



**The Foundation for Intelligent Physical Agents**

**Fipa 97 specification  
Version 1.0**

**Copyright FIPA 1997**



# FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

## FIPA 97 Specification

### Part 1

## Agent Management

Publication date : 10<sup>th</sup> October 1997

© 1997 FIPA - Foundation for Intelligent Physical Agents

*Geneva, Switzerland*

#### Notice

Use of the technologies described in this specification may infringe patents, copyrights or other intellectual property rights of FIPA Members and non-members. Nothing in this specification should be construed as granting permission to use any of the technologies described. Anyone planning to make use of technology covered by the intellectual property rights of others should first obtain permission from the holder(s) of the rights. FIPA strongly encourages anyone implementing any part of this specification to determine first whether part(s) sought to be implemented are covered by the intellectual property of others, and, if so, to obtain appropriate licenses or other permission from the holder(s) of such intellectual property prior to implementation. This FIPA '97 Specification is subject to change without notice. Neither FIPA nor any of its Members accept any responsibility whatsoever for damages or liability, direct or consequential, which may result from the use of this specification.

**Contents**

1 Scope.....1

2 Normative reference(s) .....1

3 Terms and definitions .....1

4 Symbols (and abbreviated terms) .....4

5 Overview .....5

6 Reference Model.....5

6.1 Agent .....6

6.2 Directory Facilitator (DF).....6

6.2.1 Actions Supported by the DF.....7

6.2.2 Reserved Constants in Ontology for the DF .....7

6.3 Agent Management System (AMS).....7

6.3.1 Actions Supported by the AMS .....7

6.3.2 Reserved Constants in Ontology for the AMS .....8

6.4 Agent Communication Channel (ACC) .....8

6.4.1 Actions Supported by the ACC.....8

6.4.2 Reserved Constants in Ontology for the ACC .....8

6.5 Software .....8

7 The Agent Platform (AP).....9

7.1 Overview .....9

7.2 Relationship between key entities within AP .....9

7.3 The Home Agent Platform .....10

7.4 Agent Registration on an AP .....10

7.5 The communication act .....11

7.5.1 Agent Communication Channel and Agent Addressing .....11

7.5.2 Message Routing .....12

7.6 The Agent Platform Life-Cycle.....15

7.6.1 State Description.....15

7.6.2 Transition Description.....16

8 Agent Domain.....16

8.1 Overview .....16

8.2 Registering with the Directory Facilitator.....16

8.3 The domain life-cycle.....17

8.3.1 State Descriptions.....17

8.3.2 Transition Descriptions .....18

9 FIPA Agent Management Ontology.....19

9.1 Agent Management Grammar .....19

9.2 Agent Platform Actions .....23

9.2.1 register .....23

9.2.2 search.....25

9.2.3 modify .....27

9.2.4 deregister .....28

9.2.5 register-agent .....29

9.2.6 deregister-agent .....30

9.2.7 modify-agent.....31

9.2.8 authenticate .....32

9.2.9 forward .....33

9.3 Agent Management Objects.....34

9.3.1 fipa-man-df-agent-description .....34

9.3.2 fipa-man-platform-profile .....35

9.3.3 fipa-man-service-description .....35

9.3.4 fipa-man-ams-agent-description .....36

9.3.5 fipa-man-exception .....37

## Foreword

The Foundation for Intelligent Physical Agents (FIPA) is a non-profit association registered in Geneva, Switzerland. FIPA's purpose is to promote the success of emerging agent-based applications, services and equipment. This goal is pursued by making available in a timely manner, internationally agreed specifications that maximise interoperability across agent-based applications, services and equipment. This is realised through the open international collaboration of member organisations, which are companies and universities active in the agent field. FIPA intends to make the results of its activities available to all interested parties and to contribute the results of its activities to appropriate formal standards bodies.

This specification has been developed through direct involvement of the FIPA membership. The 35 corporate members of FIPA (October 1997) represent 12 countries from all over the world

Membership in FIPA is open to any corporation and individual firm, partnership, governmental body or international organisation without restriction. By joining FIPA each Member declares himself individually and collectively committed to open competition in the development of agent-based applications, services and equipment. Associate Member status is usually chosen by those entities who do not want to be members of FIPA without using the right to influence the precise content of the specifications through voting.

