

Summary of P1914.1 Functional Split proposals

Jouni Korhonen

Broadcom Ltd

9/13/2013



Compliance with IEEE Standards Policies and Procedures

Subclause 5.2.1 of the *IEEE-SA Standards Board Bylaws* states, "While participating in IEEE standards development activities, all participants...shall act in accordance with all applicable laws (nation-based and international), the IEEE Code of Ethics, and with IEEE Standards policies and procedures."

The contributor acknowledges and accepts that this contribution is subject to

- The IEEE Standards copyright policy as stated in the *IEEE-SA Standards Board Bylaws*, section 7, <http://standards.ieee.org/develop/policies/bylaws/sect6-7.html#7>, and the *IEEE-SA Standards Board Operations Manual*, section 6.1, <http://standards.ieee.org/develop/policies/opman/sect6.html>
- The IEEE Standards patent policy as stated in the *IEEE-SA Standards Board Bylaws*, section 6, <http://standards.ieee.org/guides/bylaws/sect6-7.html#6>, and the *IEEE-SA Standards Board Operations Manual*, section 6.3, <http://standards.ieee.org/develop/policies/opman/sect6.html>

**IEEE P1914.1
NGFI
Jinri Huang, huangjinri@chinamobile.com**

[Summary of P1914.1 Functional Split proposals

]

Date: 2016-09-13

Author(s):

Name	Affiliation	Phone [optional]	Email [optional]
Jouni Korhonen	Broadcom Ltd		jouni.korhonen@broadcom.com

Contents

Terminology and split naming

- Need for alignment.
- Proposal to align with 3GPP as much as possible.

Split proposal summary

- Identify splits with most interest.

Architecture proposals

- Starting to identify commonalities with envisioned deployment architectures and eventually form a common P1914.1 reference architecture.

Summarizing P1914.1 split discussion

Input papers (see <http://sites.ieee.org/sagroups-1914/p1914-1/ieee-p1914-1-tf-meeting-materials/ieee-p1914-1-tf-august-meeting-materials/>) with split and architecture proposals:

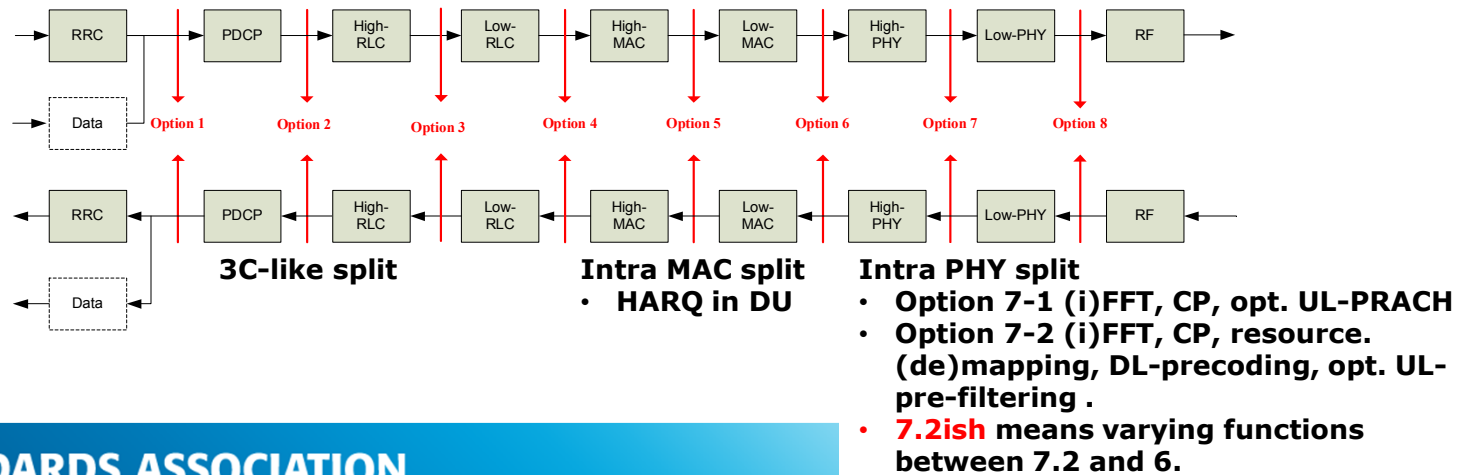
- tf1_1608_Huang_gap-analysis-and-scenarios_2.pdf
- tf1_1608_al-obaidi_l1-offload_1.pdf
- tf1_1608_Assimakopoulos_Flexible-Ethernet-Fronthaul_3.pdf
- tf1_1608_Bartelt_5GFronthaul_2.pdf
- tf1_1608_cai_kapoulas_tazi_NGFI_use_cases_3.pdf
- tf1_1608_Checko_FronthaulConsiderations_2.pdf
- tf1_1608_garcia-saavedra_RAN-split_1.pdf
- tf1_082016_Ramamurthi_5GBroadbandTransportReq_3.pdf
- tf1_1608_Tam_NGFI-Requirements-and-Architecture_3.pdf
- tf1_1608_korhonen_practical_approach_2.pdf
- tf1_1608_yang_Latency-requirements-and-analysis_1.pdf
- tf1_1608_saavedra_5g-crosshaul_2.pdf

