Wireless Sensor Networks

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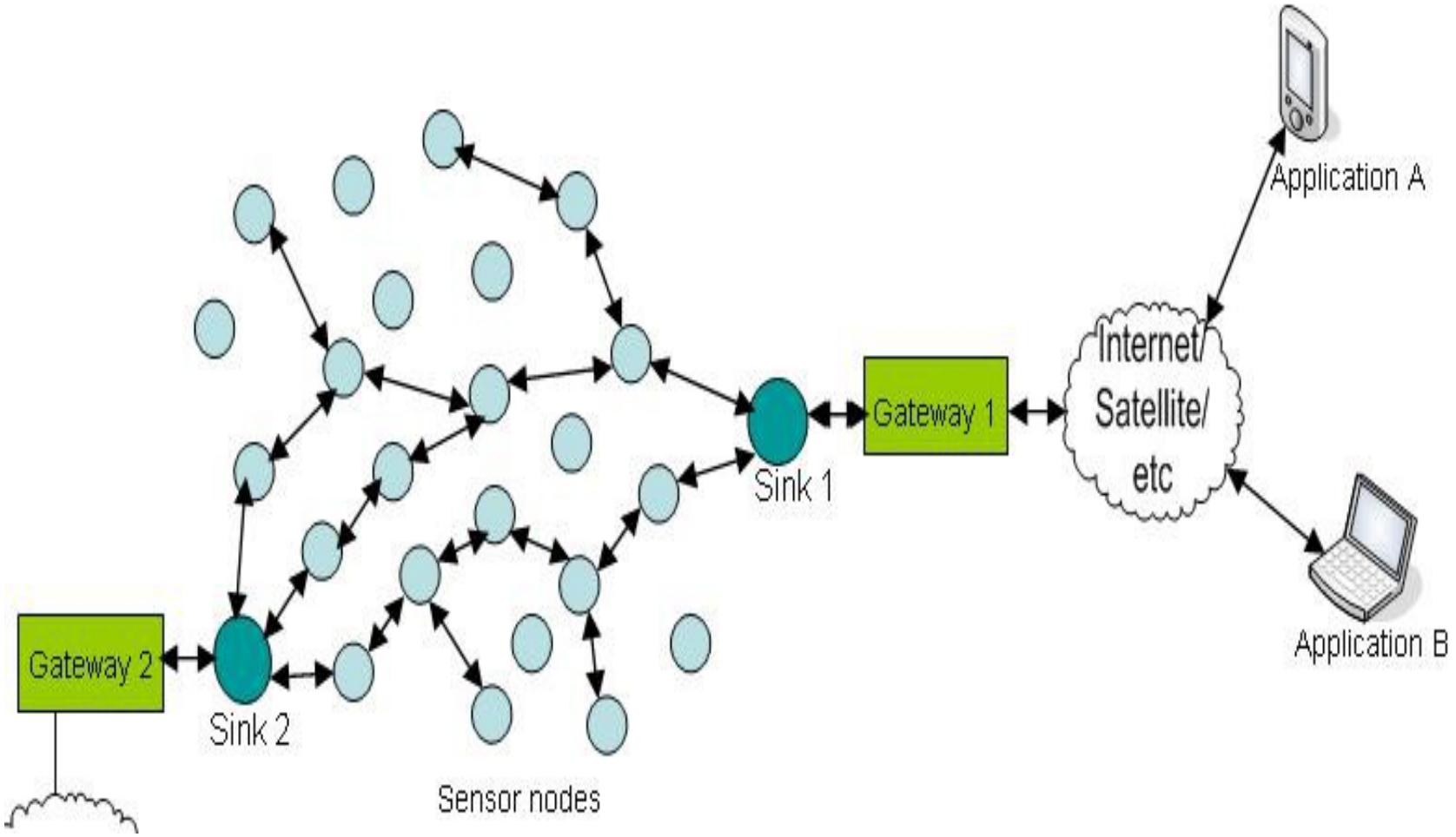
Wireless Sensor Network



ABSTRACT

Advances in hardware and wireless network technologies have created low cost, low power, multifunctional sensor devices. These devices make up hundreds or thousands of ad hoc tiny sensor nodes spread across a geographical area. A sensor nodes collaborate among themselves to establish a sensing network. A sensor network can provide access to information by collecting, processing, analyzing data. Thus the network actively participates in creating a smart environment.

