ASSESS CT

Assessing SNOMED CT for Large Scale eHealth Deployments in the EU

Workpackage 2- Building new Evidence

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Studies performed

- Annotating clinical models (terminology binding) by terminology experts
- Manual annotation of clinical narratives by terminology experts
- Machine annotation of clinical narratives using Natural language processing

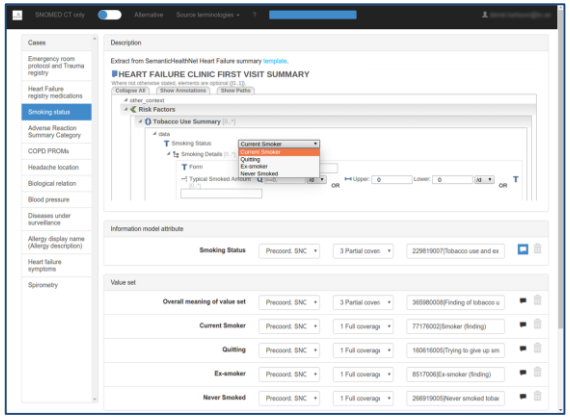
Annotating clinical models

- Assumptions
  - Use of terminologies in clinical information models representative of a major terminology use case
  - Agreement across country, cultural, language, etc. borders representative of EU-wide, cross-border use

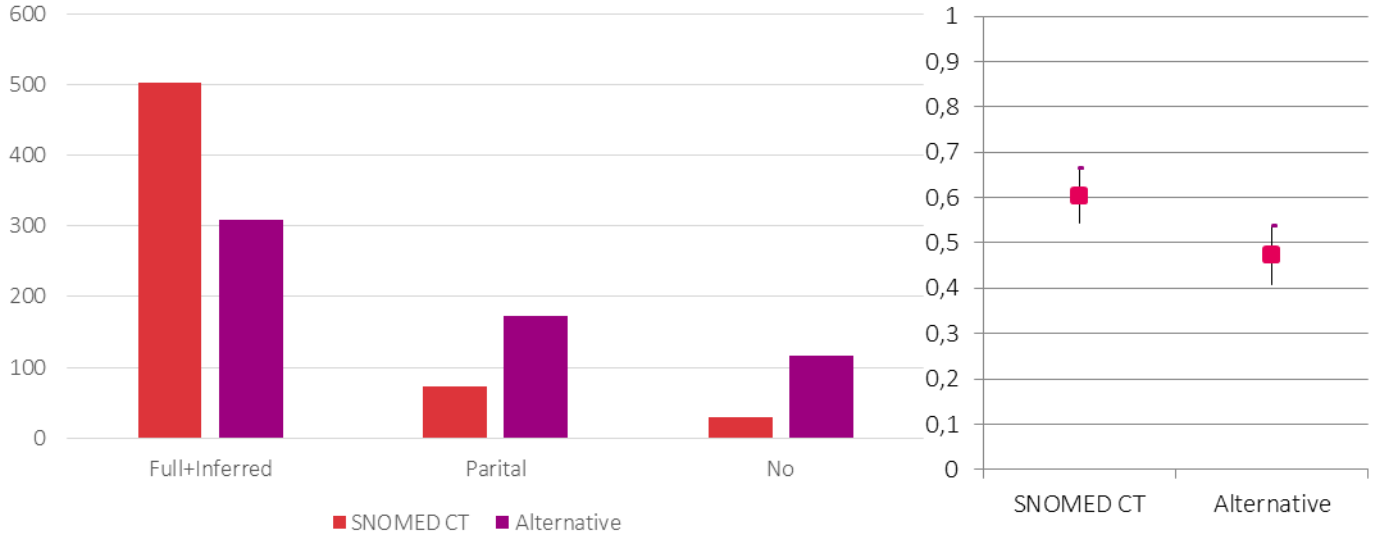
Annotating clinical models

Annotating clinical models

- End points
  - Content coverage
  - Inter-annotator agreement
- Material / Methods
  - 12 information models extracts, 101 elements
  - Full SNOMED CT
  - Set of ICD-10, ATC, LOINC, and MeSH
  - 6 participants from 6 countries (5 EU + US)



Comparison SNOMED CT vs. Alternative



Krippendorff's α
(95% CI)

SNOMED CT
0.61 (0.55-0.66)

Alternative
0.47 (0.41-0.54)

- Small agreement on coverage assessment (ISO TR 12300)
- Difference agreement only after basic quality control

Annotating clinical narratives

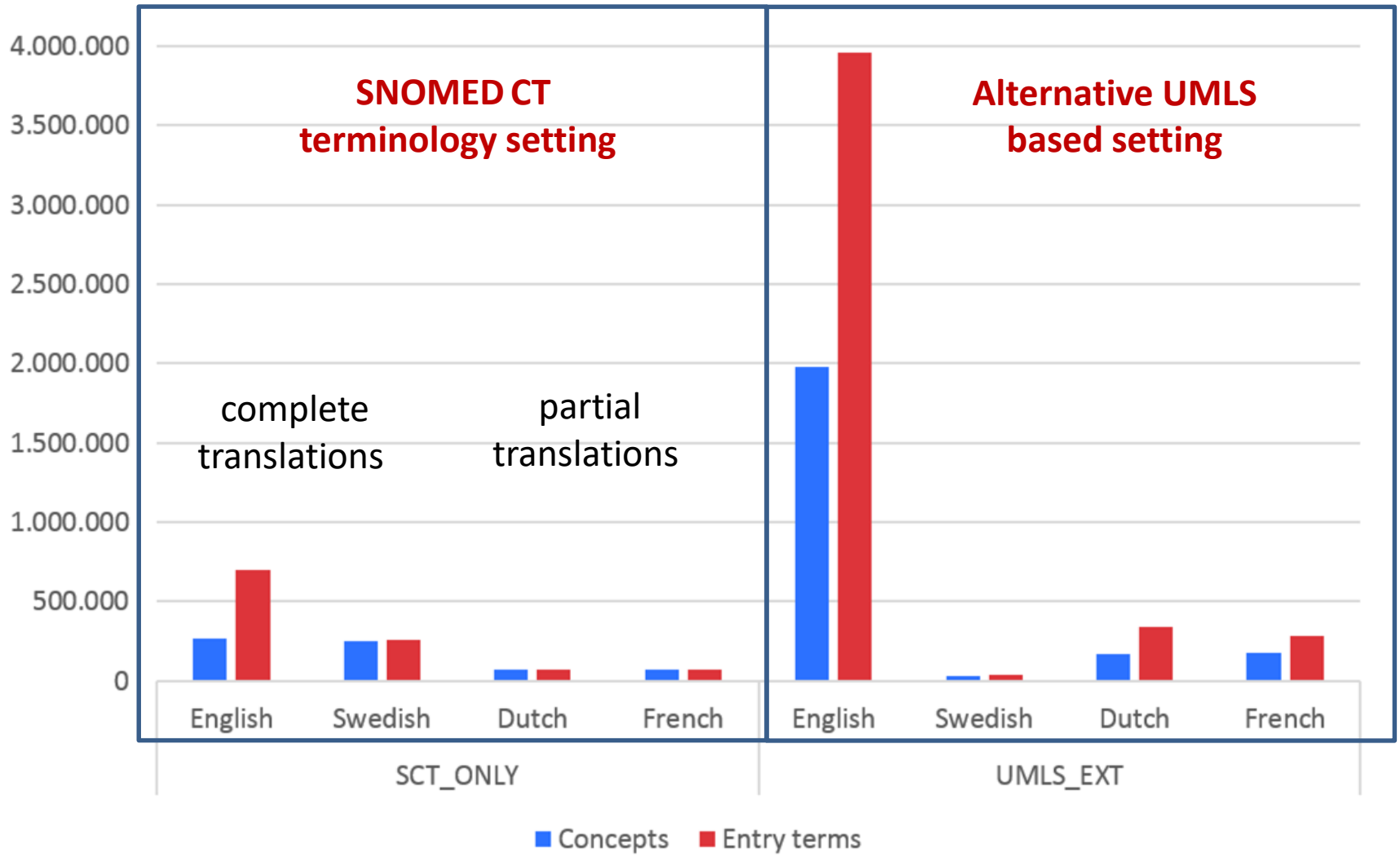
- End points
  - Content coverage → reference terminology
  - Inter-annotator agreement → reference terminology
  - Term coverage → user interface terminology
- Material / Methods
  - Parallel corpus of 60 clinical text samples in 6 languages

