



Despite Our Best Efforts,  
**Ontologies are not the problem.**

**Tom Gruber**

[tomgruber.org](http://tomgruber.org)

[Stealth-Company.com](http://Stealth-Company.com)



# outline

- Components don't matter
- Systems that matter
  - *Collective knowledge*
  - *Intelligent Interface*
- Discuss



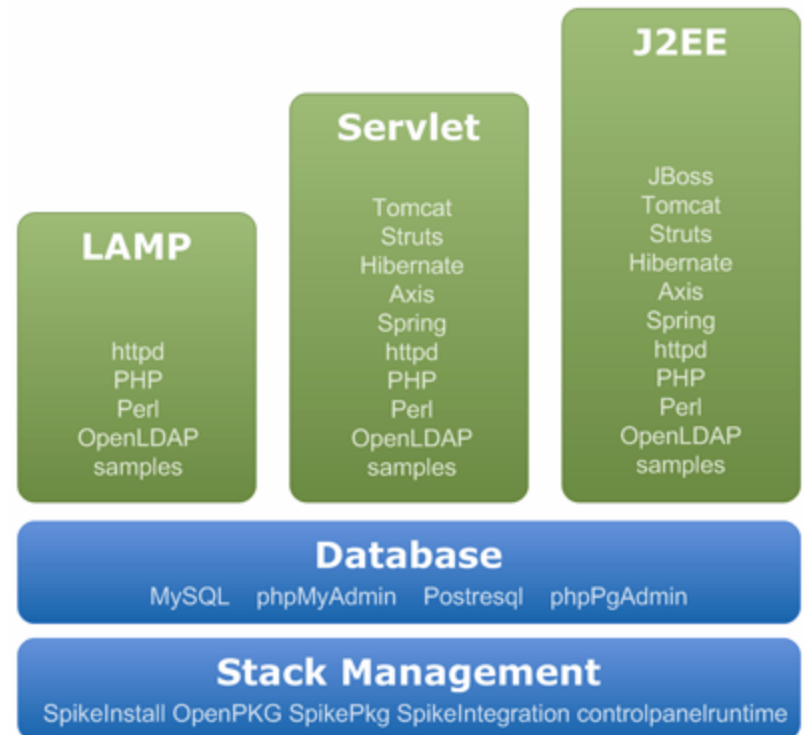
# Where's the key technology?



