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Modeling a Dynamic Ad-Hoc Routing Control protocol

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Abstract : Based on the Trust all the wireless node associates dynamic network is Ad-Hoc network in MANET- Mobile Ad-hoc Networks, it mainly depends on the mobility speed, energy, Adapting dynamic topology change, and bandwidth maintain all these in one algorithm is the default, so depends on the application can change some of the routing parameters , change the behavior of the routing to maintain the performance , reducing the latency and message overhead , improve the network bandwidth of user communication, reducing the control routing, in this process we are provided the modeling of new routing protocols with design criteria.

Index Terms **- Routing, Ad Hoc network, dynamic topology.**

I. INTRODUCTION

Ad-Hoc network unicast multi hop wireless network, which involves of sum of moveable nodes. These generate nodes traffic to be progressed to some other nodes or a group of nodes. Because of a dynamic landscape of ad hoc networks, outmoded fixed network routing protocols are not feasible. Based on that reason several proposals for routing protocols have been existing. Ad Hoc networks have various application areas. Some shares to be revealed to sensor, military, commercial, conferencing, health and emergency applications. To each of these application extents have their exact necessities for routing mechanism behavior of protocols. For, in military applications low possibility of discovery and interception is a vital factor such is routing effectiveness throughout disappearing and disturbed radio frequency bandwidth environments. Sensor base level applications lowest energy feeding is a requirement for an independent pull and push process. In general, commercial applications are definite quality of service for interactive plug-in service area is a wanted feature. Altogether application ranges have some structures and necessities for protocols guiding communication. Mainly to congestion nor a local change in link is not allowed, and the guide routing protocol overhead network traffic is not permitted to drive the network all parameter cause a huge control traffic storm all over the network.

