android battery consumption

the what & how

kumar rangarajan

little eye labs

introducing

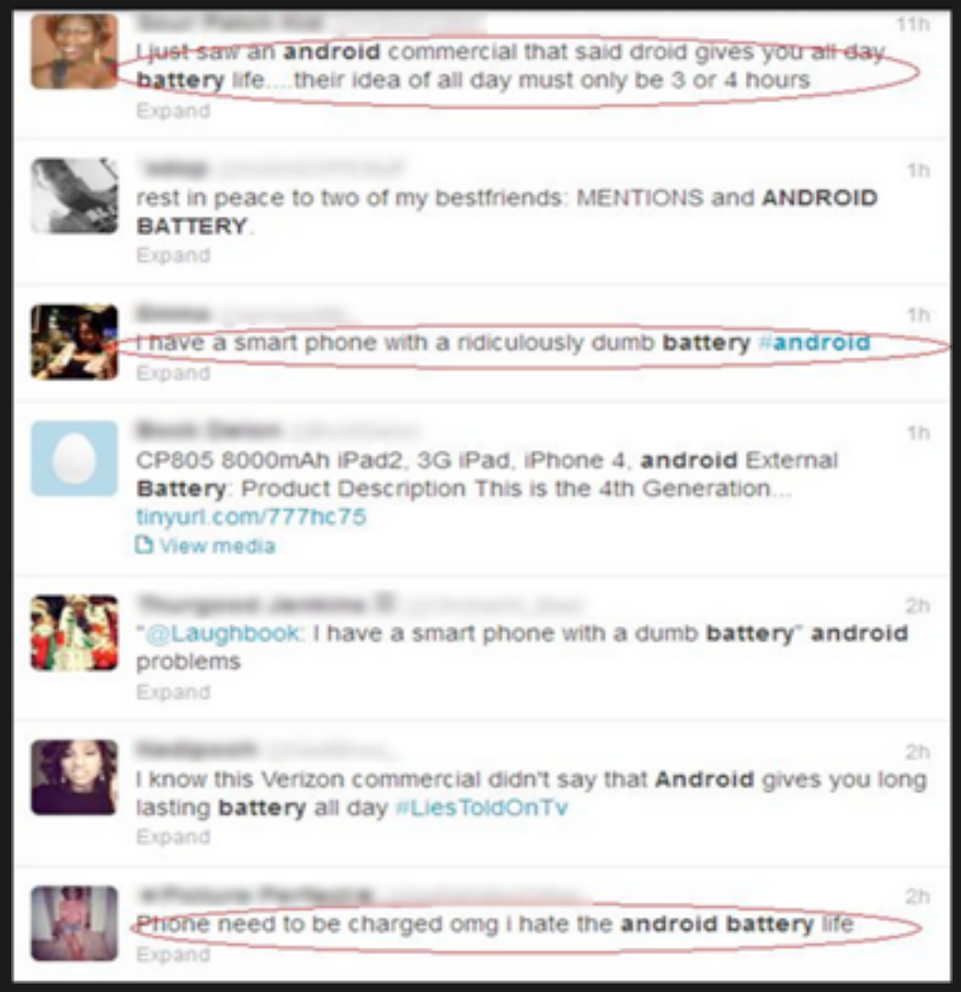
littleEye appInsight

CT scanner for your Android App

why should you care about battery consumption?

- #1 pain point of smart phones users.
- more visible on Android than in iOS
- unlike memory, you can never reclaim excess usage!
- no moore's law for battery capacity
- improving battery capacity is an ongoing research activity, but no current solution
- even then keeping up with consumption would be difficult as apps get more powerful and resource hungry

