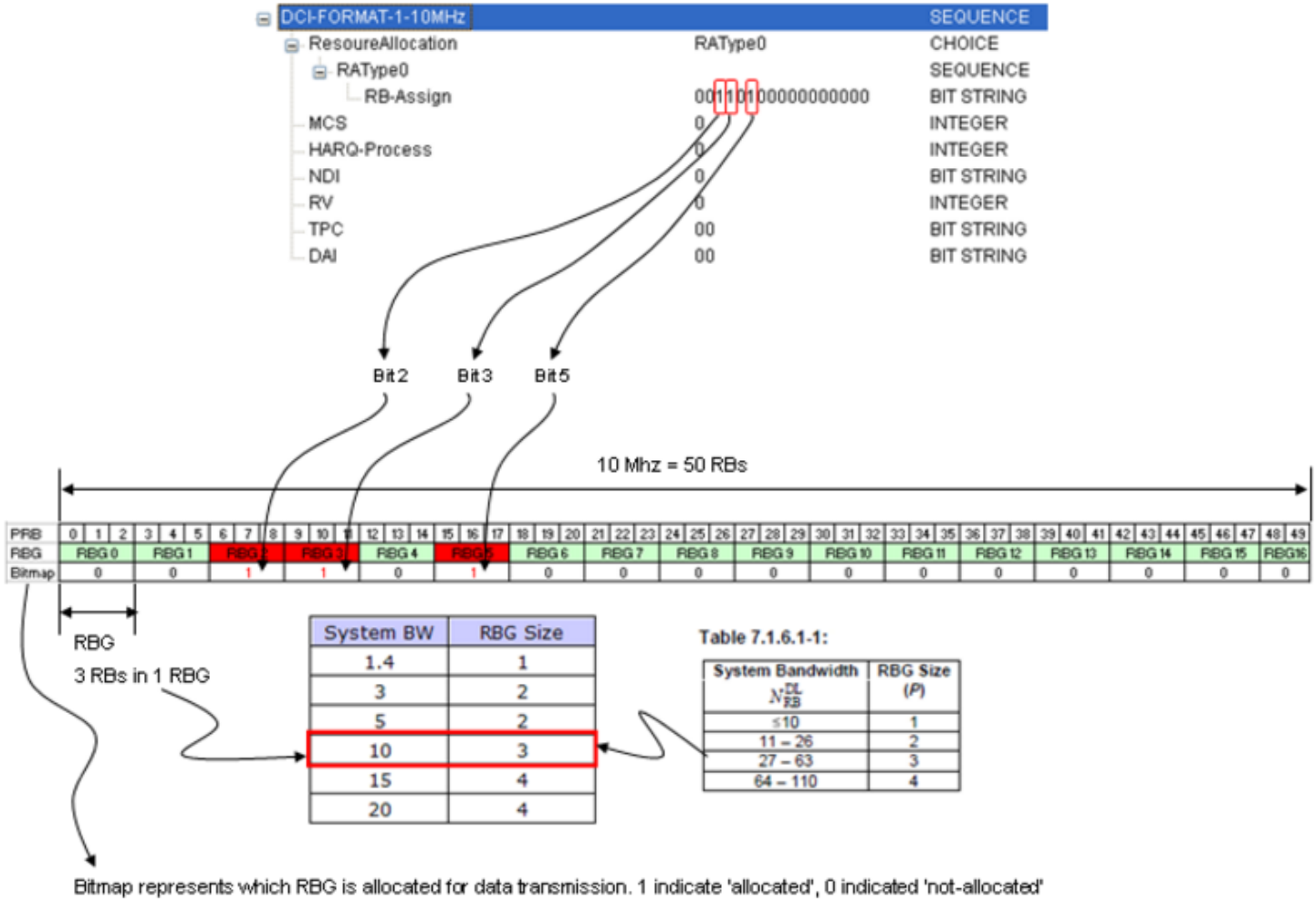