Terminology and split naming

- Using 3GPP TR 38.801v0.4.0 terminology (with varying success)

Proposal	Meaning
Digital Unit (DU)	RRH/RRU/RE/RU
Central Unit (CU)	BBU/REC/RCC/C-RAN/V-RAN
New Radio (NR)	"5G" radio
Aggregation unit	RAU/DU
Remote Radio Head (RRH)	standalone radio head, remote unit, DU ??

- Using 3GPP TR 38.801v0.4.0 split naming (with clarifications)



Split proposals

Comcores

- Option 7-2ish

NEC

- Options 2 and 5

iCIRRUS project

- Options 7.1 (split III), 7.2 (split II), 7.2ish (split I)

5G-XHaul project/TU Dresden

- Options 7.2 (split B), 4 (split C)

Fujitsu & Actus/HFR

- Options 7.2ish (splits 3 and 4)

Verizon

- Options 7.1 (PHY Pre), 7.2 (PHY Sym), 2 (PDCP-RLC), 4 (MAC-PHY)

Broadcom

- Options 7.1 (NGFI1), 7.2 (NGFI2), 2 (NGFI2)

AT&T, MTI, CMCC

- No clear recommendation

Split proposals - summary

Higher splits– above PHY:

- Option 2 – 3 proponents
- Option 4 – 2 proponents
- Option 5 – 1 proponent

Lower splits – within PHY:

- Option 7.1 – 3 proponents
- Option 7.2(ish) – 7 proponents
 - 3 are more “7.2ish” variants

Concluding:

- Higher splits: option 2 – PDCP-RLC
- Lower splits: options 7.2 – intro PHY split

