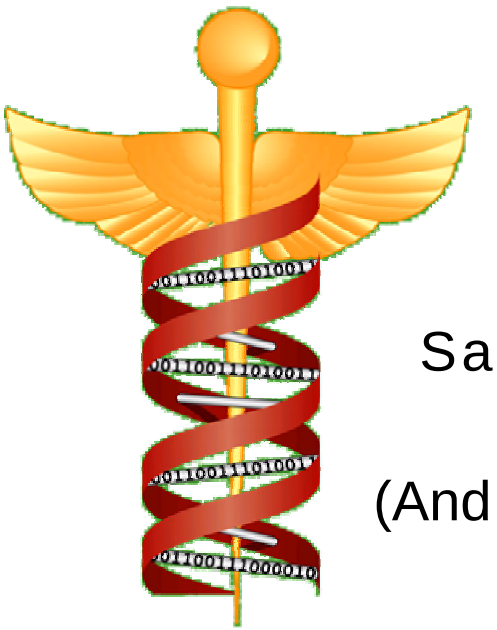
Workbench and Wizard: Making Protégé Usable as a Workbench for Encoding Clinical Practice Guidelines



Samson Tu, Ravi Shankar, Mark Musen

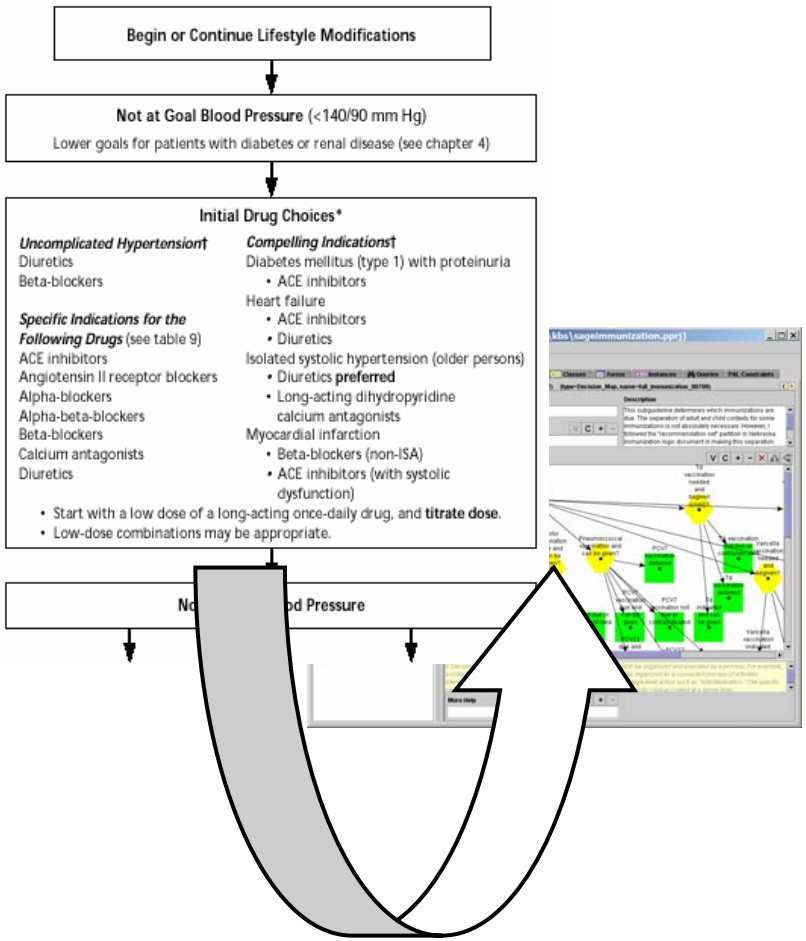
Stanford Medical Informatics

(And SAGE Project partners: IDX, Nebraska, Mayo, Apelon, IHC)

Overview

- Clinical practice guidelines (CPG) and their use in clinical decision support
- Enhancement to Protégé-2000 for encoding CPGs
  - A knowledge-acquisition wizard
  - A terminology plug-in
  - Validation plug-ins
- Outstanding issues
- Protégé wish list

