

# 11th Protégé Conference

2009

Amsterdam  
Netherlands



## A great year for Protégé

- 11<sup>th</sup> great Protégé Conference
- 21<sup>st</sup> anniversary of PROTÉGÉ I
- 123,612 Protégé registrations
- Major development activities shifting from Protégé 3 to Protégé 4

## Lots of new stuff happening to Protégé

- Even more performance enhancements
- New features that facilitate collaboration
- New Web-based version for Protege
- Amazing new plug-ins for
  - Rules
  - Spreadsheets
  - Cognitive support
- More intergration with technology from the National Center for Biomedical Ontology
- All the work that we will hear about for the first time at this conference!

## Protégé at 21

*Protégé no longer gets carded*

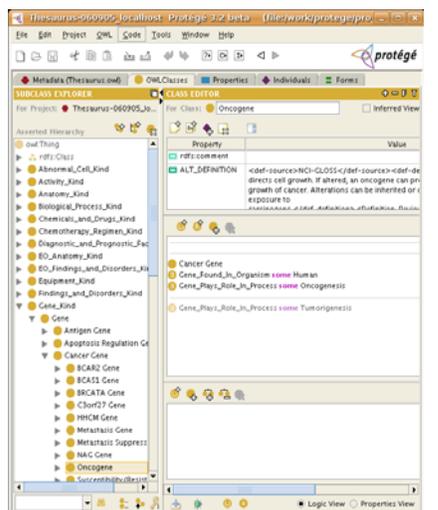
Mark A. Musen  
Stanford Center for Biomedical  
Informatics Research



## The Protégé ontology editor

- Free, open source ontology editor and knowledge-base framework
- Support for different:
  - ontology languages (OWL, RDF(S), Frames)
  - backends: Database, XML, CLIPS, etc.
- Strong user community: more than 123K downloads
- Used widely in academic, government, and industry

<http://protege.stanford.edu>



## PROTÉGÉ-I was build for a different world

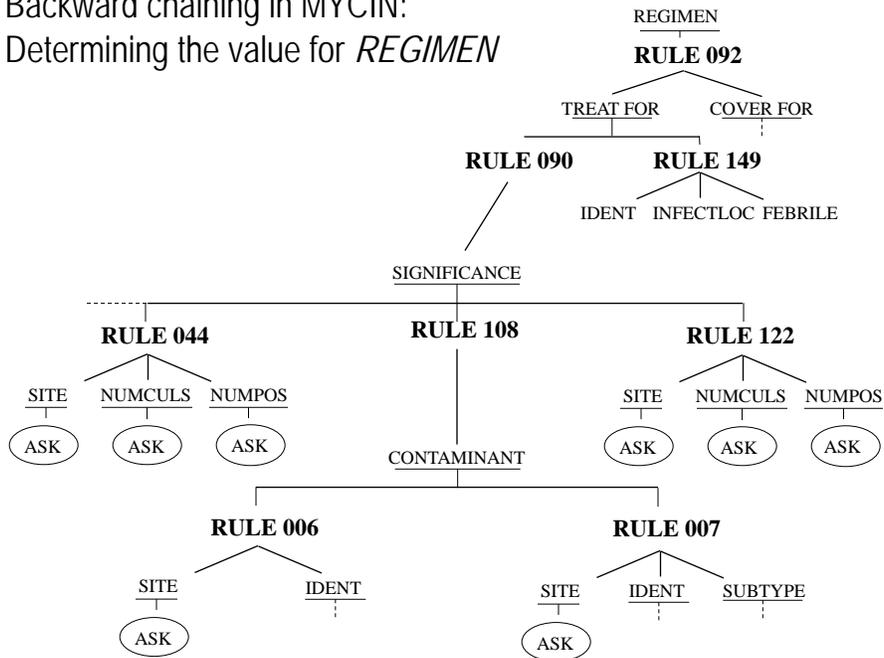
- No Web
- No “agents”
- No notion of ontologies as engineering artifacts
- No standard languages for knowledge representation
- No significant interest in description logic
- Just tons of people trying to build rule-based expert systems—that were failing

## Sample MYCIN Rule

**PREMISE:** (\$AND  
 (SAME CNTXT GRAM GRAMPOS)  
 (SAME CNTXT MORPH COCCUS)  
 (SAME CNTXT CONFORM CLUMPS))  
**ACTION:** (CONCLUDE CNTXT IDENT STAPHYLOCOCCUS  
 TALLY 700)

**IF:** 1) The gram stain of the organism is grampos  
 2) The morphology of the organism is coccus  
 3) The conformation of the organism is clumps  
**THEN:**  
 There is suggestive evidence (.7) that  
 the identity of the organism is staphylococcus

Backward chaining in MYCIN:  
 Determining the value for *REGIMEN*



## Consider this rule ...

IF: (1) A “Complete Blood Count” test is available  
 (2) The White Blood Cell Count is  
 less than 2500

THEN:

The following bacteria might be causing infection:

E. coli,  
 Pseudomonas aeruginosa  
 Klebsiella-pneumonia

## What is implicit in this rule?

- “White Blood Cell count less than 2500”  
*is-a-subclass-of* “immunosuppressed patient,” which *is-a-subclass-of* “compromised host”
- E. coli, Pseudomonas, and Klebsiella are *instances of* “gram negative rod,” which *is-a subclass-of* “bacterium normally found in the gut”
- Unless a Complete Blood Count test has been ordered, it’s pointless to ask the value of the White Blood Cell Count (White Blood Count *is-a-part-of* a Complete Blood Count)

## Some other screening clauses in MYCIN

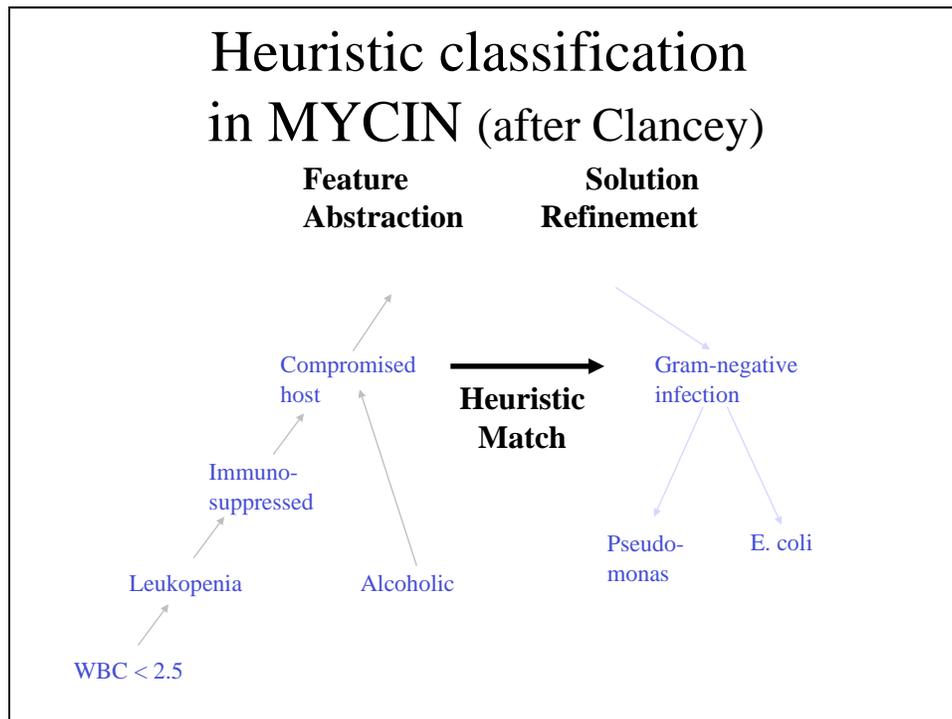
- If the patient has undergone surgery and the patient has undergone neurosurgery, then ...
- If the patient is older than 17 and the patient is an alcoholic, then ...

