ODM and Rules - Semantic Enabled Complex Event Processing

Paul Vincent, Business Optimization Group, TIBCO Software

Presenter

- **Paul Vincent**
  - CTO, Business Rules and Complex Event Processing
  - Contributor to standards (OMG PRR Co-Chair, W3C RIF)
  - Contributor to Event Processing research
    - EPTS Reference Architecture Working Group co-chair
    - EPTS Metamodelling Working Group co-chair
  - Co-author http://tibcoblogs.com/cep/
- **TIBCO Software**
  - Largest independent software integration company
  - 3,000 customers in 40 countries using SOA, BPM and Business Optimization
  - Complex Event Processing one of the fast growing trends

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Agenda

1. **Complex Event Processing**
   What is it and where does it fit in the
   IT and semantics worlds?
2. **Semantic Processing and Real-time Event Processing**
   How can semantics assist in
   real-world, real-time event processing?

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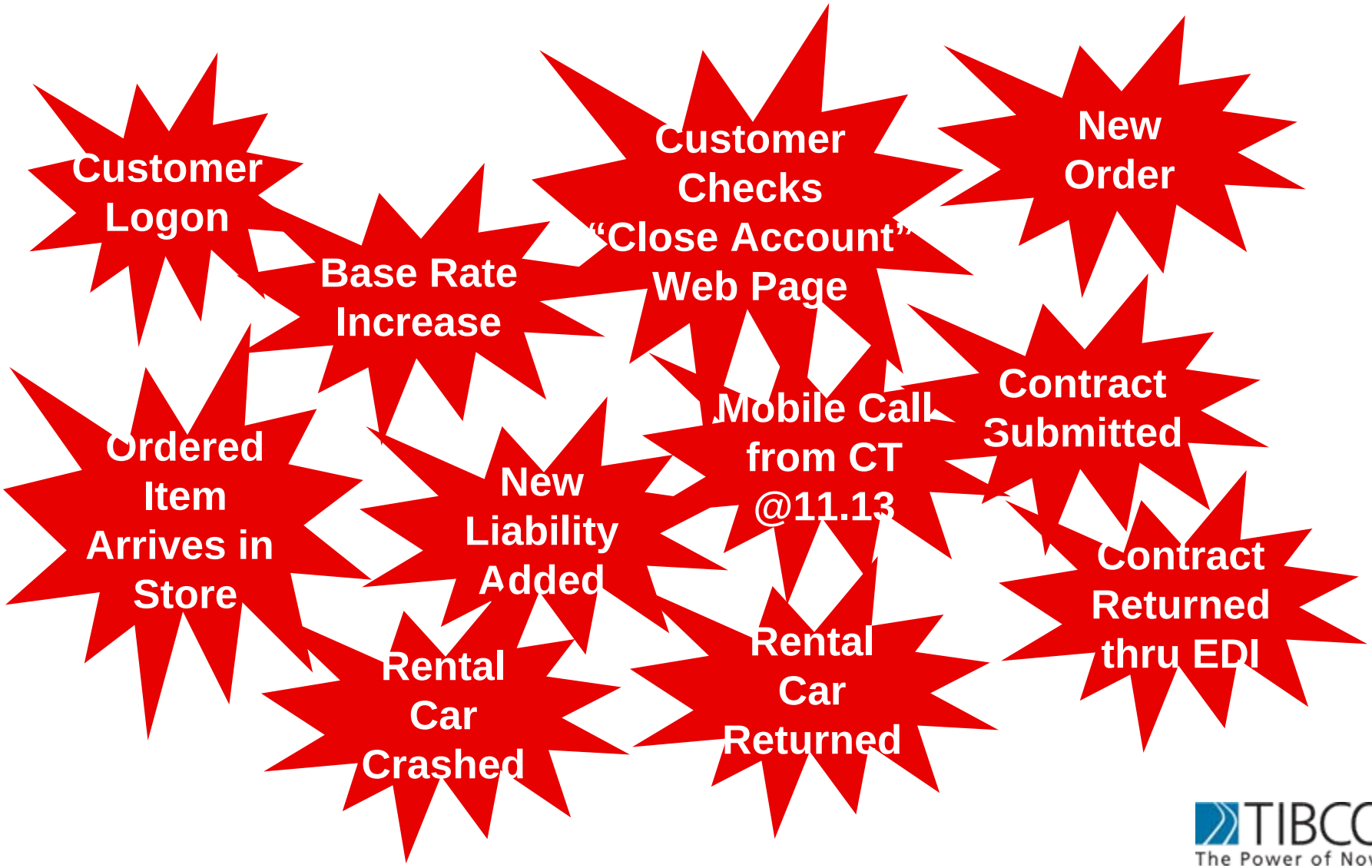
Real-world Events



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Customer Logon
Base Rate Increase
Customer Checks Close Account Web Page
New Order
Ordered Item Arrives in Store
New Liability Added
Mobile Call from CT @11.13
Contract Submitted
Rental Car Crashed
Rental Car Returned
Contract Returned thru EDI


Fraud Risk!
Risk of Customer Defection
Customer CrossSell Opportunity
Change in Product Sales Trend
Stock Capacity trending to limit
Compliance Limit Approached
Cell phone fraud alert
Contract Validated
Rental Contract Complete
Customer now rated Gold
Contract Valid

The Event Cloud

- What **meaning** can we derive from the increasing "cloud of events"?
- Can we **infer** important business events by correlating events automatically + earlier, regardless of source / type?

