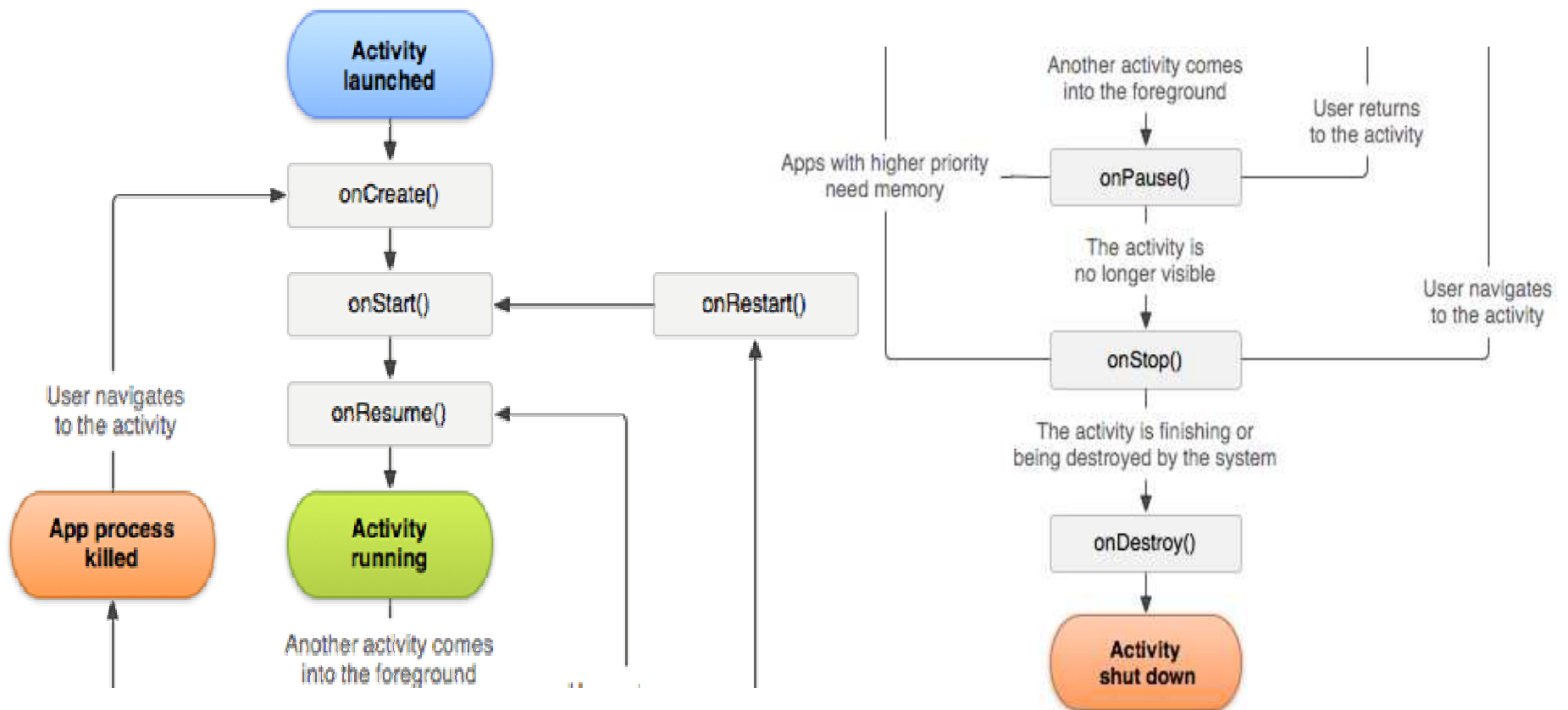
Index

- ▶ Dalvik application lifecycle
- ▶ Application interaction
- ▶ Notification Alarms
- ▶ Memory management

