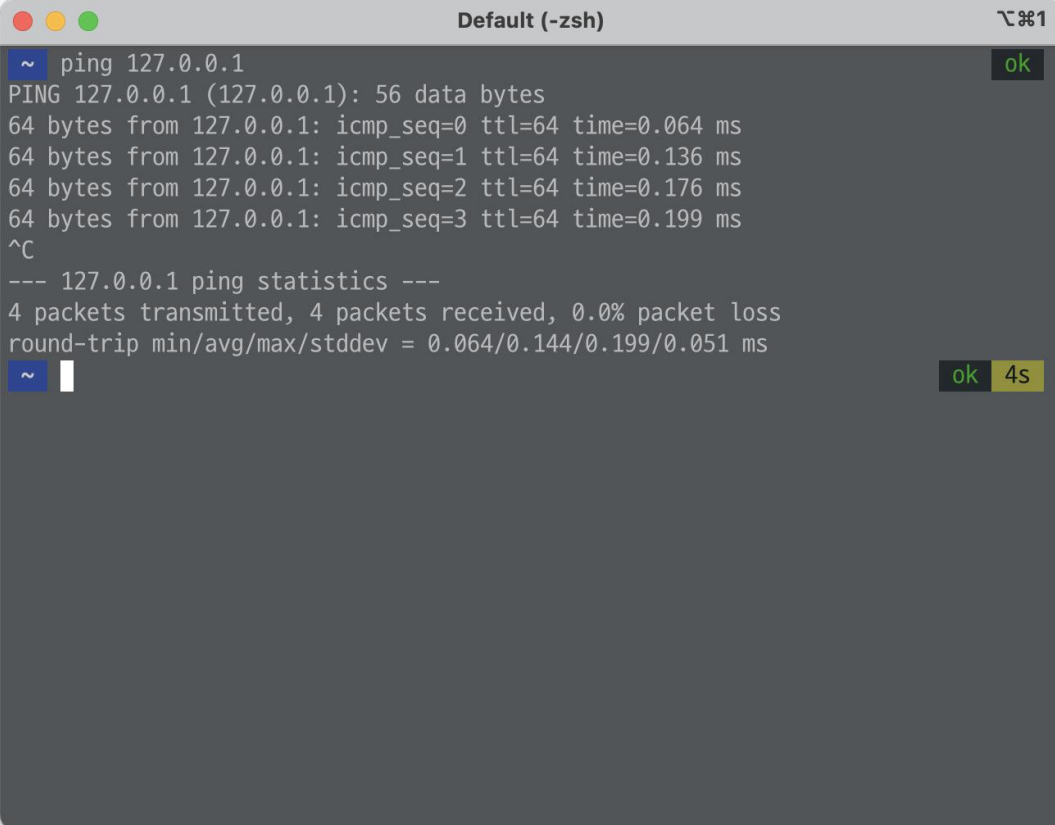


4. Software Interface test

4.1. Cloud Function (API Caller)

4.1.1. Connection test



```
Default (-zsh)
~ ping 127.0.0.1
PING 127.0.0.1 (127.0.0.1): 56 data bytes
64 bytes from 127.0.0.1: icmp_seq=0 ttl=64 time=0.064 ms
64 bytes from 127.0.0.1: icmp_seq=1 ttl=64 time=0.136 ms
64 bytes from 127.0.0.1: icmp_seq=2 ttl=64 time=0.176 ms
64 bytes from 127.0.0.1: icmp_seq=3 ttl=64 time=0.199 ms
^C
--- 127.0.0.1 ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 0.064/0.144/0.199/0.051 ms
~
```

Figure 1: Ping Command and Result Example

4.1.1.1. 2DMap_API

Test case Object: Caller 와 2DMap_API 사이의 네트워크 연결 test

Test Input:

ping 14.35.156.38

Expected Results:

