Journal of Computer Science and Applications.
ISSN 2231-1270 Volume 9, Number 1 (2017), pp. 19-31

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Predicting Node Location Using Geomap for Mutlipath Transmission in Heterogeneous Wireless Networks

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Abstract

Wireless networking is becoming more popular and widespread in recent computing era. Network consumers are rapidly increasing in count which also increases the count of mobile nodes and networks range. The people also need speeder and reliable network communication for current financial and commercial purposes. To solve this problem we introduce **GeoMap** Predicted Multipath Transmission (GMPMT), which uses Stable Path Scheduling (SPS) to calculate routing path from source to the destination. To utilize all available stable base stations on the network, GMPMT calculate multi path transmission from source to destination via the available stable channels. It is aimed to provide a break free network communication throughout the travel of the node from source to destination. A continues path switching algorithm is implement to avoid the above mentioned signal breakdown. Algorithm and experiment shows that the proposed algorithm can provide a flawless network communication with improved throughout and decreased dataloss.

Keywords: GeoMap Predicted Multipath Transmission, Stable Path Scheduling, Node Location Prediction

1. INTRODUCTION

1.1 Multi-Path Network Communications

Throughput capacity is a key characteristic of wireless networks. It represents the long-term achievable data transmission rate that a network can support. Throughput of the transmission may vary based on network design, energy and bandwidth allocated, routing used, interference, etc. A good understanding of the capacities of different network architectures allows a designer to choose architecture appropriate for his or her specific purpose. There are several network models are provided for the wireless Networks. In a wireless cellular network or a wireless LAN, nodes communicate with each other through base stations or access points. A node first connects to the nearest base station or access point in order to communicate with other nodes. A base station serves as a communication gateway for all the nodes in its cell.

1.2 Heterogeneous Wireless Networks

In this paper Heterogeneous Wireless Network is taken as the keen domain. Heterogeneous Wireless Network is the network with various kind of devices running different platform and with various access protocol. An ad hoc network is a communication network formed by a collection of nodes without the aid of any fixed infrastructure. Solving problem of Transmission breakage is taken as objective of the work as the fast moving vehicles over the network change locations rapidly. Consider than the node traveling in a fast moving car or train with the speed of 105 km/hr. Location of the node rapidly changes from base-station to base-station within seconds is the major problem identified is such an network. The heterogeneous network is considered in the paper where the network topology and infrastructure changes accordingly. The report focuses on the case when the number of base stations in the hybrid network grows sub-linearly with the network size. Previous results suggest that there exists a protocol that provides an improvement in capacity as compared to a pure ad-hoc network if the infrastructure growth is at least as fast as square root of the size of the network.

1.3 Throughput capacities

The success in the development of wireless communications in late 90s has resulted in the installation of commercial cellular networks. The ease of use and importance of mobility has led to the exploded use of cell phones. In many cases such systems are limited in the number of mobile users they can simultaneously handle. Market competition drives the costs lower which results in the increased number of users willing to pay for the wireless service. To utilize the traveling time most of the travelers use their mobile phones or other media to connect Internet. Both government

and private travel agencies provide free WiFi Internet Connections for their travelers. But whether the Internet is provided with full quality is a Question? The throughput capacity of a heterogeneous wireless network is highly questioned as the node travels from location to location in high speed. To improve throughput the nodes location should be predetermined to calculate for routing. Adding multi path transmission is with path prediction technique may helpful in improving the throughout.

1.4 Precalculated Multipath Transmission

While most of the algorithms are concentrating on managing the network capacity this model concentrates on node location prediction and transmission with predicted multipath. It is not clear how much capacity gain a network can achieve by adding a certain number of base stations to an ad hoc network and forming a Heterogeneous Wireless Network. Advantages of the proposed network model is the size of the network not exceeds a certain limit but the network is highly dynamic. Ad Hoc Network within the vehicles should not be disturbed in any cause and the transmission to data should match the speed of node in moving vehicle. It is the purpose of this work to study of heterogeneous wireless networks. Contribution of this proposed work is given as follows.

