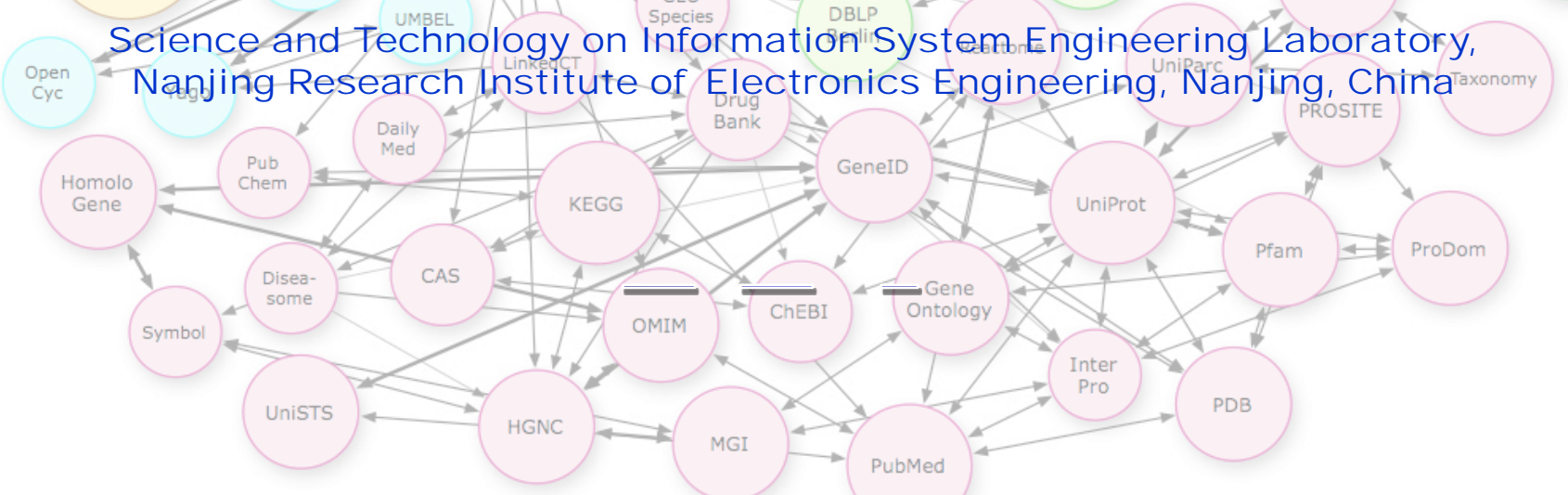


# Link Correlated Military Data for Better Decision Support



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# Problem: Locate required data from a “data sea”

—— To win the information superiority

- What a decider requires:
  - Data directly useful to solve decision problem
  - Data of interest or highly related to decision problem
- What a decider usually gets:
  - Huge amount of data while few have relevancy
- So the decider needs to:
  - Check each data’s relevancy till required data are found
  - Guess the location of required data by experience

**Better solution?**

# One answer: Data navigation

- Data navigation:
  - Meaning: Lead the path to the required data step by step, based on some kind of guidance
- Three basic kinds of guidance:
  - Classification: guide through data taxonomy
  - Keyword: guide through keyword-based search results
  - Correlation: guide through correlations among data

