

FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

FIPA Request Interaction Protocol Specification

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23 industry of intelligent agents by openly developing specifications supporting interoperability among agents and agent-
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1 FIPA Request Interaction Protocol

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

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

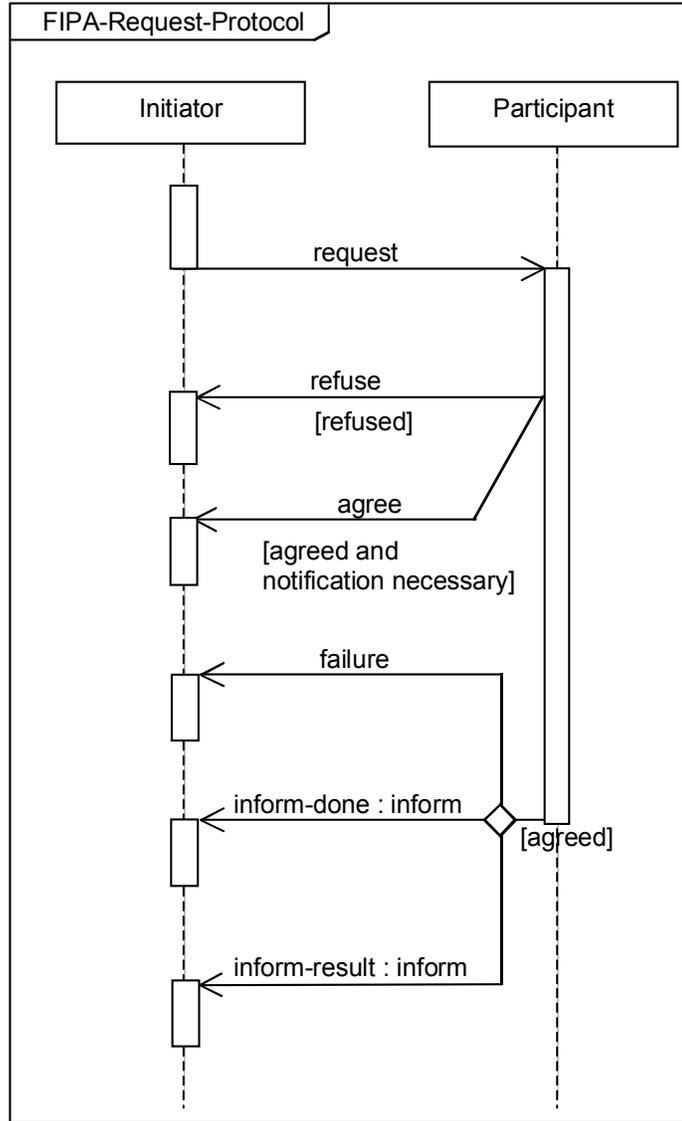


Figure 1: FIPA Request Interaction Protocol

1.1 Explanation of the Protocol Flow

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

If conditions indicate that an explicit agreement is required (that is, “notification necessary” is true), then the Participant 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

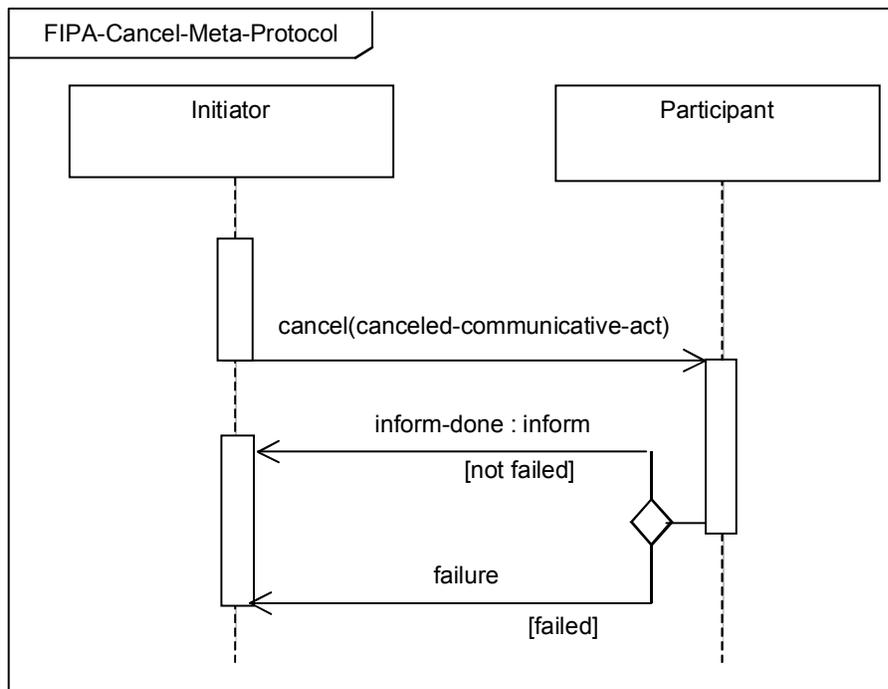


Figure 2: FIPA Cancel Meta-Protocol

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

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FIPA Query Interaction Protocol Specification

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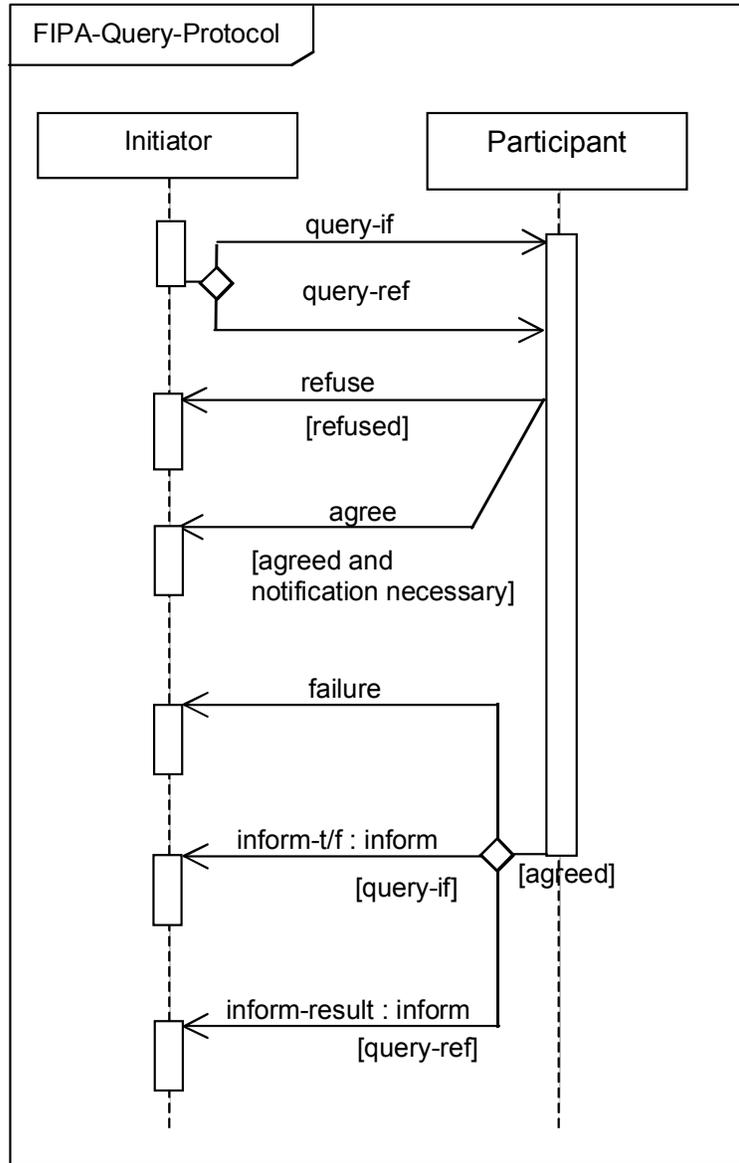
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47 **1 FIPA Query Interaction Protocol**