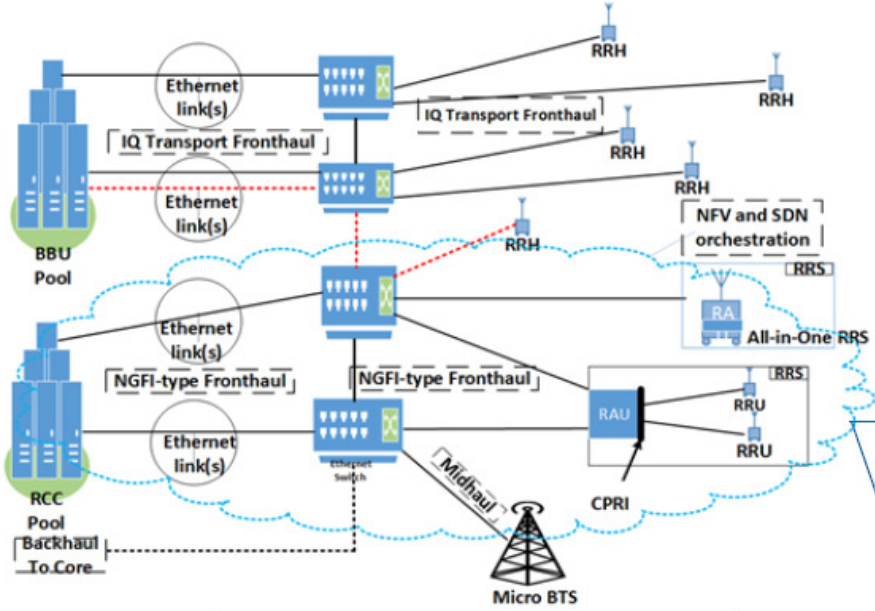
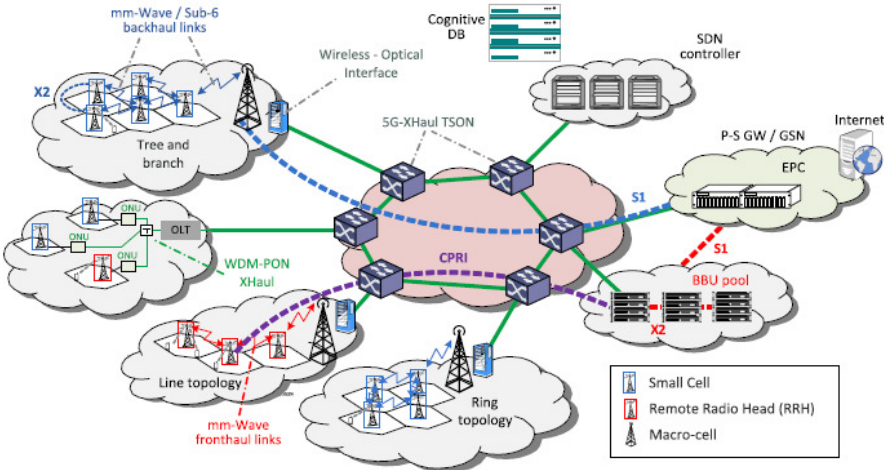
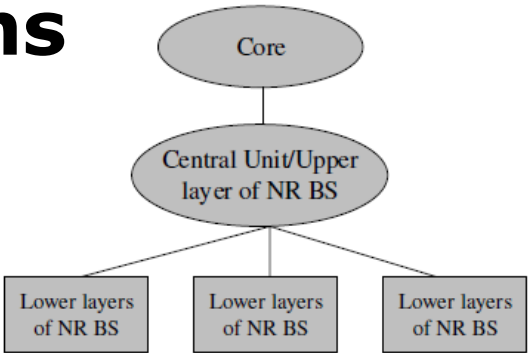
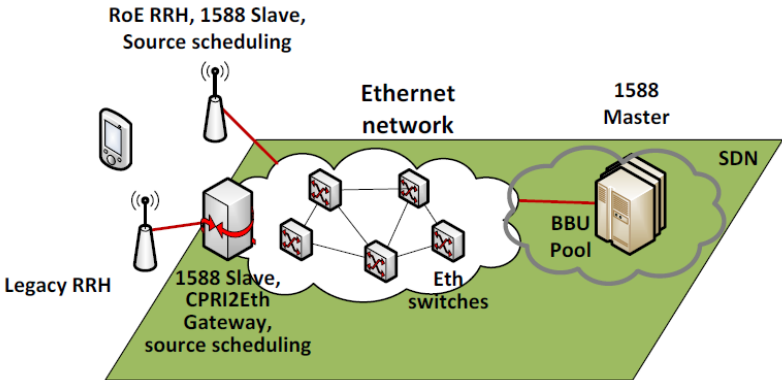
Intra PHY splits

- Option 7.1 is "clear":
 - Selection of functions is almost unambiguous.
 - "Easy" from hardware point of view.
 - More or less stateless.
 - Plain cell processing.
- Option 7.2 gets already blurry:
 - Current bias seems to be just including resource (de)mapping as part of the essential functions.
 - Involves tracking of used resource elements/blocks – implementation complexity.
- Option 7.2 significantly better than 7.1 when it comes to bandwidth savings. No real difference in latency/jitter requirements.