- How to predetermine the location of the node over the heterogeneous wireless network?
- How to wisely select the intermediate basestation and secondary basestation for the multipath routing?
- How to reduce the network breakage over the transmission that can reduce the

This paper proposes a heterogeneous wireless network model with **GeoMap Predicted Multipath Transmission (GMPMT),**to improve network connectivity and transmission capacity. In the model, secondary base stations is planted along the railways for faster communication wireless network is placed within an ad hoc network. Heterogeneous wireless network may consists of mobile nodes with various platform and some well-connected secondary base stations. It is called a heterogeneous wireless network since it consist of traditional cellular networks and pure ad hoc networks. In fast moving wireless networks, there is no infrastructure, data can only be forwarded by the nodes in a multipath routing fashion. In cellular networks, data are always forwarded through the infrastructure. While in a heterogeneous wireless network, data will be transmitted in a multihop fashion through the infrastructure. The data will be transmitted from server to calculated basestation and to secondary basestation and finally to the network node via the WiFi provider. It is of great interest to understand what performance gains can be achieved by the hybrid networks.

2. RELATED WORK

Many researchers have given their interest on Vehicular Ad Hoc Network because it broadly in implementation all over the world. It is difficult to provide better QOS in such a network with video-on-demand (VOD) [1] sessions is a challenging problem. For Urban environments the adaptive geographic routing scheme is used to VOD transmission. In this scheme, rather than one route, number of routes gets calculated based on the volume of the size of requested video is divided with respect to the calculated paths. The connectivity probability of route is calculated by the closed form equations, which is used to select best connected routes. The experimental result shows the following output as the packet loss ratio is omitted by 40.79% and transmission delay is gradually increased by 25 ms compared with those of junction-based multipath source routing at the cost of 2-ms degradation in the end-to-end delay.

The property of the delay tolerant network (DTN) [1] is highly depend on social behavior of the connected nodes. The hypercube-based routing protocol supported by the social feature selection with analytical model is implemented for this DTN. And for routing guidance the social features of the node and its individuality is used with the routing protocol calculation. This method is derived from the social network communication based on their social groups and their social relationships and how it affects the routing calculation is kept on mind. This protocol solves the mobility problem by moving considering the unstructured network M-Space to the static structured F-Space. To calculate the feature selection as step-by-step procedure is used with hypercube-based feature matching to calculate multipath. To resolve feature matching shortcut algorithm more than one feature difference is used. The multipath calculated for routing is not depended on the nodes on the network rather depends on the base-station.

Traffic in optical backbone networks is increasing and make the network as heterogeneous network with respect to bandwidth and Quality of Service requirements due to the abitlity of high-bandwidth services, which need to coexist with older services like HTTP. Mixed-Line-Rate (MLR) [2] network supports bandwidth of different rates vary from 10, 40 and 100 GB/s. These are all being studies to improve the quality of the heterogeneous network. Most routing techniques need some basic information about the node location and network infrastructure like trajectory, node history and transmission history. However the above mentioned information is highly dynamic and may or may not be appropriate that makes decision process difficult.This paper uses the social features of the node lies in the network to calculate the routing table. By this way the feature based routing problems in highly unstructured network become more and more difficult.To solve this problem this paper shows a way of considering the network as the human contact networks where the Infocom 2006 trace and MIT [4] uses the data mining technique to identify the

node movement trace using the trajectory data sets. Using this the node location movement can be calculated.

Unlike other routing algorithms the routing path is not calculated based on source and destination. The routing path is calculated based on the source and the available stable base-station on the network that can provide data to the destination node. This paper used the tree based construction of path from the source server to the multiple destination location of the receiver node as it is in the movement. Using this tree method the routing it is possible to avoid routing failure as there is the flexibility in the packet transmission.The performance is evaluated by comparing the calculated tree with the previously calculated channels throughput and its transmission rate based on the locations. This paper also evaluates the performance of the trees when used for multipath routing and compare it to equal-cost multipaths (ECMP) [5].

