3GPP 5G CoreNetwork Status

TSG CT Chairman
Georg Mayer (Huawei)
Outline

› 5G in 3GPP (CT)
  › Timeline
  › Landscape
  › Transformation of the CoreNetwork

› Service Based Architecture
  › Framework, Roles, Services
  › Protocols, API Operations

› Status of Other 5G Issues
  › Northbound APIs
  › Network Slicing
  › Misscion Critical Services
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# 5G Timeline

<table>
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<tr>
<th>Year</th>
<th>Q1</th>
<th>Q2</th>
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- **Rel-14 / 5G Study**
- **Rel-15 / 5G Phase 1**
- **Rel-16 / 5G Phase 2**

### Requirements
- P1 Studies
- P1 Normative
- P2 Studies
- P2 Normative

### Architecture
- P1 Studies
- P1 Normative
- P2 Studies
- P2 Normative

### Protocols
- P1 Studies
- P1 Normative
- P2 Studies
- P2 Normative

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Transformation of the Core Network

- Functional entities
- Single Core
- Dedicated protocols
- Service Based (SBA/SBI/NAPS)
- Virtualization & Slicing
- Softwarization / Cloudification
- Application Programming Interfaces
- Harmonized protocols (HTTP ...)
- Exposure to 3rd Parties
- Backward & Forward Compatibility

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Service Based Architecture

- **NEF**: Network Exposure Function
- **NRF**: Network Repository Function
- **PCF**: Policy Control Function
- **UDM**: Unified Data Management
- **AF**: Application Function
- **AUSF**: Authentication Server Function
- **AMF**: Access & Mobility Management Function
- **SMF**: Session Management Function
- **UE**: User Equipment
- **(R)AN**: (Radio) Access Network
- **UPF**: User Plane Function
- **DN**: Data Network

Network Function (NF)
Service Based Interface (SBI)
Service Based Architecture (SBA)
SBA Service Framework

NF Service Consumer
(e.g. PCF)

NRF
Network Function
Repository Function

NF Service Producer
(e.g. AMF)
SBA Service Framework

NF Service Consumer (e.g. PCF)

NRF Network Function Repository Function

NF Service Producer (e.g. AMF)

(1) NF Service Registration
SBA Service Framework

NF Service Consumer (e.g. PCF)

NF Service Producer (e.g. AMF)

NRF Network Function Repository Function

(1) NF Service Registration
(2) NF Service Discovery
(2a) NF Service Authorization
SBA Service Framework

NF Service Consumer (e.g. PCF)

(2) NF Service Discovery
(2a) NF Service Authorization

(3) NF Service Request
(3a) NF Service Authorization

NF Service Producer (e.g. AMF)

NRF Network Function Repository Function

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SBA Example NF Services

› AMF (Access Management Function)
  › Communication – enables other NFs to communication with the UE / the access network
  › Mobility Event Exposure – other NFs can subscribe to notifications about the UE’s mobility events

› SMF (Session Management Function)
  › PDUSessions – Protocol Data Units exchange with the UE, including policy and charging.

› UDM (Unified Data Management)
  › Context – provides information about UEs serving NF & status
  › UEAuthentication – provides authentication data & info
5G SBI Protocols

- HTTP/2 adopted as the application layer protocol for the service based interfaces
- TCP adopted as the transport layer protocol;
- Use of QUIC, binary encoding (e.g. CBOR) and other aspects are left FFS for possible support in future releases
- JSON adopted as the serialization protocol;
- REST-style service design whenever possible and custom (RPC-based) methods otherwise.
REST

- Representational State Transfer
- distribute web services *paradigm* (not a architecture, not a protocol)

**Principles**
- Client-server based
- Stateless
- Addressable Resources (unique URI)
- everything is a resource (service trigger, dynamic data, ...)

**Example:**
- temperature in a room (continuously provided by a sensor) is a unique uri, `https://example.home/living-room/1.0/temp?format=celcius`

**3GPP AMF Service**
`https://amf3.slice5.operator.3gpp/ Namf_Communication /1.0/?query`
HTTP/2

› HTTP 1.1
  › browsing the web
  › web applications / transporting API calls and responses
  › widely deployed, lots of experience, huge developer community

› HTTP 2
  › natural evolution of HTTP 1.1
  › already widely accepted and deployed
  › text & binary encoding
  › header compression, stream multiplexing, flow control
QUIC

- QUIC = Quick UDP Internet Connections
- Replacement of TCP/TLS transport
- Resolving several problems (head-of-line blocking, multiplexing)
- Currently under development by IETF
- Will not be finished by end of Rel-15, but most likely during Rel-16
- Several open issues, e.g. privacy & security requirements need to weight against needs of network management
Example API Operations

**Query (Resource)**
- e.g. UE’s Authentication Data @UDF

1. GET …/resource?query_parameter=value ()
2. 200 OK (ResourceRepresentation)

**Subscription**
- e.g. to UE’s mobility events @AMF

1. POST …/xyz_subscriptions (XyzSubscription)
2. 201 Created (XyzSubscription)

**Notification**
- e.g. about UE mobility events

1. POST {callback_ref} (Notification)
2. 204 No Content

NF service consumer (taking the role of a HTTP server)

NF service producer (taking the role of a HTTP client)
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Northbound APIs (NAPS)

› NEF – Network Exposure Function
› Core Network capabilities exposed to 3rd parties
› Service specific
  › e.g. oneM2M specific (NAPS)
› Framework study currently ongoing (SA6)
› Also here: HTTP & REST
Mission Critical Services

- Mission Critical work is essential part of 3GPP since Rel-13
- Rel-13 MCPTT (MC Push to Talk) was completed
- Rel-14 included 3 MC Services:
  - Improvements to MCPTT
  - Mission Critical Video
  - Mission Critical Data
- Only a stand-alone subset of these services was completed in R14.
- Rel-15 therefore has three more MC Service related Work Items
- Rel-15 will also see other MC related work, e.g. for railroads
Thank You

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