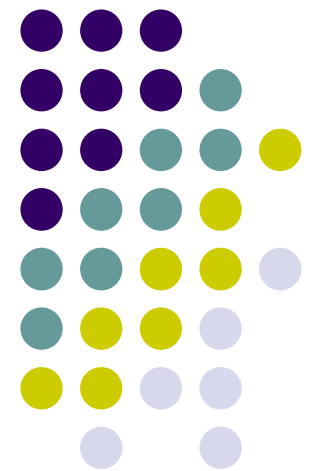


Breaking for Commercials: Characterizing Mobile Advertising

Yejin Li

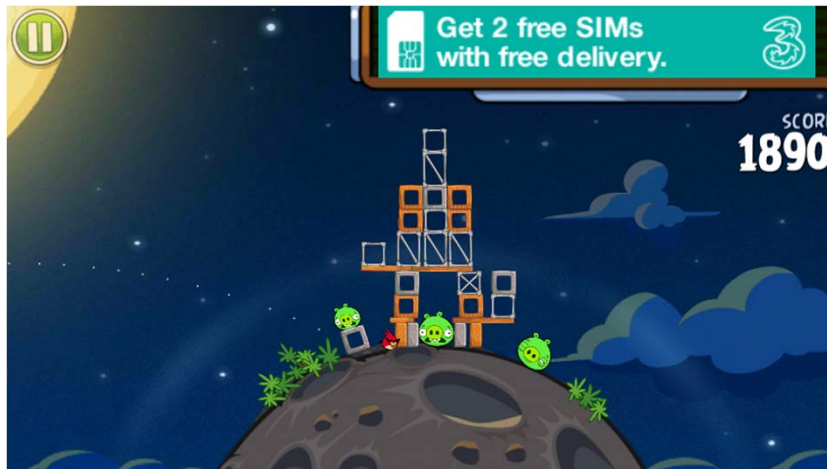
*Electrical and Computer Engineering Dept.
Worcester Polytechnic Institute (WPI)*





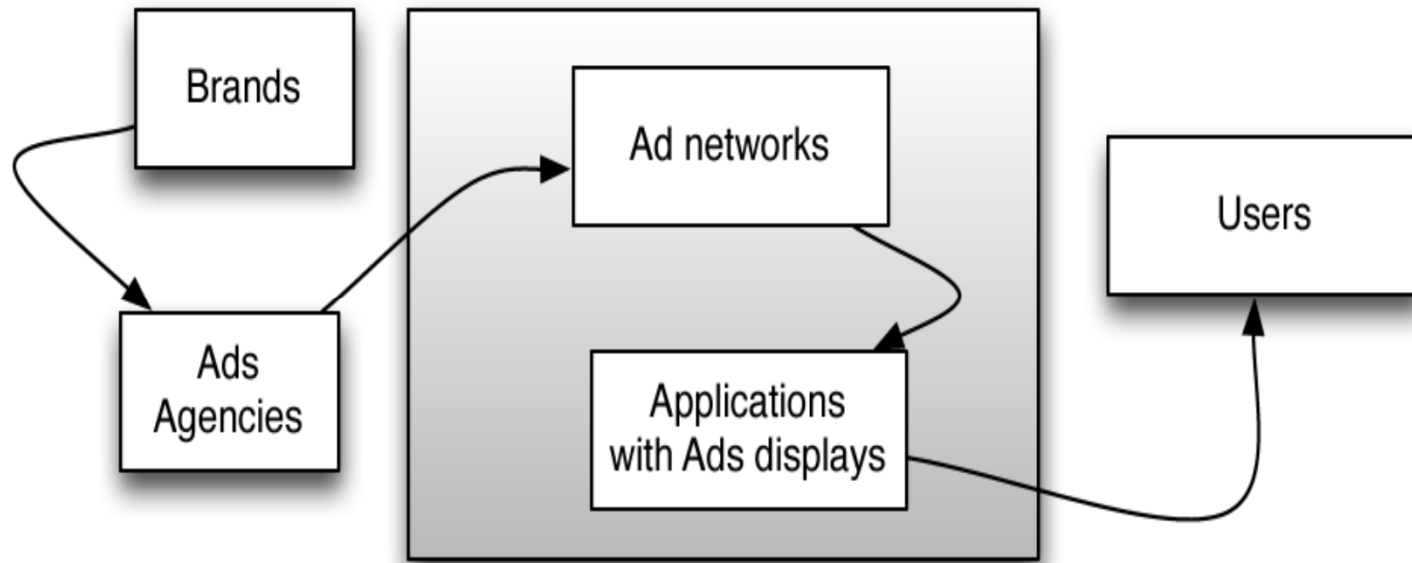
Mobile Phone Advertising

- FREE Apps always come with different ads, which can be really **annoying**.
- Style: Banner, Videos and etc.





