

# Optimizing Android Apps for Emerging Markets





2009



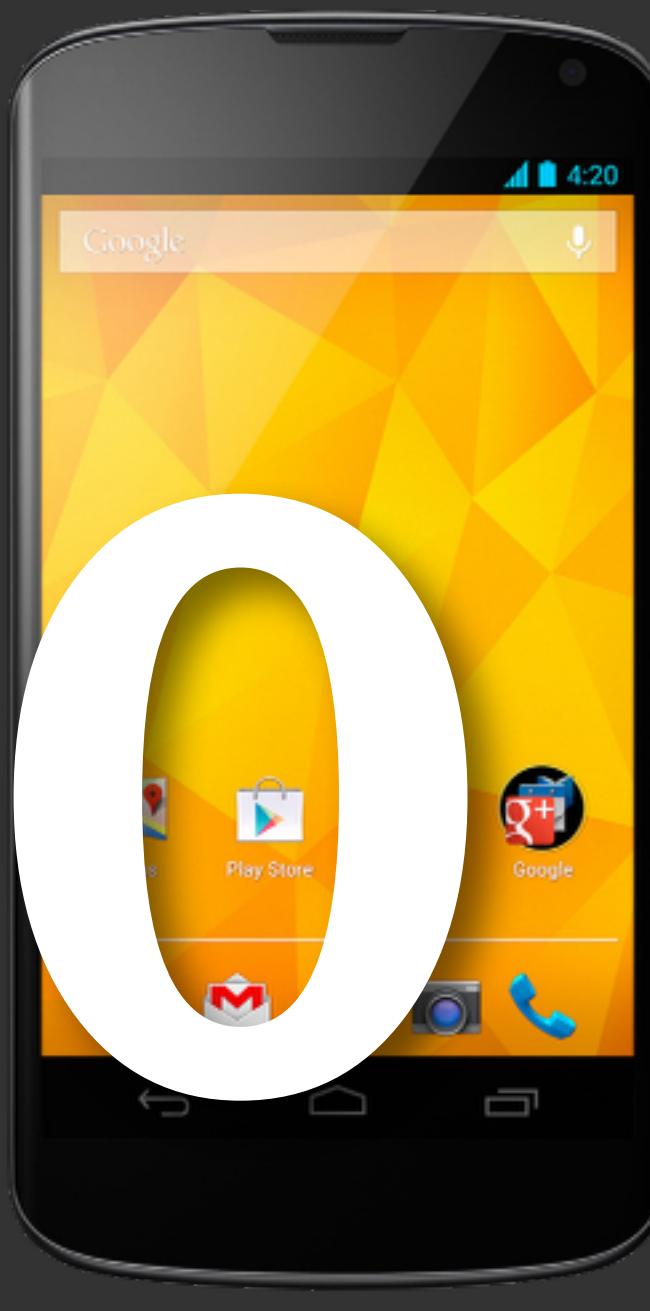
2010



2011



2012



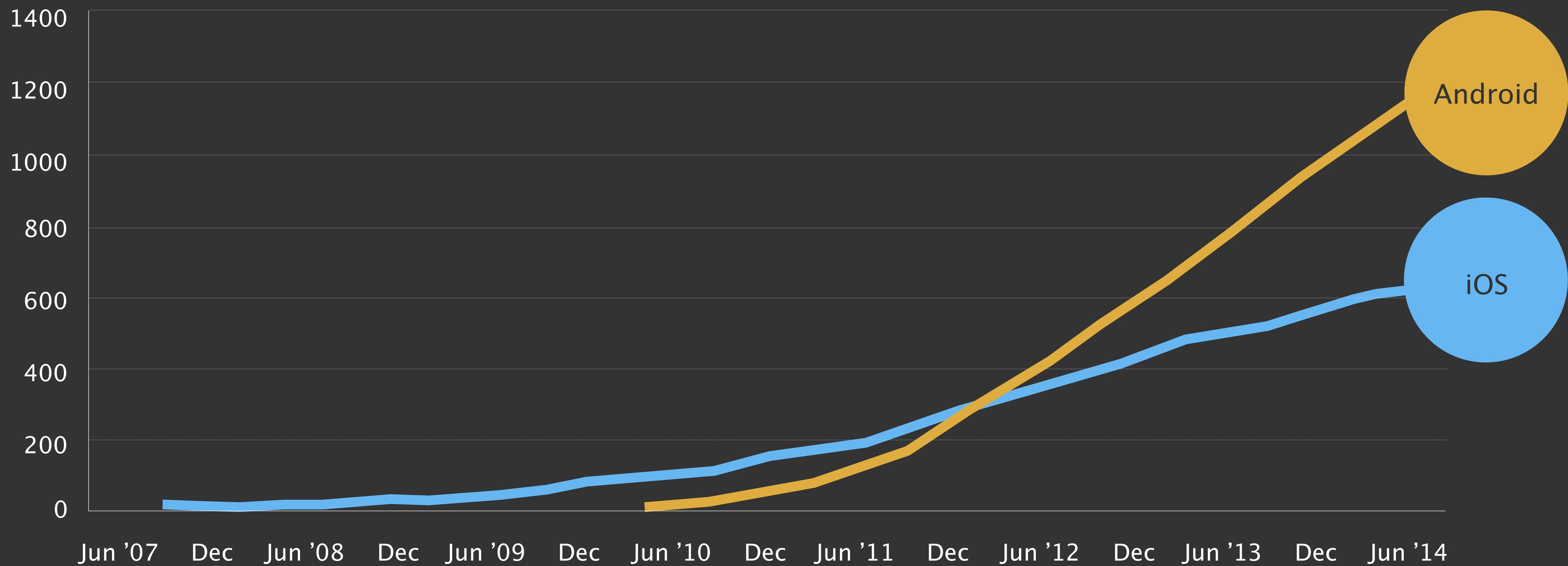
2013



10,000

# Android is growing like crazy

Active Devices (m)



