

# FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

## FIPA Request Interaction Protocol Specification

|                        |   |                            |                       |
|------------------------|---|----------------------------|-----------------------|
| <b>Document title</b>  | FIPA Request Interaction Protocol Specification |                            |                       |
| <b>Document number</b> | SC00026H  | <b>Document source</b>     | FIPA TC Communication |
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39 **Contents**

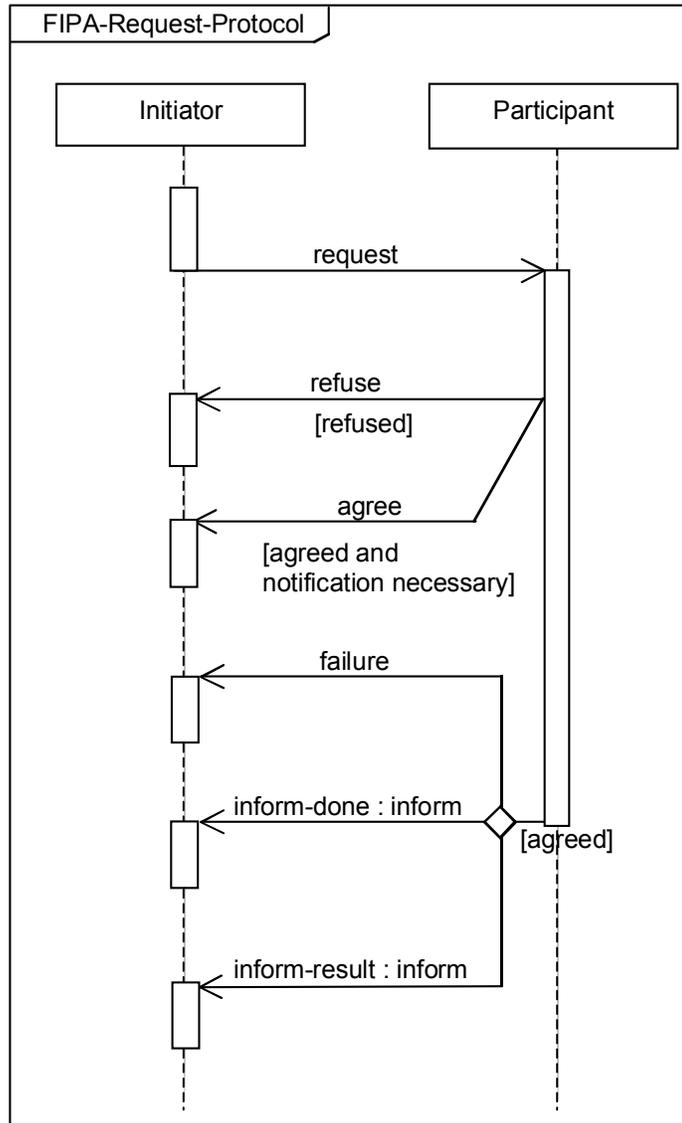
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| 46 | 3.2 | 2002/12/03 - version H by FIPA Architecture Board ..... | 5 |

47 **1 FIPA Request Interaction Protocol**

48 The FIPA Request Interaction Protocol (IP) allows one agent to request another to perform some action.

49

50 The representation of this protocol is given in *Figure 1* which is based on extensions to UML 1.x. [Odell2001]. This  
 51 protocol is identified by the token `fipa-request` as the value of the `protocol` parameter of the ACL message.  
 52



53 **Figure 1: FIPA Request Interaction Protocol**

54  
55  
56

57 **1.1 Explanation of the Protocol Flow**

58 The FIPA Request Interaction Protocol (IP) allows one agent to request another to perform some action. The Participant  
 59 processes the request and makes a decision whether to accept or refuse the request. If a refuse decision is made, then  
 60 “refused” becomes true and the Participant communicates a `refuse`. Otherwise, “agreed” becomes true.

61

62 If conditions indicate that an explicit agreement is required (that is, “notification necessary” is true), then the Participant  
 63 communicates an `agree`. The `agree` may be optional depending on circumstances, for example, if the requested

64 action is very quick and can happen before a time specified in the `reply-by` parameter. Once the request has been  
 65 agreed upon, then the Participant must communicate either:  
 66

- 67 • A `failure` if it fails in its attempt to fill the request,
- 68
- 69 • An `inform-done` if it successfully completes the request and only wishes to indicate that it is done, or,
- 70
- 71 • An `inform-result` if it wishes to indicate both that it is done and notify the initiator of the results.
- 72

73 Any interaction using this interaction protocol is identified by a globally unique, non-null `conversation-id` parameter,  
 74 assigned by the Initiator. The agents involved in the interaction must tag all of its ACL messages with this conversation  
 75 identifier. This enables each agent to manage its communication strategies and activities, for example, it allows an  
 76 agent to identify individual conversations and to reason across historical records of conversations.  
 77

### 78 1.2 Exceptions to Protocol Flow

79 At *any* point in the IP, the receiver of a communication can inform the sender that it did not understand what was  
 80 communicated. This is accomplished by returning a `not-understood` message. As such, *Figure 1* does not depict a  
 81 `not-understood` communication as it can occur at any point in the IP. The communication of a `not-understood`  
 82 within an interaction protocol may terminate the entire IP and termination of the interaction may imply that any  
 83 commitments made during the interaction are null and void.  
 84

85 At any point in the IP, the initiator of the IP may cancel the interaction protocol by initiating the meta-protocol shown in  
 86 *Figure 2*. The `conversation-id` parameter of the cancel interaction is identical to the `conversation-id` parameter  
 87 of the interaction that the Initiator intends to cancel. The semantics of `cancel` should roughly be interpreted as meaning  
 88 that the initiator is no longer interested in continuing the interaction and that it should be terminated in a manner  
 89 acceptable to both the Initiator and the Participant. The Participant either informs the Initiator that the interaction is done  
 90 using an `inform-done` or indicates the failure of the cancellation using a `failure`.  
 91

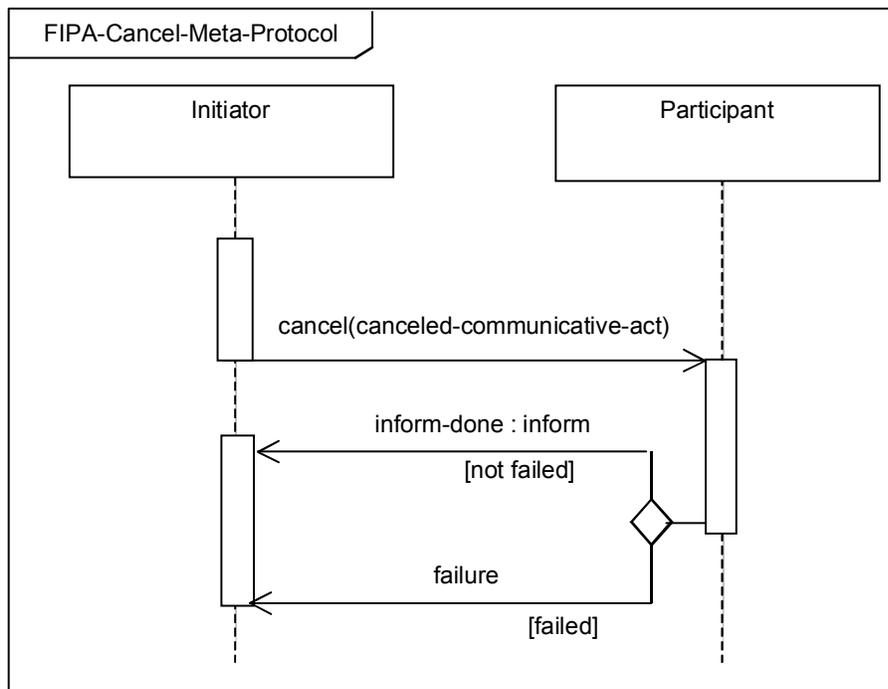


Figure 2: FIPA Cancel Meta-Protocol

92  
 93  
 94

95 This IP is a pattern for a simple interaction type. Elaboration on this pattern will almost certainly be necessary in order to  
96 specify all cases that might occur in an actual agent interaction. Real world issues such as the effects of cancelling  
97 actions, asynchrony, abnormal or unexpected IP termination, nested IPs, and the like, are explicitly not addressed here.  
98

99

## 2 References

100  
101  
102  
103  
104

[Odell2001] Odell, James, Van Dyke Parunak, H. and Bauer, B., *Representing Agent Interaction Protocols in UML*. In: Agent-Oriented Software Engineering, Ciancarini, P. and Wooldridge, M., Eds., Springer, pp. 121-140, Berlin, 2001.  
<http://www.fipa.org/docs/input/f-in-00077/>

### 105 3 Informative Annex A — ChangeLog

#### 106 3.1 2002/11/01 - version G by TC X2S

- 107 Page 1, Figure 1: The communication labeled `inform-ref` was changed to `inform-result` for clarity; the  
 108 purpose of this communication is to inform the initiator of a result and `inform-result`  
 109 implies `inform-done`
- 110 Page 1, Figure 1: The `not-understood` communication was removed
- 111 Page 1, Figure 1: Reworked the protocol flow to make the `agree` optional which also involved changing the  
 112 exclusive-or with the `agree` to a different AUML notation
- 113 Page 1, Figure 1: To conform to UML 2, the protocol name was placed in a boundary, `x` is removed from the  
 114 diamonds (`xor` is now the default) and the template box was removed
- 115 Page 1, line 41: Reworked and expanded the section description of the IP
- 116 Page 1, line 50: Added a new section on Explanation of Protocol Flow
- 117 Page 1, line 50: Reworked and expanded the section on Exceptions of Protocol Flow to incorporate a meta-  
 118 protocol for cancel
- 119 Page 1, line 50: Added a paragraph explaining the `not-understood` communication and its relationship with  
 120 the IP  
 121

#### 122 3.2 2002/12/03 - version H by FIPA Architecture Board

- 123 Entire document: Promoted to Standard status  
 124

# FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

## FIPA Query Interaction Protocol Specification

|                        |   |                            |                       |
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| <b>Document title</b>  | FIPA Query Interaction Protocol Specification |                            |                       |
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| 45 | 3.1 | 2002/11/01 - version G by TC X2S.....                  | 5 |
| 46 | 3.2 | 2002/12/03 - version H by FIPA Architecture Board..... | 5 |

# 1 FIPA Query Interaction Protocol

The FIPA Query Interaction Protocol (IP) allows one agent to request to perform some kind of action on another agent.

The representation of this IP is given in *Figure 1* which is based on extensions to UML1.x [Odell2001]. This protocol is identified by the token `fipa-query` as the value of the `protocol` parameter of the ACL message.

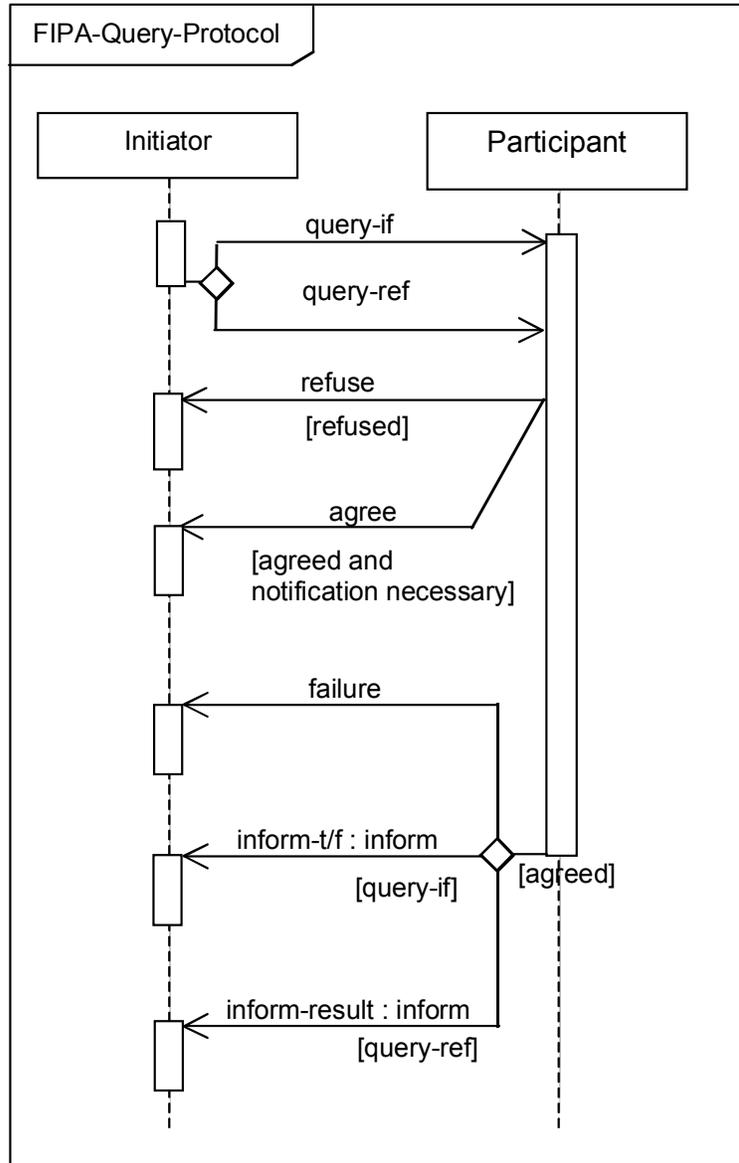


Figure 1: FIPA Query Interaction Protocol

## 1.1 Explanation of the Protocol Flow

The Initiator requests the Participant to perform some kind of `inform` action using one of two query communicative acts, `query-if` or `query-ref` (see [FIPA00037]). The `query-if` communication is used when the Initiator wants to query whether a particular proposition is true or false and the `query-ref` communication is used when the Initiator wants to query for some identified objects. The Participant processes the `query-if` or `query-ref` and makes a decision whether to accept or refuse the query request. If the Participant makes a refuse decision, then “refused” becomes true and the Participant communicates a `refuse`. Otherwise, “agreed” becomes true.

