
Self-organizing 802.11b Networks

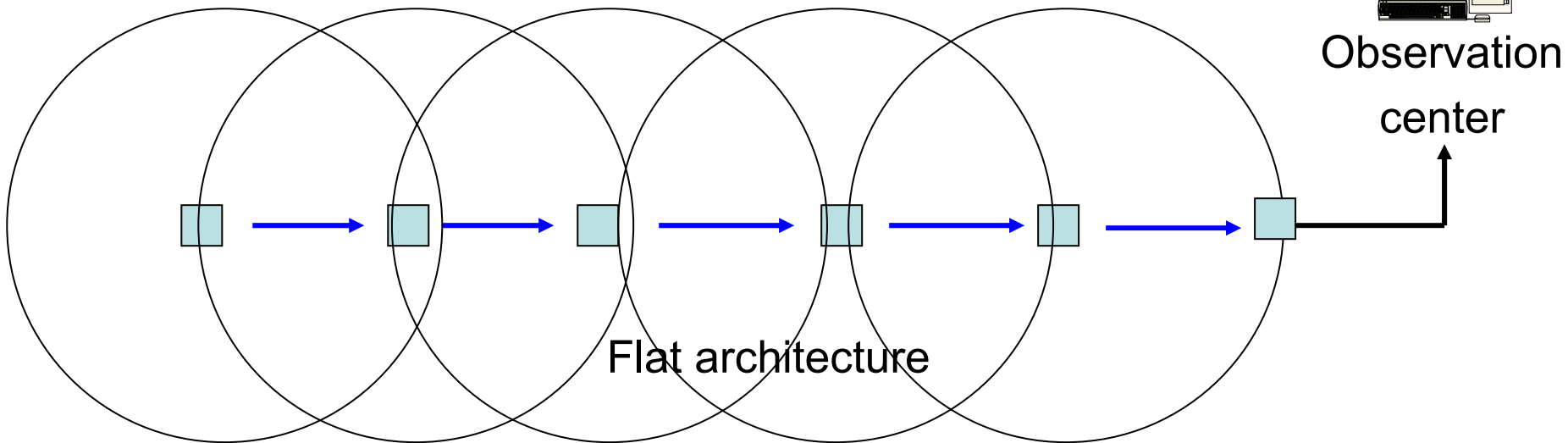