II. A ROUTING PROTOCOLS

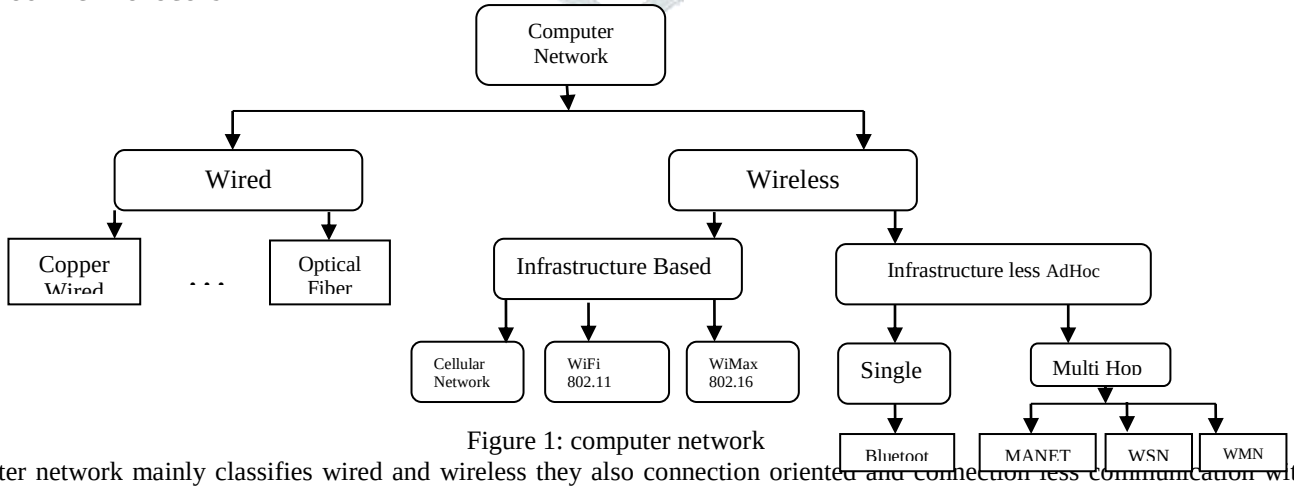

Figure 1: computer network

Computer network mainly classifies wired and wireless they also connection oriented and connection less communication with and without medium, In the wired using physical medium like copper, optical fiber all are fast delivers the data without any loss of connections, but uses of the pre-defined path for communications it's not supporting to the dynamic functionality network creating, most of the structure is pre configuration is need. But in the wireless, it's adapting the all the fusibility of the end user view, it creates the dynamic network depends on user request, in this also infrastructure based and less application-based models are used, the pure dynamic the end user can create the network is Ad hoc, if it some infrastructure is used and maintain for communication just like mobile, home Wi-Fi all the one end is structure another end user access wireless.

The Adhoc protocols is need for new classify of protocols rather than the general routing protocols, in this classification mainly table- driven to source based on demand driven routing protocols [1], In general table-driven steering protocols attempt to maintain regular, update steering information from each node to all over the network nodes, in the period time unit by update the throughout the network route update for consistent network view.

Source -originated on- request protocols make routes only when these are required, the requisite is initiated by the source node. Node is needing the destination, it internally run the route discovery process, it is end until node packet reaches the destination.
This taxonomy has some weaknesses because of its uneven the scale or level of detail in a set of data. To that organization it is possible to make some alterations (e.g., in [2]). These alterations can make some statement about if the routing, flat or hierarchical and GPS info is cutting-edge use. Some pretty grouping has been presented by Feeney [3]. This grouping is based on to division protocols according to following criteria, reflecting important design and application choices: Message model. What is the wireless message model? Multi/single channel?

- Structure: Are all nodes treated uniformly? How are distinguished nodes selected? Is the addressing hierarchical or flat?
- State Information: Is network-scale topology evidence gained at every one node?
- Scheduling. Is route information continually maintained for each destination?

This classical don't take a version a protocol is unicast, multicast, geo-cast or broadcast. Also, the
Classification doesn't deal with the question how the link or node associated costs are dignified. These properties are cost to be reflected in organization and calculating applicability of protocols.

Based on that lack the classification has been marginally improved by addition such features as type of cast and cost function. The stated taxonomy is applied to unicast protocols, while in the context of multicast and geo cast protocols. The overall taxonomy and particularly the unicast protocol classification figure 5. The cost function is a classification to be concatenated after presented taxonomy. It is like a remark to be noticed when seeing the pertinence protocol.

2. Routing:

Wireless Ad Hoc Network the main building bloc in Ad Hoc networking is routing. Design routing protocols for deferent applications. Few of routing protocols have been proposed in order to meet required functionalities related to a specific application field. No routing protocol that not fit to all types of applications in Ad Hoc network [6], [7]. Routing protocols can be classified using protocol is designed. In figure: 2.

