

Guiding Channel For Optimization In Wireless Mesh Networks

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ABSTRACT

In a wireless mesh networks through multiple radios, a node can also increase its capacity by transmitting through multiple radios concurrently using orthogonal channels. Make the most of on these potential advantages requires effective routing and well-organized mapping of channels to radios (channel assignment (CA)). While well-organized channel assignment can greatly reduce interference from nearby transmitters, effective routing can potentially release bottleneck on paths to the infrastructure. Routing, however, needs that only packets pertaining to a particular connection be routed on a predetermined route. Random network coding (RNC) breaks this restriction by allowing nodes to randomly mix packets overheard so far before forwarding. So relay node only needs to know how many packets it should send, and not which packets. High speed routers furnished with innovative antennas, communicate with each other in a multi-hop fashion through wireless channels and form a broadband backhaul. Though, the throughput of a WMN may be severely tainted due to presence of some selfish routers that avoid forwarding packets for other nodes but they send their own traffic through the network. It present an algorithm for detection of selfish routers in a WMN. It uses statistical theory of implication for reliable clustering of the nodes and is based on local observations by the neighbor nodes.

1. INTRODUCTION

Infrastructure wireless mesh networks (WMNs) have been gradually deployed and extensively used for numerous purposes such as broadband Internet access or moveable telephony backhauling [1]. Compared to conventional single hop Wi-Fi networks, the WMN arrangements are more elastic and self-configured. In WMN Wireless coverage can be easily prolonged by adding more wireless mesh routers to form a wireless organization. Such routers can be further furnished with a gateway functionality to

interface with a wired organization and with an access point functionality to help as an entrance/outlet point

for mobile/wireless clients' traffic. Routing and channel assignment (CA) are mutually reliant and usually considered together. While channel assignment determines the capacity of each link in a network, routing regulates the traffic rate at each link. CA decisions thus affect routing decisions inevitably. The problem that addressed in this paper can be understood of as the (network) coded WMNs analog of the joint problem of CA, routing and scheduling in the orthodox routed WMNs.

The idea of network coding was first introduced by Ahlswede et al. [2] and shown to be a promising approach for refining network throughputs for multicast. In preference to just replication and forwarding, network coding permits intermediate nodes to algebraically chain (or code) packets before forwarding them to next hop neighbors. By doing such random joining, generally speaking, it does not matter what is received or lost at a destination, but it only matters that enough data is received. We can think of routing as being a distinctive case of network coding, where for each broadcast there is only one packet to combine and coefficients for such combining are all ones.

In WMN some selfish nodes may present among relay nodes. They send their own traffic through the network but they won't forward the data to neighbor node. However, the selfish behavior of an node degrades the performance of a WMN meanwhile it increases the latency in packet delivery and packet drops and decreases the network throughput.

To impose assistance among nodes and detect selfish nodes in ad hoc wireless networks, various collaboration schemes have been proposed in the literature [3]. Majority of these suggestions are based

on trust and reputation outlines which attempts to identify misbehaving nodes by suitable decision making systems and then isolate or penalize them. The status of participating nodes is built based on local observation at the node, second-hand observation at other nodes or both. To address the issue of selfish nodes in a WMN, this paper presents a system that uses local observations in the nodes for detecting node misbehavior. The scheme is applicable for on-demand routing protocol like AODV.

2. SYSTEM MODEL

We consider a WMN, shown in Fig.2.1, consisting of a wired infrastructure, stationary wireless mesh routers. Each wireless mesh router having access point functionality serves as an entrance or outlet for the combined traffic related with the mobile/wireless clients in its area that can be covered by it. Such traffic is routed to and from the wired infrastructure via multiple wireless hops molded by the wireless mesh routers some of which also function as gateways to the wired infrastructure. Each wireless router may be furnished with multiple wireless interfaces (radios) each of which can be operates on an orthogonal channel.

of hyper arcs. A hyper graph is a simplification of a graph, where each hyper arc connects a starting node with any number of ending nodes. That is, a hyper arc is a pair (i, J) , where the initial node i is an element of IN , and J , the set of nodes, is a non-empty subset of IN . In the superior case when the set J has only one element, we simply refer to a pair (i, j) as an "arc" (instead of "hyper arc") which we write (i, j) instead of $(i, \{j\})$.

