



T. J. Watson Research Center

PANDA:

**Policy-driven Automated Negotiation Decision-making Approach**

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# Outline

- Project Objective
- Automated Service Negotiations
- PANDA Framework
- Conclusion & Outlook

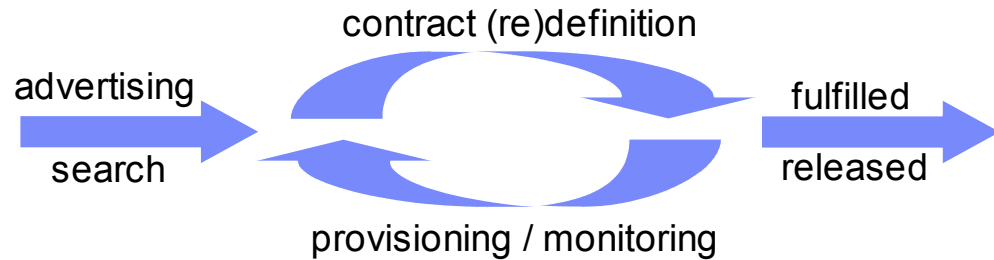
## Assumptions

- Cross-organizational use of Web and Grid services
- Agreements that define these services
- Marketplace for comparable services
- Costs of new agreements must be low

## PANDA Objective

- Automated negotiation of service contracts
- Explicit representation of intended behavior

## Service Life-cycle:



### ■ Why automated negotiation of service contracts?

#### Negotiation

- Fine granularity, just when need arises
- On demand services
- No unprofitable long-term contracts
- Not just unilateral description (WSDL, WS-Policy)

#### Automation

- Human negotiations are slow and costly
- They suffer from culture, ego, pride
- (Semi) automation reduces cost and time

