JessTab: Using Jess together with Protégé

Henrik Eriksson

Background

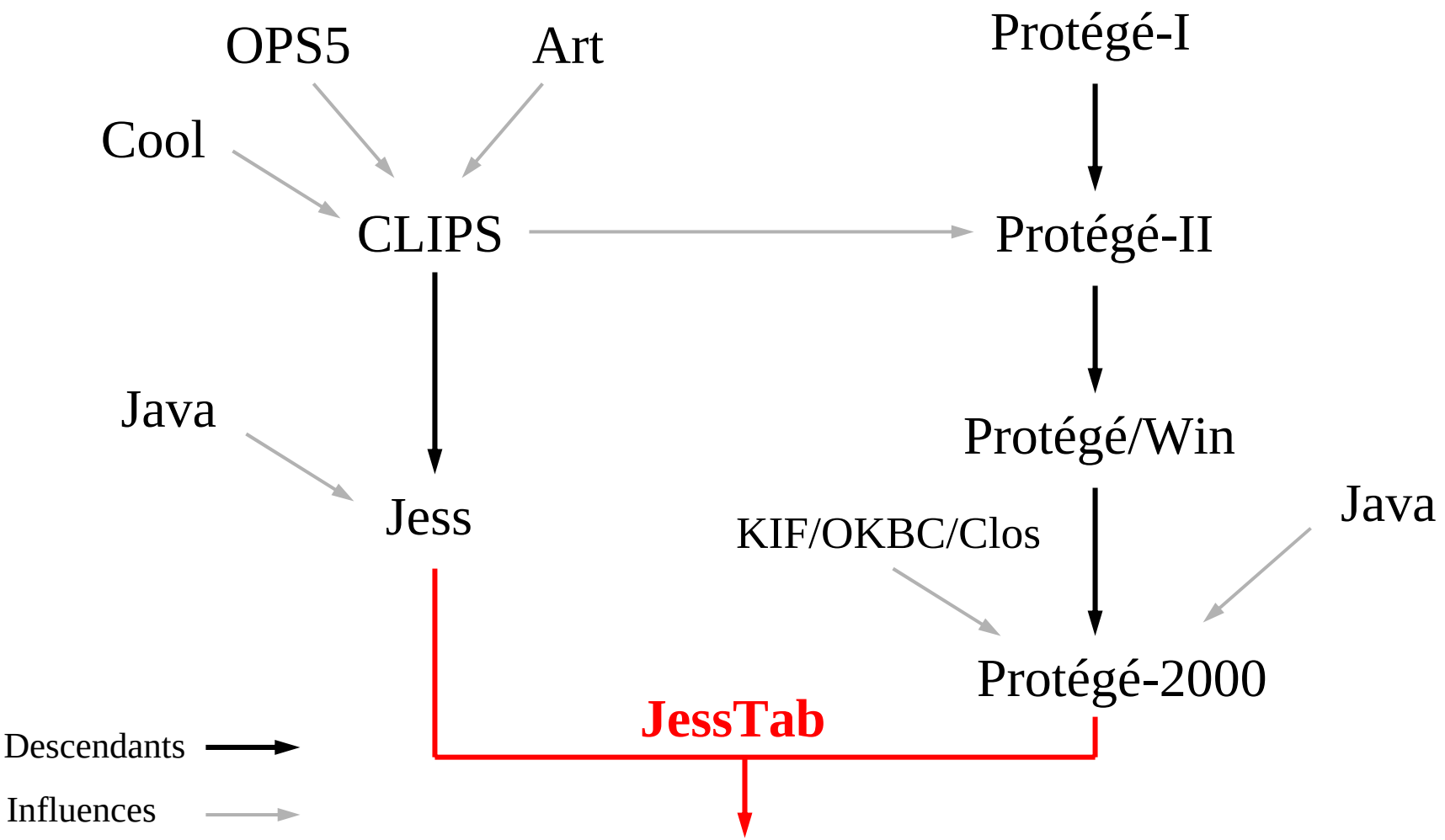
Problems:

- Difficult to directly integrate problem solving and ontology development in Protégé
  - Languages/shells need direct access to Protégé
- Difficult manage large/complex ontologies
  - Ontology editors should be programmable

Background: What is Jess?

