OntoMediate

Ontological Mediation and Semantic Gateways for Domain/Enterprise Translations

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Outline

- ## Introduction
  - ### Aims & Objectives
  - ### Issue Tackled
  - ### Related Work

- ## OntoMediate Approach
  - ### Community Driven Data Integration
  - ### System Features

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OntoMediate project

Aims & Objectives

- Exploit social and collaborative processes for easing the ontology matching task for integrating data
  - Give the community the power to drive the integration process, explicitly addressing causes of semantic misunderstanding among parties

- Facilitate the dynamic construction of shared ontologies for data integration

- Enable the gradual and **flexible alignment** of ontologies
  - instead of an **One ontology fits all** approach

- Mediate between different formats, encodings, meanings, etc.

Task (data integration) Issues

- **Difficulty of agreeing in ontologies definition for 'open' communities of interest**

  - Communities can group loosely related entities

  - Standard bodies procedures can be slow (e.g. balloting, survey)

- **Necessity of addressing model mediation and evolution**

  - Application requirements can change over time and can be different for different sub communities

  - New data sources type can eventually become available

Data not compliant with adopted ontology
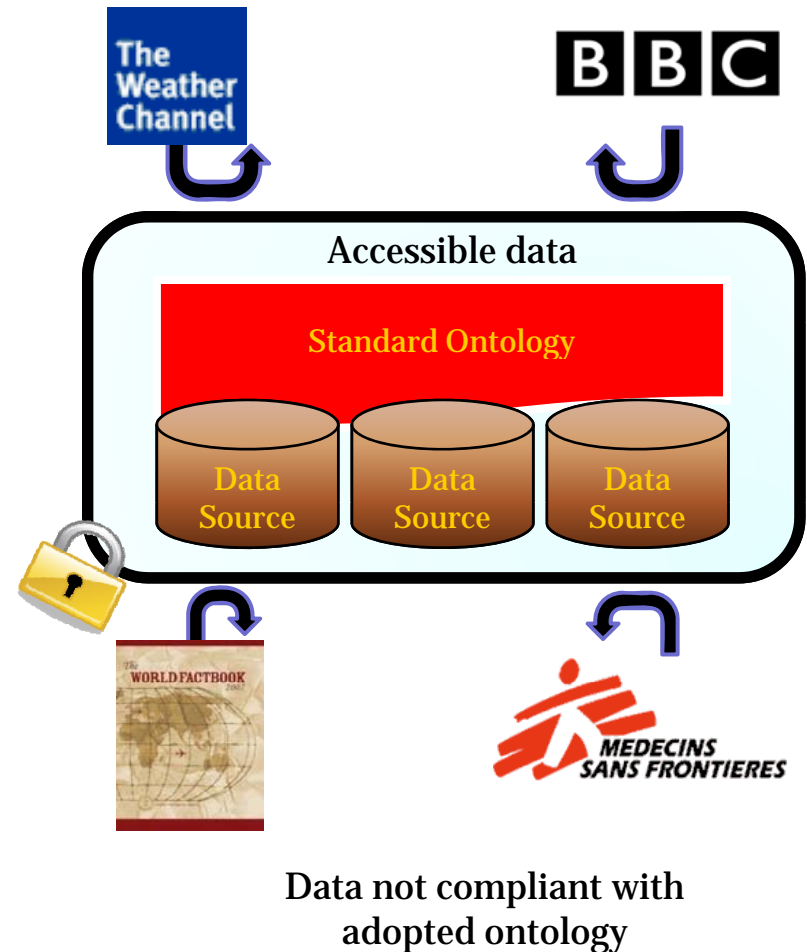
Collaborative approaches

- Historically the Knowledge Sharing Effort is the first attempt to open knowledge authoring to communities

- Technologies and tools address issues like:
  - orchestrate collaborative efforts,
  - assure global consistency
  - reach consensus ?
  - enhance understanding ?

Collaborative approaches

- New technologies (social web, micro formats, web 2.0) are fuelling web applications allowing people to create and share content and knowledge more easily

- How to exploit social interactions for creating formal artefacts (e.g. ontologies, ontology alignments)?

- Can we use the social approach for easing user tasks (e.g. data integration) within community of practice?

