

Examples and Trends in Sensor Platforms for Ubiquitous Sensor Networks

Presented at the 1st Annual Netted Sensors Community Workshop

Hosted by MITRE Corporation (McLean, VA)

Presenter: John Suh

Mote Environment Monitoring Package (“MEP”)



Contents

- **4 MEP510s**
 - Relative humidity/temperature sensors
- **2 MPE410s**
 - Barometric pressure
 - Relative humidity (internal and external)
 - Temperature
 - Total Solar Radiation (incident and reflected)
 - Photosynthetic Active Radiation (incident and reflected)
- **1 Base Station**
 - Serial interface
 - 5 VDC power supply input

Sandia Labs Controlled Environment Agriculture Pilot

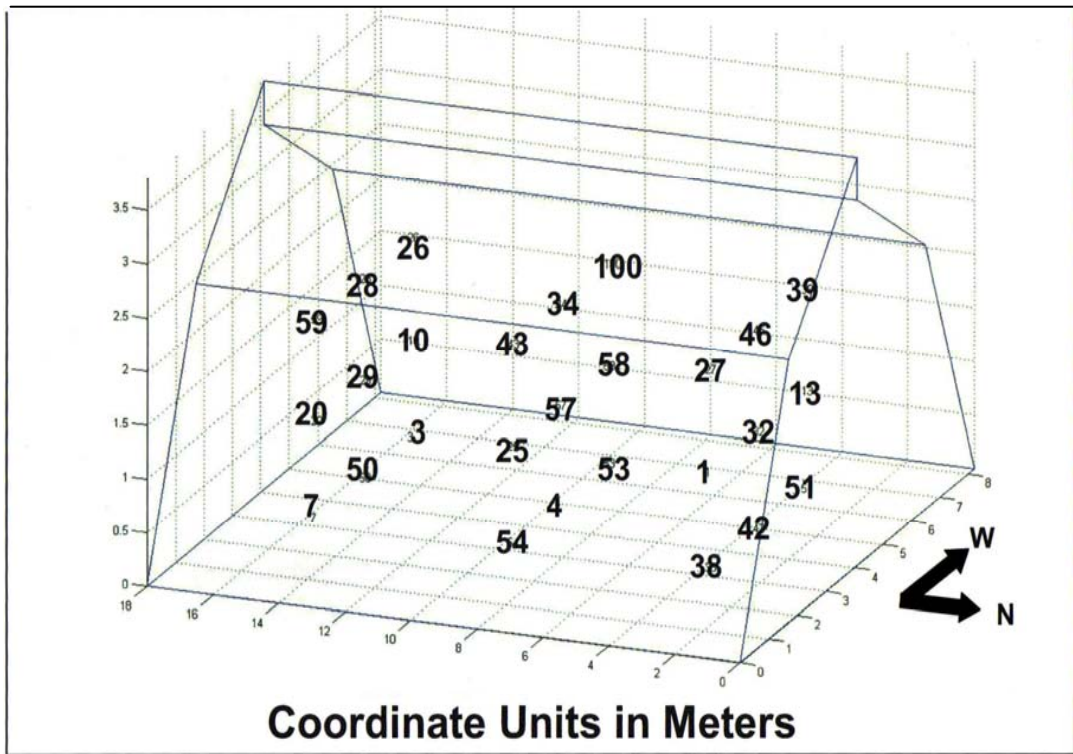


Figure 6-3 Location layout and ID #s for the 27 sensor nodes hung in the three center aisles in the greenhouse facility. Nodes are indicated by unique ID # at their (x, y, z) locations in the greenhouse coordinate system.