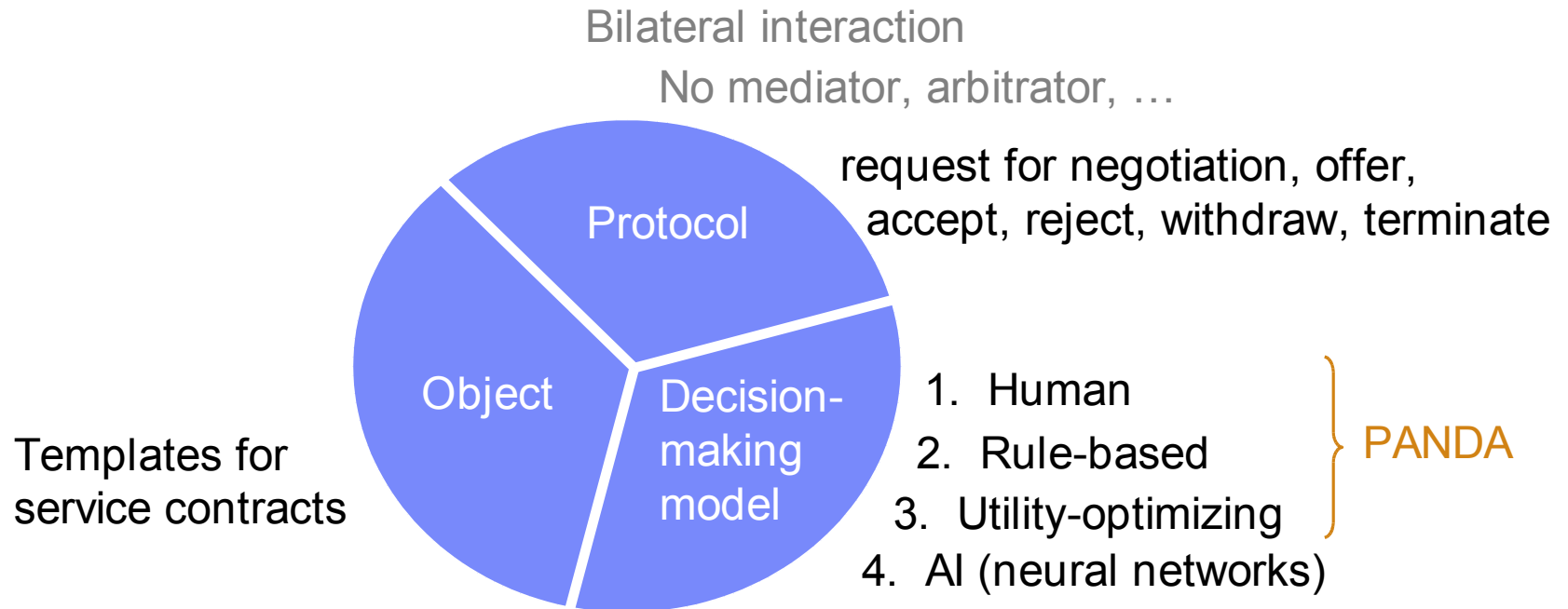
# Definition of a negotiation

A negotiation is an	Definition	Example
exchange of messages		offer, acceptance, ...
between two or more parties		provider & client
intended to reach an agreement.		service contract

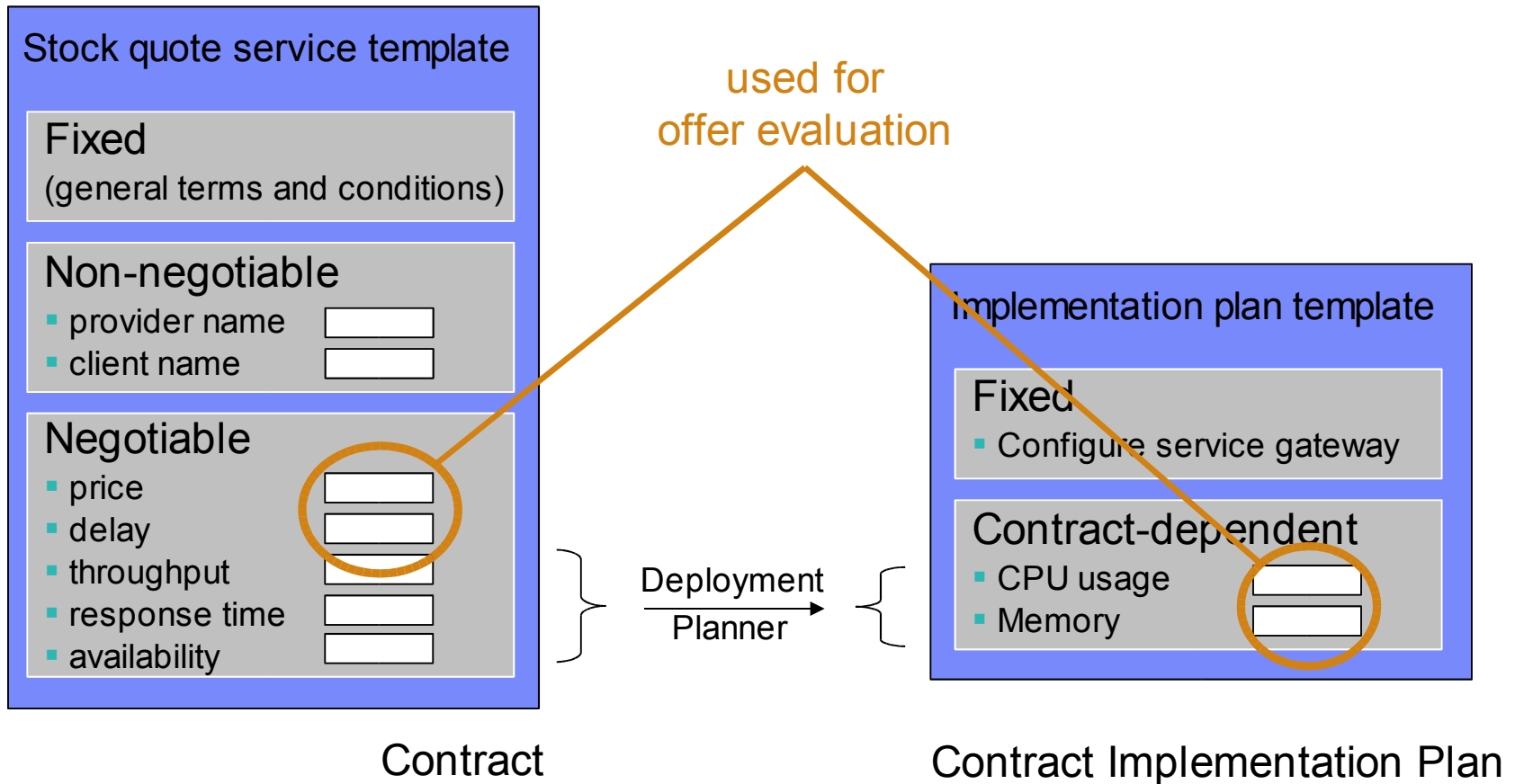
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# Issues in Negotiations



