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PUBLICLY VIEWABLE DOCUMENT

Document Status: Tech Analysis Draft

Hub and Spoke Model for Bahmni

Table of Contents

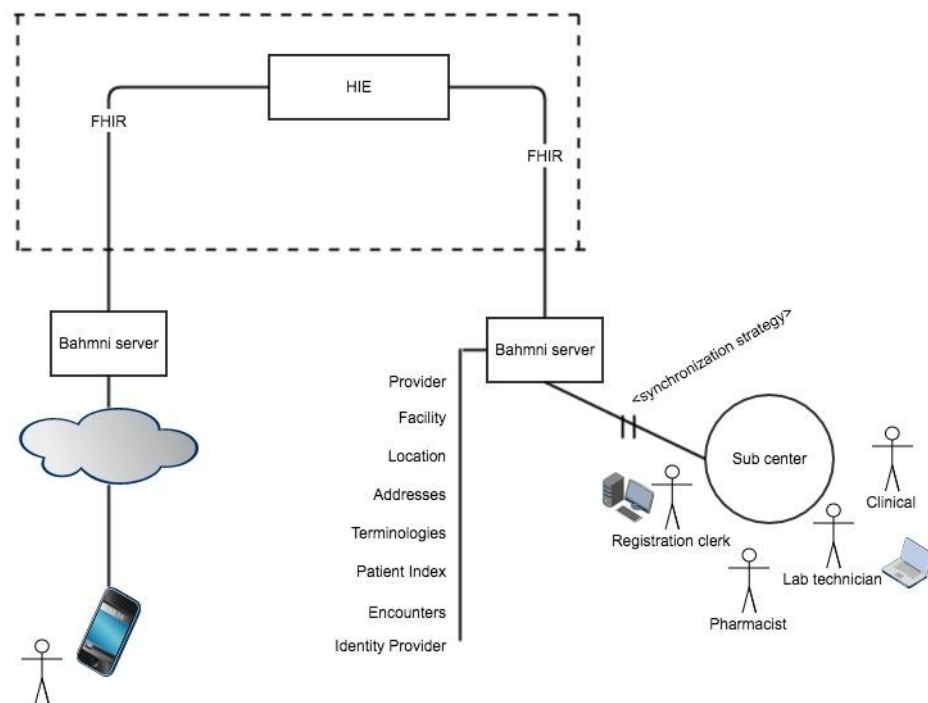
Table of Contents	1
Concept Note	3
Architecture	3
Description	5
Things to consider	5
Information to be synchronized:	5
Use cases for Hub & Spoke	6
Findings	6
Details of Resources to Sync	7
Patient (FHIR Patient)	7
Patient Id Generation	9
Provider (FHIR Practitioner)	11
Encounter (FHIR Encounter)	12
Observation (FHIR Observation)	14
DrugOrder (FHIR MedicationOrder / MedicationRequest)	16
Lab and Radiology Order (FHIR DiagnosticOrder / DiagnosticRequest)	19
Procedure (FHIR ProcedureRequest)	20
Diagnosis (FHIR Condition)	22
Disposition (FHIR Observation)	23
Chief Complaint (Condition)	23
Bacteriology	24
Location (FHIR Location)	24

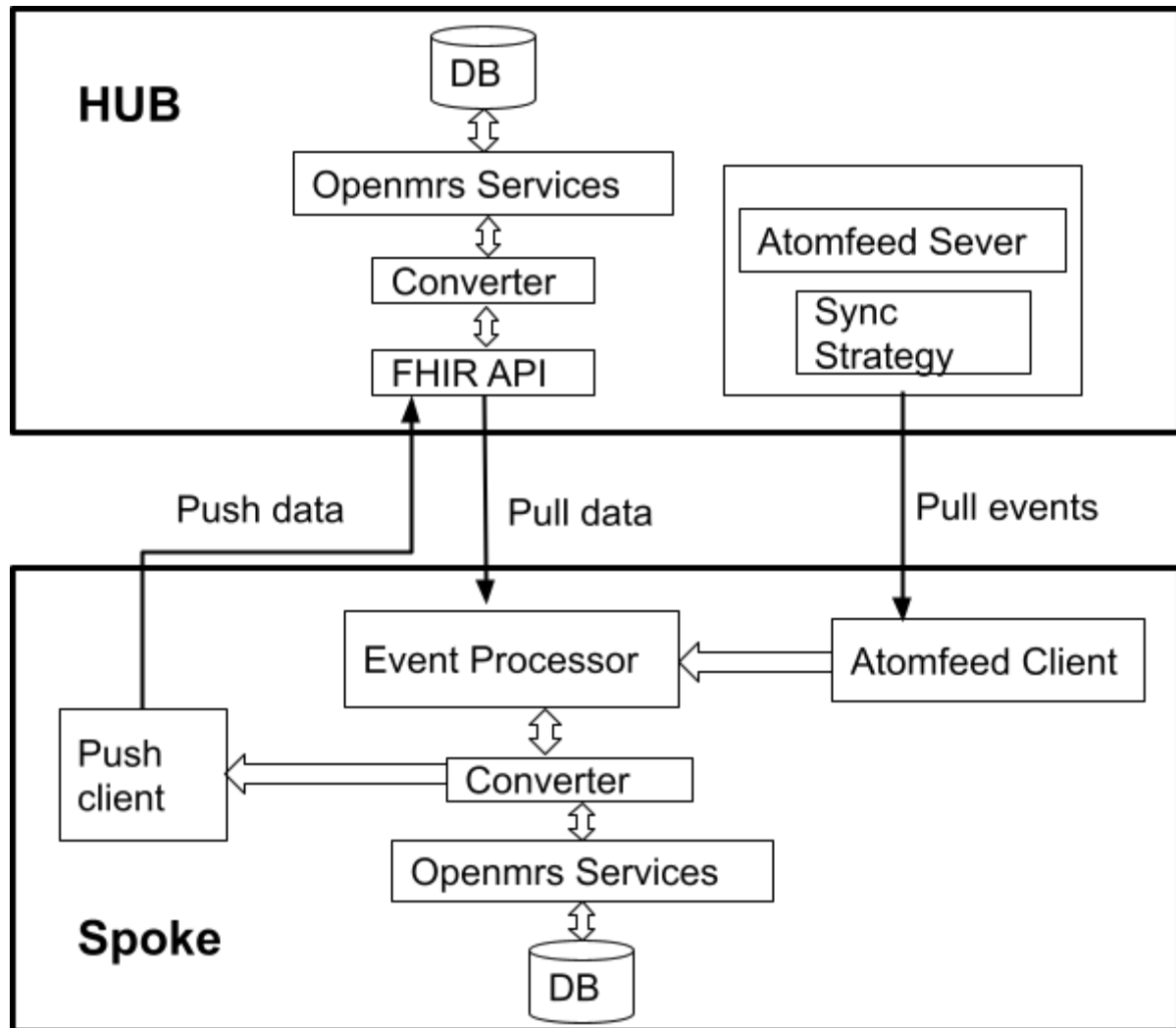
Documents & Images Upload	25
Patient Program (FHIR)	26
Authentication and Authorization	26
ERP & ELIS	26
Metadata	28
Concept	28
Concept Related	29
Concept Reference Terms	29
Drugs	29
Address (FHIR Location): (no rest api currently available)	29
Person attribute types	30
Location	30
Visit	30
Encounter types	30
Provider attribute type	30
Patient identifier types	31
Program	31
Order attributes	31
Privilege	31
Role	31
Reporting (no rest api currently available)	31
Observation (no rest api currently available)	31
Form	31
Global Properties	32
Other entities	32
Synchronization Strategy	33
Concept Ignore List	33
Profiling (for Validations)	33
Large Sync Data - Performance issues (Circuit Breaker)	34
Logging & Monitoring	34