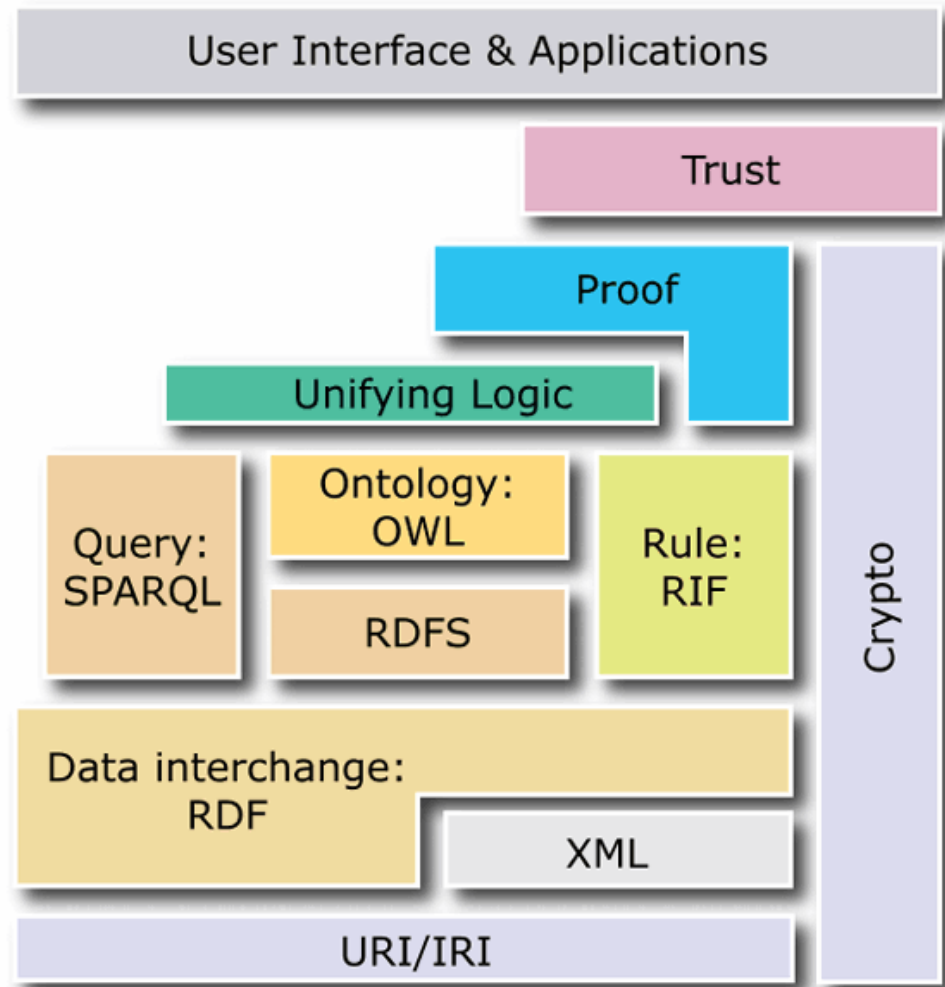
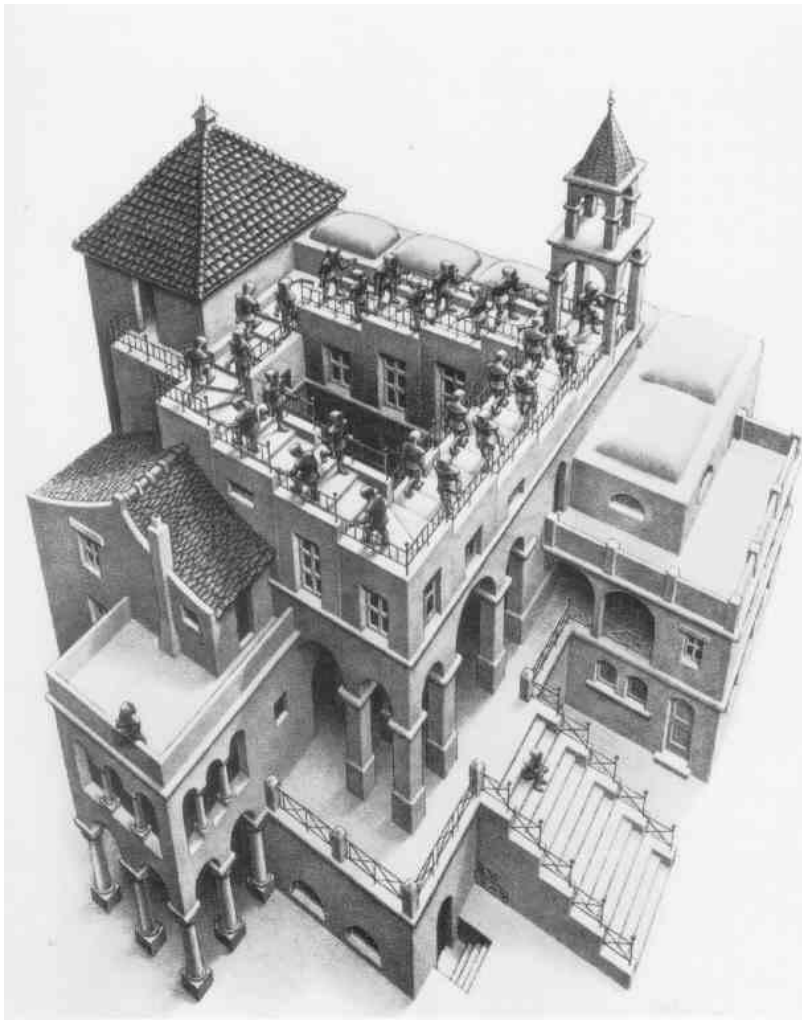
# Which is the important part?



# What part of the stack is critical?



# The Tower of Semantics





“Let them eat layer cake.”

Oops. We didn't mean that.

# Field of Dreamers

~~“If you build it, they will come.”~~

“If they use it, it will build itself.”



“Don't ask what the Web knows,  
ask what the World knows.”

# World-changing Technology

- Everything can be captured.
- Everything can be stored.
- Everything can be distributed everywhere.
- Everyone can talk to everyone.
- **Everyone can learn from everyone.**
  - *Insert Semantic Web here* 😊

# Augmenting Human Intelligence

- Web 1.0
    - *Accessing human knowledge*
  - Web 2.0
    - *Gathering human knowledge*
  - Web 3.0
    - *Applying human knowledge*
- ➔ *How can we use technology to make us smarter, individually and collectively?*

# The Semantic Web Potential

*How can the Semantic Web fundamentally change our experience of the world?*

- Enable Collective Intelligence
- Bring Intelligence to the Interface



# Collective Intelligence

Where the Social Web Meets  
the Semantic Web

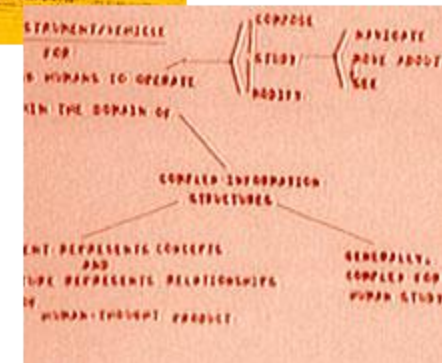
context **knowledge** interface conversation

# Collective Intelligence 1968



"The grand challenge is to boost the collective IQ of organizations and of society. "

Doug Engelbart



# Collective Intelligence 2001



“The Semantic Web is not a separate Web but an extension of the current one, in which information is given well-defined meaning, better enabling **computers and people** to work in cooperation.”

