An Algorithm Of Dynamic Resource Reservation For multimedia Wireless Communication

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Abstract

Wireless communication that provides voice only is not sufficient to support the necessity of user. In the future, the major of advantage of third generation wireless communication(3G)are providing packet data communication, mobile internet, and mobile multimedia data communication. This kind of data type requires more bandwidth to transmit data. Sometimes, the communication would be encountered the transmitting block because the new cell has no enough resource allocating to Mobile Station(MS or MH) in handoff.

How to reduce the losing probability of data packets in wireless communication networks is important things which can raise the Quality of Service(QoS) and degrade the time and resource consume. In this paper, a resource reservation method is proposed to improve QoS and resource switching management to reduce data packet loss for multimedia communication at handoff operation.

keyword:wireless communication,Quality of Service(Q0S),Mobile resource reservation protocal(RSVP),Handoff

1 Introduction

The second generation of wireless system (GSM) provides the service focusing on the voice and additional for short message and e-mail services. But in the 3G, most of data transmitting is mobile multimedia service, which includes real-time and non-real-time data. In communication, the multimedia data need more bandwidth and can not suffer too much delay time. The two factors affected the QoS while the handoff happened. So we propose a strategy to ensure the quality of transmitting before handoff, to raise the successful communication and reduce the blocking probability.

In this paper, we propose a resource reservation stratagem to allocate the resource before handoff. First, we would predict the directions of the MS movement which is based on signal measured. Therefore, we distinguish the resource reserved time which is a threshold of resource establishment by the type of transmitted data. Then, according to the predicted value and the threshold to create the resource reservation. Finally, there is a checking mechanism to compare and modifying again to ensure the resource reservation correctly.

In section 1, some related background are describes. Section 2 describes the signal strength□attenuation and distance relations and according to the theory of communication to derive an equation of resource prediction. Section 3 describes the proposed resource reservation algorithm. Section 4 focus on the analysis of algorithm. Section 5 offers concluding remarks and directions for future work.

The moving characteristic of MH is affected the stability of transmitted data. When the MH is located near the BS(Base Station),the transmitted signal strength is more powerful so the communication is more stable, lost packet probability rarely. Oppositely, the MH is far from BS, the received signal strength of MH is more weak, the attenuation is more serious and add the interference factor ie..climate, environment…. and so on let the handoff of MH more early and more frequent. We will encounter the resource problem while the handoff frequency is increasing gradually. If the new cell has no enough resource in the handoff moment, The communication will be blocked. This situation cause serious QoS problem and waste the resource having been arranged to MH. In order to keep the communication well to reach the best QoS,

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we propose a stratagem to maintain it.

Handoff

The third generation wireless systems need to incorporate multimedia services, such as voice, video, and continuous data streams, etc. With the anticipated impact of next generation wireless mobile network and personal communication system, the micro cell, pico cell, and hybrid cell(macro-, micro-, pico-) structures are also being exploited to support a drastic increase in demand for resources. The smaller size of cells and variable propagation of signals cause much frequent handoffs. Usually, the type of services can be separated into two types of real-time and non real-time services. The next generation of wireless mobile network has to support a true combination of both real-time service(such as voice, video transmission)and nonreal-time service(such as data transmission).

Handoff means that MS moves to the boundary of cell and into another cell, then the new cell provide service and old cell would be released the resource for MS. There are three measure ways to determine the handoff active.

- Word Error Indicator(WEI)：To check the result of encoding data in fixed time and analyse WEI is expressed the correct probability of decoding.
- Received Signal Indication(RSSI): RSSI indicate the measured signal strength.
- Quality Indicator(QI)：It is presented the ratio of interfere and noise.

Mobile RSVP

Mobile resource reservation Protocol(MRSVP)was proposed by Talukdar [1][2] to achieve the desired mobility independent service guarantees for real-time multimedia application in an Integrated Service Packet Network. MRSVP protocol makes advance resource reservations at multiple locations where the MH may possibly visit during the service time. The MH can thus achieve the required service quality when it moves to new location where resources reserved in advance.

2 Signal Measure and Analysis

In the wireless communication, the radio is transmitted by the air which has some interference factors making the signal strength attenuation. According to the theory of communication, we can get the equation.

Attenuation = P_1 / P

P_1：received signal (power)

P ：transmitted signal(power)

Base on [3][4] the distance and power relationship, we can get the equation：

Attenuation: $P_1 / P = 1 / d^2$

d：the distance form transmitter to receiver

According to the equation, we get the signal strength and distance relationship shows in Figure 3.

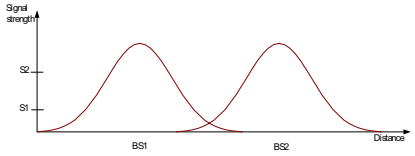

Figure3: signal strength and distance relationship

In order to perform the location estimate using signal strength, there is defined two signal-threshold S1 and S2.

We consider a cell in a wireless network with a base station is partitioned into three concentric zones by S1 and S2 signal strength(figure4). The cell's radius is R. After computation, we can get the radius of the S1 and S2 which are R1 and R2.

