

Sensor Data Management: New Applications and New Challenges

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Sensors...what does Merriam-Webster has to say about them?

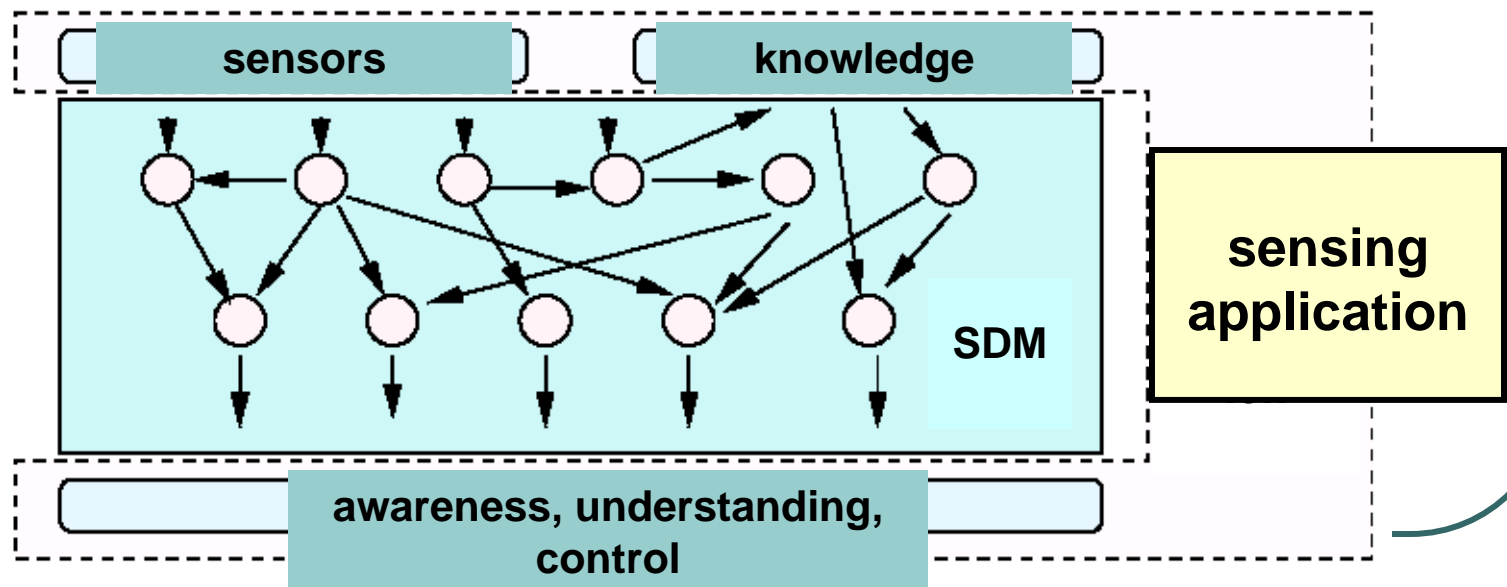
- a device that
 - responds to a **physical stimulus** (as heat, light, sound, pressure, magnetism, or a particular motion) and
 - transmits a resulting impulse (as for **measurement** or operating a **control**)

Sensors...what does Merriam-Webster has to say about them?

- Etymology
 - from latin “sentire” or “to perceive”
- “perceive”
 - “to attain awareness or understanding of...”
 - “aware” implies vigilance in observing or alertness in drawing inferences from what one experiences
 - “understanding” is the power to make experience intelligible by applying *concepts and categories*

..did you notice something?

- ...there is a big gap between the first meaning (**device, measurement**) and the second (**awareness, understanding**)
- ..and that gap (or **the infrastructure needed to bridge that gap**) is what sensor data management is about..



Sensing applications?

- ..obviously, there are (increasingly) many of these applications,

training
smart-rooms
robotics
child-care
education
health-care
sciences
rehabilitation
production
entertainment
space exploration
elderly-care
personal-data management
retail
advertisement
security
life-sciences
defense
retail
pet-care
smart-offices
sports
supply-chain
transportation
arts

Sensing applications?

