

Patient Safety Ontology and Instances (in progress)

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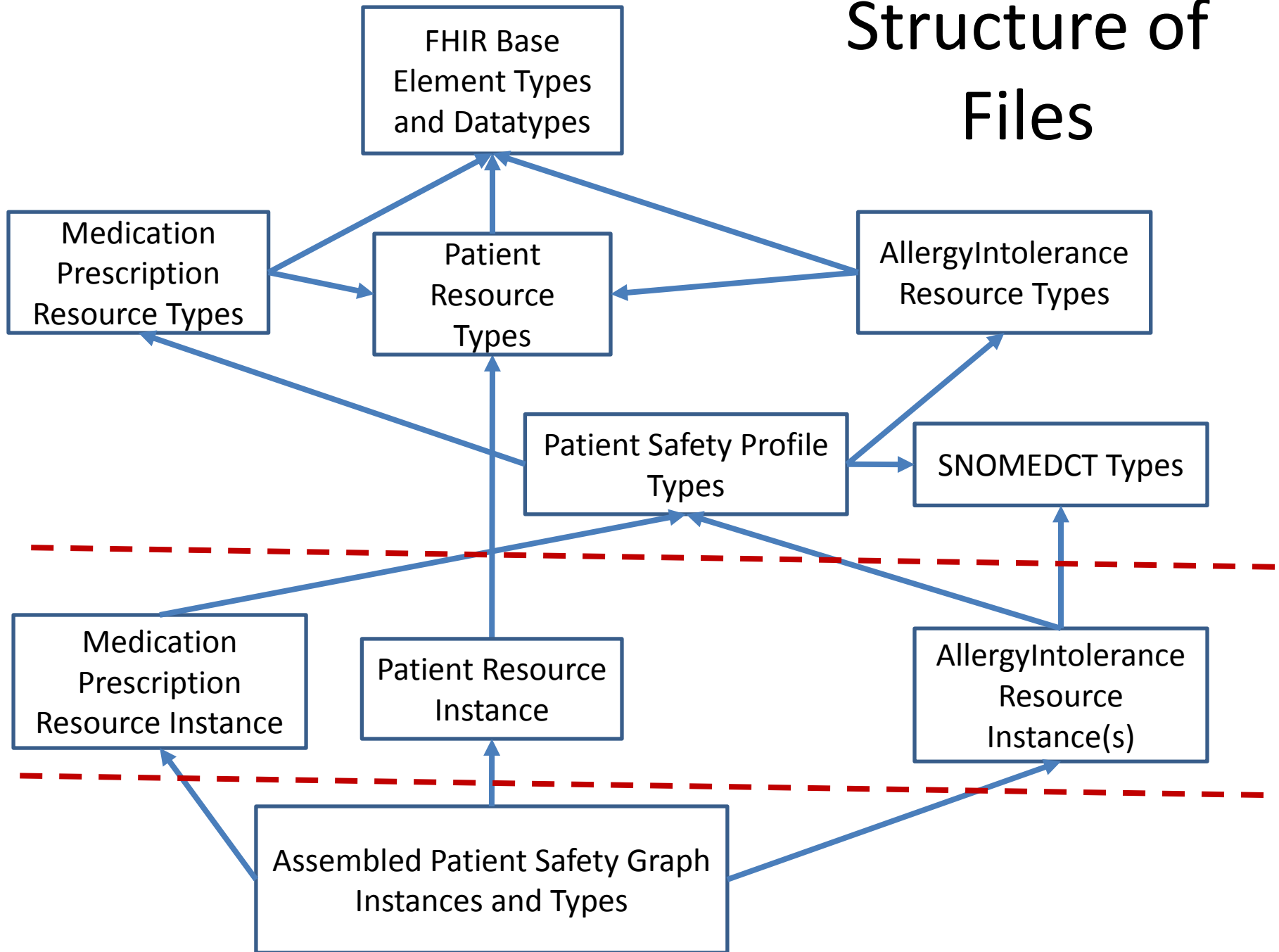
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Objective