This paper concentrates on the Hybrid Wireless Network which combines the features of wireless network and Ad Hoc Network together in same network. By this way the data transmission is not only depend on the base station network also through the Mobile Ad hoc network can be possible which increase the transmission rate. For such an combined network an efficient routing protocol should be determined to manage the capacity of the network where network is highly dynamic. As the property of the adhoc transmission is used along with the cellular network then the security problems of the ad hoc network is also adopted by the cellular network so care is security should be taken. Distributed Three-Hop Routing (DTR) [1] [6]can also consider as one of the technique effectively used for the multipath routing. To utilize all the base station and nodes in the network the DTR uses the distributed multipath transmission by segmenting data into several paths and send it via multiple paths. Using this method the throughout of the transmission is the hybrid network is highly improved with less traffic and security.

3. PROBLEM IDENTIFICATION

Mobility: Heterogeneous Wireless Networks are highly dynamic in nature. And the consideration is made on the fast moving node may be in VANET. So managing mobility is a very big challenging one in this model.

Location Prediction: Node position be accurately identified to calculate the routing path for transmission. Existing location identification methods will not be suitable for this model a novel algorithm should be created for the identification. After predicting the node locations the multipath calculation should be done for routing.

Low reliability. Due to dynamic nature and long paths data transmission is not assured. Network breakage or quick pass though of node may cause is high data drop and wastage in transmission effort. There will be efficiency wastage occurs when the

node crosses the calculated destination path, so these wastage will be omitted throughout the transmission.

Proposed Model

To provide better network throughput, security, traffic avoidance, reduce data loss, ommit communication brakate this proposes a novel algorithm named **GeoMap Predicted Multipath Transmission (GMPMT).** This algorithm could be implemented on Heterogenious wireless network which can perform the following action. Before calculating the routing path node location should be predicted for the destination nodes. For predicting the node location GeoMap algorithm is used. Its is like trajectory analysis which compares the node location history with the actual route map. Unlike the existing system GMPMT will not divide the data into several segments, it will first calculate available routes via available base stations. Then based on the paths available on the network the data is divided into N Segments. The transmission thread is started predetermined manner. With the routing table of the predicted node location the data segments are transmitted along the predetermine path. The data will be sent to the secondary base-station which will be the mini tower along the railway towers. When the node come near the secondary base-station the data is submitted to the WiFi provider [7].

4. PROPOSED METHOD

4.1 Wireless Network Setup

As the Heterogeneous Wireless Network is consider as the network environment, the network will be having various kinds of nodes with various kinds of platform running different protocols. Mostly base station oriented wireless networks are trusted for the better transmission output. The network environment will be having the Internet Service Provider [8] , required base stations, required secondary base stations and WiFi provider inside the vehicle and the mobile nodes in the VANET [9]. The network environment will be created in the ns2 environment with above mentioned nodes. The simulation will be made on that NAM to test the implemented methodology and obtain certain throughput and traffic.

4.2 Node Location Prediction

Trajectory data is taken in consideration to identify location of the nodes. After the network formation the WiFi devices will gather information of every network nodes. These information includes the node bandwidth, node IP, node ID, node traffic rate, current buffer status, transmission history and Location History [10]. These location history is identified by tower traversal technique, where the node movement from base station to base station is identified. With this information the network nodes

future destination can be predicted with the trajectory data. Where X_0 refers the tower where node lies X_{-n} , … , X_{-2},X_{-1}, X_0 are the node location history. Where Y_1, Y_2, Y_3,Y_4…,Y_n. Is the trajectory path then, if $X_{-2} == Y_1$ and $X_{-1} == Y_2$ and $X_0 == Y_3$ then $X_1=Y_4$ and $X_2=Y_5$.

