

FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

FIPA Messaging Interoperability Service Specification

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20 **Foreword**

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22 industry of intelligent agents by openly developing specifications supporting interoperability among agents and agent-
23 based applications. This occurs through open collaboration among its member organizations, which are companies
24 and universities that are active in the field of agents. FIPA makes the results of its activities available to all interested
25 parties and intends to contribute its results to the appropriate formal standards bodies.

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29 to implement or use specific agent-based standards, recommendations and FIPA specifications by virtue of their
30 participation in FIPA.

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32 specification can be either Preliminary, Experimental, Standard, Deprecated or Obsolete. More detail about the
33 process of specification may be found in the FIPA Procedures for Technical Work. A complete overview of the FIPA
34 specifications and their current status may be found in the FIPA List of Specifications. A list of terms and abbreviations
35 used in the FIPA specifications may be found in the FIPA Glossary.

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

39 Contents

40	1	Scope	1
41	2	Overview.....	2
42	2.1	Reference Model.....	2
43	3	FIPA Messaging Interoperability Service	3
44	3.1	Requesting a Translation Service	3
45	3.1.1	Receiver Initiated Translation Service	3
46	4	Messaging Interoperability Service Ontology.....	4
47	4.1	Object Descriptions	4
48	4.1.1	Translation Identifier	4
49	4.2	Function Descriptions.....	4
50	4.2.1	Available Encodings.....	5
51	4.2.2	Resolve Encoding.....	5
52	4.2.3	Transform Encoding.....	5
53	4.2.4	Request Incoming Translation	6
54	4.2.5	Cancel Incoming Translation	6
55	4.3	Exceptions.....	6
56	4.3.1	Not Understood Exception Propositions	6
57	4.3.2	Refusal Exception Propositions	6
58	4.3.3	Failure Exception Propositions	7
59	5	Registration of a FIPA Messaging Interoperability Service with the DF	8
60	6	References	9
61	7	Informative Annex A — Examples.....	10
62	7.1	Transformation Encoding Request	10
63	7.2	Resolve Encoding	12
64	7.3	Receiver initialised transformations	13

65 **1 Scope**

66 This document is part of the FIPA specifications and deals with message conversion between inter-operating agents.
67 This document also forms part of the FIPA Message Transport Service Specification [FIPA00067] and contains
68 specification for:

69
70 FIPA Message conversion between different Message Transport Protocols or/and concrete encoding.
71

72 The document provides a series of examples to illustrate the agent management functions defined.
73

74 2 Overview

75 The FIPA Messaging Interoperability Service (FIPA-MIS) provides a means for converting between Message Transport
76 Protocols (MTPs) and between concrete encodings of FIPA-message parts. FIPA-MIS can be used where direct end-
77 to-end interoperability is impossible, impractical or undesirable. Direct end-to-end interoperability is impossible when
78 communicating platforms/agents do not support any common message transport protocol or encoding of FIPA-
79 message components, for example. Direct end-to-end interoperability may be impractical when communicating over a
80 slow wireless link with a peer in the fixed network that does not support any message transport protocol suitable for
81 wireless links.
82

83 2.1 Reference Model

84 The reference model for FMIS comprises four levels (see *Figure 1*):

- 86 1. The Message Transport Protocol Gateway (MTP-GW) is used to translate between Message Transport Protocols.
87 For example, the Message Transport Protocol Gateway may translate between `fipa.mts.mtp.iioip.std` and
88 `fipa.mts.mtp.wap.std`.
- 90 2. The Message Envelope Encoding Gateway (ENV-GW) is used to translate between Message Envelope
91 encodings. For example, the Message Envelope Encoding Gateway may translate between
92 `fipa.mts.env.rep.xml.std` and `fipa.mts.env.rep.bitefficient.std`.
- 94 3. The ACL Encoding Gateway (ACL-GW) is used to translate between ACL encodings. For example, the ACL
95 Encoding Gateway may translate between `fipa.acl.rep.xml.std` and
96 `fipa.acl.rep.bitefficient.std`.
- 98 4. The Content Language Encoding Gateway (CL-GW) is used to translate between Content Language encodings.
99 Note that the current specification does not allow conversion between *different* content languages, only between
100 *different encodings* of the same content language¹. However, if this kind of functionality is needed, it can be added
101 easily to the gateway specification. How such a translation is actually performed is an application implementation
102 issue, and hence is out of scope.