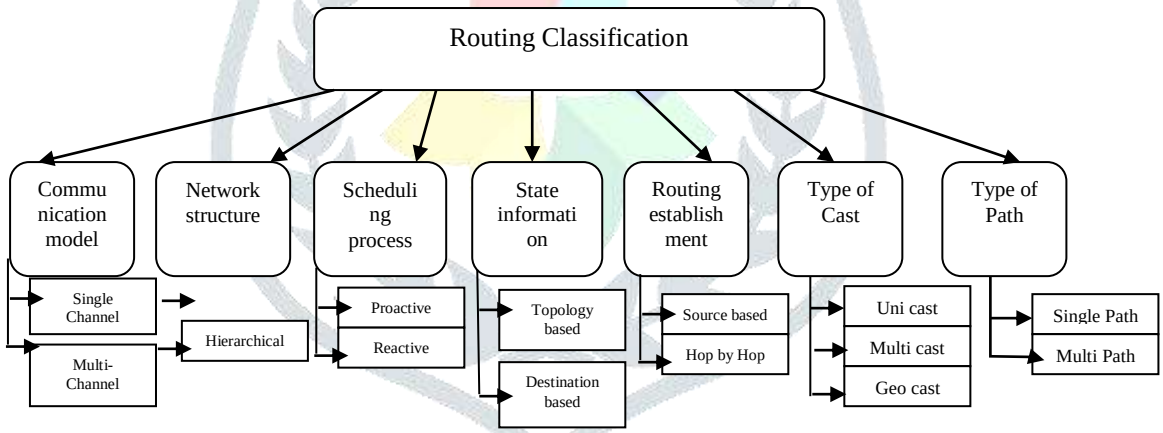

Figure 2: Routing Classification

2.1 Communication model

Communications model to routing protocols that are intended for multi-channel / or single channel communications for Medium Access Control (MAC). Multi-channel protocols are routing protocols generally used in TDMA or CDMA-based networks figure 3. They combine channel assignment and routing functionality. That kind of protocol is e.g., Cluster head Gateway Switched Routing (CGSR) [4]. Single channel protocols believe one common media to be used. They are generally CSMA/CA-oriented, but they have a wide diversity in which extend they rely on specific link-layer behaviors.

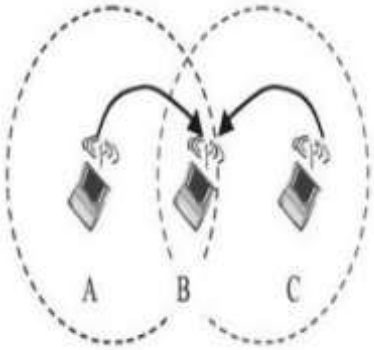

Figure 3: channel communication

2.2 Network structure

Building of a network can be classified affording to node uniformity. Some protocols treat all the nodes uniformly, other make distinctions between different nodes. In uniform protocols there is no hierarchy in network, all nodes send and respond to routing control messages at the same manner.

In nonuniform protocols nearby is an effort to reduce the control traffic burden by separating nodes in dealing with routing information. Non-uniform protocols fall into two categories: protocols in which each node focuses routing activity on a subset of its neighbors and protocols in which the network is topologically partitioned.

By neighbor choice mechanism in every node has its individual criteria to categorize network nodes to near or to remote nodes. In partitioning protocols that differentiation is to use hierarchical node separation. Hierarchical protocols consume some higher level and minor level nodes and confident info change among them.

2.3 Scheduling model

The way to obtain route information can be a continuous or a regular procedure or it can be trigged only by on demand. On that foundation the routing protocols can be classified to proactive on-demand routing protocols. Proactive routing protocols, which are also known as table-driven protocols, maintain all the time routing information for all known destinations at every source. In these protocols' nodes exchange route information periodically and / or in response to topology change. In on-demand i.e., in reactive protocols the route is only calculated on demand basis. The route calculation process is divided to a route discovery and a route ma intendance phase. The route discovery process is initiated when a source needs a route to a destination. The route maintenance process deletes failed routes and re-initiates route discovery in the case of topology change.

2.4 State Information

Protocols may be labelled in terms of the state info obtained at each node and or exchanged among nodes. Topology-based protocols use the principle that every node in a network maintains large scale topology information. This belief is just the same as link state protocols use.

Destination-based protocols do not maintain large-scale topology information. They maintain network topology info wanted to know the adjacent neighbors. Such routing protocols are distance vector protocol, which uphold a distance and a vector to a destination hop total or other measured and subsequent hop.

2.5 Route establishment:

Routing protocols can be distinguished according the way a data packet is forwarded from the source to the destination. There are two approaches [1], [2]: First, source routing protocols, such as Dynamic Source Routing (DSR), which place the entire route information in the packet header then intermediate nodes only forward the packet according to route information stored in the header. In this approach intermediate nodes do not need to compute and maintain updated routing information, as a result much less time is needed for traffic delivery and much less control traffic is generated. However, Source routing do not scale very well in large network and dynamic topology, especially when the route is long, data packet header become large and consume too much of scarce bandwidth. Second approach is hop by hop, which use next hop information stored at each node involved into an active path, like OLSR. Thus, when a node receives a packet, its lookup the routing table and forward the packet to the next hop. The advantage of this strategy is that routes are adaptable to the dynamically changing environment. The drawback of hop-by-hop routing is that each intermediate node has to maintain routing information for each active route and each node may require being aware of their surrounding neighbors through the use of beaconing messages.