we code... consumers suffer



Bad battery life is a big problem for

- Users
- Developers
- Ad networks
- Smartphone manufacturers

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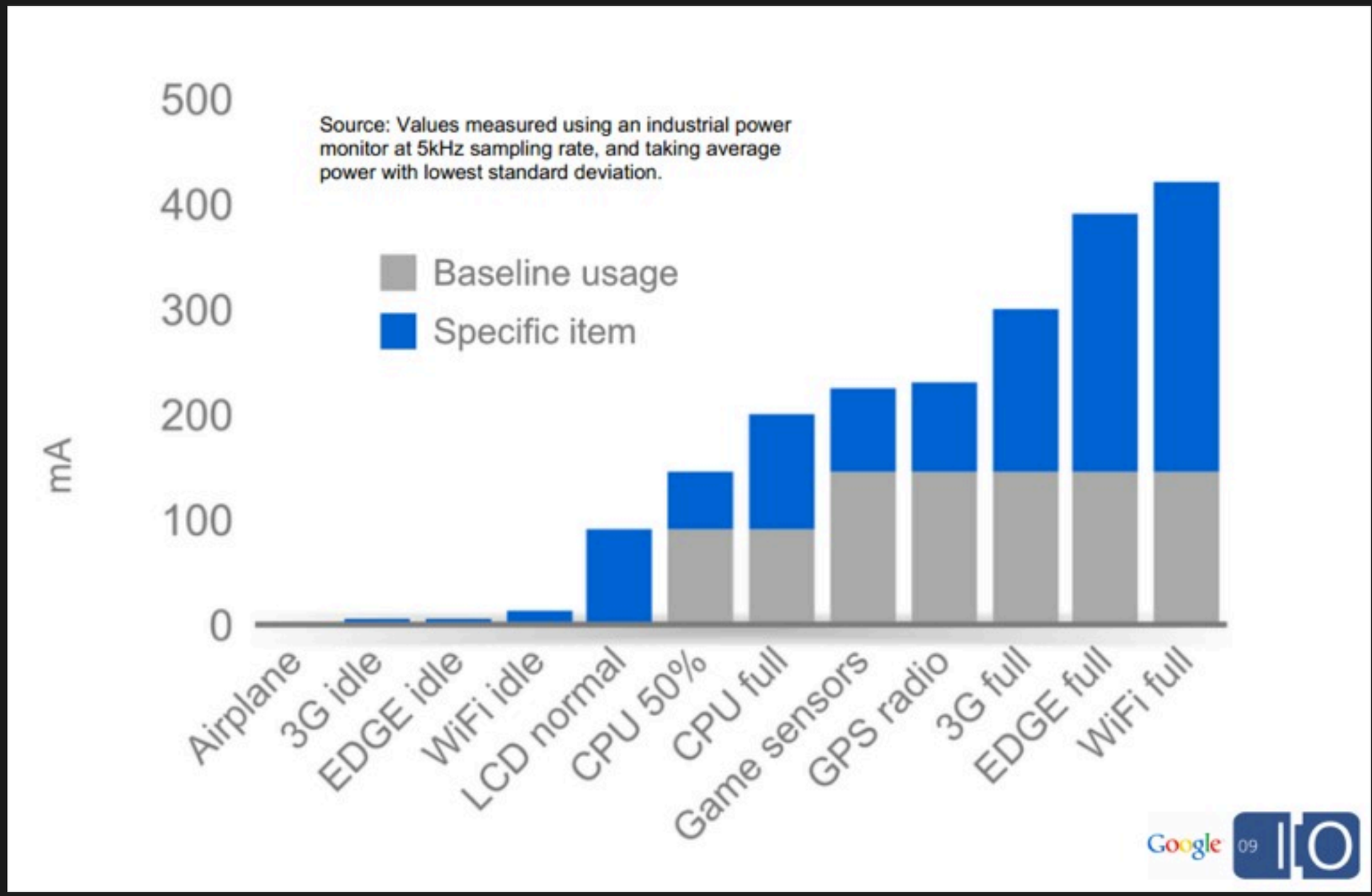
what consumes power?



originally published in Google IO by Jeff Sharkey

network activity

- EDGE consumes less power for a byte of data transfer, but is slow
- Wifi consumes more power on average, but can do job faster
- 3G consumes more power than Wifi, and typically slower than Wifi.
- 4G consumes more power than 3G, and depending on availability, faster than Wifi

4G > 3G > Wifi > 2G

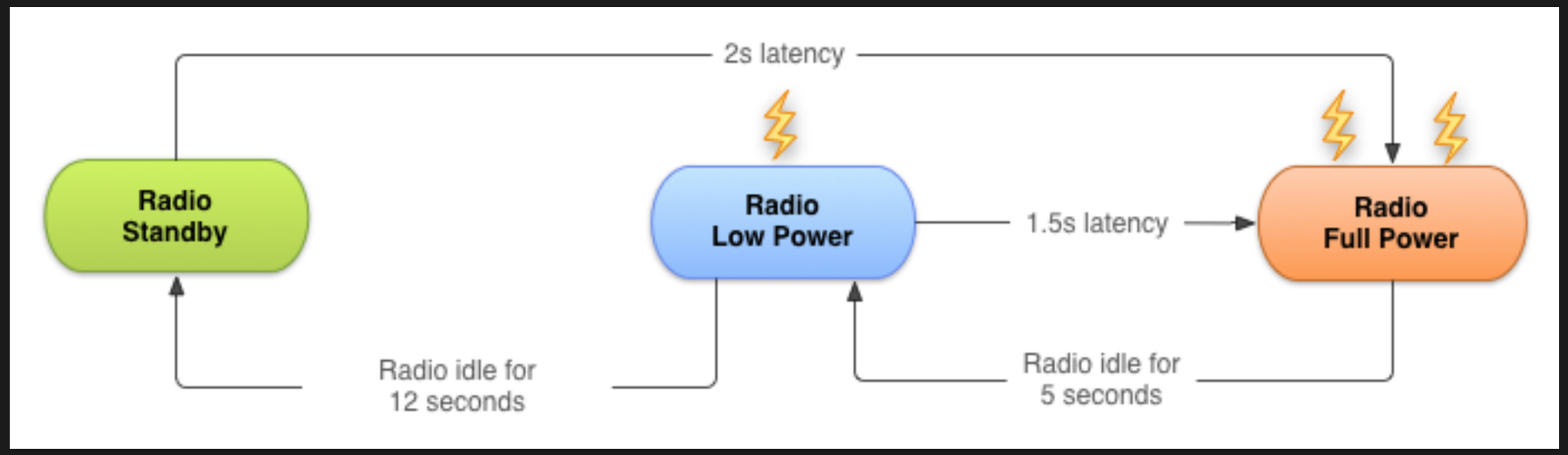
what causes power consumption?

