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13 FEBRUARY 2014

New Client API Model in Google Play Services

By Magnus Hyttsten, Google Developer Relations

Google Play services 4.2 has now been **rolled out to the world**, and it's packed with much-anticipated features such as the brand new Cast API and the updated Drive API.

In addition to these blockbuster announcements, we are also launching a slightly less visible but equally important new API — a new way to connect client APIs and manage API requests. As with the initial Drive API, these changes were available as a developer preview in earlier releases of Google Play services. We're now happy to graduate those APIs to fully supported and official.

In this post we'll take a look at the new Google Play services client APIs and what they mean for your apps — for details be sure to read Accessing Google Play services and the API reference documentation.

Connecting Client APIs

The client connection model has now been unified for all the APIs. As you may recall, you were previously required to use separate client classes for each API you wanted to use, for example: `PlusClient`, `GamesClient`, etc. Instead, you should now use `GoogleApiClient`, which allows you to connect to multiple APIs using a single call. This has great advantages such as:

- **Simplicity**—The `onConnected()` method will be called once, and only when connectivity to all the client APIs you are using have been established. This means you do not have to intercept multiple callbacks, one for each API connected, which simplifies the code and state management.
- **Improved user experience**—With this design, Google Play services knows about everything your app needs up front. All APIs, all scopes, the works. This means that we can take care of the user consents at once, creating a single consolidated user experience for all the APIs. No more sign-in mid-process terminations, partial state management, etc.

Below is an example of establishing a connection the Google+ and Drive APIs. To see the reference information for this new client connection model, you should check out the `com.google.android.gms.common.api` package.

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

    // Builds single client object that connects to Drive and Google+
    mClient = new GoogleApiClient.Builder(this)
            .addApi(Drive.API)
            .addScope(Drive.SCOPE_FILE)
            .addApi(Plus.API, plusOptions)
            .addScope(Plus.SCOPE_PLUS_LOGIN)
            .addConnectionCallbacks(this)
            .addOnConnectionFailedListener(this)
            .build();
}

@Override
protected void onStart() {
    super.onStart();

    // Connect to Drive and Google+
    mClient.connect();
}
```

```
@Override
protected void onConnected(Bundle connectionHint) {
    // All clients are connected
    startRockAndRoll();
}

@Override
protected void onConnectionFailed(ConnectionResult result) {
    // At least one of the API client connect attempts failed
    // No client is connected
    ...
}
```

Enqueuing API Calls

Another new feature is enqueuing of API calls, which allows you to call read methods before the API clients are connected. This means you can issue these calls up front, for example in onStart/onResume, rather than having to wait and issue them in different callback methods. This is something which will greatly simplify code if your app requires data to be read when it is started. Here is an example of where a call like this can be placed:

```
@Override
protected void onStart() {
    super.onStart();
    mClient.connect();
}

@Override
protected void onResume() {
    super.onResume();

    // Enqueue operation.
    // This operation will be enqueued and issued once the API clients are connected.
    // Only API retrieval operations are allowed.
    // Asynchronous callback required to not lock the UI thread.
    Plus.PeopleApi.load(mClient, “me”, “you”, “that”).setResultCallback(this);
}
```

Supporting both Asynchronous and Synchronous Execution

With this release of Google Play services, you now have the option to specify if an API call should execute asynchronously (you will receive a callback once it is finished), or synchronously (the thread will block until the operation has completed). This is achieved by using the classes `PendingResult`, `Result`, and `Status` in the `com.google.android.gms.common.api` package.

In practice, this means that API operations will return an instance of `PendingResult`, and you can choose if you want the method to execute asynchronously using `setResultCallback` or synchronously using `await`. The following example demonstrates how to synchronously retrieve the metadata for a file and then clear any starred flag setting:

```
// Must be run in a background task and not on UI thread
new AsyncTask <DriveFile, Void, Void> {
    protected void doInBackground(DriveFile driveFile) {

        // Get the metadata synchronously
        MetaDataResult mdGetResult = driveFile.getMetadata(mClient).await();
        if (!mdGetResult.isSuccess()) {
            // Handle error
        }

        MetaData md = mdGetResult.getMetadata()
        // Perform operations based on metadata

        // Update the meta data, unconditionally clear the starred flag
        MetaDataChangeSet mdCS = new MetadataChangeSet.Builder()
            .setStarred(false)
            .build();

        MetaDataResult mdUpdateResult =driveFile.updateMetaData(mClient,mdCS).await();
        if (!mdUpdateResult.isSuccess()) {
            // Handle error
        }
```

