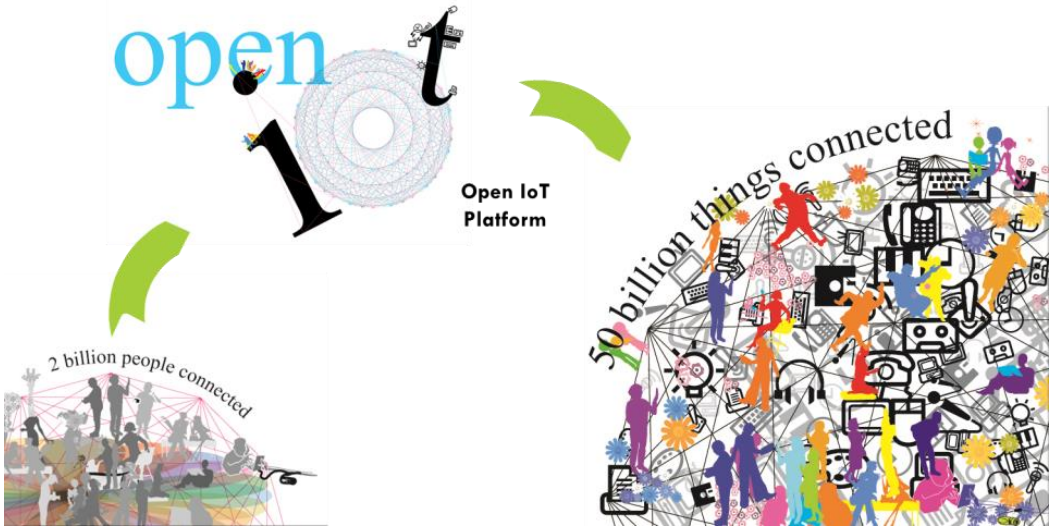
oneM2M Application AndroidSample UserGuide v0.6



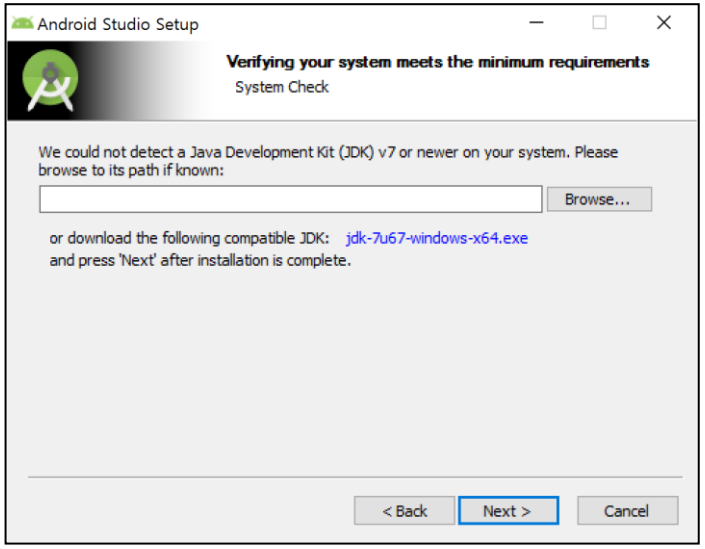
KETI (Korea Electronic Technology Institute)

(araha@keti.re.kr)

Android Studio Installation

■ Android Studio download and installation

https://developer.android.com/sdk/index.html (Android Studio Install ..., Java Development Kit 7u79 Install)



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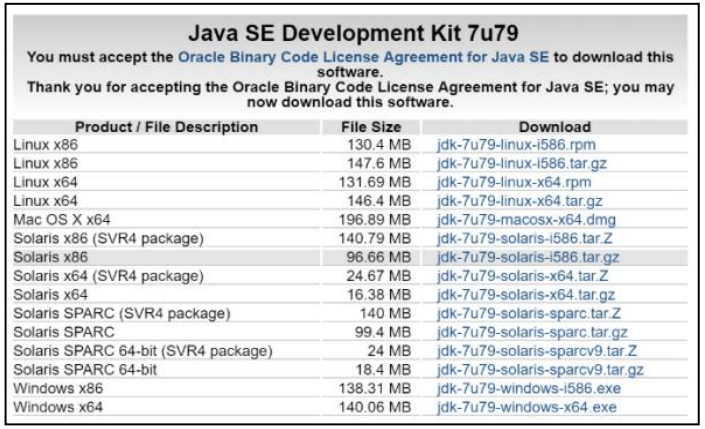

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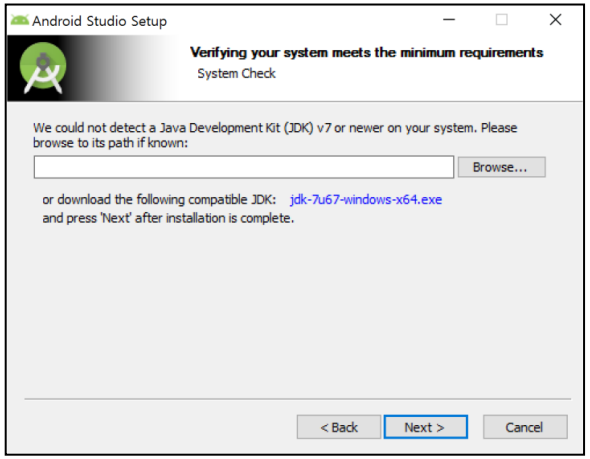

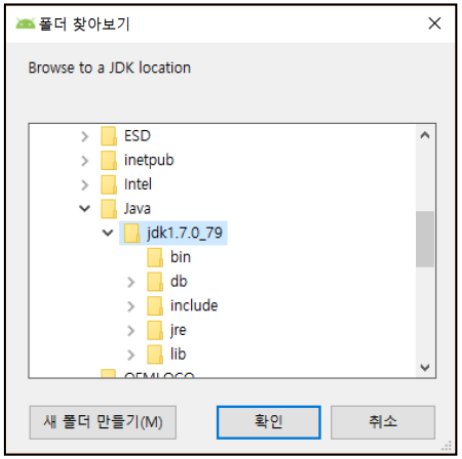

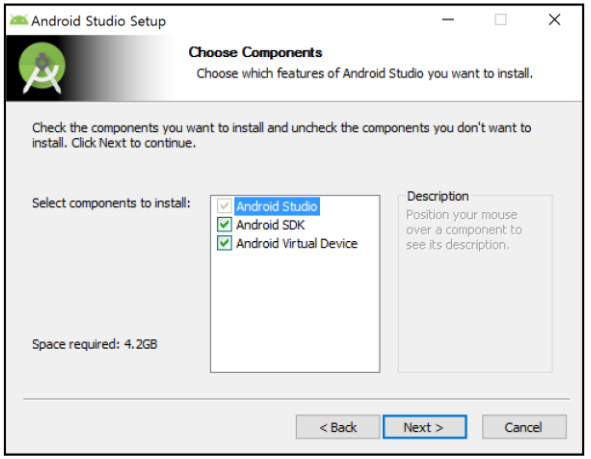

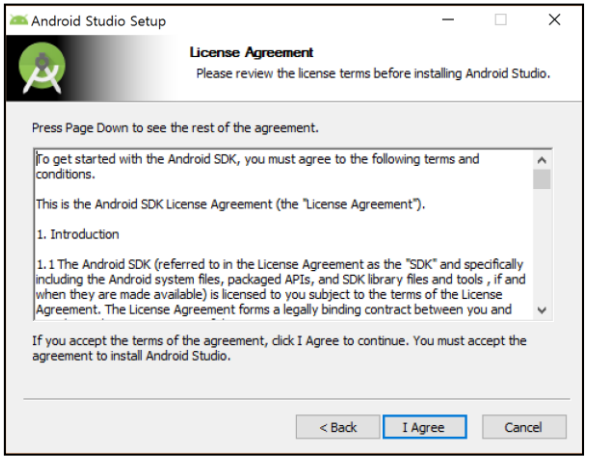

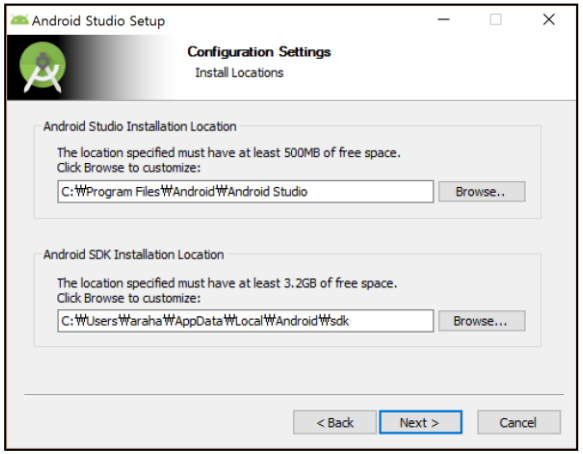

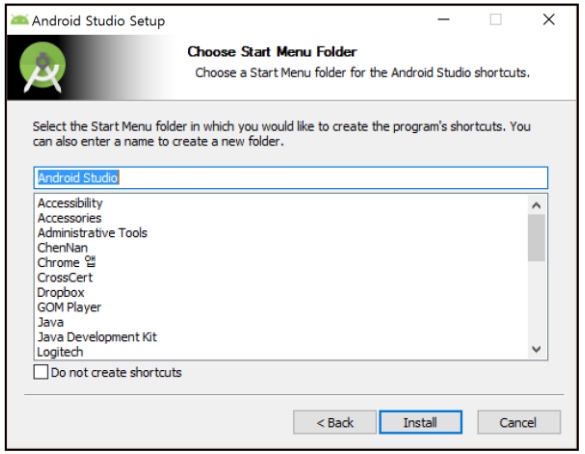

Android Studio Installation

■ Android Studio download and installation

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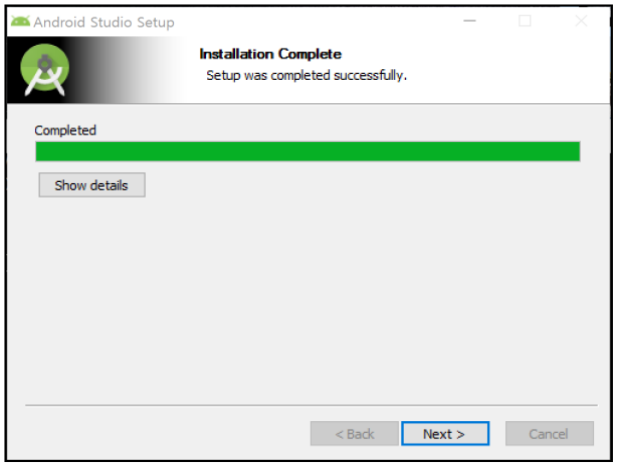
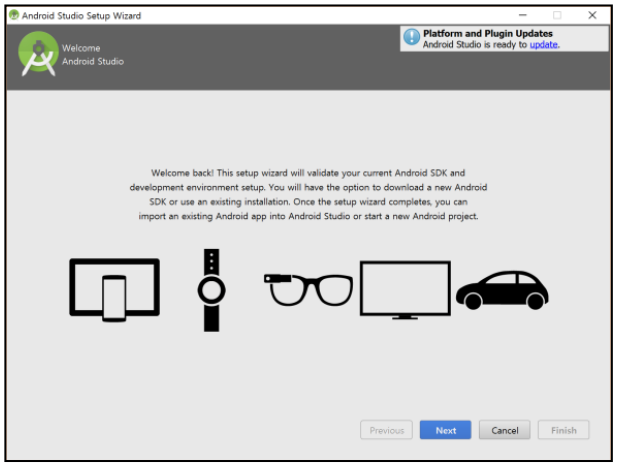
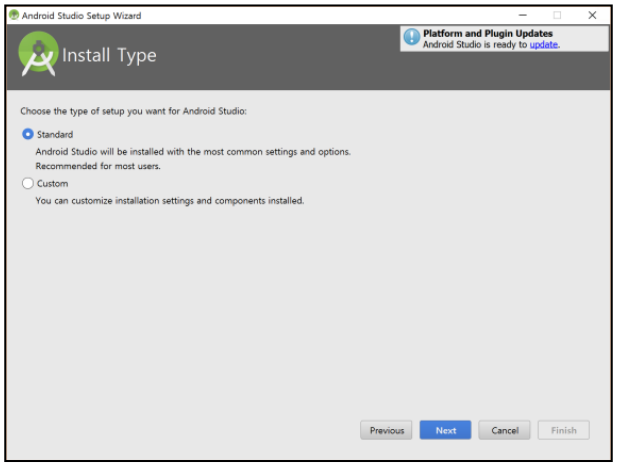
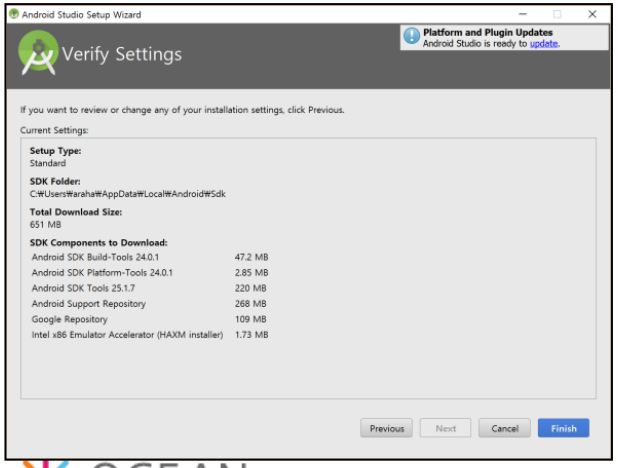
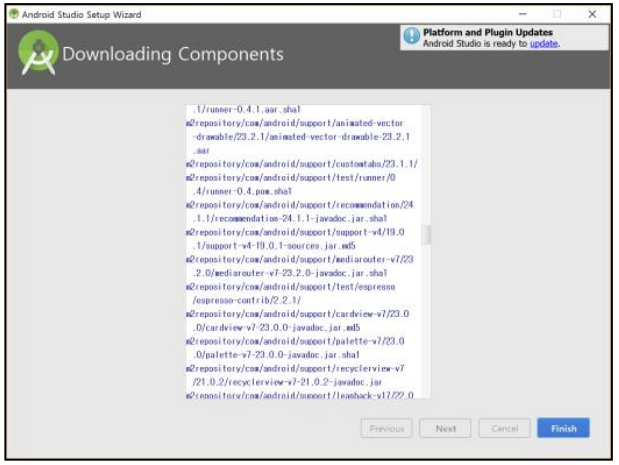
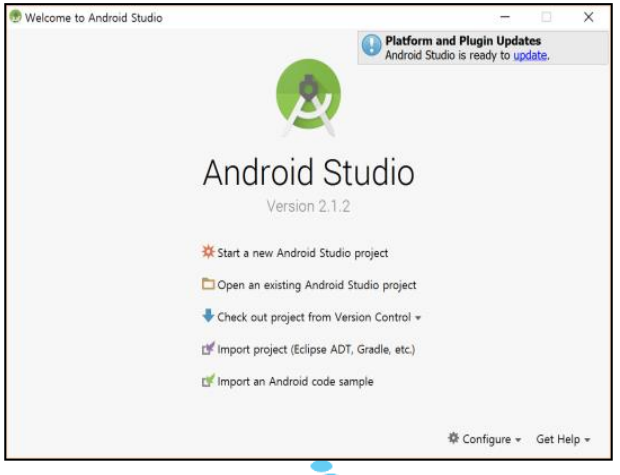








