

# Implementing FHIR resource profiles as XML schemas

Application Implementation and Design (AID) User Group Monday Q3  
HL7 WGM San Antonio

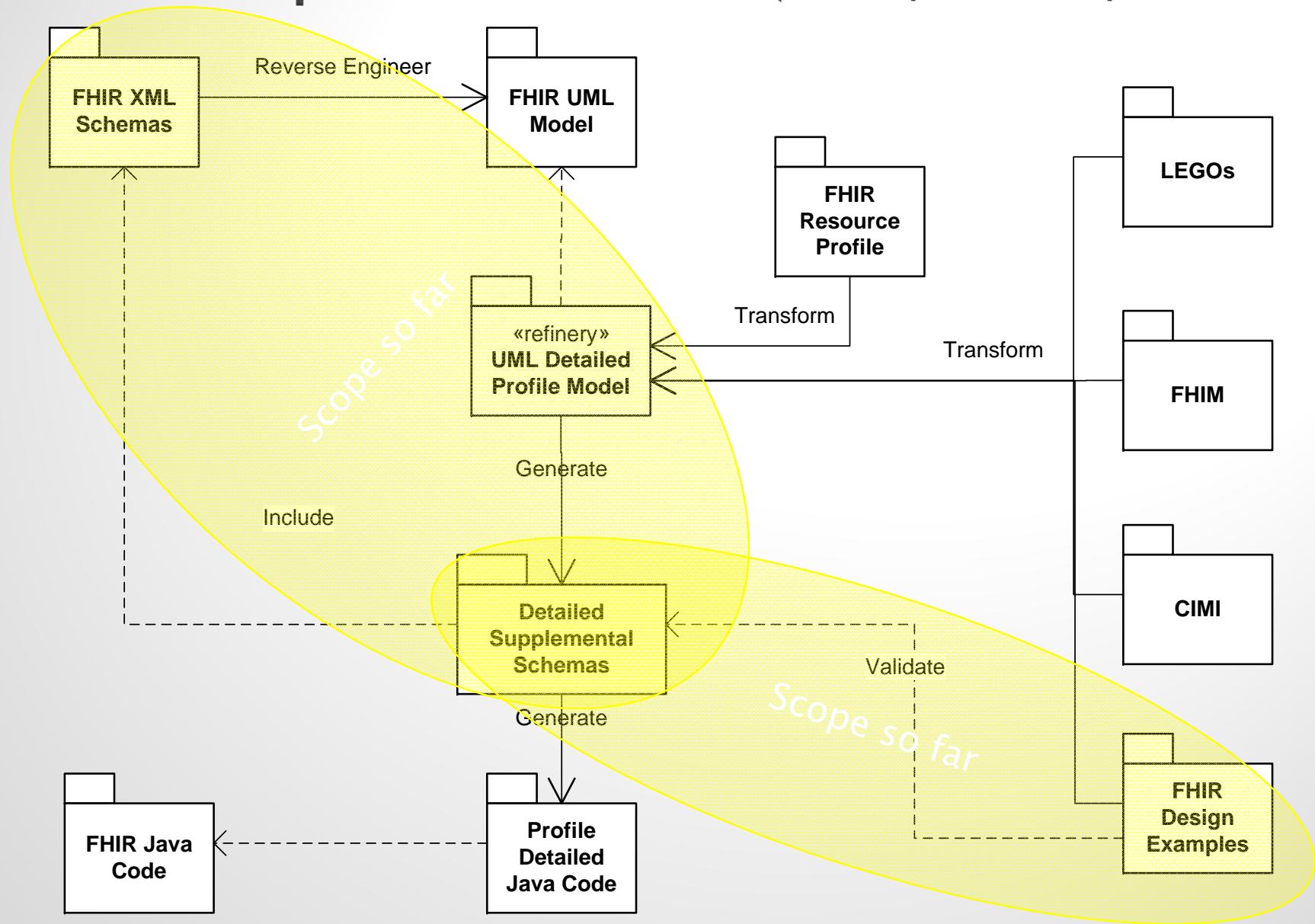
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# Problem Statement

1. FHIR Schemas and profiles are generalized – multiple implementation options will not be interoperable
2. Interoperability relies on criteria e.g. singular invariant XPath per concept
3. Some resources are undefined as to how they are constructed in detail (e.g. Blood Pressure Vital Sign)
4. Can existing metadata standards such as XML be used to define the profile to the right detail?
5. Can existing mature tooling be used to implement FHIR validation?
6. Can we integrate terminology?
7. Optionally is there a way to define this with UML?
8. Can this be done with minimal disruption to FHIR?

