

MESH NETWORK

Pei Ping

Belarusian National Technical University,
Minsk, Belarus, peiping123456.love@gmail.com

Nowadays, the internet has been becoming an essential part of people's daily lives. And many common applications could be completed through the internet, such as online banking, online booking and network shopping. In addition, Internet is one of the best sources of entertainment that is why a large part of youth surfs the Internet, mainly for entertainment and social networking. If the network requires providing more services, the demand for broadband has to be expanded.

Since cellular network has provided an increasing number of services, the internet could offer wireless access for more general user. However, with the increase of the number of wireless user, the wireless network does not seem to be carrying heavy loads. In order to solve this problem, a new generation of wireless network technology - mesh network technology - comes into being. Normally speaking, when creating a new network or upgrading the existing network, which would mean installing or replacing a lot of infrastructure. At this point, the wireless mesh network needs a little new infrastructure to improve wireless internet access.

At first, cellular network, as its name, its wireless coverage is composed of a number of cellular (cell); each cell is located in the vicinity of the center of a base station. A cellular network consists of mobile units linked together to switch equipment.

Mesh network has been applied to people's daily lives already, like cobweb or modern city street. The basic features of a mesh network are given below.

1. Mesh network has no master node, so it is regarded as multi-hop network. It constitutes the distribution network wireless access point (AP), Fig 1, [1].
2. When the data is transmitted in mesh network, it could reach any other node through intermediate nodes.
3. The wireless mesh network AP has equipped with automatic configuration.

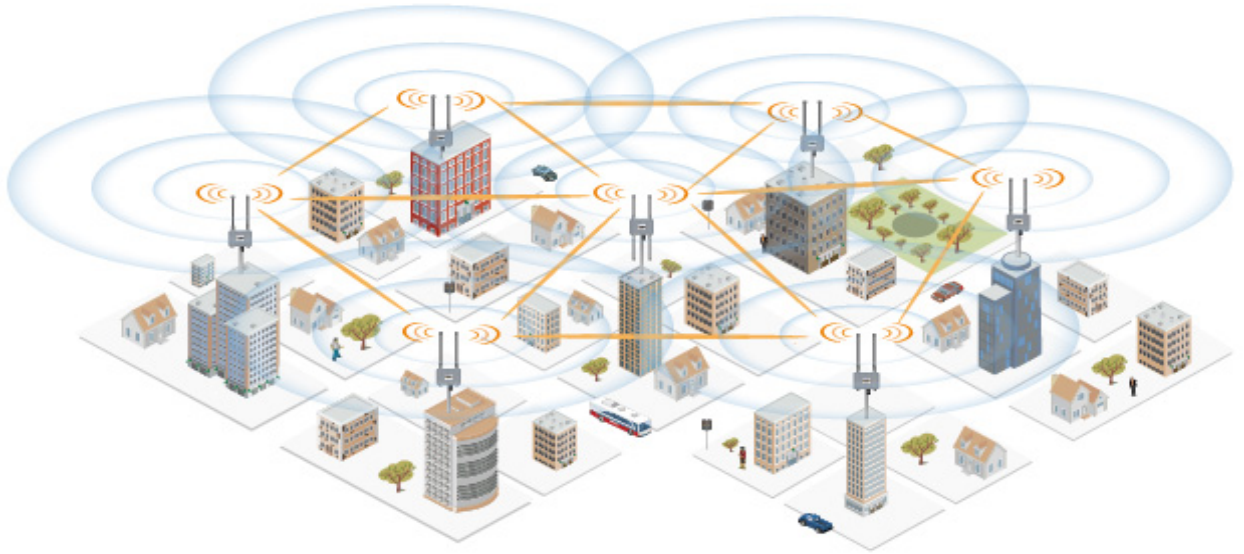


Figure1 - Metro Mesh Network (Netkrom Group 2013).

The mesh network has two important advantages in development

1. Expand the coverage of the existing network.
2. Reduce the demand for infrastructure.

Normally, the base station is located on the top level of the tall central building, Fig. 2. [2] Definitely, there are many obstacles around the central building, which would exert a great influence on base station's signal propagation, weakening the signal. In order to improve this situation, multi-hop mode is adopted in cellular network. It means that all users' node multi-hop between each other can be kept under the cellular network coverage and provide a strong signal for the user. This method will be used for "wireless city" construction, and nodes are arranged at the crossing of modern streets [3].