**Any difference?**

# Example decision problem – Who are robbers?

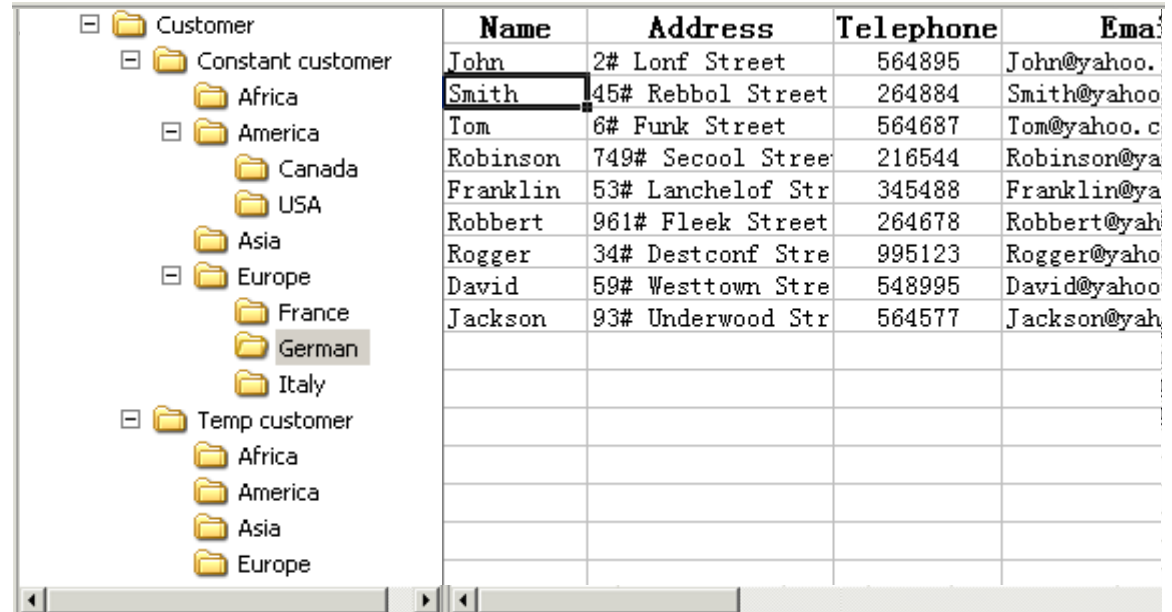
- “A bank was robbed last night. A man named Tom was arrested inside the bank, with a QSZ92 5.8mm gun found in his hand, made in company KGE. He refused to provide other robbers’ names.”
- To find other robbers, a possible way:
  1. Investigate company KGE, list its customers
  2. Gather intelligence, analyze each customer’s recent activities
  3. Check features of each activity (time, place, weapons, etc.), compare with the bank robbery event, so as to find suspects

How to support this decision  
through data navigation?

# Data navigation method - Classification-based

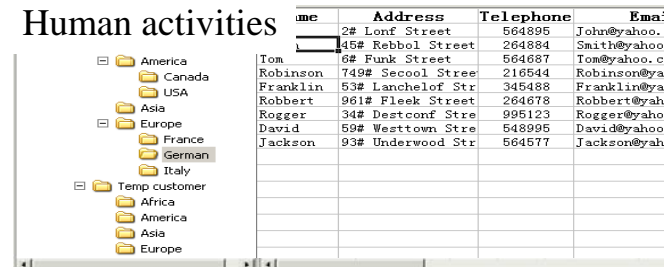
- Users need to know exactly under which branch of the tree he can or may find the required data

## Customers of company KGE



Name	Address	Telephone	Email
John	2# Lonf Street	564895	John@yahoo.
Smith	45# Rebbol Street	264884	Smith@yahoo
Tom	6# Funk Street	564687	Tom@yahoo.c
Robinson	749# Secool Stree	216544	Robinson@ya
Franklin	53# Lanchelof Str	345488	Franklin@ya
Robbert	961# Fleek Street	264678	Robbert@yah
Rogger	34# Destconf Stre	995123	Rogger@yaho
David	59# Westtown Stre	548995	David@yahoo
Jackson	93# Underwood Str	564577	Jackson@yah

## Human activities



Name	Address	Telephone	Email
John	2# Lonf Street	564895	John@yahoo.
Smith	45# Rebbol Street	264884	Smith@yahoo
Tom	6# Funk Street	564687	Tom@yahoo.c
Robinson	749# Secool Stree	216544	Robinson@ya
Franklin	53# Lanchelof Str	345488	Franklin@ya
Robbert	961# Fleek Street	264678	Robbert@yah
Rogger	34# Destconf Stre	995123	Rogger@yaho
David	59# Westtown Stre	548995	David@yahoo
Jackson	93# Underwood Str	564577	Jackson@yah



# Data navigation method - Keyword-based

- Users need to master precise keywords to both extract required data, and filter out irrelevant ones

**检索结果** TI=((semantic\* OR ontolog\*) AND (military OR combat OR battle\* OR war OR warfare OR "command and control" OR C4ISR OR C3I OR operation\*))  
入库时间=所有年份 数据库=SCI-EXPANDED, SSCI, CPCL-S, IC, CCR-EXPANDED.