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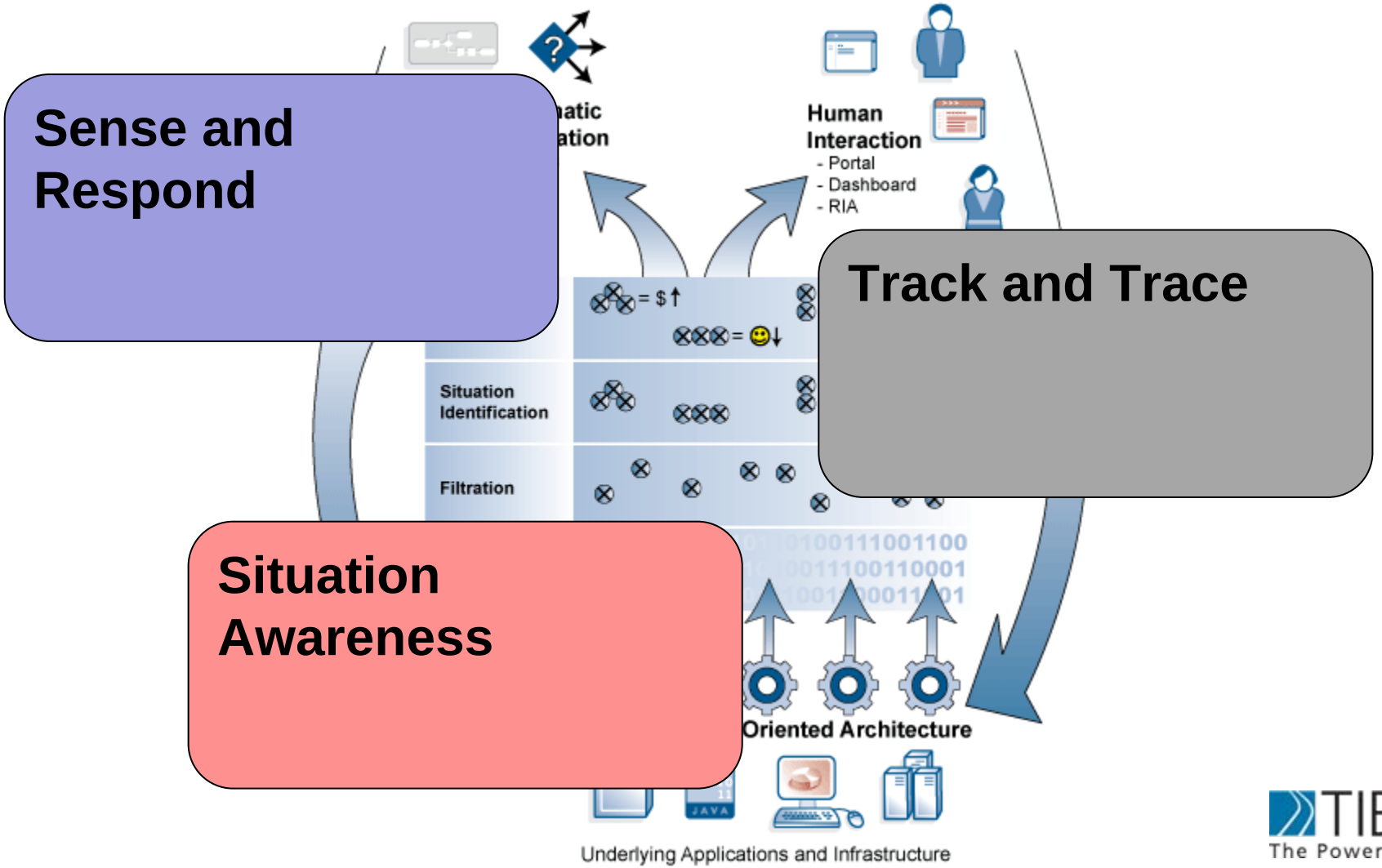
Complex Event Processing



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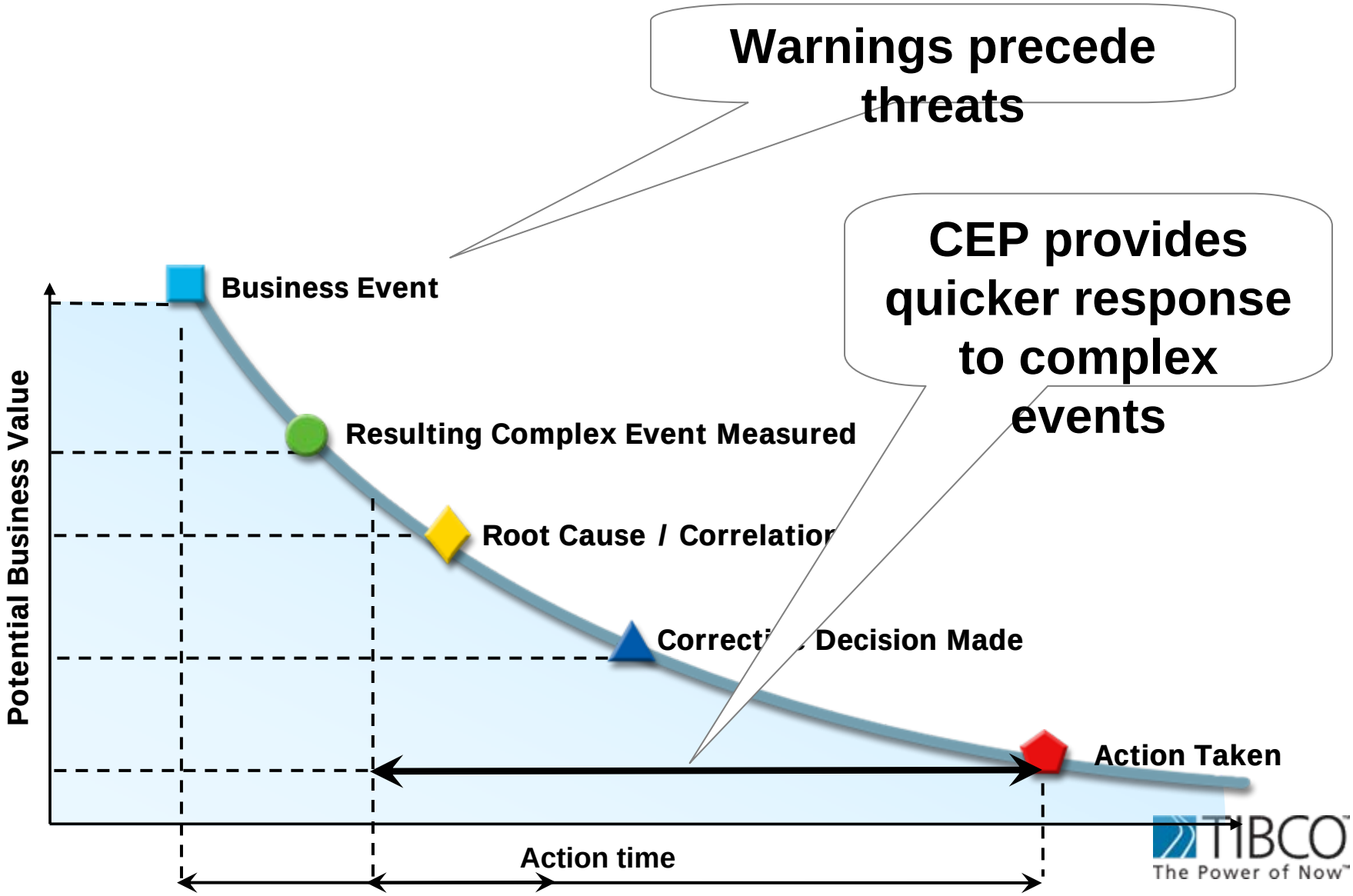
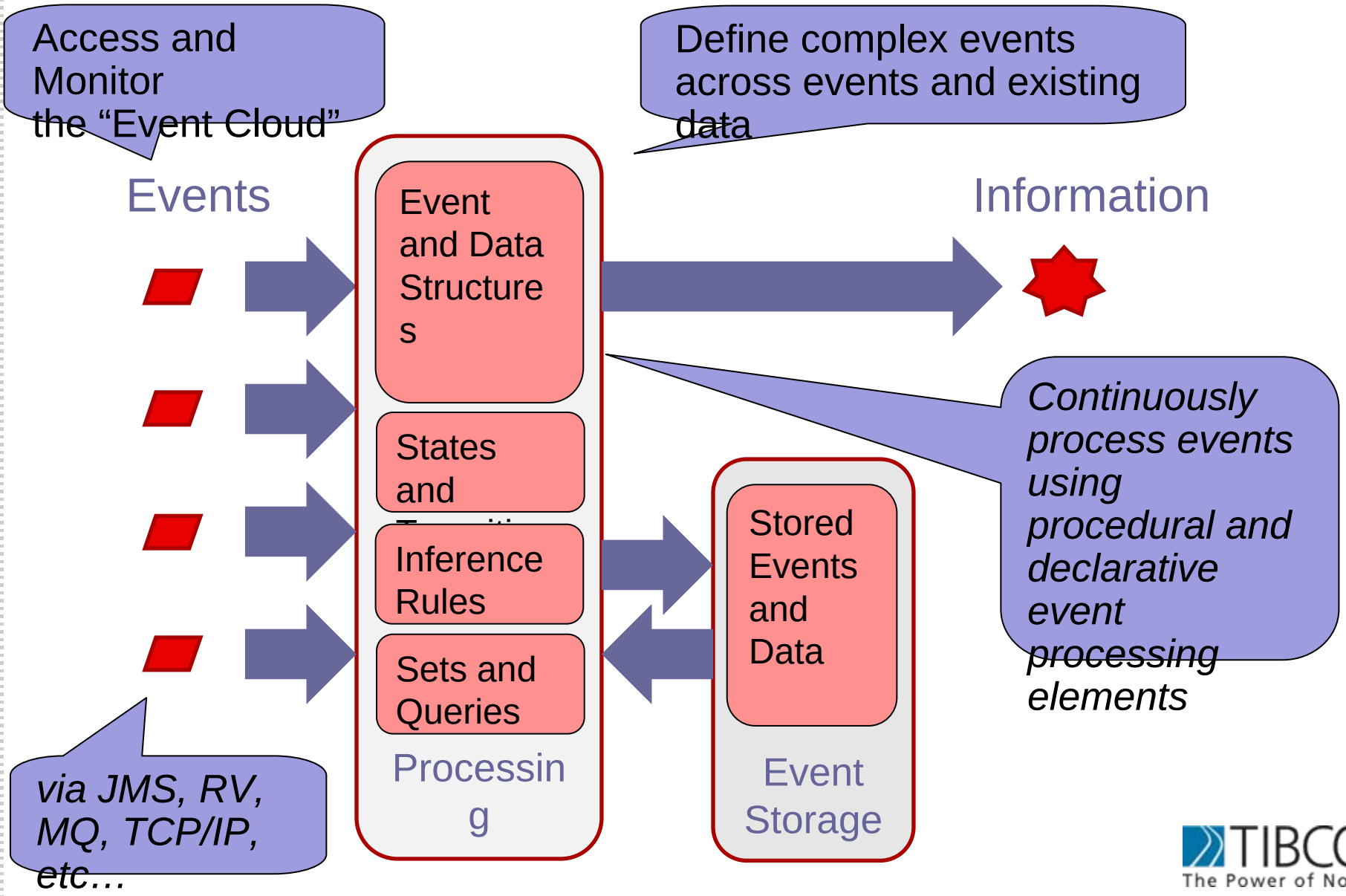
What Does CEP Solve?