- Java Expert System Shell; based on CLIPS
- Forward chaining; production rules
- Fact-base and pattern matching
- Lisp-like syntax
- No support for object orientation
  - The Cool subsystem of CLIPS not implemented
- Developed by Sandia Laboratories
  - http://herzberg.ca.sandia.gov/jess/

Background – History



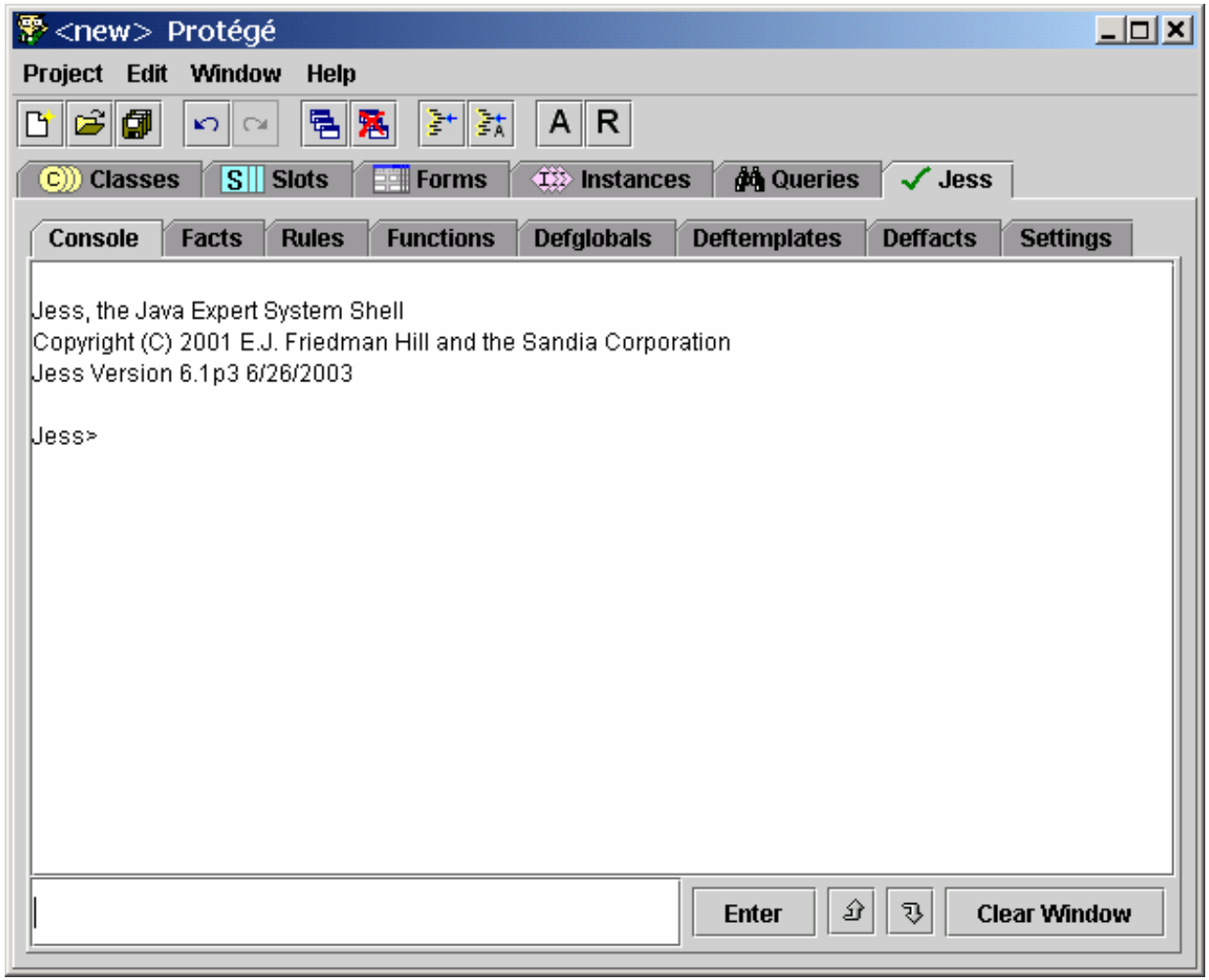
Integration – Two possibilities

- Loose integration
  - No changes to each representation model
  - Translators between formats
  - Independent software
- Tight integration
  - Changes to representation models when needed
  - Integrated software (e.g., same Java VM)
  - Unified user interface