Except for source node s representing the wired organization, the nodes of the hyper graph IH correspond to separate wireless mesh routers. Each hyper arc (i, J) then represents a wireless broadcast link from starting node i to ending nodes in the nonempty set J .

2.1 Random Network Coding

Every packet in our system is a linear combination of a specified bunch of source packets more precisely, every packet that is transmitted on each link is coded using a distributed Random Network Coding scheme (RNC).

For each connection, a bunch of K packets $p_1, p_2, p_3, \dots, p_k$ will be delivered. We assume that these K packets are kept in the memory of a central coding

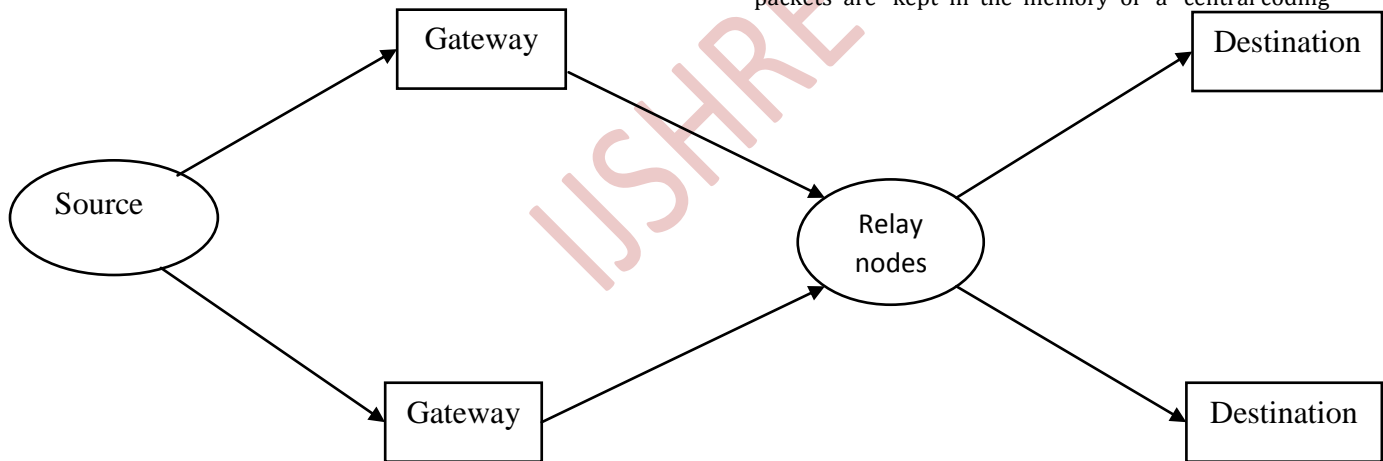


Fig 1: Network model

Each node in our system can algebraically combine entering packets according to the random linear network coding (RNC) scheme before promoting the resulting combined packets to other nodes via its broadcast link. We assume that wireless nodes are in unrestrained mode and that all wireless communications are in broadcast mode. Those wireless nodes that hear such communications may involve in packet forwarding. It is also expected that our system operates synchronously in a time based mode. It models the given multiradio WMN with a directed hyper graph $IH = (IN, \mathcal{A})$, where IN is the set of nodes, and \mathcal{A} is the set

module attached to nodes. All packets are assumed to have equal length of L_{bit} bits. We represent each packet in our system by a vector of length L_{sym} containing of symbols drawn from the finite field $GF(q)$ such that $L_{bit} = L_{sym} \cdot \log_2 q$.

