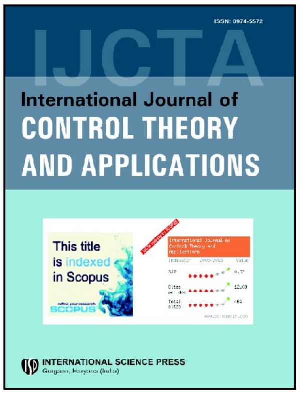

International Journal of Control Theory and Applications

ISSN : 0974-5572

Volume 10 • Number 10 • 2017

Survey of Wireless Network Communication Techniques

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***Abstract*:** A wireless network is used wireless data connections for connecting network nodes. The wireless telecommunications networks are generally implemented and administered using radio communication. Performance of wireless networks satisfies a variety of applications such as data or information, voice and video. Use of this technology also gives room for expansions, such as from 2G to 3G and, most recently, 4G technology, which stands for modern generation of cell phone mobile communications standards. Wireless networking has become commonplace, sophistication increases through configuration of network and greater capacity to send and receive larger amounts of data, faster, is achieved. In this paper we discuss a survey of performance based wireless communication and routing techniques in WAN. This paper provides the major improvement in the wireless communication and routing techniques in WAN research using these approaches the features and categories in the surveyed work

Keywords: Wireless network, Cooperative communication, Relays Selection Techniques, Relay Selection, Relaying, Routing.

I. INTRODUCTION

Wireless wide area networks [1] are wireless networks that typically cover large areas, as between neighboring towns and cities. These networks [2] can be used to connect branch offices of business or as a public internet access system. In the new technological environment [3], these networks are needed for computers to relay information in packets to other computers in order for the information to reach the intended destination, generally because of the limited range of each computer host‘s wireless transmission [4]. Wireless network is an autonomous system of mobile routers and associated hosts which may work in isolation or within a fixed network, connected by the wireless links. Nodes are free to move randomly and organize arbitrarily. Thus, network‘s wireless topology may change quickly with time as nodes move around. The distinguishing feature of such networks [5] is that the only direct communication is that between neighboring nodes. Wireless connectivity between remote nodes is based on the multi-hop activity. The nodes are energetically and randomly located in such a manner that the interconnections [6] between them are capable of changing on a continual basis. In the absence of fixed infrastructure [7], all nodes act as routers, forming two categories of network: Single-hop wireless networks and Multi-hop wireless networks.

The term single-hop networks‘ means that all nodes [8] in the network operate in a single radio frequency (RF) range, such as Bluetooth, as can be seen in wireless personal area networks (PANs). Multi-hop networks [9] are used when nodes have dissimilar RF ranges and connect to one another only through their neighbors (intermediate nodes), which act as routers. This can be seen in wireless local area networks (LANs) and wireless wide area networks (WANs) [1] and [3].

The primary responsibility of routing is the exchange of route information, the best path to a destination being based on criteria such as hop length, minimum power [10] required and the lifetime of the wireless link. One of the key mobility issues is that links make and break randomly and often. When fixed routers and stable links are absent between an existing distance vector and link state-based routing protocols, then they are unable to keep up with such frequent link changes. Multicasting plays a vital role in applications of wireless networks and military communications. Routers are static, so most of the multicast protocols rely on them. When a multicast tree is formed, its nodes will not move. However, this is not so for wireless networks. Energy management is defined as the process of managing the sources and consumers of energy in nodes or in the network as a whole, in order to enhance the lifetime of the network. Most existing network protocols [12 M] assume the presence of static hosts and routers, powered by mains electricity, thus not considering power consumption to be an issue. Most nodes in wireless networks act as hosts and routers, and they are operated by batteries with a limited lifetime. Thus, energy management and consumption can be quite significant for them. The main objectives of transport layer protocols include setting up and maintaining end-to-end connections, reliable end-to-end delivery of data packets, flow control and congestion control. The main issue for a transmission control protocol (TCP) is that it will not be capable of distinguishing between the presence of mobility and network congestion. Hence, some improvements are needed to ensure that the TCP performs correctly without affecting the end-to-end communication throughput. Two very important properties that wireless network should exhibit are organization and maintenance of the network itself. Major self-organization activities that the network is required to perform are neighbor discovery and topology organization; it should be able to perform self-organization quickly and efficiently in such a way that it is transparent to the user and the application. In this paper, we discussed a survey of performance based *wireless communication and routing techniques in WAN*.

