

# Policy analysis using a hybrid semantic reasoning engine

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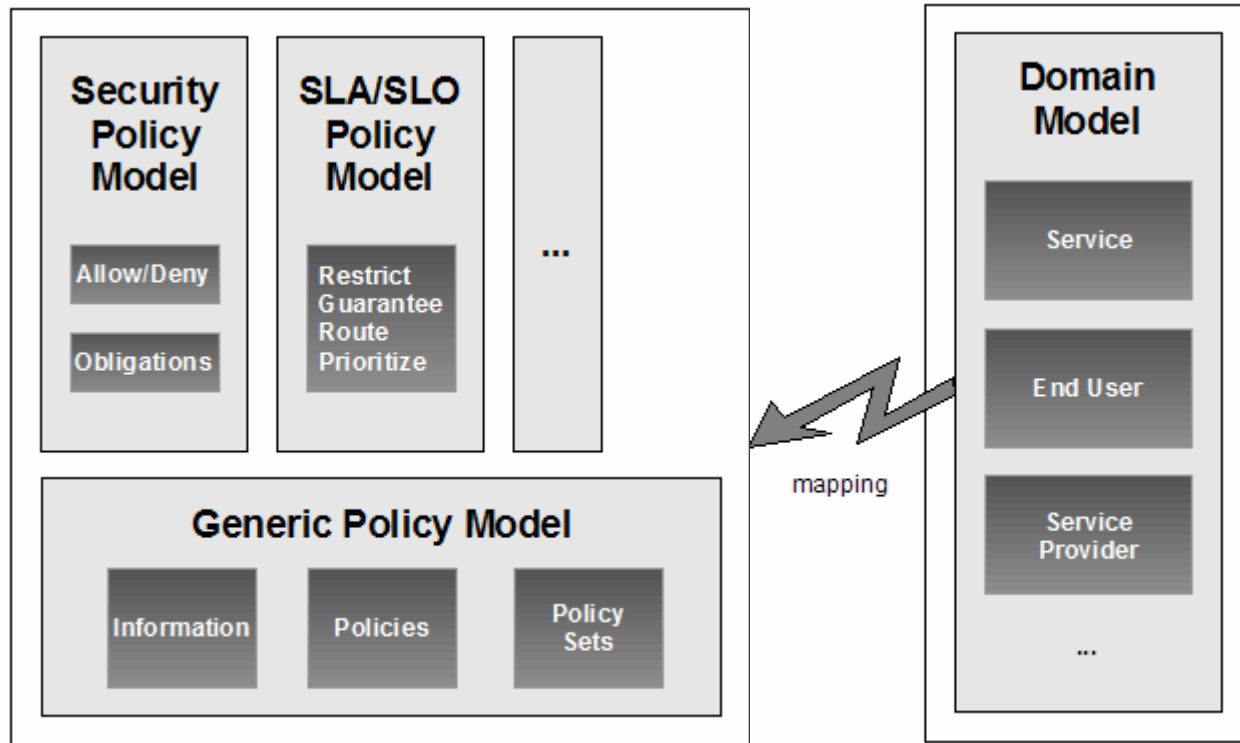
Performed in the context of the “*Technologies and Capabilities for Service-Enabling*” project



# Policy reasoning

- Policies are used in many different areas ...
  - Security, quality of service, user preferences, etc.
- ... and domains
  - Telecom, healthcare, etc.

