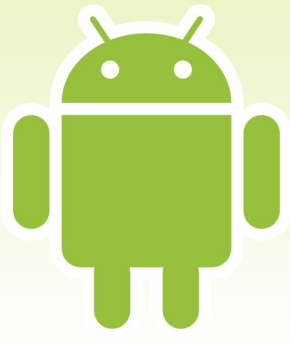
Android Builders Summit

Android App Tuning Techniques

Part Three: Bandwidth & Power



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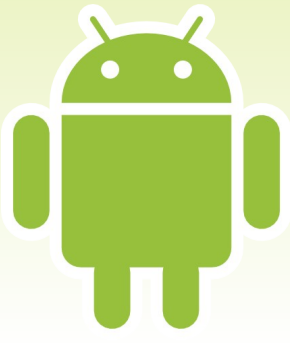
The #A4C739 Mantra

- Reckon
- Reduce
- ~~Reorder~~
- Reuse
- ~~Recycle~~
- ~~Cheat~~



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Bandwidth: Reckon

- Data Usage in Settings
  - Focused on mobile data, not WiFi
  - Fairly coarse-grained

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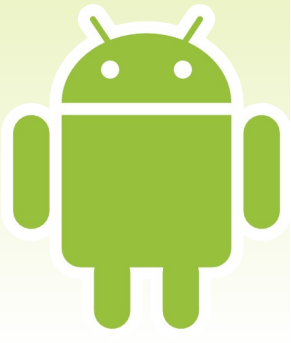
Bandwidth: Reckon

- TrafficStats
  - Point-in-time bandwidth consumption
    - Since last boot
    - Since last reset
  - Overall, by UID, Rx/Tx, etc.
  - Collect data, compute deltas
    - Test cases
    - Production for in-app bandwidth shaping



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Bandwidth: Reckon

- DDMS Network Traffic
  - Chart, table showing network usage
    - Process
    - By tag as set via TrafficStats
  - Tagging helps identify more specific culprits

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Bandwidth: Reckon

- Outside-the-SDK Options
  - Low-level Linux monitoring
    - May require root
  - Proxies
  - Measurement in the network
    - Robust access points, firewalls, etc.

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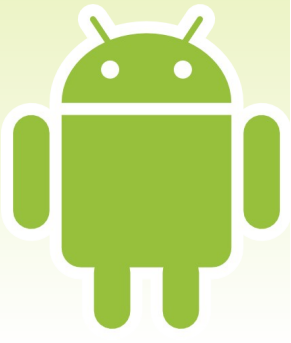
Bandwidth: Reuse

- Client-Side Caching
  - Tactical
    - ETag, If-Modified-Since, and kin
    - HTML5 cache manifests
  - Strategic
    - PhoneGap vs. Web app



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Bandwidth: Reduce

- More Compact Transfers
  - GZIP
  - Binary Instead of Text
    - Favor protobuf & Thrift over JSON & XML
  - Deltas
    - Diffs
    - Commands to be replayed
    - Feeds

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Bandwidth: Reduce

- Push It (Real Good)
  - Use GCM to tell the app when there is data available
  - Pattern
    - Have long poll/sync period, as backstop if GCM messages are not being delivered
    - On receipt of GCM message, schedule a poll/sync in tandem with other apps (e.g., inexact alarms)

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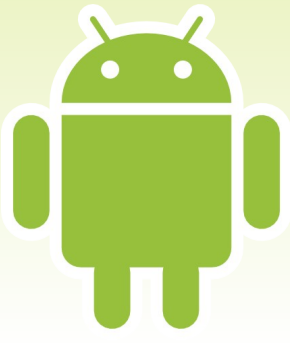
Bandwidth: Reduce

- Tricks from Web Development
  - E.g., fonts-and-glyphs vs. individual images
  - Be careful of techniques that may not work across environments
    - CSS sprites



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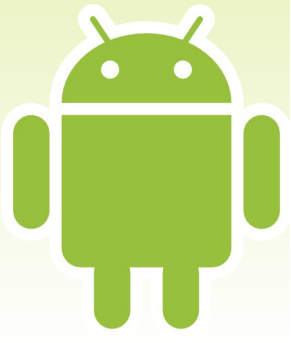
Power: Reckon

- Battery “Blame” Screen in Settings
  - Very coarse-grained
  - Based on educated guesswork



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Power: Reckon

- The Tool That Must Not Be Named
  - Qualcomm
  - Works with instrumented hardware (MDP series)
  - Cannot say more due to non-disclosure terms in software license agreement

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Formal Research

- "How is Energy Consumed in Smartphone Display Applications?"

