Android Games Analysis – Why does my playtime reduce my talk time?

Project Status Report

Team Hunger-Games

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Brief Revisit

Now-a-days smartphones have become very common in households. Games account for 16% of the total time spent on mobile apps in the US. Mobile games are one of the biggest sources of mass entertainment these days. It appeals to a diverse group of audience ranging from young to old people across the world. Social games, puzzles and board games account for 77% of the played games on smartphones.

However mobile games are heavy and consume huge amount of memory (RAM), Storage Space, Data and most importantly Battery. This makes them kill the phone battery and reduce the talk time of the phone which results in smartphones not lasting even one full day of charge. The light casual and social games are connected to internet all the time and also cause battery drain on phones. In this project we intend to study the smartphone resource consumption by games and come up with the main issues which cause battery drain.

From the industry perspective, our project will help mobile app developers to improve their games and consume smartphone resources efficiently thus increasing games usage stats and revenues. From a consumer point of view, users will play games and still not require charging their phones often thus making better use of the mobile charge and the data plans.

Milestones Accomplished

1. Games Identified

After some research we have finalized 2 games for the course of this study:

1. Farm Heroes Saga - We selected this game as it is one of the most popular games in Google Play Store. It is a social game which can be played both online as well as offline. This gives us an opportunity to compare resource usage in both scenarios. It is also a graphics intensive game.
2. 2048 - 2048 is also a highly popular game on Google Play Store. It also supports both online and offline versions. However unlike Farm Heroes Saga, 2048 is a casual game which does not require heavy graphic rendering.

2. Tools Identified

ARO

ARO is a free diagnostic tool which can pinpoint the source of wasteful data and power drains. It also gives useful suggestions about the ways for fixing these issues. Majorly, ARO will be used for capturing game-related traces from the smartphone and analyze the associated TCP connections and data traffic.

Wakelock Detector

Wakelock detector will be used to detect wakelock issues in the games. Wakelock Detector app needs root permissions to execute.

Power Tutor

Power tutor tool gives 5 minute duration graphs for CPU, Memory, Screen rotation and GPU. These details will help measure and monitor the effects of the games on the resources of the smartphone.

UseMon

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3. Test Subjects

ARO needs rooted phone for remote data collection. ARO also supports data collection on a phone without rooting via the USB debugging mode. So we are using the USB debugging mode for our project. Hence, test subjects will not be required for specifically collecting data. Moreover the resource consumption of the game is not dependent upon expertise of player.

4. Test Cases Identified

We have identified the test cases which we will be testing in the current scope of our project. Each test will be recorded over duration of 5 min. These test cases are listed in the following table.

Table 1: Scenario Listing

Scenario #	Description	Network Channel	Game
Scenario 1	Game Screen On, Idle	No Internet/Wi-Fi/LTE	Farm Heroes Saga 2048
Scenario 2	Game Playing	No Internet/Wi-Fi/LTE	Farm Heroes Saga 2048
Scenario 3	Ad Statistics	Wi-Fi/LTE	Farm Heroes Saga 2048
Scenario 4	Sensor Statistics	-	Farm Heroes Saga 2048

Scenario 5	Tab vs. Mobile	-	Farm Heroes Saga 2048
Scenario 6	User Privacy	-	Farm Heroes Saga 2048

5. Tests Completed and Results

Test #	Description	Network Channel	Game
Test 1	Game Screen On, Idle	No Internet	Farm Heroes Saga

- Energy Consumed: 252.32 J / 5 mins
- Low Energy Efficiency (0.9 J/kb)
- Signaling Overhead: 0 (Due to no internet connectivity)

