# Inform!

The Newsletter of the Foundation for Intelligent Physical Agents

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## Helsinki Meeting Report

The 26th FIPA meeting was held in Helsinki, Finland, July 22nd to 26th, hosted by Sonera. It was an active meeting, although not as well attended as previous meetings, which was partly due to the difficult economic climate in the high-tech industry.

A major decision that affects the structure of future meetings was made - to reduce the number of meetings from four to three meetings a year; and to reduce the length of each meeting. It is hoped that this will significantly reduce the cost of participation in FIPA -- a matter that has materially affected many in the current economic climate.

The expected schedule of meetings will be January (three days), May (three days) and October (four days): the extra day taking into account the Annual General Meeting. This will take effect from 2003.

The main technical activities current in FIPA are the X2S effort to promote a suite of currently experimental specifications to standard status; the semantics effort to construct a better framework to account for the genuine needs of semantically grounded interoperation; the Ontology effort of relating the needs of agent systems and ontologies; ad hoc networks of agents meeting spontaneously (perhaps over coffee?) and web services.

TC X2S is making substantial progress on closing a number of issues with many of the experimental specifications. The focus during the Helsinki meeting was on the Interaction Protocols, some of the trickier performatives (such as CANCEL) and on management. It is hoped that this will culminate in success during the next FIPA meeting in Pensacola, Florida.

TC Semantics concentrated on scoping the semantic framework itself. We had very useful input from Prof. Andrew Jones and Jeremy Pitt. A white paper will be worked on that combines some of the requirements input, logical foundations and technologies to construct a coherent picture. The aim is to account for the requirements of systems interoperating across ownership and trust boundaries although security per se is not part of the semantics framework, a

*(Continued on Page 4)*

**Inside this issue:**



**Special Announcement**

The FIPA Abstract Architecture is being translated into Japanese by the Japanese Standards Association (JSA).

The FIPA membership will be voting for two new directors to the board at the General Assembly at the 27th FPA meeting in Pensacola.

**News in Brief**

The 27th FIPA Meeting will be held in Pensacola, Florida, from October 14—19. See http://www.fipa.org/activities/meetings.htm for more details.

FIPA is interested in receiving notification of any FIPA related papers being published so they can be maintained on the FIPA webpage as a service to the FIPA community. Papers of interest include those specifically about the work of FIPA, as well as more generally those that discuss aspects of multi-agent systems that are related to FIPA's work. If you have an article, paper or technical report you would like to add to this site please go to http://www.fipa.org/resources/documents.html

## Helsinki Workshop

The workshop held at the 26th FIPA meeting in Helsinki had five interesting talks, which addressed FIPA and its technology from different viewpoints.

**Professor Rune Gustavsson** from Blekinge Institute of Technology, Sweden opened the workshop with his talk about the **CRISP project**, which topic is distributed intelligence in critical infrastructures. The project aims to investigate, develop, and test how latest advanced intelligence by ICT technologies can be exploited in a novel way for cost-effective, fine-grained and reliable monitoring, management, and control of power networks. Rune Gustavsson started by setting the scene of dependable systems. He discussed security issues and presented results of the CONDENS project. Then he discussed trustworthy systems. A proposal is to have two frameworks: 1) Information protection framework, which is a combination of two models: to protect confidentiality and to protect information integrity and support auditing. 2) Policy based process model of security, which combines time dependence of protection, detection, and response. Rune Gustavsson continued his presentation by talking about sustainable systems and smart distributed systems. He concluded his talk by introducing the SOLACE and GateSpace platform, which is a distributed service platform. For further information, please, contact Prof. Rune Gustavsson [rgu@bth.se].

**Pekka Ala-Siuru** from VTT Technical Research Centre of Finland started a short introduction to Finnish FIPA related activities. VTT's vision is to develop a comprehensive service platform based on an agent technology. The service platform is a development kit for building intelligent applications for the Internet and mobile services. Pekka Ala-Siuru presented the first outcome of the vision: **GENIE – an agent architecture for ubiquitous servants**. VTT has designed GENIE architecture and implemented it. GENIE architecture is illustrated in Figure 1.