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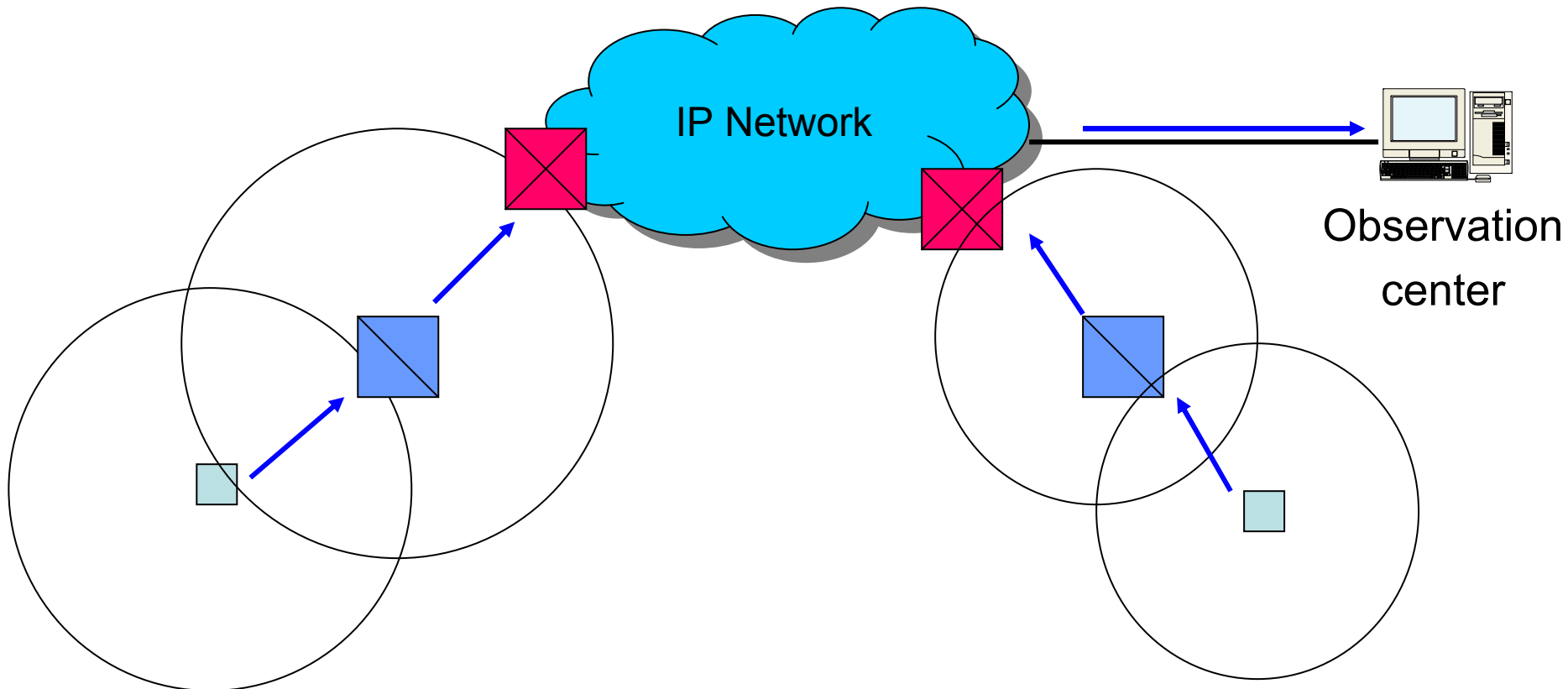
Motivation