64

65 If conditions indicate that an explicit agreement is required (that is, “notification necessary” is true), then the Participant  
 66 communicates an `agree`. The `agree` may be optional depending on circumstances, for example, if the requested  
 67 action is very quick and can happen before a time specified in the `reply-by` parameter. If the Participant fails, then it  
 68 communicates a `failure`.

69

70 In a successful response, the Participant replies with one of two versions of `inform`:

71

- 72 • The Participant uses an `inform-t/f` communication in response to a `query-if` where the content of the  
 73 `inform-t/f` asserts the truth or falsehood of the proposition, or,

74

- 75 • The Participant returns an `inform-result` communication in response to a `query-ref` and the content of the  
 76 `inform-result` contains a referring expression to the objects for which the query was specified.

77

78 Any interaction using this interaction protocol is identified by a globally unique, non-null `conversation-id` parameter,  
 79 assigned by the Initiator. The agents involved in the interaction must tag all of its ACL messages with this conversation  
 80 identifier. This enables each agent to manage its communication strategies and activities, for example, it allows an  
 81 agent to identify individual conversations and to reason across historical records of conversations.

82

## 83 1.2 Exceptions to Interaction Protocol Flow

84 At *any* point in the IP, the receiver of a communication can inform the sender that it did not understand what was  
 85 communicated. This is accomplished by returning a `not-understood` message. As such, *Figure 1* does not depict a  
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 88 commitments made during the interaction are null and void.

89

90 At any point in the IP, the initiator of the IP may cancel the interaction protocol by initiating the meta-protocol shown in  
 91 *Figure 2*. The `conversation-id` parameter of the cancel interaction is identical to the `conversation-id` parameter  
 92 of the interaction that the Initiator intends to cancel. The semantics of `cancel` should roughly be interpreted as meaning  
 93 that the initiator is no longer interested in continuing the interaction and that it should be terminated in a manner  
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96

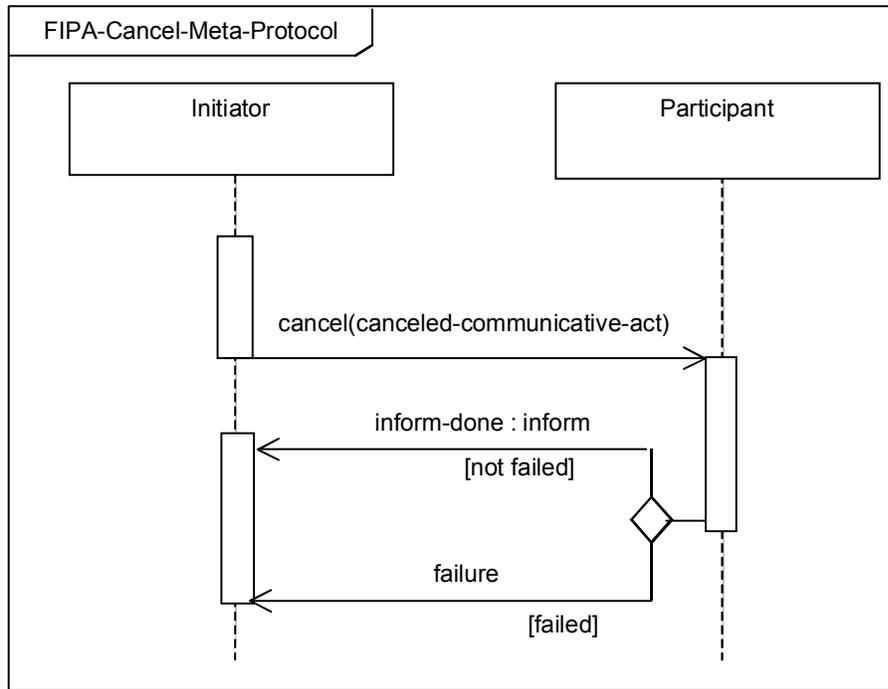


Figure 2: FIPA Cancel Meta-Protocol

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103

This IP is a pattern for a simple interaction type. Elaboration on this pattern will almost certainly be necessary in order to specify all cases that might occur in an actual agent interaction. Real world issues such as the effects of cancelling actions, asynchrony, abnormal or unexpected IP termination, nested IPs, and the like, are explicitly not addressed here.

104 **2 References**

105 [FIPA00037] FIPA Communicative Act Library Specification. Foundation for Intelligent Physical Agents, 2000.  
106 <http://www.fipa.org/specs/fipa00037/>

107 [Odell2001] Odell, James, Van Dyke Parunak, H. and Bauer, B., *Representing Agent Interaction Protocols in UML*.  
108 In: Agent-Oriented Software Engineering, Ciancarini, P. and Wooldridge, M., Eds., Springer, pp. 121-  
109 140, Berlin, 2001.  
110 <http://www.fipa.org/docs/input/f-in-00077/>  
111

## 112 **3 Informative Annex A — ChangeLog**

### 113 **3.1 2002/11/01 - version G by TC X2S**

- 114 Page 1, Figure 1: The `not-understood` communication was removed
- 115 Page 1, Figure 1: Reworked the protocol flow to make the `agree` optional and made explicit the different inform  
116 response content expected for a `query-if` as opposed to a `query-ref`
- 117 Page 1, Figure 1: To conform to UML 2, the protocol name was placed in a boundary, `x` is removed from the  
118 diamonds (`xor` is now the default) and the template box was removed
- 119 Page 1, line 42: Reworked and expanded the section description of the IP
- 120 Page 1, line 54: Added a new section on Explanation of Protocol Flow
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125

### 126 **3.2 2002/12/03 - version H by FIPA Architecture Board**

- 127 Entire document: Promoted to Standard status
- 128

# FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

## FIPA Request When Interaction Protocol Specification

|                        |  |                            |                       |
|------------------------|--|----------------------------|-----------------------|
| <b>Document title</b>  | FIPA Request When Interaction Protocol Specification |                            |                       |
| <b>Document number</b> | SC00028H   | <b>Document source</b>     | FIPA TC Communication |
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| 46 | 3.2 | 2002/12/03 - version H by FIPA Architecture Board ..... | 4 |

### 1 FIPA Request When Interaction Protocol

The FIPA Request When Interaction Protocol (IP) allows an agent to request that the receiver perform some action at the time a given precondition becomes true. This IP provides a framework for the `request-when` communicative act (see [FIPA00037]).

The representation of this IP is given in *Figure 1* which is based on extensions to UML1.x. [Odell2001]. This protocol is identified by the token `fipa-request-when` as the value of the `protocol` parameter of the ACL message.

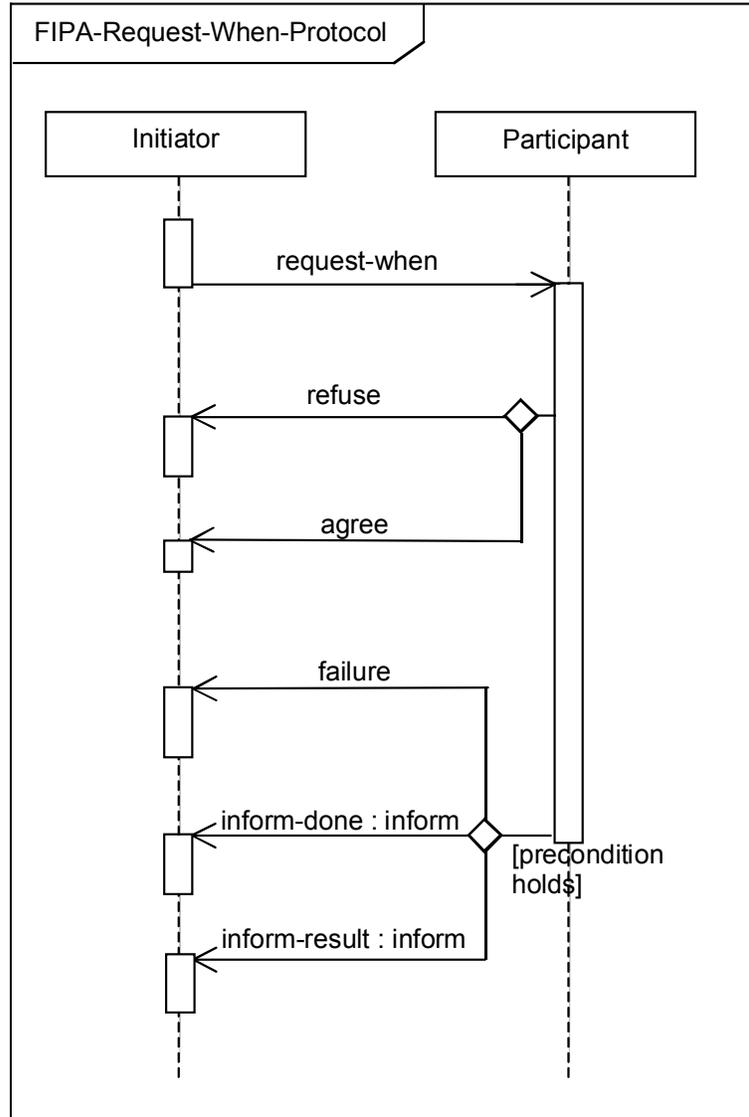


Figure 1: FIPA Request When Interaction Protocol

#### 1.1 Explanation of the Protocol Flow

The initiator uses the `request-when` action to request that the participant do some action once a given precondition becomes true. If the requested agent understands the request and does not initially refuse, it will `agree` (see [FIPA00037]) and wait until the precondition occurs. Then, it will attempt to perform the action and notify the requester accordingly.

