DROOLS

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May 29, 2011

Outline

Outline

Drools - "Business Logic Integration Platform"

Expert - Rule Engine

Fusion - Event Processing

Flow - Workflow

Guvnor - Rule Repository

Planner - Constraint Solver

Drools Expert

- Open Source
- Interamente realizzato in Java
- Linguaggio Proprietario (standard previsti...)
- Integrato con Eclipse

Contatti

Comunitá aperta di utenti e sviluppatori

- **http://www.jboss.org/drools**
- **http://blog.athico.com/**
- **irc.codehaus.org** *#drools*

Outline

Dal "Modus Ponens"

$$\frac{\langle P(x), P(X) \rightarrow C(Y) \rangle}{C(y)}$$

- Data l'implicazione $\rightarrow$ (vera)
- la premessa (vera) consente di dedurre la conseguenza (vera)

... alle "Production Rules"

Premise $\Rightarrow$ Conclusion

- Regola $\Leftrightarrow$ Implicazione (vera)
- Forward Chaining
- Regole *reattive*

... alle "Production Rules"

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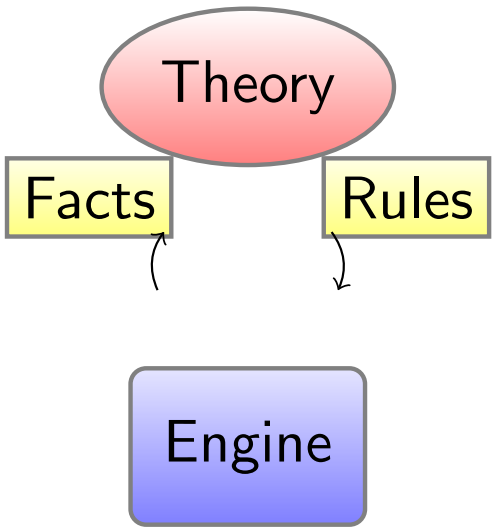

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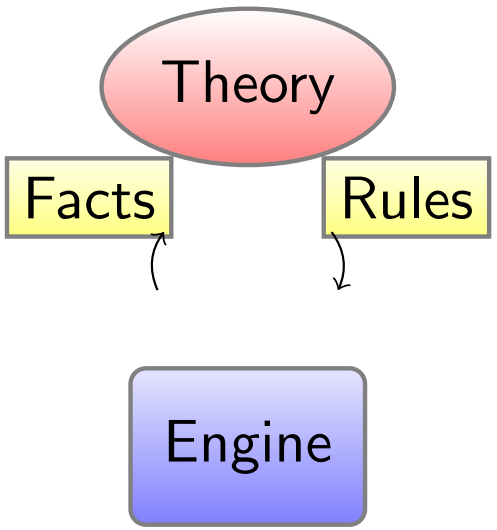

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... alle "Production Rules"

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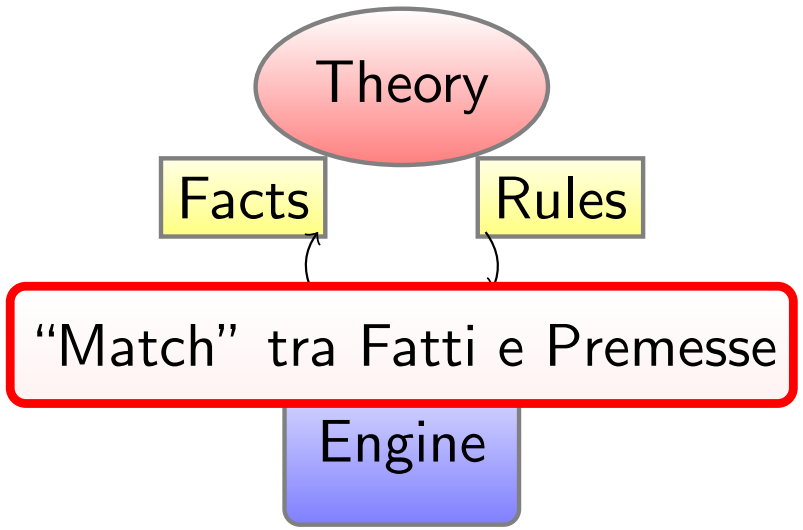

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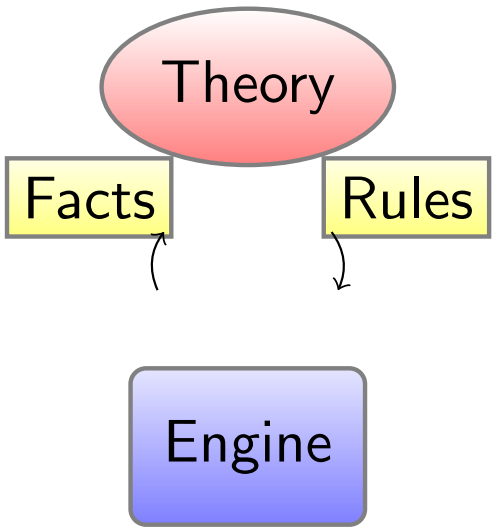

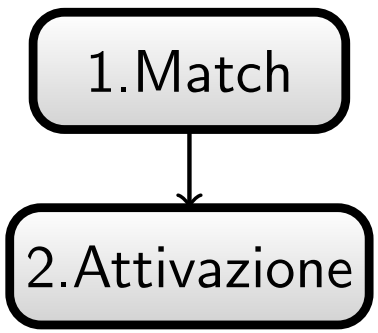

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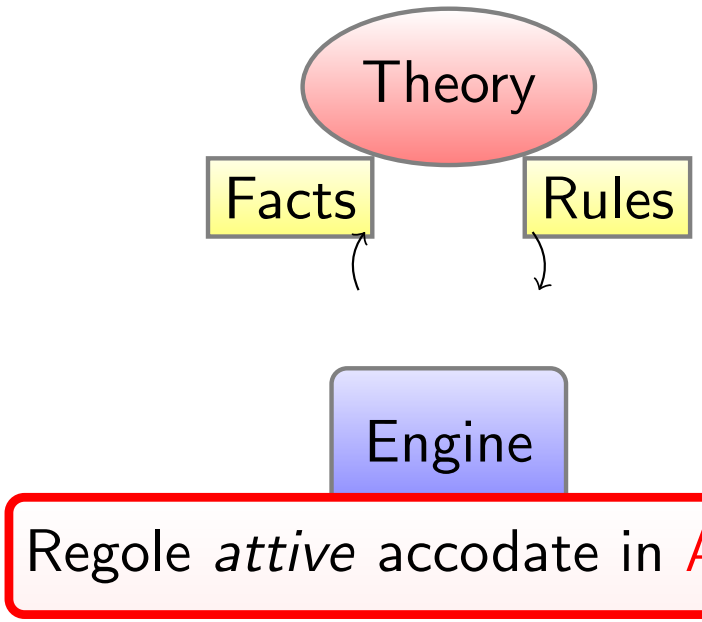

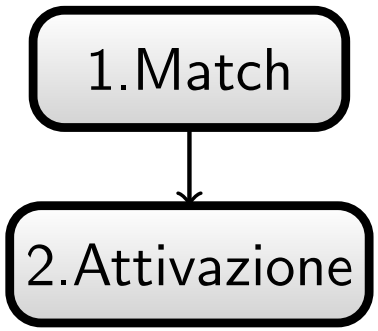

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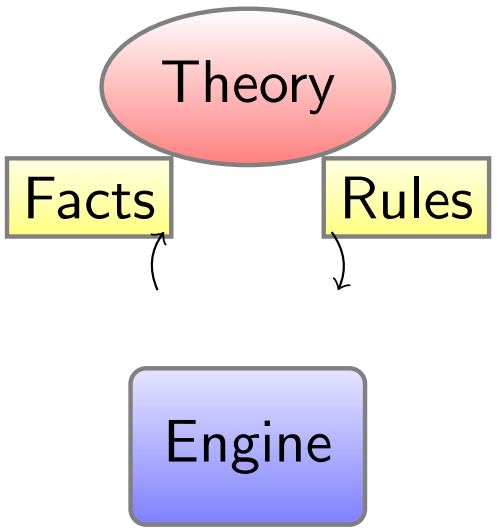

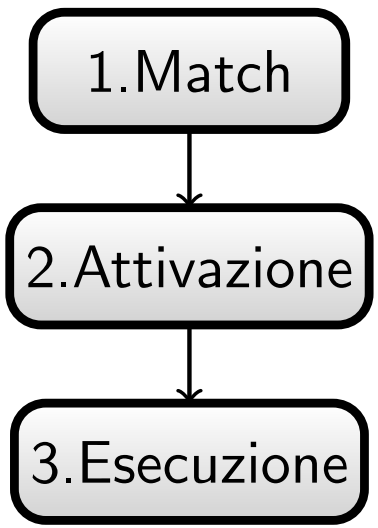

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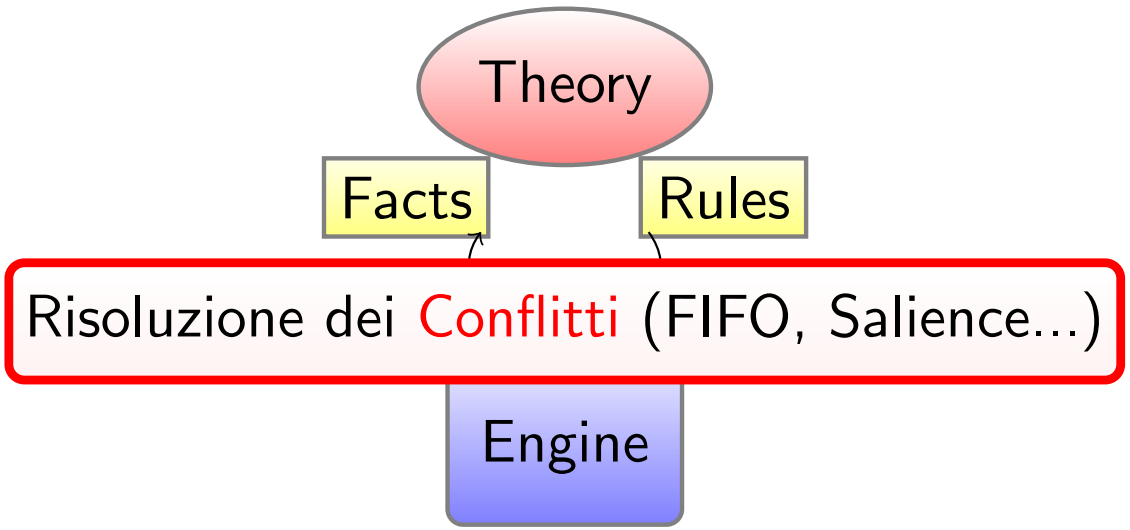

