Increased Throughput In MANETs With The Heterogeneous Environment

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Abstract: Mobile ad hoc network (MANET), flexible and self-autonomous wireless network architecture, is very promising to find many important applications in the daily information exchange, disaster relief, military troop communication, etc. In MANETs for long life and reliability the throughput capacity must be increased. This work deals the per node throughput capacity of a MANET, where the transmission power of each node can be controlled to adapt to a specified transmission range and a generalized two-hop relay with limited packet redundancy is used for packet routing. Based on the concept of automatic feedback control and the Markov chain model, an Inter-MANET Routing protocol called InterMR that can handle the heterogeneity and dynamics of MANETs is used. First it defines an Inter-MANET address scheme based on a variety of node attributes. Next the contribution is to provide a seamless routing mechanism across heterogeneous MANETs without modifying the internal routing mechanisms in each MANET, by packet-level simulation, that the performance of InterMR will be improved by adaptive gateway assignment functionalities. From the routing values the throughput parameters is obtained. Increasing the transmission power of the nodes with this routing mechanism improves the capacity, and even at high packet rate increased throughput can be achieved.

Keywords: Throughput, Inter-MANET Routing, Mobility model, Heterogeneous Network

I Introduction
Mobile ad hoc network (MANET), flexible and self-autonomous wireless network architecture, is very promising to find many important applications in the daily information exchange, disaster relief, military troop communication, etc. By now, the lack of a general Shannon limit like network capacity theory is still a challenging roadblock stunting the development and commercialization of Manets [1], [2]. It is helps to understand the fundamental network throughput limit and thus serves as an instruction guideline for the network design, performance Optimization. The i.i.d. mobility model, it is possible to achieve a per node throughput by employing a two-hop relay scheme [6]. The per node throughput can also be achieved under other mobility models, like the random walk model, the two-dimensional Brownian motions model and the restricted mobility model [8]. Now it is explored that the exact capacity for the MANETs based on a specific two-hop relay routing algorithm with limited packet redundancy, i.e., a limited number of copies can be dispatched for each packet, and further extended capacity analysis to the scenario where each transmitter is allowed to conduct multiple rounds of probing for identifying a possible receiver [9]. It is noticed that the capacity results in [18]–[19] hold only when the packet redundancy is smaller than a specific value (i.e., falls within a restricted range); while in [14], [16], the capacity was derived without considering the important interference, medium contention and traffic contention issues. Since it is generally believed that the local transmission mode could result in the maximum pernode throughput capacity, these work generally adopt the local transmission mode in their analysis, where either each node has a small transmission range [12], [13], [15], or it can only transmit to some other node(s) in the same cell [7], [8], [14]. Therefore, the throughput capacity under a general setting of node transmission range remains unknown by now. Numerous routing protocols have been developed in the wireless networking community to target various scenarios, and much research effort has been paid to study the taxonomy of ad hoc routing protocols and to survey the representative protocols in different categories. For example, Boukerche et al. [11] provides the comprehensive summary of the routing protocols for MANETs. Unfortunately, most of the existing protocols are limited to homogenous networks and perform ineffectively in power heterogeneous networks. There are some routing protocols for heterogeneous MANETs. Multiclass (MC) [12] is a position-aided routing protocol for power heterogeneous MANETs. The idea of MC is to divide the entire routing area into cells and to select a highpowered node in each cell as the backbone node (B-node).

