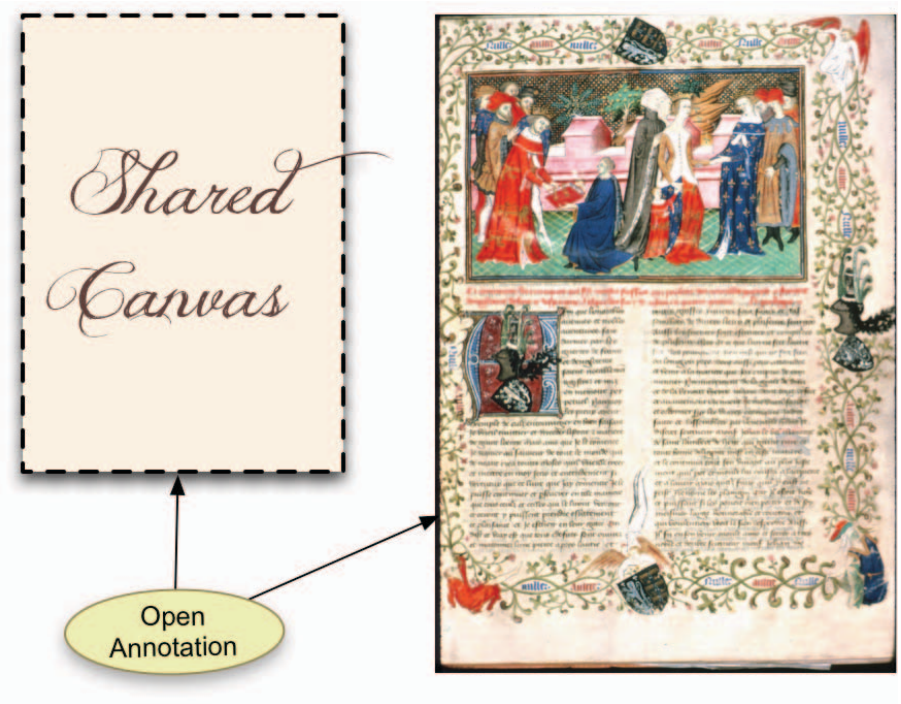
RDF: Resource Description Failures and Linked Data Letdowns



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Overview

- Graphs
- The Wide Open World
- Ontologies and Identities
- Serializations and Technologies
- Linked Data
- Temporal Issues

- Summary

<blink> WARNING: Controversy Within </blink>

RDF, Linked Data, Semantic Web… oh my!

The Semantic Web was a ***great*** idea in 2003

The Semantic Web is still a great ***idea*** in 2013

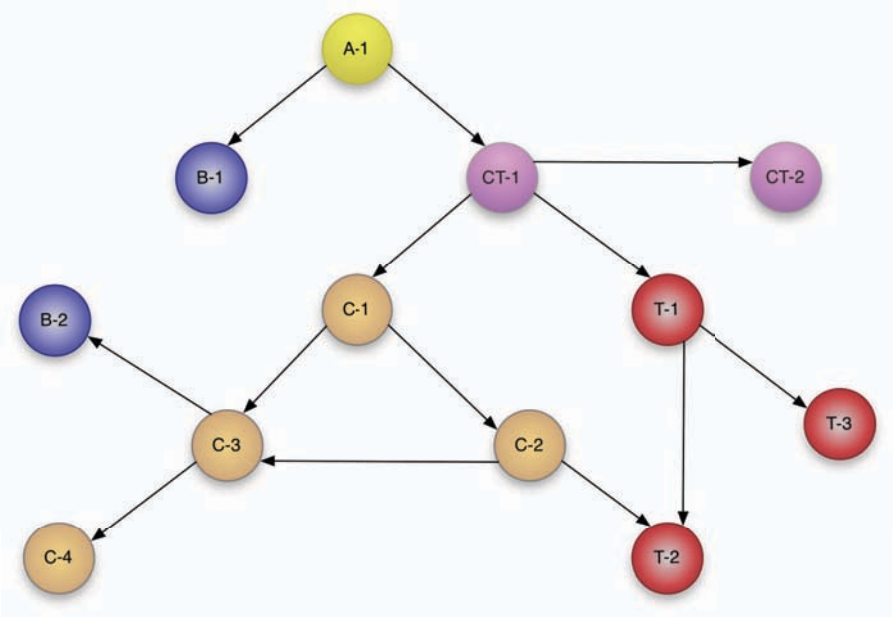
Lots of progress made, but lots of challenges remain

This talk is *not*:

- An introduction to RDF
- An advertisement for Linked Data
- An apology for the Semantic Web

Graphs

- ✓ Graphs are very powerful for modeling reality
  - ✓ Tree is just a simple Graph
    (directed, acyclic, with known root node)
  - ✓ Novel information can be automatically inferred
  - ✓ More interesting questions can be asked
  - ✓ Don't end up in XML semantic/syntactic hell



Graphs: Structure and Data

- Querying is much more complicated

Graph: Structure *and* Data important,
but data currently treated as second class citizen
Other: Only Data important, so easier to work with

Graph Query: Find books written by "Sanderson"

```
?book a b:Book ; dc:creator ?who .
?who a f:Person ; f:name "Sanderson"
```

Or when you don't need to worry about structure:

```
au:Sanderson
```

Graphs: Structure and Data

- Serialization and Storage are complicated

Serialization has a start and end, unlike a graph

- No obvious place to start or stop writing
- Need to link within the serialization, and without
- Will come back to this … it gets worse!

Storage can't look at "documents", deals with structure

- All assertions in graph (triples) are stored in one big lump
- Serialization is a very temporary artifact to transfer some subset of the triples
- Needs to worry about structure and data, not just data

Graphs: Structure and Data

- Visualization is difficult to get right
  - … and hard to know when it is right
  - Documents “easy” to visualize
    (eg browser, pdf viewer, image viewer etc)
  - Data visualization understood
    (eg ManyEyes, charts, time series, etc)
  - Graph visualization almost universally terrible
    … because structure is crucial

Visualization Done Right

http://www.facebook.com/note.php?note_id=469716398919

Not So Right

Graphs

✓ Graphs are very powerful

➢ Graphs become complicated to work with

Mitigating Factors:

- Software libraries can manage complexity
- NoSQL solutions improving rapidly
- Treat part of the graph as a document (having cake)
  And also ingest into TripleStore (eating it)

- Other structures don't get complicated
  because they lack the expressiveness of a graph

The Open World

- ✓ A *Single Global* Graph that everyone contributes to
  - ✓ Great for data re-use
  - ✓ Richness of data from multiple sources
  - ✓ Anyone can make assertions about anything
  - ✓ Global identities
  - ✓ Distributed: Can incrementally add to others descriptions
  - ✓ Fits with the WWW: The Data Web

Technically: If a statement is not asserted, then its truth-value is unknown, rather than false.