The Members are not restricted in any way from designing, developing, marketing and/or procuring agent-based applications, services and equipment. Members are not bound to implement or use specific agent-based standards, recommendations and FIPA specifications by virtue of their participation in FIPA.

This specification is published as FIPA 97 ver. 1.0 after two previous versions have been subject to public comments following disclosure on the WWW. It has undergone intense review by members as well non-members. FIPA is now starting a validation phase by encouraging its members to carry out field trials that are based on this specification. During 1998 FIPA will publish FIPA 97 ver. 2.0 that will incorporate whatever adaptations will be deemed necessary to take into account the results of field trials.

## FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

### FIPA 97 Specification

#### Part 2

## Agent Communication Language

Publication date: 28<sup>th</sup> November, 1997

© 1997 FIPA - Foundation for Intelligent Physical Agents

*Geneva, Switzerland*

#### **Notice**

Use of the technologies described in this specification may infringe patents, copyrights or other intellectual property rights of FIPA Members and non-members. Nothing in this specification should be construed as granting permission to use any of the technologies described. Anyone planning to make use of technology covered by the intellectual property rights of others should first obtain permission from the holder(s) of the rights. FIPA strongly encourages anyone implementing any part of this specification to determine first whether part(s) sought to be implemented are covered by the intellectual property of others, and, if so, to obtain appropriate licences or other permission from the holder(s) of such intellectual property prior to implementation. This FIPA '97 Specification is subject to change without notice. Neither FIPA nor any of its Members accept any responsibility whatsoever for damages or liability, direct or consequential, which may result from the use of this specification.

**Contents**

1	Scope .....	1
2	Normative references .....	2
3	Terms and definitions .....	3
4	Symbols (and abbreviated terms).....	5
5	Overview of Inter-Agent Communication.....	7
5.1	Introduction.....	7
5.2	Message Transport Mechanisms .....	8
6	FIPA ACL Messages .....	10
6.1	Preamble.....	10
6.2	Requirements on agents.....	10
6.3	Message structure .....	11
6.3.1	Overview of ACL messages .....	11
6.3.2	Message parameters .....	11
6.3.3	Message content .....	13
6.3.4	Representing the content of messages .....	14
6.3.5	Use of MIME for additional content expression encoding .....	14
6.3.6	Primitive and composite communicative acts .....	15
6.4	Message syntax .....	15
6.4.1	Grammar rules for ACL message syntax.....	16
6.4.2	Notes on grammar rules .....	17
6.5	Catalogue of Communicative Acts .....	18
6.5.1	Preliminary notes .....	18
6.5.2	accept-proposal.....	21
6.5.3	agree .....	22
6.5.4	cancel.....	23
6.5.5	cfp .....	24
6.5.6	confirm.....	25
6.5.7	disconfirm .....	26
6.5.8	failure .....	27
6.5.9	inform.....	28
6.5.10	inform-if (macro act).....	29
6.5.11	inform-ref (macro act) .....	30
6.5.12	not-understood .....	31
6.5.13	propose.....	32

6.5.14	query-if .....	33
6.5.15	query-ref .....	34
6.5.16	refuse.....	35
6.5.17	reject-proposal.....	36
6.5.18	request.....	37
6.5.19	request-when .....	38
6.5.20	request-whenever.....	39
6.5.21	subscribe.....	40
7	Interaction Protocols .....	41
7.1	Specifying when a protocol is in operation.....	41
7.2	Protocol Description Notation .....	41
7.3	Defined protocols .....	42
7.3.1	Failure to understand a response during a protocol.....	42
7.3.2	FIPA-request Protocol .....	42
7.3.3	FIPA-query Protocol.....	43
7.3.4	FIPA-request-when Protocol .....	43
7.3.5	FIPA-contract-net Protocol.....	43
7.3.6	FIPA-Iterated-Contract-Net Protocol .....	44
7.3.7	FIPA-Auction-English Protocol.....	45
7.3.8	FIPA-Auction-Dutch Protocol.....	46
8	Formal basis of ACL semantics.....	48
8.1	Introduction to formal model .....	48
8.2	The SL Language .....	49
8.2.1	Basis of the SL formalism .....	49
8.2.2	Abbreviations.....	50
8.3	Underlying Semantic Model .....	50
8.3.1	Property 1 .....	51
8.3.2	Property 2.....	51
8.3.3	Property 3.....	51
8.3.4	Property 4.....	51
8.3.5	Property 5.....	52
8.4	Notation .....	52
8.5	Primitive Communicative Acts.....	52
8.5.1	The assertive Inform .....	52
8.5.2	The directive Request .....	52
8.5.3	Confirming an uncertain proposition: Confirm.....	53
8.5.4	Contradicting knowledge: Disconfirm .....	53
8.6	Composite Communicative Acts .....	53
8.6.1	The closed-question case .....	54