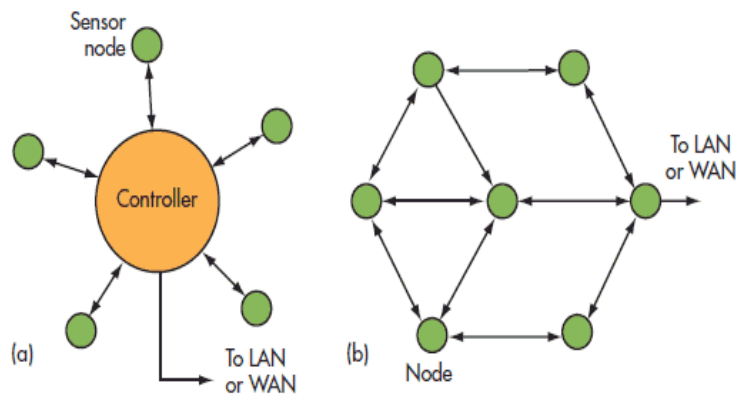
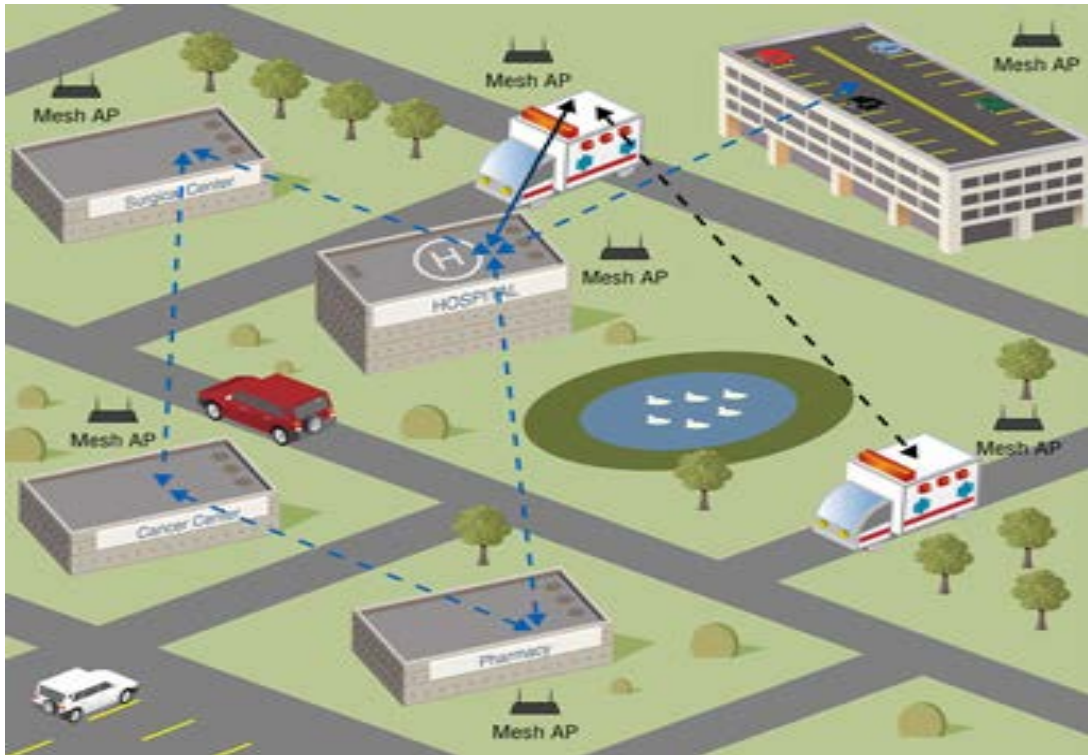


Figure 2 - Three Key Benefits of Wireless Mesh Networks (Jackson 2011)

Nowadays, a lot of wireless cities have come on the scene, in which the internet is provided for people all the time. The mesh wireless network not only could be used in general public place, but also can be used in local government.

What is the mesh network arrangement? How does it work? These are main questions in a digital city. Mesh wireless nodes are deployed at the corner of the street. WI-FI access point is included by each mesh wireless node Fig. 4. [4]. So that users can connect the mesh network through the WIFI device. The network operator will provide a return connectivity for all of access points.

