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A Routing Protocol of Hybrid Wireless Network

Pathmanaban J, Vijayanand G
Muthayammal Engineering College, Rasipuram, Rasipuram, Tamil Nadu, India

ABSTRACT

Hybrid wireless networks combining the advantages of both mobile ad-hoc networks and infrastructure wireless networks have been receiving increased attention due to their ultra-high performance. An efficient data routing protocol is important in such networks for high network capacity and scalability. However, most routing protocols for these networks simply combine the ad-hoc transmission mode with the cellular transmission mode, which inherits the drawbacks of ad-hoc transmission. This Project presents a Distributed Three-hop Routing protocol (DTR) for hybrid wireless networks. To take full advantage of the widespread base stations, DTR divides a message data stream into segments and transmits the segments in a distributed manner. It makes full spatial reuse of a system via its high speed ad-hoc interface and alleviates mobile gateway congestion via its cellular interface. Furthermore, sending segments to a number of base stations simultaneously increases throughput and makes full use of widespread base stations. In addition, DTR significantly reduces overhead due to short path lengths and the elimination of route discovery and maintenance. DTR also has a congestion control algorithm to avoid overloading base stations. Theoretical analysis and simulation results show the superiority of DTR in comparison with other routing protocols in terms of throughput capacity, scalability and mobility resilience. The results also show the effectiveness of the congestion control algorithm in balancing the load between base stations.

Keywords : Hybrid wireless networks combining, DTR, MANET, HWN, WSN

I. INTRODUCTION

1.1 MOBILE AD-HOC NETWORK

Mobile ad-hoc network (MANET) is a type of ad-hoc networks. MANET is a collection of mobile nodes sharing a wireless channel without any centralized control or established communication backbone. Each terminal which may be mobile act as host and terminal MANET has dynamic topology and each node has limited resources. This kind of infrastructure-less network is very useful in battlefields, natural disasters etc. The nodes which are in the transmission range of each other communicate directly otherwise communication is done through intermediate nodes which are willing to forward packet hence these networks are also called as multi-hop networks. MANET is simple, fast and cheap. As the network structure is decentralized single component failure will not affect up to a certain limit. The capacity of the wireless links is always much lower than in wired counter parts. Hybrid wireless network consists of both an infrastructure wireless network and a mobile ad-hoc network. Wireless devices such as smart-phones, tablets and lap-tops, have both an infrastructure interface and an ad-hoc interface. As the number of such devices has been increasing sharply in current centuries, a hybrid transmission structure will be widely used in the near future. Such a structure synergistically combines the inherent advantages and overcome the disadvantages of the infrastructure wireless networks and mobile ad-hoc networks. A hybrid wireless network synergistically combines an infrastructure wireless network and a mobile ad-hoc network to leverage their advantages and overcome their limitations, and finally increases the output capacity of a wide-area wireless network. A routing protocol is a serious constituent that affects the throughput capacity of a wireless network in data transmission.

Most current routing protocols in hybrid wireless networks simply combine the cellular transmission mode (i.e. BS transmission mode) in infrastructure wireless networks and the ad-hoc transmission mode in mobile ad-hoc networks the protocols use the multi-hop routing to forward a message to the mobile gateway nodes that are closest to the BSes or have the highest bandwidth to the BSes. The bandwidth of a channel is the maximum throughput that can be achieved.

The mobile gateway nodes then forward the messages to the BSes, functioning as bridges to connect the ad-hoc network and the infrastructure network. In DTR a source node divides a message stream into a number of segments. Each segment is sent to a neighbor mobile node. Based on the QoS requirement, these mobile relay nodes choose between direct transmissions or relay transmission to the BS. In relay transmission, a segment is forwarded to another mobile node with higher capacity to a BS than the current node. In direct transmission, a segment is directly forwarded to a BS. In the network the segments are rearranged in their original order and sent to the destination. The number of routing hops in DTR is limited to three, including at most two hops in the ad-hoc transmission mode and one hop in the cellular transmission mode. Hybrid networks are made by adding base stations to ad-hoc Network. Hybrid wireless networks have the advantages of both ad-hoc and base stations Hybrid wireless network used in wireless communications that are highly supporting real time transmission with limited Quality of Service. The hybrid networks inherit advantages of both infrastructure networks and MANETs which improves scalability, coverage. A hybrid topology is reliable and the failure of one node does not affect the performance of the network. There are various paths among the nodes.

