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Algorithm based on Awareness in Wireless Networks

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Abstract: Among them, the universality of network utility to heterogeneous network makes heterogeneous network load comparability comparable, able to achieve switching between heterogeneous network load balancing. Simulation results show that the proposed gateway load balancing algorithm can improve integration of heterogeneous network throughput, reduce business latency and packet loss rate, with strong robustness to achieve network load balancing and to achieve a balanced use of network resources.

Keywords: QOS; Business; Algorithm

1. Introduction

LOUHA K put forward the concept of soft load balancing - the downlink IP grouping into sub-streams, each sub-stream accessing to different wireless network. This method can improve resource utilization in heterogeneous wireless networks. But when SON H and LOUHA K investigated the best diversion rates of in the case of specific network topology and ideal channel, the findings did not have universal applicability. Load balancing algorithm proposed by SHI Wenxiao, etc [19-22]. Presenting a method that can dynamically change optimal splitting ratio of IP flow; when the network load is heavy, it can constantly adjust the rate of user accessing to each network sub-flow. However, it did not consider that when the load is light, there is a difference between rate requirements of user business and wireless service. Meanwhile, Sun Zhuo also pointed out that as the radio resource units were appropriately allocated to the appropriate users to better meet user QOS, it will also improve the utilization of radio resources [23-25].

For the above what we has discussed, a gateway load balancing algorithm is put forward, which is based on the QOS (Quality of service, QOS), and the algorithm first defines a generalization for payoff function of network terminal and the utility function of heterogeneous networks respectively, to characterize the quality of service and network load terminal situation. Then, in a dynamic, iterative manner, the heaviest load of the network QOS gains and lower resource efficiency of terminal can be improved and scheduled to gain network lightest load in QOS revenue, to reduce load variation of between the networks and improve efficiency in the use of network resources.

In order to further validate the correctness and efficiency of the proposed gateway load balancing algorithm about the packet loss rate, packet delay and throughput performance, the author made a comparison with switching decisional algorithm proposed by Yan X for load balancing, and simulation experiments evaluated its performance of gateway load balancing algorithm based on QOS by using OMNET + + 4.0. Setting there are two types of 802.11 and 802.16 RAN in the system, each type of RAN has 2. Both algorithms at packet loss rate of a constant rate traffic remained unchanged, but the proposed algorithm in this paper significantly reduces packet loss rate of the real-time variable rate business and packet delay; as the load increases, the proposed algorithm can significantly improve the whole network throughput. Experiments show that: QOS-based gateway load balancing algorithm has strong robustness, and it can significantly improve the integration of heterogeneous network throughput, reduce business latency and packet loss rate. It can reach the effects of improving efficiency of network resource utilization.

2. Load Balancing Algorithm Design

The core idea of algorithm is: the QOS income of terminal end can reflects the current level of network quality of service received, the greater the benefits is, the better the resulting quality of service is, and vice versa; the average QOS benefit of all terminals in a accessing network (hereinafter defined as a network utility) can reflects the load level of the network, the larger the average gain of the terminal is, the load on the network is lighter, and vice versa. In order to achieve diversification and to increase the service quality of load terminal, the algorithm will switch small businesses with gain heavy load in the network to a lighter terminal network load.

In order to carry out the terminal to select the RAN and its access effectively and dynamically, the multimode terminal will experience unified management from the network side, which will be completed by the network side management entity (Network side manager, NSM). The terminal will interact with NSM through the terminal-side management entity (Terminal-side manager, TSM), dynamically achieving refactoring of switching/accessing. The interaction between NSM and TSM is completed through management control channel (Management and control channel, MCC). NSM is deployed in the core network, and is shared by a plurality of RAN. RAN will convey each context information to NSM, then NSM transfer each context information of RAN to the terminal for the decisions through the MCC downlink transmission. TSM of each terminal sends context information of the terminal through uplink transmission of the MCC to NSM. Based on context information of RAN and terminal, NSM uses the appropriate network selection algorithm to develop strategies and policies issued under the various terminals. Terminal then chooses according to their needs and network reconfiguration decisions and configures to access the appropriate RAN. The paper will assume the terminal in the network / inter-cell handover fast enough, and thus, the load balancing process, due to switching delay caused by the upper risk of business disruption can be ignored.

For real-time services, at the premise to meet the minimum bandwidth, using an average delay d_{ij} to measure user gains, the smaller the time delay is , the higher the gain is; for non-real-time services to the user, using average speed r of the user gains to measure, the larger the rate is, the higher the income is;

$$\frac{d_{ij}-d_{ij}^{e}}{d_{ij}^{\max}-d_{ij}^{r}} \tag{1}$$

If delay for real-time services the normalized, wherein d_{ij}^{e} denotes the expectancy of average delay of real-time services:

$$\frac{\beta_{ij}-\beta_{ij}^{e}}{\beta_{ij}^{\max}-\beta_{ij}^{r}} \tag{2}$$

As the normalization about Non-real-time services' rate, it helps to ensure a minimum rate of non-real-time services; β_{ij} and β_{ij} is constant parameters, which determines the steepness of the curve of the function, the larger the value is, the steeper the curve changes, the higher the sensitivity to the end quality of service is. Formula (3) as defined in revenue function reflects QOS-awareness of terminal, the function maps a plurality of QOS parameters with reasonable perception or experience for the user to QOS level, gives a measurement of the QOS of different users by using uniform quantization levels standards.

