IOSR Journal of Computer Engineering (IOSR-JCE)
e-ISSN: 2278-0661,p-ISSN: 2278-8727
PP 34-37
www.iosrjournals.org

A Classification Framework for Scheduling Algorithms in Wireless Mesh Networks

Mayuri Panchal[1], Dr. Rajesh Bansode[2]
[1]*M.E.I.T, Thakur College of Engineering and Technology/ Mumbai University, Mumbai, India*
[2]*Assoc. Prof, Thakur College Of Engineering and Technology / Mumbai University, Mumbai, India*

Abstract- *Scheduling MAC-layer transmissions in multi-hop wireless networks is an active area of research. An overview of link scheduling algorithms in Spatial Time Division Access (STDMA) Wireless Mesh Networks is provided. There are several interesting algorithms proposed in the literature in the problem space of scheduling for multi-hop wireless networks, specifically for WiMAX mesh networks, long distance multi-hop Wi-Fi networks, and Vehicular Ad-hoc Networks (VANETs). Wireless Mesh Networks offer advantages over other wireless networks; these include easy deployment, greater reliability, self-configuration, self-healing and scalability. WMNs comprises of two types of nodes: Mesh Routers and Mesh Clients. Mesh Routers have specific routing functions to support mesh networking. Mesh routers are not very mobile and they are considered as the mesh back-bone for clients. Mesh routers have multiple wireless interfaces which can be built on either the same or different wireless access technologies.Mesh Clients have additional functions for mesh networking and can also work as routers. Mesh client has only one interface. Mesh clients have a higher variety of devices compared to mesh routers. Routing is an important factor to provide the data packet from source to destination. The Wireless Mesh Routing protocols can be divided into proactive routing, reactive routing and hybrid routing protocols.In the existing system the network consists of 20 nodes with 2 servers and achieved Packet Delivery Ratio of 80%. The bandwidth of each channel is 100 Mbps having transmission time and throughput as 116 ms and 50% respectively. The topology used is grid topology.The research focuses on the network that consists of 30 nodes with around 10 servers achieving Packet Delivery Ratio up to 100%. The bandwidth of each channel is 110 Mbps having transmission time and throughput 50 ms and 70% respectively. The topology used is chain topology to achieve shortest path to reach all the nodes.*

Keywords -*Multimedia Access Control, Mobile Adhoc Network, Vehicular Ad-hoc Networks, Wireless Fidelity, Wireless Mesh Network*

I. Introduction

Wireless Mesh Network is a first step towards providing cost effective and dynamic high-bandwidth networks over a specific coverage area. Wireless mesh infrastructure is, in effect, a network of routers minus the cabling between nodes. It's built of peer radio devices that don't have to be cabled to a wired port like traditional WLAN access points (AP) do.Mesh infrastructure carries data over large distances by splitting the distance into a series of short hops. Intermediate nodes not only boost the signal, but cooperatively pass data from point A to point B by making forwarding decisions based on their knowledge of the network, i.e. perform routing. Such an architecture may, with careful design, provide high bandwidth, spectral efficiency, and economic advantage over the coverage area [1]-[2].

Wireless mesh networks have a relatively stable topology except for the occasional failure of nodes or addition of new nodes. The path of traffic, being aggregated from a large number of end users, changes infrequently. Practically all the traffic in an infrastructure mesh network is either forwarded to or from a gateway, while in ad hoc networks or client mesh networks the traffic flows between arbitrary pairs of nodes.

This type of infrastructure can be decentralized (with no central server) or centrally managed (with a central server). Both are relatively inexpensive, and can be very reliable and resilient, as each node needs only transmit as far as the next node. Nodes act as routers to transmit data from nearby nodes to peers that are too far away to reach in a single hop, resulting in a network that can span larger distances. The topology of a mesh network is also reliable, as each node is connected to several other nodes. If one node drops out of the network, due to hardware failure or any other reason, its neighbors can quickly find another route using a routing protocol.

