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2 **FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS**

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5 # FIPA ACL Message Structure Specification

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Foreword

The Foundation for Intelligent Physical Agents (FIPA) is an international organization that is dedicated to promoting the industry of intelligent agents by openly developing specifications supporting interoperability among agents and agent-based applications. This occurs through open collaboration among its member organizations, which are companies and universities that are active in the field of agents. FIPA makes the results of its activities available to all interested parties and intends to contribute its results to the appropriate formal standards bodies.

The members of FIPA are individually and collectively committed to open competition in the development of agent-based applications, services and equipment. Membership in FIPA is open to any corporation and individual firm, partnership, governmental body or international organization without restriction. In particular, members are not bound to implement or use specific agent-based standards, recommendations and FIPA specifications by virtue of their participation in FIPA.

The FIPA specifications are developed through direct involvement of the FIPA membership. The status of a specification can be either Preliminary, Experimental, Standard, Deprecated or Obsolete. More detail about the process of specification may be found in the FIPA Procedures for Technical Work. A complete overview of the FIPA specifications and their current status may be found in the FIPA List of Specifications. A list of terms and abbreviations used in the FIPA specifications may be found in the FIPA Glossary.

FIPA is a non-profit association registered in Geneva, Switzerland. As of January 2000, the 56 members of FIPA represented 17 countries worldwide. Further information about FIPA as an organization, membership information, FIPA specifications and upcoming meetings may be found at http://www.fipa.org/.

Contents

1   Scope

This document contains specifications for the FIPA ACL message elements including: the list of current FIPA ACL message elements, procedures for maintenance of this list, and criteria for adopting new elements in the list.

The objectives of standardizing the form of a FIPA compliant ACL message are:

To help ensure interoperability by providing a standard set of ACL message structure, and,

To provide a well-defined process for maintaining this set.

72   2   FIPA ACL Message Structure

73 A FIPA ACL message contains a set of one or more message elements. Precisely which elements are needed for
74 effective agent communication will vary according to the situation; the only element that is mandatory in all ACL
75 messages is the `performative`, although it is expected that most ACL messages will also contain `sender`,
76 `receiver` and `content` elements.

77

78 If an agent does not recognize or is unable to process one or more of the elements or element values, it can reply with
79 the appropriate `not-understood` message.

80

81 Specific implementations are free to include user-defined message elements other than the FIPA ACL message
82 elements specified in *Table 1*. The semantics of these user-defined elements is not defined by FIPA, and FIPA
83 compliance does not require any particular interpretation of these elements.

84

85 Some elements of the message might be omitted when their value can be deduced by the context of the conversation.
86 However, FIPA does not specify any mechanism to handle such conditions, therefore those implementations that omit
87 some message elements are not guaranteed to interoperate with each other.

88

89 The full set of FIPA ACL message elements is shown in *Table 1* without regard to their specific encodings in an
90 implementation. FIPA-approved encodings and element orderings for ACL messages are given in other specifications.
91 Each ACL message representation specification contains precise syntax descriptions for ACL message encodings
92 based on XML, text strings and several other schemes.

93

94 A FIPA ACL message corresponds to the abstract element message payload identified in the [FIPA00001].

95

Element	Category of Elements
performative	Type of communicative acts
sender	Participant in communication
receiver	Participant in communication
reply-to	Participant in communication
content	Content of message
language	Description of Content
encoding	Description of Content
ontology	Description of Content
protocol	Control of conversation
conversation-id	Control of conversation
reply-with	Control of conversation
in-reply-to	Control of conversation
reply-by	Control of conversation

96

97   **Table 1:** FIPA ACL Message Elements

98

99 The following terms are used to define the ontology and the abstract syntax of the FIPA ACL message structure:

100

101   **Frame**. This is the mandatory name of this entity, that must be used to represent each instance of this class.

102

103   **Ontology**. This is the name of the ontology, whose domain of discourse includes their elements described in the
104   table.

