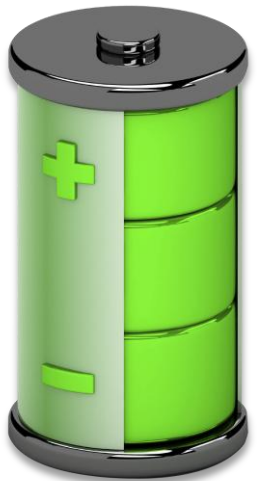


Optimizing Your Game for Energy Efficiency with ARM® DS-5™ Streamline™

Ronan Synnott
Select Core Competency FAE
ARM



What Do You Want From a Smartphone?



9.04%

“improved battery life received almost twice as many consumer votes as any other smartphone feature”

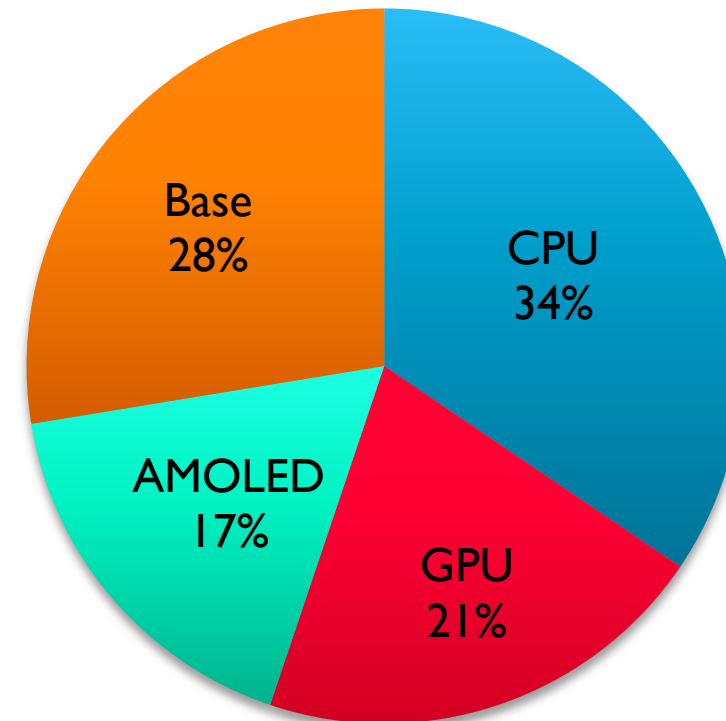
Source:Versus, December 2013

Where Does the Energy Go?

“Due to the large volume of graphic computation on CPU/GPU and high display quality requirement, video games have become one of the most power-consuming application types in smartphones.”