Data: Grass is Green.

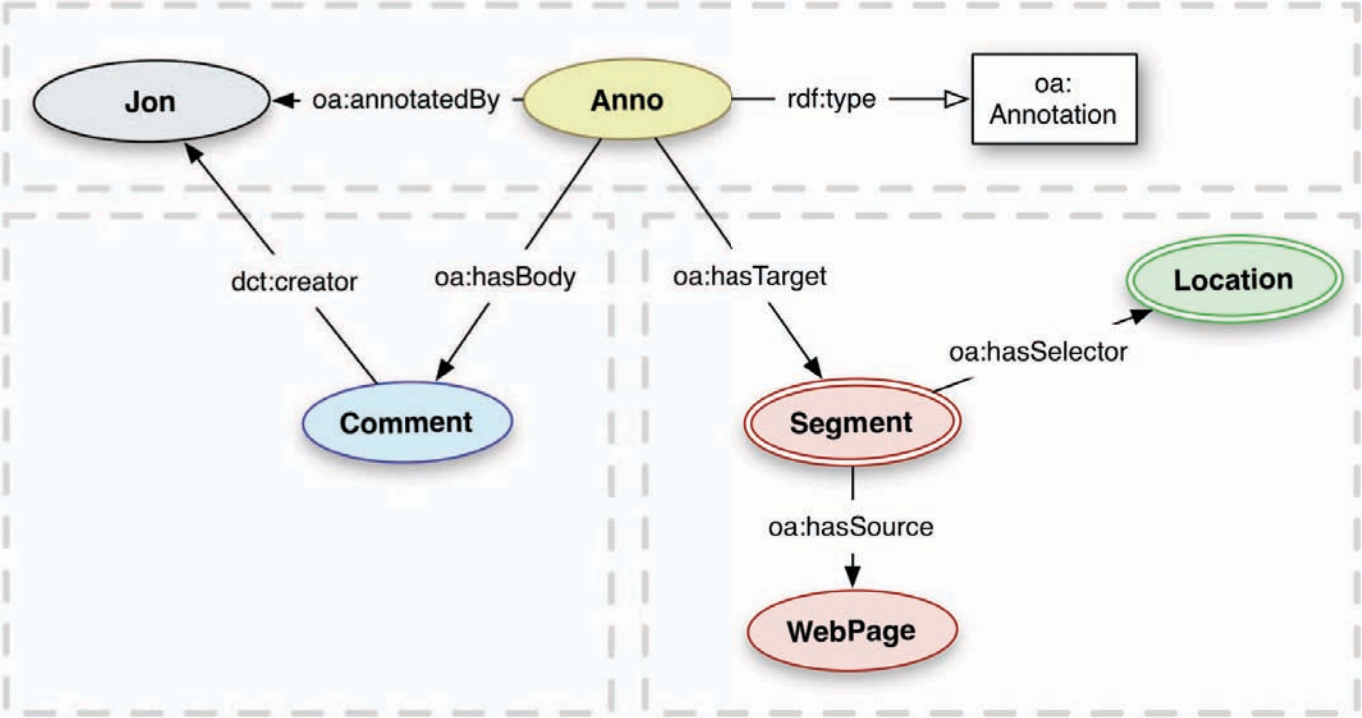
Question: Is Grass Red?