4.3 Predictive Multi-Path Route Calculation

Depending on the point where a network is sourced, there are various types of routes that could be present in heterogeneous wireless networks. The type of the route influences the route that is selected and installed by the router in the routing table. The available path calculated based on the available base station on the network. One of the intriguing aspects of routing selection, especially for those new to Heterogeneous Wireless Network [11][12], is how the Base Station chooses which route is the best among those presented by routing protocols. The routers in the network will have the information of every node or part of the nodes in the network. Further the router is implemented to monitor the communication on the network nodes. The Server also gathers and validate the node by its network ID, by using GeoMap and the Server calculates all available paths from server to the predicted node destinations. The selected node details will send to the sender whenever it requests the send request. The data get received by the router of selected network and it will transmitted in the secure path as possible it can. In case of performing intermediate node transmission it will apply Degree of Belief algorithm to select the best node for transmission.

```
calculateMultipath()
{
list<path> paths=new arraylist<path>();
nodes=getNetworkNodes()
for(node:nodes)
{
nodeDistance=node1~node2
if(nodeDistance<(NodeBandwidth/2))
paths.add(node);
}
}
```

4.4 Data Segmentation

The data segmentation is done for the purpose to transmitting the data much faster in multiple paths. The segments count is equal to the number of available path on the network. The data is divided into several path and submitted to the available base station on the networks. Then it is responsible of the base station to send the data to the receiver nodes. Where N is the count of calculated path from server to the Node Locations [13][14]. Then S1, S2, S3, … SN are the segmented data for the transmission.

```
dataSegmentation(){
N=paths.size()
data=getData()
List<Data> datas=new ArrayList<>();
x=datas.size/N
while(j<data.length){
data[i]=datas(i,j)
i=j
j=j+x
}
}
```

4.5 Predetermined Transmission Thread

After calculating all available routing paths from server to the node destinations, server will send the segmented data one by one though the calculated paths. Then the server must initiate a transmission thread to transmit data in a desired path. T1(S1,P1), T2(S2,P2), T3(S3,P3) ,.. TN(SN,PN) are the threads created to transmit the data where T- Thread, S- Segment of Data and P-Path to transmit Data. Simultaneously the node position verification will be done to ensure that the node traveling through the Calculated Path [15].

4.7 Node Location Verification

There may be a possibility for the node to deviate from the calculated from some other path, this is names as the fading node. The fading node among the network nodes can be calculated by comparing the node coverage and current of the node from

the predicted node locations. Where X_0, X_{-1},X_2, X_3 are the node current traversal and Y_1, Y_2, Y_3,Y_4 are the calculated predetermine paths then,

while(true){

X={ X_{-1},X_2, X_3, X_4}

Y={Y_1, Y_2, Y_3,Y_4}

if(X_n!=Y_n){

calculateMultepath();

}

}

The fading channel may occur at any time in the network while on the transmission. To overcome it and to avoid data loss the backup path which can be used at the time of path breakage is also calculated by our Predictable Path Algorithm. The predictable path algorithm is works based on monitoring node movements on the network. The node location history is considered as an important parameter for calculating the predictable paths. The network nodes are instructed to switch the neighbor to forward data.

