FHIR COURSE

Introduction to FHIR – Transactions

How to submit your activity

Contents

1. What is expected from you in this assignment?

Post at least 3 transactions for the same patient, holding four different measures for the 4 vital signs. The measures shall be separated by 15 minutes. Transactions are BUNDLES of the required resources.

Example: For Patient: DOE, JOHN # 120202, Device ZZZZZ,

Measure	05.12.2016 10:30	05.12.2016 10:45	05.12.2016 11:00
Systolic BP	120	125	120
Diastolic BP	80	85	78
Heart Rate	120	135	127
Respiratory Rate	15	18	22

You can try and test all these operations at any FHIR test server using your rest client but you will have to do the same finally **at the course software** for your grade record

NOTE: Some operations could work using POSTMAN or your REST client, and fail in the course server. Note that the course server is more restrictive and has more controls.

2. How to submit this assignment

1. When you edit your submission you will face an interface like the one depicted here:

2. Select the correct Method, content-type and endpoint. Then paste your first transaction in the text area and send it to the server with the **Send Transaction** button. If you bundle is correct you will create your first transaction.

After this, you need to send the second group of measures. **Same patient, same device** but the **observation values** and **effective time** have to be **different.** You need to paste the new bundle in the text area and repeat the first step using the **Send Transaction** button.

3. How to Start?

The basic template for your transaction Bundle is provided in XML and JSON formats.

Go to the home page of the FHIR course, under Unit 3, and you will find two files:

MeasureTemplateComplete.xml and **MeasureTemplateComplete.json**

You have to update this file three times in order to generate three different transactions, one for each date/time.

4. CONCEPTS

Transaction Bundle

Please note that Bundle means, in layman's terms, one XML or JSON with multiple resources inside it. When you POST this Bundle as transaction, automatically, all resources inside it will also get created or updated in the FHIR server. Each Bundle has different entries with all the needed resources according to the specification.

In this case you have a Patient (your Patient), a Device (use the device template) and four observations.

Use the base url of server to POST transaction- http://fhirserver.hl7fundamentals.org/fhir

Each **entry** shall contain a **resource** and a **request** element. And the **request** element has two mandatory elements:

- **METHOD** = "POST" / "PUT" / "DELETE" / "GET". This is to indicate at the server WHAT OPERATION will the server do with our resources.
- **URL**= the address for the method also including a search parameter if needed to perform conditional inserts or updates.

POST vs. PUT

Whenever you send the POST verb or method, the server will create a new Resource, irrespective of whether the same resource (with the same identifier or other values is already stored on the server or not). So, if you POST the same resource multiple times, it will end up creating multiple resources on server for the same details instead of versions of the same resource. Resource is the most basic or atomic thing in FHIR.

CONDITIONAL PUT

When you issue a PUT verb/method, the FHIR RESTful server tries to update an existing resource and if not found, then it will create a new resource.

If you perform conditional updates, these rules apply

- **No matches:** The server performs a create interaction

- **One Match:** The server performs the update against the matching resource

- **Multiple matches:** The server returns a 412 Precondition Failed error indicating the client's criteria were not selective enough

So, for Organization, Patient, Device resources, in all three transactions, we use the PUT method, and the url.value contains the condition.

The server will try to search for these resources matching the condition given in the value attribute of the url element. So, **the first time**, when the server could not find such resource, **it will create a new one** and for **next two transactions it will not create new resources for Organization, Patient, Device.**

5. WHAT WILL YOU DO?

What we provide is a template. You will replace the information in brackets [LIKE_THIS] with actual information.

