CORE NETWORK

Rahul Pal

Packet Core Design
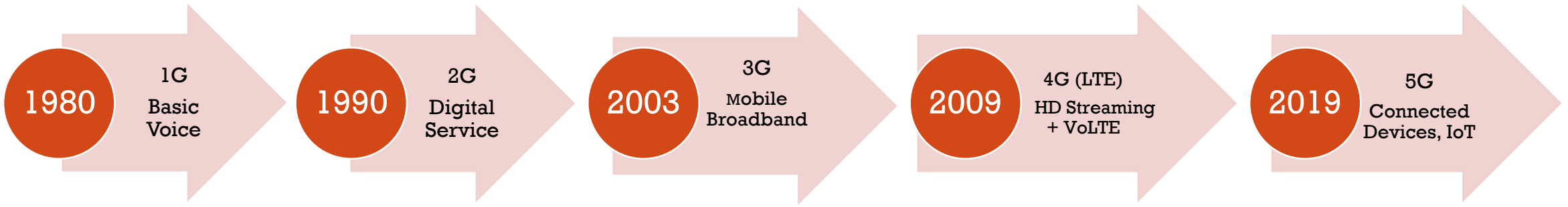
T-Mobile USA
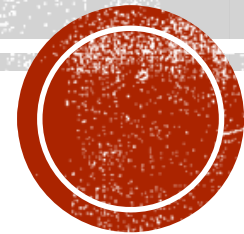
MOBILE EVOLUTION TO 5G
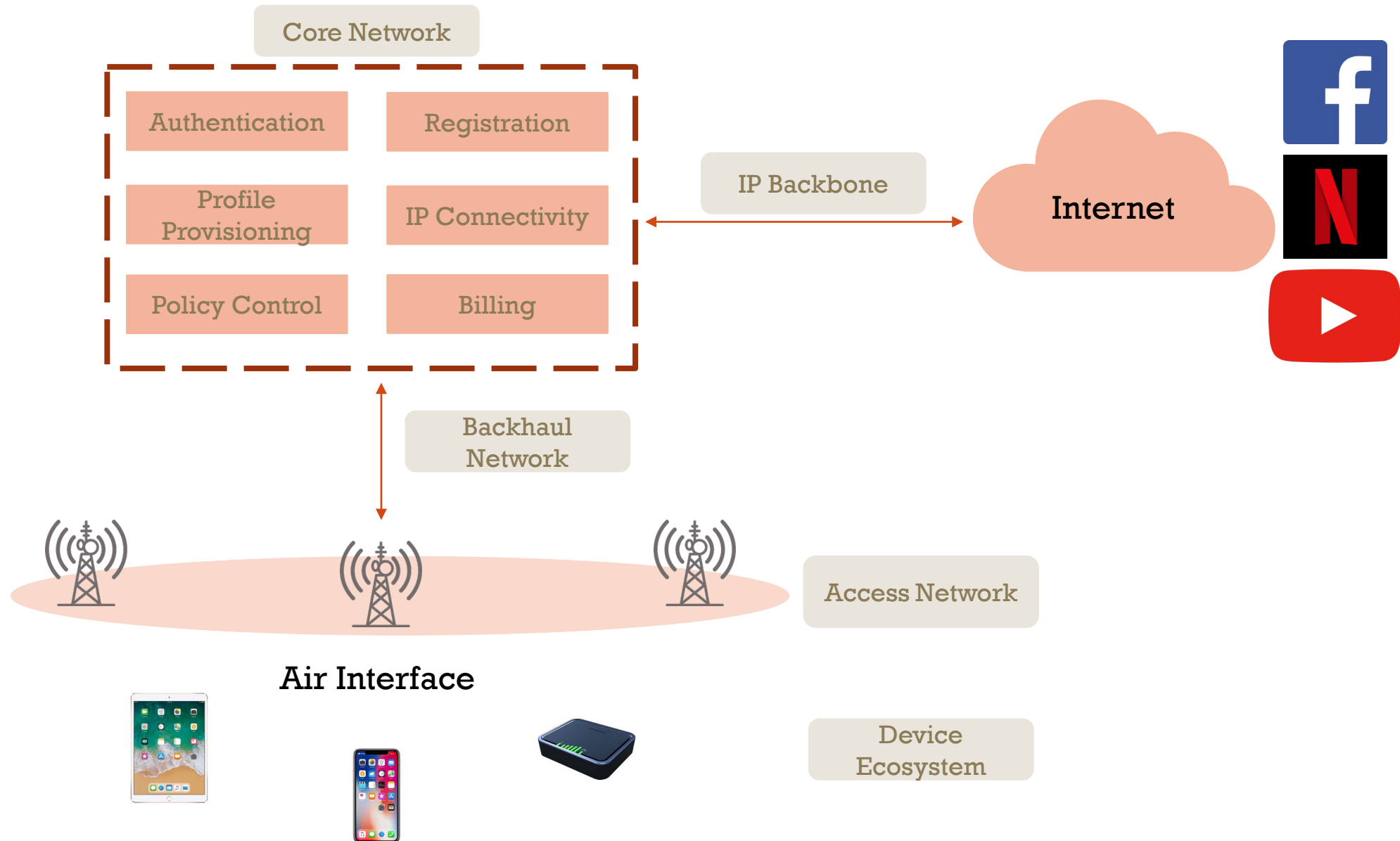
CORE NETWORK EVOLUTION TO 5G