# Templates and multiple attributes





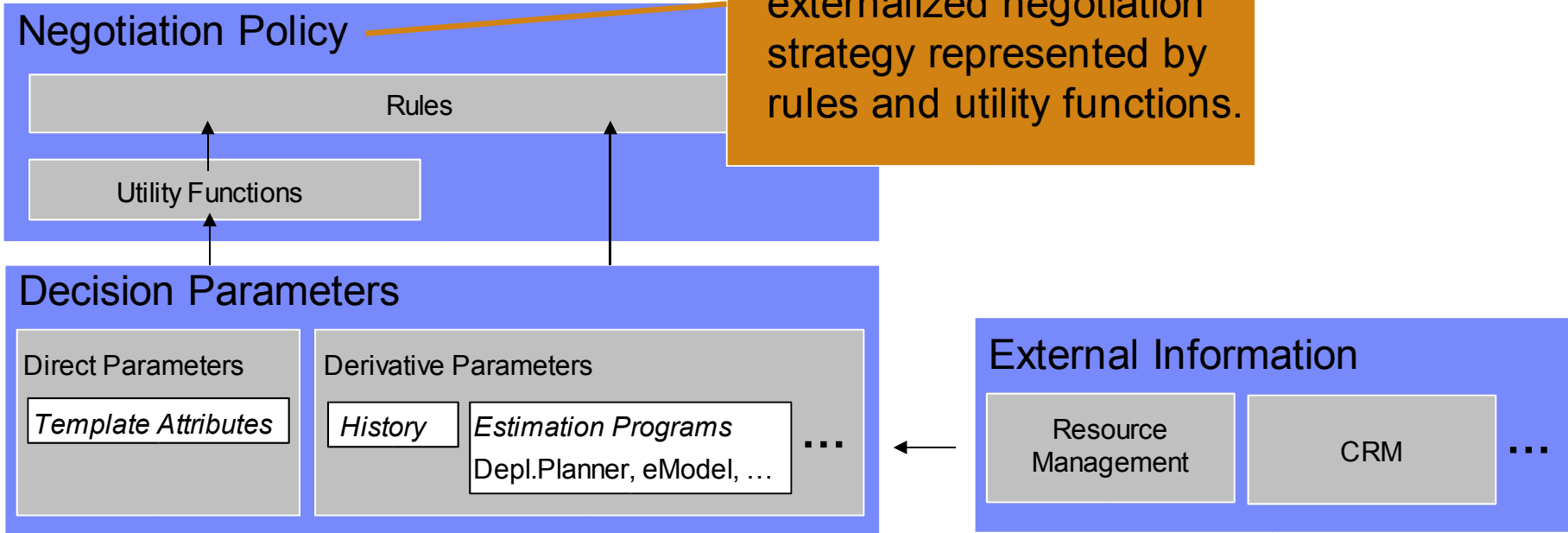
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# Decision-making

