FOUNDATION FOR INTELLIGENT PHYSICAL AGENTS

FIPA 97 Specification

Part 5

Personal Assistant

Obsolete

10th October 1997

© 1997 FIPA - Foundation for Intelligent Physical Agents

Geneva, Switzerland

—

Contents

51 **Foreword**

52 The Foundation for Intelligent Physical Agents (FIPA) is a non-profit association registered in Geneva, Switzerland. FIPA's
53 purpose is to promote the success of emerging agent-based applications, services and equipment. This goal is pursued by making
54 available in a timely manner, internationally agreed specifications that maximise interoperability across agent-based applications,
55 services and equipment. This is realised through the open international collaboration of member organisations, which are companies
56 and universities active in the agent field. FIPA intends to make the results of its activities available to all interested parties and to
57 contribute the results of its activities to appropriate formal standards bodies.
58 This specification has been developed through direct involvement of the FIPA membership. The 35 corporate members of FIPA
59 (October 1997) represent 12 countries from all over the world
60 Membership in FIPA is open to any corporation and individual firm, partnership, governmental body or international organisation
61 without restriction. By joining FIPA each Member declares himself individually and collectively committed to open competition in
62 the development of agent-based applications, services and equipment. Associate Member status is usually chosen by those entities
63 who do want to be members of FIPA without using the right to influence the precise content of the specifications through voting.
64 The Members are not restricted in any way from designing, developing, marketing and/or procuring agent-based applications,
65 services and equipment. Members are not bound to implement or use specific agent-based standards, recommendations and FIPA
66 specifications by virtue of their participation in FIPA.
67 This specification is published as FIPA 97 ver. 1.0 after two previous versions have been subject to public comments following
68 disclosure on the WWW. It has undergone intense review by members as well non-members. FIPA is now starting a validation
69 phase by encouraging its members to carry out field trials that are based on this specification. During 1998 FIPA will publish FIPA
70 97 ver. 2.0 that will incorporate whatever adaptations will be deemed necessary to take into account the results of field trials.

71   **Introduction**

72   This FIPA 97 specification is the first output of the Foundation for Intelligent Physical Agents. It provides specification of basic
73   agent technologies that can be integrated by agent systems developers to make complex systems with a high degree of
74   interoperability.
75   FIPA specifies the interfaces of the different components in the environment with which an agent can interact, i.e. humans, other
76   agents, non-agent software and the physical world. See figure below

77
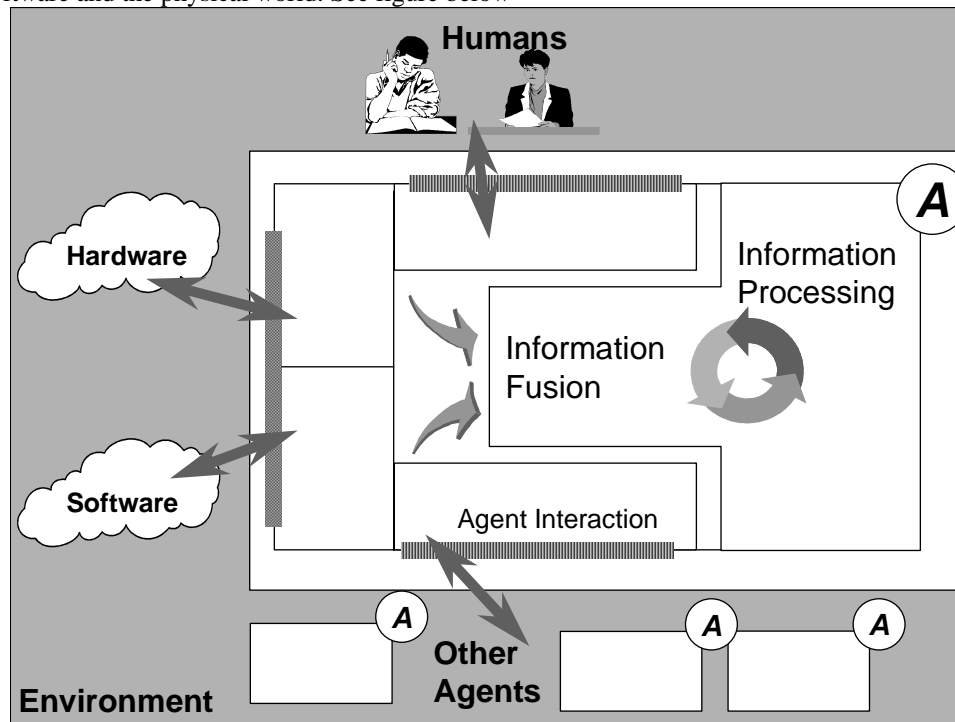
78   **Figure 1 — Outline View of Agent Interaction**
79   FIPA produces two kinds of specification
80   **normative** specifications that mandate the external behaviour of an agent and ensure interoperability with other FIPA-
81   specified subsystems;
82   **informative** specifications of applications for guidance to industry on the use of FIPA technologies.
83   The first set of specifications – called FIPA 97 – has seven parts:
84   three normative parts for basic agent technologies: agent management, agent communication language and agent/software
85   integration
86   four informative application descriptions that provide examples of how the normative items can be applied: personal travel
87   assistance, personal assistant, audio-visual entertainment and broadcasting and network management and provisioning.
88   Overall, the three FIPA 97 technologies allow:
89   the construction and management of an agent system composed of different agents, possibly built by different developers;
90   agents to communicate and interact with each other to achieve individual or common goals;
91   legacy software or new non-agent software systems to be used by agents.
92   A brief illustration of the FIPA 97 specification is given below
93   *Part 1 Agent Management*
94   This part of FIPA 97 provides a normative framework within which FIPA compliant agents can exist, operate and be managed.
95   It defines an agent platform reference model containing such capabilities as white and yellow pages, message routing and life-cycle
96   management. True to the FIPA approach, these capablities are themselves intelligent agents using formally sound communicative
97   acts based on special message sets. An appropriate ontology and content language allows agents to discover each other's
98   capabilities.

