PROCEEDINGS OF SCIENCE

Routing Analysis of Protocol AODV in Wireless Mesh Network

Weiwei Zhang
College of Computer Science and Technology, Jilin University; Changchun Normal University
Changchun, 130032, China
Email: zwwzdd@sohu.com

Jiafeng He
Troops 31693 PLA
Harbin, 150036, China
Email: 769968204@qq.com

Guowang Gao
College of Electronic Engineering, Xi'an Shiyou University
Xi'an, 710065, China
Email: wwgao1205@163.com

Lili Ren
Changchun Normal University
Changchun, 130032, China
Email: 444251129@qq.com

Xuanjing Shen [1]
College of Computer Science and Technology, Jilin University
Changchun, 130012, China
Email: xjshen@jlu.edu.cn

According to the characteristic in a wireless Mesh network system structure, this paper issues the method and principle and optimize the performance based on the AODV . Using the simulation platform NS2, this paper compares and analyzes the transmission delay, average send success speed and the transmission delay. This paper makes full of use data from MAC to conduct hierarchical design, fully considers all kinds all impact factors and sets the routing criteria in order to improve the routing performance.

ISCC2017
16-17 December 2017
Guangzhou, China

1Corresponding author:Xuanjing Shen
This paper is supported by National Natural Science Foundation of China (NSFC) (41774081), the Poverty Alleviation Project of Science and Technology of Department of Science and Technology of Jilin Province(Grant:20150417020CB), Major project of Education Department of Shanxi province(15JS095)

PoS(ISCC 2017)048

1.Introduction

Wireless Mesh Network-WMN is a kind of wireless wide band access technology based on IP protocols. It combines the advantages of both the WLAN and Ad hoc. It supports multipoint to multipoint network communication mode, with intelligent advantages network automatic, auto repair, many hop uplink and node self-management. It has the characteristics of mobility, wide broadband and wireless location. It is a kind of network of high speed, large capacity and wide coverage, and is ideal solution to solve the last 1 km wireless broadband access bottleneck problem [1].

The ADOV advantage of the reactive routing protocol is that the path to be built always uses the latest link status information to effectively reduce the network resources. The ADOV disadvantage is that there is a path discovery time, which increases the send*ing* delay of the first packet [2].

At present, there are many improvement algorithms for the AODV routing protocol. The reference selected different transmission paths to improve the routing efficiency according to the energy usage of individual nodes and the total path energy consumption. When the load is high, the delay is not good. The reference[3] presented a new node cost function based on path stability and energy efficiency, which has a better performance in routing overhead and node mortality, but the delay is much longer. Reference [4] selected the average neighbour number of the nodes in the link as the route selection comparison parameter, which increased the probability of success of fracture link repair. The source node can switch the better route at any time to carry out the data transmission and perform well in the delay, but the energy consumption of the node increases while the transmission data is also searched for better route. Aiming at the above shortcomings, this paper proposes an Improved AODV, which takes into account the minimum number of hops.

2.Related Work

The Wireless Mesh routing mechanism mainly includes routing finding, routing judgment and routing maintenance. The design of routing metrics is the core of routing algorithm. In order to improve the routing performance, the researchers proposed the idea and mechanism of WMN routing optimization design from different technical aspects[5].

$$ETX = \sum_{k=1}^{\infty} k \cdot s(k) = \frac{1}{1-p} \tag{2.1}$$

The sum of all the ETX jumps on a path is the routing metrics：p represents the probability of packet transmission incorrect.

$$P=1-(1-pf)(1-pr) \tag{2.2}$$

p_f and p_r respectively represent the forward and reverse packet loss rate. If the transmission fails, it automatically starts the retransmission mechanism. ETX is the expected transmission times from the source node to the target node. Process of simulation. The maximum speed is 100m/sat which a node chooses to move， and the Expected Transmission Count (ETX) is maximum. When the node selects the moving speed 100m/s, the mean delay is maximum and a jump arises [6]. In AODV routing mechanism, at the same time considering the physical

channel conditions, link quality, network congestion situation and the hop limitation during routing selection, three respectively parameters are combined into a new hybrid routing criterion (Improved AODV): interference and data rate cost function from the physical layer; the frame rate from MAC layer; the minimum hop the network from routing layer [7].

3.Methodology

Wireless Mesh Access Point is made up of WMN, ignore asymmetric one-way links and only consider two-way Wireless links. Network model corresponding to the graph theory, the WMN is available vectorial graph *G (V, E)*, where V is the vertices set in the graph, $\forall v \in V$ that the network of a Mesh Access Point, Eis set for the directed edges in the graph, $\forall e_{ij} \in E$ indicates a link of Wireless Access Point vi to vjto in network.It assumeswireless access points are isomorphic and increased by two-cross layer module on each MAP in the network, parameter call module is responsible to provide statistics data interface for the network layer routing protocol. These statistics include the parameter collector module to collect link quality related information of the node to the other adjacent nodes on the data link layer. The information in this metrics includes the current load information of nodes and links the delivery rate information. For$\forall v \in V$, considering the node load current, for $\forall e_{ij} \in E$, considering average send success rate of the wireless link.

4.Analysis of Simulation Result

AODV routing algorithm is implemented and verified on network simulator NS2. By changing the time, the packet transmission delay, average send success speed are analyzed under different scenarios.

