M8.1
Summer 1
interconnected tests report

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MEIS
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ABSTRACT

The purpose of the document is documentation of first summer tests performed in Sweden and in Slovenia.

The document includes:

- Organisational description,
- Technical description,
- Recommendations for further developments.

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Dissemination level

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First summer tests – milestone report

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0. INTRODUCTION

Aim of the first summer tests was to try and check the legacy hardware and software from the previous test. During the test time people involved in this project has a chance to get to know with the current hardware and software solutions, including all the practical problems with it. 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. Tests in Slovenia were done in more controlled environment focusing on actual routing through the DTN and ProPHET platform.
1. **DESCRIPTION OF USED DTN TOPOLOGIES**

a) **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.

<table>
<thead>
<tr>
<th>Node name</th>
<th>Architecture</th>
<th>OS</th>
<th>NSMI service</th>
<th>DTN service</th>
<th>Webcam</th>
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</thead>
<tbody>
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<td>Yes</td>
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</table>

*Table 1: Node's services description table 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 has a DTN file transfer service transport.
<table>
<thead>
<tr>
<th>Node name</th>
<th>Wireless client device</th>
<th>Driver</th>
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<td>Intel Windows driver</td>
<td>Ad-Hoc</td>
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<td>Intel Windows driver</td>
<td>Ad-Hoc</td>
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<td>Linux Ndiswrapper with Asus's driver</td>
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<td>Asus WL-167g</td>
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<td>Pop4</td>
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<td>Intel Windows driver</td>
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<td>Linux Ndiswrapper with Asus's driver</td>
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<td>Solonote</td>
<td>Asus WL-167g</td>
<td>Linux Ndiswrapper with Asus's driver</td>
<td>Ad-Hoc</td>
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Table 2: Used wireless adapters in Slovenia

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<tr>
<td>Krokodilcek</td>
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<td>Bmzjcek</td>
<td>24</td>
<td>192.168.2.24</td>
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<td>13</td>
<td>192.168.2.13</td>
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<td>22</td>
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<td>Pop3</td>
<td>26</td>
<td>192.168.2.26</td>
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<td>Bart</td>
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<td>Pop4</td>
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<td>Solonote</td>
<td>21</td>
<td>192.168.2.21</td>
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</tbody>
</table>

Table 3: Node's Id and IP used during testing in Slovenia
Figure 1: Typical view from WEBCAM node located in Veliki Ločnik.

Figure 2: Typical view from BART node located in Nožice.
b) 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.

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 Fyskflyg'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 Ritstem and Staloluokta. Staloluokta is a small Sami village located approximately 60km 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.
<table>
<thead>
<tr>
<th>Node name</th>
<th>Architecture</th>
<th>OS</th>
<th>NSMI service</th>
<th>DTN service</th>
<th>Webcaching service</th>
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<td>Imedia Linux</td>
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<td>Imedia Linux</td>
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<td>Yes</td>
<td>Yes</td>
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<td>Hotspot6</td>
<td>x86</td>
<td>Imedia Linux</td>
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<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Table 4: Node’s services description table 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).
<table>
<thead>
<tr>
<th>Node name</th>
<th>Wireless client device</th>
<th>Driver</th>
<th>Mode</th>
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<tbody>
<tr>
<td>GW1</td>
<td>Intel Wireless</td>
<td>Linux driver</td>
<td>Ad-Hoc</td>
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<td>Hotspot1</td>
<td>Wistron CM9 Atheros</td>
<td>Linux Atheros driver</td>
<td>Ad-Hoc</td>
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<td>Hotspot2</td>
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<td>Linux Atheros driver</td>
<td>Ad-Hoc</td>
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<tr>
<td>Hotspot6</td>
<td>Wistron CM9 Atheros</td>
<td>Linux Atheros driver</td>
<td>Ad-Hoc</td>
</tr>
</tbody>
</table>

Table 5: Used wireless adapters in Sweden

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

<table>
<thead>
<tr>
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<th>Node Id</th>
<th>Node IP</th>
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<tbody>
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Table 6: Node's Id and IP used during testing in Sweden
2. DESCRIPTION OF SUMMER TESTS IN 2008

a) Tests in Slovenia

DTN Summer 1 test has been organized to test the connections between all nodes involved in preliminary test bed coded Medo-Net. It has been performed in summer 2008 between the 28th July 2008 and 11th August 2008.