- four primary states -
  - establishing connection or association
  - maintaining association (idle)
  - transmission (two or more sub states)
  - tail state (pseudo state)

	Establish	Maintain	Transmit	Tail
Wifi	High	Low	Low	Low
2G	Low	Low	Low	Low
3G	Low	Low	High	High

derived from http://people.cs.umass.edu/~arun/papers/TailEnder.pdf

more about states

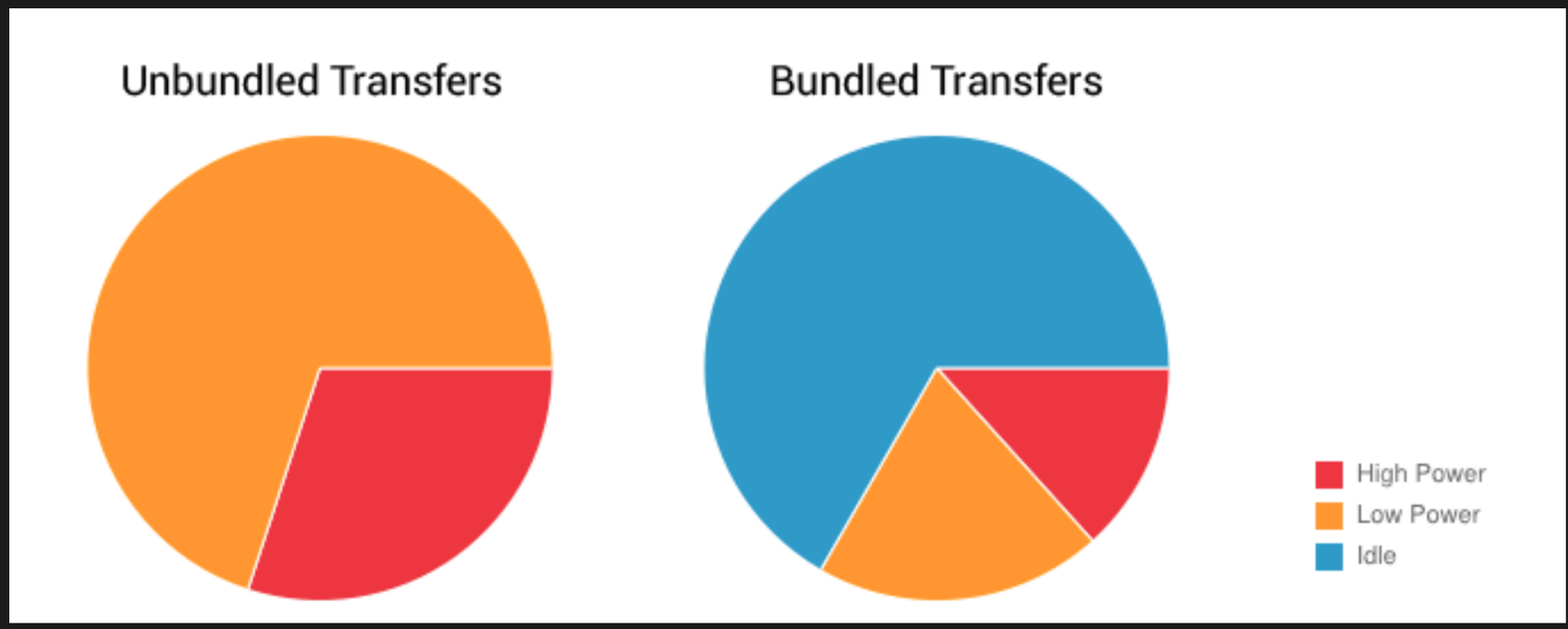


time between state reduction = tail state

how apps can impact state

	number of data operations	duration between operations	size of each operation	time in high/ low state
app1	3	18	1 mb/s	18 + 42 seconds
app2	3	0 (bundled)	1 mb/s	8 + 12 seconds