Concept Note

<https://docs.google.com/document/d/1qUk4qP5MnbU1hROWi7Dt-2Ds1EcCS2RCL2knAttz4gE>

Architecture





Description

Things to consider

As part of this analysis we will identify:

- What information is currently being captured as part of a typical Hub & Spoke model setup
- Identify which information needs to flow from Hub to Spoke (and vice-versa) and what information will reside only on Spoke and need not be synced to Hub
- We will be using HL7 FHIR STU3 standard resources for synchronization of the information
- How we will go about with the synchronization of these information. Whether there are FHIR resources available for us to map this information
- How will we handle Metadata
- Other aspects like pluggable synchronization strategy, security standards, profiling etc.
- Impact on other modules (OpenERP & OpenELIS)
- Look into aspects like Security, Performance

Information to be synchronized:

We have identified the following information that needs to be synched:

- Patient
- Provider
- Encounter
- Observation
- Drug Orders
- Lab and Radiology Orders
- Procedure
- Diagnosis
- Disposition
- Chief Complaint
- Bacteriology
- Location

In addition to these we have identified the following Metadata to be handled differently:

- Concept
- Concept Reference terms
- Drugs related metadata
- Address attribute types
- Person attribute types

- Visit attribute type
- Encounter type
- Provider attribute type
- Patient identifier types
- Privileges and Roles
- Reporting
- Obs attributes
- Form resources
- Global properties
- Other entities

This information needs to be present in the Spoke before initial synchronization takes place

Context: We already have Shared Health Records (SHR) implementation in Bangladesh which has a similar set-up for Hub & Spoke. We would be reusing some of the work we have done here. We will be referring to this in multiple places within this document.

More information on this implementation can be found here:
<https://sharedhealth.atlassian.net/wiki/display/docs/Introduction>

Details of Resources to Sync

1. Patient (FHIR Patient)

Shared Health Records (Bangladesh) Context

For this specific implementation Bangladesh uses Citizen Core Data Structure (CCDS) structure for capturing patient related information. More information can be found [here](#). We will want to use FHIR Patient resource for consistency.

Notes

- Patient information and Patient relationship information will be captured as part of this
- While creating patient, person should also be created (person, person_name, person_address, person_attribute). OpenMRS patient save API already does that.
- If present, related person and the relation should also be captured
- One patient could have multiple identifiers. All these should be captured
- Patients should be synced from central hub to sub-systems and also from sub-system to central hub
- All patients might not be needed to be synced from central hub to sub-system. Create a pluggable strategy to sync patient information from central hub to sub-systems
- For additional patient attributes, undeclared extensions can be used
- Profiling can be done for validations

Mapping

OpenMRS	FHIR (Patient)
patient.identifiers	identifier
patient.person.names	names
patient.person.gender	gender
patient.person.birthDate	birthDate
patient.person.birthDateEstimated	<extension>
patient.person.dead	deceasedBoolean
patient.person.deadDate	deceasedDateTime
patient.person.deathDateEstimated	<extension>
patient.person.causeOfDeath	<extension>
patient.person.addresses	address

personAttributes	<extension>
patient.person.voided	
patient.person.birthTime	<extension>
patient.person.link	Link
patient.voided	active
relatedPerson	Link(stu3)
image	photo

OpenMRS	FHIR (RelatedPerson)
personB.identifier	identifier
personA	patient
relationshipType	relationship
voided	Active (stu3)

Assumptions

Related person Identifier can be practitioner id or patient identifier. Type of the identifier should be sent.

- Practitioner will be there in the central system always
- Patient will be synced to central system. So, when relation is created with patient, information will be available

(If unavailable in central system at that time, failed event will be generated and in some retry, it will pass)

Example of FHIR resource

An example of FHIR XML bundle (with patient and relation information) is in the [pastebin here](#).

