Performance Analysis of Ad-hoc Routing Protocols in Multicast Environment

S. Aruna[a,*], A. Vanitha[b,1] , Dr.A. Subramani[c,2]

Abstract— **Recent advances in mobile computing and wireless technologies are opening up exciting possibilities for the future of mobile wireless networks. An ad hoc mobile network consists of mobile platforms, which are free to move arbitrarily. In MANETs, nodes are mobile and the connectivity between nodes may change frequently due to mobility of nodes. In recent years, a number of new multicast protocols of different styles have been proposed for ad hoc networks. This paper examines eight different multicast routing protocols for ad hoc wireless networks and evaluates them based on a set of parameters. It also provides an overview of multicast protocols by presenting their features and functionality, and compare and discuss their merits and disadvantages.**

Index Terms — **Ad-hoc networks, MANET, Routing Protocol, Multicast**

I. INTRODUCTION

A mobile ad hoc network (MANET) is an autonomous system of mobile hosts (also serving as routers) connected by wireless links, the union of which form a communication network modeled as an arbitrary communication graph [1]. This is in contrast to the known model of a single hop cellular network that meets the needs of wireless communications by installing base stations, access points. In cellular networks, communications between two mobile nodes rely entirely on the backbone cable and fixed base stations. In a MANET, there is no infrastructure, and network topology can dynamically change in an unpredictable manner since nodes are free to move. Multicasting is the transmission of datagram to a group of hosts identified by a unique destination address and thus is aimed at computer-oriented groups. In MANETs, multicast can efficiently support a variety of applications that are characterized by their close collaboration. For example, "community based applications," is expected to attract much attention in the world of data communication in the near future. This is a typical application of ad hoc network, where users are mobile and a community of interest is how demand for use of portable devices. There are many applications of MANETs, "the transfer of email and file" can be considered easier to implement in an ad hoc network environment. "Web services" are also possible if all nodes in the network can serve as a gateway to the world. However, MANETs, having the ability to self-organization can be used effectively on the battlefield. Therefore, if you can combine efficiently the characteristics of a MANET with the utility of multicast, it is possible to conduct a series of planned correspond to groups of applications. With this in mind, this document provides information on the current state of the art in multicast protocols for MANETs and compared with respect to various performance metrics. The paper is organized as follows. Initially summarizes the specific features that are needed to provide multicast in a MANET. Next, cover multicast routing protocols in a MANET in detail, their classification based forwarding mechanism. Open problems in the field of multicast over MANETs that still need attention are described. We conclude this article by providing information about future directions of this research field.

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II. ISSUES IN PROVIDING MULTICAST IN A MANET

Well established routing protocols exist to provide an efficient multicast service in conventional wired networks. These protocols, having been designed for fixed networks cannot keep up with node movements and frequent topology changes in a MANET. As nodes become increasingly mobile, these protocols must evolve to provide an efficient service in the new environment. Therefore, the adoption of multicast protocols existing wired as such to a MANET, which completely lacks infrastructure, it seems less promising. The host mobility increases the protocol overhead substantially. By contrast, the new protocols are proposed and investigated with topics such as topological changes into account. Moreover, the nodes in a MANET based on the batteries; Thusman routing protocols must limit the amount of control information passed between nodes. Most applications are in areas where rapid diffusion and dynamic reconfiguration are necessary and a landline is unavailable. These include military battlefields, sites search and rescue emergency, classrooms, and conventions where participants share information dynamically using their mobile devices. These applications lend themselves well to multicast operation. Furthermore, within a wireless medium is even more crucial to reduce the overhead transmission and energy consumption. Multicasting can improve the efficiency of wireless connections, sending multiple copies of messages, by exploiting the inherent broadcast property of wireless medium when multiple mobile nodes are in transmission range of a node. However, in addition to the problems of any ad hoc routing protocol above, wireless mobile multicasting faces several challenges. The members of the multicast group can move, which prevents the use of a fixed multicast topology. Transient loops may form during reconfiguration of the distribution structure (eg a tree), as a result of mobility. Therefore, the reconfiguration plan should be simple to maintain low overhead channel. As we can see, providing efficient multicast on MANET faces many challenges, including the membership of the group dynamic and constantly updating the route of delivery due to movement of the node.

III. MULTICAST ROUTING PROTOCOLS

A simple way to provide multicast in a MANET is through flooding. With this approach, data packets are sent through the MANET, each node receiving this packet is transmitted to all its immediate neighboring nodes only once. It is suggested that a network of highly mobile ad hoc, flooding the entire network can be a viable alternative for reliable multicast. However, this approach has considerable overhead because a number of duplicate packets sent and packet collisions occur in a MANET-based multiple access. This section discusses the proposed multicast routing protocols for MANET. For simplicity, we classified into four categories based on how to create paths to group members:

• Tree-based approaches
• Meshed approaches
• Hybrid approaches

A. Tree-Based Approach

Tree-based multicast is a well established concept in wired networks. Most plans to provide multicast in cable networks are shared code or tree base. Different researchers have tried to broaden the approach for providing multicast tree in a MANET. This section provides a summary of some of these approaches.

I) Ad Hoc Multicast Routing Protocol Utilizing Increasing ID Numbers (AMRIS): Amris [3] is a protocol to the letter that builds a shared tree multicast delivery (Figure 1) to support multiple senders and receivers in a multicast session. Amris dynamically allocates an identification number to each node each multicast session. Based on the identification number, a tree of multicast delivery - rooted in a special node with the smallest ID (SID) - is created, and increased identification number as the tree expands from the SID . In general, Sid is the source or the node that initiates a multicast session. The first step in Amris protocol operation is the selection of Sid If a single consignor of a group, the SID is usually the source of the group. In the case of multiple senders, a Sid is selected from the set of senders. SID Once identified, sends a new session to your neighbors. The contents of this message includes multicast SID member ID of the session (MSM-id) and routing metrics. The nodes receiving the message NEW SESSION generate their own msm-IDS, which are larger than the msm-ID of the sender. If a node receives NEW SESSION multiple messages from different nodes, the message remains the best routing metrics and calculates msm-IDS. To join an ongoing session, a control node the new message of the session, a parent determines the lowest msm-id, and unicasts a JOIN-REQ to its potential parent node. If the node TGE father is in the tree of multicast delivery, it responds with a JOIN-ACK. Otherwise, the father attempts to join the multicast tree by sending a JOIN-REQ to his father. If a node can not find any potential parent node, runs a branch of the reconstruction (BR) process to join the tree. BR consists of two subprograms. BR1 is executed when a node has a parent node potential of a group (as mentioned above). If there are no potential parent node, BR2 runs. In BR2, instead of sending a unicast JOIN_REQ a potential parent node, the node sends a JOIN-REQ, which consists of a field investigation to specify the range of the nodes to jump R. After rupture of the link, the node with the highest msm-id is meeting with the tree by running any of the mechanisms of BR. Amris is noteworthy that detects the disconnection of a mechanism for signaling link. Therefore, until the tree is rebuilt, the packets might be dropped.

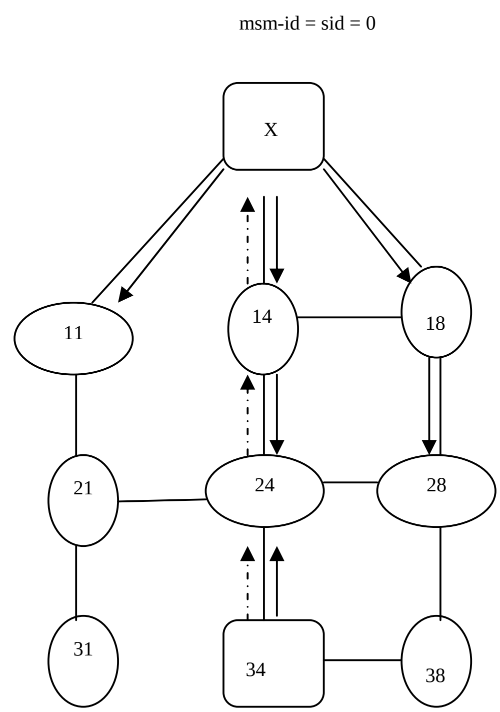
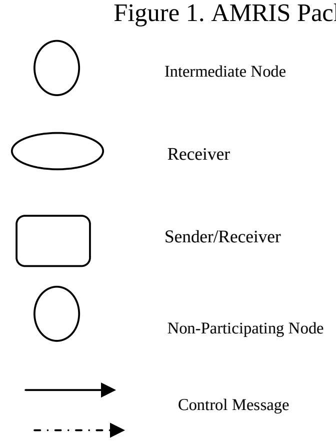


Figure 1. AMRIS Packet Forwarding



II) Multicast Ad Hoc On-Demand Distance Vector (MAODV) Protocol: MAODV routing protocol [4] follows directly from unicast and multicast AODV discovers routes to the letter with a broadcast route discovery mechanism employing the same route request (RREQ) and route reply (RREP) messages that exist in the unicast AODV protocol. A mobile node originates a RREQ message when it wants to join a group, or has data to send to a multicast group, but has no route to that group. Only one member of the desired multicast group may respond to a RREQ join. If the RREQ is not a solicitation to participate, any node with a fresh enough route (based on group number sequence) to the multicast group can respond. If an intermediate node receives a RREQ to join a multicast group that is not a member or that receives a RREQ and do not have a route to that group, which broadcasts the RREQ to its neighbors. As the RREQ is transmitted through the network nodes to establish indicators to establish the reverse route in their routing tables. A node receiving a RREQ first updates its routing table to record the sequence number and next hop information for the source node. This reverse route entry may later be used to transmit a response to the source. To join RREQs, an additional entry is added to the multicast routing table and is not activated unless the route is selected to be part of the multicast tree. If a node receives a RREQ to join a group, you can respond if a member of the multicast group tree and its recorded sequence number for the multicast group is at least as great as that contained in the RREQ. Responding node updates its route and multicast route tables by placing next to the requesting node hop information in the tables, and then a unicasts RREP to the source. As nodes in the path to the source receiving the RREP, they add both a routing table and an entry in the multicast routing table for the node receiving the RREP, thereby creating a way forward (Fig. 2). When a source node broadcasts a RREQ for a multicast group, which often receive more than one answer. The source node keeps the received route with the highest sequence number and least number of hops to the nearest member of the multicast tree for a given period of time, and ignores other routes. At the end of this period, enables the selected next hop routing table multicast and unicast an activation message (MACT) to this selected next hop. The next leap, to get this message allows the entry for the source node in its multicast routing table. If this node is a member of the multicast tree, it spreads the message further. However, if this node is not a member of the multicast tree, it would have received one or more RREPs of its neighbors. It keeps the best next hop for the route to the multicast group, unicast MACT for the next hop, and allows the entry in its multicast routing table. This process continues until the node that originated the RREP chosen (member of tree) is reached. The activation message ensures that the multicast tree does not have multiple paths to any tree node. Note that the nodes transmit data packets only along the active route. The first member of the multicast group becomes the leader of that group, which also becomes responsible for maintaining the multicast group sequence number and spread this number to the multicast group. This update is done through a Group Hello message. The Group Hello contains extensions that indicate the multicast group IP address and sequence numbers (incremented every Group Hello) of all multicast groups to which the node is the group leader. Since AODV maintains "hard state" in its routing table, the protocol has to actively follow and react to changes in this tree. If a member terminates their membership with the group, the multicast tree requires pruning. Links in the tree are monitored to detect a broken link, and the node that is farther from the multicast group leader (downstream of the break) takes the responsibility to repair the broken link. If the tree cannot reconnect to a new leader for the disconnected downstream node is chosen as follows. If the node that initiated the route rebuilding is a member of the multicast group becomes the new leader of the multicast group. On the other hand, if not a member of the group and has only one next hop for the tree, pruning the tree by sending its next hop a prune message. This continues until a group member is reached.

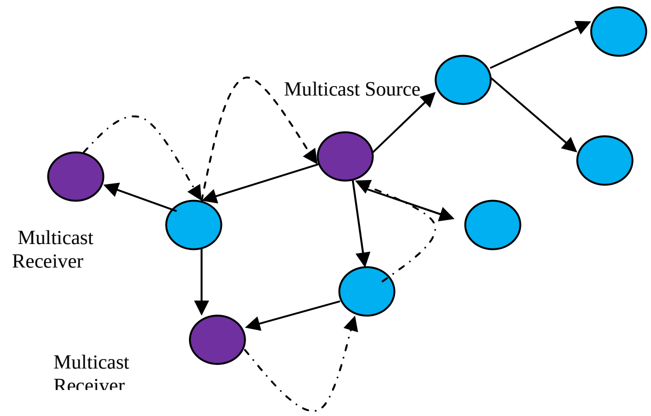
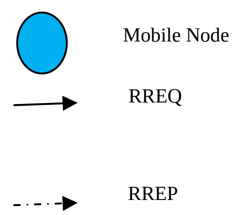


Figure 2. Route Discovery in MAODV Protocol



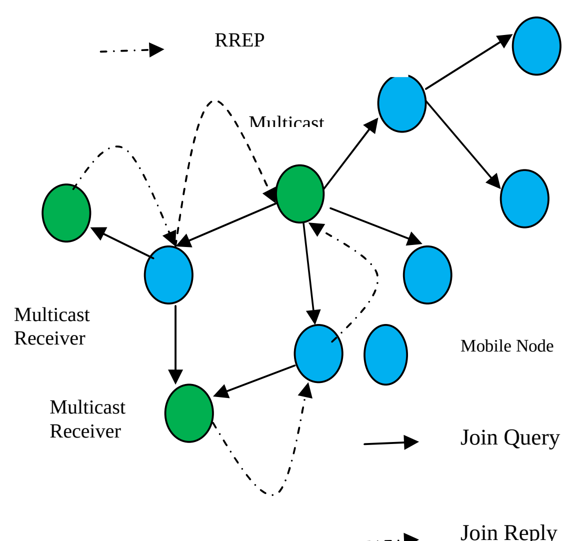


Figure 3. Mesh Creation in ODMRP

Once separate partitions reconnect, a node receives the final group for the information of multicast group Hi group containing different leader of the information you have. If this node is a member of the multicast group, and if a member of the partition that the group leader has the lowest IP address, you can start the reconnection of the multicast tree.