8.6.2 The query-if act:..... 55

8.6.3 The confirm/disconfirm-question act:..... 55

8.6.4 The open-question case: ..... 55

8.6.5 Summary definitions for all standard communicative acts ..... 56

8.7 Inter-agent Communication Plans ..... 61

9 References ..... 62

Annex A (informative) ACL Conventions and Examples ..... 64

A.1 Conventions ..... 64

A.1.1 Conversations amongst multiple parties in agent communities..... 64

A.1.2 Maintaining threads of conversation..... 64

A.1.3 Initiating sub-conversations within protocols..... 65

A.1.4 Negotiating by exchange of goals ..... 65

A.2 Additional examples..... 66

A.2.1 Actions and results ..... 66

Annex B (informative) SL as a Content Language ..... 67

B.1 Grammar for SL concrete syntax..... 67

B.1.1 Lexical definitions ..... 68

B.2 Notes on SL content language semantics ..... 68

B.2.1 Grammar entry point: SL content expression ..... 69

B.2.2 SL Well-formed formula (SLWff) ..... 69

B.2.3 SL Atomic Formula..... 70

B.2.4 SL Term ..... 70

B.2.5 Result predicate..... 70

B.2.6 Actions and action expressions ..... 70

B.2.7 Agent identifier ..... 71

B.2.8 Numerical Constants..... 71

B.3 Reduced expressivity subsets of SL..... 71

B.3.1 SL0: minimal subset of SL..... 71

B.3.2 SL1: propositional form ..... 72

B.3.3 SL2: restrictions for decidability..... 72

Annex C (informative) Relationship of ACL to KQML ..... 75

C.1 Primary similarities and differences..... 75

C.2 Correspondence between KQML message performatives and FIPA CA's..... 75

C.2.1 Agent management primitives ..... 76

C.2.2 Communications management ..... 76

C.2.3 Managing multiple solutions ..... 76

C.2.4 Other discourse performatives ..... 77

Annex D (informative) MIME-encoding to extend content descriptions ..... 78

D.1 Extension of FIPA ACL to include MIME headers ..... 78

D.2 Example.....78

**FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS**

---

FIPA 97 Specification

Part 3

Agent Software Integration

---

Publication date : 10<sup>th</sup> October 1997

© 1997 FIPA- Foundation for Intelligent Physical Agents

*Geneva, Switzerland*

**Notice**

Use of the technologies described in this specification may infringe patents, copyrights or other intellectual property rights of FIPA Members and non-members. Nothing in this specification should be construed as granting permission to use any of the technologies described. Anyone planning to make use of technology covered by the intellectual property rights of others should first obtain permission from the holder(s) of the rights. FIPA strongly encourages anyone implementing any part of this specification to determine first whether part(s) sought to be implemented are covered by the intellectual property of others, and, if so, to obtain appropriate licences or other permission from the holder(s) of such intellectual property prior to implementation. This FIPA 97 Specification is subject to change without notice. Neither FIPA nor any of its Members accept any responsibility whatsoever for damages or liability, direct or consequential, which may result from the use of this specification.

