Wireless Embedded Systems and Networking

Lab Day 1: Part 1: First Table-top IP/WSN

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Form Six Groups (~5 people)

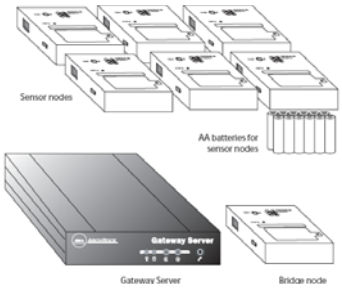
Exercise 1-1: Get to know members of your group

- Little interview to open discussion

- **For each group**
  - Name of the group
  - Name of the members
- **Each person interviews another member of group**
  - Their Name
  - Their Affiliation
  - Reasons to attend this course. What do they want to get out of it?
  - Background (system, networking, analog circuits, etc.)
  - What programming languages do you like? Use? Know?
    - » C, Java, C++, PHP, …
  - What aspects of networking are you familiar with?
  - Operating systems?
  - Hardware design?
  - Mathematical analysis?

Checking your inventory

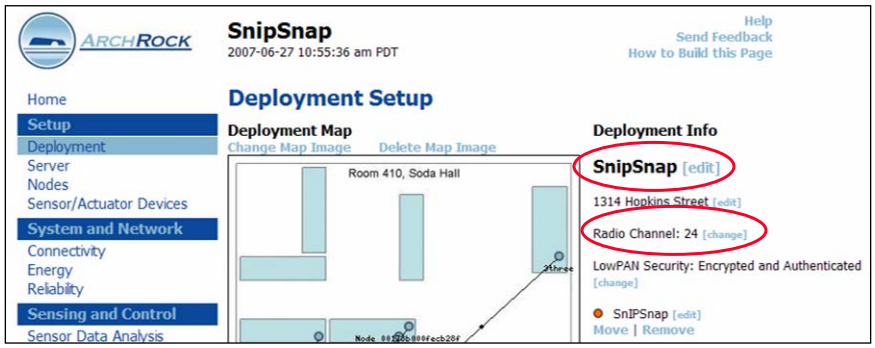
- **Each group will have a dedicated wireless sensor network with a gateway server and a collection of Arch Rock Primer Pack nodes, Kmotes.**



Specifics of the class sensor nets, IP addresses, etc. to be provided in lab.

Building a table top network

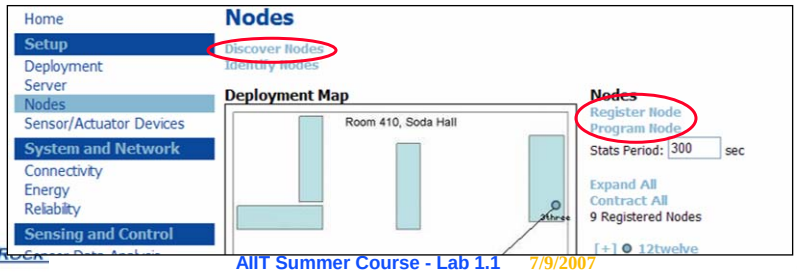
- **Open a browser and connect to the group server.**
  - **Name: admin, Passwd: XpressK**
- **Using the deployment page, pick a name for the deployment and select the 802.15.4 channel assigned to your group.**
- **Select a security passphrase.**



Building a table top network

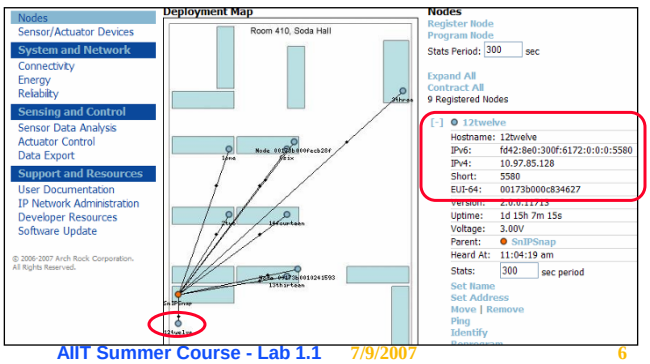
- **Place the server on the (empty) map. Program the bridge node. Remove the bridge node.**

- **Program each of the motes. Replace the bridge node. On the nodes page, discover the nodes. Register all the nodes.**