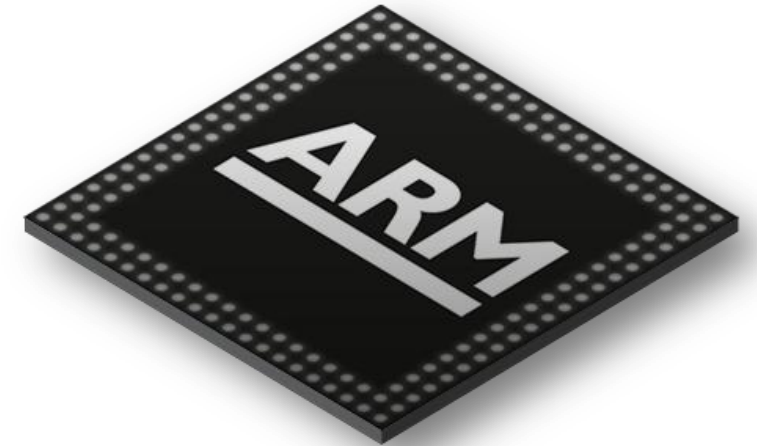
Source: Chen et al, ACM HotMobile'13

Power Consumption, Quake3

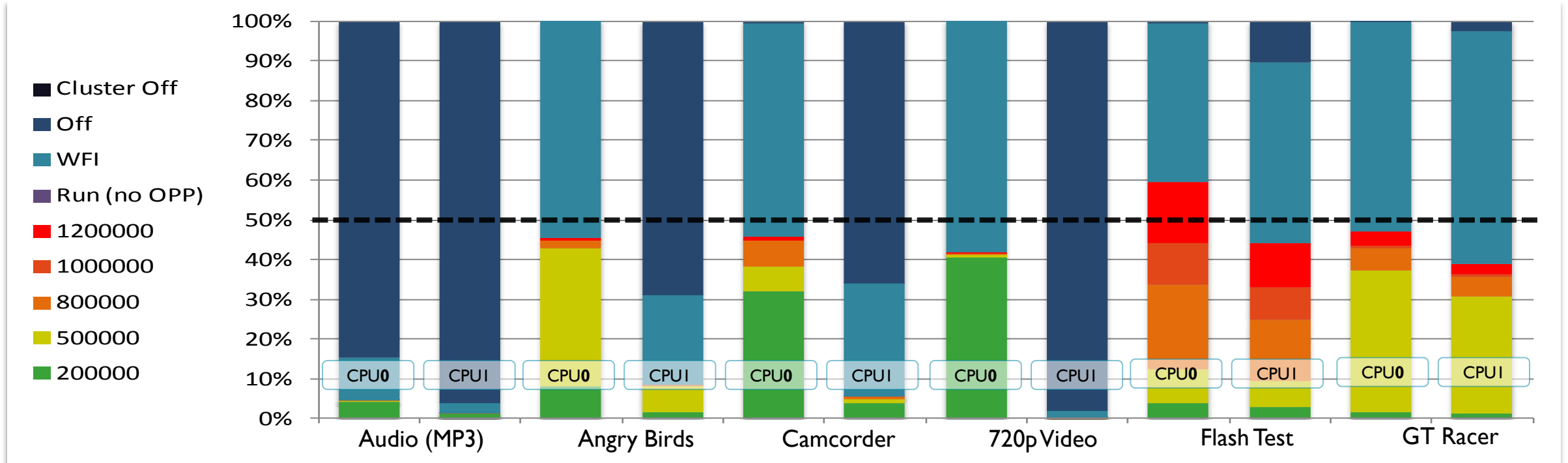


CPU-Related Energy Consumption Factors

- Static leakage vs. dynamic power
 - Depends on silicon process and granularity of power domains
 - No one-size-fits-all solution
- Task scheduling and power states
 - OS power management strategy
 - Parallelism and multi-processing
- Peripheral control
 - Burst vs stream
 - Peripheral power management

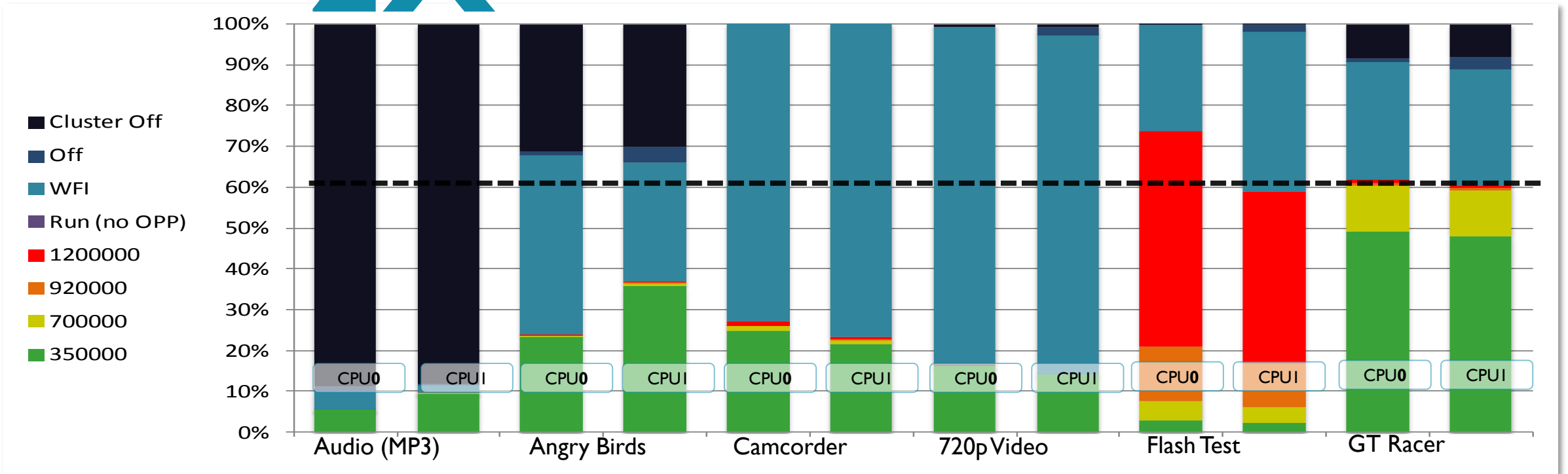


Dual-Core Smartphone "A"



Dual-Core Smartphone "B"