- Detect a prescription which will risk allergic reaction
- Assemble a health record graph from multiple resources
 - Closure to the same patient
 - Closure with SNOMED CT ontology
 - Closure with FHIR Model Ontologies
- Make graph suitable for Reasoners and SPARQL
- Research the style for RDF construction
 - Structures not confined to patient safety use case

Structure of Files



FHIR Base - Datatypes

- fhir:date-primitive rdf:type rdfs:Datatype ;
-
- owl:equivalentClass [rdf:type rdfs:Datatype ;
- owl:intersectionOf ([rdf:type rdfs:Datatype ;
- owl:unionOf (xsd:date
- xsd:gYear
- xsd:gYearMonth
-)
-]
- [rdf:type rdfs:Datatype ;
- owl:onDatatype xsd:string ;
- owl:withRestrictions (
- [xsd:pattern "\\d{4}(\\-\\d{2}(\\-\\d{2})?)?(Z|\\+|\\-)\\d{2}:\\d{2}]"
-]
-)
-]
-)
-] .

FHIR Base - Element

- `fhir:Element a owl:Class ;`
- `rdfs:comment "The base element used for all FHIR elements and resources - allows for them to be extended with extensions" ;`
- `rdfs:label "Element" ;`
- `rdfs:subClassOf owl:Thing ;`
- `rdfs:subClassOf [a owl:Restriction ;`
- `owl:maxQualifiedCardinality "1"^^xsd:nonNegativeInteger ;`
- `owl:onDataRange fhir:id-primitive ;`
- `owl:onProperty fhir:Element.id`
- `] .`

- Extensions TBD

FHIR Base - Coding

- `fhir:Coding a owl:Class ;`
- `rdfs:subClassOf fhir:Element ;`
- `rdfs:subClassOf [a owl:Restriction ;`
- `owl:maxQualifiedCardinality "1"^^xsd:nonNegativeInteger ;`
- `owl:onClass fhir:boolean ;`
- `owl:onProperty fhir:Coding.primary`
- `] ;`
- `rdfs:subClassOf [a owl:Restriction ;`
- `owl:maxQualifiedCardinality "1"^^xsd:nonNegativeInteger ;`
- `owl:onClass fhir:code ;`
- `owl:onProperty fhir:Coding.code`
- `] ;`
- `rdfs:subClassOf [a owl:Restriction ;`
- `owl:maxQualifiedCardinality "1"^^xsd:nonNegativeInteger ;`
- `owl:onClass fhir:string ;`
- `owl:onProperty fhir:Coding.version`
- `] ;`
- `rdfs:subClassOf [a owl:Restriction ;`
- `owl:maxQualifiedCardinality "1"^^xsd:nonNegativeInteger ;`
- `owl:onClass fhir:string ;`
- `owl:onProperty fhir:Coding.display`
- `] ;`
- `rdfs:subClassOf [a owl:Restriction ;`
- `owl:maxQualifiedCardinality "1"^^xsd:nonNegativeInteger ;`
- `owl:onClass fhir:uri ;`
- `owl:onProperty fhir:Coding.system`
- `] .`

