3GPP & IETF Collaboration on 5G

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Partners

ARIB — Japan
atis — North America
CCSA — China
tsdsi — India
TTA — Korea
TTC Telecommunication Technology Committee — Japan
ETSI — Europe

Member Oranizations & Companies of Partners participate in 3GPP TSGs & WGs

3GPP
A GLOBAL INITIATIVE

PCG
Project Coordination Group

TSG RAN
Radio Access Networks

RAN1
radio layer 1

RAN2
radio layer 2 & 3

RAN3
RAN-CN interface

RAN4
radio performance

RAN5
terminal testing

RAN6
legacy radio

TSG SA
Services & Architecture

SA1
services & requirements

SA2
architecture

SA3
security

SA4
Codec

SA5
management

SA6
(mission critical) applications

TSG CT
Core Network & Terminal

CT1
end-2-end aspects

CT3
interworking with external networks

CT4
network internal protocols

CT6
smart card applications

How 3GPP works

› 3 Stages of specification

  › Stage 1: Requirements

  › Stage 2: Architecture

  › Stage 3: Protocols

› Consensus driven (tougher than rough)

› Contribution driven

  › you need to participate in order to get your ideas discussed

› Face-to-face meetings

› Releases with strict deadlines

3GPP so far

› 3G / UMTS

  › Circuit Switched (CS) & Packet Switched (PS) Domains in parallel

› LTE

  › All IP

  › Mobile Broadband

  › Voice over LTE (IMS/VoLTE)

› LTE Advanced Pro

  › Paves the way for 5G

  › Cellular Internet of Things

  › Mission Critical Push To Talk

  › Dedicated Core Networks, Traffic Steering, …

(please)