104 The services specified here may also provide other kinds of translations (e.g., application dependent translation, etc.).
105 This kind of functionality, however, should not be specified by FIPA, but hooks for such services exist in the
106 specification.

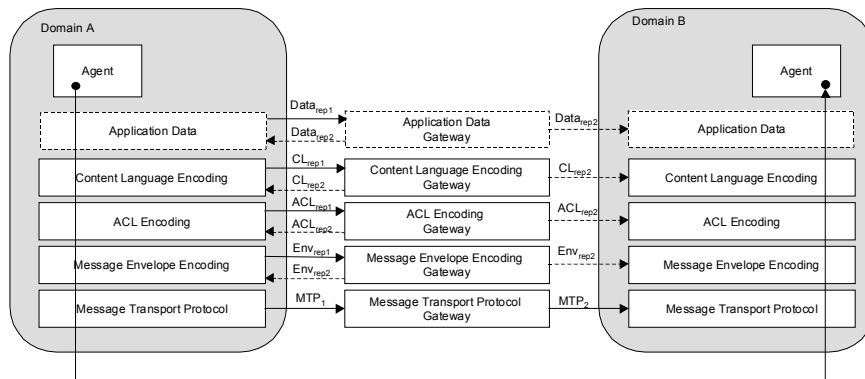


Figure 1: FIPA Messaging Interoperability Service Reference Model

107
108

¹ However, currently there is no content language specified in the FIPA Content Language Library that has more than one concrete encoding.

109

110 3 FIPA Messaging Interoperability Service

111 3.1 Requesting a Translation Service

112 When an ACC (or another gateway) finds out that some or all parts of a message or a MTP must be converted to
113 another, it must first find a messaging interoperability service that can perform the necessary translations (this process
114 is not defined here). After this, the functions provided by the service can be used in order to translate between
115 message components (i.e., content language, ACL, or envelope). If translation of message transport protocol is
116 needed, the message can be sent to the service that provides MTP-GW. The service knows implicitly the target MTP
117 by examining the transport address of the destination agent. For example, let's assume that the agent-identifier of the
118 destination agent is as follows:

```
119  
120 (agent-identifier  
121   :name foo@helluli.com  
122   :addresses (sequence (wap://helluli.com http://helluli.com/acc)))
```

123

124 When receiving the message using the message transport protocol, for example IOP, the MTP-GW translates the
125 message transport protocol to WAP.
126

127 3.1.1 Receiver Initiated Translation Service

128 When an agent knows in advance that it is not able to receive messages encoded in a particular encoding, it may
129 request the messaging interoperability service to automatically translate all the messages directed to it. The agent
130 sends a description of the encoding it is able to understand to the FIPA-MIS, which will translate the message with the
131 suggested encoding.
132

133 4 Messaging Interoperability Service Ontology

134 4.1 Object Descriptions

135 This section describes a set of frames that represent the classes of objects in the domain of discourse within the
 136 framework of the FIPA-MIS ontology.

137
 138 The following terms are used to describe the objects of the domain:

139
 140 **Frame.** This is the mandatory name of this entity that must be used to represent each instance of this class.

141
 142 **Ontology.** This is the name of the ontology, whose domain of discourse includes the parameters described in the
 143 table.

144
 145 **Parameter.** This is the mandatory name of a parameter of this frame.

146
 147 **Description.** This is a natural language description of the semantics of each parameter.

148
 149 **Presence.** This indicates whether each parameter is mandatory or optional.

150
 151 **Type.** This is the type of the values of the parameter: Integer, Word, String, URL, Term, Set or Sequence.

152
 153 **Reserved Values.** This is a list of FIPA-defined constants that can assume values for this parameter.
 154

155 4.1.1 Translation Identifier

156 This type of object represents the unique identification for the incoming message translation.
 157

Frame	translation-id			
Ontology	FIPA-MIS			
Parameter	Description	Presence	Type	Reserved Values
Id	Unique identifier for the incoming message translation. The identifier is unique only in one Messaging Interoperability Service.	Mandatory	String	

158

159 4.2 Function Descriptions

160 The following tables define usage and semantics of the functions that are part of the FIPA-MIS ontology.

161
 162 The following terms are used to describe the functions of the FIPA-MIS domain:
 163

164 **Function.** This is the symbol that identifies the function in the ontology.

165
 166 **Ontology.** This is the name of the ontology, whose domain of discourse includes the function described in the
 167 table.

