MIE09 SARAJEVO
Medical Informatics in a United and Healthy Europe
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The Role of Ontologies for Sustainable, Semantically Interoperable and Trustworthy EHR Solutions

TermInfo Draft Standard for Trial Use (DSTU): Managing overlap between SNOMED CT and HL7-RIM

Stefan SCHULZ
University Medical Center Freiburg, Germany
Edward CHEETHAM
NHS Connecting for Health, United Kingdom

Outline

- Health information standards
- Typology of representation artifacts
- Semantic overlap between representation artifacts
- TermInfo Draft Standard for Trial Use
- Outlook

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Two Health Information Standards

	HL7 Version 3	SNOMED CT
Characterization	Messaging Standard for healthcare workflows	Terminology Standard for healthcare
	Information model	Ontology-inspired Terminology
	Model of use	Model of meaning
Represents	Informational artifacts	Clinical reality: patients, diseases, procedures, drugs
	States of knowledge	Meaning of terms
Methodological foundation	UML	Description logics
SDO	HL7, Inc Ann Arbor, Michigan, USA	IHTSDO International Healthcare Terminology Standards Development Organisation Copenhagen, Denmark
Participation	HL7 local organizations in over 30 countries	Member states: Australia, Canada, Cyprus, Denmark, Lithuania, New Zealand, Singapore, Spain, Sweden, The Netherlands, United Kingdom, United States

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From metaphysics...

Ontology

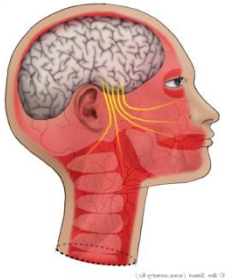
- theory of reality

Semantics

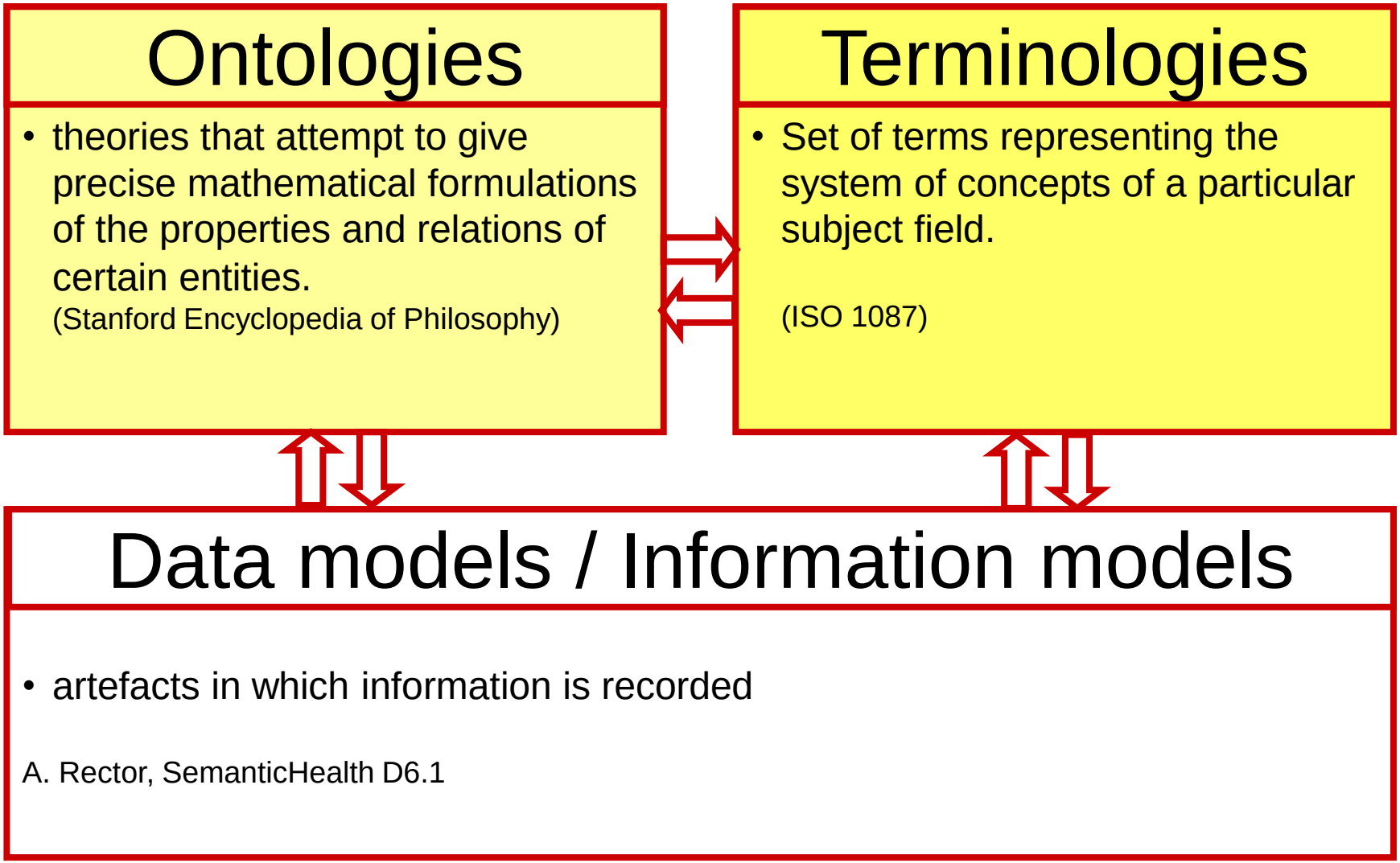
- theory of meaning of (human language) designations

