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Estimating the Throughput using Weighted Fair Queuing in Hybrid Wired-Wireless Network

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Abstract— **This paper presents the throughput analysis of wireless access link in the hybrid wired-wireless network. The shared-access mechanism of IEEE 802.11 network along with collisions and channel fading make the measurement of the throughput of a wireless access link complex. Here, throughput is defined as the rate at which data bits can be transmitted in the time taken to transmit a given packet. The throughput is equivalent to the available bandwidth if the maximum packet size that can be transmitted is used. This paper is to analyze the throughput of the wireless access link in the hybrid wired-wireless network. The packets are sent from wired source host to the wireless destination host in the end to end path. The source is connected to a destination through multiple wired links and a wireless access link. The proposed scheme is based on the weighted fair queuing mechanism for scheduling the packets in order to smoothing out the flow of data. Furthermore, the proposed scheme achieves the throughput in the wireless access link. For that three users are used at the distance of 2km,4km,6km.The packets received by all the three users are simulated and the throughput is achieved.**

Index terms- IEEE 802.11, link capacity, bandwidth, wireless throughput.

I.INTRODUCTION

Hybrid network is the combination of both wired and wireless network. Wired network uses physical medium for connecting different components that involved in communication. Wireless network does not have a physical medium it uses air as a medium

A. Wired communication

A classic example of wired communications is the traditional home telephone that is connected to the local telephone switch via wires that are ran from the home to the switch. Wireless communication solutions have become more common , the use of wired services remains common and is not likely to disappear in the near future. Internet access from desktop computer systems is also a common example of modern wired communications. Telephone service providers often utilize the same wiring to provide both high speed Internet solutions and basic telephone services to residential and business customers. Rely on the nature of the connection, this may require wiring and cables that have a higher capacity than standard wires. In general, wired communications are considered to be the most stable of all types of communications services. They are relatively resistant to adverse weather conditions.

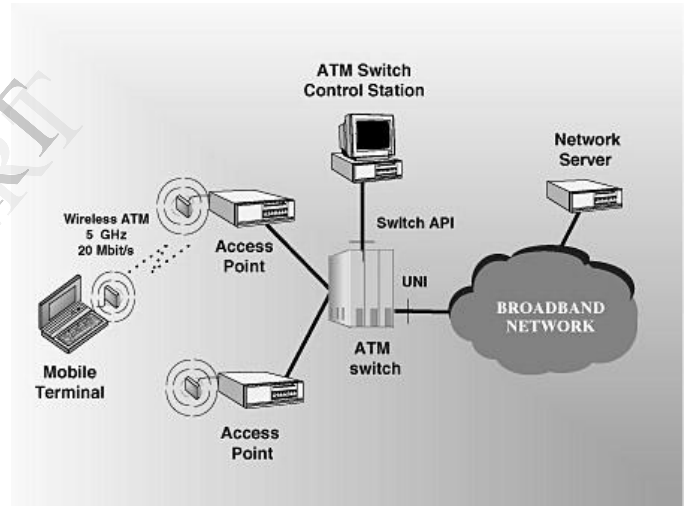

Fig.1 Wired-Wireless Network

when compared to wireless solutions. With several forms of wired services, the strength of the transmission is splendid to other solutions, such as microwave transmissions. These characteristics have permit wired communications to remain fashionable.

B. Wireless communication

Wireless communication is the transfer of information between two or more points that are not connected by an electrical conductor. The following situations justify the use of wireless technology. To extend a distance beyond the capabilities of typical cabling. To render a backup communications link in case of normal network failure. To relate portable or temporary workstations. To defeat situations where normal cabling is difficult or financially impractical. To connect mobile users or networks remotely.

C. Ieee 802.11b

802.11b has a maximum raw data rate of 11 Mbps and uses the same CSMA/CA media access method defined in the original standard. Due to the overhead that occurred in CSMA/CA protocol , the maximum 802.11b throughput that can achieve is about 5.9 Mbps using TCP and 7.1 Mbps using UDP. Technically, the 802.11b standard uses Complementary code keying (CCK) as its modulation technique. The spectacular increase in throughput of 802.11b(compared to the original standard) along with simultaneous substantial price reductions led to the rapid evaluation of 802.11b as the definitive wireless LAN technology.

