

3GPP TSG RAN Meeting #71
Goteborg, Sweden, 7-11 March 2016

RP-160301

Source: Huawei, HiSilicon
Document for: Information
Agenda Item: 10.1.2

Motivation for new WI on Light Connection in LTE

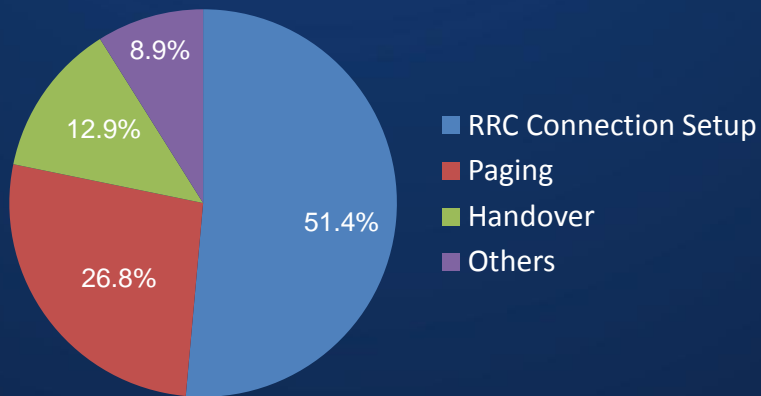


Motivation 1: High signaling load in LTE networks



- The penetration of smart phones is high in the current LTE networks, the number of installed applications continues to expand.
- High signalling load caused by smart phones has already been observed in current LTE networks.

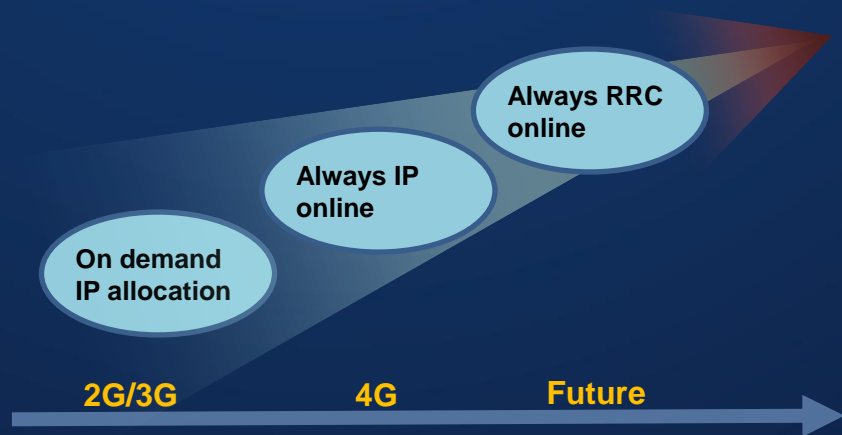
Reasons of high signaling load



RRC signaling statistics collected in several live LTE networks

- RRC connection setup and Paging are the two major contributors to the high signaling load.
- Because:
 - Numerous applications frequently contact the server, therefore triggering frequent RRC connection setup, and each RRC connection setup uses 12 messages (i.e. 8 RRC/NAS messages and 4 S1 messages).
 - Numerous applications frequently push messages to the client, therefore triggering frequent Paging, and each Paging uses 2 messages for each cell in the TA (i.e. 1 RRC message and 1 S1 message).

Motivation 2: Increased demand for better user experience in LTE networks



- Numerous applications require an always-on mobile broadband experience.
- The current RRC connection setup latency (i.e. 120ms for mobile originated calls and 280ms for mobile terminated calls*) still need to be further reduced to improve the end user experience.

* The latency is calculated as per TR 36.912 (Feasibility study for LTE-A), assuming the S1 latency is 10ms and the Paging cycle is 320ms.

Proposal: Light Connection



Network capacity on UE context storage is increased nowadays, which facilitates the support of a large connected user population.

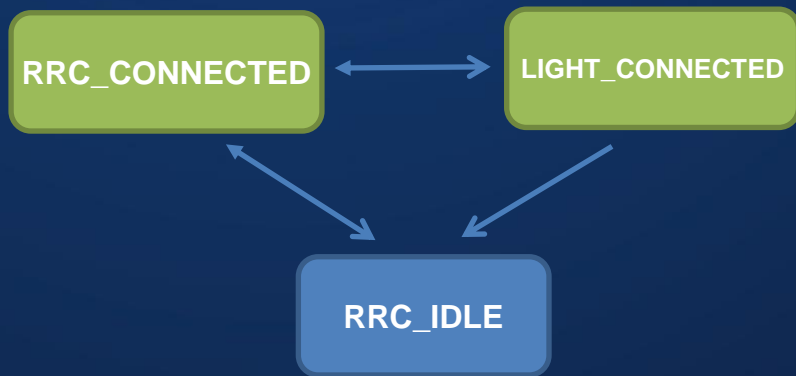
Light Connection means a “light” RRC connection.

