Usage Analytics And System Tuning Framework For Interactive Mobile Applications

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System Energy Efficiency Lab

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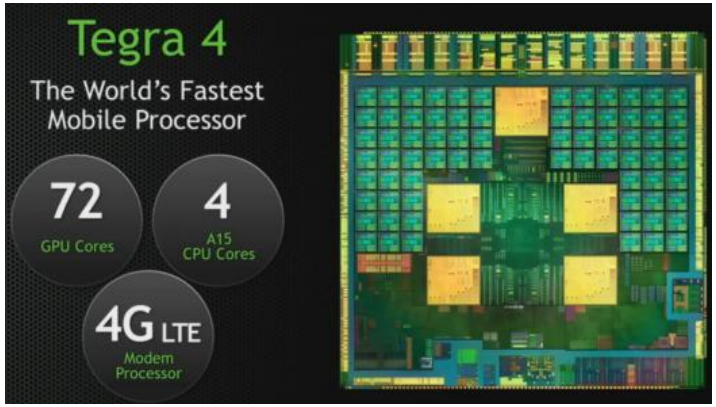
Evaluating Interactive Mobile Applications: Why is it a challenge?

- Mobile systems are rapidly evolving
- How do we evaluate such interactive systems?

Diverse platforms
different power/thermal limits



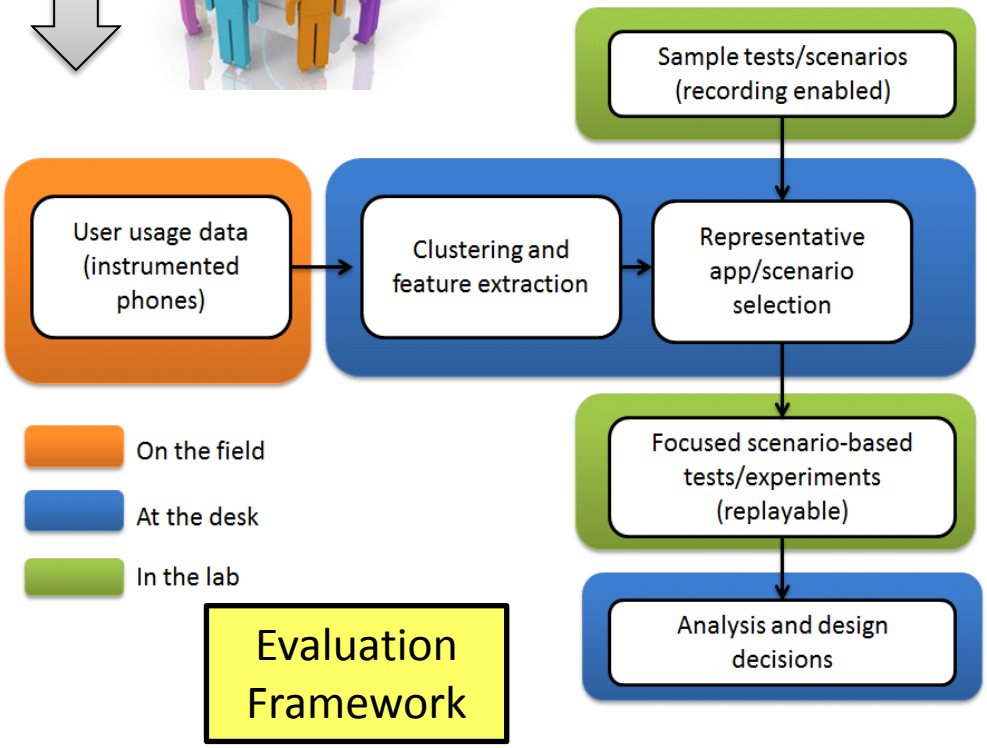
CPU-GPU integration
e.g. Tegra Platform

- Challenges include
  - Incorporating real user behavior
  - Incorporating interactive and diverse use-cases
  - Understanding platform limit impact
  - Evaluating across integrated subsystems (e.g. CPU-GPU)

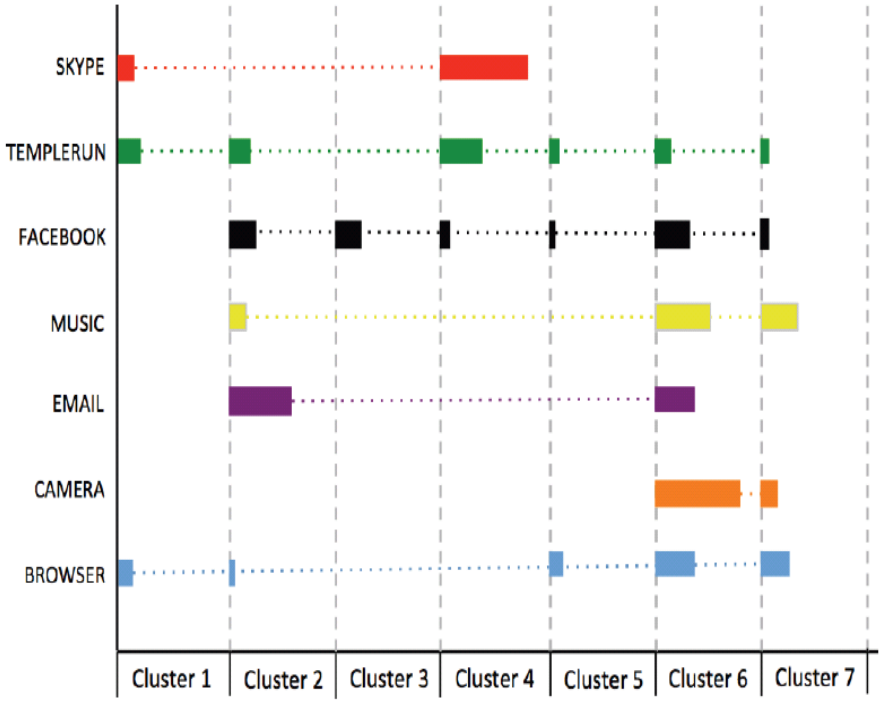
Mobile Usage Analytics and System Evaluation Methodology