**Contents**

1 **Scope**..... 1

2 **Normative reference(s)**..... 1

3 **Term(s) and definition(s)** ..... 1

4 **Symbols (and abbreviated terms)** ..... 3

5 **Overview of Agent Software Integration**..... 5

6 **Normative Specification**..... 8

6.1 **Reference Model** ..... 8

6.2 **Agent Resource Broker service**..... 11

6.2.1 **FIPA-ARB Ontology** ..... 11

6.2.2 **Querying the ARB**..... 17

6.2.3 **Registering the ARB service with the DF** ..... 17

6.2.4 **Conformance** ..... 18

6.3 **Wrapper Service**..... 19

6.3.1 **FIPA-WRAPPER Ontology**..... 19

6.3.2 **Querying the WRAPPER** ..... 29

6.3.3 **Registering the WRAPPER service with the DF**..... 29

6.3.4 **Conformance** ..... 30

**Annex A (normative) EBNF Grammar for FIPA-ARB Ontology** ..... 31

**Annex B (normative) EBNF Grammar for FIPA-WRAPPER Ontology**..... 32

**Foreword**

The Foundation for Intelligent Physical Agents (FIPA) is a non-profit association registered in Geneva, Switzerland. FIPA's purpose is to promote the success of emerging agent-based applications, services and equipment. This goal is pursued by making available in a timely manner, internationally agreed specifications that maximise interoperability across agent-based applications, services and equipment. This is realised through the open international collaboration of member organisations, which are companies and universities active in the agent field. FIPA intends to make the results of its activities available to all interested parties and to contribute the results of its activities to appropriate formal standards bodies.

This specification has been developed through direct involvement of the FIPA membership. The 35 corporate members of FIPA (October 1997) represent 12 countries from all over the world

Membership in FIPA is open to any corporation and individual firm, partnership, governmental body or international organisation without restriction. By joining FIPA each Member declares himself individually and collectively committed to open competition in the development of agent-based applications, services and equipment. Associate Member status is usually chosen by those entities who do want to be members of FIPA without using the right to influence the precise content of the specifications through voting.

The Members are not restricted in any way from designing, developing, marketing and/or procuring agent-based applications, services and equipment. Members are not bound to implement or use specific agent-based standards, recommendations and FIPA specifications by virtue of their participation in FIPA.

This specification is published as FIPA 97 ver. 1.0 after two previous versions have been subject to public comments following disclosure on the WWW. It has undergone intense review by members as well non-members. FIPA is now starting a validation phase by encouraging its members to carry out field trials that are based on this specification. During 1998 FIPA will publish FIPA 97 ver. 2.0 that will incorporate whatever adaptations will be deemed necessary to take into account the results of field trials.

---

FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

**FIPA 97 Draft Specification**

**Part 4**

**Personal Travel Assistance**

© 1997 FIPA - Foundation for Intelligent Physical Agents

*Geneva, Switzerland*

This revision of FIPA '97 specification part 4 supersedes all previous documents.  
*The latest ratified version of this document and its peers may be found on the FIPA web site:*  
<http://drogo.cseft.stet.it/fipa>

**Notice**

Use of the technologies described in this specification may infringe patents, copyrights or other intellectual property rights of FIPA Members and non-members. Nothing in this specification should be construed as granting permission to use any of the technologies described. Anyone planning to make use of technology covered by the intellectual property rights of others should first obtain permission from the holder(s) of the rights. FIPA strongly encourages anyone implementing any part of this specification to determine first whether part(s) sought to be implemented are covered by the intellectual property of others, and, if so, to obtain appropriate licences or other permission from the holder(s) of such intellectual property prior to implementation. This FIPA '97 Specification is subject to change without notice. Neither FIPA nor any of its Members accept any responsibility whatsoever for damages or liability, direct or consequential, which may result from the use of this specification.

**Contents**

1	Scope.....	1
2	Normative references.....	1
3	Terms and definitions.....	2
4	Symbols (and abbreviated terms).....	2
5	General Analysis.....	3
5.1	Introduction.....	3
5.2	Problem Statements.....	5
5.3	Business Domain analysis.....	5
5.4	Actors and Roles.....	6
5.5	Overall Scenario.....	7
5.6	External Software Integration.....	7
5.7	Internal Software (Degrees and Types of Intelligence).....	8
5.8	Internal Capabilities.....	8
5.9	Human-Agent Interface.....	9
5.10	Agent Management.....	9
6	Architecture.....	10
6.1	Services Architecture and Protocols.....	10
6.2	Agent Definitions.....	10
6.2.1	Mini-PTA.....	11
6.2.2	Personal Travel Agent.....	11
6.2.3	Travel Broker.....	11
6.2.4	Tourist Office Broker.....	12
6.2.5	Flight Service Provider.....	12
6.2.6	Web Service Provider.....	12
6.3	Platform Profiles.....	13
6.3.2	Travel Broker Agent Platform.....	13
6.3.3	Agent „Hotel“ Platform (on-trip execution).....	13

