First Annual Partners’ Meeting Presentation
Decentralized, Asynchronous Sensor Networks for Arctic Regions

Arctic Domain Awareness Center (ADAC)
A DHS Center of Excellence

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June 29 & 30, 2015
Motivation

Unimak Pass
Marine traffic and congestion monitoring
Motivation

Marine traffic and congestion monitoring
Marine traffic and congestion monitoring
Motivation

Wildfire monitoring
Case Scenario

Marine traffic and congestion monitoring
Case Scenario

Challenges

Geography/Technology:
- Large
- Remote
- Power-less
- Communication-less

Monitoring:
- Unmanned
- Areal/Satellite
  - Unreliable
  - Sparse
- Good Samaritan
Case Scenario

Proposed Solution

Sensor networks for event sensing in the Arctic region

- Large number of simple, power-aware sensors
- Locally connected
- Parallel
- Potentially faulty
- Decentralized, aspatial
- Asynchronous - clockless
- A sub-system for
  - Secondary system (SamCam)
  - UAV, Kite
Architecture
Proposed Solution

Network simulator

AI Search Module
Device Programming and Control

HW testbed
Case Scenario

✔ Large number of simple, power-aware sensors
✔ Locally connected
✔ Parallel
✔ Potentially faulty
✗ Decentralized, aspatial
✗ Asynchronous, clockless

• A sub-system for
  ➢ Secondary system (Sar
  ➢ UAV, Kite
Status Report

"80 hours"

In-progress / 50% done

✔ Soldered connected 60 devices
✔ Sensor network simulator
✔ Proof of concept network
✔ Device power profile
✔ Device transmission profile
✔ Communication protocols
Status Report
Network Simulator
Status Report

Network Simulator → HW substrate

Network simulator

AI Search Module
Device Programming and Control

HW testbed
All Tests/All Temperatures Compared

Clock Speed

Max Transmit
Receive
Min Transmit
Read/Write

Power Data [milliamps]
Next Steps

- Robust emergent event processing by decentralized spatial computation
  - AI search
  - e → E (noise vs. signal)
  - Event triangulation
- Sensors
- Network/Protocol power profile
- Subsystem integration
  - 'Eyes on the ground'
- Event activation in noisy environments
- Power supply
Stakeholders
Sub-system flexibility
Demo and questions