As mentioned before Slovenian part of the test was focused mainly on routing through the ProPHET network. Traffic was generated using two web cams located on the separated endpoints of the network. They were capturing live images every hour and sending those images over the delay tolerant network to the other nodes. Beside web cam images the so called “Not So Instant Messaging” service was used for the communicating between the people involved in this test.

In the following tables items are listed that were transferred from each node. Each row of the table describes from-to relation and items that have been transferred.

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</tr>
<tr>
<td>KROKODILCEK</td>
<td>WEBCAM</td>
<td>NSIM</td>
</tr>
<tr>
<td>KROKODILCEK</td>
<td>BART</td>
<td>NSIM</td>
</tr>
<tr>
<td>KROKODILCEK</td>
<td>LISA</td>
<td>NSIM</td>
</tr>
<tr>
<td>KROKODILCEK</td>
<td>DPOP3</td>
<td>NSIM</td>
</tr>
<tr>
<td>KROKODILCEK</td>
<td>DPOP4</td>
<td>NSIM</td>
</tr>
<tr>
<td>KROKODILCEK</td>
<td>BMZJCEK</td>
<td>NSIM</td>
</tr>
<tr>
<td>KROKODILCEK</td>
<td>MAGGIE</td>
<td>NSIM</td>
</tr>
<tr>
<td>KROKODILCEK</td>
<td>SOLONOTE</td>
<td>NSIM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE NODE</th>
<th>DESTINATION NODE</th>
<th>TRANSFERRED ITEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMZJCEK</td>
<td>GRABLA</td>
<td>NSIM</td>
</tr>
<tr>
<td>BMZJCEK</td>
<td>WEBCAM</td>
<td>NSIM</td>
</tr>
<tr>
<td>BMZJCEK</td>
<td>BART</td>
<td>NSIM</td>
</tr>
<tr>
<td>BMZJCEK</td>
<td>LISA</td>
<td>NSIM</td>
</tr>
<tr>
<td>BMZJCEK</td>
<td>DPOP3</td>
<td>NSIM</td>
</tr>
<tr>
<td>BMZJCEK</td>
<td>DPOP4</td>
<td>NSIM</td>
</tr>
<tr>
<td>BMZJCEK</td>
<td>MAGGIE</td>
<td>NSIM</td>
</tr>
<tr>
<td>BMZJCEK</td>
<td>KROKODILCEK</td>
<td>NSIM</td>
</tr>
<tr>
<td>BMZJCEK</td>
<td>SOLONOTE</td>
<td>NSIM</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>SOURCE NODE</th>
<th>DESTINATION NODE</th>
<th>TRANSFERRED ITEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRABLA</td>
<td>MAGGIE</td>
<td>NSIM</td>
</tr>
<tr>
<td>GRABLA</td>
<td>WEBCAM</td>
<td>NSIM</td>
</tr>
<tr>
<td>GRABLA</td>
<td>BART</td>
<td>NSIM</td>
</tr>
<tr>
<td>GRABLA</td>
<td>LISA</td>
<td>NSIM</td>
</tr>
<tr>
<td>GRABLA</td>
<td>DPOP3</td>
<td>NSIM</td>
</tr>
<tr>
<td>GRABLA</td>
<td>DPOP4</td>
<td>NSIM</td>
</tr>
<tr>
<td>GRABLA</td>
<td>BMZJCEK</td>
<td>NSIM</td>
</tr>
<tr>
<td>GRABLA</td>
<td>KROKODILCEK</td>
<td>NSIM</td>
</tr>
<tr>
<td>GRABLA</td>
<td>SOLONOTE</td>
<td>NSIM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOURCE NODE</th>
<th>DESTINATION NODE</th>
<th>TRANSFERRED ITEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOLONOTE</td>
<td>GRABLA</td>
<td>NSIM</td>
</tr>
<tr>
<td>SOLONOTE</td>
<td>WEBCAM</td>
<td>NSIM</td>
</tr>
</tbody>
</table>
The following table represents the connections where it is described which node had met other nodes.