```
        … // continue doing other things synchronously
}).execute(fileName);
```

It should be stressed though that the old best practice rule — do not block the UI thread — is still in effect. This means that the execution of this sequence of API calls described above must be performed from a background thread, potentially by using `AsyncTask` as in the example above.

Moving your apps to the new client API

We believe these changes will make it easier for you to build with Google Play services in your apps. For those of you using the older clients, we recommend refactoring your code as soon as possible to take advantage of these features. Apps deployed using the old client APIs will continue to work since these changes do not break binary compatibility, but the old APIs are now deprecated and we'll be removing them over time.

That's it for this time. Google Play services allows Google to provide you with new APIs and features faster than ever, and with the capabilities described in this post, you now have a generic way of using multiple client APIs and executing API calls. Make sure to check out the video below for a closer look at the new client APIs.

To learn more about Google Play services and the APIs available to you through it, visit the Google Services area of the Android Developers site. Details on the APIs are available in the API reference.

For information about getting started with Google Play services APIs, see Set Up Google Play Services SDK

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Posted by Android Developers at 12:30 PM Links to this post
Labels: Google client API, Google Play services

03 FEBRUARY 2014

Google Play Services 4.2

The latest release of Google Play services is now available on Android devices worldwide. It includes the full release of the Google Cast SDK, for developing and publishing Google Cast-ready apps.

You can get started developing today by downloading the Google Play services SDK from the SDK Manager.

Google Cast SDK

The Google Cast SDK makes it easy to bring your content to the TV. There's no need to create a new app — just incorporate the SDK into your existing mobile and web apps. You are in control of how and when you publish your Google Cast-ready app to users through the Google Cast developer console.

You can find out more about the Cast SDK by reading Ready to Cast on the Google Developers Blog. For complete information about the Cast SDK and how to use the Cast APIs, see the Google Cast developer page.

Google Drive

The Google Drive API introduced in Google Play services 4.1 has graduated from developer preview. The latest version includes refinements to the API as well as improvements for performance and stability.

Google client API

This release introduces a new Google API client that unifies the connection model across Google services. Instead of needing to work with separate client classes for each API you wanted to use, you can now work with a single client API model. This makes it easier to build Google services into your apps and provides a more continuous user experience when you are using multiple services.

For an introduction to the new Google client API and what it means for your app, start by reading New Client API in Google Play Services.

More About Google Play Services

To learn more about Google Play services and the APIs available to you through it, visit the Google Services area of the Android Developers site. Details on the APIs are available in the API reference.

For information about getting started with Google Play services APIs, see Set Up Google Play Services SDK

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Posted by Android Developers at 10:36 AM Links to this post
Labels: Google Cast, Google Play services, TV

31 JANUARY 2014

Process Stats: Understanding How Your App Uses RAM

By Dianne Hackborn, Android framework team

Android 4.4 KitKat introduced a new system service called **procstats** that helps you better understand how your app is using the RAM resources on a device. Procstats makes it possible to see how your app is behaving over time — including how long it runs in the background and how much memory it uses during that time. It helps you quickly find inefficiencies and misbehaviors in your app that can affect how it performs, especially when running on low-RAM devices.

You can access procstats data using an adb shell command, but for convenience there is also a new **Process Stats** developer tool that provides a graphical front-end to that same data. You can find Process Stats in **Settings > Developer options > Process Stats**.

In this post we'll first take a look at the Process Stats graphical tool, then dig into the details of the memory data behind it, how it's collected, and why it's so useful to you as you analyze your app.

Looking at systemwide memory use and background processes

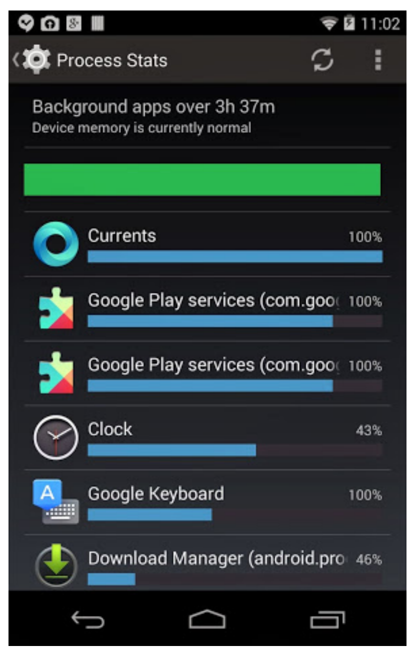
When you open Process Stats, you see a summary of systemwide memory conditions and details on how processes are using memory over time. The image at right gives you an example of what you might see on a typical device.

At the top of the screen we can see that:

- We are looking at that data collected over the last ~3.5 hours.
- Currently the device's RAM is in good shape ("Device memory is currently normal").
- During that entire time the memory state has been good — this is shown by the green bar. If device memory was getting low, you would see yellow and red regions on the left of the bar representing the amount of total time with low memory.

Below the green bar, we can see an overview of the processes running in the background and the memory load they've put on the system:

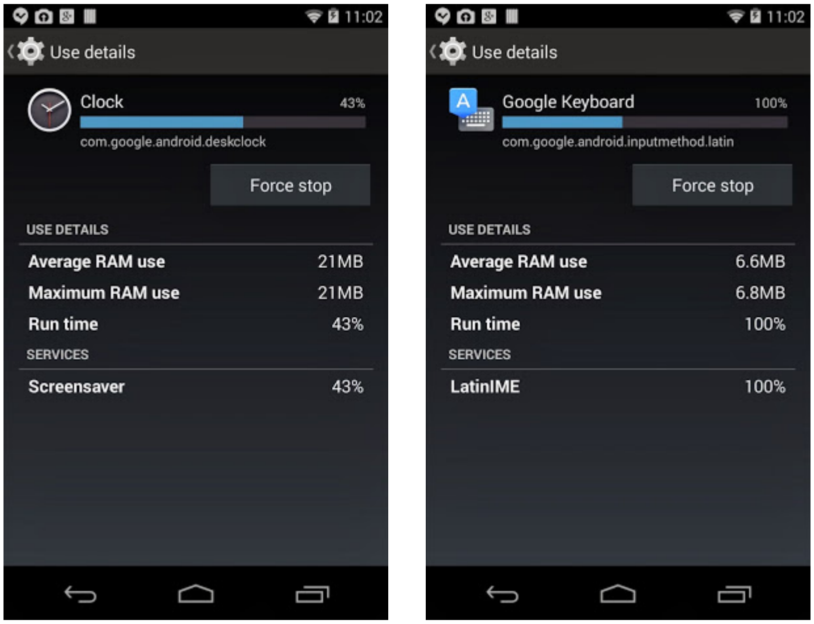
- The percentage numbers on the right indicate the amount of time each process has spent running during the total duration.
- The blue bars indicate the relative computed memory load of each process. (The memory load is `runtime*avg_pss`, which we will go into more detail on later.)
- Some apps may be listed multiple times, since what is being shown is processes (for example, Google Play services runs in two processes). The memory load of these apps is the sum of the load of their individual processes.
- There are a few processes at the top that have all been running for 100% of the time, but with different weights because of their relative memory use.



Process Stats overview of memory used by background processes over time.

Analyzing memory for specific processes

The example shows some interesting data: we have a Clock app with a higher memory weight than Google Keyboard, even though it ran for less than half the time. We can dig into the details of these processes just by tapping on them:



Process Stats **memory details** for Clock and Keyboard processes over the past 3.5 hours.

The details for these two processes reveal that:

- The reason that Clock has been running at all is because it is being used as the current screen saver when the device is idle.
- Even though the Clock process ran for less than half the time of the Keyboard, its ram use was significantly larger (almost 3x), which is why its overall weight is larger.

Essentially, procstats provides a “memory use” gauge that’s much like the storage use or data use gauges, showing how much RAM the apps running in the background are using. Unlike with storage or data, though, memory use is much harder to quantify and measure, and procstats uses some tricks to do so. To illustrate the complexity of measuring memory use, consider a related topic: task managers.

Understanding task managers and their memory info

We’ve had a long history of task managers on Android. Android has always deeply supported multitasking, which means the geeky of us will tend to want to have some kind of UI for seeing and controlling this multitasking like the traditional UI we are used to from the desktop. However, multitasking on Android is actually quite a bit more complicated and fundamentally different than on a traditional desktop operating system, as I previously covered in Multitasking the Android Way. This deeply impacts how we can show it to the user.

Multitasking and continuous process management

To get a feel for just how different process management is on Android, you can take a look at the output of an important system service, the activity manager, with `adb shell dumpsys activity`. The example below shows a snapshot of current application processes on Android 4.4, listing them from most important to least:

```
ACTIVITY MANAGER RUNNING PROCESSES (dumpsys activity processes)
Process LRU list (sorted by oom_adj, 22 total, non-act at 2, non-svc at 2):
  PERS #21: sys   F/ /P  trm: 0 23064:system/1000 (fixed)
  PERS #20: pers  F/ /P  trm: 0 23163:com.android.systemui/u0a12 (fixed)
  PERS #19: pers  F/ /P  trm: 0 23344:com.nuance.xt9.input/u0a77 (fixed)
  PERS #18: pers  F/ /P  trm: 0 23357:com.android.phone/1001 (fixed)
  PERS #17: pers  F/ /P  trm: 0 23371:com.android.nfc/1027 (fixed)
  Proc # 3: fore  F/ /IB trm: 0 13892:com.google.android.apps.magazines/u0a59 (service)
    com.google.android.apps.magazines/com.google.apps.dots.android.app.service.SyncServic
  Proc # 2: fore  F/ /IB trm: 0 23513:com.google.process.gapps/u0a8 (provider)
    com.google.android.gsf/.gservices.GservicesProvider<=Proc{13892:com.google.android.ap
  Proc # 0: fore  F/A/T  trm: 0 24811:com.android.settings/1000 (top-activity)
  Proc # 4: vis   F/ /IF trm: 0 23472:com.google.process.location/u0a8 (service)
```

```
    com.google.android.backup/.BackupTransportService<=Proc{23064:system/1000}
  Proc #14: prcp  F/ /IF trm: 0 23298:com.google.android.inputmethod.latin/u0a57 (service
    com.google.android.inputmethod.latin/com.android.inputmethod.latin.LatinIME<=Proc{230
  Proc # 1: home  B/ /HO trm: 0 23395:com.android.launcher/u0a13 (home)
  Proc #16: cch   B/ /CA trm: 0 23966:com.google.android.deskclock/u0a36 (cch-act)
  Proc # 6: cch   B/ /CE trm: 0 7716:com.google.android.music:main/u0a62 (cch-empty)
  Proc # 5: cch   B/ /CE trm: 0 8644:com.google.android.apps.docs/u0a39 (cch-empty)
  Proc # 8: cch+2 B/ /CE trm: 0 5131:com.google.android.youtube/u0a78 (cch-empty)
  Proc # 7: cch+2 B/ /CE trm: 0 23338:com.google.android.gms/u0a8 (cch-empty)
  Proc #10: cch+4 B/ /CE trm: 0 8937:com.google.android.apps.walletnfcrel/u0a24 (cch-empt
  Proc # 9: cch+4 B/ /CE trm: 0 24689:com.google.android.apps.plus/u0a70 (cch-empty)
  Proc #15: cch+6 B/ /S  trm: 0 23767:com.google.android.apps.currents/u0a35 (cch-started
  Proc #13: cch+6 B/ /CE trm: 0 9115:com.google.android.gm/u0a44 (cch-empty)
  Proc #12: cch+6 B/ /S  trm: 0 7738:android.process.media/u0a6 (cch-started-services)
  Proc #11: cch+6 B/ /CE trm: 0 8922:com.google.android.setupwizard/u0a19 (cch-empty)
```

Example output of **dumpsys activity** command, showing all processes currently running.

There are a few major groups of processes here — persistent system processes, the foreground processes, background processes, and finally cached processes — and the category of a process is extremely important for understanding its impact on the system.

At the same time, processes on this list change all of the time. For example, in the snapshot above we can see that “com.google.android.gm” is currently an important process, but that is because it is doing a background sync, something the user would not generally be aware of or want to manage.

Snapshotting per-process RAM use

The traditional use of a task manager is closely tied to RAM use, and Android provides a tool called `meminfo` for looking at a snapshot of current per-process RAM use. You can access it with the command adb shell dumpsys meminfo. Here's an example of the output.