Source: @BenedictEvans, Apple, Google, a16z







# Drastic Mobile Differences



**PHONES**  
New vs. Old  
Latest vs. Last Gen  
\$600 vs. \$100

# Drastic Mobile Differences



## DATA PLANS

Contract vs. Prepaid  
\$-per-GB vs. Time Windows  
Unreliable Income

# Drastic Mobile Differences



## CELL NETWORKS

LTE vs. 3g

Well-Maintained vs. Congested

Low or Slow Wifi Availability



Slow Phone



Small Screen



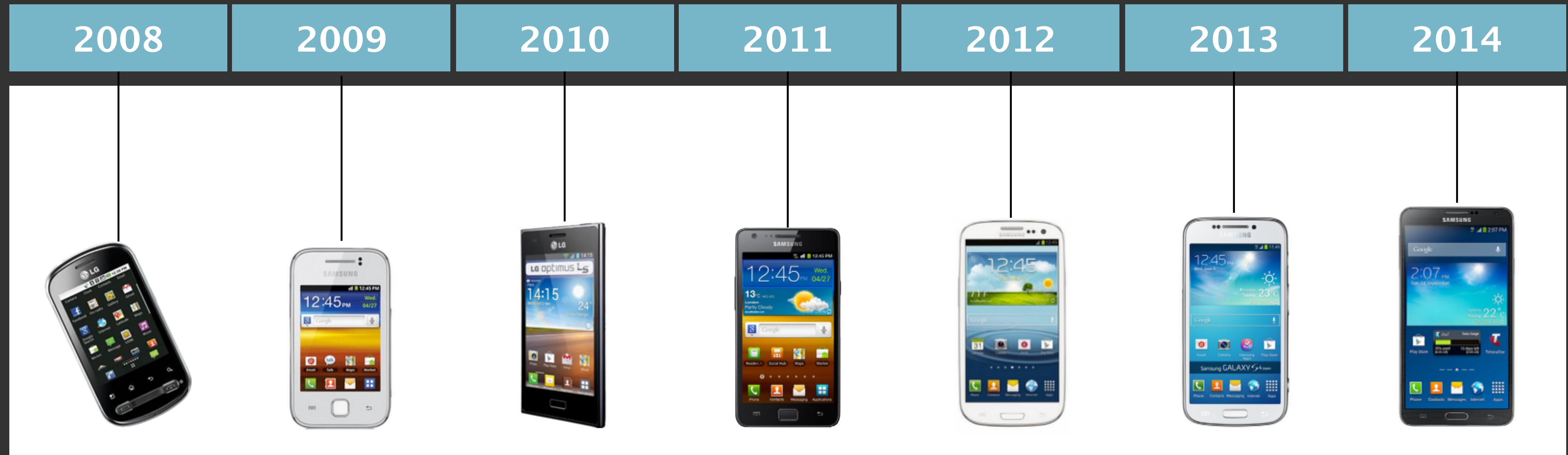
Bad Network



# ANDROID YEAR CLASS

In what year would this phone have been considered high-end?

