

Argumentation and the Semantic Web: the ARGUGRID perspective

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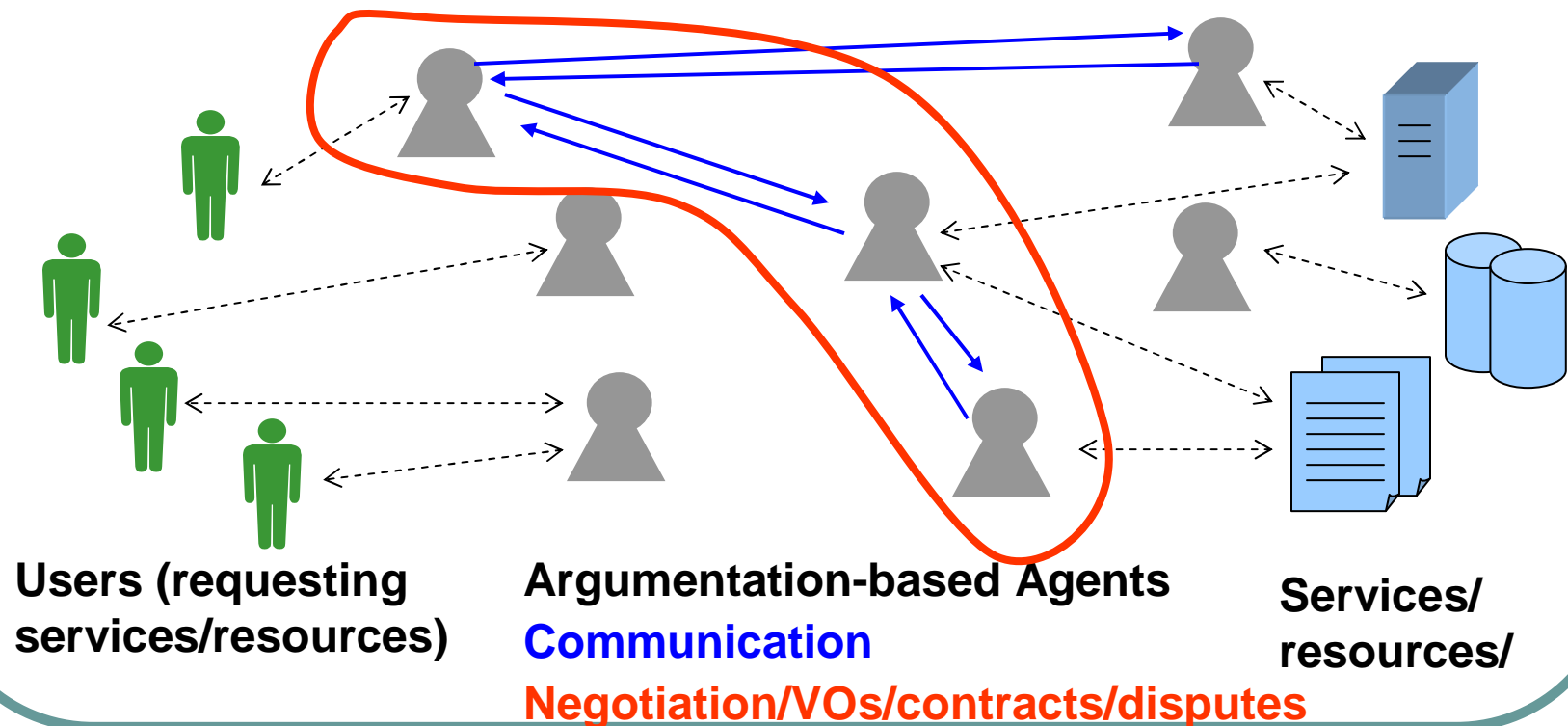
<http://www.argugrid.eu>

Outline

- ARGUGRID: vision, platform, scenarios, components
- The case for argumentation: decision-making, contract negotiation (and dispute resolution)
- Assumption-based argumentation, Dispute derivations, CaSAPI system, ARGUGRID scenario

ARGUGRID vision

- Develop a *semantic grid/service-oriented architecture* to support applications