```
Total PSS by OOM adjustment:
    31841 kB: Native
               13173 kB: zygote (pid 23001)
                4372 kB: surfaceflinger (pid 23000)
                3721 kB: mediaserver (pid 126)
                3317 kB: glgps (pid 22993)
                1656 kB: drmserver (pid 125)
                 995 kB: wpa_supplicant (pid 23148)
                 786 kB: netd (pid 121)
                 518 kB: sdcard (pid 132)
                 475 kB: vold (pid 119)
                 458 kB: keystore (pid 128)
                 448 kB: /init (pid 1)
                 412 kB: adbd (pid 134)
                 254 kB: ueventd (pid 108)
                 238 kB: dhcpcd (pid 10617)
                 229 kB: tf_daemon (pid 130)
                 200 kB: installd (pid 127)
                 185 kB: dumpsys (pid 14207)
                 144 kB: healthd (pid 117)
                 139 kB: debuggerd (pid 122)
                 121 kB: servicemanager (pid 118)
    48217 kB: System
               48217 kB: system (pid 23064)
    49095 kB: Persistent
               34012 kB: com.android.systemui (pid 23163 / activities)
                7719 kB: com.android.phone (pid 23357)
                4676 kB: com.android.nfc (pid 23371)
                2688 kB: com.nuance.xt9.input (pid 23344)
    24945 kB: Foreground
               24945 kB: com.android.settings (pid 24811 / activities)
    17136 kB: Visible
               14026 kB: com.google.process.location (pid 23472)
                3110 kB: com.android.defcontainer (pid 13976)
     6911 kB: Perceptible
                6911 kB: com.google.android.inputmethod.latin (pid 23298)
    14277 kB: A Services
               14277 kB: com.google.process.gapps (pid 23513)
    26422 kB: Home
               26422 kB: com.android.launcher (pid 23395 / activities)
    21798 kB: B Services
```

```
                16242 kB: com.google.android.apps.currents (pid 23767)
                 5556 kB: android.process.media (pid 7738)
    145869 kB: Cached
                41588 kB: com.google.android.apps.plus (pid 24689)
                21417 kB: com.google.android.deskclock (pid 23966 / activities)
                14463 kB: com.google.android.apps.docs (pid 8644)
                14303 kB: com.google.android.gm (pid 9115)
                11014 kB: com.google.android.music:main (pid 7716)
                10688 kB: com.google.android.apps.magazines (pid 13892)
                10240 kB: com.google.android.gms (pid 23338)
                 9882 kB: com.google.android.youtube (pid 5131)
                 8807 kB: com.google.android.apps.walletnfcrel (pid 8937)
                 3467 kB: com.google.android.setupwizard (pid 8922)