B. Mesh-Based Approach

In contrast to an approach based on trees, mesh-based multicast protocols can have multiple paths between any source and receiver. Existing studies show that tree-based protocols are not necessarily the most suitable for MANET multicast on a network, where frequent changes in topology. In such an environment mesh-based protocols seem to outperform tree-based proposals due to the availability of alternative paths that allow multicast datagrams to be delivered to recipients, even if the links do not. This section provides a summary of some of the mesh-based approaches to provide multicast in a MANET.

I) On-Demand Multicast Routing Protocol (ODMRP): ODMRP [7] is a mesh protocol uses a concept of group sending (only a subset of nodes forwards multicast packets). A soft state approach is taken in ODMRP to maintain multicast group members. No explicit control message is required to leave the group. In ODMRP, group membership and multicast routes are established and updated by the source of demand. When a multicast source has packets to send but no route to the multicast group, transmitting a control packet of Income and consultation across the network. This package of income-query periodically broadcast to update the membership information and update routes as shown in the figure. 3. When an intermediate node receives a packet of Income-consultation, which stores the source ID and sequence number in its cache to detect duplicate messages. The routing table is updated with a corresponding node ID (ie, backward learning) from which the message has been received. If the message is a duplicate and the TTL is greater than zero, which is relayed. When a packet Income-query reaches a receiver, which creates and broadcasts a Join-Reply to its neighbors. When a node receives a Join-reply, it checks if the ID of next hop node of the entries matches its own identification. If it does, the node realizes that it is on the way to the source and therefore the group of the expedition, and sets the forwarding group flag (FG_FLAG). It then transmits its own Join-response based on the matching entries. The next hop node ID field contains the information from its routing table. Thus, each group member propagates the Join-Reply until it reaches the multicast source via the selected (shortest) path. This process constructs (or updates) the routes from sources to receivers and creates a mesh of nodes. After setting a transmission group and the process of building the route, a source can multicast packets to receivers via selected routes and forwarding groups. While a node has data to send, the source periodically sends query packets to update Income-group transmission and routes. Upon receiving the multicast data packet, a node sends only when there is a duplicate and the setting for the multicast group FG_FLAG has not expired. This procedure minimizes traffic overhead and prevents sending packets through stale routes. In ODMRP, no explicit control packets should be sent to join or leave the group. If a multicast source wants to leave the group, simply stops sending Join-Query packets since it does not have data to send to the multicast group. If the receiver does not want to receive a multicast group, which sends the Join-response for that group. Nodes forwarding group are demoted to the lymph nonforwarding if not updated (no Join-Replies received) before timeout.

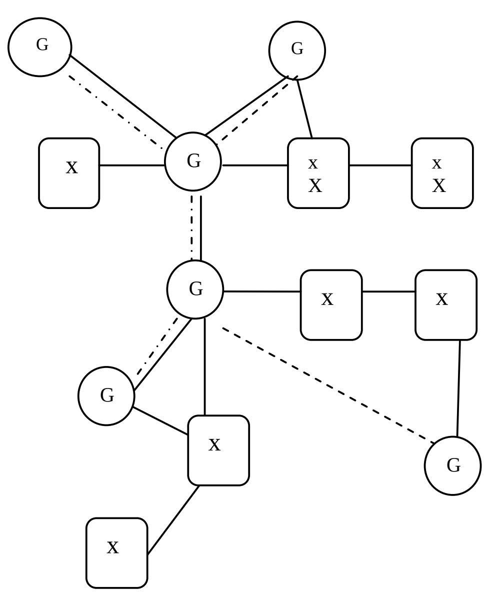
II) Core-Assisted Mesh Protocol (CAMP): Core-assisted mesh (CAMP) [8] supports multicasting by creating a shared mesh for each multicast group. Meshes created to help keep connectivity to multicast users, including mobility of the node. Take concepts of CBT, but unlike the CBT in which all traffic flows through the hub, the central nodes of CAMP are used to limit the control traffic needed for receivers to join multicast groups . The basic operation of the field includes the construction and maintenance of the mesh of multicast to a multicast group. It is assumed that a mapping service that provides routers with the addresses of groups identified by their names. This also implies the availability of routing information from a unicast routing protocol. Each router maintains a routing table (RT) built with the unicast routing protocol. This table is modified by CAMP when multicast group has to be inserted or removed. Based on RT, a multicast routing table (MRT) is built, which consists of a set of groups known to the router. A router can update its MRT based on the topological changes or messages received from its neighbors. CAMP classifies nodes in the network in three modes: single, double, and non-members. A router joins a group in simple mode if it intends only to send the traffic received from the specific nodes or neighbors to the rest of the group, and has no intention of sending packets of the group. A member of the duplex forward multicast packets for the group, while the nodes that are not members need not be in the mesh of multicast delivery. CAMP uses a receiver initiated method for routers to join a multicast group. If a router wishing to join a group of neighbors has multiple faces that are members of the multicast group, it simply changes MRT and directly announces to its neighbors that it is a new member of the multicast group with multicast routing update. If you have neighbors who are members of the multicast group, or propagates a request to join a multicast group of "core" or attempts to reach a member by expanding your search of the ring. Any router that is a regular member of the multicast group and has received the application for membership is free to join to transmit an acknowledgment (ACK) to the source router. A router can leave a group if you have hosts that are members of the group and has no neighbors for whom it is an anchor, ie, as long as there is no need to provide efficient routes for the dissemination of packets in the mesh multicast groups. The cores are also allowed to leave the multicast group, if there are routers used as anchors.

C. Hybrid Approach

Multicast protocols in MANETs provide discussed so far relate to both efficiency and robustness, but not both simultaneously. The tree-based approaches provide high data transmission efficiency at the expense of low strength, while the mesh-based approaches provide better robustness (link failure may not trigger a reconfiguration) to expense of higher costs of sending and increased network load. Therefore, it is possible that a hybrid multicast can achieve better performance by combining the advantages of both approaches on trees and mesh. This section discusses some of the different hybrid approaches to provide ad hoc multicasting.

I) Multicast Routing Protocol Special (AMRoute): The

Special Committee Multicast Routing Protocol (AMRoute) [11] creates a bidirectional tree, shared by senders and receivers of only one group as the nodes of the tree of data distribution. The protocol has two main components: the creation of the mesh and the tree configuration (Fig. 5). The creation of mail identifies and designates certain nodes as logical cores, and these are responsible for initiating the operation of the signaling and maintenance of the multicast tree with the rest of the group. A non-essential node only responds to messages from the main nodes and serves as a passive agent. The selection of a core logic in AMRoute is dynamic and can migrate to any node of another member in terms of the dynamics of the network and membership in the group. AMRoute not analyze the dynamics of the network and assumes that the underlying unicast protocol takes care of it. To create a mesh, each member begins identify itself as a core and packages JOIN_REQ emissions increase the lifetime (TTL) to find other members. When a nucleus JOIN_REQ receives from a core in a different mesh for the same group, it responds with a JOIN_ACK. A bi-directional tunnel is created between the two cores, and one of them is selected as a core following the merger of the mesh. Once the mesh has been set, the kernel starts the process of creating trees. The core sends out regular messages TREE_CREATE over incidents of links on your screen. The use of unicast tunnels, the messages are sent only to TREE_CREATE group members. Members of the group that receives a message unduplicated TREE_CREATE forwarded to all mesh links except the entry, and marks the incoming and outgoing links and the links of the trees. If a relationship is not going to be used as part of the tree, TREE_CREATE_NAK TREE_CREATE is discarded and sent back to inbound links. A member node you want to leave a group can do so by sending a message to its neighboring nodes JOIN_NAK. AMRoute virtual mesh links used to establish the multicast tree, which helps keep the tree from the multicast delivery unchanged with changes in network topology, as long as the routes between the main nodes and tree limbs available through links in the mesh. The main disadvantage of this protocol is that it may have loops and temporary trees can create optimal host mobility.



G – Group Member/Router

X – Non-group Member

Link

Virtual multicast tree

Figure 4. AMRoute Virtual Multicast Tree

D. COMPARISON OF MULTICAST ROUTING PROTOCOLS

The basic idea behind defining multicast routing protocols for MANETs is to form a path to group members with minimal redundancy, and various protocols have been deviced to achieve this goal using different mechanisms. Therefore, the following table compares the prominent multicast protocols over MANETs under several metrics.

Protocols	**Multicast Topology**	**Loop Free**	**Dependence on Unicast Protocol**	**Periodic Message**	**Control Packet Flooding**
AMRIS	Tree	Yes	No	Yes	Yes
MAODV	Tree	Yes	Yes	Yes	Yes
ODMRP	Mesh	Yes	No	Yes	Yes
CAMP	Mesh	Yes	Yes	Yes	No
AMRoute	Hybrid	No	Yes	Yes	Yes

Table-1: Comparison of Ad-hoc Multicast Routing Protocols

E. CONCLUSION

Within the wired network, well-established existing routing protocols to provide efficient multicast service. The adoption of cable multicast protocols for MANET, which are devoid of infrastructure, it seems less promising. These protocols, having been designed for fixed networks can not keep up with node movements and frequent topology changes due to host mobility and protocol costs can increase substantially. By contrast, the new protocols that operate on-demand are being proposed and investigated. Existing studies show that the tree based on demand protocols are not necessarily the best choice for all applications. In a hostile environment, where changes in the topology of the network frequently, the mesh-based protocols seem to outperform tree-based protocols because of the availability of alternative paths that allow data grams multicast be delivered to all or most multicast receivers, although some links. Among the tree-based approaches and the base mesh, we can find hybrid protocols suitable for medium mobility network drawing on both a tree and a mesh structure. We have provided a detailed description of the current state of the art in multicast protocols for MANETs and compared with several criteria.

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BIOGRAPHY

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Journal of Computer Applications (JCA)
ISSN: 0974-1925, Volume IV, Issue 2, 2011

Refinement of K-Means Clustering Using Genetic Algorithm

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Abstract--- **K-means clustering is a popular clustering algorithm based on the partition of data. However, there are some shortcomings of it, such as its requiring a user to give out the number of clusters at first, and its sensitiveness to initial conditions, and second it can only find linearly separable clusters. There are a lot of variations of the k-means clustering algorithm. Kernel k-means is an extension of the standard k–means algorithm to solve the second limitation of k-means clustering. Recent attempts have adapted the k-means clustering algorithm as well as genetic algorithms based on rough sets to find interval sets of clusters. And an important point is, so far, the researchers haven't contributed to improve the cluster quality once it is clustered. In this paper, we have proposed a new context to improve the cluster quality from k-means clustering using Genetic Algorithm (GA). The performance is analyzed and compared with the standard and kernel k-means clustering in medical domain.**

Index Terms **– K-means, Kernel K-means, Genetic Algorithm.**

I. INTRODUCTION

Clustering techniques have become very popular in a number of areas, such as engineering, medicine, biology and data mining [1,2]. A good survey on clustering algorithms can be found in [3]. The k-means algorithm [4] is one of the most widely used clustering algorithms. The algorithm partitions the data points (objects) into C groups (clusters), so as to minimize the sum of the (squared) distances between the data points and the center (mean) of the clusters. In spite of its simplicity, the k-means algorithm involves a very large number of nearest neighbor queries. The high time complexity of the k-means algorithm makes it impractical for use in the case of having a large number of points in the data set. Reducing the large number of nearest neighbor queries in the algorithm can accelerate it. In addition, the number of distance calculations increases exponentially with the increase of the dimensionality of the data [5-7].

Many algorithms have been proposed to accelerate the k-means. In [5,6], the use of kd-trees[8] is suggested to accelerate the k-means. However, backtracking is required, a case in which the computation complexity is increased [7]. Kd-trees are not efficient for higher dimensions. Furthermore, it is not guaranteed that an exact match of the nearest neighbor

can be found unless some extra search is done as discussed in [9]. Elkan[10] suggests the use of triangle inequality to accelerate the k-means. In [11], it is suggested to use RTrees. Nevertheless, R-Trees may not be appropriate for higher dimensional problems. In [12-14], the Partial Distance (PD) algorithm has been proposed. The algorithm allows early termination of the distance calculation by introducing a premature exit condition in the search process. Recently, Kernel -means [15] is an extension of the standard k-means algorithm that maps data points from the input space to a feature space through a nonlinear transformation and minimizes the clustering error in feature space. Thus, nonlinearly separated clusters in input space are obtained, overcoming the second limitation of k-means.

As seen in the literature, the researchers contributed only to accelerate the algorithm; there is no contribution in cluster refinement. In this study, we propose a new algorithm to improve the k-means using Genetic Algorithm (GA) is applied to refine the cluster to improve the quality.

The paper is organized as follows: the following section presents the general k-means algorithm. Section 3 presents the kernel k-means clustering and Section 4 discusses the proposed cluster refinement algorithm with genetic algorithm. Section 5 presents the results and the work is concluded in section 6.

II. STANDARD K-MEANS CLUSTERING

One of the most popular clustering techniques is the k-means clustering algorithm. Starting from a random partitioning, the algorithm repeatedly (i) computes the current cluster centers (i.e. the average vector of each cluster in data space) and (ii) reassigns each data item to the cluster whose centre is closest to it. It terminates when no more reassignments take place. By this means, the intra-cluster variance, that is, the sum of squares of the differences between data items and their associated cluster centers is locally minimized. k -means' strength is its runtime, which is linear in the number of data elements, and its ease of implementation. However, the algorithm tends to get stuck in suboptimal solutions (dependent on the initial partitioning and the data ordering) and it works well only for spherically shaped clusters. It requires the number of clusters to be provided or to be determined (semi-) automatically. In our experiments, we run k-means using the correct cluster number.

1. Choose a number of clusters k
2. Initialize cluster centers $\mu_1, \ldots \mu_k$
    a. Could pick k data points and set cluster centers to these points
    b. Or could randomly assign points to clusters and take means of clusters
3. For each data point, compute the cluster center it is closest to (using some distance measure) and assign the data point to this cluster.
4. Re-compute cluster centers (mean of data points in cluster)

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5. Stop when there are no new re-assignments.