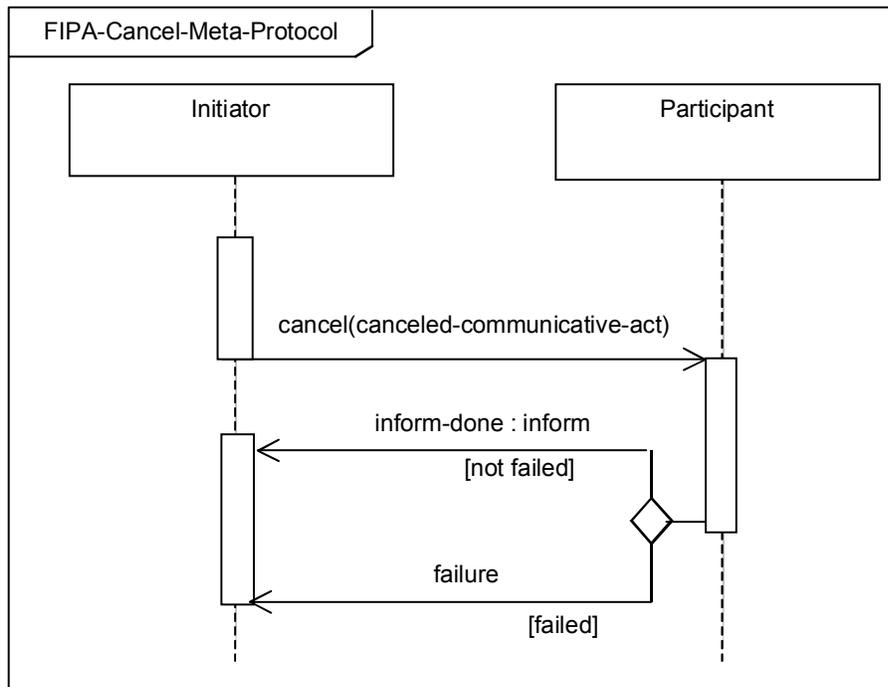
65 If after the initial agreement the participant is no longer able to perform the action, then it will send a failure action  
66 (see [FIPA00037]) to the initiator. Once the action has completed and the failure, inform-done, or inform-  
67 result has been sent, the conversation ends.  
68

69 Any interaction using this interaction protocol is identified by a globally unique, non-null conversation-id parameter,  
70 assigned by the Initiator. The agents involved in the interaction must tag all of its ACL messages with this conversation  
71 identifier. This enables each agent to manage its communication strategies and activities, for example, it allows an  
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77 not-understood communication as it can occur at any point in the IP. The communication of a not-understood  
78 within an interaction protocol may terminate the entire IP and termination of the interaction may imply that any  
79 commitments made during the interaction are null and void.  
80

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84 that the initiator is no longer interested in continuing the interaction and that it should be terminated in a manner  
85 acceptable to both the Initiator and the Participant. The Participant either informs the Initiator that the interaction is done  
86 using an inform-done or indicates the failure of the cancellation using a failure.  
87



88 **Figure 2: FIPA Cancel Meta-Protocol**

89  
90  
91 This IP is a pattern for a simple interaction type. Elaboration on this pattern will almost certainly be necessary in order to  
92 specify all cases that might occur in an actual agent interaction. Real world issues such as the effects of cancelling  
93 actions, asynchrony, abnormal or unexpected IP termination, nested IPs, and the like, are explicitly not addressed here.  
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- 110 diamonds (`xor` is now the default) and the template box was removed
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#### 118 **3.2 2002/12/03 - version H by FIPA Architecture Board**

- 119 Entire document: Promoted to Standard status
- 120

# FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

## FIPA Contract Net Interaction Protocol Specification

|                        |  |                            |                       |
|------------------------|--|----------------------------|-----------------------|
| <b>Document title</b>  | FIPA Contract Net Interaction Protocol Specification |                            |                       |
| <b>Document number</b> | SC00029H   | <b>Document source</b>     | FIPA TC Communication |
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| <b>Contact</b>         | fab@fipa.org   |                            |                       |
| <b>Change history</b>  | See <i>Informative Annex A — ChangeLog</i>           |                            |                       |

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39 **Contents**

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## 47 **1 FIPA Contract Net Interaction Protocol**

48 The FIPA Contract Net Interaction Protocol (IP) is a minor modification of the original contract net IP pattern<sup>1</sup> in that it  
49 adds rejection and confirmation communicative acts. In the contract net IP, one agent (the Initiator) takes the role of  
50 manager which wishes to have some task performed by one or more other agents (the Participants) and further wishes  
51 to optimise a function that characterizes the task. This characteristic is commonly expressed as the price, in some  
52 domain specific way, but could also be soonest time to completion, fair distribution of tasks, etc. For a given task, any  
53 number of the Participants may respond with a proposal; the rest must refuse. Negotiations then continue with the  
54 Participants that proposed.

55  
56 The representation of this IP is given in *Figure 1* which is based on extensions to UML1.x. [Odell2001]. This protocol is  
57 identified by the token `fipa-contract-net` as the value of the `protocol` parameter of the ACL message.  
58

---

<sup>1</sup> Originally developed by Smith and Davis.

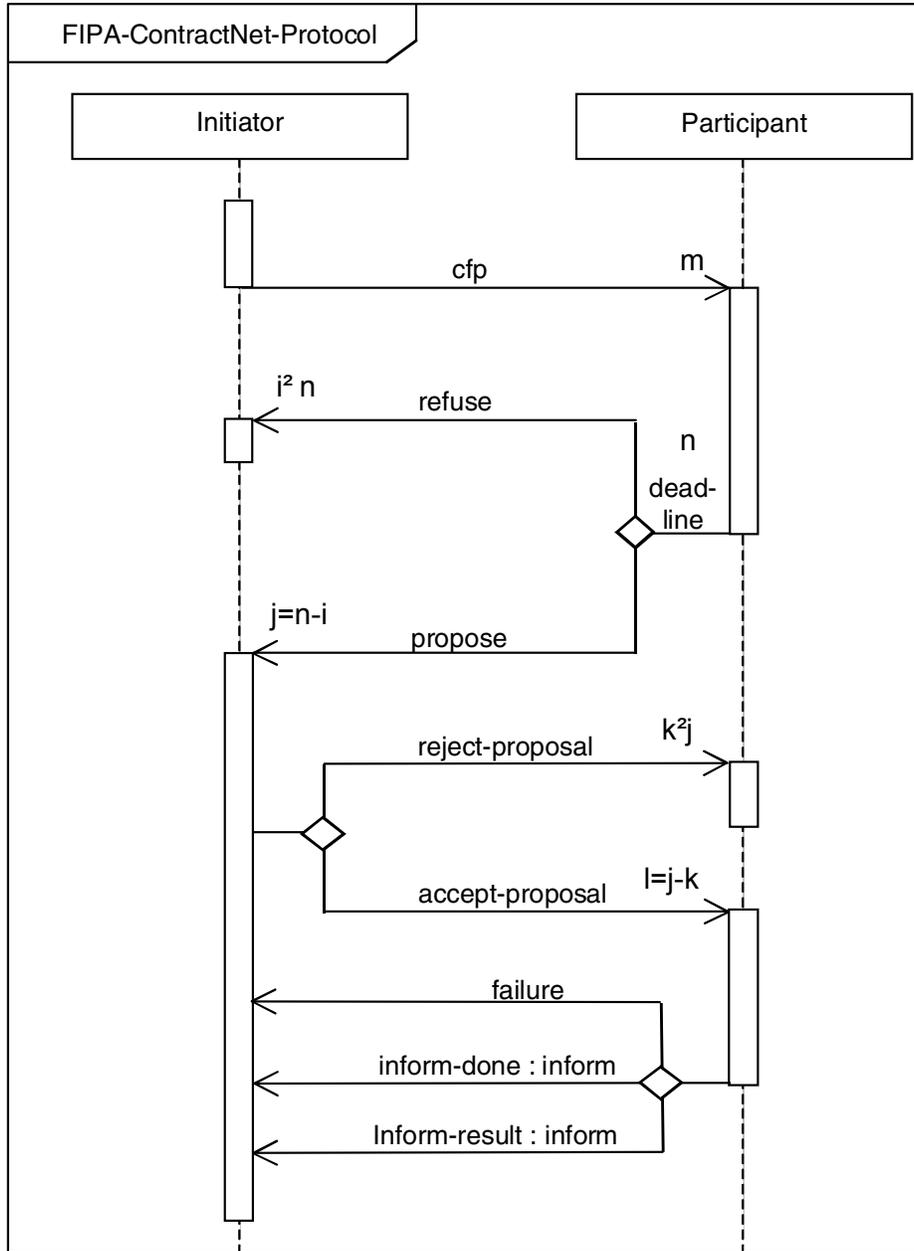


Figure 1: FIPA Contract Net Interaction Protocol

60  
61  
62  
63

64 **1.1 Explanation of the Protocol Flow**

65 The Initiator solicits  $m$  proposals from other agents by issuing a call for proposals (*cfp*) act (see [FIPA00037]), which  
66 specifies the task, as well any conditions the Initiator is placing upon the execution of the task. Participants receiving the  
67 call for proposals are viewed as potential contractors and are able to generate  $n$  responses. Of these,  $j$  are proposals to  
68 perform the task, specified as *propose* acts (see [FIPA00037]).

69  
70 The Participant's proposal includes the preconditions that the Participant is setting out for the task, which may be the  
71 price, time when the task will be done, etc. Alternatively, the  $i = n - j$  Participants may *refuse* (see [FIPA00037]) to  
72 propose. Once the deadline passes, the Initiator evaluates the received  $j$  proposals and selects agents to perform the  
73 task; one, several or no agents may be chosen. The  $l$  agents of the selected proposal(s) will be sent an *accept-*

74 proposal act (see [FIPA00037]) and the remaining  $k$  agents will receive a `reject-proposal` act (see [FIPA00037]).  
75 The proposals are binding on the Participant, so that once the Initiator accepts the proposal, the Participant acquires a  
76 commitment to perform the task. Once the Participant has completed the task, it sends a completion message to the  
77 Initiator in the form of an `inform-done` or a more explanatory version in the form of an `inform-result`. However, if  
78 the Participant fails to complete the task, a `failure` message is sent.

79

80 Note that this IP requires the Initiator to know when it has received all replies. In the case that a Participant fails to reply  
81 with either a `propose` or a `refuse` act, the Initiator may potentially be left waiting indefinitely. To guard against this,  
82 the `cfp` act includes a deadline by which replies should be received by the Initiator. Proposals received after the  
83 deadline are automatically rejected with the given reason that the proposal was late. The deadline is specified by the  
84 `reply-by` parameter in the ACL message.

85

86 Any interaction using this interaction protocol is identified by a globally unique, non-null `conversation-id` parameter,  
87 assigned by the Initiator. The agents involved in the interaction must tag all of its ACL messages with this conversation  
88 identifier. This enables each agent to manage its communication strategies and activities, for example, it allows an  
89 agent to identify individual conversations and to reason across historical records of conversations.

90

91 In the case of 1:N interaction protocols or sub-protocols the Initiator is free to decide if the same `conversation-id`  
92 parameter should be used or a new one should be issued. Additionally, the messages may specify other interaction-  
93 related information such as a timeout in the `reply-by` parameter that denotes the latest time by which the sending  
94 agent would like to have received the next message in the protocol flow.

95

## 96 1.2 Exceptions to Interaction Protocol Flow

97 At *any* point in the IP, the receiver of a communication can inform the sender that it did not understand what was  
98 communicated. This is accomplished by returning a `not-understood` message. As such, *Figure 1* does not depict a  
99 `not-understood` communication as it can occur at any point in the IP. The communication of a `not-understood`  
100 within an interaction protocol may terminate the entire IP and termination of the interaction may imply that any  
101 commitments made during the interaction are null and void. However, since this IP broadcasts to more than one  
102 Participant, multiple responses are also possible. Each response, then, must be evaluated separately – and some of  
103 these responses might be `not-understood`. However, terminating the entire IP in this case might not be appropriate,  
104 as other Participants may be continuing with their sub-protocols.

105

106 At any point in the IP, the initiator of the IP may cancel the interaction protocol by initiating the meta-protocol shown in  
107 *Figure 2*. The `conversation-id` parameter of the cancel interaction is identical to the `conversation-id` parameter  
108 of the interaction that the Initiator intends to cancel. The semantics of `cancel` should roughly be interpreted as meaning  
109 that the initiator is no longer interested in continuing the interaction and that it should be terminated in a manner  
110 acceptable to both the Initiator and the Participant. The Participant either informs the Initiator that the interaction is done  
111 using an `inform-done` or indicates the failure of the cancellation using a `failure`.

112

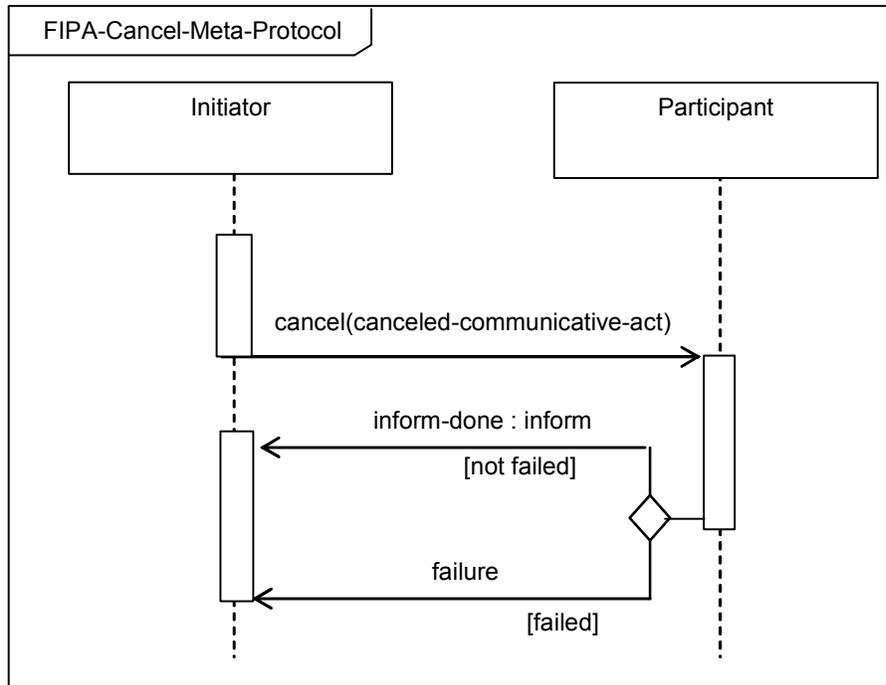


Figure 2: FIPA Cancel Meta-Protocol

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119

This IP is a pattern for a simple interaction type. Elaboration on this pattern will almost certainly be necessary in order to specify all cases that might occur in an actual agent interaction. Real world issues such as the effects of cancelling actions, asynchrony, abnormal or unexpected IP termination, nested IPs, and the like, are explicitly not addressed here.

