Cloud Computing & Big Data

ITU-T standardization

Bilel Jamoussi

Chief, ITU-T Study Groups Department

*Membership-driven **Study Groups** develop international standards (ITU-T Recommendations)*

*Open-to-all **Focus Groups** define new directions in ITU standardization*

*Open-to-all **Workshops and Symposia** analyze emerging trends and encourage peer-learning*

History of cloud computing

- 2010, February:
  - Establishment of the FG Cloud by TSAG
    - ✓ In operation 2/2010 – 12/2011
    - ✓ Delivered 7 Technical Reports
- 2012, January:
  - ✓ TSAG entrusted the lead SG responsibility for cloud computing to SG13
  - ✓ TSAG established JCA-Cloud with SG13 as parent
- 2012, February:
  - ✓ Extraordinary SG13 meeting focused on cloud computing work organization
  - ✓ France, CT, China Unicom and ZTE proposed to start new Questions on cloud computing in SG13
  - ✓ Proposal to set up a dedicated WP in SG13 to concentrate on the cloud computing work
  - ✓ First meeting of JCA-Cloud
- 2012, April:
  - ✓ First meetings of cloud computing Questions of SG13 (in Geneva)

Cloud Computing: Definition (ITU-T Y.3500)

"Paradigm for enabling network access to a scalable and elastic pool of shareable physical or virtual resources with self-service provisioning and administration on-demand"

NOTE – Examples of resources include servers, operating systems, networks, software, applications, and storage equipment.

[Source: ISO/IEC 17788 | Recommendation ITU-T Y.3500 "Information technology - Cloud computing - Overview and vocabulary", approved on 13 August 2014]