Mobile Advertising Ecosystem



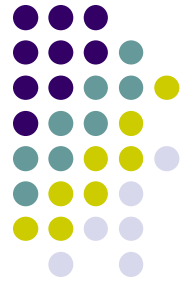
- Study: one day of traffic for more than 3 million subscribers of a major European mobile carrier.



Properties of AD Ecosystem

- *The mobile ad ecosystem is overcrowded and unmoderated, with **AdMob** and other Google services being the leaders.*
- *Ads are not just a strain on **Android** devices but are also prominent on **Apple** devices.*
- *Ads account for **1% of all mobile traffic** in our data set.*
- *Mobile ad traffic is mainly composed of static images and text files that are likely to be **re-downloaded**, with refresh of a few seconds.*

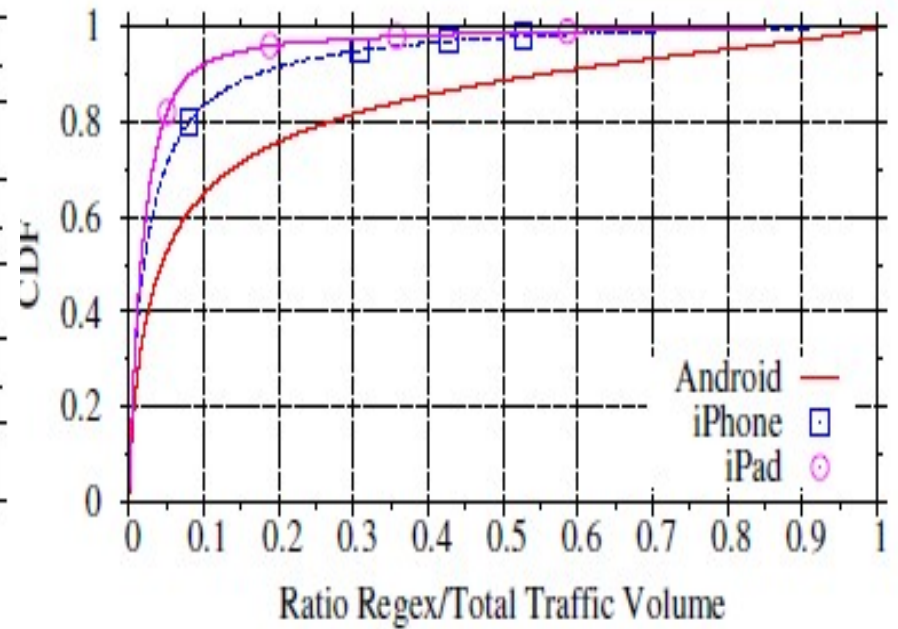
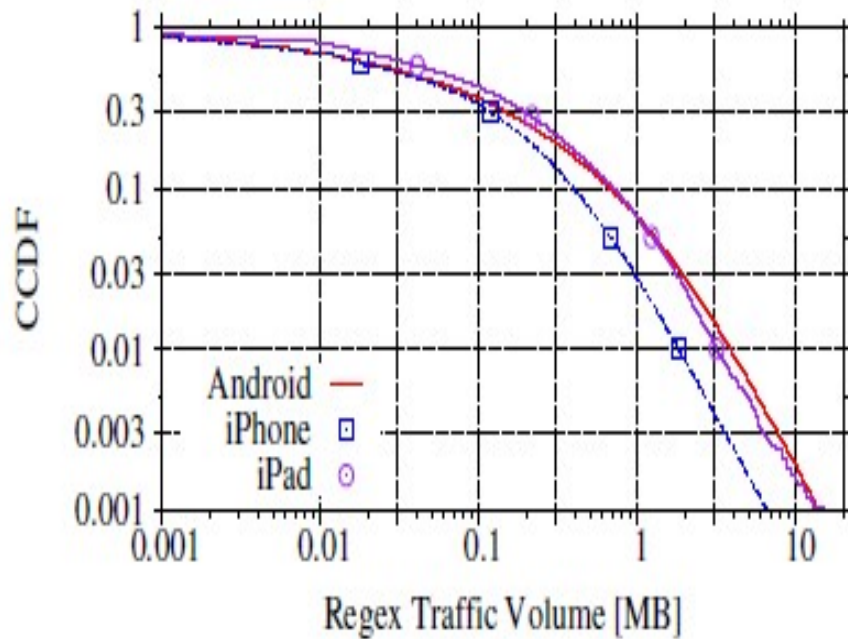
Ad Ecosystem Traffic



