FIREWORKS

SEVENTH FRAMEWORK PROGRAMME

Project

N4C Deliverables D8.1.1 and D9.6.1

n4c-wp9-010-light_deliverable_D8.1.1_&_D9.6.1-01

N4C SELF ASSESSMENT ON LINKS BETWEEN RESEARCH AND EXPERIMENTATION AND FEDERATION REQUIREMENTS

N4C Feedback

Editor:	Avri Doria and Maria Udén, Luleå University of Technology (LTU), Elwyn Davies, FOLLY, Maria Zlata Boznar, MEIS and Barbro Fransson, PLAB
Deliverable nature:	Report (R)
Dissemination level: (Confidentiality)	(PU)
Contractual delivery date:	D8.1.1 Month 6 resp. and D9.6.1 Month 6
Actual delivery date:	25/03/2009
Suggested readers:	
Version:	0.5
Total number of pages:	30
Keywords:	Federation requirements, FIRE, Test Bed, Experimentally driven character

Abstract

This report takes the initial position on the role of N4C as a technology project and user driven project in the future of federated Test Beds. It has been written in response to an invitation by the Fire project. It contains a self assessment of the experimental driven character of the project.

[End of abstract]

Disclaimer

Impressum

[Full project title] Networking for Communications Challenged Communities

[Short project title] N4C

[Number and title of work package]: WP8 Tests and Validation in two Remote Test Beds and WP 9 Dissemination

[Document title] N4C response to self assessment on links between research and experimentation and federation requirements

[Editor: Avri Doria, Maria Udén, Luleå University of Technology, Elwyn Davies, FOLLY, Maria Zlata Boznar, MEIS and Barbro Fransson, PLAB]

[Work-package leader: For WP8 Maria Zlata Boznar, MEIS and for WP9 Barbro Fransson, PLAB

[Estimation of PM spent on the Deliverable: 0,5 PM]

Executive summary

Networking for Communication Communities (N4C) is a technology and user driven project that has its goal the creation of two DTN Test Beds; one in Swedish Lapland and one in Kočevje region in the Slovenian mountain. The aim is that the two Test Beds can be interconnected to and through the Legacy Internet. It is assumed that given the nature of the DTN Test Beds it may be advantageous to interconnect to other Test Beds. While it is still premature to discuss how this can be done at this point, some of the initial thoughts have been recorded in this report in response to Firework's invitation to contribute on this subject.

List of authors

Company	Author
Luleå University of Technology (LTU)	Avri Doria
Folly Consulting Ltd. (FOLLY)	Elwyn Davies
Luleå University of Technology (LTU)	Maria Udén
MEIS d.o.o. (MEIS)	Maria Zlata Boznar
Power Lake AB (PLAB)	Barbro Fransson

Table of Contents

List of figures and/or list of tables

Tables

Figures

Abbreviations

Abbreviation or Acronym	Meaning
DTN	Delay and Disruption Tolerant Networking
TTL	Time To Live

Definitions

Term	Definition
Delay- and Disruption-Tolerant Networking	A networking technique originally developed for interplanetary network currently finding application in terrestrial networks. In DTN there is a disparity between the latency requirements of the applications and the latency capabilities of the underlying networks. The protocols and other techniques are meant to bridge this disparity.
Communications Challenged Region/Area	A region where the wired and/or wireless infrastructure required to support the low latency (lower, usually significantly lower, than immediate human tolerance) Internet communications expected by many of today's Internet applications does not exist, and, in many cases, is unlikely to be installed for technical, environmental or economic reasons.
Sample of testers	Population that is randomly selected
Volunteers	Testers that are recruited on self motivated participation

1 Introduction

Form the requirements for the paper:

> *FIRE is about future internet research AND experimentation, how to keep these dimensions close to each other, benefiting and developing mutually, that's the quest. In this template for 'light' deliverables of FIRE projects the aim is to collect considerations of this union, and also about the prospects for Test Bed federation, towards building a European Experimental facility, FIRE Facility. Depending on the scope of the FIRE project in question the emphasis between chapters 2 and 3 may vary, not all is relevant to all, but all input nevertheless is welcome in order to serve future internet research that is needed, and in order to build an infrastructure that makes sense for its customers, and is achievable in reality.*

N4C is a technology and user driven project that includes creating two DTN Test Beds; one in Swedish Lapland and one in Kočevje region in the Slovenian mountain, with the goal to make at least one of them sustainable for applications that have a latency requirements that cannot be met by the underlying network. The technology is commonly referred to as Delay- and Disruption-Tolerant Networking (DTN). DTN networking is the type of networking that occurs when there is a disparity between the latency requirements of the applications and the latency capabilities of the underlying system. This condition is the case when trying to use normal internet applications in an environment where there is not broadband network connectivity.

Discovering the requirements for a DTN Test Beds is an N4C goal. In this first year of the project, we have been investigating what is required for sustainable testing in the harsh conditions of remote and other communications challenged communities and meeting with presumptive future owners and funders of the Test Beds.

The requirements for DTN Test Beds include the ability to connect the network to the legacy Internet and thus that they can be seen to require an infrastructure that allows the interconnections of diverse Internet. This may be one area where federation with other Test Beds may be useful and practical. This, however, remains to be investigated in any detail and will be investigated as the project progresses. Another area is to develop business models and charging schemes for services offered on the Test Bed.