Screening clauses coerce the system to ask questions in a certain way, while obscuring the knowledge that caused the clauses to be created in the first place.

## Why rule-based systems failed

- A few hundred rules were barely manageable; a few thousand rules were impossible to keep straight.
- Developers “programmed” the systems in nonobvious ways, by tinkering with the order of rules and of clauses
- Developers could rarely tell by inspection how any element of the system contributed to problem solving

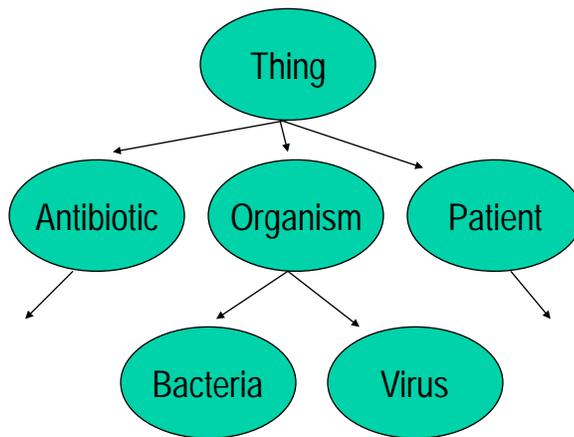
## Heuristic classification in MYCIN (after Clancey)



## Conceptual building blocks for designing intelligent systems

- **Domain ontologies**
  - Characterization of concepts and relationships in an application area, providing a domain of discourse
- **Problem-solving methods (PSMs)**
  - Abstract algorithms for achieving solutions to stereotypical tasks (e.g., constraint satisfaction, classification, planning, Bayesian inference)

For MYCIN, those building blocks would be ...

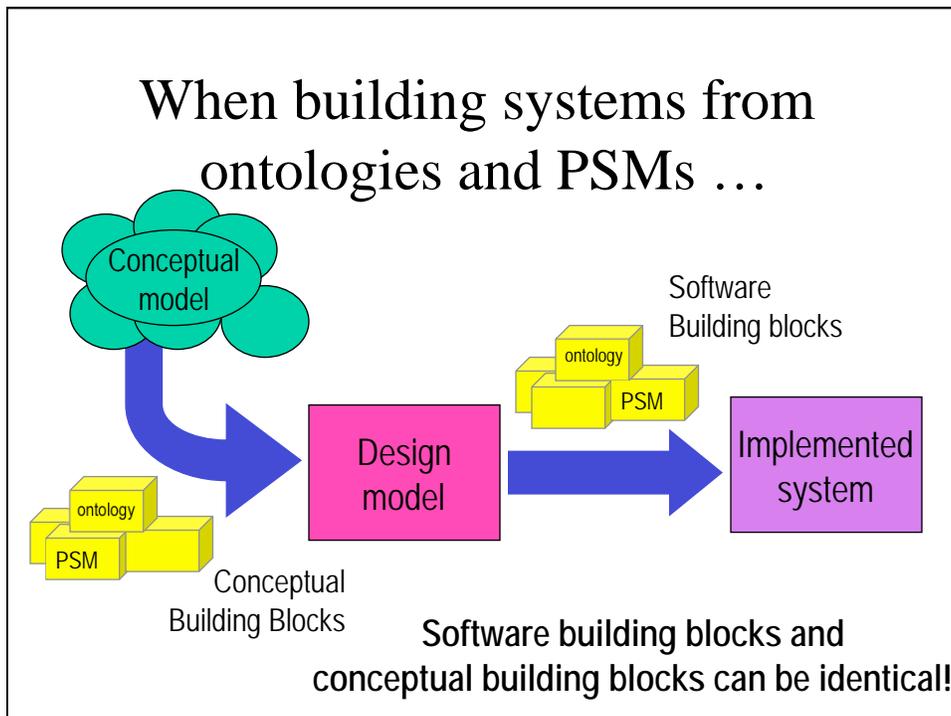
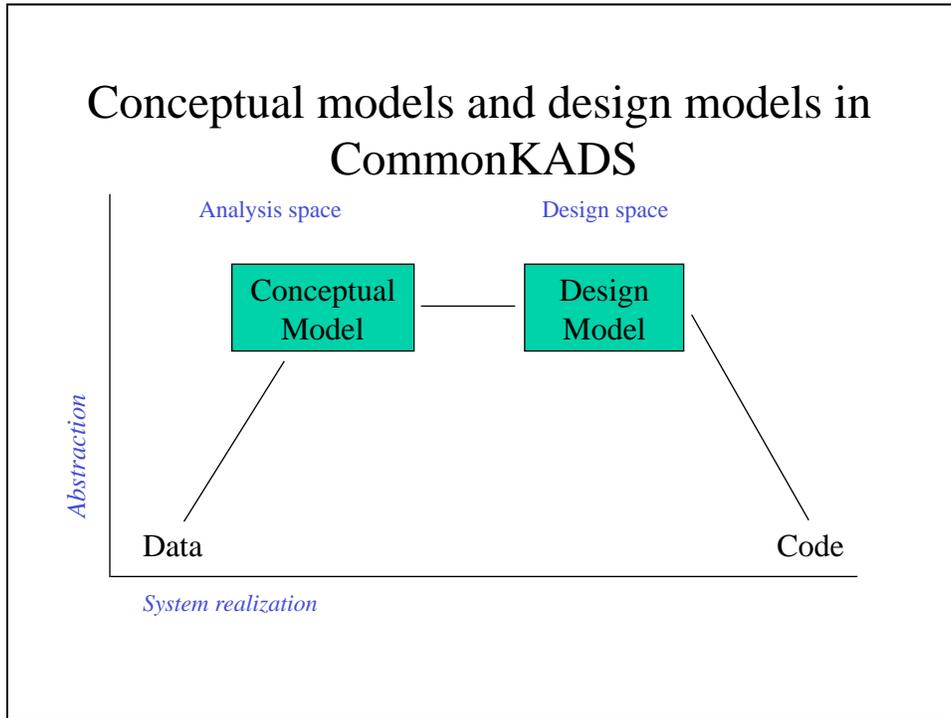


