

# KEX: Knowledge Enabled Experiences and Semantics

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# Industry Trends

Knowledge

> Web is evolving to become knowledge centric

Structured Data

> Explosion of structured sources like Linked Data, Facebook Open Graph

Social

> Emergence of the power of social networks

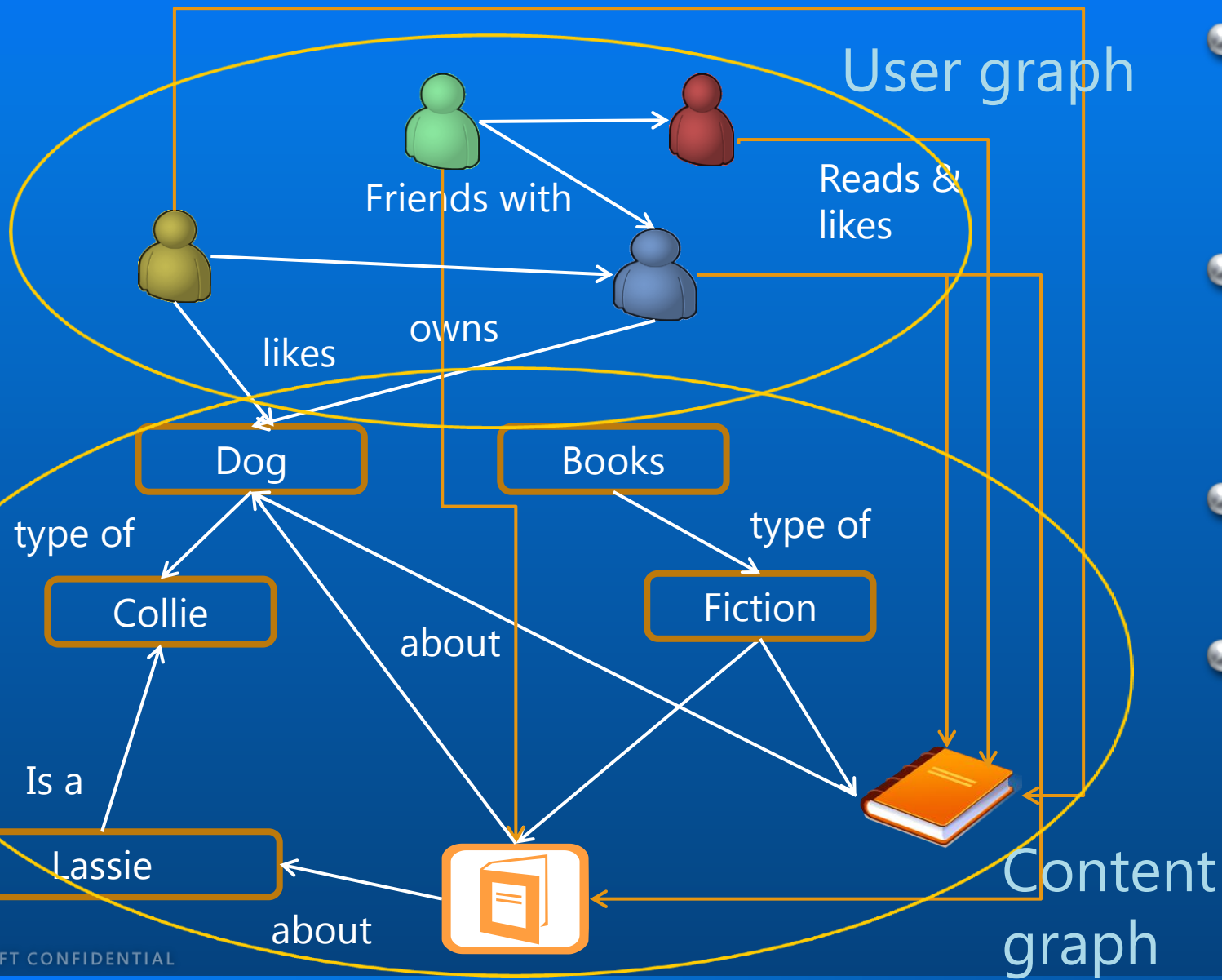
Mobile & Apps

> Change in consumption behavior

Intent & Tasks

> Going beyond single queries

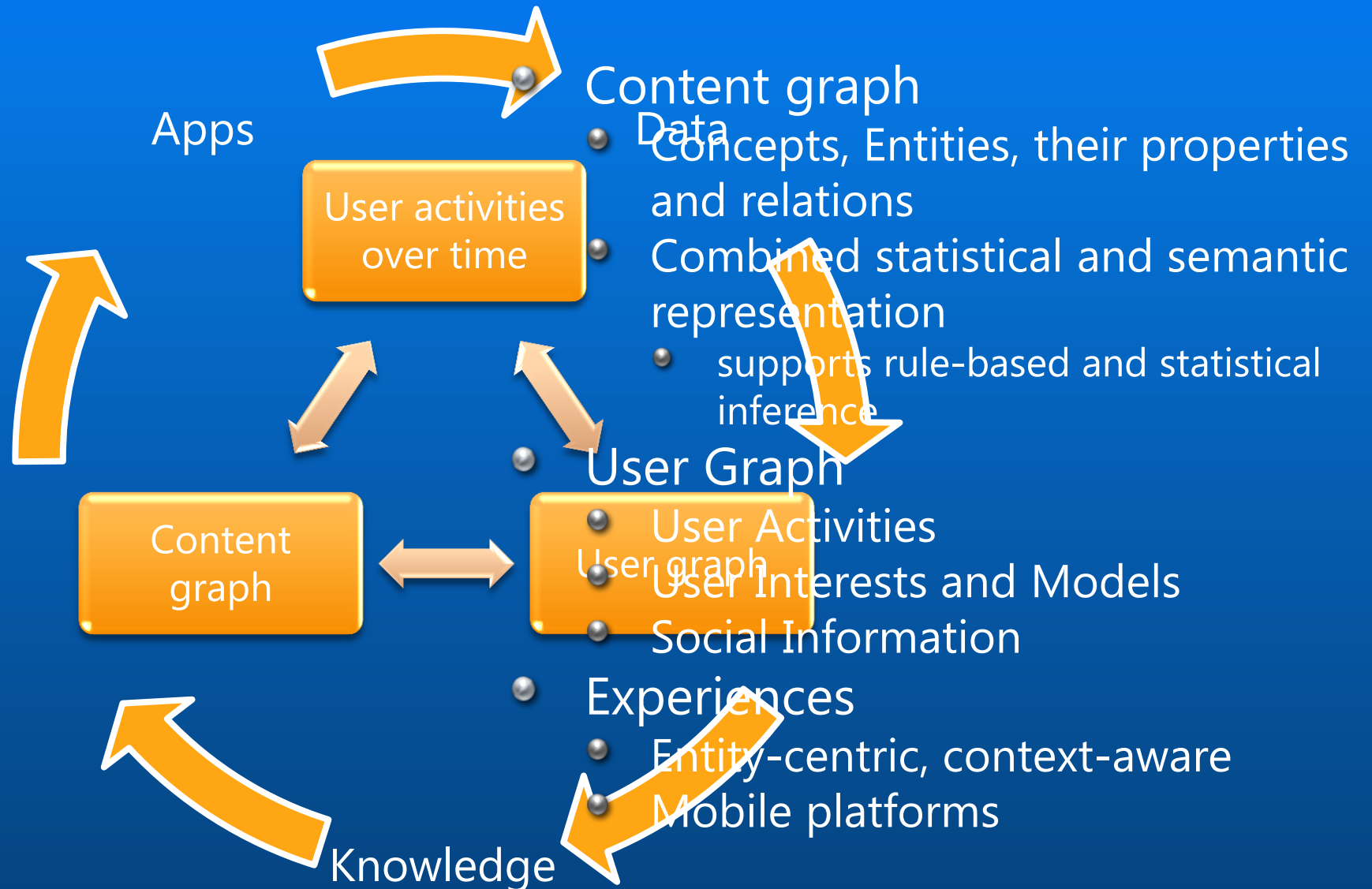
# The Power of Connections



- Knowledge
- Semantics
- Discovery
- Finding connections
- Experiences
- Network effects
  - "The Long Tail", Chris Anderson

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# Knowledge Web



# Knowledge Web

Re-imagine the next phase in the evolution of search and engineer the assets necessary towards that goal

## Data Assets

- Knowledge bases – domain focused and broad
- Ontologies
- Data processing pipeline



## Engines

- Semantic interpretation engines
- Recommendation engines
- Clustering, classification engines



## Experiences

- New knowledge enabled experiences that leverage data assets
- Discovery
- New presentations on mobile devices



