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FHIR CONNECTATHON 2021

FHIR Server Implementation
Plain Server Use Case

Connectathon Session 01

Agenda

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Plain Server Use Case Overview

Understand OpenEMR DB Structure

Patient Resource Demo

Create, Search, Read functions

Patient Resource Hands-on

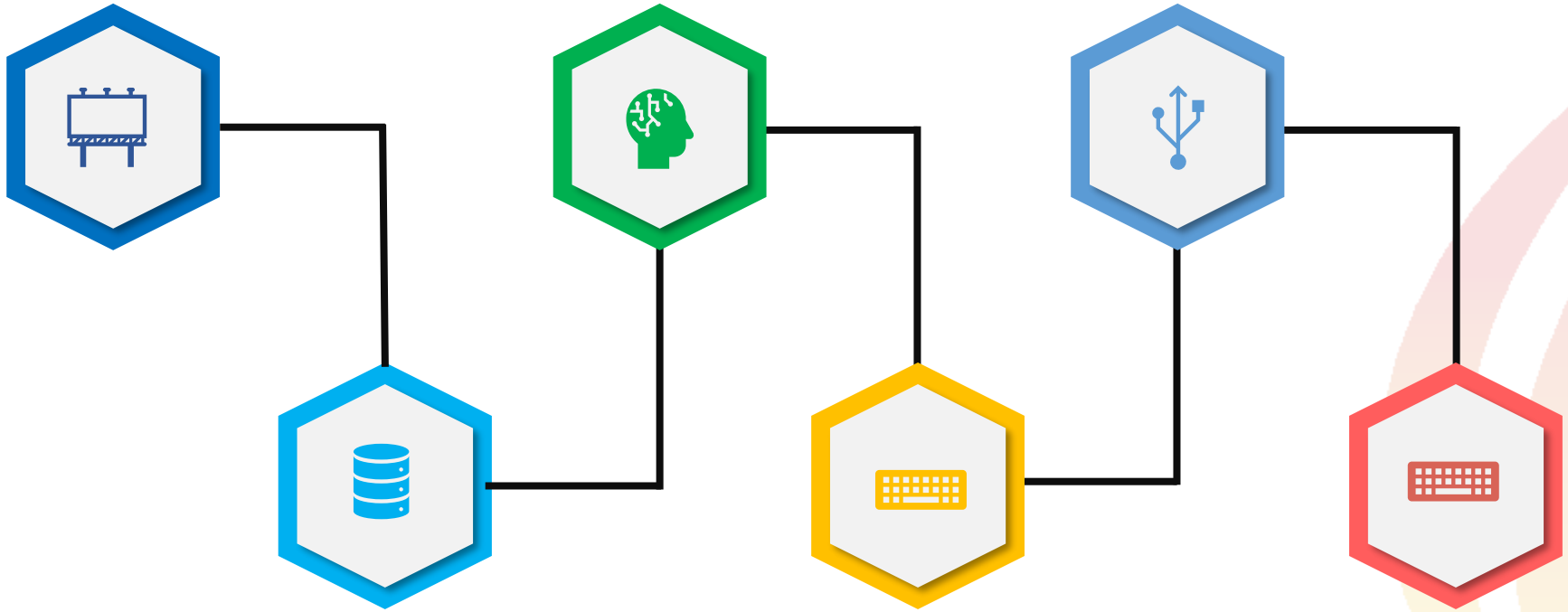
Create, Search, Read functions

Observation Resource

Understand the Design

Observation Resource Hands-on

Create, Search, Read functions



Plain Server Use Case
Overview

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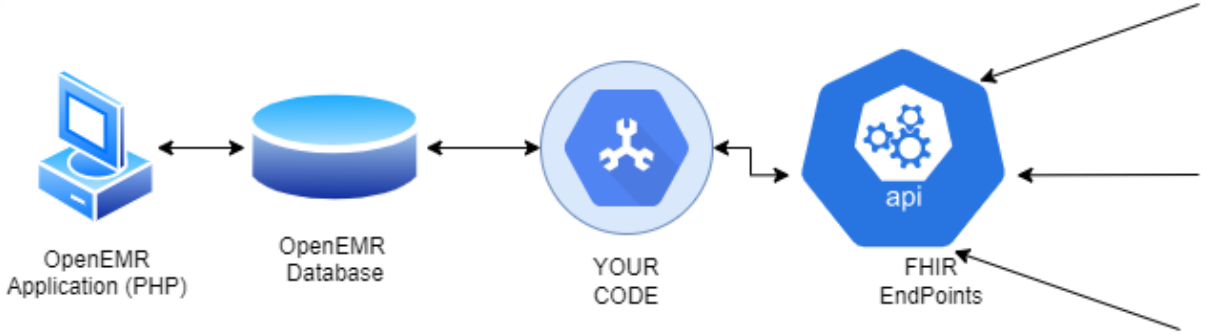

OpenEMR contents

- 21 Patients. 1 deceased
- Multiple Encounters per Patient
- One or more Procedure Orders (Lab Investigations) in every Encounter
- These Procedures are resulted

Patient

- MRN and Health Id need to be unique
- PID is primary key in OpenEMR and is numeric.
- Can be created from app / FHIR
- Use supported Gender and Marital Status

Encounter

- To be created from app
- Onset/Hospitalization Date is required for our project

Order

- To be created from app
- One Test per Order

Result (Observation)

- Observation ID should be numeric
- Code, Name and System for Observation should be same as that of the order
- Always use supported value for status
- Patient Id in patient reference should be numeric
- Service Request Id Service request reference should be numeric