Ping status: 4 packets transmitted, 4 packets received, 0.0% packet loss

4.1.1.2. PanoramaMap_API

Test case Object: Caller 와 PanoramMap_API 사이의 네트워크 연결 test

Test Input:

```
ping 14.35.156.35
```

Expected Results:

```
Ping status: 4 packets transmitted, 4 packets received, 0.0% packet loss
```

4.1.1.3. DoorInfo_API

Test case Object: Caller 와 DoorInfo_API 사이의 네트워크 연결 test

Test Input:

```
ping 14.35.156.36
```

Expected Results:

```
Ping status: 4 packets transmitted, 4 packets received, 0.0% packet loss
```

4.1.1.4. DBGateway_API

Test case Object: Caller 와 DBGateway_API사이의 네트워크 연결 test

Test Input:

```
ping 14.35.156.40
```

Expected Results:

```
Ping status: 4 packets transmitted, 4 packets received, 0.0% packet loss
```

4.1.2. Validation test

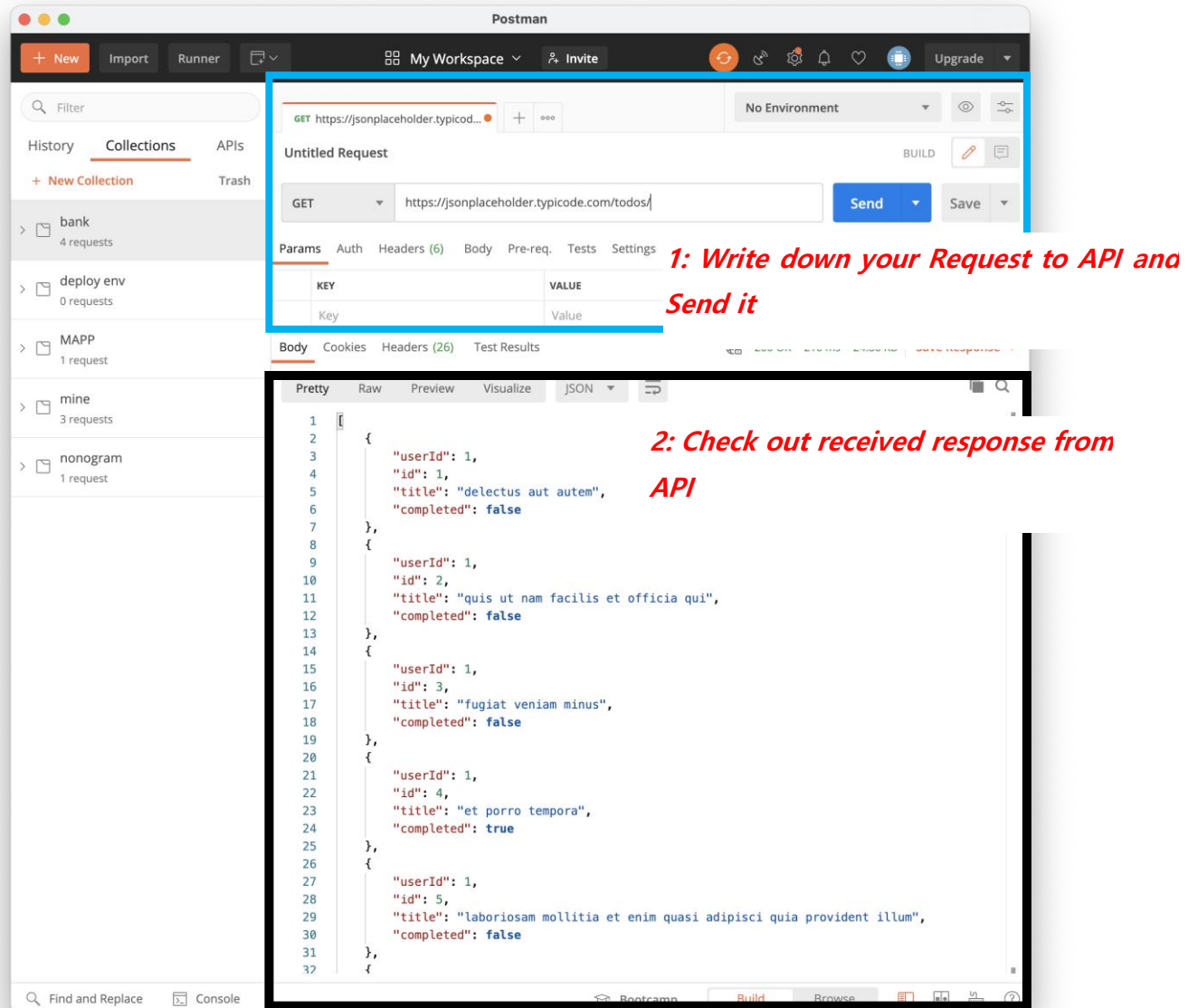


Figure 2: Postman Tool Usage Example

4.1.2.1. 2DMap_API

Object: Caller와 2DMap_API 사이에서 작동하는 기능적인 측면의 소프트웨어 인터페이스 Test

Test case 1 Object : 2DMap_API가 올바르게 Caller에게 현재 위치정보를 계산해서 보내주는지 테스트

Test Input1:

Attribute	Detail	
Method	GET	
URI	GET: http://insidecampus/map/gps	
Header	Stations Address Array (위도, 경도)	[(37.486908, 127.046808), (37.489055, 127.066038), (37.512011, 127.104587)]
Header	WIFI AP Address Array (위도, 경도)	[(37.488262, 127.066013), (37.488538, 127.065078), (37.488214, 127.064767)]

Expected Results: 현재 GPS Info

```
HTTP/1.1 200 OK
Cache-Control: no-cache
Date: {Current Date}
Content-Type: application/json

[
  {