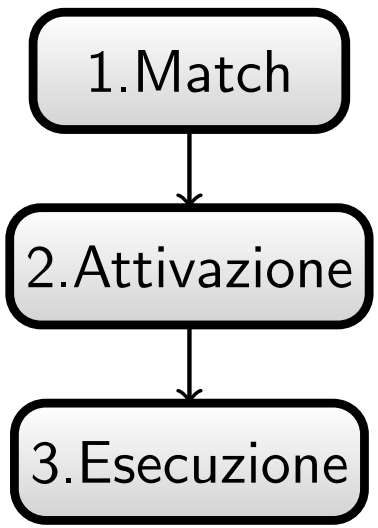

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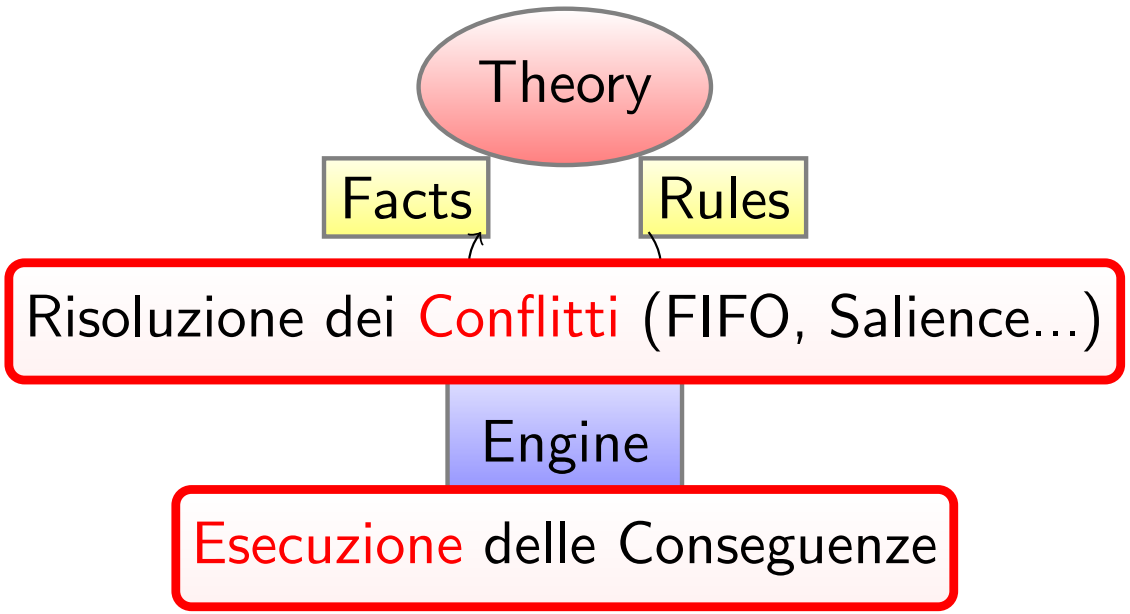

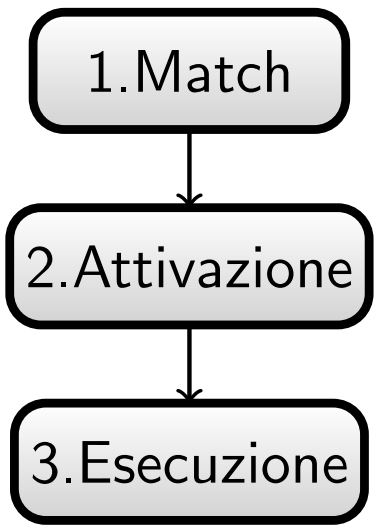

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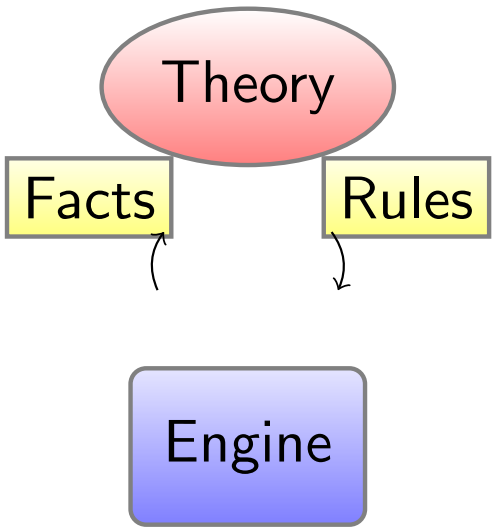

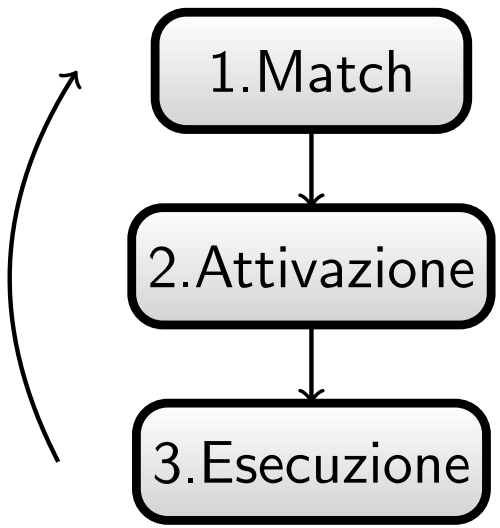

Outline

Regole

Struttura delle regole:

```
rule "ID_Regola"
  // attributi
when
  // LHS - Premessa
then
  // RHS - Conclusione
end
```

LHS - Pattern / 1

Pattern

- Elemento *atomico* per la scrittura di regole
- Filtra gli oggetti inseriti nella WM
- Definisce un insieme di *vincoli*

LHS - Pattern / 2

Person( )

- Pattern di base - semplice vincolo di tipo
- `x instanceof Person` ?

LHS - Pattern / 2

Person(name == "john" , age > 18)

- *Field constraints*
- Operatori classici : ==, <, >=, ...
  - in *and* : ',' oppure '&&'
  - in *or* : '||'
- `x.getName().equals("john") && x.getAge() > 18` ?

LHS - Pattern / 2

```
$p: Person( $n : name == "john" , age > 18 , $add : address )
```

- *Variabili*
- Assegnamento mediante ':'

LHS - Join

```
rule "Join"
when
   $p : Person( $n : name, age >= 30 )
   Course( $s : subject == "ai", teacher == $p )
then
   ...
end
```

- Pattern multipli nella premessa
- Generano tutte le combinazioni usando oggetti che fanno match
- Variabili per definire constraint *tra* pattern diversi
- *rightarrow* Join nei DB relazionali

RHS - Conseguenze

Conseguenze

- Logiche...
  - Insert : genera nuovi fatti nella WM
  - Retract : rimuove fatti esistenti
  - Modify : aggiorna fatti esistenti
- ... e non
  - Qualsiasi "side effect"
  - Codice JAVA libero

Outline

RETE

- Efficiente per grandi quantitá di regole e fatti
- Usato nella maggior parte dei Production Rule System commerciali e non
  - Drools, CLIPS, Jess, ILOG, ...

- Le regole vengono *compilate* in una "data-flow network"
- I fatti sono memorizzati in una memoria distribuita
- I nodi della rete vengono condivisi quando possibile

Outline

RETE al lavoro

Regola "Professori e Corsi di AI"

$p : Professor($n : name, age >= 30)
Course($s : subject == "ai", teacher == $n)

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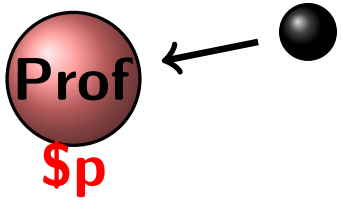

for each Pattern *j* : new type node

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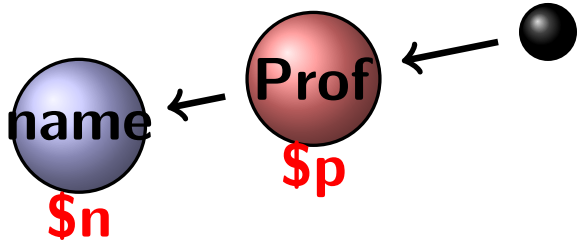

P_j : for each Literal Constraint k : new alpha node $\alpha_{j,k}$

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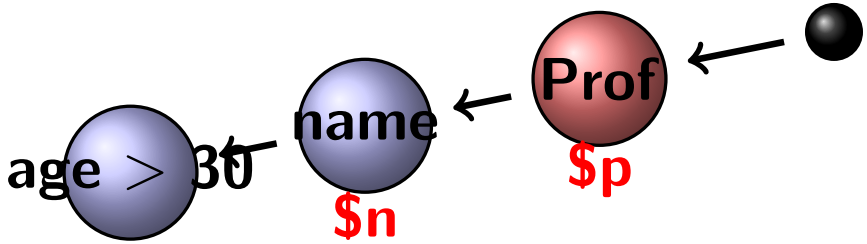

