More Effective Testing on Android Devices

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More Effective Testing on Android Devices
Don’t - if you can avoid it
Best - JUnit tests on JVM

Pros

- Cacheable in most build systems
- Multiple orders of magnitude faster
- Nudges tests to unit test scope

Cons

- Requires refactoring to pure JVM projects / isolation from android.* APIs
Best - JUnit tests on JVM

Tips

- Run multiple tests at once `maxParallelForks`
- Gradle Enterprise test distribution
Robolectric

A framework for running Android tests on JVM.

Built from Android source code with additional fakes.

Google-employee maintainers, but not an Google-owned product
Good - Robolectric tests

Pros

- Cacheable
- Multiple orders of magnitude faster
- Able to test components that have Android tie-ins
- Easily fake system state (e.g. WiFi off)

Cons

- Not an accurate representation of a real Android device
- Google support is shaky
Good - Roboelectric tests

Tips

- Cache system image downloads in CI
- Try to minimize Android API usage
- 4.10 support @GraphicsMode(NATIVE)
Okay - Activity-less on device

Pros

- Can be <100ms per test method
- Testing real Android behavior

Cons

- No caching* unless using Gradle Managed Devices (GMD) or custom runner
- Sharding on through multiple connected devices
- Flaky due to device instability
If you must - with Activity on device

Pros

- Testing real Android behavior

Cons

- Really slow
- No caching* unless using GMD or custom runner
- Sharding on through multiple connected devices
- Flaky due to device instability
Robolectric tests

JUnit tests on JVM

Activity-less tests

UI tests

Fidelity

Performance
Test Stability Highly Important

- Flaky JVM tests are bad, flaky Android tests are worse
- Disable/delete flaky tests as running them has high costs
- State clean-up (e.g. @After)
- Factory reset or Android User Profiles in custom lab
On Device Tips
Only run what you need

- AOSP system images
  - Disable noisy applications (adb shell pm disable-user)
- Automated Test Devices (ATD) images
Modularize Tests Along With Features

- Splitting tests allows to shard
- Less interference between tests
AndroidX case study
Build Time at Bay

Mean time spent per presubmit run

Test Time Continuing to Grow

Mean time spent per presubmit run

- Mean End-to-End time
- Mean Bottleneck Build Time
- Mean Bottleneck Test Time
Key Insight on APK checksums

Test results don’t change if both application and test APKs are the same

Combined with modularization → higher hit rate
Unstable APK generation

- baseline.profm (issuetracker.google.com/issues/231837768)
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- shadow jar including incremental kotlin data (r.android.com/2089482)
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- r8 + API 34 record types regression
Caching

APK checksum result caching
Migration From Custom Lab to Firebase Test Lab

Caching
APK checksum result caching

Sharding
from n devices to run m APK sets → 1:1
Migration From Custom Lab to Firebase Test Lab

Caching
APK checksum result caching

Sharding
from $n$ devices to run $m$ APK sets $\rightarrow$ 1:1

Isolation
multiple APKs sets per device $\rightarrow$ dedicated device per APK set
Effects on Mean Time

Mean time spent per presubmit run

- Mean End-to-End time
- Mean Bottleneck Build Time
- Mean Bottleneck Test Time
What’s next?

- Replace FTL shard retries to per method retries
- Emulator stability work
Thanks!