Introduction: Tutorial Goals

- Bridge between RuleML, Fact-Based Modeling, and Decision Management
- Explain rules for a harbor security use case, leading to Cyber Physical Systems
- Exemplify the Pragmatic Semantic Web by prohibiting certain ships to enter a harbor
- Provide a hands-on demo with audience-driven queries of the Object-Relational Decision Model
- Recommend models using generalized rule (and ontology) expressivity in PSOA RuleML
1. This Introduction (Gen Zou, Harold Boley)
2. RuleML Update (Harold Boley)
3. Fact-Based Model in PSOA RuleML (Harold Boley)
   http://ruleml.org/talks/PortClearanceRulesPSOARuleML-talk.pdf
5. Port Clearance Demonstration (Gen Zou)
RuleML models data and knowledge
- Visualization and (here) presentation syntaxes for logics (facts+taxonomies+rules)
- XML syntax uniform across logics, platforms, and tools
- Translators for (multi-paradigm/model) interchange of logics

Current spec release is RuleML 1.02
- Includes Deliberation (e.g., Horn logic) and Reaction (e.g., event-processing) RuleML families
- Integrated via Consumer RuleML family
- Part of OASIS LegalRuleML Core 1.0
- See more: http://ruleml.org
PSOA RuleML is a novel subfamily of object-relational integrations that started with OO RuleML and Datalog/Hornlog RuleML. PSOA constructs extend to all of Deliberation RuleML as well as to Consumer and Reaction RuleML. PSOA use cases include Port Clearance Rules, supporting future physical (sensor-based) constraints. See more: http://wiki.ruleml.org/index.php/PSOA_RuleML
Conceptual schemas / fact-based models can be mapped to deductive databases.

PSOA RuleML can be seen as an object-relational deductive database.

Facts and rules (incl. “fact types” / constraints) of fact-based models can be mapped to relational or object-centered fragments of PSOA (in simplified presentation syntax).

This will be sketched with the Illustrative Example of “Fact-Based Modelling Metamodel (version WD08): Exchanging Fact-Based Conceptual Data Models”, pp. 2-6 (http://www.factbasedmodeling.org/Data/Sites/1/media/FBM1002WD08.pdf, Fig. 1-1 ff).
name(:101 "Ann Jones") % Relationships as facts
title(:101 Dr) % (happen to be binary)
gender(:101 F)
manages(:101 :102) % Global IDs get ":" prefix
manages(:101 :103)

name(:102 "Sue Wong")
title(:102 Mrs)
gender(:102 F)
reportsTo(:102 :101)
manages(:102 :104)
manages(:102 :105)

name(:103 "John Smith")
title(:103 Dr)
gender(:103 M)
reportsTo(:103 :101)
Fact-Based Model in PSOA RuleML (Objects): Facts

:101#Employee(name->"Ann Jones" % Frames as facts
title->Dr % (OIDs & slots)
gender->F
manages->:102 % "#" for 'member of'
manages->:103)

:102#Employee(name->"Sue Wong"
title->Mrs
gender->F
reportsTo->:101
manages->:104
manages->:105)

:103#Employee(name->"John Smith"
title->Dr
gender->M
reportsTo->:101)
“Each Employee reports to at most one Employee.”

\[
\text{Forall } \text{?e1 } \text{?e2 } \text{?e3} (\quad \% \text{Explicit quantifiers} \\
\text {?e1 } = \text {?e2 } : - \quad \% \text{Prolog-like 'if'} \\
\text{And} (\text{reportsTo} (\text{?e3 } \text{?e1}) \quad \% \text{Prefix-'And'} \\
\text{reportsTo} (\text{?e3 } \text{?e2}) \\
) \\
) 
\]
“Each Employee reports to at most one Employee.”

\[
\text{Forall } ?id1 \ ?id2 \ ?id3 ( \ % "#" \ for 'member of' \\
\text{?id1#Employee} = \ ?id2#Employee \ :- \\
\text{?id3#Employee} (\text{reportsTo}->?id1#Employee \\
\text{reportsTo}->?id2#Employee)
\]
“If employee e1 reports either to employee e2 or to some employee e3 who ultimately (via a chain of one or more intermediate managers) reports to e2 then e1 is a subordinate of e2.”

\[
\text{Forall } ?e1 \ ?e2 \ ?e3 \ ( \\
\quad \text{subordinateOf}(?e1 \ ?e2) \ :- \ \\
\quad \text{Or}(\text{reportsTo}(?e1 \ ?e2) \\
\quad \quad \text{And}(\text{reportsTo}(?e1 \ ?e3) \\
\quad \quad \quad \text{subordinateOf}(?e3 \ ?e2) \\
\quad \quad \quad ) \\
\quad \quad ) \\
\quad ) \\
\)
“If employee id1 reports either to employee id2 or to some employee id3 who ultimately (via a chain of one or more intermediate managers) reports to id2 then id1 is a subordinate of id2.”

\[
\text{Forall } \text{id1} \text{ id2 id3 (}
\text{id1\#Employee(subordinateOf->id2\#Employee) :- Or(id1\#Employee(reportsTo->id2\#Employee) And(id1\#Employee(reportsTo->id3\#Employee id3\#Employee(subordinateOf->id2\#Employee) ) ) ) ) }
\]
Elaborate this sketch of Fact-Based Modeling in PSOA RuleML for an FBM PSOA:

- Make FBM’s fact types available as a new PSOA signature level
- Make PSOA’s translators available to reach new FBM target engines