ART-DECOR

for Software Developers/Implementers

ART-DECOR Developer Day @ IHIC 2015
9th February 2015, Prague, Czech Republic

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Maarten Ligtvoet (NL)
Marc de Graauw (NL)
Abderrazek Boufahja (BE)

heitmann consulting and services
competence in Healthcare IT worldwide

Agenda

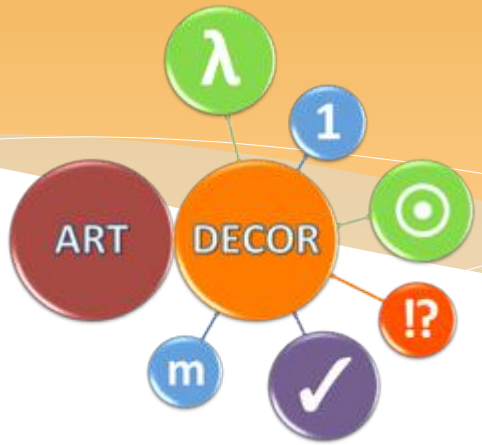
ART-DECOR for Software Developers

- Schematron and other artefacts
- FHIR with ART-DECOR
- Publications
- Testing with ART-DECOR
- ART-DECOR Application (ADA)
- IHE Gazelle ObjectsChecker: Concepts, Benefits, Demonstration and Access

Agenda

- Maarten Ligtvoet (NL)
  - Nictiz, Product Manager ART-DECOR
  - ART-DECOR Expert
- Marc de Graauw (NL)
  - ART-DECOR Expert
- Dr Kai U. Heitmann (DE)
  - ART-DECOR Expert, HL7 Germany / Netherlands
- Abderrazek Boufahja (BE)
  - IHE Europe

Schematron – Validation of CDA Instances



CDA Standard and Specifications

CDA-Standard

Use Case + Business model .

Implementation Guide

Business Rules *Constraints*

Implementation Guides

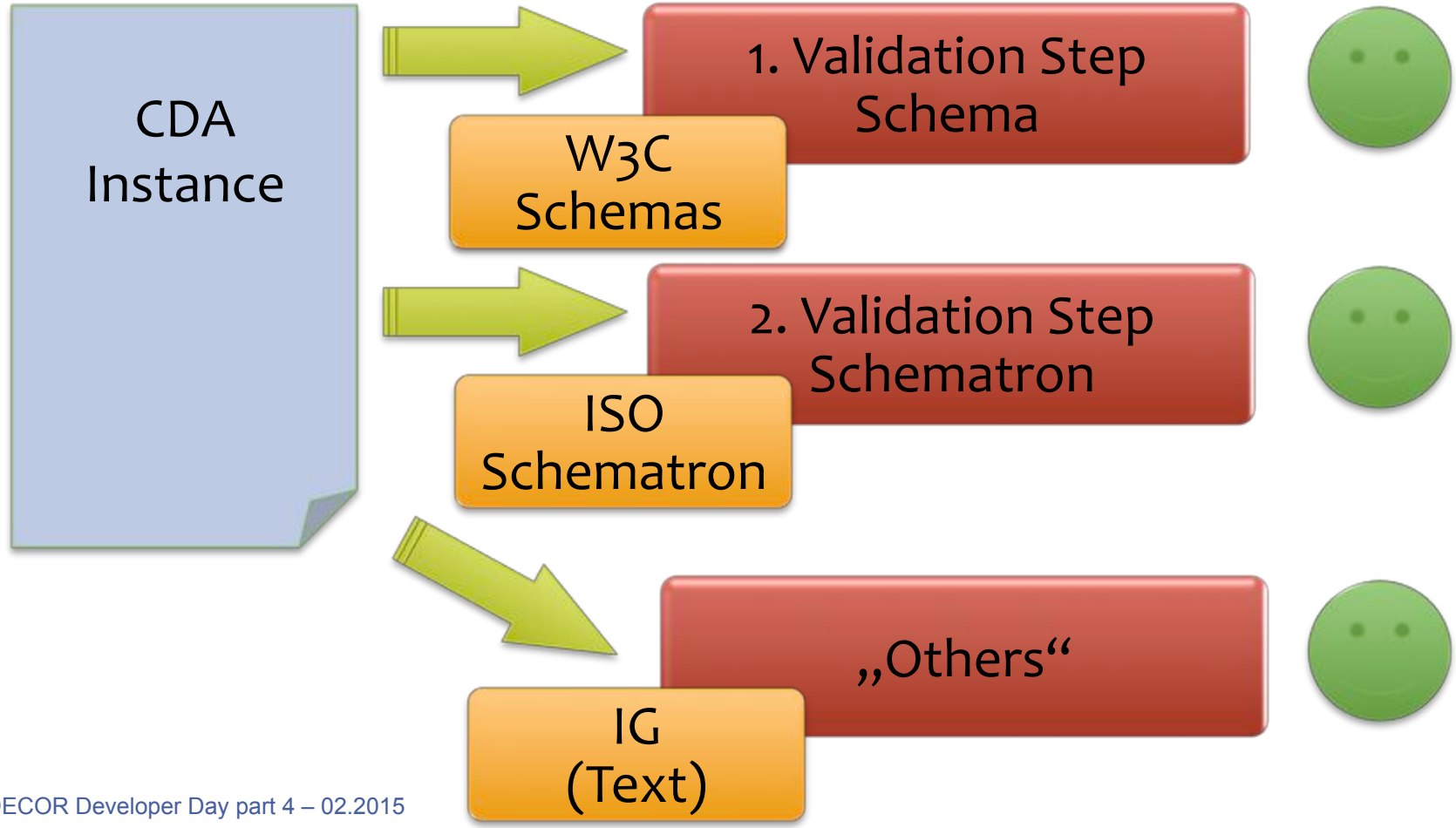
- CDA Implementation Guides and Profiles
  - Discharge Letter
  - Patient Summary
  - Operation Note
  - EKG Report
  - Lab Results
  - Medication List
  - Prescription