I. Wireless Mesh Network

A. Introduction

Wireless Mesh Network is a promising wireless technology for several emerging and commercially interesting applications, e.g., broadband home networking, community and neighborhood networks, coordinated network management, intelligent transportation systems. It is gaining significant attention as a possible way for Internet Service Providers (ISPs) and other end-users to establish robust and reliable wireless broadband service access at a reasonable cost. WMNs consist of mesh routers and mesh clients. Different from traditional wireless networks, WMN is dynamically self-organized and self-configured. In other words, the nodes in the mesh network automatically establish and maintain network connectivity. This feature brings many advantages for the end-users, such as low up-front cost, easy network maintenance, robustness and reliable service coverage. The benefits of WMNs are increased reliability, low installation costs, large coverage area and automatic network connectivity [4].

B. Wireless Mesh Network

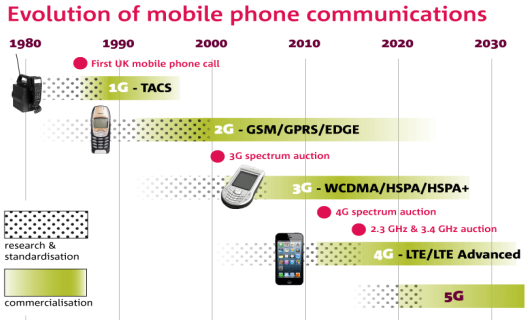

Fig. 1. Generations of Wireless Communications

WMNs as a kind of multi-hop network, have received increasing attention due to their advantages, e.g., low cost, ease of deployment and wide range of application scenarios, and widely accepted as a promising solution to provide wireless broadband access.

Fig. 1. Shows the wired network that is a common type of wired configuration. Most wired networks use Ethernet cables to transfer data between connected PCs. In a small wired network, a single router may be used to connect all the computers. Larger networks often involve multiple routers or switches that connect to each other.

The Gateway, which is the computer that routes the traffic from a workstation to the outside network that is serving the web pages. In homes, the gateway is the ISP that connects the user to the internet. In enterprises, the gateway node often acts as a proxy server and a firewall.

The Mesh Router, it forwards traffic to and from the gateways which may, but need not to be connected to the Internet. It continuously monitors the activity and maintaining the list of other devices in the vicinity. When a potential node appears, it broadcasts its address and networking capabilities.

C. Features of WMN

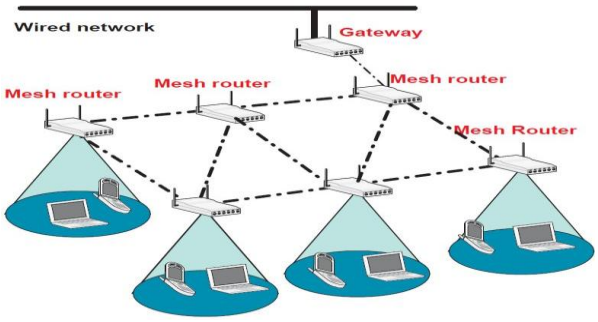

Fig. 2. Wireless Mesh Network

***C.1** Self-healing and Self-Configuring:*WMNs are flexible in network architecture and are not dependent on the implementation and the protocols. The main features of WMN such as self-healing and the self-configuring enhances the performance of the network further. Due to the self-healing feature of WMN, it automatically finds the fastest and reliable path when the nodes lose their connectivity and blocked in the network. The self-

configuring feature can easily add new nodes, remove or relocate existing nodes to or from the network without human intervention. Hence, because of these features, the end users demand can be fulfilled and the network set-up time and maintenance cost can be reduced.

C.2 *Low Utilization cost:*Mesh routers are wireless and static; they have the facility to service in multi-hop environments. In large areas, the uses of wireless routers are cheaper when compared to single hop router with wired connection. In general wired connections are more expensive to install and maintain. The deployment of WMN leads to low operation cost due to faster installation and maintenance.

C.3 *Better Reliability:* In WMN, the packets are transmitted from source to destination through multiple paths. The multiple paths are used as alternate paths in case of failure. The alternate paths are preferred to minimize the bottleneck in congested area of the network. Using multiple paths, the traffic load can be balanced in the network. Load balancing and minimizing the bottleneck through alternate path can considerably increase the network reliability in WMN.

