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OPTIMIZED ROUTING IN ZHLS USING CORE ZONE EXTRACTION

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Abstract: An ad-hoc network is the cooperative engagement of a collection of mobile nodes without the required intervention of any centralized access point. Most conventional protocols exhibit their least desirable behaviour for highly dynamic interconnection topology. In this paper, in order to reduce communication overhead such as flooding in mobile adhoc network, we present a routing scheme for zone based hierarchical link state routing protocol with core zone extraction(ZHLS-CZE).In distributed adhoc routing protocol.ZHLS is a hybrid routing protocol for mobile adhoc network in which a network is divided into non- overlapping zones. All network nodes in ZHLS construct two routing tables, an intra zone routing table and an inter zone routing table, by flooding node LSPs within the zone and zone LSPs throughout the network. However, this incurs a large communication overhead in the network. In our proposed scheme, we first select the core nodes in each zone and then core zones for the entire network. A packet can be send from source to destination by using selective core zones only and thus reducing communication overhead significantly.Furthermore,in ZHLS-CZE,only the core zone store zone LSPs and construct inter zone routing tables therefore the total storage capacity required in the network is less than in ZHLS.

Keywords: CEDAR, ZHLS, and Routing.

I. INTRODUCTION:OVERVIEW OF ZHLS

Unlike other mobile networks, such as cellular and IP mobile networks, which have wired backbones and centralized controllers, a mobile ad hoc network [1] neither has a wired backbone nor a centralized controller. The network is self-organizing and is suitable for rapid deployment. A network node not only acts as an end node (a host) but also acts as a routing node (a router). The network topology changes rapidly due to the node mobility. The route from a source node to a destination node dynamically changes. As a result finding a route to a destination node with minimum communication overhead (control packets) has been a challenging task for researchers for many years. There are various types of routing protocols designed for ad hoc networks. They can be divided into two categories: proactive and reactive. A good review of ad-hoc routing protocols can be found in [2].In proactive routing protocols [3], [4], each node floods its link state packet (LSP) throughout the network. Based on the link state packets of all nodes in the network, each node calculates the shortest path to every node and constructs a routing table. When the topology (link state) changes, due to the mobility of the nodes, LSPs are flooded to reflect the changes and the routin table is updated. A source node refers to its routing table to send data to a destination node and forwards the data to the next hop node which forwards it to its next hop node and so on until the data reaches the destination node. In reactive routing protocols [5], [6], a source node, which wants to send data to a destination node, first broadcasts a destination node route discovery packet. When the destination node receives the packet, it sends back a route reply packet via the route it received the route discovery packet. When the source receives the reply packet it sends the data packet via the nodes which are included in the route reply packet. If the path is broken due to the mobility of the nodes in the path, the source node initiates the path discovery process again. In order to reduce the number of route discovery packets (in reactive protocol) or routing table building LSP packets (in proactive protocol), hierarchical design schemes which are both reactive and proactive such as the Zone Routing Protocol (ZRP) [7] and Zone-Based Hierarchical Link State (ZHLS) routing protocol [8] have been proposed.ZRP exploits the routing zone structure through a process called border casting. If a destination node is within the routing zone of a source node, the source node uses its routing table maintained proactively to forward the data to the destination node. Otherwise it border casts to its peripheral nodes which bordercast to their peripheral nodes until the destination node is found. The route reply is sent back to the source with the list of peripheral nodes stored in the packet header or being cached in the queried peripheral nodes. Any changes in peripheral nodes cause another route discovery process. ZHLS is more robust and peer-to-peer hierarchical routing protocol, which creates two routing tables, an intrazone routing table and an interzone routing table, by flooding NodeLSP and ZoneLSP, which will be explained.

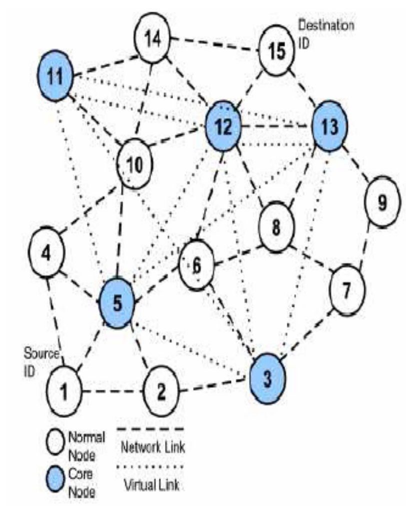
II. PROBLEMS WITH ZHLS

In ZHLS, ZoneLSPs are flooded throughout the network so that all nodes know both zone level and node level topologies of the network. This simplifies the routing but introduces communication overhead. In this paper, we propose a scheme called Zone-based hierarchical Link State routing protocol with core zone extraction (ZHLS-CZE),in which only core zones know the zone level topology of the network.In ZHLS-CZE zone LSPs are flooded to core zones only and only the core zones maintain the interzone routing table. Non-core zones are not flooded with ZoneLSPs and do not construct a interzone routing table. Therefore the numbers of ZoneLSPs flooded throughout the network are significantly reduced.