1980	1G Basic Voice	1990	2G Digital Service	2003	3G Mobile Broadband	2009	4G (LTE) HD Streaming + VoLTE	2019	5G Connected Devices, IoT

Voice centric NW	SS7/IP based Data NW	All IP Data Network	All IP Data Network	All IP Data Network
Advance Mobile Phone Service (AMPS)	Circuit Switch Support for Voice	Direct Tunnel, Voice over Circuit Switch	Voice over LTE, Circuit Switch Support for Voice	Control & User plane separation
Analog transmission of signal	Control Plane - SGSN, GGSN, PCRF, HLR, MSC, VLR	Control Plane - SGSN, GGSN, PCRF, HLR , MSC, VLR	Control Plane - MME, SPGW, PCRF, HSS	Control Plane - AMF, SMF, PCF, UDM
	User Plane - GGSN	User Plane - GGSN	User Plane - SPGW	User Plane - UPF

CORE NETWORK OVERVIEW

Core Network

Authentication

Registration

Profile Provisioning

IP Connectivity

Policy Control

Billing

IP Backbone

Internet

Backhaul Network

Access Network

Air Interface

Device Ecosystem

CORE NETWORK FUNCTIONS

Device & SIM Authentication

Allow only legitimate devices to access network services.

How?
Use encryption algorithms between device & Core Network

Data Connectivity & Mobility

Act as Gateway to internet to enable data services on devices

How?
Anchor point for Data service registration & IP connectivity

CORE NETWORK FUNCTIONS (CONTD.)

Charging aka Billing

Allow accounting of network services used by users on real time or monthly basis.

Prepaid Plans/Postpaid Plans

How?
Create charging data records for each user.

