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AN OVERVIEW OF ADHOC NETWORK ROUTING PROTOCOLS

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Abstract:

Ad hoc Networks neither have centralized control nor specific infrastructure. These types of networks have become very popular in last few years and a number of studies are being done to investigate and propose an optimized routing protocol. This paper describes Wireless ad-hoc network and comparative study on routing protocols. As these type of networks are used when no infrastructure is available. There is also focus on MANET (Mobile Ad Hoc Networks) and various routing protocols used in MANET. We have included a brief description of VANET (Vehicular Ad Hoc Networks) and comparison between various MANET routing protocols.

Keywords: VANET, Routing protocols, WiFi, MANET.

Introduction

Wireless ad-hoc networks typically consist of a large number of spatially dispersed nodes. Each node can communicate with any other nod over the wireless channel. Thus, these nodes can cooperate to transmit and receive information via joint encoding, relaying, and joint decoding. Each nodes participating in the network, act both as a host and a router. When two users want to communicate without any form of centralized administration Ad-hoc network is mainly used. Ad-hoc network is having dynamic topology, nodes can change there position frequently using specific protocols which adapt topology changes easily. A Mobile Ad-hoc Network (MANET) is a selfconfiguring network of mobile devices connected by wireless links. In MANET each device is free to move independently in any direction, and will therefore change its links to other devices frequently. Vehicular Ad Hoc Networks (VANETs) is a type of MANET and used for communication among vehicles and between vehicles and roadside equipment.

Wireless Ad-hoc Network

In wireless ad-hoc network nodes are having wireless interface and communicate each other over radio or infrared. Laptop computer is an example of such network. Wireless ad-hoc

network has an advantage over wired network that no physical cabling is required between two nodes. There are many usages, characteristics and routing in a wireless ad-hoc network as explained in following paragraphs**.**

Usage

There are many usage of wireless ad-hoc network. In some areas where no internet facility, an ad-hoc network can be used for wireless mobile hosts. An ad-hoc network also helpful for business associates who want to share in airport terminal, or class of students needing to interact during lecture. Ad hoc networks are very useful in emergency search-and-rescue operations, meetings or conventions in which persons wish to quickly share information, and data acquisition operations in inhospitable terrain.

Characteristics

An ad-hoc network is having dynamic topology means various nodes change there physical location by moving around. For this an ad-hoc network requires some routing protocols which helps nodes to decide proper routes. In an ad-hoc network the power usage is minimum because of very limited bandwidth and limited capacity of CPU.

Routing

Routing is mainly used to provide routes to the packet from source to destination. Routing rotocols are required to send packets from source to destination. Main function of these protocols is to decide routes for packet to send it at proper destination. A source routing is used to provide proper path to the packet. In this routing the each packet must carry its path that packet should take through the network, means source decides the path. Flooding is also used to transfer information from origin node to neighbor node and so on, until the packet has reached to all nodes in network. Routing protocols in an ad-hoc network is classified in to different categories as:

a) Centralized Vs Distributed.
b) Reactive Vs Proactive.
c) Static Vs Adaptive.

Properties of Routing Protocols in Ad-Hoc Network:

The following properties of routing protocols are desirable in an ad-hoc network:

- To avoid waste of CPU consumption and Bandwidth routing protocol should be Loop-free.
- To improve routing protocol performance there should be unidirectional link support between nodes.
- Routing protocol should not be dependent on centralized controlling node; it should be distributed in nature so that the node in network can enter/leave the network at any time.

- To ensure desired behavior from routing protocol authentication and encryption of data is required for security purposes.
- Congestion can be avoided by providing multiple routes within network.
- For real time-time traffic support some sort of quality of service support is required.

MANET

Mobile Ad- hoc Network (MANET) is a kind of wireless ad hoc network that usually has a routable networking environment on top of a Link Layer ad hoc network. They are also a type of mesh network, but many mesh networks are not mobile or not wireless. The MANET becomes a popular research topic since the mid to late 1990s because of growth of laptops and 802.11/Wi-Fi wireless networking. Practical use of MANET is one laptop per child program has developed a laptop making use of an IEEE 802.11 based ad hoc wireless mesh net working chip. So in MANET topology changes frequently, no cellular infrastructure is required and multi-hop wireless links are used. All data must be routed via intermediate nodes.