II. BACKGROUND TECHNIQUES

(A) Wireless Mesh Network (WMN)

The wireless mesh networking has emerged as a promising technology for future broadband wireless access. When applying mesh networking techniques over shared wireless medium with limited radio spectrum, many new challenges are raised such as fading mitigation, effective and efficient medium access control (MAC), quality of service (QoS) routing, call admission control etc. Wireless mesh networks (WMNs) consist of wire line gateways, mesh routers, and mesh clients, organized in three-tier architecture as shown in Figure 1.

(B) Design Criteria and Classification of Distributed MAC

MAC is crucial in wireless communications, which defines the way how wireless nodes contend and share the scarce radio resources. Generally, it is impossible for a wireless node to transmit and receive at the same time over the same bandwidth, and hence collision is hard to detect during transmission. Simultaneous transmissions of hidden terminals can cause a collision at the common receiver. In addition, the exposed terminal problem can reduce the system utilization. Therefore, a primary goal of MAC protocols for WMNs is to avoid collisions and allow simultaneous transmissions whenever possible WMNs are expected to support wireless multimedia communications for future broadband Internet access. One major challenge in distributed MAC is QoS provisioning with efficient resource utilization. In the shared wireless medium, simultaneous transmissions of different nodes may result in collisions so that retransmissions are needed which may increase transmission delay or cause packet loss [2] and [3].

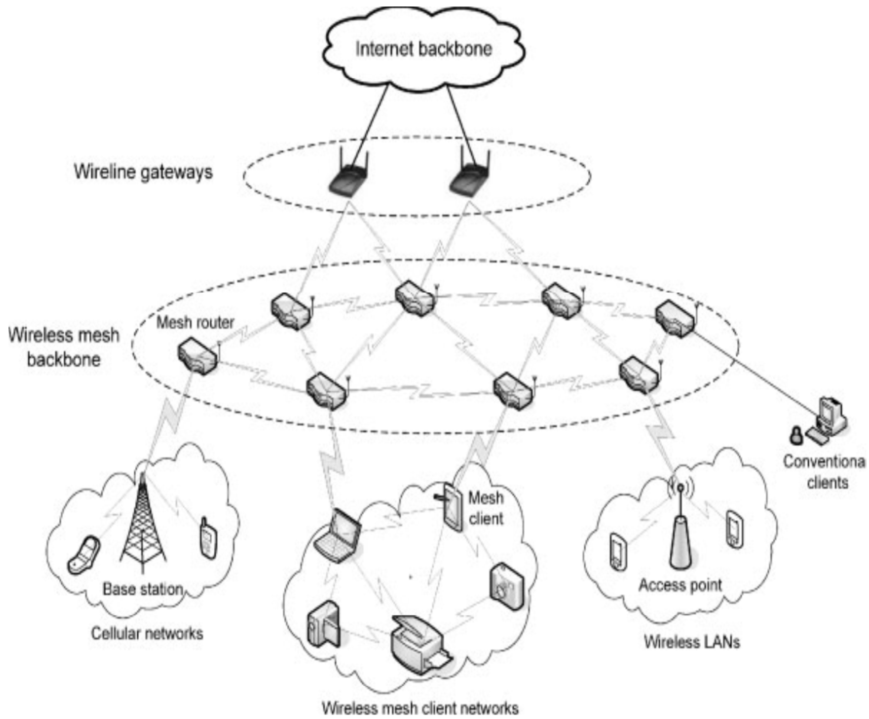

Figure 1: An illustration of wireless mesh network

(C) Transmission Control Protocol (TCP)

TCP provides an end-to-end, reliable, byte-oriented service to the applications. To prevent senders from overwhelming the receivers, TCP employs flow control whereas in order to avoid overwhelming the network, it uses congestion control. In this section, we focus on the congestion control algorithm used by TCP.

