

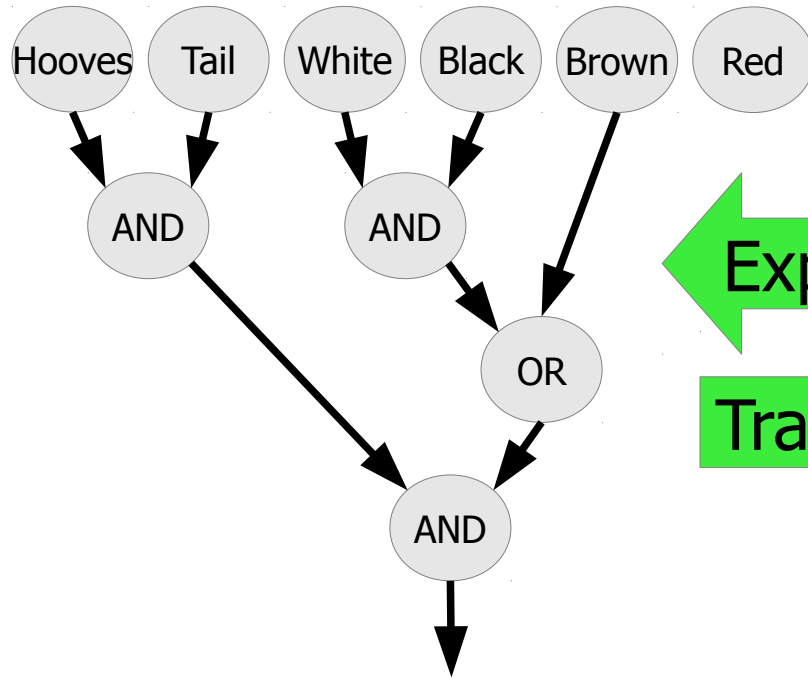
Foundation Ontology and Semantic Language for Distributed Agents

Anton Kolonin
akolonin@aigents.com



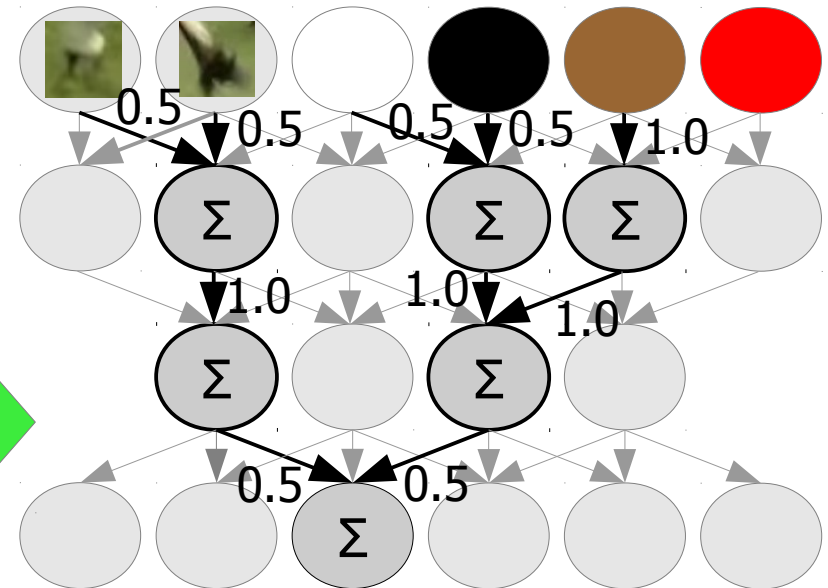
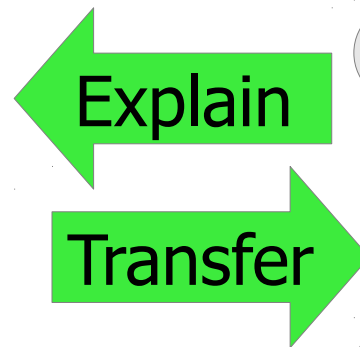
SingularityNET
<https://singularitynet.io>

Bridging the Symbolic-Subsymbolic gap for “explainable AI” and “transfer learning”

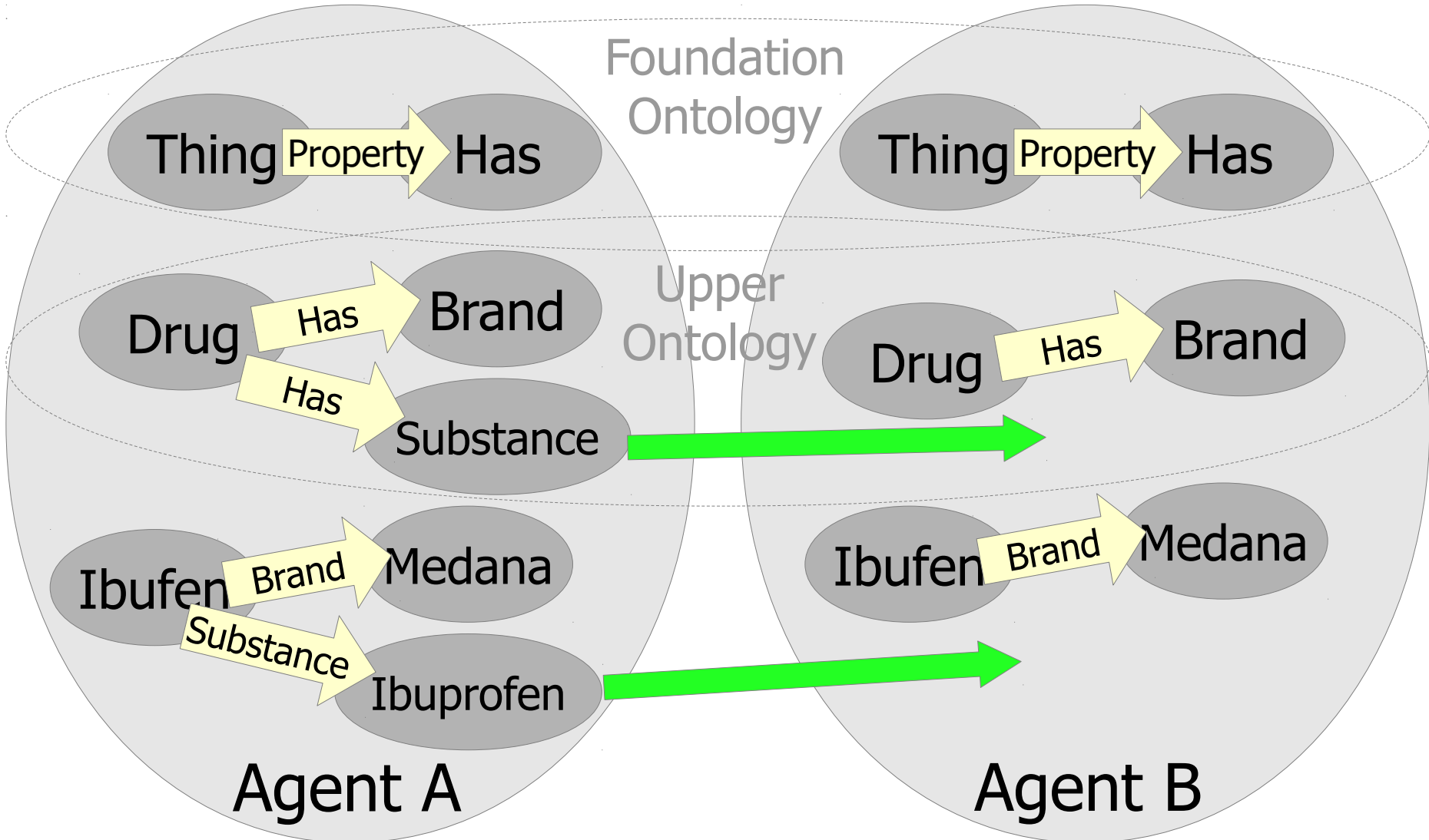


(Hooves AND Tail) AND
((White and Black) OR Brown)