Example:

If the template includes

```
value="[YOUR_PATIENT_IDENTIFIER]"
```

You will replace it with your actual identifier in our course. In my case, it is "john.doe", so I will replace

```
value="john.doe"
```

We will now proceed to explain what to do, resource by resource

I.   Patient Resource

Here you will replace

Placeholder	Content	Example
[YOUR_PATIENT_IDENTIFIER]	Your identifier [1]	john.doe
[YOUR LAST]	Your last name [2]	John
[YOUR FIRST]	Your first name [2]	Doe
[YOUR CITY]	Your city [2]	Ann Arbor
[YOUR ADDRESS]	Your address [2]	5 Interop Ave, Suite 22
[YOUR STATE]	Your state [2]	MI
[YOUR COUNTRY]	Your country [2]	US

[1] Make sure that for "[YOUR_PATIENT_IDENTIFIER]", you use the same identifier, you have used in Unit-1 and Unit-2. In example, it is "john.doe"

This is NOT the server assigned id, like in Patient/22019. It is the **identifier.value element for the Patient resource**. The request method.url value attribute must have the exact same value as written for Patient **identifier.**

[2] All other values can be invented, not need to include actual/real information

Patient Resource - XML

```xml
<entry>
   <resource>
      <Patient>
         <text>
            <status value="generated"/>
            <div xmlns="http://www.w3.org/1999/xhtml"> [YOUR NAME] Id # [YOUR_PATIENT_IDENTIFIER] </div>
         </text>
         <identifier>
            <system value="www.mypatientidentifier.com/ids"/>
            <value value="[YOUR_PATIENT_IDENTIFIER]"/>
         </identifier>
         <name>
            <family value="[YOUR LAST]"/>
            <given value="[YOUR FIRST]"/>
         </name>
         <address>
            <line value="[YOUR ADDRESS]"/>
            <city value="[YOUR CITY]"/>
            <state value="[YOUR STATE]"/>
            <country value="[YOUR COUNTRY]"/>
         </address>
         <managingOrganization>
            <reference value="urn:uuid:17C7D86E-664F-4FE2-91D7-AF9A8E47311E"> </reference>
         </managingOrganization>
      </Patient>
   </resource>
   <request>
      <method value="PUT"/>
      <url value="Patient?identifier=www.mypatientidentifier.com/ids|[YOUR_PATIENT_IDENTIFIER]"/>
   </request>
</entry>
```

Patient Entry - JSON

```json
"entry": [
                {
                        "fullUrl": "urn:uuid:0fc374a1-a226-4552-9683-55dd510e67c9",
                        "resource": {
                                "resourceType": "Patient",
                                "text": {
                                        "status": "generated",
                                        "div": "<div xmlns=\"http://www.w3.org/1999/xhtml\"> [YOUR NAME] Id #
[YOUR_PATIENT_IDENTIFIER] </div>"
                                },
                                "identifier": [
                                        {
                                                "system": "www.mypatientidentifier.com/ids",
                                                "value": "[YOUR_PATIENT_IDENTIFIER]"
                                        }
                                ],
                                "name": [
                                        {
                                                "family": "[YOUR LAST]",
                                                "given": [
                                                        "[YOUR FIRST]"
                                                ]
                                        }
                                ],
                                "address": [
                                        {
                                                "line": [
                                                        "[YOUR ADDRESS]"
                                                ],
                                                "city": "[YOUR CITY]",
                                                "state": "[YOUR STATE]",
                                                "country": "[YOUR COUNTRY]"
                                        }
                                ],
                                "managingOrganization": {
                                        "reference": "urn:uuid:17C7D86E-664F-4FE2-91D7-AF9A8E47311E"
                                }
                        },
                        "request": {
                                "method": "PUT",
                                "url":
"Patient?identifier=www.mypatientidentifier.com/ids|[YOUR_PATIENT_IDENTIFIER]"
                        }
                }
        ]
```

II.   Device Resource

Here you will replace

Placeholder	Content	Example
[YOUR_PATIENT_IDENTIFIER]	Your identifier [1]	john.doe

Our transaction template includes a complete Device entry, the only thing required from you is to fill the identifier value.

In real life this would be a device identifier, like a unique serial number.