A TCP source maintains a sliding window called congestion window or *cwnd*, which indicates its current belief about the number of packets that the network can safely handle. TCP increases *cwnd* after every new acknowledgement1 until it detects a packet loss, upon which, TCP decreases *cwnd*, which in turn reduces the load on the network. TCP detects packets losses by two mechanisms. First, when a packet is sent, it initializes a timer. If no acknowledgement is received within the timeout interval, the packet is assumed to be lost. Second, when out-of-order packets are received by TCP receivers, they send acknowledgements for the last in-order packet received [5] and [6] and [7].

(D) Routing Metrics for WMNs

Most of the ad hoc routing protocols [8] use hope count as a routing metric. In the early stages these routing metrics are also used in WMNs. These assume that the link in the path work properly or not work at all and consider all links of equal bandwidth. So in this case minimizing the hop count will reduce the packet delay and also increases the throughput [9]. But in wireless mesh networks links are not of equal bandwidth. A minimum hop count [10] path has higher average distance between nodes present in that path compared to a higher hop count path. This reduces the strength of the signal received by the nodes in that path and thereby increases the loss ratio at each link [11]. Hence, it is always possible that a two-hop path with good link quality provides higher throughput than a one-hop path with a poor/lossy link. The wireless links usually have asymmetric loss rate [12]. Hence, new routing metrics [13] based on the link quality like ETX (Expected Transmission Count), per-hop RTT (Round-Trip Time), and per-hop packet pair is proposed [7,8,9].

(E) Rate control mechanism in WMN

Rate-control mechanisms that operate independently of the transport-layer protocols have also been proposed. We provide a summary of this work below.

Router-assisted Control

In general, router-assisted resource management encompasses a set of mechanisms including congestion signaling, packet scheduling, and queue management. Active Queue Management (AQM) protocols [1,3] like Random Early Detection (RED) are examples of such router-assisted congestion control mechanisms. RED gateways are typically used at network boundaries where queue build-ups are expected when flows from high throughput networks are being aggregated across slower links. RED gateways [2,4] provide congestion avoidance by detecting incipient congestion through active monitoring of average queue sizes at the gateway.

Rate-based Protocols

In contrast to window-based protocols [5, 7], rate-based protocols require the receiver or the network to inform the sender of the rate at which it can support that connection. EXACT is a end-to-end rate-based flow control technique for ad hoc networks. It requires each router to periodically estimate its local capacity and use that to compute the fair share of all egress flows. A special IP header (called flow control header) [6, 8] is then populated with the lowest end-to-end rate along the path of a flow. This rate is communicated back to the source where it is enforced locally. However, maintaining per-flow state at intermediate routers is a challenge in scaling EXACT to large multi-hop networks [11, 12].

(F) Alternative Distributed Protocol Designs

Distributed algorithms [9] for enforcing fairness in multihop networks [10] have been proposed, amongst others. In general, distributed computation of fair rates requires periodic signaling between contending senders. For example, a change in the status of a stream activity needs to be propagated to all nodes along the path of the stream and as well as their contending neighbors [11].

Further, contending nodes need to periodically synchronize their estimate of the network capacity.

Hybrid Networks: WiMAX and 802.11 WMNs- While WiMAX MMR specifications [12,13] have only recently been ratified, 802.11 radios have become a commodity platform with over 387 million chipset sales reported in 2008 alone. This economy of scale has resulted in 802.11 becoming the preferred radio platform for developing last mile access networks for a large number of commercial entities.

IEEE 802.11s

The IEEE 802.11 Task Group s is working on standardizing a set of amendments to the 802.11 MAC to create an Extended Service Set (ESS) of Mesh Points (MPs) that are connected via a multi-hop Wireless Distribution System (WDS) [13] and [14].

III. SURVEY OF WIRELESS NETWORK COMMUNICATION TECHNIQES

Before you begin to format your paper, first write and save the content as a separate text file [11]. Keep your text and graphic files separate until after the text has been formatted and styled. Do not use hard tabs, and limit use of hard returns to only one return at the end of a paragraph. Do not add any kind of pagination anywhere in the paper. Do not number text heads-the template will do that for you.