    "currentGPSLatitude": 37.488295,
    "currentGPSLongitude": 127.065572
  }
]
```

Test case 2 Object: 2DMap_API가 올바르게 두 장소 사이의 최단 경로를 response해주는지 테스트

Test Input2:

Attribute	Detail	
Method	GET	
URI	GET: http://insidecampus/map/path	

Attribute	Detail	
Header	Source Coordinates (위도, 경도)	(37.486908, 127.046808)
Header	Destination Coordinates (위도, 경도)	(37.488262, 127.066013)

Expected Results:

```

HTTP/1.1 200 OK
Cache-Control: no-cache
Date: {Current Date}
Content-Type: application/json

[
  {
    "Source": {
      "latitude": 37.486908,
      "longtitude": 127.046808
    },
    "intermediate point 1": {
      "latitude": 37.486908,
      "longtitude": 127.049808
    },
    "intermediate point 2": {
      "latitude": 37.483948,
      "longtitude": 127.076808
    },
    "intermediate point 3": {
      "latitude": 37.483038,
      "longtitude": 127.099808
    },
    "intermediate point 4": {
      "latitude": 37.423408,
      "longtitude": 127.043308
    },
    "Destination": {
      "latitude": 37.488262,
      "longtitude": 127.066013
    }
  }
]
```

4.1.2.2. PanoramaMap_API

Object: Caller 와 PanoramaMap_API 사이에서 작동하는 기능적인 측면의 소프트웨어 인터페이스 Test

Test case Object : PanoramaMap_API 가 Caller에게 올바른 Roadmap data을 전송하는지 test

Test Input:

Attribute	Detail	
Method	GET	
URI	GET: http://insidecampus/roadview	
Header	Location Coordinates (위도, 경도)	(37.486908, 127.046808)
Header	Direction (위도, 경도)	One of (East, West, South, North)
Header	Accept-Ranges (Bytes)	4000

