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Introduction

3GPP CT status and overview

This presentation provides an overview of the ongoing work in 3GPP CT with status October 2023. The intention is to reflect the ongoing work in the different CT working groups.
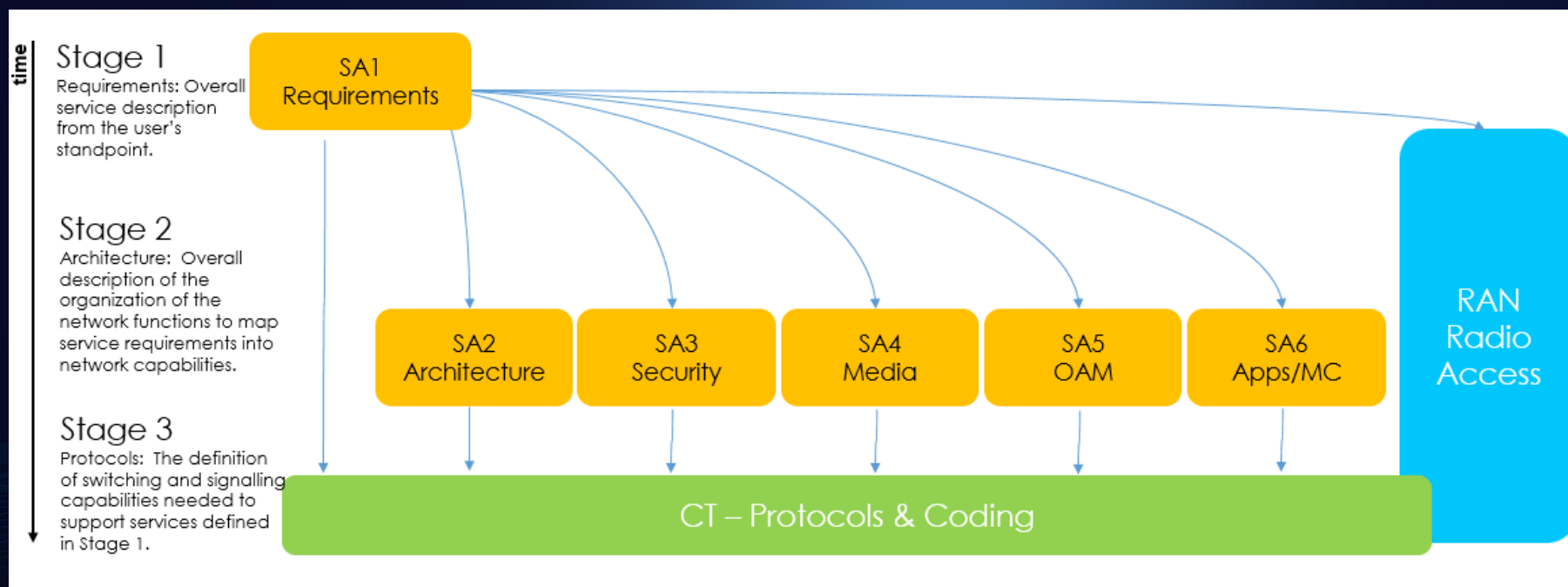
TSG CT (Core network and terminal) of 3GPP

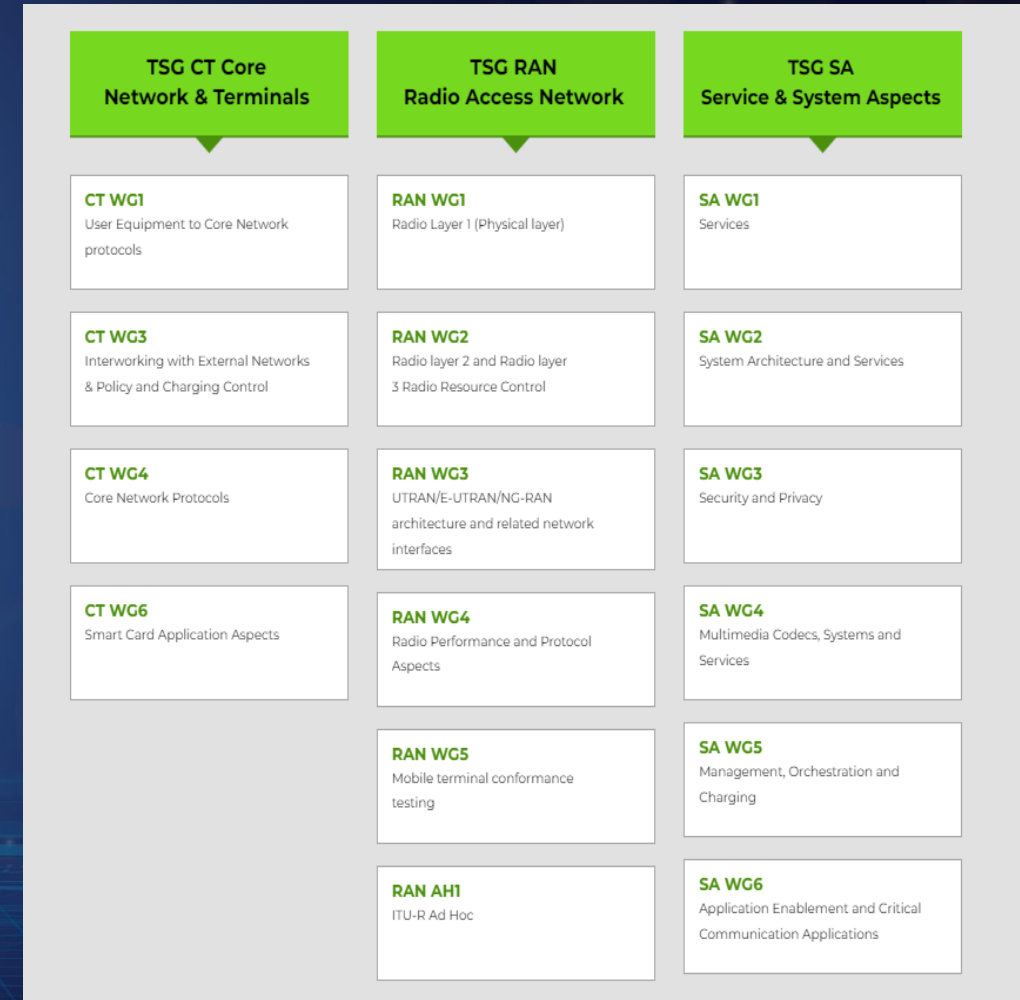**Product implementation shall follow CT specifications.**

