

# Bytewalla IV

## Implementation of Delay Tolerant Networks on the Android platform

### Thesis Plan - Draft

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## Revision History

Version	Date	Remarks
Draft	2011-02-21	Document creation.



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## Abbreviations used in this document

Abbreviation	Description
NordSecMob	Master's Programme in Security and Mobile Computing
KTH	Kungliga Tekniska Högskola
NTNU	Norwegian University of Science and Technology
DTN	Delay-Tolerant Network
PRoPHET	Probabilistic Routing Protocol using History of Encounters and Transitivity
SSA	Sentinel Surveillance Application



## Introduction

### Background

Nowadays and in many developed countries such as Sweden, Internet is omnipresent and plays a major role in the economy, people social life, research and other areas. More generally, it allows everyone to deliver and to get access to information.

However, there are still places or situations where access to Internet is extremely challenging. For instance, some rural parts of Africa have low levels of access to Internet [1]. This is mainly due to several obstacles including poor infrastructure and high costs of Internet services. Also there are situations where Internet suddenly becomes hardly available. For example, natural disaster governments firewall.

Hence, aiming to bring solutions for these situations, KTH started the development of Bytewalla. Bytewalla has already been through three iterations including two team projects and one Master's Thesis.

Bytewalla is based on Delay-Tolerant Networking (DTN). The Delay Tolerant Networking Research Group is 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"[2]. There are several implementations based on this research, but Bytewalla was the first to implement it on an Android platform.

While Bytewalla 1 started the implementation on Android [3], and Bytewalla 2 focused on the security issues [4], Bytewalla 3 enhanced the implementation and developed an email application on top of the DTN protocol [5]. People can now send emails within bundles which are carried by mules from the village to the city as shown in figure 1.

In addition, another application named Sentinel Surveillance Application was built for the healthcare system. Doctors can manage and contact patients thanks to Bytewalla.

These two applications stand as proofs-of-concept.



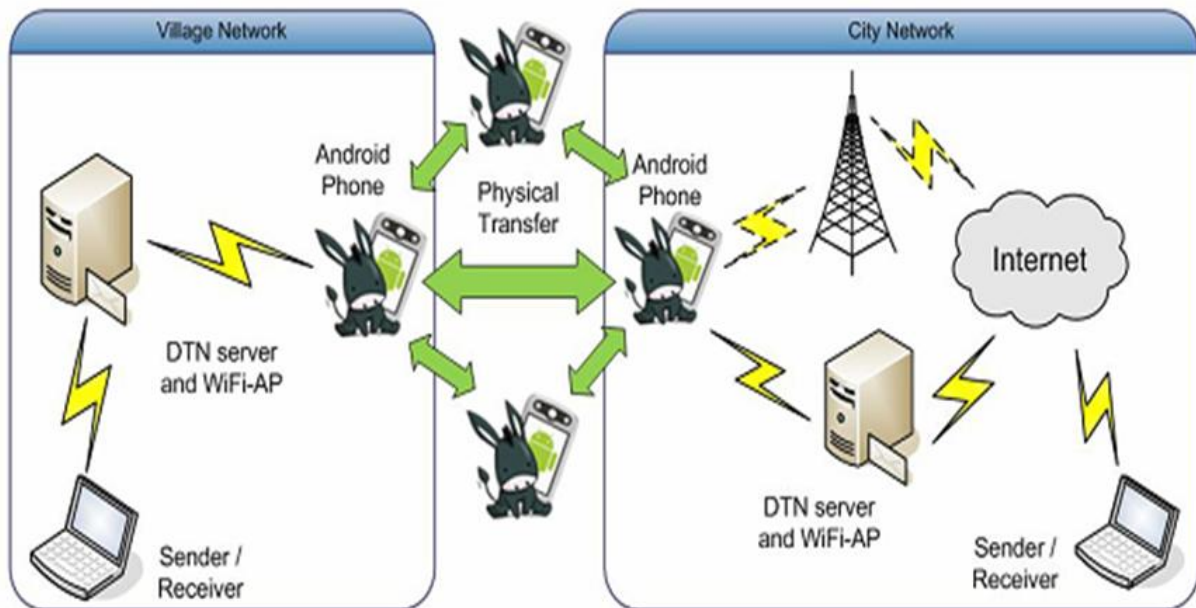


Figure 1

## Motivation

Despite all the work which has already been done on Bytewalla, there is still room for improvement.

