Handover in LTE networks

E O Pokhormchikova and I.M. Daudov

1 Irkutsk National Research Technical University, 83, Lermontov str., Irkutsk, 664074, Russia
2 Chechen State University, 17а, Dudaev Boulevard, Groznyy, 364015, Russia

E-mail: elena.isea@mail.ru

Abstract. Since users of cellular communication networks are mobile and can move around during communication sessions (which is why the radio conditions in which subscriber stations are located are constantly changing), it is necessary to support procedures that allow providing continuous service to subscribers, even while they are moving. To do this, use the handover procedure (handover). This procedure allows you to switch the mobile station service from one base station (BS) to another BS (usually having a better connection to the mobile station, but not always).

1. Introduction

In this paper, the parameters of the handover were considered on the example of the equipment of the Huawei vendor.

The inter-frequency handover sequence can be divided into several phases:

1) Select the target cell / frequency. For the measurement, eNodeB generates a list of candidate cells based on the measurement results between the technologies.

For blind redirection / handover, the serving eNodeB selects the target cell based on the priority of the blind handover or the priority of the frequency of neighboring cells. During measurement or blind handover for LTE services, eNodeB filters the frequencies or cells on which the VoLTE service cannot be implemented. That is, it checks the parameter EutranInterFreq.VolteHoTargetInd. If the value of this parameter is set to NOT_ALLOWED, the cell data is filtered out [1–5].

2) The decision on the transfer of service. At the handover decision stage, eNodeB checks the list of candidate cells. Based on the result of the check, eNodeB determines whether the handover should be initiated and to which cell the UE should be passed.

3) Handover execution. During the handover execution phase, eNodeB manages the UE handover procedure to the target cell. The redirection mode is selected only if a blind A2 event is triggered in the script, or the UE does not support handover.

2. Results and discussion

During inter-frequency handover based on measurement coverage, or blind redirection / blind handover can be initiated and set by various events, as shown in the table 1.

With blind handover, eNodeB does not deliver events that trigger the inter-frequency handover.

The IfCoverPreBlindHoSwitch option of the CellHoParaCfg. CellHoAlgoSwitch parameter specifies whether blind handover is enabled [6, 7]. After the UE gets access to the network, eNodeB checks whether there are suitable blind neighboring cells or frequencies, and delivers the A2 event for...
the blind handover. After event A2 initiated, eNodeB transmits the UE from the serving cell viablind redirection to avoid loss of service. The EmcInterFreqBlindHoSwitch parameter of the CellHoParaCfg.CellHoAlgoSwitch parameter specifies whether redirection between frequencies or between technologies is used during the resulting inter-frequency blind handover.

| Table 1. Events for each procedure |
|-----------------------------------|
| the procedure                     | the subroutine                  | Event to activate | Event to stop |
| Measurement                       | Inter-frequency measurements    | Event A2          | Event A1      |
|                                  | Inter-frequency handover.       | Event A3, Event A4, Event A5 |
| Blind redirection                 | –                              | Event A2          | Event A1      |
| Blind handover                    | –                              | Event blind A2    | Event blind A1 |

Figure 1 shows the selection of blind redirection and handover based on measurements. If the signal quality in the service cell is below the specified threshold, the UE reports the A2 event for the inter-frequency measurement. After receiving the report, eNodeB provides the measurement configuration between the frequencies.

![Figure 1. Selecting a blind redirect/handover](image-url)
If the signal quality in the serving cell further deteriorates and the eNodeB does not perform a handover for the UE, the UE reports a blind event A2. After receiving the report, eNodeB considers that the serving cell can no longer provide services for the UE, and performs a blind redirect.

On the basis of these data, the areas with poor coverage were thoroughly checked. As a result, it was revealed that the neighboring frequency (LTE 1800) was not registered, as a result of which no handover was made to this cell. After the addition of the neighborhood, the utilization of LTE 1800 increased. Coverage it should also have increased, since the range of the LTE 1800 is greater than the LTE 2600.

Figure 2 shows the result of the neighborhood adjustment.

![Figure 2. Disposal of LTE 2600 (blue and green) and disposal of LTE 1800 (black).](image)

It was necessary to check the presence of this neighborhood on all other cells. An upload was made and about 5 more BS with this problem were found. After the adjustment, the result was similar.

Then the optimal parameters for the inter-frequency handover and MLB settings were selected. The thresholds were changed empirically, which gradually allowed us to observe the change in the utilization of carriers. The result of changing the thresholds is shown in Figure 3.

![Figure 3. Disposal of RB blocks (black – LTE1800, blue and green-LTE2600)](image)

MLB can balance both the number of users and the number of RB. The threshold (the difference in utilization by the number of UES/RB) at which MLB-HO was activated was reduced. Also, the timer that evaluates UE/RB has been reduced, and the indicator of the simultaneous number of subscribers who can make MLB-HO at a time has been increased.

The result of the MLB adjustment is shown below (Figure 4).
By implementing this goal, we managed to increase the speed in LTE in the entire region. The amount of traffic also increased slightly. Figures 5 and 6 show the final results of this work.

3. Conclusion
The graphs show that at the time of 15.04, the average speeds were 6 mbit/s. The adjustment was made for several days, based on daily statistics. At the time of 25.04, we managed to find the optimal parameters, as a result of which the average speed in LTE increased to 12 mbit/s.

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