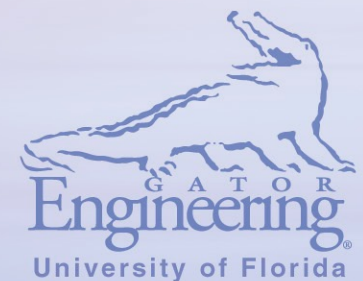




# Introduction to Pervasive Computing

**Sumi Helal, Ph.D.**

Computer & Information Science & Eng. Department  
**University of Florida**



# Talk Overview

- Sensors: History and Evolution
- Promising Applications of Sensor Networks
- Grand Challenges
- Programming the Sensor Network
- The Atlas Sensor Platform
  - Service-Oriented Architecture
  - Sensor Plug and Play
- Case Studies in the Gator Tech Smart House
- Standards for Sensor Networks
- Concluding Remarks



# The Computer Evolution



Mainframe  
Computer, 1960



The PC, 1980



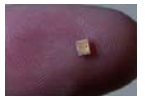
Mobile  
Computer 1990



Sensor  
Platforms 2000



Smart Dust ...



# Sensor Network Forecast

- “The Quest for the Next Big Thing”

- Business Week, August 2003

- Utility Computing
- **The Sensor Revolution**
- Plastic Electronics
- Bionic Bodies



- “10 Emerging Technologies That Will Change The World”

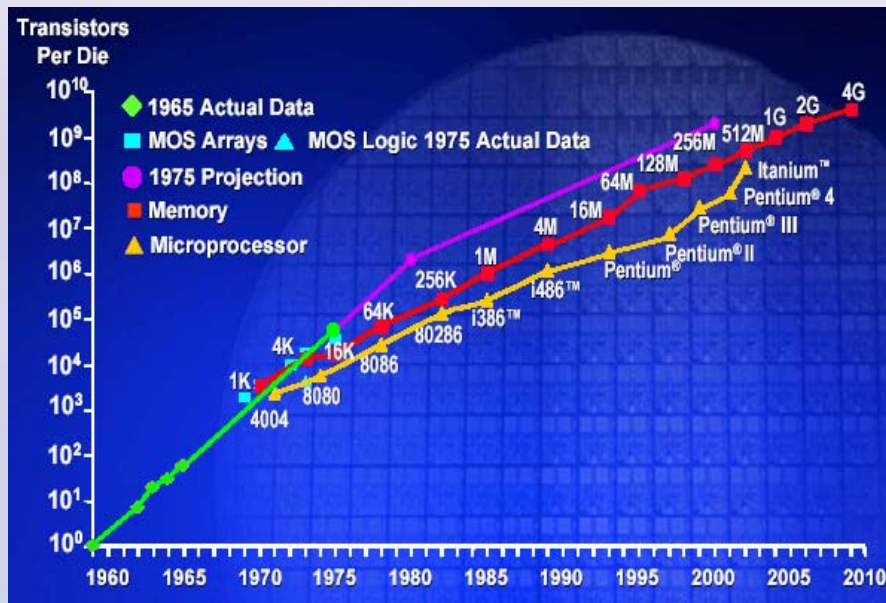
- MIT ENTERPRISE TECHNOLOGY REVIEW, Feb. 2003

- **Brain-Wireless Sensor Networks**
- Grid computing
- Software Assurance
- and more