检索结果: 336 第 1 页, 共 34 页 转至 排序方式: 被引频次

打印 电子邮件 添加到标记结果列表 保存到 EndNote@Web 分析检索结果  
保存到 EndNote, RefMan, ProCite 更多选项 创建引文报告

**精炼检索结果**  
结果内检索

**学科类别** 精炼

- COMPUTER SCIENCE, THEORY & METHODS (192)
- COMPUTER SCIENCE, SOFTWARE ENGINEERING (48)
- COMPUTER SCIENCE, INFORMATION SYSTEMS (41)
- COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE (39)
- MATHEMATICS, APPLIED (22)

更多选项/分类...

**文献类型** 精炼

- PROCEEDINGS PAPER (185)
- ARTICLE (142)
- EDITORIAL MATERIAL (5)
- MEETING ABSTRACT (2)
- REVIEW (2)

更多选项/分类...

**作者**

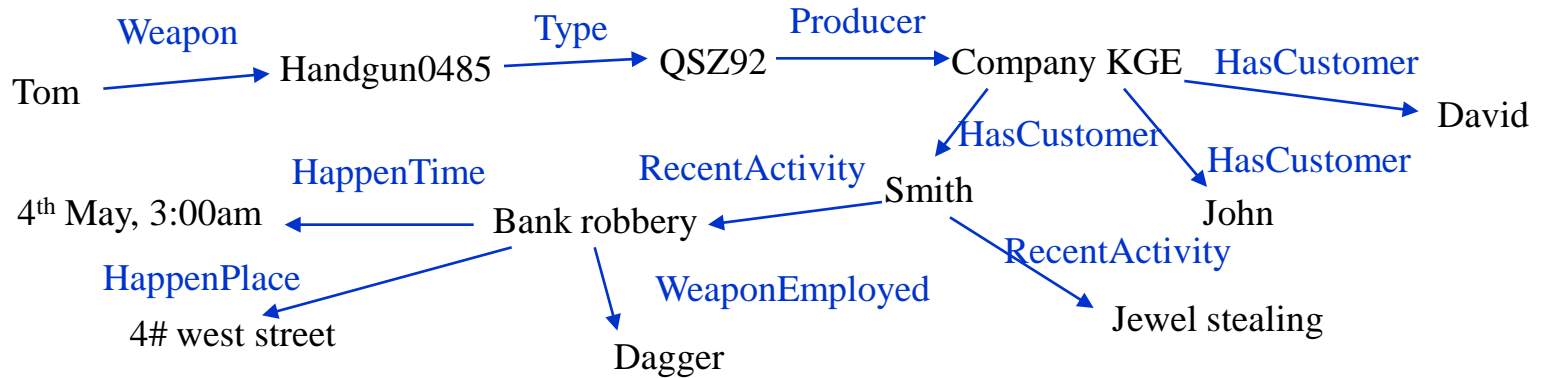
**来源出版物**

**出版年**

**会议标题**

1. 标题: STRUCTURED OPERATIONAL SEMANTICS AND BISIMULATION AS A CONGRUENCE  
作者: GROOTE JF, VAANDRAGER F  
来源出版物: INFORMATION AND COMPUTATION 卷: 100 期: 2 页: 202-260 出版年: OCT 1992  
被引频次: 101  
[Link](#) [全文](#)
2. 标题: A structural approach to operational semantics  
作者: Plotkin GD  
来源出版物: JOURNAL OF LOGIC AND ALGEBRAIC PROGRAMMING 卷: 60-1 页: 17-139 出版年: JUL-DEC 2004  
被引频次: 88  
[Link](#) [全文](#)
3. 标题: A DISTRIBUTED OPERATIONAL SEMANTICS FOR CCS BASED ON CONDITION EVENT SYSTEMS  
作者: DEGANO P, DENICOLA R, MONTANARI U  
来源出版物: ACTA INFORMATICA 卷: 26 期: 1-2 页: 59-91 出版年: 1988  
被引频次: 65  
[Link](#) [全文](#)
4. 标题: Modality-specific operations in semantic dementia  
作者: Lauro-Grotto R, Piccini C, Shallice T  
来源出版物: CORTEX 卷: 33 期: 4 页: 593-622 出版年: DEC 1997  
被引频次: 58  
[Link](#) [全文](#)
5. 标题: OPERATIONAL PETRI NET SEMANTICS FOR CCSP  
作者: OLDEROG ER  
来源出版物: LECTURE NOTES IN COMPUTER SCIENCE 卷: 266 页: 196-223 出版年: 1987  
被引频次: 53  
[Link](#)