Dutch	English	Finnish	French	German	Swedish
Echo nieren Enige dilatatie van pyelum en calyces linker nier, passend bij milde hydronefrose links. Linker ureter niet evident verwijd. Rechter nier: geen bijzonderheden. X-buikoverzicht Foto goed beoordeelbaar, goede belichting. Wat gas in de darmen. Linker nier is licht vergroot. Concrement van 1.5 x 0.5 cm mediodistaal van linker nier t.h.v. L3 passend bij proximale (ureter)steen links. IVP (negatieve score indien aangevraagd) Foto goed beoordeelbaar. Goede belichting. Geen afwijkingen aan bot of weke delen.	Kidney ultrasound Certain dilatation of renal pelvis and calices of the left kidney, matching mild hydronephrosis on the left side. Left ureter not clearly dilated. Right kidney: normal. Abdominal x-ray Image easily assessable, good lighting. Some gas in the bowels. Left kidney is slightly enlarged. Concrement to 1.5 x 0.5 cm mediodistal of the left kidney on level L3 matching proximal (ureteral) calculus on the left. IVP (negative experience when requested) Image easily assessable. Good lighting. No abnormalities of bone or soft tissue.	Munuaisten ultraääni Vasemman munuaisen pyelonin ja maljan tietty dilataatio, mikä sopii vasemman puolen lievään hydronefroosiin. Vasen virtsanjohdin ei ilmeisesti laajentunut. Oikea munuainen: ei mitään huomiota herättävää.Röntgen-katsaus vatsasta Kuva helposti arvosteltavissa, hyvä valaistus. Vähän kaasua suolessa. Vasen munuainen on hieman suurentunut. 1.5 x 0.5 cm kokoinen konkrementti mediodistaalisesti vasempaan munuaiseen nähden korkeudella L3 sopien vasemman puoleiseen proksimaaliseen (ureter-)kiveen. IVP (negatiivinen tulos, jos vaaditaan) Kuva helposti arvosteltavissa. Hyvä valaistus. Ei poikkeamia luissa eikä pehmytosissa.	Ultrason des reins Certaine dilatation de pyélon et calices du rein gauche, assortie à la légère hydronéphrose à gauche. Uretère gauche n'est pas manifestement élargi. Rein droit: aucune particularité. Vue d'ensemble du ventre aux rayons X Image bien interprétable, bon éclairage. Un peu de gaz dans l'intestin. Rein gauche légèrement agrandi. Concrétion de 1.5 x 0.5 cm médiodistal du rein gauche à la hauteur de L3 assortie au calcul proximal (d'uretère) à gauche. UIV (résultat négatif, sur demande) Image bien interprétable, bon éclairage. Pas de divergences des os ou tissus mous.	Ultraschall der Nieren Gewisse Dilatation von Pyelon und Kelchen der linken Niere, passend zur milden Hydronephrose links. Linker Harnleiter nicht offensichtlich erweitert. Rechte Niere: keine Auffälligkeiten.Röntgen-Abdomenübersicht Bild gut beurteilbar, gute Beleuchtung. Etwas Gas im Darm. Linke Niere ist leicht vergrößert. Konkrement zu 1.5 x 0.5 cm mediodistal der linken Niere auf Höhe von L3 passend zu proximalem (Ureter-)Stein links. IVP (negatives Ergebnis, wenn angefordert) Bild gut beurteilbar. Gute Beleuchtung. Keine Abweichungen an Knochen oder Weichteilen.	Ultraljudsundersökning av njurarna Viss dilatation av pyelon och kalkar på vänster njure, verkar vara mild vänstersidig hydronefros. Vänster urinledare är inte synbart vidgad. Höger njure: inget anmärkningsvärt. Röngten av buk Bild är lätt att bedöma, bra belysning. Lite gas i tarmen. Vänster njure är en aning förstorad. Konkrement på 1,5 x 0,5 cm mediodistal på vänster njure med höjden L3 vilket tyder på proximal vänstersidig (ureter-)sten. IVP (negativt resultat, om det krävs) Bild lätt att bedöma. Bra belysning. Inga avvikelser vad gäller ben eller mjukdelar.

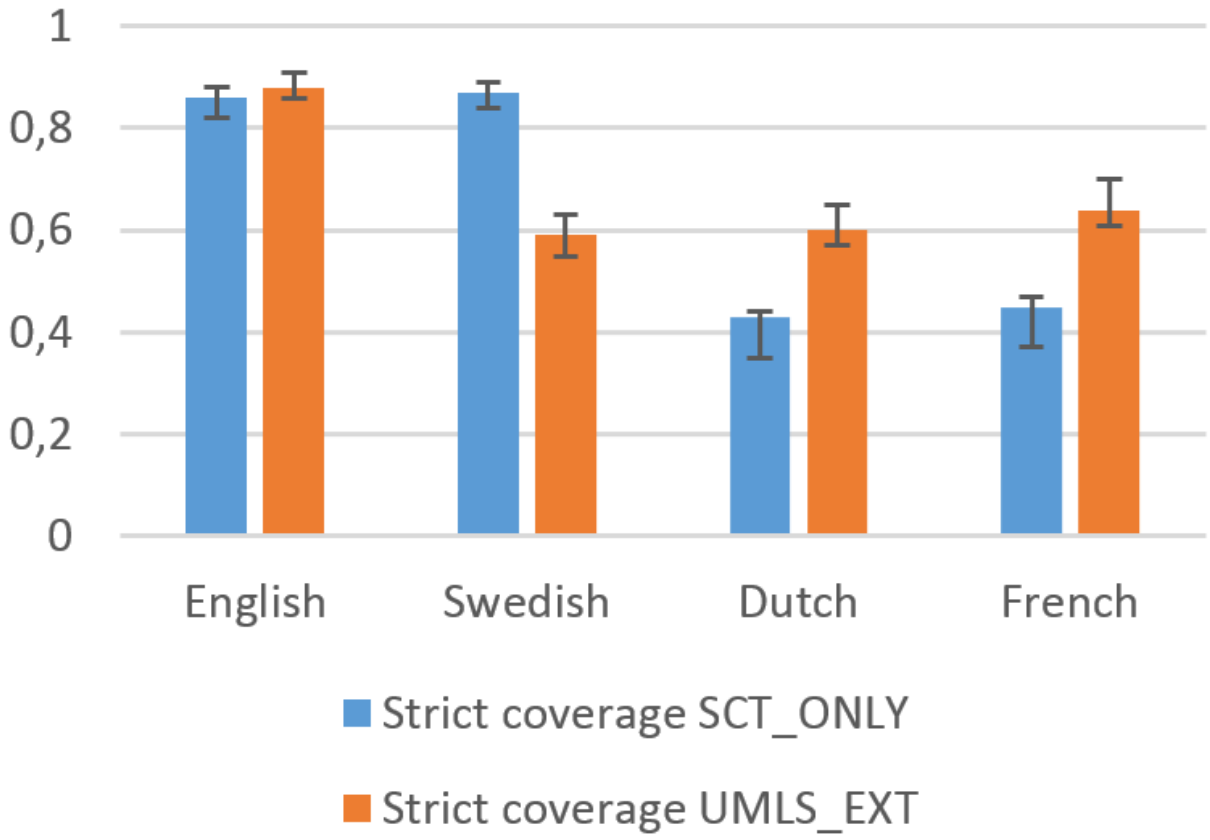
Annotating clinical narratives

- End points
  - Content coverage → reference terminology
  - Inter-annotator agreement → reference terminology
  - Term coverage → user interface terminology
- Material / Methods
  - Parallel corpus of 60 clinical text samples in 6 languages
    - representing clinical specialties, document types, text sections
  - 2 human annotators per language
- Three terminology settings compared
  - SNOMED CT (English, Swedish, French,)
  - A compilation of international terminologies
    - extended subset of UMLS for text annotation
  - A local scenario with German language terminologies

