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ByteWalla: Delay Tolerant Networks on Android phones

Project Plan

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Table of Contents

Document History

Version	Description	Date	Changes made
5.0	Updated according to need	2009-10-05	• Made change in Project specific, Milestones and Gannt chart
4.0	Updated version according to feedback	2009-09-17	• Reformating CV • Correct several mistakes in the article • Made change in reference
3.0	Updated version according to feedback	2009-09-11	• Second overarching goals rewritten • Document history added • Previous works discussion and MIME type as payload added to Introduction Section • Overall architecture figure and description added to Measurable objectives section • Research paper and DTN2 implementation porting added to a Unique contribution section • Missing deliverables, organization of the deliverables and brief description of each deliverable added to the deliverable section • The iteration process figure improved • Human, space, hardware resources specified in more detail in Resource section • Business approach added to Approach section • Testing tools for the Android platform added to Approach section • Each member CV's format unified and irrelevant information removed • References properly changed according to newly added contents • Preliminary organization added to Organization section • First and second work package group together • Gantt chart regenerated • Stakeholder Analysis section improved
2.0	Final version for the first week	2009-09-04	• Summary rewritten • Introduction rewritten • Work packages discussed and defined • Individual responsibility matrix discussed and defined • Each member CV added
1.0	Preliminary version	2009-09-02	• Sections drafted

Abbreviation used in this document

Abbreviation	Description
PC	Personal Computer
NordSecMob	Master's Programme in Security and Mobile Computing
KTH	Kungliga Tekniska Högskolan
CV	Curriculum vitae
MIME	Multipurpose Internet Mail Extensions
DTN	Delay-Tolerant Network
ICT	Information and communication technologies
MAP	Mobile access point
AP	Access Point
TCP	Transmission Control Protocol
SVN	Subversion
SDK	Software Development Kit
JDK	Java development Kit
IEEE	Institute of Electrical and Electronics Engineers
Wi-Fi	Trademark of a product based on IEEE 802.11
CPU	Central Processing Unit
MB	Megabyte
GB	Gigabyte
CSD	Communication System Design
RAM	Random-access memory

Summary

There is no argument that the current information technology connects people around the world and the connection is very beneficial to our daily life. Nonetheless, not all of the people are under that condition. Some parts of the world especially in the underdeveloped countries or distant areas are disconnected from the technology. This is because there is no communication infrastructure available or they could not afford the connection's cost.

In order to solve the problem, this project focuses on connecting the people in the area with the world by using state of the art technology. The technology will enable communication even though the infrastructure is unavailable. The key idea of the technology is to allow people commuting between the city and the area to carry data in their mobile phones. After they arrive at the city or the village, the data will be transmitted to the destination's link.

This technology is called Delay-Tolerant Network (DTN). Our project focuses on implementing DTN in the Android mobile platform. This is because it is the promising and open platform. Even though, it is in an early stage in the market, we believe that it will be widespread soon.

This project has two main goals including implementing the technology and researching the business opportunity of the technology for the mobile operator. The business area is also significant. This is because in order for the technology to be widely adopted, it must be profitable or create a win-win strategy between a mobile phone owner and a mobile operator.

1 Introduction and Background

In the 21st century, the Internet is the center of a technological, social, economical, and business research; Internet plays a vital role in today's world not only for the research but it is also widely used at homes and in portable devices. It allows people access to all kind of information easily. We could say that the lack of Internet and the different services that come with it could stop countries from an economical and social development. In other words, the Internet extremely influences the country's development.

Despite all advantages that the Internet provides and its wide deployment, it is possible to find places, especially in underdeveloped countries, which "have no access to ICT due to high costs of wired/wireless connections" [7]. For example, in Africa, people could not afford or find the Internet connection for their homes. If this keeps going on, the gap between underdeveloped and developed countries will be even larger.

With the idea of offering an answer to the limited connectivity in these rural areas, Bytewalla was born. The idea behind Bytewalla or "byte mules" is that people traveling from the city to the small villages could bring pieces of information by using their mobile phones installed with our smart application. Then, when they are in the city where there usually is a communication infrastructure, the pieces of the information they took from the villages will be forwarded to the destination via the normal Internet connection.

There are several previous works similar to this idea. DakNet[11] is a network connecting people in rural villages in India to the Internet by using public bus equipped with mobile access points (MAP). The bus moves from the town to the villages, collects data from each village's kiosk, and submits the data to the city's internet access point when it is back to town. Daknet supports wide range of applications including email, web caching, and Voicemail over IP.

Wizzy digital courier [15] is a project originally developed for providing Internet connectivity in South African schools where there is no Internet infrastructure available. The users of the project can send emails and request websites. The project created a technology for collecting network requests, making a batch dial-up connection when the dail-up rate is lower than normal, for example, during the off-peak period, then submitting the collected requests. This project's technology also supports transferring network data physically. For instance, the client can store emails in a portable device such as USB drive, relocate the device to the server with an Internet connection, then the server will transmit the emails to the destination.

Saami Network Connectivity (SNC) project targets to connect the Saami population of Reindeer Herders living in the northern part of Sweden with the rest of the world[12]. The project developed several applications including email, web caching, and Not so instant messaging.

Several field tests are conducted on the real Saami villages and the result was very gratifying [13]. Later on, EU funded the Networking for Communications Challenged Communities project (N4C)[14] which is a follow-up project of the SNC.

In this project, the idea will be accomplished by the Delay-Tolerant Networking (DTN) technology. DTN is an emerging research area suitable for "challenged networking environments in which traditional communication paradigms would fail or perform rather poorly" [6]. The DTNRG proposed the communication protocols for DTN [8]. Several implementations of the protocol exist. Nonetheless, none of them is compatible with our target platform.

Our target phone platform is Android because of its openness and profound industry support. As an illustration, the source code for the platform is publicly available and currently 50 leading telecom, hardware, software companies registered as its member [9]. Thus, our challenge is to implement the protocol on the platform for facilitating the exchange of data (uploading/downloading) between the phones and the network.

Beside, the protocol, we will also develop the application. The application we selected is an electronic mail [16] because of its simplicity but yet powerful. The application will support MIME types [17, 18, 19, 20, 21] as payload. Hence, the users can attach any digital files such as images, videos, voices to the email as well.

Even though, this project aims to support only electronic mail application, it is worth to note that our protocol implementation will work on future applications implemented on top of the DTN protocol as well. This email application is a proof of concept for our protocol implementation.

In addition to the technical implementation, we will also provide the business plan for the project. This business plan shows how the project can make money or be beneficial to users and mobile operator. We believe that only if the project is profitable, it will be widely adopted. Because the project relies on the people commuting between the rural area and the city, incentive for them is a must; few people are going to allow their phone to carry data for free.

Thereby, the problem of no access to ICT in many rural areas can be eventually solved with this proposal. People in the village can communicate with the rest of the world easier than before. There is no doubt that there will be challenges and difficulties for us during the working process. Nonetheless, this is seen as an opportunity for us to enjoy the project activities and practice our skills.

2 Goals

2.1 Overarching Goals

1. To connect people who lack of continuous network connectivity using Delay-Tolerant network in Android phones

2. To provide our Delay-Tolerant Networks service to the target market, we are going through two main phases: first, in the short term, our business case, for example, is to put advertisement in target market for those companies which have needs, and the profit point is the advertising; then, for the long term goal, we are going to make a business plan which contains and demonstrates the financial steps necessary to create a successful business or successfully carry out a business activity.