<table>
<thead>
<tr>
<th>NODE</th>
<th>MET NODES</th>
</tr>
</thead>
<tbody>
<tr>
<td>BART</td>
<td>GRABLA, SOLONOTE</td>
</tr>
<tr>
<td>LISA</td>
<td>DPOP3, DPOP4</td>
</tr>
<tr>
<td>MAGGIE</td>
<td>GRABLA, SOLONOTE, KROKODILCEK, DPOP3, DPOP4, BMZJCEK</td>
</tr>
<tr>
<td>WEBCAM</td>
<td>SOLONOTE, KROKODILCEK</td>
</tr>
<tr>
<td>GRABLA</td>
<td>BART, SOLONOTE, DPOP3, DPOP4, MAGGIE, KROKODILCEK,</td>
</tr>
<tr>
<td>DPOP3</td>
<td>GRABLA, MAGGIE, KROKODILCEK, DPOP4, LISA, SOLONOTE</td>
</tr>
<tr>
<td>DPOP4</td>
<td>GRABLA, MAGGIE, KROKODILCEK, DPOP3, LISA, SOLONOTE</td>
</tr>
<tr>
<td>KROKODILCEK</td>
<td>GRABLA, MAGGIE, DPOP4, DPOP3, SOLONOTE, LISA</td>
</tr>
<tr>
<td>BMZJCEK</td>
<td>MAGGIE</td>
</tr>
</tbody>
</table>
Figure 4: Image collage from Slovenian test side
The following table represents the number of received NSIM-s within each node and detailed statistics. Detailed statistics shows how many NSIM-s has been sent from certain node and how many has been delivered (SENT/DELIVERED). The obtained statistics show that NSIM transfer proved to be very reliable because none of the sent NSIM-s has been lost.

<table>
<thead>
<tr>
<th>NODE</th>
<th>NUMBER OF RECEIVED NSIM</th>
<th>DETAILED STATISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BART</td>
<td>11</td>
<td>DPOP3 (1/1), GRABLA (1/1), BMZJCEK (3/3), WEBCAM (5/5), MAGGIE (1/1)</td>
</tr>
<tr>
<td>LISA</td>
<td>15</td>
<td>GRABLA (2/2), BMZJCEK (3/3), BART (4/4), DPOP4 (1/1), WEBCAM (4/4), MAGGIE (1/1)</td>
</tr>
<tr>
<td>MAGGIE</td>
<td>34</td>
<td>DPOP3 (13/13), DPOP4 (5/5), BMZJCEK (7/7), BART (4/4), KROKODILCEK (2/2), LISA (1/1), GRABLA (2/2)</td>
</tr>
<tr>
<td>WEBCAM</td>
<td>16</td>
<td>BMZJCEK (4/4), DPOP4 (2/2), DPOP3 (5/5), GRABLA (1/1), KROKODILCEK (2/2), BART (2/2)</td>
</tr>
<tr>
<td>GRABLA</td>
<td>22</td>
<td>BART (5/5), LISA (2/2), DPOP4 (4/4), DPOP3 (3/3), BMZJCEK (6/6), MAGGIE (1/1), SOLONOTE (1/1)</td>
</tr>
<tr>
<td>DPOP3</td>
<td>10</td>
<td>GRABLA (5/5), BMZJCEK (3/3), DPOP4 (1/1), KROKODILCEK (1/1)</td>
</tr>
<tr>
<td>DPOP4</td>
<td>16</td>
<td>GRABLA (4/4), MAGGIE (2/2), BMZJCEK (5/5), BART (3/3), WEBCAM (2/2)</td>
</tr>
<tr>
<td>KROKODILCEK</td>
<td>28</td>
<td>MAGGIE (4/4), GRABLA (2/2), DPOP3 (8/8), DPOP4 (3/3), BMZJCEK (6/6), WEBCAM (5/5), BART (2/2)</td>
</tr>
<tr>
<td>BMZJCEK</td>
<td>20</td>
<td>DPOP3 (9/9), WEBCAM (5/5), GRABLA (2/2), MAGGIE (3/3), LISA (1/1)</td>
</tr>
<tr>
<td>SOLONOTE</td>
<td>5</td>
<td>DPOP4 (2/2), GRABLA (2/2), BART (1/1)</td>
</tr>
</tbody>
</table>