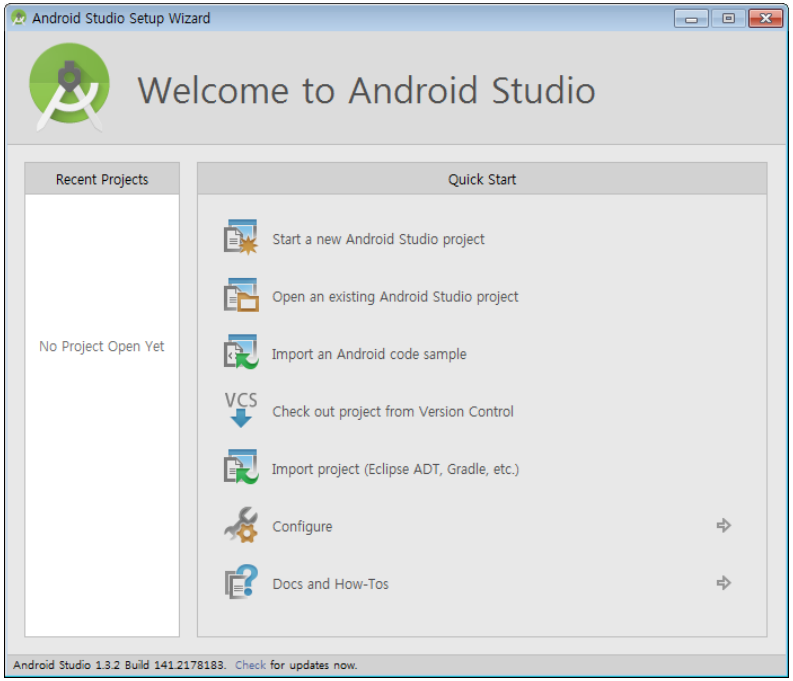


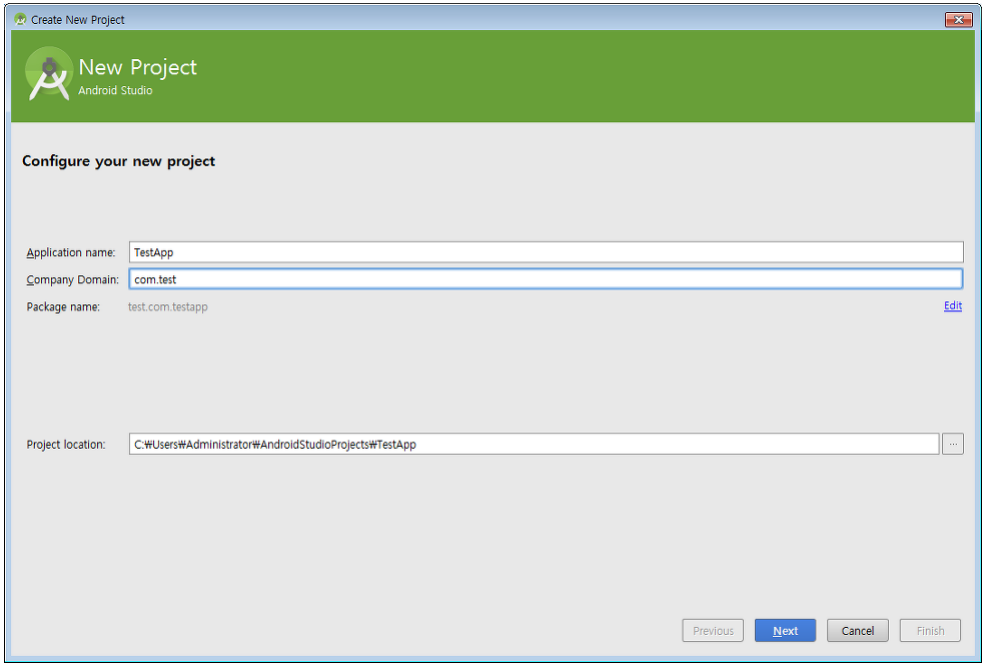


Android Studio Installation

■ Execute Android Studio

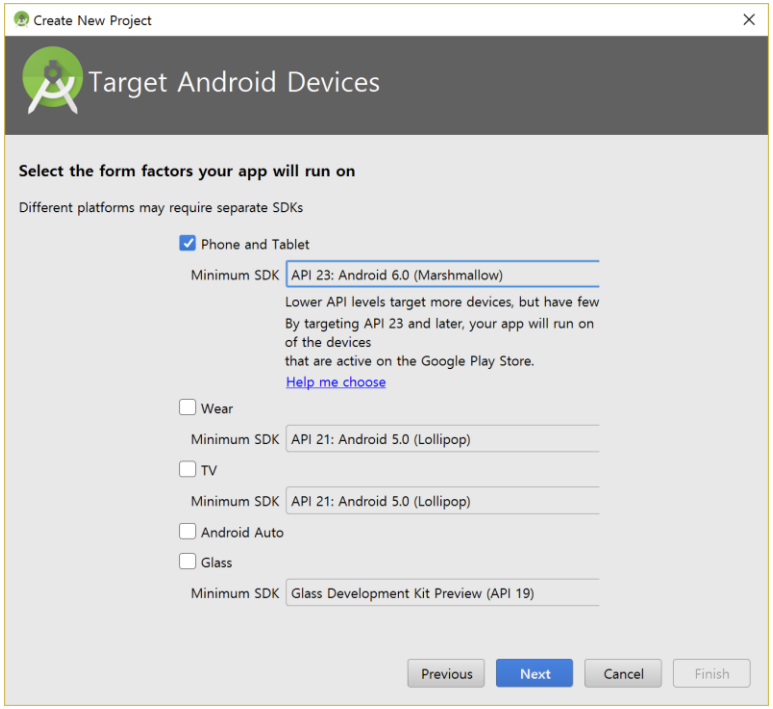
- Click “Start a new Android Studio project”.
- Type the application name and company domain

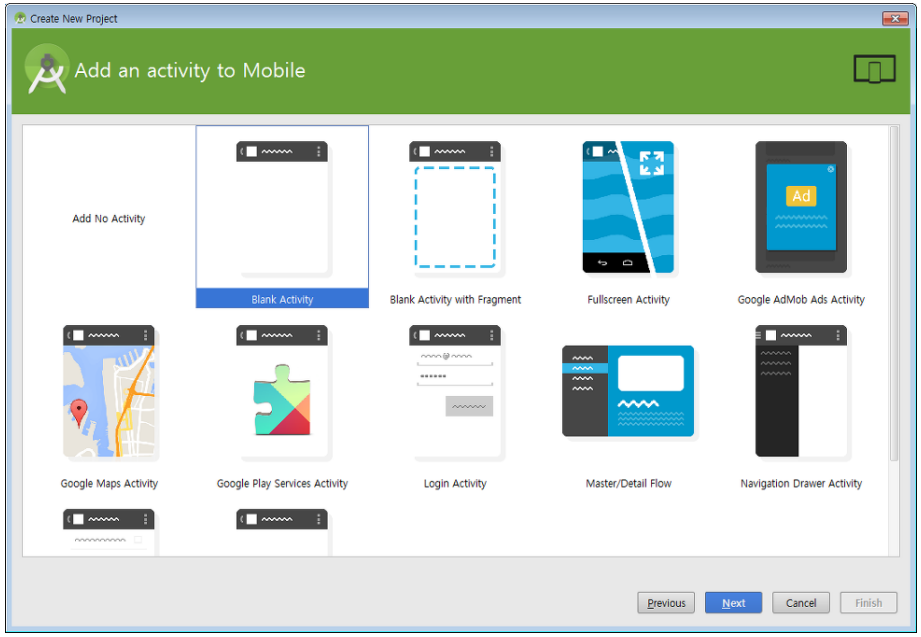




Android Studio Installation

- Configure ADK version and activity for targeting android devices
  - Change Minimum SDK to API 23
  - Select “Blank Activity”

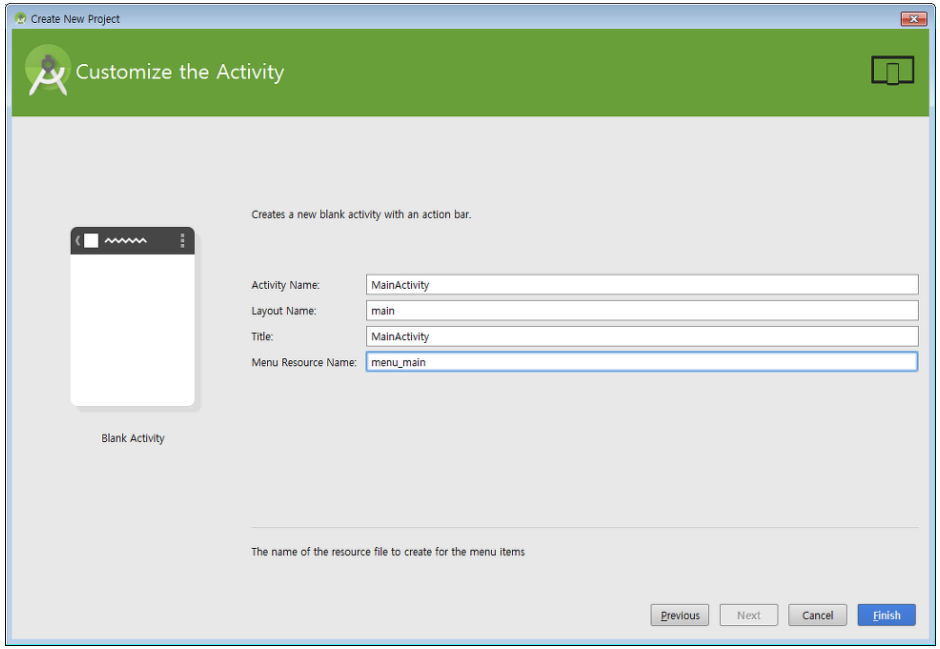


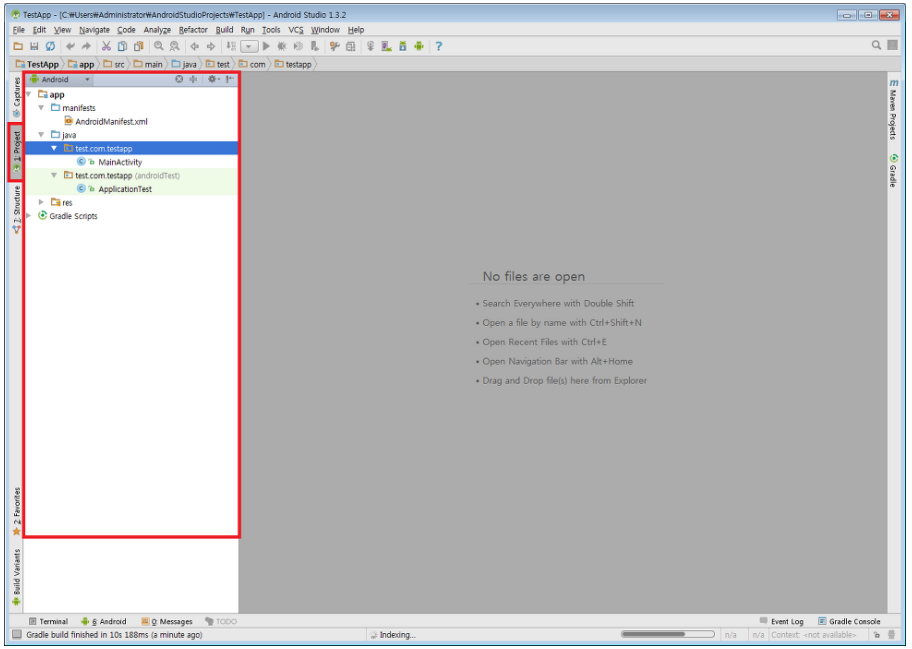


Android Studio Installation

■ Customize the activity

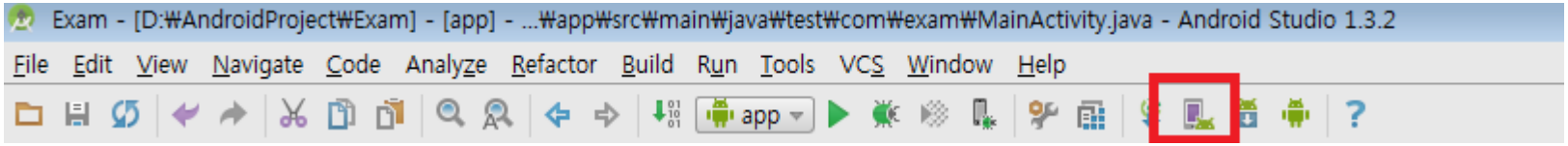
- Input activity name and click “Finish” button.
- Right menu show the project file structure.





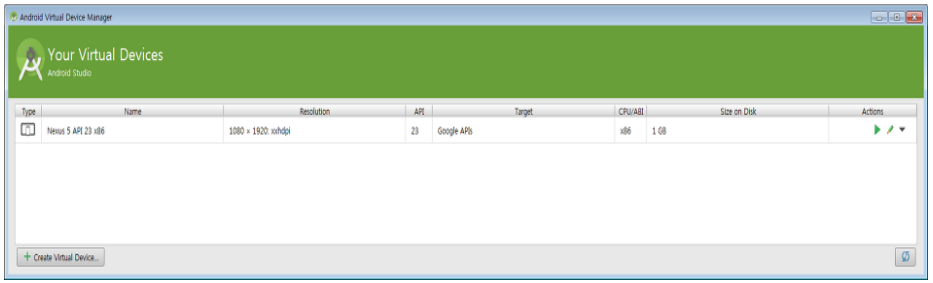
Android Studio Installation

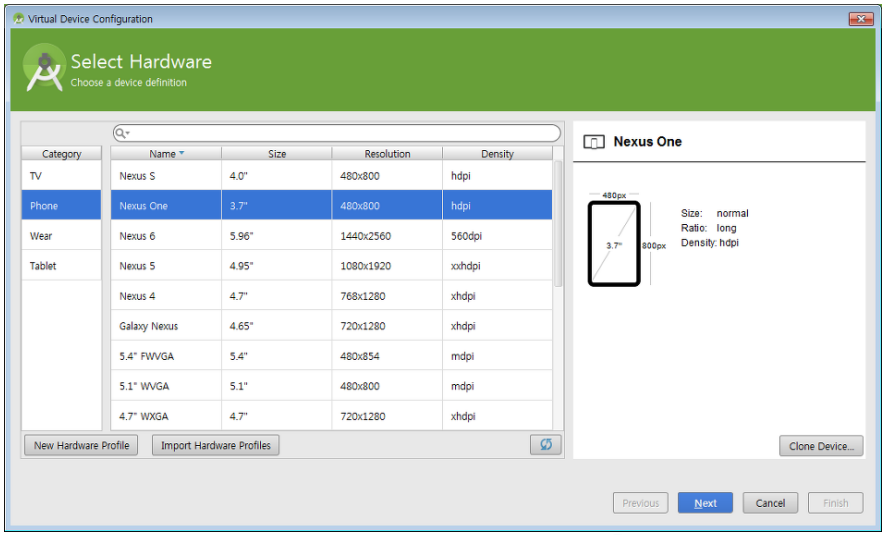
■ Android Studio Virtual Devices



■ Click “AVD Manager” menu

1. The default virtual device is Nexus 5
2. [Add a new virtual device]
3. Click “Create Virtual Device”
4. Select a the phone type as VD