Expected Results:

```
HTTP/1.1 200 OK
Server: WAS/6.0
Content-Length: 1664
Content-type: application/xml

<?xml version="1.0" encoding="UTF-8"?>
<transfers>
  <transfer start-time="2021-05-27T13:10:04.209+01:00" status="Complete"
id="414d51205245444841542e434f4f5244ed60b44b03310020">
    <source>
      <agent qmgr="REDHAT.SOURCE.QM" name="REDHAT.SOURCE.AGENT" />
      <metadata>
        <key value="REDHAT.SOURCE.AGENT" name="com.ibm.wmqfte.SourceAgent" />
        <key value="REDHAT.DEST.AGENT" name="com.ibm.wmqfte.DestinationAgent"
/>>
        <key value="192.168.243.133" name="com.ibm.wmqfte.OriginatingHost" />
        <key value="fteuser" name="com.ibm.wmqfte.MqmdUser" />
        <key value="414d51205245444841542e434f4f5244ed60b44b03310020"
name="com.ibm.wmqfte.TransferId" />
        <key value="fteuser" name="com.ibm.wmqfte.OriginatingUser" />
      </metadata>
    </source>
    <destination>
      <agent qmgr="REDHAT.SOURCE.QM" name="REDHAT.SOURCE.AGENT" />
      <metadata>
        <key value="REDHAT.SOURCE.AGENT" name="com.ibm.wmqfte.SourceAgent" />
```

```

        <key value="REDHAT.DEST.AGENT" name="com.ibm.wmqfte.DestinationAgent"
/>
        <key value="fteuser" name="com.ibm.wmqfte.MqmdUser" />
        <key value="192.168.243.133" name="com.ibm.wmqfte.OriginatingHost" />
        <key value="fteuser" name="com.ibm.wmqfte.OriginatingUser" />
        <key value="414d51205245444841542e434f4f5244ed60b44b03310020"
name="com.ibm.wmqfte.TransferId" />
    </metadata>
</destination>
<stats retry-count="0" file-warnings="0" file-failures="0" bytes-
transferred="67" />
<transfer-set>
    <file result-code="0" mode="text">
        <source-file name="/home/fteuser/accounts.txt">
            <attribute-values last-modified="2021-03-17T16:55:17.000Z" file-
size="67" disposition="leave" checksum-method="none" />
        </source-file>
        <destination-file name="/tmp/accounts.txt">
            <attribute-values last-modified="2021-04-01T13:10:04.000+01:00"
file-size="67" exists-action="error" checksum-method="none" />
        </destination-file>
    </file>
</transfer-set>
</transfer>
</transfers>

```

4.1.2.3. DoorInfo_API

Object: Caller 와 DoorInfo_API 사이에서 작동하는 기능적인 측면의 소프트웨어 인터페이스 Test

Test case object: DoorInfo_API 가 해당 건물에 대해서 올바른 정보를 주는지 Test

Test Input:

Attribute	Detail	
Method	GET	
URI	GET: http://insidecampus/map/location/info	
Header	Coordinates (위도, 경도)	(37.486908, 127.046808)

Expected Results: 문 개폐 정보들

```

HTTP/1.1 200 OK
Cache-Control: no-cache
Date: {Current Date}
Content-Type: application/json

```

```
[
  {
    "opened Door": [1, 3, 4],
    "closed Door": [2, 5, 6, 7, 8]
  }
]
```

4.1.3. Defect test

4.1.3.1. 2DMap_API

object: Caller 와 2DMap_API의 에러 추가 발견

Test case 1 Object : 2DMap_API가 Caller에게 잘못된 GPS 요청을 받았을 때 발생할 결함 발견이 목적
Test Input1: (의도적으로 에러를 일으키는 test case, Array가 비어있는 상태)

Attribute	Detail	
Method	GET	
URI	GET: http://insidecampus.com/map/gps	
Header	Stations Address Array (위도, 경도)	[]
Header	WIFI AP Address Array (위도, 경도)	[]

Expected Results 1:

```
HTTP/1.1 400 Bad Request
Cache-Control: no-cache
Date: {Current Date}
```