# Most popular devices by year class



## **LG Optimus ME**

Single Core / 140 MB  
LDPI

## **Galaxy Y**

Single Core / 290 MB  
LDPI

## **LG Optimus L5**

Single Core / 512 MB  
MDPI

## **Galaxy S2**

Dual Core / 1 GB  
HDPI

## **Galaxy S3**

Dual Core / 2 GB  
XHDPI

## **Galaxy S4**

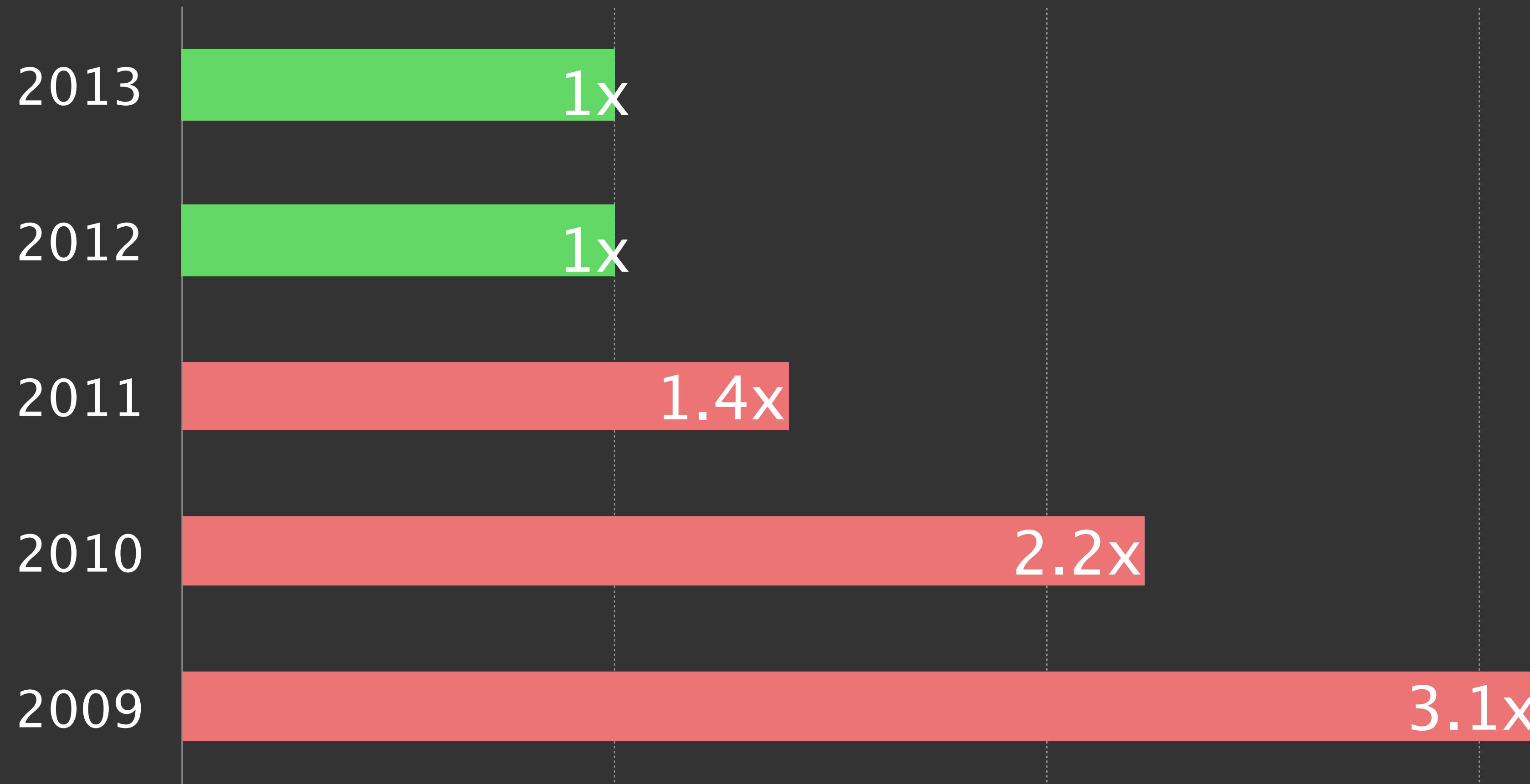
Quad Core / 2 GB  
XXHDPI

## **Galaxy Note 3**

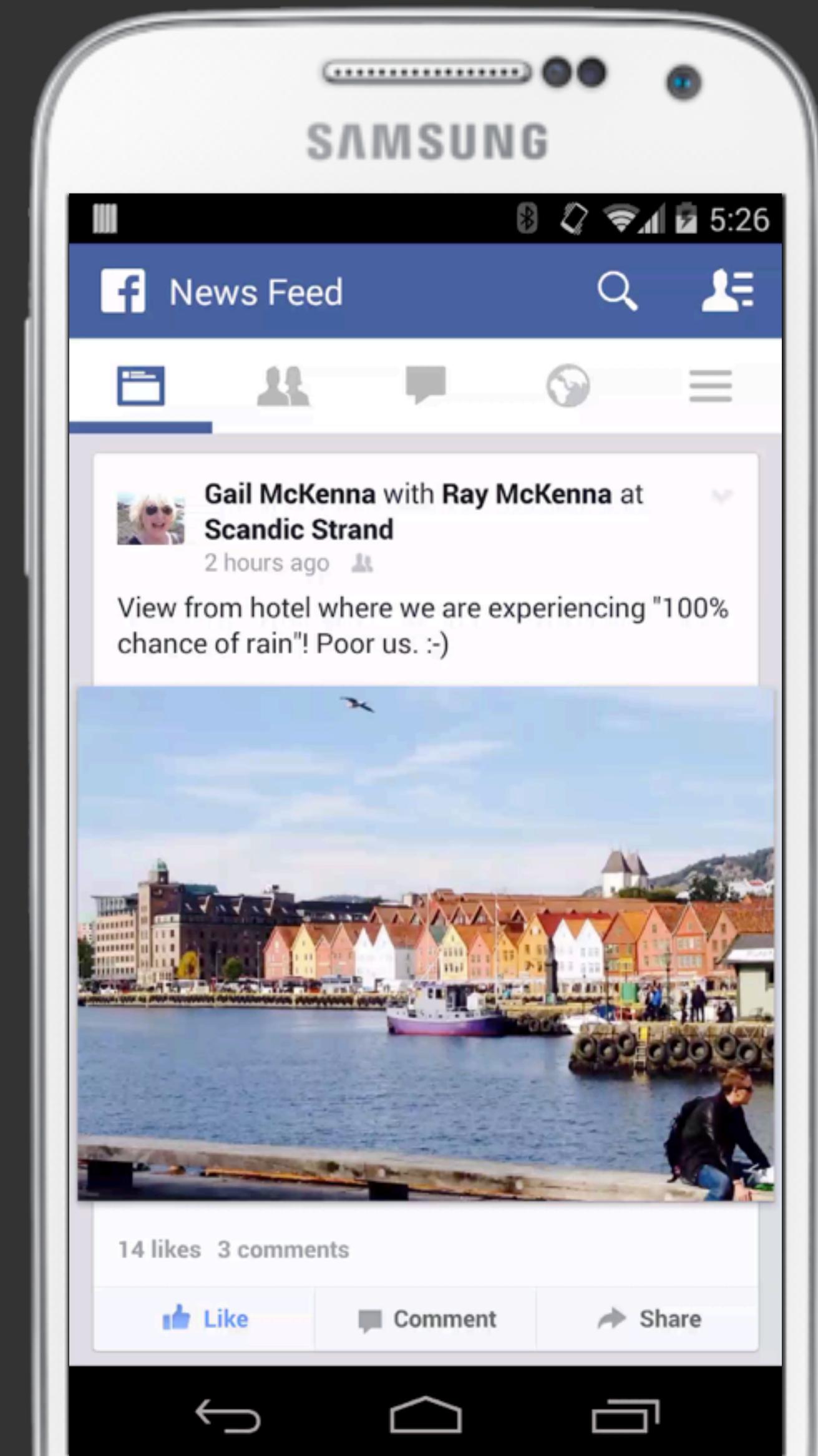
Quad Core / 3 GB  
XXHDPI

# Relative Crashiness by Year Class

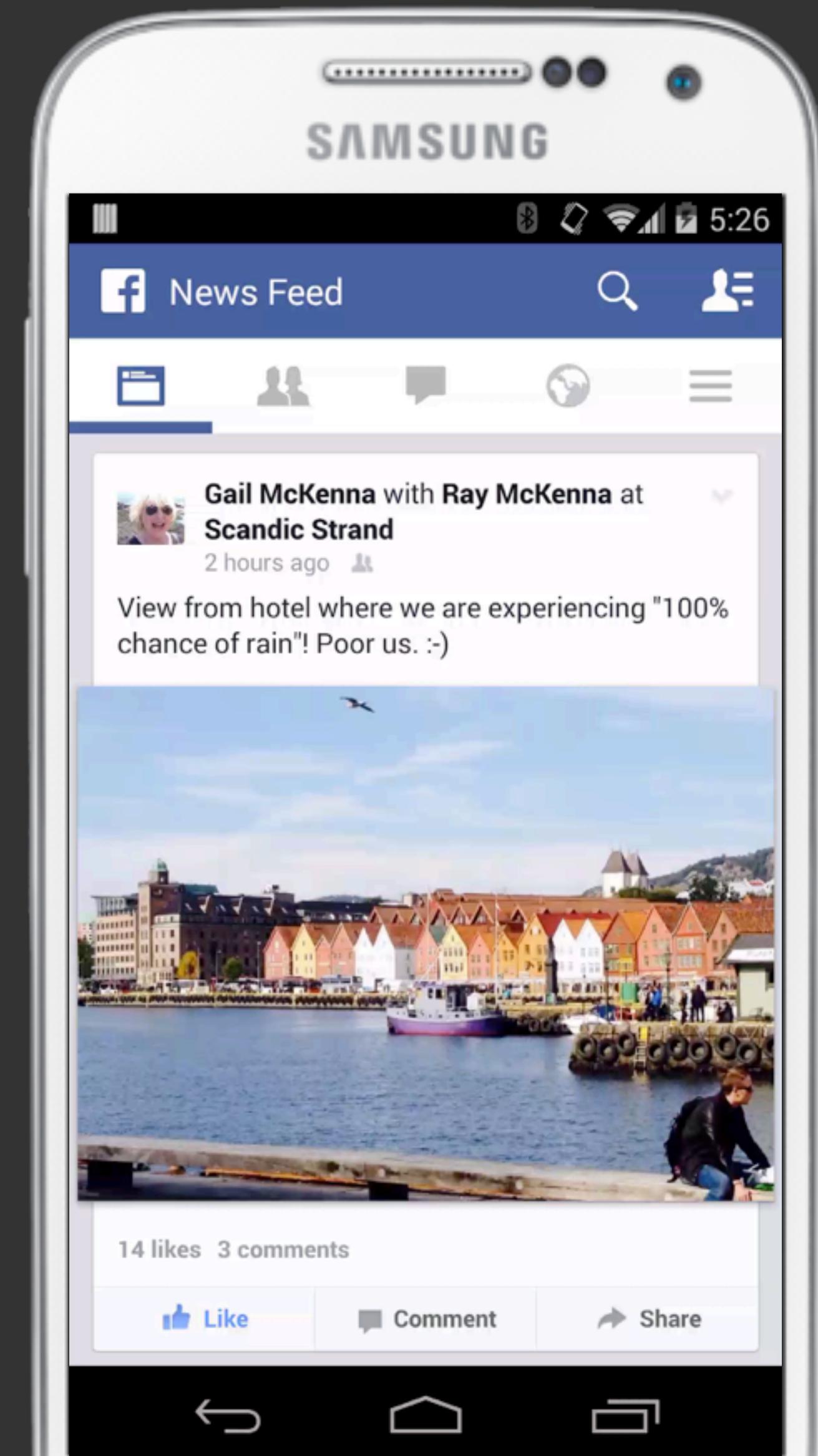