New Offers & Services

Identify traffic and create new plans and offers for customers.
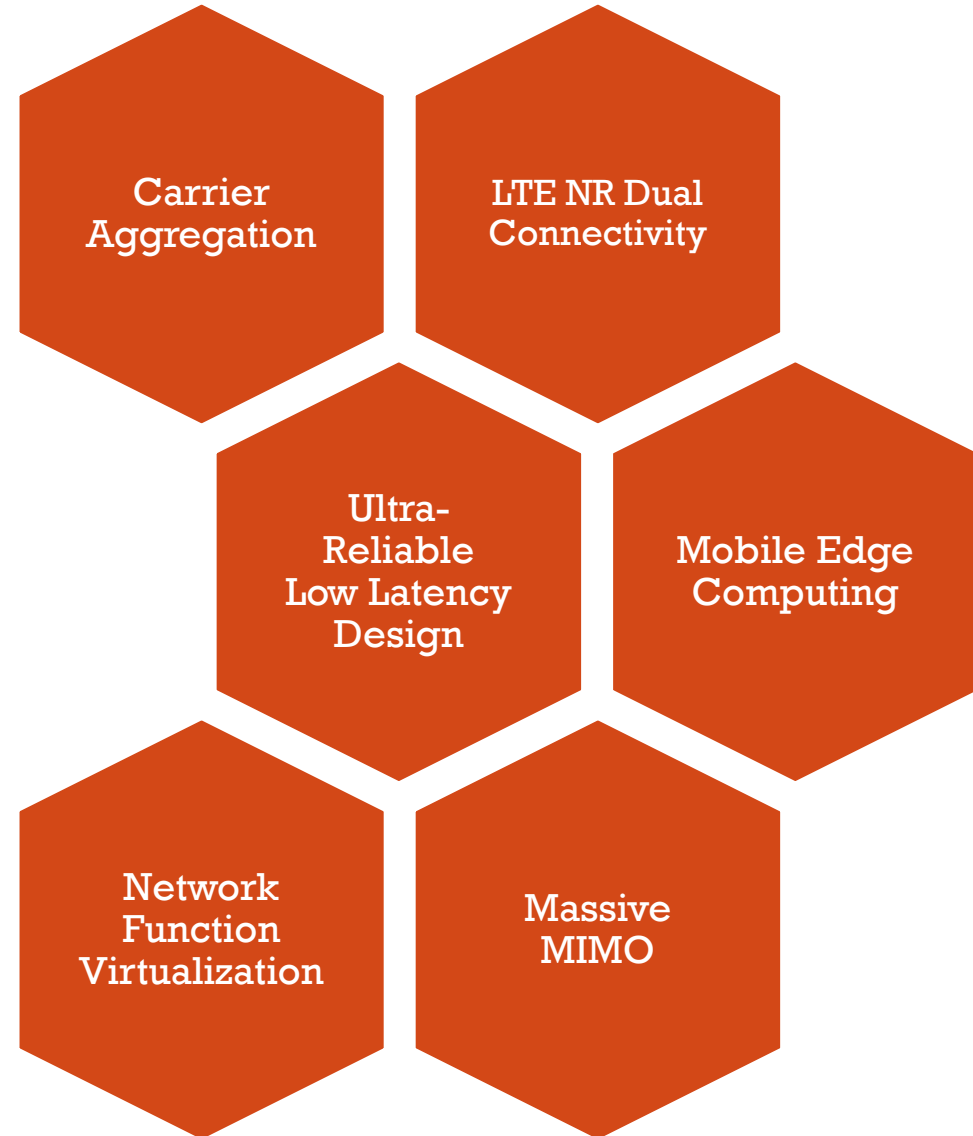