Alternative Wireless Network Technology Implementation for Rural Zones

F.J. Watkins, R.A. Hinojosa, A.M. Oddershede

Francisco J. Watkins,
Ricardo A. Hinojosa,
Astrid M. Oddershede
Universidad de Santiago
Departamento de Ingenieria Electrica
Santiago, Chile
E mail francisco.watkins@usach.cl,
ricardo.hinojosa@usach.cl,
astrid.oddershede@usach.cl

Abstract:
This paper describes a methodology that allows wireless networking allowing interconnection to the Internet through a Gateway, to interact and obtain products and services delivery. These Wireless Mesh Network(WMN), are based on routers which are programmed to work as nodes of a network. There are certain routers that allow the programming of its firmware to form network nodes. Communication is transmitted between nodes in the network and it is possible to cover long distances. The signal of a distant node, hop from node to node till reach the Gateway. This generates delays and congestion in the network. A path that contains nodes that make more faster connection to the Gateway can be designed as a solution. This is called a backbone, has a different channel frequency of the common nodes. The characteristics of these networks is its fast implementation and low cost. This make them useful for rural areas, for developing countries and remote regions.
Keywords: wireless mesh network.

1 Introduction

The methodology can be structured to generate a transmission infrastructure of broadband hybrid wireless mesh of low cost that shall extend to a great extent with nodes placed point to point. This to access products and services delivers the Internet. In modern times the Internet has been a powerful network of communication and exchange of information with a strong endorsement of communication technology. On the other hand, it can be defined as a powerful instrument of social development that provides information, communication between people and a way of obtaining knowledge.

The Internet is a valuable tool for business, industry, trade, education, and social development of communities. A computer is physically connected to the Internet via a MODEM or a card NIC (Net Work Interface Card). The logical connection applies standards called protocols. A protocol is a formal description of a set of rules and conventions that govern so that communicate with devices on the network. The network connection can use multiple protocols this set is the (TCP/IP), transport control protocol, Internet packages, to receive or transmit information.

The most important is have the connectivity for getting the Internet benefits.

Based on the modern technology support, a communication network can be implemented, hacking the characteristic of its software and implementing some passives devices that modify the hardware characteristics.

The network design for a wireless mesh network will depend on the geographic landscape and distances between the points to be connected. A combination of point-topoint long distance links

(using directional antennas) and local point-to-multipoint links (using omni-directional antennas) between mesh nodes can create a reliable mesh network.

This type of wireless communication network has been denoted as Wireless Mesh Network [1]. There are several pilot projects in development at underdevelopment countries, mainly in rural areas.