Closed World: No

Open World: I Don't Know

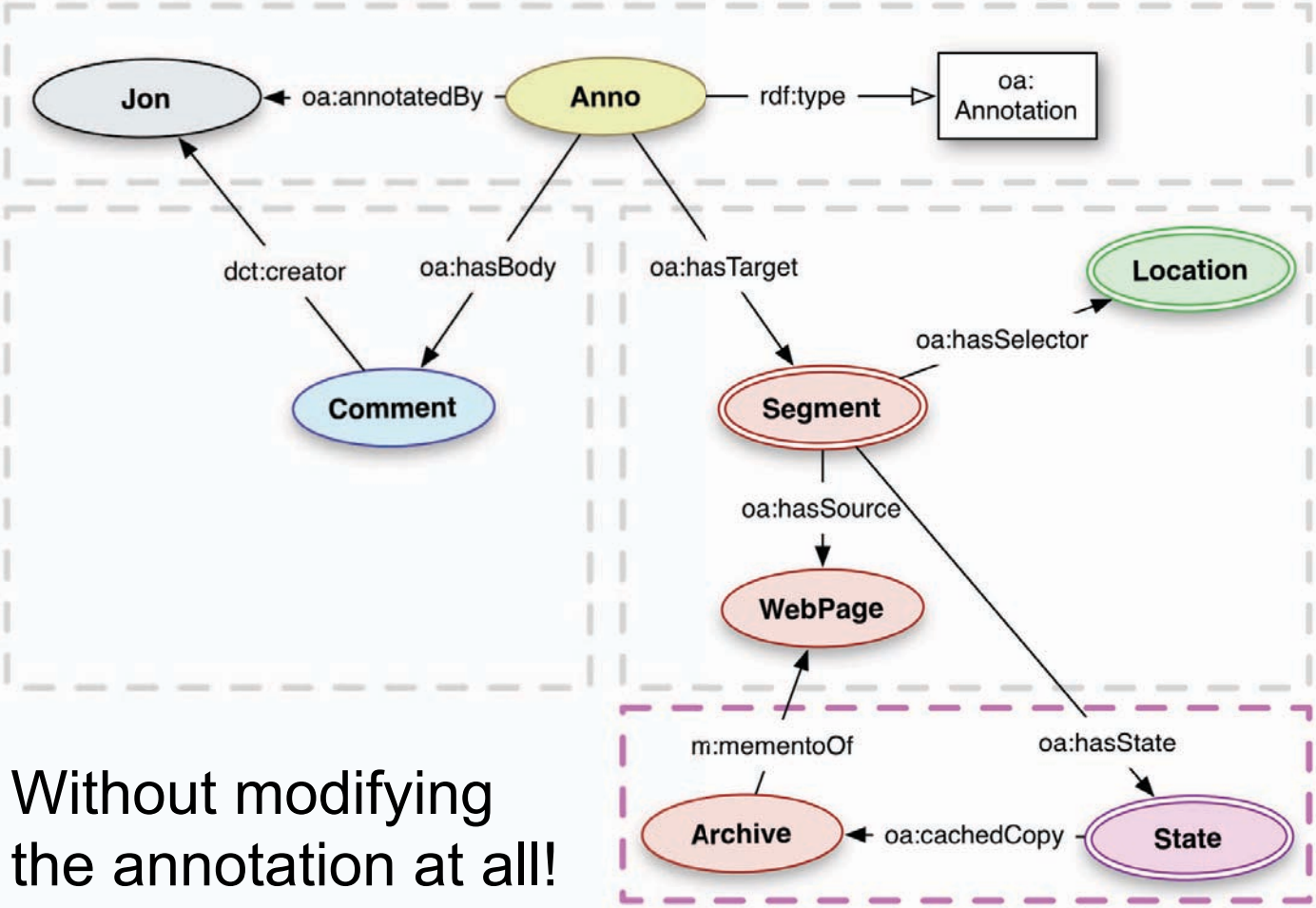
The Open World: Positive Use Case

Jon publishes an Annotation about part of a web page.



The Open World: Positive Use Case

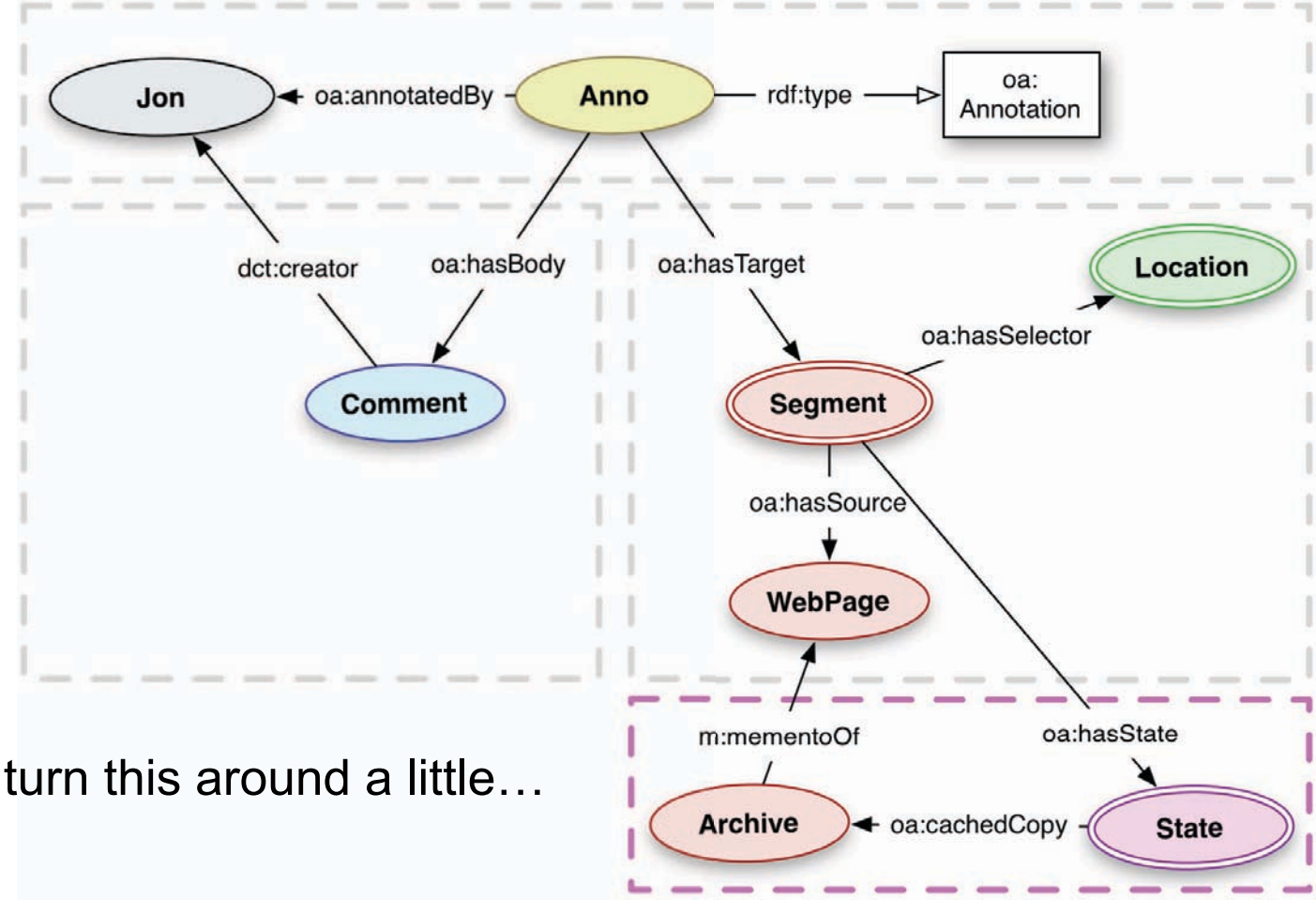
Brewster archives the page … and says where it is.



✓ Without modifying the annotation at all!

