

# FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

## FIPA TC Semantics Request for Information

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*Geneva, Switzerland*

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## Foreword

The Foundation for Intelligent Physical Agents (FIPA) is an international organization that is dedicated to promoting the industry of intelligent agents by openly developing specifications supporting interoperability among agents and agent-based applications. This occurs through open collaboration among its member organizations, which are companies and universities that are active in the field of agents. FIPA makes the results of its activities available to all interested parties and intends to contribute its results to the appropriate formal standards bodies.

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

The FIPA specifications are developed through direct involvement of the FIPA membership. The status of a specification can be either Preliminary, Experimental, Standard, Deprecated or Obsolete. More detail about the process of specification may be found in the FIPA Procedures for Technical Work. A complete overview of the FIPA specifications and their current status may be found in the FIPA List of Specifications. A list of terms and abbreviations used in the FIPA specifications may be found in the FIPA Glossary.

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

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## 1 Objectives

The main objective of this Request for Information is to obtain information which will allow FIPA to establish a new semantic framework that addresses the requirements associated with semantically grounded interaction between agents.

A semantic framework is a notation or set of notations, backed by well understood rules of inference and interpretation, that can be used to express a desired range of concepts. FIPA is most interested in semantic frameworks that can be used to express the range of concepts involved in inter-agent interactions; i.e., individual communicative acts, conversations, ontologies, contracts, agreements and policies.

A prime requirement for this work is a semantic framework that supports verifiable compliance and accountability. This requires an approach that is focussed on externally observable events as opposed to the internal mental states of agents.

In particular, the objective is to adopt or define a semantic framework that can give an account of FIPA's existing communicative acts and interaction protocols as well as a number of additional constructs such as contracts, agreements, policies, trust, agent descriptions and so on. It is important to note that actually developing specifications for all of these is *not* part of this work: it is envisaged that subsequent work would address these specific areas.

Submissions shall focus on potential logical notations, identification of key concepts and techniques for expressing these concepts.

## 2 Introduction

The core mission of FIPA is to construct specifications that permit semantic interoperability between agent systems. This includes being able to share tasks in meaningful and mutually beneficial ways. A key feature of this is the assumption that the systems belong to different owners, and that they are using 'public' means of communication.

A means of communication is public if an observer which shares relevant knowledge is able to infer the expected behaviour of the two (or more) parties involved in the conversation.

FIPA assumes that the purpose of a conversation is either to reach an agreement about future behaviours of agents or parts of plans of activities that has previously been agreed to. In either case, it is clear that agreements and contracts represent key concepts in the interoperability of agents.

A focus on contracts marks a radical departure from the previous semantic framework used by FIPA. Instead of focussing on the *mental states* of agents – for example in terms of their Beliefs, Desires and Intentions – we wish to focus on modelling contracts and associated obligations. This requires paying attention to the *public behaviour* of agents and to the public relationships between agents.

FIPA is therefore issuing a RFI, or Request for Information, in which individuals and organizations with expertise in semantics and multi-agent systems are invited to propose solutions to some or all of the specific problems associated with representing public interactions in agent systems.

In Section 5 below we set forth the specific issues which we wish to address, together with a series of scenarios which demonstrate how these issues, individually or collectively, apply to particular multi-agent applications.

Submissions can address all or some of the issues listed below. A submission should indicate which specific issue or issues are being addressed. We also invite submitters to comment on the relevance of their submission to particular scenarios, and to offer additional scenarios which they believe that FIPA should consider.

## 3 Instructions for Submitters

### 3.1 Responding to this RFI

#### 3.1.1 Timescales

See *Table 3* in *Section 5.9, Timetable* for submission deadlines.

#### 3.1.2 Notification of Intent

Individuals or companies must notify the FIPA secretariat ([secretariat@fipa.org](mailto:secretariat@fipa.org)) of their intention to respond to this RFI (see *Table 3*).

#### 3.1.3 Separate Proposals

A submitter may respond to any or all parts of this RFI. Each technology will be evaluated independently by TC Semantics. It should be noted that a given technology (theoretical or tested and proven work) may support two or more parts of the RFI.

#### 3.1.4 Completeness of Proposals

Proposals for each separate response item need not be complete. However, reasons for not being complete must be clearly stated.

### 3.2 Confidential and Proprietary Information

The FIPA specification adoption process is an open process. Responses to this RFI become public documents of the FIPA and are available to members and non-members alike for perusal. No confidentiality or proprietary information of any kind will be accepted in a submission to this RFI. Potential submitters are advised to examine the FIPA policy on intellectual property rights as outlined in the FIPA statutes [f-out-00061].

### 3.3 Format of RFI Submissions

This section provides guidance on how to structure a submission.

#### 3.3.1 General

- Submissions must be written in English.
- Submissions should be concise and easy to read.
- Submitted documentation should be directly relevant to the technology requested in the RFI.
- The file format of the submissions should be one of plain text, HTML, PDF, Microsoft Word or PostScript.

