Regulating Bandwidth Flow Estimation and Control for Wired/Wireless Networks

Pallavi Sharma, Vijay Singh Rathore

Abstract- In this topic, an analysis will be made on the problems faced by bandwidth constrained applications which comes under networking domain. For bandwidth constrained applications, a proper monitoring of available bandwidth is an important factor to avoid degradation in performance while execution. Such application example could be video or voice chat on Internet , which consumes more bandwidth and its overall performance is bandwidth constraint. After the implementation of 802.11e Wireless Sensor Networks are capable to provide good level of QoS but research works are not much for improving performance of bandwidth constraint applications by checking sufficiency of bandwidth available in transmission route. We propose to design and develop a system for 802.11 based ad-hoc networks, which estimate the network traffic bandwidth and control the flow of traffic on given channels. Our research would be capable to work on both wired and wireless ad-hoc network, On top of it, It would be able to show the simulation results on multiple computers.

Index Terms- Bandwidth, Estimation, Control, Wired/Wireless Networks

I. INTRODUCTION

BANDWIDTH can be defined as the rate by which data (frame/packet) is transmitted over the network link or network path. In general, for digital devices, we analyze the amount of data transmitted in a second and estimate the bandwidth. Sometimes we may even calculate it in bytes per second, but for analogue devices we need to calculate as cycles per second i.e Hertz (Hz). Two metrics that are associated commonly with path are capacity and available bandwidth. The available bandwidth is the maximum throughput that the path can provide to an application, given the paths current cross traffic load. The capacity on the other hand, is the maximum throughput that the path can provide to an application when there no cross traffic. This is our one of the main objective to develop the methodology and techniques that can accurately measure these bandwidth metrics. Available bandwidth describes what portion of the path is currently unused by traffic.

More precisely, available bandwidth is determined by subtracting the utilization from the capacity of the network path [1, 2].In practice, traffic shapers that allow some traffic to consume more or less bandwidth than other traffic can consume may also affect available bandwidth.

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Bandwidth estimation is an important factor for admission control in both the wired and wireless networks. In wired networks, as we see flow of data and secureness is much when compared to wireless. Where as in wireless networks, the available bandwidth may experience channel fading, signal distraction and some errors all this physical obstacles make bandwidth estimation much challenging. Moreover, number of hosts ready to utilizing for the channel may affect the available bandwidth rate.

Every application generating multimedia like video and audio rely on proper flow of data. These applications may benefit from a quality of service support in the network. Few protocols provide strong assurance to the applications on the transmission characteristics like bandwidth, delay, packet loss or network load. Where as, mobile environment always tries and needs to find the best route among all possible routes is necessary. Many of the previous works and researches had left the problem aside, thinking that upper layer protocols would be able to perform such an evaluation. But, they do not.

This research focuses on one of the fundamental resources: throughput, estimating remaining bandwidth at given time in given network is very complex task in wireless networks because the medium is shared between closed nodes. To compute the available bandwidth between two neighbor nodes sender and the receiver, accurate identification of both sides as well as co-ordination among them is much important and needs proper evaluation of their impact. Data carried on the medium between nodes and information about the nodes should be taken in order to derive the amount of free resources in the medium. Users require that consistent monitoring of the performance is carried out, in order to detect faults quickly and predict the optimization for the network. These tasks are very complex to realize when there are sparse networks in between the nodes and sharing the medium without being able to exchange information directly.

To overcome all of these problems, in this paper we will develop to design a system for 802.11 based ad-hoc networks which can estimate the network traffic bandwidth

and control the flow of traffic on given channels. And this research would be capable to work on both wired and wireless ad-hoc networks. To achieve these results, concepts like estimation of bandwidth between close nodes, maximum throughput that the packet can transmit between two peers without disturbing ongoing flow between the medium. Protocols associated with the estimation of bandwidth so on. We will study the bandwidth flow estimation features like path, available bandwidth,

throughput of previously carried out works. We will develop java based programming code to carry out simulation. The developed research would give us optimized and accurate result.