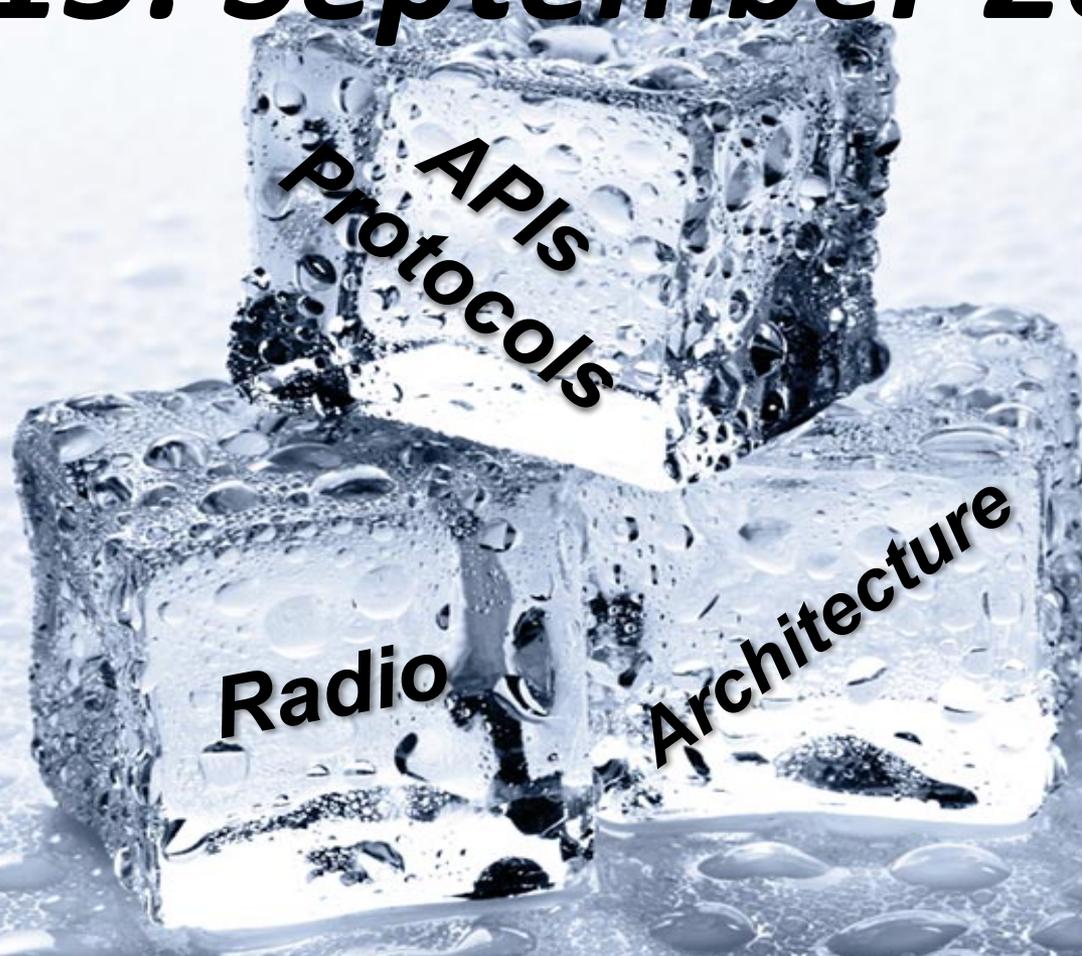# 5G in 3GPP

› 3GPP develops a deployable 5G system now

› Study Phase
  › Rel-14 studies on requirements – completed

  › Rel-15 studies on architecture and protocols

› Two phases for the normative work
  › Phase 1 (Rel-15) to be completed by June 2018
    addresses the more urgent subset for commercial deployments

  › Phase 2 (Rel-16) to be completed by March 2020
    IMT 2020 submission, addresses all identified use cases & requirements
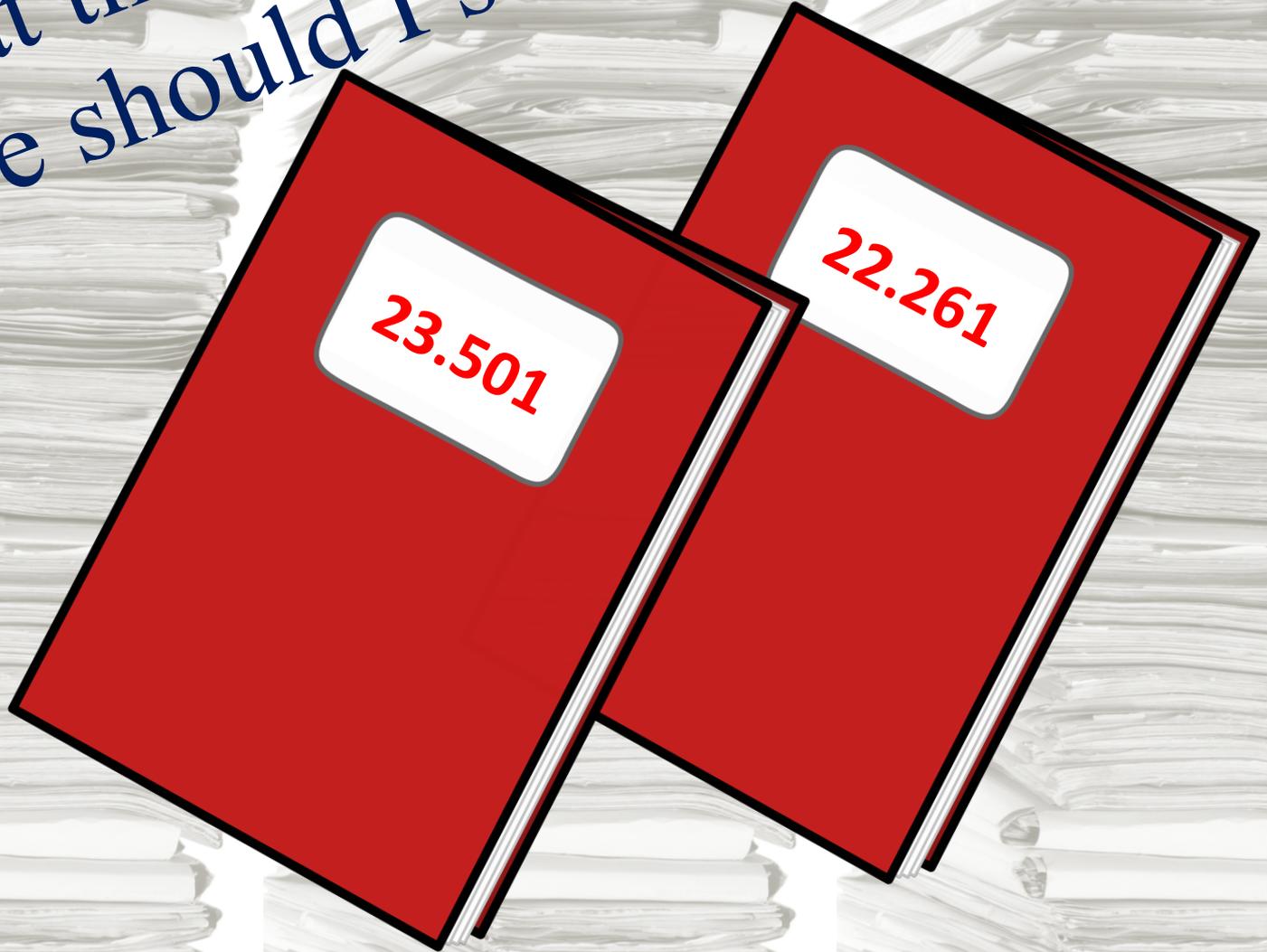
5G Timeline

