Technische Universität Berlin

Development of a Sequence Detection System in Wireless Sensor Networks

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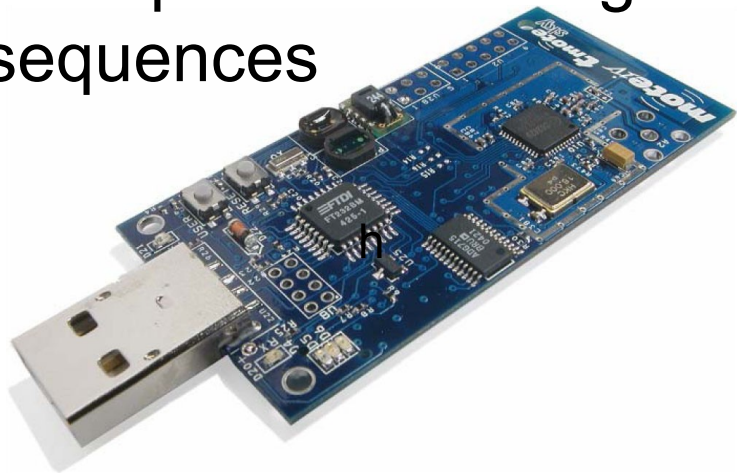
Telecommunication

Introduction

- Wireless sensor networks
- Collecting and relay any environmental data
- Location information is important
- In some cases relative physical sequence is enough
- We assume one dimensional sequences



Motivation

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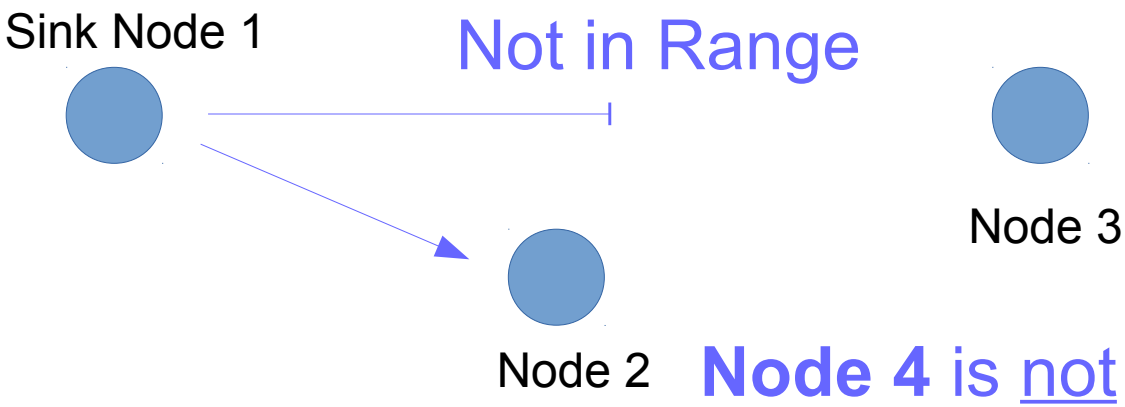
Create measurement data for sequence detection in multihop sensor networks

- Multihop support
- Measurment management
- Measurment collection and transmission
- Automated node discovery

What's Multihop?



Node 4 is not in Range of **Node 1**

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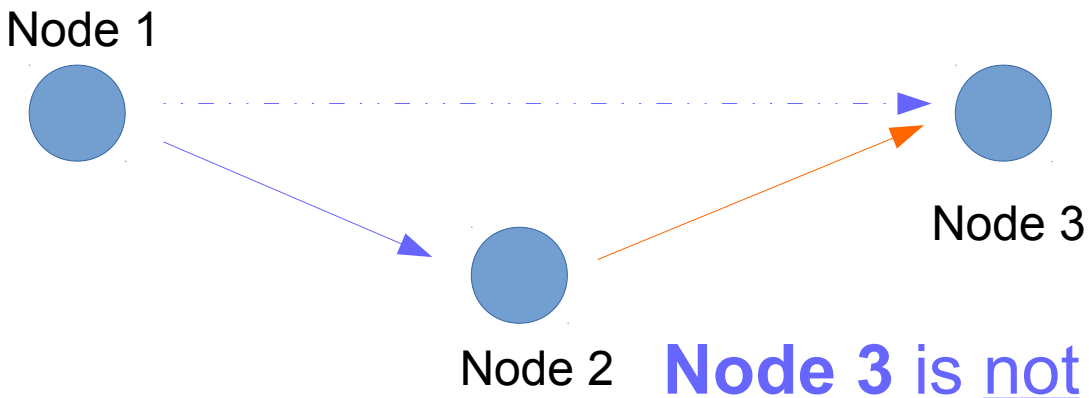
What's Multihop?



