

# Pultronics

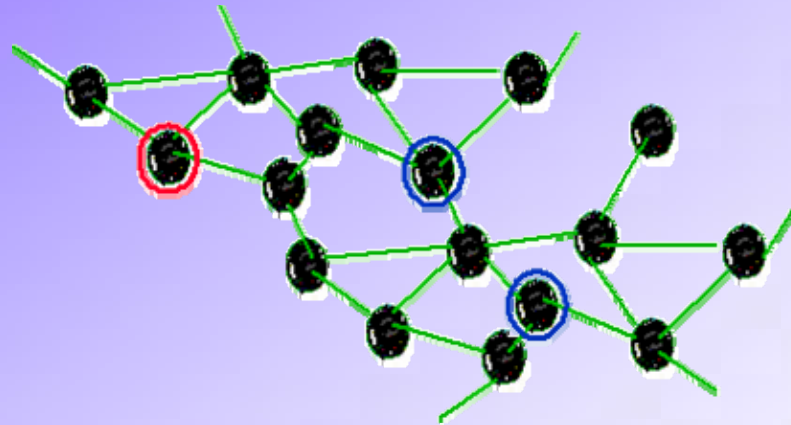
A thick, horizontal yellow brushstroke with a textured, painterly appearance, extending across the width of the slide below the title.

Wireless sensor networks

# Sensor networks changing our life style

*"While the last 50 years have been dominated by a march to ever more complex computers, the next few decades will see the rise of simple sensors -- by the billions."*

*Business Week*



# Sensor networks / mesh networks

## ■ Total asset visibility

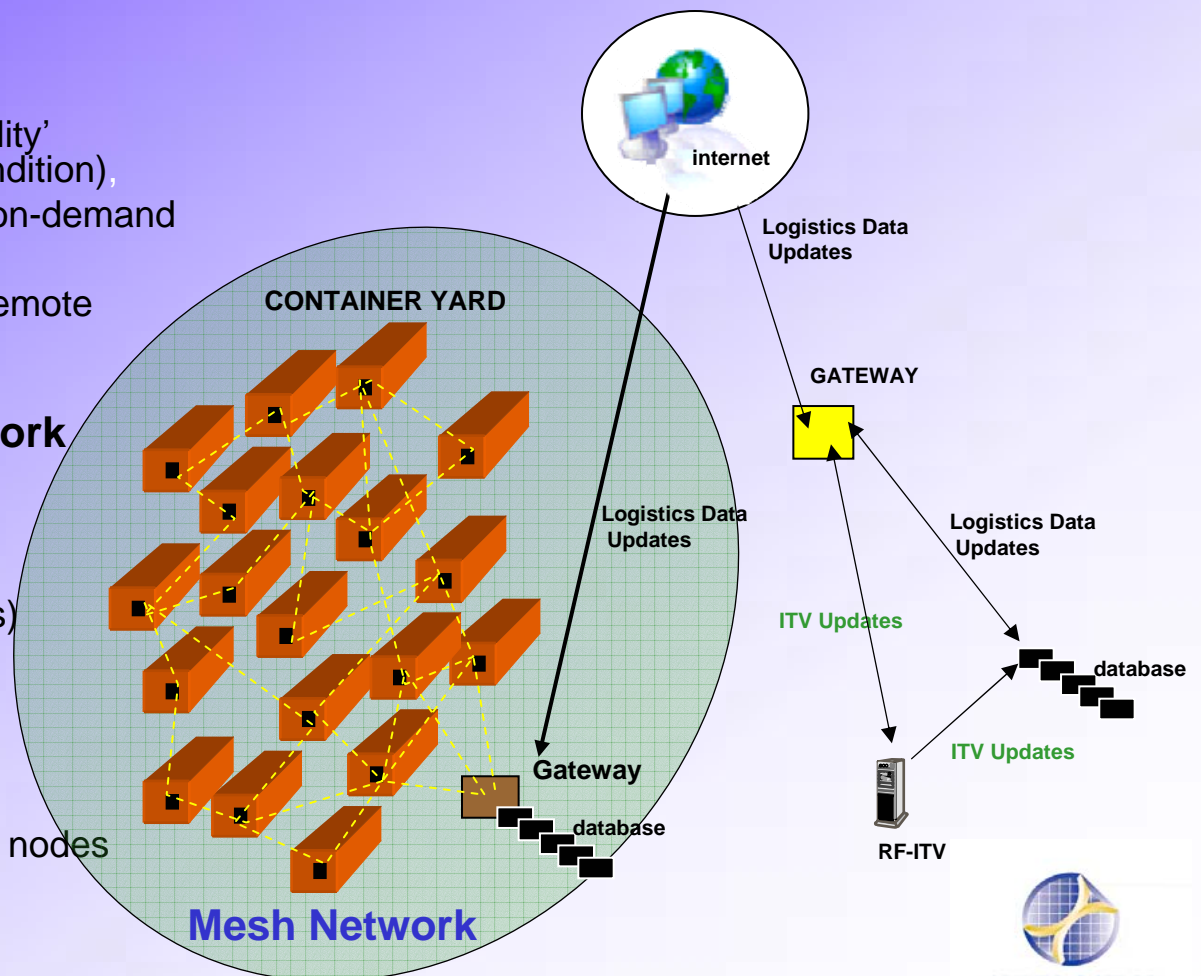
- Enables 'Total Asset Visibility' (location, identification, condition)
- Global, 'Near-Real-Time', on-demand
- Multiple Sensor Integration
- Event Management and Remote Programming

