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An Extensive Hypothetical Review on Call Handover Process in Cellular Network

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Abstract:
This paper gives an overview on call handover process in cellular communication network. Mobility is key issue in current and future cellular networks such as GSM, UMTS and LTE. The handover process impacts on Quality of Service for network provider. If this process accomplishes inaccurately handover can result in loss of call. Handover is the process in which active call is transferred from one cell to another cell as the subscriber moves all over the coverage area of cellular network. Received signal level, received signal quality etc. parameters play vital role in handover decision process. MS station detects the signal level of current serving BTS along with surrounding BTS. The type of handover occurrence depends on cellular network structure. In this paper we revised the concept of handover process, different handover schemes and types then we briefly illustrate inter BSC handover sequence process.

***Keywords*:** *Cellular network, call handover process, received signal level, received signal quality, Quality of service, GSM, UMTS, LTE.*

I. INTRODUCTION

One of the important parts of the cellular or mobile communication system like GSM (Global system for mobile communication) is network which is split in several radio cells. To provide frequency and coverage to these cells from limited available frequency (spectrum) and from these limited frequency operator have to cover all cellular network. So operators reuse these available frequencies to cover all over network by taking care of adjacent and co-channel interference should be less. The subscriber when moves from one cell to another cell without breaking call this process is known as handover. On the performance of handover process the (quality of service) QoS of operator is dependent. Handover is also known as Handoff. The term handover is more used within Europe, while handoff term uses more in North America [2].

Handover schemes are categories by hard, soft and seamless handoffs. They are also characterized by "break before make" and "make before break." In hard handover, current radio link are released before new resources are used; in soft handover, both existing and new radio link are used during the handover process [5]. Different cellular generations handle handover in slightly different ways. This paper explains way of handovers in GSM. Figure 1 shows the basic call handover process.

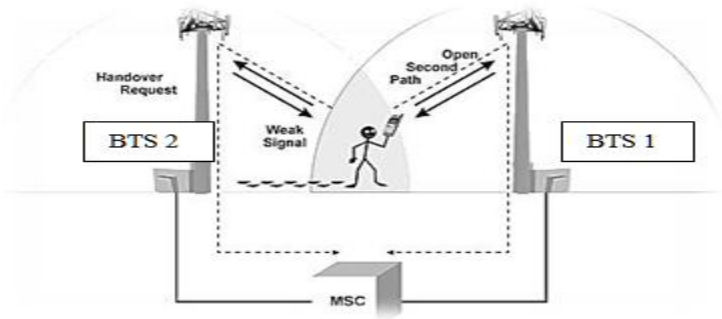

Figure 1. Basic Call Handover Process

Figure1 shows the basic call handover process. In this diagram, a mobile subscriber is communicating with (Base Trans receiver Station) BTS1. BTS 1 provides a list of radio channels to measure nearby BTS. After the cellular phone measures the quality of the radio channels, it returns this information to the serving BTS. Using this information from neighboring BTS, the serving BTS sends a handover message which instructs the cellular phone to tune to a new radio channel of the adjacent BTS 2. The cellular phone begins transmission on the new channel by sending a short burst. The new BTS uses this information to send a command to adjust the relative timing of the cellular phone. After the cellular phone adjusted, the voice channel from the MSC is switched from BTS 1 to BTS 2 and voice conversation can continue [10].

There are number of parameters that needed to know to determine whether a handover is required. These parameters are RXQUAL (received signal quality), RXLEV (received signal strength), and DISTANCE (Distance of MS from BTS), PBGT (Drops below power budget margin). The mobile scans radio channels and reports back the quality of the link to the BTS. In this way the mobile assists in the handover decision and as a result this from of GSM handover is known as MAHO (Mobile Assisted Hand Over). The cellular network system known the quality of the link between the mobile and the BTS as well as the strength of local BTSs as reported back by the mobile. It also knows the availability of channels in the nearby cells. As a result it has all the information it needs to be able to make decision about whether it needs to hand the mobile to hand the mobile over from one BTS to another[11][13].

If the network decides that it is necessary for the mobile to handover. It assigns a new channel and time slot to the mobile. It informs the BTS and the mobile of the change. The mobile then retunes during the period it is not transmitting or receiving, i.e. in an idle period. A key element of the GSM handover is timing and synchronization. There are a number of possible scenarios that may occur dependent upon the level of synchronization [11].