- Flat architecture in Sensor Networks:
 - Low throughput per node, $O(1/\sqrt{n})$
 - Complex costly sensors
 - Large overhead (route discovery, flooding)



Motivation

- Most of the traffic from sensors to access points, traffic pattern is different from usual assumption of ad hoc network



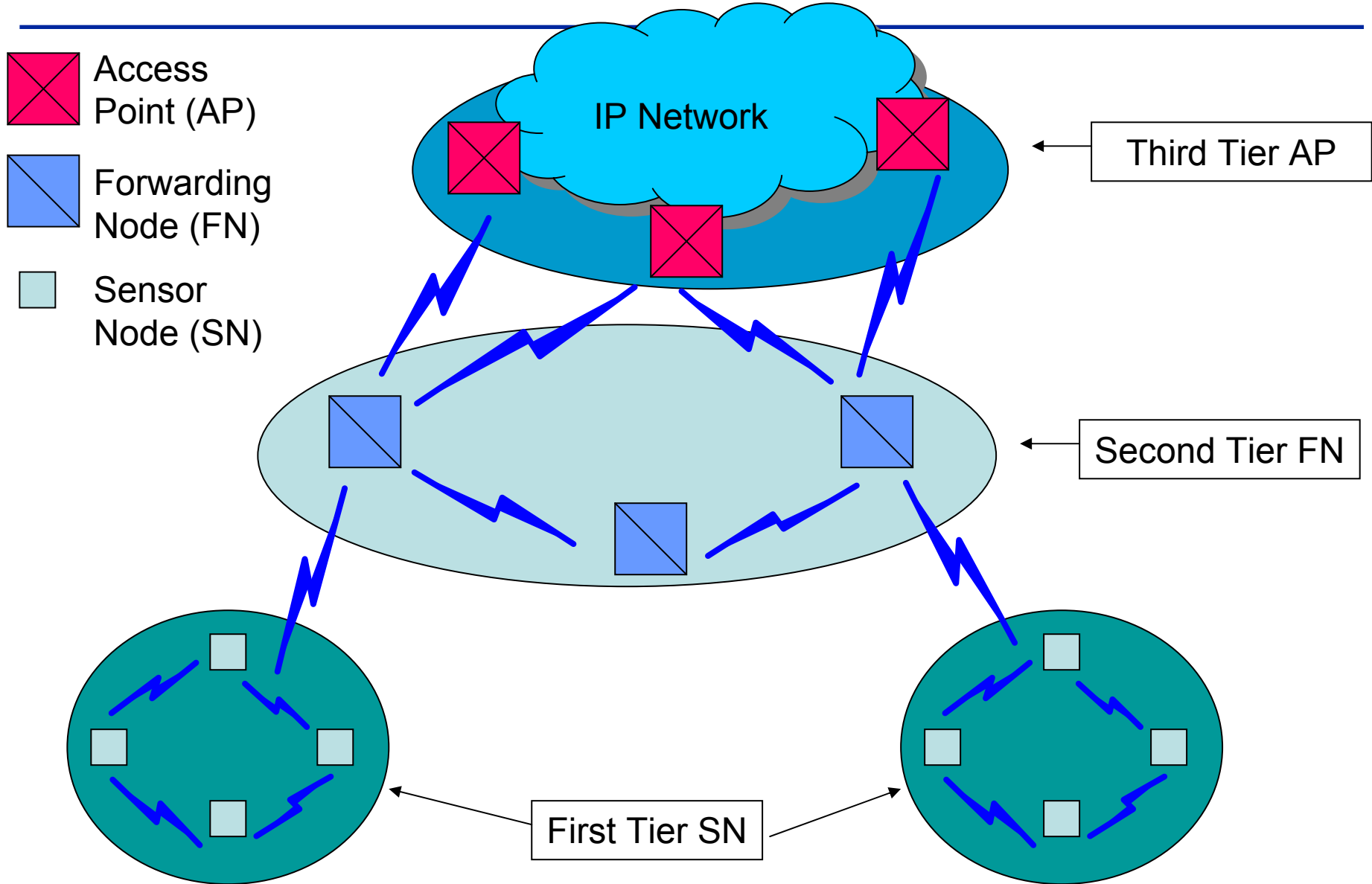
802.11 Networks

- Problems
 - No power control
 - Inefficient MAC for multi hops network
 - No forwarding capability between nodes
- Widely available hardware
 - Good for prototyping
- Our work is not limited to 802.11 networks

Project Objectives

- Create sensor networks architecture with:
 - Hierarchy
 - Heterogeneous network nodes
 - Scalable architecture
- Design sets of protocols to provide:
 - Power aware MAC layer clustering
 - Power aware routing
- Show proof of concept:
 - Simulation studies
 - Implementation in test-bed