The Open World: Global Complexity

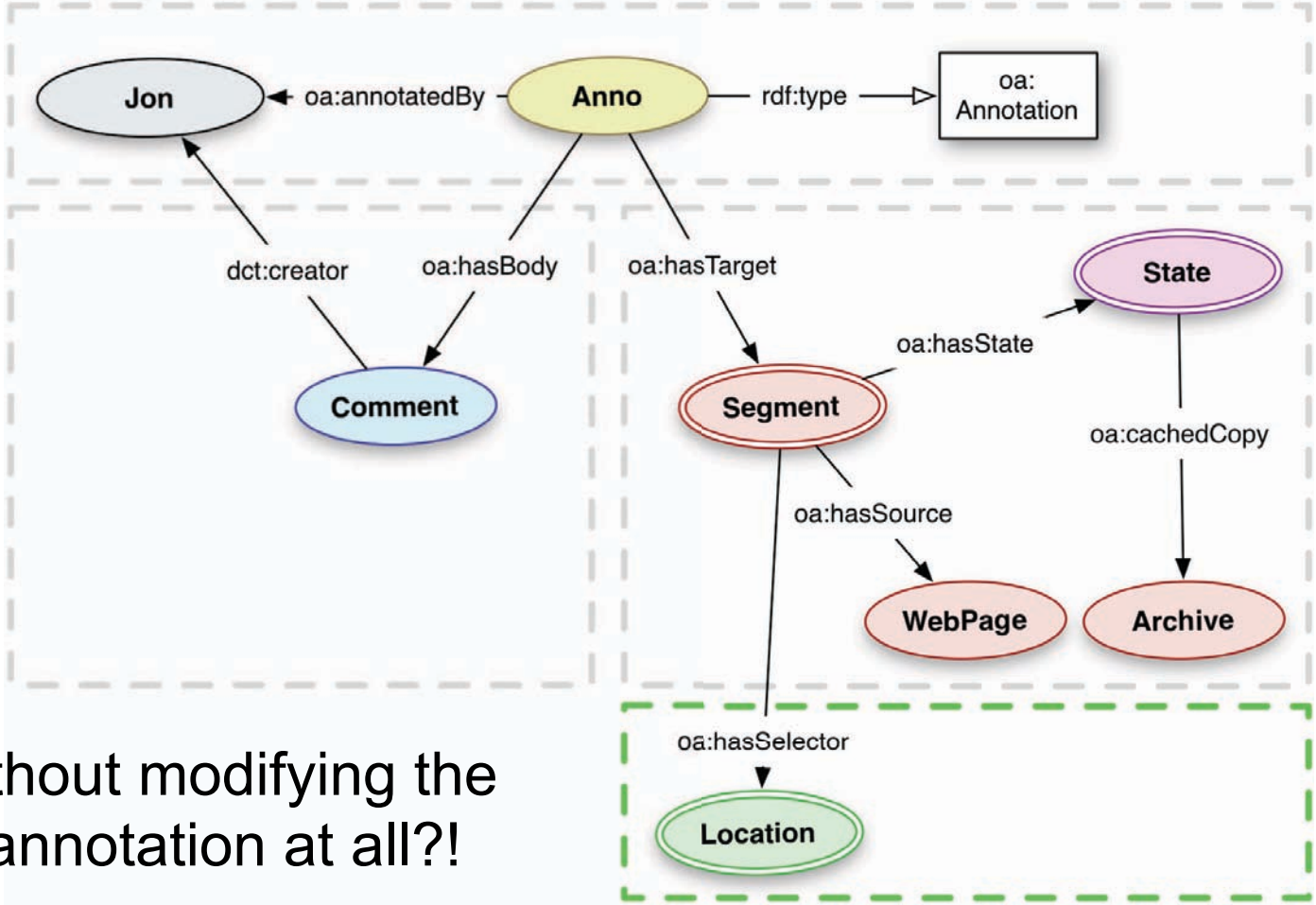
- New assertions can drastically change meaning



Let's turn this around a little…

The Open World: Global Complexity

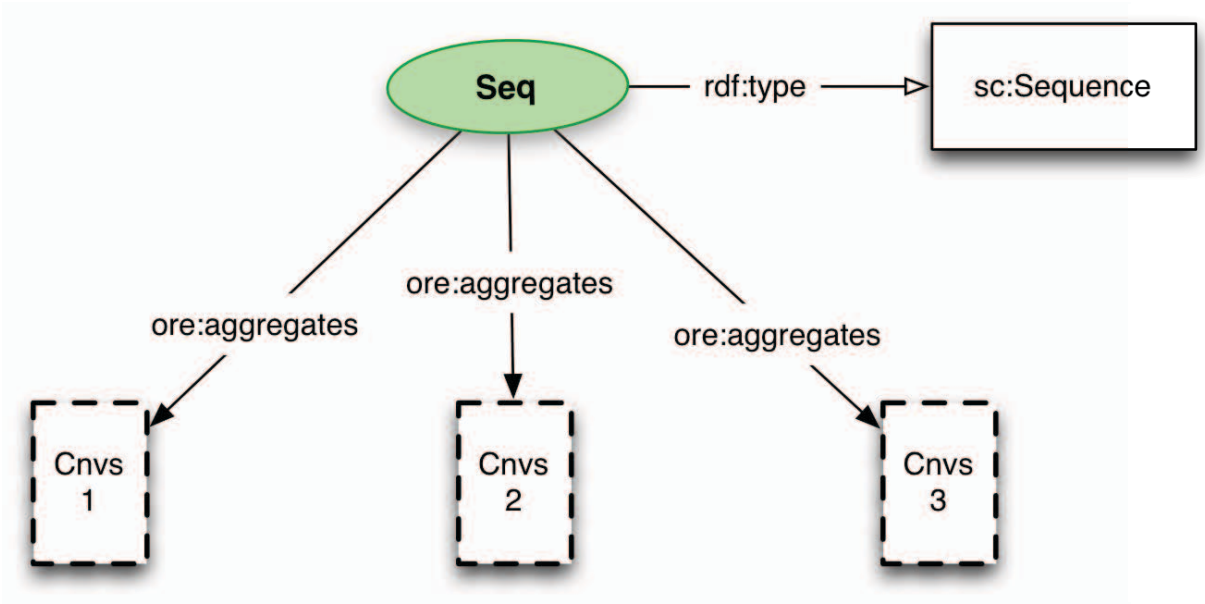
- Fred asserts:



Without modifying the annotation at all?!