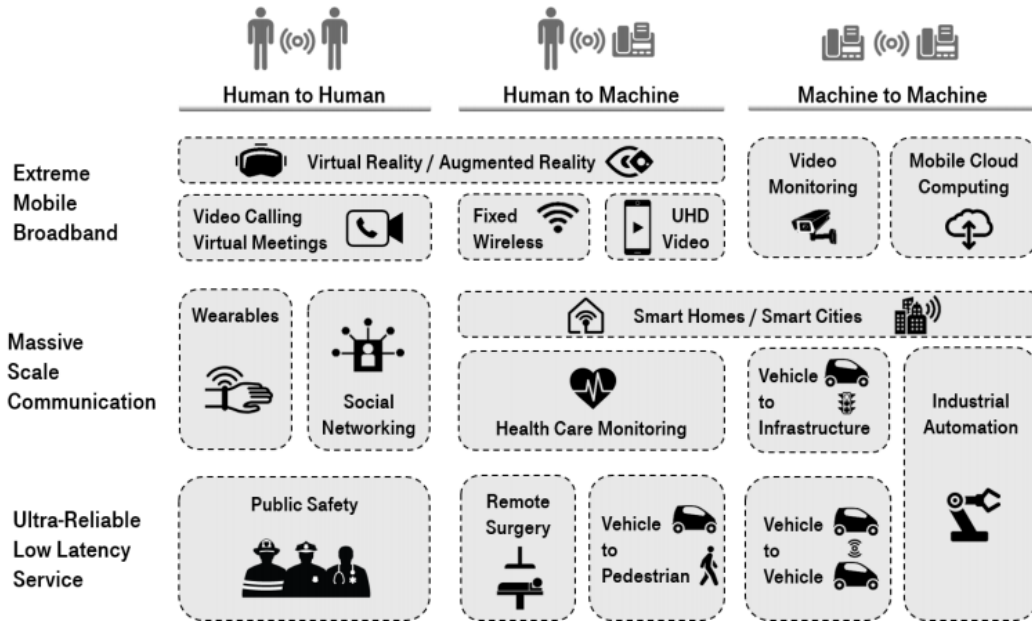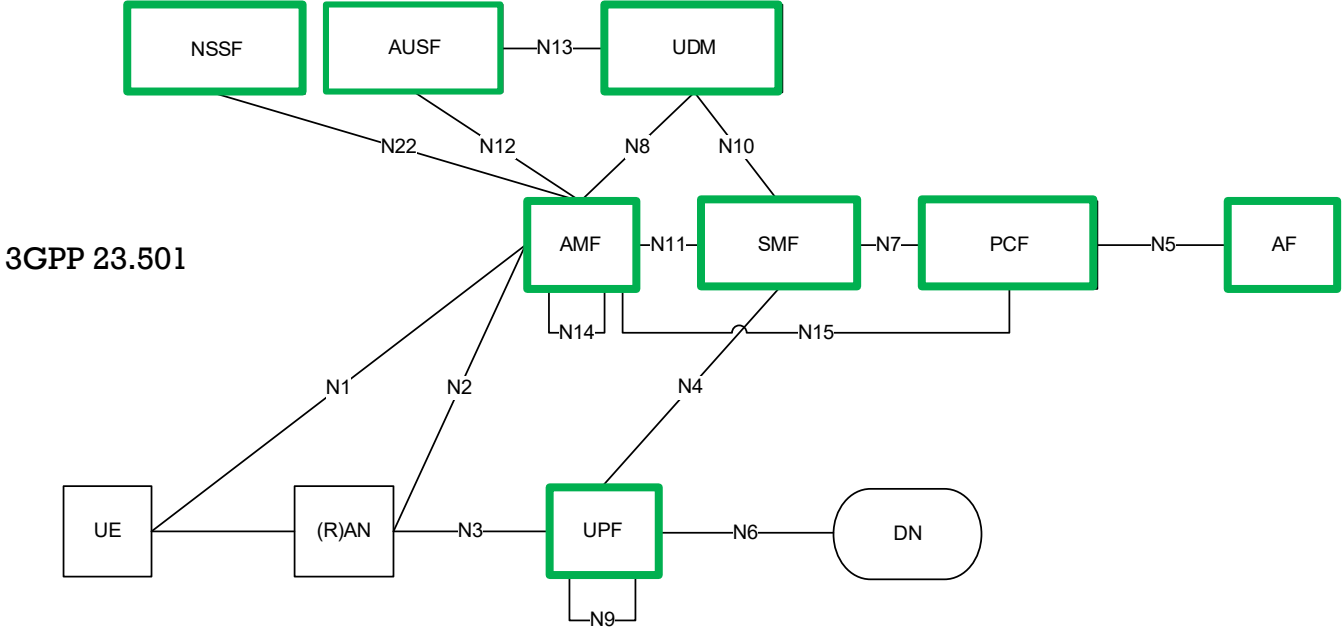
Free Music Streaming
Video streaming @ 480p