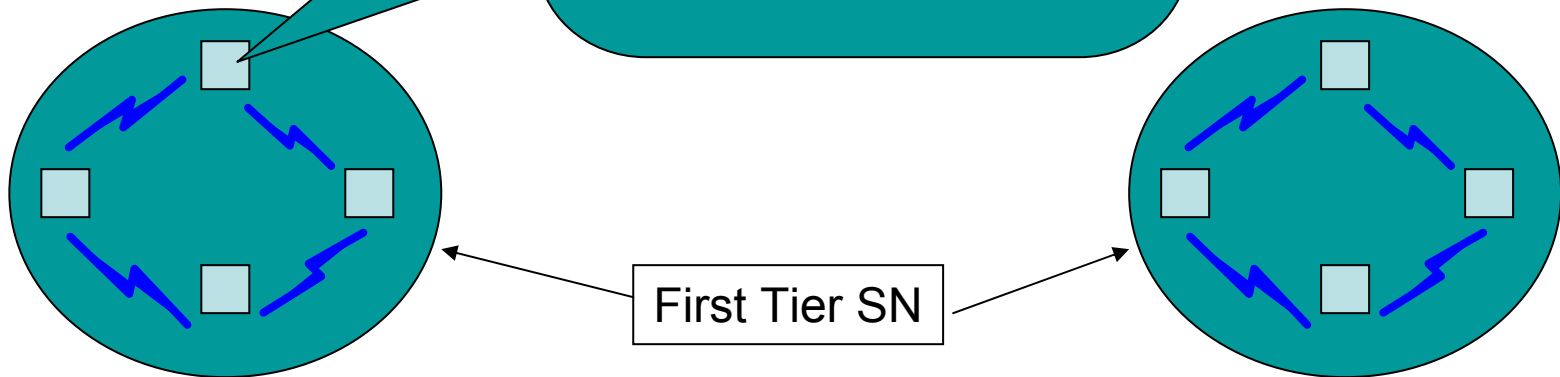
Hierarchical Architecture



First Tier: Sensor Nodes

Sensor Node

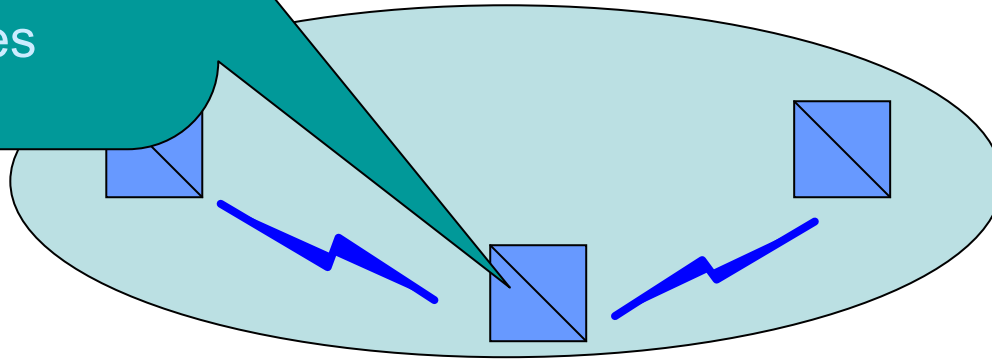
- Lowest tier
- No forwarding & routing
- Clusters around FNs and APs