The 3GPP TSG Core Networks and Terminals (**CT**) is responsible for the technical co-ordination of the specification work done in the following Working Groups:

CT WG1: production, the enhancement and the maintenance of specifications for **User Equipment (UE) to Core Network interfaces** for 5G Core, EPC, 3G PS/GPRS and 2G CS

CT WG3: production, the enhancement and the maintenance of specifications for **IWK between a CN and external Networks, PCC, QoS** mechanisms and Northbound APIs between the AS and the CN

CT WG4: specify the **protocols within the Core Network** for Numbering and Identification, MM, SM, Subscription data management, DNS procedure, Restoration, CP and UP Separation and roaming

CT WG6: **specifications for the 3GPP secure access applications**, which are based on secure platforms (e.g. UICC) developed by ETSI TC SCP and the interface between these applications with the Mobile Terminal

TSG CT Core Network & Terminals	TSG RAN Radio Access Network	TSG SA Service & System Aspects
CT WG1 User Equipment to Core Network protocols	**RAN WG1** Radio Layer 1 (Physical layer)	**SA WG1** Services
CT WG3 Interworking with External Networks & Policy and Charging Control	**RAN WG2** Radio layer 2 and Radio layer 3 Radio Resource Control	**SA WG2** System Architecture and Services
CT WG4 Core Network Protocols	**RAN WG3** UTRAN/E-UTRAN/NG-RAN architecture and related network interfaces	**SA WG3** Security and Privacy
CT WG6 Smart Card Application Aspects	**RAN WG4** Radio Performance and Protocol Aspects	**SA WG4** Multimedia Codecs, Systems and Services
	RAN WG5 Mobile terminal conformance testing	**SA WG5** Management, Orchestration and Charging
	RAN AH1 ITU-R Ad Hoc	**SA WG6** Application Enablement and Critical Communication Applications

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Working on 5G Advanced Standard

4G
2009

4G-A
2015

5G
2020

5G-A
2024

Self-driving cars

Work &Play in the Cloud

Smart City

Augmented Reality

Industry Automation
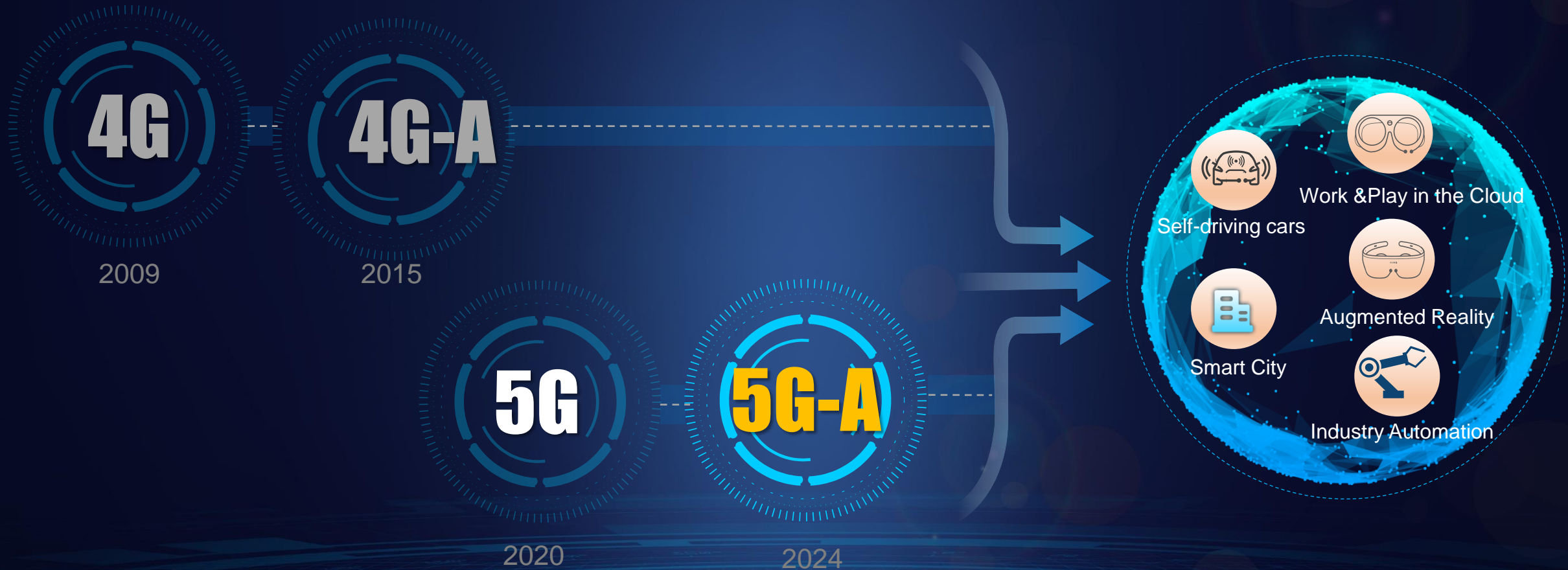
3GPP Rel-18 is the first release of 5G-A Network

Release 18 timeline

Global ICT Standards Conference
글로벌 **ICT** 표준 컨퍼런스 2023
3GPP

2021		2022		2023		2024	

TSGs #93-e **Sep** #94-e **Dec.** #95-e **Mar.** #96 **Jun** #97-e **Sep.** #98-e **Dec.** #99 **Mar.** #100 **Jun.** #101 **Sep** #102 **Dec.** #103 **Mar.** #104 **Jun.** #105 **Sep.**

SA1 Stage 1 100%

RAN Content def.

RAN4 content def.

Release 18

Stage 2 (SA2, SA6,...) Normative

RAN1 Maint.

