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绿色通信研究中心
Green Communication Research Center

China Mobile's View on Next Generation Fronthaul Interface

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Challenges for future 5G networks

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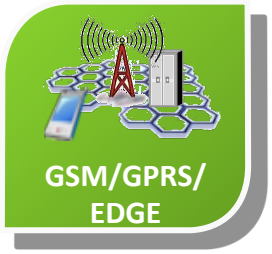
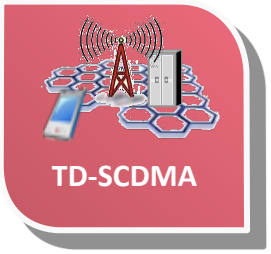
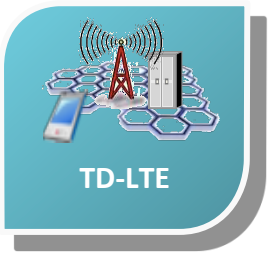
Agility, openness, scalability, efficiency







- So many issues for current “hard” mobile networks
  - ✓ Time-to-market
  - ✓ Service innovation
  - ✓ Energy efficiency
  - ✓ TCO
  - ✓ Interoperability
  - ✓ …

Special Challenge for CMCC

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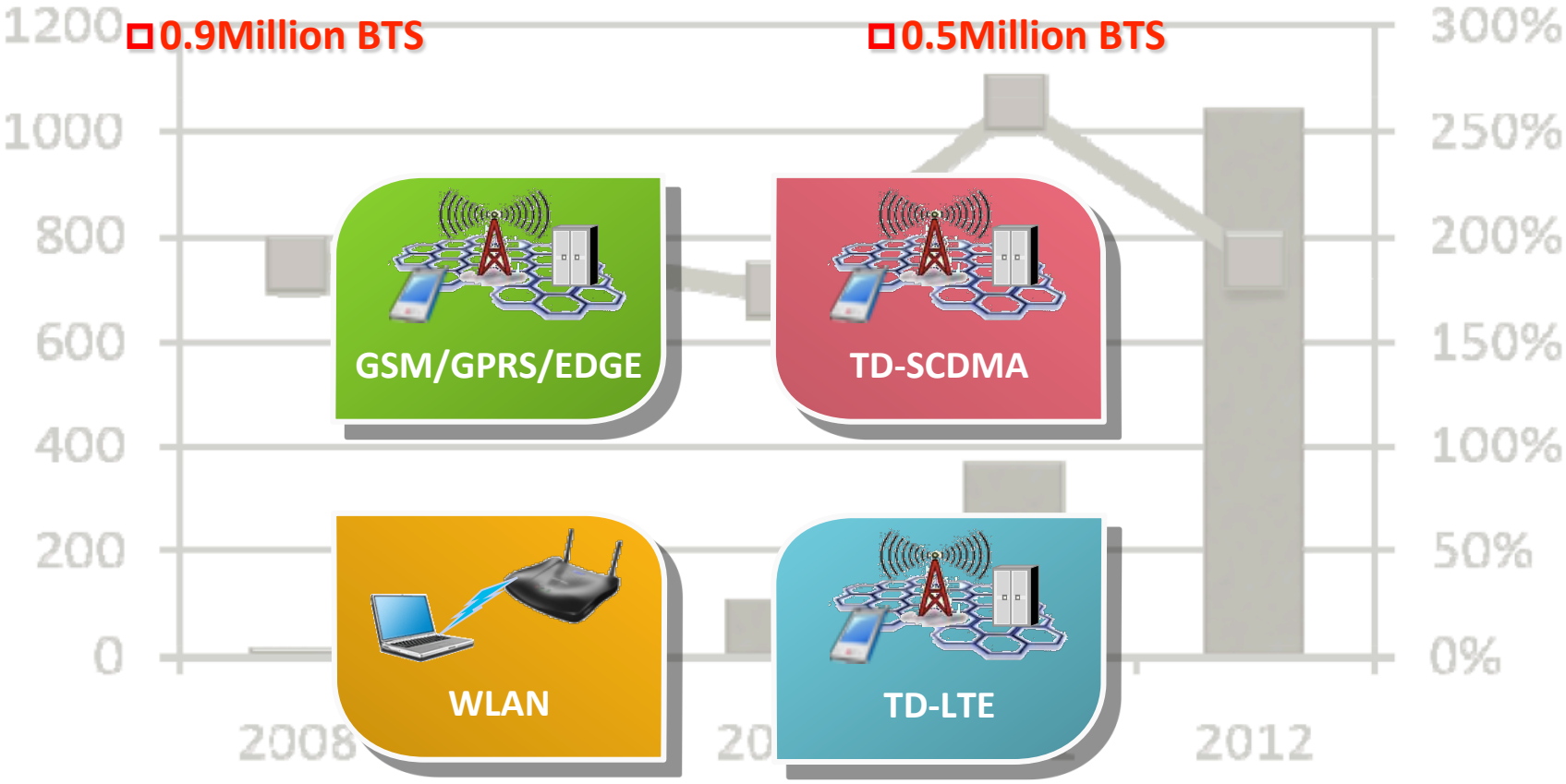
How to coordinate our four networks to satisfy user needs?