# Data navigation method - Correlation-based



## Customers of company KGE

- Users just follow links of interest
- No restriction on content of links – by all possible data correlations

	Name	Address	Telephone	Email
Customer				
Constant customer				
Africa				
America				
Canada				
USA				
Asia				
Europe				
France				
German				
Italy				
Temp customer				
Africa				
America				
Asia				
Europe				

Name	Address	Telephone	Email
John	2# Lonf Street	564895	John@yahoo.
<b>Smith</b>	45# Rebbol Street	264884	Smith@yahoo
Tom			yahoo.c
Robinson			nson@ya
Franklin			klin@ya
Robert			ert@yah
Rogger			
David			
Jackson			

Age	Bank robbery
Sex	Jewel Stealing
Weapon	
RecentActivity	HappenTime
	HappenPlace
	WeaponEmployed
...	...

# Merits of correlation-based method

- By links, one can jump from data to data directly.
- Navigation by links is as easy as surfing on Internet.
- Link construction is based on data correlations. Link selection is upon user interest.
- What user may associate, there is a link to support him, given links rich enough.

**A method suited to human  
association habit?**



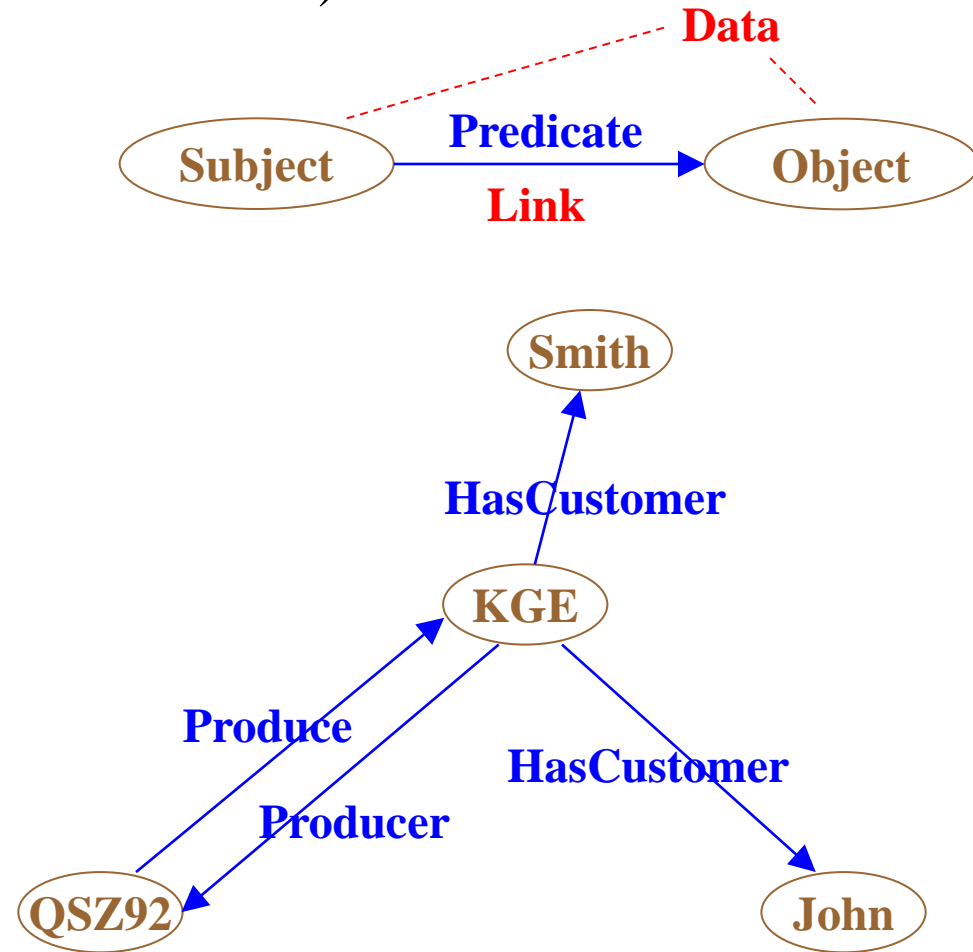
# Method: Unified correlation description