RAN Completion (RAN2/3/4core) Maint. RAN4_Perf

Stage 3 (CT & SA)

ASN.1 & Open APIs

**Note: All starting dates are indicative**

Now

CT Statistics: Approved CRs

5G

- Rel-15 freeze
  - Stage 2 #77 (Sept 2017)
  - Stage 3 #80 (June 2018)
  - OpenAPI#81 (Sept. 2018)

- Rel-16 freeze
  - Stage 2 #84 (june 2019)
  - Stage 3 #87 (March 2020)
  - OpenAPI#88 (June 2020)

- Rel-17 freeze
  - Stage 2 #92 (June 2021)
  - Stage 3 #95 (March 2022)
  - OpenAPI#96 (June 2022)

5G Advanced

- Rel-18 freeze
  - Stage 2 #100 (June 2023)
  - Stage 3 #103 (March 2024)
  - OpenAPI#104 (June 2024)
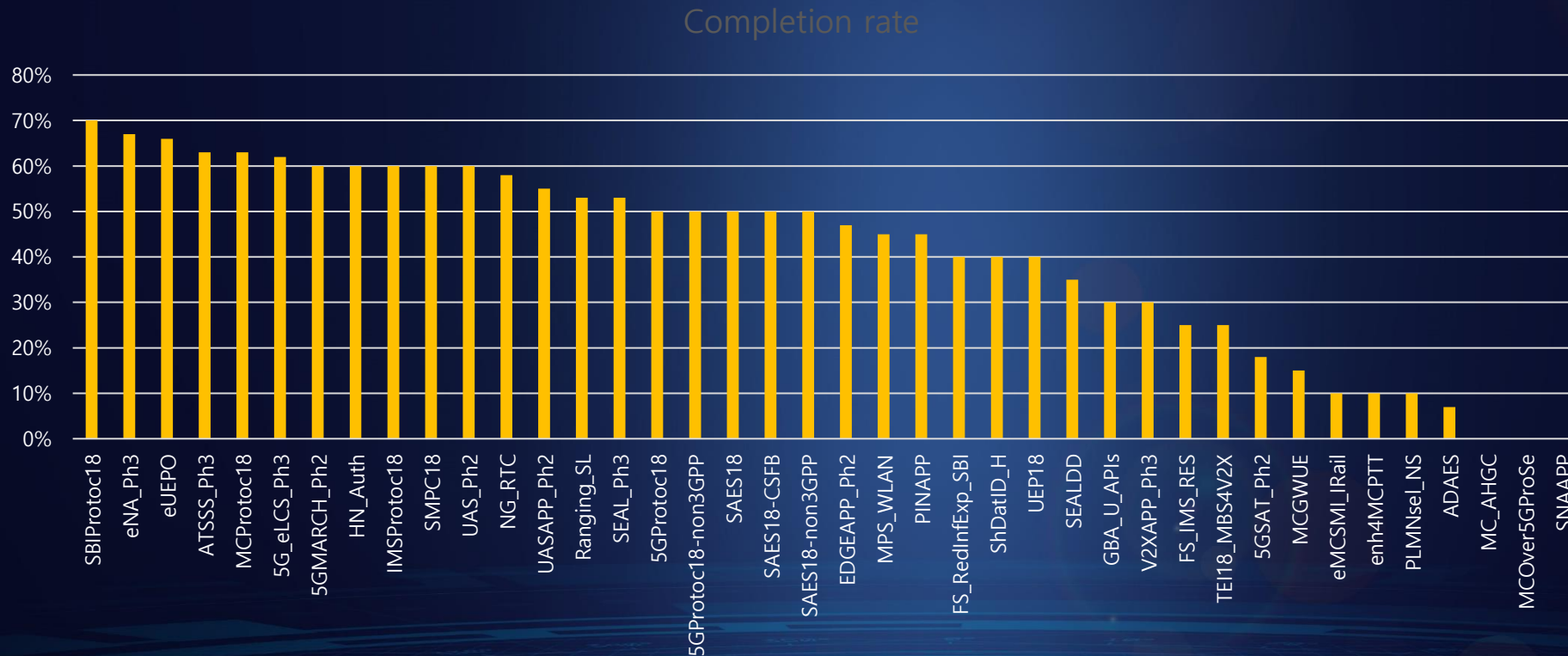

