International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

Fairness Issues in a Wireless LAN

Vaggala Navyatha[1], E. Sunil Reddy[2]

[1]Student, M. Tech CSE Department, Institute of Aeronautical Engineering, Hyderabad-500043, Telangana, India

[2]Assistant Professor, IT Department, Institute of Aeronautical Engineering, Hyderabad-500043, Telangana, India

Abstract: ***Fairness is an important issue when we access a shared wireless channel. Using fair scheduling, it is possible to allocate the bandwidth in proportion to weights of the packet flows sharing the channel. This paper presents fully distributed algorithm for fair scheduling in a wireless LAN and also implements the algorithm using a centralized coordinator to arbitrate medium access. The proposed algorithm is able to transmit the allocated bandwidth to different flows which is proportional to their weights. One of the advantage features of proposed approach is that we can implement it with simple modifications to the IEEE 802.11 standard.***

Keywords: MAC (Medium Access Control), wireless networks, weighted fairness, distributed protocols.

1. Introduction

In wireless LANs we propose a distributed packet scheduling scheme which improves the short-term fairness in a WLAN. Distributed coordination function (DCF) models the channel contention dynamics of the system IEEE 802.11 rather than the Markov chains. This model is much simpler than Markov chain models. Markov chain models are used to model the DCF's binary exponential back off (BEB) procedure. Back off stage and back off value counter are represented as queuing system. We model entire 802.11 WLAN as a closed queuing network and derive the performance which is based on the queuing theory. By the analytic results, we develop a simple distributed runtime estimation scheme which is used to calculate the number of contending stations. Finally, we propose a distributed scheduling scheme that improves the fairness of the short-term to the network IEEE 802.11.Wireless Local area Networks has a greater use with the advent of IEEE 802.11 standard. The availability of several commercial products are based on this standard. Fairness has a prominent issue while accessing a shared wireless channel. Fairness can be scheduled using allocated bandwidth in proportion to their weights. IEEE 802.11 wireless MAC is not fair the proposed protocol is derived from distributed coordination function (DCF) in IEEE 802.11. Distributed Fair Scheduling improves fairness compared to 802.11 and scaled 802.11. No DFS protocol may accurately emulate-conserving centralized protocols unless clocks are synchronized.

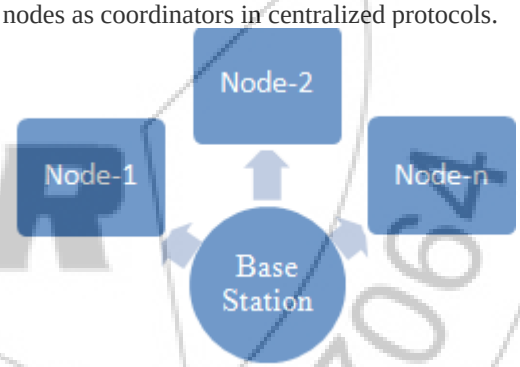
2. Proposed System

Distributed Fair Scheduling (DFS) approach is obtained by modifying the Distributed Coordination Function (DCF) in IEEE 802.11 standard. The proposed protocol can allocate bandwidth in proportion to the weights of the flows sharing the channel. We propose various mappings that can be used to choose the appropriate back off interval for a packet and also proposed a scheme for dynamic adaption of the scaling factor. An interesting feature of proposed approach is that it can be implemented with simple modifications to IEEE 802.11.

3. Medium Access Control (MAC)

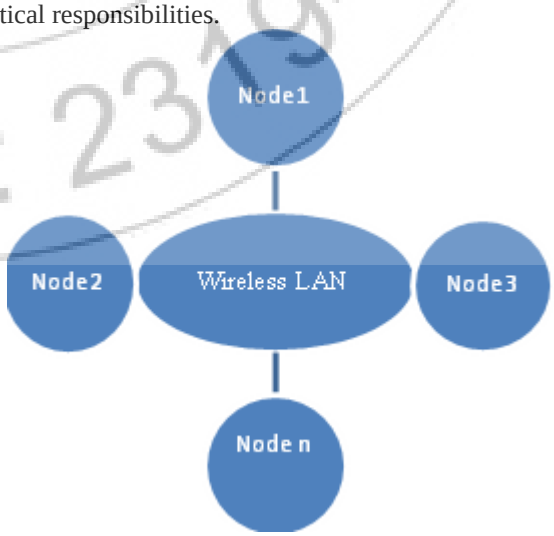
Wireless medium is a broadcast medium, transmissions by multiple nodes that can interfere. MAC has the following proposals such as centralized protocols and distributed protocols.