Second Tier: Forwarding Nodes

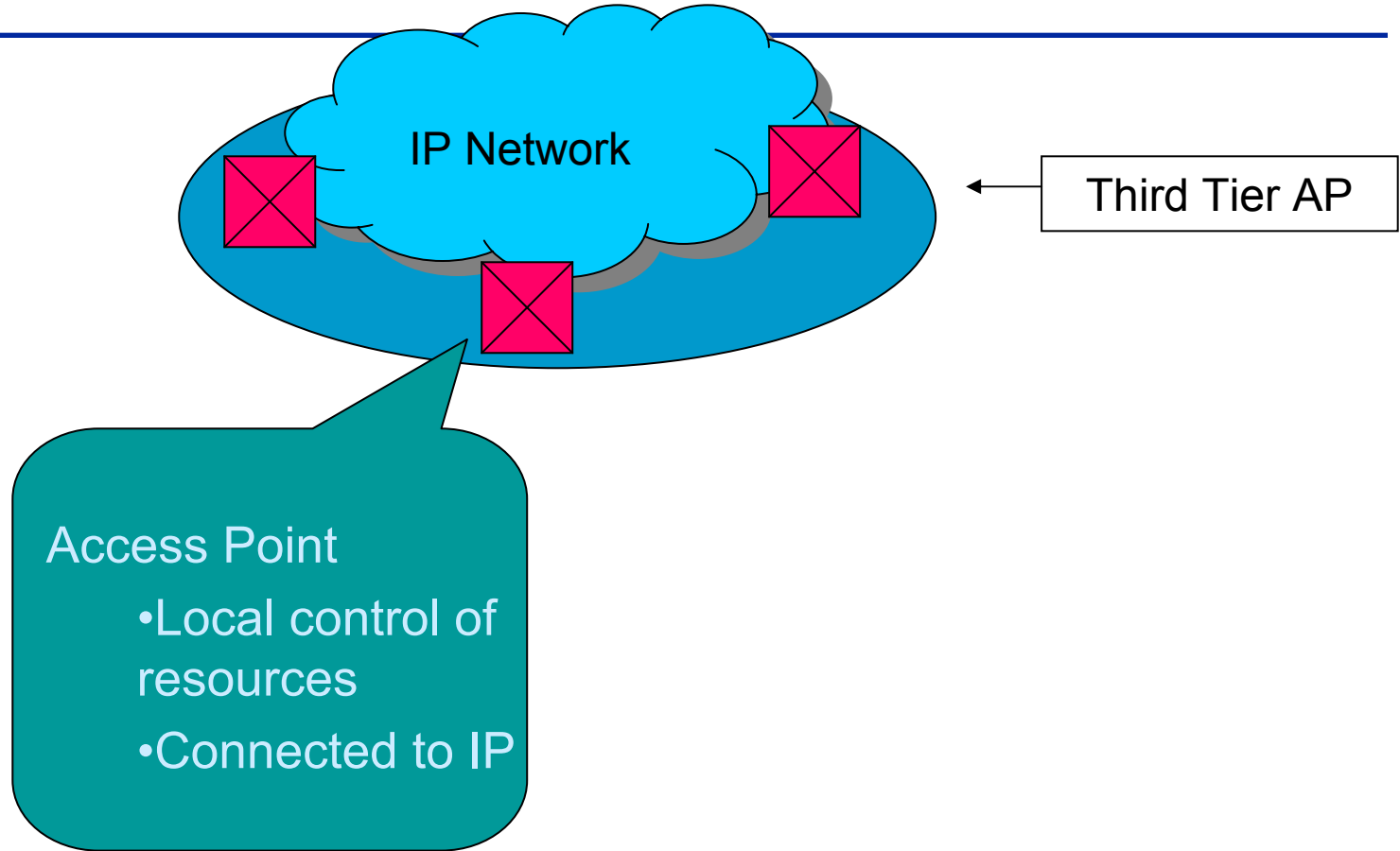
Forwarding Node

- Super set of SN
- Routing & forwarding
- Two Wireless interfaces



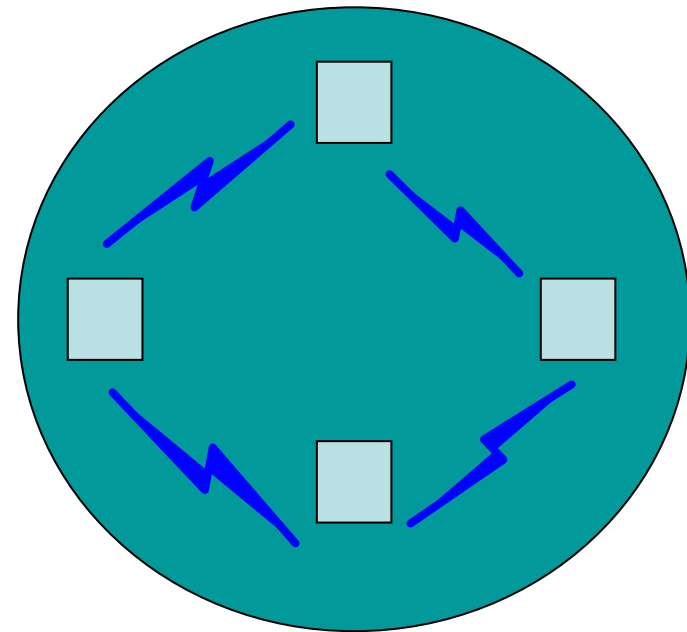
Second Tier FN

Hierarchical Architecture



MAC Clustering

- Use of MAC clustering:
 - Reduce overhead traffic and routing delay
 - Reduce routing complexity
 - Help scalability
- MAC clustering
 - Based on power



