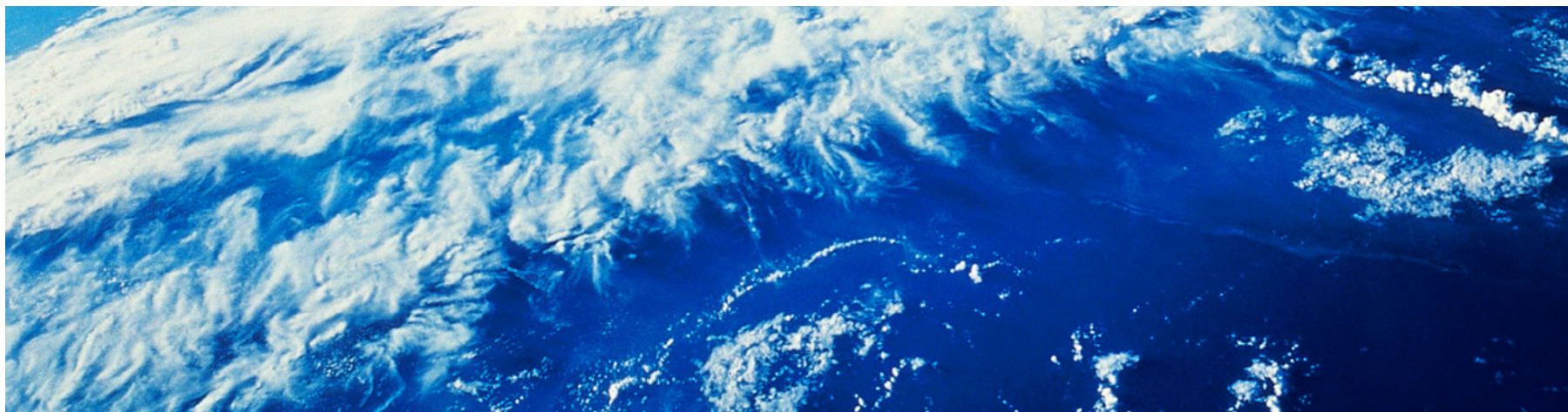


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# Supporting IT Service Information Management with Knowledge Graph

Mu Qiao<sup>1</sup>, Taiga Nakamura<sup>1</sup>, Monika Gupta<sup>2</sup>, Costel Crihana<sup>3</sup>, Shachi Sharma<sup>2</sup>

IBM Almaden Research Center<sup>1</sup> IBM Indian Research Lab<sup>2</sup> IBM Global Technology Services<sup>3</sup>



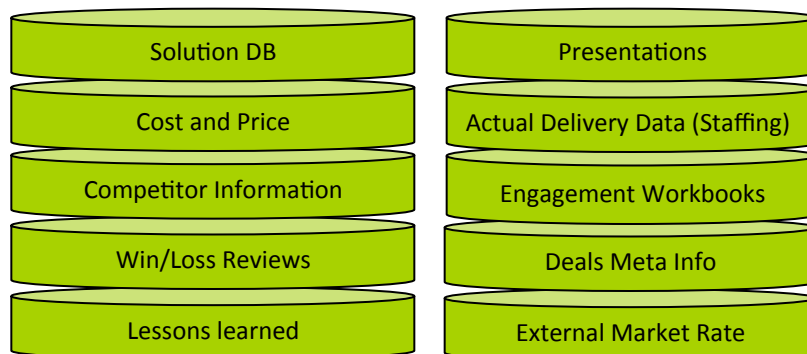
- IT strategic outsourcing is the process of contracting IT related business functions to external service providers:



- Deal teams need to respond to potential clients' request for proposals (RFS) by submitting a detailed technical solution in a bidding process:



*search*



*diverse environment, heterogeneous sources*



*collaboration*



*short time*

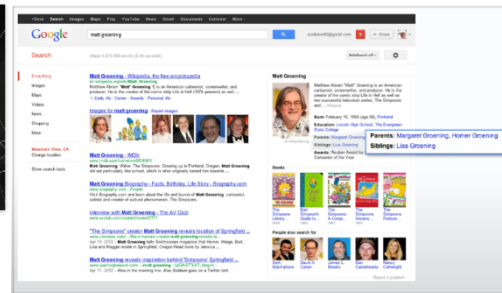
- **Help in creating winning solutions by improving solution quality**
  - Tap into the full breadth knowledge and expertise available to create high quality solution
  - Facilitate the process of information exploration and knowledge sharing
- **Increase solutioning productivity to win more with available workforce**
  - Allow people to focus on creating values instead of spending too much time on searching
  - Help to derive insights from dense documentation spread across different repositories
  - Bring less experienced practitioners up to speed faster



