



Networking for Communications Challenged Communities:  
Architecture, Test Beds and Innovative Alliances  
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# D9.5

# N4C WIKI



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## ABSTRACT

Starting in May 2008, N4C is a 36 month research project funded by the Seventh Framework Programme ([www.cordis.lu/fp7](http://www.cordis.lu/fp7)). This is a cooperation project between end-users, in Northern Sweden and Kočevje region in Slovenian mountain, and technological partners (RTD performers and companies). Under the scope of the project we will design and experiment with an architecture infrastructure and applications in field trials and build two test beds.

This document describes the implementation of the wiki page for the N4C project, the wiki impact and the plan for the sustainability of the wiki page. The contents stored in the wiki consist mainly in the N4C initiatives and in the DTN technology, as a way to turn the wiki into a tool that serves to disseminate both the DTN concept and the knowledge obtained by all the partners with this project, as well as a repository of applications that can be downloaded and installed by visitors, with the help of existing auxiliary documentation and procedure manuals.

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## 1. INTRODUCTION

This document aims to state the wiki page's development and deployment about DTN and the N4C project. Furthermore, it is presented the wiki impact and the plan for the sustainability of the wiki page.

During the state of the art investigation phase, the most missed item found in the existing wikis about DTN was the dissemination of the DTN applications. The applications are very important in the worldwide dissemination of any technology. These provide the connection between the technology and the users. The roadmap from the DTN technology to the users is presented in the Figure 1.

One possible outcome is that DTN might see widespread deployment as a standard part of most device network stacks, for use when those devices are used in challenged networking contexts.

After evaluate the existent wiki pages, it was decided to add in the N4C's project wiki (N4C, 2009), a section focused in the DTN applications in development under the scope of the N4C project in addition to the N4C projects initiatives.

In this document, it is initially presented the state of the art, which is formed by two wikis about DTN technology and one wiki focused in the N4C initiatives. Subsequently, it will be described the deployment procedures and the contents of the DTN Applications wiki page. Finally, it will be presented the prototype of that wiki page.

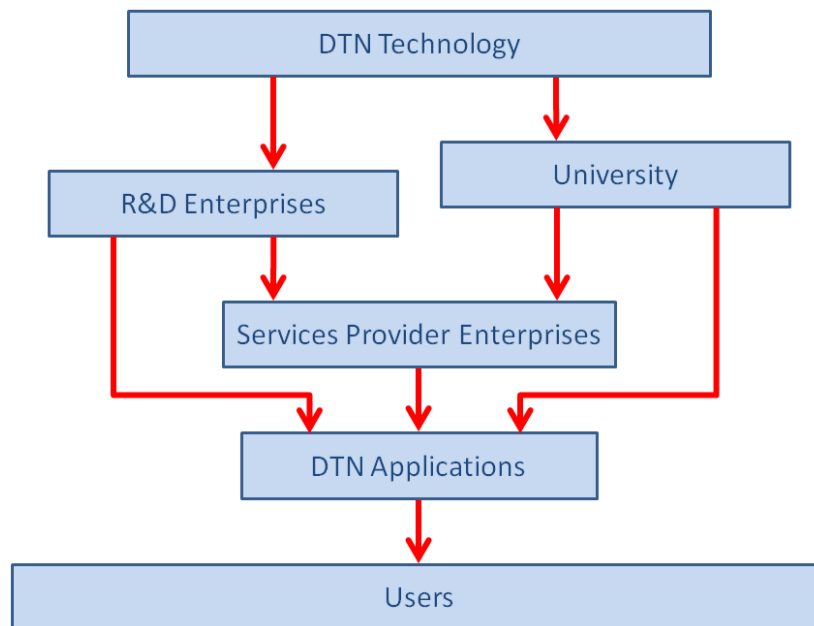


Figure 1 - Roadmap from the DTN technology to the users.

## 2. OBJECTIVES

The fundamental objective of the project's wiki (*Wiki, 2009*) is to spread the information as far as possible. So, as a dissemination tool, the N4C wiki intends to disseminate the knowledge obtained from the current project, as well as to share the best practices that can lead this project to its accomplishment, serving also as a roadmap for future project's developments. Together with this, it is also intended to develop the sustainability of this wiki, in order to assure the continuity of the wiki itself, even after all tasks of the project are achieved. Finally, the wiki serves as a mean for supporting the implementation and the impact of the technical N4C's results.

