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Channel Assignment over Multihop MACNETs using Distributed Stable Routing

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ABSTRACT: Data communication in mobile ad hoc cognitive networks (MACNETs) considerably suffers from link instability and channel interference. The availability and stability of every link in MACNETs extremely depends on not solely the relative movement of neighbour nodes however additionally the adjacent communication among primary nodes and among cognitive nodes. In multihop and multiflow MACNETs, this drawback becomes even worse because multiple links probably interfere with one another. In this paper, we have to propose a cross-layer distributed approach called as Hybrid protocol, to maximize the network throughput by jointly selecting stable routes and assigned channels avoiding inter and intra-flow interferences based on mobility prediction. To quantitatively evaluate the communication quality of links, we propose a new metric data transmission cost (DTC) that captures node mobility, impact to primary nodes, and channel incompatibility between cognitive nodes. In our Hybrid protocol, each relay node selects the most effective link with the lowest DTC as the next hop, within a specified region towards the target. NS2-based simulation results demonstrate that our Hybrid algorithm significantly improves network throughput, and also the higher degree of interference MACNets experience, the lot of improvement will be achieved.

KEYWORDS: MACNets, DTC, MP-JSRCA,AODV, NS2

I. INTRODUCTION

MOBILE ad hoc cognitive networks (MACNETs) have been attracting increasing study interests as a result they can partially solve the frequency insufficiency problem through dynamic spectrum access. Totally different from conventional wireless ad hoc networks, wherever nodes communicate on a similar unlicensed channel, cognitive nodes (CNs) will smartly detect and opportunistically use the unutilized spectrum licensed to primary nodes (PNs) in MACNETs. PNs, however, have high priority within the utilization of the spectrum so that a CN should instantly vacate the channel once a PN activates again.

In this paper, we propose a Hybrid approach to solve the mentioned difficult problems, aiming at maximizing network throughput. For the route selection, we have to target on the stability of a path to enable the path period as long as possible. For the channel assignment, we take into account a best solution that fully avoids the impact to PNs and at a similar time, mitigates intra and inter-flow interferences among CNS utilizing minimal range of available channels. Previous researches either don't take into account channel detection, mobility prediction and channel vacation for PNs, or set up route and assign channels individually. In this paper, we focused on investigation of joint route selection and channel assignment based on mobility prediction in multichannel multi-flow MACNETs. Our main contributions in this paper are summarized as follows.

1) We propose a new live metric data transmission cost (DTC) to quantitatively valuate the standard of links for solving the MP-JSRCA drawback. The DTC considers not only the route stability suffered from the node mobility however also the appearance of PNs additionally the channel interference among inter and intra-flows.
2) We tend to develop and valuate uniquely distributed Hybrid protocol to stabilize route selection and interference-avoiding channel assignment. The MP-JSRCA protocol runs hop by hop. Once receiving a route selection packet, a

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relay node starts running this protocol to search out successive hop inside a given sector region in terms of the less DTC.

3) The Hybrid protocol assigns the lowest number of orthogonal channels for an incoming flow whereas minimizing the interference to intra and inter-flows.

Our Hybrid protocol will simply be implemented for industrial applications through fixing it between the network layer and data link layer of mobile cognitive devices. It begins operating before a new data transmission session is initiated.

II. RELATED WORK

Recent proposals have studied routing protocols and channel assignment. In terms of the mobility of target environments, these results are categorized as static networks orientated and mobile networks headed schemes. Moreover, they fall under separated design and joint design according to whether routing and channel assignment area unit jointly considered. We tend to review the foremost connected works below. Most existing proposals on joint routing and channel assignment are designed just for static networks. Whether selected routes or assigned channels area unit straight forward to break by node mobility. Routing or channel assignment schemes oriented to mobile networks are targeted at mobile ad hoc networks, where nodes cannot find unused licensed channels. Instead, they solely use pre-allocated channels. The researches most associated with our work are PCTC. However, each PCTC did not think about joint assignment channels for avoiding inter- and intra-flow interferences in mobile cognitive networks. In summary, existing works either didn't take the channel detection, mobility prediction and channel vacation to PNs into account, or started routing and assigned channels one by one. To our best information, there has not nevertheless been an approach on prediction-based joint routing style and channel assignment for mobile cognitive networks.

III. PROPOSED WORK

In MACNETs, the node mobility deteriorates the standard of wireless links. Primary nodes on an irregular basis use data channels, making the case worse. To evaluate our Hybrid protocol, we tend to develop a simulation system, which is made on the NS2 simulator with multi radio multichannel extensions. Here, we tend to present our simulation results to evaluate our Hybrid protocol. First, we describe the simulation system setting. We then demonstrate the performance of our Hybrid protocol by comparing it with related proposals underneath different traffic loads, numbers of primary nodes, mobility of cognitive nodes, and network areas.