Decision Support For Guideline Based Care



Guideline Knowledge Acquisition Process

Patient Data

Guideline Decision-Support System

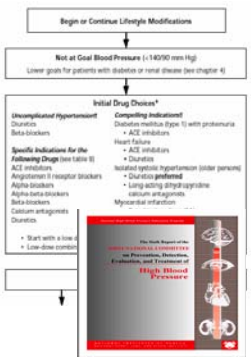
Consider adding an ACE Inhibitor because of a compelling indication (heart failure)

Guideline Knowledge-Acquisition Process

Guideline Model

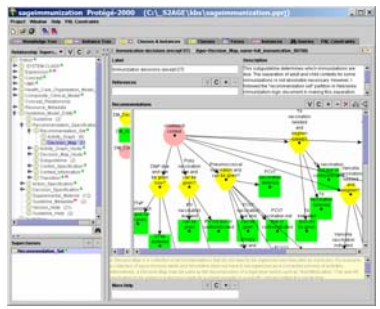
External Resources (Terminology)

Source Documents



Conceptualization

Access Model and Resources



Validation

Protégé-2000 As a Guideline KA Workbench

- Automatic generation of model-specific user-interface forms allows rapid prototyping
- No guidance for conceptualization and encoding of CPG in KBs
  - Create ‘wizards’ to support KA tasks
- Protégé-2000 is component-based and has an extensible architecture
  - Access to external terminology through slot plug-in
  - Validation through special tab plug-ins