105

106   **Element**. This identifies each component within the frame.   The type of the element is defined relative to a
107   particular encoding. Encoding specifications for ACL messages are given in their respective specifications.
108
109   **Description**. This is a natural language description of the semantics of each element. Notes are included to clarify
110   typical usage.
111
112   **Reserved Values**. This is a list of FIPA-defined constants associated with each element. This list is typically
113   defined in the specification referenced.
114
115 All of the FIPA message elements share the frame and ontology shown in *Table 2*.
116

Frame	FIPA-ACL-Message
Ontology	FIPA-ACL

117
118   **Table 2:** FIPA ACL Message Frame and Ontology
119

120 ## 2.1   Type of Communicative Act

121 ### 2.1.1   Performative

Element	Description	Reserved Values
performative	Denotes the type of the communicative act of the ACL message	See [FIPA00037]

122
123 **Notes:** The performatives is a required element of all ACL messages. Developers are encouraged to use the FIPA
124 standard performatives (see [FIPA00037]) whenever possible.
125

126 ## 2.2   Participants in Communication

127 ### 2.2.1   Sender

Element	Description	Reserved Values
sender	Denotes the identity of the sender of the message, i.e. the name of the agent of the communicative act.	

128
129 **Notes:** The sender element will be an element of most ACL messages. It is possible to omit the sender if, for example,
130 the agent sending the ACL message wishes to remain anonymous. The sender refers to the agent which performs the
131 communicative act giving rise to this ACL message.
132

133 ### 2.2.2   Receiver

Element	Description	Reserved Values
receiver	Denotes the identity of the intended recipients of the message.	

134
135 **Notes:** Ordinarily, the receiver will be a part of every ACL message. It is only permissible to omit the receiver if the
136 message recipient can be reliably inferred from context, or in special cases such as the embedded ACL message in
137 proxy and propagate.
138
139 The receiver may be a single agent name, or a non-empty set of agent names. The latter corresponds to the situation
140 where the message is multicast. Pragmatically, the semantics of this multicast is that the sender intends the message
141 for each recipient of the CA encoded in the message. For example, if an agent performs an inform act with a set of
142 three agents as receiver, it denotes that the sender intends each of these agents to come to believe the content of the
143 message.
144

145 **2.2.3 Reply To**

Element	Description	Reserved Values
reply-to	This element indicates that subsequent messages in this conversation thread are to be directed to the agent named in the reply-to element, instead of to the agent named in the sender element.	

146

147 **2.3 Content of Message**

148 **2.3.1 Content**

Element	Description	Reserved Values
content	Denotes the content of the message; equivalently denotes the object of the action.	

149

150 Notes: Most ACL messages require a content expression. Certain ACL message types, such as cancel, have an implicit
151 content, especially in cases of using conversation-id or in-reply-to.

152

153 **2.4 Description of Content**

154 **2.4.1 Language**

Element	Description	Reserved Values
language	Denotes the language in which the content element is expressed.	See [FIPA00007]

155

156 **Notes:** The ACL content element is expressed in a formal language. This field may be omitted if the agents receiving
157 the message can be assumed to know the language of the content expression.

158

159 **2.4.2 Encoding**

Element	Description	Reserved Values
encoding	Denotes the specific encoding of the content language expression.	See [FIPA00007]

160

161 **Notes:** The content expression might be encoded in several ways. The encoding element is optionally used to specify
162 this encoding to the recipient agent. If the encoding element is not present, the encoding will be specified in the
163 message envelope that encloses the ACL message.

164

165 **2.4.3 Ontology**

Element	Description	Reserved Values
ontology	Denotes the ontology(s) used to give a meaning to the symbols in the content expression.	

166

167 **Notes:** The ontology(s) is/are used in conjunction with the language element to support the interpretation of the content
168 expression by the receiving agent. In many situations, the ontology(s) will be commonly understood by the agent
169 community, and so this message element may be omitted.

170

171

171   **2.5   Control of Conversation**

172   **2.5.1   Protocol**

Element	Description	Reserved Values
`protocol`	Denotes the interaction protocol that the sending agent is employing with this ACL message.	See [FIPA00025]

173

174   **Notes:** The protocol message element defines the interaction protocol in which the ACL message is generated. This
175   element is optional; however, developers are advised that employing ACL without the framework of an interaction
176   protocol (and thus directly using the ACL semantics to control the agent's generation and interpretation of ACL
177   messages) is an extremely ambitious undertaking.

