PermaSense SwissEx Integration
Project Status and Future Workplan

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The PermaSense Application
PermaSense Project – Alpine Permafrost Monitoring

- Cooperation with Uni Basel (C. Tschudin) and Uni Zurich (S. Gruber)
PermaSense 2007 – The Matterhorn

- Located in Zermatt, CH
- 4478 m
- Site of recent rockfall due to extreme warming (07/2003)

  - 25 nodes
  - Different sensors
    - Temperature, rock electrodes, rock motion, ice and water pressure
    - –40 to +65° C
    - Rockfall, snow and ice, avalanches
    - 30 min. duty-cycle
    - 3 years unattended lifetime
PermaSense Scientific Goals – Validation of Models

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[Uni Zurich, Physical Geography]
PermaSense – Sensor Stations on the Mountain
PermaSense Technology
PermaSense – System Architecture

- Shockfish TinyNode
  - TI MSP430 – 48K Flash
  - Xemics 868 MHz Radio
- Custom DAQ Board
- Single Battery (Li-SOCl2)
  - 300 μA average power budget
- Ruggedized
PermaSense – Sensor Types Used

Distances/ Crack Motion

Temperatures/ Conductivity

Ice Pressure
Water Pressure
PermaSense Testbed – Emulating Severe Conditions
Project History and Near Term Work Plan

- Monitoring Permafrost in the Swiss Alps
  - NCCR MICS collaboration of Uni Zurich and Basel ETH Zurich added on later
  - Low-data/low-sampling rate (30sec) – long lifetime (3 years)

- Sensor Network Deployments
  - Initial Site – Jungfraujoch 2006
  - Second Site – Matterhorn 2007

- Current Activities
  - Test and development of second generation architecture
  - Integration with SwissEx data infrastructure (GSN)
  - Field deployment of 2nd gen. in 07/2008
Long Term Work Plan and Competence

- **Extend Measurement and Monitoring Capabilities**
  - Higher data acquisition rates
  - Different sensors (imaging, geophones)
  - On-node processing and filtering
  - More and reliable storage on all nodes (data backup/validation)

- **Data Handling, Modeling and Evaluation**
  - Based on GSN data backend

- **Collaboration with SwissEx Partner Projects**
  - Technology integration and reuse
  - Test and validation of sensor networks