R1 = R* sin45：

R2 = R * sin15：

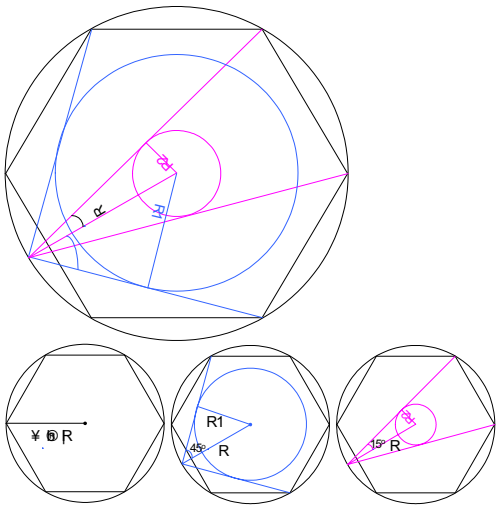

Figure 4 Cell assignment by signal strength

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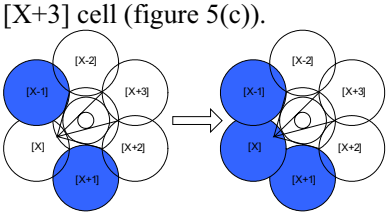
According the attenuation equation, we can derive and get the S1 and S2 value.

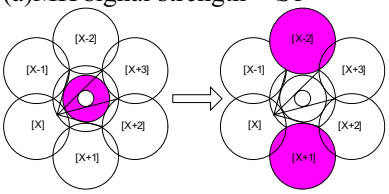
$S1 = S / R12 = S /(R * \sin 45^{\circ})2$

$S2 = S / R22 = S /(R * \sin 15^{\circ})2$

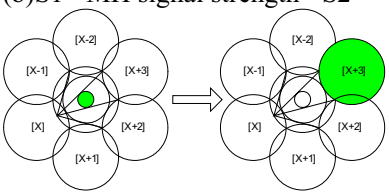
In contrast to the model, if the MH is from [X] cell to [Y] cell and signal strength is lower than S1, it located between large round and middle round and estimate it will go into [X+1] or [X-1] cell(figure 5(a)). If the MH signal strength is between S1 and S2, it locate between middle round and inner round and estimate it will go into [X+2] or [X-2] cell(figure 5(b)). If the MH signal strength is higher than S2, it locate in inner round and estimate it will go into [X+3] cell (figure 5(c)).



(a)MH signal strength < S1



(b)S1< MH signal strength< S2



(c)MH signal strength > S2

Figure 5 location and estimation relation

3 Resource Reservation Algorithm

In this section, we propose the resource reservation algorithm(figure 6)to ensure the QoS. The algorithm almost distinguish into three parts including resource prediction, resource reservation created and checking mechanism. We assume the MH movement from [X] cell toward [Y] cell. While the MH enter the cell and cell begin to service for it, the algorithm mechanism is installed and detect the signal strength of MH continuously. It will enter the resource prediction process to predict the possibly ongoing path if the continuous measurement of signal strength is belonged to gain. Otherwise, it is going to the resource reservation mechanism which will establish different thresholds by transmitted data type then using the threshold as the installed time point of created resource reservation. When the resources have been reserved, the scheme will go into check mechanism. First, detecting the MH reach to the overlap area or not. There is compared the overlap cell with predicted cell While the MH reach to the overlap area. If the result is the same, going to modify resource reservation in detail. Otherwise, releasing the resources reservation in advance and reestablish resource according to the overlap area.

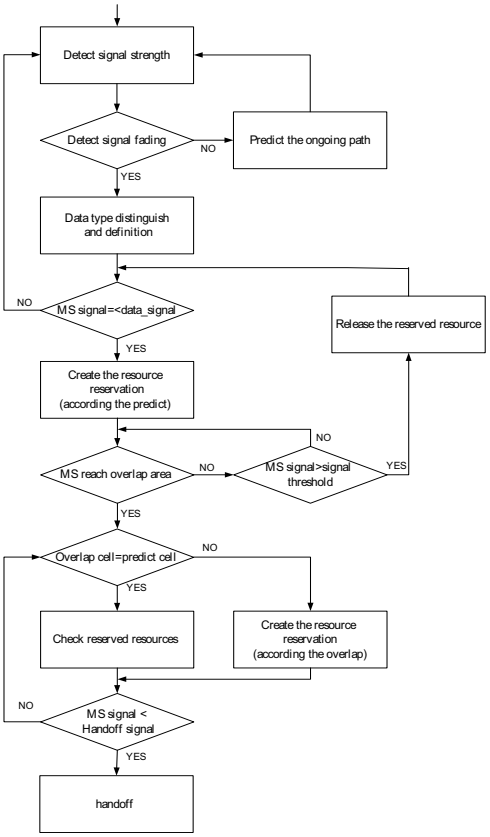


Figure6 Resource Reservation Algorithm

The previous section explains the algorithm schedule, we can get correct resource reservation by prediction modifying and check process. The figure7 shows t the prediction which has been pass the check mechanism and reserved resource relationship.