Approach – JessTab plug-in for Protégé

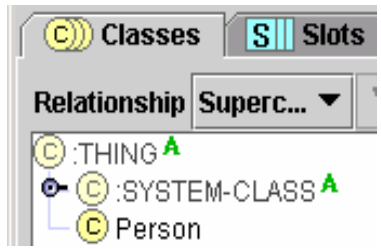
- Jess console window in Protégé
- Mapping instances to Jess facts
- Functions for knowledge-base operations
- Mirroring Jess definitions in Protégé knowledge bases
- Support for metalevel objects
- Support for methods and message handlers (coming)

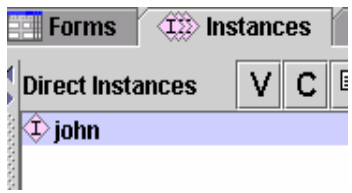
Jess console window in Protégé



Defining classes and instantiating them

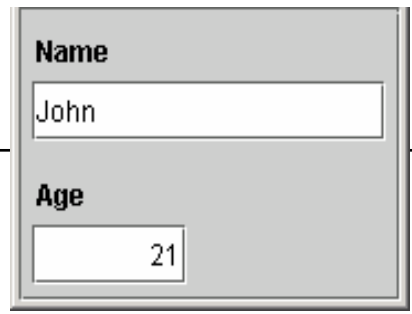
```
Jess> (defclass Person (is-a :THING)
(slot name (type string))
(slot age (type integer)))
TRUE
Jess> (make-instance john of Person (name "John") (age 20))
<External-Address:SimpleInstance>
Jess> (mapclass Person)
Person
Jess> (facts)
f-0 (object (is-a Person) (is-a-name "Person")
(OBJECT <External-Address:SimpleInstance>)
(age 20) (name "John"))
For a total of 1 facts.
```





Modifying slots

```
Jess> (slot-set john age 21)
Jess> (facts)
f-1 (object (is-a Person) (is-a-name "Person")
(OBJECT <External-Address:SimpleInstance>)
(age 21) (name "John"))
For a total of 1 facts.
```



Creating a second instance

```
Jess> (make-instance sue of Person (name "Sue") (age 22))
<External-Address:SimpleInstance>
Jess> (facts)
f-1 (object (is-a Person) (is-a-name "Person")
(OBJECT <External-Address:SimpleInstance>)
(age 21) (name "John"))
f-4 (object (is-a Person) (is-a-name "Person")
(OBJECT <External-Address:SimpleInstance>)
(age 22) (name "Sue"))
For a total of 2 facts.
```