Tim Berners-Lee

Scientific American, May 2001

# Collective Intelligence 2006



"The central principle behind the success of the giants born in the Web 1.0 era who have survived to lead the Web 2.0 era appears to be this, that they have embraced the power of the web to **harness collective intelligence**"

Tim O'Reilly





# Collective Knowledge is Real

- FAQ-o-Sphere - self service Q&A forums
- Citizen Journalism – “We the Media”
- Product reviews for gadgets and hotels
- Collaborative filtering for books and music

# Collective Knowledge Systems

- provide new and useful information
  - *from large collections of data*
- based on human contributions
  - *augmented by technology*
- get better as more people participate
  - *increasing returns with scale*

# Web 2.0: *Collected Intelligence*

06 africa amsterdam animals april architecture art august australia autumn baby  
barcelona beach berlin birthday black blackandwhite blue boston bw california  
cameraphone camping canada canon car cat cats chicago china christmas  
church city clouds color concert day dc dog england europe fall family festival  
film florida flower flowers food france friends fun garden geotagged  
germany girl graffiti green halloween hawaii hiking holiday home honeymoon hongkong  
house india ireland island italy japan july june kids lake landscape light live london  
macro may me mexico mountain mountains museum music nature new newyork  
newyorkcity newzealand night nikon nyc ocean october paris park party people  
portrait red river roadtrip rock rome san sanfrancisco scotland sea seattle september  
show sky snow spain spring street summer sun sunset sydney taiwan texas  
thailand tokyo toronto travel tree trees trip uk urban usa vacation vancouver  
washington water wedding white winter yellow york zoo

- Intelligent *collection*?
  - *social bookmarking, search*
- “Database of intentions”
  - *attention (click streams)*
  - *Opinion (ratings, tags)*
  - *Behavior (buying)*
- Collected communications
  - *blogs, wikis, discussion lists*

## The Wisdom of Clouds

“database of intentions” – Tim O’Reilly

# Web 3.0: *Emergent* Knowledge Systems

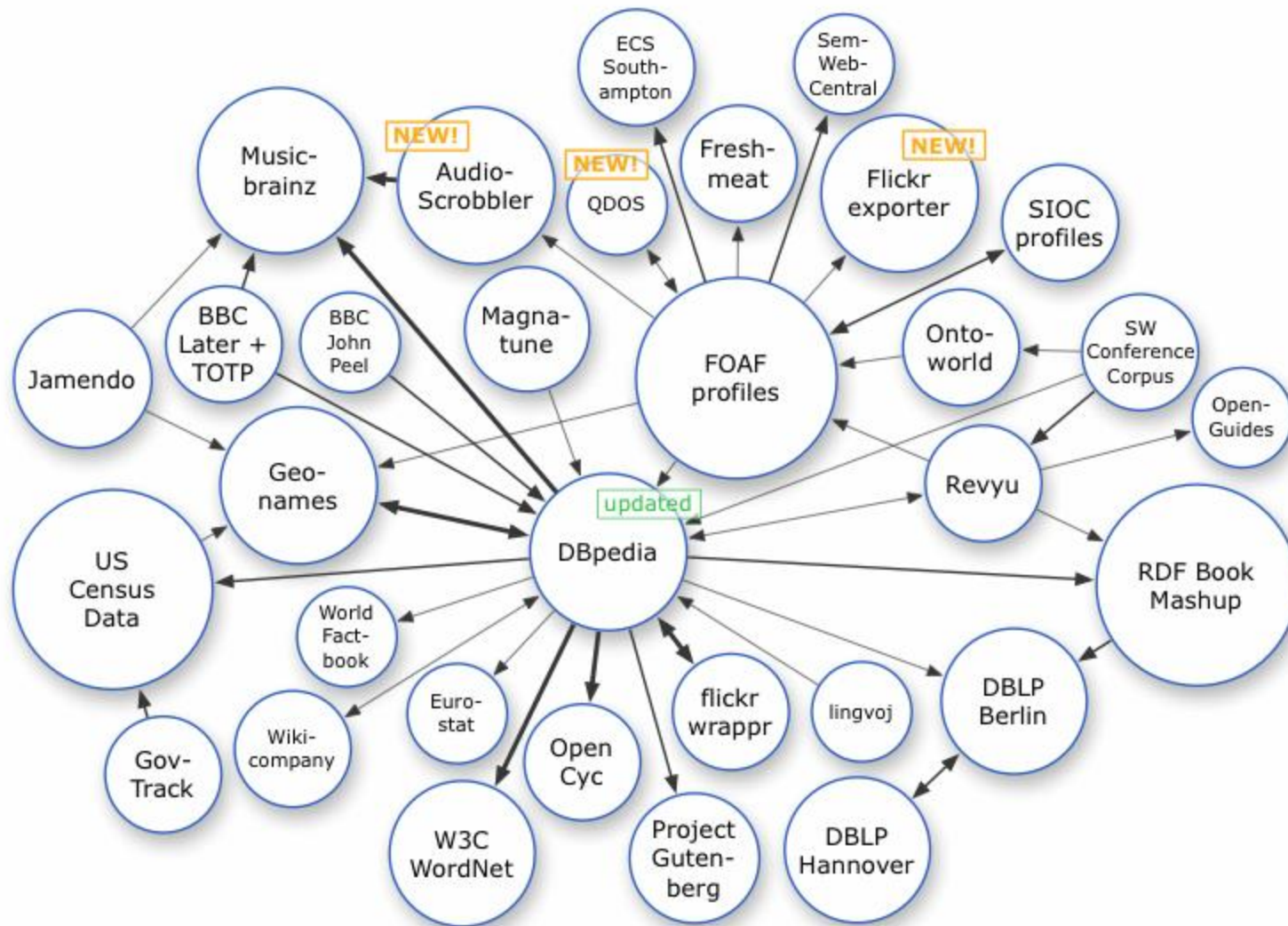
- provide new and useful information
  - *from **multiple**, large collections of data*
- based on human contributions
  - *augmented by technology **and structured data***
- get better as more people participate.
  - *with increasing returns at scale*
- **provide answers, solutions, discoveries or other results beyond the original data.**
  - *based on computation and inference*