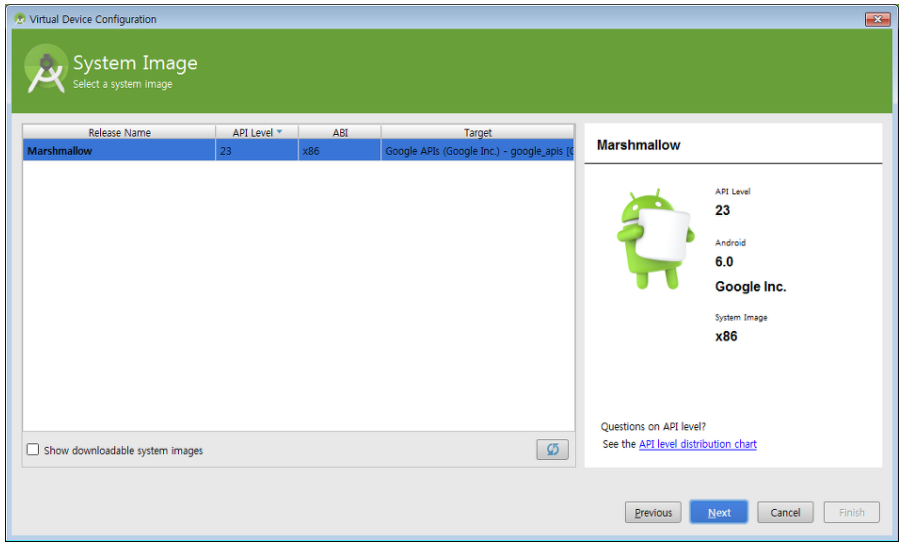




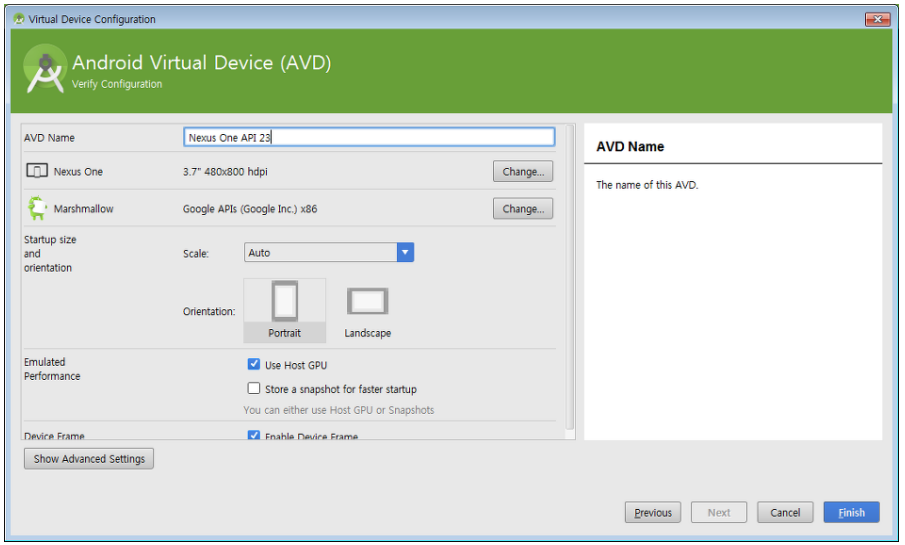
Android Studio Installation

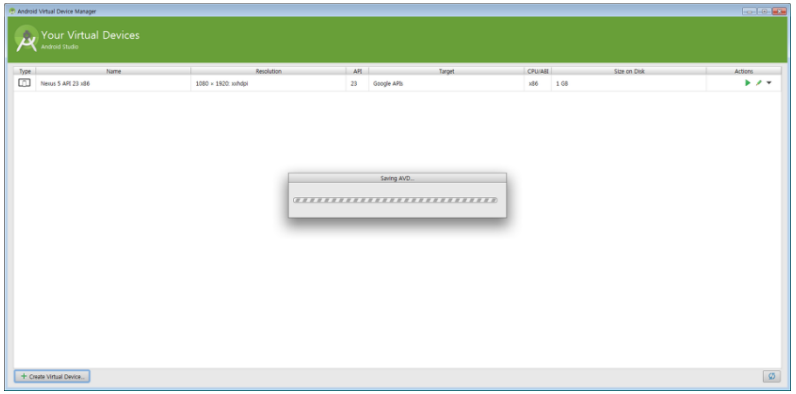
■ Android Studio Virtual Devices

Select OS image



Android Virtual Device(AVD) Configuration

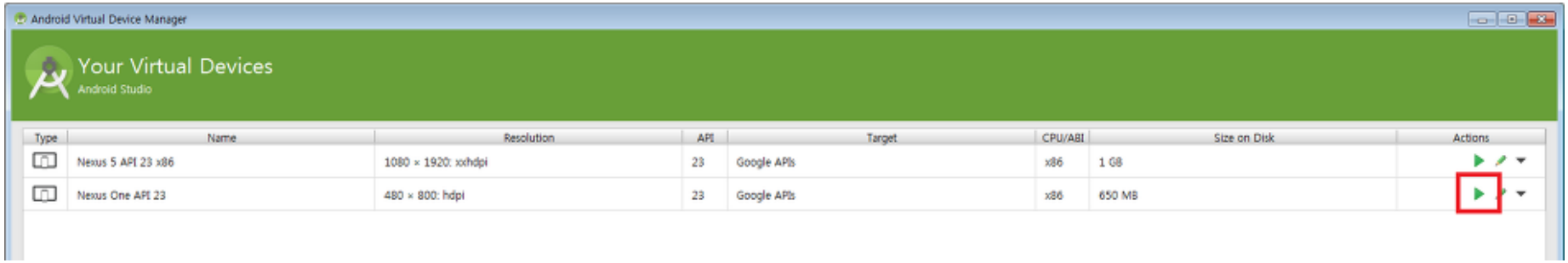


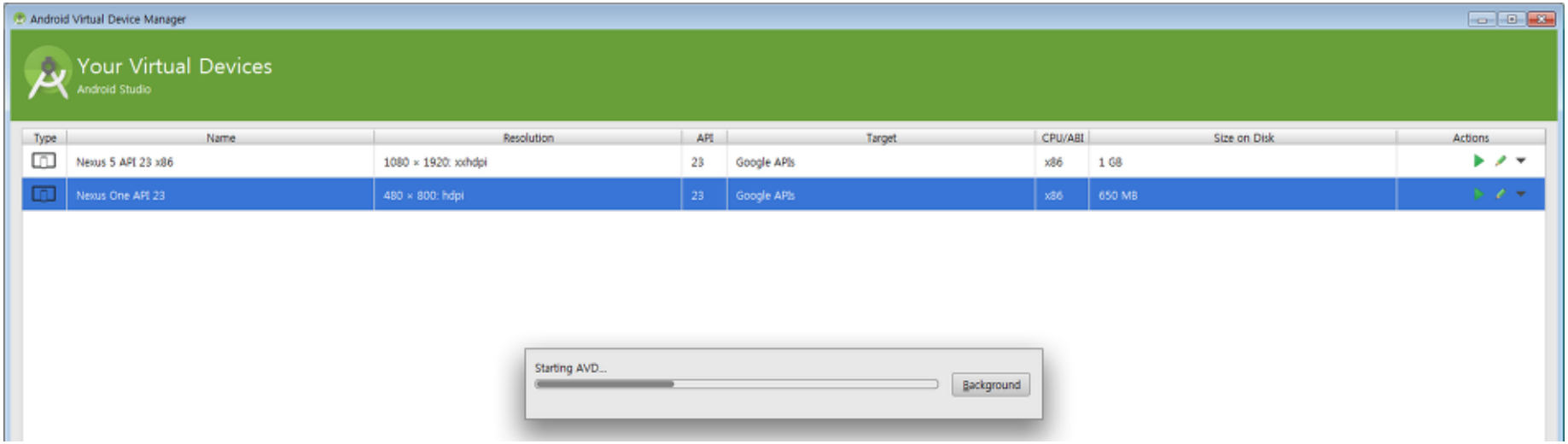


Android Studio Installation

■ Android Studio Virtual Devices

- Click start button to turn on the VD





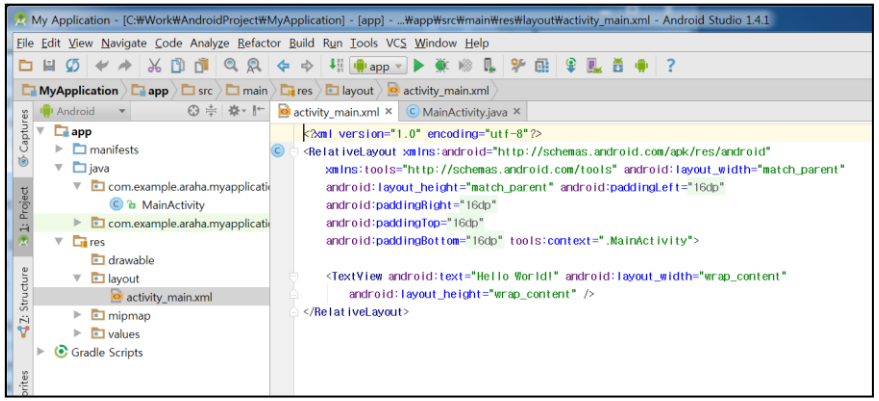
Android Studio Installation

- Android Studio Virtual Devices
  - Wait for the VD system loading

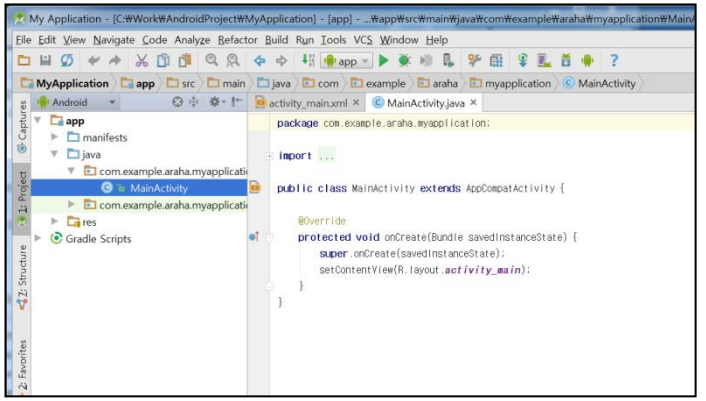
Web View APP

■ Basic Default Code

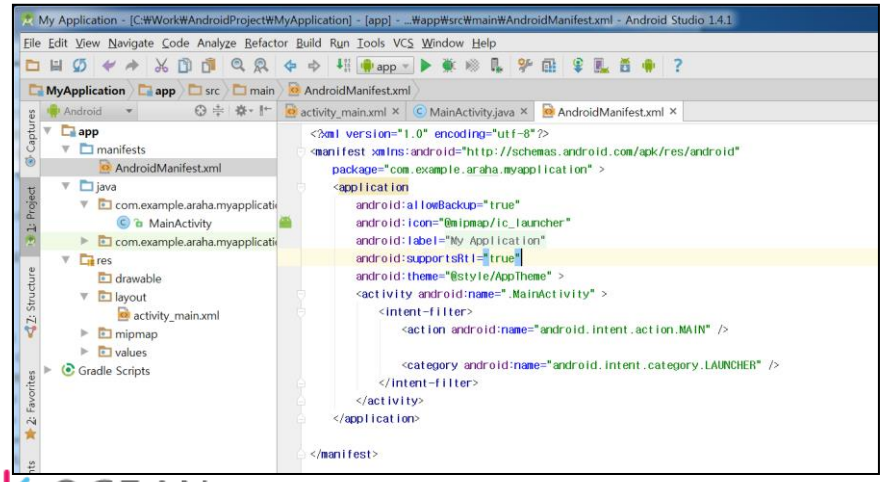
activity_main.xml



MainActivity.Java



AndroidManifest.xml



AndroidManifest?

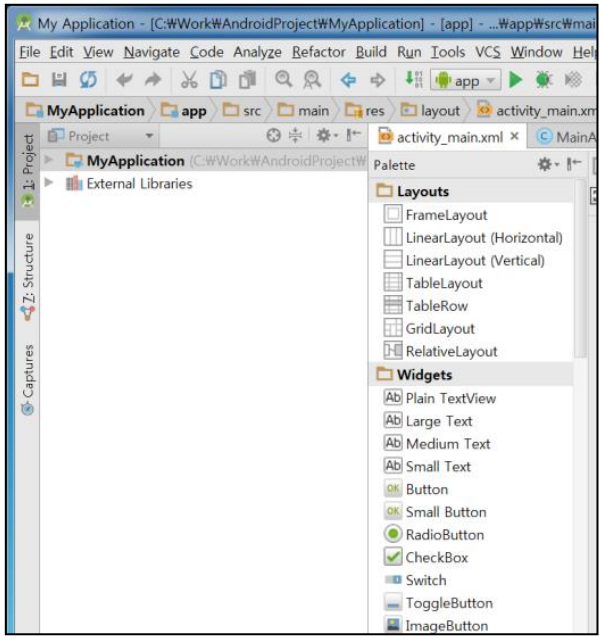
Descript and configure the android project

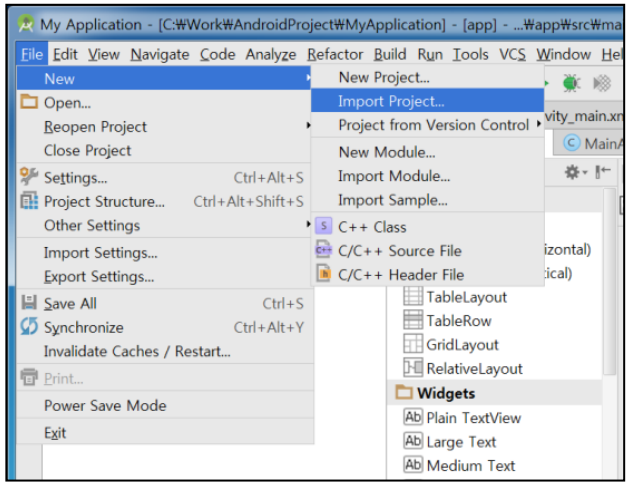
- **App name, ID, icon, theme**
- **App access right**
- **Activity, Service, Intent**