MSP410 Mote Security Package

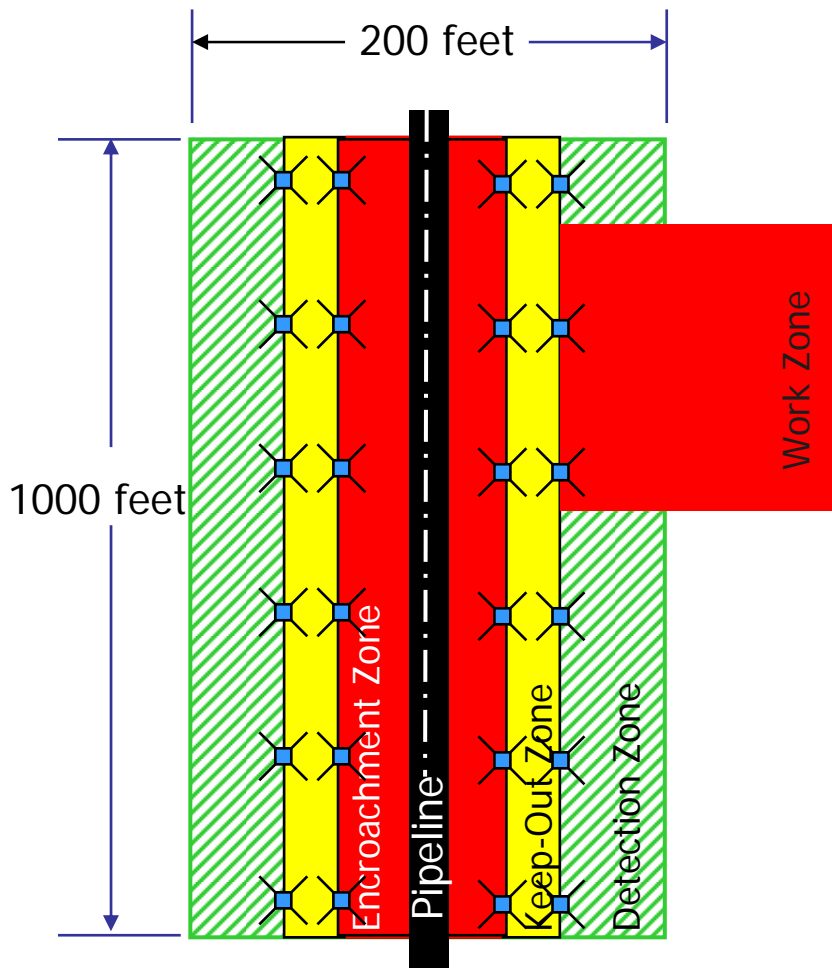


8 MSP410 Sensor Nodes

- Microcontroller running XMesh
 - 8 bit microcontroller
 - 7.3728 MHz clock
- 433 MHz RF Transceiver
- Sensors
 - 4 PIR
 - 2 axis magnetic field sensor
- Optional
 - Acoustic sounder
 - Microphone
- 2 AA cells

Activity Monitor for BP Gas Pipelines

Objective: Avoid potentially catastrophic events caused by damage to underground pipelines by assigning geofencing right-of-ways



Zone engagement rules:

- **Work zone:** Construction site which overlaps into the detection zone. This is the permitted work area for the construction crew.
- **Detection zone:** Approximately 1000 feet by 200 feet. Most activity is monitored in this zone.
- **Keep out zone:** Potential danger to the pipeline. Activates a warning to the construction crew.
- **Encroachment zone:** Possible damage to the pipeline which results in an immediate cease and desist order to the construction crew.



About the Wireless Vibration Monitoring System: MDA440



The MDA440CA is a wireless vibration monitoring platform for harsh industrial and outdoor environments.

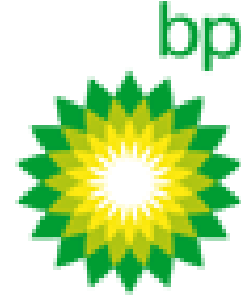
Features

- High-speed analog front end for interfacing with hi-fidelity sensors
- XMesh™: a proven wireless mesh networking protocol for reliable data collection.
- 32-bit MCU
- 802.15.4 transceiver