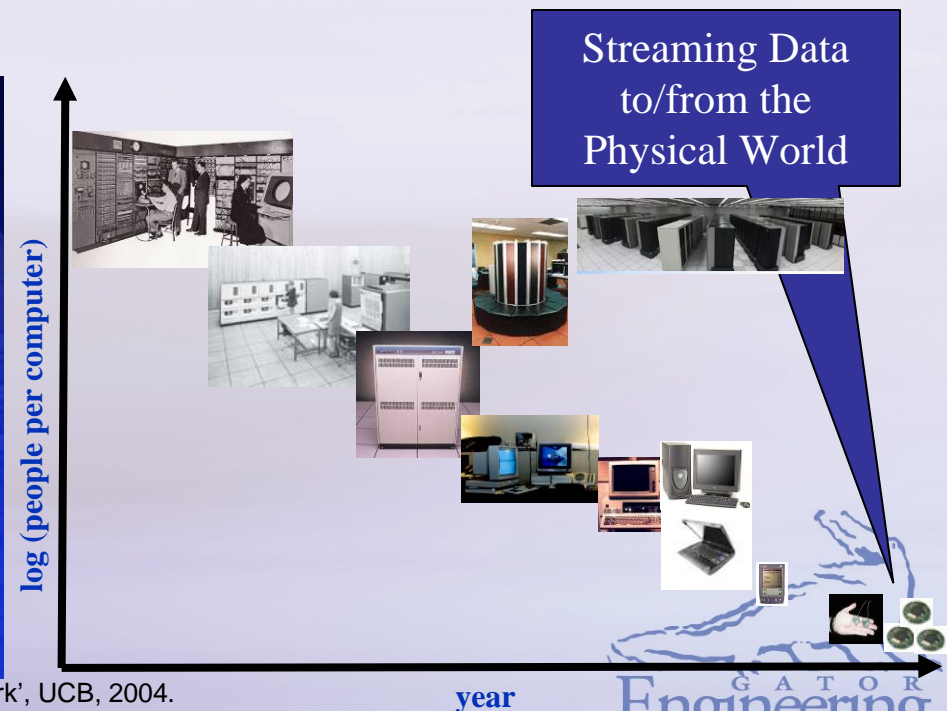


# Trend – Faster, Smaller, Numerous

- Moore's Law
  - “Stuff” (transistors, etc) doubling every 1-2 years
- Bell's Law
  - New computing class every 10 years



Excerpted from 'The Mote Revolution: Low Power Wireless Sensor Network', UCB, 2004.



