

5G and Edge Computing

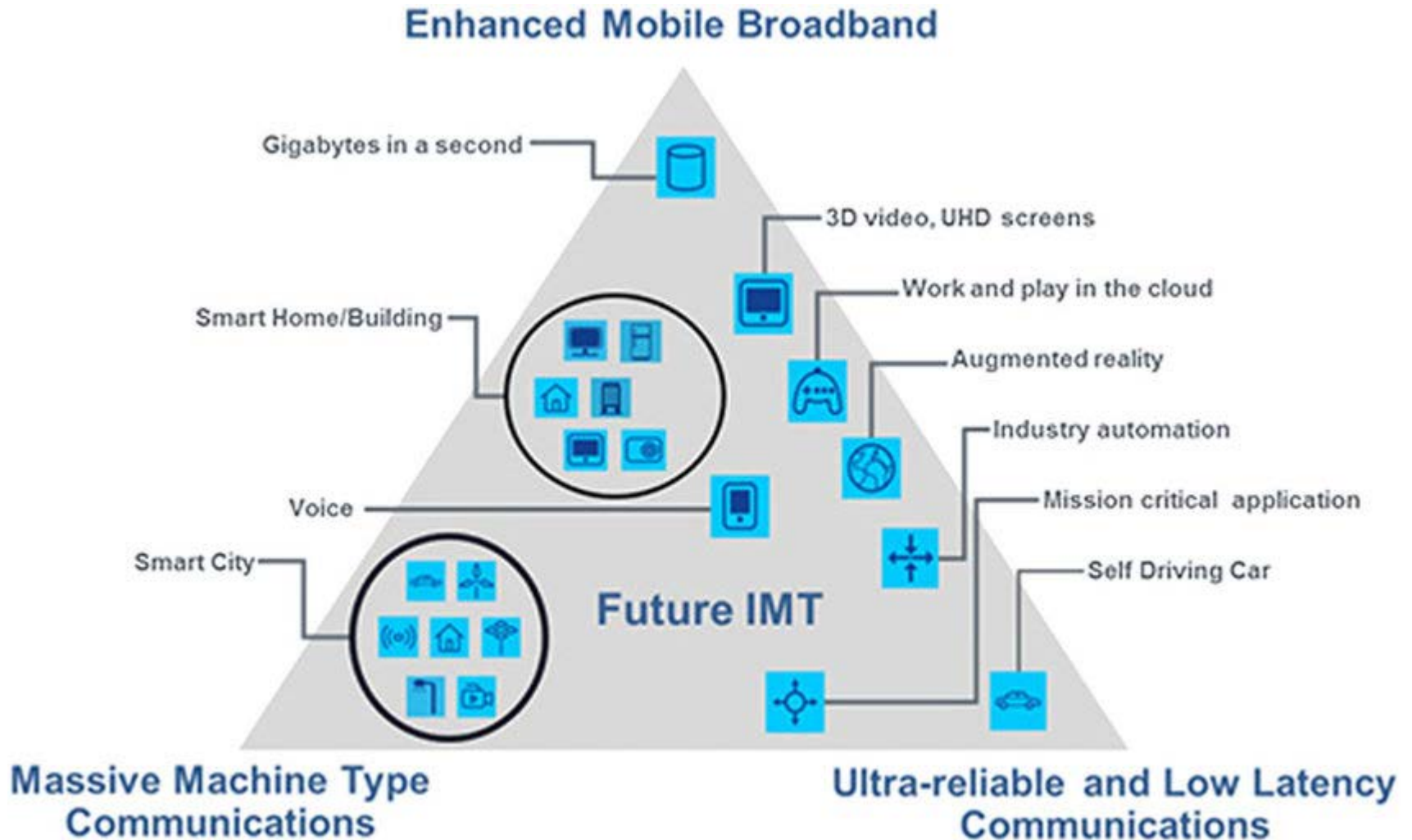
2019년 11월 27일

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5G Vertical Services



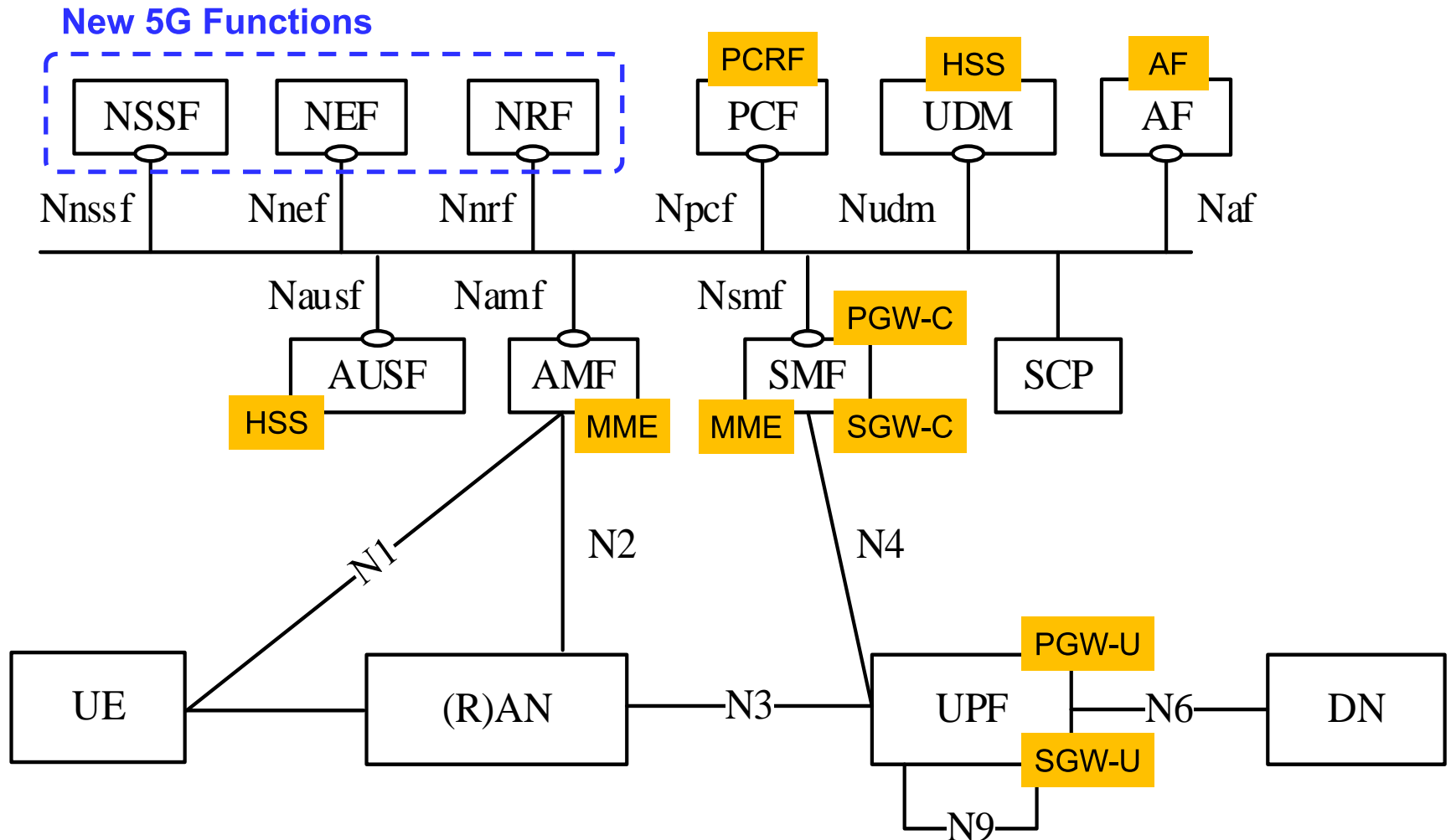
(Rel-14) SA2: NextGen Study

- Study on Architecture for Next Generation System (TR 23.799)
 - Shall support at least the new RAT(s), the evolved LTE, non-3GPP accesses and minimize access dependencies
 - Proposals for the new architecture can be based on an evolution of the current architecture or based on a “clean slate” approach
- NextGen study has been finalized in Dec. 2016

(Rel-15) SA2: 5G Systems (5GS)

- System Architecture for 5G System (TS 23.501)
 - Specifies the overall system architecture reference model including network functions and description of high level functions
- Procedures for 5G System (TS 23.502)
 - Specifies the procedures and flows to capture the interactions between network functions, access network(s) and UE for the listed features