The links between research and experimentation may eventually be of different kind and is yet to be determined. In this report we display the type of tests carried out in field this far in our project. Content from our different WPs has already been experimented with in different explorative phases. The content here may thus be a pointer towards the future.

2 Links between research and experimentation

2.1 Scope of needed experimentation

- What is to be experimented with

  The Interconnection of the legacy Internet with a DTN network being used both for experimentation and for the needs of people living in remote and communications challenged communities.
- What type of controllable parameters

  This type of information remains to be collected. Some of the parameter may include:
  - ✓ Latency variation in the DTN zone
  - ✓ Number of nodes in the DTN zone
  - ✓ Number of gateways between the DTN zone and the Legacy zone
  - ✓ Routing protocols used within the DTN zone
  - ✓ Number of different DTN zones connected through the legacy zone
- Use case(s) for experimentation

The aim of the N4C is

- ❖ Use of standard internet applications on DTN network under conditions of latency of greater then 6 hours round trip time. Applications to be considered include:
  - ✓ Web Accessibility
  - ✓ E-mail service
- ❖ The aim is also to carry out tests on the DTN network on applications developed in the project:
  - ✓ Animal tracking (reindeer) - with connection of animal tracking application in remote communications challenged regions with users who have legacy Internet broadband connectivity. This application is developed by Tannak and UPM and is field tested in Swedish Lapland.
  - ✓ Hiker (PDA-applications) developed by partner NORUT and tested in Swedish Lapland
  - ✓ Metrological and Environmental data. This application is developed by partner MEIS and tested in Kočevje region in the Slovenian mountain.

The links between research and experimentation may eventually be of different kind and is yet to be determined. In this report we display the type of tests carried out in field this far in our project. Content from our different WPs has already been experimented with in different explorative phases. The content here may thus be a pointer towards the future.

2.2 Relation to Test Beds

- **Existing / planned experiments, where:**

The DTN Test Bed is still being developed. The goal is to have at least one sustainable permanent Test Beds by 2011; (from the two that are being developed in Swedish Lapland and in Slovenian mountain). The idea of the Test Bed is to combine the Test Bed used by researchers with a basic experimental network that provides Internet services for people living in the communications challenged areas.

Experiments that has been planned and carried out so far are:

2.2.1 Summer tests 2008[1]

Tests were carried out both **in Swedish Lapland** and **in Slovenian mountain** but with different aims.

Summer Test 1 (2008) in Sweden and in Slovenia[2]

In the first test week in Sweden (week 4 August—8 August 2008 in Saltoluokta) the "general public" in Saltoluokta was test population being invited to come to the tee pee internet café which was set up and test mail service on the DTN network. Apart from "Sami population in Saltoluokta (there is no permanent population there but a large number of Sami families) tourists staying at the STFs mountain lodge or living in tents participated. Test week 2 in Sweden (11 August — 15 August 2008 in Staloluokta) was carried out in real harsh environment which only could be reached by helicopter.

In Slovenian mountain tests were carried out on how the DTN network can be utilised on delivering data from environment and meteorological stations.

Aim of the first summer tests was to try and check the legacy hardware and software from the previous work carried out during the Objective 1 (Kommunikationsplattform Padjelanta 2006) and the Interreg project (Crocopil 2007) tests. During the test time, people involved in this project had a chance to get familiarized with the current hardware and software solutions, including all the practical problems with field testing. The Swedish part of the tests was done in Lapland's hard to access mountain area focusing on the actual use of various services using the DTN and ProPHET platform where both local Sami and tourists participated. Tests in Slovenia were done in more controlled environment focusing on actual routing through the DTN and ProPHET platform.

Topology used in Slovenia

Two different type of nodes included in the network were used, because of DTN reference implementation "Linux only" platform restriction. The nodes which were not running under Linux operating system were using only the ProPHET protocol and they weren't able to use all the DTN user's services. Anyhow they were able to act as a normal carrier of the DTN bundles through the network

[1] http://www.n4c.eu/Summer2008.htm

[2] See N4C Milestone report 8.1

Node name	Architecture	OS	NSMI[3] service	DTN service	Webcam
Maggie	x86	Ubuntu EEE	Yes	Yes	No
Krokodilcek	x86	Windows XP	Yes	No	No
Bmzjcek	x86	Windows XP	Yes	No	No
Webcam	x86	Ubuntu 8.04	Yes	Yes	Yes
Grabla	x86	Windows XP	Yes	No	No
Pop3	x86	Windows XP	Yes	No	No
Bart	x86	Ubuntu 8.04	Yes	Yes	Yes
Pop4	x86	Windows XP	Yes	No	No
Lisa	x86	Ubuntu 7.10	Yes	Yes	No
Solonote	x86	Windows XP	Yes	No	No

Table 1: Node's services description table in Slovenia

[3] NSMI service stands for “not so instant short text messages transfer”

