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Title

Systems Infrastructure (SYS 18)

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Publication Date

2006



Systems Infrastructure

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Problem Space: Assembling complete deployments from a variety of available components

The Systems Infrastructure team assembles, tests, and provides complete sensor network solutions containing both exploratory and hardened components, from high-level applications and analysis tools, down to hardware at the sensor platform level. We assist domain science teams with planning and execution.

ESS: Extensible Sensing System



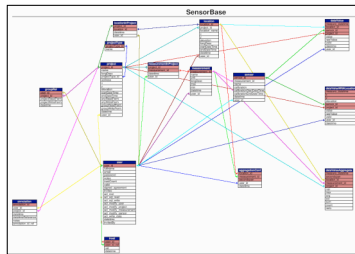
- ESS Components**
- **TinyOS:** Provides a scheduling system and the underlying CC1000 radio stack
 - **MDA300 Driver:** Provides an interface to sample various sensors attached to an MDA300 sensor board
 - **Routing layer:** An interchangeable layer to transport data packets to a central micro server
 - **Time synchronization:** Works through the routing layer to provide reliable mote time stamping
 - **DTN:** A persistent data buffer that works above the transport layer to provide in-network data storage and retransmission
 - **Sympathy:** Provides system status information and fault isolation
 - **Data Sampling Engine:** Allows a user to remotely program motes with queries to periodically return sensor data
 - **Deluge:** Allows remote reprogramming of all nodes in the network
- Areas of Focus**
- **Worst-case connectivity requirements**
 - Science-driven placement of nodes
 - **Continuous interactivity with nodes**
 - Especially during installation
 - **Energy versus robustness**
 - **Vertical integration**
 - Sensor to microserver as well as microserver to database
 - **Real-time visibility**
 - To adjust individual sensor placement and alignment

Routing Algorithms

- **Interchangeability**
 - The routing layer was designed to be modular
 - Allows easy insertion, testing, and verification of various algorithms
- **Multihop**
 - A beacon-based multihop service
 - Slow to adapt to changing network conditions
- **Centroute**
 - A centralized tree-based routing protocol
 - All routing decisions made on the sink
 - Constant sized state stored on mote for increased scalability
- **Hyper**
 - Creates routing trees in response to a “tree formation” message flooded from the sink
 - Converges extremely quickly

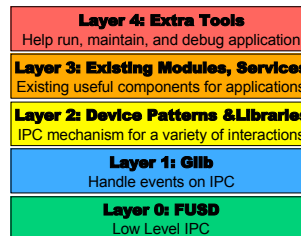
SensorBase.org

- **Current challenges of data management:**
 - Different sensor networks use different data push mechanisms
 - Difficult to cull, parse, interpret from different sources
 - Difficult to search for data sets
 - Difficult to share/publish/annotate data sets



EmStar

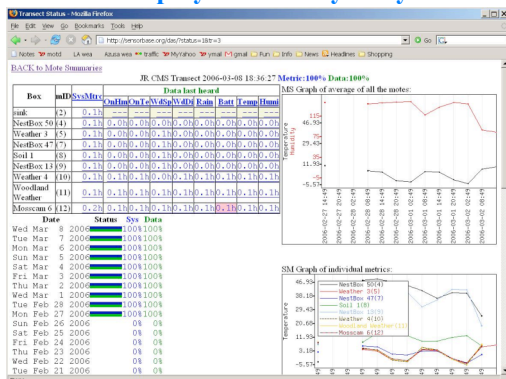
- **A framework that allows a simple development path from simulation to deployment**
- **Fault isolation through multiple processes**
- **Modular design**
- **Visualization and debug tools**



Futures

- **Additional tools and module development**
- **Interface improvements**
- **Documentation and usability**
- **Port to other platforms**

DAS: Deployment Analysis System



Future Directions

- **More robust hardware to improve reliability**
 - Fleck motes
 - Stargate-2
 - Slauson
- **Rewrite of EmStar for new features and ease of installation**
- **Various small applications to target specific deployment concerns**
 - Mobile sink to receive network data from the field
 - Instantly check connection reliability to all neighboring nodes