Implementing Complex Event Processing



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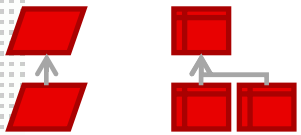
Sample “IT Models” used in CEP



Event Model and Concept Model
for static event and concept relationship

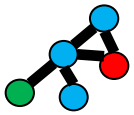
UML Class

UML Event

State Model
for dynamic, time-based concept life

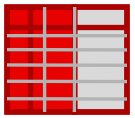
UML State

Query Model
for sets and windows of events and concepts



Rule Model
for patterns of events and co

UML PRR



Decision Model
for managed decision tables

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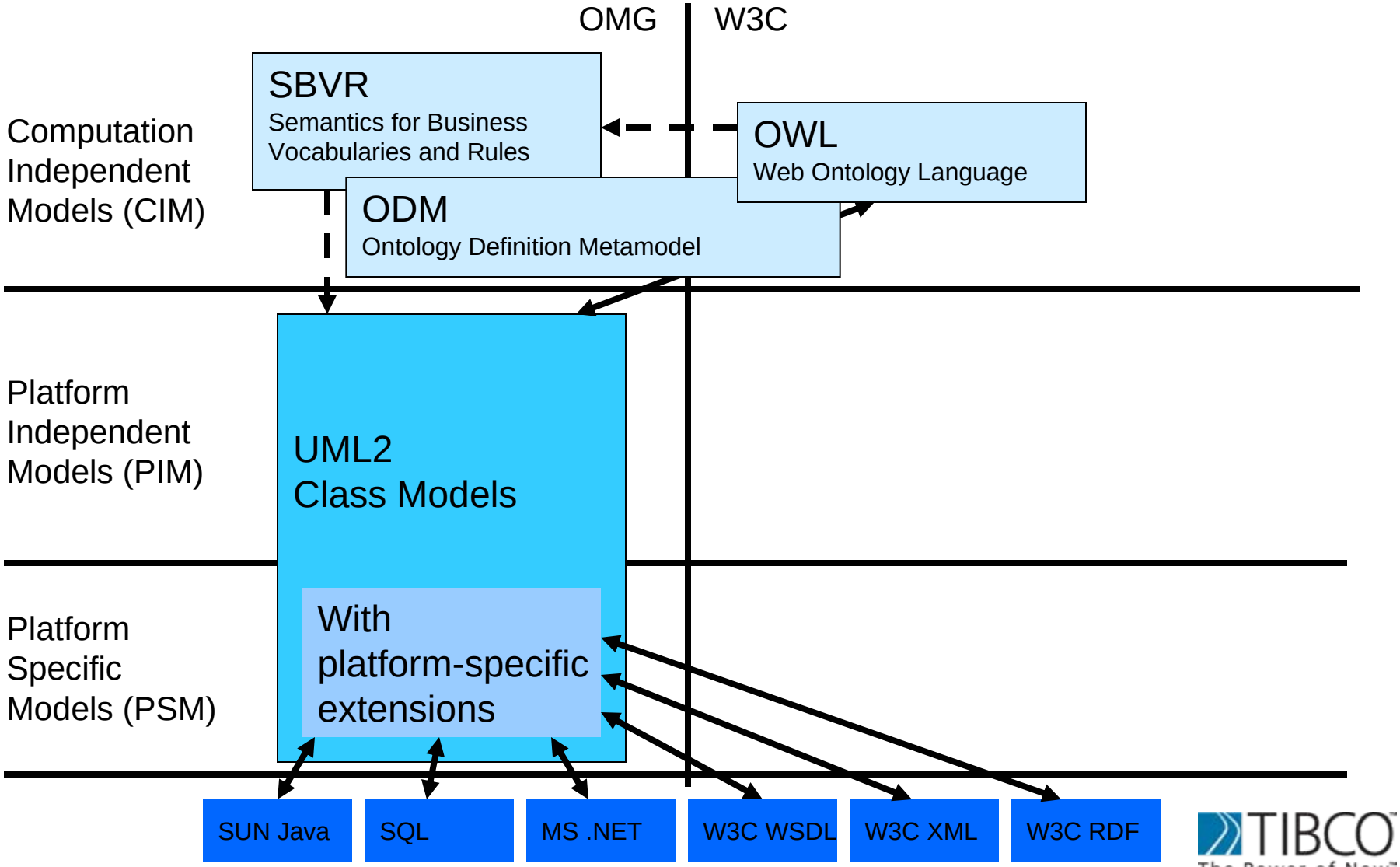
OMG MDA and Class/Object/Data Models