5GS Architecture in TS 23.501



Service-based interface representation

5G NF: AMF and SMF

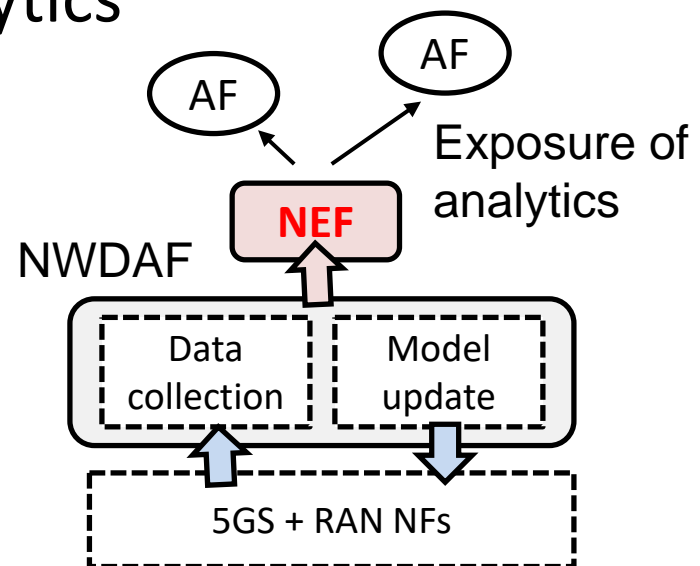
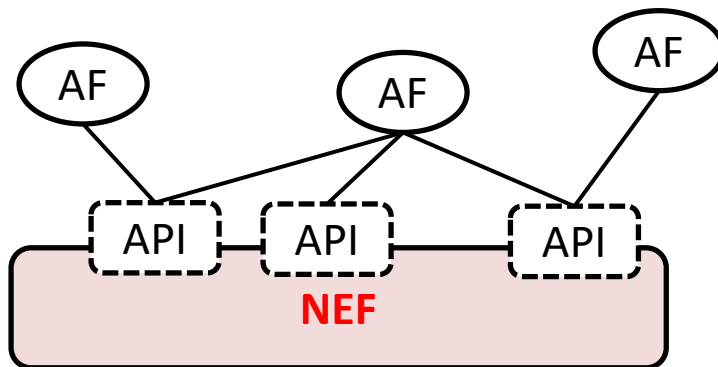
- Access and Mobility Management Function (AMF)
 - Registration, Mobility, Reachability, and Connection management
- Session Management Function (SMF)
 - Session establishment/modification/release, and IP address allocation

5G NF: UPF and AF

- **User Plane Function (UPF)**
 - External PDU session point of interconnect to data network (DN)
 - Anchor for Intra- and Inter- RAT mobility
 - Packet routing & forwarding
 - Packet inspection / Traffic usage reporting
- **Application Function (AF)**
 - Interacts with the 5G core network to provide service (e.g., application influence on traffic routing)

5G NF: NEF

- **Main Feature: Information Exposure**
 - Exposure of capabilities & events
 - Secure provision of information from external application to 3GPP network
 - Exposure of NWDAF analytics



5G NF: NSSF and NRF

- **Network Slicing Selection Function (NSSF)**
 - Select the set of network slice instances
 - Determining AMF set to be used to serve the UE or based on configuration by querying NRF (i.e., a list of candidate AMFs)
- **NF Repository Function (NRF)**
 - Support service discovery function
 - Maintains the NF profile of available NF instance and their supported service

(Rel-16) Main Topics

- Enhancement of URLLC supporting in 5G
- UE radio capability signaling optimization
- Satellite Access in 5G
- Cellular IoT support and evolution
- Enablers for Network Automation Architecture
- Mission Critical, Public Warning, Railways & Maritime
- User identities, Authentication, Multi-Device Slicing

5GC: Key Technologies

- Vertical services/industries
 - Network Slicing
 - Edge Computing support
 - Network Capabilities Exposure
- Softwarization and Virtualization
 - SDN and NFV
 - CP and UP Separation (CUPS)
 - Modularization of NFs
 - Service-Based Architecture (SBA)

Why Edge Computing?

ex FOOD
휴게소 대표 음식

한국도로공사

갈치세트
이천(하남) 휴게소

말죽거리 소고기국밥
서울만남(부산) 휴게소

해물볶음돈가스
천안(서울) 휴게소

명품 닭개장
망향(부산) 휴게소

불향 제육볶음덮밥
서산(서울) 휴게소

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인삼 가마솥비빔밥
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흑돼지 김치찌개
곡성(순천) 휴게소

차돌박이 된장찌개
섬진강(순천) 휴게소

초당두부
강릉

한우떡덕
횡성

새뱅이
단양

이동삼 안동김
안동

청송
청송

누구나
건천

창녕
창녕

춘향
지리

새작삼
사천

‘고객과 전문가가 선택한 휴게소의 맛!’
고속도로휴게소 대표음식 20개를 소개합니다.