- A knowledge base that stores semantic search information gathered from a wide variety of sources in a graph structure
- Users are shown structured details about the search topic and links to other repositories that may be of interest.
- Users can find out everything they want without needing to look at multiple repositories to find the overall picture



Interest graph



Knowledge graph



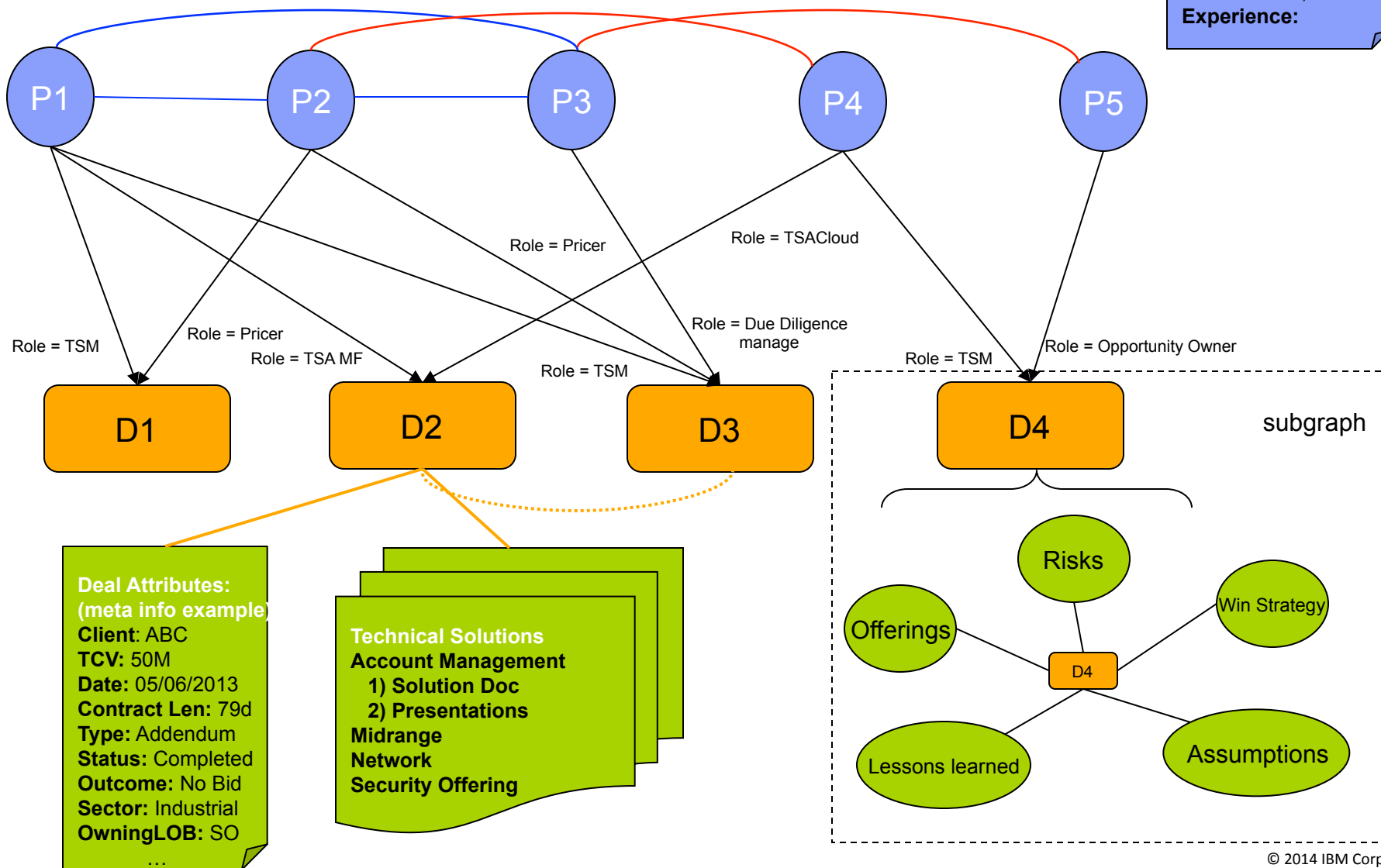
Graph search

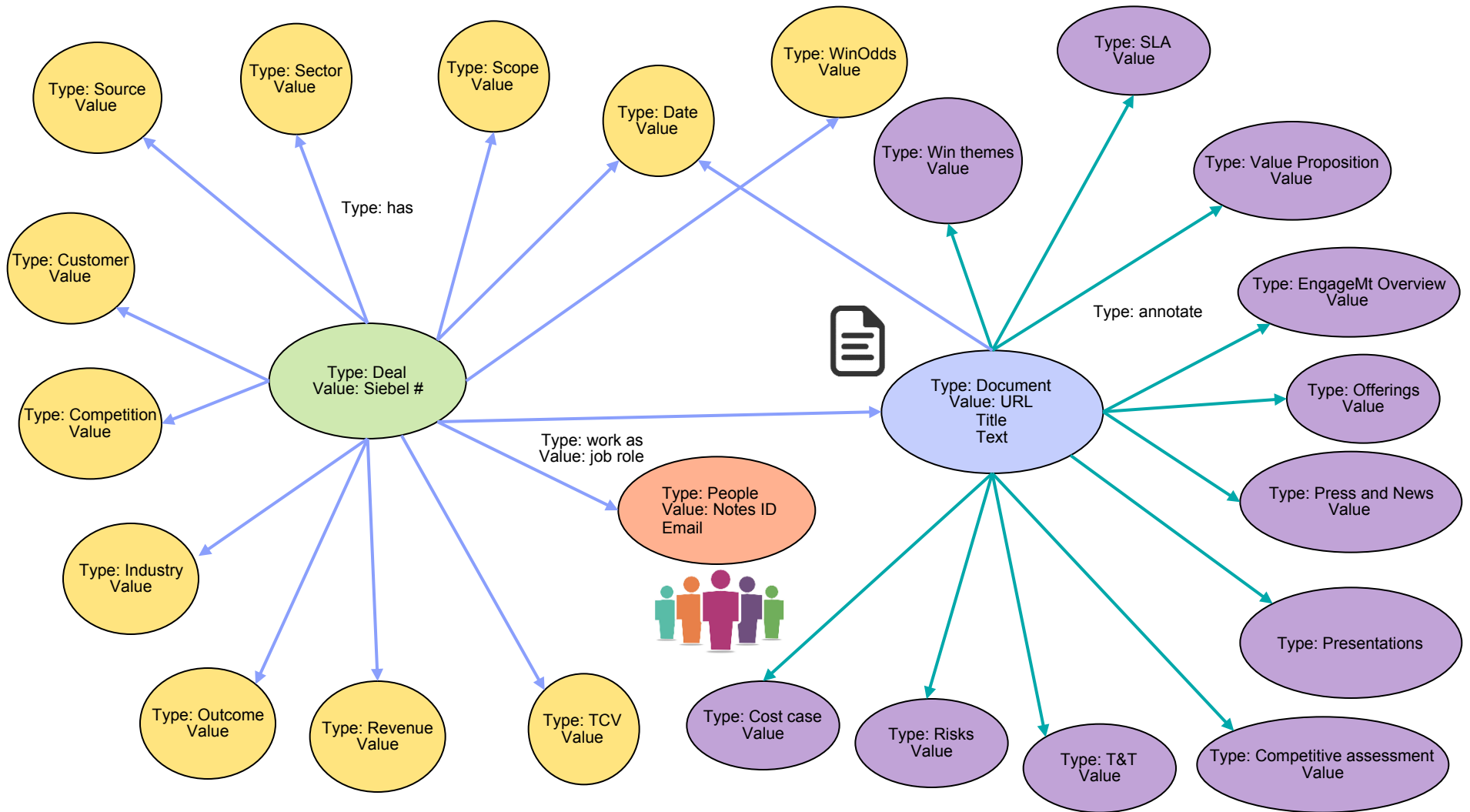
# A Conceptual Data Model for Knowledge Graph



- --- People
- Deal Collaboration
- ⋯ Supplemental edge
- Deal
- Social Collaboration
- Co-occurrence