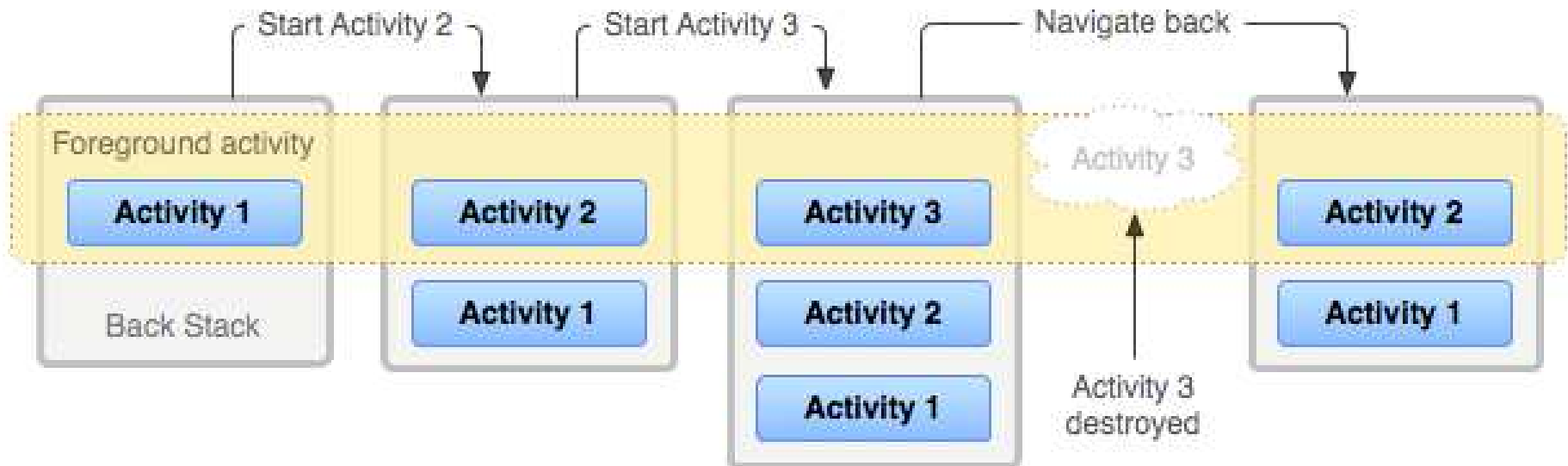
Dalvik application

- ▶ Don't have a **main()**
- ▶ Can contains at least one component
 - ▶ Activity
 - ▶ Service
 - ▶ Intent
 - ▶ Content provider
 - ▶ Sensor Listener

Activity lifecycle



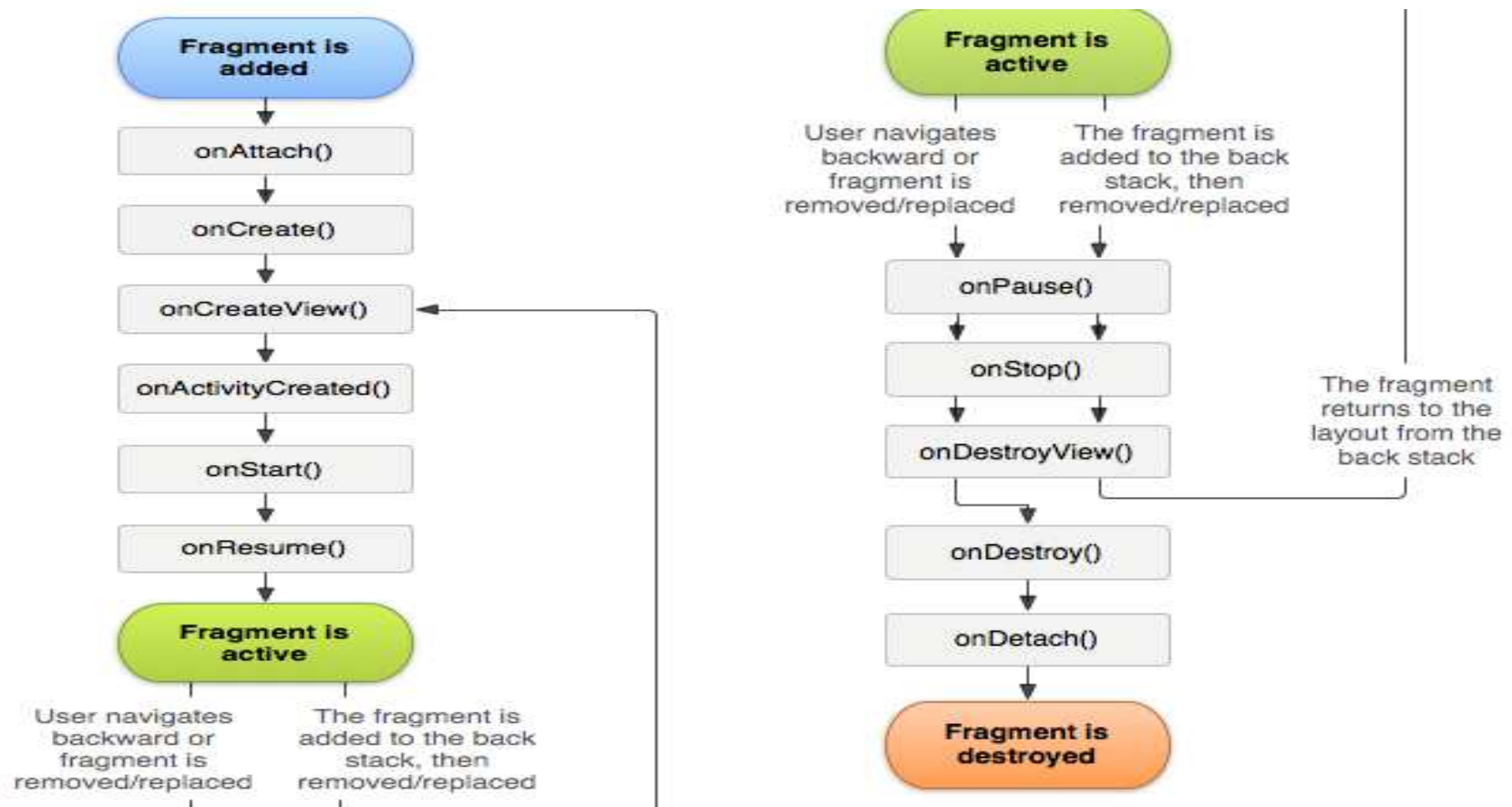
Tasks and Back Stack



You can—and **should**—proactively retain the state of your activities using callback methods, in case the activity is destroyed and must be recreated