Plain Server Use Case
Project Structure

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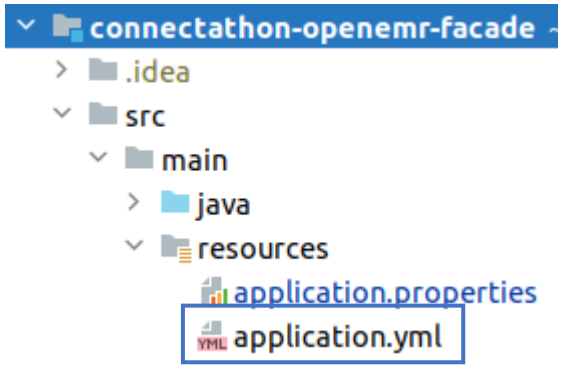
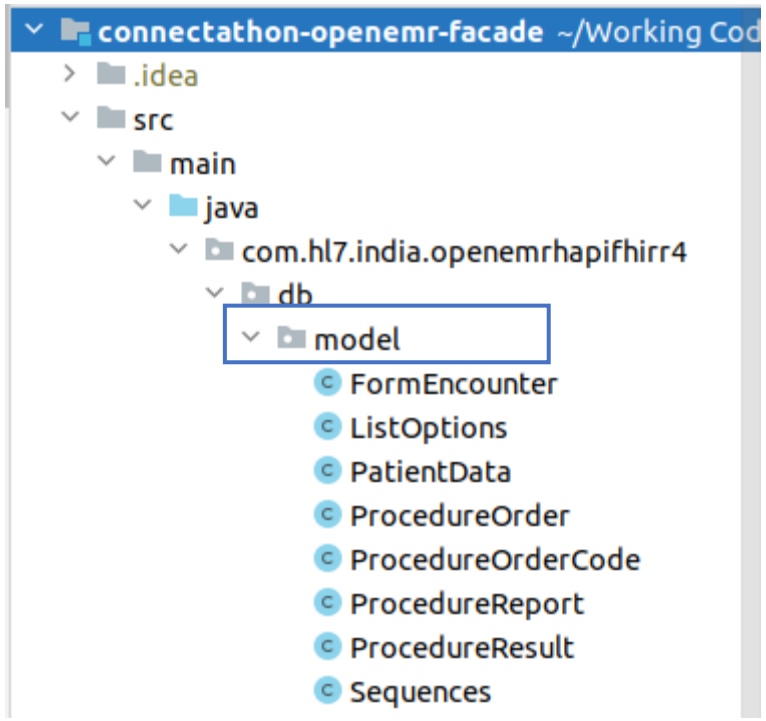
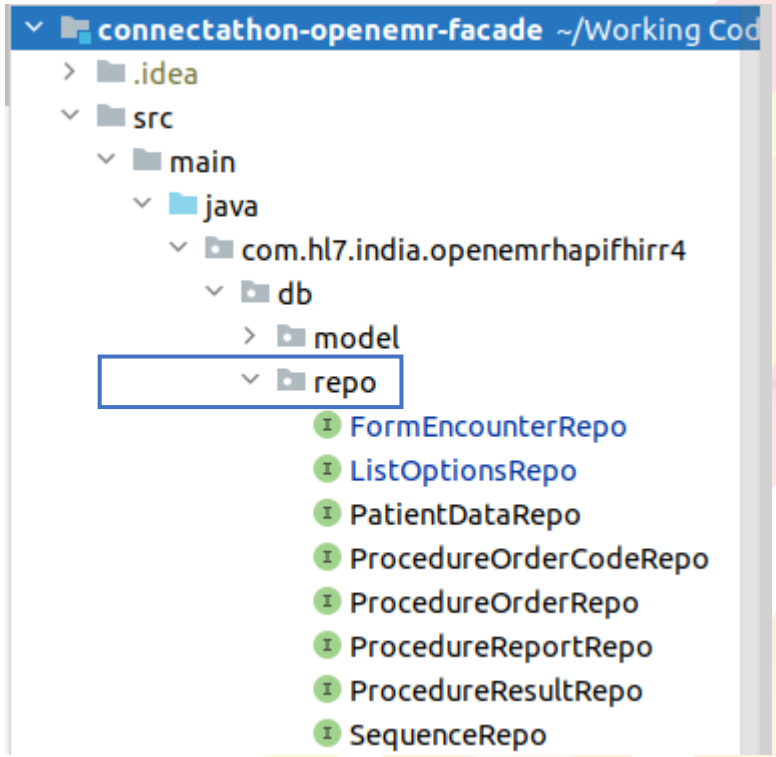