Every node codes packets in the similar method. Received packets are kept in the node's memory. Whenever a transmission chance arises, all the packets in the memory are linearly united, preparing for inoculation into an outgoing broadcast link attached to

that node. The coefficients used for such grouping are drained homogeneously at random from $GF(q)$. Any coded packet in the network can always be expressed as a linear combination of the source packets to see this, consider a unicast connection on a tandem network of nodes formed on the multilayered hyper graph H.

Assume that after a specific period the gateway gw has received from source sa a total of K' packets $v_1, v_2, v_3, \dots, v_{K'}$. Each of these packets can be expressed as

$$V_j = \sum_{l=1}^k \text{coeff}_{jl} \cdot p_l \quad \dots \dots \dots 1$$

Where Coeff_{jl} is a coding coefficient drawn uniformly at random from the finite field $GF(q)$ by nodes for source packet P_l in order to form the j th coded packet V_j .

2.2 Channel Assignment

The main aim of such channel assignment is to derive a reasonable mapping of radios to channels for all nodes involved in packet inoculation of the transmission links of the multilayered hypergraph H. This proposed method is performed in two phases. In Phase 1 we deal with assigning hyper arcs (i, J) with packet injection rate $Z_{i,j}(1)$ to time slots on channel 1 (or equivalently on any given channel) such that no interference acquires (interference-free broadcast link scheduling). How many time slots should be assigned to a specific hyper arc depends toughly on the packet injection rate $Z_{i,j}(1)$. Using the output from Phase 1 as a orientation and taking into account the number of radios at each node, Phase 2 next will try to assign hyper arcs $(i(m), J(m))$ with nonzero packet inoculation rates to time slots sequentially on the remaining channels $m=2, \dots, M$, by way of auction. Phase 2 as a two-sided multiassignment problem in which we try to assign hyper arcs to time slots, and vice versa, in order to maximize the benefit in terms of total packet injection rates.

To be allocated to certain time slots, a given hyper arc has to offer for them and win the auction. On the other hand, to be assigned back to certain hyper arcs a given time slot has to submit the highest offer. Therefore, a single slot may be allocated to multiple hyper arcs if those hyper arcs do not interfere with one another. Similarly, a sole hyper arc can also be assigned to concurrent communications in those time slots. In Phase 2, it will use the output from a earlier stage (channel $m-1$) to guide its processes in a current stage for channel m . node b. The number of radios per node

are shown in the figure. Assume that three orthogonal channels are available in the network. Time is divide into equally spread out slots on all at all the nodes. On channel 2, both $(a, \{b, c\})$ and (b, c) will competitively bid for time slots in Phase 2. One probable assignment for channel 2 is as shown in the figure. All nodes now have multiple noncontiguous time slots if the member nodes of that hyper arc have enough idle radios to support

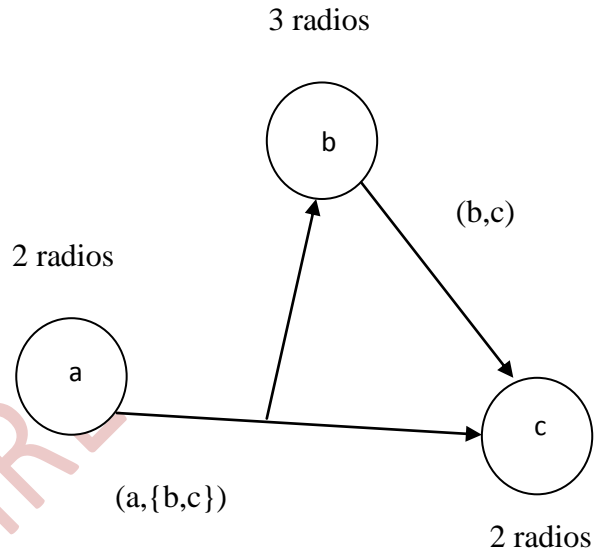


Fig 2: Network with two hyperarc

two concurrent communications, using 2 radios per node. In Fig 3.2 displays that how the final solution to the two-step approach. Consider the network shown in Fig 3.2, where only two hyperarcs exist. Node a is to transport unicast packets to node c with the help of relay channel 3, channels, hyper arc $(a, \{b, c\})$ will need at least nine time slots to inoculate its packets, and arc (b, c) will need 10. Phase 1 attempts to allocate the first available time slots 1-9 to hyperarc $(a, \{b, c\})$ and time slots 10-20 to arc (b, c) on channel 1. One radio is now tuned to channel 1 however, concurrent communications are not allowed in the first 18 time slots, because nodes a and b do not have enough radios to do so. Both links then contest for the remaining time slots in which (b, c) wins the bid.