III. KERNEL K-MEANS CLUSTERING

Kernel k-means [15] is a generalization of the standard k-means algorithm where data points are mapped from input space to a higher dimensional feature space through a nonlinear transformation ϕ and then k-means is applied in feature space. This results in linear separators in feature space which correspond to nonlinear separators in input space. Thus, kernel k-means avoids the limitation of linearly separable clusters in input space that k-means suffers from. The objective function that kernel k-means tries to minimize is the clustering error in feature space. We can define a kernel matrix $K \in R^{N\times N}$, where $K_{ij} = \phi(X_i)^T \phi(X_j)$. Any positive-semidefinite matrix can be used as a kernel matrix. Notice that in this case cluster centers m_k in feature space cannot be calculated. Usually, a kernel function $K(x_i, x_j)$ is used to directly provide the inner products in feature space without explicitly defining transformation ϕ (for certain kernel functions the corresponding transformation is intractable), hence $K_{ij} = K(x_i, x_j)$. Some kernel function examples are given in Table 1. Kernel k-means is described in the following algorithm.

Input: Kernel Matrix K, number of clusters k, initial cluster centers $C_1,\ldots,C_k$
Output: Final Clusters $C_1,\ldots,C_k$ with clustering error E

a. For all points x_n, n = 1,…,N do
    i. For all clusters C_i where i = 1 to k do
        Compute $\| \phi(x_n) - m_i \|^2$
    ii. End
    iii. Find $c^*(x_n) = \arg\min_i (\| \phi(x_n) - m_i \|^2)$
b. End for
c. For all clusters C_i where i = 1 to k do
    Update cluster $C_i = \{x_n\ c^*(x_n) = i$
d. End
e. If converged then
    Return final clusters $C_1,\ldots,C_k$ and the Error
f. Else
    Goto Step (a)
g. End if

Table 1. Examples of Kernel Functions

Polynomial Kernel	$K(x_i, x_j) = [(x_i)^T x_j + \gamma]^\delta$
Gaussian Kernel	$K(x_i, x_j) = \exp(-\| x_i - x_j \|^2 / 2\sigma^2)$
Sigmoid Kernel	$K(x_i, x_j) = \tanh(\gamma(x_i^T x_j) + \theta)$

It can be shown that kernel k-means monotonically converges if the kernel matrix is positive semidefinite, i.e., is a valid kernel matrix. If the kernel matrix is not positive semidefinite, the algorithm may still converge, but this is not guaranteed.

IV. GENETIC ALGORITHM BASED REFINEMENT

Genetic algorithm (GA) [16] is randomized search and optimization techniques guided by the principles of evolution and natural genetics, having a large amount of implicit parallelism. GA perform search in complex, large and multimodal landscapes, and provide near-optimal solutions for objective or fitness function of an optimization problem. In GA, the parameters of the search space are encoded in the form of strings (called chromosomes). A collection of such strings is called a population. Initially, a random population is created, which represents different points in the search space. An objective and fitness function is associated with each string that represents the degree of goodness of the string. Based on the principle of survival of the fittest, a few of the strings are selected and each is assigned a number of copies that go into the mating pool. Biologically inspired operators like cross-over and mutation are applied on these strings to yield a new generation of strings. The process of selection, crossover and mutation continues for a fixed number of generations or till a termination condition is satisfied. An excellent survey of GA along with the programming structure used can be found in [17]. GA have applications in fields as diverse as VLSI design, image processing, neural networks, machine learning, job shop scheduling, etc.

The basic reason for our refinement is, in any clustering algorithm the obtained clusters will never give 100% quality. There will be some errors known as mis-clustered. That is, a data item can be wrongly clustered. These kinds of errors can be avoided by using our refinement algorithm.

The cluster obtained from the kernel k-means clustering is considered as input to our refinement algorithm. Initially a random point is selected from each cluster; with this a chromosome is build. Like this an initial population with 10 chromosomes is build. For each chromosome the entropy is calculated as fitness value and the global minimum is extracted. With this initial population, the genetic operators such as reproduction, crossover and mutation are applied to produce a new population. While applying crossover operator, the cluster points will get shuffled means that a point can move from one cluster to another. From this new population, the local minimum fitness value is calculated and compared with global minimum. If the local minimum is less than the global minimum then the global minimum is assigned with the local minimum, and the next iteration is continued with the new population. Otherwise, the next iteration is continued with the same old population. This process is repeated for N number of iterations.

A. String Representation

Here the chromosomes are encoded with real numbers; the number of genes in each chromosome is equal to the number of clusters. Each gene will have 5 digits for vector index. For example, our data set contains 5 clusters, so a sample chromosome may looks like as follows:

00100 10010 00256 01875 00098

Here, the 00098 represents, the 98th instance is available at first cluster and the second gene says that the 1875 instance is at second cluster. Once the initial population is generated now we are ready to apply genetic operators.

B. Reproduction (selection)

The selection process selects chromosomes from the mating pool directed by the survival of the fittest concept of natural genetic systems. In the proportional selection strategy adopted in this article, a chromosome is assigned a number of copies, which is proportional to its fitness in the population, that go into the mating pool for further genetic operations. Roulette wheel selection is one common technique that implements the proportional selection strategy.

C. Crossover

Crossover is a probabilistic process that exchanges information between two parent chromosomes for generating two child chromosomes. In this paper, single point crossover with a fixed crossover probability of p_c is used. For chromosomes of length l, a random integer, called the crossover point, is generated in the range [1, l-1]. The portions of the chromosomes lying to the right of the crossover point are exchanged to produce two offspring.

D. Mutation

Each chromosome undergoes mutation with a fixed probability p_m. For binary representation of chromosomes, a bit position (or gene) is mutated by simply flipping its value. Since we are considering real numbers in this paper, a random position is chosen in the chromosome and replace by a random number between 0-9.

After the genetic operators are applied, the local minimum fitness value is calculated and compared with global minimum. If the local minimum is less than the global minimum then the global minimum is assigned with the local minimum, and the next iteration is continued with the new population. The cluster points will be repositioned corresponding to the chromosome having global minimum. Otherwise, the next iteration is continued with the same old population. This process is repeated for N number of iterations. From the following section, it is shown that our refinement algorithm improves the cluster quality. The algorithm is given as:

---

1. Choose a number of clusters k
2. Initialize cluster centers $\mu_1, \ldots \mu_k$ based on mode
3. For each data point, compute the cluster center it is closest to (using some distance measure) and assign the data point to this cluster.
4. Re-compute cluster centers (mean of data points in cluster)
5. Stop when there are no new re-assignments.
6. GA based refinement
   a. Construct the initial population (p1)
   b. Calculate the global minimum (Gmin)
   c. For i = 1 to N do
      i. Perform reproduction
      ii. Apply the crossover operator between each parent.
      iii. Perform mutation and get the new population. (p2)
      iv. Calculate the local minimum (Lmin).
      v. If Gmin < Lmin then
         a. Gmin = Lmin;
         b. p1 = p2;
   d. Repeat

V. EXPERIMENTS & RESULTS

For clustering, two measures of cluster “goodness” or quality are used. One type of measure allows us to compare different sets of clusters without reference to external knowledge and is called an internal quality measure. The other type of measures lets us evaluate how well the clustering is working by comparing the groups produced by the clustering techniques to known classes. This type of measure is called an external quality measure. One external measure is entropy [18], which provides a measure of “goodness” for un-nested clusters or for the clusters at one level of a hierarchical clustering. Another external measure is the F-measure, which, as we use it here, is more oriented toward measuring the effectiveness of a hierarchical clustering. The F measure has a long history, but was recently extended to data item hierarchies in [19].

Entropy

We use entropy as a measure of quality of the clusters (with the caveat that the best entropy is obtained when each cluster contains exactly one data point). Let CS be a clustering solution. For each cluster, the class distribution of the data is calculated first, i.e., for cluster j we compute p_{ij}, the “probability” that a member of cluster j belongs to class i. Then using this class distribution, the entropy of each cluster j is calculated using the standard formula

$$E_j = -\sum_i p_{ij} \log(p_{ij})$$

where the sum is taken over all classes. The total entropy for a set of clusters is calculated as the sum of the entropies of each cluster weighted by the size of each cluster:

$$E_{CS} = \sum_{j=1}^{m} \frac{n_j * E_j}{n}$$

where n_j is the size of cluster j, m is the number of clusters, and n is the total number of data points.

F measure

The second external quality measure is the F measure [19], a measure that combines the precision and recall ideas from information retrieval [20]. We treat each cluster as if it were the result of a query and each class as if it were the desired set of data items for a query. We then calculate the recall and precision of that cluster for each given class. More specifically, for cluster j and class i

$$\text{Recall}(i, j) = n_{ij} / n_i$$
$$\text{Precision}(i, j) = n_{ij} / n_j$$

where n_{ij} is the number of members of class i in cluster j, n_j is the number of members of cluster j and ni is the number of members of class i.

The F measure of cluster j and class i is then given by

$$F(i, j) = (2 * \text{Recall}(i, j) * \text{Precision}(i, j)) / ((\text{Precision}(i, j) + \text{Recall}(i, j))$$

For an entire hierarchical clustering the F measure of any class is the maximum value it attains at any node in the tree and an overall value for the F measure is computed by taking the weighted average of all values for the F measure as given by the following.

$$F = \sum_i \frac{n_i}{n} \max\{F(i,j)\}$$

where the max is taken over all clusters at all levels, and n is the number of data items.

The following table presents the results, shows that our proposed method outperforms than the standard method.

Table 2. Performance Analysis of Cluster Quality

	Wisconsin Breast Cancer Dataset			**Dermatology Dataset**		
	K-Means	**Kernel K-Means**	**Refined K-Means with GA**	**K-Means**	**Kernel K-Means**	**Refined K-Means with GA**
No. of Classes	2	2	2	6	6	6
No. of Clusters	2	2	2	6	6	6
Entropy	0.3637	0.2373	0.1502	0.1826	0.0868	0.0103
F-measure	0.9125	0.9599	0.9799	0.8303	0.8537	0.8841

VI. CONCLUSION

In this paper, we have proposed a new framework to improve the cluster quality from k-means clustering using genetic algorithm. The proposed algorithm is tested in medical domain and show that refined initial starting points and post processing refinement of clusters indeed lead to improved solutions. The method is scalable and can be coupled with a scalable clustering algorithm to address the large-scale clustering problems in data mining. Experimental results show that the proposed algorithm achieves better results than the conventional and kernel k-means algorithm when applied to real data sets.

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Journal of Computer Applications (JCA)
ISSN: 0974-1925, Volume IV, Issue 2, 2011

Traffic Control And Network Security In OSPF Without Filtering

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Abstract— **The paper addresses the interoperability & network security issues, between Open Shortest Path First (OSPF) with filtering & OSPF without filtering. Furthermore, it shows how the OSPF without filtering concept serve to be more useful in controlling traffic without the device being disconnected from the network. The new non–filtering concepts of stubby, totally stubby, not so stubby, totally not so stubby areas in OSPF are therefore designed to gain maximum control over handling the routes thus ensuring the security. The applicability of this proposed algorithm is demonstrated through diagrams for different network architectures and traffic conditions. Description of such concepts and the interoperability issues between them with the suggestions how to make use of them are presented. Practical implementation of the presented issues and concepts was done and was found to be very effective in establishing Network Security.**

Index Terms — **Access lists, stubby, totally stubby, NSSA, Totally NSSA, Link State Advertisement**

I. INTRODUCTION

OSPF (Open shortest path first) is an open standard protocol that provides area wise networks to be created. [1] It works in a single autonomous system. After forming the topology, OSPF uses this topology to route the packets [2]. Each path is assigned a cost based on the throughput, round-trip time, and reliability of the link [3] . The sum of the costs across a particular path between hosts determines the overall cost of the path. Using the shortest path first algorithm the packets are routed along the path. OSPF routes packets along each path alternately, if multiple equal-cost paths exist between a source and destination address [4]. To control the traffic, filtering can be done [5]. This however is very tedious to configure as it lacks security. To gain more security and to get desired routes on a particular router or in a specific area, the concept of stub can be applied [6].

In this paper, we have had discussed the filtering using access lists & we had shown how the stub concept can be used to control traffic & add secured networks with desired routes in a particular area. This paper is organized as follows: Section 2 describes the filtering using access lists. The problems of access lists are stated in section 3. Section 4 & 5 describes LSA's and OSPF areas. Traffic control & network security without filtering is described in section 6 and conclusions are drawn in the final section.

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II. FILTERING USING ACCESS LISTS

The access list is a group of statements which defines a pattern that would be found in an IP packet [7]. As each packet comes through an interface with an associated access list, the list is scanned from top to bottom in the exact order that it was entered for a pattern that matches the incoming packet. A permit or deny rule associated with the pattern determines that fate of the packet. The pattern statement also can include a TCP or UDP port number. There are many reasons to configure access lists, which are to provide security for your network, to provide traffic flow control, to filter packets that flow in or out of router interfaces and to restrict network use by certain users or devices[8].

III. PROBLEMS WITH FILTERING

The main issue with the access lists is that access list provide the facility of deny which completely stops the communication with that device on which the command is applied. Consider two routers R1 & R2 connected via serial link having 200 routes on router R1, where R1 is the Bank and the R2 is the investors' router respectively. But as they re in the same network, investors would be able to see the Bank accounts, which is threat to government's fund. So now the main goal is to restrict R2, from accessing the R1 routes. Under such circumstances, we are unable to apply the access list because it will completely disconnect the investors from the bank.

In order to achieve network security by not allowing the routes from R1, be seen on router R2 without disconnecting R1 from the network, the concept of filtering is not appropriate. Thus, the network security is obtained in OSPF without filtering by the use of concept called as "stub" which was found to be very efficient. The concept of stub can be well understood by understanding LSAs.

IV. LINK STATE ADVERTISEMENT

For the Internet Protocol, LSA is a basic communication means of the OSPF routing protocol [9]. Communication of router's local routing topology to all other local routers in the same OSPF area is done by LSA. Some LSAs are not flooded out on all interfaces, but only those that belong to the appropriate area. Thus the detailed information can be kept localized, while summary information is flooded to the rest of the network.

• Type 1 (Router LSA) - Every router generates router-link advertisements for each area to which it belongs. Router-link advertisements describe the states of the router's links to the area and are flooded only within a particular area [9].

