ISSN:0975-9646

Vibhoo Sachan et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 6 (3) , 2015, 2541-2544

A Survey on IP Address Assignment in a Mobile Ad Hoc Network

Vibhoo Sachan
M-Tech (Final Year)
Computer SC.& ENGG. KNIT
Sultanpur

Samir Srivastava
Associate Professor
Computer sc. &engg. Deptt. KNIT
Sultanpur (U.P) India

Dr. P.K.Singh
Associate Professor
Computer sc.& engg. Deptt.
Mmmut Gorakhpur (U.P) India

***Abstract*—A Mobile Ad hoc Network (MANET) is an infrastructure-less, continuously self-configuring and temporary multi-hop wireless network, which is consisting of mobile nodes or group of mobile nodes. The topologies of the network can changes frequently due to unpredictable mobility of nodes. Ip addressing protocol is to automatically assign a unique network address to an un-configured node in the network so that it can communicate with the other un-configured nodes in the network via multi-hop wireless links. In order to allow continuously and infrastructure-less networking, a protocol is needed for dynamically assign Ip addresses to un-configured nodes, because pre-configuration of addresses is not possible due to unpredictable mobility of nodes and every node must configure its network interface with a unique address in order to communicate with other nodes so that the packets can be relayed hop by hop and delivered to the destination. Ip address assignment in mobile ad hoc network is a challenging task. In recent years, various Ip addressing protocols have been proposed in the literature to solve this problem.**

***Keywords*—mobile ad hoc network, auto-configuration, spanning tree, variable length address, address allocation, duplicate address detection**

I. INTRODUCTION

A mobile ad hoc network (MANET) is an autonomous self-organizing independent wireless mobile nodes or groups of Mobile nodes, which is infrastructure-less and spontaneously form an Ip-based network. The addresses are allocated by the nodes and each node functions as an end host and a wire-less relay. Automatic address allocation by nodes, increases the speed of auto-configuring a new node or a new network as minimal infrastructure is required. Ip address assignment in MANETs is an unresolved and challenging issue due to random mobility of nodes or networks, in which the nodes frequently changes their position or leaves the current network and join another network. It means a node requires new unique Ip address to join new network. Nodes are free to move in any direction in MANETs and consists of peer-to-peer self-forming network which has routable networking environment on the top of a link layer ad hoc network. In this type of network, a route between any two hosts may consist of multiple hops through one or more nodes. So mobile nodes are acts as router which forwards the packets to the correct destination node. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic.

In general, ip addressing protocols proposed for mobile ad hoc networks can be classified into three categories, approaches, stateless approaches and hybrid approaches. A stateful approach [24] assumes the existence of a central entity to keep an address allocation table for whole network, thus the network has to maintain state information about already used and/or free addresses and assigns unique address for un-configured node. However, when two or more subnet merges, it is highly difficult to synchronize multiple central entities. Stateless approaches do not have a central entity to maintain an address allocation table. Instead of having central entity, each node have the same address pool which means they must maintain global allocation state information and selects an address by itself and verifies its uniqueness with the duplicate address detection (DAD) [11] procedure. If duplication is detected, at least one of the nodes with duplicate addresses must change its address. Hybrid approaches combine both stateful and stateless approaches by maintaining an address allocation [2] table and performing a duplicate address detection (DAD), which can increase the robustness, but may result in higher complexity and higher protocol overhead.

Variable addressing scheme: In mobile ad hoc networks, pre-configuration is not always possible. So, an auto-configuration protocol is required to provide allocation of node's address dynamically. Recent ad hoc routing architectures use flat addressing which uses fixed length for addressing each node. The overhead in control packets of source routing is reduced highly with variable addressing scheme. This routing address length is variable, but remains same for all the nodes in the network at one point of time. This technique allocates addresses in such a way that nearby nodes have same prefixes, thereby helping the routing protocols [1] to make use of the location information of nodes from their addresses.

II. BACKGROUND

In this section, we describe the traditional address allocation schemes [2] and explain why they cannot be directly applied in MANETs. The address allocation schemes can be in general classified into stateful schemes or stateless schemes. The stateful schemes keep state information in a database that keeps track of which addresses have been assigned to which computers; while the stateless schemes allows the computers to select an address by themselves and perform a procedure, called Duplicate Address Detection (DAD).

