



flight

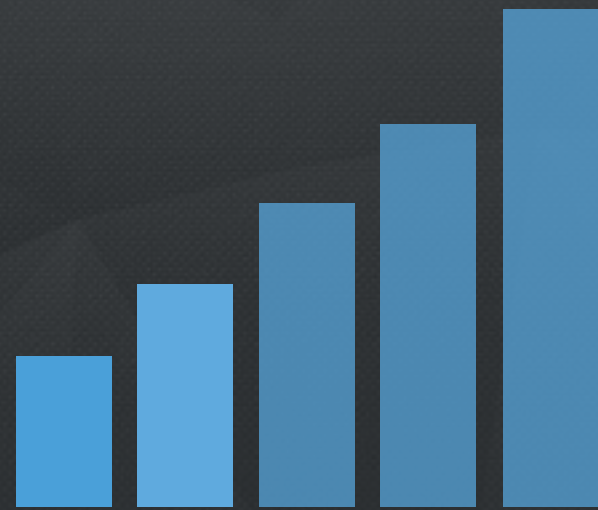


# Mobile Applications For Unreliable Networks

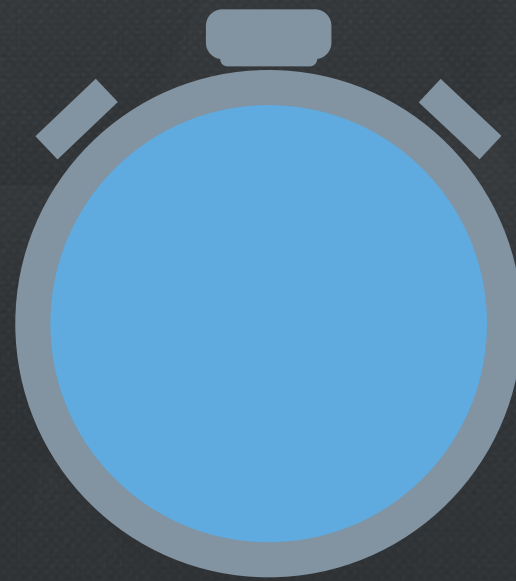
**Jie Jin**

Sr. Software Engineer | @jiegantic

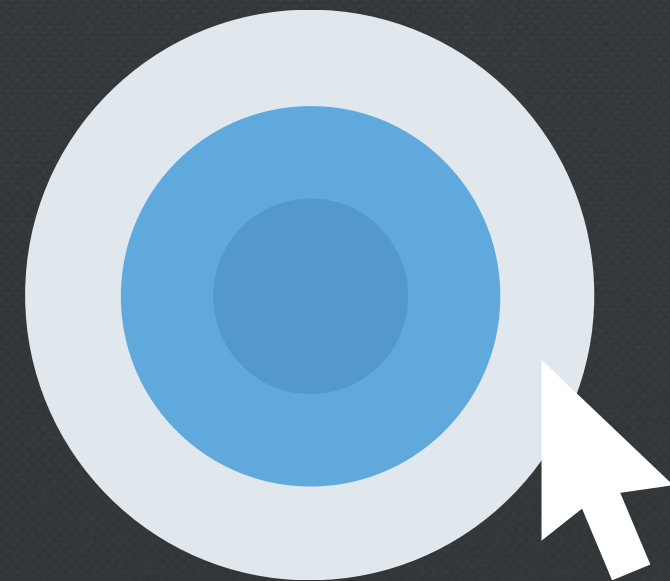
# Mobile Networks Are Unreliable



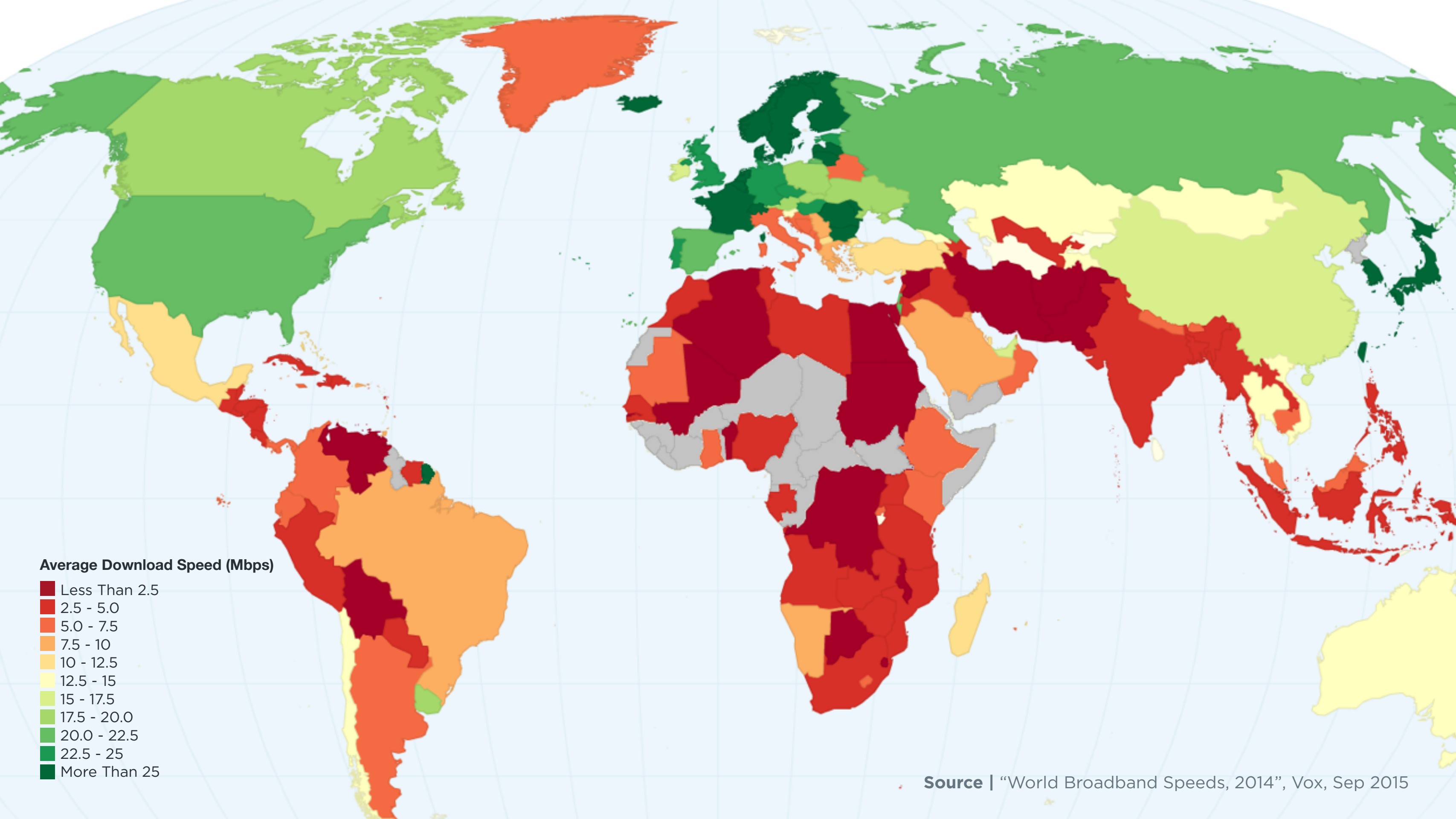
LOSSY



SLOW



INCONSISTENT



**Average Download Speed (Mbps)**

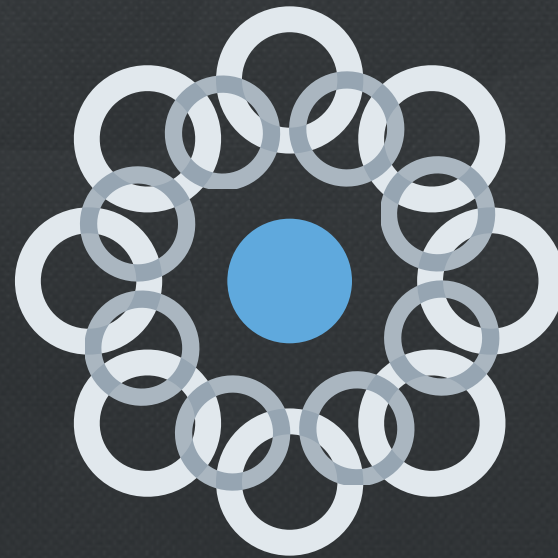
- Less Than 2.5
- 2.5 - 5.0
- 5.0 - 7.5
- 7.5 - 10
- 10 - 12.5
- 12.5 - 15
- 15 - 17.5
- 17.5 - 20.0
- 20.0 - 22.5
- 22.5 - 25
- More Than 25