• Type 2 (Network LSA) – Designated Routers generate network link advertisements for multi access networks, which describe the set of routers attached to a particular multi access network. Network link advertisements are flooded in the area that contains the network. The link-state ID of the type 2 LSA is the DR's IP interface address.

• Types 3 and 4 (Summary LSA) – ABRs generate summary link advertisements. Summary link advertisements describe the following inter area routes:
• Type 3 describes routes to the area's networks (and may include aggregate routes also).
• Type 4 describes routes to ASBRs .The link-state ID is the destination network number for type 3 LSAs and the router ID of the described ASBR for type 4 LSAs.
These LSAs are flooded throughout the backbone area to the other ABRs. Type 3 LSAs are not flooded into totally stubby areas or totally stubby NSSAs. Type 4 LSAs are not flooded into any type of stub area.
• Type 5 (autonomous system external LSA) - ASBRs generate autonomous system external link advertisements. External link advertisements describe routes to destinations external to the autonomous system and are flooded everywhere except to any type of stub areas. The link-state ID of the type 5 LSA is the external network number.
• Type 6 (Multicast OSPF LSA) - These LSAs are used in multicast OSPF applications.
• Type 7 (LSAs for NSSAs) - These LSAs are used in NSSAs.
• Type 8 (External attributes LSA for BGP) - These LSAs are used to internetwork OSPF and BGP.

V. OSPF AREAS

The possible area types of OSPF are [10]: • Standard area-This default area type accepts all updates, and external routes.
• Backbone area- The backbone area is labeled area 0, and all other areas connect to this area to exchange the route information.
• Stub area- This area type does not accept information about routes external to the autonomous system, such as routes from non-OSPF sources. If routers need to route to networks outside the autonomous system, they use a default route, indicated as 0.0.0.0. Stub areas cannot contain ASBRs. An area can be made stub if it has same incoming and outgoing route physical connection.
• Totally stubby area [10] — This Cisco proprietary area type does not accept external autonomous system routes from other areas internal to the autonomous system. If a router needs to send a packet to a network external to the area, it sends the packet using a default route. Totally stubby areas cannot contain ASBRs.
• NSSA (Not so stubby area) — This area type defines a special LSA type 7. NSSA offers benefits that are similar to those of a stub area. They do not accept information about routes external to the autonomous system, but instead use a default route for external networks. However, NSSAs allow ASBRs, which is against the rules in a stub area.
• Totally NSSA - Cisco routers also allow an area to be configured as a totally NSSA which allows ASBRs, but does not accept external routes from other areas. A default route is used to get to networks outside of the area.

Table1. Types of areas that can be defined to restrict particular LSA's

Area	Restrictions
Normal	None
Stub	No Type 5 AS-external LSA allowed.
Totally Stub	No Type 3, 4 or 5 LSAs allowed except the default summary route.
NSSA	No Type 5 AS-external LSAs allowed, but Type 7 LSAs that convert to Type 5 at the NSSA ABR can traverse.
Totally NSSA	No Type 3, 4 or 5 LSAs except the default summary route, but Type 7 LSAs that convert to Type 5 at the NSSA ABR are allowed.

VI. HOW THE TRAFFIC IS CONTROLLED & NETWORK SECURITY IS INCURRED?

To avoid use of excessive commands in filters i.e. in access lists, use of stub concept serve the purpose. It ensures security by displaying the default route instead of all routes. Moreover it has an additional advantage. It reduces the total number of routes arriving on that router thus reducing the load on that router and making it work efficiently. Consider there are 500 routes coming from Rip and 200 routes coming from R1. Now what to do if the R3 routes capacity is 300 routes? Thus to makes possible R3 is made stub as stub restricts LSA 4, 5. By doing this all 200 routes from R1 is accepted but the R4 routes are converted to default route 0.0.0.0 so the routes that approach are 201.

To aptly illustrate the network security rendered by total stubby area, consider R1 router as the bank, R4 is the regional office and R2 as the ABR as shown in the Figure1.

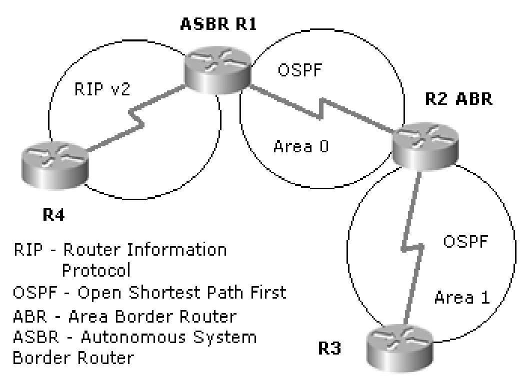

Figure1. Topology having RIP and OSPF protocols enabled in the redistributed network.

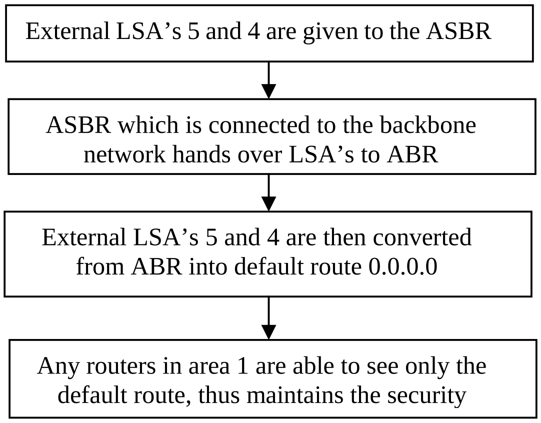

Figure2. Conversion in default route of external routes when area is made totally stubby.

R1 is running both the protocols on its interfaces. Rip is redistributed with OSPF for the routes to traverse. Now as R3 is the investor, he shouldn't be able to see the routes of the bank & its regional office as it would be a threat to accounts. But as they are in the same redistributed network the R3 will be able to see all the routes. To ensure this, area 1 is made totally stubby area. As it restricts LSA 3, 4, 5, R3 will get the default routes 0.0.0.0 from R4 and R1 and R3 would not understand which networks exists behind the default route. Figure 2 illustrates how the conversion in default route takes place if the area is totally stubby

In the live scenario, only one router is not used many routers are connected to the backbone area using virtual links. Now consider R3 has one more router connected i.e. R5 running EIGRP protocol having autonomous system 1 as shown in the figure2.

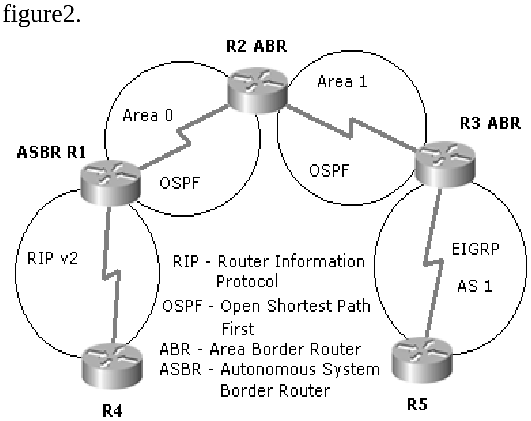

Figure3. Topology having RIPV2, OSPF & EIGRP protocols enabled in the redistributed network.

This is now redistributed with OSPF and the network is formed. Here if R5 is also the router connected to the investors & if they want to make transactions with the bank, it is impossible to make R4 stub as it is now ASBR. So R4 area 2 is made Totally NSSA which converts external type LSA's 3 ,4,5 into one default route 0.0.0.0 causing OIA and OE1/E2 to disappear. Then it converts the same area LSA 5 into type 7 and LSA 7 into type 5 again when it passes through ABR to the backbone area router. Thus security is again prevailed in spite of increase in number of routers.

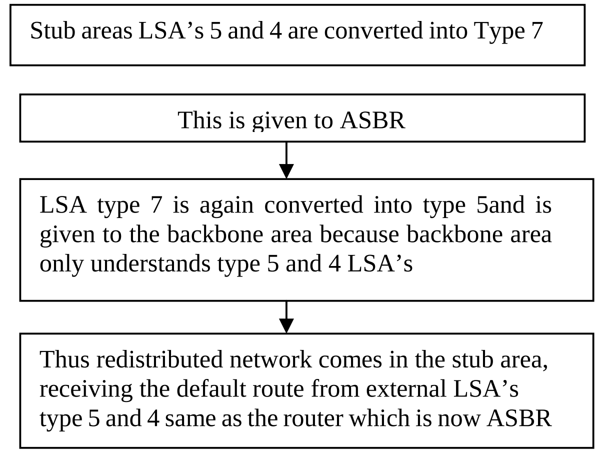

Figure4. Conversion of LSA's types when area is made totally not so stubby.

This configuration is done on the NSSA ASBR shown in the figure3. Figure 4 illustrates the conversion of the LSA types when the area is totally not so stubby.. Thus security is again prevailed in spite of increase in number of routers.

VII. CONCLUSION

The paper studies the fault recovery performance of the OSPF without filtering over filtering in terms of network security. The analysis highlights insightful features of Link state advertisements, concept of stubby, totally stubby, not so stubby area & totally not so stubby area and explains how to control the traffic and generate network security by laying restrictions on specific LSA's. Furthermore, the concept explains how the default route is generated without blocking completely any of the networks, which made us useful to apply in various areas, one of them is net banking.

VIII. ANALYTICAL ASSESSMENT

We have made practical implementation of these OSPF non filtering concepts in Network labs (CISCO) at Thane centre, and we further investigated the working of them, which was found to be very efficient in terms of traffic control and Network security.

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Earthquakes: Precursors and Prediction

Dr. A. Pethalakshmi [a,*], R.RajaRajeswari [b,1]

***Abstract*— Earth quake prediction research is being carried out since two decades. But the amalgamation of Geographical or spatial data, realtime systems and Earth Quake prediction algorithms still remain as a challenge. This article explores the precursors for earthquakes , earlier efforts of earthquake prediction and role of soft computing in this arena.**

***Index Terms* — Earthquakes, Precursors, Soft computing, Prediction.**

I. EARTHQUAKES: AN INTRODUCTION

Earthquakes, the most devastating natural calamity has stirred interest among researchers in the recent past. And with the recent happening of major earthquakes and Tsunami in Japan, India plans to delve deep in earthquake prediction as reported by Physics today on May 4, 2011. This important research area has kept association with the field of soft computing for more than a decade. This research paper brings an overview of earthquakes, its precursors and prediction, earlier and current efforts and the involved role of soft computing in this area of research.

II. EARTHQUAKES AND PRECURSORS

An earthquake [1] is the result of sudden release of energy in the Earth's crust that creates seismic waves. The seismicity or seismic activity of an area refers to the frequency, type and size of earthquakes experienced over a period of time. Earthquakes are measured using observations from seismometers. The moment magnitude is the most common scale on which earthquakes larger than approximately 5 are reported for the entire globe. The earthquakes smaller than magnitude 5 reported by national seismological observatories are measured mostly on the local magnitude scale, also referred to as the Richter scale. Magnitude 3 or lower earthquakes are mostly almost imperceptible and magnitude 7 and over potentially cause serious damage over large areas. The largest earthquakes in historic times have been of magnitude slightly over 9 and the most recent large earthquake of magnitude 9.0 or larger was a 9.0 magnitude earthquake in Japan in March 2011 and it was the largest Japanese earthquake since records began. A precursor [1] in the context of an earthquake is an indicator of approaching events. Periodic variations in the earth's variations of electrical and magnetic fields at the Earth's surface. Fluctuations in the Magnetotellurics signal may be able to predict the onset of seismic events. Thermal anomalies have been identified, associated with large linear structures and fault systems in the Earth's crust, on the basis of satellite infrared thermal images of the Earth's surface. Increased levels [3] of radon gas (222Rn) in wells is a precursor of earthquakes recognized by the IASPE. Over the years, scientists[2] have explored a number of techniques for trying to determine with some precision, when and where a quake will strike.

Radon, a naturally occurring radioactive gas, has been listed as one of several possible indicators of an impending trembler. An Italian scientist Giuliani has said in March 23, 2009 that radon gas as seismic precursor manifests itself between six and twenty four hours ahead of a quake.

In the last decade, several studies [5] have concluded that elevated concentrations of radon gas in soil or groundwater could be the sign of an imminent earthquake. It is believed that the radon is released from activities and cracks as the Earth's crust is strained prior to the sudden slip of an earthquake. In order to test this hypothesis, however, researchers would need to deploy several detector devices along an fault zone. Although several commercial devices could, in theory, perform this task, these devices are too expensive for large scale application. In addition it is not clear whether many of these devices could still work in the presence of water. Now, a group of physicists, led by physics Nobel Laureate Georges Charpak, has developed a new detector that could measure radon gas emission, has come to the rescue of Earthquake research. Also soft computing methodologies facilitate further earthquake prediction research and is being dealt in the next section.

III. SOFT COMPUTING AND EARTHQUAKE PREDICTION

Soft computing became a formal computer science area of study in the early 1990s.Earlier computational approaches could model and precisely analyze only Relatively simple systems .And soft computing deals with imprecision, uncertainty, partial truth and approximations to achieve tractability, robustness and low solution cost. Components of soft computing include neural networks, fuzzy systems, evolutionary computation and swarm intelligence. Many of these soft computing methods are used for earthquake prediction. A survey of existing literature on Earthquake prediction using soft computing models follows.