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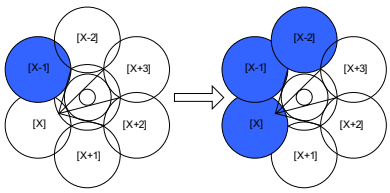
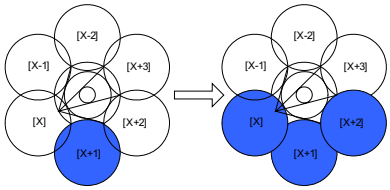
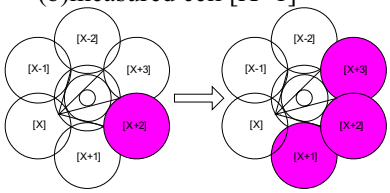


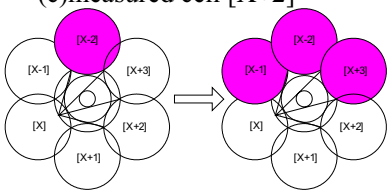
(a)measured cell [X-1]



(b)measured cell [X+1]



(c)measured cell [X+2]



(d)measured cell [X-2]
(e)measured cell [X+3]

Figure7.prediction and resource reservation Relationship passed check mechanism

4 Research Analysis

There is divided into three parts to analyse the reserved resource properly.

Correct reservation

In the paper, we propose a reserved strategy, focusing on the prediction to create reservation amounting to three cell. The algorithm can achieve the most correct reservation if the MH direction of movement does not change. Even though the reservation is wrong, we can use the check mechanism to modify it and reach the correct reservation.

Reserved probability

Compared to the Mobile RSVP (MRSVP) method, our proposed reservation strategy provide the more efficient resource allocation than it. Because MRSVP would reserve all of surrounding cell and whole the time until the MH move into one of reserved cell. Oppositely, our method reserve neither whole the time nor all of surrounding cell. It will begin to reserve resource while the MH signal strength is lower than the threshold. And it just reserve the adjacent three cell.

The Time and Cost of Analysis

We assume that a MH moves from X_0 cell to X cell. Then it removes from X cell to Y cell after a moment. There is assumed that the 'T' is the stayed time of MH in X cell and t_1, t_2 represent MRSVP and our method reserved time for Y cell resource during the MH stayed X cell. So we can get reserved time during MH stayed X cell. The t_1 means the reserved time for Y cell while MH move from X cell to Y cell. Because the MRSVP method is reserved all the time of stayed X cell period so the reserved time t_1 would equal T. The t_2 means the cost time of using our method. The t_2 would be small than t_1 because it is not reserved all the time just reserved a part of period until the signal reach the threshold, it would trigger the reserved mechanism.

$$t_1 = T \quad \text{.....(1)}$$
$$0 <= t_2 < T \text{ ....(2)}$$

$T-t_2$ means the time of MH signal strength higher than threshold segment when MH is stayed in X cell. Accordind to (1) (2), we can get

$$t_2 < t_1 \text{ .....(3)}$$

We assume that r is the basic unit of resource reserved and R_1,R_2 represent MRSVP and our method reserved resource during the MH stayed X cell. The MRSVP method reserve six cell of the surrounding cell, so

$$R_1 = 6r\text{.....(4)}$$

Our method just reserve three cell, so

$$R_2 = 3r\text{.....(5)}$$

According to (4) (5) we can get equation

$$R_2 = 1/2\ R_1\text{.....(6)}$$

We use the C to express the cost and C_1,C_2 represent MRSVP and our method

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reserved resource during the MH stayed X cell. So the reserved cost can be expressed the following equation.

Cost(C)= Resource(r)*Time(t) …(7)

The cost of MRSVP is

$$C1 = R1 * t1 = 6r \cdot t1 \quad \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

The cost of our method is

$$C2 = R2 * t2 = 3r \cdot t2 \quad \ldots\ldots\ldots\ldots\ldots\ldots (9)$$

According to(3), we can derive

$$r \cdot t2 <= r \cdot t1$$

$$3r \cdot t2 < 6r \cdot t1$$

$$C_2 < C_1 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

$$C_2 / C_1 = (3r \cdot t_2)/(6r \cdot t1) <= (3r \cdot t_1)/(6r \cdot t_1) = 1/2$$

Compare with MRSVP, the cost of our method is less than MRSVP. Even it is equal or less the half of MRSVP cost.

5 Conclusion

We propose a resource reservation algorithm to maintain the QoS which can reserve resource efficiently so it can raise the successful probability of handoff and degrade the fail of handoff. Furthermore, the method can assign reserved resource efficiently and reduce the resource wasted. Finally, the proposed algorithm is based signal strength, the computation method is simple and efficient.

In the future, we can distinguish the transmitted data more detail and can get accurate thresholds, it would raise the integrated resource management efficiently.

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