CROSS-COMMUNITY INTEROPERATION BETWEEN THE EMERALD AND RULE RESPONDER MULTI-AGENT SYSTEMS

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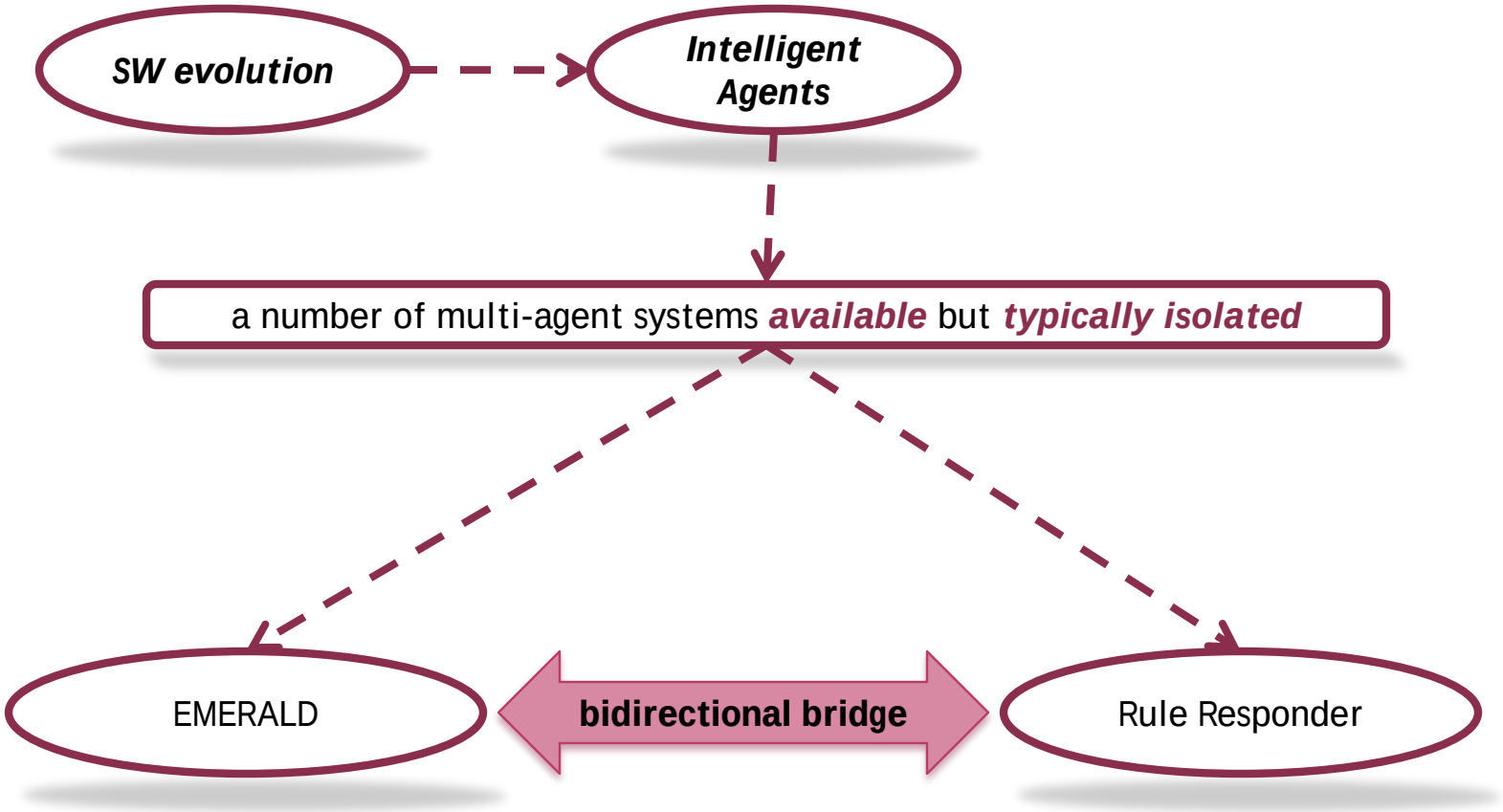
Overview