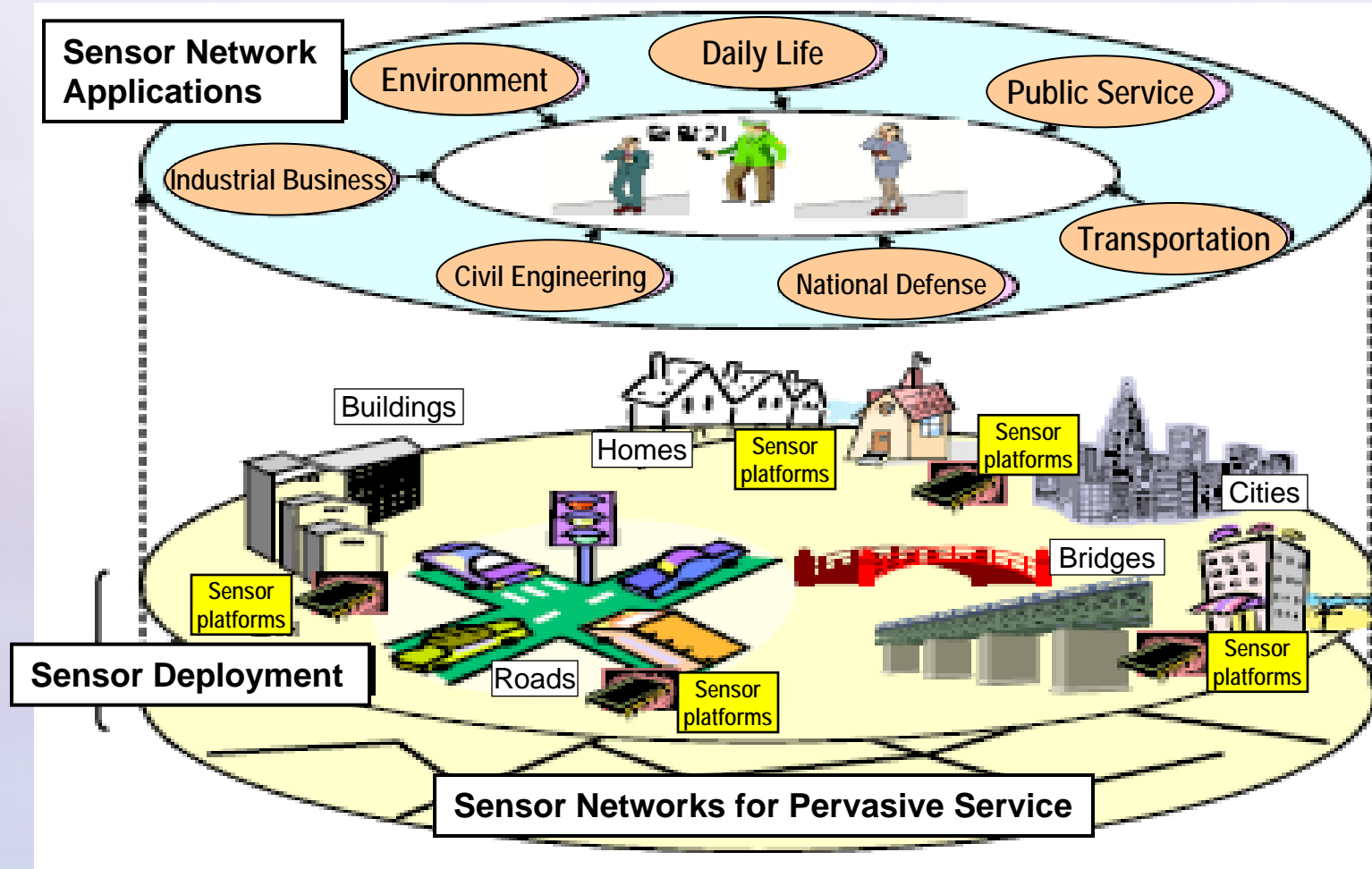


- “Sensor Nation”, IEEE Spectrum magazine, July 2004

We will soon be able to know almost everything about everyone.



# Promising Applications



# Promising Applications

## Daily Life

- Home Automation
- Home Security
- Sports & Fitness
- Weather Forecasting
- Childcare / Baby monitoring
- Elderly remote monitoring
- Local Community Activities

## Public Service

- Energy Saving
- Water Resource Saving
- Smart Schools
- Smart Learning
- Medical Service
- Rehabilitation
- Medical Surgery/Treatment
- Healthcare & Immunization
- Postal Service
- Governmental Service

## Transportation

- Traffic Monitoring
- Traffic Accident Avoidance
- Transportation Traceability
- Connectivity Optimization
- Shortest Routing Service
- Logistic & Delivery
- Vehicle Sensors
- Tire Pressure Real-time Monitoring sensors
- Roadside sensor deploying

## Environment

- Monitoring Ocean Pollutant
- Monitoring Terrestrial
- Habitants
- Natural Disaster Avoidance
- Foods Traceability
- Agriculture Automation
- Poultry & Meat Traceability
- Man Disaster Avoidance
- Integrated Biology
- Habitant Monitoring

## National Defense

- Military Operation Assist
- Military Resource Management
- Personnel Management
- Tactics & Battlefield Assist
- Logistic Traceability
- Frontier Guard Assist
- Open public space Surveillance (airports...)
- Mobile C4I Services

## Industrial Business

- Sales Market Monitoring
- Logistics and Delivery
- Office Automation
- Manufacturing Automation
- Factory Automation
- Building Automation
- Legacy SCM, CRM and ASP Interface
- Resources Sensing (underground resources)

## Civil Engineering

- Logistic
- Bridge Health Monitoring
- Architecture Monitoring
- Structural Monitoring
- Engineering Measurement
- Tension & Cracks Monitoring
- Road Monitoring
- Corrosion Monitoring