Internal ValueSet - AllergyIntoleranceStatus

- `<http://hl7.org/fhir/vs/allergyIntoleranceStatus> rdf:type owl:Class ;`
- `rdfs:subClassOf <http://hl7.org/fhir/base/ValueSetTerm> ;`
- `owl:disjointUnionOf (<http://hl7.org/fhir/allergyIntoleranceStatus/confirmed>`
- `<http://hl7.org/fhir/allergyIntoleranceStatus/entered-in-error>`
- `<http://hl7.org/fhir/allergyIntoleranceStatus/refuted>`
- `<http://hl7.org/fhir/allergyIntoleranceStatus/resolved>`
- `<http://hl7.org/fhir/allergyIntoleranceStatus/unconfirmed>`
- `).`
- `<http://hl7.org/fhir/allergyIntoleranceStatus/confirmed> rdf:type owl:Class ;`
- `rdfs:subClassOf <http://hl7.org/fhir/vs/allergyIntoleranceStatus> ,`
- `[rdf:type owl:Class ;`
- `owl:intersectionOf (fhir:code`
- `[rdf:type owl:Restriction ;`
- `owl:onProperty fhir:value ;`
- `owl:hasValue "confirmed"`
- `]`
- `)`
- `].`
- `### http://hl7.org/fhir/allergyIntoleranceStatus/entered-in-error`
- `<http://hl7.org/fhir/allergyIntoleranceStatus/entered-in-error> rdf:type owl:Class ;`
- `rdfs:subClassOf <http://hl7.org/fhir/vs/allergyIntoleranceStatus> .`

Instance binding to Internal ValueSet

- record:Allergy1 rdf:type profile:AllergyIntolerance ,
- owl:NamedIndividual ;

- allergy:AllergyIntolerance.status [rdf:type fhir:Code ,
- <http://hl7.org/fhir/allergyIntoleranceStatus/confirmed> ;
- fhir:value "confirmed"
-] ;

- Type is injected or inferred (Inference to be tested)

Coding instance binding to external Valueset

- `:Allergy1 rdf:type profile:AllergyIntolerance , owl:NamedIndividual ;`
- `profile:AllergyIntolerance.substance [rdf:type fhir:CodeableConcept ;`
- `fhir:CodeableConcept.coding [rdf:type fhir:Coding ,`
- `<http://snomed.info/id/346325008> ;`
- `fhir:Coding.display [rdf:type fhir:string ;`
- `fhir:value "Antibacterial drugs"`
- `];`
- `fhir:Coding.system [rdf:type fhir:uri ;`
- `fhir:value "http://snomed.info/id/"`
- `];`
- `fhir:Coding.code [rdf:type fhir:Code ;`
- `fhir:value "346325008"`
- `]`
- `]`
- `];`