1. An ontology of infectious diseases

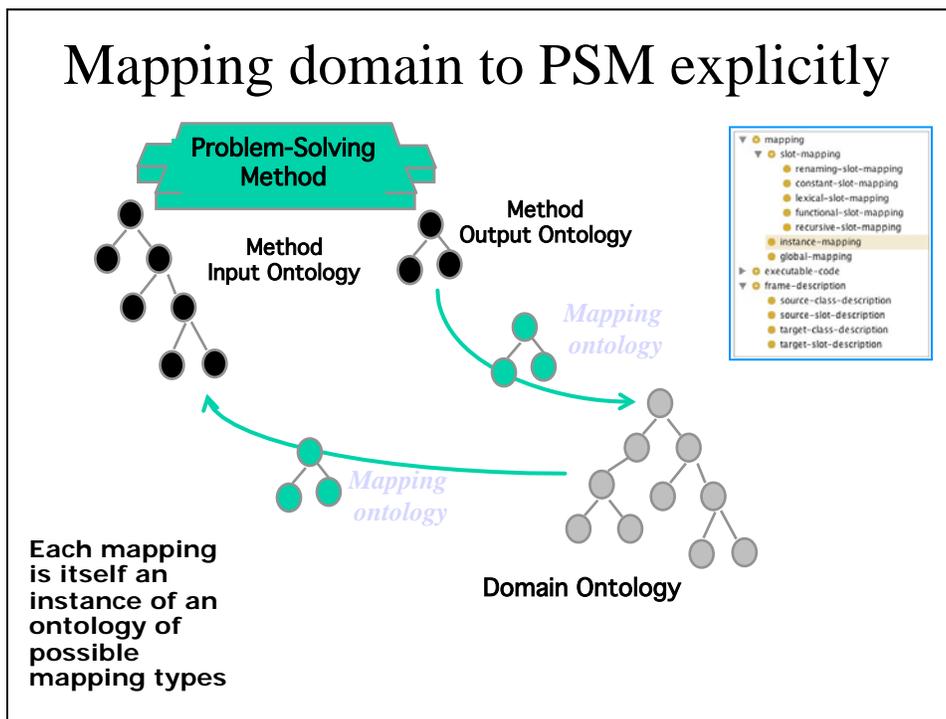
2. A problem-solving method that can use the ontology to identify likely pathogens and to recommend appropriate treatment

## Common KADS

- Result of nearly 20 years of collaborative research in the European Union
- Centered at University of Amsterdam, with dozens of other partners
- Applies principled, software-engineering approach to development of intelligent systems
- De facto software-engineering standard for building intelligent systems



## Mapping domain to PSM explicitly



## User interface from the workstation version of ONCOCIN (ca. 1986)

Cover Sheet									
Case 7 1-89									
Disease Activity									
Hematology									
BSA (m <sup>2</sup> )									
Arm assignment									
Combination Name	POCC	VAM	POCC	POCC	VAM	VAM	VAM	POCC	POCC
Cycle #	1	2	2	2	3	3	3	3	3
Subcycle	B		A	B				A	B
Visit type	TREAT	TREAT	TREAT	TREAT	DELAY	DELAY	TREAT	TREAT	TREAT
Preparations (100 (MG/M <sup>2</sup> ))	200		200	200				200	200
Vincristine (1.5 (MG/M <sup>2</sup> ))	2.0		1.5	2.0				2.0	2.0
Cyclophosphamide (1300 (MG/M <sup>2</sup> ))	1300		1300	1300				1300	1300
Docetaxel (80 (MG/M <sup>2</sup> ))			130	0				130	
VPTB (75 (MG/M <sup>2</sup> ))		170					130		
Xelrepin (80 (MG/M <sup>2</sup> ))		110					80		
Metoprolol (50 (MG/M <sup>2</sup> ))		85					41		
Radiotherapy									
Symptom Review									
Toxicity									
Physical Examination									
Chemistry									
To order: Labs and Procedures									
To order: Nuclear Medicine and Tomography									
Scheduling									
Day	6	27	20	31	24	1	8	29	5
Month	Feb	Feb	Mar	Mar	Apr	May	May	May	Jun
Year	86	86	86	86	86	86	86	86	86

## A rule from an early version of ONCOCIN (ca. 1980)

### **RULE075**

To determine the attenuated dose for drugs in MOPP chemotherapy  
or for all drugs in PAVe chemotherapy

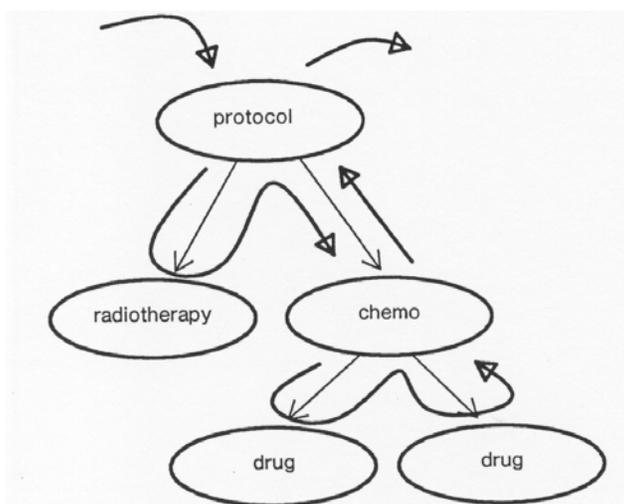
### **IF:**

- 1) This is the start of the first cycle after a cycle as aborted, and
- 2) The blood counts do not warrant dose attenuation

### **THEN:**

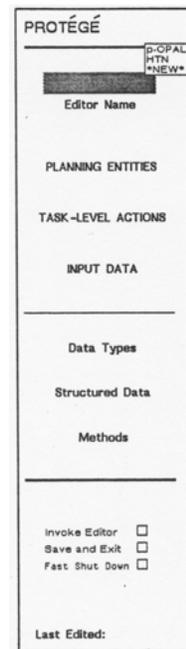
Conclude that the current attenuated dose is 75% of the previous  
dose