Collaborative approaches

- Proposals have been done for addressing communities for:

  - Ontology population (OntoWiki, DBin)

  - Collaborative ontology authoring (Hozo, Collaborative Protégé)

  - Collaborative construction of less formal knowledge (SOBOLEO, BibSonomy)

- Few proposals so far for exploiting collaboration for managing ontology alignments

  - Zhadanova and Shvaiko addressed alignment reuse using groups and user profiles

  - OntoMediate

OntoMediate proposal

OntoMediate Approach

- SOCIAL & COLLABORATIVE
  - Community support for the evolution of an agreed structured vocabulary by means of argumentation of changes, discussion of proposal, voting on change proposals, etc.
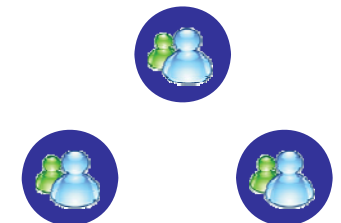 - Minimal shared ontological commitment
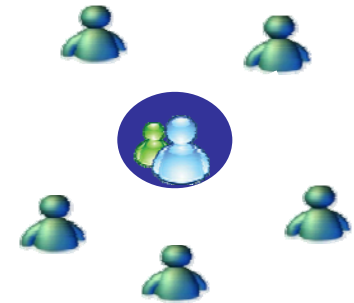
- ONTOLOGY MAPPING
  - Semi-automatic ontology mapping and mediation tools for supporting different information representations and meanings
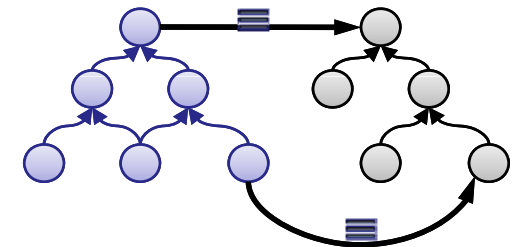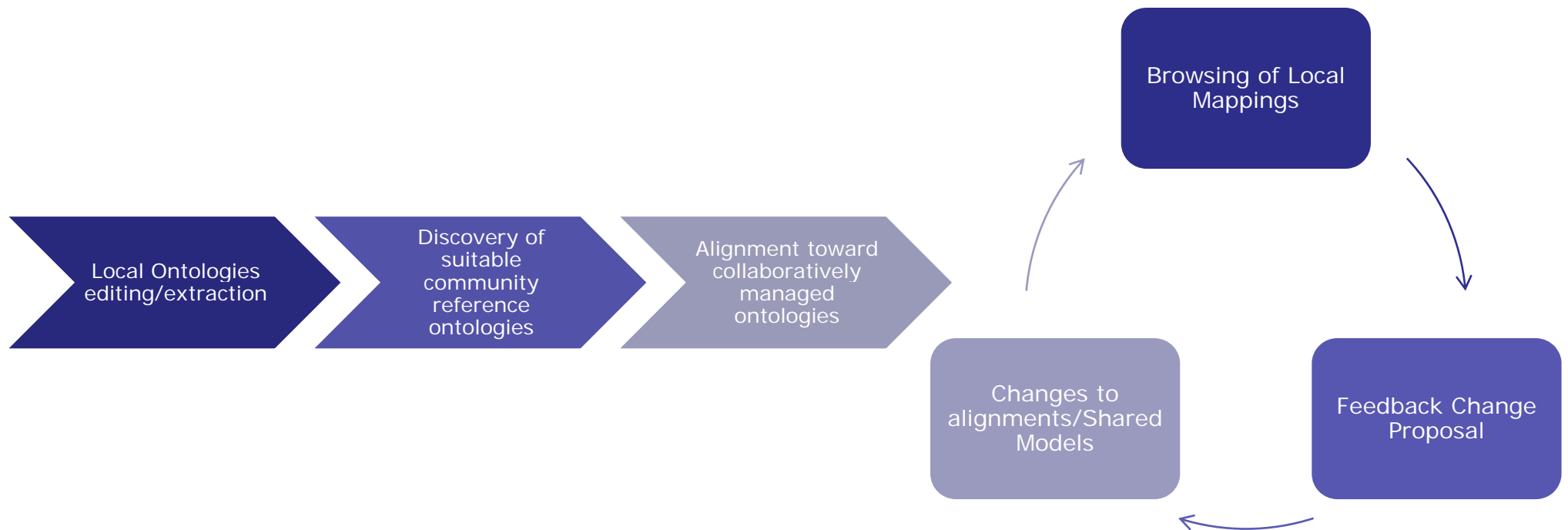
- INFORMATION NETWORK
  - Integration via a network of different ontologies
  - No requirement for changing the local vocabulary

Community Data Integration (Vision)

Community Data Integration (Process)

Local Ontologies editing/extraction → Discovery of suitable community reference ontologies → Alignment toward collaboratively managed ontologies →

Browsing of Local Mappings → Feedback Change Proposal → Changes to alignments/Shared Models → (back to Browsing of Local Mappings)