=> Horse

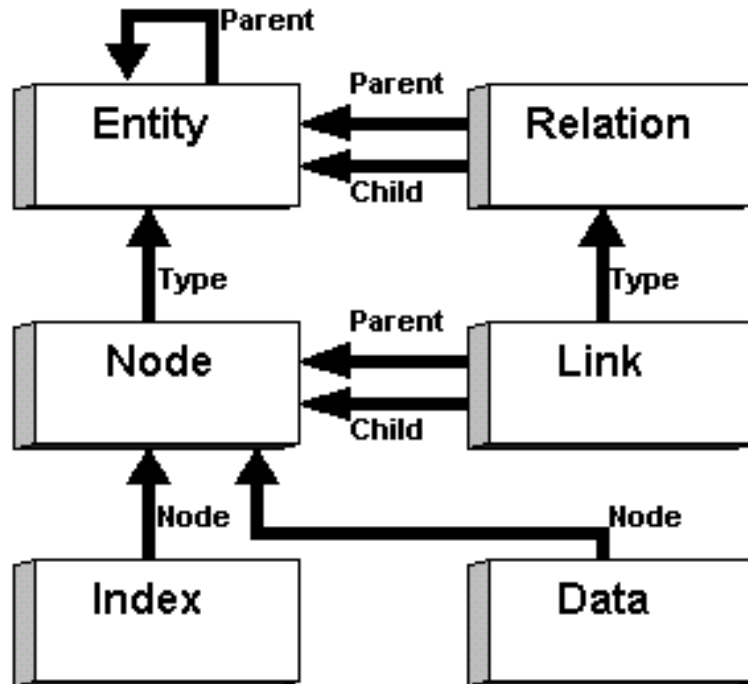


Foundation Ontologies for Distributed (Multi-Agent) Systems

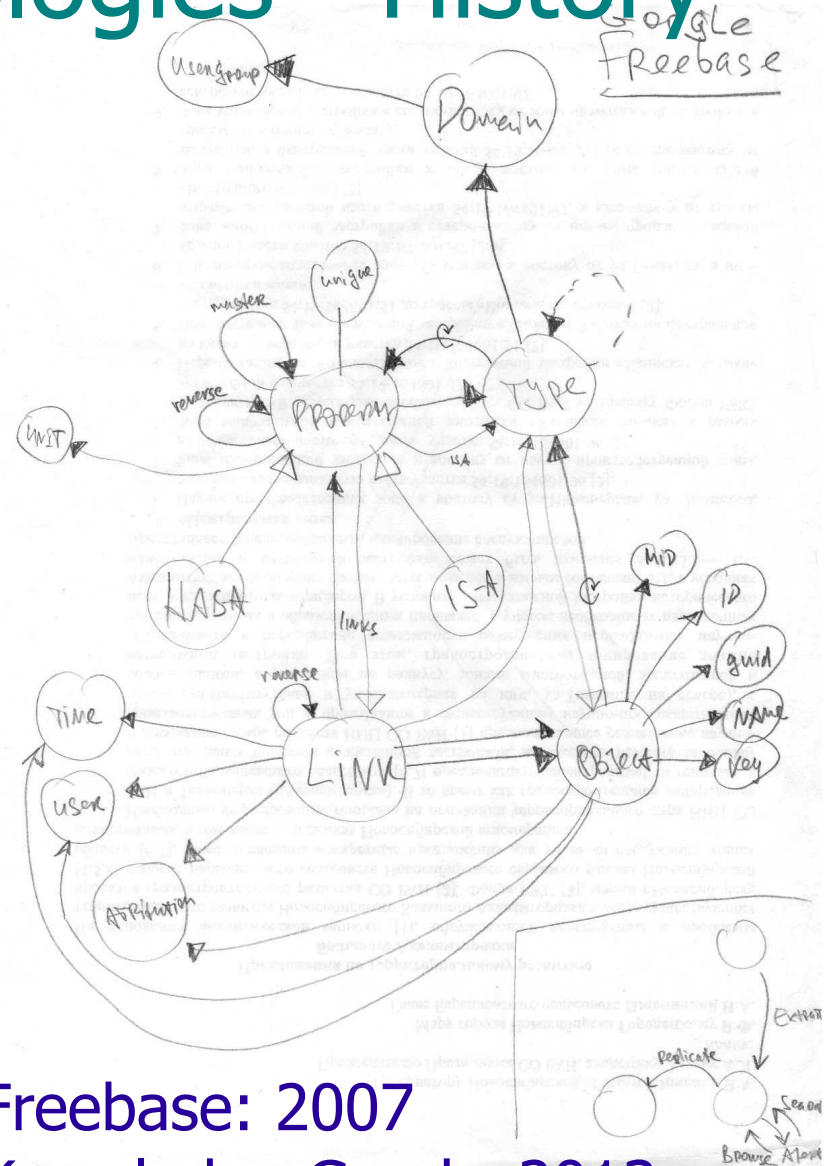


Foundation Ontologies - History

Database scheme view



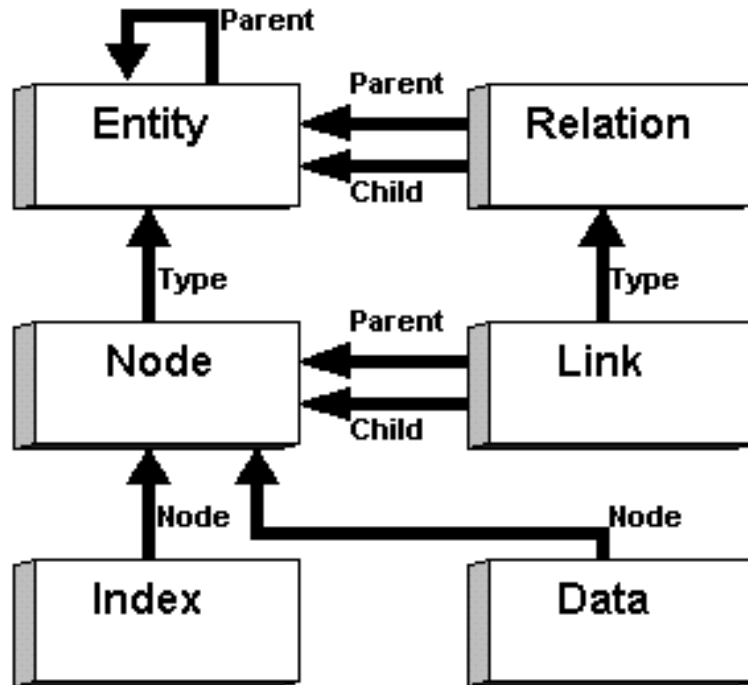
Data4: 1995



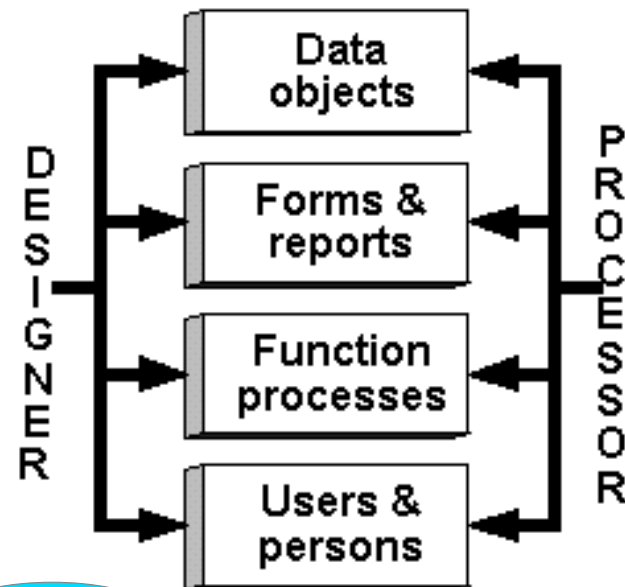
Freebase: 2007
Knowledge Graph: 2013

Foundation Ontologies - Applications

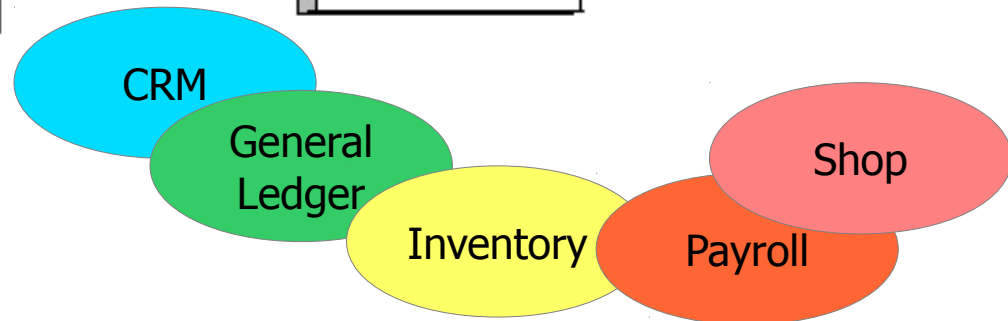
Database scheme view



User interface view



Data4: 1995

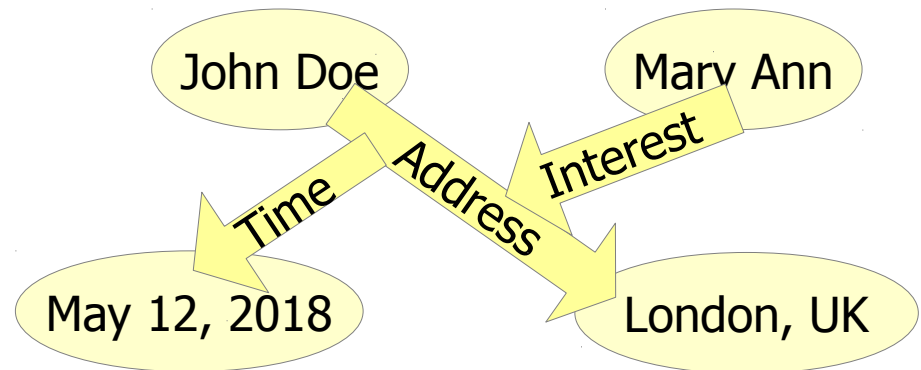
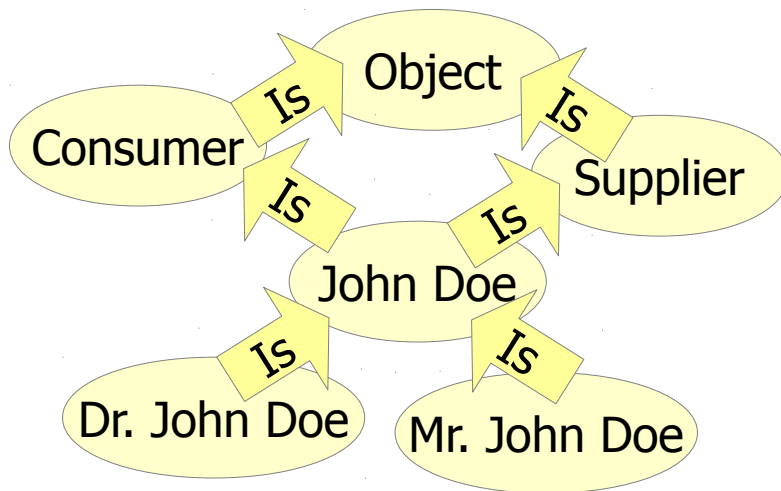


Lessons Learned:

1. Class is an Object

2. Object may be a Class

3. Link can be a Node



Semantic Modeling of Business Processes

UFO/URL: 1997-1999

The screenshot displays the ProPro software interface, which is used for semantic modeling of business processes. The interface is divided into several panes:

- Иерархия классов (Class Hierarchy):** A tree view on the left showing the structure of the system. It includes entities like **Сущность (ENTITY)**, **Объект (OBJECT)**, **Данные предметной области (DATA)**, **Account (ACCOUNT)**, **Addresses (ADDRESS)**, **Departments (DEPARTMENT)**, **Document (DOCUMENT)**, **Persons (PERSON)**, **Record (RECORD)**, **Атрибут представления (SOURCE_A)**, **Класс значений 1:M (DOMAIN_CLASS)**, **Класс представления (SOURCE_CLA)**, **Класс элементов M:1 (ELEMENT_CLA)**, **Класс, выбирающий значения (CLAS)**, **Сводное представление (SUMMARY)**, and **Справочная информация (DICTIONAR)**.
- Атрибуты (Attributes):** A table in the center showing attributes for the selected class. It includes columns for **Имя (Name)**, **Текст (Text)**, **Док (Doc)**, **Ключ (Key)**, **№ п/п (No)**, **Об (Obj)**, **Па (Pa)**, **Тип (Type)**, and **Область значений (Value Area)**. The attributes listed are **NUMBER** (Account code), **ACC_TYPE** (Account type), **DEBIT** (Debit), **CREDIT** (Credit), **SALDO** (Balance), and **COLOR** (Color).
- Объекты (Objects):** A table on the right showing data for the selected class. It includes columns for **Account code**, **Account**, **Debit**, **Credit**, **Balance**, and **Color**. The objects listed are **00**, **01**, **02**, **03**, **04**, **05**, **10**, **12**, **41**, **50**, and **51**.
- Методы (Methods):** A table at the bottom right showing methods for the selected class. It includes columns for **Имя (Name)**, **Текст (Text)**, **Тип (Type)**, **Обращение (Call)**, and **Таблица (Table)**. The methods listed are **GET_ACCOUNT_COLOR** (Paint account), **CONVERT_SALDO** (Make balance), and **UPDATE_DEBIT** (Update account balance).

The interface also includes a **Дерево классов (Class Tree)** pane on the left, a **Методы (Methods)** pane at the bottom right, and a **Объекты (Objects)** pane at the bottom right. The **Объекты (Objects)** pane shows a detailed view of the **Paint account (GET_ACCOUNT_COLOR)** method, including its logic and parameters.

Project: ProPro Group obtains the order from RTS Stock Exchange to develop Back-Office automation system.

Requirements: Tremendous amount of initial business rules and forms. Possibility to amend and extend the business rules and forms during the system life cycle.

Problem: The RTS analysts are not capable to supply the representative scope of initial business rules and forms timely enough so development can start fitting the given time frame

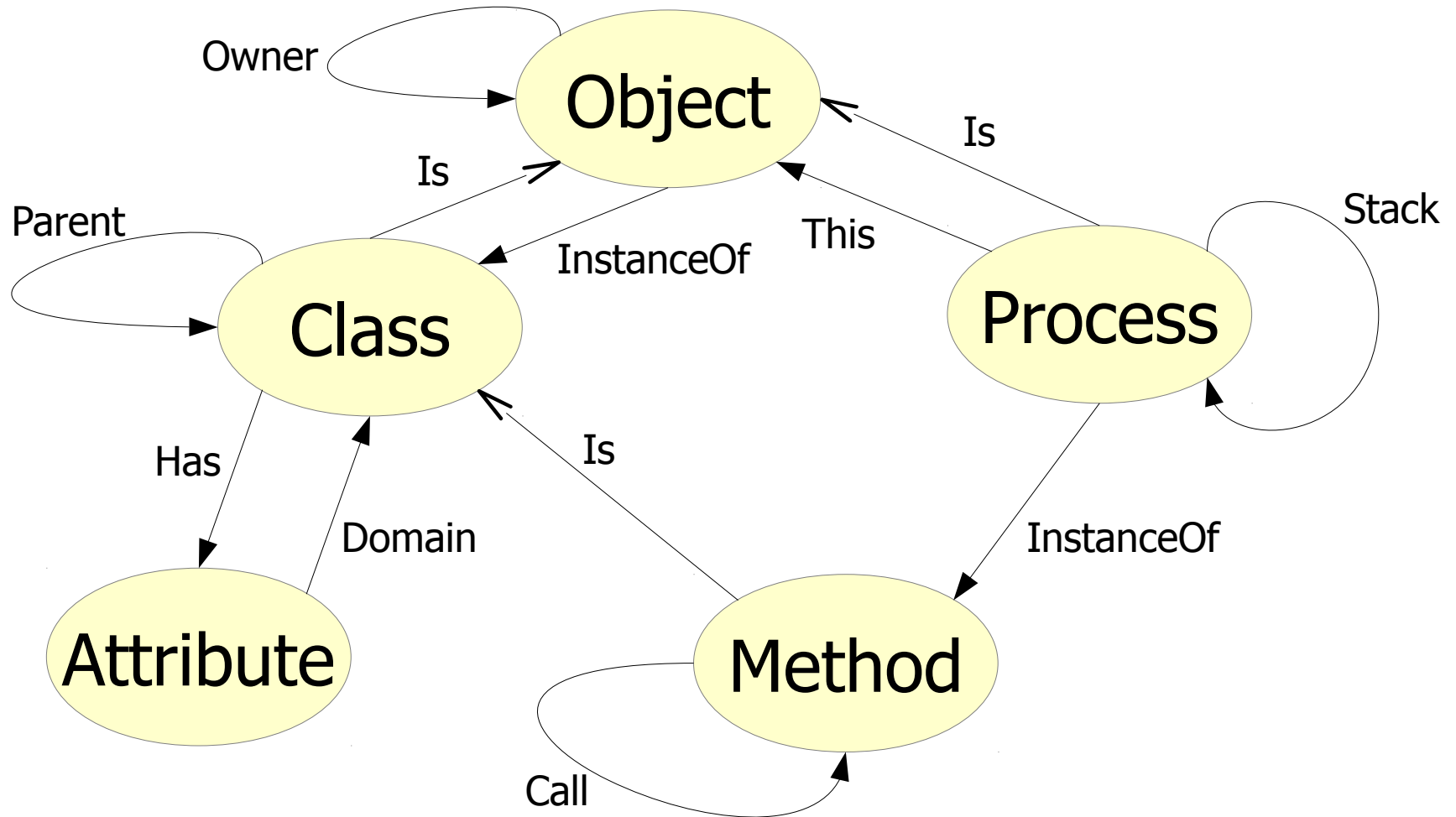
Decision: ProPro gives RTS analysts a language to encode the business rules and forms so the rules and forms can be quickly uploaded into the system when done. ProPro develops a system which can upload business rules and forms, play them in the course of system operation and provide an UI for the amendment and extension of rules and forms on the fly.