relative power consumption



Total Current Consumed for 1 minute

app1	78mA
app2	28mA

app1 consumes 3x app2

best practices for network

- prefetch data
  - to avoid switching states frequently, try and read as much data as possible
  - trade-off between too much pre-fetch and battery drain
  - google recommends prefetching data that you will initiate in the next 2 to 5 minutes, and in the order of 1-5 MB size
- batch data
  - do data send/receive in batches rather than on-demand
  - eg: batch analytics information, rather than sending them as they are collected

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- detect network connection
  - avoid connection attempts if no network is active
- avoid polling and use GCM when possible
  - avoids multiple connections
  - reduces the number of device state changes
- using inexact timers
  - *AlarmManager.setInexactRepeating()*
  - use *ELAPSED_REALTIME* instead of *ELAPED_REALTIME_WAKEUP*

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- varying download pattern
  - modify pattern based on connection type
  - download more data per session on faster networks
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- monitor charge level and state
- monitor and determine the docking state and type
- monitor the connectivity state
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if your audience has not gone
to sleep yet
&
organizers have...

screen

- color matters!
  - esp on OLED screens
- darker the color, lesser the consumption
- brightness levels have more impact
  - refer to - http://stackoverflow.com/questions/5032588/cant-apply-system-screen-brightness-programmatically-in-android
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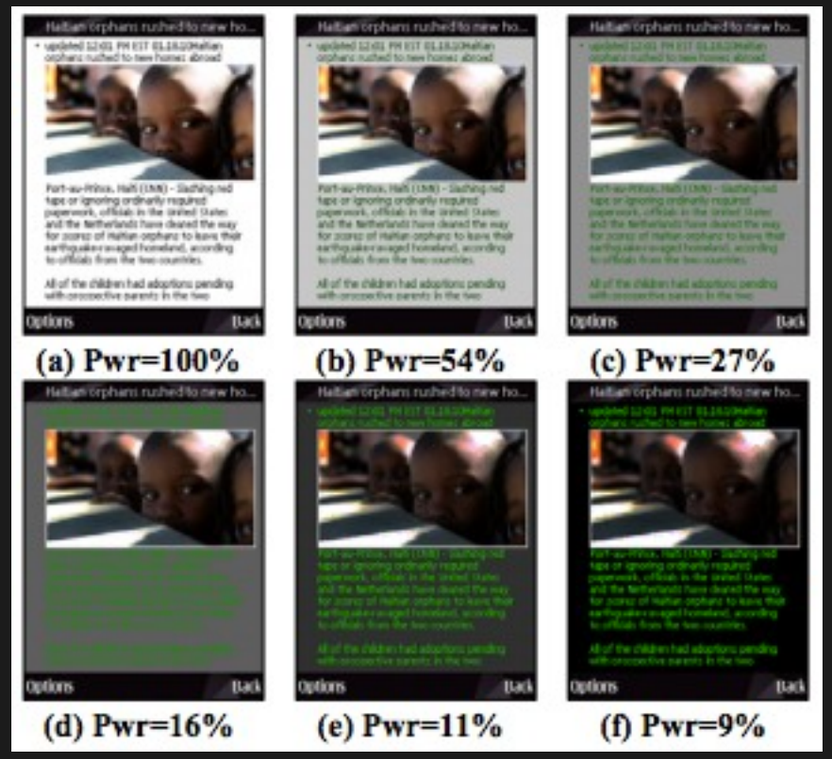

