

Overview and requirements

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IEEE 1914
Next Generation Fronthaul Interface
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Overview and requirements

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Introduction

Class	Sub Class (P1)	Priority Level (P2)	Latency upper bound requirement (P3)	Throughput requirement (P4)	Reserved	Informative
control & management	synchronization	0		Low BW		
	Low latency RAN control-plane	1		Low BW		
data-plane	Subclass1	2		R3_low - R3_high		3GPP model Option 6,7,8
	Subclass_2	3		R4_low - R4_high		3GPP model Option 4,5
	Subclass_3	4		R5_low - R5_high		3GPP model Option 1,2,3
Transport NW control & management		?	?	Low BW		
Reserved						

Way forward [1]:

- Need to fill in the transport class table
 - What are they? What are their properties? Are they technology-specific?
- Requirements (following Prof. Choi's contribution, Transport requirements for different splits (ATT))
- Need architecture (following Jouni's contribution)

[1] 201610 IEEE 1914 f2f meeting summary

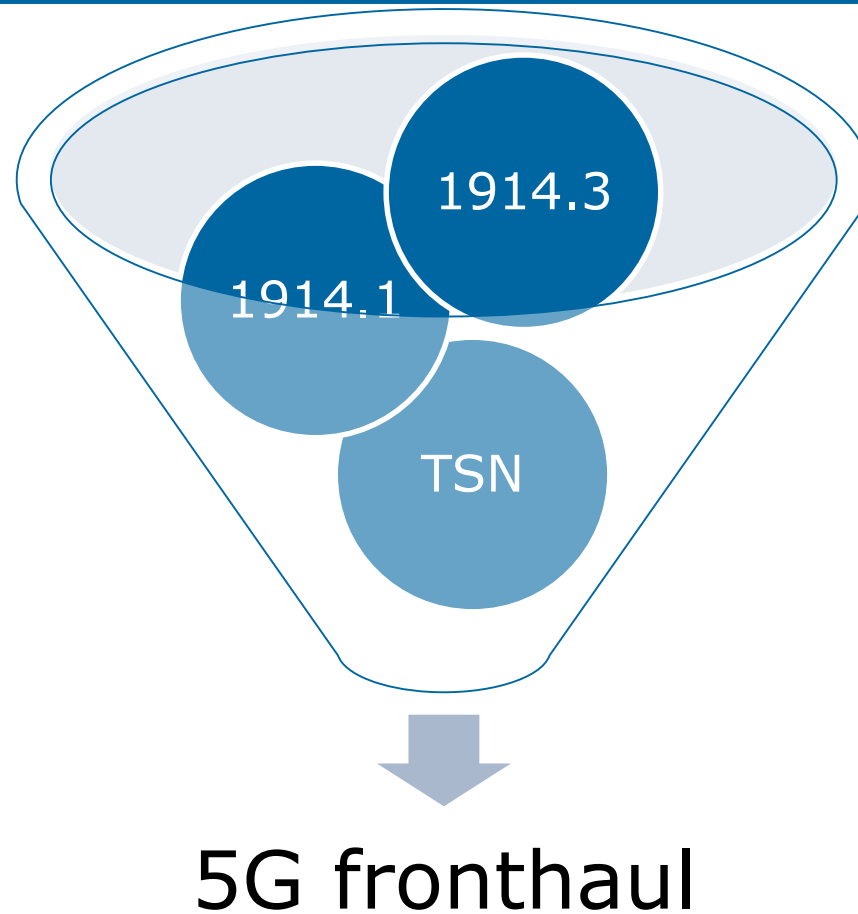
Agenda

- Standardization overview - motion
- Transport network requirements - motions
 - Towards filling in the transport class table

STANDARDIZATION EFFORT OVERVIEW

Standardization effort overview

3GPP



IEEE 1914

1914.3 – packets (header + payload definition) for sending:

- IQ over Ethernet time domain – split 8
- IQ over Ethernet frequency domain FFT+CP - split 7.1
- Will other splits be covered corresponding to 1914.1 classes definition?

1914.1 – network to transport these packets:

- architecture (# of nodes, distance, topology, types of traffic multiplexed)
- transport network requirements for different splits (e.g.: frequency accuracy: 16 ppb is allowed in the network to ensure 50 ppb on air interface)

P802.1CM - TSN

TSN – mechanisms for transporting time sensitive data

CM defines profile for fronthaul: 802.1CM/D0.5 focused on CPRI traffic (Class 1), there are placeholders for other types of traffic (Class 2).

Solutions for Class 1:

Profile A: bridging with strict priority queuing

Profile B: using frame preemption

	Class 1	Class 2
Requirements	✓	From 1914.1?
Profiles	✓	From 802.1CM?

