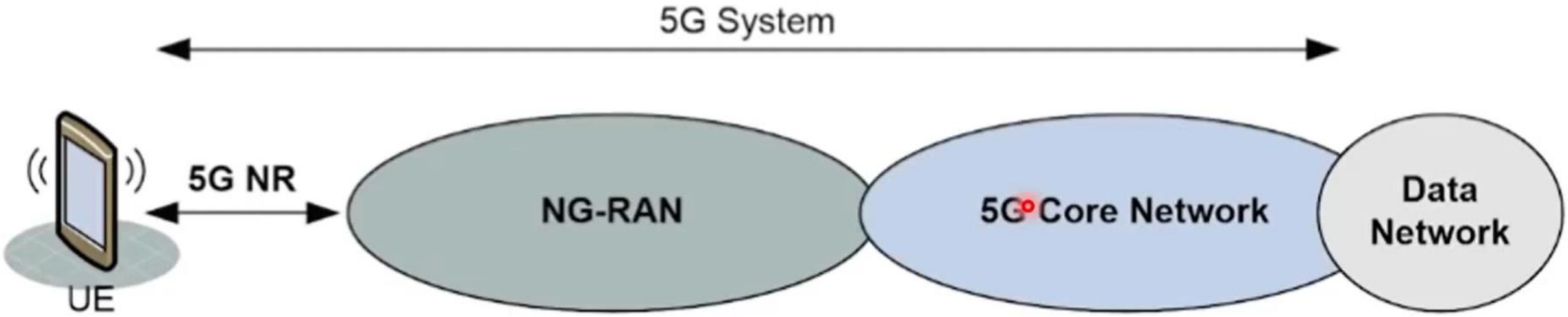
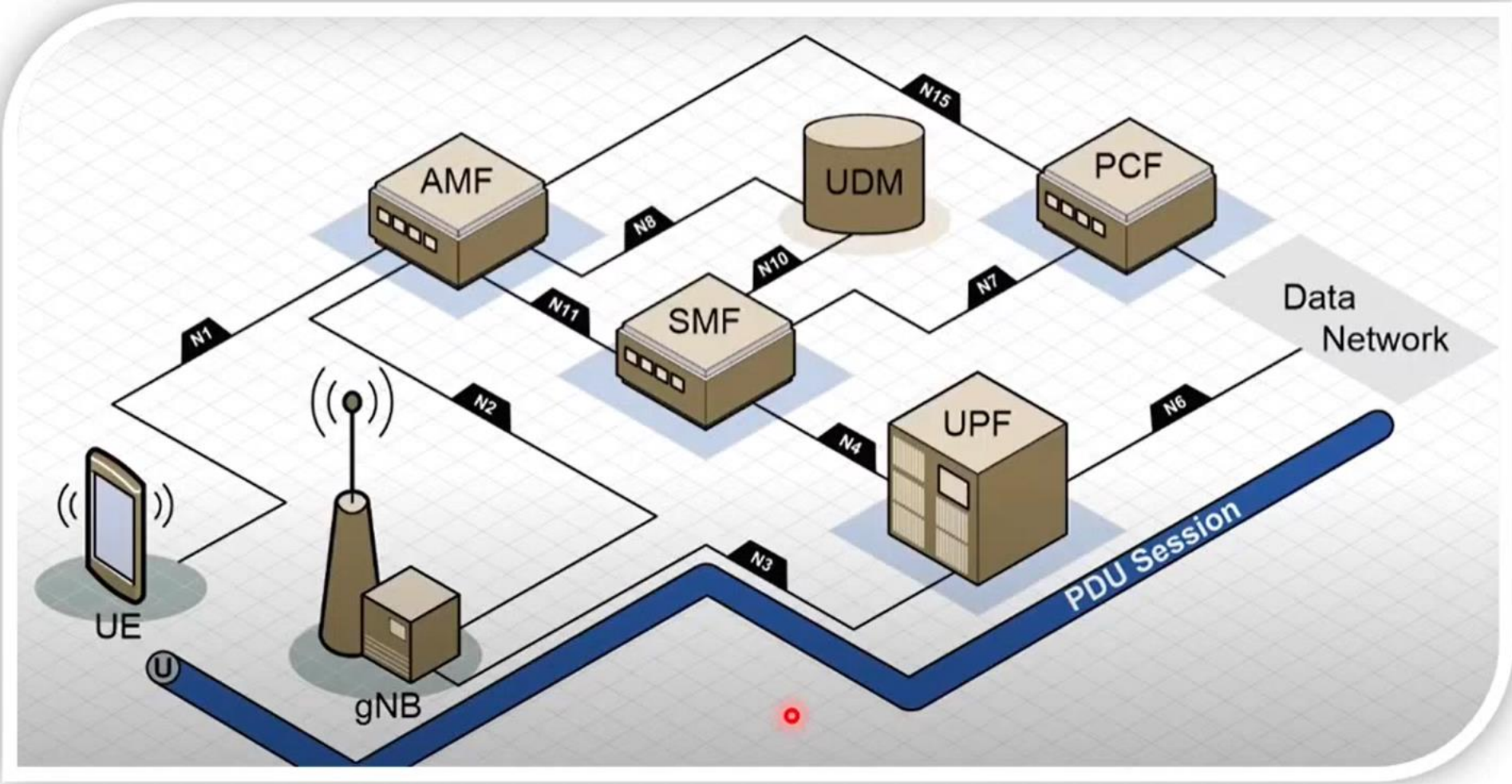
5GC

High Level 5G System

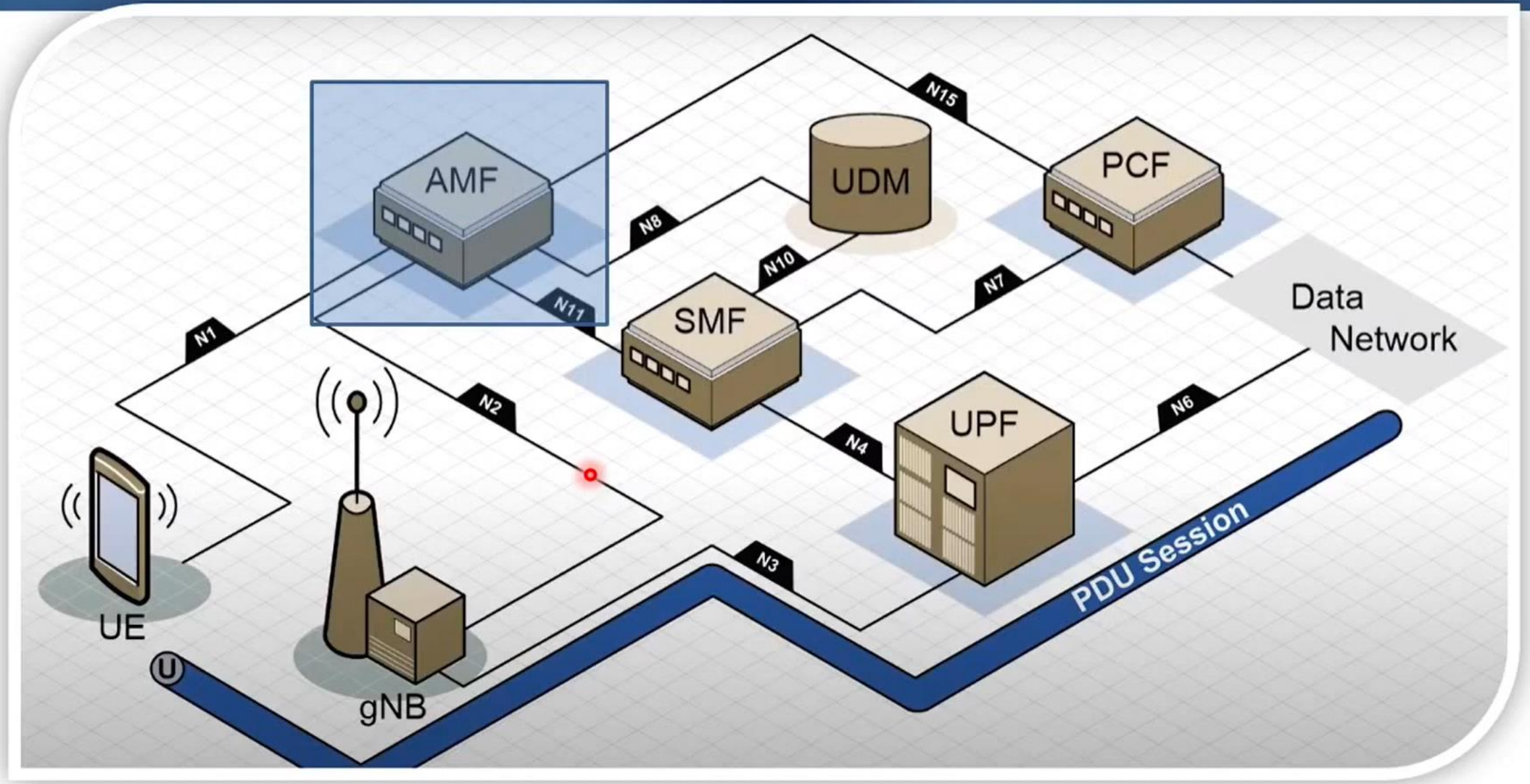


5G System Architecture

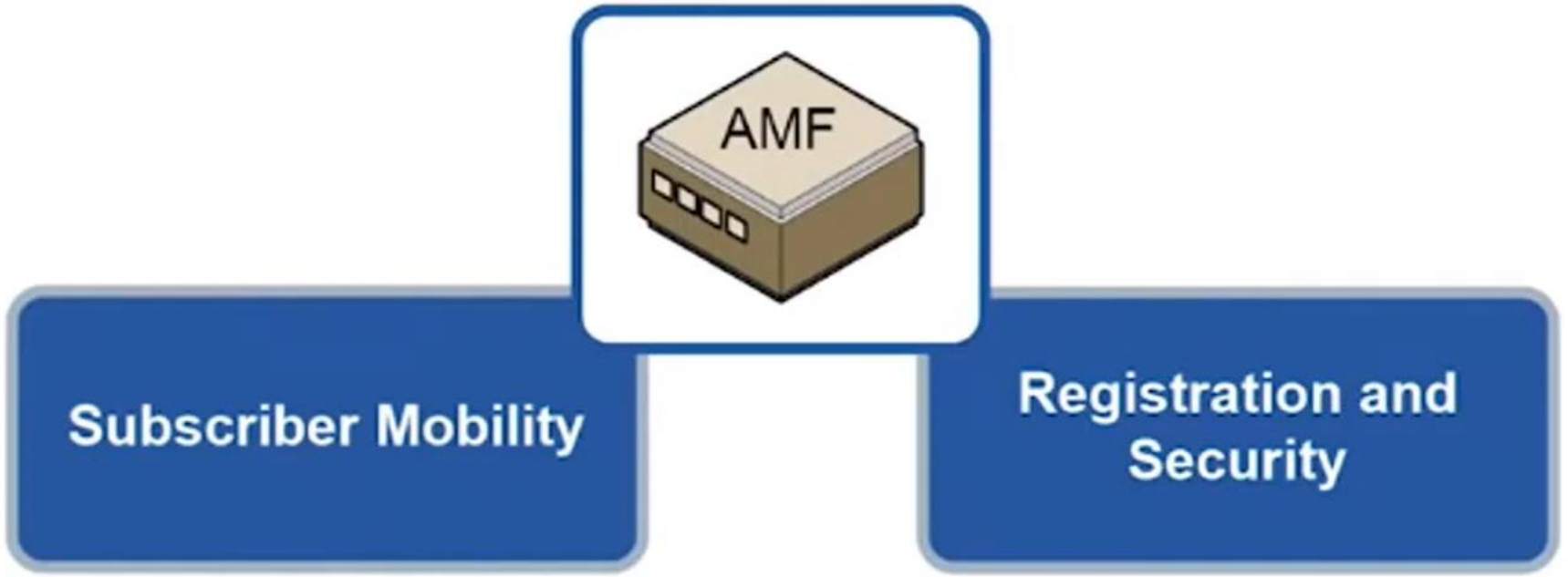


- UE-User Equipment
- gNB-g Node B
- AMF-Access and Mobility Function
- SMF-Session Management Function
- UPF- User Plane Function
- PCF- Policy Control Function
- UDM – Unified Data Management