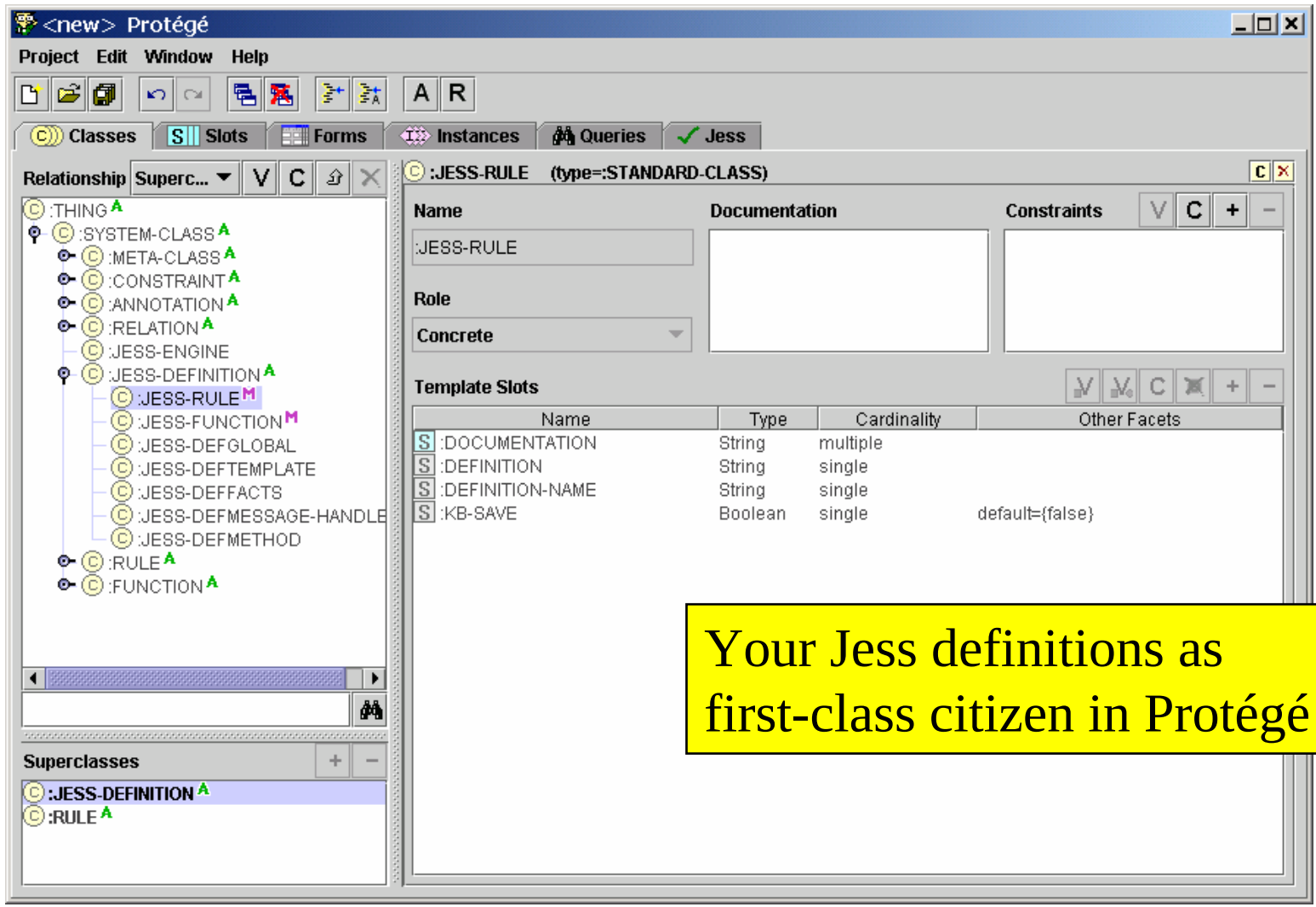
Adding a Jess rule

```
Jess> (defrule twentyone
  (object (is-a Person)
  (name ?n) (age ?a&:(>= ?a 21)))
=>
(printout t "The person " ?n
            " is 21 or older" crlf))
TRUE
Jess> (run)
The person John is 21 or older
The person Sue is 21 or older
2
Jess>
```