Cloud ecosystem: definitions, taxonomies use cases & high-level requirements

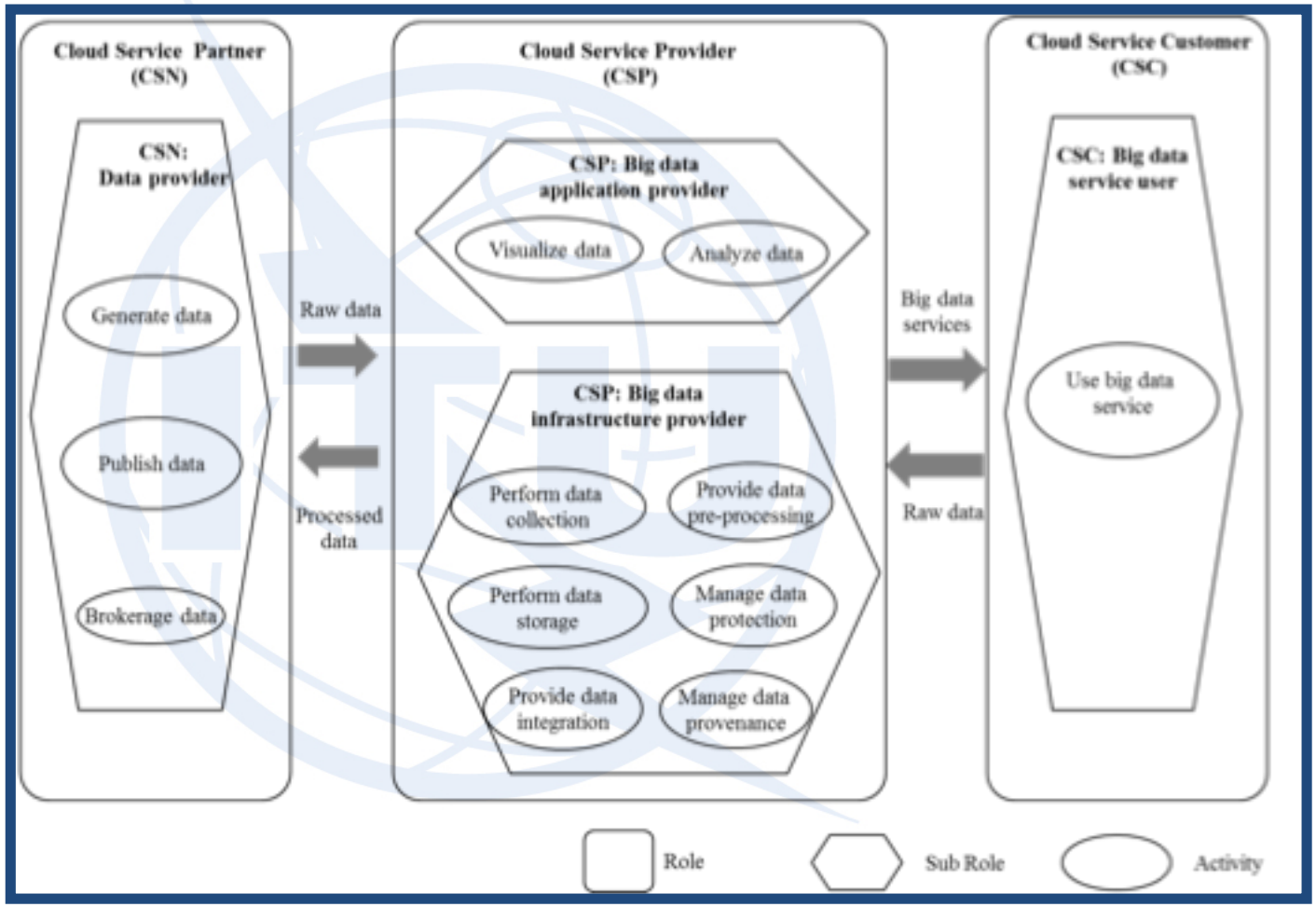
1. Cloud Computing related definitions & taxonomies: 5 Cloud service categories (SaaS, CaaS, PaaS, IaaS, NaaS) with 2 new categories for Communication (real time) and network (transport & inter-cloud)
2. Cloud ecosystem actors (provider, partner & user) and roles
3. Inter-cloud Scenarios : Peering, Federation & Service Broker
4. Telecommunication centric use cases: Service Delivery Platform, Desktop as a Service, Call center, Cloud migration and portability, Inter-cloud (SLA, performance, availability...)
5. High level requirements:
   - For cloud infrastructure accessibility, massive data processing, portability, responsiveness…
   - For cloud services: SLA support, management, Inter-cloud