Finally, complete content and organizational editing before formatting [10]. Please take note of the following items when proofreading spelling and grammar:

(A) Co-operative routing for wireless sensor networks using network coding

R.R. Rout and S.K. Ghosh and S. Chakrabarti *et al.* [1] proposed a network coding-based probabilistic routing (NCPR) scheme. This work is to design the network coding-based procedures for probabilistic routing protocols. In NCPR, a sensor node initializes a transmission process in a WSN cluster [1, 7] by transmitting a packet from its sensed queue. Each neighbor node encodes its received packet with its sensed packet using XOR network coding and transmits the coded packet with certain probability. Three network coding-based procedures have been proposed for encoding and decoding of packets in intra-cluster and inter-cluster communications by distributing [2,6] roles among the sensor nodes.

The proposed scheme along with the three network coding procedures are presented as reliability, network coding gain and energy consumption of the WSN (using NCPR) are discussed. Network coding attempts [3, 6] to provide reliability to the network without retransmission of lost data packets. Reliability against information loss due to link failure or collision of data packets is an essential task in WSN. Energy consumption of the NCPR scheme [4, 7] and the probabilistic routing scheme is calculated using the existing NCPR scheme restricts the number of retransmissions against packet loss due to link failure. Without network coding, the minimum number of transmissions (lower bound) required to share the data packets. The proposed NCPR improves the performance of the network with high network coding gain and low energy consumption. Further, the NCPR scheme [8, 9] provides better reliability in terms of protection of data packets against link failures. Also, the routing probability of retransmitting nodes can be controlled [10, 11] depending upon the network topology and number of sensor nodes in the WSN. Using network coding, both the intra-cluster and the inter-cluster communication are discussed. For many-to-many communication paradigm, suitable values of routing probabilities of the proposed scheme have been identified [12, 13] to minimize the number of collisions of network coded packets. The efficacy of the proposed approach has been shown through simulation results and theoretical analysis.

The performance need to improve of NCPR in a dynamic scenario with some mobile sensor nodes in a monitoring area. This dynamic behavior [2, 4] may lead to the formation of dense and sparse regions only. Further, in future, The NCPR scheme is not suitable for delay sensitive applications [1].

(B) Cooperative Media Access Control with Optimal Relay Selection in Error- Prone Wireless Networks

Bin Cao and Gang Feng and Yun Li and Chonggang Wang et. al.[2] addressed the issue of Relay Node (RN) selection while taking into account MAC overhead [5, 7], which is incurred by not only handshake signaling but frame retransmissions due to transmission failure and also designed a cooperative MAC mechanism with our optimal RN selection algorithm, which is called optimal relay selection MAC [3, 9]. In addition, they derived network saturation throughput based on an analytical model to evaluate its performance and conduct simulation experiments using Network Simulator (NS-2) to validate the effectiveness of our analytical model and evaluate the performance.

They assumed that the transmission failure probability is equal to the transmission error probability in proposed optimal RN selection algorithm. The analytical model can significantly improve network performance in terms of throughput and decrease transmission error probability. The outperforms conventional cooperative MAC mechanisms without incurring significant complexity overhead in system design. The impact of interference is not for better performance in multi-hop wireless networks. It should be plan to analyze the tradeoff of cooperation performance gain, cooperation overhead, and energy efficiency and explore their tradeoff space to provide some valuable strategies [2].

(C) SOLOR: Self Optimizing WLANs with Legacy- Compatible Opportunistic Relays

Andres Garcia-Saavedra and Balaji Rengarajan and Pablo Serrano and Daniel Camps-Mur and Xavier Costa-P´erez et. [3] al. proposed a novel framework, Self-Optimizing, Legacy-Compatible Opportunistic Relaying

(SOLOR), which jointly takes into account the above considerations and greatly improves network performance even in systems comprised mostly of vanilla nodes and legacy access points. They focused on the case of uplink traffic for simplicity of exposition, the above problem formulation can also be used to model the scenarios with bi-directional traffic. In this case, utility function are defined separately for each of the uplink and downlink flows and consider, both uplink and downlink traffic are in contention, and a throughput model similar to the one defined and used to calculate the throughput of both the uplink and downlink flows. The proposed technique greatly improves network throughput performance and power consumption even in systems. The proposed scheme needs to reduce the end to end delay [3].