99 ***Part 2 Agent Communication Language***
100 The FIPA Agent Communication Language (ACL) is based on speech act theory: messages are actions, or *communicative acts*, as
101 they are intended to perform some action by virtue of being sent. The specification consists of a set of message types and the
102 description of their pragmatics, that is the effects on the mental attitudes of the sender and receiver agents. Every communicative
103 act is described with both a narrative form and a formal semantics based on modal logic.
104 The specifications include guidance to users who are already familiar with KQML in order to facilitate migration to the FIPA ACL.
105 The specification also provides the normative description of a set of high-level interaction protocols, including requesting an action,
106 contract net and several kinds of auctions etc.
107 ***Part 3 Agent/Software Integration***
108 This part applies to any other non-agentised software with which agents need to „connect". Such software includes legacy software,
109 conventional database systems, middleware for all manners of interaction including hardware drivers. Because in most significant
110 applications, non-agentised software may dominate software agents, part 3 provides important normative statements. It suggests
111 ways by which Agents may connect to software via „wrappers" including specifications of the wrapper ontology and the software
112 dynamic registration mechanism. For this purpose, an Agent Resource Broker (ARB) service is defined which allows advertisement
113 of non-agent services in the agent domain and management of their use by other agents, such as negotiation of parameters (e.g. cost
114 and priority), authentication and permission.
115 ***Part 4 - Personal Travel Assistance***
116 The travel industry involves many components such as content providers, brokers, and personalization services, typically from
117 many different companies. In applying agents to this industry, various implementations from various vendors must interoperate and
118 dynamically discover each other as different services come and go. Agents operating on behalf of their users can provide assistance
119 in the pre-trip planning phase, as well as during the on-trip execution phase. A system supporting these services is called a PTA
120 (Personal Travel Agent).
121 In order to accomplish this assistance, the PTA interacts with the user and with other agents, representing the available travel
122 services. The agent system is responsible for the configuration and delivery - at the right time, cost, Quality of Service, and
123 appropriate security and privacy measures - of trip planning and guidance services. It provides examples of agent technologies for
124 both the hard requirements of travel such as airline, hotel, and car arrangements as well as the soft added-value services according
125 to personal profiles, e.g. interests in sports, theatre, or other attractions and events.
126 ***Part 5 - Personal Assistant***

127 One central class of intelligent agents is that of a personal assistant (PA). It is a software agent that acts semi-autonomously for and
128 on behalf of a user, modelling the interests of the user and providing services to the user or other people and PAs as and when
129 required. These services include managing a user's diary, filtering and sorting e-mail, managing the user's activities, locating and
130 delivering (multimedia) information, and planning entertainment and travel. It is like a secretary, it accomplishes routine support
131 tasks to allow the user to concentrate on the real job, it is unobtrusive but ready when needed, rich in knowledge about user and
132 work. Some of the services may be provided by other agents (e.g. the PTA) or systems, the Personal Assistant acts as an interface
133 between the user and these systems.

134 In the FIPA'97 test application, a Personal Assistant offers the user a unified, intelligent interface to the management of his personal
135 meeting schedule. The PA is capable of setting up meetings with several participants, possibly involving travel for some of them. In
136 this way FIPA is opening up a road for adding interoperability and agent capabilities to the already established domain of Personal
137 Information Management.
138 ***Part 6 - Audio/Video Entertainment & Broadcasting***
139 An effective means of information filtering and retrieval, in particular for digital broadcasting networks, is of great importance
140 because the selection and/or storage of one's favourite choice from plenty of programs on offer can be very impractical. The
141 information should be provided in a customised manner, to better suit the user's personal preferences and the human interaction
142 with the system should be as simple and intuitive as possible. Key functionalities such as profiling, filtering, retrieving, and
143 interfacing can be made more effective and reliable by the use of agent technologies.
144 Overall, the application provides to the user an intelligent interface with new and improved functionalities for the negotiation,
145 filtering, and retrieval of audio-visual information. This set of functionalities can be achieved by collaboration between a user agent
146 and content/service provider agent.
147 ***Part 7 - Network management & provisioning***

148 Across the world, numerous service providers emerge that combine service elements from different network providers in order to
149 provide a single service to the end customer. The ultimate goal of all parties involved is to find the best deals available in terms of
150 Quality of Service and cost. Intelligent Agent technology is promising in the sense that it will facilitate automatic negotiation of
151 appropriate deals and configuration of services at different levels.
152 Part 7 of FIPA 1997 utilizes agent technology to provide dynamic Virtual Private Network (VPN) services where a user wants to
153 set up a multi-media connection with several other users.

154 The service is delivered to the end customer using co-operating and negotiating specialized agents. Three types of agents are used
155 that represent the interests of the different parties involved:
156   The Personal Communications Agent (PCA) that represents the interests of the human users.
157   The Service Provider Agent (SPA) that represents the interests of the Service Provider.
158   The Network Provider Agent (NPA) that represents the interests of the Network Provider.
159 The service is established by the initiating user who requests the service from its PCA. The PCA negotiates in with available SPAs
160 to obtain the best deal available. The SPA will in turn negotiate with the NPAs to obtain the optimal solution and to configure the
161 service at network level. Both SPA and NPA communicate with underlying service- and network management systems to configure
162 the underlying networks for the service.
163 One central class of intelligent agents is that of a personal assistant (PA). A personal assistant is a software agent that acts semi-
164 autonomously for and on behalf of a user, modelling the interests of the user and providing services to the user or other people and
165 PAs as and when required. These services include managing a user's diary, filtering and sorting e-mail, managing the user's
166 activities, locating and delivering (multimedia) information, and planning entertainment and travel. Some of the services may be
167 provided by other agents or systems, the Personal Assistant acts as an interface between the user and these systems.
168 In the FIPA'97 test application, a Personal Assistant offers the user a unified, intelligent interface to the management of his personal
169 meeting schedule. The PA is capable of setting up meetings with several participants, possibly involving travel for some of them.
170 This turns the PA into a multi-agent application, because the services of the PAs of these other users as well as of the Personal
171 Travel Assistant system will be needed.
172 The design of the PA application is based on a set of scenarios that represent an increasing level of co-operation needed between
173 the PAs of the users involved. In the simplest scenario, the initiator of the meeting specifies time and place, to which other users
174 (PA's) can conform or not. A more flexible scenario, however, involves negotiation about time, place, and possibly other aspects of
175 the proposed meeting (such as attendance).
176 These scenarios exercise the Agent Communication Language, as well as the Interaction Protocols adopted by FIPA. Also
177 Directory Facilitators, Agent Name Servers, inter-domain address resolution, and possibly one or more Agent Request Brokers to
178 interface with non-FIPA compliant software are used. The PA application uses at least one other FIPA test application, viz. the
179 Personal Travel Assistant.

180   **1 Scope**

181   This part of the FIPA 97 specification defines one of the four test applications that serves as an initial test of the technology-
182   oriented normative parts of the FIPA 97 specification (Parts 1,2, and 3).