How?
Detection of application traffic (DPI) (HTTP/HTTPS) and applying pre-defined rules on traffic.

5G - DRIVERS & TECHNOLOGY ENABLERS

	Human to Human	Human to Machine	Machine to Machine
Extreme Mobile Broadband	Virtual Reality / Augmented Reality		Video Monitoring / Mobile Cloud Computing
	Video Calling Virtual Meetings	Fixed Wireless / UHD Video	
Massive Scale Communication	Wearables / Social Networking	Smart Homes / Smart Cities	
		Health Care Monitoring	Vehicle to Infrastructure / Industrial Automation
Ultra-Reliable Low Latency Service	Public Safety	Remote Surgery / Vehicle to Pedestrian	Vehicle to Vehicle

Carrier Aggregation

LTE NR Dual Connectivity

Ultra-Reliable Low Latency Design

Mobile Edge Computing

Network Function Virtualization

Massive MIMO

5GCN AKA 5G CORE NETWORK

3GPP 23.501

| NSSF | AUSF —N13— UDM |

N22   N12   N8   N10

| AMF | —N11— | SMF | —N7— | PCF | —N5— | AF |

N14   N15

N1   N2   N4

| UE | — | (R)AN | —N3— | UPF | —N6— | DN |

N9

Control & User Plane Separation

NFV/SDN

Slicing

Key Principals

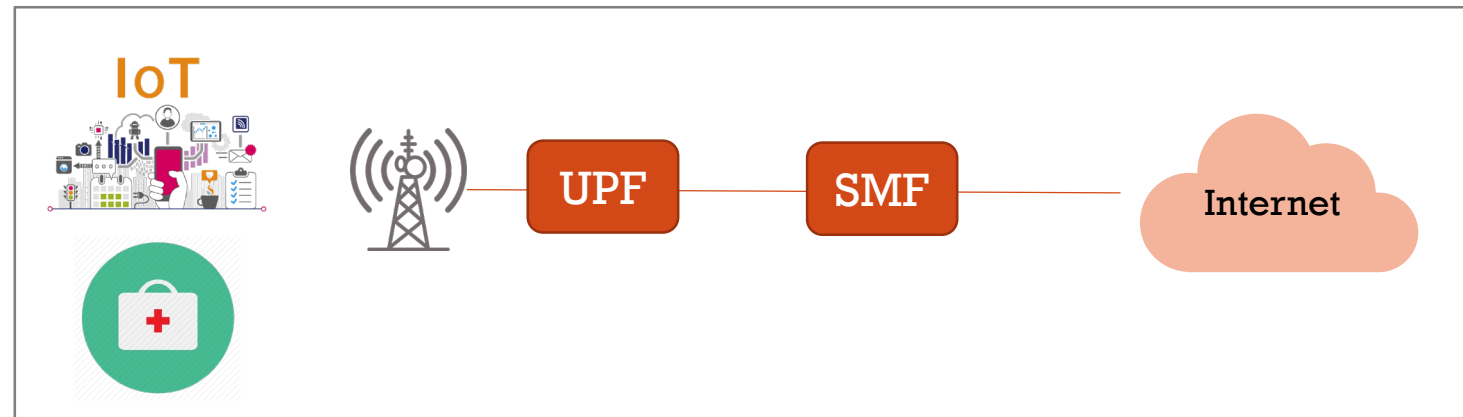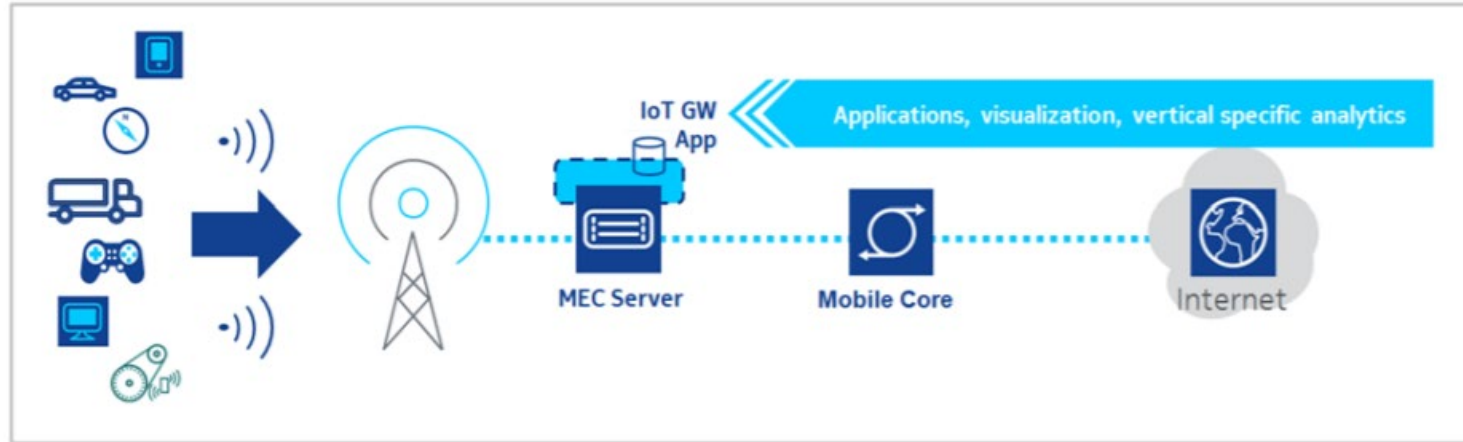| 5GC	Network Function
AMF	Access and Mobility Management Function
UDM	Unified Data Management
NRF	NF Repository Function
SMF	Session Management Function
PCF	Policy Control Function
UPF	User Plane Function
AF	Application Function
AUSF	Authentication Server Function
NSSF	Network Slice Selection Function

