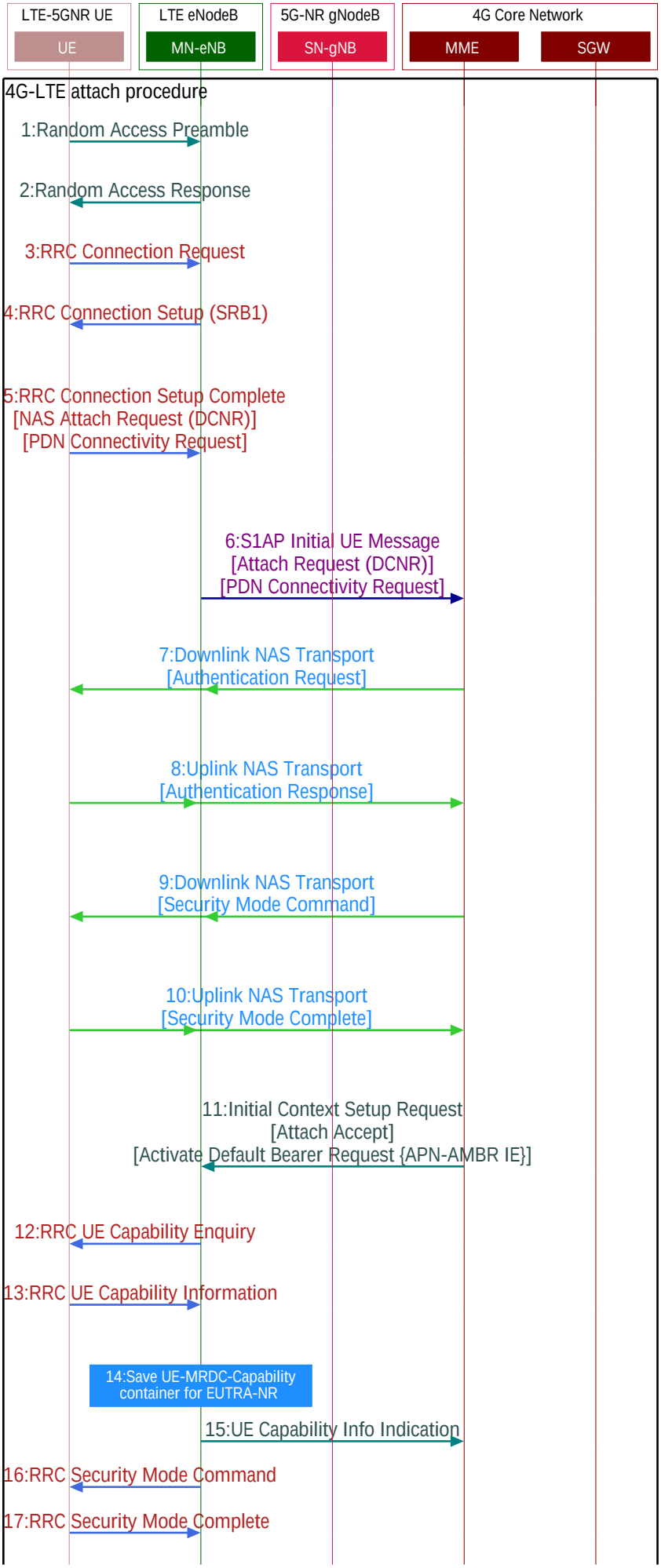


The terminal initiates a new session with the randomly selected preamble.

The eNodeB responds to the preamble with the "Random Access Response" message on the DL-SCH.

The UE uses a UL-SCH allocation to send the RRC Connection Request message.

eNodeB responds with an RRC Connection Setup message on the DL-SCH.

The UE signals the completion of the RRC connection. The message carries the NAS Attach Request. The DCNR bit in the "UE Network Capability" IE is set. This signals to the 4G Core Network that the UE supports dual connectivity with 4G-LTE and 5G-NR.

The NAS messages from the UE are signaled to the Core Network via the Initial UE message.

MME initiates the authentication procedure

Authentication is successfully completed.

MME initiates NAS level security procedure.

NAS level security procedure is completed. From this point, all communication between MME and UE will be encrypted.

MME responds back to the eNodeB with a message containing three messages: S1AP Initial Context Setup Request, NAS Attach Accept and Activate Default Bearer Request. 5G downlink and uplink data rates are signaled via Extended UE-AMBR Downlink and Uplink Information Elements.