## ■ Advantages of mesh network

- Ad-hoc
- Self – configuring
- Redundant ( Multiple Paths)
- Fault-tolerant

## ■ Disadvantages of MN

- Bidirectional-power hungry nodes



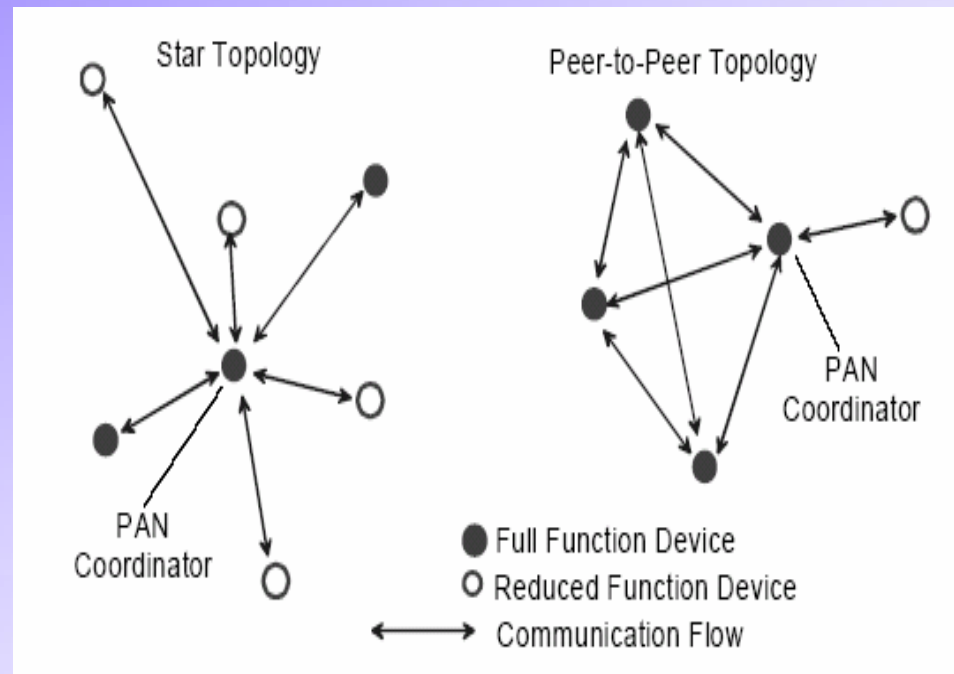
# Sensor networks

## ■ Advantages of P2P topology

- Ad-hoc
- Self – configuring
- Plug and Play
- Redundant ( Multiple Paths)
- Fault-tolerant

