ADHOC Networks Based Bandwidth Estimation of IEEE 802.11

Ashutosh Pradhan, Department of Computer Science & Engineering RDEC, Ghaziabad. ashutosh.p@gmail.com

Abstract

Bandwidth, which refers to the quantity of data that a connection or network channel can provide per unit of time, is fundamental to digital communications, and more especially to packet networks. Thanks to service differentiation, IEEE 802.11-based networks may provide a particular quality of service (QoS).IEEE 802.11e amendment. Unfortunately, there is currently no agreed-upon system or methodology for reliably gauging the available resources on any particular channel. On the other hand, applications with limited bandwidth might benefit greatly from such an examination. Finally, we determine the bandwidth, which is used to decrease collisions and enhance throughput values.Assessing such a network is much more challenging in multihop ad hoc configurations. Therefore, one of the primary challenges in this area is still the assessment of the available bandwidth, despite the many contributions to this area of study. We provide a better method for estimating the available bandwidth in ad hoc networks based on IEEE 802.11. We simulate the proposed estimate and compare its accuracy to that of existing state-of-the-art QoS protocols.

Keywords:Digital Communications, Ad Hoc Networks, Quality Of Service (Qos).

Introduction

Improving the performance of Ad Hoc Network packet transmission and reducing latency in packet transmission are the primary goals of bandwidth estimation for IEEE 802.11-based ad hoc networks. In order to function, ad hoc networks do not require any established infrastructure, such as base stations. With this technique, data packet movement and the nodes handle receiving. Although widely employed in wireless systems, the IEEE 802.11 standards were not originally intended for use with ad hoc networks and are thus ill-suited to them.

Autonomous, decentralised, wireless, and mobile networks are what we call AD hoc networks. The nodes self-organize to handle data packet transfers and topological changes caused by mobility, thus there's no need to put up any fixed infrastructure like access points. Since interface cards and simulation models are widely available for the IEEE 802.11 standard, many of the recent contributions to the field of ad hoc networking presume that this is the underlying wireless technology. Direct communication between mobile devices is made possible by this standard's ad hoc mode. Because of regulatory constraints, long-distance communications must use a dispersed routing protocol. Unfortunately, multihop ad hoc operation has not been the primary focus of this standard, so it may not perform flawlessly with such networks. Multiple modern applications depend on the secure and timely transfer of important control traffic or produce multimedia data flows. A network that supports quality of service (QoS) might be useful for certain applications. For that reason, quality of service (QoS) solutions for ad hoc networks are becoming increasingly popular and this area has seen a lot of research. Having said that, QoS is an umbrella word for a number of ideas. It is the intention of some protocols to provide applications with robust guarantees on transmission parameters, such as bandwidth, delay, packet loss, or network utilisation. Some alternatives, which appear more adapted to a mobile setting, merely choose the optimal path from all available options based on the same criteria. Both situations call for a precise assessment of the routes' capacities. Since most existing QoS approaches presume that link layer protocols can do such an evaluation, they ignore this issue. But that is not the case. Assessing resources is a hugedoes not rely on easily quantifiable factors like node mobility, but rather on a number of phenomena connected to the wireless environment.

Quality of service (QoS) has been achieved by networks based on IEEE 802.11 standards via the use of the modification to IEEE 802.11e, which allows for service differentiation. On the other hand, applications with limited bandwidth might benefit greatly from such an examination. The difficulty of such an assessment increases in multi-hop ad hoc networks.

Therefore, one of the primary challenges in this area is still the assessment of the available bandwidth, despite the many contributions around this study subject.

The IEEE 802.11 subcommittee standardised a medium access protocol that could be used for the prototype of mobile ad hoc networks. The protocol was based on collision avoidance and could accept concealed terminals.

Without any permanent infrastructure or centralised servers, an ad hoc network consists of a collection of nodes that connect over wireless networks in a multi-hop way. There is a novel way to assess the available bandwidth in ad hoc networks that is based on the IEEE 802.11 MAC layer; this approach has several practical uses, such as personal area networking and emergency military operations.

Existing System:

1. The widespread availability of interface cards and simulation models leads the ad hoc networking industry to presume that the underlying wireless technology is the IEEE 802.11 standard.
2. This standard isn't tailor-made for multihop ad hoc operations as it wasn't originally intended for that purpose.
3. It is essential to accurately assess the routes' capabilities. The majority of the existing quality of service approaches disregards this issue, supposing that the link layer protocols can carry out such an assessment.