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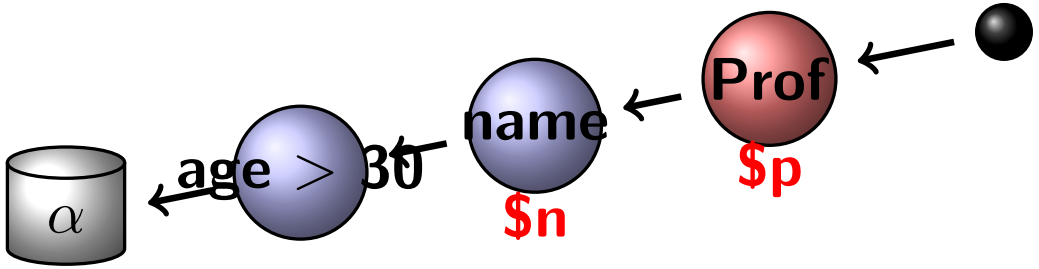

P_j : new alpha memory α_j

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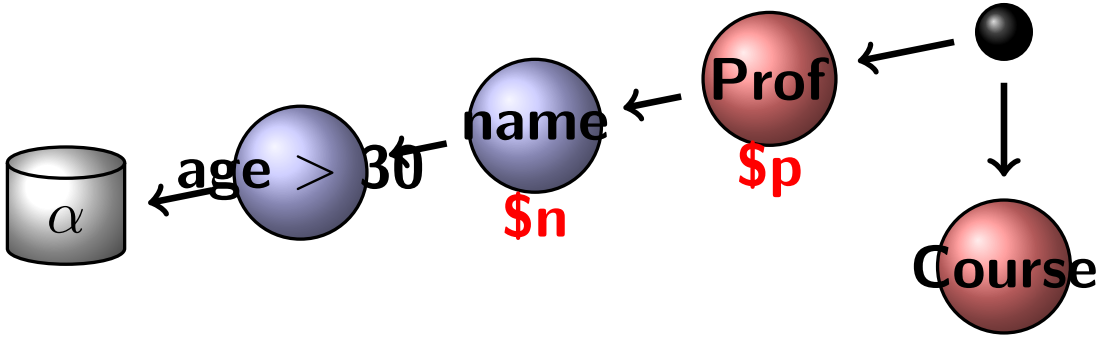

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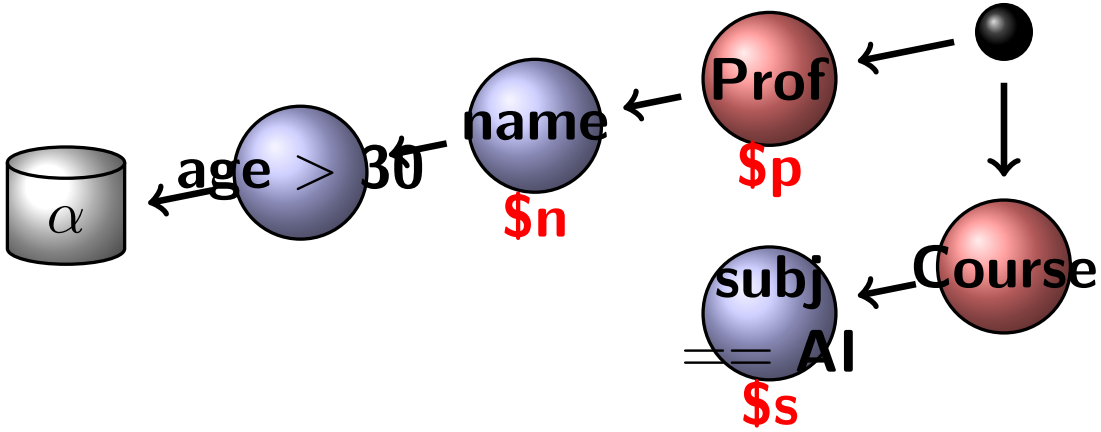

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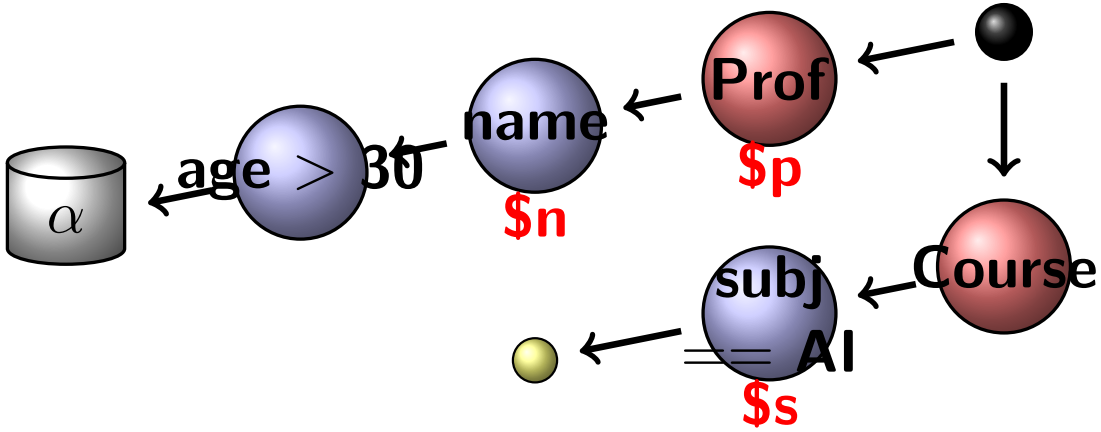

(Skip Variable Constraints)

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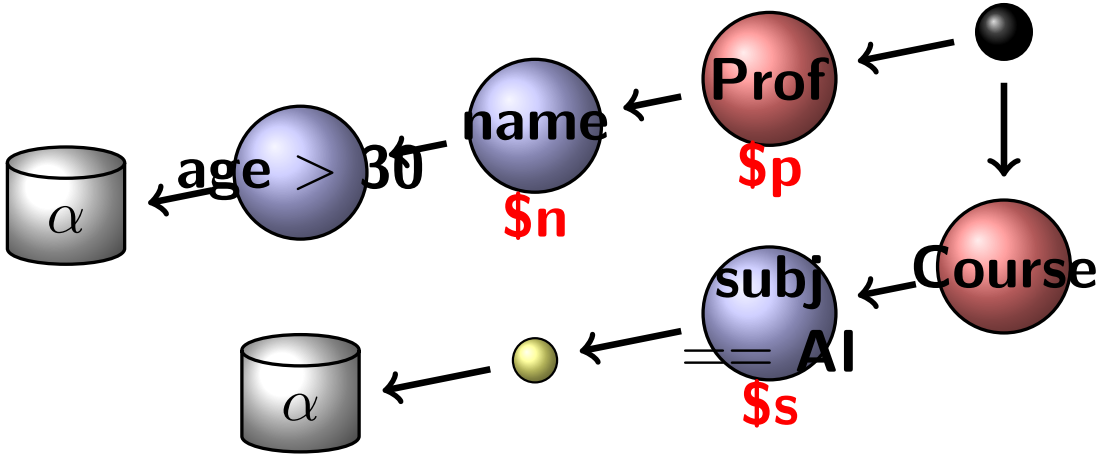

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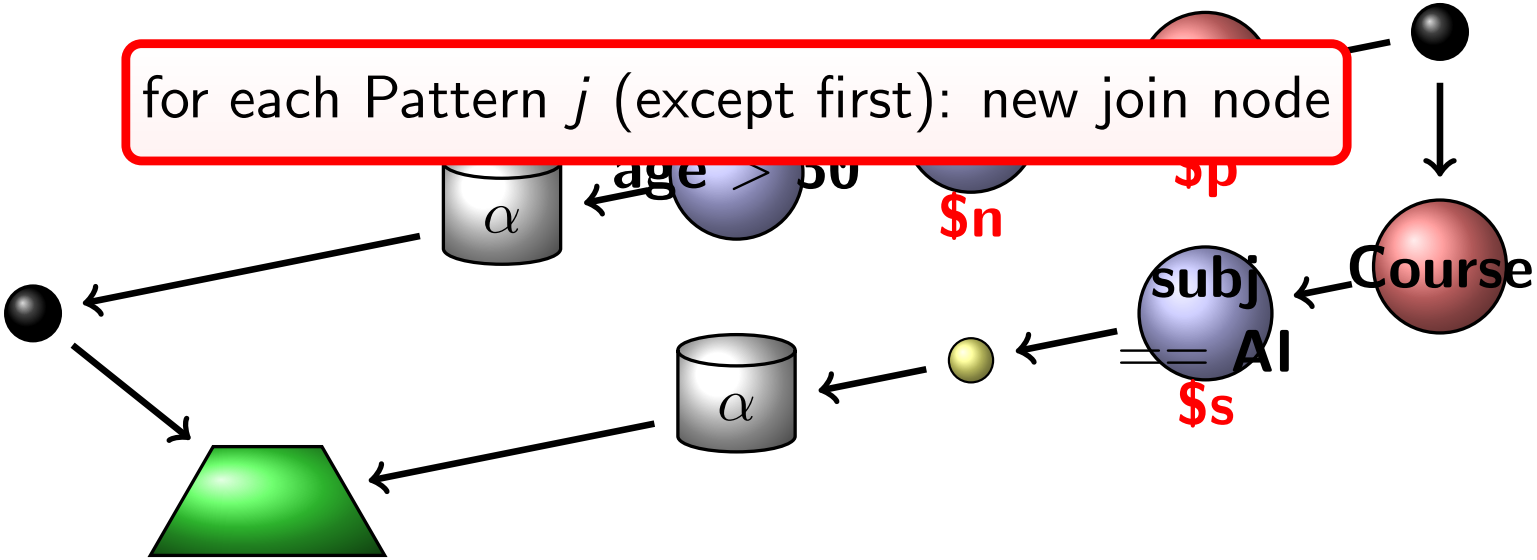