## ■ Advantages of star topology

- Low power
- Rx or Rx/Tx nodes
- Low traffic
- Plug and Play



# Pultronic platform

## ■ Preferred topology - star

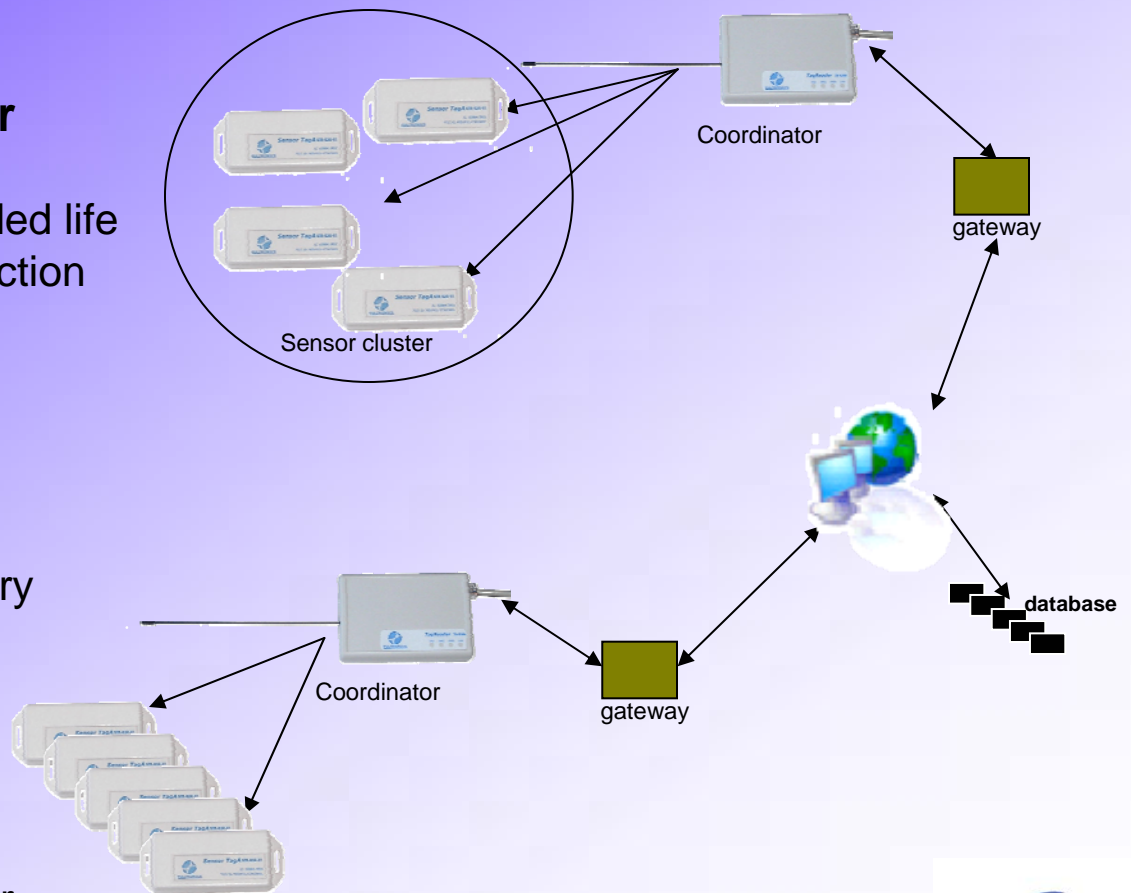
- Very low power – extended life
- Anti-aliasing, error correction
- Plug and Play
- Very low cost

## ■ Node

- Tx or Rx/Tx
- Rx/Tx nodes with memory
- Distributed data base
- Multiple sensors