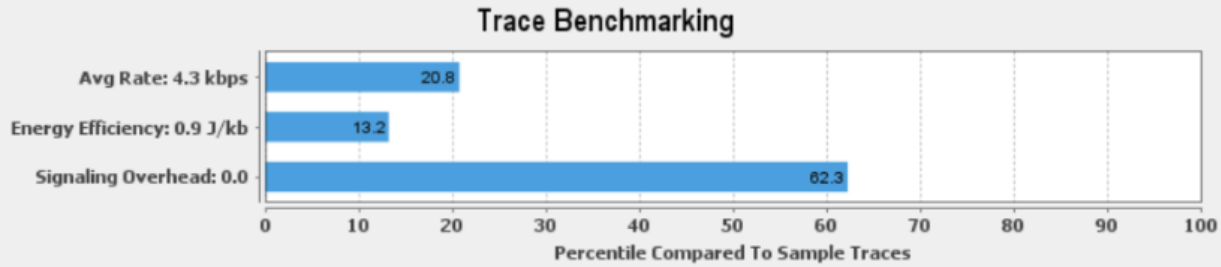

Figure 1: Screen Idle Test without Internet: Trace Benchamark as captured by ARO

- Game has overridden the default screen timeout setting (30 sec) of android. The screen remains ON all the time even when the game is idle, thus consuming more energy.

Test 2	Game Screen On, Idle	Wi-Fi	Farm Heroes Saga

- Energy Consumed: 412.39 J / 5 mins
- Energy Efficiency (0.6 J/kb)
- Signaling Overhead: 0.1 (Low score)

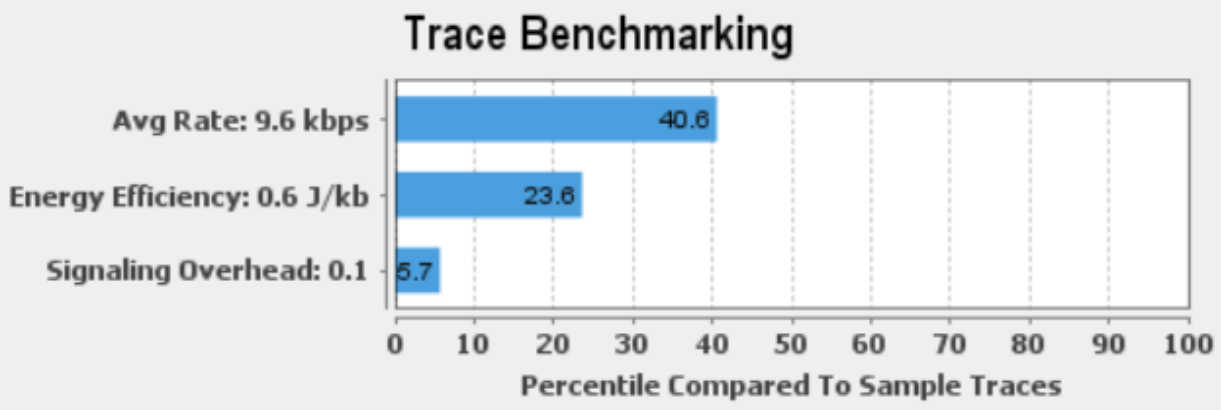

Figure 2: Screen Idle Test with Wi-Fi: Trace Benchmark as captured by ARO

- Total Data transferred by game: 173,167 bytes
- Total packets transferred by game: 551 packets

- Connections count: 26 connections
  Even though the game is idle, it connects to the domain farmheroesmobile.king.com 26 times.
- Game has overridden the default screen timeout setting (30 sec) of android. The screen remains ON all the time even when the game is idle, thus consuming more energy.
- RRC States analysis
  Even though the game is idle, it remains in DCH state for 38.91% and in FACH state for 43.66% of the time.

Test 3	Game Screen On, Idle	LTE	Farm Heroes Saga

- Energy Consumed: 495.27 J / 5 mins
- Energy Efficiency (0.6 J/kb)
- Signaling Overhead: 0.0

