A Bargaining Game Based Network Access Selection Scheme for Heterogeneous Wireless Networks

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We propose a bargaining game based network access selection (BAGNAS) scheme for heterogeneous wireless networks, which consist of CDMA network, OFDMA-based network, and WLAN. The BAGNAS scheme intends to reduce the handoff occurrence and handoff blocking ratio, while maintain the QoS requirement. The scheme is enabled whenever a new call or a handoff call originates. It is decomposed into two phases. At the first phase, the scheme determines a candidate network set according to three constraints in order to maintain the QoS for the ongoing calls and to guarantee the QoS for the call request. At the second phase, it finds the most suitable network for the call request through a bargaining game, in which the call request negotiates with each candidate network in the set for amount of the resource allocated to it. If there are three candidate networks, there will be three two-person bargaining games. In each two-person bargaining game, the call request and one of the candidate networks are the two players and they would like to split the residual resource of the candidate network. From the perspective of the call request, it prefers to attain more resource in order to have better QoS. From the perspective of candidate network, it prefers to remain more resource in order to accommodate more total number of calls and avoid less handoff in order to lessen the signaling overhead. Hence, the payoff functions for the two players are designed to represent their satisfaction. The payoff function of the call request is related to the resource it attains and the packet dropping ratio of the candidate network, while the payoff function of the candidate network is related to the resource it remains, the dwelling factor of the call request, and the preference of the candidate network for the call request. After finding the Nash equilibrium for each two-person bargaining game, the network from which the call request can attain the largest ratio of the residual resource will be chosen as the access network for the call request.

Simulation results show that the handoff occurrence and handoff blocking ratio of the BAGNAS scheme outperform those of the TOPSIS and EGA schemes without decreasing system throughput. As shown in Figure 1, the BAGNAS scheme can achieve lower handoff occurrence frequency by 40% and 99% than the TOPSIS and EGA schemes. The reason is that the candidate network in BAGNAS scheme considers the dwelling factor of the call request, which is equal to the dwelling time of the call request in the candidate network over the residual holding time of the call request. The TOPSIS scheme considers the speed of the call request. The ongoing calls in the EGA scheme can dynamically handoff to a better network.

Besides, as shown in Figure 2, the BAGNAS scheme can achieve lower handoff blocking ratio by 84.9% and 99% than the TOPSIS and EGA schemes. This is because the candidate networks in the BAGNAS scheme reserve resource for the mobile call request.

![Fig. 1. Handoff occurrence frequency](image)

![Fig. 2. Handoff call blocking ratio](image)