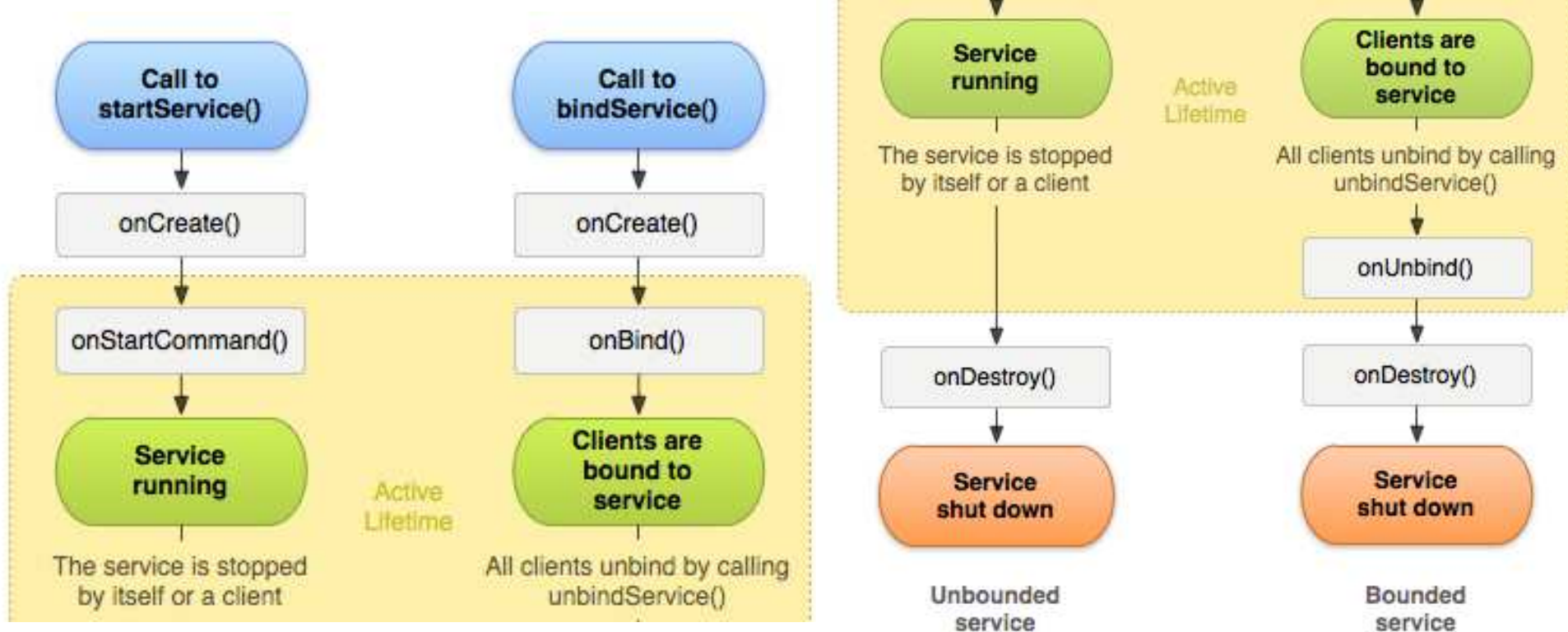
The lifecycle of a fragment

- ▶ Can be considered a sub activity of an activity
- ▶ Has its own life cycle during the lifecycle of the activity



Services lifecycle

- ▶ Used for long operation
- ▶ Run in background
- ▶ Low priority
- ▶ Longer life than activity



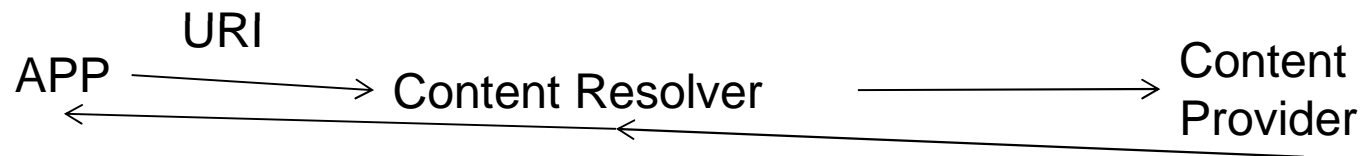
Services

- ▶ Service – application component that can perform long-running operations in the background and do not provide a user interface.
- ▶ Another application component can start a service and it will continue to run in the background even if the user switches to another application.
- ▶ Additionally, a component can bind to a service to interact with it and even perform IPC.
- ▶ A service can be Started or Bound

- ▶ Logging Service
 - ▶ Client Activity sends log messages to service
 - ▶ Service writes messages to a log console
- ▶ Music playing Service
 - ▶ Client Activity tells service to play a music file
 - ▶ Services plays music in the background (even if Client Activity pauses or terminates)
- ▶ ID Service
 - ▶ Client Activity requests system-wide unique ID
 - ▶ Service returns ID to Client

