International Journal of Electrical and Electronics Research ISSN 2348-6988 (online)
Vol. 3, Issue 2, pp: (613-617), Month: April - June 2015, Available at: www.researchpublish.com

Performance Analysis of Network Parameters, Throughput Optimization Using Joint Routing, XOR Routing and Medium Access Control in Wireless Multihop Network

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Abstract: **In mobile ad hoc network routing across the network is exploring to its heights. Much of the network performance is based on the end to end routing with minimum distortion. In order to avoid the complexity, a simple slotted aloha is chosen as the medium access control for link layer operation. Joint routing, access probability and rate allocation across the network is being formulated. In addition a XOR network coding is inculcated which helps to increase the performance of the network. The novel part of the project is that joint routing provides a significant increase in the throughput in the presence of the physical interference. Simulation results show that gradual increase in the throughput as the transmission power in increased in steps.**

Keywords: **Medium access control, network coding, routing, throughput, transmission rate.**

I. INTRODUCTION

Network coding has emerged as a promising technique both in wired and wireless networks to improve throughput performance. Wireless networks suffer from interference due to the inherent broadcast nature of the wireless medium. Network coding is an important method that turns this apparent broadcast limitation into an advantage for better throughput performance. Network coding has been used in many contexts in wireless networks, including end-to-end multicasting, unicasting at the link layer and physical-layer transmission. Due to the simplicity and practicality of link-layer network coding, this technique has attracted a lot of attention from the wireless research community.

The optimal joint configuration of routing, access probability, and transmission rate parameters is studied in slotted ALOHA wireless networks with network coding to maximize the minimum throughput of the flows. Effective link rate for slotted aloha under SINR based physical interference is modeled .Throughput improvement is achieved significantly by jointly optimizing access probability and network coding. The objectives are to provide the insights on the throughput gains by joint design.

II. RELATED WORK

Since from 1990's, researchers have tried to address the problem of joint routing and MAC (JRM) for multihop ALOHA wireless networks. In a nonlinear joint optimization problem is formulated using a simple interference model and solved by decoupling the routing and the MAC problems. For the routing problem, a heuristic is used to find the minimum-hop path with low interference, and then the MAC problem is solved by an iterative numerical method. A tightly coupled joint routing, access probability, and transmission rate allocation problem based on a more sophisticated interference model is analyzed. A simple link –layer network coding is studied that is XOR-type coding between a pair of flows is analyzed.

Network coding has been studied by joint routing, scheduling, and network coding under a simplistic interference model and provides bounds on throughput. In this the study is based on joint congestion control, scheduling, and bidirectional

network coding. Different from the existing works, in this paper, study is on joint design in slotted-ALOHA-based wireless networks with an XOR-based network coding.

III. MOTIVATION

❖ **802.11 Protocol and Slotted ALOHA:**

A network of computers based on multi-access medium requires a protocol for effective sharing of the media. As only one node can send or transmit signal at a time using the broadcast mode, the main problem here is how different nodes get control of the medium to send data, that is "who goes next?". The protocols used for this purpose are known as Medium Access Control (MAC) techniques. The key issues involved here are - Where and how the control is exercised. 'Where' refers to whether the control is exercised in a centralized or distributed manner. In a centralized system a master node grants access of the medium to other nodes. A centralized scheme has a number of advantages as mentioned below:

Greater control to provide features like priority, overrides, and guaranteed bandwidth.

- Simpler logic at each node.
- Easy coordination.

Although this approach is easier to implement, it is vulnerable to the failure of the master node and reduces efficiency. On the other hand, in a distributed approach all the nodes collectively perform a medium access control function and dynamically decide which node to be granted access. This approach is more reliable than the former one.

'How' refers to in what manner the control is exercised. It is constrained by the topology and trade off between cost-performance and complexity. The MAC techniques can be broadly divided into four categories and they are Contention-based, Round-Robin, Reservation-based and. Channelization-based.

❖ **ALOHA:**

➢ The ALOHA scheme was invented by Abramson in 1970 for a packet radio network connecting remote stations to a central computer and various data terminals at the campus of the university of Hawaii. A simplified situation is shown in Fig. 1.1. Users are allowed random access of the central computer through a common radio frequency band f1 and the computer centre broadcasts all received signals on a different frequency band f2. This enables the users to monitor packet collisions, if any. The protocol followed by the users is simplest; whenever a node has a packet to sent, it simply does so. The scheme, known as Pure ALOHA, is truly a free-for-all scheme. Of course, frames will suffer collision and colliding frames will be destroyed. By monitoring the signal sent by the central computer, after the maximum round-trip propagation time, an user comes to know whether the packet sent by him has suffered a collision or not.