81x from 2008 to 2012



The answer: Green and Soft

C-RAN: the revolutionary evolution towards 5G, proposed by CMCC in 2009

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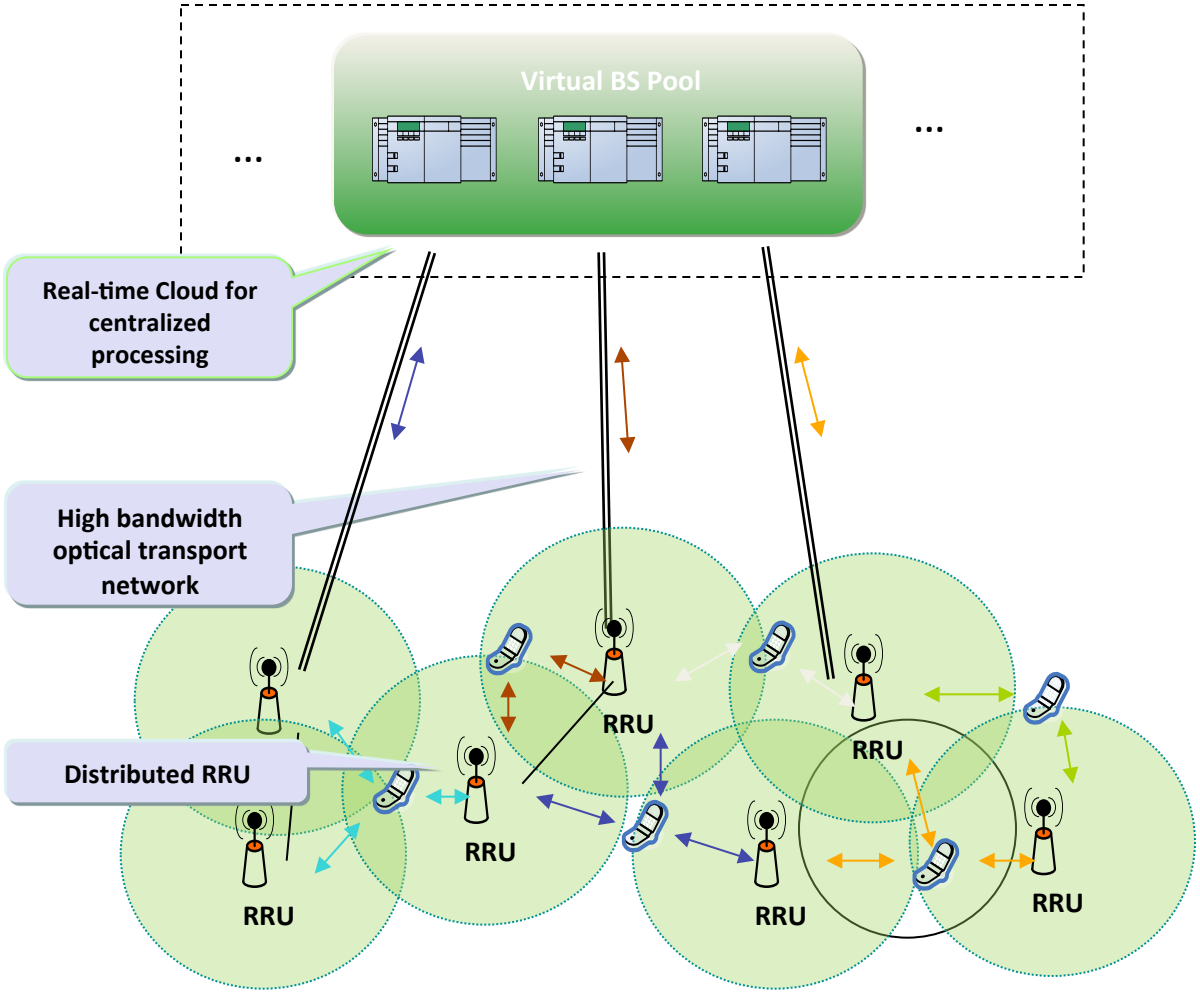
"Soft BS " in C-RAN virtualization/cloudization