User Study

- We used real usage behavior
- 1 month user study, 33 users
- Instrumented the phones to understand CPU-GPU joint behavior



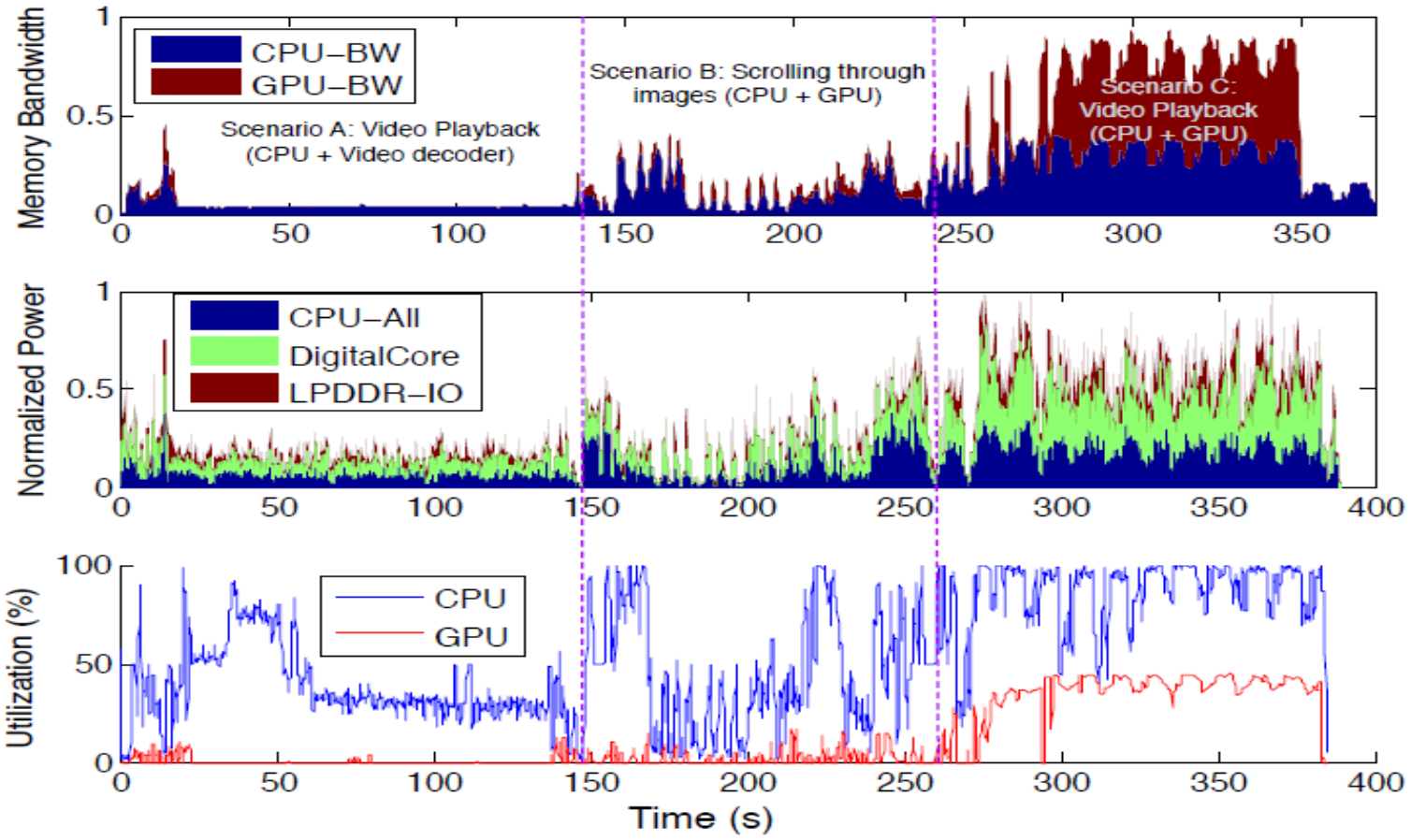
Evaluation Framework



- Figures shows the spread of sessions depending on relative CPU-GPU usage

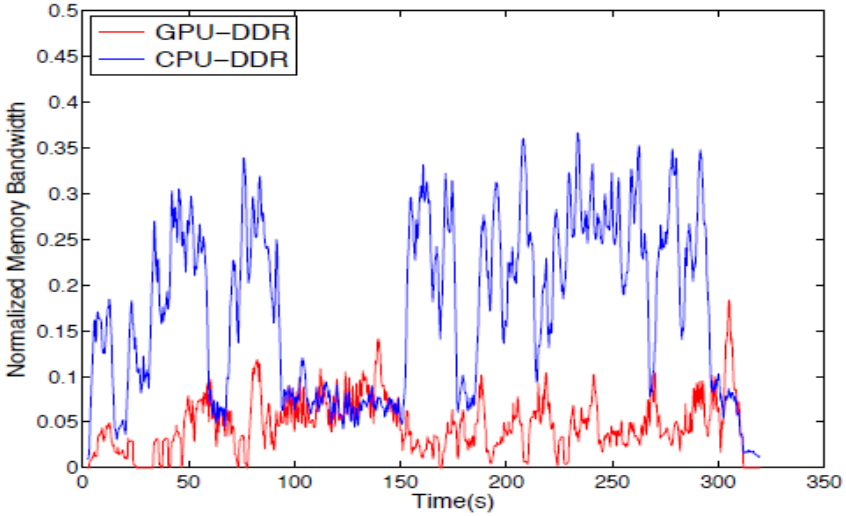
Clustering Results

Application CPU-GPU dynamics Captured Via Timelines

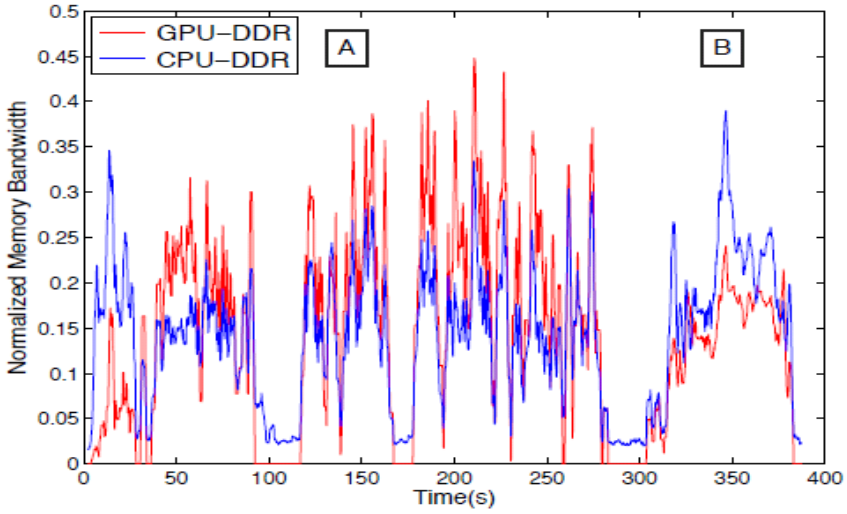


- Figure points out to three scenarios across a single facebook app
- We capture utilization, power and memory bandwidth statistics
- GPU utilization varies across the scenarios (from none, to medium and high). This is reflected in power and the memory bandwidth statistics also.