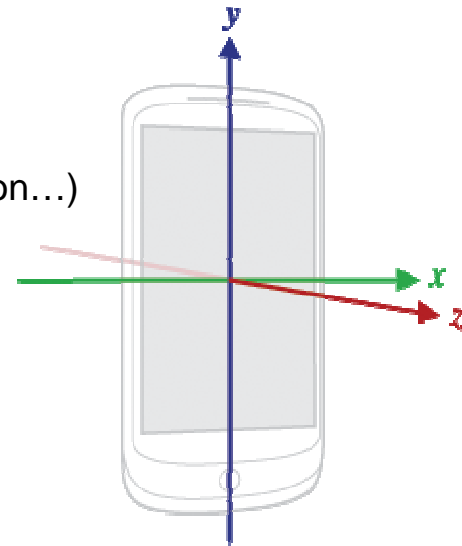
Content Provider

- ▶ manages access to a structured central repository of data
- ▶ It is part of an application
- ▶ provide data to other components
- ▶ Use SQLite and it's based on URL
- ▶ Android includes content providers that manage data such as audio, video, images, and personal contact information.



Sensor Listener

- ▶ **Motion sensors** - measure acceleration forces and rotational forces along three axes
 - ▶ accelerometers, gravity sensors, gyroscopes, and rotational vector sensors.
- ▶ **Environmental sensors** - measure various environmental parameters
 - ▶ barometers, photometers, and thermometers
- ▶ **Position sensors** - measure the physical position of a device
 - ▶ orientation sensors and magnetometers
- ▶ Using the Android sensor framework one can:
 - ▶ Determine which sensors are available on a device.
 - ▶ Determine an individual sensor's capabilities (max range, resolution...)
 - ▶ Register, unregister & acquire raw data
- ▶ Important function
 - ▶ registerListener
 - ▶ onAccuracyChanged
 - ▶ onSensorChanged
 - ▶ getSensorList
 - ▶ unregisterListener



Memory management

▶ Heap Size limits

- ▶ G1:16 MB
- ▶ Droid:24 MB
- ▶ Nexus One:32 MB
- ▶ Google Nexus 4 : 512 MB
- ▶ Google Nexus 5 : 512 MB
- ▶ Nexus 10: 512 MB

▶ OutOfMemoryError

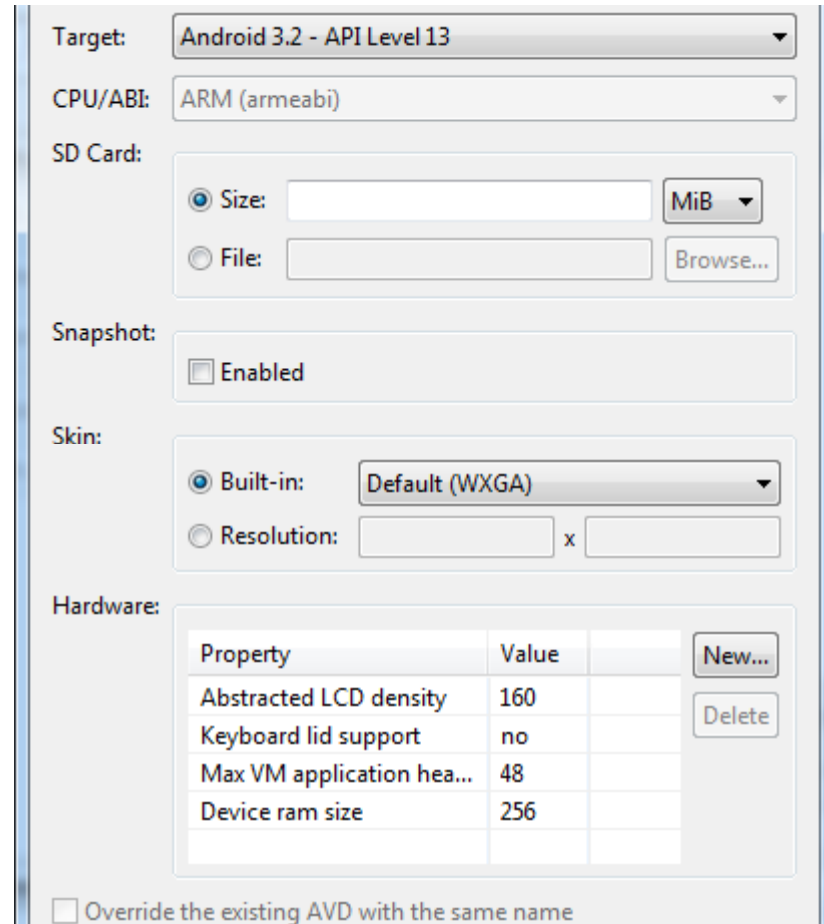
```
<application
```

```
...
```

```
android:largeHeap="true"
```

```
...
```

