Android Developer Codelab

You can help develop the most widely installed operating system in the history of Earth. Yes, you're here to embark upon the journey of becoming an Android platform engineer.

Although the path is challenging, the Android team strives to simplify your journey, every release. And the team makes improvements every day through direct work in the Android Open Source Project (AOSP).

So sit back, fire up a terminal, and let's make history.

[Goals]

The mission of this codelab is:

1. To give you a idea of what the developer workflow is like for Android engineers working on the platform (the operating system).

[Environment]

Typically, users build and develop on the workstation directly. Because you may be working in various terminals, and many of the commands used are terminal-specific, you will need to rerun them in each terminal session. Specifically, these include the `source build/envsetup.sh` and `lunch` commands.

[Build the code]

To build Android, you must select a target device type to build with the `lunch` command. A target is a device permutation, such as a specific model or form factor.

The device target included below, `aosp_cf_x86_64_phone-userdebug`, enables you to build the Cuttlefish virtual Android device for testing without a physical device.

To build and update a physical device instead, choose another target and follow the instructions for flashing devices.

1. Set up your environment for building Android devices by running the following command from the root of your source code checkout:

   ```
   cd ~/aosp

   source build/envsetup.sh
   ```

2. Pass the build target to the lunch command, like this:

   ```
   lunch aosp_cf_x86_64_phone-userdebug
   ```

3. Build the code from anywhere in your checkout with:

   ```
   m
   ```

Expect the first build to take hours. Subsequent builds take significantly less time.

[Create an Acloud instance]

Acloud is a command-line tool in AOSP that assists users in creating virtual Android devices, in this case Cuttlefish.

If you're in the same terminal session used to build the code, proceed. Otherwise, rerun the `envsetup.sh` script and the same `lunch` command you used there first. Then

1. Create an Acloud local instance with:

   ```
   acloud create --local-image --local-instance
   ```

2. Accept updates to required packages.
3. If prompted, restart your workstation for all changes to take effect.
4. Select the Cuttlefish device.

You should be greeted with a VNC session containing an Android device!

You can interact with the virtual device on your workstation using your mouse and keyboard. You can also follow the activity within the logs while you use your device by employing the Android Debug Bridge (adb) `logcat` command:

```
adb logcat
```

Make a change

Update the source code following this example changelist.

1. From the root of your checkout (`aosp/` directory), navigate to the `frameworks/native` Git project:

   ```
   cd frameworks/native
   ```

2. Start a temporary project with this command:

   ```
   repo start <some-name> .
   ```

3. Edit `SurfaceFlinger.cpp` to include the updates from the changelist at the following location:

   ```
   aosp/frameworks/native/services/surfaceflinger/SurfaceFlinger.cpp
   ```

4. Find these two lines:

   ```
   postFrame();
   postComposition();
   ```

5. Replace those two lines with the following:

   ```
   postFrame();
   postComposition();
   mClientColorMatrix = mat4(vec4,
                             vec4);
   updateColorMatrixLocked();
   ```

6. Build the code:

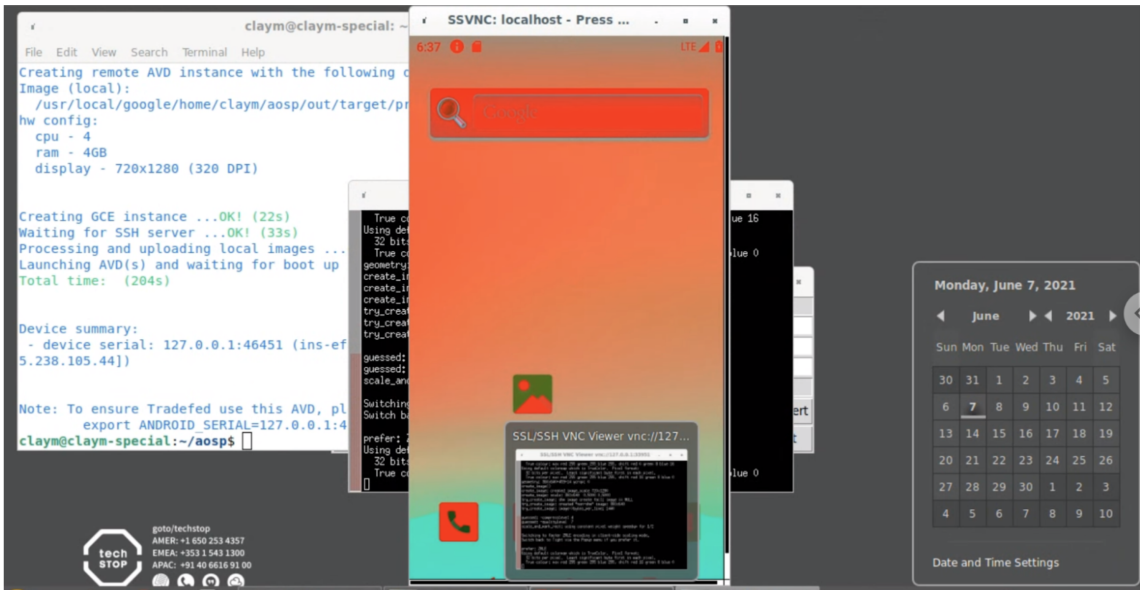
   ```
   m
   ```

7. Update the build on the device:

```
adb root
adb remount
adb sync
adb reboot
acloud reconnect
```

8. If you're prompted to select a device, choose the one that shows the shortest elapsed time. (This is probably the last one in the list you see.) To see all virtual device instances, use the `acloud list` and `acloud list -v` commands.

