5G/IMT2020 Transport Requirements
Considerations and Next Steps

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Introduction

- The transport network will need to evolve for optimum support of 5G/IMT2020. For example:
  - The Fronthaul and Backhaul bandwidths will increase dramatically
  - The Middlehaul is being added to the wireline access network
  - Network slicing is increasingly important
- Many standards organizations are becoming involved. The ITU-T is well positioned to capture the transport network requirements, which helps clarify what portions of the work are best suited to different groups
  - As a first step, SG15 is creating a Technical Report GSTR-TN5G **
    - First version scheduled for approval at the February 2018 SG15 meeting
    - To be updated as the 5G standards progress

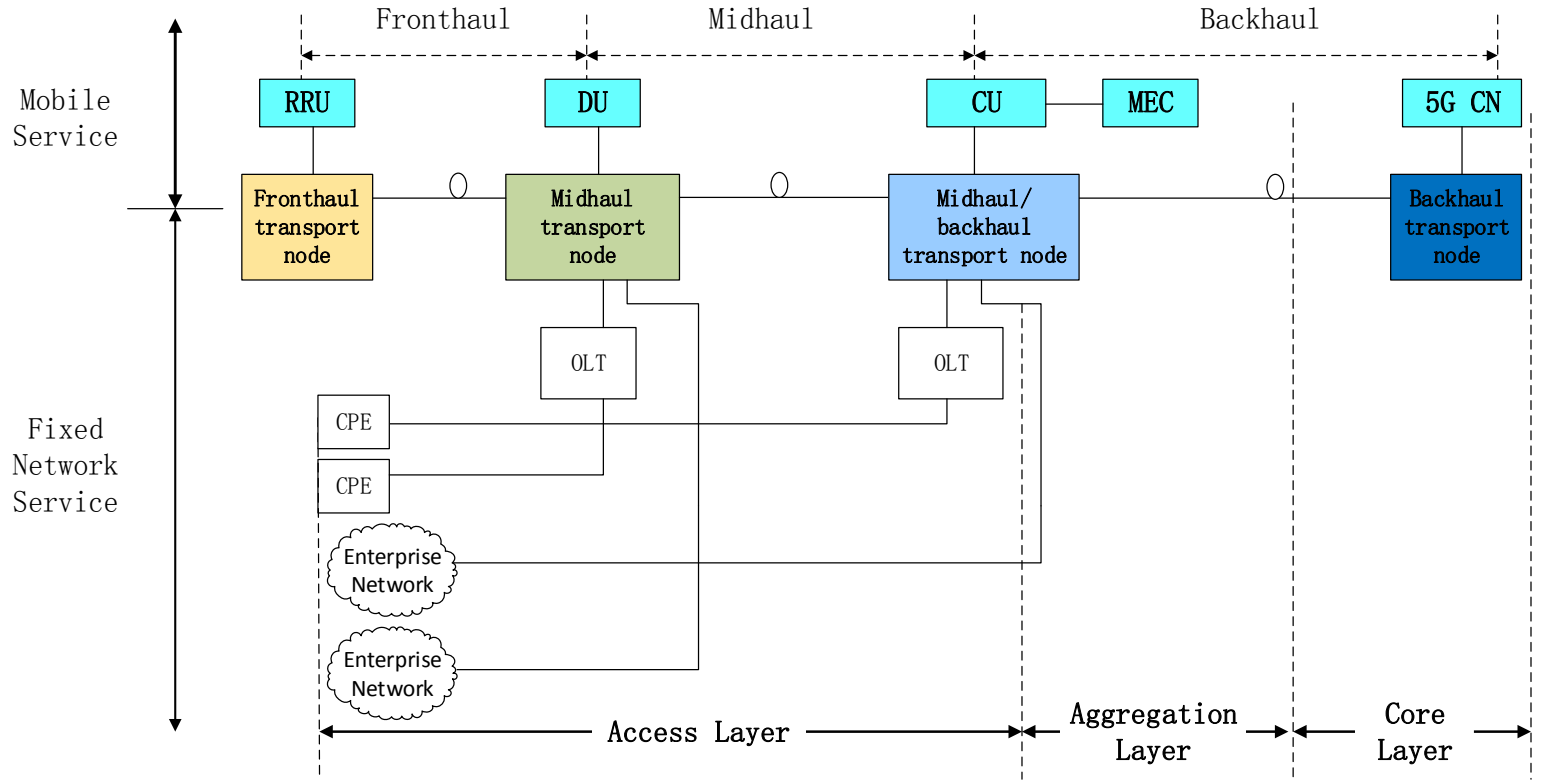
IEEE 802

ITU

Notes on the network segments

- Fronthaul:
  - CPRI or new eCPRI
- Middlehaul:
  - The base station functions are split between a centralized unit (CU) and distributed unit (DU), with Middlehaul as the CU-DU connection
  - CPRI terminated at DU, which allows for statistical multiplexing over the Middlehaul network
  - Expected to be similar to the backhaul network
- Backhaul:
  - Remains the same expect higher bandwidth