Cloud Computing & Big Data

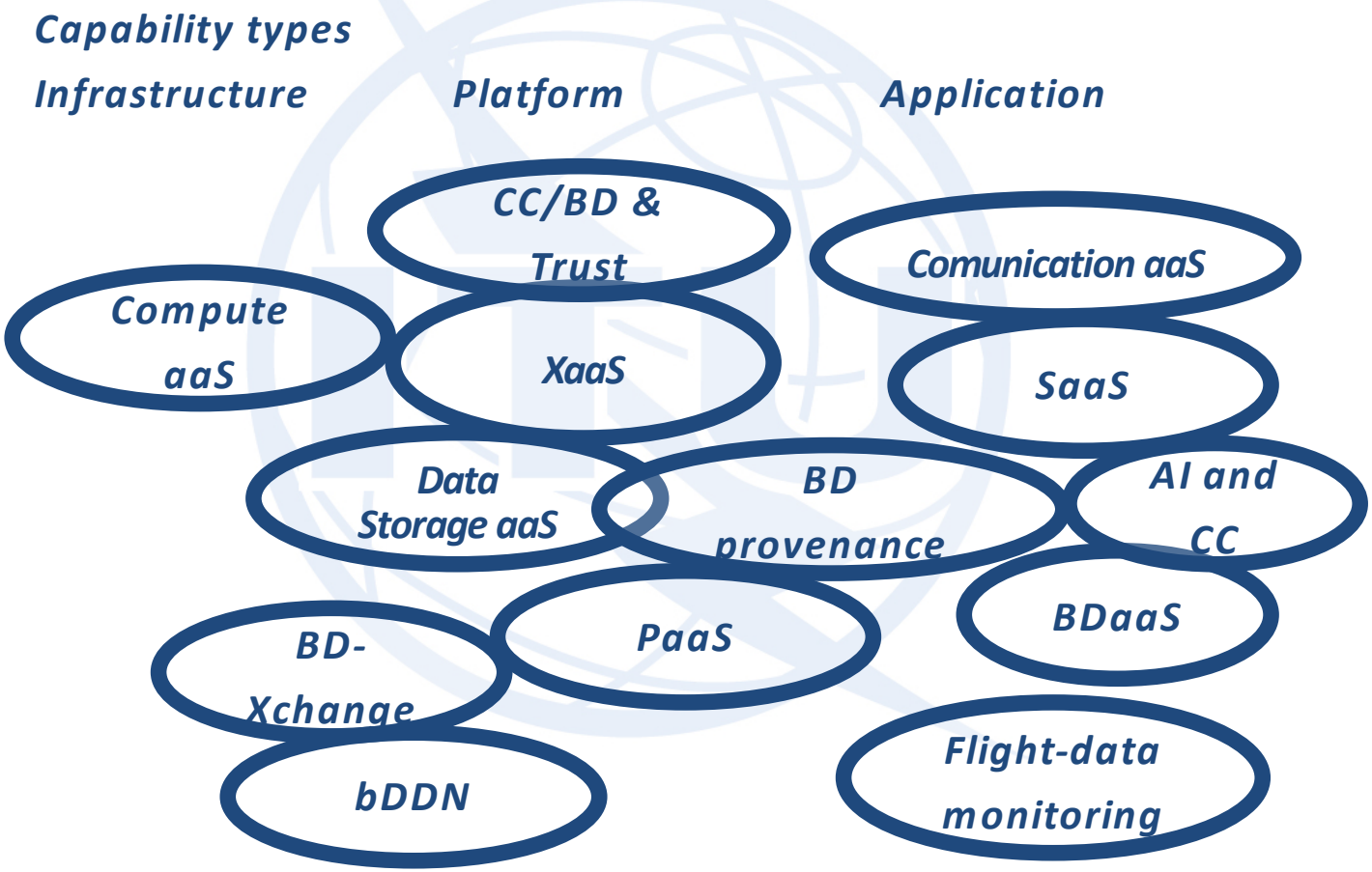
Volume

Variety

Velocity



Cloud computing/Big Data – what's next



Related activities

Cloud-based event data monitoring for vehicles and other connected machinery

- Continues from ITU-T Focus Group on 'aviation applications of cloud computing for flight data monitoring' (FG-AC)

Data processing and management for IoT and smart cities

- Active ITU-T Focus Group (FG-DPM)

Machine Learning of 5G

- Active ITU-T Focus Group (FG-ML5G)

Cloud computing security and protection of personally identifiable information

- See ITU-T Study Group 17 (Security)

IMT-2020 (5G)