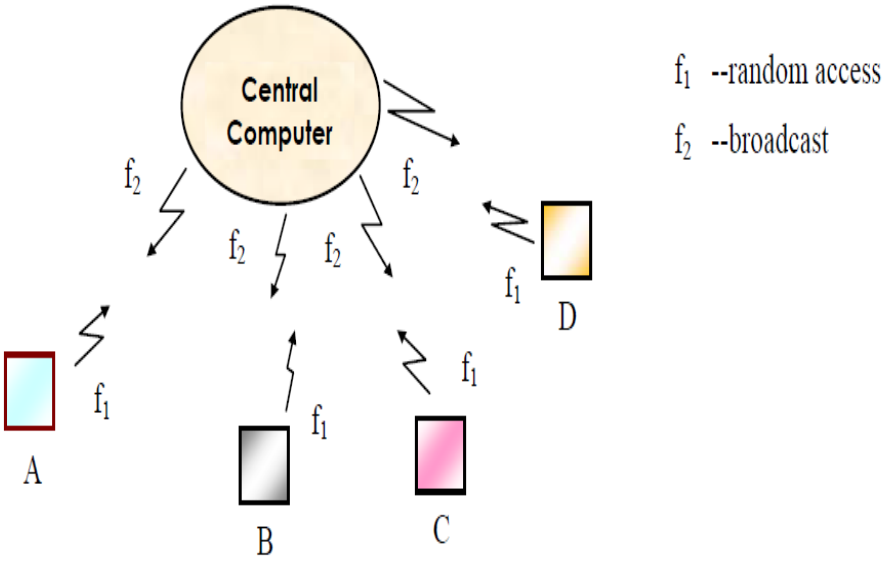


Figure 1.1 Simplified ALOHA scheme for a packet radio system

- ALOHA is being classified into two categories, they are:

1. Pure ALOHA.
2. Slotted ALOHA.

➢ **Pure ALOHA:**

It may be noted that if all packets have a fixed duration of τ (shown as F in Figure), then a given packet A will suffer collision if another user starts to transmit at any time from τ before to until τ after the start of the packet.

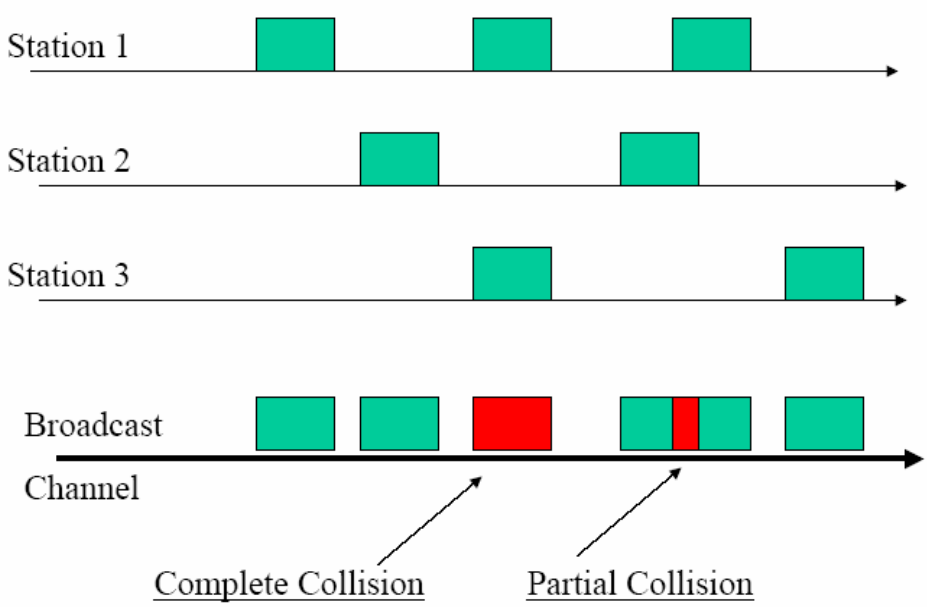


Figure 1.2 : Collision In Pure ALOHA

➢ **Slotted ALOHA:**

In order to overcome the problem of collision, efficiency of the transmission is improved using Slotted ALOHA. Subsequently, in a new scheme known as Slotted ALOHA, was suggested to improve upon the efficiency of pure ALOHA.