D. Ieee 802.11g

802.11g is the third modulation standard for wireless LANs. It works in the 2.4 GHz band but operates at a maximum raw data rate of 54 Mbps, or about 22 Mbps net throughput 802.11g hardware is fully backwards congenial with 802.11b hardware. Details of making b and g work well together occupied much of the lingering technical process. In an 802.11g network, the presence of 802.11b participant will significantly decrease the speed of the overall 802.11g network. Some 802.11g routers utilize a back-compatible mode for 802.11b clients called 54g LRS (Limited Rate Support).

The modulation scheme used in 802.11g is OFDM copied from 802.11a.It has the data rates of 12, 18, 24, 36, 48, and 54 Mbps, and reverts to CCK (like the 802.11b standard) for 5.5 and 11 Mbps and DBPSK /DQPSK +DSSS for 1 and 2 Mbps. Though 802.11g operates in the same frequency band as 802.11b, it can achieve high data rates because of its heritage to 802.11a.

II. PREVIOUS WORK

Other precedingwork on bandwidth measurement has used a following techniques.

A. BART(bandwidth available in real time)

It is a active end-to-end bandwidth measurement method it estimates not only the available bandwidth but also the link capacity of the bottleneck link. It uses a Kalman filter to give estimates in real time during a measurement session. In this paper, we have studied the impact of 802.11 networks on the bandwidth estimates produced by BART. The Kalman filter used by BART is tunable, and one of the contributions of this paper is to show how the Kalman filter should be adjusted to improve real-time tracking and estimation accuracy when the bottleneck is an 802.11 link**.**It was reported on how to tune the Q matrix in the Kalman filter used by BART to get even better tracking properties and accurate bandwidth estimates when the bottleneck of an end-to-end network path is an 802.11 link. BART measure the fair share bandwidth when the bottleneck is an link 802.11.

B. Deterministic Model Of Packet Delay

Describe a deterministic model of packet delay and use it to derive both the packet pair property of FIFO queuing networks and a new technique (packet tailgating) for actively measuring link bandwidths. Analyze with previously known techniques, packet tailgating usually devour less network bandwidth, does not depending on consistent behavior of routers handling ICMP packets, and does not depending on timely delivery of acknowledgments.

A novel technique, called packet tailgating, for measuring link bandwidths along a path through the Internet. Packet tailgating represents link-specific characteristics by causing queuing of packets at particular links. For each link, the technique sends a large packet with a time-to-live (TTL) set to expire at that link followed by a very small packet that will queue continuously behind the large packet until where the large packet expires. Packet tailgating consumes less network bandwidth than previous techniques.

C. Wbest

It is difficult to apply current bandwidth estimation tools to multimedia streaming applications in wireless network. This paper presents a new Wireless Bandwidth estimation tool (WBest) make for fast, non-interfering, accurate estimation of available bandwidth in IEEE 802.11 networks. WBest applies a two-step algorithm: 1) a packet pair technique to estimate the effective capacity of the wireless networks; 2) a packet train technique to estimate the achievable throughput and report the inferred available bandwidth.

The advantage of WBest is that it does not depend upon search algorithms to find the available bandwidth but instead, statistically observe the available fraction of the effective capacity, justify estimation delay and the force of random wireless channel errors.

WBest is implemented and evaluated on an 802.11 wireless testbed. Comparing WBest with other popular bandwidth estimation tools shows WBest to have higher accuracy, lower interfere and faster convergence times. Thus, WBest exhibit the potential for improving the performance of applications that need bandwidth estimation.

WBest is compared with other popular available bandwidth estimation tools in a wireless testbed under a variety of wireless and network conditions. The following conclusion scan be drawn. Current bandwidth estimation tools are significantly impacted by wireless network conditions, such as contention from other traffic and rate adaptation. This results in inaccurate estimates and high and varying convergence times and intrusiveness.

