Smallest Latest Time First Spatial Channel Reuse Scheme for CORMAN

Ms. J.Chitralega[#1], Mr. S.Arumugam, B.E.,M.Sc(Engg).,Ph.D.,[#2]
[#]*M.E- CSE, Nandha College of Technology, Erode, India*
[#]*Principal, Nandha College of Technology, Erode, India*
[1]jchitralega21@gmail.com
[2]arumugamdote@yahoo.co.in

Abstract- **Spatial Reuse Protocol behaves quite like the Point-to-Point Protocol (PPP) does in a Packet Over SONET (POS) environment. PPP acts as an abstraction layer between a higher level layer 2 technologies such as POS and a layer 1 technology such as SONET/SDH. Layer 1 and high level layer 2 protocols cannot interact directly without having an intermediate low level layer 2 protocol, in the case of DPT the layer 2 protocol is SRP.**

Existing work presented Cooperative Opportunistic Routing in MANET (CORMAN) where the nodes use lightweight proactive source routing to determine intermediate node lists for data route (to destination). Data broadcast from upstream node reach downstream nodes are en-routed to its destination by cooperative communication at link and network layers. Nodes running CORMAN, forward data packets in fragments. This increased hop length between source and destination cause nodes at different segment of the route to operate simultaneously. This needs a pipeline of data transportation.

Proposed work present Spatial Channel Reuse based Smallest Latest time First (SLF) technique to precise timing node back off. This is produce periodic updates transmitted to other nodes that processed in real-time to enable collaboration. Simulation was carried out with AODV for CORMAN with and without Spatial Channel Reuse based Smallest Latest time First (SLF) to analyze the performance improvement in terms of moderate and high channel utilization that includes collision probability rate.

Index terms: **Spatial reuse, co-operative opportunistic routing.**

I. INTRODUCTION

Wireless channel have varied link qualities for data communication. Broad cast transmission are perceived differently by different receivers at different geographic locations same receiver get different link quality at different times. Problem of link quality variation with broadcast nature is addressed to cooperative communication.

This presented lightweight proactive source routing. Objective of CORMAN are broadens applicability of EXOR to mobile multi-hop wireless network without depending on node positions Incur smaller overhead by having shorter forwarder lists in data packets.

DPT (Dynamic Packet Transport) environments contain dual, counter-rotating rings, somewhat like FDDI. SRP (Spatial Reuse Protocol**)** has a unique bandwidth efficiency mechanism which allows multiple nodes on the ring to utilize the entirety of its bandwidth; this mechanism is called the Spatial Reuse Capability. Nodes in an SRP environment can send data directly from source to destination.

Destination stripping means that the destination of the data removes it from the ring network; this differs from "source stripping" in that the data is only present on the section of network between the source and destination nodes. In source stripping, the data is present all the way around the ring and is removed by the source node. FDDI and token ring networks use source stripping, whereas DPT and SRP use destination stripping.

Spatial multiplexing (seen abbreviated SM or SMX) is transmission technique in MIMO wireless communication to transmit independent and separately encoded data signals, so-called streams, from each of the multiple transmit antennas. Therefore, the space dimension is reused, or multiplexed, more than one time.

Least Slack Time (LST) scheduling is a scheduling algorithm. It assigns priority based on the slack time of a process. Slack time is the amount of time left after a job if the job was started now. This algorithm is also known as Least Laxity First. Its most common use is in embedded systems, especially those with multiple processors. It imposes the simple constraint that each process on each available processor possesses the same run time, and that individual processes do not have an affinity to a certain processor. This is what lends it suitability to embedded systems.

LST scheduling is most useful in systems comprising mainly aperiodic tasks, because no prior assumptions are made on the events' rate of occurrence. The main weakness of LST is that it does not look ahead, and works only on the current system state. Thus, during a brief overload of system resources, LST can be sub-optimal. It will also be suboptimal when used with uninterruptible processes. However, like earliest deadline first, and unlike rate monotonic scheduling, this algorithm can be used for processor utilization up to 100%.

I. LITERATURE REVIEW

Among all the applications and services run by mobile devices, network connections and corresponding data services are without doubt the most demanded service by the mobile users. In this way, not only can mobile nodes communicate with each other, but can also receive Internet services through Internet gateway node, effectively extending Internet services to the non-infrastructure area. As the wireless network continues to evolve, these ad hoc capabilities are expected to become more important, the technology solutions used to support more critical and significant future research and development efforts can be expected in industry and academy [3]. The PRN model, assumes that each node of an ad hoc network always transmits at the same transmission power. Modern mobile wireless units have the ability of adjusting their transmission power according to the transmission needs, subject to a maximum limit. Such power control reduces interference, conserves battery power of the mobile units, and hence allows for better use of the channel bandwidth [4].