Source | "World Broadband Speeds, 2014", Vox, Sep 2015

# How To Deal With Slow, Unreliable Networks



RELIABILITY



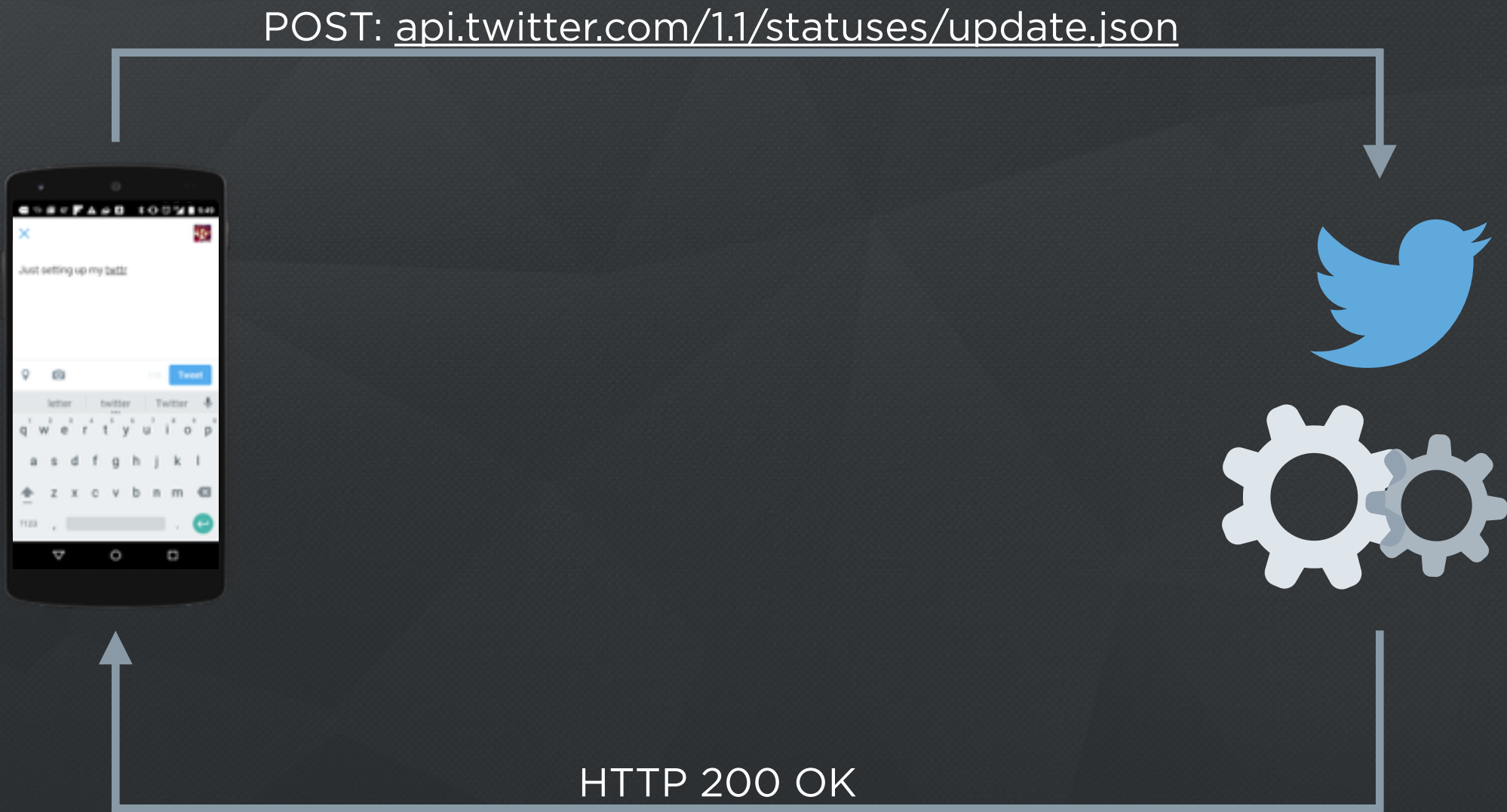
RESILIENCY



PERFORMANCE

# Reliability

# Example: Posting A Tweet

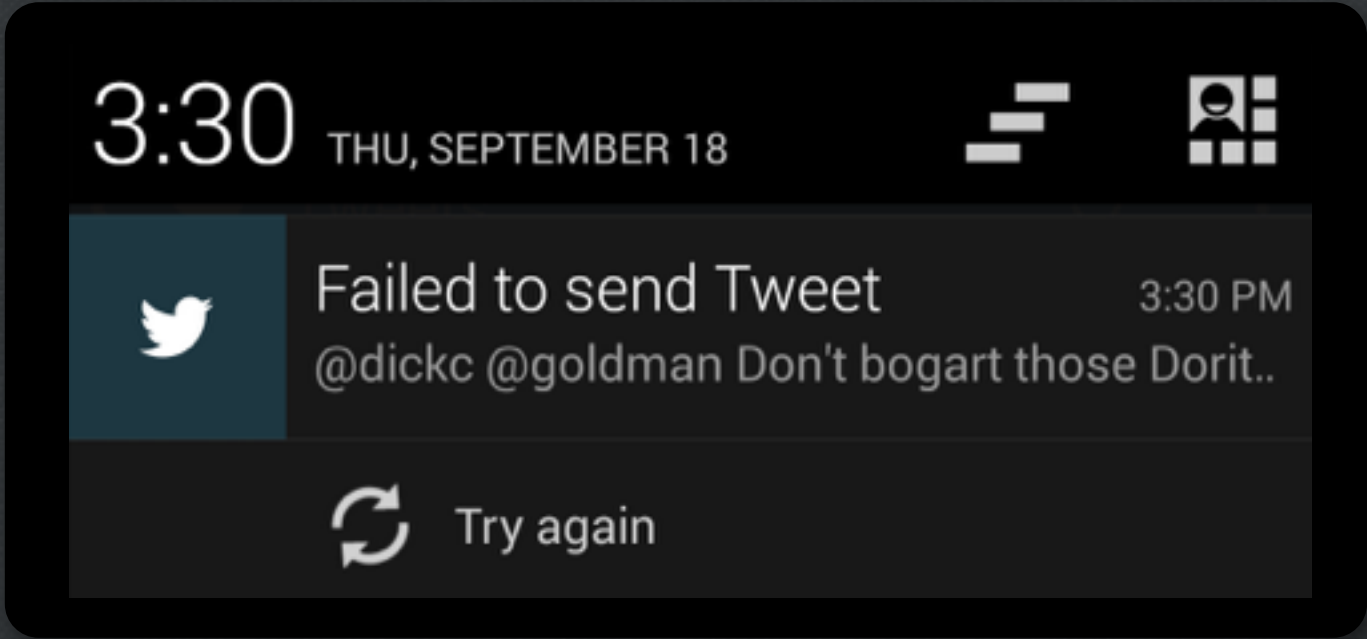


# What If Posting Fails?



599