IV. EARTH QUAKE RESEARCH: EARLIER EFFORTS

In [8] scheme of Earth quake prediction is iterated as follows. Prediction of a strong earthquake was based on the rise of seismic activity in the medium magnitude range. The total

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area of rupture surfaces in the earthquake sources was chosen a measure of seismic activity defined by the function.

$$\sum(t) = \sum 10^{B m_i}, m_i < M \text{ –(1)}$$

Here , m_i is the magnitude of i^{th} earthquake (a logarithmic measure of energy release) and M is the magnitude of a strong earthquake targeted for prediction. summation is taken over the earthquakes that occurred within the sliding time window (t-s,t) in the region considered. The value of parameter B was chosen from condition that each term under summation is coarsely proportional to the rupture area in a source. The premonitory seismicity pattern ∑ was diagnosed by the condition $\sum(t) \geq C_\sum$. The threshold $C_\sum$ is self adapting to a target magnitude M .It is proportional to the rupture and in the source of a single strong earthquake. The emergence of pattern ∑ before 20 strong earthquakes worldwide was demonstrated by Keilis Borok & Malinovskaya. They have considered prediction as a pattern recognition problem: Given is the dynamics of seismicity in a certain area prior to amount t ;to predict whether a strong earthquake will or will not occur within that area during the subsequent time interval (t, t+▲), In terms of pattern recognition the "object of recognition" is a moment t. the problem is to recognize whether or not it belongs to the time interval ▲ preceding a strong earthquake. Next an overview of prediction algorithms based on premonitory seismicity patterns are dealt with. And these algorithms, are composite prediction algorithms, which are a combination of individual precursors. Algorithm M8 was designed by retrospective analysis of seismicity preceding the greatest (M≥8) earthquakes world wide, hence its name. It successfully predicted all size strong earthquake that occurred from 1992-2000. Algorithm M.Sc., of " Mendicino scenario" was developed by retrospective analysis of seismicity prior to the Eureka earthquake (1980, M=7.2) near Cape Mendocino in California. Algorithm CN was developed by retrospective analysis of seismicity preceding the earthquakes with M≥ 6.5 in California and the adjacent part of Nevada. Algorithm SSE (second strong earthquake) aims at predicting a second earthquake in the region, aftermath of an occurrence of a strong earthquake in the region. Current earthquake predictions have limited accuracy. The attributes of an earthquake prediction are

- Content of a current alarm (what is predicted and where)
- The probability of a false alarm. And
- The cost / benefit ratios of disaster preparedness measures.

Existing research converge on the goal: development of the next generation of prediction algorithms, 5 to 10 times more accurate than existing ones.

V.CURRENT APPROACHES
VI.

Fangzhow xu [7] et al, have developed a Neural Network Model for Earth quake prediction using data through DMETER satellite observation and data of the year 2008. In Research paper [9], Fuzzy systems by learning from examples are used in seismic prediction and pre-warning of time series of the earth quakes of maximum magnitude in northern China. In [4] discusses earthquake time series analysis method and theory, studies genetic neural networks application in earthquake forecasting . Its facility and validity are proved by experiments using MATLAB. In [6] an application of Neuro Fuzzy classifier for short term earthquake prediction using saved seismogram data is investigated. In [10] review papers which analyzed earthquake precursors and historic earthquake data. Apart from the linear monitoring studies concerning the relationship between radon and earthquake, an ANN model approach is presented in the research work [11] .

VII. CONCLUSION

Earthquake prediction is pivotal for reduction of the chaos from earthquakes. This problem is of urgent practical importance because earthquakes pose a rapidly growing threat to survival and sustainable development of human civilization. This is due to the well known inter related developments : proliferation of radioactive waste disposals, high dams, nuclear power plants, whose damage poses an unacceptable risk; self destruction of megacities and destabilization of the environment; Earthquake prediction is necessary to undertake disaster preparedness measures, reducing the damage from the earthquakes. This requires that the accuracy of prediction be known, but to belief, a timely prediction of low accuracy may be very useful.

ACKNOWLEDGEMENT

We gratefully acknowledge the funding of UGC and consultancy of Dr.D.Manjula , Associate Professor of CSE,Anna University,Chennai for our Minor Research Project in earthquake prediction.

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BIOGRAPHY

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An Empirical Comparison Of Three Object Recognition Methods

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Abstract— **In this paper, we evaluate an object recognition system building on three types of method, Gradient based method, Histogram based method and Texture based method. These methods are suitable for objects of uniform color properties such as cups, cutlery, fruits etc. The system has a significant potential both in terms of service robot and programming by demonstration tasks. This paper outlines the three object recognition system with comparison, and shows the results of experimental object recognition using the three methods.**

Index Terms — **Gradient based method, Histogram based method, Texture based method, object recognition.**

I. INTRODUCTION

Object recognition in computer vision is the task of finding a given object in an image or video sequence. Humans recognize a multitude of objects in images with little effort, despite the fact that the image of the objects may vary somewhat in different viewpoints, in many different sizes / scale or even when they are translated or rotated. Objects can even be recognized when they are partially obstructed from view. This task is still a challenge for computer vision systems in general. For any object in an image, there are many 'features' which are interesting points on the object that can be extracted to provide a "feature" description of the object. It is important that the set of features extracted from the training image is robust to changes in image scale, noise, illumination and local geometric distortion, for performing reliable recognition.

In the field of Programming by Demonstration the user teaches the robot new tasks by simply demonstrating them. The robot can initially imitate human behavior and then improve through continuous interaction with the environment. For task learning by instruction, complex systems that involve object grasping and manipulation, visual and haptic feedback may be necessary. If the kinematics of robot arm/hand system is the same as for the human, a one-to-one mapping approach may be considered. This is, however, seldom the case. The problems arising are not only related to the mapping between different kinematics chains for the arm/hand systems but also to the quality of the object pose estimation provided by the vision system. Considering specifically object manipulation tasks, the work on automatic grasp synthesis and planning is of significant relevance.

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One of the most important problems in grasping and manipulation is the selection of contact points to grasp an object. Grasping involves fixturing the object relative to a gripper, and forms a necessary condition for object manipulation without changing object or finger contacts. Grasp planning requires a method of evaluating the potential quality of contact points for fixturing the object. Solutions to this problem involve specifying an appropriate grasp quality measure and an algorithm that optimizes this measure to formulate a reaching plan. A successful reaching plan directs the fingers to contact points on the object that are both high quality and achievable by the particular robotic gripper [16].

II. LITERATURE REVIEW

Although generic object recognition and classification have been one of the goals of computer vision scientists since its beginnings, there are still a number of major obstacles for achieving this goal. However, in terms of the identification of known objects in different poses considering novel viewing conditions, significant progress has been made recently, [12]. The two main approaches to the problem are appearance and shape/model based methods. Appearance based approaches represent an object in terms of several object views, commonly raw brightness images. By acquiring a set of object images or reference views, an appearance based object model is constructed.

Since our previous work considered appearance based approaches, [10], [3], we will in this paper, consider the latter approach. The basic idea is that closed 2D curves can be represented by a periodic function, and hence by Fourier descriptors. One such method is for example described in [13]. In this work, closed 2D curves are parameterized, and Fourier descriptors are used to produce a set of normalized coefficients which are invariant under affine transformations. The method is demonstrated on silhouettes of aircraft. Since the shapes of airplanes are more or less planar when seen from large distances, they give rise to affine transformations when rotated in 3D. Hence, the method is ideal for this specific task.

Syntactic matching of curves has also been used, for example in [15]. Here, the curve is represented by an ordered list of shape primitives, and syntactic matching between two curves is performed by dynamic programming. In this particular paper the syntactic matching is only used to align the curves. Proximity matching is then used to measure the similarity between the shapes. The method can deal with partial occlusion, and substantial deformations. Experiments matching the occluding contours of real 3D objects have been carried out, and the method has also been used to classify a large set of 2D silhouettes into classes of similar shapes. Like in [14], this method can be applied to open curves.

III. COMPARISON OF THREE METHODS

A similar method, also using local features, and also specialized in recognizing objects with long thin parts such as bikes and rackets is the method by Mikolajczyk et al. [20]. In this work, the SIFT feature [21] has been generalized to represent the edges in a neighborhood. The algorithm we have chosen to investigate further is a method by Nelson and Selinger [2], [11].

The given input image is converted into gray scale image. The main stage in the 2D correlation based is the creation of a correlation kernel. Sobel horizontal edge emphasizing filter is chosen. The Sobel operator is used in image processing, particularly within edge detection algorithms. Technically, it is a discrete differentiation operator, computing an approximation of the gradient of the image intensity function. The Sobel operator is based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical direction and is therefore relatively inexpensive in terms of computations. Mathematically, the gradient of a two-variable function (here the image intensity function) is at each image point a 2D vector with the components given by the derivatives in the horizontal and vertical directions. This implies that the result of the Sobel operator at an image point which is in a region of constant image intensity is a zero vector and at a point on an edge is a vector which points across the edge, from darker to brighter values. Mathematically, the operator uses two 3×3 kernels which are convolved with the original image to calculate approximations of the derivatives, one for horizontal changes and one for vertical. If we define A as the source image, and G_x and G_y are two images which at each point contain

3.1 2D Correlation Based Method

The block diagram of simple 2D correlation based object recognition method is shown in Figure (1).

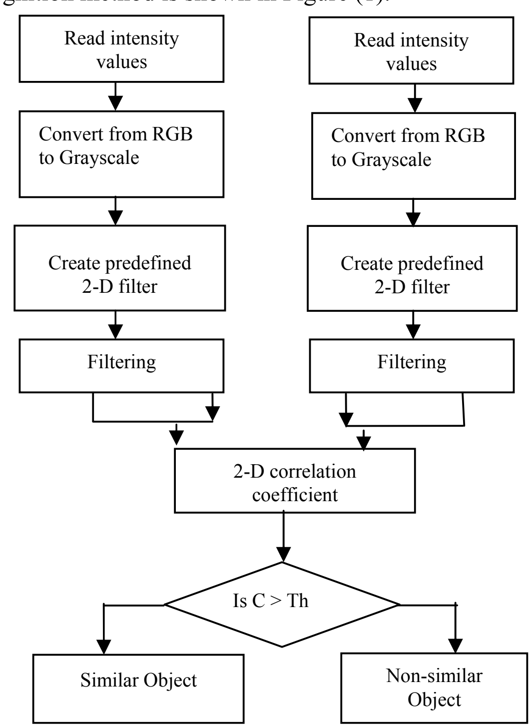


Figure 1. 2D Correlation based Object Recognition method

the horizontal and vertical derivative approximations, the computations are as follows:

$$G_y = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix} * A \text{ and}$$

$$G_x = \begin{bmatrix} 1 & 0 & -1 \\ 2 & 0 & -2 \\ 1 & 0 & -1 \end{bmatrix} * A \qquad (1)$$

Where * here denotes the 2-dimensional convolution operation.

The x-coordinate is here defined as increasing in the "right"-direction, and the y-coordinate is defined as increasing in the down"-direction. At each point in the image, the resulting gradient approximations can be combined to give the gradient magnitude, using the equation (2)

$$G = \sqrt{{G_x}^2 + {G_y}^2} \qquad (2)$$

Using this information, we can also calculate the gradient's direction by using (3)

$$\theta = \arctan\left(\frac{G_x}{G_y}\right) \qquad (3)$$

Where, for example, Θ is 0 for a vertical edge which is darker on the left side. Finally 2D correlation coefficients are computed for the images in the database. If the correlation coefficients between the two images are less than a predefined threshold T, then the two images are identical or non similar object.

3.2 Histogram Based

The equation used in deriving the distance between two color histograms is the quadratic distance metric:

$$d^2(Q,I) = \left(H_Q - H_I\right)^t A \left(H_Q - H_I\right) \qquad (4)$$

The equation (4) consists of three terms. The derivation of each of these terms will be explained in the following sections. The first term consists of the difference between two color histograms; or more precisely the difference in the number of pixels in each bin. This term is obviously a vector since it consists of one row. The number of columns in this vector is the number of bins in a histogram. The third term is the transpose of that vector. The middle term is the similarity matrix. The final result **d** represents the color distance between two images. The closer the distance is to zero the closer the images are in color similarity. The further the distance from zero the less similar the images are in color similarity.

Global color histogram is used to extract the color features of images. In analyzing the histograms there were a few issues that had to be dealt with. First there was the issue of how much we would quantize the number of bins in a histogram. By default the number of bins represented in an image's color histogram using the ***imhist()*** function in MATLAB is 256. Meaning that in our calculations of similarity matrix and histogram difference, the processing would be computationally expensive. The second issue was in which color space we would present our color map. Should it be **RGB** or **HSV**? This was solved right away when we found that ***QBIC***'s similarity matrix equation was using the **HSV** color space in its calculation.

3.2.1 Similarity Matrix

As can be seen from the color histograms of two images ***Q*** and ***I***, the color patterns observed in the color bar are totally different as shown in Figure (2). This metric is referred to as a *Minkowski-Form Distance Metric*, shown in Figure (3) which only compares the "same bins between colour histograms".

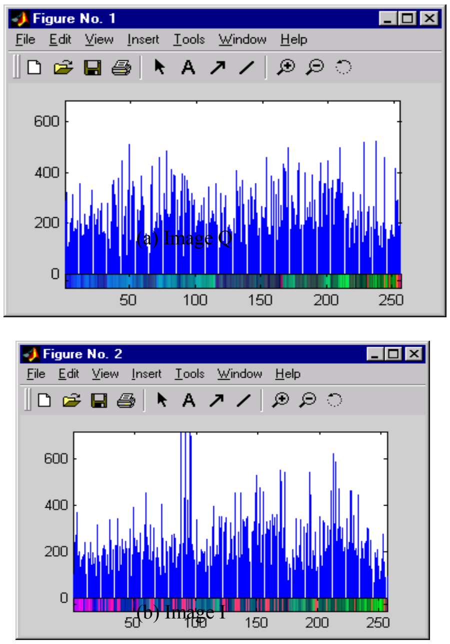
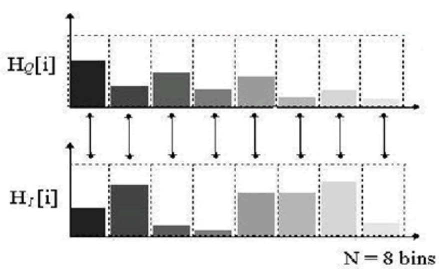


Figure 2. Colour Histograms of two images



This is the main reason for using the quadratic distance metric. More precisely it is the middle term of the equation or similarity matrix ***A*** that helps us overcome the problem of different colour maps. The similarity matrix is obtained through a complex algorithm:

$$a_{q,i} = 1 - \frac{\left[(v_q - v_i)^2 + (s_q\cos(h_q) - s_i\cos(h_i))^2 + (s_q\sin(h_q) - s_i\sin(h_i))^2\right]^{1/2}}{\sqrt{5}} \quad (5)$$

Which basically compares one colour bin of $\boldsymbol{H_Q}$ with all those of $\boldsymbol{H_I}$ to try and find out which colour bin is the most similar, as shown in Figure (4) :

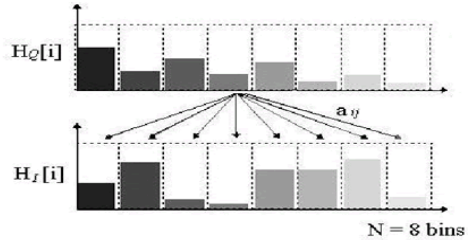


Figure 4. Quadratic Distance Approach

This is continued until we have compared all the color bins of $\boldsymbol{H_Q}$. Finally, we get an ***N* x *N*** matrix, ***N*** representing the number of bins. If the diagonal entirely consists of one's then the color patterns are identical as in Figure (5).

