Overview and requirements

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Overview and requirements			
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Introduction

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		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)

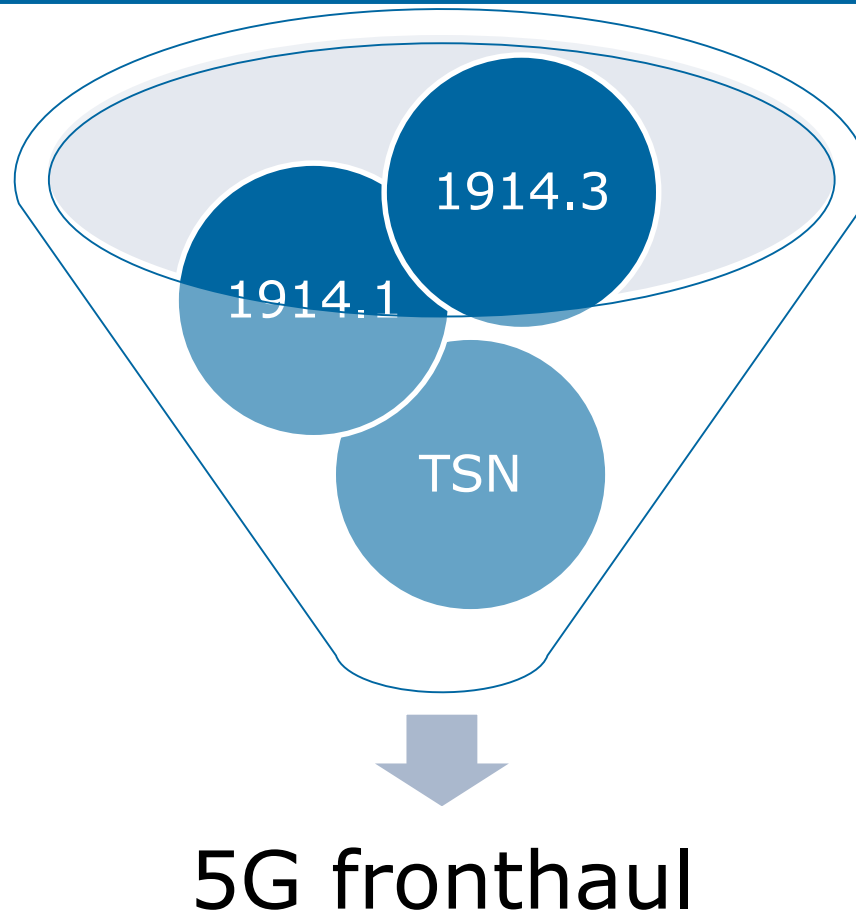[1] 201610 IEEE 1914 f2f meeting summary

Agenda

- Standardization overview - motion

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

STANDARDIZATION EFFORT OVERVIEW

Standardization effort overview

3GPP

1914.3

1914.1

TSN

5G fronthaul

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?

Existing liaison between TSN and 1914.1 on architectural requirements

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

- Seconder:

- 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
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						

I. {control & management rows}
II. {data-plane rows}

I. Low latency RAN control-plane

Classification (non-exchausting):

- 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**	Quantizied IQ – time domain
	Flow control		No (Jitter buffers)	
Dependencies :	Bandwidth (1GHz = 50*20MHz), 256 QAM	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**

Option 8 (5G) has significantly higher throughput requirements comparing to option 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 (20MHz) 256 QAM	$50\times(4/3)\times$ $(151^{SCF} - 196^{3GPP})$ Mbps	$50\times(4/3)\times$ $(151^{SCF} - 211^{3GPP})$ Mbps
	MIMO layers up to 8 (2)	$4\times50\times(4/3)\times$ $(151^{SCF} - 196^{3GPP})$ Mbps	$4\times50\times(4/3)\times$ $(151^{SCF} - 211^{3GPP})$ Mbps
	Max Rate:	**40 - 52.3 Gbps**	**40 – 56 Gbps**

◈IEEE

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[3GPP] Flow control needed[3GPP]
Dependencies:	Bandwidth 1GHz (20MHz) 256 QAM	50 x (4/3) x150Mbps		
	MIMO layers up to 8 (2)	50 x (4/3) x 4 x150Mbps		
	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 18.

- Mover: Aleksandra Checko

- Seconder:

- Yes: ___ No: ___ Abstain: ___ (technical motion needs >= 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
	Latency Requirements	$100\ us^{3GPP}$ $250\ us^{NGMN}$ (4ms)	$100\ us^{3GPP}$ $250\ us^{NGMN}$ (4ms)	$100\ us^{3GPP}$ $250\ us^{NGMN}$ (4ms)
Synchronization requirements	Cell phase synchronization accuracy	(±5usec ±1.5 usec)		
	CA	(±65 ns - ±130 ns)		
	CoMP	(±1.5 us)		
	MIMO	(±65 ns)*	(±65 ns)*	(±65 ns)
	911 calls	100ns**		

*Not all TM supported, ** http://www.gps.gov/cgsic/meetings/2012/weiss1.pdf

Subclass 2: Latency/Synchronization Requirements

Need to derive the budget for the transport network

Legend: 1914 requirement (3GPP requirement)

	Requirements	Option 4	Option 5
	Latency Requirements	100 us^{3GPP} - 6 ms^{SCF}	hundrets us^{3GPP} - 6 ms^{SCF}
Synchronization requirements	Cell phase synchronization accuracy	($\pm$5us $\pm$1.5 us)	
	CA	Not-dependent	($\pm$65 ns - $\pm$130 ns)
	CoMP	Not-dependent	($\pm$1.5 us)
	MIMO	Not-dependent	Not-dependent
	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
	Latency Requirements	10 ms[3GPP]	1.5-10ms[3GPP], 30ms[SCF]	1.5-10ms[3GPP]
Synchronization requirements	Cell phase synchronization accuracy	33us (500us)	33us (500us)	5usec / 1.5 usec
	CA	Not-dependent		
	CoMP	Not-dependent		
	MIMO	Not-dependent		

Proposed NGFI transport classes of service

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	Hundreds us (100 us for option 4) – 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						

Should option 4 be kept?

Motion #___

- Add synchronization requirements as column in the NGFI table as proposed in slide 23.

- Mover: Aleksandra Checko

- Seconder:

- Yes: ___ No: ___ Abstain: ___ (technical motion needs >= 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