III. REQUIREMENTS

(i) A protocol for IP addresses assignment should meet the following requirements: The protocol should make sure that only authorized nodes are entered and configured into network resources.
(ii) There should not be any conflict in IP address assignment, i.e., at any given point of time no two or more nodes with the same IP address.
(iii) When an IP is assigned, it means the node is inside the network. When the node leaves the network, its IP address should become free for assignment to other requesting nodes.
(iv) Protocol should handle network partitioning and merging. When two different partitions merge, then there is a possibility that two or more nodes have the same IP address. Such duplicate addresses should be detected and resolved.

IV. EXISTING IP PROTOCOLS

4.1. Best Effort Allocation

4.1.1. Prophet Scheme [14]: A conflict free distributed address configuration scheme named Prophet Address Allocation using a function f (n) that produces a series of random numbers for address allocation. The first node generates a random number and sets its IP address. It also uses a random state value as the seed for its f (n). Another node can get an IP address from node A along with a state value as the seed for its f (n). Whenever a node joins the MANET, the same process continues for the address allocation. Prophet address allocation outperforms the others in terms of communication overhead (i.e., the total number of control packets generated to ensure the uniqueness of a new IP address) and latency (i.e., the time needed to generate a unique IP address). Thus, prophet address allocation has better scalability that the other schemes.

4.1.2. Weak Dad [11]: This mechanism is used for the purpose of detecting address duplication during ad hoc routing and prevents a packet from being routed to a wrong destination. In this technique a unique key for each node is included in the routing control packets and in the routing table entries. When mobile node receives a routing control packet, it compares pair of address and key contained in the packet with those in the routing table.

4.1.3. Passive DAD [12]: in this mechanism each node uses periodic link state routing information to notify other nodes about their neighbors. It is usually very costly and will result higher redundancy and collision.

4.2. Leader Based Allocation

4.2.1. DHCP (Dynamic Host Configuration Protocol) [8]: DHCP is the first mechanism proposed for dynamically assigning IP addresses. which is based on a client/server architecture .DHCP has a central entity, the DHCP server, is responsible for assigning IPs for requesting nodes and maintaining the state for each address of the available address range, thus address duplication is totally avoided. DHCP is widely used in Ethernets and Wireless LANs.

4.2.2. DACP [15] (Dynamic Address Configuration Protocol): This mechanism is used to ensure duplicate address detection while minimizing the participation of network nodes. In DACP, the leader is an elected Address Authority (AA) that maintains the state information of the network, such as the node addresses, as well as their lease lifetime and a unique network identifier. The main drawback of this protocol is due to DAD that causes high overhead.

4.2.3. ODACP (Optimized DACP) [10]: To overcome the overhead caused by DACP, this is introduced without DAD [11].ODACP is in such a manner, that if the node receives a registration confirmation message after it already requested a new IP address, the new node will use the IP address contained in the reply message and skip the waiting for the new registration request (that means, the new node ignores all new incoming registration responses).

4.3. Decentralized Allocation [10]

4.3.1. MANETCONF [18]: It is an "Agent Based Addressing" where only one node is responsible for assigning addresses and maintaining the allocation table, Manetconf prevents concurrent assignment of the same address by maintaining an additional allocation table for pending allocations. Thus, the synchronization of these distributed tables constitutes the most critical and complex task of this protocol. The main advantage is that it has low communication overhead.

4.3.2. AAA (AD-HOC ADDRESS AUTO-CONFIGURATION) [19]: addresses are randomly selected from the address range 169.254/16. Duplicate address detection (DAD) is performed by each node to guarantee the uniqueness of the selected address. During this process, a node floods an Address Request message in the network to query for the usage of its tentative address. If the address is already in use, an Address Reply message is unicast back to the requesting node so that a different address can be selected. The absence of an Address Reply indicates the availability of the requested address.

4.3.3. PRIME DHCP [20]: It can allocate addresses to the hosts without broadcasting over the whole MANET. The concept of DHCP proxies and the prime numbering address allocation algorithm (PNAA) together eliminate the needs for broadcasting in the MANET. It can significantly reduce the signal overhead and the latency

4.3.4. AIPAC (AUTOMATIC IP ADDRESS CONFIGURATION) [21]: This protocol assigns unique IP address to each node of wide and very dynamic ad hoc networks. The main purpose is to watch over the bounded resources of devices in the ad hoc network. This protocol manages possible duplicate addresses due to the mobility of nodes in the network. It avoids the storage of large amounts of data and makes use of procedures that minimize the number of exchanged packets. It avoids overloading nodes and communication channels whenever two networks merge.

