The Semantic Web: Lighter, Faster, Easier

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A myth that needs debunking

- ***The Semantic Web needs Ontologies (true)***
- ***But Ontologies*** are
  - Inefficient (slow)
  - Complicated to express (Heavy)
  - Difficult to Build (Hard)

  (false)
- We can build them:
  - ***Faster, Lighter, Easier!!***

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Traditional AI ontology

- *cf.* US National Center for Biotechnology Information, "Oncology Metathesaurus"
  - 50,000+ classes, ~8 people supporting full time, monthly updates, mandated for use by NIH-funded cancer researchers
    - OWL DL rigorously followed
    - Provably consistent

Sem Web use case

- *cf.* Friend of a Friend (Foaf)
  - 30+ classes, Dan Brickley and Libby Miller made it, maintained by consensus in a small community of developers
    - Violates DL rules (undecidable)
    - Used in many unexpected contexts
- FOAF
  - 10s of millions of Foaf people
    - (not necessarily distinct individuals)
  - Exported by a growing number of providers
    - If you use LiveJournal, you have a FOAF file
      - Also flickr, ecademy, tribe, joost, …
      - Apps to export Foaf from Facebook and other soc netw sites
  - Becoming de facto standard for open social networking

A lot more users than the NCI ontology!

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Why?

- NCBI view: Formal properties
  - Based on a decidable subset of KR
    - Description logics
  - For which much scaling research has been happening
    - *Ca. 2000 - 10,000 axioms, no facts, 1 day*
    - *Ca. 2008 - 50,000 axioms, million facts, 10 min.*
      - Not just faster computers (but Moore's Law helps), significant research into optimization, "average case"
      - Moving to parallel (Web server)
  - But still not "Web Scale"

In this view OWL is a formal *knowledge representation* standard

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O*ntology*: the traditional view

- **O**ntology as Barad-Dur (Sauron's tower):
  - Extremely powerful!
  - ~~Patrolled by Orcs~~ Decidable Logic basis
    - Let one little ~~hobbit~~ inconsistency in, and the whole thing could come crashing down

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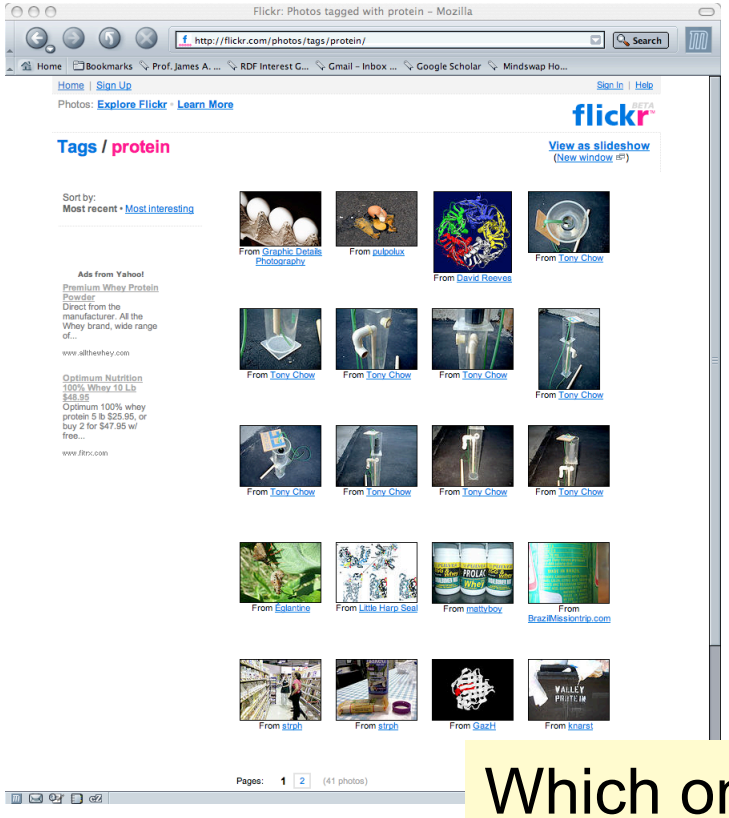
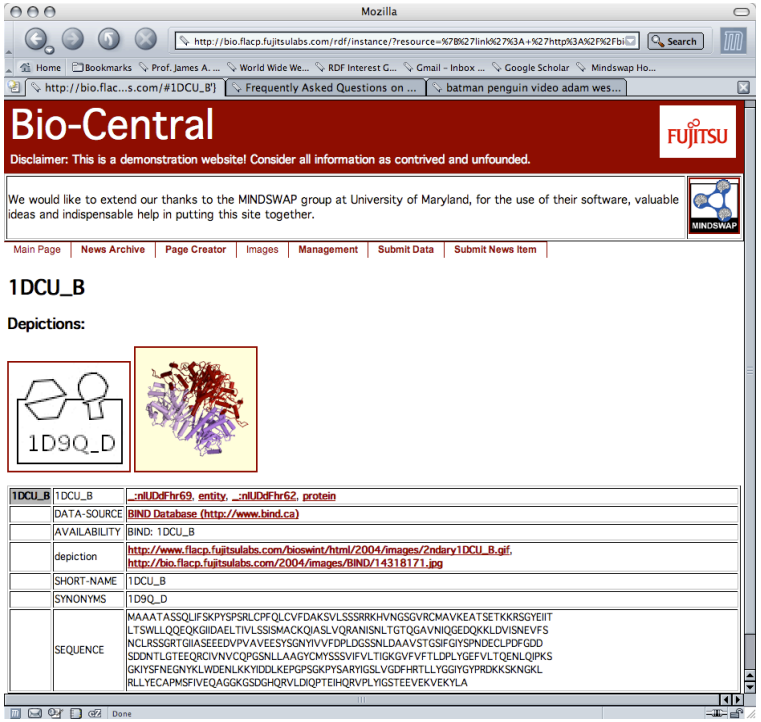
The argument for this seems compelling





