"Reduction of Handoff failure in GAN Using Adaptive Keep-Alive Interval"

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ABSTRACT

Handoff refers to the process of transferring an ongoing call or data session from one channel connected to the core network to another. A gateway approach is adopted in the GAN architecture to integrate 3GPP core network with other radio technologies. The Generic Access Network (GAN) is developed by 3GPP extends services to unlicensed spectrum. A mobile station (MS) with multiple air interfaces can access 3GPP services through GAN and roam seamlessly between different radio access networks. However, mobility management and resource management are critical issues in GAN. To allocate GAN resources efficiently, we propose Adaptive Keep-alive Interval (AKI). By using AKI, an MS can send less signaling messages. In addition, AKI can increase system utilization by releasing unused resources. A mathematical model is to be evaluate the handoff analysis of the proposed AKI. The results analysis is validated by extensive simulations. The results show that the proposed AKI can reduce handoff failure probability and increase GAN utilization significantly.

Key words: 3GPP Generic Access Network (GAN), interworking, performance analysis, mobility and resource management,

1. INTRODUCTION:

Third Generation Partnership project (3GPP) develop the Generic Access Network (GAN) evolves from the Unlicensed Mobile Access (UMA). It extends Global System for Mobile Communications GSM)/General Packet Radio Service (GPRS)/Universal Mobile Telecommunications System (UMTS) services to unlicensed spectrum. Basically, a gateway approach is adopted in the GAN architecture to integrate 3GPP core network with other radio technologies. From the viewpoint of a 3GPP core network, GAN is just another Radio Access Network (RAN) like GSM/EDGE RAN (GERAN). A Mobile Station (MS) with multiple air interfaces can access 3G services through GAN and roam seamlessly between GAN, GERAN, and UMTS Terrestrial RAN (UTRAN). Besides, many different wireless access technologies, such as IEEE 802.11Wireless Local Area Networks (WLAN) and Bluetooth, can be applied to GAN

Wireless Communications is the main source of expansion in the area of communications in recent years; it has evolved rapidly and is one of the most promising areas of research. Third generation networks, with provision for streaming applications, internet access and gaming have now been commercially realized and the standardization of fourth generation technology has already begun.

2. REVIEW

Handoff management is the process by which a mobile node keeps its connection active when it moves from one access point to another. Handoff refers to the process of transferring an ongoing call or data session from one channel connected to the core network to another.

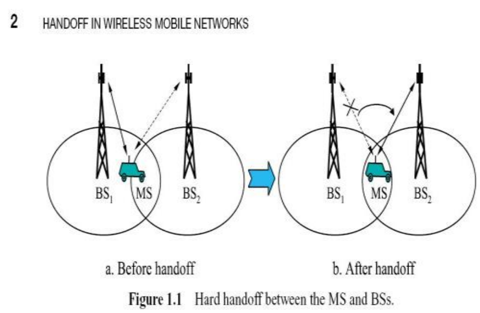

Figure 1: Handoff between MS and BS

Seamless handover is a fundamental concern in any system with mobility. Seamless handoff across the different wireless networks is becoming increasingly important. Whereas wired networks regularly grant high bandwidth and consistent access to the Internet, wireless networks make it possible for users to access a variety of services even when they are moving. As a result, seamless handoff, with low delay and minimal packet loss, has become a crucial factor for mobile users who wish to receive continuous and reliable services. Seamless handover is when a handover from one cell to another takes place without perceptible interruption of the radio connection. Seamless handover is a fundamental concern in any system with mobility. There are not signals generated internally that control the selection of the output multiplexers. Instead, the input signal, exhibiting a full voltage swing and no extra delay, is used to drive the multiplexers.

3. OBJECTIVE OF WORK

In this paper, the proposed AKI with various performance metrics by simulation have been evolved. Through simulation experiments, we found that the GAN handoff probability is the most important factor affecting mobile users to access GAN services. To get more insights of the problem, in previous paper mathematical analysis for handoff failure probability is conducted. In that paper the mathematical analysis is described. In the analysis, handoff is defined as the switching of radio connection from a Base Station (BS)/Access Point (AP) to another BS/AP. GAN Architecture illustrates the network topology used in the analysis. Cells and GAN cells are overlapped. Therefore, an MS can seamlessly roam between different cells. Please note that Fig does not show the overlaps of the cells. There are two types of cells GERAN/UTRAN cell and GAN cell. For each cell, there are Nnb neighboring cells consisting of Ng GAN cells and $(Nnb - Ng)$ GERAN/UTRAN cells. In Fig. there are 2 neighboring GAN cells and 2 neighboring GERAN/UTRAN cells around each cell. There are 4 moving directions for each

MS. The topology is wrapped-up. That is, an MS moving up outside the boundary will reach to the bottom cell, and same as that in left and right sides. With different user preferences, the handoff decision will be different.