Network connect timeout error





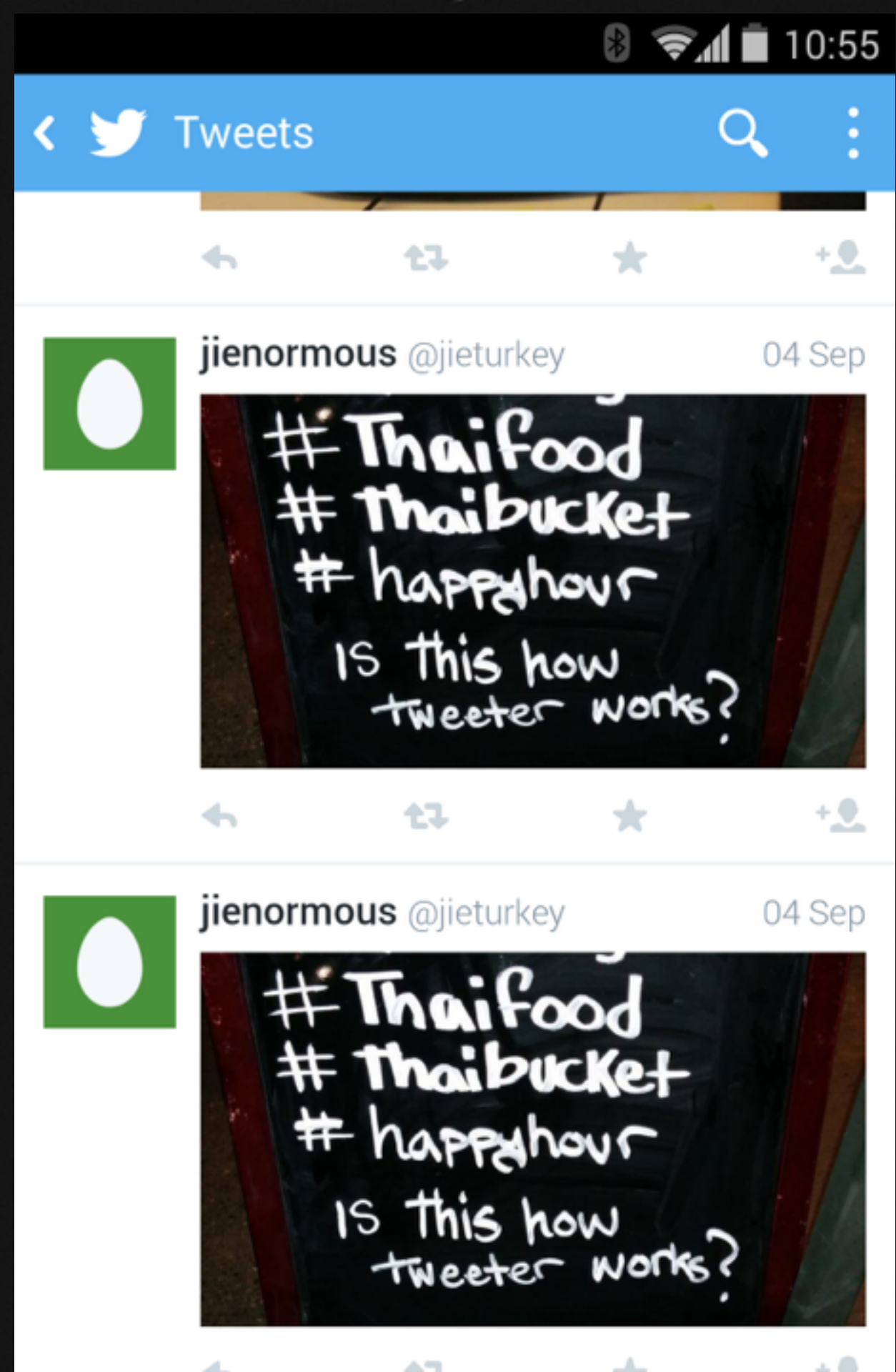
# Solution: Retry



# Don't DDOS Yourself



# Idempotency

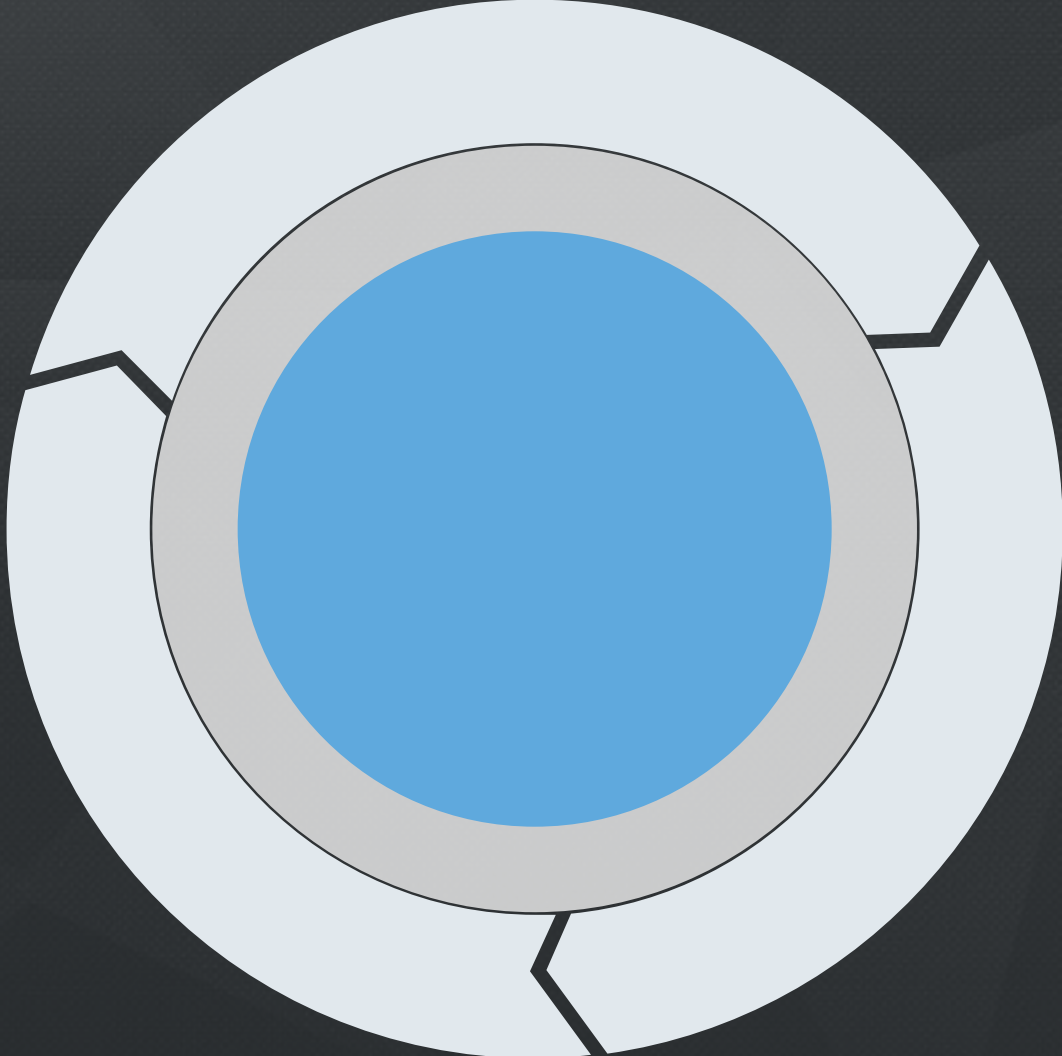




Reduction in Tweet failure rates from adding retries on network failures

# Resiliency

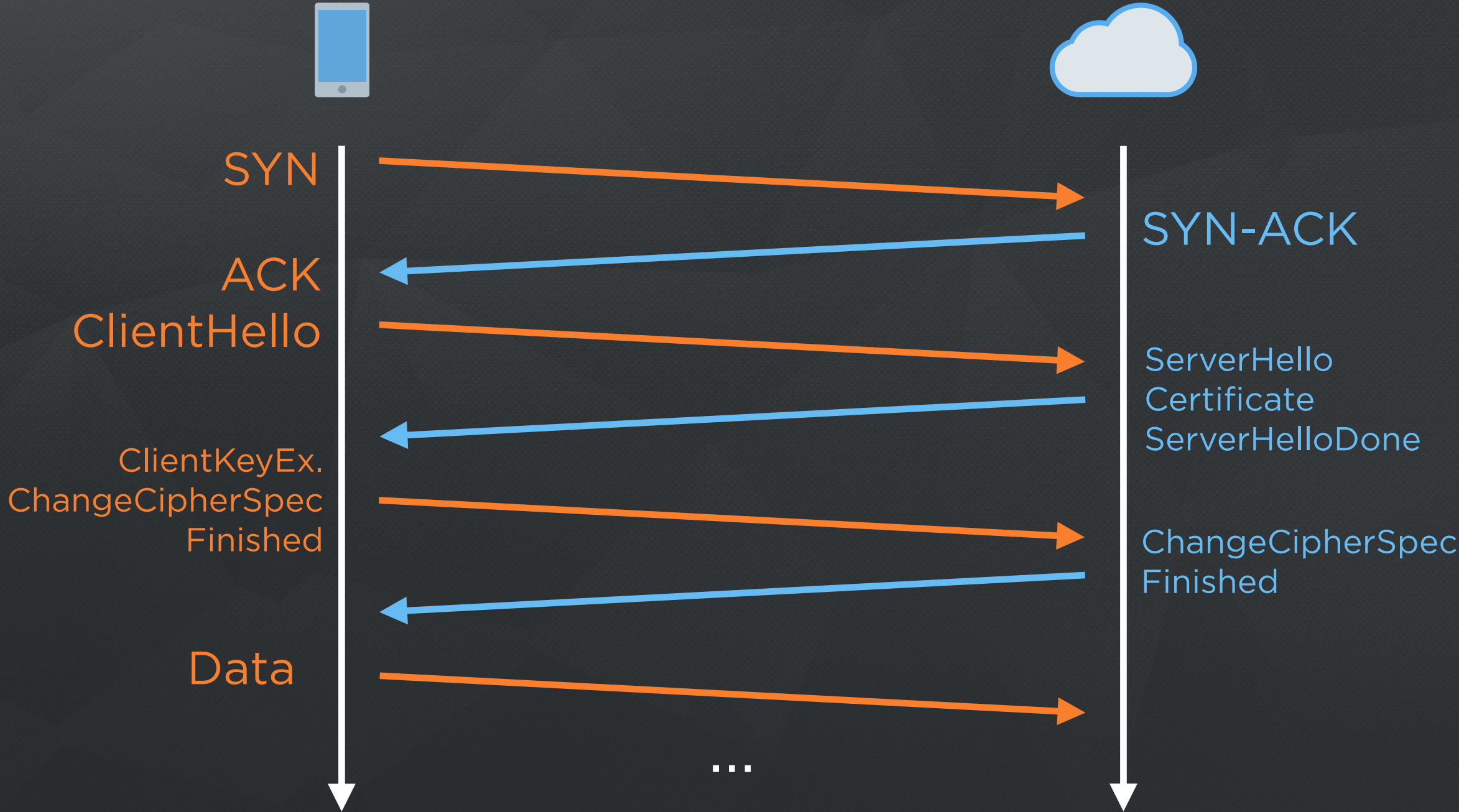
