DEVELOP THE MULTI-HOP ROUTING METRIC IN WIRELESS MESH NETWORKS

A. Ramakrishna[1], Dr. K. Subba Rao[2]
[1]Asst.Professor, MLRITM-R.R.Didtrict-Telangana-India,
[2]Professor, BVRIT-Narsapur-Medak,-India

ABSTRACT
Wireless Mesh Networks (WMNs) is a promising new technology in near future. It provides high access to internet through dedicated broadband links for various applications. Wireless Mesh Networks is an efficient and cost effective wireless connectivity. The WMN has been the ideal technology for the next generation wireless community networks that offers self-configuring, self-healing and self-organizing. In the light of these observations, in this paper, we propose a "Packet Relaying in Multi-Hop Networks method". It is used to develop the multi-hop routing metric in both cellular networks and WMNs used to either enhance the coverage of network or improve the central management of the network layer,
Keywords: multi-hop routing, cellular network, wireless mesh network.

I. INTRODUCTION:

Network is the practice of linking two or more computing devices together for sharing data. Two computers are said to interconnect if they are able to exchange information. The Internet will be everywhere, and will be a vastly deeper and more powerful environment than we know today. The information society will be a networked society, with individuals and businesses always linked locally and to the Internet. *Wireless Mesh Networking* (WMN), also known as wireless community networking, is an emerging technology in which, each node is outfitted with radio communications gear and acts as a relay point for other nodes. WMNs also can be used to upgrade the existing metropolitan fibre networks in expanding the network coverage.

In the past ten years, centralized multi-hop routing has been developed in both cellular networks and WMNs used to either enhance the coverage of network or improve the central management of the network layer. Despite some proposals of cellular networks that have implemented gateway centralized routing, the issue of centralized multi-hop routing of WMNs is rarely studied. In fact, most existing work on WMNs has omitted the role of gateway nodes in delivering application services that require a central management at the provider side. For instance, neighbourhood applications such as online TV, games and video applications, are all offered by service providers and require a certain management level that takes place in the gateway. Unfortunately, existing work treats all the WMN nodes equally as in MANET, ignoring the specific features of WMNs, where
gateway plays a vital role in communication. Consequently, many management/control based applications at the service provider side cannot be handled efficiently. we concentrate on developing a new centralized multi-hop routing metric especially for WMNs to enhance the capability of WMNs to provide a wide range of applications.

II. BACKGROUND AND RELATED WORK:

a) Wireless Mesh Networking:

WMNs are a particular type of Mobile Ad-hoc Networks (MANET). A WMN consists of mesh clients, mesh routers and gateways where mesh routers and mesh clients are designed to increase the coverage of WMNs by only using wireless radio and gateway use both wireless radios and fibre optic cable. Mesh clients connect to gateways through mesh routers, while mesh routers connect to a backbone network via

gateways and gateways relay the message from internet to the mesh clients. Hence, there are three layers in a typical WMN: Internet Gateway Layer (Layer 1), Mesh Router Layer (Layer 2) and Mesh Client Layer (Layer 3) as depicted in Figure 1

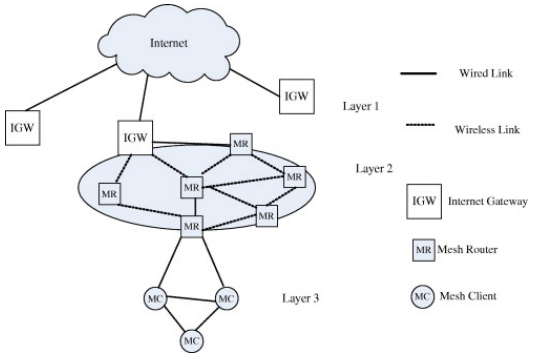

Figure 1: The architecture of a typical WMN.

