



Comparing the Yosemite Project and ONC Roadmaps for Healthcare Information Interoperability

David Booth, PhD

**Yosemite Project Steering Committee
Rancho BioSciences, LLC
Hawaii Resource Group, LLC**

These slides: <http://dbooth.org/2015/onc/>

<http://YosemiteProject.org/>

Outline

- Yosemite Project roadmap
- ONC roadmap
- Comparison
- Q&A

Imagine a world

Imagine a world

in which **all healthcare systems**

speak the **same language**

with the **same meanings**

covering **all healthcare.**

Healthcare today



Tower of Babel, Abel Grimmer (1570-1619)



REPORT TO THE PRESIDENT
REALIZING THE FULL POTENTIAL OF
HEALTH INFORMATION TECHNOLOGY
TO IMPROVE HEALTHCARE
FOR AMERICANS:
THE PATH FORWARD

Executive Office of the President
President's Council of Advisors
on Science and Technology

December 2010



*"PCAST has also concluded that to achieve these objectives it is crucial that the Federal Government facilitate the nationwide adoption of a **universal exchange language** for healthcare information"*



2013 Workshop on "RDF as a Universal Healthcare Exchange Language"

The screenshot shows a Mozilla Firefox browser window displaying the Semantic Technology & Business Conference website. The page title is "RDF as a Universal Healthcare Exchange Language - Mozilla Firefox". The URL is "http://semtechbiz2013.semanticweb.com/sessionPop.cfm?confid=708&proposolid=5326". The main header features the "SEMANTIC TECHNOLOGY & BUSINESS CONFERENCE" logo and the dates "June 2-5, 2013 · San Francisco". Below the header, the workshop title "RDF as a Universal Healthcare Exchange Language" is displayed. A sidebar on the left lists the speakers: David Booth (Senior Software Architect, KnowMED), Stanley M. Huff (Chief Medical Informatics Officer, Intermountain Healthcare), Josh C. Mandel (Research Faculty, Children's Hospital Informatics Program at Harvard-MIT), Emory Fry (Founder, Chief Medical Informatics Officer, Cognitive Medical Systems), and Conor Dowling (CTO, Ceregraf). The main content area includes a "Share this Session:" link with social media icons, the date "Wednesday, June 5, 2013", the time "01:00 PM - 02:00 PM", the level "Business/Strategic", and the location "Imperial A". The text describes the challenges of healthcare information exchange and the role of RDF in addressing these challenges, referencing the PCAST report and the benefits of semantic interoperability.

- 32 participants
- Ended up creating the *Yosemite Manifesto* . . .



Yosemite Manifesto

on RDF as a Universal Healthcare Exchange Language

- 1. RDF is the best available candidate for a universal healthcare exchange language.*
- 2. Electronic healthcare information should be exchanged in a format that either: (a) is an RDF format directly; or (b) has a standard mapping to RDF.*
- 3. Existing standard healthcare vocabularies, data models and exchange languages should be leveraged by defining standard mappings to RDF, and any new standards should have RDF representations.*
- 4. Government agencies should mandate or incentivize the use of RDF as a universal healthcare exchange language.*
- 5. Exchanged healthcare information should be self-describing, using Linked Data principles, so that each concept URI is de-referenceable to its free and open definition.*



Yosemite Manifesto

on RDF as a Universal Healthcare Exchange Language

1. RDF is the best available candidate for a universal healthcare exchange language.
2. Electronic healthcare information should be exchanged in a format that either: (a) is an RDF format directly; or (b) has a standard mapping to RDF.

3. Existing standards should be leveraged and new standards should have a standard mapping to RDF.

4. Government and non-government healthcare entities should exchange information in a standard format.

5. Exchange standards should be based on principles, standards, and best practices.

"1. RDF is the best available candidate for a universal healthcare exchange language."

Supporters

1. David Booth, Ph.D., KnowMED, Inc.
2. Charlie Mead, M.D., MSc., Octo Consulting Group
3. Tracy Allison Altman, Ph.D., PepperSlice
4. Michel Dumontier, Associate Professor of Bioinformatics, Carleton University
5. Rafael Richards MD MS, Johns Hopkins School of Medicine
6. Stanley M. Huff, MD, CMIO Intermountain Healthcare
7. Olivier Curé, PhD, UPEM France
8. Emory Fry, MD, Cognitive Medical Systems
9. Karl Seiler, CEO and founder NIMO Health, a Modus Operandi, Inc. Business
10. Erick Von Schweber, Executive Co-chair SURVEYOR health "Endorses RDF as a universal exchange framework"
11. Tom Munnecke, Independent Consultant
12. Thomas J. Kelly, PMT, Cognizant Technology Solutions
13. Dean Allemang, PhD, Working Ontologist LLC
14. Erich A. Gombocz, CSO, IO Informatics, Inc.
15. Blair Myers, Sr. Enterprise Information Architect, STA Group, LLC
16. Hans Constandt, CEO ONTOFORCE, Gent (Belgium)
17. Dave McComb, Semantic Arts
18. Manuel Wahle, Dipl.-Inform. MS, The University of Texas Health Science Center at Houston
19. Michael Erdmann, PhD, DIQA GmbH (Germany)

20. Kerstin Forsberg, Principal Informatics Scientist, AstraZeneca
21. Niklas Lindström, senior developer, National Library of Sweden
22. Mark Montgomery, Founder & CEO, Kyield
23. Karl Reti, CEO, Crosslink Software
24. David L. Woolfenden President, eVectis Technologies LLC
25. Matthew Vagnoni, MS, CTO KnowMED.com
26. Christopher Regan
27. Doug Burke, President, Cognitive Medical Systems
28. Jerry Scott, Emcee Partners LLC
29. Rick Pope, Cognitive Medical Systems
30. Charles B. Owen, MD, CMIO, Afoundria
31. Conor Dowling, CTO, Caregraf
32. James McCusker, Yale University
33. Cartik Kothari, PhD, CEO, Perfect Informatics, IN/DIA
34. Carl Matlocks, Founder, Wellness Intelligence Institute
35. Lee Feigenbaum, VP and Founder, Cambridge Semantics
36. Jamie Ferguson, VP Health IT Policy, Kaiser Permanente.
37. Christian Seppa, Senior Developer, Squishymedia Inc.
38. Dr. Matthias Samwald, Medical University of Vienna
39. Michael Uschold, PhD, Senior Ontology Consultant, Semantic Arts, USA
40. Jon McBride, BACS, MBA, CIO
41. Kathrin Dentler, PhD student, VU University Amsterdam & University of Amsterdam
42. Claude Nijmjo, MA MPH, Zynex Health Inc
43. Murray Bent, e-researcher
44. Pedro Lopes, PhD, University of Aveiro
45. Sibi Jacob, Senior Information Analyst, Ramsay Healthcare
46. Carlton Northern, Senior Software Engineer, The MPTRE Corporation
47. Michael Denny, PhD, ontology consultant
48. Robert Stanley, CEO, IO Informatics
49. Renato Iannella, PhD, Semantic Identity
50. Junice Kite MBB, MEd, A.I.M. Consulting Ltd, UK
51. Jeff Niman, co-founder, Ugly Research
52. Stephanie Jellali, CTO, smartKalen LLC
53. Frank van Harmelen, Prof., VU University Amsterdam

54. Tim Finin, Professor, University of Maryland, Baltimore County
55. François Schaffré, Maître de conférences, Université Montpellier 2
56. Varish Mulkwad, PhD candidate, Computer Science, UMRBC
57. Deborah M Cooper, Principal, Deborah M Cooper Consulting LLC
58. Joana S. Luciano, BSc MSc PhD, Research Associate Professor, Agnèsard Polytechnic Institute, President, Predictive Medicine, Inc.
59. M. Scott Marshall, PhD, MARSIPRO Clinic, Maastricht, The Netherlands
60. Xalina Bontcheva, PhD, University of Sheffield
61. Alan Rasmberg, Director of Data Warehouse at Institute for Health Informatics, University at Buffalo
62. Dan Brickley, Google
63. Kristina Rumar Kjøgl, MS, KnowMED Incorporated.
64. Sergey Krikov MS, University of Utah
65. Shelly Kulesza, Project Manager, KnowMED
66. Sofia T. Amiri, MEd, MS, KnowMED Inc.
67. Xoy Medical, healthcare software
68. Mary Dee Harris, PhD, independent consultant
69. David Cesar, PhD, University of Aberdeen, UK
70. Christophe Lambert, PhD, Golden Medix Inc.
71. Javier Fernandez Iglesias, Independent Consultant, Spain
72. Paolo Ciccarelli, MS PhD, Harvard Medical School
73. Francis Bellan, PhD, PhD, Harvard Medical School
74. Michael Kiper, MD, MD, Radcom Cancer Center
75. Mikael, qph Ltd
76. Foster Carr, MD, Sciencelink.com
77. Sjoegan Tiddens, MPhil, MSc
78. Silvia Waga, MD, IT Project Manager, Scientific Society of General Medicine - Belgium
79. Markus Schneider, Healthcare Data Analyst
80. Ted Slater, CTO, OpenHCL Consortium
81. Lucian Ionescu, CTO, HCL Group
82. Andrea Ispoglanti, director, intelligiinf
83. RJ Harris, The US, The Consortium
84. Eran Schiffer, Switzerland, independent consultant
85. Erik Brown, MSc., Sony World University
86. Alan T. Kuhl, MD, PhD, FRCR, FRCR (1982-2009)
87. Ailing Kapur, McMaster University
88. David Murali, Murali Computing
89. Sachin Kumar, PhD, Stanford University
90. Marc Tringali, MEd, PhD, Agile Healthcare N/A
91. Stuart Turner, PhD, MS, Logical Informatics
92. Hong Sun, PhD, Agile Healthcare
93. Ankita Zappa, PhD, PhD, PhD at NCI Gateway - The Centre for Data Analytics
94. Yoshinori Kamezaki, MD, PhD
95. Barry Kelson, Original Architect of QJGEL
96. Graham Hughes, MD, PhD, Australia
97. Suresh Arundani, MD, MS, ONCOLOGY
98. Sarah Bates, MS, Belgium
99. Sebastian Muegel, Bioinformatics, Study University
100. Benedikt Wittenberg, Research Associate, Karlsruhe Institute of Technology, Germany
101. Brian Nove, CTO, Ringier Technology LLC
102. Stefan Döcker, PhD, MARSIPRO Clinic
103. Sébastien Lefebvre, PhD, Health Entrepreneur & Developer
104. Marcelo Bay, PhD, Federal University of Minas Gerais - Brazil
105. Natalia Dias Rodrigues, M. Sc., Philips Research
106. A.D. Paul, PhD, ONCOLOGY

- 100+ signatures at <http://YosemiteManifesto.org/>
- Led to Yosemite Project in 2014

The Yosemite Project

MISSION:

*Semantic interoperability
of
all structured healthcare information*

STRATEGY:

*RDF as a
universal information representation*

What is RDF?

- W3C standard
- Captures information content independent of data format



Different source formats, same RDF

HL7 v2.x

```
OBX|1|CE|3727-0^BPsystolic,  
sitting||120||mmHg|
```

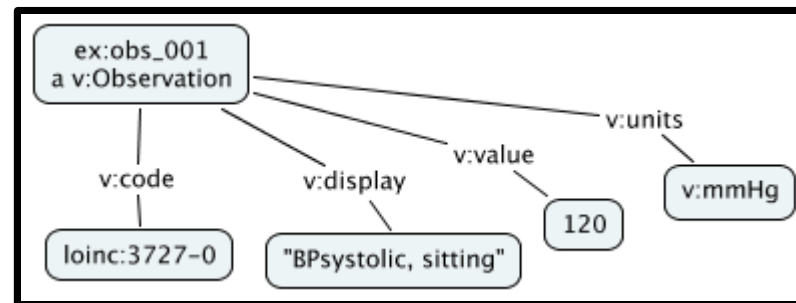
FHIR

```
<Observation  
  xmlns="http://hl7.org/fhir">  
  <system value="http://loinc.org"/>  
  <code value="3727-0"/>  
  <display value="BPsystolic, sitting"/>  
  <value value="120"/>  
  <units value="mmHg"/>  
</Observation>
```

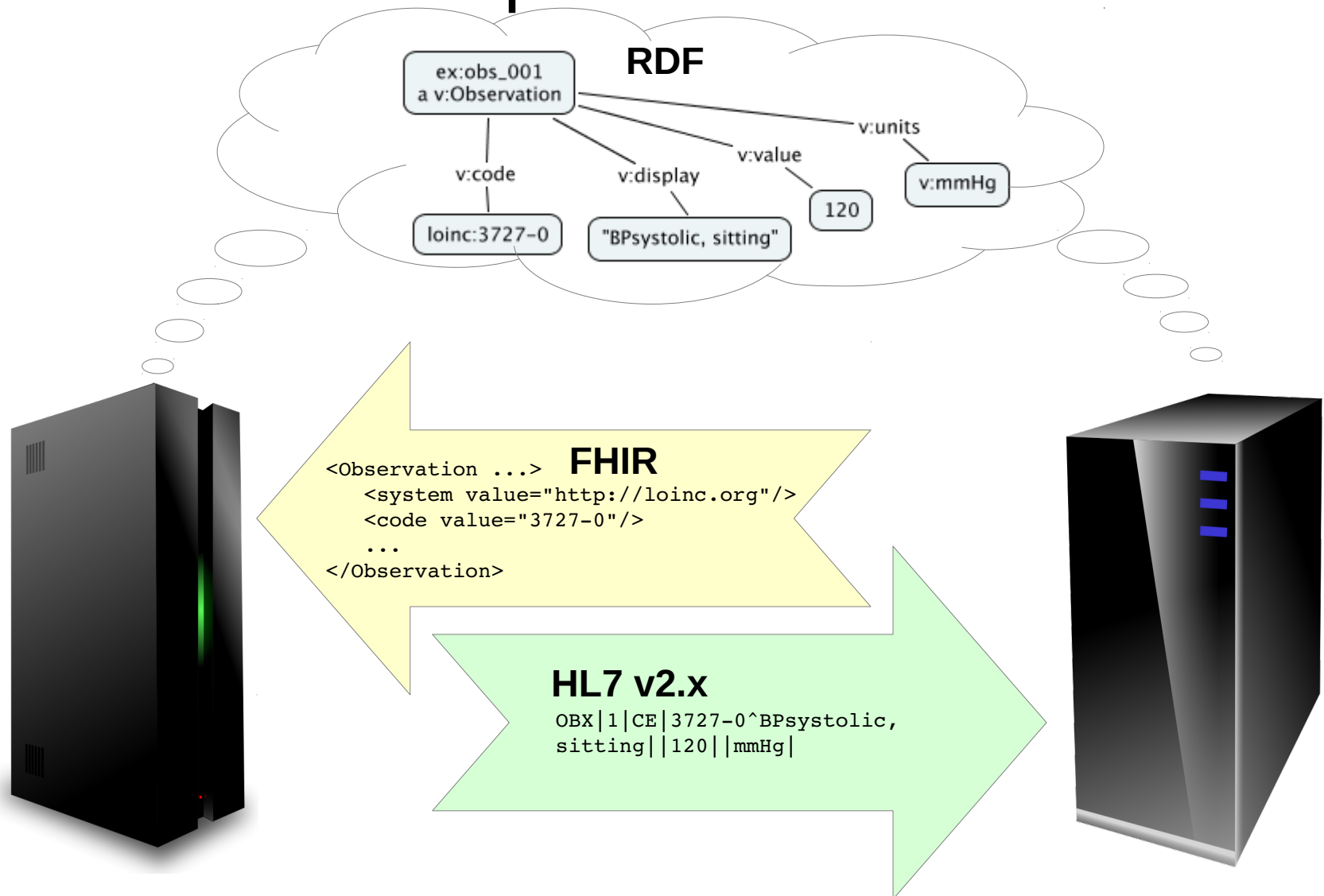
Maps to

Maps to

RDF information content



RDF as a universal information representation

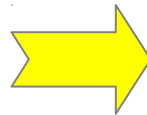


Universal information representation

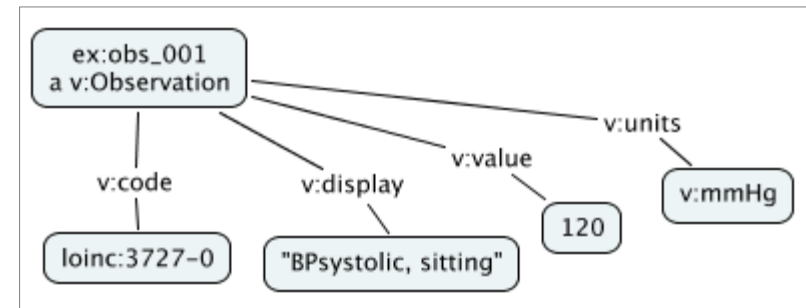
- Q: What does this mean?
- A: Determine its RDF information content

Instance data

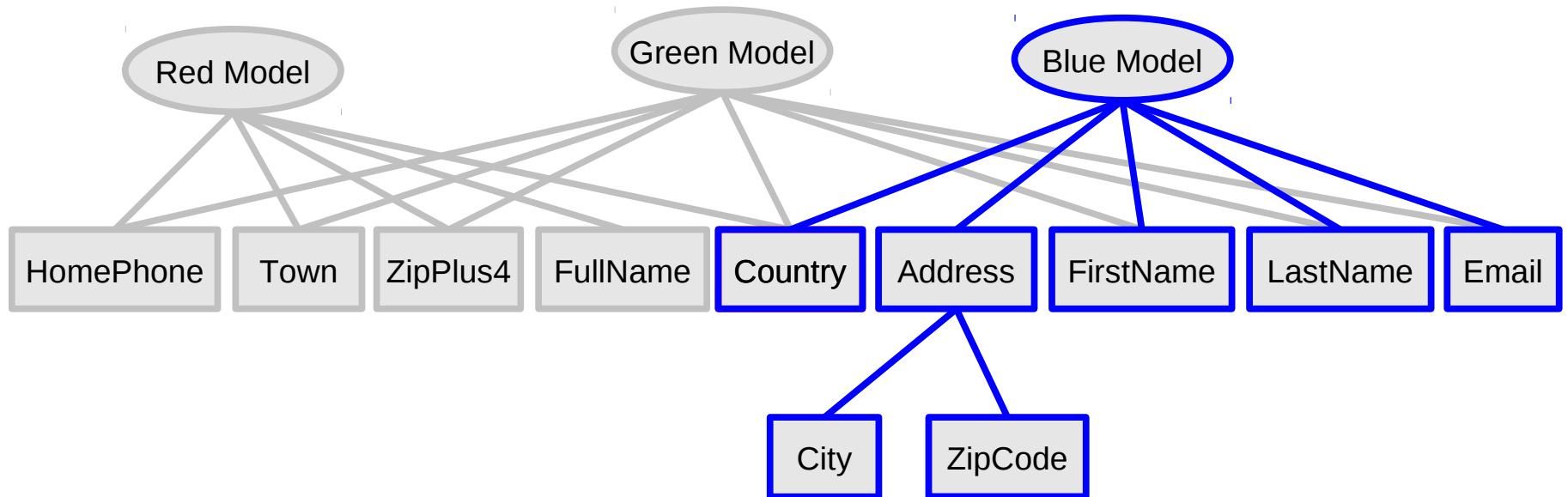
```
<Observation
  xmlns="http://hl7.org/fhir">
  <system value="http://loinc.org"/>
  <code value="3727-0"/>
  <display value="BPsystolic, sitting"/>
  <value value="120"/>
  <units value="mmHg"/>
</Observation>
```