# Persistent Actions



# Performance

OBJECTIVE & USER-PERCEIVED

# TCP + TLS Handshake



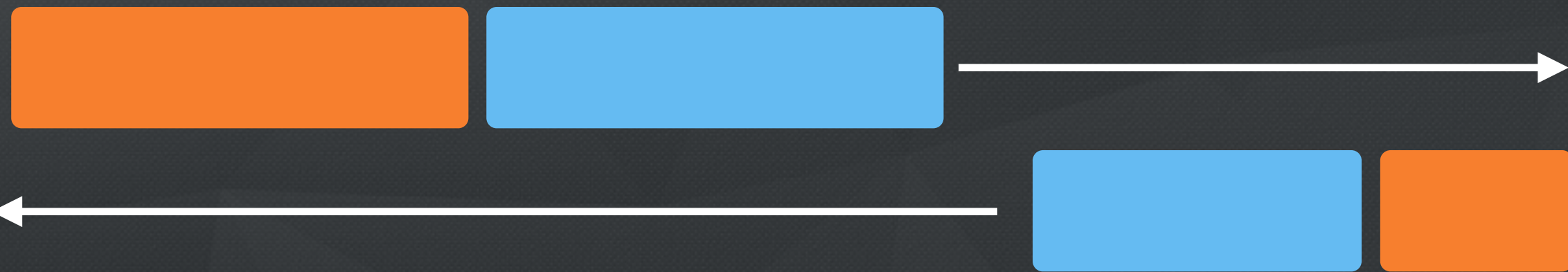
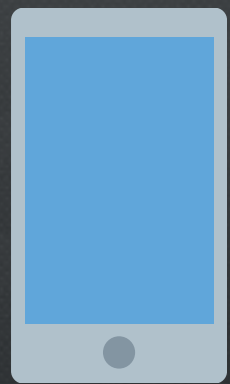
**3  
ROUND  
TRIPS!**



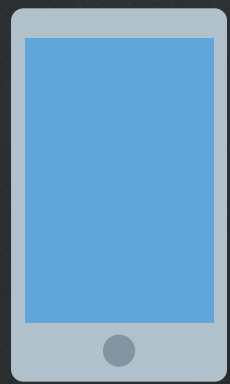
# Points of Presence (POPs)