Patient Id Generation

Refer to this [OpenMRS talk](#) for more details

Criteria

- Patient Identifier can not be duplicated across the points of services which are registering patients.
- A patient may have multiple identifiers, and searchable at any PoS.

Approach 1 (Ruled out)

- idgen_identifier_source (GAN, SEM, JSS) should be unique for all systems
- We should always select our sub-center in patient identifier source (We should not be able to select GAN when we are in Semaria)
- **This is ruled out because** we need this scenario in JSS and such other centers.

Approach 2

- If sub-centers want to select identifier source of another sub-center (GAN from Semariya), then there should be an offline (manual) process of allocating ids for the same.
- This is currently followed in JSS.
- This ID will be unique across all systems and can be used for syncing data.
- But this is prone to errors

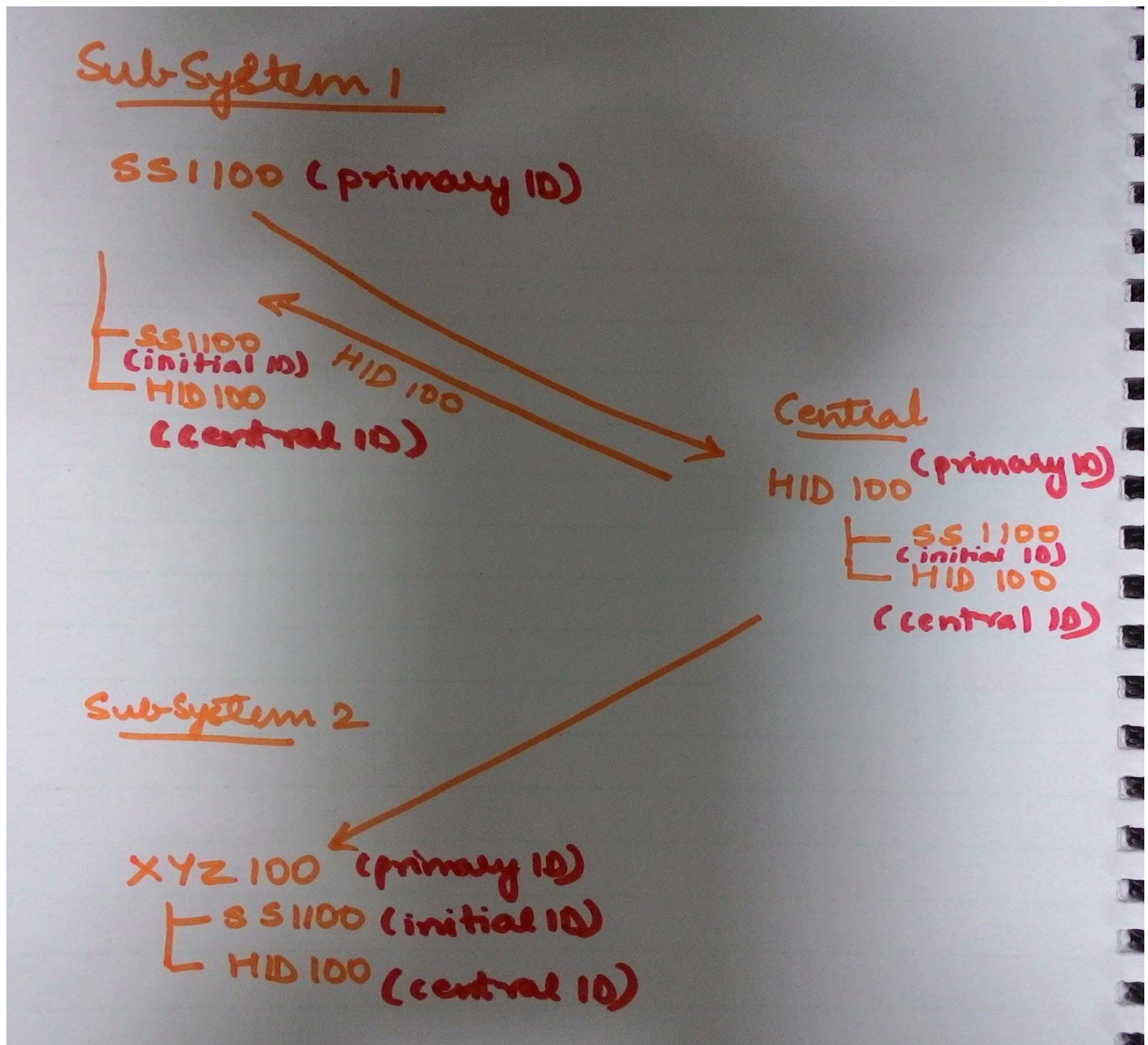
Approach 3

- Every systems will have unique node ids. (Say, Node1 in Ganyari and Node2 in Semariya)
- We will generate ids like <identifier-source>-<nodeUniqueId>-<someNumber>. E.g: GAN-Node1-123
- If we want to create an id for patient with Ganyari from Semariya, we will be able to generate a unique id (without manual intervention) because of the node id - GAN-Node2-123
- No migrations for existing data will be required as the existing ids will still be unique

Approach 4 (Ruled out)

- Every system will create it's own primary identifier.
- The primary identifier of the central system will be sent as a response to the sub-system during sync and will be stored as a secondary identifier
- Initial identifier created will also be stored as secondary identifier in all systems (including central system and other sub-systems where this data gets synced)
- So, we will have the following:
 - primary identifier which will be current system specific
 - healthId (additional identifier) which will be the Id generated in central system

- Initial Id (additional identifier) which will be the Id first generated in some system



- **This is ruled out because** two different patients might have the same initial id which could lead to confusion. Also, if one of the patient data isn't synced, we might get result of the wrong patient on search and this could be risky.