The following table represents the number of received webcam pictures within each node and some statistics with comments. From each node was expected to send 336 pictures in 2 weeks (1 picture for each 1 hour). There were some problems with scripts used to pass the pictures to DTN reference implementation and also with DTN reference implementation. Detailed description of problems that occurred is given in comments for each node. In the table only Linux nodes are listed which were able to generate and received picture. The reason is that DTN reference implementation has been developed only for Linux operation system.

<table>
<thead>
<tr>
<th>NODE</th>
<th>NUMBER OF RECEIVED WEBCAM PICTURES</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BART</td>
<td>38</td>
<td>38 pictures has been delivered from WEBCAM node,</td>
</tr>
</tbody>
</table>
the WEBCAM node has some problems with scripts to pass the pictures to the DTN reference implementation, the problem was diagnosed and solved very late at last days of testing, the number of send different pictures was very low, that is also the reason for low number of received pictures.

<table>
<thead>
<tr>
<th>Node</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEBCAM</td>
<td>112</td>
</tr>
<tr>
<td>LISA</td>
<td>200</td>
</tr>
<tr>
<td>MAGGIE</td>
<td>235</td>
</tr>
</tbody>
</table>

112 pictures has been delivered from BART node, relatively low number of received pictures was caused at the beginning the script that was not passing the pictures to DTN reference implementation, and at the end of testing some problems with DTN reference implementation occurred where database “crashed”. Due to this “crash” many bundles were lost and some node did not receive some pictures. This is also the reason why different nodes received different number of pictures from BART node.

24 pictures has been delivered from WEBCAM node and 176 from BART node, for WEBCAM node see comments from BART, and for BART node see comments from WEBCAM

43 pictures has been delivered from WEBCAM node and 192 from BART node, for WEBCAM node see comments from BART, and for BART node see comments from WEBCAM

**List of unexpected events during testing time in Slovenia:**

- DTN interface implementation “crashed” on 9th of August (last day of testing) on node “Bart”. The reason was too full database of bundles from webcam. The database had been recovered by restore process where most of bundles were lost. Some picture from node “Webcam” had been lost.

- On the node “Webcam” the script was not configured correctly, so the node has emitted one and the same picture every five minutes to three nodes: “Maggie”, “Bart” and “Lisa”. This process generated large number of bundles that had been traveling across “Medo-Net” DTN. Until the problem was detected and eliminated approximately 3000 bundles had been emitted. This large number of bundles produced some problems that are described in detail conclusions and recommendations.

**b) Tests in Sweden**

Tests in Sweden involved local community and tourists. First week has been performed in summer 2008 between the 4th August 2008 and 8th August 2008. The second week has been performed in summer 2008 between the 11th August 2008 and 15th August 2008.

This year’s test were performed with the same configurations as the previous SNC tests but with a new version of PRoPHET. Because we were testing with a new version of the software we took the decision to start first week of testing in Saltoluokta so that we easier could solve any upcoming problems (closer to electricity, telephones and internet).
Second week of testing was located in Staloluokta which is located further up in the mountains in a road less area. All the used equipment were powered and charged only by using two 80W solar panels and three 12V 80A/h solar batteries.

Users were able to send and receive emails and check few cached web pages that were predefined for web caching on gateway, on three Nokia's PDAs. There was also a chance to use any other computer with the WIFI network adapter set to ProPHET Ad-Hoc network. During the second week we were also able to remotely (from the test field) update our test blog on the Internet. Blog can be viewed on page: http://staloluokta.grasic.net
Figure 5: Image collage from Swedish test site
List of unexpected events during testing time in Sweden:

- Relaying WRAP located on the top of the mountain weren't able to connect to the passing by helicopters because of limited WIFI range.

- NMT modem that we were using for an Internet connection on Gateway stop responding twice because of unknown reason. After flying back to helicopter base in Ristem and manual restart it worked again.