Each ExOR node maintains state for each batch of packets in which it is participating, as indicated by the node's presence in the batch's forwarder list. Nodes begin keeping state after receiving a single packet. The packet buffer stores the successfully received packets in the current batch. The local forwarder list contains a copy of the prioritized list of nodes, copied from one of the packets in the packet buffer. The forwarding timer indicates the time at which the node predicts that it should start forwarding packets from its packet buffer. The transmission tracker records the measured rate at which the currently sending node is sending, along with the expected number of packets it has left to send. The batch map indicates, for each packet in a batch, the highest-priority node known to have received a copy of that packet [1].

Multiple nodes may hear a packet broadcast and unnecessarily forward the same packet. ExOR deals with this issue by tying the MAC to the routing, imposing a strict scheduler on routers' access to the medium. The scheduler goes in rounds. Forwarders transmit in order, and only one forwarder is allowed to transmit at any given time. The others listen to learn which packets were overheard by each node [5]. Decoding requires solving a set of linear equations. In practice, this can be done as follows. A node stores the encoded vectors it receives as well as its own original packets, row by row, in a so-called decoding matrix [10].

In order to enhance the resilience of MANET routing protocols in face of nodes' failure or malicious nodes' misbehavior, a certain degree of redundancy and randomness are important factors or requirements. Reduction in control messages can make it more difficult for malicious nodes to carry out attacks and redundancy can increase the survivability of the whole system [7]. Data networks are usually based on packet-switching, where there is no fixed physical path between a sender and a receiver. Instead, when a sender has a block of data to send, it is received in its entirety and then forwarded to the next hop along the path to the destination. Even though providing service guarantees is easier in circuit-switched mode of operation, because of the bursty nature of the traffic, packet-switching is favored in the present day Internet [8].

Each node implementing WRP (Wireless Routing Protocol) keeps a table of routes and distances and link costs. It also maintains a 'message retransmission list' (MRL). Routing table entries contain distance to a destination node, the previous and next nodes along the route, and are tagged to identify the route's state: whether it is a simple path, loop or invalid route. (Storing the previous and successive nodes assists in detecting loops and avoiding the counting-to-infinity problem - a shortcoming of Distance Vector Routing.) [2]. Proactive routing means that nodes in the network should maintain valid routes to all destinations at all time. Instead, reactive routing means the nodes in the network do not always maintain routing information. When a node receives data from the upper layer for a given destination, it must first find out about how to reach the destination [9].

AODV is an on-demand routing protocol. It is loosely based on the distance-vector concept. In on-demand protocols, nodes obtain routes on an as needed basis via a route discovery procedure. Route discovery works as follows. Whenever a traffic source needs a route to a destination, it initiates a route discovery by flooding a route request (RREQ) for the destination in the network and then waits for a route reply (RREP) [6].

II. CO-OPERATIVE OPPORTUNISTIC ROUTING IN MANET

The phases involved in the proposed scheme are:

- MANET Routing
- Cooperative Opportunistic Routing
- Small Scale Retransmission
- Spatial Channel Reuse
- Per Hop Smallest LST

A. MANET Routing

Mobile ad hoc network with opportunistic routing topology is initialized. Node coordination is done with ExOR accommodate node mobility. Proactive Source Routing (PSR) provides each node with the complete routing information to all other nodes in the network forwarder list contains identities of nodes on the path from the source node to the destination. In PSR, nodes periodically exchange network structure information converges after number of iterations equal to the network diameter. Each node has spanning tree indicate shortest paths to all other nodes. PSR is used by path finding and Link vector algorithms.

B. Cooperative Opportunistic Routing

CORMAN generalizes opportunistic data forwarding in ExOR to suit mobile wireless network. When data packets are received by and stored at a forwarding node. Node has different view to forward them to destination from forwarder list carried by packets. Forward closer to destination than source node. Discrepancy means forwarding node has more updated routing information. Forwarding node updates part of forwarder list in the packets. Towards destination according to its own knowledge. When packets with updated forwarder list are broadcast by forwarder update about network topology change propagates back to its upstream neighbor. Neighbor incorporates change to packets in its cache. Cached packets are broadcasted later. Update is further propagated towards source node. Update procedure is faster than rate at which a proactive routing protocol disseminates routing information.