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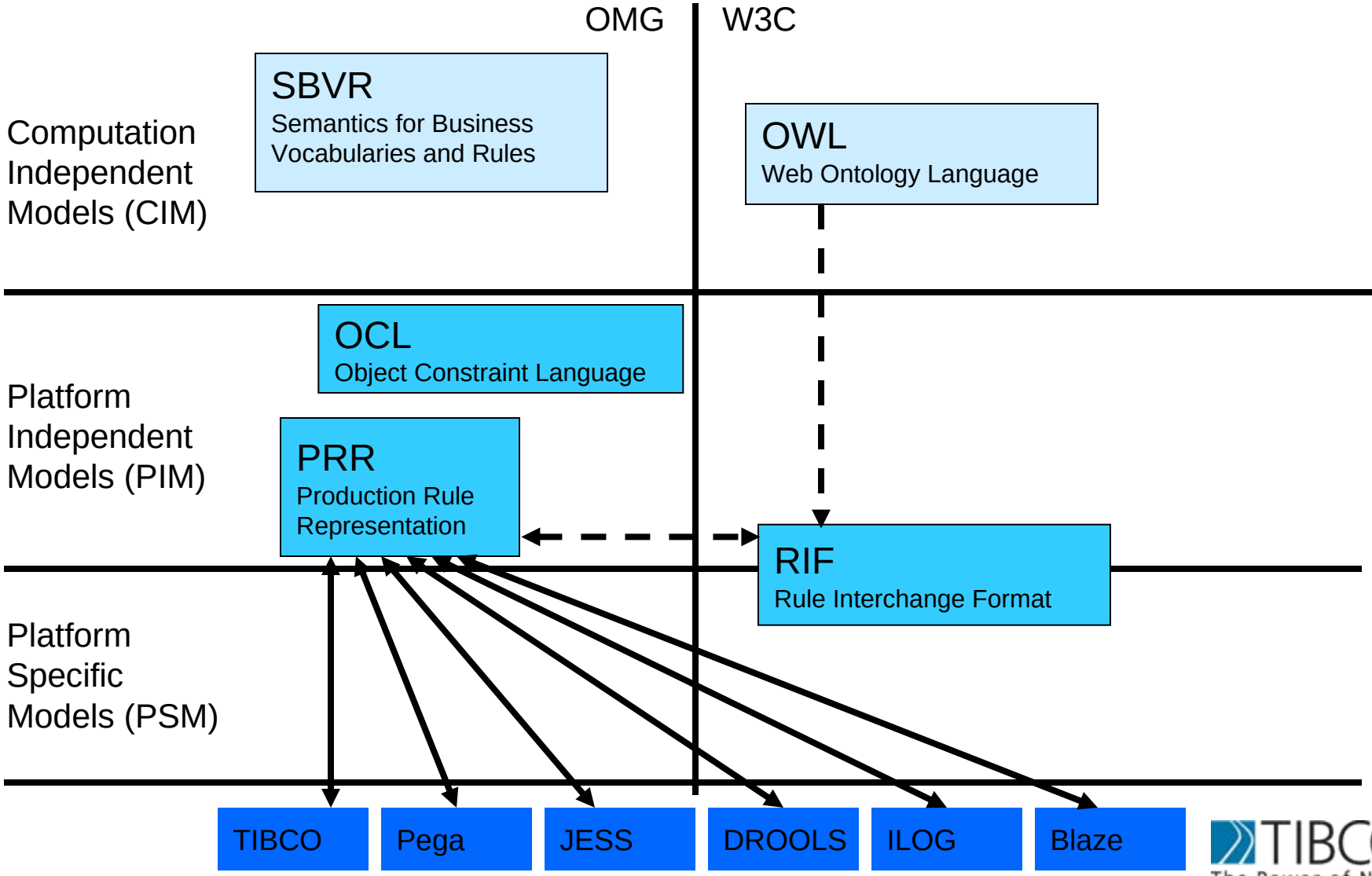
OMG MDA and Rule Models



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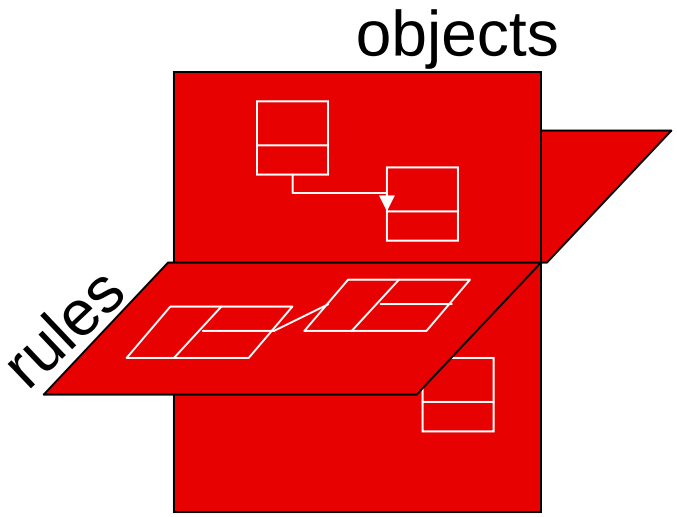
MDA: OMG PRR