Epistemology

- theory of knowledge



...to an ideal world of representation artifacts



Examples

Ontologies

Formal descriptions
- MRSA *subtype-of* SA
- SA *subtype-of* Staphylococcus
- SA *implies* bearer-of *some* MR quality

Textual descriptions
- “MRSA is defined as SA for which methicillin has no toxic effect”

Terminologies

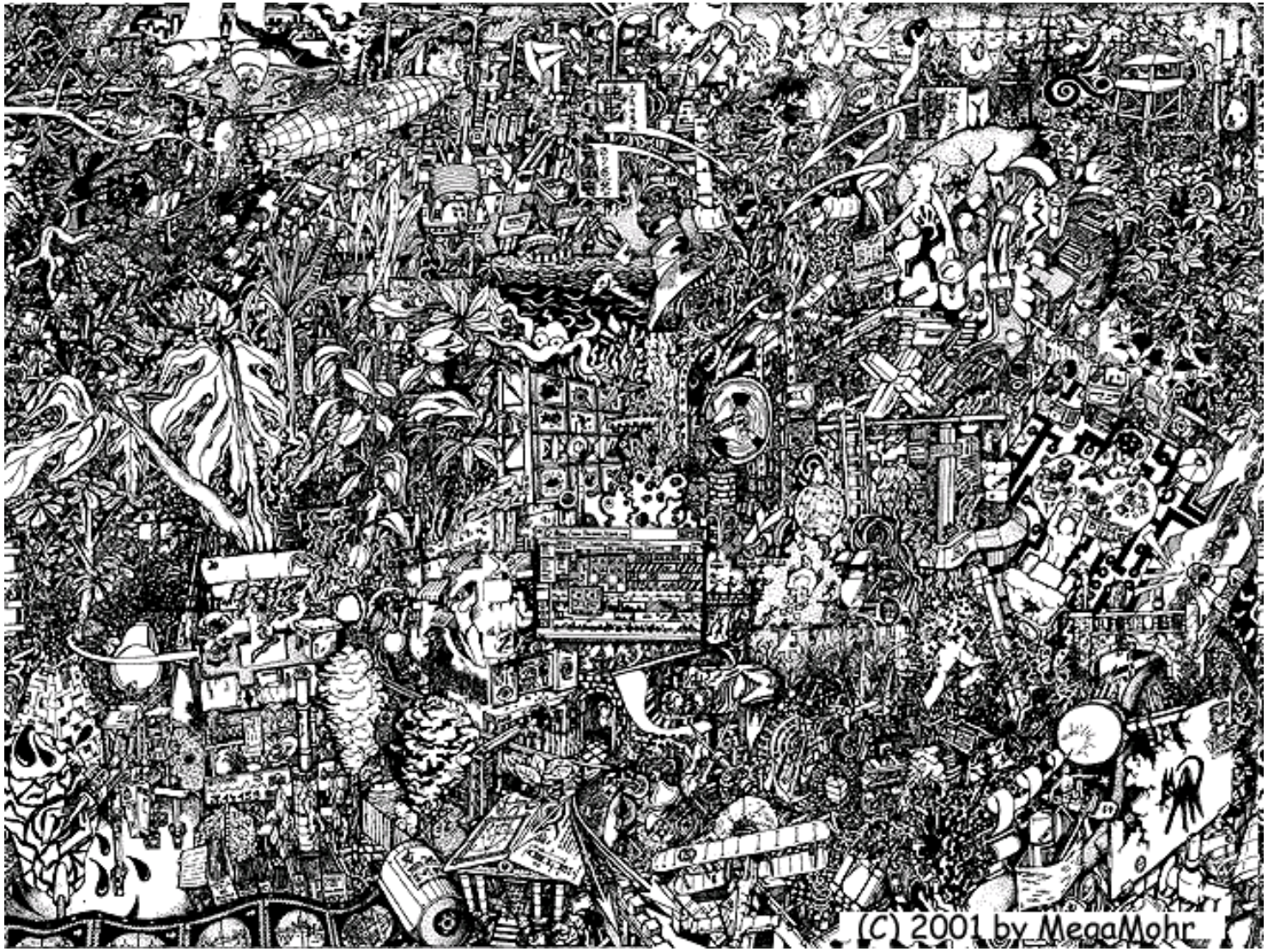
- Concept 1 – Synonyms:
  - -SA
  - -Staphylococcus aureus
  - -Staph. aur.
- Concept 2 – Synonyms:
  - -MRSA
  - -Methicillin-resistant SA
  - -Methicillin-resistant Staphylococcus Aureus