**Personal profile**  
**Name:** John Smith  
**Org:** Global Tech Serv  
**Skills:** Cloud, network  
**Experience:**



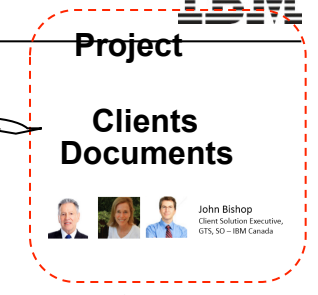
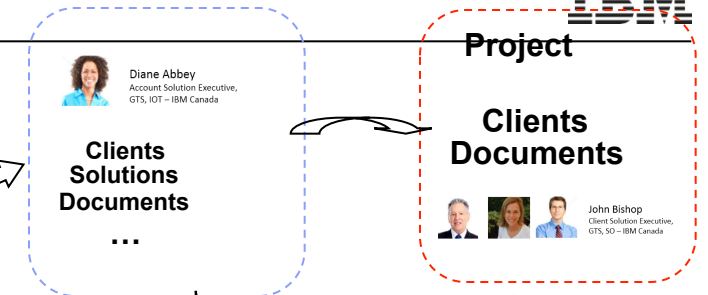
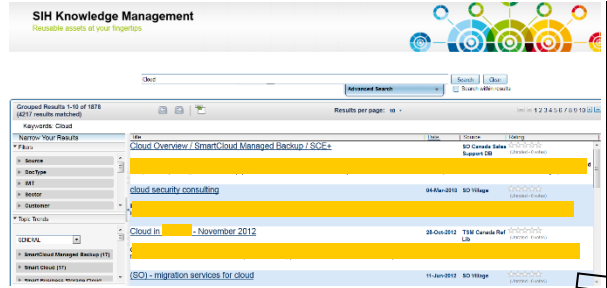


# System Architecture

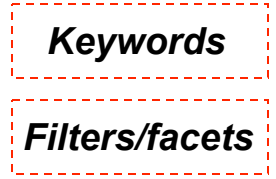
people-centric view

project-centric view

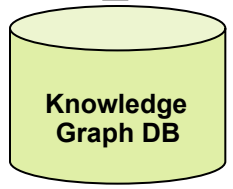
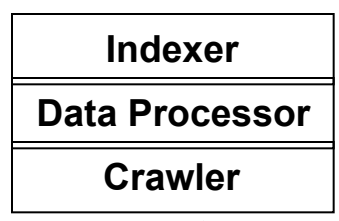
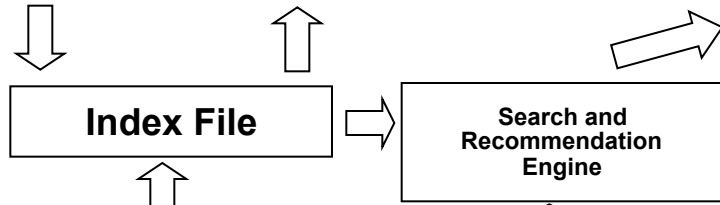
## Front-end UI



