Towards a Formal Pedigree Ontology for Level-One Sensor Fusion

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Outline

- Objectives
- The Web Ontology Language OWL
- Pedigree as Metadata
- Proposed Pedigree Ontology
- A Candidate Application
- Challenges

Our Objective

- Preliminary work to exploit data pedigree information to improve the interpretation and use of Navy track data (OTH GOLD)
  - develop an OWL ontology so we can formally reason about pedigree information
- Part of a larger ONR SBIR effort
  - to lessen information overload and improve the exchange of disparate data
  - uses a C2IEDM-based Track Ontology (OWL) for data mediation (see 11:00am talk today in Old Dominion)
  - joint work by VIS, Referentia Systems, Northeastern University and SPAWAR

Web Ontology Language

OWL is

- Semantic Web Ontology Language
- a W3C Recommendation (i.e., a standard)
- a formal language for writing ontologies;
  an ontology defines the language of discourse for a particular domain by identifying
  - pertinent object classes
  - relations between objects (e.g., object-properties)
  - object attributes (e.g., data-properties)
- developed by the W3C out of the DARPA-funded DAML project

OWL Pros and Cons

- Pros:
  - W3C standard with an XML syntax
  - well grounded formal semantics backed by years of research in formal logic, knowledge representation & artificial intelligence
  - growing number of applications for editing, checking and processing OWL documents
- Cons:
  - everything is represented with RDF triples
    - very low level and cumbersome to read and write
  - OWL properties are limited to binary relations
  - unable to represent general implications e.g. uncleOf(X,Y)