120

## 2 References

121

[FIPA00037] FIPA Communicative Act Library Specification. Foundation for Intelligent Physical Agents, 2000.

122

<http://www.fipa.org/specs/fipa00037/>

123

[Odell2001] Odell, James, Van Dyke Parunak, H. and Bauer, B., *Representing Agent Interaction Protocols in UML*.

124

In: *Agent-Oriented Software Engineering*, Ciancarini, P. and Wooldridge, M., Eds., Springer, pp. 121-

125

140, Berlin, 2001.

126

<http://www.fipa.org/docs/input/f-in-00077/>

127

### 128 3 Informative Annex A — ChangeLog

#### 129 3.1 2002/11/01 - version G by TC X2S

- 130 Page 1, line 42: Reworked and expanded the section description of the IP
- 131 Page 2, Figure 1: The communication labeled `inform-ref` was changed to `inform-result` for clarity; the
- 132 purpose of this communication is to inform the initiator of a result and `inform-result`
- 133 implies `inform-done`
- 134 Page 2, Figure 1: The `not-understood` communication was removed
- 135 Page 2, Figure 1: To conform to UML 2, the protocol name was placed in a boundary, `x` is removed from the
- 136 diamonds (`xor` is now the default) and the template box was removed
- 137 Page 2, line 72: Added a new section on Explanation of Protocol Flow
- 138 Page 2, line 72: Reworked and expanded the section on Exceptions of Protocol Flow to incorporate a meta-
- 139 protocol for cancel
- 140 Page 2, line 72: Added a paragraph explaining the `not-understood` communication and its relationship with
- 141 the IP

#### 142 3.2 2002/12/03 - version H by FIPA Architecture Board

- 143 Entire document: Promoted to Standard status
- 144

# FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

## FIPA Iterated Contract Net Interaction Protocol Specification

|                        |   |                            |                       |
|------------------------|---|----------------------------|-----------------------|
| <b>Document title</b>  | FIPA Iterated Contract Net Interaction Protocol Specification |                            |                       |
| <b>Document number</b> | SC00030H  | <b>Document source</b>     | FIPA TC Communication |
| <b>Document status</b> | Standard  | <b>Date of this status</b> | 2002/12/03            |
| <b>Supersedes</b>      | None  |                            |                       |
| <b>Contact</b>         | fab@fipa.org  |                            |                       |
| <b>Change history</b>  | See <i>Informative Annex A — ChangeLog</i>                    |                            |                       |

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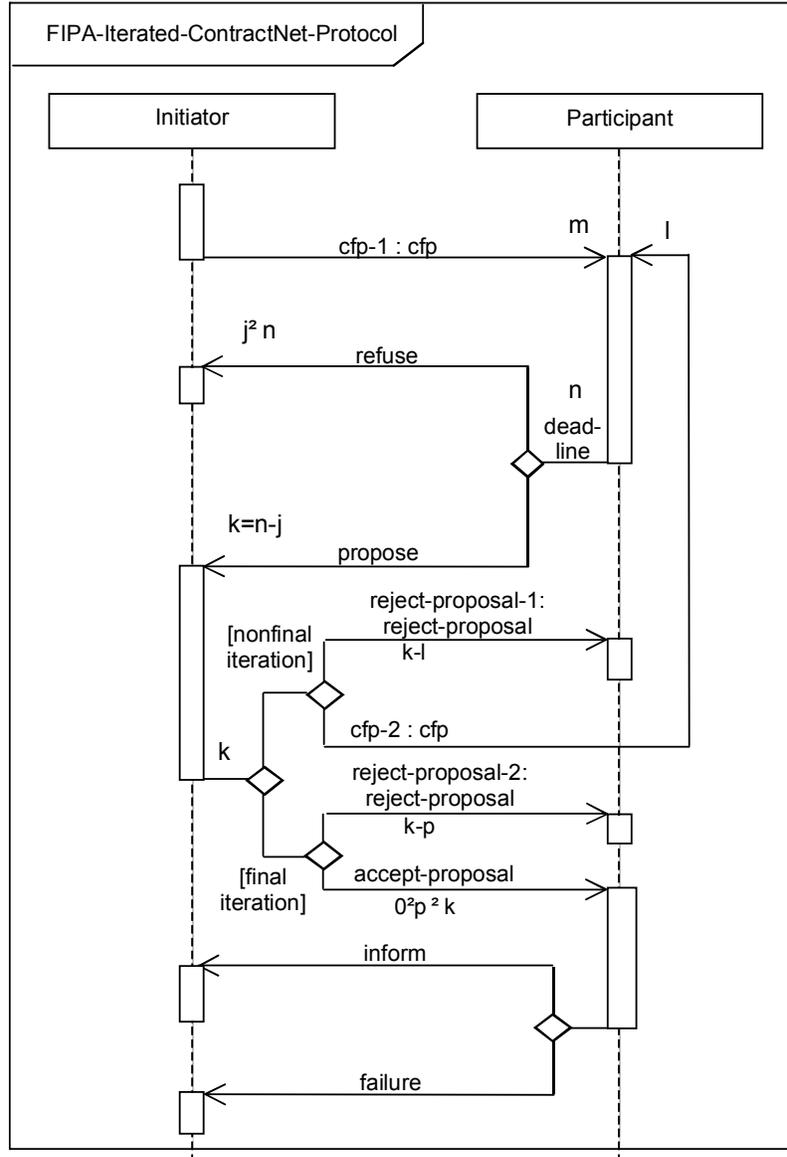
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| 44 | 3   | Informative Annex A — ChangeLog .....                   | 5 |
| 45 | 3.1 | 2002/11/01 - version G by TC X2S .....                  | 5 |
| 46 | 3.2 | 2002/12/03 - version H by FIPA Architecture Board ..... | 5 |

47 **1 FIPA Iterated Contract Net Interaction Protocol**

48 The FIPA Iterated Contract Net Interaction Protocol (IP) is an extension of the basic FIPA Contract Net IP (see  
 49 [FIPA00029]), but it differs by allowing multi-round iterative bidding.

50  
 51 The representation of this IP is given in *Figure 1* which is based on extensions to UML1.x. [Odell2001]. This protocol is  
 52 identified by the token `fipa-iterated-contract-net` as the value of the `protocol` parameter of the ACL  
 53 message.  
 54



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**Figure 1:** FIPA Iterated Contract Net Interaction Protocol

59 **1.1 Explanation of the Protocol Flow**

60 As with the FIPA Contract Net IP, the Initiator issues  $m$  initial call for proposals with the `cfp` act (see [FIPA00037]). Of  
 61 the  $n$  Participants that respond,  $k$  are `propose` messages (see [FIPA00037]) from Participants that are willing and able  
 62 to do the task under the proposed conditions and the remaining  $j$  are from Participants that `refuse`.  
 63

64 Of the  $k$  proposals, the Initiator may decide this is the final iteration and accept  $p$  of the bids ( $0 \leq p \leq k$ ), and reject the  
 65 others. Alternatively the Initiator may decide to iterate the process by issuing a revised `cfp` to  $l$  of the Participants and  
 66 rejecting the remaining  $k-l$  Participants. The intent is that the Initiator seeks to get better bids from the Participants by  
 67 modifying the call and requesting new (equivalently, revised) bids. The process terminates when the Initiator refuses all  
 68 proposals and does not issue a new `cfp`, the Initiator accepts one or more of the bids or the Participants all refuse to  
 69 bid.

70

71 Any interaction using this interaction protocol is identified by a globally unique, non-null `conversation-id` parameter,  
 72 assigned by the Initiator. The agents involved in the interaction must tag all of its ACL messages with this conversation  
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80

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 89 as other Participants may be continuing with their sub-protocols.

90

91 At any point in the IP, the initiator of the IP may cancel the interaction protocol by initiating the meta-protocol shown in  
 92 *Figure 2*. The `conversation-id` parameter of the cancel interaction is identical to the `conversation-id` parameter  
 93 of the interaction that the Initiator intends to cancel. The semantics of cancel should roughly be interpreted as meaning  
 94 that the initiator is no longer interested in continuing the interaction and that it should be terminated in a manner  
 95 acceptable to both the Initiator and the Participant. The Participant either informs the Initiator that the interaction is done  
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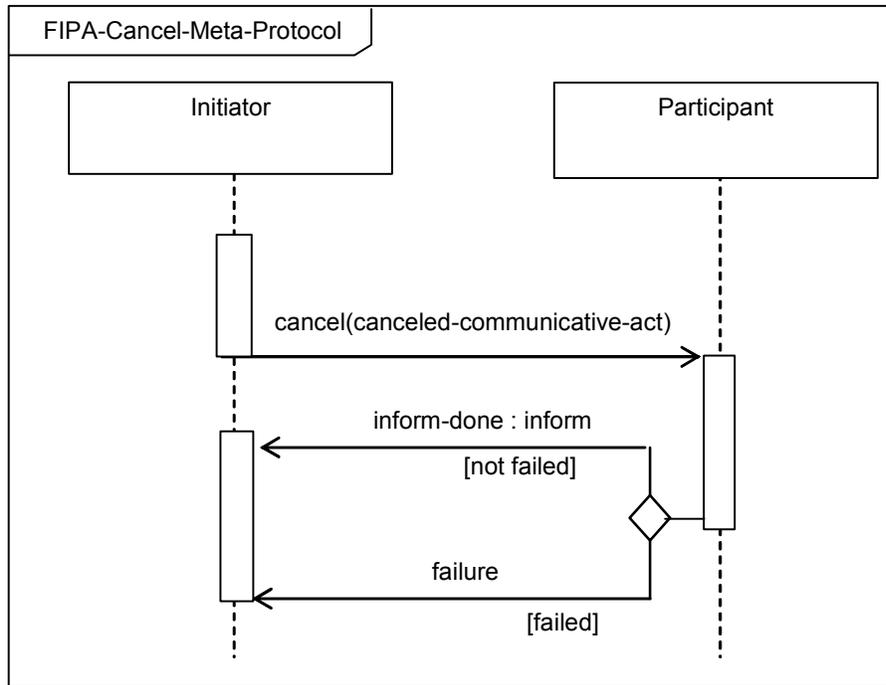


Figure 2: FIPA Cancel Meta-Protocol

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104

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106 [FIPA00029] FIPA Contract Net Interaction Protocol Specification. Foundation for Intelligent Physical Agents, 2000.  
107 <http://www.fipa.org/specs/fipa00029/>

108 [FIPA00037] FIPA Communicative Act Library Specification. Foundation for Intelligent Physical Agents, 2000.  
109 <http://www.fipa.org/specs/fipa00037/>

110 [Odell2001] Odell, James, Van Dyke Parunak, H. and Bauer, B., *Representing Agent Interaction Protocols in UML*.  
111 In: Agent-Oriented Software Engineering, Ciancarini, P. and Wooldridge, M., Eds., Springer, pp. 121-  
112 140, Berlin, 2001.  
113 <http://www.fipa.org/docs/input/f-in-00077/>  
114

### 115 **3 Informative Annex A — ChangeLog**

#### 116 **3.1 2002/11/01 - version G by TC X2S**

- 117 Page 1, Figure 1: The `not-understood` communication was removed
- 118 Page 1, Figure 1: To conform to UML 2, the protocol name was placed in a boundary, x is removed from the
- 119 diamonds (xor is now the default) and the template box was removed
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- 124 Page 1, line 57: Added a paragraph explaining the `not-understood` communication and its relationship with
- 125 the IP
- 126

#### 127 **3.2 2002/12/03 - version H by FIPA Architecture Board**

- 128 Entire document: Promoted to Standard status
- 129

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## FIPA Brokering Interaction Protocol Specification

|                        |   |                            |                       |
|------------------------|---|----------------------------|-----------------------|
| <b>Document title</b>  | FIPA Brokering Interaction Protocol Specification |                            |                       |
| <b>Document number</b> | SC00033H  | <b>Document source</b>     | FIPA TC Communication |
| <b>Document status</b> | Standard  | <b>Date of this status</b> | 2002/12/03            |
| <b>Supersedes</b>      | None  |                            |                       |
| <b>Contact</b>         | fab@fipa.org                                      |                            |                       |
| <b>Change history</b>  | See <i>Informative Annex A — ChangeLog</i>        |                            |                       |

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| 45 | 3.1 | 2002/11/01 - version G by TC X2S .....                  | 5 |
| 46 | 3.2 | 2002/12/03 - version H by FIPA Architecture Board ..... | 5 |

# 1 FIPA Brokering Interaction Protocol

The FIPA Brokering Interaction Protocol (IP) is designed to support brokerage interactions in mediated systems and in multi-agent systems, for example, [Finin97].