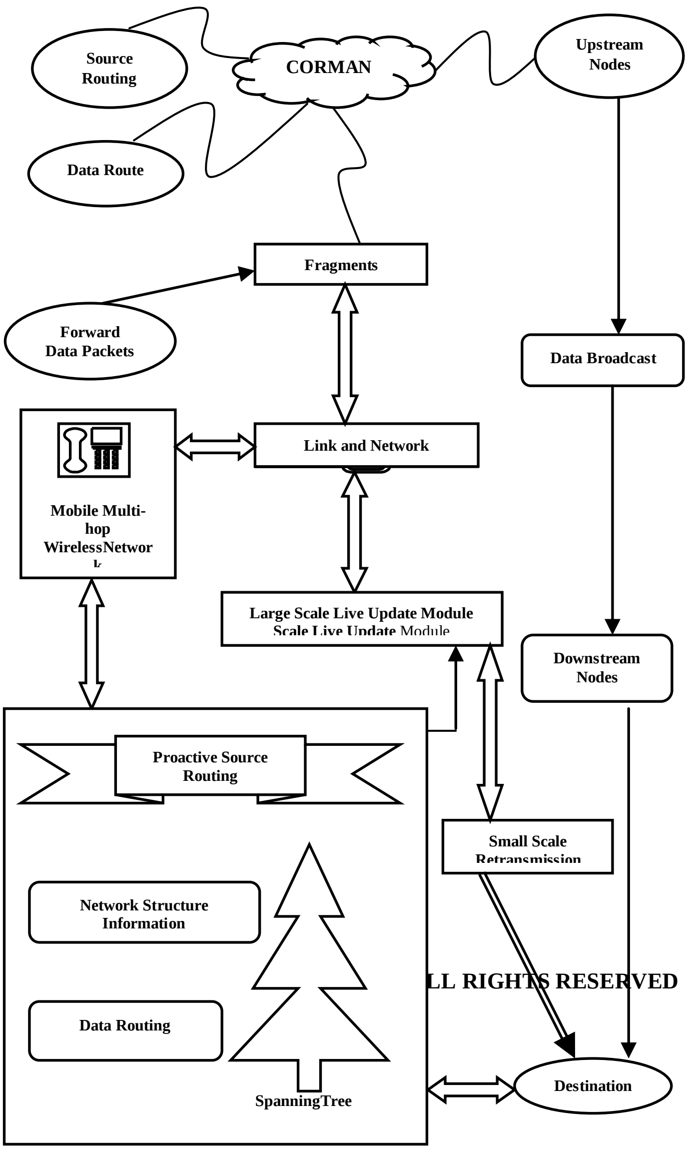

Fig.1 Architecture Diagram

C. Small Scale Retransmission

Short forwarder list forces packets to be forwarded over long and possibly weak links. Increase reliability of data forwarding between two listed forwarders. CORMAN allows nodes that are not on forwarder list but situated between two listed forwarders to retransmit data packets if downstream forwarder not received packets successfully. Multiple nodes between a given pair of listed forwarders CORMAN coordinate retransmission attempts. Small scale retransmission operates at the time granularity of a fragment and space granularity of a single link. Node separation distance estimated using RSSI (Received Signal Strength Indicator) recorded when packets are received. Forwarding nodes using scoring function. Scoring function favors a node close to the midpoint of the line segment. Forward node is aware of RSSI measurements of all links incident on a node realized simply by every node broadcasting the RSSI of all incident links periodically. Ensures node have best suitability score among those satisfying conditions.

D. Spatial Channel Reuse

Channel Reuse-based Smallest LST First (CR-SLF) approach. Message deadlines at each hop to avoiding collisions. Exploit spatial reuse, Partition the set of message transmissions into disjoint sets. Transmissions within each set do not interfere with one another executed in parallel. Sets are ordered sequentially. All transmissions within a set finish before transmissions in the next set begin. Scheduler considers transmissions in the order of LSTs. At each step transmission with the smallest LST is chosen scheduler checks feasibility to assign transmission to an existing set. On feasibility transmission does not interfere with existing message transmissions in that set. Message scheduled for transmission to finish time is no later than its deadline. Inserting the transmission into the set does not cause deadline violations for currently scheduled transmissions in other sets.

E. Per Hop Smallest LST

Per-hop Smallest LST First (PH-SLF) is a distributed scheduler. Each node makes local scheduling decisions independent of other nodes. Given a set of messages queued up at a node. Node schedules the message with the smallest LST for transmission. Observe latest start time (LST deadline by which the node starts transmitting the message in order for it to meet its effective (end-to-end) deadline. Resort to heuristics to schedule multi-hop messages through the network.