- ***Motivation***
- ***Multi-Agent Systems***
  - ***EMERALD***
  - ***Rule Responder***
- ***EMERALD – Rule Responder Interoperation***
  - ***Comparison***
  - ***Gateway Architecture***
- ***SymposiumPlanner***
  - ***Interoperation Use Case***
- ***Conclusions – Future Work***

Motivation


SW evolution
Intelligent Agents
a number of multi-agent systems available but typically isolated
EMERALD
bidirectional bridge
Rule Responder

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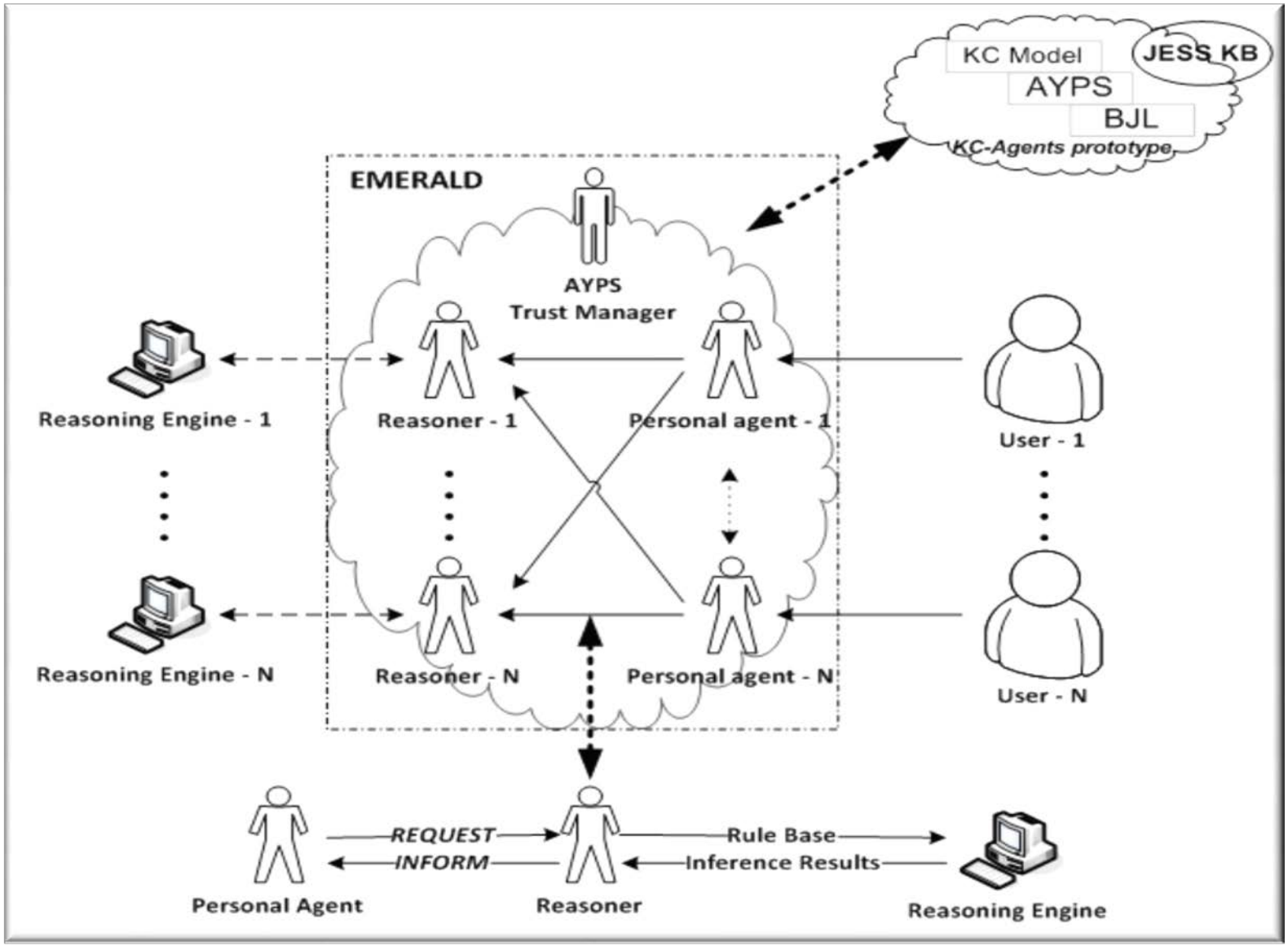
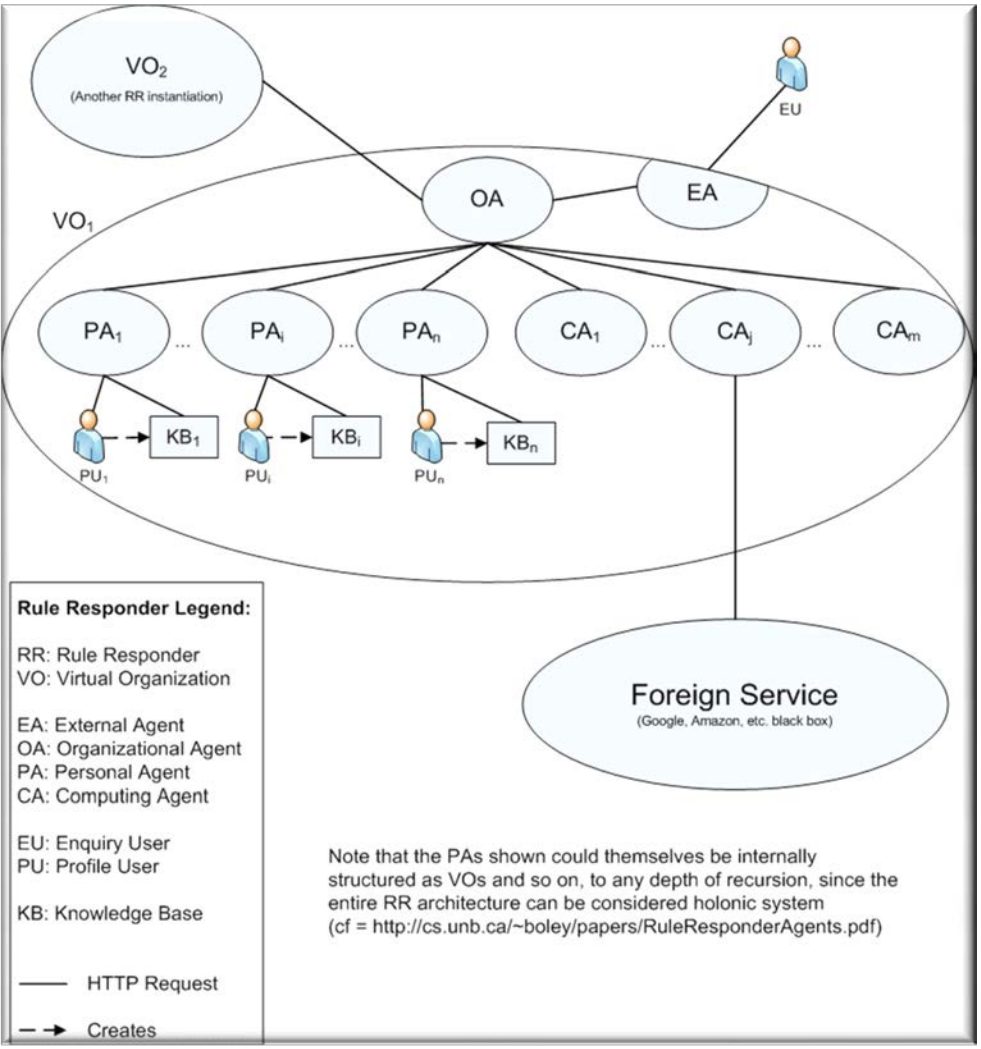
EMERALD