	2016				2017				2018				2019			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Rel-14 / 5G Study

Rel-16 / 5G Phase 2

Rel-15 / 5G Phase 1

Requirements

P1 Studies

P1 Normative

P2 Studies

P2 Normative

Architecture

P1 Studies

P1 Normative

P2 Studies

P2 Normative

Protocols

P1 Studies

P1 Normative

P2 Normative

10

R15: September 2018

APIs
Protocols

Radio
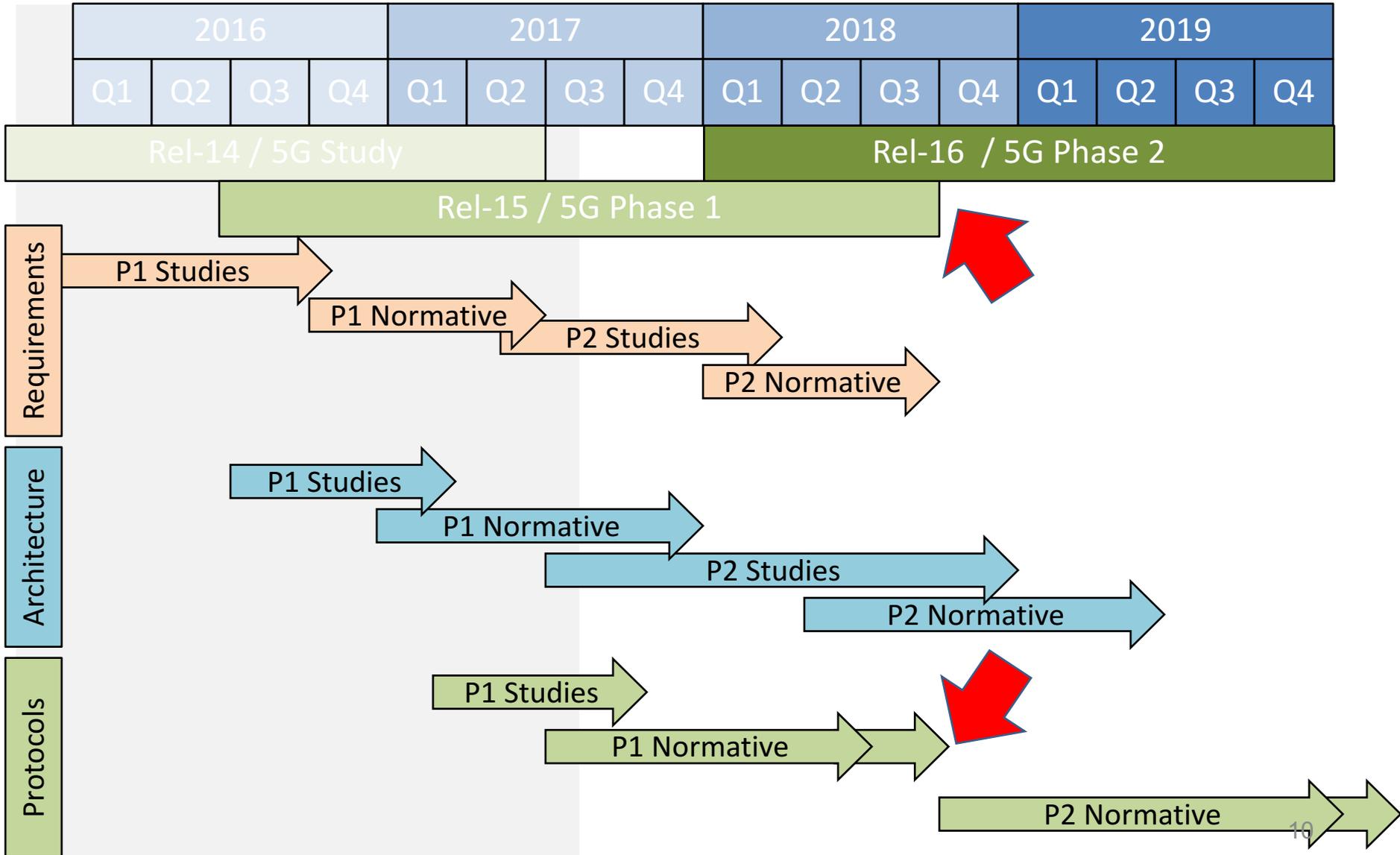
Architecture

NOTE WELL: Work in Progress

› The statements concerning 5G Requirements, Architecture, Protocols, Security, etc are currently under discussion in 3GPP and can change any time.