3. To assess the target market, we are going to look into Burundi in Africa. The market assessment includes the following steps:
    - Internet is always an easy way to search for useful information
    - Social survey
    - Market Analysis includes analyze customer, competitors and partners

2.2 Measurable objectives

In this section, we will explain our measurable objectives but in order to see where the objectives fit in the big picture, the overall architecture must be described first.

The overall architecture of our system is shown in Figure 2.1. Please note that this is a simplified version of our architecture, the detailed version will be discussed in the System architecture design document. Two challenge transactions supported by this architecture are sending email from the village network to the city network and vice versa. The transactions will be explained in detail below. Transferring email within the city network and village network itself are done trivially using legacy network technology.

In order to send the email from the village, a villager first submits the email using a legacy network technology to the DTN Mail Proxy server. This proxy server is required to allow the sender to disconnect after he finishes sending so he does not have to wait the Android phone to pick up the message in that moment. After that, when an Android phone equipped with our application arrives in the village network, the email will be downloaded from the DTN Mail Proxy Server to the phone. Then, when the Android phone goes back to the city network, the stored email will be uploaded automatically to the DTN Mail Gateway server. The server having an account of the villager will submit the email on behalf of the villager to the legacy network,

pass through the Internet, and reach the receiver of the email. On the other hand, the email transaction from the Internet user to the village network is similar but in the other direction.

As the above paragraph explained the overall architecture of the project, the measurable objectives can be clearly seen and explained. They are listed below.

1. Working system allows a user to send and receive email from the village to the city via the Delay-Tolerant network as discussed in the transactions above.
2. Report of the active time and battery consumption it takes to download and upload data from/to the Android phones.
3. Suggesting suitable business model for this project.
4. The social point of view survey about people traveling between villages and cities.
5. Manual how to use the system.
6. Develop and put documentation and video production in the website of the project.

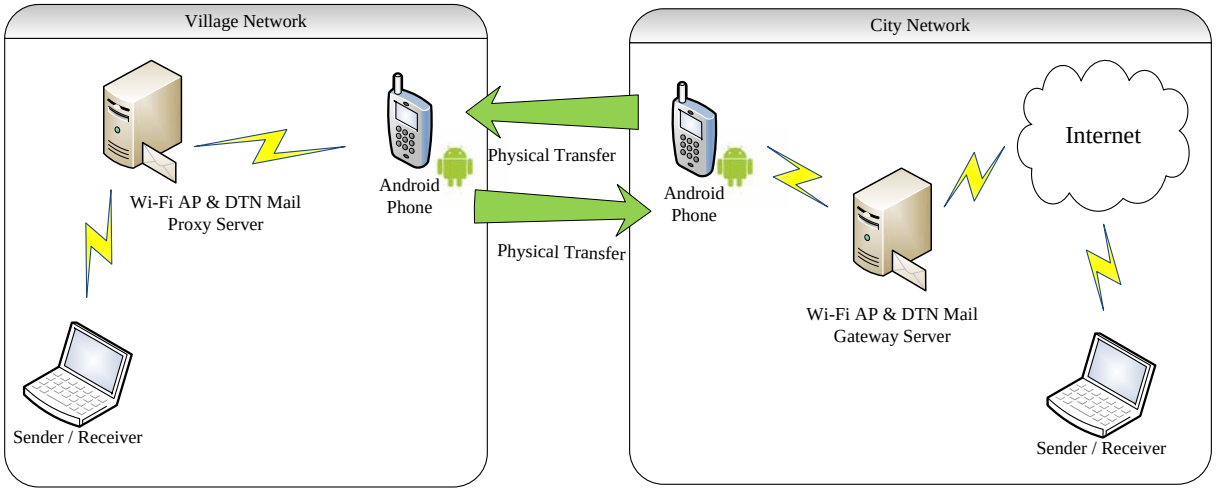

Figure 2.1 Overall Architecture of the Bytewalla project

2.3 Deliverables and Deliveries

2.3.1 Generic:

Table 2.1 Generic deliverables and deliveries

No.	Project Deliverables	Date	Delivery Method	Receiver(s)
1	Project plan including Contract	4 Sep 2009	Project Website	Champion, principal, co-coach and coach.
2	Project Website Launch	4 Sep 2009	Project Website	Champion, principal, co-coach and coach and other students.
3	Weekly Report	Every week	Project Website	Champion, principal, co-coach and coach.

4	Lesson Learn Paper	5 Jan 2009	Project Website	Champion, principal, co-coach and coach.
5	Individual Timesheets	Every week	Project Website	Project Manager.
6	Midterm Presentation Slides	19-20 Oct 2009	Project Website	Champion, principal, co-coach and coach.
7	Midterm Peer Reviews	# TBD	Project Website	Project team to be reviewed.
8	Video Production	7 Jan 2009	Project Website	Champion, principal, co-coach and coach and other students.
9	Exhibition Poster	7 Jan 2009	Project Website	Champion, principal, co-coach and coach and other students.
10	Press Release	7 Jan 2009	Project Website	Champion, principal, co-coach and coach.
11	Oral Presentation Slides	7 Jan	Project Website	Champion, principal, co-coach and coach.
12	Wiki and project website including all documentation	7 Jan 2009	Project Website	Champion, principal, co-coach and coach.
13	Final Report	7 Jan 2009	Project Website	Champion, principal, co-coach and coach.

1. Project Plan. In this document we state how and when we will achieve all the objectives of the project. The project plans also include the business plan, the stakeholder analysis, and the organization of the members of the team. We have divided the project into tasks, assigned certain number of tasks to each member depending on the number of credits taken.
2. Project Website Launch. This tool allows people in general to be aware about changes and progress made in the project. This is also a channel for the upper management to retrieve our deliverable.
3. Weekly Report. It is the paper which will show the weekly progress of the project. It works like a proof that the members have fulfill the requirements (such as work hours per day/week, work load) to accomplish the objectives planned for a specific week.
4. Lesson Learn Paper. It contains the reflections of the team and each member about the experience of working on a real problem. This report includes all the knowledge acquired during the whole working period.
5. Individual Timesheets. It reflects the work hours per day and week of each member, as well as the activities made during this time.
6. Midterm Presentation Slides. At this point we will expose the objectives achieved so far, as well as how they were reached. The slide will contemplate all this information.
7. Midterm Peer Reviews. This activity is leaded to motivate the students to read, know in detail, and assess the work of students involved in a different project.
8. Video Production. By using the art of the images and voice, people will be able to understand the product (how it works and who the target is) in a short time.
9. Exhibition Poster. It is made with the purpose of offering people a good understanding of the

project, by using visual elements such as diagram, documents, pictures, etc.
10. Press Release. It summarizes the impact, the importance, and the features of the new product.
11. Oral Presentation Slides. It contains most important things of the final version of the project in order to be exposed in short time.
12. Wiki. It hosts all the documentations collected during all the development of the project.
13. Final Report. The final writing which contains the details of all the project: abstract, background, design, methodology, results and conclusions.

