5G impact on FH transport & potential NGFI scenarios

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IEEE P1914.1
1914 NGFI WG
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Motivation

- Scope of P1914.1*
  - *Architecture for the transport of mobile fronthaul traffic (e.g., Ethernet-based), including user data traffic, and management and control plane traffic.*
  - *Requirements and definitions for the fronthaul networks, including data rates, timing and synchronization, and quality of service.*
- Purpose of P1914.1*
  - *The Fronthaul Packet Transport standard enables the implementation of critical 5G technologies, such as mMIMO, CoMP, C-RAN etc…..*

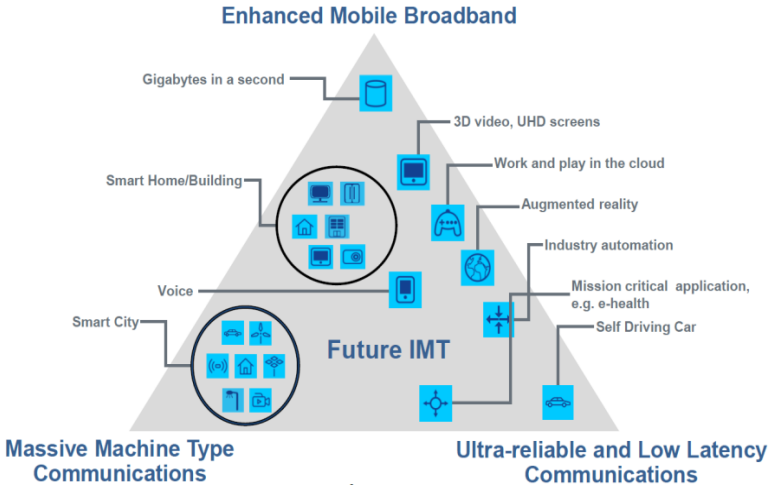
What is 5G?
What is the impact on transport by 5G?
From where to start?

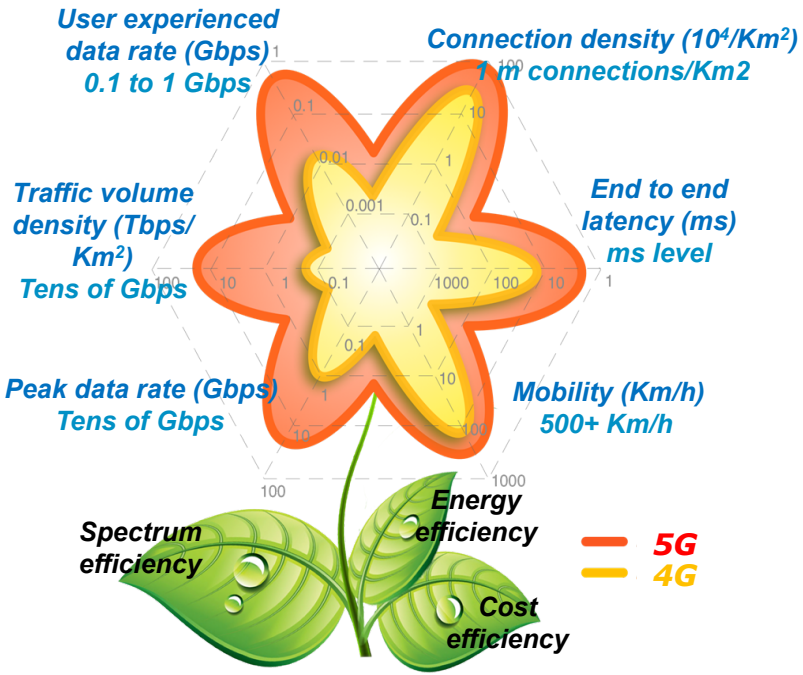
*: *IEEE P1914.1 PAR, http://sites.ieee.org/sagroups-1914/files/2016/06/P1914.1.pdf*

5G at a glance

Three major application scenarios

Naming:IMT-2020





"Information a finger way, Everything in Touch"

Too many scenarios, requirements, technologies, and architectures covering so many industries

Natural questions

- Which scenarios may have potentially noticeable impact on FH transport?
- Which features may have potentially noticeable impact on FH transport?
- *Which technologies are having potentially noticeable impact on FH transport?*

This contribution: to propose a framework/methodology for gap analysis and to suggest potential NGFI scenarios&use cases, which could serve as the basis for requirement development
Methodology: to propose a template for analysis of FH transport impact for the features/technologies ONE BY ONE