2. Provider (FHIR Practitioner)

Shared Health Records (Bangladesh) Context

- They use a different API to get the Provider information which is more like a filter (updatedSince).
- Practitioner are created only in the central system and synced to the sub-systems. A person corresponding to the practitioner is not synced/ created in the sub-system.

But we would want to use Atom Feed and FHIR standards for consistency. Please refer to [FHIR Practitioner](#) for more details.

Assumptions and suggestions

- Practitioner will be created only in the central system and will be synced to the sub-systems.
- The identifier of practitioner in the central system should be the synced and maintained in the sub-centers. Currently, Bangladesh uses a different table to keep the identifier to practitioner mappings. It is not necessary to a separate mappings table. We can use the practitioner table itself.
- **After OpenMRS 2.0 upgrade, a practitioner has to be linked to a person. So, we will have to create a person for the provider in sub-system.** Sub-centers will create their own users and map to existing provider.

Provider Attributes

Provider attributes can be synced using undeclared extensions:

- The extension url will have the attribute name. But attribute names could have spaces, etc. So, we might have to do some url encoding.
- From the URL, we will have to find the dataType of the attribute and the value should be validated with the type. Validation can be done with Profiling.
- Every main implementation will have it's own profiling (because the attributes might be different per implementation).
- Drawback of this approach is that there will be many extensions and readability might go down.

Mapping

Name	Practitioner.name
Identifier	Practitioner.identifier
Retired	Practitioner.active
Provider_role_id	

Map all possible person attributes.

Example of FHIR resource

```
<Practitioner xmlns="http://hl7.org/fhir">
  <identifier>
    <system value="http://172.18.46.109:8085/api/v2/vs/provider-identifier" />
    <value value="mark" />
  </identifier>
  <active value="true" />
  <name>
```

```

    <family value="G" />
    <given value="Mark" />
  </name>
  <gender value="male" />
  <birthDate value="1982-10-31">
    <extension url="http://hl7.org/fhir/StructureDefinition/patient-birthTime">
      <valueDateTime value="1982-10-31T06:00:00+05:30" />
    </extension>
  </birthDate>
  <address>
    <extension
url="https://sharedhealth.atlassian.net/wiki/display/docs/fhir-extensions#AddressCode"
>
      <valueString value="302602" />
    </extension>
    <line value="124th school" />
    <country value="050" />
  </address>
</Practitioner>

```

OpenMRS Provider API:

<https://192.168.33.10/openmrs/ws/rest/v1/provider/c1c26908-3f10-11e4-adec-0800271c1b75?v=full>

3. Encounter (FHIR Encounter)

Shared Health Records (Bangladesh) Context

- When encounters are synced back to the central systems with the provider information, in Bangladesh, the encounters with unknown providers are ignored.
- Currently, we use an identifier called 'lab manager' for encounters from ELIS. Currently, in Bangladesh, the provider identifier is added in every sub-center in ELIS.

<https://192.168.33.10/openmrs/ws/rest/v1/encounter/d7dfa064-def8-4d53-8be5-ff60eb24578d?v=full>

Mapping

OpenMRS	FHIR (Encounter)
visitType / visitTypeUuid	class
encounterType / encounterTypeUuid	type
patient	patient
providers	participant

location	serviceProvider
encounterDateTime	period
visit	
patient	patient
patientProgram	→ used only in request
context	→ used only in request
Extension // any generic object - currently used for bacteriology specimen - Can be mapped to FHIR Specimen	→ used only in request

Example of FHIR resource (Encounter)

```
<Encounter xmlns="http://hl7.org/fhir">
  <identifier>
    <value value="urn:uuid:ce19e24a-d150-4538-9e80-68443f4de4d6" />
  </identifier>
  <status value="finished" />
  <class value="outpatient" />
  <type>
    <text value="REG" />
  </type>
  <patient>
    <reference value="http://172.18.46.53:8081/api/default/patients/98001497513" />
    <display value="98001497513" />
  </patient>
  <participant>
    <individual>
      <reference value="http://hrmtest.dghs.gov.bd/api/1.0/providers/22651.json" />
    </individual>
  </participant>
  <serviceProvider>
    <reference value="http://hrmtest.dghs.gov.bd/api/1.0/facilities/10000137.json" />
  </serviceProvider>
</Encounter>
```

Example of FHIR resource (Encounter Bundle with Observations, etc.)

<http://pastebin.com/tKuGHRpY>

4. Observation (FHIR Observation)

Notes

- Observations in OpenMRS can be mapped to Observation FHIR resource.
- Refer to this link <https://www.hl7.org/fhir/observation.html> for more details

Questions

- What do we do about obs_relationship? - After discussion - We don't need it

Mapping

OpenMRS	FHIR (Observation resource)
id	identifier
person	subject
concept	code.coding
encounter	encounter
Value (of different types)	value (different types)
comments	Comments / comment (stu3)
	status → mandatory field (https://www.hl7.org/fhir/valueset-observation-status.html)
EncounterProvider	performer
Obs_group (with children)	related → hasMember
voided	
obs_datetime	
Obs relation	<extention>

Example of FHIR resource

1. With relation to child obs

```
<Observation xmlns="http://hl7.org/fhir">
  <identifier>
    <value value="urn:uuid:25c3efff-5083-4c0b-838b-e311f93b3adc" />
  </identifier>
  <status value="preliminary" />
  <code>
```

```

        <coding>
          <display value="Vitals" />
        </coding>
      </code>
    <subject>
      <reference
value="https://mci-showcase.twhosted.com/api/default/patients/98001251340" />
      <display value="98001251340" />
    </subject>
    <encounter>
      <reference value="urn:uuid:3872787e-3cfd-463a-b474-592c3b621b2e" />
    </encounter>
    <performer>
      <reference
value="http://hrmtest.dghs.gov.bd/api/1.0/providers/22651.json" />
    </performer>
    <related>
      <type value="has-member" />
      <target>
        <reference value="urn:uuid:6d09804c-b607-4478-bed4-54c6557cf3c5" />
      </target>
    </related>
  </Observation>