# SPDY and HTTP/2

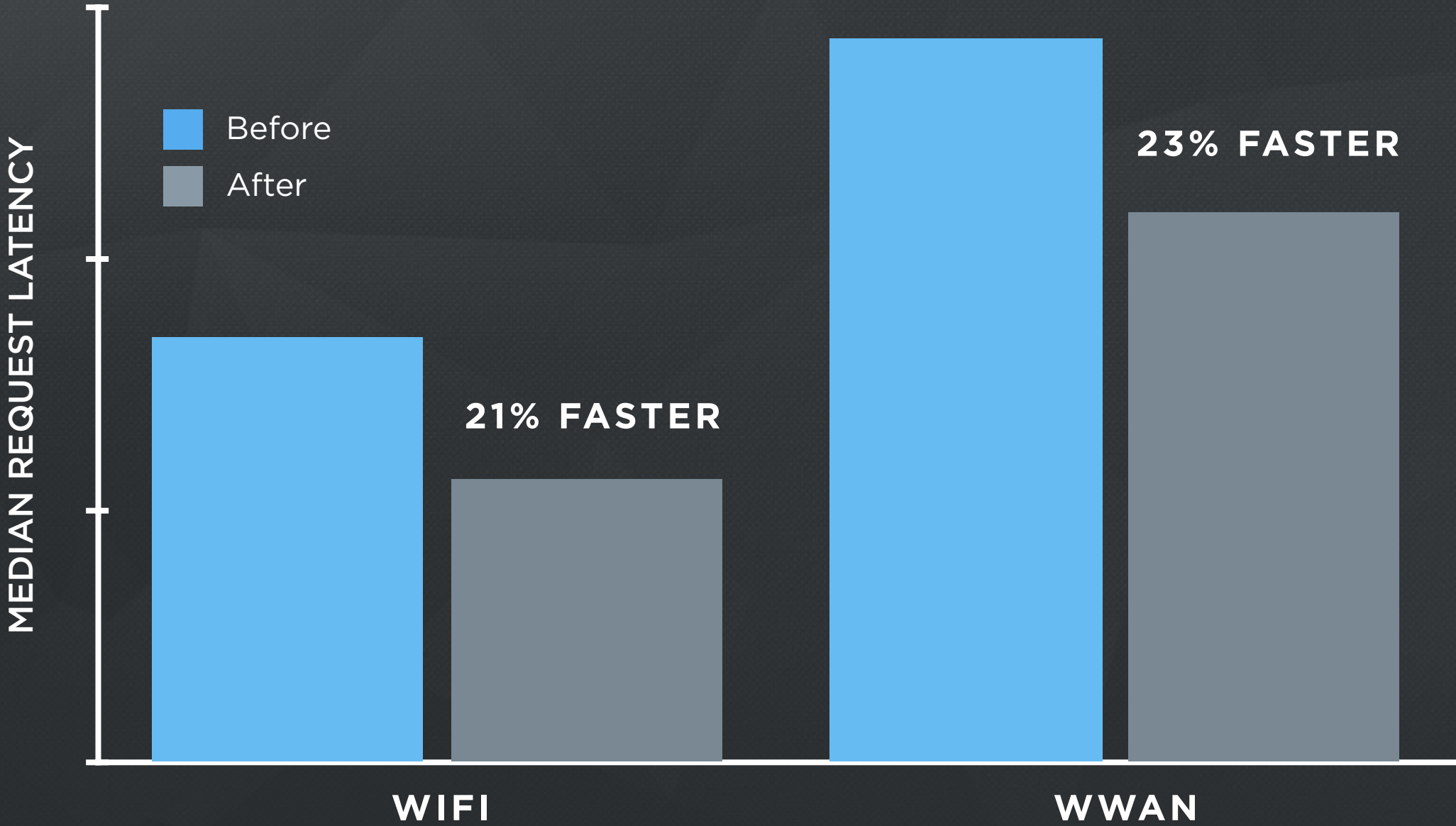
HTTP/1.1



HTTP/2

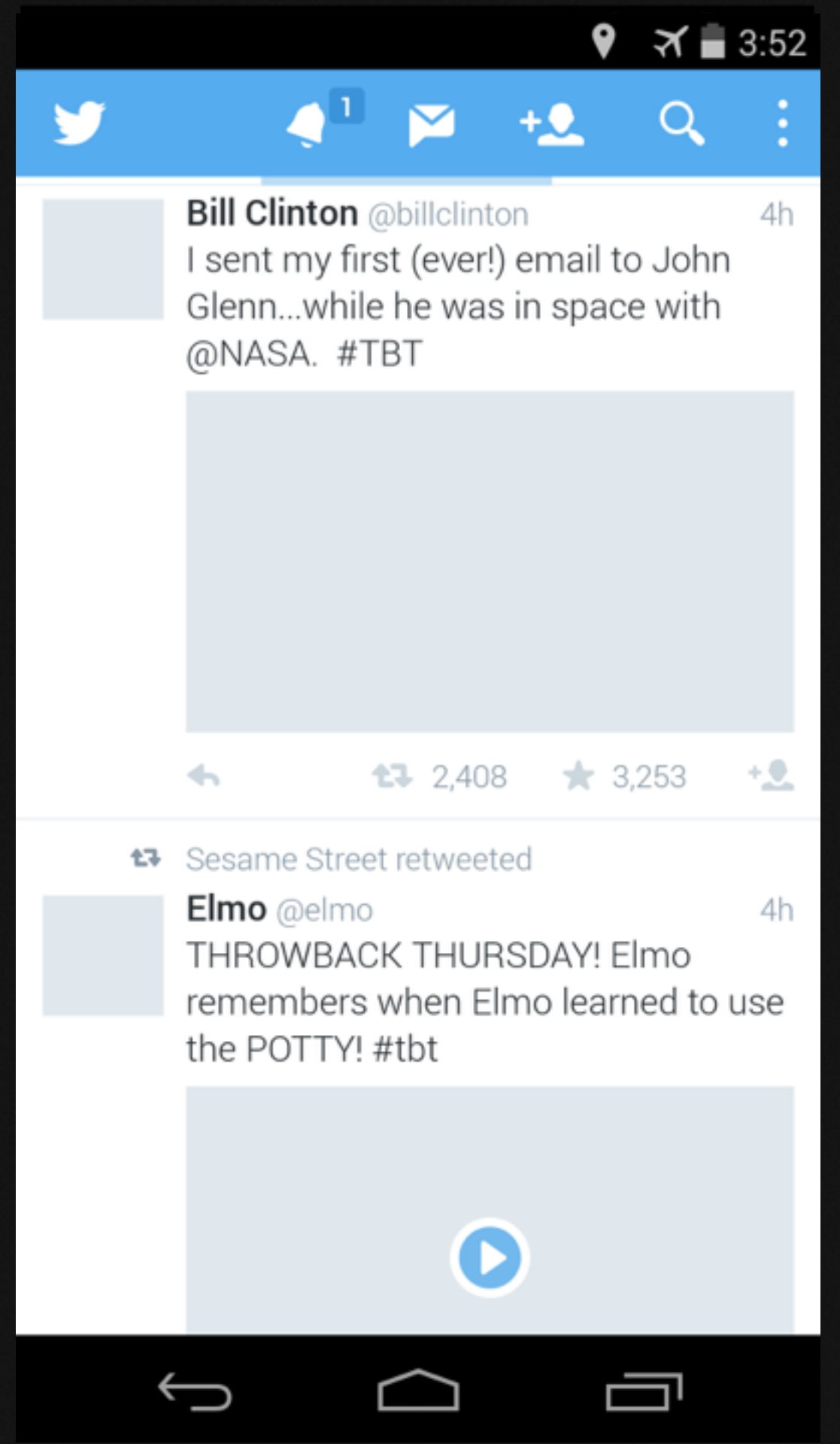


# Experimental Results (Additional POP & SPDY)



A USER PAIN POINT