Centralized Control and/or Processing

- Centralized processing resource pool that can support 10~1000 cells

Collaborative Radio

- Multi-cell Joint scheduling and processing

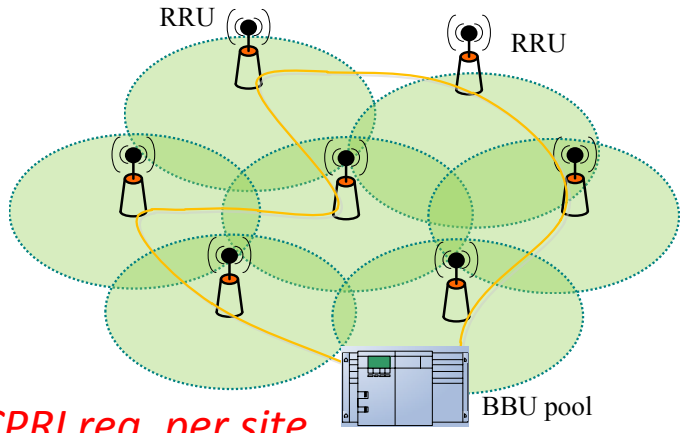
Real-Time Cloud

- Target to Open IT platform
- Consolidate the processing resource into a Cloud
- Flexible multi-standard operation and migration

Clean System Target

- Less power consuming
- Lower OPEX
- Fast system roll-out

Fronthaul is a major challenge for C-RAN deployment



CPRI req. per site

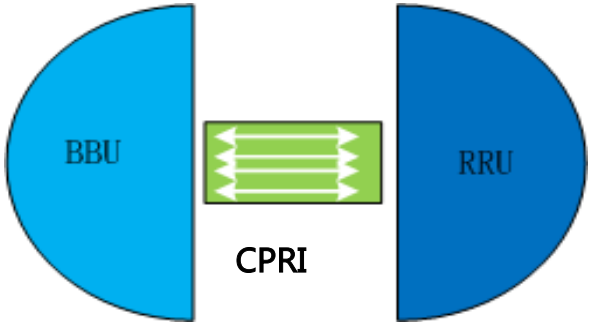
Challenge by fronthaul b/w BBU and RRU

- Data rate b/w BBU and RRU using CPRI is as high as 9.83Gbps for 8-antenna TD-LTE, requiring 4 fibers for each carrier with 6G SFP

	Typical configuration	# of carriers	CPRI data rate per carrier	Total CPRI data rate before compression
GSM	3 RRU, S6/6/6	36	40Mbps	1.44Gbps
TD-S	3 RRU, S3/3/3	9	300Mbps	2.7Gbps
Current TD-LTE	3 RRU, S1/1/1	3	10Gbps	30Gbps
Medium term TD-LTE	S2/2/2	6	10Gbps	60Gbps
In addition, CPRI has critical requirements on synchronization and latency.				