„Valid“ CDA Documents…

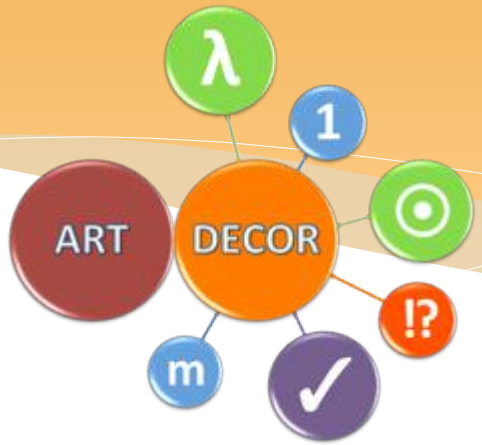
- validate against the published W3C XML Schema → XML Schema
- validate against the generic CDA Model →MIF (model interchange format)
- validate against the requirements mentioned in the implementation guide → ISO Schematron
- validate against Template Definitions → Schematron, MIF, W3C Schema, …

Multi Phase Validation

Sender Side



W3C Schema



CDA XML W3C Schema for "Person"

Patient
classCode*: <= *PSN*
determinerCode*: <= *INSTANCE*
id: II [0..1] (Deprecated)
name: SET<PN> [0..*]
administrativeGenderCode: CE CWE [0..1] <= *AdministrativeGender*
birthTime: TS [0..1]
maritalStatusCode: CE CWE [0..1] <= *MaritalStatus*
religiousAffiliationCode: CE CWE [0..1] <= *ReligiousAffiliation*
raceCode: CE CWE [0..1] <= *Race*
ethnicGroupCode: CE CWE [0..1] <= *Ethnicity*

```
<xs:complexType name="POCD_MT000040.Patient">
    <xs:sequence>
      <xs:element name="templateId" type="POCD_MT000040.InfrastructureRoot.templateId"
          minOccurs="0" maxOccurs="unbounded"/>
      <xs:element name="id" type="II"  minOccurs="0"/>
      <xs:element name="name" type="PN"  minOccurs="0" maxOccurs="unbounded"/>
      <xs:element name="administrativeGenderCode" type="CE"  minOccurs="0"/>
      <xs:element name="birthTime" type="TS"  minOccurs="0"/>
      <xs:element name="maritalStatusCode" type="CE"  minOccurs="0"/>
    </xs:sequence>
    <xs:attribute name="nullFlavor" type="NullFlavor" use="optional"/>
    <xs:attribute name="classCode" type="EntityClass" use="optional" fixed="PSN"/>
    <xs:attribute name="determinerCode" type="EntityDeterminer" use="optional" fixed="INSTANCE"/>
</xs:complexType>
```