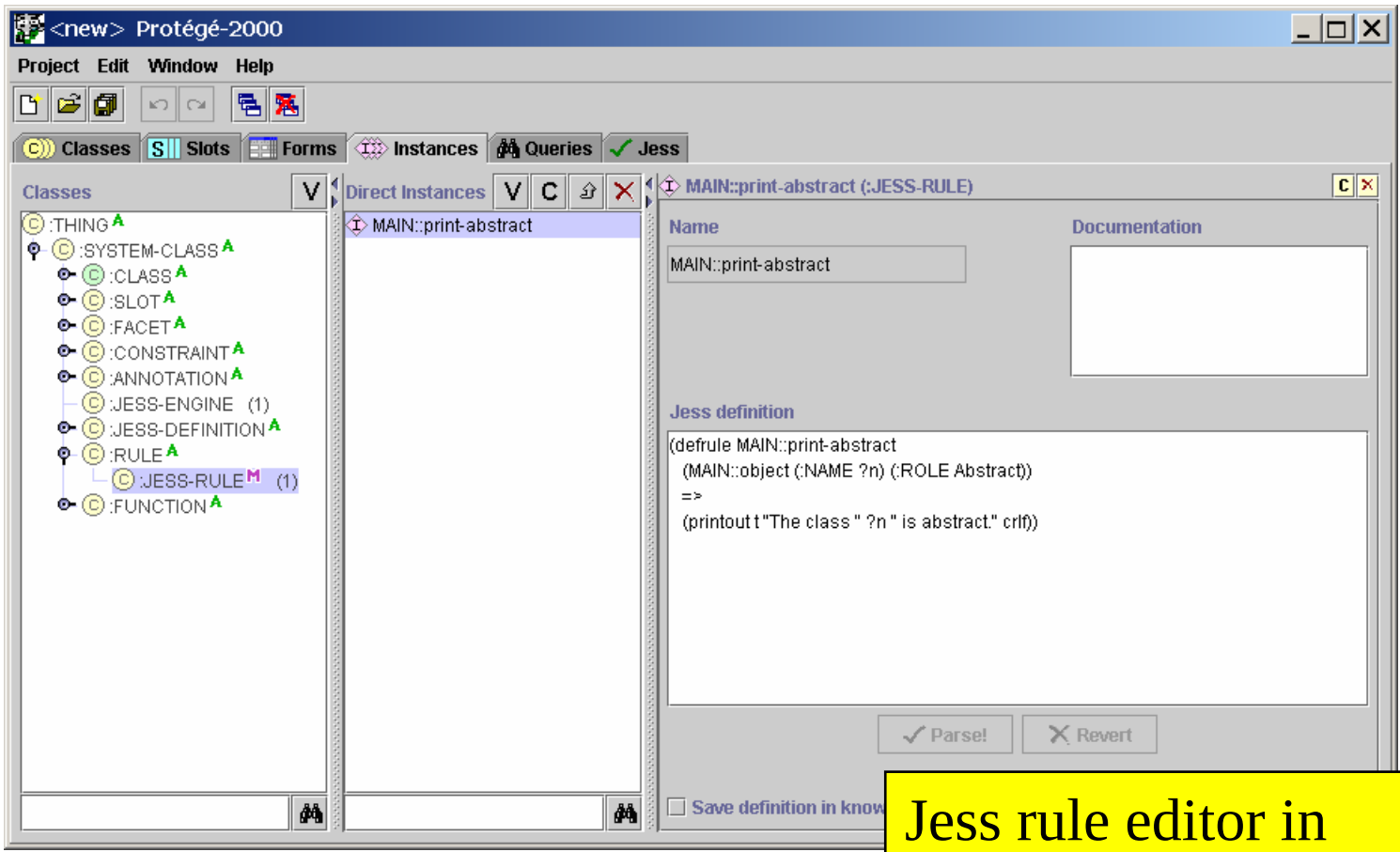
Functions for knowledge-base operations

mapclass
mapinstance
unmapinstance
defclass
make-instance
initialize-instance
modify-instance
duplicate-instance
definstances
unmake-instance
slot-get
slot-set
slot-replace$
slot-insert$
slot-delete$
slot-facets
slot-types
slot-cardinality
slot-range
slot-allowed-values
slot-allowed-classes
slot-allowed-parents
slot-documentation
slot-sources
facet-get
facet-set
class
class-existp
class-abstractp
class-reactivep
superclassp
subclassp
class-superclasses
class-subclasses
get-defclass-list
class-slots
instancep
instance-existp
instance-name
instance-address
instance-addressp
instance-namep
slot-existp
slot-default-value
set-kb-save
get-kb-save
load-kb-definitions
load-project
include-project
save-project
jesstab-version-number
jesstab-version-string
get-knowledge-base
get-tabs