This makes current tools generally impractical for applications running over a wireless link, such as streaming media, that require fast, accurate, non-intrusive bandwidth estimates. WBest consistently provides fast available accurate estimations and lower intrusiveness over all conditions evaluated.

D. End-To-End Bandwidth Measurements

The measured available bandwidth is dependent on the probe packet size (contrary to what is observed in wired networks). Another equally essential finding is that the measured link capacity, using the best known TOPP model, is rely on the probe packet size *and* on the cross-traffic intensity. Because of the increased dependence on wireless network technology, it is important to ensure that methods and tools for network performance measurement also perform well in wireless environments. In this paper, we focus on active performance measurements in terms of network bandwidth, both link capacity and the unused portion thereof; the available bandwidth.

The bandwidth measurements have been performed in a testbed containing both wireless and wired hops. Our testbed topology only exist of one wireless 802.11 bottleneck link, to be used as an access link, since that is a measurement results we have used DietTopp, a tool that implements the TOPP model, which measures the obtainable bandwidth and link capacity of an end-to-end path.

Paper shown measurement results that illustrate the difference between available bandwidth measurement results obtained in wired and wireless networks. The impact of the probe-packet size, the cross-traffic rate and the number of cross-traffic generators has been analyzed.

E. Bandwidth Estimation In Wireless Networks

Available bandwidth estimation is a vital component of admission control for quality-of-service (QoS) in both wireline as well as wireless networks. In wireless networks, the obtainable bandwidth undergoes fast time-scale variations due to channel fading and error from physical obstacles. These causes are not present in wired networks, and make estimation of obtainable bandwidth in wireless networks a dispute task. Further, the wireless channel is also a shared-access medium, and the obtainable bandwidth also varies with the number of hosts contending for the channel.

The MAC layer uses a CSMA/CA algorithm for shared use of the medium. In this abstract, they present an available bandwidth estimation scheme for IEEE 802.11-based wireless networks. It gauges the cause of phenomena such as medium contention, channel fading and interference, which affect the available bandwidth, on it. Depends on the effect of the phenomena on the working of the medium-access scheme, estimate the bandwidth of a wireless host to each of its neighbors.

The aim of available bandwidth estimation is to serve as a basis for admission control and rate control of flows sharing the network. A per-neighbor available bandwidth estimation scheme for IEEE 802.11-based wireless networks. They utilized the available bandwidth so obtained, and the concept of channel time proportion (CTP), in (a) a dynamic bandwidth management framework for single-hop mobile ad hoc networks, and (b) an explicit rate-based flow control scheme for multi hop mobile ad hoc networks.

III. PACKET PROBING TECHNIQUE

The throughput is equivalent to the available bandwidth if the maximum packet size that can be transmitted is used. The transmission speed of a packet pair, or a compound probe consisting of a large heading packet (P_h) and a small trailing packet (P_t), over a wireless access link depends on the link capacity, cross-traffic load, the number of retransmission attempts required to access the channel, the time for receiving acknowledgment (ACK), and the delays contributed by the distributed coordination function inter frame space (DIFS) and short inter frame space (SIFS).

For a P_t size of s_{tp} bytes, the throughput of the wireless access link is: $T = s_{tp/} (t_2−t_1)$, where t_1 and t_2 are the arrival times of the last bits of P_h and P_t, respectively, at the wireless destination host. Therefore, the intra-packet gap between P_h and P_t is $t_2 − t_{1.}$ However, the intra-packet gap might be affected by cross traffic and heterogeneous link capacities of the wired segment of a hybrid wired-wireless path. In this , a scheme is used to measure the throughput of a wireless access link in a hybrid wired-wireless network where the wireless link is not required to be the bottleneck link of a path under measurement.

The scheme uses two compound probes with two different *Pt* sizes, $s_t = \{s_{ta},s_{tb}\}$,to determine the smallest and average intra-packet gaps. The capacity of the wireless access link is then used to calculate the deviations on the expected intra-packet gaps. The deviation indicates the throughput of the wireless access link. Furthermore, the scheme is resilient against the presence of cross traffic on the wired links of the path.