2.6 Type of cast Routing

Conventions can be expected to work at unicast, multicast, geocast or broadcast circumstances. In unicast conventions one source communicates messages or information bundles to one objective. That is the most ordinary activity in any organization. The unicast conventions are likewise the most well-known in specially appointed climate to be created and they are the premise on which it is plausible to build other sort of conventions. Unicast conventions have thought a few needs when there is a need to send same message or stream of information to numerous objections. So, there is an evitable requirement for multicast conventions.

Multicast steering conventions attempt to develop an alluring directing tree or a cross section from one source to a few objections. These conventions have additionally to stay aware of data of joins and leave ups to a multicast bunch. The motivation behind geocast conventions is to convey information parcels for a gathering of hubs which are arranged on at indicated topographical region. That sort of convention can likewise assist with lightening the steering system by giving area data to course obtaining. Broadcast is an essential method of activity in remote medium. Broadcast utility is executed in conventions as an upheld include. Convention just to execute broadcast work is anything but a reasonable arrangement. That is the motivation not to group conventions to communicate conventions. In any case, it is worth to specify if a convention isn't supporting that strategy.

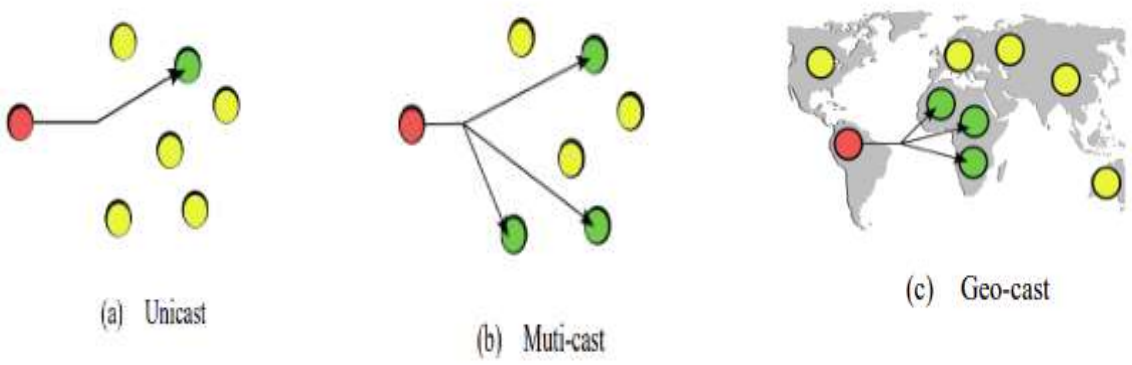

Figure 4: Type of cast routing communication

2.7 Type of Path

When making routing decisions in ad hoc environments, it is normally not enough to take only considerations to hop count. In ad hoc networks there is a wide variety of issues to consider such as link capacity, which can vary in large scale, latency, link utilization percentage and terminal energy issues to mention a few most relevant. wherefore there is a need to familiarize cost functions to route controls. Uneven organization of protocols rendering to cost purpose can be based on hop count approach and to bandwidth or energy-based cost functions. Also, quite a different approach to routing metrics is used by Associativity Based Routing (ABR) protocol, which uses degree of Association-stability for a metric to choose for a route. That means that presumably more permanent routes are preferred. [5]

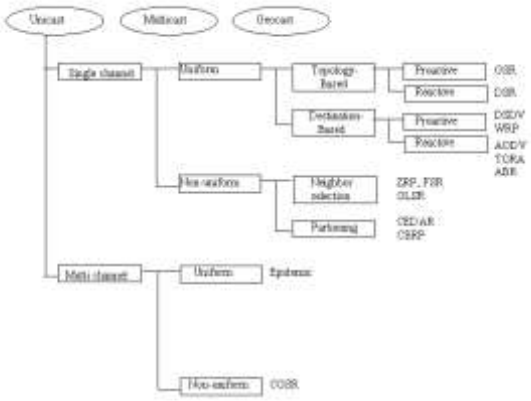

Figure 5*:* Taxonomy of Protocols. Classification of unicast protocols.

