Taking Information Into Accounts

The Data Projection Model

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IT Consultant, dba Infoloom. Innovator, based in New York.

Created the Topic Maps paradigm. Initiator of the ISO standard.

Major current project: TaxMap, an electronic delivery tool for IRS publications and forms.

Starts getting involved in Drupal applications.
Outline

The Data Projection Model
  – Accounting and Information Management
DPM, XML and the Semantic Web
Application Examples
Why was the DPM created?

TaxMap is a topic map–based application, published every other week, containing IRS publications, forms, and FAQs, accessible by topics.

Topics are extracted from XML document structure.

Relations between topics are created using rules and by applying a semantic layer authored by tax experts.

Rendition hides the creation process. Hence the question (among others): why are topics $a$ and $b$ related?
Initial Goal

Audit our own application by recording processes as well as semantic relations.

Based on the realization that any relation can be expressed as a set of elementary binary relations.

The Data Projection Model is about decomposing, and recomposing for viewing purposes.

It is a “semantic microscope”.

What is the DPM about?

- Tracking background of any information item for:
  - Research purposes: where does a piece of information come from?
  - Search engines: Why a given item is on top of the hits?
  - Identity Theft Investigation: where is the leakage?
  - Privacy: Who knows what?
  - Managing targeted funding: How is this grant being spent?
  - Integrating heterogeneous sources.
  - Expressing multiple perspectives
  - Upgrading information systems
  - Etc.
Information and Accounting

DPM similar to Double Entry Bookkeeping.
Information items are connected by links.
Money flows between accounts.

Microscope:
Any relation can be expressed as a set of binary relations.
Accounting amounts to describe transactions between accounts.

Every information item can be seen as an account.
“Account Statement”: all links to and from it.
Views

Information networks, once decomposed as binary transactions, are extremely verbose and detailed. (Too much information)

Filtering what’s useful for a given usage is a matter of perspective.

Multiple perspectives can co–exist over the same information base.
Flattening the world

- Perspectives are defined according to projections.
- Perspectives express ways 3-dimensional space is rendered into 2-dimensional, i.e. projections.
Real World Information:

- Is multidimensional.
- Can be flattened to be processed.
- **Binary relations** correspond to **2D space**
- Translating a world of n-ary relations into a world of binary relations is a kind of **projection**.
- **Perspective** is what accompanies projection from n-ary relations to binary relations.
Entity–Relationship Model

Can always be decomposed into binary relations.

Relation with Accounting

DPM:
- No piece of information exists without at least one other piece of information connected.
- Meaning comes from connections.

Accounting:
- Double Entry Bookkeeping: based on transactions between accounts.
Bookkeeping

Single Entry
- List of expenses per category
- List of income sources per category.
- Some money may be unaccounted for (although not desirable).

Double Entry
- Organized by accounts.
- Each transaction is an increase in one account matched with a decrease in another account. (Accounts are balanced.)
- No money amount unaccounted for.
Double Entry Bookkeeping

![Double Entry Bookkeeping Diagram]

Present: $13,950.00  Future: $13,950.00  Cleared: $0.00  Reconciled: $0.00  Projected Minimum: $13,950.00

Tuesday 13 October 2009
Double Entry Bookkeeping & DPM

<table>
<thead>
<tr>
<th>Date</th>
<th>Num</th>
<th>Description</th>
<th>Transfer</th>
<th>R</th>
<th>Expense</th>
<th>Rebate</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/13/2009</td>
<td></td>
<td>Plane ticket to San Francisco</td>
<td>:Current Assets:Checking Account</td>
<td>n</td>
<td>450.00</td>
<td></td>
<td>450.00</td>
</tr>
<tr>
<td>10/13/2009</td>
<td></td>
<td></td>
<td></td>
<td>n</td>
<td>Expense</td>
<td>Rebate</td>
<td></td>
</tr>
</tbody>
</table>