## 3. REQUIREMENTS

The need for having a wiki for this project came from several factors, but the main one is the dissemination of knowledge and best practices, as a result of the N4C project. Taking advantage of the new Web 2.0 (*Web 2.0, 2008*) available services, the most appropriated one seemed to be the wiki, which we can use to describe the DTN concept, together with the N4C project's initiatives, having it always updated with the newly features of the project.

Together with the dissemination of the information, this wiki also acts as a repository of software and installation procedures, in an attempt to promote other initiatives to the world, following an open source strategy for information sharing with the community and expect to receive valuable inputs to improve the system, in a symbiotic relationship.

The last requirement is to initiate and maintain a Community of Practice (CoP) about the DTN concept and the N4C solution.

## 4. STATE OF ART

### 4.1 - WIKIPEDIA: DTN WIKI

This wiki page (*Delay-tolerant networking, 2009*) is divided in six sections: introduction, history, routing, other concerns, research efforts and references.

In the introduction is shown an overview about the DTN technology. This technology is presented as being addressed to the networks that may lack continuous network connectivity. It is shown examples of this kind of networks, such as operating in mobile or extreme

terrestrial environments, or planned networks in space. It is emphasized too the term disruption-tolerant networking which has gained currency in the United States due to support from DARPA, who have funded many DTN projects. Disruption may occur because of the limits of wireless radio range, sparsity of mobile nodes, energy resources, attack, and noise.

In the second section is presented the history of the DTN technology. This section shows that DTN technology was created in 2002 by Kevin Fall, which started to adapt some of the ideas in the Interplanetary Internet design to terrestrial networks.

The section three is dedicated to the routing mechanisms and it is shown how the popular ad hoc routing protocols, such as AODV and DSR, fail to establish routes with DTN. Then, it is presented like a common solution, to maximize the probability of a message to be successfully transferred, the replication of many copies of the message in an attempt that at least one of them will succeed in reaching its destination. This is feasible only in networks with large amounts of local storage and internode bandwidth relative to the expected traffic. In many common problem spaces, this inefficiency is outweighed by the increased efficiency and shortened delivery times made possible by taking maximum advantage of available unscheduled forwarding opportunities. In others, where available storage and internode throughput opportunities are more tightly constrained, a less indiscriminate algorithm is required.

The section four, named other concerns, is focused in the bundle protocol and in the security. The bundle protocol provides a definition of a series of contiguous data blocks as a bundle, where each bundle contains enough semantic information to allow the application to make progress where an individual block may not. Bundles are routed in a store and forward manner between participating nodes over varied network transport technologies (including both IP and non-IP based transports). The transport layers carrying the bundles across their local networks are called *bundle convergence layers*.

The security guarantees in this kind of network are presented as difficult to achieve. Solutions have typically been modified from mobile ad hoc network and distributed security research, such as the use of distributed certificate authorities and Public Key Infrastructure schemes. Original solutions from the delay-tolerant research community include the use of identity-based encryption, which allows nodes to receive information encrypted with their public identifier.

In the section five, named research efforts, are presented the main initiatives based the DTN technology. The N4C project is one of them.

In the last section is presented all references which were used to build this wiki page.

## 4.2 - DTNRG WIKI PAGE

The DTNRG (Delay Tolerant Networking Research Group) wiki (DTNRG, 2009) is divided in seven main wiki pages: Home, Docs, Code, About, RecentChanges, FindPage and HelpContents.

In the Home page is presented the DTNRG as a research group chartered as part of the Internet Research Task Force (IRTF). Members of DTNRG are concerned with how to address the architectural and protocol design principles arising from the need to provide interoperable communications with and among extreme and performance-challenged environments where continuous end-to-end connectivity cannot be assumed. The current co-chairs for DTNRG are Kevin Fall (Intel Research) and Stephen Farrell (Trinity College, Dublin). Subsequently, it is described how the community can participate and collaborate in the development of the wiki and the DTN. Finally is presented the DTN-Bone as an effort is underway to establish a network of DTN (mainly DTN2 and ION) nodes on the terrestrial internet for interoperability testing, application deployment, and development of network management, naming, and routing conventions.

The page named Docs is a page with links for the documentation. It is divided through of the following sequence of issues:

- RFCs and Internet Drafts;
- Papers referencing DTN in some way;
- Tutorials;
- Presentations;
- References to the Implementation;
- Organizational Documents;
- Archived Documents;
- Projects using the DTN reference implementation;
- Other Related Materials;
- Related press releases.