Environmental Protection

- Splash
- Humidity, and
- Dust

Results from the Loch Rannoch, Phase 1



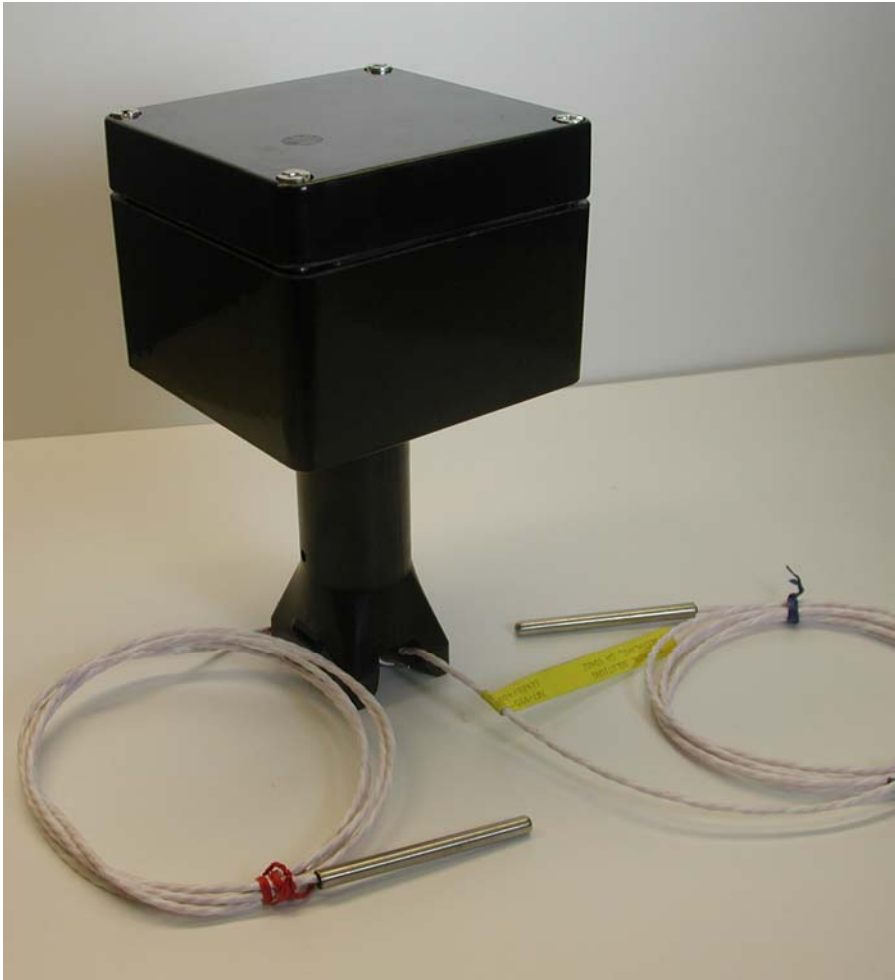
Benefits

- Much more effective condition monitoring regime
- Continuous visibility to the engine equipment and condition
- Reduced costs and errors compared to manually data collection

*2005 BP Helios Award Finalist
Innovation and Supplier Categories
October 2005
BP International Ltd*