Provider	Retrieval Mechanism		Refresh Interval (s)	
	Push	Pull	Min	Max
AdMob	✓	✓	12	120
Millennial Media		✓	15	N/A
InMobi		✓	20	N/A

Refresh intervals and retrieval mechanisms

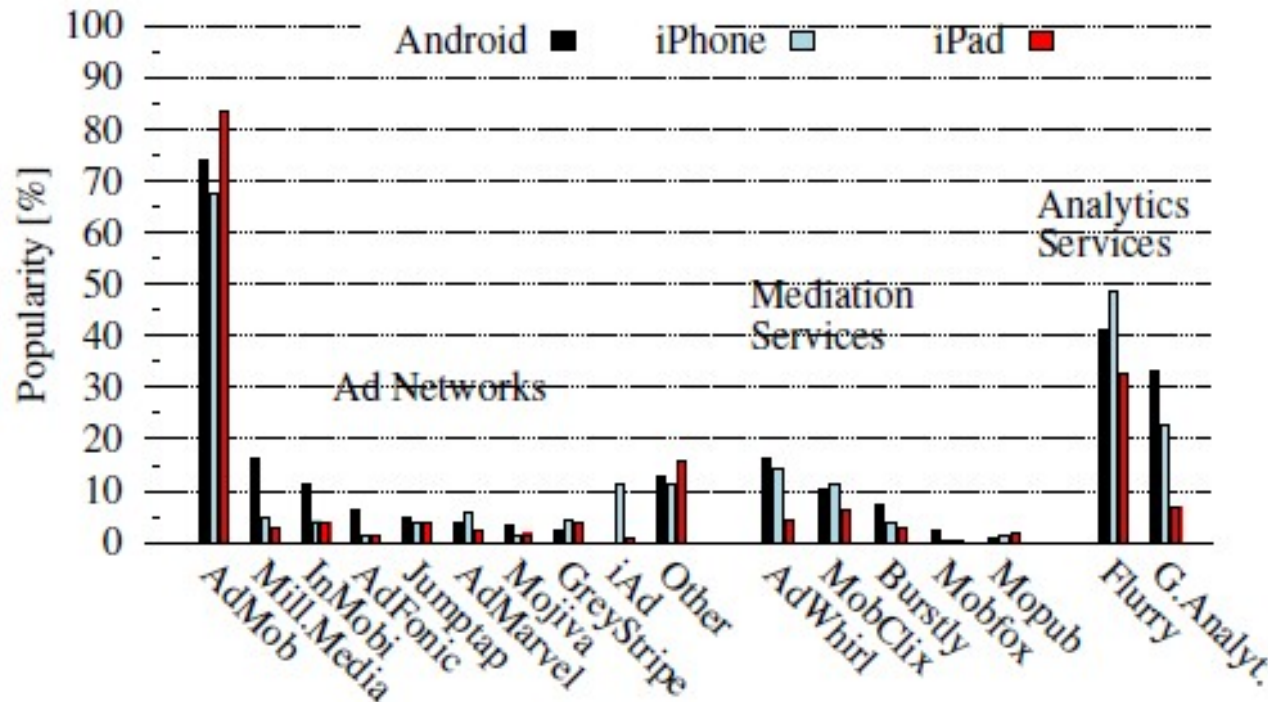
Ad Ecosystem Traffic



Complementary Cumulative Distribution Function of the volume of ad traffic per user and over total traffic