For example, as of this stage, the implementation of the Bundle Protocol does not support acknowledgement. The senders are not able to know whether their bundles have been delivered, were lost or still on the way. This feature, however, is well defined in the Bundle Protocol Specification.

Also, it is unsure whether all the functionalities were fully implemented yet. This should be verified and if needed, completed, in order to get a robust base system. For instance, the bundle queuing mechanism as defined in the PROPHET Specification.

Besides this, Bytewalla should get even easier to setup, use and to build application on before we can hope for usage growth.

## Goals

### Overarching goals

One of the overarching goals of this thesis is to make the base system robust by verifying, solving and completing the existing implementation, following the DTN/Bundle/PROPHET specifications. The Android application should also be customized for a recent version of the Android platform.

The other one is to investigate how Bytewalla can be made easier to setup/use, and how it could be used in real-world situations.

### Approach

As this thesis aims to enhance Bytewalla 3, the first phase will consist of studying the current system along with DTN, bundle protocol and PROPHET. During this phase, the system will be tested in regards of Bytewalla's 3 objectives. Issues will be reported. Also, new enhancements should be proposed out of the investigations.

Then, will come the implementation part. Issues reported before and new functionalities will be implemented during this period. This period will be followed by an analysis of the results of the thesis.

In order to keep supervisors aware of the progress, documents will all be available on the thesis website. Interim progress report will be published by mid-March.

### Measurable objectives

- Verification report of Bytewalla 3
  - Investigate what is working properly, for instances:
    - Dynamic address allocation
    - Switchover between WiFi/GPRS
    - PROPHET implementation
    - Ad-hoc phone connectivity
    - Automatic neighbors discovery
    - Management tools
    - Sentinel Surveillance Application (SSA)
  - Description of possible enhancements:
    - Improvements of incomplete functionalities
    - New functionalities
    - Usability (easy to setup and use)
    - If time allows: define a new application running over Bytewalla
- Bytewalla running on Android 2.1
- Implementation according to the verification report.

For example, some functionalities which are probably missing or incomplete:

  - Bundle Status Reports (acknowledgment)
  - Bundle priority and queuing mechanism



## Deliverables

### Generic Deliverables

- Thesis Plan
- Master's Thesis Project Website
- Interim Progress Report
- Final Thesis Presentation
- Final Thesis Report

### Master's Thesis Project Specific Deliverables

- Verification Report of Bytewalla 3
- Source code





## Resources

### Space

One room containing the hardware is allocated for this thesis, in 8<sup>th</sup> floor, Forum.

### Equipment

#### Android Phones

To transmit bundles to their destination, two phones are needed. However, to work with PROPHET and the priority mechanisms, three phones are recommended.

As we want to customize the application to the last version of the Android system, the phones should be on Android 2.1 or more recent.

#### Servers

Two servers are required. One for the village network and the other one for the city network.

The two servers which were used by Bytewalla 3 will be used as well as part on this thesis.

Here is their configuration as given by Bytewalla 3 [6]:

Specification	Requirements
CPU	2.26-GH Core Duo p8400
Hard Disk	300 GB or more
Network Interface	Wi-Fi compatible with IEEE802.11 b/g

#### Wi-Fi Access Points

Three access points are required. One for the village network, another one for the city network, and the third one to setup the intermediate network for Android phones.

However, Bytewalla 3 managed to work with only 2 access points. If required and possible we will continue this way.