\*Not real person information, for demonstration purpose only



Search Query      Results



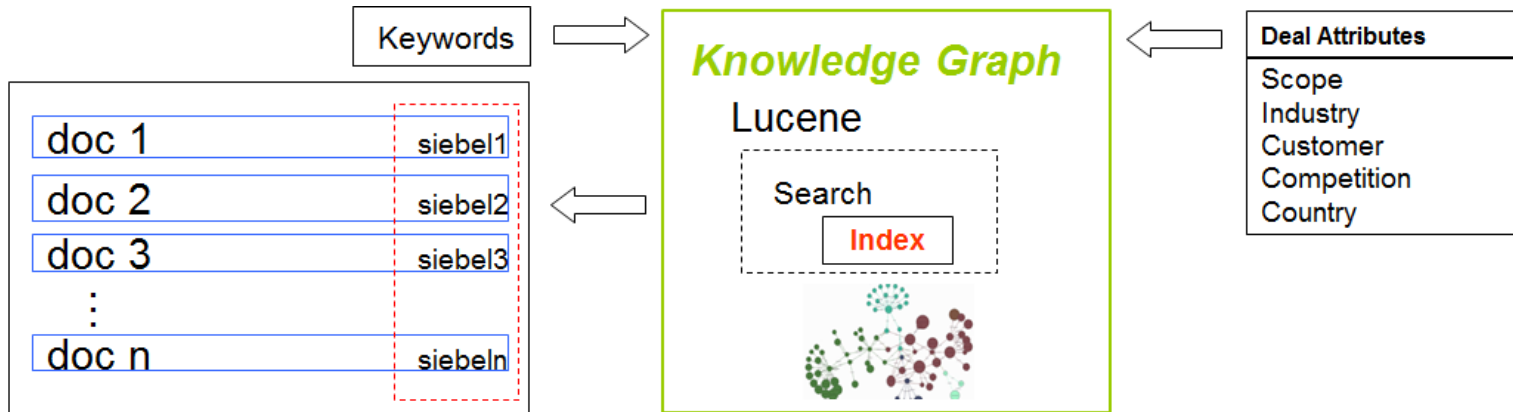
document-centric view



# Simultaneous Document, Expert, and Deal Search

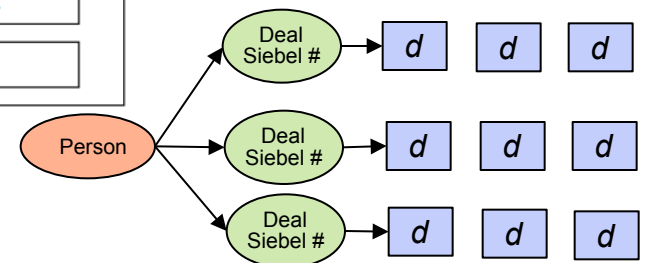
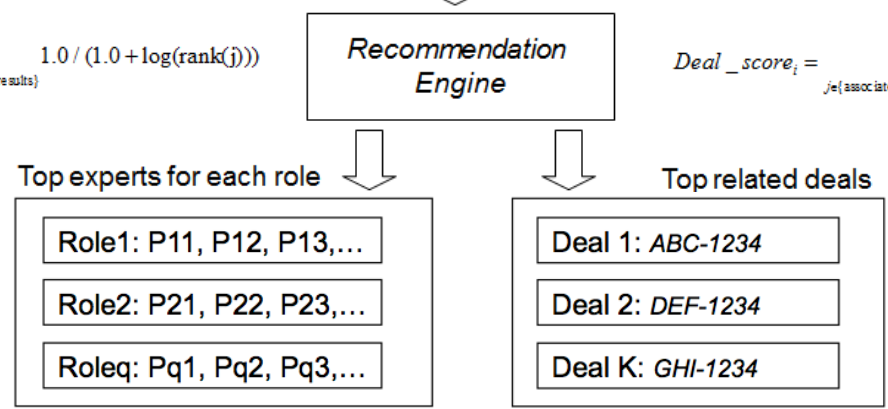


Leverage the relationships among document, deal, and people nodes in the knowledge graph  
 Each project is represented by a set of associated documents.  
 Each person is also represented by a set of associated documents.



$$Expert\_score_i = \sum_{j \in \{\text{associated documents for expert, among top } n \text{ search results}\}} 1.0 / (1.0 + \log(\text{rank}(j)))$$