```

2. Child Obs

```

<Observation xmlns="http://hl7.org/fhir">
  <identifier>
    <value value="urn:uuid:6d09804c-b607-4478-bed4-54c6557cf3c5" />
  </identifier>
  <status value="preliminary" />
  <code>
    <coding>
      <system
value="https://tr-showcase.twhosted.com/openmrs/ws/rest/v1/tr/referenceterms/d2
ad5f4e-878d-11e5-95dd-005056b0145c" />
      <code value="386725007" />
      <display value="Temperature" />
    </coding>
    <coding>
      <system
value="https://tr-showcase.twhosted.com/openmrs/ws/rest/v1/tr/concepts/d2ad27ba
-878d-11e5-95dd-005056b0145c" />
      <code value="d2ad27ba-878d-11e5-95dd-005056b0145c" />
      <display value="Temperature" />
    </coding>
  </code>
  <subject>
    <reference
value="https://mci-showcase.twhosted.com/api/default/patients/98001251340" />
    <display value="98001251340" />
  </subject>

```

```

</subject>
<encounter>
  <reference value="urn:uuid:3872787e-3cfd-463a-b474-592c3b621b2e" />
</encounter>
<performer>
  <reference
value="http://hrmtest.dghs.gov.bd/api/1.0/providers/22651.json" />
</performer>
<valueQuantity>
  <value value="44.0" />
  <unit value="Deg F" />
</valueQuantity>
</Observation>

```

5. DrugOrder (FHIR MedicationOrder / MedicationRequest)

Mapping

OpenMRS	FHIR (MedicationRequest)
drug	medication.medicationCodableConcept
administrationInstructions.additionalInstructions	note
administrationInstructions.instructions	dosageInstruction.additionalInformation
asNeeded	dosageInstruction.asNeededBoolean
Action	status
Frequency, duration, duration_units	dosageInstruction.timing
route	dosageInstruction.route
dose	dosageInstruction.doseQuantity
quantity	dispenseRequest.quantity
	dateWritten
patient	patient
provider	prescriber/ requester(stu3)
encounter	Encounter / context (stu3)
Order_group_id, sort_weight (does this need to be sent)	

Example of FHIR resource

```
<MedicationOrder xmlns="http://hl7.org/fhir">
  <extension
url="https://sharedhealth.atlassian.net/wiki/display/docs/fhir-extensions#MedicationOrderAction">
    <valueString value="NEW" />
  </extension>
  <identifier>
    <value value="urn:uuid:0aa2e828-afc8-49fc-bd8a-d32a1c1e9e34" />
  </identifier>
  <dateWritten value="2016-12-14T14:59:07+05:30" />
  <status value="stopped" />
  <dateEnded value="2016-12-14T15:36:18.000+05:30" />
  <patient>
    <reference
value="https://mci-showcase.twhosted.com/api/default/patients/98001572364" />
    <display value="98001572364" />
  </patient>
  <prescriber>
    <reference value="http://hrmtest.dghs.gov.bd/api/1.0/providers/57358.json" />
  </prescriber>
  <encounter>
    <reference value="urn:uuid:ee88c58c-fcb4-4bef-9f09-a891b2c21985" />
  </encounter>
  <note value="some additional instructions" />
  <medicationCodeableConcept>
    <coding>
      <system
value="https://tr-showcase.twhosted.com/openmrs/ws/rest/v1/tr/drugs/d2d4635f-878d-11e5-95dd-005056b0145c" />
      <code value="d2d4635f-878d-11e5-95dd-005056b0145c" />
      <display value="Cytomis 200 Tablet" />
    </coding>
  </medicationCodeableConcept>
  <dosageInstruction>
    <additionalInstructions>
      <coding>
        <display value="After meals" />
      </coding>
    </additionalInstructions>
    <timing>
      <extension
url="https://sharedhealth.atlassian.net/wiki/display/docs/fhir-extensions#TimingScheduledDate">
        <valueDateTime value="2016-12-14T14:59:06.000+05:30" />
      </extension>
    </repeat>
    <boundsQuantity>
      <value value="4" />
      <system value="http://unitsofmeasure.org" />
    </boundsQuantity>
  </dosageInstruction>
</MedicationOrder>
```

```

        <code value="d" />
      </boundsQuantity>
      <frequency value="2" />
      <period value="1" />
      <periodUnits value="d" />
    </repeat>
  </timing>
  <asNeededBoolean value="false" />
  <route>
    <coding>
      <system
value="https://tr-showcase.twhosted.com/openmrs/ws/rest/v1/tr/vs/Route-of-Administrati
on" />
      <code value="_OralRoute" />
      <display value="OralRoute" />
    </coding>
  </route>
  <doseQuantity>
    <value value="2.5" />
    <unit value="Capsule dose form" />
    <system
value="https://tr-showcase.twhosted.com/openmrs/ws/rest/v1/tr/vs/Medication-Forms" />
    <code value="385049006" />
  </doseQuantity>
</dosageInstruction>
<dispenseRequest>
  <quantity>
    <value value="20.0" />
    <unit value="Capsule dose form" />
  </quantity>
</dispenseRequest>
</MedicationOrder>

```

6. Lab and Radiology Order (FHIR DiagnosticOrder / DiagnosticRequest)

FHIR Resource: <https://www.hl7.org/fhir/diagnosticorder.html>

Mapping

OpenMRS	FHIR (DiagnosticOrder)
concept	Item.code / code(stu3)
	Intent (stu3) (order)
commentToFulfiller	note

urgency	priority
action	item.status/status(stu3)
orderType	extension
dateCreated	event.dateTime/authoredOn(stu3)
<all actions it has gone through>	Event.status (dstu2 only) Replaces (stu3) gives reference to the previous diagnosticRequest that was completed or terminated
patient	subject
provider	Orderer / requester (stu3)
encounter	encounter/context (stu3)