- ..obviously, there are (increasingly) many of these applications, **which require..**

..some form of intelligence (awareness, understanding)...

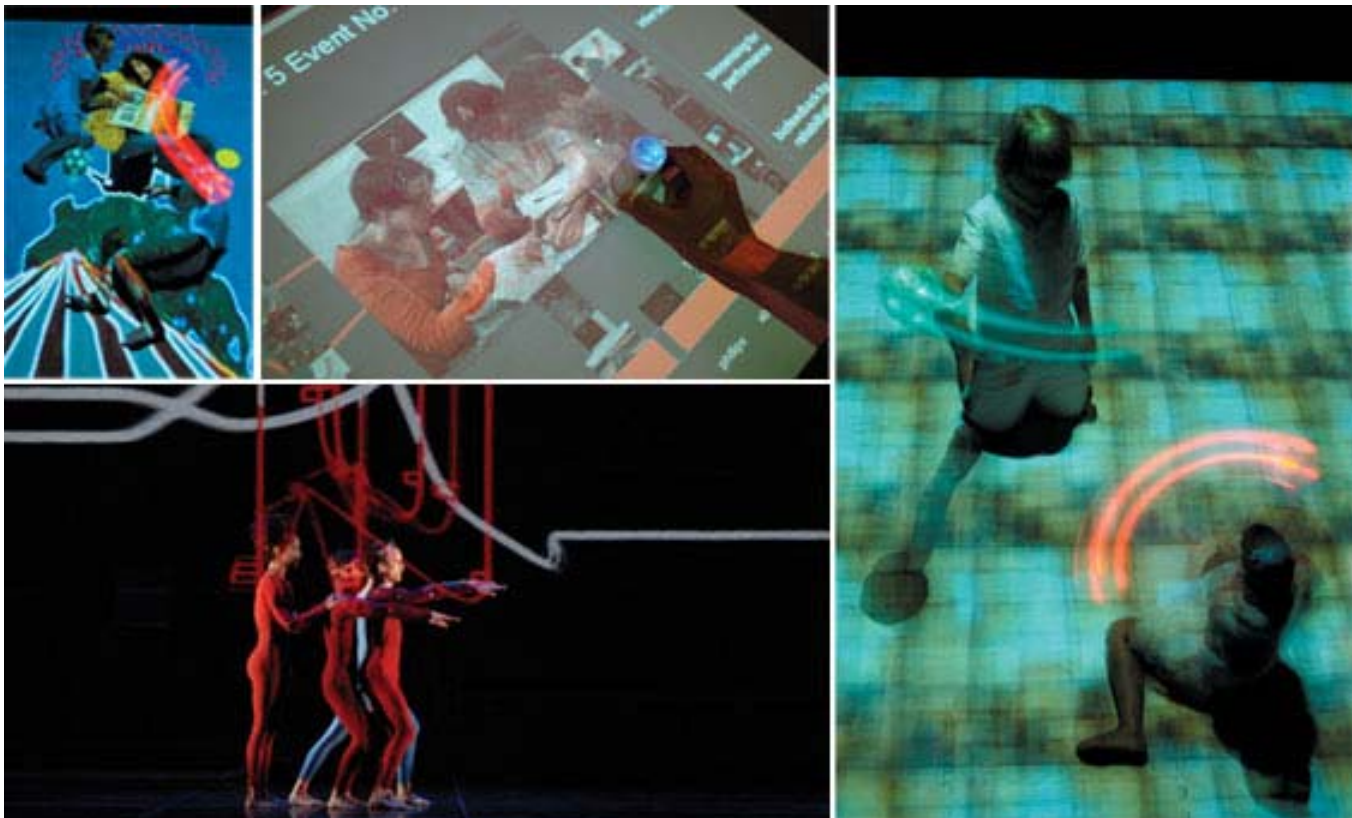
...embedded (device, measurement) **in the** (physical, commercial, or cyber) **environment in an ambient manner**

training
rehabilitation
security
smart-offices
smart-rooms
robotics
elderly-care
retail
child-care
entertainment
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supply-chain
transportation
education
health-care
sciences
advertisement
arts

