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A Survey of Protocol Classifications and Presenting a New Classification of Routing protocol in ad-hoc

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Abstract

Many Researchers are researching in the field of Wireless Networks around the world. The results of these researches are the annual production of several new protocols and standards. Since the field is divided into several sub- categories so, each new protocol is presented must place in this sub-categories based on its own structure. Many researchers proposed new ideas in the field of protocol classifications that they seem appropriate categories in the last few years. According to the expand area of wireless network research and studies on intelligent methods right now and classifications are inefficient and need to be designed a new classification. One of the most fundamental problems in this area is the lack of a comprehensive structure classification to accommodate the new intelligent protocol. In this paper, we are going to compare different protocols and available classifications, presenting a new classification by modeling from Mendeleev table where protocols can be classified in one of the branches of the tree, and allocate a unique code in the world.

Keywords: *Mobile ad-hoc network; Unintelligent routing protocols; Modern classification.*

1. INTRODUCTION

Mobile network is the network in which the relative situation of its constituent nodes is varying. The routing protocol must manage the node mobility and transfer the parcel to target accurately so that communication sides is not informed about the mobility in network nodes. One of the mobile wireless networks, which it has been recently paid attention [1], is ad-hoc network consisting of mobile nodes while it does not use any control center in routing its packets. These networks are applied in specific situation in which centrality, wire support is impossible to provide, or it is not economical to use ordinary systems such as scientific conferences, military communications, or saving the wounded in the natural disasters. By testing the protocols used for wired networks, researchers concluded that they are suitable for these networks .In these protocols, due to the mobility in network, a lot of routing overloading is created which it will be problematic because of limited sources of these networks. Using these protocols in routing made formation of loops. To solve these problems, some protocols were designed for ad-hoc networks. Regarding the properties of ad-hoc networks, due to variable structure the limitation of wireless communication bandwidth, limited energy of nodes, each of the designed protocols is confronted with problems. In this paper, we review different unintelligent routing protocols in mobile ad-hoc networks, which include routing algorithm based on network structure in terms of on-demand and on table-driven routing according to new classification. First, we explain different protocols briefly and compare them in terms of various parameters. The paper is organized as the follow: in section II, we review related works and in part, (*A*) we analyze unintelligent protocols based on network structure or on routing table. In part, (*B*) we pay attention to unintelligent protocols based on routing table and in part, (C) we pay attention to unintelligent protocols based on network structure in terms of hybrid methods. In section III, we introduce a new method in classifying routing protocols. Conclusion and further works are at the last section.

2. REVIEWING PREVIOUS WORKS AND OFFERING A COMPARATIVE TABLE FOR EACH GROUP

2.1. Investigation and analysis of unintelligent protocols based on network structure in terms of on-deman

Routing protocol of DSR [3] is a protocol in terms of on-demand that uses source routing in the algorithm that each packet contains complete information of routing. Therefore, each node is aware of information about its own neighbors. In DSR protocol, each node uses the technology of route storing to support route information that reduces routing overload. This algorithm provides the shortest path available for the enquirer.

TABLE 1. ON-DEMAND ROUTING PROTOCOLS

property / Protocol	Update destination	Update period	Structure	Route computation	Multicast capability	Hello message requirement	Route metric	Unidirectional link	Loop free	Broadcasting of route request	Overhead	Route recovery	Aware of distance between node	Usage Algorithm	Distributed
AODV [15]	Source node	Based on occurrence	flat	on demand	yes	yes	Shortest and fastest path	no	no	Network Wide broadcasting	high	Start repair at failure point	yes	DV	yes
TORA [4,5]	Neighbor nodes	Based on occurrence	flat	on demand	no	no	Shortest path	yes	yes	N/A	high	N/A	no	N/A	yes
ABR [7]	Source node	Periodically & Based on occurrence	flat	on demand	no	yes	Participate in routing	no	maybe	Network wide broadcasting	high	Start repair at failure point	yes	N/A	yes
ACOR [7]	Neighbor nodes	periodically	flat	on demand	N/A	yes	QOS	no	maybe	Network wide broadcasting	low	rediscovery	N/A	N/A	N/A
DSR [3]	Source node	Based on occurrence	flat	on demand (Reactive)	no	no	Shortest path	yes	yes	Network Wide broadcasting	low	N/A	no	DV	yes
DYMO [11]	Neighbor nodes	periodically	flat	on demand	no	no	improvement of convergence	no	no	Network wide broadcasting	low	rediscovery	no	N/A	yes