C.4 *Scalability:* In traditional wireless networks once the number of nodes increases, the performance decreases. However, in WMNs once the number of nodes increases, the performance also increases by providing alternate routes. Due to the scalability feature, the mesh network can handle hundreds or thousands of nodes. By adding more routers, the network can get rid of the weak signals and dead zones.

C.5 *Network capacity***:** WMN supports the feature of multiple channels and multiple interfaces. The routers in the mesh network are provided with multiple interfaces which increases the throughput and capacity of the network considerably.

II. Architecture of Wireless Mesh Network

A. Client Wireless Mesh Network

The Client mesh network offers peer-to-peer connection among the client devices. The devices usually have a single radio. An important aspect of this type of WMN is that the network consists of fully mobile devices without a wireless backbone. Thus, it forms a conventional ad-hoc network. The client nodes from the real network to perform routing and self-configuration functionalities.

B. Infrastructure Wireless Mesh Network

In infrastructure WMN, the mesh routers provide an end-to-end connectivity to mesh clients and form a high bandwidth wireless backbone. This type of WMN can be formed using the different types of radio technologies in addition to IEEE 802.11 technologies. The conventional clients can directly communicate with the mesh routers if both have the same type of radio technology. Otherwise, the clients can communicate with the mesh routers only through their base stations which have Ethernet connections. The mesh routers with the gateway feature can be connected to the Internet. This approaches incorporates the WMNs with existing wireless networks. The mesh routers are static in nature provide the features of self-healing and self-configuring functionality among the links themselves.

C. Hybrid Wireless Mesh Network

Hybrid Wireless Mesh Network is an elegant version of WMN. As the name indicates it is a blend of Infrastructure and Client WMN and its architecture. The Mesh Router form a Mesh backbone infrastructure while the mesh clients involve in the routing and forwarding packets. The mesh clients can access the network through mesh routers and they can directly communicate with other networks such as Wi-Fi, WiMAX, cellular and sensor networks. The routing facility of clients offer enhanced connectivity and coverage within WMNs.

III. Simulation Results

I. FLOWCHART OF PROPOSED SYSTEM

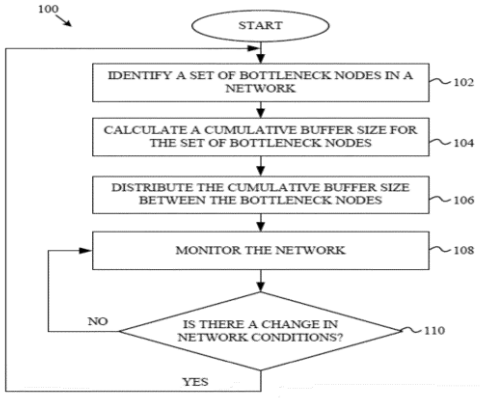

Fig. 3. Generation of Multi-hop network

Multi-hop or ad hoc, wireless networks use two or more wireless hops to convey information from a source to a destination. There are two distinct applications of multi-hop communication, with common features but different applications. A mobile ad hoc network consists of a group of mobile nodes that communicate without requiring a fixed wireless infrastructure. Multi-hop cellular networks conventionally employ single hops between mobile units and the base station. The Fig. 3 shows the flow chart of generation of Multi-hop network along with the changes in the network conditions.

IV. Expected Outcomes

To design a network with the number of nodes comprising of 300 nodes with around 10 servers and the topology used is chain topology to achieve shortest path to reach all nodes. To achieve Packet delivery ratio up to 100% with bandwidth of each channel with data rate of around 100 Mbps where packet delay should be maintained for load balancing constants in few tens of milliseconds. The wireless mesh network to contain a minimum transmission delay power of 5mw with propagation delay of 0.1ms. The transmission time and throughput should be around 200ms and 70% respectively. The desired path loss exponent γ varying between 2 to 4 with interference threshold of around 15 dB. To analyse the efficiency of network using STDMA link scheduling based on communication graph model and SINR conditions that yield higher network throughput. The SNR should be 35 dB with the transmission range of 15m at transmission rate of 6.8 Mbps having transmission power of 15mw-50mw.