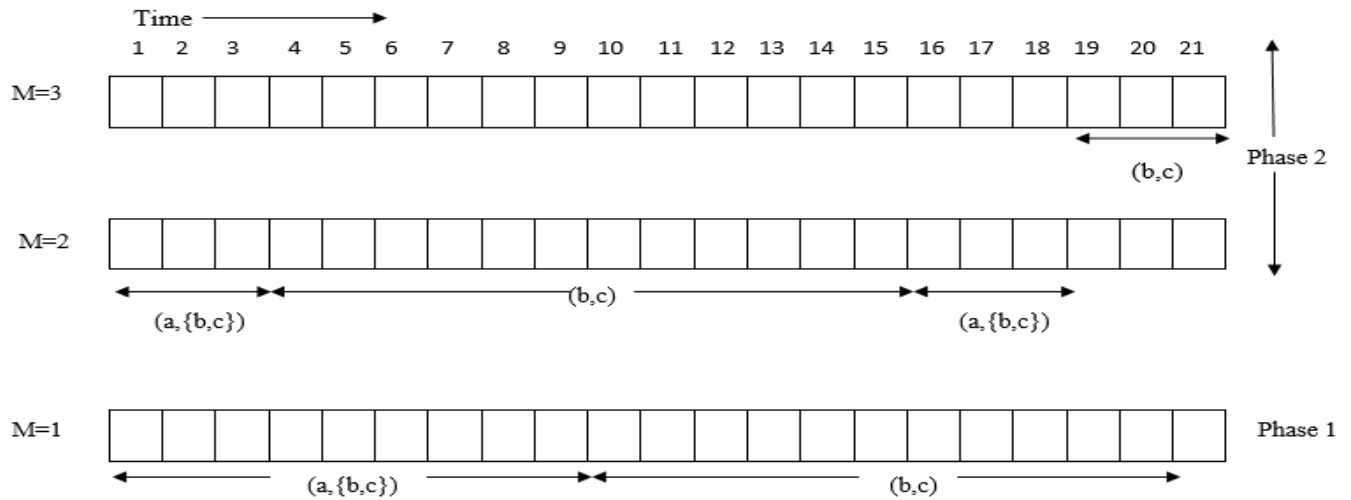


Fig. 3: Channel Assignment

2.3 Isolation of selfish nodes

Ad hoc on-demand distance vector (AODV) routing protocol practices an on-demand approach to finding routes to a destination node. It uses destination sequence numbers to identify the supremerecent path. The source node and the midway nodes pile the next-hop information corresponding to each flow. The source node sends the route request (RREQ) packet in the network when a route is not existing for the selected destination. It may discover many ways to different destinations from a single RREQ. The RREQ brings the source identifier (src_id), the destination identifier (dest_id), the source sequence number (src_seq_num), the destination sequence number (dest_seq_num), the broadcast identifier (bcast_id), and the time to live (TTL). Once an intermediate node receives a RREQ, it either forwards the request more or formulates a route reply (RREP) if it has an effective route to the destination. Every intermediate node, when forwarding a RREQ, enters the preceding node address and its BcastID. A timer is used to erase this entry in case a RREP is not received within the timer expires