Which one do you want *your* doctor to use?

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But the cost is high

- Formal modeling finds its use cases in verticals and enterprises
  - Where the vocabulary can be controlled
  - Where finding things in the data is important
- Example
  - Drug discovery from data
    - **Model** the molecule (site, chemical properties, etc) as **faithfully** and expressively as possible
    - Use "Realization" to categorize data assets against the ontology
      - **Bad or missed answers are money down the drain**
- **The modeling is very expensive and the return on investment must be very high!**

Analogy: the pre-Web hypertext book

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A better alternative for Web Development

- RDFS and OWL are based on RDF, a language designed for the (Semantic) Web
  - Built with Web architecture in mind
    - Exploits Web infrastructure, respects W3C TAG recommendations
      - Internationalization, accessibility, extensibility
  - Fits the ***Web culture***
    - Open and extensible, supports communities of interest
      - *If you don't like my ontology, extend it, change it, or build your own*
    - Fits the Web application development paradigm
      - Scales like "databases"

Analogy: HTML

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Linked Data Web

- "Data Web" approach finds its use cases in Web Applications (at Web scales)
  - Finding anything in the mess can be a win!
- Which is different because
  - A lot of data, very little semantics
  - Used mainly for query (think Google, not Cyc)
    - not every answer must be right
    - *And time = money*!

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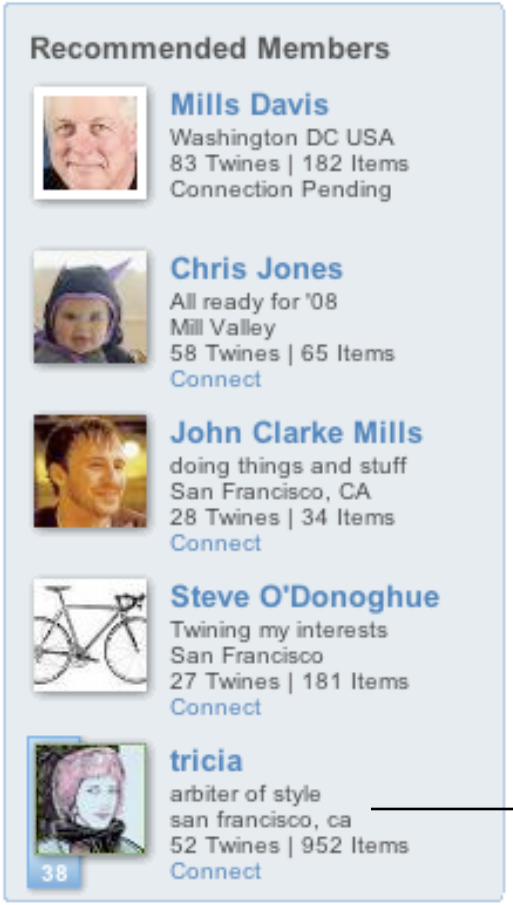
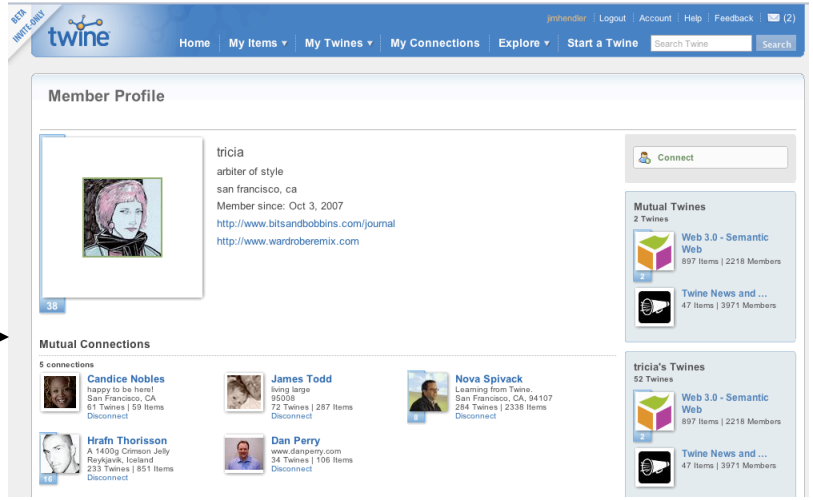
Very simple "reasoning"