- Vehicular Ad-Hoc Networks (VANETs) are used for communication among vehicles and between vehicles and road side equipment.
- Intelligent Vehicular Ad-Hoc Networks (IVANETs) are a kind of artificial intelligence that helps vehicles to behave in intelligent manners during vehicle-to-vehicle collisions, accidents, drunken driving etc.
- Internet Based Mobile Ad-hoc Networks (IMANET) are ad-hoc networks that link mobile nodes and fixed Internet-gateway nodes. In such type of networks normal ad-hoc routing algorithms don't apply directly.

Routing protocols plays an important role in MANET. These routing protocols can be divided into two categories: table-driven and on-demand routing based on when and how the routes are discovered. In table driven routing protocols up-to-date routing information to all nodes is maintained at each node whereas in on-demand routing the routes are created only when desired by the source host. In table driven protocol when the network topology changes the nodes propagate update messages throughout the network in order to maintain a consistent and up-to-date routing information about the whole network. These routing protocols differ in the method by which the topology change information is distributed across the network and the number of necessary routing-related tables. There are various types of routing protocols in table driven routing protocols.

The wireless Routing Protocols

Each node in the network maintains a Distance table, a Routing table, a Link-Cost table and a Message Retransmission list. The Distance table of a node x contains the distance of each destination node y via each neighbor z of x. It also contains the downstream neighbor of z through which this path is realized. The Routing table of node x contains the distance of each destination node y from node x, the predecessor and the successor of node x on this path. It also contains a tag to identify if the entry is a simple path, a loop. Storing predecessor and successor in the table is beneficial in detecting loops and avoiding counting-to-infinity problems. The Link-Cost table contains cost of link to each neighbor of the node and the

number of timeouts since an error-free message was received from that neighbor. The Message Retransmission List (MRL) contains information to let a node know which of its neighbor has not acknowledged its update message and to retransmit update message to that neighbor. Nodes exchange routing tables with their neighbors using update messages periodically as well as on link changes. The nodes present on the response list of update message are required to acknowledge the receipt of update message. If there is no change in routing table since last update, the node is required to send an idle Hello message to ensure connectivity. On receiving an update message, the node modifies its distance table and looks for better paths using new information. Any new path so found is relayed back to the original nodes so that they can update their tables. On receiving an ACK, the mode updates its MRL. A unique feature of this algorithm is that it checks the consistency of all its neighbors every time it detects a change in link of any of its neighbors. Consistency check in this manner helps eliminate looping situations in a better way and also has fast convergence.

Global State Routing

It takes the idea of link state routing but improves it by avoiding flooding of routing messages. In this algorithm, each node maintains a Neighbor list, a Topology table, a Next Hop table and a Distance table. Neighbor list of a node contains the list of its neighbors (here all nodes that can be heard by a node are assumed to be its neighbors). For each destination node, the Topology table contains the link state information as reported by the destination and the time stamp of the information. For each destination, the Next Hop table contains the next hop to which the packets for this destination must be forwarded. The Distance table contains the shortest distance to each destination node. The routing messages are generated on a link change as in link state protocols. On receiving a routing message, the node updates its Topology table if the sequence number of the message is newer than the sequence number stored in the table. After this the node reconstructs its routing table and broadcasts the information to its neighbors.

On Demand Routing Protocols

These protocols take a lazy approach to routing. In contrast to table-driven routing protocols all up-to-date routes are not maintained at every node, instead the routes are created as and when required. When a source wants to send to a destination, it invokes the route discovery mechanisms to find the path to the destination. The route remains valid till the destination is reachable or until the route is no longer needed. This section discusses a few on-demand routing protocols.

