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A Survey on QoS Oriented Distributed Routing for Hybrid Wireless Networks

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***Abstract*— Hybrid Wireless Networks are the next generation of wireless networks that extends the coverage of the wireless infrastructure networks and provides scalability for Mobile ad hoc network. In hybrid wireless networks, two types of wireless transmissions are allowed: using infrastructure and IEEE 802.11. The infrastructure network which consists of wireless devices that are connected through a base station or an access point (AP).MANET is a mobile ad-hoc network that are connected to each other devices without any infrastructure. In this paper, we discuss about the benefits of hybrid wireless networks including the survey for their evolving architectures. We discuss about the achieving of QoS in wireless infrastructure and MANET. We also discuss about the process of achieving QoS in hybrid Wireless Networks.**

Keywords— **Hybrid Wireless Networks, Multi-hop cellular networks, Routing Algorithms, Quality of Service, MANET**

I. INTRODUCTION

The usage of the wireless networks have led to the development of abundant wireless applications in the field of entertainment, military, education and rescue operations. Recently, People started using wireless devices for watching TV, playing games and making video calls. Some of the video streaming applications such as Qik [1], Facetime[2] using base station oriented networks has attracted the people recently. Users use the base station oriented network for connecting mobile devices to make video conference calls and watch online videos. The usage of the base station oriented networks and the ad hoc networks and also the increased demand in mobile multimedia streaming brings to the deployment of wireless multimedia services. With the advent and the intended future use of the real world multimedia applications have increased the need for the high QoS support. The QoS support reduces the delay in end-to-end transmission and the increases throughput to provide uninterrupted connection between the ad hoc wireless devices and the base station oriented networks. In the meantime, a wireless hybrid networks are proved to be the next generation of wireless networks which can be used to provide the support for achieving QoS for the wireless applications. Hybrid Wireless Networks that combine base station oriented network and the mobile ad hoc network to control each other. By using vehicular opportunistic access network(an illustration of hybrid wireless network), people if needed to upload or download a video from internet servers through a base station(an access point) distributing out in an entire city. Since, it is doubtful that the base station distributing in the entire city having strong signals, vehicles thus, forming a mobile ad hoc network in order to extend the coverage of the base station and providing uninterrupted connections.

The main problem is to achieve the QoS in the hybrid Wireless Networks with unstable bandwidth and high mobility. In base station oriented networks, to provide the QoS Support, some routing protocols (Interserv [6], differserv [7],) are being used which needs involves cooperation of nodes, scheduling of packets. Providing the QoS Support in MANET is difficult on due to their unique features such as mobility of the nodes and limitations of the channel bandwidth. The rest of the paper is organized as follows: Section 2 presents a literature review. Section 3 describes the QoS provision in Infrastructure network. Section 4 describes the QoS provision in MANET Section 5 describes the QoS provision in Hybrid Wireless Networks.

II. LITERATURE REVIEW ON HYBRID WIRELESS NETWORKS

A. Unified Cellular and Ad hoc Architecture (UCAN)

Luo et al. proposed a novel architecture [3] in which the base station sends the packets to the destination having poor channel quality. The packets are forwarded to some other proxy clients having better channel quality. The proxy client uses the ad hoc network mixed of mobile nodes and the end-to-end user links to forward the packets to the destination clients.

Figure 1: Ucan Architecture

In order to forward the packets to the destination clients using proxy clients, two types of the proxy discovery routing protocols are being used.

1) Proxy Discovery And Routing:

In UCAN Architecture, A mobile node is having two types of interfaces: HDR and IEEE 802.11. When a mobile node is receiving frames from the base station having lower channel capacity, it forwards a route request to other nodes using IEEE 802.11. The route request is sent through multiple intermediate nodes to reach the mobile node having higher channel capacity. This route request forwarding process updates the routing tables to ensure the data can travel in the reverse order.