- Twine recommends some people I may want to connect to
  - What is correctness in this case?
    - If I find some folks I like this way, I use twine more. Surprises can be fun.
  - I'm only seeing a few of a very large set so "first" is more important than "there somewhere"



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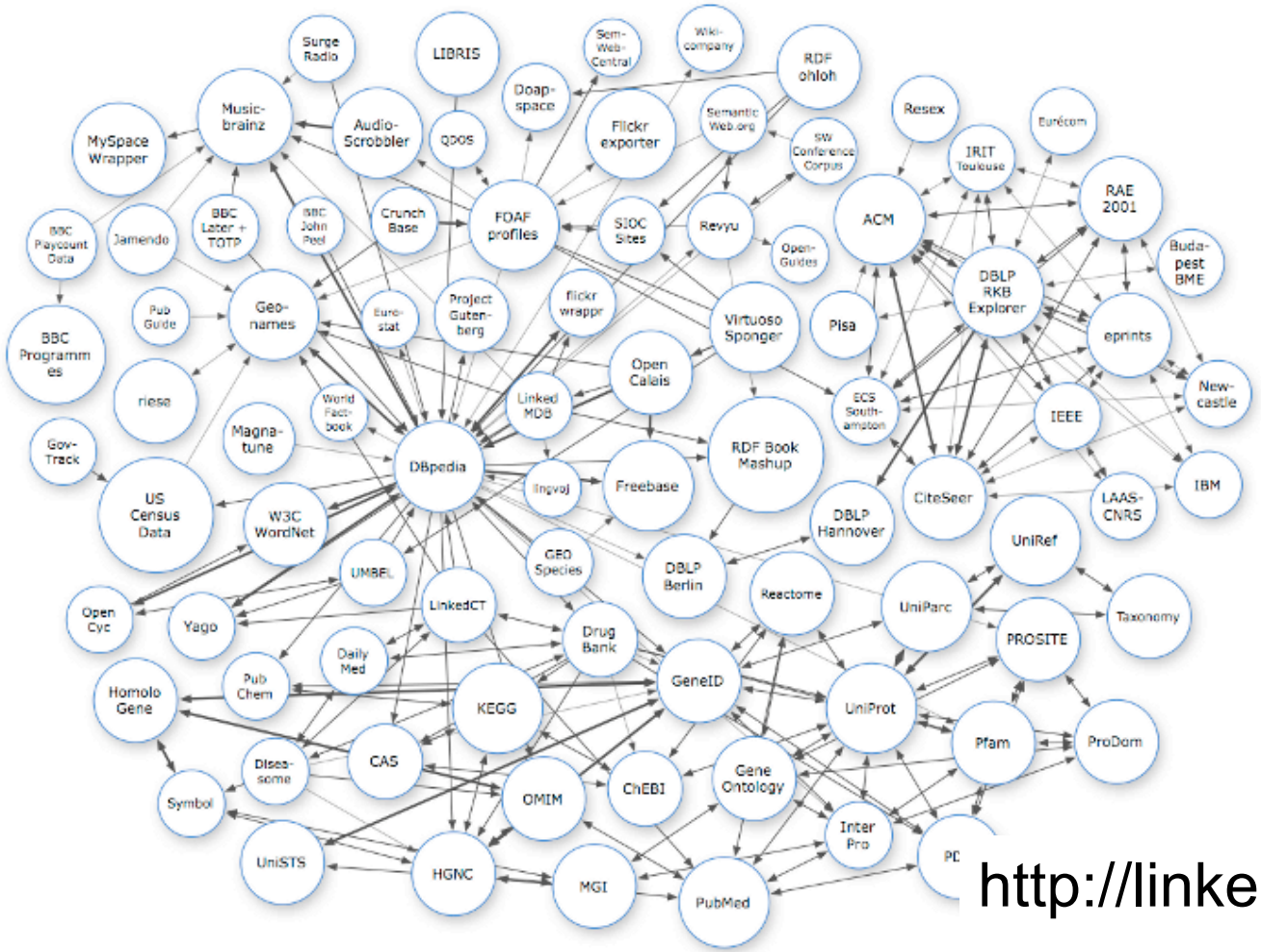

http://linkeddata.org/

The linked open data cloud now has billions of assertions, and is growing rapidly