› To follow the work you can

   › read our specifications (updated every few months)

   › follow the working groups (meetings every few weeks)

Some Documentation (Core Network)

› Requirements

  › High-Level 5G Requirements – TS 22.261 http://www.3gpp.org/DynaReport/22261.htm

› Architecture

  › Completed study – TR 23.799 http://www.3gpp.org/DynaReport/23799.htm

  › *Architecture – TS 23.501* http://www.3gpp.org/DynaReport/23501.htm

  › *System Flows – TS 23.502* http://www.3gpp.org/DynaReport/23502.htm

› Security

  › *Completed study – TR 33.899* http://www.3gpp.org/DynaReport/33899.htm

  › Normative work – TS 33.501 http://www.3gpp.org/DynaReport/33501.htm

› Operation, Orchestration

  › Completed study Network Slicing – TR 28.801 http://www.3gpp.org/DynaReport/28801.htm

  › Provisioning of Network Slicing– TS 28.531 http://www.3gpp.org/DynaReport/28531.htm

› Protocols & APIs

  › CT1 Study – End-2-End – TR 24.890 http://www.3gpp.org/DynaReport/24890.htm

  › CT3 Study – Interworking – TR 29.890 http://www.3gpp.org/DynaReport/29890.htm

  › CT4 Study – Core-Internal – TR 29.891 http://www.3gpp.org/DynaReport/29891.htm

  › CT6 Study – SmartCard Apps – TR 31.890 http://www.3gpp.org/DynaReport/31890.htm

5G – Enabler Platform for Different Services

› New Stakeholders …

  › Critical Communications (MCC)

  › Internet of Things (IoT)

  › Tactile Internet, Ultra-HD Media

  › Automotive (e.g. 5GAA), Railways (e.g. UIC), Maritime

  › Autonomous Systems (robots, drones, …)