168
 169 **Supported by.** This is the type of agent that supports this function.

170
 171 **Description.** This is a natural language description of the semantics of the function.

172
 173 **Domain.** This indicates the domain over which the function is defined. The arguments passed to the function must
 174 belong to the set identified by the domain.

Range. This indicates the range to which the function maps the symbols of the domain. The result of the function is a symbol belonging to the set identified by the range.

Arity. This indicates the number of arguments that a function takes. If a function can take an arbitrary number of arguments, then its arity is undefined.

4.2.1 Available Encodings

Function	available-encodings
Ontology	FIPA-MIS
Supported by	fipa-mis
Description	An agent may query the service to provide a list of all encoding representations known by the service.
Domain	None
Range	gateway-description
Arity	0

4.2.2 Resolve Encoding

Function	Resolve
Ontology	FIPA-MIS
Supported by	fipa-mis
Description	An agent may query the service to resolve the encoding with which the supplied message-component has been encoded. If the action is successful, the service will return the encoding-representation of supplied message-component.
Domain	message-component ²
Range	encoding-representation
Arity	1

4.2.3 Transform Encoding

Function	transform
Ontology	FIPA-MIS
Supported by	fipa-mis
Description	An agent may request the service to convert a transport-message or message component (i.e., payload, message, or content) into a particular encoding representation. The source message component is given as a parameter message-component and the encoding-representation parameter defines the target encoding. If the action is successful, the service will return the encoded message component.
Domain	message-component ² , encoding-representation
Range	message-component ²
Arity	2

² The concrete syntax of the message-component depends on the concrete representation of the message component.

188 **4.2.4 Request Incoming Translation**

Function	incoming-translation
Ontology	FIPA-MIS
Supported by	fipa-mis
Description	An agent may request the service to convert automatically a transport-message or a message component (i.e., payload, message, or content) of an incoming message into a particular encoding representation before having it delivered. The preferred encoding is described in the gateway-behaviour. If the action is successful the service will return a translation-id, which can be used to cancel the translation service.
Domain	Sequence of gateway-behaviour (see [FIPA00067])
Range	translation-id
Arity	1

189

190 **4.2.5 Cancel Incoming Translation**

Function	cancel-incoming-translation
Ontology	FIPA-MIS
Supported by	fipa-mis
Description	An agent may request the service to stop transforming messages before delivering them to the agent.
Domain	translation-id
Range	The execution of this function results in a change of the state, but it has no explicit result. Therefore there is no range set.
Arity	1

191

192 **4.3 Exceptions**

193 The exceptions for the FIPA-MIS ontology follow the same form and rules as specified in [FIPA00023].

194

195 **4.3.1 Not Understood Exception Propositions**196 The same set of “*Not Understood Exception Propositions*” as in the FIPA-Agent-Management ontology is used in
197 the FIPA-MIS ontology (see [FIPA00023]).

198

199 **4.3.2 Refusal Exception Propositions**200 The same set of “*Refusal Exception Propositions*” as defined in the FIPA-Agent-Management ontology is used in
201 FIPA-MIS ontology (see [FIPA00023]). In addition, the FIPA-MIS ontology defines the propositions given below.

202

Communicative Act	refuse	
Ontology	FIPA-MIS	
Predicate symbol	Arguments	Description
Invalid-message		The message component to be encoded is invalid in some way.
Invalid-encoding		The encoding-representation selected is unavailable.
Unidentifiable-encoding		The encoding-representation is unidentifiable by the service

203

204

4.3.3 Failure Exception Propositions

Communicative Act Ontology	failure FIPA-MIS	
Predicate symbol	Arguments	Description
internal-error	String	See [FIPA00023].
unknown-identifier	String	The translation-id is unknown.

205

5 Registration of a FIPA Messaging Interoperability Service with the DF

In order for a FIPA messaging interoperability service to advertise its willingness to provide its services to an agent domain, it must register with a DF (as described in [FIPA00023]).

As part of this registration process the following constant values are introduced that universally identify the services the agent provides:

The `type` slot in the `service-description` frame of FIPA messaging interoperability service must be declared as a constant `fipa-mis`.

The `ontology` slot in the `service-description` frame of FIPA messaging interoperability service must be declared as a constant `FIPA-MIS`.