Mirroring Jess definitions in Protégé knowledge bases

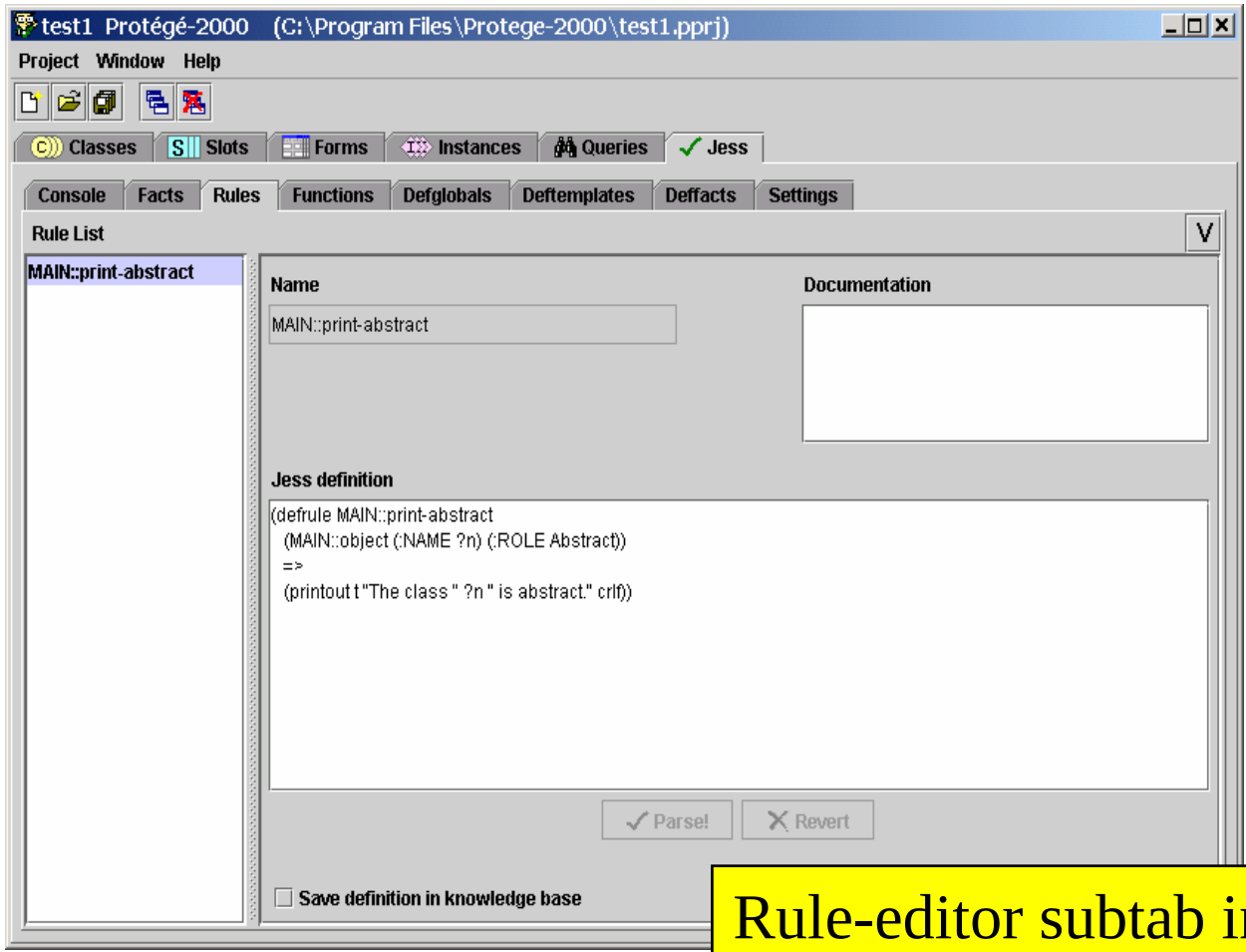


Editing Jess definitions in Protégé



Jess rule editor in Protégé

Editing Jess definitions in Protégé (cont.)



