

5G Crosshaul

5G-Crosshaul Control and Data planes

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fronthaul/backhaul integrated transport networks
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04/05/2016 1

5G Crosshaul

Overview

- 5G Crosshaul control and data plane
- Data plane / XCF
- Control plane / XCI design
- Summary and outlook

04/05/2016 2

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5G-Crosshaul Architecture

04/05/2016 3

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5G-Crosshaul Forwarding Element XFE

- Multi-layered switch
 - Packet forwarding: XPFE
 - Circuit switching: XCSE
 - Layers are optional
 - Packet layer uses common frame (XCF)

04/05/2016 4

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Data plane / XCF requirements

Functional splits		Transport Efficiency	
multiple functional splits	ranging from CPRI-like fronthaul traffic to backhaul traffic	Short overhead	The additional headers introduced by the XCF shall be short.
		Multi-path	Different paths to one destination
Multi-tenancy		Management	
Isolate traffic	one tenant shall not impact the QoS of the traffic of other tenants.	Flow differentiation	provide QoS for individual flows in addition to traffic classes.
Separate traffic	One tenant shall not be able to listen to traffic of another tenant.	Class of Service differentiation	different classes of service for different types of traffic
Differentiation of forwarding	Traffic of different tenants may be forwarded differently.	Support of multiple media	
Multiplexing gain	utilize statistical multiplexing gains among traffic of different tenants	802.3	yes/no
Tenant ID	Identify traffic of different tenants	802.11ad	yes/no
		mmWave	yes/no
Coexistence		Energy efficiency	
Ethernet Security support	Compatibility with legacy Ethernet encryption or authentication for frames	Energy usage proportional to traffic	The XFEs shall be energy efficient by using features such as sleep modes, reduced line rates, etc.
Compatible with (g)PTP	carry synchronization information on the same links as data traffic	Miscellaneous	
		No lock in based on standards	

04/05/2016 5

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Data plane / XCF

- Possible alternatives: MAC-in-MAC, MPLS-TP
- MAC-in-MAC
 - Separation of address spaces
 - VID (and optionally I-SID) to distinguish tenants
 - PCP (3bit)
 - UCA (1bit) to mark OAM packets

04/05/2016 6

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Data plane / Quality of Service

PCP	Traffic class	service class/prio	Comment
7	RoE, CPRI-like	Ideal	Frame preemption
6	Control (sync, network control, FH radio control, BH radio control)		
5	FH data GBR, mission critical	Near/sub ideal/GBR high	CIR
4	BH GBR, mission critical, tactile, voice, video	Non-ideal/high	GBR N/A
3	FH nGBR premium, mission critical	Near/sub ideal/nGBR high	CIR/EIR
2	FH nGBR best effort	Near/sub ideal/nGBR low	
1	BH nGBR premium, mission critical	non ideal/nGBR high	
0	BH nGBR best effort	non ideal/nGBR low	

- Different types of traffic
 - CPRI
 - Fronthaul
 - Synchronization
 - C-plane
 - ...
- Are 3 bits sufficient?

04/05/2016 7

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5G-Crosshaul Architecture

04/05/2016 8

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Control plane / XCI Architecture

- MANO
- SDN controller
- XPU controller

04/05/2016 9

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Control plane / XCI details

- VIMaP
 - map physical topology to virtual topology
 - configure network slice on demand
- SDN controller provides abstraction of network
 - Network applications/network service control layer
 - Network core services/infrastructure control layer
 - Abstraction layer to hide physical layer details
- Multi-domain capability
 - Controller hierarchy to hide details of technological or administrative domains
 - Plugins to hide details of technological domains

04/05/2016 10

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Summary

- Overview of data and control plane
- Selected aspects shown
 - XCF and how to provide QoS for different traffic types
 - XCI design, multi-domain capability
- Outlook: applications at NBI of XCI
 - Further presentations by Xi Li and Thomas Deiß

04/05/2016 11

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04/05/2016 12