The MANA Testbed

Monitoring in High-Arctic environments

Zackenberg - Greenland

September 28, 2011

Context

- Biologists & Scientists manually measuring in the Zackenberg area (5km from camp)
- Water chemistry and freshwater biota
- Difficulties ought to lakes freezing in winter
- Data acquisition ONLY in summer season
- Data does not represent the process in the lakes

Context

- MANA project - INTERACT
- Capoh System monitoring limnic parameters
- Aiming to:
  - Acquire reliable data
  - Automatize the process
  - Adequately describe global behavior in the lakes

Problem

- Research nature of MANA
- The Capoh System MUST evolve and adapt
- Greenland…
  - High costs associated with deployment
  - Unexpected weather conditions
  - Technical and human failures
  - Real-Time communication
- Testing???

Approach

- Build a Replica inside ITU
- Testbed for new contributions
- Create a maintainable and adaptable system
- Document!
- Contribute!
- Deploy it to Zackenberg (Greenland)
- Document!!
- Increase value of gathered data

The Capoh Architecture

The Capoh Buoy

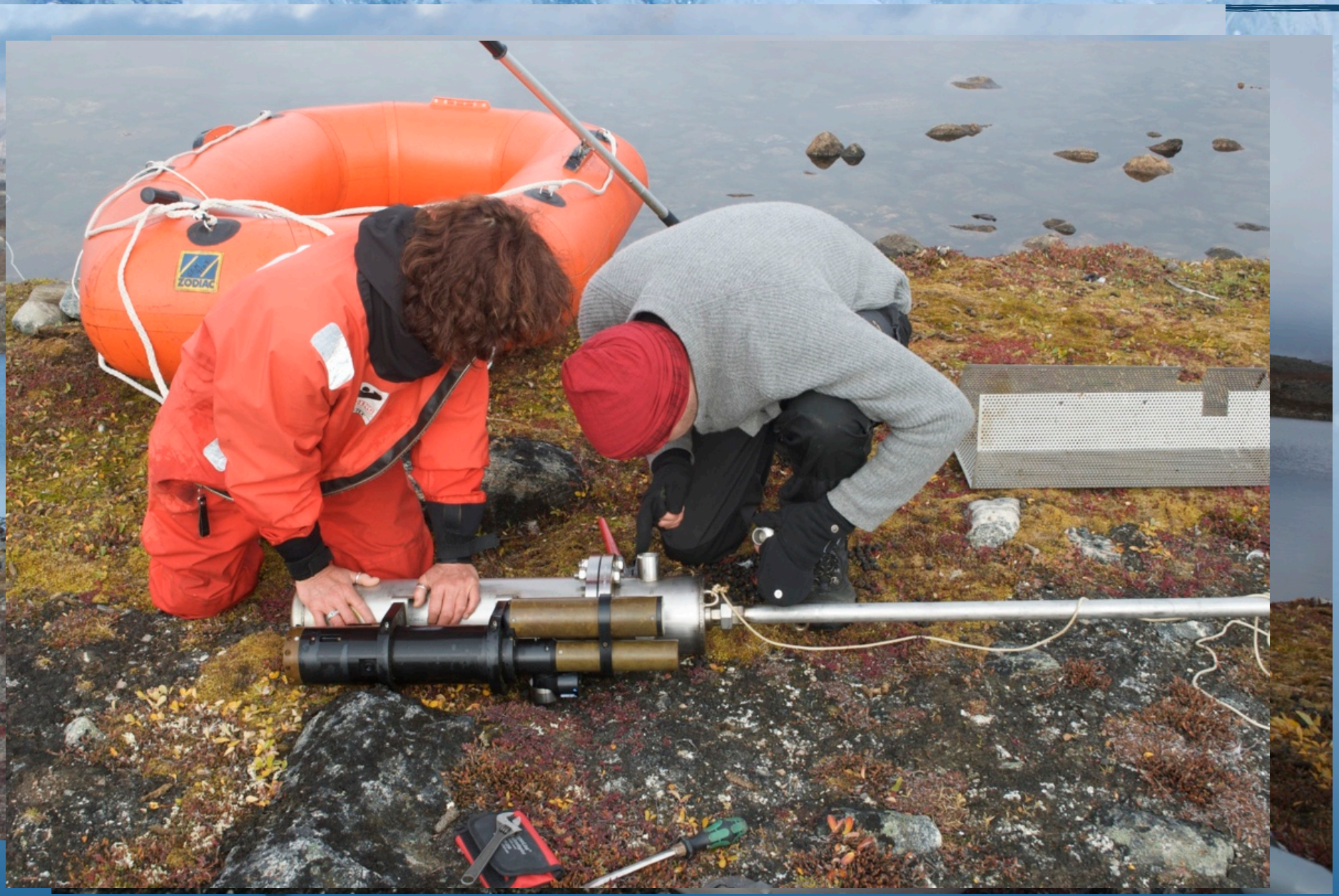
The Capoh Base Station

The Capoh Architecture

The Capoh Buoy

The Capoh Base Station

The Capoh Architecture



The Capoh Architecture

The Capoh Buoy

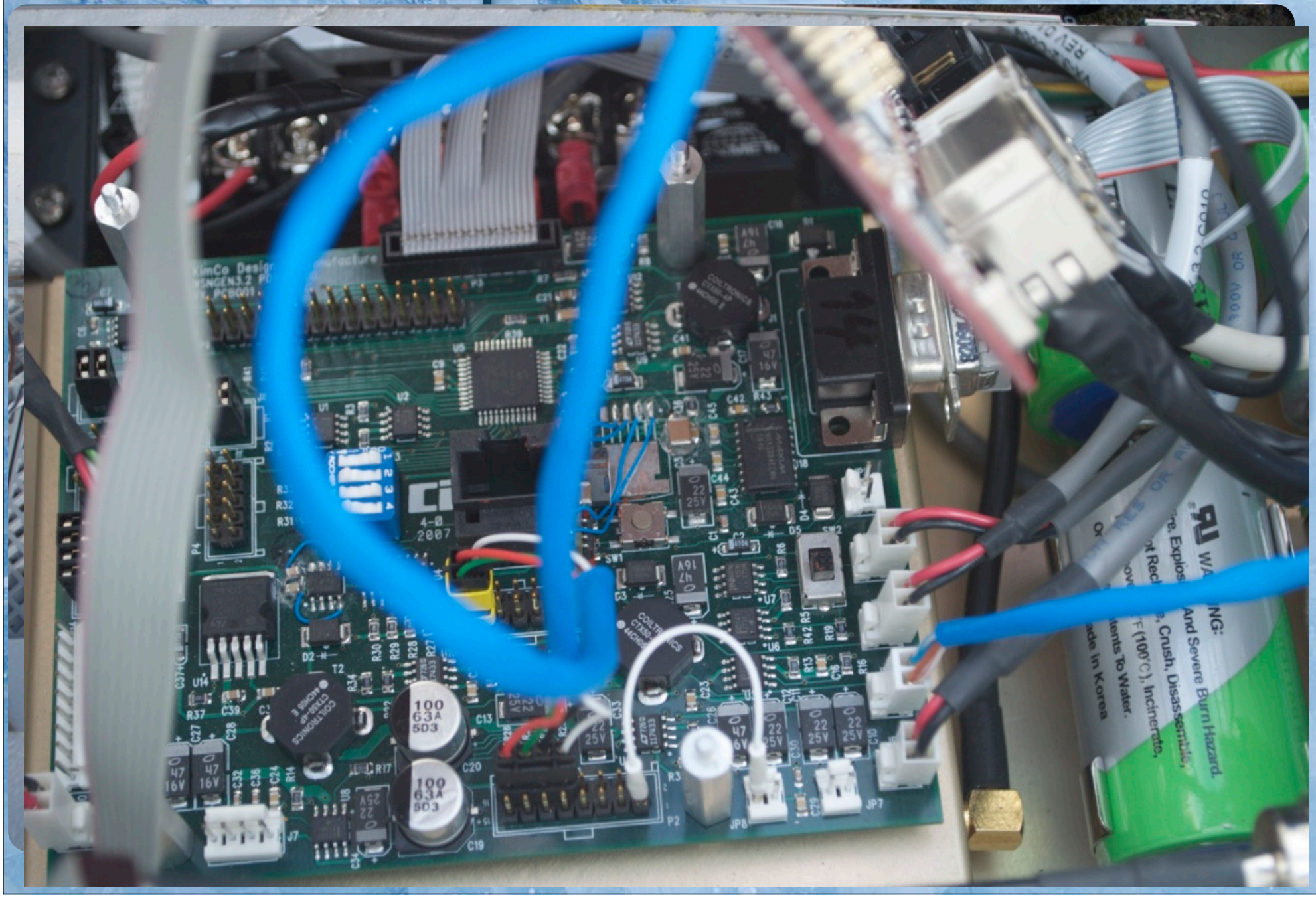
The Capoh Base Station