6.3.4	Domain Structures.....	14
7	Ontology.....	15
7.1	Content.....	15
7.1.1	Trip Summary.....	16
7.1.2	Trip Details.....	18
7.1.3	Exception.....	19
7.2	Operations.....	20
7.3	Negotiation.....	20
7.4	Elaboration of User-profile.....	21
8	Study cases.....	21
8.1	Agent Domain Boot Process.....	21
8.2	Pre-trip planning.....	22
8.3	Elaboration of Pre-trip Planning.....	25
8.4	Last-minute Auction for Lower Fare.....	26
8.5	On-trip execution.....	27
8.6	Travel Plan Monitoring.....	29
9	Examples of Agent/Software Integration.....	29
9.1	Web-based fare wrapper.....	29
9.1.1	Registration of wrapper.....	30
9.1.2	Agent request for price.....	30
9.1.3	Notification of price change.....	30
9.1.4	Internal procedural attachment.....	30
9.2	BAYERNInfo service wrapper.....	31
9.2.1	Agent request for route.....	31
10	Future PTA Developments.....	31
10.1	"Migrating" Agent to Guide Travelling User.....	31
10.1.1	Mobility of the agent in a network: travel planning.....	31
10.1.2	Mobility of the traveller: travel monitoring.....	32
10.1.3	Mobility of the traveller: travel monitoring via UMTS.....	32
10.2	Inter-operation between Agents and Workflow.....	32
11	Informative References.....	32

**FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS**

**FIPA 97 Specification**

**Part 5**

**Personal Assistant**

10<sup>th</sup> October 1997

© 1997 FIPA - Foundation for Intelligent Physical Agents

*Geneva, Switzerland*

**Notice**

Use of the technologies described in this specification may infringe patents, copyrights or other intellectual property rights of FIPA Members and non-members. Nothing in this specification should be construed as granting permission to use any of the technologies described. Anyone planning to make use of technology covered by the intellectual property rights of others should first obtain permission from the holder(s) of the rights. FIPA strongly encourages anyone implementing any part of this specification to determine first whether part(s) sought to be implemented are covered by the intellectual property of others, and, if so, to obtain appropriate licences or other permission from the holder(s) of such intellectual property prior to implementation. This FIPA '97 Specification is subject to change without notice. Neither FIPA nor any of its Members accept any responsibility whatsoever for damages or liability, direct or consequential, which may result from the use of this specification.