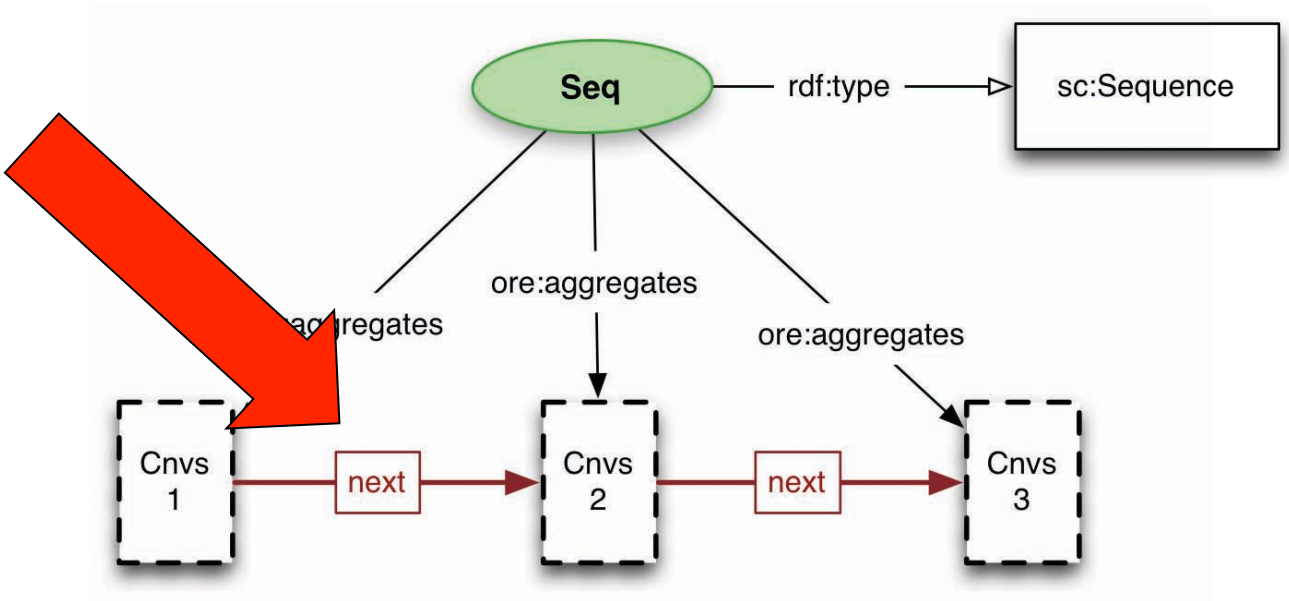
The Open World: Local Complexity

- Every assertion is considered true in all contexts



Q: How do we say that Canvas 2 comes after Canvas 1, and Canvas 3 comes after Canvas 2?

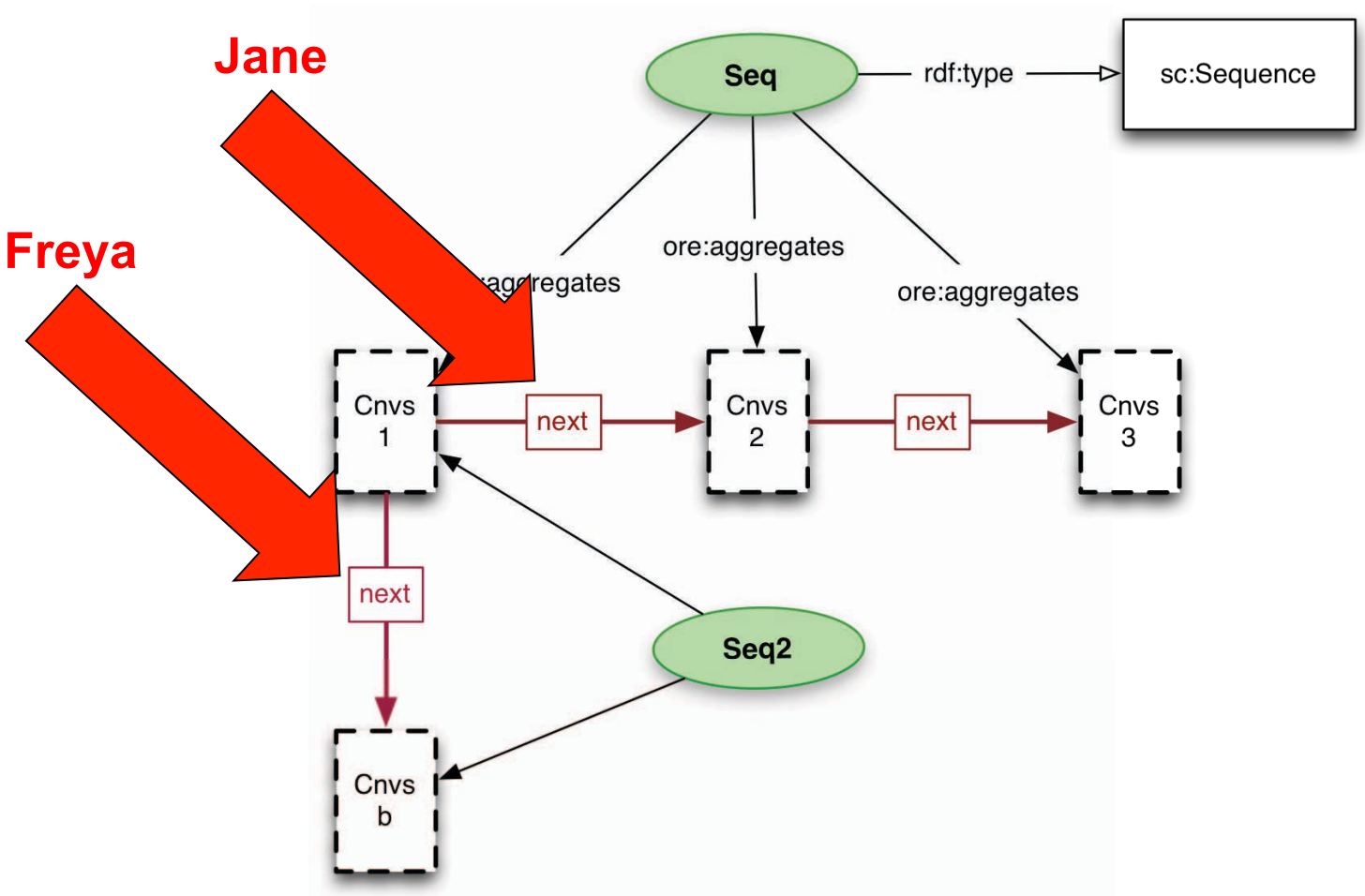
The Open World: Lists



Did you think this?

