Title
Stargate: Energy Management Techniques

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Authors
Vijay Raghunathan
Mani Srivastava
Trevor Pering
et al.

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Stargate: Energy Management Techniques

Vijay Raghunathan, Mani Srivastava, Trevor Pering†, Roy Want†
Networked and Embedded Systems Lab (NESL)
†Ubiquity SRP, Intel Research

**Introduction:** Emergence of numerous rapidly evolving sensor node platforms

**Problem Description:** Platform specific energy management is crucial for long battery lifetime

**Proposed Solution:** System level energy management techniques and support for the Stargate

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**Computation Subsystem**
- **PXA255** provides two shutdown modes (Idle, Sleep)
  - Core consumes 45mW in 33MHz Idle mode, 0.15mW in Sleep mode
- **Dynamic voltage and frequency scaling supported**
  - Results in a super-linear decrease in power consumption
  - 411 mW at 400 MHz, 178 mW at 200 MHz

**Communication Subsystem**
- **Communication subsystem supports Mote, Bluetooth, 802.11**
  - Each has vastly different performance / power characteristics.
  - Mote is efficient for sending very little data, 802.11 for bulk data transfer
  - Radio hierarchy offers 10x power reduction potential in various scenarios
- **Supports remote wakeup over Bluetooth channel**
  - Enables on-demand, event driven power management
- **Mote based wakeup mechanism**
  - Provides energy scalable computation/communication capability

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**Support for Energy Management**
- **Power gating provided for the Bluetooth and 802.11 radios**
  - Overcomes inefficiencies in shutdown modes of the radios
  - Decreases shutdown mode power of 802.11 card from 250mW to 1mW
  - Increases wakeup latency since radio needs to be powered up first
- **Gas gauge permits measurement of battery voltage and current**
  - Enables battery state aware energy management

**Power Breakdown and Observations**
- **Power consumption ranges from 15mW to 1700 mW**
- **Flash writes are a bottleneck causing power inefficient operation**
- **802.11 often an overkill**

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