Example of FHIR resource

```
<DiagnosticOrder xmlns="http://hl7.org/fhir">
  <extension
url="https://sharedhealth.atlassian.net/wiki/display/docs/fhir-extensions#DiagnosticOrderCategory">
    <valueString value="LAB" />
  </extension>
  <subject>
    <reference
value="https://mci-showcase.twhosted.com/api/default/patients/98001055865" />
    <display value="98001055865" />
  </subject>
  <orderer>
    <reference value="http://hrmtest.dghs.gov.bd/api/1.0/providers/22651.json" />
  </orderer>
  <identifier>
    <value value="urn:uuid:c305d26c-9807-47c8-a294-d3ad791dad46" />
  </identifier>
  <encounter>
    <reference value="urn:uuid:14251301-edaf-4909-ae8d-89f08bda013e" />
  </encounter>
  <item>
    <code>
      <coding>
        <system
value="https://tr-showcase.twhosted.com/openmrs/ws/rest/v1/tr/concepts/d1943700-878d-11e5-95dd-005056b0145c" />
        <code value="d1943700-878d-11e5-95dd-005056b0145c" />
        <display value="TC,DC,ESR,Haemoglobin Package" />
      </coding>
    </code>
  </item>
</DiagnosticOrder>
```

```

        </coding>
      </code>
      <status value="cancelled" />
      <event>
        <status value="requested" />
        <dateTime value="2016-12-14T17:34:03.000+05:30" />
      </event>
      <event>
        <status value="cancelled" />
        <dateTime value="2016-12-14T17:37:34.000+05:30" />
      </event>
    </item>
  </DiagnosticOrder>

```

7. Procedure (FHIR ProcedureRequest)

Mapping

OpenMRS	FHIR (ProcedureRequest)
concept	code
dateCreated	orderedOn
action	status
commentToFulfiller	notes
perviousOrderId	<extension>
provider	orderer
encounter	encounter
patient	subject
urgency	priority

Example of FHIR resource

```

<ProcedureRequest xmlns="http://hl7.org/fhir">
  <extension
url="https://sharedhealth.atlassian.net/wiki/display/docs/fhir-extensions#PreviousProc
edureRequest">
    <valueString value="urn:uuid:bf93697a-f85b-4f1e-9581-ca68ad92bf19" />
  </extension>
  <identifier>
    <value value="urn:uuid:c7ad5869-a7c5-4e1b-b3f3-39ebd9df33f8" />
  </identifier>

```

```

</identifier>
<subject>
  <reference
value="https://mci-showcase.twhosted.com/api/default/patients/98001251340" />
  <display value="98001251340" />
</subject>
<code>
  <coding>
    <system
value="https://tr-showcase.twhosted.com/openmrs/ws/rest/v1/tr/referenceterms/f712ec1b-
88b1-11e5-8d1e-005056b0145c" />
    <code value="08DJ3ZZ" />
    <display value="Extraction of lens Right eye" />
  </coding>
  <coding>
    <system
value="https://tr-showcase.twhosted.com/openmrs/ws/rest/v1/tr/concepts/f712b0d7-88b1-1
1e5-8d1e-005056b0145c" />
    <code value="f712b0d7-88b1-11e5-8d1e-005056b0145c" />
    <display value="Extraction of lens Right eye" />
  </coding>
</code>
<encounter>
  <reference value="urn:uuid:5f26635a-10e2-4663-90f2-8db545de2142" />
</encounter>
<status value="suspended" />
<orderedOn value="2016-12-15T10:52:32+05:30" />
<orderer>
  <reference value="http://hrmtest.dghs.gov.bd/api/1.0/providers/22651.json" />
</orderer>
</ProcedureRequest>

```

8. Diagnosis (FHIR Condition)

Notes

- Diagnosis are captured in OpenMRS as Observations
- In FHIR, we have a separate resource called Condition to capture Diagnosis
- This Condition resource will have reference to an encounter
- Category of condition should be diagnosis
- Verification status can be used to inform whether the diagnosis is confirmed or provisional, etc. (<https://www.hl7.org/fhir/valueset-condition-ver-status.html>)
- In SHR, during mapping from FHIR Condition to OpenMRS Obs, we get concepts by name for concepts like Visit Diagnoses, Diagnosis Certainty, Diagnosis order, etc. The concept names are hardcoded.
- With OCL coming in, concept names might not change with time, so it might be ok to have them hardcoded like in SHR.

Mapping

OpenMRS	FHIR (Condition)
patient	Patient / subject (stu3)
encounter	Encounter / context (stu3)
	Category (diagnosis)
certainty	verificationStatus (confirmed/provisional etc.)
concept	code
notes	notes
order	extention
	clinicalStatus (stu3 - mandatory)
dateCreated	dateRecorded / assertedDate (stu3)
encounterProvider	asserter

Example of FHIR resource

```
<Condition xmlns="http://hl7.org/fhir">
  <identifier>
    <value value="urn:uuid:41d5472d-c0e9-4b40-a745-54361033f3e5" />
  </identifier>
  <patient>
    <reference
value="https://mci-showcase.twhosted.com/api/default/patients/98001251340" />
    <display value="98001251340" />
  </patient>
  <encounter>
    <reference value="urn:uuid:3872787e-3cfd-463a-b474-592c3b621b2e" />
  </encounter>
  <asserter>
    <reference value="http://hrmtest.dghs.gov.bd/api/1.0/providers/22651.json" />
  </asserter>
  <code>
    <coding>
      <system
value="https://tr-showcase.twhosted.com/openmrs/ws/rest/v1/tr/referenceterms/c79f5145-
878d-11e5-95dd-005056b0145c" />
      <code value="R44.1" />
      <display value="R44.1 Visual hallucinations" />
    </coding>
  </code>
</Condition>
```

```

      <system
value="https://tr-showcase.twhosted.com/openmrs/ws/rest/v1/tr/concepts/c79f1f5f-878d-1
1e5-95dd-005056b0145c" />
      <code value="c79f1f5f-878d-11e5-95dd-005056b0145c" />
      <display value="R44.1 Visual hallucinations" />
    </coding>
  </code>
  <category>
    <coding>
      <system value="http://hl7.org/fhir/condition-category" />
      <code value="diagnosis" />
    </coding>
  </category>
  <verificationStatus value="confirmed" />
  <notes value="someComment" />
</Condition>

```

9. Disposition (FHIR Observation)

Notes

This patient should not show up on 'To be admitted' of some other hospital where this data has been synced.