The Code page contains the code developed under the scope the DTNRG. The page has the following downloadable codes:

- **Licklider transmission protocol (LTP)** - The Licklider transmission protocol is a point-to-point protocol intended for over very high delay links. There are two LTP implementations available: from Ohio University (in Java) and from Trinity College Dublin, Ireland (in C++).
- **DTN2** - The goal of this implementation is to clearly embody the components of the DTN architecture, while also providing a robust and flexible software framework for experimentation, extension, and real-world

deployment. The DTN2 source code and associated libraries are now hosted on SourceForge.

- **ION** - This is an implementation of the Bundling Protocol, AMS, and LTP. ION is produced by the Jet Propulsion Laboratory and partially maintained by Ohio University, which also hosts its software distribution site.
- **Simulation** - There are available two simulators, one using user mode Linux and other named DTNSim2 Simulator written by Waterloo and based in the java-based simulator developed by Sushant Jain.
- **Other Implementations** – This section contains: a) an alpha version of a pure python DTN implementation; b) a Java implementation of the bundling protocol that is based significantly on the design of DTN2; c) a DTN implementation for Symbian phones; d) a prototype implementation of the DTN architecture, written in C; e) another Java implementation of DTN, currently being developed by Matt Bradbury.

The page named About is focused in five issues. They are the following:

- **The challenges of communicate in extreme environments:** large delay for transmissions resulting from either physical link properties or extended periods of network partitioning, routing capable of operating efficiently with frequently-disconnected, pre-scheduled, or opportunistic link availability, high per-link error rates making end-to-end reliability difficult, heterogeneous underlying network technologies (including non-IP-based internets), and application structure and security mechanisms capable of limiting network access prior to data transit in an environment where round-trip-times may be very large.
- **The germination of the DTNRG:** the DTNRG was formed in 2002 as a result of the observation that a non-interactive, asynchronous form of messaging service, able to operate over diverse types of networks, would be useful for several networks currently in use or being contemplated.
- **Relation between IPNRG, IETF and IRTF:** The DTNRG is an IRTF-sponsored open research group. IRTF is the research-oriented relative of IETF. Prior to the chartering of DTNRG, the bundling architecture was developed within the Interplanetary Internet Research Group (IPNRG), which is now of 'historical' status within IRTF.
- **Other projects focused in similar issues:** The topic contains links of the projects which have similar issues than DTNRG, for example, the N4C project.

The RecentChanges page presents the recent changes provided by the wiki developer group. It is presented, for each change, the author, the data, the time and the changed section.

The FindPage is dedicated to search pages in the wiki. That has three kind of search: by title, by full-text and by direct page.

In the HelpContents page are found links to the followings help pages:

- **HelpForBeginners:** for new wiki users;
- **HelpOnNavigation:** explains the navigational elements on a page;
- **HelpOnPageCreation:** how to create a new page, and how to use page templates;
- **HelpOnUserPreferences:** explain how to make a user known to the wiki, and adapt default behavior to user's taste;
- **HelpOnEditing:** explain how to edit a page;
- **HelpOnActions:** present the tools that work on pages or the whole site;
- **HelpMiscellaneous:** more details, and a FAQ section;
- **HelpOnAdministration:** help to maintain a MoinMoin wiki;
- **HelpOnInstalling:** is dedicated to install a MoinMoin wiki;
- **HelpForDevelopers:** explain how to add user's own features by changing the MoinMoin code.

## 5. N4C INITIATIVES WIKI PAGE

N4C's initiatives wiki part (N4C, 2009) is divided into four sections: the *Main* page, the *Community Portal* page, the *Current Events* page and the *Calendar* page. The *Main* page, where most contents are, is divided into the *Abstract*, the *Project's Participants*, the *Project's Description*, the *Project's public Web Site*, the *Project's Technical Information web site*, the *Bibliography*, *Other Useful Information*, *Student Opportunities*, the *Project Planning and Presentations about the Project*. In the *Main* page there is also a link to the wiki's feeds.

The requirements described in the following sections are derived from those exposed in section 3, and the objectives for each page are derived from those exposed under section 2.

## **5.1 - MAIN PAGE**

### **5.1.1 - ABSTRACT**

#### **5.1.1.1 - OBJECTIVE**

Introduce visitors to the problems being faced by the N4C project and give them an overview of the possible solutions.

#### **5.1.1.2 - REQUIREMENTS**

Introduce the DTN concept, the N4C's initiatives, and the product knowledge.