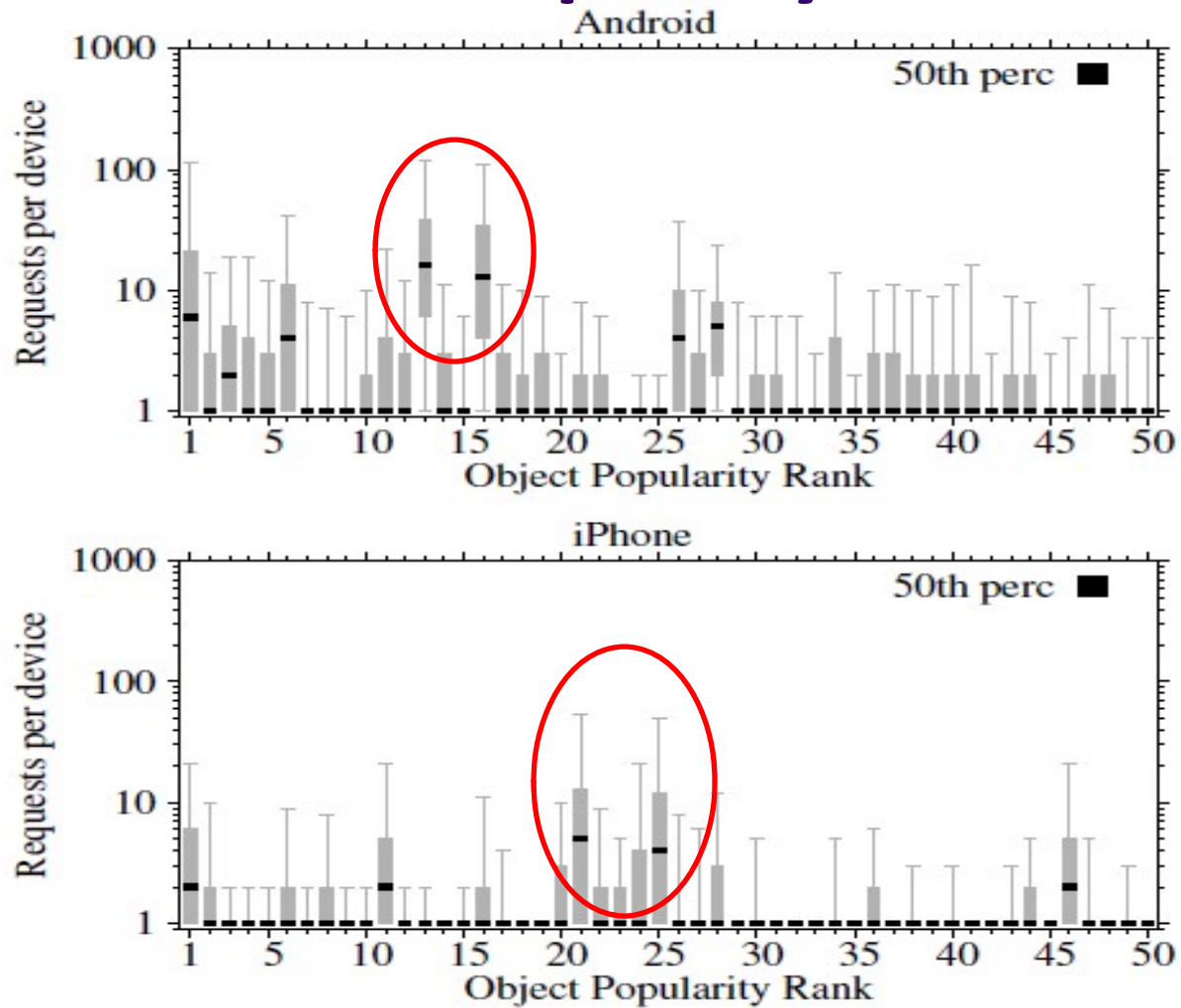


Popular AD Networks



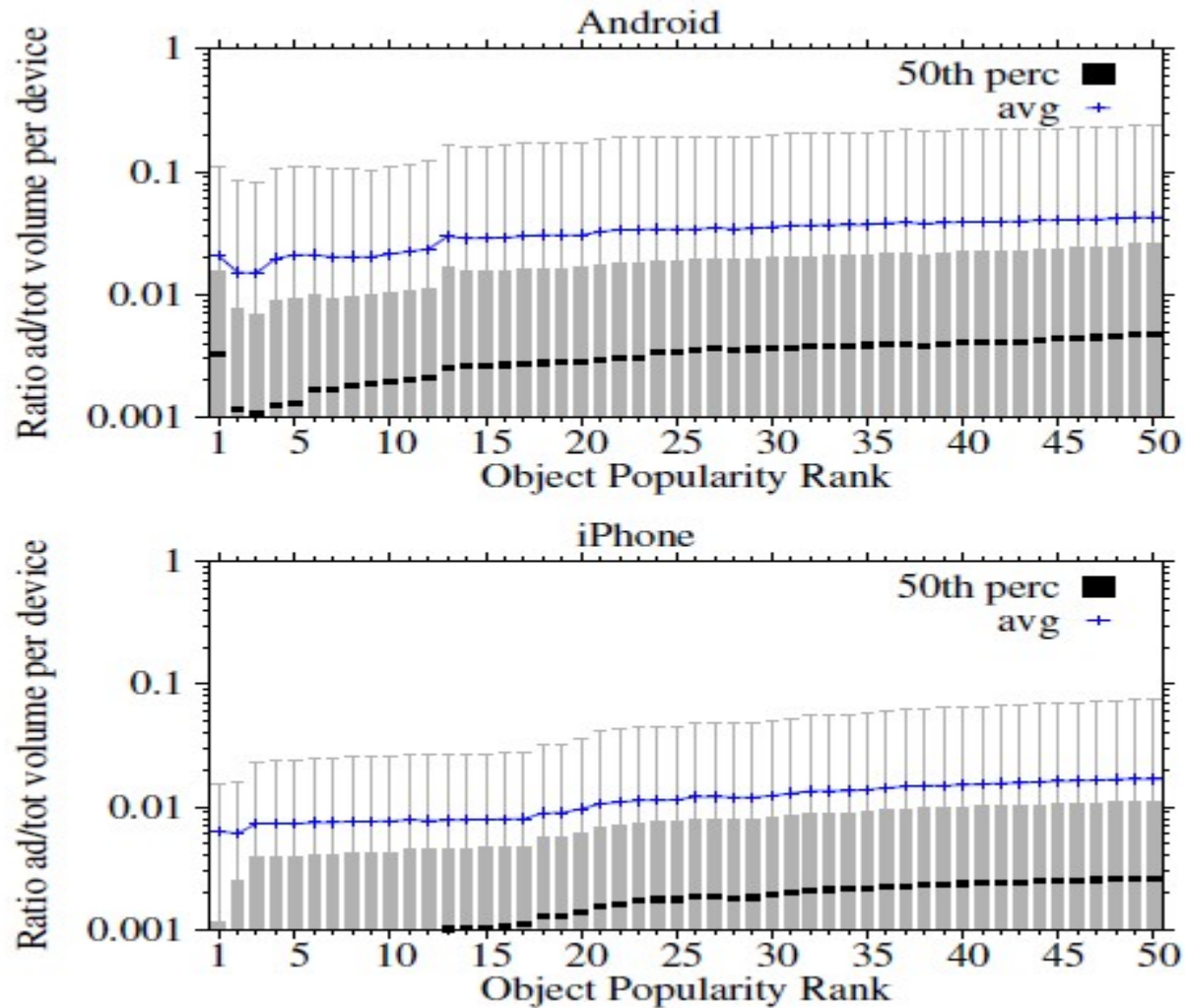
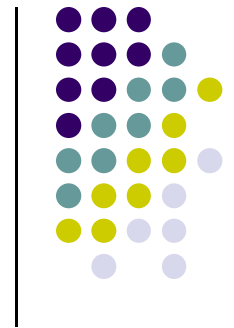
Ads and analytics services popularity. AdMob, Google Analytics, and AdWhirl for Google; iAd for Apple

Ad traffic frequency



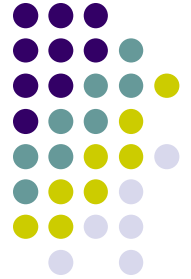
Box plots of the number of requests **each device** performs for the top 50 most popular objects on Android and iPhone devices.