Edge Computing: Definition

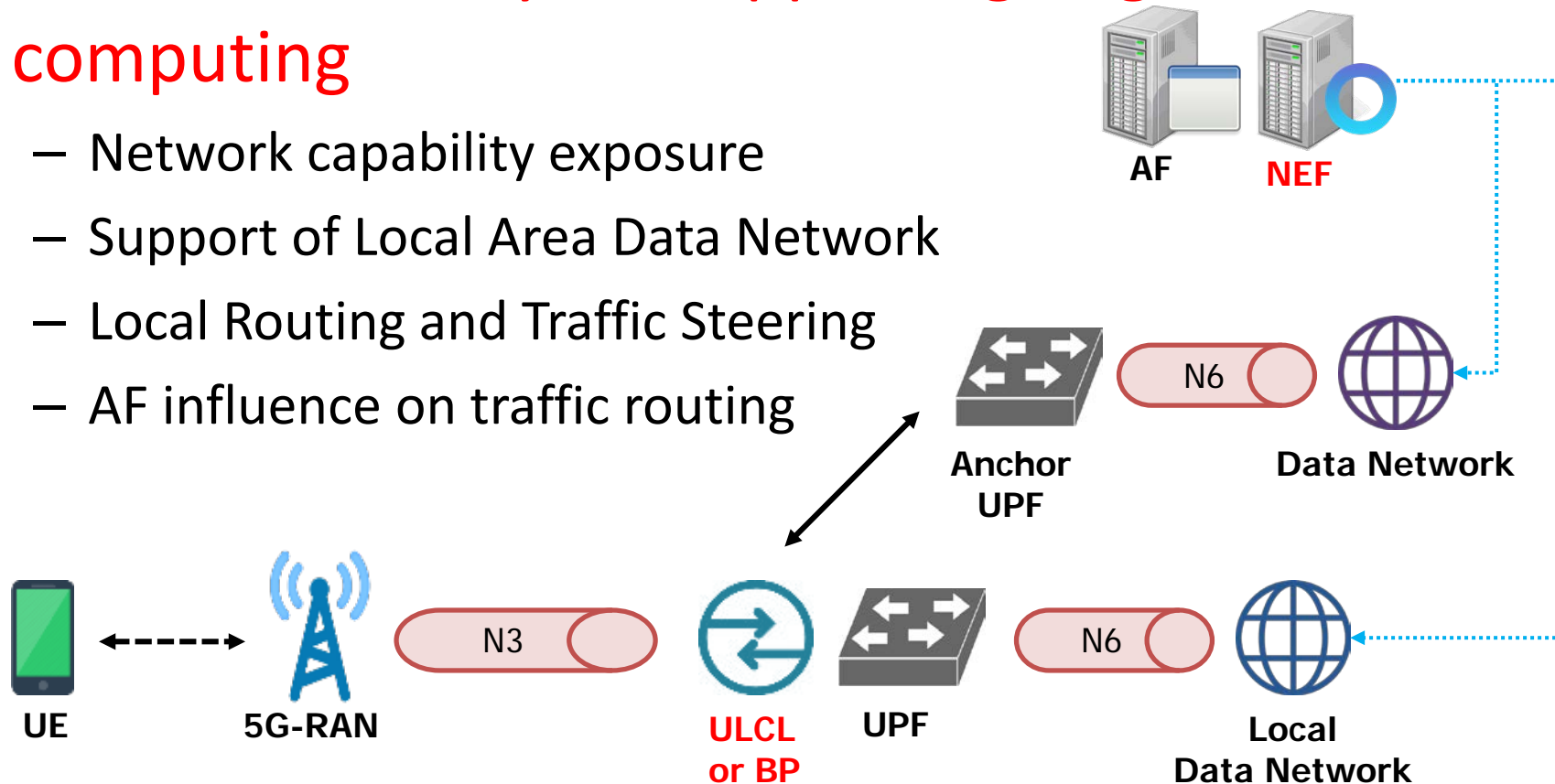
- **Edge computing**
 - A method of optimizing cloud computing systems "by taking the control of computing applications, data, and services away from some central nodes (the "core") to the other logical extreme (the "edge") of the Internet" which makes contact with the physical world (*from Wikipedia*)

IDC predicts that by 2025, nearly 45 percent of the world's data will be moved closer to the network edge. Fog is the only architecture to withstand this amount of data and enable IoT, 5G and AI.

Supporting Edge Computing in 5G

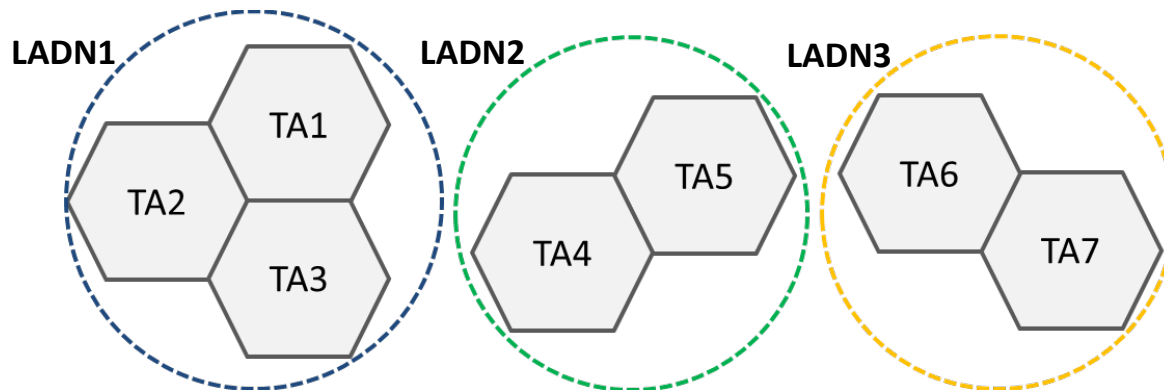
- The functionality for supporting edge computing