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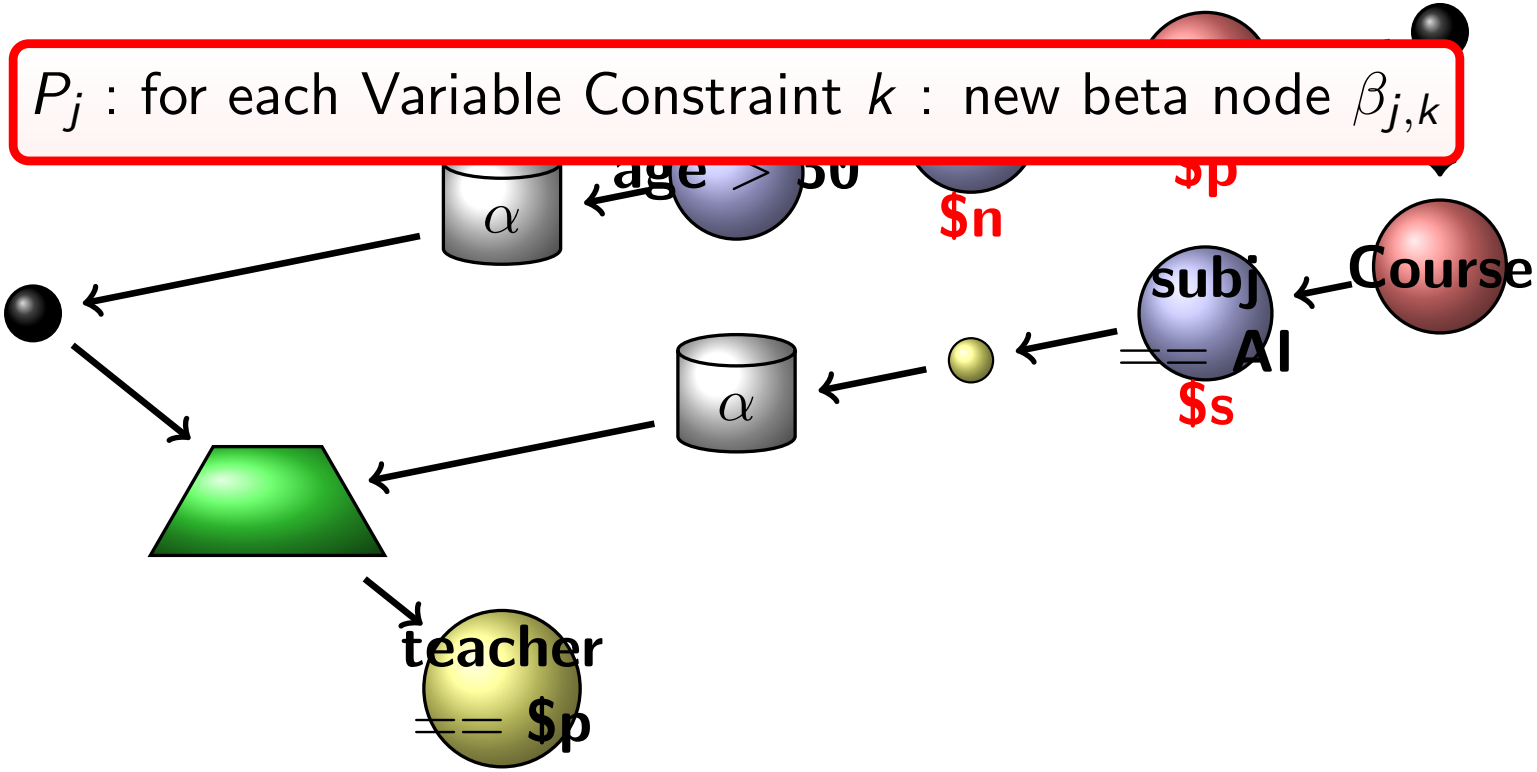

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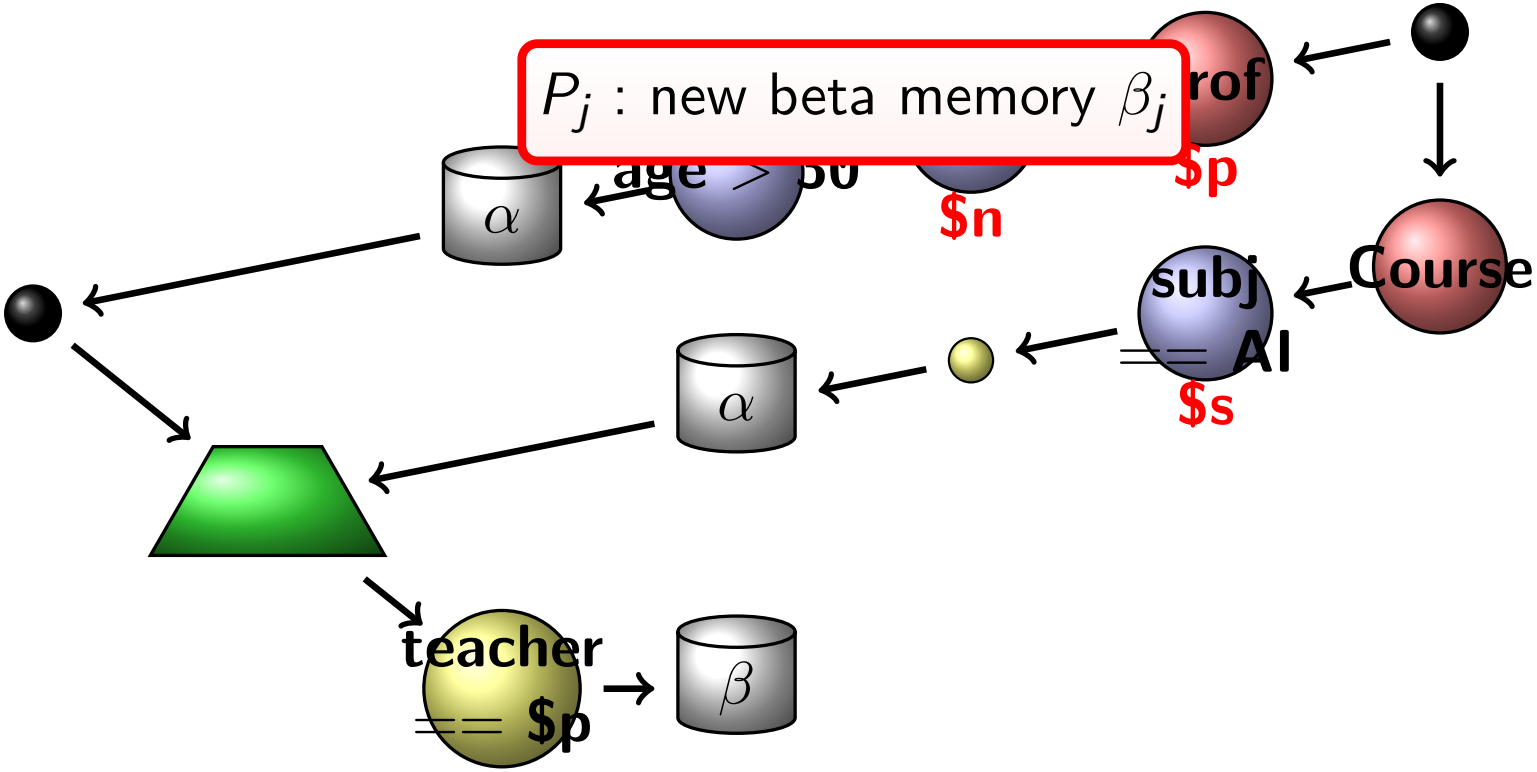

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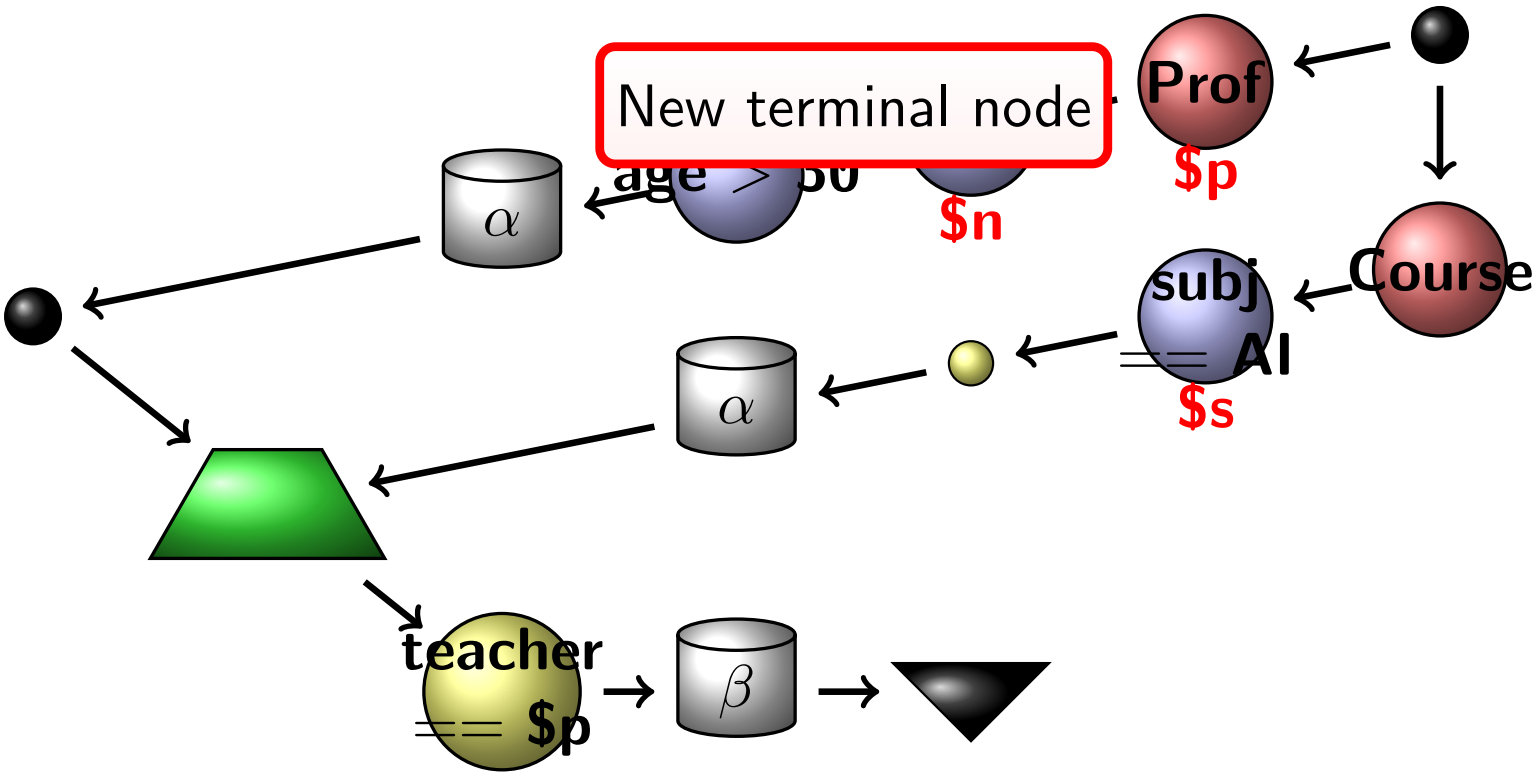