- RDF (Resource Description Framework)

- <Subject, Predicate, Object>

- Example:

- <http://company.org/KGE,  
http://company.org/HasCustomer,  
http://people.org/Tom>
  - <http://company.org/KGE,  
http://company.org/HasCustomer,  
http://people.org/John>
  - <http://company.org/KGE,  
http://company.org/Produce,  
http://weapon.org/QSZ92>
  - <http://weapon.org/QSZ92,  
http://company.org/Producer,  
http://company.org/KGE >

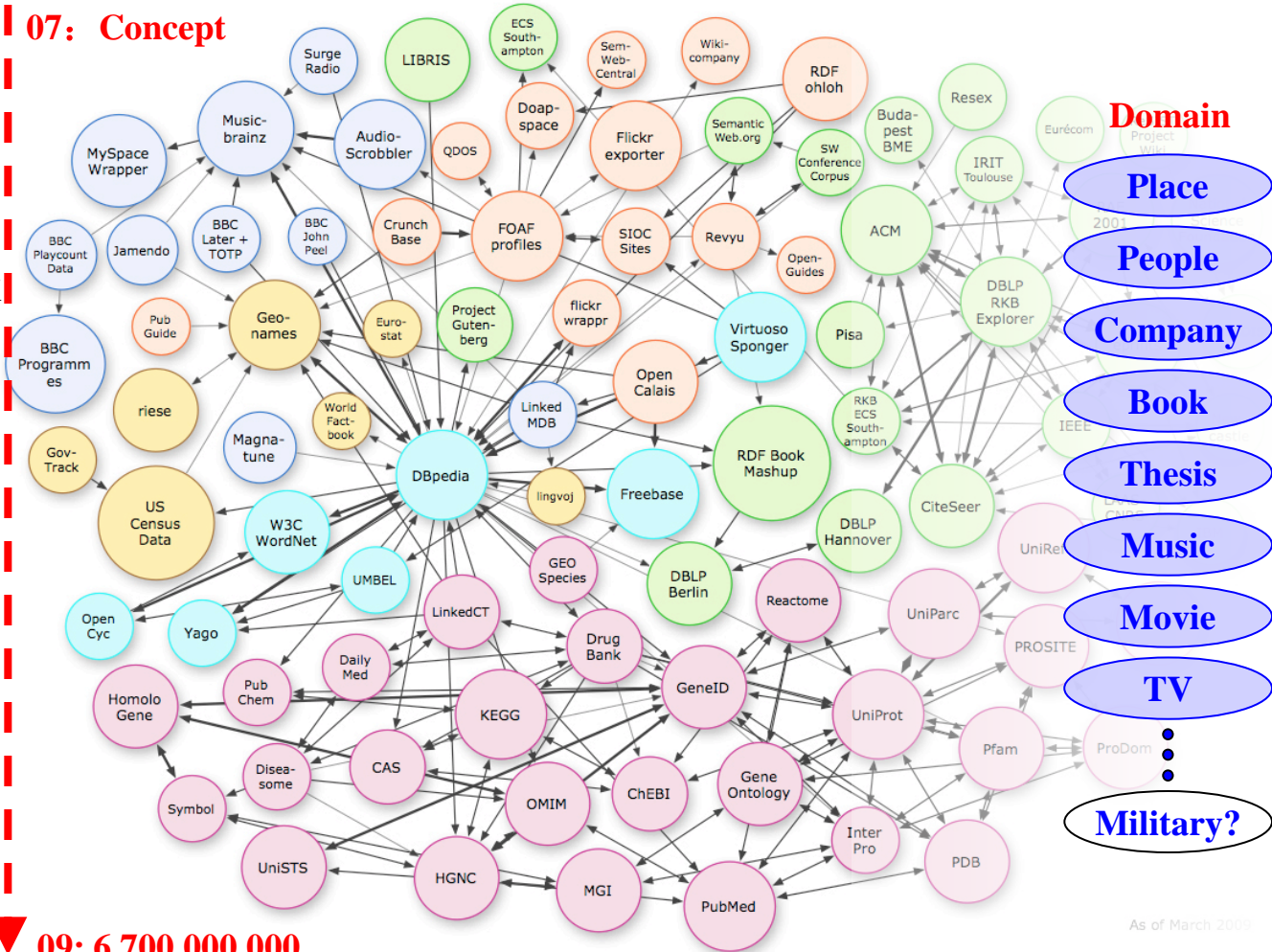


# Method: Unified correlation description

## Linked Data

- Use URIs as names for things;
- Use HTTP URIs so that people can look up those names;
