

Summary of the second year May 2009–April 2010

OBJECTIVES

EC Innovation policy is a cornerstone in economic development of Europe. It is in this context development of test beds and the FIRE networks should be viewed. By decreasing time between development and actual launch, more viable hardware and ICT services can be obtained. In view of this N4C is proud to report that our development in year 2 has resulted in new products being launched by the Spanish broadband system provider Alentia Systems S.A. and, that a new company incorporating N4C achievements (Tolerant Networks Ltd.) is being set up in Ireland.

The FP7 ICT project Networking for Communications Challenged Communities (N4C) aims to extend Internet access to people, businesses and authorities operating in remote locations. In cooperation with users in Swedish Lapland and the Kočevje region in the Slovenian mountains, the project conducts field trials of architecture, design, infrastructure and applications. These were the aims in the Grant agreement signed in 2008 and they still remain the same.



Photo 1: Test bed in Swedish Lapland.



Photo 2: Test bed in Slovenian mountain.

In this context N4C does:

1. Use emerging, novel technologies and create an opportunistic networking architecture to exploit the communication opportunities. Delay and Disruption Tolerant Networking (DTN) is a focus in the N4C efforts. Other achievements include WiMAX for rural areas.
2. Develop two test beds demonstrating how DTN-based networking can be integrated with the existing internet and investigating business models appropriate for communication challenged regions.
3. Develop and conduct tests on DTN of applications for a) Web caching and email services, b) Tracking of animals, c) Gathering of Climate data and, d) Hiker's Personal Digital Assistant (PDA).

The N4C Consortium consist of: Luleå University of Technology (coordinator), Alentia Systems S.A., Universidad Politécnica de Madrid, Intel, Trinity College Dublin, Northern Research Institute Tromsø AS, ITTI Ltd., Instituto Pedro Nunes, MEIS d.o.o., Tannak AB, Power Lake AB and Folly Consulting Ltd.

Following illustration shows the use of DTN in N4C project:

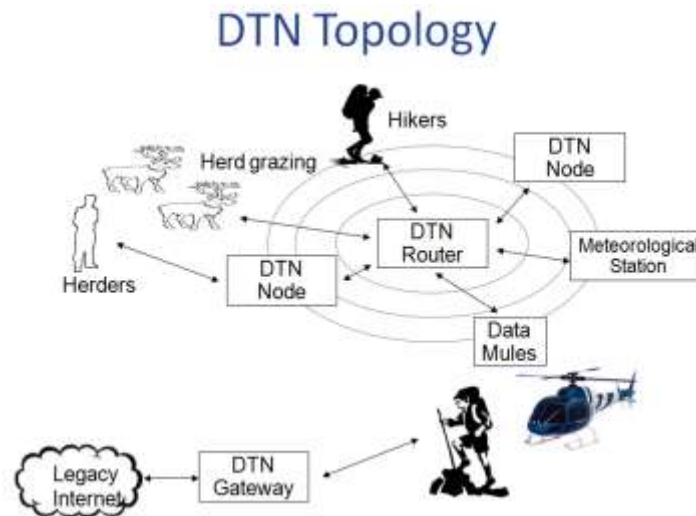


Figure 1: The N4C DTN Topology.

The work is divided into nine Work Packages, relating to each other as shown in Figure 2:

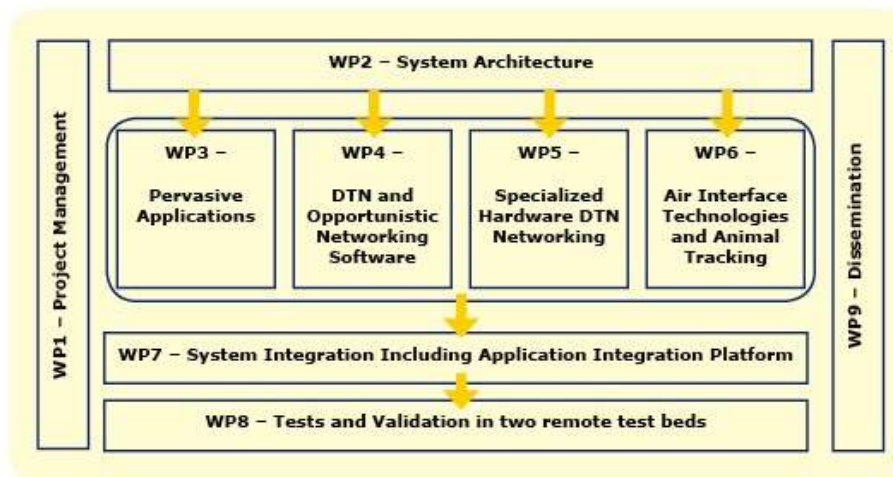


Figure 2: Work Packages chart.

