

Data Systematics: The PSOA RuleML Metamodel Illustrated by Grailog Visualization of Wedding Atoms

(PDF version: ruleml.org/talks/PSOAMetamodelGrailogWedding.pdf)

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Started: 13 July 2018

RULES: Logic and Applications (RULES 2019). NTUA, Athens, Greece, 16-17 December 2019

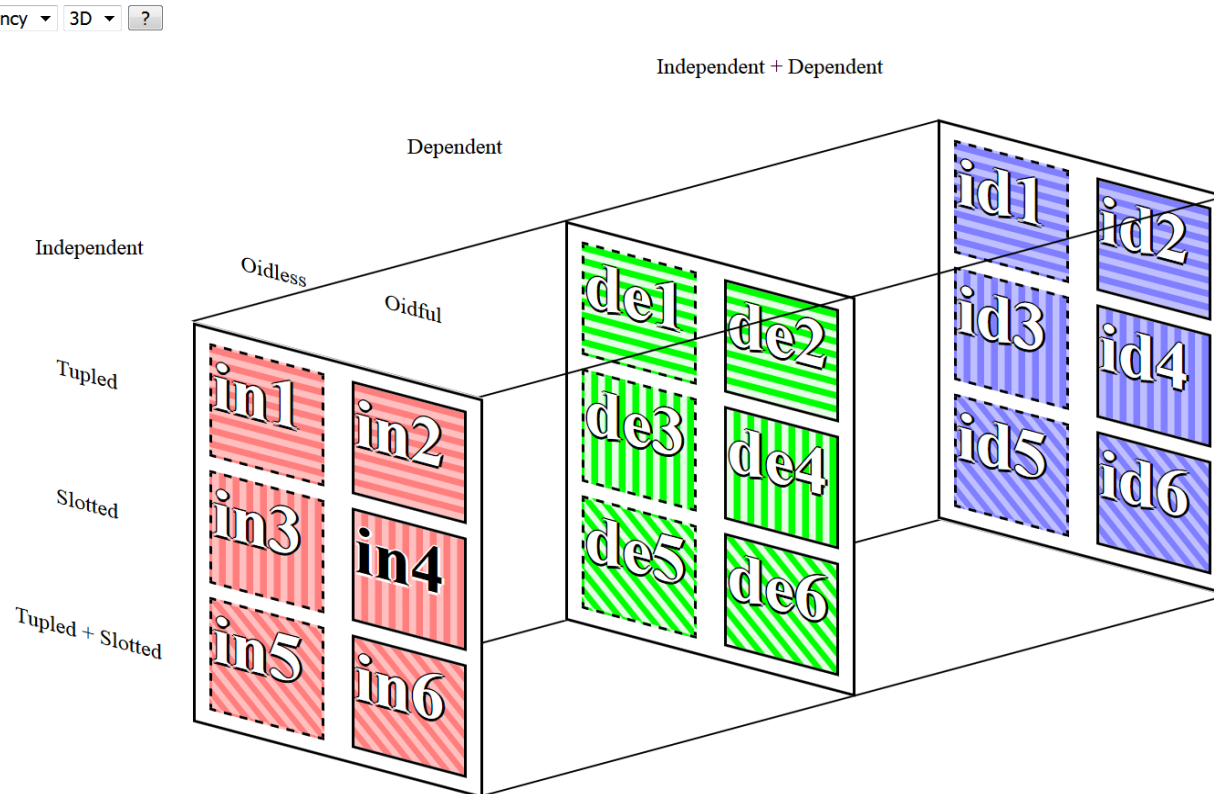
Introduction

- [PSOA RuleML](#) builds on a novel data systematics
- Slicing and dicing the *PSOA metamodel cube* (from [PSOAPerspectivalKnowledge](#), Appendix A)
- Exemplify with oidless/oidful, tupled/slotted/combined, independent/dependent/combined atoms ($2*3*3 = 18$)
- Illustrate all kinds of atoms by [Grailog](#) visualization, realizing them in *presentation syntax* by [PSOATransRun](#)
- Informal syntax templates and English semantics (formal in [PSOAPerspectivalKnowledge](#), Sections 4 and 5)
- Experience full metamodel dynamically by online [PSOAMetaViz](#) visualization, realized in JavaScript/JSON