2X longer audio playtime than A

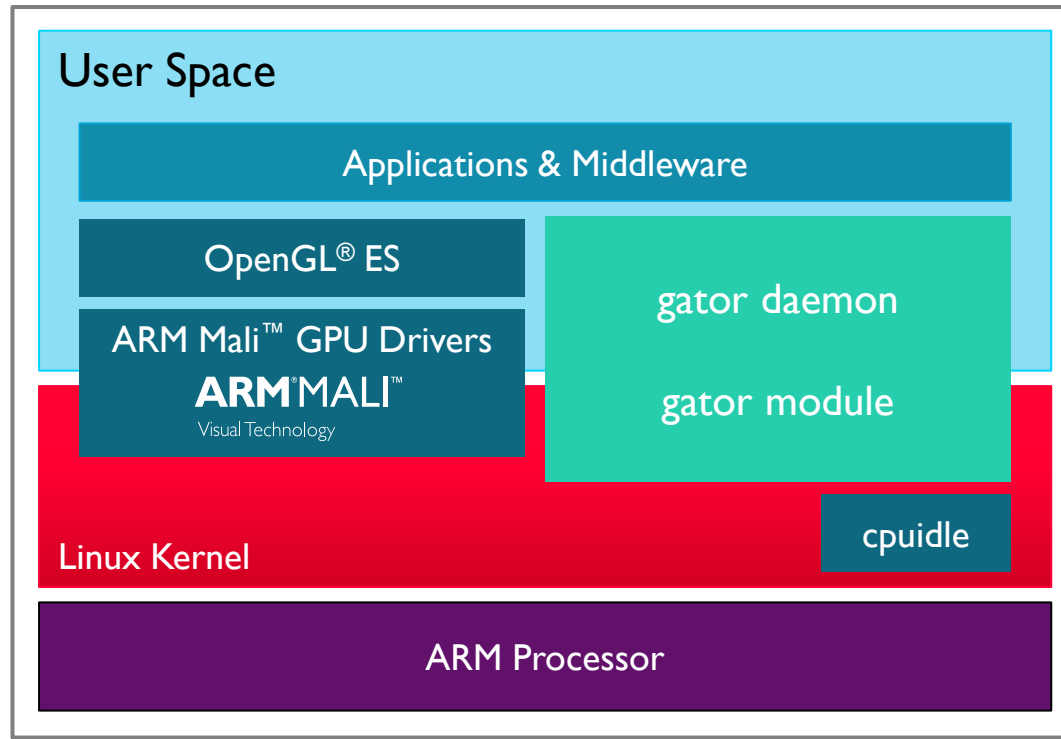


Measuring Energy Consumption



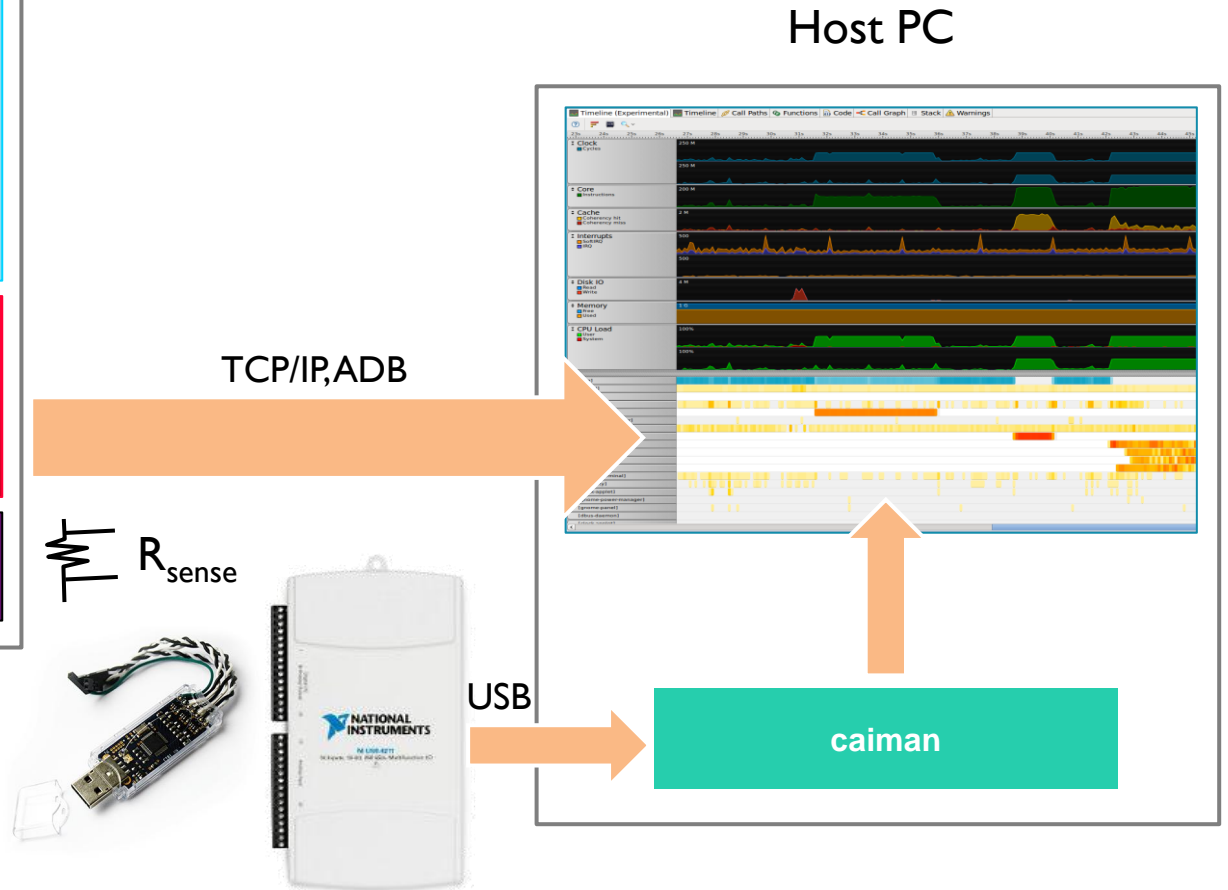
- Quite a few approaches out there...
 1. Rely on OS estimation
 2. Profile your software (CPU)
 3. Fully charge the battery and run your workload until you run out of juice
 4. Tap into built-in power measurement points
 5. Use external measurement on an instrumented device