Plane Ticket to SFO

PTSFO 091013 $450.00

Checking Account

Air

Travel

Expenses

2009-10-13
**Double Entry Bookkeeping & DPM**

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
<th>Transfer</th>
<th>R</th>
<th>Expense</th>
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<td>n</td>
<td>450.00</td>
<td></td>
<td>450.00</td>
</tr>
</tbody>
</table>

**Plane Ticket to SFO**

- **Description**: Plane ticket to San Francisco
- **Date**: 10/13/2009
- **Transfer**: :Current Assets:Checking Account
- **Expense**: $450.00
- **Subaccount**: Checking Account

**Arrow Diagram**

- **2009-10-13**
- **Plane Ticket to SFO**
- **Checking Account**
- **Air**
- **Travel**
- **Expenses**
### DPM Notation

<table>
<thead>
<tr>
<th>Description</th>
<th>Date</th>
<th>Subaccount of</th>
<th>2009-10-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plane ticket to SFO</td>
<td>2009-10-13</td>
<td>Checking Account</td>
<td></td>
</tr>
<tr>
<td>Checking Account</td>
<td></td>
<td>Travel</td>
<td></td>
</tr>
<tr>
<td>Travel</td>
<td></td>
<td>Expenses</td>
<td></td>
</tr>
<tr>
<td>Air</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subaccount of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$450.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-$450.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>Date</td>
<td>Subaccount of</td>
<td>2009-10-13</td>
</tr>
<tr>
<td>Description</td>
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<td>Description</td>
<td>Date</td>
<td>Subaccount of</td>
<td>2009-10-13</td>
</tr>
</tbody>
</table>

**Plane Ticket to SFO**

- Description: Plane ticket to SFO
- Date: 2009-10-13
- Subaccount: Checking Account
- Subaccount of: Travel
- Expenses

**Description**

- Date: 2009-10-13
- Amount: $450.00
- Subaccount: Checking Account

**Air**

- Subaccount of: Travel

**Travel**

- Subaccount of: Expenses
A “perspector” is notated:

\[ < x \mid o \mid y > \]

\( x \) and \( y \) are operands (order matters).
\( o \) is an operator.

A perspector can represent a semantic relation, for example:

\[ < \text{New York} \mid \text{is a} \mid \text{city} > \]

(This is an instance/class relationship)

or \( < \text{city} \mid \text{added to the system by} \mid \text{MB} > \)

(This is usually considered metadata).
DPM and XML: Angle brackets

< Washington | is a | city >

can be written:

<perspector id="p1">
<x>Washington</x><o>is a</o><y>city</y>
</perspector>

This is XML.
DPM & XML: Conceptual

Binary Relations:
Decompose into pieces / Recompose into views

SGML & XML
Separate presentation from content. Apply styles afterwards.
From Multiple to Multiple Via One

**SGML / XML**
- One source,
- Multiple outputs

*(Ex Uno Plures)*

**DPM**
- Diverse inputs,
- One common representation,
- Multiple outputs

*(E Pluribus Plures Via Unum)*
DPM and RDF

- RDF is based on triples that express statements: subject – object – predicate
- RDF connects URIs
- RDF statements are not automatically reified.

- DPM is based on triples that express operations: x operand – operator – y operand
- DPM is not limited to URIs
- DPM perspectors are automatically reified.
DPM and Topic Maps

- Topic Maps is a Navigation system using topics as nodes for representing subjects.
  - Names, Types, Occurrences are topics connected through specific relationships.

- DPM is a Navigation system based on nodes
  - All nodes are related with other nodes.
  - Topic Maps can be considered an application of DPM.
Example: Name versus Subject

A Name does not identify a Subject:
- Variant names may be used to designate the same subject.
  - Synonyms
  - Typographical variations
- One name may identify several subjects.
Names

- Wash D.C.
- Washington, DC
- General Washington
- Denzel Washington
- George Washington
- Washington State
- Wa
## Names

| Washington | is an alternate name for | Wash. D.C. > |
| Washington | is an alternate name for | Washington, DC > |
| Washington | is an alternate name for | General Washington > |
| Washington | is an alternate name for | George Washington > |
| Washington | is an alternate name for | Wa > |
| Washington | is an alternate name for | Washington State > |
| Washington | is an alternate name for | Denzel Washington > |
Emerging Subjects

