Introduction

Scenario: Data gathering

The information is useful only if sink knows where the node that detects the data is.
Introduction

- How to know the location information?
  - GPS
    - Is not suitable for low-power, low-cost sensor node
Introduction

- Choose the position that is Near the earth

- Satellite1
- Satellite2
- Satellite3

Objective
- Sensor Nodes determine their position by communication and computation
  - 2-dimensional: (x,y)
Basic Positioning Techniques

- Measurement of distance
  - TOA, TDOA, RSSI
- Position method
  - Triangulation

**TOA: Time of arrival**

\[ \frac{(T_3 - T_0) - (T_2 - T_1)}{2} \]

**TDOA: Time difference of arrival**

\[ \frac{(T_3 - T_0) - (T_2 - T_0)}{V_{RF} - V_{US}} \]
Basic Positioning Techniques

- Measurement of distance
  - RSSI
    - Measure distance by signal strength

Basic Positioning Techniques

- Triangulation

a, b, c: know its position
Node1: locate its position through a, b, c
Taxonomy

- Reference node base
- Non-Reference node base

What is Reference point?
- Sensor node equips with GPS component
- Most of papers call Reference point as anchor

Sensor Nodes compute their location information through reference nodes beacons
A Sensor Node act as reference node
Taxonomy

- Static Reference node
- Mobile Reference node

- Centralized algorithm vs. distributed algorithm
- Technique
  - Range-based
    - Sensor Nodes Compute their locations by estimating distances
  - Range-free
Taxonomy

- **Range-based**
  - To compute location through measuring distance

- **Range-free**

\[ (x_1, y_1) = \left( \frac{x_a + x_b + x_c}{3}, \frac{y_a + y_b + y_c}{3} \right) \]

Thank you.