4G & 5G Mobile Technology

5G Architecture

5G Architecture

❖ Cellular Network Architecture

eNB (enhanced NodeB)	**LTE** (Long Term Evolution)	**EPC** (Evolved Packet Core) **4G**
gNB (Next generation NodeB)	**NR** (New Radio)	**NGC** (Next Generation Core) **5G**
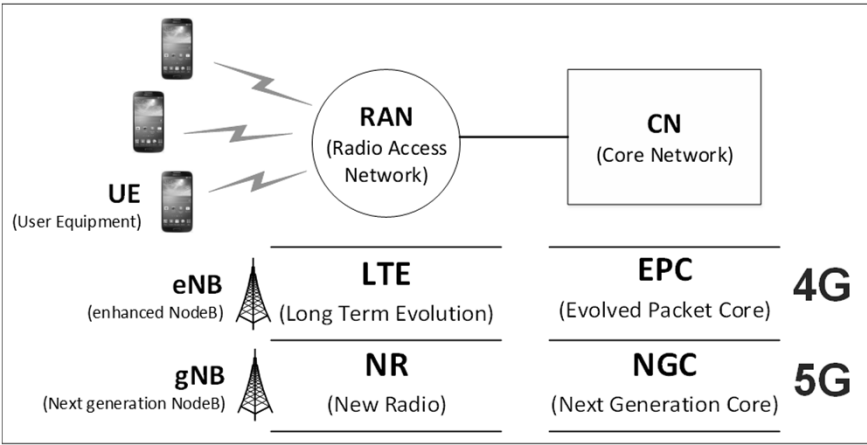
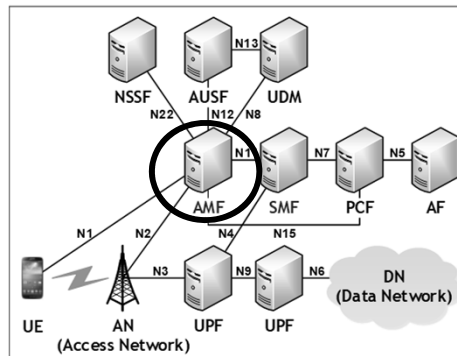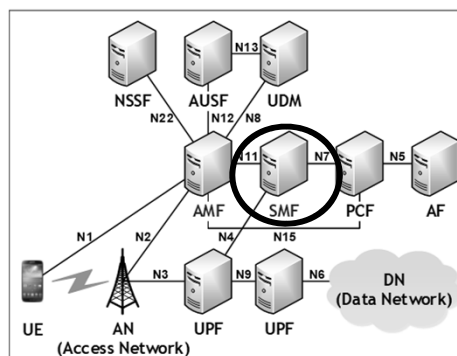## 5G Architecture

❖ NGC Network Functions

- AMF (Access and Mobility Function)
  - Registration & connection management
  - Mobility management
  - Access authentication
  - Access authorization

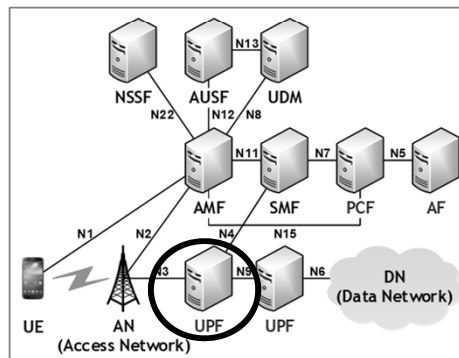## 5G Architecture

❖ NGC Network Functions

- SMF (Session Management Function)
  - Session Management
  - IP address allocation & management
  - Select and control UPF (User Plane Function) for data transfer
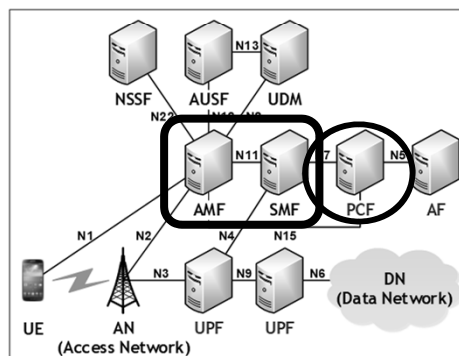
5G Architecture

❖ NGC Network Functions

- UPF (User Plane Function)
  - Packet routing & forwarding
  - Anchor point for Intra-RAT and Inter-RAT mobility

5G Architecture

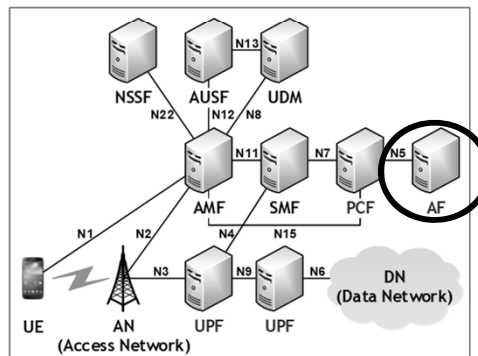### ❖ NGC Network Functions

- PCF (Policy Control Function)
  - Provide policy rules to control plane functions (e.g., AMF, SMF)