Core Access and Mobility Management Function (AMF)

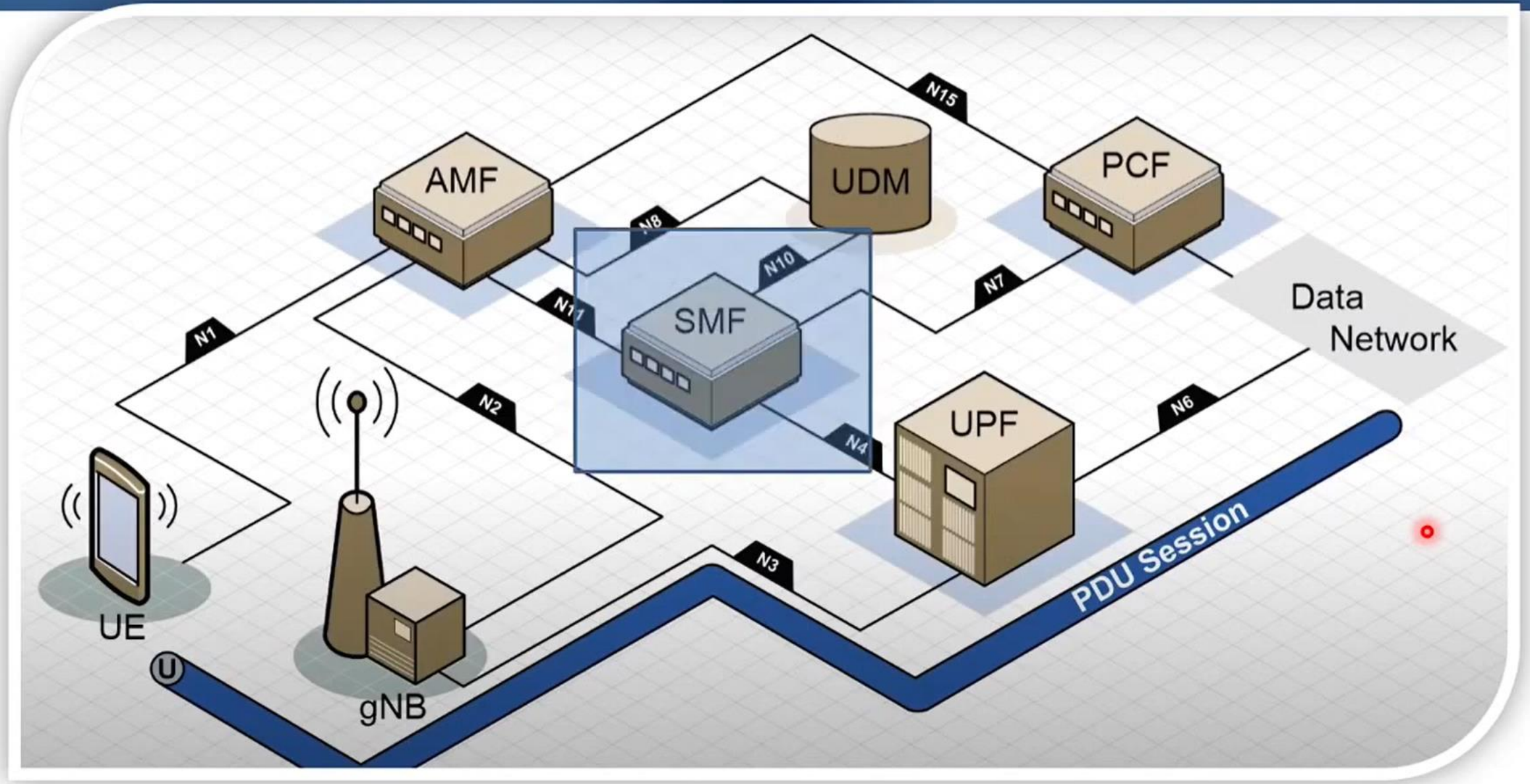


Core Access and Mobility Management Function (AMF)

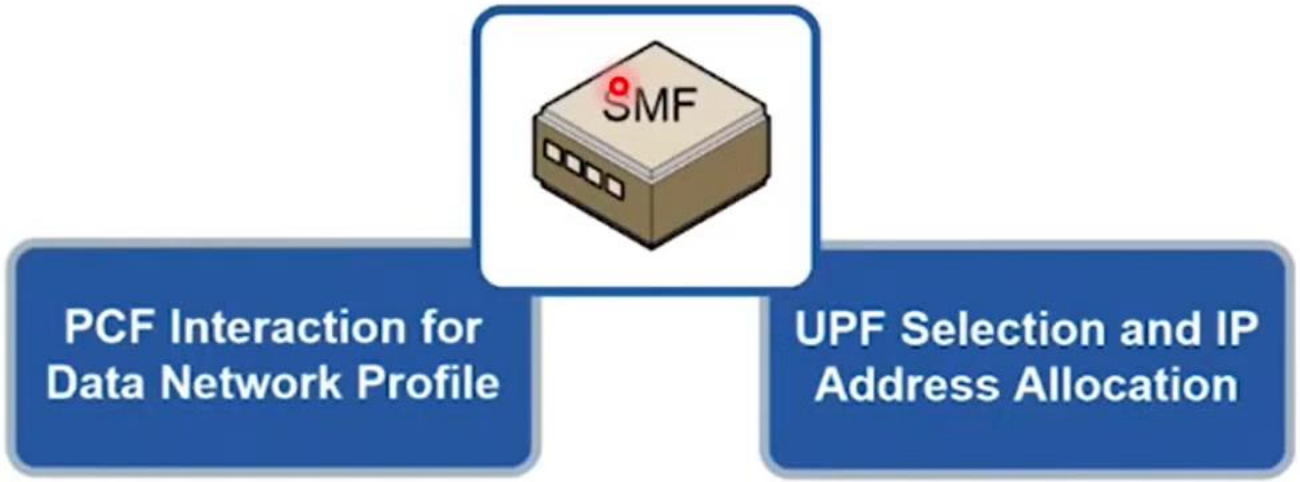


- AMF Knows where the subscriber is in the network (Potential cell or tracking area)
- Liaison with other NEs to ensure that subscriber is allowed on the network
- Key role in Authenticating the subscriber
- Provides the device a temp id GUTI.

Session Management Function (SMF)