Solution: Object-Relational Language (**ORL**) effectively usable by analysts and software system at the same time. Universal Financial Object (**UFO**) three-tier (client, middleware and server) system using ORL for bootstrapping as well as intra-tier communications (instead of DCOM).

Semantic Modeling of Business Processes

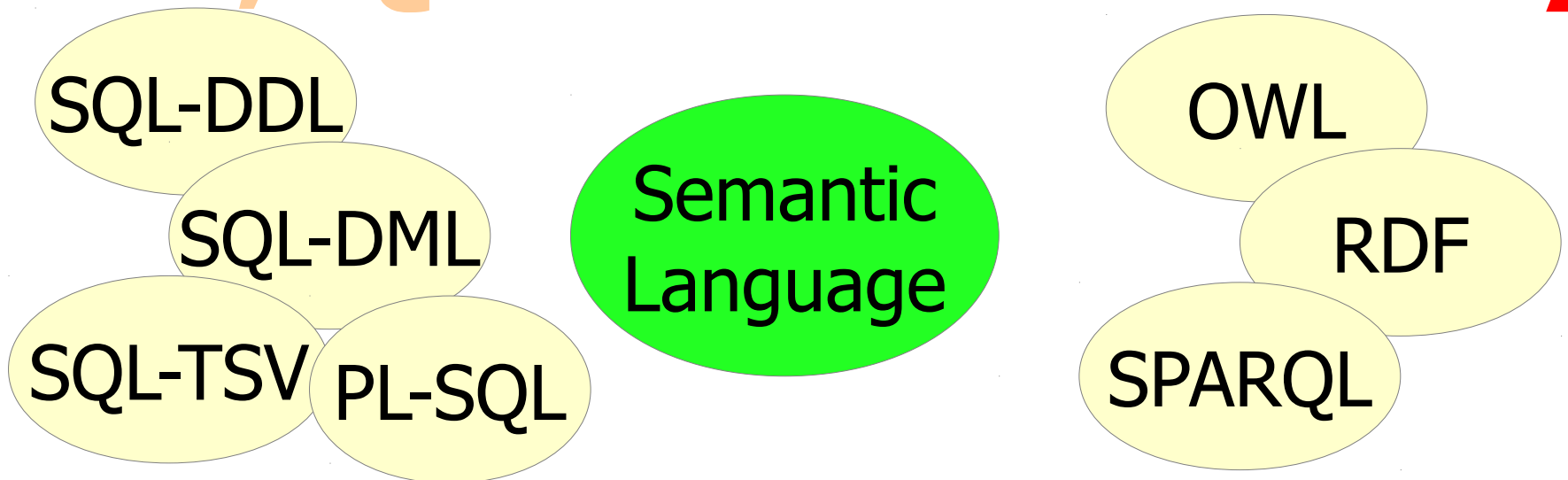
UFO/URL: 1997-1999

Foundation Ontology



Lesson Learned:

Can have **only one**,
language for **DDL, DML,**
PL, QL instead of **many**.



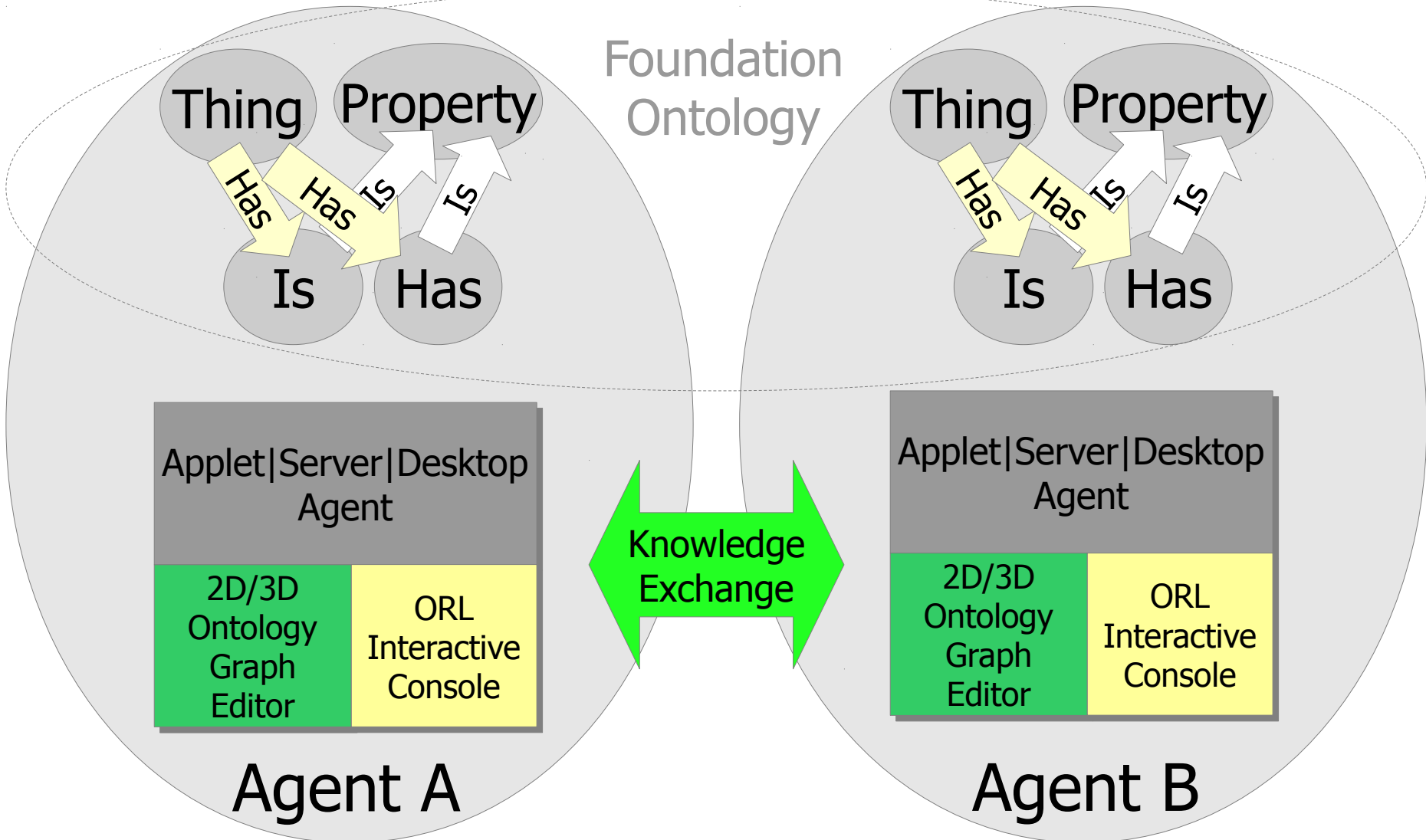
Semantic Modeling of Business Processes

Object Relational Language (ORL)

English	ORL
Here are the items A, B and C where A has properties X and Y while B and C are in relationship Z.	ITEM A,B,C;; A HAS (X), (Y);; B Z(C);;
In order to reach goal 1 one needs condition 2 and 3 to be held true while 2 can be true only if condition 4 happens.	CONDITION C2,C3,C4;; GOAL G1 REQUIRES (C2),(C3);; CONDITION(C2) REQUIRES (C4);;
Each morning need to perform this and that in order, having such and such done at once next.	PROCESS TIME "8:00"; REPEAT (DAILY); ORDER DO THIS, DO THAT;; FORK DO SUCH, DO SUCH;;;
What is that my stuff you mentioned yesterday or the day before?	STUFF(OWNER (ME), UPDATE (AUTHOR (YOU), {TIME "2013-03-22", TIME "2013-03-21"}).TELL;
What were the relationships between P and Q last year?	PROPERTY(OWNER (P), THING (Q), TIME "2012").TELL;
Let me know once they roll out next version of the product.	DO EMAIL TO "me@at.org";; WHEN PRODUCT(VENDOR (THEY)).VERSION CHANGE;;