Operators will be motivated to keep the UEs longer in RRC connected mode (possibly permanently after the UE was powered on).

Benefits:

1. Light Connection can alleviate the high signalling load problem caused mainly by frequent RRC connection setup and Paging.
2. Light Connection can also significantly improve the end user experience due to shorter call setup latency.

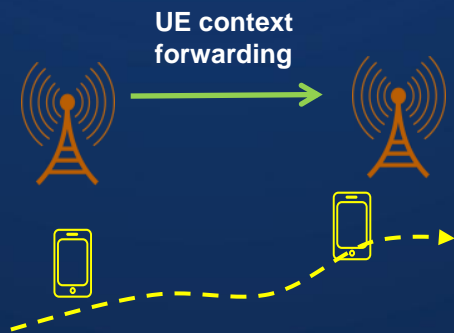
Light Connection: Concept



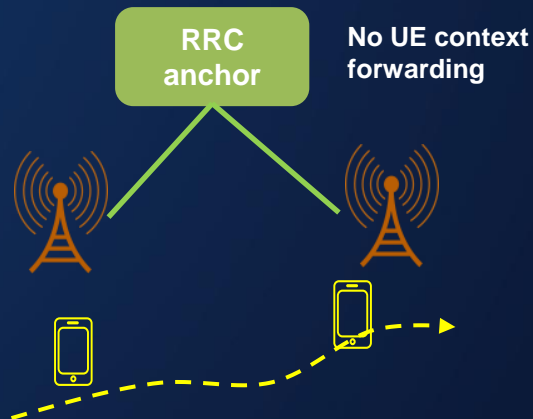
- RRC anchor (with UE context stored)
- Light mobility
- Light Paging
- Light UE power consumption

Light Connection is applicable for all device types, e.g. smart phones, MTC devices, etc.

Light Connection: RRC anchor

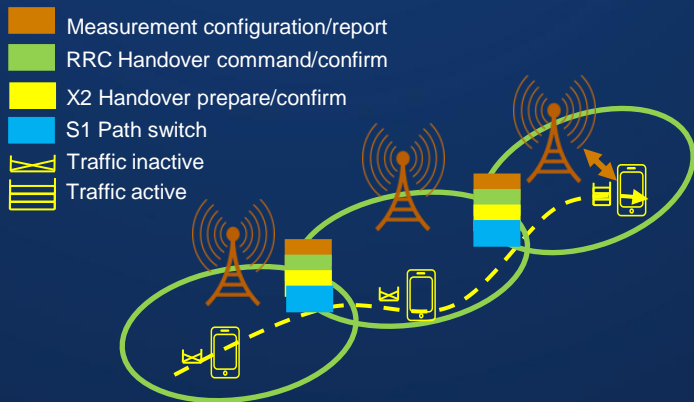


- Today, the source eNB will forward the UE context to the target eNB during each handover.

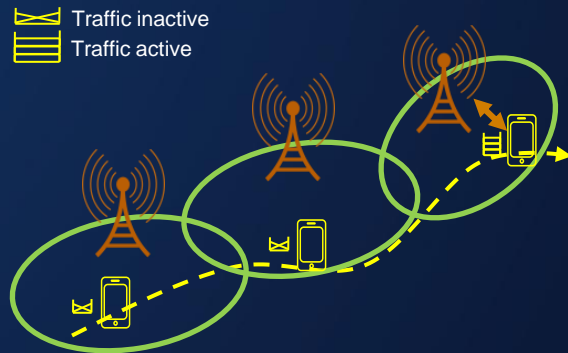


- RRC anchor can alleviate the network signaling since UE context forwarding during cell change is not needed.

Light Connection: Light mobility

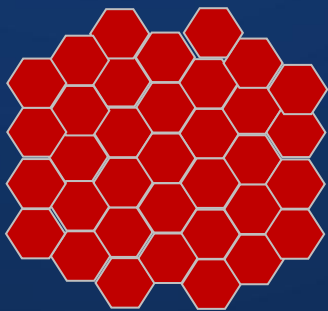



- Today, there is signaling overhead due to handover, especially considering the unnecessary signalling overhead when the UE is temporarily inactive.



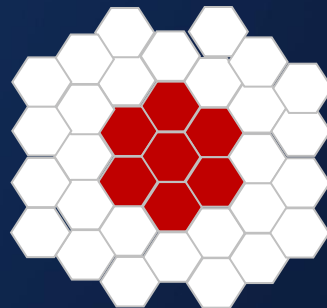
- UEs in Light Connection use UE centric mobility (e.g. cell reselection) for signaling reduction.


