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Reptor: Realizing API Virtualization on Android

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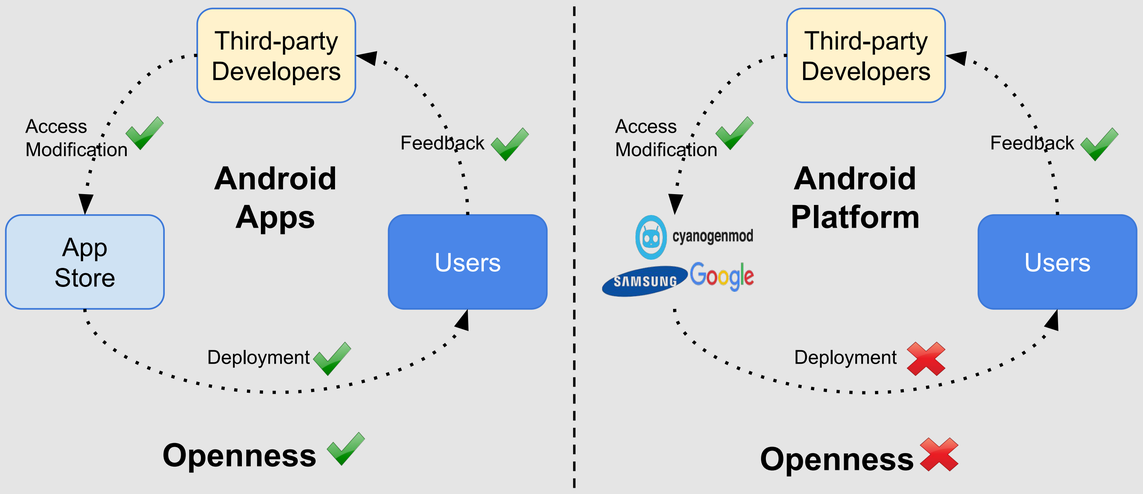
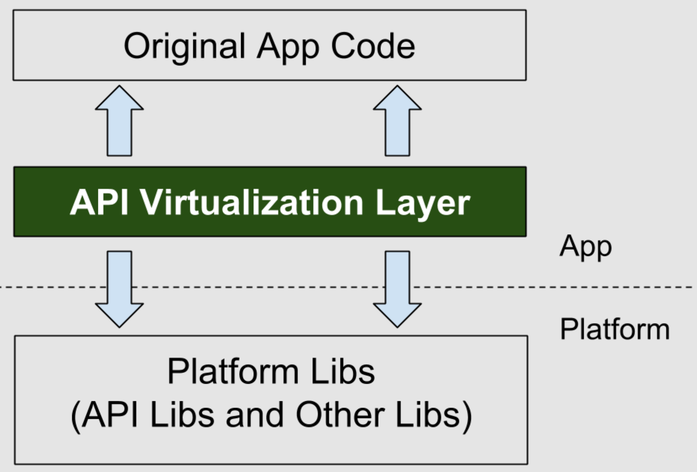
Motivation



❖ **Openness spurs innovation in system research.**

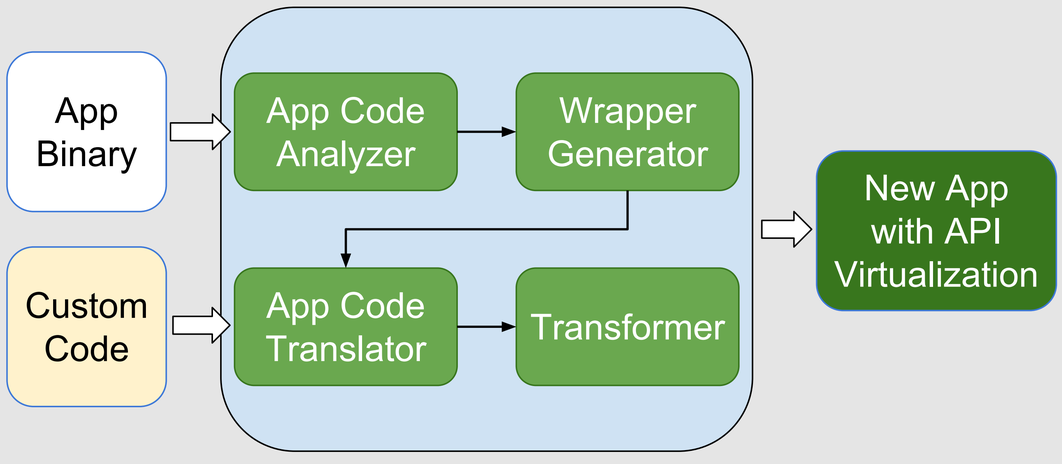
- ❑ Observation 1: Innovation in app space is widely open to third parties.
- ❑ Observation 2: Distribution of Android platform-level modifications is a stiff barrier to open innovation. Only a select few vendors can control the innovation on Android.

Proposal



- ❑ A set of wrapper classes injected into an app
- ❑ A wrapper class for each platform API class that a third-party developer wants to replace
- ❑ Rewriting the app so that the app code uses wrapper classes instead of platform API classes
- ❑ Interception of any and every platform API call made by an app

Reptor Overview



- ❑ A third-party developer provides an app binary and custom code that want to be injected as input to Reptor.
- ❑ Once Reptor finishes, the developer obtains a modified app with new behavior as intended via the code injection.