Remember anyone can say anything, and it's global…

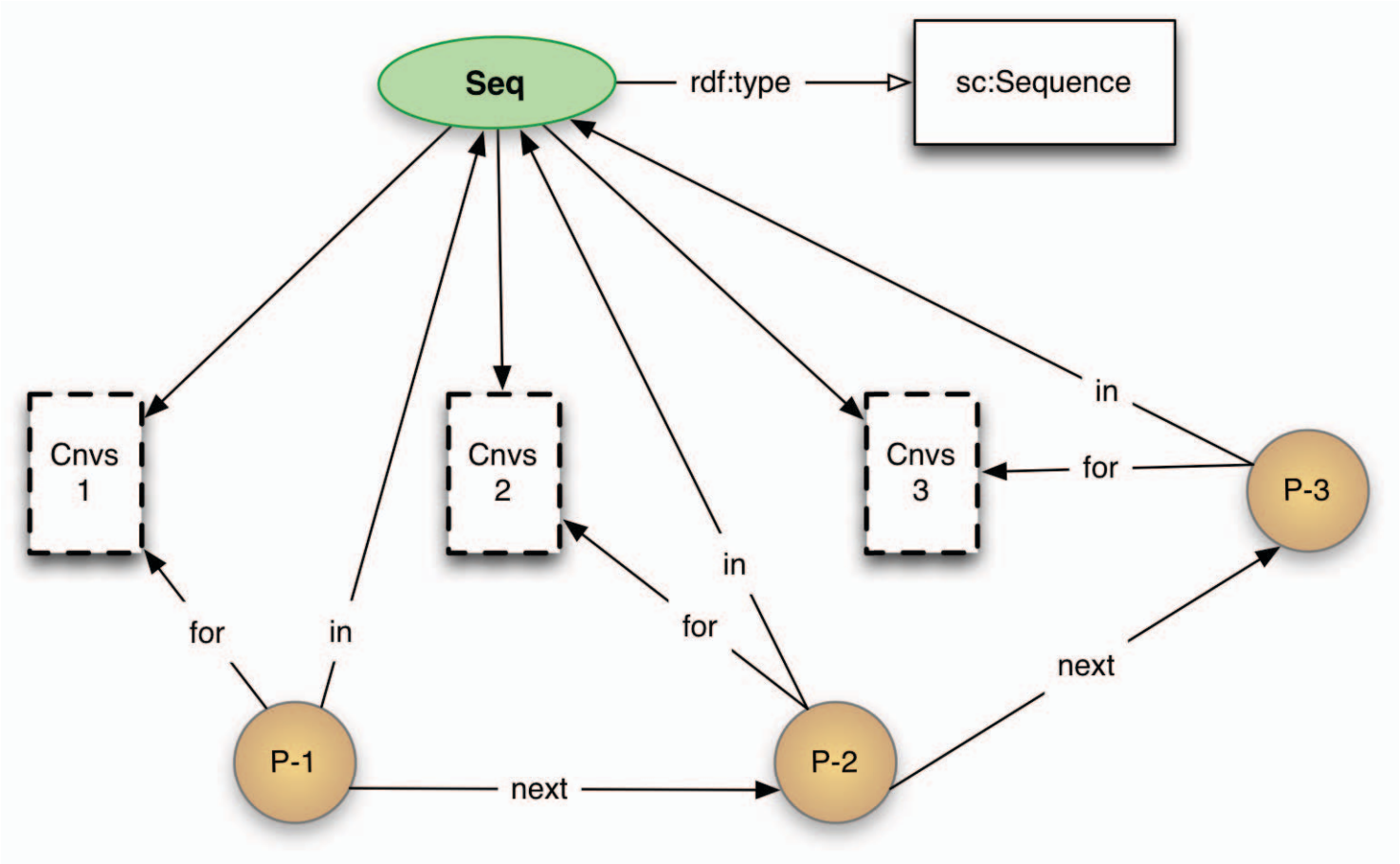
The Open World: Lists



Now there are two next links from Canvas 1, and our list is … a graph.

Use Case: Manuscript has different page order at different times

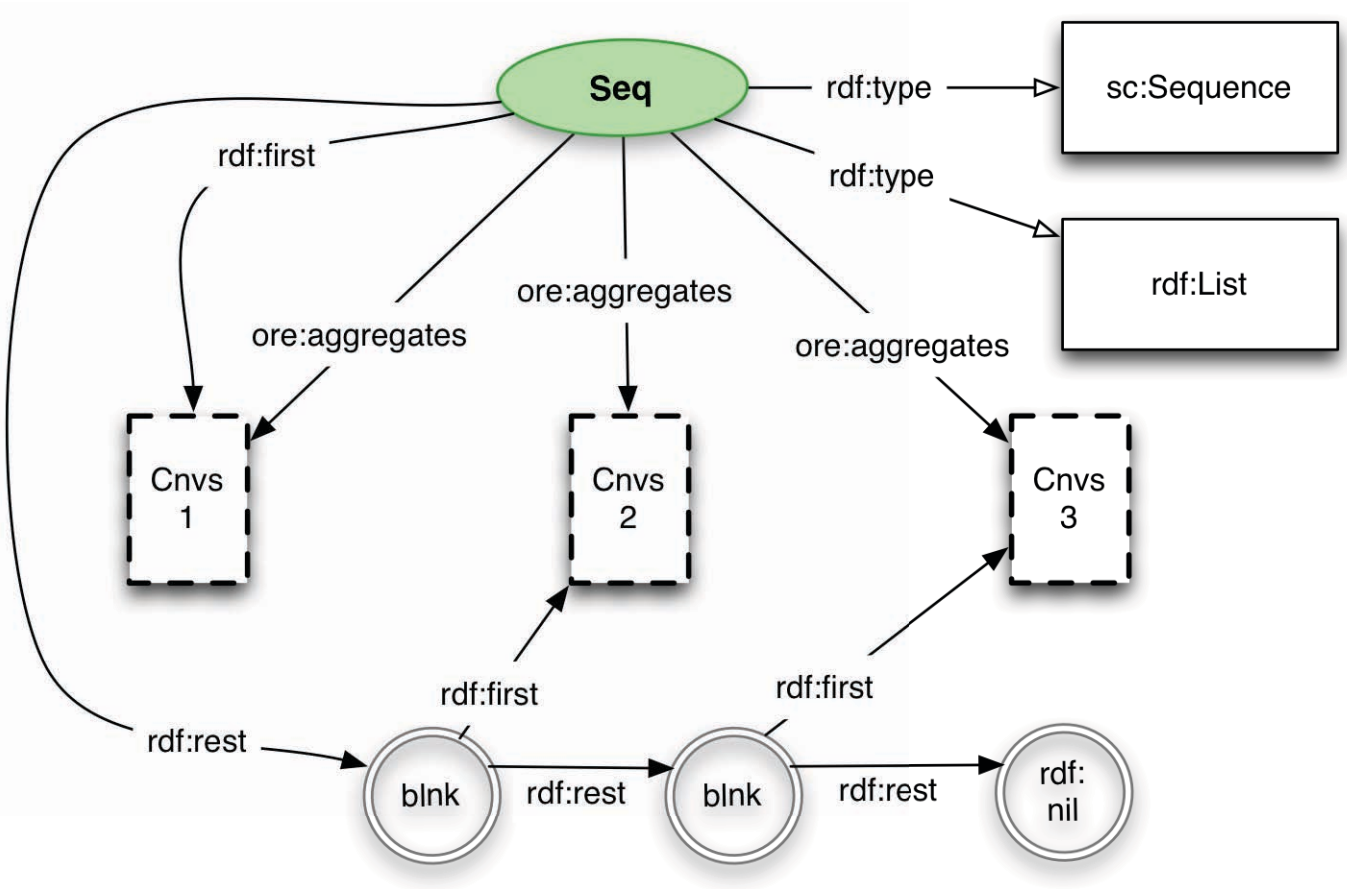
The Open World: Lists



ORE introduces proxy nodes, as not just order is local.