In order to simplify this assignment, the device identifier will be same as your Patient Identifier, and for me it will be: john.doe

Device Entry - XML

```xml
<entry>
    <fullUrl value="urn:uuid:b405c692-54ea-4d0d-afb1-8f91880a3f24"/>
    <resource>
      <Device xmlns="http://hl7.org/fhir"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <text>
          <status value="generated"/>
          <div xmlns="http://www.w3.org/1999/xhtml"> UW Device [YOUR_PATIENT_IDENTIFIER]
          </div>
        </text>
        <identifier>
          <system value="www.uwearme.com/dev"/>
          <value value="[YOUR_PATIENT_IDENTIFIER]"/>
        </identifier>
        <expirationDate value="2020-10-10"/>
        <lotNumber value="22222"/>
        <modelNumber value="u888800-1"/>
        <type>
          <coding>
            <system value=" http://snomed.info/sct"/>
            <code value="33894003"/>
            <display value="Experimental Device"/>
          </coding>
        </type>
        <patient>
          <reference value="urn:uuid:0fc374a1-a226-4552-9683-55dd510e67c9"/>
        </patient>
        <owner>
          <reference value="urn:uuid:17C7D86E-664F-4FE2-91D7-AF9A8E47311E"/>
        </owner>
      </Device>
    </resource>
    <request>
      <method value="PUT"/>
      <url value="Device?identifier=www.uwearme.com/dev|[YOUR_PATIENT_IDENTIFIER]"/>
    </request>
  </entry>
```

Device Entry - JSON

```json
"entry": [
        {
                "fullUrl": "urn:uuid:b405c692-54ea-4d0d-afb1-8f91880a3f24",
                "resource": {
                        "resourceType": "Device",
                        "text": {
                                "status": "generated",
                                "div": "<div xmlns=\"http://www.w3.org/1999/xhtml\"> UW Device
[YOUR_PATIENT_IDENTIFIER]\n          </div>"
                        },
                        "identifier": [
                                {
                                        "system": "www.uwearme.com/dev",
                                        "value": "[YOUR_PATIENT_IDENTIFIER]"
                                }
                        ],
                        "expirationDate": "2020-10-10",
                        "lotNumber": "22222",
                        "modelNumber": "u888800-1",
                        "type": {
                                "coding": [
                                        {
                                                "system": " http://snomed.info/sct",
                                                "code": "33894003",
                                                "display": "Experimental Device"
                                        }
                                ]
                        },
                        "patient": {
                                "reference": "urn:uuid:0fc374a1-a226-4552-9683-55dd510e67c9"
                        },
                        "owner": {
                                "reference": "urn:uuid:17C7D86E-664F-4FE2-91D7-AF9A8E47311E"
                        }
                },
                "request": {
                        "method": "PUT",
                        "url": "Device?identifier=www.uwearme.com/dev|[YOUR_PATIENT_IDENTIFIER]"
                }
        }
    ]
```

Note: Make sure that in the request method, you have PUT and the url.value attribute with the same identifier as you filled for Device identifier. [YOUR_PATIENT_IDENTIFIER] – Here write the value you have written for Device identifier.value and would be same as Patient identifier.

III.   Observation Resources

Fill the placeholders in the template to include your 4 Observation Resources.

Placeholder	Content	Example
[YOUR_PATIENT_IDENTIFIER]	Your identifier	john.doe
[DESCRIPTION_RESP_RATE]	Description for Respiratory Rate	Respiratory Rate
[VALUE_RESP_RATE]	Value for Respiratory Rate	60
[UNIT_RESP_RATE]	Unit for Respiratory Rate	/min
[LOINC_CODE_RESP_RATE]	LOINC Code for Respiratory Rate	9279-1
[MEASURE_DATE]	Date and time for measurement	20210203T10:30:00Z

We are including only one of the Observation resources (Respiratory Rate) below in XML and JSON as an example, but you will need to modify all (4) of them in the template, specifying the LOINC Code, Description, Units and Measure Date for each Observation

Description	LOINC Code	Unit
Systolic BP	8480-6	mmHg
Diastolic BP	8462-4	mmHg
Heart Rate	8867-4	/min
Respiratory Rate	9279-1	/min

Note that for Observation the method is always POST, and the url value is going to be just 'Observation', because we don't want the server to search for any Observation (like we did for Patient, Device etc.). We want to create new Observation resources each time we POST our transaction

You will need to change the values for Observation.effectiveTime and Observation.valueQuantity.value to simulate the different observation times and measurements.