Data models / Information models

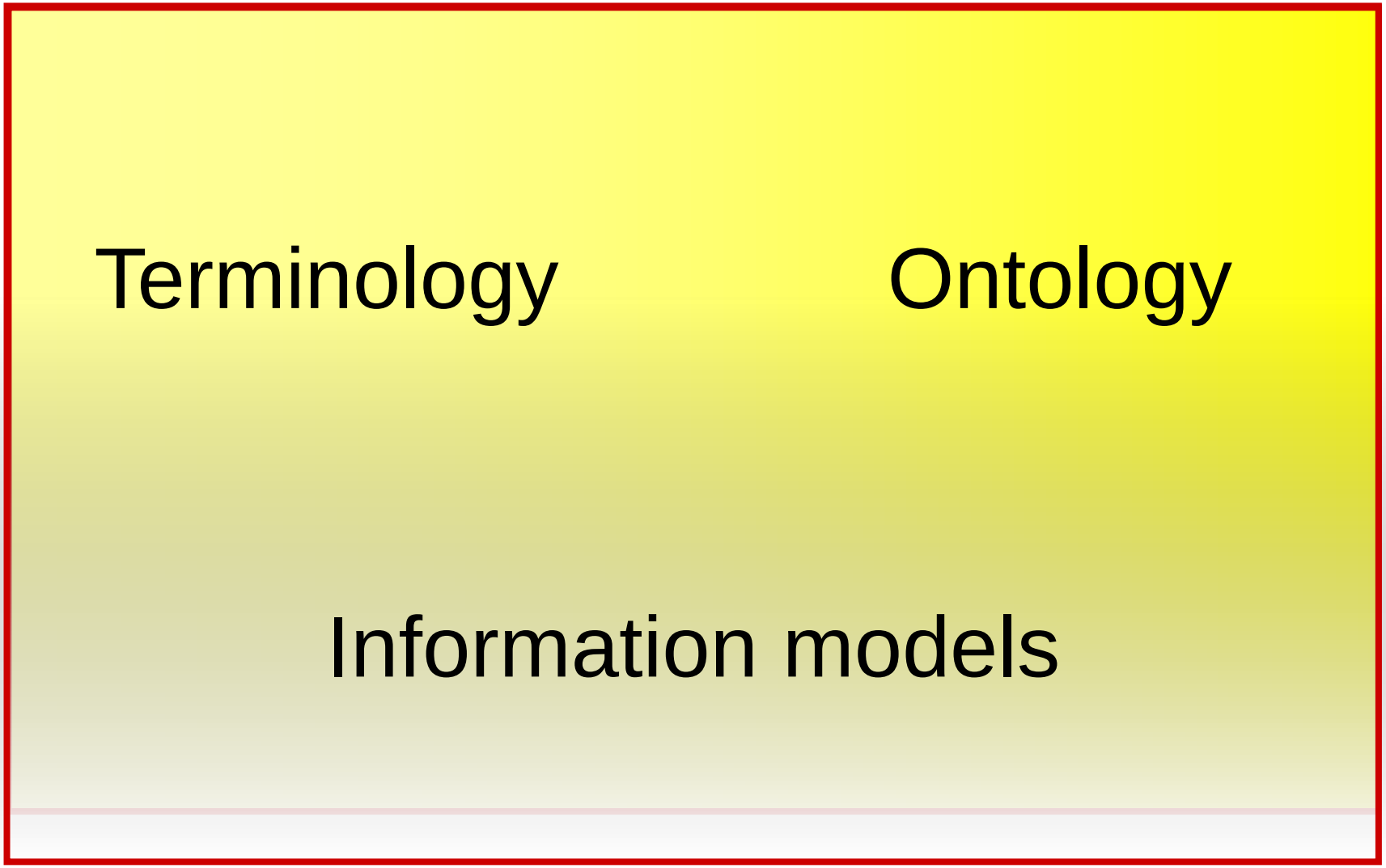
Methicillin resistance

- ☐Clinically confirmed
- ☐Confirmed by antibiogram
- ☑Suspected
- ☐None
- ☐Unknown

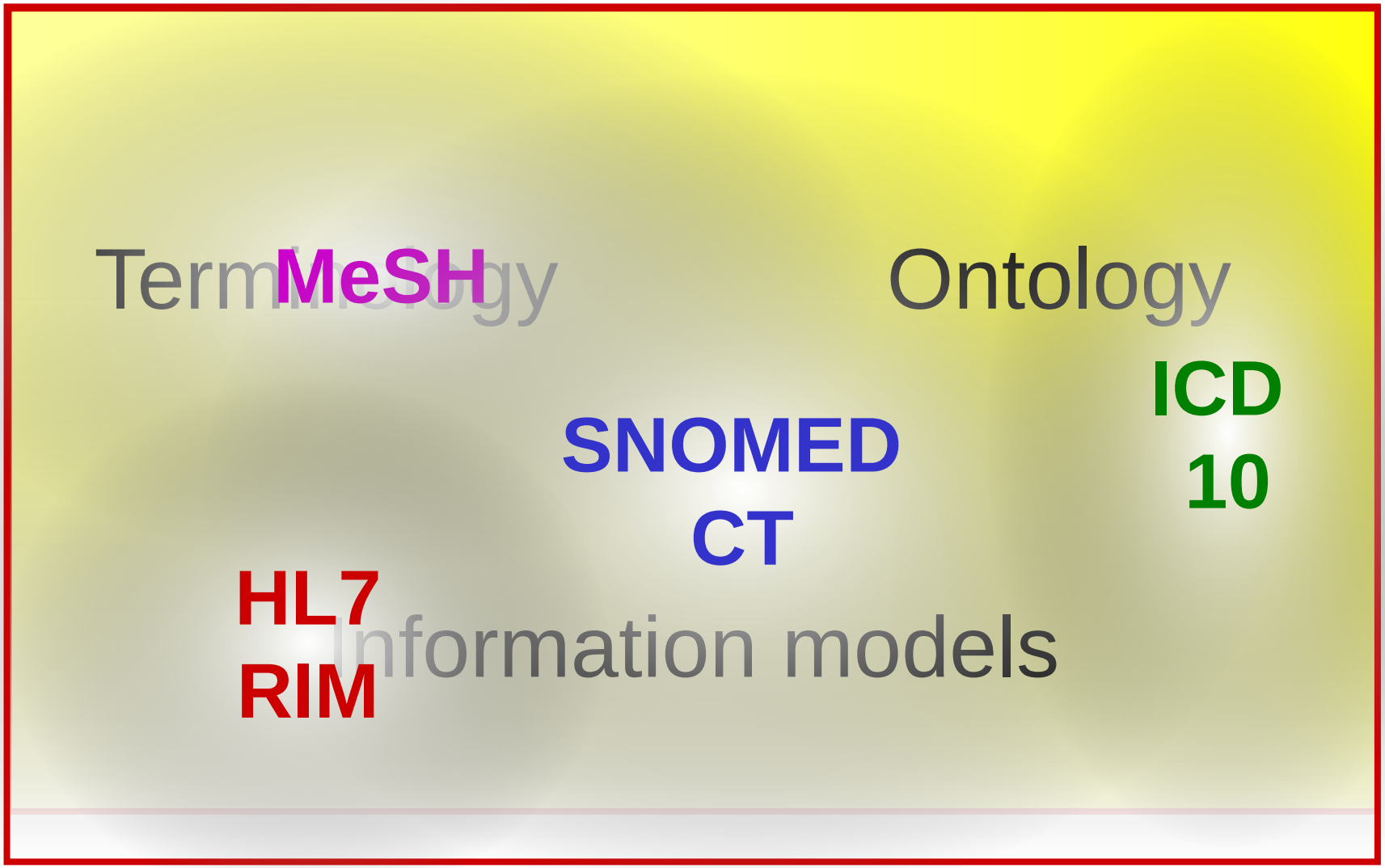
but in the real, chaotic world...