CR statistics
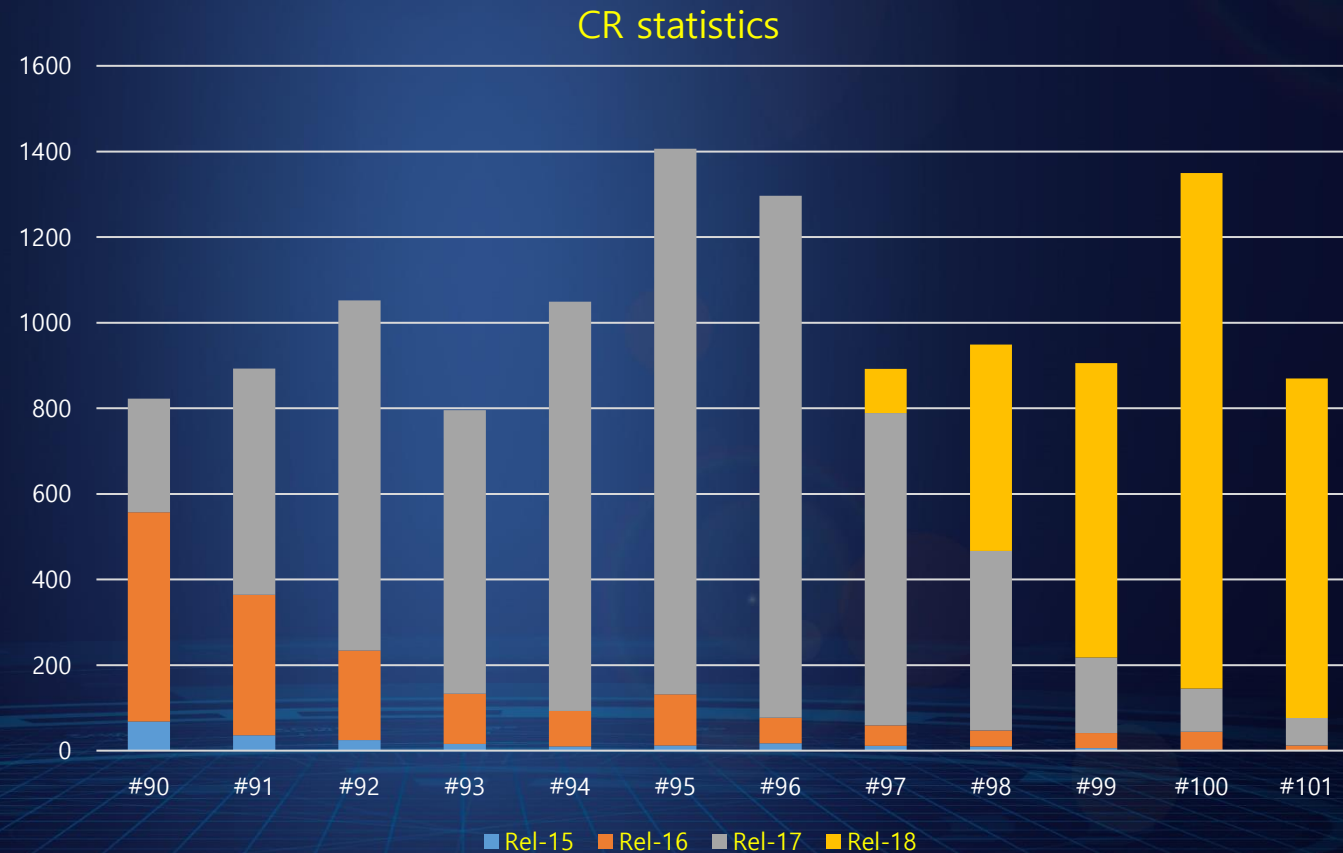
Feature status Rel-18 in CT (page 1 of 2)

Completion rate
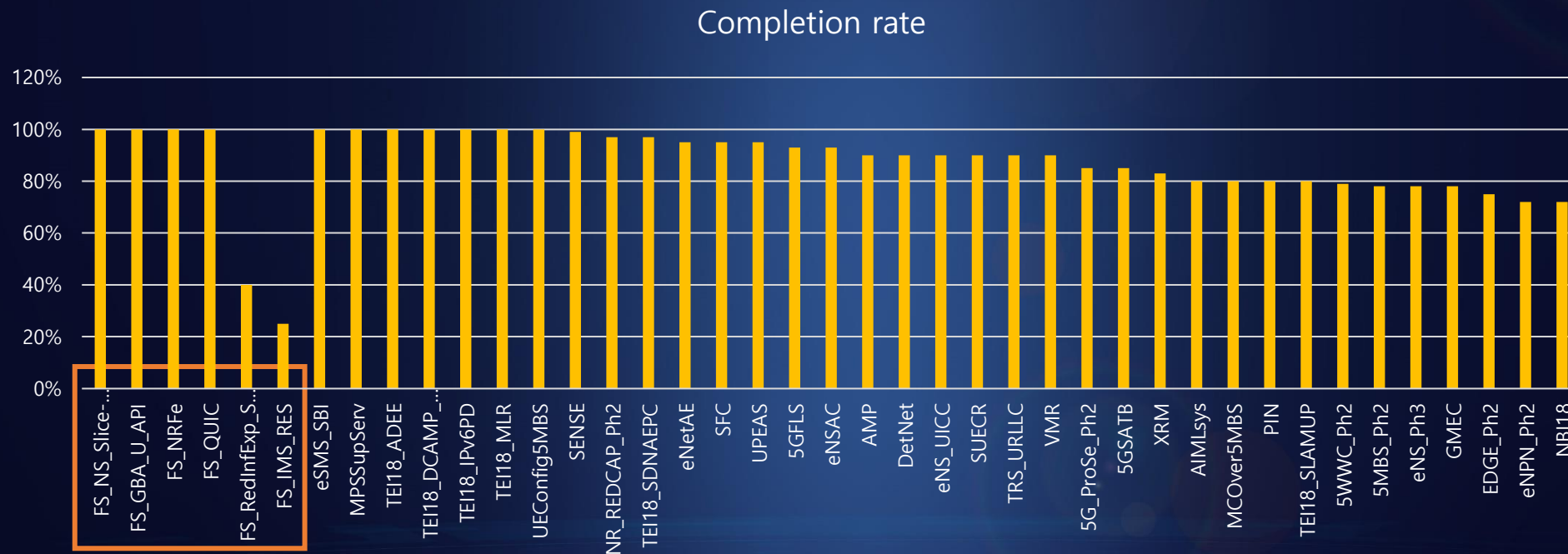
Except the requirements from SA/RAN, CT will also approve some own study items or work items for net work function enhancement or core network reliability.

Feature status Rel-18 in CT (page 2 of 2)

Completion rate

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Rel-18 SIDs

**Completed study on QUIC
(A UDP-Based Multiplexed and
Secure Transport)**

- ❑ QUIC should not be used as transport
  for Service bases interfaces (control
  plane) we should stick to TCP in
  5G advanced

**Completed the study on NRF (Network Repository
Function) API enhancements to avoid signalling
and storing of redundant data**

- ❑ avoid data storage overhead in the NRF due to many
  NFs registering with identical
  information,

- ❑ avoid signalling overhead

- ❑ avoid processing overhead resulting
  e.g. from signalling overhead.

- ❑ In CT4 in October new WID is agreed "NRF API enha
  ncements to avoid signalling and storing of redundan
  t data" to introduce the result of the study in normati
  ve TSs.

Rel-18 SIDs

New Study on IMS Disaster Prevention and Restoration Enhancement

Ongoing Study on Reducing Information Exposure over SBI

❑ To create/enhance corresponding
the restoration mechanism to
support the normal use of voice,
video and SMS services in the IMS network (e.g. b
ypass the involved
faulty network functions or links).

❑ To create/enhance corresponding network disaster
prevention mechanisms
(e.g. to prevent registration with missing paramete
r or incorrect parameters
repeatedly).