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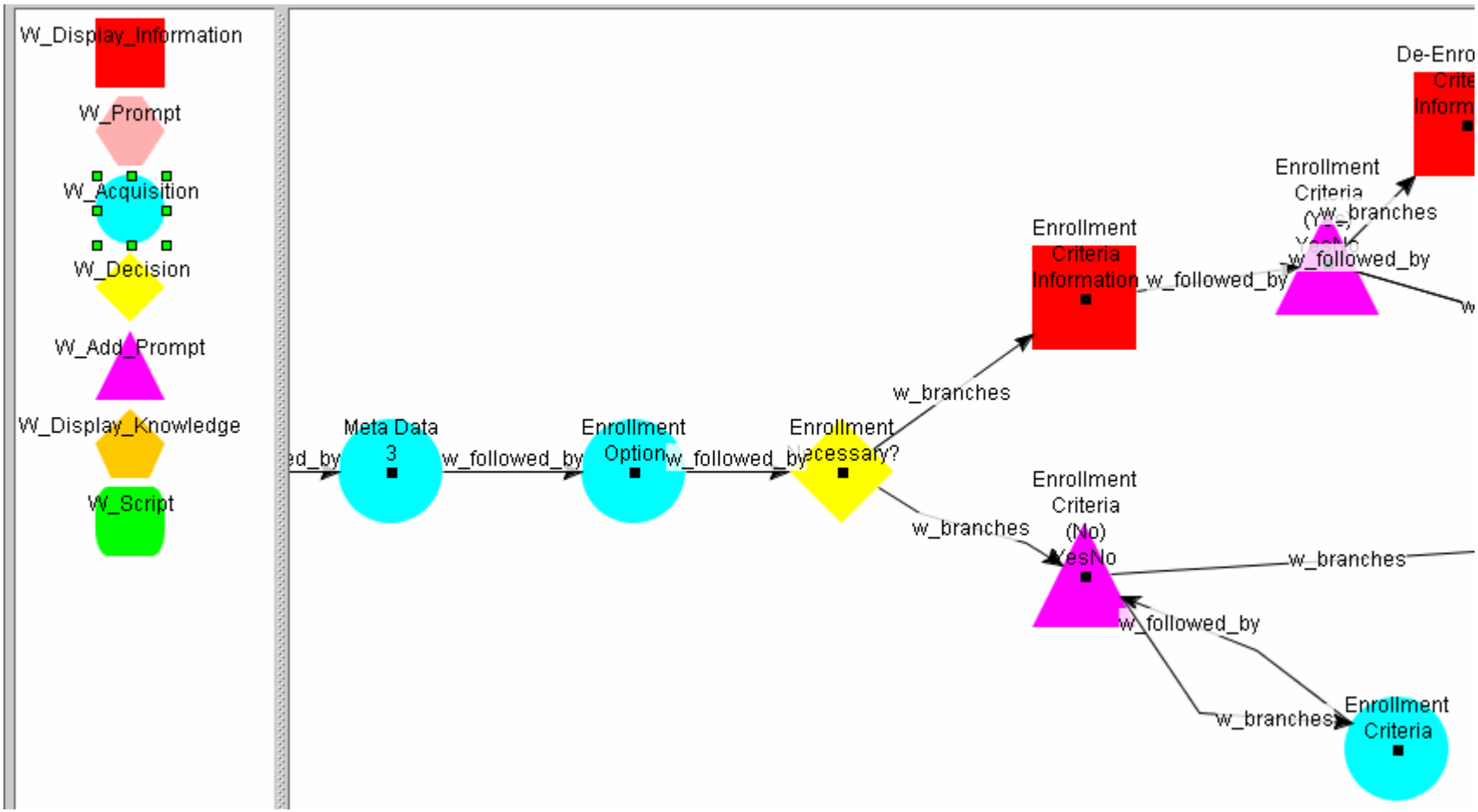
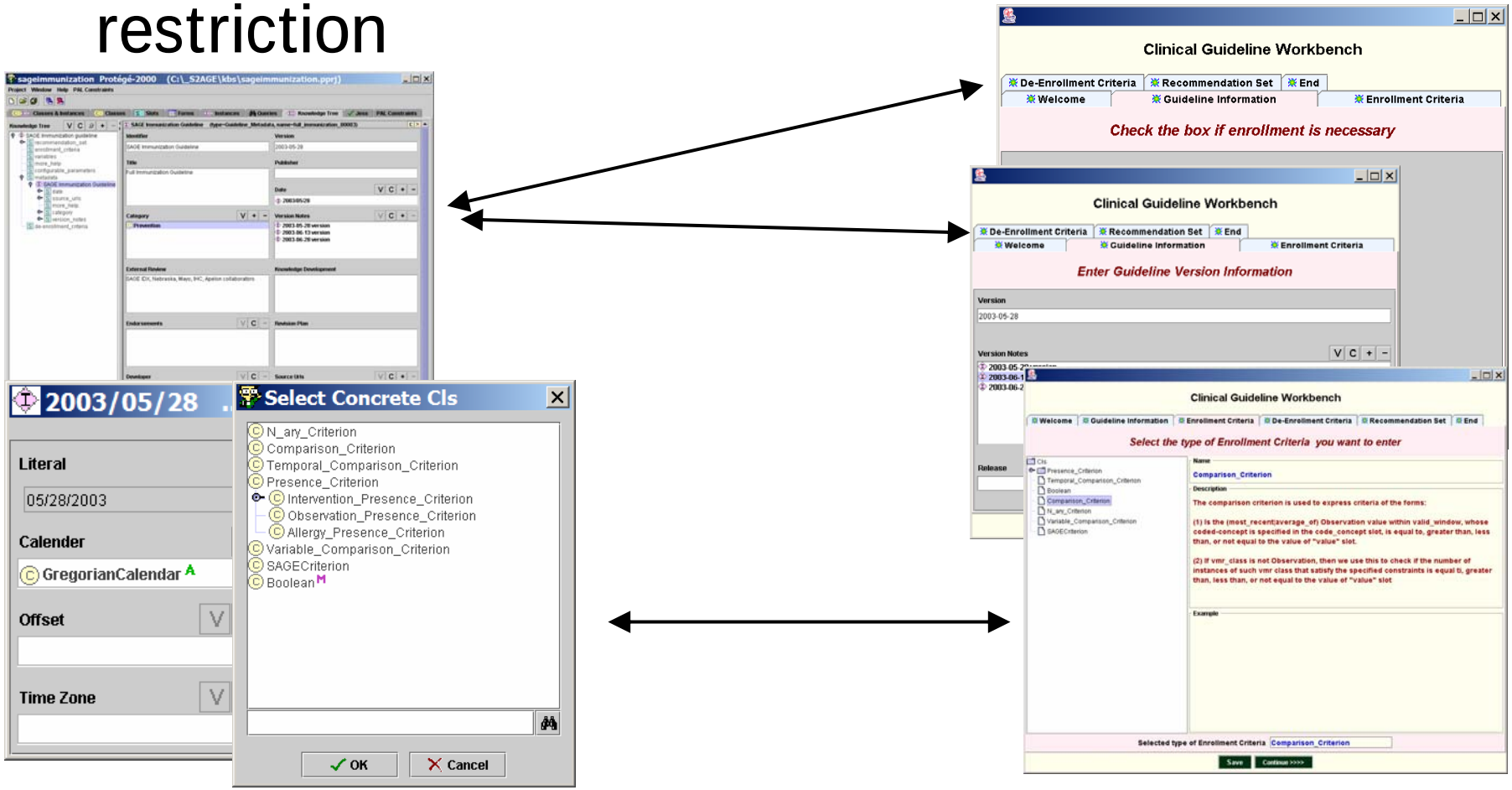
KA Wizard (1): Explicit Modeling of Guideline KA Process