## Episodic Skeletal Plan Refinement was the Problem Solver used with PROTÉGÉ I



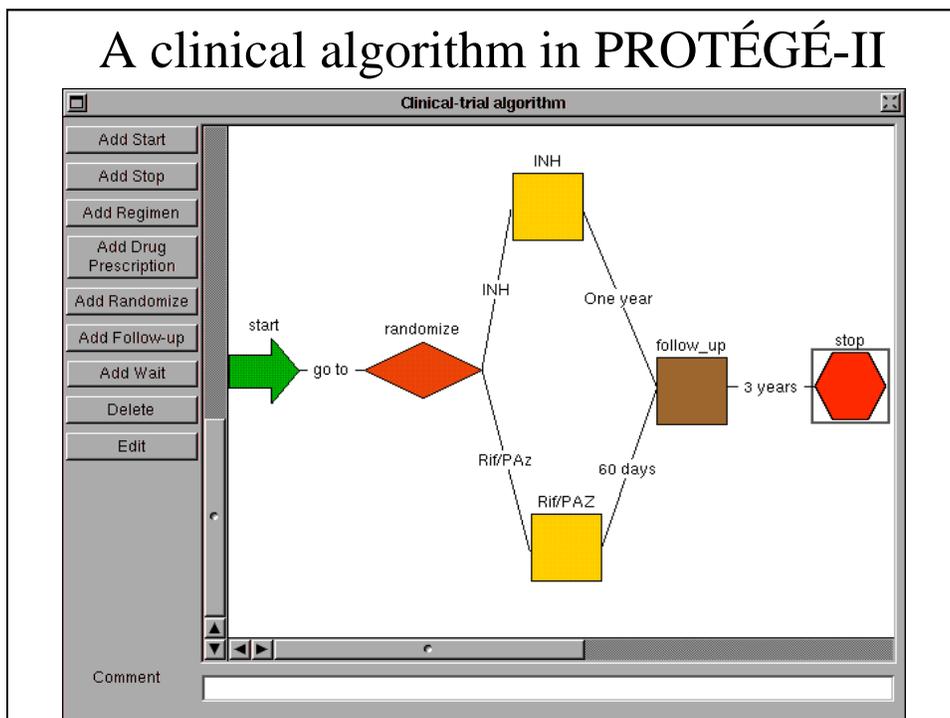
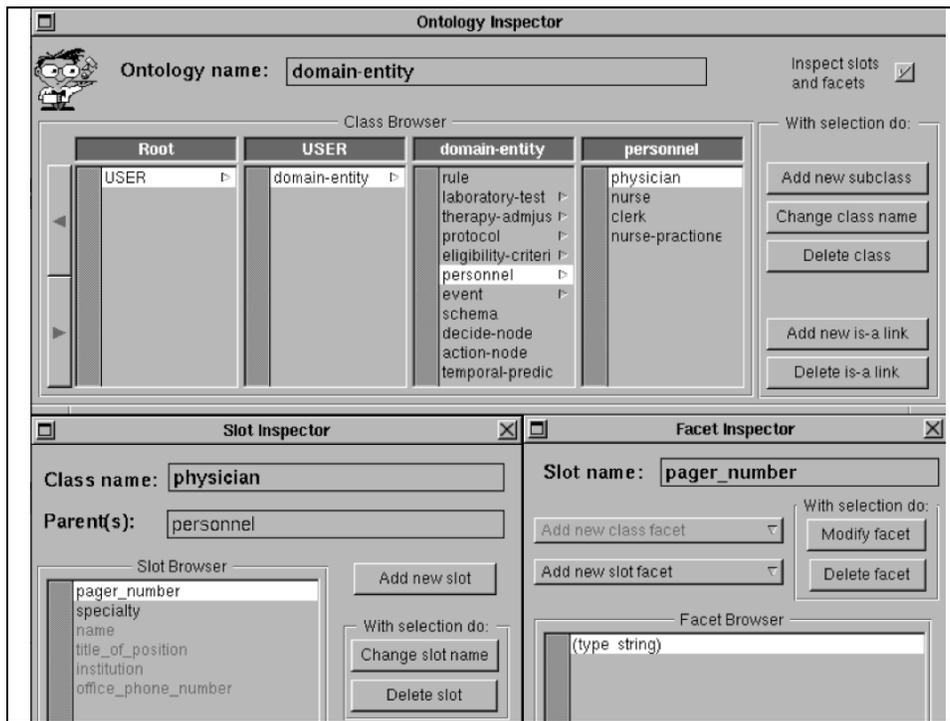
## PROTÉGÉ I construed problem solving as the interplay of

- A hierarchy of **plans** that might be invoked
- **Actions** that could affect the way in which the planning would take place
- **Data** input from the environment that might directly or indirectly predicate the plans to be involved or the actions to take

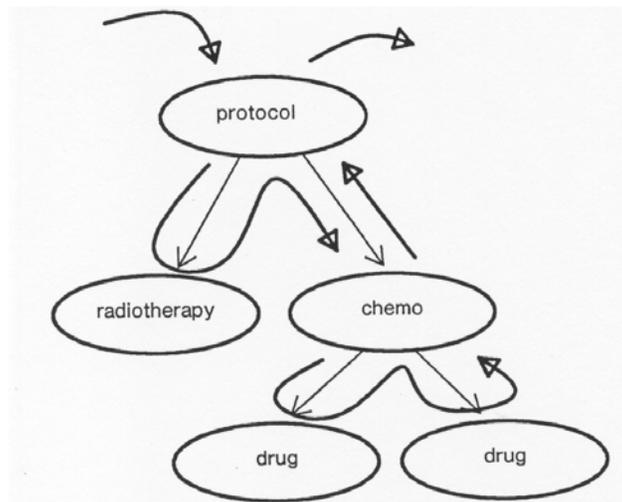


## The Next Step: PROTÉGÉ-II

- Made ontologies explicit with a separate ontology editor
- Supported arbitrary problem-solving methods—dropped the dependence on ESPR
- Allowed sophisticated facilities for generating knowledge-acquisition interfaces based on the domain ontology
- Took advantage of sophisticated NeXTSTEP object-oriented UI system
- First tool to use the Protégé nerd icon!



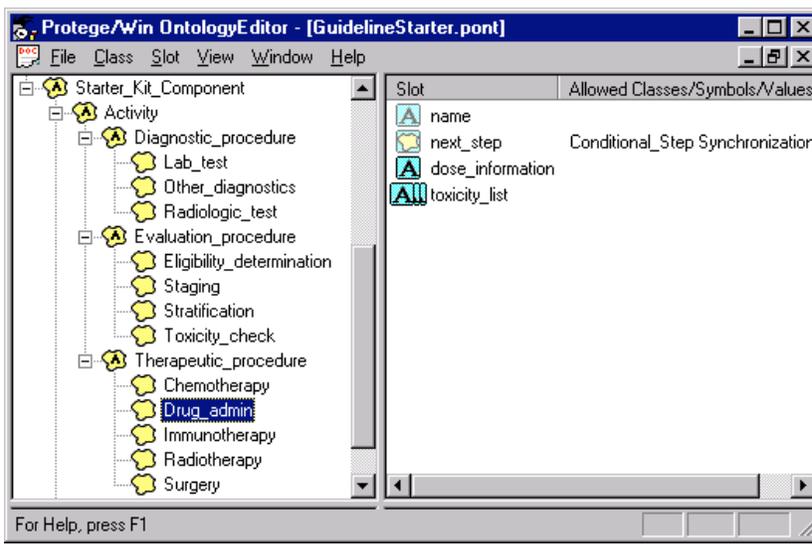
## Episodic Skeletal Plan Refinement was the Problem Solver used with PROTÉGÉ I



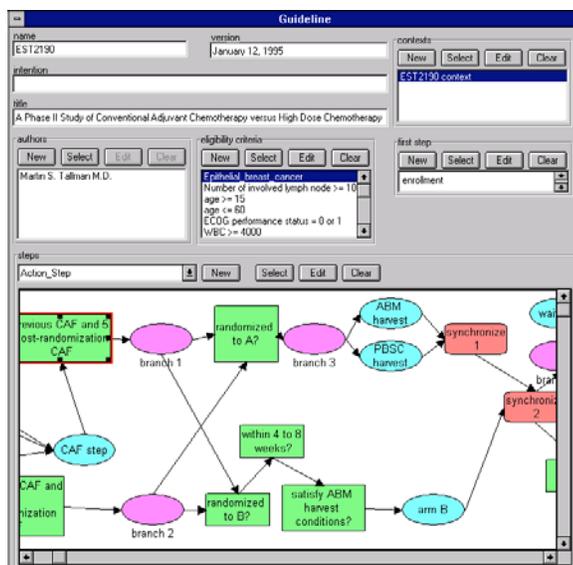
## Protégé/Win *Built for the Masses!*

- Moved Protégé to a widely available platform—just in time!
- Enabled integrated ontology editing and forms layout —eliminating the need for batch forms generation
- Marked the start of a growing Protégé user community