Below is given an example content of an agent `df-agent-description` frame which provides the following functionality:

Translation service from XML encoded envelopes to bit-efficient envelopes, and,

Translation service from XML encoded ACL messages to bit-efficient ACL messages.

```
(df-agent-description
  :name
    (agent-identifier
      :name fipa-gateway@iiop://foo.com/acc
      :addresses (sequence iiop://foo.com/acc))
  :ontology (set FIPA-MIS)
  :language (set FIPA-SL0)
  :services (set
    (service-description
      :name fipa-messaging-interoperability-service
      :type fipa-mis
      :ontology FIPA-MIS
      :properties
        (gateway-description
          :acl-translation
            (acl-gateway-description
              :from
                (encoding-representation :name fipa.acl.rep.xml.std)
              :to
                (set
                  (encoding-representation :name fipa.acl.rep.bitefficient.std))))
          :envelope-translation
            (envelope-gateway-description
              :from
                (encoding-representation :name fipa.mts.env.rep.xml.std)
              :to
                (set
                  (encoding-representation
                    :name fipa.mts.env.rep.bitefficient.std))))))
    :ownership (set Helluli))))
```

257 **6 References**

258 [FIPA00023] FIPA Agent Management Specification. Foundation for Intelligent Physical Agents, 2000.
259 <http://www.fipa.org/specs/fipa00023/>
260 [FIPA00067] FIPA Agent Message Transport Service Specification. Foundation for Intelligent Physical Agents,
261 2000. <http://www.fipa.org/specs/fipa00067/>

262 7 Informative Annex A — Examples

263 7.1 Transformation Encoding Request

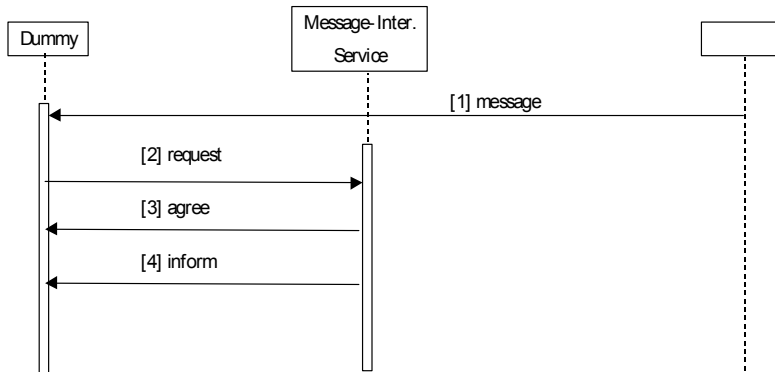


Figure 2: Transformation of message-component encoding

264 This example shows how an agent requests the Messaging Interoperability Service to transform a message
 265 component from one encoding to another. The message flow is illustrated in *Figure 2*.

266

- 267 1. Message [1]: The agent *dummy* receives a message and wants to transform the ACL-encoding of the message.
 268
 269 2. Message [2] *request*: The agent *dummy* sends the transform request to the Messaging Interoperability Service.
 270 The request contains the message-component to be transformed and the requested new encoding representation.

271

```

272 (request
273   :sender
274     (agent-identifier
275       :name dummy
276       :addresses (sequence http://helluli.com/acc))
277   :receiver (set
278     (agent-identifier
279       :name fipa-messaging-interoperability-service
280       :addresses (sequence http://fmis.com/acc)))
281   :ontology FIPA-MIS
282   :language FIPA-SL0
283   :protocol fipa-request
284   :content
285     (action
286       (agent-identifier
287         :name fipa-messaging-interoperability-service)
288       (transform
289         (message-component (request ...))
290         (encoding-representation
291           :name fipa.acl.rep.bitefficient.std))))
292 
```

293 3. Message [3] agree: The Messaging Interoperability Service agrees to perform the transformation:

```
294
295 (agree
296   :sender
297     (agent-identifier
298       :name fipa-messaging-interoperability-service
299       :addresses (sequence http://fmis.com/acc))
300   :receiver (set
301     (agent-identifier
302       :name dummy
303       :addresses (sequence http://helluli.com/acc)))
304   :ontology FIPA-MIS
305   :language FIPA-SL0
306   :protocol fipa-request
307   :content
308     ((action
309       (agent-identifier
310         :name fipa-messaging-interoperability-service)
311       (transform
312         (message-component (request ...) )
313         (encoding-representation
314           :name fipa.acl.rep.bitefficient.std)))
315       true))
316
```