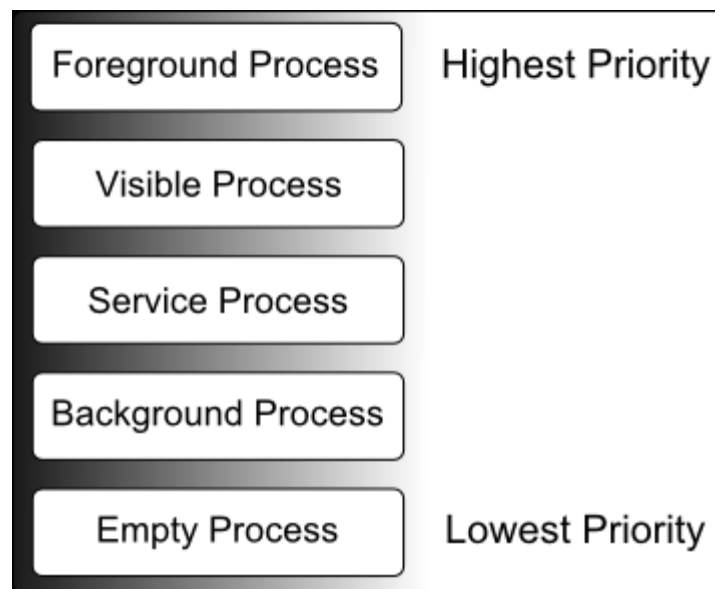
```
</application>
```

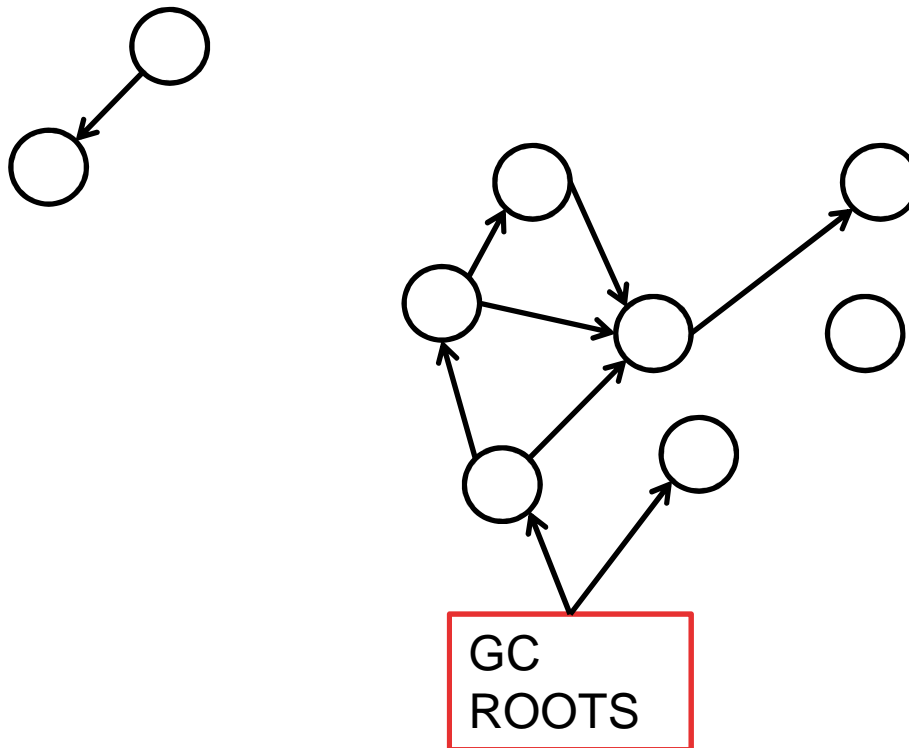
The screenshot shows the 'Configure AVD' dialog in Android Studio. It includes settings for Target (Android 3.2 - API Level 13), CPU/ABI (ARM (armeabi)), SD Card (Size and File options), Snapshot (Enabled checkbox), Skin (Built-in: Default (WXGA) or Resolution), and Hardware (a table of properties like Abstracted LCD density, Keyboard lid support, Max VM application heap size, and Device ram size). There are 'New...' and 'Delete' buttons for the hardware properties.