W3C-Schema for "Observation"

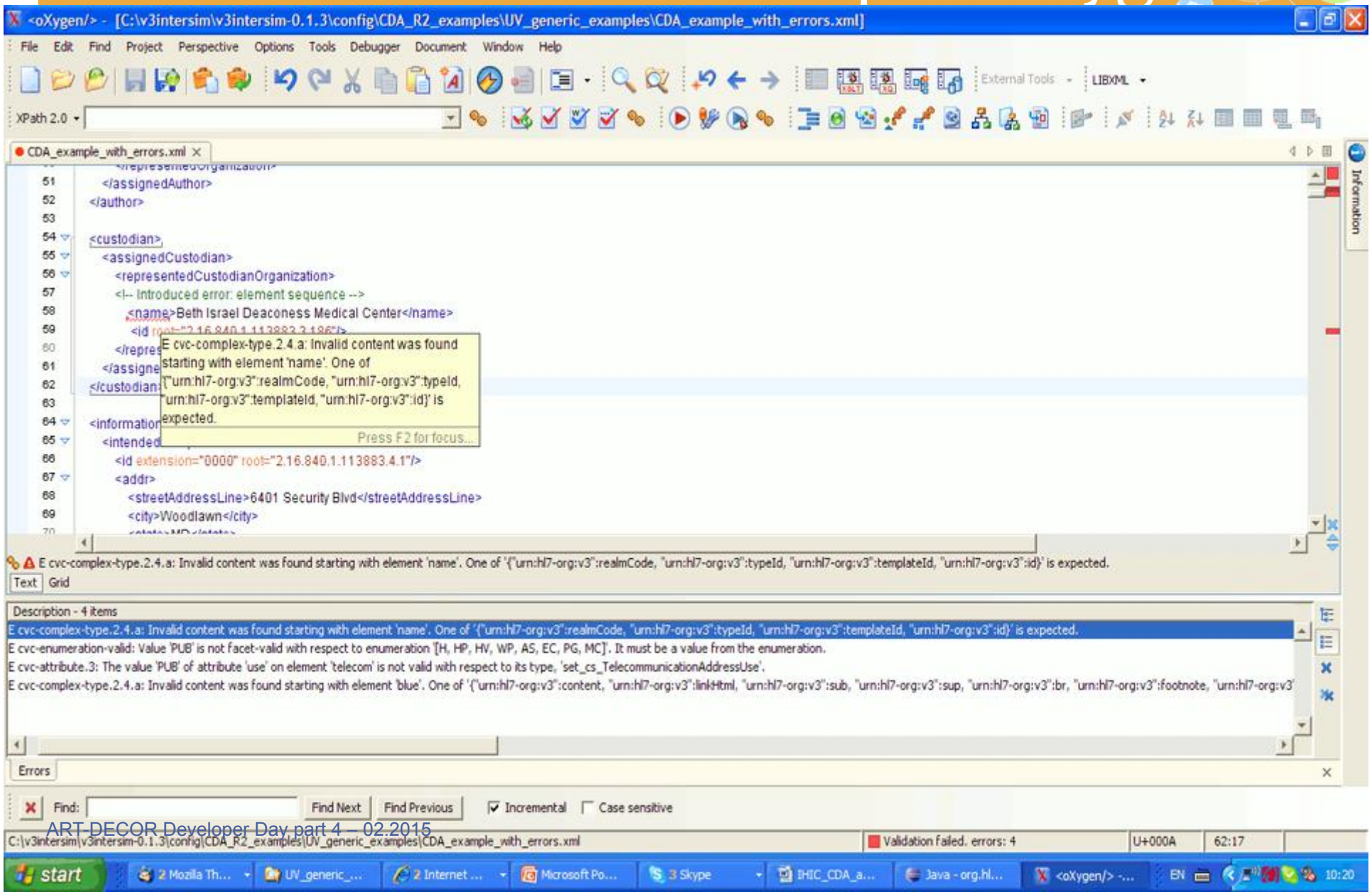
```
<xs:complexType name="POCD_MT000040.Observation">
  <xs:sequence>
    <xs:element name="realmCode" type="CS"  minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="typeId" type="POCD_MT000040.InfrastructureRoot.typeId"  minOccurs="0"/>
    <xs:element name="templateId" type="POCD_MT000040.InfrastructureRoot.templateId"
      minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="id" type="II"  minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="code" type="CD" />
    <xs:element name="text" type="ED"  minOccurs="0"/>
    <xs:element name="statusCode" type="CS"  minOccurs="0"/>
    <xs:element name="effectiveTime" type="IVL_TS"  minOccurs="0"/>
    <xs:element name="value" type="ANY"  minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="interpretationCode" type="CE"  minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="methodCode" type="CE"  minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="targetSiteCode" type="CD"  minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="subject" type="POCD_MT000040.Subject"  minOccurs="0"/>
    <xs:element name="performer" type="POCD_MT000040.Performer2"
      minOccurs="0" maxOccurs="unbounded"/>
  </xs:sequence>
  <xs:attribute name="nullFlavor" type="NullFlavor" use="optional"/>
  <xs:attribute name="classCode" type="ActClassObservation" use="required"/>
  <xs:attribute name="moodCode" type="x_ActMoodDocumentObservation" use="required"/>
  <xs:attribute name="negationInd" type="bl" use="optional"/>
</xs:complexType>
```