  › Smart Cities, Smart Factories, …

  › Energy Providers, Broadcast Agencies, Satellite Operators, …

› … require a flexible enabler platform

  › Open up the core – capability exposure

  › On-demand resource allocation – local and end-2-end

  › Internal architecture of the core needs to be service based

  › Guarantee certain capabilities exclusively – network slicing

  › Ultra low latency & high reliability

5G Landscape

BIG
Data

3rd Party Service Providers

112

```
<header>
  <type>
    web-service
  </type>
  ----
</header>
...
```

A P I

bps

12

5G

NB-IoT

5G

5G

5G

5G

5G

Internet

Enterprise

LTE
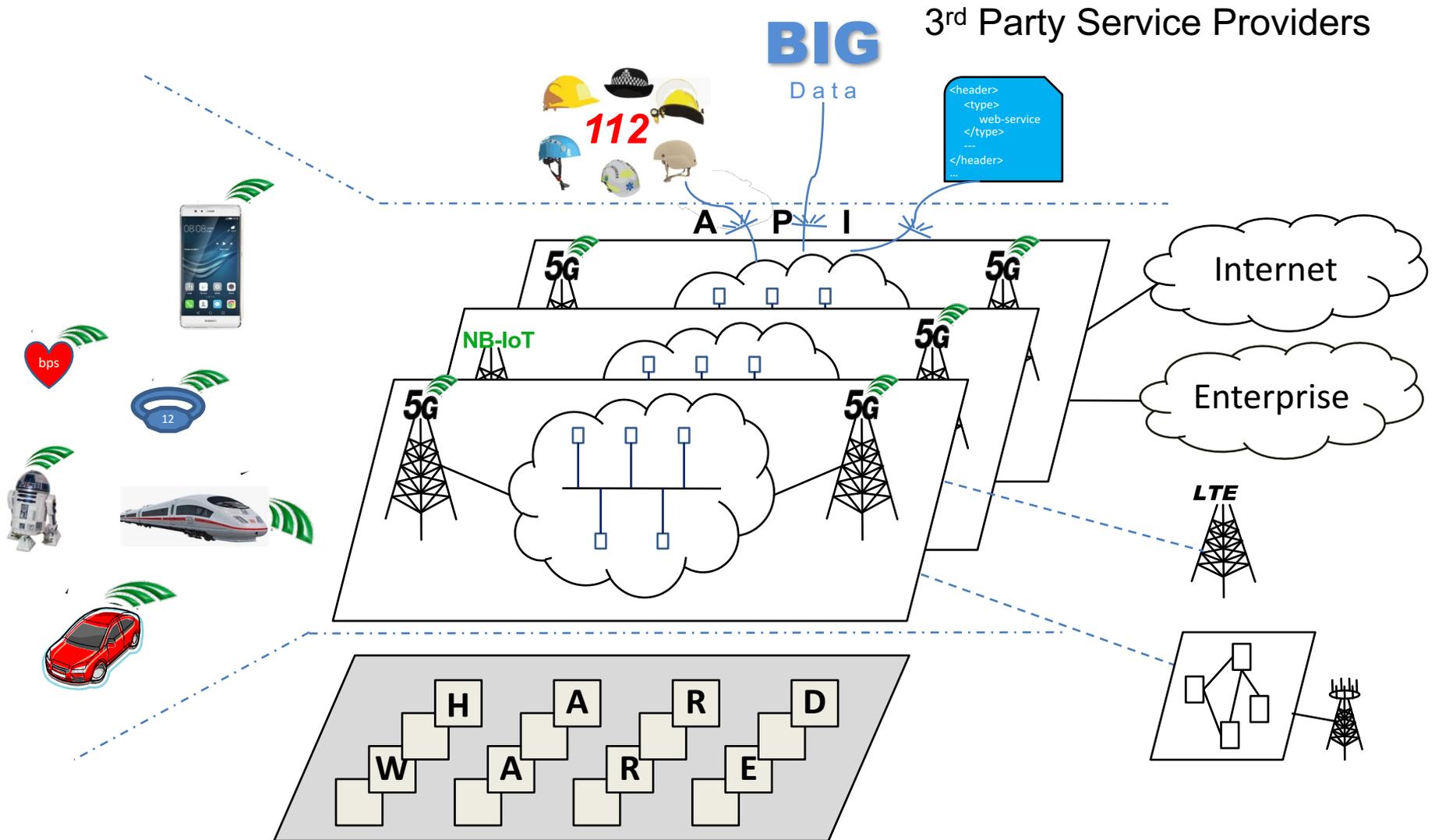
H A R D
W A R E

Software & Service Centric Transformation

› One Network fits all -> Open & Flexible Enabler

› Telecoms -> Multiple Stakeholders

› Phones -> Things

› Procedures -> Services

› Protocols -> APIs

› Dedicated Hardware -> Orchestrated Resources

    › Network Function -> Virtualization

    › Network -> Slice

Architecture Principles

› Control Plane (CP) and User Plane (UP) separation

› Modular function design

› Define Services instead of Procedures (re-usability)

› Direct Network Function communication

› Access Independence

› Capability Exposure (APIs)

› Unified Authentication Framework

Essential 3GPP Capabilities

› Mobility & Roaming

› Voice Calls (via IMS, i.e. SIP), SMS

› Emergency Telecommunication Services

› Non-3GPP Accesses (Fixed/BBF, WiFi, ...)

› Mobile Network Sharing

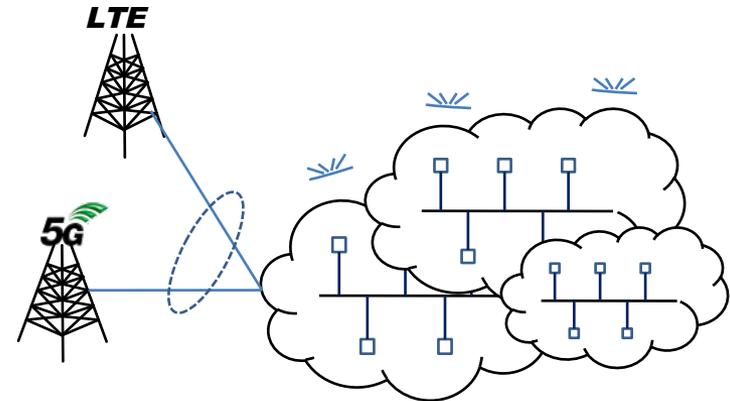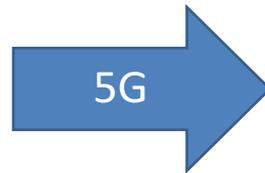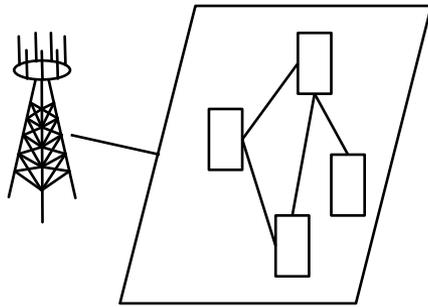› Interworking with LTE/Legacy