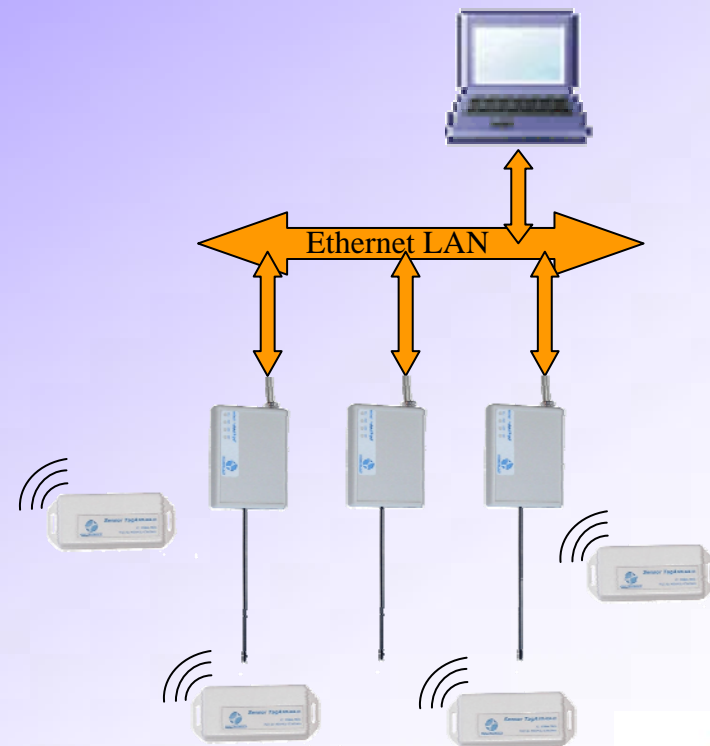
## ■ Coordinator

- Multiple sensors
- Can be wireless repeater

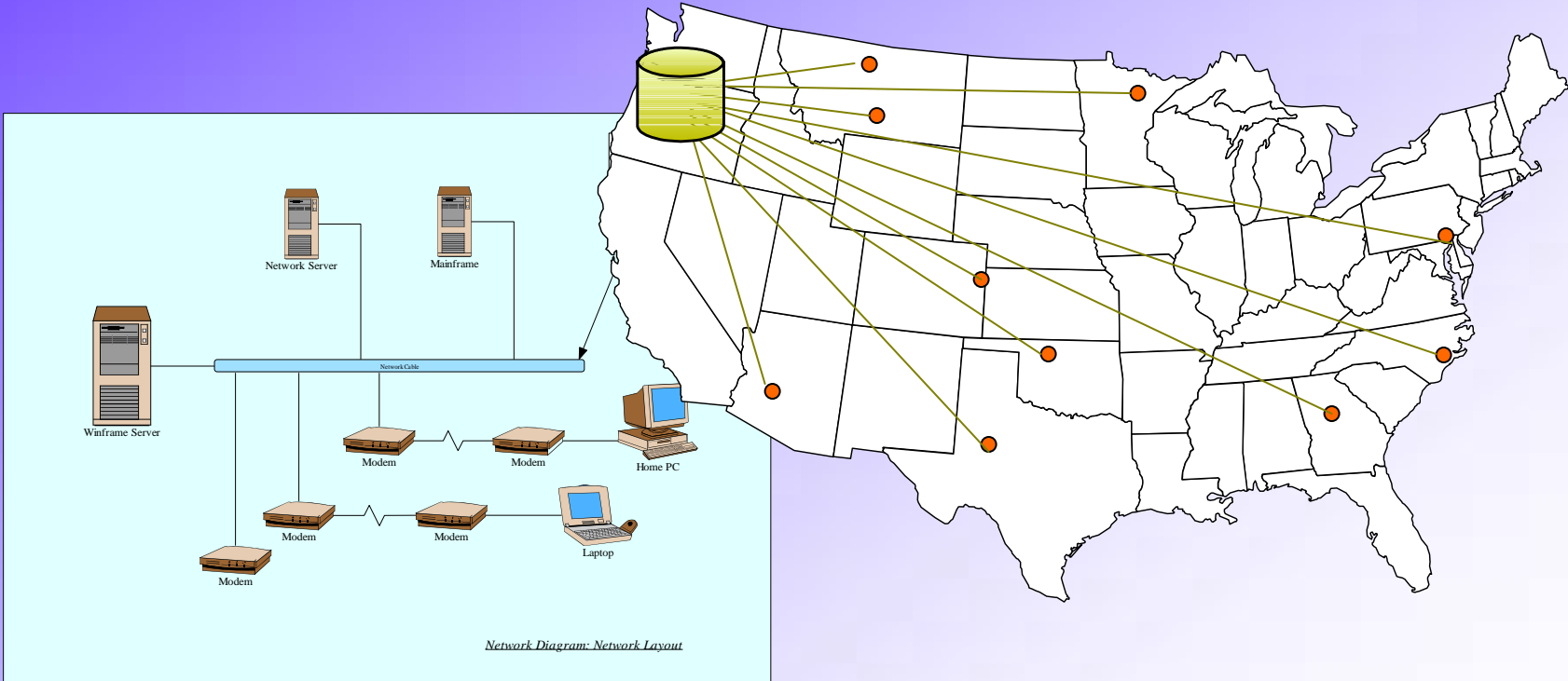


# Sensor Tracking system

- **comprehensive 3-part system**
  - **RFIDs** miniature remote sensors with RF transmitter
  - **Readers** RF receivers receiving data from RFIDs, connected to internet
  - **software application**
- **developed for real-time data acquisition**
  - remote sensing
  - identification, location and tracking
  - real-time database
- **Connectivity options**
  - local LAN (single hospital) or
  - central data base collecting data from multiple locations
  - readers are accessible through internet
  - Active or passive communication