Using HL7 v3 Schemas (XML ITS)

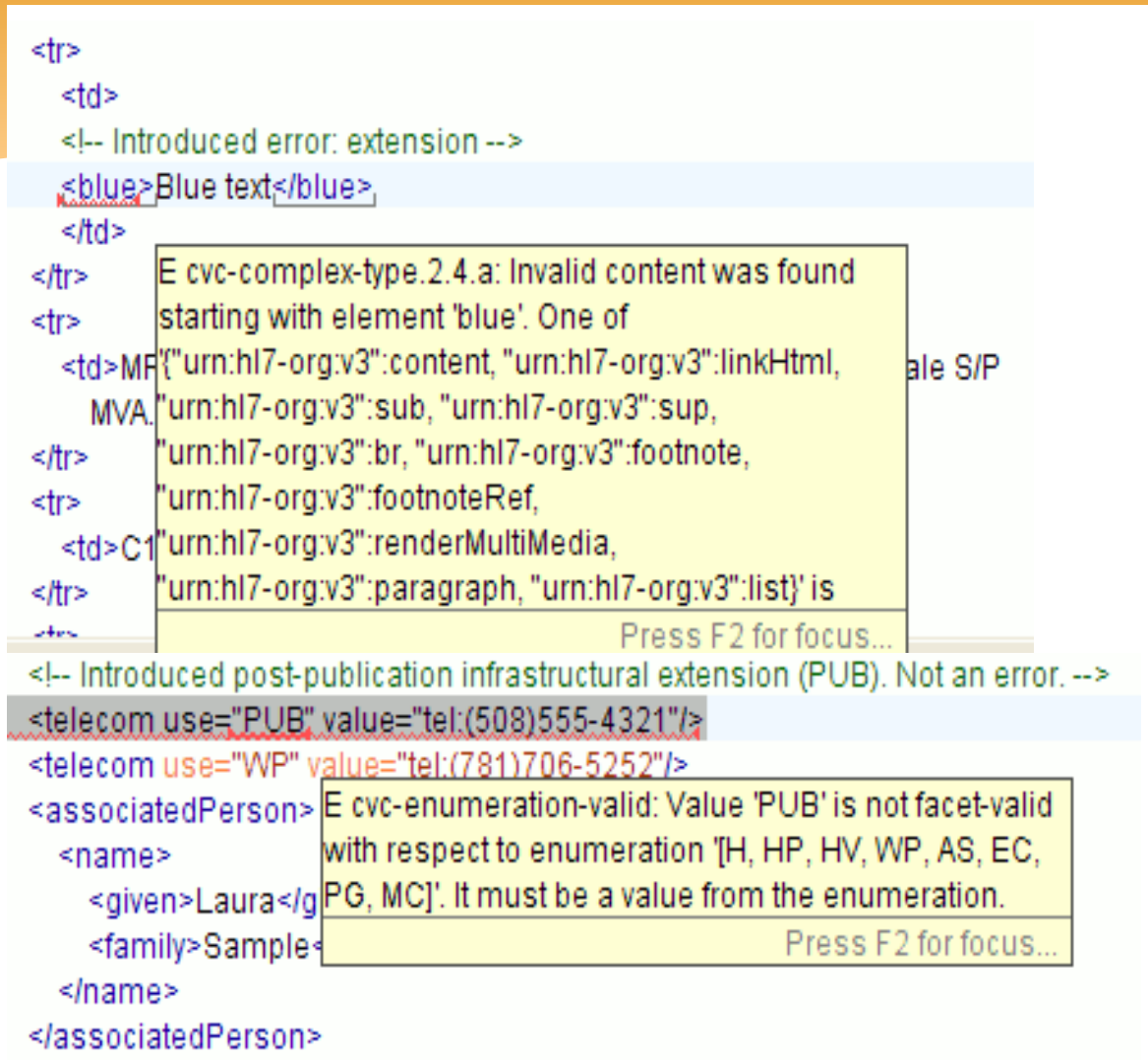
- HL7: *informative* XML Schema Definitions (XSD) for v3/CDA
- There are no **normative Schemas**
- Get the message here:

An XML Document, that validates against the W3C Schema, is *not* necessarily a valid HL7 CDA-Document

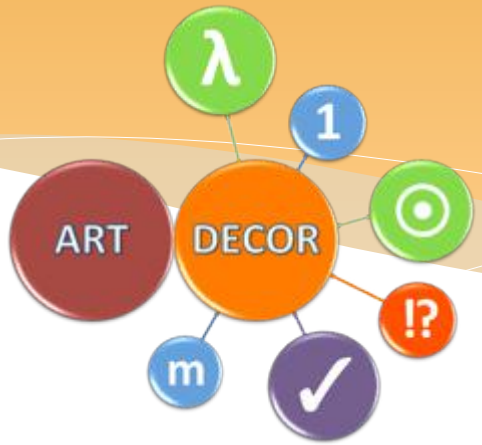
Schema Validator Example: Oxygen



Schema Validator Example: Oxygen



Schematron Basics with Examples



Business Rules

- Implementation guides quite often define "templates" in the form of textual requirements
  - *The CDA document SHALL contain a 'discharge diagnosis' section, which SHALL have the 3645-3 LOINC code.*
  - *A 'discharge diagnosis' section SHOULD have an entry with a ICD-10 diagnosis code.*
  - *The section MAY have an author, which if present, should be identified using the national provider identifier.*
- These requirements can be tested using Schematron.

Schematron Use Case

- Rules-based validation language
  - direct checks beyond what schemas can express
  - produce reports for complicated checking by humans
- Find patterns in documents
- Check elements against a controlled vocabulary (from external XML file)

Schematron is

- A rule-based XML validation language
- To validate XML Documents using rules and conditions to test
  - ...content (elements, attributes)
  - ...patterns (structures/context)
  - ...co-constraints (business rules)
- Has a cool Report Generator
- An ISO Standard: ISO/IEC 19757-3

What Schematron Does

- Validate/report on document structure
  - presence/absence of elements
  - sequence of elements
  - presence/absence of attributes
- Validate/report on document content
- Validate/report on attribute content
- Check co-occurrence constraints
  - (If patient is „female“, then ask for „pregnancy“)