- When someone looks up a URI, provide useful information, using the standards (RDF, SPARQL);
- Include links to other URIs, so that they can discover more things.

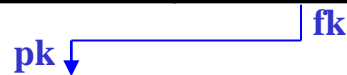
07: Concept



09: 6,700,000,000

# Method: Automatic link construction

	Name	Product
1	KGE	QSZ92
2	KGE	QSS05



	Type	Range
1	QSZ92	500m
2	QSS05	300m

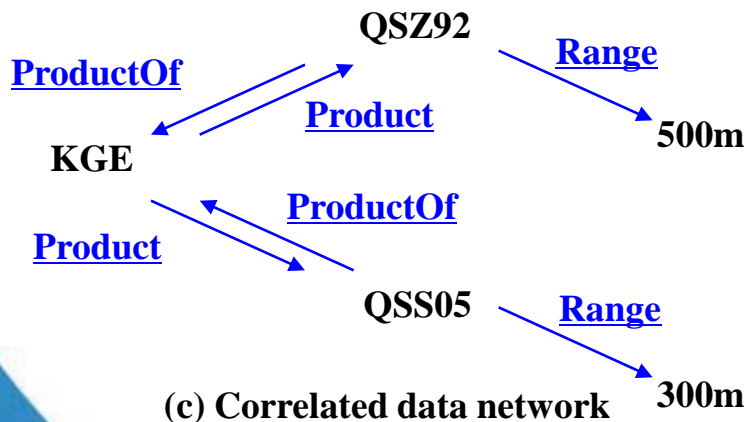
(a) Data in relational database

Company Info	
Name	VARCHAR(200) <pk>
Product	VARCHAR(200) <fk>
...	

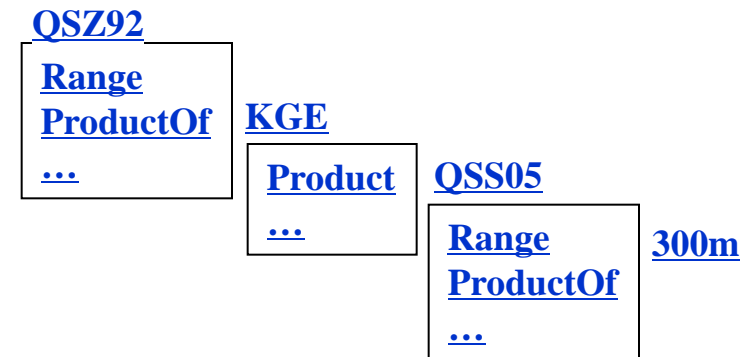


Weapon Info	
Type	VARCHAR(200) <pk>
Range	DOUBLE
...	