INTRODUCTION

What are wireless sensor networks?

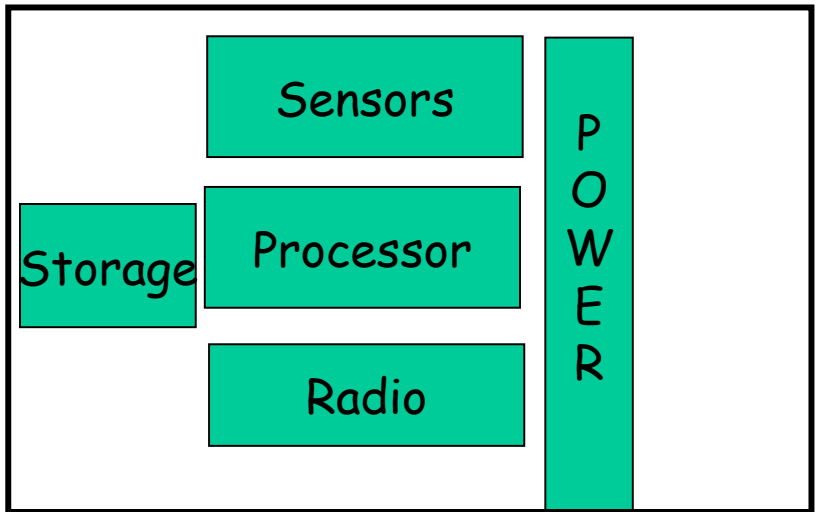
Unique characteristics/challenges.

Basic concepts and terminology.

What are wireless sensor networks (WSNs)?

WSN combines sensing, computation, and communication into single tiny device called sensor node.

Group of sensors linked by wireless media to perform distributed sensing task.