Node 3 is not in Range of **Node 1**

Node 3 is in Range of **Node 2**

So data can reach **Node 3** from **Node 1** via **Node 2**

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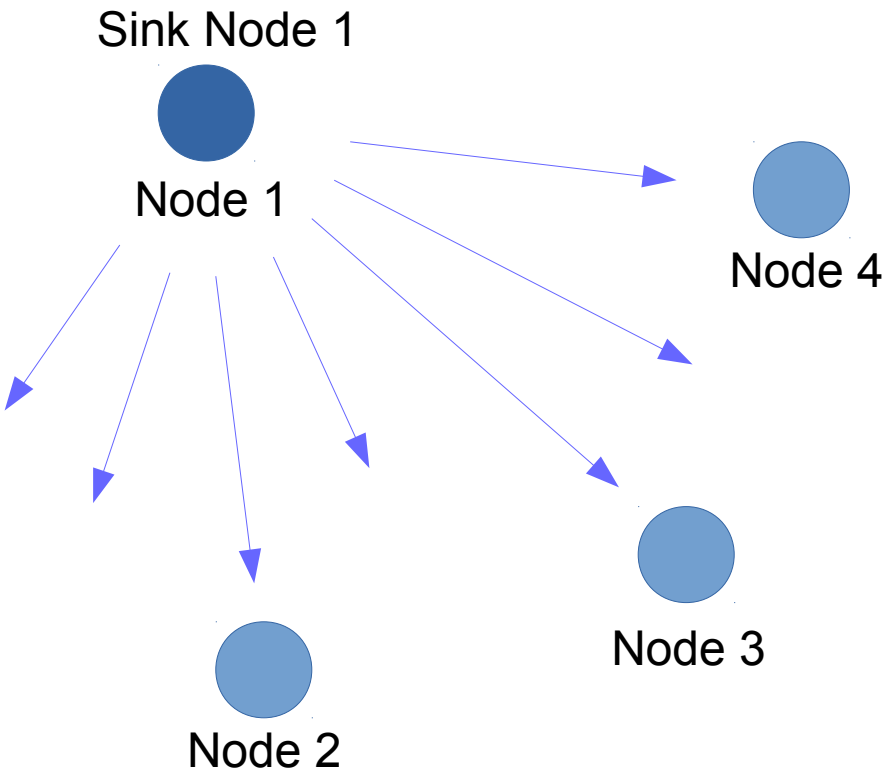
Design

- Sink node(Management)
  - Node Detection
  - Sender Selection
  - RSS measurement
  - Channel Selection
  - Data Collection
- Measurement nodes
  - React on sink node