Routing protocol of TORA [4,5] is an on-demand protocol in terms of bi-directional links that increases the transmission of packet numbers along the path thereby increasing the overload in this protocol. TORA has found the ability to be used in ad-hoc networks with high densities by modifying the method of using bi-directional links.

ABR routing protocol [7] is an on-demand protocol in terms of source routing, which does not keep and store routing information of nodes while founded or relatively stable paths. (I.e. the paths are valid for a certain time in which nodes are without movement). In this protocol, the chosen path is the most stable although there is the possibility of unexpected movement of nodes that the reconstruction trend of path will be started of course, the path may not be reconstructed, and the source is forced to start discovering from onset. This protocol has a flat structure and uses HELLO messages periodically, which increases overload. Therefore, this protocol is not suitable for high dense and great mobile networks but it is suggested for networks in which lifetime is a priority as it produces paths of lifetime.

ACOR routing protocol [8] is based on demand and uses a flat structure. The main aim is to improve the quality of routing that is using QOS parameters. It does not use network sources in unnecessary occasions and starts to discover the path when it is necessary. The response time to the path request is great in this protocol but ACOR improves end-to-end delay parameter to solve the problem. Network lifetime increases by the protocol that makes it suitable for large networks with high density.

DYMO routing protocol [11] with a flat structure is the main aim of which is to improve the convergence in network that prevents from loop and count to infinity problems in routing. DYMO protocol uses discover and storage processes. With the breaking of each path, the discovery process is started again. This protocol does not use periodical messages of HELLO, which result in the reduction of routing overload thereby meeting the requirements of high dense networks.

AODV Routing protocol [15] is a reactive protocol, which needs the support of routing information about active paths. This protocol uses some tables to restore the path information. The number of route request exchanges of message and request response is great. As the diffusion of these messages is performed through distribution, there are extra messages produced which reduces the node battery power. Bandwidth and network efficiency is the reason if message redundancy. At present, this protocol is the best and commonest.

2.2. analysis of structure based on unintelligent protocols and routing table

DSDV routing protocol [2] is a table-driven protocol which is not suitable for high dense and great mobile ad-hoc networks due to creation of large overload in the situation of

vast mobility in nodes , unreasonable use of network resources to keep un used information, of course , DSDV protocol could reduce routing overload by using two different partial and whole updating. The main aim of this protocol is to remove the loop problem and count to infinity that most table-driven protocols suffer.

OLSR routing protocol [6] is a table-driven protocol that has improved the classic bind state route –finding algorithm in which every node distributes all route information to its own neighbors, while OLSR sends the information to a selected node named MPR that, reduces the number of updates and overload remarkably. This is ineffective for high dense and vast movable ad-hoc networks due to dependency on routing tables.

IARP routing protocol [9] is a table-driven protocol with hierarchical structure that supports the routes immediately. It does not periodic messages of Hello that helps to reduce the overload while functioning on the shortest route and route repair. The main aim of this protocol is to meet routing requirement without any attention to network resources and overload. It cannot be suitable for networks with limited energy resources.

FSR routing protocol [13] is a table-driven protocol based on link-state algorithm that exploits a mechanism similar to fisheye's that makes the nearest node and/or the most qualified route in priority. Therefore, the accuracy of routing information in this protocol is dependent on the distance to destination, which could decrease the network overload due to information exchange with nearest nodes frequently. FSR is a better performance compared with other protocols with link-state algorithms, as it does not try to obtain information about all available nodes.