2.3.2 Project Specific:

Table 2.2 Project Specific deliverable

No.	Project Deliverables	Date	Delivery Method	Received by
1	System Architecture Design Document	20 Sep 2009	Project Website	Champion, principal, co-coach and coach.
2	Business idea	21 Sep 2009	Project Website	Champion, principal, co-coach and coach.
3	The social point of view survey about traveling from villages to cities	16 Oct 2009	Project Website	Champion, principal, co-coach and coach.
4	Market Assessment	30 Oct 2009	Project Website	Champion, principal, co-coach and coach.
5	Suggesting suitable business model for this project	25 Nov 2009	Project Website	Champion, principal, co-coach and coach.
6	Working Delay tolerant network protocol stacks[1] on the Android platform	30 Nov 2009	TSLab SVN- Server and Official Source Tree of the N4C Project.	Champion, principal, co-coach and coach.
7	Working simple mail application on the network	30 Nov 2009	TSLab SVN-Server	Champion, principal, co-coach and coach.
8	Report the active time and battery consumption it takes to download and upload the data from/to the Android phones	11 Dec 2009	Project Website	Champion, principal, co-coach and coach.
9	System Requirements	20 Dec 2009	Project Website	Champion, principal, co-coach and coach.
10	Business Plan	25 Dec 2009	Project Website	Champion, principal, co-coach and coach.
11	User Manual for the Simple Mail Application.	30 Dec 2009	Project Website	Champion, principal, co-coach and coach.
12	Develop and put documentation and video production in the website of the project	30 Dec 2009	Project Website	Champion, principal, co-coach and coach.
13	Scientific Paper	15 Jan 2009	Email	Champion, principal, co-coach and coach.

1. System Architecture Design Document. It elaborates the technical details of the Overall Architecture shown in figure 2.1.

2. Business Idea. It is a brief and preliminary sketch of Business model.

3. The Social Point of View Survey about People carrying data from villages to cities. It contains social research, result analysis and business data.

4. Market Assessment. It is a complete analysis of the market， include selecting target market and customer needs.

5. Suggest suitable business model. It explains the suitable business model, revenue stream and value chain for our project.

6. Working DTN Protocol Stacks [1] on the Android platform. It includes the implementation of the convergence layer and bundle layer on the stack of androids phones.

7. Working Simple mail application on the network. It refers to the delivery of the code source to the SVN-Server to be revised and improved in a future.

8. Report the active time and battery consumption it takes to download and upload the data from/to the Android phones. It shows the results obtained once the battery consumption and the downloading/uploading time are measured. It will be explaining as well the methodology used for measuring.

9. System Requirements. It explains the devices and software need to obtain our results. It means hardware specification, operating system, peripherals, etc.

10. Business Plan. It will contain business model, market analysis, financial analysis, risk analysis and SWOT analysis.

11. User Manual for the Simple Mail Application. This includes the instructions for using the Simple Mail Application suggested in this project.

12. Develop and put documentation and video production in the website of the project. It allows people to know and understand the different aspects of the project: final product, target, use, etc.

13. Scientific Paper for submitting to a suitable conference. The paper might cover design, implementation, business issues we experienced during the project.

2.4 Unique contribution

1. Delay Tolerant Network Protocol [1] implementation on the Android Platform
Several implementations of the protocol defined by the Delay Tolerant network research group (DTNRG) exist. Nonetheless, none of them is compatible with the Android platform. As a result, our work on the protocol implementation is unique. The implementation will include Bundle Protocol Layer [1] and Convergence Layer [1] for the TCP layer on the Android platform. We will base our implementation on DTN2 [5] which is a reference implementation of the protocol done by the DTNRG. Nonetheless, our implementation will not include all the features of DTN2

because we have limited resource for the implementation. We will cover only the essential parts making the result conforming to [1] with static routing setup. Other extra parts, for example, the DTN simulator framework, and Prophet routing [23] implementation will be left for future work.

2. Report on the active time and battery consumption it takes to download and upload the data from/to the Android phones.

3. Research and evaluation of the Delay-Tolerant network business plan for the Mobile operator.

4. A scientific paper ready for submission to an appropriate conference. The paper may discuss about design, implementation, business issues we experienced during the project.

3 Approach

3.1 Software Development Approach

Initially, we have limited technical knowledge of our project but we will uncover the technical issues as we investigate more. Then, we will move towards the development of the project step by step. Iterative Process suits our project best because it will help us to progress with the current requirements we have.

3.1.1 Iteration Process

Iterative process model has six stages including Problem Definition, Analysis, Design, Implementation, Testing and Documentation. This model works step by step and once you move to next stage, you cannot come back; you will have to repeat the whole process from start. Process starts with defining the problem. Next, the process moves on to analysis of the problem, and then design the system to solve the problem according to the analysis. After the implementation of the design, we will test the system and if it doesn't work then go back to analysis and start all over again. The process is illustrated as in figure 3.1**.**

We will do the following activities in the different steps of the Iteration Process.

Problem Definition

Gather all the required data from different sources

- Gather requirement from principal, coaches, and co-coach
- Delay-Tolerant Network Documentation
- DTN Open Source Projects
- Android documentation and books
- Related Projects

Analysis

In the second phase we will analyze all the gathered requirements and data which involves

- Analyze DTN implementation requirements and how can we implement it on Android platform
- Analyze Android power consumption
- Analyze Download and Upload rate using an android phone
- Analyze related projects

Design

After the result of the analysis, we will prepare our complete System Design**.**

Implementation

In this stage of Iteration model we will implement the Delay-Tolerant Network and program our mobile application for carrying data.

Testing

Test the complete system if it works according to the plan which includes:

- Test Delay-Tolerant Network
- Test Mobile Application
- Test if it's transferring the data streaming correct without any error
- Test Android power consumption
- Test Download and Upload rate using an android phone

Documentation

Document the whole system so it can be deployed or other team can understand our work.

- Document Delay-Tolerant Network deployment
- Document Android mobile application development
- User Manual for using the system

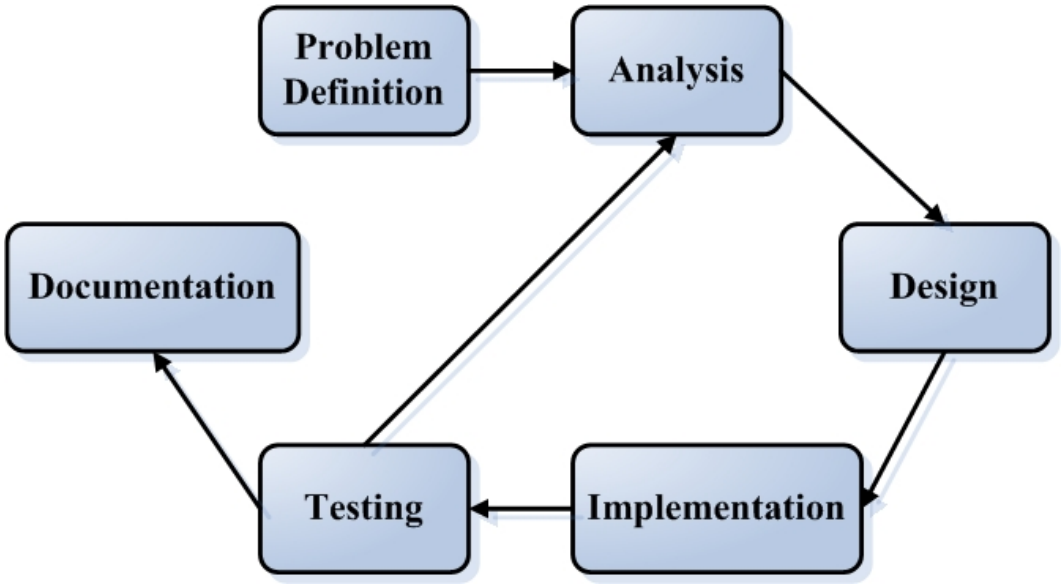

Figure 3.1 our software development approach: Iteration Process

3.2 Tools

3.2.1 Android SDK

Android provides operating system, middleware and applications for mobile devices. We will use Android SDK[2] in the Android phones to make them support for the delay tolerant networks.

