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COMPACT ROUTING USING SWARM ALGORITHM

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***Abstract*— In this paper we borrow the ideas from swarm intelligence to propose a model for compact routing mechanism so as to decrease the size of the routing list in a multipath network.. Swarm intelligence is the study of computational systems inspired by the 'collective intelligence'. A large part of the research in swarm intelligence has focused on the reverse engineering and the adaptation of collective behaviors observed in natural systems with the aim of designing effective algorithms for distributed optimization. We are focusing here on the design of routing algorithms that store a small amount of information in a routing list at each node in a network, and provide a bound on the stretch of messaging routes which is also referred to as Compact Routing.**

***Index Terms*— swarm intelligence, collective intelligence algorithm, compact routing.** *(Key words)*

A. Introduction.

A network is a collection of computers and other hardware interconnected by communication channels that allow sharing of resources and information. The process of selecting paths in a network along which to send network traffic is called routing. Routing may be divided in the following categories:

a. Proactive, reactive, and hybrid routing
b. Source and next hop routing
c. Flat and hierarchical routing
d. Distributed and centralized routing
e. Single path and multipath routing

In **proactive routing** fresh lists of destinations and their routes is maintained by periodically distributing routing tables throughout the network. Respective amount of data for maintenance is required to be handled and there is slow reaction on restructuring and failures. This technique is also referred to as table driven routing. In reactive routing which also called on demand routing we find a route on demand by flooding the network with Route Request packets. Here the latency time in route finding is high. Hybrid routing combines the advantages of proactive and of reactive routing. The routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding. The choice for one or the other method requires predetermination for special cases [1].

In **source routing**, the data packet has the complete route called source route in the header. Typically, the source node builds the whole route and the data packet routes itself [2]. In next hop routing the routing table on each node contains the next hop node and a cost metric for each destination. Data packet only has the destination address .This routing is also known as **hop by hop routing**.

In a **flat routing**, each network ID is represented individually in the routing table. Flat routing protocols distribute information as needed to any router that can be reached or receive information. No effort is made to organize the network or its traffic. The only requirement here is to discover the best route hop by hop to a destination by any path [3]. In **hierarchical routing** routers are grouped together by function into a hierarchy. The routers contain all the details about how to route the packets to the destination within its own region. It is necessary to group the regions into clusters, the clusters into zones and zones into groups and so on.

Centralized routing model is a routing model in which routing is centrally carried out using a centralized database. In other words, the routing table is kept at a single "central" node, which should be consulted when other nodes need to make a routing decision. This centralized database possesses a global network view. In distributed routing model, each node keeps a separate routing table**. Distributed routing** model is a routing model, which is excellent for domains that can be identified as entirely opaque. In case of a failure (when there is a need to restore rapidly), distributed routing system can be relied upon to bear the responsibility of the on-demand computation of a paths of recovery for each of the light-paths that have failed (even at the point of detecting an expected failure) [4].

In a **single-path routing** infrastructure, only a single path exists between any two networks in the internetwork. While this may simplify the routing tables and the packet flow paths, single-path internetworks are not fault tolerant. Single Path protocols learn routes and select a single best route to each destination. It will only insert a single path to a destination in the IP routing table. In a **multipath routing** infrastructure, multiple paths exist between networks in the internetwork. Multipath internetworks are fault tolerant when dynamic routing is used, and some routing protocols, such as OSPF, can balance the load of network traffic across multiple paths with

the same metric value. Multi-path protocols learn routes and can select more than one path to a destination

In this paper we are focusing on selecting minimum distance between the source and the destination with compact sized routing list at each node. A routing list which is also known as routing information base (RIB), is a data table stored in a router or a networked computer that lists the routes to particular network destinations, and in some cases, metrics or distances associated with those routes. The routing list contains information about the topology of the network immediately around it. There are multiple paths connecting each node in a network. We here divide the flow among a number of paths instead of using a single path results in a better balancing of load throughout the network. Compact routing algorithm is used for balancing load of each node which helps to optimize network throughput and Swarm Intelligence Algorithm is used for selecting the minimum path between two nodes.

B. Compact Routing

A routing scheme is a distributed algorithm that allows any source node to route messages to any destination node, given the destination's network identifier. In the routing strategy each node contains a routing table which specifies an output port for each destination [11]. Compact routing is basically used for minimizing the size of the routing list.

C. Swarm Intelligence

Swarm Intelligence is a relatively novel field. It addresses the study of the collective behaviours of systems made by many components that coordinate using decentralized controls and self- organization. Swarm intelligence has focused on the collective behaviours observed in natural systems. Swarm intelligence is used in designing of effective algorithms for distributed optimization. Swarm intelligence (SI) is a relatively novel field that was originally defined as ''Any attempt to design algorithms or distributed problem-solving devices inspired by the collective behaviour of social insects and other animal societies" [6].

D. Working Model

Early work on compact routing focused on routing schemes for special networks such as rings, trees and grids. Peleg and Upfal were the first to construct a universal compact routing scheme. Compact routing uses a routing scheme algorithm for generating a routing scheme for every given network, that is, for all sorts of topologies. A trivial version of this routing strategy .In this strategy each node contain a routing table which specifies an output port for each destination.

Although this routing strategy can guarantee routing through the shortest path, each router has to store locally O(n log d) bits of memory, where d is the degree of the node and n is the total number of nodes in the network. As the network grows in size, it becomes necessary to reduce the amount of memory store at each node.

Let a network G (a weighted connected graph) G= (V, E) with |v|=n be a labelled undirected network. Here Complexity Measures in the terms of Space & Stretch.

Space = size of the largest local routing tables

More precisely, size of the smallest local routing algorithm including all constants and data-structures

In the grid example: space = O(log n) bits

Stretch = ratio between length of the route and distance

|route(x, y)| 6 stretch • dist(x, y)

In the grid example: stretch = 1 (shortest path)(1…..)

In this we are using the swarm optimization algorithm to find the shortest path between the source and the destination node. The Particle Swarm Optimization algorithm comprises of a collection of particles that move around the search space influenced by their own best past location and the best past location of the whole swarm or a close neighbour.

Procedure to minimize the size of routing tables using swarm algorithm is as follows:

1) Now firstly take the empty buffer at each node.
2) In the population size buffer the routing list generated randomly.
3) When the particles stop the movement from node to node then the final position of the particle updated in the list.
4) After that it updates the velocity and the final position of the particle in buffer.
5) The actual position of the particle with particle route is updated in the list.

Hence the routing table is minimized.

E. Conclusion & future work

Networks consist of large sets of resource-constrained nodes. The design of effective, robust, and scalable routing algorithm in these networks is a challenging task. On the other hand, the relatively novel domain of swarm intelligence offers algorithmic design principles, inspired by complex adaptive biological systems that well match the constraints and the challenges of networks. This is the reason, in the last years a number of routing algorithm for networks have been developed based on Swarm Intelligence principles, and, more specifically, taking inspiration from foraging behaviours of ant and bee colonies [9]. In this paper, we have presented a rather extensive survey of these SI-based algorithms for routing in networks. Finally, we have outlined a general methodology which is scientifically sound in evaluating optimized distance between two nodes with minimized routing list.

To conclude, we want to sketch some future directions for the field rather than highlighting methodological problems. We strongly believe that we will witness a large diffusion of Swarm Intelligence-based solutions for real-world networks whether it is wired or wireless.

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