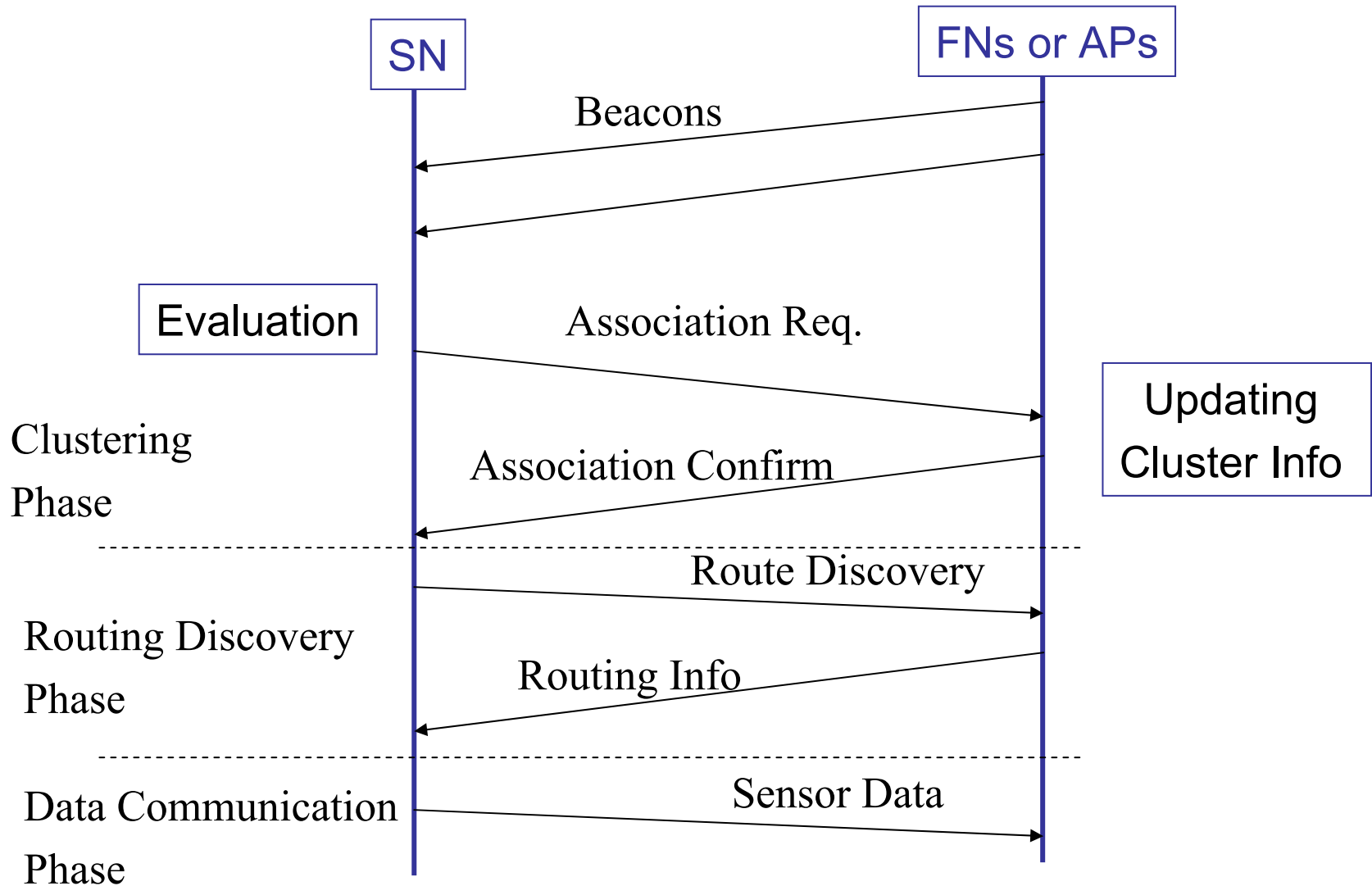
Discovery: Beacons and Important Parameters

- AP and FN will beacon, and SNs use these cluster

MAC HD	Device type	Battery life index	TX Power	Channel info	Beacon interval	Reserved
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- Sensor uses:
Ratio Rx power / Tx power, and Battery life index to decide which cluster to join.