(D) Decode-and-Forward Two-Way Relaying with Network Coding and Opportunistic Relay Selection

Qing F. Zhou, Yonghui Li, Francis C. M. Lau, and Branka Vucetic et. Al [4]. proposed an opportunistic two-way relaying (O-TR) scheme based on joint network coding and opportunistic relaying. The scheme, one single "best relay" is selected with MaxMin criterion to perform network coding on two decoded symbols sent from two sources, and then to broadcast the network-coded symbols back to the two sources. The proposed protocol imposes no restriction on the frame length, which results in a more flexible frame design at the sources. The benefit of the proposed protocol is threefold. Firstly, there is no restriction on the frame length N, which results in a more flexible frame design at the sources as $\mathbb{S}1$ and $\mathbb{S}2$. Secondly, no distributed-space-time linear transformation is performed at the relays. Thirdly, the decoding at the sources $\mathbb{S}1$ and $\mathbb{S}2$ is made simpler. The paper derived the upper-bound of the frame error rate (FER) of the proposed O-TR method and have shown that the proposed method can accomplish the full diversity order and O-TR method outperforms the fully-distributed space-time two-way relaying method [6, 8]. The proposed method is not more efficient in large number of node operate in wireless network [4].

(E) Optimal Relay-Subset Selection and Time-Allocation in Decode-and-Forward Cooperative Networks

Elzbieta Beres and Raviraj Adve *et. al.* [5] developed the optimal selection of a relaying subset and allocation of transmission time. This resource allocation is found by maximizing over the rates achievable for each possible subset of active relays and also present a recursive algorithm [5, 9] to solve the optimization problem which reduces the computational load. It is observed that the instantaneous numbering scheme uses more relays than the random numbering scheme when resource allocation is used, and that this difference is constant over the SNR region of interest [12, 14]. Without resource allocation, on the other hand, the number of relays used when using instantaneous and random numbering decreases quickly and is constant for SNR values higher than 10 dB. The proposed techniques determined the optimal channel resource allocation, in terms of transmission-time allocation [7, 13], for the N-node cooperative diversity, multi-hop network using DF. The optimal solution overall is found by choosing the network size with the maximum rate for each possible sub-network. In big network system the proposed scheme is not suitable; it should improve in future [5].

(F) Opportunistic relay selection for cooperative networks with secrecy constraints

I. Krikidis *et al.* [6] proposed an Opportunistic relay selection for cooperative networks with secrecy constraints. This study deals with opportunistic relay selection in cooperative networks with secrecy constraints, where an eavesdropper node tries to overhead the source message. Previously reported relay selection techniques are optimised for non-eavesdropper environments and cannot ensure security. Two new opportunistic relay selection techniques, which incorporate the quality of the relay-eavesdropper links and take into account secrecy rate issues, are investigated. The first scheme assumes an instantaneous knowledge of the eavesdropper channels and maximises the achievable secrecy rate. The second one assumes an average knowledge of the eavesdropper channels and is a suboptimal selection solution appropriate for practical applications.

(G) Weighted Bidirectional Relay Selection for Outdated Channel State Information

Hongyu Cui, Lingyang Song, and Bingli Jiao et. al.[7] proposed a weighted bidirectional RS scheme [3, 6], in which a deterministic weight factor decided by the correlation coefficient of outdated CSI, is introduced in the selection process. Outage probability bound of the weighted bidirectional RS [3, 6] is derived and verified, along with the asymptotic expression in high signal to noise ratio (SNR). The weighted RS of the bidirectional AF relay is proposed when the CSI is outdated, and the outage probability expression is derived. Based on the analytical expressions, the optimal weight factor and the optimal power allocation scheme in minimizing the outage probability are obtained. The expression reveals that the optimal factor [4, 6] is decided by the number of relays, the correlation coefficients of outdated CSI [6, 8], and the channel variances. Simulation results reveal that the weighted bidirectional RS with the optimal weight factor can achieve the considerable performance gain over the conventional bidirectional RS, when the network structure is asymmetric. In this paper analyzed the impact of outdated CSI on the performance of bidirectional AF RS. The weighted bidirectional RS was proposed to improve the performance of RS with outdated CSI. The outage probability bound [2, 6] of the proposed RS scheme was obtained and verified, along with the asymptotic outage probability. The transmission capacity factor into the wireless networking will need to improve in future [7].