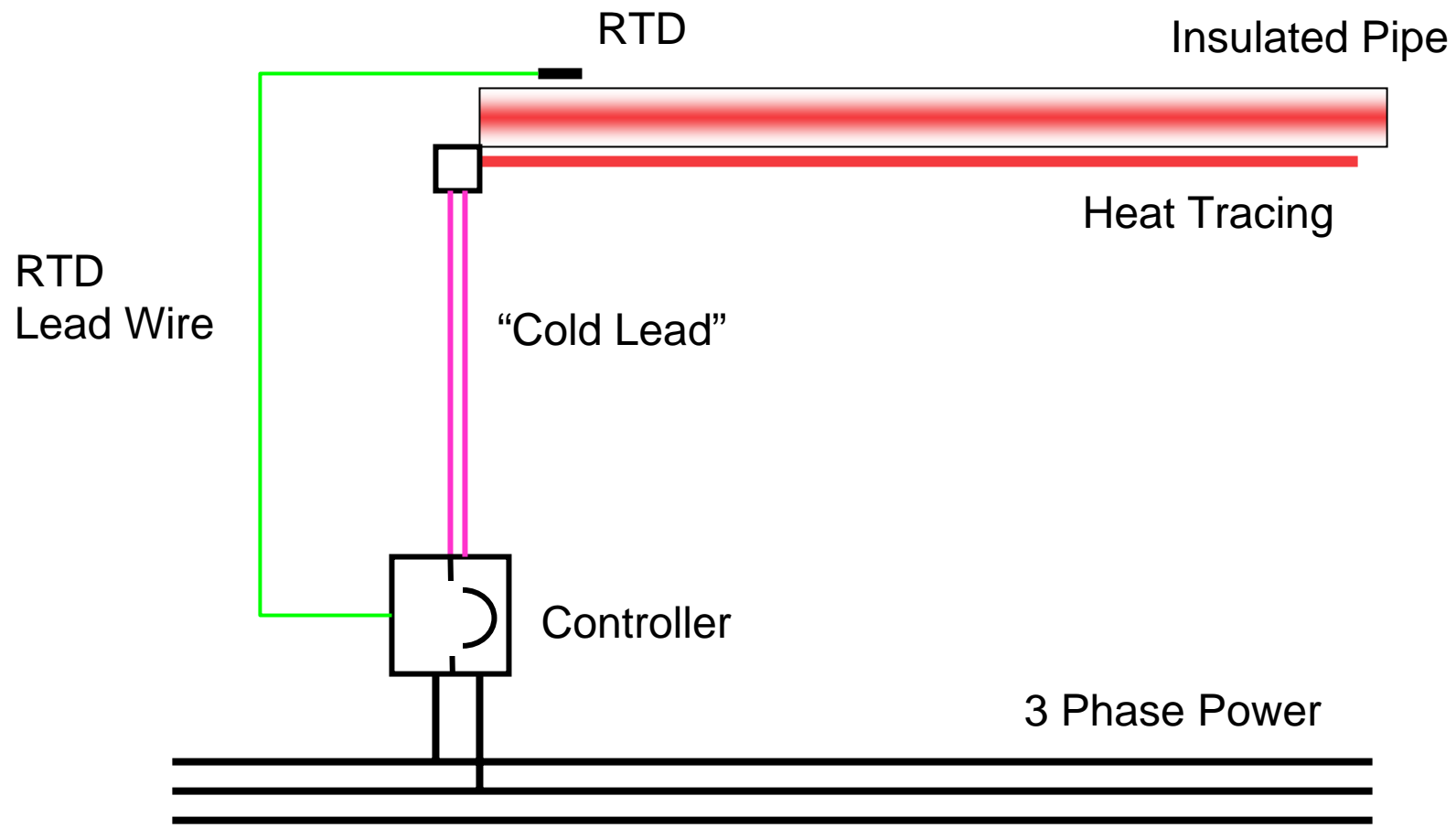
Wireless Temperature Sensor for Heat Tracing: MTP400