TBRPF routing protocol [14] is a table-driven protocol with link-state algorithm, which provides the shortest route by hop-by-hop routing method. Each node has a table, which keeps the information of all accessible nodes. It uses periodic messages of Hello to discover and supervise the route but the number of Hello messages is fewer than usual. It aims at successful routing and uses the network suitably, which makes it usable in ad-hoc networks.

2.3. analysis of Hybrid structure based on unintelligent protocols

ZRP routing protocol [10] is a Hybrid protocol that uses on-demand method in intra zone routing and table –driven methods in inter zone routing. This will reduce control in table-driven method and recession (The response time of route request) in on-demand method. The network is divided in to routing zones according to the distance between the mobile nodes. ZPR protocol has considered different routing methods to find the routes inter zone and intra zone that can provide the shortest and best route. In addition, in this protocol the overload is low which makes it suitable for high dense network in which routing quality is in priority.

CBRP is a Hybrid protocol [12] that uses meshing. In this protocol, each node must support its own neighbor table and contains the information required for all cluster members. This protocol provides the fastest and shortest route while its biggest problem is using network resources unnecessarily. The overload is high in this protocol due to using route-finding table and distributing Hello messages periodically. It is suitable for high dense networks because the network never fails to work.

3. A NEW METHOD TO CLASSIFY ROUTING PROTOCOLS

In this paper, we present a comprehensive classification for routing protocol, which covers all-important items of expand routing.

A new classification offered in [21], the important factors are the main problems, which does not consider. For example, learner automata based intelligent algorithm [23], which pays attention to routing error tolerability, cannot be placed in it. In [22], the classification is introduced with only one factor of situation of services, which limited. In [24] a relatively more comprehensive classification, which again does not consider any place for intelligent algorithms [25], shows only a classification for mobile models. There are also other classifications in [16-20].

All these support the idea that researchers have sought to find a classification to cover their preferred algorithm. In our proposed method, we consider a tree the root of which is routing. The root has two main elements being weighed 1 or 0 based on being intelligent or unintelligent respectively. One of the important aims of designing and allocating code to its elements is that the algorithm located at the subset of the last leaf will have a specific code after being surveyed and the order of placing each algorithm is based on the publishing year and the importance while the algorithm codes start from 1.

The left side element (unintelligent) is consisted of two position-based and topology-based subsets position-based part has two types of subset of aware and unaware parts. The topology-based part is divided in to Topology-aware and Topology-unaware parts. We have classified the former part in to flat and hierarchical parts and the latter in to four distinct parts. The right side element (intelligent) contains four subsets, which the researchers have used to make the algorithms intelligible. The subset of these parts is a part, which specifies the main feature of intelligent algorithm and contains various subsets dependent on algorithm. Take, for example, ZRP and ZHLS algorithms. In our method, as in figure (1), the code of algorithm ZRP is (001101) which lets us know that it is a routing algorithm of unintelligent (the first digit 0), structure based (second digit 0) and hierarchical (third digit 1) which has hybrid method. Using the last digit, we know that it is the first protocol in this class our proposed classification is shown in figure (1). As shown in Fig (2), it is illustrated routing protocol classification with new method.

TABLE 2. TABLE-DRIVEN ROUTING PROTOCOLS

Property / Protocol	Distributed	Usage Algorithm	Aware of distance between node	Route recovery	Overhead	Broadcasting of route request	Loop free	Unidirectional link	Route metric	Hello message requirement	Multicast capability	Route computation	Structure	Update period	Update destination
DSDV [2]	yes	DV	no	No recover	high	N/A	no	no	Shortest path	no	no	Table driven	flat	hybrid	Neigh bor nodes
OLSR [6]	yes	LS	no	Start repair at failure point	high	Only broadcasting to MPRs	yes	no	Shortest path	yes	yes	Table driven	flat	Periodically	MPR node
FSR [13]	yes	LS	yes	Rediscov ery	low	flooded into the network	aybe	no	Shortest path	no	no	Table driven	flat	Periodically	Neigh bor nodes
TBRPF [14]	NO	LS	no	N/A	medium	Network Wide broadcast	yes	N/A	Shortest path	yes	yes	Table driven	flat	Periodically	Neigh bor nodes
IARP [9]	yes	LS	no	N/A	medium	Broadcast To Intrazone	N/A	no	Shortest path and route repair	no	N/A	Table driven	hierarc hically	Periodically	N/A

