WIRELESS ADHOC NETWORK COMMUNICATION USING FAILURE INSENSITIVE ROUTING FOR UNDERGROUND MINES

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Abstract

The wireless ad-hoc network based on FIR (Failure Insensitive Routing) for the underground mining environment is to improve existing mining wireless network deficiencies. It is a proactive local rerouting based approach has the characteristics of interface specific forwarding, suppressing the link state advertisement and rerouting using a backwarding table when compare with OSPF (Open Shortest Path First Link State Routing Protocol). OSPF is a Proactive routing protocol and it does not provide flexibility in terms of packet forwarding to achieve any network optimization and causing significant forwarding discontinuity after a node failure. The drawback with this protocol is that they need off routing stability and forwarding continuity. To improve failure resiliency without routing stability we propose a FIR approach. In this paper, we prove that when a node in a network fails the FIR finds an alternate path to the destination during any disaster happens in the underground mining environment.

Keywords—wireless ad-hoc network, backwarding table**,** packet forwarding, proactive routing, underground mining.

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I. INTRODUCTION

TODAY, , the underground mine accidents are in the form mud sliding, fire explosion, toxic gas emission and suffocation. The main reason is due to information technology in our country is relatively backward in technology .The mining industry has greater development, but did not achieve an effective control of disasters and accidents. Communication concerns in such places needed effective and proper routing mechanisms. With the extended deployment of wireless networks, new routing mechanism needs to be introduced in order to work efficiently on such an unstable and rapidly changing environment. In wireless networks, communications between two end nodes are carried out through a number of intermediate nodes whose function is to relay information from one point to another. In the last few years, many research works have focused on wireless networking. The reason is that wireless mobility gives us new dimensions of freedom in mining. However there are a lot of challenges arisen and many problems to be overcome. Among the emerging technologies, the ad-hoc topology seems to be the most interesting and promising one. One reason why ad-hoc is so attractive is that ad-hoc networks are found in more applications and therefore a lot of research has been done on it.

The mining industry uses the ad-hoc topology because it consists of a collection of nodes that communicate with each other over a wireless medium dynamically and without need of any kind of infrastructure. This makes them highly scalable and easily deployable. Furthermore, ad hoc networks differ from cellular networks in that communication is limited in higher extent by the battery power of the network nodes, the limited bandwidth, the high rate of topological changes and failures caused by obstacles. The penetration of wireless networking is increasing drastically in the modern society. Research in this field is conducted by the working group MANet of Internet Engineering Task Force (IETF).

There are two kinds of routing protocols, the reactive protocols and the pro-active protocols. Proactive protocols are based on periodical link-state updates using control packets and therefore generate extra traffic that weigh down the actual data traffic. Update messages are broadcasted all over the network via optimized flooding. OSPF is an example of proactive protocols. Contrary to proactive algorithms, reactive routing protocols cache topological information and update the cached information on-demand. Reactive protocols avoid the prohibitive cost of routing information but do not guarantee creation of optimal routing tables. While the idea results in good average performance, the worst-case latency could be high. An example of reactive protocol is the Ad-hoc On Demand Distance Vector (AODV).

In this work, we demonstrate that Failure Insensitive Routing can have a significant impact on communication network. Addressing the routing in mining environment requires that we first analyze and understand the performance characteristics of routing protocols and techniques. This paper presents a routing stability and implements the split-horizon and hold-down mechanisms to prevent incorrect routing information.

II. RELATED WORK

To give more prospective about the performance of the compared routing protocols, this section discusses the results obtained from other related papers survey. A wireless ad hoc network is a distributed network which is suitable for emergency situations such as natural disasters and mining conflicts due to its convenient configuration and quick development. For a long period of time, mines have been special areas because gas explosions are frequently triggered by safety problems. Urgently, it is quite vital to maintain communication for rescuing injured people besieged in the mine where former equipments and infrastructure for communication may be severely destroyed in disasters. As an available solution, the wireless ad hoc network has been introduced for quickly bridging communication between a miner and a operator which is controlled to search life in the tunnel of mine instead of human-beings.