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

49
50 The representation of this IP is given in *Figure 1* which is based on extensions to UML1.x [Odell2001]. This protocol is
51 identified by the token `fipa-query` as the value of the `protocol` parameter of the ACL message.
52



53
54
55 **Figure 1: FIPA Query Interaction Protocol**
56

57 **1.1 Explanation of the Protocol Flow**

58 The Initiator requests the Participant to perform some kind of `inform` action using one of two query communicative
59 acts, `query-if` or `query-ref` (see [FIPA00037]). The `query-if` communication is used when the Initiator wants to
60 query whether a particular proposition is true or false and the `query-ref` communication is used when the Initiator
61 wants to query for some identified objects. The Participant processes the `query-if` or `query-ref` and makes a
62 decision whether to accept or refuse the query request. If the Participant makes a refuse decision, then “refused”
63 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
86 `not-understood` communication as it can occur at any point in the IP. The communication of a `not-understood`
87 within an interaction protocol may terminate the entire IP and termination of the interaction may imply that any
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
94 acceptable to both the Initiator and the Participant. The Participant either informs the Initiator that the interaction is done
95 using an `inform-done` or indicates the failure of the cancellation using a `failure`.

96

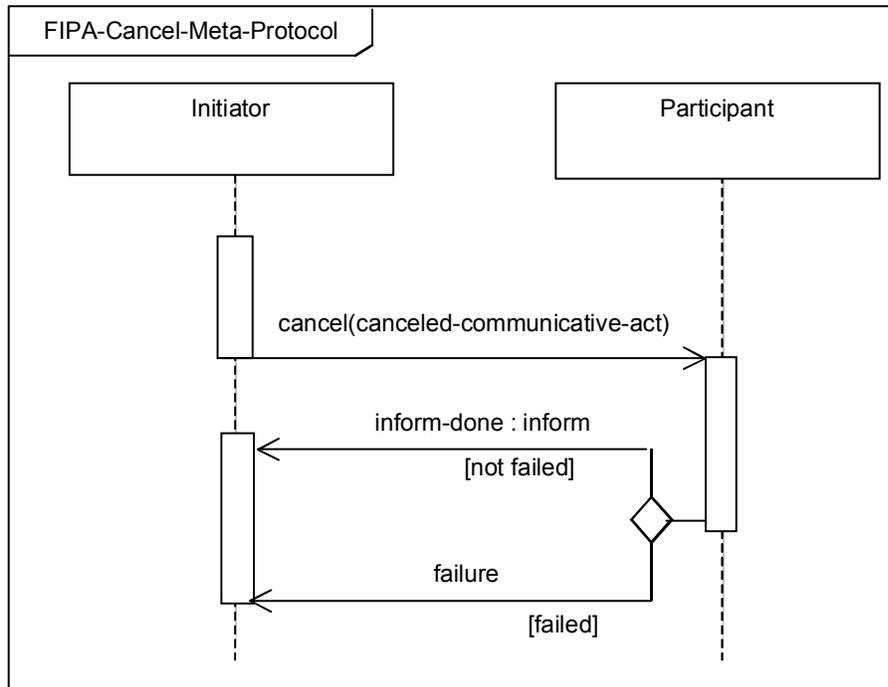


Figure 2: FIPA Cancel Meta-Protocol

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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*.
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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
- 121 Page 1, line 54: Reworked and expanded the section on Exceptions of Protocol Flow to incorporate a meta-
122 protocol for `cancel`
- 123 Page 1, line 54: Added a paragraph explaining the `not-understood` communication and its relationship with
124 the IP
- 125

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

- 127 Entire document: Promoted to Standard status
- 128

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FIPA Request When Interaction Protocol Specification

Document title	FIPA Request When Interaction Protocol Specification		
Document number	SC00028H	Document source	FIPA TC Communication
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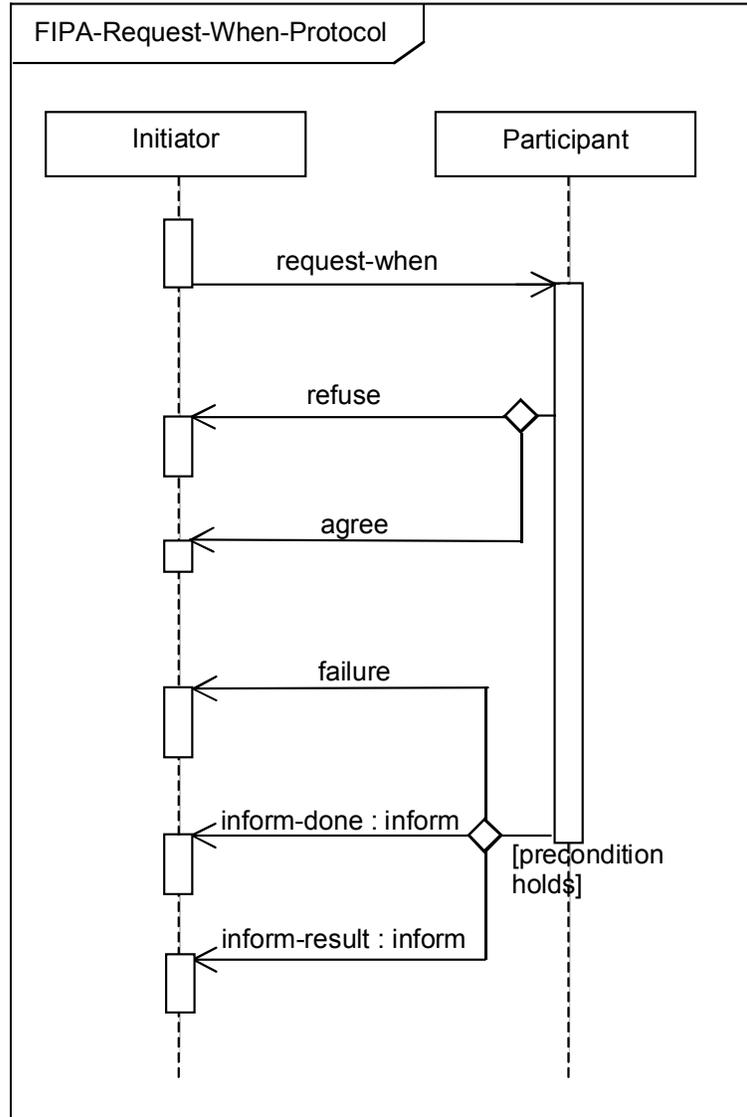
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47 1 FIPA Request When Interaction Protocol

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

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



55
56
57 **Figure 1:** FIPA Request When Interaction Protocol
58

59 1.1 Explanation of the Protocol Flow

60 The initiator uses the `request-when` action to request that the participant do some action once a given precondition
61 becomes true. If the requested agent understands the request and does not initially refuse, it will `agree` (see
62 [FIPA00037]) and wait until the precondition occurs. Then, it will attempt to perform the action and notify the requester
63 accordingly.
64