**Contents**

1 **Scope**..... 1

2 **Conformance**..... 1

3 **Normative reference(s)**..... 1

4 **Term(s) and definition(s)**..... 1

5 **Symbols (and abbreviated terms)**..... 1

6 **Overview of the Personal Assistant Domain**..... 2

6.1 **Introduction** ..... 2

6.2 **Personal Assistant Reference Model**..... 2

6.2.1 **Directory Services**..... 4

6.2.2 **Meeting Scheduling Services**..... 4

6.2.3 **Information Management Services** ..... 4

6.2.4 **Travel Planning Service** ..... 5

6.3 **Personal Assistant FIPA'97 Application**..... 5

6.3.1 **Scenario** ..... 5

6.3.2 **System Architecture**..... 5

6.4 **FIPA technologies used** ..... 8

6.4.1 **Agent Management**..... 8

6.4.2 **Agent Communication Language** ..... 8

6.4.3 **Agent / Software Integration** ..... 9

6.4.4 **Personal Travel Assistance**..... 9

7 **Detailed Specification**..... 9

7.1 **Informal Description of PA Content Language**..... 9

7.2 **Concrete Syntax of PA Content Language**..... 10

7.3 **Interaction Protocols** ..... 11

7.3.1 **Negotiating Meeting Details (normative)**..... 11

7.3.2 **Scheduling a Meeting (informative)**..... 12

8 **Examples**..... 13

9 **References** ..... 13

# FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

---

## FIPA '97 Specification

### Part 6

## Audio/Video Entertainment and Broadcasting

---

© 1997 FIPA - Foundation for Intelligent Physical Agents

*Geneva, Switzerland*

#### Notice

Use of the technologies described in this specification may infringe patents, copyrights or other intellectual property rights of FIPA Members and non-members. Nothing in this specification should be construed as granting permission to use any of the technologies described. Anyone planning to make use of technology covered by the intellectual property rights of others should first obtain permission from the holder(s) of the rights. FIPA strongly encourages anyone implementing any part of this specification to determine first whether part(s) sought to be implemented are covered by the intellectual property of others, and, if so, to obtain appropriate licences or other permission from the holder(s) of such intellectual property prior to implementation. This FIPA '97 Specification is subject to change without notice. Neither FIPA nor any of its Members accept any responsibility whatsoever for damages or liability, direct or consequential, which may result from the use of this specification.

**Contents**

1 Scope ..... 6

2 Normative References ..... 6

3 Definitions ..... 6

4 Symbols and Abbreviations ..... 7

5 General Analysis ..... 8

5.1 A few Underlying Assumptions ..... 8

5.2 Required Functionalities and Capabilities ..... 8

5.3 Actors, Roles and Domains ..... 9

5.3.1 Agents ..... 9

5.3.2 Resources and handlers ..... 9

5.3.3 Domains ..... 9

5.4 Generic Model ..... 10

5.4.1 Detailed functions of agents ..... 10

5.4.2 Analysis of interactions: ..... 11

5.5 Scenarios ..... 14

5.5.1 Scenario 1 ..... 14

5.5.2 Scenario 2 ..... 15

5.5.3 Scenario 3 ..... 16

5.5.4 Scenario 4 ..... 16

6 Detailed Analysis ..... 16

6.1 User Profile ..... 16

6.2 Agent Definitions ..... 18

6.3 Ontology ..... 20

6.4 Interaction Protocol ..... 24

6.4.1 FIPA-AVEB-Request-Notification ..... 25

FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

## FIPA 97 Specification

### Part 7

# Network Management and Provisioning

© 1997 FIPA - Foundation for Intelligent Physical Agents

*Geneva, Switzerland*

#### **Notice**

Use of the technologies described in this specification may infringe patents, copyrights or other intellectual property rights of FIPA Members and non-members. Nothing in this specification should be construed as granting permission to use any of the technologies described. Anyone planning to make use of technology covered by the intellectual property rights of others should first obtain permission from the holder(s) of the rights. FIPA strongly encourages anyone implementing any part of this specification to determine first whether part(s) sought to be implemented are covered by the intellectual property of others, and, if so, to obtain appropriate licences or other permission from the holder(s) of such intellectual property prior to implementation. This FIPA 97 Specification is subject to change without notice. Neither FIPA nor any of its Members accept any responsibility whatsoever for damages or liability, direct or consequential, which may result from the use of this specification.