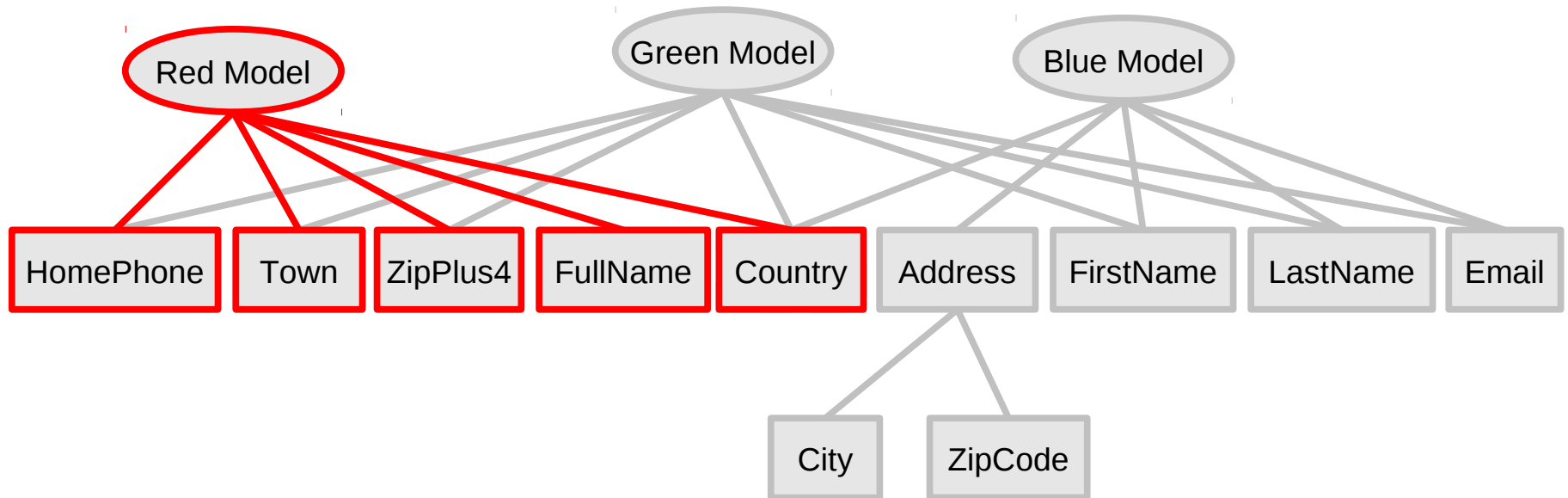
RDF



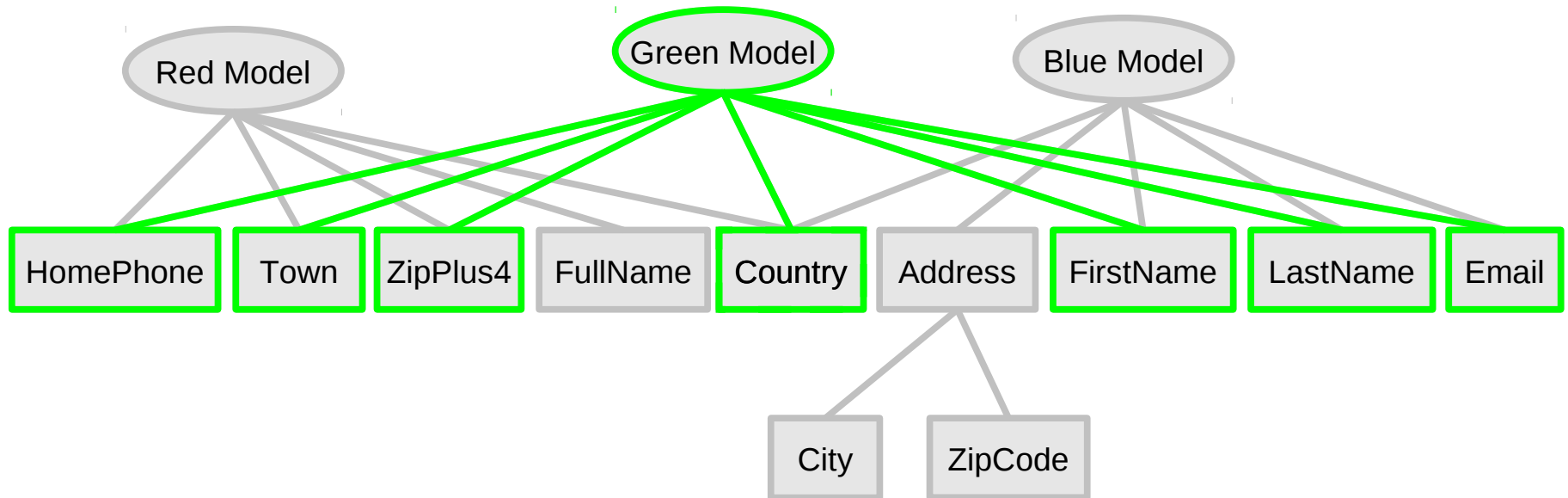
Multi-schema friendly



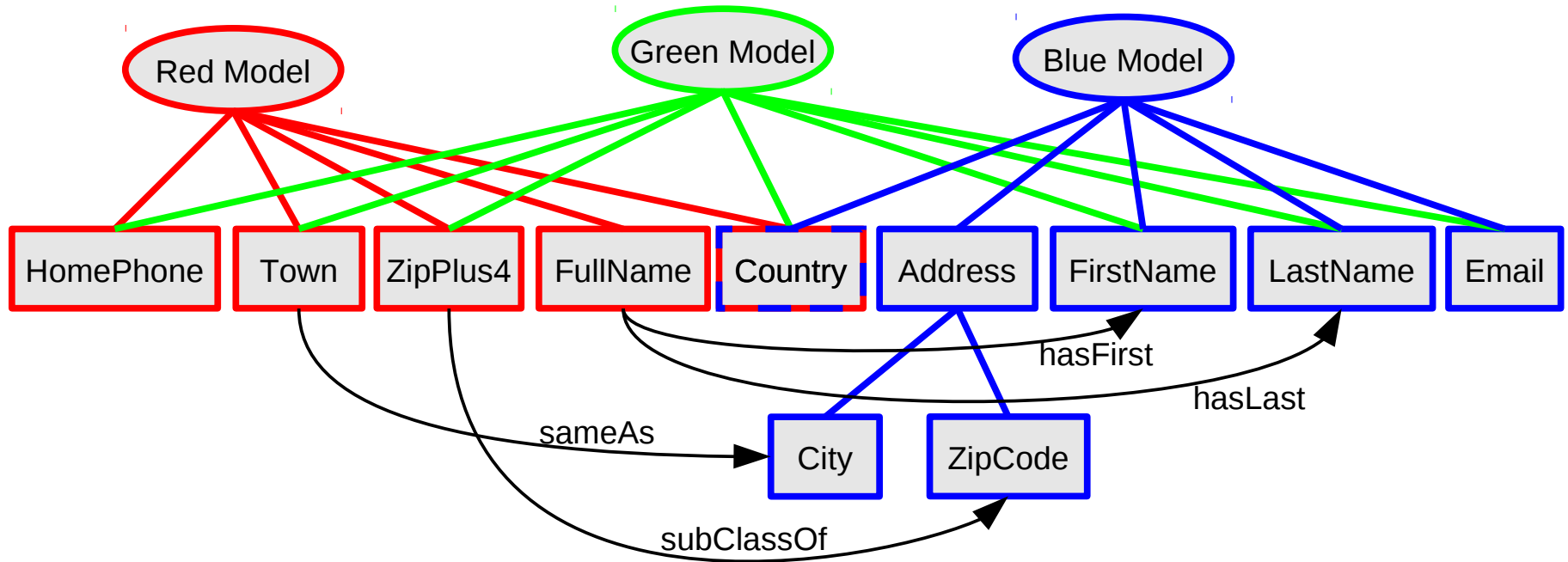
Multi-schema friendly



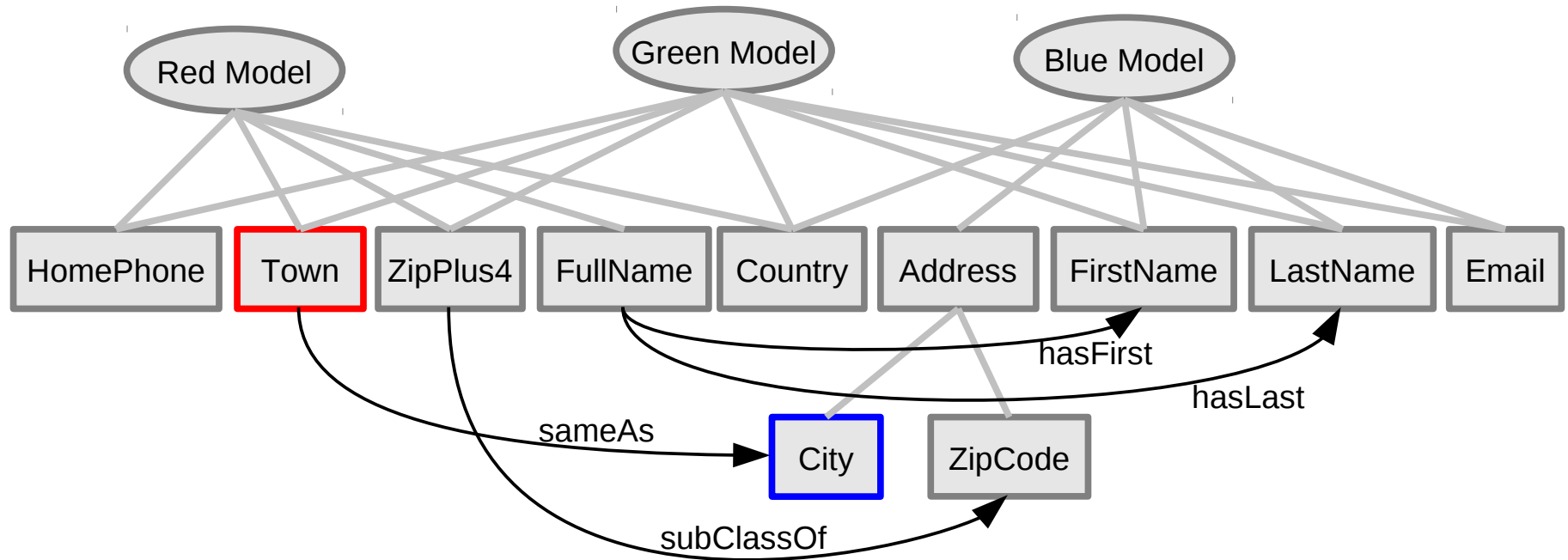
Multi-schema friendly



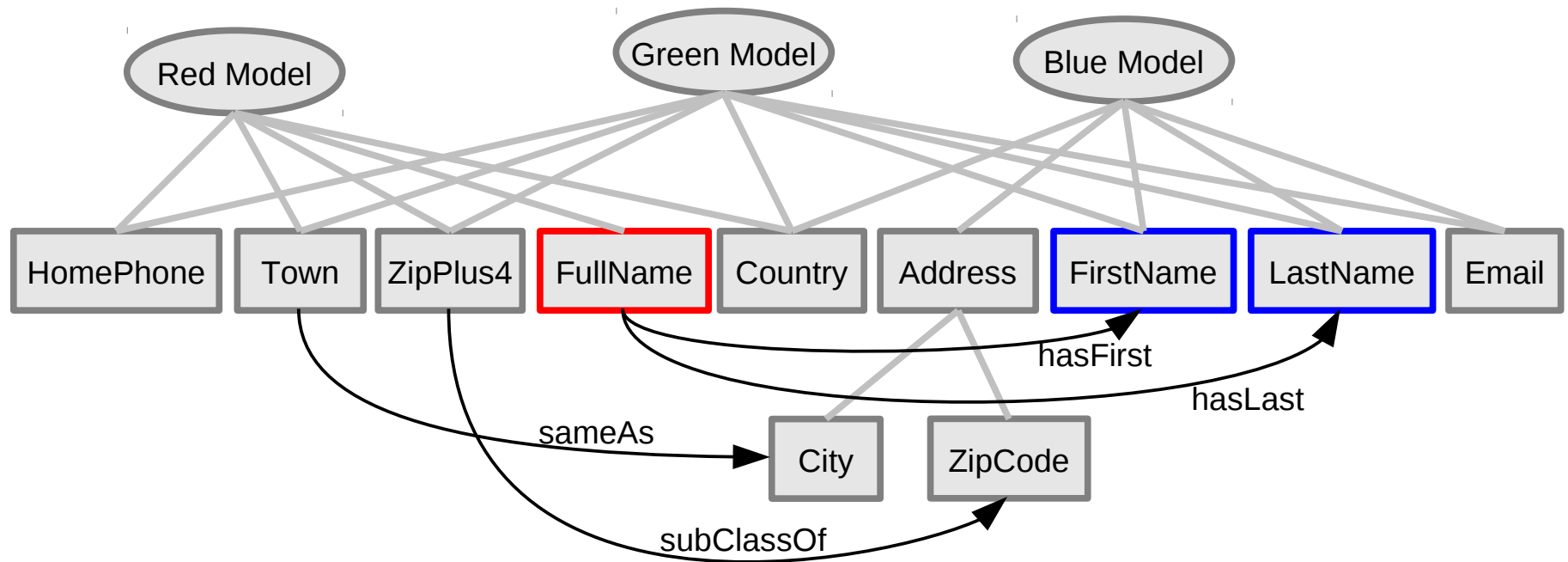
Multi-schema friendly



Supports inference



Supports inference



Semantic interoperability:

*The ability of computer systems
to exchange data
with unambiguous, shared meaning.*

– Wikipedia

Two ways to achieve interoperability

- Standards:
 - Make everyone speak the same language
 - I.e., same data models and vocabularies
- Translations:
 - Translate between languages
 - I.e., translate between data models and vocabularies

Obviously we prefer
standards.

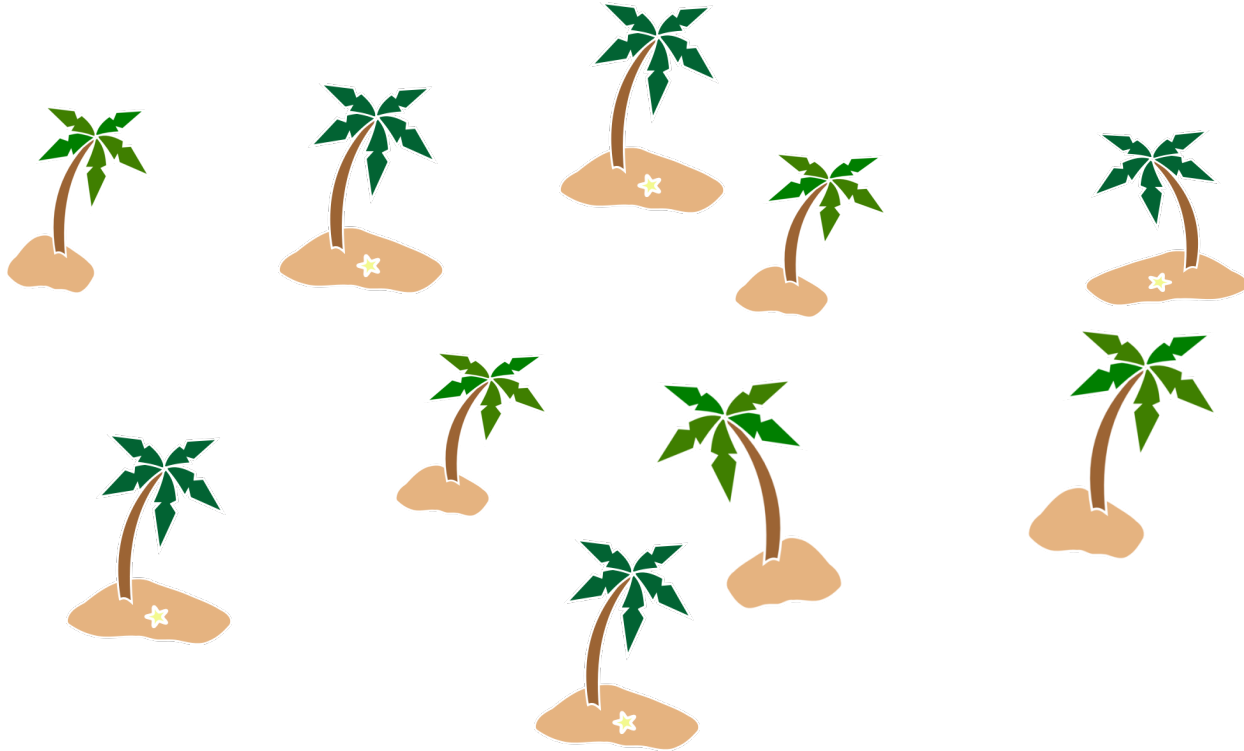
But

Standard Vocabularies in UMLS

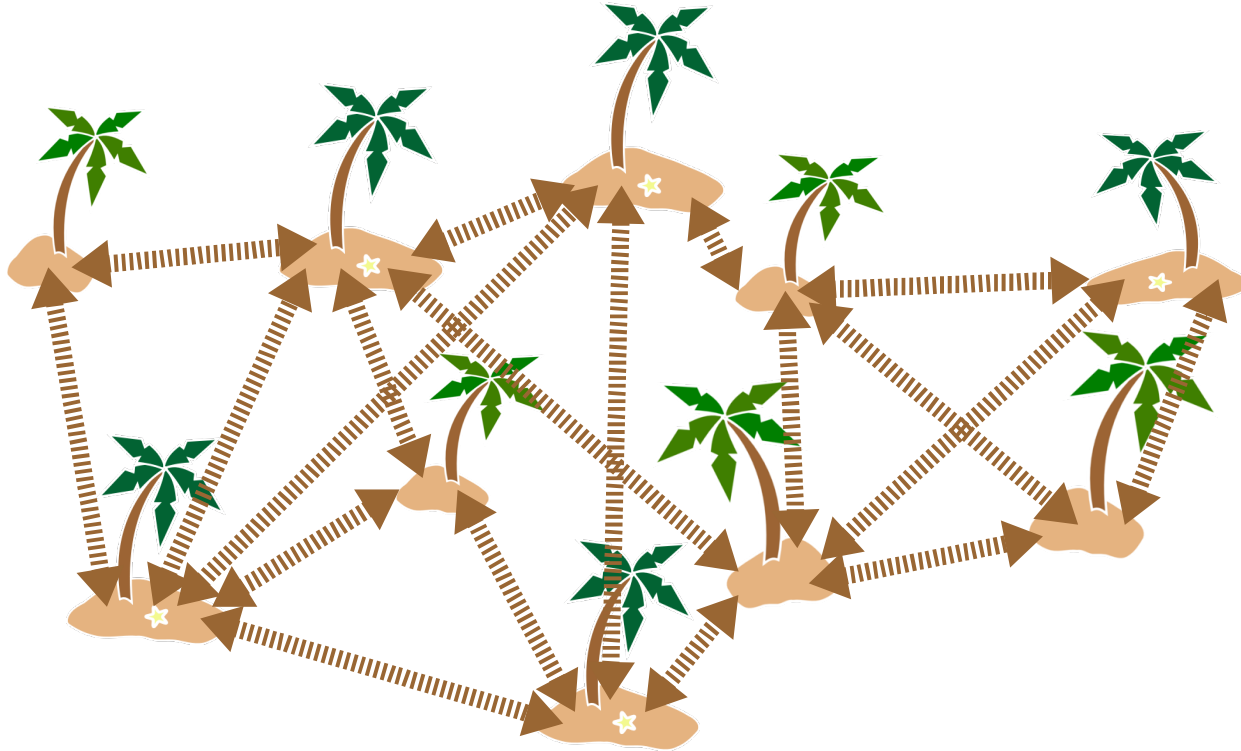
AIR ALT AOD AOT BI CCC CCPSS CCS CDT CHV COSTAR CPM
CPT CPTSP CSP CST DDB DMDICD10 DMDUMD DSM3R DSM4 DXP
FMA HCDDT HCPCS HCPT HL7V2.5 HL7V3.0 HLREL ICD10 ICD10AE
ICD10AM ICD10AMAE ICD10CM ICD10DUT ICD10PCS ICD9CM ICF
ICF-CY ICPC ICPC2EDUT ICPC2EENG ICPC2ICD10DUT
ICPC2ICD10ENG ICPC2P ICPCBAQ ICPCDAN ICPCDUT ICPCFIN
ICPCFRE ICPCG ICPCHE ICPCHE ICPCHE ICPCHE ICPCHE ICPCHE
ICPCSPA ICPCW ICPCW ICPCW ICPCW ICPCW ICPCW ICPCW
MEDLINEPLUS MSHOE MSHDUT MSHIN MSHFRE MSHGER MSHITA
MSHJPN MSHLAV MSHNOR MSHPOL MSHPOR MSHRUS MSHSCR
MSHSPA MSHSWE MTH MTHCH MTHHH MTHICD9 MTHICPC2EAE
MTHICPC2ICD10AE MTHMST MTHMSTFRE MTHMSTITA NAN NCISEER
NIC NOC OMS PCDS PDQ PNDS PPAC PSY QMR RAM RCD
RCDAE RCDSA RCDSY SNM SNMI SOP SPN SRC TKMT ULT UMD
USPMG UWDA WHO WHOFRE WHOGER WHOPOR WHOSPA

Over 100!