Design – Node Detection



Request for node ID

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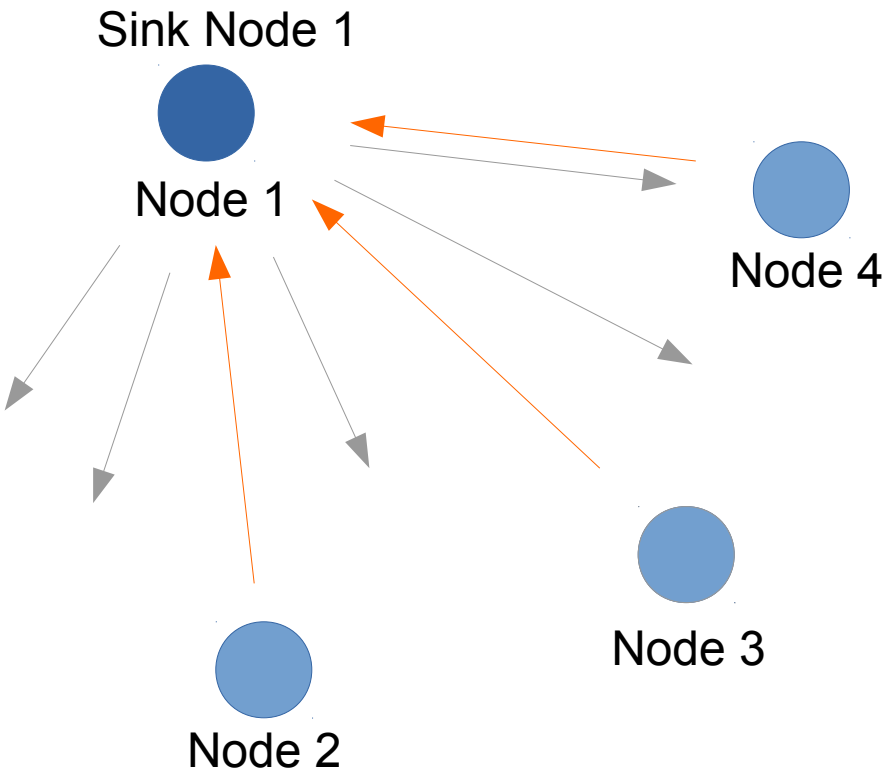
Design – Node Detection



Request for node ID

Node response for availability

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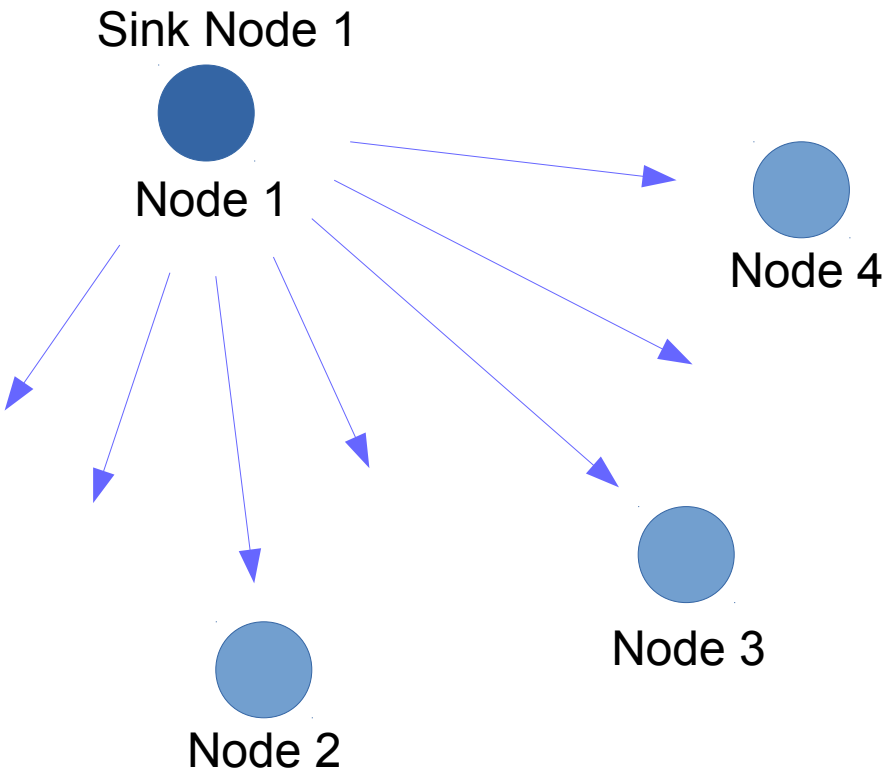
Design – Sender Selection