#### **5.1.1.3 - IMPLEMENTED SOLUTION**

The abstract page serves to alert visitors for the problems that the N4C project intends to solve – namely, the communication in areas where there are no infrastructures to common internet –, and also informs them of the N4C objectives as well as the way developers are following to accomplish the project's objectives.

### **5.1.2 - PROJECT'S PARTICIPANTS**

#### **5.1.2.1 - OBJECTIVE**

Give visitors information about the participants of the project.

#### **5.1.2.2 - REQUIREMENTS**

Introduce the participant entities to visitors and give them an idea of each partner's expertise area.

#### **5.1.2.3 - IMPLEMENTED SOLUTION**

In this page are displayed all the consortium's partners, a summary of some of the entities, together with a direct link to each one's web page.

### **5.1.3 - PROJECT'S DESCRIPTION**

#### **5.1.3.1 - OBJECTIVE**

Present a detailed description of the N4C project.

#### **5.1.3.2 - REQUIREMENTS**

Provide visitors with a digital copy, preferentially in pdf format, of the project's details, enabling visitors to save the document and analyze it in offline mode.

### **5.1.3.3 - IMPLEMENTED SOLUTION**

In the main page, the Project's description link gives visitors the full description of the project, a copy of the original project's proposal in pdf format.

## **5.1.4 - PROJECT'S PUBLIC WEB SITE**

### **5.1.4.1 - OBJECTIVE**

Enable visitors to know, beyond the project's wiki, the web site, oriented to the audience that is searching for other kind of information.

### **5.1.4.2 - REQUIREMENTS**

Provide visitors with a hyperlink, giving them the opportunity to visit N4C's web site.

### **5.1.4.3 - IMPLEMENTED SOLUTION**

In the main page, users can access to N4C's public web site through the link available.

## **5.1.5 - PROJECT'S TECHNICAL INFORMATION WEB SITE**

### **5.1.5.1 - OBJECTIVE**

Guide visitors who are searching for information more detailed, from a technical point of view, for N4C's technical information web site.

### **5.1.5.2 - REQUIREMENTS**

Provide visitors with a hyperlink to N4C's technical information web site.

### **5.1.5.3 - IMPLEMENTED SOLUTION**

As an alternative to the public web site, and oriented for users who want to get information with a greater level of technical details, there is a link for the N4C's technical information web site.

## **5.1.6 - BIBLIOGRAPHY**

### **5.1.6.1 - OBJECTIVE**

Disseminate the knowledge obtained and collected during the project's course.

### **5.1.6.2 - REQUIREMENTS**

Provide visitors with links to web sites that contributed to the project and with relevant contents.

### **5.1.6.3 - IMPLEMENTED SOLUTION**

In the Bibliography page, visitors can reach other web sites through links used to gather information for this wiki's construction, each of which containing a brief description of the contents that can be found in there.

## **5.1.7 - OTHER USEFUL INFORMATION**

### **5.1.7.1 - OBJECTIVE**

Disseminate information obtained in past projects.

### **5.1.7.2 - REQUIREMENTS**

Provide important background information to visitors.

### **5.1.7.3 - IMPLEMENTED SOLUTION**

In the "Other useful Information" page, visitors are presented with some background information, such as information on the SNC project, N4C's ascendant.

## **5.1.8 - STUDENT OPPORTUNITIES**

### **5.1.8.1 - OBJECTIVE**

Disseminate N4C initiatives and opportunities for students.

### **5.1.8.2 - REQUIREMENTS**

The opportunities for students are listed in this page, grouped by the partner who's offering the position, and, for each position offered, there is a link that leads visitors to a page with further details on that opportunity.

### **5.1.8.3 - IMPLEMENTED SOLUTION**

This page informs visitors, namely students, of current work opportunities that currently exist in the N4C's project. The opportunities are listed and each one has a link that leads to a page with more details about the opportunities.

## **5.1.9 - PROJECT PLANNING**

### **5.1.9.1 - OBJECTIVE**

Disseminate best practices and develop roadmaps for future projects' development.

### **5.1.9.2 - REQUIREMENTS**

Group and list events according to its date, hosting, in each one, relevant documentation.

### **5.1.9.3 - IMPLEMENTED SOLUTION**

This page serves to inform visitors of activities that are or will be happening in a near future, as well as to host documents that result from those activities.

## **5.1.10 - PRESENTATIONS ABOUT THE PROJECT**

### **5.1.10.1 - OBJECTIVE**

Disseminate the knowledge produced during the project's course.

### **5.1.10.2 - REQUIREMENTS**

Together with information about each one, events are grouped by the partner who presented it, the presentation itself, preferentially in pdf format.