There are two proxy discovery protocols. First one is On-Demand and the Second one is Greedy. The Greedy Protocol is proactive. It maintains the channel downlink capacity of their neighbors. When the route request message is forwarded, it unicasts to the nearby neighbors with the highest downlink capacity. The route request message is sent to the intermediate nodes with highest downlink through a set of relay clients and finally it reaches the base station. The on-Demand protocol is reactive. When a mobile client sends a route request message, it is being sent to all the nodes within a geographic location. The node which has the highest downlink channel are declared to serve as the proxy by forwarding application messages to the base station. Based upon the forwarding of the route request messages, each proxy discovery protocol gets different nodes that are acting as proxy clients.

a) Greedy Proxy Discovery

Greedy Proxy Discovery discovers the neighboring mobile nodes updating their downlink channel capacity by exchanging a advertising message or beacon message. Thus, each mobile nodes maintains a routing table of their neighboring ID's and their downlink channel capacity. When a sender looks for a proxy node, it forwards a unicast route request message to the mobile nodes having best downlink channel capacity. The receiver alters the time of the route request for the transmission range and the length of the routing path. Greedy proxy Discovery depends on the presence of a routing path to reach a proxy client with high downlink channel capacity. Still, greedy path may not find the proxy with the best downlink chancel capacity.

b) On-Demand Proxy Discovery

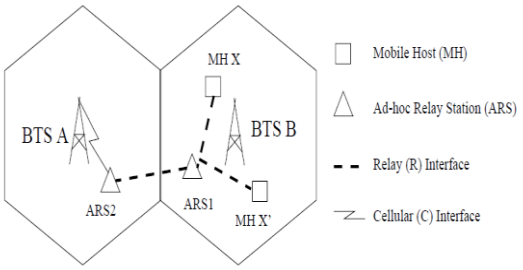
The on-demand proxy discovery does not maintain a routing table as Greedy Proxy Discovery. The receiver reactively floods a route request message within a certain geographic location. The Route request transfers the best downlink channel capacity and a sequence number that is added every time and the receiver starts a new process of proxy discovery.

In the comparison of Greedy, on demand proxy discovery is able to identify the proxy client with the highest downlink channel capacity.

B. An Integrated Cellular and Ad hoc Relaying System(iCAR)

Wu et al proposed an integrated cellular and ad hoc relaying system that supports a cellular network to achieve its QoS. [4] It can effectively be used for balancing the traffic load and sharing the channel resources by using ARS to transmit from one cell to another cell energetically. Usage of Ad hoc Relay stations in cellular networks not only increases the system's capacity and also reduces the transmission power for mobile nodes and extends the coverage of the networks. In cellular networks, each mobile servicing centre is used for controlling the BTS. The only difference between a BTS and Ad hoc relay station is: Once, a BTS is installed, it is fixed and is wired to the MSC but the ARS is a wireless device which has more functionality and is used for communicating with an MH or another ARS or a BTS directly.

The ad hoc Relay system mainly having two interfaces. The R interface is used for communicating with another ARS or an MH whereas the C interface is used for communicating with the Base Station



A transmitting example where a mobile node X communicating with BTS A around two ad hoc Relay station (ARS). When an ARS is communicating with a mobile node, it is called as proxy and when an ARS is communicating with a BTS, it is called as gateway. (An ARS can act as both proxy and a gateway at the same time). The C-interfaces is used when it acts as a gateway and the R-interface is used when it acts as a proxy.

For relaying process, a mobile node (MH) must contain the R interface to communicate with an ARS and in addition to communicate with a BTS, it must contain the C interface

where a MH can acts as an ARS. The usage of ARS is to transmit the call from the congested cells to the non-congested cells whereas the congested cells are being called as hot spots and the non-congested cells are called as cold spots.

Zhou et al proposed an architecture named PARCELS [5]: pervasive Ad-hoc Relay for cellular Systems that is a combination of the cellular and ad-hoc systems. The main feature of the parcel is that it does not contain any special devices as ARS. In parcels, the route relaying are performed by the mobile hosts itself.