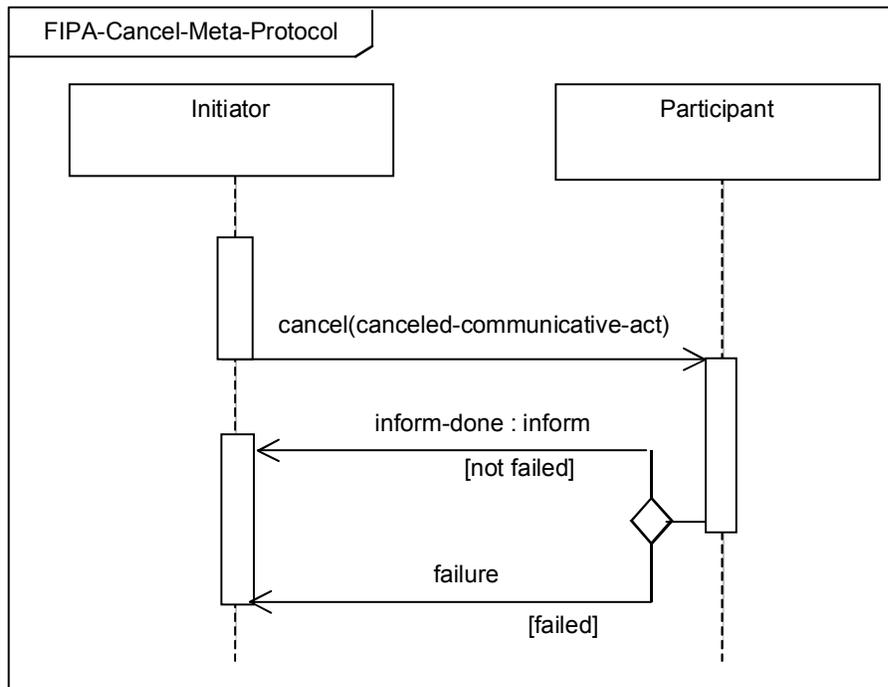
65 If after the initial agreement the participant is no longer able to perform the action, then it will send a *failure* action
 66 (see [FIPA00037]) to the initiator. Once the action has completed and the *failure*, *inform-done*, or *inform-*
 67 *result* has been sent, the conversation ends.
 68

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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 85 acceptable to both the Initiator and the Participant. The Participant either informs the Initiator that the interaction is done
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88 **Figure 2: FIPA Cancel Meta-Protocol**

89
 90
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118 3.2 2002/12/03 - version H by FIPA Architecture Board

- 119 Entire document: Promoted to Standard status
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FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

FIPA Contract Net Interaction Protocol Specification

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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 pattern¹ 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

¹ Originally developed by Smith and Davis.

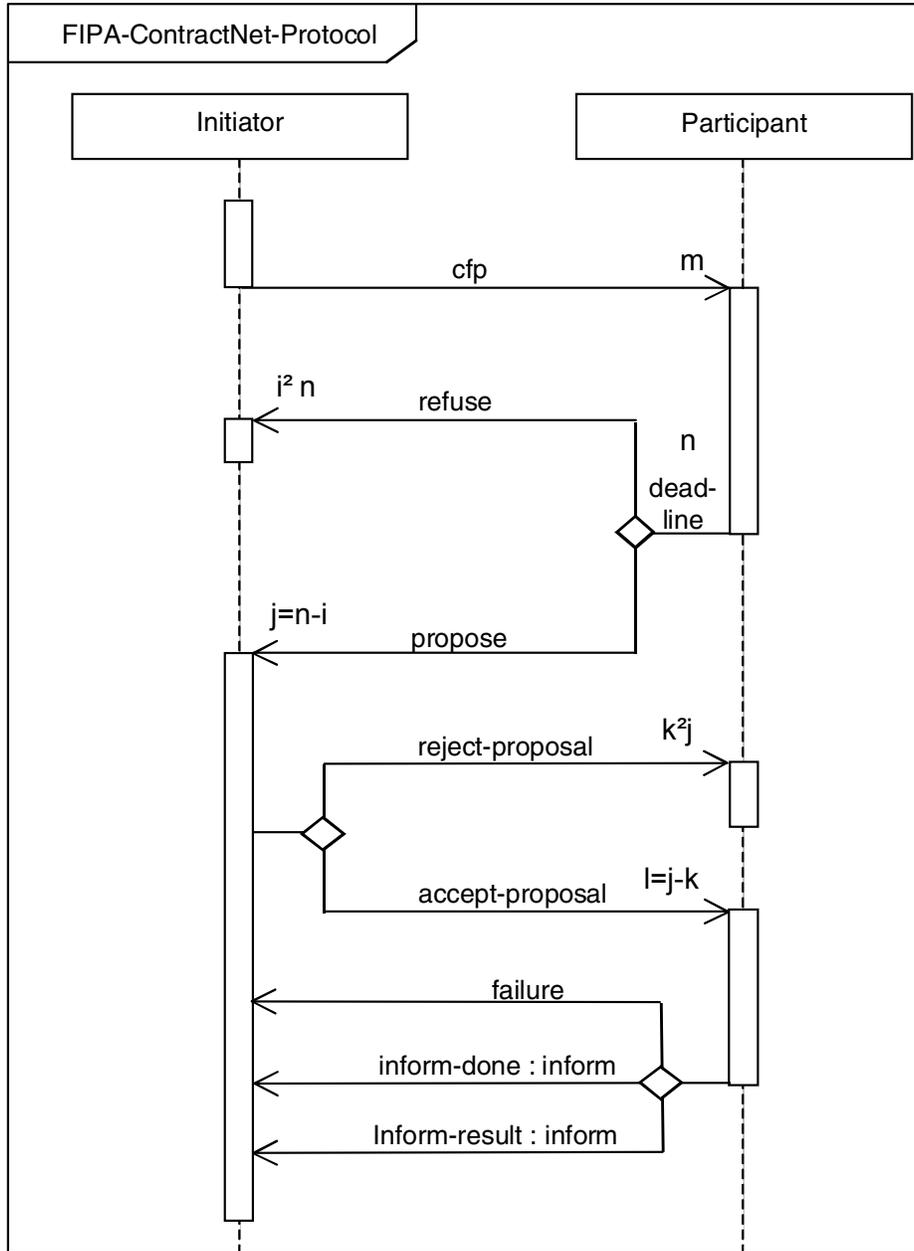


Figure 1: FIPA Contract Net Interaction Protocol

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1.1 Explanation of the Protocol Flow

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

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`.

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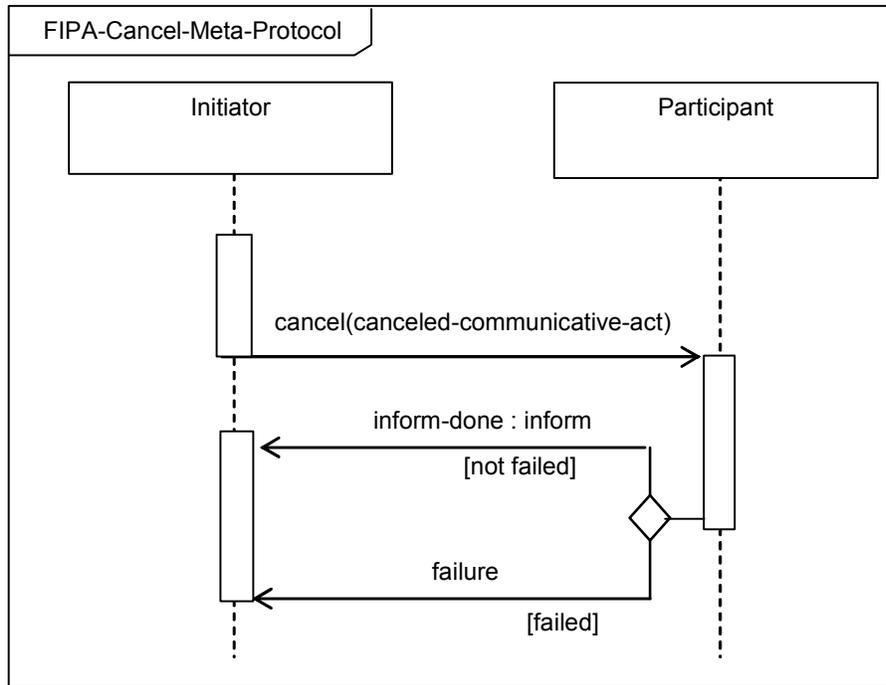


Figure 2: FIPA Cancel Meta-Protocol

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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

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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