- Our email server and IP was blacklisted, so may of the emails were rejected or marked as spam on some mail servers. This was one of the biggest problems because we were practically unable to send out any email or post to our blog during that time.

- Some smaller logistical problems with the missed equipment. One missed UTP cable, small charger or tool can cause lots of troubles in such remote area.
3. CONCLUSIONS AND RECOMMENDATIONS

a) From Slovenian tests

The main idea behind this test has been to train the technical and application teams of MEIS. During the training both teams acquired knowledge and applications inherited from SNC project.

During the test time large amount of log files were collected and stored. In depth analysis of those log files will be done before next tests. Gathered results should give us a good enough routing evaluation and ideas how to improve protocol. High traffic load, lots of node encounters and many active nodes are welcome for this type of evaluation.

Some new valuable experiences have been obtained during the test:

- Prophet user interface has been very well adapted for simple users and advanced users. Configuration file is relatively simple to configure because it includes relatively good comments on specific setting. In some cases some additional comments would be very practical.

- The ad-hoc network drivers for some wireless network adapters are not functioning according to standard. Sometimes it was impossible to make connections between some nodes. A lot of effort has been invested to diagnose the problems. Usually the problem was solved by activating nodes in specific order (i.e. node Maggie had to be activated before node Grabla, so that the Maggie could taken charge of ad-hoc connection to Grabla).

- When a database of bundles increased beyond 10% of available resource, the initialization of prophet became very slow. The user interface was not responding during the initialization. It was also responding slowly during the data transfers between the nodes when the number of bundles to be exchanged was relatively high.

- DTN reference implementation has several very serious deficiencies.

- DTN reference implementation is not developed as cross-platform application and it can be used only on Linux operating system.

- DTN reference implementation database “crashes” when the number of bundles exceeds certain level. Database restore is needed where all bundles are lost. This is very serious deficiency.

- Communication between the Prophet and DTN reference implementation is very unreliable. Very often DTN reference implementation service stopped responding. The problem had been solved only by resetting the service. This is again very serious deficiency.

There are some suggestions and recommendation for developers from technical and application teams:

- In the modern global network cross-platform applications have great advantage. For successful communication between a varieties of computers on the global network using cross-platform application is very important. A great number of different operating systems exists and none of
them is dominant. The situation will probably continue in the future, so development of cross-platform DTN reference implementation or it’s successor with the same properties is needed.

- The database of bundles in Prophet should be upgraded. The best solution would be to improve the existing database. The existing database is based on the simple system where each bundle is stored as file in file system. Some additional indexing should be added to improve the initialization performances, because standard search of files in one directory can become very slow in the case of large number of files. Large number of files in one directory can also have negative effects on the performances of the operating system. It is recommended to store bundles from (or for) each node in separate directory to improve the access time to the bundle. Rearranging the bundle database would also improve the overview of the application for system administrators and for analyzing purposes.

- A database of network adapters and their drivers should be made. The database should consists of adapters that properly support ad-hoc mode. In future that would eliminate a lot of problems with connections and would also improve the number of successfully delivered bundles.

- It is suggested that a Prophet should be also able to transfer files not only NSIM-s. The files could be gathered by Prophet from predefined directory where a subdirectory with the destination node would exists. The files from this directory would be transferred by Prophet Protocol to destination node where they would appear in certain predefined sub-directory. This sub-directory would be named by name of the source node.

- Some minor modifications of Prophet user interface are also suggested. The application should be made multi-threaded to eliminate the “freeze” of user interface when some relatively time consuming operations occur (i.e. updating the bundle database, exchange of large bundles). Current status of communication should be made clearer. The progress bar that shows the current status of transferred data should be refreshed faster. The possibility to sort NSIM messages by source node should be added.

- It is also suggested to add a special TRACEROUTE bundle to Prophet protocol to trace the most probable route of bundles from selected source and destination node. With this TRACEROUTE bundle also approximate time for delivery could be estimated. The bundle would go from source node through different nodes to destination node. When the destination node would be reached it would return to the source node. During the path in the content of the bundle would be added information about passing different nodes.