This work is triggered by LSs from GSMA asking e.g. for
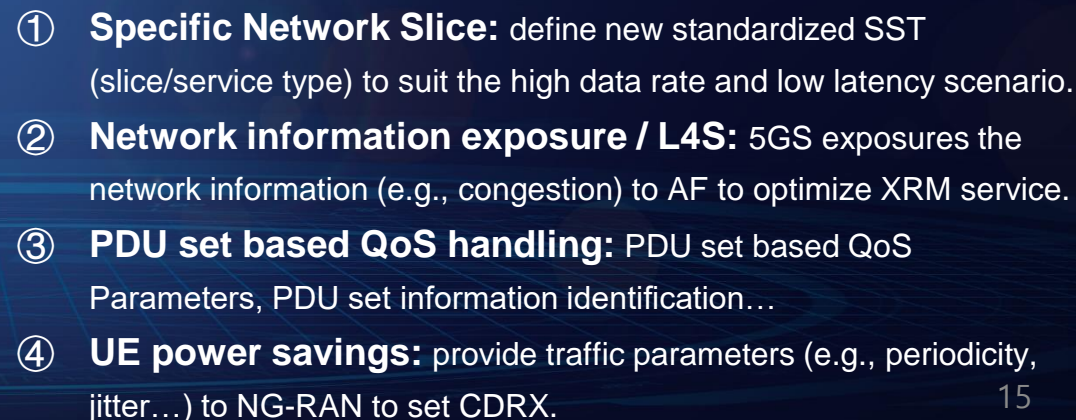possibilities to Prevent consumer NFs from receiving more
data than they require

❑ To study the need and potential solutions for avoiding
excessive data exposure over SBI. ,

❑ To study the need and potential solutions for avoiding i
ndirect access to data via, e.g. subscriptions, even as dir
ect access to the data-set is not allowed.

Rel-18 Feature: XRM

Status: Architecture Enhancements for XR (Extended Reality) and media service (~80%)

Scenario: UL/DL high data rate, real-time interaction

Busines

| exhibition | medical assistance | manufacture | industrial-design |

Customers

| game | education | social | shopping |

The blind forwarding mode of network cannot ensure the high experience requirements of XRM services

Key Standard work in CT:
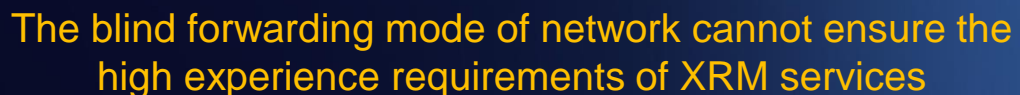
- **Interface enhancement:** N3, N4, N7, N5 …
- **PDU set based handling**
- **Network exposure**
- **UE power saving**
- …

End to End solution

NEF
PCF — SMF — AMF
- differentiated QoS PSDB, PSER
5-tuples, frame rate…
N4 rule
QoS profile
XR Server
UL data
DL data
QoS flow
network exposure ❷
UPF
status of air interface
RAN
UE
PDU set information
❸ ❹
- identification - L4S
information via GTP-U
- PDU set handling - L4S
CDRX
❶ **HDLLC Slice**

① **Specific Network Slice:** define new standardized SST (slice/service type) to suit the high data rate and low latency scenario.

② **Network information exposure / L4S:** 5GS exposures the network information (e.g., congestion) to AF to optimize XRM service.

③ **PDU set based QoS handling:** PDU set based QoS Parameters, PDU set information identification…

④ **UE power savings:** provide traffic parameters (e.g., periodicity, jitter…) to NG-RAN to set CDRX.

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Rel-18 Feature: eUEPO

Status: eUEPO, CT aspects of enhancement of 5G UE Policy

Breakpoints for to consumer network slicing

- **URSP (UE Route Selection Policy) enables the UE to select the network slice for the application/service based on the URSP policy delivered by the network side.**
- **In to consumer market, there are a huge number of APPs. It is difficult to manage APP ID traffic descriptors in URSP for traffic-slice mapping.**
- **Operators need another type of traffic descriptor to make URSP more efficient to manage. Traffic Categories specified in GSMA can be the right direction to solve the problem.**

Key Standard work in CT:

- **Enhance connection capabilities in TS 24.526 based on the traffic categories specified in GSMA.**
- **Expand the operator specific connection capability identifier which can match against a operator specific traffic category.**

End to End solution

Connection Capabilities (TS 24.526)
(i.e. Traffic Categories from GSMA)

IMS
SUPL
Internet
IoT delay-tolerant
IoT non-delay-tolerant
Downlink streaming
Uplink streaming
Vehicular communications
Real-time interactive
Unified communication traffic
Background
Mission Critical Communication
Low latency loss tolerant communication

APP 1	S-NSSAI 1
APP 2	S-NSSAI 2
...	...
APP n	S-NSSAI n

Thousands of APP ID based rules

V.S.

IMS	S-NSSAI 1
Internet	S-NSSAI 2
...	...
Background	S-NSSAI n

Dozen of rules

URSP via NAS

① **URSP maps Traffic Categories to Network Slices.**
② **APP traffics match to Traffic Categories by APP/OS in UE.**

Connection Capabilities make URSP much easier for traffic-slice mapping

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Rel-18 Feature: NG_RTC

Status: **Next Generation Real Time Communication (~58%)**

Scenario:

- Extend the IMS network to support data channel and AR communication

Key Standard work in CT:

- Specify the IMS data channel applications
- Update the usage of SIP and SDP protocol to support IMS data channel
- Define MF (Media function) services
- Define IMS AS (Application Server) services
- Update the NRF services to support DCSF and MF service registration and discovery
- Define the Sc interface and update HSS services and Sh interface to support data channel service profile