Slicing and Dicing the PSOA Metamodel Cube

- The **full metamodel** cube, via 3 (orthogonal) dimensions, systematizes 18 kinds of atoms that are contained in 18 unit cubes (units) named *inj*, *dej*, *idj* ($j=1,\dots,6$)
- Choosing one of the reductions DVO, VDO, or OVD (s. below), users can slice and dice the cube, in a kind of (meta)[OLAP](#), initially reducing its 3 dimensions to slices of 2 dimensions:
- **DVO** reduction, via **Dependency** dimension, to 3 slices, each with 6 units structured by **Variety**-row (tupled/slotted/combined) and **OID**-column (oidless/oidful) dimensions:
 - 6 **independent** units *inj* ($j=1,\dots,6$) vs. 6 **dependent** units *dej* ($j=1,\dots,6$) vs. 6 combined independent+dependent units *idj* ($j=1,\dots,6$)
- The **core metamodel** is an 8-unit subcube of the full metamodel cube, which can be reduced, DVO-style, to 2 Dependency slices: *in1-in4* and *de1-de4*
 - Each includes a 'landmark' unit: **framepoint** (*in4*) and **relationship** (*de1*) atoms
- **VDO** reduction (e.g., for full metamodel), via **Variety** dimension, to 3 slices, each with 6 units structured by **Dependency**-row and **OID**-column dimensions:
 - 6 tupled+slotted units *inj*, *dej*, *idj* ($j=5,6$) vs. 6 slotted units *inj*, *dej*, *idj* ($j=3,4$) vs. 6 tupled units *inj*, *dej*, *idj* ($j=1,2$)
- **OVD** reduction (e.g., for full metamodel), via **OID** dimension, to 2 slices, each with 9 units structured by **Variety**-row and **Dependency**-column dimensions:
 - 9 oidful units *inj*, *dej*, *idj* ($j=2,4,6$) vs. 9 oidless units *inj*, *dej*, *idj* ($j=1,3,5$)

The PSOAMetaViz Cube with Current Selection of Framepoint Atoms from Independent Slice



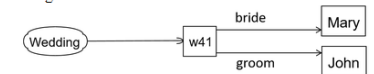
Name:
 Systematic: in4
 Common: framepoints

Dimension:
 Dependency: independent
 Variety: slotted
 OID: oidful

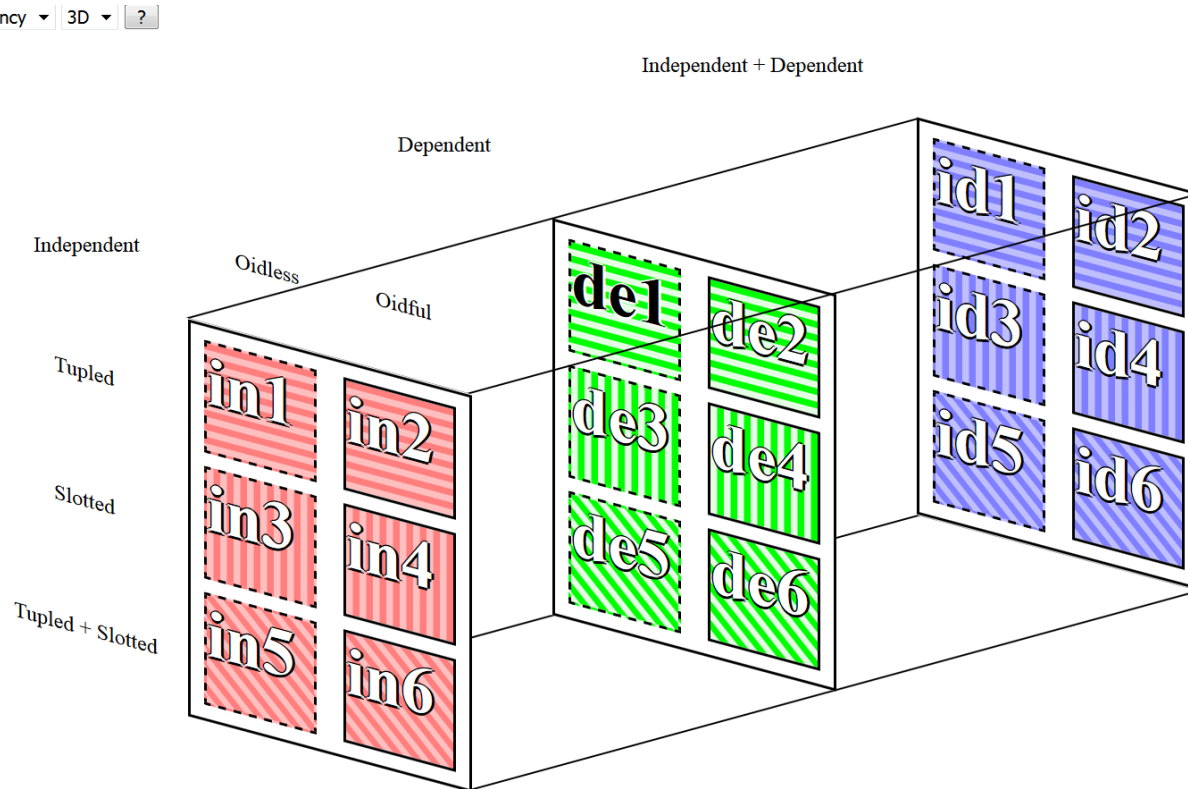
Semantics:
 Explicit OID o; slots $p \rightarrow v$ independent from predicate f