This will be synced as observation.

10. Chief Complaint (Condition)

Mapping

OpenMrs	FHIR
Concept (Chief Complaint)	code
	Category (complaint)
Duration	onsetDateTime / onsetPeriod (this is used in SHR)
notes	notes

PatientWithChiefComplaint (Condition): <http://pastebin.com/J2fU0epj>

11. Bacteriology

- We currently have a bacteriology omod that fetches the bacteriology related observations. It comes as part of 'extensions.mdrtbSpecimen' in the Encounter transaction.

- We will need special handling to convert this to FHIR resource.

OpenMRS	FHIR (Specimen)
extensions.mdrtbSpecimen.identifier	accessionIdentifier
extensions.mdrtbSpecimen.dateCollected	receivedTime
extensions.mdrtbSpecimen.type	type
typeFreeText	Extension

- Information from following will be captured as FHIR Observation:
 - extensions.mdrtb.sample.additionalAttributes
 - Extensions.mdrtb.report.result
- There will be a link to Specimen in these observation.

12. Location (FHIR Location)

Shared Health Records (Bangladesh) Context

- They use a custom API (updateSync) to fetch location. This was done by another team.
- They use FredAPI: <http://facilityregistry.org/> based on which the facility resource is described.
- They don't have location hierarchy which is required in Bahmni

But we would want to maintain consistency and use FHIR standards (sync with AtomFeed).

Please refer this [link for more details related to FHIR Organisation](#).

Question

- Should this be two way sync? - One way only

Mapping

OpenMRS	FHIR
name	Location.name
address1, address2, city, state, postal_code, country	Location.address
retired	Location.active
parent_location	Location.partOf
location_tags, location_attributes	Undeclared extensions can be used

	http://hapifhir.io/doc_extensions.html https://www.hl7.org/fhir/extensibility.html
--	--

13. Documents & Images Upload

Notes

- When documents and images are uploaded, the name of the files are generated using logic: patientId-encounterTypeName-uuid.format
- This information is captured as obs. This can be synced with FHIR observation
- Size of documents may be an issue

TODO

Check if on demand sync is an option

Case 1 (Unique Identifier source for systems):

- There will not be fileName collision and it can be used as is

Case 2 (No unique identifier source - central id approach)

- FileName collisions are possible
- After getting central id, we can update the fileName and the obs (which has path to the file) with central id.
- Disadvantage of this approach is that voided obs will be unavoidable

Case 3

- Do not allow document uploads at all till central id is present for the patient.

Case 4

- We do not sync documents (Do we need to sync them?)
- We should also not sync the obs corresponding to the document upload

Approach 1 (FHIR Media resource)

File	FHIR (Media)
fileName / path	identifier
Type of file	type = photo, etc.
File format	content.contentType → mimeType
File content	Content.data → base64 encoded content

Approach 2 (RSync)

- Currently active-passive setup share the documents using RSync
- We can use this for sharing the documents
- Disadvantage of this is that we will be doing something different from FHIR standard and other external systems might not be able to consume this information (if required)

14. Patient Program (FHIR)

For MVP, we will not sync this data.

15. Authentication and Authorization

TODO

- ATNA
- `HttpContext.BecomeUser` → API

Validations

Security and authorization (IDP)

- Authorization between systems can be done via Authenticator - the same way we are doing for atomfeed clients.
- FHIR apis should be put behind authentication - can be done the same way as `webservice.rest api`

16. ERP & ELIS

- Data from ELIS is stored as observations in OpenMRS. We will sync this data.
- We will not sync ERP related data
- Currently, communication between Bahmni and ERP/ Elis is not with FHIR standards. We can move this to FHIR standards in the future.

Metadata

Questions:

- Is assumption that sub-centers will not create own metadata valid?
- Should we maintain mappings table for all the metadata? Or, should we use the same ids (including the db id)?

1. Concept

Shared Health Records (Bangladesh) Context

- **Atom Feed** is used currently for syncing concepts from Master to sub centers. Refer to the following links:
 - <https://tr-showcase.twhosted.com/openmrs/ws/atomfeed/concept/recent>
 - <https://tr-showcase.twhosted.com/openmrs/ws/rest/v1/tr/concepts/22da7b7a-f2e4-4860-89ab-4f4e0be04b42>
- This is a little chatty since we get the URLs of concept back from the first feed and then query for individual concepts. But since not many new concepts will be added often, this seems alright.
- They are not using FHIR standards because concepts is specific to OpenMRS and FHIR specifications don't match all our needs
- The concept uuid after sync to sub-center is different from the concept uuid created to master. So, a **separate mappings table** (shr_id_mapping) is used to map these two ids. (The concept id of master is sent in the response). *After OCL, we might want to use the same id as the master in sub centers. We can still continue using the mappings table and it will have same ids.*

Assumption/suggestions

Sub-centers will ideally not create their own concepts. But if they do, those should not be synced back to central system. All observations captured against this concept will be rejected by the central system.