# Data-Economics of Metabase

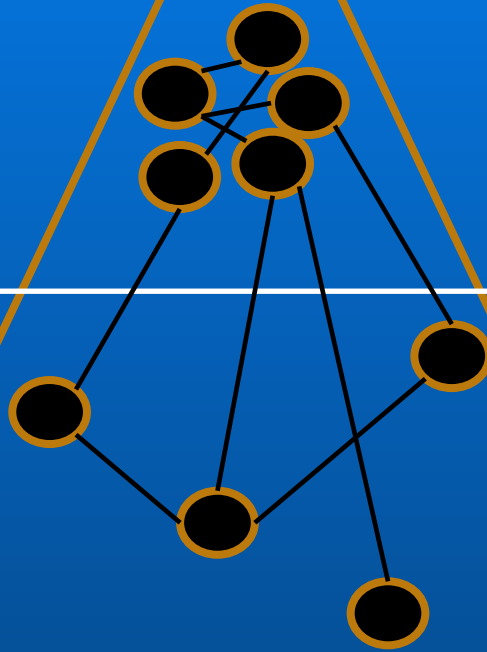
Economic incentive for creating schemas & ontologies

Collaboratively created by community

Incentive for automated (noisy) annotation

Textual & Statistical semantics

General web pages



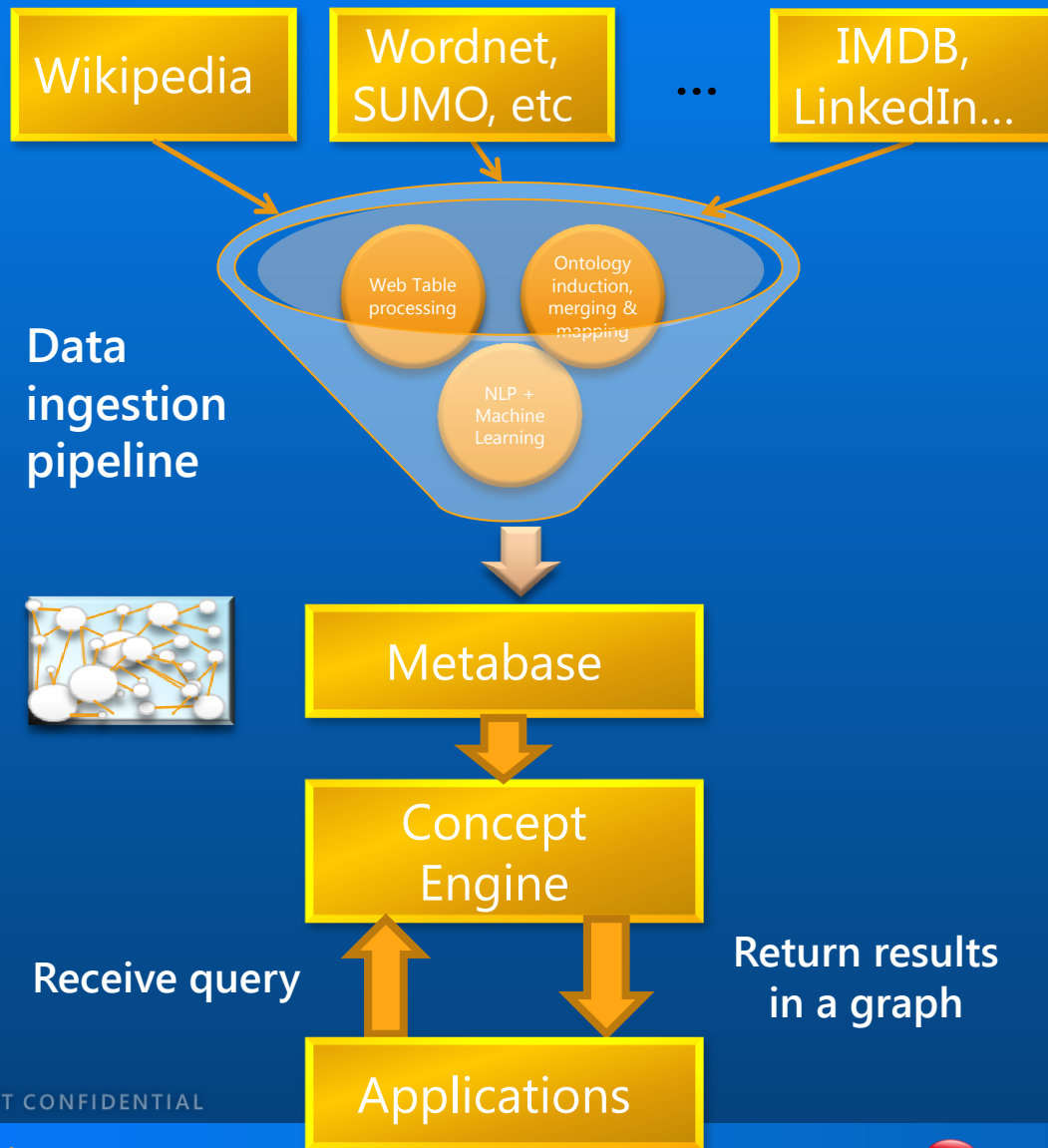
Highest "bang for the buck"  
Connecting data increases value at top