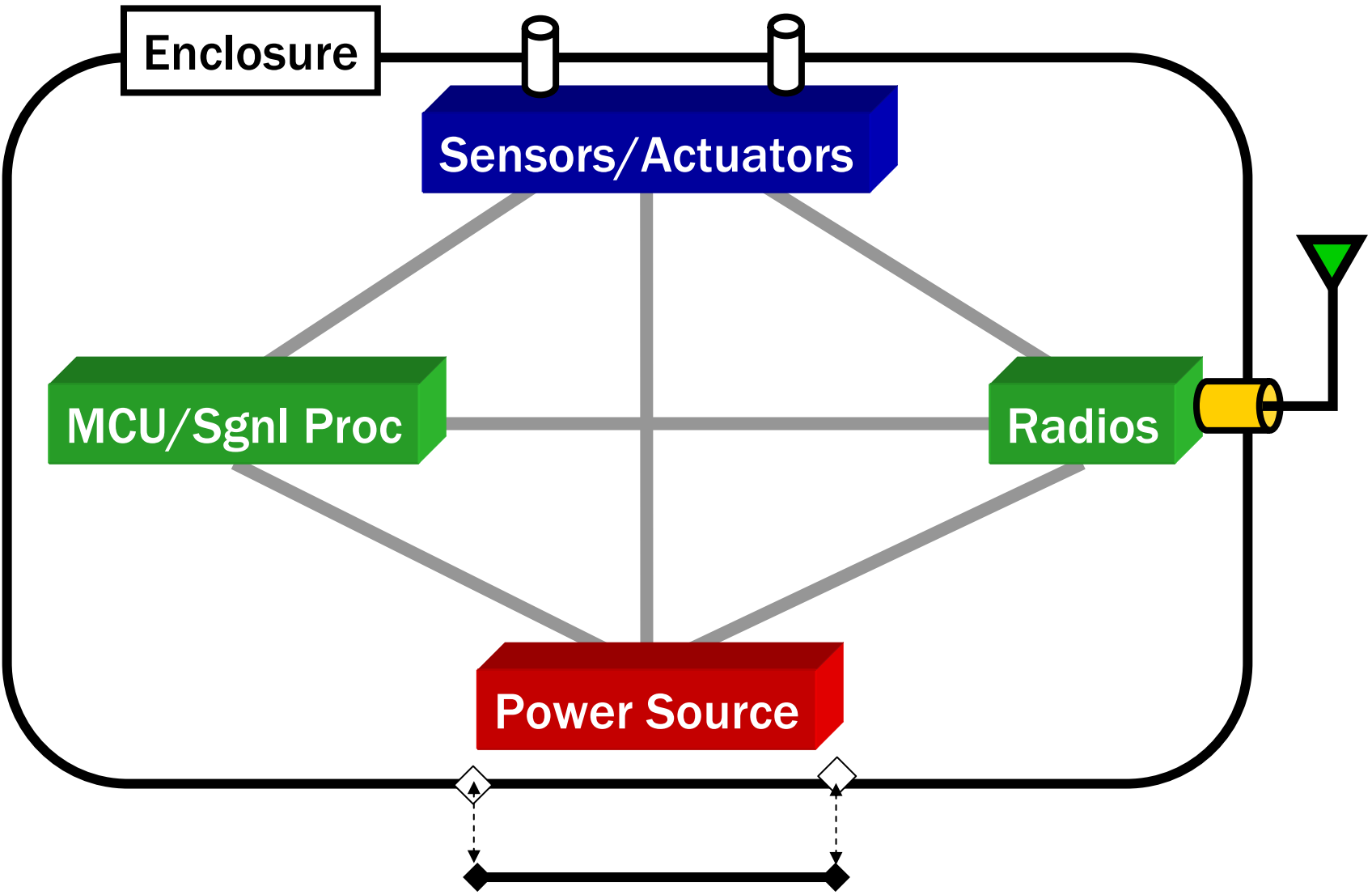
Wireless RTD replacement

- Battery operation, 3 to 5 year life
- Motes rated for hazardous area installation
- Antenna inside of enclosure
- 3 temperature inputs per mote
- Gateway emulates legacy Modbus register map