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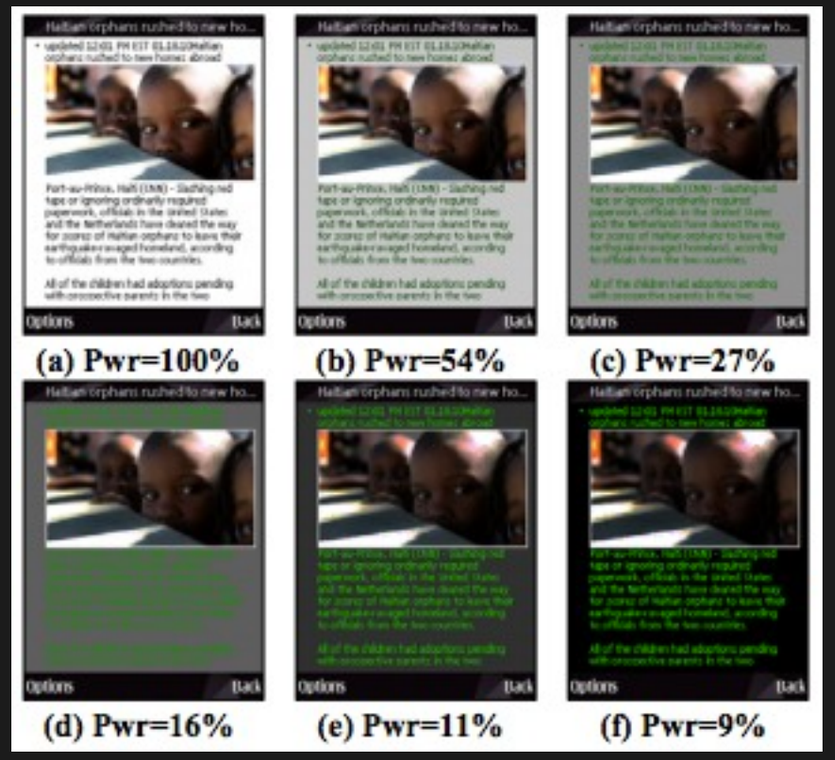

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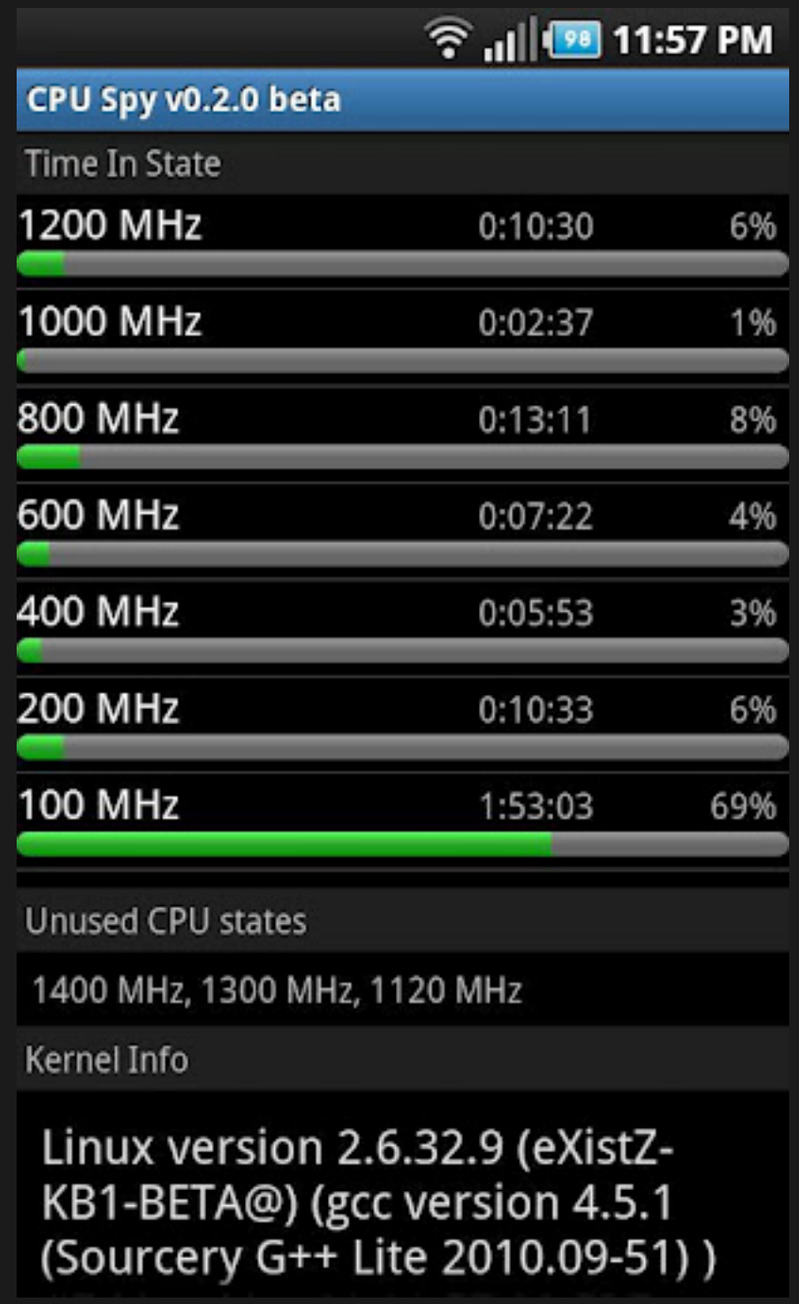
cpu