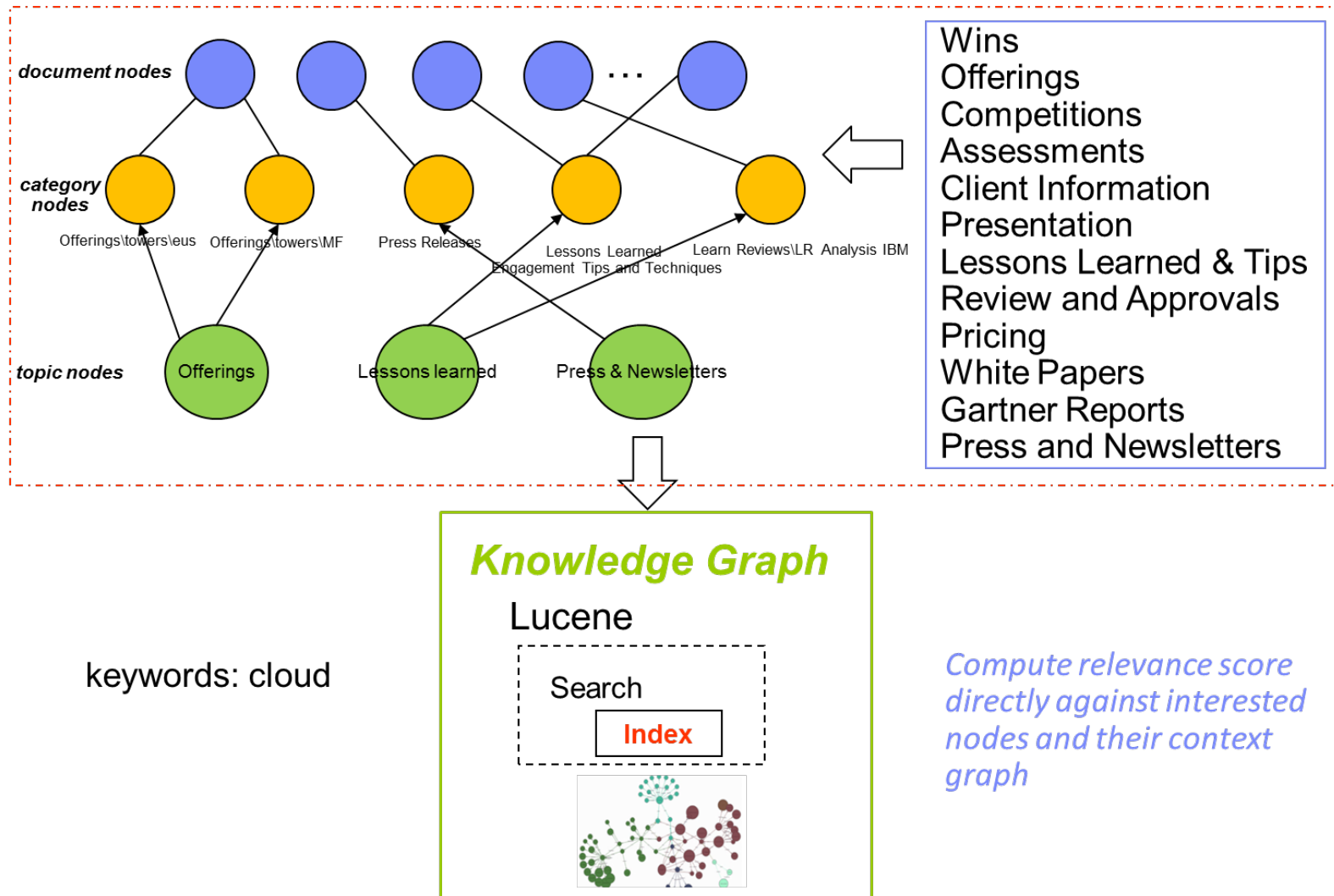
$$Deal\_score_i = \sum_{j \in \{\text{associated documents for deal, among top } n \text{ search results}\}} 1.0 / (1.0 + \log(\text{rank}(j)))$$



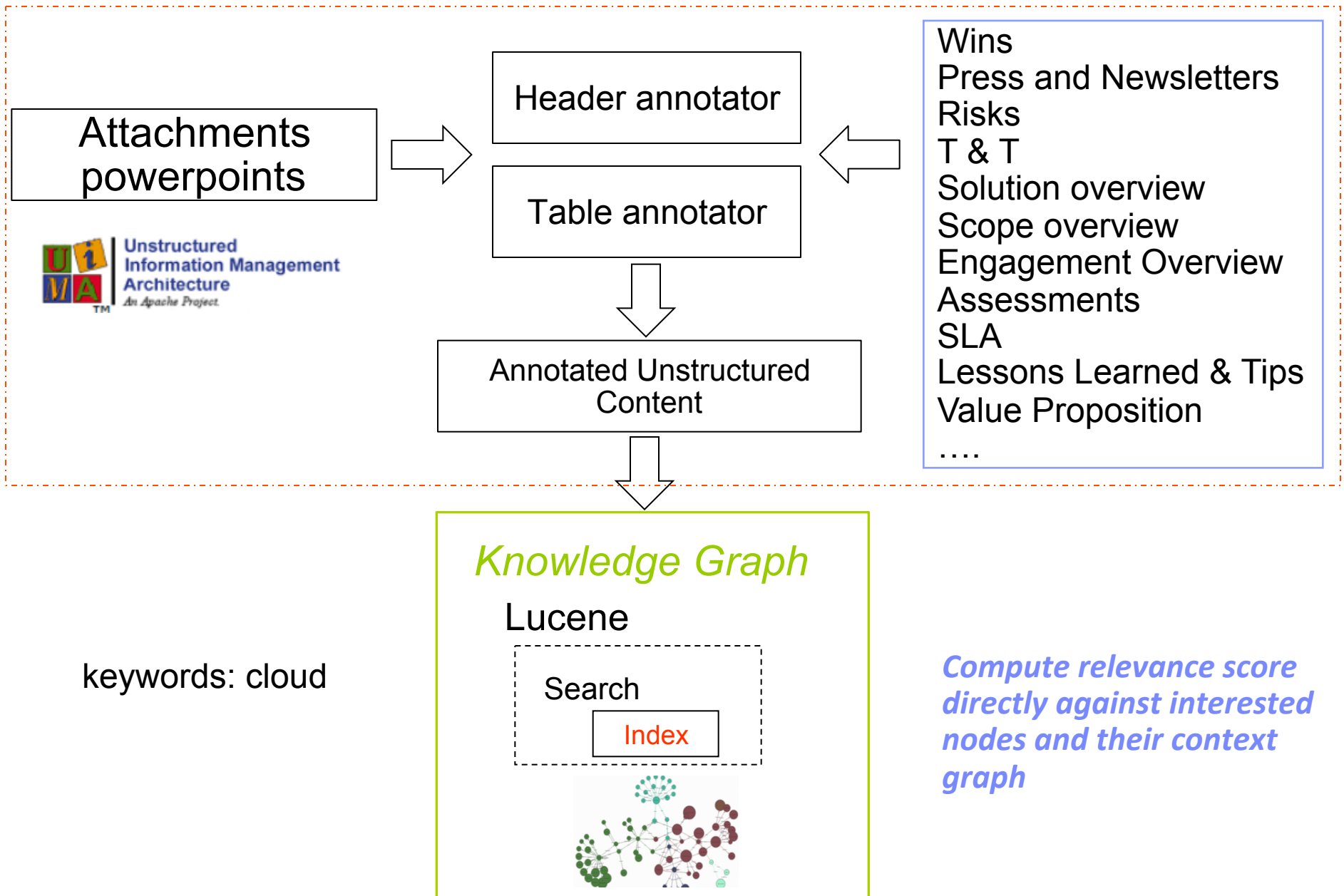
Linear computational cost: O(n)