Elements of a Heat Tracing Circuit

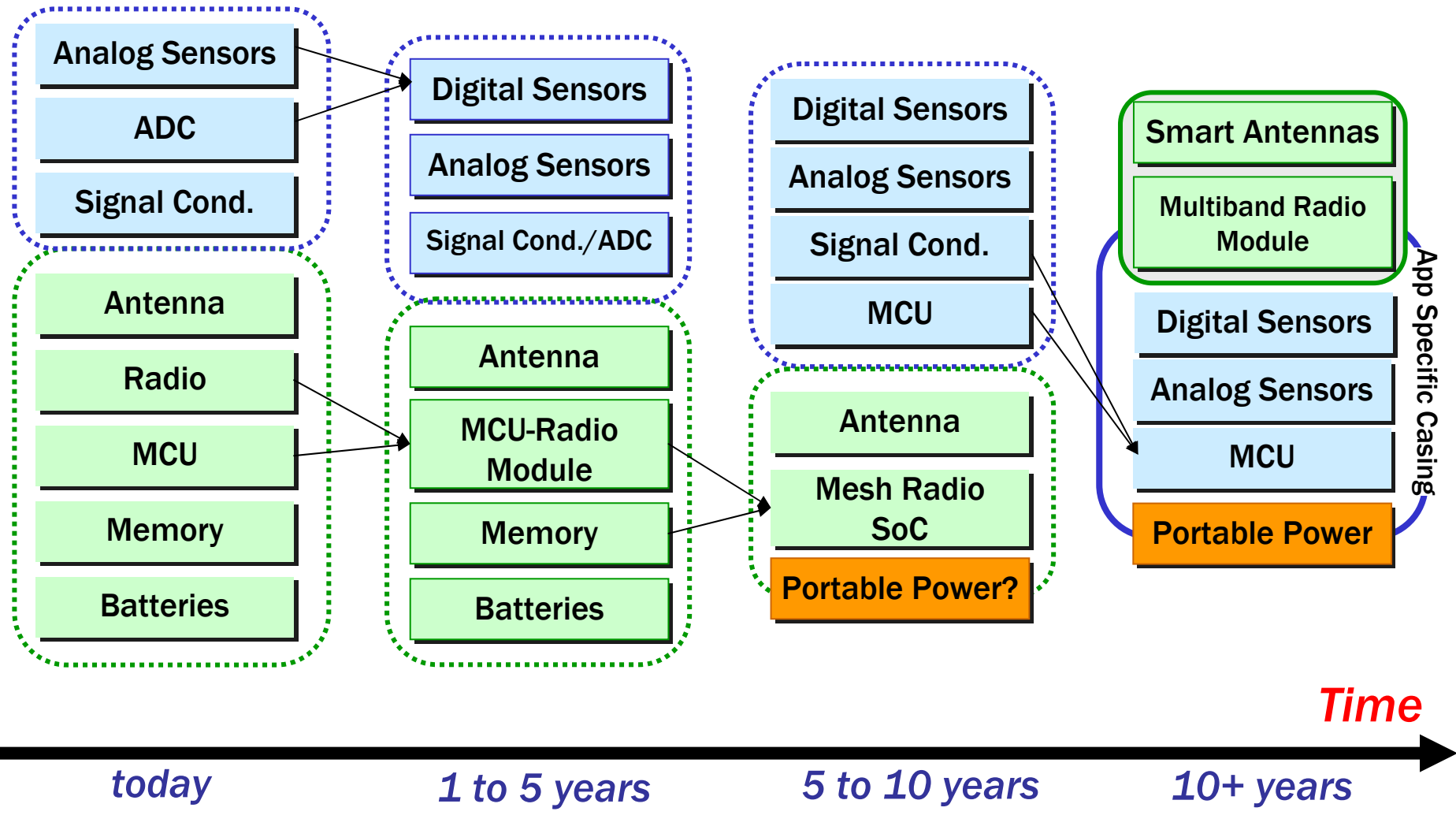


Sensor Platform: Component Relationships

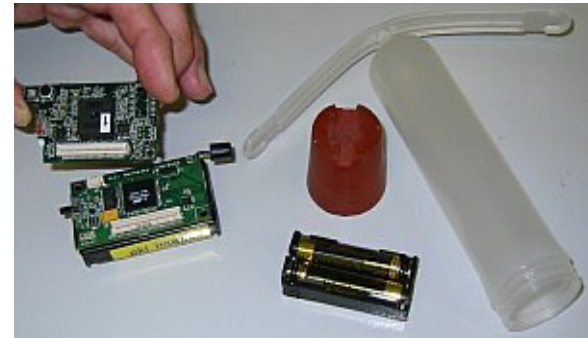


Trends (Speculation?) in Meshed Sensors

S Sensing Function
M Wireless Network Function



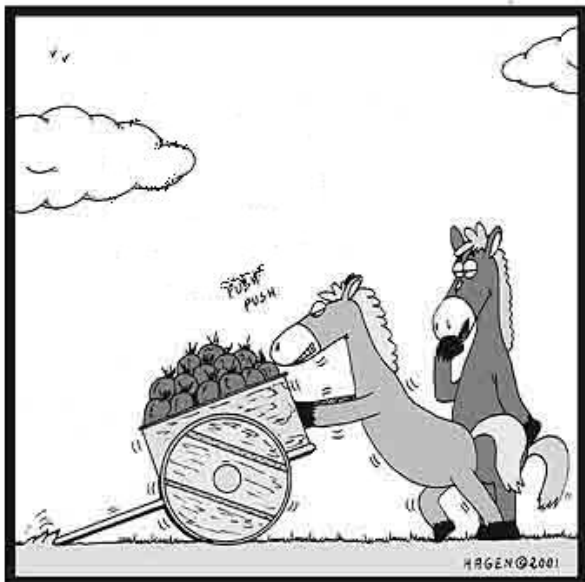
Packaging is the Last Mile for Sensor Networks



<http://www.smartspaces.csiro.au/applic/smart-lands.htm>

Note: MEMS has faced and is still dealing with packaging issues

Market Pull: Putting the Horse Before the Cart



Hang on... We must be doing something wrong...
How does the saying go again?