... and elevates value in the middle  
More value with less processing





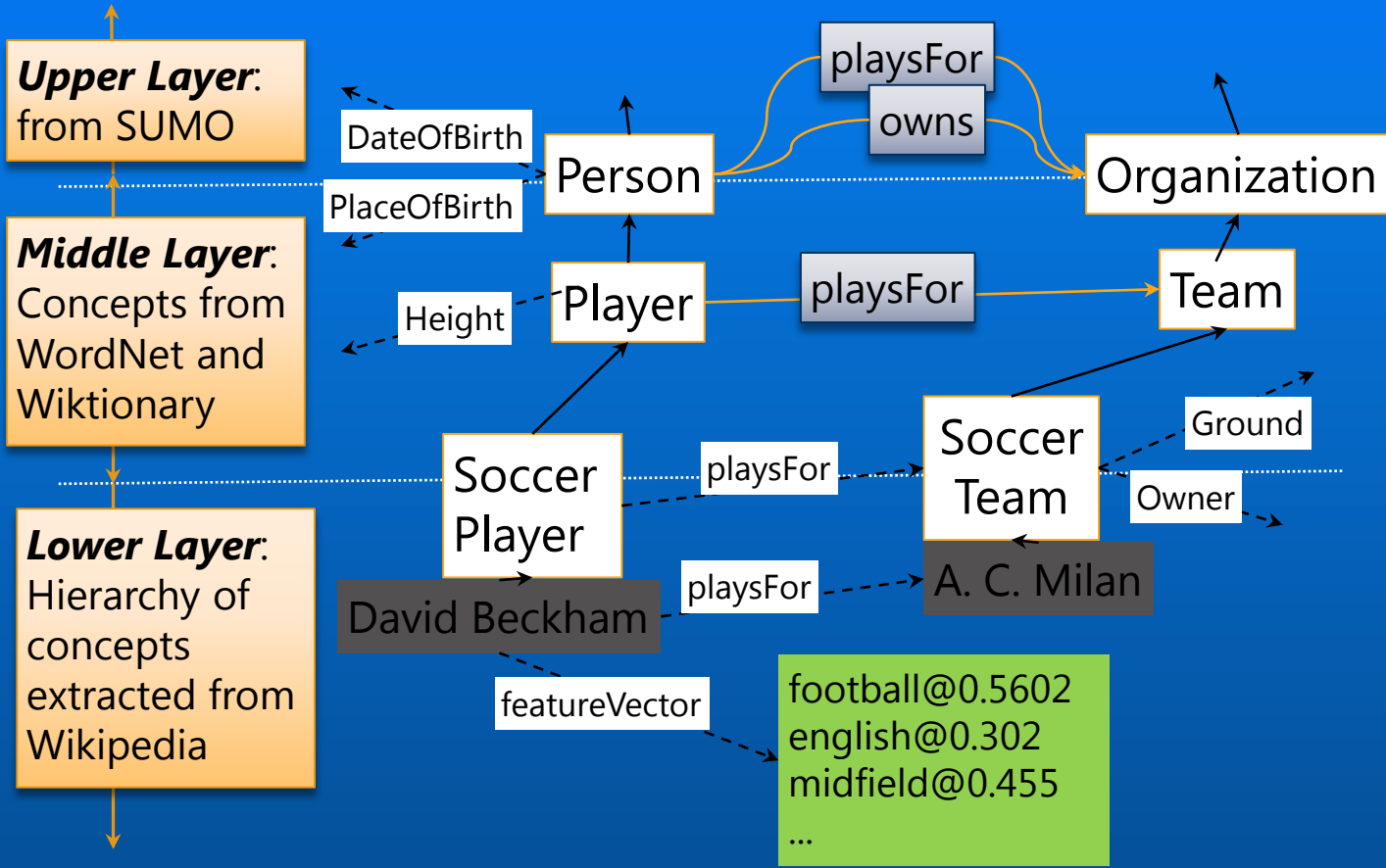
# Building Concept Graph



- Ingest data from Structured and semi-structured data sources
  - Domain Specific Knowledge Bases: Finance
  - Broad-coverage Knowledge Base: Metabase
    - Sourced from Wikipedia, WordNet, Wiktionary, SUMO, etc.
- Common Information Architecture
  - Layered representation of ontologies and knowledge base
  - Represent and organize semantic and statistical information
  - Ability to represent and project different interpretations of concepts
- Engines for Knowledge-enabled Experiences
  - Support applications with APIs for different knowledge access and interpretation
  - E.g. find entities in a query, their connections and related concepts



# Metabase: Layered Ontologies



Metabase Statistics	
<b>SUMO</b>	20K concepts, 70K axioms or rules
<b>WordNet</b>	147,306 Words, 117,659 Concepts, 990,149 facts
<b>Wiktionary</b>	236,258 Words, 197,866 Concepts, 236K synonym relations
<b>Wikipedia</b>	3.6M Entities, 60M facts, 305K category-WordNet links, 200M triples in feature graph

**David Beckham**

**Text and Wikilinks:** David Robert Joseph Beckham, OBE (born 2 May 1975) is an English footballer who currently plays in midfield for Milan in Serie A, on loan from Major League Soccer club Los Angeles Galaxy. He is also an established member of the England national team.

**Infobox:** Personal information: Full name: David Robert Joseph Beckham, Date of birth: 2 May 1975 (age 35), Place of birth: Leytonstone, London, England, Height: 6 ft 0 in (1.83 m), Playing position: Midfielder. Club information: Current club: Milan (on loan from Los Angeles Galaxy), Number: 32. Youth career: [empty]

**Tables:** International goals table with columns: Goal, Date, Venue, Opponent, Score, Result, Competition, Reports.

**Sections:** Coaching career: On 14 May 2010 was announced Beckham will work as Assistant Coach of Fabio Capello for the England national football team at the 2010 FIFA World Cup.