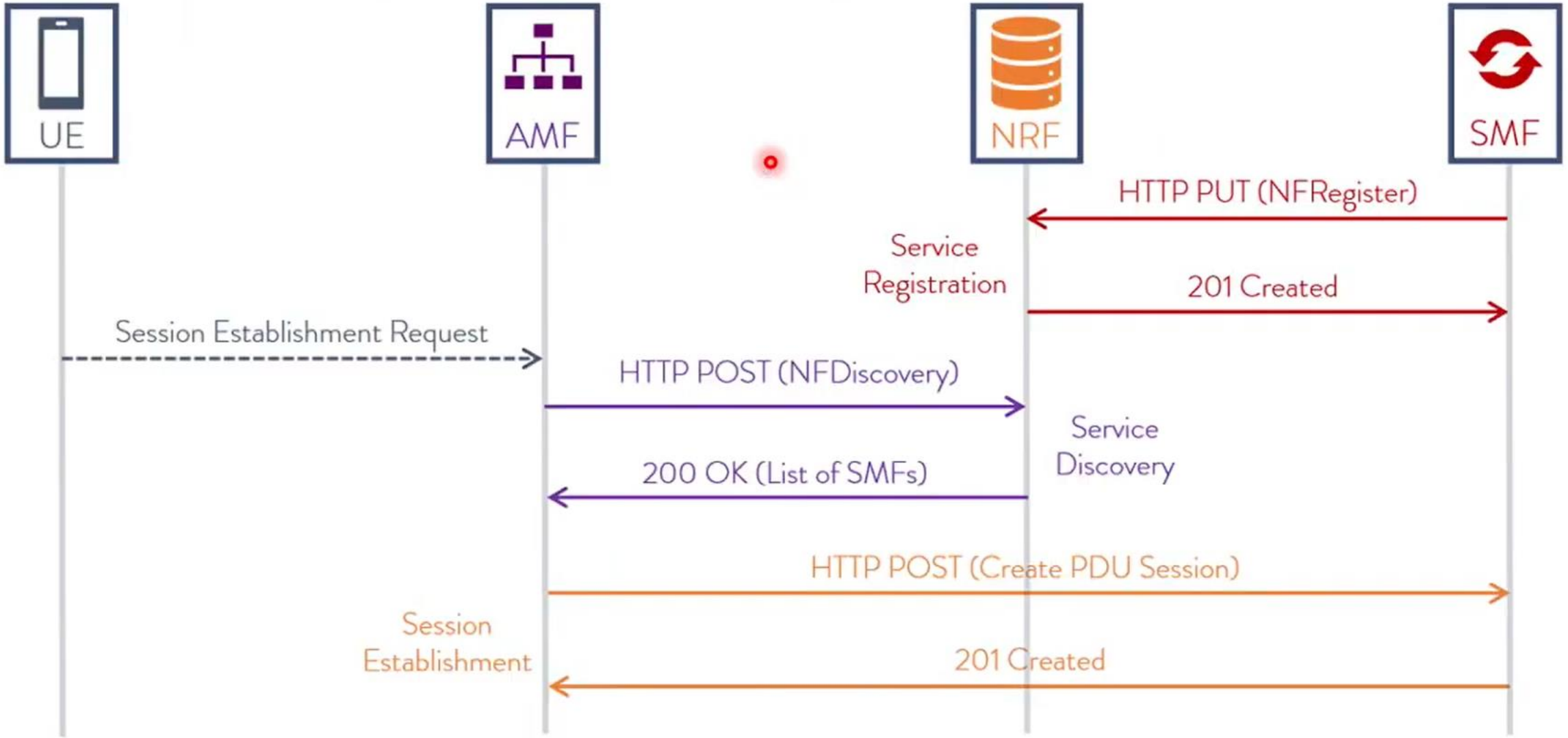


Session Management Function

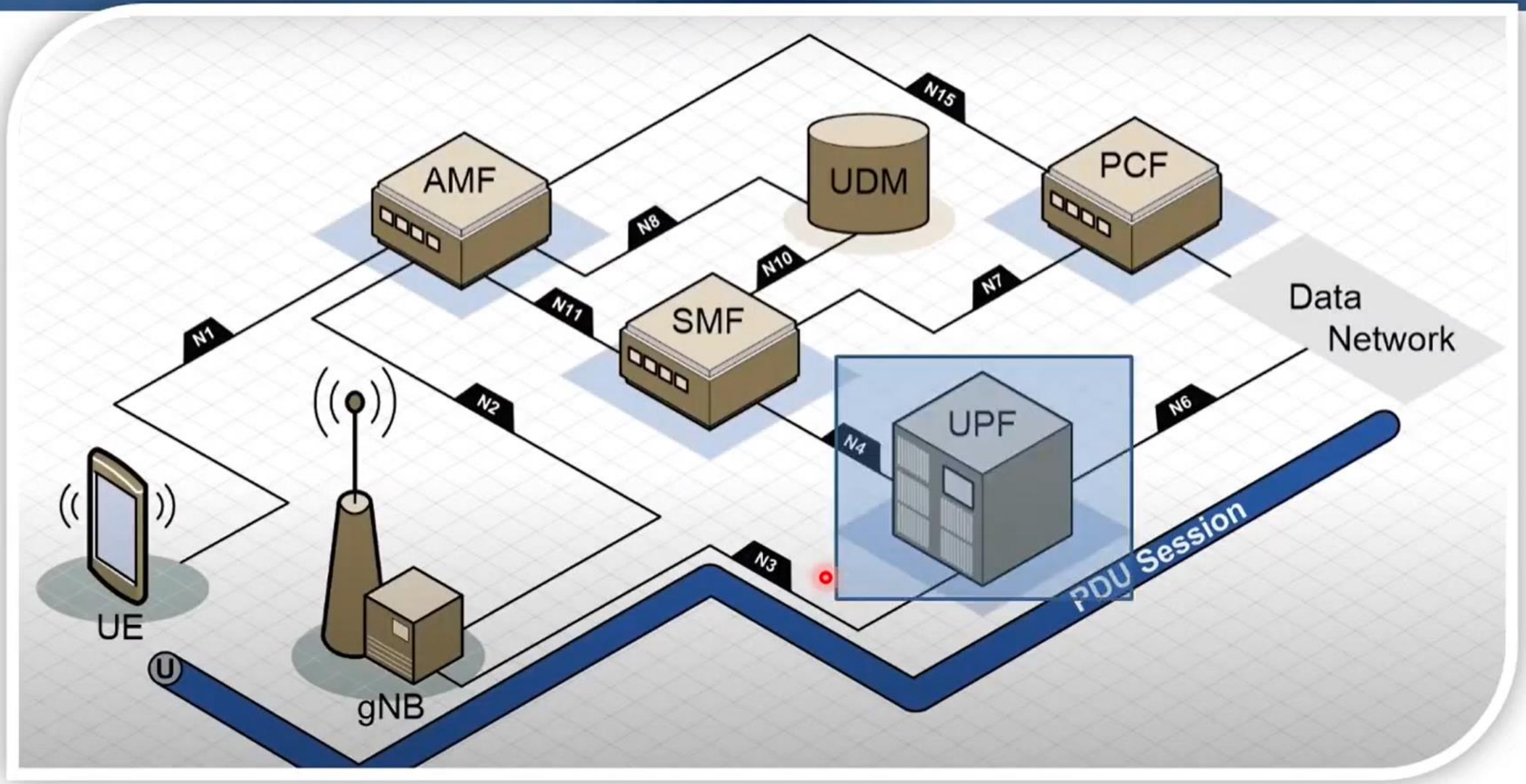


- Session Management
- Liaison with PCF and policy and QoS enforcement
- UE IP address allocation
- Selection and control of UPF
- Traffic steering

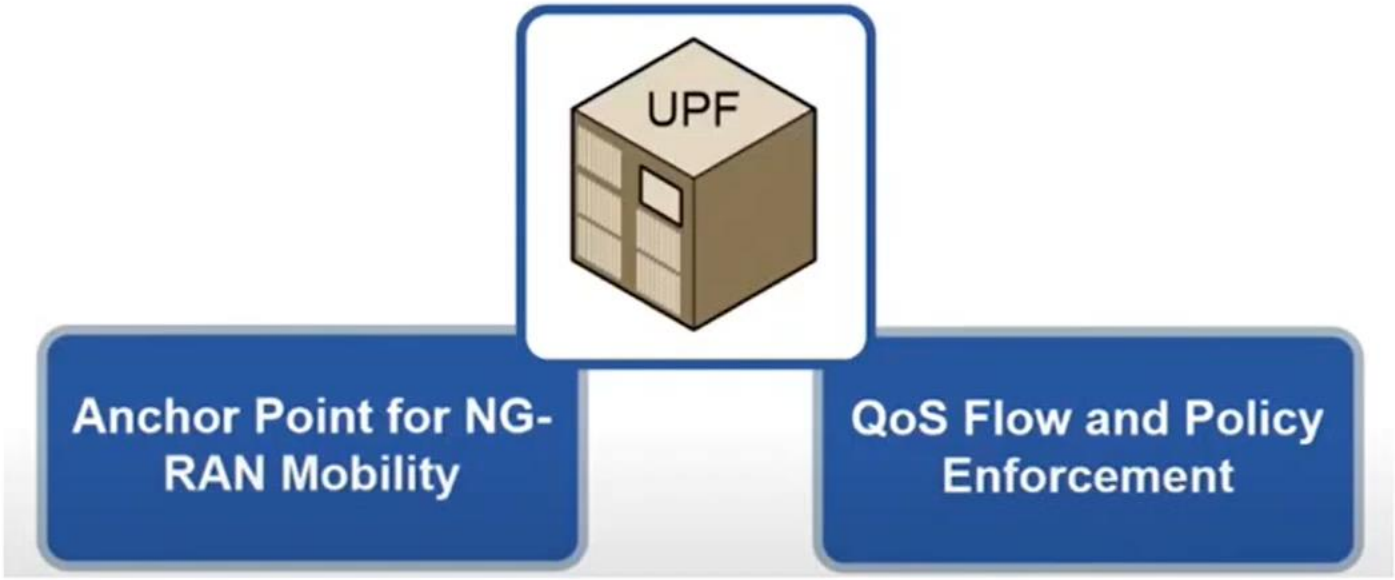
Creation of PDU Session



Use Plane Function (UPF)

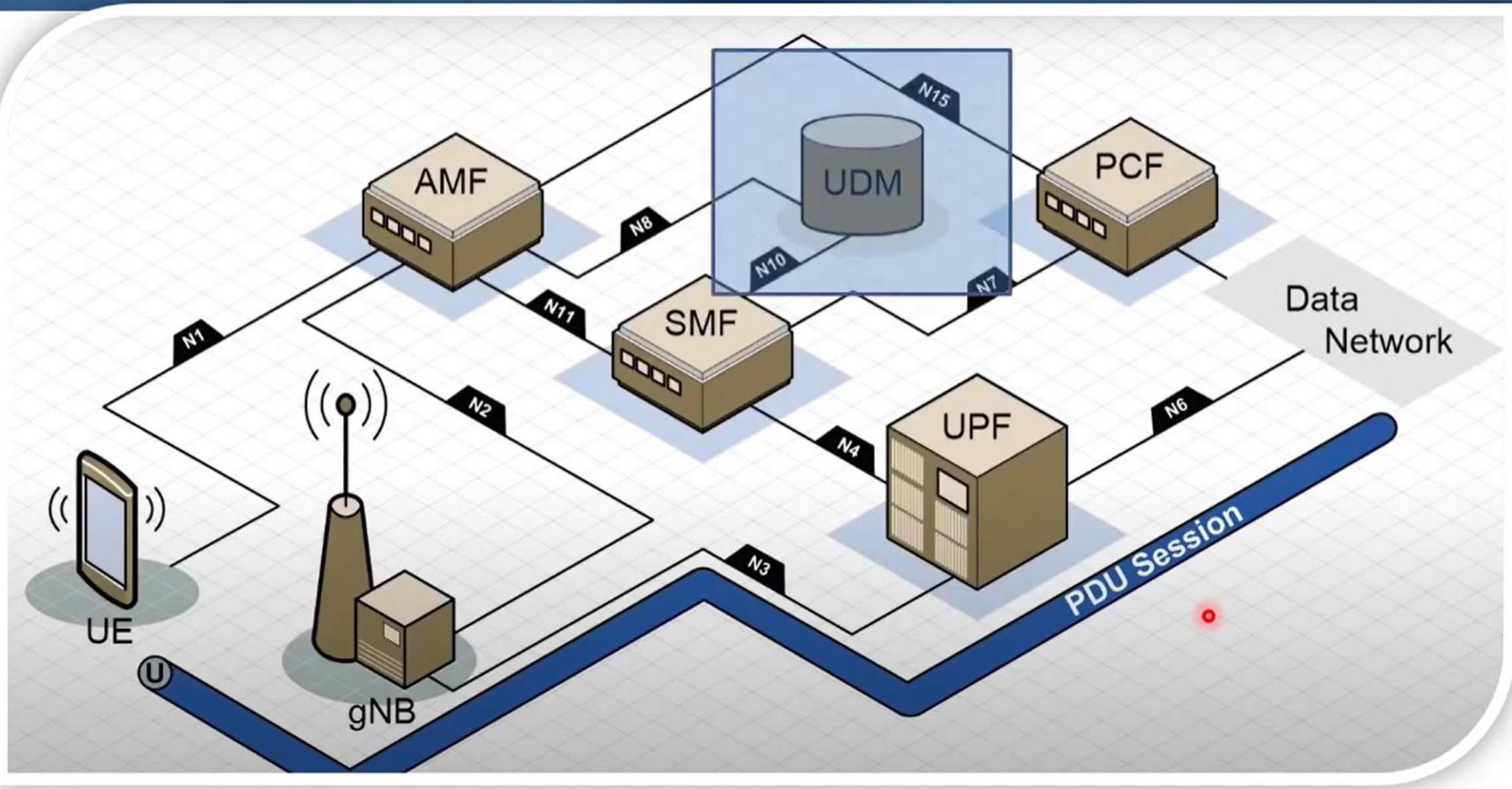


Use Plane Function (UPF)

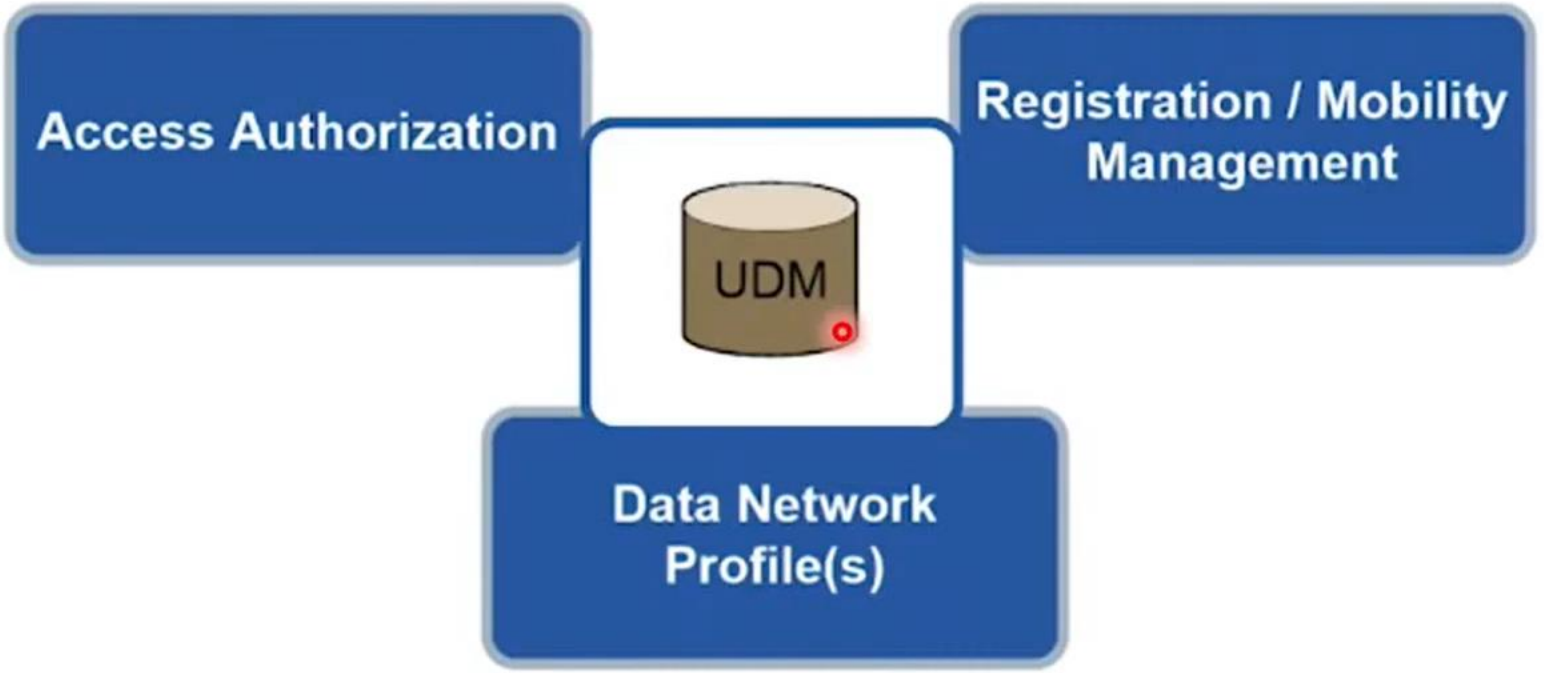


- Act as Anchor point during NG RAN Mobility
- It ensures quality of Service
- Implement Policy as appropriate (Ex. Throttling of Data)
- Packet routing and forwarding