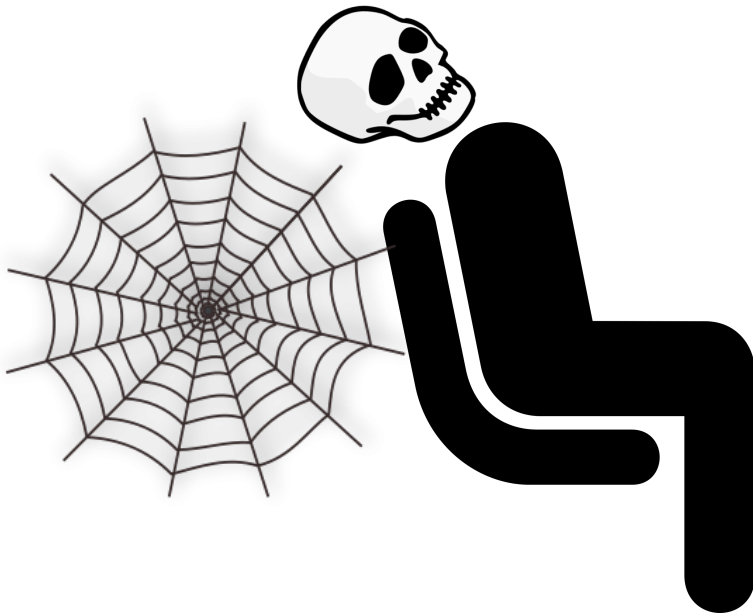
Each standard is an island



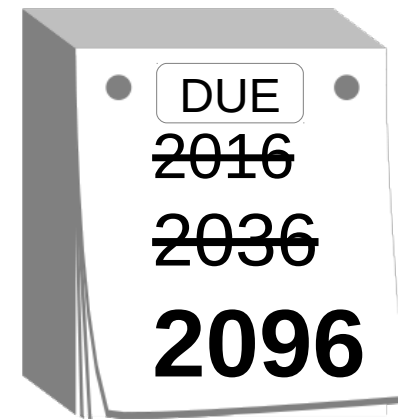
RDF enables semantic bridges



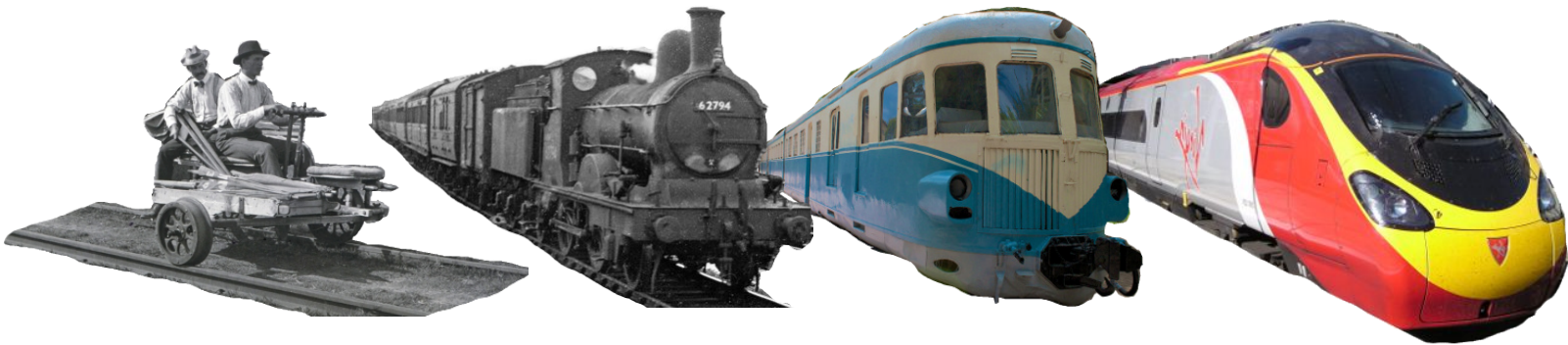
Standardization takes time



COMING SOON!
**COMPREHENSIVE
STANDARD**



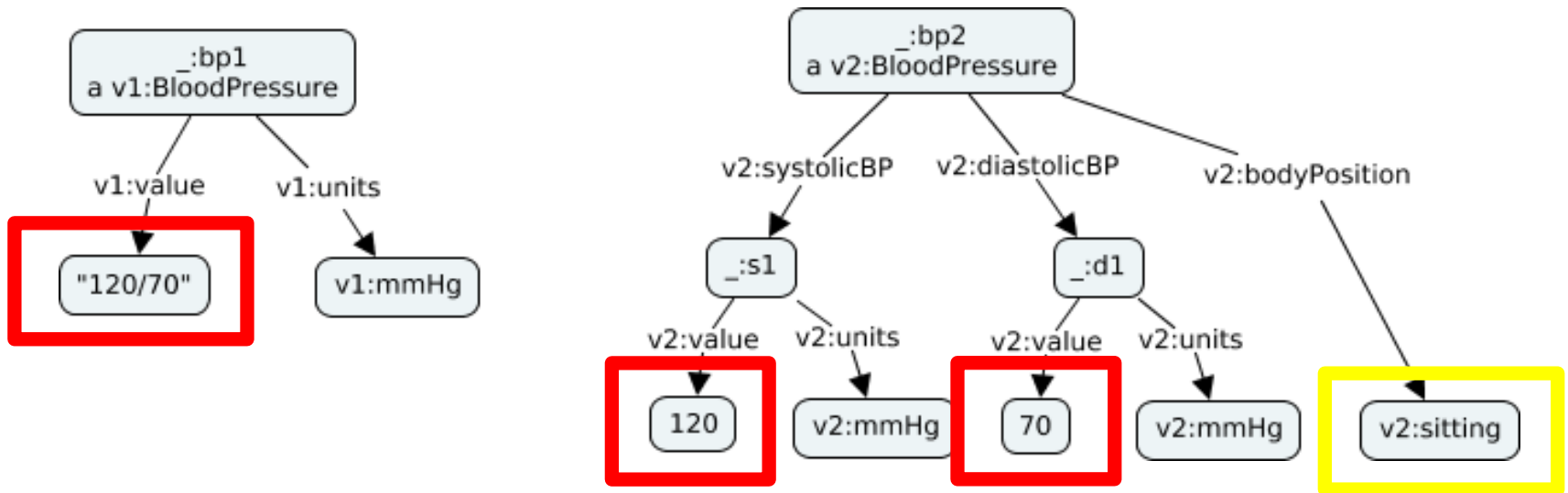
Modernization takes time



- Existing systems cannot be updated all at once

Diverse use cases

- Different use cases need different data, granularity and representations



*One standard does **not** fit all!*

Cannot fit all use cases into one data model or vocabulary!

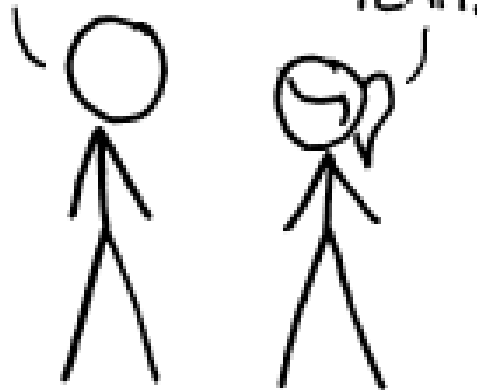


HOW STANDARDS PROLIFERATE:

(SEE: A/C CHARGERS, CHARACTER ENCODINGS, INSTANT MESSAGING, ETC.)

SITUATION:
THERE ARE
14 COMPETING
STANDARDS.

14?! RIDICULOUS!
WE NEED TO DEVELOP
ONE UNIVERSAL STANDARD
THAT COVERS EVERYONE'S
USE CASES.



YEAH!

SOON:

SITUATION:
THERE ARE
15 COMPETING
STANDARDS.

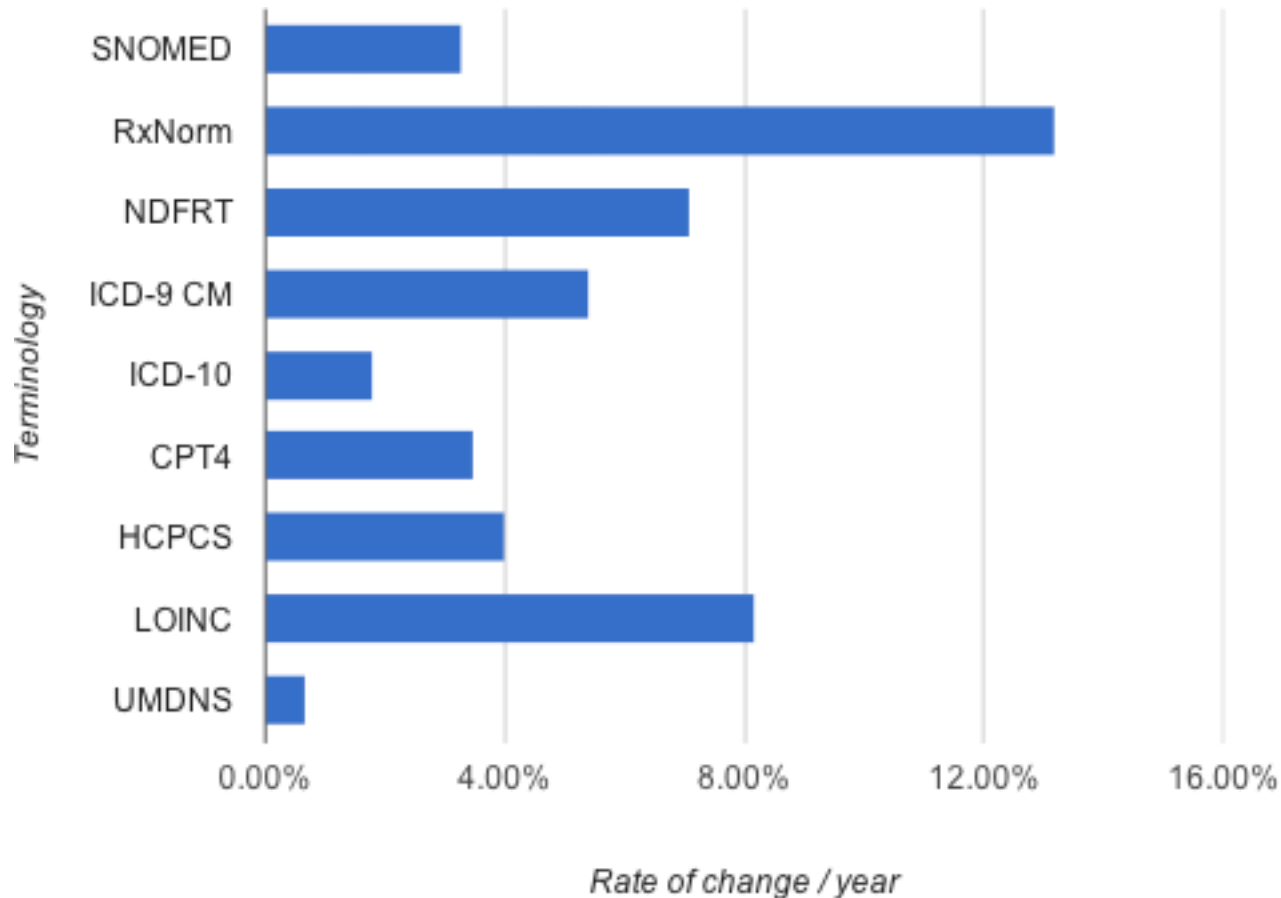
<http://xkcd.com/927/>
Used by permission

Standards evolve

- Version $n+1$ improves on version n



Healthcare terminologies rate of change

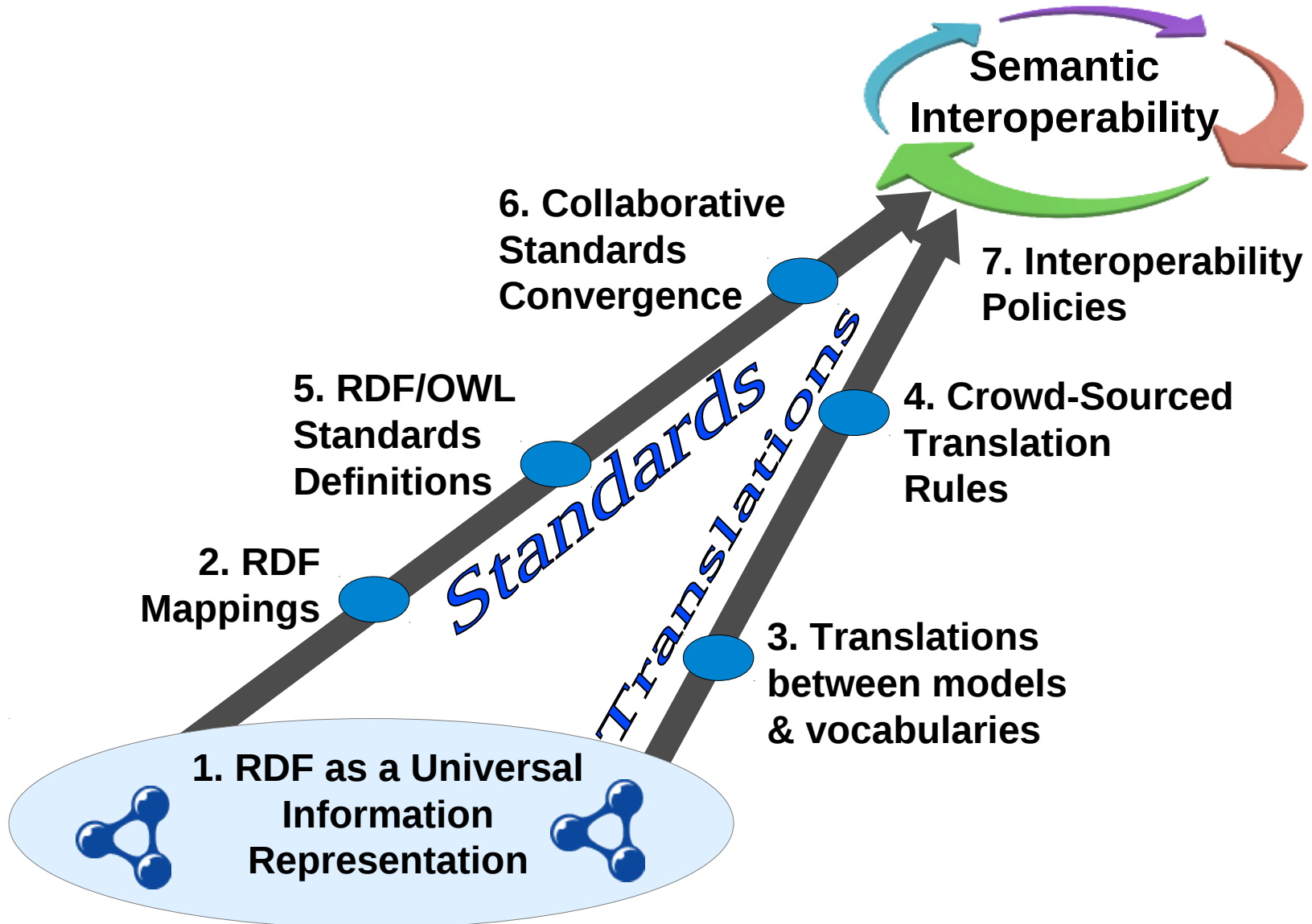


Slide credit: Rafael Richards (VA)

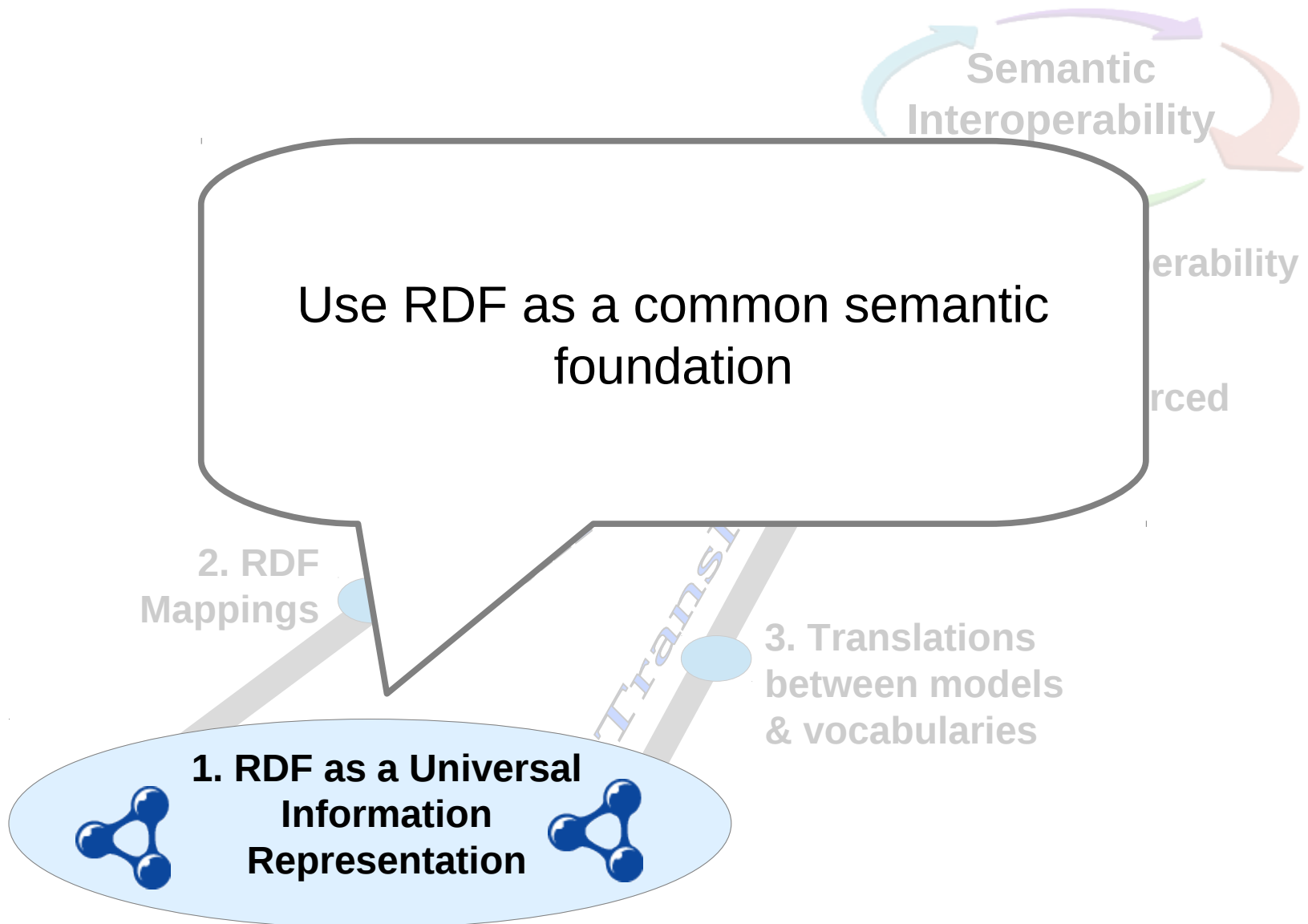
Translation is unavoidable!