The breakdown of one chain or communication line allows the network to provide an alternate route between a sender and a receiver. Hybrid wireless networks combining the advantages of both mobile ad-hoc networks and infrastructure wireless networks have been receiving increased attention due to their ultra-high performance. An effectual data sending protocol is important in such networks for high network size and scalability. Though, best transmitting protocols for these networks simply combine the ad-hoc transmission mode with the cellular communication mode, which receives the shortcomings of ad-hoc transmission.

Wireless sensing element network is assortment of sensor nodes deployed over wide geographical space. Hybrid WSN is collection of cellular and multi-hop wireless networks. In HWN, it is necessary to cut back the ability consumption while increasing the turnout and potency of the network. To increase the lifetime of HWN, low energy consumption is important. Finding the faulted nodes in the network and replacing the nodes with another high capability node plays a vital role in reducing the ability consumption. In MANET knowledge is routed to its destination in distributed/multi-hop manner through intermediate nodes. Multi-hop routing needs on demand route discovery and maintenance.

As compare to Infrastructure Wireless Networks MANET are low reliable and appropriate for solely transmission of native knowledge. In Infrastructure Wireless Network nodes communicate with each alternative via base stations. Infrastructure Wireless Network provides high data transmission responsibility and channel access potency however suffers from the drawback of upper power consumption on mobile nodes and single purpose of failure. This paper proposes an algorithm for fault node detection and fault node recovery which will increase the lifetime of HWN in context of low power consumption and high efficiency. An important component which affects the strength of wireless network in data transmission is routing protocol. When some of the sensor node fails down then using of this algorithm results in detecting the fault node and also will replace the same with another high capacity node. Thus the algorithm increases the lifetime of the HWN and reduces the impacts occurred due to the faulted node. Following subsection describes the algorithms used in Distributed Three hop Routing protocol:

1. Algorithm for Load Balancing: This algorithm gives Load balancing scheme called CAR for cellular network, which places relay nodes at such a locations to divert the traffic from congested cells to less congested or noncongested cells.

2. Algorithm for Wireless Network with RRP: This algorithm contains two algorithms for recovery and replacement of faulted node which are grade diffusion algorithm and generic algorithm which is also called as RRP algorithm.

3. DTR: This algorithm divides the incoming message stream into multiple segments and sends this segment towards the segment nodes which will then forwards the data streams to sink nodes. Sink node will forward all streams to the destination and all the segments will arrange in proper sequence. It limits the path length to three as name itself contains three-hop routing.

1.2 ASSUMPTION AND OVERVIEW

Since base stations are connected with a wired backbone, we assume that there are no bandwidth and power constraints on transmissions between base stations. We use intermediate nodes to denote relay nodes that function as gateways connecting an infrastructure wireless network and a mobile ad-hoc network. We assume every mobile node is dual-mode; that is, it has ad-hoc network interface such as a WLAN radio interface and infrastructure network interface such as a 3G cellular interface. Long routing paths increase the probability of the occurrence of path breakdown due to the highly dynamic nature of wireless ad-hoc networks. These problems become an obstacle in achieving high throughput capacity and scalability in hybrid wireless networks. Considering the widespread base stations, the mobile nodes have a high probability of encountering a BS while moving. Taking advantage of this feature, we propose a Distributed Three-hop Data Routing protocol (DTR). In DTR, a source node divides a message stream into a number of segments. Each segment is sent to a neighbor mobile node. Based on the QoS requirement, these mobile relay nodes choose between direct transmissions or relay transmission to the BS. In relay transmission, a segment is forwarded to another mobile node with higher capacity to a BS than the current node. In direct transmission, a segment is directly forwarded to a BS. In the infrastructure, the segments are rearranged in their original order and sent to the destination. The number of routing hops in DTR is confined to three, including at most two hops in the ad-hoc transmission mode and one hop in the cellular transmission mode. To overcome the aforementioned shortcomings, DTR tries to limit the number of hops.