A . Simulation System Result

In our system, each PNs and CNs are at random deployed in a square during an area of 1500 m*1500 m. Each PNs and CNs have the same radio radius 125 m and an equivalent interference range 250 m, respectively. Every data packet is set as 512 KB. Totally, there's 200 CNs, 20 PNs, 5 data flows, and 15 available channels within the system. Highest speed of system is set as 10 m/s except in the quality testing. Each PN is allotted a fixed data channel and randomly uses it. All CNs within the network share an equivalent common control channel. Every CN has multiple accessible data channels. Moreover, in all experiments, we check completely different performance metrics for 500 s. Every flow is generated through NS2-based FTP data generator and transferred through a transmission control protocol connection..

In our simulation system, PNs keep fixed. However, each CN moves at a random and dynamically changing direction. The speed of CNs follows the distinct uniform distribution within the following experiments. On the other hand, if the speed of CNs complies with the normal distribution with a small standard deviation.

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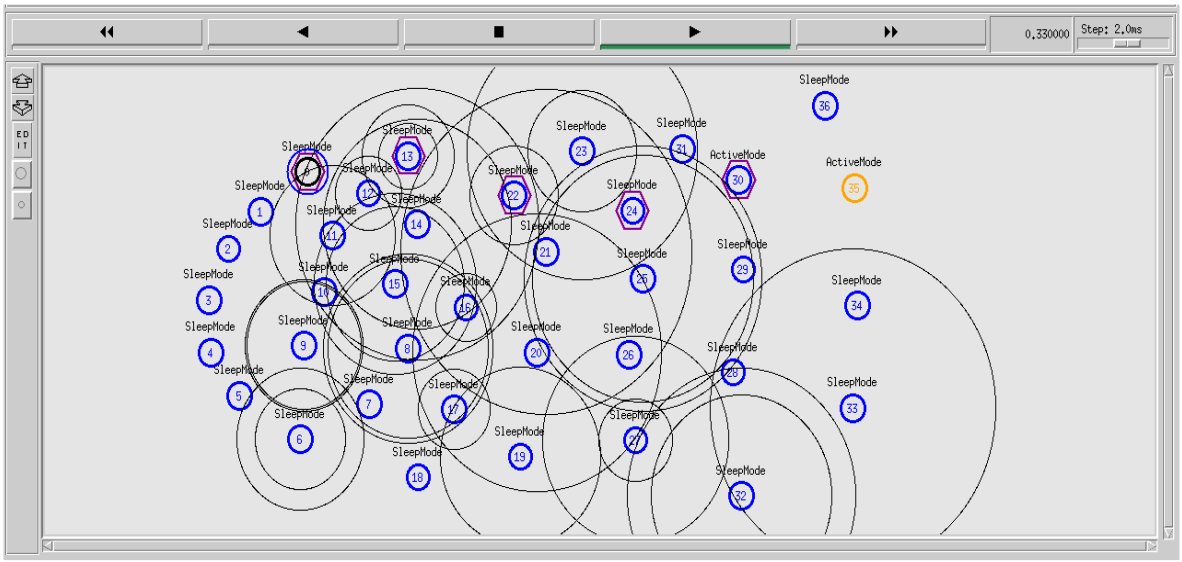