Content in SNOMED CT vs. Alternative



Manual Annotation : concept coverage



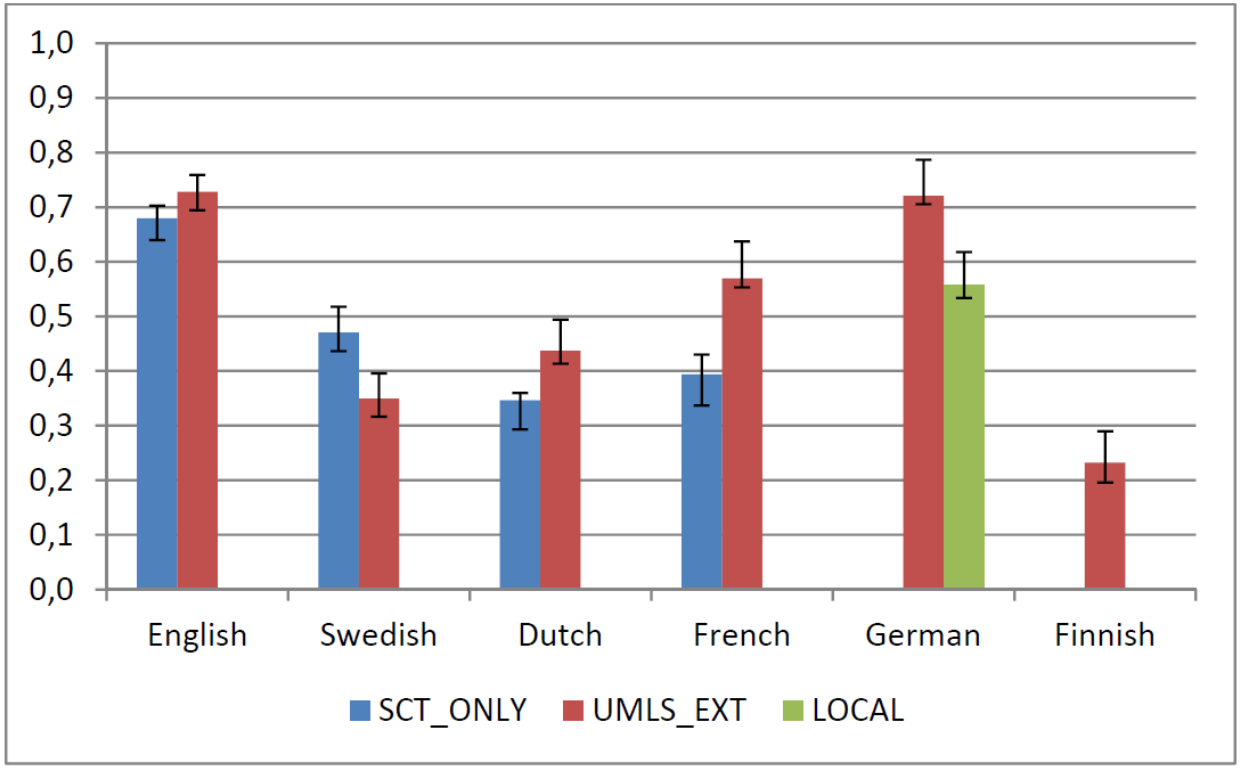
- English: no significant difference in measured concept coverage
- Swedish equals English for concept coverage
- French / Dutch: incomplete SNOMED CT translation shows significant impact in concept coverage; more resources in alternative

Concept annotation: inter-annotator agreement

Krippendorff's Alpha	SCT ONLY	UMLS EXT
English	0.40	0.40
Swedish	0.35	0.41
Dutch	0.37	0.45
French	0.31	0.30

- Fair agreement values
- Swedish better agreement for alternative scenario (however with much less coverage)
- French / Dutch: incomplete SNOMED CT translation: no good performance compared to alternative

Manual Annotation : term coverage



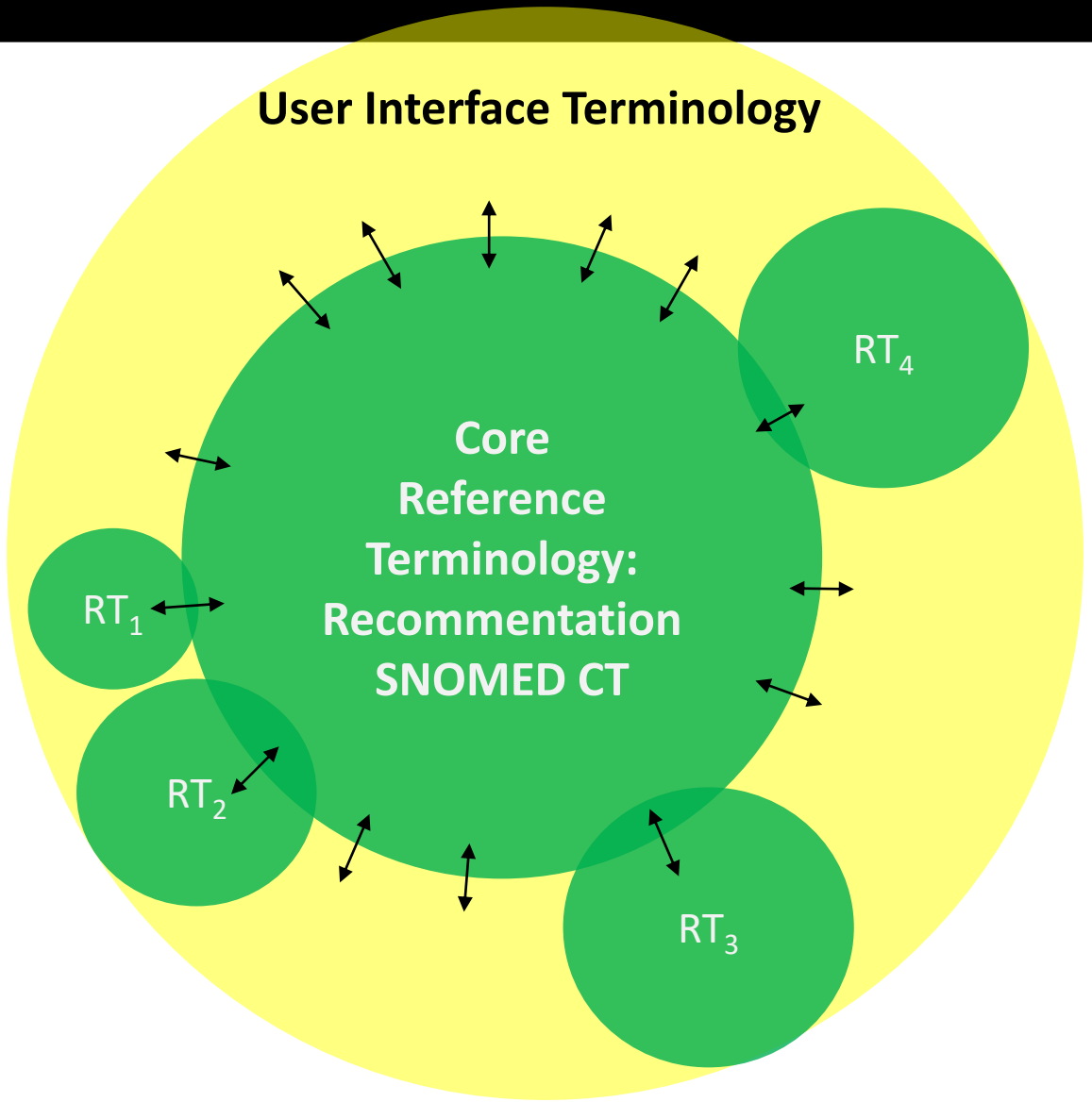
- Only English SNOMED provides an acceptable coverage of user interface terms
- Fully specified terms only (like in Swedish SNOMED version): less than 50% coverage
- Existing terminologies: many interface terms for French
- German as an example for good coverage with alternative international terminologies
- Finnish as opposing example (typical for small European languages)