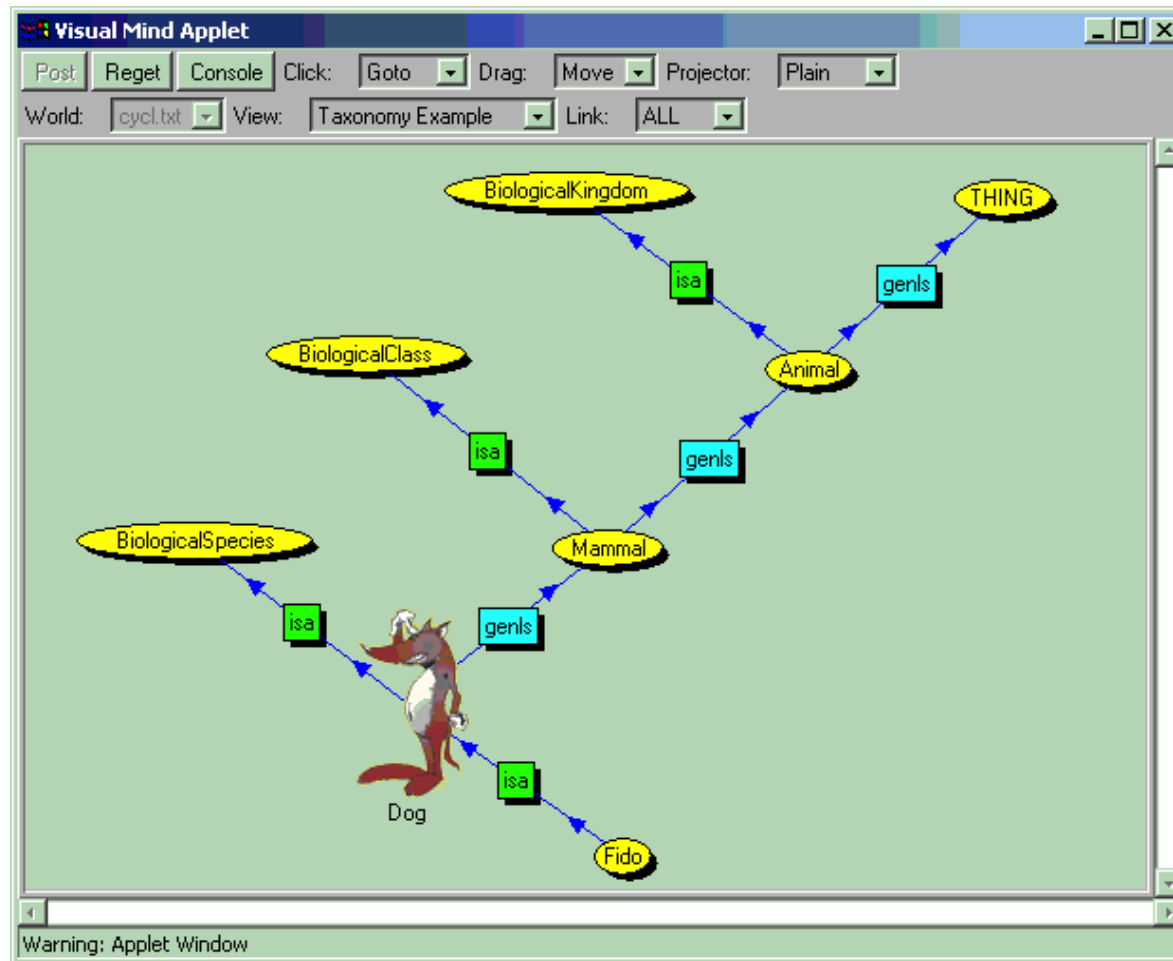
Distributed Knowledge Editor

Webstructor: 2001-2006



Webstructor: Distributed Knowledge Editor

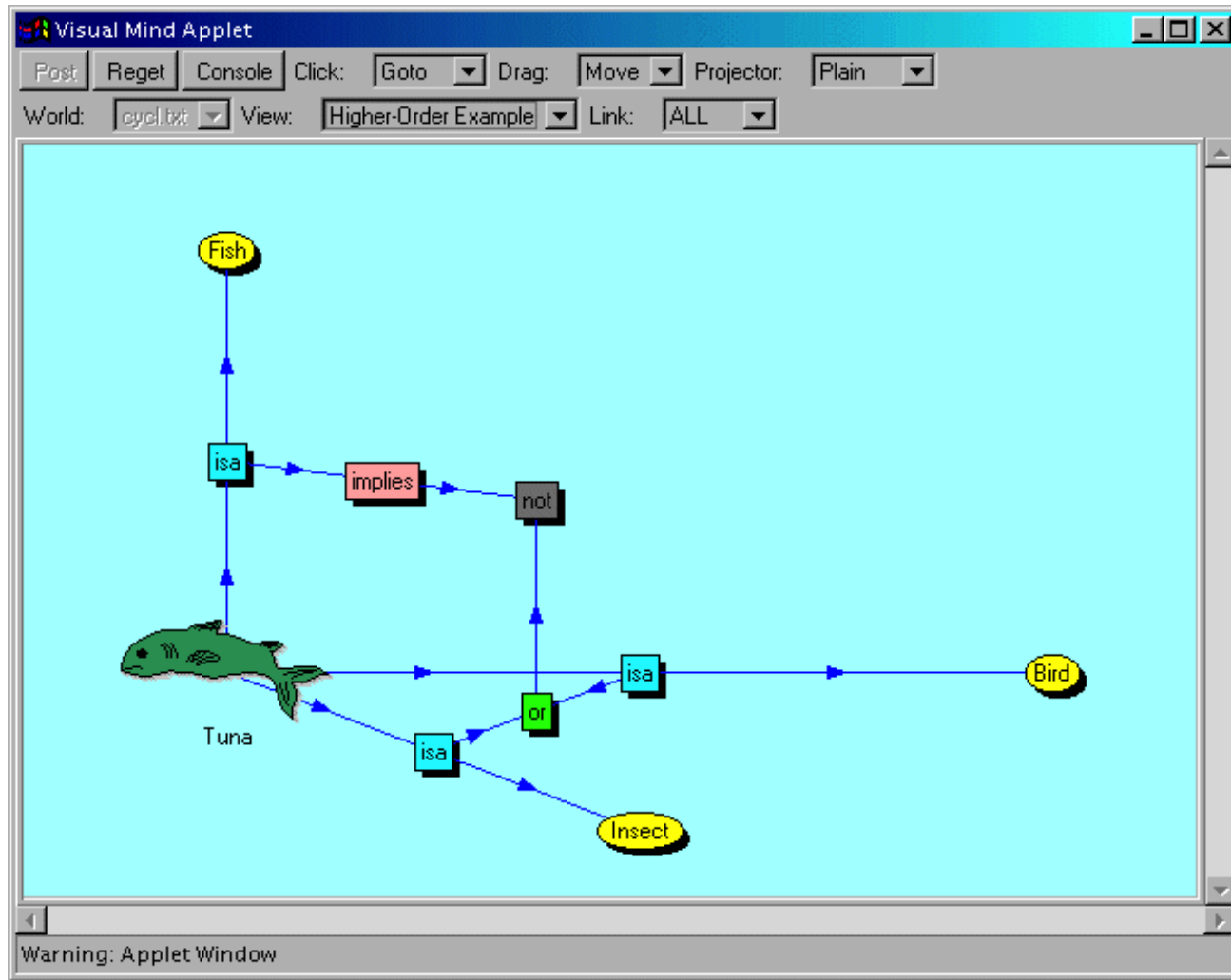
Visual ontology editor - representing Cyc «micro-theory»



Fragment of «biological kingdom» of Cyc «upper ontology»

Webstructor: Distributed Knowledge Editor

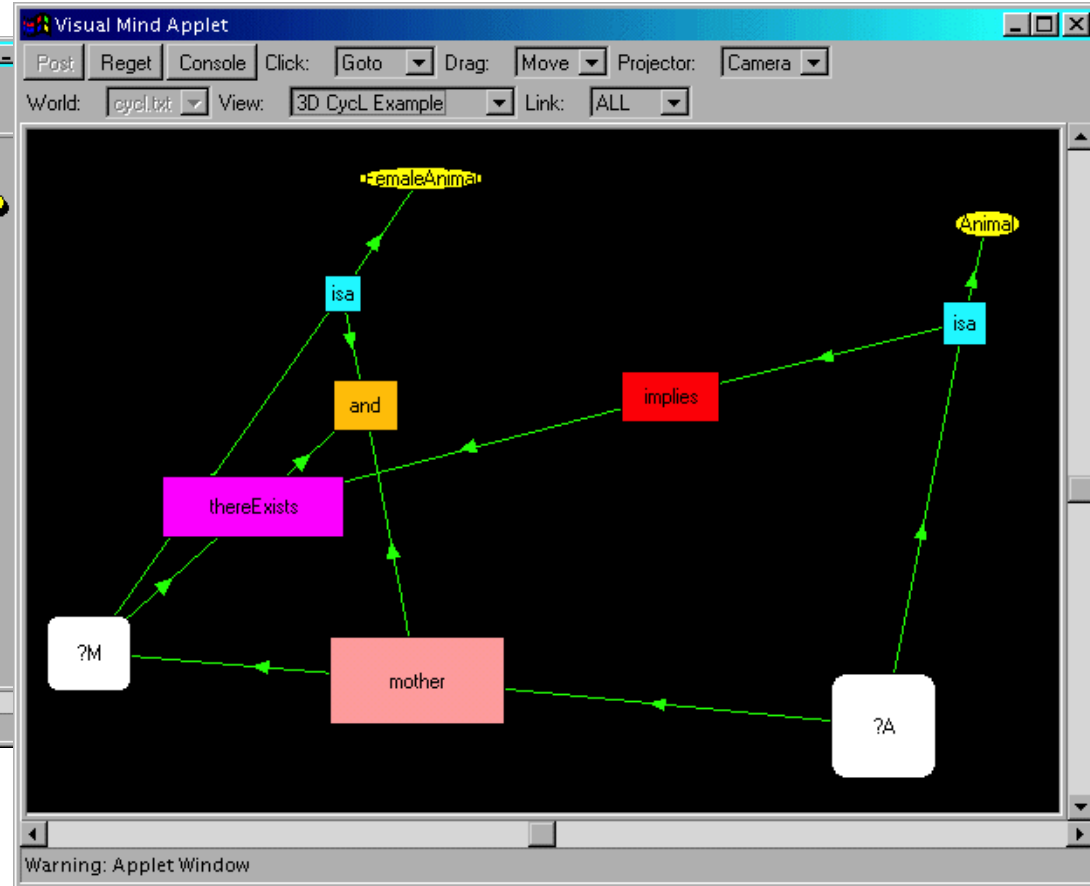
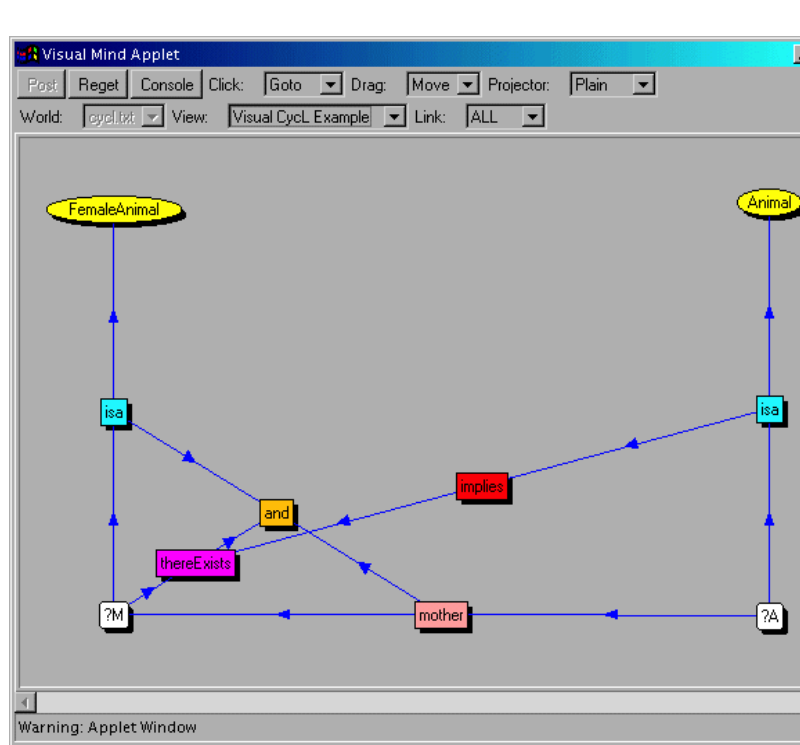
Visual ontology and predicate logic formula editor



Expression: «If tuna is a fish, that implies it is not an insect or a bird.»

Webstructor: Distributed Knowledge Editor

Visual 2D/3D editor of logical assertions (e.g. CycL)



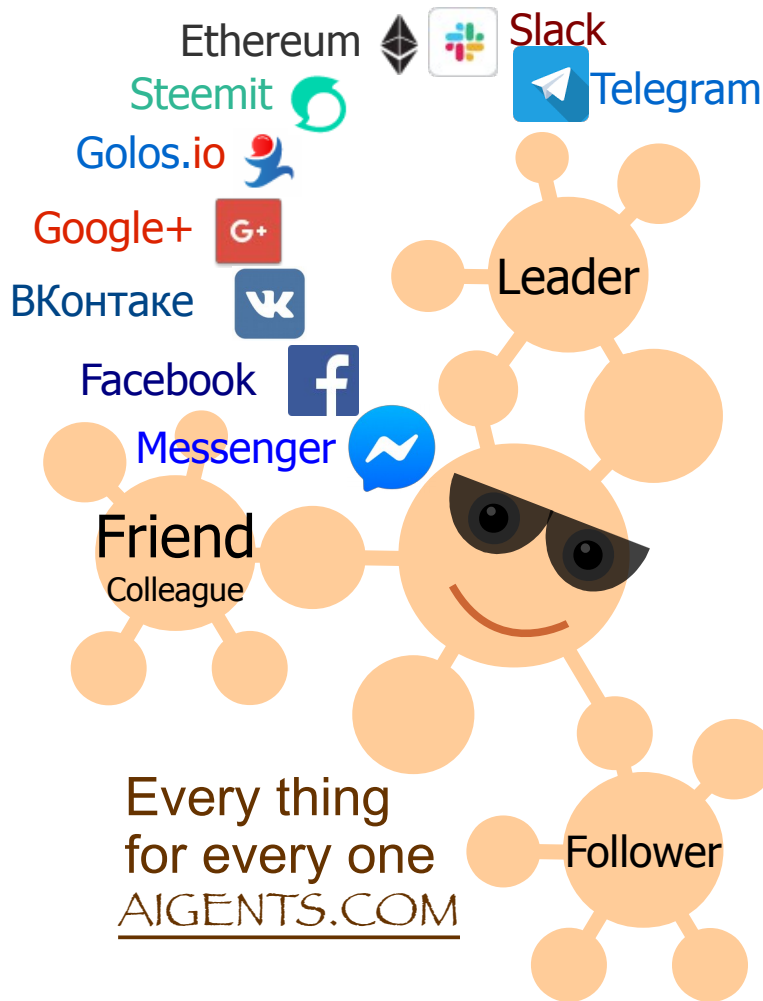
(implies (isa ?A Animal) (thereExists ?M (and (mother ?A ?M) (isa ?M FemaleAnimal))))
=

Mother of an animal is a female animal.