A Multi-Agent Knowledge-Based Framework



Rule Responder



- Open source framework
- Creating virtual organizations

- Provides the infrastructure for rule-based collaboration
- Assisting by semi-autonomous rule-based agents

OA: (global) goals/strategies
PA: assist single person
EA: Web interface/ queries
CA: perform automated task

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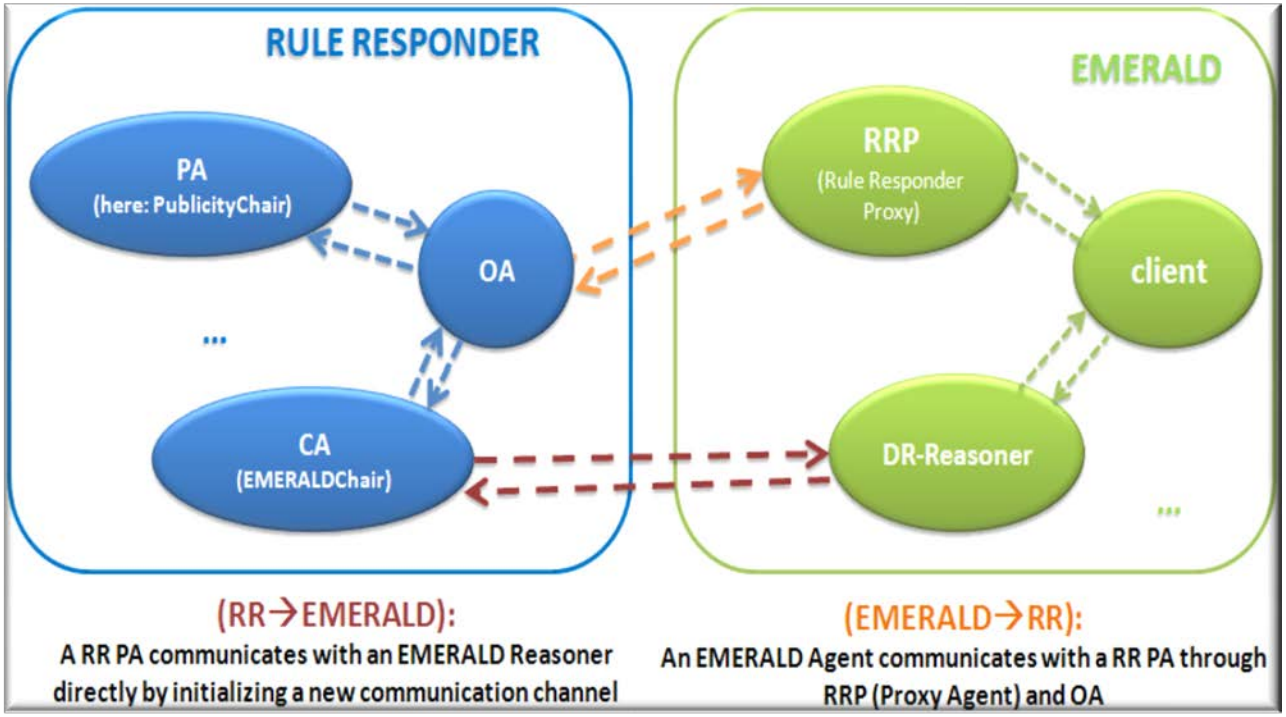
EMERALD–Rule Responder Comparison

	Rule Responder	EMERALD
Agent technology	Java servlets / Mule	Java (JADE) agents
Interchange principles	Mule middleware	JADE (ACL)
RuleML	Reaction RuleML	(D)R-DEVICE RuleML
Agent knowledge	Internal rule base Internal & External data-knowledge base	External rule base External data-knowledge base
Reasoning	Multiple reasoning engines and instances of reasoning engines	Multiple reasoning engines (independent external services)
Directory service	NO	AYPS
Use of Prova	OAs always written in Prova, PAs and CAs optionally	A Prova Reasoner has been developed (one of the reasoning agents) prova 3 not supported because it does not support JADE yet
Use	Use cases can be obtained as instantiations of the Rule Responder framework	Use cases can be obtained by using different reasoners and different agent behavior KBs