To characterize the load level of the accessing network, the wireless access network defines the utility of all the terminals connected to the network average of QOS benefit. Suppose at a time, a terminal can only access a RAN, then the gain RAN $J \in I$ can be expressed as

$$R_{ij}=\begin{cases}\dfrac{\sum_{j\in i}\alpha_{ij}n_{ij}}{\sum_{J\in I}\alpha_{ij}}, & \sum_{I\in J}\partial_{ij}\neq 0\\ 1, & \sum_{i\in j}\partial_{ij}=0\end{cases} \tag{3}$$

Wherein, $\partial_{ij}=\begin{cases}1 \text{ terminal } i \text{ int} o\ RAN_j\\ 0\quad other\end{cases}$

Obviously, the heavier network load will result in lower average QOS benefit of terminal, otherwise the terminal average QOS gains will be higher. Therefore, the average QOS benefit of the terminal, namely the network load of the network utility can reflects the situation. Network utility is higher, indicating that the network load is lighter, otherwise it indicates the network load is heavier.

3. Experimental Results

By using OMNET + + 4.0, it can evaluate its performance of load balancing algorithm based on QOS-awareness. Supposing that, there are two types of 802.11 and 802.20 RAN in the system, each type of RAN has 2. Simulation only consider the upstream traffic, 802.20 RAN adopts the TDD mode of single carrier , each TDD frame in the uplink and downlink frames has each half; 802.23 RAN uses DCF mode. There are 30 supposed user (terminal), each user uses only one business, each has 10 business users. Setting the density of user in 802.20 RAN, the user from the SNR to the RAN randomly changed. Users can access a RAN at the same moment. Service packets arrive to Poisson distribution. The minimum rate of Variable rate services reached 1/2 of average rate. Users initially access network, whose selections are based on SINR (Signal-to-interference plus noise ratio, SINR) criterion, that is, channel conditions between the user and the various RAN, dynamically select the highest RAN of SINR to access, while according to network selection principle of 802.20/802.23 converged network users to access, business users access to 802.20 networks real-timely at a constant rate. The associated parameter settings used by network simulation are shown in Table 1.

Table 1. Experimental Parameters

Parameter names	The parameter value	Parameter names	The parameter value
The 802.20 frame length/ms	1	Packet length/bit	1000
The 802.20disabled when the time/ms	0.2	w_{xy} /ms	0
802.20 Frame when the number of disabled/ms	5000	w_{xy} /ms	100

The 802.23disabled when the time/ms	20	η_x	0.53
The SIFS length/ms	10	η_y	0.02
The DIFS length/ms	53		

In order to verify the performance of the proposed gateway load balancing algorithm, by using handover decision load balancing algorithm (Handoff decision load-balancing algorithm, HDLBA) proposed by Yan X, etc as a compared algorithm, the packet loss rate, packet delay and throughput performance were compared. Figure 1 - Figure 4 shows the simulation results of the comparison.

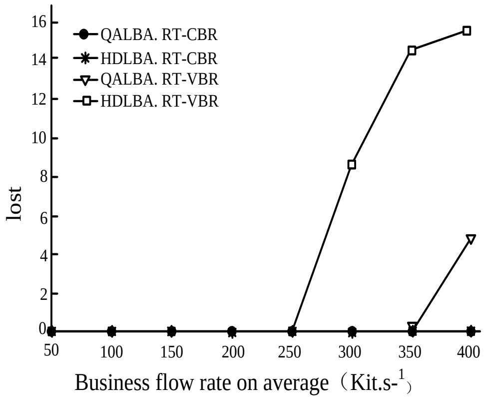

Figure 1. Real-time Service of Packet Loss Rate

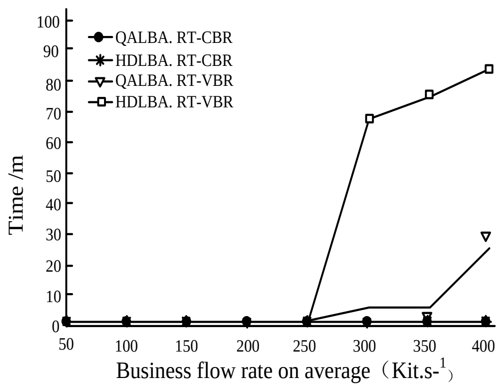

Figure 2. The Average Packet Delay of Time Business

4. Conclusion

HDLBA algorithm is lower than the throughput of other four algorithms. The load balancing of QALBA algorithm is the strongest, HDLBA algorithm the second and HDLBA algorithm the worst. Simulation results show that: QALBA algorithm can balance the network load, and compared to the traditional MLB algorithm and DLBD algorithm, the average blocking rate of packet service and the throughput performance have been improved significantly, and the robustness of algorithm is really strong, which can achieve network load balancing to achieve a balanced use of network resources.

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