TABLE 3. HYBRID ROUTING PROTOCOLS

Protocol / Property	CBRP [12]	ZRP [10]
Update destination	N/A	Neighbor nodes
Update period	Periodically	Periodically
Structure	flat	hierarchical
Route computation	Hybrid	Hybrid
Multicast capability	no	no
Hello message requirement	yes	yes
Route metric	Shortest and fastest path	Shortest path
Unidirectional link	yes	no
Loop free	yes	yes
Broadcasting of route request	Only broadcasting to clusterheads	Network Wide broadcasting
Overhead	high	medium
Route recovery	Start repair at failure point	no
Aware of distance between node	yes	DV
Usage Algorithm	LS	Yes
Distributed	NO	N/A

4. CONCLUSION AND FURTHER WORKS

Routing is an important component of communication protocols in mobile ad-hoc networks. The design of a protocol in these networks is performed to obtain special objectives, based on available requirements, network specifications, or application in different zones. In this paper, we introduce variety of routing protocols along with its applied features. We present a new classification (taxonomy) method, based on Mendeleev table in which each algorithm with a new code.

This tree is undergoing the development and each researcher can locate his or her algorithm in one of the classes with a unique code. Our future work is to develop the proposed tree in all areas of ad-hoc networks such as security, secure routing, coverage, and research about intelligent algorithms.

