Implementing Hub and Spoke Topologies in Virtual Private Network using Enhanced Interior Gateway Routing Protocol

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***Abstract* -Network coding is an effective idea to boost the capacity of wireless networks, and a variety of studies have explored its advantages in different scenarios. However, there is not much analytical study on throughput and end-to-end delay of network coding in multi-hop wireless networks considering the specifications of IEEE 802.11 Distributed Coordination Function. In this project, we first present and define the coding conditions to identify a coding host. The bandwidth consumption of a coding host is then estimated under the contention-based wireless networks with a random access mechanism. Finally, we propose a bandwidth-satisfied and coding-aware multicast routing protocol (BCMRP). By taking into account the residual bandwidth of the carrier-sense neighbors of the forwarders, the proposed protocol can satisfy the bandwidth requirements of the requested flow and other ongoing flows. As a consequence of considering coding opportunities in multicast tree construction, the proposed multicast protocol can reduce the total bandwidth consumption. The simulation results show that BCMRP outperforms the prior multicast routing protocols in receiving ratio, admission ratio, and total bandwidth consumption.**

Keywords: Routing Information Protocol (RIP), Routing Protocol, GNS 3 software tool, Open Short Path First (OSPF), Enhanced Interior Gateway Routing Protocol (EIGRP).

I INTRODUCTION

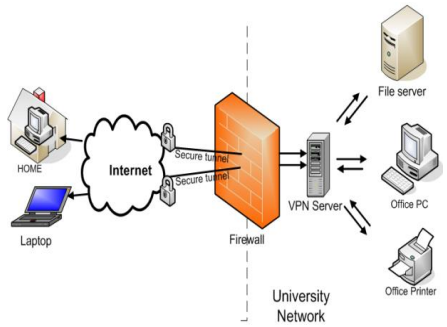
In many real applications such as environmental surveillance or weather forecasting, achieving the maximum amount of collected data from sensor nodes or in other words, increasing the network throughput is one of the most challenging issues.

However, the data acquisition by relying on data forwarding or route discovery approaches increases the data delivery latency, Capacity is a crucial resource in multi-hop wireless networks as it is shared not only between the source and destination of data packets but also among relay nodes forwarding packets. To increase the transmission capacity of wireless networks, the powerful concept of network coding has been introduced that can improve performance significantly in collision and interference. However, network protocols inevitably deal with such physical phenomena and constraints. Therefore, more theoretical studies are needed to better quantify the benefits of network coding over traditional forwarding for

Actual protocols considering PHY/MAC layer Specification.

In wireless networks, it is always beneficial for the nodes to know the global knowledge of channel state information (CSI) such as the channel gain or the link loss probability. This is because global knowledge of CSI not only constitutes the necessary condition for the network design, but also greatly eases the network optimization and improves the system performance in general. Consider the CSI of a connected link between node *i* and node *j*. This information is considered local to *i* and *j*, and can be obtained fairly easily. However, for a third-party node *k* (where $k \neq i, j$), the channel information of link *i, j* becomes some sort of global knowledge and needs to take special arrangement to obtain it. The problem, referred to as "third-party information exchange", was first proposed. The objective of third-party information exchange is to develop deterministic and efficient algorithms to enable all the nodes to obtain the complete global information by exchanging packets among themselves.

The Virtual Private Network is a private network which enables a secure way of connectivity through a public network. VPN creates tunnel through the network traffic is encrypted in order to ensure network security and privacy as shown in Fig no.1. VPN technology is a way to allow remote users to securely access co-operate application and other resources in order to ensure safety in VPN. The data travels through tunnels as discussed and the users must use authentication method to gain access to the VPN. The open VPN is a popular VPN protocol that is based on SSN, TLS encryption which is rapidly gaining its popularity due to the high level of security customizability and compatibility with most network environments.



VPN also creates a safe & encrypted connection over a less secure network similar as internet. VPN offers protection as it prevents anyone on the same network from intercepting the web traffic. Many VPN service also provide its own DNS resolution system. So VPN DNS system is considered as another layer of protection. VPN also mitigate some of the effects of net neutrality that treats ISP web services equally. There are different protocols used to secure & encrypt users like IP security, secure socket layer, transport layer security, point-to-point tunneling protocol.

