UMTS Handover

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There are following categories of handover (also referred to as handoff):

- Hard Handover

Hard handover means that all the old radio links in the UE are removed before the new radio links are established. Hard handover can be seamless or non-seamless. Seamless hard handover means that the handover is not perceptible to the user. In practice a handover that requires a change of the carrier frequency (inter-frequency handover) is always performed as hard handover.

- Soft Handover

Soft handover means that the radio links are added and removed in a way that the UE always keeps at least one radio link to the UTRAN. Soft handover is performed by means of macro diversity, which refers to the condition that several radio links are active at the same time. Normally soft handover can be used when cells operated on the same frequency are changed.

- Softer handover

Softer handover is a special case of soft handover where the radio links that are added and removed belong to the same Node B (i.e. the site of co-located base stations from which several sector-cells are served. In softer handover, macro diversity with maximum ratio combining can be performed in the Node B, whereas generally in soft handover on the downlink, macro diversity with selection combining is applied.

Generally we can distinguish between intra-cell handover and inter-cell handover. For UMTS the following types of handover are specified:

- Handover 3G -3G (i.e. between UMTS and other 3G systems)
- FDD soft/softer handover
- FDD inter-frequency hard handover
- FDD/TDD handover (change of cell)
- TDD/FDD handover (change of cell)
- TDD/TDD handover
- Handover 3G - 2G (e.g. handover to GSM)
- Handover 2G - 3G (e.g. handover from GSM)

The most obvious cause for performing a handover is that due to its movement a user can be served in another cell more efficiently (like less power emission, less interference). It may however also be performed for other reasons such as system load control.

- **Active Set** is defined as the set of Node-Bs the UE is simultaneously connected to (i.e., the UTRA cells currently assigning a downlink DPCH to the UE constitute the active set).
- Cells, which are not included in the active set, but are included in the CELL_INFO_LIST belong to the **Monitored Set**.
- Cells detected by the UE, which are neither in the CELL_INFO_LIST nor in the active set belong to the **Detected Set**. Reporting of measurements of the detected set is only applicable to intra-frequency measurements made by UEs in CELL_DCH state.

The different types of air interface measurements are:
- **Intra-frequency measurements**: measurements on downlink physical channels at the same frequency as the active set. A measurement object corresponds to one cell.
- **Inter-frequency measurements**: measurements on downlink physical channels at frequencies that differ from the frequency of the active set. A measurement object corresponds to one cell.

- **Inter-RAT measurements**: measurements on downlink physical channels belonging to another radio access technology than UTRAN, e.g. GSM. A measurement object corresponds to one cell.
- **Traffic volume measurements**: measurements on uplink traffic volume. A measurement object corresponds to one cell.
- **Quality measurements**: Measurements of downlink quality parameters, e.g. downlink transport block error rate. A measurement object corresponds to one transport channel in case of BLER. A measurement object corresponds to one timeslot in case of SIR (TDD only).
- **UE-internal measurements**: Measurements of UE transmission power and UE received signal level.
- **UE positioning measurements**: Measurements of UE position.

The UE supports a number of measurements running in parallel. The UE also supports that each measurement is controlled and reported independently of every other measurement.

Further reading: 3GPP 25.331

	UMTS Network	UMTS Frequencies	UMTS Coding	UMTS Link Budget
	UMTS Security	UMTS Codes	Synchronisation	Co-location
	3G Data Speeds	UTRA Time Slots	UTRA Channels	WCDMA Spreading
	UMTS QoS	Channel Coding	Media Formats	Compressed Mode
	UMTS HSDPA	UMTS Handovers	Location Services	UMTS Power Control
UMTS Overview	Cell Search	Random Access	RCC States	Iui Frame Structure
CDMA Overview	Call Setup	UTRAN Interfaces	Paging	Virtual Home Environment