Generally speaking, a broker is an agent that offers a set of communication facilitation services to other agents using some knowledge about the requirements and capabilities of those agents. A typical example of brokering is one in which an agent can request a broker to find one or more agents who can answer a query. The broker then determines a set of appropriate agents to which to forward the query, sends the query to those agents and relays their answers back to the original requestor. The use of brokerage agents can significantly simplify the task of interaction with agents in a multi-agent system. Additionally, brokering agents also enable a system to be adaptable and robust in dynamic situations, supporting scalability and security control at the brokering agent.

The representation of this IP is given in Figure 1 which is based on an extension of UML 1.x. [Odell2001]. This protocol is identified by the token `fipa-brokering` as the value of the `protocol` parameter of the ACL message.

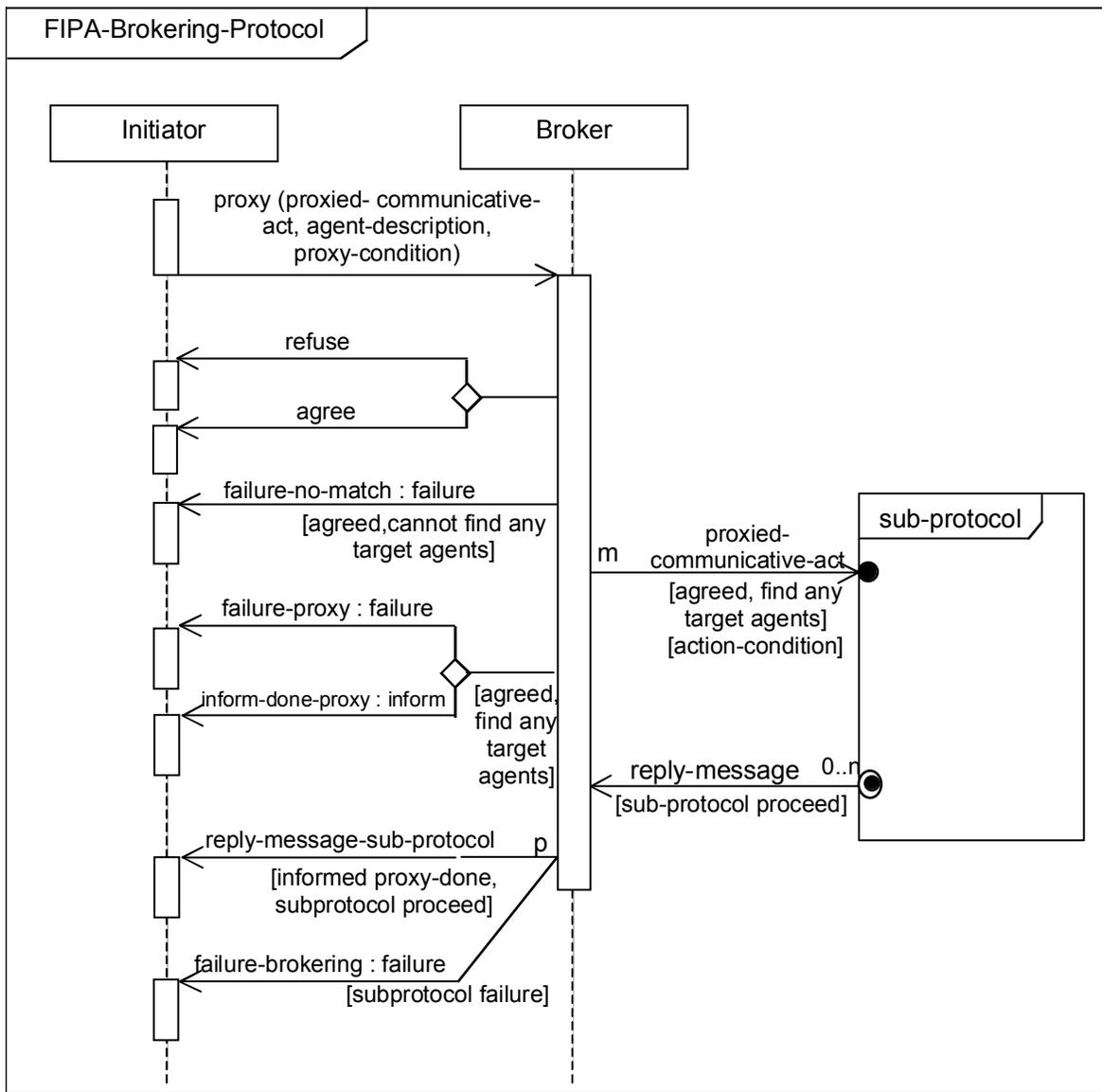


Figure 1: FIPA Brokering Interaction Protocol

62  
63  
64  
65

## 66 1.1 Explanation of the Interaction Protocol Flow

67 The FIPA Brokering Interaction Protocol (IP) is a macro IP since the `proxy` communicative act (see [FIPA00037]) for  
 68 brokerage embeds a communicative act as its argument and so the IP for the embedded communicative act is also  
 69 embedded in this IP. This embedded IP guides some parts of the remainder of the interaction, thus parts of this protocol  
 70 are written very generically.

71  
 72 The Initiator of the brokering interaction begins the interaction with a `proxy` message which contains the following: a  
 73 referential expression denoting the target agents to which the broker should forward the communicative act, the  
 74 communicative act to forward and a set of proxy conditions such as the maximum number of agents to which the  
 75 message should be forwarded. The Broker processes the request and makes a decision whether to agree to or refuse  
 76 the request and communicates either an `agree` or a `refuse` communicative act accordingly. Communication of a  
 77 `refuse` terminates the interaction.

78  
 79 Once the Broker has agreed to be a proxy, it then locates agents per the description from the `proxy` message. If no  
 80 such agents can be found, the Broker returns a `failure-no-match` and the interaction terminates. Otherwise, the  
 81 Broker may modify the list of matching agents based on the `proxy-condition` parameter. It then begins  $m$   
 82 interactions with the resulting list of  $n$  agents with each interaction in its own separate sub-protocol. At this point, the  
 83 Broker should record some of the ACL parameters (see [FIPA00061]), for example, `conversation-id`, `reply-`  
 84 `with` and `sender`, of the received `proxy` message to return in the  $r$  replies to the Initiator.

85  
 86 Note that the nature of the sub-protocol and the nature of the replies are driven by the interaction protocols specified in  
 87 the communicative act from the `proxy` message. As the sub-protocol progresses, the Broker forwards the responses  
 88 that it receives from the sub-protocol to the Initiator. These messages are defined as the `reply-message-sub-`  
 89 `protocol` communications, and may be either successful replies as defined by the sub-protocol or `failure`. If the  
 90 initial proxy was an `inform`, there may in fact be no replies from the sub-protocol (and in fact means that the  
 91 interaction is identical to a recruited `inform`). When the sub-protocol completes, the Broker forwards the final `reply-`  
 92 `message` from the sub-protocol and the brokering IP terminates. However, there can be other failures that are not  
 93 explicitly returned from the sub-protocol, for example, the agent that is executing the sub-protocol has failed. If the  
 94 Broker detects such problems, it returns a `failure-brokering`, which terminates the IP.

95  
 96 A second issue to address occurs because multiple agents may match and therefore multiple sub-protocols ( $m$  of them)  
 97 may be initiated by the Broker within the brokering IP. In this case, the Broker may collect the  $n$  received responses and  
 98 combine them into a single `reply-message-sub-protocol`, or may forward the `reply-message-sub-protocol`  
 99 messages from the separate sub-protocols individually ( $1 \leq p \leq n$ ). This is complicated by situations such as one agent  
 100 responding with a `failure` while a second agent returns a `reply-message`, or the situation where results are  
 101 inconsistent. The Broker must determine whether to resolve such situations internally or forward the responses to the  
 102 Initiator. In doing this, the Broker must also be careful to avoid disruptive acts such as directly forwarding a `failure`  
 103 from a sub-protocol, which would have the inadvertent effect of ending the brokering IP.

104  
 105 Any interaction using this interaction protocol is identified by a globally unique, non-null `conversation-id` parameter,  
 106 assigned by the Initiator. The agents involved in the interaction must tag all of its ACL messages with this conversation  
 107 identifier. This enables each agent to manage its communication strategies and activities, for example, it allows an  
 108 agent to identify individual conversations and to reason across historical records of conversations.

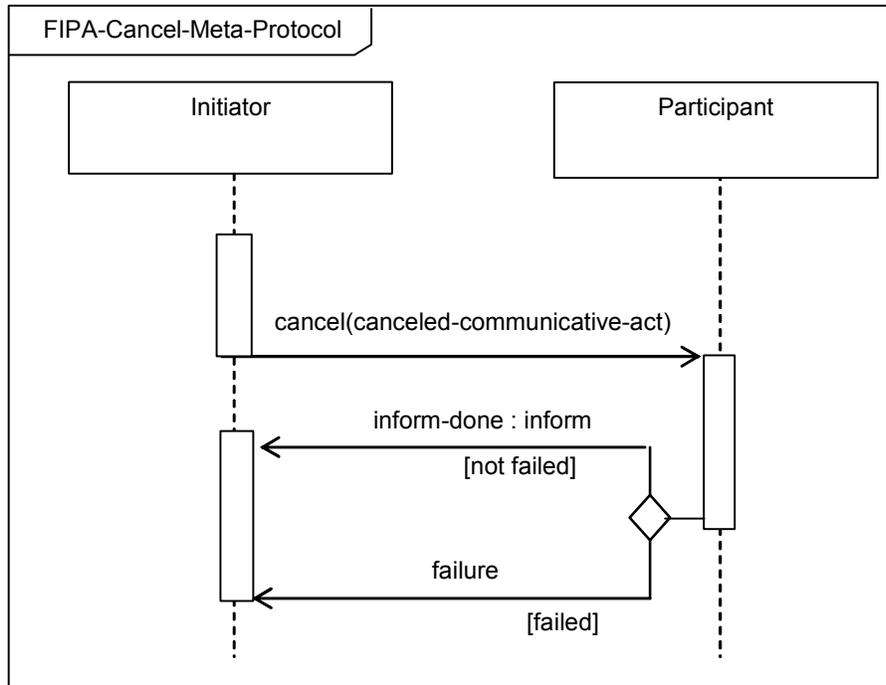
109  
 110 In the case of 1:N interaction protocols or sub-protocols the Initiator is free to decide if the same `conversation-id`  
 111 parameter should be used or a new one should be issued. Additionally, the messages may specify other interaction-  
 112 related information such as a timeout in the `reply-by` parameter that denotes the latest time by which the sending  
 113 agent would like to have received the next message in the protocol flow.