Proposed template

Features/technologies	// brief description
Typical configuration	// If possible, to give quantitative figure
Key impact on FH transport	//if sticking to traditional CPRI, what is the impact on FH transport to implement the technology/feature
Potential solution to transport	//high-level/general description
Potential scenarios of the feature/tech.	
Applicable for D-RAN or C-RAN	
Priority	// (Operators' view) How important? Operators' view

For each table (corresponding to one feature/tech.), paragraphs of text description should be provided in the future in order to be incorporated to the final spec. Some items should be continuously updated with the progress of 5G study

Massive MIMO

mMIMO	
Typical configuration	64 Tx/Rx for sub-6GHz and 256 Tx/Rx for 30GHz, 1024 Tx/Rx for 70GHz
Key impact on FH transport	Very high FH bandwidth, e.g. on the 100G order of magnitude
Potential solution to transport	Novel function split scheme
Potential scenarios of the feature/tech.	Dense urban, outdoor-to-indoor coverage, indoor coverage
Applicable for D-RAN or C-RAN	Currently D-RAN; To support C-RAN, the FH issue MUST be addressed;
Priority	High

Joint transmission/reception (JT/JR)

JT/JR	
Typical configuration	3~7 collaborating points
Key impact on FH transport	High synchronization accuracy, low latency and jitter
Potential solution to transport	The same requirement as in CPRI
Potential scenarios of the feature/tech.	Dense urban
Applicable for D-RAN or C-RAN	Mainly C-RAN
Priority	Low or medium

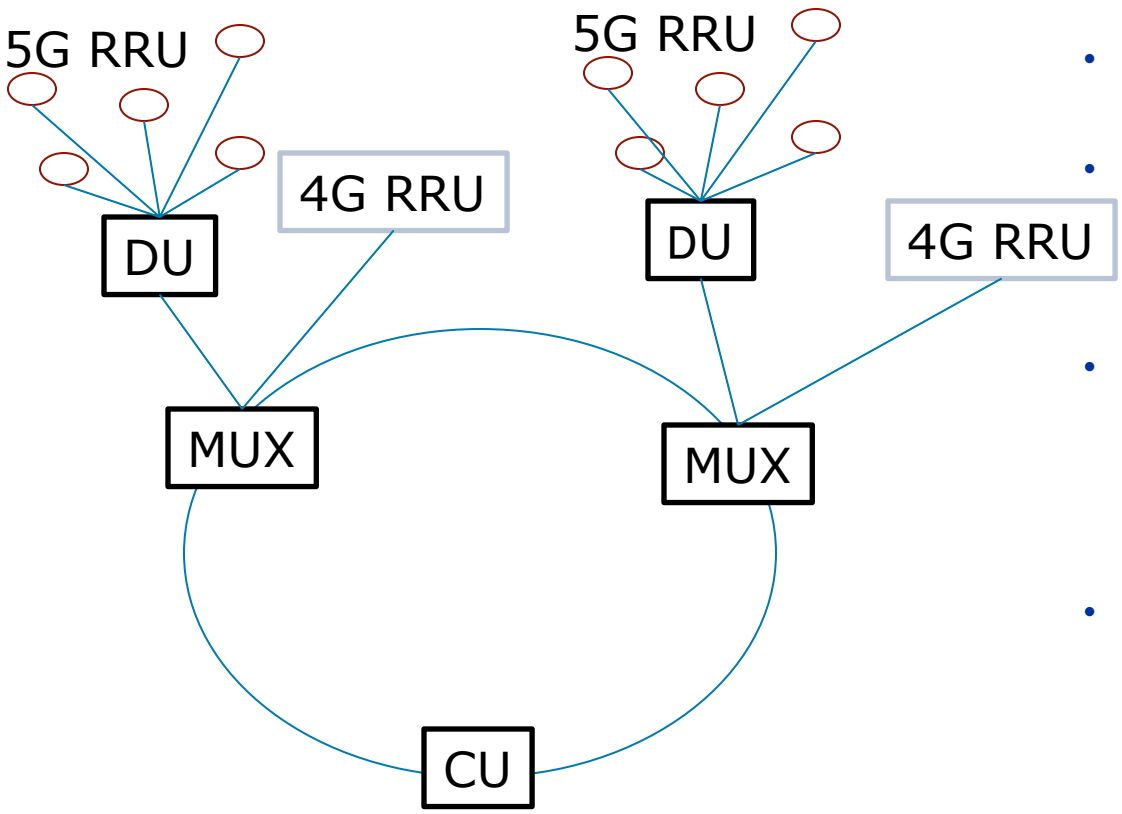
- Other technologies/features:
  - Higher carrier frequency, higher modulation order, larger bandwidth etc.
  - NOMA, numerology, new waveform etc.
  - SDN, CA,, MEC etc.