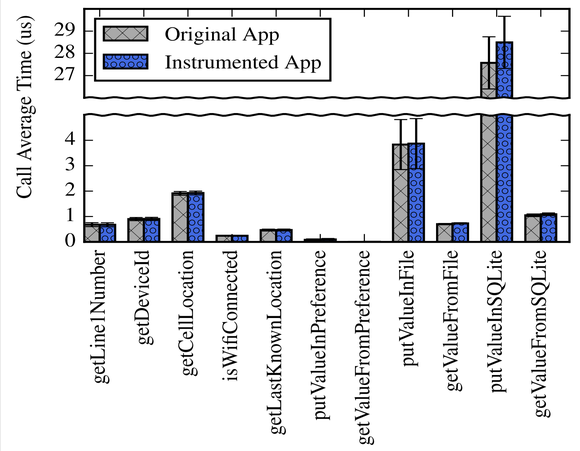
Contribution

- ❑ Mitigating the lack of openness in mobile systems by proposing a new technique called API Virtualization
- ❑ Exploring and addressing a unique set of challenges that API Virtualization brings in order to correctly and completely handle all features of Android and Java.
- ❑ Realizing the API Virtualization prototype, and showing its feasibility and practicality

Reptor Performance

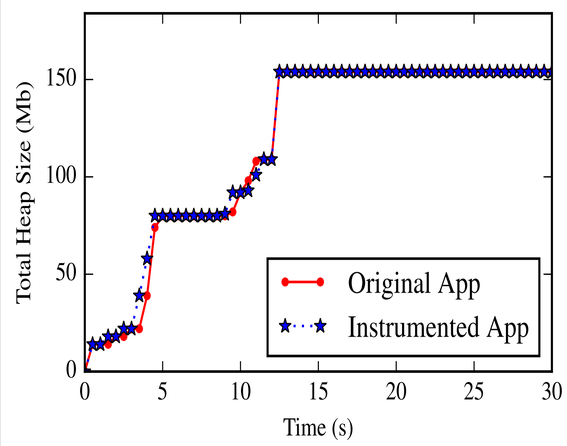
- ❑ Samsung Galaxy Nexus Devices running Android 4.4
- ❑ Stay-awake mode enabled
- ❑ CPU governor set to “Performance”

Call Latency to Invoke Android Platform Methods



- ❑ To measure call latency, we use a micro-benchmark app that calls eleven platform methods from four categories: device information, network, storage, and sensing (GPS).

Heap Usage of Temple Run



- ❑ To measure runtime memory usage, we use one popular game that uses accelerometer and gyroscopes on a mobile phone for game play and contains a heavy UI component.

Power Consumption Measurement

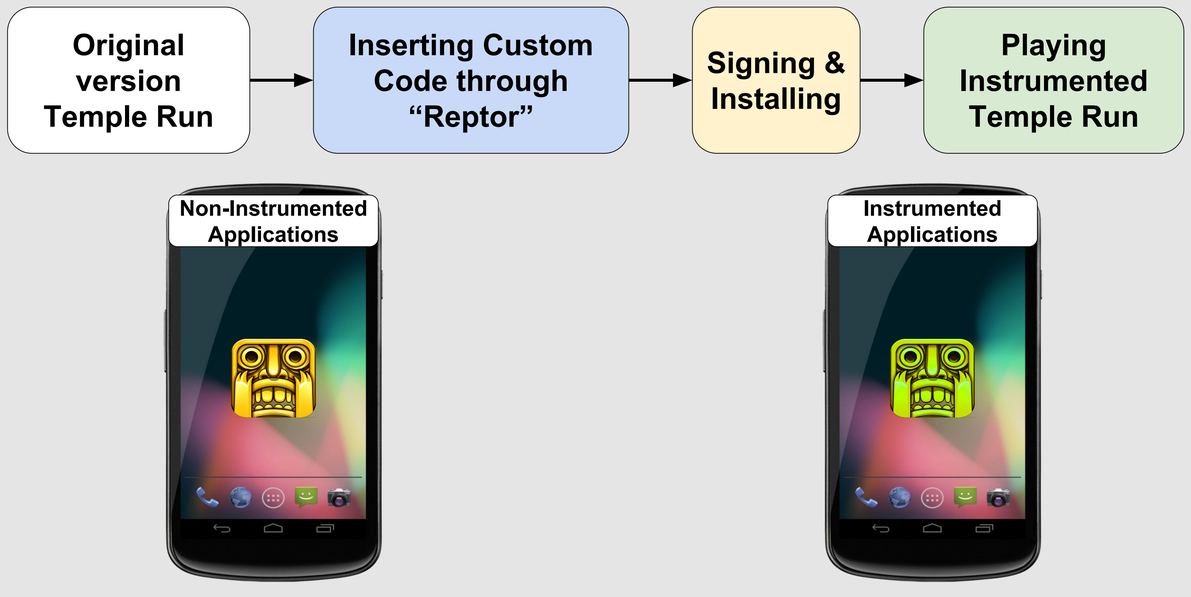
App Name	Average Consumption (10 minutes / 5 runs)	Std. Deviation
TempleRun	991.5J	29.5J
TempleRun*	992.95J	22.3J

Instrumentation Statistics

App Name	#Class	APK Size	Instrumenting Time
TempleRun	1213	23.8M	N/A
TempleRun*	2689	24.7M	26.44 (sec)

* Denotes an instrumented app.

Demo Workflow



Both the non-instrumented and instrumented version are installed on Samsung Galaxy Nexus running Android version 4.4.

- **Play the non-instrumented and instrumented version of Temple Run.**
- **Compare the performance.**
- **Scan to watch Reptor demo video.**

RMS Lab: https://nsr.cse.buffalo.edu/