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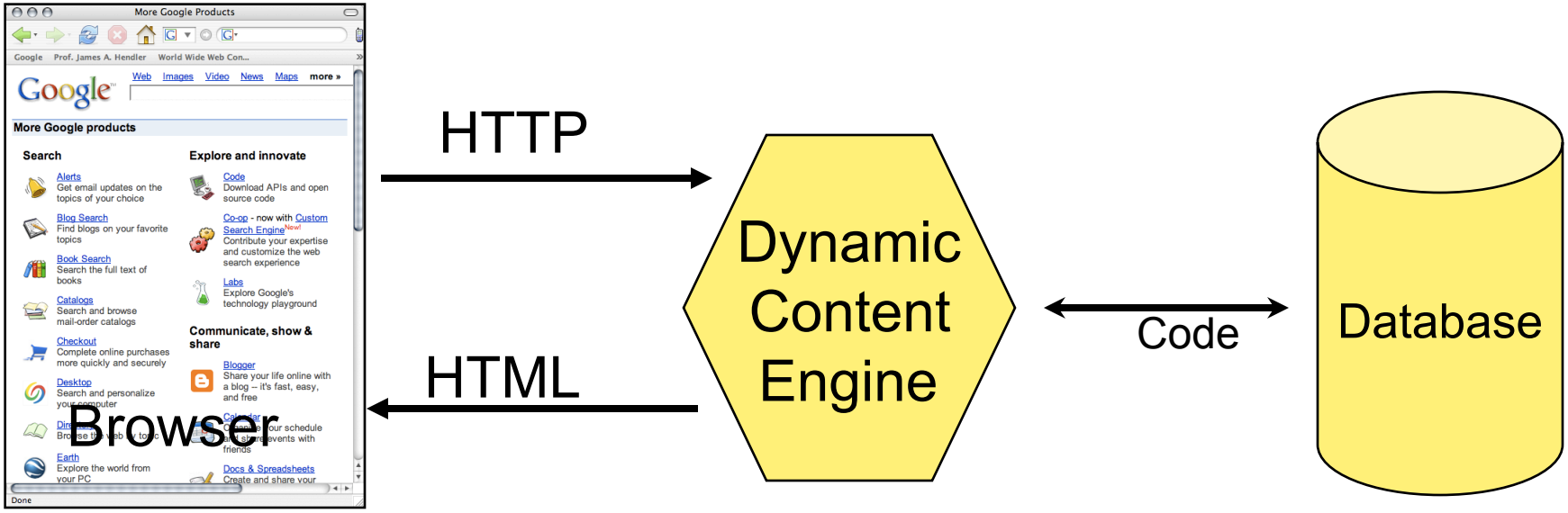
Traditional Web applications



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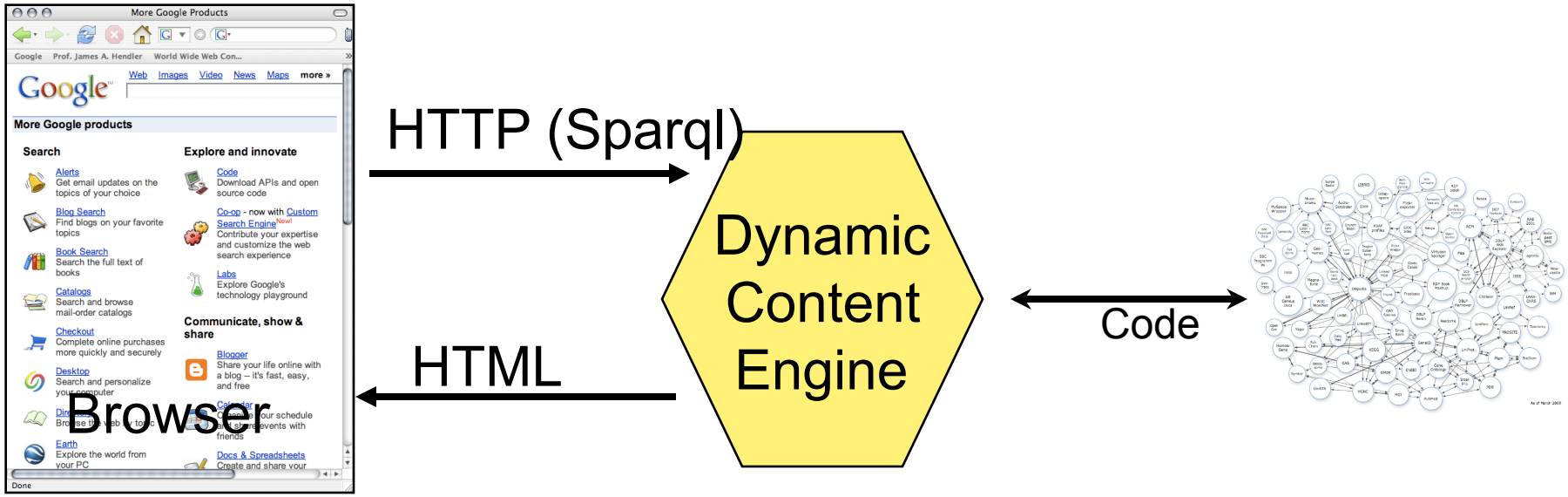
Semantic Web applications