Machine annotation (NLP)

- Heterogeneous results
- Most reportable:
  - NLP reaches
    68% of the human performance in UMLS_ONLY
    79% in the SNOMED CT scenario
    90% in the abstain scenario
    (averaged over all six languages)

Summary

- Suitability of SNOMED CT as reference terminology:
  - for English: comparable to alternative
  - for Swedish: better than alternative
- Inter-annotator agreement
  - needs improvement (multiple strategies), not specific to SNOMED CT annotations
- Partial localisations of SNOMED CT
  - not convincing results
- SNOMED CT as source for interface terms
  - only for English, not ideal
  - Recommendation: interface terminology aspects (synonyms, short forms) to be addressed by separate terminologies, linked to reference terminology


User Interface Terminology
Core
Reference
Terminology:
Recommentation
SNOMED CT
RT1
RT2
RT3
RT4

- Thank you!
- Contact:
  - Daniel Karlsson
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  - Stefan Schulz
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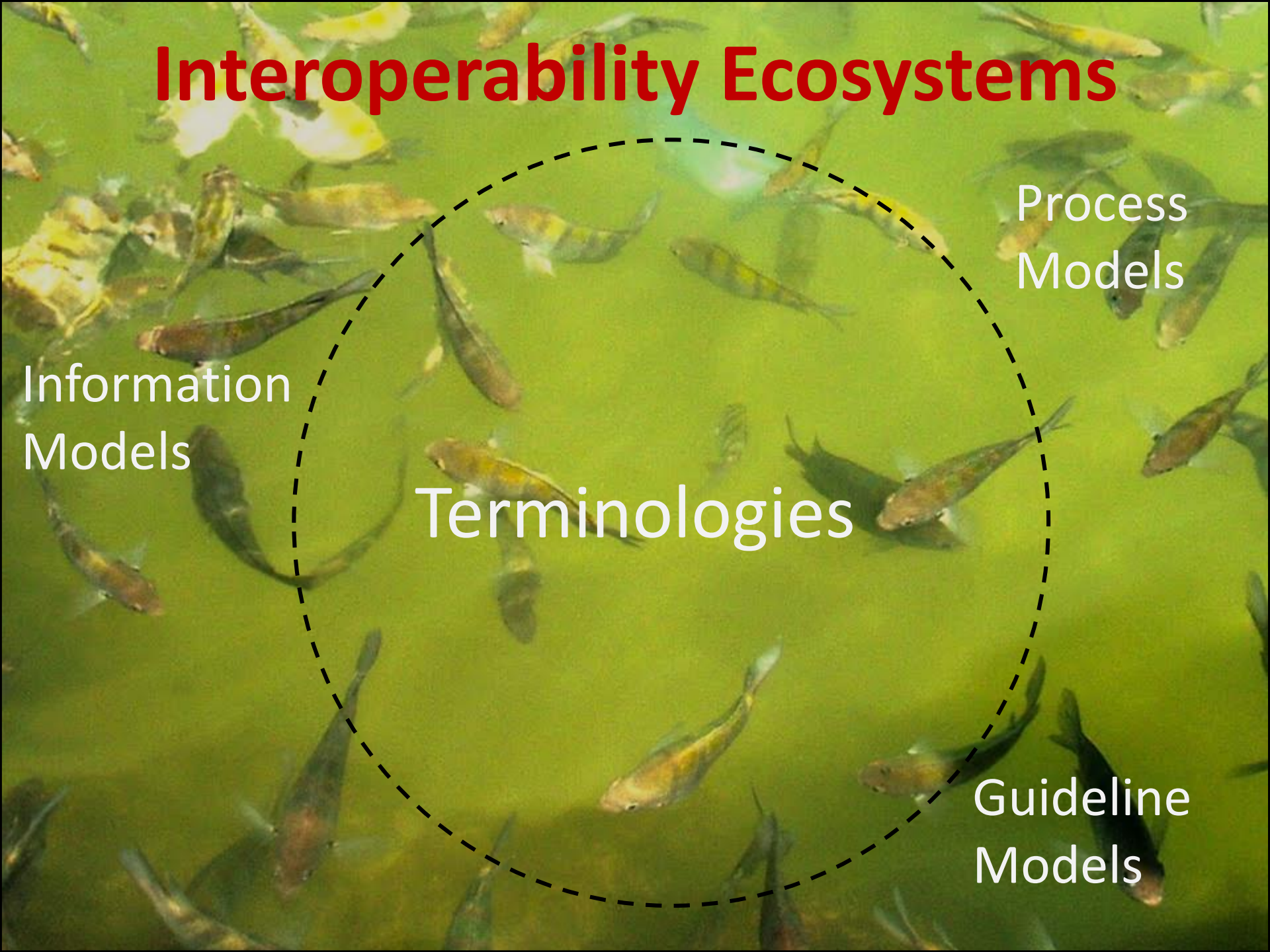
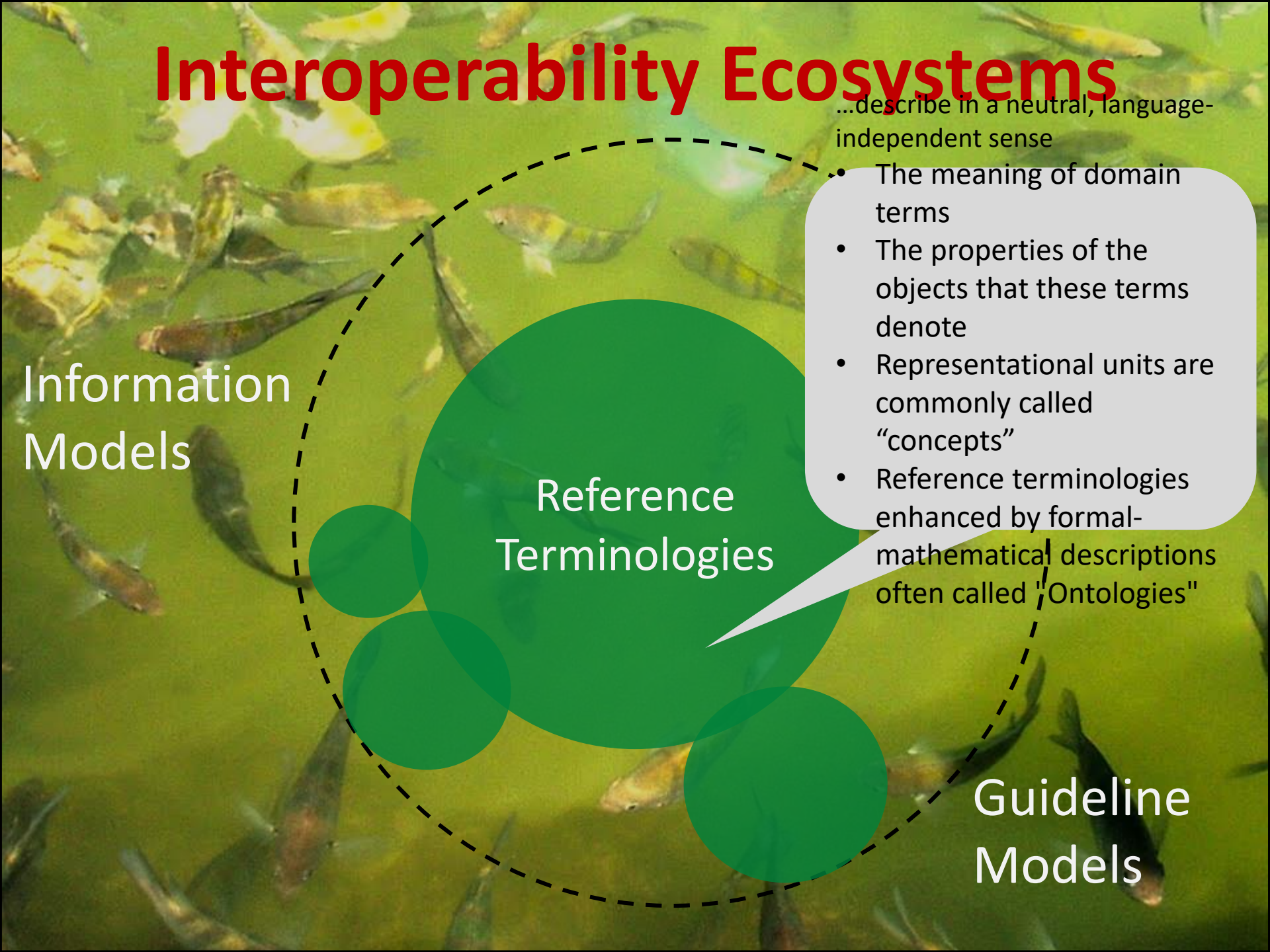

