

FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

FIPA Agent Message Transport Service Specification

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21 **Foreword**

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35 00003]. A complete overview of the FIPA specifications and their current status may be found on the FIPA Web site.

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37 represented many countries worldwide. Further information about FIPA as an organization, membership information,
38 FIPA specifications and upcoming meetings may be found on the FIPA Web site at <http://www.fipa.org/>.

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75 **1 Scope**

76 This document deals with message transportation between inter-operating agents and also forms part of the FIPA
77 Agent Management specification (see [FIPA00023]). It contains specifications for:

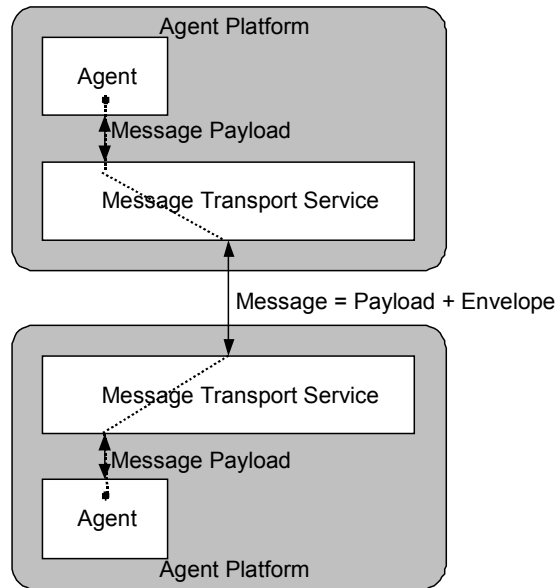
- 78
- 79 • A reference model for an agent Message Transport Service, and,
 - 80
 - 81 • Definitions for the expression of message transport information to an agent Message Transport Service.
 - 82

83 2 Agent Message Transport Reference Model

84 2.1 Reference Model

85 The reference model for agent message transport comprises three levels (see *Figure 1*):

- 86
- 87 1. The Message Transport Protocol (MTP) is used to carry out the physical transfer of messages between two ACCs.
- 88
- 89 2. The Message Transport Service (MTS) is a service provided by the AP to which an agent is attached. The MTS
- 90 supports the transportation of FIPA ACL messages between agents on any given AP and between agents on
- 91 different APs.
- 92
- 93 3. The ACL represents the payload of the messages carried by both the MTS and MTP.
- 94



95
96
97
98 **Figure 1:** Message Transport Reference Model

99 2.2 Message Structure

100 In its abstract form, a message is made up of two parts: a message envelope expressing transport information and a
101 message payload comprising the ACL message of the agent communication.

102
103 For the purposes of message interpretation by an agent:

- 104
- 105 • ACL semantics are defined only over the ACL message delivered in the message payload of a message (see
106 [FIPA00023]).
- 107
- 108 • All information in the message envelope is supporting information only. How and if this information is used to by an
109 agent for any kind of additional inference is undefined by FIPA. However, under some circumstances, an agent
110 might be required to process the envelope information in order to properly interpret the received message payload;
111 for instance when the payload has been encrypted or in order to discover the ACL representation used by the
112 sender.
- 113

114 **3 Message Transport Service**

115 The MTS provides a mechanism for the transfer of ACL messages between agents. The agents involved may be local
116 to a single AP or on different APs. On any given AP, the MTS is provided by an Agent Communication Channel (ACC).
117

118 **3.1 Message Envelope**

119 Any MTP may use a different internal representation to describe a message envelope, but must express the same
120 terms, represent the same semantics and perform the corresponding actions.

121 The following are general statements about the form of a message envelope:
122

- 123 • A message envelope comprises a collection of parameters,
- 124 • A parameter is a name/value pair,
- 125 • A message envelope contains at least the mandatory `to`, `from`, `date` and `acl-representation` parameters,
126 and,
- 127 • A message envelope can contain optional parameters.