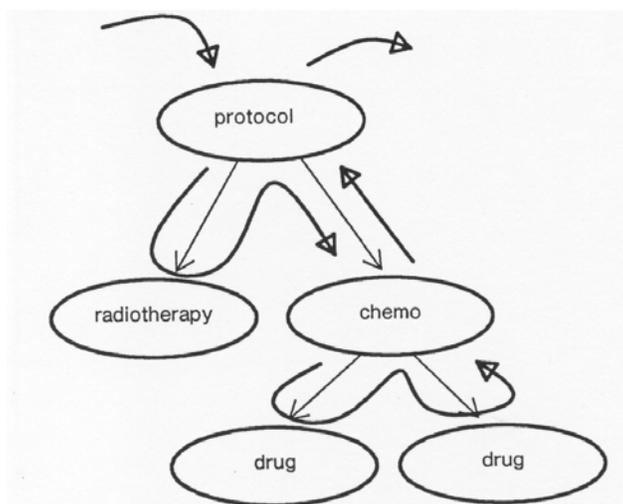
## A Protocol Ontology in Protégé/Win



## Protégé/Win KA tool



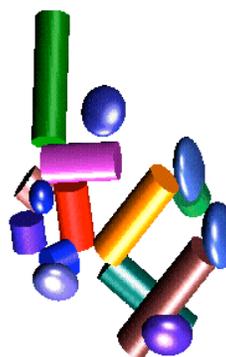
## Episodic Skeletal Plan Refinement was the Problem Solver used with PROTÉGÉ I



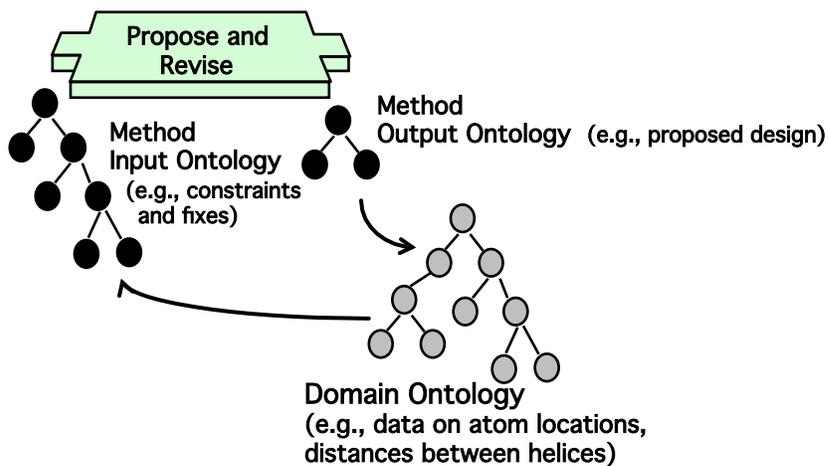
## Reuse of the

### *propose-and-revise* method

- Determination of ribosome structure from NMR data can be construed as constraint satisfaction
- Mapping propose-and-revise to a new domain ontology automates the structure-determination task

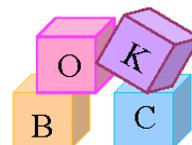


## Use of *propose-and-revise* to solve the ribosome problem



## The Next Step: Protégé-2000

- Ray Fergerson rewrote the whole thing in **Java**
- We provided support for the (then) OKBC frame standard
  - Metaclasses
  - Slots as first-class entities
  - Axioms
- We created an open, **plug-in** architecture



## Perot Systems Organizational Model in Protégé-Frames

The screenshot displays the Protégé-Frames interface for editing the 'Organization' class. The left pane shows a class hierarchy under 'Enterprise\_Description\_Classes', with 'Organization' selected. The main editor shows the following details:

- NAME:** Organization
- ALIASES:** Department
- ROLE:** Concrete
- DOCUMENTATION:** An Organization is some structure used to oversee a group of organizational resour configured products.
- TEMPLATE SLOTS:**

Name	Cardinality	Type
Subsidiary_Organizations	multiple	Instance of Organization
Parent_Organizations	multiple	Instance of Organization
Resources	multiple	Instance of Organization
Name	required single	String
Description	single	String

## The NCI Thesaurus in Protégé-OWL

The screenshot displays the Protégé-OWL interface for editing the 'Benign\_Conditions\_of\_the\_Mouse\_Intestinal\_Tract' class. The left pane shows a complex class hierarchy under 'Mouse\_Pathologic\_Diagnoses'. The main editor shows the following details:

- Name:** Benign\_Conditions\_of\_the\_Mouse\_Intestinal\_Tract
- Annotations:**

Property	Value	Lang
D code	C22102	
D DesignNote	Autonomous new grow...	
D Display_Name	Benign Conditions of th...	
D FULL_SYN	<term-name>Benign Co...	
D FULL_SYN	<term-name>Benign Co...	
D hasType	primitive	
D Preferred_Name	Benign Conditions of th...	
- Properties and Restrictions:**
  - rEO\_Disease\_Has\_Associated\_EO\_Anatomy (someValuesFrom Gastrointestinal\_Tract\_MM#HCC, someValuesFrom Gastrointestinal\_Tract\_MM#HCC)
  - Digestive\_System\_MM#HCC [from Mouse\_Digestive\_System\_Disorder]
  - rEO\_Disease\_Has\_Associated\_Cell\_Type
  - rEO\_Disease\_Has\_Property\_or\_Attribute
  - rEO\_Disease\_Maps\_to\_Human\_Disease
- Superclasses:**
  - Mouse\_Noncancerous\_Conditions
  - Mouse\_Digestive\_System\_Disorder

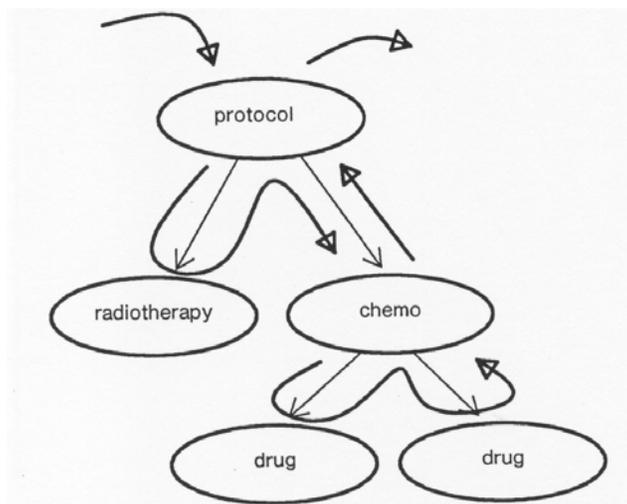
## By now, everyone was concentrating on ontologies

- The world rediscovered description logic
- The emphasis became building better and better knowledge representations
- Ontologies alone were great for question-answering tasks
- Tools for building ontologies (including Protégé) flourished
- And people became less focused on problem solving

## The Era of Big Ontologies was Upon Us

- Foundational Model of Anatomy
- NCI Thesaurus
- Gene Ontology
- Word Net
- SNOMED-CT
- OBI

## Episodic Skeletal Plan Refinement was the Problem Solver used with PROTÉGÉ I



Screenshot of the Protégé 3.4 interface showing a list of SWRL rules. The window title is "IHCOup2 Protégé 3.4 (file: C:\Development\AIM\Kbs\Clean\IHCOup2.ppr, OWL / RDF Files)". The interface includes a menu bar (File, Edit, Project, OWL, Reasoning, Code, Tools, Window, Help) and a toolbar with various icons. The main area displays a table of SWRL rules with columns for "Enabled", "Name", and "Expression".