% weekly users who experience a crash



# Comment Flyout Redesign



# Comment Flyout Redesign





240 x 320

320 x 480

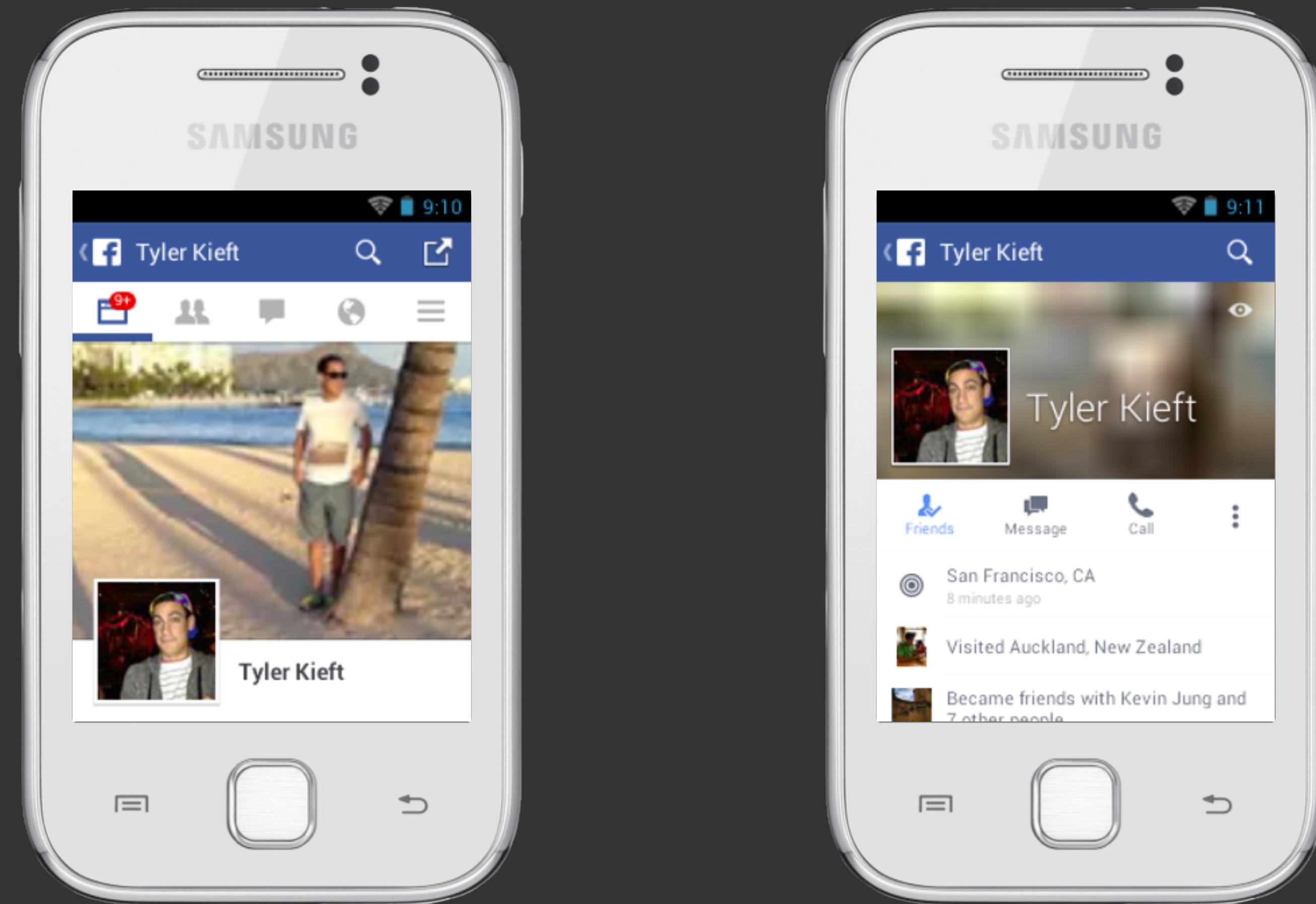
480 x 800

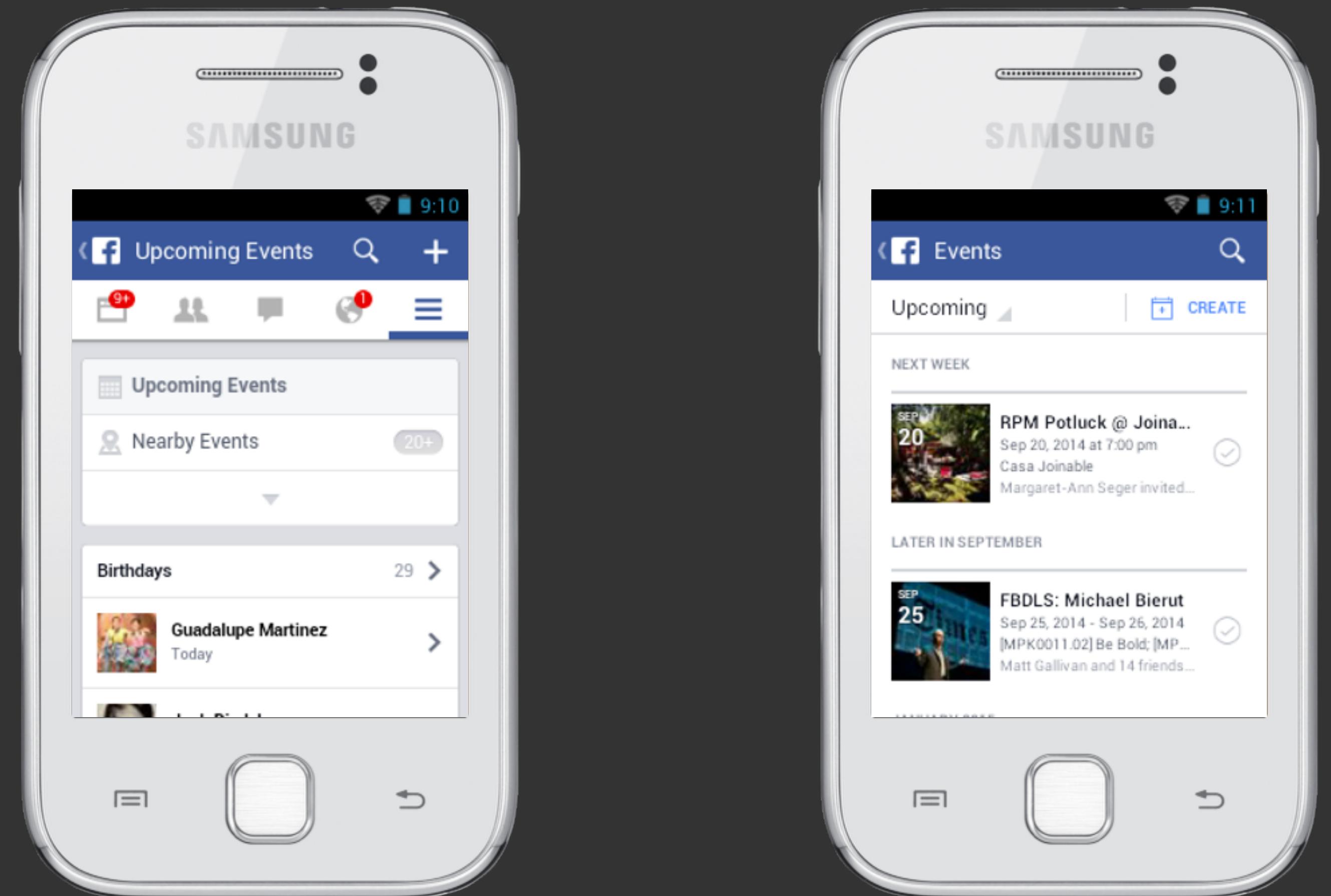
540 x 960 (7%)

720 x 1280 (27%)

1080 x 1920









**70.6%**  
US 3G Penetration

**280 ms**  
Average Latency



**6.9%**  
India 3G Penetration

**500 ms**  
Average Latency



**38.6%**  
Brazil 3G Penetration

**850+ ms**  
Average Latency

# Takeaways



Android as the  
world's platform

You are not like  
other people



Make things good  
with smart  
segmentation

# Tuning Facebook for Constrained Networks

# TUNING FACEBOOK FOR CONSTRAINED NETWORKS

# Agenda



Image Download  
Sizes



Network Quality  
Detection



Prefetching  
Content

# Image Download Sizes

# Image Downloads Dominate



# Image Scaling

Request an appropriate image size for the viewport

- Thumbnail, preview, full image
- Users may never need more than a thumbnail
- Low-res devices may never need a full resolution image