A. Experimental Results

The performance of the scheme in a testbed environment over two end-to-end path scenarios: a) single hop and b) multiple hops. The wireless links in these two scenarios are tested for IEEE 802.11b (11 Mb/s) and IEEE 802.11g (54 Mb/s) transmission rates. The single-hop path consists of a wired link and a wireless link without cross-traffic load along the path. The multiple-hop path has multiple wired links and a wireless access link with 50% and 75% cross-traffic loads on the second ($L2$ = 155 Mb/s) and third ($L3$ = 10 Mb/s) wired links, respectively. In the testbed, the wireless link constitutes the bottleneck link in the single-hop scenario, while the third wired link ($L3$ = 10 Mb/s) is the bottleneck link in the multiple-hop scenario.

The scheme is based on sending compound probes with two different trailing- packet sizes. We experimentally tested the scheme on single-hop and multiple-hop paths, with different bottleneck-link locations and under different cross-traffic loads on the wired links. The experimental results show that the proposed scheme achieves 90% and 61% accuracy on IEEE802.11b and 802.11g links, respectively.

IV. PROPOSING TECHNIQUE

In this proposed system, the throughput of the wireless access link in the hybrid wired-wireless network is simulated and analyzed. Here weighted fair queuing mechanism is used for scheduling the packets.

A. Weighted Fair Queuing

Weighted fair queuing (WFQ) is a method of automatically smoothing out the flow of data in packet-switched communication networks by sorting packets to minimize the average latency and prevent exaggerated discrepancies between the transmission efficiency afforded to narrowband versus broadband signals. Here the priority given to network traffic is inverse to the signal bandwidth Thus, narrowband signals are passed along first, and broadband signals are buffered. WFQ has little or no effect on the speed of narrowband signals. But the transmission of broadband signals gets slow down , during peak network traffic. The resources that can be used by the broadband signals are the low-bandwidth signals remain after the transmission of low bandwidth signals. The sharing of resources is done according to weights assigned.

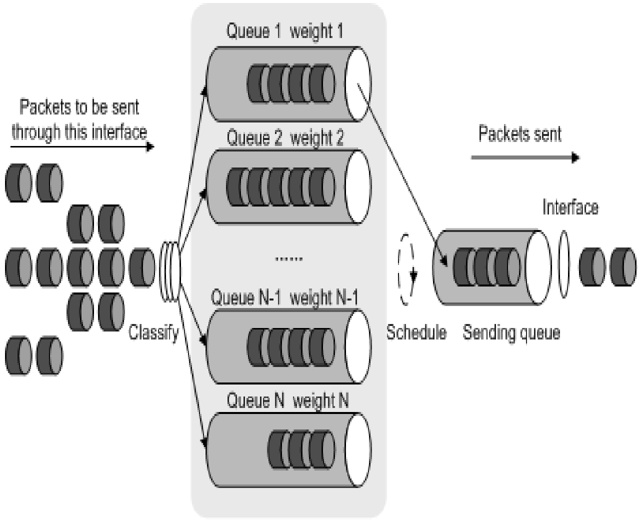

Fig.2 Weighted Fair Queuing

In flow-based WFQ, also called standard WFQ, packets are classify into flows according to one of four criteria: the source Internet Protocol address (IP address), the destination address, the Transmission Control Protocol of the source or User Datagram Protocol port, or the destination TCP or UDP port. Each flow receives an equal assignation of network bandwidth.

Both of these forms of WFQ operate according to principles similar to that of standard (flow-based) WFQ. WFQ can prevent high-bandwidth traffic from overwhelming the resources of a network, a phenomenon which can cause incomplete or complete failure of low-bandwidth communications during periods of high traffic in poorly managed networks.