A realistic strategy for semantic interoperability must address both **standards and translations.**

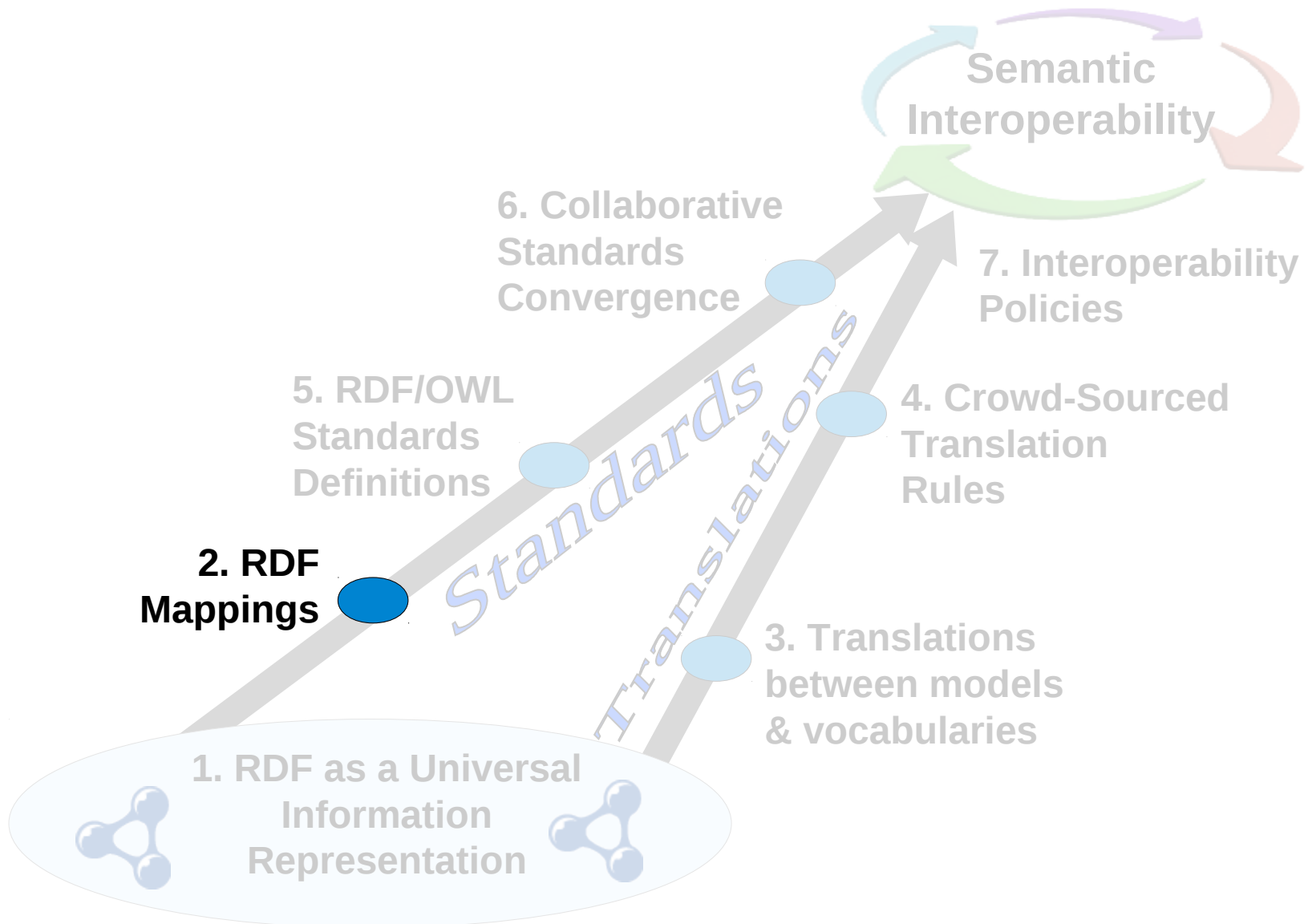
Yosemite Project Roadmap



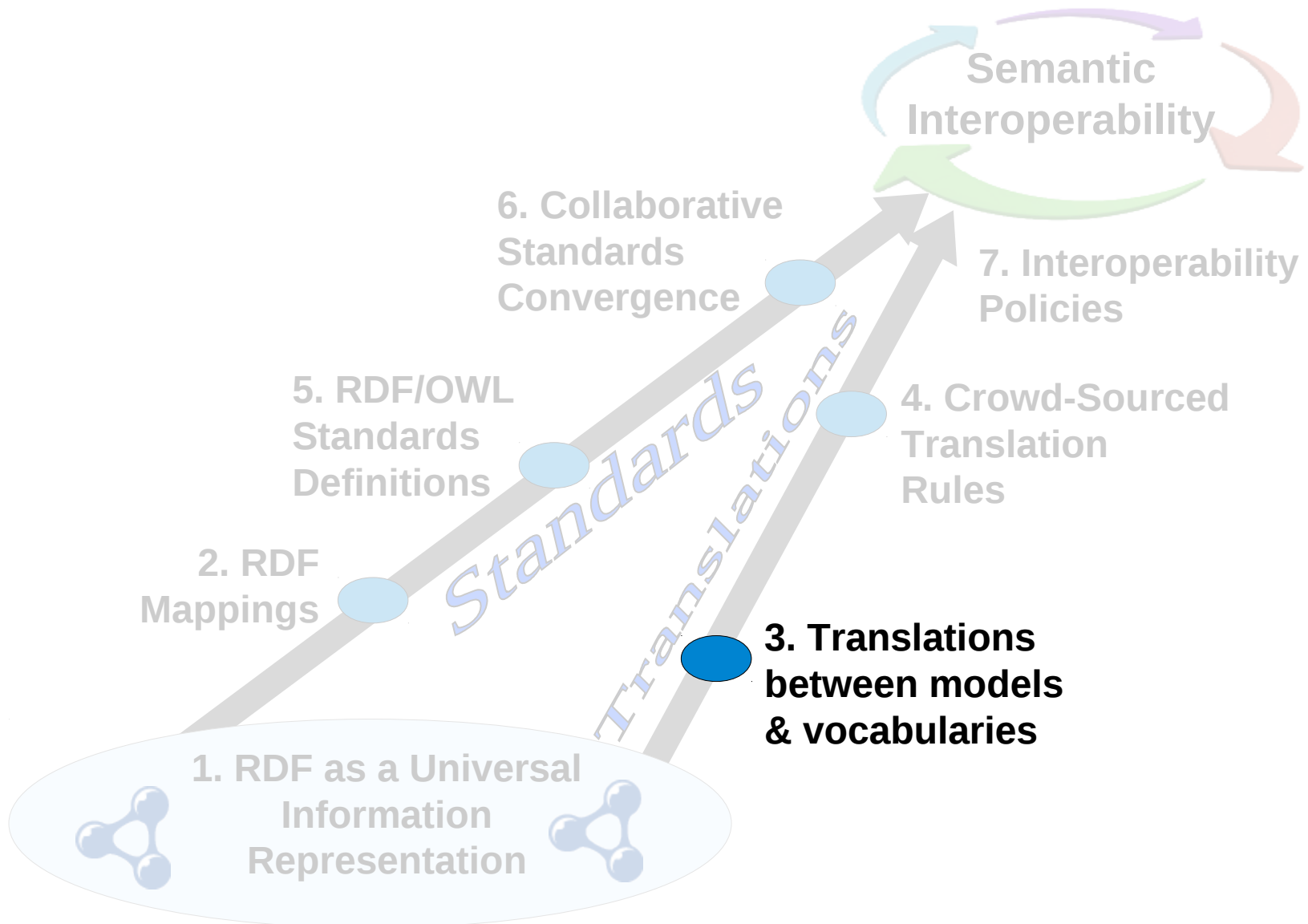
Roadmap - 1



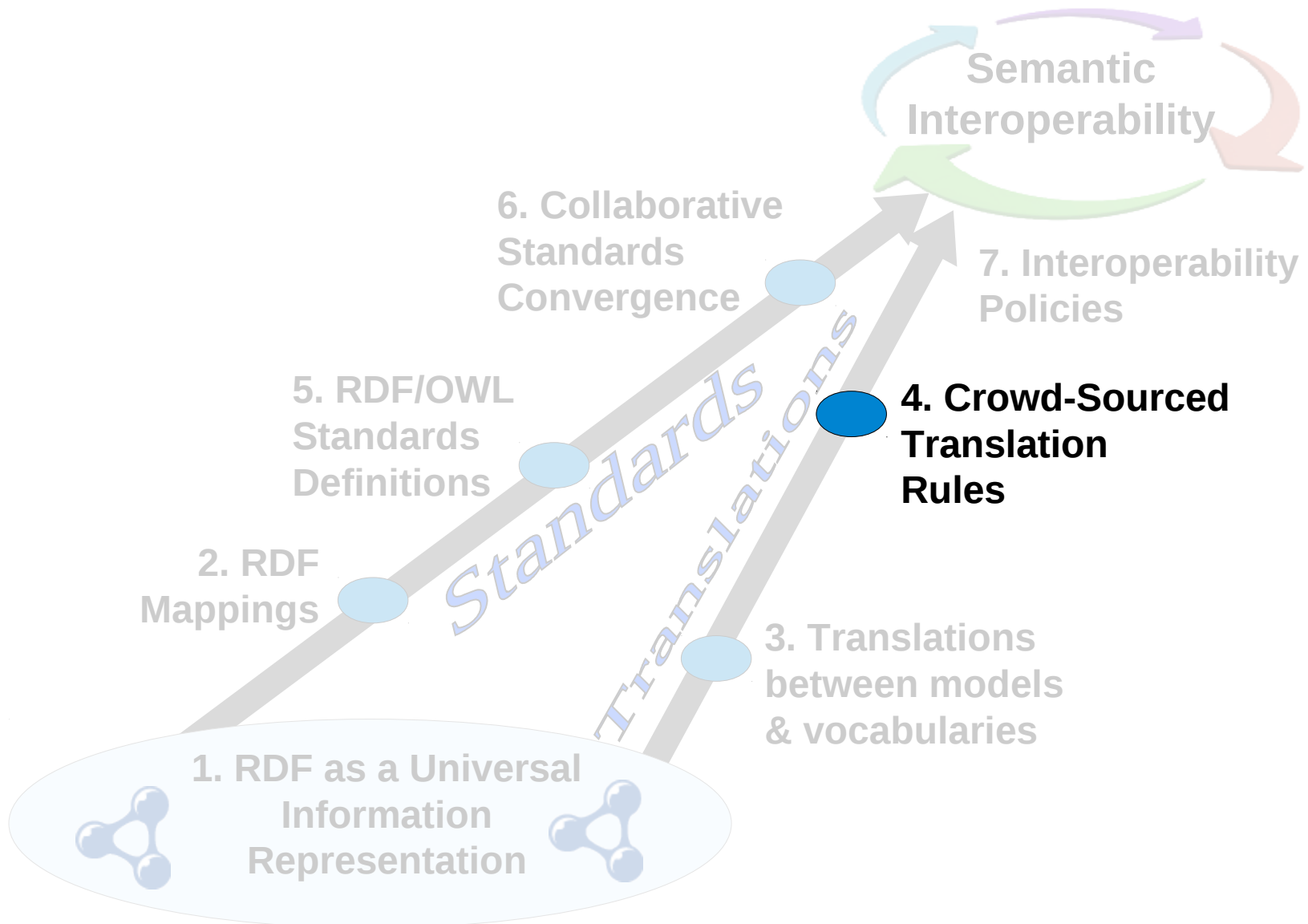
Roadmap - 2



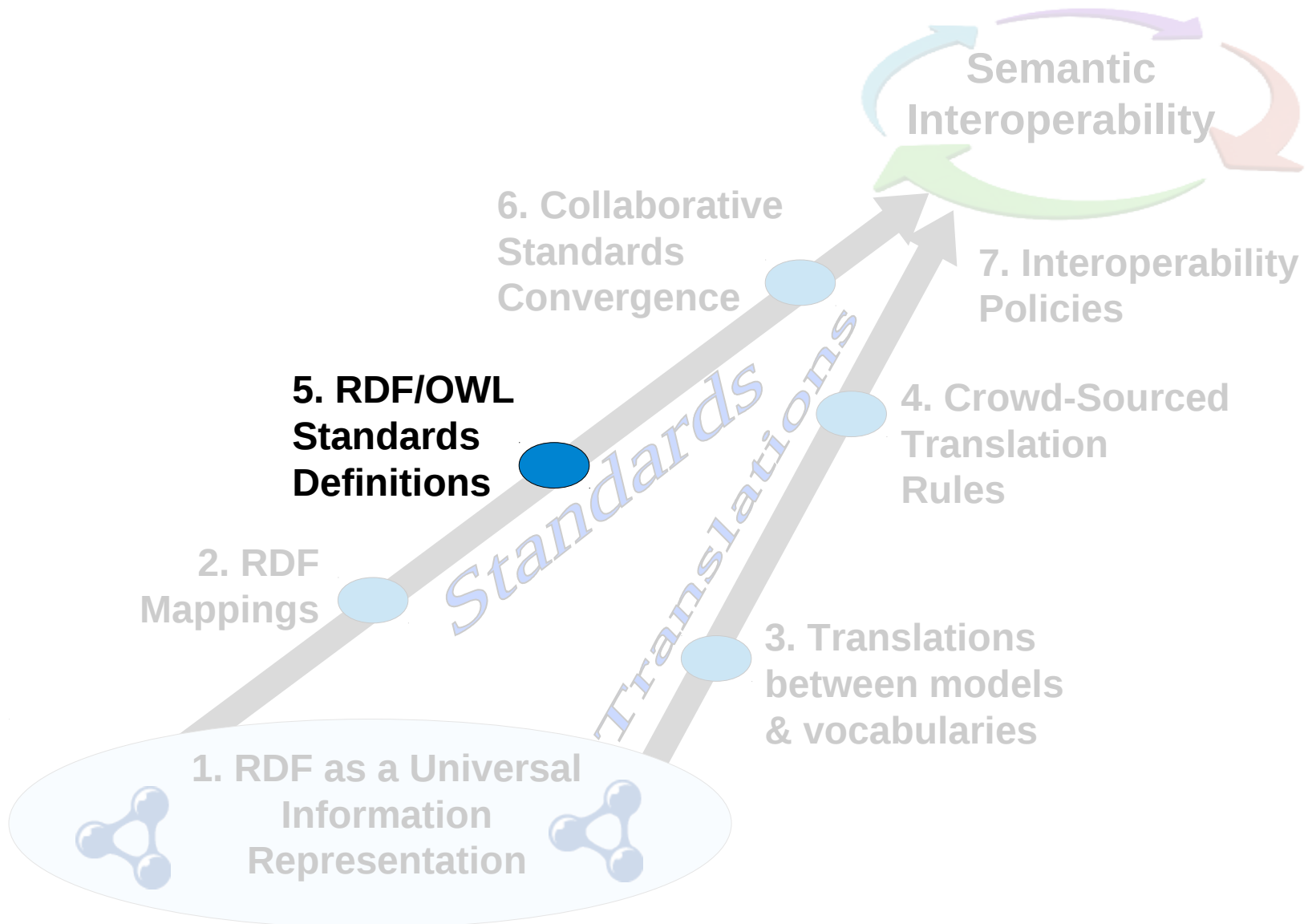
Roadmap - 3



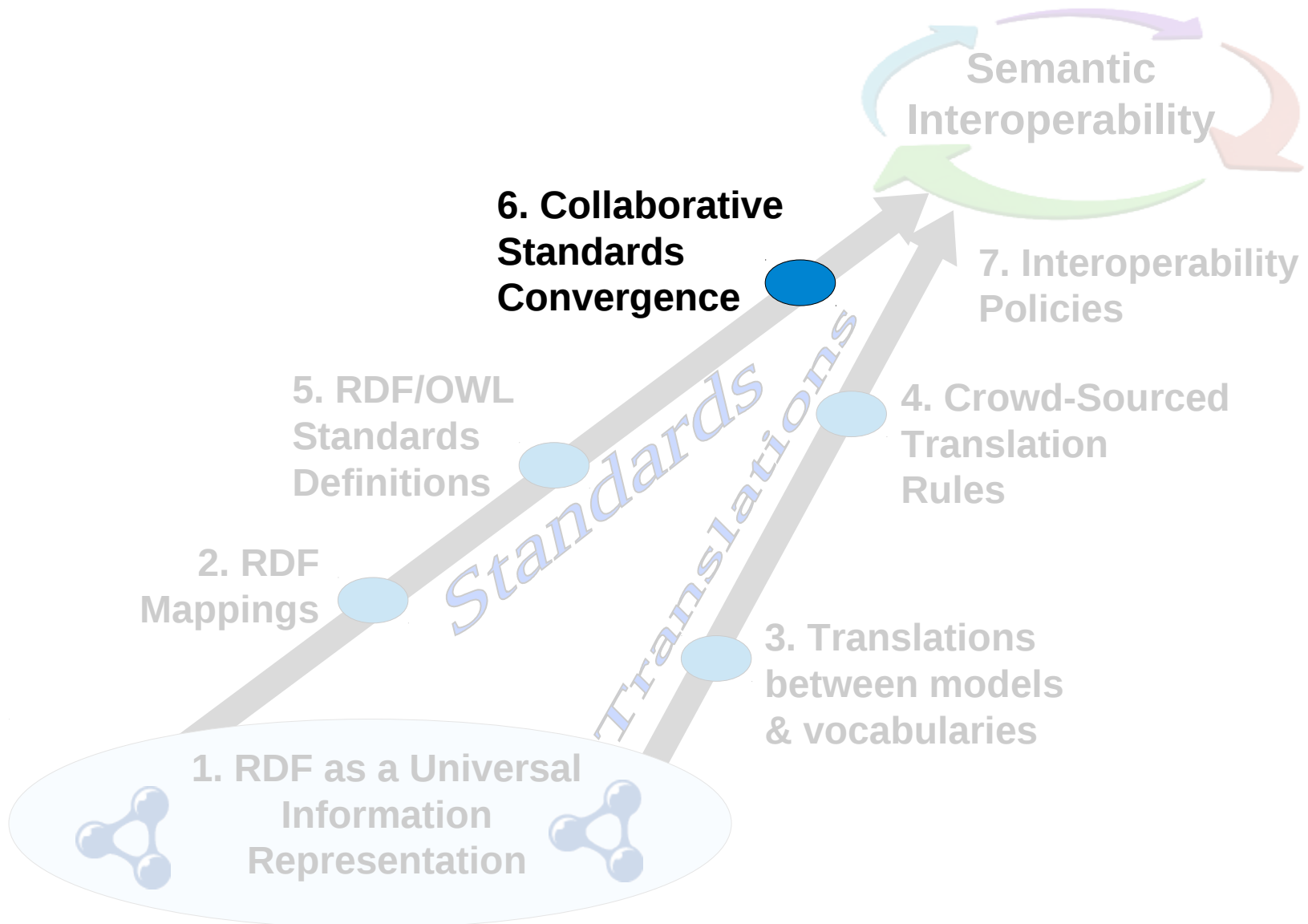
Roadmap - 4



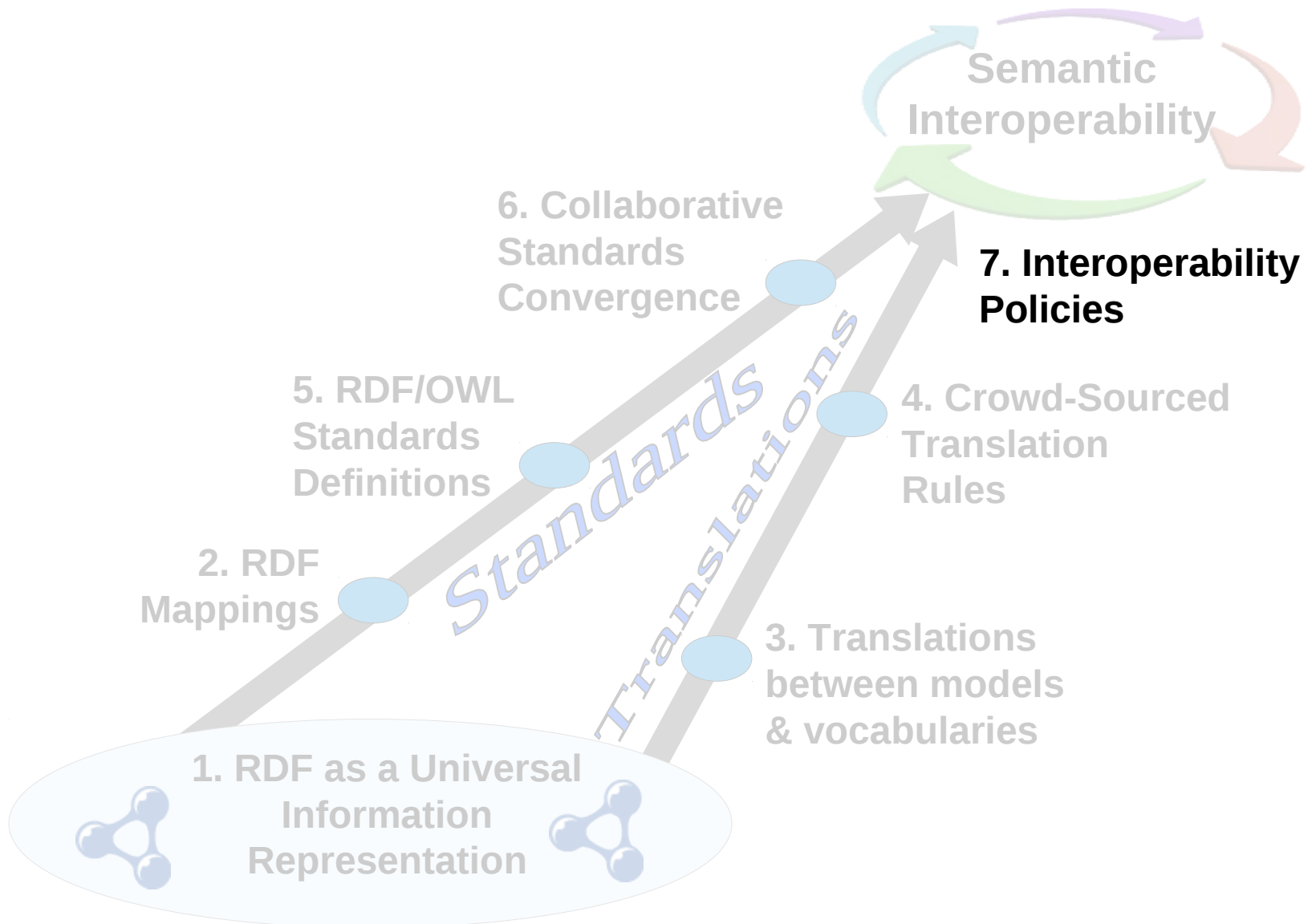
Roadmap - 5



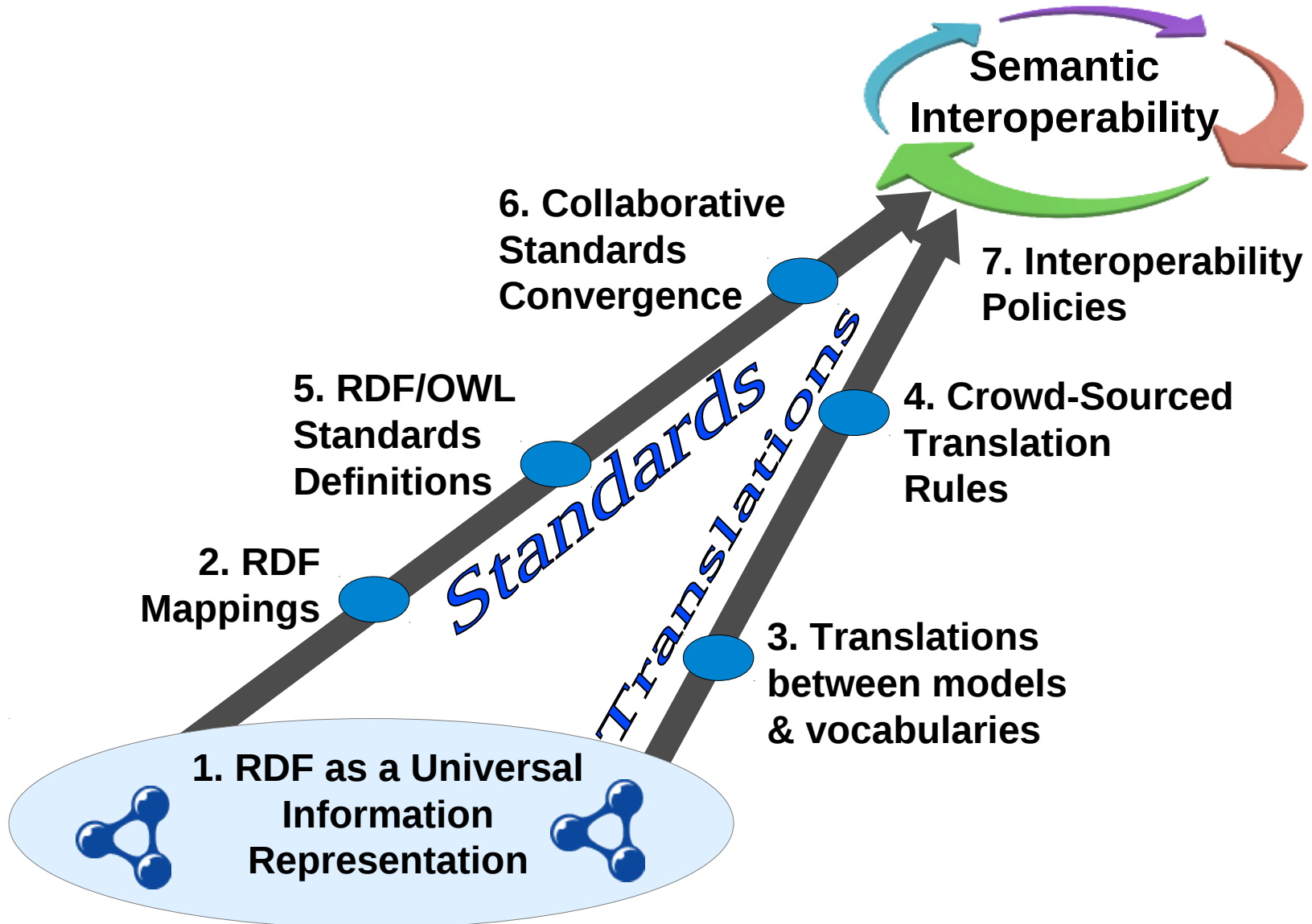
Roadmap - 6



Roadmap - 7



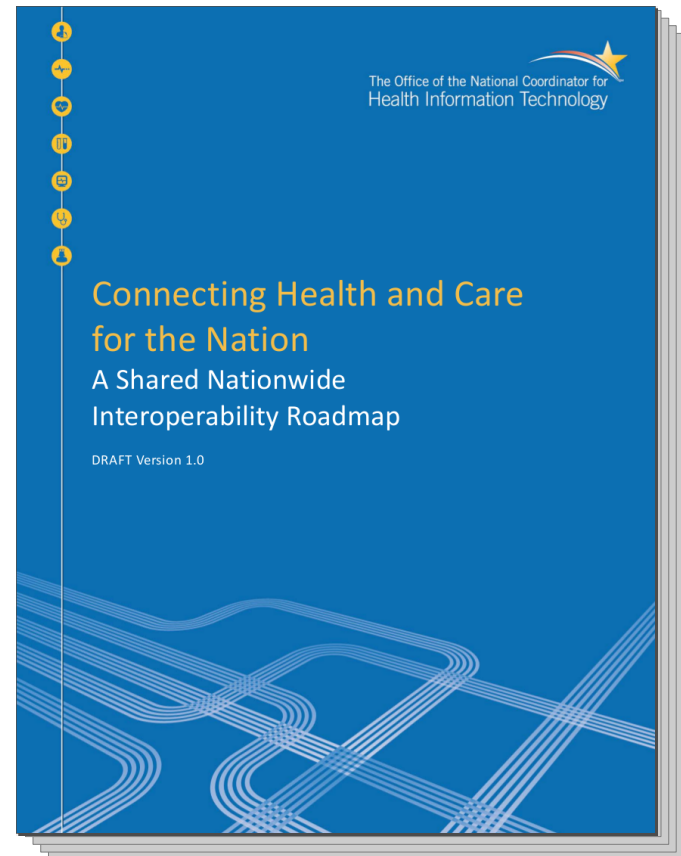
Yosemite Project Roadmap



ONC Roadmap

ONC Interoperability Roadmap Draft v1.0

- 166 pages
- Comments due 3-Apr-2015



<http://www.healthit.gov/policy-researchers-implementers/interoperability>

ONC Roadmap Quick Reference

The Office of the National Coordinator for Health Information Technology

CONNECTING HEALTH AND CARE FOR THE NATION: A SHARED NATIONWIDE INTEROPERABILITY ROADMAP – DRAFT VERSION 1.0

Quick Reference Factsheet

WHERE ARE WE GOING

The Department of Health & Human Services has identified that sharing information more broadly to providers, consumers, and others to support better decisions while maintaining privacy, is one way of achieving better care, smarter spending and a healthier nation. To guide the nation toward these goals, the Office of the National Coordinator (ONC) released [A Shared Nationwide Interoperability Roadmap – Draft Version 1.0](#) (Roadmap) which defines the implementation of how the government in collaboration with the private sector should approach sharing electronic health information and addresses the collaborative impact of all stakeholders in advancing interoperability. This also speaks directly to the second goal of the [Federal Health IT Strategic Plan 2015-2020](#), to advance secure and interoperable health information, and further drives the entire nation toward realizing the development of a nationwide learning health system. ONC is accepting [public comments](#) on the draft Roadmap now through 5 p.m. ET on April 3, 2015.

WHO NEEDS TO COME ALONG ON THE JOURNEY

People who receive care or support the care of others		People and organizations that deliver care and services	
Organizations that pay for care		People and organizations that support the public good	
People and organizations that generate new knowledge, whether research or quality improvement		People and organizations that provide health IT capabilities	
People and organizations that govern, certify, and/or have oversight		People and organizations that develop and maintain standards	

WHAT ARE THE GUIDING PRINCIPLES

An interoperable health IT ecosystem that is person-centered makes the right electronic health information available to the right people at the right time across products and organizations, in a way that can be relied upon and meaningfully used by recipients. This ecosystem should adhere to the interoperability guiding principles. Based on feedback from a wide range of stakeholders, ONC updated this set of guiding principles in version 1.0 of the Roadmap.

BUILD UPON EXISTING HEALTH IT INFRASTRUCTURE	MAINTAIN MODULARITY	ONE SIZE DOES NOT FIT ALL
CONSIDER THE CURRENT ENVIRONMENT AND SUPPORT MULTIPLE LEVELS OF ADVANCEMENT	EMPOWER INDIVIDUALS	SIMPLIFY
PROTECT PRIVACY AND SECURITY IN ALL ASPECTS OF INTEROPERABILITY	SERVE THE MARKET	FOCUS ON VALUE
SCALABILITY AND UNIVERSAL ACCESS		

WHEN AND HOW WE GET THERE

The Roadmap identifies critical actions that are necessary to achieve interoperability goals over the next three, six, and ten-year timeframes.