(H) Relay Selection for Secure Cooperative Networks with Jamming:

Ioannis Krikidis, John S. Thompson, and Steve McLaughlin *et. al.* [8] proposed selection technique jointly protects the primary destination against interference [2, 4] and eavesdropping and jams the reception of the eavesdropper and analyzed for different complexity requirements based on instantaneous and average knowledge of the eavesdropper channels.

The new approach is analyzed under two different complexity constraints [3, 5, 7] which correspond to (i) global instantaneous knowledge of all links and (ii) average knowledge of the eavesdropper links. Theoretical and numerical results reveal that jamming techniques significantly outperform previously reported approaches for scenarios with strong eavesdropper channels. In addition to the investigation are jamming-based selection techniques. The proposed selection schemes select two nodes which access the channel simultaneously. The first relay [4, 6, 8] forwards the data of the source, and the second one transmits an intentional interference signal in order to confuse the eavesdropper. The investigated techniques select the two nodes by achieving an optimization of the perfect secrecy capacity and have been analyzed based on both instantaneous and average knowledge of the eavesdropper channels. It is proven that jamming [10, 12, 14] is an efficient solution for scenarios with strong eavesdropper links. The proposed is needed to focus on designing the synchronization control mechanism to solve this problem [8].

(I) Cooperative Communication in Wireless Networks

Aria Nosratinia, and Todd E. Hunter *et. al.* [9] proposed that enables single antenna mobiles in a multi-user environment to share their antennas and generate a virtual multiple-antenna transmitter that allows them to achieve transmit diversity [3, 5]. The idea of cooperation is general, and perhaps even more suitable to ad hoc wireless networks and wireless sensor networks [4, 6] than cellular networks. Systems such as cellular, in which the users communicate with a central base station, offer the possibility of a centralized mechanism. Assuming that the base station has some knowledge of the all the channels between users, partners could be assigned to optimize a given performance criterion, such as the average block error rate for all users in the network. In contrast, systems such as ad hoc networks and sensor networks typically do not have any centralized control. Such systems therefore require a distributed cooperative protocol, in which users are able to independently [6, 8] decide with whom to cooperate at any given time. A related issue is the extension of the proposed cooperative methods to allow a user to have multiple partners. Wireless cooperative communication [9, 11] is a technique that allows single antenna mobiles to share their antennas and thus enjoy some of the benefits of multiple antenna systems. Several signaling schemes for cooperative communication are presented. Practical implications and requirements on system design are discussed, as well as extensions to the basic idea. Results to date are indicative of a promising future for more cooperative with secure communication [13].

(J) Relay Selection Approaches for Wireless Cooperative Networks

Seunghoon Nam, Mai Vu, and Vahid Tarokh *et. al.* [12] proposed two selection methods: Best expectation, which adaptively selects the relays, and Best-m, which selects an optimally pre-determined number of relays [11, 3]. Each method is implemented with a simple and optimal algorithm and further provided closed-form, analytical approximations of these algorithms' performance, which help simplify the process of finding the optimal number of cooperating relays.

It is observed that the *Best Expectation method*uses 7.8497 actively cooperating relays in average. For the *Best-m method*, using 8 cooperating relay terminals minimizes the average total transmission time in (10), so the optimal m? is 8. The analytical approximation values match well with the simulation and also result in $m^* = 8$. the connection between the *Best-m method* relay selection method and the network geometry are more realistic channel with both path loss and fading. Simulation results showed a close match between these approximations and the numerical values. The approximations provide a simple way of determining the optimal number of actively cooperating relays in the *Best-m method*. Through initial studies for channels with both fading and path loss, also observed that the *Best-m method* translates to a simple geometrical method for selecting relays, which uses only the distance between the relay and the source.