Assign next sender

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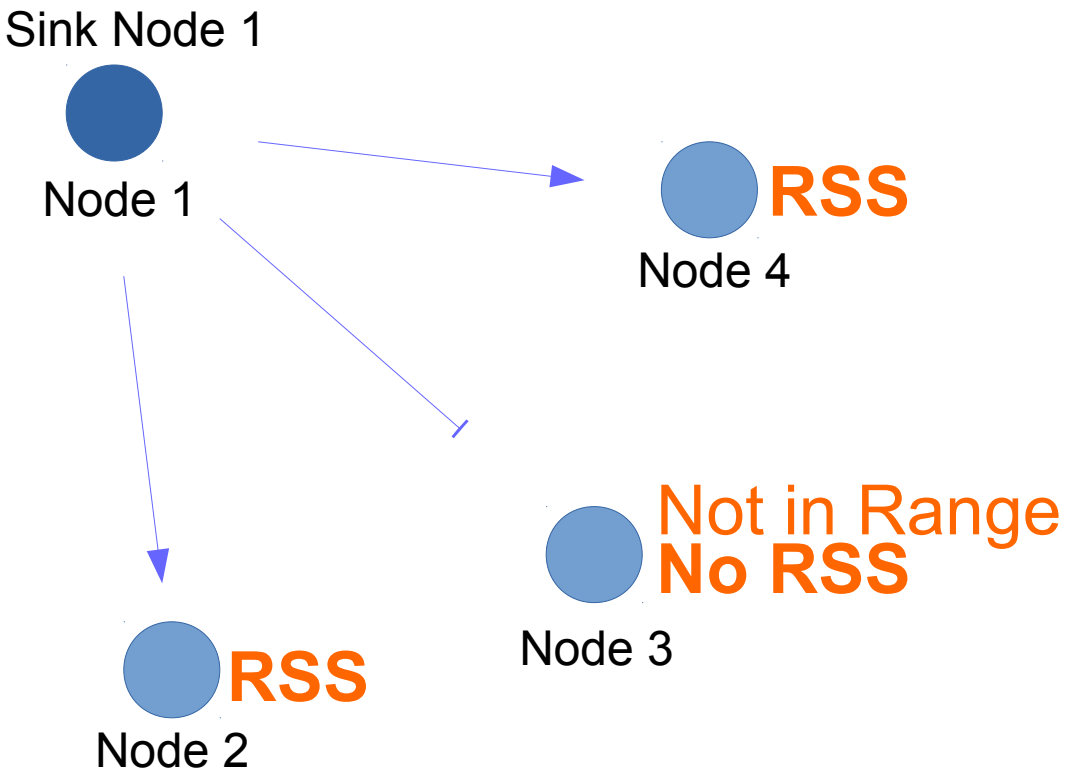
Design – RSS measurement



After assigning next sender ...

Receivers "in range" are MEASURING RSS

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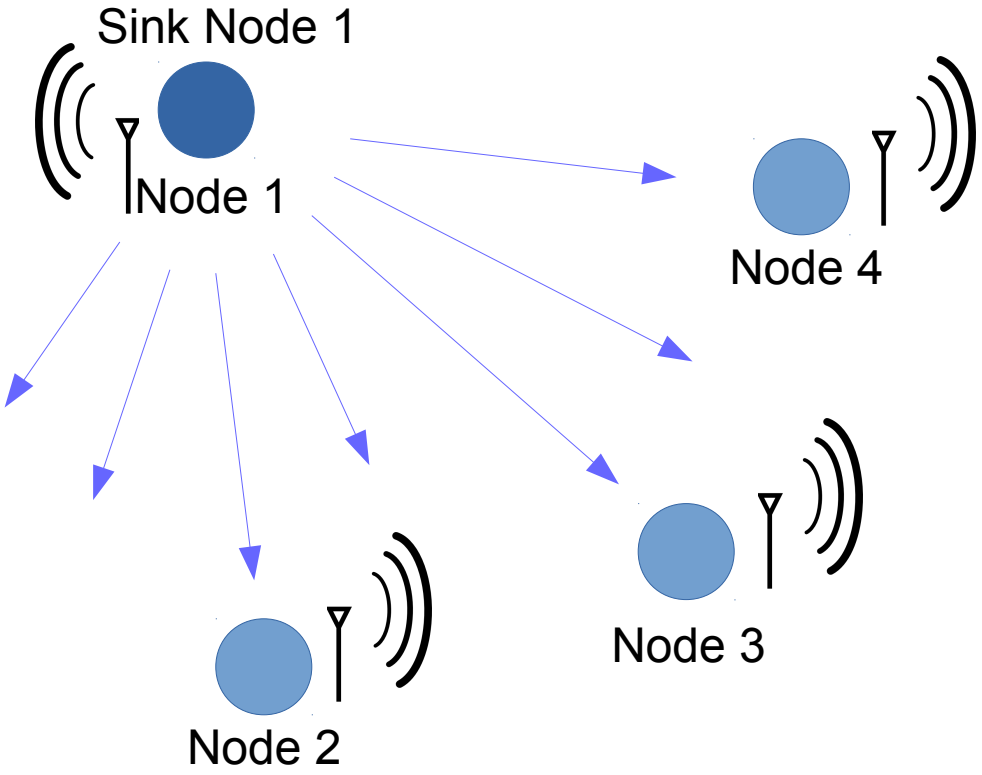
Design – Channel Switching