Do your mashup on the underlying data instead of presentations thereof

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Ontologies?

- Mostly reuse of a few simple ones (Dbpedia terms, foaf, doap, etc.)
  - Faster
- Uses simple parts of language (RDFS and a very small amount of OWL)
  - Lighter (sometimes called "lightweight ontologies"
- Mostly small and "local"
  - Easier

Reasoning?

- Very little
  - Mainly just which data in one sphere is related to another
    - (easy)
  - Mainly based on small vocabularies
    - (Light)
  - Mainly procedural
    - (fast)

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Example LD applications

Dbpedia mobile

HealthFinland

Semaplorer

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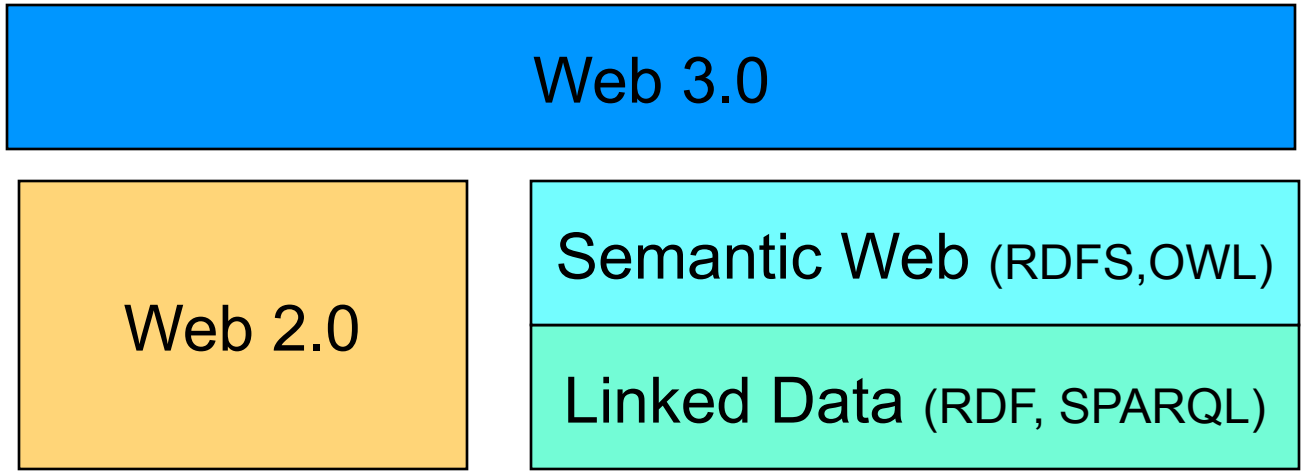
The industrial "meme"



Web 3.0 extends current Web applications using Semantic Web technologies and graph-based, open data.