Community Data Integration (Approach)

- ## Data integration requires an agreed data vocabulary
  - But agreement over metadata definition must be fostered and (if possible) measured against community needs

- ## Users (data owners/administrators) can provide:
  - Local data vocabularies
  - Data sources valuable to the community
  - Alignments toward agreed upper vocabularies
  - Feedback

- ## Feedback – building block of collaboration
  - Community correction of inevitable human/machine mistakes/omissions
  - Agreement reaching upon the desired shape of shared ontologies

OntoMediate Features

- **Ontology and datasets management**
  - Ontology/Dataset add/delete/browsing
  - Ontology mapping (integrated FalconOA, CMS, INRIA)

- **Ontology discussion**
  - Browse ontologies and their mappings
  - Propose changes to mappings
  - Propose changes to ontology evolution

- **Proposal discussion and voting**

- **Data integration and querying**

Collaborative Mapping Management
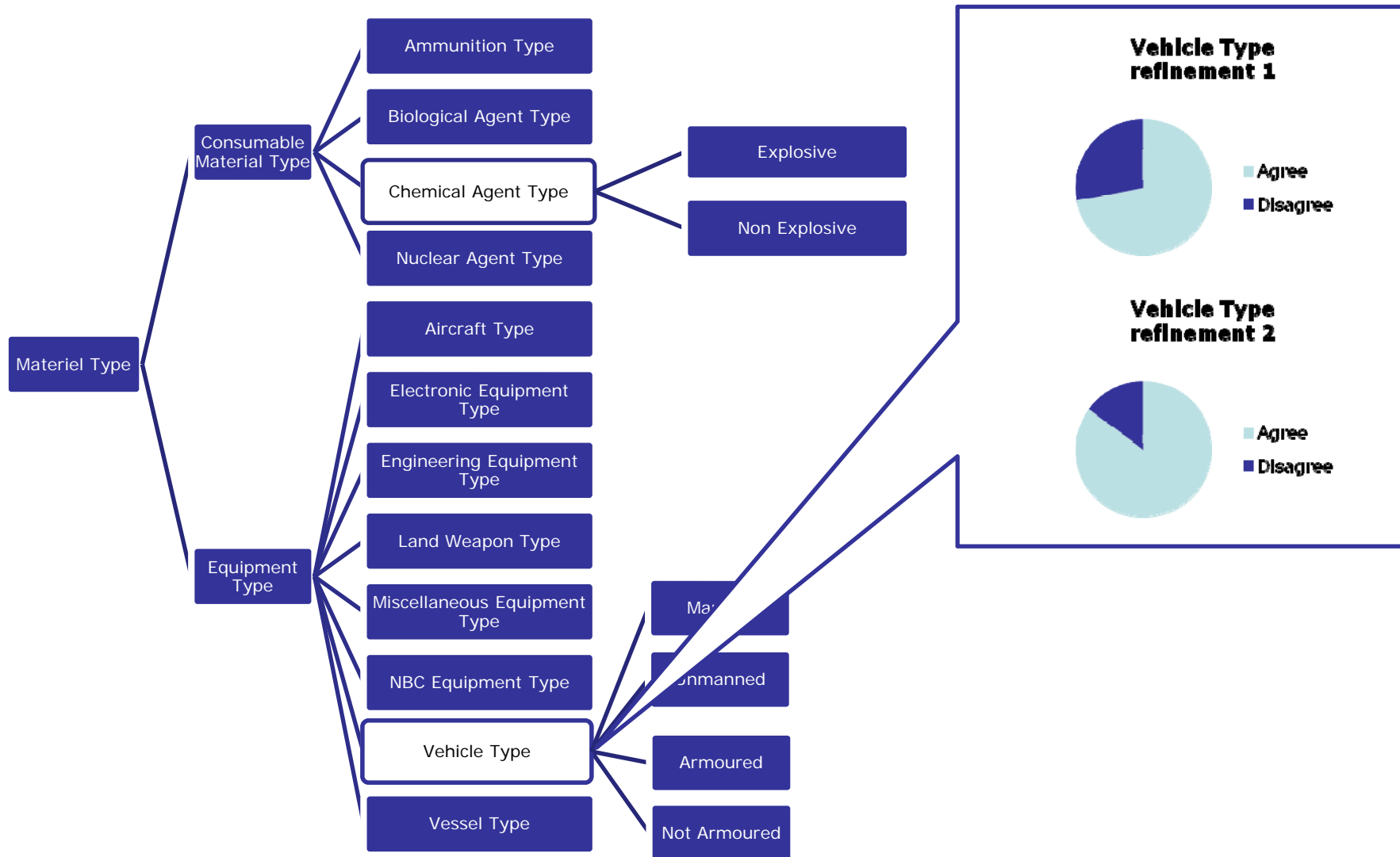
Mapping Management