(b) Table structure



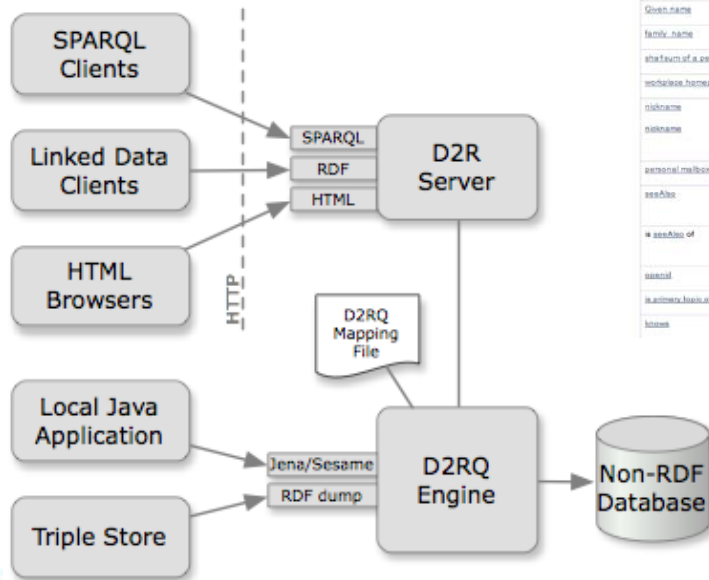
(c) Correlated data network



(d) Hyperlinks on user interfaces

# Method: Automatic link construction

- D2R tool



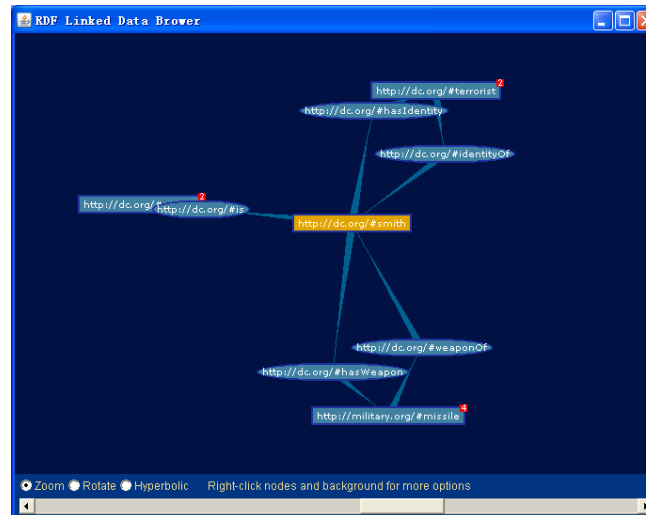
The screenshot shows a web browser displaying a page for Tim Berners-Lee. The page is titled 'Tim Berners-Lee' and contains various properties and values. Red arrows point to specific elements on the page:

- An arrow points to the title 'Tim Berners-Lee' with the text 'One data'.
- An arrow points to the 'label' property with the text 'Links'.
- An arrow points to the 'name' property with the text 'Linked objects'.

The page content includes properties such as 'label', 'sameAs', 'image', 'WebSite', 'name', 'Given name', 'family name', 'shortform of a personal mailbox URI name', 'wikipedia\_homepage', 'nickname', 'personal mailbox', 'website', 'subclass of', 'social', and 'known by'. Each property has a list of values, often with small colored icons representing different data types or links.

# Implementation

- Correlations generated from relational database





# Implementation

- Description script of data correlations

```
<rdf:RDF
  xmlns:dc="http://dc.org/#"
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:military="http://military.org/#" >
<rdf:Description rdf:about="http://dc.org/#tom">
  <dc:hasWeapon rdf:resource="http://military.org/#gun"/>
  <dc:hasIdentity rdf:resource="http://dc.org/#police"/>
  <dc:is rdf:resource="http://dc.org/#people"/>
</rdf:Description>
<rdf:Description rdf:about="http://dc.org/#terrorist">
  <dc:identityOf rdf:resource="http://dc.org/#smith"/>
</rdf:Description>
<rdf:Description rdf:about="http://dc.org/#USA">
  <dc:producerOf rdf:resource="http://military.org/#gun"/>
</rdf:Description>
<rdf:Description rdf:about="http://military.org/#missile">
  <dc:hasproducer rdf:resource="http://dc.org/#iraq"/>
  <dc:weaponOf rdf:resource="http://dc.org/#smith"/>
```

```
<dc:hasType rdf:resource="http://military.org/#heavyWeapon"/>
  <dc:is rdf:resource="http://military.org/#weapon"/>
</rdf:Description>
<rdf:Description rdf:about="http://dc.org/#police">
  <dc:identityOf rdf:resource="http://dc.org/#tom"/>
</rdf:Description>
<rdf:Description rdf:about="http://military.org/#musket">
  <dc:hasproducer rdf:resource="http://dc.org/#iraq"/>
  <dc:weaponOf rdf:resource="http://dc.org/#stephon"/>
  <dc:hasType df:resource="http://military.org/#lightWeapon"/>
  <dc:is rdf:resource="http://military.org/#weapon"/>
</rdf:Description>
<rdf:Description rdf:about="http://dc.org/#iraq">
  <dc:producerOf rdf:resource="http://military.org/#musket"/>
  <dc:producerOf rdf:resource="http://military.org/#missile"/>
</rdf:Description>
...
</rdf:RDF>
```