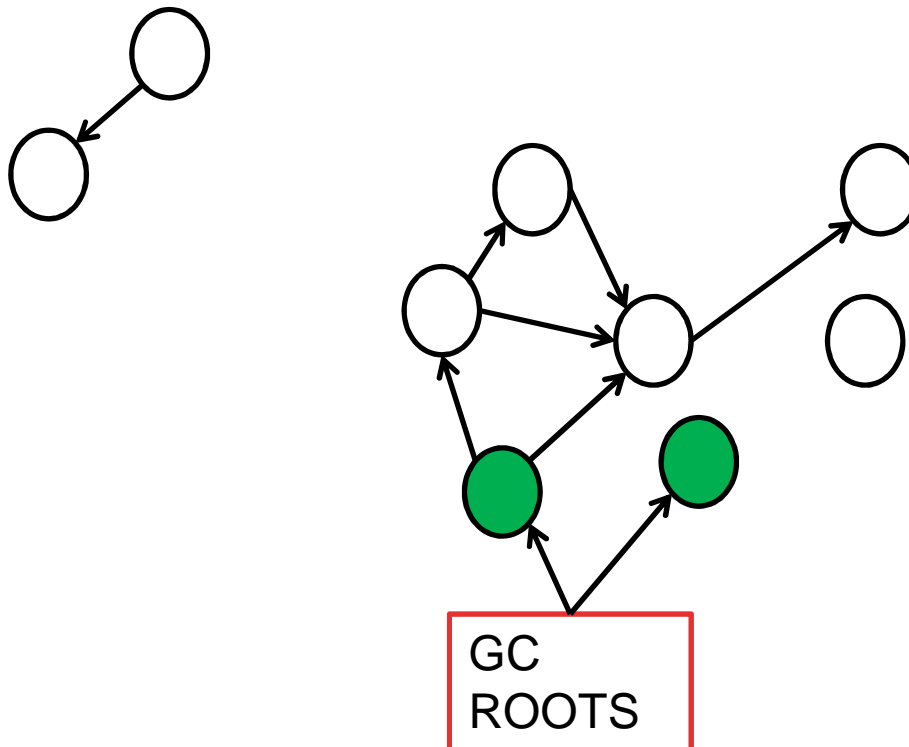
Property	Value	
Abstracted LCD density	160	
Keyboard lid support	no	
Max VM application heap size	48	
Device ram size	256	

Memory management

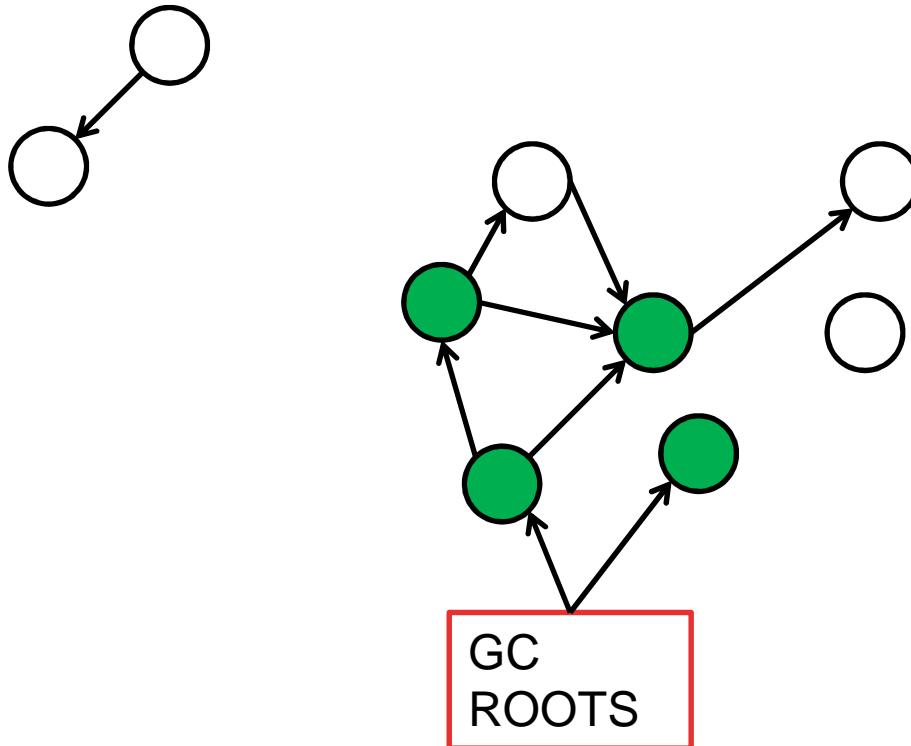
- ▶ At the shortage of memory the kernel select a low priority process and kill it.
- ▶ In Android specification about application life cycle is specified that all application should store there own state
- ▶ Most apps should not need this “largeheap” and should instead focus on reducing their overall memory usage for improved performance. Enabling this also does not guarantee a fixed increase in available memory, because some devices are constrained by their total available memory.