# Contextual Content Recommendation (Structured)



# Contextual Content Recommendation (Unstructured)



Knowledge graph | Analytics | About the tool

## Solution Information Manager V2.0

Keywords:

Source:

Sector:

IMT:

Customer:

Competition:

Outcome:

**Natural language query**

Powered by SIM knowledge graph search © Copyright IBM Corporation 2014

**P** Collaborators who worked with client XYZ with a role **TSA Cloud**

- Collaborators who worked with client XYZ with a role **TSA MF**
- Collaborators who worked with client XYZ with a role **TSM**
- Collaborators who worked with client ABC with a role **Pricer**
- Collaborators who worked with client ABC in **2013**
- Collaborators who worked with client XYZ with a role **TSA Cloud**
- Collaborators who worked **as TSA Cloud**

See more results for "Collaborators who worked with"

**D** Winning technical solutions done by John Smith with client

- Winning technical solutions done by John Smith with client
- Winning technical solutions done by John Smith with client
- Winning technical solutions done by John Smith in **2013**
- Winning technical solutions done by John Smith with client  **2013**
- Winning **customer presentations done by John Smith**
- Winning **customer presentations done by John Smith in 2013**

See more results for "Winning technical solutions for"

# Demo: Simultaneous Expert, Document, and Deal Search



gts-so-vm2.almaden.ibm.com:9080/SimUI/sim.jsp

Welcome taiga@us.ibm.com   About the tool   FAQ   Resources   Feedback   Help

## Solution Information Manager

Reusable assets at your fingertips

data center   Search   Clear   Advanced Search    Search within results

Now Showing Results 1-10 of 13865   Page 1   Results per page: 10

**Query : data center**

**Narrow Your Results**

Filters

- Source
- DocType
- IMT
- Sector
- date

New search  
 Add to search

Search   Clear

Topic Trends

- CSF (27)
- AM-IBM (27)
- CSF AM-IBM (27)
- AM-Non IBM (18)
- SSO-Storage (41)
- SSO-Midrange (40)

**Top related deals:** [redacted]

You may also consider the following offerings: disk storage; mainframe; transition; data center capabilities service models; cross functional

Wins   Offerings   Competitions   Assessments   Client Information   Presentation

Lessons Learned and Tips   Review and Approvals   Pricing Information   White Papers

Gartner Reports   Press and Newsletters

Title	Date	Source	Rating
<a href="#">Resiliency Example - Healthcare</a>	[redacted]	<a href="#">CES Handbook</a>	(0 votes) ☆☆☆☆☆

to a client building a new **data center** to support...Resilient **Data Center** for Healthcare.ppt...Resiliency Example - Healthcare, , Main Deck, Resilient **Data Center**... to a client building a new **data center** to support... : English - Resilient **Data Center** for Healthcare.ppt

