Netted Sensors (NS) Workshop October 24 -26, McLean VA

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MITRE

Logistics

- Meeting is unclassified
  - MITRE is a secure facility workshop attendees are not permitted beyond the marked boundary without an escort
- Phones are located in south lobby, rest rooms are located in front and back of auditorium
- Phone numbers for messages are 703-983-6361 or 703-983-6362
- Posters for each session day will be shown in room 1H302
- Demos will be shown in the atrium during the poster sessions
- Refreshment will be served in the atrium, demos will also be shown in the atrium
- Lunch will be served in the cafeteria
- Classified session
  - Any non MITRE employee that is going from the auditorium will need an escort
- Badges will need to be turned into security at the end of each day
- There is no smoking within MITRE – use designated areas outside

Overview of 1st Day Sessions (1)

- **Applications and Scalability:**
  - Hard part is "operationalizing" mote hardware package
    - Big mismatch between mote design (processor, sensors, antennas, packaging, etc.) and DoD operational needs/schedules
    - Mote platform needs to be made robust – little invested in DoD R&D in this area
  - Need flexible reconfiguration through software centric solutions:
    - Fabric model to support multiple applications

- **Sensors and Platforms:**
  - Evolution towards digital sensors, radio in silicon, and smart antennas
  - To what question are we trying to provide an answer? (push-pull paradox)
  - Discussion of Zigbee (802.15.4) contrasted with 802.11
  - Some challenges facing community: scalability, robustness & reliability, low-power consumption, latency, network management, etc.

Overview of 1st Day Sessions (2)

- **Keynote speaker – Dr. Ted Bially:**
  - Stressed the need to utilize the power of the network
  - Challenges: power, mobility, auto-calibration, composition, mobile software, and robustness
  - Thoughts:
    - How do you control platforms autonomously when communications can't handle the load?
    - What about distributed network processing for ISR (fingerprinting, change detection, etc.)?
    - Spatial diversity?

- **Distributed Computing and Processing:**
  - Three themes: Mobile networks, distributed tracking, and distributed (grid-based) computation
  - Overview of Globus Toolkit: open-source software for grid enterprises – facilitates collaboration between computers, networks, sensors, and databases using components that handle information, resource, and data management using common/standard protocols and interfaces
    - Can it be scaled down to small sensor networks?

Overview of 1st Day Sessions (3)

- **Information Management:**
  - Stressed importance of sensor information management – with the goal of making sensors intelligent – discussed three components: sensor database management, data mining, and security policy integration
  - Discussions of the enterprise service bus, micro-brokers, autonomic sense and response, complex event processing, etc.
  - Overview of XML-based sensor model language (SensorML) for in situ and remote sensing

Overview of 2nd Day Sessions (1)

- **Fusion and Resource Management**
  - Problems have natural (phenomenology, space, time, etc) partitioning
  - Assert a hierarchical approach with both global and local control and optimization
  - Must adapt to unknowns and be flexible to support multiple missions; learn in the field; can not rely on humans
  - Need rigorous treatment; should not rely on ad hoc development

- **Security for Netted Sensors**
  - Sensor networks require new adversary models
    - Must accept *probabilistic security properties*
  - Netted sensor services such as localization can provide robust estimates even if majority of nodes are compromised
  - Porting current security regimes to mobile networking is problematic: e.g., multi-level secure inter-networking
  - Unattended sensor networks must be secure, power-aware, and loss-tolerant
  - Hardware-based security techniques (e.g., Trusted Platform Modules) may help secure netted sensors

Overview of 2nd Day Activities (2)

- **Keynote Address – Dr. Neil Gershenfeld (MIT):**
  - **Engaging talk spanning the realm from Internet-0 techniques for waveform coding using broadband impulse response functions to statistical mechanics approaches for designing systems-of-systems**
  - **Neil showed that it might be possible to design large robust systems from the top down – i.e., specify the Lagrangian (an energy functional) that mimics the problem to be solved and use the mathematical structure of statistical mechanics to develop the equations describing the local interactions (nodes, links, etc.)**
    - **Although not explicitly stated, why couldn't a similar approach be used to design a netted sensor system in the thermodynamic limit where the sensor grid is dense?**

Overview of 2nd Day Activities (3)

- **Com & Networking**
  - **Presentations emphasized the importance of cross layer coupling in wireless sensor networks**
  - **Link metric needs to take HW power consumption as well as detection accuracy into account**
  - **Cross layer design is in early stages of research, there are many variables and knobs to consider**
    - **No adequate fundamental framework and design methodology exists**

Agenda for October 25

0700 - 0800 **Registration and Continental Breakfast**

0800 - 0820 **Logistics, Summary of Day 1 and Day 2, and Day 3 Agenda**
Dr. Danny Tromp (MITRE)

0820 - 0850 **Keynote Address**
Dr. Kris Pister (Dust Networks and University of California, Berkeley) *"From Smart Dust to Reliable Networks"*

0850 - 1105 **Environmental Monitoring and Netted Sensor Challenges (EM)**

0850 - 0905 Session Chair Briefing - Dr. Brian Flanagan (MITRE)

0905 - 0925 Dr. Sergio Servetto (Cornell University) *"On the Structure of Data Sets Observed by Physically Embedded Networks"*

0925 - 0945 Prof. David Fries (University of South Florida) *"SEAMST - Sea Microsystems Technology (MST) Advances for Sensor Networks For Environmental and Security Monitoring"*

0945 - 1005 **Break**

1005 - 1025 Dr. Yannis Paschalidis (Boston University) *"The Role of Optimization in Sensor Networks: Localization and Energy-Aware Routing"*

1025 - 1045 Mr. Ron Stich (Tendril Networks)

1045 - 1105 Round Table Discussions / Speaker Questions and Answers

1105 - 1200 **Poster Session and Exhibits**

1200 - 1300 **Lunch**

1300 - 1500 **Commercial Applications and Netted Sensor Challenges (CA)**

1300 - 1315 Session Chair Briefing - Mr. Marcus Glenn (MITRE)

1315 - 1335 Dr. Akbar Sayeed (University of Wisconsin, Madison) *"Active Wireless Sensing and Applications in RFID-Enabled Systems"*

1335 - 1355 Dr. Andreas Savvides (Yale University) *"Recognizing Behaviors in Physical Space using Distributed Imager-Based Sensor Networks"*

1355 - 1415 Mr. Mark Goodman (Crossbow Technology) *"Commercialization of Wireless Sensor Networks: Challenges and Opportunities"*

1415 - 1435 Dr. Dennis McLain (Sun Microsystems) *"Java-Based Sensors"*

1435 - 1500 Round Table Discussions / Speaker Questions and Answers

1500 **Adjourn**