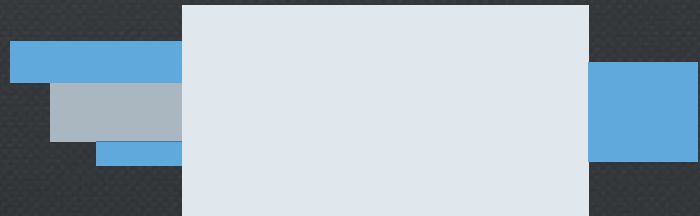
# Grey Boxes



# Solution



**NEW IMAGE  
FORMATS**



**BANDWIDTH  
REDUCTION**

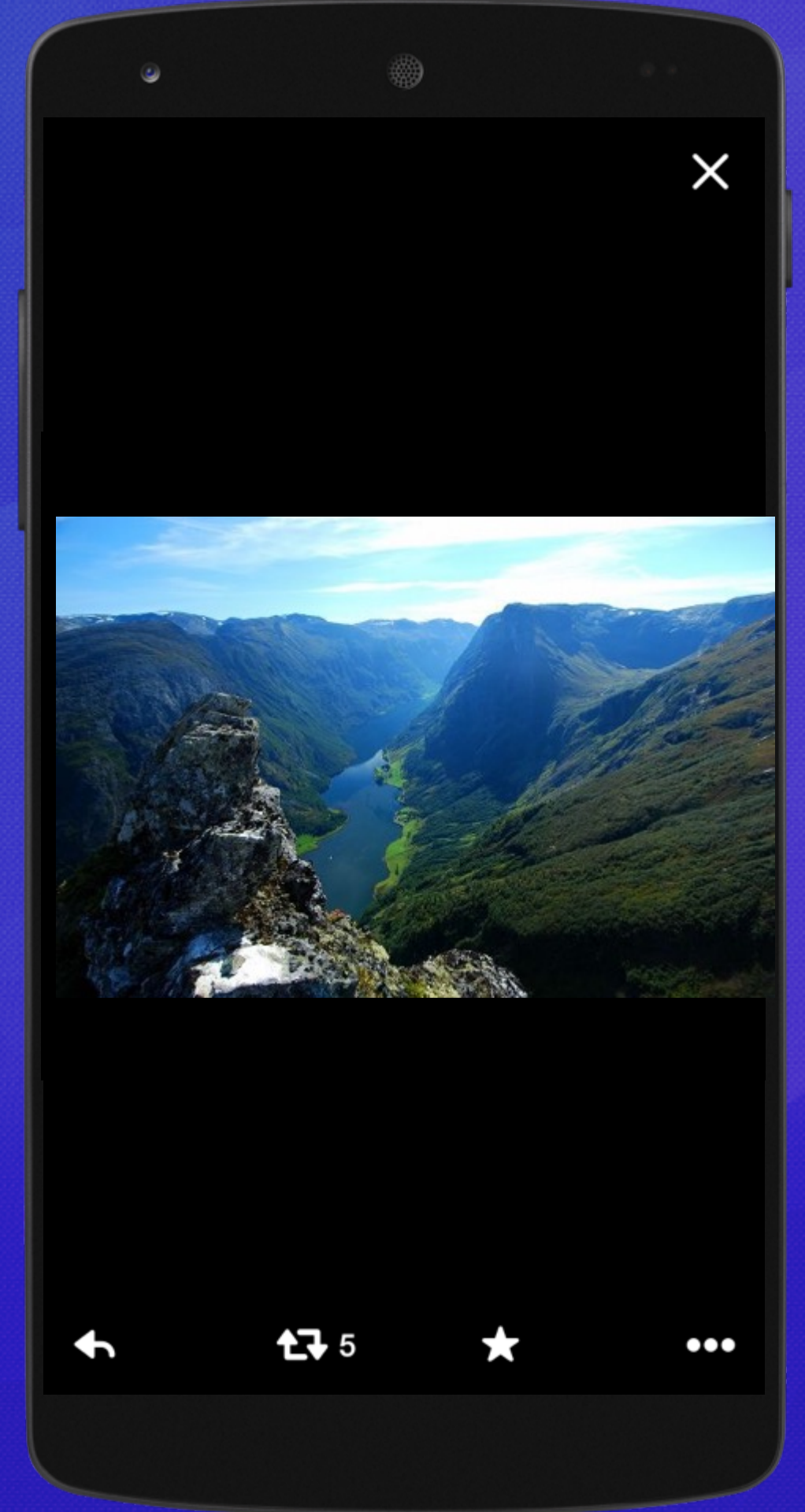
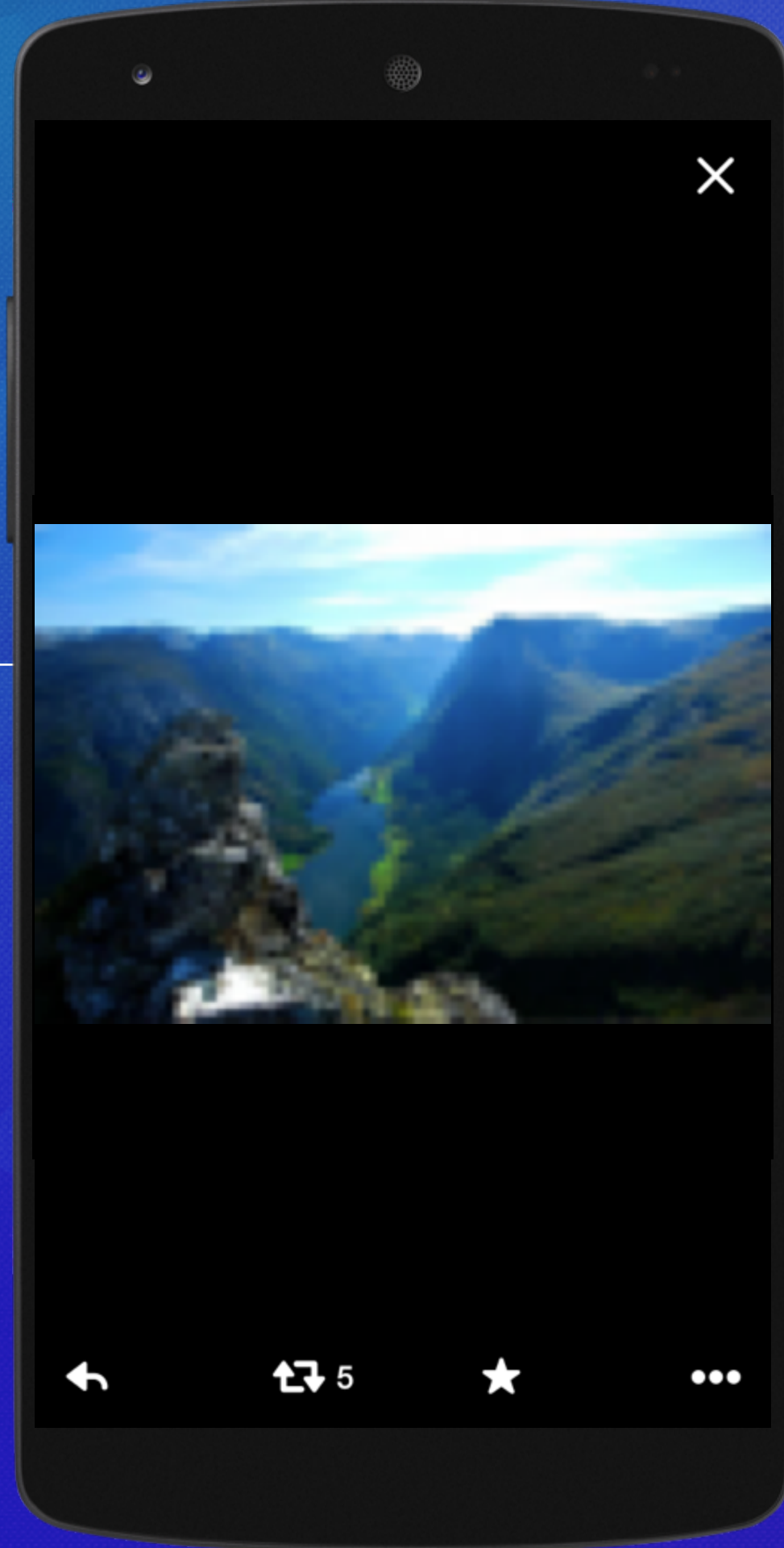
NEW IMAGE FORMAT