Use this configuration file to set database connections



Models are classes that map with Database Tables



Repositories are interfaces which contain methods to perform database operations

Plain Server Use Case Overview

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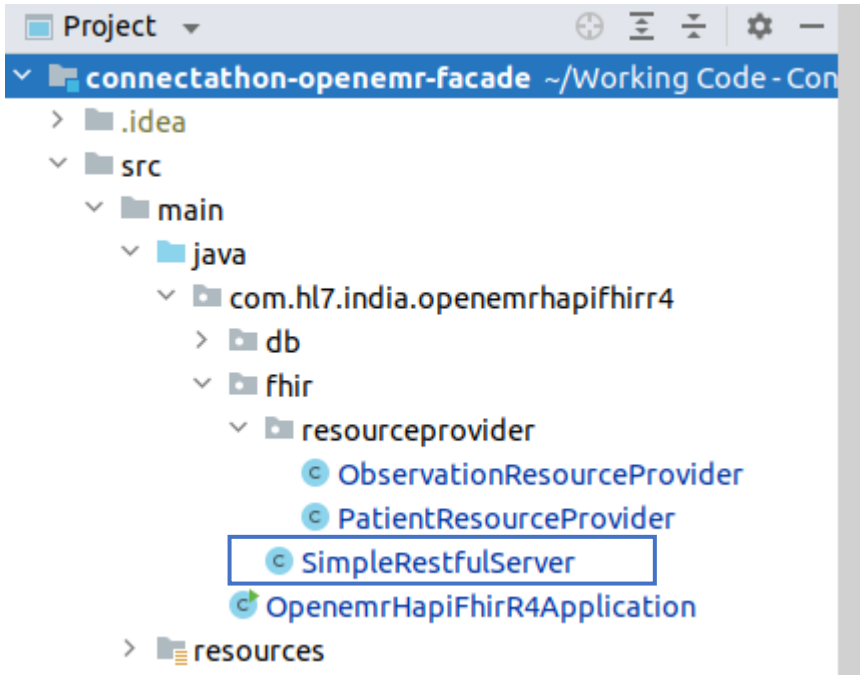
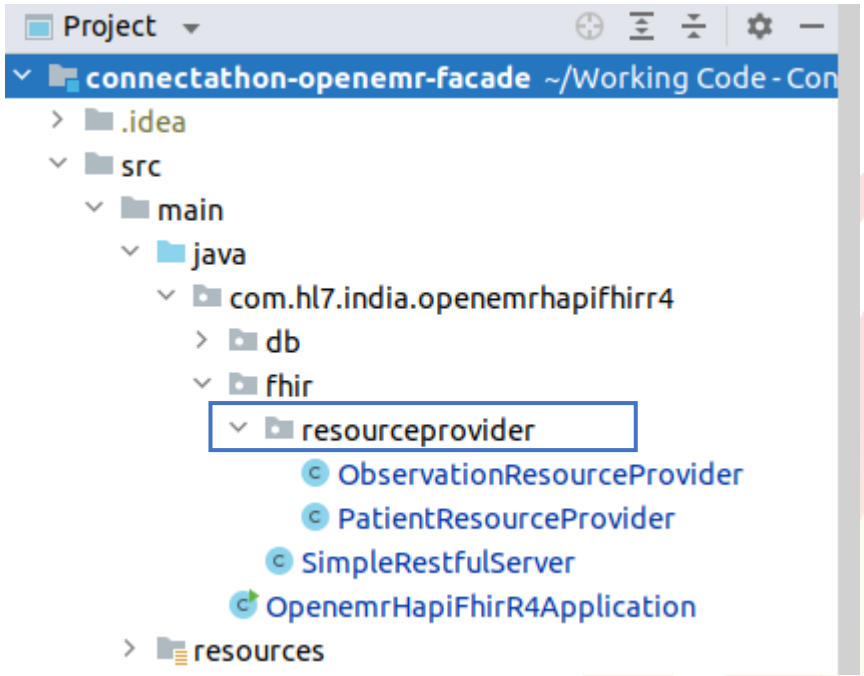


Main servlet class that contains FHIR Context, Resource Providers and Interceptors



Resource Provider contains FHIR Endpoints.
One resource provider per FHIR Resource