End to End solution
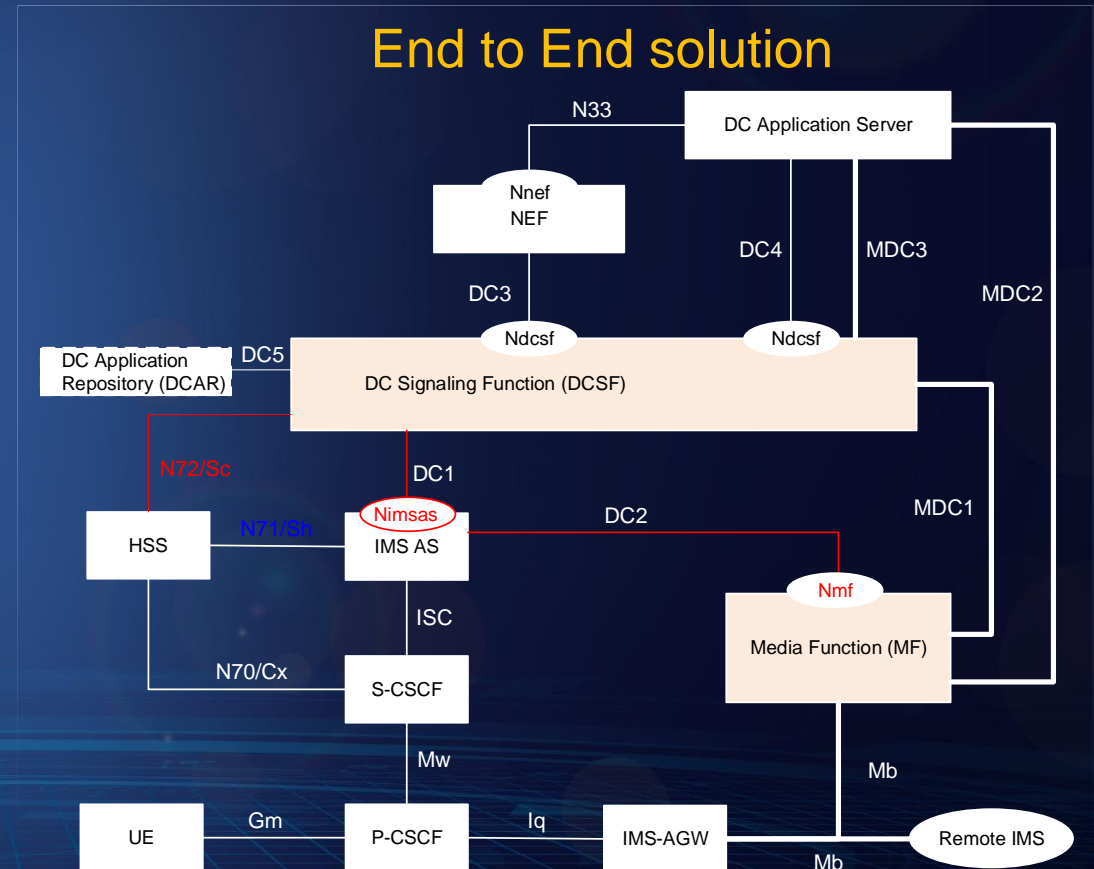
Rel18 Feature: NR_RedCap_Ph2

Status: 5GS support of NR RedCap UE with long eDRX for RRC_INACTIVE State **(~97%)**

Scenario:

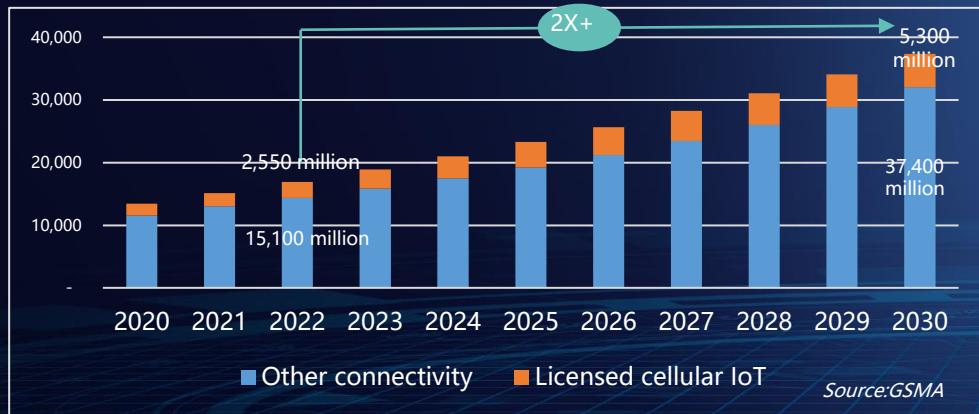**Electricity**   **Industry**   **Security protection**   **Vehicle-mount ed/wearable**   **4G migration**
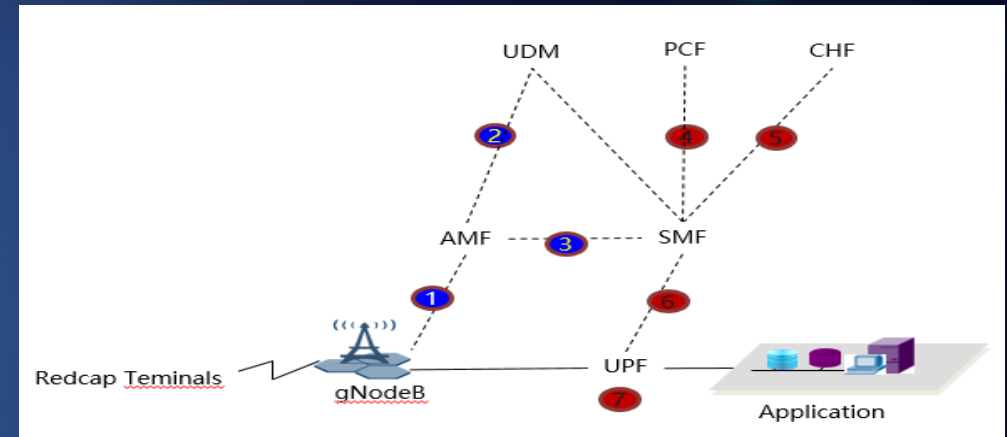
Industry situation:

- **Overall scale:** **Currently, 2.5 billion connections worldwide, with a double growth of 5.3 billion connections @ 2030**