5G Architecture

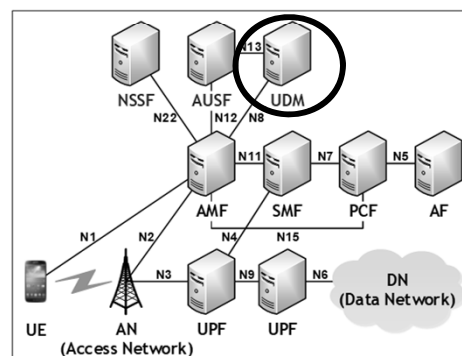❖ **NGC Network Functions**

- AF (Application Function)
  - Interact with core network to provide services

5G Architecture

❖ **NGC Network Functions**

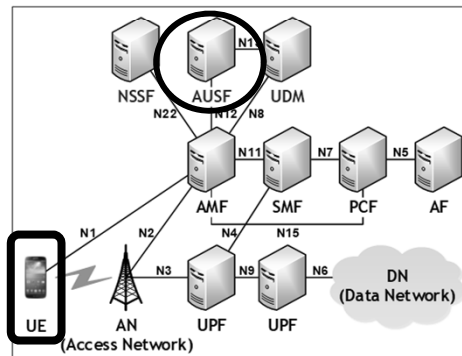- UDM (User Data Management)
  - Store & manage subscription data of UE
  - Access authorization based on subscription data

5G Architecture

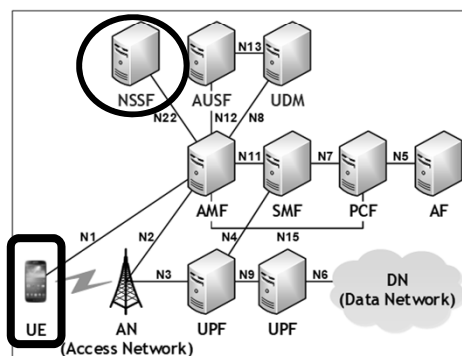❖ **NGC Network Functions**

▪ AUSF (Authentication Server Function)

- Store authentication data of UE

5G Architecture

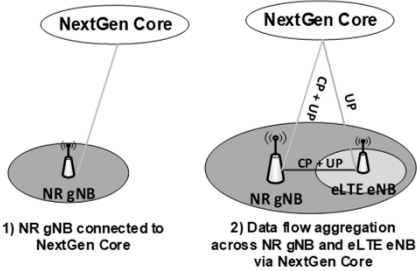❖ **NGC Network Functions**

▪ NSSF (Network Slice Selection Function)

- Select the set of network slice instances
  serving the UE

5G Deployment Scenarios

❖ NSA (Non-standalone) Options

- NR gNB as a master node
    1. NR gNB connected to NGC (NextGen Core)
    2. Data transport through NR gNB and/or
       eNB connected to NGC

3GPP TR 38.804 "Study on New Radio Access technology; Radio Interface Aspects (Release 14)," v14.0.0 Mar. 2017

5G Deployment Scenarios

❖ NSA (Non-standalone) Options

- NR gNB as a master node
    1. NR gNB connected to NGC (NextGen Core)
    2. NR gNB or eNB connected to NGC
    3. Data transport through NR gNB(s) via NGC

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5G Deployment Scenarios

❖ NSA (Non-standalone) Options

- NR gNB as a master node

  - For 2) and 3), there exists one
    CP (C-plane) connection between CN and RAN

    - CN: Core Network

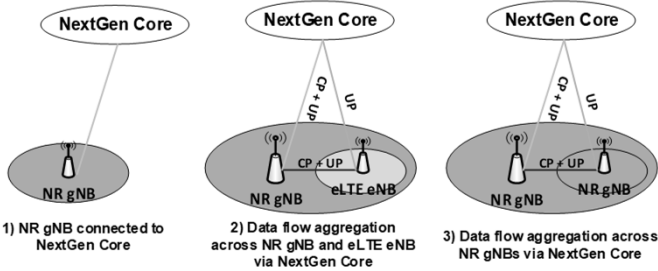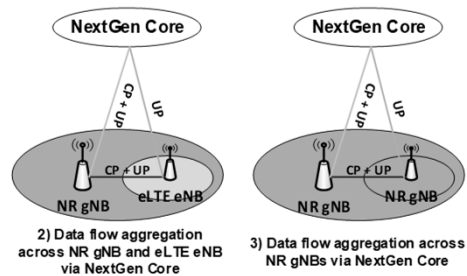   - RAN: Radio
      Access
      Network