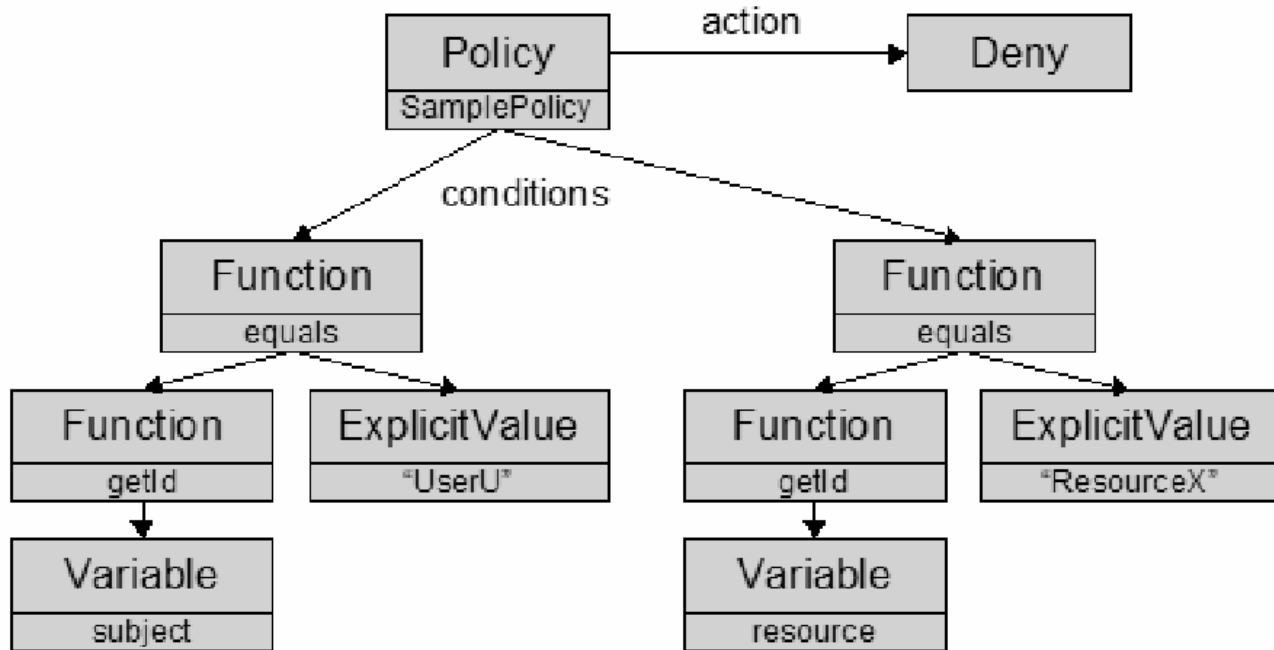
# Policy ontology



K. Verlaenen, B. De Win, W. Joosen, Towards simplified specification of policies in different domains, Integrated Network Management (IM2007)

# Policy example

- “UserU” is denied access to “ResourceX”



# Policy reasoning

- Policies are used in many different areas ...
  - Security, quality of service, user preferences, etc.
- ... and domains
  - Telecom, healthcare, etc.
- Large sets of policies
- Many different actors
- ...

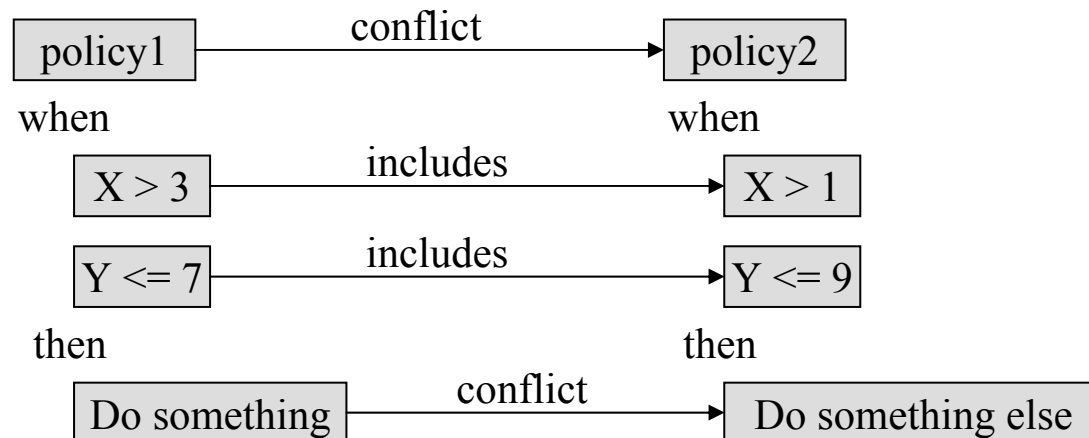
Support authors in detecting problems  
in large policy sets !

# Policy reasoning

- Policy equivalence
- Policy inclusion or policy containment
- Policy incompatibility
- Policy conflict
- Policy incoherence
- Dominance checking
- Policy optimization
- Coverage checking
- Policy combination
- Policy deduction
- ...