Light Connection: Light Paging



 Cell to Page

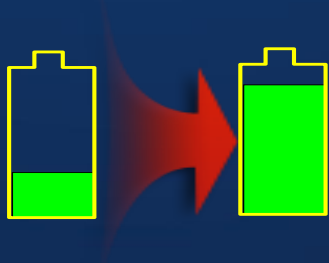
- Today, for UEs in Idle mode, the network will page them within all the cells in the Tracking Area.



 Cell to Page

- For UEs in Light Connection, the network will only page them within a more limited area, even in a single cell.

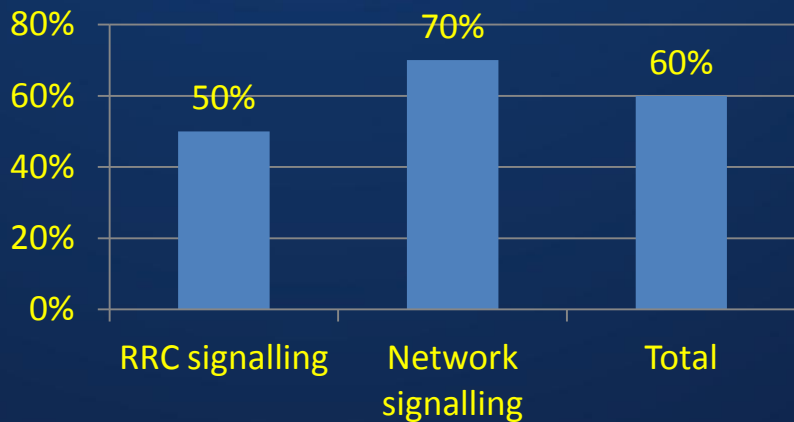
Light Connection: Light UE power consumption



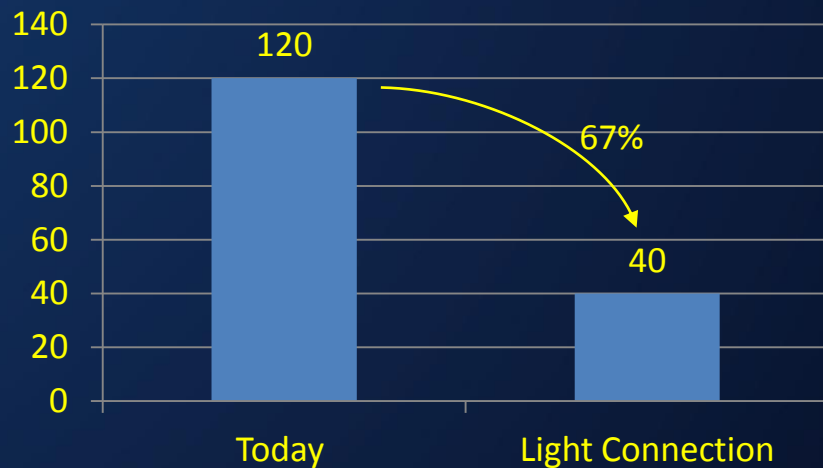
- For UEs in Light Connection, with necessary enhancements (e.g. longer DRX cycle), the UE power consumption will be comparable to that in Idle mode.

Light Connection: Gains

Signaling reduction gain
(Light Connection vs. Today)



MO call latency



* The Traffic Model is provided in the Annex.

Difference with NB-IoT UP solution

	NB-IoT UP solution	Light Connected
UE State	ECM-IDLE	ECM-Connected
S1/CN impact	S1 connection is released after RRC is suspended (more network signaling overhead to recover the S1 connection in case of data arrival)	S1 connection is always maintained (transparent to CN)
AS context storage	Only partial AS context is stored after RRC is suspended, which will cause additional signaling overhead to reconfigure the UE after RRC is resumed	Full AS context will always be kept (in both UE side and network side), since the UE stays in RRC_CONNECTED
Mobility	Support of limited mobility (UE context retrieval only in case X2 interface between source eNB and target eNB is available)	Support full mobility, which is important for smart phones and moving MTC UEs
Paging	-	Paging optimization, i.e. Paging within a more limited area (even within a single cell)

THANK YOU

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Traffic Model

Procedure	Times/User/Busy Hour
PS call	180
CSFB (redirection)	5
TAU/Attach/Detach	30
Intra-eNB Handover	10
Inter-eNB Handover	80
RRC re-establishment	2
Paging	20

* This Traffic Model is based on the statistics collected in several live LTE networks.