Some routing protocols are able to find multiple paths to a destination, like Multipath Ad hoc on demand Distance Victor protocol (AODVM), which make routing efficient in case of frequent links break due to nodes mobility. In contrast, others routing protocols are simple and find only one path to a destination. Single path routing protocols should re-compute new route each time a link failure is detected which become more complicated in highly dynamic environment [15].

2.8 Overview of selected Protocols:

There are unicast, single channel protocols, which are uniform or non-uniform. Uniform protocols are divided to topology-based protocols, in where nodes are aware of the topology information of all other nodes in the network or to destination-based protocols, in where nodes only see the favored next hop to a terminus. One protocol to belong to that topology-based class is GSR (Global State Routing) and the other is DSR (Destination Source Routing). One main difference between these protocols is the scheduling method. GSR proactive routing protocol, which motivation all the time have the info wanted for routing. DSR is on its behalf a reactive protocol, which will obtain needed information only on demand.

To destination-based protocols belong such protocols as DSDV, AODV, TORA, ABR and WRP. The well-known difference between e.g., DSDV and AODV is the scheduling method. The DSDV is proactive as is WRP, but AODV, TORA and ABR all are reactive protocols. To be classified to single channel, non-uniform protocols there are such protocols as ZRP, FSR, OLSR, CEDAR and CBRP. Form these protocols ZRP, FSR, and OLSR belong to neighbor selection protocols, which have a common feature to select network subsets by individual nodes themselves. In partitioning protocols there are some kinds of clustering and cluster head selection mechanism. To partitioning protocols belongs e.g.

CEDAR and CBRP. To unicast multi-channel protocols, include such protocols as CGSR and Epidemic. CGSR is a nonuniform protocol and Epidemic is a uniform protocol. The unicast protocols are the following:

- GSR WRP,OLSR,FSR,CEDAR,CGSR,Epidemic

2.9 Protocols by Cost Function

The classification of protocols according to cost function is based on the idea that there is some variable in network to be minimized or maximized. For example, that variable can be the energy consumed by nodes, available bandwidth for a connection or latency. In Ad-Hoc situation battery energy makes has improvement. This is because of battery energy is more limited from its nature as is e.g., available memory space or computing power. Routing Protocols to lessen energy used, following advantages:

- Minimizing produced power will allow longitudinal reuse of regularities. That will increase the total throughput of network

- Multiuser interference will be minimized. That will improve the quality of communications channels

- In military applications low probability of intercept and low probability of detection could be attained. One protocol to minimize the energy consumed or as it is said

– energy conscious protocol - is Minimum Power Routing (MPR). The main idea of MRP is to select the path between a given source and destination that will require the least amount of total power expected, while still maintaining an acceptable signal-to-noise ratio at each receiver.

III. Applicability of different Protocols of Use

3.1 Evaluation criteria

Different kind of ad hoc routing protocols are suitable for different kind of network structures and node behaviors. When evaluating protocols, one needs some appropriate classification also for the features of performance metrics.

The critical features for ad hoc networks can be classified according to Sub baron to following quantitative and qualitative features. Quantitative features are:

- Network settling time: the time for a network to reach a constant state and be intelligent to direct its first message consistently.

- Network join time, which is the time for an entering node or group of nodes to become integrated into the ad hoc network.

- Network depart time, which is the time required for the ad hoc network to recognize the loss of one or more nodes, and reorganize itself to manage lacking links.

- Network recovery time, which is the time for a network to recover after a condition that dictates reorganization of the network.