- *More input in the future*

Scenario 1: indoor hotspot

- E.g: office building
- Key features:
  - High capacity
  - Interference not an issue
- Potential solutions/technologies
  - C-RAN initially motivated by deployment need
  - mMIMO
- Potential requirements on NGFI
  - Multiplexing capability
  - Reduced maximum bandwidth
  - Traffic-dependent

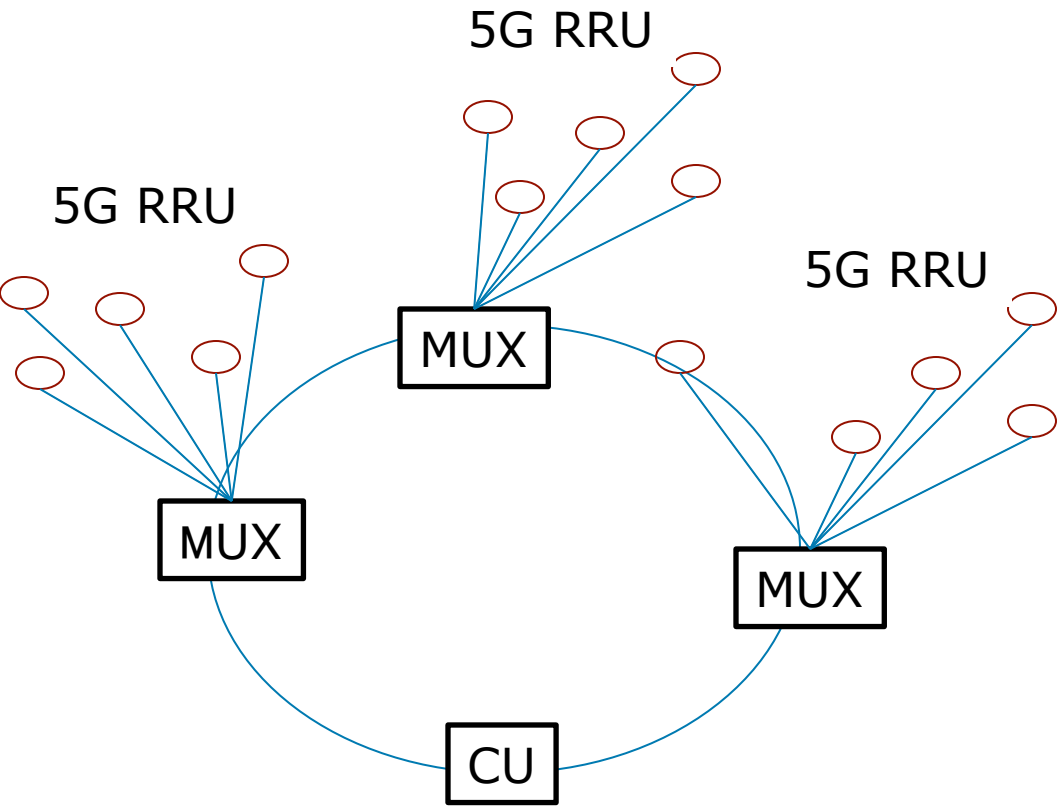
Scenario 2-1: dense urban with 4G/5G co-located



CU: central unit
DU: digital unit
MUX: to aggregate 5G FH and 4G backhaul/FH

- Pedestrian street, open-air square etc.
- Features:
  - Dense population; outdoor; high traffic load
  - Interference is an issue
- Potential solutions/technologies
  - C-RAN-based Hetnet architecture
  - Interference cancellation schemes (JT/JR/CS/CB etc.)
  - mMIMO for capacity
- Some attributes:
  - 1 ring ~ 6-8 MUX, 2-5km^2 coverage
  - 1 DU ~ xx (e.g. 6-10) 5G RRU + 1 4G RRU
  - Distance b/w DU and 5G RRU: < 2km
- Potential requirements on NGFI
  - Multiplexing capability
  - Reduced maximum bandwidth
  - Flexible split options

Scenario 2-2: dense urban with 5G RRU only



- Green field scenario
- Big difference from previous one:
  - Removal of stringent requirements via 4G RRU (i.e. CPRI requirements)

Conclusions

- *Proposed methodology & template for gap analysis*
- *Two use cases*
- *Need more refinement in the future meetings, as well as frequently update as 5G progresses*
- *Suggested timeline: to get stable draft on the gap analysis and scenarios/use cases section by Dec. meeting*
- *Next step:*
  - *Call for more input on gap analysis, based on the template*
  - *More refinement on use cases*
  - *Call for more contributions on scenarios, especially from operators*

Q&A