# Daily Life Applications

## - Home Automation



# Smart Homes are coming ....



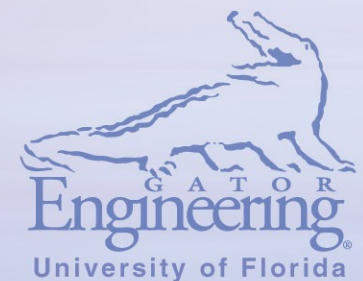
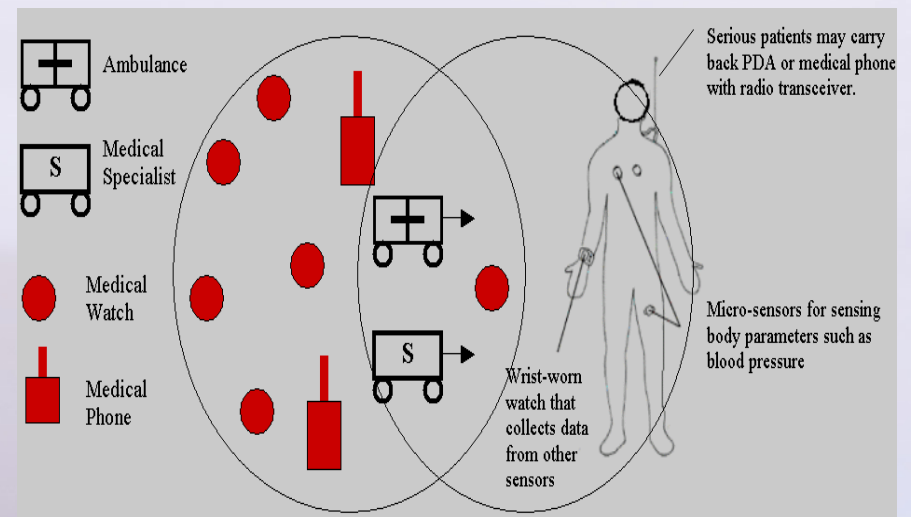
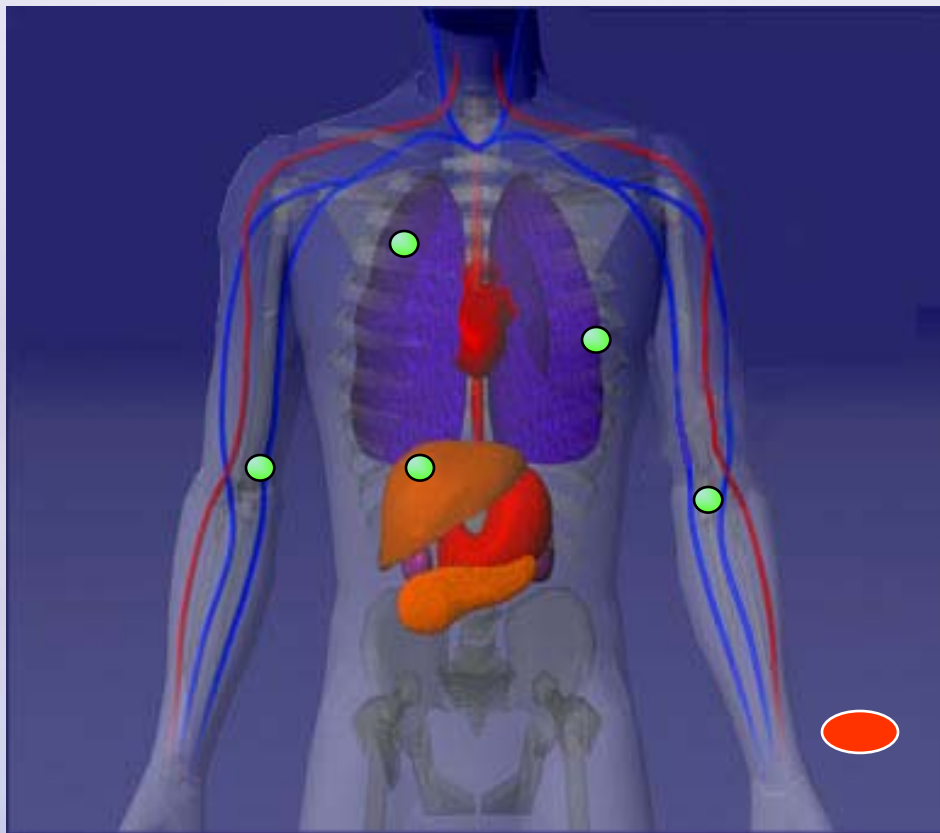
# Smart Grocery Shopping



# Public Service Applications

## - Medical Service

- Healthcare: Embedded Sensor networking for patient monitoring

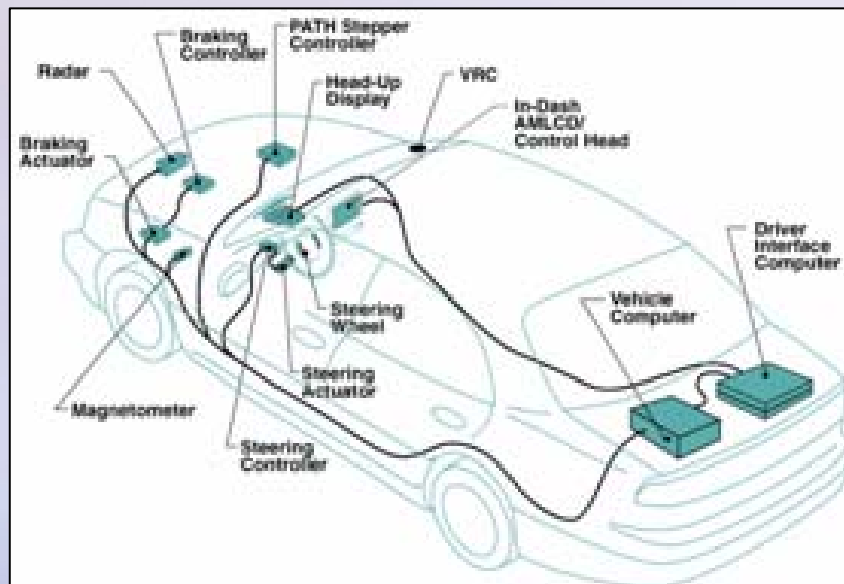




# Transportation Applications

## - Vehicle Sensors

- Smart Cars?
  - Safety
  - Power/energy saving
  - Navigation & Tracking



Excerpted from 'Sensor Network Survey', ICU, 2005.