EMERALD–Rule Responder Gateway Architecture



EMERALD – RR
RRP: communicating directly with OA

RR – EMERALD
CA: handles appropriate communication channel

EMERALD – RR collaboration key feature: interchange of information

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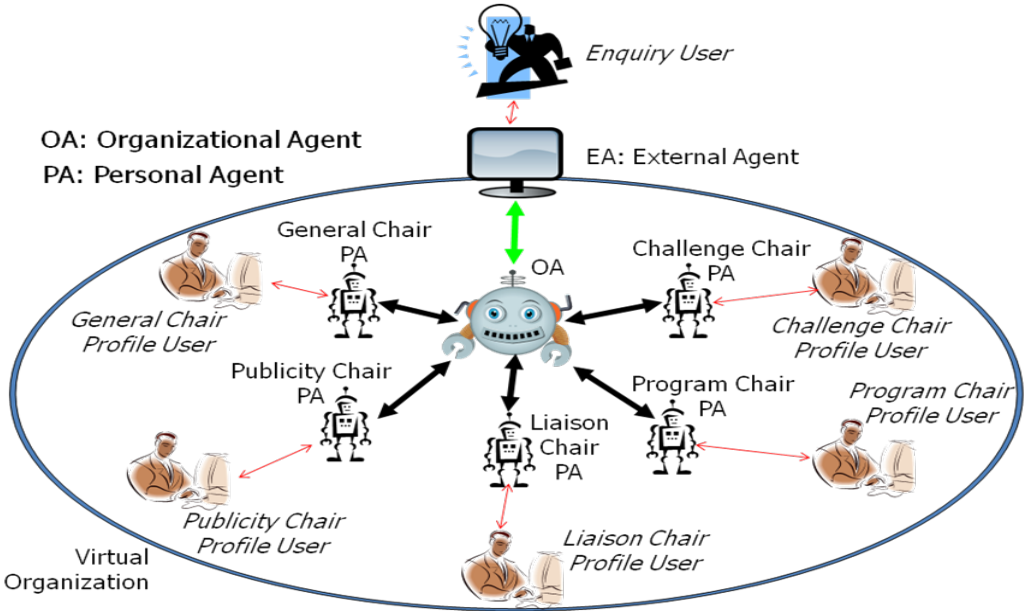
SymposiumPlanner