128 Each ACC handling a message may add new information to the message envelope, but it may never overwrite existing
129 information. ACCs can add new parameters to a message envelope which override existing parameters that have the
130 same parameter name; the mechanism for disambiguating message envelope entries is specified by each concrete
131 message envelope syntax.
132

133 **3.1.1 Updating Message Envelope Information**

134 To update a value in one of the envelope parameters, the ACC must add a new copy of the message envelope
135 parameter (containing the new value) to the envelope.
136

137 Since this mechanism permits multiple occurrences of the same parameters in a message envelope (with different
138 values), each concrete message envelope syntax must provide a general mechanism for identifying which copy of the
139 parameter is current..
140

141 **3.1.2 Additional Message Envelope Parameters**

142 Additional parameters not defined in this document can be added to the envelope as well as to all the frames defined in
143 this specification. The prefatory string “x-” must be used for the names of these non-FIPA standard additional
144 parameters and implementations are free to ignore such additional parameters.
145

146 **3.2 Agent Identifiers and Transport Addresses**

147 Agent Identifiers (AIDs) and transport addresses are defined in [FIPA00023].
148
149

150 **3.3 Agent Communication Channel**

151 The ACC is an entity providing a service directly to the agents on an AP. The ACC may access information provided by
152 the other AP services (such as the AMS and DF) to carry out its message transport tasks.
153
154
155
156
157
158

159 **3.3.1 Standard Interfaces**

160 When messages are received over a message interface advertised as implementing one of the FIPA standard MTPs,
 161 these messages must be handled as specified in Section 3.3.3.
 162

163 **3.3.2 Proprietary Interfaces**

164 FIPA does not specify how agents communicate using proprietary interfaces with the MTS.
 165

166 **3.3.3 Message Handling Behaviour**

167 To provide the MTS, an ACC must transfer the messages it receives in accordance with the transport instructions
 168 contained in the message envelope. An ACC is only required to read the message envelope; it is not required to parse
 169 the message payload. In performing message transfer tasks, the ACC may be required to obtain information from the
 170 AMS or DF on its own AP. Some implementations of ACCs may provide some form of buffering capability to help
 171 agents manage their messages.
 172

173 **3.3.4 Message Envelope Interpretation**

174 The message forwarding behaviour of an ACC is determined by the instructions for message delivery that are
 175 expressed in the message envelope (see *Table 1*).
 176

Parameter	Description
to	If no <i>intended-receiver</i> parameter is present, then the information in this parameter is used to generate <i>intended-receiver</i> field for the messages the ACC subsequently forwards.
from	If required, the ACC returns error and confirmation messages to the agent specified in this parameter.
comments	None.
acl-representation	None. This information is intended for the final recipient of the message.
payload-length	The ACC may use this information to improve parsing efficiency.
payload-encoding	None. This information is intended for the final recipient of the message.
date	None. This information is intended for the final recipient of the message.
intended-receiver	An ACC uses this parameter to determine where this instance of a message should be sent. If this parameter is not provided, then the first ACC to receive the message should generate an <i>intended-receiver</i> parameter using the <i>to</i> parameter.
received	A new <i>received</i> parameter is added to the envelope by each ACC that the message passes through. Each ACC handling a message must add a completed <i>received</i> parameter. If an ACC receives a message it has already stamped, it is free to discard the message without any need to generate an error message.
transport-behaviour	Reserved for future use.

177 **Table 1:** Agent Communication Channel Interpretation of Message Envelope
 178
 179

180 **3.3.5 Forwarding Messages**

181 The recipients of a message are specified in the *to* parameter of a message envelope and take the form of AIDs.
 182 Depending upon the presence of *intended-receiver* parameter, the ACC forwards the message in one of the
 183 following ways:
 184

- 185 • If an ACC receives a message envelope without an *intended-receiver* parameter, then it generates a new
 186 *intended-receiver* parameter from the *to* parameter (possibly containing multiple AIDs). It may also generate
 187 multiple copies of the message with different *intended-receiver* parameters if multiple receivers are specified.
 188 In all cases, the ACC is required to process all entries in the *to* field parameter and enforced not to add and not to

remove any AID that was contained in the original message. The `intended-receiver` parameters form a delivery path showing the route that a message has taken.