Lessons Learned:

1. 2D graphs are **fun** but **not always** practical
2. 3D graphs are even **more fun** but even **more less practical**
3. Distributed removal of knowledge (and its truth assessment) needs **account for evidence and social reference**

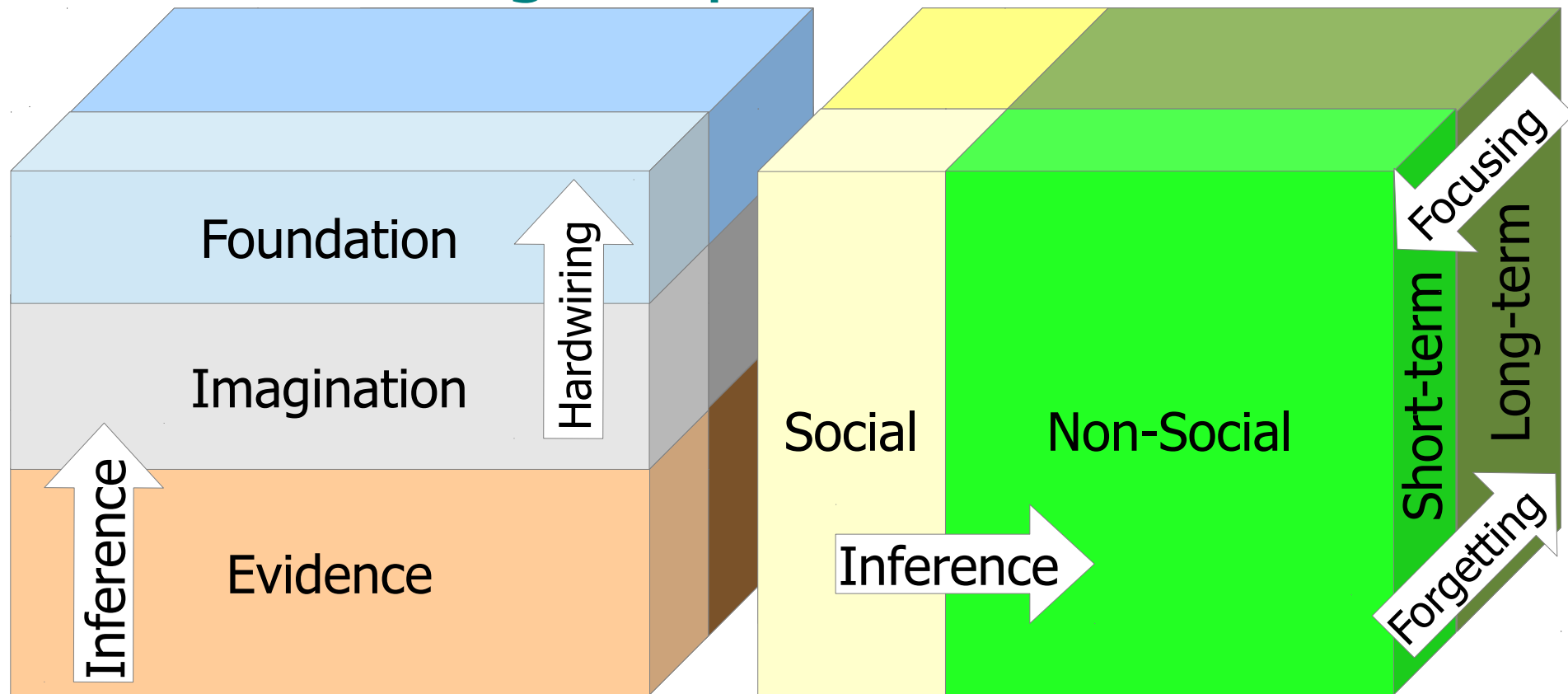
Aigents® Platform for Distributed Personal Agents



Monitoring
content and
social dynamics
in online
networks

Anton Kolonin
akolonin@aigents.com

Social-Evidence based Knowledge Representation Model



Top layer - “foundation graph” of basic knowledge, which is necessary for social system to be shared by all of its members in order to communicate.
Middle layer - “imagination graph” keeping “inferred” knowledge.
Bottom layer - “evidence graph” containing everyday life-time experiences.

Using “Semantic Language” for Knowledge Transfer between Software Agents and Human Users

Lisp, AIML/XML,
RDF/OWL/XML + SPARQL,
Turtle, JSON-LD

Too complex and unfriendly?

“Interlingua”
“Controlled language”
“Semantic language”

Just right!

Lojban,
Esperanto,
English

Too complex and ambiguous?

Artificial
Agent

Human
User

Agent Language (AL) for Home Automation and Internet-of-Things (IoT) – multilingual example

A: My is appliance, agent, thermostat, device.

A: My has shape, color, voltage.

A: My has location.

A: My shape rectangular, color white, voltage 220, location kitchen.

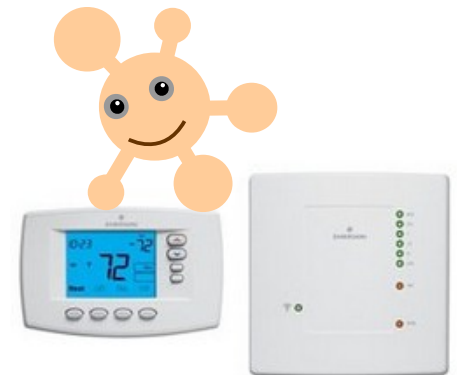
A: My has temperature, humidity, CO2, feeling.

A: Temperature, humidity, CO2 is number.

A: Feeling is good or bad.

H: What your feeling, temperature, humidity?

A: My feeling good, temperature 20, humidity 72.



A: Моя это прибор, агент, термостат, устройство.

A: Моя иметь форма, цвет, питание.

A: Моя иметь место.

A: Моя форма прямоугольный, цвет белый, питание 220, место кухня.

A: Моя иметь температура, влажность, CO2, самочувствие.

A: Температура, влажность, CO2 это число.

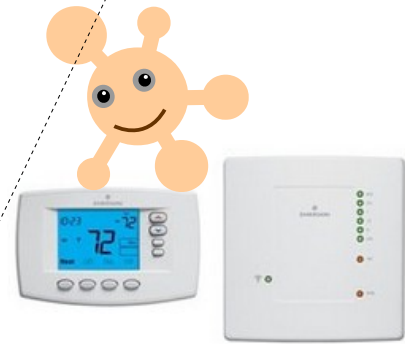
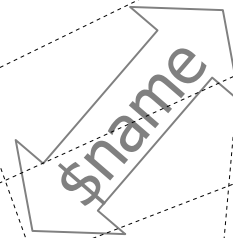
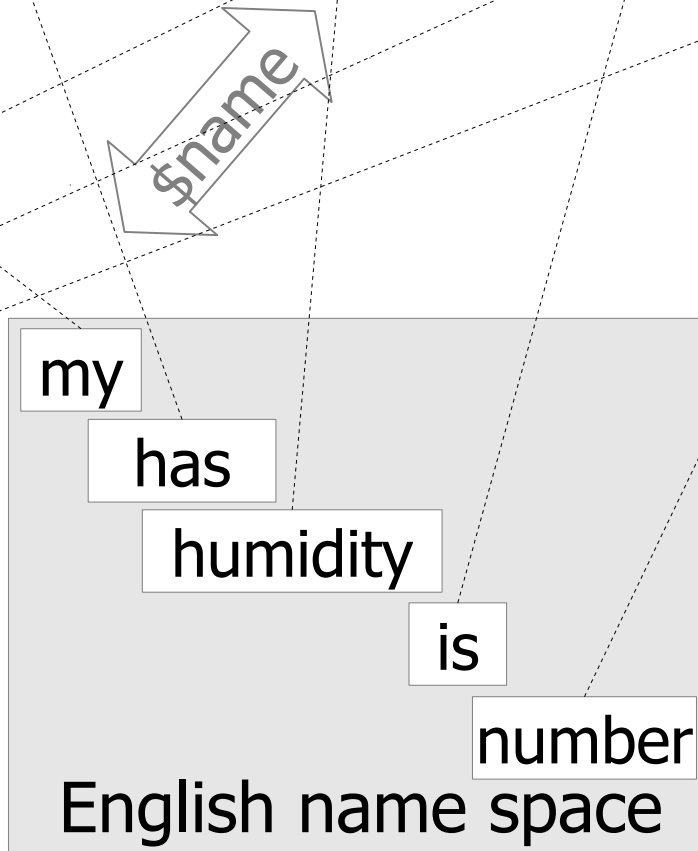
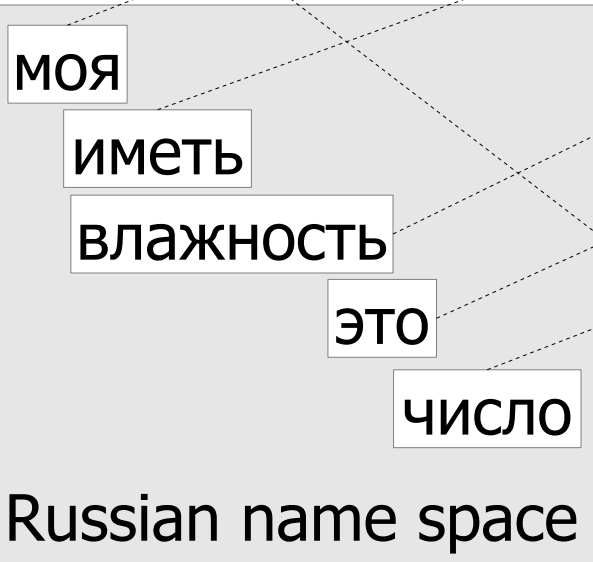
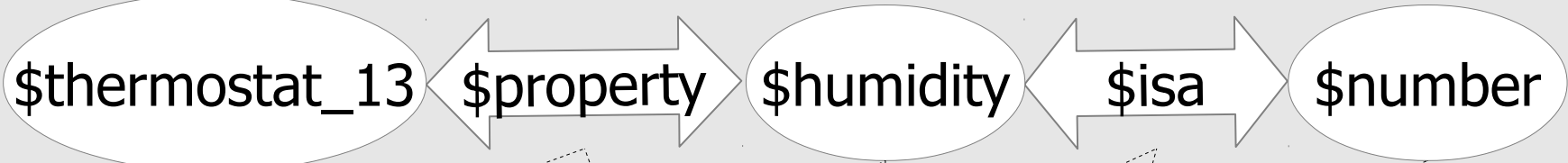
A: Самочувствие это хорошо или плохо.

H: Как твоя самочувствие, температура, влажность?

A: Моя самочувствие хорошо, температура 20, влажность 72.