III. QoS PROVISIONING IN WIRELESS INFRASTRUCTURE NETWORKS

In order to achieve the QoS in Wireless Infrastructure networks, some of the commonly used routing protocols are InterServ [6] and DiffServ [7]. This section describes about the working of routing protocols in Wireless Infrastructure networks.

a) Integrated Services:

In olden days, the internet applications was provided with the best effort services. These types of applications have tolerated packet loss and packet delay but recent wireless applications such as the voice and video are not following the best effort services as it requires a finite end-to-end delay. The integrated services in the internet provided Guaranteed and Controlled load services which are used for real time applications and the best effort services which are used for packet delay applications. The Guaranteed load services is used for providing secure end-to-end delay guarantees. The guaranteed load services is used for guaranteeing both bandwidth and delay. By using the network parameters, it is used for calculating the maximum delay of a packet. The delay in a packet has two parts: queuing delay and the fixed delay. The fixed delay is determined by the setup mechanism whereas the Queuing delay is determined by using the Guaranteed Services itself. The controlled Services is mainly used for providing the better performance for the applications that have been using the best effort services. The controlled services are used for supporting the applications at the delay-adaptive real-time or the predictive services.

b) Differential Services:

Differential services are used to identify the important individual for achieving the service guarantees in the internet. This model is built upon an end-to-end service through a single domain with a suitable service level agreements that are assumed to be fixed at the edges of the domain. Thus, the simple but actual Quality of service is being achieved. The Quality of Service in a network can be seen in two ways: The first look is based on the service that an end user requests, either directly or indirectly measurable at the end's machine. So, the user can be able to predict whether the QoS requirements are met or not by simple measurements. The second look is based on the view of the network administrator. The objectives of the network administrator is to quantify the measurements of the traffic that an end user cannot measure.

IV. QoS PROVISIONING IN MOBILE AD-HOC NETWORKS

Mobile Ad Hoc network are formed using the mobile devices without requiring any infrastructure. Since, the mobile devices have many problems such as fading and environmental obstacles, etc. since there are no access points in MANETs, Each device must act as an access point to transmit the packets from one another to ultimate destination. Mostly, there are several types of classification for the provisioning of QoS in Mobile Ad hoc networks such as layered classification which classifies based on the TCP/IP protocol suite used, and functional classification based on the types of the function and the parametric classification based on the parameters, and behavioral classification based in which the QoS is provided such as per flow, per hop, per class etc. Each classification will be subdivided based on the categories used. For example, In Layered Classification, the method of provisioning is divided into three categories such as

- Network Layer
- Cross Layer
- MAC Layer

Based on the methods used, the categories may get subdivided into subcategories. The MAC Layer can be divided into

- CDMA
- TDMA
- IEEE 802.11

The cross layer can be sub classified into the following categories: multi rate, scheduling, resource allocation, and the approaches in the network layer consists of the routing paths which can be classified into unipath and multipath categories.

a) QoS at Network Layer:

The approaches in the network layer consists of the routing protocols which can be classified based on the functionalities. There are several types of the routing protocols used for provisioning of QoS in MANET.

1) Bandwidth estimation based aware Routing

Generally, routing protocols are mainly used to find the feasible route from a source to destination without considering the network traffic and specifications. Hence, the network gets overloaded and the QoS cannot be met. The bandwidth estimation based aware routing protocol which combines the admission scheme with the feedback scheme for achieving the QoS in the network. There are two methods used for the estimation of bandwidth: 'listen' based estimation and 'hello' based estimation. In listen based method, the nodes listen to the channel and estimate the bandwidth based on the ratio of the time when the channel is free and in Hello based, the nodes disseminate the bandwidth information along with the hello packets.

2) Interference aware Routing

The protocol works for probing several paths using packet flow in a distributed fashion for meeting the QoS requirements. The path that meets the QoS requirements are called as candidate paths. The destination nodes chooses the paths which are best among the candidate paths.

3) QoS routing with resource reservation

The protocol combines the process of routing along with the allocation of resources along the routes. It finds an optimal path between a given source and a destination and computes the required resources for the intermediate nodes in order to meet the QoS requirements in the path.

b) QoS at MAC LAYER

We discuss about few MAC layers: CSMA, TDMA, CDMA, and IEEE 802.11 which are used for meeting the QoS specifications.

1) CSMA/CA based Networks

The CSMA/CA is used for forwarding the packets of real time applications with higher priority than the packets of non-real time applications. In this scheme, nodes senses for the channel until it becomes free. The node forwards the packets of the real time with higher priority than the packets of the non-real time applications.