## Time Plan

Weeks	Activity Breakdown	Deliverable
1-2	<ul style="list-style-type: none"><li>• Review of previous Bytewalla projects.</li><li>• Literature Study: DTN, Bundle Protocol, PROPHET etc.</li><li>• Thesis topic definition.</li></ul>	<ul style="list-style-type: none"><li>• Thesis plan</li><li>• Thesis Website</li></ul>
3-5	<ul style="list-style-type: none"><li>• Testing and verifying Bytewalla system.</li><li>• Continue literature study.</li></ul>	<ul style="list-style-type: none"><li>• Bytewalla verification report</li><li>• New objectives / Updated thesis plan</li></ul>
6	<ul style="list-style-type: none"><li>• Customize the Android application to a recent version of the Android platform</li><li>• Progress report</li></ul>	<ul style="list-style-type: none"><li>• Application for Android 2.1</li><li>• NordSecMob Progress Report (Mid-March)</li></ul>
7-15	<ul style="list-style-type: none"><li>• Enhancement and implementation according to verification report.</li></ul>	Source code
16-18	<ul style="list-style-type: none"><li>• Implementation analysis and Conclusion</li></ul>	Final thesis draft
19-20	<ul style="list-style-type: none"><li>• Thesis final version</li></ul>	<ul style="list-style-type: none"><li>• Printed version of approved final thesis</li><li>• Thesis presentation</li></ul>



## Contact Information

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## References

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- [2] DTNRG, <http://www.dtnrg.org/wiki>, Last visited – Feb 21st, 2011
- [3] “Bytewalla 1: Final Report”, [http://www.tslab.ssvl.kth.se/csd/projects/092106/sites/default/files/Bytewalla\\_Final\\_Report\\_v1.0.pdf](http://www.tslab.ssvl.kth.se/csd/projects/092106/sites/default/files/Bytewalla_Final_Report_v1.0.pdf), Last visited – Feb 21st, 2011
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- [6] “Bytewalla 3: Project Plan”, [http://www.online.kth.se/csd/projects/1031352/sites/default/files/Project\\_Planv2.0.pdf](http://www.online.kth.se/csd/projects/1031352/sites/default/files/Project_Planv2.0.pdf), Last visited – Feb 21st, 2011



## Resume

### MICHEL HOGNERUD

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#### OBJECTIVE

Any position as software engineer. Preferably related to web, mobile or network.

#### EDUCATION / INTERNATIONAL EXPERIENCE

<b>Master's Programme in Security and Mobile Computing (NordSecMob)</b>	Royal Institute of Technology Stockholm, Sweden	August 2010-June 2011
	Norwegian University of Science and Technology Trondheim, Norway	August 2009-August 2010
<b>Exchange Student</b>	University of Iowa Iowa City, USA	August 2008-May 2009
<b>Bachelor in Computer Science</b>	University de Franche-Comté Besançon, France	August 2006-June 2008

#### PROFESSIONAL EXPERIENCE

<b>Master's Thesis</b>	Royal Institute of Technology Stockholm, Sweden	February 2011-June 2011
Implementation of Delay Tolerant Networks on the Android platform.		
<b>Technical Manager</b>	Royal Institute of Technology Stockholm, Sweden	August 2010-January 2011
Developing an "instant-talk" (VoIP) application on the Android platform, with a team of 8 people. Project includes: defining specifications, product development, communication around the project and validation from the project owner. More details at <a href="http://nebula.hognerud.net">http://nebula.hognerud.net</a> From February 2011: Continuation of the project with subset of original team for a Swedish start-up.		
<b>Freelance</b>	Independant Telecommuting	July 2007-January 2008 And March 2010-...
Subcontracting for Web-Agencies. Developing a new project for small businesses (to be released).		
<b>Research Assistant</b>	University of Iowa Iowa City, USA	January 2009-May 2009
Contributed to a project whose goal was to automate the detection of malicious script using malicious scripts features. My objective was to automate samples recolling, filtering, and analysis with Weka (Weka is a collection of machine learning algorithms for data mining tasks).		

#### SKILLS SUMMARY

**Coding:** Java, Python, C(++)  
**Web Techs:** PHP, (X)HTML, XML, CSS, Web Services, Web Semantics  
**Database:** SQL, MySQL  
**Engineering/Project:** Scrum, GIT, SVN, SDL, UML, ASN-1, ProcessAlgebra, Design Patterns  
**Network:** DHCP, MPLS, TCP/IP, DNS, RIP, OSPF, BGP, NAT, SNMP  
**Security:** Web App. Security, Software Security, Fuzzing, Viruses/Rootkits, Cryptography  
**System:** Windows, Android, Linux  
**Language:** English (Fluent), French (Native), Norwegian/Swedish (Beginner)