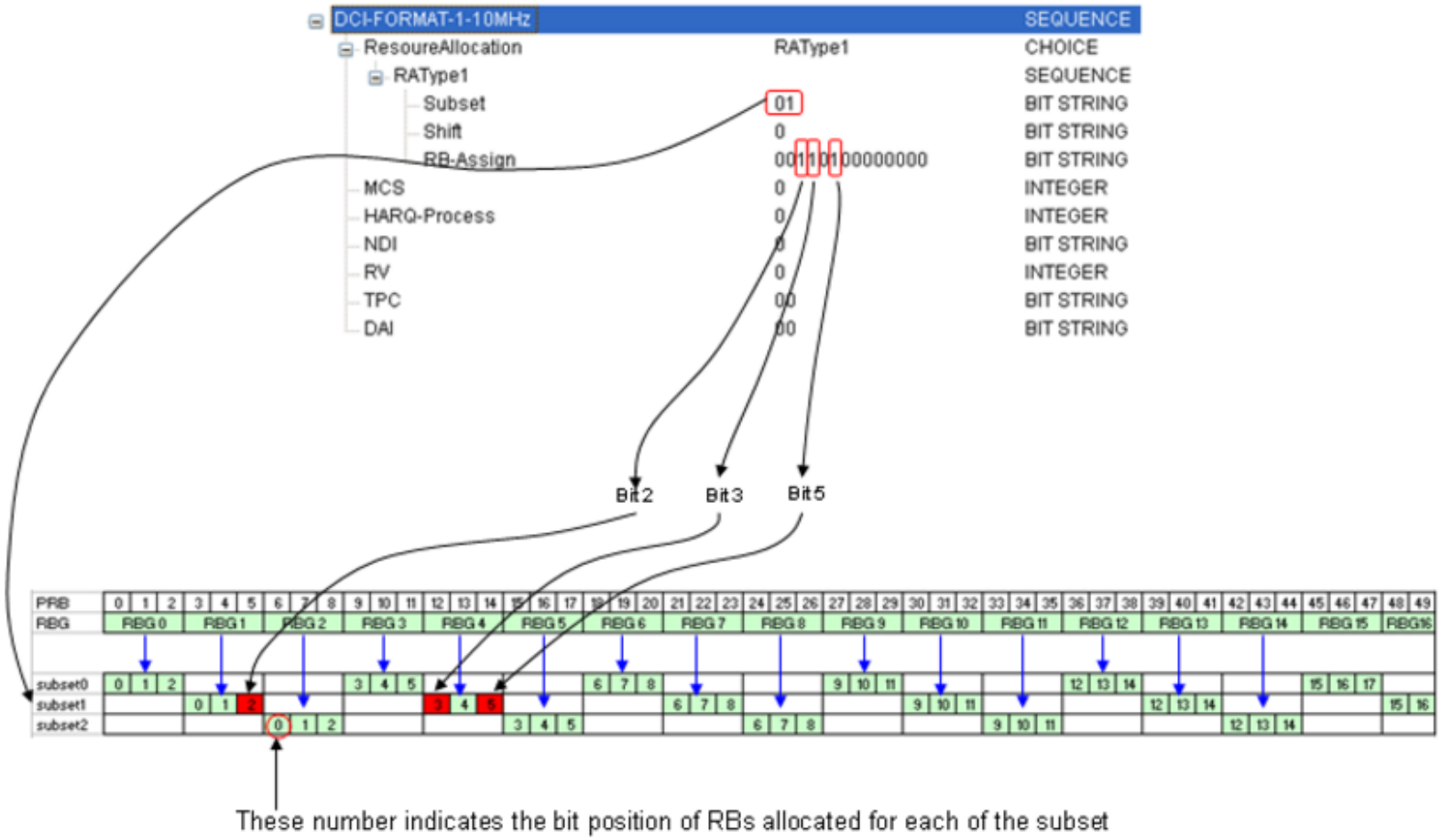
Resource Allocation Type