WebP



NEW IMAGE FORMAT

# Progressive JPEG



PJPEG

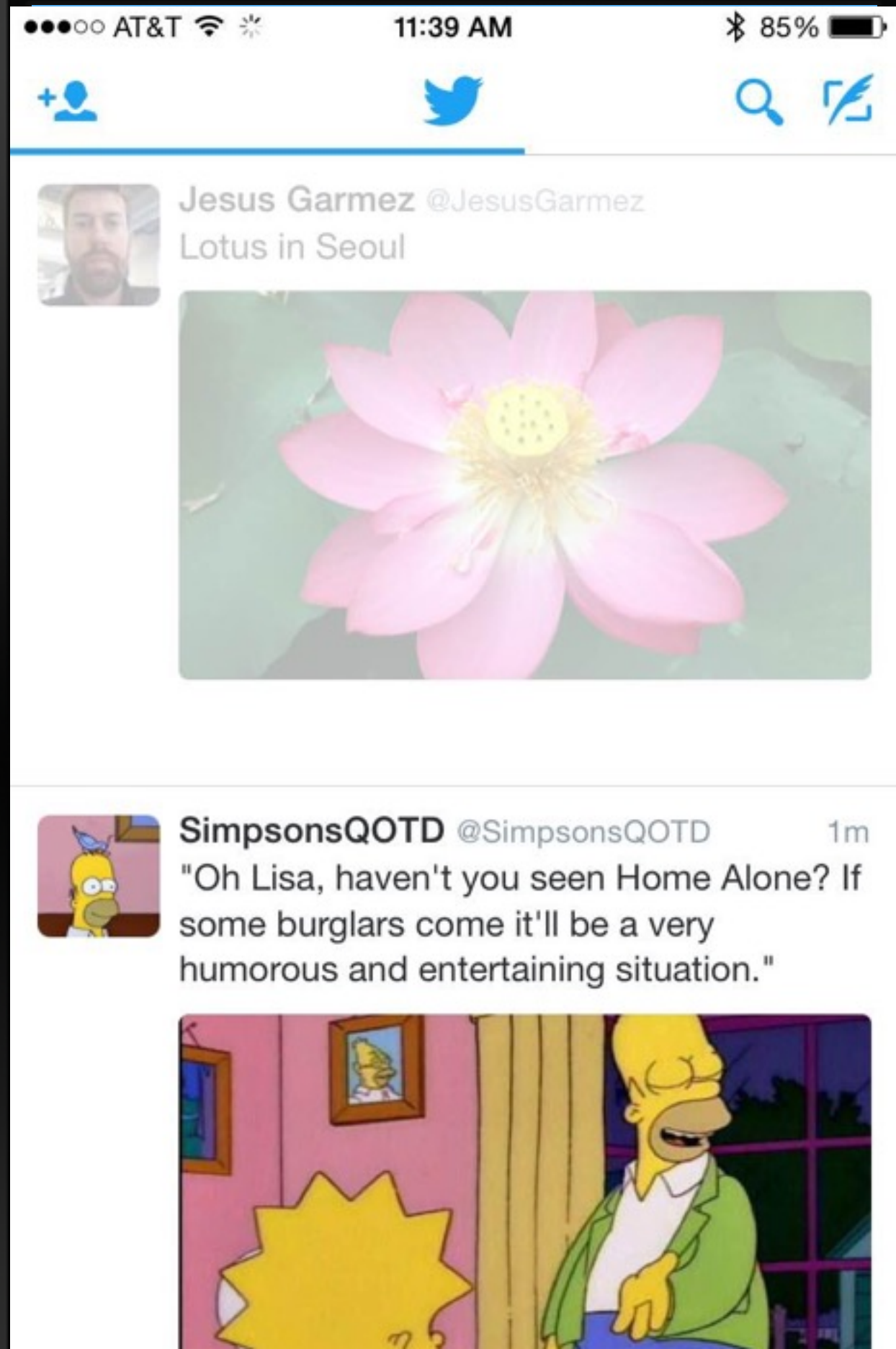
JPEG



# Waiting For Actions



# Communicate Network Status



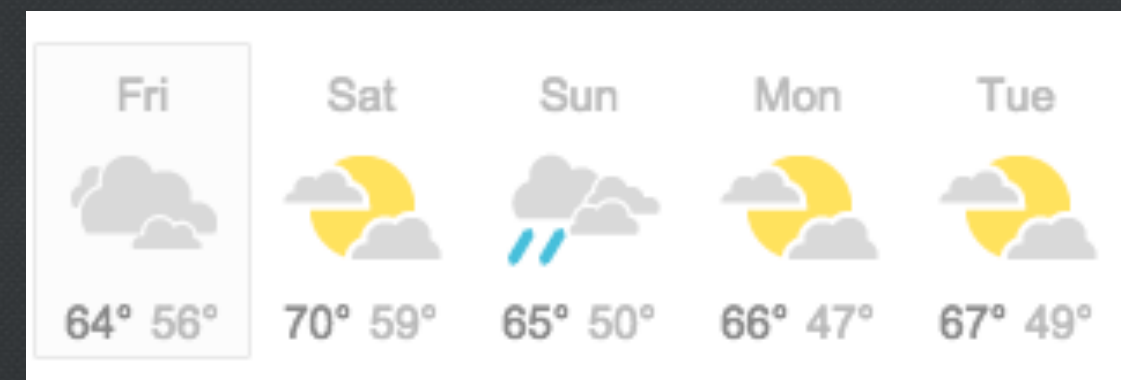
# Request Prioritization

- User actions
- Foreground API Requests
- Images
- Background API Requests
- Prefetching and Polling