- **Formal UML model for production rules**
  - Defined in UML
  - Extends UML so production rules are **1st class citizens** alongside objects
- **Vendor-neutral UML-friendly rule representation**
  - Rules specified via tools, not manually!
- **2 rule "semantics" (types):**
  1. Forward chaining inference rules (e.g. Rete-model)
  2. Sequentially processed procedural rules (e.g. scripts)
- **Import/export for rule modeling**
  - XMI between UML tools and BREs

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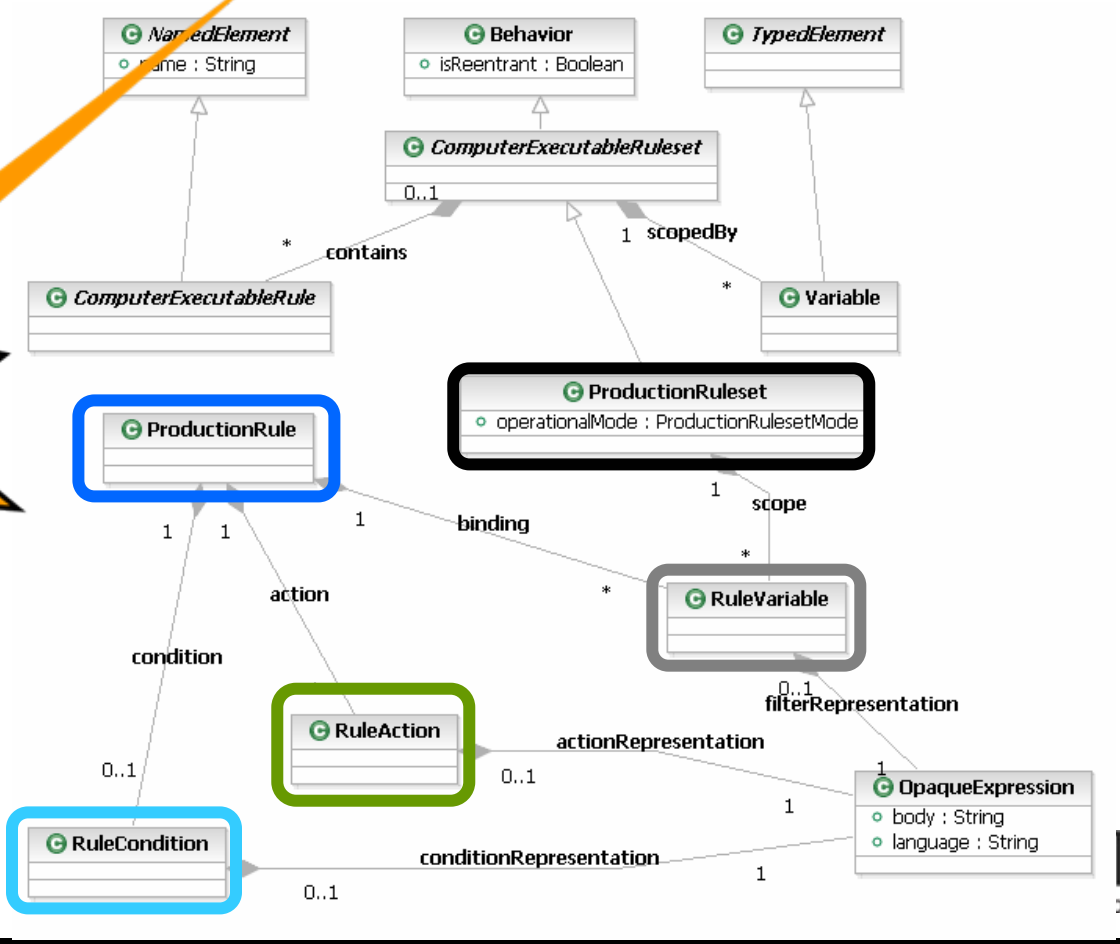
PRR metamodel

- Ruleset = collection of Rule
- Rule is (for RuleVariables) if <Condition> then <Actions>



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Assumptions (1)

- **Most IT processing uses conventional, "fixed" IT models**
  - Knowledge mapped to structured object-oriented structures that run in JVM etc efficiently: changes require recompilation
  - Moving to knowledge-based models (*e.g.* RDF data) for existing applications is too expensive (abstraction, runtime, performance)
  - New IT management capabilities sometimes use RDF/OWL to support dynamic enterprise views & reduce application change time

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Assumptions (2)

- **Knowledge-based solutions may be most valuable when dealing with change / changeable entities / discovery or where flexibility is essential**
  - Business intelligence / discovery activities
  - Complex cross-domain / cross-organizational information-based service delivery
  - Software system development and maintenance

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Assumptions (3)

- **Mitigated today in conventional IT systems through techniques like**
  - Declarative production rules
  - BPM
  - Event driven architecture (type of SOA)

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Assumptions (4)

- **Semantics help in the “software system – person” boundaries, to augment conventional approaches, increase scalability of rule sets, or where reuse potential is high**

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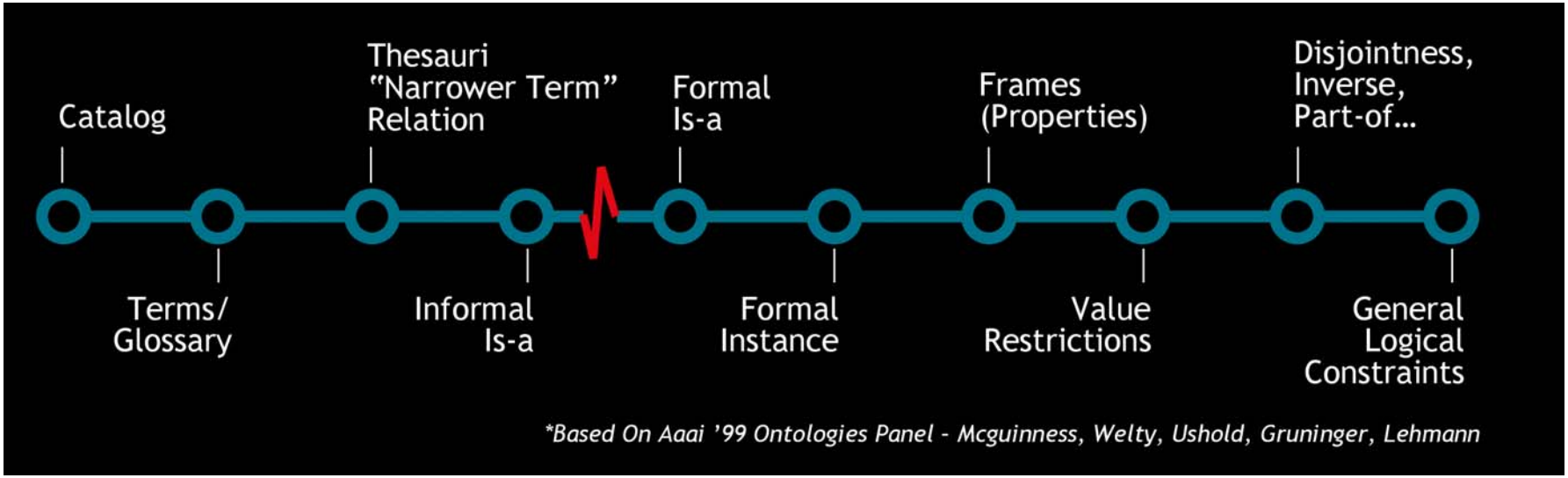
Definitions