Centralized protocol: Base station coordinates access to the wireless channel. Centralized approach has the disadvantage of a node which cannot talk to the base station it cannot transmit to other nodes. Base station need to know the state of other nodes and keep in track. It is hard to use the failure-prone nodes as coordinators in centralized protocols.



In centralized approaches base station coordinates medium access.

Distributed protocol: In this protocol all the nodes have identical responsibilities.



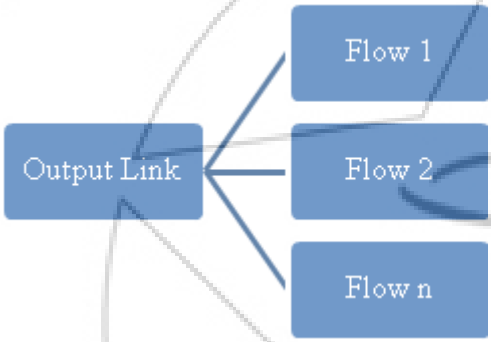
4. Fairness

The packet which has to be transmitted has several flows where as each flow is assigned a weight and bandwidth assigned. Each backlogged flow is proportional to its weight.

- The two issues which are worth nothing are the propose technique which can be extended to the algorithm start time fair queuing.
- The Distributed implementation of Start Time Fair queuing (SCFQ) is different to emulate.

4.1. Fair Queuing

There are many centralized fair queuing protocols which exists WFQ, WF2Q, SCFQ, SFQ. A scheduler needs to know the state of all flows. All fair queuing disciplines try to emulate Generalized Processor Sharing. Previous work on fairness in distributed MAC protocols are limited in scope which provide equal bandwidth share, suffer in the presence of location dependent errors.

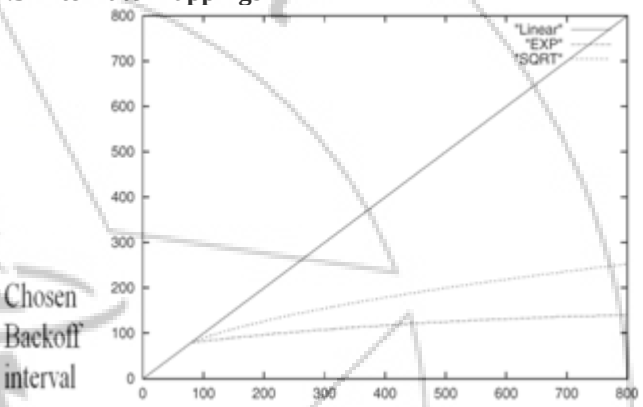


4.2. Distributed fair scheduling (DFS)

DFS is a new protocol for fairness scheduling.802.11 Distributed coordination function is derived from the distributed algorithm. Emulation of self-clocked Fair Queuing (SCFQ) in a distributed manner packets scheduler maintains a virtual clock to keep track of packets which has to be serviced in DFS all nodes are identical and have identical responsibilities i.e., nodes do not need to be aware of each other's state. It maintains compatibility with an existing standard specially, IEEE 802.11 Distributed Coordination Function (DCF).

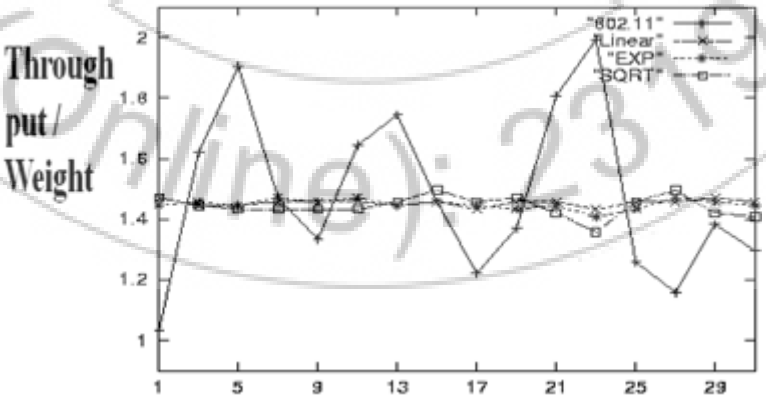
- **Collision handling:** To reduce priority reversals, a small back off interval is chosen after the first collision that is primary collision. Back off interval increases exponentially depending upon the further collisions.
- **Potential drawbacks:** It can exhibit short-term unfairness and also shows impact on small weights of backlogged flow.
- **Impact of small weights:** Back off intervals are being used to compare length and weight. Small weights can lead to high idle times throughput degradation. Any kind of non-decreasing function of length and weight may be used to obtain back off intervals and need to explore alternate mappings.