3 Year Agenda (2015-2017) Send, receive, find and use a common clinical data set to improve health and health care quality	6 Year Agenda (2018-2020) Expand interoperable health IT and users to improve health and lower cost	10 Year Agenda (2021-2024) Achieve a nationwide learning health system
--	---	--

For more information: www.healthit.gov/interoperability

The Roadmap is based on a core set of business and functional requirements to achieve a learning health system, organized by five critical building blocks that support the business, policy and technical needs of a nationwide interoperable electronic health information infrastructure.

Interoperability Roadmap Building Blocks	Learning Health System Requirements
Rules of engagement and governance	A. Shared governance of policy and standards that enable interoperability
Supportive business, clinical, cultural and regulatory environments	B. A supportive business and regulatory environment that encourages interoperability C. Individuals are empowered to be active managers of their health D. Care providers partner with individuals to deliver high value care
Privacy and security protections for health information	E. Ubiquitous, secure network infrastructure F. Verifiable identity and authentication of all participants G. Consistent representation of permission to collect, share, and use identifiable health information H. Consistent representation of authorization to access health information
Certification and testing to support adoption and optimization of health IT products and services	I. Stakeholder assurance that health IT is interoperable
Core technical standards and functions	J. Consistent Data Formats and semantics K. Standard, secure services L. Consistent, secure transport technique(s) M. Accurate identity matching N. Reliable resource location

Although these actions will have to be taken by stakeholders to achieve near-term and long-term interoperability goals, the following four critical pathways are of highest priority:

1. Establish a coordinated governance framework and process for nationwide health information interoperability
2. Improve technical standards and implementation guidance for sharing and using a common clinical data set**
3. Advance incentives for sharing health information according to common technical standards, starting with a common clinical data set
4. Clarify privacy and security requirements that enable interoperability

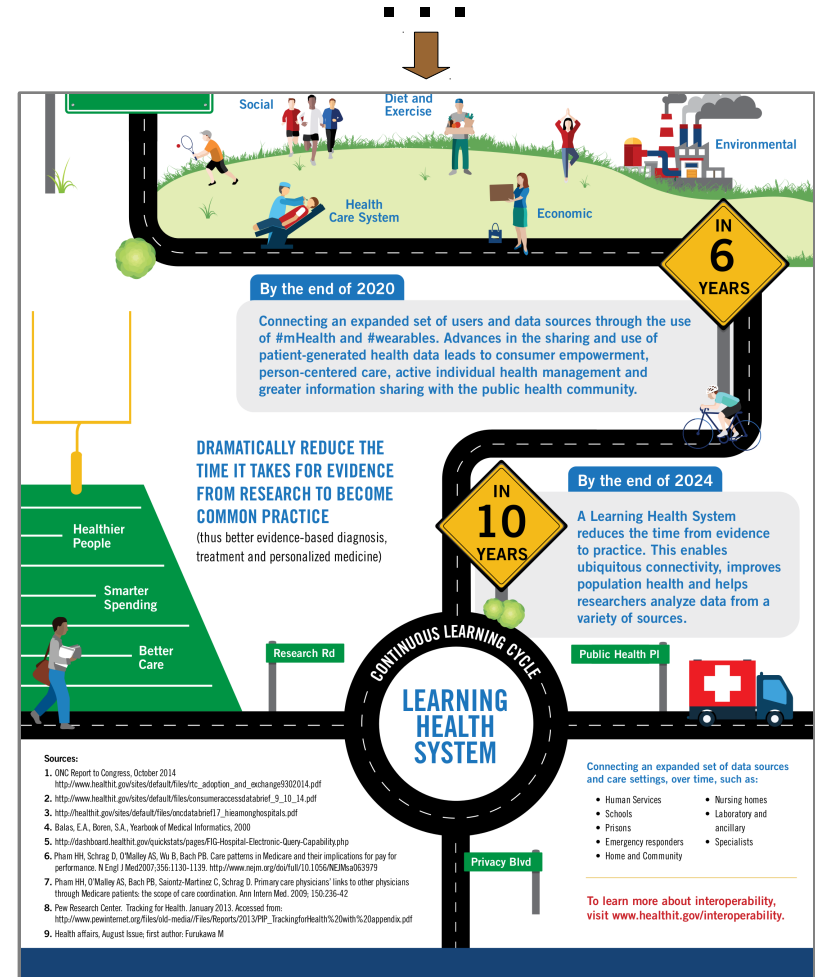
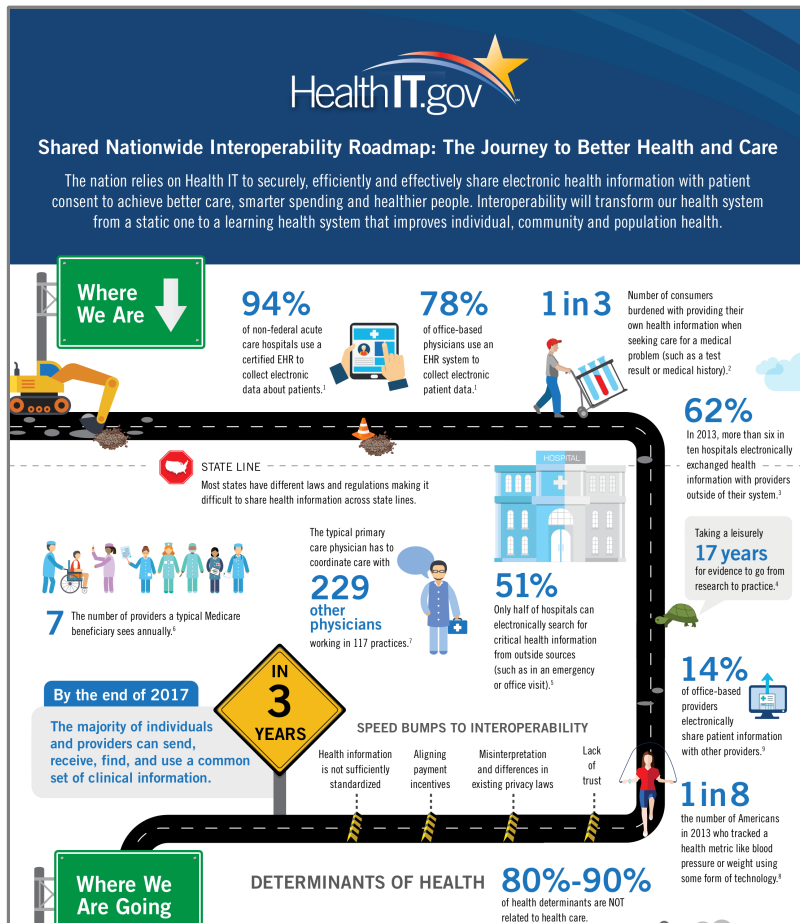
WHY IT MATTERS

Most determinants of health status are social and are influenced by actions and encounters that occur outside traditional institutional health care delivery settings, such as in employment, retail, education, and other settings. This shift requires a high degree of information sharing between individuals, providers, and organizations, and therefore a high degree of interoperability between many different types of health IT, such that systems can exchange and use electronic health information without special effort on the part of the user. The goal of this shift is to a nationwide learning health system—an environment that links the care delivery system with communities and societal supports in "closed loops" of electronic health information flow, at many different levels, to enable continuous learning and improved health. This kind of system allows individuals to select platforms and apps to share and use their own electronic health information to meet their needs without undue constraints.