- Can this contract be supported? (risk of violation)
- Is this contract profitable?
- How desirable is this contract? (cancel existing contract?)
- Will the counterparty lose int

Def.:  
*A negotiation policy is an externalized negotiation strategy represented by rules and utility functions.*

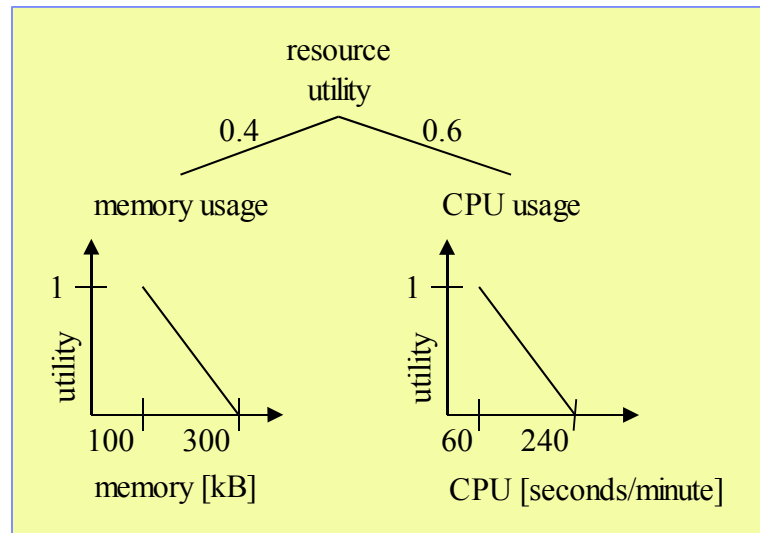


# Utility functions

Def.:

A *utility function* maps decision parameters on a single dimensional abstract utility value.

- Standard tool in economics: descriptive and prescriptive use
  - Trade-offs between otherwise “incomparable” parameters (CPU usage, memory)
  - Representation of non-linear preferences