The set of all messages corresponding to a RREQ saturating and the unicast RREP is mentioned to as a message unit. The subsection of a message unit that a node can witness is mentioned to as the local message unit (LMU). The LMU for a particular node consists of the messages communicated by that node, the messages communicated by all its neighbors, and messages overheard by the node. The discovery of selfish nodes is made on the basis of data collected by each node from its observed LMUs. A node whose action is being monitored by its neighbors is mentioned to as a monitored node, and its neighbors are mentioned to as

a monitor node. In the proposed protocol, each node plays the double role of a monitor node and a monitored node for each of its neighbors. In the proposed method, a node is expected to monitor the actions of its neighbors which are recognized by their individual indices 1, 2, ..., R. For clustering, an agglomerative hierarchical clustering technique is used. This is a single connection approach in which each cluster is denoted by all of the objects in the cluster. We can find the selfish node by comparing the number of packets received and forwarded by that node.

3.RESULT

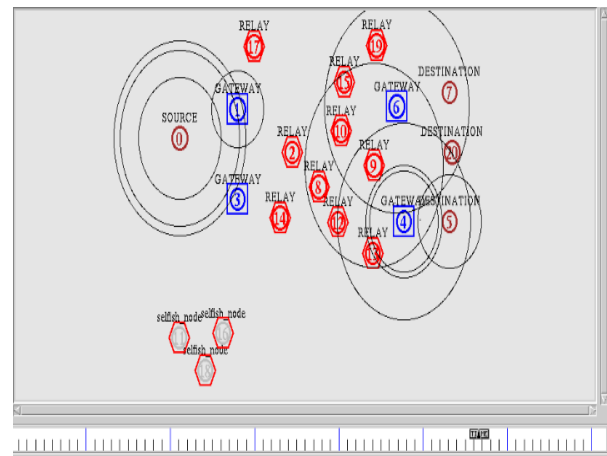


Fig 4: Simulation result

This figure shows the simulation result, source is broadcasting the packet to the destination with the help of relay node and random network coding concepts. Some selfish nodes present among the relay nodes. By

this method selfish nodes are identified and they are separated from relay nodes. Then data will be broadcasted with the help of relay nodes

4. CONCLUSION

The main aim is to optimize throughputs for multiple unicast connections in a reasonable way. This paper validated that proposed solution can efficiently exploit the growing number of channels and radios. Discovery of selfish nodes is crucial in WMNs meanwhile these nodes don't forward packets for other nodes and degrade the performance of the networks. This paper has offered a statistical theory of inference-based clustering algorithm for detection of selfish nodes.

REFERENCES

- [1] I.F. Akyildiz and X. Wang, "Wireless Mesh Networks: A Survey," *Computer Networks*, vol. 47, pp. 445-487, 2005.
- [2] R. Ahlswede, N. Cai, S.Y.R. Li, and R.W. Yeung, "Network Information Flow," *IEEE Trans. Information Theory*, vol. 46, no. 4, pp. 1204-1216, July 2000.
- [3] L. Santhanam, B. Xie, and D.P. Agrawal, "Selfishness in mesh networks: wired multihop MANETs," *IEEE Wireless Comm. Magazine*, Vol 15, No 4, August 2008, pp. 16-23
- [4] A.A. Franklin and C. S.R. Murthy, "An introduction to wireless mesh networks," in *Security in Wireless Mesh Networks*, Y. Zhang, J. Zheng, and H. Hu, Eds. CRC Press, 2007, pp. 3-44.
- [5] A. Pirzada and C. McDonald, "Establishing trust in pure ad hoc networks," in *Proceedings of the 27th Australian Conference on Computer Science*, 2004, pp. 181-199.
- [6] Raniwala, K. Gopalan, and T.-C. Chiueh, "Centralized Channel Assignment and Routing Algorithms for Multi-Channel Wireless Mesh Networks," *ACM Mobile Computing and Comm. Rev.*, vol. 8, no. 2, pp. 50-65, 2004
- [7] M. Kodialam and T. Nandagopal, "Characterizing the Capacity Region in Multi-Radio Multi-Channel Wireless Mesh Networks," *Proc. ACM MobiCom*, pp. 73-87, 2005.

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