Enabled	Name	Expression
<input checked="" type="checkbox"/>	Rule-1	aim:ImageAnnotation(?ia) ^ aim:imageReferenceCollection(?ia, ?ir) ^ aim:study(?ir, ?study) ^ aim:date(?study, ?vdate) ^ swrlc:createOWLThing(?M, ?ia) => tempor...
<input checked="" type="checkbox"/>	Rule-10	aim:ImageAnnotation(?ia) ^ rc:numberOfGeometricShapes(?ia, 1) ^ aim:geometricShapeCollection(?ia, ?pl) ^ aim:PolyLine(?pl) ^ rc:numberOfSpatialCoordinates(?pl...
<input checked="" type="checkbox"/>	Rule-11	aim:ImageAnnotation(?ia) ^ rc:numberOfGeometricShapes(?ia, 0) => rc:findingsIdentified(?ia, false)
<input checked="" type="checkbox"/>	Rule-12	aim:ImageAnnotation(?ia) ^ aim:patient(?ia, ?p) ^ aim:patientID(?p, ?pid) ^ aim:name(?ia, ?n) ^ temporal:hasValidTime(?ia, ?M) ^ clinical:Subject(?subject) ^ rc:h...
<input checked="" type="checkbox"/>	Rule-13	clinical:Subject(?S) ^ rc:hasFinding(?S, ?f) ^ rc:hasImageAnnotation(?f, ?ia) ^ aim:geometricShapeCollection(?ia, ?pl) ^ aim:geometricShapeCollection(?ia, ?pl) ^ ...
<input checked="" type="checkbox"/>	Rule-14	rc:ActualStudyArm(?ASA) ^ rc:hasPlannedArm(?ASA, ?PSA) ^ research:hasStudyInterventionOrExposure(?PSA, ?IS) ^ rc:hasAnchorSpecification(?PSA, ?An...
<input checked="" type="checkbox"/>	Rule-16	rc:ActualStudyArm(?ASA) ^ rc:hasPlannedArm(?ASA, ?PSA) ^ rc:hasContextSpecification(?PSA, ?ContextSpec) ^ rc:hasStartAnchoredDuration(?ContextSpec, ?s...
<input checked="" type="checkbox"/>	Rule-17	rc:ActualStudyArm(?ASA) ^ rc:hasPlannedArm(?ASA, ?PSA) ^ rc:hasContextSpecification(?PSA, ?CS) ^ research:studySubject(?ASA, ?S) ^ rc:hasContext(?S...
<input checked="" type="checkbox"/>	Rule-18	rc:ActualStudyArm(?ASA) ^ rc:hasPlannedArm(?ASA, ?PSA) ^ rc:hasContextSpecification(?PSA, ?CompositeContext) ^ rc:CompositeContextSpecification(?Compo...
<input checked="" type="checkbox"/>	Rule-19	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:IHC_NormalLymphNodeLesion) ^ rc:hasContextSpecificationClass(onc_criterion:IHC_Nor...
<input checked="" type="checkbox"/>	Rule-2	aim:ImageAnnotation(?ia) ^ abox:hasNumberOfPropertyValues(?n, ?ia, aim:geometricShapeCollection) => abox:hasValue(?ia, rc:numberOfGeometricShapes, ?n)
<input checked="" type="checkbox"/>	Rule-20	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:CancerLesion_Mass_Nodule) ^ rc:hasContextSpecificationClass(onc_criterion:CancerLesion_Mas...
<input checked="" type="checkbox"/>	Rule-21	rc:NormalLymphNodeStatus(?AT) ^ rc:hasContextSpecificationClass(?AT, ?CSC) ^ rc:hasQuantitativeValueConstraint(?AT, ?value) ^ rc:hasConstraintBulky(?AT, ?L...
<input checked="" type="checkbox"/>	Rule-22	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:IHC_NormalLymphNode_Long_15_Short_10) ^ rc:hasContextSpecificationClass(onc_criterion:IHC...
<input checked="" type="checkbox"/>	Rule-23	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:RECIST_EnlargedLymphNode_Short_10) ^ rc:hasContextSpecificationClass(onc_criterion:RECIST_...
<input checked="" type="checkbox"/>	Rule-24	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:IHC_EnlargedLymphNode_LongAxis_15) ^ rc:hasContextSpecificationClass(onc_criterion:IHC_Enl...
<input checked="" type="checkbox"/>	Rule-25	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:IHC_EnlargedLymphNode_Long_11-15_Short_10) ^ rc:hasContextSpecificationClass(onc_criteri...
<input checked="" type="checkbox"/>	Rule-26	rc:BaselineLymphNode_MeasurableStatus(?AT) ^ rc:hasContextSpecificationClass(?AT, ?CSC) ^ rc:hasQuantitativeValueConstraint(?AT, ?value) ^ rc:hasConstraint...
<input checked="" type="checkbox"/>	Rule-27	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:RECIST_BaselineNonMeasurableEnlargedLN_Long_15) ^ rc:hasContextSpecificationClass(onc_c...
<input checked="" type="checkbox"/>	Rule-28	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:IHC_BaselineEnlargedLN_BaselineMeasurable) ^ rc:hasContextSpecificationClass(onc_criterion:HC...
<input checked="" type="checkbox"/>	Rule-29	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:BaselineNonMeasurable_NonTargetLesion) ^ rc:hasContextSpecificationClass(onc_criterion:Base...
<input checked="" type="checkbox"/>	Rule-3	aim:ImageAnnotation(?ia) ^ aim:geometricShapeCollection(?ia, ?p) ^ aim:PolyLine(?p) ^ abox:hasNumberOfPropertyValues(?n, ?p, aim:spatialCoordinateCollection) => ...
<input checked="" type="checkbox"/>	Rule-30	rc:GreatestNetClassification(?AT) ^ rc:hasResponseCriteria(?AT, onc_criterion:InternationalHarmonizationCriteria) ^ rc:hasContextSpecificationClass(?AT, ?CSC) ^ ...
<input checked="" type="checkbox"/>	Rule-31	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:BaselineNonTarget_Follow-upNonTarget) ^ rc:hasContextSpecificationClass(onc_criterion:Baselin...
<input checked="" type="checkbox"/>	Rule-32	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:BaselineTarget_Follow-upTarget) ^ rc:hasContextSpecificationClass(onc_criterion:BaselineTarget...
<input checked="" type="checkbox"/>	Rule-33	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:F-TargetLesion_NotIdentified_Resolved) ^ rc:hasContextSpecificationClass(onc_criterion:F-Target...
<input checked="" type="checkbox"/>	Rule-34	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:F-NonTargetLesion_NotIdentified_Resolved) ^ rc:hasContextSpecificationClass(onc_criterion:F-NC...
<input checked="" type="checkbox"/>	Rule-35	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:F-TargetLesion_EnlargedLN_Persistent) ^ rc:hasContextSpecificationClass(onc_criterion:F-Target...
<input checked="" type="checkbox"/>	Rule-36	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:F-NonTarget_EnlargedLN_Persistent) ^ rc:hasContextSpecificationClass(onc_criterion:F-NonTarge...
<input checked="" type="checkbox"/>	Rule-37	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:F-TargetLesion_NormalLN_Resolved) ^ rc:hasContextSpecificationClass(onc_criterion:F-TargetLe...
<input checked="" type="checkbox"/>	Rule-38	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:F-NonTarget_NormalLN_Resolved) ^ rc:hasContextSpecificationClass(onc_criterion:F-NonTarget...
<input checked="" type="checkbox"/>	Rule-39	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:B-NormalLN_F-NormalLN_NotNewLesion) ^ rc:hasContextSpecificationClass(onc_criterion:B-Norm...
<input checked="" type="checkbox"/>	Rule-4	aim:ImageAnnotation(?ia) ^ aim:geometricShapeCollection(?ia, ?p) ^ aim:PolyLine(?p) ^ rc:numberOfSpatialCoordinates(?pl, 2) ^ aim:spatialCoordinateCollection(?p...
<input checked="" type="checkbox"/>	Rule-40	rc:ResponseCriteria(?RC) ^ rc:hasAbstractionTask(?RC, onc_criterion:B-NormalLN_F-EnlargedLN_NewLesion) ^ rc:hasContextSpecificationClass(onc_criterion:B-Norm...
<input checked="" type="checkbox"/>	Rule-41	rc:BaselineNonMeasurableStatus(?AT) ^ rc:hasContextSpecificationClass(?AT, ?CSC) ^ rc:hasQuantitativeValueConstraint(?AT, ?value) ^ rc:hasConsd...