3.2.2 Java development kit

The Android codes are based on Java programming language. We will use java development kit to develop and debug codes for Android phones. JDK will also be used to code The DTN protocol in the servers.

3.2.3 JUnit for testing automation

JUnit[4] will be used to create and test different test cases with its unit testing frameworks. JUnit will help us to check the basic operation of the code. It will save time to test the codes with JUnit rather than testing manually

3.2.4 Subversion(SVN) for source control

SVN[10] will be used to create different versions of the program and to keep history of all the versions.

3.2.5 Eclipse for Integrate development Environment

Eclipse will be the Integrated Development Environment for our project. We could have chosen other editors also which support Java. But, the main reason to choose eclipse is that the Android development plugin by Google which is named as Android development tools (ADT) is supported only by Eclipse.

3.2.6 GoogleDocs for concurrent and collaborative editing

We are using GoogleDocs to share our report among the project members so that they can work on the report simultaneously. It's the only tool to the best of our knowledge that is very mature and supports concurrent document editing. Nonetheless, GoogleDocs is used only during the report writing activities among the group members. The final documentations will be published in the suitable channels (e.g. wiki or project website).

3.2.7 GoogleGroup for collaborative communication

GoogleGroup serves as a main communication channel for our team. We or other party can send a message to all of the group's members by inputting only single address instead of the addresses of all the members. Beside the convenience of submitting the message, it also helps keep track of our group communication logs.

3.2.8 Coding Convention

In order to make the development work smoothly and easy to maintenance in the future, we are going to adopt the Java Coding convention from Sun [3] for our programming.

3.2.9 Mercurial

As N4C project mainly use Mercurial for keeping the source code, we need to use this tool to submit our works into the project's repository.

3.2.10 Watts - Android Application

Watts [23] is a free Android application for monitoring the status of battery consumption. We will use this application to for testing Android phone battery consumption during the upload/download process.

3.3 Business Approach

To accomplish the business plan; several key steps have been set up before taking any action:

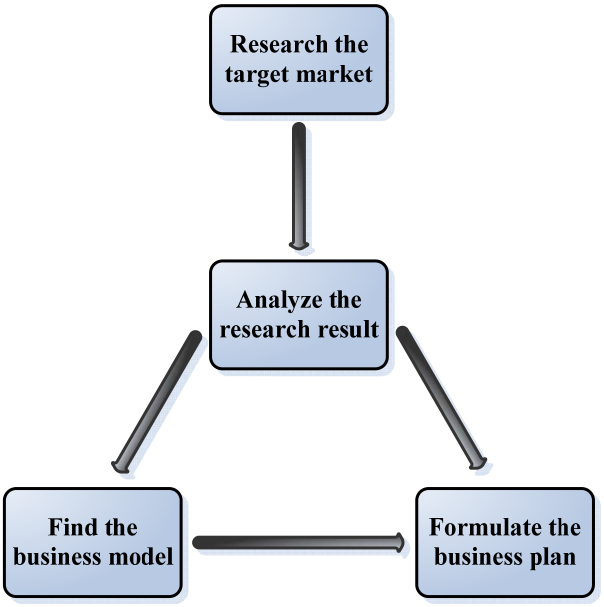

Figure 3.2 Key steps for setting up business goal

As the business model is the core part in the whole business plan, we will try to design a more commercial business model to fit into the target market. For example, companies which plan to run business in the Africa pay a fee for putting an advertisement in our system.

- Research the target market
  Finding an appropriate way to do a social survey
  Making survey material
  Doing social survey in certain areas or channels
- Analyze the research result
  Analyze the result we got from the social survey,
  Gathering the business data
  Giving market assessment
  Choosing target market
- Find the business model
  Design an appropriate business model
  Prepare several promotion strategies, marketing strategies and competition strategies
  Define channels and customer relationships in our business model
  Define cost structure, revenue stream and value chain for our business model
- Formulate the business plan
  Making a financial analysis, risk analysis, SWOT analysis
  Writing the final business plan

4 Resources

4.1 Human Resources

Table 4.1 Human Resource

Team Member	Program	Education	Skills	Credit	Title
Rerngvit Yanggratoke	NordSecMob	Bachelor of Computer Engineering, Chulalongkorn University, Bangkok, 2006	Software development: PHP, Python, C, C++, C#, Java Network Management Computer Security	30	Software Engineer
Sharjeel Ahmed	ICT Entrepreneurship	Bachelor of Sciences in Computer Science, COMSATS Institute of Information Technology, Lahore, Pakistan, 2007	Web and Mobile Applications Development	24	Software Engineer
Abdullah Azfar	NordSecMob	Bachelor of Science (B.Sc) in Computer Science and Information Technology, Islamic University of Technology (IUT), Bangladesh, 2005.	Network management, Web application, Java, Computer Security	24	Web Master, Network Engineer
Li Shan	ICT Entrepreneurship	Bachelor in Electronic Commerce, School of Electronic Commerce South China University of Technology, Guangzhou, China	Business, Marketing Analysis, Financial Analysis, Plan design	24	Business Analyst
Jiong Jiang	ICT Entrepreneurship	Bachelor Degree of Business and Information Technology, Kemi-Tornio University of Applied Science, 2007	HTML Language, Write business letters and business plan, Strategic Planning and SWOT Analysis	30	Project Coordinator, Business Analyst
Maria Jose Peroza Marval	Internetworking	Electronic Engineer, Simón Bolívar University Caracas, Venezuela, 2005	Network design and management. Computer Security. C, C++, Java.	15	Software Engineer

4.2 Space Resources

All the project members need to work together in a room to make a good progress of their work. A calm and quite environment is expected for working. A fixed room for working would ensure all these things. There will be a number of hardware resources in the project including the servers and Android phones. These hardware resources need to be stored in a locker room with adequate security facility.

4.3 Hardware Resources

From figure 2.1, it is directly seen that we need 2 servers namely DTN Mail proxy server and DTN mail gateway server, and an Android phone. The DTN mail proxy server will be in the rural area with no Internet connectivity. The DTN Mail gateway will be in the city where Internet connection is available. the Android phone will act as a "bytewalla" which will carry data from rural area to city and vice versa. We will need another Android phone for testing whether the system and application properly handles 2 phones working at the same time, for example, testing whether they will download the same content.

4.3.1 2 Android phones

RAM: 256 MB
Well equipped with Wi-Fi

4.3.2 2 servers with Wi-Fi card installed

CPU: 2.26-GHz Core 2 Duo P8400
System Memory: (MB) 4096
Total Hard Disk Size: (GB) 1000
Wi-Fi card: Any Wi-Fi card compatible with IEEE 802.11n/g

5 Work Breakdown Structure

5.1 List of Work Packages and Activities

Planning Package
Wp-leader: Jiong Jiang

1. Information gathering
2. Roles and tasks distribution
3. Time scheduling
4. Group meetings and Project Plan
5. Progress Report Meeting with teaching teams and professor
6. Making all appointment, contact, communication with other parties such as coach, teaching team, co-coach
7. Keep track of the current project progress and update the project plan accordingly
8. Aggregating and formatting the group's draft documentations (most likely on the GoogleDocs system) into final documentations. This activity includes adding table of contents, changing to consistent font, and etc.