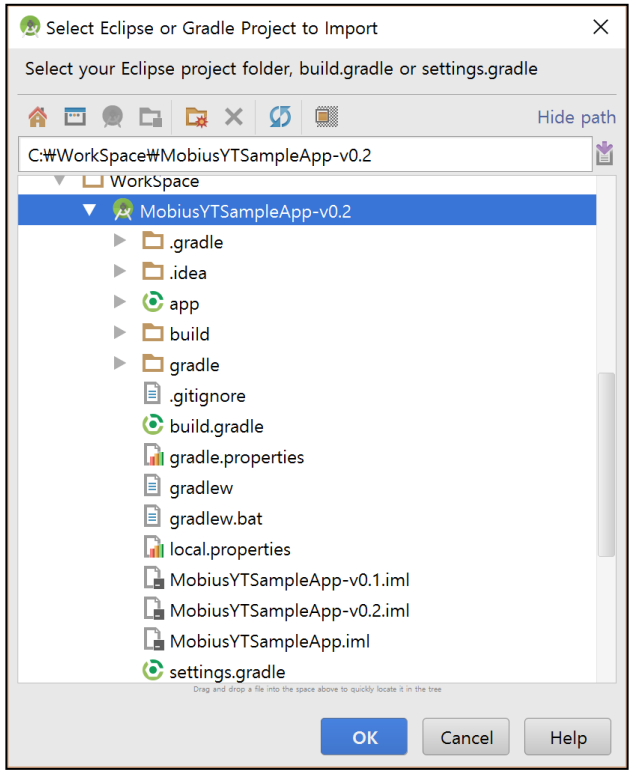
Mobius and APP connectivity

■ Import sample project

Android Project Import





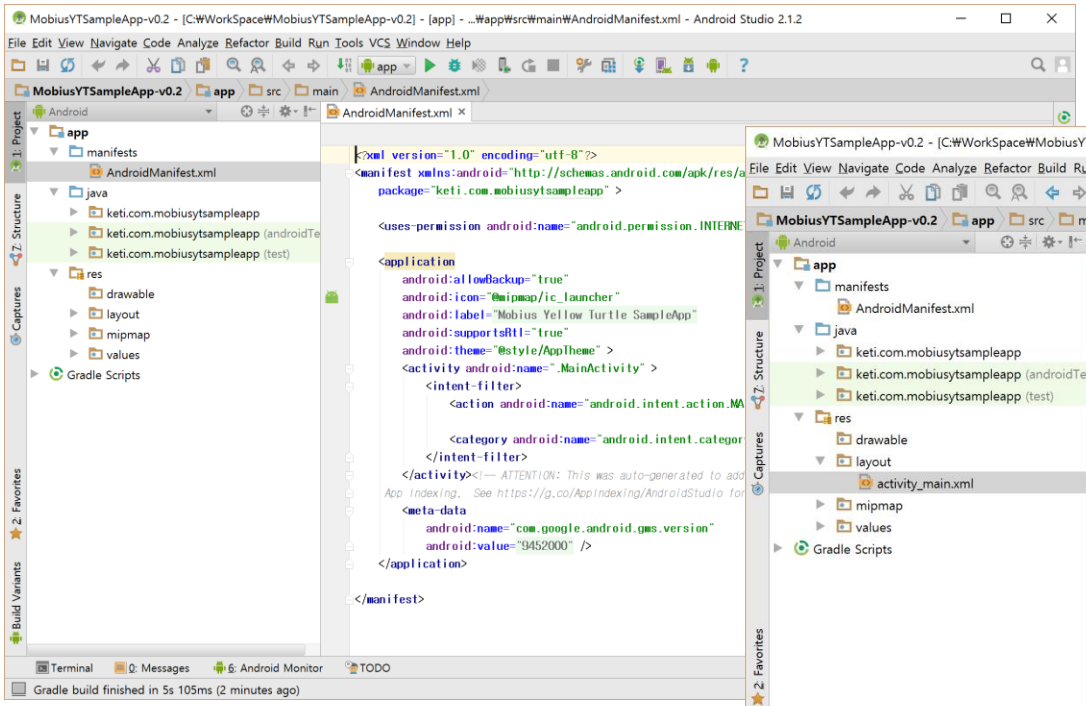


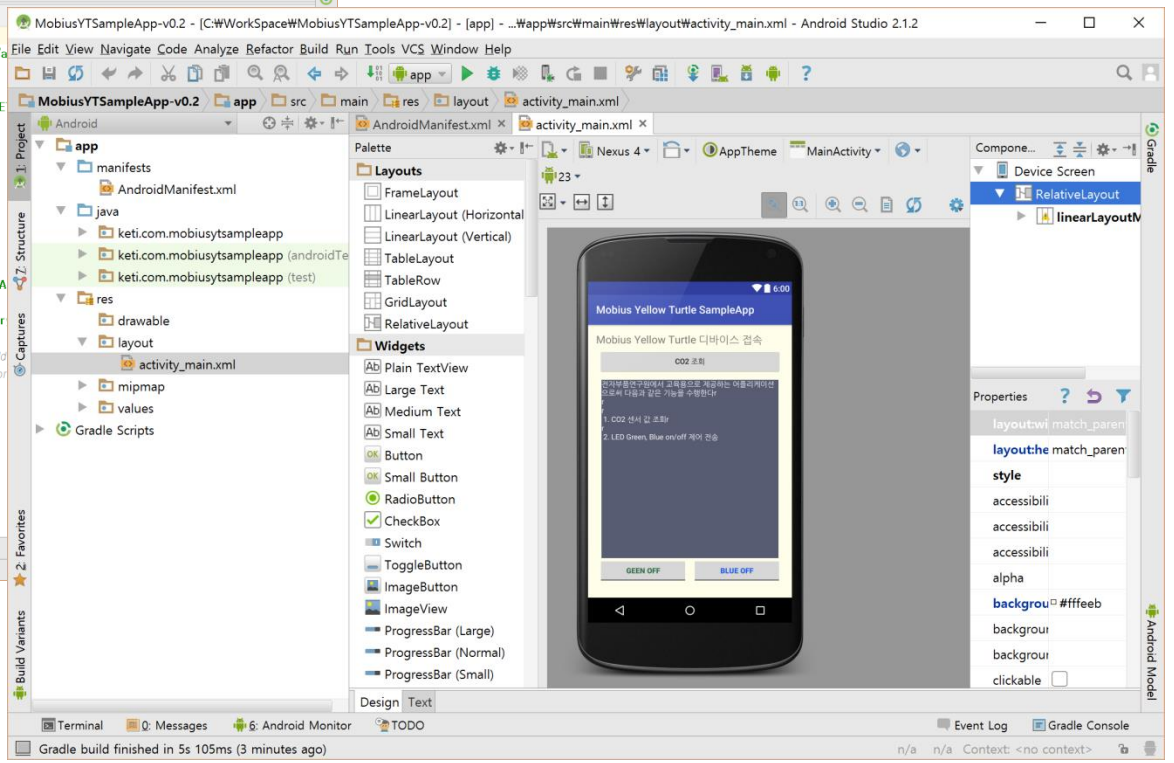
*** Download the sample source from IoT OCEAN (www.iotocean.org)**

Mobius and APP connectivity

■ Import sample project

Android/app/manifest(AndroidMainifest.xml)



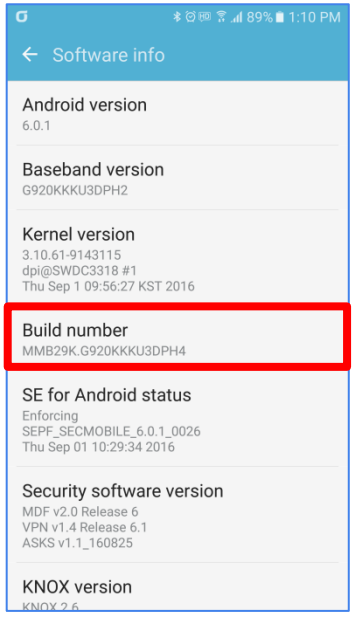


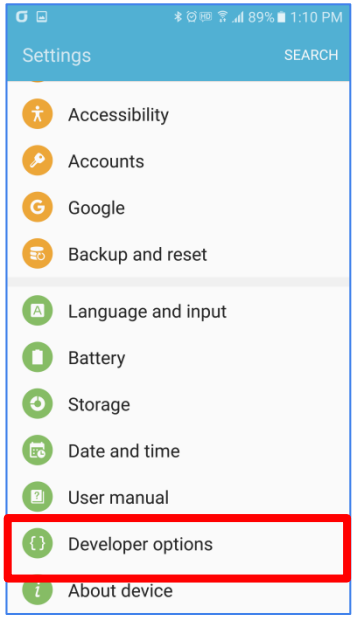
Android/app/res/layout/activity_main.xml(Design)