4.8 System Model

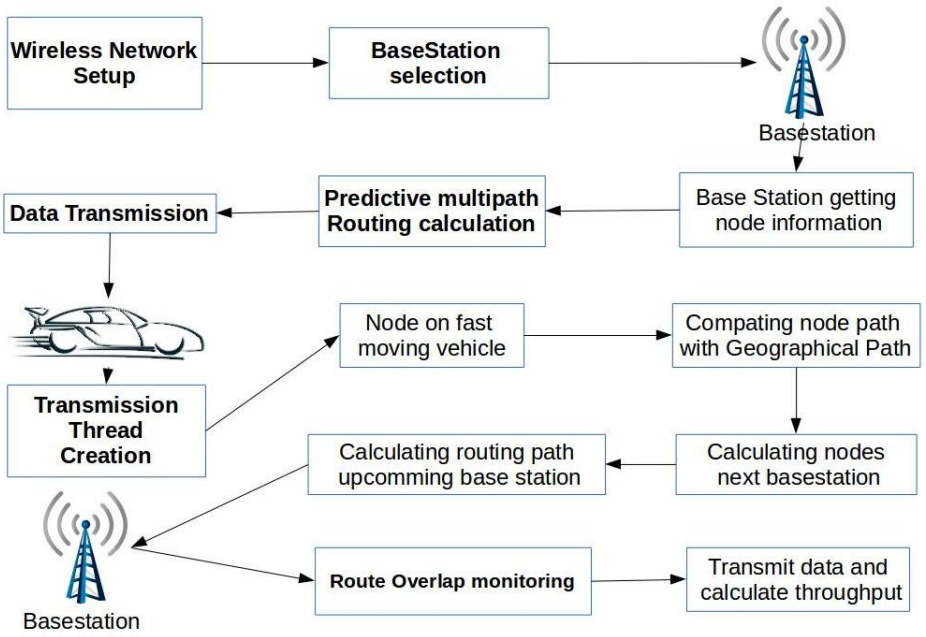


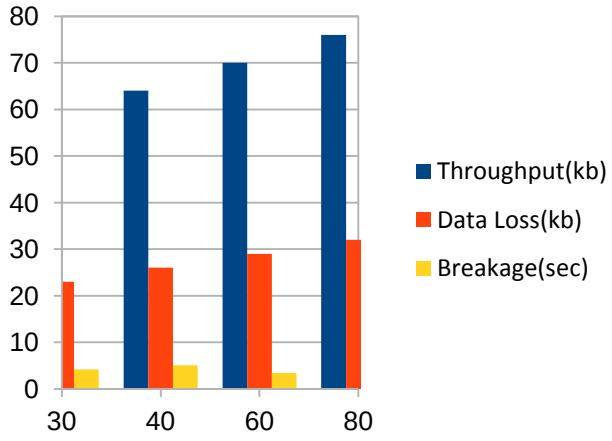
Fig 1: GeoMap Predicted Multipath Transmission Model

5. EXPERIMENTAL EVALUATION

5.1 Experimental Setup

Ubuntu 16.04 LTS is taken as the experimental platform and ns2 simulator is used for network simulation to implement the proposed GMPMT model. System powered with the Intel i3 6th Gen processor and 8GB of RAM. TCL script is used to create and implement the node in the simulation environment. Glib5.6, gcc5.6, libmt, libmu, libxt, xgraph, nam and build-essentials are installed along with ns2 simulation environment.

5.2 Experiment and Result



Graph 1: graph of Throughput, Data loss, Breakage

The traffic and flow of the entire network is monitored for the entire transmission and shown and represented as the graph. Using this graph we can conclude that the efficiency of our algorithm is calculated and shown better result in detecting fading node.

Our proposed algorithm is implemented and tested in an simulated environment to verify the support of the current trending environment and features of network. The simulated environment will have the N number of nodes allowed to freely move along the network here and there and transmit data. We have selected some node as the sender and some node as the receiver. And then the sender initiated to transmit some amount of data to the receiver. Before sending the data the nodes calculate the actual path by deciding the distance of the neighbor nodes. The nodes allowed to transmit data and at the same time it monitors the present node fading channel. If the fading

channel is occurs at some time the node instructed to switch based on the predictable path calculation.

6. CONCLUSION

As by the result it can be said that our proposed method of path prediction and GeoMap Predicted Multipath Routing (GMPMR) is working effectively to avoid the failure in data transmission due to fading node on fast moving lane or track. The continuity of the data in maintained in the network the throughput of th data also be improved in higher rate. End-to-End delay is minimized by avoid on time calculation of path. The wireless nodes energy should be managed in the future work. The node selection in the present algorithm is based on the node frequency and distance to find the fading channel. In future some additional properties will be added to support network security. The time interval can be set to avoid giving overload to the network node on monitoring the neighbor. The predictable path calculation is a good thing but it is not suitable when there is only very few neighbors present in the network. As per the result obtained in the experiment it can be concluded that the proposed method of multipath routing namedGeoMap Predicted Multipath Routing is suitable one for the current transport technologies. This method and algorithm can be implemented in fast moving train network for fast moving car communication network with unbreakable communication with available neighbors.

In future the work can be extended to support heavy data like multimedia communication, gameplay which cannot be send in predetermine manner. So an adoptable algorithm can be introduced in the future to support the missing feature in the current work.