› 3GPP Authentication Framework

New RAN

› New RAN (NR)

› TS 38.300 – NR Architecture http://www.3gpp.org/DynaReport/38300.htm
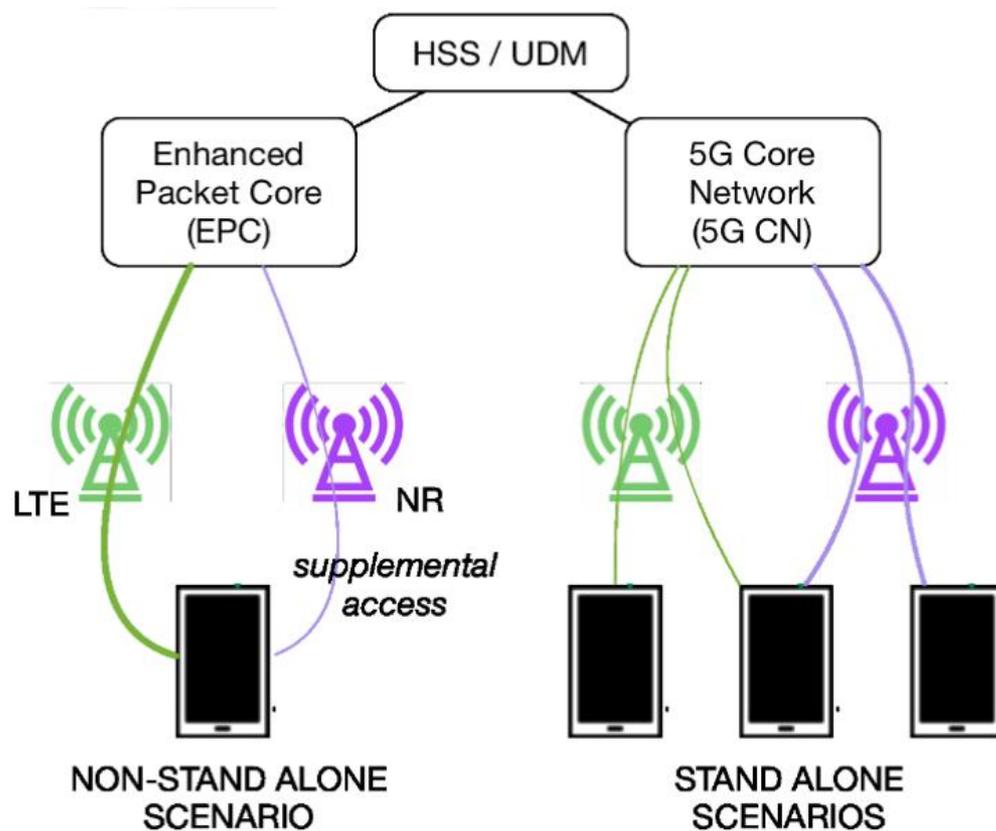
Access Independence & Protocol Harmonization