Eg may wish to cite a resource in the context of a set of resources.

The Open World: Lists



Shared Canvas uses multiple classes and the rdf:List construction.

Serializations hide the list's anonymous nodes.

The Open World

- ✓ A Single Global Graph that everyone contributes to
- ➢ Local constructions are complex
- ➢ Remote assertions can change understanding

Mitigating Factors:

- Local identity for local context is good practice
- Harder to take short cuts, forces understanding
- Some grass <u>is</u> red. Could be both red and green
- Trust is required in <u>all</u> data, not just linked data

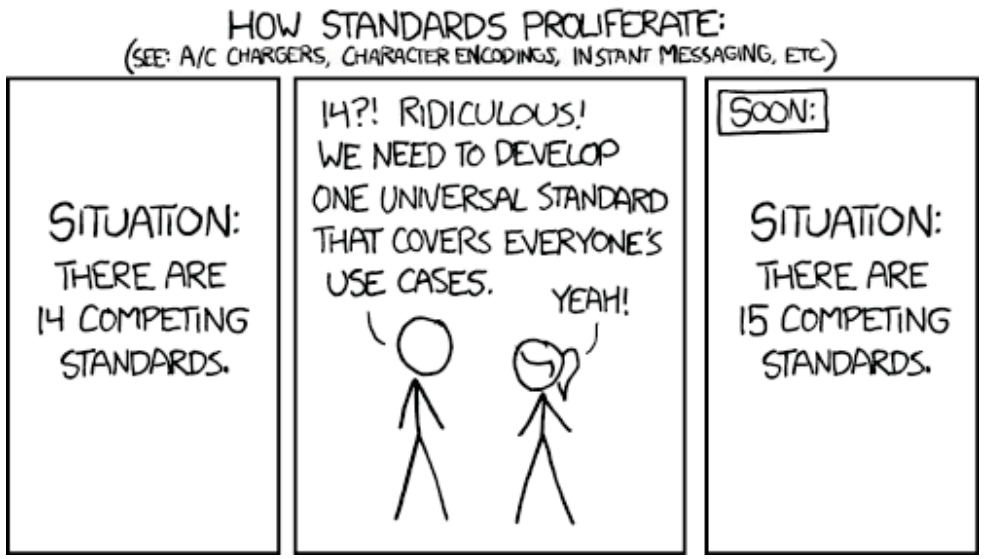
Ontologies and Identities

- ✓ Shared ontologies increases semantic interoperability
  - ✓ dc:title is ‘name’ or ‘label’, not property title or Dr.
  - ✓ Re-use of semantics makes it easier to build applications
  - ✓ Communities can develop own ontologies independently (as opposed to microdata/schema.org)

- ✓ Shared Identity makes it possible for graph to merge serendipitously
  - ✓ Everyone can mint own IDs using http URIs
  - ✓ By reusing ids, graphs will merge, creating new knowledge

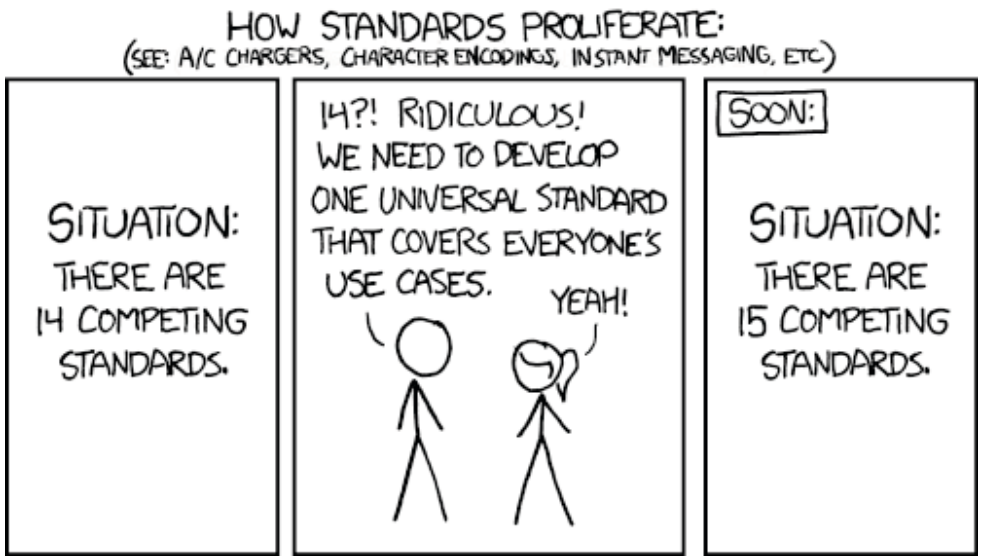
Ontologies and Identities

- "The nice thing about … Ontologies … is that there's so many to choose from"
  - Far far too many to choose from, hard to find the right one
  - If almost right, do you reuse and hope for the best, or specialize and create yet another ontology?



http://xkcd.com/927/

Ontologies and Identities



BIBO

Dublin Core Elements

Dublin Core Terms

RDA

MARC21RDF

PRISM

NSDL

…

BibFrame

Ontologies and Identities

- "The nice thing about … Identities … is that there's so many to choose from"
  - Far far too many to choose from, hard to find the right one
  - As anyone can create identity for anything, they do
  - Identity can have a contextual component – does LANL's identifier for Oppenheimer differ from DBPedia's?