### **5.1.10.3 - IMPLEMENTED SOLUTION**

This page lists all the presentations, grouped by date, performed in the N4C's context. Along with the list of presentations, this page hosts also the presentations themselves, in pdf format.

## **5.2 - COMMUNITY PORTAL**

### **5.2.1 OBJECTIVE**

Disseminate the knowledge produced and share best practices from this work.

### **5.2.2 REQUIREMENTS**

Each partner can insert information about its part of the project, as well as documentation that is considered to be relevant.

### **5.2.3 IMPLEMENTED SOLUTION**

This page, as its name shows, is turned for the community. It intends to provide links for documentation of the work performed by N4C's partners and of planned events, like field tests. Each partner can have, in this page, a link for its own page, for its own activities and documentation.

The goal of this page is embedded in Web 2.0 philosophy, as it intends to be seen by visitors like a blog, where partners can add, according to the work's course, information, like bloggers do.

## **5.3 - CURRENT EVENTS**

### **5.3.1 - OBJECTIVE**

Provide visitors with the project's events to be executed in a short term.

### **5.3.2 - REQUIREMENTS**

Events can be grouped by its subject or by the location in which it will be executed.

### **5.3.3 - IMPLEMENTED SOLUTION**

This page informs visitors of the project's agenda, along with a brief description of the event, its location and date.

## **5.4 - CALENDAR**

### **5.4.1 - OBJECTIVE**

Provide visitors with information about the project's events – such as those described in the section 5.3, but with the possibility of consulting past and planned events.

### **5.4.2 - REQUIREMENTS**

Insert events in a calendar with a link. The calendar must be able to be browsable, allowing visitors to jump back and forward in the project's timeline. The link of each event must redirect visitors to a page with further information on the event.

### **5.4.3 - IMPLEMENTED SOLUTION**

In this page is presented a calendar of the current month and year, along with any event that might be scheduled. Visitors can also consult other months or years, seeing events scheduled to the dates they have requested.

For each event scheduled, there is a link that takes visitors to a page where they can be informed on the event's location, time and date, its participants, relevant deliverables, contacts and eventual notes.

## **5.5 - RSS FEEDS**

### **5.5.1 - OBJECTIVES**

Provide users another Web 2.0 service, the RSS (*RSS, 2009*), in a way that followers – those who subscribe the feeds – can read the latest news in an easy way, without having to navigate through pages searching for new contents.

### **5.5.2 - REQUIREMENTS**

The link to the wiki's feeds must be displayed in the main page, in two possible places: at the bottom of the page or in the left column, within the navigation menu.

### **5.5.3 - IMPLEMENTED SOLUTION**

The link to the RSS feeds stands in navigation menu, and it can be used with any feeds aggregator software.

## **6. N4C DTN APPLICATIONS WIKI PAGE**

### **6.1 - OVERVIEW**

#### **6.1.1 - OBJECTIVE**

Present the DTN applications in development by N4C project. Disseminate these applications capabilities and features to the potential users.

#### **6.1.2 - REQUIREMENTS**

This page should show an introduction with the presentation of all applications and subsequently a clearly and detailed description of the applications. This page should include mechanism to become the wiki more affordable to the user from the view point of the navigation (e.g. shortcuts to other pages of the wiki).

#### **6.1.3 - IMPLEMENTED SOLUTION**

In order to implement this requirement, the following steps were required:

- Add, in the actual wiki page of the N4C project, a new frame menu named “DTN Applications”;

- Add, in the DTN Applications window menu, a shortcut named “Overview” which connects to the wiki page named “N4C DTN Applications”;
- In the top of the N4C DTN Applications page is an introduction, presenting all applications in development by the N4C project;
- Below the introduction is a detailed description of the applications, each of which in a different section;
- When available, add links, within each application’s section, to the documents and to the software.

## **6.2 - DOCUMENT SHARING (INSTALLATION PROCEDURES AND USER MANUALS)**

### **6.2.1 - OBJECTIVE**

Help users handling the applications. It is important for an application’s acceptance a clearly procedure for application’s installation and a user manual.

### **6.2.2 - REQUIREMENTS**

Provide links to download the installation procedures and the user manuals for each application, in a standard format (e.g. pdf format). This page should be clear and intuitive for the general user.