- typically runs on various frequencies
- frequency transition controlled by governor policy installed
- same concept as on linux based PCs, but typically more aggressive
- system drops down to ‘deep sleep’ as much as it can
- frequencies are scaled based of usage



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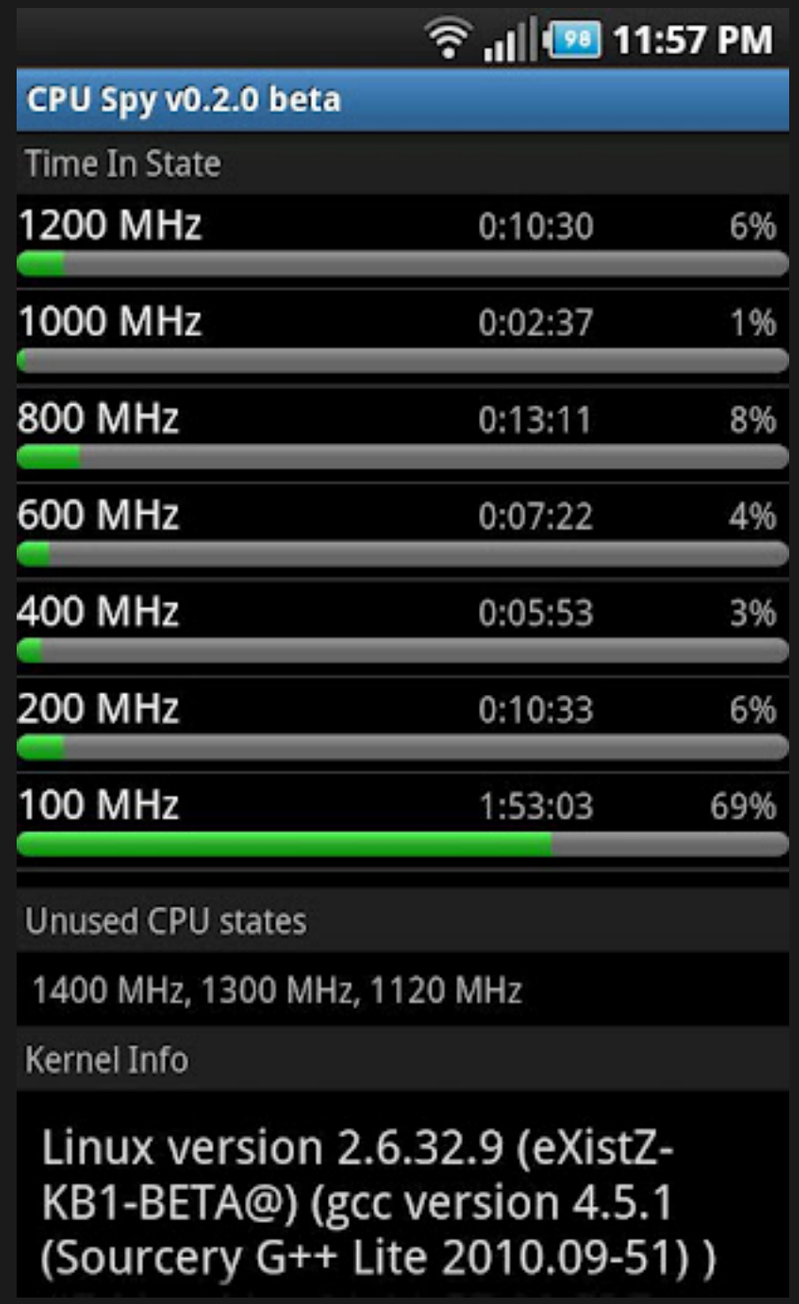