- Network capability exposure
- Support of Local Area Data Network
- Local Routing and Traffic Steering
- AF influence on traffic routing



Local Area Data Network

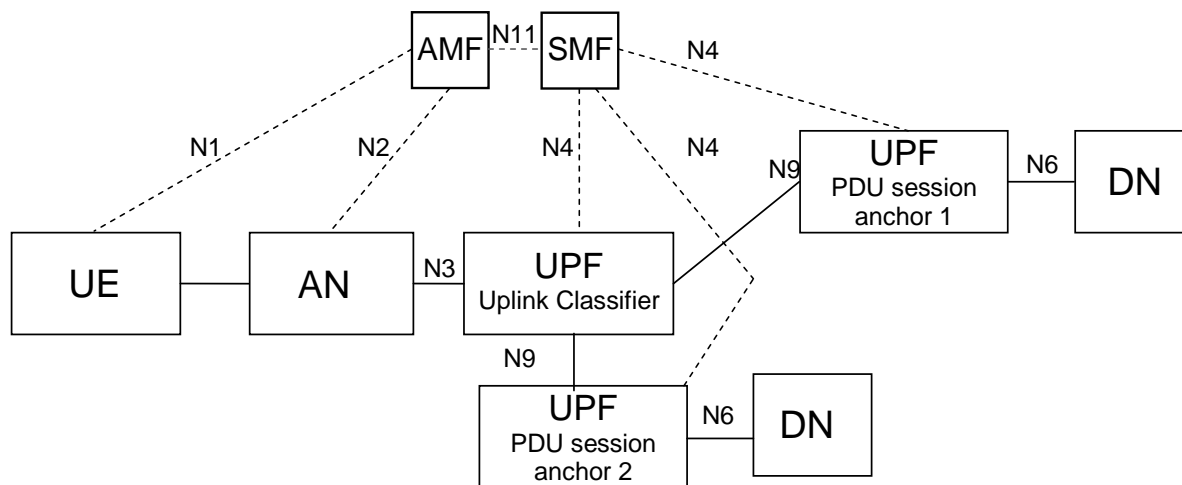
- **Local Area Data Network (LADN)**
 - Access to a DN via a PDU Session for a LADN is only available in a specific LADN service area
 - LADN Information is configured in the AMF
 - AMF tracks UE's location and notifies the SMF
 - relationship between UE location and a LADN service area (i.e. IN, OUT, UNKNOWN)



LADN service area is a set of Tracking Areas

Uplink Classifier (ULCL)

- Uplink Classifier (ULCL)
 - Diverting some traffic matching traffic filters provided by the SMF
 - Insertion and removal of an UPF supporting ULCL controlled by the SMF



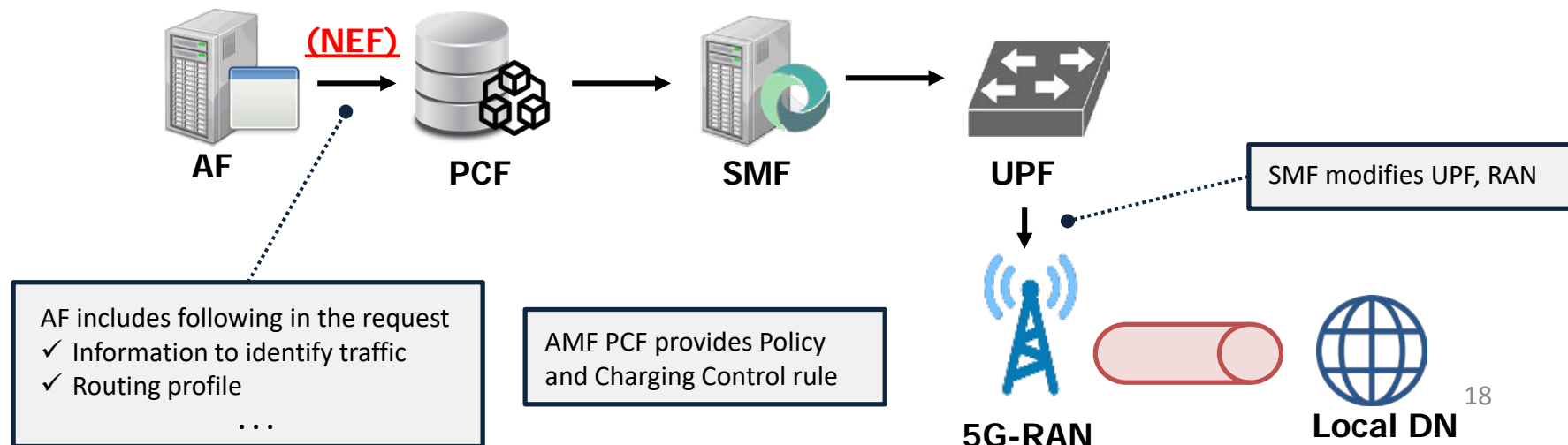
Local access to the same DN

Network Exposure Function

- Network Exposure Function
 - In the all-connected work of 5G, the customer's server housing the application needs to be allowed to communicate with the network functions of the mobile network
 - NEF: The capability exposure function used by the external network entities to interface with 5G core network