2) IEEE 802.11 based networks

IEEE 802.11 are the most used MAC layer for MANETs. There are two major parts of IEEE 802.11 regarding coordination function. First, is Distributed Coordination Function (DCF) and the other is Enhanced Distributed Channel Access (EDCA). The IEEE 802.11 are mainly being used for achieving the QoS in WLAN's.

c) QoS at CROSS LAYER

A Cross layer protocol may operate with the properties or functionalities of more than one layer. It mainly uses about network oriented process (routing) and also session oriented process (MAC Layer)

V. QoS PROVISIONING IN HYBRID WIRELESS NETWORKS

Hybrid Wireless networks are the next generation of wireless networks that extends the coverage of the wireless infrastructure networks and provides the scalability of the MANETs. By directly adapting resource reservation based QoS routing in MANET, it gets invalid reservation and race conditions problem. To overcome this, Ze Li et al. proposed a Quality of service Oriented Distributed Routing protocol to improve the QoS support in Hybrid Wireless networks. Normally, a hybrid wireless network has extensive base stations. In hybrid wireless networks, the data transmission occurs in two features: First, a base station can be a source or a destination to any mobile nodes and next, the transmission medium between a mobile node and an AP is limited. The first feature allows a flow to have any cast transmissions beside multiple transmission paths from to destination through the base stations. The second feature enables a source node to connect to a base station through the intermediate nodes. By using the two features, the QoD protocol converts the packet routing problem into a dynamic resource scheduling problem. The QoD protocol incorporates five algorithms:

a) QoS assured neighbor selection algorithm:

The algorithm selects qualified intermediate nodes and works with deadline driven scheduling algorithm to achieve QoS Routing.

b) Distributed Packet Scheduling Algorithm

After qualified intermediate nodes are identified, the algorithm schedules packet routing. It allocates earlier generated packets to forwarders with higher queuing delays, while allocates more recently generated packets to forwarders with lower queuing delays to reduce the total transmission delay.

c) Mobility based segment resizing Algorithm

The source node resizes each packet in its packet flow for each intermediate node based on the node's mobility in order to meet the QoS requirements of the packets from the source node.

d) Soft-deadline based forward scheduling Algorithm

The algorithm first forwards the packets to the intermediate node with the least time allowed to wait before being forwarded out to achieve fairness in forwarding the packets.

e) Data redundancy elimination based transmission Algorithm

Based on the broadcasting of the wireless networks, the access Points and mobile nodes can eavesdrop and store packets. The algorithm removes the redundant data to develop the QoS of the packet transmission.

VI. CONCLUSION

The route identification and packet transmission become the most important issue during provisioning in hybrid wireless networks. In this paper various methods of QoS provisioning in various networks have been surveyed. The process of achieving the QoS in various networks have been explained. Various types of parameters have been need for estimating the performance metrics of the networks.

REFERENCES

[1] Qik. http://qik.com.

[2] Facetime http://www.facetime.com

[3] H.Luo, R.Ramajeey, P.Sinhaz, L.Lily, and S.Lu, UCAN: A unified cell and ad-hoc network architecture. In Proc.*of* MOBICOM, 2003

[4] H. Wu, C.Qiao, S.De, and O. Tonguz. Integrated Cell and ad-hoc relaying system: iCAR. J-SAC, 2001.

[5] J.Zhou, and Y.R.Lang. PARCelS: Pervasive ad-hoc relaying for cell systems In.Proc.*of* Med-Hoc-Net, 202.

[6] R.Braden, D.Clark, and S.Shenker. RFC1633:Integrated Services in the Internet Architecture: an overview. *IETF*, 1998.

[7] Brian E. Carpenter, Kathleen Nichols;" Differential Services in the internet", IEEE. Invited Paper.

[8] I.Jawahar. and J.Wu. Quality of Service routing in mobile ad hoc networks. Springer, Network Theory and Appli., 2004.

[9] T.Reddy, I.Karthigeyan, B. Manoj, and C.Murthy. Quality of Service provisioning in ad hoc wireless networks: a survey of issues and solutions. Ad hoc Networks, 2006.

[10] Z. Li and H.Shen. A QoS-oriented distributed routing protocol in hybrid Wireless networks. In Proc. *of* MASS, 2010

[11] Z. Li and H.Shen,". A QoS-oriented distributed routing protocol in hybrid Wireless networks". IEEE Transactions on Mobile Computing Vol. 13, No. 3, March 2014.