

Making Sensors Happen



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Challenges and Needs

•The promise is obvious – if we can build an intelligent environment that assesses, anticipates, and responds to us then the opportunities will be enormous

- Health and Wellness Management
- Energy Efficiency
- Safety and Security

• System needs to be transparent and completely dependable.

- Quality of service
- Ease of use
- Implementation cost and complexity

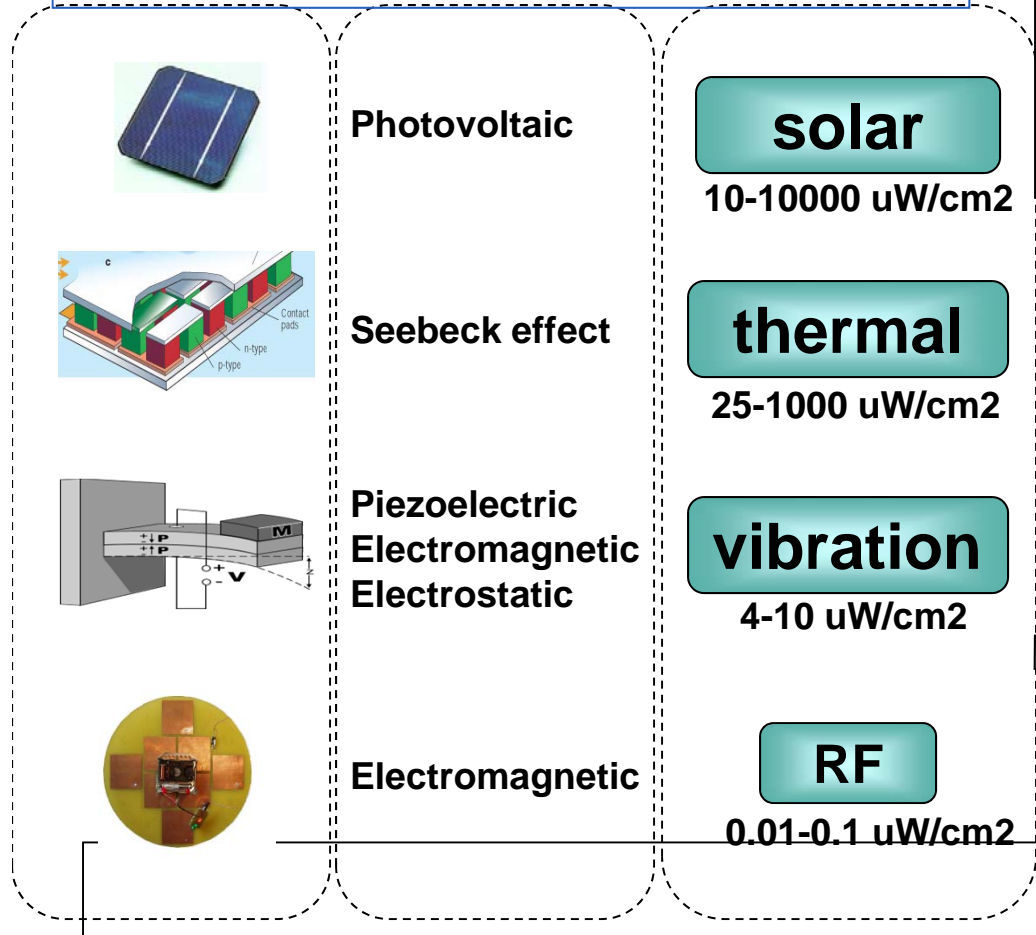
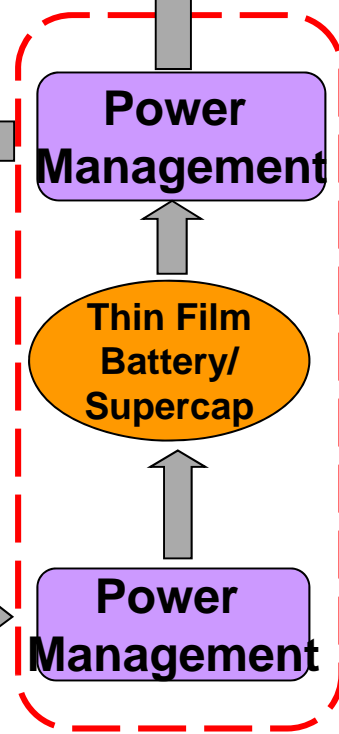
• Hardware components for the signal chain are already available.