In recent years, lots of many routing protocols are proposed, but there is no a common routing protocol been proposed for ad-hoc because the ad-hoc routing algorithm has the relatively strong with the applications and the deployment and the topology of ad-hoc in different Applications is not the same. Tong [1] proposed a geographic information and hop gradient based greedy routing algorithm aiming at the frequent changes of network topology. Chen [2] proposed a distance based routing protocol to meet the data transmission requirement of the ad-hoc, which establish the routing path by the level relations between the nodes. Xiao [3] proposed an Energy-Based Multi-path Routing (EBMR) protocol which establish the routing path by the energy and connection quality. Tian [4] proposed a semi-proactive routing protocol based on tree topology, which can adapt to network topology changes. Jiang [5] proposed a node priority based routing algorithm which can quickly detect the changes of the network topology and choose the best route.

Unlike outdoor mediums where signals relatively travel almost freely in open spaces, indoor environments such as underground mines stem from more complicated scenarios that need to be modeled in order to estimate how the signal would be received after reacting with the channel. Surveys on wireless indoor positioning techniques [6] provide multiple detailed discussions of different localization approaches.

III. PRELIMINARIES

A In this section, we provide a brief overview of commonly employed routing concepts and terminology. We begin by defining the widely used terms in the fields of wireless and communication, and follow it by describing different kinds of routing measures, referred to as mining objectives, desired in practical applications with a need for packet transmission. The concern for mining in practice is addressed by choosing a routing protocol, which achieves all the required mining objectives. Routing protocols realize the mining objectives through the use of appropriate routing algorithms.

Existing Routing Terminology

OSPF -is a non-optimized link state algorithm and representative of link state routing protocols. Link state information is passed from node to node, flooding the whole network, so each node will have a complete knowledge of network topology. Then, each node can apply a shortest path algorithm like Dijkstra to find an optimum path to each destination.
So as to achieve the distribution of knowledge among the network nodes, OSPF performs two different tasks:

- Neighbor Discovery, to detect the quality of adjacent links.
- Topology Broadcast, to advertise these links to the rest of the nodes.

Discovery and Broadcast messages are periodically generated, as OSPF is in fact a proactive routing protocol. Since OSPF was mainly designed for static topologies such as wired networks or wireless infrastructure networks, it was never optimized; link advertisements are flooded through the whole network as control messages to every connected node (e.g. router).

OLSR - the inefficiency of the OSPF protocol presented in the previous section, the OLSR protocol was invented. OLSR protocol is a link state protocol such as OSPF, but it optimizes the control overhead in the network via two means [1-3]:

1. The important adjacent links are limited to MultiPoint Relay (MPR) nodes.
2. The flooding of the topology control packet is limited to MPR nodes (MPR flooding).

Before we continue, some definitions need to be introduced. The neighborhood of a host A is defined as the set of nodes which have an adjacent link to A. The two hop neighborhood of A is the set of nodes which do not have a valid link to A, but have a valid link to the neighborhood of A. Based on these definitions the MPR set of node A is defined as the subset of the neighborhood of A which satisfies the following condition: every node in the two-hop neighborhood of A must have a valid link toward A. The smaller the MPR set is, the more optimal is the routing protocol. As far as the second mean of improvement is concerned, a node retransmits a broadcast packet only if it has received its first copy from a node for which it is a multipoint relay. The OLSR modifications to the original link state protocols improve routing performance in the two following aspects:

- The number of retransmissions in a flooding or broadcast procedure is reduced significantly.

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- The size of the control packets is reduced since nodes only broadcast their multipoint relay set compared to OSPF where they broadcast the whole neighbor list.

IV. PROPOSED WORK

The following algorithm is proposed for finding the MPR set:

1. Select as MPR, the node which has the largest number of links in the two-hop neighbor set.

2. Remove this MPR node from the neighbor set and the neighbor nodes of this MPR from the two-hop neighbor set.
3. The previous steps, until the two-hop neighbor set is empty.

The aforementioned algorithm can be further improved if one more step is implemented. In this step the two-hop neighbor nodes which have a single parent in the neighbor set are detected. The parents are selected as MPR nodes and their neighbors are eliminated in the two-hop neighbor set. This algorithm is not optimal, but it is proved that is not more than – worse than the optimal, which is a very good bound.

V. Conclusion

Wireless ad-hoc networks have strict constraints on the transmissions, such as data packets, memory space and processing time. How to maximize packet transmission while maintaining a desirable level of delivery is very challenging. In this paper we proposed a proactive protocol and measured the packet transmission on simulation which is better than OSPF.

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