Industrial scenarios

- Earth observation (**GMV – Spain**)
 - Select appropriate sensors/satellites e.g. for dealing with oil spill
 - Combine sensors/satellites + other services (weather) e.g. for fire monitoring
- E-procurement (**CosmoONE – Greece**)
 - Select (combinations of) appropriate products/service to purchase
 - Features of products/services influence business strategic benefits for the buyer

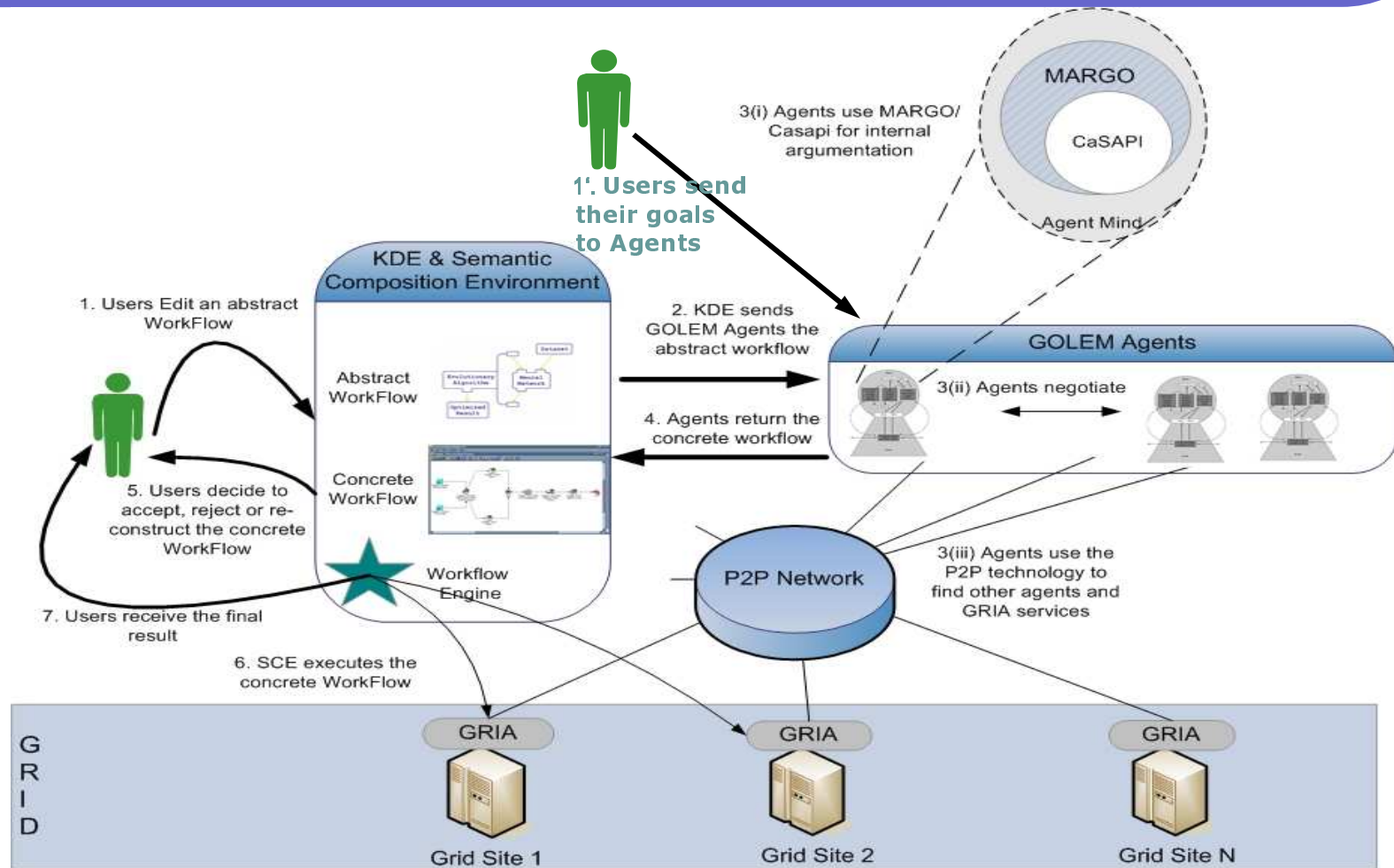
Analysis of scenarios

- defeasible, conflicting information/ beliefs (*it will be windy; it won't be windy*)
- preferences over beliefs (*I trust weather forecast by A more than by B*)
- mutually exclusive decisions (*sensor S1 or sensor S2?*) for the achievement of goals (*I need images every hour*)
- preferences over decisions (*S1 is typically more reliable than S2*) and goals (*quality of images more important than cost*).
- negotiation (*I need images every 2 hours for a week, can I get a special price?*)