This paper is organized as follows. Section I gives introduction of this paper. Types of handovers are described in section II. Sections III describe handover mechanism. Section IV concluded this paper.

II. GSM HANDOVER TYPES

Handover types can be distinguished depending on the cellular network structure. In the GSM cellular system there are four types of handover which are as follows [13].

2.1 Intra BSC handover

This type of handovers is occurs when subscriber moves from one cell to another cell of the coverage area of one BTS to another belonging to the same BSC (Base Station Controller).

2.2Inter BSC handover

When subscriber moves from one cell to another cell of the coverage area of one BTS to another belonging to the one BSC to another but within the same MSC (Mobile Switching Center). This type of handover is called as Inter BSC handover.

2.3 Inter MSC handover

This form of handover occurs within two different MSC.When subscriber moves from one cell to another cell of the coverage area of one BTS to another belonging to the oneBSC to another within two different MSC.

2.4Intra BTS handover

In this type of handover subscriber remains attached to the same BTSbut only cell can be changed.

With advanced the evolution in cellular system. Technology migrates from GSM to UMTS/WCDMA (Universal Mobile Telecommunication System/ Wideband Code Division Multiple Access) as well then LTE (Long Term Evolution). So there is a need of handover from one technology to another technology. These handovers are called as intersystem handover or inter-RAT (Radio Access Technologies) handover. The two most common inter system handovers are as follows

2.5 UMTS/WCDMA to GSM

While in UMTS, i) if the currently assigned UMTS cell falls below the UMTS threshold (implying that the connected UMTS cell is not 'strong-enough'), and ii) if there is no other UMTS neighboring cell whose threshold is larger, then the algorithm looks for GSM cells to handover. If conditions i) and ii) above are met, and if the RSSI of the strongest GSM cell is above the GSM threshold, then the mobile is instructed to do aninter-system handover from UMTS to GSM; otherwise the mobile continues with UMTS (in which case the call quality, in terms of received threshold may get worse, eventually leading to a call drop if no suitable GSM cell or better UMTS cell is found) [8].

2.6 GSM TO UMTS/WCDMA

While in GSM, i) if the RSSI (Received Signal Strength Indicator) of the currently assigned GSM cell falls below the GSM threshold (implying that the connected GSM cell is not 'strong-enough'), and ii) if there is no other GSM neighboring cell whose RSSI is larger, then algorithm looks for UMTS cells to handover. If conditions i) and ii) above are met, and if the strongest UMTS cell is above the UMTS threshold then the mobile is instructed to do an inter-system handover from GSM-UMTS; otherwise the mobile continues with GSM (in which case the call quality, in terms of received RSSI may get worse, Eventually leading to a call drop)[8].

III. HANDOVER MECHANISM

In this section we are focusing on the handover procedure. For understanding handover procedure sequence in detail we see the mechanism of inter BSC handover sequence stepwise. The procedure is described as follows. Figure 2 shows handover mechanism and figure 3illustrates diagram of inters BSC handover sequence with commands [14].

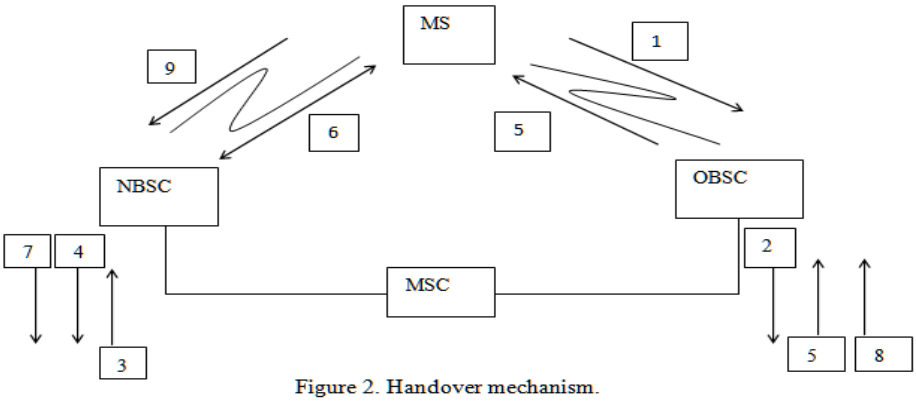

Figure 2. Handover mechanism.