- If an ACC receives a message envelope with an `intended-receiver` parameter, this is used for delivery of this instance of the message and the `to` parameter is ignored.
- If an ACC receives a message envelope with more than one `intended-receiver` parameter, the most recent is used.

Before forwarding the message, the ACC adds a completed `received` parameter to the message envelope. Once an ACC has forwarded a message it no longer needs to keep any record of the existence of that message.

3.3.6 Handling a Single Receiver

In delivering a message to a single receiver specified in the `to` or `intended-receiver` parameters of a message envelope, the ACC forwards the message to one of the addresses in the `addresses` parameter of the AID. If this address leads to another ACC, then it is the task of the receiving ACC to deliver the message to the receiving agent (if the agent is resident on the local AP) or to forward it on to another ACC (if the agent is not locally resident).

3.3.7 Handling Multiple Transport Addresses for a Single Receiver

The AID given in the `to` or `intended-receiver` parameter (in the case of both parameters being present, the information in the `intended-receiver` parameter is used) of a message envelope may contain multiple transport addresses for a single receiving agent. The ACC uses the following method to try to deliver the message:

- Try to deliver the message to the *first* transport address in the `addresses` parameter; the first is chosen to reflect the fact that the transport address list in an AID is ordered by preference.
- If this fails, because the agent or AP was not available or because the ACC does not support the appropriate message transport protocol, etc., then the ACC creates a new `intended-receiver` parameter containing the AID with the failed transport address removed. The ACC then attempts to send the message to the next transport address in AID in the intended receiver list (now the first in the newly created `intended-receiver` parameter).
- If delivery is still unsuccessful when all transport addresses have been tried (or the AID contained no transport addresses), the ACC may try to resolve the AID using the name resolution services listed in the `resolvers` parameter of the AID. Again, the name resolution services should be tried in the order of their appearance.

Finally, if all previous message delivery attempts have failed, then an appropriate error message for the final failure is passed back to the sending agent (see Section 3.3.11).

3.3.8 Handling Multiple Receivers

An ACC uses the following rules in delivering messages to multiple intended receivers¹:

- If an ACC receives a message envelope with no `intended-receiver` parameter and a `to` parameter containing more than one AID, it may or may not split these up to form separate messages². Each message would contain a subset of the agents named in the `to` and `intended-receiver` parameters.
- If an ACC receives a message envelope with an `intended-receiver` parameter containing more than one AID, it may or may not split these up to form separate messages.

¹ An ACC may decide to optimise the delivery of messages where a given message is intended for multiple receivers that reside on the same host. However, whether an ACC decides to make this optimisation or not, the semantics of message delivery within an ACC must remain the same. This is so that optimised ACCs and non-optimised ACCs can inter-operate.

² Not splitting up messages may be more efficient when several copies would be delivered to the same address.

- 237 • If an ACC splits a message as described above, then it is enforced not to add and not to remove any AID that was
 238 contained in the original message
 239

240 The resulting messages are handled as in the single receiver case (see Section 3.3.6).
 241

242 3.3.9 Delivering Messages

243 Once a message has arrived at ACC which can directly deliver it to the agent or agents named in the *intended-*
 244 *receiver* parameter of the message envelope, this ACC should pass the message to the agents concerned. This
 245 specification does not specify how final message delivery is performed; the message may be passed to the agents
 246 using any of the ACC proprietary or standard MTP interfaces. An ACC should deliver the whole message, including the
 247 message envelope, to the receiving agent. However, particular AP implementations may provide middleware layers to
 248 free agents from the task of processing the envelope.
 249

250 If an ACC receives a message it has already stamped, then it is free to discard the message without any need to
 251 generate an error message.
 252