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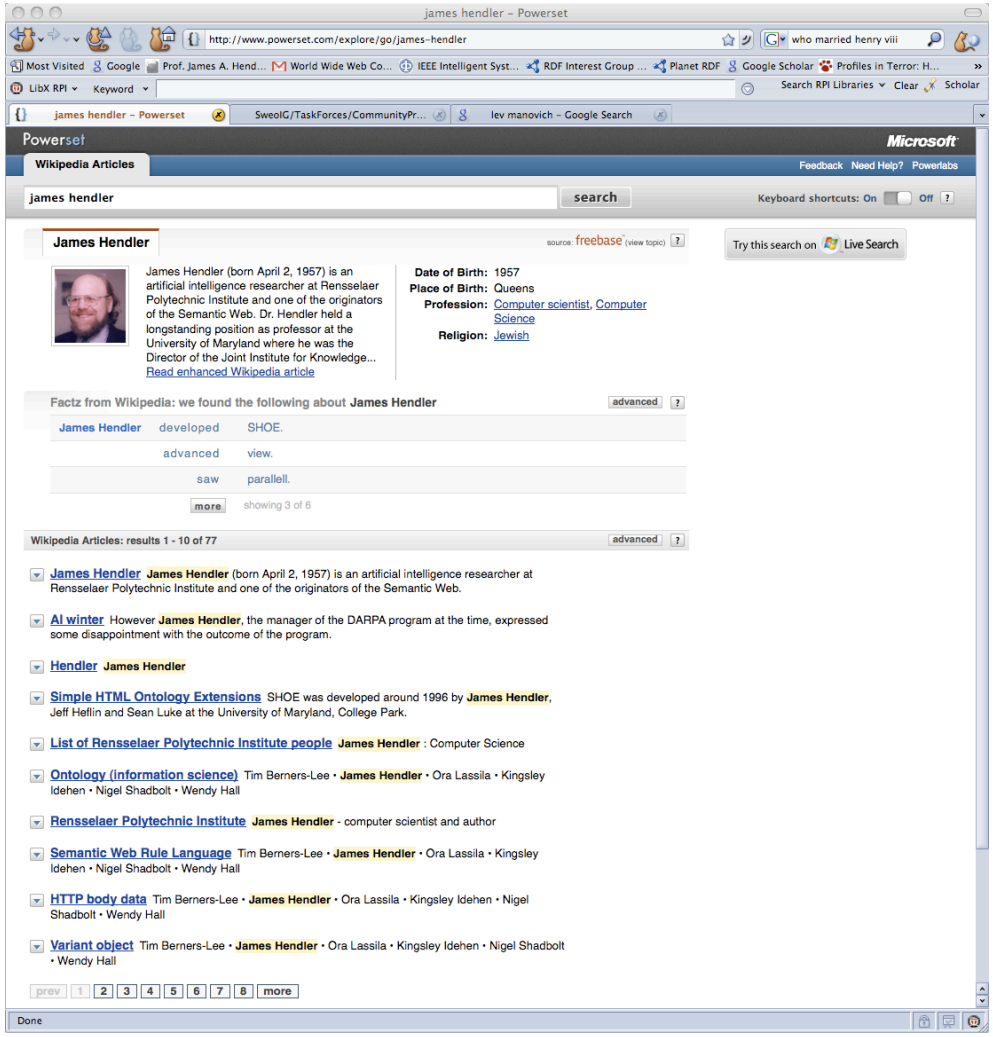
Web 3.0 examples



Semantic Search (Powerset.com)

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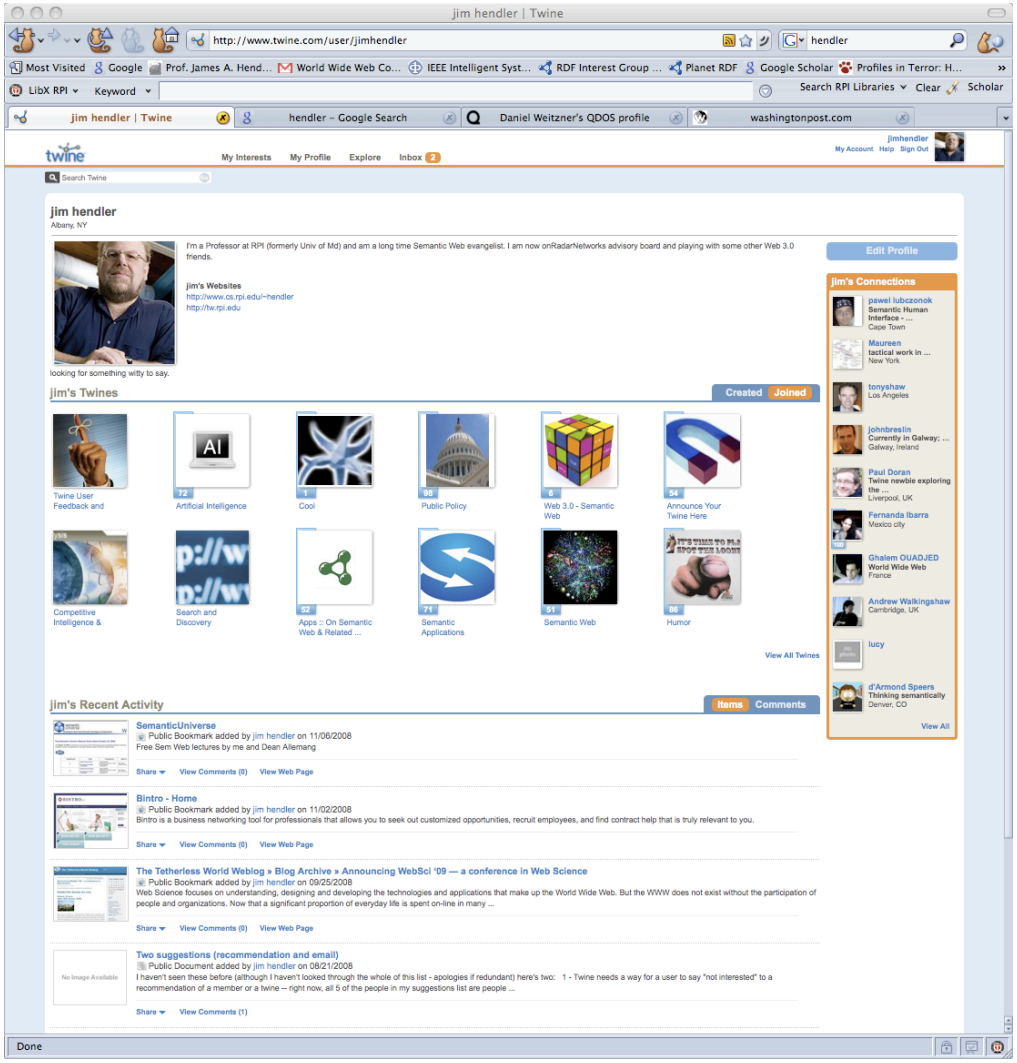
Web 3.0 examples