4.3 Alternate Mappings



- **Advantage**
  a) We have smaller back off intervals.
  b) Less time is wasted in counting down when weights of backlogged flows are small.
- **Disadvantage**
  a) In linear scale back off intervals are different which may become identical on the compressed scale.
  b) There is more possibility of collisions in great number.

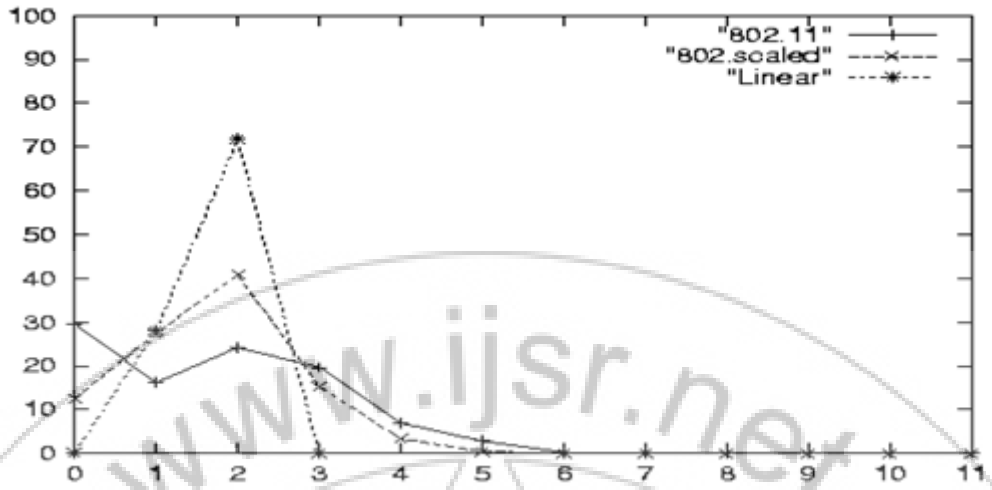
4.4 Throughput/Weight variation across flows



4.5 Flow Destination Identifier

Scaled 802.11: In 802.11 fairness is improved by using larger back off intervals. As large back off intervals are used in DFS, fairer is simple. Scaling factor is determined by collisions both small and large. Small number may result in more collisions and large number may result in large overhead.

4.6 Short Term Fairness



Number of Packets Transmitted by a flow (over 0.04 second windows)

5. Future Work

DFS is the only the first step towards practical fairness. Scaling factor has failed to choose reasonable values which can degrade throughput or short term fairness. Flow weights in upper layer specify dynamically or static assignment based on static criteria and need to focus on Ad hoc network related issues.

6. Conclusion

Possible to augment DFS with other techniques to improve fairness in presence of transmission errors. No performance cost even if weight assigned to a flow is changed on a per packet basis. In centralized protocols execution complexity increase and has a possibility of handling multiple flows per node.

References

[1] Aad and C. Castelluccia, “Differentiation Mechanisms for IEEE 802.11,” Proc. INFOCOM 2001 Conf., 2001.
[2] J.C.R. Bennett and H. Zhang, “Wf2q: Worst-Case Fair Weighted Fair Queuing,” Proc. INFOCOM ’96 Conf., Mar. 1996.
[3] V. Bharghavan, A. Demers, S. Shankar, and L. Zhang, “MACAW:A Media Access Protocol for Wireless LANs,” Proc. ACMSIGCOMM Conf., pp. 212-225, Aug. 1994.
[4] Demers, S. Keshav, and S. Shankar, “Analysis and Simulation of a Fair Queuing
[5] Algorithm,” Proc. SIGCOMM Conf., Sept. 1995.
[6] D. Eckhardt and P. Steenkiste, “Effort-Limited Fair (ELF) Scheduling for Wireless Networks,” Proc. IEEE INFOCOM 2000 Conf., 2000.
[7] K. Fall and K. Varadhan, “ns Notes and Documentation, “technical report, VINT Project, Univ. of California at Berkeley and Lawrence Berkeley Nat’l Laboratory, 1997.
[8] R. Graces and J.J. Garcia-Luna-Aceves, “Near-Optimum Channel Access Protocol Based on Incremental Collision Resolution and Distributed Transmission Queues,” Proc. IEEE INFOCOM Conf., Mar.-Apr. 1998.
[9] N.H. Vaidya and P. Bahl, “Fair Scheduling In Broadcast Environments,” Technical Report MSR-TR-99-61, Microsoft Research, Aug. 1999.
[10] N.H. Vaidya, P. Buhl, and S. Gupta, “Fair Scheduling in a Wireless LAN,” technical report, Texas A&M Univ., Apr. 2000.
[11] S. Gupta, “Study of Distributed Fair Scheduling in a Wireless LAN,” Master of Science thesis, Texas A&M Univ., May 2000.