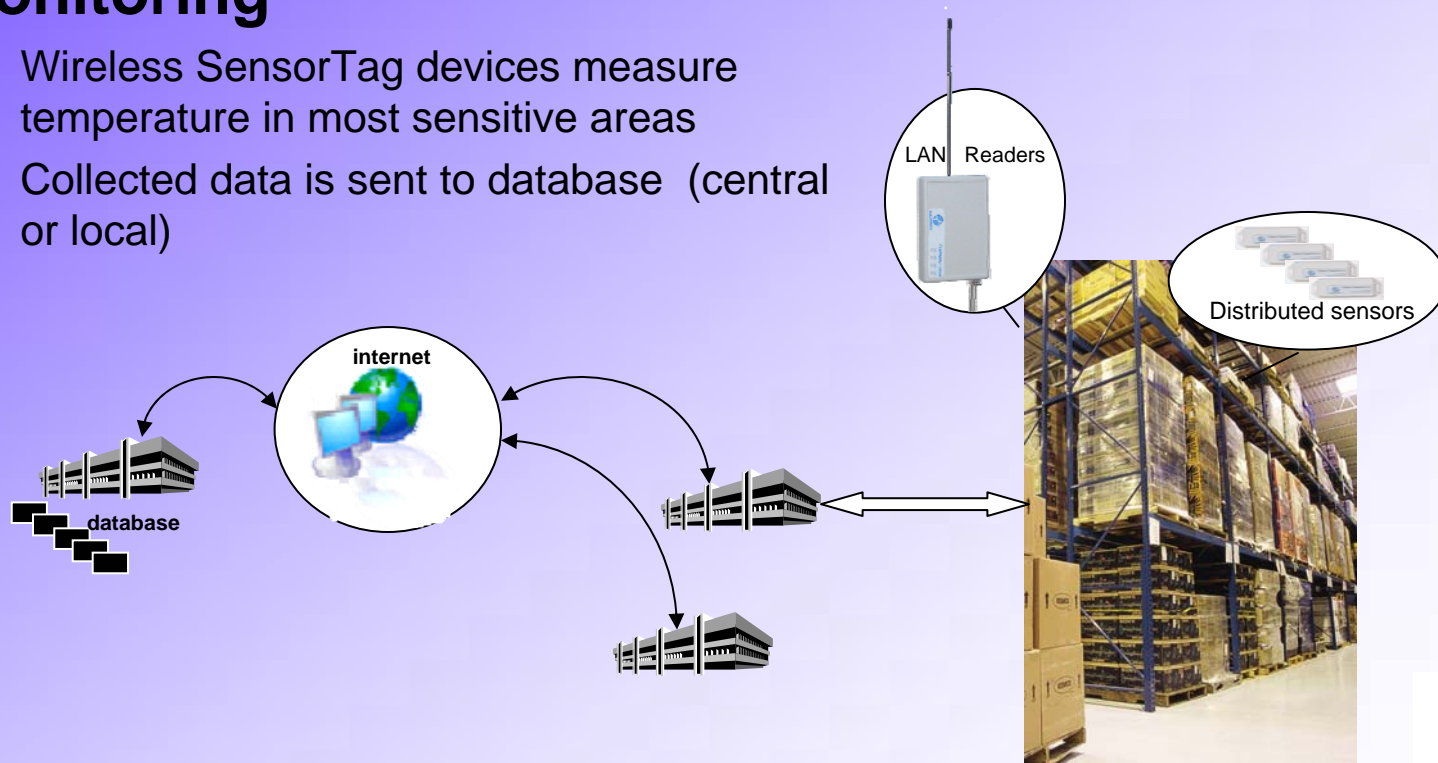
# Central database serving multiple locations