- Every user is allowed to **browse** ontologies
  - concepts descriptions are enhanced with information from other users (e.g. mappings to other concepts, community messages)

- Every user is allowed to issue **change proposals** if the user disagrees with the existing mapping

- The community is notified of new change proposals via RSS feeds

- Community can then discuss/agree/disagree those proposals in the forums

Collaborative Ontology Evolution
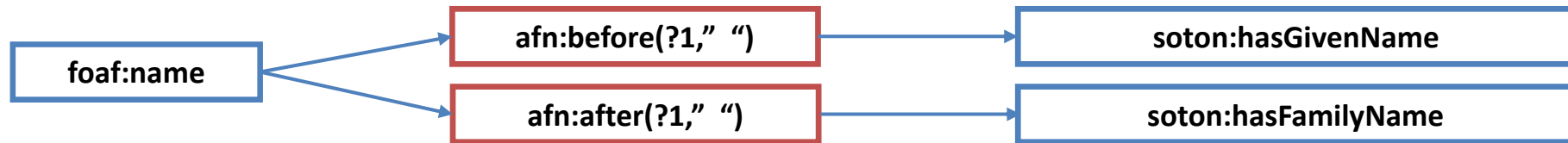
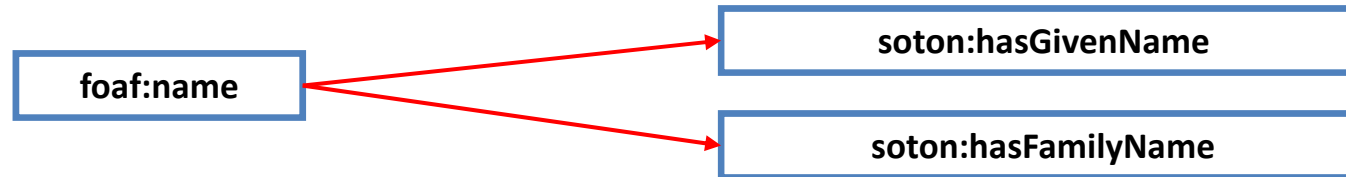# Ontology Evolution

- Users can actually drive the definition of shared ontologies by proposing concepts refinement

- Users can propose extensions to shared hierarchies
  - So far, only subclass addition is permitted

- Axioms can be used to logically define the refinement
  - Coverage - $C \equiv C_1 \cup C_2 \cup \ldots \cup C_n$
 - Pair wise disjoint - $i \neq j : C_i \cap C_j \equiv \varnothing$

Ontology Evolution


```
Materiel Type
├── Consumable Material Type
│   ├── Ammunition Type
│   ├── Biological Agent Type
│   ├── Chemical Agent Type
│   │   ├── Explosive
│   │   └── Non Explosive
│   └── Nuclear Agent Type
└── Equipment Type
    ├── Aircraft Type
    ├── Electronic Equipment Type
    ├── Engineering Equipment Type
    ├── Land Weapon Type
    ├── Miscellaneous Equipment Type
    ├── NBC Equipment Type
    ├── Vehicle Type
    │   ├── Ma...
    │   ├── Unmanned
    │   ├── Armoured
    │   └── Not Armoured
    └── Vessel Type
```

Vehicle Type refinement 1

Agree
Disagree

Vehicle Type refinement 2

Agree
Disagree

Data Integration

Data Integration

| foaf:name | → | soton:hasGivenName |
| | | soton:hasFamilyName |

| foaf:name | → | afn:before(?1," ") | → | soton:hasGivenName |
| | | afn:after(?1," ") | → | soton:hasFamilyName |

- The system encodes the alignments as n:1 relationships that can produce the rules for decoding/encoding of queries and data if needed

- Query translation algorithm implemented
  - RDF-based representation of alignments (i.e. works with every RDF vocabulary: OWL, DAML-OIL, SKOS)
  - Extendible via XML technologies: XQuery/XPath functions