Ad traffic frequency



Box plots of the fraction of **cumulated volume** related to the 50 most popular objects on Android and iPhone devices

Energy consumption

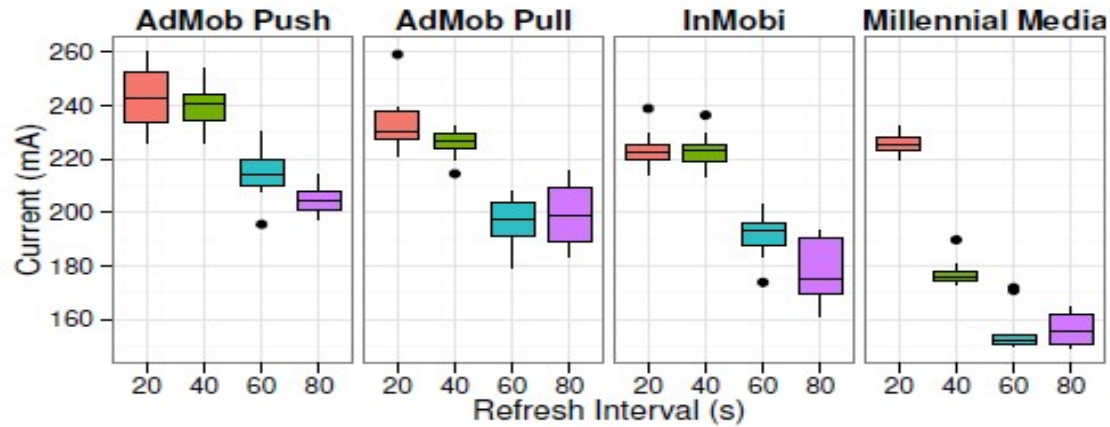


Average current consumption (mA)

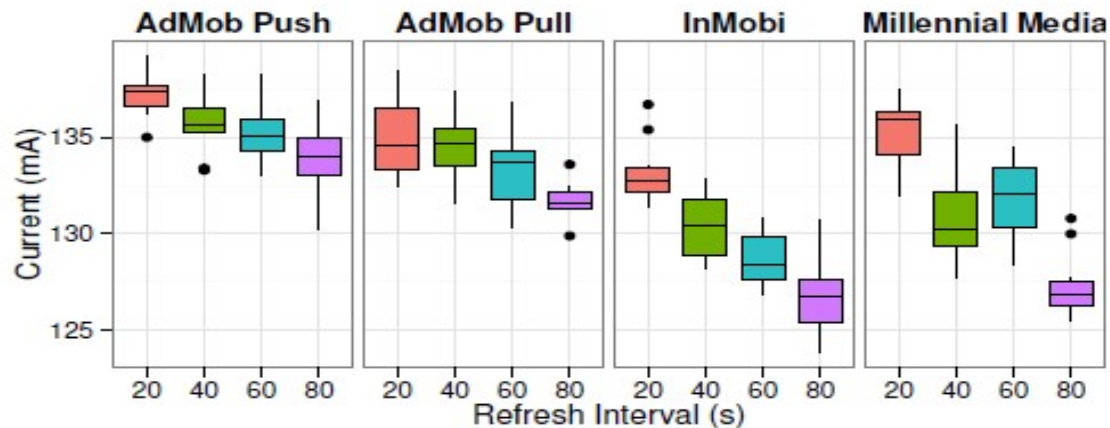
Power Mode	Mobile Network	Wi-Fi
Airplane Mode. Idle	2.1(0.1)	
Airplane Mode. Min Bright.	109.4 (0.1)	
Airplane Mode. Max Bright.	140 (1.4)	
Idle	3.3 (0.1)	5.4 (0.4)
Min brightness	110.6 (0.2)	118.6 (1.2)
Max brightness	141.3 (0.3)	149.4 (1.0)