Agent Language (AL) as a “Labeled Turtle”

Common domain-specific ontology for “controlled interlingua”



Agent Language (AL) as a Graph Manipulation

Interrogation:

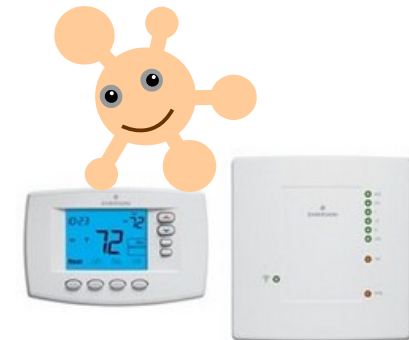
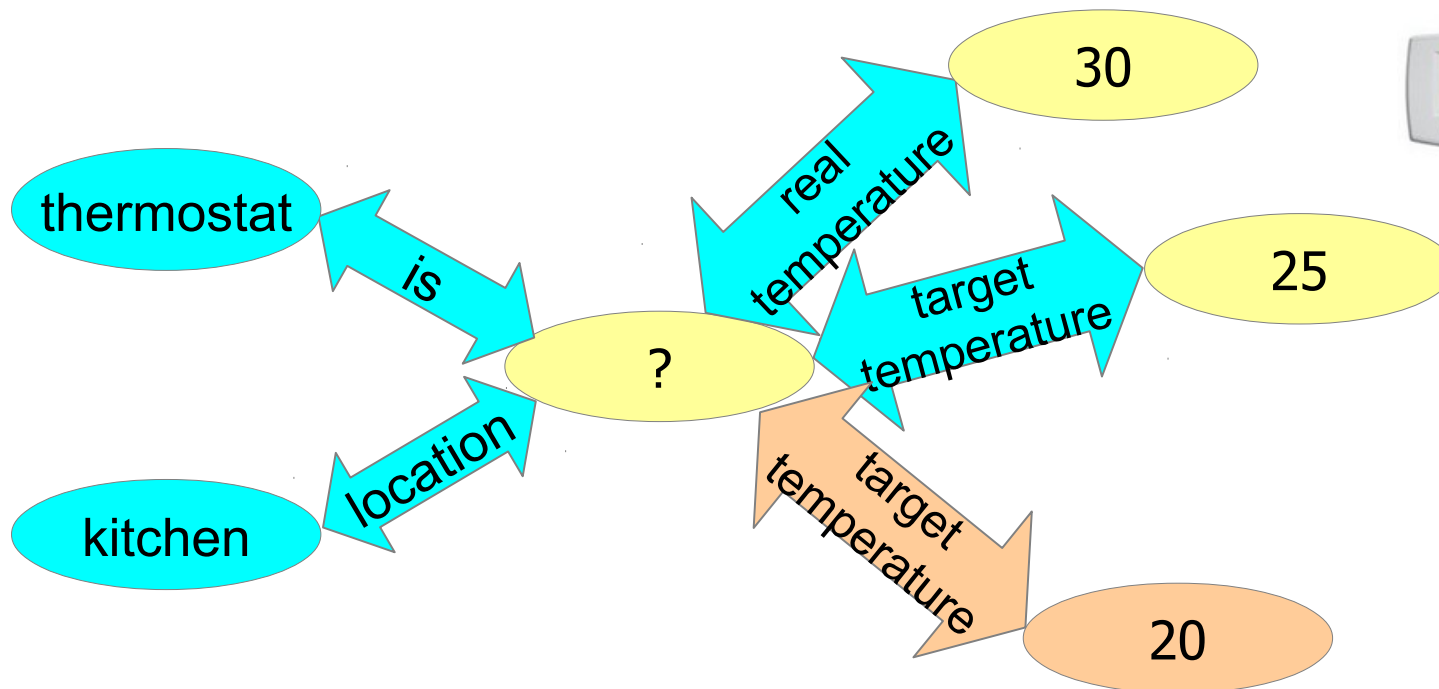
What is thermostat, location kitchen real temperature, target temperature?

Declaration:

Is thermostat, location kitchen real temperature 30, target temperature 25.

Direction:

Is thermostat, location kitchen target temperature 20!



Agent Language - EBNF

<message> := (<statement> | <acknowledgement>)
<acknowledgement> := ('ok' | ('true' | 'yes' | <number>) | ('no' | 'false' | 0)) '!'
<statement> := <interrogation> | <confirmation> | <declaration> | <direction>
<interrogation> := 'what' ? <expression> '?' (* "open" incomplete graph *)
<confirmation> := 'if' ? <expression-set> '?' (* "closed" complete graph *)
<declaration> := (<expression-set>) '!' (* "closed" complete graph *)
<direction> := 'do' ? <expression-set> '!' (* "closed" complete graph *)
<expression> := <term> (' ' <term>)
<expression-set> := <all-set> | <any-set> | <seq-set> (* separated by spaces *)
<term> := <negation>? (<anonymous>? | <self> | <peer> | <id> | <name> | <value> | <qualifier>)
<qualifier> := <expression> | <expression-set> (* different kinds of sets *)
<any-set> := <or-list> | ('{' <or-list> '}')
<all-set> := <and-list> | ('(' <and-list> ')')
<seq-set> := <next-list> | ('[' <next-list> ']')
<or-list> := <expression> ((',' | 'or') <expression>)
<and-list> := <expression> ((',' | 'and') <expression>)
<then-list> := <expression> ((',' | 'next') <expression>)
<negation> := 'not' | 'no' | '~'
<anonymous> := ('there' ('is'|'are')) | 'any' | 'anything' ?
<self> := 'my'|'i'|'we'|'our'
<peer> := 'your'|'you'
<value> := <number> | <date> | <time> | <string>

That is all!
There rest is done by
means of domain-
specific ontology and
providing national-
specific name space

Agent Language - comparisons

English

What is your feeling?
If your feeling is good?
Your feeling is good.
Have your feeling good!

Agent Language

Your feeling?
Your feeling good?
Your feeling good.
Your feeling good!

Russian (with tonal modulation)

Твое ощущение? (rising tone)
Твое ощущение хорошее? (rising tone)
Твое ощущение хорошее. (neutral tone)
Твое ощущение хорошее! (lowering tone)

Agent Language - written

I (can (eat, sleep), want (dance, sing)).
I {can (eat, sleep), want (dance, sing)}.
I (can {eat, sleep}, want {dance, sing}).
You [eat (rice, meat), drink {tea, beer}]!

Agent Language - spoken

I can eat and sleep and want dance and sing.
I can eat and sleep or want dance and sing.
I can eat or sleep and want dance or sing.
You eat rice and meat next drink tea or beer!

Agent Language

A C (D,E).
A (C D, F G).
A (C (D,E), F (G,H)).
(A,B) C D.
(A,B) (C (D,E), F (G,H)).

Term logic

A C D. A C E.
A C D. A F G.
A C D. A C E. A F G. A F H.
A C D. B C D.
A C D. A C E. B C D. B C E. A F G. A F H. B F G. B F H.

Turtle

A C D,E.
A C D; F G.
A C D,E; F G,H.

Aigents® Upper Ontology for Online Media Monitoring & Studies

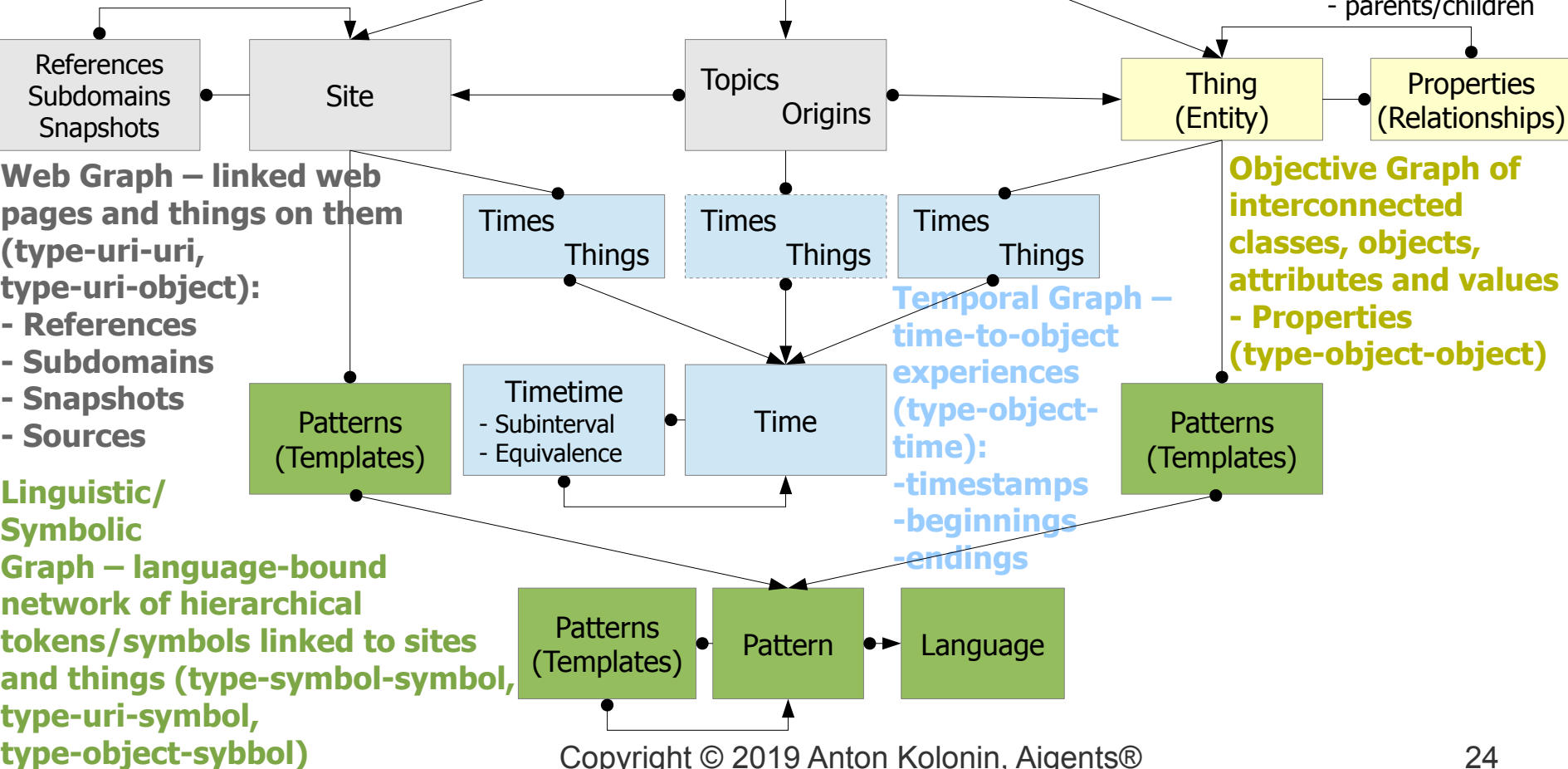
Personal Graph - person-to-object relationships map (type-subject-object):

- Topics (in Things)
- Shares
- Likes

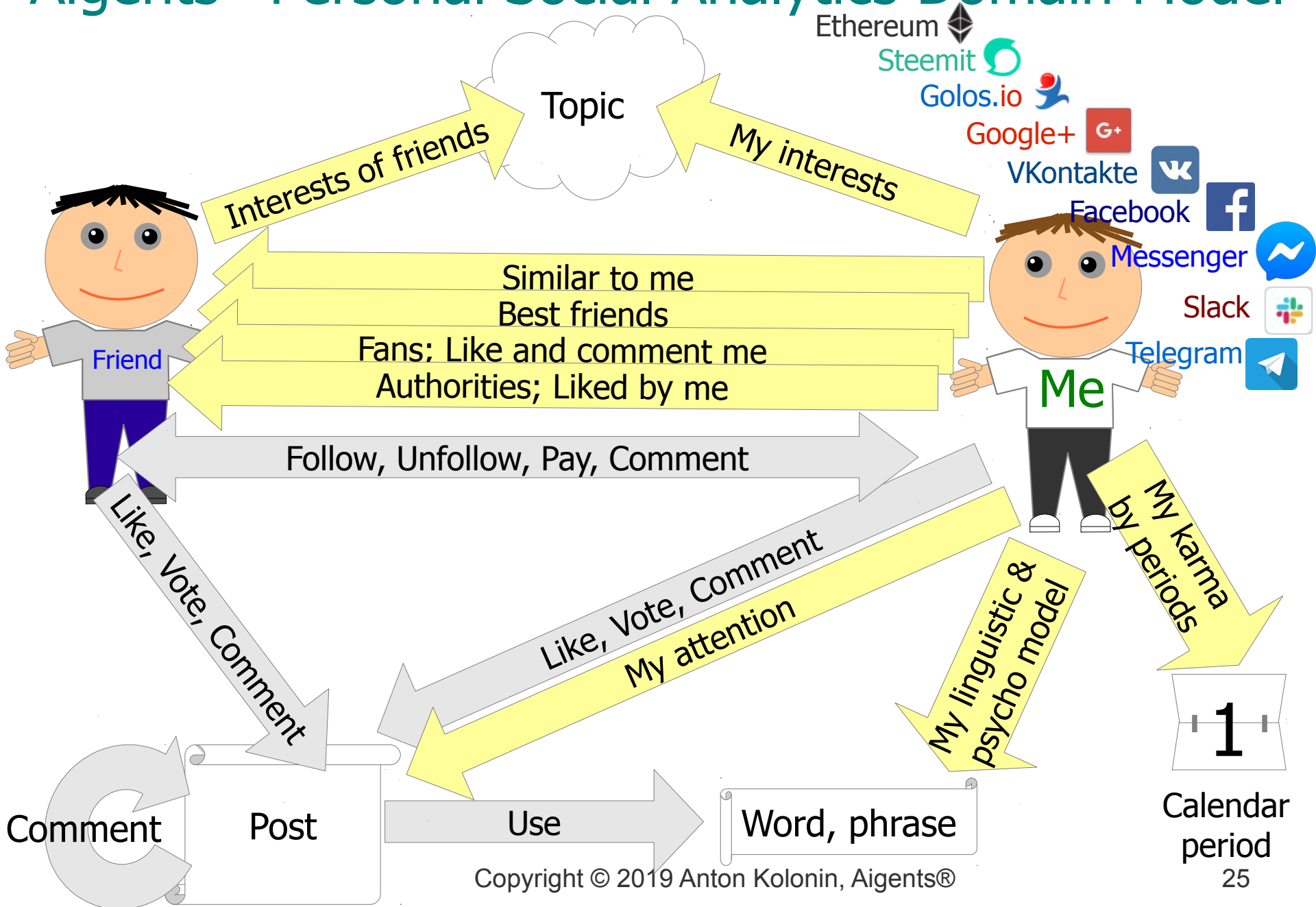
Social Graph – person-to-person trust/confidence relationships (type-subject-subject):