II. LITERATURE REVIEW

2.1 TITLE: Three-hop Routing Protocol to Increase the Capacity of Hybrid Wireless Networks

Author: K. Sushma , Y. Vamsidhar

Hybrid wireless networks combining the advantages of both mobile ad-hoc networks and infrastructure wireless networks have been receiving increased attention due to their ultra-high performance. An efficient data routing protocol is important in such networks for high network capacity and scalability. However, most routing protocols for these networks simply combine the ad-hoc transmission mode with the cellular transmission mode, which inherits the drawbacks of ad-hoc transmission. This paper presents a Distributed Three-hop Routing protocol (DTR) for hybrid wireless networks. To take full advantage of the widespread base stations, DTR divides a message data stream into segments and transmits the segments in a distributed manner. It makes full spatial reuse of a system via its high speed ad-hoc interface and alleviates mobile gateway congestion via its cellular interface.

2.2 TITLE: A Distributed Three-hop Routing Protocol to Increase throughput and makes full use of widespread base station in Hybrid Wireless Networks

Author: Dr.V.Goutham , Mrs.P.Jyothi , K.Tejasvi

A proficient data routing protocol is significant in such networks for elevation in terms of network capacity and scalability. Hybrid wireless networks conjoining the recompenses of both mobile ad-hoc networks and arrangement wireless networks have been getting augmented consideration due to their ultra-high recital. Conversely, most routing protocols for these networks merely cartel the ad-hoc transmission mode with the cellular transmission mode, which receives the hitches of ad-hoc transmission. A Distributed Three-hop Routing Protocol to upsurge throughput and makes full routine of pervasive base station in Hybrid Wireless Networks presents a Distributed Three-hop Routing protocol (DTR) for hybrid wireless networks. DTR divides a message data stream into segments and transmits the segments in a distributed manner and makes full spatial reuse of a system via its high speed ad-hoc interface and relieves mobile gateway congestion via its cellular interface.

Additionally, sending segments to a number of base stations simultaneously increases throughput and makes full use of widespread base stations. DTR significantly reduces overhead due to short path lengths and the elimination of route discovery and maintenance.

DTR also has a congestion control algorithm to avoid overloading base stations.

III. SYSTEM INFORMATION

3.1 EXISITING SYSTEM:

A hybrid wireless network synergistically combines an infrastructure wireless network and a mobile ad-hoc network to leverage their advantages and overcome their shortcomings, and finally increases the throughput capacity of a wide-area wireless network. A routing protocol is a critical component that affects the throughput capacity of a wireless network in data transmission.

Most current routing protocols in hybrid wireless networks simply combine the cellular transmission mode (i.e. BS transmission mode) in infrastructure wireless networks and the ad-hoc transmission mode in mobile ad-hoc networks.

The protocols use the multi-hop routing to forward a message to the mobile gateway nodes that are closest to the BSes or have the highest bandwidth to the BSes. The bandwidth of a channel is the maximum throughput (i.e., transmission rate in bits) that can be achieved. The mobile gateway nodes then forward the messages to the BSes, functioning as bridges to connect the ad-hoc network and the infrastructure network.

3.1.1 Limitations:

- Suffer from higher power.
- Consumption on mobile nodes and the single point of failure problem.
- Low reliability.
- Low overhead. Hot spot reduction.

3.2 PROPOSED SYSTEM

1. Low overhead: It eliminates overhead caused by route discovery and maintenance in the ad-hoc transmission mode, especially in a dynamic environment.

2. Hot spot reduction: It alleviates traffic congestion at mobile gateway nodes while makes full use of channel resources through a distributed multi-path relay.

3 High reliability: Because of its small hop path length with a short physical distance in each step, it alleviates noise and neighbor interference and avoids the adverse effect of route breakdown during data transmission.