we have to deal with “living” representational artifacts far from being ideal



that combine teminology, ontology and information model elements



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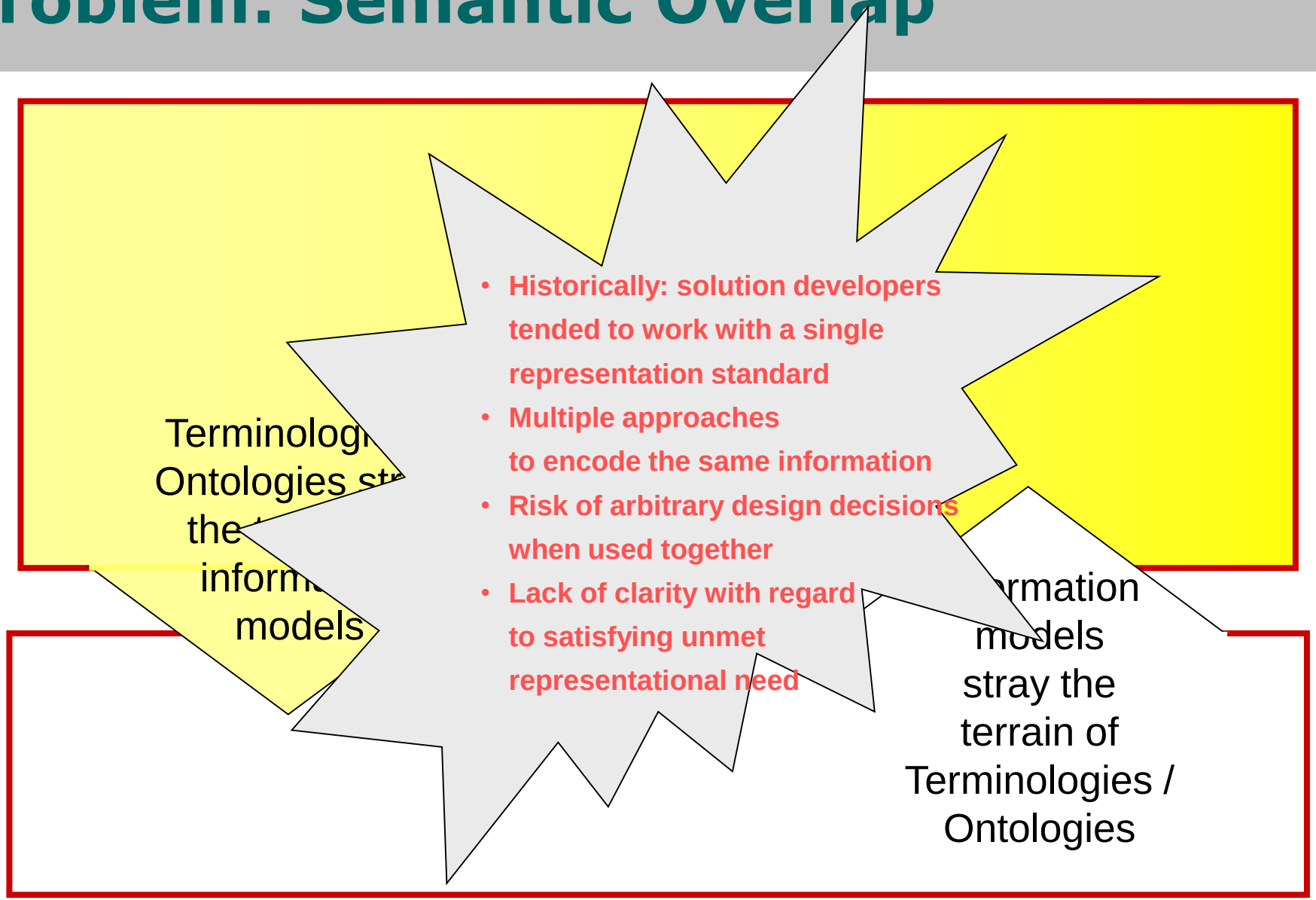
Problem: Semantic Overlap



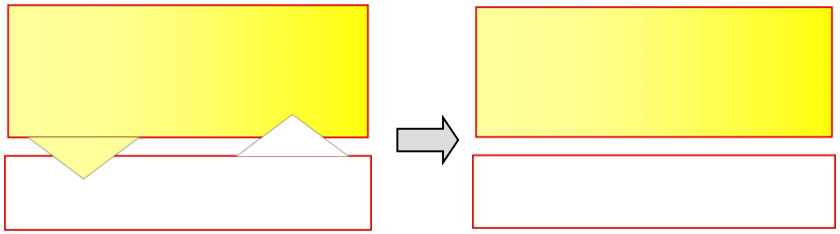
Examples of "epistemic intrusion"