Controlled test: 480*80 pixels (standard banners) across various conditions

Energy consumption

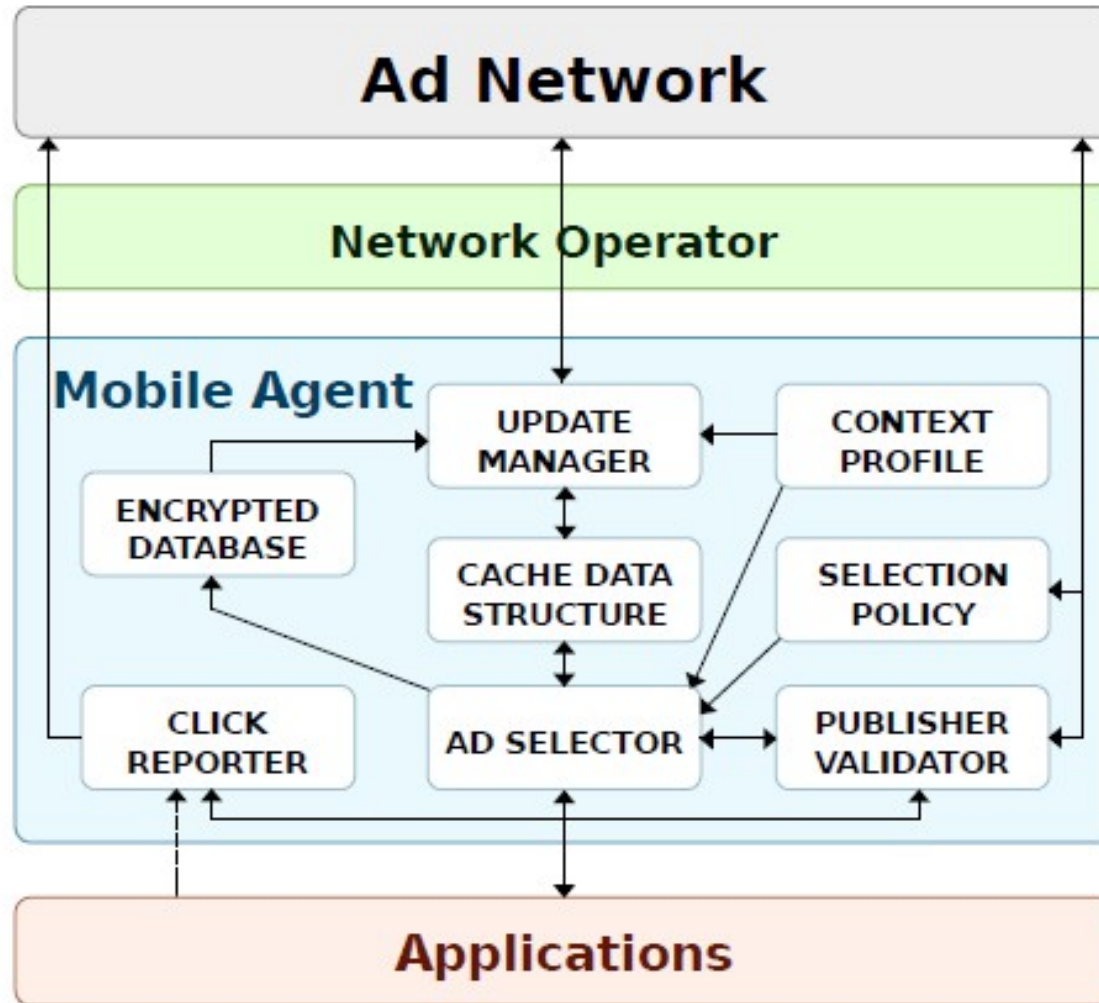


(a) Mobile Networks (3G)