**Categories:** 1998 FIFA World Cup players | 2002 FIFA World Cup players | 2006 FIFA World Cup players | A.C. Milan players | BBC Sports Personality of the Year winners | British sportspeople in the United States | British expatriates in Italy | British expatriates in Spain | England international footballers | England under-21 international footballers | English bloggers | English expatriates in the United States | English expatriate footballers | English footballers | English Football Hall of Fame inductees | Expatriate footballers in Italy | Expatriate footballers in Spain | Expatriate

# Challenges: Ontology and Knowledge Representation

## Ontology Induction

- > Representation that yields well for learning from data
- > Projecting knowledge to find gaps in information
- > Learning from anomalies found in the data

## Ontology Alignment

- > Mapping and Merging of Ontologies and Knowledge bases

## Entity Resolution

- > Collapsing Entities from different sources and different associated attributes
- > Identifying new Entities

## Validation and Verification

- > Correctness and completeness of source data and ontology
- > information in the Knowledge base
  - > Identifying and filling missing gaps in the KB

# Social Semantics and Mobile Experiences

User Graph: Capture, represent and understand users, their connections and interactions with other users and content

Sources	Representation & Models	Engines & Experiences
<ul style="list-style-type: none"><li>• Social Networks: Facebook, Twitter, etc.</li><li>• Friend, Follow, Like, Check-in</li><li>• Semantics<ul style="list-style-type: none"><li>• Open Graph</li><li>• Schema.org</li></ul></li></ul>	<ul style="list-style-type: none"><li>• Genome of Users and Things<ul style="list-style-type: none"><li>• Music Genome (Pandora)</li></ul></li><li>• Capturing User Context<ul style="list-style-type: none"><li>• Current Environment and Situation, Information Need</li><li>• Short- and long-term interests</li></ul></li><li>• User Interests and Models<ul style="list-style-type: none"><li>• Project as graph linking concepts and users</li></ul></li></ul>	<ul style="list-style-type: none"><li>• Social in Search Engines</li><li>• Recommendation Engines<ul style="list-style-type: none"><li>• Hotpot (Google)</li><li>• Simon (Microsoft) - Decision at a Glance</li></ul></li><li>• Mobile experience<ul style="list-style-type: none"><li>• More contextual data (e.g. geo), need more contextual understanding</li><li>• Proactive recommendations (collaborative + content + social filtering)</li><li>• Social experience</li></ul></li></ul>