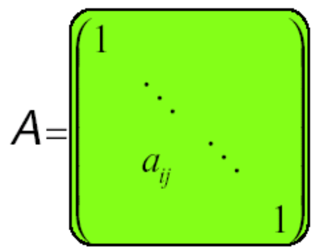


Figure 5. Similarity Matrix A, with a diagonal of one's

3.3 Texture Based Method

We used a method called the pyramid-structured wavelet transform for texture classification. Its name comes from the fact that it recursively decomposes sub signals in the low frequency channels. It is mostly significant for textures with dominant frequency channels.

Using the pyramid-structured wavelet transform, the texture image is decomposed into four sub images, in low-low, low-high, high-low and high-high sub-bands. This is first level decomposition. Using the low-low sub-band for further decomposition, we reached second level decomposition. The reason for this is the basic assumption that the energy of an image is concentrated in the low-low band.

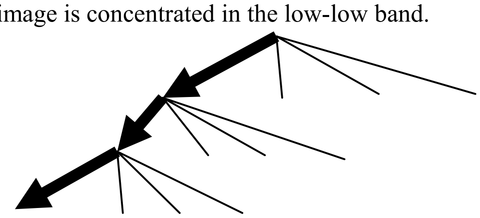


Figure 6. Pyramid-Structured Wavelet Transform.

3.3.1 Energy Level Algorithm:

The Energy Level Algorithm is given below.

1. Decompose the image into *four* sub-images
2. Calculate the energy of all decomposed images at the same scale, using:

$$E = \frac{1}{MN}\sum_{i=1}^{m}\sum_{j=1}^{n}|x(i,j)| \quad (6)$$

Where ***M*** and ***N*** are the dimensions of the image, and ***X*** is the intensity of the pixel located at row ***i*** and column ***j*** in the image map.

3. Repeat from step 1 for the low-low sub-band image, until index ***ind*** is equal to 5. Increment ***ind***.

Using the above algorithm, the energy levels of the sub-bands were calculated and further decomposition of the low-low sub-band image. This is repeated five times, to reach fifth level decomposition. These energy level values are stored to be used in the Euclidean distance algorithm.

3.3.2 Euclidean Distance:

The calculation of Euclidean distance algorithm is given below.

1. Decompose query image.
2. Get the energies of the first dominant $\boldsymbol{k}$ channels.
3. For image $\boldsymbol{i}$ in the database obtain the $\boldsymbol{k}$ energies.
4. Calculate the Euclidean distance between the two sets of energies:

$$D_i = \sum_{k=1}^{k} (x_k - y_{i,k})^2 \qquad (7)$$

5. Increment $\boldsymbol{i}$. Repeat from step 3

Using the above algorithm the query image is searched in the image database. The Euclidean Distance is calculated between the query image and every image in the database. This process is repeated until all the images in the database have been compared with the query image. Upon completion of the Euclidean distance algorithm, we have an array of Euclidean distances, which is then sorted. The five topmost images are then displayed as a result of the texture search.

IV. EXPERIMENTAL RESULTS

We have tested the three proposed system with many objects of different orientation. The test objects are shown in Figure (7).

Figure 7. Test Images

The experimental results are listed in Table (1).

Methods	Matches/No of images	% of recognition
2D Correlation based	28/30	93.3
Histogram Based	28/30	93.3
Texture Based Method	29/30	96.6

Table (1) Recognition Results of three methods

V. CONCLUSION

In this paper, three different methods for object recognition are evaluated. Experimental results demonstrate that the 2D correlation based is suitable for objects having less texture and less colour variation. Histogram based method is well suited for objects having less textures and is independent of the colour variation. Texture based method is well suitable for all type of objects irrespective of colour and texture. All three methods are independent of shapes and orientation.

Although our proposed system tests a small number of objects, our system is designed to continuously adapt in a real-time environment, such as robot navigation. In future, we are going to investigate the possibility of allowing objects having more complicated shapes.

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Journal of Computer Applications (JCA)
ISSN: 0974-1925, Volume IV, Issue 2, 2011

Modified Efficient Geographic Multicast Protocol in Multicasting over Mobile Ad Hoc Networks for QOS Improvements

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***Abstract*— By the development of new network technologies, multicasting has become one of the important networking services. MANET (Mobile Ad hoc Network) a self-configuring infrastructure less network of mobile devices connected by wireless links. But, it is big challenge to implement the well-organized and scalable multicast in MANET due to the difficulty in group membership scheme and multicast packet forwarding over a dynamic topology. During recent years several multicast protocols have also been designed specifically for MANETs like ODMRP and MAODV. These protocols all follow the traditional multicast approaches, i.e. distributed group membership management and distributed multicast routing state maintenance. Efficient Geographic Multicast Protocol (EGMP) uses a virtual-zone-based structure to implement scalable and efficient group membership scheme. In board network, a zone based bidirectional tree is constructed to achieve more efficient membership management and multicast delivery. The position information is used to guide the zone structure building, multicast tree construction, and multicast packet forwarding, which efficiently reduces the overhead for route searching and tree structure maintenance. These approaches, especially when applied for use with small and sparsely distributed groups, may become even less efficient and more expensive to function in MANETs due to bandwidth constraints, network topology dynamics, and high channel access cost. Similarly, to reduce the topology maintenance overhead and support more reliable multicasting, an option is to make use of the position information to guide multicast routing. Several strategies have been proposed to further improve the efficiency of the protocol. We propose a Modified Efficient Geographic Multicast Protocol (MEGMP). Making use of the position information to design a scalable virtual-zone-based scheme for efficient membership management, which allows a node to join and leave a group quickly. Geographic unicast is enhanced to handle the routing failure due to the use of estimated destination position with reference to a zone and applied for sending control and data packets between two entities so that transmissions are more robust in the dynamic environment Supporting efficient location search of the multicast. An important concept is zone depth, which is efficient in guiding the tree branch building and tree structure maintenance, especially in the presence of node mobility. Nodes self-organizing into zones, zone-based bidirectional-tree-based distribution paths can be built quickly for efficient multicast packet forwarding. The scalability and the efficiency of MEGMP are evaluated through simulations and quantitative analysis.**

***Index Terms* — Geographic Routing, Wireless Networks, Mobile Ad Hoc Networks, Multicasting, Protocol.**

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I. INTRODUCTION

Ad-Hoc Networks also called as Mobile Ad-Hoc Network (MANET) is a group of wireless mobility nodes which is self organized into a network without the need of any infrastructure. It is a big challenge in developing a robust multicast routing protocol for dynamic Mobile Ad-Hoc Network (MANET). MANETs are used in many magnificent areas such as disaster relief efforts, emergency warnings in vehicular networks, support for multimedia games and video conferencing. As a consequence, multicast routing in mobile ad-hoc networks has attracted significant attention over the recent years. Multicast is the delivery of a message or information to a group of destinations simultaneously in a single transmission using routers, only when the topology of the network requires it. Multicasting is an efficient method in realize group communications with a one-to-many or many-to-many relationship transmission pattern. However, there is a big challenge in enabling efficient multicasting over a MANET whose topology may change constantly.

In this work, we propose a Modified Efficient Geographic Multicast Protocol, MEGMP, which can extent to a large group size and large network size. The protocol is designed to be comprehensive and self-contained, yet simple and efficient for more reliable operation and consumes less energy when compared to existing one. Instead of addressing only a specific part of the problem, it includes a zone-based scheme to efficiently handle the group membership management, and takes advantage of the membership management structure to efficiently track the locations of all the group members without resorting to an external location server. The zone structure is formed *virtually* and the zone where a node is located can be calculated based on the position of the node and a reference origin. Conventional topology-based multicast protocols include tree-based protocols and mesh-based protocols. Tree-based protocols construct a tree structure for more efficient forwarding of packets to all the group members. Mesh-based protocols expand a multicast tree with additional paths which can be used to forward packets when some of the links break.

In topology-based cluster construction, a cluster is normally formed around a cluster leader with nodes one hop or k-hop away, and the cluster will constantly change as network topology changes. Although number of efforts were made to develop the scalable topology-based routing protocols. Now, in the existing the zones are partitioned according to the position but in proposed protocol the zones are partitioned according to the transmission range of the mobility nodes. At the initial stage all the nodes are at sleep mode. Because of the sleep mode the energy and power utilization becomes very less. In contrast, there is no need to involve a big overhead to create and maintain the geographic zones proposed in this work, which is critical to support more efficient and reliable communications over a dynamic MANET. By making use of the location information, MEGMP could quickly and efficiently build packet distribution paths, and reliably maintain the forwarding paths in the presence of network dynamics due to unstable wireless channels or frequent node movements.

II. RELATED WORK

Multicasting in mobile ad hoc networks is a relatively unexplored research area, when compared to the area of unicast routing for MANET. Many applications envisioned for mobile ad-hoc networks rely on group communication. As a consequence, multicast routing in mobile ad-hoc networks has attracted significant attention over the recent years.

Geographic routing protocols [13] are generally more scalable and reliable than conventional topology-based routing protocols [8] [4] with their forwarding decisions based on the local topology. In MANET, geographic routing protocols unicast routing [9], [13], [14] have been proposed in recent years for more scalable and robust packet transmissions. In the existing position based geographic routing protocols generally assume mobile nodes are aware of their own positions through certain positioning system like Global Positioning system (GPS), and a source can obtain the destination position through some type of location service [21] [22]. In GPSR [13], the intermediate node makes its forwarding choices based on the destination position inserted in the packet header by the source and the positions of its one-hop neighbors learned from the periodic change of the neighbors. Similarly in SPBM [20], the packets form the source with the header are forwarded are based on the next hop position. In order to extend position-based unicast routing to multicast, SPBM provides an algorithm for duplicating multicast packets at intermediate nodes if destinations for that packet are no longer located in the same direction.

Similarly, to reduce the overhead of topology maintenance for dynamic Manet and support more reliable multicasting, an option is to make use of the position information to guide multicast routing. However, there are many challenges in implementing an efficient and robust geographic multicast scheme in MANET. A straightforward way to extend the geography-based transmission from unicast to multicast is to put the addresses and positions of all the members into the packet header, however, the header overhead will increase significantly as the group size increase, which constrains the application of geographic multicasting only to a small group.

Topology-Based Multicast Routing Protocols [20]:

Topology-based multicast protocols for mobile ad-hoc networks can be categorized into two main classes: tree-based and mesh-based protocols. The tree-based approaches build a data dissemination tree that contains exactly one path from a source to each destination. Topological information is used for its construction. The trees can be sub-classified further into source trees and shared trees.

Position-Based Unicast and Multicast Routing Protocols[20]:

The forwarding decisions in position-based routing are usually based on the node's own position, the position of the destination, and the position of the node's direct radio neighbors. Since no global distribution structure—such as a route—is required, position-based routing is considered to be very robust to mobility. It typically performs best when the next-hop node can be found in a greedy manner by simply minimizing the remaining distance to the destination. However, there are situations where this strategy leads to a local optimum, and no neighbor can be found greedily to forward the packet further, although a route exists. This paper deals with the "Location-Guided Tree Construction Algorithms", the sender includes the addresses of all destinations in the header of a multicast packet. In addition, the location of all destinations is included as well. It remains open how the sender is able to obtain the position information, and the scaling limitations.

Location-Based Multicast Protocols [26]:

Two approaches may be used to implement location based Multicast: First, maintain a multicast tree, all nodes within multicast region at any time belong to the multicast tree. The tree would need to be updated whenever nodes enter or leave the multicast region. Second, do not maintain a multicast tree. In this case, the multicast may be performed using some sort of "flooding" scheme. This paper considers multicast group members send a packet to specific multicast region.

III. EXISTING PROTOCOL AND ITS PERFORMANCE

In this section, we will describe the EGMP protocol in details. We first give an overview of the protocol and introduce the notations to be used in the rest of the paper in Section 3.1. In Sections 3.2 and 3.3, we present our designs for the construction of zone structure and the zone-based geographic forwarding.

3.1 Protocol Overview

EGMP supports scalable and reliable membership management and multicast forwarding through a two-tier virtual zone- based structure. At the lower layer, in reference to a predetermined virtual origin, the nodes in the network self organize themselves into a set of zones, and a leader is elected in a zone to manage the local group membership. At the upper layer, the leader serves as a representative for its zone to join or leave a multicast group as required. As a result, a network-wide zone-based multicast tree is built. For efficient and reliable management and transmissions, location information will be integrated with the design and used to guide the zone construction, group membership management, multicast tree construction and maintenance, and packet forwarding. The zone-based tree is shared for all the multicast sources of a group.

Some of the notations to be used are:

- **Zone:** The network terrain is divided into square zones.

- **r:** Zone size, the length of a side of the zone square. The zone size is set to $r \leq r_t / \sqrt{2}$, where r_t is the transmission range of the mobile nodes.
- **zone ID:** The identification of a zone. A node can calculate its zone ID (a, b) from its position coordinates (x, y) as: a $=[x\text{-}x_0/r]$, b$=[y\text{-}y_0/r]$, where (x_0, y_0) is the position of the virtual origin, which can be a known reference location or determined at network setup time. A zone is virtual and formulated in reference to the virtual origin. For simplicity, we assume the entire zones IDs are positive.
- **zLdr:** Zone leader. A zLdr is elected in each zone for managing the local zone group membership and taking part in the upper tier multicast routing.
- **tree zone:** The tree zones are responsible for the multicast packet forwarding. A tree zone may have group members or just help forward the multicast packets for zones with members.
- **root zone:** The zone where the root of the multicast tree is located.
- **zone depth:** The depth of a zone is used to reflect its distance to the root zone. For a zone with ID (a, b), its depth is

$$\text{Depth} = \max(|a_0\text{-}a|,|b_0\text{-}b|)$$

where (a_0, b_0) is the root-zone ID.