Ad-hoc On-demand Distance Vector Routing (AODV)

It minimizes the number of broadcasts by creating routes on-demand that maintains the list of all the routes. To find a path to the destination, the source broadcasts a route request packet. The neighbors in turn broadcast the packet to their neighbors till it reaches an intermediate node that has recent route information about the destination. A node discards a route request packet that it has already seen. The route request packet uses sequence numbers to ensure that the routes are loop free and to make sure that if the intermediate nodes reply to route requests, they reply with the latest information only. When a node forwards a route request packet to its neighbors, it also records in its tables the node from which the first copy of

the request came. This information is used to construct the reverse path for the route reply packet. AODV uses only symmetric links because the route reply packet follows the reverse path of route request packet. As the route reply packet traverses back to the source, the nodes along the path enter the forward route into their tables. If the source moves then it can reinitiate route discovery to the destination. If one of the intermediate nodes move then the moved nodes neighbor realizes the link failure and sends a link route discovery if needed.

Vehicular Ad-hoc Networks (VANET)

It is a subclass of Mobile ad hoc networks which provides a distinguish approach for intelligent transport system (ITS). The survey of routing protocols in VANET is important and necessary issue for smart ITS. It provides communication among vehicles and roadside equipment. The main goal of VANET is providing safety and comfort for passengers. Each vehicle equipped with VANET device will be a node in the Ad-hoc network and can receive & relay other messages through the wireless network. Collision warning, Road signal arms and in place traffic view will give the driver essential tool to decide the best path along the way. VANET or Intelligent Vehicular Ad-Hoc Networking provides an intelligent way of using vehicular networking .VANET integrates multiple Ad-Hoc networking technologies such as WiFi IEEE 802.11 b/g, WiMAX 802.16, Bluetooth, and ZigBee for easy accurate effective and simple communication between vehicles on dynamic mobility. VANET helps in defining safety measures in vehicles, streaming communication between vehicles. With the sharp increase of vehicles on roads in the recent years, driving becomes more challenging and dangerous. Roads are saturated; safety distance and reasonable speeds are hardly respected. The leading car manufacturer decided to jointly work with govt. agencies to develop solution aimed at helping drivers on the roads by anticipating hazardous events or bad traffic areas. One of the outcomes has been a novel type of wireless access called wireless access for vehicular environment (WAVE) used for vehicle to vehicle and vehicle to road side communication. VANET integrates multiple Ad-Hoc. The architecture of VANET consists of three categories: Pure cellular/WLAN, Pure Ad hoc and hybrid. VANET may use fixed cellular gateways and WLAN/WiMax access points at traffic intersections to connect to the Internet, gather traffic information or for routing purposes. This network architecture is pure cellular or WLAN. VANET can compile both cellular network and WLAN to form the network VANET can compile both cellular network and WLAN to form the network. If at any hop there are no nodes in the direction of destination then GPSR utilizes a recovery strategy known as perimeter mode. The perimeter mode has two components one is distributed planarization algorithm that makes local conversion of connectivity graph into planar graph by removing redundant edges. Second component is online routing algorithm that operates on planer graphs. So in VANET perimeter mode of GPSR is used. In GPSR if any obstruction or void occurs then algorithm enter perimeter mode and planner graph routing algorithm start operations, it involves sending the message to intermediate neighbor instead of sending to farthest node, but this method introduces long delays due to greater no. of hop counts. Numbers of routing protocols are designed in VANET. A major challenge in protocol design in VANET is to improve reliability of Protocols and to reduce delivery delay time and the number of packet retransmission.

Conclusion

This paper describes Wireless ad-hoc network and comparative study on routing protocols. As these type of networks are used when no infrastructure is available. There is also focus on MANET (Mobile Ad Hoc Networks) and various routing protocols used in MANET. We have included a brief description of VANET (Vehicular Ad Hoc Networks) and comparison between various MANET routing protocols. This paper includes advantages of wireless ad-hoc network compared to the wired network. We have also described MANET which have frequently varying topology and information is transmitted through various nodes. In this paper we have limited our discussion on two categories of routing protocols i.e. table information to all the nodes in the network whereas in on-demand protocols a node finds the route to a destination when it desires to send packets to the destination. This paper also shows that how VANET is helpful to avoid accident in heavy traffic conditions. Authors are working on simulation of Mobile Ad hoc Network routing protocols using Network Simulator NS-2 to find efficient and effective routing protocols for MANET.

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