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

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24 based applications. This occurs through open collaboration among its member organizations, which are companies and
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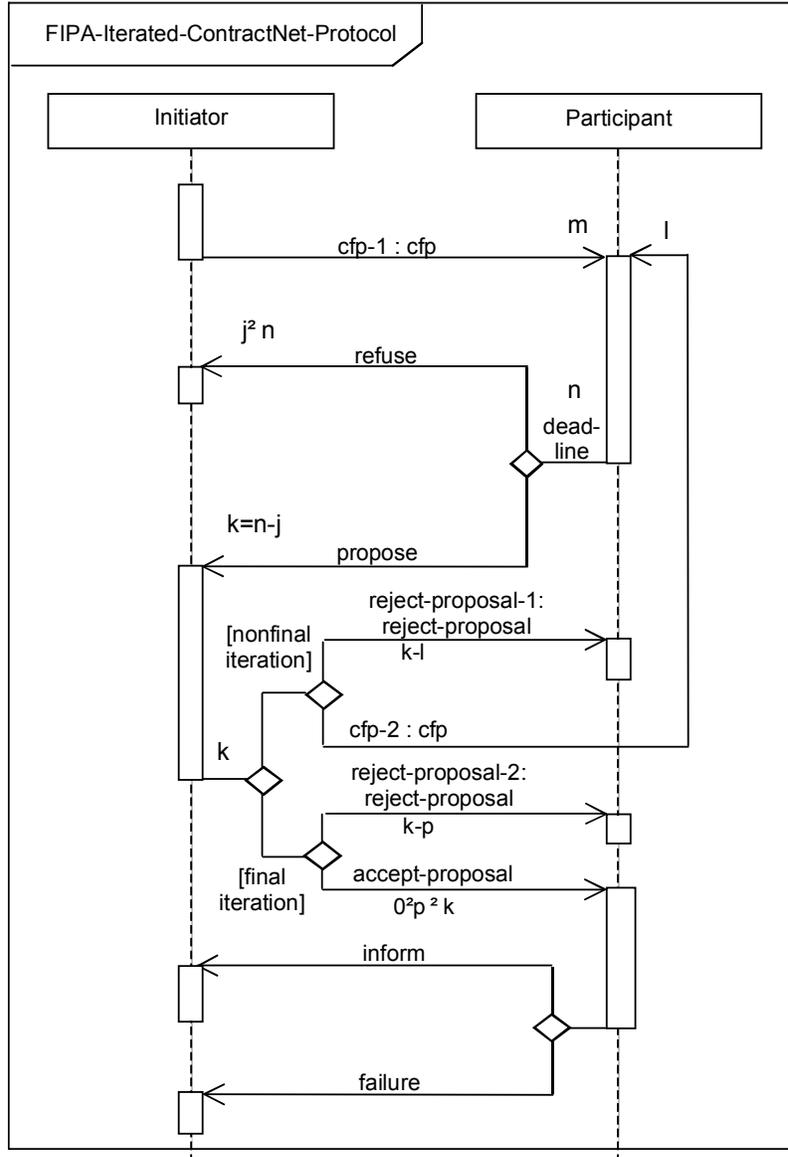
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47 **1 FIPA Iterated Contract Net Interaction Protocol**

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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 57
 58

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
 73 identifier. This enables each agent to manage its communication strategies and activities, for example, it allows an
 74 agent to identify individual conversations and to reason across historical records of conversations.

75

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

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`
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 86 commitments made during the interaction are null and void. However, since this IP broadcasts to more than one
 87 Participant, multiple responses are also possible. Each response, then, must be evaluated separately – and some of
 88 these responses might be `not-understood`. However, terminating the entire IP in this case might not be appropriate,
 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
 96 using an `inform-done` or indicates the failure of the cancellation using a `failure`.

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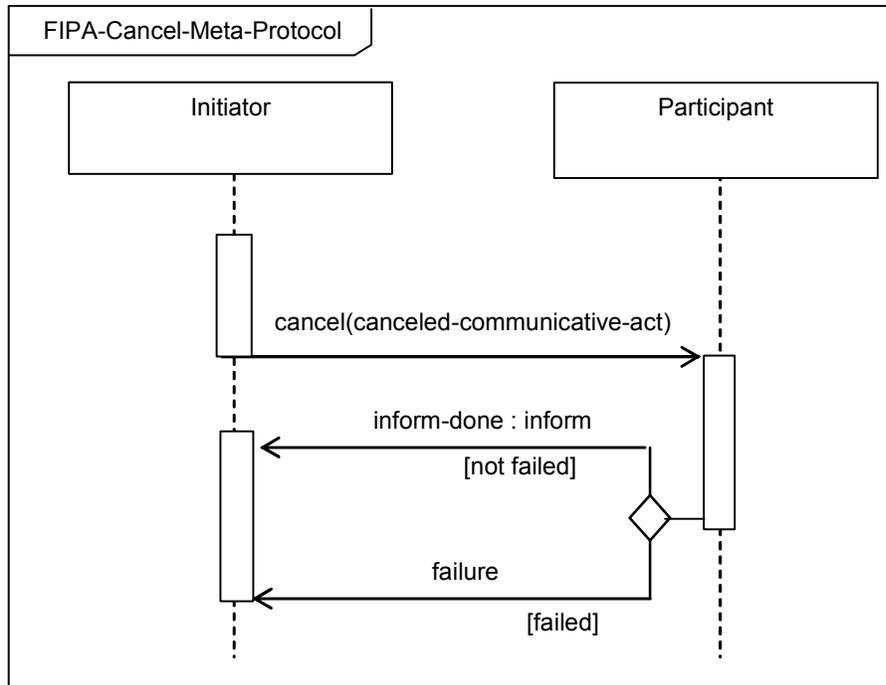


Figure 2: FIPA Cancel Meta-Protocol

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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.

105 **2 References**

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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- 123 protocol for cancel
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- 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 Brokering Interaction Protocol Specification

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Contact	fab@fipa.org		
Change history	See <i>Informative Annex A — ChangeLog</i>		

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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.