II LITERATURE SURVEY

Regarding multi-hop wireless networks, Sagduyu et al. [16] consider a collision-free scheduled access to formulate throughput for both saturated and non-saturated queues. However, in case of a random access scheme, their analytical model is limited to saturated queues. In this paper, instead of limiting nodes to scheduled access, we study the performance using IEEE 802.11 MAC layer, where collision can occur without assuming saturated queues. In addition, we provide simulation results to verify our model.

In wireless networks, throughput optimization is an essential performance objective that cannot be adequately characterized by a single criterion (such as the minimum transmitted or sum-delivered throughput) and should be specified over all source–destination pairs as a rate region. For a simple and yet fundamental model of tandem networks, a cross-layer optimization framework is formulated to derive the maximum throughput region for saturated multicast traffic. The contents of network flows are specified through network coding (or plain routing) in network layer and the throughput rates are jointly optimized in medium access control layer over fixed set of conflict-free transmission schedules (or optimized over transmission probabilities in random access). If the network model incorporates bursty sources and allows packet queues to empty, the objective is to specify the stability region as the set of maximum throughput rates that can be sustained with finite packet delay. Dynamic queue management strategies are used to expand the stability region toward the maximum throughput region. Network coding improves throughput rates over plain routing and achieves the largest gains for broadcast communication and intermediate network sizes. Throughput optimization imposes fundamental tradeoffs with transmission and processing energy costs such that the throughput-optimal operation is not necessarily energy efficient.

III EXISTING SYSTEM

Regarding multi-hop wireless networks consider a collision-free scheduled access to formulate throughput for both saturated and non-saturated queues. However, in case of a random access scheme, their analytical model is limited to saturated queues. In this paper, instead of limiting nodes to scheduled access, we study the performance using IEEE 802.11 MAC layer, where collision can occur without assuming saturated queues. In addition, we provide simulation results to verify our model. In a similar theoretical-based approach for multicast sessions derive throughput for multi-hop wireless networks. They also define a new metric, network unbalance ratio, which identifies the amount of unbalance in stability among nodes. However, their estimate of service time does not take into account some important features of IEEE 802.11 DCF like binary exponential random back-off. Furthermore, they postpone transmission of the native packet at a node until receiving a packet from another flow to be combined with it, and thus, causing a long delay.

In another work considering IEEE 802.11 DCF, investigate the throughput capacity of physical layer network coding in which a common center node exchanges packets with others in multi-hop wireless networks. They analyze such canonical networks both with equal and variable link-length, and find the optimal number of hops to maximize the throughput.

In addition the throughput and end-to-end delay of multi-hop wireless networks utilizing IEEE 802.11 DCF only for traditional forwarding, when every node initiates a flow with the same rate to a random destination, and same arrival rate is assumed at all nodes. They derive a delay-constrained capacity in terms of carrier sensing range and packet generation rate. Furthermore an analytical framework for bidirectional unicast flows in multi-hop wireless networks. Their work considers collision and different interference levels in CSMA/CA by varying the carrier sensing range and signal-to-interference ratio to maximize the throughput in different retransmission schemes.

IV PROPOSED SYSTEM

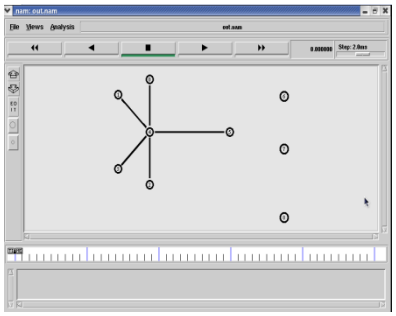
We apply multi-class queuing network to study the performance of multi-hop wireless mesh networks applying inter-flow network coding, where intermediate nodes can mix packets of different flows by bitwise XOR operation. This model provides an analytical framework for a multi-hop chain topology with bidirectional unicast flows in opposite directions. In contrast to other studies, no artificial delay is injected in forwarding native packets even if there is no coding opportunity. In fact, we do not postpone transmission of native packets artificially to generate coded packets (i.e., opportunistic coding). Also, we consider separate classes of queues for native and coded packets, while the coded queue is a higher-priority queue.