- Frequency of updates, the amount of control packets to overhead bytes inside packets to be sent in a given time to maintain proper network operation. This means also same as overhead.

- Memory required, which is the storage space required for routing tables and other management tables.

- Network scalability number, the number of nodes that a network can scale to and motionless reserve infrastructures. According to RFC 2501 quantitative metrics for network routing protocol performance are:

- End-to-end data throughput and delay.

- Route acquisition time, which is a particular concern for on-demand protocols - Percentage out-of-order delivery, which can affect how efficiently transport layer protocols can perform its own task

- Efficiency: an inside measure of protocols efficiency. It deals with the protocol overhead questions. It could be said to be some kind of utilization ratio between routing effectiveness and overhead.

Network recovery time is an important factor for fast changing dynamic networks. If the recovery time is too long, it causes the network to maintain a too long a time an unstable state. The routing errors to occur, which on its side sources missing packets and needs for retransmissions. Frequency of updates is also a meaningful parameter for bandwidth constrained radio networks. If the protocol needs too often or too large update packets to be sent, it will consume in dynamic networks too much available total capacity. Network scalability number has a meaning when there is a need for large scale networks to be constructed. The large scale is not a clear term, but the number of nodes can surpris ingly grow up, when ad hoc environments reach their success. In military environments scalability is an essence.

The qualitative critical features are the following:

- Knowledge of nodal locations. the routing algorithm need local or global info of the network?

- Effect to topology changes. The routing algorithm need complete rearrangement or incremental updates?

- Adaptation to radio communications environment. Do nodes use estimation knowledge of fading, shadowing or multiuser interference on links in their routing decisions?

- Power Consciousness. Routing mechanisms that consider battery life of a node?

- Single or multichannel. The routing algorithm utilizes a different control channel?

- Bidirectional or unidirectional links. Does the routing algorithm perform efficiently on unidirectional links?

- Preservation of network security. Does the routing algorithm uphold the fidelity of the network, for example low probability of detection or interception and overall security features?

- QoS routing and handling of priority messages. Does the routing algorithm support priority messaging and reduction of latency for delay sensitive real time traffic?

- Real-time voice and video services. The RFC 2501 also mention some qualitative properties. One feature not mentioned above is ability to use multiple routes to avoid congestion One very important question is, if a protocol is able to use only bi-directional links. Decision not to use unidirectional links, may have noticeable effects to total network throughput. Quite many ad hoc protocols are only operating at bi-directional links, some to mention are e.g., DSDV and AODV. Unidirectional links in ad hoc environment are not exceptions, because of asymmetrical nature of radio channel caused by interference, jamming and different receiver or transmitter characteristics.

Quality of services and support for real time services, including priority messages and data packets, is an acute problem to be solved. Applications to need these services will emerge most probably in all ad hoc network solutions, so the implemented routing method should support that need. Also, scalability and congestion avoidance / management will be a main feature for any routing protocol to be used in any real-life implementations.

3.2 Small Scale Static Networks

When choosing a routing protocol for a small-scale static network there is not so many constrains to take into account. Because of small size and minor node movements, proactive protocols have no problems to keep up with their tables. Non-uniform protocols would surely be overkill. Sensor networks or with laptop computers. Ability to use multiple routes could be an important issue. Phenomena, typical for license-free radio bands. A sudden appearing interference should not interrupt the ongoing voice transmission, but the routing protocol should be able to manage that situation seamlessly. From presented protocols GSR or WRP may be the right selection, but also one should consider to use some mesh-based multicast protocols e.g., CAMP. The advantage for the mesh-based approach is the ability to maintain several routes, which is a robust method against interference as well as for managing the movement. Also, small static scale networks here can be fairly heterogeneous collection of devices. So even when selecting a protocol for an "easy" case there is still some constrain to be considered. But if a protocol is able to use e.g., different metrics per link, this is probably a resolvable question.