Proposed System:

1. The 802.11 MAC layer is being used to determine the appropriate bandwidth in this system.
2. The medium occupancy of each node may be estimated using this technique, which includes channel monitoring.
3. Estimating the influence of variable overhead, synchronisation between nodes, and the collision risk between each pair of nodes are all factors that are taken into consideration when the results are probabilistically combined.
4. It is possible to implement this approach without significantly increasing the extra overhead as it just requires one-hop information exchange.
5. NS-2 simulations demonstrate the precision of the available bandwidth measurement.
6. These findings demonstrate that multi-hop and single-hop flows are accepted with higher precision, leading to enhanced stability and overall performance.

AD-Hoc Network

An ad hoc network (or AD-HOC) is a group of unstructured nodes that work together to create a network. These networks revolutionized the way networks are set up and are perfect for situations when the infrastructure is either unavailable or too expensive to implement.More and more people are opting for ad hoc networks that use the Distributed Co-ordination Function (DCF) mode of the IEEE 802.11 protocol. The 802.11 protocol may function in DCF mode without a central authority coordinating user broadcasts. Nodes may freely enter and exit the network as they see fit. As this occurs, connections between nodes are strengthened as they approach each other and severed when they recede. Protocols for communication face a formidable obstacle in maintaining multi-hop communication between nodes in the face of such dynamic topologies.

Fig.1: Ad Hoc (Client to Client)

More and more people are opting for ad hoc networks that use the Distributed Co-ordination Function (DCF) mode of the IEEE 802.11 protocol. There is no need for a centralized body to coordinate user transmissions while using the 802.11 protocol in DCF mode. Nodes may freely enter and exit the network as circumstances dictate. As this occurs, new connections are formed as two nodes move further apart, old linkages terminate and new ones form as the nodes approach each other. Maintaining multi-hop communication between nodes in the face of such dynamic topologies is a formidable task for communication protocols. Initiatives like GloMo and NTDR, which stand for "near-term digital radio," have relied heavily on ad hoc networks for military purposes and associated research. With the proliferation of smaller and more affordable mobile computers and other practical forms of wireless ad hoc networking, the technology has recently attracted a slew of new commercial and industrial users. One way to look at the history of ad hoc networks is as a series of generations, beginning with the first and continuing through the third. We are now in the third generation of ad hoc network infrastructures. Beginning in 1972, we have the first generation. Those networks were known as PRNETs (Packet Radio Networks) back then. On a trial basis, various networking capabilities were provided in a combat situation by combining PRNET, a distance-vector routing method, with ALOHA and CSMA, which stand for "authentic locations of hazardous atmospheres," and medium access control techniques. The 1980s saw the rise of ad hoc networks' second iteration. In a setting devoid of infrastructure, this allowed the mobile battlefield to access a packet-switched network. The radios' performance was enhanced by this programme, which made them smaller, cheaper, and more resistant to electronic assaults.

Conclusion

We have introduced a novel method for calculating the available bandwidth between two adjacent nodes and, therefore, along a route. This technique incorporates channel monitoring to determine the occupancy of all nodes' media, including remote emissions; it then uses a probabilistic mixture of these values to account for synchronisation across nodes; and last, it estimatesthe likelihood of collisions between each pair of nodes, and the assessment of the effect of changing overhead. This approach can be implemented with little extra overhead as it just needs one-hop information transmission.For benchmarking reasons, this method is now part of AODV. The precision of the current bandwidth measurements is shown. These findings demonstrate that both multi-hop and single-hop flows are acknowledged with higher precision, leading to enhanced stability and overall performance. Both fixed and mobile networks have shown promising results. We conclude from these examples that estimating network resources is more challenging than routing when developing a quality of service protocol.

We want to concentrate our future efforts on two main points. To begin, the bandwidth used by best effort flows and QoS flows is treated equally in our present assessment. Consequently, best effort flows may use up all of a node's capacity even while the node thinks the bandwidth it has available on a connection is almost nothing. Reducing the velocity of these flows could increase the rate of QoS flow adoption. A more efficient use of the network's resources may be another outcome of distinguishing between different kinds of flows. Concurrently, we are looking at the delay metric as early research suggests that this and another crucial parameter might be used to transform certain aspects of the method presented here.