II. LITERATURE REVIEW

There are some significant bandwidths which are established against set of standards in wired and wireless Communities. These are classified in two techniques.

A. ACTIVE approach: This estimates the bandwidth availability by the emission of start point to end point probe packets.

B. PASSIVE approach: Here we can identify the utilization of bandwidth by using local information.

Let's classify them briefly:

III. ESTIMATION OF ACTIVE BANDWIDTH TECHNIQUE

Active Bandwidths sends equal size packets from source point to receiver to estimate the bandwidth availability [3]. The rate of emission of probe packets will get increased when the source is increased. The characteristics of this kind of probe packet flow can be measured at receiver's edge. These measurements are used to find the bandwidth availability. Many protocols like SLOPS [4] and TOPP [5] will also come under active approach category. But these sometimes differ in some issues like increase in the packet sequence rate and in probe packets flow metrics. This type of technique is a benefit to the show the influence on existing flows due to the probe traffic.

By monitoring the delay time of probing packets, we can detect the presence of congestion. The medium suffers from congestion if the delay continues to go larger than the theoretical delay. By taking such type of measurements we can calculate the medium utilization and we can also derive the capacity of a channel from the usage of channel ratio.

Where as in wireless networks, the authors of DietTOPP [6] evaluates the accuracy based on TOPP. The volume of cross traffic and the size of probe packet have a great impact on already measured bandwidth in this environment when compared to wired network. This may lead to the inaccurate results in wireless environment.

IV. DRAWBACKS OF ACTIVE TECHNIQUES

There are mainly two drawbacks regarding hop and multi hop networks. If several nodes perform an evaluation at several end points then introducing the large amount of probe packets in network is important. Thus it interacts with the others probes as well as with the data traffic modifying the other estimations. Local detection and reconstruction may be more important in many situations while updating to a modification in available resources.

V. ESTIMATION OF PASSIVE BANDWIDTH TECHNIQUE

It is all about a dynamic bandwidth management schemes for single hop and ad hoc networks [7]. To evaluate the bandwidth in the cell a node should host the bandwidth manager process, which is in the network and it also allocates the bandwidth to each peer. During this process node may ask for the access to channel during same time by using some control messages. As the topology is decreased to single cell, the available time proportion is calculated as **Total time share = sum of the individuals loads**[8]

The total bandwidth can be computed by translating fraction of time in to an available bandwidth but it depends mainly on the wireless link. This can be calculated by the measurement of data packet's throughput. So usually from small size packets, few control packets get exchanged. This phenomenon can be taken into consideration as passive as the exchange of control packets is very less and of small size. On the other hand, this result is applied for the nodes that are inside the communicating area of that network topology but these nodes are not allowed to be used directly in ad hoc and multi-hop networks [10].

VI. SYSTEM ANALYSIS

Existing System

- The standard provided by IEEE 802.11 was not so enough for multi-hop wireless or ad-hoc network processes. This protocol provides mobile devices to converse directly. Because of the constraints in conversation scope of the mobile systems, a dispersed multi-hop routing protocol is necessary to permit extended distance conversations.
- It is highly required to measure the capacity of the routers. But many of the present Quality of Service [9] applications ignore the accurate measurement of router capacity and depend on the supposition that link layer protocols are capable to carry out these types of assessments.

Proposed System

- Proposed system we use 802.11 MAC layer to assess the exact network bandwidth. This technique includes path observation to evaluate each computer's average tenancy also it takes into account the collision possibilities for correct estimations.
- This technique requires just single hop information converse and may be put without producing extra burden. These estimates show that single-hop transmission and multi-hop transmission are acknowledged more correctly [10], ensuing in an enhanced constancy and on the whole performance.