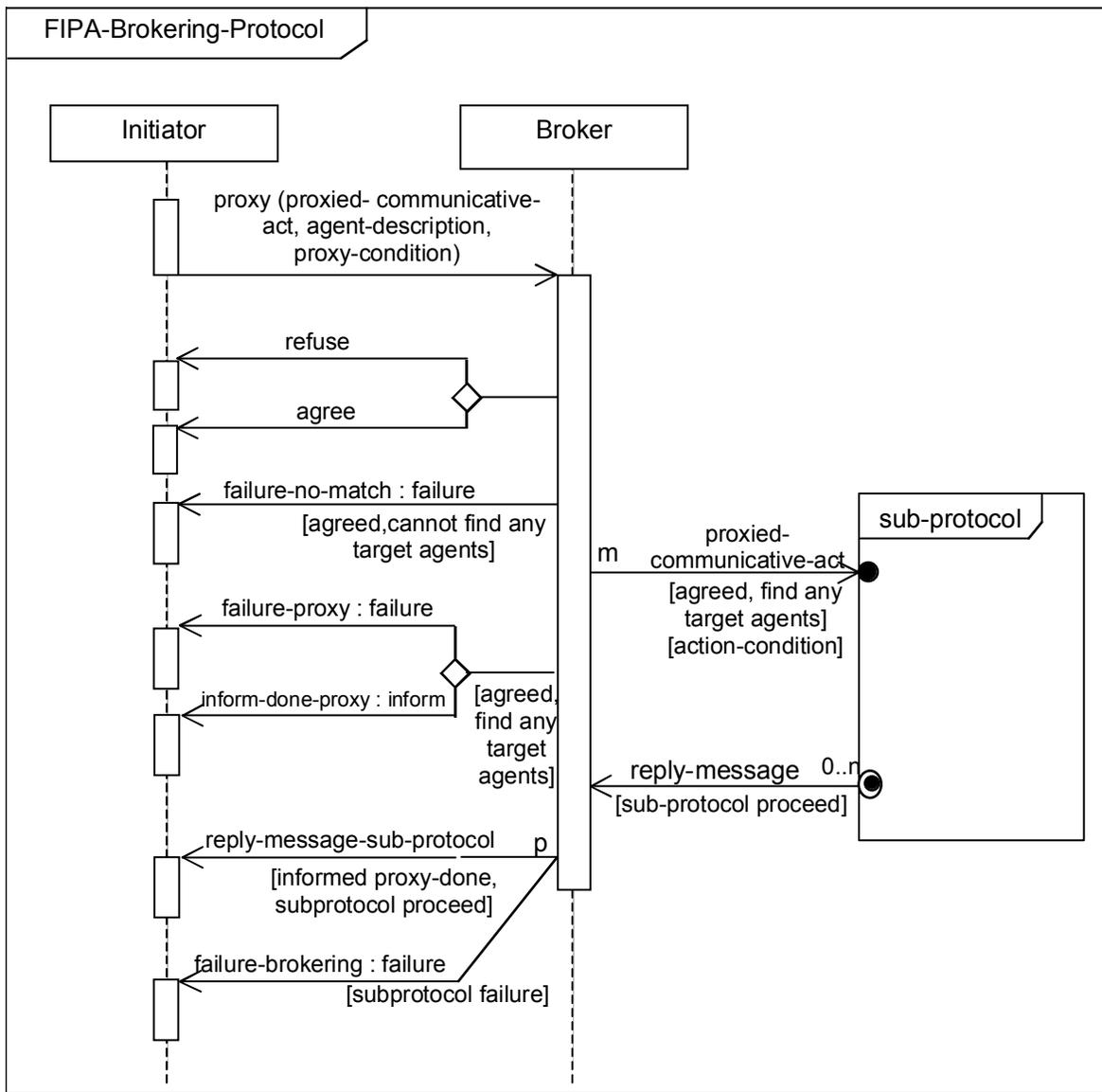


Figure 1: FIPA Brokering Interaction Protocol

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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`
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 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

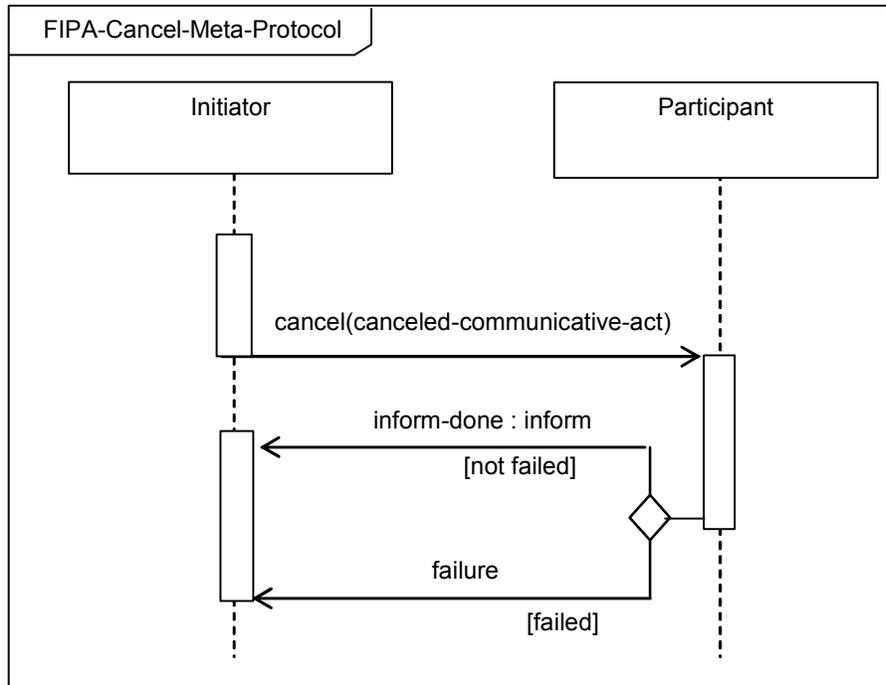


Figure 2: FIPA Cancel Meta-Protocol

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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.

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

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

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

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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

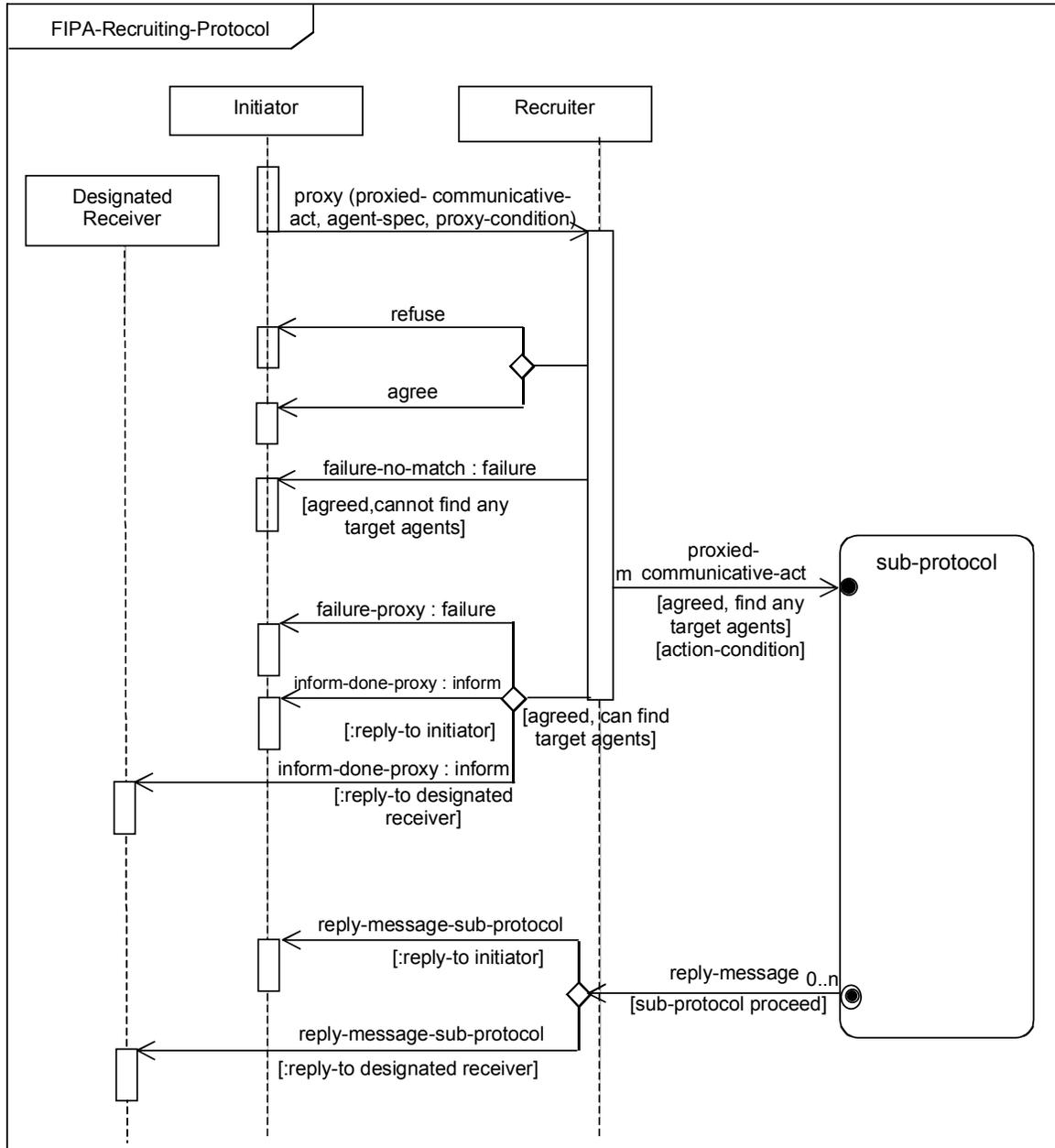


Figure 1: FIPA Recruiting Interaction Protocol

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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