III. EXPERIMENTAL RESULTS AND DISCUSSIONS CO-OPERATIVE OPPORTUNISTIC ROUTING IN MANET

In this section we evaluate performance of Smallest Latest Time First Spatial Channel Reuse scheme for Co-operative Opportunistic Routing in MANET through NS2 simulation. One of the major contributions of this work is the Spatial Channel Reuse. To confirm the analytical results, we implemented Smallest Latest Time First Spatial Channel Reuse schemein the MANET simulator ns-2 and evaluated the performance of technique.

The performance of Smallest Latest Time First Spatial Channel Reuse scheme is evaluated by the following metrics.

- Throughput
- Gains Ratio
- Accurate Timing Estimates

TABLE I
THROUGHPUT

Number of Mobility	Existing CORMAN	Proposed Spatial Channel Reuse
20	5	6
40	4	5
60	3	4
80	2	3
100	1	2

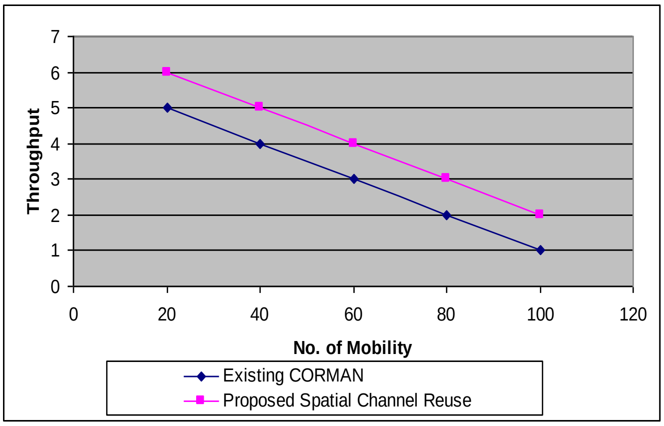

Fig.2 Throughput

Figure 2 demonstrates the throughput. X axis represents the number of mobility whereas Y axis denotes the throughput using both the CORMAN and our proposed Spatial Channel Reuse scheme. When the number of mobility increased, throughput gets decreases accordingly. The throughput is illustrated using the existing the CORMAN and proposed Spatial Channel Reuse scheme. Figure 2 shows better performance of proposed Spatial Channel Reuse scheme in terms of mobility than existing CORMAN and proposed Spatial Channel Reuse scheme. Spatial Channel Reuse scheme achieves 15 to 25% less throughput variation when compared with existing system.

TABLE II
GAIN RATIO

Number of Mobility	Existing CORMAN	Proposed Spatial Channel Reuse
20	200	300
40	180	250
60	150	220
80	100	180
100	80	150

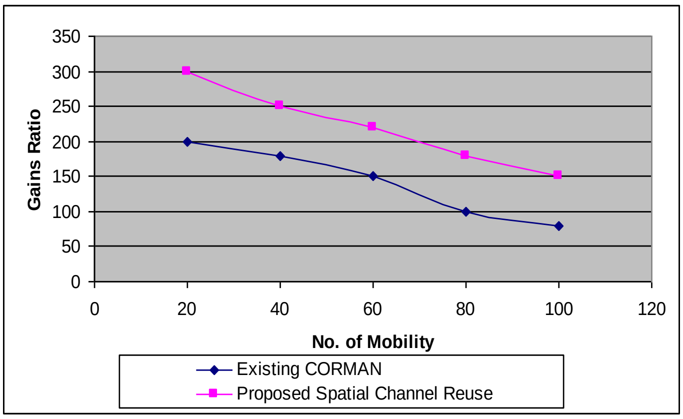

Fig.3 Gain Ratio

Figure 3 demonstrates the gains ratio. X axis represents the number of mobility whereas Y axis denotes the gains ratio using both the CORMAN and our proposed Spatial Channel Reuse scheme. When the number of mobility increased, gains ratio gets decreases accordingly. The gains ration is illustrated using the existing the CORMAN and proposed Spatial Channel Reuse scheme. Figure 3 shows better performance of proposed Spatial Channel Reuse scheme in terms of mobility than existing CORMAN and proposed Spatial Channel Reuse scheme. Spatial Channel Reuse scheme achieves 20 to 35% less gains ratio variation when compared with existing system.