Interoperability Ecosystems
Process Models
Information Models
Terminologies
Guideline Models

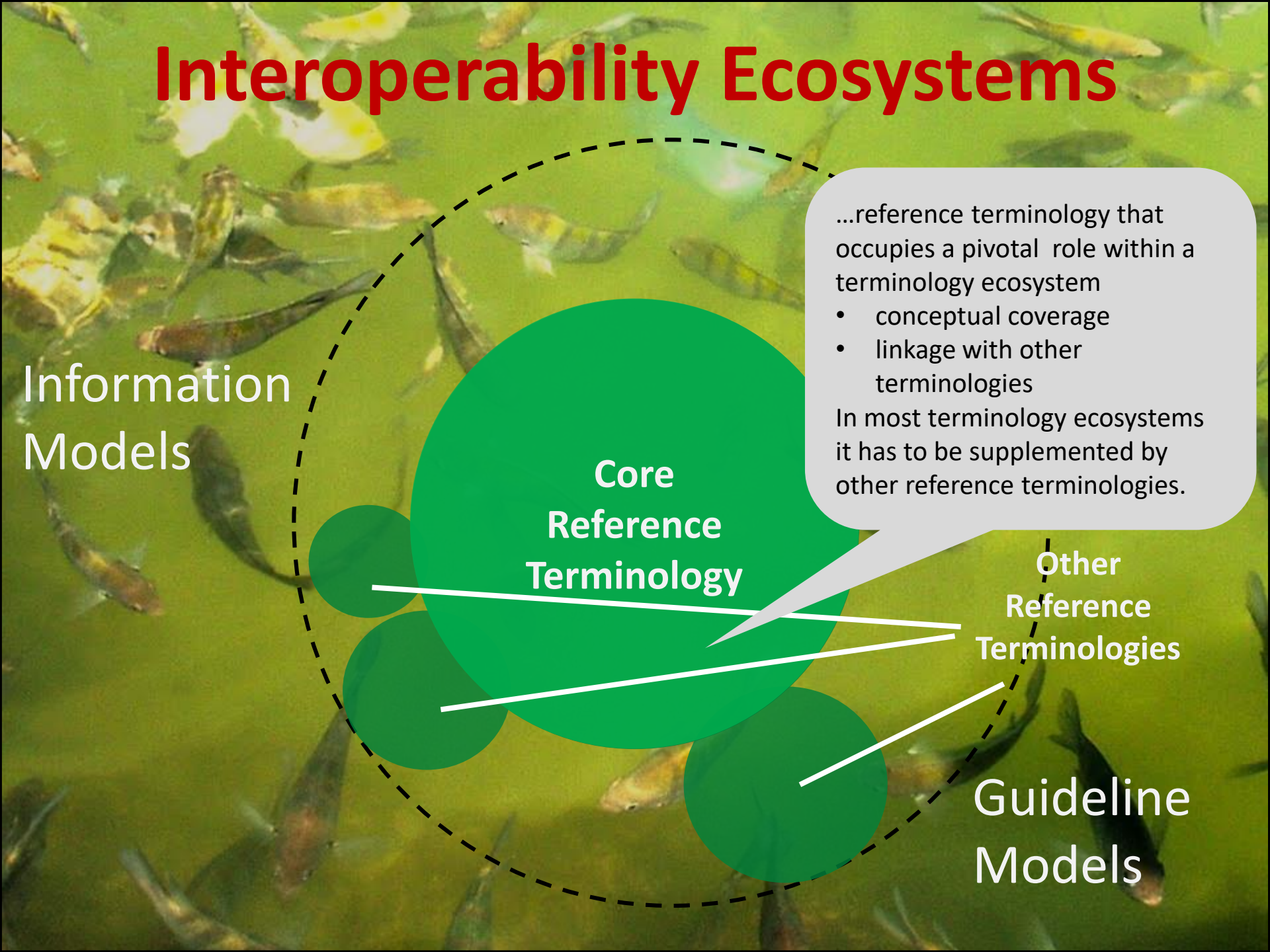
Interoperability Ecosystems



…describe in a neutral, language-independent sense

- The meaning of domain terms
- The properties of the objects that these terms denote
- Representational units are commonly called “concepts”
- Reference terminologies enhanced by formal-mathematical descriptions often called "Ontologies"