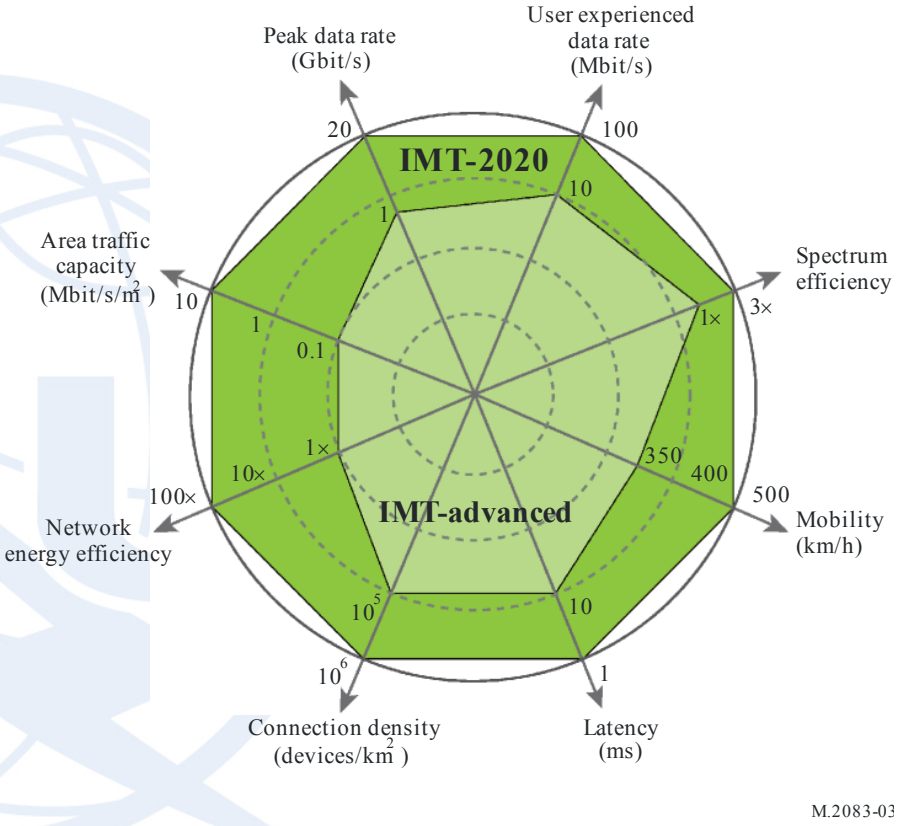
ITU's Radiocommunication Sector (ITU-R)

coordinating the international standardization and