Vision: The Case for Context-Aware
Selective Resume

Presented by: Eric Wright, University of Toronto
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Problem

• Energy is a limited resource

• Energy saved by sleeping

• Resuming takes time
  – Resume wakes all devices

• Precludes sleep in many cases
  – i.e., its not worth for < the resume time
Solution

• Selective Resume

• Resume only resumes the devices / services needed
  – E.g., wake-up just the NIC and CPU

• Reduces resume-sleep cycle time

• Reduces energy use
  – More time in sleep mode
  – Fewer devices enabled
“Any sufficiently advanced technology is indistinguishable from magic”
- Arthur C. Clarke, 3rd Law of Prediction

“Any sufficiently fast resume is indistinguishable from being awake”
Cloudlet Scenario

Discover Cloudlet Server
  Sleep
Evaluate Resume Context
Resume NIC, MEM, CPU
  Sleep
Evaluate Resume Context
Resume All

1. Send VM Overlay

Execute VM on Cloudlet
[processing]
[processing]
Computation Done

2. Send Data Request

3. Return Data

4. Send VM Residue
Data Transfer

Copy File to Memory
  Sleep

Evaluate Resume Context
Resume NIC, MEM, CPU
  Sleep

Evaluate Resume Context
Resume MEM, CPU

1. LAN Tx: 5Mb@50Mbps (0.8s)

2. Send Data Request

3. LAN Tx: 5Mb@50Mbps (0.8s)

4. Send File Complete Ack

Buffer Data
WAN Tx: 5Mb@5Mbps (8s)
  Low Buffer

Full Buffer

Upload Done

Internet

5Mbps DSL WAN
System Resume Timeline

- PME Wake-Up Event (0s)
- H/W Initialization Complete (1.18s)
- BIOS Routines Complete (1.90s)
- User Space Return (2.65s)
- NIC Back to Pre-Sleep State (4.49s)
- Connection to Remote Host (5.70s)
Software Cycle Time

![Bar chart showing time in BIOS/Kernel for different states: Active→Sleep, Sleep→Active (user), Sleep→Active→Sleep. The chart indicates significantly higher time for Sleep→Active→Sleep.]
System Cycle Time

- Normal: Hardware Time (H/W Time) and Software Time (S/W Time: Sleep->Active->Sleep)
- Selective Resume: Hardware Time (H/W Time) and Software Time (S/W Time: Sleep->Active->Sleep)
Conclusions

• Normal Resume
  – Most time spent in software

• Selective Resume
  – Decreases time in software
  – Enables fine-grained control or resume
  – Makes sleep states more useful
Future Work

• Analysis of mobile systems

• BIOS implementation

• Fast memory server implementation