### **6.2.3 - IMPLEMENTED SOLUTION**

To implement this requirement, the following steps were performed:

- Add, in the DTN Applications frame menu, a shortcut named “Documentation” that connects to the wiki page with the same name;
- When available, in the Documentation page there will be links to download the installation procedures and the user manuals of each application, in pdf format;
- The N4C DTN Applications page should have a shortcut to the Documentation page, in order to improve the accessibility of the wiki page.

## **6.3 - COMMUNITY OF PRACTICE (CoP)**

### **6.3.1 - OBJECTIVE**

Provide interaction with the community, contributing to dispel user's doubts about the DTN applications, as well as provide a place where users can report found bugs. This CoP must be integrated in the project's philosophy, so it is proposed to deploy this CoP to the public through the project's blog (N4C, Delay? What Delay?? The N4C Blog, 2009). By the use of the blog, it is proposed an interaction with the DTN community in a democratic way, due to the commenting capability of blogs. Together with this, the combination of text, images and links, the *permalinks* and RSS capabilities (Blog, 2009) turn blogs into a quite flexible option. However, it is left open to discussion the possibility of embedding the CoP in the wiki, under a forum form, if the blog turns to be somehow limited.

### **6.3.2 - REQUIREMENTS**

Deploy a blog focused in the user's doubts and bugs report about the applications. Through the categorization of pages, topics can be grouped and successive comments, or even questions, can be followed with great simplicity through the use of feeds. As an initial approach, two categories are proposed - "doubts" and "report bugs" – and also opportune links, like a link to the wiki, as a way to improve users' easiness of navigation through the web pages.

The management of the blog requires authentication, but read it or post a comment is accessible to anyone.

### **6.3.3 - IMPLEMENTED SOLUTION**

To implement this requirement, the following steps must be performed:

- Add, in the wiki, a hyperlink to the blog, designated by "Blog";
- The blog was built using the WordPress platform;
- If it becomes necessary to migrate this service to the wiki page, this operation can be done using the AWC's Forum extension available for MediaWiki (MediaWiki, 2009);
- All users will be able to post questions through the use of comments functionality;
- Posts are shown in reverse chronological order, so the latest ones can be viewed first.

## **6.4 - SOFTWARE REPOSITORY**

### **6.4.1 - OBJECTIVE**

Provide the download of DTN software applications and its updates to the community.

### 6.4.2 - REQUIREMENTS

Provide links to download the applications software and its updates for each application, in a standard compact format (e.g. zip format). This page should be clear and intuitive for the general user.

### 6.4.3 - IMPLEMENTED SOLUTION

To implement the requirement, the following steps must be performed:

- Add, in the DTN Applications frame menu, a shortcut named “Downloads” which connects to the wiki page named “DTN Applications Download”.
- When available, in the DTN Applications Download page there will be links to download the applications software and possible updates of these;
- The N4C DTN Applications page should have a shortcut to the DTN Applications Download page to improve the accessibility in the wiki page.

## 7. PLAN FOR A SUSTAINABLE WIKI

Once N4C’s project is over, it is desirable that DTN remains a subject to be discussed and used, and if possible, improved. Thinking of this, the wiki intends to be a platform that continues to exist and be useful to the population, even after the project’s conclusion.

To accomplish this, it is required that the discussion on the DTN subject continues and that the support for those who wish to use DTN applications remains active. To accomplish these requirements, there are a couple of essential factors:

- The use of a platform like the wiki allows that members can continue to update contents and submit updates for the applications, and the use of the deployed CoP for reporting bugs and doubts is a resource where people can interact in a way that contribute to people to use/develop/improve DTN-related material;
- Beyond the interaction given by the wiki, the logistic part of the question is the other concern in what comes to the wiki’s future. Nonetheless, this is the major worry of most open-source projects and can however be solved with external resources, like, for instance, publicity in the wiki – banners or adds – or even with the sponsorship of some entities, like NGOs or enterprises who which to invest and promote DTN technology as part of an expansion process for their market.

So, attending to the functionalities offered by the wiki, to some sort of logistical support and to visitors' contribution, it has all to be a sustainable product which will remain for as long as the interest for the DTN subject remains.

## 8. PROTOTYPE

According to the requirements specified in chapters 5-610, the wiki can be divided in two sections – the N4C initiatives and the DTN concepts. These two sections can be accessed through the menus on the left (Figure 2): the “navigation” menu, for the N4C initiatives, and the “DTN Applications” menu, for the DTN-related contents.