Communication Package
Wp-leader: Maria Jose Peroza Marval

1. Design the websites for the project including Wiki and Drupal website
2. Upload and verify the documents are on the website
3. Design and work on the project logo
4. Design and work on the video production
5. Design and work on the exhibition poster
6. Design and work on the press release
7. Design and work on the template for the group presentation

Business Plan Package
Wp-leader: Li Shan

1. Do social survey and get market segment
2. Market Analysis include analyze customer, competitors and partners
3. Finding resources include marketing, business system, human, and financial resources
4. Decide Marketing strategy include promotion and competitor strategy
5. Design the Value Chain
6. Decide the Business Model
7. Financial Analysis
8. Analyze the Risk
9. Write the Business Plan

Software Development Package
Wp-leader: Rerngvit Yanggratoke

1. Information gathering - Study the protocol[1], Android Development
2. System Architecture Design

3. Develop the test case for the Bundle Protocol on the Android Platform
4. Implement the Bundle Protocol on the Android Platform
5. Document the implementation of the Bundle Protocol on the Android Platform
6. Develop the test case for Phone Convergence Layer for TCP on the Android Platform
7. Implement the Phone Convergence Layer for TCP on the Android Platform
8. Document the implementation of Phone Convergence Layer for TCP on the Android Platform
9. Design the user interface of the simple mail application
10. Implement it simple mail application on the network
11. Document the implementation of simple mail application on the network
12. Manual how to use the simple mail application

System Integrated system package
Wp-leader: Abdullah Azfar

1. Information gathering DTN protocol implementation [6]
2. Install DTN protocol implementation [6]
3. Configure the servers, Wi-Fi access points, 2 android phones according to the Integration setup
4. Document the configuration
5. Run the integration system and record the active time used in the lab, write the report
6. Run the integration system and record the battery consumption used in the lab and write the report
7. Scientific paper writing
8. (Optional) Run the integration system in the African village

5.2 List of Milestones and Tollgates

There are several important milestones and tollgates in the development of the project.

Table 5.1 Milestones and tollgates

No.	Milestone	Date
1.	System Design	21 Sep, 2009
2.	Software Test cases are developed	16 Oct, 2009
3.	Business Model	25 Nov, 2009
4.	DTN implementation is done	30 Nov, 2009
5.	System Test Reports	11 Dec, 2009
6.	Business Plan	25 Dec, 2009
7.	Research Paper for submitting to the conference	15 Jan, 2010