Enhanced Social Networks (twine.com)

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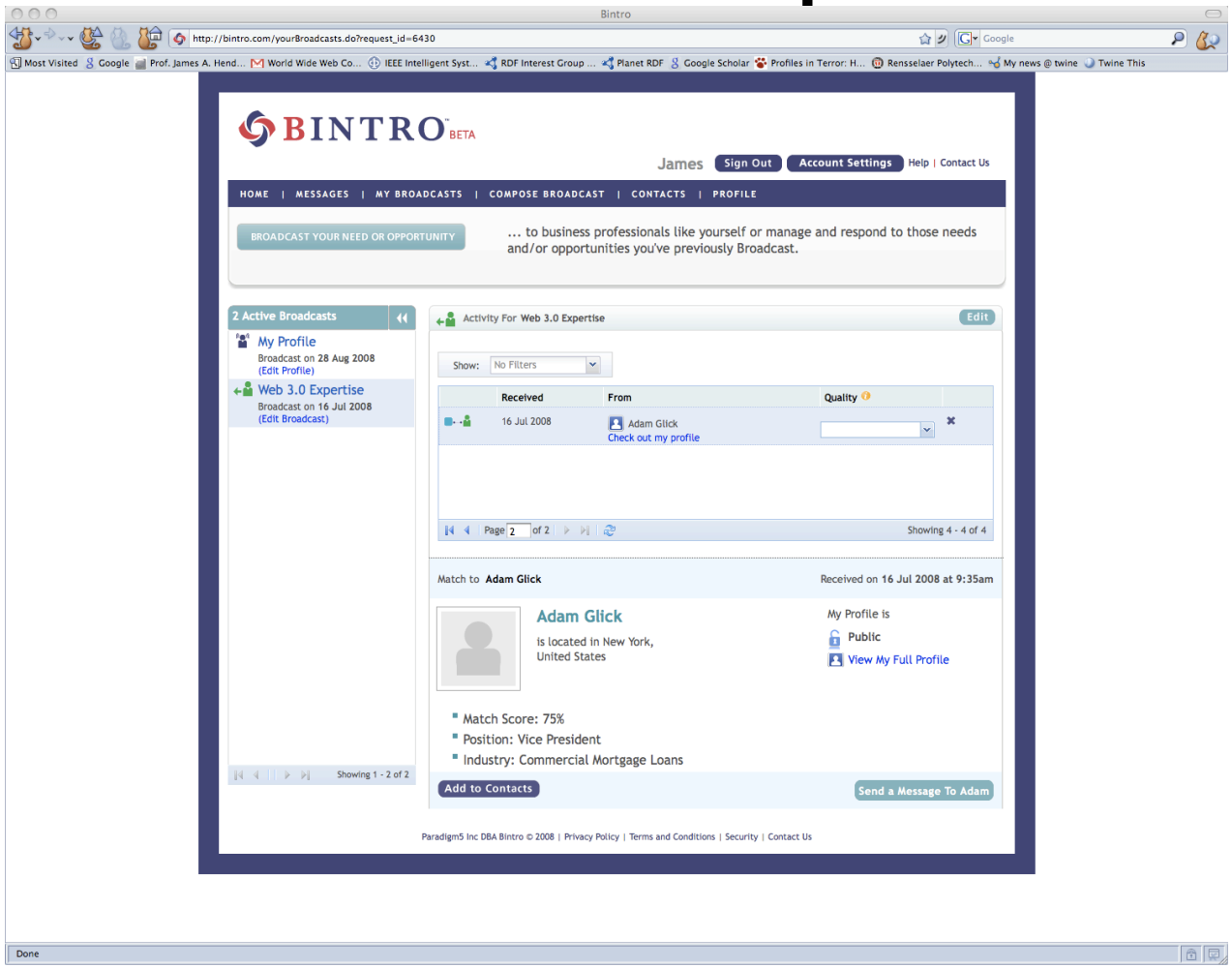
Web 3.0 examples