Architecture of a Sensor Node

1. HARDWARE

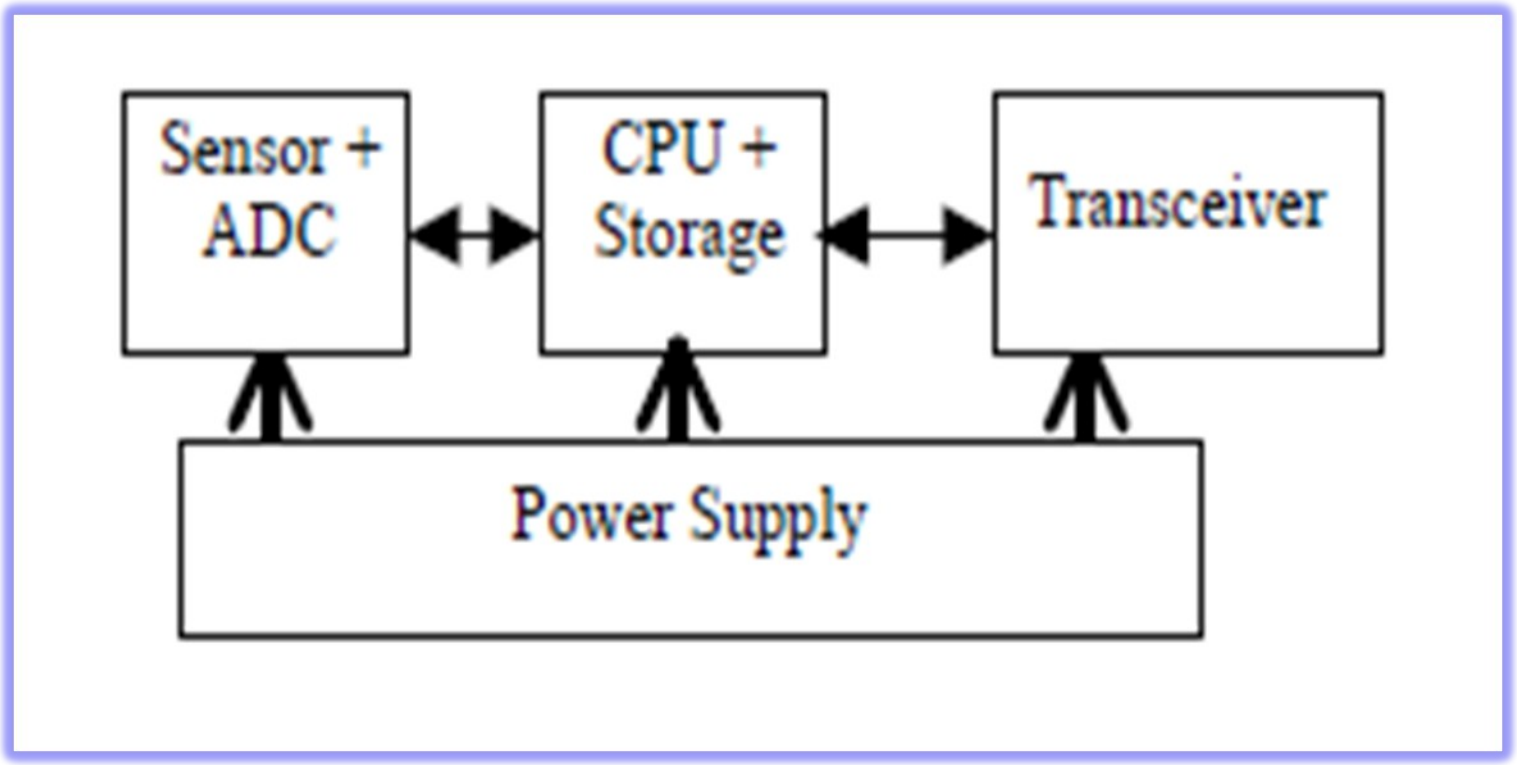
- A Power unit (Battery)
- Computational logic & Storage
- Sensor transducer
- communication

WSN node components

- Low-power processor.
  - Limited processing.
- Memory.
  - Limited storage.
- Radio.
  - Low-power.
  - Low data rate.
  - Limited range.
- Sensors.
  - temperature, light, etc.
  - Cameras, microphones
- Power.

Contd..

Architecture of a sensor node.



2. SOFTWARE

- Operating System
- Sensor Drivers
- Communication Processors
- Communication Drivers
- Data Processing