183   **2 Conformance**

184   Methodologies for conformance of an implementation to this specification will be published in a later document.

185   **3 Normative reference(s)**

186   FIPA TC1:1997, *International standard for the inter-operation of software agents – Part 1: Agent Management.*
187   FIPA TC2:1997, *International standard for the inter-operation of software agents – Part 2: Agent Communication Language*
188   FIPA TC3:1997, *International standard for the inter-operation of software agents – Part 3: Agent/Software Integration*
189   ISO 8601:1988*, Data elements and interchange formats – Information interchange – Representation of dates and times*
190   ISO 8601:1991*, Technical Corrigendum 1, Data elements and interchange formats – Information interchange – Representation of*
191   *dates and times*
192   versit:1996, *vCalendar – The Electronic Calendar and Scheduling Exchange Format, Version 1.0,*(maintained by the Internet Mail
193   Consortium)

194   **4 Term(s) and definition(s)**

195   **User**
196   The human user of a *personal assistant*. Usually, there is one personal assistant to a user.
197   **User Interface Agent**
198   A software agent which translates services from a user interface (e.g. graphical or speech-based) into ACL.
199   **Personal Assistant (PA)**
200   A software agent dedicated to and acting on behalf of a *user*. There is usually one user to a personal assistant.
201   **Personal Travel Assistant (PTA)**
202   A software system providing assistance in planning and execution of trips.
203   **Travel Broker Agent (TBA)**
204   A software agent acting as the front-end to the PTA system, which handles travel queries.
205   **vCalendar**
206   The generic term for an electronic, virtual collection of calendaring and scheduling information that can be
207   transferred between computers, PDAs, or other electronic devices through telephone lines, or e-mail
208   networks, or infrared links. How, when, why, and where vCalendar are used depends on the applications
209   developed utilising a vCalendar.

210   **5 Symbols (and abbreviated terms)**

211   PA: *Personal Assistant*
212   PTA: *Personal Travel Assistance*
213   API: *Application Programming Interface*
214   UTC: *Universal Time Coordinated; also known as UCT, for Universal Coordinated Time*

215   **6 Overview of the Personal Assistant Domain**

216   **6.1 Introduction**

217   One central class of intelligent agents is that of a personal assistant (PA). A personal assistant is a software
218   agent that acts semi-autonomously for and on behalf of a user, modelling the interest of the user and
219   providing services to the user or other people/PAs as and when required.

220 A personal assistant is like a secretary, it accomplishes routine support tasks to allow the user to concentrate
221 on the real job, it is unobtrusive but ready when needed, rich in knowledge about user and work.
222 The notion of a personal assistant is very open-ended. There are many internal and external functions and
223 services that can and will be used to provide and extend a Personal Assistant's basic functionalities. In fact,
224 such openness to new services is a critical requirement where interoperability of PA's functions/services is
225 desirable. The use of agent technology to support the Personal Assistant helps in achieving this requirement.
226 Examples of such functions/services include:
227   managing a user's diaries (e.g., meeting scheduling)
228   filtering and sorting mails (e.g., electronic mails)
229   managing a user's desktop environment (e.g., file system)
230   managing a user's activities, plans and tasks (e.g., workflow)
231   locating and delivering (multimedia) information
232   recommending entertainment (e.g. movies, restaurants, theatres)
233   purchasing desired items
234   planning travel, etc.
235 Whereas this specification focuses on the generic requirements for the personal assistant application, other
236 FIPA application scenarios - especially Personal Travel Assistance (PTA) and Audio-Visual Entertainment
237 and Broadcasting - also include the notion of personal assistance for specific applications.
238 In particular, the PTA service is different from the Personal Assistant service in the following sense. PTA is
239 an integrated system which spans a particular market segment of the electronic marketplace. On the other
240 hand, the PA provides a user-oriented front-end to a wide variety of different services, one of which may be
241 the PTA travel service.
242 In this section, we first describe the general model of the Personal Assistant domain as adopted by FIPA, then
243 introduce the particular application, that of scheduling meetings, chosen for the FIPA'97 Personal Assistant
244 application. The next section will provide the detailed specification of the application. A field trial will verify
245 the applicability and feasibility of the specification with regard to the Personal Assistant domain; the details
246 and underlying assumptions of the PA field trial are provisionally described in [FIPA Document fipa7607].
247 **6.2 Personal Assistant Reference Model**

248 In general, a personal assistant comprises:
249   Intelligence and associated capabilities such as rationality (reasoning and planning) and
250   adaptability/learning.
251   Knowledge including facts, rules and adapted/learned knowledge for and about an end-user.
252   Interaction capabilities and facilities with the user, other agents and software/hardware
253   services/functions.
254   The services/functions and their procedures for the agent to work with them.
255 The scope of this composite is limited to the tasks which are given by the user as goals and preferences for
256 behaviour. Other agents will also exist and interact with the personal assistant, but such other agents will not
257 tend to represent particular user's preferences, or access authority and other differentiators. The composite is
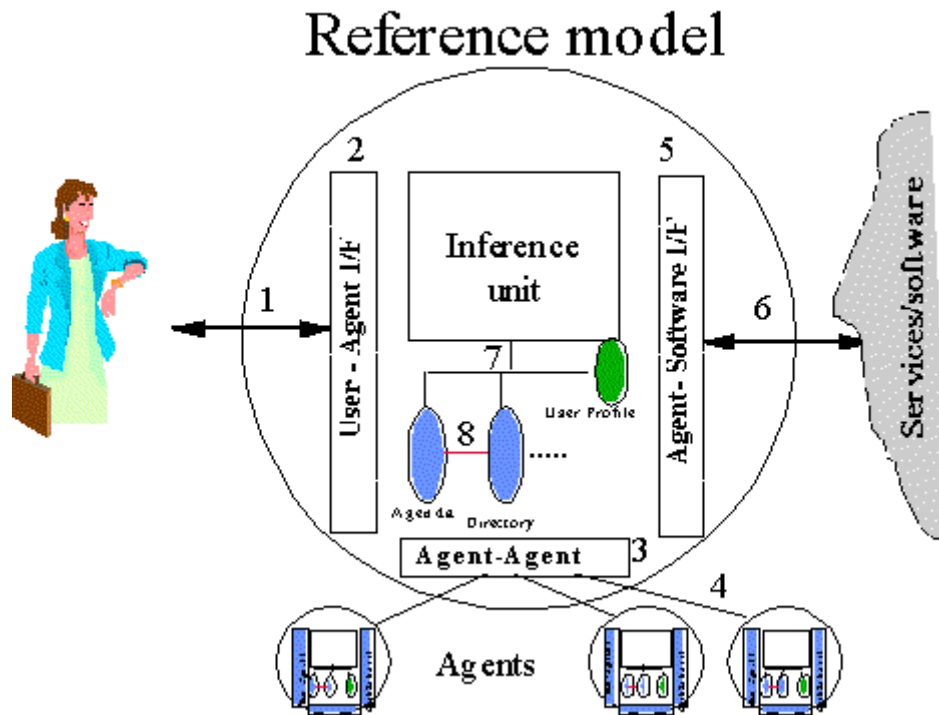258 visualised in the following reference model.