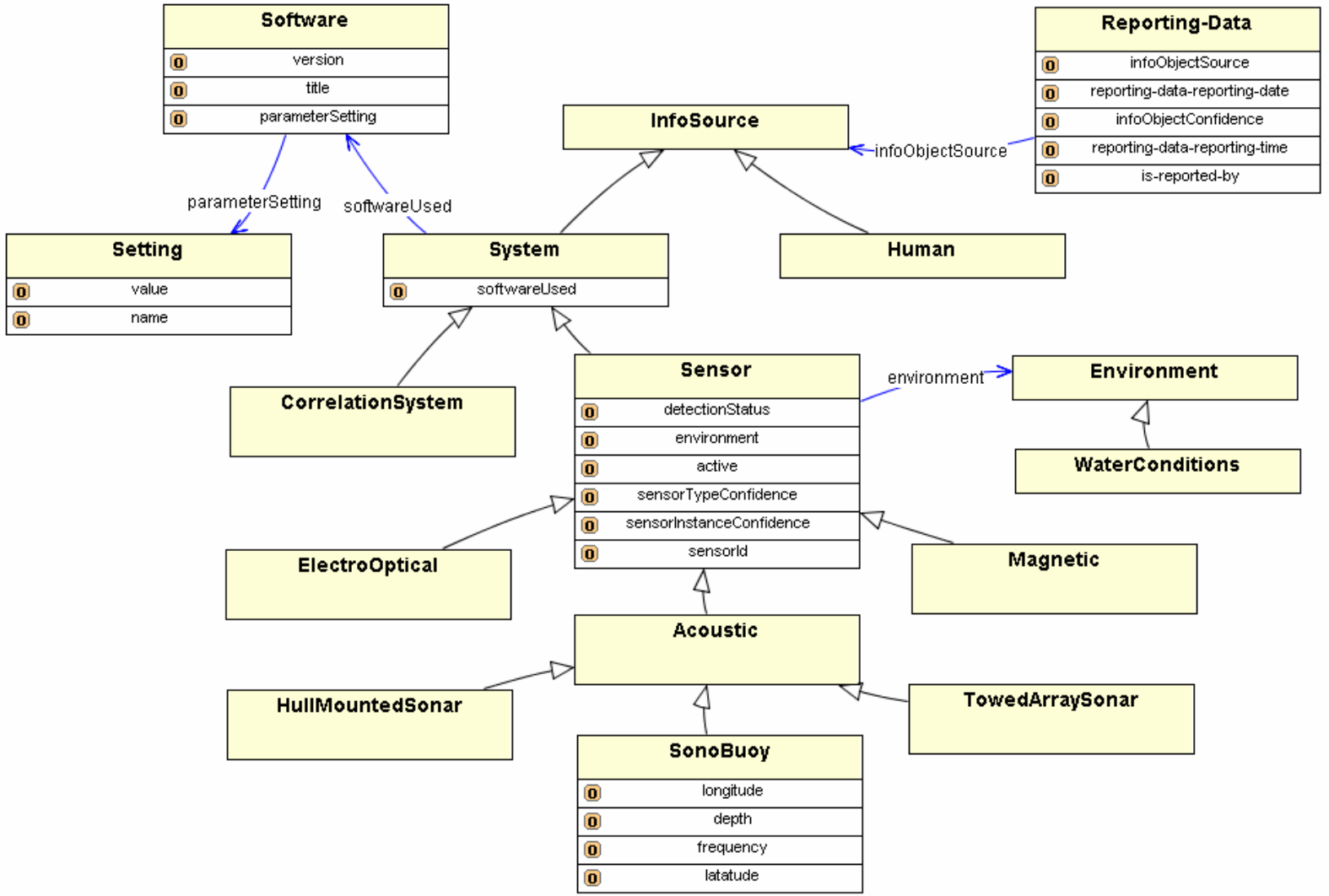
Pedigree = Metadata

- Data Pedigree = “data provenance” = “data lineage” = metadata = data about data
- Can include information about data such as
  - where did it come from?
  - what were the conditions it was derived under?
  - when was it sensed? received? expires?
  - how was it derived?
  - who produced it? owns it? validates it?
- Usually not available beyond simple time and source information
- Yet, can be important for evaluating quality, confidence, trust, usability, share-ability, etc.

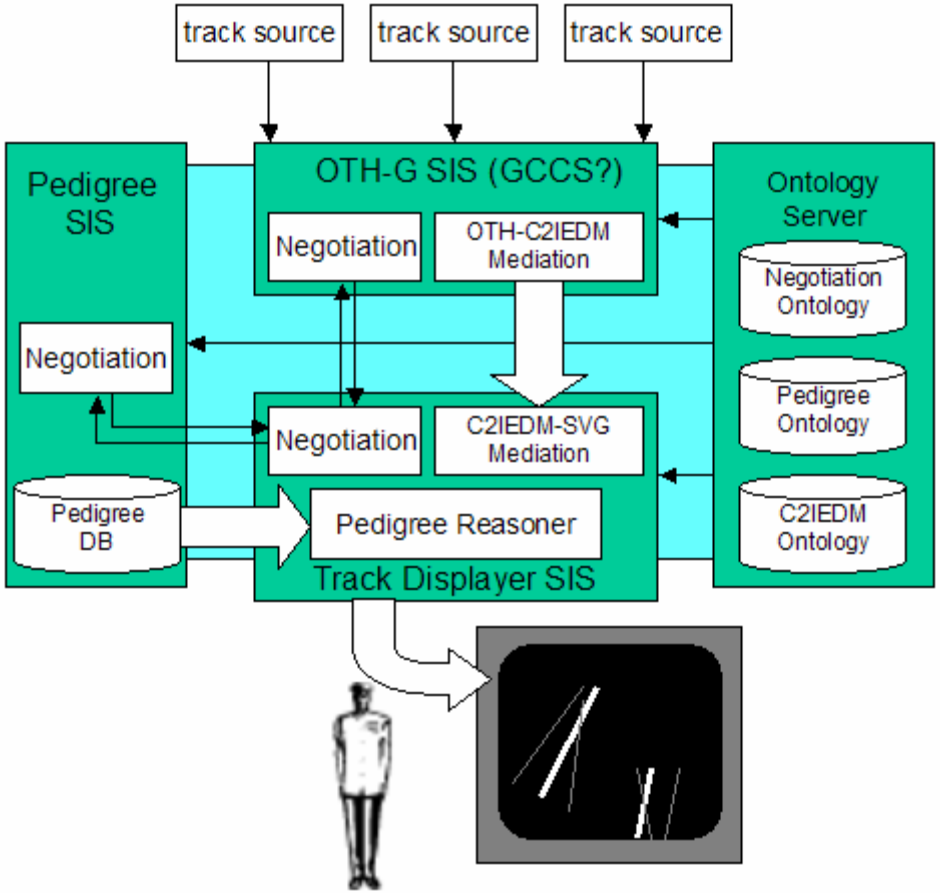
Track Data Pedigree

- OTH GOLD track data can provide information about provider, time & sensor type
- Other track data pedigree candidates:
  - sensor configuration
  - sensor type trust, sensor instance trust
  - fusion system use/configuration
  - environment conditions
- Interested in a pedigree ontology that
  - can be extended to other types of data
  - has a connection to C2IEDM via Reporting-Data entity

Proposed Pedigree Ontology



Application Concept



Challenges

- Where does the pedigree data come from?
- How does it get tagged to legacy data?
  - suggestion: OTH-GOLD REMARK field
- Are the rewards of metadata collection worth the cost?

Recap

- Objectives
- Overview of OWL
- Pedigree as Metadata
- Proposed Pedigree Ontology
- A Candidate Application
- Challenges