Efficient fronthaul solution is required to enable C-RAN large-scale deployment

Time to rethink FH for the sake of 5G evolution



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- *CPRI for 5G? Probably NOT*
  - Too high data bandwidth
  - Scalability issue to support 5G evolution
  - Lower efficiency due to TDM mode

3

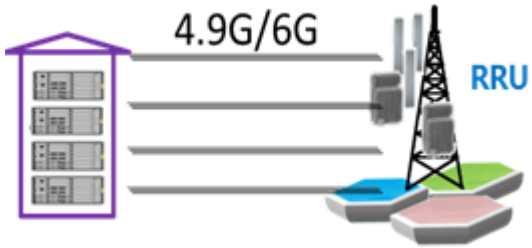
- Initial work in SDOs
  - NGMN conducted initial function split solutions for LTE
  - Newly founded project in CCSA to study the requirements, scenarios and the key technologies
  - Discussion in ITU-T and IEEE TSN recently

2

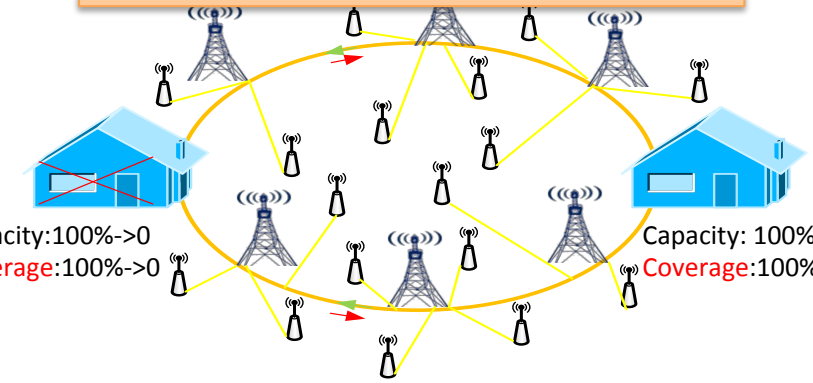
- Rethink FH
  - Traffic dependent to enjoy and enable statistical multiplexing for FH transport networks
  - Decoupling cell processing and UE processing
  - Decoupling UL and DL
  - Support key 5G technologies, e.g. LSAS, CoMP etc.
- A new FH requires joint design from both wireless and transport perspectives
  - Function split b/w BBU and RRU
  - Careful transport network design to address the latency, jitter and in particular, synchronization requirements
- *More radically, could we relax the critical CPRI requirements* (e.g. 0.002ppm sync. requirement)?

Expected benefits

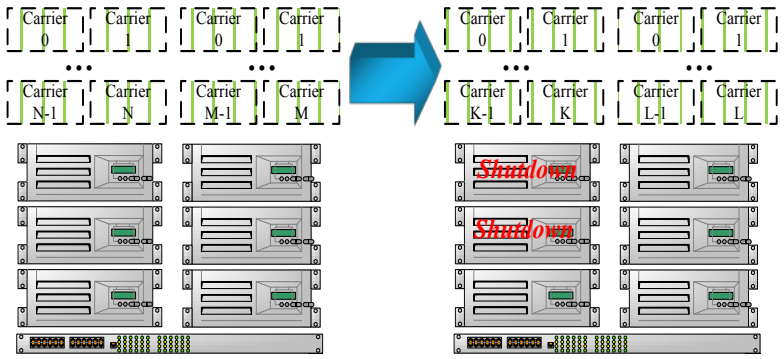
Reduced FH bandwidth and therefore the cost



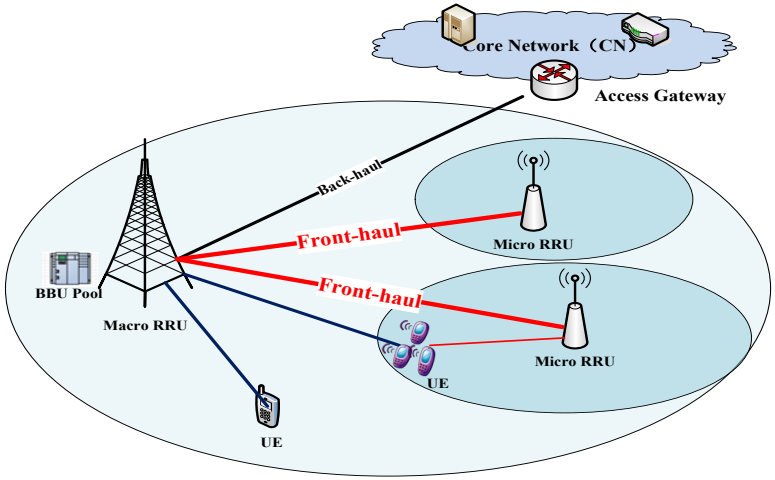
Disaster-tolerant backup thanks to flexible mapping b/w BBU pool and RRU