Figure 2 — Personal Assistant Reference Model

259
260 The reference model includes the following interfaces/protocols of interaction that are candidates for
261 standardisation.
262 1) User-Agent Dialogue
263 2) Multi-Modal User-Agent Interface
264 3) Agent-Agent Communication Interface
265 4) Protocols for Agent-Agent Interaction
266 5) Agent-Software Interfaces
267 6) Agent-Software Communication Protocols
268 7) Agent-Functions Interfaces
269 8) Function Interoperability Interfaces/mechanisms
270 Multi-modality is the ultimate goal for human-agent interfaces. As a user interacts with a real personal
271 assistant, he/she can speak face-to-face with the assistant or over the phone. Obviously, unconstrained natural
272 language comprehension is also desirable. However, as first steps toward this general goal, "multi-modal"
273 interaction is taken not as requirement for all agents to support all modalities, but merely that any single
274 application should be able to select the one or more modalities required for the application. The composition
275 of the personal assistant should be media-independent in order to allow for this choice, and otherwise provide
276 the multi-modal conversions required such as converting text to speech in order to pass information over the
277 phone.
278 In order to provide some concrete examples, the following scenarios serve to expose the basic PA's
279 functions/services needed.
280 **6.2.1 Directory Services**
281 One of the basic functions of a PA is the management of the user's directory. This directory includes other
282 people's/organisations' telephone numbers, addresses and personal and useful information about them. This
283 information facilitates responses the PA may provide to user's needs in an intelligent way, based on the
284 context of the request. For example, if the user asks to call an organisation and the PA by reference to the

285 opening and closing time notices that the call cannot be made, it will suggest alternative actions by inferring
286 the user's possible intentions on the basis of the services provided by the organisation. A request for a call to
287 a specific travel agency out of opening hours may result in the PA suggesting contacting a 24-hour call centre
288 of an airline company.

289 **6.2.2 Meeting Scheduling Services**

290 The personal assistant includes, obviously, a calendar facility, that among other things can be used for
291 scheduling of meetings, and negotiation with users and other agents. The functionality includes:

292   Identifying a mutually appropriate time for all participants to attend a meeting
293   Reserving an appropriate venue for the meeting
294   Organising associated facilities (e.g., lunch, OHP, etc.)
295   Issuing reminders to participants
296   Handling any problems which might arise at a later date
297   Cancelling meetings.

298 **6.2.3 Information Management Services**

299 This is a very large and nebulous set of tasks but also addresses one of the most critical needs for intelligent
300 personal assistants. Most professionals are now inundated with too many sources of information, generally
301 this is called "information overload". An agent can serve to semi-autonomously filter, sort, or otherwise
302 respond to all these sources to help off-load some of the more mundane tasks these professionals now must
303 do themselves. Such task include:

304   E-mail and news filtering (such as "junk" mail or news appends)
305   Sorting and prioritising all sorts of received information
306   Automatically responding or forwarding information to another user

307 A key aspect of such information management is not just filtering out the low priority information, but also
308 providing the timely delivery of high priority items - anywhere, anytime, anyhow. Such delivery is dependent
309 on the user's location, media/equipment limitations, and user preferences. For instance, an agent can be
310 instructed to deliver important e-mail to an end-user even if the user only has a mobile phone by converting
311 the text to speech. Of course, this same text-to-speech delivery of e-mail over a mobile phone can be applied
312 to any text-based information source such as NNTP news, stock quotes, etc. Furthermore, given the cost of
313 mobile phone connectivity, other technologies such as text summarisation can be employed, for most
314 efficient delivery, to save the users time and cost. The provision of such summarisation and media to media
315 transformation could be provided, for example, via external services.

316 Even under the most constrained situations, such as the user only having a pager, a personal assistant can at
317 least notify the user about the existence and accessibility of an important new multimedia document. Even
318 though the pager device cannot deliver the information, the personal assistant can notify the user of the
319 appropriate equipment in the locality of the user that is available where the multimedia document
320 could/would be sent to.

321 A less well-developed but equally important aspect of information management is the personal storage and
322 retrieval of information. Even personal computer storage is becoming difficult to manage. Files are often
323 duplicated, directory structures are haphazard, and the file systems themselves does not provide rich indexing
324 and content search facilities. Here, a personal assistant can be asked to file and retrieve documents or even
325 isolated bits of information, much like a personal secretary manages paper-based documents in the office.

326 As an example of an external service which can be accessed by a PA, we briefly mention travel planning.

327 **6.2.4 Travel Planning Service**

328 A personal assistant can assist in planning the user's trip by interacting with the user, other agents and
329 external directory services (such as yellow pages) and providing an appropriate plan of an intended trip and
330 other guidance services. See the description of the FIPA'97 Personal Travel Assistance application for more
331 details. In particular, the PA may assume much of the functionality of the Personal Travel Assistant agent.