Unified Data Management (UDM)



Unified Data Management (UDM)



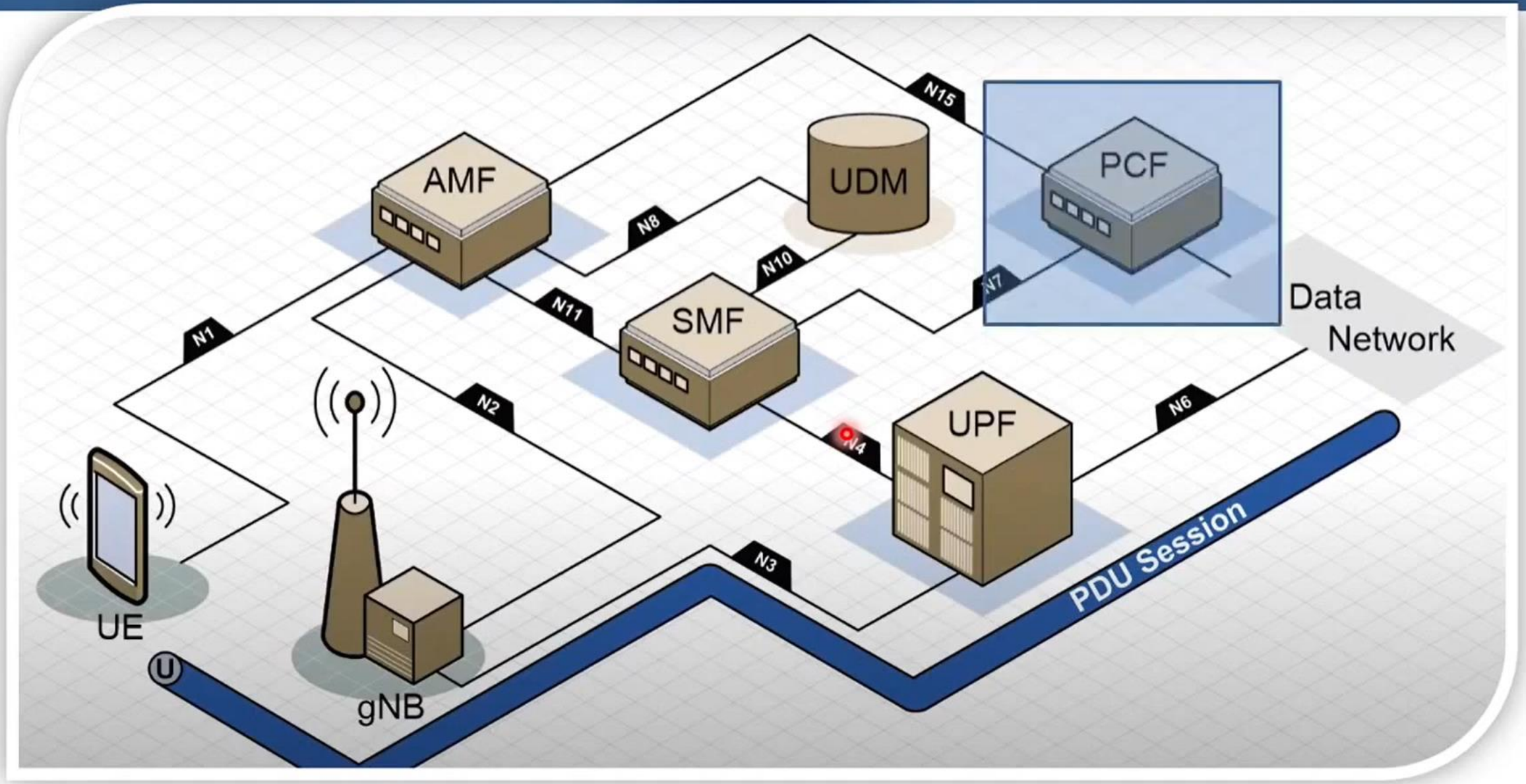
It contains Central Registry of Subscriber information and data network profile

Involved in Access Authorisation

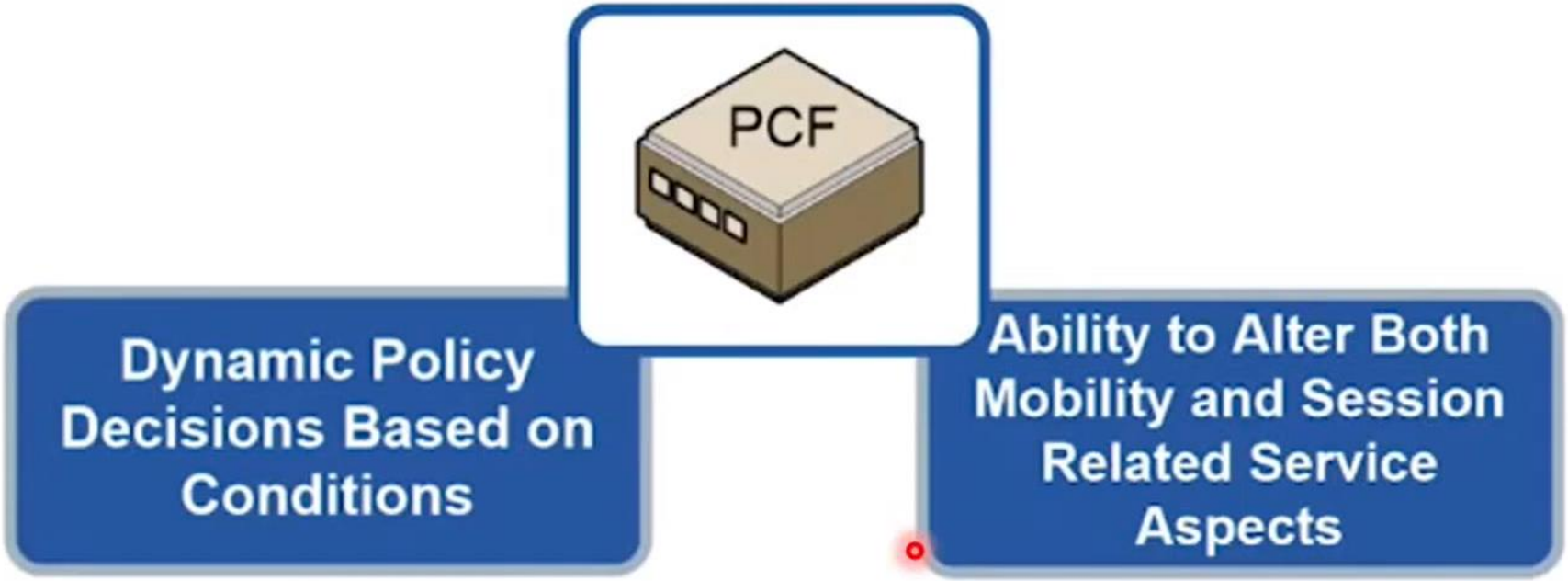
Involved in Registration and Mobility management

Tells AMF and SMF what is allowed /not allowed .Which QoS profile / data network they can connect to etc

Policy Control Functions(PCF)



Policy Control Functions(PCF)