identification of spectrum for 5G mobile development

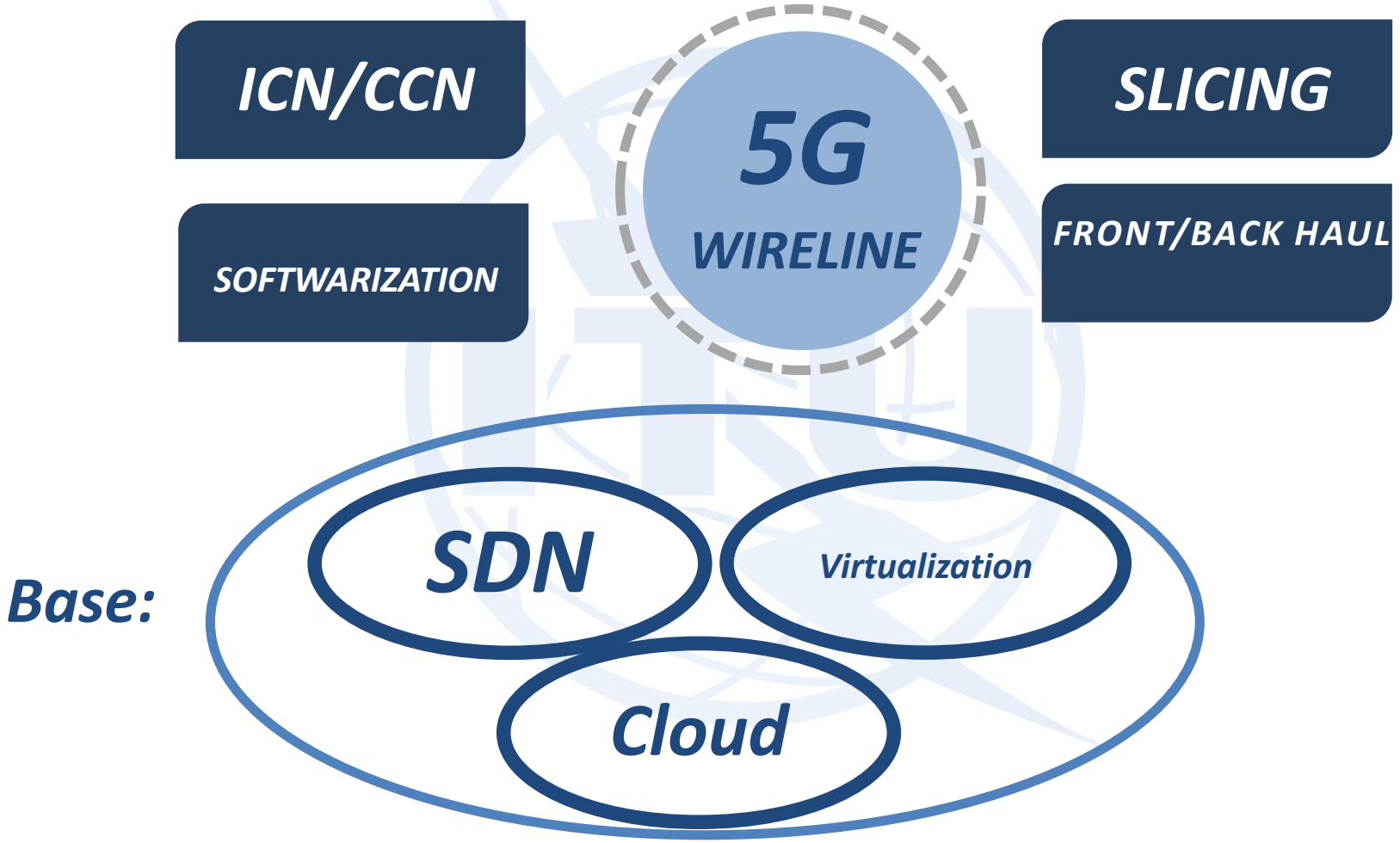
ITU's Standardization Sector (ITU-T)