DB Structure

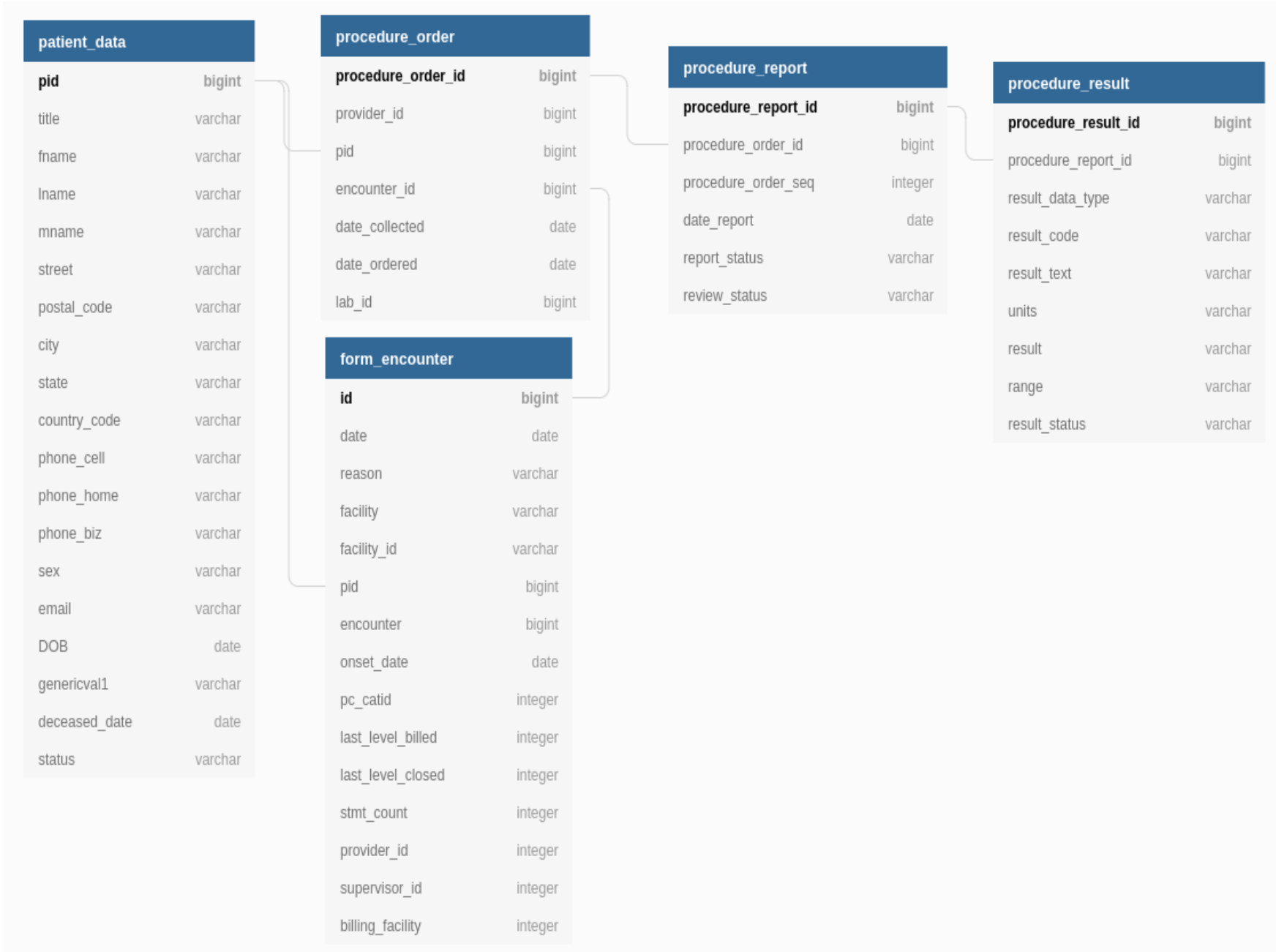
Patient Resource

patient_data	
pid	bigint
title	varchar
fname	varchar
lname	varchar
mname	varchar
street	varchar
postal_code	varchar
city	varchar
state	varchar
country_code	varchar
phone_cell	varchar
phone_home	varchar
phone_biz	varchar
sex	varchar
email	varchar
DOB	date
genericval1	varchar
deceased_date	date
status	varchar

sequences	
id	int
encounter_id	bigint
pid	bigint

DB Structure

Observation Resource



Patient Resource Design

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Sample JSON

Sample Patient JSON

```
{
resourceType: "Patient",
id: "697565847",
identifier: [
{
type: {
coding: [
{
system: "http://terminology.hl7.org/CodeSystem/v2-0203",
code: "MRN95505",
display: "Medical record number"
}
]
},
system: "https://healthid.ndhm.gov.in",
value: "77-2614-1671-1275"
}
],
name: [
{
text: "Narayan Sodhani",
family: "Sodhani",
given: [
Narayan,
A
],
prefix: [
Mr.
]
}
],
telecom: [
{
system: "phone",
```