Broadcast to all nodes, the new Sender frequency

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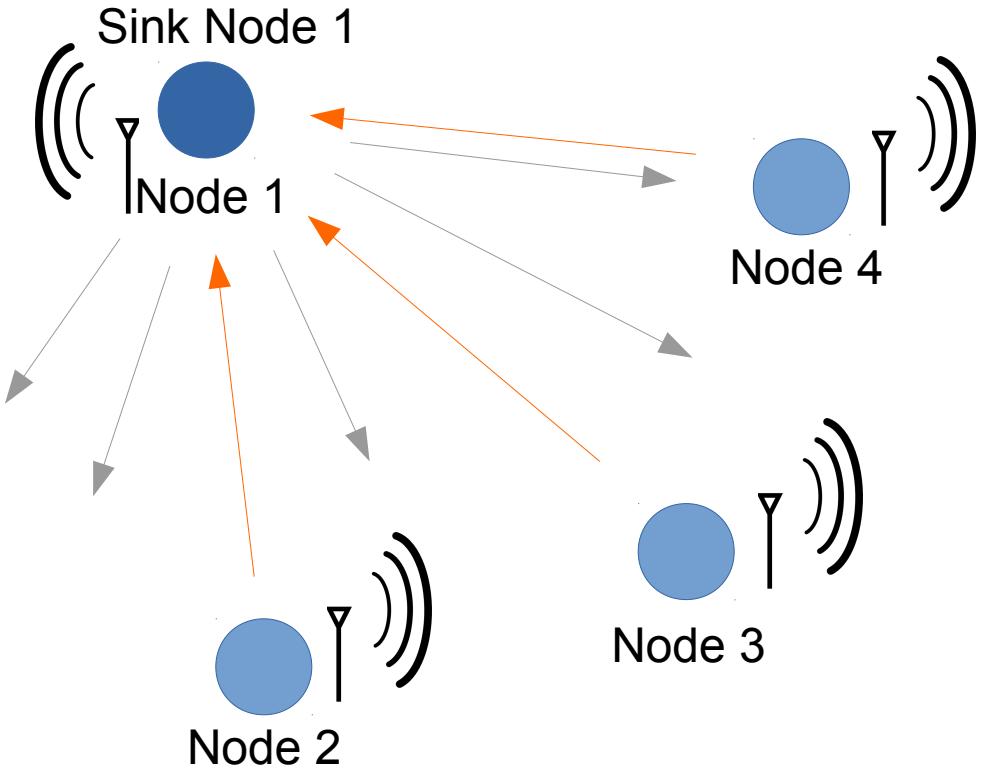
Design – Channel Switching