## How can we evaluate ontologies independent of problem solvers?

- How do we know whether they make the “right” distinctions?
- How do we know where the gaps are?
- How do we find inconsistent granularity?
- How do we know what our ontologies are actually competent at describing?

## BioSTORM: A Prototype Next-Generation Surveillance System

- Developed at Stanford, initially with funding from DARPA, now from CDC
- Provides a test bed for evaluating alternative data sources and alternative problem solvers
- Demonstrates
  - Use of ontologies for data acquisition and data integration
  - Use of a high-performance computing system for scalable data analysis

# Biosurveillance Data Sources Ontology

The screenshot shows the Protégé ontology editor interface. The left pane displays a class hierarchy starting with `THING` and `SYSTEM-CLASS`, with `Data_Source` as a subclass. The right pane shows the details for the `Data_Source` class, including its name, role (Abstract), documentation, and a table of template slots.

**Template Slots**

Name	Type	Cardinality	Other Facets
Text_Name	String	required single	
Unique_Identifier	String	required single	
Location_of_Data_Collection	Instance	single	classes=(Location)
Specifications_of_Measur...	Instance	multiple	classes=(Measurement_
Measurement_Stream	Instance	multiple	classes=(Measurement)
Internal_Data_Sources	Instance	multiple	classes=(Data_Source)

## Ontology defines how data should be accessed from the database

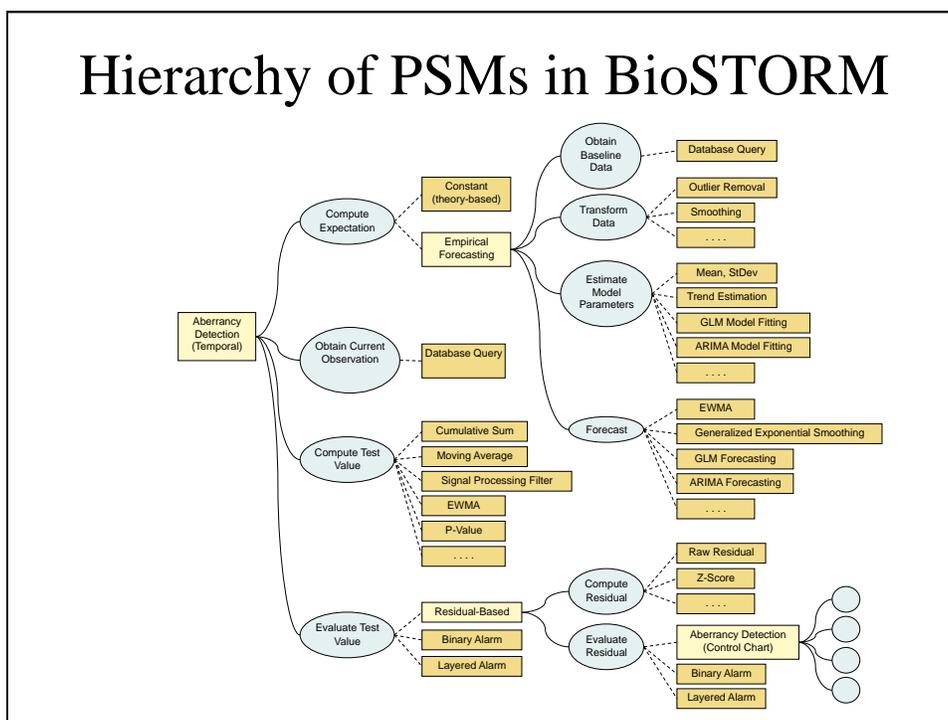
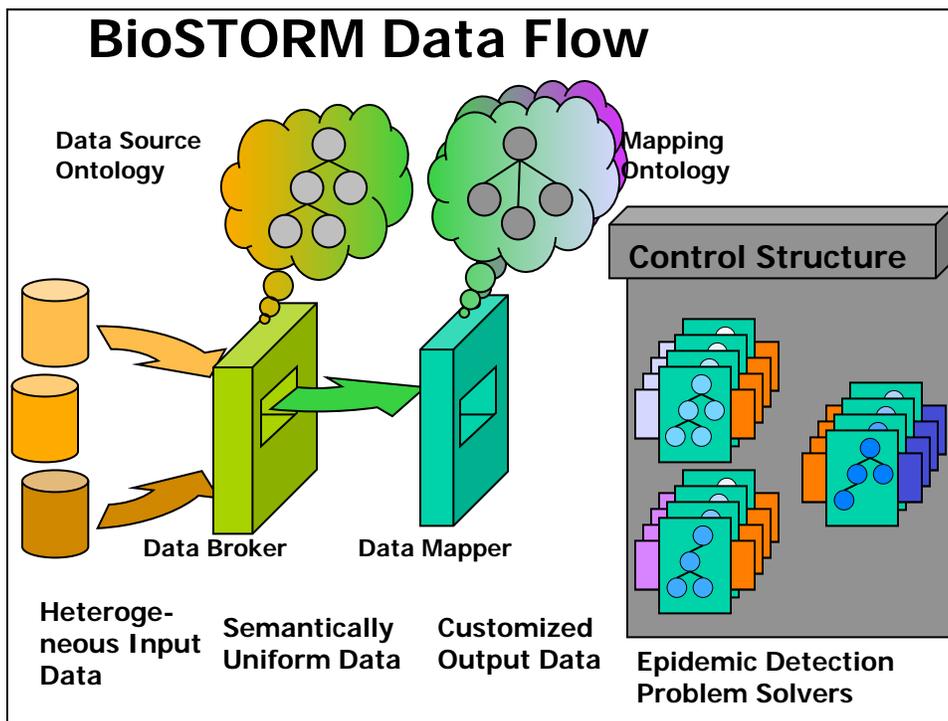
(Stanford) Emergency-911 Call Data Group (Measurement\_Specification)