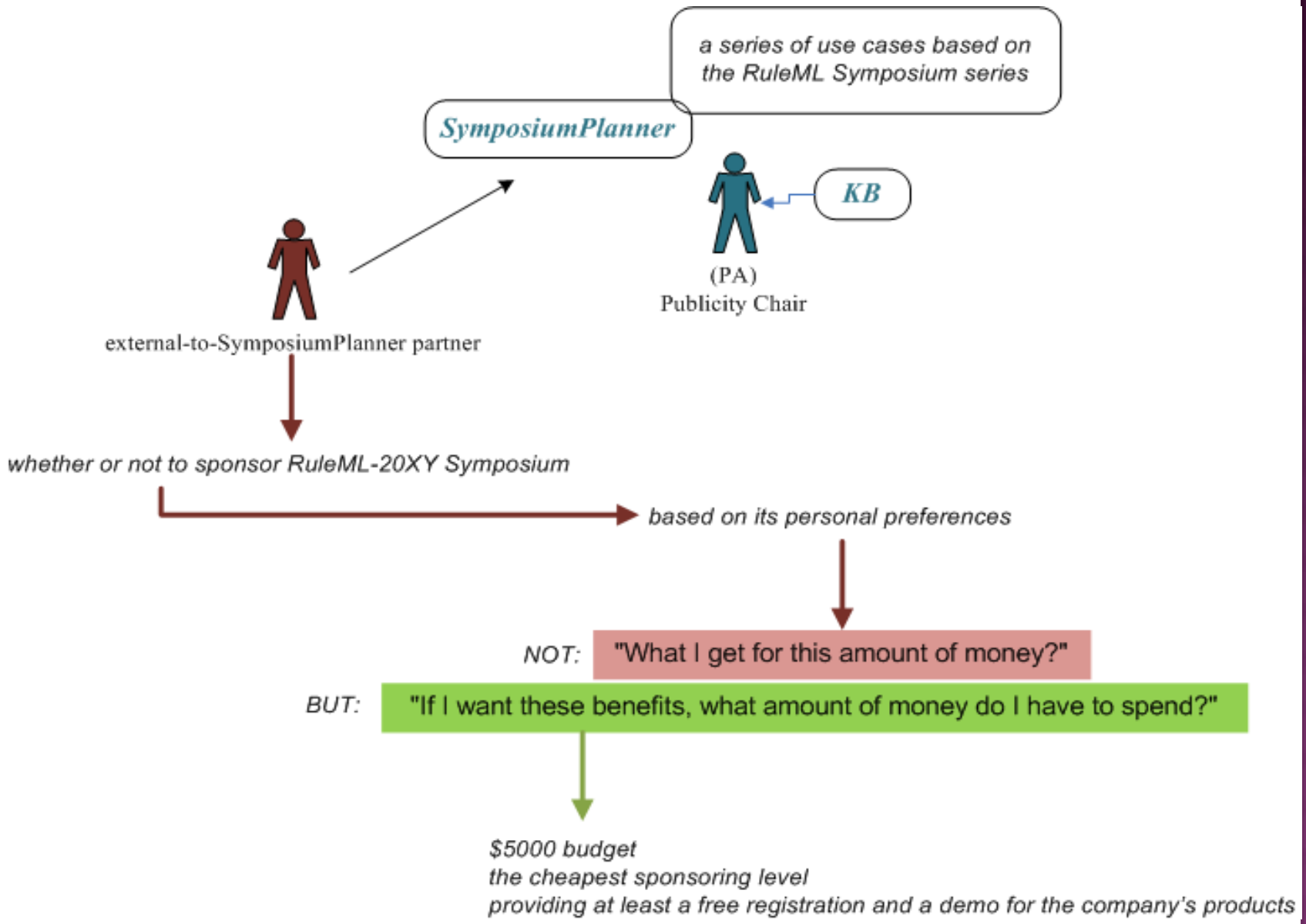


SymposiumPlanner: series of applications based on the RuleML Symposium developed with Rule Responder