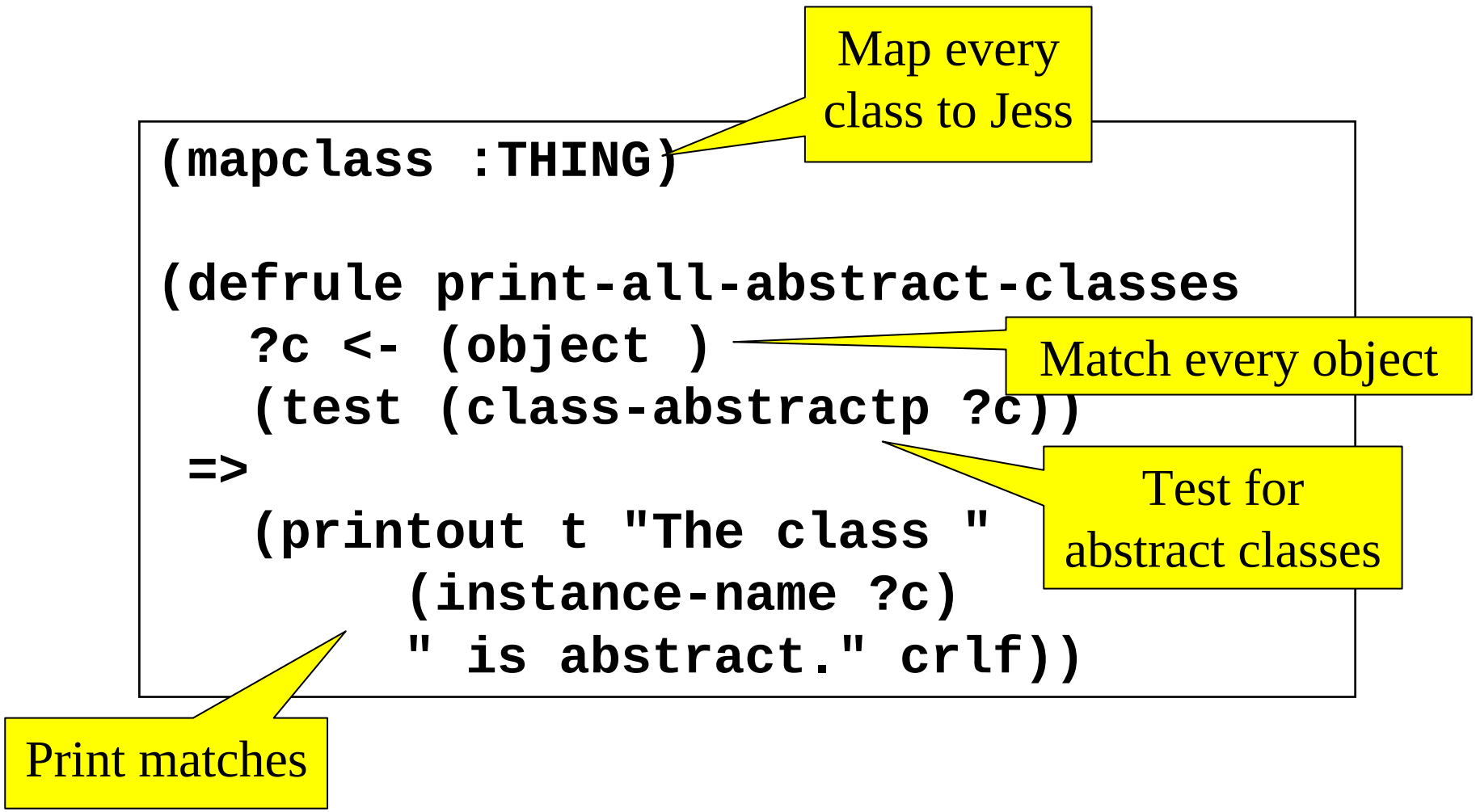
Rule-editor subtab in JessTab

Support for Protégé metalevel objects

- JessTab support for metaclasses, metaslots, and metafacets
- Functions for instances work for classes too
  - and for slots and facets
- Defining classes by instantiating metaclasses:

```
(make-instance Person of :STANDARD-CLASS
        (:DIRECT-SUPERCLASSES :THING))
```

Printing abstract classes in Protégé



Modifying ontologies

Change the role to *abstract* for classes that have subclasses, but do not have any instances:

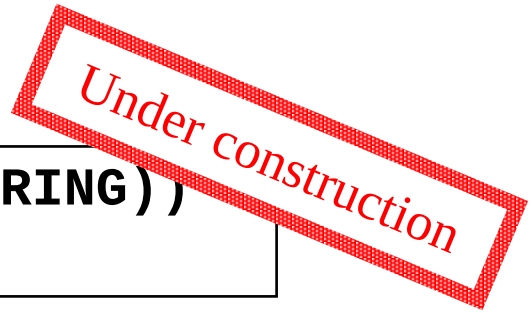
```
(defrule make-classes-abstract
   ?c <- (object (:NAME ?n)
                 (:ROLE Concrete)
                 (:DIRECT-INSTANCES ))
   (not (object (:NAME ?n) (:DIRECT-SUBCLASSES)))
 =>
   (slot-set ?c :ROLE Abstract))
```

Concrete classes & no instances

No subclasses

Change role

Support for methods and message handlers




```
(defmethod add ((?a STRING) (?b STRING))
   (str-cat ?a ?b))
```

```
(defmethod add ((?a MyClass) (?b MyClass))
    …)
```