The Capoh Architecture

The Capoh Buoy

The Capoh Base Station

The Capoh Architecture



The Capoh Architecture

The Capoh Buoy

The Capoh Base Station

The Capoh Architecture

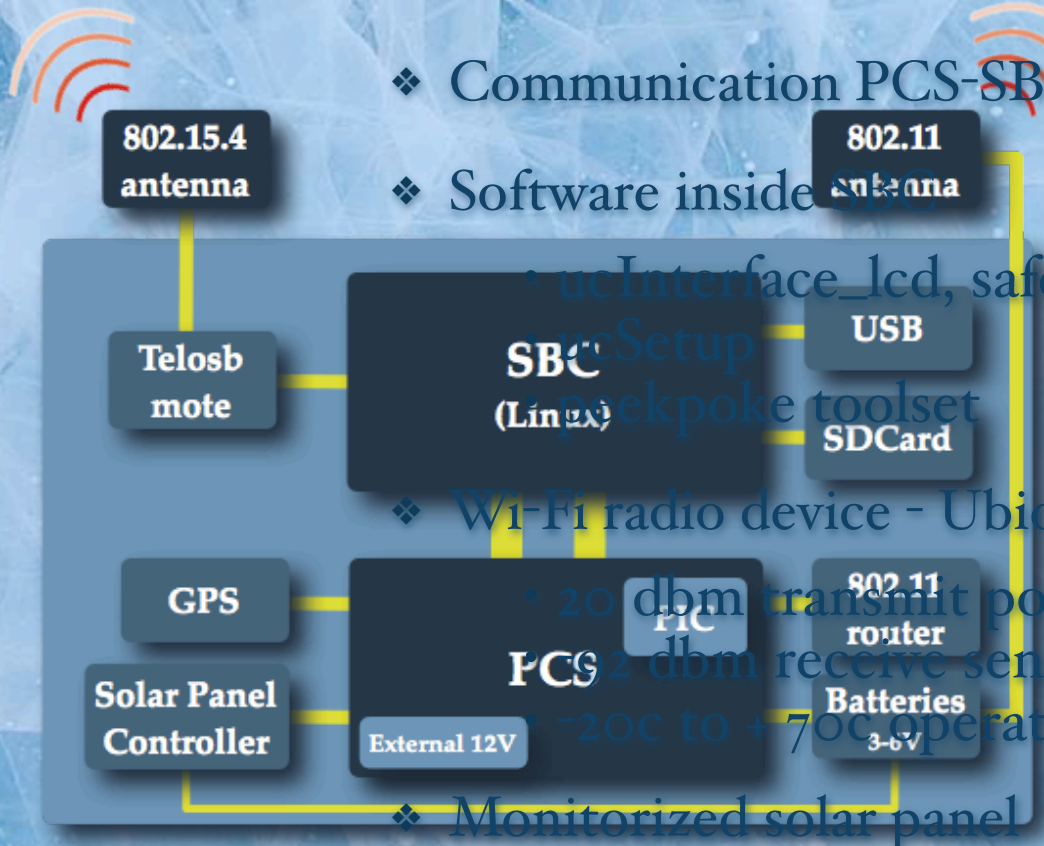
The Capoh Buoy

The Capoh Base Station

The Capoh Architecture

Microserver

- Core component of the Capoh Architecture
- Based on Rob Fatland's Vexcel Microserver



- Communication PCS-SBC
- Software inside SBC
  - ucInterface_lcd, safeoff_lcd,...
  - ucSetup
  - peekpoke toolset
- Wi-Fi radio device - Ubiquiti Bullet
  - 20 dbm transmit power
  - -92 dbm receive sensivity
  - -20c to +70c operating rate
- Monitorized solar panel

Microserver

SBC (TS-7260)