Broadcast to all nodes, the new Sender frequency

Nodes acknowledge on the “next” channel, that they changed

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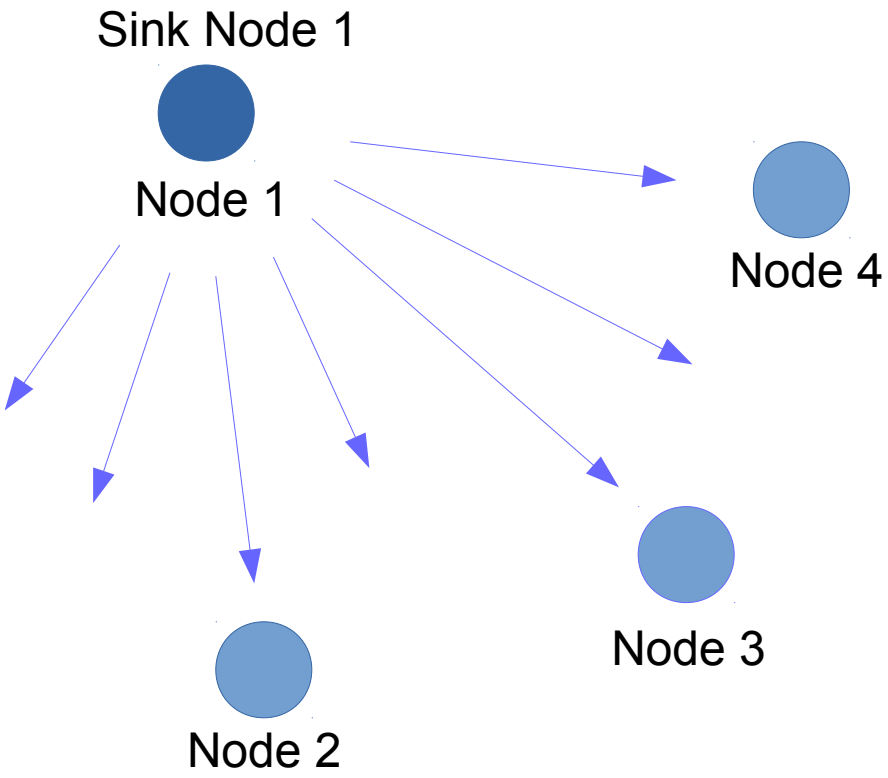
Design – Data Collection



Sending Data Request to all Nodes

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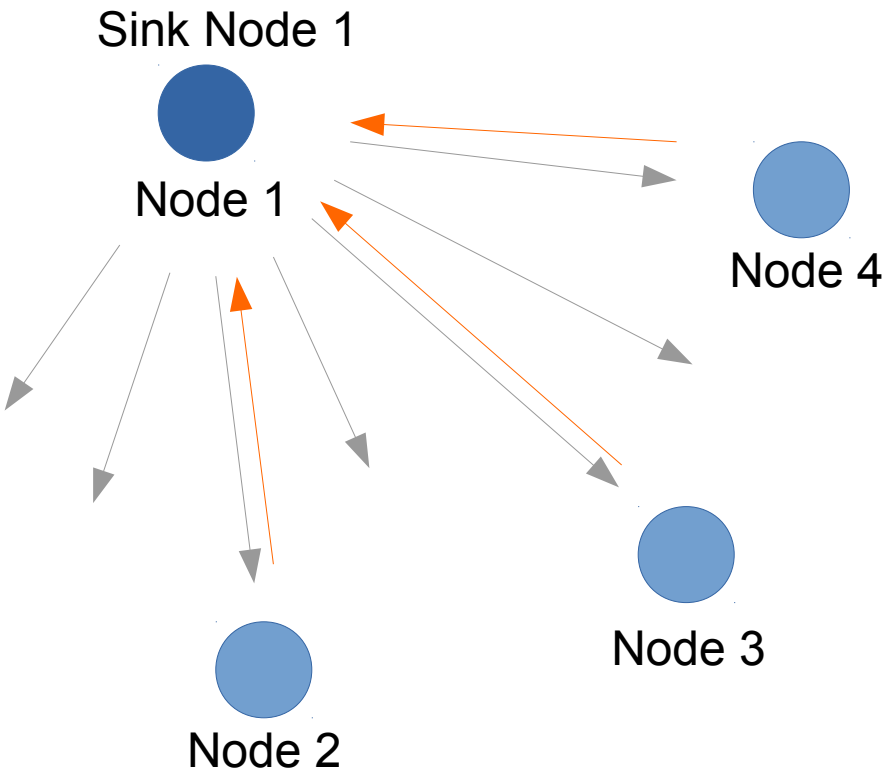
Design – Data Collection