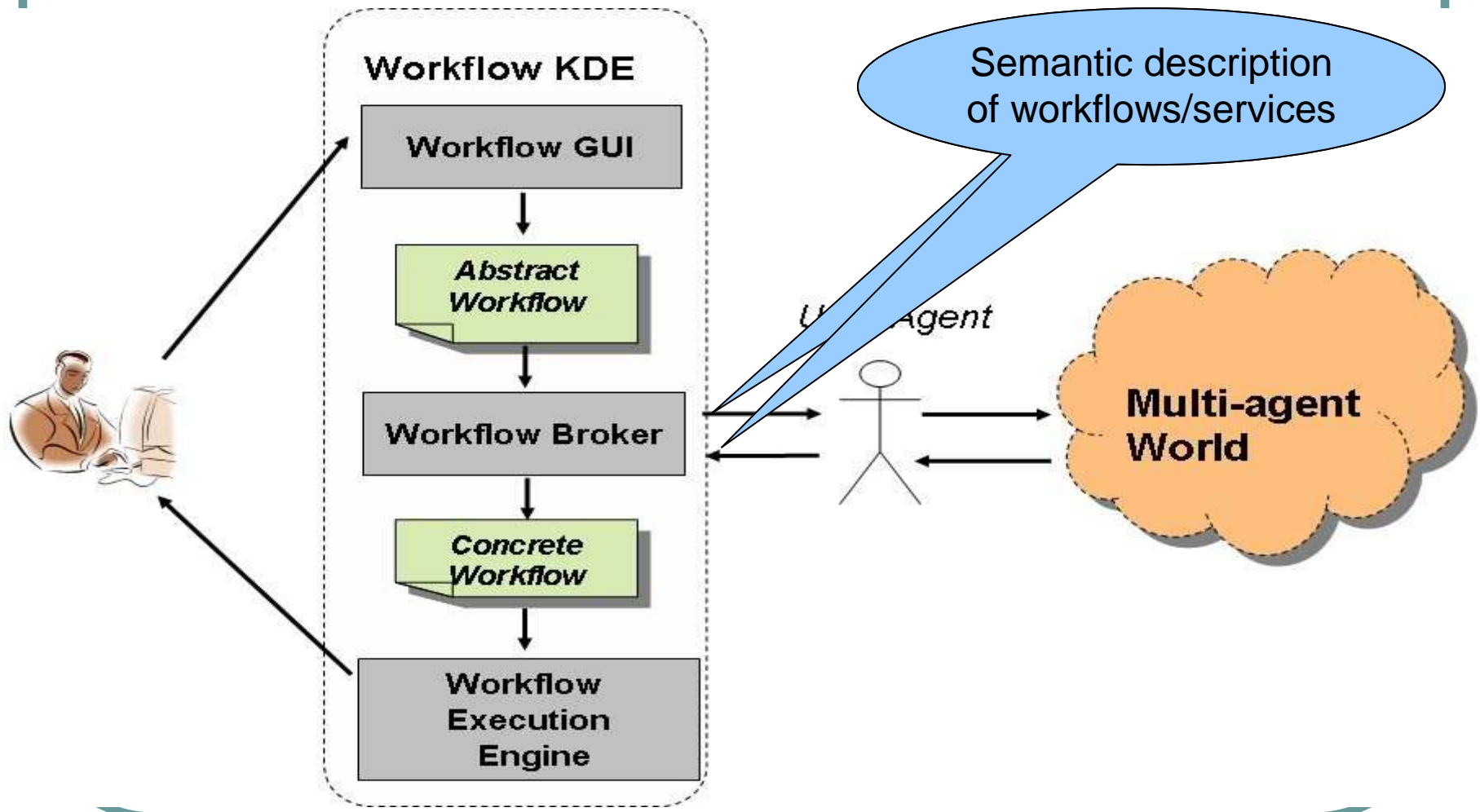
The case for argumentation

- Decision-making/practical+epistemic reasoning
 - Alternative decisions
 - Contradictory beliefs
 - Preferences
 - Morge&Mancarella, ArgMAS07 : MARGO
 - ABA, CLIMAVIII: CaSAPI
- Negotiation and dispute resolution
 - Justification
 - Persuasion