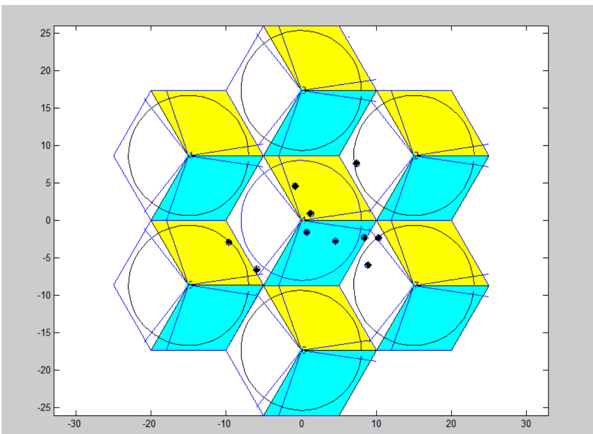

Figure 2: Hexagonal Cell Area

Theoretically the cell area is considered as hexagonal in shape because they give the maximum distance to center for Minimum number of cells to cover an area. In reality, They are designed based on uniform design. Base stations are close to designed locations. Real Footprints should be simulated or measured in real deployments. Base stations/Mobile Switching Centers (MSC) coordinate Handoff and control functions. Shrinking cell size increases capacity, as well as networking Cost and burden. Divide the area into "Cells" with different Base Stations

Frequencies/timeslots/codes reused at spatially-separated Locations. Cells should be far enough so that signals do not interfere.

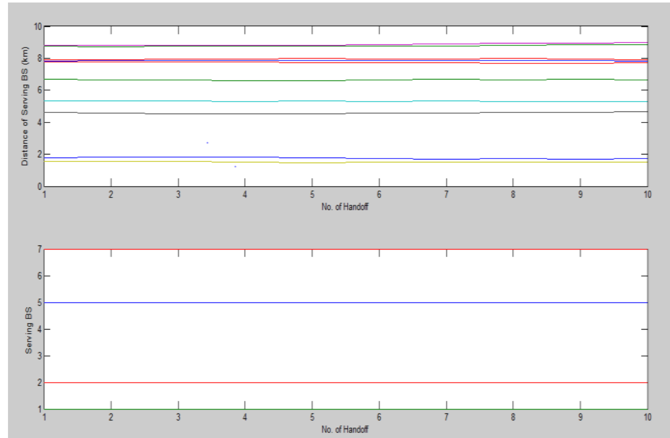

Figure 3: No. of Handoff vs. Serving BS

Above fig shows the graphical representation of no. of handoff versus distance of serving base station(km) And no. of handoff versus serving base station. First fig shows the no. of handoff takes place within the particular range of distance of serving base station. Other fig shows no. of handoff takes place within the serving base station. All these depends upon the signal strength of serving base station and mobile network.

The proposed AKI can reduce the amount of keep-alive messages. In addition, it provides a way to decide which reserved GAN resources should be released. In light of the aforementioned discussion, GAN resources may be reserved but not be used immediately by the early registered MSs. Therefore, when the load of GAN is heavy, newly handover-in sessions may be dropped.

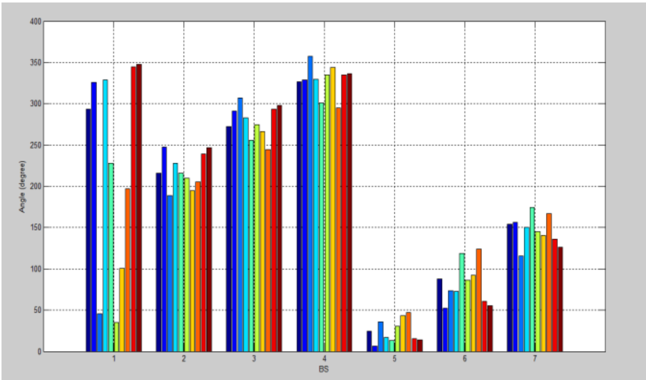

Figure 4: Handoff angle at BS

Above figure shows the graphical representation of different handoff angle at different BS (Base Station). It depends on the signal strength of MS (Mobile Station). It shows on what time interval the connection is established between the current access point and another access point. Also it shows the angle of handoff at the access point. Angle is measured with MS and strong signal from serving BS. Also we can determine the range of the serving BS.

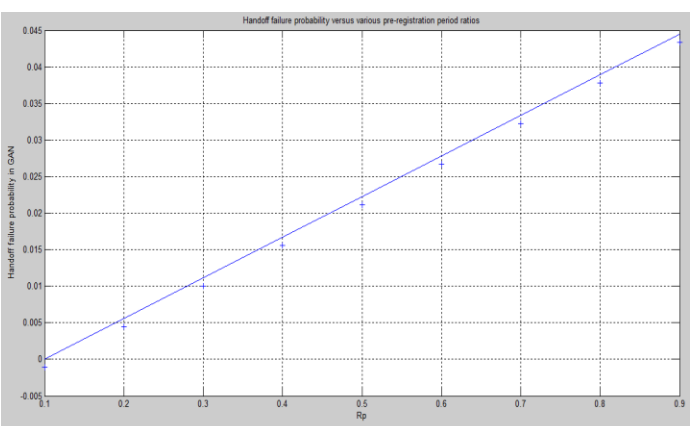

Figure 4: Handoff failure probability versus various pre-registration period ratios.