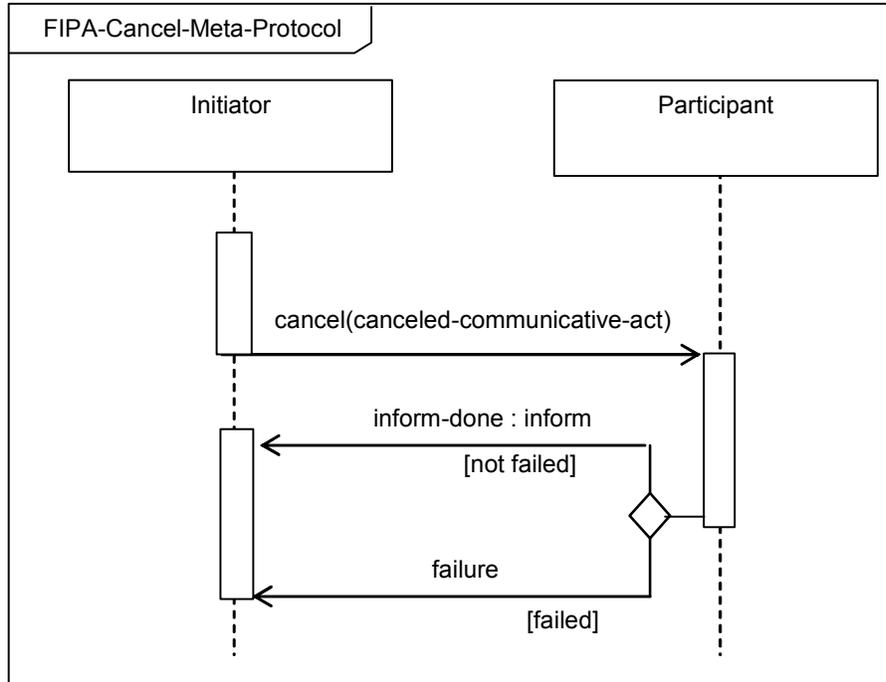


Figure 2: FIPA Cancel Meta-Protocol

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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.

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

148 [FIPA00061] FIPA ACL Message Structure Specification. Foundation for Intelligent Physical Agents, 2000.
149 <http://www.fipa.org/specs/fipa00061/>

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

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

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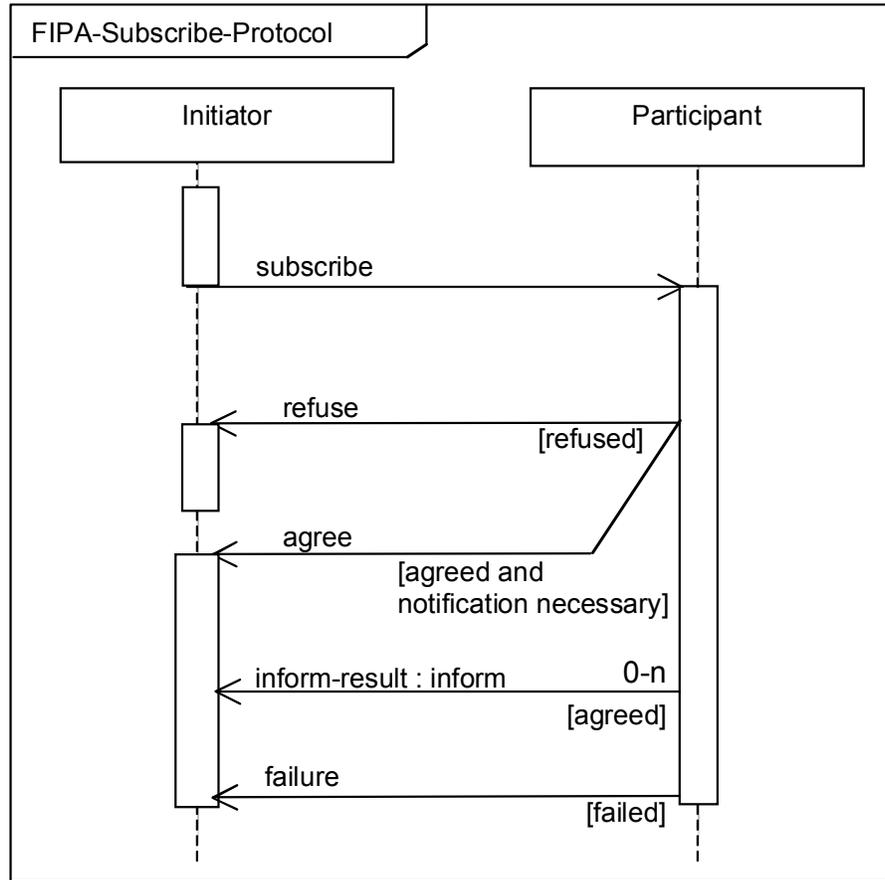
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47 **1 FIPA Subscribe Interaction Protocol**

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

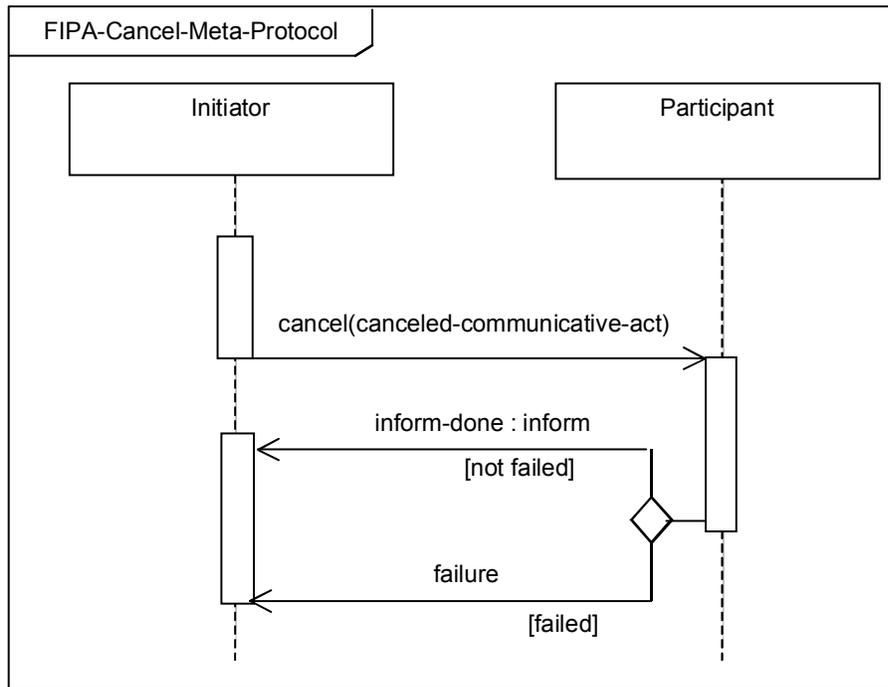
71 failure, then it communicates this with a *failure* message, which also terminates the interaction. Otherwise, the
72 interaction may be terminated by the Initiator using the cancel meta-protocol as described in Section 1.2.
73

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.
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101

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107 140, Berlin, 2001.
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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

Document title	FIPA Propose Interaction Protocol Specification		
Document number	SC00036H	Document source	FIPA TC Communication
Document status	Standard	Date of this status	2002/12/03
Supersedes	None		
Contact	fab@fipa.org		
Change history	See <i>Informative Annex A — ChangeLog</i>		