## 114 115 1.2 Exceptions to Interaction Protocol Flow

116 At *any* point in the IP, the receiver of a communication can inform the sender that it did not understand what was  
 117 communicated. This is accomplished by returning a `not-understood` message. As such, *Figure 1* does not depict a  
 118 `not-understood` communication as it can occur at any point in the IP. The communication of a `not-understood`  
 119 within an interaction protocol may terminate the entire IP and termination of the interaction may imply that any

120 commitments made during the interaction are null and void. However, since this IP broadcasts to more than one  
 121 Participant, multiple responses are also possible. Each response, then, must be evaluated separately – and some of  
 122 these responses might be *not-understood*. However, terminating the entire IP in this case might not be appropriate,  
 123 as other Participants may be continuing with their sub-protocols.  
 124

125 At any point in the IP, the initiator of the IP may cancel the interaction protocol by initiating the meta-protocol shown in  
 126 *Figure 2*. The *conversation-id* parameter of the cancel interaction is identical to the *conversation-id* parameter  
 127 of the interaction that the Initiator intends to cancel. The semantics of cancel should roughly be interpreted as meaning  
 128 that the initiator is no longer interested in continuing the interaction and that it should be terminated in a manner  
 129 acceptable to both the Initiator and the Participant. The Participant either informs the Initiator that the interaction is done  
 130 using an *inform-done* or indicates the failure of the cancellation using a *failure*.  
 131



**Figure 2:** FIPA Cancel Meta-Protocol

132 This IP is a pattern for a simple interaction type. Elaboration on this pattern will almost certainly be necessary in order to  
 133 specify all cases that might occur in an actual agent interaction. Real world issues such as the effects of cancelling  
 134 actions, asynchrony, abnormal or unexpected IP termination, nested IPs, and the like, are explicitly not addressed here.  
 135  
 136  
 137  
 138

139 **2 References**

- 140 [Finin97] Finin, T. Labrou, Y. and Mayfield, J., *KQML as an Agent Communication Language*. In: Software  
141 Agents, Bradshaw, J., Ed., MIT Press, 1997.
- 142 [FIPA00037] FIPA Communicative Act Library Specification. Foundation for Intelligent Physical Agents, 2000.  
143 <http://www.fipa.org/specs/fipa00037/>
- 144 [FIPA00061] FIPA ACL Message Structure Specification. Foundation for Intelligent Physical Agents, 2000.  
145 <http://www.fipa.org/specs/fipa00061/>
- 146 [Odell2001] Odell, James, Van Dyke Parunak, H. and Bauer, B., *Representing Agent Interaction Protocols in UML*.  
147 In: Agent-Oriented Software Engineering, Ciancarini, P. and Wooldridge, M., Eds., Springer, pp. 121-  
148 140, Berlin, 2001.  
149 <http://www.fipa.org/docs/input/f-in-00077/>  
150

### 151 3 Informative Annex A — ChangeLog

#### 152 3.1 2002/11/01 - version G by TC X2S

|     |                   |  |
|-----|-------------------|--|
| 153 | Page 1, line 42:  | Reworked and expanded the section description of the IP  |
| 154 | Page 2, Figure 1: | The <code>not-understood</code> communication was removed  |
| 155 | Page 2, Figure 1: | Used a more generic set of communicative acts which the Broker is going to forward the responses it received from the sub-protocol and if the Broker notices some failure, such as no response at all from the sub-protocol after a given time period, then the Broker may send the Initiator a failure of its own |
| 156 |                   |  |
| 157 |                   |  |
| 158 |                   |  |
| 159 | Page 2, Figure 1: | Multiple sub-protocols indicated by inserting $m$ , $n$ and $p$ respectively on three arcs; $m$ sub-protocols can be started, resulting in $n$ responses that the Broker can consolidate into $p$ responses to the Initiator   |
| 160 |                   |  |
| 161 |                   |  |
| 162 | Page 2, Figure 1: | To conform to UML 2, the protocol name was placed in a boundary, $x$ is removed from the diamonds ( <code>xor</code> is now the default) and the template box was removed  |
| 163 |                   |  |
| 164 | Page 2, line 70:  | Added a new section on Explanation of Protocol Flow  |
| 165 | Page 2, line 70:  | Reworked and expanded the section on Exceptions of Protocol Flow to incorporate a meta-protocol for cancel   |
| 166 |                   |  |
| 167 | Page 2, line 70:  | Added a paragraph explaining the <code>not-understood</code> communication and its relationship with the IP  |
| 168 |                   |  |
| 169 |                   |  |

#### 170 3.2 2002/12/03 - version H by FIPA Architecture Board

|     |                  |                             |
|-----|------------------|-----------------------------|
| 171 | Entire document: | Promoted to Standard status |
| 172 |                  |                             |

# FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

## FIPA Recruiting Interaction Protocol Specification

|                        |  |                            |                       |
|------------------------|--|----------------------------|-----------------------|
| <b>Document title</b>  | FIPA Recruiting Interaction Protocol Specification |                            |                       |
| <b>Document number</b> | SC00034H   | <b>Document source</b>     | FIPA TC Communication |
| <b>Document status</b> | Standard   | <b>Date of this status</b> | 2002/12/03            |
| <b>Supersedes</b>      | None   |                            |                       |
| <b>Contact</b>         | fab@fipa.org                                       |                            |                       |
| <b>Change history</b>  | See <i>Informative Annex A — ChangeLog</i>         |                            |                       |

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

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38 FIPA specifications and upcoming meetings may be found on the FIPA Web site at <http://www.fipa.org/>.

39 **Contents**

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| 42 | 1.2 | Exceptions to Interaction Protocol Flow .....           | 3 |
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| 45 | 3.1 | 2002/11/01 - version G by TC X2S .....                  | 6 |
| 46 | 3.2 | 2002/12/03 - version H by FIPA Architecture Board ..... | 6 |

## 47 **1 FIPA Recruiting Interaction Protocol**

48 The FIPA Recruiting Interaction Protocol (IP) is designed to support recruiting interactions in mediated systems and in  
49 multi-agent systems, for example, [Finin97].

50

51 A recruiter agent is a form of broker, which, generally speaking, is an agent that offers a set of communication  
52 facilitation services to other agents using some knowledge about the requirements and capabilities of those agents. A  
53 typical example of brokering is one in which an agent can request a broker to find one or more agents who can answer  
54 a query. The broker then determines a set of appropriate agents to which to forward the query and sends the query to  
55 those agents.

56

57 In the case of recruiting (as opposed to brokering), the answers from the selected target agents either go directly back  
58 to the original requestor or to some designated receivers. The use of recruiter agents can significantly simplify the task  
59 of interaction with agents in a multi-agent system. Recruiter agents also enable a system to be adaptable and robust in  
60 dynamic situations, supporting scalability and security control at the recruiting agent.

61

62 The representation of this IP is given in *Figure 1* which is based on an extension of UML 1.x. [Odell2001]. This protocol  
63 is identified by the token `fipa-recruiting` as the value of the `protocol` parameter of the ACL message.

64

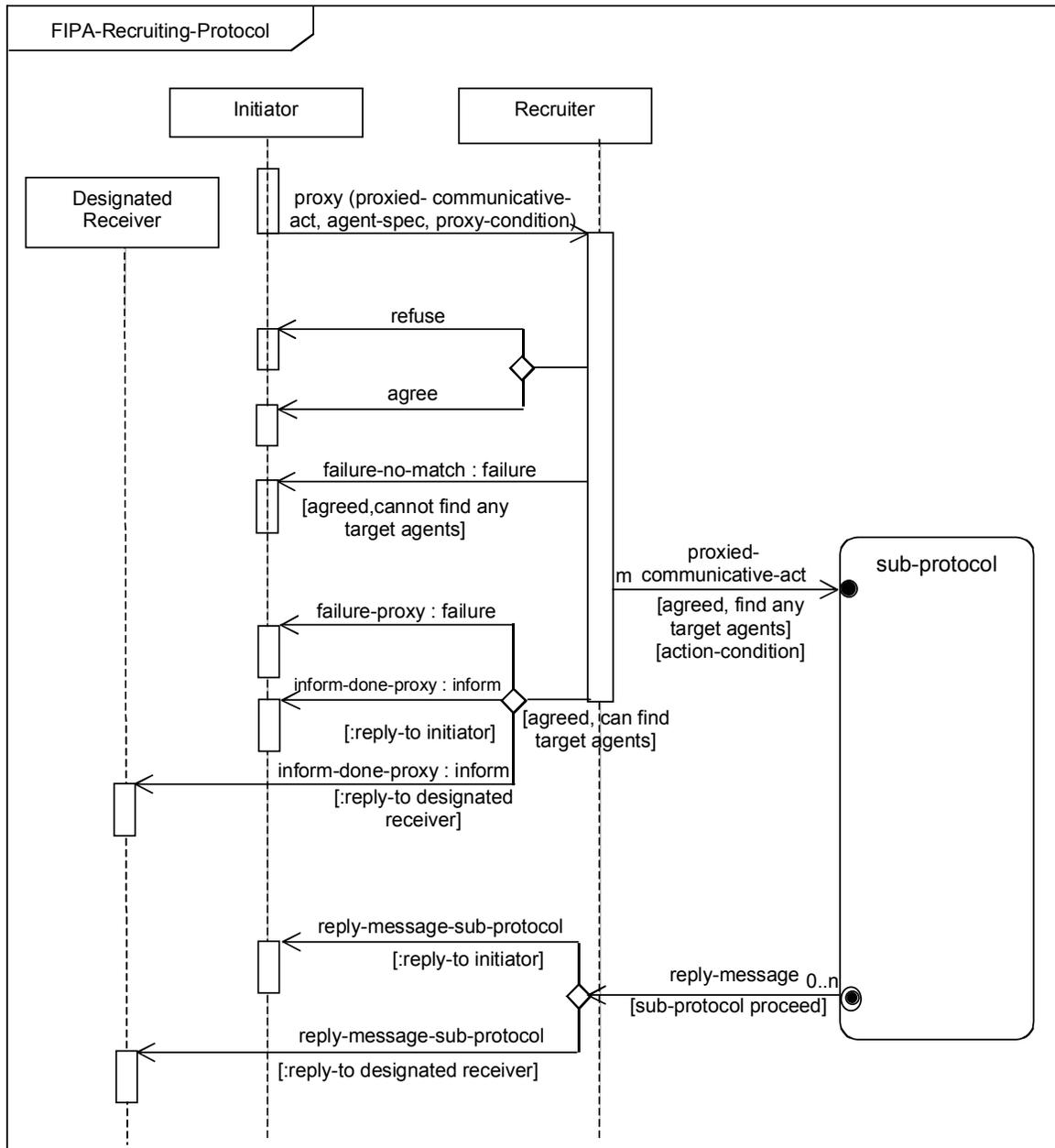


Figure 1: FIPA Recruiting Interaction Protocol

65  
66  
67  
68

69 **1.1 Explanation of the Interaction Protocol Flow**

70 The FIPA Recruiting Interaction Protocol (IP) is a macro IP since the `proxy` communicative act (see [FIPA00037]) for  
 71 recruiting embeds a communicative act as its argument and so the IP for the embedded communicative act is also  
 72 embedded in this IP. This embedded IP guides some parts of the remainder of the interaction, thus parts of this protocol  
 73 are written very generically.

74  
 75 The Initiator of the recruiting interaction begins the interaction with a `proxy` message which contains the following: a  
 76 referential expression denoting the target agents to which the recruiter should forward the communicative act, the  
 77 communicative act to forward and a set of proxy conditions such as the maximum number of agents to be forwarded.  
 78 The Recruiter processes the request and makes a decision whether to agree to or refuse the request, and  
 79 communicates either an `agree` or a `refuse` communicative act accordingly. Communication of a `refuse` terminates  
 80 the interaction.

81

82 Once the Recruiter has agreed to be a proxy, it then locates agents per the description from the `proxy` message. If no  
 83 such agents can be found, the Recruiter returns a `failure-no-match` and the interaction terminates. Otherwise, the  
 84 Recruiter may modify the list of matching agents based on the `proxy-condition` parameter. It then begins  $m$   
 85 interactions with the resulting list of  $n$  agents with each interaction in its own separate sub-protocol. The initiation of the  
 86 sub-protocol should be done with care, using the ACL parameters (see [FIPA00061]) to correlate the responses to the  
 87 request. If the Recruiter has been given a message containing a separate `designated-receiver` parameter from  
 88 the interaction Initiator, it needs to start each sub-protocol with a `reply-to` parameter containing the Designated  
 89 Receiver and the `conversation-id` of the original conversation. If the Recruiter instead is to indicate that the Initiator  
 90 should receive the replies, then the `reply-to` parameter should designate the Initiator and the `conversation-id` of  
 91 the recruiting conversation. Other ACL parameters may also need to be propagated.

92

93 Note that the nature of the sub-protocol and the nature of the replies are driven by the interaction protocols specified in  
 94 the communicative act from the proxy message. As the sub-protocol progresses, it forwards its responses back either  
 95 to the Designated Receiver or to the Initiator, depending on the value of the `reply-to` parameter in the `proxy`  
 96 message. These messages are defined as `reply-message-sub-protocol` communications and may be either  
 97 successful replies as defined by the sub-protocol or `failure`. If the initial proxy was an `inform`, there may in fact be  
 98 no replies from the sub-protocol (and in fact means that the interaction is identical to a brokered `inform`). When the  
 99 sub-protocol completes, the Recruiter forwards the final `reply-message-sub-protocol` from the sub-protocol and  
 100 the recruiting IP terminates.

101

102 A second issue to address occurs because multiple agents may match and therefore multiple sub-protocols may be  
 103 initiated by the Recruiter within the recruiting IP. In this case, the sub-protocols may be communicating multiple `reply-`  
 104 `message-sub-protocol` communications from the different agents involved in the IP (for a total of  $m$  responses).  
 105 This is complicated by such situations as one sub-protocol responding with a `failure` while a second sub-protocol  
 106 returns a `reply-message-sub-protocol`, or the situation where results are inconsistent. The agent that receives  
 107 the messages must determine how to detect and resolve such situations internally.