In EGMP, the zone structure is virtual and calculated based on a reference point. Therefore, the construction of zone structure does not depend on the shape of the network region, and it is very simple to locate and maintain a zone. The zone is used in EGMP to provide location reference and support lower-level group membership management. A multicast group can cross multiple zones. With the introduction of virtual zone, EGMP does not need to track individual node movement but only needs to track the membership change of zones, which significantly reduces the management overhead and increases the robustness of the proposed multicast protocol. We choose to design the zone without considering node density so it can provide more reliable location reference and membership management in a network with constant topology changes.

3.2 Neighbor Table Generation and Zone Leader Election

A node constructs its neighbor table without extra signaling. When receiving a beacon from a neighbor, a node records the node ID, position, and flag contained in the message in its neighbor table. The zone ID of the sending node can be calculated from its position. To avoid routing failure due to outdated topology information, an entry will be removed if not refreshed within a period $Timeout_{NT}$ or the corresponding neighbor is detected unreachable by the MAC layer protocol. A zone leader is elected through the cooperation of nodes and maintained consistently in a zone. When a node appears in the network, it sends out a beacon announcing its existence. Then, it waits for an $Intval_{max}$ period for the beacons from other nodes. Every $Intval_{min}$ a node will check its neighbor table and determine its zone leader under different cases: 1) the neighbor table contains no other nodes in the same zone; it will announce itself as the leader. 2) The flags of all the nodes in the same zone are unset, which means that no node in the zone has announced the leadership role. If the node is closer to the zone center than other nodes, it will announce its leadership role through a signal message with the leader flag set. 3) More than one node in the same zone have their leader flags set, the one with the highest node ID is elected. 4) Only one of the nodes in the zone has its flag set, and then the node with the flag set is the leader.

3.3 Multicast Tree Construction

In this section, we present the multicast tree creation and maintenance schemes. In EGMP, instead of connecting each group member directly to the tree, the tree is formed in the granularity of zone with the guidance of location information, which significantly reduces the tree management overhead. With a destination location, a control message can be transmitted immediately without incurring a high overhead and delay to find the path first, which enables quick group joining and leaving. In the following description, except when explicitly indicated, we use G, S, and M, respectively, to represent a multicast group, a source of G and a member of G.

3.4 Multicast Route Maintenance and Optimization

In a dynamic network, it is critical to maintain the connection of the multicast tree, and adjust the tree structure upon the topology changes to optimize the multicast routing. In the zone structure, due to the movement of nodes between different zones, some zones may become empty. It is critical to handle the empty zone problem in a zone-based protocol. Compared to managing the connections of individual nodes, however, there is a much lower rate of zone membership change and hence a much lower overhead in maintaining the zone-based tree. As the tree construction is guided by location information, a disconnected zone can quickly reestablish its connection to the tree. In addition, a zone may be partitioned into multiple clusters due to fading and signal blocking.

3.5 Performance Evaluation

A multicast source broadcasts a Join-Query message to the entire network periodically. An intermediate node stores the source ID and the sequence number, and updates its routing table with the node ID (i.e., backward learning) from which the message was received for the reverse path back to the source. A receiver creates and broadcasts a Join Reply to its neighbors, with the next hop node ID field filled by extracting information from its routing table. The ID neighbor node whose matches the next hop node ID of the message realizes that it is on the path to the source and is part of the forwarding group. It then broadcasts its own Join Table built upon matched entries. This whole process constructs (or updates) the routes from sources to receivers and builds a mesh of nodes, the forwarding group. Table 1 lists the simulation parameters of EGMP with beacon interval 200sec. The simulations for ODMRP are based on the codes carried with the simulator, with the parameters set as in [9].

Parameter	Value
r(zone size)	75m
$Intval_{min}$	2 sec
$Intval_{max}$	4 sec
$Intval_{active}$	3 sec
$Timeout_{NT}$	3 sec

Table 1: Parameter Values for EGMP Simulations

We fixed several bugs in the GloMoSim codes which would prevent a forwarding group node from sending JOIN TABLES. The improvement doubles the delivery ratio and reduces the control overhead of ODMRP. Additionally, we implemented SPBM in GloMoSim according to [20] and the ns2 codes provided by the authors with the same parameter settings except that the square size was set to 150 m so that the nodes in a square are within each other's transmission range. The number of levels of the quad-tree changes accordingly with the square size and the network size we used. For packet forwarding in SPBM, different from the scheme described in [20], we used the square center as the destination position, which improves the delivery ratio of SPBM.

The work attempts to improve the stateless multicast protocol, which allows it a better scalability to group size. In contrast, EGMP uses a location-aware approach for more reliable membership management and packet transmissions, and supports scalability for both group size and network size.

IV. MODIFIED EFFICIENT GEOGRAPHIC MULTICAST PROTOCOL(EGMP)

EGMP uses a virtual-zone-based structure to implement scalable and efficient group membership management. A network wide zone-based bidirectional tree is constructed to achieve more efficient membership management and multicast delivery. The position information is used to guide the zone structure building, multicast tree construction, and multicast packet forwarding, which efficiently reduces the overhead for route searching and tree structure maintenance. Several strategies have been proposed to further improve the efficiency of the protocol. Making use of the position information to design a scalable virtual-zone-based scheme for efficient membership management, which allows a node to join and leave a group quickly. Geographic unicast is enhanced to handle the routing failure due to the use of estimated destination position with reference to a zone and applied for sending control and data packets between two entities so that transmissions are more robust in the dynamic environment Supporting efficient location search of the multicast. Group members, by combining the location service with the membership management to avoid the need and overhead of using a separate location server. An important concept zone depth, which is efficient in guiding the tree branch building and tree structure maintenance, especially in the presence of node mobility. Nodes self-organizing into zones, zone-based bidirectional-tree-based distribution paths can be built quickly for efficient multicast packet forwarding.

4.1 Framework Setup:

Routing in a communication network is the process of forwarding a message from a source host to a destination host via intermediate nodes. A wireless ad hoc network consists of mobile nodes (MNs) with wireless communication capabilities for specific sensing tasks. Modify mobility and driver partition which apt to node placement under zone process thus creates the framework for our proposed protocol. Mobility describes the node movement and the driver initializes position of each and every nodes. Each and every protocol developed under three states which are initialization, packet event section and finalization. Some more function which consists of edge calculation, report generation etc... These functions executed under several instances which are depend under the nodes position. In EGMP, making use of the position information to design a scalable virtual-zone-based scheme for efficient membership management, which allows a node to join and leave a group quickly. Geographic unicast is enhanced to handle the routing failure due to the use of estimated destination position with reference to a zone and applied for sending control and data packets between two entities so that transmissions are more robust in the dynamic environment.

4.2 Input Configuration:

The design phase is a multi step process which focuses on system creation with the help of user specifications and information gathered in the above phases. It is the phase where the system requirements are translated to operational details. System has to be designed for various aspects such as input, output etc. Based upon edge calculation the nodes are placed. According to our proposed protocol we configure some input parameters some are simulation time, Mac protocol, radio type, number of nodes, etc…

V. RESULTS AND DISCUSSIONS

We implemented the MEGMP protocol using Global Mobile Simulation (GloMoSim) [18] library. The simulations were run with 32 nodes randomly distributed in an area of 950m x 950 m. The nodes moved following the modified random waypoint mobility model. The moving speed of nodes are uniformly set between the minimum and maximum speed values which are set as as 1 m/s (with pause time as 100 seconds) and 20 m/s, respectively, except when studying the effect of mobility. Each simulation lasted 200 simulation seconds. A simulation result was gained by averaging over six runs with different seeds.

We focus on the studies of the scalability and efficiency of the protocol under the dynamic environment and also in consideration with the energy and power utilization of nodes. The performance of the proposed MEGMP algorithm is evaluated via glomosim simulator. Performance metrics are utilized in the simulations for performance comparison:

Packet arrival rate: The ratio of the number of received data packets to the number of total data packets sent by the source.

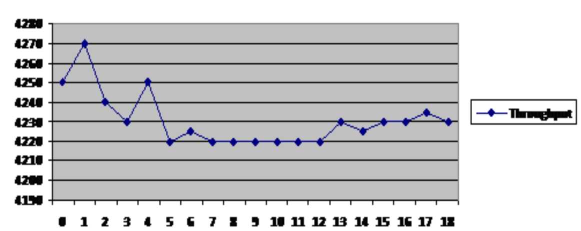

Figure 1. Packet arrival rate of Proposed Protocol

Average end-to-end delay: The average time elapsed for delivering a data packet within a successful transmission.

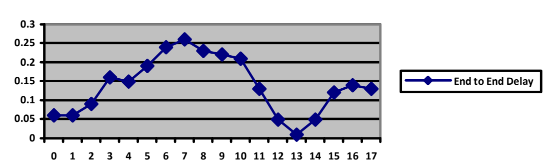

Figure 2. Packet arrival rate of Proposed Protocol

Energy consumption: The energy consumption for the entire network, including transmission energy consumption for both the data and control packets.

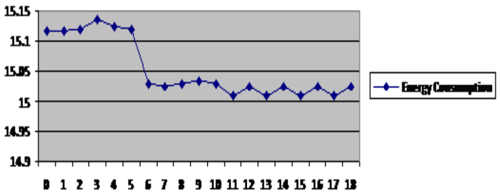

Figure 3. Energy consumption of Proposed Protocol

Collision rate: The average Collision rate for the entire data transmission from source to destination is much controlled and reduced when compared to the existing protocol.

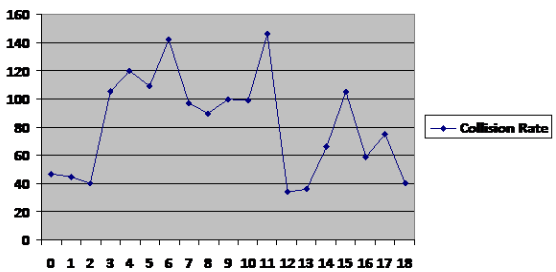

Figure 4. Collision Rate of Proposed Protocol

Communication overhead: The average number of transmitted control bytes per second, including both the data packet header and the control packets.

V. CONCLUSIONS

There is an increasing demand and a big challenge to design more scalable and reliable multicast protocol over a dynamic ad hoc network (MANET). In this paper, we propose an efficient and scalable geographic multicast protocol, EGMP, for MANET. The scalability of EGMP is achieved through a two-tier virtual-zone-based structure, which takes advantage of the geometric information to greatly simplify the zone management and packet forwarding. A zone-based bidirectional multicast tree is built at the upper tier for more efficient multicast membership management and data delivery, while the intrazone management is performed at the lower tier to realize the local membership management. The position information is used in the protocol to guide the zone structure building, multicast tree construction, maintenance, and multicast packet forwarding. Compared to conventional topology-based multicast protocols, the use of location information in EGMP significantly reduces the tree construction and maintenance overhead, and enables quicker tree structure adaptation to the network topology change. We also develop a scheme to handle the empty zone problem, which is challenging for the zone-based protocols. Additionally, MEGMP makes use of geographic forwarding for reliable packet transmissions, and efficiently tracks the positions of multicast group members without resorting to an external location server.

Compared to the classical protocol ODMRP, both geometric multicast protocols SPBM and EGMP could achieve much higher delivery ratio in all circumstances, with respect to the variation of mobility, node density, group size, and network range.

Our results indicate that geometric information can be used to more efficiently construct and maintain multicast structure, and to achieve more scalable and reliable multicast transmissions in the presence of constant topology change of MANET. Our simulation results demonstrate that MEGMP has high energy consumption, high packet delivery ratio, and low control overhead and multicast group joining delay under all cases studied, and is scalable to both the group size and the network size. Compared to the geographic multicast protocol SPBM and EGMP, it has significantly lower control overhead, data transmission overhead, and multicast group joining delay.

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BIOGRAPHY

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Journal of Computer Applications (JCA)
ISSN: 0974-1925, Volume IV, Issue 2, 2011

Enhancing Security In ATM Networks Through Congestion Control Technique

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***Abstract*— In ATM networks, the information is transmitted using short fixed-length cells, which reduces the delay variance, making it suitable for integrated traffic consisting of voice, video and data. By proper traffic management, ATM can also ensure efficient operation to meet different quality of service (QoS) desired by different types of traffic. In ATM networks, traffic control and congestion control can be done by a set of QoS parameters and classes for all ATM services that is to minimize network, end-system complexity while maximizing network utilization. The future telecommunication should have such characteristics: broadband, multimedia, economical implementation for diversity of services Broadband integrated services digital networks (B-ISDN) provides what we need. Asynchronous Transfer Mode (ATM) is a target technology for meeting these requirements.**

***Index Terms* — ATM, B-ISDN, QoS**

I. INTRODUCTION

ATM network uses fixed-length cells to transmit information. The cell consists of 48 bytes of payload and 5 bytes of header. The flexibility needed to support variable transmission rates is provided by transmitting the necessary number of cells per unit time. ATM network is connection-oriented. It sets up virtual channel connection (VCC) going through one or more virtual paths (VP) and virtual channels (VC) before transmitting information. The cells is switched according to the VP or VC identifier (VPI/VCI) value in the cell head, which is originally set at the connection setup and is translated into new VPI/VCI value while the cell passes each switch. ATM resources such as bandwidth and buffers are shared among users, they are allocated to the user only when they have something to transmit. So the network uses statistical multiplexing to improve the effective throughput.

Recent advances in high-speed multiplexing, switching, and optical transmission systems coupled with potential opportunities to provide new services have stimulated a great deal of interest in Integrated Services Digital Networks (ISDN) with Broadband ISDN (BISDN) capabilities. The Asynchronous Transfer Mode (ATM) technique provides the required flexibility for supporting heterogeneous services in a BISDN environment.

Due to the flexible and dynamic nature of ATM and the heterogeneity of services in a BISDN environment, the definition of an effective overall congestion control strategy will play a critical role in the ultimate success of BISDN. Our paper summarize the main overall congestion control strategies that have been proposed in literature and standard forums discuss the basic techniques that could be used in implementing the overall congestion control in ATM networks.

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II. SELECTION CRITERIA

To design congestion control scheme is appropriate for ATM network and non-ATM networks as well, the following guidance are of general interest.