standardizing technologies and architectures of the wireline elements of 5G systems

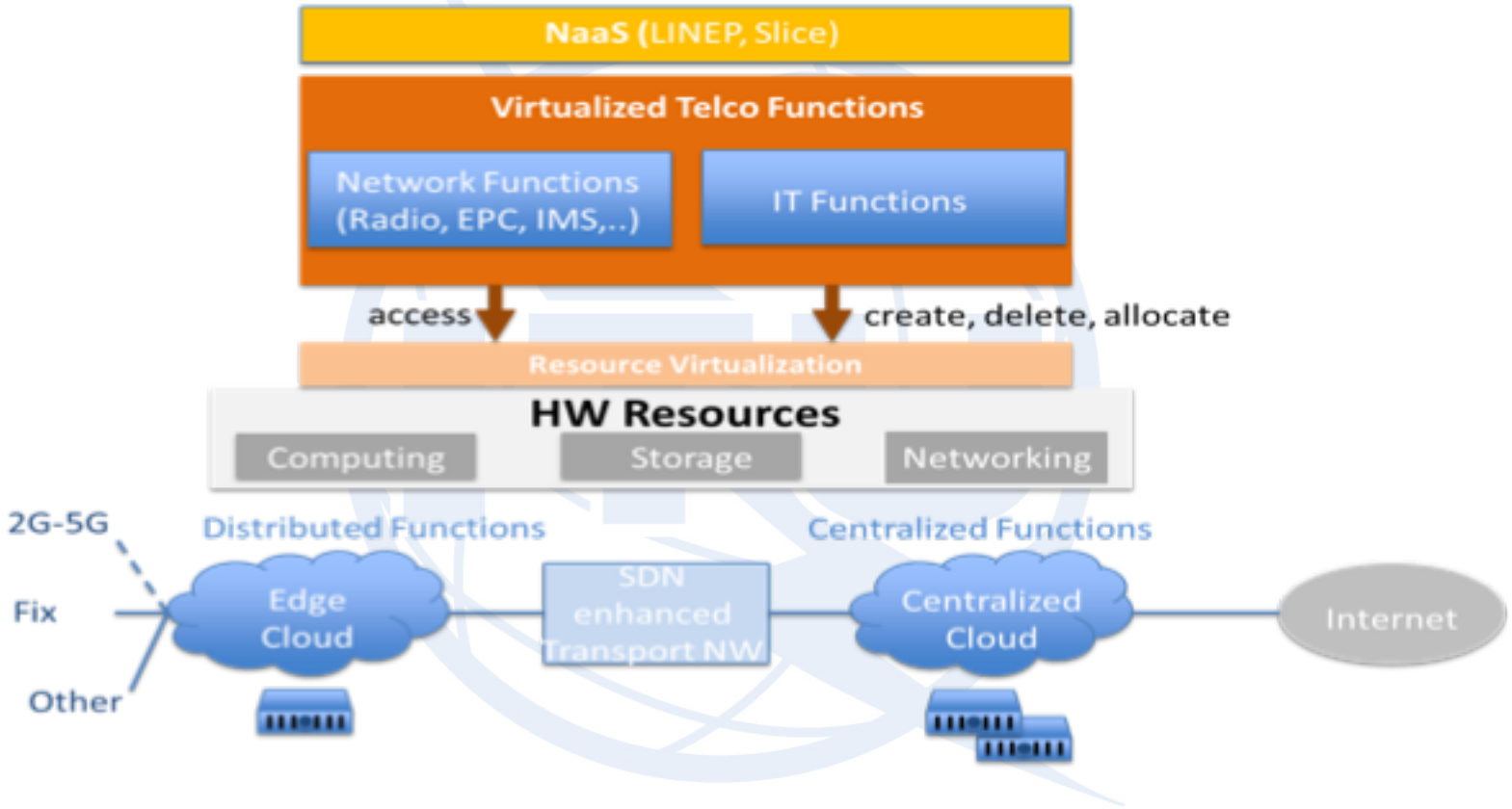
e.g. network softwarization and slicing; information-centric networking; fixed-mobile convergence