- SNOMED CT: "Suspected autism"
- SNOMED CT: "Biopsy planned"
- SNOMED CT: "Take at regular intervals"
- ICD 10: "Tuberculosis of lung, confirmed histologically"
- ICD-O: "Basal cell tumor, uncertain whether benign or" malignant
- ICD-9-CM: "Replacement of unspecified heart valve"
- NCI Thesaurus: "Unknown If Ever Smoked"
- NCI Thesaurus: "Absent Adverse Event"

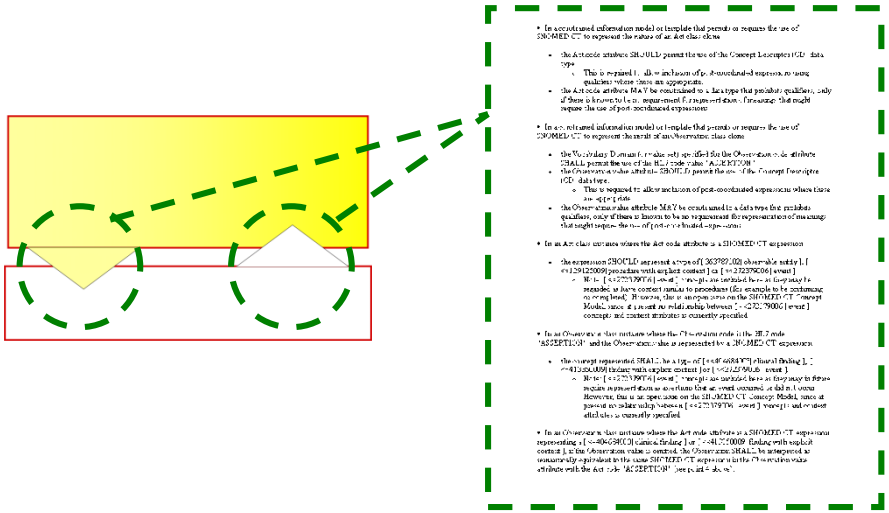
Bodenreider et al. The Ontology-Epistemology Divide: A Case Study in Medical Terminology. *Proceedings of FOIS 2004*

Solutions

- Establish a clear boundary between information models and ontologies:
  desirable but unfeasible for legacy systems



- Develop rules for managing ambiguities
  - HL7 TermInfo



*https://svn.connectingforhealth.nhs.uk/svn/public/nhscontentmodels/TRUNK/ref/HL7/TermInfo.htm

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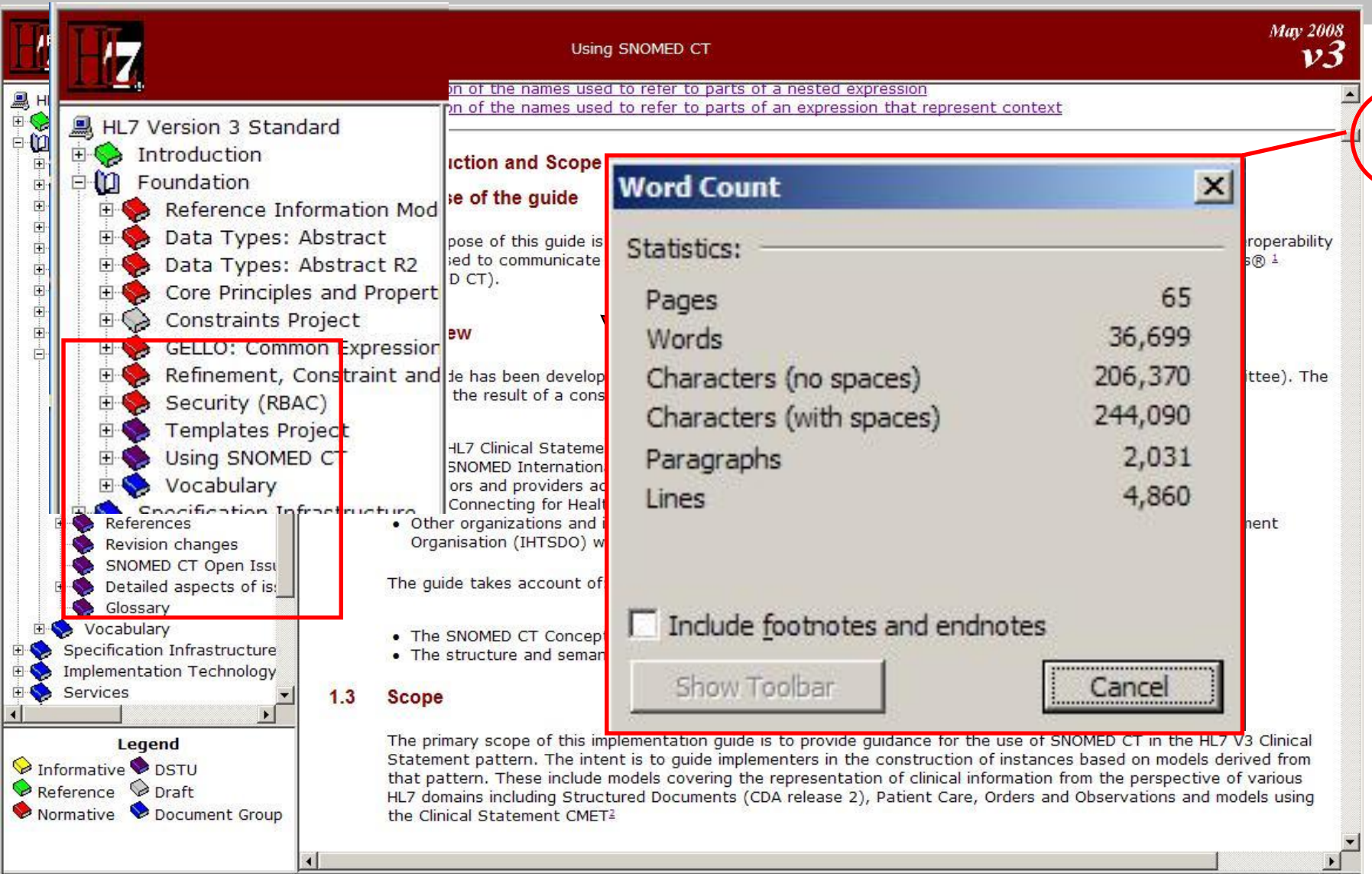
TermInfo Draft Standard for Trial Use (DSTU): History