III. MECHANISM PROPOSED

A. Cedar Architecture:

CEDAR is a hybrid routing protocol.The Qos architecture in core extraction distributed adhoc routing(CEDAR) has three components[9]. (a)The establishment of the core in adhoc network to manage topology information and perform route computation.(b)the propagation of link state of high bandwidth and stable links in core sub graph through increase and decrease wave, and (c)the route computation algorithm at core nodes using only local state



B. Core extraction:

We dynamically extract the core of the network by approximating a minimum dominating set of adhoc network using only local computation and local state. Each host in the core establishes a virtual link via a tunnel to a nearby core host. Each core host maintains the local topology in its domain and also perform the route computation on behalf of this host. The core management upon change in the network topology is a purely local computation, thus the core adapts efficiently to the dynamic of the network.

C. Link State Propagation:

QoS routing in CEDAR is achieved by propagating the bandwidth availability information of stable links in the core subgraph.The basic idea is that the information about stable links with large available bandwidth can be made known to nodes far away in the network, while information about dynamic link or low bandwidth link should remain local. The propagation of link state is achieved through slow moving 'increase' waves, which denote the increase of bandwidth and fast moving 'decrease' waves which denotes the decrease of bandwidth.

D. Route Computation:

Route computation first establishes a core path from the domain of the source to the domain of the destination. The initial phase involves probing like DSR (Dynamic Source Routing) though it is only performed on the core graph. The core path provides the directionality of the route from the source to the destination. Using this directional information, CEDAR iteratively tries to find a partial route from source to the domain of the furthest possible node in the core path which can satisfy requested bandwidth. Effectively the computed route is a shortest widest furthest path algorithm using the core path as the guideline.

IV. ZONE EXTRACTION IN ZHLS

Our proposed scheme consists of three components.

(a) Core node identification
(b) Core zone identification
(c) Route computation

A. Core Node Identification:

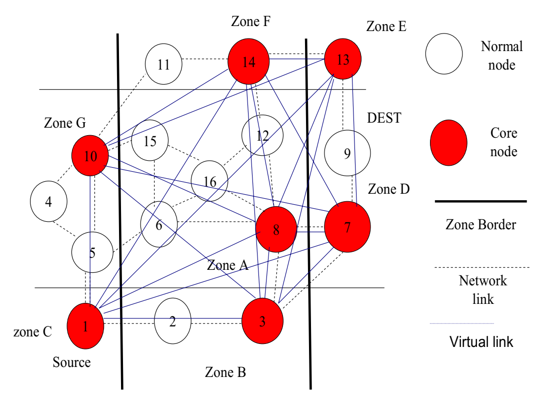


Fig. CEDAR-CZE Architecture

There should be one core node for every zone. The core node is the node whose degree is maximum. In zone (A-F), there is only one core node for each zone based on node LSPs.But in node G, there are two nodes such as 10 and 5 of same degree. Now we are checking for zone LSPs and we have to check the priority. A has the highest priority because zone lSP is four. Now in node 10 , zone LSPs are four as 4,5,A,F and in node 5,zone LSPs are also four as 4,10,A,C.So we have to check the priority of F and C.For C,zonLSPs are two and for F,zone LSPs are three. So F has the highest priority.So 10 is the core node in zone G.

B. Algorithm For Selecting Core Nodes:

1. Choose a zone Z

2. m, node id

3. d (m), the degree of m (no of direct neighbour)

4. Core (m), the core node

5. In zone Z, the node for which d (m) is greatest will be core (m)

6. (a) if in a zone d (m) will be same for two nodes, then apply zone LSP

(b) The node m for which zone LSP is greatest selected as the core (m).

B. Core Zone Identification:

If we have some selected no of core zones then we can send packet from source to destination by using that core zones only. By using this we can reduce flooding. Central zone should get the priority because it generally consists of more nodes than the nodes in other zones and nodes of central zone mostly connect the nodes in other zones. So zone A is one of the core zones. next core zone will be the zone with maximum nodes but less than zone A. next core zone will be zone G.we are not considering zone C and E, because both zone contains only one node. Now zone B,D,F should have the same priority because all zones have two nodes, but we have to select only one zone as the core zone. Among them. Now we have to check the zones LSPs.zone B have two zones LSPs.zone D and F have three zone LSPs. So zone B will be discarded. Now in zone F, zone LSPs are A, E, G.We have already selected A and G as the core zones. But in zone D, zone LSP G is absent. So zone F will get the priority. Core zones are A,G and F.

C. Algorithm For Selecting Core Zones:

1. cen(z),the central zone should get the Priority because the network is partitioned in such away that central zone should contain maximum number of nodes.