Syntax:
 $o \# f(p \rightarrow v \dots p \rightarrow v)$

Example:
 Symbolic: w41#Wedding(bridge->Mary groom->John)
 Diagram:



The PSOAMetaViz Cube with Current Selection of Relationship Atoms from Dependent Slice



Name:

Systematic: de1

Common: relationships

Dimension:

Dependency: dependent

Variety: tupled

OID: oidless

Semantics:

Implicit existential OID; tuples $+[t \dots t]$ dependent on predicate f

Syntax:

$f(+[t \dots t] \dots +[t \dots t])$

$f(t \dots t)$ or $f(+[t \dots t])$

Example:

Symbolic: $\text{Wedding}(\text{Mary John})$ or $\text{Wedding}(+[\text{Mary John}])$

Diagram:

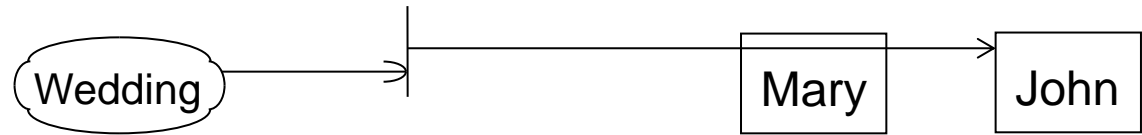


Exemplifying the Dependency Slices

Core oidless/oidful, tupled/slotted atoms that are **independent**:

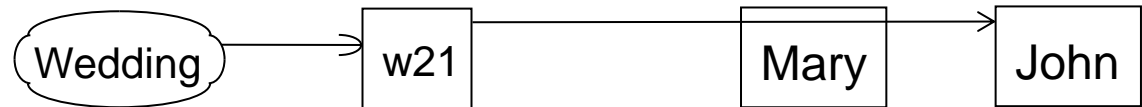
Grailog:

in1. single-tuple:
shelfships



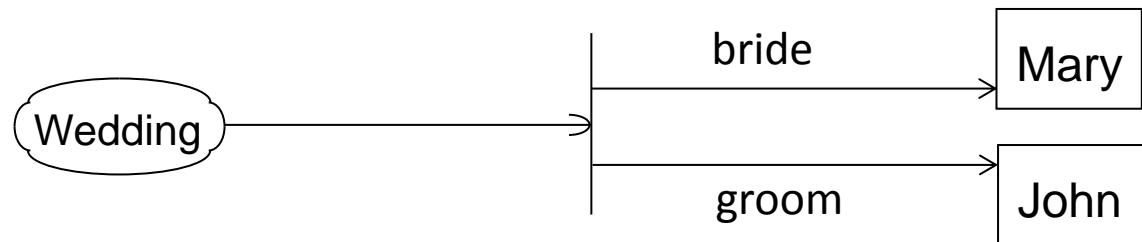
`Wedding(-[Mary John])`

in2. single-tuple:
shelfpoints



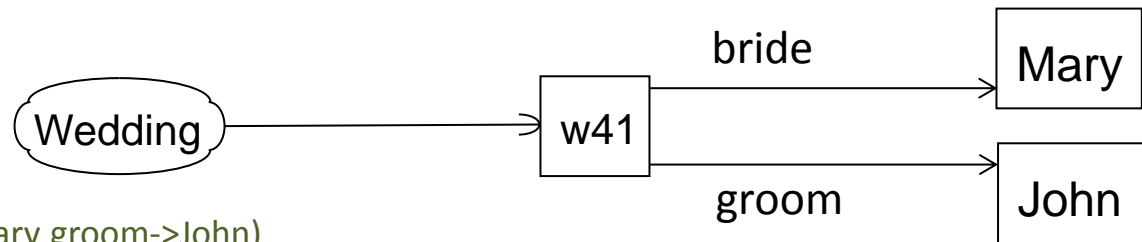
`w21#Wedding(-[Mary John])`

in3. frameships



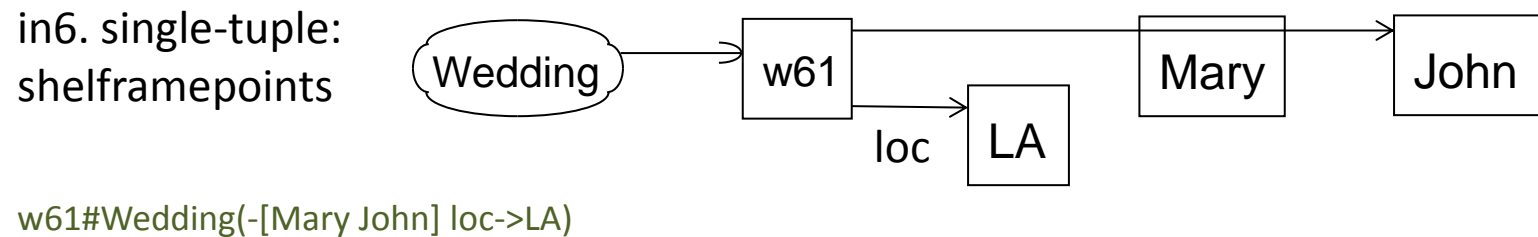
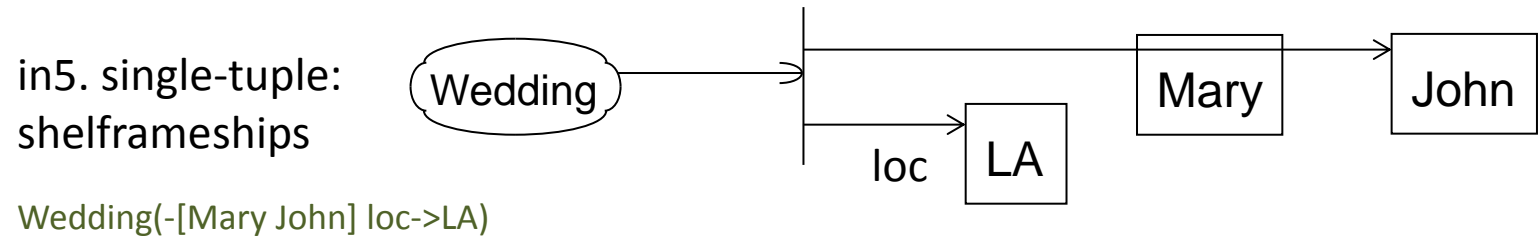
`Wedding(bride->Mary groom->John)`

in4: **framepoints**



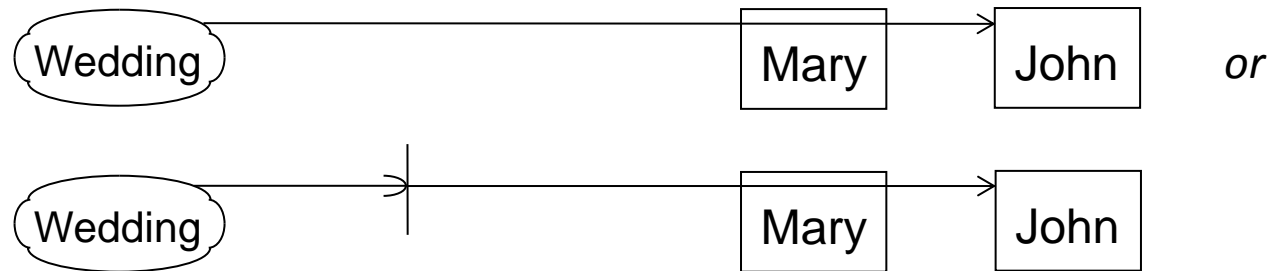
`w41#Wedding(bride->Mary groom->John)`

Extra oidless/oidful, combined tupled+slotted atoms that are **independent**:



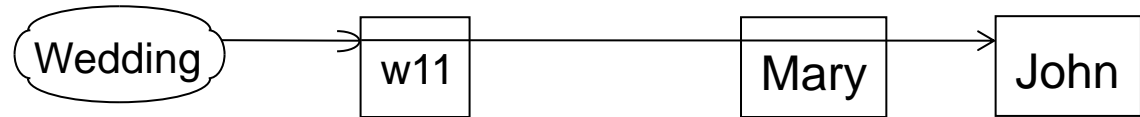
Core oidless/oidful, tupled/slotted atoms that are **dependent**:

de1. single-tuple:
relationships



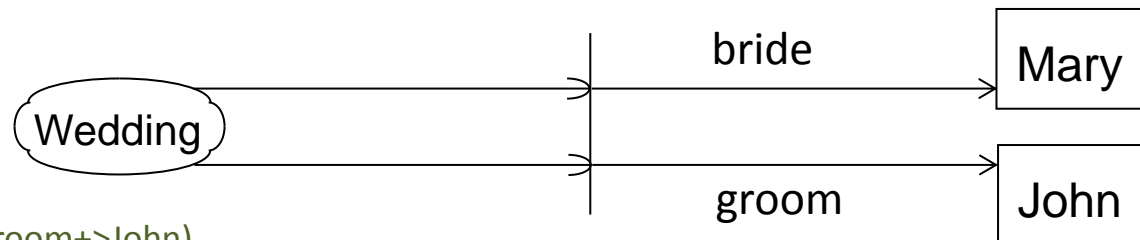
Wedding(Mary John) or Wedding(+[Mary John])

de2. single-tuple:
relationpoints



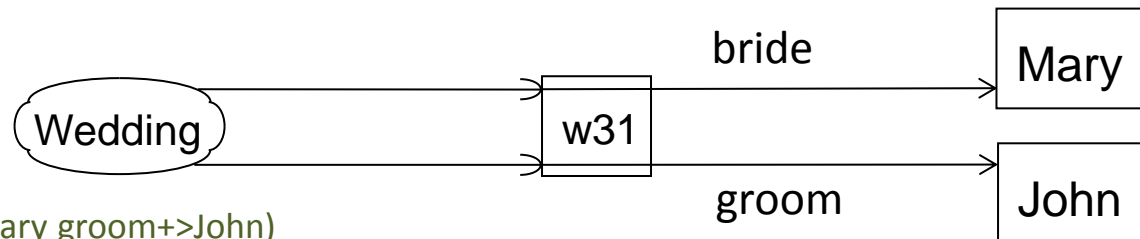
w11#Wedding(+[Mary John])

de3: pairships



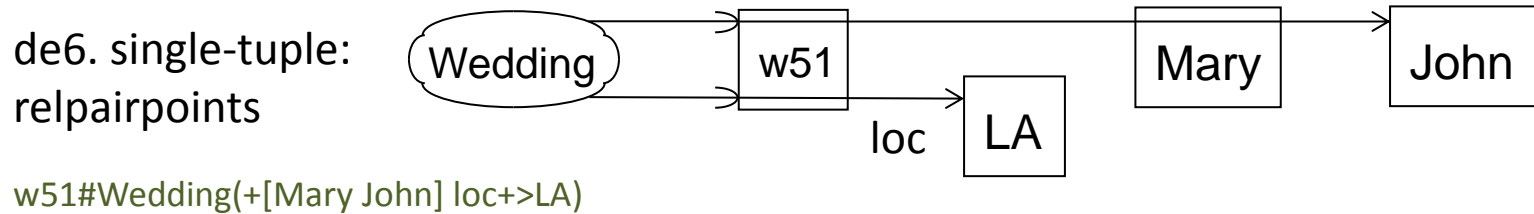
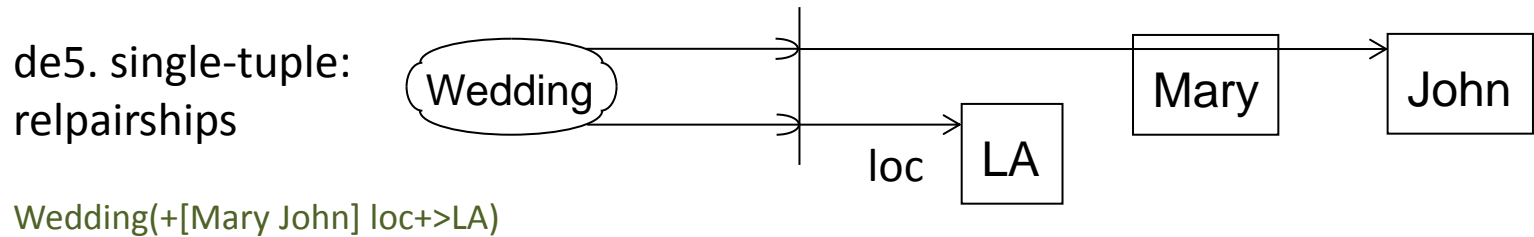
Wedding(bride+>Mary groom+>John)