Semantic Match (bintro.com)

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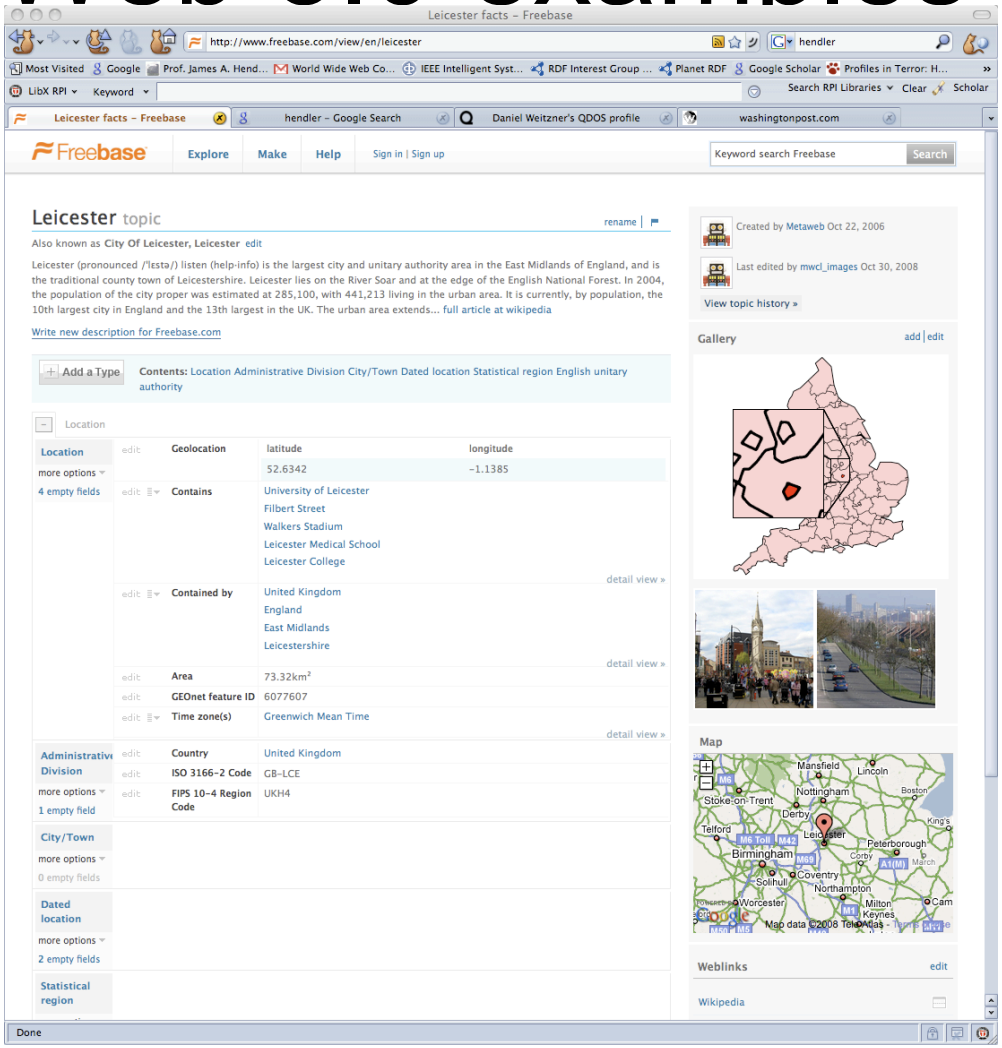
Web 3.0 examples



Social database (freebase.com)

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"Cutting Room Floor"

- RDF, RDFS data model/details
- Linked data Web tools
  - http://linkeddata.org/tools
- RDFa, GRDDL - embedding RDF in (X)HTML
- Yahoo! Search Monkey
  - http://developer.yahoo.com/searchmonkey/
- Advantages of RDF/Linked Data over RDBs for Ruby on Rails development
  - O'reilly: Programming the Semantic Web (coming)
    - http://oreilly.com/catalog/9780596802066/
- My own research work (http://tw.rpi.edu)
  - Scaling RDFS inference, policy/accountability

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Bottom line

- The "low end Semantic Web, powered by technologies such as RDFS, SPARQL, and a little bit of OWL is showing tremendous promise
  - Can embed the power of the Semantic Web in traditional Web apps
    - Closer to Web 2.0 in look and feel
    - Similar implementation approach
- Significant and growing industrial interest
  - Web 3.0: the big one is still out there!!!!!

Lighter, Faster, Easier!

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