To simplify the description of the routing algorithm, we combine Layer 2 and Layer 3 as gateway node in this paper as both mesh routers and mesh clients are routing devices use wireless radio and connect to backbone internet via gateways.

b) Related Work:

The Hybrid Wireless Mesh (HWMP) protocol is proposed to discover an optimal path in network layer in 802.11s framework. This protocol is designed on the basis of AODV-HOP. When a source intends to find a path to the destination, it has to send a request packet to the gateway. Then gateway directs the destination to contact the source by broadcasting a reply.. In this work, every mobile station relays traffic and paths are managed in the gateway which results in improving the coverage and throughput of the network. Hierarchical Multi-hop Cellular Network (HMCN) protocol with the similar functionality to MCN, with three MANET routing protocols, DSR, AODV-HOP and DSDV.

Hop Count is widely used in the existing protocol such as DSR [9], AODV-HOP [8] and DSDV [10]. A routing protocol with the hop count metric finds the routing path with the minimum distance, i.e. hop number. It does not consider other issues such as interferences, transmission rates, and packet loss ratios. Therefore, using hop count metric may result in poor performance.

Load Count is a load balancing metric for wireless networks, which is

$$Load\_Count = \sum_{i=1}^{n} Load_i$$

where *Loadi* is the traffic load of *node_i* which is normally captured by calculating the IFQ length. The IFQ (Network Interface Queue) is a drop-tail buffer at the MAC layer of 802.11 radios, which contains outbound frames to be transmitted by the physical layer. IFQ length is calculated by counting the number of remaining packets in the IFQ buffer.

We have developed the GLBM [15] as a routing protocol that uses Load Count to calculate routing for multicasting in WMNs.

***Expected Transmission Count* (*ETX*):**

It estimates the expected number of MAC layer transmissions for the wireless links and measures the packet loss rate. A node sends out probe packets to all its neighbour nodes every second to measure *ETX*. The advantage of *ETX* is the probing overhead is reduced. However, *ETX* does not involve the data rate in measuring delivery ratio.

Airtime Link Metric is used to calculate routing prospect of each linked pair of nodes within the 802.11s mesh standards HWMP. It is defined as the amount of channel resources consumed by transmitting the frame over a particular link.

III. PROPOSED SYSTEM (*Packet Relaying in Multi-Hop Networks*):

In wireless Mesh Networks, The multi-hop routing metric is based on, nodes communicate with each other using wireless Channels and do not have the need for common infrastructure or centralized control. Nodes may cooperate with each other by forwarding or relaying each other packets, possibly involving many intermediate relay nodes. This enables nodes that cannot hear each other directly to communicate over intermediate relays without increasing transmission power. Such multi-hop relaying is a very promising solution for increasing throughput and providing coverage for a large physical area. By using several intermediate nodes, the sender can reduce transmission power

thus limiting interference effects and enabling spatial reuse of frequency bands. In ad-hoc networks, the medium is shared and nodes arrange access to the medium in a distributed way independent of their current traffic demand. In particular given standard ad-hoc routing protocols that try to minimize relaying nodes on the path, nodes closer to the network centre are more likely to become a relay node. This has the inherent drawback that a node that serves as a relay node for transmissions of multiple neighbouring nodes is prone to become a performance bottleneck. As it is necessary to understand performance of such relay networks, the next sub section provides an overview on performance analysis of a relay node. When multiple relays are involved across an end-to-end path, it is important to control overhead for each single packet transmission. Unfortunately, current

Medium Access Control (MAC) and physical layers for *Wireless Local Area Network.*

(WLAN) based multi-hop networks impose high overhead for the transmission of small data packets, which is common for *Voice over Internet Protocol* (VoIP). By combining several small packets into larger ones, per packet transmission overhead can be reduced significantly.

Figure 2:Multi-Hop Routing Metric Various Wireless Networks.

The above figure shows, the Mesh Routers connected with Mesh Client, Cellular Networks, MANET and other Networks..

