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Less Cost Any Routing With Energy Cost Optimization

R.Jegadeesan [1],Dr.N.Sankar Ram[2] M.Naveen Kumar [3]
Ph.D Research Scholar [1], Supervisor[2],Assistant Professor [3]
Anna University-chennai(India)[1], Anna University.Chennai(India) [2],T.J.S Engineering College, Peruvoyal,Thiruvallur Dist [3]
ramjaganjagan@gmail.com [1], n_sankarram@yahoo.com[2],naveenkumar.m2002@gmail.com[3]

ABSTRACT — The traditional routing is based on shortest path routing schemes where the packets are transmitted in the pre-determined path which usually suits for wired networks. Whereas the wireless networks are based on broadcast (any cast) nature of routing schemes where the packets are transmitted to any node in the set of neighbours instead of one specific node. This is the motivation behind the opportunistic routing. In Opportunistic routing the route (next hop) is selected after the packets are transmitted, which combines multiple week links into one strong links. The motivation is with unreliable wireless links, the probability of a packet successfully being received by at least one node in a set of neighbours is greater than one specific node receiving it. The OR copes very well with unreliable and unpredictable wireless links. The Any path Routing is the generalization of opportunistic routing which selects optimal number of candidate relays and prioritizes them in the distributed way. The Least Cost Any path Routing algorithm is used to select the optimal number of candidate relays and prioritize it. The algorithm is general and can be applied to any wired or wireless networks. The algorithm shall be implemented as a protocol which sits in the layer-3 (network layer) of the OSI reference model that selects the optimal number of candidate relay nodes for every node which takes care of sending the packets to the destination.

EXISTING SYSTEM

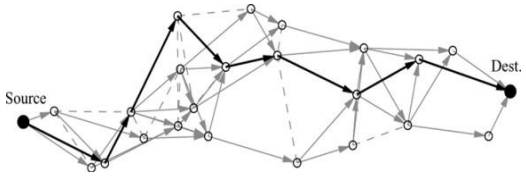
The existing Opportunistic Protocols like EX-OR (Extremely Opportunistic Routing Protocol) selects all the neighbour nodes as the candidate relay nodes for a given node where the forwarding cost of the packet is decreased if the number of candidate relays are increased.

Increasing the number of candidate relays sometimes makes the shortest-path route to become a longest-path route since there are many candidate relay nodes associated with the given node. The disadvantages to the existing opportunistic protocols is that it does not make optimal choices on the number of candidate relays where each packet can travel to all possible paths which is having different costs associated with it to reach the destination. Which path each packet has to follow is purely depends on the decision made by the link-layer and network layer protocols.

PROPOSED SYSTEM

The proposed system solves the problem of finding the optimal number of candidate relay sets and prioritizes them in the distributed way. To achieve it the generalization of single-path routing is used which is any path routing where the next hop to reach the destination shall be treated as a set of neighbors instead of single node.

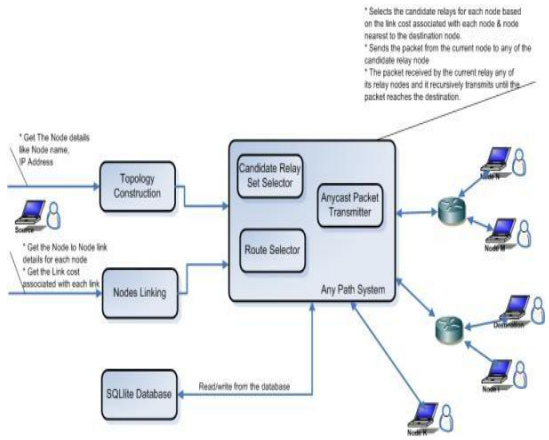
ARCHITECTURE



ADVANTAGES

The any path routing routes are more robust and stable as compared to the single-path route distances.

ARCHITECTURE DIAGRAM



The diagram above shows the overall architecture of the any path routing system. The system is built based on the simple LAN networks where multiple nodes are connected with each other in the network through routers and LAN.

As discussed since in real-time the any path routing algorithm shall be implemented as a network and data link layer protocols which maintains the list of candidate relay set nodes that takes care of packet transmission, the proposed solution shall be implemented as a simulation of algorithm in the simple wired LAN networks with min. 5 to 10 desktops.