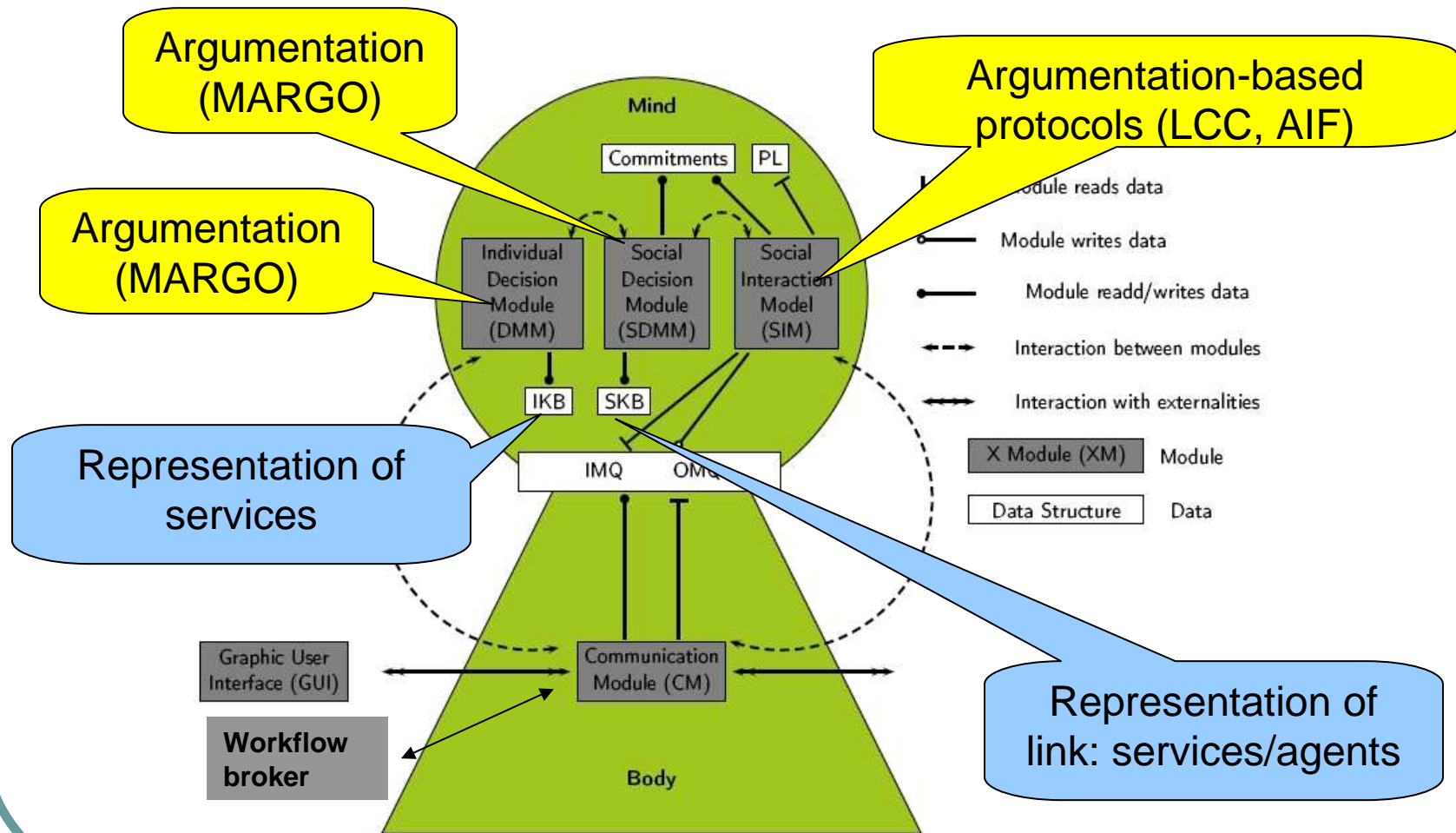
ARGUGRID platform



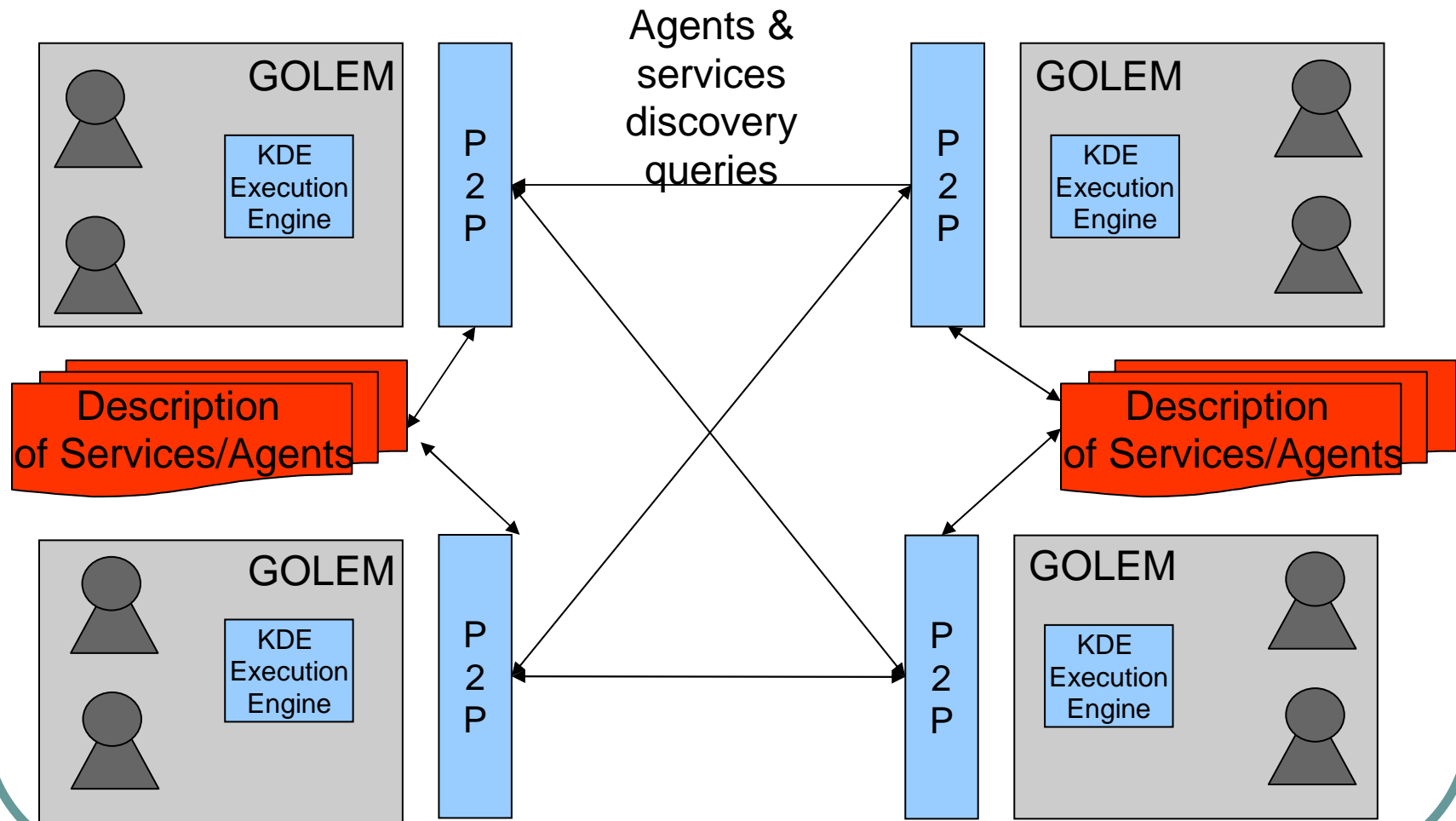
A workflow perspective



An agent perspective



A multi-agent perspective: GOLEM+P2P



Semantic web technology

- Choice: re-use and interface with existing standards:
 - WSMO (extension of OWL-S) for describing
 - Services
 - Goals (requirements of requestors/providers)
 - DPML+WSMO for describing workflows+annotations
 - Mapping of WSMO/DPML descriptions into argumentation frameworks (in MARGO) and back

