KIF as a FIPA-CLL Content Language *
– An ontology for actions –
(CFP7 001)

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1 Introduction

FIPA started the standardization of FIPA Content Language Library (abbreviated "FIPA-CLL" in the following text) for the completion in the year 1999.

KIF (Knowledge Interchange Format) is a content language for agent systems, which is already used widely in agent community. AGENTPRO [1], Fujitsu's soon-to-be-released agent system software product, and many other agent systems use KIF as their content language. It is also on the ANSI standard track. As such, we believe KIF should be included in FIPA-CLL as one of annex sections.

In this documents, we give reasons why KIF should and can be included in FIPA-CLL.

When KIF should be included in FIPA-CLL, the most problematic of all is that KIF itself does not have actions [2]. To deal with it, we introduce a small ontology for actions to express actions in FIPA.

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[1] AGENTPRO runs on INTERSTAGE, Fujitsu's CORBA middleware. There is a link to the description of AGENTPRO from [5]. AGENTPRO uses KQML and KIF for the current version. AGENTPRO plans to use FIPA-ACL for the next version (probably along with KQML), but AGENTPRO will continue to use KIF as the content language at least for a while.

[2] We know there are still discussions going on about relaxing the criterion that FIPA-CLL content language should have actions.

2 Inclusion criteria and KIF

In this section we will see how KIF can satisfy the inclusion criteria of FIPA-CLL. We have excerpted the inclusion criteria from the section 8 of [2].

1. A good level of syntactical development is required. A "good" level means that for example the syntax of the language should allow the implementation of an effective parser.

2. In the item above, there is a discussion that a content language must be able to express propositions, objects, and actions (FIPA97, Part2 section 6.3.3 Requirement 6).

3. A clear and intuitive (although not necessarily formal) semantics that fits with the use of FIPA-ACL must be specified. In particular, the composite semantics of ACL messages containing a communicative act which supervenes on a content expression must be specified.

4. Examples of the usage of such a language (a parallel with SL for instance for a better understanding of what objects, actions and propositions are etc.) are recommended.

5. Substantial and clear documentation must be provided. This means that the proposal must be already well structured. FIPA members are in no way responsible for translating submitted content language into an acceptable form.

6. The utility of such a new language should be made clear. Either the language should include functionality which is useful across a wide range of agent activities (introducing extensions or improvements on existing language) or it should directly support a single but very common agent activity (e.g., travel assistance).

We believe KIF 3.0 specification [4] gives enough foundations for the items 1 and 5

As for the item 2, KIF can represent (first-order) propositions, and it can represent objects as terms. The section 3 will give how actions are treated in KIF.

As for the item 3, the situations need to be considered are not clear for us. Therefore we left it to be discussed at the San Francisco meeting.

Examples as in the item 4 are given in the section 4.

Since KIF is already used widely in agent community, the utility in the item 6 of KIF is obvious.

3 Actions in KIF - an ontology for actions

We believe the following treatment of actions in KIF is appropriate.

We treat actions as objects in KIF. (The notion of objects in KIF is quite broad. See section 3.1 in [4].) For that purpose, we introduce a small ontology which mainly consists of function constants [3].

The table 1 gives the correspondence between the terms in the ontology for the actions and the terms which appears in the definition of SLActionExpression in SL.

KIF	SL
fipa-action	action
fipa-acl-ca	
fipa-non-deterministic-choice	|
fipa-sequencing	;

Table 1: Actions in KIF and SL: We show the correspondence between the terms in the ontology for actions and the terms which appears in the definition of SLActionExpression in SL.

Here follows BNF definition of actions in KIF. Examples are given in the section 4. For the definition of `Expression`, See [4].

```
Action          = "(" "fipa-action" agent Expression ")"
                | "(" "fipa-acl-ca" "'" FIPAACLCommunicativeAct ")"
                | "(" "fipa-non-deterministic-choice"
                      Action Action ")"
                | "(" "fipa-sequencing"
                      Action Action ")" .
Expression      = [See \cite{KIF}].
```

4 Examples

This section gives examples of use of the ontology for actions. In the table 2, the first column gives expressions in SL and the second column gives corresponding expressions in KIF. Some examples taken from section 6.4.14 "propose" in [1].

5 Conclusion

We have given reasons why KIF should and can be included in FIPA-CLL. In that, we described a small ontology for actions and how actions can be treated in KIF.

We believe that KIF has enough foundations to be included in FIPA-CLL.

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[3]Functions are a special kind of relations in KIF.

SL	KIF
`(action j (sell plum 50))`	`(fipa-action j (sell plum 50))`
``(propose
:sender j
:receiver i
:content
((action j (sell plum 50))
(cost 200))
:in-reply-to proposal2
:language s1
...
)```	```(fipa-acl-ca
'(propose
:sender j
:receiver i
:content
((action j (sell plum 50))
(cost 200))
:in-reply-to proposal2
:language s1
...
)
)```
``(	(inform :content a)
(inform :content b))```	```(fipa-non-deterministic-choice
(fipa-action '(inform :content a))
(fipa-action '(inform :content b))
)```
``(; (inform :content a)
(inform :content b))```	```(fipa-sequencing
(fipa-action '(inform :content a))
(fipa-action '(inform :content b))
)```

Table 2: Examples in KIF and SL: The first column gives expressions in SL and the second column gives corresponding expressions in KIF.

References

[1] FIPA,
FIPA Spec 2 - 1998, Agent Communication Language.

[2] FIPA,
FIPA Spec 18 - 1999, DRAFT, Version 0.1 FIPA Content Language Library.

[3] FIPA,
FIPA's Seventh Call for Proposal,
`http://www.fipa.org/cfp/cfp7.html`

[4] "Knowledge Interchange Format, draft proposed American National Standard",
`http://logic.stanford.edu/kif/dpans.html`

[5] "INTERSTAGE",
`http://www.fujitsu.co.jp/hypertext`
`/softinfo/product/net/INTERSTAGE/`