 Total RAM: 998096 kB
  Free RAM: 574945 kB (145869 cached pss + 393200 cached + 35876 free)
  Used RAM: 392334 kB (240642 used pss + 107196 buffers + 3856 shmem + 40640 slab)
  Lost RAM: 30817 kB
    Tuning: 64 (large 384), oom 122880 kB, restore limit 40960 kB (high-end-gfx)
```

Example output of **dumpsys meminfo** command, showing memory currently used by running processes.

We are now looking at the same processes as above, again organized by importance, but now with on their impact on RAM use.

Usually when we measure RAM use in Android, we do this with Linux's **PSS (Proportional Set Size)** metric. This is the amount of RAM actually mapped into the process, but weighted by the amount it is shared across processes. So if there is a 4K page of RAM mapped in to two processes, its PSS amount for each process would be 2K.

The nice thing about using PSS is that you can add up this value across all processes to determine the actual total RAM use. This characteristic is used at the end of the `meminfo` report to compute how much RAM is in use (which comes in part from all non-cached processes), versus how much is "free" (which includes cached processes).

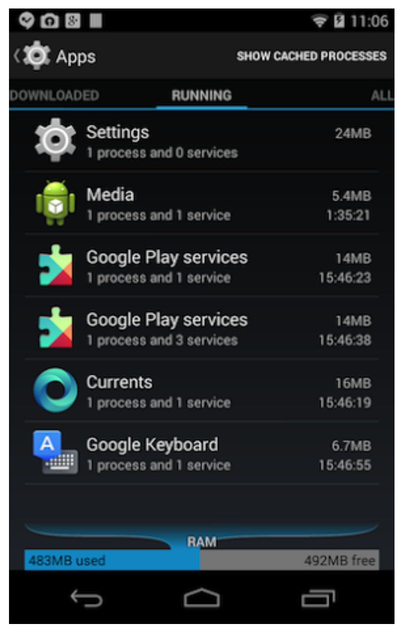
Task manager UI based on PSS snapshot

Given the information we have so far, we can imagine various ways to present this in a somewhat traditional task manager UI. In fact, the UI you see in **Settings > Apps > Running** is derived from this information. It shows all processes running services ("svc" adjustment in the LRU list) and on behalf of the system (the processes with a "<=Proc{489:system/1000}" dependency), computing the PSS RAM for each of these and any other processes they have dependencies on.

The problem with visualizing memory use in this way is that it gives you the instantaneous state of the apps, without context over time. On Android, users don't directly control the creation and removal of application processes — they may be kept for future use, removed when the system decides, or run in the background without the user explicitly launching them. So looking only at the instantaneous state of memory use only, you would be missing important information about what is actually going on over time.

For example, in our first look at the process state we see the com.google.android.apps.magazines process running for a sync, but when we collected the RAM use right after that it was no longer running in the background but just being kept around as an old cached process.

To address this problem, the new procstats tool **continually monitors the state of all application processes over time**, aggregating that information and collecting PSS samples from those processes while doing so. You can view the raw data being collected by procstats with the command `adb shell dumpsys procstats`.



Task-manager style memory info, showing a snapshot of memory used by running apps.

Seeing memory use over time with procstats

Let's now go back to procstats and take a look at the context it provides by showing memory use over time. We can use the command `adb shell dumpsys procstats --hours 3` to output memory information collected over the last 3 hours. This is the same data as represented graphically in the first Process Stats example.

The output shows all of the processes that have run in the last 3 hours, sorted with the ones running the most first. (Processes in a cached state don't count for the total time in this sort.) Like the initial graphical representation, we now clearly see a big group of processes that run all of the time, and then some that run occasionally — this includes the Magazines process, which we can now see ran for 3.6% of the time over the last 3 hours.

```
  * com.google.android.inputmethod.latin / u0a57:
           TOTAL: 100% (6.4MB-6.7MB-6.8MB/5.4MB-5.4MB-5.4MB over 21)
          Imp Fg: 100% (6.4MB-6.7MB-6.8MB/5.4MB-5.4MB-5.4MB over 21)
  * com.google.process.gapps / u0a8:
           TOTAL: 100% (12MB-13MB-14MB/10MB-11MB-12MB over 211)
          Imp Fg: 0.11%
          Imp Bg: 0.83% (13MB-13MB-13MB/11MB-11MB-11MB over 1)
         Service: 99% (12MB-13MB-14MB/10MB-11MB-12MB over 210)
  * com.android.systemui / u0a12:
           TOTAL: 100% (29MB-32MB-34MB/26MB-29MB-30MB over 21)
      Persistent: 100% (29MB-32MB-34MB/26MB-29MB-30MB over 21)
  * com.android.phone / 1001:
           TOTAL: 100% (6.5MB-7.1MB-7.6MB/5.4MB-5.9MB-6.4MB over 21)
      Persistent: 100% (6.5MB-7.1MB-7.6MB/5.4MB-5.9MB-6.4MB over 21)
  * com.nuance.xt9.input / u0a77:
           TOTAL: 100% (2.3MB-2.5MB-2.7MB/1.5MB-1.5MB-1.5MB over 21)
      Persistent: 100% (2.3MB-2.5MB-2.7MB/1.5MB-1.5MB-1.5MB over 21)
  * com.android.nfc / 1027:
           TOTAL: 100% (4.2MB-4.5MB-4.6MB/3.2MB-3.2MB-3.3MB over 21)
      Persistent: 100% (4.2MB-4.5MB-4.6MB/3.2MB-3.2MB-3.3MB over 21)
  * com.google.process.location / u0a8:
           TOTAL: 100% (13MB-13MB-14MB/10MB-11MB-11MB over 21)
          Imp Fg: 100% (13MB-13MB-14MB/10MB-11MB-11MB over 21)
  * system / 1000:
           TOTAL: 100% (42MB-46MB-56MB/39MB-42MB-48MB over 21)
      Persistent: 100% (42MB-46MB-56MB/39MB-42MB-48MB over 21)
  * com.google.android.apps.currents / u0a35:
           TOTAL: 100% (16MB-16MB-16MB/14MB-14MB-14MB over 17)
         Service: 100% (16MB-16MB-16MB/14MB-14MB-14MB over 17)
  * com.android.launcher / u0a13:
           TOTAL: 77% (25MB-26MB-27MB/22MB-23MB-24MB over 73)
             Top: 77% (25MB-26MB-27MB/22MB-23MB-24MB over 73)
          (Home): 23% (25MB-26MB-26MB/23MB-23MB-24MB over 12)
  * android.process.media / u0a6:
           TOTAL: 48% (5.0MB-5.3MB-5.5MB/4.0MB-4.2MB-4.2MB over 11)
          Imp Fg: 0.00%
          Imp Bg: 0.00%
         Service: 48% (5.0MB-5.3MB-5.5MB/4.0MB-4.2MB-4.2MB over 11)
        Receiver: 0.00%
        (Cached): 22% (4.1MB-4.5MB-4.8MB/3.0MB-3.5MB-3.8MB over 8)
  * com.google.android.deskclock / u0a36:
           TOTAL: 42% (20MB-21MB-21MB/18MB-19MB-19MB over 8)
          Imp Fg: 42% (20MB-21MB-21MB/18MB-19MB-19MB over 8)
         Service: 0.00%
        Receiver: 0.01%
        (Cached): 58% (17MB-20MB-21MB/16MB-18MB-19MB over 14)
  * com.android.settings / 1000:
           TOTAL: 23% (19MB-22MB-28MB/15MB-19MB-24MB over 31)
             Top: 23% (19MB-22MB-28MB/15MB-19MB-24MB over 31)
      (Last Act): 77% (9.7MB-14MB-20MB/7.5MB-11MB-18MB over 8)
        (Cached): 0.02%
  * com.google.android.apps.magazines / u0a59:
           TOTAL: 3.6% (10MB-10MB-10MB/8.7MB-9.0MB-9.0MB over 6)
          Imp Bg: 0.03%
         Service: 3.6% (10MB-10MB-10MB/8.7MB-9.0MB-9.0MB over 6)
        (Cached): 17% (9.9MB-10MB-10MB/8.7MB-8.9MB-9.0MB over 5)
  * com.android.defcontainer / u0a5:
           TOTAL: 1.4% (2.7MB-3.0MB-3.0MB/1.9MB-1.9MB-1.9MB over 7)
             Top: 1.2% (3.0MB-3.0MB-3.0MB/1.9MB-1.9MB-1.9MB over 6)
          Imp Fg: 0.19% (2.7MB-2.7MB-2.7MB/1.9MB-1.9MB-1.9MB over 1)
         Service: 0.00%
        (Cached): 15% (2.6MB-2.6MB-2.6MB/1.8MB-1.8MB-1.8MB over 1)
  * com.google.android.youtube / u0a78:
           TOTAL: 1.3% (9.0MB-9.0MB-9.0MB/7.8MB-7.8MB-7.8MB over 1)
          Imp Bg: 1.0% (9.0MB-9.0MB-9.0MB/7.8MB-7.8MB-7.8MB over 1)
         Service: 0.27%
      Service Rs: 0.01%
        Receiver: 0.00%
        (Cached): 99% (9.1MB-9.4MB-9.7MB/7.7MB-7.9MB-8.1MB over 24)
  * com.google.android.gms / u0a8:
           TOTAL: 0.91% (9.2MB-9.2MB-9.2MB/7.6MB-7.6MB-7.6MB over 1)
          Imp Bg: 0.79% (9.2MB-9.2MB-9.2MB/7.6MB-7.6MB-7.6MB over 1)
```