- Resource allocation type 0
  - “RB --> RBG”
- Resource allocation type 1
  - “RB --> RBG --> RBG Subset”
- Resource allocation type 2
  - allocate the multiple contiguous RBs

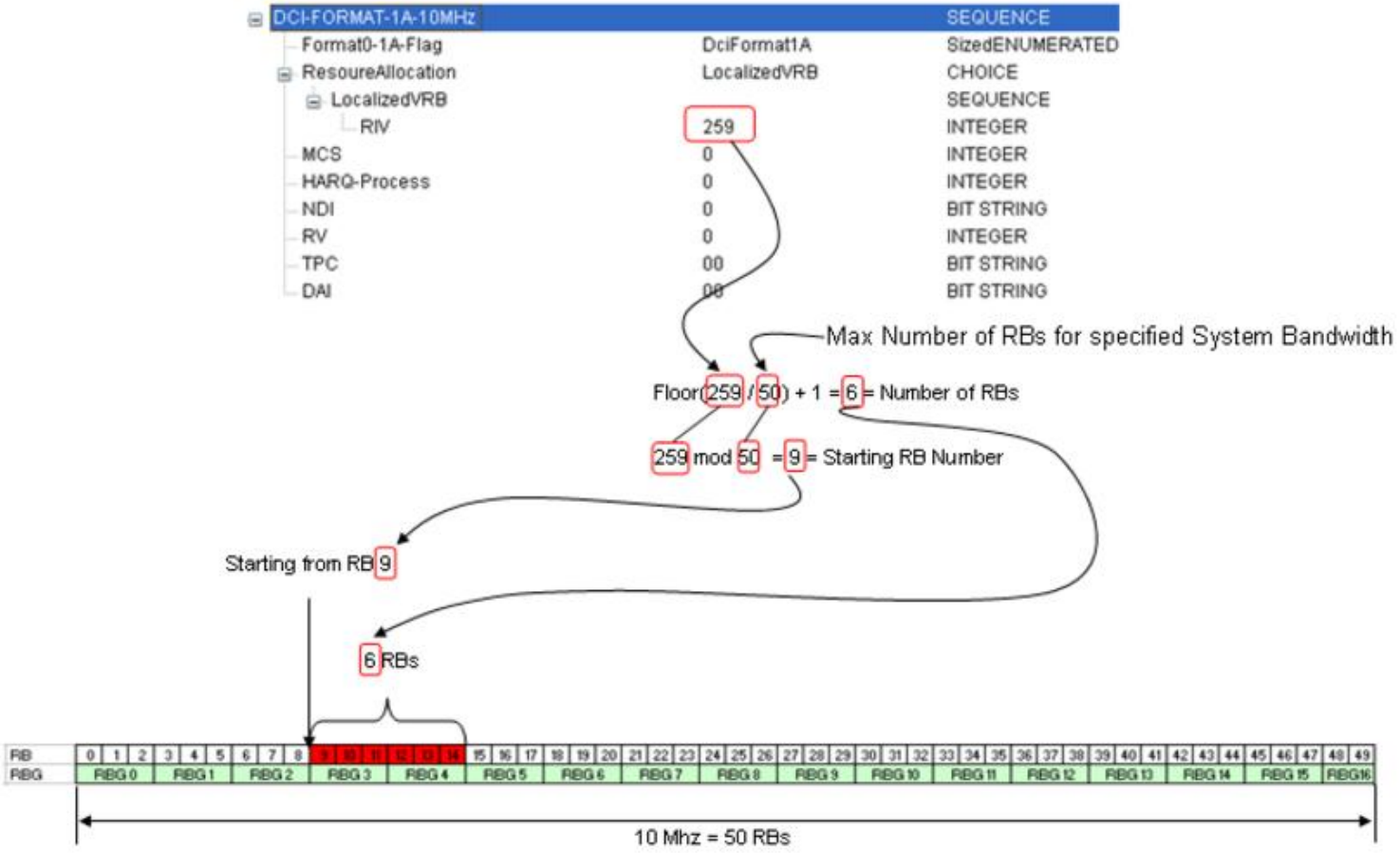
Resource Allocation Type 0



Resource Allocation Type 1



Resource Allocation Type 2



Outline

- Introduction
  - ICIC
  - Resource allocation type
  - CQI feedback type
- Testbed
  - Devices
  - Architecture
  - Network setting
  - System test
- Future work
- Reference

