



News Fact Sheet

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Intel Developer Forum Research Labs Briefing

Sept. 24, 2009 — Intel Corporation is holding its Intel Developer Forum in San Francisco from Sept. 22-24. Intel Labs hosted a media briefing to discuss research efforts and its vision for the future of energy.

Andrew Chien, “Smart Grids”

Vice President Intel Labs, Director Future Technologies Research

Andrew Chien described a new research effort at Intel Labs to create self-sustaining, easy to use, affordable and secure smart microgrids for future communities of homes, buildings and vehicles. Researchers at Intel are exploring novel sensing, computation, communication and energy storage technologies that enable efficient, resilient and scalable microgrid architecture. These technologies were briefly described as below:

- **Power Sensors:** Power monitoring today requires complex, labor-intensive sensor deployment. Intel Labs demonstrated a prototype designed in the labs, with voltage sensors to automatically detect what appliances are switched on, and how much power they are consuming.
- **Intelligent Control:** Intel Labs is architecting a framework for measurement-inference-control-actuation based on data from ubiquitous power sensors. Key attributes of the framework include closed-loop control of load and distribution inside a single building and across multiple buildings, and balanced power generation and consumption to reduce energy waste.
- **Secure Communication:** Today, power usage data is not encrypted for privacy or security. The labs are researching new communication protocols to allow transmission of authenticated, encrypted personal power usage profiles over new wireless and wired communication standards for intelligent endpoints.

- **Energy Storage:** Energy storage in the grid today is prohibitively expensive. Nanotechnology promises new materials and approaches for storage which may be significantly cheaper and denser than current batteries.
- **Smart Grid Demonstration:** A prototype system was demonstrated that uses simple voltage sensors to infer what appliances are in operation and how much power they are consuming. Traditionally, this monitoring has been accomplished with expensive and complex electrician-installed house monitors or with gross approximations based on complex user interactions with online services and power company data. Intel Labs is developing methods that eliminate intrusive and expensive monitoring, putting the user in control of the data.



Wen-Hann Wang, “Innovative Research in Power and Energy Efficiency”

Director, Circuits and Systems Lab

Intel is poised to deliver dramatic improvements in the energy efficiency of computing devices. A broad set of research from Intel Labs is looking to extend beyond Intel silicon to include innovations across the platform. Wen-Hann Wang highlighted research in the key areas of circuits, architecture and platforms.

- **Resilient Circuits** – Under normal operating conditions, processors regularly experience dynamic variations that, left unchecked, could cause problems in operation. To protect against these potential problems, guard bands are put in place which intentionally slow the processor and also cause it to operate at higher power. Intel researchers have developed a new technology called resilient circuits that enable the system to run at faster speeds and lower power.
 - These circuits detect potential problems on critical timing paths and when needed briefly re-execute at slower speeds to ensure correct results before returning to normal operation.
 - Initial tests show a 21 percent throughput gain or 37 percent power reduction.
- **Super Capacitors** – Intel researchers have shown how super capacitors can be used to provide added power during short, peak demand cycles. Average power consumption of a laptop system is 17.5 watts, and in normal operation, intermittent power peaks can occur to more than double that. These peaks can force compromises in the choices of battery and power supply to ensure they can supply up to a steady 65 watts when needed. Wang explained how super capacitors could lead to more efficient batteries and power supplies while also enabling peak bursts of 70 watts for new features in the 2010 Core family of processors such as Turbo Mode.
- **Energy Harvesting** – Researchers at Intel Labs are engaged in long-term research to explore the viability and potential for harvesting alternative energy sources. Much of this potential (e.g., solar and kinetic) could be used to help extend the availability of computing.
- **Low-Power Network Agent** – Intel researchers have developed a low-power network agent that enables a computer or consumer device to enter a sleep state while maintaining

its network presence thereby significantly reducing its power consumption. The low-power network agent listens to network traffic and wakes the machine only for important packets.

- ***Platform Power Management*** - For meaningful improvements in energy efficiency, Intel researchers are looking beyond optimizing just a single component or device and considering platform behavior as a whole. Managing platform power well requires a broad set of changes in areas such as software, peripherals, core logic and telemetry. Intel is taking a fundamentally new approach to platform power management where the operating system provides guidance based on an understanding of the system as a whole while the hardware provides the fine grain power management across the platform to maximize efficiency. This technology will be in the “Moorestown” platform which will achieve a 50x idle power reduction over the “Menlow” platform.

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