# Overall Proposed Process (Other paths are possible)



# Design example – Blood Pressure

From Ballot version

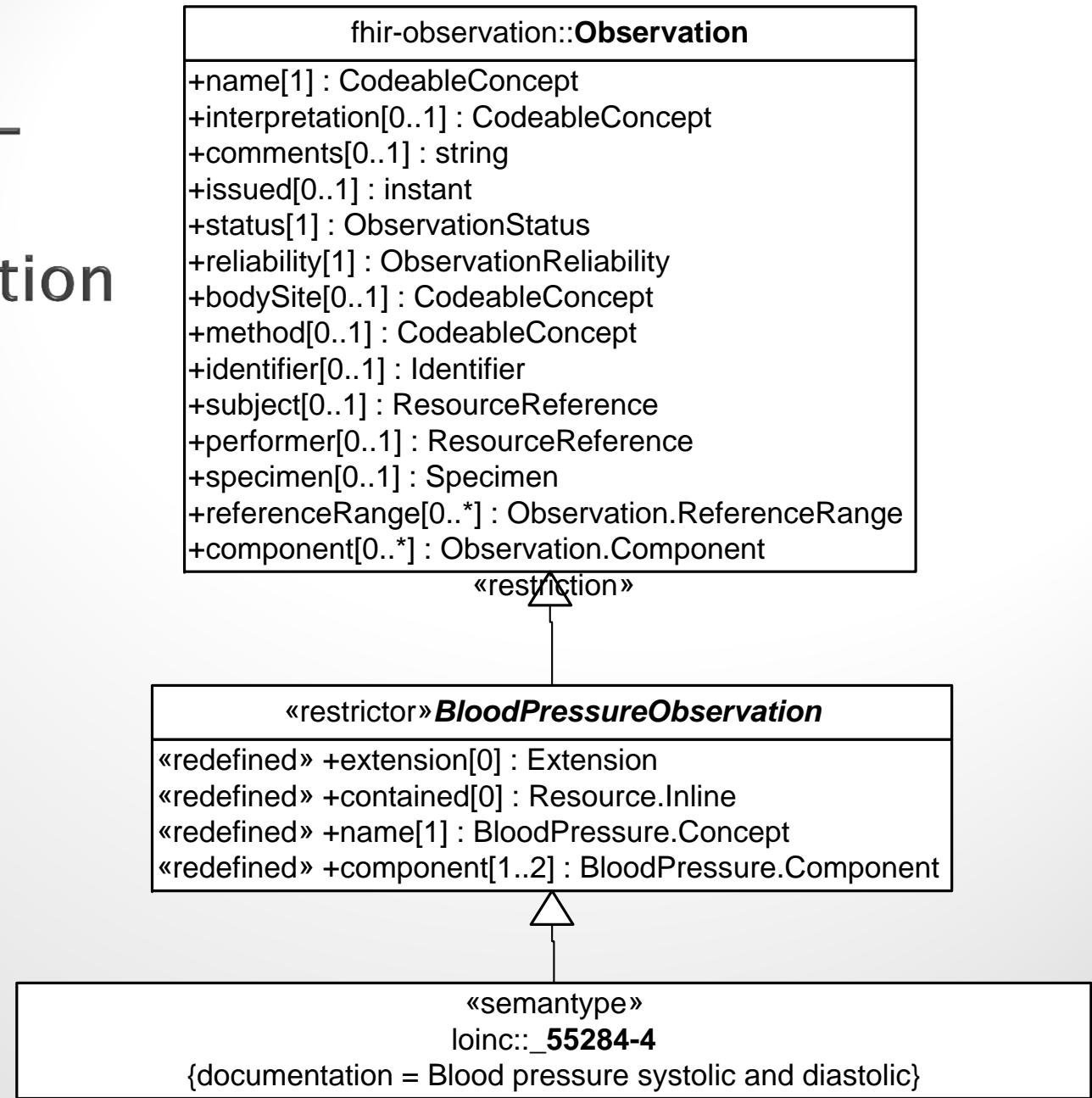
```
<Observation xmlns="http://hl7.org/fhir">
  <text>
    <status value="generated"/>
    <div xmlns="http://www.w3.org/1999/xhtml">Sept 17, 2012: Blood pressure 107/65 (normal)</div>
  </text>
  <name>
    <coding>
      <system value="http://loinc.org"/>
      <code value="55284-4"/>
      <display value="Blood pressure systolic and diastolic"/>
    </coding>
  </name>
  ....
```