1. What answer are you providing my business?
2. What is the question to your answer?

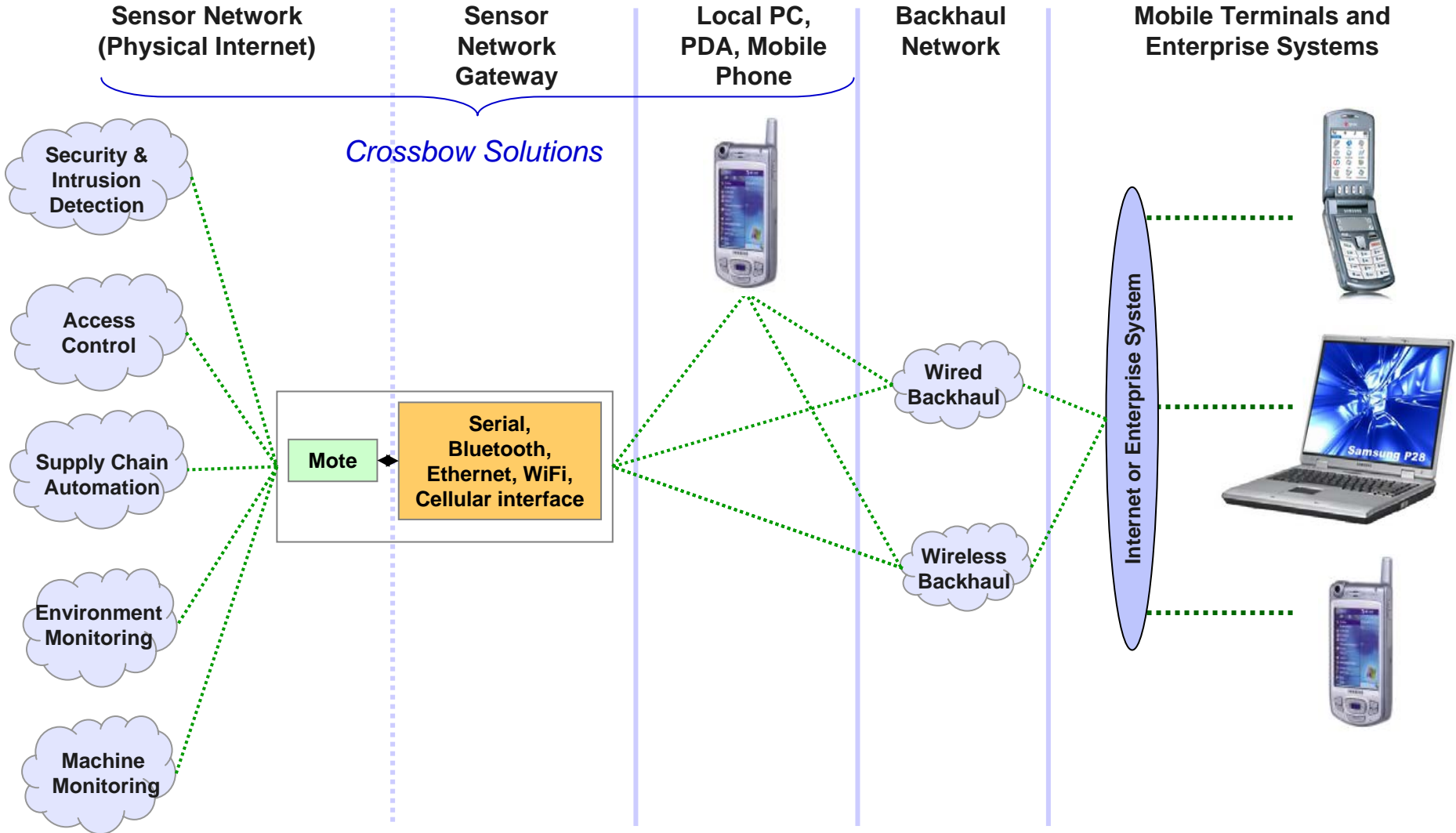
Technology Adoption Inhibitors

- 1. Reliability**
- 2. Ease of use, education**
- 3. Standards**
- 4. Operational lifetime and environment**
- 5. Real world implementations**