Better support for live migration

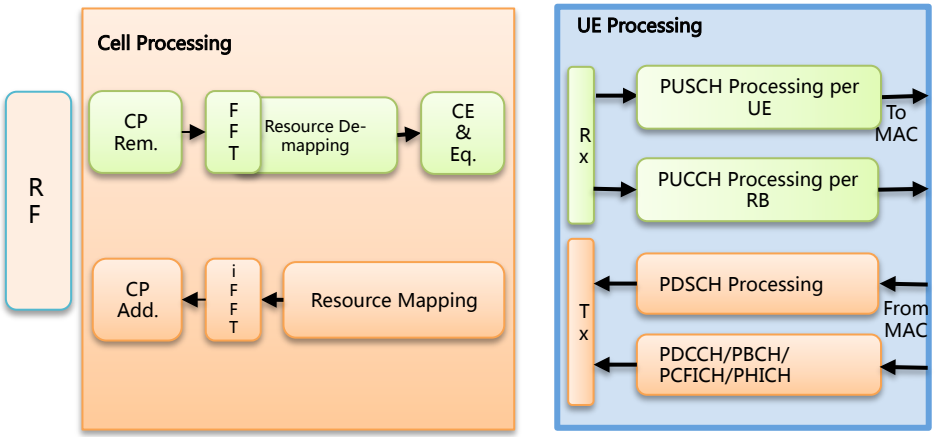


Better support for 5G technologies due to the flexible routing capability

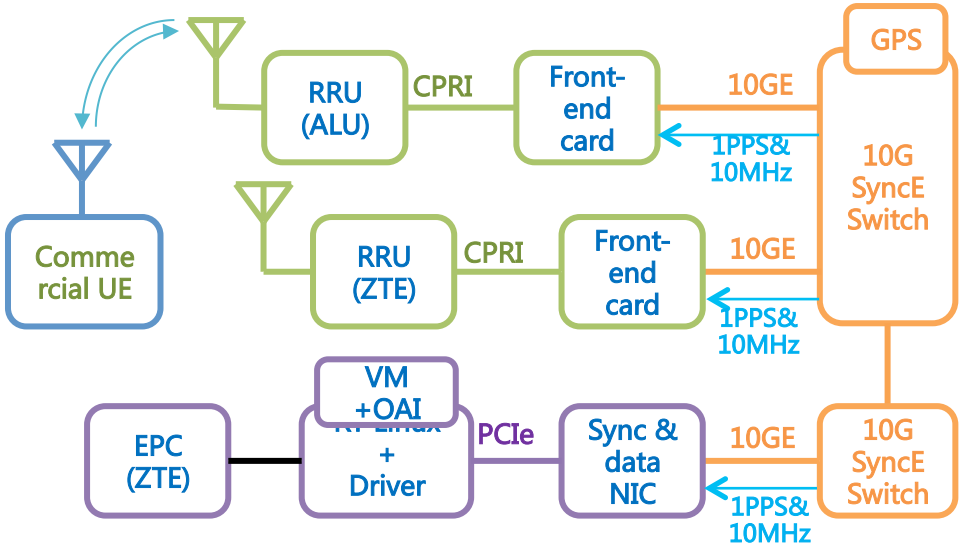


Some initial work in this front

- Initial study on BBU-RRU function split for LTE
- Design principle:
  - Traffic-dependent BW adaptation
  - Statistical multiplexing
  - Multiple mapping relationship b/w BBU and RRU
  - Independent of antenna number