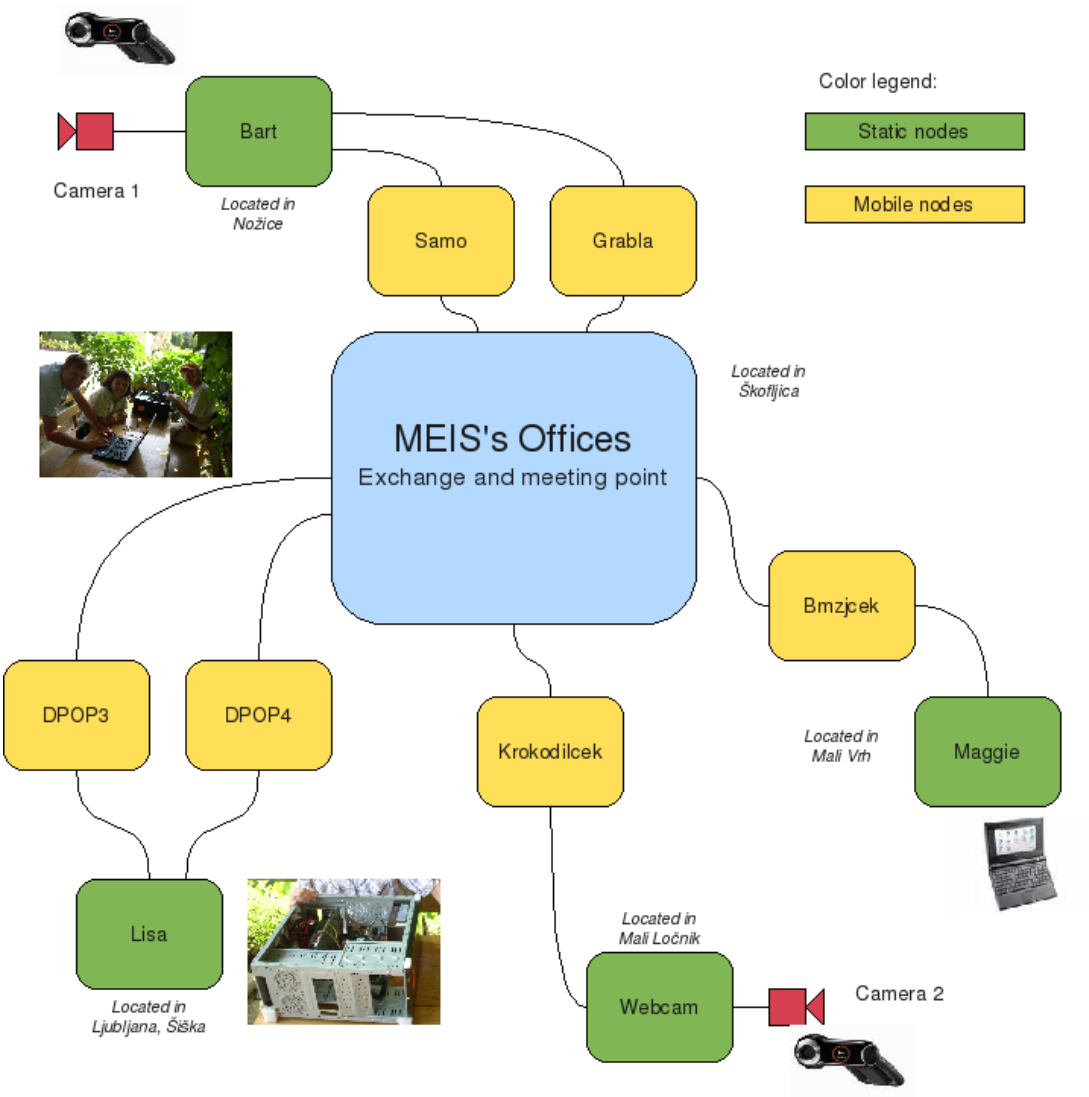


Figure 1: Used topology in Slovenia

Six mobile nodes were distributed between MEIS's employees. All the static nodes were placed on their homes. During the test time they were carrying those mobile nodes between homes and MEIS's offices. At that point the nodes were exchanged between employees or they were randomly connected between each other. Usually no more than two nodes were connected at the same time to prevent forming a typical star topology. The web cam images were sent out to all other statical nodes which have a DTN file transfer service transport.

Node name	Wireless client device	Driver	Mode
Maggie	Atheros AR5BXB63	Linux MadWifi driver	Ad-Hoc
Krokodilcek	IntelPRO/Wireless 2200BG	Intel Windows driver	Ad-Hoc
Bmzjcek	IntelPRO/Wireless 2200BG	Intel Windows driver	Ad-Hoc
Webcam	Asus WL-167g	Linux Ndiswrapper with Asus's driver	Ad-Hoc
Grabla	IntelPRO/Wireless 3945ABG	Intel Windows driver	Ad-Hoc
Pop3	IntelPRO/Wireless 2200BG	Intel Windows driver	Ad-Hoc
Bart	Asus WL-167g	Linux Ndiswrapper with Asus's driver	Ad-Hoc
Pop4	IntelPRO Wireless 2200BG	Intel Windows driver	Ad-Hoc
Lisa	Asus WL-137	Linux Ndiswrapper with Asus's driver	Ad-Hoc
Solonote	Asus WL-167g	Linux Ndiswrapper with Asus's driver	Ad-Hoc