- Analog front end, power management, microcontroller, NV memory, radios.
- Can do more on power reduction and energy generation (harvesting/battery)
- Products already in the market.

Wireless Sensor Node

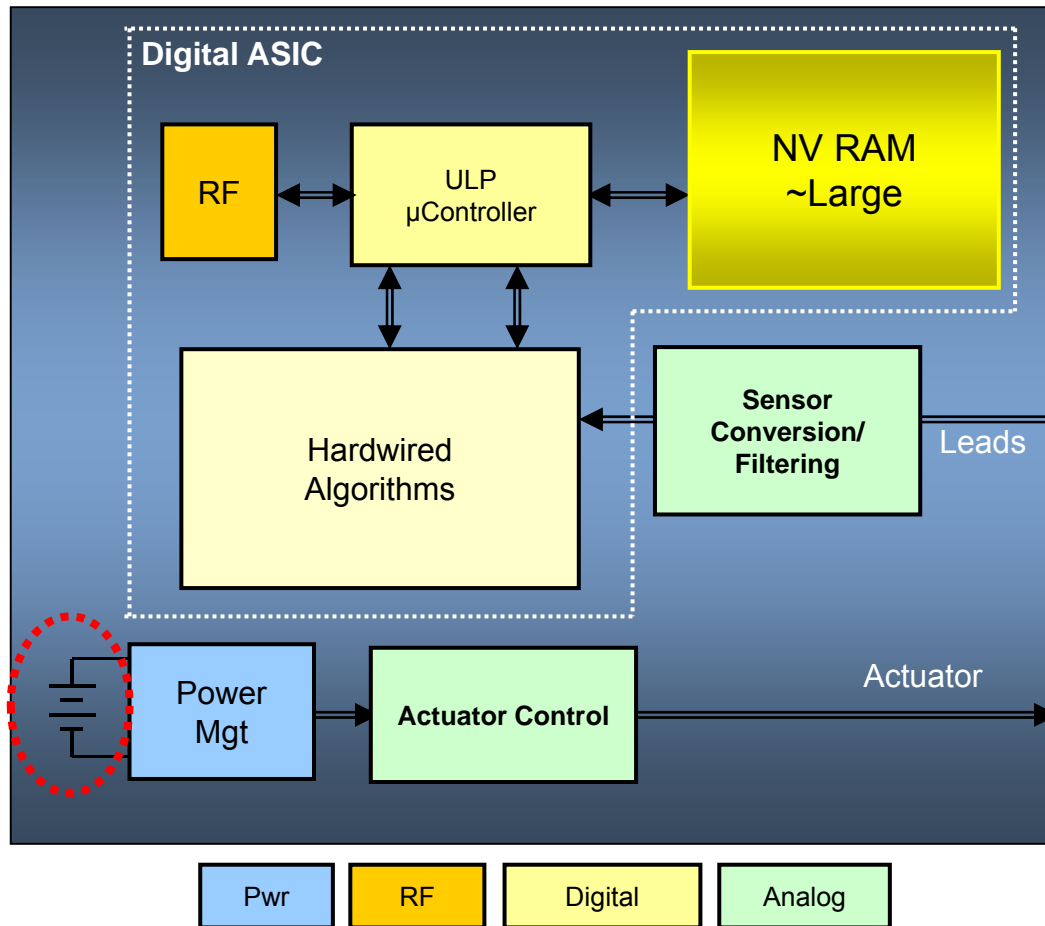
- ◆ Low power microcontroller & radio
- ◆ Power management and sensor interface
- ◆ Sensor
- ◆ Energy source (battery, harvester, supercap)

Sensor
100's uW



Wireless Sensor Node

Intelligent Ambient Applications



1mA-Hr Battery for ~10 years
~10nA average power budget
~1nA average for digital system