# Roles for Semantic Net Technology

- **Composing and integrating** user-contributed data across applications
  - *The Gigantic Join*
- **Creating aggregate value** from a mix of structured and unstructured data
  - *Example: Recommendation engines*

# Ontologies for the Gigantic Join



<http://richard.cyganiak.de/2007/10/lod/>

# Travel Recommendation Engine

The screenshot shows the RealTravel website interface. At the top, there is a navigation bar with links for home, recommendations, destinations, topics, forums, deals, my travel blog, and my trip plan. A search bar is also present. The main content area is titled "Recommended Destinations in Ecuador" and includes a sub-header "By matching your personal travel interests and style to like-minded travelers, we recommend you consider these destinations for your next trip." Two destination cards are displayed: "Galapagos Islands" and "Coca". Each card features a map, a description, and a list of "Matching Travelers".

**realtravel™**  
Real People. Real Advice. Real Experiences.™

home recommendations destinations topics forums deals my travel blog my trip plan

Start Over > Trip Details > Traveler Profile > Purpose > Ratings > Countries > Destinations > Recommendations

## Recommended Destinations in Ecuador

By matching your personal travel interests and style to like-minded travelers, we recommend you consider these destinations for your next trip.

### Galapagos Islands

Explore Recommended Blogs in Galapagos Islands ▶

a Region in Ecuador

One of the few places in the world where you can literally come face to face with wild animals, the Galapagos Islands are a treat for any nature-loving traveler. From tortoises and flamingoes to sea lions and dolphins, life here has remained mostly untouched by man. The wealth of life, as well as the volcanic island landscape, make these islands a perfect destination for ecotourism.

#### Matching Travelers

- Forrest World Tour
- The Journeyers
- Freyja

#### Matching Interests

beaches and islands diving & snorkeling nature and wildlife viewing

### Coca

Explore Recommended Blogs in Coca ▶

a City in Napo

A popular lead-in to the Amazon rainforest, Coca mainly offers hotels, restaurants and other necessities a traveler in the region may desire.

#### Matching Travelers

- Rich and Hayley
- M and M

- Mix of structured and unstructured data
- Machine learning to extract clusters and synthetic dimensions
- Interview users to elicit profile and interests
- Recommend destinations and trips based on multidimensional matching
- Output is human readable experiences, selected by machine inference

<http://tomgruber.org/writing/collective-knowledge-systems.htm>

# Intelligence at the Interface

The Killer App for Semantics  
is your online life.

context knowledge **interface** conversation

# Interaction Paradigms

- Breadcrumbs in the forest
- Follow the leader
- Abracadabra
- Room service

# Breadcrumbs in the forest: The Hyperlink

## User Role

- Choose your path

## System Roles

- connect the dots



Artwork by [Arthur Rackham](#), 1909.



Technical breakthrough: *universal resource identity*



# Follow the leader: **The Portal**

## User Role

- choose your channels  
(and consume them)

## System Roles

- deliver the content



Technical breakthrough: ***frictionless broadcasting***

# Abracadabra: The Search Engine

## User Role

- state your query  
(and shift through results)

## System Roles

- find relevant content and  
filter on quality

A B R A C A D A B R A  
A B R A C A D A B R  
A B R A C A D A B  
A B R A C A D A  
A B R A C A D  
A B R A C A  
A B R A C  
A B R A  
A B R  
A B  
A

Technical breakthrough: *web-scale indexing and ranking*



# Room Service: Intelligence at the Interface

## User Role

- Live your life

## System Roles

- Tell me what I need to know.
- Help me solve my problems.
- Help me meet my needs.
- Work for me. Be proactive.



Technical breakthrough: *personalized, context-aware AI*

# What can IaI do?

- Know about your context
- Keep you informed and connected
- Help you remember
- Help you discover
- Work for you

# Helps you organize, share, and discover

twine

Home My Items My Twines My Connections Explore Start a Twine Search Twine Search

Cool

Summary Items Members Add Item

This is a twine for sharing really cool things we find on the Web.