Table 2: Used wireless adapters in Slovenia

Node name	Node Id	Node IP
Maggie	14	192.168.2.14
Krokodilcek	23	192.168.2.23
Bmzjcek	24	192.168.2.24
Webcam	13	192.168.2.13
Grabla	22	192.168.2.22
Pop3	26	192.168.2.26
Bart	8	192.168.2.8
Pop4	25	192.168.2.25
Lisa	9	192.168.2.9
Solonote	21	192.168.2.21

Table 3: Node's Id and IP used during testing in Slovenia

Overview of first Slovene Summer Test 2008

The MEIS SME team involved in this summer test has successfully become familiar with the present state of ProPHET and DTN reference applications. First useful experimental results for routing protocols were collected. The experiences were very valuable for further detail planning on meteorological data collection in the following tests.

Topology used in Sweden

Two different topologies and test places were used in test in Sweden. First one was a trivial regarding the routing itself and it was done in small Sami village Saltoluokta during first week of testing. Only two nodes were used during testing. One of them was used as a hotspot and the second one as a gateway. The aim of this test was to check whether email and web caching services works well.

For an Internet connection NMT modem was used. When there was a need to connect gateway to the Internet we used boat and/or car to drive few kilometres down along the river to send and receive emails and web cached web pages, because there was no NMT coverage in Saltoluokta. This was done on a daily bases.

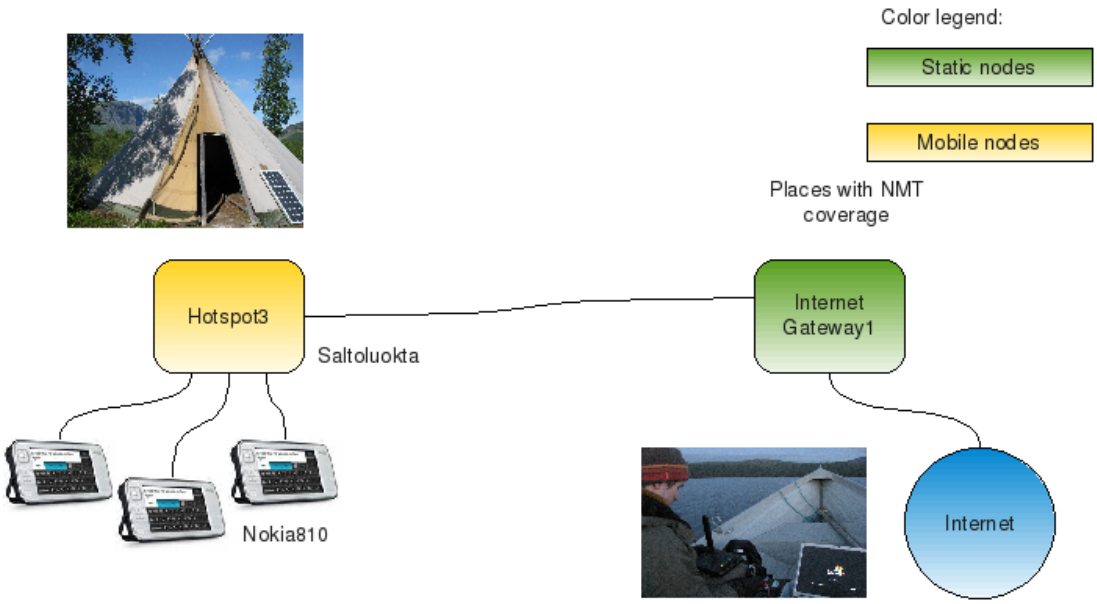


Figure 2: First week's network topology used in Sweden

For the second week of tests three more nodes were used (beside hotspot and gateway) as carriers. Gateway was placed inside the cabin at the Fiskeflyg's helicopter base in Ritsem. Two of the relaying nodes were mounted inside two helicopters. One of the relaying nodes was placed on one of the mountains on a flight route between Ritsem and Staloluokta. Staloluokta is a small Sami village located approximately 60 km from Ritsem and it is close to the Norwegian border. There is no electricity and it is accessible only by walking (4 days walk) or flying.

Node name	Architecture	OS	NSMI service	DTN service	Web caching service
GW1	x86	Ubuntu 6.04	Yes	Yes	No
Hotspot1	x86	Imedia Linux	No	Yes	No
Hotspot2	x86	Imedia Linux	No	Yes	No
Hotspot3	x86	Imedia Linux	No	Yes	Yes
Hotspot6	x86	Imedia Linux	No	Yes	No