```
        Service: 0.11%
       Receiver: 0.00%
       (Cached): 99% (8.2MB-9.4MB-10MB/6.5MB-7.6MB-8.1MB over 25)
  * com.google.android.gm / u0a44:
          TOTAL: 0.56%
         Imp Bg: 0.55%
        Service: 0.01%
       Receiver: 0.00%
       (Cached): 99% (11MB-13MB-14MB/10MB-12MB-13MB over 24)
  * com.google.android.apps.plus / u0a70:
          TOTAL: 0.22%
         Imp Bg: 0.22%
        Service: 0.00%
       Receiver: 0.00%
       (Cached): 100% (38MB-40MB-41MB/36MB-38MB-39MB over 17)
  * com.google.android.apps.docs / u0a39:
          TOTAL: 0.15%
         Imp Bg: 0.09%
        Service: 0.06%
       (Cached): 54% (13MB-14MB-14MB/12MB-12MB-13MB over 17)
  * com.google.android.music:main / u0a62:
          TOTAL: 0.11%
         Imp Bg: 0.04%
        Service: 0.06%
       Receiver: 0.01%
       (Cached): 70% (7.7MB-10MB-11MB/6.4MB-9.0MB-9.3MB over 20)
  * com.google.android.apps.walletnfcrel / u0a24:
          TOTAL: 0.01%
       Receiver: 0.01%
       (Cached): 69% (8.1MB-8.4MB-8.6MB/7.0MB-7.1MB-7.1MB over 13)
  * com.google.android.setupwizard / u0a19:
          TOTAL: 0.00%
       Receiver: 0.00%
       (Cached): 69% (2.7MB-3.2MB-3.4MB/1.8MB-2.0MB-2.2MB over 13)

Run time Stats:
  SOff/Norm: +1h43m29s710ms
  SOn /Norm: +1h37m14s290ms
      TOTAL: +3h20m44s0ms