# Application to projects

## ■ Warehouse Temperature monitoring

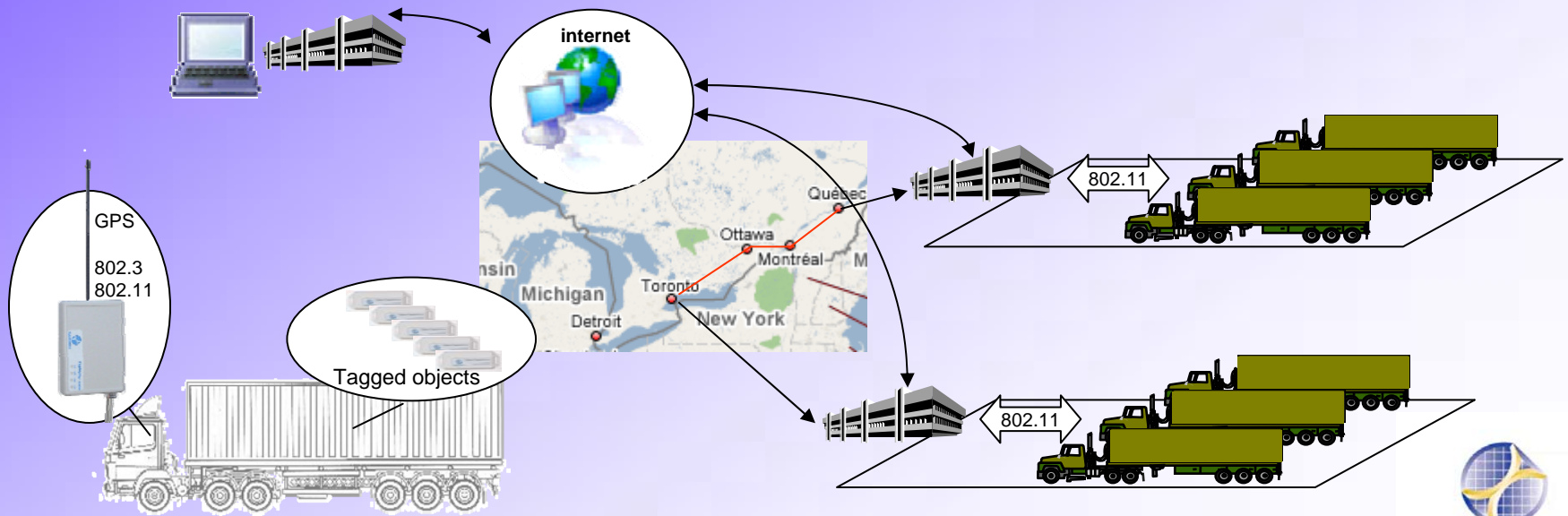
- Wireless SensorTag devices measure temperature in most sensitive areas
- Collected data is sent to database (central or local)



# Application to projects

## ■ In transit monitoring and datalogging

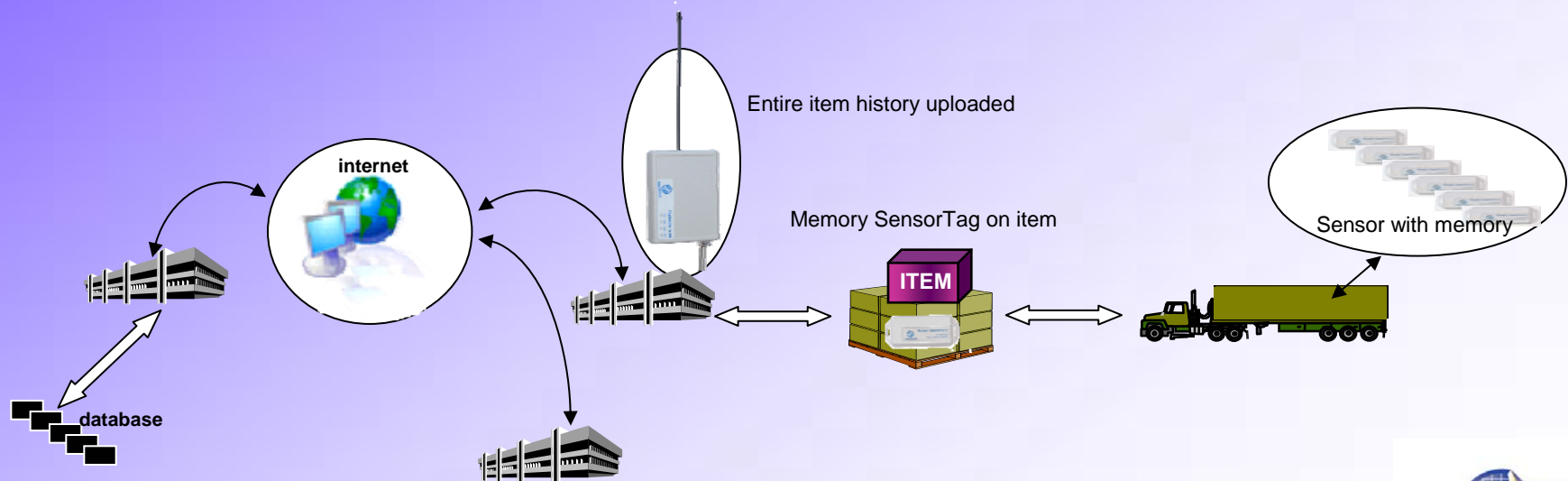
- SensorTag data + GPS position, time, etc. are collected during transport and stored in the Reader for further retrieval
- Collected data is sent to the server using wireless LAN (when available), or using cellular phone infrastructure