3.2.1 ADVANTAGE OF PROPOSED SYSTEM

- Increases the throughput capacity of a wide-area wireless network.
- High overhead.
- Hot spots.
- High reliability

3.3 SYSTEM SPECIFICATION

HARDWARE REQUIREMENTS SYSTEM

- PENTIUM IV 2.4 GHZ
- HARD DISK : 40 GB
- FLOPPY DRIVE : 1.44 MB
- MONITOR : 15 VGA COLOUR
- MOUSE : LOGITECH
- RAM : 512 MB

SOFTWARE REQUIREMENTS:

- OPERATING SYSTEM : WINDOWS XP
- SIMULATION TOOL : CYGWIN-NS-2
- COMPILER : NOTEPAD++

IV. SYSTEM ORGANIZATION

4.1 MODULES DESCRIPTION

List of Modules

Module 1: Distributed Three-Hop Routing Protocol

Module 2: Three-hop Data Routing protocol

Module 3: Wireless Network

Module 4: Performance Evaluation

4.1.1 DISTRIBUTED THREE-HOP ROUTING PROTOCOL (DTR):

Distributed Three-hop Routing (i.e. DTR) Data Routing Protocol that improves the features of hybrid

wireless networks in the data transmission process. In DTR, a source node is divides a message stream into segments and transmits it into its mobile neighbors, which again forward the segments to destination through an infrastructure network path.

V. IMPLEMENTATION

5.1 NETWORK SIMULATOR 2:

NS is a Unix-like environment and command-line interface for Microsoft Windows. It provides native integration of Windows-based applications, data, and other system resources with applications, software tools, and data of the Unix-like environment. Thus it is possible to launch Windows applications from the environment, as well as to using tools and applications within the Windows operating context.

Ns2 is an open-source simulation tool that runs on Linux. It is a discreet event simulator targeted at networking research and provides substantial support for simulation of routing, multicast protocols and IP protocols, such as UDP, TCP, RTP and SRM over wired and wireless (local and satellite) networks. Ns is a discrete event simulator targeted at networking research. Ns provides substantial support for simulation of TCP, routing, and multicast protocols over wired and wireless networks.

5.2 SIMULATION SETTING:

We conducted the simulation experiments using network simulator-2 and considered the network with 30 mobile nodes. Here the base station transmit the packets randomly. The DTR algorithm will be running on background, it will measure the Performance of Packet delivery ratio, Delay, Average energy consumption, overhead and Throughput.

5.3 DISTRIBUTED THREE-HOP ROUTING PROTOCOL ALGORITHM:

Step 1: The Message stream of source node divides the several segments.
Step 2: Source node distribute the segments to the near (first) Base Station
Step 3: After a Base station receive the segments needs to forward the Destination node.
Step 4: DTR select the neighbor node based on the Capacity (each node periodically exchanges their capacity level).
Step 5: The neighbor node transmits the segments to Final Base station (near for Destination).
Step 6: After the destination Base Station receives the segments of a message it and re-arrange the segments in to original message and the sends to Destination node.

5.4 DESIGNING PARAMETERS:

- Network simulator 2
- Tcl script language
- Perl language
- Linux OS

VI. CONCLUSION AND FUTURE WORK

A hybrid wireless network combining an infrastructure wireless network and a mobile ad-hoc network leverages their advantages to increase the throughput capacity of the system. However, current hybrid wireless networks simply combine the routing protocols in the two types of networks for data transmission, which prevents them from achieving higher system capacity. In this paper, we proposed a Distributed Three-hop Routing (DTR) data routing protocol that integrates the dual features of hybrid wireless networks in the data transmission process. In DTR, a source node divides a message stream into segments and transmits them to its mobile neighbors, which further forward the segments to their destination through an infrastructure network. DTR limits the routing path length to three, and always arranges for high-capacity nodes to forward data. Unlike most existing routing protocols, DTR produces significantly lower overhead by eliminating route discovery and maintenance. In addition, its distinguishing characteristics of short path length, short-distance transmission, and balanced load distribution provide high routing reliability and efficiency. DTR also has a congestion control algorithm to avoid load congestion in base stations in the case of unbalanced traffic distributions in networks. Theoretical analysis and simulation results show that DTR can dramatically improve the throughput capacity and scalability of hybrid wireless networks due to its high scalability, efficiency, and reliability and low overhead.

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