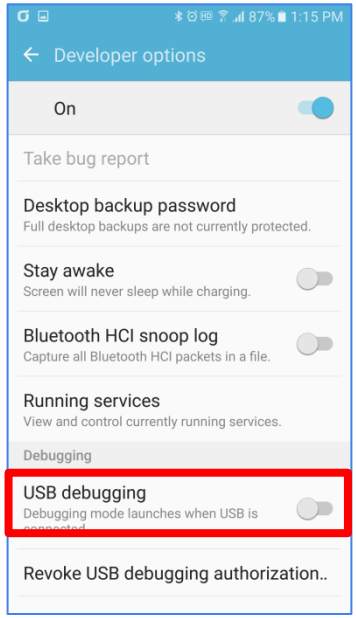
Mobius and APP connectivity

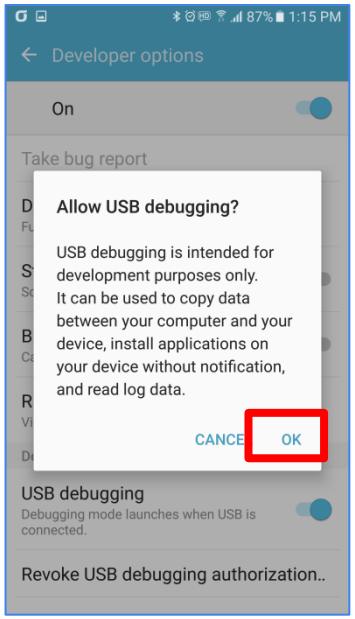
■ USB Debugging Mode on Android

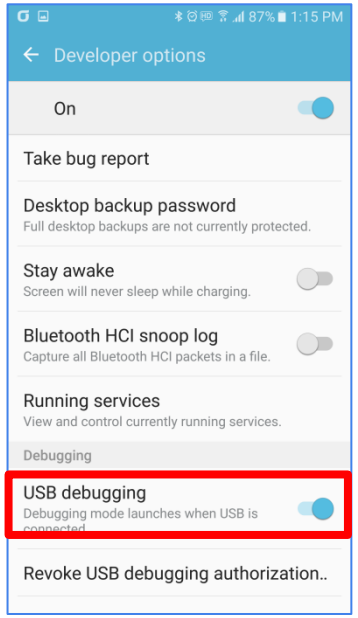
Change device to debugging mode









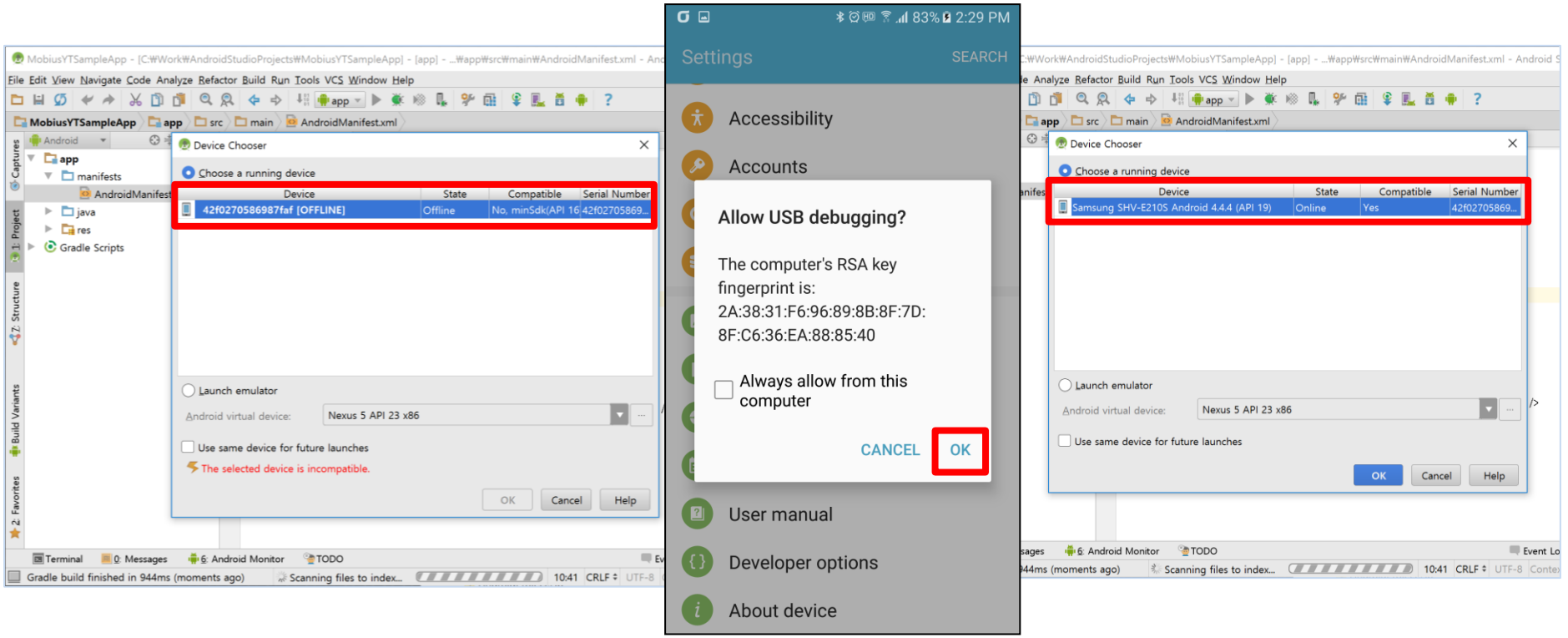


Click “Build number” continue

Mobius and APP connectivity

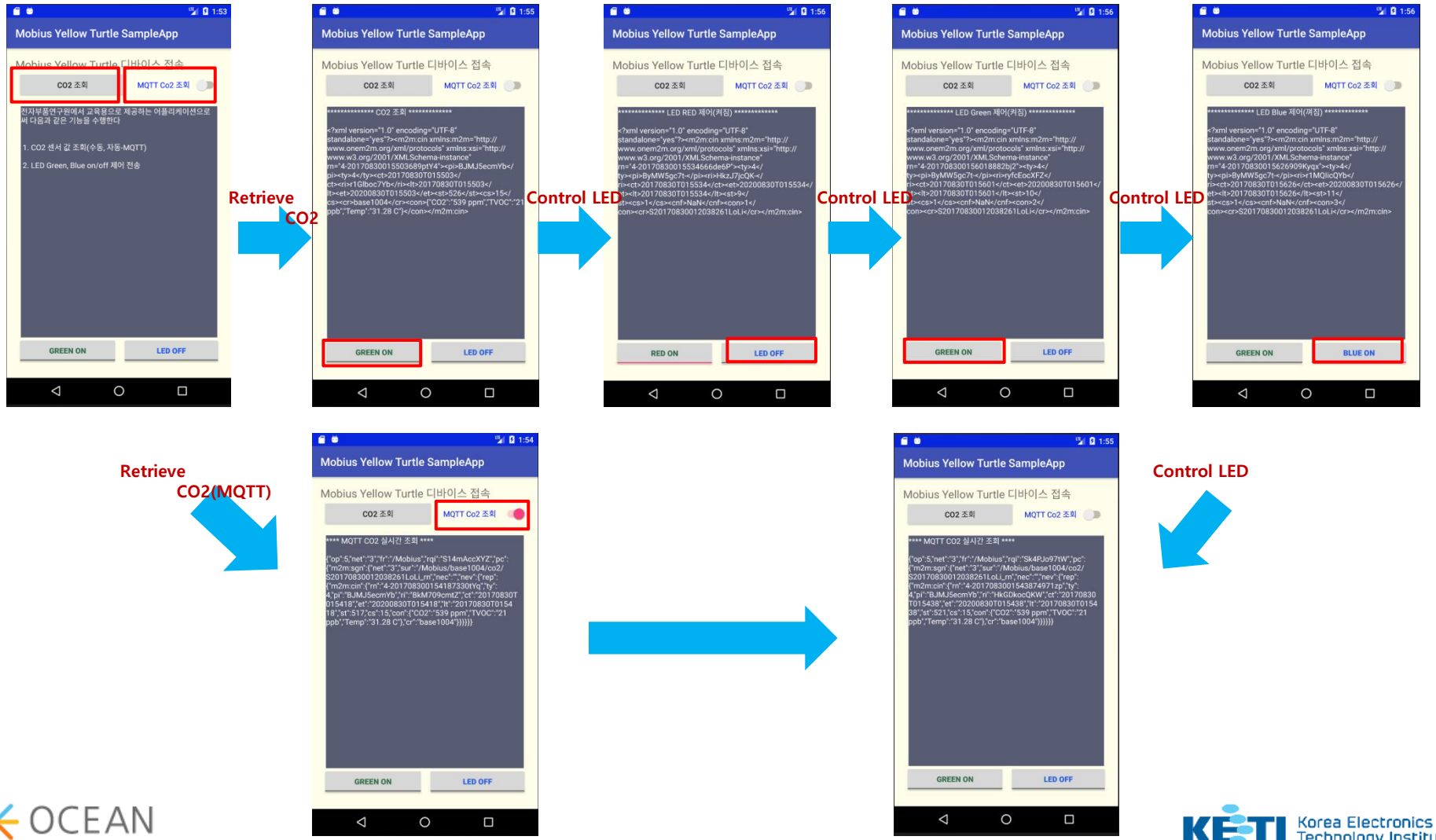
■ App Running

Android Phone Device Debugging Mode Connect



Mobius and APP connectivity

■ App Running



App Code Review

■ Internet Permission Setting [MQTT]

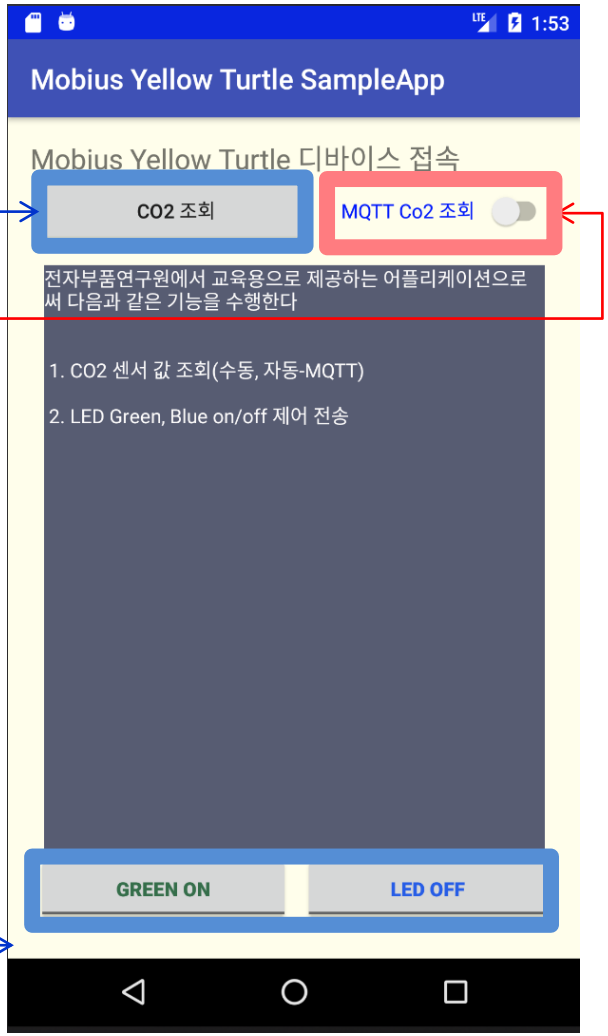
[AndroidManifest.xml]

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android" package="keti.com.mobiusytsampleapp" >

    <uses-permission android:name="android.permission.INTERNET" />
    <uses-permission android:name="android.permission.WAKE_LOCK" />
    <uses-permission android:name="android.permission.ACCESS_NETWORK_STATE" />
    <uses-permission android:name="android.permission.READ_PHONE_STATE" />

    <application
        android:allowBackup="true"
        android:icon="@mipmap/ic_launcher"
        android:label="@string/app_name"
        android:supportsRtl="true"
        android:theme="@style/AppTheme" >
        <activity android:name=".MainActivity" >
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
        <service android:name="org.eclipse.paho.android.service.MqttService" />
    </application>

</manifest>
```

App Code Review

■ Code Structure Review

```
// Main
public MainActivity() { handler = new Handler(); }
/* onCreate */
protected void onCreate(Bundle savedInstanceState) {...}
/* AE Create for Androdi AE */
public void GetAEInfo() {...}
/* Switch - Get Co2 Data With MQTT */
public void onCheckedChanged(CompoundButton buttonView, boolean isChecked) {...}
/* MQTT Subscription */
public void MQTT_Create(boolean mtqqStart) {...}
/* MQTT Listener */
private IMqttActionListener mainIMqttActionListener = new IMqttActionListener() {...};
/* MQTT Broker Message Received */
private MqttCallback mainMqttCallback = new MqttCallback() {...};
@Override
public void onClick(View v) {...}
@Override
public void onStart() {...}
@Override
public void onStop() {...}

/* Response callback Interface */
public interface IReceived {...}

/* Retrieve Co2 Sensor */
class RetrieveRequest extends Thread {...}
/* Request Control LED */
class ControlRequest extends Thread {...}
/* Regeust AE Creation */
class aeCreateRequest extends Thread {...}
/* Retrieve AE-ID */
class aeRetrieveRequest extends Thread {...}
/* Subscribe Co2 Content Resource */
class SubscribeResource extends Thread {...}
```



App Code Review

■ Code Structure Review [AE Create or AE Retrieve …]

```
/* Request AE Creation */
class aeCreateRequest extends Thread {
    private final Logger LOG = Logger.getLogger(aeCreateRequest.class.getName());
    String TAG = aeCreateRequest.class.getName();
    private IReceived receiver;
    int responseCode=0;
    public ApplicationEntityObject applicationEntity;
    public void setReceiver(IReceived hanlder) { this.receiver = hanlder; }
    public aeCreateRequest(){
        applicationEntity = new ApplicationEntityObject();
        applicationEntity.setResourceName(ae.getappName());
    }
    @Override
    public void run() {...}
}
/* Retrieve AE-ID */
class aeRetrieveRequest extends Thread {
    private final Logger LOG = Logger.getLogger(aeCreateRequest.class.getName());
    private IReceived receiver;
    int responseCode=0;

    public aeRetrieveRequest() {...}
    public void setReceiver(IReceived hanlder) { this.receiver = hanlder; }

    @Override
    public void run() {...}
}
```


```
<?xml version="1.0" encoding="utf-16" standalone="yes"?>
<m2m:ae xmlns:m2m="http://www.onem2m.org/xml/protocols"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
rn="ncubeapp">
  <pi>/Mobius</pi>
  <ty>2</ty>
  <ct>20160928T161212</ct>
  <ri>/mobius-yt/ncubeapp</ri>
  <lt>20160928T161212</lt>
  <api>0.2.481.2.0001.001.0001114</api>
  <aei>xxxxxx</aei>
  <rr>true</rr>
</m2m:ae>
```

Note: In oneM2M standard Android Application is mapping with Application Entity(AE). It should use the AE-ID as request “origin” to do other resource operation(Create, Retrieve, Update, Delete).

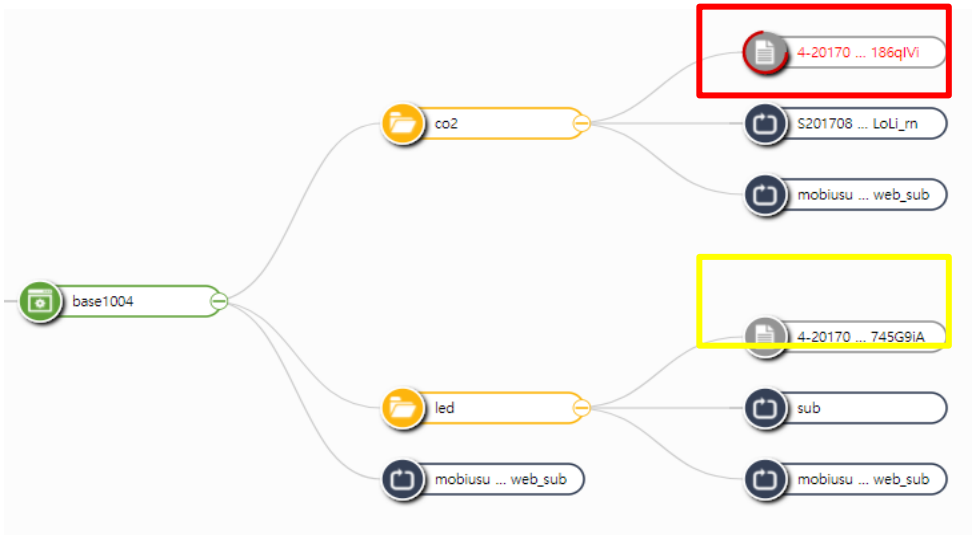
App Code Review

■ Code Structure Review [CO2 Retrieve, LED Control]

```java
/* Retrieve Co2 Sensor */
class RetrieveRequest extends Thread {
    private final Logger LOG = Logger.getLogger(RetrieveRequest.class.getName());
    private IReceived receiver;
    private String ContainerName = "co2";

    public RetrieveRequest(String containerName) { this.ContainerName = containerName; }
    public RetrieveRequest() {}
    public void setReceiver(IReceived hanlder) { this.receiver = hanlder; }

    @Override
    public void run() {...}
}
```

```java
/* Request Control LED */
class ControlRequest extends Thread {
    private final Logger LOG = Logger.getLogger(ControlRequest.class.getName());
    private IReceived receiver;
    private String container_name = "led";

    public ContentInstanceObject contentinstance;
    public ControlRequest(String comm) {
        contentinstance = new ContentInstanceObject();
        contentinstance.setContent(comm);
    }
    public void setReceiver(IReceived hanlder) { this.receiver = hanlder; }

    @Override
    public void run() {...}
```

<?xml version="1.0" encoding="utf-16" standalone="yes"?><m2m:cin xmlns:m2m="http://www.onem2m.org/xml/protocols" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" rn="4-20160925121654339wkyn"><pi>/Mobius/base1004/led</pi><ty>4</ty><ct>20160925T121654</ct><ri>/Mobius/base1004/led/4-20160925121654339wkyn</ri><lt>20160925T121654</lt><st>18</st><mni>9007199254740991</mni><cs>1</cs><cnf>text</cnf><con>4</con></m2m:cin>

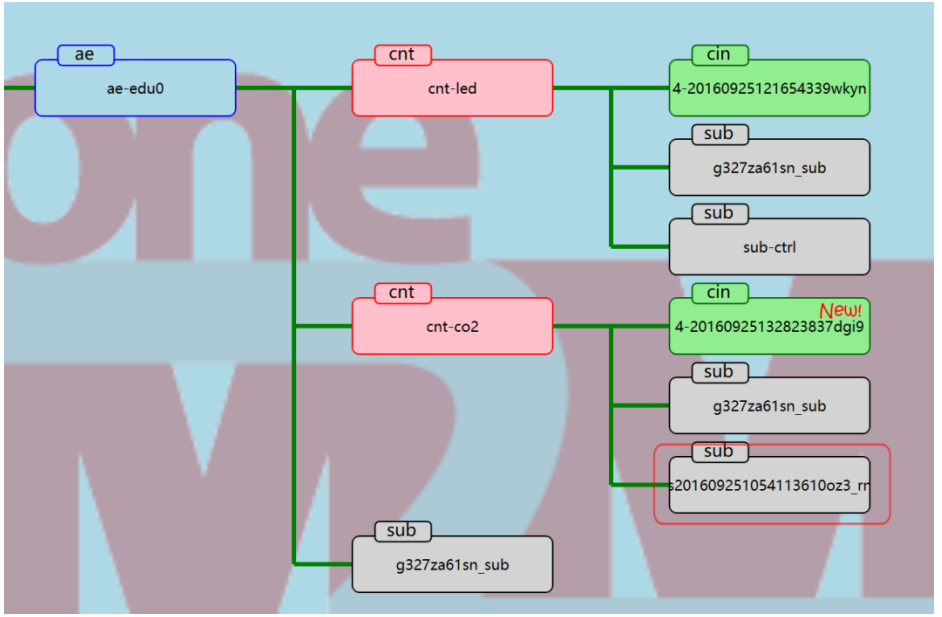


<?xml version="1.0" encoding="utf-16" standalone="yes"?><m2m:cin xmlns:m2m="http://www.onem2m.org/xml/protocols" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" rn="4-20160925130205542urps"><pi>/Mobius/base1004/co2</pi><ty>4</ty><ct>20160925T130205</ct><ri>/Mobius/base1004/co2/4-20160925130205542urps</ri><lt>20160925T130205</lt><st>3756</st><mni>9007199254740991</mni><cs>3</cs><con>719</con></m2m:cin>

App Code Review

■ Code Structure Review [Subscription create for MQTT]

```java
/* Subscribe Co2 Content Resource */
class SubscribeResource extends Thread {
    private final Logger LOG = Logger.getLogger(SubscribeResource.class.getName());
    private IReceived receiver;
    private String container_name = "co2"; //change to control container name

    public ContentSubscribeObject subscribeInstance;
    public SubscribeResource() {
        subscribeInstance = new ContentSubscribeObject();
        subscribeInstance.setUrl(csebase.getHost());
        subscribeInstance.setResourceName(ae.getAEid()+"_rn");
        subscribeInstance.setPath(ae.getAEid()+"_sub");
        subscribeInstance.setOrigin_id(ae.getAEid());
    }
    public void setReceiver(IReceived hanlder) { this.receiver = hanlder; }

    @Override
    public void run() {...}
}
```




```
<?xml version="1.0" encoding="utf-16" standalone="yes"?><m2m:sub
xmlns:m2m="http://www.onem2m.org/xml/protocols"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
rn="s20160925105411361oz3_rn"><pi>/mobius-yt/ae-edu0/cnt-
co2</pi><ty>23</ty><ct>20160925T133651</ct><ri>/mobius-yt/ae-edu0/cnt-
co2/s20160925105411361oz3_rn</ri><lt>20160925T133651</lt><st>0</st><enc
><net>3</net></enc><nu>mqtt://192.168.25.47/S20160925105411361oz3_sub</
nu><nct>2</nct><cr>S20160925105411361oz3</cr></m2m:sub>
```

App Code Review

■ Code Structure Review [Button Click Event]

```
public void onClick(View v) {

    switch (v.getId()) {

        case R.id.btnRetrieve: {
            RetrieveRequest req = new RetrieveRequest();
            textViewData.setText("");
            req.setReceiver(new IReceived() {
                @Override
                public void getResponseBody(final String msg) {
                    handler.post(new Runnable() {
                        @Override
                        public void run() {
                            textViewData.setText("********** CO2 조회 ***;
                        }
                    });
                }
            });
            req.start();
            break;
        }
        …

                ..