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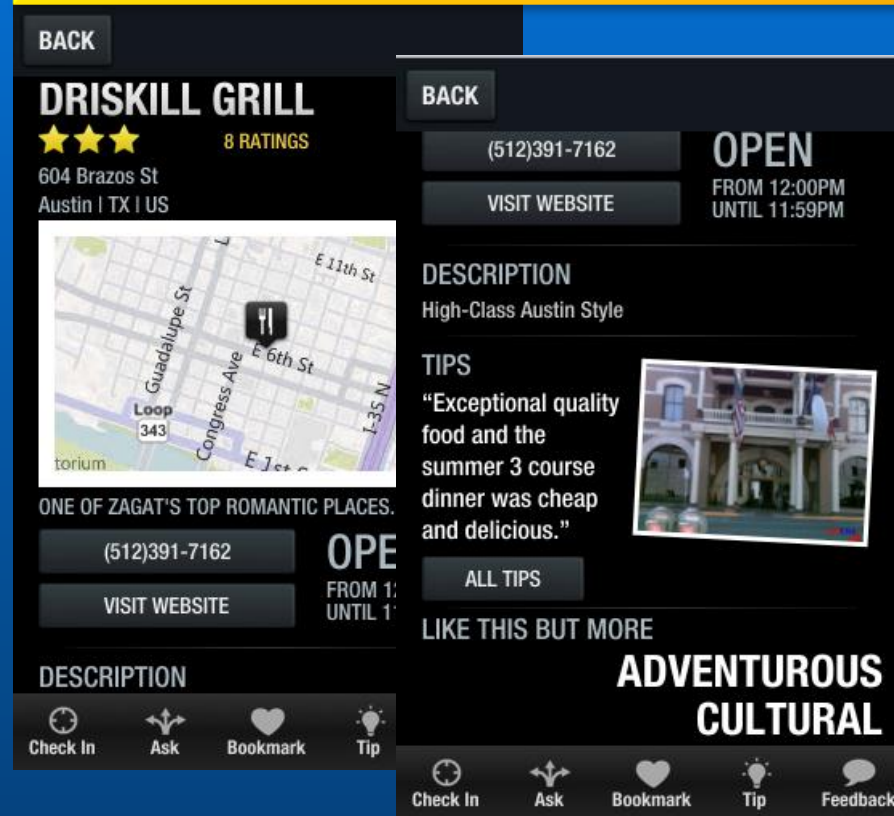
# Simon: Knowledge-enabled Mobile Experience

Recommend restaurants and events on mobile platform with minimal or no query box user experiences.

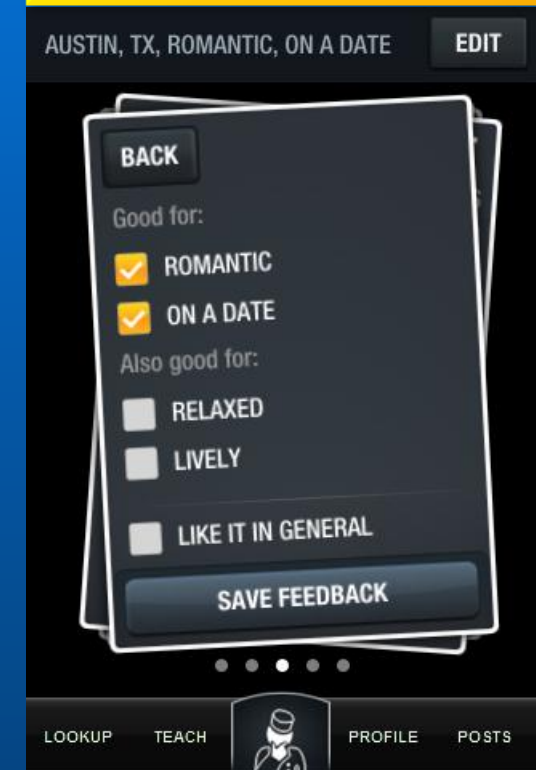
## Decision at a glance



## Details and contextual drill-down



## User Feedback to learn from



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# Challenges: Social Semantics and Mobile Experiences