**Top experts**

[redacted]

# Demo: Simultaneous Expert, Document, and Deal Search



The screenshot shows the Solution Information Manager interface. At the top, there is a navigation bar with links for 'About the tool', 'FAQ', 'Resources', 'Feedback', and 'Help'. The main header displays 'Solution Information Manager' and the tagline 'Reusable assets at your fingertips'. A search bar contains the query 'data center'. Below the search bar, the interface shows search filters and results. A popup window titled 'Expert profile' is overlaid on the search results, displaying two expert profiles with redacted information. The background search results include a list of 'Top related deals' and a table of search results with columns for 'Title', 'Date', and 'Rating'. The table contains entries such as 'Resiliency Example - Healthcare' and 'Data Center Functionality'.

Expert profile

Customer: [Redacted]  
Siebel ID: [Redacted]  
Job Role: **TSE**  
Competitor: [Redacted]  
Sector: [Industrial](#)  
Country: [Redacted]  
Scope: [CSF/AM-IBM HW](#)  
Offering: [Service Desk](#)  
Outcome: [Redacted]  
Date: **07-Jun-2011**

Customer: [Redacted]  
Siebel ID: [Redacted]  
Job Role: **TSE**  
Competitor: [Redacted]  
Sector: [Industrial](#)  
Country: [Redacted]  
Scope: [SSO-Storage](#)  
Offering: [Service Desk](#)  
Outcome: [Redacted]  
Date: **14-Nov-2011**

Title	Date	Rating
Resiliency Example - Healthcare	[Redacted]	(0 votes)
Data Center Functionality	18-Apr-2011	(0 votes)

# Demo: Contextual Content Recommendation



Welcome taiga@us.ibm.com    About the tool    FAQ    Resources    Feedback    Help

## Solution Information Manager

Reusable assets at your fingertips

data center    Search    Clear    Search within results

04. Review Package & Approvals

- Solution Local Review Board Presentation - 12 Dec 2004 ( )
- Selection Meeting Minutes - 14th July, 2010 ( )
- IP Release Meeting Minutes - 15 May, 2009 ( )
- DC in ( )
- Global Price Release for 2008 (Bid Object 4 & 5) - Minutes - 28/03/08 ( )
- Release Board Minutes - 14/04/2008 ( )
- Release for Services Meeting Minutes- 27th Apr 2011 ( )
- Selection Meeting Minutes - 06 November,2009 ( )
- Delivery KickOff Solution Strategy Board Meeting Minutes - 22nd Jan,2009 ( )
- BAFO Release Meeting Minutes - 06th August, 2010 ( )
- Review Board Meeting Minutes - 20 July 2007 ( )
- Review Board Meeting Minutes - 17 Sept 2007 ( )
- BAFO Release Meeting Minutes - 15th June, 2010 ( )

Results per page: 10

How Showing Results 1-1

Query : data center

Narrow Your Results

Filters

- Source
- DocType
- IMT
- Sector
- date

New search  
 Add to search  
 Search    Clear

Topic Trends

- CSF (27)
- AM-IBM (27)
- CSF AM-IBM (27)
- AM-Non IBM (18)
- SSO-Storage (41)
- SSO-Midrange (40)

Lessons Learned and Tips    Review and Approvals    Pricing Information    White Papers  
 Gartner Reports    Press and Newsletters

**Contextual Search**

Title	Date	Source	Rating
<a href="#">Resiliency Example - Healthcare</a>		<a href="#">CES Handbook</a>	(0 votes) ☆☆☆☆☆

to a client building a new **data center** to support...Resilient **Data Center** for Healthcare.ppt...Resiliency Example - Healthcare, , Main Deck, Resilient **Data Center**... to a client building a new **data center** to support... : English - Resilient **Data Center** for Healthcare.ppt

berta Health:  
service models; cross

Presentation

Top experts

.com

- Empower information sharing in IT services with knowledge graph
  - Knowledge hub: 360 degree view of knowledge at a single site
  - Integrate the information from heterogonous resources
  - Transform existing structured and unstructured information into a user friendly knowledge base
  - Simultaneous Document, Expert, and Deal Recommendation
  - Contextual content recommendation
- Ongoing and Future work
  - Natural language query understanding
  - Knowledge graph security access control
    - Edge access control in querying facts stored in graph databases
  - Personalized recommendation
  - Large-scale graph indexing and search