**Contents**

1 Foreword .....1

2 Introduction .....2

3 Scope.....5

4 Normative reference(s).....5

5 Term(s) and definition(s).....5

6 Symbols (and abbreviated terms) .....6

7 Overview .....7

7.1 Agent-based Dynamic VPN Provisioning .....7

7.2 Document Overview.....7

8 Functional Requirements .....9

8.1.1 (Initiating) User Requirements.....9

8.1.2 (Receiving) User requirements .....11

8.1.3 Service Provider Requirements .....11

8.1.4 Third Party (Network Operator) Requirements .....11

9 Advantages of Agent Technology .....12

9.1 Agents for Satisfying the Functional Requirements of Dynamic VPN Provisioning .....12

9.2 Satisfying the User Requirements.....13

9.3 Satisfying Receiving User Requirements .....13

9.4 Satisfying Provider Requirements .....13

9.5 Third Party Requirements .....14

10 Architecture .....14

10.1 Introduction .....14

10.2 Personal Communication Agent (PCA).....15

10.3 Service Provider Agent (SPA).....15

10.3.1 Functional Composition .....15

10.4 Network Provider Agent (NPA) .....16

10.5 Other Actors .....16

10.5.1 Local Agent Platform (LAP) .....16

10.5.2 Customer Care System (CCS).....17

10.5.3 Network Management System (NMS).....17

10.5.4 Certification Server .....17

10.6 System Requirements .....17

10.6.1 Requirements for all Agents (PCA, SPA, NPA).....17

10.6.2 Initiating PCA requirements.....18

10.6.3 Receiving PCA requirements.....19

10.6.4 Requirements for the SPA.....19

10.6.5 Requirements for the NPA .....20

11 Scenarios .....20

11.1 Overview .....20

11.2 Subscribe VPN scenario.....22

11.3 Negotiate VPN Requirements Scenario .....24

11.4 ENPA Negotiation Scenario .....26

11.5 Provision VPN Service Scenario .....27

11.6 Re-Configure VPN Scenario.....28

11.7 Manage VPN Service Scenario .....29

11.8 Unsubscribe VPN Scenario.....30

11.9 Generic negotiation Scenario .....31

11.10 Generic negotiation Scenario's .....31

11.10.1 Basic contract net protocol .....31

11.10.2 Iterated contract net protocol .....32

11.11 Overview of the User Interaction .....33

11.11.1 Setting Preferences .....34

11.11.2 Request Service .....34

11.11.3 Respond to Proposed Service.....34

12 High Level Information Model.....35

13 FIPA VPN Provisioning Ontology.....36

13.1 VPN Provisioning Grammar .....36

13.2 Network Management and Provisioning Actions .....38

13.2.1 setup-comm-service .....38

**13.2.2 get-additional-requirements.....39**

**13.2.3 cfps to spas .....40**

**13.2.4 establish-vpn-service .....41**

**13.2.5 update-vpn-service .....42**

**13.2.6 terminate-vpn-service.....43**

**13.2.7 setup-vpn-service .....43**

**13.2.8 cfps-to-npas.....44**

**13.2.9 establish-network-connection-service.....45**

**13.2.10 update-network-comm-service.....46**

**13.2.11 terminate-network-comm-service.....47**

**13.2.12 setup-vpn-links.....48**

**13.2.13 roll-back-network-service.....48**

**13.2.14 update-connection-service .....49**

**13.2.15 terminate-connection-service.....50**

**13.3 VPN Provisioning Objects.....51**

**13.3.1 fipa-vpn-service-description .....51**

**13.3.2 fipa-vpn-connection-service-description .....51**

**13.3.3 fipa-vpn-video-descriptor .....52**

**13.3.4 fipa-vpn-voice-descriptor .....52**

**13.3.5 fipa-vpn-data-descriptor.....52**

**13.3.6 fipa-vpn-videoconference-descriptor.....52**

**1 Foreword**

The Foundation for Intelligent Physical Agents (FIPA) is a non-profit association registered in Geneva, Switzerland. FIPA's purpose is to promote the success of emerging agent-based applications, services and equipment. This goal is pursued by making available in a timely manner, internationally agreed specifications that maximise interoperability across agent-based applications, services and equipment. This is realised through the open international collaboration of member organisations, which are companies and universities active in the agent field. FIPA intends to make the results of its activities available to all interested parties and to contribute the results of its activities to appropriate formal standards bodies.

This specification has been developed through direct involvement of the FIPA membership. The 35 corporate members of FIPA (October 1997) represent 12 countries from all over the world.

Membership in FIPA is open to any corporation and individual firm, partnership, governmental body or international organisation without restriction. By joining FIPA each Member declares himself individually and collectively committed to open competition in the development of agent-based applications, services and equipment. Associate Member status is usually chosen by those entities who do not want to be members of FIPA without using the right to influence the precise content of the specifications through voting.

The Members are not restricted in any way from designing, developing, marketing and/or procuring agent-based applications, services and equipment. Members are not bound to implement or use specific agent-based standards, recommendations and FIPA specifications by virtue of their participation in FIPA.

This specification is published as FIPA 97 ver. 1.0 after two previous versions have been subject to public comments following disclosure on the WWW. It has undergone intense review by members as well non-members. FIPA is now starting a validation phase by encouraging its members to carry out field trials that are based on this specification. During 1998 FIPA will publish FIPA 97 ver. 2.0 that will incorporate whatever adaptations will be deemed necessary to take into account the results of field trials.