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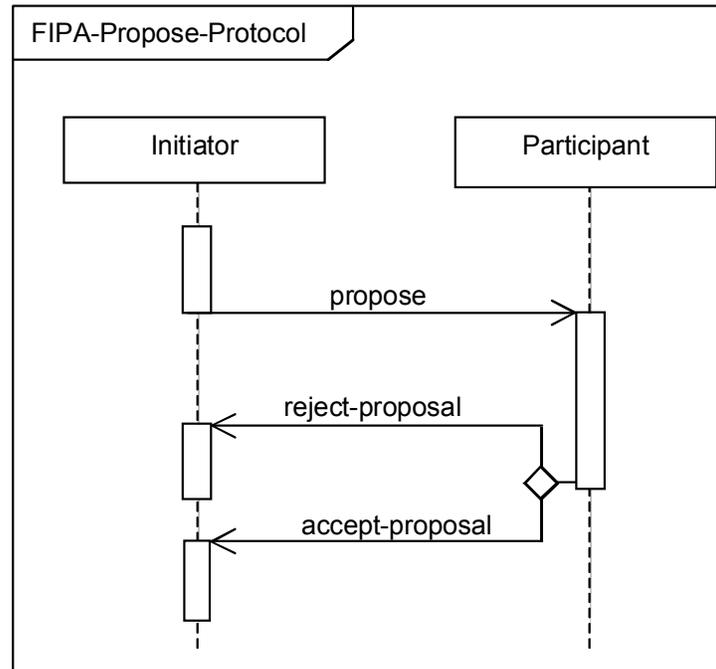
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47 1 FIPA Propose Interaction Protocol

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

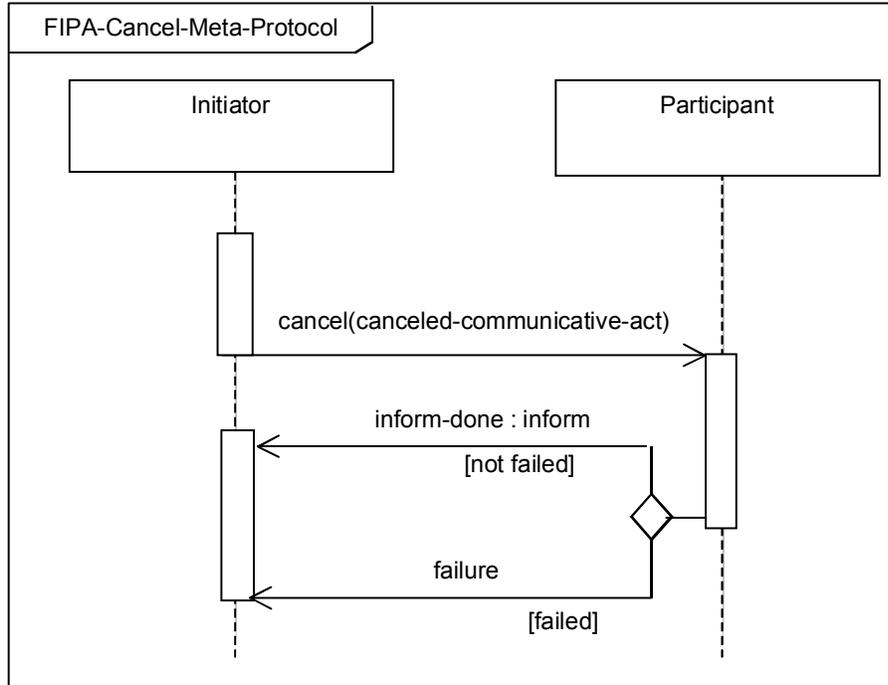
60 The Initiator sends a `propose` message to the Participant indicating that it will perform some action if the Participant
 61 agrees. The Participant responds by either accepting or rejecting the proposal, communicating this with the `accept-`
 62 `proposal` or `reject-proposal` communicative act, 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



85
86 **Figure 2: FIPA Cancel Meta-Protocol**
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
90 actions, asynchrony, abnormal or unexpected IP termination, nested IPs, and the like, are explicitly not addressed here.
91

92 **2 References**

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

95 [Odell2001] Odell, James, Van Dyke Parunak, H. and Bauer, B., *Representing Agent Interaction Protocols in UML*.
96 In: Agent-Oriented Software Engineering, Ciancarini, P. and Wooldridge, M., Eds., Springer, pp. 121-
97 140, Berlin, 2001.
98 <http://www.fipa.org/docs/input/f-in-00077/>
99

100 **3 Informative Annex A — ChangeLog**

101 **3.1 2002/11/01 - version G by TC X2S**

- 102 Page 1, Figure 1: The *not-understood* communication was removed
- 103 Page 1, line 42: Reworked and expanded the section description of the IP
- 104 Page 1, line 54: Added a new section on Explanation of Protocol Flow
- 105 Page 1, line 54: Reworked and expanded the section on Exceptions of Protocol Flow to incorporate a meta-
106 protocol for cancel
- 107 Page 1, line 54: Added a paragraph explaining the *not-understood* communication and its relationship with
108 the IP
- 109

110 **3.2 2002/12/03 - version H by FIPA Architecture Board**

- 111 Entire document: Promoted to Standard status
- 112

FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

FIPA English Auction Interaction Protocol Specification

Document title	FIPA English Auction Interaction Protocol Specification		
Document number	XC00031F	Document source	FIPA TC C
Document status	Experimental	Date of this status	2001/08/10
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Contact	fab@fipa.org		
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2001/01/29	Approved for Experimental		
2001/08/10	Line numbering added		

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Geneva, Switzerland

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37 specifications and upcoming meetings may be found at <http://www.fipa.org/>.

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40	1.1	Exceptions to Interaction Protocol Flow.....	2
41	2	References.....	3
42			

42 1 FIPA English Auction Interaction Protocol

43 In the FIPA English Auction Interaction Protocol (IP), the auctioneer seeks to find the market price of a good by initially
44 proposing a price below that of the supposed market value and then gradually raising the price. Each time the price is
45 announced, the auctioneer waits to see if any buyers will signal their willingness to pay the proposed price. As soon as
46 one buyer indicates that it will accept the price, the auctioneer issues a new call for bids with an incremented price. The
47 auction continues until no buyers are prepared to pay the proposed price, at which point the auction ends. If the last
48 price that was accepted by a buyer exceeds the auctioneer's (privately known) reservation price, the good is sold to that
49 buyer for the agreed price. If the last accepted price is less than the reservation price, the good is not sold

50
51 In *Figure 1*, the auctioneer's calls, expressed as the general *cfp* act (see [FIPA00037]), are multicast to all participants
52 in the auction. For simplicity, only one instance of the message is portrayed. Note also that in a physical auction, the
53 presence of the auction participants in one room effectively means that each acceptance of a bid is simultaneously
54 broadcast to all participants and not just the auctioneer. This may not be true in an agent marketplace, in which case it
55 is possible for more than one agent to attempt to bid for the suggested price. Even though the auction will continue for
56 as long as there is at least one bidder, the agents will need to know whether their bid (represented by the *propose* act -
57 see [FIPA00037]) has been accepted. Hence the appearance in the IP of the *accept-proposal* (see [FIPA00037]) and
58 *reject-proposal* acts (see [FIPA00037]), despite this being implicit in the English Auction process that is being modelled.

59
60 Note that the proposals that are submitted by the bidders primarily concern the bidding process. In response to a *cfp* to
61 submit bids to purchase a good X, a proposal would be something of the order: "I propose that the bidding level be
62 raised to purchase price Z and I assert that I am able to pay Z for X." This allows the auctioneer to be confident that the
63 bidder can indeed pay the price without committing to actually paying it until the auctioneer specifically requests X (at
64 price Z) from the winning bidder.

65
66 At the end of the IP, the auctioneer will typically enter a *request* IP (see [FIPA00026]) with the winning bidder to
67 complete the auction transaction.

68
69 The representation of this IP is given in *Figure 1*.