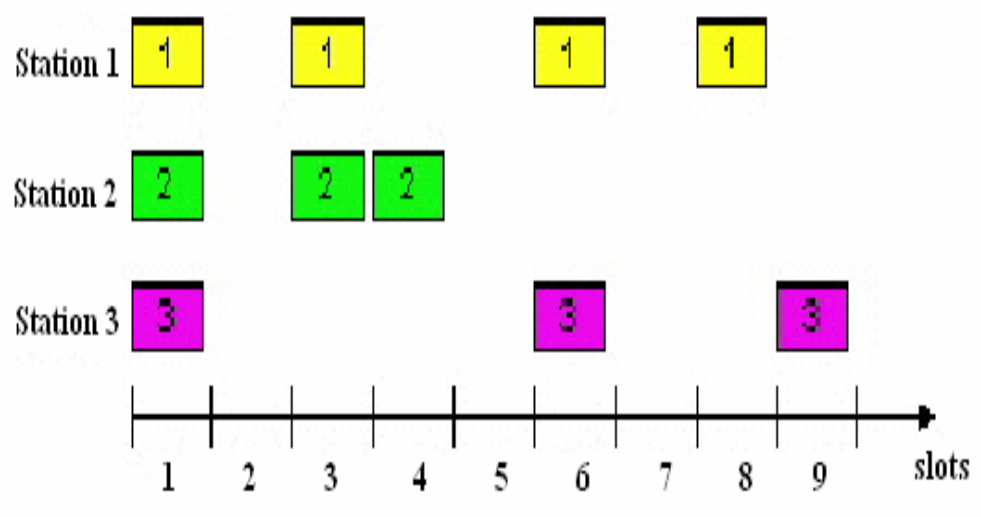


Figure : Slotted ALOHA: Single active node can continuously transmit at full rate of channel

In this scheme, the channel is divided into slots equal to τ and packet transmission can start only at the beginning of a slot as shown in Fig. This reduces the vulnerable period from 2τ to τ and improves efficiency by reducing the probability of collision.

IV. PERFORMANCE ANALYSIS

In order to test the performance of the project, simulator used is ns-2.34 as network tool. An IEEE 802.11 MAC protocol is used as one the routing protocol which helps to analyze the parameters like throughput, delay and energy in steps whenever the transmission power is changed in steps.

i)Throughput versus Transmission power:

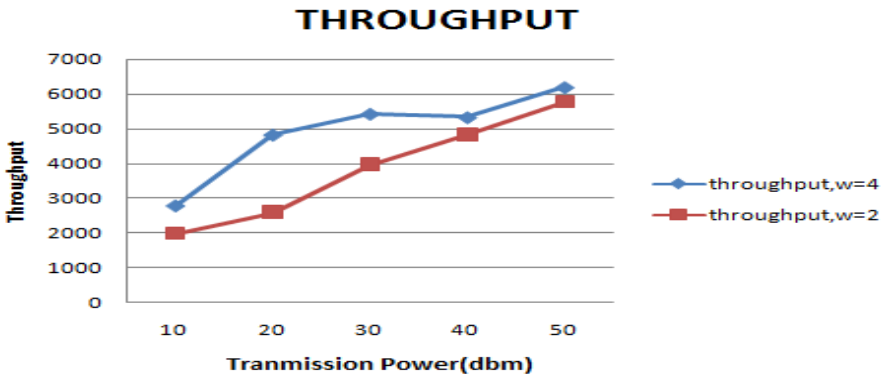


Figure1.3 Throughput vs Transmission power

As the transmission power is changed in values of steps there is change in the throughput , which gives the average packet transmission. Throughput improvement is highly dependent in the transmit power but it is never large.

(ii) Delay versus Transmission power:

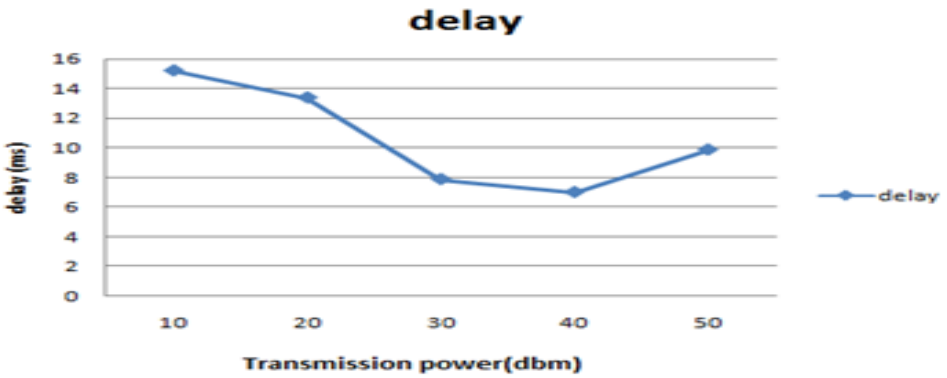
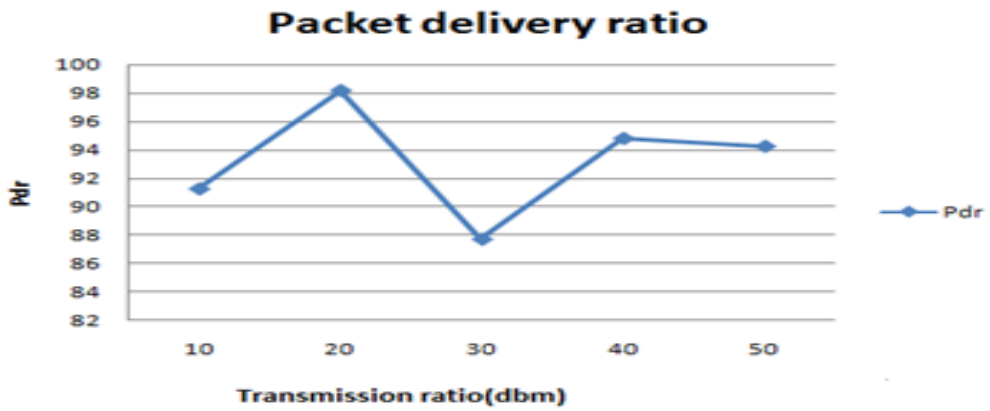


Figure 1.4 Delay vs Transmission power

As throughput is increased, delay also increases respectively. If delay is more then the network is no more stable so Xor network coding is applied.

(iii) Packet Delivery Ratio versus Transmission Power:



V. CONCLUSION

In this paper the joint configuration of routing, access probability, and transmission rate parameters in slotted ALOHA wireless mesh networks are being studied. Several steps have formulated and solved several optimization problems for several wireless mesh network scenarios. The studies for the network systems show that using joint routing a significant throughput improvement and at low transmit power, a simple XOR network coding helps to increase the improvement in the network.

REFERENCES

[1] J. R. Yee and F. M. Shiao, "On calculating high throughputs in multi-hop slotted Aloha packet radio networks," in Proc. IEEE INFOCOM, Jun. 1990, pp. 382–388.

[2] X. Wang and K. Kar, "Cross-layer rate control for end-to-end proportional fairness in wireless networks with random access," in Proc. ACM MobiHoc, May 2005, pp. 157–168.

[3] Ritesh Madan,Member ,IEEE,Shigang Cui,Member IEEE,"cross layer design for lifetime maximization in interference-limited wireless sensor networks",vol 5,No.11,Novemember 2006

[4] D.Umehara, T.Hirano, S.Denno, andM.Morikura, "Throughput analysis of wireless relay slotted ALOHA systems with network coding," in Proc. IEEE GlobeCom, Nov.–Dec. 2008, pp. 1–5.

[5] D. Umehara, S. Denno, M. Morikura, and T. Sugiyama, "Throughput analysis of two-hop wireless CSMA network coding," in Proc. IEEE ICC, 2010, pp. 1–6.

[6] Chun-Hsiang,Member, santoshi Denno ,senior member,"Enchancement of csma/ca and network coding in single-relay Mulit-user wireless networks"vol.E93-12,December 2010

[7] J. Zhang, Y. P. Chen, and I. Marsic, "MAC-layer proactive mixing for network coding in multi-hop wireless networks," Computer Network., vol.54, no. 2, pp. 196–207, Feb. 2010.

[8] J. Luo, C. Rosenberg, and A. Girard, "Engineering wireless mesh networks: joint scheduling, routing, power control and rate adaptation, "IEEE/ACM Trans. Netw., vol. 8, no. 5, pp. 1387–1400, Oct. 2010.

[9] L. Jiang and J. Walrand, "A distributed CSMA algorithm for throughput and utility maximization in wireless networks," IEEE/ACMTrans. Netw., vol. 18, no. 3, pp. 960–972, Jun. 2010.

[10] M. F. Uddin, C. Rosenberg, W. Zhuang, and A.Girard, "Joint configuration of routing and medium access parameters in wireless networks," in Proc. IEEE GLOBECOM, Feb 2014, pp1–8.