Is the intention to transport Class 1&2 traffic using 1914?

Motion: Can 1914 communicate about agreed traffic classes for non-CPRI splits to P802.1CM to contribute to class 2 requirements and profiles?

Motion #___

- Once concluded, communicate requirements on Class 2 to 802.1CM, based on NGFI transport classes definition
- Mover: Aleksandra Checko
- Secunder:
- Yes: ___ No: ___ Abstain: ___

NETWORK TRANSPORT REQUIREMENTS (5G)

Based on

3GPP TR 38.801 (12-2016), R3-161813

SCF documentation (159)

Proposed NGFI transport classes of service

Motion on transport classes definition from Oct meeting – the aim is to fill in this table

Class	Sub Class (FFS)	Priority Level (FFS)	Latency upper bound requirement (FFS)	Throughput requirement (FFS)	Reserved	informative
I. control & management	synchronization	0		Low BW		
	Low latency RAN control-plane	1		Low BW		
II. data-plane	Subclass1	2		R3_low – R3_high		3GPP model Option 6,7,8
	Subclass_2	3		R4_low – R4_high		3GPP model Option 4,5
	Subclass_3	4		R5_low – R5_high		3GPP model Option 1,2,3
Transport NW control & management		?	?	Low BW		
Reserved						

I. Low latency RAN control-plane

Classification:

- Configuration information between the centralized unit and distributed unit
 - Low BW, possible high latency
- Coordination for Radio resource management (X2 alike)
 - Low BW, mid latency
- Coordinated multipoint, Massive MIMO, precoding weights
 - Mid towards high BW, low latency
- NR air interface control plane (e.g. HARQ, CSI, pilot tones)
 - Low to high BW, low latency

How do we define requirements?

II. Throughput & Latency Requirements for data plane DL

Assumptions:

- For throughput requirements, DL only
 - 20MHz bandwidth
 - 2X2 MIMO (2 antenna ports)
 - Bitwidth 32 bits
 - 64 QAM
- For latency requirements:
 - Considered only TTI = 1ms
 - FFS to expand for TTI less than 1ms

Subclass 1: Throughput Requirements

	Requirements	Option 6	Option 7 ^{SCF}	Option 8
Format:	Payload	Baseband bits MAC PDUs DCI/UCI PDUs	Soft bits/ Modulated Symbols/ Quantized IQ in freq domain	Quantized IQ – time domain
	Flow control	No (Jitter buffers)		
Dependencies:	Bandwidth (1GHz = 50*20MHz)	50x(4/3)x (152 ^{SCF} – 211 ^{3GPP})Mbps	50x(4/3)x173Mbps - 50x1,1Gbps	~50x2Gbps
	MIMO layers (up to 8 =4*2)	4x50x(4/3)x (152 ^{SCF} – 211 ^{3GPP})Mbps	4x50x(4/3)x173Mbps -50x1,1Gbps	-
	Antenna Ports (up to 256)	NA	4x50x(4/3)x173Mbps -(256/2)x50x1,1Gbps	~(256/2)x50x 2Gbps
	Max Rate	41 - 56 Gbps	<46Gbps-6,9Tbps	~12,8 Tbps

**Split 8 (5G) has significantly higher BW requirements comparing to split 6 and 7
– will option 8 be adopted at all for 5G?
Support can be maintained for 4G option 8)**

Subclass 2: Throughput Requirements

	Requirements	Option 4	Option 5
Format:	Payload	Baseband bits RLC PDUs Control plane	Baseband bits MAC SDU/PDUs
	Flow Control	Required	Required
Dependencies:	Bandwidth (1GHz)	$50 \times (4/3) \times$ (151 ^{SCF} - 196 ^{3GPP}) Mbps	$50 \times (4/3) \times$ (151 ^{SCF} - 211 ^{3GPP}) Mbps
	MIMO layers (up to 8)	$4 \times 50 \times (4/3) \times$ (151 ^{SCF} - 196 ^{3GPP}) Mbps	$4 \times 50 \times (4/3) \times$ (151 ^{SCF} - 211 ^{3GPP}) Mbps
Max Rate:		40 - 52.3 Gbps	40 - 56 Gbps

Subclass 3: Throughput Requirements

	Requirements	Option 1	Option 2	Option 3
Format:	Payload	GTP UP data RRC PDUs	Baseband bits PDCP PDUs	Baseband bits RLC SDUs
	Flow Control	same as S1-U	Flow control (X2 - existing)	RLC buffer; real time flow control exit in TX side** Flow control needed***
Dependencies:	Bandwidth 1GHz (20Mhz)	50 x 150Mbps		
	MIMO layers up to 8 (2)	50 x 4 x 150Mbps		
	Modulation QAM 2 ⁸ (2 ⁶)	50 x 4 x (4/3) x 150Mbps		
	Total Rate	40Gbps	(UP)40Gbps+ (CP PDCP)16^{3GPP}Mbps	40Gbps