de4. pairpoints

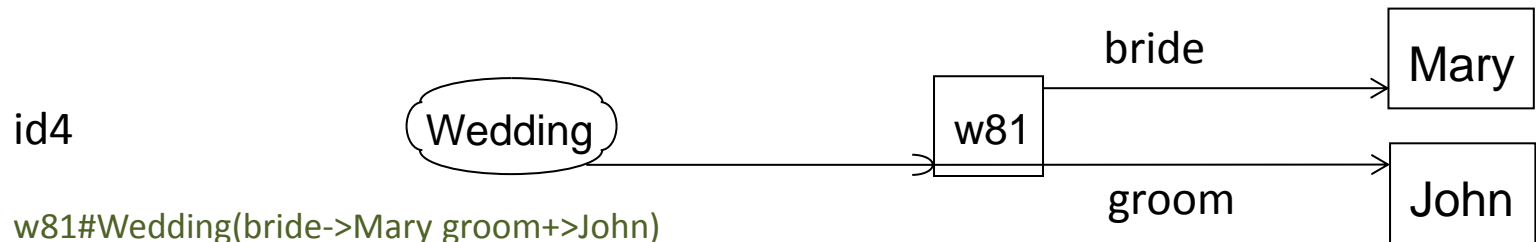
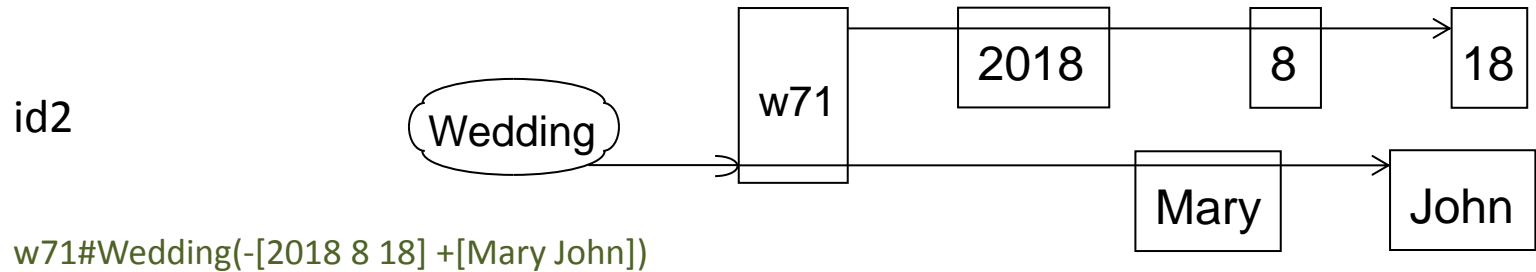
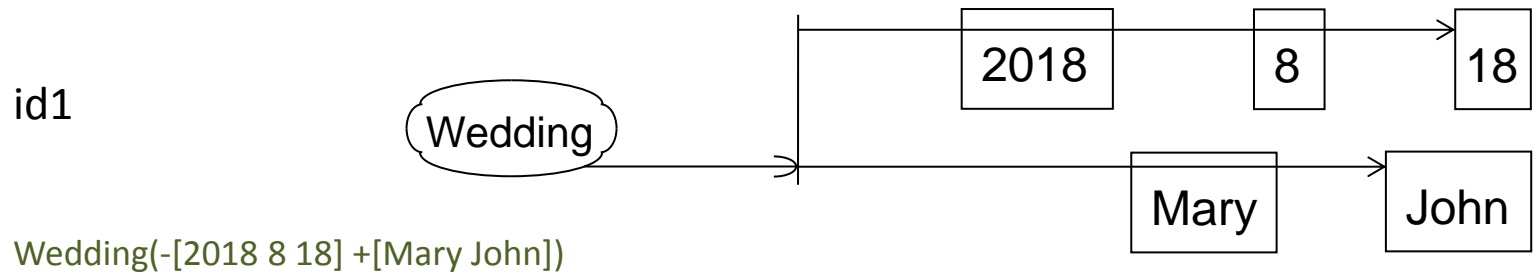


w31#Wedding(bride+>Mary groom+>John)