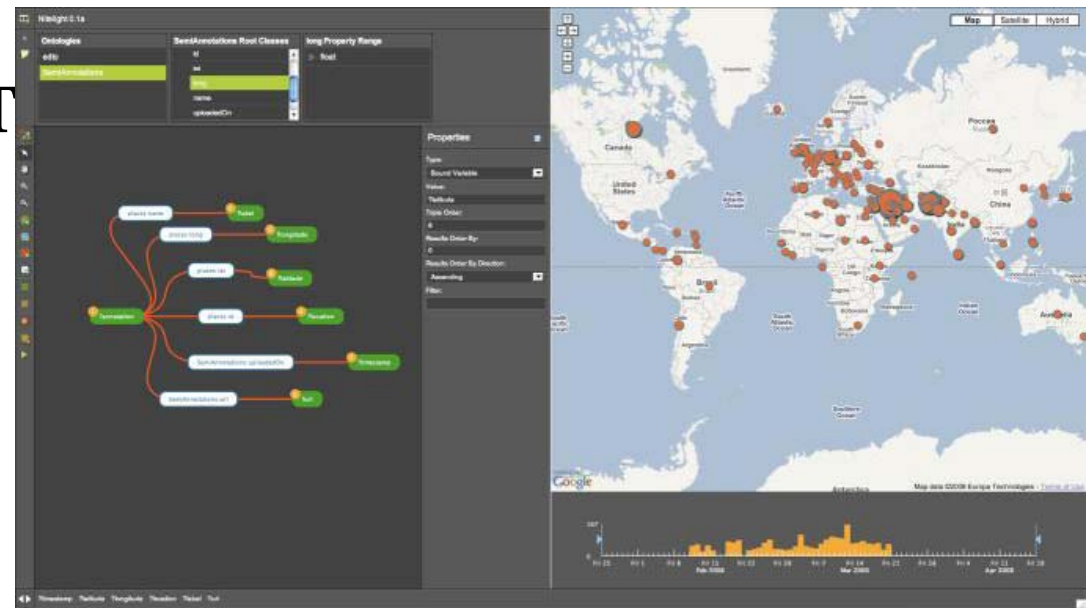# Query Translation
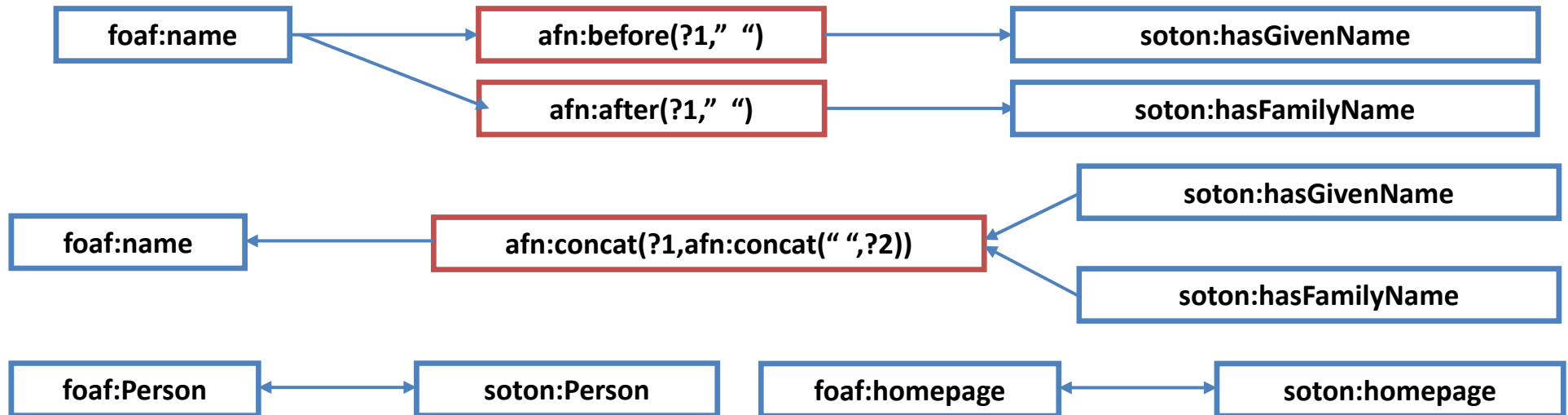
PREFIX soton: <http://rdf.ecs.soton.ac.uk/ontology/ecs>
SELECT ?name ?home WHERE {
?X a soton:Person.
?X soton:hasGivenName ?1.
?X soton:hasFamilyName ?2.
?X soton:homepage ?3.
LET (?name = afn:concat(?1,afn:concat(" ",?2))).
LET (?home = ?3).
FILTER startsWith(?home, "http://www.ecs.soton.ac.uk/")}

Future Work

- Instance mapping and disambiguation

- Support for user profiling and social network exploitation
  - Ontology alignment support
  - Data discovery

- Integration with NITELIGHT

Conclusions and Demo

- Flexible approach to data integration

- Social features for community driven management

- Query translation approach to data integration