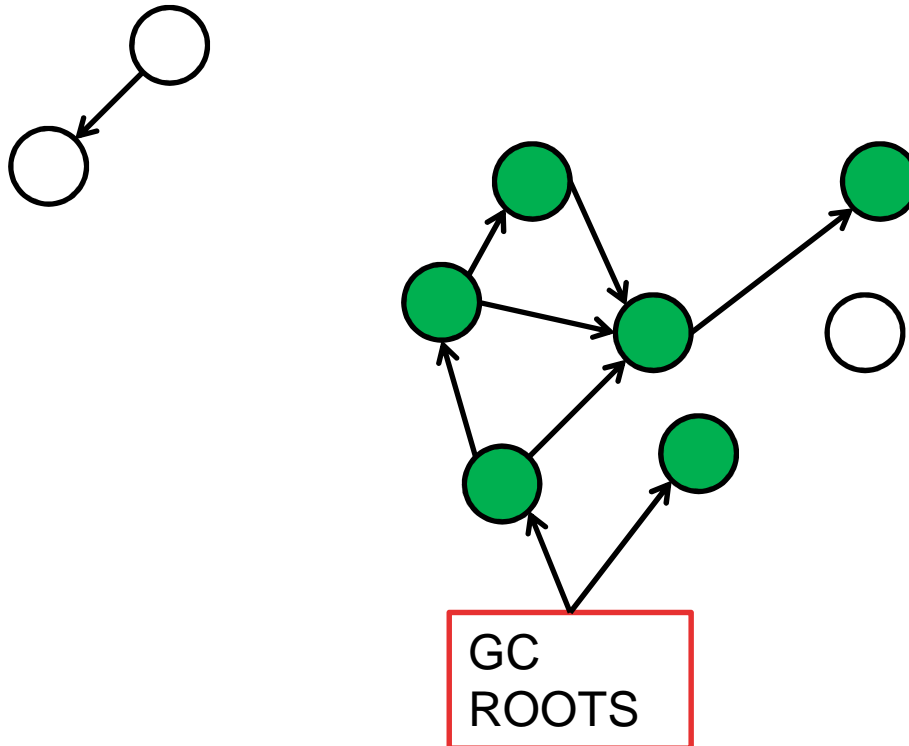


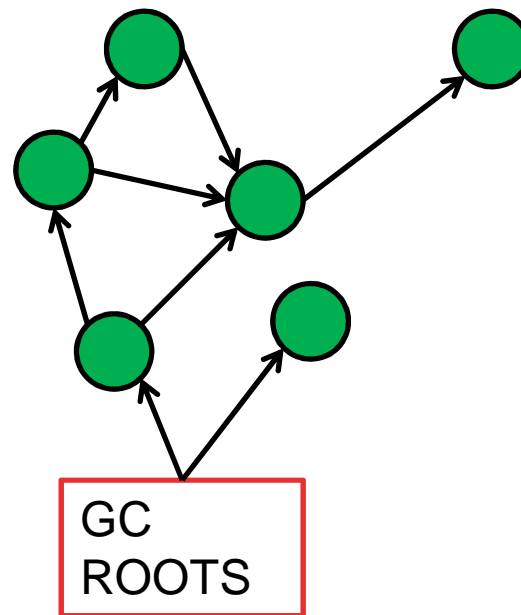


GC



GC





GC improvement

1.0 – 2.2	2.3.x ->
Stop to collect	Concurrent GC
Full heap collection	Partial Collections
Pause often >100ms	Pause time <5ms

Android Runtime (ART) replaces Dalvik since Android 5.0 (Lollipop)

- One GC pause instead of two
 - Parallelized processing during the remaining GC pause
- Collector with lower total GC time for the special case of cleaning up recently-allocated, short-lived objects
- Improved garbage collection ergonomics, making concurrent garbage collections more timely

Intent

- ▶ An Intent is a data structure that specifies:
 - ▶ An operation to be performed
 - ▶ An event that has occurred
- ▶ Broadcast by one component
- ▶ Received by 0 or more components
- ▶ there are three fundamental use-cases:
 - ▶ To start an activity
 - ▶ To start a service
 - ▶ To deliver a broadcast

Intent Action

Constant	Target component	Action
ACTION_CALL	activity	Initiate a phone call.
ACTION_EDIT	activity	Display data for the user to edit.
ACTION_MAIN	activity	Start up as the initial activity of a task, with no data input and no returned output.
ACTION_SYNC	activity	Synchronize data on a server with data on the mobile device.
ACTION_BATTERY_LOW	broadcast receiver	A warning that the battery is low.
ACTION_HEADSET_PLUG	broadcast receiver	A headset has been plugged into the device, or unplugged from it.
ACTION_SCREEN_ON	broadcast receiver	The screen has been turned on.
ACTION_TIMEZONE_CHANGED	broadcast receiver	The setting for the time zone has changed.

Intent Category

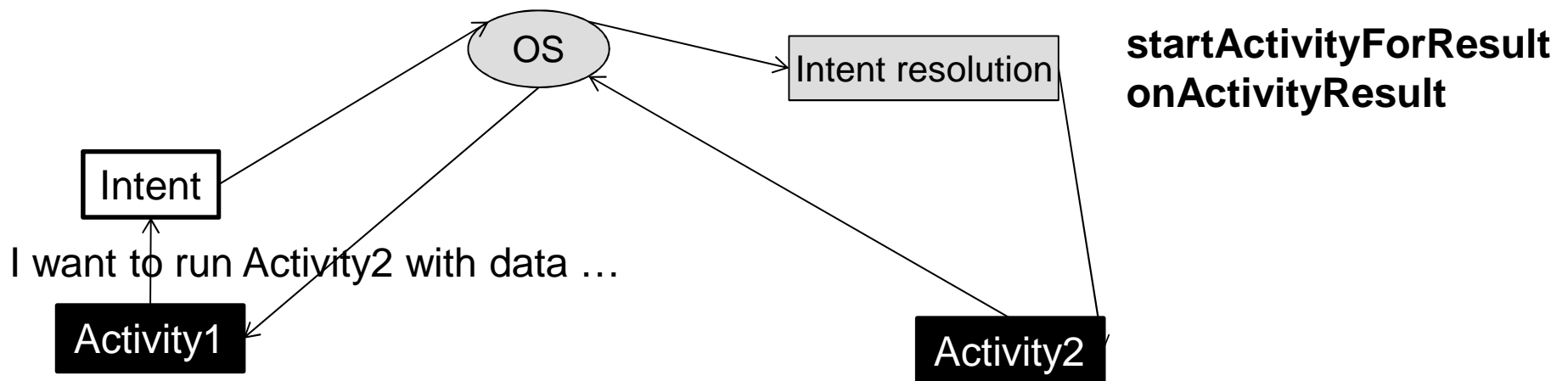
Constant	Meaning
CATEGORY_BROWSABLE	The target activity can be safely invoked by the browser to display data referenced by a link — for example, an image or an e-mail message.
CATEGORY_GADGET	The activity can be embedded inside of another activity that hosts gadgets.
CATEGORY_HOME	The activity displays the home screen, the first screen the user sees when the device is turned on or when the <i>Home</i> button is pressed.
CATEGORY_LAUNCHER	The activity can be the initial activity of a task and is listed in the top-level application launcher.
CATEGORY_PREFERENCE	The target activity is a preference panel.