An **ontology** specifies a rich, updatable and verifiable description of the

- Terminology, **concepts**, nomenclature
- **Properties** explicitly defining concepts
- **Relations** among concepts (hierarchical and lattice)
- **Rules** to distinguish concepts, refining definitions and relations (constraints, restrictions, regular expressions)

relevant to a particular domain or area of interest.



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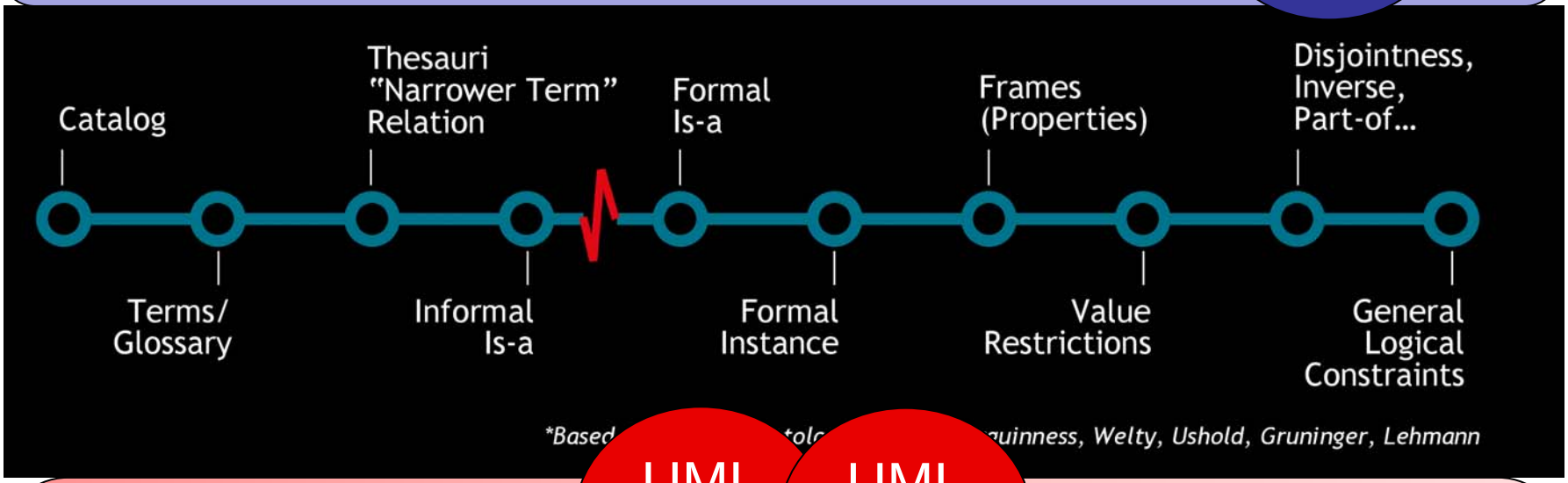
Ontologies versus IT Models