Need orders of magnitude reduction in power from where we are today

Sridhara, VLSI Symp. 2010

Required Attributes

Self Sustaining for Energy Need

- Multiple Sources: Fixed, Harvesting, Re-claiming

Always on & Always Aware

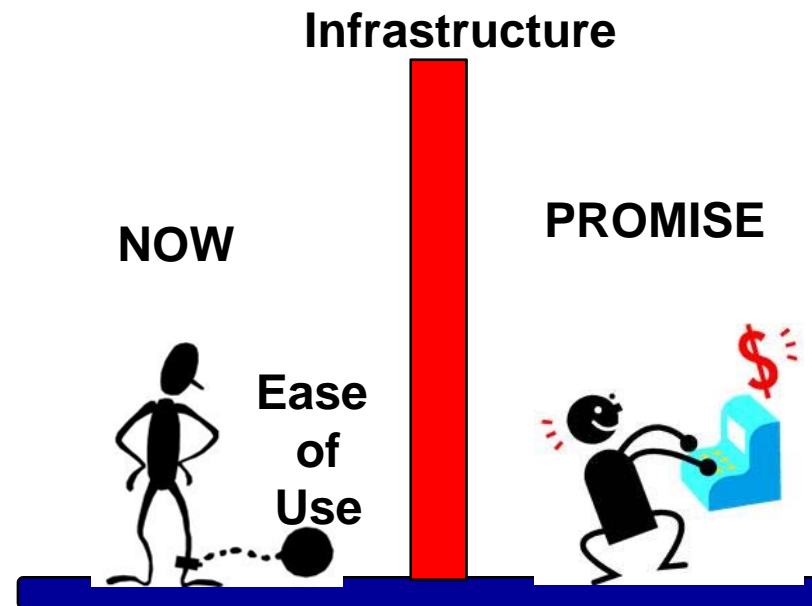
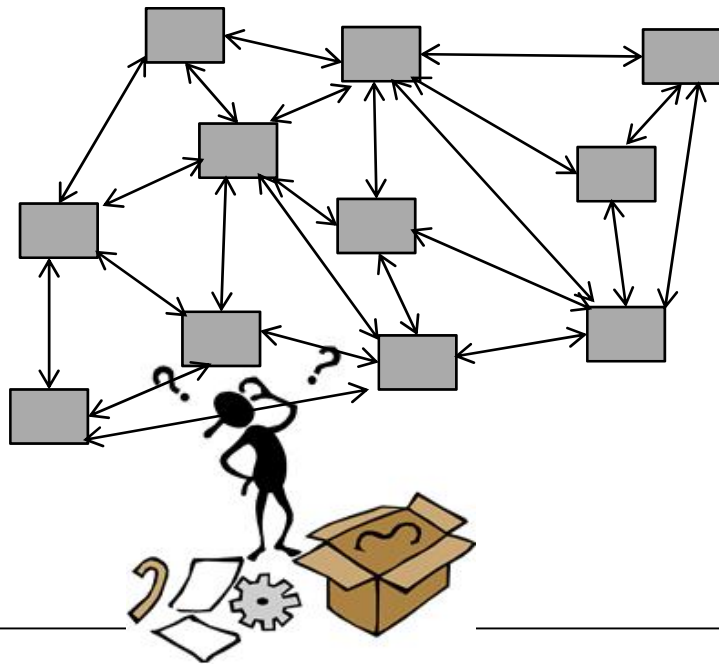
- Very LOW (Active/Standby) duty cycle

Hardware components are already available.

- Analog front end, power management, microcontroller, NV memory, radios.
- Products already in the market.
- Power is critical for expanding into future applications

Wanted!

- Infrastructure for dependable and consistent experience.
 - Seamless connectivity and networking
 - Software and OS that works
 - Minimize/eliminate the level of touch



Wanted!

- Smart sensors must have:
 - Ease of deployment
 - Intelligent sensors for vision, smell, taste, touch, audio
 - Ultra-low power
 - Power-efficient systems
 - Intelligent power management
 - Low cost
 - Trillions of connected devices.....