Observation Entry - XML

```xml
<entry>
    <fullUrl value="urn:uuid:9b3055be-bb9f-4fce-b5da-599286eb2841"/>
    <resource>
      <Observation xmlns="http://hl7.org/fhir"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <text>
          <status value="generated"/>
          <div xmlns="http://www.w3.org/1999/xhtml"> UW Measure for Pat #
            [YOUR_PATIENT_IDENTIFIER] [DESCRIPTION_RESP_RATE]:
            [VALUE_RESP_RATE][UNIT_RESP_RATE] on [MEASURE_DATE] </div>
        </text>
        <identifier>
          <system value="www.uwearme.com/measures"/>
          <value value="[YOUR_PATIENT_IDENTIFIER]-[MEASURE_DATE]-[LOINC_CODE_RESP_RATE]"/>
        </identifier>
        <status value="final"/>
        <code>
          <coding>
            <system value="http://loinc.org"/>
            <code value="[LOINC_CODE_RESP_RATE]"/>
            <display value="[DESCRIPTION_RESP_RATE]"/>
          </coding>
        </code>
        <subject>
          <reference value="urn:uuid:0fc374a1-a226-4552-9683-55dd510e67c9"> </reference>
        </subject>
        <effectiveDateTime value="[MEASURE_DATE]"/>
        <valueQuantity>
          <value value="[VALUE_RESP_RATE]"/>
          <unit value="[UNIT_RESP_RATE]"/>
        </valueQuantity>
        <device>
          <reference value="urn:uuid:b405c692-54ea-4d0d-afb1-8f91880a3f24"> </reference>
        </device>
      </Observation>
    </resource>
    <request>
      <method value="POST"/>
      <url value="Observation"/>
    </request>
  </entry>
```

Observation Entry - JSON

```json
{"entry": [
            {
                    "fullUrl": "urn:uuid:9b3055be-bb9f-4fce-b5da-599286eb2841",
                    "resource": {
                            "resourceType": "Observation",
                            "text": {
                                    "status": "generated",
                                    "div": "<div xmlns=\http://www.w3.org/1999/xhtml\
UW Measure for Pat # [YOUR_PATIENT_IDENTIFIER] [DESCRIPTION_RESP_RATE]:
[VALUE_RESP_RATE][UNIT_RESP_RATE] on [MEASURE_DATE] </div>"
                            },
                            "identifier": [
                                    {
                                            "system": "http://uwearme.com/measures",
                                            "value": "[YOUR_PATIENT_IDENTIFIER]-[MEASURE_DATE]-
[LOINC_CODE_RESP_RATE]"
                                    }
                            ],
                            "status": "final",
                            "code": {
                                    "coding": [
                                            {
                                                    "system": "http://loinc.org",
                                                    "code": "[LOINC_CODE_RESP_RATE]",
                                                    "display": ""[DESCRIPTION_RESP_RATE]"
                                            }
                                    ]
                            },
                            "subject": {
                                    "reference": "urn:uuid:0fc374a1-a226-4552-9683-55dd510e67c9"
                            },
                            "effectiveDateTime": "[MEASURE_DATE]",
                            "valueQuantity": {
                                    "value": "[VALUE_RESP_RATE]",
                                    "unit": "[UNIT_RESP_RATE]"
                            },
                            "device": {
                                    "reference": "urn:uuid:b405c692-54ea-4d0d-afb1-8f91880a3f24"
                            }
                    },
                    "request": {
                            "method": "POST",
                            "url": "Observation"
                    }
            }
    ]
}
```

Once you are ready with your Transaction XML or JSON, POST it on the course site.