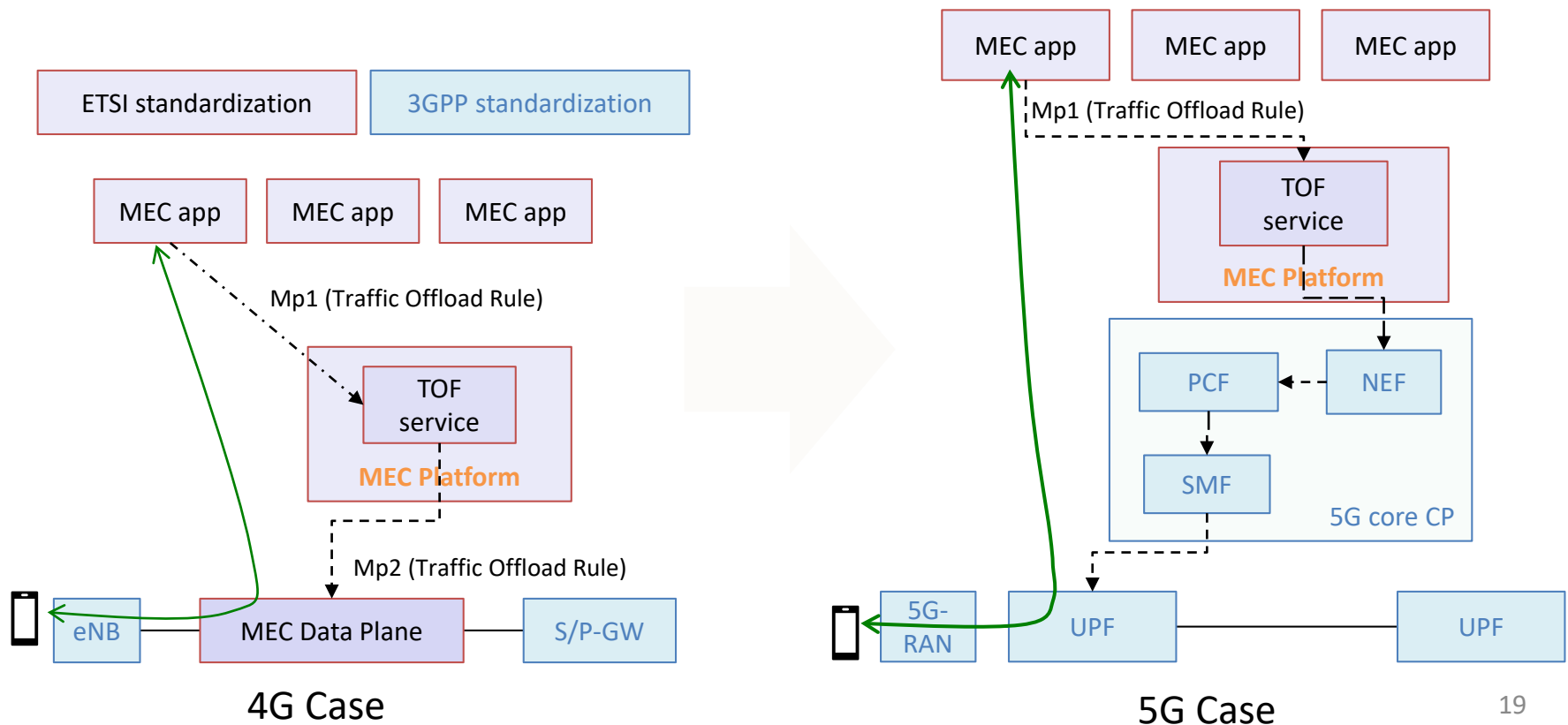
AF Influence on Traffic Routing

- AF influence on traffic routing
 - AF sends requests to influence SMF routing decisions for User Plane traffic of PDU Sessions
 - AF requests may influence UPF (re)selection and allow routing of user traffic to a local access to a Data Network



Advantage of 5G Edge Computing

- AF influence on traffic routing case
 - 4G: S1 breakout (Bump in the Wire)