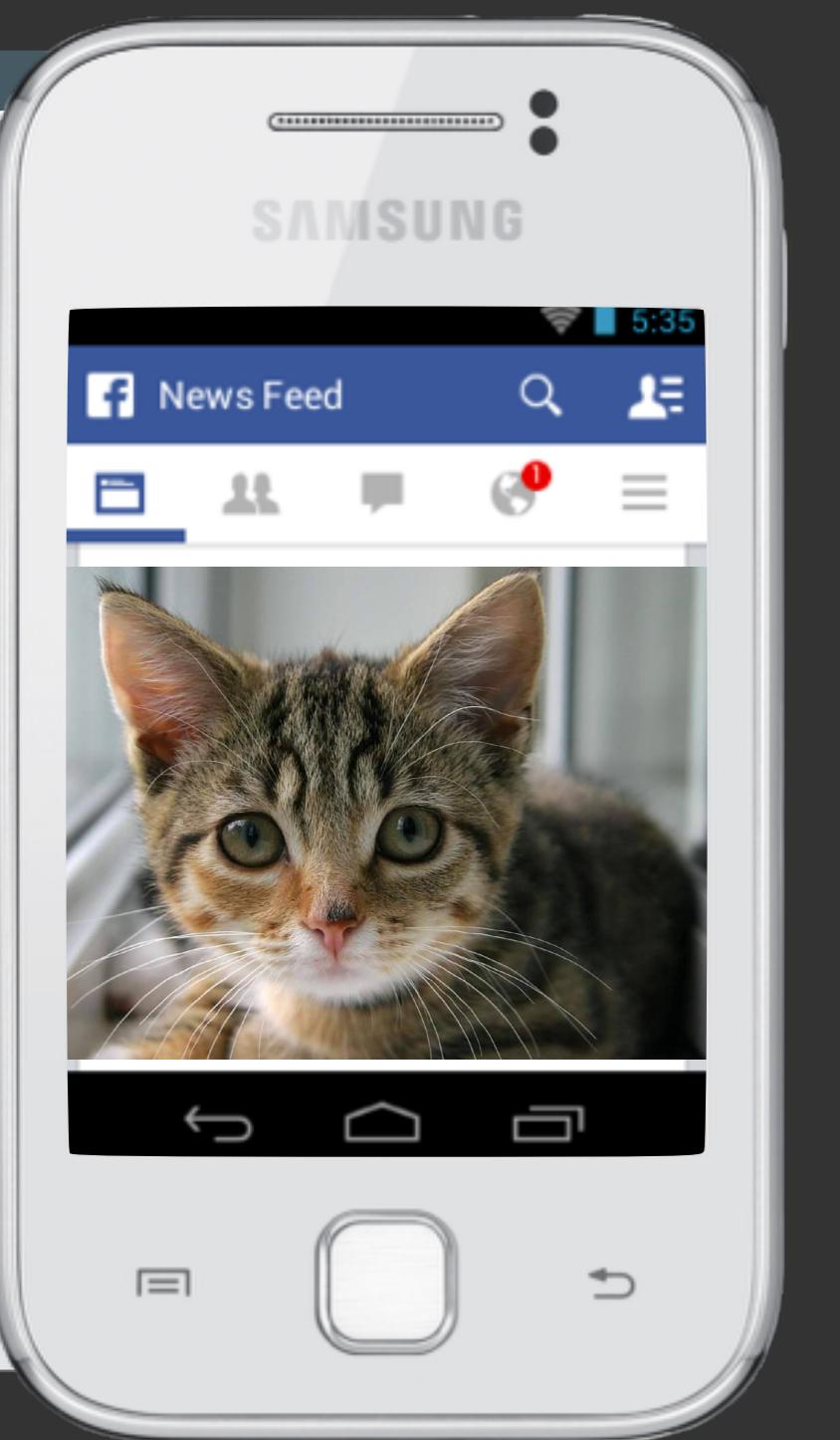


# Image Scaling



# Image Scaling

Image Width	File Size	Size Reduction
240	11KB	86%
480	33KB	58%
720	61KB	23%
960	79KB	*

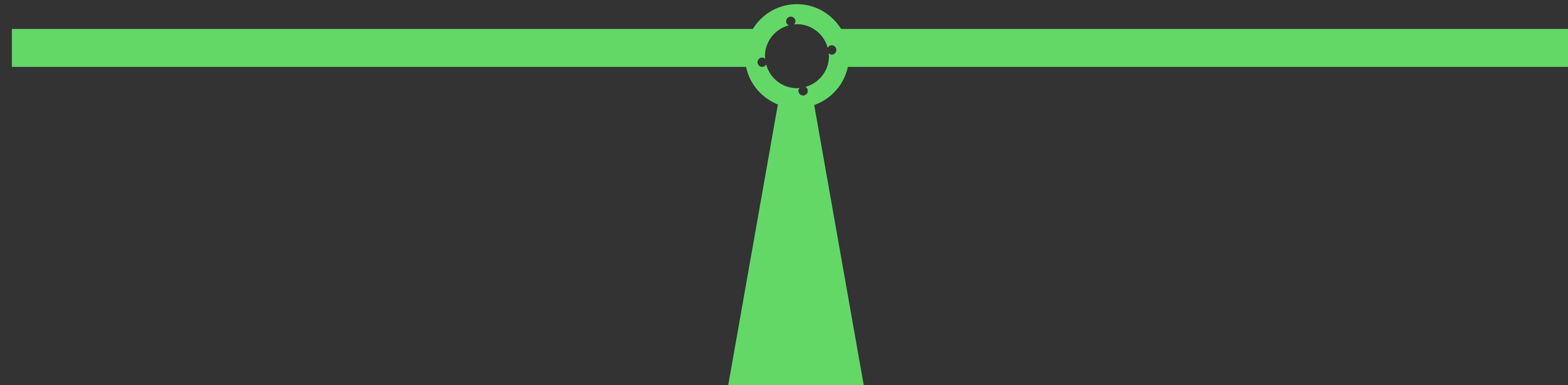


# Image Scaling

A bit of a balancing act:

Smaller files  
download  
quickly

Downloading too  
many sizes can use  
more data



# Image Formats

	JPEG	WEBP	PNG	GIF
Lossy Compression	✓	✓		
Lossless		✓	✓	
Transparency		✓	✓	✓ *
Animation		✓		✓

90% 

of images sent to Facebook & Messenger for Android are WebP format

# Image Compression

- WebP **saves** 7% download size over JPEG for equivalent MS-SSIM results
- By moving to WebP and tuning quality parameters, we **saved** 30% over JPEG
- No noticeable change in user perceived quality

# Image Compression



JPEG  
86KB



WebP  
63KB

# Image Compression

- WebP also supports transparency and animation
- Save 80% over PNG – beneficial for stickers



PNG  
132KB



WebP  
29KB

# Image Compression

WebP support on different Android OS versions:

- Use native WebP decoder on Android 4.2 and later
- Use libwebp and libpng to transcode to back JPEG and PNG on older