Mapping

ADBM Patient Profile Fileds	OpenEMR DB's Fields	Notes
id	patient_data.pid	
identifier		
use		
type		
coding		
system		Hardcocode to "http://terminology.hl7.org/C
version		
code	patient_data.pubpid	
display		Hardcode to "Medical record number"
userSelected		
text		
system		Hardcode to "https://healthid.ndhm.gov.in"
value	patient_data.genericval1	Contains Unique Health Identifier as define
period		
assigner		
name		
use		
text	patient_data.fname + " " + patient_data.lname	Firstname + Lastname
family	patient_data.lname	
given	patient_data.fname, patient_data.mname	
prefix	patient_data.title	
suffix		
period		
telecom		
system		Hardcode to "phone"
value	patient_data.phone_cell	
use		Hardcode to "mobile"
rank		
period		
telecom		
system		Hardcode to "phone"
value	patient_data.phone_home	
use		Hardcode to "home"
rank		

Data Translation

Sl	FHIR Field	OpenEMR Table.Field	OpenEMR ID	OpenEMR Title	FHIR Code	FHIR System
1	maritalStatus	patient_data.status	divorced	Divorced	D	http://terminology.hl7.org
			married	Married	M	http://terminology.hl7.org
			domestic partner	Domestic Partner	T	http://terminology.hl7.org
			single	Single	U	http://terminology.hl7.org
			widowed	Widowed	W	http://terminology.hl7.org
			separated	Separated	L	http://terminology.hl7.org
					A	http://terminology.hl7.org
					I	http://terminology.hl7.org
					P	http://terminology.hl7.org
					S	http://terminology.hl7.org
					UNK	http://terminology.hl7.org
2	gender		Male		male	http://hl7.org/fhir/R4/valu
			Female		female	http://hl7.org/fhir/R4/valu
					other	http://hl7.org/fhir/R4/valu
					Unknown	http://hl7.org/fhir/R4/valu

Patient Resource Demo

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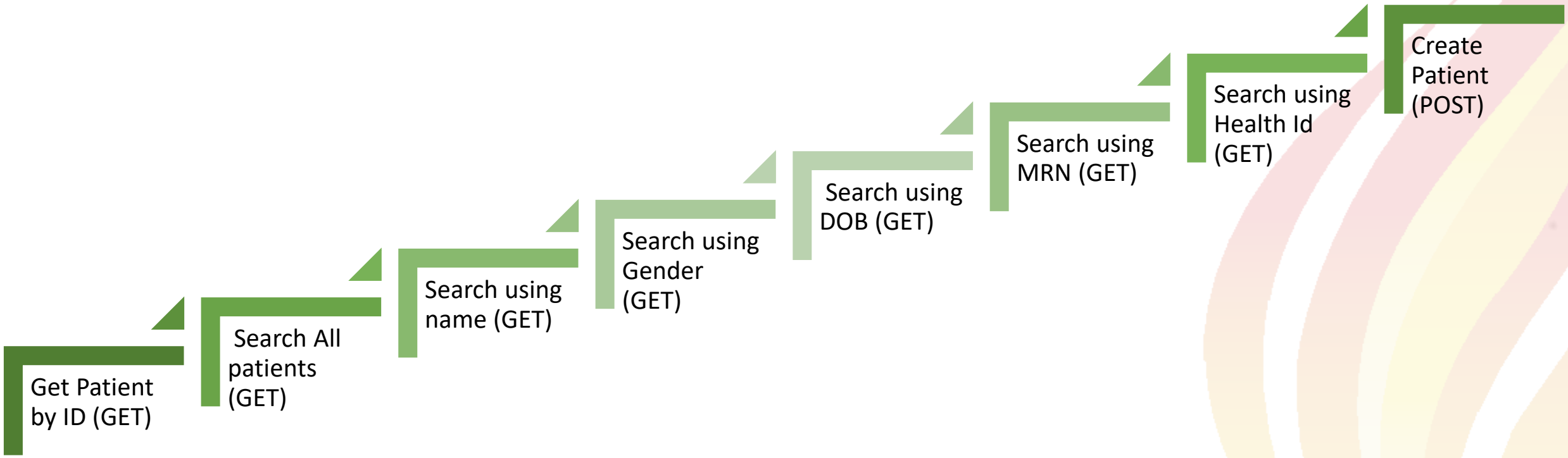