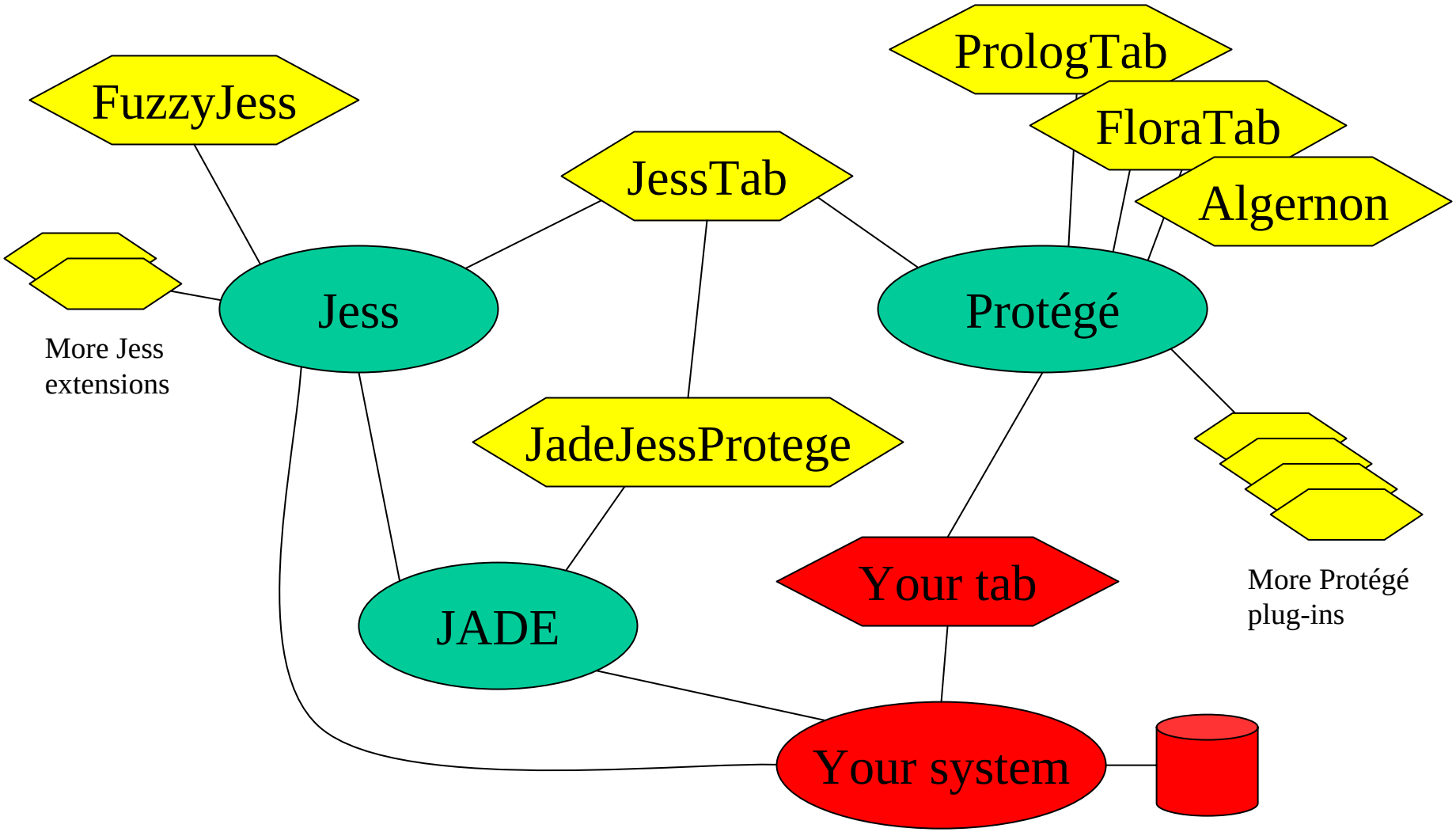
```
(defmessage-handler MyClass get-foo ()
   ?self:foo)
```

```
(defmessage-handler rectangle find-area ()
   (* ?self:side-a ?self:side-b))
```

Examples of applications

- Ontology engineering and reengineering
  - Jess as macro/scripting for ontologies
- Importing ontologies
  - Jess as input filter
- Semantic Web
- Problem-solving methods
- Agent frameworks
  - JadeJessProtege

Tool Web/Library



Ideas for future work

- Support for managing Protégé forms
- Improved GUI
- Multiple Jess engines
- Multiple knowledge bases
- Aspect-oriented functionality (e.g., pointcut for message-handlers)
- ???

Trying JessTab

- Obtain Protégé
  - Download from http://protege.stanford.edu/
- Obtain Jess
  - Download from http://herzberg.ca.sandia.gov/jess/
  - License required (commercial or free academic)
  - Compilation required
- Get JessTab
  - Download from http://www.ida.liu.se/~her/JessTab/

Summary

- JessTab: Protégé – Jess integration
- Manage Protégé ontologies and knowledge bases from Jess
- Rule-based reasoning in Protégé
- Protégé as graphical, object-oriented extension to Jess