2. choose a zone z1 such that z1 contains Nodes but less than cen (z) but more than other Zones (z')

$$z'(m) < z1(m) < cen(z)$$

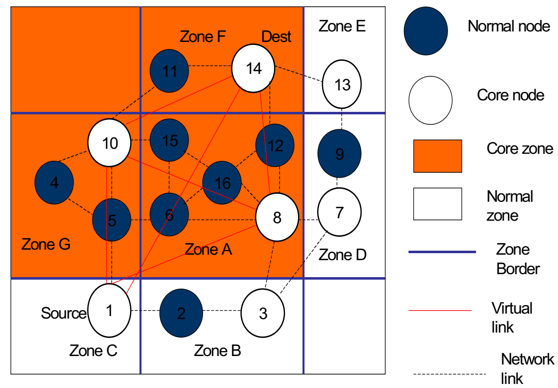
3. If two or more zones have equal number of nodes then we apply zone LSP.

4. The zone in which the nodes are mostly connected with already selected core zones, now selected as the next core zone, core (z).

5 neglect the zones which have least number of nodes.

D. Algorithm For Route Computation:

Here, Dijkstra's single source shortest path algorithm is used. Here path is selected based on the metric such as path length or path weight. When second path in consider, then length of the first path is also taken into account. In this way an entire path from source to destination is selected. Packet can be send



from source to destination by using core zones only.

1.'t' be end point of chosen path and p(s, t) denote the chosen path.

2. Core sends core (d) the following message
<s, d, b, t, p(s, t), core(s), core (d)>
Where,
s denotes the source
d denotes the destination
b denotes the bandwidth

3. Core (d) may be itself is a core node, otherwise it performs the route computation and sends the packet to the dest d by an admissible path.

CONCLUSION

In this paper, a core zone extraction scheme (ZHLS-CZE) is proposed for zone based hierarchical link state routing protocol. In this proposed scheme, ZoneLSPs packets are flooded which are used to construct interzone Routing tables, to core zones instead of all zones. Communication overhead in constructing the network topology is significantly less than the traditional ZHLS. This is because in our proposed scheme, when a core zone receives a ZoneLSP from the neighbouring zone, it calculates the shortest path to other core zones and forwards the packet which passes through the core nodes in the shortest path. In the traditional ZHLS, Zone LSP will be forwarded to all nodes and all zones. In our proposed scheme, non-core zones do not construct interzone routing tables thus do not store ZoneLSPs.

FUTURE WORK

An ad-hoc network is the cooperative engagement of a collection of mobile nodes without the required intervention of any centralized access point. Most conventional protocols exhibit their least desirable behaviour for highly dynamic interconnection topology. In my future work, I will be designing an algorithm for route computation. This algorithm should be optimal, so that the packet can be send from source to destination in minimum time and minimum cost. Next, I will be simulating the proposed algorithms by using network simulation software.

REFERENCES

[1] C. Toh, Ad Hoc Mobile Wireless Networks: Protocols and Systems. Prentice Hall PTR, 2002.

[2] E. Royer and C.-K. Toh, "A review of current routing protocols for ad-hoc mobile wireless networks,"IEEE Personal Communication Magazine, pp. 46–55, April 1999.

[3] C. E. Perkins and P. Bhagwat, "Highly dynamic destination-sequenced distance-vector routing (dsdv) for mobile computers," Computer Communication Review, pp. 234–244, Oct. 1994.

[4] S. Murthy and J. Garcia-Luna-Aceves, "An efficient routing protocol for wireless networks,"ACM Mobile Networks and Application Journal, Special Issue on Routing in Mobile Communication Networks, pp. 183–197, Oct. 1996.

[5] D. B. Johnson and D. A. Maltz, "Dynamic source routing in ad-hoc wireless networks," in Mobile Computing ed T.Imielinski and H.korth, pp. 153–181, Kluwer Academic Publishers, 1996.

[6] C. E. Perkins and E. Royer, "Ad-hoc on-demand distance vector routing," in Proceedings of the 2nd IEEE Workshop on Mobile Computing System and Application, (New Orleans LA), pp. 90–100, IEEE, Feb. 1999.

[7] Z. J. Haas, M. R. Pearlman, and P. Samar, "The zone routing protocol (zrp) for ad hoc networks," Internet Draft, July 2002.

[8] M. Joa-Ng and I.-T. Lu, "A peer-to-peer zone-based two-level link state routing for mobile ad hoc networks,"IEEE Journal on selected Areas in Communication,vol. 17, pp. 1415–1425, Aug. 1999.

[9] R.Sivakumar, P.Sinha and V.Bharghavan," Core Extraction Distributed Adhoc Routing (CEDAR) specification", Internet Draft draft-ietf-manet-cedar-spec-00.txt, Sept, 1998.