253 3.3.10 Using a Name Resolution Service

254 In certain circumstances, if an AID for a receiver contains no transport addresses then the ACC may try to resolve the
 255 AID by contacting one of the entities listed in the *resolvers* parameter of the AID, as specified in [FIPA00023].
 256

257 3.3.11 Error and Confirmation Messages

258 Error and confirmation messages sent to *a sending agent* by the MTS are in the form of ACL messages over the MTS.
 259 These MTS information messages are sent on behalf of the AMS agent responsible (the *sender* parameter of the
 260 message must be set the local AMS's AID) of the ACC's AP³.
 261

262 If an error message needs to be returned, the message generated must follow the exception model defined in
 263 [FIPA00023] such that:
 264

- 265 • The communicative act is a *failure*,
- 266
- 267 • The failed action is the ACL message that was not delivered properly,
- 268
- 269 • The predicate symbol is *internal-error*, and,
- 270
- 271 • The argument parameter is a string describing the error which occurred (the form and content of which is
 272 implementation-dependent and can be ignored by implementations).
 273

274 This generated *failure* ACL message must include the same *conversation-id* value as the message that was
 275 not delivered and must contain the expression in the *reply-with* field (of the message that was not delivered) in its
 276 *in-reply-to* parameter.
 277

278 3.4 Using the Message Transport Service

279 3.4.1 Sending Messages

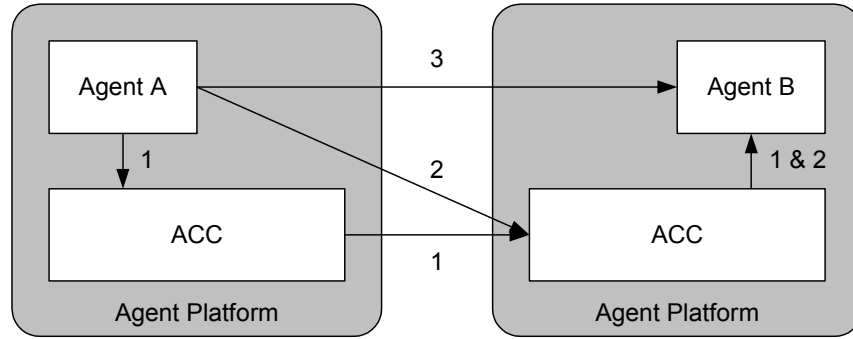
280 An agent has three options when sending a message to another agent resident on a remote AP (see *Figure 2*):
 281

- 282 1. Agent A sends the message to its local ACC using a proprietary or standard interface. The ACC then takes care of
 283 sending the message to the correct remote ACC using a suitable MTP. The remote ACC will eventually deliver the
 284 message.

³ How the message is generated (whether by the AMS or by the ACC on behalf of the AMS) is not specified by FIPA.

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2. Agent A sends the message directly to the ACC on the remote AP on which Agent B resides. This remote ACC then delivers the message to B. To use this method, Agent A must support access to one of the remote ACC's MTP interfaces.
3. Agent A sends the message directly to Agent B, by using a direct communication mechanism. The message transfer, addressing, buffering of messages and any error messages must be handled by the sending and receiving agents. This communication mode is not covered by FIPA.



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297

Figure 2: Three Methods of Communication between Agents on Different Agent Platforms⁴

3.4.2 Receiving Messages

An agent receives an entire message including both the message envelope and message payload. Consequently, the receiving agent has access to all of the message transport information expressed in the message envelope, such as encryption details, ACL representation information, the delivery path of the message, etc.

3.5 Querying Message Transport Service Polices and Capabilities

An AP must support queries about its message transport policies and capabilities. Information pertinent to the MTS (such as the particular MTPs supported by an ACC) is given in the AP description, that can be accessed by sending a `get-description` request to an AMS (see [FIPA00023]).