**The draft [2015 Interim Interoperability Standards Advisory](#) was released on January 30, 2015. ONC is also accepting [public comment](#) on this document now through May 1, 2015 5 p.m. ET.

For more information: www.healthit.gov/interoperability

ONC Roadmap Infographic



What's in the ONC roadmap?

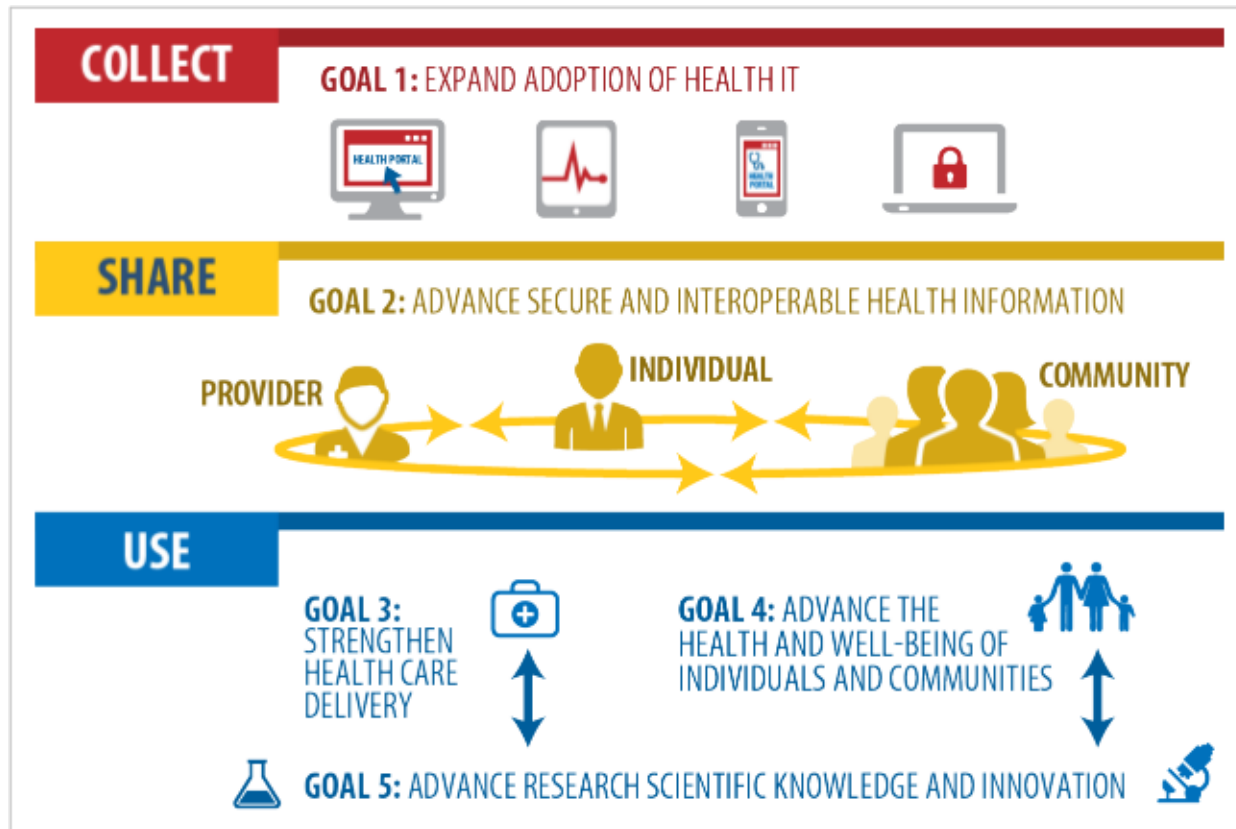
- Health IT vision: "learning health system"
- Interoperability goals: 3, 6, 10 years
- Problem description
 - Components, stakeholders and issues
- Solution guidance, involving:
 - Governance
 - Standards
 - Policies

Institute of Medicine: Learning Health System



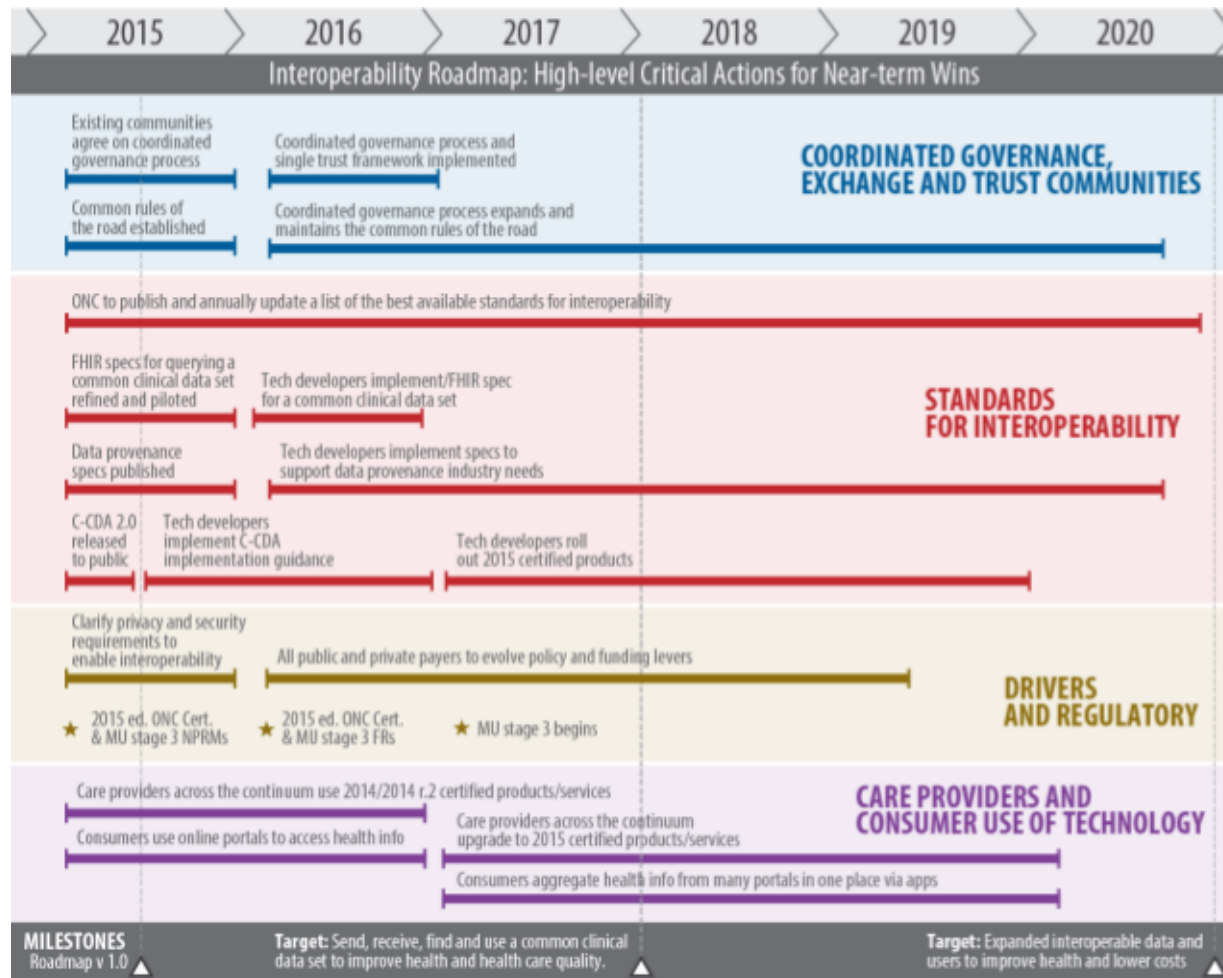
See <http://www.iom.edu/Activities/Quality/VSRT.aspx>

ONC strategic goals



ONC Roadmap p16

ONC timeline



ONC Roadmap p15

ONC building blocks

Interoperability Roadmap Building Blocks	Learning Health System Requirements
Rules of engagement and governance	A. Shared governance of policy and standards that enable interoperability 10 pages
Supportive business, clinical, cultural and regulatory environments	B. A supportive business and regulatory environment that encourages interoperability C. Individuals are empowered to be active managers of their health D. Care providers partner with individuals to deliver high value care 15 pages
Privacy and security protections for health information	E. Ubiquitous, secure network infrastructure F. Verifiable identity and authentication of all participants G. Consistent representation of permission to collect, share, and use identifiable health information H. Consistent representation of authorization to access health information 22 pages
Certification and testing to support adoption and optimization of health IT products and services	I. Stakeholder assurance that health IT is interoperable 3 pages
Core technical standards and functions	J. Consistent Data Formats and semantics K. Standard, secure services L. Consistent, secure transport technique(s) M. Accurate identity matching N. Reliable resource location 25 pages

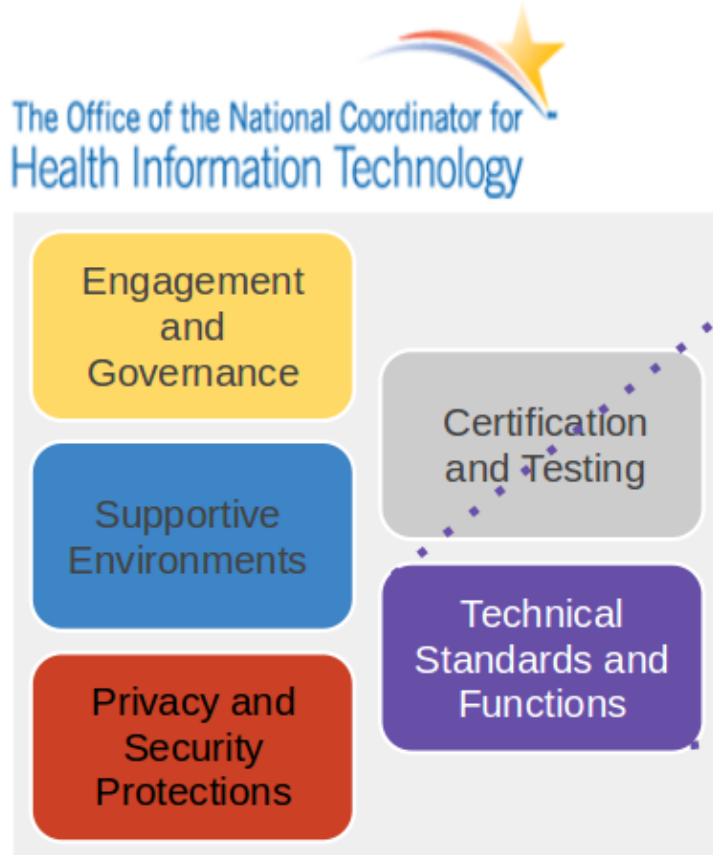
ONC Quick Reference p2

ONC building blocks

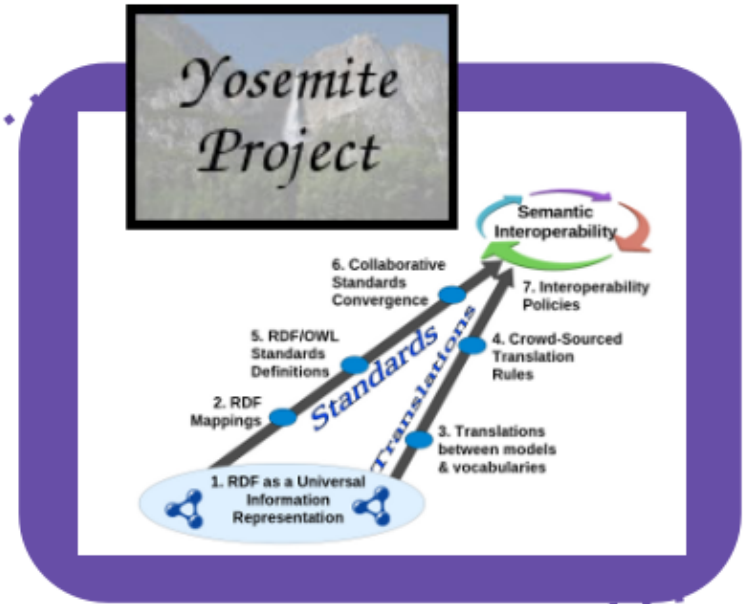
Interoperability Roadmap Building Blocks	Learning Health System Requirements	
Rules of engagement and governance	A. Shared governance of policy and standards that enable interoperability	10 pages
Supportive business, clinical, cultural and regulatory environments	B. A supportive business and regulatory environment that encourages interoperability C. Individuals are empowered to be active managers of their health D. Care providers partner with individuals to deliver high value care	15 pages
Privacy and security protections for health information	E. Ubiquitous, secure network infrastructure F. Verifiable identity and authentication of all participants G. Consistent representation of permission to collect, share, and use identifiable health information H. Consistent representation of authorization to access health information	22 pages
Certification and testing to support adoption and optimization of health IT products and services	I. Stakeholder assurance that health IT is interoperable	3 pages
Core technical standards and functions	J. Consistent Data Formats and semantics K. Standard, secure services L. Consistent, secure transport technique(s) M. Accurate identity matching N. Reliable resource location	25 pages

ONC Quick Reference p2

Comparison of roadmaps



- Addresses *all* aspects of interoperability
- Goal: Interop of a common *subset* of healthcare data
- Federally sponsored



- Addresses the technical problem of information interoperability
- Goal: Interop of *all* structured healthcare information
- Collaborative initiative

Kudos: General



- Undertaking this roadmap!
- Addressing all stakeholders
- Joint public & private governance strategy
- Attention to standards
- Policy incentives
- Removing barriers to interoperability

Suggestion: Clarify "Rules of the Road"

- Not clear what this phrase means
- Policies? Governance process?
 - Policies (incentives & remove barriers)



Kudo:

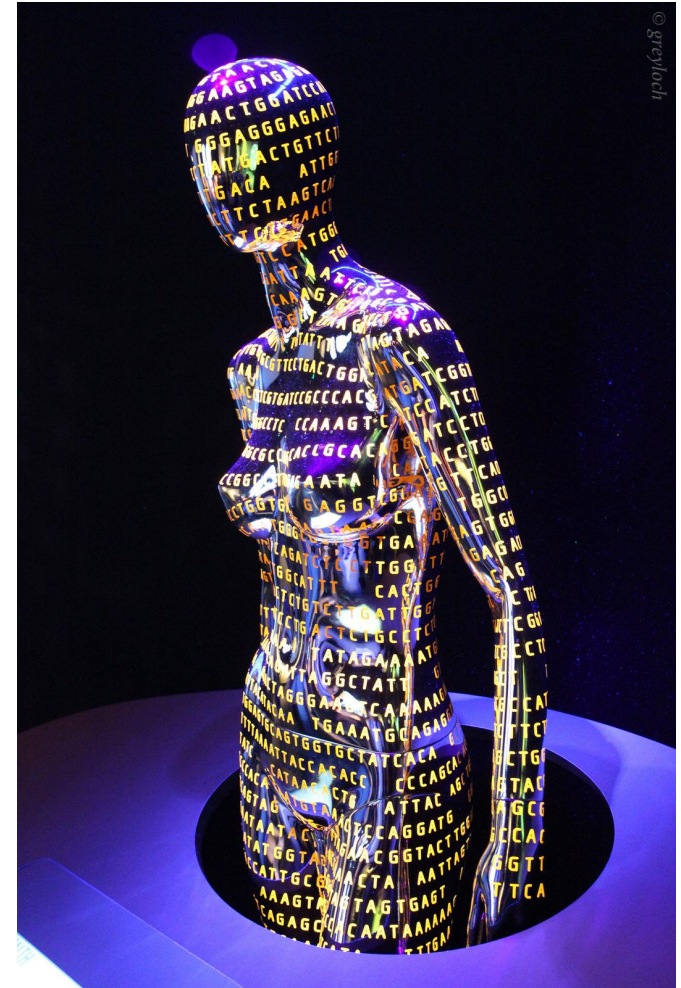
Need for interoperability incentives

- Key barrier: "fee-for-service" payment models -- p38
 - *"Current policies and financial incentives often prevent . . . exchange, even when it is technically feasible."* -- p37
 - *"[We] need to migrate policy and funding levers to create the business imperative and clinical demand for interoperability"* -- p37
 - *"Rules that govern how health and care are paid for must create a context in which interoperability is not just a way to improve care, but is a good business decision."* -- p37
- SUGGESTION:
Stronger incentive policies (carrot/stick)

Kudo:

Empowering the individual

- Increasingly important:
 - Mobile population – receiving care from multiple providers
 - Rising costs
 - Patient-generated health data
- SUGGESTION:
Data must be both human and **machine understandable**
 - Encourages innovation



Kudo:

Access to Personal Health Information

- *"No policy, business, operational, or technical barriers that are not required by law should be built to prevent information from appropriately flowing across geographic, health IT developer and organizational boundaries in support of patient care." -- p31*
- SUGGESTION:
Should apply to *all* aspects of healthcare (research, quality measurement, etc.)