Interoperability Ecosystems

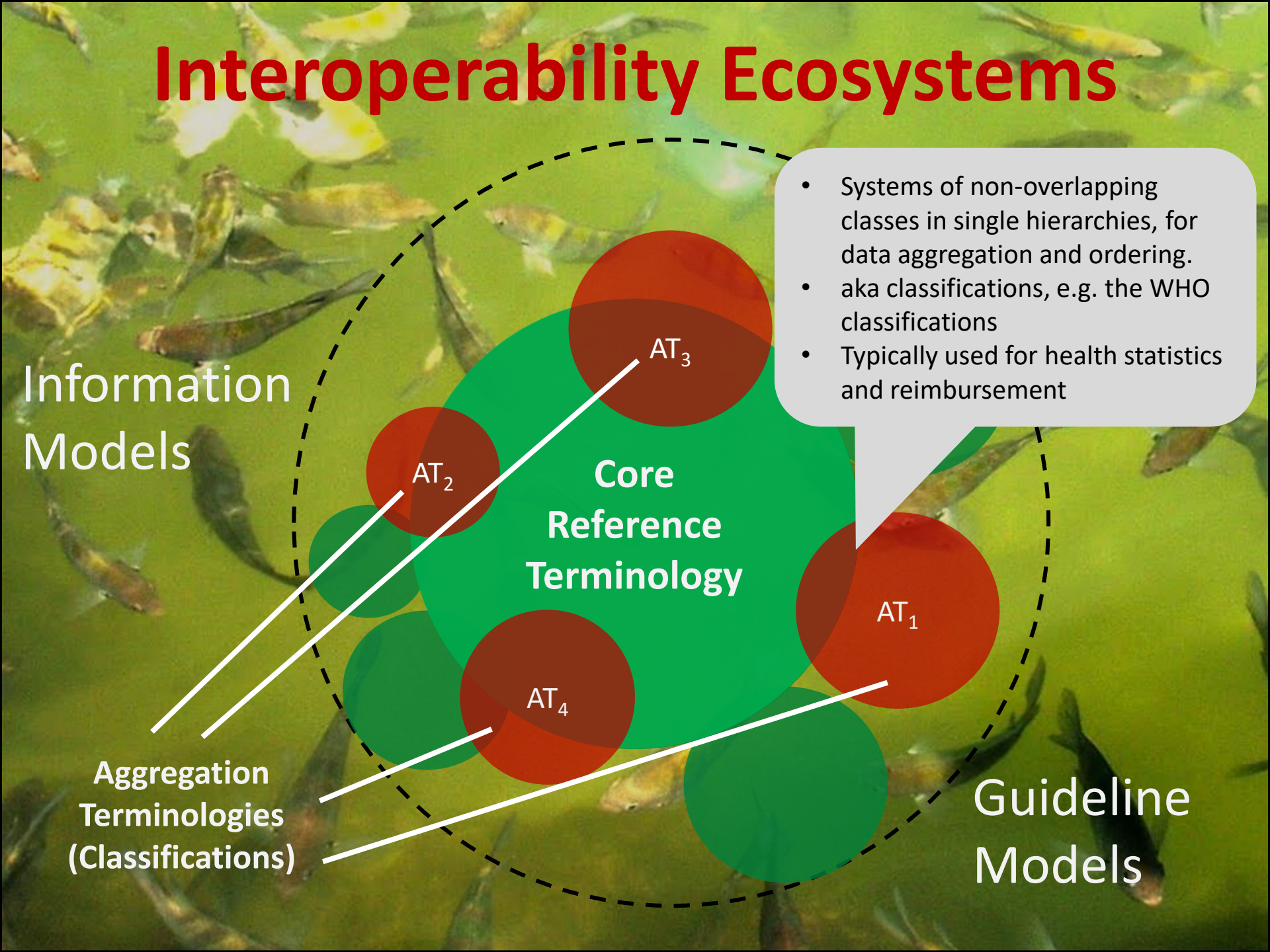


…reference terminology that occupies a pivotal role within a terminology ecosystem

- conceptual coverage
- linkage with other terminologies

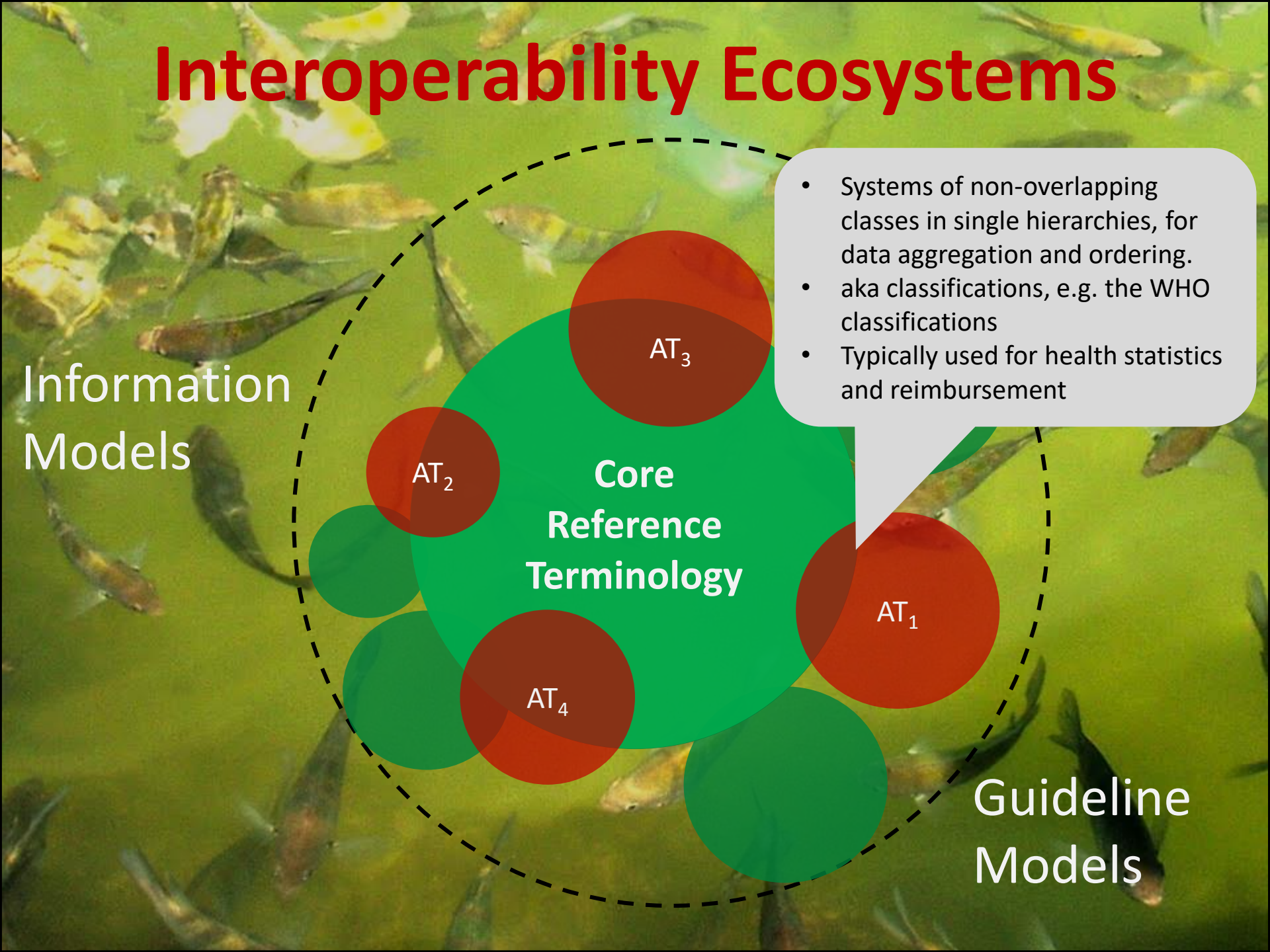
In most terminology ecosystems it has to be supplemented by other reference terminologies.