- Scripts define sequence of KA tasks



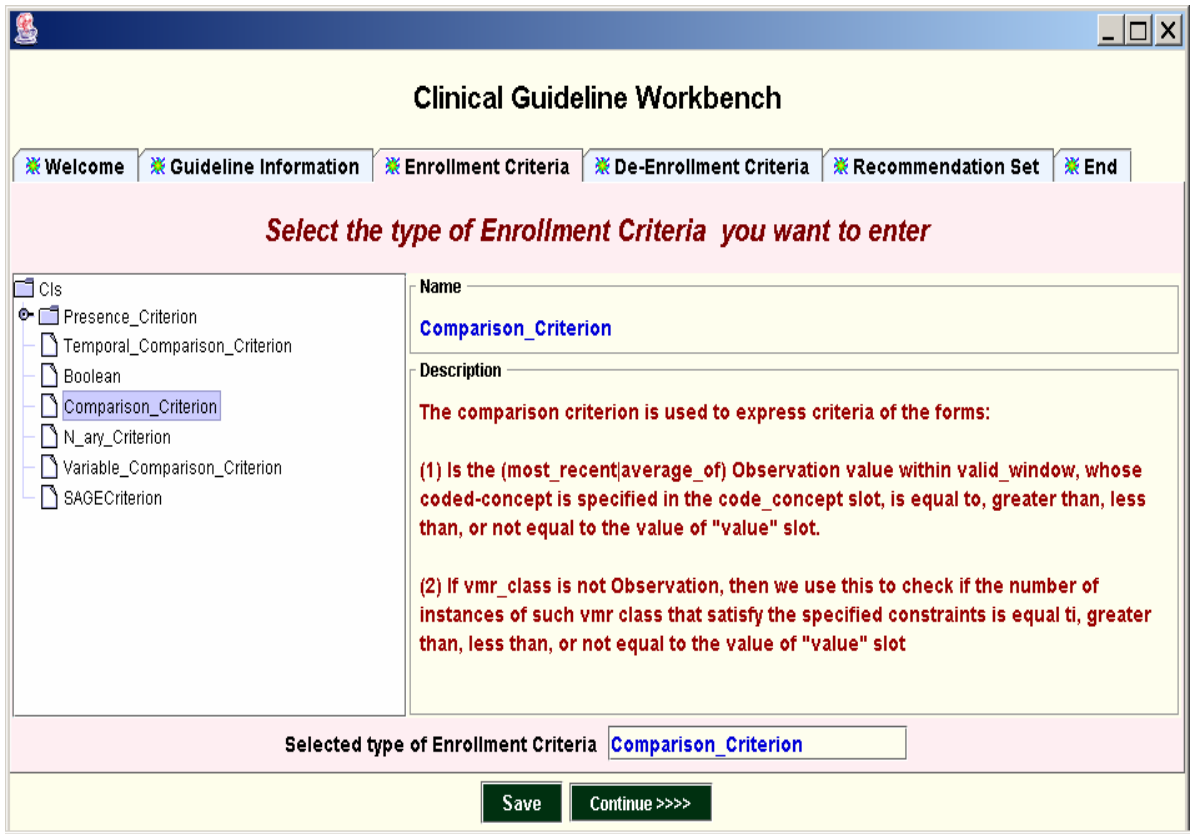
KA Wizard (2): Creation of Alternative Views of Protégé Forms