Proposed NGFI transport classes of service

Motion on transport classes definition; new motion: add synchronization

Class	Sub Class (FFS)	Priority Level (FFS)	Latency upper bound requirement (FFS)	Throughput requirement (FFS)	Reserved	informative
control & management	synchronization	0		Low BW		
	Low latency RAN control-plane	1		Low BW		
data-plane	Subclass1	2		41Gbps – 6,9 Tbps (12.8Tbps)		3GPP model Option 6,7,8
	Subclass_2	3		40Gbps – 56Gbps		3GPP model Option 4,5
	Subclass_3	4		40Gbps – 41Gbps		3GPP model Option 1,2,3
Transport NW control & management		?	?	Low BW		
Reserved						

Motion #___

- Agree on throughput requirements for different NGFI subclasses as proposed in slide 21.
- Mover: Aleksandra Checko
- Secunder:
- Yes: ___ No: ___ Abstain: ___ (technical motion needs $\geq 2/3$)

Subclass 1: Latency/Synchronization Requirements

Need to derive the budget for the transport network

Legend: 1914 requirement (3GPP requirement)

	Requirements	Option 6	Option 7	Option 8
Req.	Latency Requirements	100 μs^{CM} 250 $\mu\text{s}^{\text{NGMN}}$ (4ms)	100 μs^{CM} 250 $\mu\text{s}^{\text{NGMN}}$ (4ms)	100 μs^{CM} 250 $\mu\text{s}^{\text{NGMN}}$ (4ms)
	Cell phase synchronization accuracy	($\pm 5 \mu\text{s}$ $\pm 1.5 \mu\text{s}$)		
Tech. Depend.	CA	($\pm 65 \text{ ns}$ - $\pm 130 \text{ ns}$)		
	CoMP	($\pm 1.5 \mu\text{s}$)		
	MIMO	($\pm 65 \text{ ns}$)*	($\pm 65 \text{ ns}$)*	($\pm 65 \text{ ns}$)
	911 calls	100ns (Core network-UE)		

*Not all TM supported

Subclass 2: Latency/Synchronization Requirements

Need to derive the budget for the transport network

Legend: 1914 requirement (3GPP requirement)

	Requirements	Option 4	Option 5
Req.	Latency Requirements	100 $\mu\text{s}^{\text{3GPP}}$ - 6 ms^{SCF}	X00 $\mu\text{s}^{\text{3GPP}}$ - 6 ms^{SCF}
	Cell phase synchronization accuracy	(±5 μs ±1.5 μs)	
Techn. Depend.	CA	-	(±65 ns - ±130 ns)
	CoMP	-	(±1.5 μs)
	MIMO	-	-
	911	100ns (Core network-UE)	

Subclass 3: Latency / Synchronization Requirements

Need to derive the budget for the transport network

Legend: 1914 requirement (3GPP requirement)

	Requirements	Option 1	Option 2	Option 3
Req.	Latency Requirements	10 ms ^{3GPP}	1.5-10ms ^{3GPP} , 30ms ^{SCF}	1.5-10ms ^{3GPP}
	Synchronization Requirements	TAG for DC	TAG for DC	5usec / 1.5 usec
Techn. Depend.	CoMP	No support		
	CA	No support		
	MIMO	No support		

Proposed NGFI transport classes of service

Motion on transport classes definition; new motion: add synchronization

Class	Sub Class (FFS)	Priority Level (FFS)	Latency upper bound requirement (FFS)	Throughput requirement (FFS)	Reserved	informative
control & management	synchronization	0		Low BW		
	Low latency RAN control-plane	1		Low BW		
data-plane	Subclass1	2	100us	R3_low – R3_high		3GPP model Option 6,7,8
	Subclass_2	3	100us – 6ms	R4_low – R4_high		3GPP model Option 4,5
	Subclass_3	4	1.5ms-30ms	R5_low – R5_high		3GPP model Option 1,2,3
Transport NW control & management		?		Low BW		
Reserved						

Motion #___

- Add synchronization requirements as column in the NGFI table as proposed in slide 25.
- Mover: Aleksandra Checko
- Secunder:
- Yes: ___ No: ___ Abstain: ___ (technical motion needs $\geq 2/3$)

Summary

- Standardization overview - Motion
- Transport network requirements towards filling in the transport class table - Motions

BACKUP

3GPP naming of functional splits

From 38.801