- 2004 onwards, Growing interest in use of SNOMED Clinical Terms (SNOMED CT) in the HL7 community
- HL7 Vocabulary Technical Committee (supported by SNOMED International and NASA) launched the 'TermInfo Project' with the following missions:
  - General: investigate interfacing between HL7 information models and terminologies or code systems.
  - Specific: A guide on use of SNOMED CT within the HL7 V3
- Outcome September 2007:
  - Guide to Use of SNOMED CT in HL7 Version 3' accepted as a Draft Standard for Trial Use (DSTU)

- http://www.hl7.org/v3ballot/html/welcome/environment/index.htm

Using SNOMED CT in HL7 v3 DSTU



Structure of SNOMED CT in HL7 v3 DSTU

1. Introduction and Scope
2. **Guidance on Overlaps between RIM and SNOMED CT Semantics**
3. Common Patterns
4. Normal Forms
5. SNOMED CT vocabulary domain constraints
6. Glossary

Appendix A General Options for Dealing with Potential Overlaps

Appendix B References

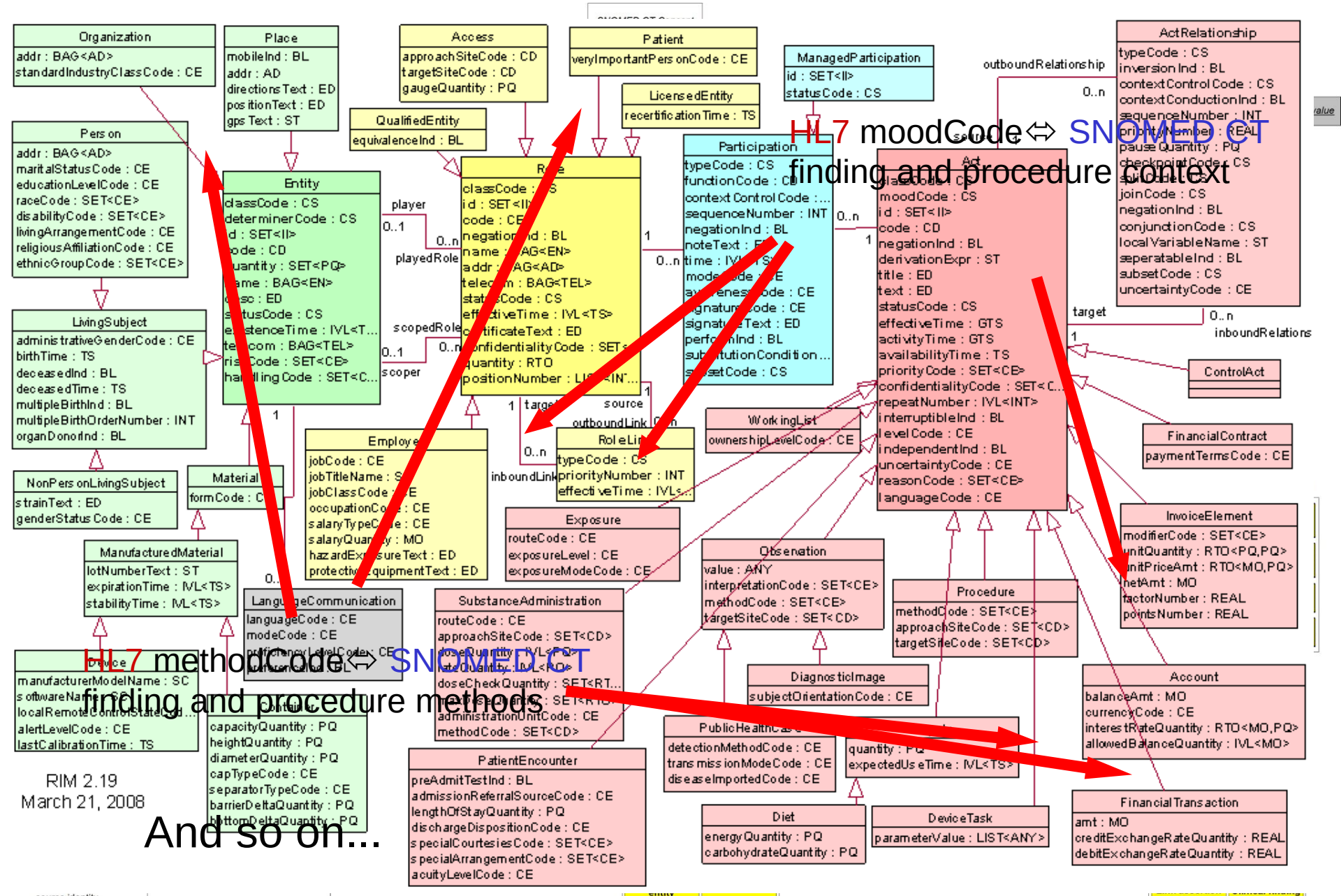
Appendix C Revision changes

Appendix D SNOMED CT Open Issues

Appendix E Detailed aspects of issues with a vocabulary specification formalism

Section 2:
Guidance on overlaps between RIM and SNOMED CT Semantics

- Detailed walk-through of RIM attributes vs. SNOMED CT properties:
  - Act.classCode
  - Act.code and Observation.value
  - Act.moodCode
  - Act.statusCode
  - Procedure.targetSiteCode and Observation.targetSiteCode
  - Procedure.approachSiteCode and SubstanceAdministration.approachSiteCode
  - Procedure.methodCode and Observation.methodCode
  - Act.priorityCode
  - Act.negationInd
  - Act.uncertaintyCode
  - Representation of Units
  - Dates and Times


