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2 **FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS**

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5 **FIPA Iterated Contract Net Interaction Protocol**

6 **Specification**

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

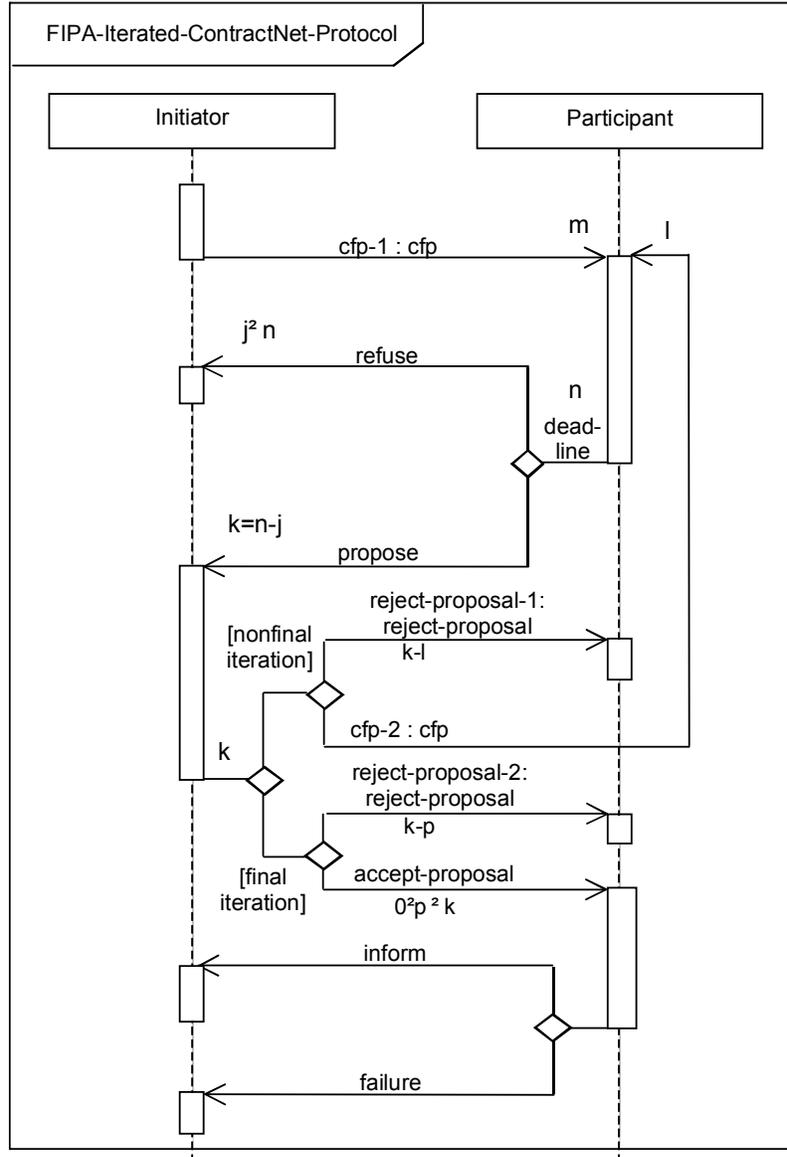
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47 **1 FIPA Iterated Contract Net Interaction Protocol**

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.
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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
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`
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. 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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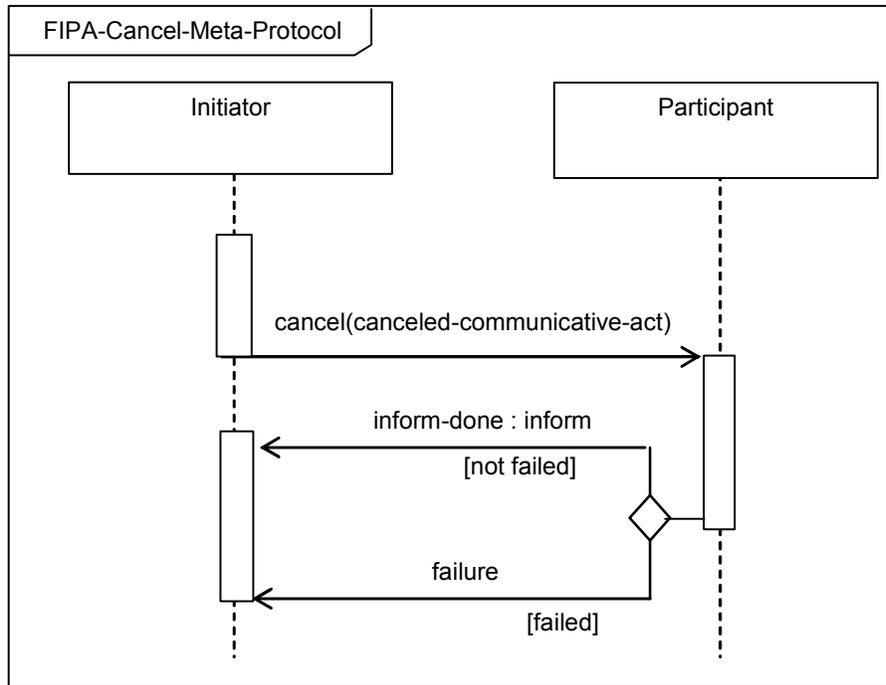


Figure 2: FIPA Cancel Meta-Protocol

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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
- 120 Page 1, line 42: Reworked and expanded the section description of the IP
- 121 Page 1, line 57: Added a new section on Explanation of Protocol Flow
- 122 Page 1, line 57: Reworked and expanded the section on Exceptions of Protocol Flow to incorporate a meta-
- 123 protocol for cancel
- 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