2   The wireless mesh network (WMN)

It is a network structures by several nodes, that form the backbone of the network. The nodes, because of its software, can be configure automatically and re configure to maintain the network connectivity.
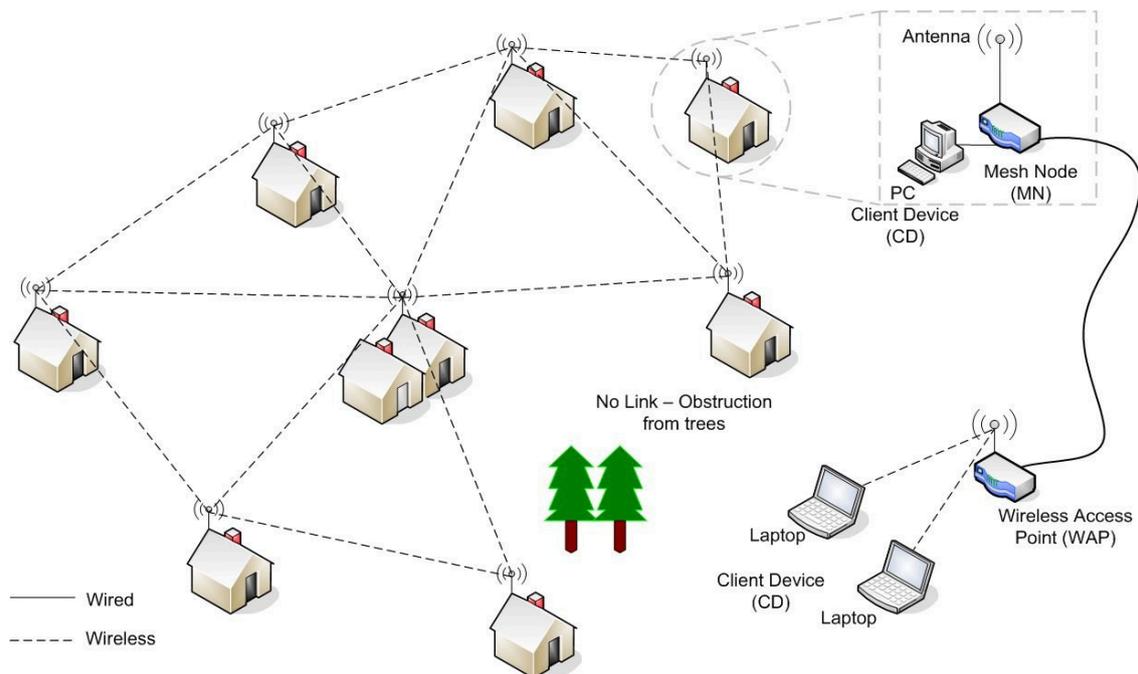

Figure 1: Wireless mesh network

In Figure 1, the wireless nodes are interconnected, and a wireless node is a router with its antenna, The antenna could be omni-directional or directional. A mesh node only communicate with others mesh nodes. A wireless access point is a point which alloys the interaction with the wireless mesh network of any wi-fi device. Its is consist of a wireless router and an antenna. In this case, the antenna is a omni-directional antenna.

In a mesh wireless network any node can be connected in no structured.

A simple wireless network can consist of two wireless routers and its antennas.

3   Characteristics and Advantages of a Wireless Mesh Network

The link between nodes the routers could be configure in different way, generating links that cover big distances or for giving service to several user in a small area. The connection could be by physics means or wireless.

In mesh wireless network , the unidirectional antennas are used, and in same places its can used wired connection. The large distance s are cover by using static wireless nodes with unidirectional antennas.

The mesh wireless network are robust and of simple configuration , because its software will determine the path of the data in real time. The backbone of the network its depend on the site topography.

Communication of all mesh nodes are based on wi-fi . All the nodes of the mesh wireless network operate at same channel frequency. In a WMN, each node must be communicated with at least with other two nodes in order to maintain a robust mesh connectivity, which is the main features of a WMN.

In a WMN, each node have the same name and number. The IP address should be unique to allow to connect to any computer in the network. A computer can connect to the mesh via LAN cables connected to the mesh node or a wireless connection to a separate access point connected to a LAN or a mesh node.

A network device, is connected physically to the network through a modem or a NIC(Network Interface Card) and the logic connection is made through protocols. A protocol is a formal description of a set of rules and agreements for defining a communication way between the different devices of the network. The protocols TCP/IP, (Transport and Control Protocol/ Internet Packages) and OSI (Open System Interconnection). The users to manage the mesh thought navigators. A navigators initiate (Start up) the connection to a server and could required or received information. This software interpret hipertext language label (HTML), which is one of language to code of a Web page content. In a WMN, a routing protocol, will route de IP traffic between the wireless interfaces of the mesh nodes. Manage the routing information and maintains routing tables dynamically. This provide an alternative route when a node fails.

The advantages of a WMN, are the following: Self-forming. The wireless mesh forms their structure automatically once its nodes have been configured and activated. It is a robust network. Fault tolerance because of redundant routes exist in the network. Information is not interrupted in the rest of the network when a node fails. Low cost of the of the nodes of the WMN, which allows the admission of extra nodes to increment the network, given a low incremental cost of the network. Easy deployment of the network. New member of the community, with little training can built their own nodes.