- It is suggested to improve the time synchronizations of the nodes clocks. So far from the log files cannot be determined how the bundles travel through DTN if clocks of the nodes are not synchronized. The problem could be solved by using some predefined TIMESYNC bundle that would travel through the DTN from certain time reference node.

b) From Swedish tests

Suggestions and recommendation for developers technicians for next test:

- Install UPS on the gateway side.

- Have a person on the internet side of the world to perform short daily checks on gateway.
- Teach the persons (Fiskflyg staff) who have an access to the gateway how to restart it (pull out and in the power plug).

- Install the wraps in the every available helicopter (we can not count on pilots to take care of that before the flight).

- Buy a high gain (21dB) slot antennas for the helicopters wraps and hotspots.

- Test the vertical and horizontal range of the slotted antennas with the helicopter. While doing that we should also check which polarisation works best (how to turn antennas).

- During the test preparation all the equipment should be available at one place and tested. If possible including the equipment for the internet connection which will be used later on. Everything should be packed and ready at least one week before test starts.

- Prepare a check list of the used equipment and the running services which will be later used. Use it before going to the testing field.

- Take care of the mail server in the gateway. Check the exim mail server configuration.

- Obtain the static (and clean) IP for the NMT modem if possible.

- Equipment in the helicopters should be mounted using a strong holders and screws should be glued (I think that this is a standard in aviation). Constant strong vibrations can make things to fall apart. We should also add some very sensitive fuses on helicopters power supply. We really don't want to blow some helicopter's fuses when they are in the air.

- Every operation that is done using the costly helicopters should be planned and prepared in advance. The whole group should go through the whole procedure before flight and prepare all the necessary equipment.

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Suggestions and recommendation for developer’s technicians for next test:

- Change the way of using the mail services. We shouldn't be using our own mail server any more. New mail service solution should be using the client's own mail servers. The gateway should work as a POP3 and SMTP client, which fetch and send the emails from the clients everyday mail account. Later on the mail is delivered to the hotspots where the client will be located. For the guest who will just want to send email a guest account should be prepared on some of the free mail accounts servers. If we want to use this approach, the users account information should be encrypted (same with the actual mail).

- As seen in the WRAP's technical specifications the lowest temperature that WRAPs should be used is 0 degree Celsius. Probably they will run below that temperature but we can not be sure about that. We should be aware of this problem when buying new equipment.

- The wraps in the helicopters are switched on and off on almost every flight. Right now there is no backup power supply in the wraps so the power is cut off without any signal to OS to shut down the system. We can therefore expect some problems with corrupted files in the future.
- Design a simplified system (without any hacks) which can be later on easily used and maintained by the people in the "third world" countries.
4. ACCESSIBILITY OF USED CODE AND LOG FILES

The ProPHET protocol source code is publicly available on Subversion repository located on: http://grasic.net/prophet

It can be easily downloaded and stored using one of the Subversion's client programs. Use the “checkout” command to download the latest version. For further information how to use Subversion repositories go to: http://subversion.tigris.org/

The code can be also seen using only the web browser on address: http://grasic.net/prophet/

All the gathered log files from both test sites were stored on Subversion repository located on: http://grasic.net/logfiles

The log files are not publicly available because some of the log files contains used email addresses that users were sending emails to. For access to log files contact WP8 leader (for username and password).

The log files can be also seen using only the web browser (using user name and password) on address: http://grasic.net/logfiles/  [username: _______ password: ______]

The log files will be created separately for each day and type of event. From the in depth analysis of the log files will be later on possible to extract all the node encounters, encountering duration, route of each bundle inside the network, size and type of the bundle, deliverable probability of each node, transferred data size, node's system startup and shutdown time, etc.. Log files will be collected at the end of each test and will be stored in a following folder structure for all tests:

/country/year/season/period/node_name/log_type...

Description of folder names:

country] “SI” for Slovenia, “SE” for Sweden,

[year “year” of the test,

[season] “Summer” or “Winter” test time,

[period] if the test location or the node's topology was changed during testing season the logs should be stored in separated folders e.g. “W1”,”W2”,...

[node_name] node name used in DTN network

[log_type] e.g. “log”PRoPHET logs, “list” for list of messages, “dtn” for DTN logs, etc,...