A Short Example

- ...in a CDA instance

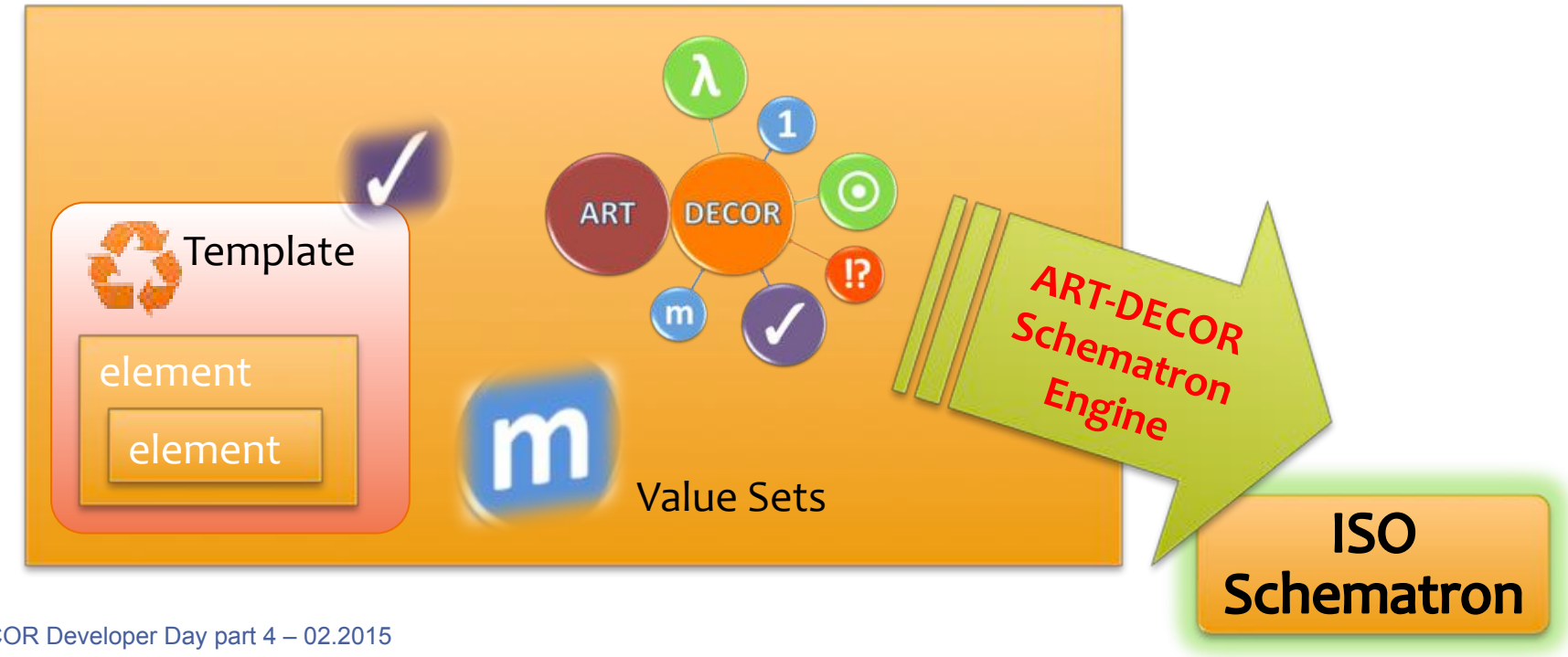
```
<typeId extension="POCD_HD000040" root="2.16.840.1.113883.1.3"/>
```