# Application to projects

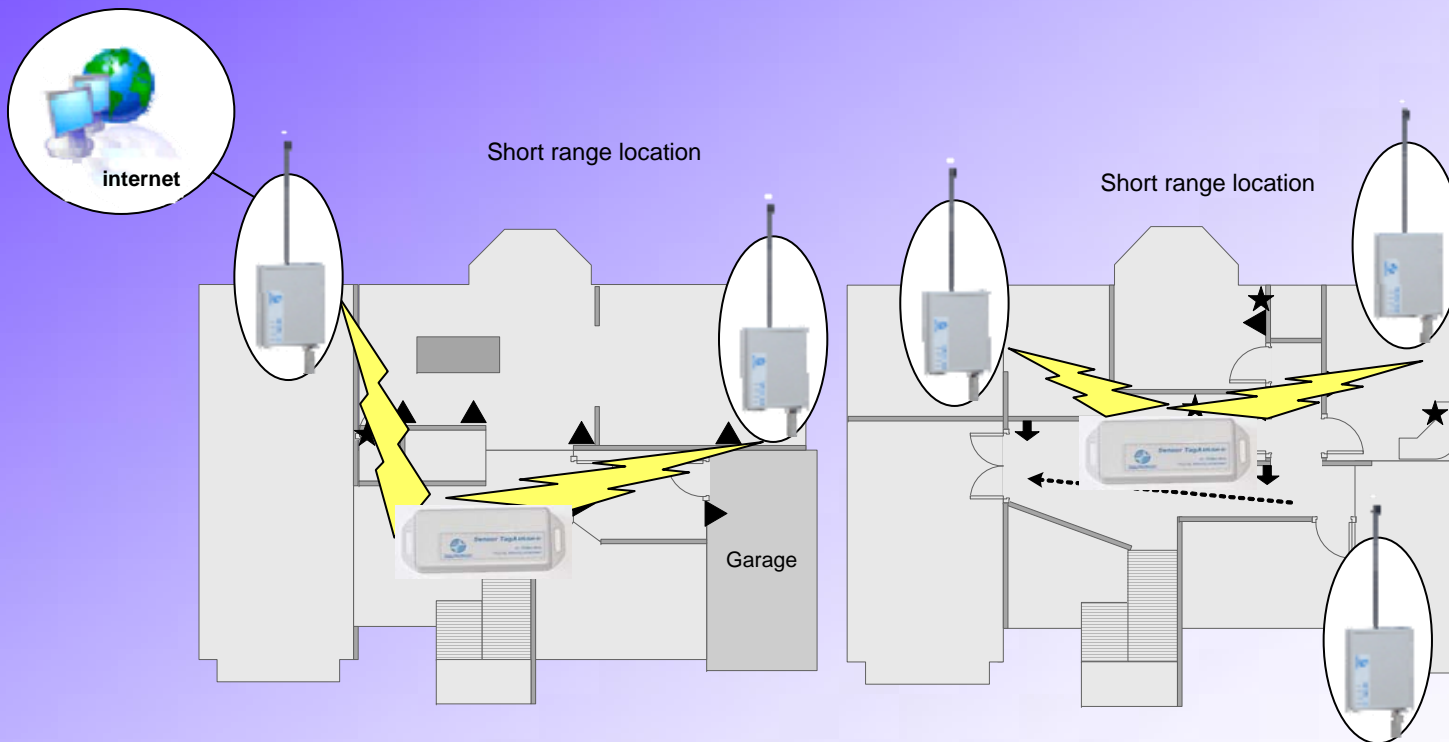
## ■ In transit datalogging

- SensorTag (on item or pallet) measures temperature at small time intervals and stores measured data
- Item history can be read from SensorTag



# Application to other projects

## ■ Activity and location

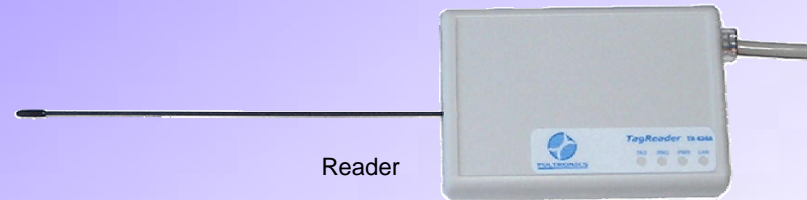


# Key Products Features / Reader

- Real-time communication with network
- RF:
  - ASK, FSK, 433.92 to 920 MHz
  - Anti-collision and error detection/ correction mechanism
  - Received signal strength measurement (RSSI) in reader
- Network connection:
  - 100Base-T Ethernet
  - TCP/IP, UDP
  - ARP (address resolution protocol)
  - IP modification
  - Active and passive connection
  - Ping
  - Http
  - Optional: RS-232, USB port
- Firmware upgrade through TCP/IP