108

109 Any interaction using this interaction protocol is identified by a globally unique, non-null `conversation-id` parameter,  
 110 assigned by the Initiator. The agents involved in the interaction must tag all of its ACL messages with this conversation  
 111 identifier. This enables each agent to manage its communication strategies and activities, for example, it allows an  
 112 agent to identify individual conversations and to reason across historical records of conversations.

113

114 In the case of 1:N interaction protocols or sub-protocols the Initiator is free to decide if the same `conversation-id`  
 115 parameter should be used or a new one should be issued. Additionally, the messages may specify other interaction-  
 116 related information such as a timeout in the `reply-by` parameter that denotes the latest time by which the sending  
 117 agent would like to have received the next message in the protocol flow.

118

## 119 1.2 Exceptions to Interaction Protocol Flow

120 At *any* point in the IP, the receiver of a communication can inform the sender that it did not understand what was  
 121 communicated. This is accomplished by returning a `not-understood` message. As such, *Figure 1* does not depict a  
 122 `not-understood` communication as it can occur at any point in the IP. The communication of a `not-understood`  
 123 within an interaction protocol may terminate the entire IP and termination of the interaction may imply that any  
 124 commitments made during the interaction are null and void. However, since this IP broadcasts to more than one  
 125 Participant, multiple responses are also possible. Each response, then, must be evaluated separately – and some of  
 126 these responses might be `not-understood`. However, terminating the entire IP in this case might not be appropriate,  
 127 as other Participants may be continuing with their sub-protocols.

128

129 At any point in the IP, the initiator of the IP may cancel the interaction protocol by initiating the meta-protocol shown in  
 130 *Figure 2*. The `conversation-id` parameter of the cancel interaction is identical to the `conversation-id` parameter  
 131 of the interaction that the Initiator intends to cancel. The semantics of cancel should roughly be interpreted as meaning  
 132 that the initiator is no longer interested in continuing the interaction and that it should be terminated in a manner  
 133 acceptable to both the Initiator and the Participant. The Participant either informs the Initiator that the interaction is done  
 134 using an `inform-done` or indicates the failure of the cancellation using a `failure`.

135

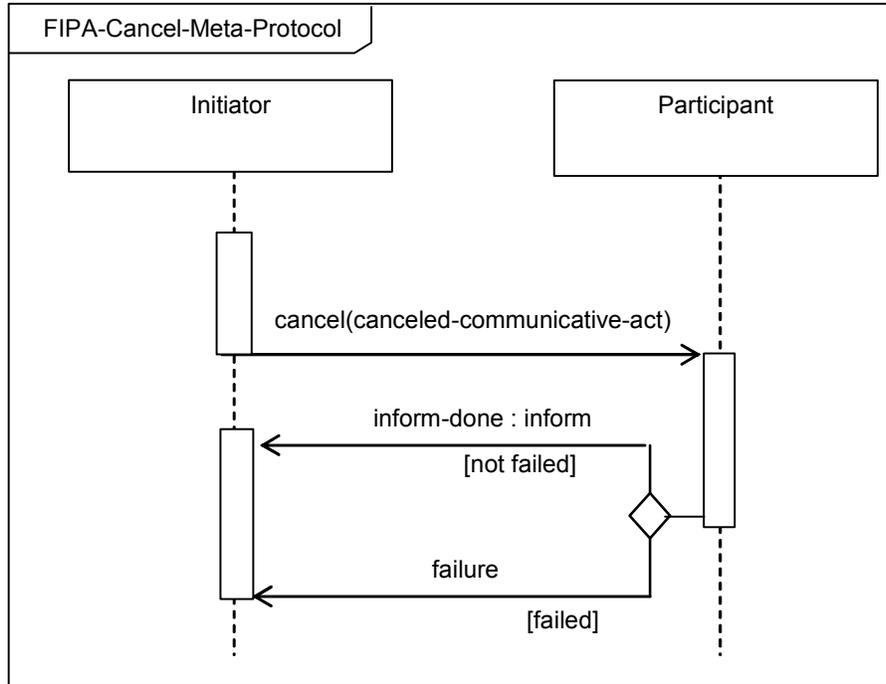


Figure 2: FIPA Cancel Meta-Protocol

136  
137  
138  
139  
140  
141  
142

This IP is a pattern for a simple interaction type. Elaboration on this pattern will almost certainly be necessary in order to specify all cases that might occur in an actual agent interaction. Real world issues such as the effects of cancelling actions, asynchrony, abnormal or unexpected IP termination, nested IPs, and the like, are explicitly not addressed here.

143 **2 References**

144 [Finin97] Finin, T. Labrou, Y. and Mayfield, J., *KQML as an Agent Communication Language*. In: Software  
145 Agents, Bradshaw, J., Ed., MIT Press, 1997.

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150 [Odell2001] Odell, James, Van Dyke Parunak, H. and Bauer, B., *Representing Agent Interaction Protocols in UML*.  
151 In: Agent-Oriented Software Engineering, Ciancarini, P. and Wooldridge, M., Eds., Springer, pp. 121-  
152 140, Berlin, 2001.  
153 <http://www.fipa.org/docs/input/f-in-00077/>  
154

### 155 3 Informative Annex A — ChangeLog

#### 156 3.1 2002/11/01 - version G by TC X2S

|     |                   |  |
|-----|-------------------|--|
| 157 | Entire document:  | Changed the name Destinator to Designated Receiver   |
| 158 | Page 1, line 42:  | Reworked and expanded the section description of the IP  |
| 159 | Page 1, Figure 1: | The <code>not-understood</code> communication was removed  |
| 160 | Page 2, Figure 1: | Used a more generic set of communicative acts which indicates that the sub-protocols are going to forward their responses (failure or references) to either the Initiator or the Designated Receiver |
| 161 |                   |  |
| 162 |                   |  |
| 163 | Page 2, Figure 1: | Multiple sub-protocols indicated by inserting $m$ and $n$ respectively on two arcs; $m$ sub-protocols can be started, resulting in $n$ responses   |
| 164 |                   |  |
| 165 | Page 2, Figure 1: | To conform to UML 2, the protocol name was placed in a boundary, $x$ is removed from the diamonds ( <code>xor</code> is now the default) and the template box was removed                            |
| 166 |                   |  |
| 167 | Page 2, line 69:  | Added a new section on Explanation of Protocol Flow  |
| 168 | Page 2, line 69:  | Reworked and expanded the section on Exceptions of Protocol Flow to incorporate a meta-protocol for cancel   |
| 169 |                   |  |
| 170 | Page 2, line 69:  | Added a paragraph explaining the <code>not-understood</code> communication and its relationship with the IP  |
| 171 |                   |  |
| 172 |                   |  |

#### 173 3.2 2002/12/03 - version H by FIPA Architecture Board

|     |                  |                             |
|-----|------------------|-----------------------------|
| 174 | Entire document: | Promoted to Standard status |
| 175 |                  |                             |

# FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

## FIPA Subscribe Interaction Protocol Specification

|                        |   |                            |                       |
|------------------------|---|----------------------------|-----------------------|
| <b>Document title</b>  | FIPA Subscribe Interaction Protocol Specification |                            |                       |
| <b>Document number</b> | SC00035H  | <b>Document source</b>     | FIPA TC Communication |
| <b>Document status</b> | Standard  | <b>Date of this status</b> | 2002/12/03            |
| <b>Supersedes</b>      | None  |                            |                       |
| <b>Contact</b>         | fab@fipa.org                                      |                            |                       |
| <b>Change history</b>  | See <i>Informative Annex A — ChangeLog</i>        |                            |                       |

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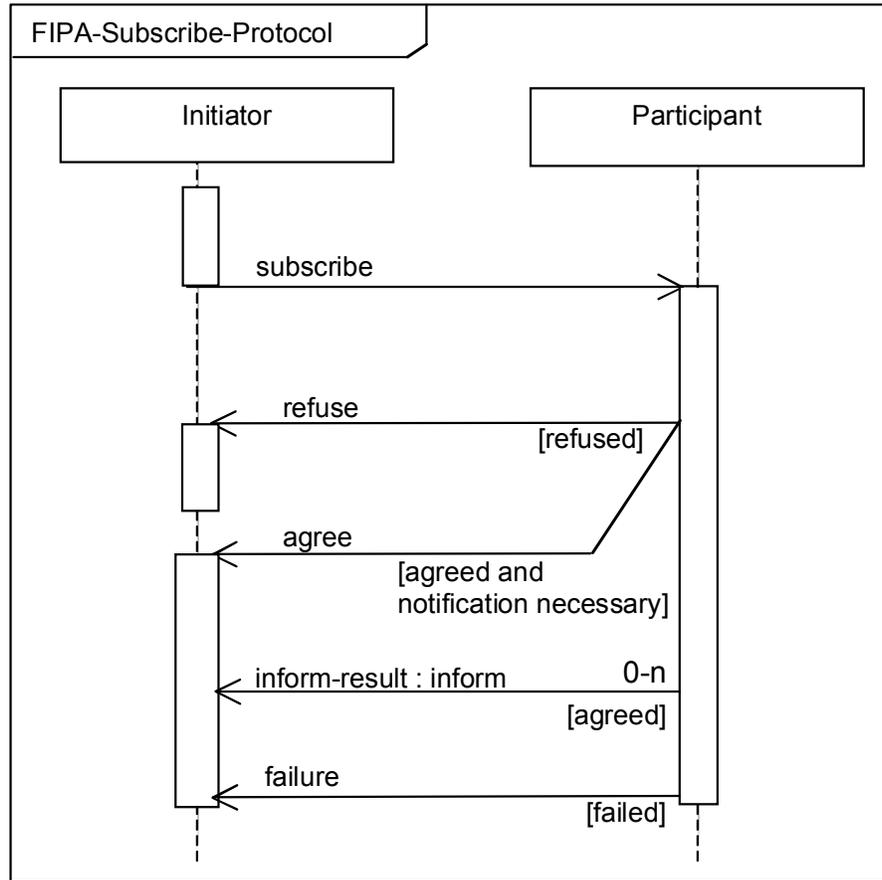
39 **Contents**

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| 44 | 3   | Informative Annex A — ChangeLog.....                   | 4 |
| 45 | 3.1 | 2002/11/01 - version G by TC X2S.....                  | 4 |
| 46 | 3.2 | 2002/12/03 - version H by FIPA Architecture Board..... | 4 |

47 **1 FIPA Subscribe Interaction Protocol**

48 The FIPA Subscribe Interaction Protocol (IP) allows an agent to request a receiving agent to perform an action on  
 49 subscription and subsequently when the referenced object changes.

50  
 51 The representation of this IP is given in *Figure 1* which is based on an extension of UML 1.x. [Odell2001]. This protocol  
 52 is identified by the token `fipa-subscribe` as the value of the `protocol` parameter of the ACL message.  
 53



54  
 55  
 56 **Figure 1: FIPA Subscribe Interaction Protocol**  
 57

58 **1.1 Explanation of the Protocol Flow**

59 The Initiator begins the interaction with a `subscribe` message containing the reference of the objects in which they are  
 60 interested. The Participant processes the `subscribe` message and makes a decision whether to accept or refuse the  
 61 query request. If the Participant makes a refuse decision, then “refused” becomes true and the Participant  
 62 communicates a `refuse`. Otherwise, “agreed” becomes true.

63  
 64 If conditions indicate that an explicit agreement is required (that is, “notification necessary” is true), then the Participant  
 65 communicates an `agree`. The `agree` may be optional depending on circumstances, for example, if the requested  
 66 action is very quick and can happen before a time specified in the `reply-by` parameter.

