

Integrated Billing System for Rural Wireless Mesh Network

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Declaration

I, JARED CHRISTIANS, declare that this thesis “*Integrated Billing System for Rural Wireless Mesh Network*” is my own work, that it has not been submitted before for any degree or assessment at any other university, and that all the sources I have used or quoted have been indicated and acknowledged by means of complete references.

Signature:

Date:

JARED CHRISTIANS.

Abstract

This project involves design, development, unit and integration testing, as well as user-centred usability testing of a billing service for a community run wireless mesh-network. A homegrown prepaid billing system is currently used for VOIP. The integrated billing service will add additional functionality in order to bill different user types, for data usage, VOIP and charging phones at solar charging stations.

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Glossary

VOIP Voice over Internet Protocol.

DTI Department of Trade and Industries.

ICASA Independent Communications Authority of South Africa.

IVR Interactive Voice Response.

ISP (Internet Service Provider) a company or organisation which connects users to the Internet, through landlines or wireless networks.

Network An arrangement of equipment in various places, able to communicate between those places, by landline or radio.

Chapter 1

Introduction

1.1 Background

Mankosi is situated in one of the most disadvantaged areas of the Eastern Cape province in South Africa and has a population of 3400 people in 12 villages governed by a Tribal Authority. Only 2.1% of community households are connected to the grid with an average income of R388 per person, per month according to previous research done in Mankosi by the University of The Western Cape.

Residences of Mankosi spend 22% of their disposable income on communication via mobile phone services. In 2012 researchers proposed the introduction of a community owned Internet Service Provider with the use of a mesh network in Mankosi. The concept was accepted after being explained at a meeting called by the chief. A non-profit Telecommunications co-operative was registered with the DTI and obtained the necessary licenses exemptions from the ICASA.(Rey-Moreno)

The difference between a traditional telecoms network and a mesh network is that the traditional consists of central beacons that each user device connects to. A mesh consists of scattered nodes. Each node can connect with a number of others. A message spreads from one part of a mesh to any other part by passing through as many nodes as necessary. In a traditional network, the beacons are usually connected to each other by a backbone land line or microwave radio link. A mesh network may or may not have a gateway which is just one of its nodes which is also connected to a traditional network. Thus if one member of a mesh has an Internet connection, it can be shared by the entire mesh network. The nodes still have the ability to connect to each other

when there is no gateway.(1)

The Zenzeleni Network consists of 13 nodes connected to an Internet gateway and 8 charging stations which are all solar powered. The charging stations provide services at half the cost of other service providers in the community. There are also 12 public phones that provide free calls on the network. Zenzeleni was able to enter into an arrangement with a company providing Internet phone services (Voice over Internet Protocol, or VOIP). This enables the Network to provide break-out calls at half the price of other available service providers (2). This also allows public phones to accept break-in calls. The VOIP System uses a prepaid isiXhosa IVR based billing system. The revenue generated by the network is used to upgrade and maintain the network services (Rey-Moreno).

Zenzeleni is currently in the process of upgrading the infrastructure and connecting to a fibre network to provide Internet access to the local primary school, the high school, and a set of hot-spots in the community at a fraction of the cost of the other services available.

1.2 User Requirements

The Zenzeleni network is currently using a homegrown prepaid billing system which was co-designed with the community. It uses IVR and A2Billing. An integrated billing system is needed to facilitate billing for usage in addition to voice. The network services that need to be billed are VOIP, data usage and usage of solar powered stations to charge personal devices. The system needs to cater for variable user types proposed by the community.

The billing system needs to be designed with the community in order for the project to remain viable after its initial launch

(Marie Josee Ufitamahoro, Isabella M. Venter, Carlos Rey-Moreno, and William D. Tucker).

1.3 User Requirements Analysis

The proposed solution, based on the user requirements is a responsive web based billing system. The functionality of the system will include adding prepaid credit to a users billing account as well as deducting credit when services are used. A native android application will be developed in order to track user account activity on a mobile device. Figure 1 describes the proposed system structure.

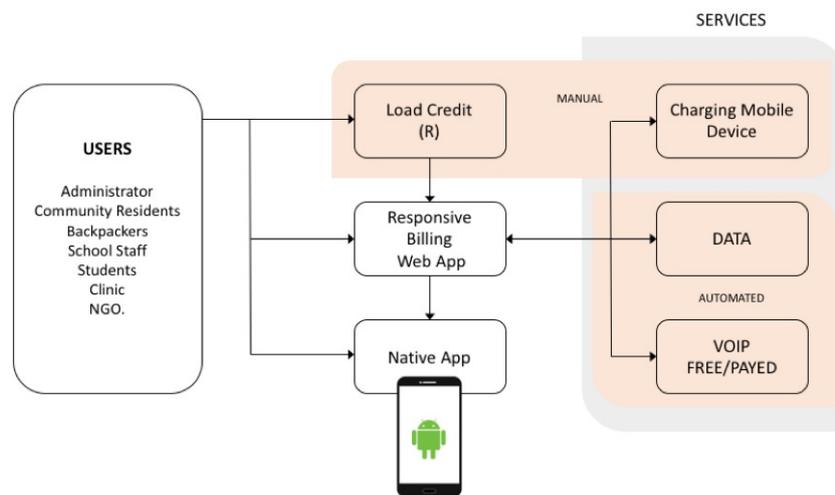


Figure 1.1: Proposed System Structure.

1.4 Project Plan

In the initial stages; all of the projects content is only conceptual. The ideas for the project will be refined by means of further research of the current system, examining similar systems available and discussion with the Mankosi Community ISP. This will ultimately determine the direction for future progress.

The second stage will be the system design, which will define the structure of the system and all of its components. It also specifies the components as well as the data capture, automation and programming.

The third stage of the project will be the implementation of the system. The implementation process will include unit and integration testing.

The fourth and final stage of the project will be user-centred usability testing.

Bibliography

- [1] (2015a). What is mesh networking? URL <http://zenzeleni.net/2015/09/23/what-is-mesh-networking>. Accessed 19 April 2017.
- [2] (2015b). *Zenzeleni Do It For Yourself - An Introduction to Community Telecommunications Networks*. Right2Know. URL <http://www.r2k.org.za/wp-content/uploads/Zenzeleni-booklet-web1.pdf>. Accessed 19 April 2017.
- [Marie Josee Ufitamahoro, Isabella M. Venter, Carlos Rey-Moreno, and William D. Tucker] Marie Josee Ufitamahoro, Isabella M. Venter, Carlos Rey-Moreno, and William D. Tucker. Promoting trust for billing of service on a rural wireless mesh network.
- [Rey-Moreno] Rey-Moreno, C. Zenzeleni networks ltd building community telcos. URL <http://www.wapa.org.za>.