The proposed technique is not suitable for large network system and also need to improve in end to end delay from source to destination [12].

(K) Performance Analysis of Best Relay Selection in Cooperative Wireless Networks

Qabas Ali Hikmat, Bin Dai, Rokan Khaji and Benxiong Huang *et. al.* [13] *proposed a relay selection technique based on Decode-and-Forward (DF) relaying protocol, using the available channel state information (CSI) at the source and the relays.* In this work, suggest a cooperative protocol based on the best relay selection technique with the availability [12, 14] of the channel state information (CSI) at the source and the relays. And the authors use relay selection and calculate the outage probability and channel capacity for the cooperative model. Within this paper, relay selection (RS) is employed in the Decode-and-Forward (DF) cooperative wireless network [11, 13] model in order to get developments in the multi-relay network, where only two time slots are necessary. In this paper established a tight SER lower bound with both MPSK and MQAM signal. A development for the SER with an optimal power technique by using best relay selection technique was proved in order to enhance the performance of the system. In addition, the derived SER lower bound could be used to determine the optimum transmission power for the source node and the best relay selected then the optimum power allocation could enhance the error probability of the system efficiently, mainly in the low SNR regime.

The proposed technique is not effectively efficient for high SNR regime; it is needed to improve [13].

(L) Efficient Cooperative MAC and Routing in Wireless Networks

Shamna H R and Lillykutty Jacob *et. al.* [14] proposed a cooperative MAC protocol by enhancing IEEE 802.11 DCF with minimal modifications to maximize the benefit of cooperative diversity. Its performance is compared to that of an existing cooperative MAC and legacy 802.11 DCF protocols and shown to be superior. And also, proposed a cluster based cooperative routing protocol which has minimal control overhead and time consumed in establishing the cooperative paths. The proposed protocol is backward compatible with the legacy 802.11 DCF protocols. The protocol requires minimum modification to the data packet header and control packets. The simulation results show that the proposed MAC protocol achieves significant throughput improvement compared to Coop-MAC and IEEE 802.11 DCF protocols in single hop networks. Through extensive simulations, performance of the proposed protocols was evaluated in terms of throughput, delivery ratio, end-to-end delay and energy distribution. The delay performance is expected to be much better in actual network deployment, as the proposed routing protocol gets rid of the extra processing by the network layer routing protocols.

The proposed cooperative routing protocol with minimal energy cooperative need to modify the technique for improve the energy consumption in the future work [14].

IV. CONCLUSION

In a wireless network the medium is shared by all nodes in a certain area. Dealing with this property is a big challenge when one wants to perform congestion control in such networks: it makes congestion a spatial phenomenon, happening no longer in a node. In a multi-hop network, however, the greedy behavior of the nodes may result in service degradation as the packets transmitted by a source might not reach their final destination due to network congestion. In a congested network packets might be dropped in an intermediate node. Such a behavior will result in waste of the system resources used to deliver the packets to the intermediate node. The network also exhibits extreme unfairness, including starvation, for flows originating multiple hops away from the gateway. This starvation is observed even with Transmission Control Protocol (TCP) which provides fair sharing of bottleneck links in wired networks. Overcoming these fundamental performance challenges is a key requirement for WMNs to become a viable competitor to other access technologies.

In during the survey on wireless communication techniques and we conclude some points that can be further explored in the future using a framework of mechanisms that can enforce an efficient access flow control of available network capacity. We wish to interest in establishing similar centralized controls in a WMN with the traffic flows predominantly directed to and from the gateways, the gateway router will develop a unified view of the network state.

Surveying Different Techniques we define the Advantages and Disadvantages of Techniques in the Table

Techniques	*Advantages/Merits*	*Disadvantages /Future Improvement Direction*
WMN, NCPR, Sensor Network	For many-to-many communication paradigm, suitable values of routing probabilities of the proposed scheme have been identified to minimize the number of collisions of network coded packets.	The performance need to improve of NCPR in a dynamic scenario with some mobile sensor nodes in a monitoring area. This dynamic behavior may lead to the formation of dense and sparse regions only. Further, in future, The NCPR scheme is not suitable for delay sensitive applications [1].
Wireless network, Cooperative communication, (MAC), overhead, relay node (RN).		The impact of interference is not for better performance in multi-hop wireless networks. It should be plan to analyze the tradeoff of cooperation performance gain, cooperation overhead, and energy efficiency and explore their tradeoff space to provide some valuable strategies [2].