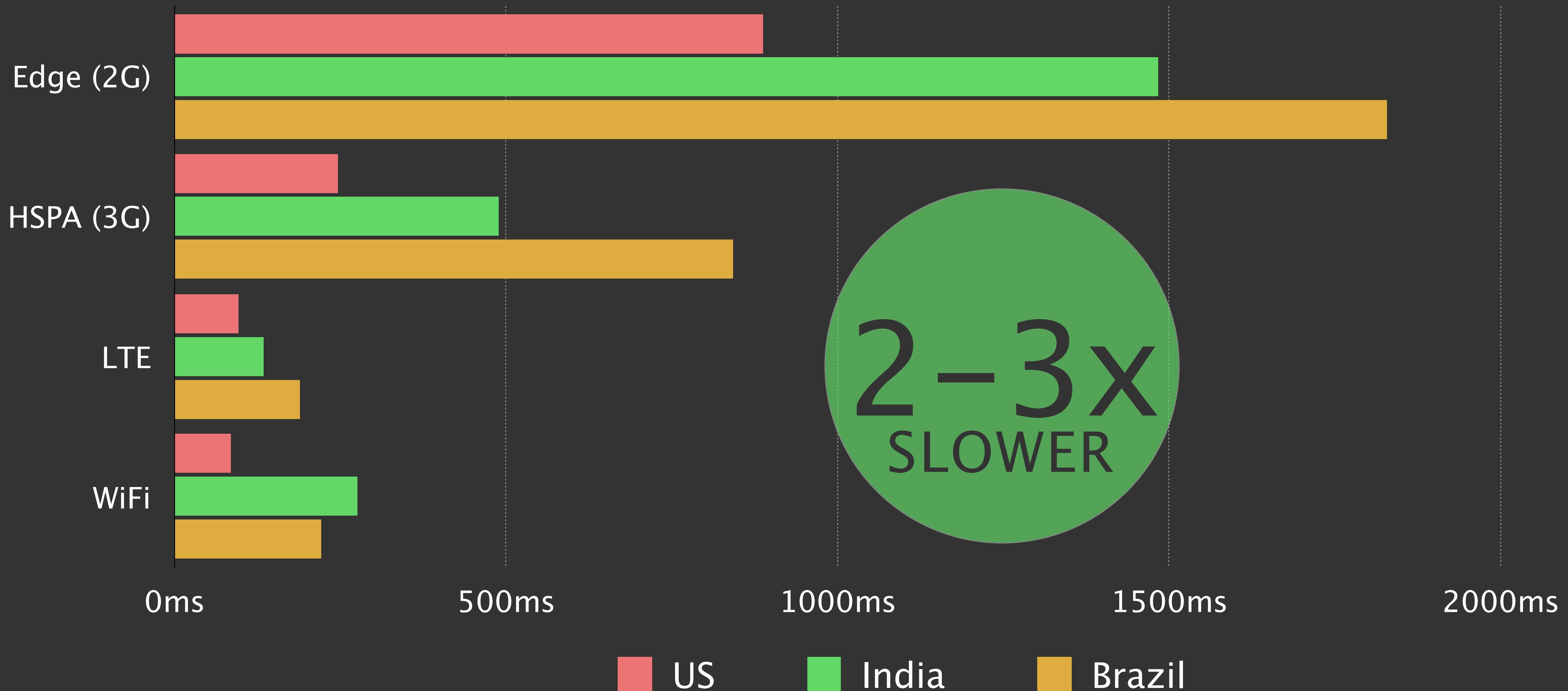
Alternative to avoid transcoding cost: use JPEG with  
mozjpeg 2.0

- Compatible with JPEG



# Network Quality Detection

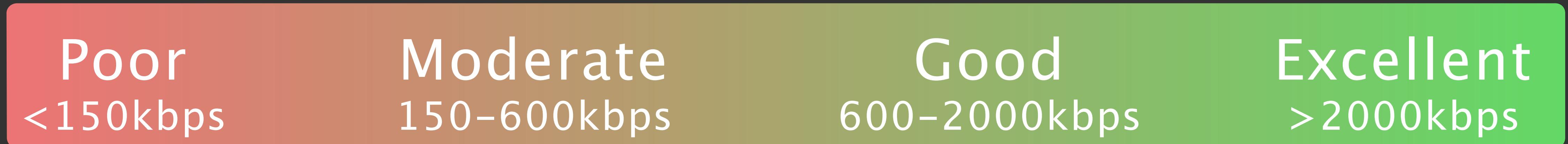
# Network Round Trip Times



# Network Quality Detection

Monitor quality of current network connection:

- Measure throughput on all large network transfers (images)
- Servers provide Round Trip Time (RTT) estimates with each response
- Client maintains a moving average of these values



