Reference design of CU Test Case based on OAI 4G eNB

Chunli Ye
China Mobile Research Institute
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Introduction of C-RAN PoC

PC(FTP Server) -> Commercial EPC -> OAI eNB -> RRU (Smartile) -> Commercial UE -> PC (Client)
LAN

Commercial UE (VLC Client)

VLC video streaming demo
- 2 UE 720p video streaming
- Multipath radio scenario

Performance
- iPerf TCP testing mode: 18Mbps downloading bitrates
- FTP downloading bitrates: 2.0MBytes/s

LTE TDD
Config 1 and 3
Optimization of algorithms in uplink receiver

**Frequency Offset Estimation**

- d means frequency offset (Hz)
- m means MCS

**Time consuming**

<table>
<thead>
<tr>
<th>Method</th>
<th>CPU cycles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original</td>
<td>13260</td>
</tr>
<tr>
<td>Based on DMRS</td>
<td>18720</td>
</tr>
</tbody>
</table>

**Noise Estimation**

- m means MCS

**Time consuming**

<table>
<thead>
<tr>
<th>Method</th>
<th>CPU cycles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boumard</td>
<td>13855.64706</td>
</tr>
<tr>
<td>DASS</td>
<td>4379.058824</td>
</tr>
</tbody>
</table>

**Timing Offset Estimation**

RB=100, delay=20 samples

**Time consuming**

<table>
<thead>
<tr>
<th>Method</th>
<th>CPU cycles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on CP</td>
<td>9233.167</td>
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<tr>
<td>Based on DMRS</td>
<td>13005.396</td>
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</table>
C-RAN project in OPNFV

What is OPNFV

- An open source community.
- Focus on NFV platform and integration testing.
- Adapt the code from other communities to make them work together.
- Support various requirements of applications.

C-RAN project proposal has been established this year.
- Integration of RAN functions and NFVI.
- Goal is to document the requirements and propose a reference architecture of the RAN functions (such as CU) so that we can deploy them on NFVI.
- Help to make CU open source.
CU test case based on 4G eNB

Instruction of CU test case

- The picture is the final structure of CU based on LTE.
- A tool is introduced to test CU.
- CU and the tool will be deployed on VMs with CentOS.
- This test case is used to test whether the NFVI can meet the requirement about throughput and delay of CU.
- The split code is an independent file, so it will be easy to be merged into develop branch.

Progress of CU test case

- The CU/DU is split based on LTE with TDD1 20M bandwidth.
- The interface between CU and DU is designed based on the master branch of OAI in 2014.
- The protocol is used to encapsulate data as the protocol-split branch does.
- CU and DU have been split completely and they can run on two servers. CU is server and DU is client and they exchange messages through socket without TNL.

Ongoing work

- CU will be split into CU-C and CU-U. DU will be replaced by the tool.
- Migrate the test case from Ubuntu to CentOS.
Summary and rough plan

• CU test case based on 4G eNB
  ➢ DU waits for subframe indication from hardware.
  ➢ CU and DU run asynchronously.
  ➢ Two commercial UEs can make random access and achieve ping package through EPC at the same time.

• Rough plan
  ➢ The interface between CU and DU is private. F1 interface will be used when NR CU completed.
  ➢ The work about CU/DU splitting will be continue and we hope the NR CU will be tested in C-RAN project.
Thank you!