## Interpreting Links

- > Not all likes are Equal
- > Interpreting User Links to suggest actions
  - > E.g. *Can John provide better answers for this question?*

## Modeling Users and their Interests

- > Capturing and deriving common representation from different sources of user interaction
- > Modeling user interests over time

## User Context

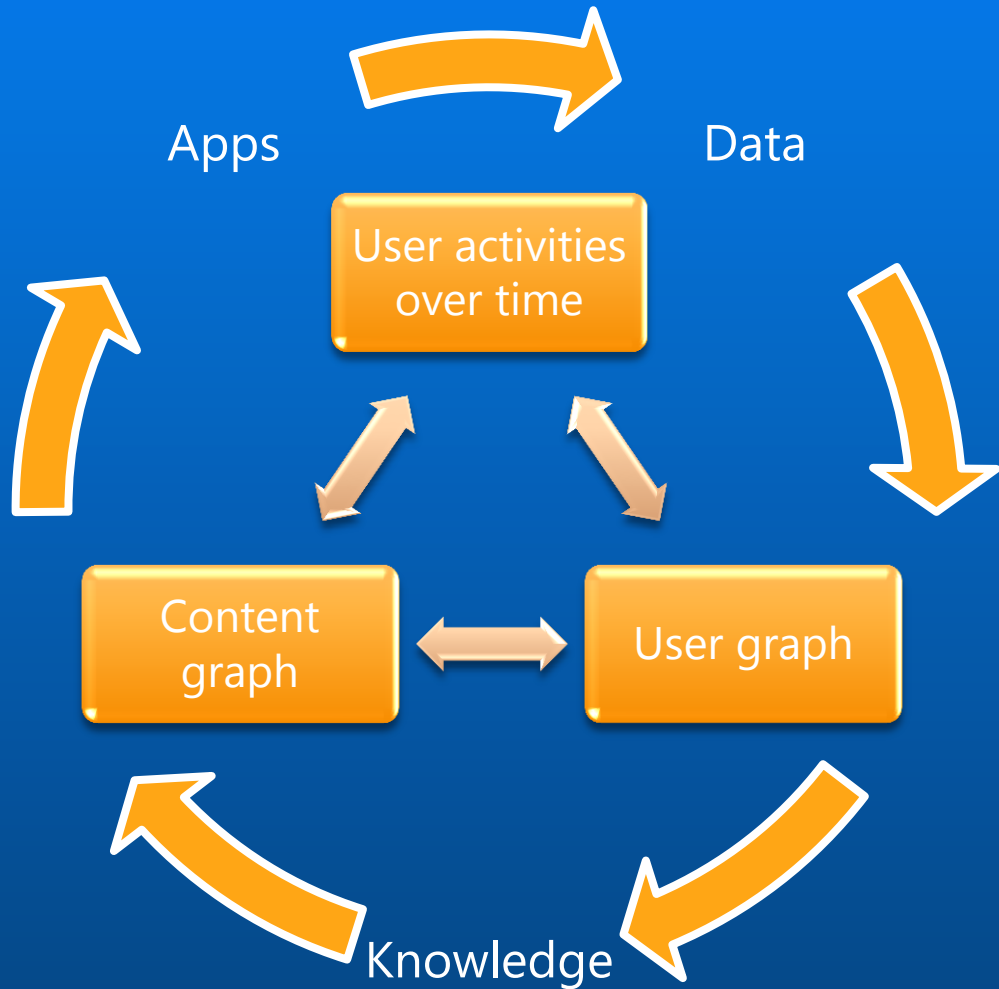
- > Learning from different sources of user actions (social network, search logs)
- > Context and Consumption Behavior (Mobile settings)

## Recommendation

- > Enabling Contextual Discovery
- > Genome of Users and Things



# In Summary



- Data-Economics Pyramid
  - Exploit structured and semi-structured data
  - Focus on Information Organization and Integration
- Layered Semantic Representation
  - Ontology Alignment and Entity Resolution
  - Combine Semantics and Statistics
- Social and Mobile Experiences
  - Modeling User Context and Interests
  - Entity-centric, context-aware recommendations

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# Faculty Summit



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2011 ← 2031