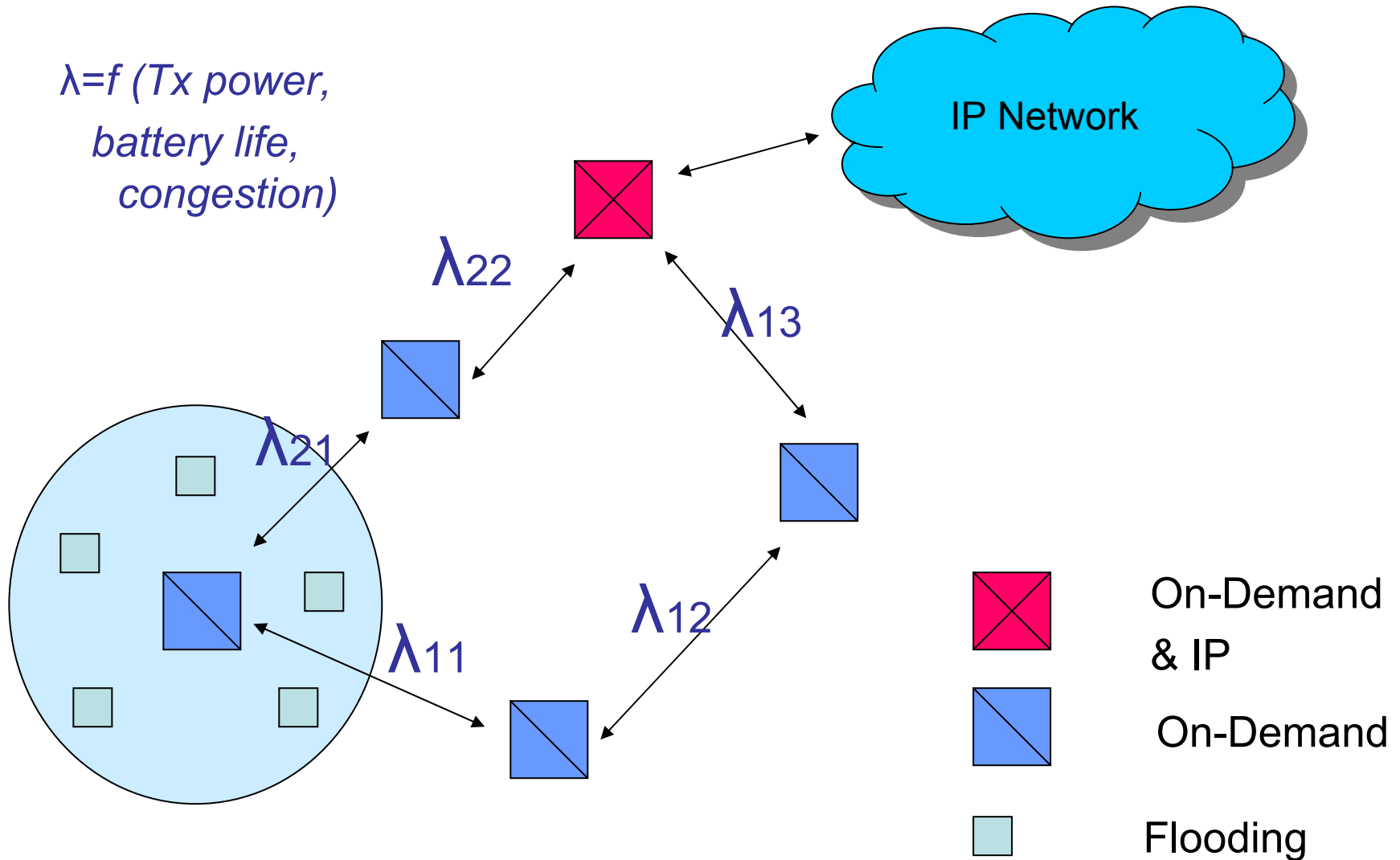
Discovery for SNs



Routing in Sensor Networks

- We consider on-demand routing such as variation of DSR.
 - Less overhead than pro-active
- Investigate if these protocols can be applied successfully to hierarchical networks?
- How will routing in the sensor networks and IP networks interact?

Initial Ideas on Routing



Current State of Project

- Architecture is decided and protocols are in development.
- Power based clustering and discovery protocols have been implemented in the test-bed by using
 - IEEE802.11b WLAN cards and Linux OS
 - Protocols developed in portable platforms

Work in Progress

- Modify DSR routing for hierarchical architecture
- Understand cost metrics in routing protocol for hierarchy
- IP ↔ Sensor routing and interactions
- Implementation of the concept in the test-bed and develop open source software
- NS2 simulations