                .
```

```
case R.id.btnControl_Green: {
                if (((ToggleButton) v).isChecked()) {
                    ControlRequest req = new ControlRequest("1");
                    req.setReceiver(new IReceived() {
                        @Override
                        public void getResponseBody(final String msg) {
                            handler.post(new Runnable() {
                                @Override
                                public void run() {
                                    textViewData.setText("********** LED RED 제어(켜짐)..");
                                }
                            });
                        }
                    });
                    req.start();
                } else {
                    ControlRequest req = new ControlRequest("2");
                    req.setReceiver(new IReceived() {
                        @Override
                        public void getResponseBody(final String msg) {
                            handler.post(new Runnable() {
                                @Override
                                public void run() {
                                    textViewData.setText("********** LED Green 제어(켜짐)..");
                                }
                            });
                        }
                    });
                    req.start();
                }
                break;
            }
```

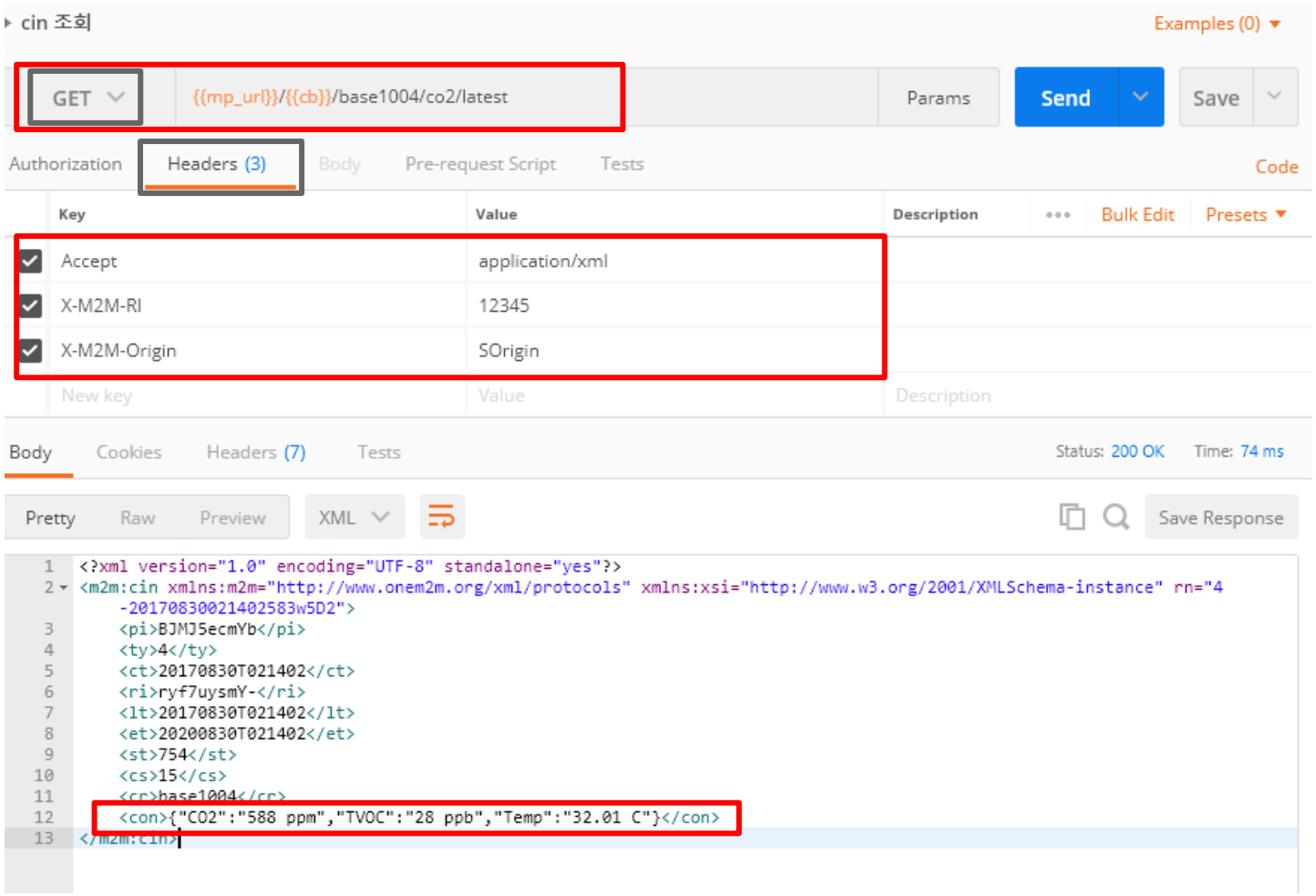
App Code Review

■ Code Structure Review [Switch onCheckChanged Event]


```
public void onCheckedChanged(CompoundButton buttonView, boolean isChecked)
if (isChecked) {
      Log.d(TAG, "MQTT Create");
      MQTT_Create(true);
   } else {
      Log.d(TAG, "MQTT Close");
      MQTT_Create(false);
   }
}
/* MQTT Subscription */
public void MQTT_Create(boolean mtqqStart) {
   if (mtqqStart && mqttClient == null) {
      /* Subscription Resource Create to Yellow Turtle */
      SubscribeResource subcribeResource = new SubscribeResource();
      subcribeResource.setReceiver(new IReceived() {
         public void getResponseBody(final String msg) {
            handler.post(new Runnable() {
               public void run() {   …    }
            });
         }
      });
      subcribeResource.start();

      /* MQTT Subscribe */
      mqttClient = new MqttAndroidClient(this.getApplicationContext(), "tcp://" + csebase.getHost() + ":" +
csebase.getMQTTPort(), MqttClient.generateClientId());
      mqttClient.setCallback(mainMqttCallback);
      try {
         IMqttToken token = mqttClient.connect();
         token.setActionCallback(mainIMqttActionListener);
      } catch (MqttException e) {
         e.printStackTrace();
      }
   } else {
      /* MQTT unSubscribe or Client Close */
      mqttClient.setCallback(null);
      mqttClient.close();
      mqttClient = null;
   }
}
```

App Code Review

■ Retrieve by POSTMAN [CO2 Sensing Data]



App Code Review

■ Retrieve by Java Code [CO2 Sensing Data]

```
private String ServiceAEName = “base1004";

...

public void GetAEInfo() {

    csebase.setInfo(“203.253.128.161","7579",“Mobius","1883"); //Sample IP
    ...

    ...
}
```

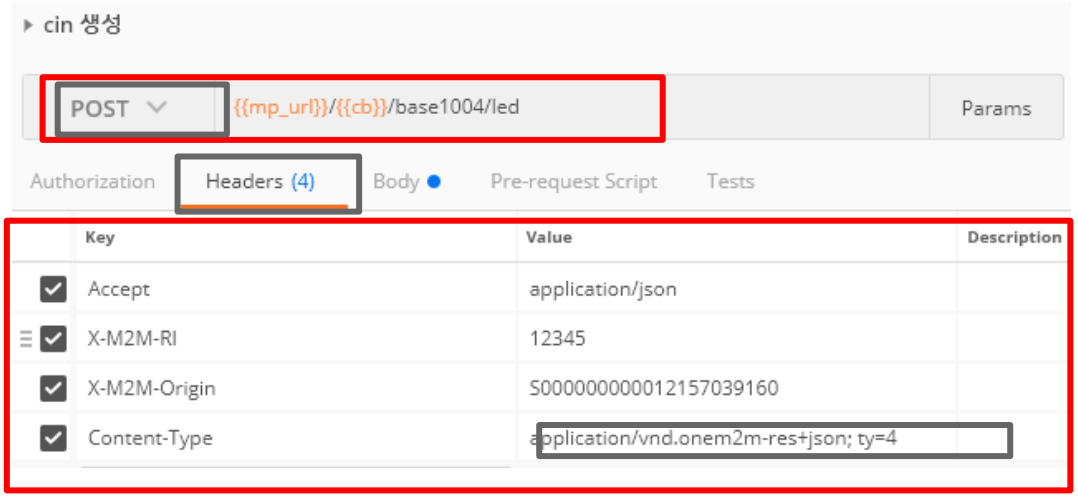
```
/* Retrieve Co2 Sensor */
class RetrieveRequest extends Thread {
    private final Logger LOG = Logger.getLogger(RetrieveRequest.class.getName());
    private IReceived receiver;
    private String ContainerName = "co2";

    public RetrieveRequest(String containerName) {
        this.ContainerName = containerName;
    }
    public RetrieveRequest() {}
    public void setReceiver(IReceived hanlder) { this.receiver = hanlder; }
```

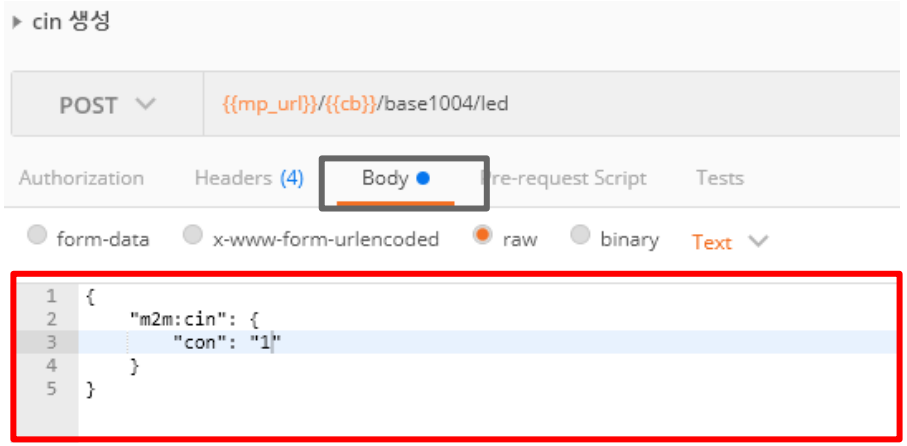
```
@Override
public void run() {
    try {
        String sb = csebase.getServiceUrl() + "/" + ServiceAEName + "/" + ContainerName + "/" + "latest";

        URL mUrl = new URL(sb);

        HttpURLConnection conn = (HttpURLConnection) mUrl.openConnection();
        conn.setRequestMethod("GET");
        conn.setDoInput(true);
        conn.setDoOutput(false);

        conn.setRequestProperty("Accept", "application/xml");
        conn.setRequestProperty("X-M2M-RI", "12345");
        conn.setRequestProperty("X-M2M-Origin", ae.getAEid() );
        conn.setRequestProperty("nmtype", "long");
        conn.connect();

        String strResp = "";
        BufferedReader in = new BufferedReader(new InputStreamReader(conn.getInputStream()));

        String strLine= "";
        while ((strLine = in.readLine()) != null) {
            strResp += strLine;
        }

        if ( strResp != "" ) {
            receiver.getResponseBody(strResp);
        }
        conn.disconnect();

    } catch (Exception exp) {
        LOG.log(Level.WARNING, exp.getMessage());
    }
}
}
```

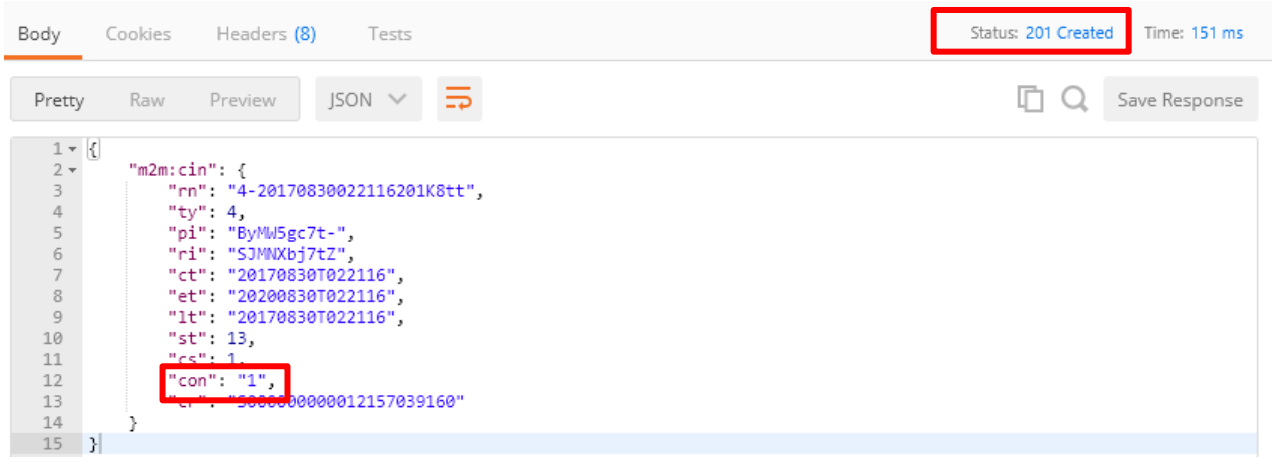
```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<m2m:cin xmlns:m2m="http://www.onem2m.org/xml/protocols" xmlns:xsi
    ="http://www.w3.org/2001/XMLSchema-instance" rn="4
    -20170830021402583w5D2">
    <pi>BJMJ5ecmYb</pi>
    <ty>4</ty>
    <ct>20170830T021402</ct>
    <ri>ryf7uysmY-</ri>
    <lt>20170830T021402</lt>
    <et>20200830T021402</et>
    <st>754</st>
    <cs>15</cs>
    <cr>base1004</cr>
    <con>{"CO2":"588 ppm","TVOC":"28 ppb","Temp":"32.01 C"}</con>
</m2m:cin>
```

App Code Review

■ Control by POSTMAN [LED Control]







1: RED LED ON

2: Green LED ON

3: Blue LED ON

0: ALL LED OFF

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App Code Review

■ Control by Java Code [LED Control]

```
private String ServiceAEName = “base1004";

...

public void GetAEInfo() {

    csebase.setInfo(“203.253.128.161","7579",“Mobius","1883");
    ...