178

179   **2.5.2   Conversation Identifier**

Element	Description	Reserved Values
`conversation -id`	Introduces an expression (a conversation identifier) which is used to identify the ongoing sequence of communicative acts that together form a conversation.	

180

181   **Notes:** An agent may optionally tag ACL messages with a conversation identifier to manage its communication
182   strategies and activities. Typically this will allow an agent to identify individual conversations with multiple agents. It will
183   also allow agents to reason across historical records of conversations.

184

185   **2.5.3   Reply With**

Element	Description	Reserved Values
`reply-with`	Introduces an expression that will be used by the responding agent to identify this message.	

186

187   **Notes:** This message element is designed to be used to follow a conversation thread in a situation where multiple
188   dialogues occur simultaneously. For example, if agent i sends to agent j a message which contains:

189
190   `reply-with <expr>`

191
192   Agent j will respond with a message containing:

193
194   `in-reply-to <expr>`

195

196   **2.5.4   In Reply To**

Element	Description	Reserved Values
`in-reply-to`	Denotes an expression that references an earlier action to which this message is a reply.	

197

198   **Notes:** See notes for *Section 2.5.3, Reply With*.

199

200   **2.5.5   Reply By**

Element	Description	Reserved Values
`reply-by`	Denotes a time and/or date expression which indicates the latest time by which the sending agent would like to have received a reply.	

201

202 **Notes:** The time will be expressed according to the sender's view of the time on the sender's platform. The reply
203 message can be identified in several ways: as the next sequential message in an interaction protocol, through the use
204 of reply-with, through the use of a `conversation-id` and so forth. The way that the reply message is identified is
205 determined by the agent implementer.
206
207

3   Maintenance of the FIPA ACL Message Elements List

The most effective way of maintaining the FIPA ACL message element list is through the use of the elements themselves by different agent developers. This is the most direct way of discovering possible bugs, errors, inconsistencies, weaknesses, possible improvements, as well as capabilities, strengths, efficiency etc.

In order to collect feedback on the FIPA ACL message elements in this document and to promote further research, FIPA encourages coordination among designers, agent developers, and FIPA members. FIPA will make an annual report on the use of the ACL element in this document.

FIPA will designate a Technical Committee (TC) to maintain the FIPA ACL message elements. This TC will manage the FIPA ACL message elements and will be responsible for the following items:

Collecting feedback and the comments about the FIPA ACL elements. Depending on interest, the TC may organize more specific Working Groups. These groups would be responsible for maintaining public lists referring projects and people that are currently using ACL elements of interest.

Inviting contributions in various forms: e-mail comments, written reports, papers, technical documents, and so forth. The current email address of the TC is: comm@fipa.org

All TC members will be notified about contributions, comments or proposed changes and should be able to access them.

The proposed updates to the FIPA ACL elements must be discussed and approved during an official FIPA meeting, in order that the FIPA community may be involved with and informed of all of the FIPA approved FIPA ACL elements in this document library.

3.1.1   Inclusion Criteria

To populate the FIPA ACL element list, it is necessary to set some basic guidelines for the selection of specific FIPA ACL elements. The minimal criteria that must be satisfied for a FIPA ACL element to be FIPA compliant are:

Substantial and clear documentation must be provided,

The message element must not duplicate an existing element, and,

The usefulness of a new ACL element should be made clear.

3.1.2   Comments and Questions

The latest version of this document may be found on the FIPA web site (http://www.fipa.org). Comments and questions regarding this document and the specification therein should be addressed to agent_comm@fipa.org.

4   References

246

247   [FIPA00001]   FIPA Abstract Architecture Specification. Foundation for Intelligent Physical Agents, 2000.
248   `http://www.fipa.org/specs/fipa00001/`
249   [FIPA00007]   FIPA Content Languages Library Specification. Foundation for Intelligent Physical Agents, 2000.
250   `http://www.fipa.org/specs/fipa00007/`
251   [FIPA00025]   FIPA Interaction Protocol Library Specification. Foundation for Intelligent Physical Agents, 2000.
252   `http://www.fipa.org/specs/fipa00025/`
253   [FIPA00037]   FIPA Communicative Act Library Specification. Foundation for Intelligent Physical Agents, 2000.
254   `http://www.fipa.org/specs/fipa00037/`