# Key Products Features / Reader cont.

- **Captured data:**
  - ID
  - Time stamp
  - RSSI
  - Battery state
  - Data from sensors
- **Flash memory buffer available to store captured data**
  - 2MB flash memory or Smart Card
  - will not lose information at power failure
- **Real time clock**
- **Remote test functions**
- **Dimensions 10 x5 cm, current below 100mA**



# Some performances / reader

<b>Operating frequency</b>	<b>433.92 MHz</b>
<b>Storage capacity</b>	<b>2MB flash or smart card available for captured data (ID, time, etc.)</b>
<b>Data retention</b>	<b>10 years</b>
<b>Communication protocol</b>	<b>TCP/IP, UDP/IP, HTTP</b>
<b>Sensitivity</b>	<b>-103 dBm</b>
<b>Throughput</b>	<b>50 tag/s</b>
<b>Data rate (RF)</b>	<b>Up to 100 Kbps</b>

# Key Products Features / SensorTag

- RF transmission, range up to 100m
  - Scheduling
    - Periodic transmission
    - Event triggered, Sensor activated transmission
    - Battery low alarm
  - Millions of unique IDs
  - Optionnal sensors:
    - Temperature
    - Accelerometer
    - Pressure
    - Tilt
    - Shock
    - Rotation
    - Light



# Some performances / SensorTag

<b>Operating frequency</b>	<b>433.92 MHz</b>
<b>Range</b>	<b>Over 100m</b>
<b>Unique codes</b>	<b>16 mln</b>
<b>Operating voltage</b>	<b>3.3V</b>
<b>Life expectancy</b>	<b>Over 5 years</b>
<b>Operating temperature</b>	<b>-20 to +70 °C</b>

# Standard frequencies for RFID

frequency range [MHz]	comment	fieldstrength / transmission power
< 135 kHz	passive	72 dB $\mu$ A/m
6.765 .. 6.795	passive	42 dB $\mu$ A/m
7.400 .. 8.800	EAS (electronic article surveillance) only, passive	9 dB $\mu$ A/m
13.55 13.56	contactless smartcards (ISO 14443, MIFARE, LEGIC, ...), smartlabels (ISO 15693, Tag-It, I-Code, ...)	42 dB $\mu$ A/m
26.95. 27.28	item management (ISO18000-3), passive special applications only, passive	42 dB $\mu$ A/m
433	UHF (ISM), active	10 .. 100 mW
868 .. 870	UHF (SRD), active	500 mW, Europe only
902 .. 928	UHF (SRD), backscatter coupling, several systems , active	4 W – spread spectrum, USA/Canada
2.40 ..2.48GHz	SHF (ISM), backscatter coupling, several systems, (vehicle identification: 2.446 .. 2.454 GHz)	4 W - spread spectrum, USA/Canada
5.725 .. 5.875 GHz	SHF (ISM), backscatter coupling, rarely used for RFID	500 mW, Europe 4 W USA/Canada,

# Existing RFID Standards

## 1. Identification cards - contactless integrated circuit cards

ISO 10536 (ISO SC17/WG8) - Close coupled cards

ISO 14443 (ISO SC17/WG8) - proximity cards

ISO 15693 (ISO SC17/WG8) - vicinity cards

ISO 10373 (SC17/WG1/8) Identification cards - Test Methods

## 2. RFID for Item Management

ISO 10374 (ISO TC 104) - Freight containers - Automatic identification

ISO 15960 (SC31 WG2/4) - Transaction, Message Profiles

ISO 15961 (SC31 WG2/4) - Host Interrogator - Tag functional commands and other syntax features

ISO 15962 (SC31 WG2/4) - Data Syntax

ISO 15963 (SC31 WG2/4 - Unique identification of RF Tag and Registration Authority to manage the uniqueness

ISO/IEC TR 18000 (SC31 WG4/SG3) - Air Interface for each window

ISO 18001 (SC31 WG4) - Information technology - Application Requirements Profiles