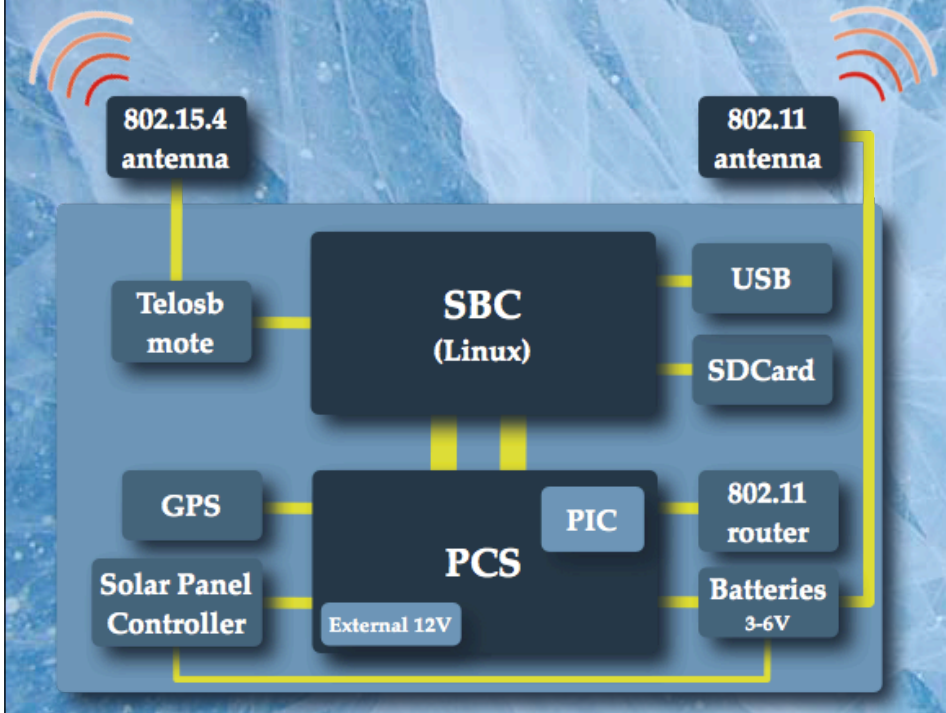
- Linux Debian Lenny (2.6 kernel version)
- Booting from USB and SDCard
- Contains all the logic
  - Scripts in the INIT sequence
  - DAE's code
  - Controls PCS's parameters
  - ...

Microserver

PCS

- Controls power consumption
- Bases its operation on *Sleep* and *drop-dead* parameters
- Corner stone of the Microserver
- Direct communication with SBC
- Indispensable!!

