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MOBILE AD HOC NETWORKS (MANETS) AND ITS FUTURE WORK

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ABSTRACT

A QoS architecture using cross-layer design is proposed, which extends from the application layer to the MAC layer and specifies each layer's features and the information that should be shared among the layers. A performance comparison between the traditional layered design used in MANETs and the proposed QoS cross-layer design in terms of network performance has been made. These results show that using a QoS cross-lay

INTRODUCTION

Wireless communication has shown its numerous advantages over wired communication since Guglielmo Marconi successfully transmitted signals across the English Chan-nel for the first time in 1898. Since then, fueled by digital and Radio Frequency (RF) fabrication developments, portable mobile devices, such as cellular phones, personal digital assistants (PDA) and laptops, have brought great demands on wireless communication. Various wireless communication networks have been developed, such as cellular networks [2], wireless LANs (WLAN) [3], Bluetooth networks], Ultra-wideband (UWB) networks , Mobile Ad Hoc Networks (MANETs, and WiMax . Among these, cellular networks, Bluetooth networks, and WLANs are the most widely used. However, cellular networks and WLANs are centralized networks, which means that costly infrastructure and centralized administration are required. Using Bluetooth technology, hosts can connect to each other in an ad hoc fashion, but this technology is only targeted at low power short-range wire replacement. Therefore, a distributed, selforganized and multi-hop network—a Wireless Mobile Ad Hoc Network—is a different type of network that has obtained tremendous attention in recent years.

A MANET is a distributed network that does not require centralized control, and every host works not only as a source and a sink but also as a router. This type of dynamic network is especially useful for military communications or emergency searchand- rescue operations, where an infrastructure cannot be supported. Furthermore, the simplicity of building an ad hoc network enables sharing data in a meeting or in inhospitable terrain conveniently. At the same time, the rapid development of coding tech -nologies, such as MPEG-4 and H.264 , makes low data rate video over wireless feasible. Enabling such multi-media applications as video and audio-communication in MANETs requires quality of service (QoS) support.

OVERVIEW OF MOBILE AD HOC NETWORKS

A MANET is an autonomous collection of distributed mobile users. Every host in a MANET works as a source and a sink, and also relays packets for other hosts and is thus a router as well. This type of network can be used in fire/safety/rescue/disaster recovery operations, conference and campus settings, car networks, personal networking, etc. MANETs have similar characteristics to other wireless communication networks, which are mainly attributed to the wireless channel's properties. A wireless channel is error-prone, which means that link bandwidth and packet delay are unpredictable due to multi-path fading, interference, and shadowing. Besides this common characteristic, MANETs have their own features: they are autonomous and infrastructureless; they utilize multi-hop routing; they support a dynamic network topology; the nodes are energy constrained; the bandwidth is limited; and they are self-organizing and self-administering. Therefore, many widely used network protocols cannot directly be ap-plied to MANETs.

DESIGN GOALS

Mobile ad hoc networks (MANETs) distinguish themselves from other types of networks by their physical characteristics, organization format and dynamic topology:

• Physical characteristics: Wireless channels are inherently error-prone, due to such effects as multi-path fading, interference and shadowing, causing unpredictable link bandwidth and packet delay.

• Organization format: The distributed nature of MANETs means that channel resources cannot be assigned in a pre-determined way.

• Dynamic topology: As hosts in a MANET are mobile, links are created and destroyed in an unpredictable way.

FUTURE WORK

There is much work to be done to finally realize stable support for QoS in MANETs. Future work in this area can be divided into two parts – further detailed work on remaining issues to be solved layer by layer and combining the layers into a complete system. The possible work to be done is as follows:

Transport Layer As real-time applications generally use UDP for the underlying trans-port protocol, in this dissertation only UDP's performance is investigated. How-ever, in order to not lose generality for supporting different types of traffic, it is important to also consider TCP's performance for providing QoS. In addition, TCP's overall performance is poor in MANETs, especially its stability. We be-lieve that obtaining network status information from the lower layers and actively adjusting TCP's window instead of only passively adjusting its window according to the acknowledgements from the destination could help improve TCP's overall performance in MANETs.

Routing Layer The QoS-aware routing based on bandwidth estimation does not incor-porate any route break prediction. Therefore, there is a performance degradation as the mobility of the nodes increases. A route break predict scheme could aid in the quick response of the protocol to route breaks.

MAC Layer MAC protocol design is a very challenging task in MANETs. DMAC only partially solves the QoS problem, which is far from sufficient. DMAC does not currently offer scheduling based on different priority level. Therefore, de-signing a MAC protocol that fully supports QoS is the subject of future work.

Architecture The QoS architecture proposed in this dissertation is a general model. The specified details for implementing all layers, the possible interactions and the overall performance are needed for providing QoS in MANETs. Furthermore, the implementation of all these protocols into a hardware solution is the final goal for enabling a real MANET to support QoS

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