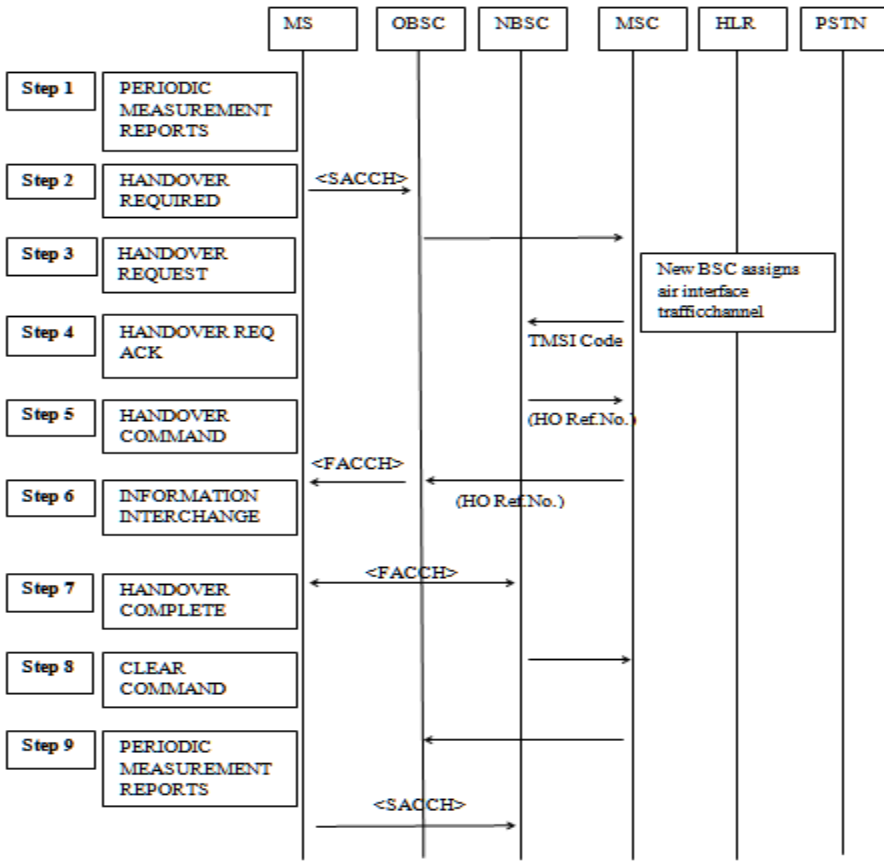

Figure3.Inter BSC Call Handover Sequence.

Step1: The MS is in the conversation state and is continuously compiling measurement both of the current transmission and the broad control channels of up to the thirty two surrounding cells. The measurements from the six best cells are reported back to the BSC, every480ms.
Step2: When the handover is required, due to low receive signal strength indication (RSSI)or poor signal quality the existing "originating" BSC (oBSC) notifies the MSC ("handover required").
Step3: The target or "new" BSC (nBSC) is alerted with the message "handover request" tagged with the TMSI (Temporary mobile subscriber identity).
Step4: The new BSC allocates a handover reference number which it uses to determine whether the correct MS gains access to the air interface channel which it allocates, and acknowledges the MSC's request with "handover request Ack". This tagged with the HO reference number. The nBSC assigns a traffic channel.
Step5: The MSC, via the oBSC orders the MS to change to the new channel with the message "handover" commands on FACCH (Fast associated control channel).
Step6: There is an information interchange between nBSC and MS. This the FACCH channel but an access burst is used. The messages and information carried depend upon the type of the handover being performed.
Step7: Once all necessary information has been transferred the message "handover complete" is sent to the MSC.
Step8: The MSC now sends a "clear commands" to the oBSC; this frees the radio resources for another MS. The channel is not cleared until this point in case the new BSC cannot accommodate the MS being handed over.
Step9: The MS, still in the conversation mode, then continues to prepare periodic measurement reports and sends them to the new BSC.

IV. CONCLUSION

In this paper we extensively revised call handover process in GSM cellular network. The different call handover schemes and types are discussed and gives focused on the Received signal level, received signal quality etc. parameters that are involved in call handover decision. Finally we gives theoretical demonstration of inter BSC call handover sequence.

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