5G
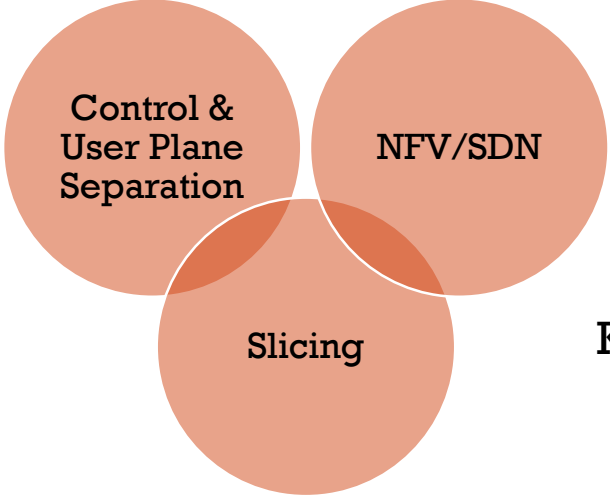
MOBILE EDGE COMPUTING (MEC)
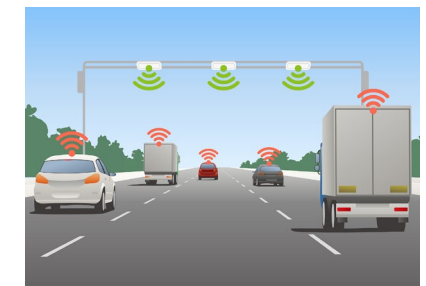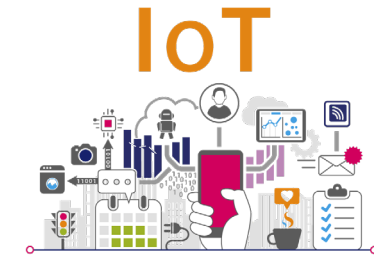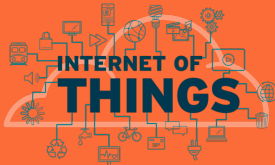
NETWORK SLICING

Low Latency Slice

| UDM | AUSF | PCF |
| SMF | AMF |

UPF

Internet

IoT Slice

| UDM | AUSF | PCF |
| SMF | AMF |

UPF

Internet

eMBB Slice

Ultra HD 8K

| UDM | AUSF | PCF |
| UPF | SMF | AMF |

Internet

5G

Q & A