5.3 Gantt Chart

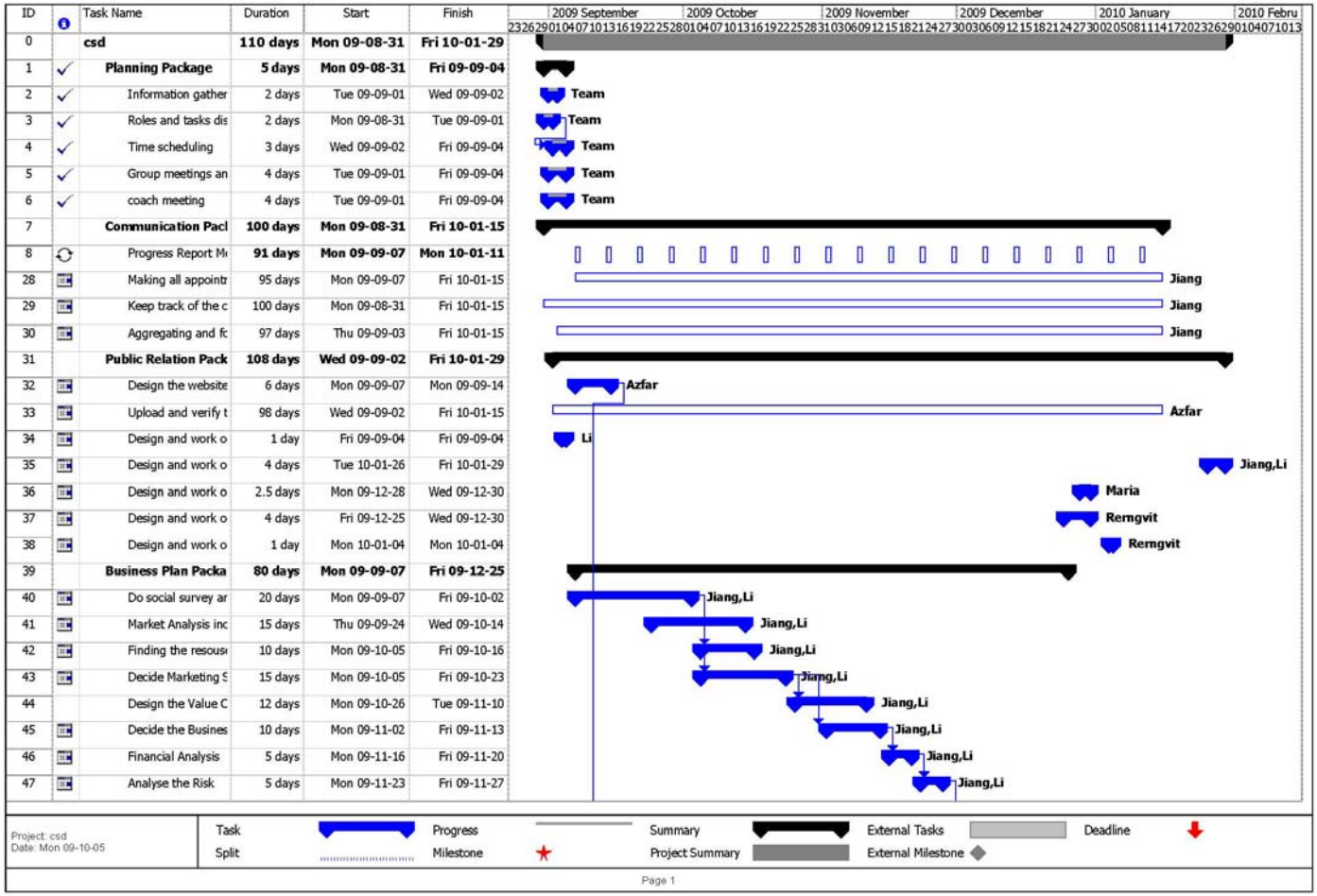

Figure 5.1 Gannt Chart 1/2

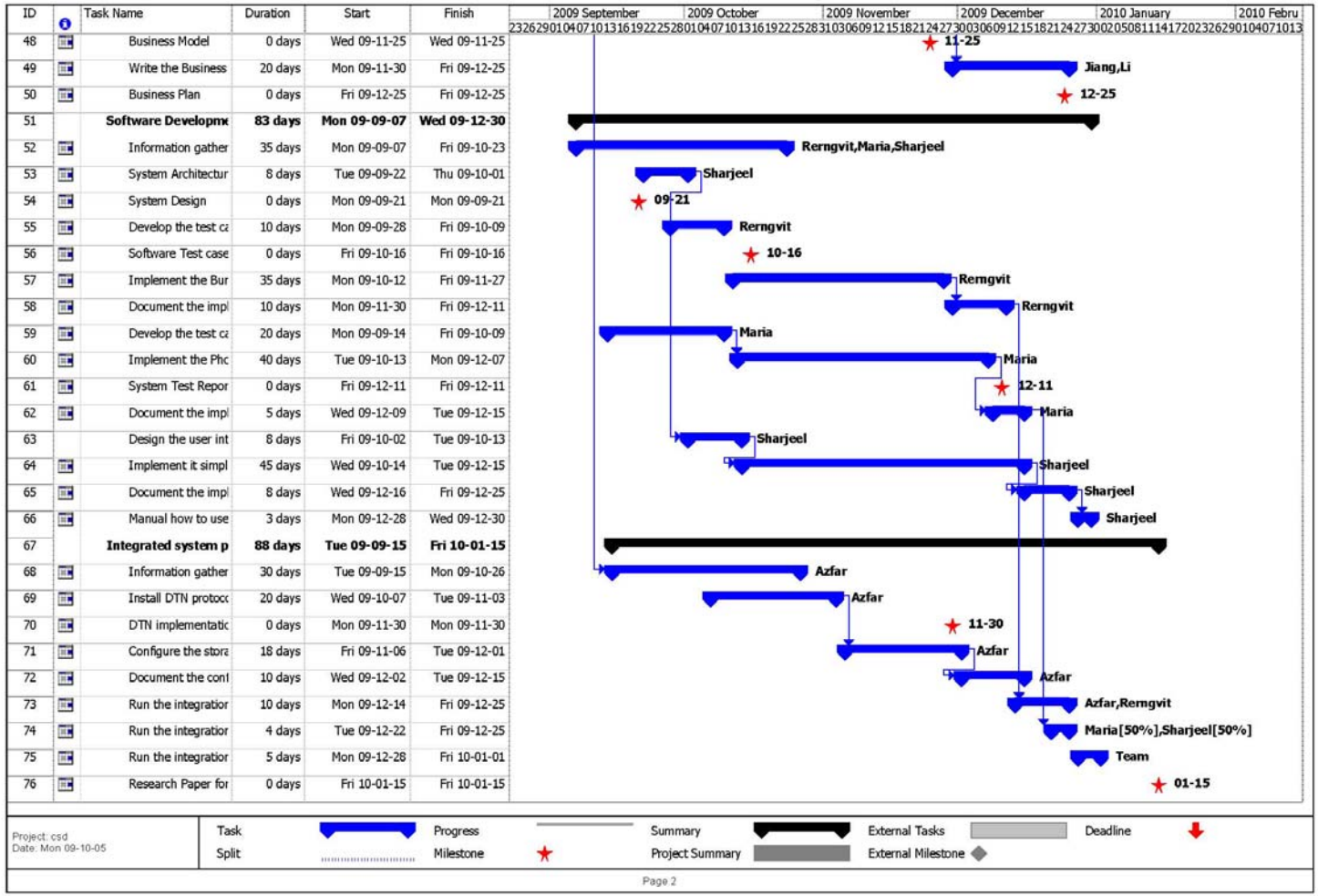

Figure 5.2 Gannt Chart 2/2

5.4 Individual Responsibilities Matrix

Table 5.2 Individual Responsibilities Matrix

Responsible	Activities	Work Day per Activity	Work Hours per day	Total Hours
Abdullah Azfar	Study about Drupal	1	6	6
Abdullah Azfar	Information gathering for web site	1	6	6
Abdullah Azfar	Designing the web site	5	6	30
Abdullah Azfar	Weekly update of the site	20	3	60
Abdullah Azfar	Information gathering DTN protocol implementation [6]	30	6	180
Abdullah Azfar	Install DTN protocol implementation [6]	20	6	120
Abdullah Azfar	Configuring the storage server	12	6	72
Abdullah Azfar	Configuring wifi access pointsand Android phones	8	6	48
Abdullah Azfar	Document the configuration	10	6	60
Abdullah Azfar	Publishing the project in Wiki web site	6	6	36
Abdullah Azfar	Research paper writing for a suitable conference	7	6	42
Credit	**24**	**Total working hours**		**660**

Responsible	Activities	Work Day per Activity	Work Hours per day	Total Hours
Rerngvit Yanggratoke	Planning Package	10	8	80
Rerngvit Yanggratoke	Design and work on the template for the group presentation	1	8	8
Rerngvit Yanggratoke	Design and work on the press release	4	8	32
Rerngvit Yanggratoke	Information gathering	20	8	160
Rerngvit Yanggratoke	Develop the test case for the Bundle Protocol on Android Platform	10	8	80
Rerngvit Yanggratoke	Implement the Bundle Protocol on the Android Platform	35	8	320

Rerngvit Yanggratoke	Document the implementation of the Bundle Protocol on the Android Platform	10	8	80
Rerngvit Yanggratoke	Run the integration system test and record the active time used in the lab, write the report	10	8	40
Credit	**30**	**Total working hours**		**800**

Responsible	**Activities**	**Work Day per Activity**	**Work Hours per day**	**Total Hours**
María José Peroza M.	Planning Package	5	4	20
María José Peroza M.	Exhibition Poster	2,5	4	10
María José Peroza M.	Information Gathering	25	4	100
María José Peroza M.	Develop the test case for phone convergence layer for TCP on Android platform	20	4	80
María José Peroza M.	Implement the phone convergence layer for TCP on Android Platform	40	4	160
María José Peroza M.	Document the implementation of phone convergence layer for TCP	5	4	20
María José Peroza M.	Run the integrated system and record the battery consumption used in the lab and write the report.	5	4	20
Credit	**15**	**Total working hours**		**410**

Responsible	**Activities**	**Work Day per Activity**	**Work Hours per day**	**Total Hours**
Sharjeel Ahmed	Information gathering	35	6	210
Sharjeel Ahmed	System Architecture Design	8	6	48
Sharjeel Ahmed	Design the User Interface of Android Application	10	6	60
Sharjeel Ahmed	Implementation of Android Application	40	6	240

Sharjeel Ahmed	Document the implementation of Android application for TCP	8	6	48
Sharjeel Ahmed	Write a Android Application User Manual	3	6	18
Sharjeel Ahmed	Run the integration system and record the battery consumption used in the lab and write the report	4	6	24
Credit	**24**	**Total working hours**		**648**

Responsible	**Activities**	**Work Day per Activity**	**Work Hours per day**	**Total Hours**
Li Shan	Planning Package	4	8	32
Li Shan	Project Logo	0.5	6	3
Li Shan	Video Production	4	6	24
Li Shan	Do social survey and get market segment	20	2	40
Li Shan	Market Analysis include analyze customer, competitors and partners	15	6	90
Li Shan	Finding the resource include Marketing, Business system, human resource and financial resources	10	6	60
Li Shan	Decide Marketing Strategy include Promotion strategy, competitor Strategy	15	6	90
Li Shan	Design the Value Chain	12	6	72
Li Shan	Decide the Business Model	10	6	60
Li Shan	Financial Analysis	5	6	30
Li Shan	Analyze the Risk	5	6	30
Li Shan	Write the Business Plan	20	6	120
Credit	**24**	**Total working hours**		**651**

Responsible	Activities	Work Day per Activity	Work Hours per day	Total Hours
Jiong Jiang	Planning package	4	8	32
Jiong Jiang	Communication package	130	1.5	195
Jiong Jiang	Video Production	4	6	24
Jiong Jiang	Do social survey and get market segment	20	2	40
Jiong Jiang	Market Analysis include analyze customer, competitors and partners	15	5	75
Jiong Jiang	Finding the resource include Marketing, Business system, human resource and financial resources	10	5	50
Jiong Jiang	Decide Marketing Strategy include Promotion strategy, competitor Strategy	15	5	75
Jiong Jiang	Design the Value Chain	12	6	72
Jiong Jiang	Decide the Business Model	10	6	60
Jiong Jiang	Financial Analysis	5	6	30
Jiong Jiang	Analyze the Risk	5	6	30
Jiong Jiang	Write the Business Plan	20	6	120
Credit	**30**	**Total working hours**		**803**

5.5 Organization

5.5.1 Team's organization

Principal: Marco Zennaro

Coach: Hervé Ntareme

Co-coach: Avri Doria

Champion: Björn Pehrson

Team Manager: Jiong Jiang

Students: Sharjeel Ahmed, Rerngvit Yanggratoke, Abdullah Azfar, Li Shan, Jiong Jiang, Maria Jose Peroza Marval

This project is specified by the Principal: Marco Zennaro.