(b) Wi-Fi

AdCache Architecture

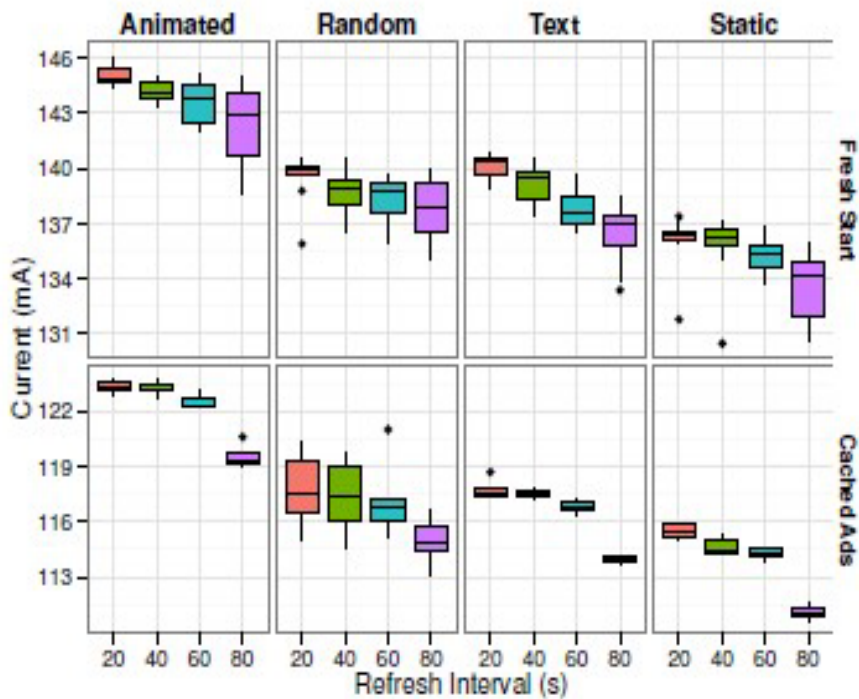




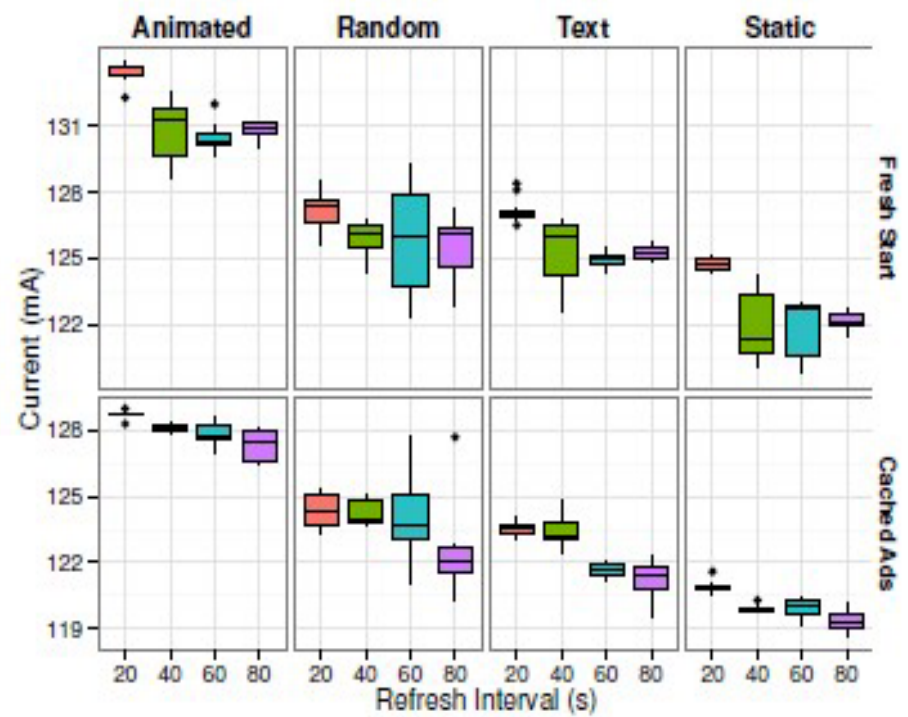
AdCache Architecture

- *No cache misses*
- *Ads will not be **pre-fetched** if there are enough valid ads or there is*
- ***No app demand** hence reducing traffic volume*
- *Allows to efficiently use **network and energy-intense** resources.*

Current drain with Adcache



(a) Mobile Network (3G)

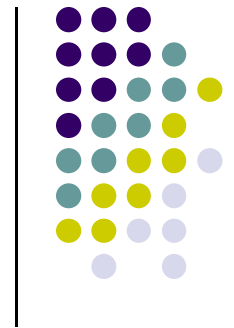


(b) Wi-Fi



Conclusion and discussion

- *Ad networks have greater impact on **Android**;*
- *Ad traffic can be a **significant fraction** of the total traffic of the users;*
- *Mobile ad traffic is responsible for important **energy** and network overhead by forcing offline apps to become online apps;*
- *Many of these requests are **redundant** due to the lack of caching capabilities in the SDKs.*



Thank You!