Test case 2 Object: 2DMap_API가 Caller에게 잘못된 경로 탐색 요청을 받았을 때 발생할 결함 발견이 목적

Test Input2: (의도적으로 에러를 일으키는 test case, 좌표 오류인 상태)

Attribute	Detail	
Method	GET	
URI	GET: http://insidecampus.com/map/path	
Header	Source Coordinates (위도, 경도)	()

Attribute	Detail	
Header	Destination Coordinates (위도, 경도)	()

Expected Results 2:

```
HTTP/1.1 400 Bad Request
Cache-Control: no-cache
Date: {Current Date}
```

4.1.3.2. PanoramaMap_API

Test case Object : Caller 가 잘못된 로드 뷰 데이터 전송요청시에 발생할 수 있는 에러 추가 발견

Test Input:

Attribute	Detail	
Method	GET	
URI	GET: http://insidecampus/roadview	
Header	Location Coordinates (위도, 경도)	(37.486908, 127.046808)
Header	Direction (위도, 경도)	One of (East, West, South, North)
Header	Accept-Ranges (Bytes)	0 (받을 데이터 양을 0으로 하여 오류 발생시키기)

Expected Results:

```
HTTP/1.1 400 Bad Request
Server: WAS/6.0
Content-Length: 1664
Content-type: application/json

[
  {
    "message": "Byte parameter Error"
  }
]
```

4.1.3.3. DoorInfo_API

Test case object: To check whether it has undetected errors between Caller and DoorInfo_API.

Test case object: DoorInfo_API 가 잘못된 건물 정보 요청에 대해서 발생할 에러 탐색

Test Input:

Attribute	Detail	
Method	GET	
URI	GET: http://insidecampus/map/location/info	
Header	Coordinates (위도, 경도)	()

Expected Results: 에러 메시지

```
HTTP/1.1 400 Bad Request
Cache-Control: no-cache
Date: {Current Date}
```

4.2. DBGateway_API

4.2.1. Connection test

4.2.1.1. Road View DB

Test case object: To check external software interfaces (connection) between DBGateway_API and Road View DB.

Test Input:

```
ping 14.35.156.51
```

Expected Results:

```
Ping status: 4 packets transmitted, 4 packets received, 0.0% packet loss
```

4.2.1.2. Gate Info DB

Test case object: To check external software interfaces (connection) between DBGateway_API and Gate Info DB.

Test Input:

```
ping 14.35.156.52
```

Expected Results:

```
Ping status: 4 packets transmitted, 4 packets received, 0.0% packet loss
```

4.2.1.3. Campus Map DB

Test case object: To check external software interfaces (connection) between DBGateway_API and Campus Map DB.

Test Input:

```
ping 14.35.156.53
```

Expected Results:

```
Ping status: 4 packets transmitted, 4 packets received, 0.0% packet loss
```

4.2.2. Validation test

4.2.2.1. Road View DB

Test case object: To check external software interfaces (valid functionality) between DBGateway_API and Road View DB.

Test Input:

Attribute	Detail	
Method	GET	
URI	GET: http://14.35.156.51:3306/DB	
Header	Location Coordinates (위도, 경도)	(37.486908, 127.046808)
Header	Direction (위도, 경도)	One of (East, West, South, North)
Header	Accept-Ranges (Bytes)	4000