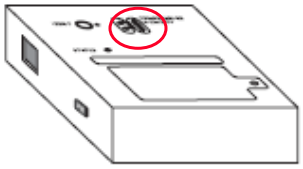
Building a table top network

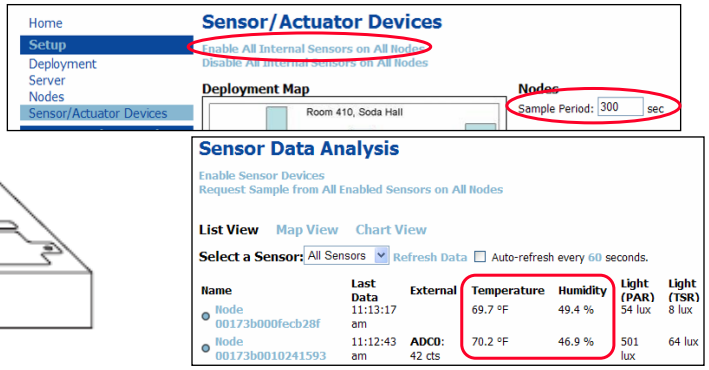
- **Place each node on the map.**
- **Ping each node and see it flash the blue LED.**
- **Push ident button on the node and see it flash on the screen.**
- **Identify which node is which by EUID64. See that they have a short address, an IPv6 address, and an IPv4 address.**



Do some table top sensing

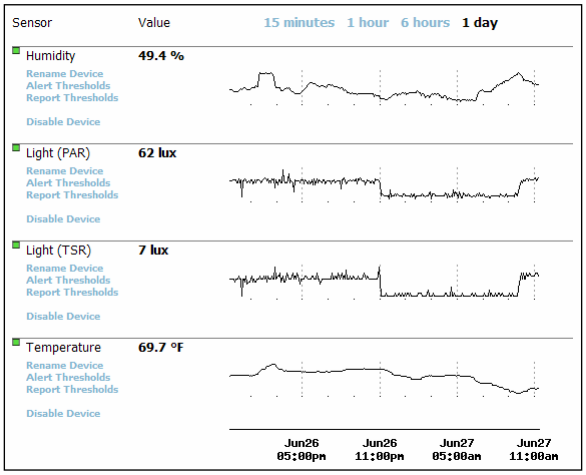
- Go to the sensor and actuators page. Enable all internal sensors. Set the sample rate to 4 secs.
- Go to the sensor data page. Set the refresh.
- Cover nodes. Blow on them. Put them in warm places. …





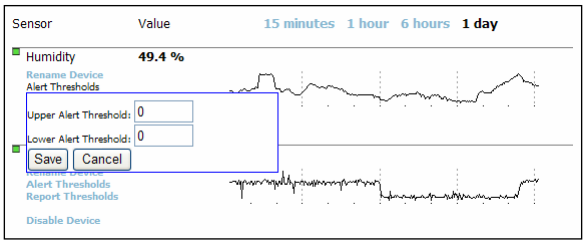
Do some table top sensing

- Click on the name of a node and open up the node web page view. See the graphs of the data over time.



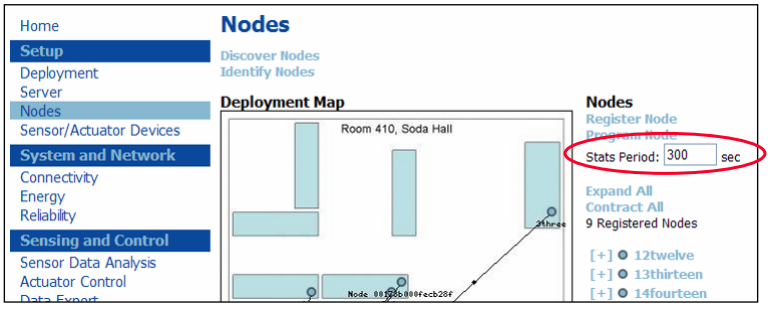
Do some table top sensing

- **Pick a node. Set thresholds. Adjust the sample rate. Configure it to send email on alarm.**



Do some table top sensing

- **Adjust the heartbeat to 30 secs. Turn off a node. See it go red. Try to ping it. Look at the data.**



Try out the Web Services

- Notice that each page has "How to Build this Page" in the upper right corner.
- Click on the one for the network home page
- Try out the REST examples

Do some table top sensing

- Try out the documentation links in the lower left corner
  - Find the Developer Resources > Arch Rock Server API Reference > Application Documention
- Get the EUID and use the REST URL to retrieve various data on demand.
- Try out other attributes

http://192.168.0.2/gw/rest/V1?method=events.readLast&name=TemperatureReadEvent&addr=00173b000fecb28f

```
<?xml version="1.0" encoding="utf-8" ?>
- <Results xmlns="urn:gw:api">
  - <Result addr="00173b000fecb28f" timestamp="1182974897.145260" seqNo="107"
      name="TemperatureReadEvent">
      <Value typeName="nx_uint16_t">7032</Value>
    </Result>
  </Results>
```

Discussion

- Congratulations, you have become acquainted with your first IP-based USN.
- Discuss with the group what you have seen, how it compares with your expectations, how might this all be working.
- How might you deploy the network around the lab?

- A signal processing thought.
  - You are running your networks at a sample rate that is 10-100x of what it typical for environmental monitoring. However, all instrumentation has its limits. Can you cause an environmental change too short in duration for your sensor network to observe? Too small in magnitude? What are its fundamental limits?