Kudo: Open Exchange

- *"There should be neutrality in the exchange of personal health information. [. . .] For instance, a health IT developer . . . shall not prevent a user from using health information exchange applications developed by competitors"*






-- p33

Suggestion:
Encourage **free and open**
interoperability standards

- No royalties
- No licensing barriers



ONC categories of standards

CATEGORIES OF STANDARDS		FUNCTIONS OF STANDARDS	EXAMPLES OF REAL WORLD USE OF THE STANDARDS
 VOCABULARY & CODE SETS (SEMANTICS)		The information is universally understood	RxNorm Code for Ibuprofen is 5640
 FORMAT, CONTENT & STRUCTURE (SYNTAX)		Information is in the appropriate format	C-CDA packages up data in the appropriate format
 TRANSPORT		The information moves from point A to point B	SMTP and S/MIME to send the C-CDA from one setting to another
 SECURITY		The information is securely accessed and moved	X.509: to ensure it is securely transmitted to the intended recipient
 SERVICES		Provides additional functionality so that information exchange can occur	DNS+LDAP: to find the recipient's X.509 certificate to encrypt a message

ONC Roadmap p78

Difference: ONC focus on a "common clinical data set"

- *"This Roadmap focuses on decisions, actions and actors required to establish the best **minimum level of interoperability** across the health IT ecosystem" -- p18*
- Forces all users into one box



Misconception:

How to achieve interoperability

- *"[It] is unlikely that a single data format . . . will support all of the needs of a learning health system" -- p82*
- That is **exactly what RDF does!**
(except that RDF is not a data *format*)
 - Universal information representation
 - Reason for the Yosemite Manifesto
 - Yosemite Project roadmap shows how

Suggestion:

More focus on data

- ONC roadmap mentions *"Interoperability of processes and workflows"*
- Data interoperability is ***far*** more important

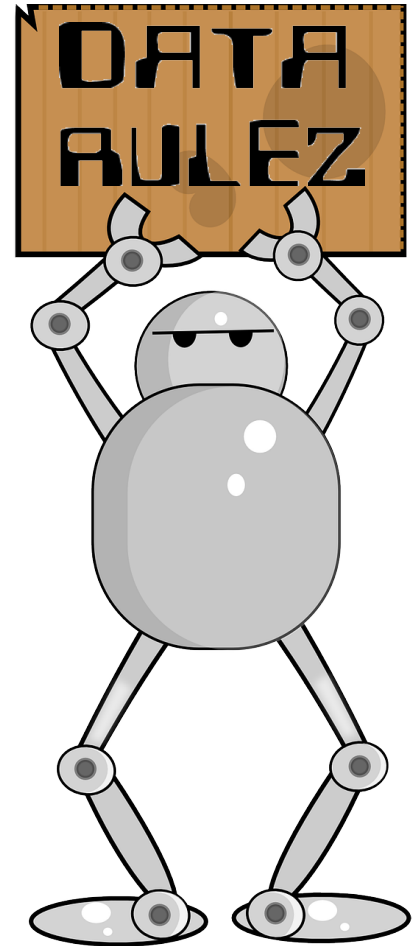
All Things

~~APIs~~

~~Services~~

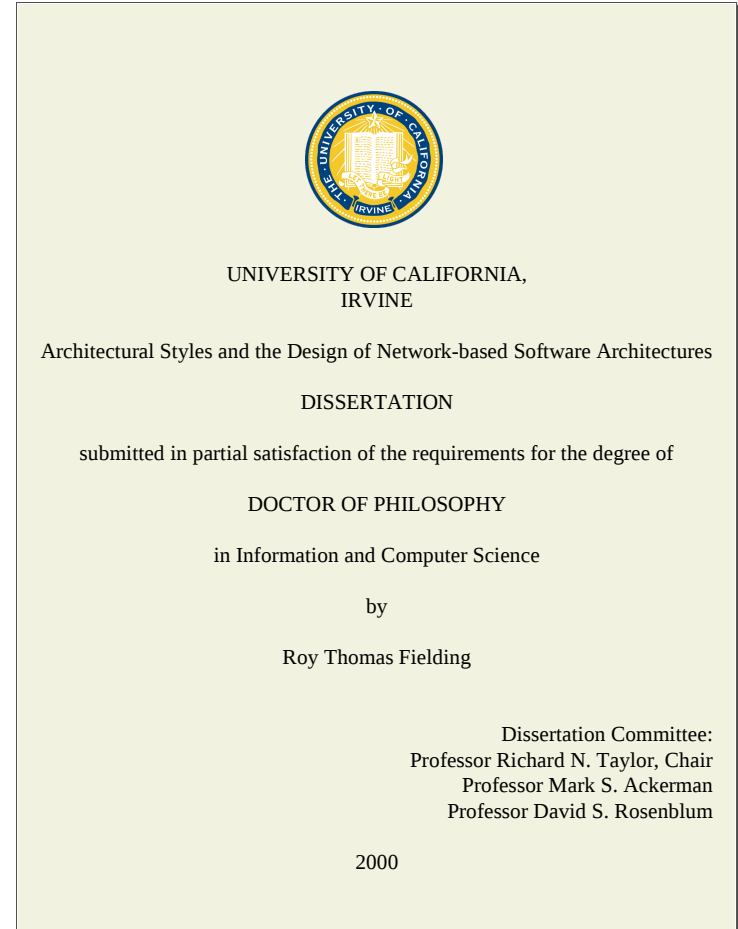
~~Workflows~~

~~Applications~~ come and go,
but **data lives forever**



Kudo: RESTful interfaces

- More than just HTTP!
- Uniform interface / API
- Data-centric ("Resource-centric")
- Obviates the need for many specialized protocols



SUGGESTION: More emphasis

Suggestion:

Stable URIs for concepts

- Use of **Linked Data** principles
- Stable URIs for all concepts
- Every concept URI should link to its **authoritative definition**
 - Both machine and human oriented
 - Free and open – **no IP barriers**



YosemiteManifesto.org

Suggestions: General

- Support the Yosemite Project
 - RDF as a common semantic layer
- Stronger policies:
 - Incentives for interoperability
 - Free and open standards

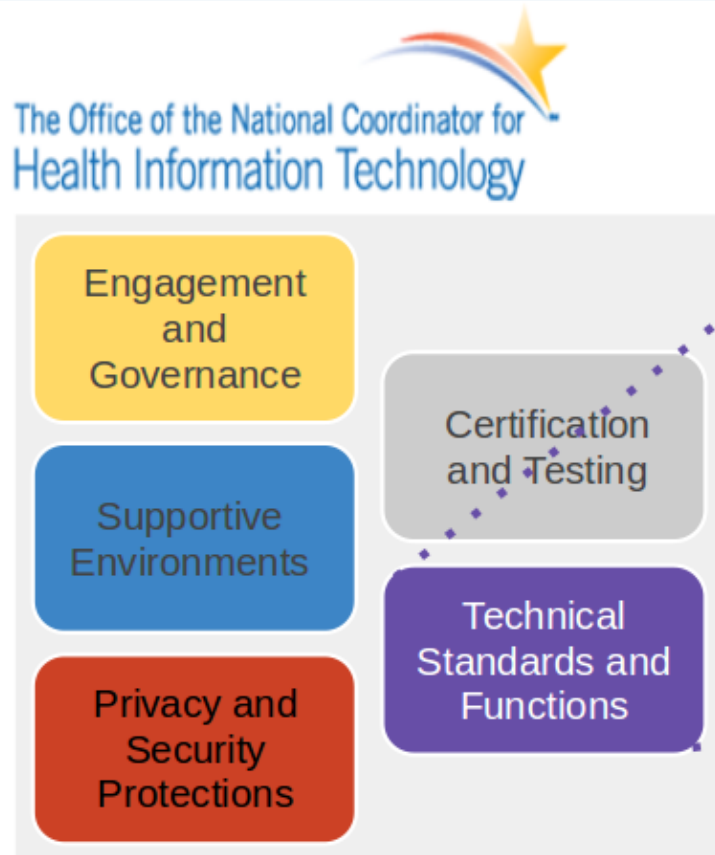


Report Card

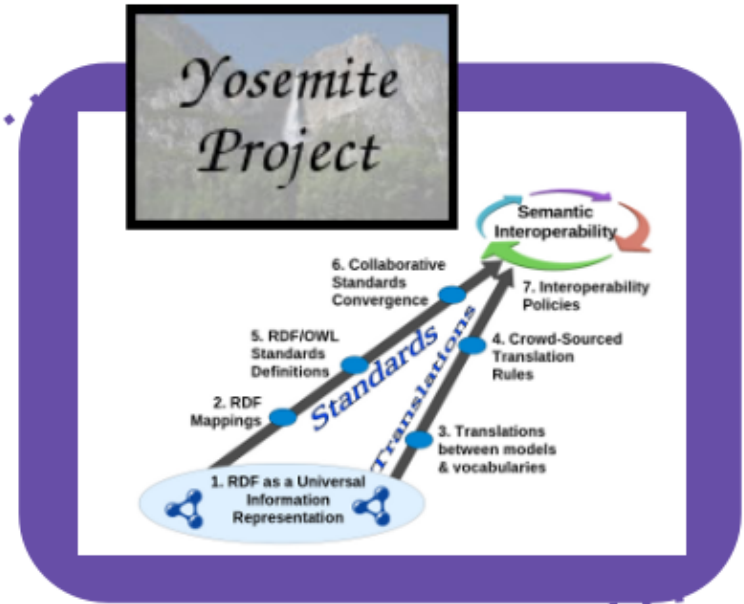
Scope and Vision	A+
Problem Insight	A
Focus	B
Articulation	B+
Feasibility	A-
Execution	?

Questions?

Comparison of roadmaps



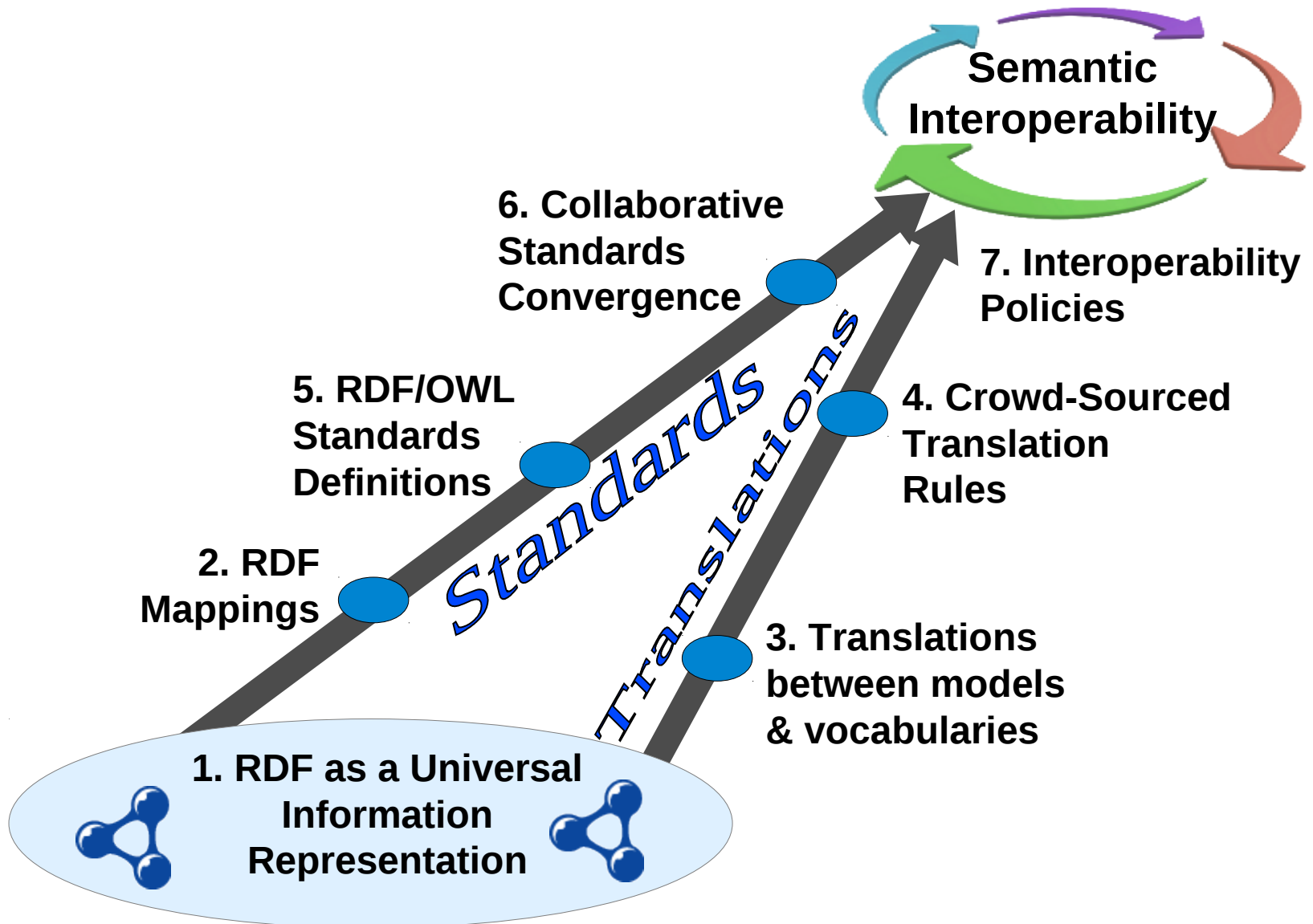
- Addresses *all* aspects of interoperability
- Goal: Interop of a common *subset* of healthcare data
- Federally sponsored



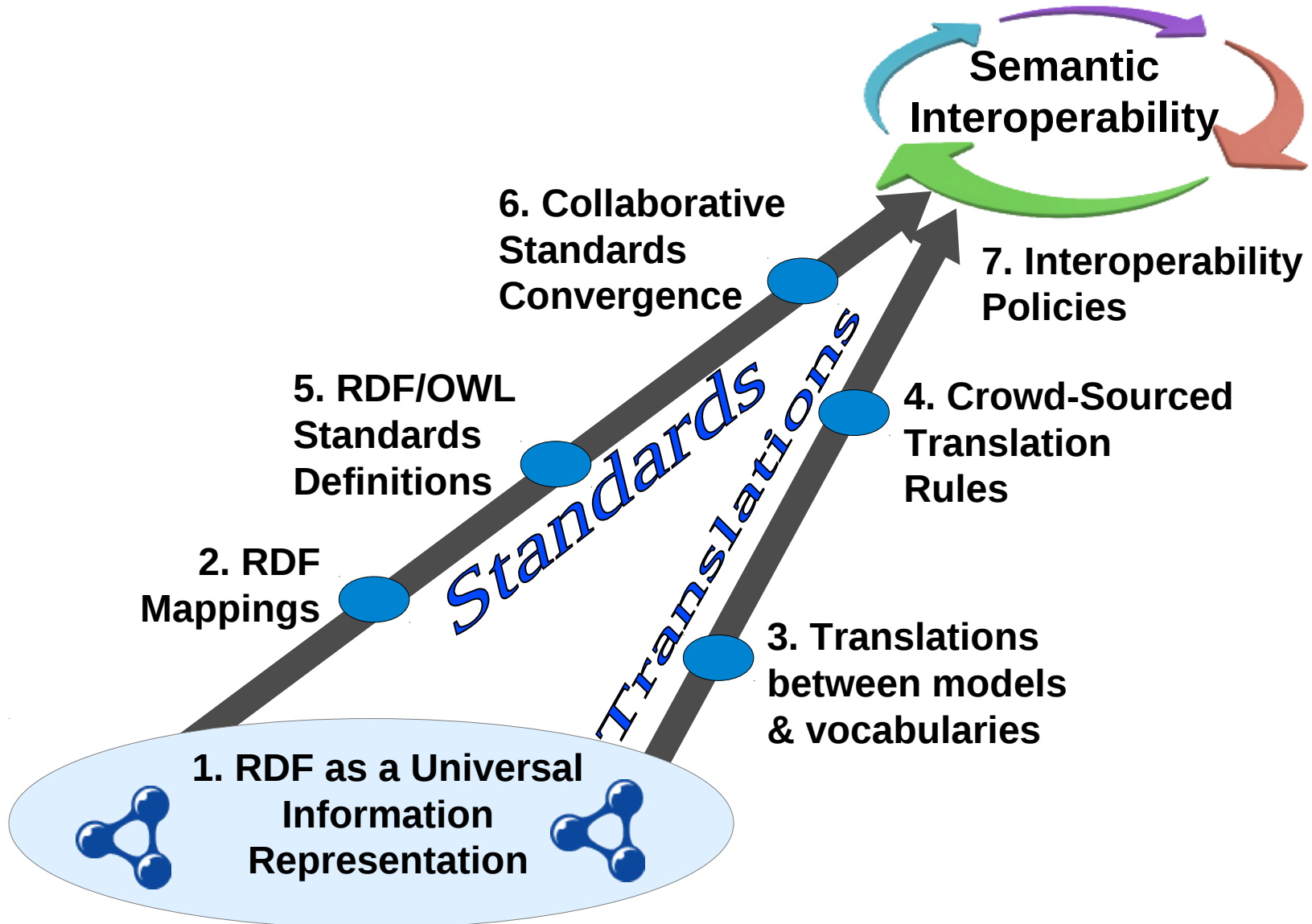
- Addresses the technical problem of information interoperability
- Goal: Interop of *all* structured healthcare information
- Collaborative initiative

BACKUP SLIDES

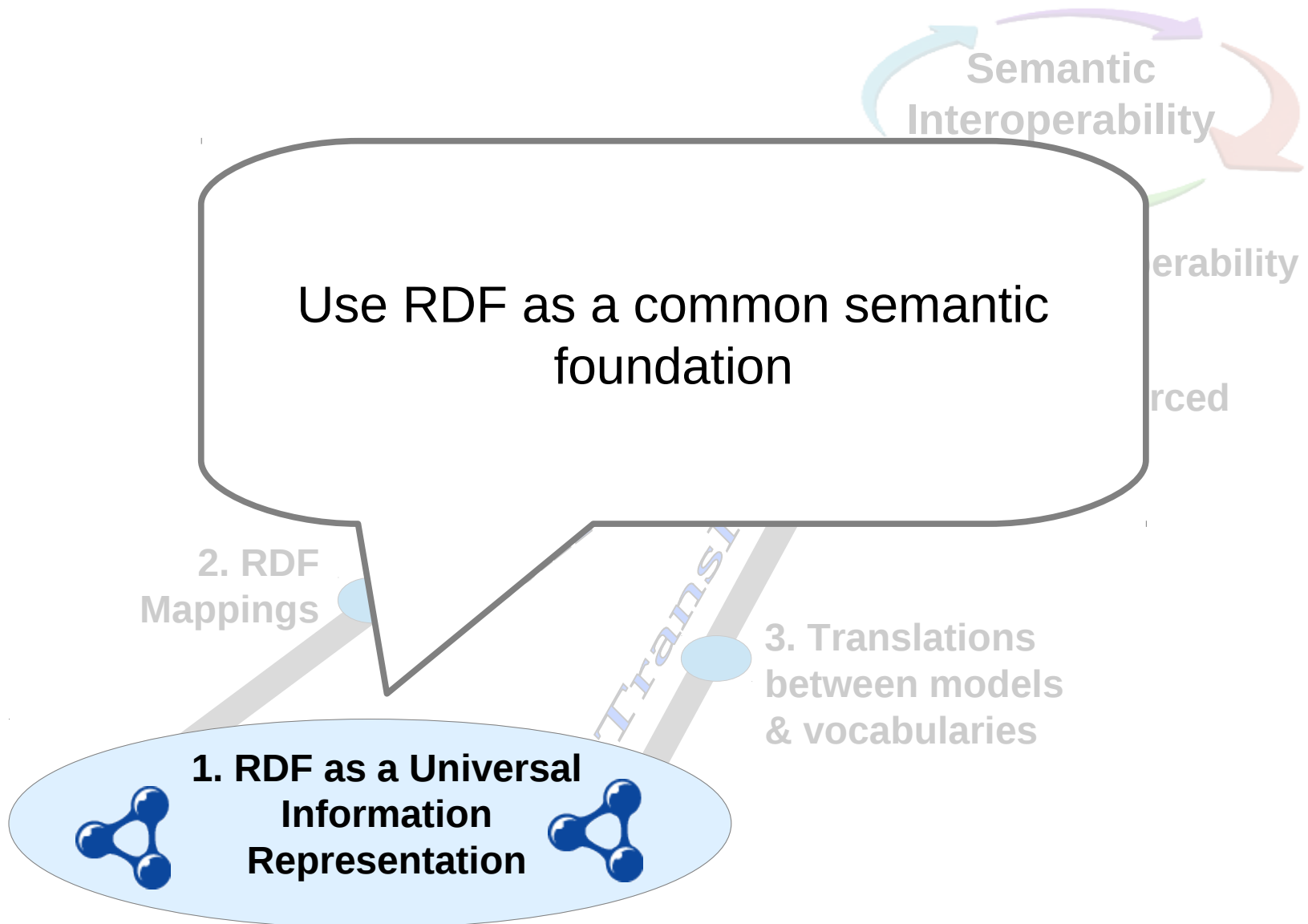
A Roadmap for Healthcare Information Interoperability



Yosemite Project Roadmap



Roadmap - 1



Roadmap - 2

For common healthcare information representations*, define an **RDF mapping** to/from each format, data model and vocabulary – "lift" and "drop".