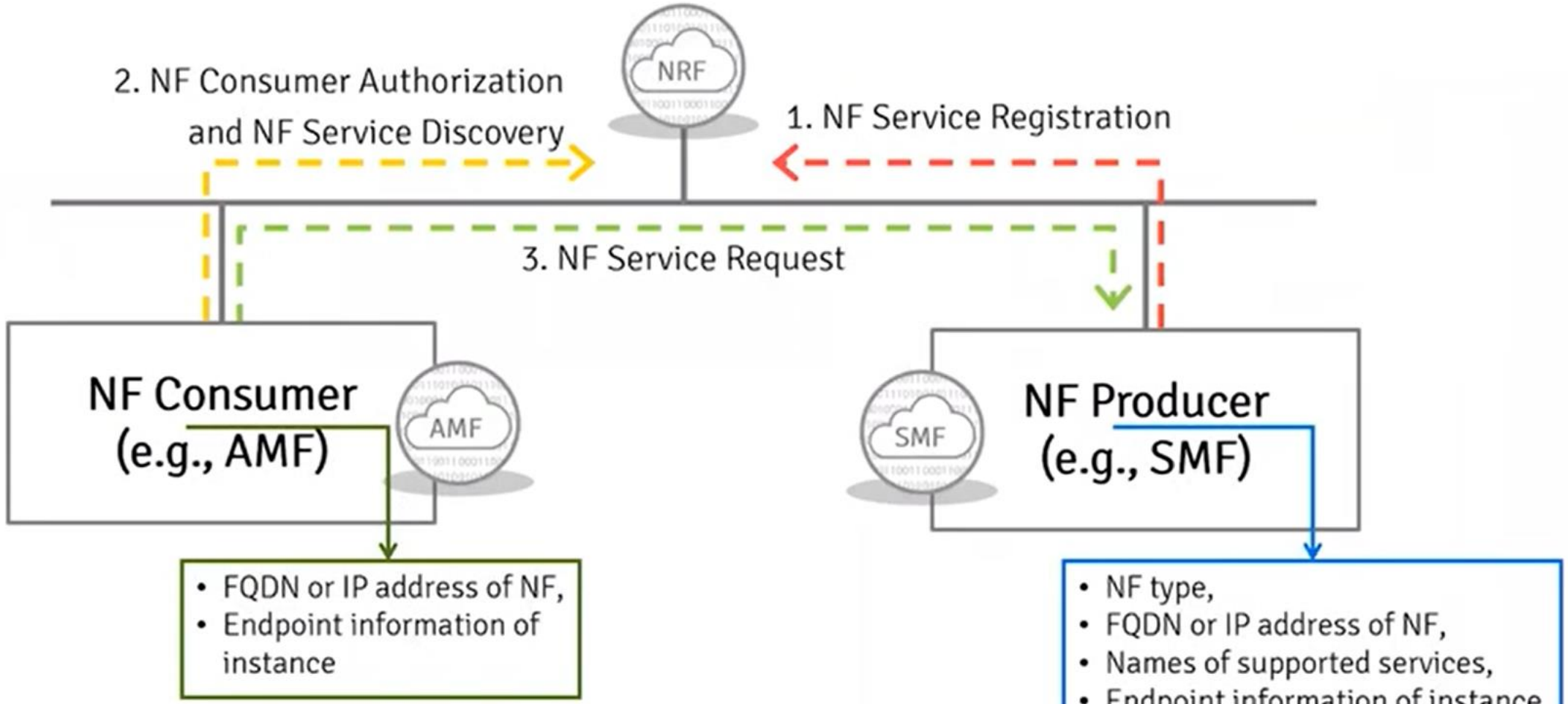


It takes dynamic decision based on present Network Condition

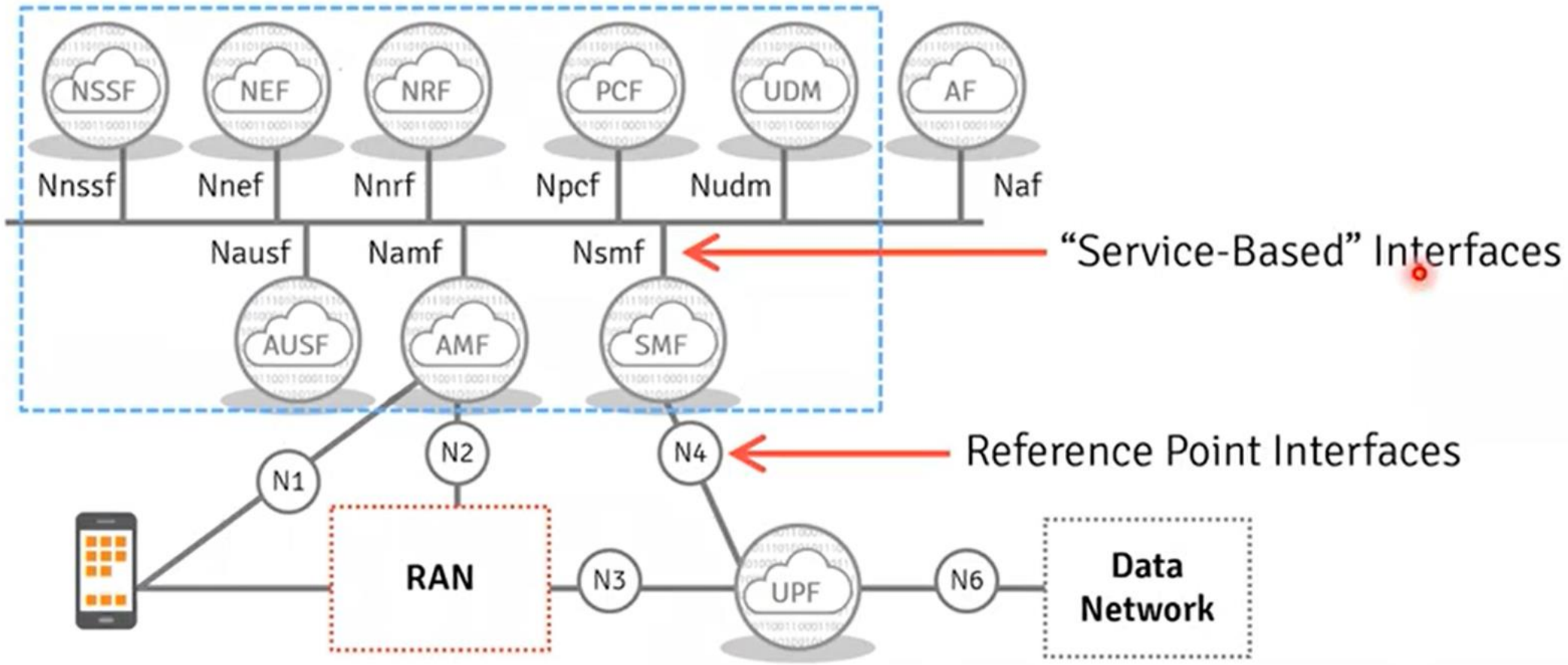
For Example, if a subscriber is in a area where no cell is there, it may ask SMF to throttle the subscriber or even do not allow PDF session itself.

Decides on correct resource allocation

5G Core Network Services Framework



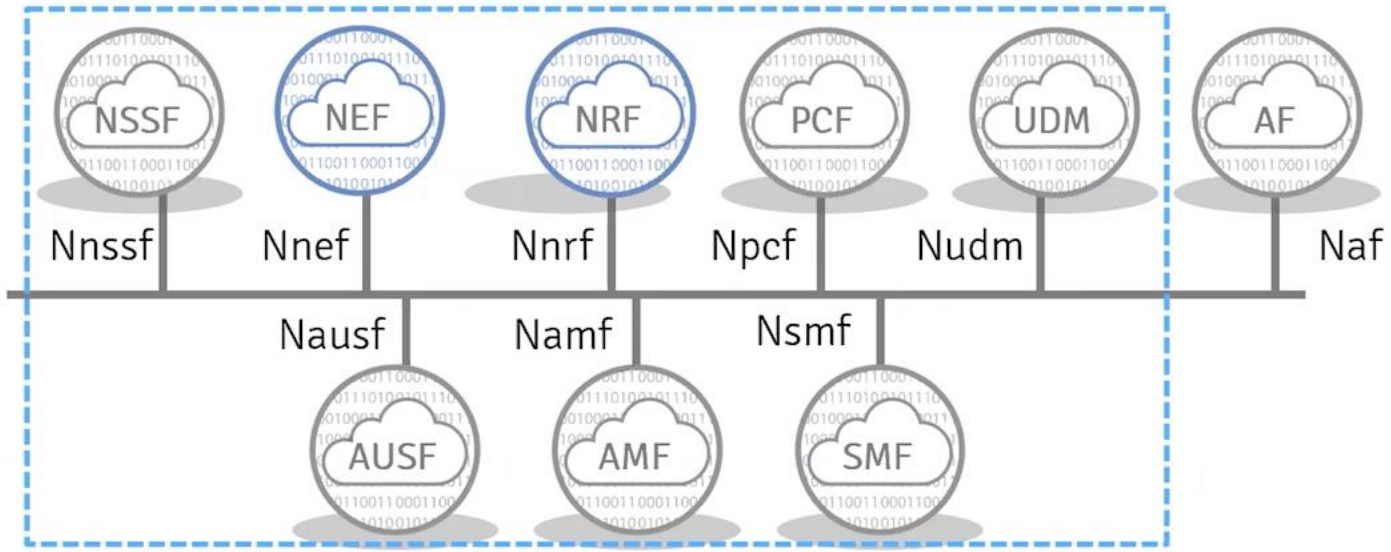
Service-Based Architecture of 5G CN



- **NSSF:** Network Slice Selection Function
- **NRF:** NF Repository Function
- **NEF:** Network Exposure Function
- **PCF:** Policy Control Function
- **UDM:** Unified Data Management
- **AF:** Application Function
- **AUSF:** Authentication Server Function
- **AMF:** Access and Mobility Management Function
- **SMF:** Session Management Function
- **UPF:** User Plane Function

Ref: 3gpp 23.501 Sec 4.2.3

Network Repository vs Network Exposure Function



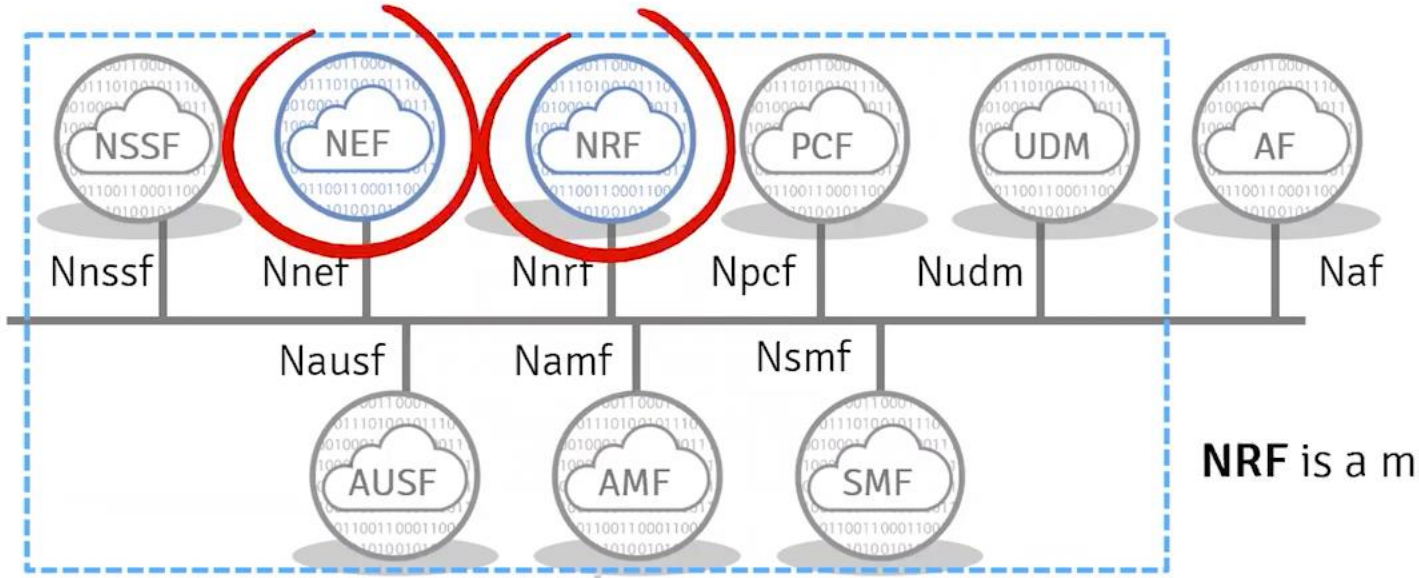
Services provided by NEF

- Expose Network Events (UE related) to AF
- Expose UE configuration and PC Rules to AF

Services provided by NRF

- Expose Producer NFs to Consumer NFs
- Expose service profile of NFs

Network Repository vs Network Exposure Function



NEF enables AF ecosystem to provide rich VAS to UE.

NRF is a matchmaker.

Services provided by NEF

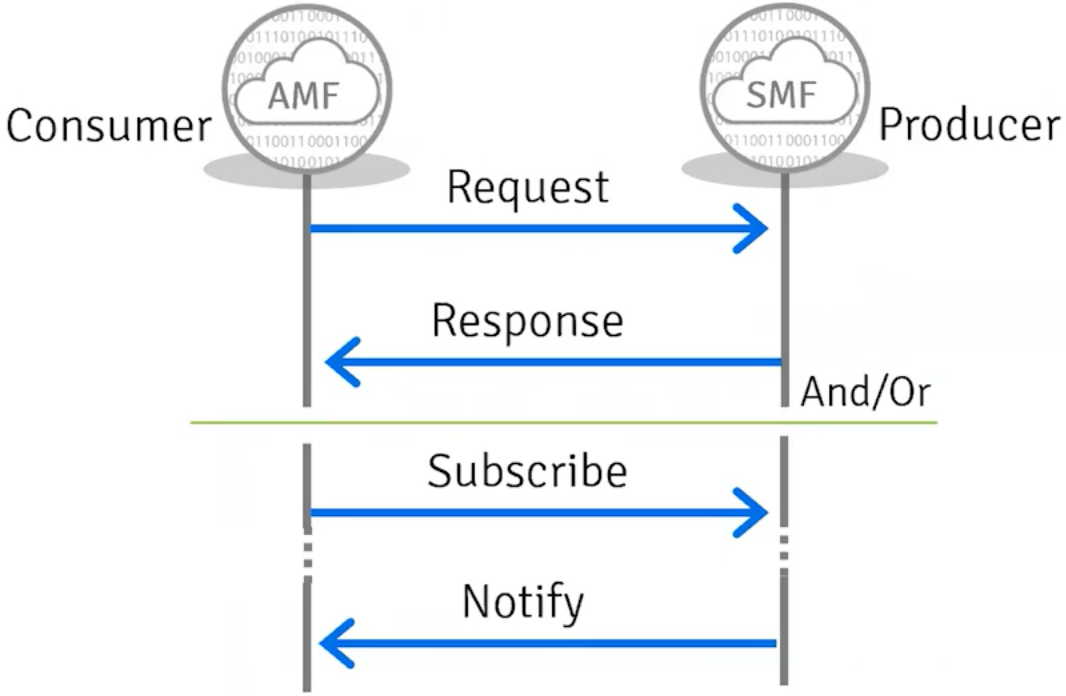
- Expose Network Events (UE related) to AF
- Expose UE configuration and PC Rules to AF