70

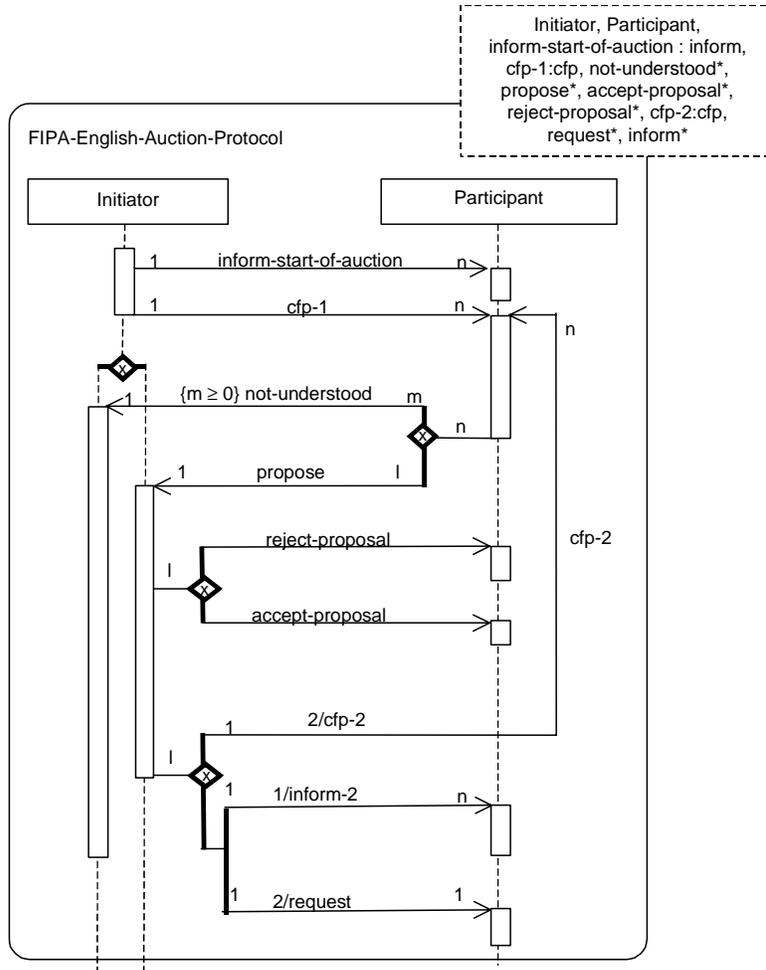


Figure 1: FIPA English Auction Interaction Protocol

71
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74

75 **1.1 Exceptions to Interaction Protocol Flow**

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

79
80

80 **2 References**

- 81 [FIPA00026] FIPA Request Interaction Protocol Specification. Foundation for Intelligent Physical Agents, 2000.
82 <http://www.fipa.org/specs/fipa00026/>
- 83 [FIPA00037] FIPA Communicative Act Library Specification. Foundation for Intelligent Physical Agents, 2000.
84 <http://www.fipa.org/specs/fipa00037/>

FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

FIPA Dutch Auction Interaction Protocol Specification

Document title	FIPA Dutch Auction Interaction Protocol Specification		
Document number	XC00032F	Document source	FIPA TC C
Document status	Experimental	Date of this status	2001/08/10
Supersedes	None		
Contact	fab@fipa.org		
Change history			
2001/01/29	Approved for Experimental		
2001/08/10	Line numbering added		

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38 **Contents**

39 1 FIPA Dutch Auction Interaction Protocol..... 1
40 1.1 Exceptions to Interaction Protocol Flow..... 2
41

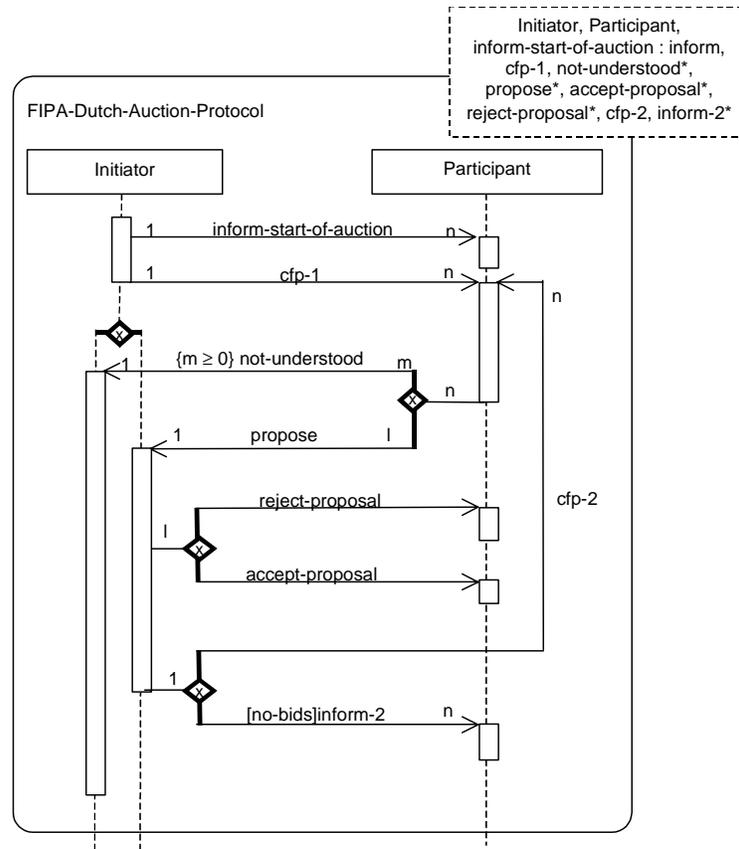
41 **1 FIPA Dutch Auction Interaction Protocol**

42 In the FIPA Dutch Auction Interaction Protocol (IP), the auctioneer attempts to find the market price for a good by
 43 starting bidding at a price much higher than the expected market value, then progressively reducing the price until one
 44 of the buyers accepts the price. The rate of reduction of the price is up to the auctioneer and they usually have a
 45 reserve price below which not to go. If the auction reduces the price to the reserve price with no buyers, then the
 46 auction terminates.

47
 48 The term "Dutch Auction" derives from the flower markets in Holland, where this is the dominant means of determining
 49 the market value of quantities of (typically) cut flowers. In modelling the actual Dutch flower auction (and indeed in other
 50 markets), some additional complexities occur. First, the good may be split: for example the auctioneer may be selling
 51 five boxes of tulips at price X, and a buyer may purchase only three of the boxes. The auction then continues, with a
 52 price at the next increment below X, until the rest of the good is sold or the reserve price met. Such partial sales of
 53 goods are only present in some markets; in others the purchaser must bid to buy the entire good. Secondly, the flower
 54 market mechanism is set up to ensure that there is no contention amongst buyers by preventing any other bids once a
 55 single bid has been made for a good. Offers and bids are binding, so there is no protocol for accepting or rejecting a
 56 bid. In the agent case, it is not possible to assume, and too restrictive to require, that such conditions apply. Thus it is
 57 quite possible that two or more bids are received by the auctioneer for the same good. The protocol below thus allows
 58 for a bid to be rejected. This is intended only to be used in the case of multiple, competing and simultaneous bids. It is
 59 outside the scope of this specification to pre-specify any particular mechanism for resolving this conflict. In the general
 60 case, the agents should make no assumptions beyond "first come, first served". In any given domain, other rules may
 61 apply.

62
 63 The representation of this IP is given in *Figure 1*.

64



65
 66
 67
 68

Figure 1: FIPA Dutch Auction Interaction Protocol

69 **1.1 Exceptions to Interaction Protocol Flow**

70 This IP is a pattern for a simple interaction type. Elaboration on this pattern will almost certainly be necessary in order to
71 specify all cases that might occur in an actual agent interaction. Real world issues of cancelling actions, asynchrony,
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