# Empathy

# Forecast Framework

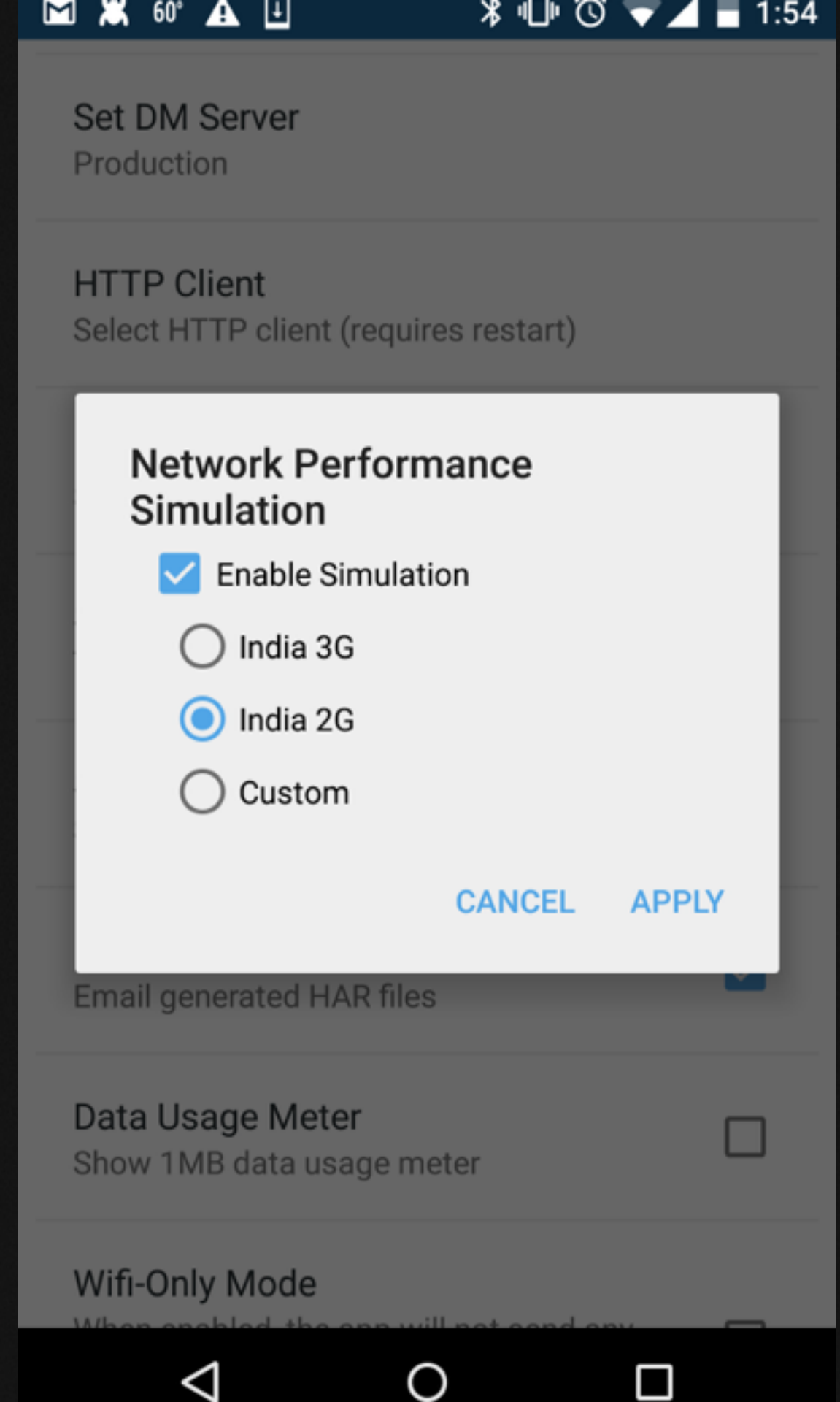
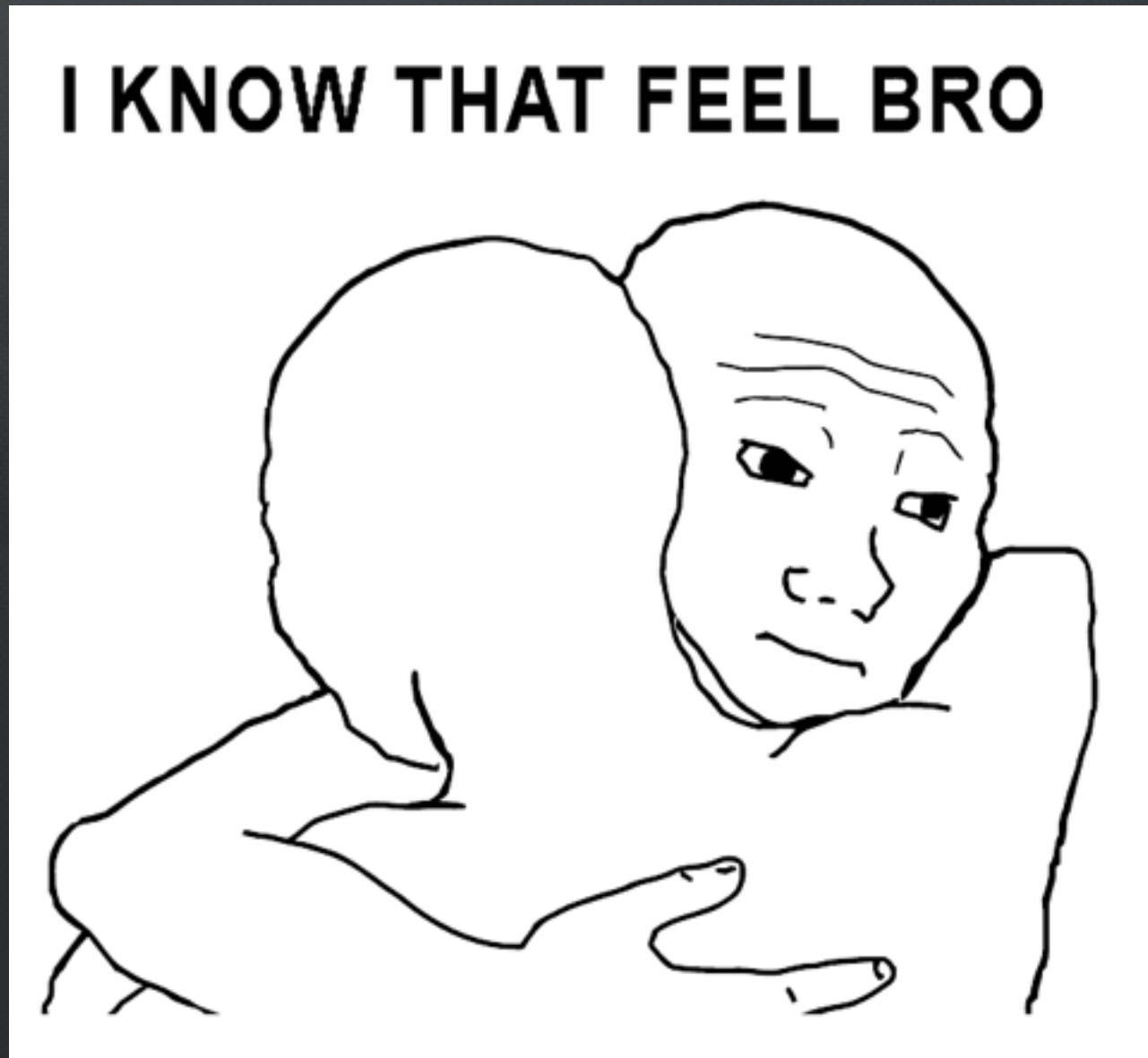
- Network quality estimation
  - Bandwidth
  - Latency
- Estimation based on application requests



# Forecast Example

```
/**
 * @return if videos should start playing automatically
 */
public boolean canAutoplay() {
    // A video can auto play if:
    return mIsFeatureEnabled &&
        !mNetworkDetails.getQuality()
            .isLessThanOrEqualTo(NetworkQuality.POOR);
    ...
}
```

# Network Simulation



# Network Debugging with HAR Logging

Android Request Group			
GET config?client=android	200 OK	2.7 KB	314ms
POST anonymize	200 OK	1.7 KB	358ms
GET install_referrer.json?os	404 Not F	1.6 KB	390ms
GET show.json?include_mec	200 OK	2.6 KB	409ms
GET MX20GPrn_x96.jpeg	200 OK	4.3 KB	338ms
GET settings.json?locale=U!	200 OK	1.8 KB	165ms
GET home.json?user_id=24:	200 OK	78.6 KB	244ms
GET suggest.json?format=h	200 OK	1.4 KB	266ms
GET device.json?udid=1d5f	200 OK	2 KB	47ms
POST push_destinations.js	200 OK	2 KB	257ms
GET settings.json?feature_s	200 OK	3.5 KB	174ms
GET suggest.json?format=h	200 OK	1.4 KB	135ms
GET aw-sOqH3_x96.jpg	200 OK	3.8 KB	41ms
GET 1b6204ccf804be6a180	200 OK	28.1 KB	92ms
GET COaefPmUEAQd8_l.jpg:	200 OK	24.1 KB	76ms
GET l3qdndtsjbuiadvbzspu_	200 OK	28.1 KB	81ms
GET COaerbWcAAFG3x.jpg:	200 OK	25.9 KB	209ms
GET status.json	200 OK	1.4 KB	90ms
GET user_updates.json?carc	200 OK	3.5 KB	175ms
POST register.json	200 OK	3.1 KB	104ms
GET about_me.json?model_	200 OK	5.8 KB	116ms
GET unread.json?cursor=tri	200 OK	1.7 KB	47ms
GET top.json?country_code:	200 OK	26.6 KB	166ms
GET lookup.json?user_id=2	200 OK	3.9 KB	82ms
GET sfWZ66dD_x96.jpeg	200 OK	5.6 KB	115ms
GET list.json?skip_status=ti	200 OK	1.8 KB	42ms
26 Requests		227.6 KB	3.82s



# Bringing it all together

# How To Deal With Unreliable Networks



ALL NETWORKS  
ARE UNRELIABLE



NO SILVER  
BULLETS



USER EMPATHY

# Thank You

Jie Jin | @jiegantic