6. Operations Outcome after POSTing the transaction

I am pasting what I got after the first POST:

```
<Bundle xmlns="http://hl7.org/fhir">
  <id value="2356d76f-b9df-4077-96ca-6b916adb1c10"/>
  <type value="transaction-response"/>
  <link>
    <relation value="self"/>
    <url value="http://fhir.hl7fundamentals.org/baseDstu3"/>
  </link>
  <entry>
    <response>
      <status value="201 Created"/>
      <location value="Organization/17146/_history/1"/>
      <etag value="1"/>
      <lastModified value="2017-07-14T13:47:44.253-04:00"/>
    </response>
  </entry>
  <entry>
    <response>
      <status value="201 Created"/>
      <location value="Patient/17147/_history/1"/>
      <etag value="1"/>
      <lastModified value="2017-07-14T13:47:44.254-04:00"/>
    </response>
  </entry>
  <entry>
    <response>
      <status value="200 OK"/>
      <location value="Device/1027/_history/76"/>
      <etag value="76"/>
      <lastModified value="2017-07-14T13:47:44.257-04:00"/>
    </response>
  </entry>
  <entry>
    <response>
      <status value="201 Created"/>
      <location value="Observation/17148/_history/1"/>
      <etag value="1"/>
      <lastModified value="2017-07-14T13:47:44.254-04:00"/>
    </response>
  </entry>
  <entry>
    <response>
      <status value="201 Created"/>
      <location value="Observation/17149/_history/1"/>
      <etag value="1"/>
      <lastModified value="2017-07-14T13:47:44.254-04:00"/>
    </response>
```

```
  </entry>
  <entry>
    <response>
      <status value="201 Created"/>
      <location value="Observation/17150/_history/1"/>
      <etag value="1"/>
      <lastModified value="2017-07-14T13:47:44.255-04:00"/>
    </response>
  </entry>
  <entry>
    <response>
      <status value="201 Created"/>
      <location value="Observation/17151/_history/1"/>
      <etag value="1"/>
      <lastModified value="2017-07-14T13:47:44.255-04:00"/>
    </response>
  </entry>
</Bundle>
```

The outcome status makes clear that the transaction was posted on server successfully

- Another important thing to notice is that my Organization or Patient resources are created now and the response gave me their actual Resource id.

"location": " Organization/17146/_history/1",

"location": " Patient/17147/_history/1",

_history/1 is showcasing that this is the first version of my resource. But here, I got the Resource id as highlighted above. In my next transaction, instead of using reference id (for conditional referencing), I can use actual Resource id for all these Resources except Observation. Try to fetch these resources by using GET on postman and using these Resource ids.

After you are done with the first transaction, you can modify just the [MEASURE_DATE] and Observation.value for the following two transactions. Remember that MEASURE_DATE for the second transaction should be 15 min after the first one, and for the third transaction, 30 min after the first one.

7. Tips for 2nd part

When you are finished posting the 12 observations you will have to perform a single query in order to READ ALL THE OBSERVATIONS. You have to retrieve all the patient's measures.

Select the correct Method, content-type, complete the URL with the FHIR query and now use the Send Query button to retrieve all of them.

If you succeed you will receive feedback like this: 4 extra points for the query and your final grade will be 10. !!!

HL7 HL7 Fundamentals

🔔 💬 Fernando Campos ▾

Start Again | Reset   Send transaction   Send Query   **Submit assignment**

Grade: 10, **Feedback :**

- Perfect ! Observation/50240 was retrieved.
- Perfect ! Observation/50241 was retrieved.
- Perfect ! Observation/50242 was retrieved.
- Perfect ! Observation/50243 was retrieved.
- Perfect ! Observation/50250 was retrieved.
- Perfect ! Observation/50251 was retrieved.
- Perfect ! Observation/50252 was retrieved.
- Perfect ! Observation/50253 was retrieved.
- Perfect ! Observation/50260 was retrieved.
- Perfect ! Observation/50261 was retrieved.
- Perfect ! Observation/50262 was retrieved.
- Perfect ! Observation/50263 was retrieved.

AMAZING !!!!!! http://fhir.hl7fundamentals.org/r4/

Your correct attempts

- 2016-10-01T10:30:00 - Result: 200 - Grade: 2 Feedback: Perfect. - Observation/50240 Observation/50241 Observation/50242 Observation/50243
- 2016-10-01T10:40:00 - Result: 200 - Grade: 2 Feedback: Perfect. - Observation/50250 Observation/50251 Observation/50252 Observation/50253
- 2016-10-01T10:50:00 - Result: 200 - Grade: 2 Feedback: Perfect. - Observation/50260 Observation/50261 Observation/50262 Observation/50263

IMPORTANT After finish performing the query, submit your assignment to save your grade.