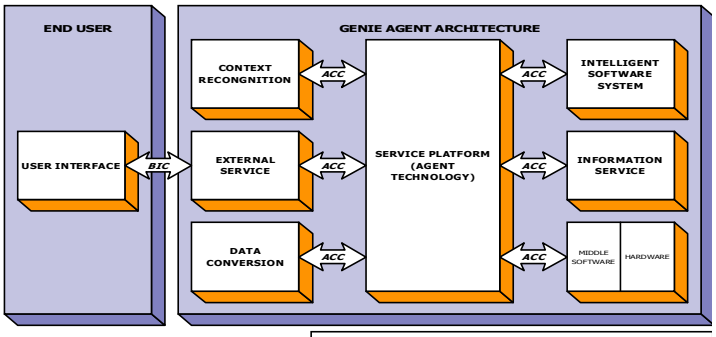


Figure 1: GENIE Architecture

The main modules are service platform, intelligent software system, context recognition, information service, data conversion, external service, and web-based graphical user interface. The modules use FIPA-ACL agent communication language in their collaboration. GENIE forms a platform to implement various intelligent applications, such as an intelligent personalization system, which VTT is currently developing. VTT continues developing GENIE by constructing an ADK toolkit and adding support for RDF and

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DAML/OIL. For further information, please, see http://www.iie.fi/genie/ .

**Kari Koivuniemi and Olli Ström** from Minutor Ltd continued presenting Finnish FIPA related activities. Minutor Ltd is a start-up company, located in Tampere, Finland. The company has a strong belief in FIPA software agent technology. Minutor Ltd uses agent technology in the field of knowledge management and business processes and is **implementing a FIPA-compliant—based on FIPA Abstract Architecture—agent platform**, which is called AgentDock. AgentDock is pure Java implementation and complies with J2EE-architecture. An overview of AgentDock is illustrated in Figure 2. System software layer comprises Web Server, RMI / JVM, J2EE Server, and Persistent Data Storage. EJB layer includes AMS and DF.

Application layer comprises DeveloperServer, AgentHost, and SystemAgent. AgentDock platform is already connected to Agentcities network. Future activities comprise IIOP transport, FIPA interoperability testing, and developing support for adhoc systems. For further information, go to http://www.minutor.fi.

**Steve Willmott** from EPFL gave a **status report of Agentcities activities**. Current activities consist of a significant number of research projects and around 100 organizations are directly or indirectly involved. Agentcities.RTD http://www.agentcities.org/EURTD creates the basis for the Agentcities network. There are three layers of activity (from bottom to top): network, service composition, and semantic interoperability. Agentcities.NET http://www.agentcities.org/EUNET funds Agentcities deployment and usage in Europe. The action comprises, among other things, technical support, competition, information days, and working group support. Currently, there are many platforms deployed (about 50), and their number is steadily growing. The

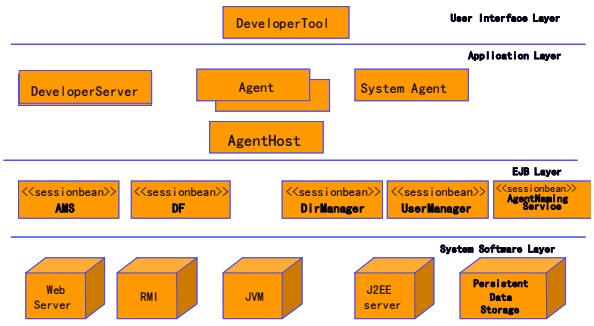


Figure 2: AgentDock Architecture

'market study' about the platforms shows that JADE is the dominant platform with 24 installations, and FIPA-OS and BlueJade/CoolAgent are next with 4 installations. Service interoperability tests were also done, but service composition is still on the horizon. The list of Agentcities.RTD services is significant, and the services deal with restaurant review, restaurant finder, theatre recommender, auction house, payment service, security service, among other things. The major challenges with services are related to ontology usage and semantic stack. Agentcities has already provided FIPA with a lot of useful input to FIPA specifications. Next activities include Agentcities information days in Barcelona, Spain, February 2003. Please see http://www.agentcities.org and http://www.agentcities.net.