- Work around Protégé's 1-class/1-form restriction



KA Wizard (3): Guiding a User through KA Tasks

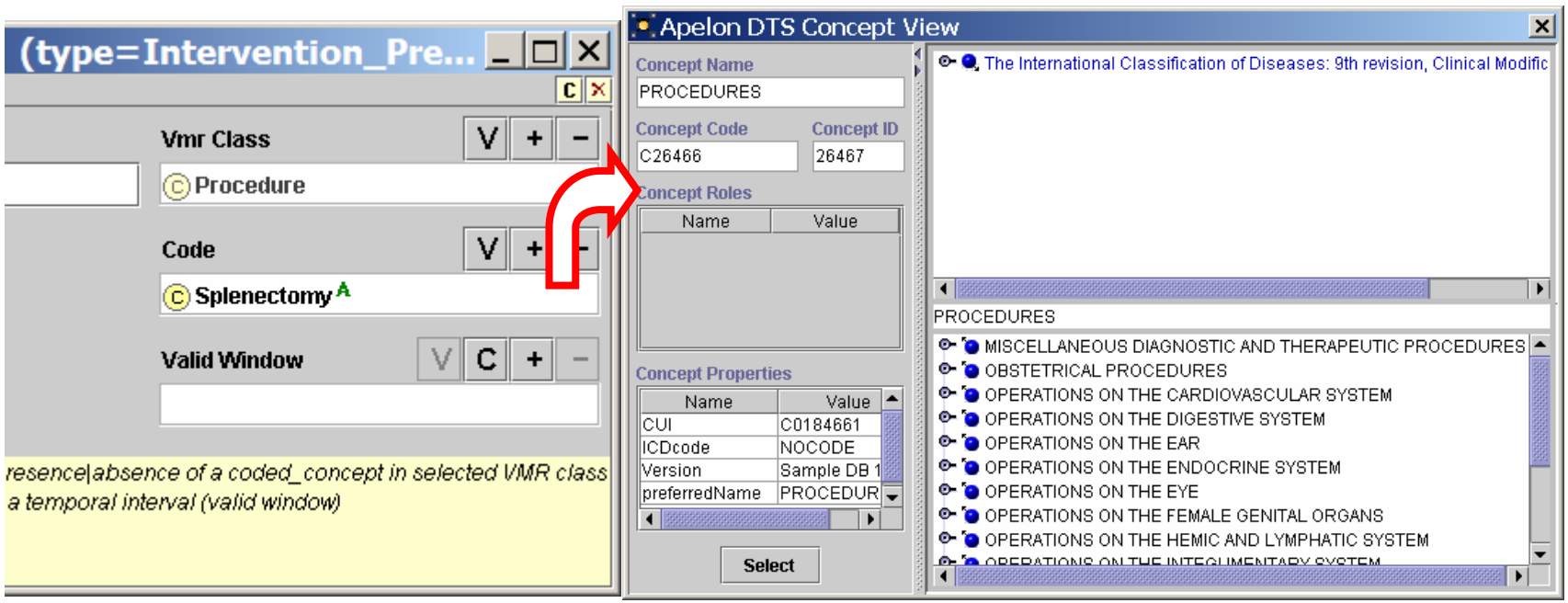
- Based on specification of KA tasks and mapping of forms, the wizard presents a sequence of KA forms



- Top-down interview (TurboTax metaphor)
- Task-oriented “recipe” of how-to (“Office paper-clip” metaphor)

Accessing External Resources: Terminology Plug-In

- A concept is represented as a terminological class
- A plug-in allows search and selection of terms from an external terminology server (developed by Apelon colleagues)
  - Invoked everywhere that a controlled term is needed
  - “Cache” references to controlled terms in Protégé to support browsing in absence of terminology server