         Start time: 2013-11-06 07:24:27
  Total elapsed time: +3h42m23s56ms (partial) libdvm.so chromeview
```

Example output of **dumpsys procstats --hours 3** command, showing memory details for processes running in the background over the past ~3 hours.

The percentages tell you how much of the overall time each process has spent in various key states. The memory numbers tell you about memory samples in those states, as `minPss-avgPss-maxPss / minUss-avgUss-maxUss`. The procstats tool also has a number of command line options to control its output — use `adb shell dumpsys procstats -h` to see a list of the available options.

Comparing this raw data from procstats with the visualization of its data we previously saw, we can see that it is showing only process run data from a subset of states: Imp Fg, Imp Bg, Service, Service Rs, and Receiver. These are the situations where the process is actively running in the background, for as long as it needs to complete the work it is doing. In terms of device memory use, these are the process states that tend to cause the most trouble: apps running in the background taking RAM from other things.

Getting started with procstats

We have already found the new procstats tool to be invaluable in better understanding the overall memory behavior of Android systems, and it has been a key part of the Project Svelte effort in Android 4.4.

As you develop your own applications, be sure to use procstats and the other tools mentioned here to help understand how your own app is behaving, especially how much it runs in the background and how much RAM it uses during that time.

More information about how to analyze and debug RAM use on Android is available on the developer page Investigating Your RAM Usage.

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Posted by Android Developers at 11:07 AM Links to this post
Labels: Android 4.4, Development Tools, Efficient Apps, Memory Management

09 JANUARY 2014

Google Play Services 4.1

The latest release of Google Play services is now available on Android devices worldwide. It includes new Turn Based Multiplayer support for games, and a preliminary API for integrating Google Drive into your apps. This update also improves battery life for all users with Google Location Reporting enabled.

You can get started developing today by downloading the Google Play services SDK from the SDK Manager.

Turn Based Multiplayer

Play Games now supports turn-based multiplayer! Developers can build asynchronous games to play with friends and auto-matched players, supporting 2-8 players per game. When players take turns, their turn data is uploaded to Play Services and shared with other players automatically.

We are also providing an optional new “Connecting to Play Games” transition animation during sign-in, before the permission dialog appears. This helps contextualize the permission dialog, especially in games that ask for sign in on game start.

Google Drive

This version of Google Play Services includes a developer preview of the new Google Drive API for Android. You can use it to easily read and write files in Google Drive so they're available across devices and on the web. Users can work with files offline too — changes are synced with Google Drive automatically when they reconnect.

The API also includes common UI components including a file picker and save dialog.

Google Mobile Ads

With Google Play services 4.1, the Google Mobile Ads SDK now fully supports DoubleClick for Publishers, DoubleClick Ad Exchange, and Search Ads for Mobile Apps. You can also use a new publisher-provided location API to provide Google with the location when requesting ads. Location-based ads can improve your app monetization.

Google+

An improved Google+ sharing experience makes it even easier for users to share with the right people from your app. It includes better auto-complete and suggested recipients from Gmail contacts, device contacts and people on Google+.

More About Google Play Services

To learn more about Google Play services and the APIs available to you through it, visit the Google Services area of the Android Developers site. Details on the APIs are avaialble in the API reference.

For information about getting started with Google Play services APIs, see Set Up Google Play Services SDK

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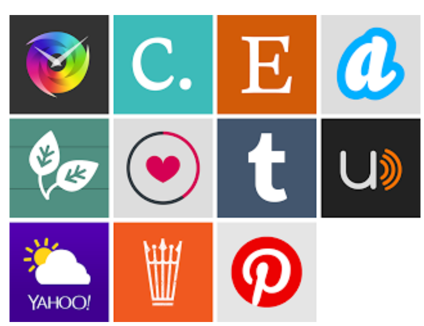
Posted by Android Developers at 2:26 PM Links to this post
Labels: Google Drive, Google Mobile Ads, Google Play game services, Google Play services, Google+

26 DECEMBER 2013

The Beautiful Design Winter 2013 Collection on Google Play

Posted by Marco Paglia, Android Design Team



While beauty’s in the eye of the beholder, designing apps for a platform also requires an attention to platform norms to ensure a great user experience. The Android Design site is an excellent resource for designers and developers alike to get familiar with Android’s visual, interaction, and written language. Many developers have taken advantage of the tools and techniques provided on the site, and every now and then we like to showcase a few notable apps that go above and beyond the guidelines.

This summer, we published the first Beautiful Design collection on Google Play. Today, we’re refreshing the collection with a new set of apps just in time for the holiday season.

As a reminder, the goal of this collection is to highlight beautiful apps with masterfully crafted design details such as beautiful presentation of photos, crisp and meaningful layout and typography, and delightful yet intuitive gestures and transitions.

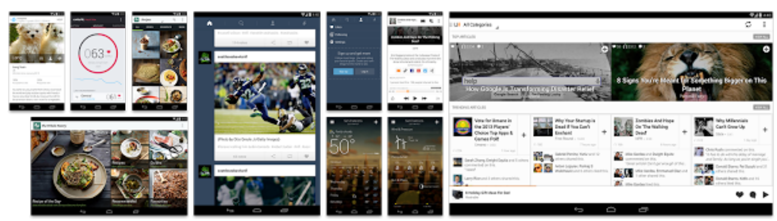
The newly updated **Beautiful Design Winter 2013 collection** includes:

Timely *(by Bitspin)*, a clock app that takes animation to a whole new level. Screen transitions are liquid smooth and using the app feels more like playing with real objects than fussing around with knobs and buttons. If you've ever wondered if setting an alarm could be fun, Timely unequivocally answers "yes".

Circa, a news reader that's fast, elegant and full of beautiful design details throughout. Sophisticated typography and banner image effects, coupled with an innovative and "snappy" interaction, makes reading an article feel fast and very, very fun.

Etsy, an app that helps you explore a world of wonderful hand-crafted goods with thoughtfully designed screen transitions, beautifully arranged layouts, and subtle flourishes like a blur effect that lets you focus on the task at hand. This wonderfully detailed app is an absolute joy to use.

Airbnb, **The Whole Pantry**, **Runtastic Heart Rate Pro**, **Tumblr**, **Umano**, **Yahoo! Weather**… each with delightful design details.



Grand St. and **Pinterest**, veterans of the collection from this summer.

If you're an Android developer, make sure to play with some of these apps to get a sense for the types of design details that can separate good apps from great ones. And remember to review the Android Design guidelines and the Android Design in Action video series for more ideas on how to design your next beautiful Android app.

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Posted by Android Developers at 11:26 AM Links to this post
Labels: Android Design, Google Play

12 DECEMBER 2013

Changes to the SecretKeyFactory API in Android 4.4

Posted by Trevor Johns, Android Developer Relations team

In order to encrypt data, you need two things: some data to encrypt and an encryption key. The encryption key is typically a 128- or 256-bit integer. However, most people would rather use a short passphrase instead of a remembering a 78-digit number, so Android provides a way to generate an encryption key from ASCII text inside of `javax.crypto.SecretKeyFactory`.

Beginning with Android 4.4 KitKat, we've made a subtle change to the behavior of `SecretKeyFactory`. **This change may break some applications** that use symmetric encryption and meet all of the following conditions:

1. Use `SecretKeyFactory` to generate symmetric keys, and
2. Use PBKDF2WithHmacSHA1 as their key generation algorithm for `SecretKeyFactory`, and
3. Allow Unicode input for passphrases

Specifically, PBKDF2WithHmacSHA1 only looks at the lower 8 bits of Java characters in passphrases on devices running Android 4.3 or below. Beginning with Android 4.4, we have changed this implementation to use all available bits in Unicode characters, in compliance with recommendations in PCKS #5.

Users using only ASCII characters in passphrases will see no difference. However, passphrases using higher-order Unicode characters will result in a different key being generated on devices running Android 4.4 and later.

For backward compatibility, we have added a new key generation algorithm which preserves the old behavior: `PBKDF2WithHmacSHA1And8bit`. Applications that need to preserve compatibility with older platform versions (pre API 19) and meet the conditions above can make use of this code:

```
import android.os.Build;

SecretKeyFactory factory;
if (Build.VERSION.SDK_INT >= Build.VERSION_CODES.KITKAT) {
   // Use compatibility key factory -- only uses lower 8-bits of passphrase chars
   factory = SecretKeyFactory.getInstance("PBKDF2WithHmacSHA1And8bit");
} else {
   // Traditional key factory. Will use lower 8-bits of passphrase chars on
   // older Android versions (API level 18 and lower) and all available bits
   // on KitKat and newer (API level 19 and higher).
   factory = SecretKeyFactory.getInstance("PBKDF2WithHmacSHA1");
}
```

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Posted by Android Developers at 1:03 PM Links to this post
Labels: Android 4.4, Security

11 DECEMBER 2013

New Tools to Take Your Games to the Next Level

In this mobile world, games aren't just for the hardcore MMOG fan anymore, they're for everyone; in fact, three out of four people with an Android phone or tablet play games. If you're a game developer, Google has a host of tools available for you to help take your game to the next level, including Google Play game services, which let's you leverage Google's strength in mobile and cloud services so you can focus on building compelling game experiences for your users. Today, we're adding more tools to your gaming toolbox, like the open sourcing of a 2D physics library, as well as new features to the Google Play game services offering, like a plug-in for Unity.

LiquidFun, a rigid-body physics library with fluid simulation

First, we are announcing the open-source release of LiquidFun, a new C++ 2D physics library that makes it easier for developers to add realistic physics to their games.

Based on Box2D, LiquidFun features particle-based fluid simulation. Game developers can use it for new game mechanics and add realistic physics to game play. Designers can use the library to create beautiful fluid interactive experiences.

The video clip below shows a circular body falling into a viscous fluid using LiquidFun.

The LiquidFun library is written in C++, so any platform that has a C++ compiler can benefit from it. To help with this, we have provided a method to build the LiquidFun library, example applications, and unit tests for Android, Linux, OSX and Windows.

We're looking forward to seeing what you'll do with LiquidFun and we want to hear from you about how we can make this even better! Download the latest release from our LiquidFun project page on GitHub and join our discussion list!

Google Play Games plug-in for Unity

If you are a game developer using Unity, the cross-platform game engine from Unity Technologies, you can now more easily integrate game services using a new Google Play Games plug-in for Unity. This initial version of the plug-in supports sign-in, achievements, leaderboards and cloud save on Android and iOS. You can download the plug-in from the Play Games project page on GitHub, along with documentation and sample code.

New categories for games in Google Play

New game categories are coming to the Play Store in February 2014, such as Simulation, Role Playing, and Educational! Developers can now use the Google Play Developer Console to choose a new category for their apps if the Application Type is "Games". The New Category field in the Store Listing will set the future category for your game. This will not change the category of your game on Google Play until the new categories go live in February 2014.

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Posted by Android Developers at 11:25 AM Links to this post
Labels: Games, Google Play game services, LiquidFun, NDK, Physics

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