Techniques	*Advantages/Merits*	*Disadvantages /Future Improvement Direction*
Wireless LAN, 802.11, rate anomaly, Relays	The proposed technique greatly improves network throughput performance and power consumption even in systems.	The proposed scheme needs to reduce the end to end delay [3].
Cooperative communications, Decode and forward,Network coding, Relay selection, Two-way relay	The paper derived the upper-bound of the frame error rate (FER) of the proposed O-TR method and has shown that the proposed method can accomplish the full diversity order and O-TR method outperforms the fully-distributed space-time two-way relaying method.	The proposed method is not more efficient in large number of node operate in wireless network [4].
Wireless network, Cooperative communication, Relays	The optimal solution overall is found by choosing the network size with the maximum rate for each possible sub-network.	In big network system the proposed scheme is not suitable; it should improve in future [5].
Wireless network, Cooperative communication, Relays Selection Techniques	The first scheme requires the estimation of the instantaneous eavesdropper channels and achieves the best possible secrecy performance. The second scheme assumes an average knowledge of the eavesdropper channel gains and seems to be an efficient solution for practical applications.	The Quality of Service (QoS) of the proposed system need to improve in wireless network [6].
Relay selection, Amplify-and-forward, Outdated channel state information	The outage probability bound of the proposed RS scheme was obtained and verified, along with the asymptotic outage probability.	The transmission capacity factor into the wireless networking will need to improve in future [7].

Techniques	*Advantages/Merits*	*Disadvantages /Future Improvement Direction*
Cooperative diversity, Secure communications, Wire-tap channel, relay selection	The investigated techniques select the two nodes by achieving an optimization of the perfect secrecy capacity and have been analyzed based on both instantaneous and average knowledge of the eavesdropper channels. It is proven thatjamming is an efficient solution for scenarios with strong eavesdropper links.	The proposed is needed to focus on designing the synchronization control mechanism to solve this problem [8].
Wireless network, Cooperative communication, Multiple-input multiple-output (MIMO) systems	Practical implications and requirements on system design are discussed, as well as extensions to the basic idea.	Results to date are indicative of a promising future for more cooperative with secure communication [9].
Cooperative Communication, Relay Selection, Relaying, Routing,	The opinion is that the investigation of relay selection schemes able to make the best out of local opportunities	The usage of such opportunistic-cooperative relay selection schemes will provide the needed distributed intelligent to support relaying over large networks in the present of nodes with dynamic behavior network system [10].
Cooperative diversity, decode-and-forward cooperative protocol, multi-node wireless relay networks	Symmetric scenario, presented an approximate expression of the achievable bandwidth efficiency, which decreases with increasing the number of employed relays.SER upper bound, proves that full diversity order is guaranteed as long as there is cooperation.	The method is not more efficient in higher band width access [11]

Techniques	*Advantages/Merits*	*Disadvantages /Future Improvement Direction*
Relay selection, cooperative communications, decode-and-forward.	*Best-m method* translates to a simple geometrical method for selecting relays, which uses only the distance between the relay and the source.	The proposed technique is not suitable for large network system and also need to improve in end to end delay from source to destination [12].
Cooperative Communications, Decode-and-Forward, Relay Selection, Optimal Power	Determine the optimum transmission power for the source node and the best relay selected then the optimum power allocation could enhance the error probability of the system efficiently, mainly in the low SNR regime.	The proposed technique is not effectively efficient for high SNR regime; it is needed to improve [13].
Cooperative MAC, Cooperative Routing, End-to-End Delay, Energy Efficiency, Cross-LayerDesign	The delay performance is expected to be much better in actual network deployment, as the proposed routing protocol gets rid of the extra processing by the network layer routing protocols.	The proposed cooperative routing protocol with minimal energy cooperative need to modify the technique for improves the energy consumption in the future work [14].

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