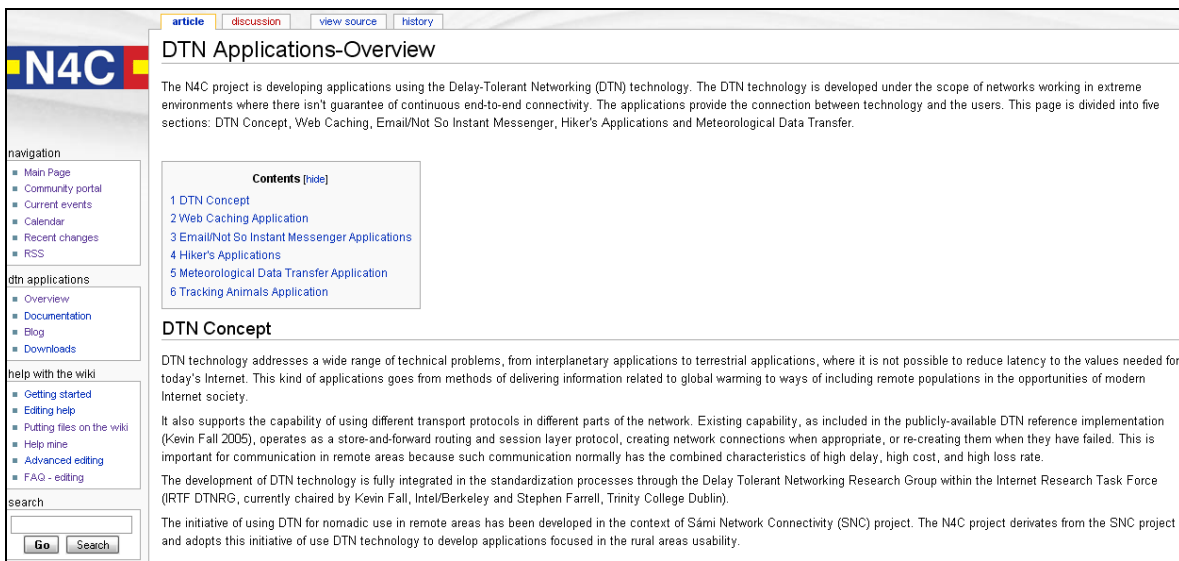


Figure 2 - Wiki's appearance

At the present time, the pages “Documentation” and “Downloads”, of the “DTN Applications” are empty, but they will be filled up as soon as documentation is written and applications become available to public.

The third link in the DTN Applications menu takes visitors to the N4C blog, which is shown in Figure 3.



Figure 3 - N4C Blog's appearance

The blog is not fully customized to the CoP, still missing the creation of proposed categories (in section 6.3.2), and then filling it with contents that can arouse interest and foster discussion between the people.

## 9. WIKI'S IMPACT

Through the treatment of the wiki's log file, using AWSTATS (Destailleur, 2008), it is possible to see the impact that this wiki is having in the world's population. First of all, as depicted in Figure 4, people from more than forty different countries accessed the wiki, only during the first 27 days of April.

Countries						
	Countries		Pages	Hits	Bandwidth	
us	United States	us	413	849	11.91 MB	
se	Sweden	se	372	882	3.65 MB	
pt	Portugal	pt	197	392	6.91 MB	
gb	Great Britain	gb	116	204	4.71 MB	
no	Norway	no	62	148	2.90 MB	
pl	Poland	pl	56	87	1.21 MB	
ie	Ireland	ie	43	129	4.32 MB	
Unknown	Unknown	unknown	39	39	1.01 MB	
jp	Japan	jp	34	55	576.09 KB	
de	Germany	de	24	68	3.11 MB	
in	India	in	21	54	1.83 MB	
ch	Switzerland	ch	20	47	327.85 KB	
cn	China	cn	13	39	640.87 KB	
ua	Ukraine	ua	6	10	67.80 KB	
ro	Romania	ro	6	6	4.92 MB	
gr	Greece	gr	6	18	900.59 KB	
pk	Pakistan	pk	6	19	128.81 KB	
fr	France	fr	5	5	853.17 KB	
au	Australia	au	5	5	228.50 KB	
ca	Canada	ca	4	4	626.10 KB	
es	Spain	es	3	3	2.70 MB	
fi	Finland	fi	3	3	1.30 MB	
it	Italy	it	3	3	564.49 KB	
kr	South Korea	kr	2	2	87.10 KB	
id	Indonesia	id	2	2	18.22 KB	
kh	Cambodia	kh	2	2	152.33 KB	
si	Slovenia	si	2	2	6.23 MB	
vn	Vietnam	vn	2	2	1.49 MB	
nl	Netherlands	nl	2	2	840.39 KB	
nz	New Zealand	nz	2	2	152.33 KB	
il	Israel	il	1	1	76.17 KB	
tr	Turkey	tr	1	1	372.86 KB	
Unknown	Unknown	rs	1	1	76.17 KB	
mx	Mexico	mx	1	1	76.17 KB	
dk	Denmark	dk	1	1	76.17 KB	
sg	Singapore	sg	1	1	76.17 KB	
sa	Saudi Arabia	sa	1	1	76.17 KB	
lt	Lithuania	lt	1	1	372.86 KB	
be	Belgium	be	1	1	368.74 KB	
cl	Chile	cl	1	1	323.24 KB	
bg	Bulgaria	bg	1	1	76.17 KB	
ar	Argentina	ar	1	1	76.17 KB	
ae	United Arab Emirates	ae	1	1	76.17 KB	
	Others		0	0	0	