- Type is injected

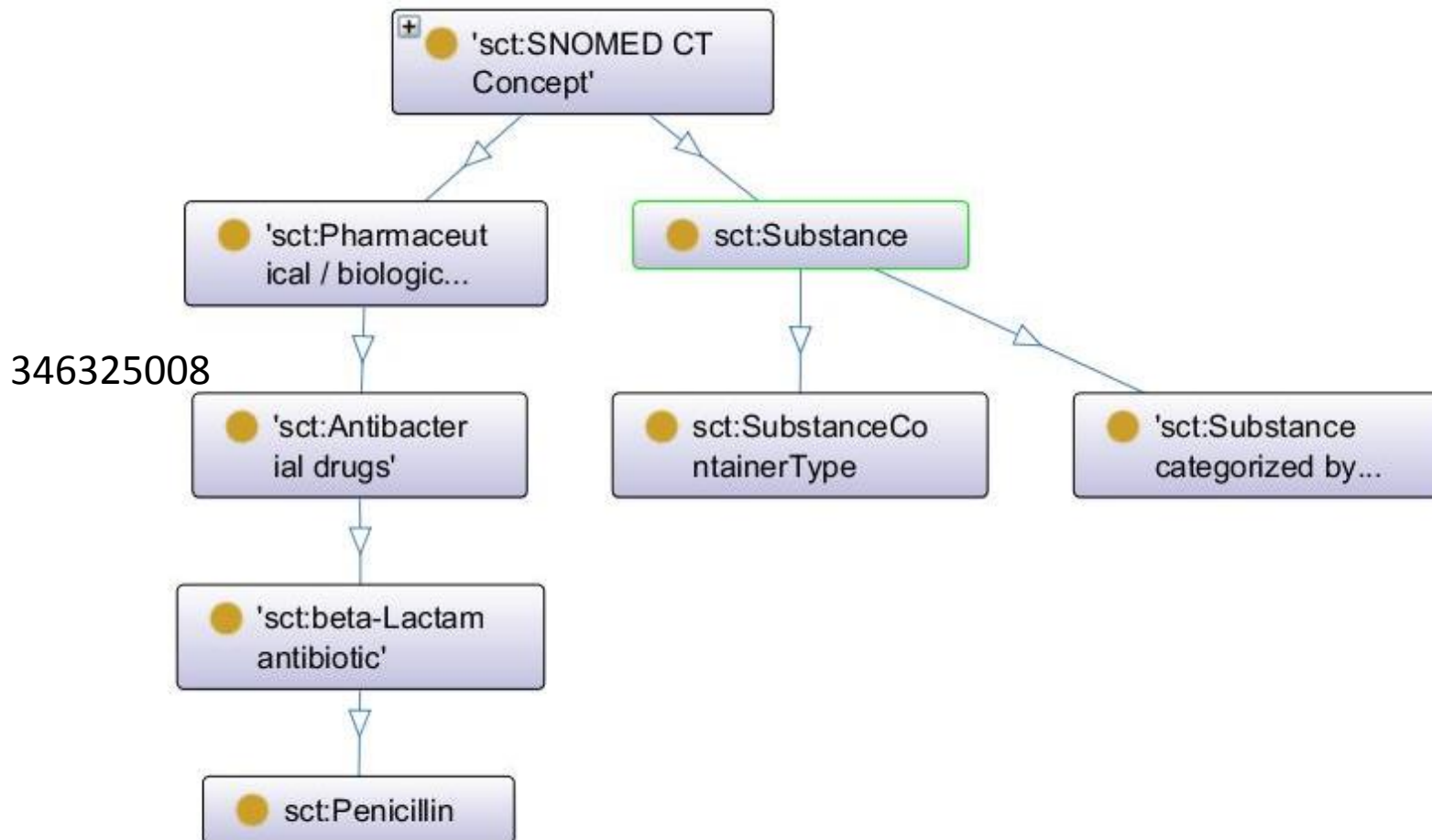
Profile restriction

- Declare a property chain
- `profile:AllergyIntolerance.substancehasCoding rdf:type owl:ObjectProperty ;`
- `owl:propertyChainAxiom (allergy:AllergyIntolerance.substance`
- `fhir:CodeableConcept.coding`
- `) .`

- `profile:AllergyIntolerance rdf:type owl:Class ;`
- `rdfs:subClassOf allergy:AllergyIntolerance ,`
- `[rdf:type owl:Restriction ;`
- `owl:onProperty profile:AllergyIntolerance.substancehasCoding ;`
- `owl:allValuesFrom [rdf:type owl:Class ;`
- `owl:unionOf (<http://snomed.info/id/105590001>`
- `<http://snomed.info/id/373873005>`
- `)`
- `]`
- `].`

External Terminology

- Example is fragment from SNOMEDCT
 - Classes show labels – names are the codes



Reference and Resolution

- Type expression

- allergy:AllergyIntolerance rdf:type owl:Class ;
- rdfs:subClassOf fhir:DomainResource ,
- [rdf:type owl:Restriction ;
- owl:onProperty allergy:AllergyIntolerance.patient ;
- owl:onClass [rdf:type owl:Class ;
- owl:unionOf (patient:Patient fhir:Reference>
-)
-];

- Patient instance reference resolved

- allergy:AllergyIntolerance.patient record:PeterPatient ;

- Practitioner instance reference

- allergy:AllergyIntolerance.recorder [rdf:type fhir:Reference ;
- fhir:Reference.display [rdf:type fhir:string ;
- fhir:value "PaulProvider"
-];
- fhir:Reference.reference [rdf:type fhir:string ;
- fhir:value "http://record#PaulProvider"
-]
-];

Conclusion

- Project is still under construction
 - (no prescription yet)
- Structure of Ontologies reasonably robust
 - Internal and External ValueSet mechanisms are aligned
- Potential for assembling the graph
 - Style must support closure to graph
- Anonymous instances are tool challenging
 - Yet to test reasoner