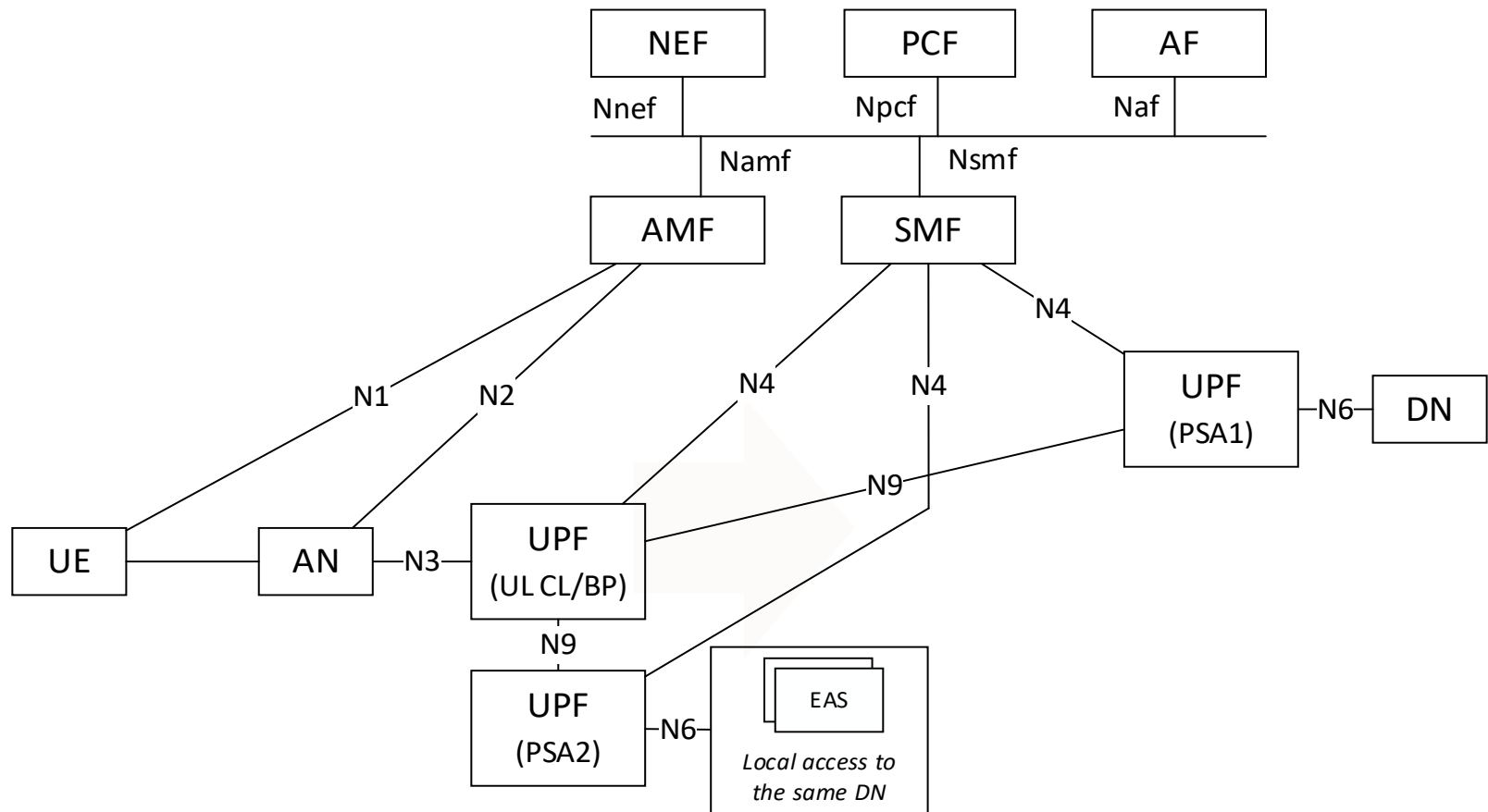
(Rel-17) Edge Computing in 5G

- **TR 23.748 (V0.1.0 (2019-10))**
 - Study on enhancement of support for Edge Computing in the 5G Core network (5GC)
- **TR 23.758 (V1.0.0 (2019-09))**
 - Study on application architecture for enabling Edge Applications

TR 23.748 (1/3)

- Study on enhancement of support for Edge Computing in the 5G Core network (5GC)
 - Objective 1: To study the potential system enhancements for enhanced Edge Computing support
 - Objective 2: To provide deployment guidelines for typical Edge Computing use cases, e.g., URLLC, V2X, AR/VR/XR, UAS, 5GSAT, and CDN

TR 23.748 (2/3)



TR 23.748 (3/3)