Formal Ontology

UML ODM



IT levels of ontology support

UML Class

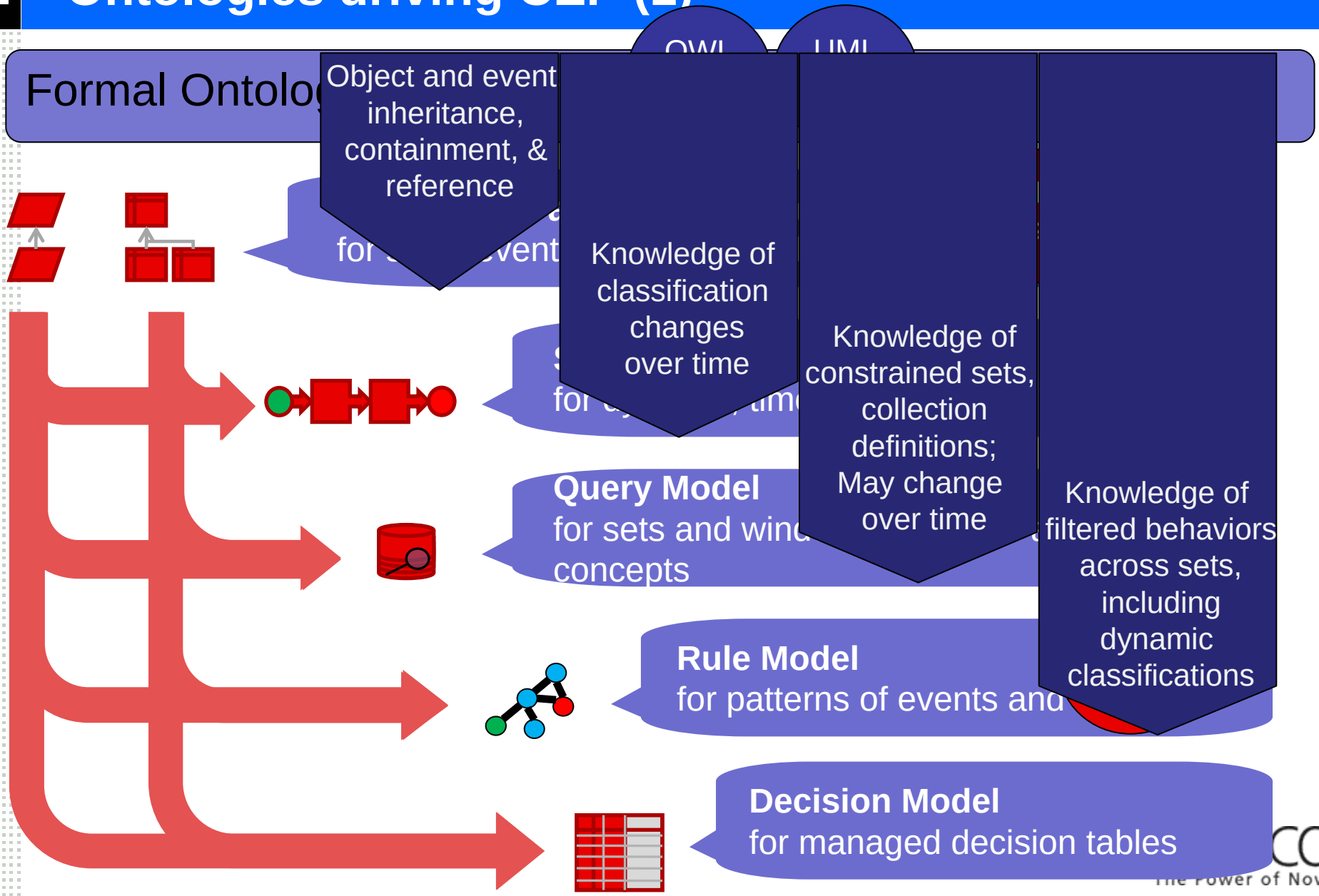
UML Event

UML PRR

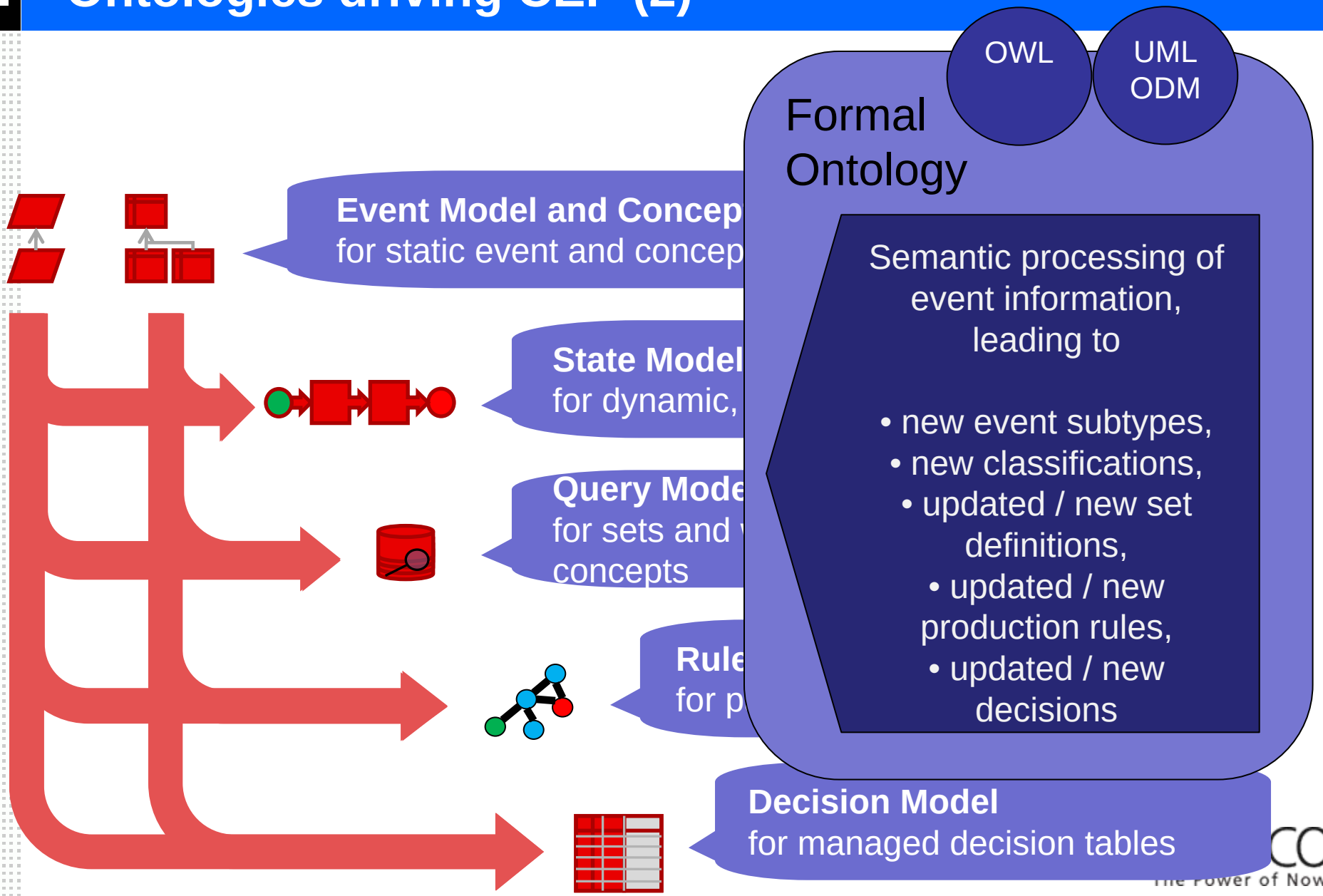
UML State

Querie

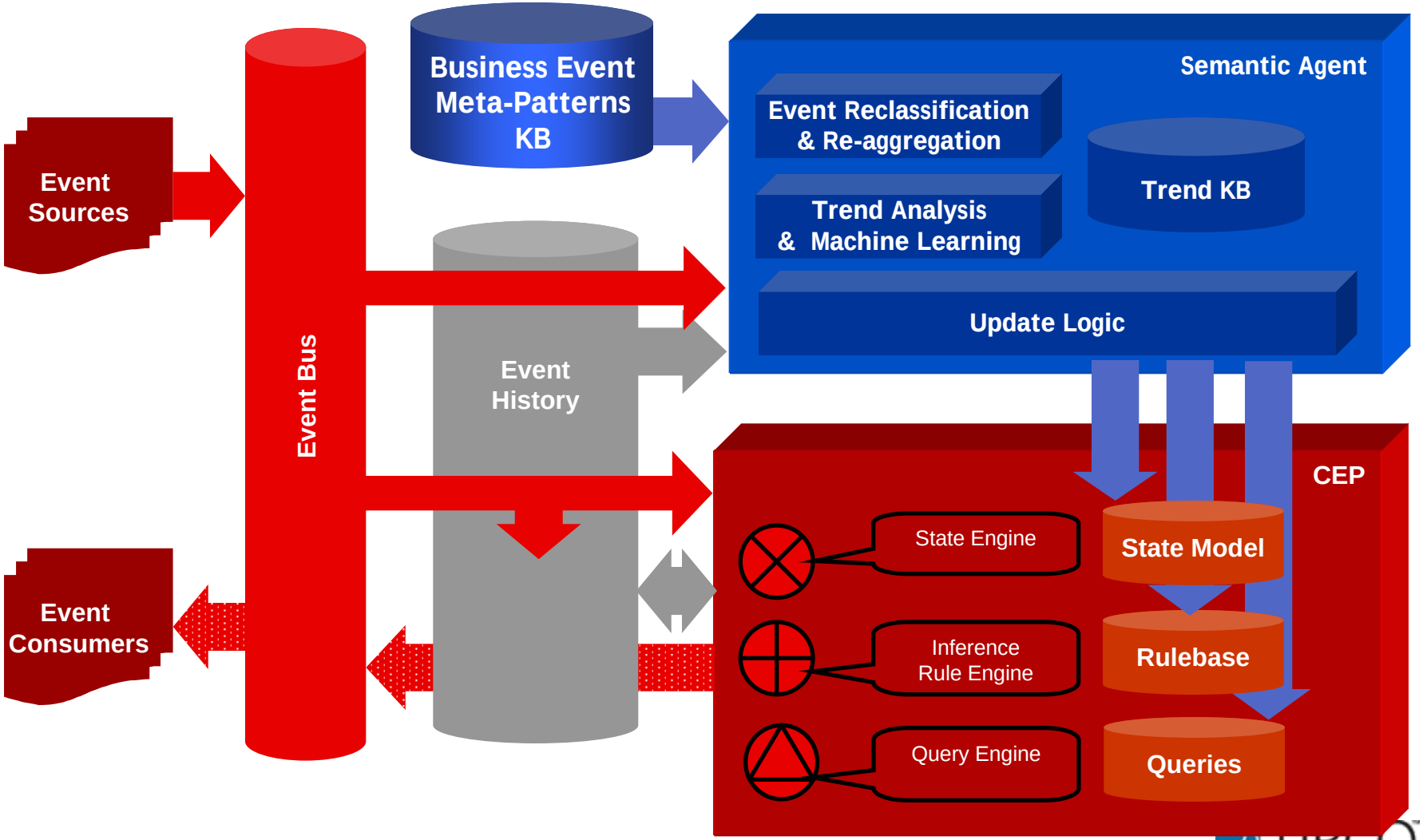
Ontologies driving CEP (1)