Expected Results:

```
HTTP/1.1 200 OK
Server: WAS/6.0
Content-Length: 1664
Content-type: application/xml

<?xml version="1.0" encoding="UTF-8"?>
<transfers>
  <transfer start-time="2021-05-27T13:10:04.209+01:00" status="Complete"
id="414d51205245444841542e434f4f5244ed60b44b03310020">
    <source>
      <agent qmgr="REDHAT.SOURCE.QM" name="REDHAT.SOURCE.AGENT" />
      <metadata>
        <key value="REDHAT.SOURCE.AGENT" name="com.ibm.wmqfte.SourceAgent" />
        <key value="REDHAT.DEST.AGENT" name="com.ibm.wmqfte.DestinationAgent"
/>
        <key value="192.168.243.133" name="com.ibm.wmqfte.OriginatingHost" />
        <key value="fteuser" name="com.ibm.wmqfte.MqmdUser" />
        <key value="414d51205245444841542e434f4f5244ed60b44b03310020"
name="com.ibm.wmqfte.TransferId" />
        <key value="fteuser" name="com.ibm.wmqfte.OriginatingUser" />
      </metadata>
    </source>
    <destination>
      <agent qmgr="REDHAT.SOURCE.QM" name="REDHAT.SOURCE.AGENT" />
      <metadata>
        <key value="REDHAT.SOURCE.AGENT" name="com.ibm.wmqfte.SourceAgent" />
```

```

        <key value="REDHAT.DEST.AGENT" name="com.ibm.wmqfte.DestinationAgent"
/>
        <key value="fteuser" name="com.ibm.wmqfte.MqmdUser" />
        <key value="192.168.243.133" name="com.ibm.wmqfte.OriginatingHost" />
        <key value="fteuser" name="com.ibm.wmqfte.OriginatingUser" />
        <key value="414d51205245444841542e434f4f5244ed60b44b03310020"
name="com.ibm.wmqfte.TransferId" />
        </metadata>
        </destination>
        <stats retry-count="0" file-warnings="0" file-failures="0" bytes-
transferred="67" />
        <transfer-set>
            <file result-code="0" mode="text">
                <source-file name="/home/fteuser/accounts.txt">
                    <attribute-values last-modified="2021-03-17T16:55:17.000Z" file-
size="67" disposition="leave" checksum-method="none" />
                </source-file>
                <destination-file name="/tmp/accounts.txt">
                    <attribute-values last-modified="2021-04-01T13:10:04.000+01:00"
file-size="67" exists-action="error" checksum-method="none" />
                </destination-file>
            </file>
        </transfer-set>
    </transfer>
</transfers>

```

4.2.2.2. Gate Info DB

Test case object: To check external software interfaces (valid functionality) between DBGateway_API and Gate Info DB.

Test Input:

Attribute	Detail	
Method	GET	
URI	GET: http://14.35.156.52:3306/DB	
Header	Coordinates (위도, 경도)	(37.486908, 127.046808)

Expected Results: 문 개폐 정보들

```

HTTP/1.1 200 OK
Cache-Control: no-cache
Date: {Current Date}
Content-Type: application/json

```

[

```
{
  "opened Door": [1, 3, 4],
  "closed Door": [2, 5, 6, 7, 8]
}
]
```

4.2.2.3. Campus Map DB

Test case object: To check external software interfaces (valid functionality) between DBGateway_API and Campus Map DB.

Test Input:

Attribute	Detail	
Method	GET	
URI	GET: http://4.35.156.53:3306/DB	
Header	Source Coordinates (위도, 경도)	(37.486908, 127.046808)
Header	Accept-Ranges (Bytes)	4000