2X+

40,000

5,300 million

30,000

2,550 million

20,000

37,400 million

15,100 million

10,000

-

2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030

■ Other connectivity ■ Licensed cellular IoT
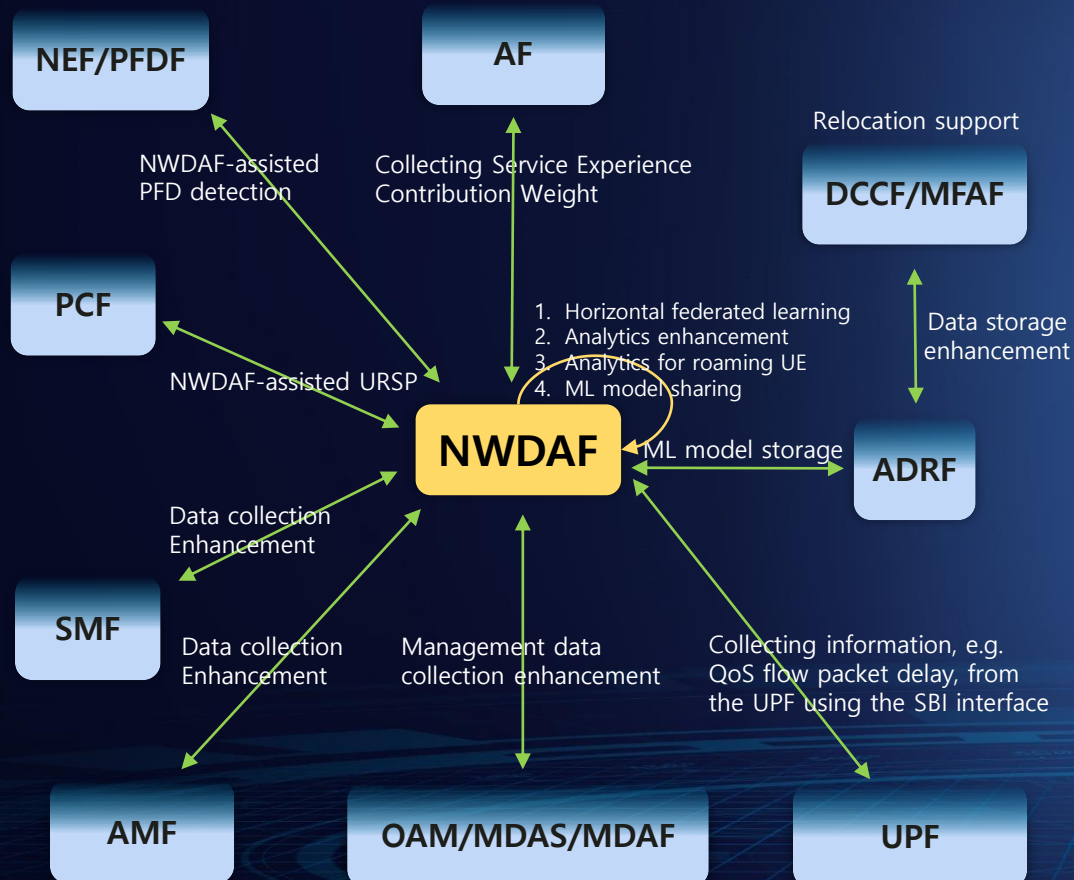
Source:GSMA

End to End solution

Technical principles:
1. The AMF obtains the UE Redcap capability from the RAN.
2. The AMF identifies that the UE's RATtype is NR_REDCAP and obtains subscription data from the UDM.
3. The AMF sends an (Nsmf_PDUSession_CreateSMContext Request) message to the SMF. In the (Nsmf_PDUSession_CreateSMContext Request) message, RATtype is set to NR_REDCAP.
4. The SMF sends an Npcf_SMPolicyControl_Create message to the PCF. In the message, RATtype is NR_REDCAP. The PCF performs QoS bandwidth control based on the subscription.
5. The SMF sends an Nchf_ConvergedCharging_Create message to the CHF. In the message, the RATtype is NR_REDCAP. In the CDR generated by the CHF, the subscriber is marked as a Redcap subscriber.
6. The SMF initiates an N4 session establishment procedure with RATtype set to NR_REDCAP. The UPF creates a PFCP session based on the RAT.
7. The UPF performs functions such as header enrichment, QoS guarantee, and bandwidth for Redcap subscribers.
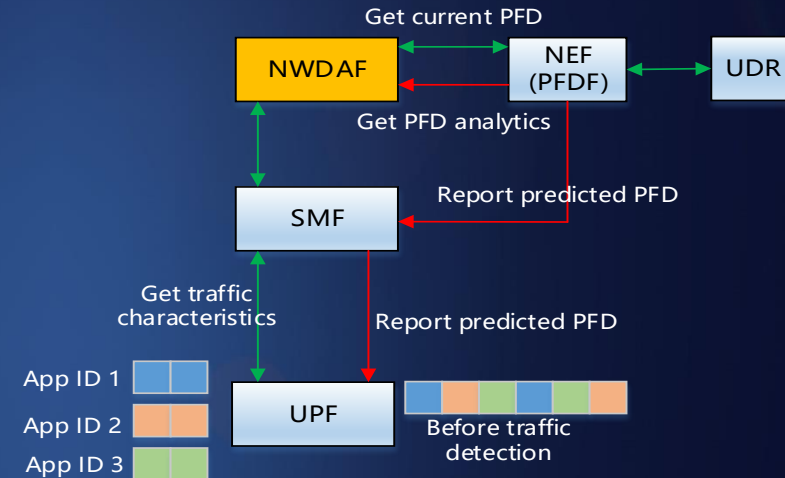
Rel-18 Feature: eNA_Ph3

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Global ICT Standards Conference 2023

