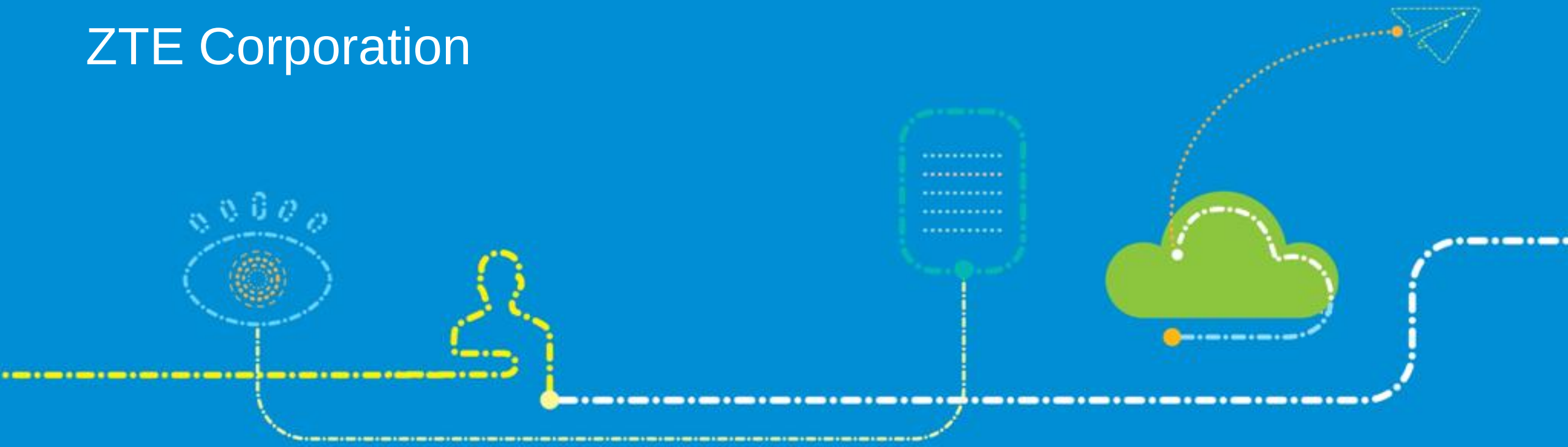
3GPP TSG RAN Meeting #79
Chennai, India, March 19 - 22, 2018

RP-180503

ZTE
Tomorrow never waits

Do 3 and 5 make 7?

ZTE Corporation



Introduction

- The NR WID currently covers all the possible architectural options identified in the study phase:
  - Option 2 (Standalone NR)
  - Option 3 family (EN-DC or NSA)
  - Option 4 family (NE-DC)
  - Option 7 family (NGEN-DC)
  - and NR-NR DC as well
- The WID on LTE connected to 5CG covers Option 5
- As well known, so far the first priority was on Option 3 (EN-DC) and then on Option 2 (Standalone), as part of the NR WID, and Option 5, as part of the WID on LTE connected to 5CG
- Assuming that the normative work for Options 2, 3 and 5 gets finalized, it's not fully clear how much additional work is needed in the RAN WGs to complete the remaining Options 4, 7 and NR-NR DC
- In any case, at least for option 7 (and possibly 4), the additional work seems only to affect RAN2 and RAN3 (for NR-NR DC, some further RAN1/RAN4 considerations on how to split UE TX power on the two legs might be needed)

LTE connected to 5GC (option 5) - Objectives

- The objective of the WID (in RP-172342) is to develop and specify necessary enhancements to connect E-UTRA to 5G-CN, including at least:
  - Specify E-UTRA protocols enhancement to support 5G-CN functions as (RAN2) e.g.:
    - Network slicing;
    - Flow based QoS framework, including potential enhancement for the dual connectivity between eNBs using flow based QoS;
    - RRC_INACTIVE state for E-UTRA when connected to 5G-CN, with similar functionality as the RRC_INACTIVE state in NR; CN aspects of the RRC-INACTIVE state are covered in 5GS-Ph1 (SP-160958) and are expected to be the same for both NR and LTE from a CN standpoint
    - New security scheme (if any).
  - Allow simultaneous support of UEs connected to EPC and UEs connected to 5G-CN in the same LTE cell. Specify the mechanism to support core network node selection functions, e.g. assist to perform initial NAS selection and NAS routing (RAN2).
  - Support handover between LTE cells connected to the EPC and LTE cells connected to the 5G-CN.
- NG-C/U and Xn interfaces are specified in the WI New radio access technology, including also E-UTRA connected to 5G-CN. If any additional LTE only related impacts are identified, then those can be discussed in this WI.
- Inter RAT mobility between E-UTRA and NR when connected to 5G-CN is specified in the WI New radio access technology. RAN2 parts of E-UTRA to E-UTRA specific aspects can be discussed in this WI.
- Specify RRM Core requirements for RRC Inactive state

EN-DC (option 3) – RAN2/RAN3 Objectives

The main RAN2/RAN3 EN-DC related objectives from the NR WID (from the latest version in RP-180481) are:

- Radio interface protocol architecture and procedures [RAN2]:
  - Control and user plane protocol architecture as recommended in TR 38.804.
  - Defining the UE state machine and transitions including RRC_IDLE, RRC_CONNECTED and RRC_INACTIVE in accordance with their characteristics as described in sub-clause 5.5.2 of TR 38.804:
    - UL and DL data transfer in RRC_INACTIVE might be studied only if all of the other objectives have been completed and time is permitted.
- Radio Access Network architecture, interface protocols and procedures including RAN interfaces Xx, Xn and NG covering both NR and E-UTRA, for the following features and connectivity options [RAN3]:
  - Mobility in RRC_CONNECTED and RRC_INACTIVE;
  - Functionalities for a Radio Access Network connected to 5G-CN, supporting NR access and E-UTRA;
  - Specify the NG interface following the requirements developed in SA2 for the N2 and N3 reference points.
- Dual Connectivity between E-UTRA and NR, for which the priority is where E-UTRA is the master and the second priority is where NR is the master, and Dual Connectivity within NR, including:
  - Standardizing bearer types recommended in TR 38.804 [RAN2];
  - Necessary physical layer mechanisms including UL power control [RAN1];
  - Identify band combinations and corresponding requirements [RAN4].

NGEN-DC (option 7) – What would be already there

- Assuming Options 5 and 3 are both finalized, the following aspects of NGEN-DC (Option 7) will automatically come for free **(same Stage3 solution / ASN.1 coding can be reused):**
  - ✓ Overall signalling architecture: the same EN-DC solution where both MN and SN have their own RRC entity and NR RRC messages are encapsulated into LTE RRC messages can be completely reused, with the addition of the SDAP layer defined as part of Option 5 (and Standalone)
  - ✓ Support of SRB3 and Split SRB
  - ✓ Flow based QoS framework defined for option 5 (and Standalone) can be reused (Note: QoS flow remapping between MN and SN would still require some discussion)
  - ✓ Support of all the bearer types available for EN-DC.
  - ✓ The same solution as for EN-DC for system information delivery can be reused (provided to the UE by dedicated RRC signalling via the MN)
  - ✓ The same solution as for EN-DC for independent measurements configuration, reporting by the UE and exchange between the MN and SN can be reused.
  - ✓ The same procedure as for EN-DC for UE capabilities coordination can be reused (Note: actual supported band combinations are not expected to change, while baseband processing capabilities might change a bit? E.g. due to SDAP support or DRB IP support?)
  - ✓ The same solution as for EN-DC for SCG/MCG failure handling can be reused
  - ✓ Support of RRC Inactive state (Note: context handling at SN side would still require discussion in RAN3)
  - ✓ Support of network slicing

NGEN-DC (option 7) – What would be missing

- Even assuming Options 5 and 3 are both finalized, at least the following aspects of NGEN-DC (Option 7) would still need further work:
  - In RAN2:
    - Security: e.g. if, instead of having only K_{eNB} and S-K_{gNB} (for MN and SN anchored bearers) as in EN-DC, multiple keys will be defined (e.g. per bearer). Note: at the moment there is no agreement in SA3 on a different key handling w.r.t. EN-DC
    - Mobility, e.g. if intra-Pcell handovers not requiring K_{eNB} change (and then no S-K_{gNB} key refresh?) are allowed. However one possibility would be to avoid this option in Rel-15, limiting additional work
    - QoS flow remapping aspects between MN and SN
  - In RAN3:
    - The SN Addition/Modification/Release/Change/etc. (including SN initiated procedures) defined for EN-DC would need to be extended to NGEN-DC (i.e. specified also for the Xn interface), also taking care of
      - Stage 3 aspects of how the MN requests SN to establish/modify/release PDU sessions and QoS flows and of data forwarding
      - Path Switch for PDU sessions and QoS flows
      - Context handling at SN side for RRC Inactive state

Additional considerations for NE-DC & NR-NR DC

- For NE-DC at least the following additional aspects (on top of those needed for Option 7) would need to be considered:
  - Stage 3 details of the EN-DC-like signalling architecture where both MN and SN have their own RRC entity, e.g. encapsulation of LTE RRC messages into NR RRC messages
  - Split SRB (where the MN is a gNB)
  - Lack of SRB3
  - Possible impacts on measurement configuration/gaps when a MgNB operating in the higher spectrum connects to a SeNB operating in the lower spectrum
  - Whether DRB integrity protection is supported for SN terminated bearers

- For NR-NR DC also the following aspects would need to be considered:
  - Discussion on the overall signalling architecture (e.g. one or two RRC entities)
  - Possible F1 impacts due to inter-gNB DU NR-NR DC

Conclusions

- 5 and 3 (almost) make 7:
  - Assuming Options 5 and 3 are both finalized, the additional effort to specify NGEN-DC (Option 7 family) would be:
    - Minimal or even negligible in RAN2
    - Probably acceptable in RAN3? (if Stage 3 details for Xn procedures for NGEN-DC aspects mimic as much as possible what is specified for X2 for EN-DC)

- 2 and 3 don't really make 4 (and NR-NR DC):
  - Assuming Standalone NR (Option 2) and EN-DC (Option 3) are both finalized, to specify NE-DC (Option 4 family) and NR-NR DC:
    - Some non-negligible work would still be needed also in RAN2

Thank you

Tomorrow never waits