ARM® DS-5™ Streamline™ Analyzer



Target Device

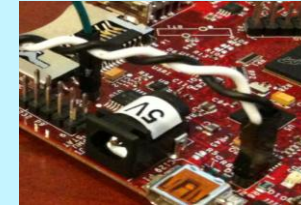
 Customizable, open source Streamline interface agents



One Solution, Multiple Use Cases

ARM® Energy Probe

Simple setup for instrumented devices, low cost
Trend spotting, coarse tuning



On-board Measurement

No wires, no external probes. Built-in hwmon support.
Measurement and real-time power management

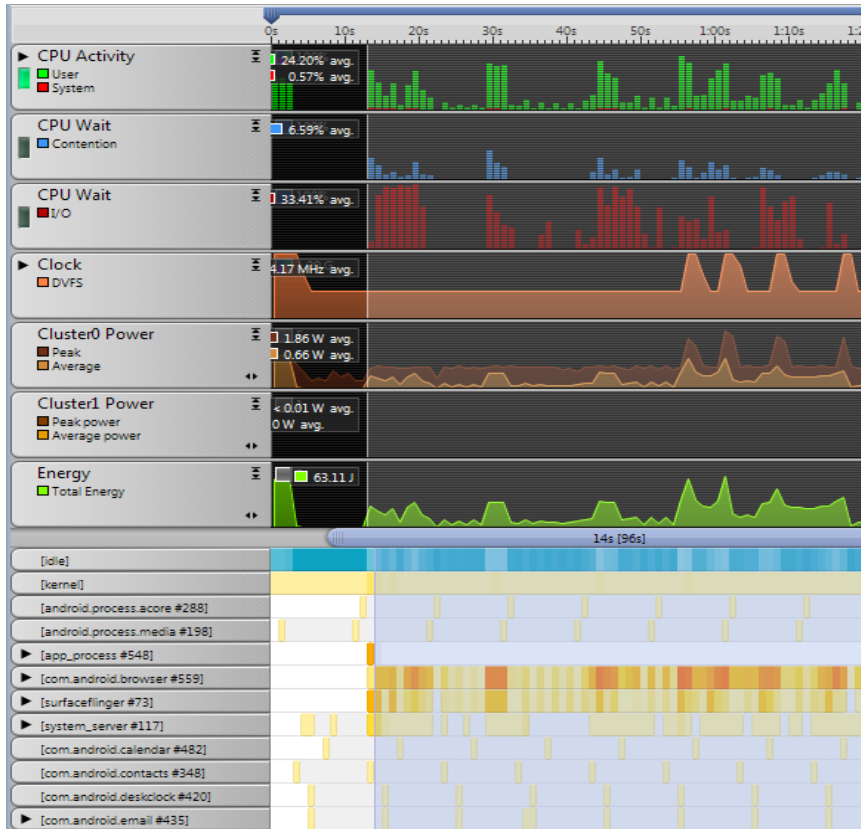


High-end Data Acquisition Units

Hi-fidelity, many channel. NI DAQ example in caiman.
Benchmarking and fine tuning



All the Information You Need to Optimize Your App



- Software profile, from process to source
- Process/thread execution trace
- Per-core CPU and GPU activity mapping
- Visibility of CPU power states (cpuidle, frequency, voltage)
- Interface for on-target or external power measurement data
- Open source agents to bring visibility into peripherals

Thank You

Please visit our demo pod for an ARM® DS-5™ Streamline™ demonstration

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