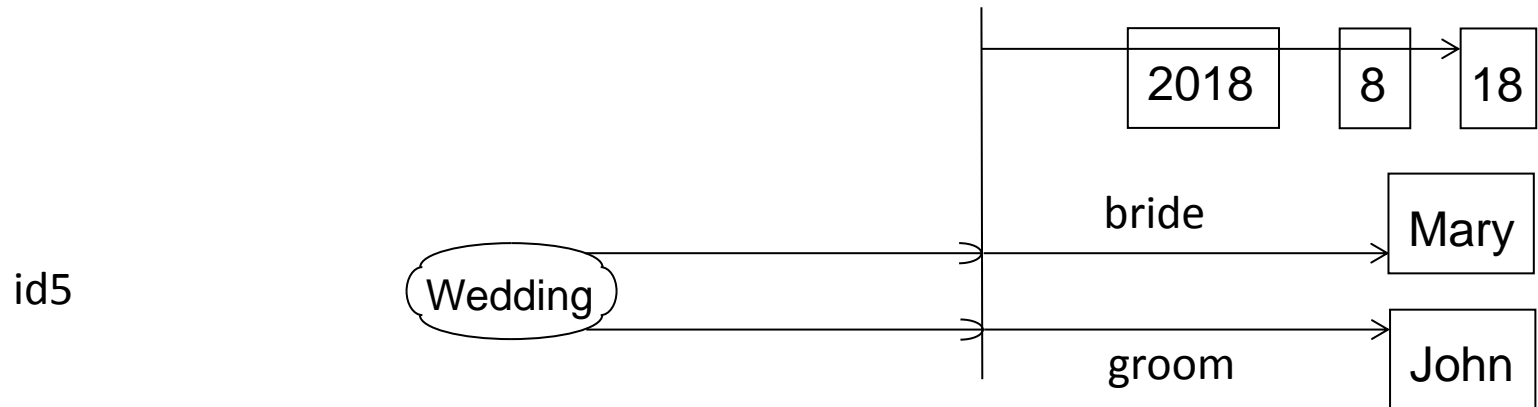
Extra oidless/oidful, combined tupled+slotted atoms that are **dependent**:



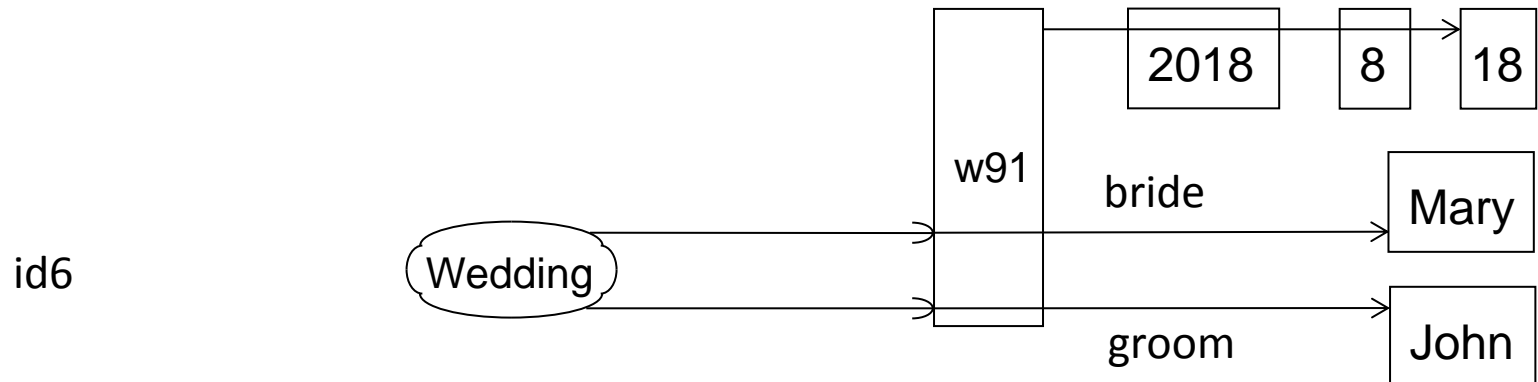
Adding oidless/oidful, tupled/slotted, combined independent+dependent atoms:



Also oidless/oidful, combined tupled+slotted, combined independent+dependent:



Wedding(-[2018 8 18] bride+>Mary groom+>John)



w91#Wedding(-[2018 8 18] bride+>Mary groom+>John)