II. RELATED WORK
Numerous techniques has been defined to increase the throughput in MANETs. Various mobility models and routing schemes are used to increase throughput in heterogeneous environment. Recently, Liu et al. [18] explored the exact capacity for the MANETs based on aspecific two-hop relay routing algorithm with limited packet redundancy, i.e., a limited number of copies can be dispatched for each packet, and further extended capacity analysis to the scenario where each transmitter is allowed to conduct multiple rounds of probing for identifying a possible receiver [19]. It is noticed that the capacity results in [18]–[19] hold only when the packet redundancy is smaller than a specific value (i.e., falls within a restricted range); while in [14], [16], the capacity was derived without considering the important interference, medium contention and traffic contention issues. Since it is generally believed that the local transmission mode could result in the maximum pernode throughput capacity, these work generally adopt the local transmission mode in their analysis, where either each node has a small transmission range [12], [13], [15], or it can only transmit to some other node(s) in the same cell [7], [8], [14]. Therefore, the throughput capacity under a general setting of node transmission range remains unknown by now. Numerous routing protocols have been developed in the wireless networking community to target various scenarios, and much research effort has been paid to study the taxonomy of ad hoc routing protocols and to survey the representative protocols in different categories. For example, Boukerche et al. provides the comprehensive summary of the routing protocols for MANETs. Unfortunately, most of the existing protocols are limited to homogenous networks and perform ineffectively in power heterogeneous networks. There are some routing protocols for heterogeneous MANETs. Multiclass (MC) [12] is a position-aided routing protocol for power heterogeneous MANETs. The idea of MC is to divide the entire routing area into cells and to select a highpowered node in each cell as the backbone node (B-node). Then, a new medium access
control (MAC) protocol called hybridMAC (HMAC) is designed to cooperate with the routing layer. Based on the cell structure and HMAC, MC achieves better performance. However, a fixed cell makes MC to work well only in a network with high density of high-power nodes. In [13], a cross-layer approach is presented that simultaneously extends the MAC and network layers to minimize the problems caused by link asymmetry and exploits the advantages of heterogeneous MANETs. Hierarchical optimized link state routing (HOLSR) [14] is a routing protocol proposed to improve the scalability of OLSR for large-scale heterogeneous networks. In HOLSR, mobile nodes are organized into clusters according to the capacity of a node. However, if the node is at a higher hierarchy, then it needs to maintain more information. In [10], a cross-layer-designed device-energy-load aware relaying (DELAR) framework that achieves energy conservation from multiple facets, including power-aware routing, transmission scheduling, and power control, is proposed. DELAR mainly focuses on addressing the issue of energy conservation in heterogeneous MANETs. Dressler et al. propose a distributed hash table (DHT) based inter-MANET routing in ad hoc networks by surrendering the control of underlying routing protocols of MANETs [11]. In the literature, there have been several proposals to enable communication among heterogeneous routing protocols for different purposes. For example, SHARP [20] uses both proactive and reactive routing protocols to adapt different traffic patterns and improve performance. The basic idea of SHARP is to create proactive routing zones around the nodes with lots of data traffic, and use reactive routing in other areas. Although the hybrid routing protocols enable communication between proactive and reactive routing protocols, they require nodes to be controlled by the same administrative policies and do not support autonomous operations by multiple MANETs. Thus they do not provide a systematic solution to interoperability among multiple MANETs with different routing protocols. Our proposal considers both the throughput and routing for heterogeneous environments.

III. SYSTEM ASSUMPTIONS AND DEFINITIONS
We define a MANET as a logical grouping of mobile nodes, where all the nodes in the same MANET employ the same wireless PHY/MAC and routing protocols and are governed by a single administrative entity. We assume that only the nodes in the same MANET can directly communicate with each other without the support of Inter MR; direct communication between nodes in different MANETs may not be allowed due to policy constraints not just because of different network technologies. The mobility model is designed to describe the movement pattern of mobile users, and how their location, velocity, and acceleration change over time.

A. RANDOM WAYPOINT MODEL
The Random Waypoint Model was used, it became a ‘benchmark’ mobility model to evaluate the MANET routing protocols, because of its simplicity and wide availability. As the simulation starts, each mobile node randomly selects one location in the simulation field as the destination. It then travels towards this destination with constant velocity chosen uniformly and randomly from $[0, V]$, where the parameter $V$ is the maximum allowable velocity for every mobile node [6]. The velocity and direction of a node are chosen independently of other nodes. Upon reaching the destination, the node stops for a duration defined by the ‘pause time’ parameter $T$. If $T = 0$, this leads to continuous mobility. After this duration, it again chooses another random destination in the simulation field and moves towards it. The whole process is repeated again and again until the simulation ends.

B. INTRA-MANET TOPOLOGY CHANGE DETECTION:
One of the key characteristics of a MANET is dynamic network topology, and thus we need to handle this issue when designing an inter-MANET routing protocol. There are two types of topology changes. First, nodes belonging to a single MANET can become partitioned into multiple sub-MANETs due to node mobility. Such a topology change must be detected by gateways in each sub-MANET. If the underlying routing protocol of the MANET is proactive, the partition will be detected automatically by the underlying routing protocol. To support change detection within a single MANET, we define a sub-protocol called i-InterMR, by which gateways maintain soft state of MANET topology via periodic beacons. Failure to receive a beacon indicates a partition. It should be noted that this probing only detects partitions involving active gateways.