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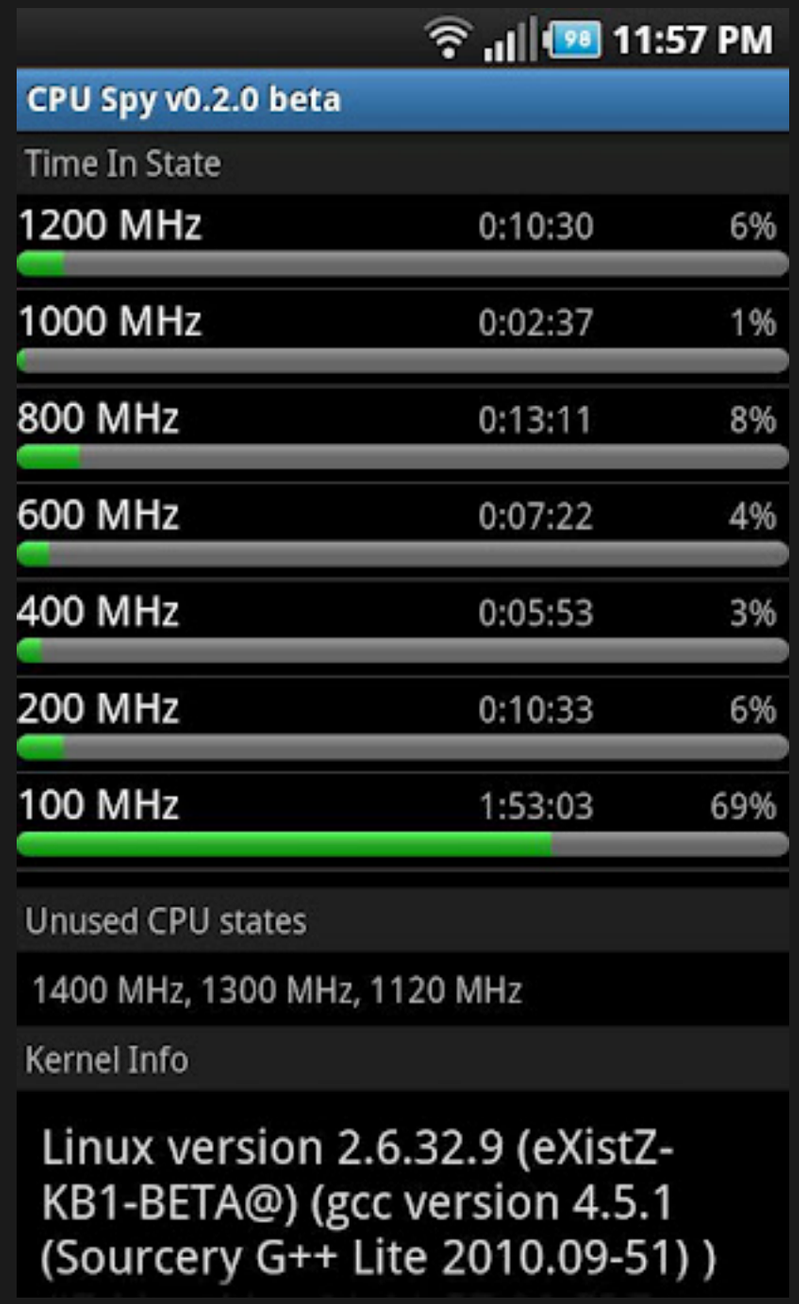

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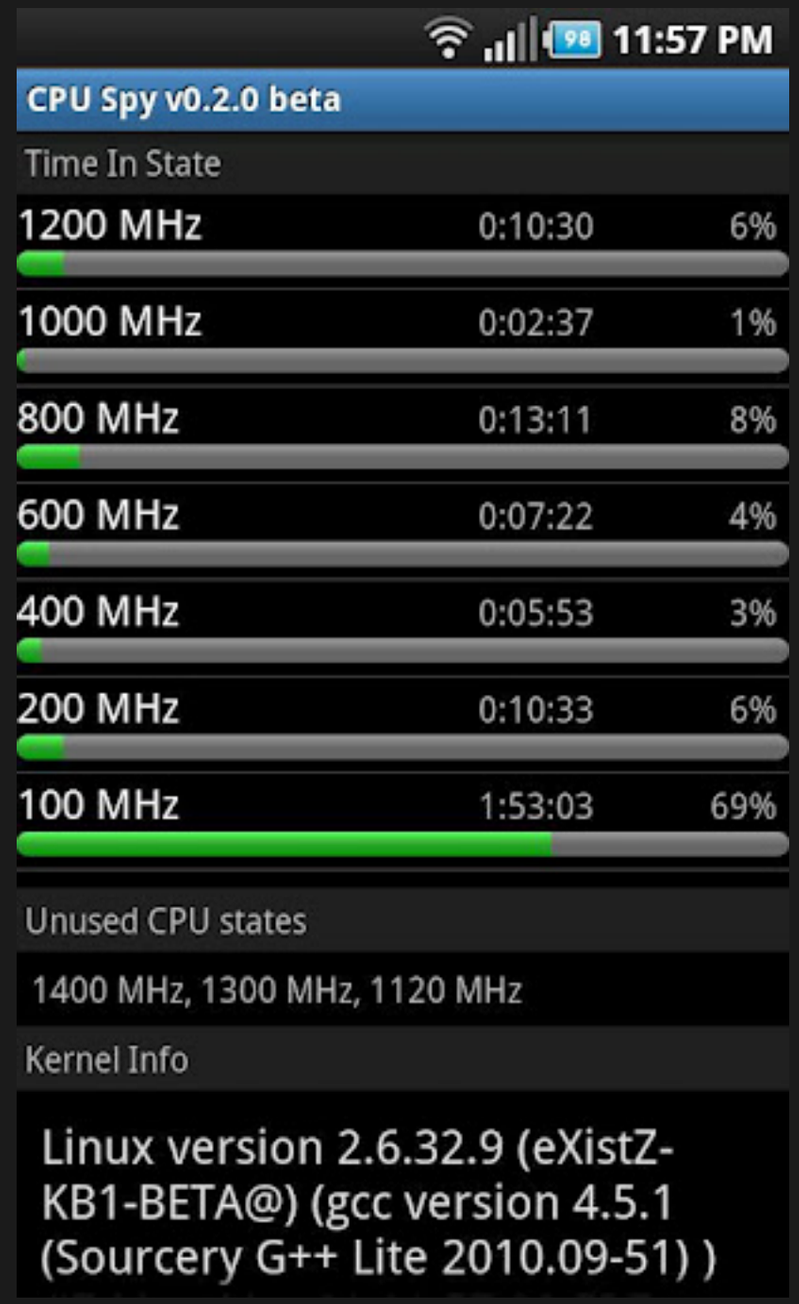