Ontologies driving CEP (2)



Semantic CEP Architecture example



Example Semantic CEP roles

- **Update object model and associated metadata**
  (time to live, history depth, etc)
- **Update rule parameters**
  (new / revised classes and subclasses to look for,
  attribute ranges that are significant, etc)
- **Update state model**
  (transition rule values,
  wait times for missing events,
  new conditions,
  eliminate invalidated states, etc)

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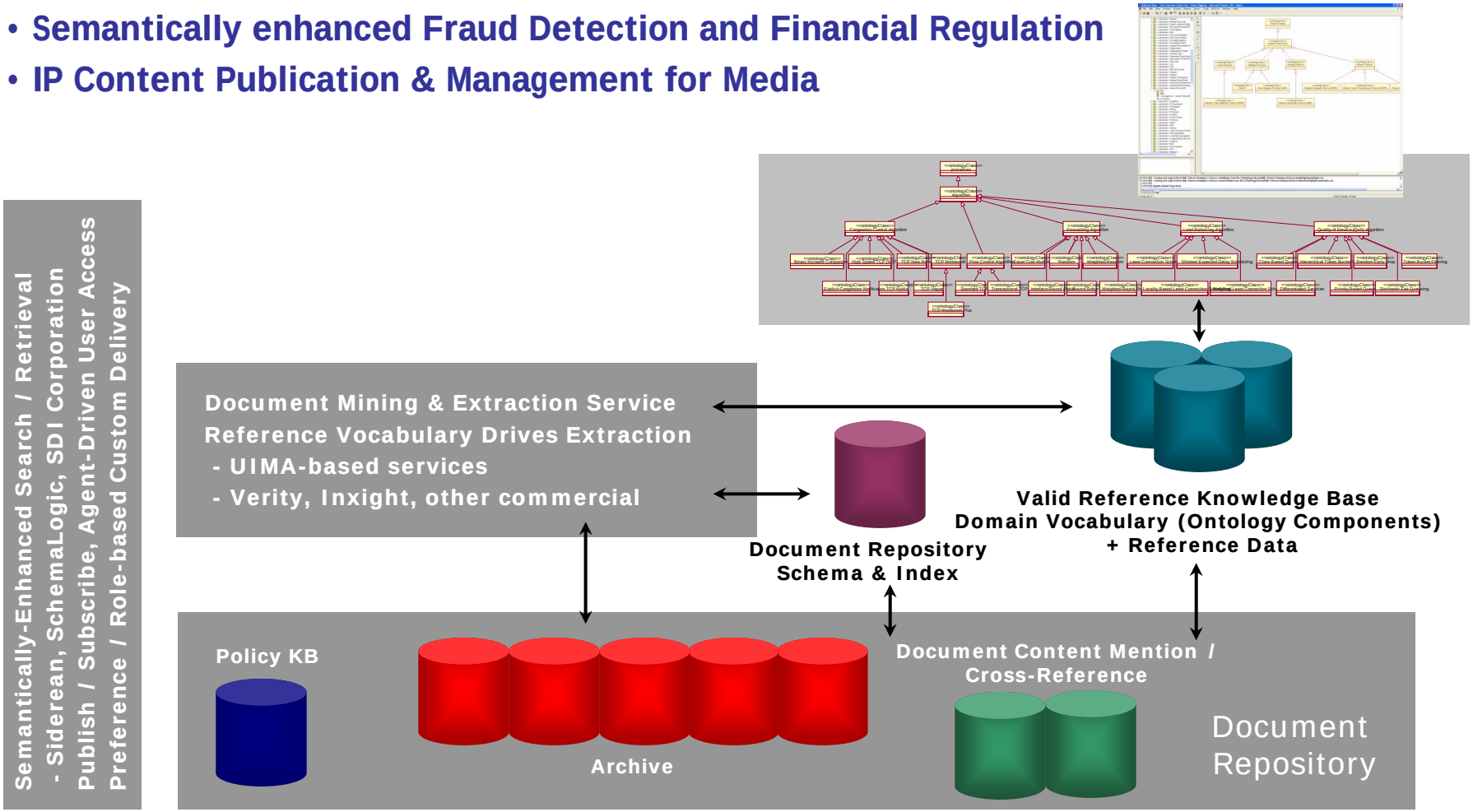
Example Semantic CEP Use Cases

- Call Center / CRM Operations to identify conflicting Client Advisories
- Intelligence Analysis supporting research operations
- Semantically enhanced Fraud Detection and Financial Regulation
- IP Content Publication & Management for Media



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Summary

- **Complex Event Processing**
  - a “new kid” on the IT block
  - using high-performance IT capabilities to provide a continuous event/data aggregation architecture
- **Semantic Extensions**
  - new approaches to bridging the semantic / KR and conventional IT / model-driven worlds
  - convergence with modern IT solutions like CEP

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