# Hybrid reasoning

- Approach: Use the reasoning power of semantic languages (OWL, SWRL, SPARQL)
  - Detect relationships between simple expressions
  - Deduce more complex relationships between policies based on these simple relationships



# Hybrid reasoning

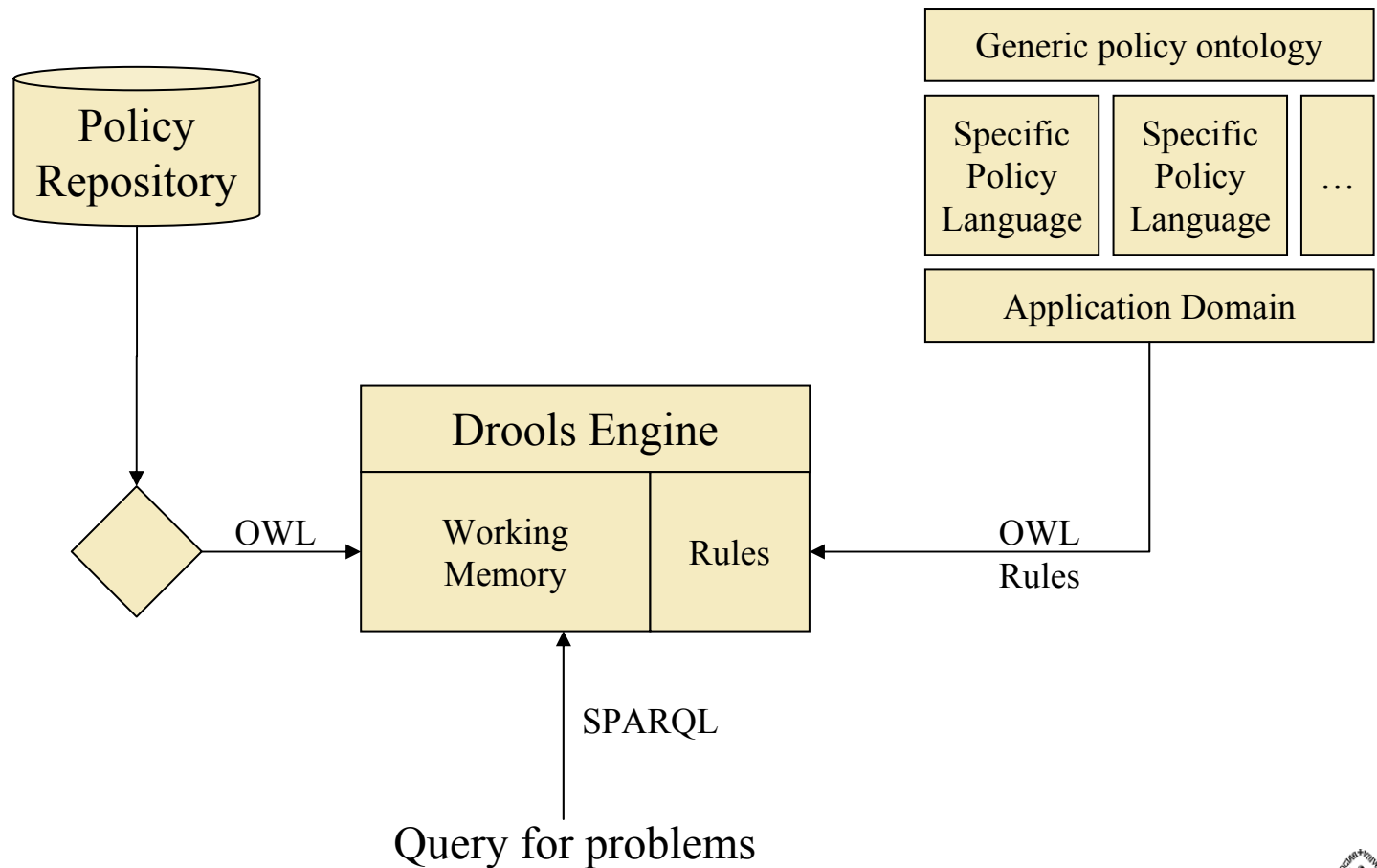
- Extend reasoning capabilities by adding support for a general-purpose rule engine
  - More advanced rule constructs
    - Arbitrary functions
    - Collection management
    - Element creation
    - Not, exist, from, etc.
  - Drools (aka JBoss Rules) with OWL support



# Hybrid reasoning

- How to derive relationships?
  - Rules for all expressions that can be used in conditions
    - E.g. ' $x > a$ ' includes ' $x > b$ ' if  $a \geq b$
  - Generic rules for more complex policy relationships
- Allows domain-specific analysis
  - Theoretical  $\neq$  practical

# Hybrid reasoning



# Conclusion

- Preliminary results: working for basic functions
  - Equivalence, inclusion, incompatibility, conflict, incoherence
- Strong focus on extensibility
  - Complex rules are generic
  - Define semantics of specific functions / actions by policy language designers
  - Policy authors never confronted with complexity

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