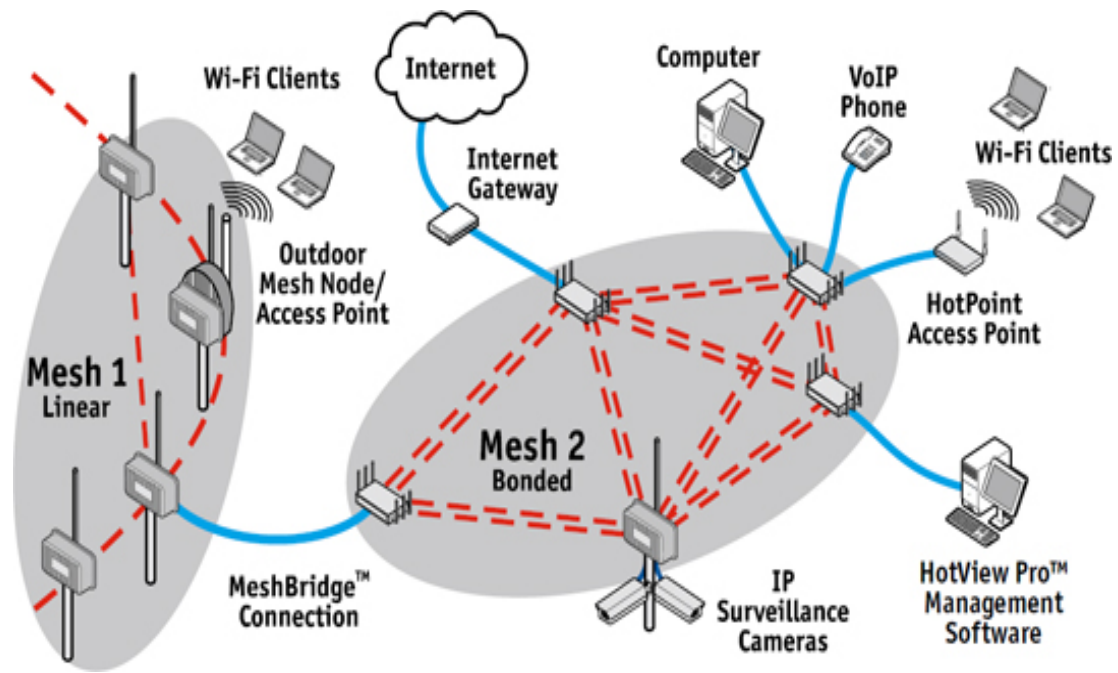


Figure 4 - Firetide HotPort 7020 Outdoor WiFi Wireless Mesh Node (Keison Internation Ltd 2013)

Intelligent Transportation System (ITS) has expected by people in many countries. When a car is close to the semaphore, the feedback signal which has an ideal stop-speed will inform driver to stop Fig. 5. [5]. Secondly, if there is an unavoidable collision with a car ahead, the safety equipment should be open through multi-hop feedback information. Computer will calculate the time of collision so as to inform that the driver has to adjust the seat belt.

The wireless communication is easy to be attacked. These security risks are amplified in multi-hop mesh network. All users are connected with AP in mesh network, which is easy for an administrator to manage. An attacker could modify the network structure by damaging mesh network routing mechanisms. For example, the attacker may control all of commands to monitor the information in network by tampering routing. Normally the router will be properly protected in the wired network. It is inconvenient to for the hacker to attack all wired network routers. However, the wireless mesh network is different from wired network; it is exposed to external environment, for example, the mesh router will be put on the top of the building or street light, which could be damaged by rain and snow. So it is not easy to protect the wireless router.



Figure 5 - BMW Testing Vehicle to Vehicle On Road Networking System (Paul 2012)

The Solution in Ariadne (A secure on Demand Routing Protocol for Ad Hoc Networks) is to use the authentication code to test the certificate in a mesh network. The basic of process is the user sends the identification code firstly, and the key word is created by ID code, while the recipient should save the identification code firstly, and then test the certificate of key words [6].

Obviously, many working areas still need to use this new kind of network technology to solve different problems that exist in normal network. The modular, multi-frequency, multi-channel network system will be utilized in this new mesh network. Nowadays, its performance and service has been questioned by many people, however, it will become the dominant force in the network if it can be applied to the right occasion.

1. Mishra, A. R. 2007. Advanced Cellular Network Planning and Optimisation. Chichester: John Wiley & Sons Ltd.
2. Methley, S. 2009. Essentials of wireless Mesh networking. Cambridge: Cambridge University Press.
3. Padron, F. M. 2009. Traffic Congestion Detection Using VANET. Florida: Florida Atlantic University Press.
4. Hossain, E. – Leung, K. K. 2008. Wireless Mesh Networks: Architectures and Protocols. New York: Springer.