The Any path system is implemented using JAVA as the programming language with SQLlite as the backend database. The SQLlite database is chosen considering the project is of small scale in size. The proposed system architecture consists of the following core modules.

- Topology Construction
- Nodes Linker
- Candidate Relay Set Selector
- Route Selector
- Any path Packet Transmitter
- Packet Receiver

The any path routing system is comprised of the main three core modules which are candidate relay set selector, route selector and any path packet transmitter.

TOPOLOGY CONSTRUCTION

The Topology construction is one of the core modules in the any path system where the node details like Node Number, Node Name and IP Address of the node are accepted as the input from the end user through the interactive JAVA GUI which is developed using JAVA Swing and AWT components. The Node details are used later for constructing the topology of the network which is the basis for the any path routing.

The GUI takes the input about the node details and stores it in the SQLlite database. The GUI has the option to add new node details, modify the existing node details and delete the existing node details. It also has the option to read the node details for View. For the proposed system the existing well established IPV4 protocol is used to implement the any path routing.

NODES LINKER

The Nodes Linker module is the second next module in the any path system whose primary job is to establish the link between nodes. The node details which are got from the topology construction module are used as the primary input by the nodes linker module. The nodes linker module gets the node to node details like the from node number and to node number between which the links needs to be established and also the link cost associated with it.

The Nodes linker module is the complex module in the proposed system architecture which actually constructs the topology of the network for the any path routing to take place. Once the Nodes linker module gets all the input details about the link between which to which node and link cost, the topology shall be constructed with well established links to form the simulation of the network.

The Nodes linker module constructs the network topology using all the available node details, links between them and the link cost associated with it for the any path system to take over on the candidate relay set selection, route selection and packet transmission and reception.

CANDIDATE RELAY SET SELECTOR

The Candidate Relay Set Selector, Route Selector and Any path Packet Transmitter nodes collectively called as Any path routing system which implements the any path routing algorithm.

The Candidate Relay Set Selector module selects the subset of candidate relays for a given node based on all its neighbors. The success of the any path routing lies in the optimal number of selection of the candidate relay nodes. The candidate relay set selector module uses the nodes linker module output to identify each node and the candidate relay set nodes for each of those nodes.

ANYPATH PACKET TRANSMITTER

The Any path Packet transmitter module transmits the packet that is received from other node or as a source, does the any cast routing of the packet to its candidate relay set nodes identified by the candidate relay set selector module. The any cast routing scheme is that the packet that is transmitted from the current node usually will be received by any one of its neighbor node which is usually the nearest neighbor based on the link cost associated between them.

The any path packet transmitter once sends the packet it will be received by any one of its candidate relay node which becomes the active candidate relay node from there on and take care of routing the packet to its own candidate relay set nodes.

ROUTE SELECTOR

The Route selector module selects the route after it receives the packet from its predecessor nodes in the any path routing scheme. Whichever the node receives the packet from the source node or its predecessor node becomes the active candidate relay node which selects the route for transmitting the packet by doing the any cast of the packet in the same way that its predecessor did to all its candidate relay set nodes.

The packets will be transferred to any one of its successor node which becomes the active candidate relay node. The main difference between traditional and opportunistic routing is lies in the candidate relay set selector and route selector modules where in case of the traditional routing the packets are transmitted in the predetermined path whereas in opportunistic routing the packets are transmitted first and then the route are identified.

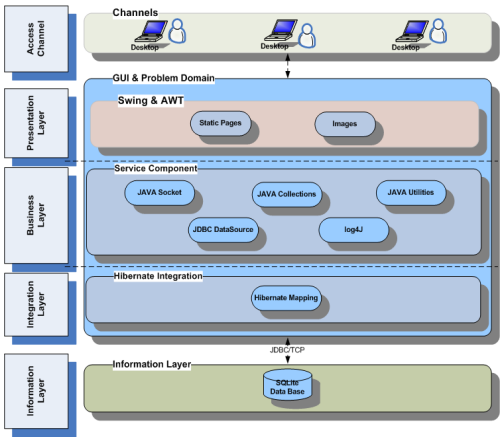
PACKET RECEIVER

The packet receiver is the receiver module where the packets are received that is sent by the any path packet transmitter module. The packet received by the node becomes the active candidate relay node which forwards the packet its neighbors by doing any cast to all its candidate relay set nodes.