Proposal for way forward with splits

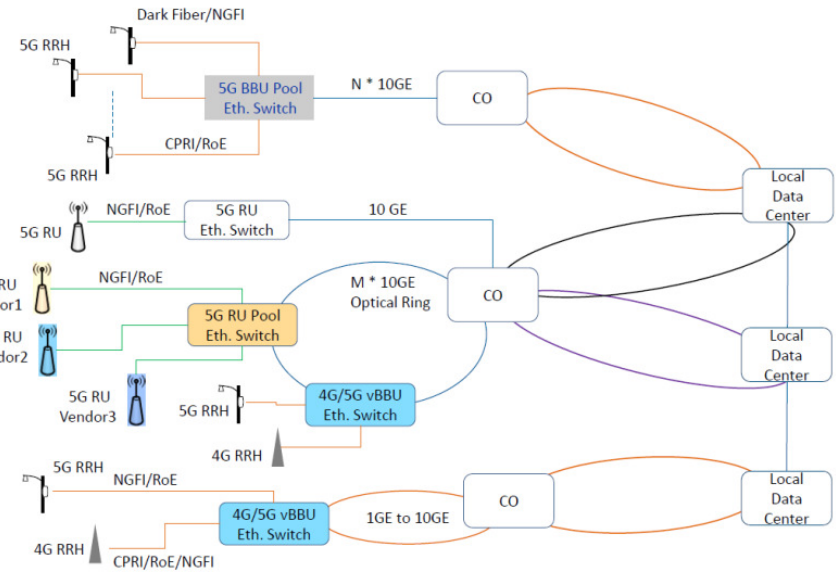
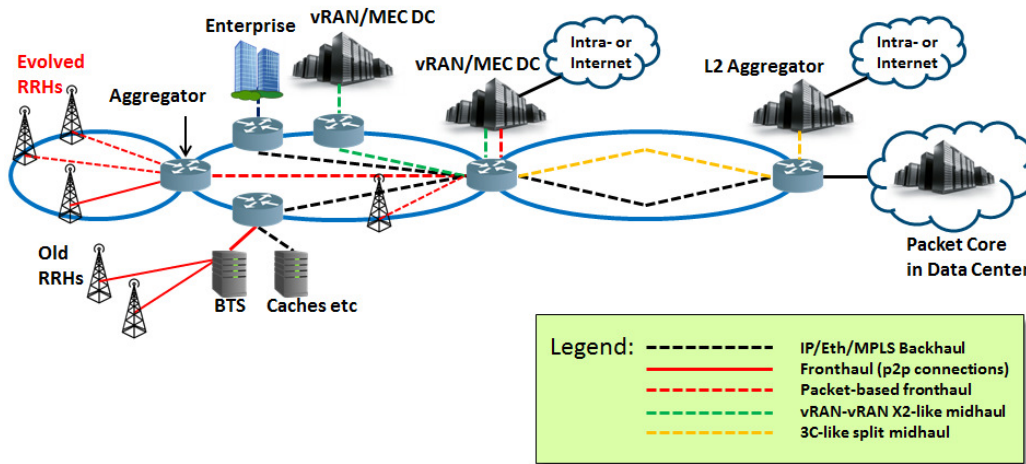
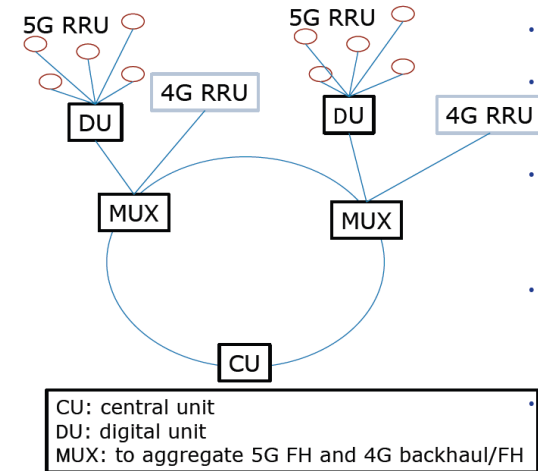
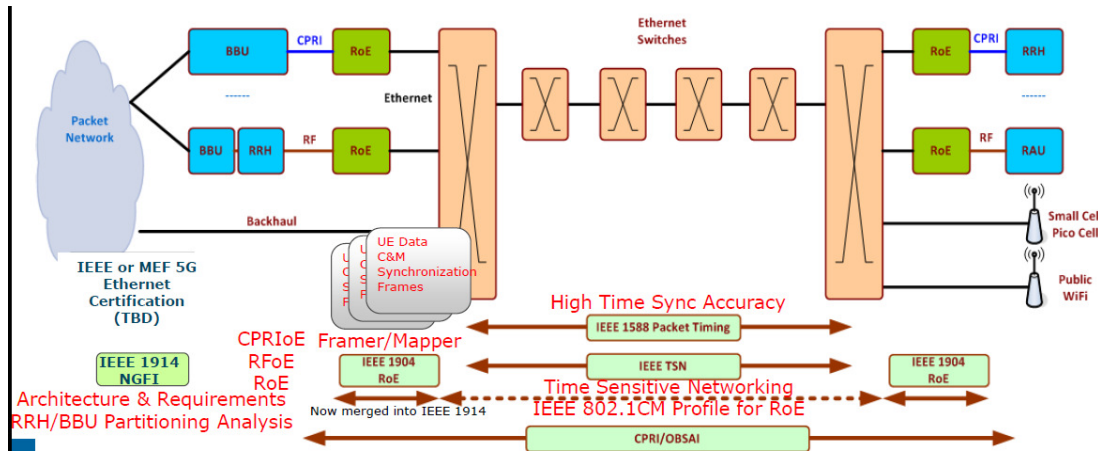
- P1914.1 to start with two splits:
 - Low level split: 3GPP option 7.2 (with more clear definition what functions are included).
 - High level split: 3GPP option 2 (DC derivate).
- Discuss still the applicability of 3GPP option 7.1 (due its simplicity).