Started Dec. 11, 2007 by Nova Spivack

cool, art, design, technology, Public | Open Membership | Comments allowed multimedia, Members may:

People

- Charlie Sorrell
- Daniel Pink
- Dante
- David Scott Lewis
- Edward
- Hrafn Thorisson
- James
- Kirk
- Matt Slater
- Miguel Lasso Copywriter
- Peter Royal
- Rasterbator
- Steve Jobs
- Steven Levitt
- Strandbeests
- Theo Jansen

Places

Organizations

Other Tags

Types of Items

Recommended Twines

- Twitch Items: 23 | Members: 9
- Educational Technology Items: 5 | Members: 3
- Semantic Wave Applications Items: 16 | Members: 7
- The Internet & Campaign 2008 Items: 3 | Members: 2
- Making Items: 8 | Members: 2

Green Business and Investing

Public

Summary Items Members Add Item

Share and Collect Comments

Green Wombat: A green-collar recession?

Bookmark added by twine on Feb 25, 2008

Public | 1 View

Original URL <http://blogs.business2.com/greenwombat2008/02/a-green-collar.html>

Description

It's all about the green economy, stupid. The United States could lose more than 156,000 green collar jobs and forgo \$19 billion in green tech investment in 2009 if Congress fails to extend two tax credits crucial to the renewable energy industry, according to a new study. One red flag about this report: It was commissioned by the American Wind Energy Association and released by the Solar Energy Industries Association -- two trade groups pressing for extension of the investment tax credit and the production tax credit. Green Wombat tends to look askance at studies paid for by business and whose conclusions support the sponsors' political agenda. But a review of the research conducted by Navigant Consulting indicates that it is solid, based on federal labor data and employment models as well as Navigant's own market analysis. Some background. The ITC provides a 30 percent tax credit for the installation of solar arrays and other equipment. Homeowners can claim a 30 percent tax credit for solar arrays up to a maximum of \$2,000. There's no cap for commercial solar arrays and the tax credit has been a key to attracting financing for large solar installations that can cost millions of dollars. (Several states, most notably California, offer even ...

Places

People

Organizations

American Wind Energy Association  
Congress  
Solar Energy Industries Association

Other tags

Created in  
Green Business and Investing

Recommended Items

- Improving our green job prospects | ...  
On the one hand we have a deepening economic recession, a mortgage and debt crisis, and rising ...  
twine
- Green Tech 101 « World is Green

This area on the home page and a twine's summary page, displays tags that represent your strongest interests.

You can add your own tags to help organize your items.

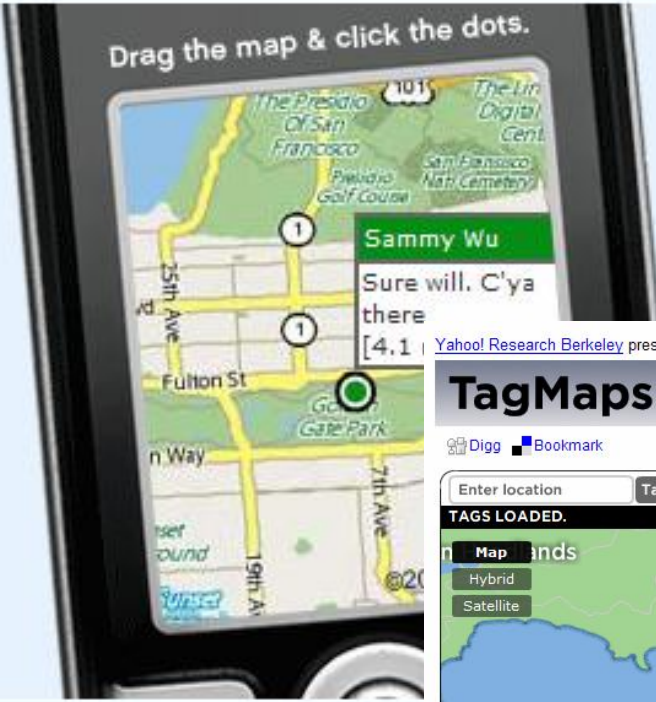
covers are highlighted  
tail view of an item.

<http://twine.com>

context knowledge interface conversation

Matt Klien Brett Smith Sue Miller

# Helps you connect, discover, stay in touch



Drag the map & click the dots.

**Sammy Wu**  
Sure will. C'ya there  
[4.1 | [Yahoo! Research Berkeley](#) presents

## what is loopt?

- find friends on the map
- know what friends are up to
- get alerts when friends are nearby

<http://loopt.com>  
<http://tagmaps.research.yahoo.com/>

## TagMaps: Trip Explorer

Explore the hidden gems from Yahoo! Travel Trip Planners

[Digg](#) [Bookmark](#)

[World Explorer](#) [Night Explorer](#) [Trip Explorer](#) [Put on your blog](#) [APIs](#) [FAQ](#)