Status: architecture evolution and use case enrichment for eNA_Ph3 (Enablers for Network Automation, Phase 3) (~68%)
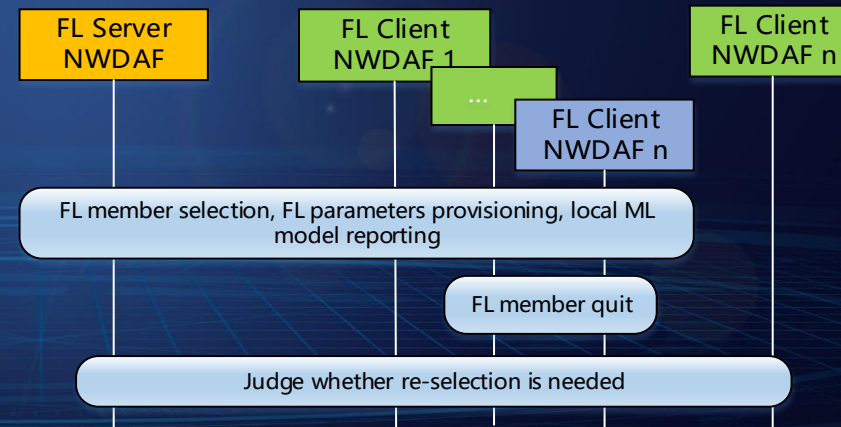
Key Standard work in CT:

NEF/PFDF

AF

Relocation support

DCCF/MFAF

NWDAF-assisted PFD detection

Collecting Service Experience Contribution Weight

PCF

1. Horizontal federated learning
2. Analytics enhancement
3. Analytics for roaming UE
4. ML model sharing

Data storage enhancement

NWDAF-assisted URSP

NWDAF

ML model storage

ADRF

Data collection Enhancement

SMF

Data collection Enhancement

Management data collection enhancement

Collecting information, e.g. QoS flow packet delay, from the UPF using the SBI interface

AMF

OAM/MDAS/MDAF

UPF

Typical scenarios and end to end solution

Get current PFD

NWDAF — NEF (PFDF) — UDR

Get PFD analytics

SMF

Report predicted PFD

Get traffic characteristics

Report predicted PFD

App ID 1
App ID 2
App ID 3

UPF

Before traffic detection

PFD prediction

If the AF does not update the initial PFD (Packet Flow Description) in time or does not update it any more, the NWDAF can collect the traffic Characteristic information from UPF and the initial PFD from the PFDF to predict the current PFD.

FL Server NWDAF

FL Client NWDAF 1

FL Client NWDAF n

...

FL Client NWDAF n

FL member selection, FL parameters provisioning, local ML model reporting

FL member quit

Judge whether re-selection is needed

Federated Learning

The NWDAF containing MTLF can leverage FL (Federated Learning) to train an ML model across multiple decentralized entities holding local data set, without exchanging/ sharing local data set.

Rel-18 Feature: AIMLsys

Status: System Support for Artificial Intelligence (AI)/Machine Learning (ML) -based Services (~60%)

Scenario:
- Support of application layer **AI/ML.**
  Distribution, transfer and identify traffic characteristics of AI/ML model.
  Training for various applications

Key Standard work in CT:
- Monitoring of network resource utilization to support the Application AI/ML operations
- Exposore of 5GC information to authorized 3rd party for Application AI/ML operations
- Enhancement of external parameter provisioning in 5GC to assist the Application AI/ML operations
- Enhancement in 5GC to enable Application AI/ML traffic transport
- Enhancement of QoS and Policy control to support Application AI/ML data transport over 5GS

End to End solution

- Policy framework is extended to leverage the data analytics of the target AoI (area of interest) capacity and performance for the corresponding UE(s) to determine the viable schedule for the application AI/ML data transport

- New monitoring network resource events include the measurement of data rate or prediction of the network resource utilization for the support of application layer AI/ML operation.

- Extending 5GC information exposure authorized third party to indicate the UE or network conditions and performance predictions on, e.g., UE location, load, and QoS

Rel-18 Feature: PIN

Status: Personal IoT Networks (~80%)

Scenario:

- Support the 3 types of personal IoT devices: communication, gateway and management capabilities

Key Standard work in CT:

- PIN communication (directly or via gateways)...
- policy and parameters provisioning for PIN ...
- UE Policy Control Service to support URSP enhancement for PIN.
- UDM to support PIN, including new subscription data, and PIN profile..
- updates of SMF to anchoring PDU Sessions of PEGCs and PEMCs based on a combination of DNN, S-NSSAI;..
- updates of UPF on traffic forwarding functionalities

End to End solution

Each PIN has at least a PEGC (PIN Element Gateway Capability) and a PEMC (PIN Element Management Capability)

- support for PIN management
- support for requesting PIN Communication for PEGC;
- support for application server discovery procedure;
- support for role replacement procedure for PEMC and PEGC;
- support for PIN service switch procedures, with and without PIN server support;
- support for PIN service continuity procedure;

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IEEE and IETF registrations

- For IANA IANA Pending Request Registry web page was created
  For Rel-18 IANA request will be performed once the new definitions to be requested are stable

- CT replied to IEEE Registration Authority Committee (RAC) regarding allocation of an EtherType value per 3GPP TS 24.193 v18.0.0. and ask to allocate a value.

- Triggered by this request we agreed that we should have a mechanism similar as for IANA requests. A web page is created
  IEEE RAC registration request tracking

Both pages are accessible today on CT1 WG webpage (trial phase) but should be accessible via the delegate corner after next 3GPP web side improvements (expected to be happen in December 2023).

IETF-3GPP Coordination meeting

- A side meeting is held during each IETF meeting
  - Participants are: CT chair, IETF liaison, IESG members, IAB members, WG chairs and delegates. About 40 attendees.
  - Topics to be discussed are:
    - Liason statement(s),
    - referenced documents by 3GPP and there status
    - Necessary action to improve the coorperation.

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Summary

- CT groups work on protocol definition related to UE and Corenetwork equipments, and shall be followed by the product implementation to avoid interoperability problem.

- CT main focus is on Rel-18, except for the WIDs agreed in stage2, there are new independent SIDs and WIDs in CT.

- Overall CT WGs progress on Rel-18 WIs are within the timeframe

- On some issues CT WGs have asked clarification from SA WGs.

- The status of the related WI can be derived from the workplan provided on the 3GPP webpage.

Information

- Rel-19 currently not discussed in CT, in principle we should take the experience from previous releases into account during the planning phase in the upcoming plenary #102.

- 6G timeline discussion are also expected to start at plenary #102

Thank you

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