- Wash D.C.
- Washington, DC
- General Washington
- George Washington
- Washington
- Wa
- Washington State
- Denzel Washington
- Washington State
Strings Become Subjects

- Wash D.C.
- Washington, DC
- General Washington
- Washington
- George Washington
- Wa
- Washington State
- Denzel Washington
- Washington State
Generalization

- Wash D.C.
- Washington, DC
- General Washington
- George Washington
- Washington State
- Denzel Washington
Names and Subjects

< Washington | is a name for | _city_of_Washington >
< Washington DC | is a name for | _city_of_Washington >
< Wash. D.C. | is a name for | _city_of_Washington >
< Washington | is a name for | _General_G_Washington >
< General Washington | is a name for | _General_G_Washington >
< George Washington | is a name for | _General_G_Washington >
< Washington | is a name for | _Washington_State >
< Wa | is a name for | _Washington_State >
< Washington State | is a name for | _Washington_State >
< Washington | is a name for | _Denzel_Washington >
< Denzel Washington | is a name for | _Denzel_Washington >
Strings as Subjects

< Washington | is in character set | UTF-8 >
< Washington | is a name for | _city_of_Washington >
< Washington | is a name in the language | English >
Integration

- Washington
- George Washington
- Denzel Washington
- Wash D.C.
- Washington, DC
- Washington State
- also known as General Washington
- represents George Washington
- is usually called
- designates is the last name of
- indicates is a code name for
- stands for
- abbreviates
- is a name for
- integrates
Diversity

< _city_of_Washington
< Washington DC
< Wash. D.C.
< Washington
< _General_G_Washington
< George Washington
< Washington
< Wa
< Washington State
< Washington
< Denzel Washington

is usually called
indicates
abbreviates
is a name for
also_known_as
represents
stands for
is a code name for
is a name for
is last name of
designates

Washington >
< _city_of_Washington >
< _city_of_Washington >
< _General_G_Washington
< General Washington >
< General G Washington >
< Washington State >
< Washington State >
< Washington State >
< Denzel Washington >
< Denzel Washington >
Perspective on Naming

< _city_of_Washington >
< Washington DC
< Wash. D.C.
< Washington
< _General_G_Washington
< _George_Washington
< Washington
< Wa
< Washington State
< Washington
< _Denzel_Washington

is named

is a name for

city_of_Washington

General_G_Washington

George_Washington

Washington

Wa

Washington State

Denzel_Washington

Washington

Washington State

Denzel_Washington

Washington

Washington State

Denzel_Washington

Washington

Washington State

Denzel_Washington

Washington

Washington State

Denzel_Washington

Washington

Washington State

Denzel_Washington
Multidimensional Information

<New York> is a name for <New York_City>
<New York> is a name for <New York_State>
<New York> is a name for <New York_County>
<New York> is a name for <Manhattan>
<New York> is a name for <Wall_Street>
<Nueva York> is a name for <New York_City>

<New York> is an old name for <Manhattan>
<Nueva York> is a name for <New York_City>

<New York> is a name in the language <English>
<Nueva York> is a name in the language <Spanish>
<New York> is a name in the language <French>

<English> is a name for <English>
<Anglais> is a name for <English>
<Anglais> is a name in the language <French>
<Inglés> is a name for <English>
<Inglés> is a name in the language <Spanish>

etc., etc., etc., etc., etc., etc., etc., etc., etc., etc., etc., etc.
Operations on Names

TaxMap is built by a combination of automatic and manual processes. Names are added, modified, sometimes deleted, or regarded as synonyms.