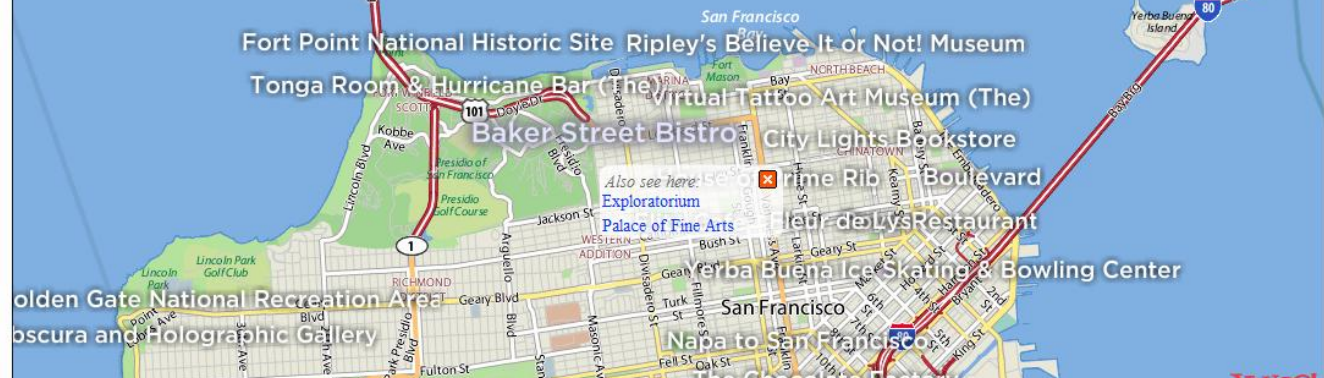
Enter location

[Link to this](#)

TAGS LOADED.

Map  
 Hybrid  
 Satellite

## • find gems from geotagged trips



# Helps you discover things you care about

**PANDORA**  
radio from the Music Genome Projectregister | sign in

Help

We created Pandora to put the Music Genome Project directly in your hands

**It's a new kind of radio -  
stations that play only music you like**

Type in the name of your favorite artist, song or composer and we'll create a radio station featuring that music and more like it.

**Listen Now**



# Works for you

The screenshot displays the Kango travel website interface. At the top, the Kango logo is accompanied by the tagline "travel planning that works for you". Navigation links include "Hello!", "Your Trips", "Register", and "Sign In". A search bar contains the text "monterey romantic hotels". Below the search bar, there are filters for "Vacation Theme" (Kid Friendly, Romantic Getaway, Pet Friendly), "Price" (under \$50, \$50-\$150, \$150-\$250, \$250-\$350, \$350+), and "Hotel Amenity" (Pool, Jacuzzi, Exercise Facility, Spa Treatments, Restaurant, Room, Cakes, Camp, Minib, Refry). A "Farecast" logo is prominently displayed. The main content area is divided into several sections: "Hotel Pacific" with a user rating of 8.7 and highlights like "jacuzzi, fireplace, balcony/lanai/terrace..."; "The Del Monte Pines" with a user rating of 8.6 and highlights like "fireplace, maid service, internet services..."; "Search Flights From/To Anywhere" with options for Round Trip, One Way, and Multi-City, and fields for From, To, Leave, and Return dates; "Airfare Predictions: Know When to Buy" with buttons for "Buy Now" (Fares will rise) and "Wait" (Fares will drop); "Top Airline Ticket Deals" listing deals like "\$272 Los Angeles to Honolulu"; and "Travel Tools: Know When to Fly" with a line graph showing departure dates and a "GO" button. At the bottom, there are award logos from TIME, PC World, Web 2.0 Awards, and Popular Science.

# Your Assistant that Learns

The image displays several components of the CALO system interface:

- Semantic Graph Viewer:** A central window showing a network of nodes and relationships. Nodes include 'Participants', 'Sub-Tasks', 'Notes', 'Categories', 'Tasks', 'DarpaTech', 'Tech Demo', 'DarpaTech Slides', 'CALO Release 2.0', 'CALO Release 1.4', and 'CALO Project'. Relationships are shown as dashed lines connecting these nodes.
- Chat Window:** A conversation interface with a blue background. Messages include:
  - Schedule PEXA, 10-11am, EJ228, very important, with Karen Myers and Pauline Berry
  - I am scheduling your meeting for you
  - Please choose a schedule for 'PEXA' below
  - Show me more schedules
  - Please choose a schedule for 'PEXA' below
- Meeting Agenda:** A window titled 'Lynn\_Voss in meeting Project\_Review\_Meeting'. It lists:
  - Meeting agenda notes
  - Non agenda notes: 1 Task: Schedule next meeting assigned to: Lynn\_Voss
  - Announcements: 1 Release 3.3 complete, 2 <Type new notes here and press return>
  - Team Status: 1 <Type new notes here and press return>
- Meeting Control Panel:** A window titled 'Mercury v3.1.9 (j...) Meetings'. It shows:
  - Create New Meeting...
  - Project Review Meeting 00:07:35
  - MT Conference Room
  - Lynn Voss (with a progress bar)
  - Clint Frederickson
  - EJ228
  - Mark Lewis
  - Buttons: Join, Leave, End
- Chat Log:** A window showing a transcript of a meeting:
  - CALO Says...
  - ACTION ITEM (CALO at 11:28)** okay sometime let's say mid october then uh wills well is we will try this um to do this scenario again i guess it depends on how long it takes the these the to rework their uh vocabulary or whatever the underlying uh structure is that that provides under seemed to find that out as part of the requirements (Owner: John\_Pedersen) (Timeframe: UNKNOWN is probably a good time for)
  - John Marlow: i think uh mid-october is probably a good time for
  - John Pedersen: okay sometime let's say mid october then uh wills well it down and we will try this um to do this scenario again i guess it depends on how long it takes the these the rework their uh vocabulary or whatever the underlying uh structure is that that provides understand seemed to find that out as part of the requirements
  - John Marlow: okay
  - John Marlow: i'd ask them that question also
- Calendar:** A window showing a calendar for Friday, Oct 24:
  - 8-9: PTIME
  - 9:30-10:30: Create Presentation
  - 10:30-11:30: PEXA
  - 11:30-12:30: Lunch
- Todo List:** A window titled 'Todo' with a list of tasks:
  - Add an item
  - Trip reimbursement (with progress bar)
  - Boston
  - Reschedule Meeting (When would you like to reschedule this meeting to?)
  - AAAI Reimbursement (e-mailing manager for approval)
  - Sign reimbursement form
  - DARPA Presentation
  - Evite: John ..., Evite: Ockto..., Upcoming.org..., jsmith has s...
  - SPARK build script - Cleaning up \$py.class files in ant clean
  - Reschedule Action Meeting (checked)