IMT-2020 (5G)


ICN/CCN
SOFTWARIZATION
5G
WIRELINE
SLICING
FRONT/BACK HAUL
Base:
SDN
Virtualization
Cloud

IMT-2020 (5G)


NaaS (LINEP, Slice)
Virtualized Telco Functions
Network Functions (Radio, EPC, IMS,..)
IT Functions
access
create, delete, allocate
Resource Virtualization
HW Resources
Computing
Storage
Networking
2G-5G
Fix
Other
Distributed Functions
Centralized Functions
Edge Cloud
SDN enhanced Transport NW
Centralized Cloud
Internet

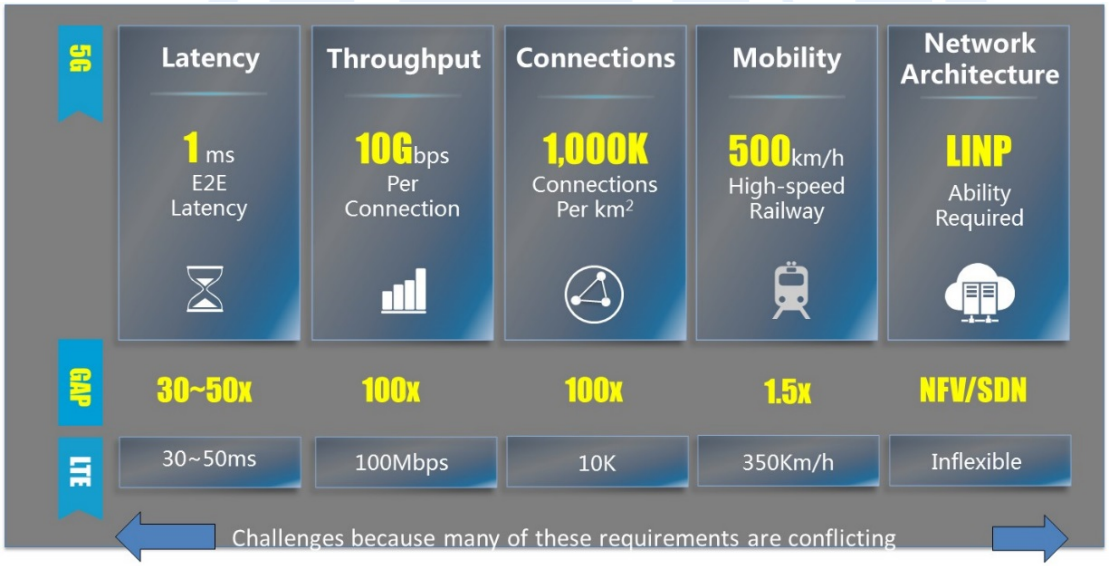
5G: From hardware to software

HW world

Dedicated appliances + Dedicated wire/radio

SW world

Virtual functions + virtual links on generic server / storage / network pool



Key wireline standardization issues

- *Fronthaul – Fronthaul ties CRAN to Antennas, major downstream effects.*
  - *Is it sliced, where, how.*
- *Backhaul/IDC – latency, jitter, loss at packet layer, flexible data paths*
- *NFV – concept needs to be made broader. Cover some of DSP and all of MEC*
- *MEC – ETSI approach ridged. Any F any CPU + RAT (merge into NFV?)*
- *Orchestration – does not exist yet. Understand AT&T to build in-house*
  - *Danger of orchestration/mgmt duplication (virtual/physical)*
- *Softwarization – high level programming model, profiles, scripts, end to end*
- *OA&M – need "cloud like" approach. Continuous test/repair not just report.*

Major Drivers for the 5G wireline architecture

- *End to end virtualization – obvious operational savings for "tidal" effects*
- *Cloud RAN – opex/capex savings, CoMP, CA, cell edge interference, migration, performance.*
- *Mobile Edge Computing – operators low delay advantage over the OTTs.*
- *Fixed Mobile Convergence – access side also looking for virtualization savings too… can they be combined?*
- *Slicing – differences between RAT's/CORES etc rather than a one size fits all allows ultra low delay etc. RATS.*
- *SDN and Orchestration – hard to implement all of above with distributed protocols and too complex for manual operation.*
- *NFV – use of general purpose compute as much as possible (but not everywhere) 4G vEPC, 5G-PacketCore[slice], … MEC + some of RAT*
- *Better operations/mgmt, more Cloud-Style, auto problem detect/fix etc.*

ITU-T Y.3500 series
ITU standards for cloud computing
&
ITU-T Y.3600 series for Big Data

ITU-T Y.3500 series – Cloud computing

Y.3500: Information technology – Cloud computing – Overview and vocabulary

Y.3501: Cloud computing – Framework and high-level requirements

Y.3502: Information technology — Cloud computing - Reference architecture

Y.3503: Requirements for desktop as a service

Y.3504: Functional architecture for Desktop as a Service

Y.3505: Cloud computing - Overview and functional requirements for data storage federation

Y.3506: Cloud computing - Functional requirements for cloud service brokerage

ITU-T Y.3500 series – Cloud computing

Y.3510: Cloud computing infrastructure requirements

Y.3511: Framework of inter-cloud computing

Y.3512: Cloud computing - Functional requirements of Network as a Service

Y.3513: Cloud computing - Functional requirements of Infrastructure as a Service

Y.3514: Cloud computing - Trusted inter-cloud computing framework and requirements

Y.3515: Cloud computing – Functional architecture of Network as a Service

Y.3516: Cloud computing - Functional architecture of inter-cloud computing

Y.3520: Cloud computing framework for end to end resource management

Y.3521: Overview of end-to-end cloud computing management

Y.3522: End-to-end cloud service lifecycle management requirements

ITU-T Y.3600 series – Big data

Y.3600: Big data – Cloud computing based requirements and capabilities

Y.3601: Big data - framework and requirements for data exchange

Y.3650: Framework of big-data-driven networking

Y.Sup40: ITU-T Y.3600 – Big data standardization roadmap

Y.Sup46: Scenarios of implementing cloud computing in networks of developing countries