4   The Wireless Mesh Network Design

Wireless Mesh networks are no problematic to build when you have a few nodes. In general you must follow the following stages:
- Map of the network;
- Place of each node;
- Network topology and channel Allocation;
- Channel Allocation for site users;
- Plan IP address allocation.

4.1   Map of the network

The map of the mesh network star with identification of the sites that will receive a mesh node, the coordinates can get with a GPS and them plot distribution nodes in a paper. The sites nodes can be linked together using the map. Each link is a straight line between to nodes. The length of each link represent the distance between sites.

### 4.2	Place of each node

For the nodes is a solution to build a backbone reaching the gateway. If we have a complex mesh, several backbones uniformly distributed are needed for the nodes reach the gateway. The backbones are path included in the connection of certain strategic nodes in such way that for any others nodes, the connection with the gateway be expedite (Connection with the gateway be through a few nodes).

### 4.3	Network Topology and Channel Allocation

Nodes in the mesh can communicate to each other, if they have the same frequency channel. When a back bone is incorporated, other channel is needed, which works as an independent network. In this case both network do not have interference problem.

### 4.4	Channel allocation of the backbone

If we have a mesh network with a backbone we need two IP ranges . A third range is needed is we adds an access point [2].

### 4.5	IP Address Allocation

The IP allocation should assure for each PC and each node a unique address, according to RFC 1918 subnet Scheme [3], [4].

For the assignment of the address of the different element of the network, we have the following:

Backbone node; wireless interface : 10.0.1.x/24 where 1Ł x < 255;

Ethernet interface: 10.3.x.y/24 where 1Ł x < 255 where 1Ł y < 255;

Normal mesh node: wireless interface: 10.1.1.a/24 where 1Ł a < 255;

Ethernet Interface:10.2.a.b/24 where 1Ł a < 255 where 1Ł b < 255, PC and Laptop connected to a node will be numbered from 100according to the setting;

Access Point : The subnet assigned to a LAN or hotspot will be the same as Ethernet LAN connected to the mesh node.

## 5	The wireless Mesh Network

### 5.1	First Steps

To build the Mesh Network the following stages should be cover:

• Configure all the mesh nodes and wireless Access Point according to the network document;

• Attach a paper to the device of the mesh node or wireless access point with the configuration detail;

• Test the equipment to be sure all is working properly;

• Connect a PC to a mesh node with a LAN cable. The PC will require a IP address. Ping other Mesh node .If the ping is successful, the mesh node of the PC and the other mesh node are working. If not, check the configuration;

• The gateway is the point where the mesh network will be connected to the internet;

• Installing the mesh nodes from the gateway, in such way you can confirm that the network is still working when a new mesh node be installed;

• Connect a PC to a mesh node with a LAN cable, ping the gateway first, and if that is successful, access to any site on the internet (Different web pages) in order to ensure the PC can connect to the internet.

5.2   The Mesh node

In order to start with the mesh node you must have the router, the LAN cable, and the power supply. To configure the mesh node, the following stage must be cover:
- Upgrade the firmware for the backbone and normal mesh nodes [5];
- Configuration of system settings;
- Configuration of wireless settings;
- Configuration of LAN settings;
- OLSR settings [6] (Optimized Link State Routing Protocol.

(OLSR) is developed for mobile ad hoc networks. It operates as a table driven and proactive protocol, thus exchanges topology information with other nodes of the network regularly).

6   Conclusions

A methodology has been given in order to plan and design a WMN , which can supply available communication systems in a similar way of Internet does. But a lower cost of internet. This can be planned specially on rural areas. Different countries can access to several routers models, but there are only a few that allow be adapted to this technology. By other hand there are free open software that allows this implementation.

This methodology makes it possible to cover a niche of potential users, especially in rural areas and in developing countries where the low density of population, not makes it attractive to commercial ISP (Internet Service Provided).

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