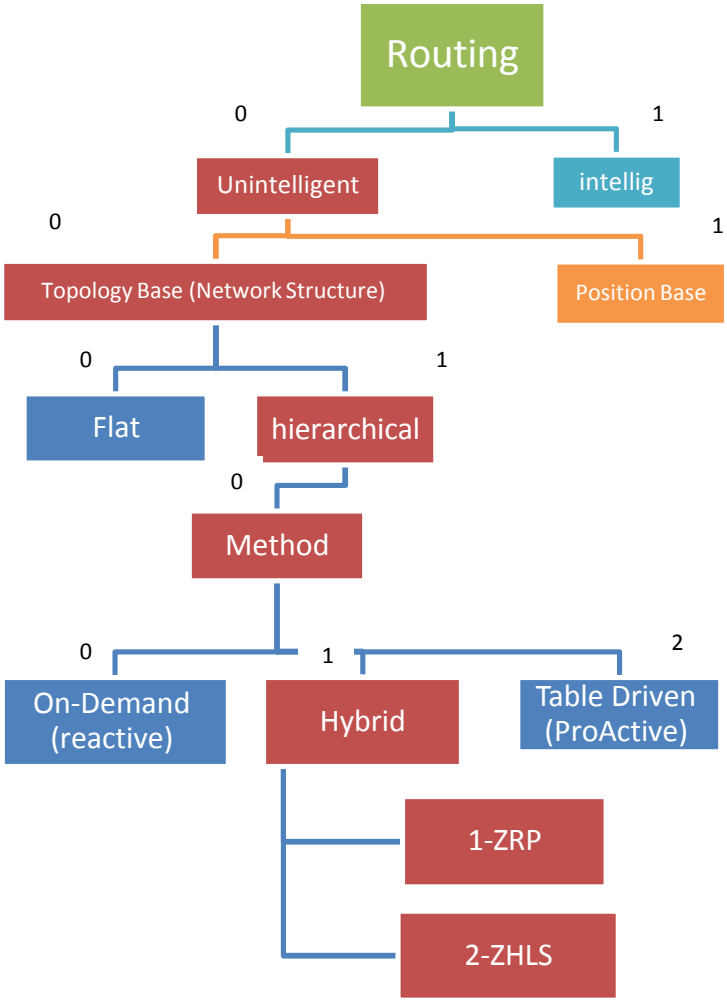

Figure 1. Example of our presented classification

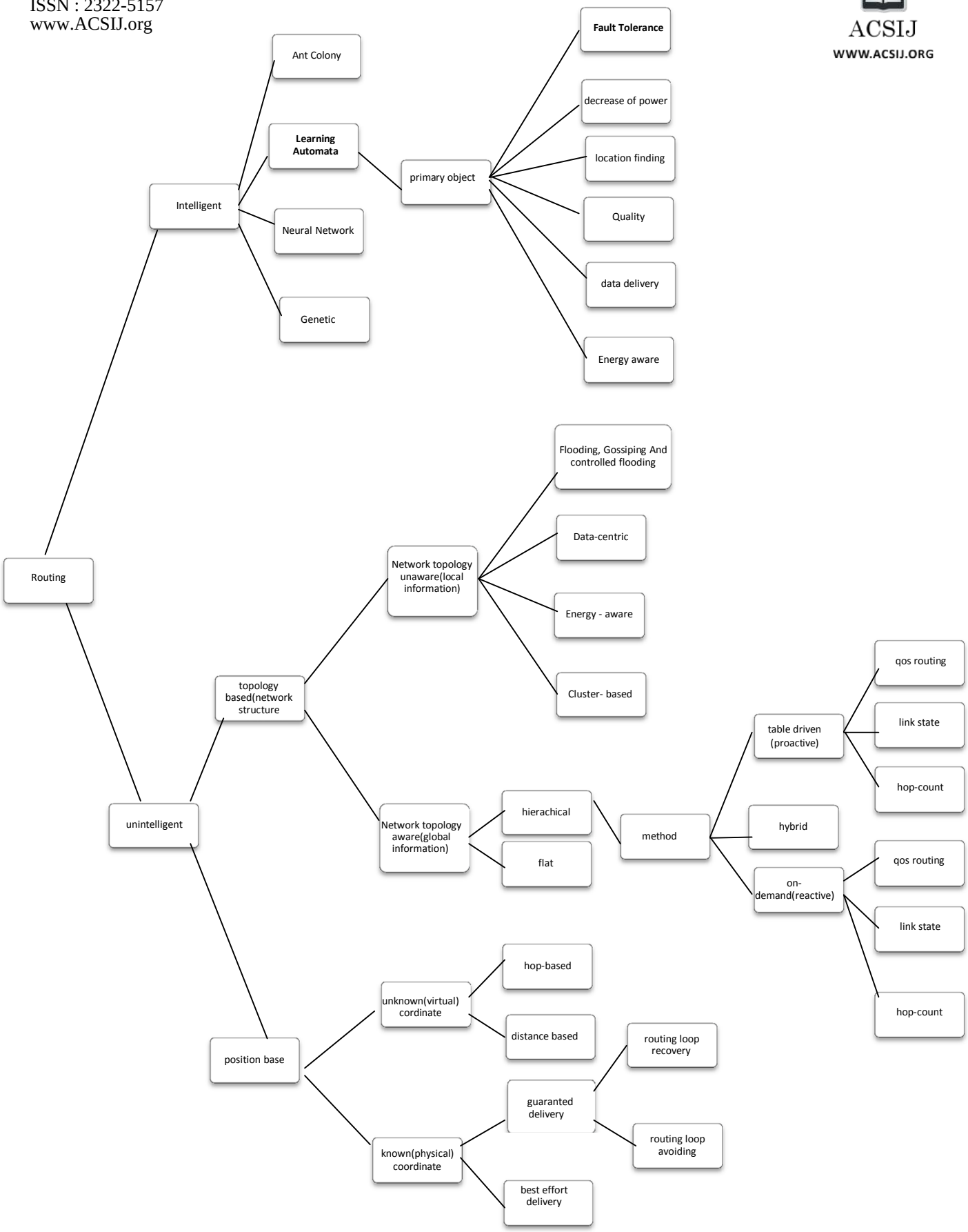

Figure 2. A view of routing protocol classification with new method

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