    ...
}
```

```
<?xml version="1.0" encoding="UTF-8"?>
<m2m:cin
    xmlns:m2m="http://www.onem2m.org/xml/protocols"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <cnf>text</cnf>
    <con>1</con>
</m2m:cin>
```

```
class ControlRequest extends Thread {
    private final Logger LOG = Logger.getLogger(ControlRequest.class.getName());
    private IReceived receiver;
    private String container_name = "led";

    public ContentInstanceObject contentinstance;
    public ControlRequest(String comm) {
        contentinstance = new ContentInstanceObject();
        contentinstance.setContent(comm);
    }
    public void setReceiver(IReceived hanlder) { this.receiver = hanlder; }
```

```
@Override
  public void run() {
    try {
      String sb = csebase.getServiceUrl() +"/" + ServiceAEName + "/" + container_name;

      URL mUrl = new URL(sb);

      HttpURLConnection conn = (HttpURLConnection) mUrl.openConnection();
      conn.setRequestMethod("POST");
      conn.setDoInput(true);
      conn.setDoOutput(true);
      conn.setUseCaches(false);
      conn.setInstanceFollowRedirects(false);

      conn.setRequestProperty("Accept", "application/xml");
      conn.setRequestProperty("Content-Type", "application/vnd.onem2m-res+xml;ty=4");
      conn.setRequestProperty("locale", "ko");
      conn.setRequestProperty("X-M2M-RI", "12345");
      conn.setRequestProperty("X-M2M-Origin", ae.getAEid() );

      String reqContent = contentinstance.makeXML();
      conn.setRequestProperty("Content-Length", String.valueOf(reqContent.length()));

      DataOutputStream dos = new DataOutputStream(conn.getOutputStream());
      dos.write(reqContent.getBytes());
      dos.flush();
      dos.close();

      BufferedReader in = new BufferedReader(new
InputStreamReader(conn.getInputStream()));

      String resp = "";
      String strLine="";
      while ((strLine = in.readLine()) != null) {
        resp += strLine;
      }
      if (resp != "") {
        receiver.getResponseBody(resp);
      }
      conn.disconnect();

    } catch (Exception exp) {
      LOG.log(Level.SEVERE, exp.getMessage());
    }
  }
}
```

```
{
    "m2m:cin": {
        "rn": "4-20170830022116201K8tt",
        "ty": 4,
        "pi": "ByMW5gc7t-",
        "ri": "SJMNXbj7tZ",
        "ct": "20170830T022116",
        "et": "20200830T022116",
        "lt": "20170830T022116",
        "st": 13,
        "cs": 1,
        "con": "1",
        "cr": "S00000000012157039160"
    }
}
```

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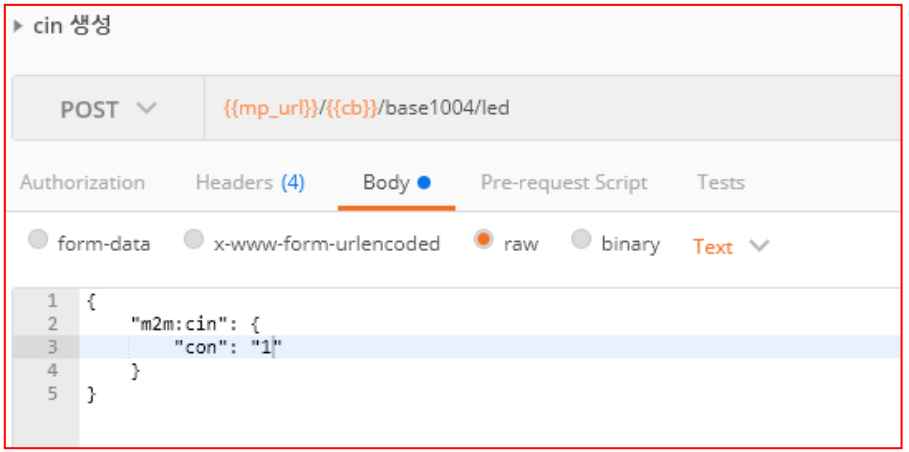
App Code Review

■ Content Instance Creation Java Code



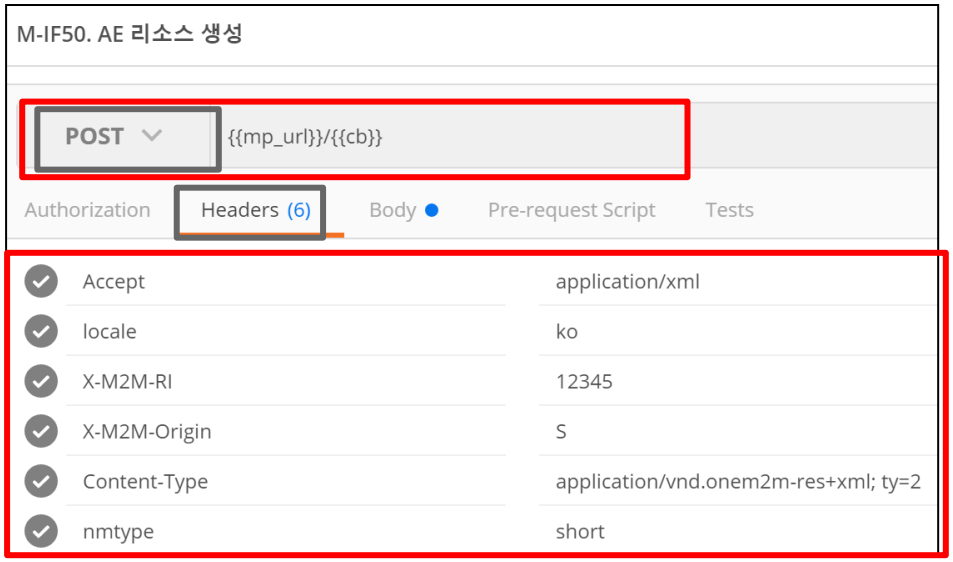
JSon

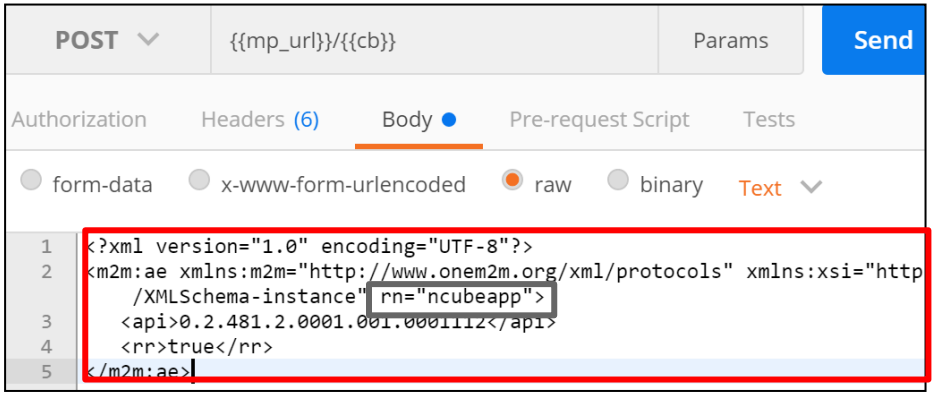
```
public class ContentInstanceObject {
    private String content = "";
    public void setContent(String contentValue) {
        this.content = contentValue;
    }

    public String makeXML() {
        String xml = "";

        xml += "<?xml version=₩"1.0₩" encoding=₩"UTF-8₩"?>";
        xml += "<m2m:cin ";
        xml += "xmlns:m2m=₩"http://www.onem2m.org/xml/protocols₩" ";
        xml += "xmlns:xsi=₩"http://www.w3.org/2001/XMLSchema-instance₩">";
        xml += "<con>" + content + "</con>";
        xml += "</m2m:cin>";

        return xml;
    }
}
```

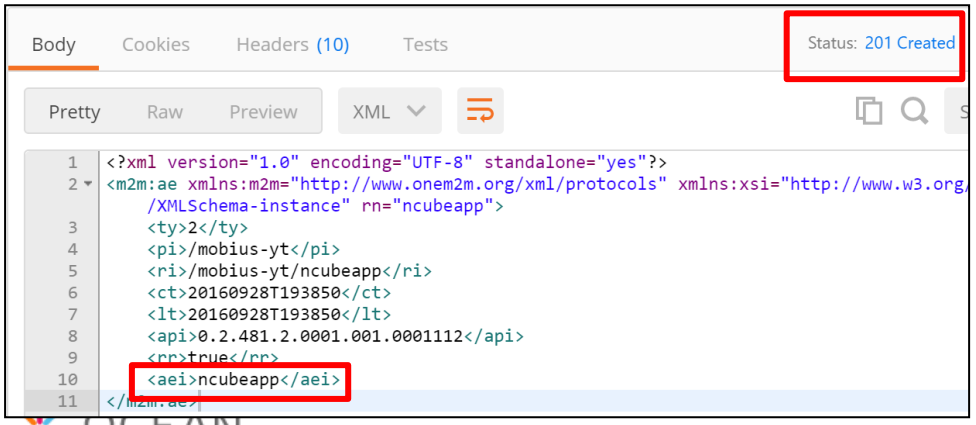
XML

App Code Review

■ AE Create by POSTMAN







App Code Review

■ AE Create by Java Code

```
private String ServiceAEName = "base1004";

...

public void GetAEInfo() {

    csebase.setInfo("203.253.128.161","7579","Mobius","1883");
    ae.setAppName("ncubeapp");

    ...

    ...
}
```

```
<?xml version="1.0" encoding="UTF-8"?>
<m2m:ae
xmlns:m2m="http://www.onem2m.org/xml/protocols"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
rn="ncubeapp">
<api>0.2.481.2.0001.001.0001114</api>
<rr>true</rr>
</m2m:ae>
```

```
class aeCreateRequest extends Thread {
    private final Logger LOG = Logger.getLogger(aeCreateRequest.class.getName());
    String TAG = aeCreateRequest.class.getName();
    private IReceived receiver;
    int responseCode=0;
    public ApplicationEntityObject applicationEntity;
    public void setReceiver(IReceived hanlder) { this.receiver = hanlder; }
    public aeCreateRequest(){
        applicationEntity = new ApplicationEntityObject();
        applicationEntity.setResourceName(ae.getappName());
    }
```

```
public void run() {
    try {
        String sb = csebase.getServiceUrl();
        URL mUrl = new URL(sb);
        HttpURLConnection conn = (HttpURLConnection) mUrl.openConnection();
        conn.setRequestMethod("POST");
        conn.setDoInput(true);
        conn.setDoOutput(true);
        conn.setUseCaches(false);
        conn.setInstanceFollowRedirects(false);
        conn.setRequestProperty("Content-Type", "application/vnd.onem2m-res+xml;ty=2");
        conn.setRequestProperty("Accept", "application/xml");
        conn.setRequestProperty("locale", "ko");
        conn.setRequestProperty("X-M2M-Origin", "S");
        conn.setRequestProperty("X-M2M-RI", "12345");
        conn.setRequestProperty("X-M2M-NM", ae.getappName() );
        String reqXml = applicationEntity.makeXML();
        conn.setRequestProperty("Content-Length", String.valueOf(reqXml.length()));
        DataOutputStream dos = new DataOutputStream(conn.getOutputStream());
        dos.write(reqXml.getBytes());
        dos.flush();
        dos.close();
        responseCode = conn.getResponseCode();
        BufferedReader in = null;
        String aei = "";
        if (responseCode == 201) {
            // Get AEID from Response Data
            in = new BufferedReader(new InputStreamReader(conn.getInputStream()));
            String resp = "";
            String strLine;
            while ((strLine = in.readLine()) != null) {
                resp += strLine;
            }
            ParseElementXml pxml = new ParseElementXml();
            aei = pxml.GetElementXml(resp, "aei");
            ae.setAEid( aei );
            Log.d(TAG, "Create Get AEID[" + aei + "]");
            in.close();
        }
        if (responseCode != 0) {
            receiver.getResponseBody( Integer.toString(responseCode) );        }
        conn.disconnect();
    } catch (Exception exp) {
        LOG.log(Level.SEVERE, exp.getMessage());
    }
```

Mobius/ncubeapp

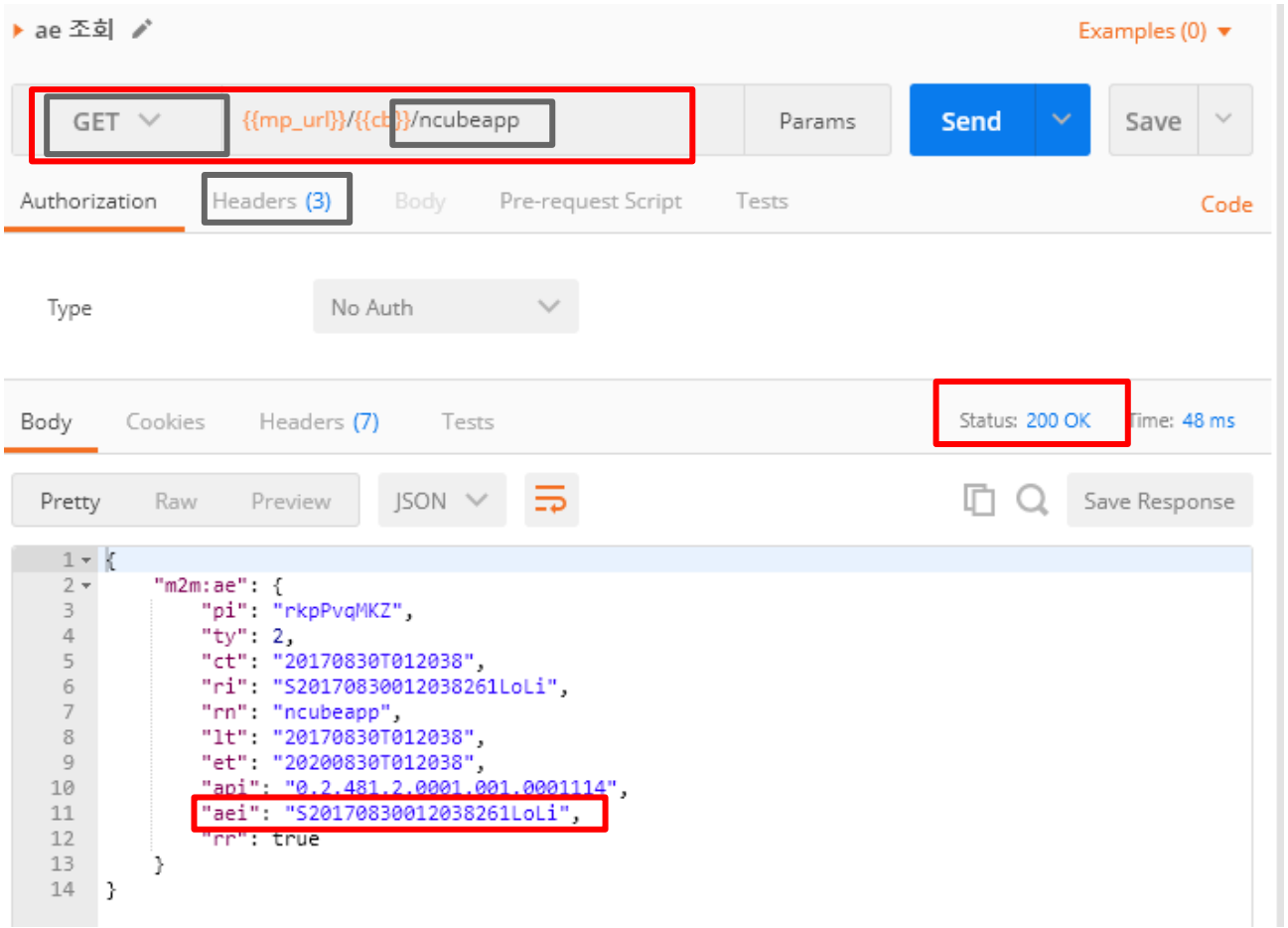
```
<?xml version="1.0" encoding="UTF-8" s
<m2m:ae xmlns:m2m="http://www.onem2m.o
    -instance" rn="ncubeapp">
    <pi> /Mobius </pi>
    <ty>2</ty>
    <ct>20160928T193850</ct>
    <ri>/Mobius/ncubapp</ri>
    <lt>20160928T193850</lt>
    <api>0.2.481.2.0001.001.0001112</a
    <aei>ncubeapp</aei>
    <rr>true</rr>
</m2m:ae>
```

OCEAN

KETI Korea Electronics Technology Institute

App Code Review

■ AE Retrieve POSTMAN [AE-ID]



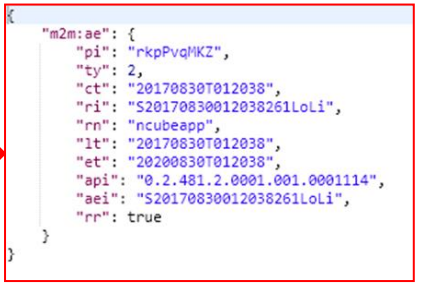
App Code Review

■ AE Retrieve Java Code

```
private String ServiceAEName = “base1004";

...

public void GetAEInfo() {

    csebase.setInfo(“203.253.128.161","7579",“Mobius","1883");
    ae.setAppName("ncubeapp");

    ...