3.5.1 Agent Platform Transport Descriptions

The transport description forms part of an AP and is expressed in `fipa-s10`. The following transport description is for an AP which supports IIOP and HTTP based transports:

```

312 (ap-description
313   :name myAPDescription
314   :ap-services
315     (set
316       (ap-service
317         :name myIIOPMTP
318         :type fipa.mts.mtp.iiop.std
319         :addresses
320           (sequence
321             corbaloc:iiop:agents.fipa.org:10100/acc
322             IOR:00000000002233
323             corbaname::agents.fipa.org:10000/nameserver#acc))
324       (ap-service
325         :name myHTTPMTP
326         :type fipa.mts.mtp.http.std

```

⁴ A fourth possibility (not illustrated) is that instead of completing the last two stages of the first path, the ACC on the first platform contacts Agent B directly – this depends upon the address that the ACC is delivering to.

```
327 :addresses  
328 (sequence  
329 http://agents.fipa.org:8080/acc))  
330
```

331 For more information on how to generate a concrete representation of a transport description, see [FIPA00061] and
332 [FIPA00008].
333

334 4 Agent Message Transport Ontology

335 4.1 Object Descriptions

336 This section describes a set of frames that represent the classes of objects in the domain of discourse within the
 337 framework of the `fipa-agent-management` ontology. The closure of symbols of this ontology can be obtained
 338 through the companion document [FIPA00023] that specifies additional set of frames of this ontology.

339 The following terms are used to describe the objects of the domain:
 340

- 341 • **Frame.** This is the mandatory name of this entity that must be used to represent each instance of this class.
- 342 • **Ontology.** This is the name of the ontology, whose domain of discourse includes the parameters described in the
- 343 table.
- 344 • **Parameter.** This is the mandatory name of a parameter of this frame.
- 345 • **Description.** This is a natural language description of the semantics of each parameter.
- 346 • **Presence.** This indicates whether each parameter is mandatory or optional.
- 347 • **Type.** This is the type of the values of the parameter: Integer, Word, String, URL, Term, Set or Sequence.
- 348 • **Reserved Values.** This is a list of FIPA-defined constants that can assume values for this parameter.

357 4.1.1 Message Envelope Description

Frame	envelope			
Ontology	fipa-agent-management			
Parameter	Description	Presence	Type	Reserved Values
to	This contains the names of the primary recipients of the message.	Mandatory	Sequence of agent-identifier	
from	This is the name of the agent who actually sent the message.	Mandatory	agent-identifier	
comments	This is a comment in the message envelope.	Optional	string	
acl-representation	This is the name of the syntax representation of the message payload.	Mandatory	string	fipa.acl.rep.bitefficient.std fipa.acl.rep.string.std fipa.acl.rep.xml.std
payload-length	This contains the length in bytes of the message payload.	Optional	string	
payload-encoding	This contains the language encoding of the message payload.	Optional ⁵	string	US-ASCII ISO-8859-1 ... ISO-8859-9 UTF-8 Shift_JIS EUC-JP ISO-2022-JP ISO-2022-JP-2

⁵ If this field is not present, the default value US-ASCII is assumed for the content encoding.

date	This contains the creation date and time of the message envelope	Mandatory	date	
intended-receiver	This is the name of the agents to whom this instance of a message is to be delivered.	Optional	Sequence of agent-identifier	
received	This is a stamp representing the receipt of a message by an ACC.	Optional	received-object	
transport-behaviour	This contains the transport requirements of the message.	Optional	(Undefined) ⁶	

358

359

4.1.2 Received Object Description

Frame Ontology	received-object fipa-agent-management			
Parameter	Description	Presence	Type	Reserved Values
by	The URL representing the transport address of the receiving ACC.	Mandatory	url	
from	The URL representing the transport address of the sending ACC.	Optional	url	
date	The date when a message was received.	Mandatory	date	
id	The unique identifier of a message. It is required that uniqueness be guaranteed within the scope of the sending ACC only.	Optional	string	
via	The type of MTP the message was delivered over.	Optional	string	fipa.mts.mtp.iiop.std fipa.mts.mtp.http.std

360

⁶ Reserved for future use.