Services provided by NRF

- Expose Producer NFs to Consumer NFs
- Expose service profile of NFs

NF←→NF and AF←→NF Communications

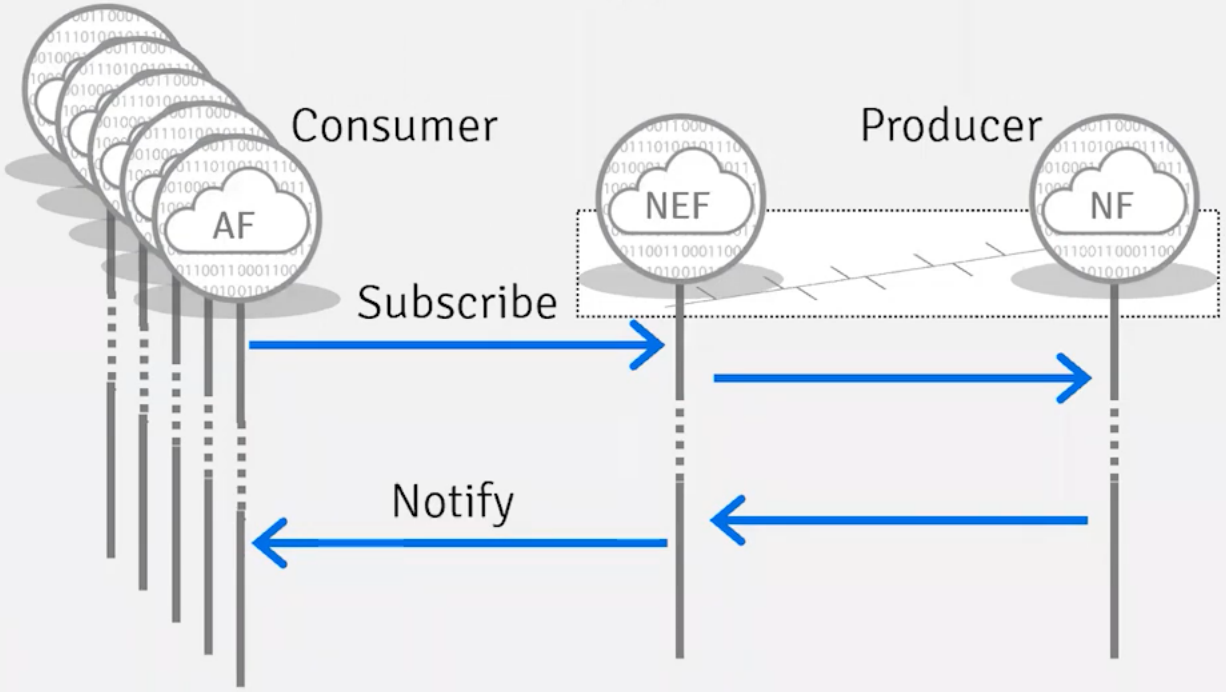
NF offers its services to other NF in a structured way



- AMF requests SMF to establish a session
- SMF sends successful response

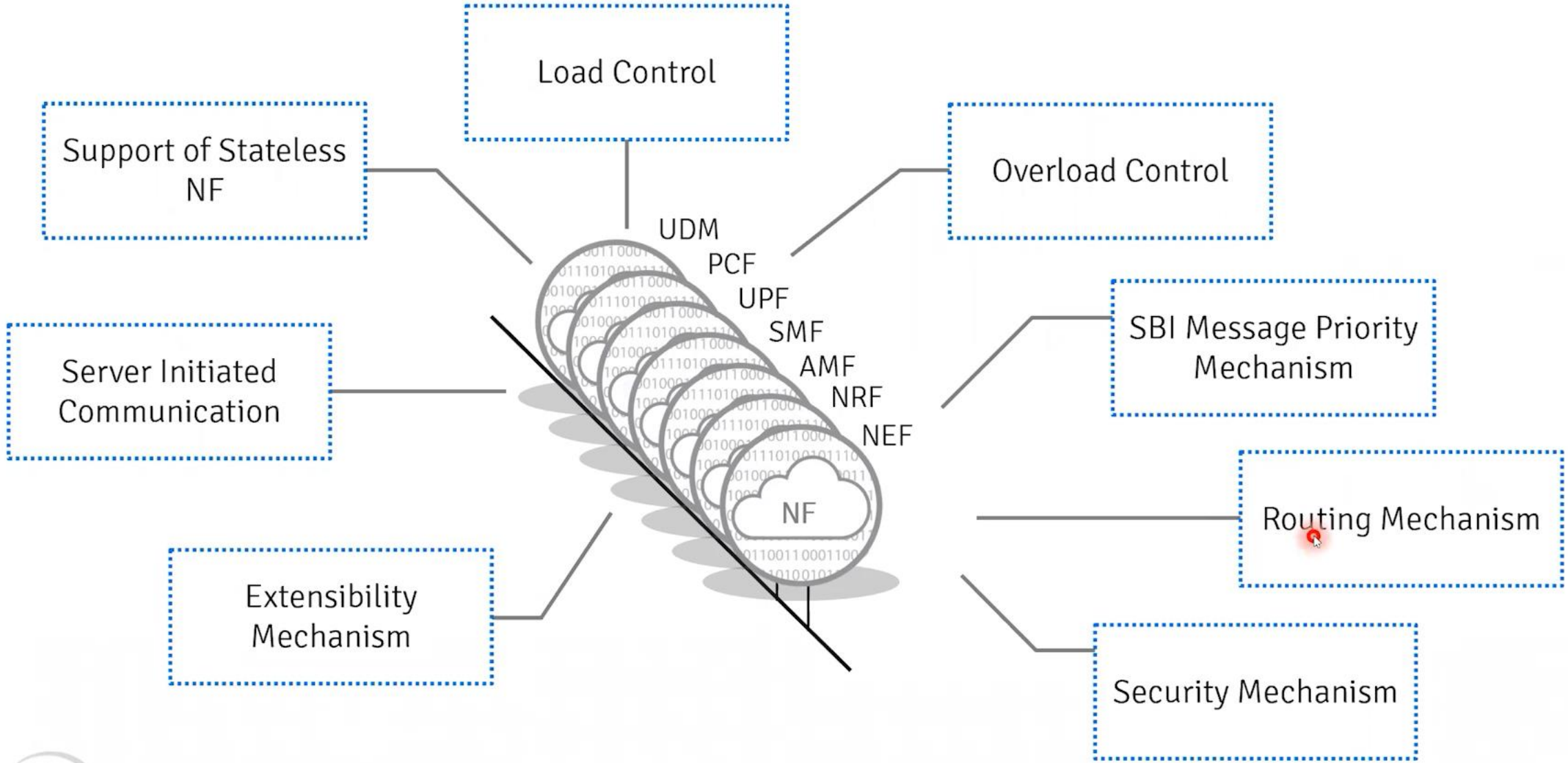
- AMF subscribes to SMF notification service (Notify me when Access Type change)
- Event triggers SMF notification

3rd party AF's are exposed to events internal to 3gpp networks



- AF subscribes to NF notification service (via NEF for e.g., with AMF for UE reachability)
- NF (e.g., AMF) notifies via NEF to AF

General Functionalities in SBA



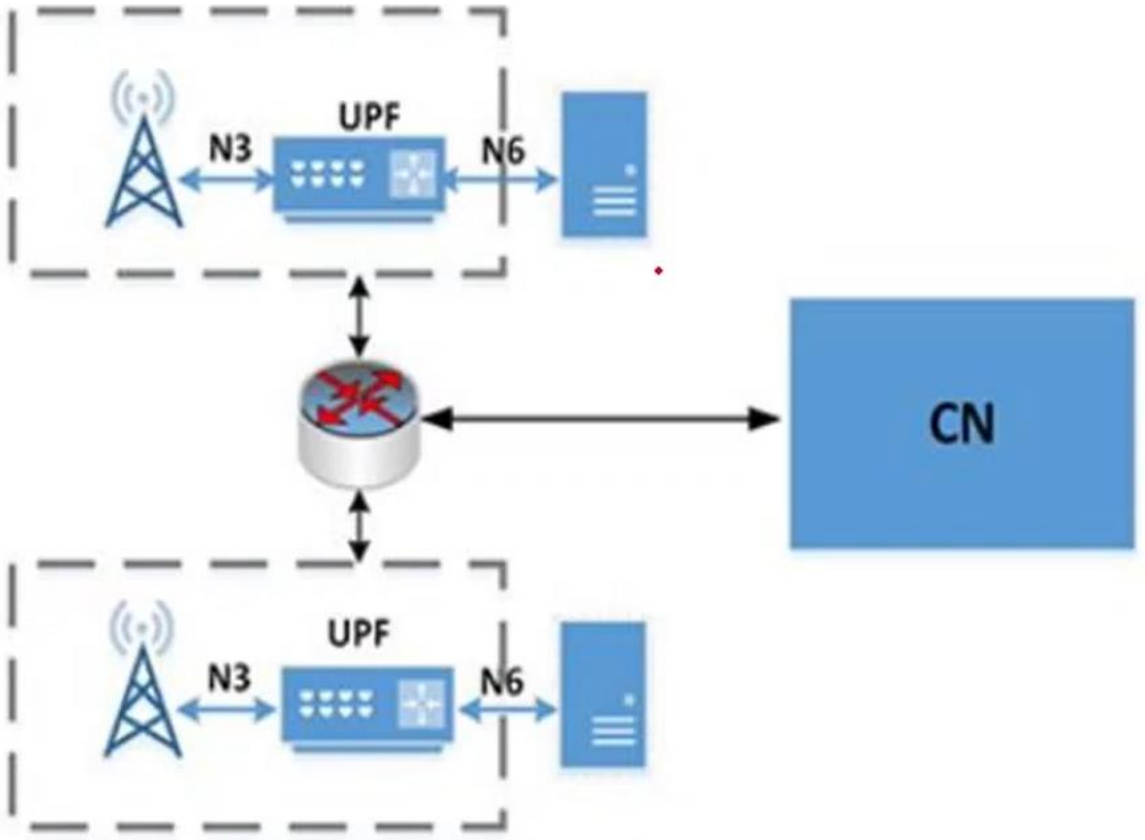
EDGE COMPUTING

Edge computing enables operator and 3rd party services to be hosted close to the UE's access point of attachment, so as to achieve an efficient service delivery through the reduced end-to-end latency and load on the transport network.

The 5G Core Network selects a UPF close to the UE and executes the traffic steering from the UPF to the local Data Network via a N6 interface. This may be based on the UE's subscription data, UE location, the information from Application Function (AF) , policy or other related traffic rules.