Ambient Applications

- **Human** centered
- **Location/context** sensitive
- **Media**-rich (..not only images and video!..how about haptics?)
- **Sensor-based**

Ambient Media Applications



<http://ame.asu.edu/>

Ambient Media Intelligence

- It is an area of increasing interest:
 - International Conference on **Ambient Media** and Systems (Ambi-Sys)
 - Workshop on **Ambient Intelligence, Media, and Sensing** (AIMS)
 - ACM Multimedia tracks (3 out of 4)
 - **Multimedia Networking and Systems**
 - **End-systems and Applications** and
 - **Human Centered Multimedia**

Examples: Ambi-sys 2008

- Enriching **Music** with Synchronized **Lyrics**, **Images** and Colored **Lights**
- Improving Dialogue Systems in a **Home Automation** Environment
- A vision-based hybrid method for **facial expression** recognition
- A Model for Ontology-Based Scene Description for Context-Aware **Driver Assistance** Systems
- Deconstructing Ambient Intelligence into Ambient Narratives: The **Intelligent Shop Window**
- **Assisting Elders** via Dynamic Multi-tasks Planning - A Markov Decision Processes based Approach
- TaPuMa: **Tangible Public Map** for Information Acquirement through the Things We Carry

Examples: Ambi-sys 2008 (cont.)

- Active Manipulation of Users in **Haptic-Enabled Virtual Environments**
- Interaction with Volumetric **Medical Data**: experiencing the **Wiimote**
- The Development of Wireless Sensor System for **Pressure** and **Temperature Signals Monitoring**
- Cooperative Caching Techniques for **Continuous Media in Wireless Home Networks**
- **Emergency Response** Simulation Using Wireless Sensor Networks
- A Semiotic Multi-Agent System for **Intelligent Building Control**

How far are we from Ambient Media and Systems?

- Sensors are there...
- ...networks are there (low-power short range wPANs for location sensitive applications)...
- ...some catchy bodyNet and personal area networking applications are there...



- ..but, unfortunately, we are **not** quite there..
 - Decentralized, Autonomous, and Networkwide Service Delivery and Multimedia Workflow Processing (DANS)

How far are we from Ambient Media and Systems?

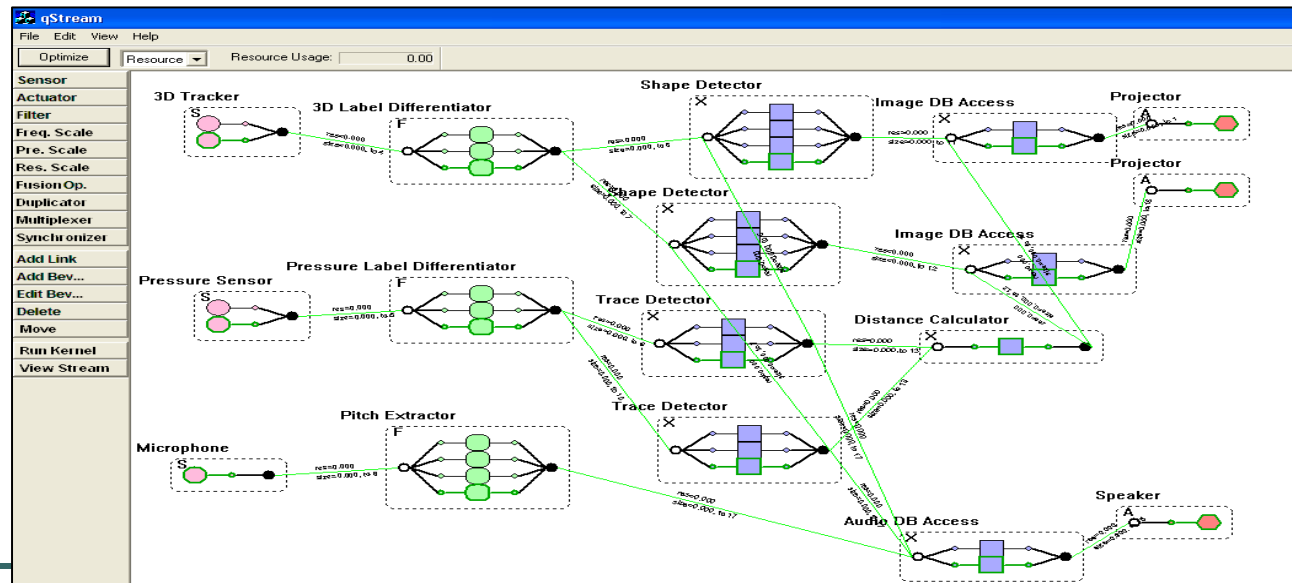
- Sensors are there...
- ...networks are there (low-power short range wPANs for location sensitive applications)...
- ..some catchy bodyNet and personal area networking (PAN) applications are there...