The coach guides on how to proceed the project and gives early feedback on our work.

Our Co-coach: Avri Doria, working on similar project but on Linux PDA, is willing to contribute knowledge and experience whenever the team need.

We communicate with the Principal and teaching team via the Team Manager. Every week, each member will write a timesheet report explaining what has been done for the past week. The project coordinator will gather all the information and report to the Principal and teaching team in a weekly meeting. Beside the progress report, the project coordinator will discuss the problems.

Figure 5.2 indicates the current organization of Bytewalla. Table 5.3 shows the main members' skill profile.

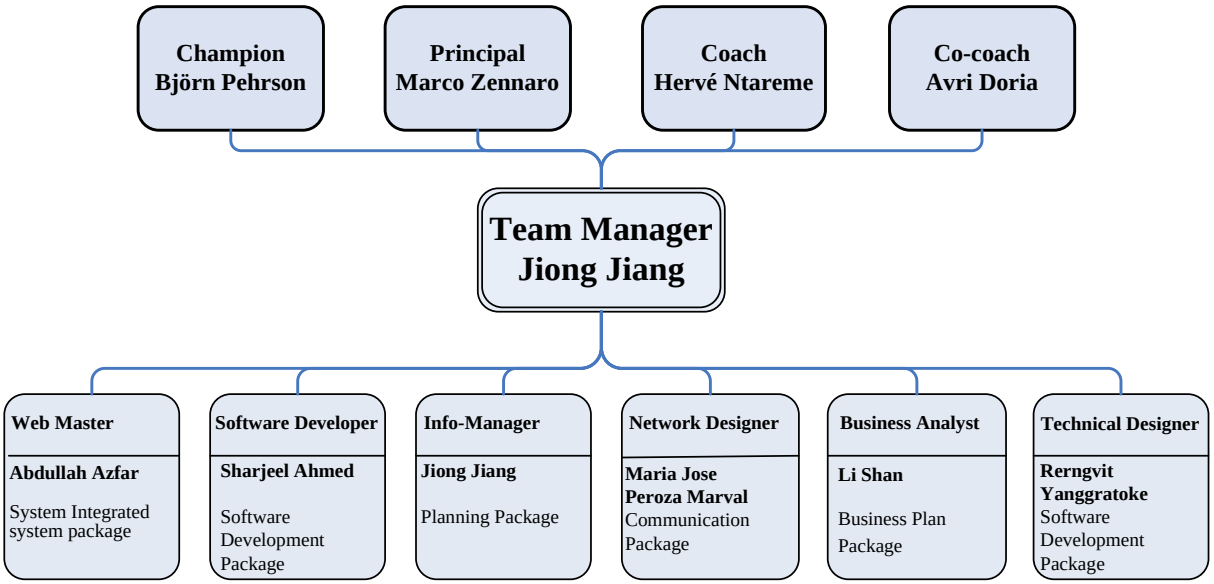

Figure 5.2 Preliminary organizations for ByteWalla project

Table 5.3. Skill Profile of main members of Bytewalla

Members / Skills	Abdullah Azfar	Sharjeel Ahmed	Jiong Jiang	María José Peroza M.	Li Shan	Rernnvit Yanggratoke
Programming Skills						
Java	++	+++		++		+++
PHP	+	+++		+		+++
Python		+				++
Network Skills						
Network Management	++			+++		++
Security	++	+		+++		++
Application Skills						
Web Application	++	+++	+	++	+	+++
Mobile Application	+	++	+		+	
Web design	++	++	+	++	+	
Business Skills						
Marketing		+	+++		++	
Financial		++	++		+++	
Branding		++	+++		+++	
Strategy		++	+++		+++	
SWOT	++	++	++		++	
Management						
Human resource	+	+	+++	+	+++	
Relationship	+	+	+++	++	++	+
Leadership	+	++	++	+	+	+
Scientific Writing	++	+		++	++	++

Note: + is Stands for the level of the skills

6 Stakeholder Analysis

Table 6.1 Stakeholder Analysis

Stakeholder	Contact	Block	Let	Help	Make	Diagnosis of Stakeholder Position	Recommended Action to move to Desired Position
N4C	Avri Doria Avri.Doria@ltu.se		X			Co-coach the project team and support the coach.	Actively contribute more useful information to the project teams.
champion	Björn Pehrson bpehrson@kth.se			X		Manage all CSD projects. Guide all project teams and find out potential mistakes in the projects.	Support each project team with more facilities.
Principle	Marco Zennaro mzennaro@ictp.it			X		Recruit well qualified students, teachers and coaches. Marco is also the owner of the project.	Give help and feedback
Teaching team	Herve Ntareme ntareme@kth.se			X		Prepare the course, participate in the selection of students, contribute relevant and important knowledge and give grade.	Guide and support teams by providing feedback and equipments to all projects
Coach	Herve Ntareme ntareme@kth.se			X		Coach the project team; report progress to the teaching team and the project managers once a week.	Actively contribute more useful information and support to the project team.
Co-coach	Avri Doria Avri.Doria@ltu.se			X		Co-coach the project team and support the coach.	Actively contribute more useful information and support to the project team.
Project team	bytewalla@googlegroups.com				X	Implement the project with their specialized skills to reach the desired goals.	See the project as a great opportunity to learn more knowledge and voluntarily contribute more time and energy.
Phone user			X			End user	People can send data wherever they were.
Google				X		Show interest and provide software support	Provide possible hardware support as well.
Huawei			X			Show interest	Give support
Ericsson			X			Show interest	Give support
Sony Ericsson			X			Show interest	Give support
United Villages			X			Offer Daknet service in India	

Note: Let, i.e., the stakeholder is going to let the team work as it wants to but the stakeholder is quite indifferent to The project
Block, i.e., the stakeholder is going to block the project so that the team will run into difficulties completing the work
Help, i.e., the stakeholder is going to help the project
Make, i.e., the stakeholder is going to put him or herself in a position where she will be of help to the team in accomplishing the work in the project.

7 Risk Analysis

The possible risks are analyzed from the view of customers, users, providers and developers. This analysis contain mitigation strategy which can prevent them occur, contingency plan which can deal with them when problems occur, severity (represented from 1-10, and 10 is worst) and probability of the problem occur which is represented in percentage.