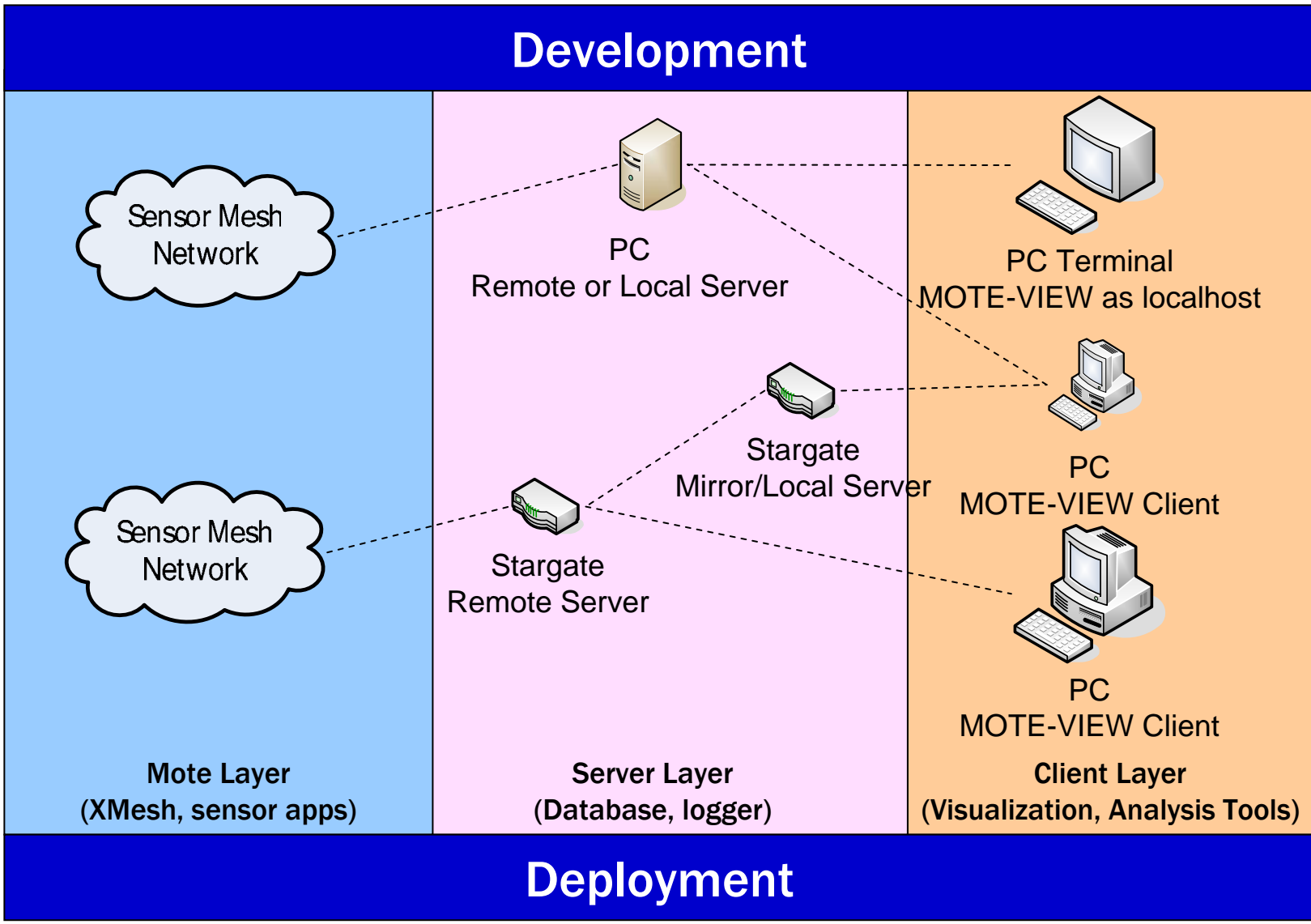
Some More Questions

- 1. What do you have that helps me save operating costs?**
 - Will the net effect of your products do this?
- 2. How can you eliminate the surprises in my business?**
 - How much of a heads up will your system give me?
- 3. What can you do to take the guess work out of my job?**
 - Will your system add or remove my attention burden?
- 4. Can you help me with my head count reduction goals?**
 - When will I benefit from this automation?

Information Spectrum



From Development to Deployment



Pre-Announcement: An Platform for WSN Development

The WiSoN Platform



Software Development Tools

- Mote Firmware SDK
- IDE
- Network System Analysis Tools

Software Platform

- OEM grade TinyOS code base
- XMesh networking protocol
- Server tools binary
- Client tools binary

Hardware Reference & Development Platform

- Reference designs
- Wireless modules, data acquisition and sensor boards
- Serial, USB, Ethernet, WiFi gateways
- Power meter