B.Throughput

Throughput is the rate at which message successfully passed through a communication channel. This data may be delivered over a physical or logical link, or over a certain network node. The throughput is always estimated in bits per second (bit/s or bps), otherwise in packets per second or packets per time slot.

Maximum theoretical throughput is closely related to the channel capacity of the system, and is the maximum data that can be transmitted under ideal condition. It is sometimes equal to the channel capacity, this can be unreal, as only non-packetized systems technologies can achieve this without data compression.

Peak measured throughput are theoretical values. Peak measured throughput is measured by a real, or a simulated system. It is the throughput measured over a short span of time.This is the time taken with respect to throughput as time reaches zero. This term is also called "instantaneous throughput". This number is useful for systems that depend on burst data transfer. For systems with a high duty cycle this is less likely to be a useful estimate of system performance.

Maximum throughput is the throughput averaged or integrated over a long time. For high duty cycle networks this is likely to be the most accurate indicator of system performance. The maximum throughput is the asymptotic throughput when the load (the amount of incoming data) is very large.

In packet switched systems where the load and the throughput always are equal (where packet loss does not occur), the maximum throughput can be defined as the minimum load in bit/s that causes the delivery time (the latency) to become unstable and increase towards infinity. This value can also be used unreal in relation to peak measured throughput to conceal packet shaping**.**

C. Qam Modulation

Quadrature amplitude modulation (QAM) is an analog/digital modulation scheme. It can carry two analog signals, or two digital streams, by modulating the amplitudes of two carrier waves, using digital modulation scheme called amplitude-shift keying or analog modulation scheme. The two carrier waves, usually sine waves, are out of phase with each other by 90° phase shift and are thus called quadrature carriers or quadrature components. The modulating waves are added, and the final waveform is a combination of phase-shift keying and amplitude-shift keying or phase modulation (PM) and amplitude modulation. Digital QAM, uses at least two phases and two amplitudes. PSK modulators are usually modelled using the QAM concept, but are not thought as QAM until the amplitude of the carrier signal which is modulated is constant. QAM is widely used as a modulation scheme for telecommunication systems.More spectral efficiencies can be succeed with QAM by making proper constellation size. The bits that can be transmitted is divided into two parts.

This process generates two independent signals to be transmitted. Then one channel is multiplied by a cosine, while the other channel is multiplied by a sine. This way there is a phase of 90° between them.