# Transportation Applications





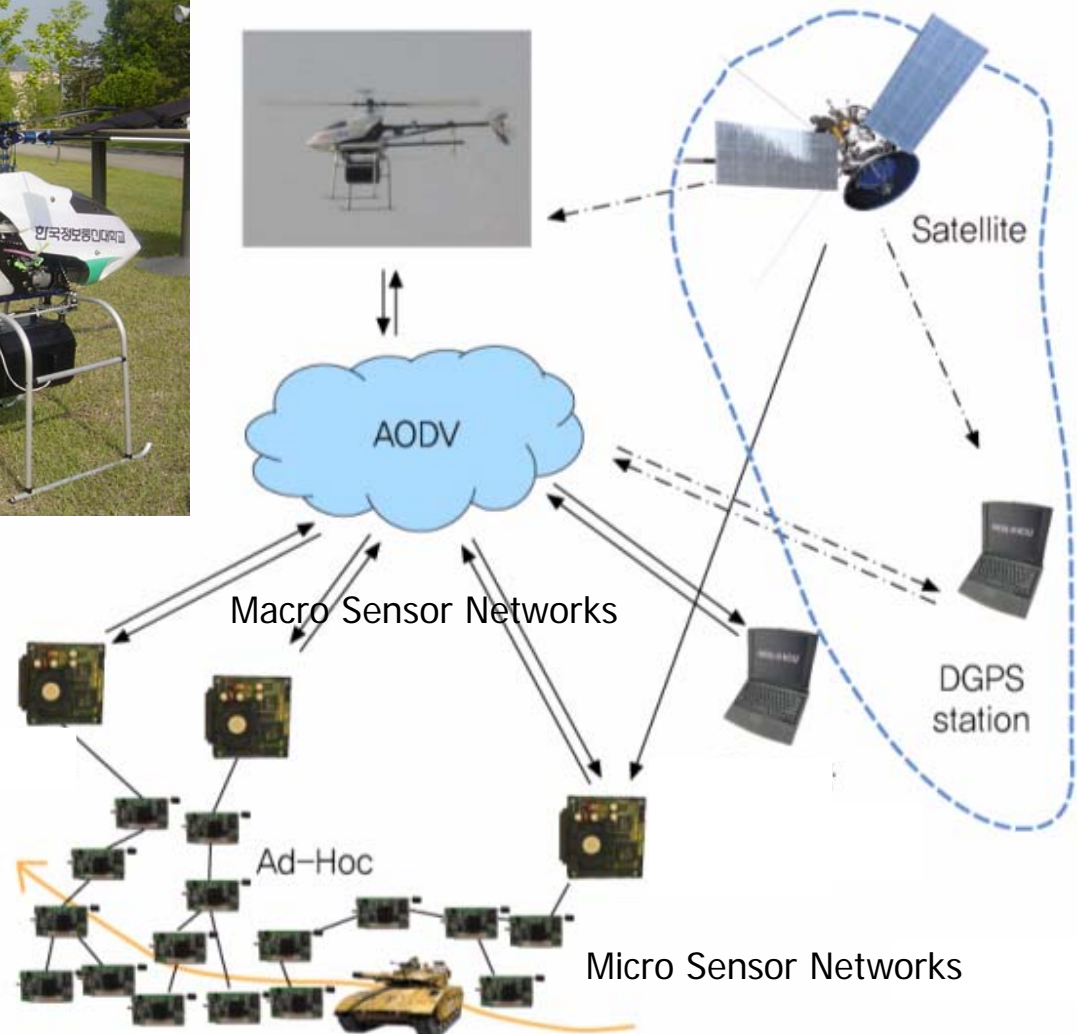
# Environment and Civil Engineering Applications