317 4. Message [4] inform: The Messaging Interoperability Service returns the encoded message component to the
318 agent.

```
319
320 (inform
321   :sender
322     (agent-identifier
323       :name fipa-messaging-interoperability-service
324       :addresses (sequence http://fmis.com/acc))
325   :receiver (set
326     (agent-identifier
327       :name dummy
328       :addresses (sequence http://helluli.com/acc)))
329   :ontology FIPA-MIS
330   :language FIPA-SL0
331   :protocol fipa-request
332   :content
333     (result
334       (action
335         (agent-identifier
336           :name fipa-messaging-interoperability-service)
337         (transform
338           (message-component (request ...) )
339           (encoding-representation
340             :name fipa.acl.rep.bitefficient.std)))
341         (message-component 0xfa... )))
```

342

343 **7.2 Resolve Encoding**

344 This example shows how an agent requests the Messaging Interoperability Service to resolve the encoding of a
 345 message component.

346

347 1. Message [1] request: The agent *dummy* sends the resolve request to the Messaging Interoperability Service:

348

349

350

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389

390

```
(request
  :sender
    (agent-identifier
      :name dummy
      :addresses (sequence http://helluli.com/acc))
  :receiver (set
    (agent-identifier
      :name fipa-messaging-interoperability-service
      :addresses (sequence http://fmis.com/acc)))
  :ontology FIPA-MIS
  :language FIPA-SL0
  :protocol fipa-request
  :content
    (action (agent-identifier :name fipa-messaging-interoperability-service)
      (resolve
        (message-component <fipa-message>...</fipa-message>))))))
```

2. Message [2] agree: The Messaging Interoperability Service agrees to perform the action.

3. Message [3] inform: The Messaging Interoperability Service informs the agent *dummy* that the message is encoded using `fipa.acl.rep.xml.std`.

```
(inform
  :sender
    (agent-identifier
      :name fipa-messaging-interoperability-service
      :addresses (sequence http://fmis.com/acc))
  :receiver (set
    (agent-identifier
      :name dummy
      :addresses (sequence http://helluli.com/acc)))
  :ontology FIPA-MIS
  :language FIPA-SL0
  :protocol fipa-request
  :content
    (result
      (action (agent-identifier :name fipa-messaging-interoperability-service)
        (resolve
          (message-component <fipa-message>...</fipa-message>))))
      (encoding-representation
        :name fipa.acl.rep.xml.std))))
```

391 **7.3 Receiver initialised transformations**

392 This example shows how an agent requests the Messaging Interoperability Service to transform messages before their
 393 delivery to the agent.
 394

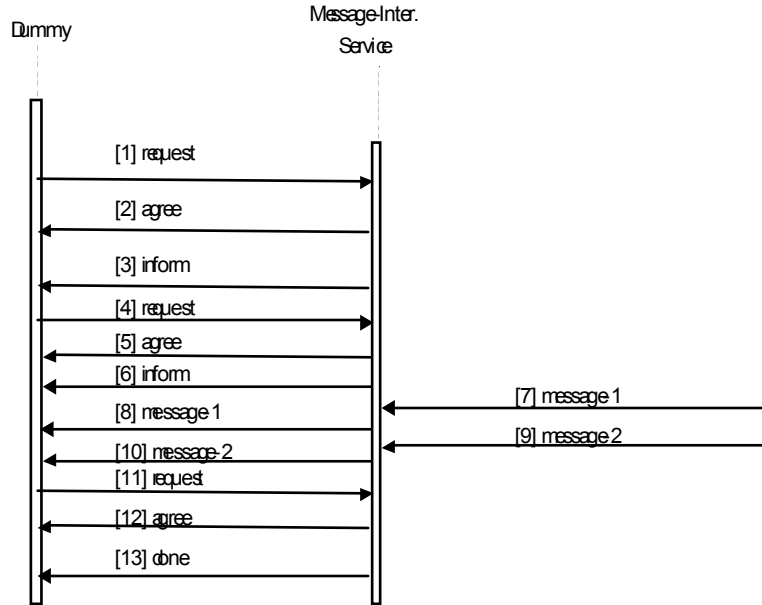


Figure 3: Receiver Initialised Transformations

395
 396 1. Message [1] request: The agent *dummy* query the Messaging Interoperability Service a list of all the encoding
 397 representations known by the service.
 398

```

399 (request
400   :sender
401     (agent-identifier
402       :name dummy
403       :addresses (sequence http://campa.com/acc))
404   :receiver (set
405     (agent-identifier
406       :name fipa-messaging-interoperability-service
407       :addresses (sequence http://fmis.com/acc)))
408   :ontology FIPA-MIS
409   :language FIPA-SL0
410   :protocol fipa-request
411   :content
412     (action
413       (agent-identifier
414         :name fipa-messaging-interoperability-service)
415       (available-encodings)))
416 )
    
```

417 2. Message [2] agree: The Messaging Interoperability Service agrees to deliver the list.