Table 4: Node's services description table used in Sweden

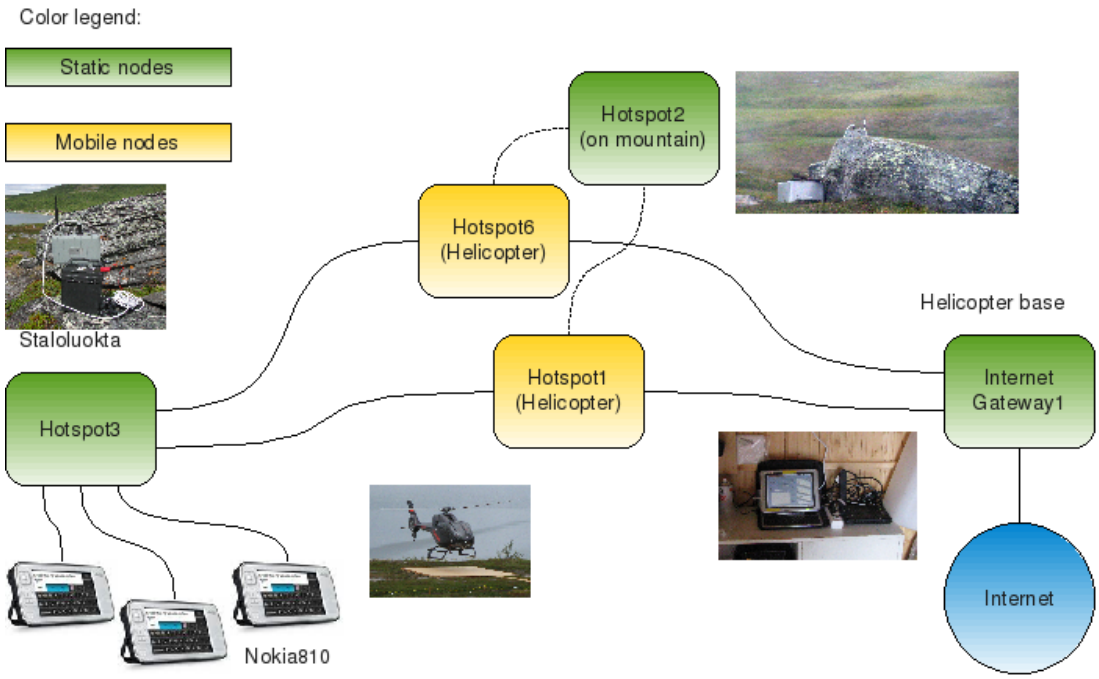


Figure 3: Second week's network topology used in Sweden

As you can see on the Figure 3 our only carriers were helicopters which were flying daily from their helicopter base in Ritsem to Staloluokta. There is one scheduled flight every day at 14h. Anyhow we had some luck at that time because they were rebuilding bridges during our test time, so we had on average at least two flights every day (sometimes even more).

Node name	**Wireless client device**	**Driver**	**Mode**
GW1	Intel Wireless	Linux driver	Ad-Hoc
Hotspot1	Wistron CM9 Atheros	Linux Atheros driver	Ad-Hoc
Hotspot2	Wistron CM9 Atheros	Linux Atheros driver	Ad-Hoc
Hotspot3	Wistron CM9 Atheros	Linux Atheros driver	Ad-Hoc
Hotspot6	Wistron CM9 Atheros	Linux Atheros driver	Ad-Hoc

Table 5: Used wireless adapters in Sweden

Nodes were communicating using the WIFI ad-hoc network named “ProPHET”. Used hotspot was also having its own DHCP server to simplify connection between hotspots and user's computers.

Node name	Node Id	Node IP
GW1	123	192.168.10.123
Hotspot1	101	192.168.10.101
Hotspot2	102	192.168.10.102
Hotspot3	103	192.168.10.103
Hotspot6	106	192.168.10.106

Table 6: Node's Id and IP used during testing in Sweden

Overview of first Swedish Summer Test 2008

The LTU (University) and Tannak SME teams were already skilled with basic available SW and HW DTN solutions/applications from previous projects. Their summer test was therefore more oriented into investigation of researcher – volunteer relationship when facing the new developed technology of DTN. Beside pure technical research and development questions, this is very important issue for further planning. Further tests configuration and Test Bed applications developed will have to be attractive for the target volunteers in order to achieve an actually living Test Bed.

2.2.2 Winter tests 2009 in Sweden[4]

One aim of the winter test was to test the DTN network and the applications for:

- Animal tracking
- Hikers PDA

Another aim was to test equipment in winter conditions and equipment to be carried by the reindeer in hash environment in realistic conditions.

Test was divided into team where:

Team Tannak-UPM: tested devices for power for the reindeer application and for communication between different reindeer as well as between reindeer and the network.

The target of the UPM team during the Jokkmokk winter test was to evaluate the viability of using a battery less radio ID module that could be used for animal (reindeer) tracking. These units were intended to be used in animals termed as 'secondary' that randomly send their ID as they move to a 'primary' node (under development) that uses batteries. In this approach, although battery use in the system is not avoided, the number of batteries in the system could be decreased and a lower maintenance would result. Besides, the specifications of the batteries that are needed to operate at low temperatures need to conform to a certain performance which can affect their price, so that reducing their number could be an economic advantage. Operation under very harsh temperature condition was a concern, but it was not evaluated because temperatures only reached about -12ºC during the test. The components used for the ID radio design are rated down to -40ºC, and have been tested operational while placing them at a fridge at -25ºC. In this mode of operation, a random communication system result and it needs to be evaluated when the system is complete.