V. Conclusion

The research contributions discusses routing algorithm and protocols for the route construction process of WMN. The problem of throughput maximization in arbitrary wireless networks with SINR constraints from a theoretical perspective, and take the first step toward developing efficient algorithm for this problem. The comparison between SINR and graph based models is complicated, and for different instances, different models might give higher estimates of the throughput capacity, suggesting the need for greater care in using these models.

References

[1] A. Gore and A. Karandikar, "Link scheduling algorithms for wireless mesh networks," *IEEE Communications Society*, vol. 13, no. 2, pp. 258-273, Mar. 2010.

[2] D. Chafekar, V. Anilkumar, M. Marathe, S. Parthasarathy and A. Srinivasan, "Capacity of wireless network under SINR Interference Constraints," *Springer-Verlag New York, Inc. Secaucus, NJ, USA*, vol. 17, no. 7, pp. 1605-1624, Oct. 2011.

[3] V. Gabale, B. Raman, P. Dutta and S. Kalyanraman, "A Classification Framework for scheduling algorithms in Wireless Mesh Networks," *IEEE Communications Society*, vol. 15, no. 1, pp. 199-222, Mar. 2012.

[4] K.P. Vijayakumar, p. Ganeshkumar and M. Anandraj, " Review on Routing algorithms in Wireless Mesh Networks," *International Journal of Computer Science and Telecommunications*, vol. 3, no. 5, pp. 87-92, May. 2012.

[5] L. Upadhyay, H. Nagar and D. Rajpoot, "A Classification on Framework for Scheduling algorithm in Wireless Mesh Network," *International journal of Exploring Emerging Trends in Engineering (IJEETE)*, vol. 2, no. 6, pp. 247-251, Dec 2015.

[6] D. Gupta, P. Mohapatra and C.N. Chuah, "Efficient Monitoring in Wireless Mesh Networks: overheads and accuracy Trade-offs," *5th IEEE International Conference on Mobile Ad-Hoc and Sensor Systems*, DOI. 10.1109/MAHSS, Oct. 2008.

[7] P. Djukic and S. Valaee, "Delay Aware Link Scheduling for multi hop TDMA Wireless Networks," *IEEE/ACM Transactions on Networking*, vol. 17, no.3, pp. 870-883, Oct. 2008.

[8] M. Taghipoor, S. Mjafari and V. Hosseini, "Scheduling Algorithm and Bandwidth allocation in Wimax," *INTECH Open Access publisher*, 2012.

[9] G. Raja and R. Jayaraman, "Cooperative cross layer topology for concurrent Transmission scheduling scheme in Broadband wireless Networks," *International journal of computer, Electrical, Automation, Control and Information Engineering*, vol. 10, no. 6, 2016.

[10] S. Katti, M. Mudard, D. Katabi and H. Balakrishnan, "Symbol level network coding for wireless mesh networks," *ACM SIGCOMM Computer Communication Review*, vol.38, no.4, pp. 401-412, Oct. 2008.

[11] V. Praba and A. Rani,"A Review on Load and Energy based Routing in Wireless Mesh Network," *International Journal of Innovative Research in Computer and Communication Engineering*, vol. 2, no. 11, pp. 6333-6341, Nov. 2014.

[12] M. Ghazvini, N. Movahhedinia and K. Jamshidi, "Scheduling Algorithms in Wireless Mesh Networks: A Review," *Pacific-Asia Conference on Circuits, Communications and System*, vol. 1, pp. 86-90, Aug. 2010.

[13] X. Shao and R. Wang, "Review of Network coding based Routing Algorithm for Wireless Mesh Networks," *Journal of Convergence Information Technology*, vol. 6, no. 12, pp. 146-153, Dec. 2011.

[14] A. K. Dwivedi and O. P. Vyas, "An Exploratory Study of Experimental Tools for Wireless Sensor Networks," *Scientific Research*, no. 3, pp. 215-240, 2011.

[15] I. Akyildiz and X. Wang, "A Survey on Wireless Mesh Network," *IEEE Communication Magazines, vol. 43, no. 9, pp. S23-S30, Sep.* 2005.

[16] D. Shila and T. Anjali, "Load Aware Traffic Engineering for Mesh Networks," *Computer Communications and Networks*, pp. 1040-1045, Sep. 2007.