In cellular and wireless local area networks, wireless communication only occurs on the last link between a base station and the ireless end system. In multi-hop wireless networks there are one or more intermediate nodes along the path that receive and forward packets via wireless links. Multi-hop wireless networks have several benefits: Compared to networks with single wireless links, multi-hop wireless

networks can extend the coverage of a network and improve connectivity. Moreover, transmission over multiple “short” links might require less transmission power and energy than over “long” links. Moreover, they enable higher data rates resulting in higher throughput and more efficient use of the wireless medium.

Multi-hop wireless networks avoid wide deployment of cables and can be deployed

in a cost-efficient way. In case of dense multi-hop networks several paths might become available that can be used to increase robustness of the network. Unfortunately, protocols developed for fixed or cellular networks as well as the Internet are not optimal for multi-hop wireless networks. This is in particular the case for routing protocols, where completely new uncast, multicast, and broadcast routing protocols have been developed for (mobile) ad-hoc and sensor networks. On the transport layer, the *Transmission Control Protocol (TCP)* is the de facto standard in the Internet and in order to allow interoperability, TCP must be supported

in multi-hop wireless networks as well. However, many protocol mechanisms such as congestion control and error control based on acknowledgements do not work efficiently in multi-hop wireless networks due to various reasons such as contention and control packet overhead. Even on application level new concepts are required to support discovery of available applications and services. Several concrete application scenarios for multi-hop wireless networks have been investigated during the last years. Initially, it has been proposed to deploy multi-hop networks to extend the coverage of cellular networks by relaying packets. Recently, wireless mesh networks have been proposed to provide broadband Internet services without the need of expensive cable infrastructures, in particular

in areas sparsely populated. Wireless mesh networks consist of mesh routers and mesh clients, where mesh routers have minimal mobility and form the backbone of wireless mesh networks. They make use of heterogeneous network technology such as IEEE 802.11, 802.16, and cellular radio networks. Relaying

nodes can also be mobile such as in case of vehicles. In that case the term mobile ad-hoc network is more appropriate. Vehicular networks as a special case of mobile ad-hoc networks make use of the frequently existing communication equipment in cars (either pre-installed or enabled by equipment carried by passengers). Wireless sensor networks are another emerging technology, can cover large geographical areas, and provide connectivity without having direct physical access to each sensor node. Sensor nodes can be configured and sensor data can be read using multi-hop networking

.

IV.CONCLUSION

Here, the WMN offers an opportunity to combine the desirable characteristics of both fixed networking and wireless networking technologies. Although several network architectures have been studied and indeed deployed in practice for wireless community networking due to evolving technology and locales, WMN has been undoubtedly the most popular architecture that proved clear superiority in different roles. WMN technology is instrumental in reshaping the wireless broadband industry and is disruptive to the current broadband Internet access paradigm, which relies on cable and DSL being deployed in individual homes. In this Paper, to develop the Multi-hop routing metric for various Wireless Networks. In the Multi-hop Routing Metric, We also discuss about the hop-count,Load Count and Expected Transmission Count.

V.REFARENCES:

[1] Mihail L. Sichitiu, "Wireless Mesh Networks: Opportunities And Challenges".

[2] Eduard Glatz, "Wireless Mesh Networks: Introduction" ATCN: WMN-BasicsWS0607.fm.

[3] Mojtaba Seyedzadegan, Mohamed Othman, Borhanuddin Mohd Ali and Shamala Subramaniam, "Wireless Mesh Networks: WMN Overview, WMN Architecture", 2011 International Conference on Communication Engineering and Networks, IPCSIT 19 (2011) IACSIT Press, Singapore.

[4] Yan Zhang, Jijun Luo, Honglin Hu, "Wireless Mesh Networking Architectures, Protocols and Standards", Auerbach Publications, Taylor & Francis Group, New York.

[5] Sonia Waharte, Raouf Boutaba, Youssef Iraqi, Brent Ishibashi, "Routing protocols in wireless mesh networks: challenges and design considerations", Multimed Tools Appl 29 (2006) 285–303.

[6]. K. Chiang, A. Asgari, E. Stansfield, "A QoS provisioning framework for Wireless Mesh Network," in *Proceedings of IEEE International Conference on Automation, Quality and Testing.,* 2008.