Tune your run.  

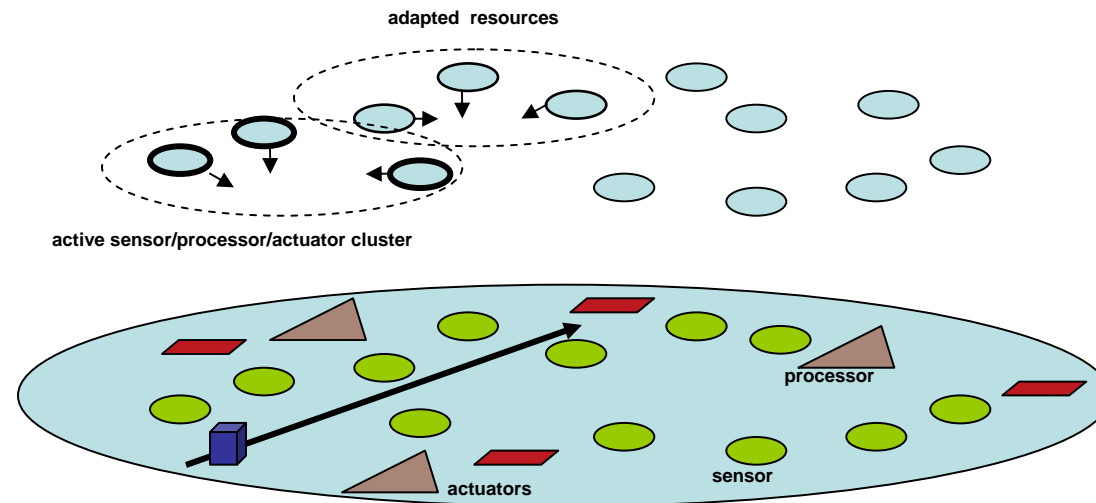
How far are we from Ambient Media and Systems?

- ..but, unfortunately, we are **not** quite there...
- why not?
 - no **design tools**.....no **design principles**,...no **standards**.....did you say **plug-and-play**?



How far are we from Ambient Media and Systems?

- ..but, unfortunately, we are **not** quite there...
- why not?
 - **loosely coupled, adaptive** and **evolvable** system design is not yet that well understood....



How far are we from Ambient Media and Systems?

- ..but, unfortunately, we are **not** quite there...
- why not?
 - what about **privacy** implications?....



<http://techblog.dallasnews.com/>

How far are we from Ambient Media and Systems?

- ..but, unfortunately, we are **not** quite there...
- why not?
 - how about **interfacing** between different ambient systems?....

..what is missing?

- ...there is a big gap between the first meaning (**device, measurement**) and the second (**awareness, understanding**)
- ..and that gap (or **the infrastructure needed to bridge that gap**) is what sensor data management is all about..