4.3.5. SECURE HOST AUTO CONFOGURATION SCHEME [28]: The scheme employs that a node has to answer a question to prove its identity. It uses the buddy system technique to allocate the IP addresses each node maintains a block of free addresses. A configured node which receives an Address Request from a new node, assigns the requesting node an IP address from its block of free addresses. It divides its block of free addresses into two equal parts and gives one half to the requesting node and the other half it keeps with itself for future use.

4.3.6. MMIP (MAC Mapped IP) [4]: This protocol proposes to map the MAC addresses of the nodes along with the IP addresses which are assigned at the time when a node enters the network. Performance analysis shows that this addressing scheme has less addressing latency and control overhead compared to the similar existing protocols.

4.3.7. ADIP [7]: This protocol utilizes nodes in the network as proxies and can generate IP addresses from its own IP for a new authenticated host. The address configuration [3] authentication is done with the help of trusted third party and as such capable of handling the security threats associated with a general dynamic IP configuration.

4.3.8. IDDIP Algorithm [6]: In this scheme, an ID based dynamic IP configuration scheme has been presented that can securely allocate IP addresses to the authorized hosts for a mobile ad hoc network without broadcasting over the entire network. Each host in the MANET can generate a unique IP address from its own IP address for a new host. Most important is no DAD mechanism [11] is used here. This scheme provides authentication for address configuration [3]without the help of a trusted third party while taking care of the security threats associated with dynamic IP configuration. The main advantage of this scheme is to solve the problem of network partitions and mergers along with the arrival and departure of a host efficiently and securely.

4.3.9. IDSDDIP Algorithm [13]: This scheme is similar to IDDIP but has been proposed for IPv6 named as ID based secure distributed dynamic IP configuration. In this scheme, each host in the MANET can generate a unique IP address for a new authorized host. It generates node ID as a node identifier which is evaluated using its public key and a secure one way hash function for node authentication purpose. This scheme can handle the problem that may arise due to host failures, message losses, mobility of the host and network portioning or merging.

VI. CONCLUSION

This report has been worked out with all possible dynamic address allocation mechanisms considering the duplicate address detection mechanism and also tried investigating the problems of dynamic addressing in a mobile ad hoc network. Short descriptions of basic addressing schemes have been given to help have an overview of this field in MANET. We also studied the current solutions by categorizing and qualitatively analyzing latency and other performance properties of the approaches.

REFERENCES

[1] C. Perkins, E. Belding-Royer, S. Das, Ad hoc On-demand Distance Vector (AODV) Routing, Draft-ietf-manet-aodv-11.txt, June 2002.

[2] Address Allocation Mechanisms for Mobile Ad Hoc Networks, Xiaowen Chu, Jiangchuan Liu, and Yi Sun, S. Misra, Guide to Wireless Ad Hoc Networks, Computer Communications and Networks, DOI 10.1007/978-1-84800-328-6_14,_ Springer-Verlag London Limited 2009.

[3] Address configuration in MANET, Mobility in TCP/IP, Spring 2006, Hai Nguyen Thi Van, hainguyen@tsc.upc.edu.

[4] U. Ghosh, R. Datta, Mmip: a new dynamic ip configuration scheme with mac address mapping for Mobile Ad Hoc Networks, in: Proceedings Fifteenth National Conference on Communications 2009, (IIT Guwahati, India), January 2009.

[5] Ip Address Assignment In A Mobile Ad Hoc Network, Mansoor Mohsin and Ravi Prakash,The University of Texas at Dallas, Richardson, TX, MILCOM 2002

[6] A secure dynamic IP configuration scheme for mobile ad hoc networks, Uttam Ghosh , Raja Datta, journal homepage: www.elsevier.com/locate/adhoc, Vol 9,February 2011.

[7] U. Ghosh, R. Datta, Adip: an improved authenticated dynamic ip configuration scheme for Mobile Ad Hoc Networks, Int. J. Ultra Wideband Commun. Syst. 1 (2) (2009) 102–117.

[8] R. Droms, Dynamic Host Configuration Protocol, RFC 2131, March 1997.