REFERENCE

[1] A Distributed Three-Hop Routing Protocol to Increase the Capacity of Hybrid Wireless Networks, Haiying Shen, Senior Member, IEEE, Ze Li, and Chenxi Qiu,IEEE TRANSACTIONS ON MOBILE COMPUTING,VOL. 14, NO. 10, OCTOBER 2015

[2] A Multi-mode Multi-band and Multi-system-based Access Architecture for High-speed Railways, Jia-Yi Zhang, Zhen-Hui Tan, Zhang-Dui Zhong, Yong Kong, 2010.

[3] An Adaptive Multipath Geographic Routing for Video Transmission in Urban VANETs Mostafa Asgharpoor Salkuyeh and Bahman Abolhassani, Member, IEEE, June 30, 2015.

[4] Analysis of a Hypercube-Based Social Feature Multipath Routing in Delay Tolerant Networks Yunsheng Wang, Student Member, IEEE, Wei-Shih Yang, and Jie Wu, Fellow, IEEE, IEEE TRANSACTIONS ON PARALLEL AND DISTRIBUTED SYSTEMS, VOL. 24, NO. 9, SEPTEMBER 2013.

[5] DAPS: Intelligent Delay-Aware Packet Scheduling For Multipath Transport, Nicolas Kuhn, Emmanuel Lochin, Ahlem Mifdaoui, Golam Sarwar, Olivier Mehani, EEE ICC 2014.

[6] Degraded Service Provisioning in Mixed-Line-Rate WDM Backbone Networks Using Multipath Routing Chaitanya S. K. Vadrevu, Rui Wang, Massimo Tornatore, Member, IEEE, Charles U. Martel, and Biswanath Mukherjee, Fellow, IEEE, IEEE/Acm Transactions On Networking, VOL. 22, NO. 3, JUNE 2014.

[7] Hypercube-Based Multipath Social Feature Routing in Human Contact Networks Jie Wu, Fellow, IEEE, and Yunsheng Wang, IEEE Transactions On Computers,Vol. 63, No. 2, February 2014

[8] Improving Onboard Internet Services for High-Speed Vehicles by Multipath Transmission in Heterogeneous Wireless Networks, Ping Dong, Member, IEEE, Bin Song, Hongke Zhang, and Xiaojiang Du, Senior Member, Ieee, Ieee Transactions On Vehicular Technology, Vol. 65, No. 12, December 2016.

[9] Improving QoS in High-Speed Mobility Using Bandwidth Maps Jun Yao, Salil S. Kanhere, Member, IEEE, and Mahbub Hassan, Senior Member, IEEE, IEEE Transactions On Mobile Computing, Vol. 11, No. 4, April 2012

[10] IP Fast Rerouting and Disjoint Multipath Routing With Three Edge-Independent Spanning Trees, Abishek Gopalan and Srinivasan Ramasubramanian, Senior Member, IEEE, IEEE/ACM Transactions On Networking, 2015.

[11] Jamming-Resilient Multipath Routing Hossen Mustafa, Xin Zhang, Zhenhua Liu, Student Member, IEEE, Wenyuan Xu, Member, IEEE, and Adrian Perrig, Senior Member, IEEE, IEEE Transactions On Dependable And Secure Computing, Vol. 9, No. 6, November/December 2012

[12] Load Balancing in IP Networks Using Generalized Destination-Based Multipath Routing Junjie Zhang, Kang Xi, and H. Jonathan Chao, IEEE/ACM Transactions On Networking, 2013

[13] Multipath Routing With Limited Cross-Path Interference in Underwater Networks Saiful Azad, Paolo Casari, Senior Member, IEEE, and Michele Zorzi, Fellow, IEEE, IEEE Wireless Communications Letters, Vol. 3, No. 5, October 2014

[14] Rate Allocation for Multipath Routing in Wireless Multihop Networks with Security Constraints Based on Erasure Channel Modeling Jinho Choi, Senior Member, IEEE, IEEE Transactions On Communications, Vol. 60, No. 9, September 2012.

[15] Redundancy Management of Multipath Routing for Intrusion Tolerance in Heterogeneous Wireless Sensor Networks Hamid Al-Hamadi and Ing-Ray Chen, Member, IEEE, IEEE Transactions On Network And Service Management, Vol. 10, No. 2, June 2013.