# Design Example- Systolic blood pressure

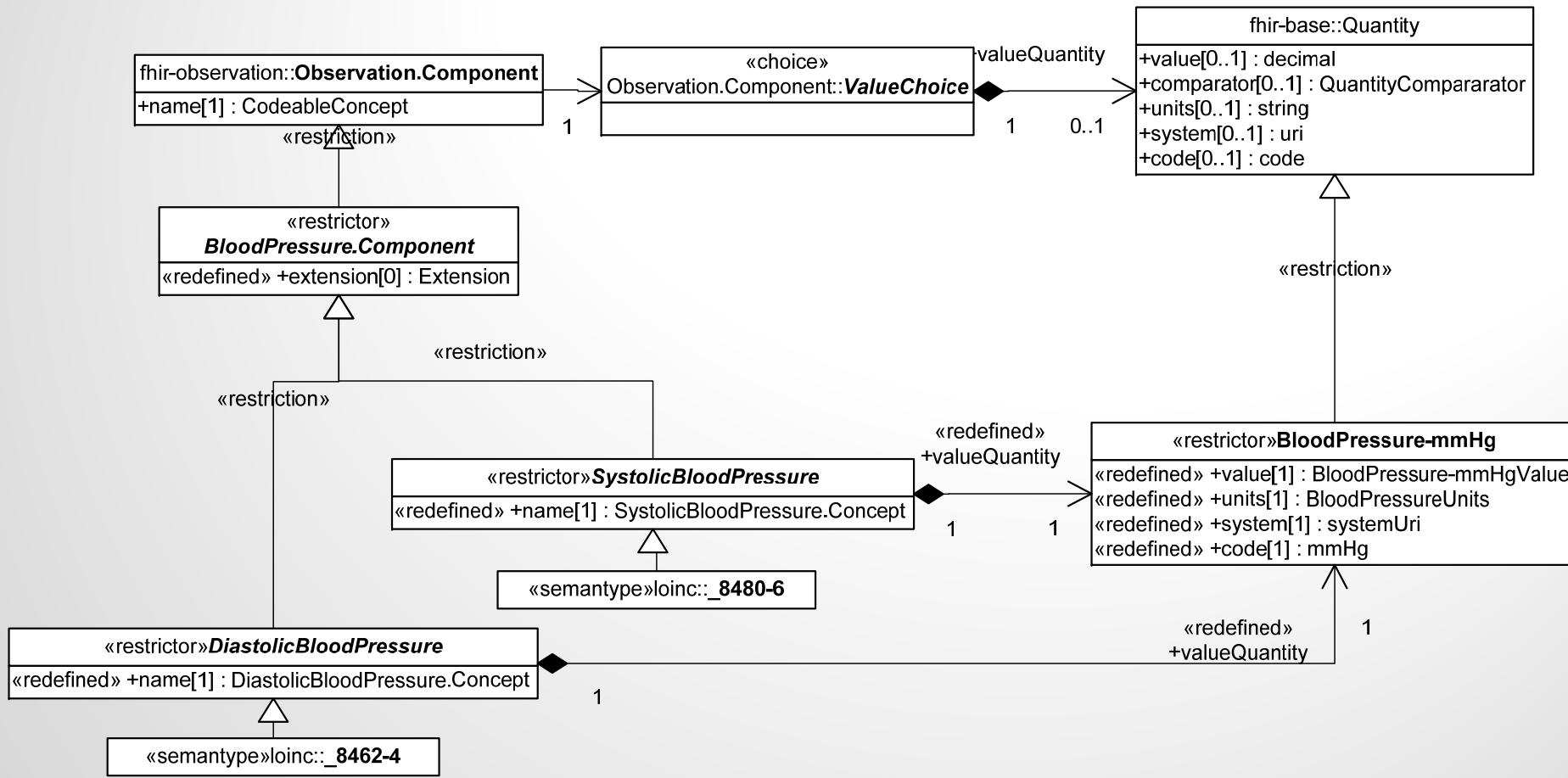
From Ballot version

```
<component>
  <name>
    <coding>
      <system value="http://loinc.org"/>
      <code value="8480-6"/>
      <display value="Systolic blood pressure"/>
    </coding>
  </name>
  <valueQuantity>
    <value value="107"/>
    <units value="mm[Hg]"/>
  </valueQuantity>
</component>
```

# Detailed UML fragment TypedObservation



# Detailed UML fragment Observation.Component



# Supplemental schema fragment – typedobservation.xsd

```
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns="http://hl7.org/fhir"  
xmlns:loinc="http://loinc.org" xmlns:ucum="http://unitsofmeasure.org"  
targetNamespace="http://hl7.org/fhir" elementFormDefault="qualified">  
  <xs:include schemaLocation="../schemas/observation.xsd" />  
  <xs:import namespace="http://loinc.org" schemaLocation="loinc.xsd" />  
  <xs:import namespace="http://unitsofmeasure.org" schemaLocation="ucum.xsd" />  
  <xs:complexType name="BloodPressureObservation" abstract="true">  
    <xs:complexContent>  
      <xs:restriction base="Observation">  
        <xs:sequence>  
          <xs:element name="extension" type="Extension" minOccurs="0" maxOccurs="0" />  
          <xs:element name="contained" type="Resource.Inline" minOccurs="0" maxOccurs="0"/>  
          <xs:element name="name" minOccurs="1" maxOccurs="1">  
            <xs:complexType>  
              <xs:complexContent>  
                <xs:restriction base="CodeableConcept">  
                  <xs:sequence>  
                    <xs:element name="coding">  
                      <xs:complexType>  
                        <xs:complexContent>  
                          <xs:restriction base="Coding">  
                            <xs:sequence>  
                              <xs:element name="system" type="loinc:systemUri"  
                                minOccurs="1" maxOccurs="1" />
```