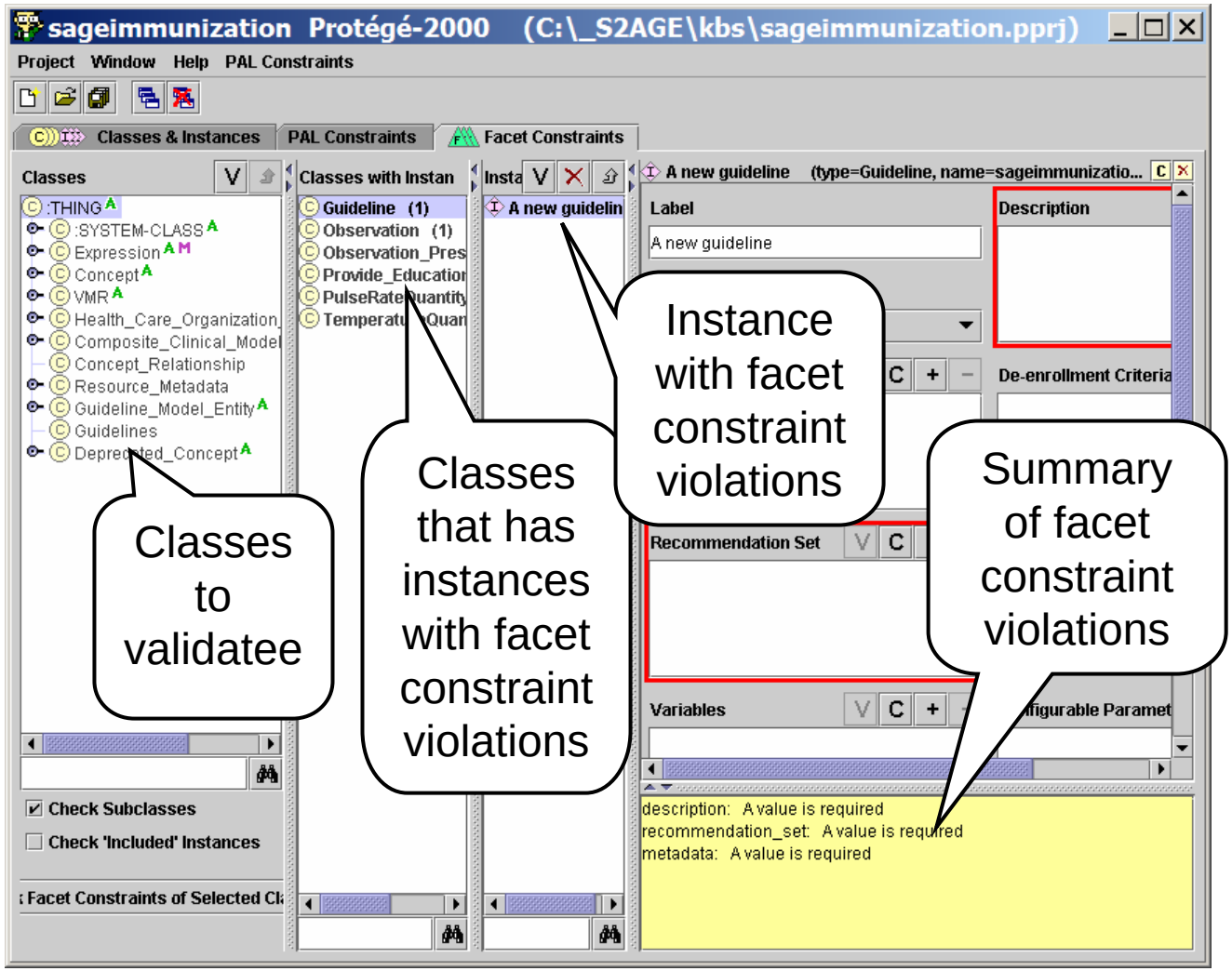


Validation of Guideline KB

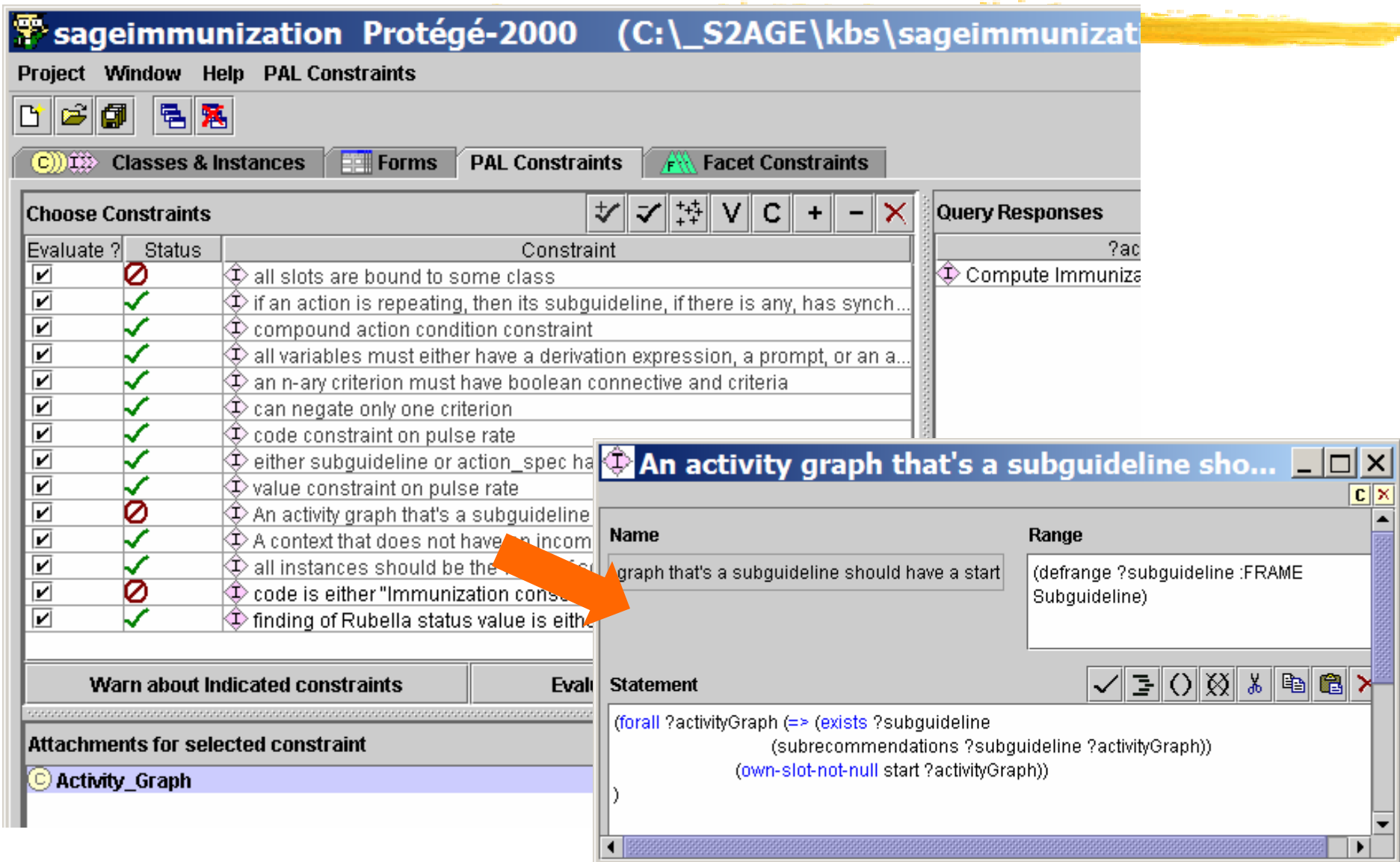
- Integrity constraints
  - Local constraints
    - constraints on slot values (e.g. type, cardinality)
    - shown with red border in Protégé GUI
  - Global constraints
    - constraints that span across multiple slots, instances, or classes
    - encoded in Protégé's PAL constraint language
- Other types of validation (not done yet)
  - Safety rules
  - Conformance to guideline intentions
  - Correctness of subsumption relationships

Local Constraints: Validation Through Facet-Constraint Tab

- Tab that allows checking of select classes for instances with facet constraint violations



Global Constraints: Validation Using PAL Constraints



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Problems in Use of Wizards

- Mapping and synchronization of guideline instances and wizard instances
  - Wizard creates and display wizard-specific forms and instances for mapped instances in guideline KB
  - Easy to partition a guideline instance into multiple wizard instances, difficult to aggregate multiple guideline instances
- Management and automation of domain-specific and book-keeping actions
- Specification of meaningful knowledge-acquisition subtasks

Problems in Use of Terminology

- Constraints on allowed terms
- Concepts used in guidelines are not always available as terms in existing terminology
  - Primitive terms
    - e.g. haemophilus influenza type b conjugate vaccine
  - Compositional terms
    - e.g. {Progressive neurological finding isa ‘Neurological finding’ Associated course ‘Progressive’}
    - e.g. {Respiratory problems excluding asthma}

Problems in Use of Constraints

- Insufficient facet constraints
  - e.g. allowed values for Instance type
- Difficulty in extending PAL
  - Not easy to add new predicates to PAL
- Weak constraint checking during editing process
  - Facet constraints insufficient to specify allowed slot values
  - PAL constraints not used for selecting slot values

Wish List

- Standardized terminology and information models
  - Express constraints on legal codes
  - Facilitate definition of new codes
- A plug-in architecture for developing and using ‘wizards’ to perform specific tasks
- A plug-in architecture for defining and using alternative constraints in selecting and setting slot values
  - A variety of constraint types
  - A standardized way to invoke alternative constraint engines for checking legal slot values

SAGE: "A word from our sponsor . . ."