Ontologies and Identities

- ✓ Shared Ontologies increase Interoperability
- ✓ Shared Identifiers make the graph merge
- ➢ Multiplicity of Ontologies
- ➢ Multiplicity of Identities

Mitigating Factors:

- Assertions of equivalence are just assertions.
  Can apply same parsers, trust mechanisms etc.
- Well-known ontologies and identifier schemes
- As the global graph continues to increase,
  winners will become obvious

Serializations

- ✓ …
- ✓ …
- ✓ The new JSON-LD format is actually pretty good?

```
{
    "@context": "http://www.w3.org/ns/oa.json",
    "@id": "http://example.org/anno1",
    "@type": "oa:Annotation",
    "annotatedAt": "2012-11-10T09:08:07",
    "annotatedBy": {
        "@id": "http://public.lanl.gov/rsanderson#me",
        "@type": "foaf:Person",
        "name": "Rob Sanderson"
    },
    “hasBody": {"chars": "This... is CNN.”},
    “hasTarget": “http://www.cnn.com/”
}
```

Serializations

- WAY Too many serialization formats
- The recommended RDF/XML is absolutely terrible
  - "RDF/XML was the Semantic Web's 3 Mile Island incident" -- Manu Sporny, *http://manu.sporny.org/2012/nuclear-rdf/*
- Multiple formats means multiple identifiers for descriptions (one per format)
  - Content Negotiation is a pain
  - Not everyone implements every format = interop hell
- Leaves room for competing models/syntaxes
  - Microdata, Schema.Org etc.

Serializations

- ✓ JSON-LD (but is it just the 15th serialization?)
- ➢ Everything else

Mitigating Factors:

- Software libraries help, but are inconsistent
- … and that's all I've got!

Platform Technologies

- ✓ RDF and Semantic Technologies rapidly improving
  - ✓ Open Source and Commercial
  - ✓ Much better scalability
  - ✓ Some cross-platform APIs
  - ✓ In use in Fortune 500 companies
    - ✓ Internally for business intelligence
    - ✓ Externally, eg Google Freebase
  - ✓ QuadStores rather than TripleStores
  - ✓ Inferencing becoming real
  - ✓ People working on User Interfaces

Linked Data

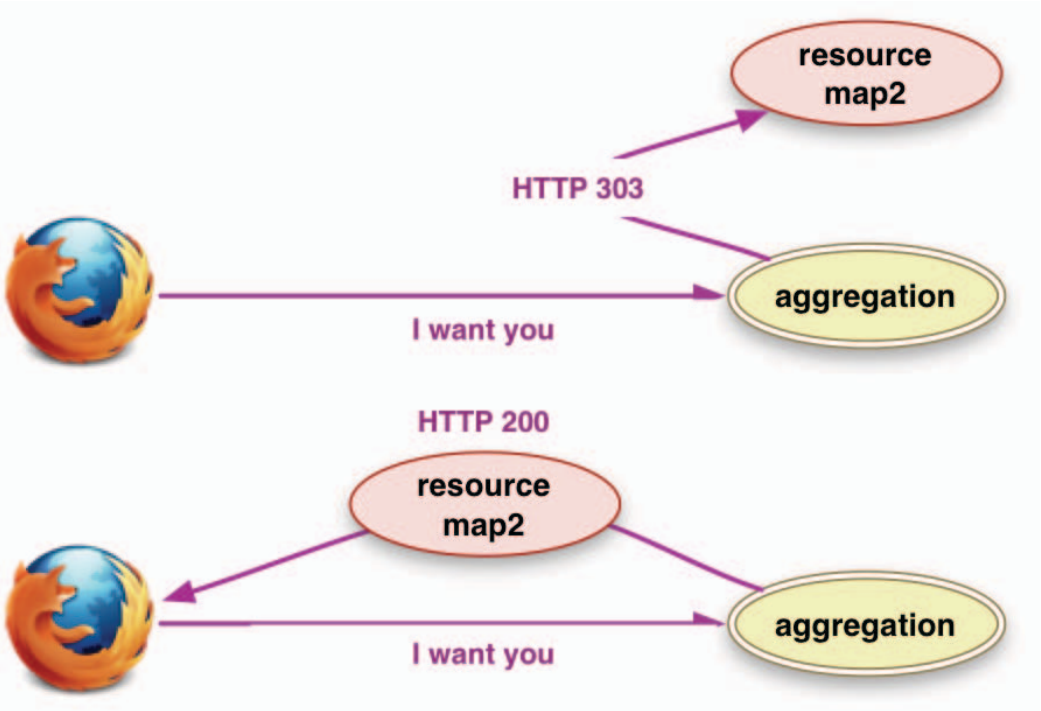
- ✓ Provides practical implementation advice
  - ✓ … which people have implemented
  - ✓ Used to be too much rope to know where to start tying the noose, now it's easy!

Linked Data:

- ✓ Give everything a URI
- ✓ Make them HTTP URIs
- ✓ Return a description of the thing from the HTTP URI
- ✓ Link to other things
- ✓ Make the description RDF
  (cough RDF/XML mumble moving right along…)

Linked Data: HTTP Range 14

- HTTP Status 303 Hijacking
  - Just took it and asserted a bunch of extra semantics
  - Arguably (and seemingly indefinitely so) …
  - … unnecessary with other, easier patterns



Linked Data: Description Headaches

- Extent of Description?
  - Only information about resource with URI, and “follow your nose” to information about other URIs
  - But what about URIs you don’t control but want to describe?
  - And URIs that are information resources, like data or images that have a representation already?
- Increases number of HTTP requests
  - Each of which has a very small response
- HTTP Headers (e.g. for Content Negotiation) are a pain

Temporal Issues

- Resources change over time
  - Reality, Data and Ontologies
  - Neither document nor data web has a solution
  - Need to remain in sync in distributed environment
  - New URIs for every version doesn't work
  - Coherency: does assertion still apply when other dataset changes?

Mitigating Factors:

- Memento
- ResourceSync

Summary

- Graphs are powerful structures, and the complexity can be managed by tools
- Open World introduces complexity, but enforces best practices. Without it, would be just data on the web
- Trust is required for reuse of any data, not just RDF
- Winners will emerge for competing ontologies and identities and better than the alternative.
- JSON-LD is very strong, and parsers exist in all common languages for all serializations
- Good people are working on the Temporal issues ;)

Thank You!

Slides:

http://www.slideshare.net/azaroth42/rdf-resource-description-failures

Open Annotation: http://www.openannotation.org/

http://www.w3.org/community/openannotation/

Shared Canvas: http://www.shared-canvas.org/

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http://public.lanl.gov/rsanderson/