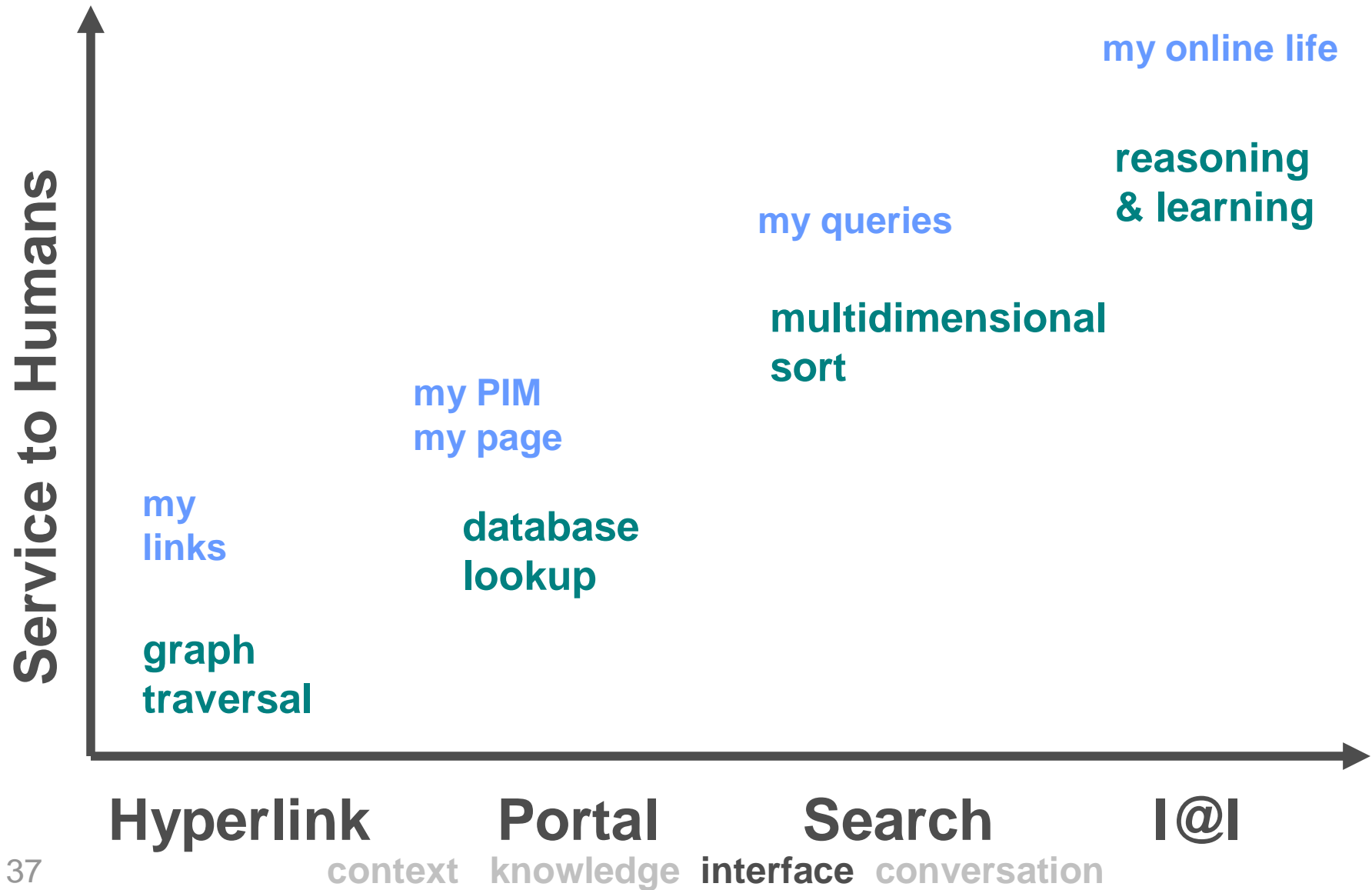


# What makes an Interface Intelligent?

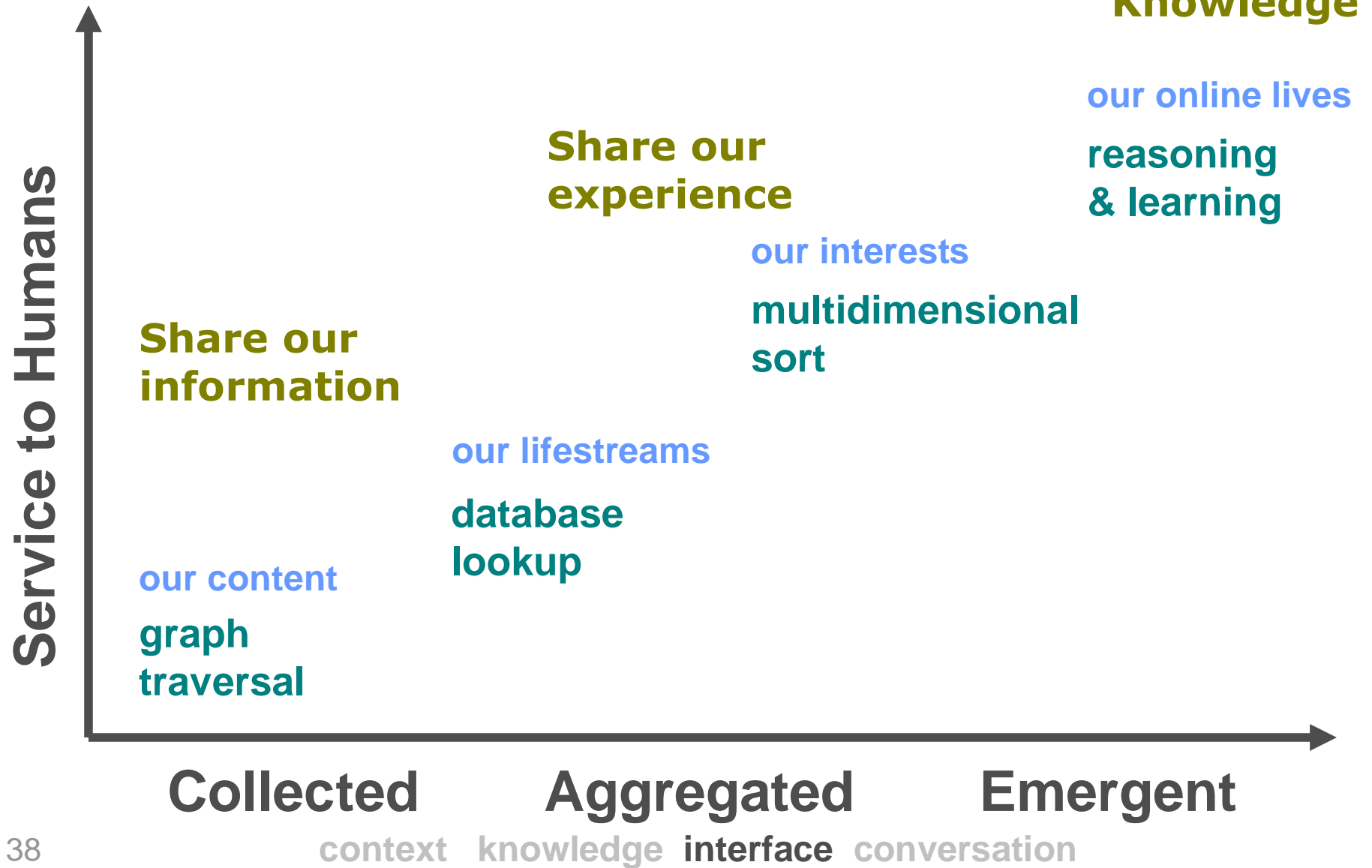
- It knows a lot about you.
- It understands you in context.
- It is proactive.
- It gets better with experience.



# Knowledge and Reasoning



# Knowledge, Reasoning, Collective Intelligence



# Last Word: What I Think Matters

When we're making our layer of the cake, consider how it contributes to these goals:

- How to get useful knowledge from all those intelligent people on the Internet
- How to give the benefit of this knowledge to everyone.

# For more information

- Tom Gruber

<http://tomgruber.org/>

- Collective Knowledge Systems

<http://tomgruber.org/writing/collective-knowledge-systems.htm>

- Intelligence at the Interface

<http://tomgruber.org/news/sdforum-dec13.htm>

- Rights: Attribution No Derivatives



<http://tomgruber.org/writing/aaai-ss08.htm>