361 5 References

- 362 [FIPA00007] FIPA Content Languages Specification. Foundation for Intelligent Physical Agents, 2000.
363 <http://www.fipa.org/specs/fipa00007/>
- 364 [FIPA00008] FIPA SL Content Language Specification. Foundation for Intelligent Physical Agents, 2000.
365 <http://www.fipa.org/specs/fipa00008/>
- 366 [FIPA00014] FIPA Nomadic Application Support Specification. Foundation for Intelligent Physical Agents, 2000.
367 <http://www.fipa.org/specs/fipa00014/>
- 368 [FIPA00023] FIPA Agent Management Specification. Foundation for Intelligent Physical Agents, 2000.
369 <http://www.fipa.org/specs/fipa00023/>
- 370 [FIPA00061] FIPA Agent Communication Language Specification. Foundation for Intelligent Physical Agents, 2000.
371 <http://www.fipa.org/specs/fipa00061/>
- 372 [ISO8601] Date Elements and Interchange Formats, Information Interchange-Representation of Dates and Times.
373 International Standards Organisation, 1998.
374 <http://www.iso.ch/cate/d15903.html>
- 375 [RFC822] Uniform Resource Identifiers: Generic Syntax. Request for Comments, 1992.
376 <http://www.ietf.org/rfc/rfc0822.txt>
- 377 [RFC2396] Standard for the Format of APRA Internet Text Messages. Request for Comments, 1998.
378 <http://www.ietf.org/rfc/rfc2396.txt>
379

380 6 Informative Annex A — ChangeLog

381 6.1 2001/10/08 - version D by FIPA Architecture Board

382 Page 8, lines 315-319: Removed section 3.5.2 which included references to obsolete specifications FIPA00077 and
 383 FIPA00078
 384

385 6.2 2002/11/01 - version E by FIPA X2S

386 Entire document: Changed all symbols to lowercase
 387 Entire document: Replaced all references to message body and message content with message payload
 388 Entire document: Removed the symbol : from all the parameter names
 389 Entire document: Removed reference to [FIPA00073] and to WAP specifications
 390 **Entire document: Removed the encrypted parameter and references to it**
 391 Page 2, Figure 1: Figure redrawn to be more accurate
 392 Page 2, line 108: Added a sentence to clarify that agents might need processing of the envelope
 393 Page 3, line 144: Made clear the usage of additional message envelope parameters
 394 Page 4, lines 157-160: Deleted paragraph on baseline MTP
 395 Page 4, line 178: Added a sentence about the possibility when an ACC can discard a stamped message
 396 Page 4, line 178: `transport-behaviour` parameter reserved for future use
 397 Page 5, line 189: Added sentence to reinforce a requirement of ACC to process all `to` parameter entries
 398 Page 6, line 236: Added sentence to reinforce a requirement of ACC to maintain the AID list in an original
 399 message
 400 Page 6, line 246: Added a sentence about the possibility when an ACC can discard a stamped message
 401 Page 6, lines 249-250: Deleted sentence on the interface to the name resolution service
 402 **Page 6, line 262: Added clarification on the generation of failure message for non-delivered messages**
 403 **Page 6, lines 265-266: Clarified that implementation can ignore arguments of `internal-error`**
 404 Page 7, lines 303-311: Modified the example according to the new definition of `ap-description`
 405 Page 9, line 325: Added a note that references [FIPA00023] for the closure of `fipa-agent-management`
 406 ontology
 407 Page 9, line 344: Added reserved values for `acl-representation`
 408 **Page 9, line 344: Relaxed the requirement that the parameter `date` had to be added by the sending**
 409 **agent**
 410 **Page 10, line 346: Added requirement for sending ACC to generate unique `id`**
 411 Page 10, line 346: Added reserved values for the `via` parameter
 412 **Page 10, lines 348-351: Removed definitions of `ap-transport-description` and `mtp-description` made**
 413 **obsolete by the new definition of `ap-description` in [FIPA00023]**
 414

415 6.3 2002/12/03 - version F by FIPA Architecture Board

416 Entire document: Promoted to Standard status
 417