4.1 Simulation Environment

In this paper, based on WMN network principle to build a wireless mesh transmission network, the performance of AODV routing protocol and Improved AODV routing protocol are compared in the same simulation environment NS2:

(1) the number of network nodes selected is 10;

(2) the total coverage scale of the network is a 50 km x 50 km square area;

(3) After the source node generating data packet, the sending gap time is set to the fixed 0.1s;

(4) the generated group size is random, and the maximum size is not more than 200 bytes;

(5) The simulation USES the 802.16 MAC layer;

4.2 Simulation analysis

4.2.1 Transmission Delay Analysis

Figure 1: Packet Transmission Delay

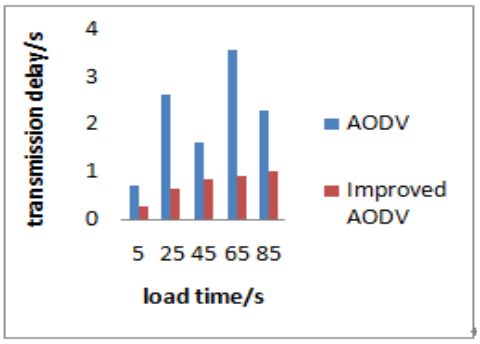

Fig. 1 compares the transmission delay of the two protocols, the content analysis of Fig. 1 shows that the Improved AODV performs better in the network delay, and the delay of the AODV is a little longer because the Improved AODV protocol is based on load balancing criteria. In order to balance the load of the nodes, some business flows need to bypass the heavily loaded nodes, increase the number of jump and increase the network delay. It is not acceptable in some applications with high real-time requirements. When the load time is not greater than 5 seconds, the network is in a light load. Both routing protocols delays are all small**.** When the load time exceeds 5 seconds, the network load is too heavy, and both routing protocols delays are all large. In comparison, Improved AODV routing protocol has some advantage. In fact, what we need to focus on is the situation where the load time is 25 seconds and 45 seconds, the delay of AODV routing protocol is significantly higher than that of the Improved AODV routing protocol.

4.2.2 Average Send Success Speed Analysis

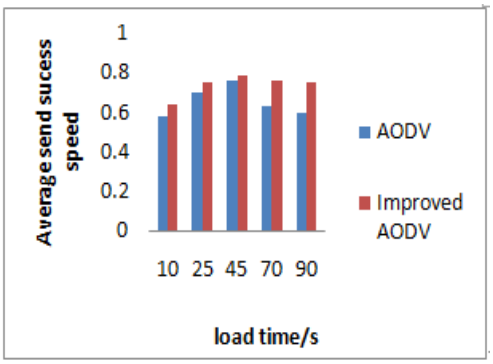

Figure 2: Average Send Success Speed

Fig. 2 compares the network average send success rate of the two protocols. As you can see in Fig. 2, the two routing protocols of the improved AODV and AODV are increasing under increasing network load, and the average send success rate gradually increases and gradually becomes smaller. As the load time increases, when the load time is 45 seconds, the average send success rate reached a maximum of 0.8. The improved AODV is better than AODV.

5.Conclusion

Our proposed algorithm can improve network performance and is more suitable for wireless mesh network which needs for reliable network quality. On the basis of Improved AODV, by modifying the packet format, the corresponding network protocol is optimization designed and gives the corresponding routing algorithm, and then selects two core indicators of the time delay and send an average success rate and are simulated on NS2 platform

implementation. The results show that comparing Improved AODV protocol and the AODVprotocol, the improved AODV has the key indicators obvious advantages, and the improved AODV protocol is more suitable for large scale network.

References

[1]Fehnker A, Van Glabbeek R, Höfner P, et al. *A Process Algebra for Wireless Mesh Networks used for Modelling, Verifying and Analysing AODV*[J]. Eprint Arxiv, 2013, 7211(5513):295-315.

[2]Liu L, Zhu L, Lin L, et al. *Improvement of AODV Routing Protocol with QoS Support in Wireless Mesh Networks*[J]. Physics Procedia, 2012, 25(22):1133-1140.

[3]Pei T, Zhi Z, Zeng W, et al. *A Cognitive Improved Hierarchical AODV Routing Protocol for Cognitive Wireless Mesh Network*[J]. Information Technology Journal, 2011, 10(2).

[4]Chen Y, Xiang Z, Dong Y, et al. *Multi-Fractal Characteristics of Mobile Node's Traffic in Wireless Mesh Network with AODV and DSDV Routing Protocols*[J]. Wireless Personal Communications, 2011, 58(4):741-757.

[5]Boukerche A, Guardalben L, Sobral J B M, et al. *A performance evaluation of OLSR and AODV routing protocols using a self-configuration mechanism for heterogeneous wireless mesh networks*[J]. 2008:697-704.

[6]Pei T, Zhi Z, Zeng W, et al. *A Cognitive Improved Hierarchical AODV Routing Protocol for Cognitive Wireless Mesh Network*[J]. Information Technology Journal, 2011, 10(2).

[7]Chen Y, Xiang Z, Dong Y, et al. *Multi-Fractal Characteristics of Mobile Node's Traffic in Wireless Mesh Network with AODV and DSDV Routing Protocols*[J]. Wireless Personal Communications, 2011, 58(4):741-757.