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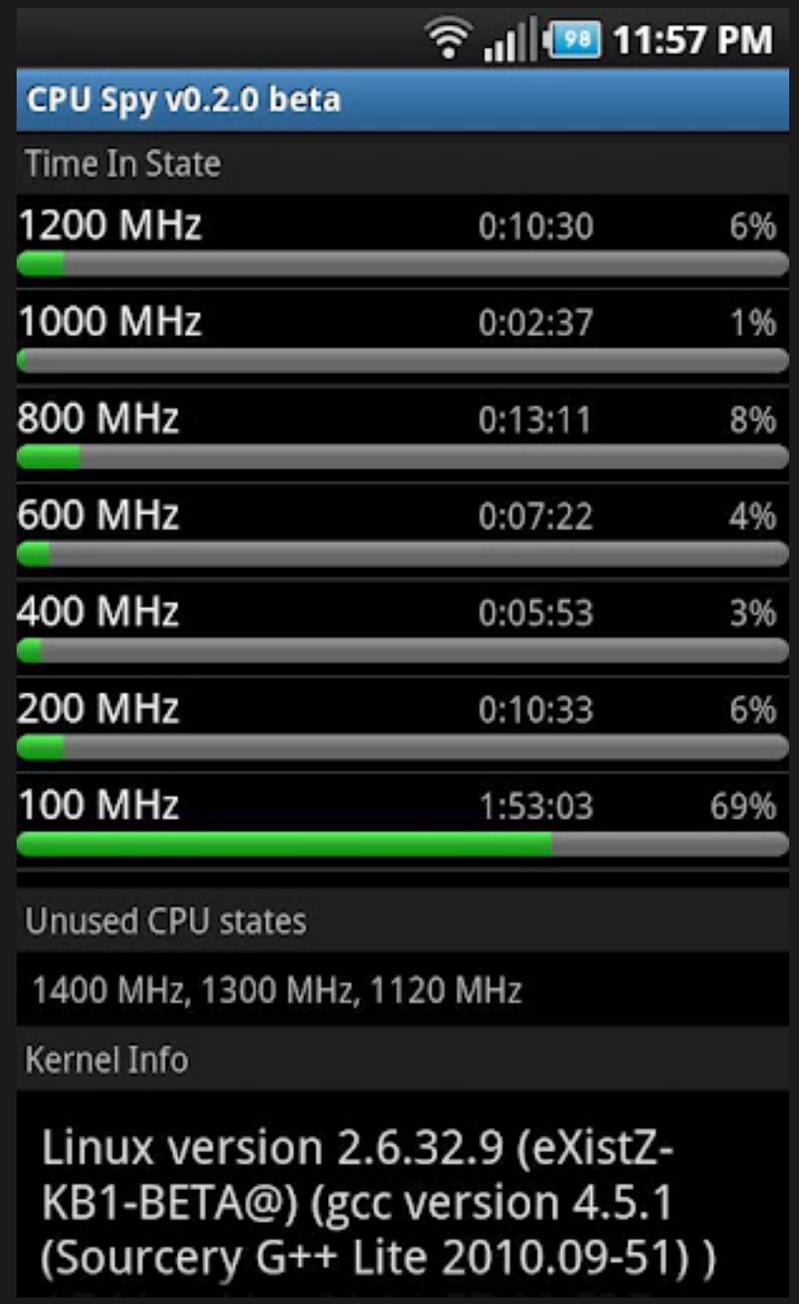

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- use them only if really needed and ensure they are removed as soon as possible
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- if possible, spread out your computationally intensive job

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SKYHOOK

references

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thank you

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