*Both standard and proprietary

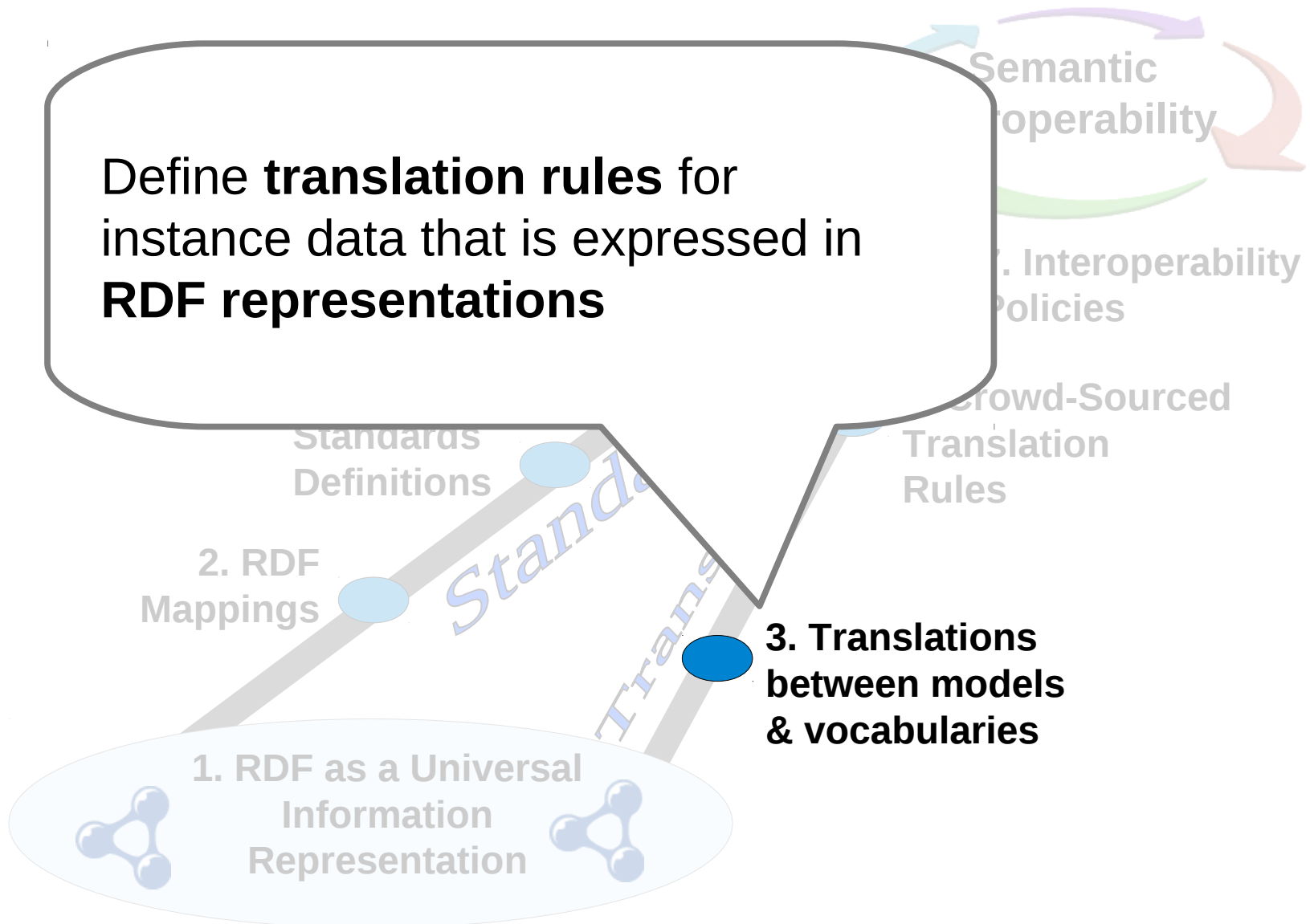
2. RDF Mappings

3. Translations between models & vocabularies

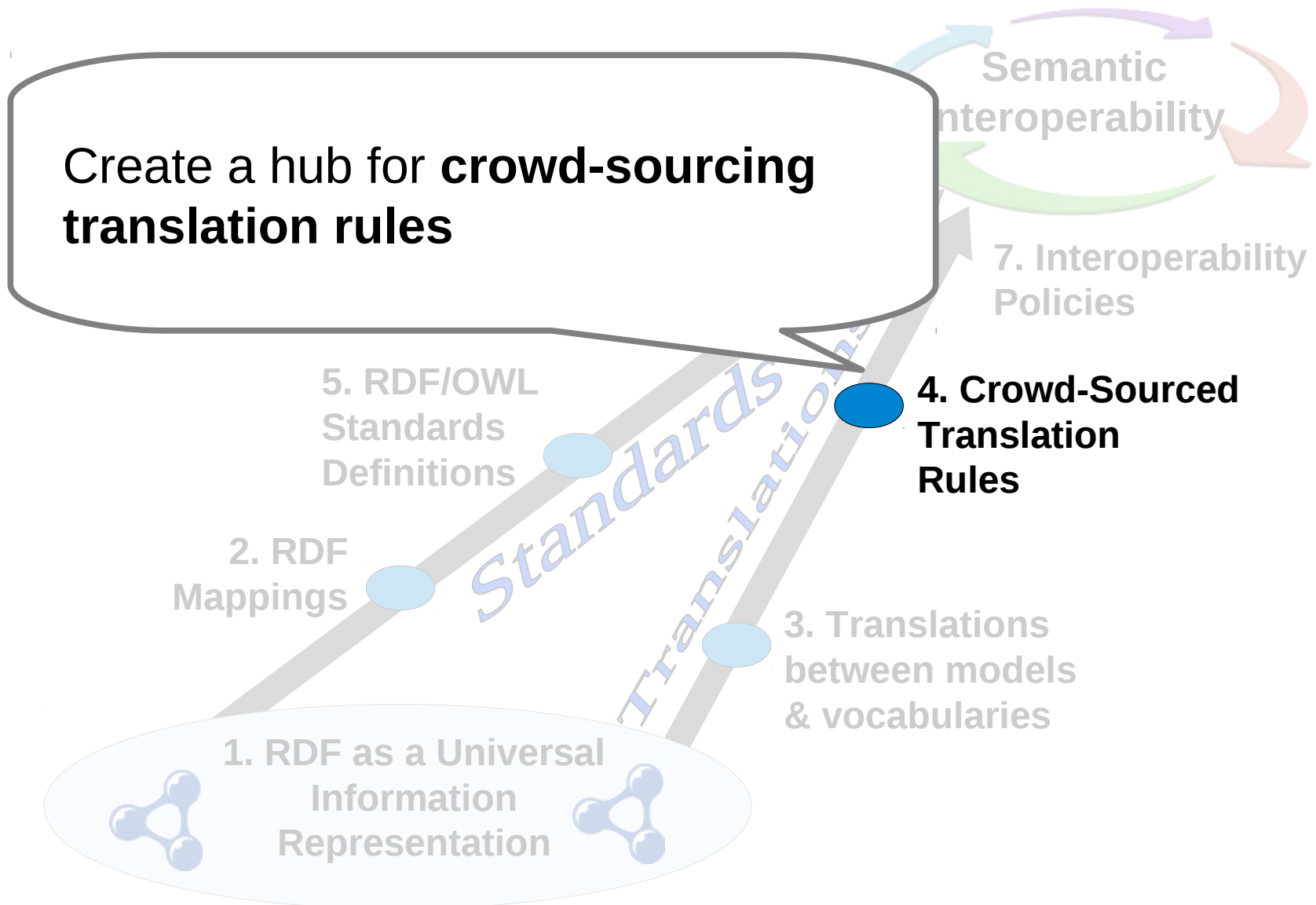
1. RDF as a Universal Information Representation

Roadmap - 3

Define **translation rules** for instance data that is expressed in **RDF representations**

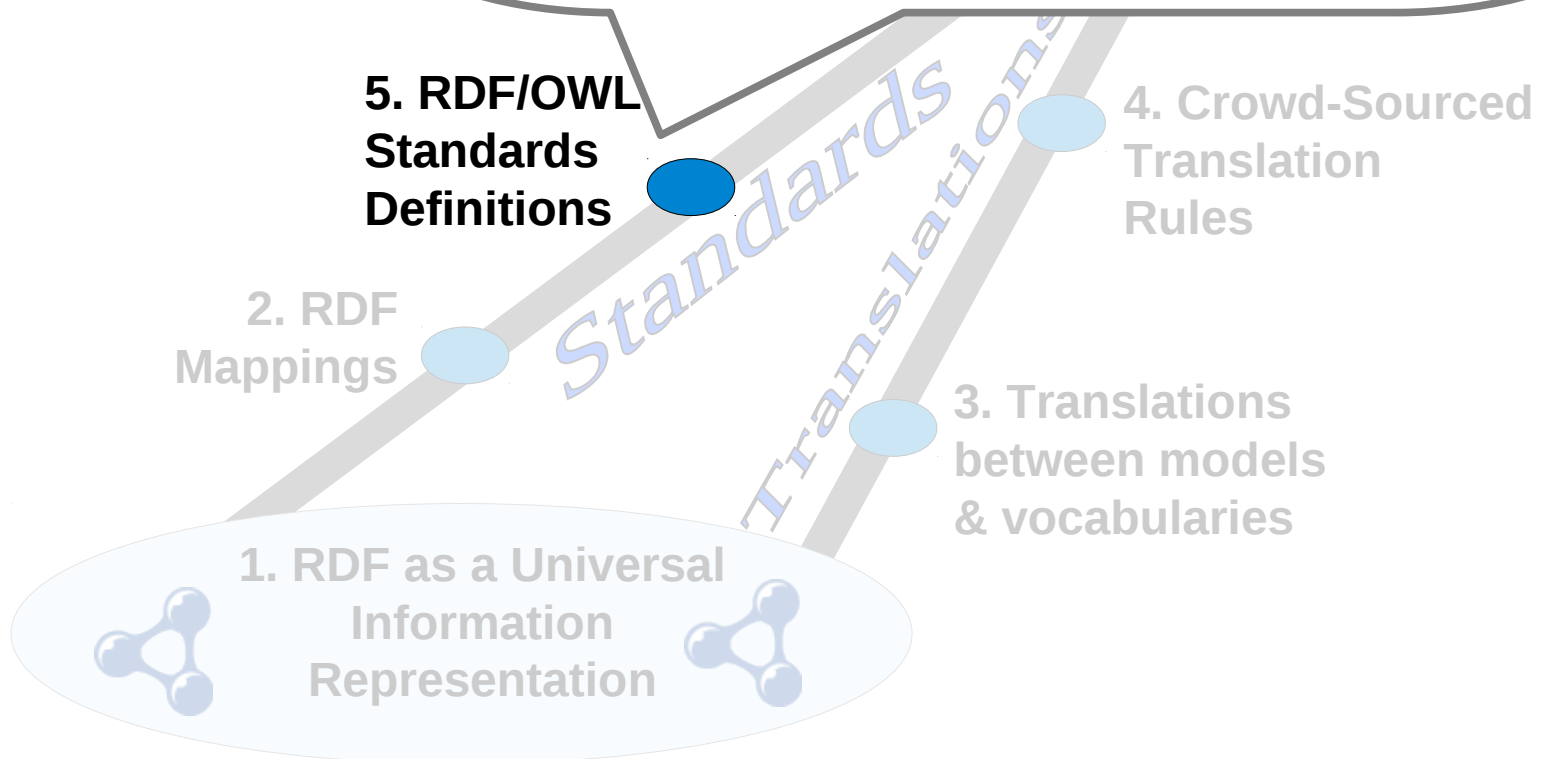


Roadmap - 4

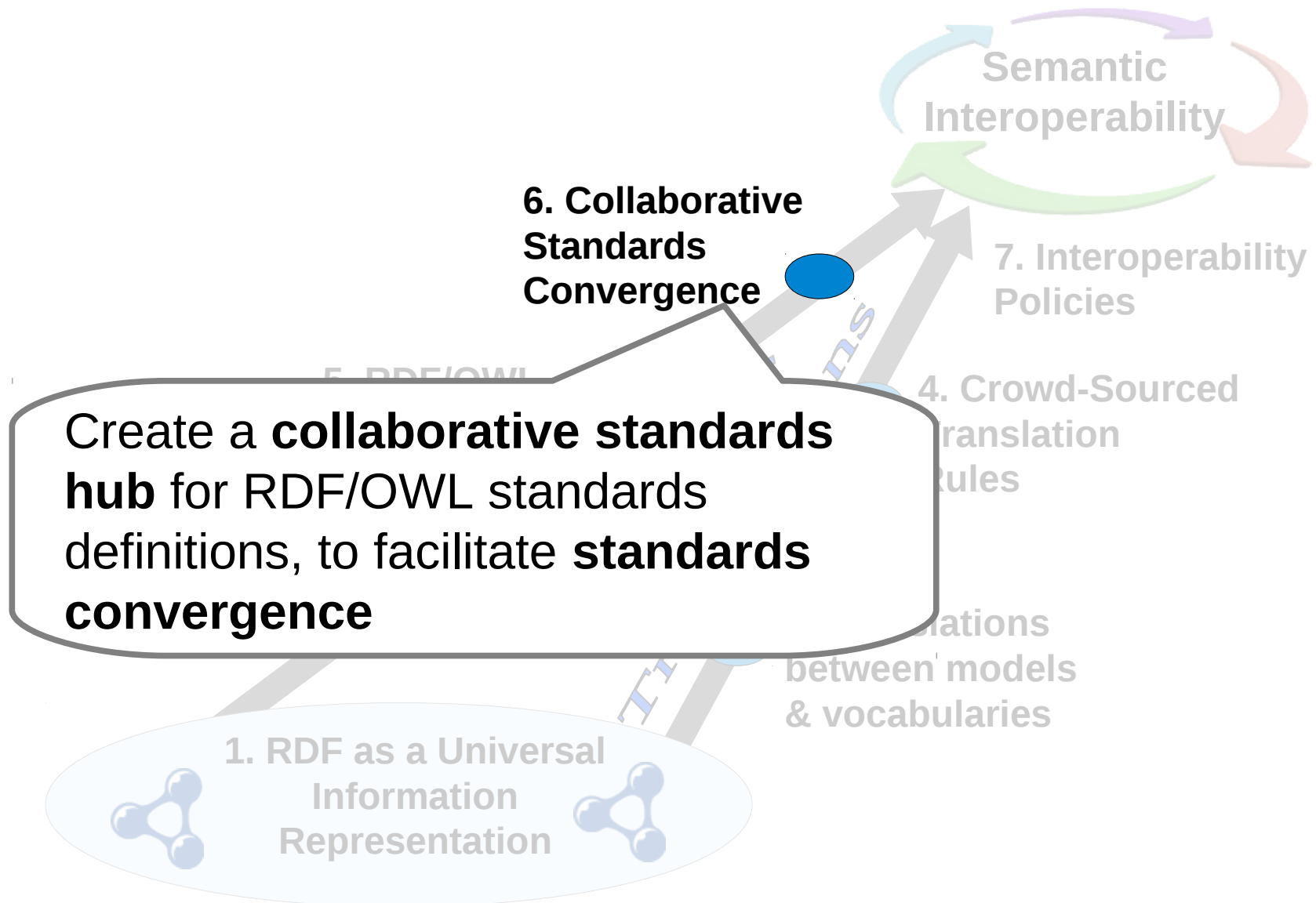


Roadmap - 5

Create **RDF / OWL definitions** of the data models and vocabularies defined by healthcare standards

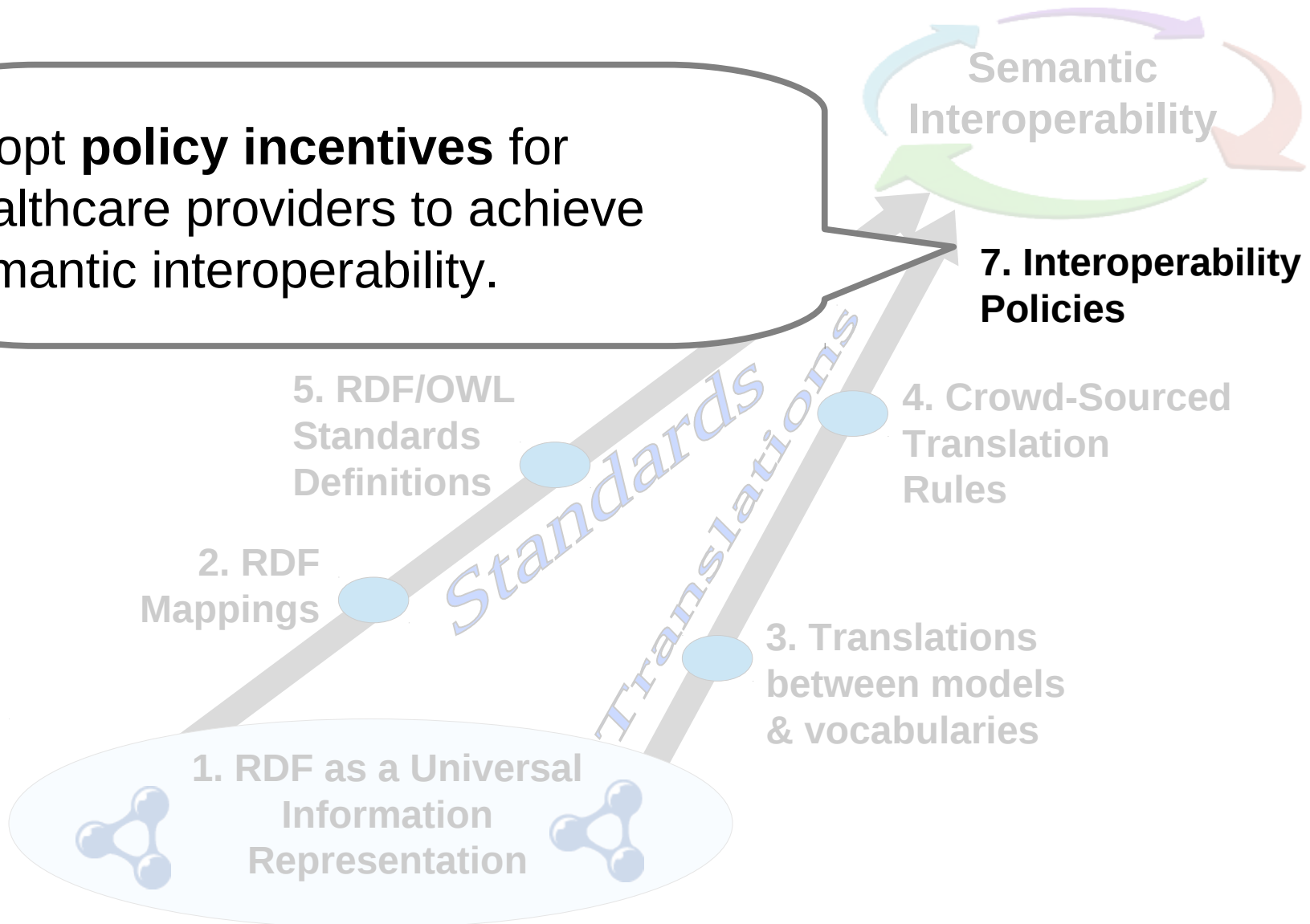


Roadmap - 6



Roadmap - 7

Adopt **policy incentives** for healthcare providers to achieve semantic interoperability.



Roadmap - 7

(a) Adopt **free and open interoperability standards.**

Why?
Eliminate **IP barriers to interoperability.**

1. RDF as a Universal
Information
Representation

3. Translations
between models
& vocabularies

4. Crowd-Sourced
Translation
Rules

7. Interoperability
Policies

Semantic
Interoperability

Roadmap - 7

(b) Adopt **policy incentives** for healthcare providers to achieve semantic interoperability.

Why?

A healthcare provider has **no natural business incentive** to make its data interoperable with competitors.

Semantic Interoperability

7. Interoperability Policies

4. Crowd-Sourced translation rules

3. Mappings between models & vocabularies

1. RDF as a Universal Information Representation

Yosemite Project Roadmap