PUSCH CQI Feedback type

- Divided by period
  - Aperiodic
  - Periodic
- Divided by bandwidth
  - Wideband CQI
  - Subband CQI
    - Higher Layer-configured
    - UE Selected

Higher Layer-configured Subband CQI

Subband differential CQI value	Offset level (dB)
0	0
1	1
2	≥2
3	≤-1

3GPP 36.213v13.0.0 Table 7.2.1-2

System Bandwidth N_{RB}^{DL}	Subband Size (*k*) (RBs)
6 - 7	NA
8 - 10	4
11 - 26	4
27 - 63	6
64 - 110	8

3GPP 36.213v13.0.0 Table 7.2.1-3

UE Selected Subband CQI

Differential CQI value	Offset level (dB)
0	≤1
1	2
2	3
3	≥4

3GPP 36.213v13.0.0 Table 7.2.1-4

System Bandwidth N_{RB}^{DL}	Subband Size *k* (RBs)	*M*
6 – 7	NA	NA
8 – 10	2	1
11 – 26	2	3
27 – 63	3	5
64 – 110	4	6

3GPP 36.213v13.0.0 Table 7.2.1-5

Aperiodic CSI Reporting Modes

PUSCH CQI Feedback Type		PMI Feedback Type		
		No PMI	Single PMI	Multiple PMI
	Wideband (wideband CQI)			Mode 1-2
	UE Selected (subband CQI)	Mode 2-0		Mode 2-2
	Higher Layer-configured (subband CQI)	Mode 3-0	Mode 3-1	

3GPP 36.213v11.2.0 Table 7.2.2-1

Periodic CSI Reporting Modes

PUCCH CQI Feedback Type		PMI Feedback Type	
		No PMI	Single PMI
	Wideband (wideband CQI)	Mode 1-0	Mode 1-1
	UE Selected (subband CQI)	Mode 2-0	Mode 2-1

3GPP 36.213v11.2.0 Table 7.2.2-1

// fapiDbSchedCommon.h (\cavium_fdd_stack\fapi\api)

```
/////////// 4.3.24 cqiType
typedef enum
{
   CQI_P10,
   CQI_P11,
   CQI_P20,
   CQI_P21,
   CQI_A12,
   CQI_A22,
   CQI_A20,
   CQI_A30,
   CQI_A31
} CqiFeedbackType;
```