332 **6.3 Personal Assistant FIPA'97 Application**

333 **6.3.1 Scenario**
334 The chosen scenario is that of arranging meetings among several participants, located across companies and
335 using different calendar management systems. This has been chosen for several reasons:
336 The scenario is instantly applicable to real-life
337 Current solutions are unwieldy and proprietary, making integration across networks and other services
338 difficult
339 The scenario can be easily extended to incorporate further services
340 This class of application has been widely studied, with many agent-based approaches (cf. [Kozieriok &
341 Maes, 1993])
342 The scenario lends itself well to agent technology, due to the need for
343 User profiling
344 Integration of heterogeneous software
345 Action on a user's behalf (semi-autonomy)
346 Local control (in particular, of the user's calendar)
347 The selected service is an integration of meeting scheduling and travel assistance. The user asks the agent to
348 set up a meeting with several participants. Because the meeting may involve travelling for some of the
349 participants, travel planning forms part of the meeting scheduling.
350 **6.3.2 System Architecture**
351 In this test application, the Personal Assistant provides a single unified interface to the user, and is
352 represented as a single agent, even though it may actually be composed of several agents.
353 Each user is represented by a Personal Assistant. These PA's negotiate with each other to find an adequate
354 meeting place and time. They interact with Travel Broker Agents (TBAs) to find out about travel schedules
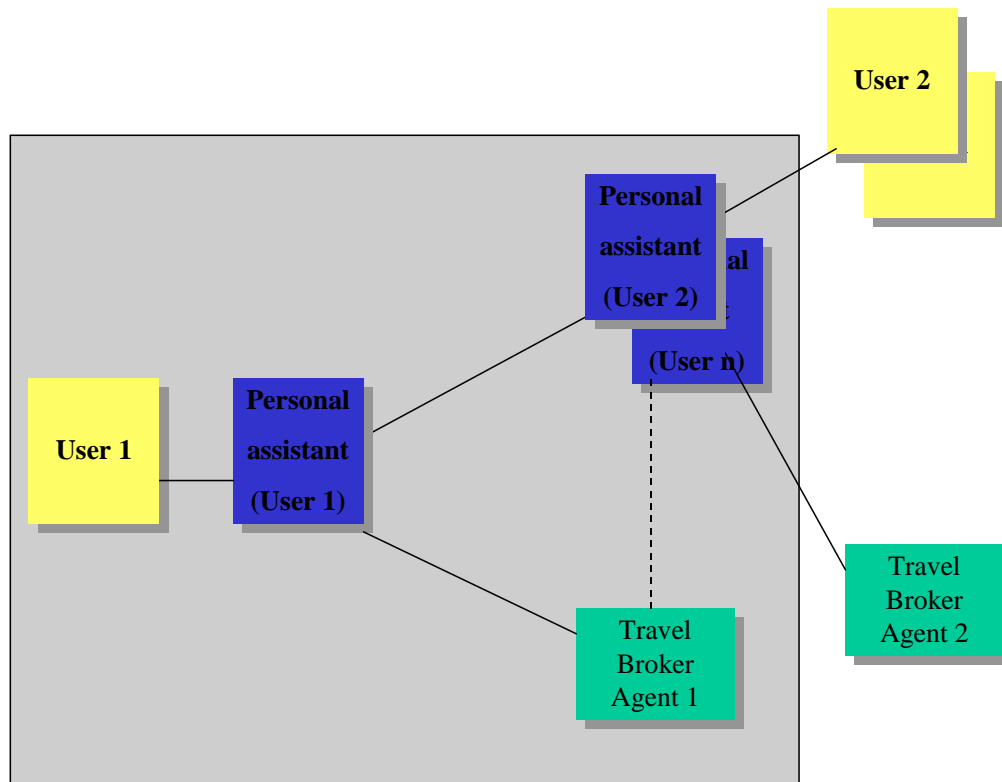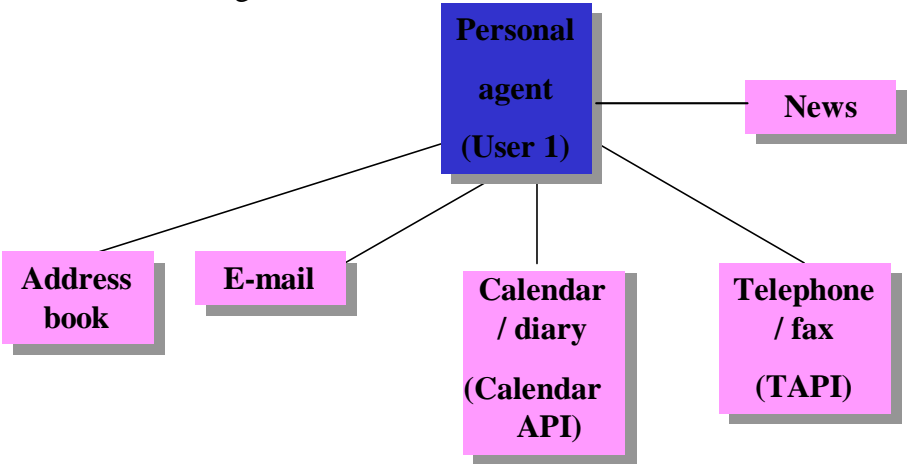355 etc.

356

357 **Figure 3 — Agent Interactions in Personal Assistant Application Scenario**

358 The PA may make use of several existing programs to perform its tasks. A possible set of relevant software
359 for this test application is shown in Figure 3.

Figure 4 — Integration of External Software

360

361 **Figure 4 — Integration of External Software**
362 The relationships between the PA and the Agent Management functions is shown in Figure 4.
363

Figure 5 — Interaction with Agent Management Entities

364
365
366

367
368
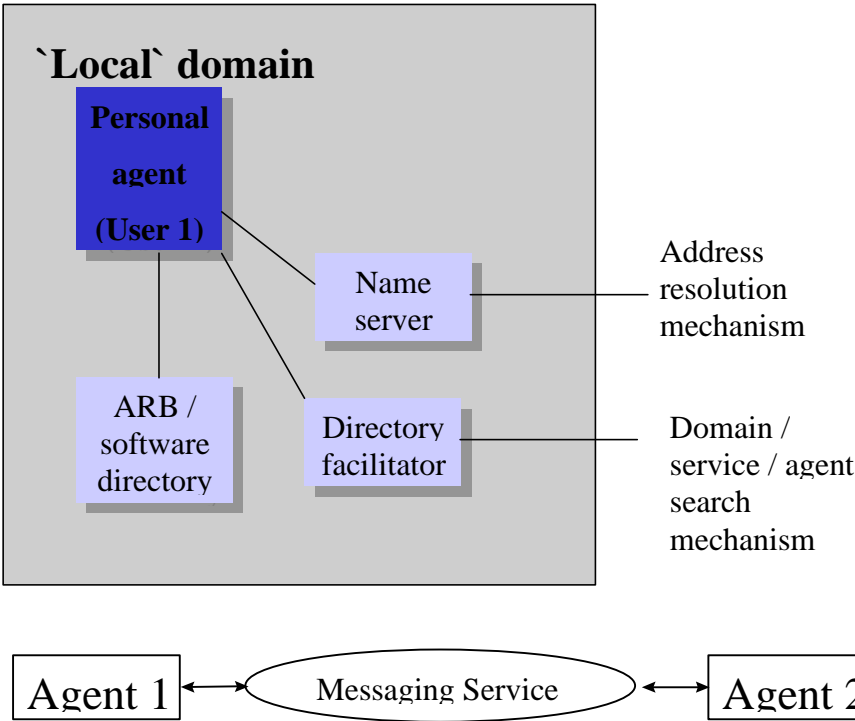
369 **Figure 5 — Interaction with Agent Management Entities**
370 FIPA technical committee TC5 is defining a set of scenarios based on one particular aspect of the Personal
371 Assisant (PA) role, that of arranging appointments for activities, such as meetings, which involve a number
372 of participants. The PAs of the participants must cooperate to ensure that the meeting is arranged for a time
373 and place which is mutually acceptable to all their users. The PAs may also consult agents offering travel
374 broking services as defined by TC4.
375 Basic scenario: User 1 is chairman of a committee, and asks his PA to arrange a committee meeting.
376 Subscenario 1: User 1 suggests a specific time, duration and location for the meeting. The simplest case is
377 that all participants are required to attend the meeting.