VII. SYSTEM DESIGN

Data Flow Diagram

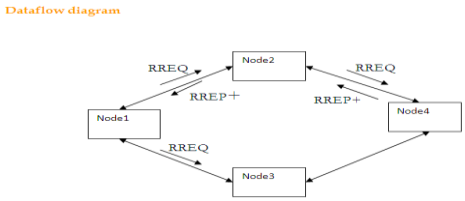

Figure 1: Data Flow Diagram

In this diagram we represent how Node1 transmits the data to Node4. Here it sends RREQ to its neighbor Node3 but didn't get RREP. So, Node1 again sends to RREQ to Node2 subsequently Node2 sends RREP to Node4. Here as the path was clear so Node 2 gets RREP from Node4 and similarly Node2 sends RREP to Node1.

Use Case Diagram

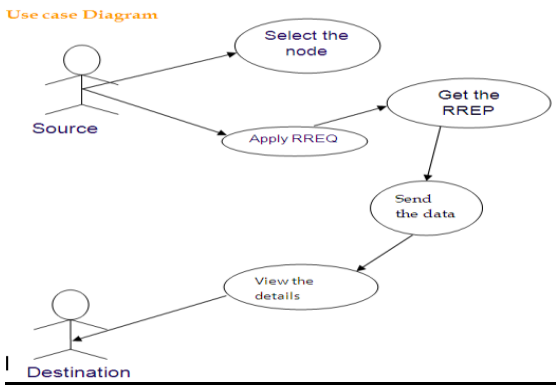

Figure 2: Use Case Diagram

Here we present how from the source machine transmission is taking place. Here the source actor selects the node and apply RREQ->Get RREP->[11]Transmit the data->View the Details->Reach the Destination.

Component Diagram

This diagram just shows the integration of components which include Network formation, Connection zone discovery and Message transformation. [12]

VIII. MODULE DESCRIPTION

GUI Design consume more resource than Swing, we have mostly used Swing package for UI designing. Swing is the extension of AWT and contains light weight component, it is quite easy to use and has many new methods in compare to AWT.

This module is designed in a very simple and easy to understand way. We have made the GUI for four nodes to interact with each other. There are two tabbed panes in every node UI. The first pane includes:

Send Message Pane: This pane includes options for sending the data to another node

Combo Box: To choose destination from the list of available nodes

File Chooser: For selecting the text files for file transmission

Text Area: Enables the user to write text or contains the selected file data to send

RREQ Button: For route request from current node to the destination

Send Button: For sending data to the destination node, it works only when the RREQ is confirmed

Clear Button: To clear the content of Text Area

Exit Button: To come out of the Application

Received Message Pane: This pane is used for displaying the text which arrive from other node.

Through Java Swing

Graphical User interface (GUI) is front end part of the application. To create the front-end through java we can use either AWT[13] (Abstract Window Toolkit) or Swings[14]. As AWT is quite complex and File Upload and Packet Formation

In our research we give choice to the user to select any text file or to enter the text manually. If user selects to upload file then the file is passed through FileInputStream and with the use of InputStreamReader it read the content, store it in buffer and display the content of the file in GUI. File Streams come under IO package of java and needs to be imported before program code.

When any data is transferred into network it is divided into small-small packets. These packets contain the piece of data being uploaded for transmission. Packets also contain other information such as the size of the data in it and the source and destination address. This module does the task to split the data into packets. Basically we provide the choice to user to select any data file or to enter the text manually in

the text area. As user gets the RREP and clicks on send button, data is divided into packets of 48 characters each.

Till the time it reach the destination it remain in the packet form so that we can calculate the bandwidth speed in respect of no. of packets transmitted in a second.

ROUTE REQUEST (RREQ) AND ROUTE RESPONSE (RREP)

The RREQ and RREP method is used to control the transmission requests and flow of data between sender and receiver node. The basic concept implemented here is before transmitting any data or file sender has to approval for his "Router Request" i.e. RREQ. This RREQ is sent to the server machine for route availability between source to the destination, after analyzing which path is available for the transmission, RREP is sent by the server machine to the source machine. This RREP contains the free path information and if no path is free then the server providing alert message that "No Path is Free, Please Try after Some Time", rejects the RREQ.