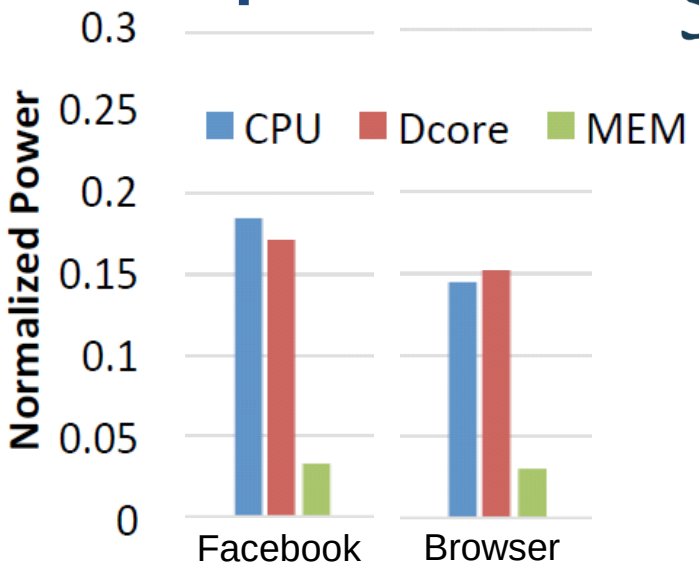
Facebook and Browser Power and Memory Bandwidth Comparison



Facebook test - View albums and pictures in a profile



Browser test - Search for pictures; Swipe through full-screen pictures from Google images(A); Scroll through the image results(B)



- Browser consumes less power relative to FB even though its total memory traffic is higher than FB.
- FB generates higher CPU memory traffic relative to GPU traffic and CPU-GPU power follow this pattern.
- FB's GPU side compute may be the cause of higher GPU power since GPU memory operations do not correlate to the obtained power numbers.