Verify that you see a color change on your selected device similar to what shows in Figure 1.



```
claym@claym-special: ~
File  Edit  View  Search  Terminal  Help
Creating remote AVD instance with the following c
Image (local):
  /usr/local/google/home/claym/aosp/out/target/pr
hw config:
  cpu - 4
  ram - 4GB
  display - 720x1280 (320 DPI)


Creating GCE instance ...OK! (22s)
Waiting for SSH server ...OK! (33s)
Processing and uploading local images ...
Launching AVD(s) and waiting for boot up
Total time:  (204s)


Device summary:
 - device serial: 127.0.0.1:46451 (ins-ef
5.238.105.44])


Note: To ensure Tradefed use this AVD, pl
        export ANDROID_SERIAL=127.0.0.1:4
claym@claym-special:~/aosp$
```

Figure 1. Screen appearance after successful color change

[Test your code]

This portion of the codelab utilizes an example test that's in the source tree and is failing. This employs Atest for running the test locally and testing the code.

To use the test, follow these instructions:

1. Run:

```
atest DevCodelabTest
```

2. The test will fail. To fix it, find the source code of the failing test:

```
atest --info android.test.example.devcodelab.DevCodelabTest#testHelloWorld
```

3. Then look here

```
platform_testing/tests/example/devcodelab
```

4. To get the file to edit, take the name of the test in `android.test.example.devcodelab.DevCodelabTest` and replace the `.` with `/`, to get this result:

   ```
   src/android/test/example/devcodelab/DevCodelabTest.java
   ```

5. Then edit

   ```
   platform_testing/tests/example/devcodelab/src/android/test/example/devcodelab/Dev
   ```

   to replace

   ```
   Assert.assertTrue(false)
   ```

   with

   ```
   Assert.assertTrue(true)
   ```

6. Run the test again to verify you fixed the issue:

   ```
   atest DevCodelabTest
   ```

[Upload your code for review]

Repo simplifies Git usage by bundling commands such as `git clone` to work across numerous Git repositories (or projects) at once.

See Source Control Tools for overviews of Git and Repo, with links to full documentation on working with Android source code. See the AOSP repository for the full list of Git projects and the individual projects (paths) for branches associated with each project.

For code review of your projects in Git, you'll use the Gerrit web-based code review system.

Important: Ensure that you're signed into Gerrit to view and respond to changes.

1. Assuming you made your changes in the `frameworks/native` project, run these commands to upload them:

   ```
   cd frameworks/native
   repo start codelab .
   git add .
   git commit
   ```

2. For your commit message, enter the following:

   ```
   Android codelab change
   Test: manual atest
   ```

3. Upload your change:

   ```
   repo upload
   ```

If you're successful, you see a message resembling this one:

```
Upload project frameworks/native/ to remote branch master:
  branch codelab ( 1 commit, Wed Aug 7 09:32:33 2019 -0700):
         ff46b36d android codelab change
to https://android-review.googlesource.com/ (y/N)? y
remote: Processing changes: refs: 1, new: 1, done
remote:
remote: SUCCESS
remote:
remote:   https://android-
review.googlesource.com/c/platform/frameworks/native/+/1098432 android codelab change
[NEW]
remote:
To https://android-review.googlesource.com/platform/frameworks/native
 * [new branch]          codelab -> refs/for/master
```

[View your change in Gerrit]

Go to the link, printed in the terminal, that resembles this one:

```
https://android-review.googlesource.com/c/platform/frameworks/native/+/1098432
```

This completes the starter codelab for Android platform development. See Submitting Patches for next steps, and for full details on developing Android, see the rest of this site.

[Revert your change]

Normally, post-testing and upon review and approval, you submit your change in Gerrit and merge it into the repository.

Instead, for the purposes of this codelab, revert your changelist by clicking **Abandon** in Gerrit.

Then abandon the associated temporary branch in the `frameworks/native` project directory (or its subdirectories):

```
repo abandon codelab .
```

Remember also to revert the changes you made to the test file. Since you didn't `repo start`, `git commit`, and `repo upload` the change, you can reset the file itself. Assuming you're in the `aosp/platform_testing directory`, use the following to reset the file:

```
git reset HEAD
tests/example/devcodelab/src/android/test/example/devcodelab/DevCodelabTest.java
git checkout .
```

At this point, you're done! Nice work!