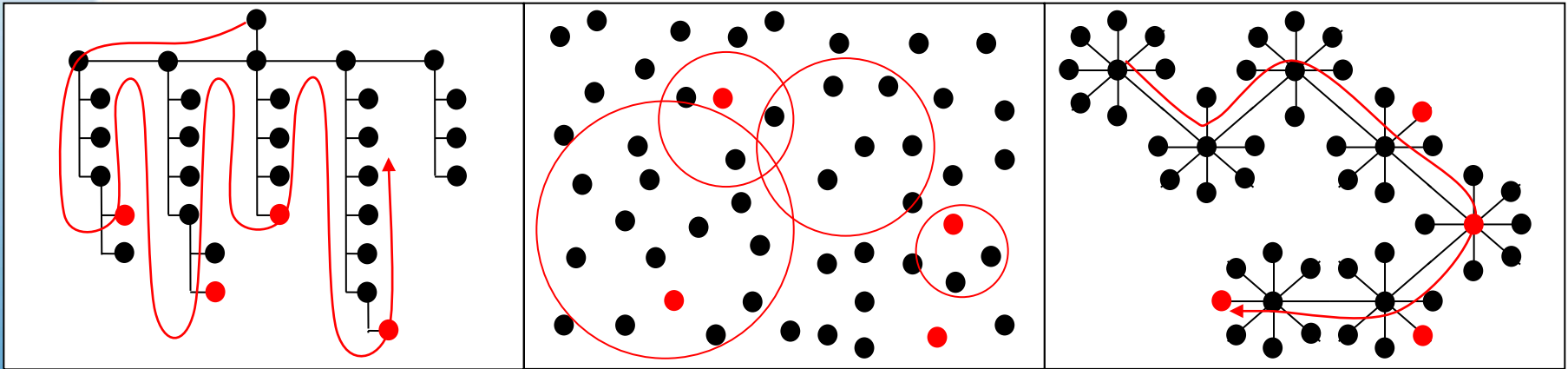
# Methods comparison

- User's view on operation mode

(a) Classification-based

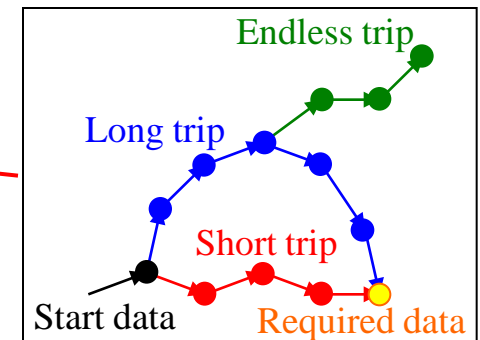
(b) Keyword-based

(c) Correlation-based



- Method performance

	<i>Problem Relativity</i>	<i>Operation Efficiency</i>	<b>Navigation Convergence</b>	<i>User Skill Requirement</i>
Classification-based	Low	Dependent	Assured	High
Keyword-based	Medium	Dependent	Not assured	High
Correlation-based	High	Dependent	Not assured	Low





# Summary

- Correlation-based method is a good complement to traditional methods, not a substitute.
- A method is suited to human association habit.
- With more data networked through correlations, and statistical-analytic tools to support network mining, existing data will be more interesting.

# Discussion

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- Is it possible to link all military data by correlations?
- How to link data in different formats, text, media...?
- How to make better use of data correlations?