[7]. IEEE P802.11s/D1.08. Draft amendment to standard – IEEE 802.11: ESS Mesh Networking. IEEE, Jan. 2008.

[8]. The network simulator, NS2, http://www.isi.edu/nsnam/ns/ [Accessed: Dec. 1, 2007].

[9]. Y. D. Lin and Y. C. Hsu, "Multi-hop cellular: a new architecture for wireless communications," in *Proceedings of Nineteenth Annual Joint Conference of the IEEE Computer and Communications Societies,* Vol. 3, pp. 1273-1282, 2000.

[10]. H. Li and D. Yu, "Comparison of ad hoc and centralized multi-hop routing," in *Proceedings of the 5th International Symposium on Wireless Personal Multimedia Communications,* , Vol. 2, pp. 791-795, 2002.

[11]. B. S. Manoj, R. Ananthapadmanabha, and C. Siva Ram Murthy, "Multi-hop Cellular Networks: Architecture and Protocols for Best-effort and Real-time Communication," in *Journal of Parallel and Distributed Computing*, 2005.

[12]. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to Algorithms," Second Edition, the MIT Press, September 2001.

[13] Bo Wang and Matt Mutka, "QoS-Aware Fair Rate Allocation in Wireless Mesh Networks", Computer Communications,

Volume 31 (7) (9) (2008) 1276-1289.

[14] Kaikai Chi, Xiaohong Jiang and Susumu Horiguchi, "Network coding-based reliable multicast in wireless networks", Computer Networks, 54 (11) (2010) 1823 -1836.

[15] Zheng Sihai, Li Layuan and Guo Lin, "QoS-Based Multicast Routing Protocol in MANET", International Conference on Industrial Control and Electronics Engineering, (2012) 262 - 265.

[16] Mohammed Saghir, Tat-Chee Wan and Rahmat Budiarto, "QoS Multicast Routing Based on Bandwidth Estimation in Mobile Ad Hoc Networks", Proceedings of the International Conference on Computer and Communication Engineering, 1 (2006) 384-389.

[17] Sonika Kandari and Manoj Kr. Pandey, "QoS Multicasting in MANET", International Journal of Current Engineering and Technology, ISSN 2277 – 4106, (2014) 1854-1858.

[18] Yun-Sheng Yen, Han-Chieh Chao, Ruay-Shiung Chang and Athanasios Vasilakos, "Flooding-limited and multi-constrained QoS multicast routing based on the genetic algorithm for MANETs", Mathematical and Computer Modeling, 53 (11–12) (2011) 2238–2250.

[19] Govindaraj.E , Dr.V.P. Arunachalam and Dr.S.Karthik," A QoS Aware Robust Multi path Routing Protocol for Wireless Mesh Networks" , European Journal of Scientific Research, (2012).

[20] Ali, Amjad, and Wang Huiqiang. "Node Centric Load Balancing Routing Protocol for Mobile Ad Hoc Networks." In Proceedings of the International MultiConference of Engineers and Computer Scientists, 1(2012).

[21] Yigal Bejerano, Seung-Jae Han and Amit Kumar, "Efficient load-balancing routing for wireless mesh networks", Elsevier, (2006).

[22] Liang Ma and Mieso K. Denko, "A Routing Metric for Load-Balancing in Wireless Mesh Networks", IEEE, (2007).

[23] Siddiqui, Muhammad Shoaib; Amin, Syed Obaid; Kim, Jin Ho; Hong, Choong Seon; "MHRP: A Secure Multi-Path Hybrid Routing Protocol for Wireless Mesh Network", Proc., IEEE, military communications conference MILCOM, (2007).

[24] A.Ramakrishna, Dr.K.Subba Rao Published a international Journal on" Awareness of Wireless Mesh Networks using Routing Metrics " International Journal of Engineering Science AND Research Technology(IJESRT), Vol:7 Issue:3 ,ISSN No:2277-9655, Mar 2018(UGC Approved Journal).