Notes :

- SHR client and server side code repositories are generic enough to be used as is for our implementation
- **Some concepts like ones with type Diagnosis are directly added as uncategorised diagnosis. This is Bangladesh specific. We should make it generic.**
- Would we want to refactor shr_id_mappings table (which holds mappings for concept, concept reference terms and medications) to more specific concept_mappings table? If yes, we should check impact on SHR.
- TODO: For Concept attributes (check for API extensions)

2. Concept Related

- concept_attribute_type
- concept_class
- concept_answer
- concept_description
- Concept_complex

3. Concept Reference Terms

Shared Health Records (Bangladesh) Context

- Details are similar to Concept as mentioned above
- Atom feed URLs:
 - <https://tr-showcase.twhosted.com/openmrs/ws/atomfeed/conceptreferenceterm/recent>
 - <https://tr-showcase.twhosted.com/openmrs/ws/rest/v1/tr/referenceterms/d4cbb624-4136-4f19-94af-b0d20d6fcb37>

4. Drugs

5. Address (FHIR Location): (no rest api currently available)

- Address_hierarchy_level
- Address_hierarchy_entry

Approach 1 - CSV Upload

Approach 2 - FHIR

Shared Health Records (Bangladesh) uses some specific contract.

We want to use FHIR location. Please refer to [FHIR Location](#) for more details.

Note: We will send the address hierarchy level information separately. Details can be found in metadata section.

Mapping

OpenMRS	FHIR
name	Location.name
level_id	Location.physicalType
parent_id	Location.partOf
latitude	Location.position.latitude

longitude	Location.position.longitude
elevation	Location.position.altitude

6. Person attribute types

- Person_attribute_type
- relationship_type

7. Location

- Location_attribute_type
- Location_tag
- Location_tag_map
- Location_encounter_type_map

8. Visit

- Visit_type
- Visit_attribute_type

9. Encounter types

- encounter_role
- Encounter_type

10. Provider attribute type

- Provider_attribute_type

11. Patient identifier types

- Patient_identifier_type
- idgen_identifier_source
- Idgen_auto_generation_option (no rest api currently available)

12. Program

- Program
- Program_attribute_type
- Program_workflow
- Program_workflow_state

13. Order attributes

- Order_frequency
- Order_set

- Order_set_member
- Order_type
- Order_type_class_map

14. Privilege

15. Role

16. Reporting (no rest api currently available)

- Reporting_age_group
- Reporting_concept_range

17. Observation (no rest api currently available)

- Obs_relationship_type

18. Form

- Form
- Form_resource

19. Global Properties

20. Other entities

- Entity_mapping_type (no rest api currently available)

Synchronization Strategy

- Currently, offline supports multiple strategies to sync transactional data like ID based, login location based, catchment based (<https://bahmni.atlassian.net/wiki/display/BAH/Bahmni+Connect+Features>)
- These strategies are decided based on global properties defined
- We can follow a similar approach for syncing our data.
- Drawback of this approach is that if a new strategy (not currently supported) is needed, someone will have to write some code for it.
- List of strategies that we could support:
 - Address based
 - Patient ID based
 - Program based (Patients enrolled in a particular program)
- When syncing data from one system to another, ensure that event_records are not created for that data.

Concept Ignore List

- We might want to have a ignore list of concepts so that we do not sync the observations of those concepts to other systems

Profiling (for Validations)

Please refer to [FHIR profiling](#) for details. One of the advantages of using profiles over undeclared extensions are:

- We can centrally define these extensions/attributes in the profile
- Readability will be better

Using Profiling we can primarily do the following

- Allows changing cardinalities,
- Slicing and
- Defining extensions
- Terminology binding

We can do the validations of provider attributes using profiling.

How to do profiling?

Forge from Furore can be used to make profiling easy.

Refer to [this](#) for more details on how to use the tool. This tool works only on Windows.

Findings

- As of now(30-DEC -16) we cannot validate extensions using profile.
- Even after profiling, extra fields on resource remains as extension. We still need to read them by urls. (given that,HAPI library has annotation driven approach for this.)
- We can validate non-extensions field of resource using profile.

Large Sync Data - Performance issues (Circuit Breaker)

- When a sub-center comes online, a lot of information might have to be synced.
- Will it slow the system down? How do we identify? How do we solve the issue?

Logging & Monitoring

Findings and Gaps identified

Gaps with respect to Shared Health Records (Bangladesh implementation):

- SHR doesn't sync all the resources like Patient, etc. Also, for resources like Location they use a different standard (FRED API). But we would want to use FHIR standards for communication
- We need to generalize code for both Bahmni and SHR
- SHR use DSTU2 but we want to use STU3
- They consume resources from external system. We will have to create APIs for the resource
- Their sync strategy is specific to catchment sync. We will have to make sync strategy pluggable

Work to be done for resources

- Event creation
- Exposing FHIR api
- Resource pull
- Resource push (only for transactional data)
- FHir - Openmrs - FHIR Mappings (Can take some things from SHR)

Work to be done for metadata

- Create event
- Create API if not already present (there are a couple of metadata resources that do not have an OpenMRS API)
- Consume metadata

Challenges

- Unique patient id generation across all systems. Refer to [this openmrs talk](#) for more details. Also, implementations like PIH might want to plugin their own identifier generation strategy.
- Information in additional attributes, etc. of resources that cannot be directly mapped to FHIR need to be sent as extension. Profiling might be needed to be done.
- When sub-system pulls data, it will not generate events. When transactional data is saved on the sub-center, events will be generated for pushing data. In this case, when data is pushed to the Hub, no events will be generated on Hub. So, the other sub-systems will not get updated data. We need to come up with a solution for this.

Note

- Patient and Encounter (with all its observations, orders, etc.) will be synced from hub to spoke and also from spoke to hub.
- All other resources will be synced only one side from hub to spoke.