The packet receiver module shall be implemented as a stateless module where it just forwards the packet that is received until the packet reaches its destination. The packet receiver does not alter the content of the packet it received whereas it just gets the message and forward it to any of its successor nodes.

The Packet Receiver module is a secondary module which is one of the core modules works in line with the other primary modules i.e., the Candidate Relay Set Selector, Route Selector and Any path Packet Transmitter modules.

TECHNICAL VIEW



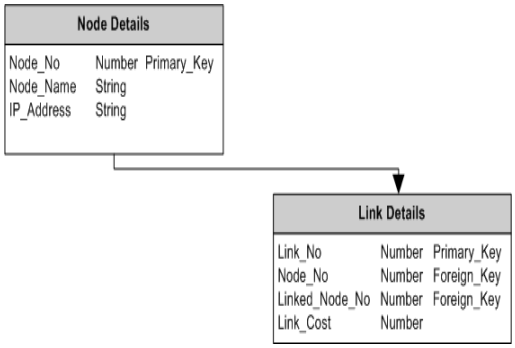
The Technical View above shows the overall technical architecture of the any path routing system. The proposed any path system is based on sustainable technology platform and Java server technologies based on the N-Tier Architecture where the presentation and business logic layer are implemented using the MVC (Modal-View-Controller) architecture design pattern. The Integration layer is the ORM (Object-Relational Mapping) layer through which the business components interact with the database (information layer).

N-TIER ARCHITECTURE

N-tier architecture is a multi-tier architecture in which the presentation, the business logic, and the data management are logically separate processes. The most widespread use of multi-tier architecture is the three-tier architecture.

N-tier application architecture provides a model for developers to create a flexible and reusable application. By breaking up an application into tiers, developers only have to modify or add a specific layer, rather than have to rewrite the entire application over, if they decide to change technologies or scale up. There shall be a presentation or client tier, a business or middle or data access tier, and a data tier.

DATABASE VIEW



The diagram shows the Entity Relationship (ER) diagram of the any path routing system. It has two tables namely Node Details and Link Details. The Node Details table has columns like Node_No, Node_Name and IP_Address of the node where all the node information is stored.

The Link Details table has the foreign key reference to the Node Details table for the Node_No column. It has the columns like Link_No, Node_No, Linked_Node_No and Link_Cost where all the link between nodes and their costs associated stored.

CONCLUSION

This proposal computes the least cost any path routes in multi-hop networks that selects the optimal number of candidate relays in a distributed way and prioritizes it which makes it robust and reduce the energy transmission cost during packet transmission.

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R.Jegadeesan has registered Ph.D (I&CE) Research in the Anna University Chennai.India on wireless sensor networks and computer Networks 2011 onwards.and he has received the B.E.and M.E in computer science and Engineering in Anna University Chennai. India.

During his undergraduate and post graduate studies, he spent time at Anna University Chennai India,From 2000 to 2007, he has contributed at many Universities for visiting faculty for his research area like Wireless Sensor networks, Computer Networks, wireless networks. He is currently working with the proposal work in Anna University Chennai. India.

He is fellow of IEEE Member for last two years and Computer society of india (CSI)last three years and and RedHAT Linux Instructor and related memberships. in addition that he has Published many National and international level Conferences and Journals, Seminars, and Workshops.

Dr.N. Sankar Ram is the Professor,Computer Science and Engineering, working in a self financing Engineering college affiliated to Anna University,Chennai.. He completed his under graduation and post graduation from Madurai Kamaraj University and Doctorate from Anna University Chennai.

His research areas of expertise are Software Architecture and Computer Networks. He has 16 years of teaching experience and he has published many research papers in International/National journals and conferences. He is a approved supervisor under Anna University of Technology, Chennai and guiding Ph.D and M.E research scholars in his area. Being a Principal Investigator, got a funded project to a tune of Rs. 9 Lakhs from AICTE under RPS scheme in the year 2011.

M.Naveen Kumar Now presently working as an Assistant Professor in CSE Dept of T.J.S Engineering College, Chennai. he has Received M.Tech in CSE from Vel Tech TechnicalUniversity,Chennai.(India) and B.Tech CSE in St.Peter's Engineering College, Anna University, Chennai. His research interest includes Computer Networks, Wireless Networks.