Architecture Assumptions

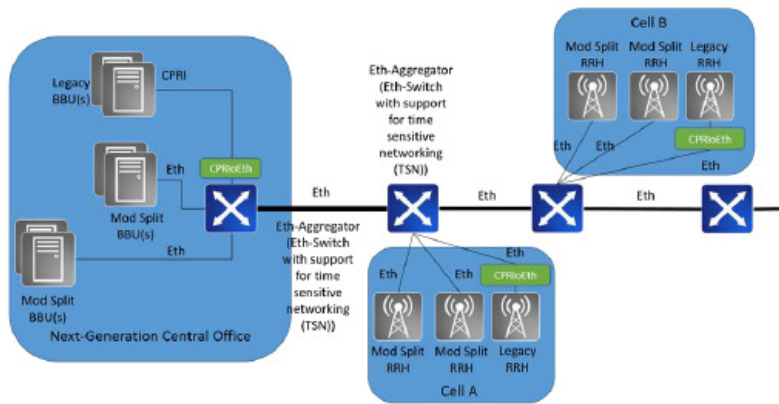


RRS: Radio Remote System RRH: Remote Radio Head
 RRU: Remote Radio Unit BBU: Base Band Unit
 RCC: Radio Cloud Centre RAU: Radio Aggregation Unit
 Micro BTS: Micro Base Station

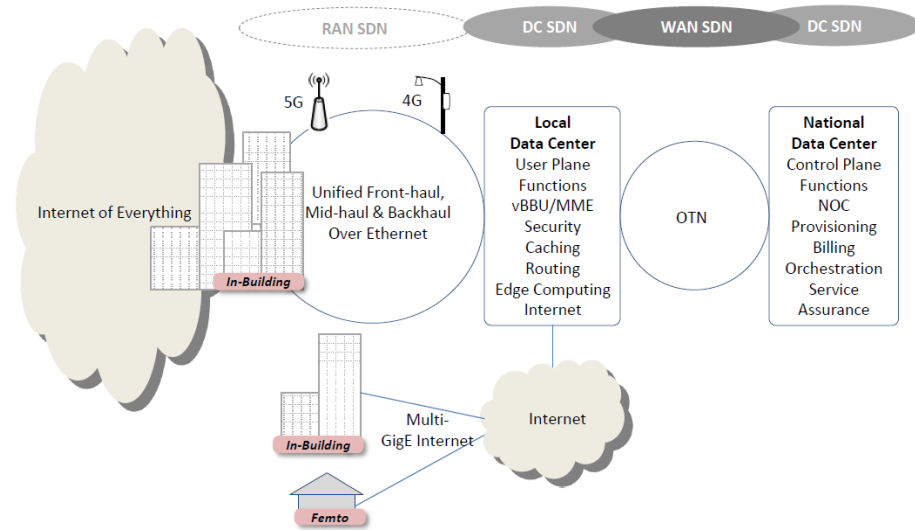
Architecture Assumptions cont'd



Architecture Assumptions cont'd



Tree topology (add and drop)



Architecture summary

Following trends visible for the NGFI interface use:

- Greenfield deployments: direct DU – CU connection over Ethernet-based NGFI interface.
- Existing fronthaul (e.g., CPRI) & also “new” DUs using old fronthaul solutions: **an aggregation DU device** terminates Ethernet-based NGFI interface between CU.
- An aggregation DU device terminates Ethernet-based NGFI interface on behalf of multiple DUs. **Forms two levels of NGFI interfaces:** DU -> aggregating DU -> CU.
- An aggregation DU device connects legacy base stations to “new” DUs: aggregating DU device -> DU using Ethernet-based NGFI interface.

Mirgation/coexistence of 4G and 5G within the same deployment.

Converged fronthaul/backhaul networks.

Dicussion..