378 Subscenario 2: User 1 suggests a range of possible times to start the meeting. The duration and location of the
379 meeting remain specific.
380 Subscenario 3: User 1 suggests a range of possible times to start the meeting as well as a set of locations at
381 which the meeting can take place.
382 In the scenarios, only those participants which have personal assistants will be considered in the agent-based
383 negotiation of the meeting. Other possible interfaces (directly between personal agent and another human)
384 will not be required.
385 It is up to the individual PA application to associate personal assistants with their users. I.e. if the initiator enters a list of
386 participants to the meeting, the initiator's agent needs to be able to communicate with the personal assistants of the participants.
387 The above subscenarios are in order of increasing sophistication and difficulty of implementation. Further
388 scenarios, which are not directly under consideration in this specification, could be achieved by allowing
389 negotiation about the duration and actual participants in the meeting.
390 A field trial prototype should demonstrate cooperative meeting arrangement involving several PAs. It should
391 implement at least the functionality required by the simplest subscenario, and preferably more. One or more
392 of the PAs should make use of travel planning services provided by a PTA field trial system. It is preferable
393 that interoperability of at least two independently-designed and implemented types of PA be demonstrated.
394 The agents in the system must communicate using an agent communication language compliant with the
395 FIPA specification. The messages must be delivered using an implementation of a FIPA message service.
396 The system must be supported by at least one Directory Facilitator (DF, yellow pages) and Agent Name
397 Server (ANS, white pages). However, it is preferable that more than one domain is involved and hence more
398 than one DF and ANS and that inter-domain address resolution, message routing and 'yellow pages' searching
399 be demonstrated.
400 Certainly further scenarios in the area of personal assistance may be defined and developed.
401 **6.4 FIPA technologies used**

402 Because the test application is primarily meant to provide an evaluation and validation of the normative parts
403 of the FIPA specification, it is here elaborated which parts of the specification are actually used within this
404 application.
405 **6.4.1 Agent Management**
406 This application makes use of the Directory Facilitator as specified in Part 1 and, as such, requires agents to
407 register with the DF according to the mandatory specification given in Part 1 Section 9.2.5 register-agent and
408 9.2.6 deregister-agent Furthermore, the following optional attributes are also to be used in the Personal
409 Assistant application:
410   search(Section 9.2.2)
411 The particular ontology used and specific representation of these attributes will be defined in the field trial.
412 **6.4.2 Agent Communication Language**
413 This application makes use of the ACL as specified in Part 2 and, as such, requires agents to communicate
414 with each other according to the ACL specification. In particular, the following communicative acts are used
415 in this application:
416   cfp, accept-proposal, reject-proposal,not-understood,propose,refuse,inform,failure,perform
417 Furthermore the FIPA-Contract-Net and FIPA-Request interaction protocols are used, thus, personal
418 assistants conforming to this specification must be capable of handling these protocols.
419 **6.4.2.1 Human-Agent Interaction (*informative*)**
420 Although the FIPA 97 specification does not specifically address the issues of Human-Agent Interaction, we
421 support the position that humans may be viewed as agents in their own right, and that their interaction
422 between software or physical agents may also be accomplished using ACL. Since humans do not speak ACL
423 directly, some sort of translation service from a user-friendly interface (e.g. graphical or speech-based) into
424 ACL is required (cf. Figure 6). This may be accomplished by supplying a special *User Interface Agent*. It is

425 recommended, but not necessary, that a particular PA implementation provide such an ACL-based interface
426 to the user. In particular, experience gained from this approach will benefit future standardisation efforts in
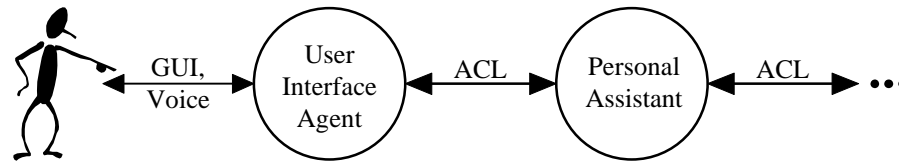427 this area.

428

429 **Figure 6 — Agent-Human Interaction via User Interface Agent**
430 **6.4.2.2 Contents of Interactions**
431 Thus, the following communicative acts between users and their personal assistants could be used:
432 a) U -> PA : give task to arrange meeting (including reporting requirements)
433 b) PA -> U: progress status of task, at least success or failure (with reasons)
434 c) U -> PA: permission to commit to meeting
435 d) PA->U: request for permission to commit
436 e) PA -> U: inform commitment made
437 f) U -> PA: degree of delegation authority
438 **6.4.3 Agent / Software Integration**
439 As a user's calendar is private to the user and his Personal Assistant, the software wrapping technology
440 specified in Part 3 is not currently used in this application. However, a Personal Assistant may access the
441 following existing software directly via the appropriate interfaces:
442   diary or calendar management system: requirements should be identified, they will probably be met by a
443   Calendar API
444   address book: basic general-purpose database
445   e-mail / fax:
446   PA can send messages to another user who has no PA
447   PA might be able to interpret structured e-mail messages
448   TAPI (for communicating via telephone with the user)
449 **6.4.4 Personal Travel Assistance**
450 Participants in a meeting may be required to travel to the location of the meeting, in which case the PA may
451 access a PTA system as specified in Part 4 to arrange a travel plan.