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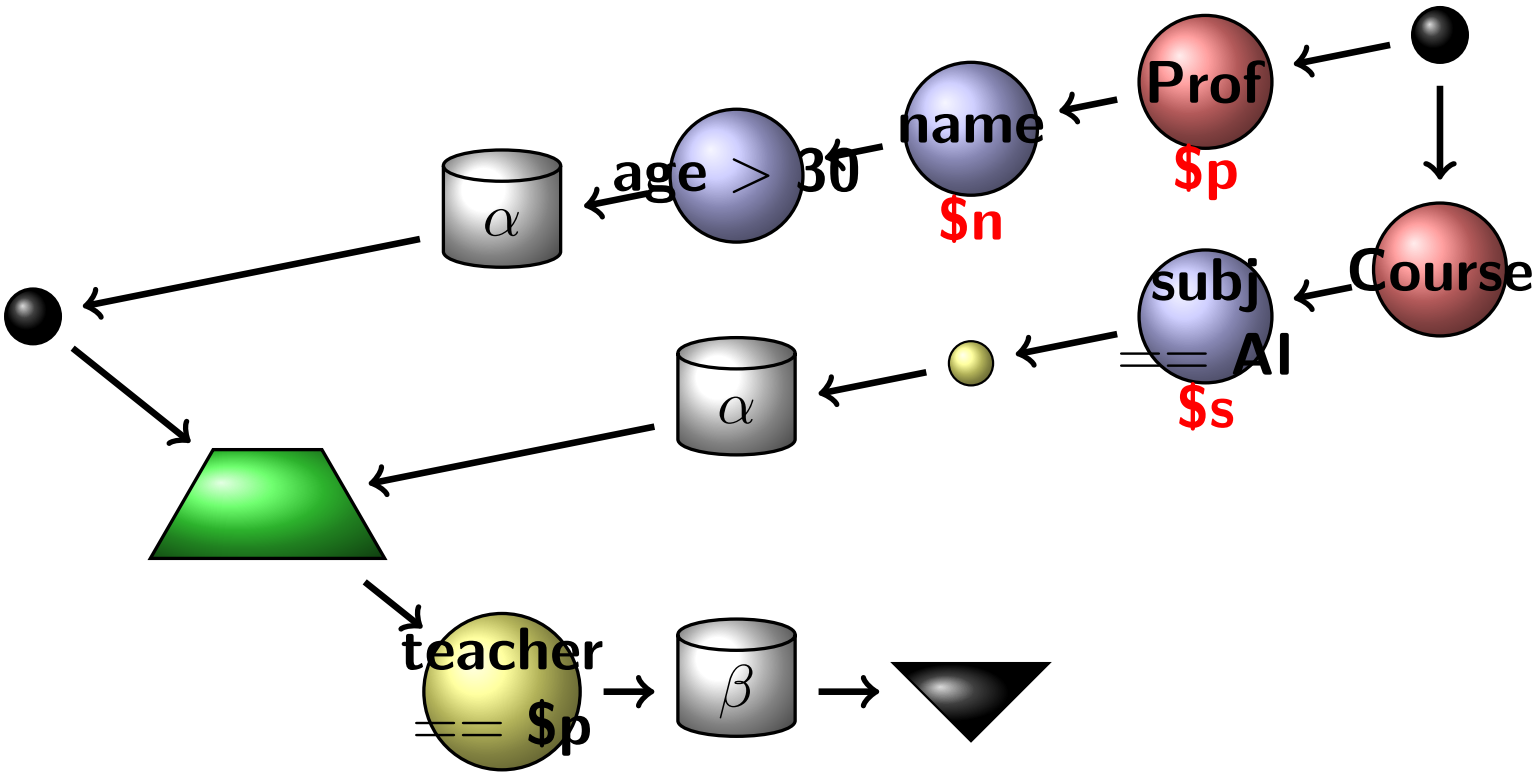

Outline

Nodi:

Alpha Network

- I nodi "Type" selezionano i fatti (vincolo sulla classe)
- I nodi "Alpha" filtrano i fatti (vincolo sui campi)
- I fatti non scartati vengono salvati nelle "alpha-memories"
- I fatti nelle "alpha-memories" fanno *match* con un pattern

Beta Network

- I nodi "Join" collegano memorie alpha e beta
- I nodi "Join" creano n-tuple a partire da fatti e (n-1)-tuple
- I nodi "Beta" filtrano le tuple
- Le tuple non scartate vengono salvate nelle "beta-memories"
- Le tuple nelle "beta-memories" fanno *match* con una sequenza (parziale) di pattern

A runtime...

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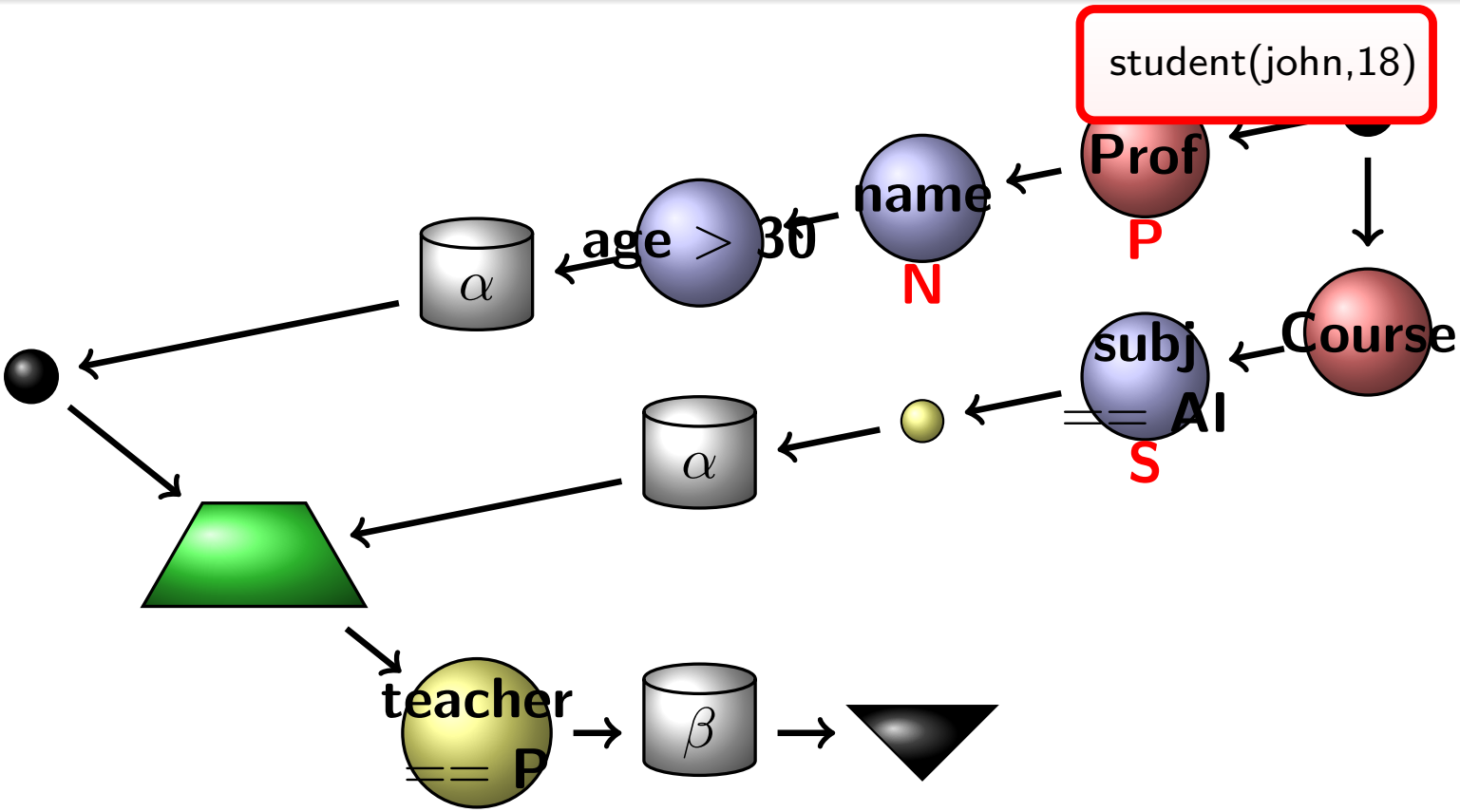