Microserver



- Core component
- Synergy between SBC and PCS
- Main contributions

Wireless Communication

Buoy - Shore

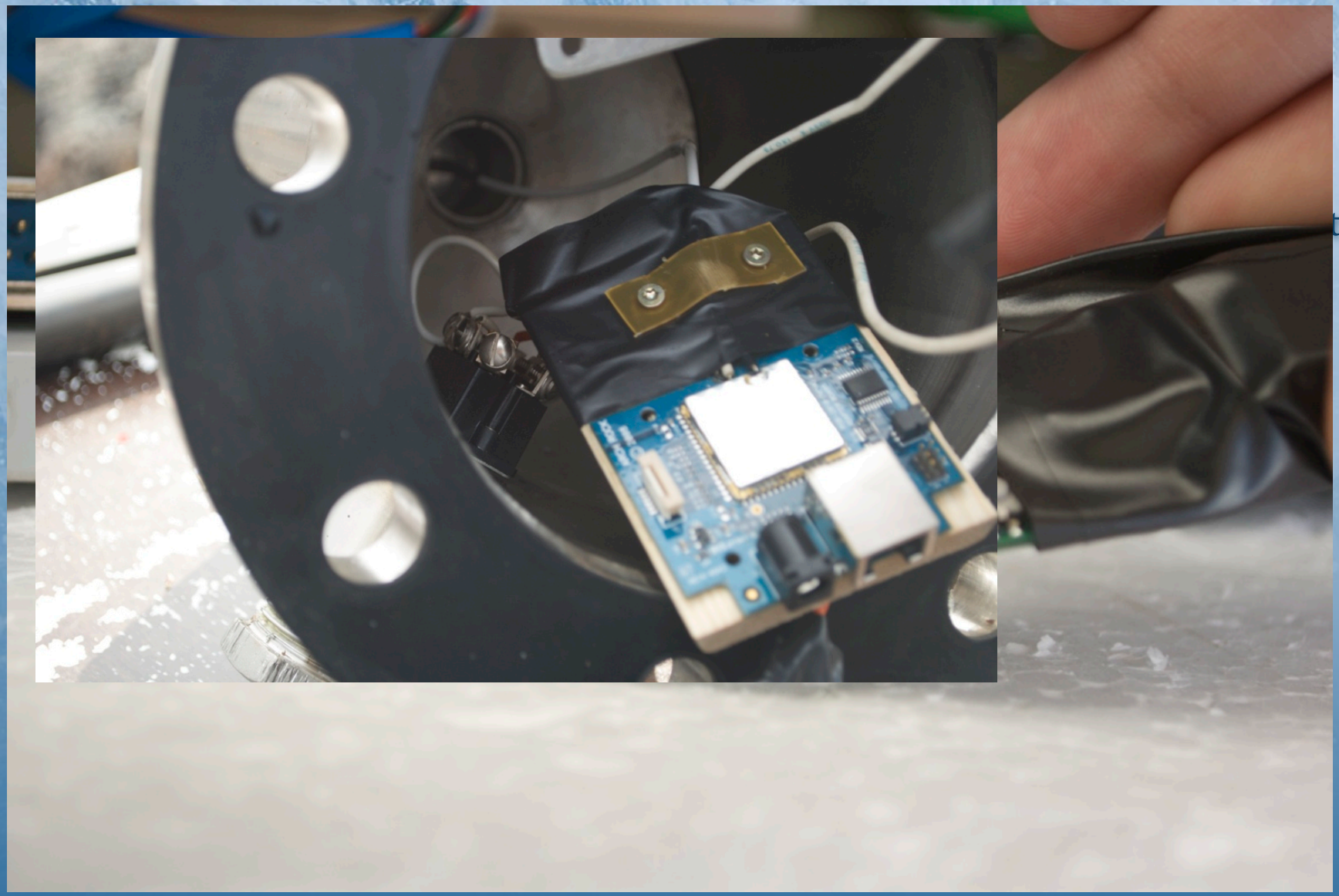
Shore - Camp

Wireless Communication

Buoy - Shore

Shore - Camp

Wireless Communication



tening

Wireless Communication

Serial Communication

- Blip based TinyOS application - RFSerial
- Send strings of data
- Use of TinyOS' TCP stack - Experimental...
- Connects to IPBaseStation
- Data acquisition - Indispensable!!
- Bottleneck - Further work needed

Wireless Communication

Buoy - Shore

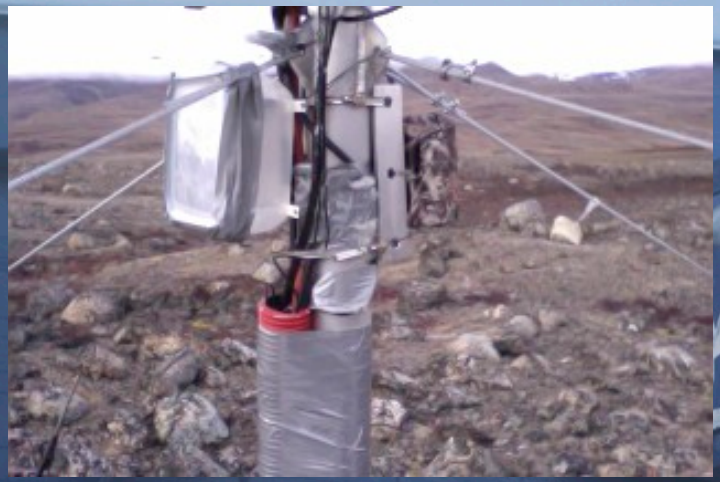
Shore - Camp

Wireless Communication

Shore - Camp

- Very last stage for our new generation of data-loggers
- Send data from Base Station to a Server via 802.11
- Ubiquiti Bullet - Directional biquad antenna (2.4GHz)
- Data being available in Real Time!! - Analysis, Treatment, Malfunctioning detection, ...
- Qualitative change for unaccessible areas' data collection!!

Wireless Communication



Conclusion

- Objectives:
  - Create a Replica of MANA inside ITU
  - Document previous and new work
  - Provide a Testbed!
  - Integrate our contributions
  - Make some tests and get feedback
  - Obtain a stable system to be deployed in Greenland
  - Deploy it!

Conclusion

- Achievements:
  - We count on a Replica - Testbed
  - We have the knowledge to push the system forward
  - Communication Buoy-Shore, Shore-Camp
  - Feedback from Greenland deployment
  - Testbed in Copenhagen - Canal in front of ITU
  - Knowledge to improve TinyOS (bottleneck)

The MANA Testbed

Monitoring in High-Arctic environments

Zackenberg - Greenland

September 28, 2011