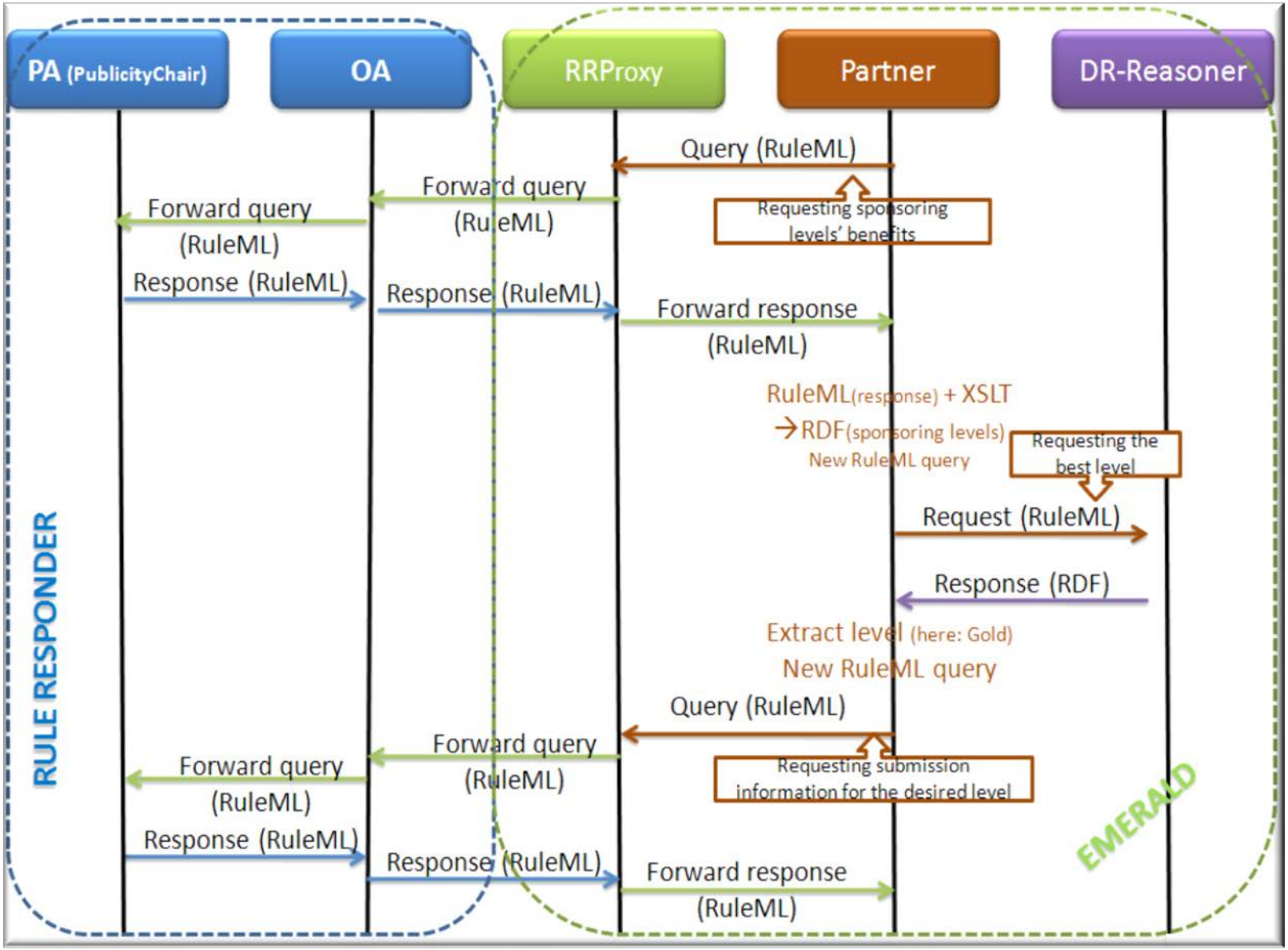
Inside the SP community each human chair (e.g. publicity chair) has a Personal Agent (PA) to assist him/her.