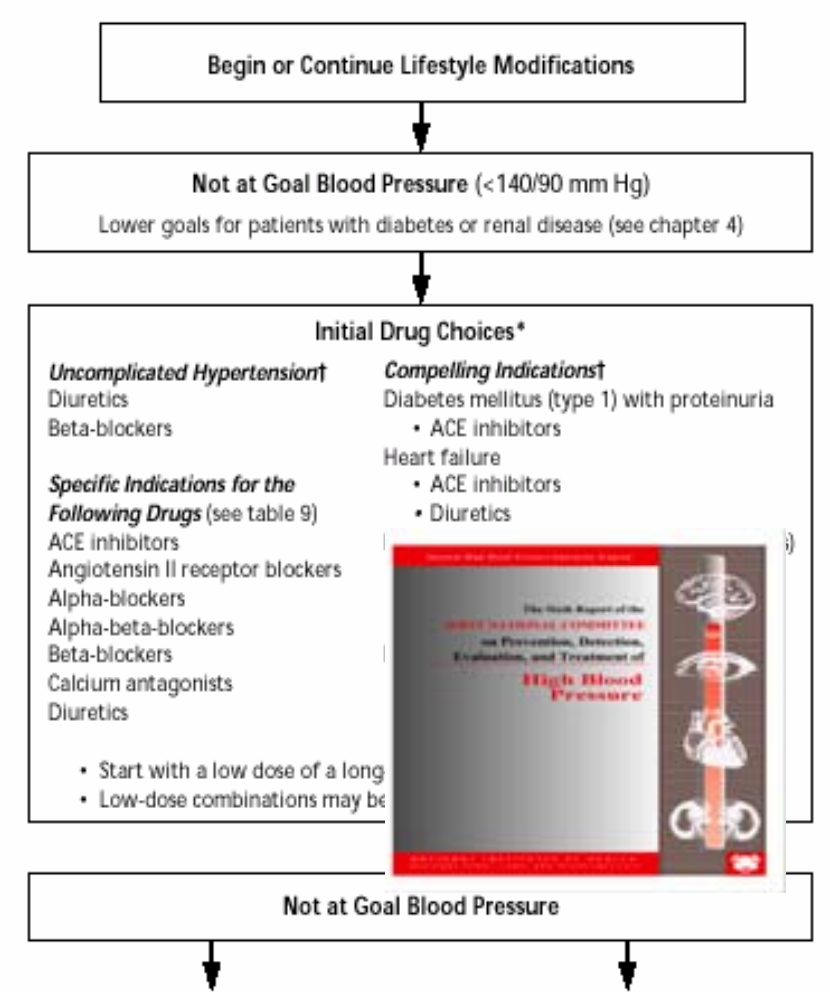
- The National Institute of Standards and Technology (NIST), an arm of the U.S. Department of Commerce, funds "high risk" research through its Advanced Technology Program (ATP).
- The mission of the NIST/ATP program is *"To accelerate the development of innovative technologies for broad national benefit through partnerships with the private sector".*
- NIST/ATP projects must entail research that 'leads to significant national benefits.'

The SAGE project is partially funded by NIST/ATP Cooperative Agreement Number 70NANB1H3049

CPG and Their Use in Clinical Decision Support

- Clinical practice guidelines
  - Statements to assist practitioner and patient in making decisions about appropriate health care in specific circumstances
  - Traditionally published as monographs or journal papers
- Methods to change physician behavior
  - Traditional diffusion model
    - Expects clinicians will change behavior on receipt of information
  - Specific strategies rather than passive dissemination
    - opinion leaders
    - performance feedback
    - computer-based decision-support at point of care

Decision Support For Guideline Based Care



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