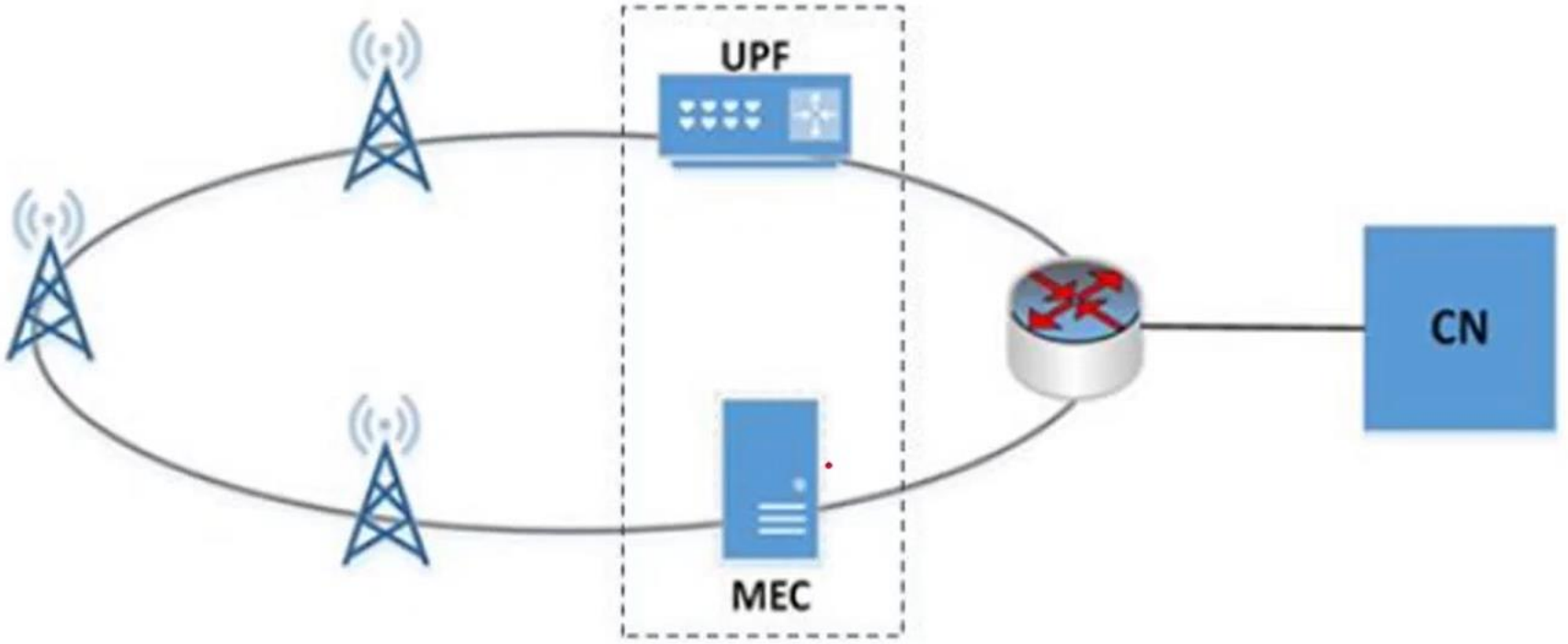
Edge computing can be supported by one or a combination of the following enablers:
- User plane (re)selection: the 5G Core Network (re)selects UPF to route the user traffic to the local Data Network
- Local Routing and Traffic Steering: the 5G Core Network selects the traffic to be routed to the applications in the local Data Network
- Session and service continuity to enable UE and application mobility
- An Application Function may influence UPF (re)selection and traffic routing via PCF or NEF
- Network capability exposure: 5G Core Network and Application Function to provide information to each other via NEF or directly
- Support of Local Area Data Network: 5G Core Network provides support to connect to the LADN in a certain area where the applications are deployed

MEC deployment scenarios 1



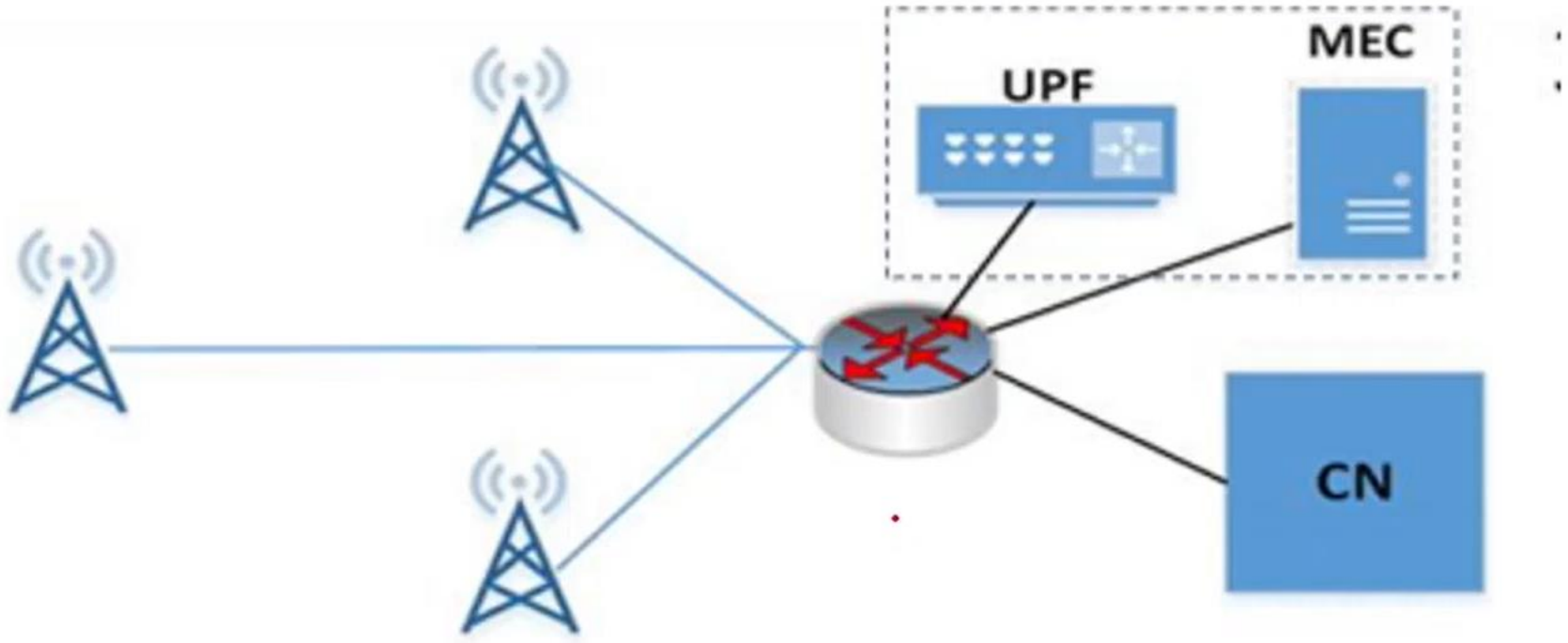
MEC and the local UPF collocated with the Base Station.

MEC deployment scenarios 2



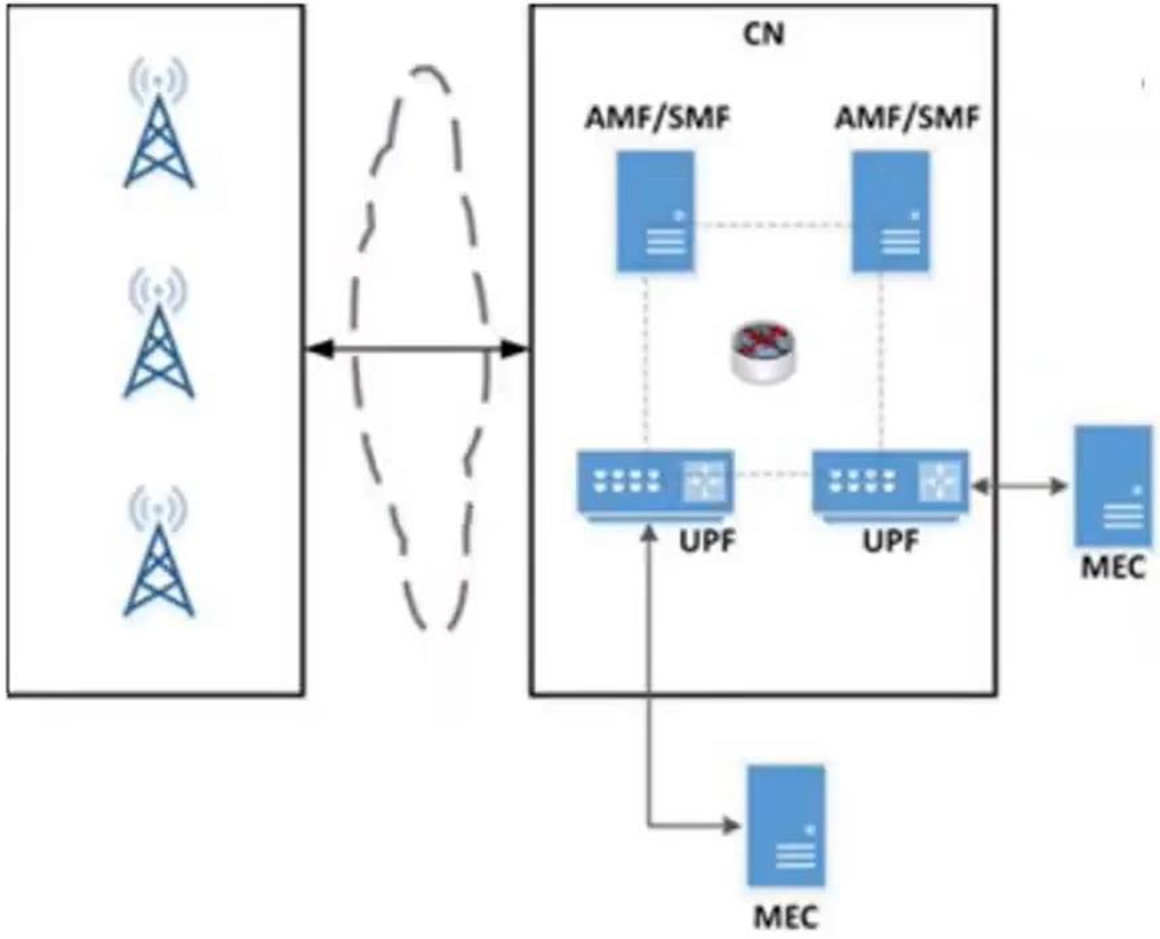
MEC collocated with a transmission node, possibly with a local UPF