Team NORUT: Carried out test of PDA application in harsh environment including Auto Discovery tests. A test line of a 100 m (roughly in east-west direction) was measured and marked on the ground. The position of the end points of the test line were recorded by a Garmin GPS: the east end point was 34W0435996/7401505, the west end point was 34W0435898/7401472 (UTM). Software on four Nokia 810: Last release of Maemo was installed on all machines. Python, support libraries for xml, imaging, database, gstreamer, GPS.

Team FOLLY: Test of equipment to reassure that equipment used delivers data correctly and test of usage of reindeer skin as to protect devices in harsh environment.

The tests were concerned with determining the behaviour of a Gateworks Cambria 2358-4 board and accessories in low temperatures and assessing the insulating qualities of reindeer skin which is proposed as a possible insulating material for retaining the internal heat generated by electronic equipment during the very low temperature periods expected to be encountered in the Sami region in winter. The work verified the effectiveness of reindeer skin, but unfortunately the temperatures during the test period were relatively mild at -12°C to 0°C so that the extreme temperature tests could not be carried out. It pointed up the need to think seriously about heat management in equipment during winter/summer testing, as the modest amount of heat (8 watts) generated by the unit under test produced a temperature differential between inside and outside of more than 40°C when wrapped in two layers of reindeer skin.

[4] http://www.n4c.eu/Winter2009.htm

Team LTU: The main goal of this winter test was to try out a new DTN set up with a new gateway and node set up. It was also a good chance for us to learn how to prepare a node from a scratch. On all desktop machines and gateway we upgraded old Ubuntu linux distribution to the latest one (8.10). We also switched from the iMedia linux to OpenWRT distribution of linux on Alix boards used in the WRAP nodes. To simplify and improve the performance of the file transfer/exchange over the network an application called DFTP was developed before the winter test. Data was collected and will be processed in WP2 and other WPs.

Overview of first Swedish Winter Test

Planning of the Test Bed in Lapland winter conditions is a difficult issue because of extremely harsh conditions that influence both the hardware used in the tests and the volunteers. First winter tests were planned in order to point out and confirm the necessary measures for taking care of people and equipment as part of Test Bed in arctic winter conditions.

2.2.3 Winter tests 2009 in Slovenia

For first winter test in Slovenia development of complete meteorological node and mobile node both based on embedded computer suitable for harsh winter environment was the main goal. These two types of nodes will be crucial component of larger topologies for climate watch network foreseen for further tests.

One complete meteorological station is set-up in the remote location in a village Veliki Ločnik below the mountain close to Kočevje region. In the house near-by a fixed DTN node is placed. It collects data from meteorological station using radio connection. Elaborated meteorological data are then prepared to be transferred by DFTP. On the same node also pictures of the environment from the WebCam are collected and also transferred by DFTP. Once per day another mobile DTN node located in a car makes a connection with the fixed node and takes the bundles that should be transferred to remote location (MEIS) where meteorological data is placed into the data base suitable for further elaborations and presentations. Similar configuration is set up also in the village Nožice below the Kamniške Alpe Mountain. At MEIS both movable nodes transfer the bundles to the destination – fixed node inside the MEIS office.

The following pictures describe the configuration of the equipment in the field.

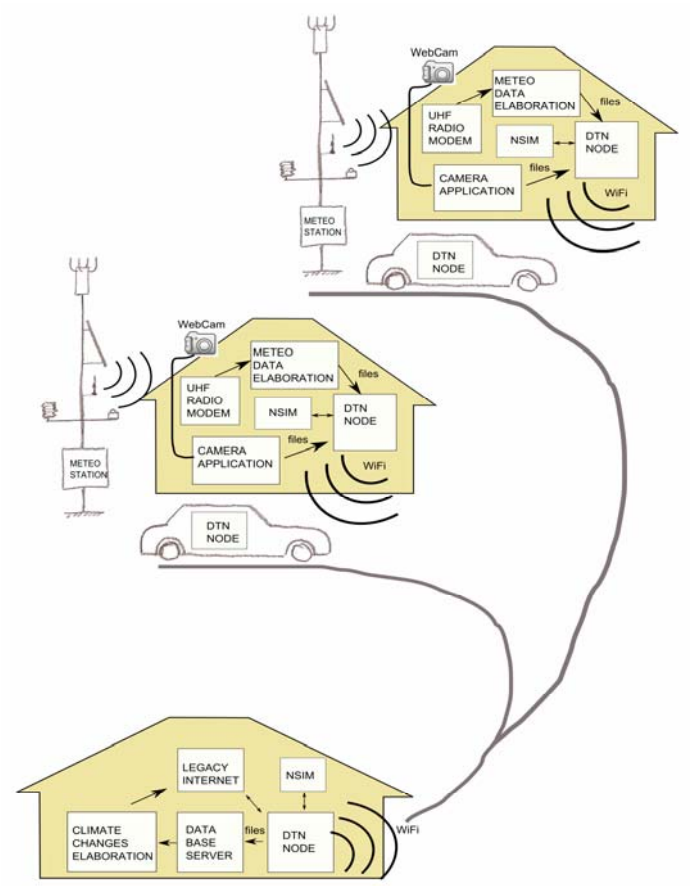
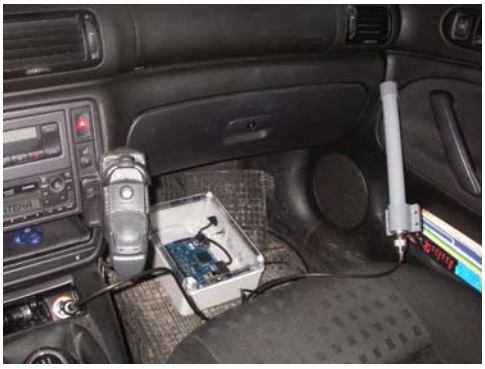