Expected Results:

```
HTTP/1.1 200 OK
Server: WAS/6.0
Content-Length: 1664
Content-type: application/xml
```

```
<?xml version="1.0" encoding="UTF-8"?>
<transfers>
  <transfer start-time="2021-05-27T13:10:04.209+01:00" status="Complete"
id="414d51205245444841542e434f4f5244ed60b44b03310020">
    <source>
      <agent qmgr="REDHAT.SOURCE.QM" name="REDHAT.SOURCE.AGENT" />
      <metadata>
        <key value="REDHAT.SOURCE.AGENT" name="com.ibm.wmqfte.SourceAgent" />
        <key value="REDHAT.DEST.AGENT" name="com.ibm.wmqfte.DestinationAgent"
/>
        <key value="192.168.243.133" name="com.ibm.wmqfte.OriginatingHost" />
        <key value="fteuser" name="com.ibm.wmqfte.MqmdUser" />
        <key value="414d51205245444841542e434f4f5244ed60b44b03310020"
name="com.ibm.wmqfte.TransferId" />
        <key value="fteuser" name="com.ibm.wmqfte.OriginatingUser" />
      </metadata>
    </source>
    <destination>
      <agent qmgr="REDHAT.SOURCE.QM" name="REDHAT.SOURCE.AGENT" />
```

```

    <metadata>
      <key value="REDHAT.SOURCE.AGENT" name="com.ibm.wmqfte.SourceAgent" />
      <key value="REDHAT.DEST.AGENT" name="com.ibm.wmqfte.DestinationAgent"
/>
      <key value="fteuser" name="com.ibm.wmqfte.MqmdUser" />
      <key value="192.168.243.133" name="com.ibm.wmqfte.OriginatingHost" />
      <key value="fteuser" name="com.ibm.wmqfte.OriginatingUser" />
      <key value="414d51205245444841542e434f4f5244ed60b44b03310020"
name="com.ibm.wmqfte.TransferId" />
    </metadata>
  </destination>
  <stats retry-count="0" file-warnings="0" file-failures="0" bytes-
transferred="4000" />
  <transfer-set>
    <file result-code="0" mode="bitset">
      <source-file name="/home/fteuser/2ndEngineering.png">
        <attribute-values last-modified="2021-03-17T16:55:17.000Z" file-
size="67" disposition="leave" checksum-method="none" />
      </source-file>
      <destination-file name="/tmp/campus_map.png">
        <attribute-values last-modified="2021-04-01T13:10:04.000+01:00"
file-size="67" exists-action="error" checksum-method="none" />
      </destination-file>
    </file>
  </transfer-set>
</transfer>
</transfers>

```

4.2.3. Defect test

4.2.3.1. Road View DB

Test case object: DBGateway_API가 Road View DB에게 잘못된 요청을 보냈을 때 발생할 수 있는 결함 발견이 목적

Test Input:

Attribute	Detail	
Method	GET	
URI	GET: http://14.35.156..51:3306/DB	
Header	Location Coordinates (위도, 경도)	(37.486908, 127.046808)
Header	Direction (위도, 경도)	One of (East, West, South, North)
Header	Accept-Ranges (Bytes)	0 (받을 데이터 양을 0으로 하여 오류 발생시키기)

Expected Results:

```
HTTP/1.1 400 Bad Request
Server: WAS/6.0
Content-Length: 1664
Content-type: application/json

[
  {
    "message": "Byte parameter Error"
  }
]
```

4.2.3.2. Gate Info DB

Test case object: DBGateway_API가 Gate Info DB에게 잘못된 2D 지도 데이터 요청을 받았을 때 발생할 결함 발견이 목적

Test Input:

Attribute	Detail	
Method	GET	
URI	GET: http://14.35.156.52:3306/DB	
Header	Coordinates (위도, 경도)	()

Expected Results:

```
HTTP/1.1 400 Bad Request
Cache-Control: no-cache
Date: {Current Date}
```

4.2.3.3. Campus Map DB

Test case Object: DBGateway_API가 Campus Map DB에게 잘못된 2D 지도 데이터 요청을 받았을 때 발생할 결함 발견이 목적

Test Input: (의도적으로 에러를 일으키는 test case, 수신할 Byte 크기가 오류인 상태)

Attribute	Detail
Method	GET

Attribute	Detail	
URI	GET: http://4.35.156.53:3306/DB	
Header	Source Coordinates (위도, 경도)	(37.486908, 127.046808)
Header	Accept-Ranges (Bytes)	0 (받을 데이터 양을 0 으로 하여 오류 발생시키기)

Expected Results:

```

HTTP/1.1 400 Bad Request
Server: WAS/6.0
Content-Length: 1664
Content-type: application/json

[
  {
    "message": "Byte parameter Error"
  }
]
```