In this project, by means of applying network coding and constructing a multicast tree, we propose a multicast routing protocol for MANETs, which can satisfy bandwidth

requirements and reduce the total bandwidth consumption to a certain degree. First, the conditions, which can determine whether a host can be a coding host on intersected uncast and multicast flows, are defined. To satisfy the bandwidth requirement, the residual bandwidth of each host and the bandwidth consumption of a coding host induced by applying network coding are then estimated. A Markov model is proposed for estimating the bandwidth consumption of a coding host. Further, an algorithm, which is made aware of coding opportunities, is proposed to construct a bandwidth-satisfied multicast tree.

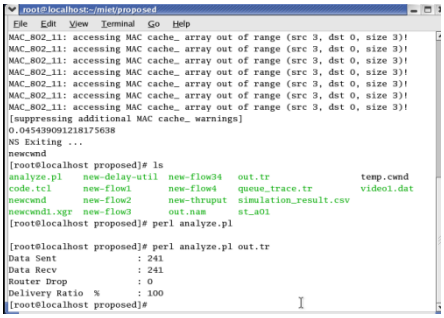
We have proposed the RSSB contention scheme for receiver selection and the transmit power adjustment scheme to compute the optimal transmit powers of the AP and TX. We performed an SINR analysis of the uplink and downlink transmissions and extensive simulations for the performance evaluation of the network throughput and fairness among clients. Further, we compared the performance of PoCMAC with that of the 802.11-based half-duplex scheme and the full-duplex scheme without power control.

1.NAM Window



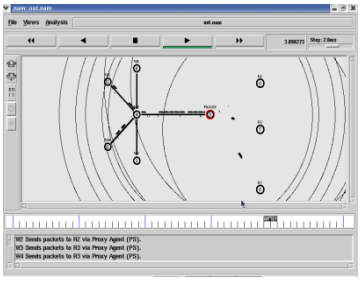
SIMULATION FOR AVERAGE THROUGHPUT

We carry out extensive simulations to evaluate the throughput performance of PoCMAC using MATLAB. For our simulations, we consider a single-cell system with an AP having full duplex capability and its associated clients with backlogged user datagram protocol (UDP) packets.



V RESULT AND DISCUSSION

In this section, we present analytical and simulation results for performance evaluation of both MAC candidates and the MAC switching point. The simulation results are used to demonstrate the accuracy of the MAC switching point calculation based on the closed-form expressions. With an error-free wireless channel in the system, to simulate the IEEE 802.11b DCF and the D-TDMA. In the simulation, a fully-connected network over a 50m $\times$ 50m square coverage area is deployed, where nodes are randomly scattered. Traffic arrivals for each node are realized as a Poisson process with being 25 and 50 packet/s, respectively, for the non-saturated traffic case and with λ set as 500 packet/s for the saturated traffic case. Each simulation point provides the average value of the corresponding performance metrics (i.e., throughput and delay). We also plot the 95% confidence intervals for each simulation result.



FUTURE WORK

In this project, we utilized queuing theory to study the throughput and end-to-end delay of both traditional forwarding and inter-flow network coding in multi-hop wireless mesh networks, where two unicast sessions in opposite directions traverse the network. We proposed an analytical framework considering the specifications of the IEEE 802.11 DCF, such as the binary exponential back-off time with clock freezing and virtual carrier sensing, to formulate the links quality, waiting time of the packets and retransmissions. Our analytical model assumes Multi-Path Multi-Hop, which is in a stable state, while coded and native packets arrive at separated queues and coded packets have a non-pre-emptive higher priority over native packets. Furthermore, in our model as opposed to previous studies, the transmission of native packets is not artificially delayed for generating more coded packets; this makes it significantly more challenging to estimate coding opportunities at nodes

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