Figure 4 Installation of fixed node with camera and the resulting picture



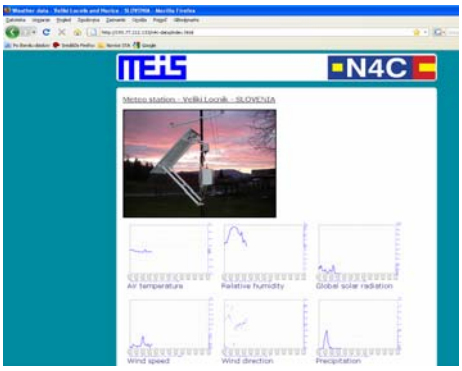


Figure 5: Mobile node in the car and web page with resulting meteorological data presentation.

Overview of first Slovene Winter Tests 2009

During the first months of the project applications were developed for meteorological data collection using DTN platform. New application was tested in half controlled environment to identify eventual problems which should be overcome until next tests. For next tests it is planned to set up a network of environmental stations connected using DTN to represent an example of climate watch in remote areas of the planet.

Lessons learned from the first tests

N4C project is not starting from “zero”, therefore the team get familiar in details with the achievements of the previous projects. First tests in simple Test Bed configurations were suitable for establishing methodology for further tests planning. The methodology will also take into account the possible interactions with other projects involved in FIREworks.

Relations of experimental Tests versus Teoretical Research

The Test Bed as it is planned in the N4C project is primarily understood as a tool where research achievements (resulting in new and upgraded DTN protocols and applications) are proven to be useful and successful (or even not) in (almost) real life conditions. To achieve this goal the tests performed should be planned with special care.

The team involved in planning consists of scientific members that foresee the further development of the underlying theoretical approaches. Then there are members that will actually deploy the new theoretical achievements into DTN infrastructure. The third parts involved are members from SMEs involved that are final users themselves or that work in the fields that are targets for useful applications. In this way planning of the further development of the Test Bed and actually performed tests is a continuing process with an incremental growth principle. Each step forward in the Test Bed development is planned according to all the aspects learned in the previous step and not only from the assumptions made at project initial planning.

In this way we hope to achieve a complex Test Bed for the final tests that will be based on the whole research and development process during the N4C project. The final tests

applications and the DTN infrastructure results should show the practical value of new developments for further technological development and deployment in real life of the remote areas population.

The tests performed so far and the initial Test Bed topologies have proven to show valuable observations to the researchers for further development. Methods for efficient tests description and collection of infrastructure's and applications' logged parameters for further investigation and analysis are being planned and developed. The real life tests confirm to be source of new information about practical value of new developments, about eventual shortcomings as seen from volunteer user perspective and about harsh environment installation, operation and maintenance problems. This is what gives the Test Bed and test their superiority over laboratory testing and simulations.

- **Needs / contributions to facilities**

The current project funding extends to creation of the technology for the Test Beds. It does not include the equipment necessary to provision the full Test Bed. Part of the N4C project includes creating the business plans for the sustainable Test Beds.

- **Cooperation terms**

This is an area that still needs to be understood in technical terms. It is uncertain what transit arrangement can be made with those Test Beds serving the legacy Internet and those who are creating other sustainable and long lasting test networks. These issues are among what need to be explored in the work being done to develop the business case for the Test Beds.

2.3 Criteria for the experimental facility

- **What access policies**

  These items are still very open for discussion. In terms of creating a Test Bed where other research outfits can test their DTN applications several conditions will need to be met including:

  - Ability to run application without interfering with either the experiments being run by others or the real life testing done by the people for whom the DTN Test Bed is their only network connection.
  - Ability of results to be kept private for each of the experimenters
  - Ability for the network activities of residents within the Test Bed to be private even if abstract data is collected on the operational properties of the network.

- **What proposed administrative and set-up processes**

  It is still too early to know this. Representatives for the N4C business planning group has meet with the municipalities (Jokkmokk and Gällivare) where the DTN network in Sweden is being set up. The Slovenian partner has also met with presumptive partners of the Test Bed in Slovenia. The outcome of these meetings has been promising. Work with business planning is on-going.

- **What type of Test Bed configuration rights needed**

It is still too early to know this. These issues will be dealt with in later report on sustainable Test Bed creation.

- **Autonomous testing vs. aided testing**

  We are hoping to establish according to both models. Autonomous testing will be most helpful to those who want to set up long term test and monitor from remote locations. On the other hand, part of creating a sustainable Test Bed requires the inclusion of the local population in the sustainable model and this involves establishing work opportunities for the population.