3.3 Large Scale Static Networks

Scalability is a problem to suddenly pop-up. Usually, technologists are able to prediction the use of their creations, but there are too many contradictory examples. In military and also in civil defense areas there is an evitable need to scale networks up to several hundreds or even thousands of nodes. Normally networks simulations have been conducted only node numbers around 20-50 nodes. Although sometimes simulation has been conducted by node numbers e.g., 500.

In large-scale networks some kind of node partitioning comes its right value. The traditional method has been to use hierarchy for partitioning, but neighbor selection methods are emerging. With the hierarchical structures there is a problem that routes not necessarily are not always the best possible. Nearby nodes to belonging different clusters are not able to use the shortest and, in many cases, the best route. Neighbor selection protocols as FSR, ZPR and OLSR may be the answer to scalability problems in large networks. In large-scale networks there is also a problem of separated networks lately to join as a part of the main network. There will be quite much control traffic to join two, say as an example one 100 nodes and the other 20 nodes, networks together. If we could use a protocol like Epidemic to carry with some probability the control traffic between networks before the actual joining, the control traffic storm would be alleviated. One clear eye for extensive networks is that not all node is equal. Obviously, some nodes require to use energy saving protocols as some would like to use protocols to ensure maximum QoS. The question arises if we need to separate large networks to cluster, which inside uses different protocols according their needs. Or should we have a meta-protocol to deal with all different kind of protocols that are needed to cover all states of a large network.

3.4 Dynamic Networks

Dynamic networks remain challenge routing, since we are intelligent to achieve with different networks. But when we have same problems in dynamic environments, there is vast number of trade-offs to consider. If we want the route acquisition time to be modest, we should prefer table-based i.e., proactive protocols are dynamic networks, it use frequent update messages. With dynamic networks we obviously have to apply reactive protocols and admit some kind of increase in route acquisition time and also, we have to accept that in case of route interrupt it will take some time to reestablish a connection. If we have remaining unidirectional link towards receiving node, it makes no sense to interrupt the whole connection if we still can use that route for voice stream to one direction. At the same time a route acquisition process could be started and a new route should be taken in use when it is operational. For dynamic networks some kinds of reactive protocols are most probably the right selection. But at the same time, we have to think if there are some parts of the network, which are not in dynamic state. The core nodes could be used by mobile nodes to behave as some kind of base-stations, and a mobile node should only to decide if it directs its traffic to a neighboring node or to a core node. That is exactly the idea used by hierarchical protocols, but that time the application area is to manage the mobility not as much the size.

3.5 Summary of Applicability

Some of suitability chart to be used for protocol assessment. Below there is one such chart, which is based only to intuitive assumptions about earlier mentioned design principles.

Figure 2: Suitability of Different kind of Ad hoc Routing Protocols

The assumptions made are the following:

- Proactive protocols have poorer performance characteristics with high mobility networks than reactive have. This is based on the fact that with high mobility it is not an easy task to manage consistent network information in all nodes.

- Topology-based protocols have the disadvantage to disseminate the topology information over the network. As the network size grows, it is a complicated task to transfer high amount of topology information especially over low bandwidth wireless links. Destination based protocols are assumed to scale a little bit better, because of smaller control traffic amounts.

- The differentiation can be based on hierarchical structures, but these are hard to maintain while the network is in high mobile state. So, the neighbor selection protocols are preferred over partitioning protocols when mobility increases.

IV. CONCLUSION

Each and every of these protocols has some common goals. Every one protocol has the capability of disseminated routing designs and each procedure try to manage the consequences caused by flexibility of nodes. But the means are such different as they can be. Main design and implementation principles behind protocols. The taxonomy is a little bit complicated and it is not always an easy task to classify a protocol according to that taxonomy, but the meaning of classifying is trying to get some rough basis for protocol's performance evaluation. Some kind of mixture of commonly compatible protocols could be needed. The other way to reach the goal is that protocols will merge and form a protocol, which has all the wished properties, but none of the weak ones.

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