Fig: Network Formation

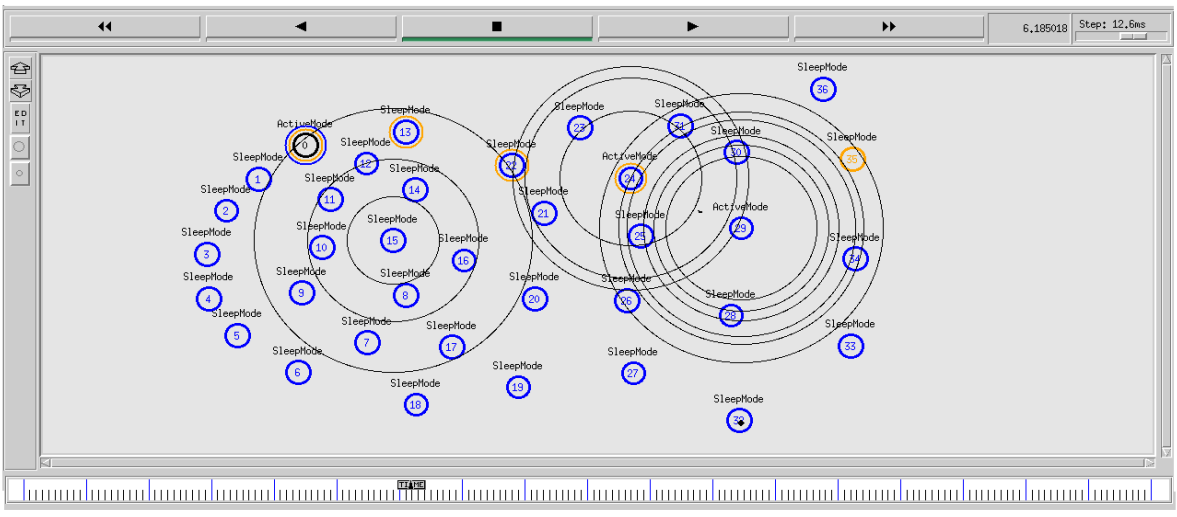

Fig: Hopped path

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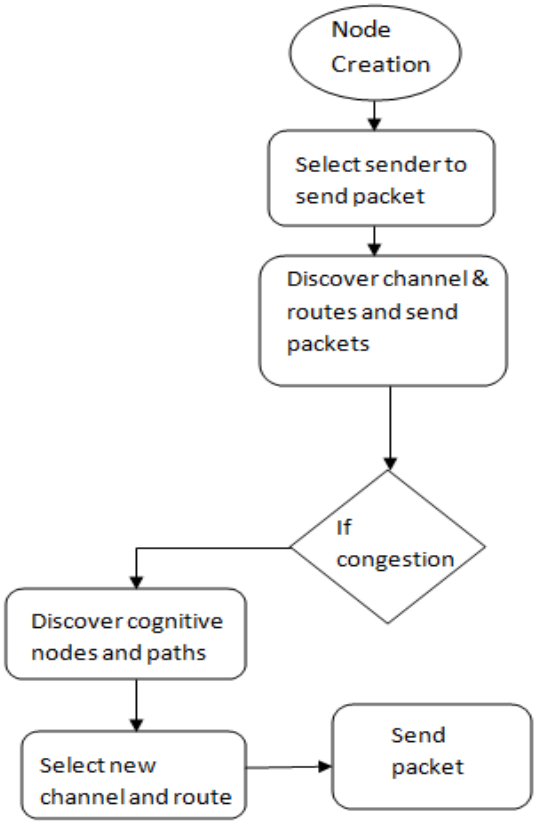
B. FLOW CHART



C. PERFORMANCE ANALYSIS

We demonstrate the performance improvement from our Hybrid protocol through comparing it with the following two connected schemes that rely on an equivalent environment as the Hybrid Protocol.

• AODV: The AODV protocol is extended for multichannel environments. It selects a path with the least latency (in general, with the least hops). Like original AODV, any pair of neighbouring nodes during a path randomly selects a common channel for the data transmission.

• MP-JSRCA (mobility prediction-joint stable routing channel assignment): This is only the routing scheme of our Hybrid protocol. MP-JSRCA aims at provisioning the cognition to CN mobility and choosing a stable route for an incoming flow. However, our channel assignment is disabled and any pair of CNs randomly chooses an accessible common channel. The contributions from our conflict-free channel assignment can be discovered through comparing the MP-JSRCA and also the Hybrid protocol. We check and compare how system output in the three solutions changes with number of data flows, number of primary nodes, highest speed of CNs and network area.