- **What tools are needed?**

  There will be a critical need for the following tools on the Test Bed:
  - Management application
  - Configuration applications
  - Logging applications
  - Reporting applications

- **Foreseen challenges**
  - To operate the Test Bed there is a need to allocate training resources for staff for the remote locations. For the Swedish Test Bed there is a good base for this in the local ICT Gymnasium (Upper Secondary School). Similar conditions are available in Slovenia.
  - The remote locations are hard to reach
  - It is difficult to layer new application onto an existing network without hands-on activities in the field
  - The conditions can be really difficult especially in the winter.
  - Unavailability of power during the winter months (no sun for solar power)
  - Extreme Temperatures occurs (-40°C and below)

- **Other preferred features**
  - Unknown at this time

3 Federation requirements

3.1 Motivation for federation

- **What does it mean to federate**

  To combine efforts in a common cause or in order to reach a common end. In general a federation requires and initial agreement on the conditions of the federations and a set of governance policies to keep the federations in place. Besides usage of a network all over Europe, federation can include sharing technical know-how, administrative set up, work load, training and business planning etc.

- **For what purposes to federate Test Beds**

  To share experience and capabilities and to avoid duplication. In some case it may also aid in the performing more complex testing. Smaller Test Beds can benefit from collaboration where they provide a niche capacity.

- **Use cases for federation**

  Uncertain at this time.

3.2 Challenges for federation

- **What objectives of federating Test Beds are challenges**
  - Reaching a common purpose can be difficult when each of the Test Beds has specific mandated goals to meet and when the Test Beds after phase out of EC funding will work under different funding regimes (private or public private partnership etc.). Deciding on the technical interface between the various networks.
  - Deciding on the administrative interface between the various projects.

- **What bottle-necks can be identified**
  - Individual project practices and management issues
  - Reporting practices
  - Initial funding

- **What constraints are there for federation**
  - Financial – while a long term goal may be to achieve economies of scale in the research community, the initial set-up of federations need to be found outside the projects themselves. Since projects are largely on fixed budgets, this is a necessarily constraint to overcome.

- **What solutions can be suggested to overcome the challenges**
  - A separate funding of a initial network during a fixed time
  - Early planning for federation in the budgets of new and continuing projects. Federation may not be something that can be easily added to existing projects but is something that could be part of the initial planning.

3.3 Heterogeneity in and cross federations

- **What differentiators inside a FIRE Test Bed**
  - Location (Different member states, different regions, different languages)
  - Test Beds that involves users versus Test Beds that involves only Instruments and researchers. Populations' involvement. One differentiator goes between Test Beds that contains permanent community users only and Test Beds with interested volunteers.
  - "Representativity" – how the Test Bed sample testers. If volunteers etc. take part i.e. the same users will be asked to participate in the tests and the Test Bed risks to be connatural and the business model risk not being sustainable. For some application sampling this is crucial (for example when tests are carried out on eHealth, eGovernment and similar applications etc.). For other applications (for example those where natural environment is the issue) this is not the problem and focus can be laid on other issues.
  - Development of applications
  - Environmental constraints
  - Capabilities of different partners
  - Interests of the different partners
  - Business Models
  - Infrastructure that is offered (DTN, 3G, DSL or only mobile etc)

- **What differentiators between FIRE Test Beds**
  - Basic technology in use on the network (Mobile, DTN, DSL, WiMAX and/or combinations)
  - Network architecture
  - Management Methodologies
  - Addressing architectures
  - Protocol choices

3.4 Interconnection

- **How to establish a link between resources**
  - **Inside of federation**
    - Facilitation by the EC (coordinated action or similar).
    - Communication and face to face meetings.
    - Use of Net 2.0 Technologies such as community documentation projects and online meeting spaces.

Comment [EBD1]: Should I know what these are? ;-)

  - **Cross federation**
    - Facilitation by the EC (coordinated action or similar), work shops, conferences.
    - Communication via web page and mail network
    - Use of Net 2.0 Technologies such as community documentation projects and online meeting spaces

- **What considerations / remarks to be noted for interconnection**
    - This will be a challenge and will require the use of skilled staff whose focus is inter and intra federation communications.

3.5 Governance

- **Different policies**
    - These will need to be negotiated in a multi stakeholder setting and using established methods for cross cultural and multi stakeholder consensus building.

- **Different incentives for sharing**
    - Different incentives will motivate differently on a cross-cultural and cross stakeholder basis. What appeals to a university research group is not likely to be the same as what motivates a SME. N4C includes partners that are both universities, research institutes, industry and SMEs.

3.6 Description of resources

- **At what level common resource description is needed**
    - Both functional and detailed in terms of capabilities and other technical specifics

- **Considerations on cost for universal meta-level description**
    - Unknown at this time

- **Propositions**

4 Conclusions

The subject of federations is interesting. N4C is trying to understand how remote European regions can be fruitfully involved in advanced federated Test Bed. We share the aim with EC that Test Beds are an important tool for development of innovations. One thing that is of use at this point in the N4C development is the learning that can come out of analysing what has been done by other Test Beds.

We look forward to the work being done by those more advanced in this area and as we create the plans for our Test Beds, will attempt to build in support for federation as appropriate.

References

[1] N4C Milestone report 8.1
[2] http://www.n4c.eu/Summer2008.htm
[3] http://www.n4c.eu/Winter2009.htm

Annex

None