N1

NR
New Radio

LTE

non-3GPP
Access

BBF, WiFi, WiMAX…

5GC
5G Core

CP: N2
UP: N3
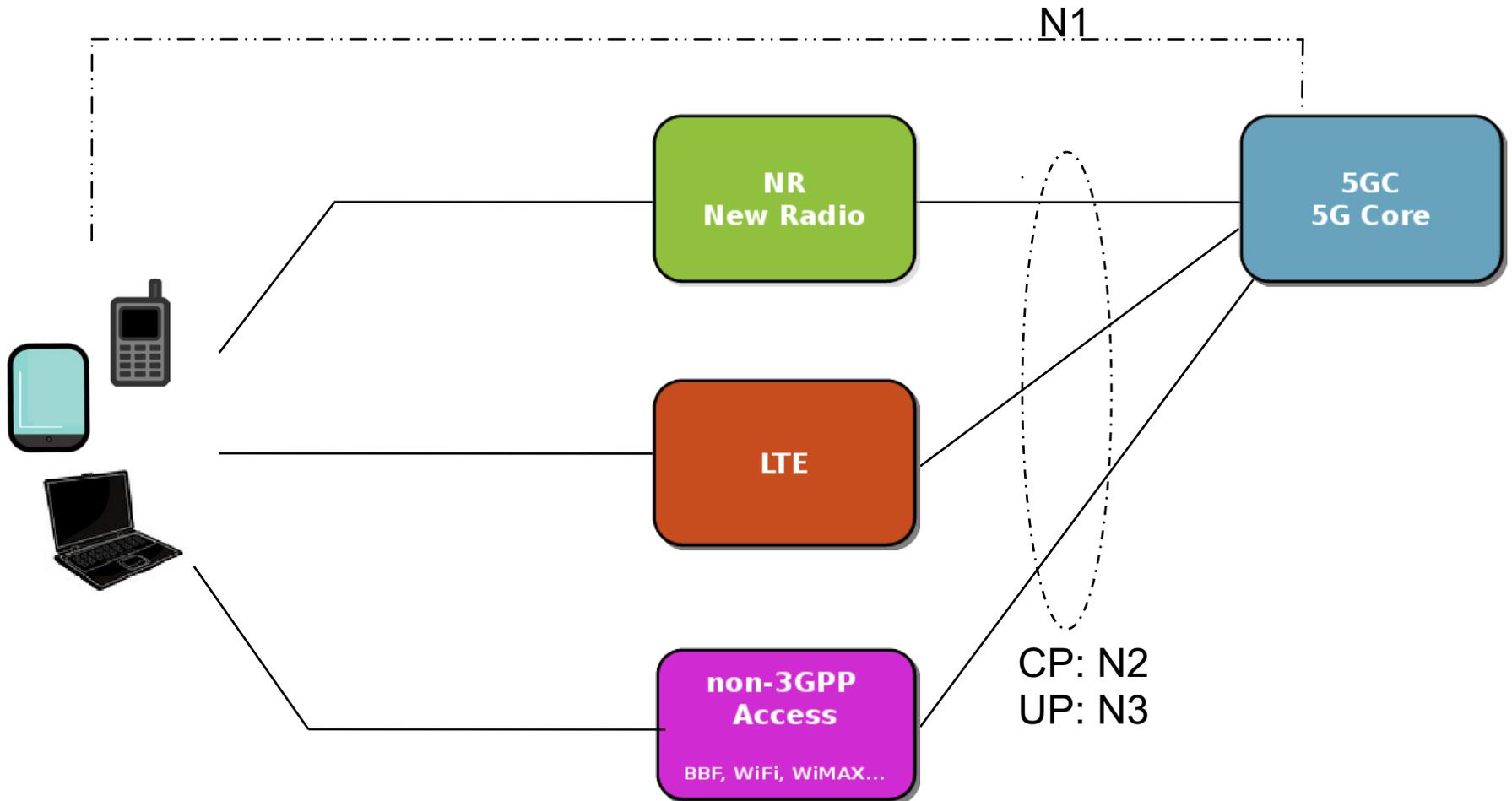
# Transformation of the Core Network

5G

- › Functional entities

- › Single Core

- › Dedicated protocols

- › Services

- › Virtual Core

- › Internal Communication: APIs

- › Harmonized protocols

- › Function/service exposure

- › CP / UP Separation

Service Based Architecutre

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
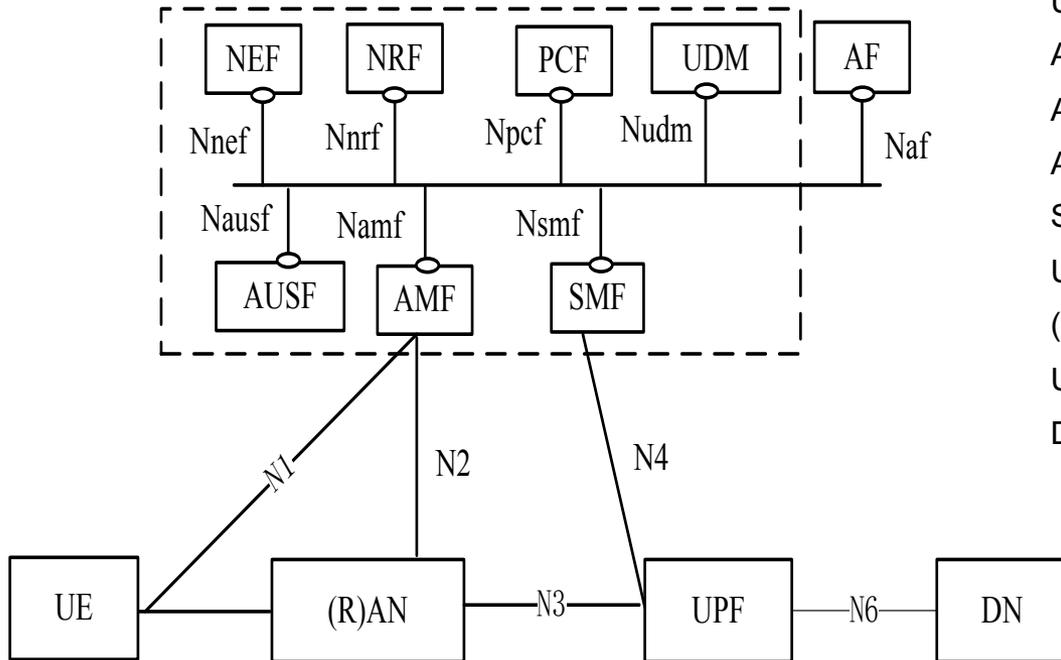
SBA – Topics Under Discussion