Patient Resource Hands-On

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- Latest pull from git
- Import Project into IDE

Step 1 – Create Project

- Configure Port and Database
- Run the Application

Step 2 – Execute Application

- Using Postman/ Insomnia

Step 3 – Test Endpoints

Observation Resource – Design

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Sample JSON

Sample Json for Observation

```
{
resourceType: "Observation",
id: "1",
basedOn: [
{
reference: "ServiceRequest/2"
}
],
status: "final",
code: {
coding: [
{
system: "http://loinc.org",
code: "3094-0",
display: "Urea nitrogen [Mass/volume] in Serum or Plasma - Instance 2"
}
],
text: "Urea nitrogen [Mass/volume] in Serum or Plasma - Instance 2"
},
subject: {
reference: "Patient/1500"
},
valueQuantity: {
value: 20.0,
unit: "mg/dL",
system: "http://unitsofmeasure.org",
code: "mg/dL"
},
referenceRange: [
{
text: "6 to 24 mg/dL"
}
]
}
```

Mapping

ADBM Observation Profile Fields	OpenEMR DB's Fields	Mapping Notes
id	procedure_result.procedure_result_id	
basedOn		
reference	procedure_order.procedure_order_id	Hardcode "ServiceR procedure_order.pro
status	procedure_result.result_status	Refer to Data Transl
code		
coding		
system		Hardcode "http://loin
code	procedure_result.result_code	
display	procedure_result.result_text	
text	procedure_result.result_text	
subject		
reference	patient_data.pid	
valueQuantity		Use this branch whe
value	procedure_result.result	
unit	procedure_result.units	
system		Hardcode "http://unit
code	procedure_result.units	
valueString		Use this branch whe
referenceRange		Use this branch whe
text		procedure_result.ran

Data Translation

OpenEMR ID	Fhir Code	FHIR System
final	Final	http://hl7.org/fhir/R4/val
prelim	preliminary	http://hl7.org/fhir/R4/val
cancel	cancelled	http://hl7.org/fhir/R4/val
error	entered-in-error	http://hl7.org/fhir/R4/val
correct	corrected	http://hl7.org/fhir/R4/val
review	Final	http://hl7.org/fhir/R4/val
	registered	http://hl7.org/fhir/R4/val
	amended	http://hl7.org/fhir/R4/val
	unknown	http://hl7.org/fhir/R4/val

Observation Resource – Hands On

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```
Observation convertProcedureResultToObservation(ProcedureResult procedureResult)
```

- In this method write the code to convert procedureResult model to ObservationResource
- Refer to mapping document to map EMR fields to FHIR Resource

```
MethodOutcome createObservation(@ResourceParam Observation observation)
```

- Write code to extract data from Observation Request and store data in `procedure_report` and `procedure_result` tables
- Refer to mapping document to map FHIR Resource fields to EMR fields

Next Steps

- Implement additional endpoints
  - Search with multiple parameters
  - Update Operation
  - Delete Operation
  - Patch Operation
- Implement related resources
  - Encounter
  - ServiceRequest
  - Observation (For Vitals)
- Use Internal APIs
- Implement Security

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1 Implement additional endpoints

Search with multiple parameters,
Update Operation, Delete Operation, Patch Operation

2 Implement related resources

Encounter
ServiceRequest
Observation (For Vitals)

3 Use Internal APIs

In place of direct DB Operations
This is most likely to be used in live projects

4 Contribute to Community

ABDM Initiatives
Disease Surveillance

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