Table 7.1 Risk Analysis

Risks	Mitigation Strategy	Contingency Plan	Severity	Probability
Project Developing Issue				
Experiencing technical bottlenecks	Increase the technical knowledge	1.Ask some skilled people for help 2.Add more working hours into it	**5**	**30%**
The principal add an additional demand	Make a clear communication with principal.	Add a new working plan to suit the new objective	**8**	**10%**
The principal requesting a major change to the project	Make a good communication with principal.	Make a new working plan to suit the new objective	**9**	**5%**
Can not follow the schedule	Make changes in work plan for increasing efficiency	Add working hours to catch the schedule	**4**	**40%**
Team member leave the team	Build team spirit	1. Have a talk with the member 2.Separate the job to other members	**8**	**10%**
Team members don't cooperate with each other	Enhance team cohesiveness	Organize some team activities	**7**	**10%**
Lack of team member with specific skills	1. Spend some time to learn the needed skills 2. Absorb the skilled person into the team	1. Using other skills to replace the unknown skills 2. Ask some skilled people for help	**8**	**20%**
The equipments haven't arrived on time	Ask our coach to support us about the equipment	Using the live version instead	**6**	**60%**
The equipments fail	Ask our coach to support us about the equipment	Using the live version instead	**8**	**30%**
Project launching Issue				
Long Data Transfer Time	Improve the service	Upgrade the hardware	**4**	**60%**
Data Abuse	Adding user authentication in the service	Block carrier's phone	**6**	**10%**
Data Privacy	Adding user authentication in the service	Don't use this carrier again	**7**	**20%**
Data Re-Download	Improve the service	Choose one	**3**	**55%**
Hardware Collapse	Make copies for data in other equipments	Using the copy and repair the hardware	**9**	**1%**
No Carriers	Making attractive promotion strategies	Hire the carriers	**9**	**20%**
Batteries Depleted	Upgrade the hardware	Charging immediately	**6**	**40%**

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9 Appendices

Appendix 1: **CV of project Members**

Abdullah Azfar

Phone : +46-765-668-966
E-mail: abdullah_azfar@yahoo.com

Education:

Aug.2008 – Jun.2009 Norweigian University of Science and Technology, Royal Institute of Technology
Master's Degree Programme in Security and Mobile Computing

Jan.2002 – Sep.2005 Computer Science & Information Technology, Islamic University of Technology, Gazipur (IUT, OIC)
Bachelor of Science (B.Sc) in Computer Science and Information Technology CGPA

Work Experience:

Mar.2006 – Jul.2008 Department of Computer Science and Information Technology (CIT), Islamic University of Technology (IUT), Gazipur, Bangladesh.
Lecturer

Oct.2005 – Mar.2006 Department of Computer Science and Engineering (CSE), Prime University, Dhaka, Bangladesh.
Lecturer

Jiong Jiang

Tel: +46-76-583-0329
Email: jiong@kth.se

Education:

Sep.2008 – Till now Royal Institute of Technology
Master Degree of ICT Entrepreneurship

Sep.2004 – Dec.2007 Kemi-Tornio University of Applied Science
Bachelor Degree of Business and Information Technology

Work Experience:

Jan.2007 – May.2007 Inforsec Project, Meri-Lappi Institute
Media Producer *Build a website, Team work experience, Preside team meeting and keep meeting minute*

Jun.2005 – Aug.2005 ArvinMeritor Light Vehicle Systems (Shanghai) co., Ltd.
Assistant of Finance Controller *Worked closely with Finance Controller, Helped to deal with business e-mails, Made finance tables and checking income and outcome*

Sept.2003 – Jun.2004 ShanghaiXinjian Travel Agency
Manager Assistant *Communicate with customers and partners, Made presentations of monthly sales figures, Took part in planning one theme journey*

Li Shan

Tel: +46-76-583-2620
Email: isa.isl@hotmail.com

Education:

Aug.2008 – Till now Royal Institute of Technology
Master in ICT Entrepreneurship, ICT School

Sep.2004 – Jul.2008 South China University of Technology, Guangzhou, China
Bachelor in Electronic Commerce, School of Electronic Commerce

Work Experience:

Mar.2008 - Apr.2008 Guandian Real-Estate Media Company
Internship customer service

Mar.2005 - Nov.2007 Culture and Entertainment Department
Vice-Minister *Hold activities as: Closing Ceremony of the E-Commerce Culture Festival, Welcome Party for incoming freshmen, Emcee Competition and Sports Meeting, etc.*

Skills: Softwares: Access, OpenWave, Office, Photoshop, Rhino, SQL

Maria Jose Peroza Marval

Tel: +46 76 5830153
Email: mjperoza@gmail.com

Education:

Aug.2008 – Till now Royal Institute of Technology, Stockholm, Sweden
Master Degree in Internetworking

1998 – 2005 Simón Bolívar University, Caracas, Venezuela
Bachelor Degree in Electronic Engineer

Work Experience:

May.2006 - Oct.2007 Movilnet, Caracas,Venezuela
Networks Engineer (Junior)
Design of new nodes to be utilized for new voice switches (determination of the equipments to be installed, configuration of the equipments complying QoS requirements)
Conditioning of the Backbone for the installation of new PDSNs (this was accomplished complying strict security criteria between the network and the users, services, etc.).

Sep.2005 - May.2006 Dayco Telecom, Caracas,Venezuela
Operations Analyst
In charge of the supervision of network services, servers, and the web platforms.
Failure resolution times were reduced in approximately 30%.

Honors/ Publications:

Cisco Certified Network Associate (CCNA). March, 2006. (CSCO11170541)
Orden José Félix Ribas en su Tercera Clase. 1997.

Rerngvit Yanggratoke

Tel: +46-73-713-5014
Email: rerng007@gmail.com

Education:

Aug.2008 – Till now Royal Institute of Technology, Helsinki University of Technology
Master Degree in Security and Mobile Computing

Apr.2002 – Apr.2006 Chulalongkorn University, Bangkok Thailand**.**
Bachelor of Computer Engineering, Second Class honor

Work Experience:

Apr.2008 - Aug.2008 Dhammasociety Thailand
System Administrator *Manage system configurations, System security inspection*

Apr.2006 - Apr.2008 Openface Internet Thailand Company
Software Engineer *Researching, designing, implementing, maintaining software systems according to client or employers needs, modifying and fixing defects of existing systems, writing operational documentation, investigating new technologies*

Skills: Software Development in Java, PHP, C#, C, C++
Network Management
Research Paper writing
Computer Security

Honors/ Publications:

Erasmus Mundus Scholarships for NordSecMob Programme
Sun Certified Programmer for the Java™ PLATFORM 1.4 (September 17, 2005)
Microsoft Certified Application Developer
Microsoft Certified Professional
Certified Information Technology Professional from National Electronics and Computer Technology Center and Software Industry Promotion Agency of Thailand

Sharjeel Ahmed

Tel: +46-73-896-6884
Email: sharjeel@kth.se

Education:

Aug.2008 – Till now Royal Institute of Technology, Stockholm, Sweden
Master Degree in ICT Entrepreneurship

Feb.2003 – Jan.2007 COMSATS Institute of Information Technology, Lahore, Pakistan
Bachelor Degree in Computer Science

Work Experience:

Feb.2008 - Aug.2008 Arbisoft, Lahore, Pakistan
Web Consultant

Mar.2007 - Oct.2007 Uraan Software Solutions, Lahore, Pakistan
Software Engineer

Skills: Programming: Java, Ruby, Ruby on Rails, PHP, C, C++
Business Models, Innovation, Ideas, Product Design

Honors/ Publications: Positioning a Mobile Subscriber in a Cellular Network System: Approved by "International Association of Engineering" for "World Congress on Engineering, 2007" London