[9] P. Wang, D.S. Reeves, P. Ning, Secure address auto-configuration for Mobile Ad Hoc Networks, in Proceedings of 2nd Annual International Conference MobiQuitous, 2005.

[10] Y. Sun, E.M. Belding-Royer, A study of dynamic addressing techniques in Mobile Ad Hoc Networks, Wireless Communications and Mobile Computing (April) (2004).

[11] N.H. Vaidya, Weak duplicate address detection in Mobile Ad Hoc Networks, Proc. ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc02), June 2002, pp. 206–216.

[12] K. Weniger, Passive duplicate address detection in Mobile Ad Hoc Networks, in WCNC, (Florence, Italy), February 2003.

[13] U. Ghosh, R. Datta : An ID based secure distributed dynamic IP configuration scheme for mobile ad hoc networks ICDCN'12 Proceedings of the 13th international conference on Distributed Computing and Networking, Pages 295-308 , Springer-Verlag Berlin, Heidelberg ©2012

[14] H. Zhou, L.M. Ni, M.W. Mutka, Prophet address allocation for large scale manets, INFOCOM, 2003, pp. 1304–1311.

[15] Y. Sun, E.M. Belding-Royer, Dynamic address configuration in Mobile Ad Hoc Networks, UCSB Tech. Rep., June 2003, pp. 2003–2011.

[16] M. Taghiloo, M. Dehghan, J. Taghiloo, M. Fazio, New approach for address auto-configuration in manet based on virtual address space mapping (vasm), in: International Conference on Information and Communication Technologies: from Theory to Applications (IEEE ICTTA 2008), Damascus, Syria, 7–11 April 2008.

[17] M. Tajamolian, M. Taghiloo, M. Tajamolian, Lightweight secure ip address auto-configuration based on vasm, in: 2009 International Conference on Advanced Information Networking and Applications Workshops, Waina 2009, pp. 176–180.

[18] S. Nesargi, R. Prakash, Manetconf: Configuration of hosts in a Mobile Ad Hoc Network, INFOCOM, 2002, pp. 1059–1068.

[19] C.E. Perkins, J.T. Malinen, R. Wakikawa, E.M. Belding-Royer, Y. Sun ,Ad hoc address autoconfiguration, IETF Internet Draft, vol. draft-ietfmanet- autoconf-01.txt, 2001.

[20] Y. Hsu, C. Tseng, Prime dhcp: a prime numbering address allocation mechanism for manets, in: IEEE Communicatons, August 2005.

[21] M. Fazio, M. Villari, A. Puliafito, Aipac: automatic ip address configuration in Mobile Ad Hoc Networks, Performance Evaluation of Wireless Networks and Communications Computer Communications 29 (8) (2006) 1189–1200.

[22] R. Finlayson, T. Mann, J. Mogul, and M. Theimer. A reverse address resolution protocol.RFC 903, June 1984.

[23] B. Croft, and J. Gilmore. BOOTSTRAP PROTOCOL (BOOTP). RFC 951, September 1985.

[24] S. Thomson, and T. Norten. Ipv6 stateless address autoconfiguration. RFC 2462, December 1998.

[25] B. Aboba, S. Cheshire, and E. Guttman. Dynamic configuration of ipv4 link-local addresses. In IETF Internet draft, July 2004, Work in Progress, http://files.zeroconf.org/draft-ietf-zeroconfipv4-linklocal.txt, July 2004.

[26] DuplicateMACAddresses on Cisco 3600 Series, http://www.cisco.com/warp/public/770/7.html, 1997.

[27] Zhihua Hu & Baochun Li., "ZAL: Zero-Maintenance Address Allocation in mobile Wireless Ad Hoc Networks," Pro-ceedings of 25th ICDCS 2005, pp 103-112, Columbus, Ohio, June 6-9, 2005.

[28] A. Cavalli, J. Orset, Secure hosts auto-configuration in Mobile Ad Hoc Networks, Data Communication and Topology Control in Ad Hoc Networks Ad Hoc Networks 3 (5) (2005) 656–667.

[29] X. Chu, Y. Sun, K. Xu, Z. Sakander, J. Liu, Quadratic residue based address allocation for Mobile Ad Hoc Networks, in:Communications, 2008. ICC '08. IEEE International Conference on, 2008.