MEC deployment scenarios 3



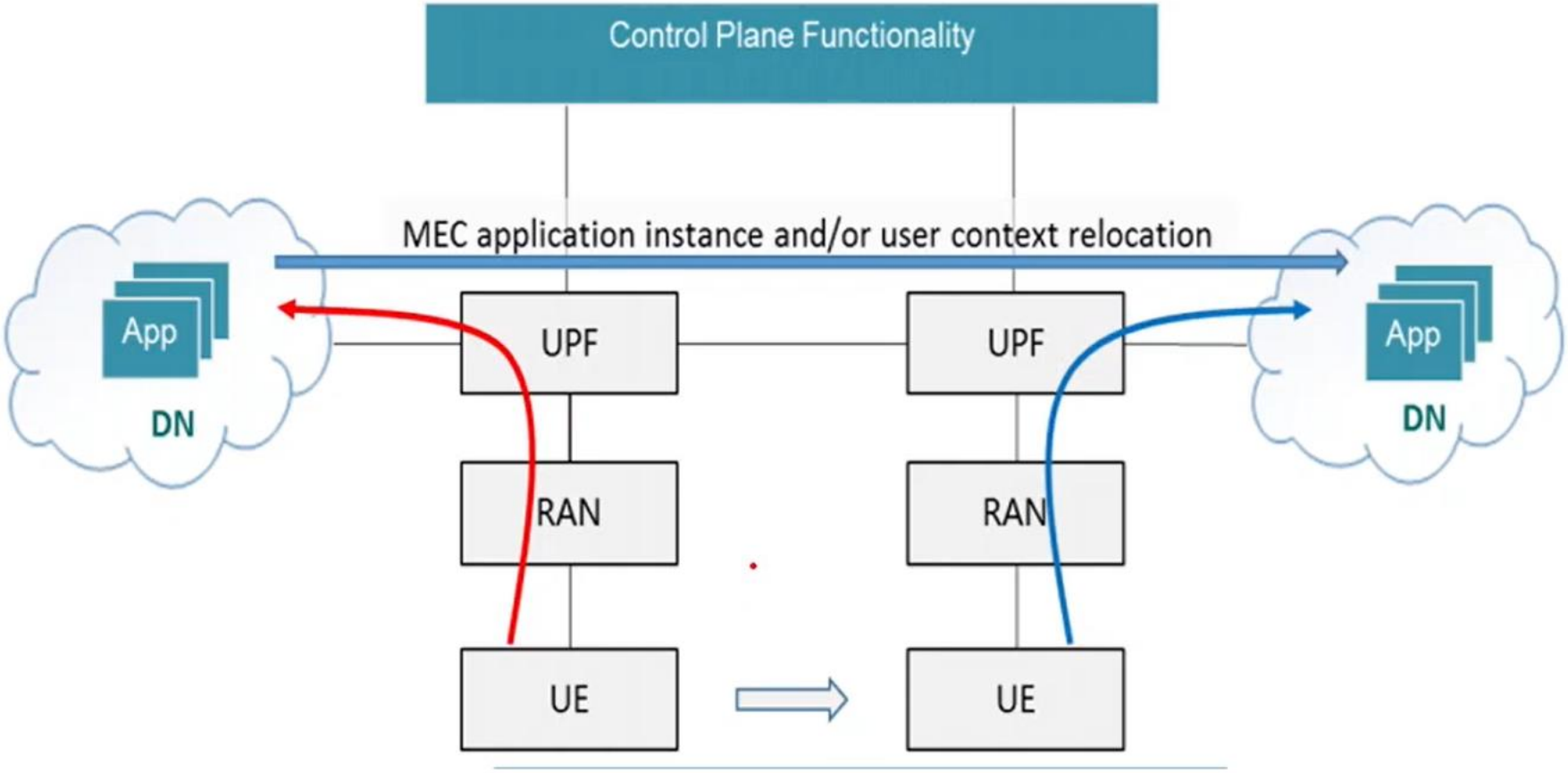
MEC and the local UPF collocated with a network aggregation point

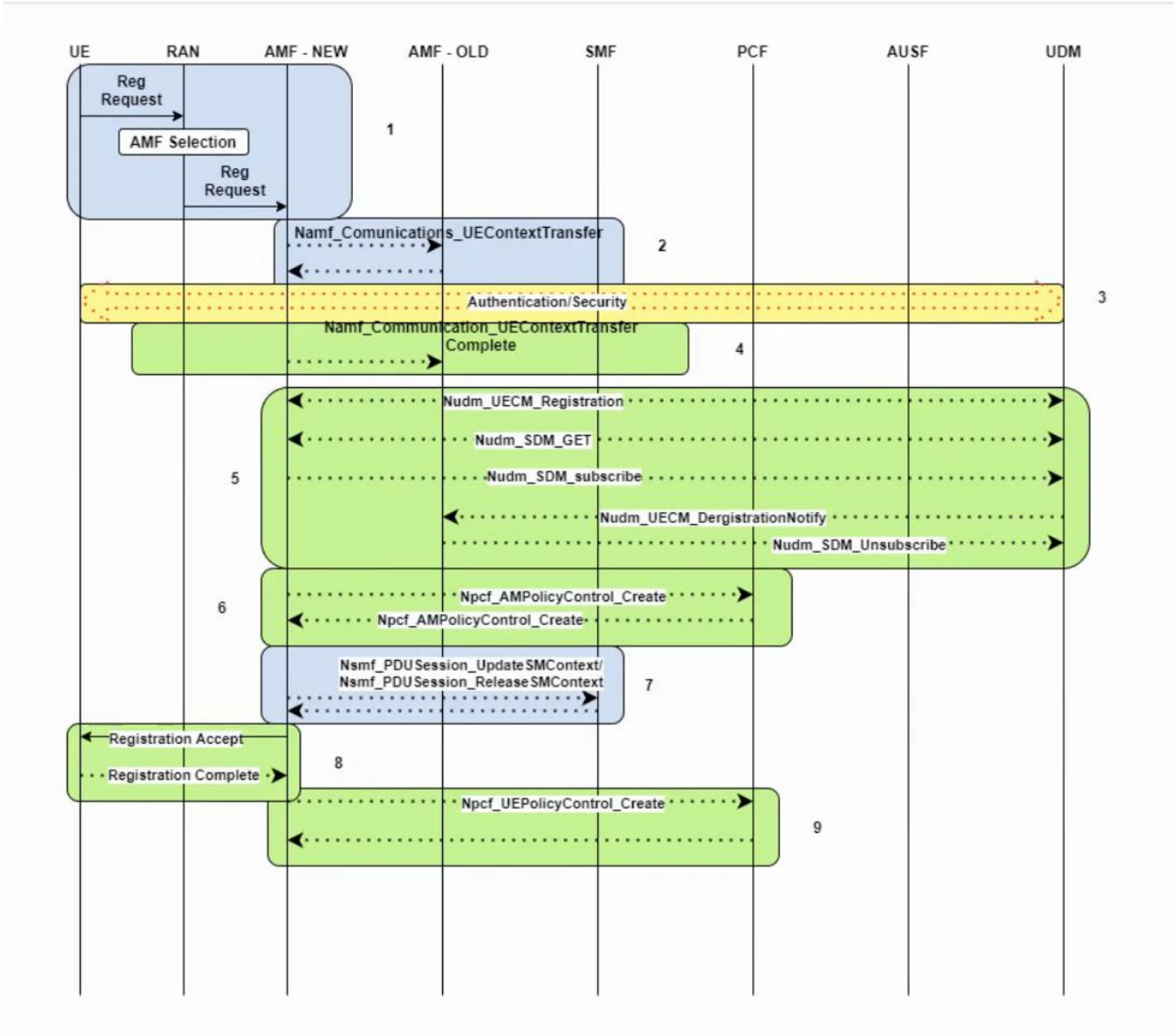
MEC deployment scenarios 3

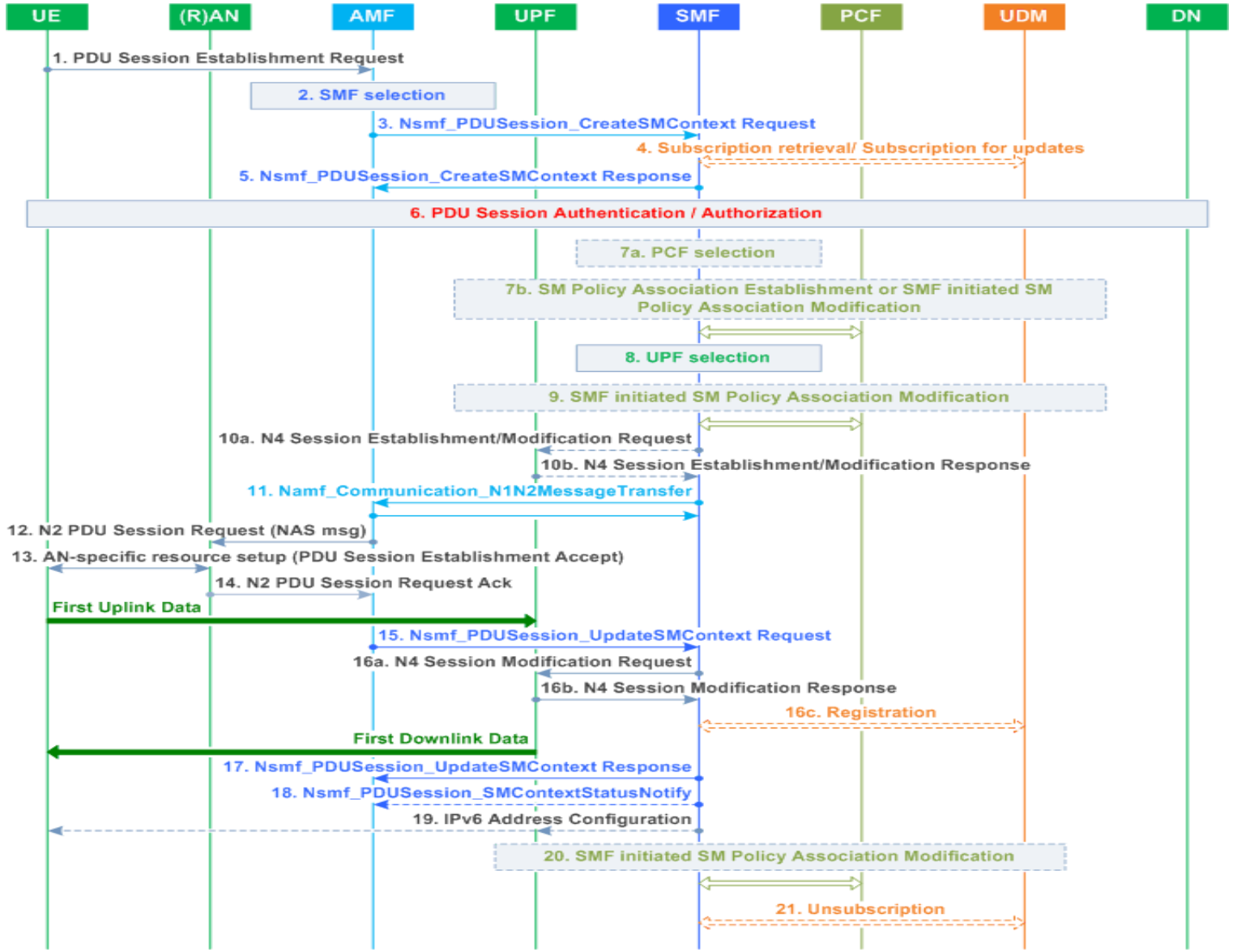


MEC collocated with the Core Network functions (i.e. in the same data centre)

UE and application mobility in MEC




UE
RAN
AMF - NEW
AMF - OLD
SMF
PCF
AUSF
UDM
Reg Request
AMF Selection
Reg Request
1
Namf_Comunications_UEContextTransfer
2
Authentication/Security
3
Namf_Communication_UEContextTransfer Complete
4
Nudm_UECM_Registration
Nudm_SDM_GET
5
Nudm_SDM_subscribe
Nudm_UECM_DergistrationNotify
Nudm_SDM_Unsubscribe
Npcf_AMPolicyControl_Create
6
Npcf_AMPolicyControl_Create
Nsmf_PDUSession_UpdateSMContext/ Nsmf_PDUSession_ReleaseSMContext
7
Registration Accept
8
Registration Complete
Npcf_UEPolicyControl_Create
9


UE
(R)AN
AMF
UPF
SMF
PCF
UDM
DN
1. PDU Session Establishment Request
2. SMF selection
3. Nsmf_PDUSession_CreateSMContext Request
4. Subscription retrieval/ Subscription for updates
5. Nsmf_PDUSession_CreateSMContext Response
6. PDU Session Authentication / Authorization
7a. PCF selection
7b. SM Policy Association Establishment or SMF initiated SM Policy Association Modification
8. UPF selection
9. SMF initiated SM Policy Association Modification
10a. N4 Session Establishment/Modification Request
10b. N4 Session Establishment/Modification Response
11. Namf_Communication_N1N2MessageTransfer
12. N2 PDU Session Request (NAS msg)
13. AN-specific resource setup (PDU Session Establishment Accept)
14. N2 PDU Session Request Ack
First Uplink Data
15. Nsmf_PDUSession_UpdateSMContext Request
16a. N4 Session Modification Request
16b. N4 Session Modification Response
16c. Registration
First Downlink Data
17. Nsmf_PDUSession_UpdateSMContext Response
18. Nsmf_PDUSession_SMContextStatusNotify
19. IPv6 Address Configuration
20. SMF initiated SM Policy Association Modification
21. Unsubscription