Abstract

Each cellular technology requires robust and seamless mobility procedure to ensure high quality of service and uninterrupted user's connectivity. Thus, global research and standardization efforts are focused on developing mobility solutions which are reliable and offer cell change with negligible or no interruption to user's data exchange process. One of the solutions designed in recent years by Third Generation Partnership Project (3GPP) was Conditional Handover (CHO). In CHO the cell change preparation and execution phases are decoupled. The user is prepared for mobility early while the actual cell change is executed late, when the target cell is sufficiently strong and suitable for admitting a new user. The decision whether to execute a cell change is subject to a condition which the user equipment (UE) continuously evaluates. It is also worth emphasizing, the UE might be prepared with as many as eight neighbouring cells towards which CHO execution is possible. Due to decoupled preparation and execution phases and thanks to the preparation of more than a single neighbour cell, the number of radio link failures (RLFs) is minimized, and the robustness of the overall mobility scheme is improved. Nevertheless, still multiple CHO-related research questions remained which are attempted to be answered in this dissertation.

First thesis formulated in this dissertation concerned the CHO recovery procedure wherein, upon radio link failure, the UE might take advantage of the CHO preparations and use one of these CHO configurations for executing a subsequent cell change instead of initiating a radio link reestablishment procedure. It has been assumed it is possible to determine a maximum practical number of CHO candidate cells for CHO recovery which ensures both the recovery effectiveness on the UE side and the radio resource reservation efficiency on the network side. The results obtained in this research work have shown it is unnecessary to prepare more than two or four CHO candidate cells (the exact number depends on the individual scenario) if CHO recovery efficiency is considered. Going beyond these values did not bring any gains in terms of CHO recovery effectiveness, while it has created additional radio resource reservation burden.

Second thesis formulated in this dissertation was focused on maximizing the ratio of contention-free random access (CFRA) during CHO. One of the discovered deficiencies of CHO is related to the beam-specific CFRA resources becoming obsolete due to decoupled CHO preparation and execution phases. It occurs as CFRA resources can be used only if they meet received signal's quality criteria at the time of CHO execution. Thus, in this dissertation it has been proposed to apply beam-level measurement reporting prior to CHO execution in order to update the CFRA resource assignments to the beams which are instantaneously better. The thesis assumed this shall lead to the CFRA rate increase with a desirable impact on key handover metrics: interruption and reliability. The results have confirmed that CFRA ratio can be increased by up to 13% thanks to beam-level measurement reporting. This in turn reduces the number of failures and accelerates the overall mobility procedure.

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