452 **7 Detailed Specification**

453 This section presents the detailed specification of the FIPA'97 Personal Assistant application scenario.
454 **7.1 Informal Description of PA Content Language**

455 The primary object in the PA Application is the action `PA-Meet`. This action is something a human
456 participant in a meeting must carry out, and is thus, the primary subject of negotiation among the humans'
457 Personal Assistants. As there is no standard ontology of actions or objects we must confine the specification
458 to the minimal requirements of PA.
459 It is suggested that a PA implement the `PA-Schedule` action, which takes a meeing as its argument. A PA
460 can be ordered to perform this action by the user via the user interface agent. The action in turn may triggers
461 the `FIPA-ContractNet` interaction protocol, as applied to the special action `PA-Participate`, which,
462 conceptually, is performed by the participants of the meeting.
463 It has been decided to adopt the vCalendar format is to be used for the representation of meeting objects. The
464 resultant confirmed meetings which have been confirmed after negotiation among the personal assistants will
465 be represented entirely conformant to Version 1.0 specification, in order to enable straight-forward

466 integration with systems using vCalendar. In particular, the following mandatory parameters of vCalendar are
467 supported by the PA application as follows:
468 `VERSION: 1.0`
469 `CATEGORIES:` - implementation specific, can be
470   specified by human initiator,
471   X-FIPA-Test for meetings which are not actually supposed to occur (e.g. for testing and demo purposes)
472   given a default value (e.g. `X-FIPA-Meeting`) by the PA
473 `DESCRIPTION:` - implementation specific, can be
474   specified by human initiator,
475   given a default value (e.g. `X-FIPA-Meeting`) by the PA
476 `SUMMARY:` - implementation specific, can be
477   specified by human initiator,
478   given a default value (e.g. `X-FIPA-Meeting`) by the PA
479 `PRIORITY:` - implementation specific, can be
480   specified by human initiator,
481   given a default value (e.g. 0) by the PA
482 Also, the following optional parameters of vCalendar are required for the PA application:
483 `ATTENDEE;ROLE=ORGANIZER:John Doe` for human initiator who is attending
484 `ATTENDEE:John Doe` for other participants
485 `SEQUENCE:` initially 0, incremented upon confirmation
486 `UID:` - implementation specific, globally unique identifier
487 `STATUS: CONFIRMED` (when the meeting has been confirmed accept-proposal)
488
489 The following optional parameters of vCalendar are also optional for the PA application:
490 `LOCATION:` PTA-compliant location designator. If location is given, the PA must/may be able to schedule the required
491 trip to the location.
492
493 The following extensions to vCalendar are required for PA:
494 `X-FIPA-ORGANIZER:` for human initiator (whether attending or not)
495
496 It is, however, necessary to slightly modify Version 1.0 of the vCalendar specification for representing
497 meetings under ongoing negotiation. The modifications are as follows:
498 `DTEND:` - UTC (if specified by human initiator) *or* `X-FIPA-`UnderNegotiation (if meeting start/end times are to be
499 negotiated)
500 `DTSTART:` - UTC (if specified by human initiator) *or* `X-FIPA-UnderNegotiation` (if meeting start/end times are to
501 be negotiated)
502 `STATUS: UNDER NEGOTIATION` (in cfp) or `CONFIRMED` (in accept-proposal)
503
504 **7.2 Concrete Syntax of PA Content Language**

505 The primary requirement of the content language is the representation of meetings, trips and the actions of
506 scheduling the meeting (as carried out by the initiator's PA) and the action of participating in the meeting (as
507 carried out by the human participants). Due to its simplicity, standard s-expression syntax is chosen.
508 This section describes the concrete syntax of the content language for the PA application (TC5).
509 The syntax is expressed in standard EBNF format as summarised in [FIPA Document fipa7612.doc].
510 Expressions in the content language appear in the ACL message format syntax as value expressions of the
511 ":`content`" parameter in the ACL message syntax, specifically as in:
512 `:content "(" PA-content-message Proposition ")" .`
513
514 The concrete syntax below further specifies the non-terminals `PA-content-message` and `Proposition` .

```
515   PA-content-message     =       "(" PA-Action ")".
516   PA-Action              =       PA-Meet | PA-Travel | PA-Schedule .
517   PA-Meet                =       "(PA-Meet" ObjectId PA-Meeting Result Status Agent
518                                  StartTime Duration Deadline ")" .
519   PA-Travel              =       "(PA-Travel" ObjectId PA-Trip Status Agent StartTime
520                                  Duration Deadline ")" .
521   PA-Schedule            =       "(PA-Schedule" ObjectId PA-Object Result Status Agent
522                                  StartTime Duration Deadline ")" .
523   PA-Object              =       PA-Meeting | PA-Trip .
524   PA-Meeting             =       "(PA-Meeting" ObjectId Initiator vCalendarObject Protocol
525                                  ")" .
526   TimeInterval           =       Time | "[" Time "," Time "]" .
527   TimeIntervals          =       "[" TimeInterval + "]" .
528   TimeIntervalTest       =       "InTimeInterval(" ObjectId".DTSTART , " TimeIntervals ")
529                                  AND" ObjectId".DTEND = " ObjectId".DTSTART + "
530                                  Number .
531   ObjectId               =       String | ObjectId"."String .
532   Protocol               =       ":protocol" String .
533   Proposition            =       "true" | "false" | TimeIntervalTest | ObjectId".LOCATION"|
534                                  "(" Proposition ")"
535                                  "(eq" Term Term ")" |
536                                  "(and" Proposition Proposition ")" |
537                                  "(or" Proposition Proposition ")" .
538   Term                   =       NumericalExpression | Time | String.
539   Reason                 =       Proposition .
540   NumericalExpression    =       Number | "(" NumericalExpression ")" |
541                                  "(+" NumericalExpression     NumericalExpression ")" |
542                                  "(-" NumericalExpression     NumericalExpression ")" |
543                                  "(*" NumericalExpression
544                                     NumericalExpression ")"  |
545                                  "(/" NumericalExpression
546                                     NumericalExpression ")" .
547   vCalendarObject        =       ":vCalendarObject" CalendarItem .
548   CalendarItem           =       <Specification of vCalendar objects as in the vCalendar
549                                  1.0 specification by the IMC and as discussed in Section
550                                  7.1> .
551   AgentReference         =       <Universal Agent Locator as specified in FIPA 97
552                                  Specification Part 1]> .
553   Time                   =       <ISO8601-Time; UTC-Format e.g. 19971010T123000Z> .
554   String                 =       <As specified in FIPA 97 Specification Part 2> .
555   Number                 =       <As specified in FIPA 97 Specification Part 2> .
```

556   **7.3 Interaction Protocols**

557   The interaction protocols to be used for scheduling meetings are described in this section. On a normative
558   basis, are the protocols used between personal assistants to determine the times and locations of the meetings.
559   On an informative basis are the protocols which may be used between the users and their personal assistants
560   for triggering the meeting scheduling process and confirming the meeting.