- **Environmental Monitoring**
  - Habitat Monitoring
  - Structural Monitoring



# National Defense Applications

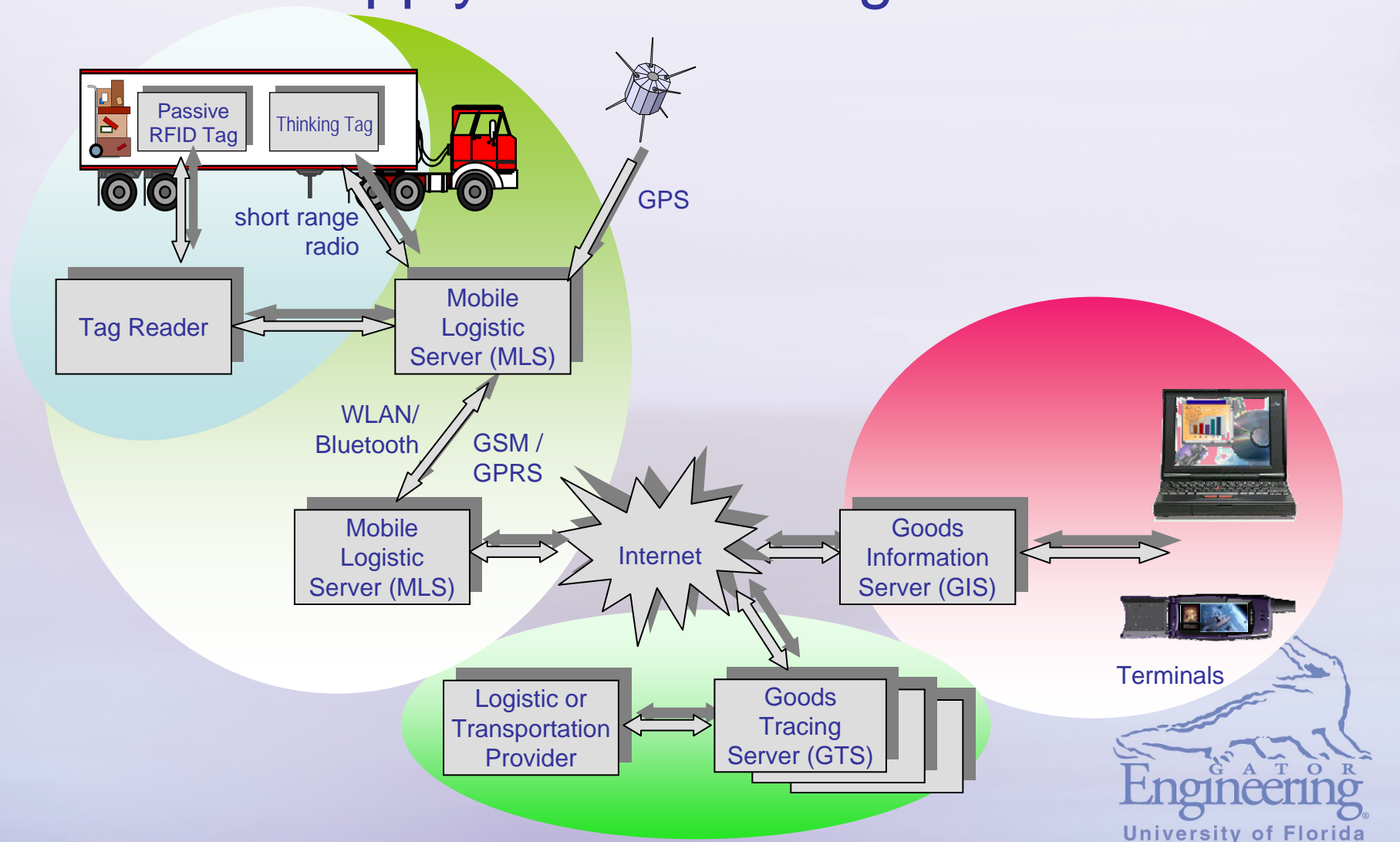
## - Surveillance Platform



Excerpted from 'Sensor Network Survey', ICU, 2005.

# Industrial Business Applications

## - Supply Chain Management



# Grand Challenges

- Large Scale Distributed processing requiring decentralization
- Long life-time requirement
- Reliability (no-repair failure model)
- Deployment
- Configuration and Network Management
- Programming the Sensor Network
- Others.





# The Computer Evolution



Cobol  
ANSI Standard



Client/Server  
TCP/IP

Synchronization  
SyncML

?

?