- **Scalability**

The scheme should not be limited to a particular range of speed, distance, number of switches, or number of VCs. The scheme should be applicable for both local area networks (LAN) and wide area networks (WAN).

- **Fairness**

In a shared environment, the throughput for a source depends upon the demands by other sources. There are several proposed criterion for what is the correct share of bandwidth for a source in a network environment. And there are ways to evaluate a bandwidth allocation scheme by comparing its results with a optimal result.

- **Fairness Criteria**

1. Max-Min
   The available bandwidth is equally shared among connections.
2. MCR plus Equal Share
   The bandwidth allocation for a connection is its MCR plus equal share of the available bandwidth with used MCR removed.
3. Maximum of MCR or Max-Min Share
   The bandwidth allocation for a connection is its MCR or Max-Min share, which ever is larger.
4. Allocation proportional to MCR
   The bandwidth allocation for a connection is weighted proportional to its MCR.
5. Weighted allocation
   The bandwidth allocation for a connection is proportional to its pre-determined weight.

- **Fairness Index**
  The share of bandwidth for each source should be equal to or converge to the optimal value according to some optimality criterion. We can estimate the fairness of a certain scheme numerically as follows.
- **Robustness**
  The scheme should be insensitive to minor deviations such as slight mistuning of parameters or loss of control

messages. It should also isolate misbehaving users and protect other users from them.

- **Impement ability**
  The scheme should not dictate particular switch architecture. It also should not be too complex both in term of time or space it uses.

To make it easier to manage, the traffic in ATM is divided into five service classes:

- **CBR: Constant Bit Rate**

Quality requirements: constant cell rate, i.e. CTD and CDV are tightly constrained; low CLR.
Example applications: interactive video and audio.

- **rt-VBR: Real-Time Variable Bit Rate**

Quality requirements: variable cell rate, with CTD and CDV are tightly constrained; a small nonzero random cell loss is possible as the result of using statistical multiplexing.
Example applications: interactive compressed video.

- **nrt-VBR: Non-Real-Time Variable Bit Rate**

Quality requirements: variable cell rate, with only CTD are tightly constrained; a small nonzero random cell loss is possible as the result of using statistical multiplexing. Example applications: response time critical transaction processing.

- **UBR: Unspecified Bit Rate**

Quality requirements: using any left-over capacity, no CTD or CDV or CLR constrained.
Example applications: email and news feed.

- **ABR: Available Bit Rate**

Quality requirements: using the capacity of the network when available and controlling the source rate by feedback to minimize CTD , CDV and CLR.
Example applications: critical data transfer, remote procedure call and distributed file service.

III. TRAFFIC DESCRIPTOR

Quality of Service

A set of parameters are negotiated when a connection is set up on ATM networks. These parameters are used to measure the Quality of Service (QoS) of a connection and quantify end-to-end network performance at ATM layer. The network should guarantee the QoS by meet certain values of these parameters.

- **Cell Transfer Delay (CTD)}:** The delay experienced by a cell between the first bit of the cell is transmitted by the source and the last bit of the cell is received by the destination. Maximum Cell Transfer Delay (Max CTD) and Mean Cell Transfer Delay (Mean CTD) are used.
- **Peak-to-peak Cell Delay Variation (CDV)}:** The difference of the maximum and minimum CTD experienced during the connection. Peak-to-peak CDV and Instantaneous CDV are used.
- **Cell Loss Ratio (CLR)}:** The percentage of cells that are lost in the network due to error or congestion and are not received by the destination.

Usage Parameters

Another set of parameters are also negotiated when a connection is set up. These parameters discipline the behavior of the user. The network only provides the QoS for the cells that do not violate these specifications.

- **Peak Cell Rate (PCR):**
  The maximum instantaneous rate at which the user will transmit.
- **Sustained Cell Rate (SCR):**
  The average rate as measured over a long interval.
- **Burst Tolerance (BT):**
  The maximum burst size that can be sent at the peak rate.
- **Maximum Burst Size (MBS):**
  The maximum number of back-to-back cells that can be sent at the peak cell rate.
- **Minimum Cell Rate (MCR):**
  The minimum cell rate desired by a user.

The traffic descriptor of a Virtual Channel (VC) and/or Virtual Path (VP) is the set of necessary and sufficient parameters that characterize the traffic of the VC/VP. The traffic descriptor plays a key role in the service provisioning, admission control, and Usage Parameter Control (UPC) of the network, because it: Constitutes the basis of the service contract between the user and the network

IV. PARA METER CONTROL. OVERALL CONGESTION CONTROL STRATEGIES

The network should perform the following functions: Control the access of the subscribers to the network resources. The admission control scheme keeps the excess traffic load out of the network and ensures that the average demand of the accepted subscribers does not exceed the network resources. In addition to call acceptance, an admission control mechanism may either permit the in call renegotiation of the traffic descriptor of a VC/VP [9]. and/or support short hold mode service [1] (i.e., burst admission control [11] for certain bursty services- of an ATM network. Protect the users' QOS against the stochastic fluctuations of the subscribers' loads and enable the network to instruct the subscribers to adjust their rate, i.e., the congestion control scheme should include flow/reactive control mechanisms. Upon the onset of congestion at a node on the end-to-end path of a VC within the network, the network should be able to inform the source, destination, or both and instruct them to take the necessary actions.

Admission Control

Admission control can be defined as the acceptance or rejection of requests for setting up new connections (i.e., VCs/VPs) in accordance with an admission policy [12]. The objectives of an admission control policy are to establish fair blocking among various service types (each of which may have significantly different bandwidth needs and QOS requirements) and assure that sufficient network resources are available for each admitted connection.

Class Related Rule

First, let us consider homogeneous conditions. Suppose that *n* is the number of VCs in a class. We can determine a VP bandwidth (Br.p) that accommodates the VCs and satisfies the QOS requirements in a simulation assuming the burst level activity of a VC conforms to the two-state

Under heterogeneous conditions, the statistical multiplexing gain is a complex function of the numbers of VCs in individual traffic classes and it is difficult to determine

QOS Evaluation Method

When a new VC requires connection, the QOS evaluation method estimates how QOS performance will be affected after the acceptance of the VC. This estimation is usually based on bounds or approximations that can be easily obtained. For example. under the assumption that the average and maximum number of cells arriving during a fixed intervals are specified, an upper bound of cell loss probability could be used [12-17].VC completes the service and leaves the system. This method can be applied under heterogeneous conditions.

Fixed Boundary Method

The fixed boundary method introduces traffic classes and provides the number of *trunks* for each class [13]. A network provider determines the VP bandwidth such that all trunks of all classes can be accommodated and some degree of statistical multiplexing among classes is achieved when the VP bandwidth is dimensioned. The call acceptance rule is quite simple. The QOS evaluation method or the following approaches can be applied to the sizing of the VP bandwidth under heterogeneous conditions. One method is to determine the VP bandwidth from a certain specified percentile of the offered load assuming a Gaussian distribution, whose mean is equal to ABR and its variance is equal to the bit rate variance of each VC [12] [15]. Another method is to assume that the cell stream from each VC can be modeled as bursts and silence periods and determine the VP bandwidth such that the probability that the amount of bursts at an arbitrary instant is less than 100& of the VP bandwidth, is 1 - E or less, where 0 < d . The amount of bursts multiplexed can be directly evaluated from PBR and ABR without assuming the distributions of bursts and silence periods in the cell arrival process. Suppose that n VCs with PBR= *R* and ABR=a are multiplexed, and p(n,k). represents the probability that the number of bursts at an arbitrary instant is *k.* Then, p(n,k) is given by:

$$P(n,k) = \binom{n}{k} a(R)^k \left(1-\frac{a}{R}\right)^{n-k}$$

and the VP bandwidth, ***B*,** is provided by

$$\sum p(n,k) < 1 - E \quad (8)$$

A similar equation can be obtained under heterogeneous conditions. Similar discussions can be found in Burgin *et al.* [17], in which the burst level is considered. However, this method does not require the bandwidth reservation that other methods need to avoid a severe degradation of blocking probability for new vcs. The fixed boundary method could result in an inefficient

Measurement Method

Bandwidth to each VC based on the specified traffic descriptor and is not concerned with the actual bandwidth required by the VC. However, if we know the actual bandwidth instead of the nominal one, more VCs are expected to be accepted and resource utilization can be improved. The measurement method [18] uses the following relationship between cell loss probability, PLO and the distribution of the number of cells arriving at a VP**.**

$$\frac{P_{Loss} \le \sum_{k=0}^{\infty}\left[k - \frac{sBvp}{L}\right] + p(k)}{\sum_{k=0}^{\infty} kp(k)}$$

The admission control scheme accepts a new VC whose average and maximum numbers of cells during the interval, s, are *a* and *R,* if an only if the right-hand side of the above said Equation , after the acceptance of the new VC, **is** less than the cell loss probability objectives of the network. After the acceptance of the VC, the probability that *k* cells arriving is assumed to be given by:

$$\begin{array}{ll} p(k)\left(1-\frac{a}{R}\right) + p(k-R)\left(\frac{a}{R}\right) & k \ge R \\ p(k)\left(1-\frac{a}{R}\right) & k < R \end{array}$$

Here, ***p(k)*** is estimated from the measurement. If the right hand side of Equation 10 is too complex to be evaluated directly, the current load vector is employed.

Planar Approximation

In this approach [29], the network uses the traffic descriptor of a VC/VP and its QOS requirements to estimate the amount of capacity required (referred to as equivalent capacity) for the support of this VC/VP. The equivalent capacity of a VC/VP is defined as the amount of capacity required to satisfy the QOS requirements of the service of this VC/VP.

Sigma Rule

In this approach [12], the probability that the total bit rates of the accepted VCs on a VP exceed the permissible throughput of the VP **is** chosen such that the cell loss requirements of all VCs within the VP are satisfied. In the Sigma rule, all VCs that may be routed on a VP are segregated into two classes, class I and **11.** The decision to accept an incoming VC is based on the mean and peak rates of the incoming and existing VCs. There is no statistical multiplexing gain for VCs of class I, and the peak rate is allocated to a VC of class I.

Usage Parameter Control

The UPC (i.e., policing or traffic enforcement) is a mechanism that ensures a VC/VP does not violate its agreements with the network (i.e., it does not exceed its traffic descriptor). The UPC monitors the traffic of a VC/VP at the ingress of the network and takes necessary actions whenever the VC/VP violates its descriptor and transmits excessive traffic into the network.

V. PAYLOADLTYPE

In the event of congestion, the network discards the marked cells [18] **[16].** To ensure that a VC/VP conforms to its agreement with the network, the network should monitor and enforce the unmarked and marked cell streams of the VC/VP at the ingress of the network [8]. The strength of this scheme **is** that it encourages the users to utilize the network and may be useful for services that do not need a stringent QOS. When the network guarantees the QOS for a VC, this scheme may become ineffective, due to the fact that unless the network could purge (discard) the marked cells of different VCs fairly, the QOS of all VCs may not be satisfied.

Leaky Bucket Algorithm

A leaky bucket scheme [13] is a counter with three parameters, a threshold value *(S*), decrementing value (d), and decrementing time period (T) established at the VC/ VP set up. The scheme functions as follows: Each time an ATM cell of the VC/VP arrives, the count is either incremented or remains unchanged depending on its actual value. The count is incremented, if it **is** below the threshold value. and the ATM cell is permitted into the network. The count remains unchanged if it has already reached the threshold value *S,* and the cell **is** discarded.

Performance Metrics of UPC

Since different algorithms can be used for the UPC, it is essential to search for a set of performance metrics that could be used to verify the effectiveness of a UPC scheme, and compare its performance with other UPC schemes. An example set of metrics that could capture key characteristics of a UPC scheme are responsiveness and error margin [18]. These metrics are defined as follows:

Responsiveness

The responsiveness of a UPC scheme indicates how quickly a UPC can detect the excessive traffic of a VC.

Error Margin

In general, the error margin reflects the Sensitivity/accuracy of the UPC mechanism. For instance, it could consist of:

- Probability of false alarm-represents the probability that the UPC incorrectly identifies non excessive traffic as excessive.
- Probability *of* late alarm-represents the probability that the UPC incorrectly permits the excessive traffic of the user into the network.

VI. QOS CONTROL AND CELL LOSS PRIORITY

Cell delay and cell loss are the key causes of QOS deterioration in an ATM network. A relative system of cell delay and/or CLPs enables the network to reduce the impact of cell delay and cell loss in the network and exerts some control on the QOS of its services. Although the dominant portion of a cell delay in a ATM network is the propagation delay and the processing delay, the delay priority reduces the cell delay jitter and protects the real-time services against the instant bursts of other traffic in the network.

V. FLOW/REACTIVE CONTROL

Since coincident bursts and focused loads may result in instantaneous overloads in a node(s) of an ATM network, the congestion control scheme of the network should provide flow reactive control capabilities. Whenever a node within the network experiences congestion, it will invoke these capabilities to react to its instantaneous overload condition. These capabilities reduce the cell loss in the network and improve the QOS for the users. To provide these capabilities, the overall congestion control strategy should include BCN or FCI.

VII. SUMMARY AND CONCLUSIONS

This paper reviewed different strategies of congestion control in ATM networks. Towards this goal, we have described the problem, presented a summary of the overall congestion control strategies, and discussed the basic capabilities that could be used in the overall congestion control of a network. The set of mechanisms that constitute a general framework for congestion control consists of admission control, UPC, relative cell delay/loss priority, and flow/ reactive control mechanisms. Depending on their service scenarios, the overall congestion control schemes of different networks may consist of different combinations of these mechanisms. Furthermore, different networks may realize the same mechanism (e.g., admission control, UPC, etc.) through the use of different algorithms and implementations. Therefore, it may be neither desirable nor practical to expect that standard forums arrive at agreements on the structure and algorithm for each one of the mechanisms described in the general framework. The issues with solutions constituting the set of basic requirements for traffic/congestion control in ATM networks are [23]: the traffic descriptor and QOS parameters of a VC/VP, the specification of the CLP field, and the means of BCN and FCI. The function of a FCI mechanism is to convey the congestion control. For instance, the congestion management strategy [22] of this paper reviews different congestion control strategies

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