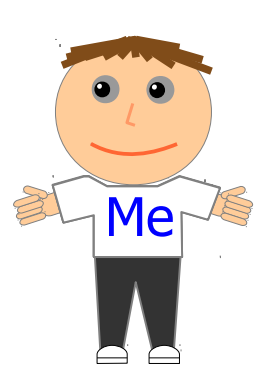
- Followers/Takes
- Sharers/Gives

- owners/properties
- classes/instances
- parents/children

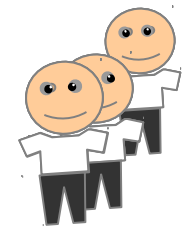


Aigents® Personal Social Analytics Domain Model





Case 1: Collaborative News Filtering: Monitoring web pages and extracting textual information with account to Personal and Social relevances



Friends

The screenshot shows the Aigents web interface. The top navigation bar includes links for Agents, Topics, Sites, News (highlighted with a yellow circle), Friends, Graph, and Chat. A search bar contains the text 'trump'. Below the search bar, a list of news results is displayed, categorized by date (today, yesterday, 2017-09-14, 2017-09-10). Each result includes a thumbnail image, a brief description, and a URL. A green arrow points from the 'Friends' label to the 'News' tab, and another green arrow points from the 'Friends' label to the first news result.

https://aigents.com

Agents Topics Sites News Friends Graph Chat

Login & Registration

trump

clapper was one of four top security and intelligence officials who put their names behind a january 6 report that said russian president vladimir put behind a complex effort of hacking and misinformation to influence the 2016 election in trump's favor
<http://www.digitaljournal.com/news/world/hollywood-stars-ex-spies-launch-russia-investigation-campaign/article/502876>

today

sections business markets world politics tech commentary breakingviews money life pictures reuters tv discover thomson reuters financial go solutions legal reuters news agency risk management solutions tax & accounting blog: answers on innovation @ thomson reuters directory of contact support featured shock tactics the garage science behind tasers immigration policy trump administration red tape tangles up visas for foreigners
<http://www.reuters.com/theWire>

today

the more intense scrutiny comes after president donald trump called for a review of the controversial program
<http://www.reuters.com/video/2017/09/20/red-tape-ties-up-h-1b-visas-for-skilled?videoId=372572112&videoChannel=1>

yesterday

and is examining any financial entanglement between russia and president trump his associates
<http://www.nytimes.com/>

2017-09-14

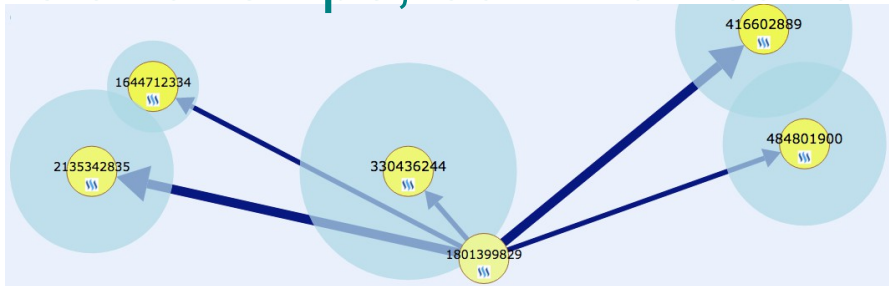
president trump came under sharp attack on thursday for appearing to set aside a border wall fight while reaching a deal on daca immigrants
<http://www.nytimes.com/>

2017-09-10

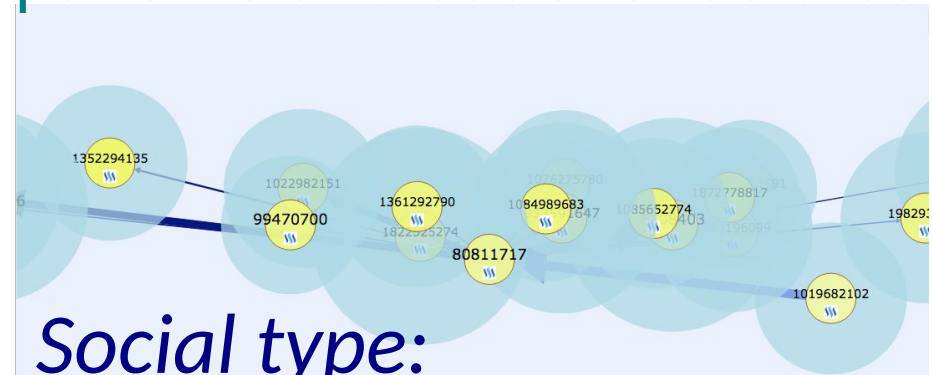
lawrence kruson on trump's...

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Case 2: Helping users to understand themselves better and perform more efficiently online – using their tracks in social networks and online resources, capture their interests, relationships, communication patterns and social structures.