- Schematron

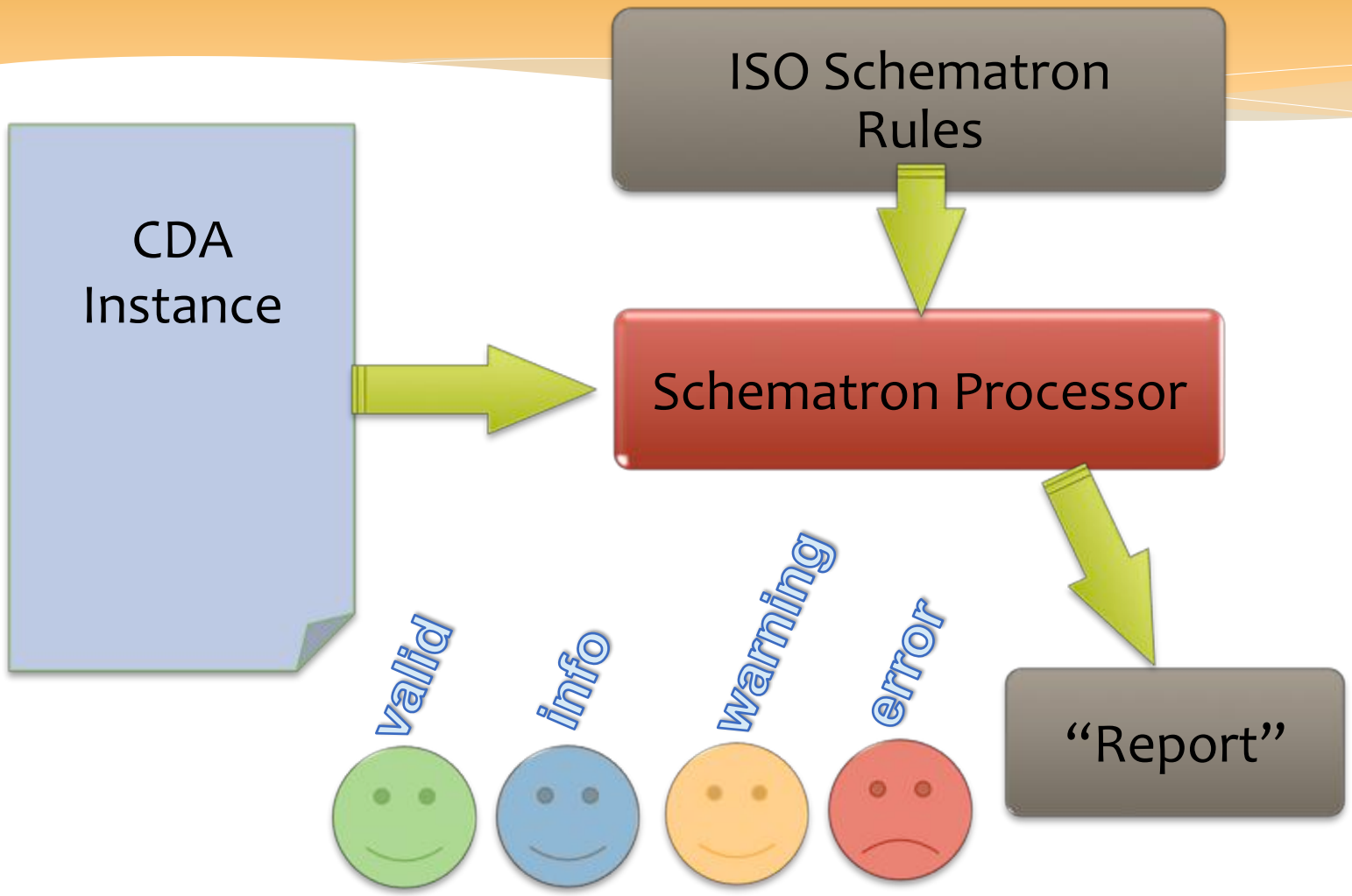
```
<rule context="hl7:typeId">
   <assert role="error“
      test="@extension='POCD_HD000040'">
      ClinicalDocument.typeId (2.16.840.1.113883.2.4.6.10.35.3)
      @extension SHALL have value POCD_HD000040 static </assert>

   <assert role="error" test="@root='2.16.840.1.113883.1.3'">
      ClinicalDocument.typeId (2.16.840.1.113883.2.4.6.10.35.3)
      @root SHALL have value 2.16.840.1.113883.1.3 static </assert>
</rule>
```

XML Schematron generators

- Schematron files can be generated from Template specifications (→ Templates DSTU)



No secrets involved



Publications
Testing with ART-DECOR

Maarten Ligvoet

ART-DECOR Application (ADA)

Marc de Graauw

IHE Gazelle ObjectsChecker: Concepts, Benefits, Demonstration and Access

Abderrazek Boufahja

ART-DECOR Benefactors

ART-DECOR is developed with funding by

- Nictiz, Den Haag (NL)

  and

- Heitmann Consulting and Services, Hürth (DE)
- Gerrit Boers, Maastricht (NL)
- HL7 Germany, Köln (DE)

Become a benefactor!

Dr Kai U. Heitmann, MD, FHL7 (DE)
Maarten Ligtvoet (NL)
Marc de Graauw (NL)
Abderrazek Boufahja (BE)

Thank you!
Questions?