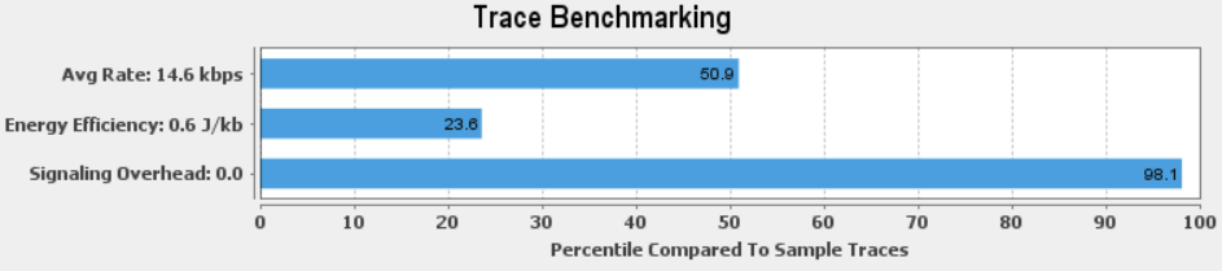

Figure 3: Screen Idle Test with LTE: Trace Benchmark as captured by ARO

- Total Data transferred by game: 198,515 bytes
- Total packets transferred by game: 657 packets
- Connections count: 31 connections
  Even though the game is idle, it connects to the domain farmheroesmobile.king.com 31 times.
- RRC States analysis
  Even though the game is idle, it remains in Long DRX state for 77.05% and in short DRX for 1.32% of the time. Overall it stays in connected mode (High Power mode) for 94.12% of the time.

6. Summary

So far, we have completed testing scenario 1 [Table 1] for Farm Heroes Saga. Throughout the current tests it was found that the screen does not turn OFF which leads to wastage of energy. Even without any activity in game, it keeps connecting to the domain farmheroesmobile.king.com which increases data usage. For the scenario when the game is idle, the energy consumption varies when the smartphone is connected to Wi-Fi, LTE and not connected to internet. It increases with 252.32 J with no internet, 412.39 J for Wi-Fi and 495.27 J with LTE connections respectively. From figure 4 and 5 it can be seen that even though the game is idle, Wi-Fi registers several transitions between IDLE, FACH and DCH while LTE remains in a high powered state throughout the test duration.

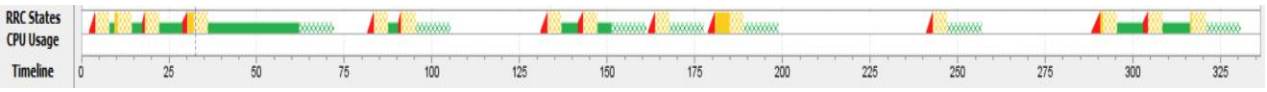

Figure 4: Screen Idle Test with Wi-Fi: RRC state transition for Wi-Fi

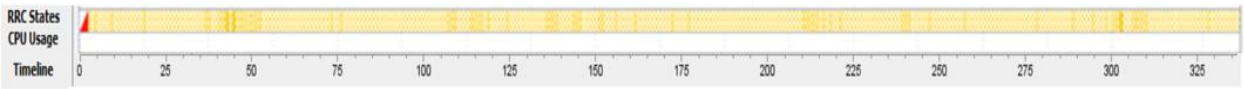

Figure 5: Screen Idle Test with LTE: RRC state transition for LTE

Deviation

Due to unforeseen challenges the project timeline was delayed by a few weeks. The initial design, tools identification, games finalization and hardware acquisition was successfully completed with the estimated timeline. However, we faced issues while installing ARO and learning how to use it. Owing to this delay, the design phase was successfully completed by Mar 8, 2015.

As we are not considering test subjects anymore, we have clubbed the Data Collection and Evaluation phase. This is also because we are, as yet unable to store the complete traces from ARO for later evaluation.

Thus far, our project timeline has been delayed by 2.5 weeks. The challenges we faced have been highlighted in more detail in the following section.

Key Challenges

1. ARO installation – Installed along with all the support tools – 3 tools include names. However there is an error after every test. – Screenshot.
2. Test traces storage problem – Not able to figure out how to store complete trace.
3. PCAP file analysis giving error
4. ADB and drivers issue – For every test device the issue occurs.
5. Game data isolation – Even after all the applications are closed, there are many other applications and IP addresses communicating via the smartphone which is difficult to isolate.
6. Unavailability of a good tool to record sensor data over a period of time.
7. We are searching for a Sensor data collection tool.

Updated Timeline

- ### Design Phase:

Feb 13, 2015 – Mar 8, 2015: *Design*

Identifying test subjects.

Initial Design, Tools and installations.

Games finalization

Hardware acquisition (SIM and phones if required)

- Implementation and Evaluation Phase:

  Mar 09, 2015 – Apr 16, 2015: *Implementation*

  Data Collection

  Data Analysis

  Recommendation

- Report:

  Apr 17, 2015 – Apr 30, 2015: *Project Report*

References

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