Specific Sensor Node

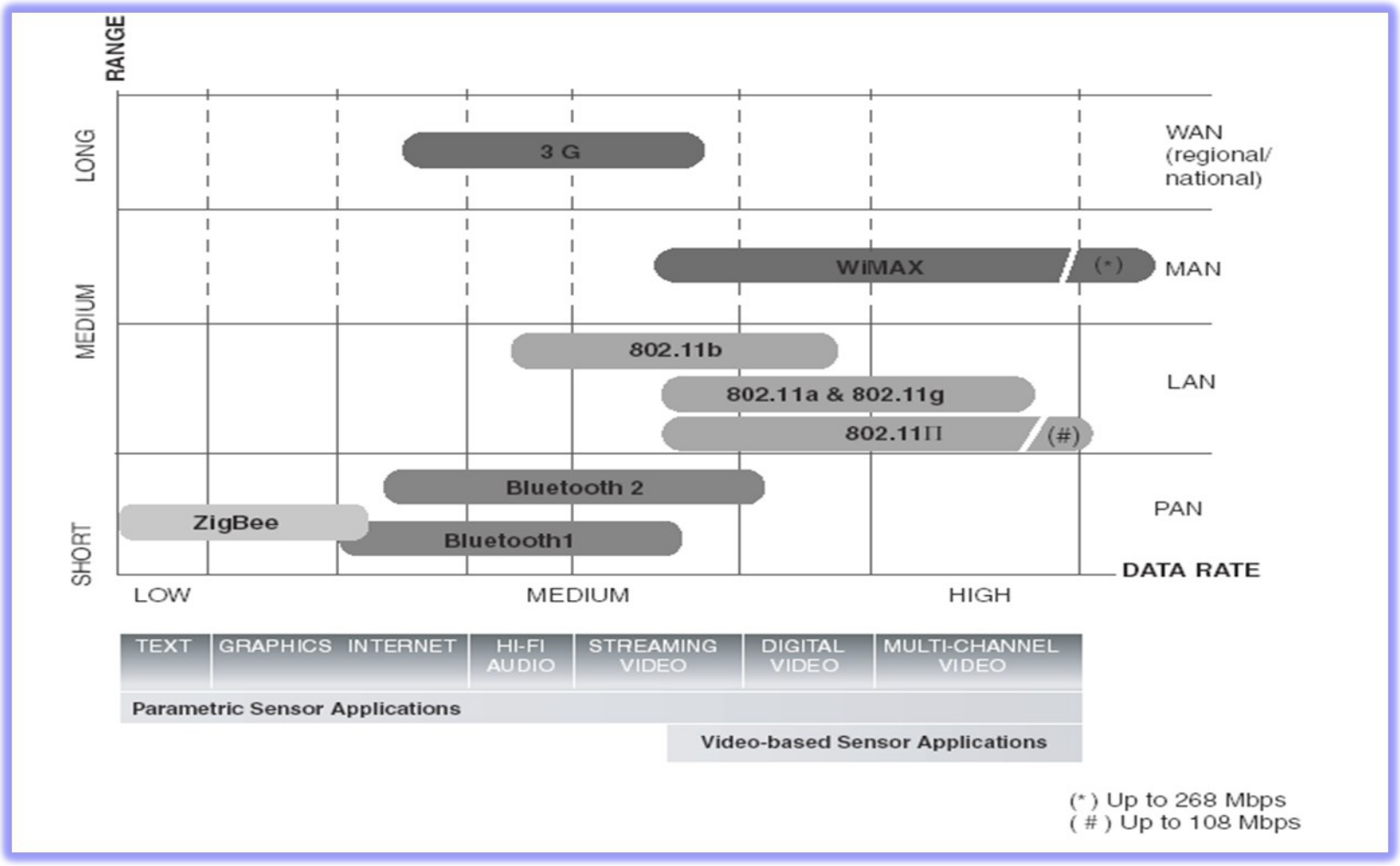
Sensor Node:

- Processor: 4Mhz
- Memory: 128KB Flash & 4KB RAM
- Radio: 916Mhz and 40Kbits/second.
- Transmission Range: 100 Feet

TinyOS:

- Operating System(small)
- Open Source
- Energy Efficient

Available Wireless Technologies



Design Challenges

Why are WSNs challenging/unique from a research point of view?

- **Typically, severely energy constrained.**
  - **Limited energy sources (e.g., batteries).**
  - **Trade-off between performance and lifetime.**
- **Self-organizing and self-healing.**
  - **Remote deployments.**
- **Scalable.**
  - **Arbitrarily large number of nodes.**

Applications of WSNs

Constant monitoring & detection of specific events

Military, battlefield surveillance

Forest fire & flood detection

Habitat exploration of animals

Patient monitoring

Home appliances

Advantages

- Implementation cost is cheaper than wired network.
- Ideal for non-reachable places.
- It avoids hell lot of wiring.
- It can accommodate new devices at any time.

Disadvantages

- Less secure because hacker's laptop can act as Access Point.
- Lower speed as compare to wired networks.
- Affected by surrounding. E.g.: walls (blocking), microwave oven , far distance

SCOPE OF FUTURE RESEARCH

To maximize the life time of sensor nodes.

To provide efficient energy harvesting techniques.

To employ more efficient technique for fault tolerance.

To provide more secure way of data transmission

Conclusion

Flexibility and fault tolerance create exciting new applications for remote sensing.

New wireless ad hoc networking techniques are required to overcome this constraints.

In future the wide range of applications will make sensor networks an integral part of our lives.