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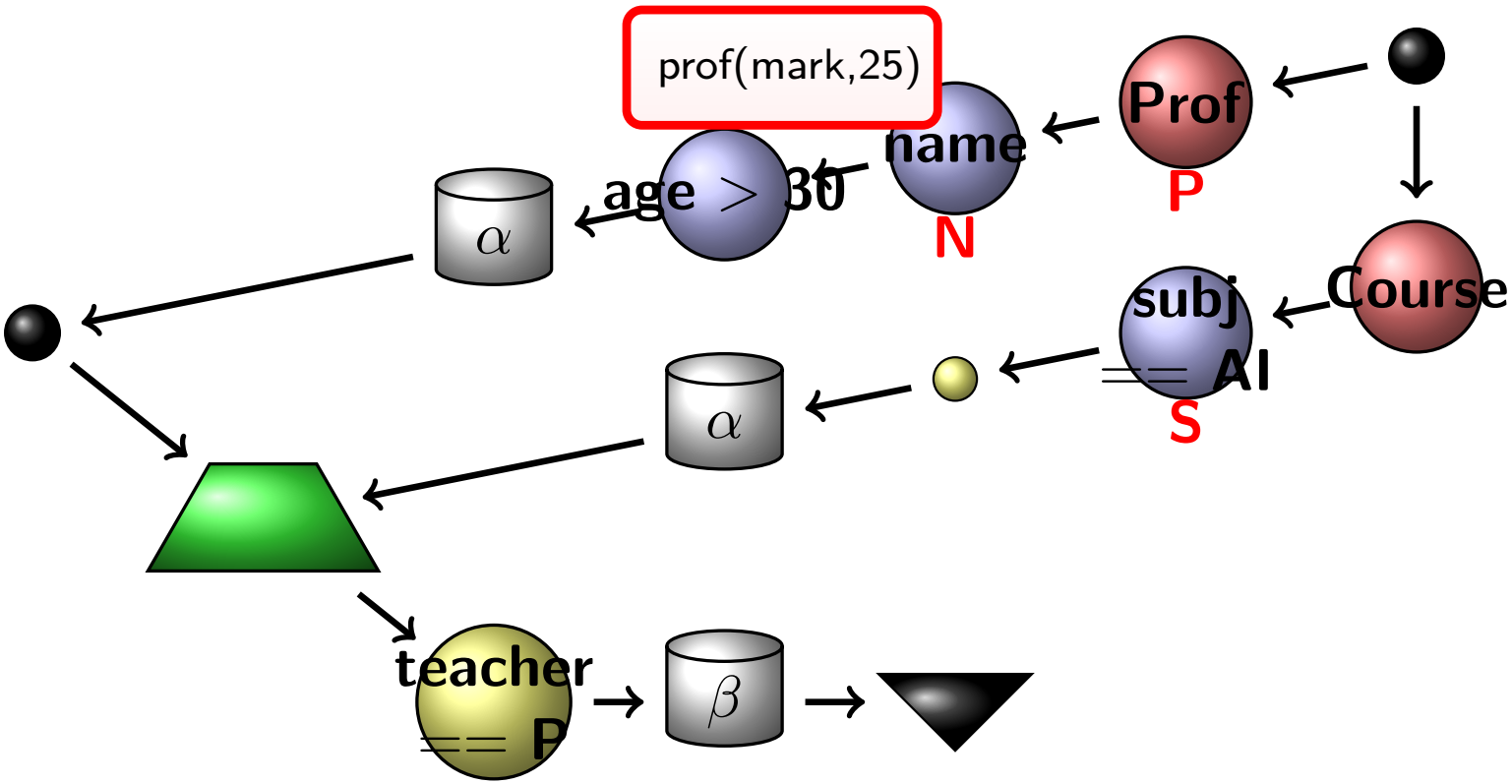

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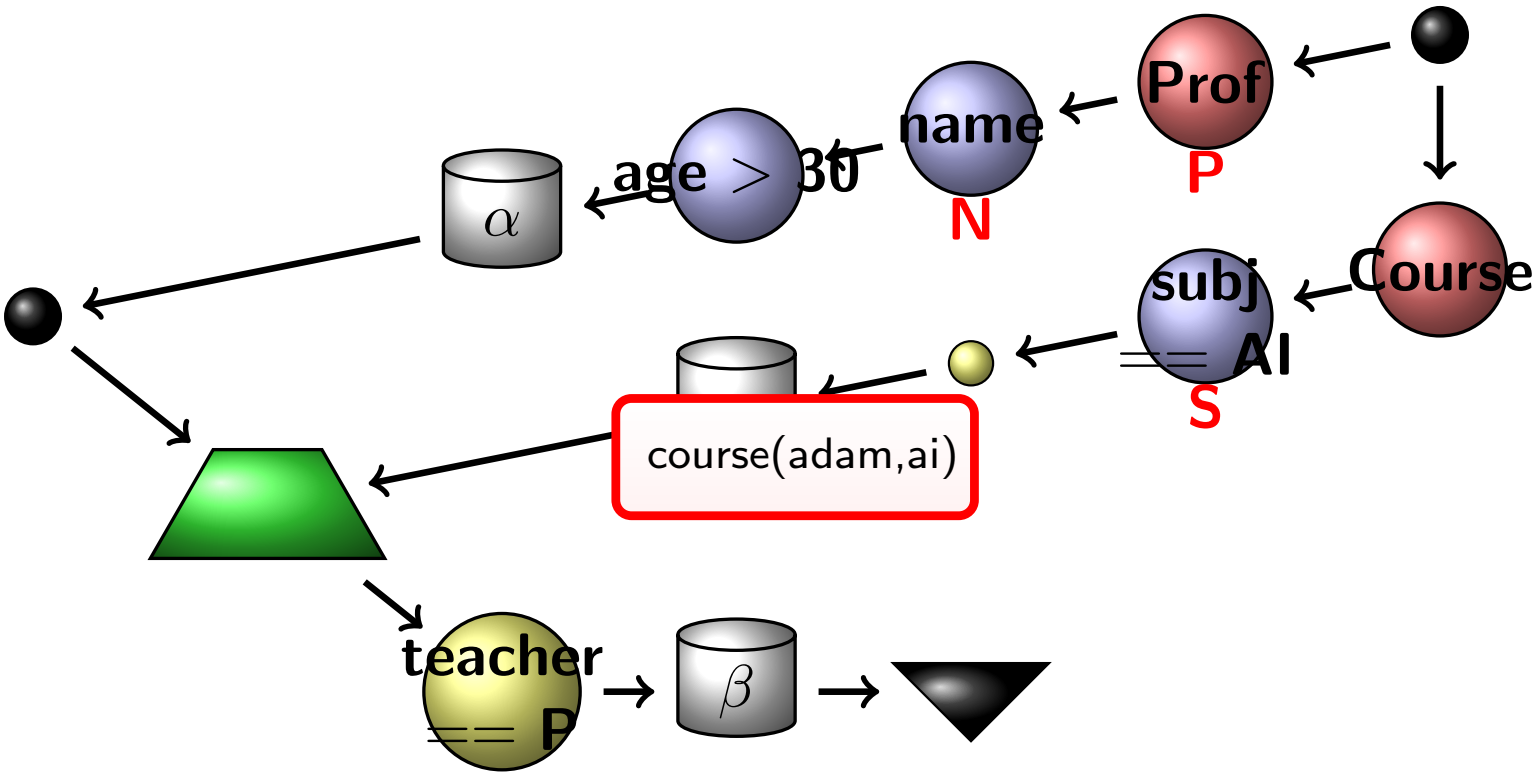

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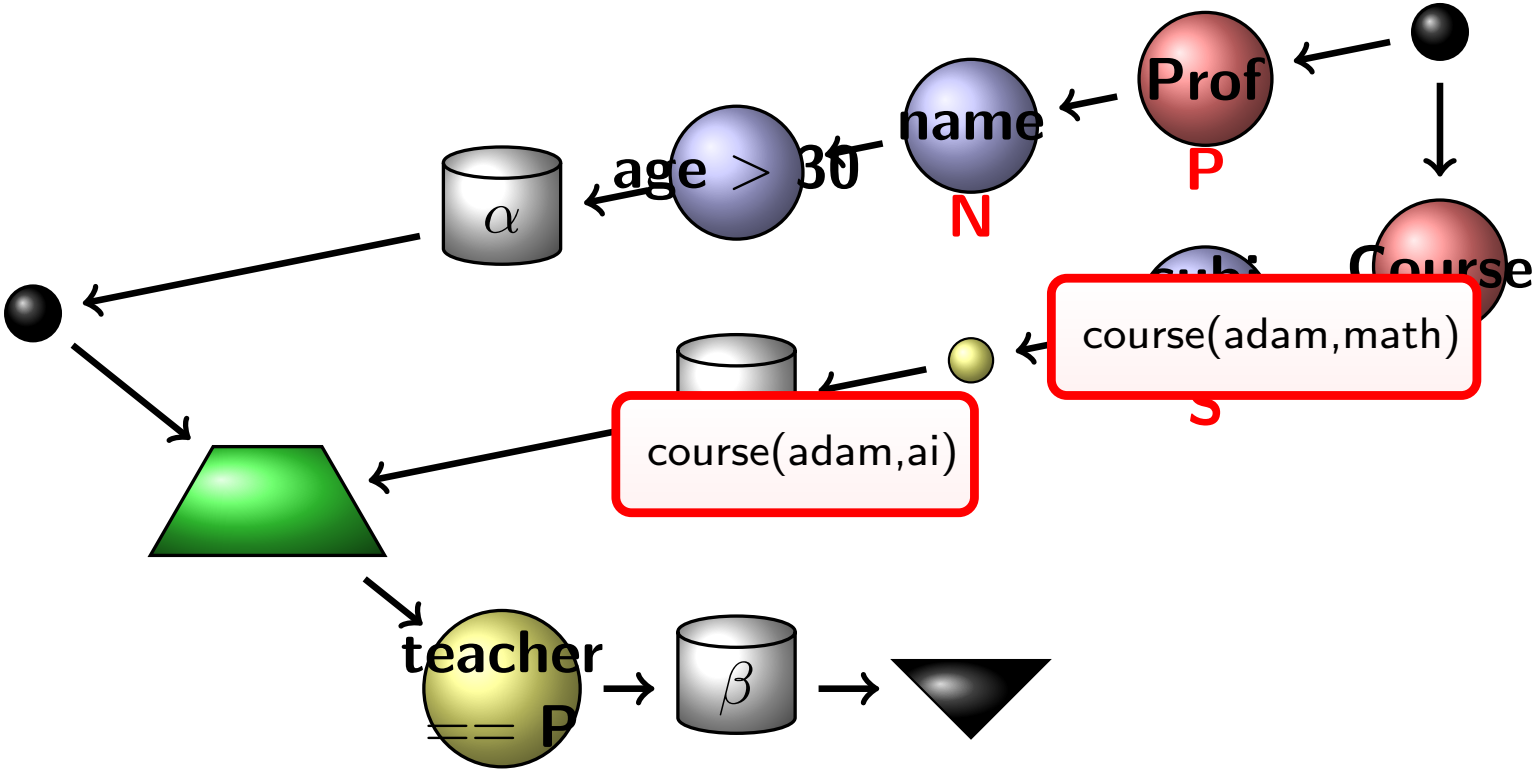