Interoperability Ecosystems



- Systems of non-overlapping classes in single hierarchies, for data aggregation and ordering.
- aka classifications, e.g. the WHO classifications
- Typically used for health statistics and reimbursement

Interoperability Ecosystems



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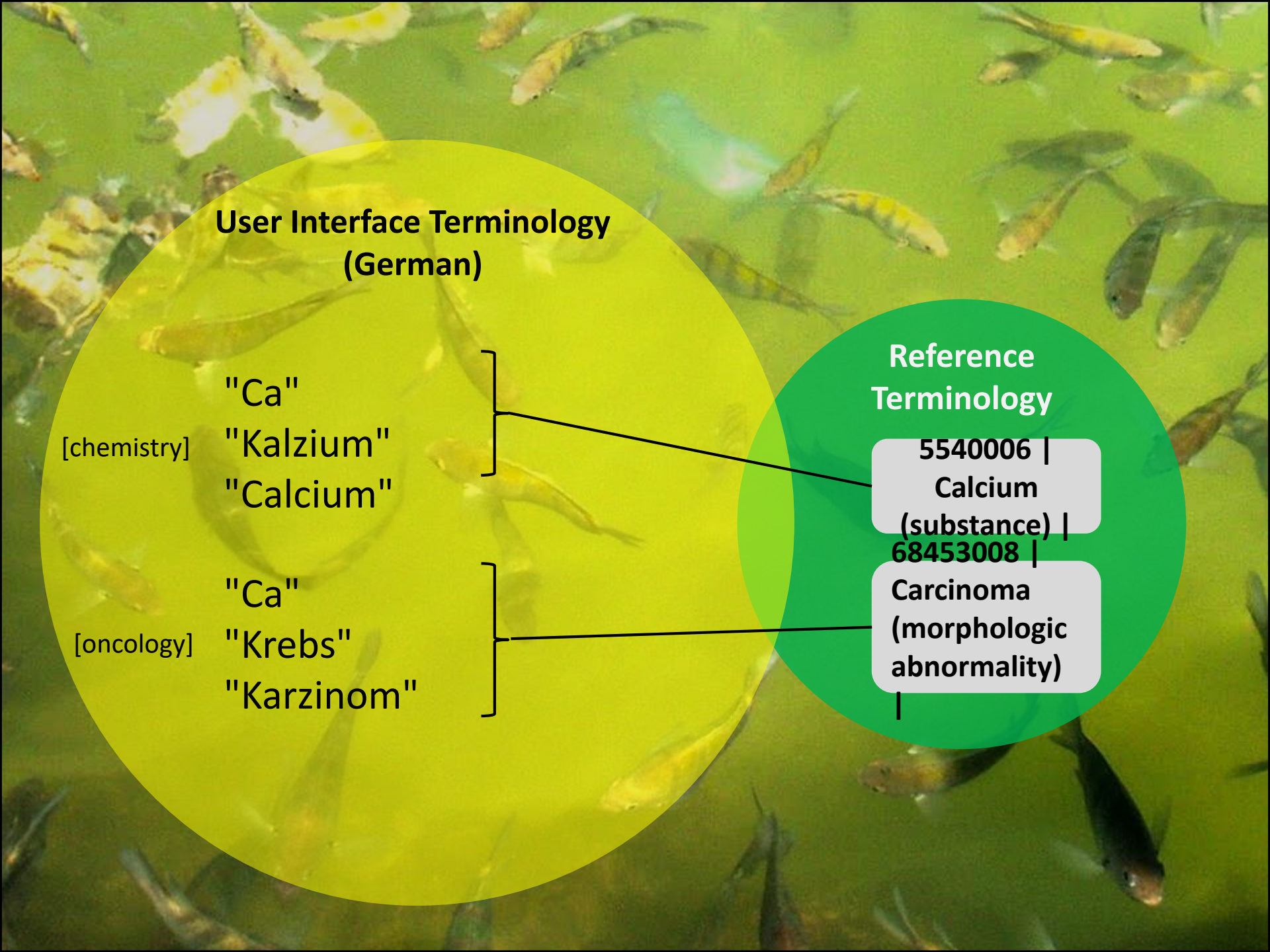
Interoperability Ecosystems

- Collections of terms used in written and oral communication within a group of users
- Terms often ambiguous.
- Entries in user interface terminologies to be further specified by language, dialect, time, sub(domain), user group.

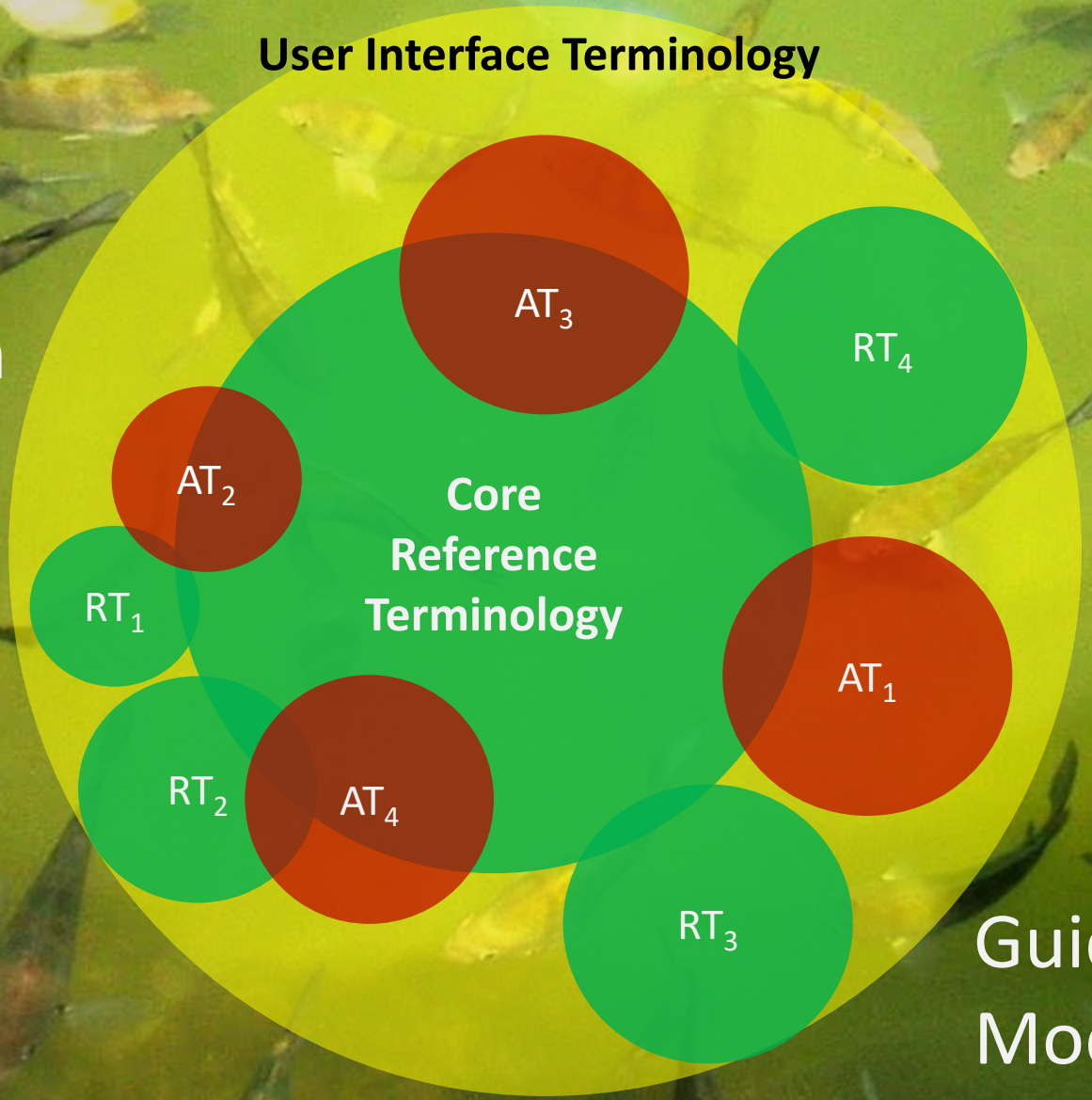
Information Models

User Interface Terminology (language specific)

Guideline Models


User Interface Terminology (German)
"Ca"
[chemistry] "Kalzium"
"Calcium"
"Ca"
[oncology] "Krebs"
"Karzinom"
Reference Terminology
5540006 | Calcium (substance) |
68453008 | Carcinoma (morphologic abnormality) |