561   **7.3.1 Negotiating Meeting Details (normative)**

562   The FIPA-ContractNet interaction protocol is used for negotiation of meetings (more accurately,
563   negotiation about the action of participating in the meetings) among the personal assistants. Whereas the
564   intent of the original contract net protocol [cf. Davis&Smith] is to select the best bid(s) of a set of submitted
565   bids, here the accept-proposal message is used only if all bids (i.e. time frames to attend the meeting) have a
566   time frame in common. This is the timeframe that is chosen. As the bids of a contract net imply firm
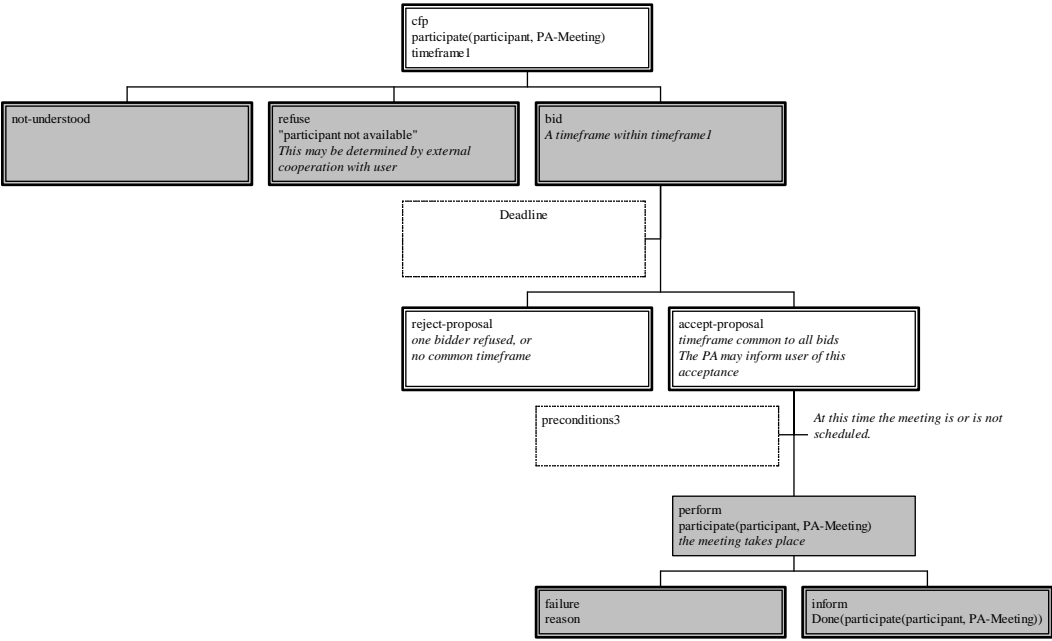567   commitment, the PAs need to check with their users the initiator agent.

568

Figure 7 — FIPA-ContractNet (applied to meeting negotiation)

7.3.2 Scheduling a Meeting (informative)

If the interaction between the user and his/her PA is also modelled using ACL, an `Order` protocol can be
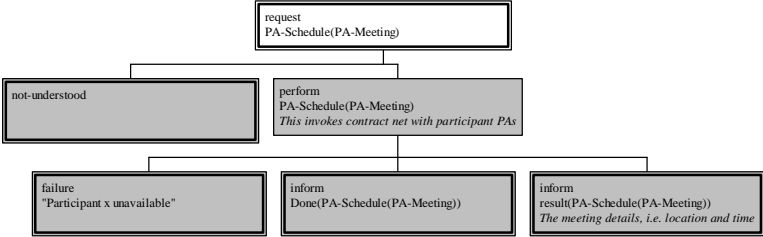used in order to initiate negotiation of a meeting:

573

Figure 8 — PA-Order (applied to meeting scheduling)

7.3.3   Confirmation with User (informative)

If the interaction between the user and his/her PA is also modelled using ACL, the `FIPA-RequestWhen` protocol can be used
by the PA to confirm the availability of the user at a suggested meeting time.
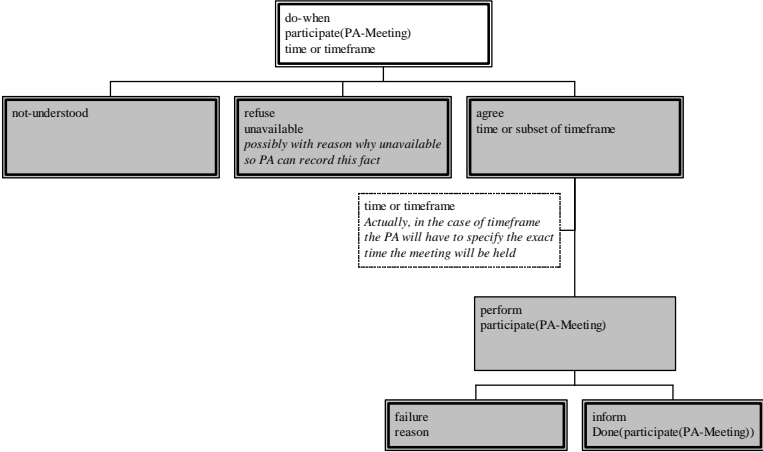

578

Figure 9 — FIPA-RequestWhen (applied to meeting scheduling)

580

581 **8 Examples**

582 We give here a concrete example. Suppose John Doe wants to schedule an hour long meeting with some
583 colleagues during some time on a given day. Then John Doe's personal assistant will send the following
584 message to the personal agents of the desired participants:

```
585  (cfp
586     :sender UA-Donald
587     :receiver UA-Wiet
588     :content ((PA-Meet
589                   :ObjectID WietMeet123
590                   :Agent Hans Mustermann
591                   :PA-Meeting (BEGIN:VCALENDAR
592  VERSION: 1.0
593  BEGIN:VEVENT
594  UID: 123
595  SUMMARY: FIPA Demo
596  ATTENDEE:Hans Mustermann
597  ATTENDEE;ROLE=ORGANIZER:John Doe
598  LOCATION:Siemens MchP 53.512
599  CATEGORIES: X-FIPA-Test
600  DESCRIPTION: This is just a test meeting. Please do
601       not attempt to attend it.
602  SEQUENCE: 0
603  PRIORITY: 0
604  DTSTART: X-FIPA-UnderNegotiation
605  DTEND: X-FIPA-UnderNegotiation
606  STATUS: UNDER NEGOTIATION
607  X-FIPA-ORGANIZER: John Doe
608  END:VEVENT
609  END:VCALENDAR
610                                  )
611                )
612              (InTimeIntervals(WietMeet123.PA-Meeting.DTSTART,[[1200,1800]])
613  DTEND = DTSTART + 60 )
614              )
615     :ontology FIPA-PA
616     :conversation-id UA-Donald345
617     :protocol FIPA-ContractNet
618     :reply-with Response123
619     :reply-by 101097T1300
620  )
```

621 **9 References**

622 [Kozieriok & Maes, 1993] R. Kozieriok, P. Maes: A learning interface agent for scheduling meetings, in:
623 International Workshop on Intelligent User Interfaces, Orlando, Fl., ACM-SIGCHI, ACM Press, 1993.