CQI Feedback Type

CQI_P10 => Periodic Mode 1-0

CQI_P11 => Periodic Mode 1-1

CQI_P20 => Periodic Mode 2-0

CQI_P21 => Periodic Mode 2-1

CQI_A12 => Aperiodic Mode 1-2

CQI_A22 => Aperiodic Mode 2-2

CQI_A20 => Aperiodic Mode 2-0

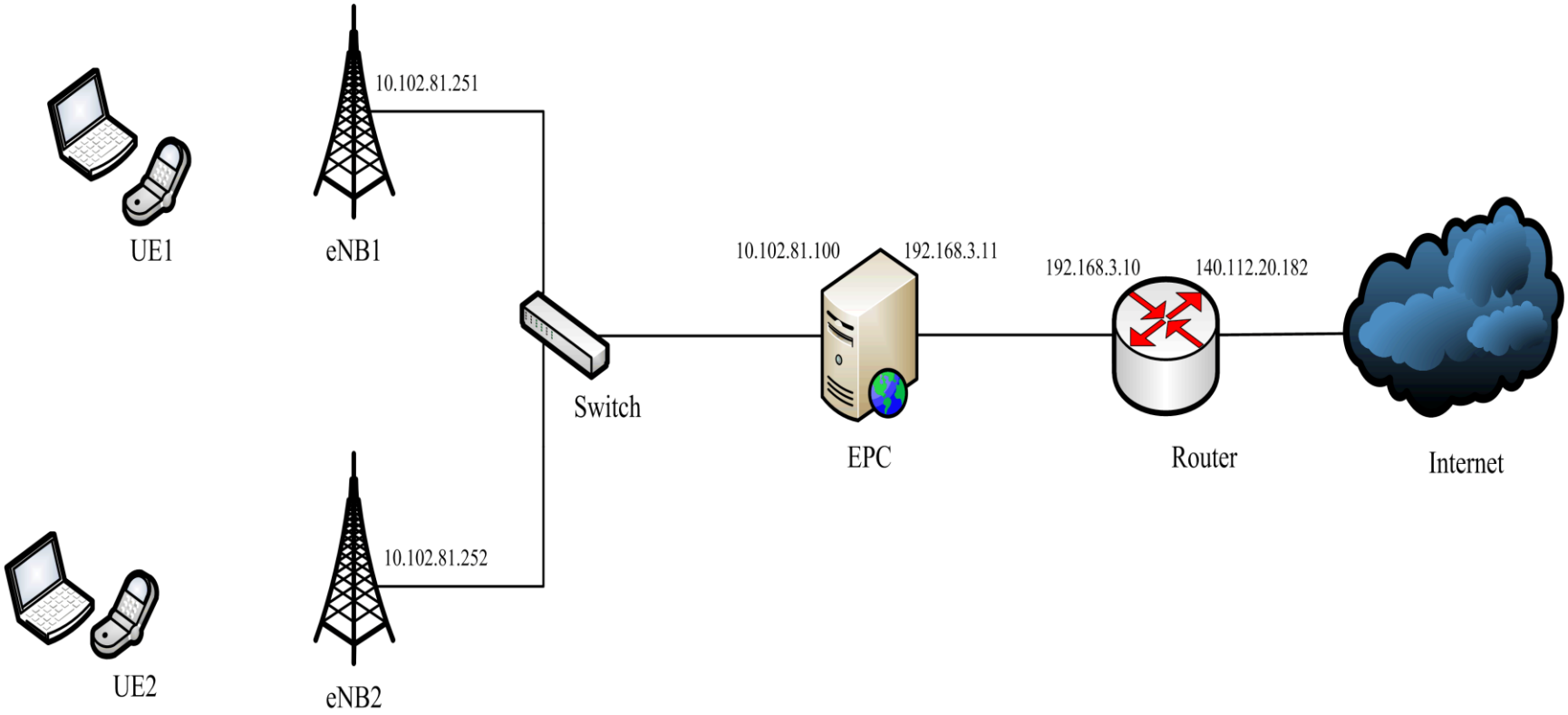
CQI_A30 => Aperiodic Mode 3-0

CQI_A31 => Aperiodic Mode 3-1

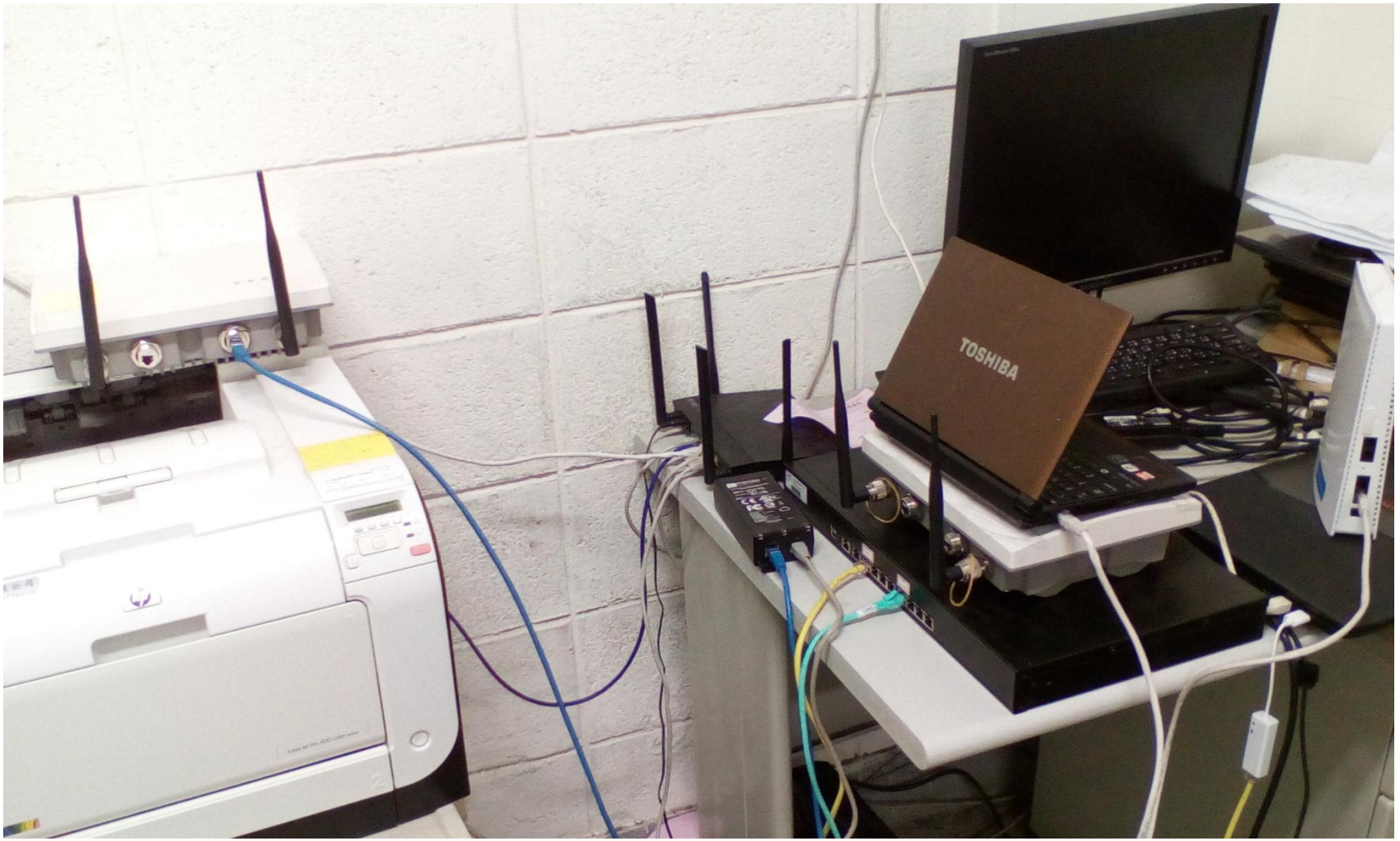
Devices

- LTE small cell *2
- UE (with SIM card) *4
- EPC *1
- Router (using a laptop) *1
- Category 5 cable
- PoE *2

Architecture



Architecture



Network Setting

- Network card interface
  - On the router, set the IP address to EPC (192.168.3.10)
- Router
  - Add the IP address of EPC in the routing table.
  - Add the prerouting, routing, forwarding, and postrouting rules by executing a Shell Script.

Destination	Gateway	Genmask	Flags	Metric	Ref	Use	Iface
Default	router20.ee.ntu	0.0.0.0	UG	1024	0	0	eth0
140.112.20.0	*	255.255.255.0	U	0	0	0	eth0
link-local	*	255.255.0.0	U	1000	0	0	eth0
172.111.0.0	192.168.3.11	255.255.0.0	UG	0	0	0	eth1
192.168.3.0	*	255.255.255.0	U	0	0	0	eth1

- UE
  - Set the IP address of UE (192.168.15.52 for UE1)
  - …

Reference

1. 3GPP HetNet/Small Cells
   http://www.3gpp.org/hetnet
2. On the Evolution of Multi-Cell Scheduling in 3GPP LTE / LTE-A, IEEE COMMUNICATIONS SURVEYS & TUTORIALS, VOL. 15, NO. 2, SECOND
3. 3GPP TS 36.213 7.1.6 Resource allocation
   http://www.sharetechnote.com/html/Handbook_LTE_RAType.html
4. 3GPP TS 36.213 11.2.0
   - 7.2.1 Aperiodic CSI Reporting using PUSCH
   - 7.2.2 Periodic CSI Reporting using PUCCH