- "An Analysis of Power Consumption in a Smartphone"

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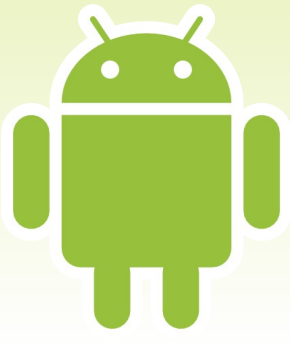
Power: Reduce

- Network: Expectation vs. Reality
  - Expectation: power drain proportional to bandwidth used
    - As rough analogue to radio time
  - Reality: cool-down period
    - Full-power radio stays at full power, before going to low-power, before going to standby
    - Spends many seconds in full- or low-power after you have stopped transferring
    - Net: additional power drain beyond transfer time



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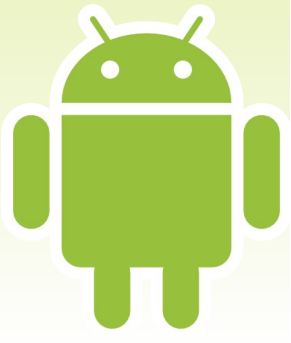
Power: Reduce

- Network: Fewer, Bigger Transfers
  - Pre-load likely material, even if not 100% certain will need
  - Think two-way sync vs. independent upload, download schedules
  - Cache and upload periodically versus uploading in real time
  - Adjust Web service API
    - Denormalize
    - APIs that request arbitrary collection of stuff



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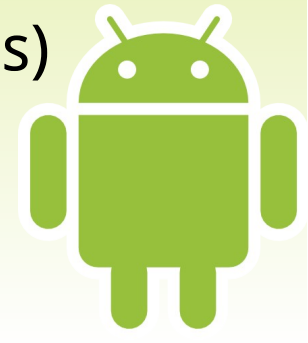
Power: Reduce

- Network: Use Better Bandwidth
  - Can your work wait a bit, to see if WiFi becomes available?
    - Higher power but (usually) faster throughput
    - Also reduces mobile data costs or hits against a usage cap
  - Offline caching vs. streaming
    - Offering user-driven download-and-cache not only may allow more use on WiFi, but adds a desired feature for places where bandwidth may not exist (e.g., planes)



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Power: Reduce

- Network: Synchronize With Other Apps
  - Try to “warm up” the radios once for all versus independent behavior
  - Examples
    - Android SyncAdapter
    - Android inexact alarms

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Power: Reduce

- Don't Force the Screen On
  - FULL_WAKE_LOCK, android:keepScreenOn, etc.
  - Allow screen to turn off at user
- Don't Force the CPU On
  - Partial WakeLocks: use sparingly
  - WakefulBroadcastReceiver & WakefulIntentService

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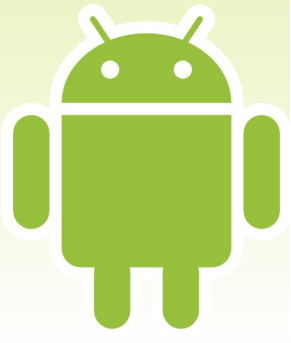
Power: Reduce

- Local I/O: Once Again, Size Matters
  - More efficient to do fewer larger I/O operations than lots of smaller I/O operations for same amount of data



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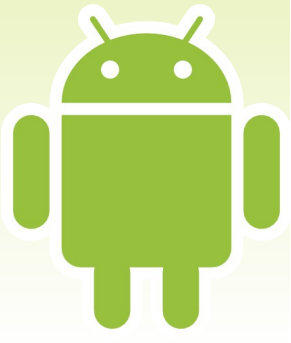
Power: Reduce

- Local I/O Mitigation
  - Memory caching for reads
    - For network, two-tier cache where appropriate
  - Memory buffering for writes
    - Example: logging
  - Consider I/O optimizing for what the app needs
    - Example: flat file appending vs. database updating



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Power: Reduce

- Sensors
  - Expensive
    - GPS
    - Camera, while in use (e.g., AR)
  - “Free”
    - Example: accelerometer “always on” for detecting when screen should light up

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Power: Reduce

- Alter Behavior as Battery Drops
  - Less-frequent updates
  - Suspend unnecessary overhead (e.g., analytics logging)

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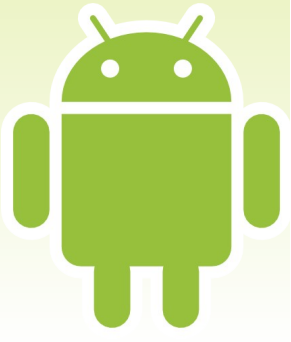
Power: Reduce

- Put the User in Control
  - Steer the user towards power-saving behavior via sensible defaults
    - Expectation management
  - Allow user to “tune” behavior to be more or less aggressive depending upon wishes
  - Help users understand power implications of configuration changes



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Slides 'n Stuff!

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