It's hard to know where a topic name comes from.
TaxMap audited
U.S. Citizens and Resident Aliens Abroad
American citizens abroad
Living Abroad

Related Topic Links
- Alien, Resident
- Bona Fide Residence Test
- Employment Abroad
- Foreign Corporation
- Foreign Income
- Income Earned Abroad
- International Issues
- Physical Presence Test
- U.S. Citizen
- U.S. Citizen and Resident
  and Nonresident Aliens
- VISA Status

Forms and Instructions

Form 2350 Application for Extension of Time to File U.S. Income Tax Return

Form 2555 Foreign Earned Income

2555 Instructions

Publications

Related Publications

Publication 54 Tax Guide for U.S. Citizens and Resident Aliens Abroad

Publication 516 U.S. Government Civilian Employees Stationed Abroad

Publication 593 Tax Highlights for U.S. Citizens and Residents Going Abroad

Links Inside Publications

Publication 17 - Your Federal Income Tax - Filing Information
  U.S. Citizens and Residents Living Outside the United States
### Living Abroad

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>U.S. Citizens and Resident Aliens Abroad</td>
</tr>
<tr>
<td>2</td>
<td>Individuals Abroad</td>
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<tr>
<td>3</td>
<td>U.S. Citizen Abroad</td>
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<td>4</td>
<td>U.S. citizens abroad</td>
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<td>5</td>
<td>U.S. Citizens and Residents Living Outside the United States</td>
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<tr>
<td>6</td>
<td>U.S. Citizens or Residents Living Abroad</td>
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<td>7</td>
<td>Employment Abroad</td>
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<td>8</td>
<td>Income Earned Abroad</td>
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<td>9</td>
<td>P516</td>
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<td>P54</td>
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<td>11</td>
<td>P593</td>
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<td>12</td>
<td>Retirees who were working abroad.</td>
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<td>Survivors of decedents who were working abroad.</td>
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<tr>
<td>17</td>
<td>topic type PFT Key Topic</td>
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</table>

Where does “Living Abroad” come from?
Containment Rule Results

862 < Roth IRAs and traditional IRAs.  |  IRAs
863 < Roth IRAs and traditional IRAs.  |  Traditional IRAs
864 < Discount on Debt Instruments  |  IRAs
865 < Hope and Lifetime Learning Credits  |  Traditional IRAs
866 < Health Spa Expenses  |  Debt
867 < Health Spa Expenses  |  Credits
868 < Exceptions to reporting OID  |  Health
869 < Exceptions to reporting OID  |  Expenses
870 < SSN on correspondence.  |  Exceptions
871 < Capital Expense  |  OID
872 < Home Mortgage  |  SSN
873 < Home Mortgage  |  Capital
874 < Maximum Exclusion  |  Home
875 < Income from property giver  |  Mortgage
876 < Income from property giver  |  Exclusion
877 < Income from property giver  |  Income
878 < Medicare Advantage MSAs  |  Property
879 < Farm Income, cash method  |  Child
880 < Farm Income, cash method  |  Medicare
881 < Farm Income, cash method  |  Farm
882 < Farm Income, cash method  |  Farm Income
Synonyms created by Tax Experts

139 < Gambling | Wagering
140 < Gift, Property | Property Received as a Gift
141 < Gift, Shares | Shares Acquired by Gift
142 < Gifts to Charity | Charitable Contributions
143 < HCTC | Health Coverage Tax Credit
144 < Help from IRS | Taxpayer Assistance
145 < Hiring Employees | Hiring New Employees
146 < Hobby Expenses | Activity not for profit
147 < Home Mortgage Interest | Itemized Deduction, Home Mortgage Interest
148 < Home Mortgage Interest | Mortgage Interest, Home
149 < Home Office | Business Use of Home
150 < Home Vacation | Vacation Home
151 < Hope Credit | Credit, Hope
152 < Household Employment | Employment, Household
153 < IC-DISC | Interest Charge Domestic International Sales Corporation
154 < IRA | Individual Retirement Account
155 < IRA | Individual Retirement Arrangement
156 < ITIN | Taxpayer Identification Number
157 < Important Reminder | Reminders, Important
158 < Important Reminder | Reminders, Important
159 < Important Reminder | Reminders, Important
More Information

Demos, other presentations available at:
http://www.infoloom.com

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