Each PA has a knowledge base containing the responsibilities of the position in order to answer queries relevant to the chair's role.

Interoperation Use Case



Exchanged messages



The Sponsoring Levels

Partner's preferences
•$5000 max •Cheapest sponsoring level •At least one free registration •Demo for the company's products

Sponsoring levels		
Bronze	$500	Logo on website Acknowledgement in proceedings
Silver	$1,000	Bronze level benefits + Sponsor student participants
Gold	$3,000	Silver level benefits + Logo in proceedings Show demo 1 free registration
Platinum	$5,000	Gold level benefits + Name included in all advance publicity. Distribution of material to all participants. 1 additional free registration
Emerald	$ 7,500	Platinum level benefits + 1 additional free registration

```
r1: possibleOffer(level->?x) :=
        sponsorLevel(level->?x).
r2: ~possibleOffer(level->?x) :=
        sponsorLevel(level->?x, demo->false).
r3: ~possibleOffer(level->?x) :=
        sponsorLevel(level->?x, amount->?y), ?y > 5000.
r4: ~possibleOffer(level->?x) :=
        sponsorLevel(level->?x, free-registration->?y), ?y < 1.
        r2 > r1.        r3 > r1.        r4 > r1.
r5: makeOffer(level->?x) :=
        possibleOffer(level->?x),
        sponsorLevel(level->?x, amount->?z),
        \+ ( possibleOffer(level->?y), ?y \= ?x,
            sponsorLevel(level->?y,amount->?w), ?w < ?z ).
```

```
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  <oid><Ind uri="r4">r4</Ind></oid>
  <head><Neg><Atom>
      <op><Rel>possibleOffer</Rel></op>
      <slot><Ind>level</Ind><Var>x</Var></slot>
  </Atom></Neg></head>
  <body><Atom>
      <op><Rel uri="sp:SponsorLevel"/></op>
      <slot><Ind uri="sp:level"/><Var>x</Var></slot>
      <slot><Ind uri="sp:free-registration"/>
       <ComplexArg><and_ComplexArg><Var>y</Var>
<Expr><Funn="yes">&lt;</Fun><Var>y</Var><Ind>1</Ind></Expr>
        </and_ComplexArg></ComplexArg></slot>
  </Atom></body></Implies>
```

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Conclusions – Future Work

Interoperation** between **EMERALD** and **Rule Responder

↓

Bidirectional gateways

- *automated collaboration*
- *declarative, knowledge-based approach*

In future:

- Bidirectional RuleML-based gateways suite
- RuleML gateways adaptation in interoperation needs (interchange of proofs)
- More use cases
- Generalized gateway principles and architectures for cross-community agent interoperation

EMERALD: http://lpis.csd.auth.gr/systems/emerald

Rule Responder: http://ruleml.org/RuleResponder

SymposiumPlanner: http://ruleml.org/SymposiumPlanner

EMERALD – Rule Responder interoperation project:
http://tinyurl.com/EMERALDRR

Thank you!
Any Questions?