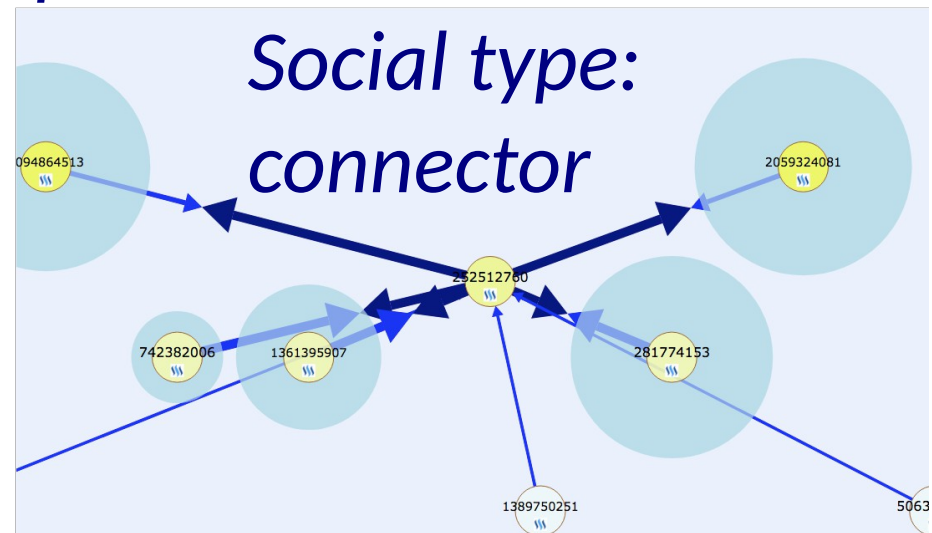
*Social type:
follower*



*Social type:
peer*

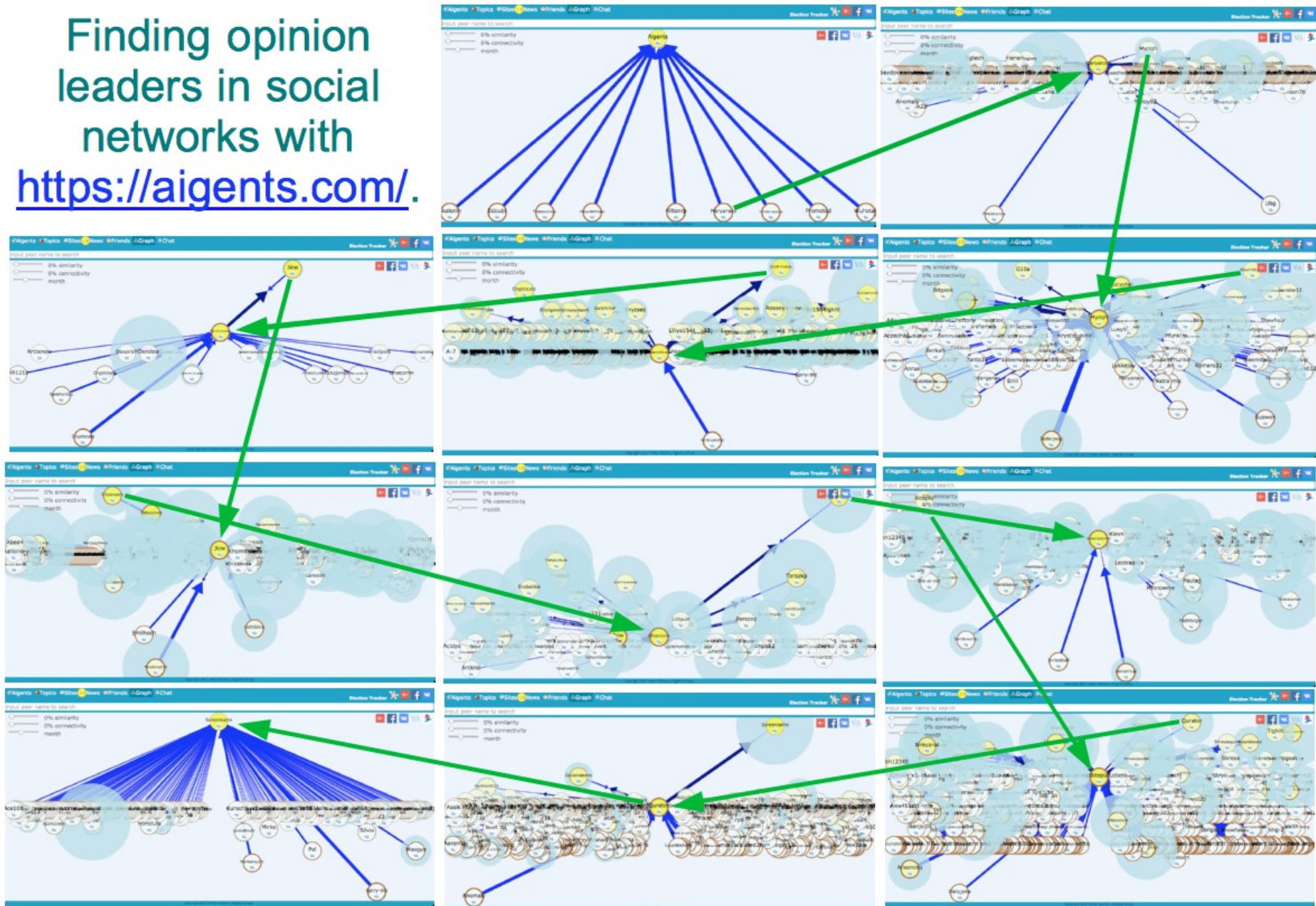


*Social type:
opinion leader*

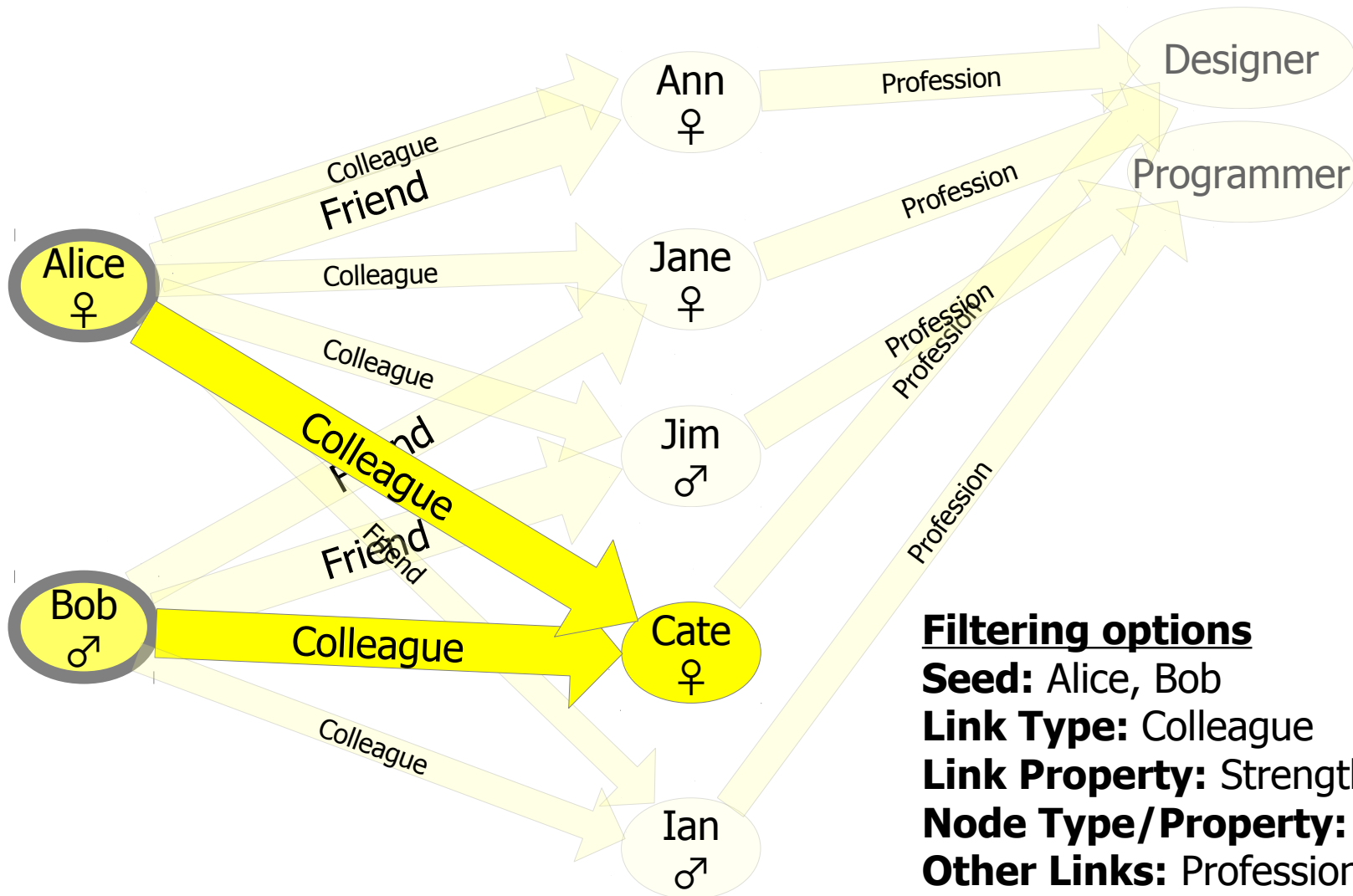


*Social type:
connector*

Case 3: Finding opinion leaders in social networks with <https://aigents.com/>.



Aigents®: Graph Builder and Filter



Filtering options

Seed: Alice, Bob

Link Type: Colleague

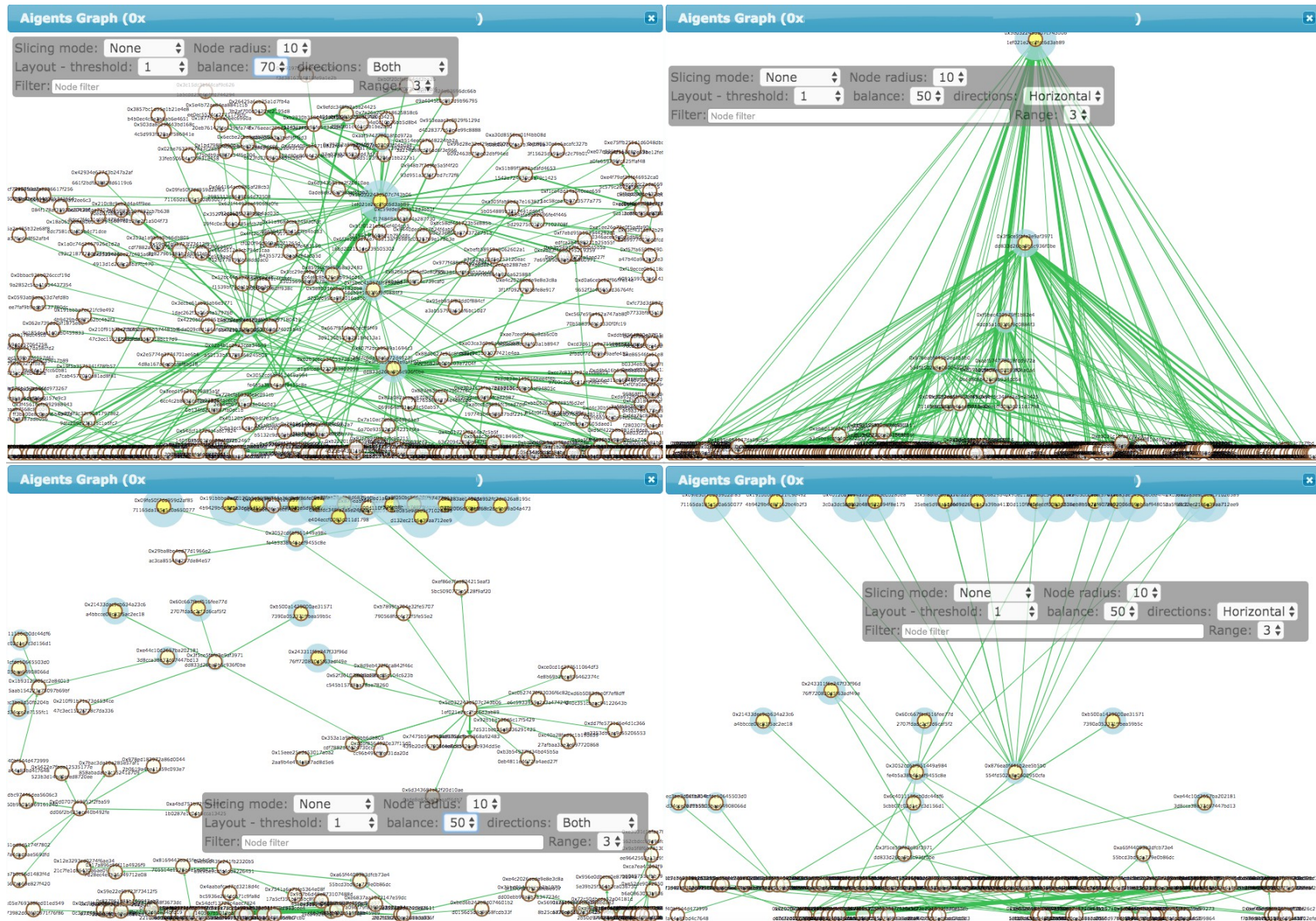
Link Property: Strength=High

Node Type/Property: ♀

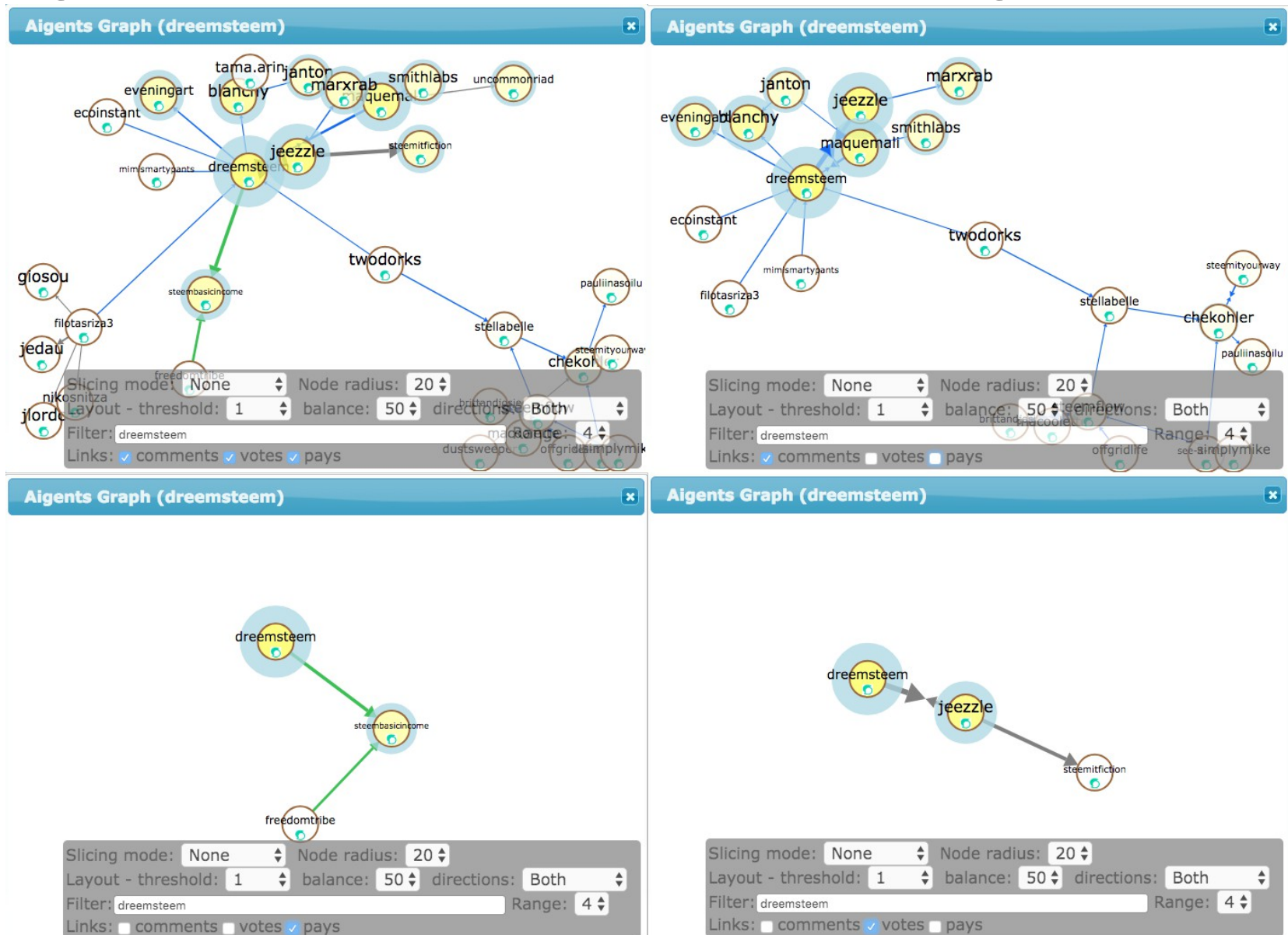
Other Links: Profession=Designer

Link Range: 1

Aigents®: Ethereum cash flow graph study



Aigents®: Steemit social network graph study



Thank you for attention!

Questions?

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Youtube: <https://www.youtube.com/aigents>

Medium: <https://medium.com/@aigents>

Steemit: <https://steemit.com/@aigents>

Facebook Messenger: [Aigents](#)

Telegram Messenger: [@AigentsBot](#)



SingularityNET

N* Novosibirsk
State
University
*THE REAL SCIENCE

TravelChain



zkylos