TABLE III
ACCURATE TIMING ESTIMATES

Number of Mobility	Existing CORMAN	Proposed Spatial Channel Reuse
20	20	10
40	40	20
60	50	30
80	70	40
100	90	50

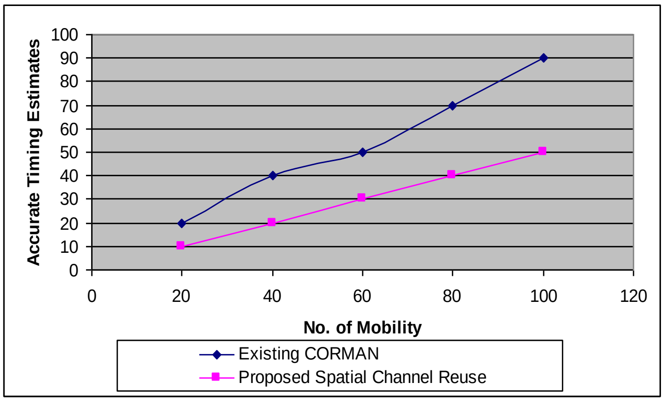

Fig.4 Accurate Timing Estimates

Figure 4 demonstrates the accurate timing estimates. X axis represents number of mobility whereas Y axis denotes the accurate timing estimates using both the CORMAN and our proposed Spatial Channel Reuse scheme. When the number of mobility increased accurate timing estimates also gets increased. Figure 4 shows the effectiveness of accurate timing estimates over different number of mobility's than existing CORMAN and proposed Spatial Channel Reuse scheme. Spatial Channel Reuse scheme achieve 30% to 50% more accurate timing estimates when compared with existing schemes.

IV. CONCLUSION

We have proposed CORMAN as an opportunistic routing scheme for mobile ad hoc networks. CORMAN is composed of three components. They are: 1) PSR—a proactive source routing protocol, 2) large-scale live update of forwarder list, and 3) small-scale retransmission of missing packets. All of these explicitly utilize the broadcasting nature of wireless channels and are achieved via efficient cooperation among participating nodes in the network. Essentially, when packets of the same flow are forwarded, they can take different paths to the destination. Through computer simulation, CORMAN is shown to have superior performance measured in PDR, delay, and delay jitter.

V. REFERENCES

[1] S. Biswas and R. Morris, "ExOR: Opportunistic Multi-Hop Routing for Wireless Networks," in Proc. ACM Conference of the Special Interest Group on Data Communication (SIGCOMM), Philadelphia, PA, USA, August 2005, pp. 133–144.

[2] S. Chachulski, M. Jennings, S. Katti, and D. Katabi, "Trading Structure for Randomness in Wireless Opportunistic Routing," in Proc. ACM Conference of the Special Interest Group on Data Communication (SIGCOMM), Kyoto, Japan, August 2007, pp. 169–180.

[3] I. Chlamtac, M. Conti, and J.-N. Liu, "Mobile Ad hoc Networking: Imperatives and Challenges," Ad Hoc Networks, vol. 1, no. 1, pp. 13– 64, July 2003.

[4] C. Fragouli, J.-Y. L. Boudec, and J. Widmer, "Network Coding: an Instant Primer," SIGCOMM Computer Communication Review, vol. 36, pp. 63–68, January 2006.

[5] M. K. Marina and S. R. Das, "Routing Performance in the Presence of Unidirectional Links in Multihop Wireless Networks," in The Third ACM International Symposium on

Mobile Ad Hoc Networking and Computing (MobiHoc'02), Lausanne, Switzerland, June 2002, pp. 12–23.

[6] S. Murthy, "Routing in Packet-Switched Networks Using Path-Finding Algorithms," Ph.D. dissertation, University of California - Santa Cruz, 1156 High Street, Santa Cruz, CA 95064, United States, 1996.

[7] S. Murthy and J. J. Garcia-Luna-Aceves, "An Efficient Routing Protocol for Wireless Networks," Mobile Networks and Applications, vol. 1, no. 2, pp. 183–197, October 1996.

[8] R. Rajaraman, "Topology Control and Routing in Ad hoc Networks: A Survey," SIGACT News, vol. 33, pp. 60–73, June 2002.

[9] Z. Wang, C. Li, and Y. Chen, "PSR: Proactive Source Routing in Mobile Ad Hoc Networks," in Proc. 2011 IEEE Conference on Global Telecommunications (GLOBECOM), Houston, TX USA, December 2011.

[10] S. Yang, F. Zhong, C. K. Yeo, B. S. Lee, and J. Boleng, "Position Based Opportunistic Routing for Robust Data Delivery in MANETs," in Proc. 2009 IEEE Conference on Global Telecommunications (GLOBECOM), Honolulu, Hawaii, USA, December 2009, pp. 1325–1330.