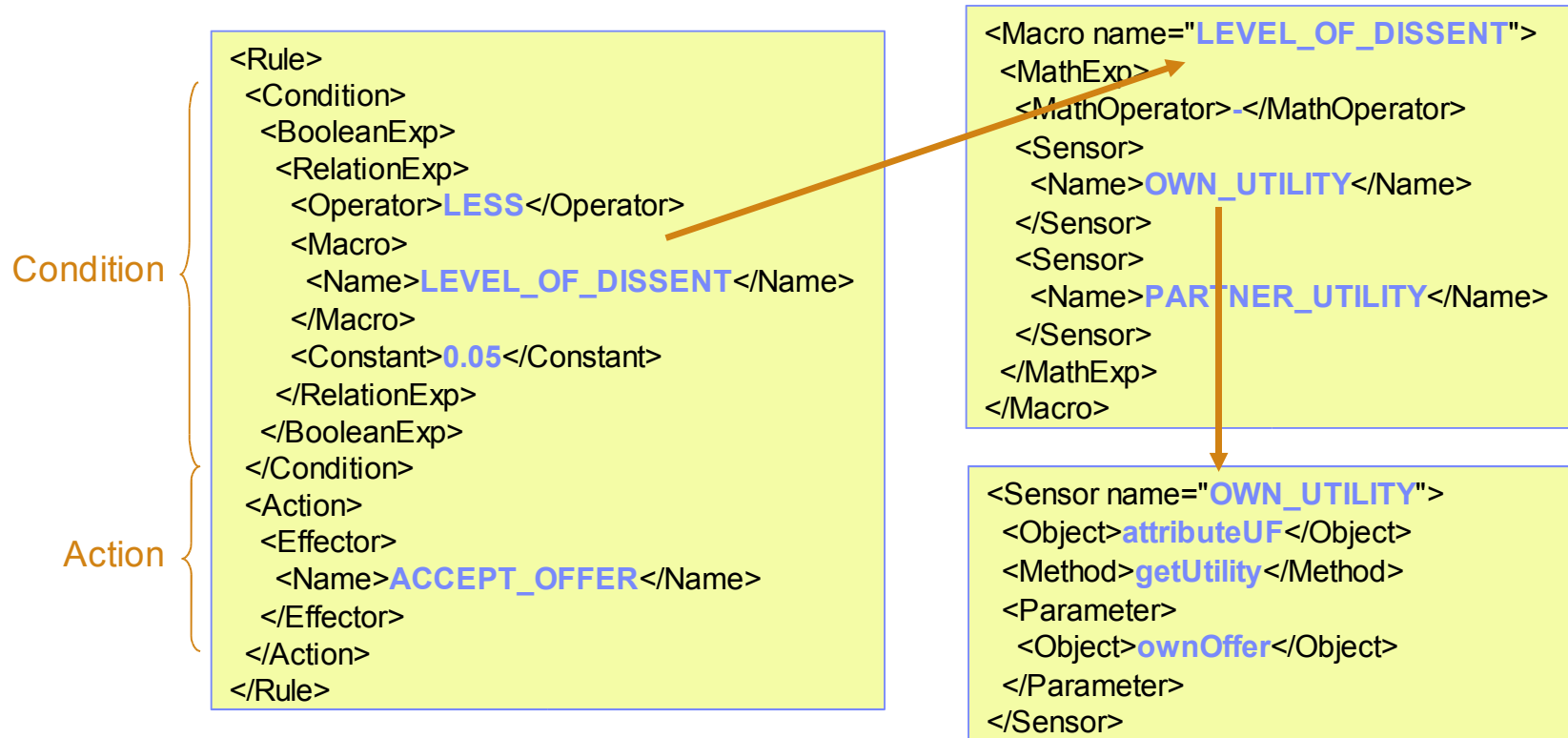


# Rules

- If-then constructs
  - Condition(s) → action(s)
- Ways to express rules
  - Java (JRules), Prolog, ...
- PANDA rule language
  - Via XML schema
  - Structure reasoning by defining accessible sensors and effectors

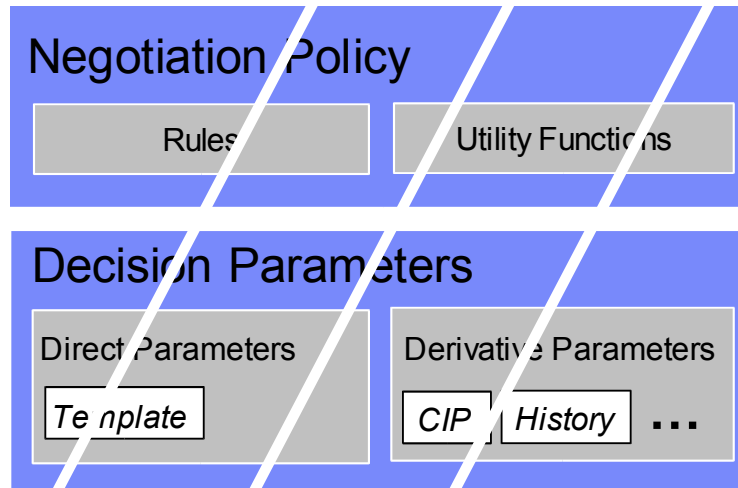
# Rule language

- Condition → Action
- Sensors & effectors map to utility functions and decision parameters
- Rule – RuleSet – decision-maker rule corpus