Syntax and Semantics of Atoms

Core oidless/oidful, tupled/slotted atoms that are **independent**:

in1. single-tuple:

shelfships

$f(-[t \dots t] \dots -[t \dots t])$

Implicit existential OID; tuples $-[t \dots t]$ independent from predicate f

in2. single-tuple:

shelfpoints

$o\#f(-[t \dots t] \dots -[t \dots t])$

$o\#f(-[t \dots t])$

Explicit OID o ; tuples $-[t \dots t]$ independent from predicate f

in3: frameships

$f(p \rightarrow v \dots p \rightarrow v)$

Implicit existential OID; slots $p \rightarrow v$ independent from predicate f

in4: **framepoints**

$o\#f(p \rightarrow v \dots p \rightarrow v)$

Explicit OID o ; slots $p \rightarrow v$ independent from predicate f

Extra oidless/oidful, combined tupled+slotted atoms that are **independent**:

in5. single-tuple:
shelframeships

$f(-[t \dots t] \dots -[t \dots t] p \rightarrow v \dots p \rightarrow v)$

Implicit existential OID; descriptors independent from predicate f

in6. single-tuple:
shelfframepoints

$o\#f(-[t \dots t] \dots -[t \dots t] p \rightarrow v \dots p \rightarrow v)$

$o\#f(-[t \dots t] p \rightarrow v \dots p \rightarrow v)$

Explicit OID o ; descriptors independent from predicate f

Core oidless/oidful, tupled/slotted atoms that are **dependent**:

de1. single-tuple:
relationships

$f(+[t \dots t] \dots +[t \dots t])$

$f(t \dots t) \text{ or } f(+[t \dots t])$

Implicit existential OID; tuples $+[t \dots t]$ dependent on predicate f

de2. single-tuple:
relationpoints

$o\#f(+[t \dots t] \dots +[t \dots t])$

$o\#f(t \dots t) \text{ or } o\#f(+[t \dots t])$

Explicit OID o ; tuples $+[t \dots t]$ dependent on predicate f

de3: pairships

$f(p+>v \dots p+>v)$

Implicit existential OID; slots $p+>v$ dependent on predicate f

de4: pairpoints

$o\#f(p+>v \dots p+>v)$

Explicit OID o ; slots $p+>v$ dependent on predicate f

Extra oidless/oidful, combined tupled+slotted atoms that are **dependent**:

de5. single-tuple:
relpairships

$f(+[t \dots t] \dots +[t \dots t] p+>v \dots p+>v)$

Implicit existential OID; descriptors dependent on predicate f

$f(+[t \dots t] p+>v \dots p+>v)$

de6. single-tuple:
relpairpoints

$o\#f(+[t \dots t] \dots +[t \dots t] p+>v \dots p+>v)$ Explicit OID o ; descriptors dependent on predicate f

Adding oidless/oidful, tupled/slotted, combined independent+dependent atoms:

id1

$f(+[t \dots t] \dots +[t \dots t]$
 $-[t \dots t] \dots -[t \dots t])$

Implicit existential OID; both in/dependent tuples w.r.t. predicate f

id2

$o\#f(+[t \dots t] \dots +[t \dots t]$
 $-[t \dots t] \dots -[t \dots t])$

Explicit OID o ; both in/dependent tuples w.r.t. predicate f

id3

$f(p \rightarrow v \dots p \rightarrow v$
 $p \rightarrow v \dots p \rightarrow v)$

Implicit existential OID; both in/dependent slots w.r.t. predicate f

id4

$o\#f(p \rightarrow v \dots p \rightarrow v$
 $p \rightarrow v \dots p \rightarrow v)$

Explicit OID o ; both in/dependent slots w.r.t. predicate f

Also oidless/oidful, combined tupled+slotted, combined independent+dependent:

id5

$f(+[t \dots t] \dots +[t \dots t]$
 $-[t \dots t] \dots -[t \dots t]$
 $p+>v \dots p+>v$
 $p->v \dots p->v)$

Implicit existential OID; both in/dependent descriptors w.r.t. predicate f

id6

$o\#f(+[t \dots t] \dots +[t \dots t]$
 $-[t \dots t] \dots -[t \dots t]$
 $p+>v \dots p+>v$
 $p->v \dots p->v)$

Explicit OID o ; both in/dependent descriptors w.r.t. predicate f

Conclusions

- Full PSOA metamodel cube visualized dynamically by [PSOAMetaViz](#), and atoms (e.g., data facts) in Grailog, to significantly facilitate learning PSOA RuleML
- Facts complemented by (interoperation) rules:
http://wiki.ruleml.org/index.php/PSOA_RuleML_Bridges_Graph_and_Relational_Databases
(includes core interoperation path de1-de3-de4-in4, e.g. abridged to one PSOA rule)
- Core path augmented to roundtrip between wedding atoms:
http://wiki.ruleml.org/index.php/Exploring_the_PSOA_RuleML_Space_of_Core_Atoms
- PSOA RuleML 1.03 being standardized by Relax NG schemas for XML-serialized facts and rules:
http://wiki.ruleml.org/index.php/PSOA_RuleML#Syntaxes
- PSOA metamodel transferrable to other languages