C. INTER-MANET TOPOLOGY CHANGE DETECTION:
The second type of the topology change is the MANET-level topology change. For instance, the neighboring MANETs of MANET A may change from MANET B, C, D to D, E due to node movement. As MANETs dynamically move, gateways in each MANET are required to detect new neighboring MANETs and start exchanging routing information with them and retire old inter-MANET routing entries. To handle this, we design another sub-protocol called e-InterMR which is used to maintain and discover inter-MANET topology changes via inter-MANET beacons and propagation of inter-MANET routing information (e.g., routing entries of destinations in other MANETs). For this, we require gateways to maintain direct connectivity with adjacent gateways of other MANETs. We note that the beacon periods of both i-InterMR and e-InterMR can be adaptively determined based on the dynamicity of topology changes.

IV EXISTING MODEL
The main contributions of the existing model are summarized as follows: First, the packet dispatching at the source and the packet receiving at the destination is modelled as Markov chains. Then apply the concept of automatic feedback control to characterize the service rate adaptation between the source and the destination. Then develop a general framework to depict the complicated packet delivery process in the challenging MANET. With the help of the theoretical framework, they develop the exact per node throughput. Simulation results are also provided to validate the throughput capacity result. Based on the new throughput result, the optimal capacity and its variation to
achieve the possible maximum throughput capacity is achieved.

A. NETWORK, COMMUNICATION AND TRAFFIC MODEL

Here a two-dimensional cell-partitioned unit torus with nindependent mobile nodes is defined. Time is slotted, and in order to exclusively explore and thus clearly illustrate the impact of transmission range on per node throughput capacity, also assume a limited channel bandwidth such that the total number of bits that can be transmitted per time slot is fixed and normalized to one packet. Further assume that during each time slot each node has the knowledge about which cell it resides in based on its location. To account for the interference among simultaneous transmissions, the Protocol adopted here. For a link i at time slot t, we use Ti (t) and Ri (t) to denote the positions of the corresponding transmitter and receiver, respectively. Based on the Protocol model, the transmission of the link i can be successful at the time slot t if for any other link j with simultaneous transmission,

\[ T_j(t) - R_i(t) \geq (1 + \Delta) |T_i(t) - R_i(t)| \]

Here permutation traffic model is considered. Under such traffic model, there will be in total n distinct flows, where each node is the source of its locally generated traffic flow and at the same time the destination of a flow originated from another node. The packet arrival process at each node is independent of the mobility process and packets arrive at the beginning of a time slot. For the purpose of throughput capacity analysis, we assume that no lifetime is associated with each packet and the buffer size at each node is large enough (or infinite) such that the packet loss due to buffer overflow will never happen.

B. ROUTING AND SCHEDULING

2HR-f routing scheme is used. Here, consider a generalization of the classic two-hop routing scheme with f-cast (2HR-f) f \in \{1, n - 2\}, where each packet waiting at the source is delivered to at most f distinct relay nodes and should be received in order at destination. Transmission group based scheduling is used, where transmission group is a subset of cells, where any two of them have a vertical and horizontal distance of some multiple of \( \alpha \) cell and all of them could conduct transmissions simultaneously.

V. INCREASED THROUGHPUT by IR Routing:

The proposed framework describes about the routing techniques and mobility patterns for the increased throughput. And also one can transmit the packets without delay.

The throughput capacity for MANETS is defined with this system. This work can be extended to develop an energy efficient heterogeneous pattern of throughput. In this model each mobile node observes movement patterns defined in all constituent models. Heterogeneous model comprises of random way point, Gauss Markov and other models and each node in the model moves in patterns defined by all models such that nodes final position of scenario is linked to the initial position of the scenario. It aims to derive the per node throughput capacity of the 2HR-f under a more general scenario in which each packet is of limited lifetime and each node has constrained buffer space, and thresholds of packet lifetime and buffer size there. The packet delay will also be considered. The Packet delivery is monitored during transmission from source to destination. The nodes mobility pattern is achieved by Random waypoint model and more accuracy in mobility can be achieved by gauss markov model. Then we present detailed design of a practical Inter-MANET routing protocol called InterMR to support interoperability across heterogeneous MANETS. Then a novel distributed algorithm to dynamically select active gateways so that we can maximize the inter-MANET connectivity when the network topology changes due to node mobility are defined. With the help of these techniques the throughput is increased in MANETS with heterogeneous environment.

IV Conclusion

In this work, we define a novel inter-MANET routing protocol to support communication across heterogeneous MANETS inorder to increase the throughput. With this routing the throughput is increased and estimated by mobility model. In particular, we identified several major challenges, namely lack of a name server, dynamic network topology change, non-existence of well defined boundaries, and heterogeneous intra-MANET routing protocols. Results we showed that our protocol provides effective inter-MANET communication among heterogeneous MANETS, and particularly that the dynamic gateway election scheme significantly performs better than the static mechanism also here it mainly focuses on heterogeneous environment.

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