# Supplemental schema fragment – loinc.xsd

```
<schema xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:fhir="http://hl7.org/fhir"
  targetNamespace="http://loinc.org" xmlns:loinc="http://loinc.org">
  <import namespace="http://hl7.org/fhir" schemaLocation="typedobservation.xsd" />

  <xs:complexType name="systemUri">
    <xs:complexContent>
      <xs:restriction base="fhir:uri">
        <xs:attribute name="value" type="fhir:uri-primitive" fixed="http://loinc.org" />
      </xs:restriction>
    </xs:complexContent>
  </xs:complexType>

  <xs:complexType name="_55284-4">
    <xs:annotation>
      <xs:documentation>Blood pressure systolic and diastolic</xs:documentation>
    </xs:annotation>
    <xs:complexContent>
      <xs:extension base="fhir:BloodPressureObservation" />
    </xs:complexContent>
  </xs:complexType>
```

# Blood Pressure Observation xml fragment

```
<Observation xsi:type="loinc:_55284-4"  
xmlns="http://hl7.org/fhir" xmlns:loinc="http://loinc.org"  
xmlns:xml="http://www.w3.org/XML/1998/namespace"  
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
xsi:schemaLocation="http://hl7.org/fhir typedobservation.xsd">
```

```
<name>  
  <coding>  
    <system value="http://loinc.org" />  
    <code value="55284-4" />  
    <display value="Blood pressure systolic and  
    diastolic" />  
  </coding>  
</name>  
.....
```

# Observation.Component instance

```
<component xsi:type="loinc:_8480-6">
  <name>
    <coding>
      <system value="http://loinc.org" />
      <code value="8480-6" />
      <display value="Systolic blood pressure" />
    </coding>
  </name>
  <valueQuantity>
    <value value="107" />
    <units value="mm[Hg]" />
    <system value="http://unitsofmeasure.org" />
    <code value="mm[Hg]" />
  </valueQuantity>
</component>
```

# Validate with Eclipse

```
<component xsi:type="loinc:_8480-6">
  <name>
    <coding>
      <system value="http://loinc.org" />
      <code value="8480-6" />
      <display value="xSystolic blood pressure" />
    </coding>
  </name>
  <valueQuantity>
    ...
  </valueQuantity>
</v>
</component>
```

cvc-complex-type.3.1: Value 'xSystolic blood pressure' of attribute 'value' of element 'display' is not valid with respect to the corresponding attribute use. Attribute 'value' has a fixed value of 'Systolic blood pressure'.

# Conclusion

- ▶ Initial experiments look promising
- ▶ Need to validate that complexity does not break XML products (e.g. Biztalk, JAXB)
- ▶ Payloads with xsi:type can be reduced to pure FHIR payloads
- ▶ Payloads without xsi:type can be enhanced from the name element or implicitly from the element tag
- ▶ Tooling to validate the xml is available but needs to be integrated behind the POST operation. Would be nice to add CTS validation.
- ▶ Fine grained models are supported beyond profiles – these are needed for interoperability and must be shared in an exchange

# Sponsorship

This work was done under sponsorship of

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Knowledge Based Systems  
Standards & Interoperability  
Health Standards

# Further work on exchanges

- ▶ FHIR Interoperability Framework (FHIF)
- ▶ FHIF Exchange is a set of Resource supplemental schemas
- ▶ Should exchanges be defined at Realm level?

Resource	Person	Medication Prescription	Document Reference
<b>FHIF Level</b>			
I-Image			DocRef-I
T-Text		Med-Rx-T	DocRef-T
F-Fielded	Person-F	Med-Rx-F	
C-Computable	Person-C	Med-Rx-C	

# Further work on interoperability criteria

1. Payload defined and controlled by computational metadata (not documents) and by mature tooling
2. A concept must have a singular invariant Xpath – alternatives can be defined with different levels.
3. Values must be of the same dimension (units) unless translation is expected
4. Codes for a concept must be from the same ValueSet
5. Detailed models and schemas need to be shared between interoperable exchange partners

# Quick Demonstration

As the King said to the Alchemist  
“Show me the Gold”

“If there is time” replied the Alchemist

# Questions?