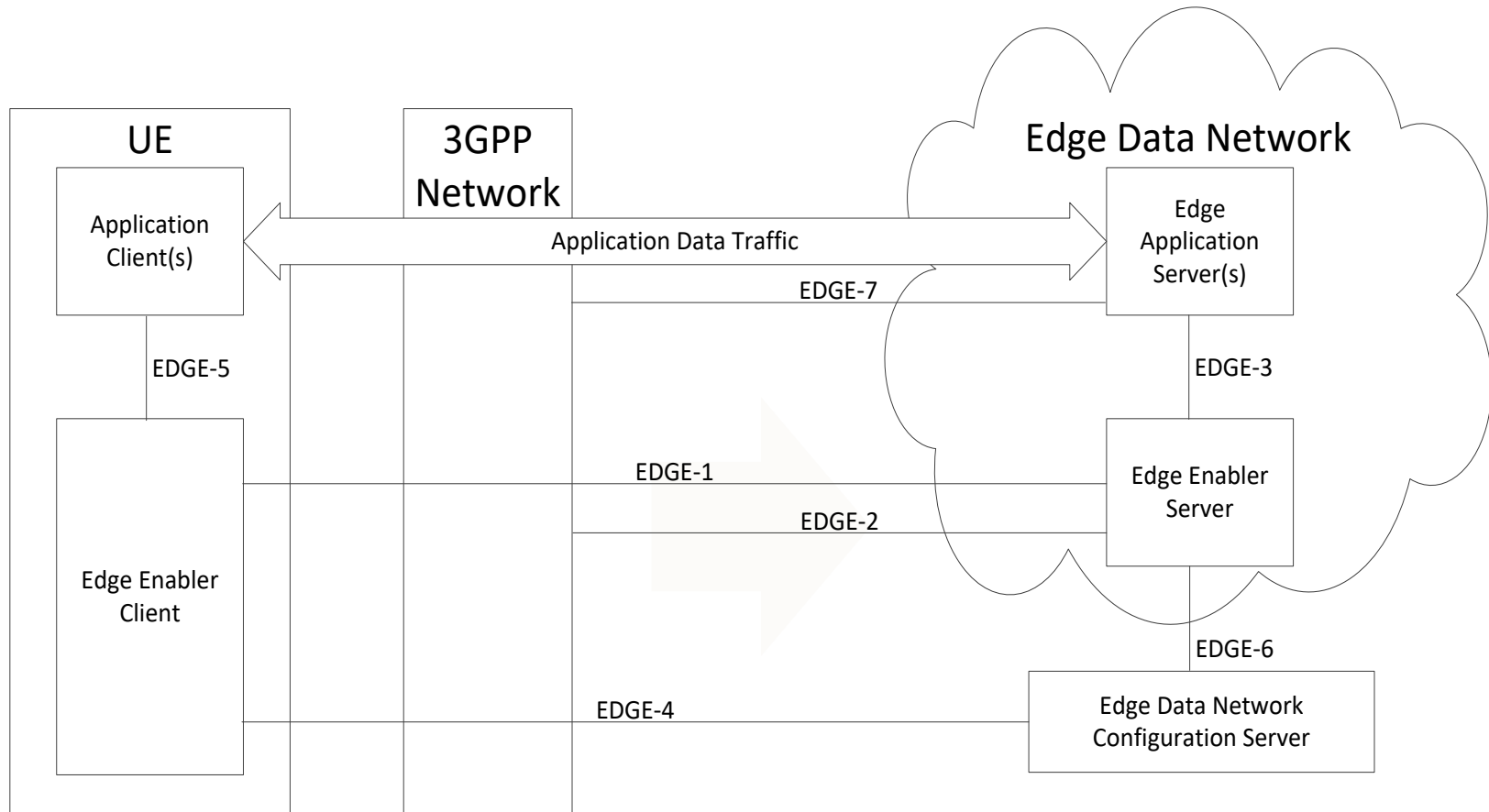
- Key Issues #1: Discovery of Edge Application Server
- Key Issues #X: TBA
- Solution #X: TBA



TR 23.758 (1/4)

- Study on application architecture for enabling Edge Applications
 - Identifying architecture requirements (e.g. discovery of edge services, authentication of the clients), supporting application layer functional model and corresponding solutions to enable the deployment of applications on the edge of 3GPP networks, with minimal impact to edge-based applications on the UE

TR 23.758 (2/4)



TR 23.758 (3/4)

- Key Issue 1: Service provisioning and configuration
- Key Issue 2: Edge Data Network discovery and registration
- Key Issue 3: Edge Application Server enablement on the Edge Hosting Environment
- Key Issue 4: Edge Application Server discovery
- Key Issue 5: Capability Exposure to Edge Application Server
- Key Issue 6: Edge Computing Service authorization

TR 23.758 (4/4)

- Key Issue 7: Flexible deployment
- Key Issue 8: Edge Data Network selection
- Key Issue 9: Preserving Service Continuity
- Key Issue 10: Dynamic availability
- Key Issue 11: User consent/authorization for network capability exposure to Edge Application Servers
- Key Issue 12: Lifecycle management
- Key Issue 13: Provision of QoS information for the Edge Application Server

Conclusion

► DATA CENTER / DATA C

Edge Computing:



NEWS ANALYSIS
CAROL WILSON,
Editor-at-large
7/24/2017

COMMENT (3)

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amazon web services = Edge?



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Thank You