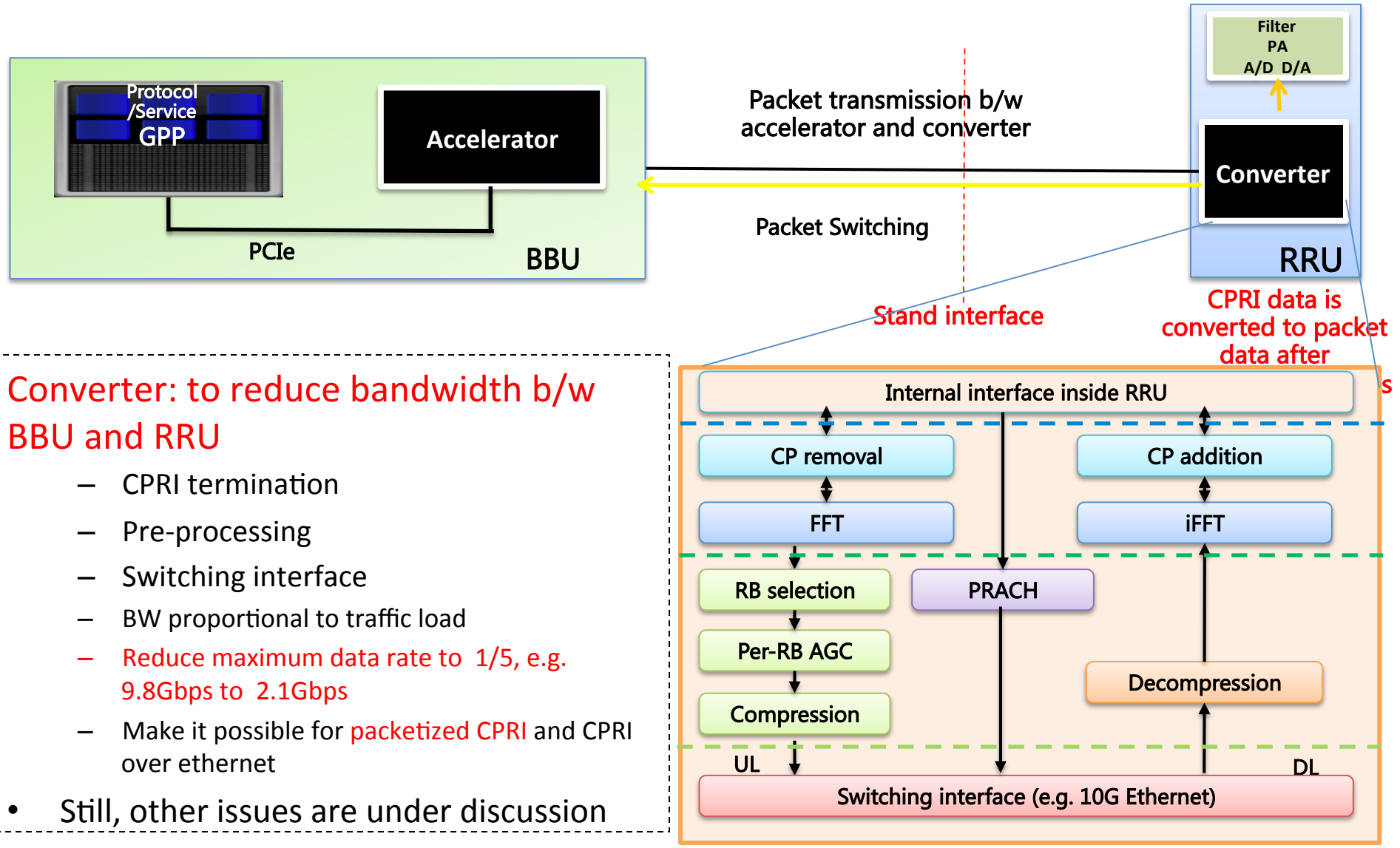


- Initial verification of the feasibility of CPRI over Ethernet
  - Simple point to point connection
  - CPRI I/Q sampling -> Ethernet packet of 512 Bytes
  - 1588v2 for RRU phase sync.



- WP on Next-generation Fronthaul Interface (NGFI) ongoing, to be published by March
- NGFI forum planned for Q2 2015 (contact: *huangjinri@chinamobile.com)*

Initial study on BBU-RRU function split



Converter: to reduce bandwidth b/w BBU and RRU

- CPRI termination
- Pre-processing
- Switching interface
- BW proportional to traffic load
- Reduce maximum data rate to 1/5, e.g. 9.8Gbps to 2.1Gbps
- Make it possible for packetized CPRI and CPRI over ethernet

- Still, other issues are under discussion

Major challenges

- NGRI requires joint re-design from both wireless and transport perspectives
- From wireless perspective:
  - BBU and RRU function split is required
  - A big impact on existing product form
  - Maintenance and future update are also concerns
- From transport perspective
  - Latency, jitter and synchronization issues on Ethernet

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Thank you!

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