



One mosquito does not make  
a summer, but two summers  
make a pretty good DTN  
system

The story of the SNC and SNC+1 deployments

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# Saami Network Connectivity

- Three year Vinnova project.
- Bring network connectivity to the Saami community in the Swedish mountains.
- Based on Delay Tolerant Networking.
- Technical results:
  - Routing (PRoPHET)
  - Application gateways
  - System design
- Work done in collaboration with the local population.

# Deployment tests

- Instead of just simulating, we wanted to test the system for real.
- Field test in Padjelanta in August 2006
- Successful
  - But not perfect...
- Winter testing
- Second summer deployment 2007

# Summer 2006

- Four fixed sites
  - Hotspots/  
gateways
- Internet gateway
  - On top of a mountain
  - Connected through BreezeNet radio link to Ritsem
- Seven mobile relays

QuickTime och en  
TIFF (LZW)-dekomprimerare  
krävs för att kunna se bilden.

# Padjelanta Map

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# Hardware/Software

- Relays and gateways
  - Tablet PCs
- Diesel generators+batteries
- Routing
  - P<sub>R</sub>oPHET
- Applications
  - Not So Instant Messaging (NSIM)
  - E-mail
    - Blog published through e-mail
  - Simple web caching
    - Only static content
- Seven mobile relays
  - Carried between the sites by hikers



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# Email



- Gateway running at SMTP server connected to the Internet, bundling incoming mail, sending those bundles to the camp gateways.
  - Currently sending to all gateway
  - Multicast could be used
  - User location registration will happen in the future
- At camp gateways, SMTP server also running, de-bundling incoming mail, and bundling outgoing mail and sending the bundles to the Internet gateway

# Experiences

- E-mail
  - Some outgoing mail classified as spam
  - First ever (?) DTN spam e-mail received
  - Internal mail “bounces” on the Internet
- Web caching needs lots of more work
- A better hardware platform is needed
  - Power requirements
  - Environment resistant.
- Routing
  - Multicast/anycast?

# Experiences (cont)

- Stability issues
- Things will not work like you expect them to.
  - Reality is not as nice as simulations and lab tests
  - Your code **will** have bugs.
- Predeployment tests crucial
  - Well-defined test cases

# On-site bug fixing



# Winter test

- Performed during the winter 2006/2007
- Test new hardware and software
- Test operation in low temperatures



# Summer 2007

- Second deployment.
  - Similar to the first, but wiser from experience of 2006 test and winter test
  - Want to try new hardware, new power solutions, new versions of software
  - Fewer nodes, greater distances
    - Two fixed remote gateways, three mounted on helicopters, one internetgateway, one handheld mobile node.

# Map, second summer

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QuickTime  
TIFF (LZW)-de  
krävs för att kunna

# Hardware

och en  
dekomprimerare  
krävs för att se bilden.

- WRAP x86-based hardware platform.
  - Environment-proofed enclosure
  - Main router/gateway
- Nokia N770/N800
- VPX
- Tablets kept as user terminals
- Power
  - Batteries, diesel, solar

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TIFF (LZW)-dekomprimerare  
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# Software

- Less buggy PRoPHET code
- Better mail gateway
  - Mail doesn't have to bounce on the Internet
  - User registration in theory possible
- WWWOFFLE cache
- Temperature measurements via email
- NSIM still the king of applications

# New experiences

- Sending of all the data works (including VPX integration), using both helicopters and/or hikers, but...
- Don't let the pilot unplug your devices!
- Solar power not enough.
- Very important to select proper lifetimes for messages
  - Too short times initially selected, causing messages to time out
  - Fewer flights than expected due to delays in the deployment

# Questions?