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IV. SIMULATION RESULTS

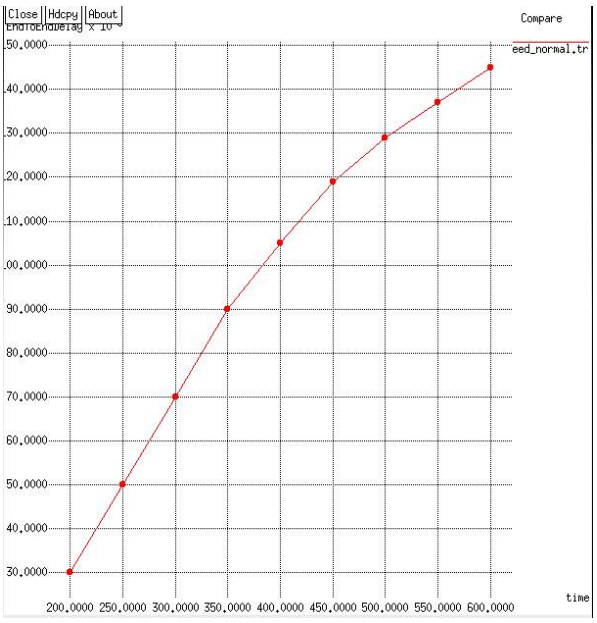

Fig.1. End to End delay v/s Time

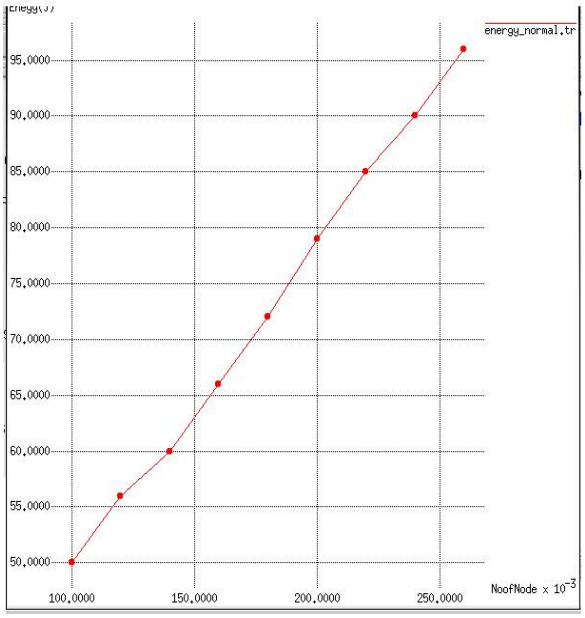

Fig.2 Energy v/s No. Of Nodes

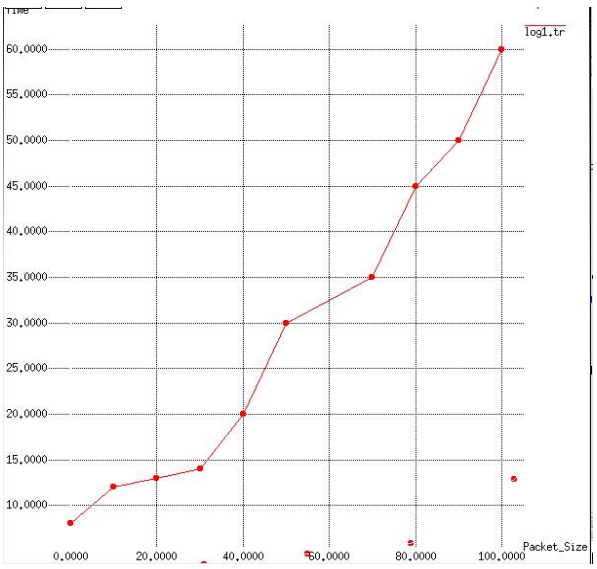

Fig. 3. Time v/s Packet size

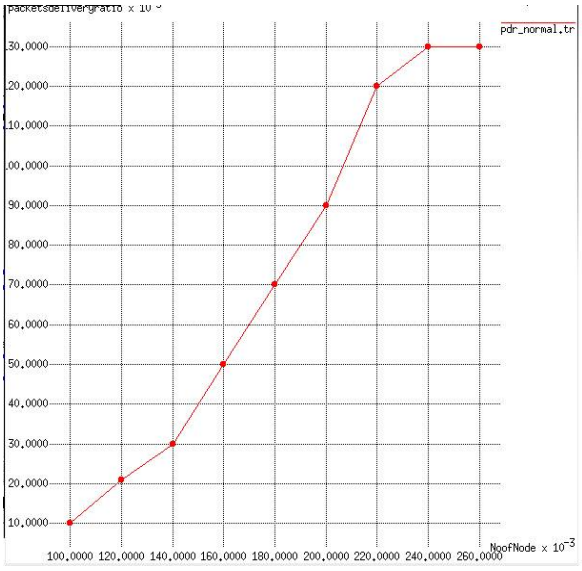

Fig 4. Packet Delivery Ratio v/s No. Of Nodes

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V. CONCLUSION AND FUTURE WORK

In this paper, we present the Hybrid protocol for MACNets that collectively take quality prediction-based stable routing and interference-avoiding channel assignment into account. First, we design a mobility prediction based mostly measure metric DTC that captures the node mobility, the impact to PNs, and the co channel interference among CNs. Next, we present channel assignment approaches for various channel interference patterns. Finally, we tend to develop the Hybrid protocol that jointly selects stable routes and assigns channels by discovering the link with the lowest DTC that considerably improves the network output. NS2-based experiment results validate that our Hybrid Protocol considerably improves the network output; and also the higher degree of interference cognitive networks experiences, a lot of improvement our Hybrid Protocol will bring back the networks.

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