References

[1] Chaudet , C., Chelius G., Lassous I.G., "Bandwidth Estimation for IEEE 802.11-Based Ad Hoc Networks", IEEE Transactions on Mobile Computing, Vol.7, Issue 10, 2008

[2] Bob Melander, Mats Bjorkman, Per Gunningberg, a New End-to-End Probing and Analysis Method for Estimating Bandwidth Bottlenecks, 2007

[3] Andreas Johnson, Bob Melander, and Mats Björkman (2010). “diettopp: A first Implementation and evaluation of a simplified bandwidth measurement method”. Department of Computer Science and Engineering Mälardalen University, Sweden. International Journal of Computer Networks & Communications (IJCNC) Vol.3, No.1, January 2011

[4] N. Ch. SrimanNarayanaIyengar, (2010) « An Efficient and secure routing protocol for Mobile Adhocnetworks », International Journal of Computer Networks & Communications (IJCNC)

[5] CheikhSarr, Claude Chaudet, Guillaume Chelius, and Isabelle Gue´ rinLassous Bandwidth Estimation for IEEE 802.11-Based Ad Hoc Networks IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. 7, NO. 10, OCTOBER 2008
[6] CheikhSarr, Claude Chaudet, Guillaume Chelius, Isabelle GuérinLassous Available Bandwidth Estimation for IEEE 802.11-based Ad Hoc networks June 2007
[7] Bandwidth Estimation for IEEE 802.11-based adhocnetworkscheikhSarr†claudechaudet‡, Guillaume Chelius† and Isabelle Gu´erinLassous_ IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. X, NO. X, APRIL 2007
[8] Heni KAANICHE1, FatmaLOUATI2 ,Mounir FRIKHA3 and Farouk KAMOUNA QOS ROUTING PROTOCOL BASED ONAVAILABLE BANDWIDTH ESTIMATION FORWIRELESS AD HOC NETWORKS International Journal of Computer Networks & Communications (IJCNC) Vol.3, No.1, January 2011 DOI :
[9] C. Sarr, C. Chaudet, G. Chelius, and I.G. Lassous, "A Node-basedavailable Bandwidth Evaluation in IEEE 802.11 Ad Hoc Networks,"Int"l J. Parallel, Emergent and Distributed Systems.6, 2006.
[10] G. Bianchi, "Performance Analysis of the IEEE 802.11 Distributed Coordination Function," J. Selected Areas in Comm, Mar. 2000.
[11] L. Chen and W. Heinzelman, "qos-Aware Routing Based onbandwidth Estimation for Mobile Ad Hoc Networks," IEEE J. Selected Areas of Comm.
[12] CheikhSarr, Claude Chaudet, Guillaume Chelius, Isabelle GuérinLassous (2005). "A node-Based available bandwidth evaluation in IEEE 802.11 ad hoc Networks". International Journal of Parallel ,Emergent and Distributed Systems.
[13] Dongyan Chen, DaqinGu and Jinyun Zhang (2004). "Supporting Real-time Traffic with qos in IEEE 802.11e Based Home Networks".MERL – A Mitsubishi Electric Research Laboratory.
[14] FedouaDidi, HoudaLabiod, Guy Pujolle and Mohamed Feham (2009) "Mobility and qos of 802.11and 802.11e Wireless LAN Standards". The International Arab Journal of Information
[15] Andreas Johnsson, Bob Melander, and Mats Björkman (2010). "Diet To pp: A first Implementation and evaluation of a simplified bandwidth measurement method". Department of Computer Science and Engineering Mälardalen University, Sweden.International Journal of Computer Networks & Communications (IJCNC) , January 2011
[16] AneliseMunaretto, Mauro Fonseca (2007). "Routing and quality of service support for Mobile ad hoc networks", Computer Networks Elsevier
[17] Dharamveer, Samsher, Singh DB, Singh AK,Kumar N.Solar Distiller Unit Loaded with Nanofluid-A Short Review. 2019;241-247. Lecture Notes in Mechanical Engineering, Advances in Interdisciplinary Engineering Springer Singapore. https://doi.org/10.1007/978-981-13-6577-5_24.
[18] Dharamveer, Samsher. Comparative analyses energy matrices and enviro-economics for active and passive solar still. materialstoday:proceedings. 2020.https://doi.org/10.1016/j.matpr.2020.10.001.
[19] Dharamveer, SamsherKumar A. Analytical study of N^{th} identical photovoltaic thermal (PVT) compound parabolic concentrator (CPC) active double slope solar distiller with helical coiled heat exchanger using CuO Nanoparticles. Desalination and water treatment.2021;233:30-51.https://doi.org/10.5004/dwt.2021.27526
[20] Dharamveer,Samsher, Kumar A. Performance analysis of N-identical PVT-CPC collectors an active single slope solar distiller with a helically coiled heat exchanger using CuO nanoparticles. Water supply. 2021.https://doi.org/10.2166/ws.2021.348