During Period 2 the respective work packages have performed work and made achievements as follows:

RESULTS FROM N4C RESEARCH AND DEVELOPMENT - THE SECOND YEAR OF WORK Architecture :

- Based on the architectural work in Period 1, N4C has extended the specification of the infrastructure by creating a comprehensive functional specification.
- A high level analysis of the progress of system integration and tests in the earlier part of the project has been fed into the integration and test planning process for Period 3 as well as providing intermediate results for publication.
- Complementing the technical work, there has been considerable work in the social science areas and this has also been fed into the test planning and deployment process.

N4C has developed functional specifications for three pervasive applications which are up for business/deployment planning and if that process is successful they are likely to be integrated into the economic life in communications-challenged communities. Application **Tracking of Animals** is in need of further development before deployment. **Capturing of Energy and Meteorological Data** is a service developed by partner MEIS that is now successfully being tested on the DTN based internet access and will be launched in near future. **Hiker's Personal Digital Assistant (PDA)** and, web services will be tested further in summer and autumn 2010.



Photo 3: Dr. Marija Zlata Boznar, MEIS d.o.o, is responsible for the development of a climate data application.

In Year 2 N4C work with software for DTN and opportunistic routing has continued with:

- Several aspects of software design and development
- E-mail management, web push and web request
- DTN2 stack for WRAP systems used as data mules
- Updates and documentation
- Participation in field tests and evaluation of field test data

N4C work with hardware during the second year has continued and included:

- Testing the rugged and user friendly DTN node "Village router" in real life field conditions
- Release of DTN node user documentation for the "Village router"
- Advanced power supply from renewable sources (solar and wind energy) and for long run autonomy

The Air-interface technology team has:

- Developed a unique implementation of WiMAX technology working in mesh connectivity
- Developed a unique implementation of WiMAX technology with multiple antennas
- Tested and validated an animal tracking system that uses batteries
- Developed a new animal tracking system with a kinetic generator that does not require batteries at the secondary nodes
- Developed a tracking simulator that is able to represent an arbitrary scenario to select the optimum set of parameters

System integration includes development of:

The system integration work has two dimensions in N4C. On the one hand, there is system integration directly preparing for the N4C test beds. On the other there is system integration which is focused on reliability and repeatable results. During Period 2, the following were accomplished:

- "Lab testing on integrated subsystems"
- "Specification, implementation and deployment and installation of platforms"

According to plans, the integration platform should be compatible with other platforms and other types of devices than those used in the N4C project. The basis of the development is on Python Programming Language which permits creating applications with a higher abstraction. Also, due to



its portability characteristic, it is possible to develop it on PCs and then port for other devices (as Nokia tablets). Figure 3 shows a draft of how the platform will look in the Nokia Tablets.

The delivery also exposes tutorials on how to install modules. These tutorials are helpful as they facilitate integration of new applications to the system.

Figure 3: Screenshot of the platform running in the Nokia Tablet simulator.

TESTS AND VALIDATION IN TWO REMOTE TEST BEDS

Also in year 2, two rounds of on-site field tests in summer and winter conditions has been carried out both in Swedish Lapland and in Kočevje and other regions in Slovenia. Tests have validated successful development of software and hardware solutions.

BUSINESS / DEPLOYMENT PLANNING

Large efforts have been allocated to development of a first Business / Deployment Plan for the DTN based internet access and the two test beds. The plan is done in interactive research form and is now being presented and developed further. Models for deployment are outlined for both the test bed in Slovenia and in Swedish Lapland and will be further developed with authorities and future users. The financial models will be built on Private Public Partnership (PPP) in Swedish Lapland and Private solutions in Slovenia. Governing models that are trialled:

- Level 1: A research test bed platform on similar level as during the N4C FP7 project
- Level 2: A small scale test bed for present research partners and for a few new clients
- Level 3: A large scale federated test beds in collaboration with FIRE network

DISSEMINATION

N4C dissemination strategy include using online communication with the N4C web site, wiki, the electronic Newsletters and press releases distributed to relevant target groups. Result of this work shows that the N4C project continues to rendered large attention in both national, EC media and in 3rd countries. This attention has led to meetings and invitations to collaborate with new partners in countries like Brazil (Amazonas), Alaska, Malaysia and Mongolia.

A workshop “Test beds for Rural Communities and Arctic Conditions” was arranged in collaboration with the Arctic Council Sustainable Development Working Group project. At this work shop a US team working with capturing environmental data in Alaska was participating and future collaboration was drafted.



Finally dissemination has included preparing and issuing a large number of articles to research communities and to take part in standardization including submission of abstract to the FIA book 2010 (Norut and LTU) and presentation of two posters on the Future Internet Assembly meeting in Stockholm 23rd-24th November 2009 (Norut and UPM).

Photo: Ms. Handmaa Karlsson visiting the LTU to discuss deployment of DTN in Mongolia.