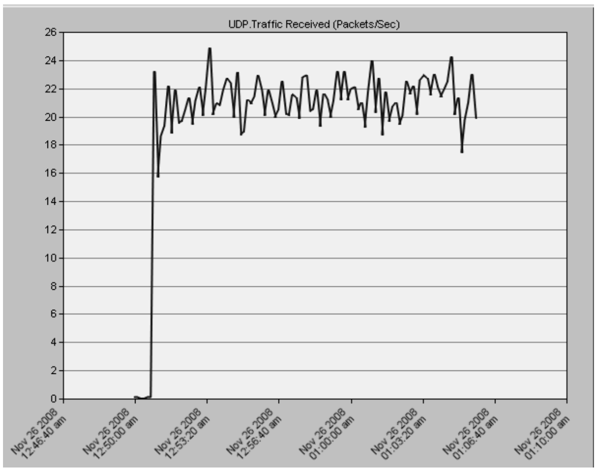

Fig.3 Traffic Received (Packets/Sec) By The User At The Distance Of 2km

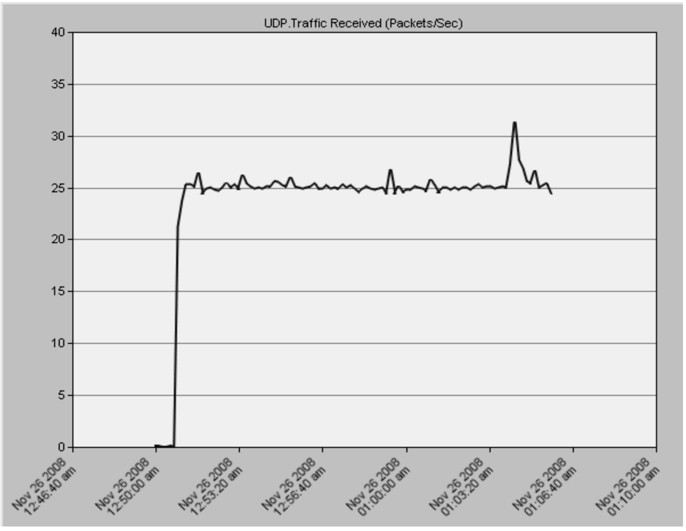

Fig.4 Traffic Received (Packets/Sec) By The User At The Distance Of 4km

Both the variations that is phase and frequency variations introduced by the channel must be compensated by properly tuning the sine and cosine , which needs the phase reference, and is usually acquired using a Phase-Locked Loop.

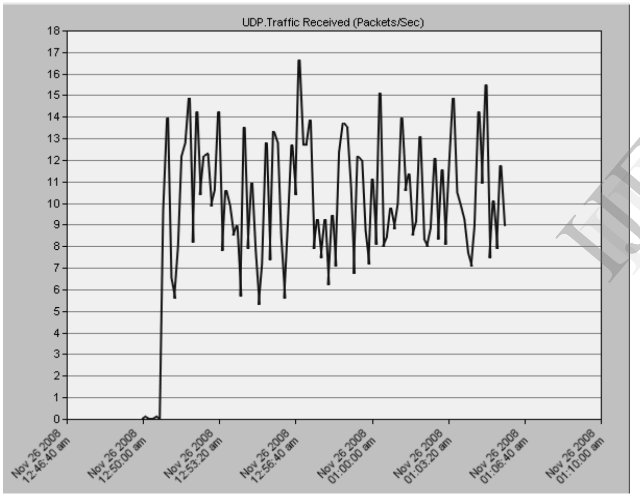

Fig.5 Traffic Received (Packets/Sec) By The User At The Distance Of 6km

TABLE.1 Packets Received By Users

USERS	PACKETS/SEC
AT 2KM	24-26
AT 4KM	25
AT 6KM	14-17

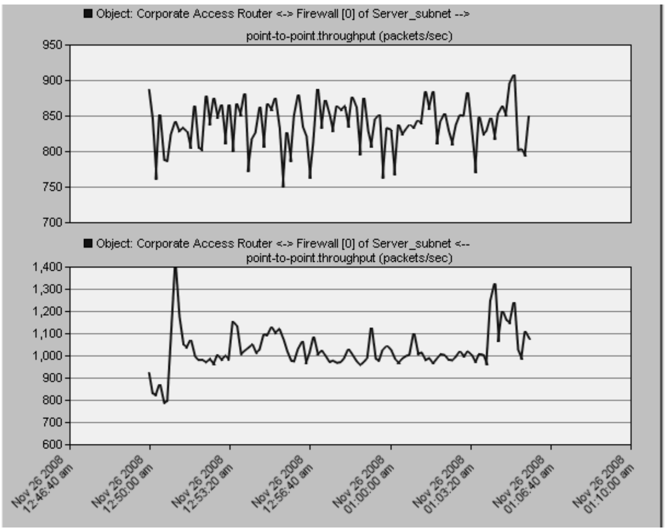

Fig.6 Point-To-Point Throughput Achieved Packets/Second At The Access Router

TABLE.2 Throughput

THROUGHPUT	PACKETS/SEC
WIRED TO WIRELESS	900
WIRELESS TO WIRED	1400

CONCLUSIONS

In this paper, the hybrid network that is wired-wireless network is used. The packets are transmitted from the source host to the wireless destination. The link capacity of the wired network is reliable but there is a loss of link capacity in the wireless network. Here the throughput is calculated for the wireless access link in the hybrid network. In this project weighted fair queuing technology is used for scheduling the packets. In wireless network, three users at 2km,4km and 6km is used. Hence show the packets received by them in simulation. Packets received by the user at 2km is more when compared to the user at 4km and 6km.hence the user nearer to the service provider receive more packets than farther one.

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