Sending Data Request to all Nodes

All measured Data from all nodes will be collected

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Architecture

- Protocols
  - Dissemination
  - Collection Tree Protocol
- Message Acknowledgement
- PC-Node communication

Architecture - Dissemination

- Provides reliable broadcasting to every node in network
- Detects when a node is missing a packet
- For small data sizes

tos/lib/net/DisseminationUpdate.nc

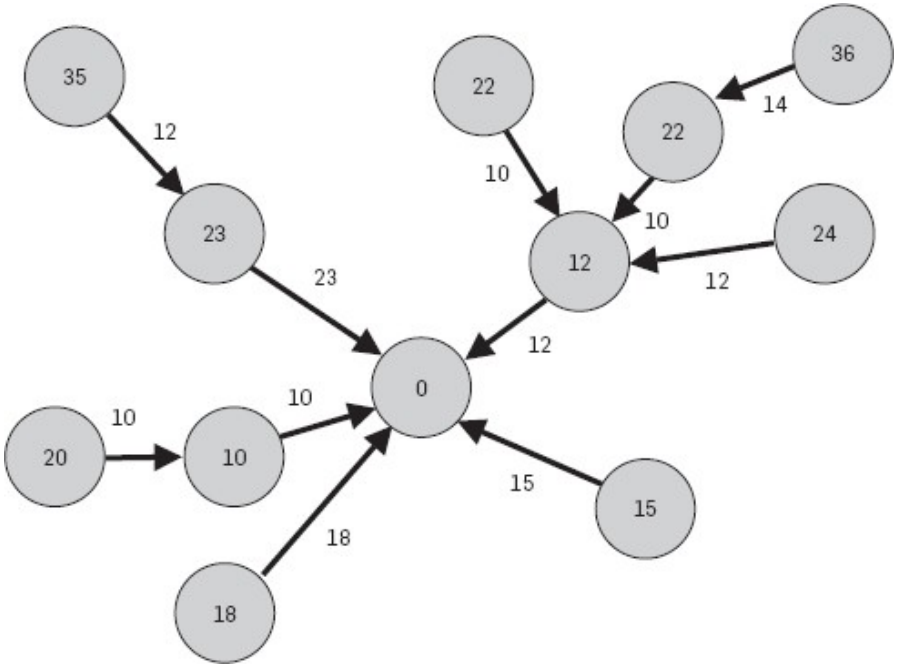
```
interface DisseminationUpdate<t> {
  command void change(t* newVal);
}
```

tos/lib/net/DisseminationValue.nc

```
interface DisseminationValue<t> {
  command const t* get();
  event void changed();
}
```

Architecture – Collection Tree Protocol

- Improves delivery reliability
  - Acknowledgements for unicast packages
- Sending data over closest nodes (parents) to the root (sync)
- Using ETX for routing
  - expected transmissions as its routing gradient



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Architecture - Acknowledgments

Still in discussion
Strategies

- Sending Acknowledgments for all control packets
  - Using Collection Tree Protocol
  - Using direct transmission
  - Using Disseminate
- Waiting after each control packets
  - May be reliable, dependent on nodes
  - May be slow

Testing

Can we collect all measurments?
Tests with

- Distance between node
- Obstacles
- Lower Transmision power

What we've done

Will be filled in with code and examples here...

Timetable

Milestone	Week	Goals	Success
Inital	43-45	Getting comfortable with environment: TinyOS, tmote, Communication Protocol, PC-Connectivity	Done
Milestone 1	46-49	Node detection PC communication/GUI Sender Selection Data Collection	
Milestone 2	50-2	Channel Switching Implement Sequence Algorithm	
Final	3-6	Testing Improvements Evaluation	

Thank You

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Extra Stuff CTP – Details

16-Bit	
|P|C| reserved	THL
ETX	
origin	
seqno	collect_id
data ...	

P: Routing pull.

C: Congestion notification.

THL: Time Has Lived.

ETX: The ETX routing metric of the single-hop sender.

origin: The originating address of the packet.

seqno: Origin sequence number.

collect_id: Higher-level protocol identifier.

data: the data payload, of zero or more bytes.

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