HL7 moodCode ⇔ SNOMED CT
finding and procedure context
HL7 methodCode ⇔ SNOMED CT
finding and procedure methods
And so on...
RIM 2.19
March 21, 2008
Organization
addr : BAG<AD>
standardIndustryClassCode : CE
Place
mobileInd : BL
addr : AD
directionsText : ED
positionText : ED
gpsText : ST
Access
approachSiteCode : CD
targetSiteCode : CD
gaugeQuantity : PQ
Patient
veryImportantPersonCode : CE
ManagedParticipation
id : SET<II>
statusCode : CS
ActRelationship
typeCode : CS
inversionInd : BL
contextControlCode : CS
contextConductionInd : BL
sequenceNumber : INT
priorityNumber : REAL
pauseQuantity : PQ
checkpointCode : CS
splitCode : CS
joinCode : CS
negationInd : BL
conjunctionCode : CS
localVariableName : ST
seperatableInd : BL
subsetCode : CS
uncertaintyCode : CE
QualifiedEntity
equivalenceInd : BL
LicensedEntity
recertificationTime : TS
Person
addr : BAG<AD>
maritalStatusCode : CE
educationLevelCode : CE
raceCode : SET<CE>
disabilityCode : SET<CE>
livingArrangementCode : CE
religiousAffiliationCode : CE
ethnicGroupCode : SET<CE>
Entity
classCode : CS
determinerCode : CS
id : SET<II>
code : CD
quantity : SET<PQ>
name : BAG<EN>
desc : ED
statusCode : CS
existenceTime : IVL<T...
telecom : BAG<TEL>
riskCode : SET<CE>
handlingCode : SET<C...
player
playedRole
scopedRole
scoper
Role
classCode : CS
id : SET<II>
code : CE
negationInd : BL
name : BAG<EN>
addr : BAG<AD>
telecom : BAG<TEL>
statusCode : CS
effectiveTime : IVL<TS>
certificateText : ED
confidentialityCode : SET<...
quantity : RTO
positionNumber : LIST<INT...
target
source
outboundLink
inboundLink
RoleLink
typeCode : CS
priorityNumber : INT
effectiveTime : IVL<...
Participation
typeCode : CS
functionCode : CE
contextControlCode : ...
sequenceNumber : INT
negationInd : BL
noteText : ED
time : IVL<TS>
modeCode : CE
awarenessCode : CE
signatureCode : CE
signatureText : ED
performInd : BL
substitutionCondition...
subsetCode : CS
Act
classCode : CS
moodCode : CS
id : SET<II>
code : CD
negationInd : BL
derivationExpr : ST
title : ED
text : ED
statusCode : CS
effectiveTime : GTS
activityTime : GTS
availabilityTime : TS
priorityCode : SET<CE>
confidentialityCode : SET<C...
repeatNumber : IVL<INT>
interruptibleInd : BL
levelCode : CE
independentInd : BL
uncertaintyCode : CE
reasonCode : SET<CE>
languageCode : CE
outboundRelationship
inboundRelationship
target
ControlAct
FinancialContract
paymentTermsCode : CE
WorkingList
ownershipLevelCode : CE
Employee
jobCode : CE
jobTitleName : S...
jobClassCode : CE
occupationCode : CE
salaryTypeCode : CE
salaryQuantity : MO
hazardExposureText : ED
protectiveEquipmentText : ED
Exposure
routeCode : CE
exposureLevel : CE
exposureModeCode : CE
Observation
value : ANY
interpretationCode : SET<CE>
methodCode : SET<CE>
targetSiteCode : SET<CD>
Procedure
methodCode : SET<CE>
approachSiteCode : SET<CD>
targetSiteCode : SET<CD>
InvoiceElement
modifierCode : SET<CE>
unitQuantity : RTO<PQ,PQ>
unitPriceAmt : RTO<MO,PQ>
netAmt : MO
factorNumber : REAL
pointsNumber : REAL
NonPersonLivingSubject
strainText : ED
genderStatusCode : CE
Material
formCode : CE
ManufacturedMaterial
lotNumberText : ST
expirationTime : IVL<TS>
stabilityTime : IVL<TS>
LanguageCommunication
languageCode : CE
modeCode : CE
proficiencyLevelCode : CE
preferenceInd : BL
SubstanceAdministration
routeCode : CE
approachSiteCode : SET<CD>
doseQuantity : IVL<PQ>
rateQuantity : IVL<PQ>
doseCheckQuantity : SET<RT...
maxDoseQuantity : SET<RTO...
administrationUnitCode : CE
methodCode : SET<CD>
DiagnosticImage
subjectOrientationCode : CE
Account
balanceAmt : MO
currencyCode : CE
interestRateQuantity : RTO<MO,PQ>
allowedBalanceQuantity : IVL<MO>
Device
manufacturerModelName : SC
softwareName : CE
localRemoteControlStateCod...
alertLevelCode : CE
lastCalibrationTime : TS
Container
capacityQuantity : PQ
heightQuantity : PQ
diameterQuantity : PQ
capTypeCode : CE
separatorTypeCode : CE
barrierDeltaQuantity : PQ
bottomDeltaQuantity : PQ
PatientEncounter
preAdmitTestInd : BL
admissionReferralSourceCode : CE
lengthOfStayQuantity : PQ
dischargeDispositionCode : CE
specialCourtesiesCode : SET<CE>
specialArrangementCode : SET<CE>
acuityLevelCode : CE
PublicHealthCase
detectionMethodCode : CE
transmissionModeCode : CE
diseaseImportedCode : CE
quantity : PQ
expectedUseTime : IVL<TS>
Diet
energyQuantity : PQ
carbohydrateQuantity : PQ
DeviceTask
parameterValue : LIST<ANY>
FinancialTransaction
amt : MO
creditExchangeRateQuantity : REAL
debitExchangeRateQuantity : REAL
source identity
Diagram version 2.0 Feb 2007