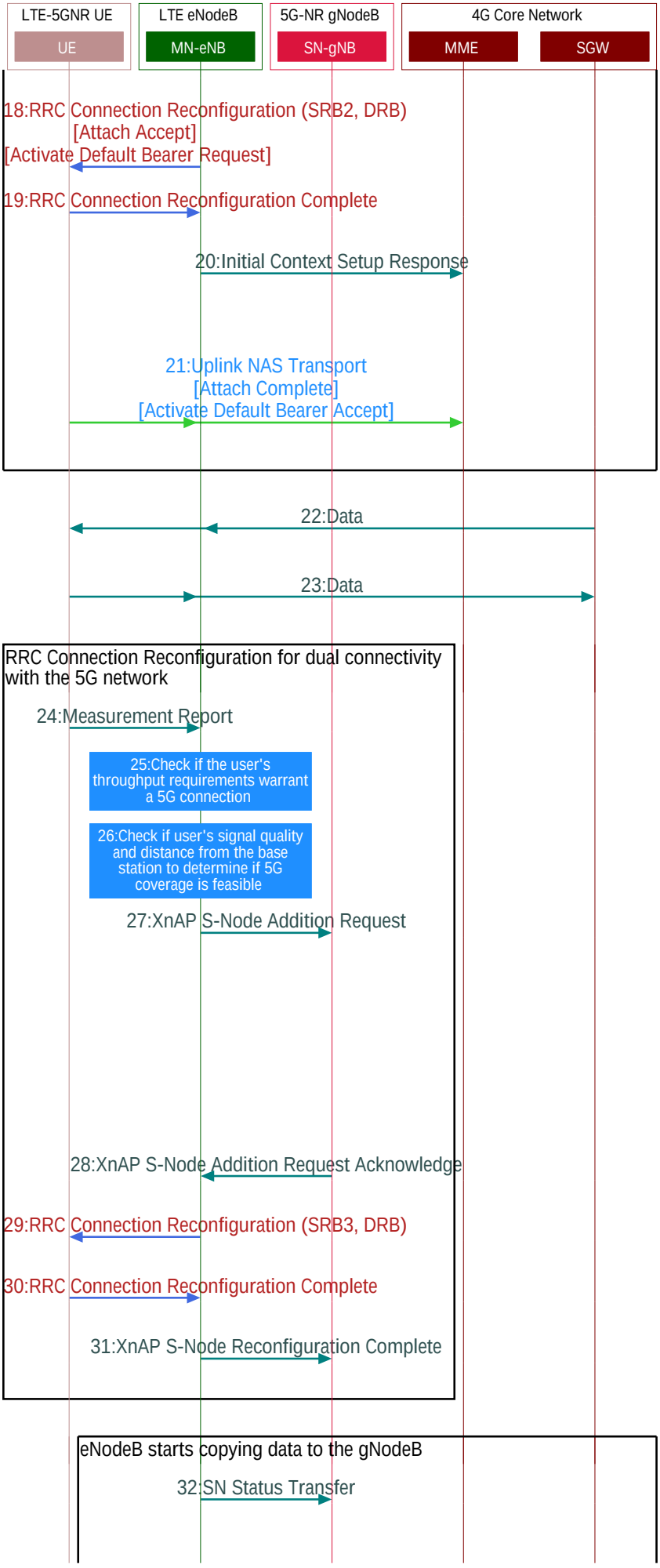
MME has not sent UE capabilities so the eNodeB asks the UE for "UE Capabilities".

UE reports that it supports the EUTRA-NR radio access technology. EUTRA-NR specific capabilities are specified in the UE-MRDC-Capability container.

UE capabilities are also passed to the MME.

Setup security between the eNodeB and the UE

Ciphering is enabled in both directions.



The RRC Connection Reconfiguration message is sent to activate the default radio bearer. The message also carries the Attach Accept message as NAS Payload.

UE signals the completion of the RRC Connection Reconfiguration.

eNodeB responds back to the Initial Context Setup message. The message also contains the GTP TEID that should be used for sending downlink data to the eNodeB.

UE signals the completion of Attach and default bearer activation.

Downlink data is flowing on the default bearer.

Uplink data is flowing on the default bearer.

5G signal quality is reported back to 4G eNB.

The 4G LTE eNodeB decides to add the 5G-NR base station as a secondary node. The eNodeB sends a Secondary Node Addition Request to the gNodeB. The message carries the RRC and Radio Bearer configuration. UE capabilities and security information are also included in the message.

The network indicates whether the UE shall use either KeNB (master node key) or S-KgNB (secondary node key) for the 5G DRB.