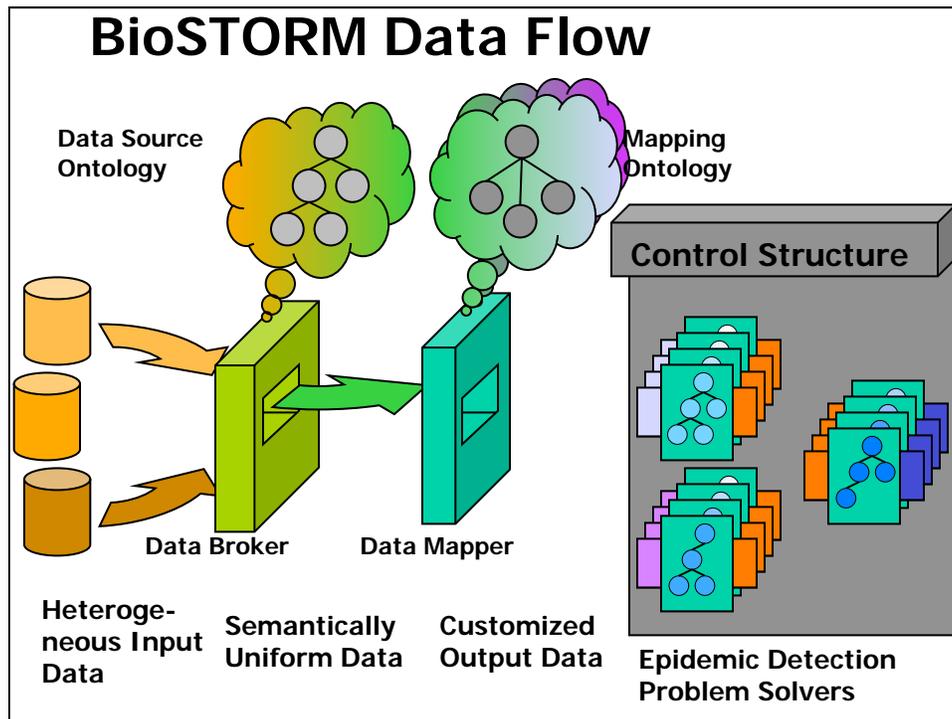
Measurement Specification Name

(Stanford) Emergency-911 Call Data Group

LOINC Term(s)

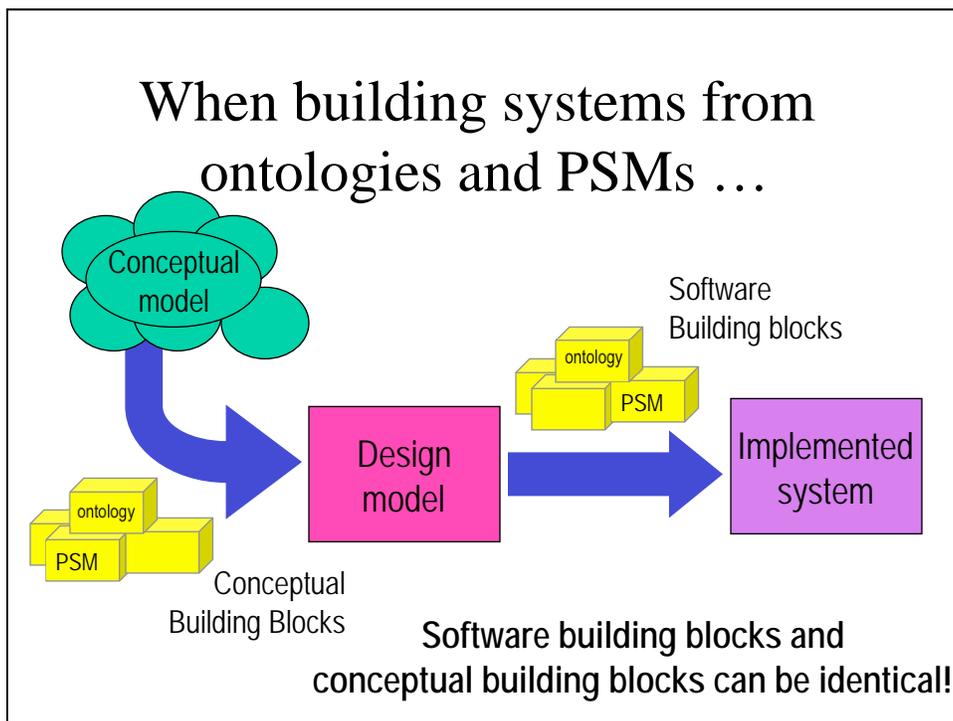
Name	Property_Measured	Kind-of-Property_Measured	Time_Aspect_of_Mea
Status	Status	Categorical Measure	Point_in_Time
Score	Score	Percent	Point_in_Time
Side	Side	Categorical Measure	Point_in_Time
GIS X-coordinate	GIS_X_Coordinate	Real Number	Point_in_Time
GIS Y-coordinate	GIS_Y_Coordinate	Real Number	Point_in_Time
Incident ID Code	Incident_ID	Text	Point_in_Time
Date	Date_of_Visit	Date	Point_in_Time
Site	Hospital_Address	Text	Point_in_Time
Area	Area_Coding	Real Number	Point_in_Time
Census Block Group	Census_Block_Group	Categorical Measure	Point_in_Time
Type	CBD_Call_Type	Categorical Measure	Point_in_Time





## There is a need for balance

- Better languages and tools for building domain ontologies
- Better languages and for designing and implementing problem-solving methods
- Better methods and tools for bringing these components together
- Building systems with *use cases*—not ontologies—as the driving component



chemotherapy-regimen-kind.owl (http://www.clef.org/ontologies/nci-extracts/chemotherapy-regimen-kind.owl) - [Users/drummond/Work/CO-ODE/Ontologies/otherAuthors/OCRE/...

chemotherapy-regimen-kind.owl (http://www.clef.org/ontologies/nci-extracts/chemotherapy-regimen-kind.owl)

Active Ontology Entities Class Matrix OWL Viz DL Query

OWL Viz Imports Graph:

Asserted class hierarchy 'Flu Matrix/gp100 Antigen/Keyhole Limpet Hemocyanin/MAGE-3/MART-1 Antigen/NY-1':

- 'Floxadine/Leucovorin Calcium/Melphalan'
- 'Floxadine/Leucovorin Calcium/Oxaliplatin'
- 'Floxadine/Leucovorin Calcium/PALM'
- 'Floxadine/Mitomycin'
- 'Floxadine/Octreotide/Streptozocin'
- 'Floxadine/Streptozocin'
- 'Flt3 Ligand/gp100 Antigen'
- 'Flt3 Ligand/gp100 Antigen/Incomplete Freund's Adjuvant/MART-1 Antigen/Tyrosinase'
- 'Flt3 Ligand/gp100 Antigen/MART-1 Antigen/Montanide ISA-51'
- 'Flt3 Ligand/gp100 Antigen/MART-1 Antigen/Tyrosinase'
- 'Flu Matrix/gp100 Antigen/Keyhole Limpet Hemocyanin/MAGE-3/MART-1 Antigen/NY-1' (selected)
- 'Flu Matrix/gp100 Antigen/MAGE-3.1/MART-1 Antigen/Tyrosinase'
- 'Flu Matrix/gp100 Antigen/MAGE-3/MART-1 Antigen/NY-ESO-B'
- 'Flu Matrix/gp100 Antigen/MAGE-3/MART-1 Antigen/NY-ESO-B'
- 'Flu Matrix/gp100 Antigen/MAGE-3/MART-1 Antigen/NY-ESO-B'

Description: 'Flu Matrix/gp100 Antigen/Keyhole Limpet Hemocyanin/MAGE-3/MART-1 Antigen/NY-1':

Equivalent classes:

- 'Chemotherapy Regimen'
- has\_component\_agent Flu\_Matrix
- has\_component\_agent some Gp100\_Antigen
- has\_component\_agent some Keyhole\_Limpet\_Hemocyanin
- has\_component\_agent some MAGE-3
- has\_component\_agent some MART-1\_Antigen
- has\_component\_agent some NY-ESO-B
- has\_component\_agent some Q521
- has\_component\_agent some Tyrosinase\_Peptide
- has\_component\_agent exactly 8 Chemotherapy\_Agent

Context menu options:

- Switch to defining ontology
- Pull into active ontology
- Move axiom(s) to ontology...
- Convert selected rows to defined class
- Create new defined class
- Create closure axiom