Using SNOMED CT in HL7 v3 DSTU

Guidance on overlaps between RIM and SNOMED CT Semantics

Each subsection in HL7 v3 DSTU Section 2: divided into:

1. Potential overlap
2. Rules and guidance
3. Rationale

Two examples

Example 1: *Procedure.targetSiteCode* and *Observation.targetSiteCode*

- Potential Overlap:
  - Complete overlap
    - HL-7 *targetSiteCodes* are defined as "the anatomical site or system that is the focus of the procedure / observation."
    - SNOMED CT finding and procedure concepts have a defining attribute that specifies the site: e.g. *Appendicitis – Finding Site – Appendix structure*
- Rules and Guidance
  - omit targetSiteCode attribute from:
    - any *Act* class clone in which SNOMED CT is the only permitted code system for the Act.code attribute.
    - any *Observation* class clone in which SNOMED CT is the only permitted code system for the Observation.value attribute...'
- Rationale
  - Argues case for SNOMED CT attribute preference
  - Precision of available attributes; relationship grouping
  - The site of an action or event is clearly of ontological nature

Example 2: *Act.MoodCode*

- Potential overlap
  - The values in *ActMood* vocabulary partially overlap with SNOMED CT representations of *Finding context* and *Procedure context*
    - *Finding context* relevant to instances of HL7 Observation classes expressed in "event", "goal", "expectation" and "risk" moods.
    - *Procedure context* relevant to (i) instances of various HL7 Act classes including Procedure, SubstanceAdministration and Supply, (ii) instances of the HL7 Observation class except in "intent" moods (including "request" and other subtype of "intent").
- Rules and guidance
  - The moodCode SHALL be present in all Act class instances
  - Rules for valied moodCode / SNOMED CT associations:
    - '...IF moodCode <>INT (or subtype), THEN *code* attribute of Observation class MAY be populated by the following SNOMED CT expression patterns...'
      - Defaults described by default correspondence tables
      - Allowable patterns described by constraint tables
  - 'If both are present then they must be kept in step

Example 2: *Act.MoodCode*

- Mood Code = SNOMED CT context default and constraint tables

moodCode	Mood Name	SNOMED CT Finding context
EVN	Event	[410515003 | known present]
GOL	Goal	[410518001 | goal]
RSK	Risk	[410519009 | at risk]
EXPEC	Expectation	[410517006 | expectation]

Finding default

Finding constraints

moodCode	Mood name	SNOMED CT Finding context
EVN	Event	[(<<36692007 | known |) OR (<<261665006 | unknown |)]
GOL	Goal	[<<410518001 | goal]
RSK	Risk	[<<410519009 | at risk]
EXPEC	Expectation	[<<410517006 | expectation]

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Next Steps - DSTU

- Encourage use and testing
  - Marketing effort
- Encourage and support submission and timely resolution of issues encountered in use
  - HL7 DSTU issue reporting mechanism (pending re-publication)
    - http://www.hl7.org/dstucomments/index.cfm
  - HL7 Project Homebase mechanism
    - http://hl7projects.hl7.nscee.edu/
- Encourage list membership and submission of issues
    - http://www.hl7.org/special/committees/list_sub.cfm?list=hl7TermInfo
  - Conference call debate and resolution
  - Establish close ties with e.g. IHTSDO expertise for timely resolution/interim suggestions
  - Advancement through IHTSDO standards approval processes

Health Level Seven, Inc.
For Immediate Release

International Health Terminology Standards Development Organisation

HL7 and IHTSDO Sign Agreement

Up front coordination will bring significant improvements in interoperability and patient safety

Chicago, IL., U.S. and Copenhagen, Denmark – April 5, 2009 – Health Level Seven® Inc. (HL7®), the leading authority for global healthcare IT standards, and the International Health Terminology Standards Development Organisation (IHTSDO®), the leading provider of standardized clinical terminology, today announced a collaboration agreement that will foster interoperability and lead to improvements in patient safety by eliminating gaps and overlaps between the HL7 and IHTSDO standards.

Conclusion

- The ontology / epistemology boundary is crossed by both standards SNOMED CT and HL7v3. Consequence: overlap !
- DSTU produced to assist in the co-implementation of SNOMED CT and HL7v3
- Provides guidance on:
  - **Representation overlap management**
  - **Sensible integration of the standards**
- Provides mechanism for issues resolution and gap management where both standards used
- Does not claim perfection and does need systematic testing
- Recommendation: decrease of SNOMED CT / HL7v3 overlaps by collaborative development of both standards, assigning representational responsibility based on reproducible boundary rules –informed by ontological/epistemological considerations, balanced with consideration of real-world practical considerations.