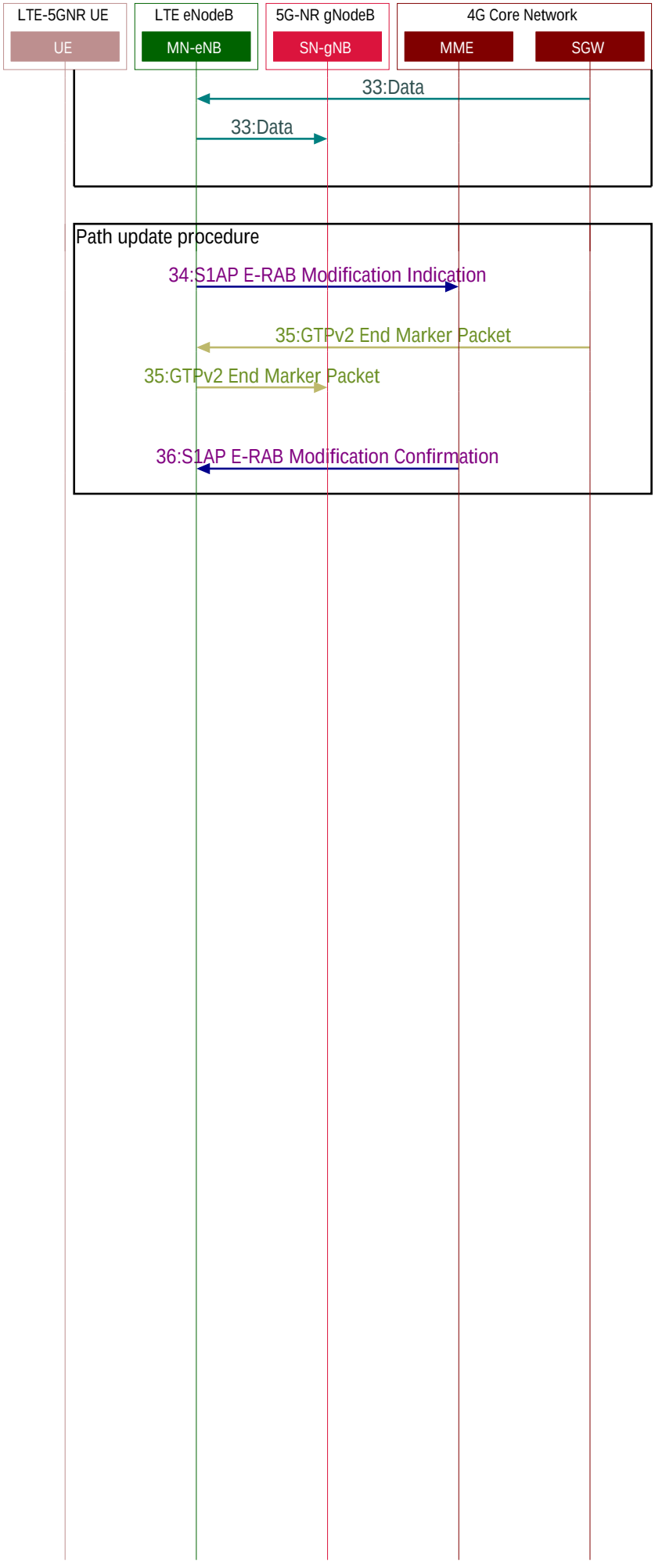
The gNodeB responds with information about the radio resources and bearers admitted with the 5G network.

The 4G eNodeB sends an RRC Connection Reconfiguration to the UE. The message assigns 5G radio resources to the UE.

The UE signals the receipt of the RRC Connection Reconfiguration to the LTE eNodeB.

The 4G eNodeB informs the secondary node (gNodeB) about the reconfiguration complete.

eNodeB informs the gNodeB about the PDCP SN and HFN for all the bearers that are being transferred to 5G.


LTE-5GNR UE
UE
LTE eNodeB
MN-eNB
5G-NR gNodeB
SN-gNB
4G Core Network
MME
SGW
33:Data
33:Data
SGW is sending data to the MN-eNB. The MN-eNB keeps forwarding that data to the SN-gNB.
Path update procedure
34:S1AP E-RAB Modification Indication
Notify the MME that the data bearer is being switched from 4G-LTE to 5G-NR.
35:GTPv2 End Marker Packet
35:GTPv2 End Marker Packet
Send the End Marker to the eNodeB. This marks the end of data transmission to the 4G-eNodeB. Subsequent data transmissions will be towards the 5G-gNodeB.
36:S1AP E-RAB Modification Confirmation
MME responds back the eNodeB.