418
 419 3. Message [3] inform: The Messaging Interoperability Service sends the list:

```

420 (inform
421   :sender
422     (agent-identifier
423       :name fipa-messaging-interoperability-service
424       :addresses (sequence http://fmis.com/acc))
425 )
    
```



```

426     :receiver (set
427       (agent-identifier
428         :name dummy
429         :addresses (sequence http://campa.com/acc)))
430   :ontology FIPA-MIS
431   :language FIPA-SL0
432   :protocol fipa-request
433   :content
434     (result
435       (action
436         (agent-identifier
437           :name fipa-messaging-interoperability-service)
438         (available-encodings))
439       (gateway-description
440         :acl-translation
441         (set
442           (acl-gw-description
443             :from fipa.acl.rep.bitefficient.std
444             :to (set fipa.acl.rep.string.std fipa.acl.rep.xml.std))
445           (acl-gw-description
446             :from fipa.acl.rep.string.std
447             :to (set fipa.acl.rep.bitefficient.std))))))
448

```

4. Message [4] request: The agent *dummy* requests to the Messaging Interoperability Service to transform messages to the `fipa.acl.rep.bitefficient.std` encoding before delivering them to the agent *dummy*:

```

451 (request
452   :sender
453     (agent-identifier
454       :name dummy
455       :addresses (sequence http://campa.com/acc))
456   :receiver (set
457     (agent-identifier
458       :name fipa-messaging-interoperability-service
459       :addresses (sequence http://fmis.com/acc)))
460   :ontology FIPA-MIS
461   :language FIPA-SL0
462   :protocol fipa-request
463   :content
464     (action (agent-identifier :name fipa-messaging-interoperability-service)
465       (incoming-translation
466         (sequence
467           (gateway-behaviour
468             :acl fipa.acl.rep.bitefficient.std))))))
469

```

5. Message [5] agree: The Messaging Interoperability Service agrees.

6. Message [6] inform: The Messaging Interoperability Service returns an translation identifier:

```

475 (inform
476   :sender
477     (agent-identifier
478       :name fipa-messaging-interoperability-service
479       :addresses (sequence http://fmis.com/acc))
480   :receiver (set
481     (agent-identifier
482       :name dummy
483       :addresses (sequence http://campa.com/acc)))
484   :ontology FIPA-MIS
485   :language FIPA-SL0
486   :protocol fipa-request
487   :content
488     (result

```

```

489     (action (agent-identifier :name fipa-messaging-interoperability-service)
490       (incoming-translation
491         (sequence
492           (gateway-behaviour
493             :acl fipa.acl.rep.bitefficient.std))))
494     (translation-id :id id1)))
495

```

7. Message [7]: The service receives a message for *dummy*, and converts the ACL encoding to *fipa.acl.rep.bitefficient.std*.

8. Message [8]: The service delivers the message to the agent *dummy*.

9. Message [9] and Message [10]: Another message delivered to the agent *dummy* after being translated.

10. Message [11] *request*: The agent *dummy* sends a request to the Messaging Interoperability Service to cancel the translation of incoming messages:

```

506 (request
507   :sender
508     (agent-identifier
509       :name dummy
510       :addresses (sequence http://campa.com/acc))
511   :receiver (set
512     (agent-identifier
513       :name fipa-messaging-interoperability-service
514       :addresses (sequence http://fmis.com/acc)))
515   :ontology FIPA-MIS
516   :language FIPA-SL0
517   :protocol fipa-request
518   :content
519     (action (agent-identifier :name fipa-messaging-interoperability-service)
520       (received-translated-cancel
521         (translation-id :id id1))))
522

```

11. Message [12] *agree*: The service agrees.

12. Message [13] *inform*: The service informs the agent that the translation of the incoming messages has been cancelled.