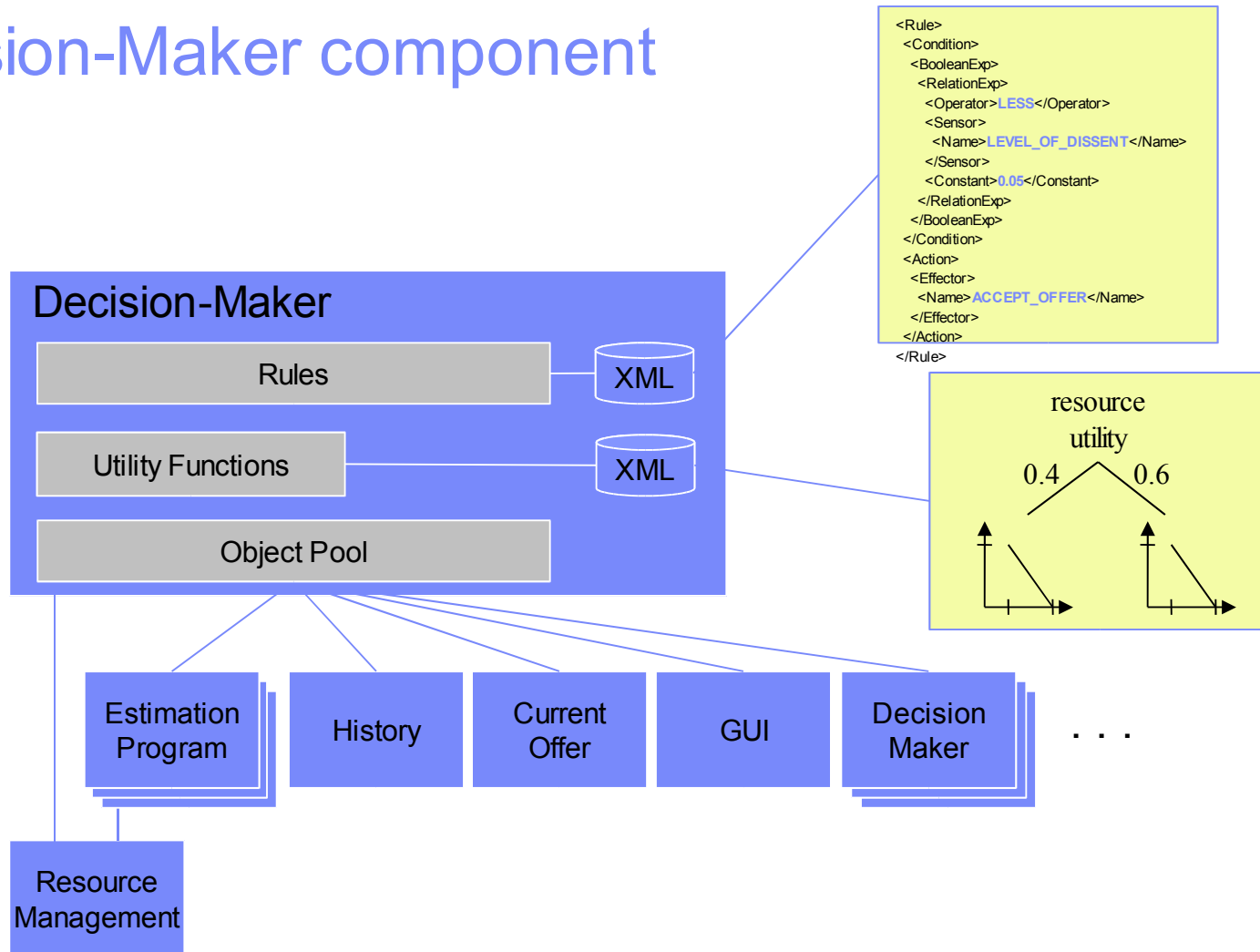
# Mixed Policies: Externalized Negotiation Behavior

- Advantages and draw-backs of rules and utility functions (expressiveness, manageability, ease of elicitation)
- Integrate both in negotiation policy