Intent Resolution

- ▶ A process for matching Intents with Activities that want to receive them
- ▶ Intent Filters describe which Intents an Activity can handle
 - ▶ Usually specified in an AndroidManifest.xml file
- ▶ Intent Resolution only matches
 - ▶ Action
 - ▶ Data (both URI and mime data type)
 - ▶ Category

Intent Resolution - *Explicit intents*

► **Explicit intents** designate the target component by its name (the component name field has a value set). Since component names would generally not be known to developers of other applications, explicit intents are typically used for application-internal messages — such as an activity starting a subordinate service or launching a sister activity.



Intent Resolution

▶ ***Implicit intents*** do not name a target (the field for the component name is blank). Implicit intents are often used to activate components in other applications.

Permission

- ▶ Applications can protect resources & data with permissions
- ▶ Applications statically declare permissions
 - ▶ Required of components interacting with them
 - ▶ Required by components they interact with
- ▶ Android requires users for consent to specific permissions when application is installed

Application permission

- ▶ Applications can require components interacting with them to have a specified permission by setting `android:permission` attribute in `AndroidManifest.xml`
- ▶ By default, permissions apply to all components hosted by the application

Notifications

- ▶ Used to notify users of events
- ▶ Three general forms of Notifications
 - ▶ Toast
 - ▶ Dialogs
 - ▶ Status Bar Notifications

Alarms

- ▶ Mechanism for broadcasting Intents at predetermined times
- ▶ Used to start Activities at a specific time or perform actions at periodic time intervals
- ▶ Once set, Alarms remain active even if target application is inactive or asleep
 - ▶ Can optionally be set to wake the device
- ▶ Canceled on device shutdown/restart

Web resources

- ▶ http://handycodeworks.com/wp-content/uploads/2011/02/linux_versus_android.pdf
- ▶ http://imsciences.edu.pk/serg/wp-content/uploads/2010/10/1st_Analysis-of-Dalvik-VM.pdf
- ▶ <http://developer.android.com/guide/basics/what-is-android.html>
- ▶ <http://www.youtube.com/watch?v=v9S5EO7CLjo&feature=plcp&context=C4987524VDvjVQa1PpcFMzwqYIYKVxDu4gnCeJXiKoUpEIRjToltM%3D>
- ▶ http://www.youtube.com/watch?v=FJDP_0Mrb-w&feature=plcp&context=C4fd0520VDvjVQa1PpcFMzwqYIYKVxDnX2uT7xWXvtxdVeqHPNbas%3D
- ▶ <http://www.youtube.com/watch?v=DTcZPE8Twpq&feature=plcp&context=C491f3faVDvjVQa1PpcFMzwqYIYKVxDrecTG8rMjGpBalFGHi28ro%3D>
- ▶ <http://www.youtube.com/watch?v=YLVBbLVtjDDw&feature=plcp&context=C4d0c4bdVDvjVQa1PpcFMzwqYIYKVxDkn3XVQj5fvUQ0TSylfUOXo%3D>
- ▶ <http://www.youtube.com/watch?v=N1aCo5LvMf8&feature=plcp&context=C4faafecVDvjVQa1PpcFMzwqYIYKVxDj0E-nzKHYt7OKR5Fpzm6hM%3D>
- ▶ http://www.youtube.com/watch?v=cdvaPyq_eBU&feature=plcp&context=C45fa262VDvjVQa1PpcFMzwqYIYKVxDq3n_R6n1AT2qwMmEa7vOVs%3D
- ▶ http://www.youtube.com/watch?v=ScW4zSeexvo&feature=plcp&context=C4506f63VDvjVQa1PpcFMzwqYIYKVxDtFmHtj77FF_ysD_ezxpSQ4%3D
- ▶ http://www.youtube.com/watch?v=49L7z3rxz4Q&feature=plcp&context=C435e62fVDvjVQa1PpcFMzwqYIYKVxDntPXXpvpvpxet3ldf8_GhG8E%3D
- ▶ <http://www.youtube.com/playlist?list=PL586D322B5E2764CF&feature=plcp>