Outline revisited

- ARGUGRID: vision, platform, scenarios, components
- The case for argumentation: decision-making, contract negotiation (and dispute resolution)
- **Assumption-based argumentation, Dispute derivations, CaSAPI system, ARGUGRID scenario**

Computational argumentation

- Needed to support platform and scenarios
- Assumption-based argumentation (ABA):
 - General-purpose instance of abstract argumentation
 - **arguments** defined in terms of:
 - a *deductive system* (rules) e.g. laws/regulations
 - a set of candidate *assumptions* e.g. uncertain/unsupported beliefs, decisions, “names” of rules
 - **attacks** defined in terms of:
 - a notion of *contrary of assumptions* e.g. negation, alternative decisions, exceptions to rules

ABA arguments and attacks

- *arguments* are (*tight*) deduction supported by sets of assumptions
- an argument α *attacks* another argument β if the conclusion of α is the contrary of one of the assumptions supporting β

(undermining attacks –
but rebuttal attacks can be obtained too)

Decision-making for e-procurement

- ABA:
 - features of services to purchase
 - uncertain/customisable features in services on offer
 - links from features to benefits for the buyer
 - “control information”
 - e.g. *rules* may include (s_5, s_8 concrete services)
 - $f_1(s_5)$ $f_2(s_8)$
 - $f_2(S) \leftarrow$ **guarantee(S)** ← *assumptions*
 - $b(S) \leftarrow f_1(S), f_2(S),$ **choose(S)** ← *assumptions*
 - $\text{not-choose}(s_5) \leftarrow b(s_8),$ **not-b(s₅)** ← *assumptions*
 - $\text{not-choose}(s_5) \leftarrow$ **choose(s₈)** ← *assumptions*
- with *contrary of*: $\text{choose}(s_5) = \text{not choose}(s_5)$
 $\text{not-b}(s_5) = b(s_5), \dots$

Decision-making for e-procurement

- ABA framework

$f_1(s_5)$ $f_2(s_8)$ $f_2(S) \leftarrow \text{guarantee}(S)$
 $b(S) \leftarrow f_1(S), f_2(S), \text{choose}(S)$ \leftarrow *contrary: not choose(S)*
 $\text{not-choose}(s_5) \leftarrow \text{choose}(s_8)$ \leftarrow
 $\text{not-choose}(s_8) \leftarrow b(s_5), \text{not-b}(s_8)$ \leftarrow *contrary: b(s₈)*

- arguments

1: $\{\text{choose}(s_5), \text{guarantee}(s_5)\} \vdash b(s_5)$
2: $\{\text{choose}(s_8)\} \vdash \text{not-choose}(s_5)$
3: $\{\text{choose}(s_5), \text{guarantee}(s_5), \text{not-b}(s_8)\} \vdash \text{not-choose}(s_8)$

- attacks: *2 attacks 1, 3 attacks 2*

- **admissible arguments =
optimal choice+contracts (customisable features)**

ABA: computation

- (Various kinds of) dispute derivations:
 - Dispute between proponent and opponent
 - Various forms of filtering to exploit overlapping between arguments
 - Outcomes: initial claim is “acceptable” (e.g. admissible) or not. If so:
 - Arguments+attacks constructed during the dispute
 - Assumptions supporting the proponent’s arguments
 - Assumptions supporting arguments by the opponent and chosen by the proponent to be counter-attacked
- Implemented system: CaSAPI
<http://www.doc.ic.ac.uk/~dg00/casapi.html>

Contract negotiation

- Two agents, a buyer and a seller, each using
 - an ABA describing
 - how to achieve “structural” goals (e.g. for buyer house with 2 toilets) and “contractual” goals (e.g. for buyer max £450K)
 - Uncertainties
 - Defeasible rules
 - Ranking of goals (preferences)
- Two-phase negotiation:
 1. Sceptical preferred semantics (equivalent to minmax preference for structural goals) for deciding options
 2. Negotiation protocol (of alternating offers and counter-offers) leading to agreement (using a Nash equilibrium strategy)

Conclusions

- ARGUGRID and semantic web services
 - Argumentative agents interfaced with semantic descriptions
 - Given in existing standards
- ABA to support argumentation
- Applications
- Ongoing:
 - Contract negotiation (versus SLAs) + VOs
 - Implementation of platform+applications
- Future: dispute resolution, trust-mediated negotiation