5th OAI Workshop

Improvement of OAI community value by Continuous Integration

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FUJITSU Activity Aug. 2017-

### Development

**Sprint#1**
- add to RRC Messages
- O&M

**Sprint#2**
- Multi Uses, O&M
- eNB Operational data collector

**Sprint#3**
- TDD configuration 1

**Experiment**

**Field Experiment (FDD)**

**Evaluation in anechoic chamber (FDD&TDD)**

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**Scope in this talk**

**Continuous Integration (CI) framework development**

And Future aims...
Achievement of FUJITSU by CI

- Things to be done with CI during the last one month (20th Apr – 19th May)

- More than 72 hours Continuous Operation

<table>
<thead>
<tr>
<th></th>
<th>FDD</th>
<th>TDD (Config1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency / Bandwidth</td>
<td>Band3(1.7GHz) / 5MHz</td>
<td>Band39(2.6GHz) / 5, 10, 20MHz</td>
</tr>
<tr>
<td>DL throughput</td>
<td>15Mbps@5MHz</td>
<td>27Mbps@20MHz</td>
</tr>
<tr>
<td>UL throughput</td>
<td>5Mbps@5MHz</td>
<td>10Mbps@20MHz</td>
</tr>
<tr>
<td>Num. of UEs</td>
<td>10 COTS UEs</td>
<td>5 COTS UEs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>64UEs, FUJITSU original simulator</td>
</tr>
<tr>
<td>Verification environment</td>
<td>Indoor field</td>
<td>Anechoic chamber</td>
</tr>
</tbody>
</table>

- Fixed the Assertion incidents. eNB : 100 points, EPC : 50 points
What is CI (Continuous Integration)?

- **Quality management**
  
  for **repeatedly** execute the cycle of software development (such as build, testing, deploying) **frequently** and **quickly**

- **Using CI tools**
  (Automation tools)
  1. Prevent being personalized
  2. Early detection of disability
  3. Status visualization
  4. Stabilization of quality
Why CI?

- **Code Quality Improvement**
  - Immediately tested when MergeRequest in gitlab
    - No more degradation
    - Easy to determine the cause
    - Short debugging time (Reduce time cost)
  - Always tested by nightly automatic test
    - Short term tests again and again (dig up hidden low % bugs)
    - Long term tests to ensure stability

- Probably the expectation for OAI gets slightly higher than before...
Current status

- Establishment of Automatic testing framework by Jenkins
- Building the framework in Eurecom
Steps to improve the value of OAI

- **Step 1**
  - Test minimum items automatically
  - Introduce Static Analysis tool (Coverity Scan)

- **Step 2**
  - Release 1st features list
  - Reinforce master branch

- **Step 3**
  - Update features list by adding test items
  - Add testable features by all developers

We should stand here soon. Users are expecting!!

We are Here

Keep growing with source code
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We are Here

Start CI in OAI development (ASAP)
Step 1-1 Test minimum items automatically

- The first thing users want to see is connection with Other nodes
- “Interoperability test with OAI-EPC & COTS-UE” was prepared in CI

Test items
- Deploy OAI-eNB & OAI-EPC to the specified server
- FDD & TDD config1
- Bandwidth 5MHz/10MHz/20MHz
- Repeat Attach & Detach with COTS-UE
- Ping, UDP iperf (Downlink, Uplink)
- Log Collection & Simple log check

Configuration example
### Step 1-1 Evaluated features by Minimum testing

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Verified</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Access scheme</strong></td>
<td>OFDMA (DL) / SC-FDMA (UL)</td>
<td></td>
</tr>
<tr>
<td><strong>Duplex mode</strong></td>
<td>FDD / TDD Config 1/2/3</td>
<td></td>
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<tr>
<td><strong>Modulation</strong></td>
<td>QPSK / 16QAM / 64QAM</td>
<td></td>
</tr>
<tr>
<td><strong>Bandwidth</strong></td>
<td>5MHz / 10MHz / 20MHz</td>
<td></td>
</tr>
<tr>
<td><strong>Num of Antenna</strong></td>
<td>2 / 1</td>
<td></td>
</tr>
<tr>
<td><strong>Downlink Channel</strong></td>
<td>PSS / SSS / PBCH / PCFICH / PHICH / PDCCH</td>
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</tr>
<tr>
<td><strong>Uplink Channel</strong></td>
<td>PRACH / PUSCH / PUCCH (format 1/1a/1b) / SRS / DRS</td>
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<td><strong>Downlink Throughput</strong></td>
<td>5MHz : 16～17Mbps (w/ COTS UE Cat 3/4)</td>
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<td><strong>Mobile terminal Control</strong></td>
<td>Connection / Paging / Release / Re-establishment</td>
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**What is Static Code Analysis tool?**
- Mechanically point out errors and vulnerabilities (e.g. Memory leak)

**Why Static Code Analysis?**
- For stability, detect bugs that can't be detected by short-time dynamic test

**Why Coverity Scan?**
- No.1 share in US and Japan
- The false detection rate is less than 15%, the Pointing outs are almost bugs
- It is free to use for OSS

**Coverity Scan’s result of OAI-RAN**
URL: [https://scan.coverity.com/projects/openairinterface5g](https://scan.coverity.com/projects/openairinterface5g)
The Pointing outs should be fixed.
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Keep growing with source code

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What is important to users?

1. Is source code working?

2. What are the working features?

3. Is the community working?

How do users evaluate above?

They look at Master branch only.

We should cherish Master branch.
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Change to testable from implemented

By making it always testable, the features becomes OAI value.

Implemented

Tested & Testable

openair5G RAN: Objectives for next period

- MAC Architecture redesign
- Implementation of OpenSource (openair5G)
- MAC implementation
- Testability improvements for 5G and 3G/LTE
- MAC documentation
- Advanced and flexible testing for OAI
- OAI implementation
- OAI performance testing

Source: Eurecom 3rd & 4th OAI workshop presentation doc.
Challenges

- Update our workflow
  - How to validate NEW features?
  - How to merge tests for existing and new features into CI test suite?
- How to manage Master branch?
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shaping tomorrow with you