Figure 4 - Wiki's Access Countries List

Also, N4C wiki is becoming more and more known, as we can see from the search engines that were displaying this wiki in results in January of the current year (Figure 5) and in during the current month (Figure 6). In only 3 months, N4C wiki got known by seven more search engines

<b>Last Update:</b> 27 Apr 2009 - 16:01		<a href="#">Awstats Web Site</a>	
<b>Reported period:</b> Jan 2009 OK			
<a href="#">Back to main page</a>			
Robots/Spiders visitors			
8 different robots			
	Hits	Bandwidth	Last visit
Googlebot	1367	60.26 MB	31 Jan 2009 - 23:40
Yahoo Slurp	115	1.08 MB	31 Jan 2009 - 22:57
Unknown robot (identified by 'robot')	31	581.91 KB	31 Jan 2009 - 04:32
MSNBot-media	24	256.22 KB	12 Jan 2009 - 06:54
MSNBot	12	45.75 KB	24 Jan 2009 - 09:14
Ask	4	13.52 KB	31 Jan 2009 - 22:53
Unknown robot (identified by 'bot' or 'bot-')	3	33.83 KB	11 Jan 2009 - 09:47
Netcraft	1	11.37 KB	07 Jan 2009 - 10:58

Figure 5 - Hits from search engines in January, 2009

<b>Last Update:</b> 27 Apr 2009 - 16:01		<a href="#">Awstats Web Site</a>	
<b>Reported period:</b> Apr 2009 OK			
<a href="#">Back to main page</a>			
Robots/Spiders visitors			
15 different robots			
	Hits	Bandwidth	Last visit
Googlebot	1114	36.67 MB	27 Apr 2009 - 15:09
MJ12bot	256	955.96 KB	07 Apr 2009 - 08:01
Unknown robot (identified by 'robot')	245	890.10 KB	25 Apr 2009 - 03:08
Yahoo Slurp	196	882.51 KB	27 Apr 2009 - 03:58
MSNBot	133	7.28 MB	27 Apr 2009 - 02:24
MSNBot-media	28	100.46 KB	24 Apr 2009 - 09:27
Ask	8	2.50 MB	22 Apr 2009 - 20:44
Nutch	7	25.67 KB	09 Apr 2009 - 21:03
Unknown robot (identified by 'spider')	5	84.07 KB	02 Apr 2009 - 00:13
MSIECrawler	2	20.25 KB	07 Apr 2009 - 00:02
Microsoft URL Control	1	629.69 KB	02 Apr 2009 - 21:54
Alexa (IA Archiver)	1	20.83 KB	24 Apr 2009 - 05:39
GigaBot	1	11.48 KB	10 Apr 2009 - 10:25
Netcraft	1	11.48 KB	09 Apr 2009 - 04:28
Unknown robot (identified by 'crawl')	1	11.48 KB	22 Apr 2009 - 06:02

\* Robots shown here gave hits or traffic "not viewed" by visitors, so they are not included in other charts.

Figure 6 - Hits from search engines in April, 2009

## 10. CONCLUSIONS

Although being notorious that the N4C project is already arousing people’s interest, the development of new tools will contribute to a great participation of people in the DTN subject, which is, after all, the great objective: contribute to the sustainability of the wiki, and therefore, the project and its subjects. Together with this, it is intrinsically associated the dissemination of the knowledge obtained with this project and, consequently, improvements on the DTN technology.

Also, the use of Web 2.0 services, like the wiki, the blog and their feeds, allows partners to have constant updated information in a quite simple way, which can contribute to a better coordination between developers of different work packages, and consequentially, to a better flow of the work.

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