67  
 68 In a successful response, the Participant replies with an `inform-result` communication with the content being a  
 69 referring expression to the subscribed objects. The Participant continues to send `inform-result` messages as the  
 70 objects denoted by the referring expression change. If at some point after the Participant agrees, it experiences a

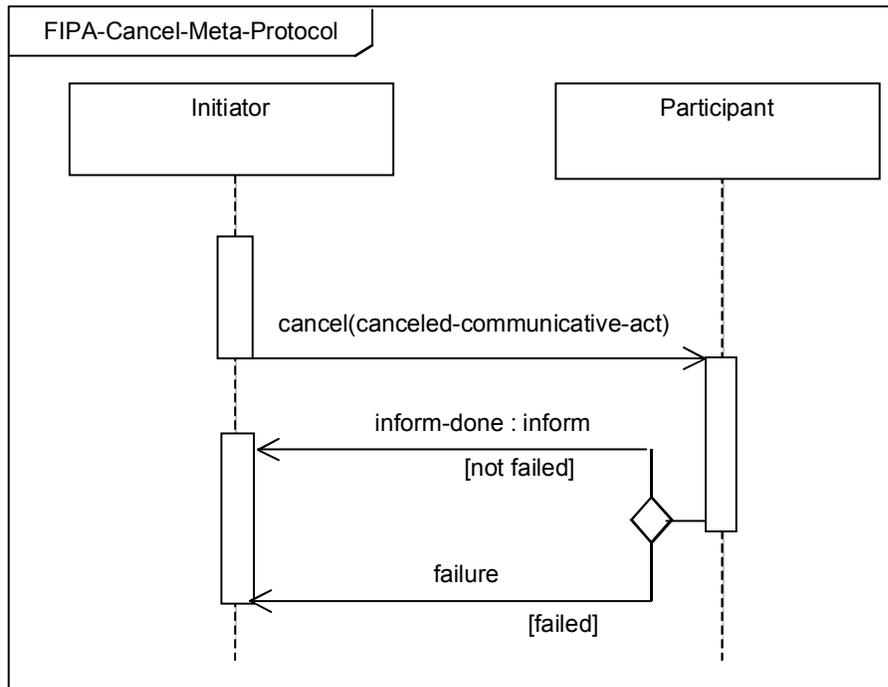
71 failure, then it communicates this with a *failure* message, which also terminates the interaction. Otherwise, the  
72 interaction may be terminated by the Initiator using the cancel meta-protocol as described in Section 1.2.  
73

74 Any interaction using this interaction protocol is identified by a globally unique, non-null *conversation-id* parameter,  
75 assigned by the Initiator. The agents involved in the interaction must tag all of its ACL messages with this conversation  
76 identifier. This enables each agent to manage its communication strategies and activities, for example, it allows an  
77 agent to identify individual conversations and to reason across historical records of conversations. Additionally,  
78 because it may be important to preserve the sequence of the *inform-result* messages, it is important that the  
79 message transport used for this IP preserve the ordering of messages.  
80

### 81 1.2 Exceptions to Interaction Protocol Flow

82 At *any* point in the IP, the receiver of a communication can inform the sender that it did not understand what was  
83 communicated. This is accomplished by returning a *not-understood* message. As such, *Figure 1* does not depict a  
84 *not-understood* communication as it can occur at any point in the IP. The communication of a *not-understood*  
85 within an interaction protocol may terminate the entire IP and termination of the interaction may imply that any  
86 commitments made during the interaction are null and void.  
87

88 At any point in the IP, the initiator of the IP may cancel the interaction protocol by initiating the meta-protocol shown in  
89 *Figure 2*. The *conversation-id* parameter of the cancel interaction is identical to the *conversation-id* parameter  
90 of the interaction that the Initiator intends to cancel. The semantics of cancel should roughly be interpreted as meaning  
91 that the initiator is no longer interested in continuing the interaction and that it should be terminated in a manner  
92 acceptable to both the Initiator and the Participant. The Participant either informs the Initiator that the interaction is done  
93 using an *inform-done* or indicates the failure of the cancellation using a *failure*.  
94



95 **Figure 2: FIPA Cancel Meta-Protocol**

96 This IP is a pattern for a simple interaction type. Elaboration on this pattern will almost certainly be necessary in order to  
97 specify all cases that might occur in an actual agent interaction. Real world issues such as the effects of cancelling  
98 actions, asynchrony, abnormal or unexpected IP termination, nested IPs, and the like, are explicitly not addressed here.  
99  
100  
101

102 **2 References**

103 [FIPA00037] FIPA Communicative Act Library Specification. Foundation for Intelligent Physical Agents, 2000.  
104 <http://www.fipa.org/specs/fipa00037/>

105 [Odell2001] Odell, James, Van Dyke Parunak, H. and Bauer, B., *Representing Agent Interaction Protocols in UML*.  
106 In: *Agent-Oriented Software Engineering*, Ciancarini, P. and Wooldridge, M., Eds., Springer, pp. 121-  
107 140, Berlin, 2001.  
108 <http://www.fipa.org/docs/input/f-in-00077/>  
109

## 110 **3 Informative Annex A — ChangeLog**

### 111 **3.1 2002/11/01 - version G by TC X2S**

- 112 Page 1, Figure 1: The *not-understood* communication was removed
- 113 Page 1, Figure 1: Reworked the protocol to insert an optional *agree*
- 114 Page 1, Figure 1: Deleted the explicit cancel from the protocol diagram because it has been moved to the meta-  
115 protocol section
- 116 Page 1, Figure 1: Added guards to the diagram to indicate that the protocol may be terminated by reaching the  
117 end of the conversation-length
- 118 Page 1, Figure 1: To conform to UML 2, the protocol name was placed in a boundary, *x* is removed from the  
119 diamonds (*xor* is now the default) and the template box was removed
- 120 Page 1, line 42: Reworked and expanded the section description of the IP
- 121 Page 1, line 54: Added a new section on Explanation of Protocol Flow
- 122 Page 1, line 54: Reworked and expanded the section on Exceptions of Protocol Flow to incorporate a meta-  
123 protocol for cancel
- 124 Page 1, line 54: Added a paragraph explaining the *not-understood* communication and its relationship with  
125 the IP
- 126

### 127 **3.2 2002/12/03 - version H by FIPA Architecture Board**

- 128 Entire document: Promoted to Standard status
- 129

# FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

## FIPA Propose Interaction Protocol Specification

|                        |   |                            |                       |
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| <b>Document title</b>  | FIPA Propose Interaction Protocol Specification |                            |                       |
| <b>Document number</b> | SC00036H  | <b>Document source</b>     | FIPA TC Communication |
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| <b>Supersedes</b>      | None  |                            |                       |
| <b>Contact</b>         | fab@fipa.org                                    |                            |                       |
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23 industry of intelligent agents by openly developing specifications supporting interoperability among agents and agent-  
24 based applications. This occurs through open collaboration among its member organizations, which are companies and  
25 universities that are active in the field of agents. FIPA makes the results of its activities available to all interested parties  
26 and intends to contribute its results to the appropriate formal standards bodies where appropriate.

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28 based applications, services and equipment. Membership in FIPA is open to any corporation and individual firm,  
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30 implement or use specific agent-based standards, recommendations and FIPA specifications by virtue of their  
31 participation in FIPA.

32 The FIPA specifications are developed through direct involvement of the FIPA membership. The status of a  
33 specification can be either Preliminary, Experimental, Standard, Deprecated or Obsolete. More detail about the process  
34 of specification may be found in the FIPA Document Policy [f-out-00000] and the FIPA Specifications Policy [f-out-  
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/>.

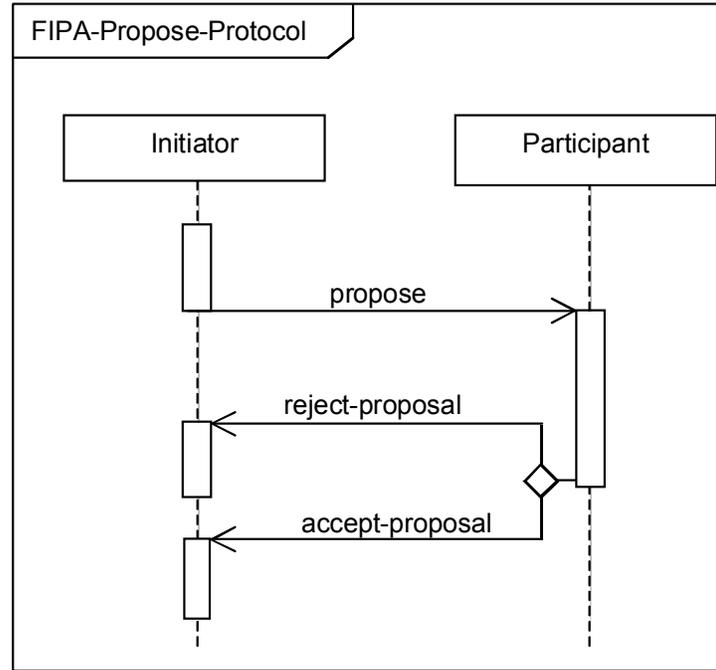
39 **Contents**

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## 47 1 FIPA Propose Interaction Protocol

48 The FIPA Propose Interaction Protocol (IP) allows an agent to propose to receiving agents that the initiator will do the  
 49 actions described in the `propose` communicative act (see [FIPA00037]) when the receiving agent accepts the  
 50 proposal.

51  
 52 The representation of this IP is given in *Figure 1* which is based on an extension of UML 1.x. [Odell2001]. This protocol  
 53 is identified by the token `fipa-propose` as the value of the `protocol` parameter of the ACL message.  
 54



55  
 56  
 57  
 58 **Figure 1: FIPA Propose Interaction Protocol**

### 59 1.1 Explanation of the Interaction Protocol Flow

60 The Initiator sends a `propose` message to the Participant indicating that it will perform some action if the Participant  
 61 agrees. The Participant responds by either accepting or rejecting the proposal, communicating this with the `accept-`  
 62 `proposal` or `reject-proposal` communicative act, accordingly. Completion of this IP with an `accept-proposal`  
 63 act (see [FIPA00037]) would typically be followed by the performance by the Initiator of the proposed action and then  
 64 the return of a status response.

65  
 66 Any interaction using this interaction protocol is identified by a globally unique, non-null `conversation-id` parameter,  
 67 assigned by the Initiator. The agents involved in the interaction must tag all of its ACL messages with this conversation  
 68 identifier. This enables each agent to manage its communication strategies and activities, for example, it allows an  
 69 agent to identify individual conversations and to reason across historical records of conversations.  
 70

### 71 1.2 Exceptions to Interaction Protocol Flow

72 At *any* point in the IP, the receiver of a communication can inform the sender that it did not understand what was  
 73 communicated. This is accomplished by returning a `not-understood` message. As such, *Figure 1* does not depict a  
 74 `not-understood` communication as it can occur at any point in the IP. The communication of a `not-understood`  
 75 within an interaction protocol may terminate the entire IP and termination of the interaction may imply that any  
 76 commitments made during the interaction are null and void.  
 77

78 At any point in the IP, the initiator of the IP may cancel the interaction protocol by initiating the meta-protocol shown in  
 79 *Figure 2*. The `conversation-id` parameter of the cancel interaction is identical to the `conversation-id` parameter  
 80 of the interaction that the Initiator intends to cancel. The semantics of cancel should roughly be interpreted as meaning  
 81 that the initiator is no longer interested in continuing the interaction and that it should be terminated in a manner  
 82 acceptable to both the Initiator and the Participant. The Participant either informs the Initiator that the interaction is done  
 83 using an `inform-done` or indicates the failure of the cancellation using a `failure`.  
 84

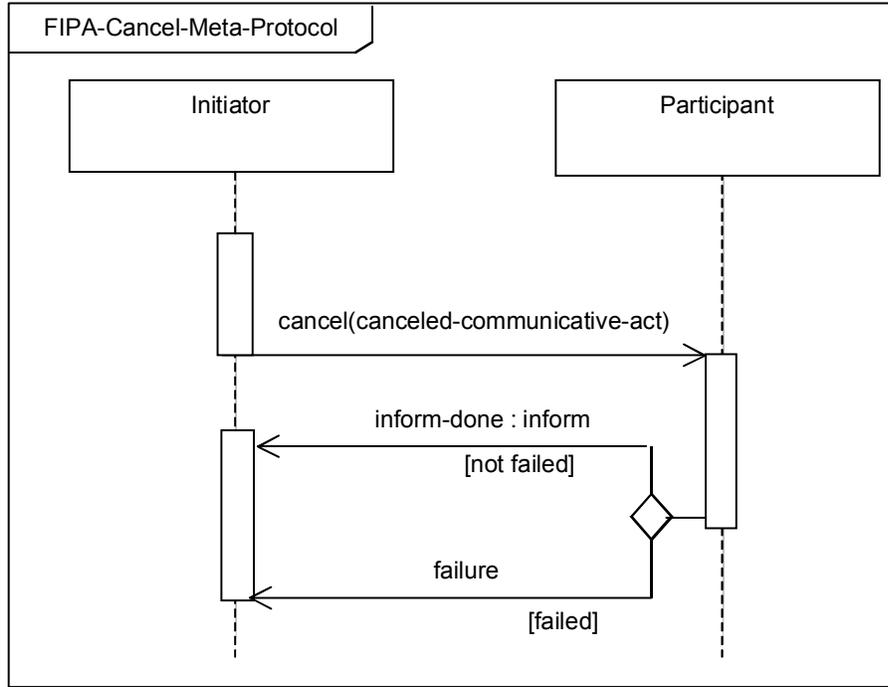


Figure 2: FIPA Cancel Meta-Protocol

85  
 86  
 87  
 88 This IP is a pattern for a simple interaction type. Elaboration on this pattern will almost certainly be necessary in order to  
 89 specify all cases that might occur in an actual agent interaction. Real world issues such as the effects of cancelling  
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