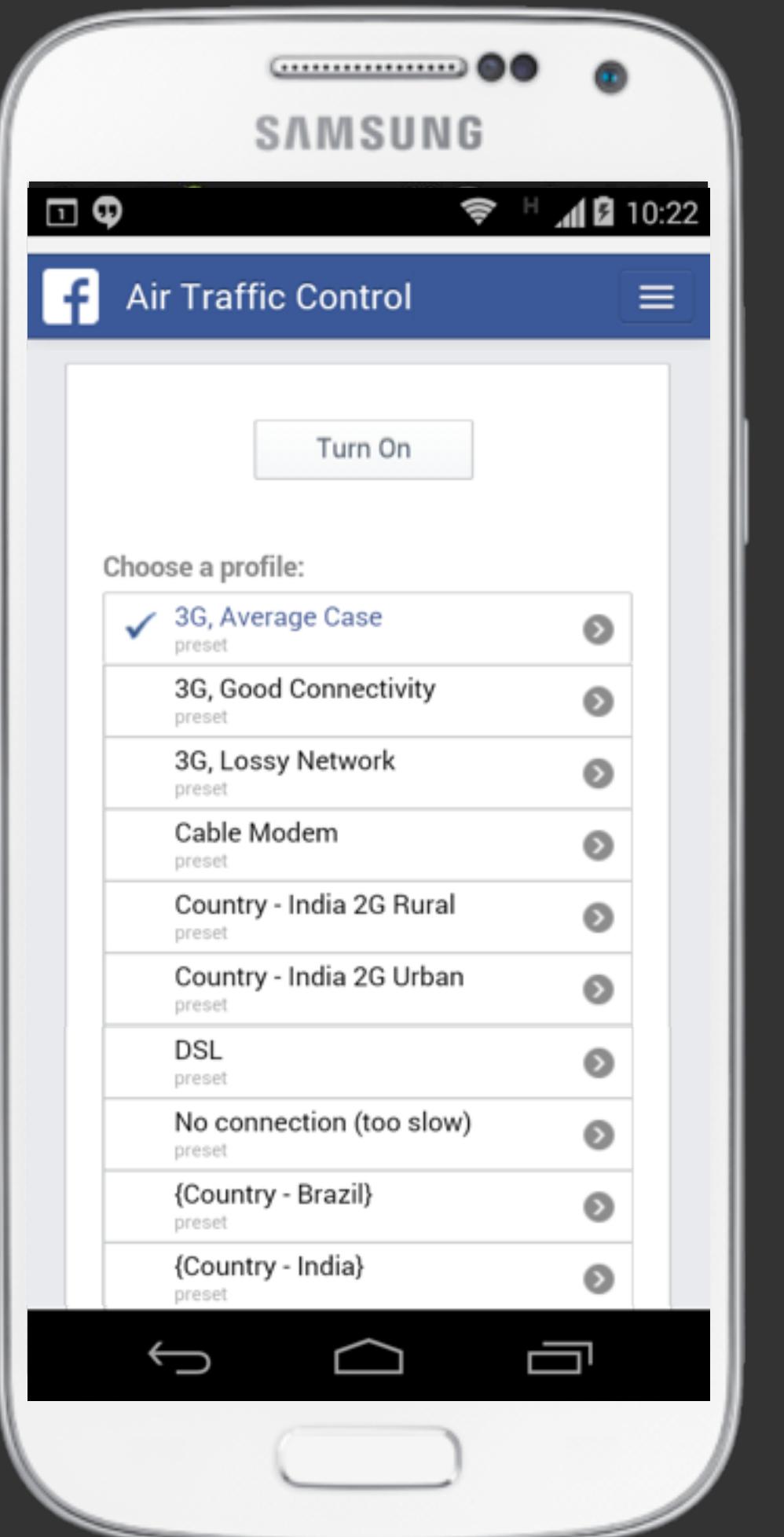
# Network Quality Detection

Connection quality values are provided to features to dynamically adjust behavior

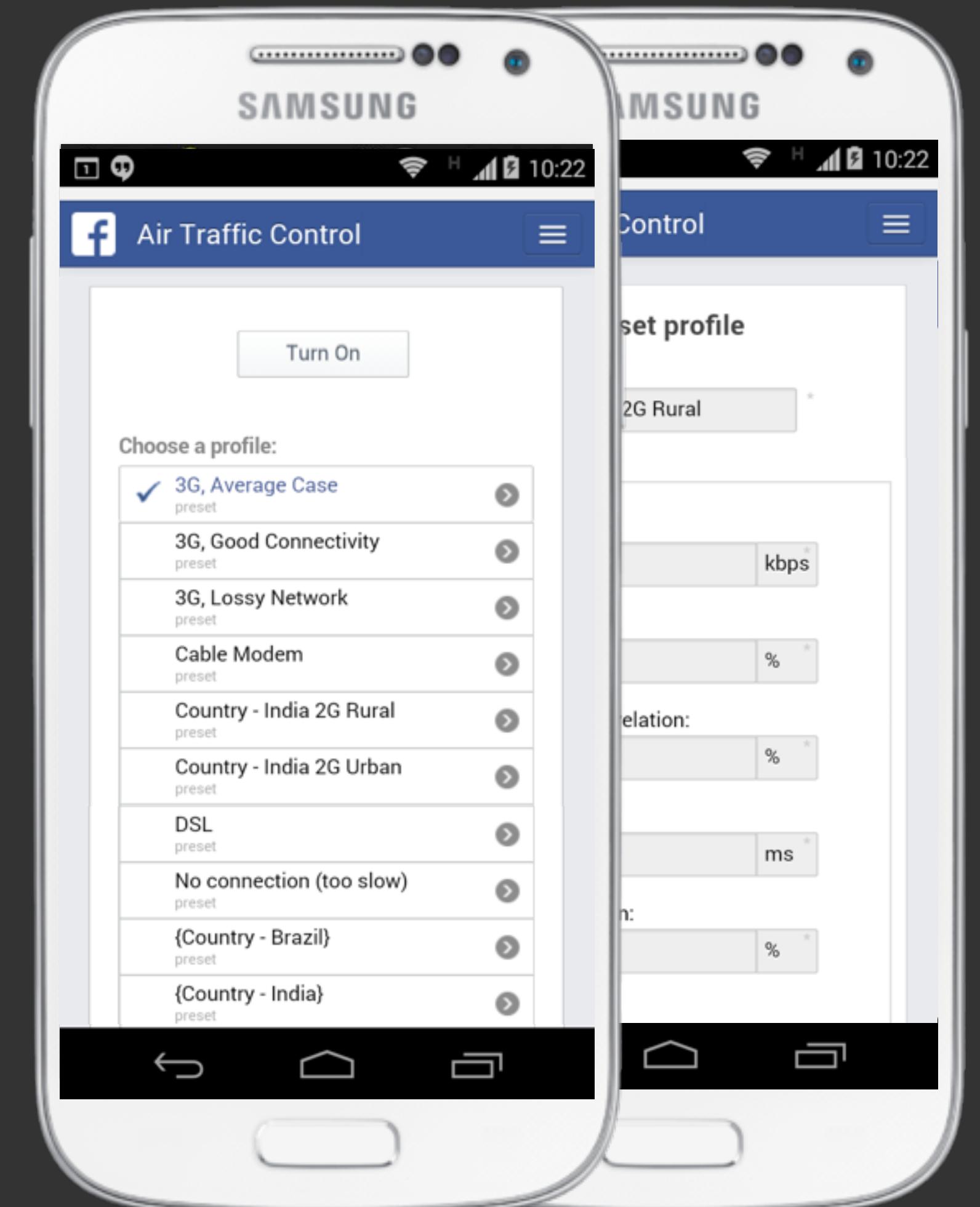
## Examples:

- Increase/decrease image compression
- Issue more/fewer parallel network requests
- Disable/enable auto-play video
- Pre-fetch more content

# Air Traffic Control



# Air Traffic Control





# Prefetching Content

# Pre-fetching Content

- Pre-fetching can be important on a high-latency connection to achieve good performance
- Issue network fetch request early during app startup
- Consider prioritizing network requests so that immediate user requests aren't blocked by pre-fetching requests
- Carefully monitor for over-fetching and judicious use of resources (e.g. data usage, CPU, battery, storage space)

# Summary

- Scale images appropriately for the viewport before downloading
- Tweak image compression knobs to further decrease image size
- Adjust app behavior on slower networks — networks outside of the US can be 2-3 times slower