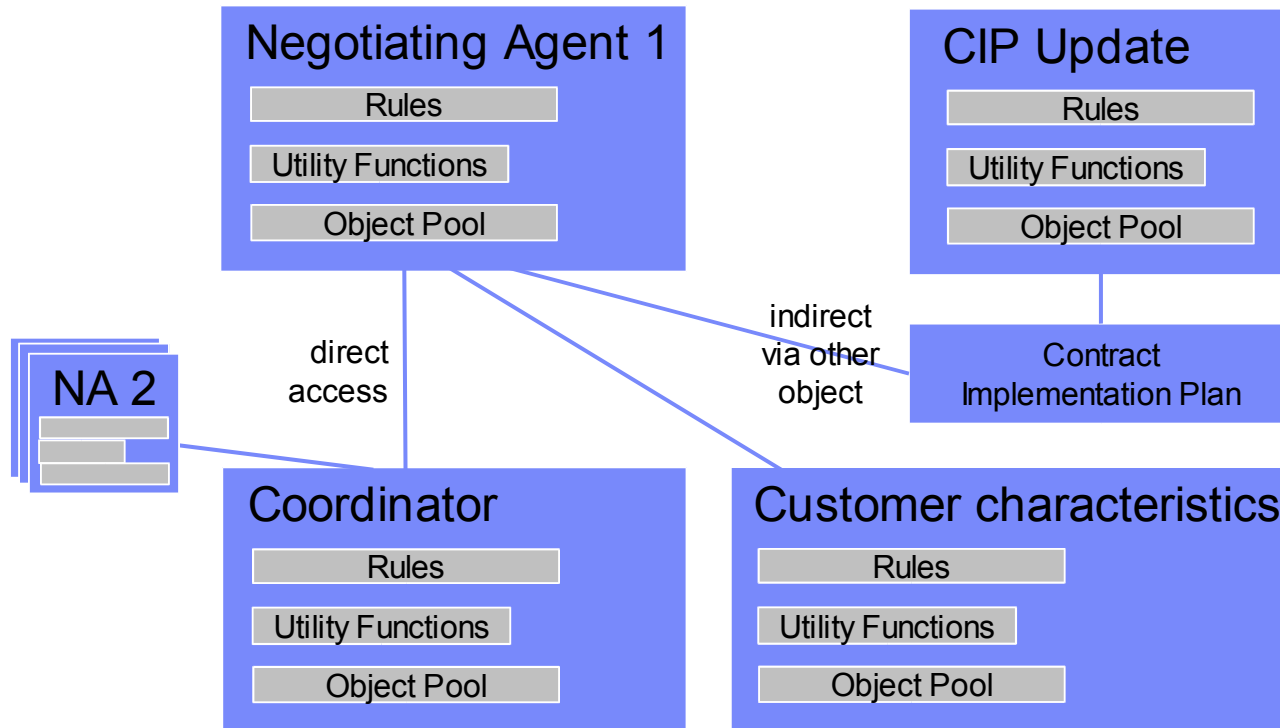
- Divide policy in small units
  - Definition of points of decision-making,
  - Association of utility functions
  - Definition of objects that can be accessed by the policy

# Decision-Maker component



# Combining decision-makers

- Different decision-makers can deal with different negotiation aspects.
- Decision-making becomes manageable!





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# Conclusion

- Assumption:
  - Cross-organizational use of Web and Grid services
  - Automated negotiation of service contracts is necessary
  
- Contribution:
  - Formalism for negotiation policy (rules + utility functions).
  - Automated execution by (multiple) decision-maker components.
  - Decomposition of decision-making.  
(no omnipotent utility function, no global consistent rule corpus)
  - Facilitates structured reasoning
  - No perfect strategy, but tool to specify and execute it.

## Future Work?

- Framework implementation
  - Renegotiation & contract versioning
  - Utility functions in XML representation
  - Usability: policy editor, library of object pool elements, ...
  
- Evaluation
  - Experimental evaluation of the usability
  
- Interaction Protocols
  - Multilateral negotiations
  - Structured exchanges and market mechanisms

PANDA:

**P**olicy-driven **A**utomated **N**egotiation **D**ecision-making **A**pproach

Thank You!



Questions?

Discussion.