› Service Granularity

› Service / API Framework

› Protocols currently under evaluation in 3GPP (CT4 / CT3)

  › HTTP1.1

  › HTTP2/TCP+TLS

  › HTTP2/QUIC

  › Diameter

  › …

› ***This might result in early cooperation with IETF***

Northbound APIs

› NEF – Network Exposure Function

› Core Network capabilities exposed to 3rd parties

› Service specific
  › e.g. oneM2M specific (NAPS)

› Framework study currently ongoing (SA6)

5G Network Slicing

› Network Slice
  › A logical end-to-end network
  › Dynamically created
  › pull together the resources you need to deliver specific service

› Different slices for different services types
  › Committed services with very different requirements – slice types
  › Dedicated customers

› May comprise
  › 5G Core Network (CP & UP)
  › 5G Radio Access Network
  › Interworking Functions to non-3GPP Access Networks

› UE connects
  › Max 8 slices in parallel
  › Common AMF for one UE in all slices

Standard Slice Type (STT) Values

Slice/Service type	SST value	Characteristics.
eMBB (enhanced Mobile Broadband)	1	Slice suitable for the handling of 5G enhanced Mobile broadband, useful, but not limited to the **general consumer space** mobile broadband applications including - streaming of High Quality Video, -Fast large file transfers etc. It is expected this SST to aim at supporting High data rates and high traffic densities
URLLC (ultra- reliable low latency communications)	2	Supporting ultra-reliable low latency communications for applications including, - industrial automation, - (remote) control systems.
MIoT (massive IoT)	3	Allowing the support of a large number and high density of IoT devices efficiently and cost effectively.

Forward Compatibility

› 5G is designed to be a modular & open system

› After R15/R16 the system will be further improved

› Incremental changes will be possible

› New protocols and changes to the architecture will be done in later releases

› This is just the beginning of 5G

IETF / 3GPP Collaboration So Far

› 3GPP is making use of a wide range of IETF protocols

  › IPv6, TCP, UDP

  › DNS, DHCP

  › HTTP, SIP, SDP, Diameter …

› IETF and 3GPP worked and are actively working together on numerous issues.

  › IMS / SIP, SDP, RTP, XCAP, WebRTC, Telepresence/CLUE, Diameter

  › IPv6

  › Security (e.g. AKA)

  › Explicit Congestion Negotiation (ECN)

  › Robust Header Compression (RHOC)

› Both bodies have a long history of collaboration – it's not always easy, but in the end it works

Prob… Challenges

› Strict 3GPP Release deadlines (incremental view)

  › still open Internet-Drafts (IDs) for Rel-12 and earlier

  › 5G deadlines must not be crossed

› Open-ended Process in IETF

  › IETF wants first requirement drafts, then work on solutions can start

  › Costs time

› Lack of 3GPP participation in IETF

› Most of the technical issues are end-to-end

  › e.g. slicing, low latency

  › involves CT, RAN and SA

Pragmatic Approach for Collaboration

› Investigate possible solutions early together

› Exchange expertise

  › Teach us about REST, YANG, etc

  › Hear us on Slicing, SBA, etc

› Rel-15:

  › collaboration will be constrained by what can be achieved by 9/2018.

  › new ideas need to be brought directly to 3GPP

› Beyond Rel-15

  › Workshops on dedicated issues
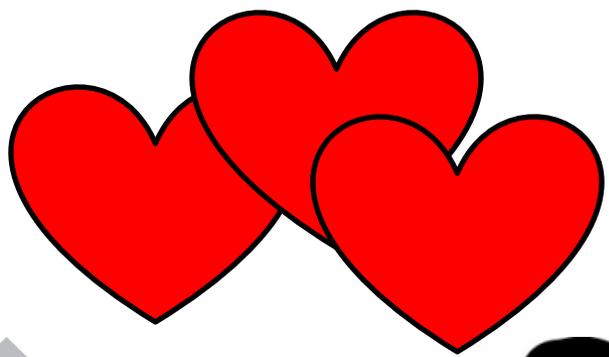
Thank You!

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http://3gpp.org