Network Architecture Example



- Borrowed from SG15 contribution C-0645, from China Mobile, Huawei, ZTE and FiberHome

ITU-T SG15 Expertise

- ITU-T SG15 is unique in the breadth of its expertise to address 5G transport requirements:
  - Network architecture (Q12)
  - L1 signal formats for Fronthaul (PON in Q2 and p2p in Q11)
  - L1 signal formats for Middlehaul and Backhaul (Q11)
  - Synchronization, including timing distribution and jitter (Q13)
  - Network management (Q14)
  - Optical network parameters (Q6)

Outline of the draft SG15 Technical Report

Technical Report ITU-T GSTP-TN5G
Technical Report ITU-T
Transport network support of IMT-2020/5G

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- **Summary**
- **Scope**
- This TR focuses on requirements on transport networks in order to support IMT-2020/5G networks. Aspects of how mobile traffic is directed onto transport networks are out of scope.
- **References**
- **Terms and definitions**
- **Abbreviations**
- **Reference Architecture**
- **Synchronization distribution Architecture**
- **Interfaces**
- **Management**
- **Multiservice support**
- **5G Slicing Support**

Working assumptions for GSTR-TN5G (from the October Joint Q12&Q11 Interim)

- Requirement to have a network architecture that shows correlation of front/mid/back-haul with 3GPP NG/F1/XN interface (S1 and X2 as well) and access/aggregation/core terminology. Consider eCPRI interfaces too.
  - Adopt 3GPP and eCPRI interface usage then map to front/mid/back-haul etc. as needed later.
- Requirement to depict entity relationships between functions shown in 1.
- Requirement to drive requirements from the 3GPP interfaces (information flows (user, control, and synchronization), capacity, etc.)
  - Interface capacity requirements – granularity e.g., 25G, 50G, 100G.
  - Latency, etc.
  - Service rates and interface rates.
  - Node capabilities.
  - Synchronization requirements
  - Nature of the data being presented to the TN
  - Availability/reliability (how are these currently met?)

Working assumptions for GSTR-TN5G (continued)

- Requirement to map information flows (across interfaces) to various transport network topologies? This helps establish context for factors such as capacity.
- Requirement to focus on management of transport network (common across the transport network), and how to present transport capabilities to wireless entities that need connectivity.
- In multiservice networks, where are non-5G services supported? Is there a requirement for multiservice (CPRI, eCPRI, private line) in fronthaul?
- Describe protection switching in the transport network. At which interfaces and for which information flows?
- Need agreed definition of slicing

Example network parameters
(proposals taken from multiple contributions)

Mobile transport	Network Entities	Transport Connection	Distance Range	Latency	Band-width	Multiplexing
Front-haul	RRU-DU	p2p	1~10km	50-200us	100G+	Transparent L0 or L1
Middle-haul	DU-CU	p2p	20-40km	~1ms	>100G	L1 multiplexing and L2 statistical multiplexing could be used.
	N*DU-CU	p2mp				
Backhaul	CU-CU or CU-MEC	p2mp	1-10km	<10ms	>400G	Statistical multiplexing , L3 Dynamic connection based on IP address and 5G signalling
	CU-5G NG or MEC-5G NG/MEC	mp2mp	40-200km			

Network Slicing

- Network slices provide separation of traffic:
  - From different users
  - From different mobile operators (e.g., if they are sharing a cell tower)
  - From different types of traffic (e.g., by QoS requirements)
- "Hard" slicing: Each slice is allocated to a different L0/L1 channel (e.g., wavelengths or TDM) to ensure full isolation between slices
- "Soft" slicing: Traffic from multiple slices shares the same L0/L1 channel; the traffic is separated in the packet domain

Summary and Conclusions

- 5G/IMT2020 transport is expected to be an important driver for network growth
- The emerging 5G access network functional splits will impact the network topology
- Multiple standards organizations are interested in this topic
- With many different potential technology approaches, it is critical to first define the transport network applications and requirements.
  - The new ITU-T GSTR-TN5G Technical Report focusses on this first step