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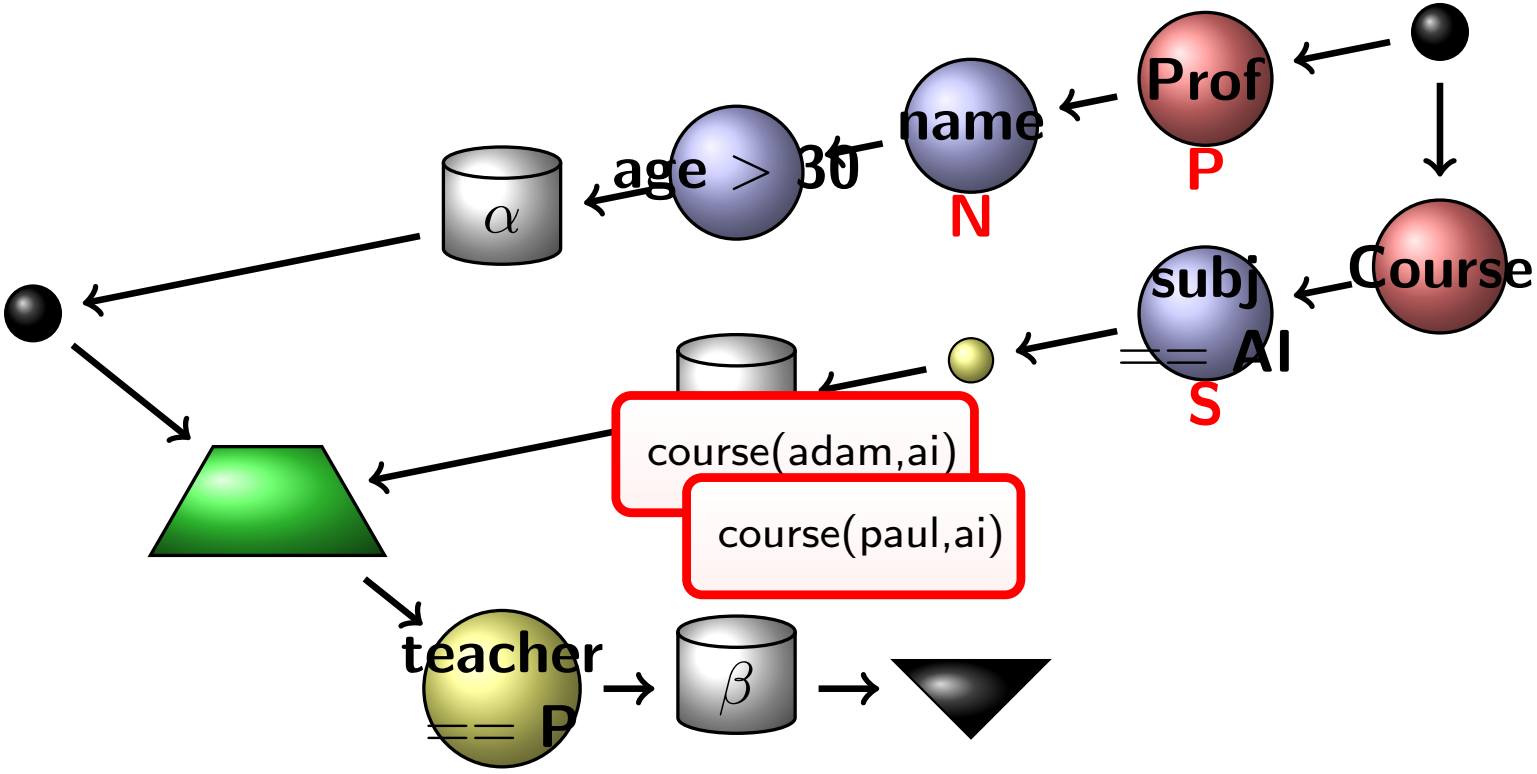

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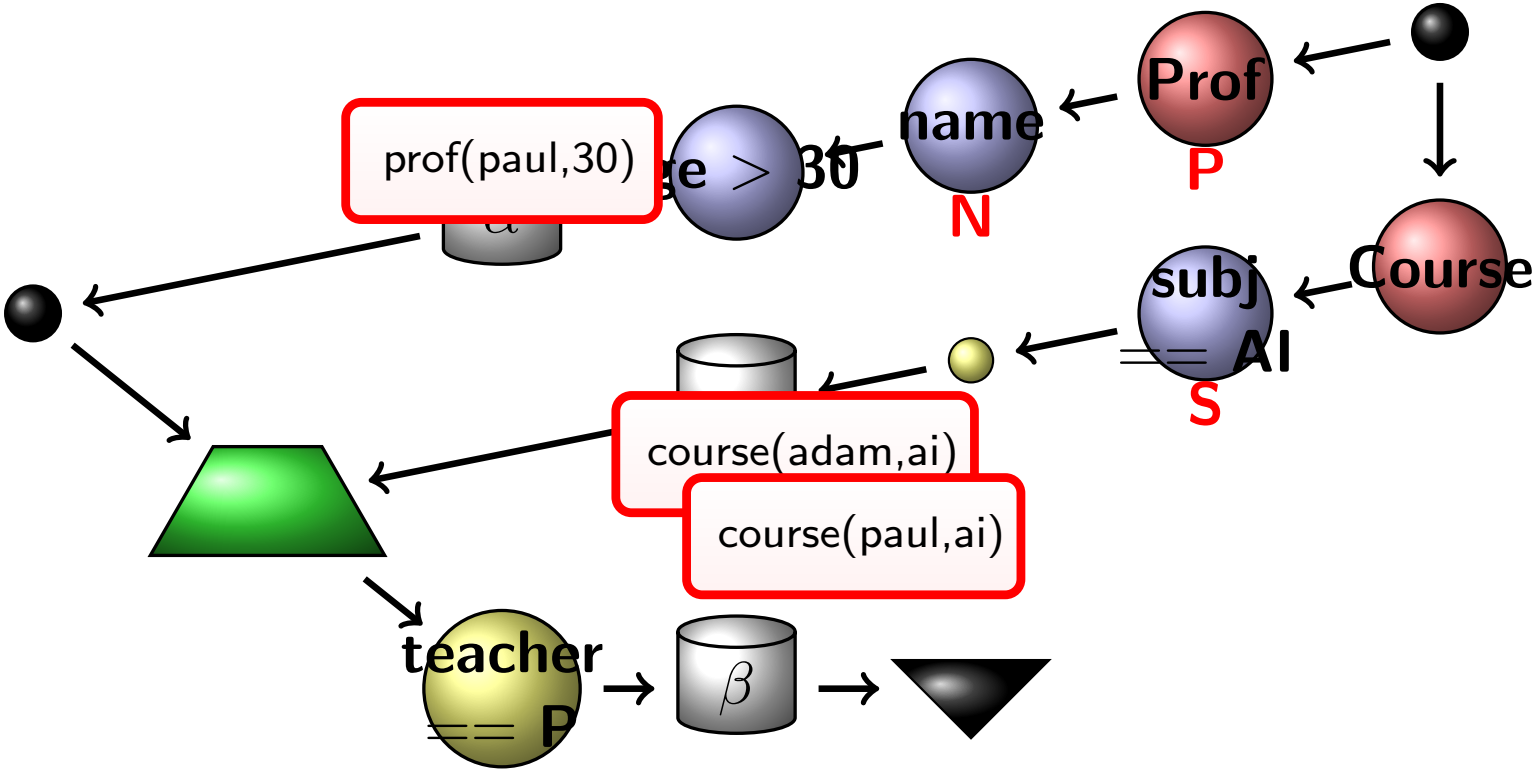

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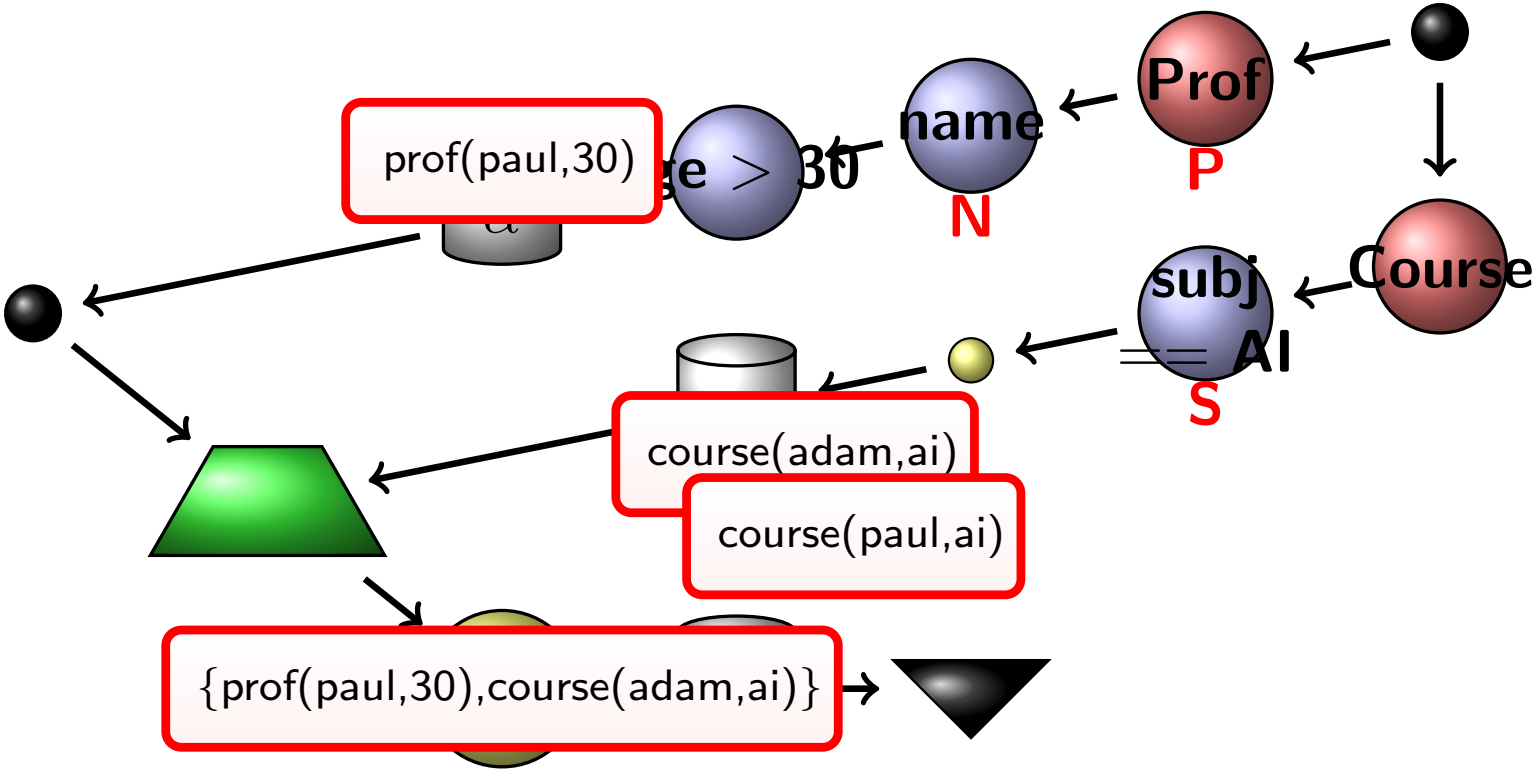