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5G Deployment Scenarios

❖ NSA (Non-standalone) Options

- NR gNB as a master node

  - UP (U-plane) data is routed to the RAN through the CN

  - Alternatively, UP data that flows in the
    same bearer is split at the RAN

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5G Deployment Scenarios

❖ NSA (Non-standalone) Options

- LTE eNB as a master node
  - LTE eNB as a master node
  - Data flow aggregation across the LTE eNB and NR gNB through the EPC
  - Data transport through the LTE eNB and/or NR gNB through the EPC
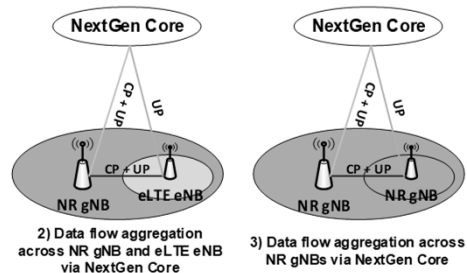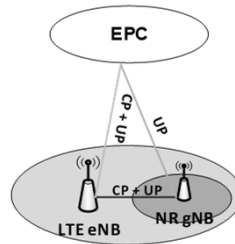

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5G Deployment Scenarios

❖ NSA (Non-standalone) Options

- LTE eNB as a master node
  - There exists one CP (C-plane) connection between the CN and RAN
  - UP (U-plane) data is routed to the RAN directly through the CN on a bearer basis
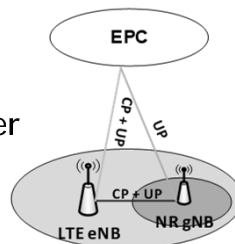 - Alternatively, the UP data that flows in the same bearer is split at the RAN

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5G Technology

❖ 5G Performance Requirement

	eMBB[1]	mMTC[2]	URLLC[2]
Data rate	UL: 10 Gbps DL: 20 Gbps	Low data rate, 1 to 100 kbps	Low to medium data rate, 50 kbps to 10 Mbps
Spectrum efficiency	UL: 15 bps/Hz DL: 30 bps/Hz	Not Defined	Not Defined
User experienced data rate	UL: 50 Mbps DL: 100 Mbps	Not Defined	Not Defined
Area traffic capacity	10 Mbps/m^2	Not Defined	Not Defined
Network energy efficiency	Defined, but not specified	Low power, up to 15 years battery life	Not Defined
Mobility interruption time	0 ms	Not Defined	0 ms
Latency	4 ms	Seconds to hours	0.5 ms
Connection density	Not Defined	1M devices/km^2	Not Defined

1) Radoicommunication SG, "Minimum requirements related to technical performance for IMT-2020 radio interface(s)," *ITU-R Documents*, Feb., 2017
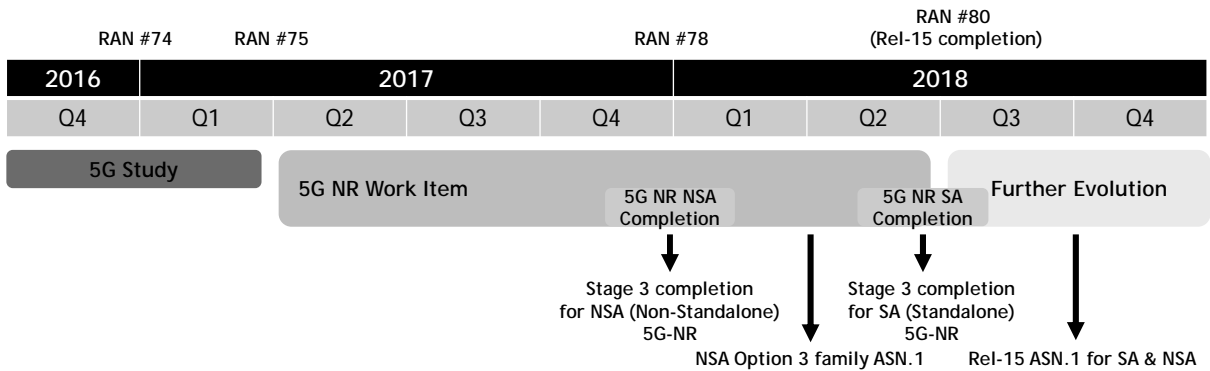2) InterDigital, 5G Vision. Available: http://www.interdigital.com/presentations/mwc17-5g-vision

5G Technology

❖ 3GPP 5G-NR eMBB Workplan

5G Technology

❖ 3GPP 5G-NR eMBB Workplan

[Ref] RP-170741 "Way Forward on the overall 5G-NR eMBB workplan,"
3GPP RAN #75 Dubrovnik, Mar. 2017

RAN #74	RAN #75				RAN #78		RAN #80 (Rel-15 completion)	
2016	2017				2018			
Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

5G Study

5G NR Work Item

Further Evolution

5G NR NSA Completion

5G NR SA Completion

Stage 3 completion
for NSA (Non-Standalone)
5G-NR

Stage 3 completion
for SA (Standalone)
5G-NR

NSA Option 3 family ASN.1

Rel-15 ASN.1 for SA & NSA

- By Mar. 2018 – NSA (Non-Standalone) 5G-NR eMBB completion

- By Sept. 2018 – SA (Standalone) 5G-NR eMBB completion