#### 3.3.2 Suggested Outline

A two-part structure for a submission is suggested:

##### PART I

- Submission contact point, including name, postal address, affiliation, email address, telephone number, fax number.
- Completeness of the submission (see *Section 3.1.4, Completeness*).

- Overview of the submission.

## **PART II**

- Proposed specification(s).

### **3.4 How to Submit**

Submitters should send an electronic version of their submission to the FIPA Secretariat ([secretariat@fipa.org](mailto:secretariat@fipa.org)) and a copy to the Semantics TC mailing list ([semantics@fipa.org](mailto:semantics@fipa.org)).

### **3.5 Response to Submissions**

Feedback on submissions will be provided in accordance with the timescales shown in *Table 3*. The response will be sent to the email and postal address provided by the submitter.

## 4 General Requirements for Submissions

Proposals should not conflict with FIPA specifications given in *Table 1* and *Table 2*.

Note the following when writing a proposal:

- Any conflicts must be clearly identified, along with reasons for them.
- Emphasis should be put on the use of reusable components.
- Proposals shall preserve maximum implementation flexibility and interoperability.
- The use of UML modelling is desirable, but not mandatory.
- Proposals can be based on theoretical work or tested, proven work.
- Proposals shall indicate the current status of the work such as theoretical, simulation, experimental, limited trials, and field trials.
- Proposals should indicate which of the problems areas identified in Section 2 they are attempting to address.



## 5 Specific Requirements for Proposals

### 5.1 Declarative approaches

FIPA is looking for semantic frameworks that are declarative in nature. We expect that the underlying models may require modal logic techniques and/or other published and accepted logical formalisms. Given the public nature of the FIPA organization we would prefer inputs to use accessible formalisms.

#### 5.1.1 Tractability

It is not expected that agents will be required to reason about contracts, conversations etc. using an inference capability that is directly based on the semantic framework. Therefore, it is not necessary that an implementation of the logical framework exists. However, agents may wish to reason about the behaviour of other agents. In which case there may be a reduced sub-set of the logical formalism that is suitable for mechanical interpretation.

However, it is important that any logic formalism is comprehensible and tractable to human agents.

#### 5.1.2 Logical foundations

The submitter is requested to provide an indication of known results about any logical formalism suggested. For example, whether it is known if the inference procedure is decidable, whether is it a complete logic. An indication of appropriate model theories and proof theories would be appreciated.

### 5.2 Semantic Framework

FIPA requires a semantic framework that can account for the communicative behaviour of agents. This includes

- contracts and agreements entered into by agents
- conversations whose form is governed by agreements established beforehand
- the relationships between agents, such as
  - Trust
  - Authority
  - Social domains
- obligations entered into by agents
- norms of behaviour
- institutions of agent communities
- ontologies
- policies that constrain the behaviour of agents and non-agent systems

A submitter does not need to address all of these aspects. In addition, other kinds of interaction between agents may also be addressed. However, the principal focus of FIPA is to support the interoperability of agents in commercial and industrial settings.

### 5.3 Relationship to existing FIPA Specifications

Table 1 identifies some of the existing FIPA Specifications which have a relationship to semantic frameworks as requested in this RFI. All the specifications can be retrieved from <http://www.fipa.org/specs/>.

Specification Number	Title
FIPA00037	FIPA Communicative Act Library Specification
FIPA00038	FIPA Communicative Act Repository Specification
FIPA00007	FIPA Content Language Library Specification
FIPA00025	FIPA Interaction Protocol Library Specification

**Table 1:** Relevant FIPA Specifications

## 5.4 Related Non-FIPA Documents

*Logic and Objects*, FG McCabe

*AlfeBiite Project*, see <http://www.alfebiite.com>

*Intention is choice with commitment*, P. Cohen and H. Levesque, *Artificial Intelligence* 42(2-3), pp 213-261, 1990.

*A social semantics for agent communication languages*, Munindhar Singh, see <http://www.csc.ncsu.edu/faculty/msingh/papers/mas>

## 5.5 Mandatory Requirements

All submissions should be electronic. Submitted documents should include all required fonts.

## 5.6 Optional Requirements

This paragraph believes it is blank.

## 5.7 Issues to be Discussed

Since compliance is an important consideration for FIPA, TC Semantics requests that the submitter addresses compliance related issues in their submissions.

Proposals should discuss potential impact on FIPA specifications. In particular, proposals should discuss interrelationship with FIPA ACL specifications.

## 5.8 Other Information

None.

## 5.9 Timetable

The timetable for this RFI is given in *Table 2*. Note that FIPA may, in certain circumstances, extend deadlines while the RFI is running, or may elect to have more than one revised submission step.

Action	Latest Date
Electronic or paper receipt of material	30th January 2002
Acknowledgement of submission	15th February 2002
FIPA Semantics TC reviews submissions at FIPA 24	11th -15th February 2002

**Table 2:** Timescales