Figure indicates that without AKI, the handoff failure probability increases linearly. With AKI, the upper bound of the handoff failure probability remains constant. Without *pre-registration miss*, the resource occupancy time is always counted as the pre-registration period plus the GAN cell residence time no matter whether preemption is performed or not. With pre-registration miss, the GAN resource occupancy time in the pre-registration period is over evaluated by counting the time of some candidate MSs. Once a pre-registered MS becomes a preemption candidate, it has no effect on the GAN resource occupancy time. Therefore, the mathematical analysis shows the upper bound of the handoff failure probability and the lower bound of the GAN utilization. When traffic load is heavy, in order to allocate resource for an MS which will use GAN service soon, the serving GANC releases some reserved resources. The *static keep-alive interval* in which the keep-alive interval remains static as that defined in the standards, the resource occupancy time can be derived accurately in mathematical analysis.

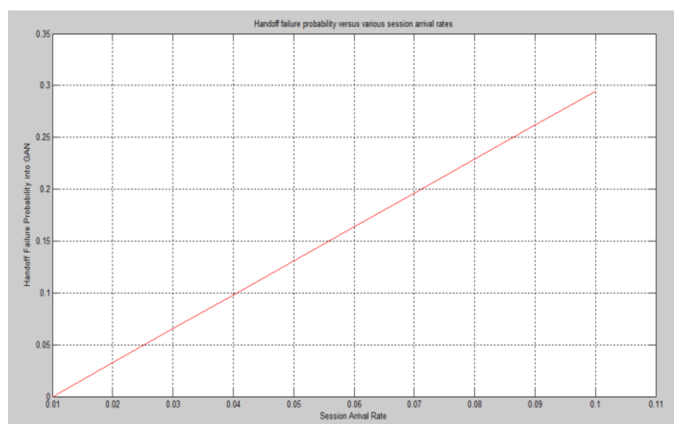

Figure 5: Handoff failure probability versus various session arrival rates.

Figure shows that the handoff failure probability is also affected by new session arrival rate. Again, AKI can reduce the handoff failure probability when session arrival rate is increased. By re-allocating GAN resource to those users who need resources immediately, AKI can alleviate the congestion in GAN. Therefore, AKI makes GAN more tolerant to heavy user traffic. The performance of different GAN capacities is also investigated. When a GAN has more capacity, it can accommodate more handoff sessions. Therefore, as shown in Figure, when the GAN capacity is increased, the handoff failure probability is decreased. Figure shows that the proposed AKI is particularly useful when the load of the GAN cell is heavy. The reserved resource in GAN can be preempted in AKI, the GAN resources are used more efficiently because the GERAN/UTRAN-preferred sessions may occupy the GAN resource but not use it immediately, and GAN utilization decreases when the GERAN/UTRAN-preferred session ratio increases when r_p is increased, it is earlier to pre-register. Thus, the GAN utilization is decreased when session arrival rate increases, the GAN utilization increased too. Reducing handoff failure probability is also beneficial to GAN utilization, ρ. When more sessions move into GAN successfully, the GAN resources are allocated more efficiently to the sessions which are really in used.

4. CONCLUSION AND FUTURE SCOPE

To allocate GAN resources efficiently Adaptive Keep Alive Interval is proposed. When traffic load is heavy, in order to allocate resource for an MS which will use GAN service soon, the serving GANC releases some reserved resources also illustrate the simulation results of the three different policies (maximum interval first, minimum interval first, random). We also compare them with the results of the static keep-alive interval. Cells should be far enough so that signals do not interfere. Frequencies/timeslots/codes reused at spatially-separated Locations. Base stations/Mobile Switching Centers (MSC) coordinate handoff and control functions. Shrinking cell size increases capacity. GAN is proposed in 3GPP to extend mobile services to Heterogeneous wireless networks. According to different user preferences, an MS has different strategies to choose the most appropriate RAN. In this paper, we propose AKI to manage the GAN resources. It can reduce unnecessary GAN signaling messages before actual handover-in happens. Without handoff prediction, a heuristic way to preempt reserved Resources is to relate keep-alive interval to the length of Pre-registration time. Proposed AKI is simple and effective. The innovation of this paper is in that a critical issue is identified which was not solved before and needs to be resolved to improve the GAN performance. We propose a simple yet practical solution which can improve the performance significantly. In addition, in this paper, we Develop an intricate analytic model to evaluate the handoff Failure probability and GAN utilization. The analysis shows the performance of a larger scale network, which exams the scalability of the proposed AKI.

The future scope is that the AKI algorithm can be used at any large network. Also the parameters such as signal strength, angle, distance, signal power, etc can be measured.

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