    ...
}
```

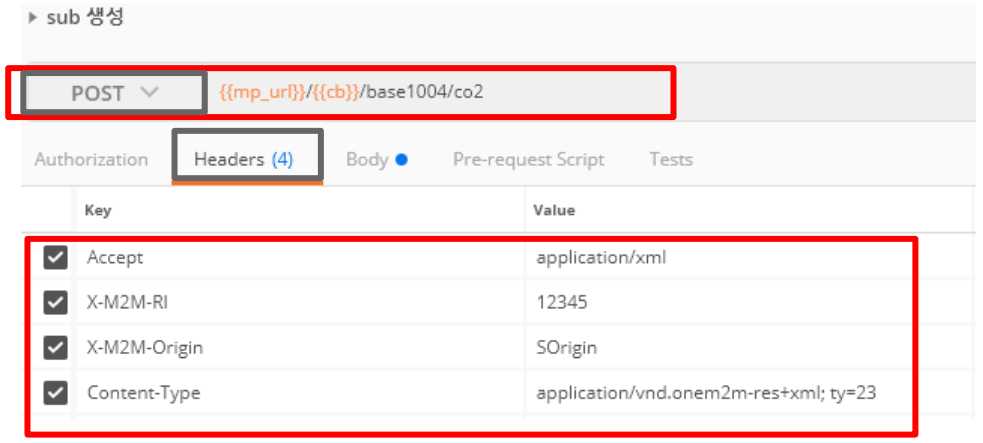
```
/* Retrieve AE-ID */
class aeRetrieveRequest extends Thread {
    private final Logger LOG = Logger.getLogger(aeCreateRequest.class.getName());
    private IReceived receiver;
    int responseCode=0;

    public aeRetrieveRequest() {
    }
    public void setReceiver(IReceived hanlder) {
        this.receiver = hanlder;
    }
```

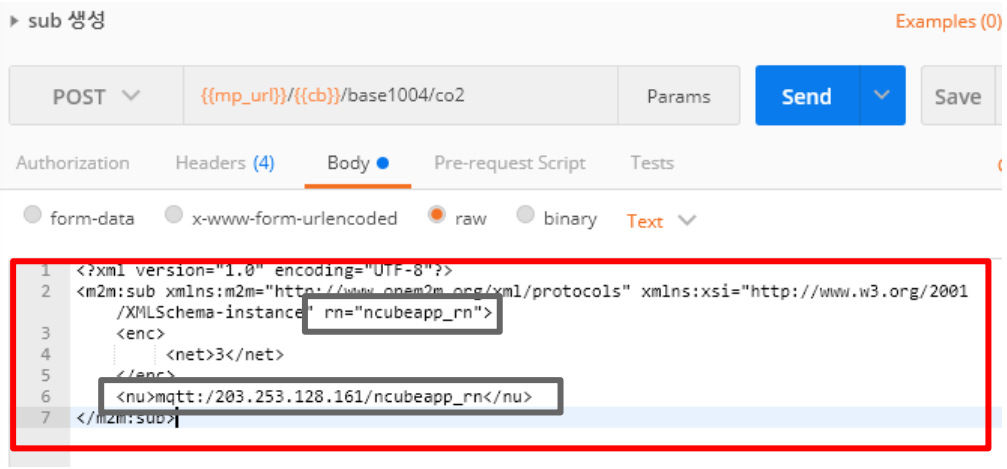
```
@Override
public void run() {
   try {
      String sb = csebase.getServiceUrl()+"/"+ ae.getappName();
      URL mUrl = new URL(sb);

      HttpURLConnection conn = (HttpURLConnection) mUrl.openConnection();
      conn.setRequestMethod("GET");
      conn.setDoInput(true);
      conn.setDoOutput(false);

      conn.setRequestProperty("Accept", "application/xml");
      conn.setRequestProperty("X-M2M-RI", "12345");
      conn.setRequestProperty("X-M2M-Origin", "Sandoroid");
      conn.setRequestProperty("nmtype", "short");
      conn.connect();

      responseCode = conn.getResponseCode();

      BufferedReader in = null;
      String aei = "";
      if (responseCode == 200) {
         // Get AEID from Response Data
         in = new BufferedReader(new InputStreamReader(conn.getInputStream()));

         String resp = "";
         String strLine;
         while ((strLine = in.readLine()) != null) {
            resp += strLine;
         }

         ParseElementXml pxml = new ParseElementXml();
         aei = pxml.GetElementXml(resp, "aei");
         ae.setAEid( aei );
         Log.d(TAG, "Retrieve Get AEID[" + aei + "]");
         in.close();
      }
      if (responseCode != 0) {
         receiver.getResponseBody( Integer.toString(responseCode) );
      }
      conn.disconnect();
   } catch (Exception exp) {
      LOG.log(Level.SEVERE, exp.getMessage());
   }
}
```

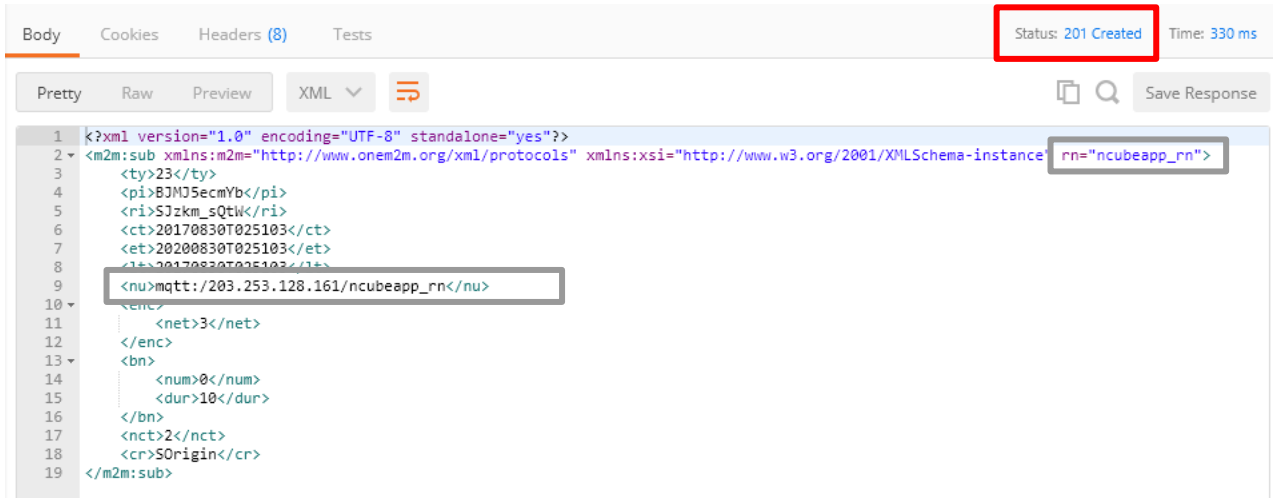


App Code Review

■ Subscription Creation by POSTMAN







App Code Review

■ Subscription Creation by Java Code

```
private String ServiceAEName = "base1004";

public void GetAEInfo() {

    csebase.setInfo("203.253.128.161","7579","Mobius","1883");
    ae.setAppName("ncubeapp");
    ...
}

/* MQTT Subscription */
public void MQTT_Create(boolean mtqqStart) {
    if (mtqqStart && mqttClient == null) {
        /* Subscription Resource Create to Yellow Turtle */
        SubscribeResource subcribeResource = new SubscribeResource();
        subcribeResource.setReceiver(new IReceived() {
            public void getResponseBody(final String msg) {
                handler.post(new Runnable() {
                    public void run() {
                        ...
                    }
                });
            }
        });
        subcribeResource.start();
        ...
}

 /* Subscribe Co2 Content Resource */
class SubscribeResource extends Thread {
    private IReceived receiver;
    private String container_name = "cnt-co2"; //change to control container name

    public ContentSubscribeObject subscribeInstance;
    public SubscribeResource() {
        subscribeInstance = new ContentSubscribeObject();
        subscribeInstance.setUrl(csebase.getHost());
        subscribeInstance.setResourceName(ae.getAEid()+"_rn");
        subscribeInstance.setPath(ae.getAEid()+"_sub");
        subscribeInstance.setOrigin_id(ae.getAEid());
    }
    public void setReceiver(IReceived hanlder) { this.receiver = hanlder; }
```

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<m2m:sub xmlns:m2m="http://www.onem2m.org/xml/protocols" xmlns:xsi="http
    ://www.w3.org/2001/XMLSchema-instance" rn="ncubeapp_rn">
    <ty>23</ty>
    <pi>BJMJ5ecmYb</pi>
    <ri>SJzkm_sQtW</ri>
    <ct>20170830T025103</ct>
    <et>20200830T025103</et>
    <lt>20170830T025103</lt>
    <nu>mqtt:/203.253.128.161/ncubeapp_rn</nu>
    <enc>
        <net>3</net>
    </enc>
    <bn>
        <num>0</num>
        <dur>10</dur>
    </bn>
    <nct>2</nct>
    <cr>SOrigin</cr>
</m2m:sub>
```

```
public void run() {
    try {
        String sb = csebase.getServiceUrl() + "/" + ServiceAEName + "/" + container_name;
        URL mUrl = new URL(sb);

        HttpURLConnection conn = (HttpURLConnection) mUrl.openConnection();
        conn.setRequestMethod("POST");
        conn.setDoInput(true);
        conn.setDoOutput(true);
        conn.setUseCaches(false);
        conn.setInstanceFollowRedirects(false);

        conn.setRequestProperty("Accept", "application/xml");
        conn.setRequestProperty("Content-Type", "application/vnd.onem2m-res+xml; ty=23");
        conn.setRequestProperty("locale", "ko");
        conn.setRequestProperty("X-M2M-RI", "12345");
        conn.setRequestProperty("X-M2M-Origin", ae.getAEid());

        String reqmqttContent = subscribeInstance.makeXML();
        conn.setRequestProperty("Content-Length", String.valueOf(reqmqttContent.length()));

        DataOutputStream dos = new DataOutputStream(conn.getOutputStream());
        dos.write(reqmqttContent.getBytes());
        dos.flush();
        dos.close();

        BufferedReader in = new BufferedReader(new InputStreamReader(conn.getInputStream()));

        String resp = "";
        String strLine="";
        while ((strLine = in.readLine()) != null) {
            resp += strLine;
        }

        if (resp != "") {
            receiver.getResponseBody(resp);
        }
        conn.disconnect();

    } catch (Exception exp) {
        LOG.log(Level.SEVERE, exp.getMessage());
    }
  }
}
```

App Code Review

■ MQTT Client Subscription, Listener, Callback, Response Java Code

```
private String ServiceAEName = “base1004";

public void GetAEInfo() {

    csebase.setInfo(“203.253.128.161","7579",“Mobius","1883");
    ae.setAppName("ncubeapp");
    ...
    MQTT_Req_Topic = "/oneM2M/req/:mobius-yt/"+ae.getAEid()+"_sub"+"/xml";
    MQTT_Resp_Topic = "/oneM2M/resp/:mobius-yt/"+ae.getAEid()+"_sub"+"/xml";
}

/* MQTT Subscription */
public void MQTT_Create(boolean mtqqStart) {
    if (mtqqStart && mqttClient == null) {
        /* Subscription Resource Create to Yellow Turtle */
        SubscribeResource subcribeResource = new SubscribeResource();
        subcribeResource.setReceiver(new IReceived() {
        ...
        subcribeResource.start();

        /* MQTT Subscribe */
        mqttClient = new MqttAndroidClient(this.getApplicationContext(), "tcp://" +
csebase.getHost() + ":" + csebase.getMQTTPort(), MqttClient.generateClientId());
        mqttClient.setCallback(mainMqttCallback);
        try {
            IMqttToken token = mqttClient.connect();
            token.setActionCallback(mainIMqttActionListener);
        } catch (MqttException e) {
            e.printStackTrace();
        }
    } else {
        /* MQTT unSubscribe or Client Close */
        mqttClient.setCallback(null);
        mqttClient.close();
        mqttClient = null;
    }
}
```

```
/* MQTT Listener */
private IMqttActionListener mainIMqttActionListener = new IMqttActionListener() {
    @Override
    public void onSuccess(IMqttToken asyncActionToken) {
        String payload = "";
        int mqttQos = 1; /* 0: NO QoS, 1: No Check , 2: Each Check */

        MqttMessage message = new MqttMessage(payload.getBytes());
        try {
            mqttClient.subscribe(MQTT_Req_Topic, mqttQos);
        } catch (MqttException e) {
            e.printStackTrace();
        }
    }
    ...
};
/* MQTT Broker Message Received */
private MqttCallback mainMqttCallback = new MqttCallback() {
    @Override
    public void connectionLost(Throwable cause) {  Log.d(TAG, "connectionLost"); }
    @Override
    public void messageArrived(String topic, MqttMessage message) throws Exception {
        Log.d(TAG, "messageArrived");
        textViewData.setText("");
        textViewData.setText("**** MQTT CO2 실시간 조회 ****\r\n\r\n" +
message.toString().replaceAll("\t|\n", ""));
        ArrayList<String> mqttMessage = new ArrayList<String>();
        mqttMessage = MqttClientRequestParser.notificationParse(message.toString());
        String responseMessage = MqttClientRequest.notificationResponse(mqttMessage);

        /* Make xml for MQTT Response Message */
        MqttMessage resmessage = new MqttMessage(responseMessage.getBytes());

        try {
            mqttClient.publish(MQTT_Resp_Topic, resmessage);
        } catch (MqttException e) { e.printStackTrace(); }
    }
    @Override
    public void deliveryComplete(IMqttDeliveryToken token) {
        Log.d(TAG, "deliveryComplete");
    }
};
```

App Code Review

■ Android Studio Generate APK

- Build -> Generate Signed APK...
- If have Key store, Select “Choose existing”
- If do not have Key store, Select “Create new”
- Save location and input file name, Password, Alias, Certification information.
- Select key file
- Locate the APK path.