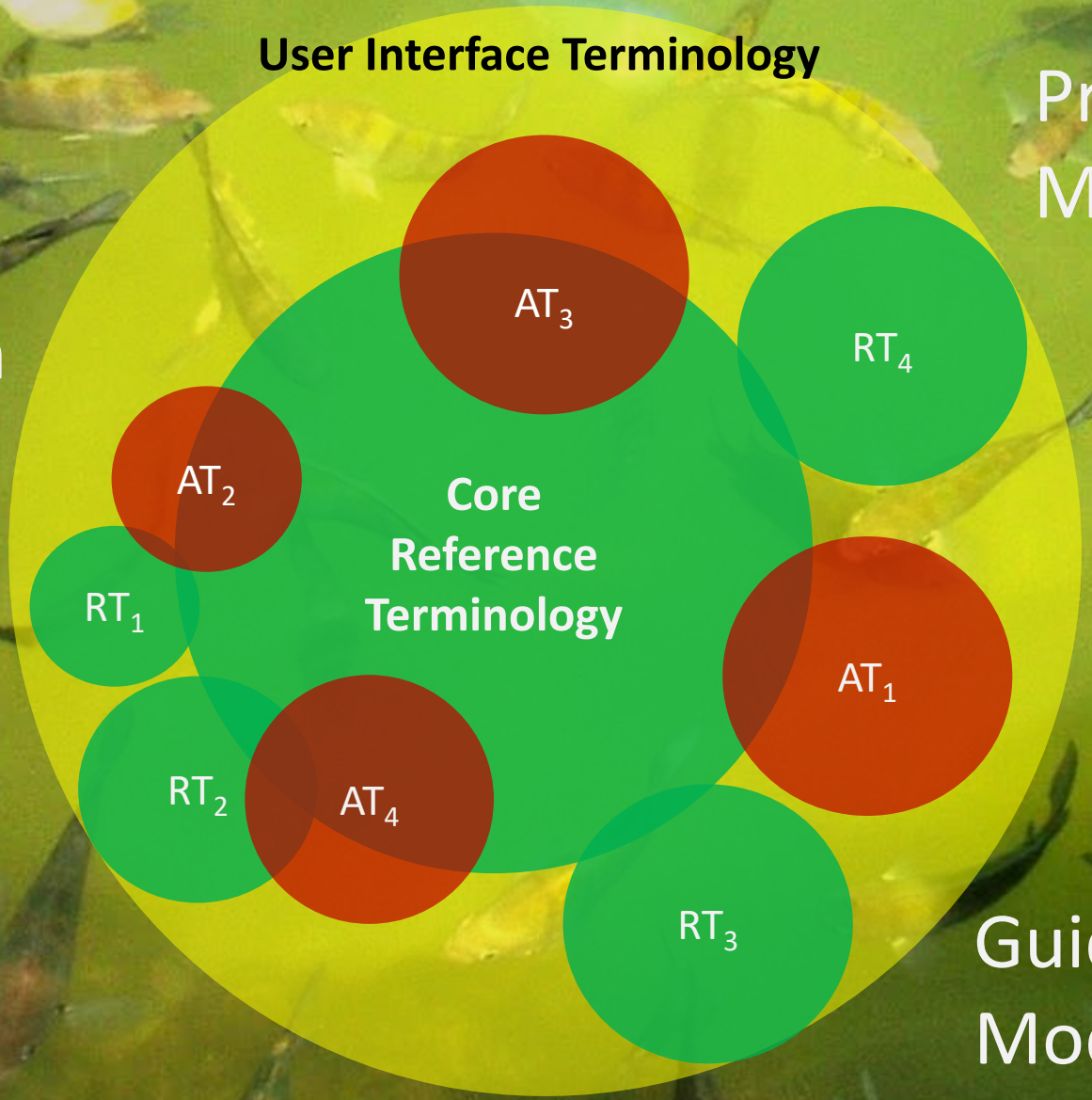
Interoperability Ecosystems



Information Models

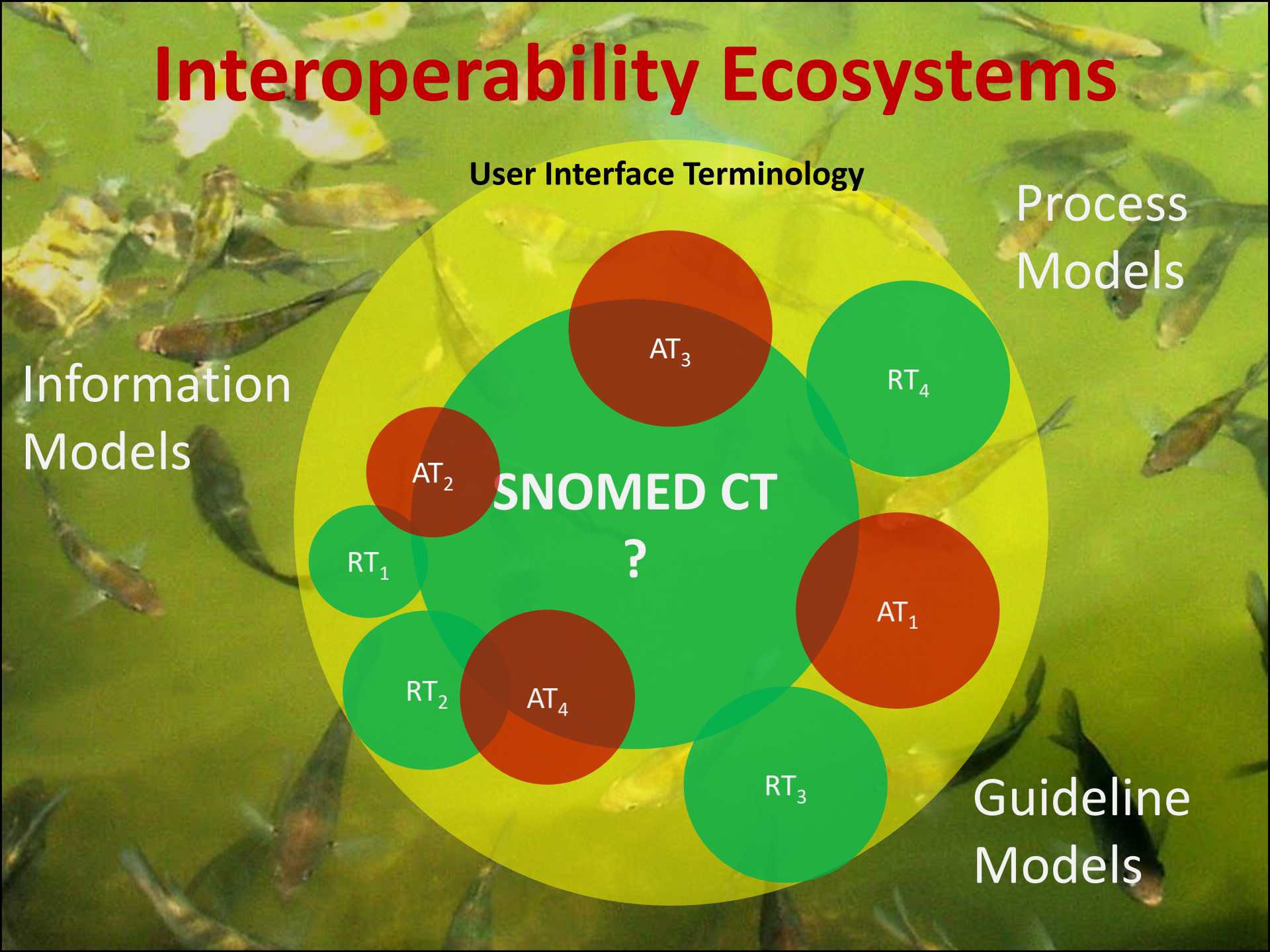
Guideline Models

Interoperability Ecosystems



Process Models

Information Models

Guideline Models

Interoperability Ecosystems