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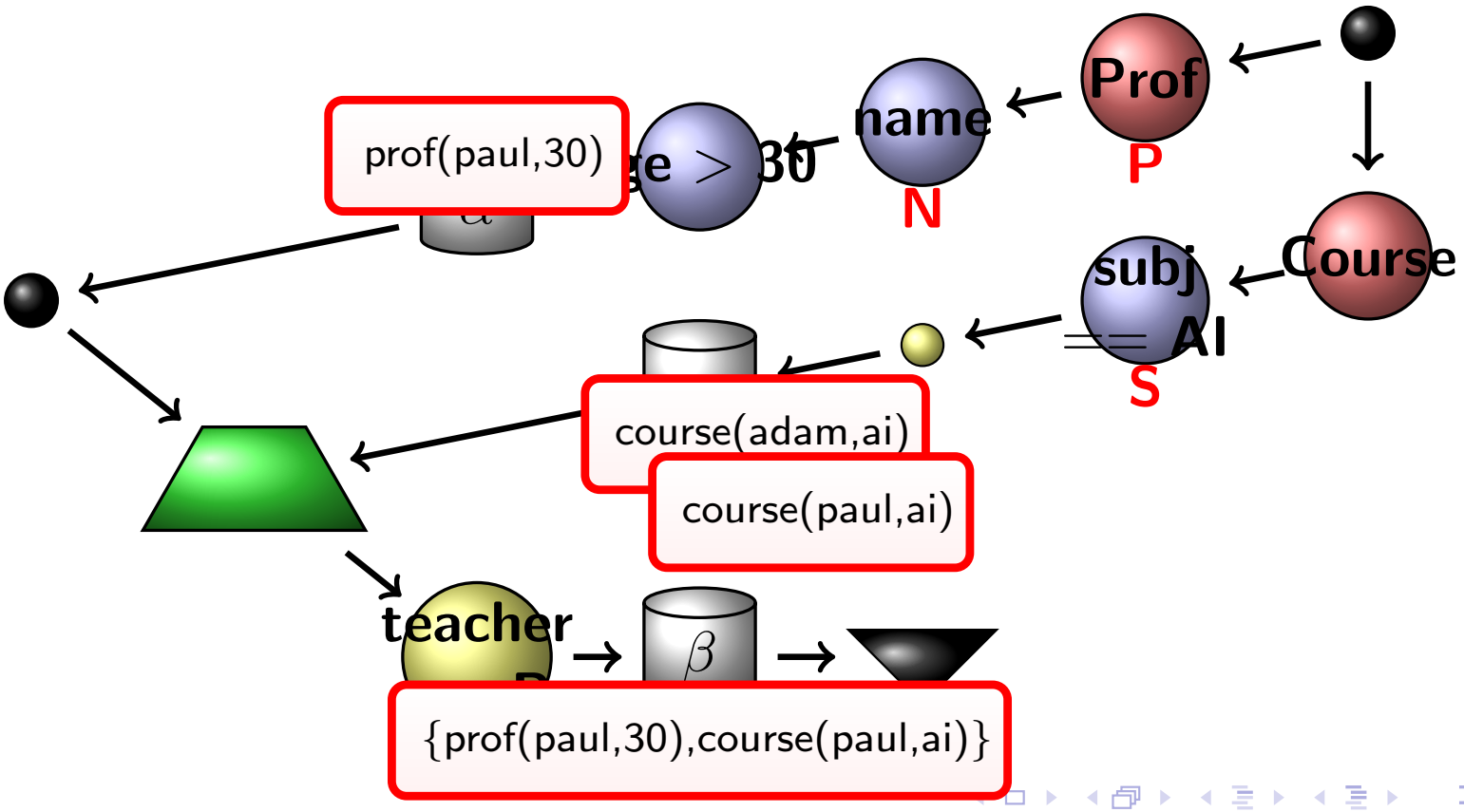

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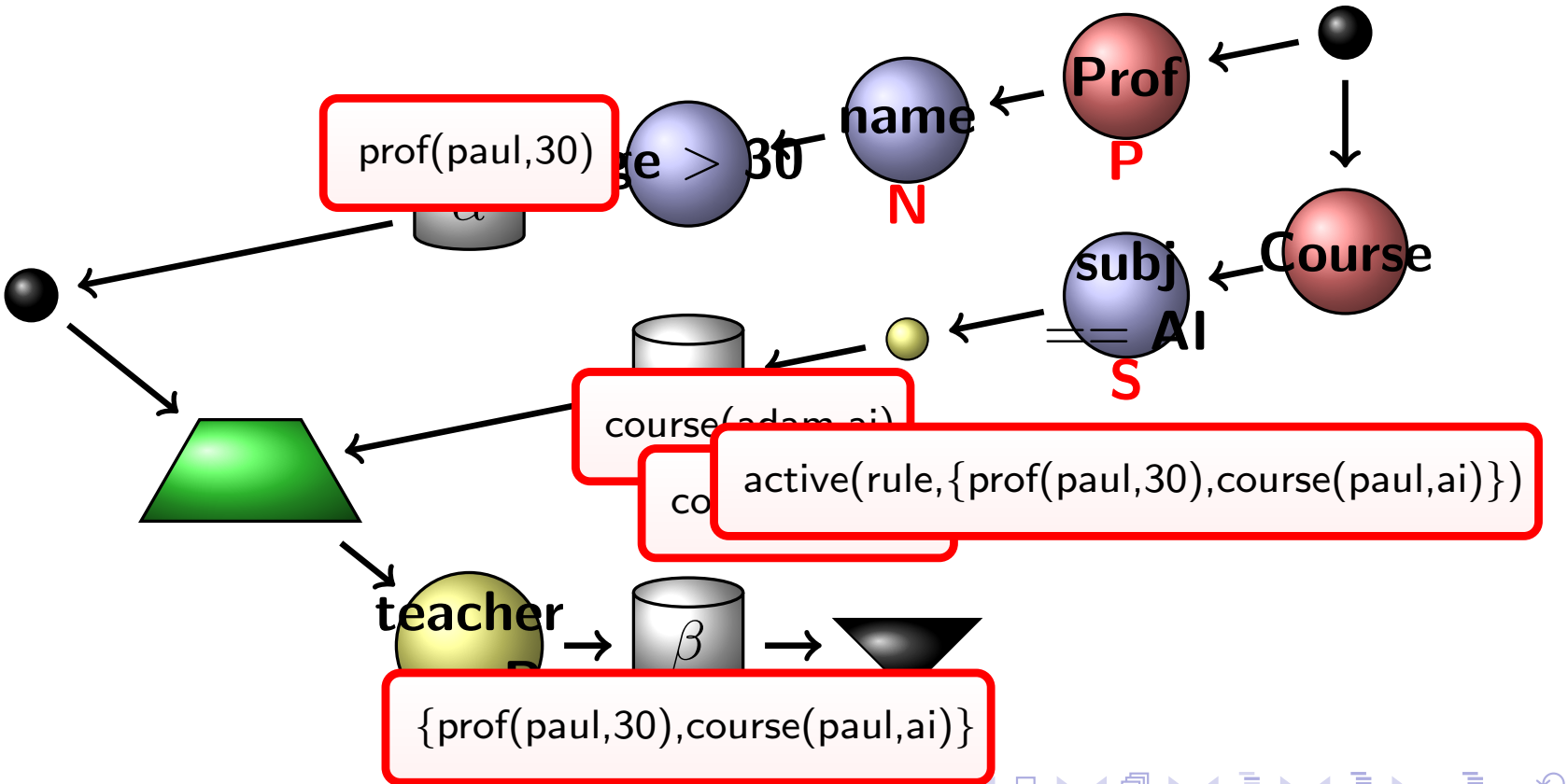
$p : Professor($n : name, age >= 30)
Course($s : subject == "ai", teacher == $n)



Outline

Link utili

- Charles Forgy, "Rete: A Fast Algorithm for the Many Pattern/Many Object Pattern Match Problem", Artificial Intelligence, 19, pp 17-37, 1982
- R.B. Doorenbos, "Production Matching for Large Learning Systems", www.zilonis.org/CMU-CS-95-113.pdf
- http://en.wikipedia.org/wiki/Rete algorithm

- Sito : http://www.jboss.org/drools
- Blog : http://blog.athico.com/
- IRC : irc.codehaus.org #drools