RREQ and RREP are most needed before transmission of any data else if sender press send button without getting RREP from the server it would get the message of re-approach. So here we can say RREQ and RREP are the main functions here to provide the details whether bandwidth is available or not. If bandwidth is not available then the transmission is rejected, thus it helps in control the transmission flow.

Transmission Control Technique

In this transmission control mechanism we particularly depend upon the status of the availability of the bandwidth in the route. Here we represent the availability by zero and if any route is occupied by any of the transmission then it is represented by one. At first we set all the routes to free and assign zero to all the paths. Once if any sender request for any transmission and send RREQ to the sender it checks with the availability of the free route for transmission, if it gets zeros in any of the possible path for transmission, it sends the RREP after assigning one to all the required paths. If the server machine finds one in all the possible routes then simply it rejects the request by the source machine and shows message to the user. This method in conjunction with the RREQ and RREP controls the transmission of data in network.

Estimations of Bandwidth & Delay

This module is the output part of the entire application. At the end of each transmission we provide certain details to the user such at time taken for the transmission, total packets got transmitted, the bandwidth used for the transmission and the delay in time during transmission. Our application regularly calculates the data packets while transmission and the time required for transmission. Finally it makes the calculation with the amount of data transmitted, no. of packets, and time taken for transmission

and shows the result to the user in the Graphical User Interface i.e. GUI.

Database Designing and Connection

In this module we design the database for the application in MS-ACCESS 2007 as database part is very small here and requires only one table for storage of zero or one values in node availability fields. MS-Access is quite convenient to use and no separate installation than MS-Office. The table designed in database consists of 4 columns which represent 4 nodes availability. For database connectivity we use type 1 driver of JDBC [15]as it is basic and comfortable. We just need to create DSN for the connection between the application and database. Basically it is only two lines of code for loading driver and making connection:

```
Class.forName("sun.jdbc.odbc.JdbcOdbcDriver");
Connection con =
DriverManager.getConnection("jdbc:odbc:a1");
```

The basic requirement here in the program for JDBC use is to import the java.sql package. Once the package is imported and connection is made we can write n number of queries and execute.

In this research, we represent the availability of path by zero and if any route is occupied by any of the transmission then it is represented by one. At first we set all the routes to free and assign zero to all the paths. Once if any sender request for any transmission and send RREQ to the sender it checks with the availability of the free route for transmission, if it gets zeros in any of the possible path for transmission, it sends the RREP after assigning one to all the required paths.

IX. CONCLUSION

This research approaches under networking realm. Here we assess the complexities came across through bandwidth controlled applications. Applications whose recital based completely on bandwidth requires to be taken care for accessibility of necessary bandwidth on the transmission path to shun degradation in performance while implementation. Such application example might be video or voice chat on Internet which takes more bandwidth and its overall performance is bandwidth restraint. Subsequent to the implementation of 802.11e Wireless Sensor Networks are competent to offer good level of QoS but research works are not much for enhancing performance of bandwidth restraint applications by examining adequacy of bandwidth accessible in transmission route. Here we recommend intending and developing a system for 802.11 based ad-hoc networks, which estimates the network traffic bandwidth and controls the flow of traffic on specified channels [16].

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AUTHORS PROFILE

Pallavi Sharma has done my Bachelors in Economics (B.Sc. Economics), Masters in Information Technology (M.Sc. IT). I always found networking interesting as well as I always wanted to be in teaching profession. On top of it, either being in networking profession or in lectureship are having better future aspects. Besides this, as being a lecturer, I always found it a respectful job. So, finally I decided to do PHD in Networking and I joined NIMS University in Jaipur. So, I picked up Regulating Bandwidth Flow Estimation and Control For Wired/Wireless Networks as my research topic. And I started doing my research work on that topic. While studying that topic, I read several books to get the information on various types of networks and how to estimate bandwidth as well as I invested a plenty of time to research the information Online. I faced lots of challenges while doing my research, because I have to study all the previous research works done to estimate the bandwidth estimation, so doing research was not an easy task.

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