The workshop ended with **Francis G. McCabe** of Fujitsu Laboratories of America talk about **the future of the semantic framework within FIPA.** He pointed out that there are problems with the current semantics, and a new approach is needed. The Internet acts as a public forum, where applications span ownership boundaries and require public semantics for interactions. The elements of interoperability are institutions, contracts, conversations and transactions, and communicative acts. An abstract agent can be modelled with an agent state (triple: beliefs, goals, and actions), an agent program (transition: t((B,G,A), Act) -> (B,G, A)), and an agent action. Institutions have permissions, obligations, and power. A contract is a formula that expresses the constraints on behaviour between two or more agents, and it is usually negotiated over. A conversation is a sequence of messages, and a transaction consists of a combination of a conversation with an effect and precondition. A communicative act is defined in terms of publicly observable semantics, and it separates an intention of a speaker from an interpretation of a listener. This approach creates a new base to develop the semantic framework within FIPA. Francis G. McCabe also discussed agent societies, system security, and FIPA abstract Interoperability architecture. For further information, please, contact Francis McCabe [fgm@fla.fujitsu.com].

*H. Laamanen*

# Technology Overview: FIPA in Mobile Adhoc Environments

In the last years developments in wireless data communications (such as GSM, GPRS) and mobile devices (such as PDAs and mobile phones) were converging in a trend: "mobile computing". Users could significantly benefit from mobile computing in many situations and agent technology has been proven to be an enabler for intelligent applications in that domain. Examples include electronic commerce, information retrieval and mobile team support (e.g. see the European projects LEAP and CRUMPET). FIPA has recognized the importance of mobile computing and provides agent standard solutions like a bit-efficient ACL and envelope encoding for connections with low bandwidth.

In contrast to that, until now FIPA has no solutions for agents interoperating in "mobile adhoc computing" environments, a currently upcoming and promising agent application area. Before describing FIPA's activities to develop solutions for these environments, a short introduction to the technologies behind is given.

### Technologies for Mobile Adhoc Computing

Mobile adhoc computing is possible because of new technologies for short range wireless data communication such as Wireless LAN and Bluetooth. Devices, equipped with the same type of that technology make the communication and collaboration between them possible, as soon as the devices come in communication range. The resulting "mobile adhoc network" (MAN) is very flexible because it has a dynamic topology where nodes are free to move arbitrarily and it allows a Peer-To-Peer (P2P) communication in an asynchronous manner without any pre-installed networking infrastructure. Dynamic message routing over multi-hops on the network layer (MANET) is a further research topic.

Beside that, the development goes in the direction of very small devices with even more limited system resources in terms of memory and processing power than PDAs or mobile phones have. Such devices will be mostly hidden in the environment as acting or sensing elements, e.g. embedded in household appliances, air conditioning systems or wearables and allow to extend the domain to "pervasive computing".

In mobile adhoc environments each of the devices may host agents offering specific services to the surrounding which can be directly used or may be combined for more complex services. Several different technologies were developed in order to describe as well as discover and share services. Some of them provide an API to infrastructure elements (e.g. Jini, Salutation), others provide no infrastructure but specific protocol implementations needed on every device (e.g. UPnP, SDP). Devices, equipped with that technology, allow the discovery of services, as soon as devices hosting services come in communication range and will release the service after the device is out of communication range.

In parallel to these developments, also dynamic service discovery technologies, e.g. SLP, JXTA, or Gnutella like protocols were developed for fixed (Internet based) P2P-networks handling the dynamic availability of nodes. The variety reaches from approaches with central elements, over pure P2P solutions until advanced P2P systems which distribute / replicate the service directory entries in an intelligent way. Because of the same nature, technologies developed for fixed P2P-networks can in general also be used for MANs.

**Relevance for FIPA** Based on the traditional DF definition (FIPA's Yellow Pages), the search of

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remote services is accomplished by using the concept of DF federations: DFs, besides registering services offered by local agents, may also register other local or remote DFs. This allows them to extend the search for services to remote platforms. This mechanism is not efficient, even less for mobile adhoc environments, e.g. because the searcher first has to find the remote DF and afterwards has to look if the services he s searching for are registered there. Allowing to register and discover agent services using existing adhoc / P2P discovery technologies, which are specifically developed for these environments, can enable a more efficient management of service descriptions and directories, as well as an efficient search and result filtering. Furthermore, once working in mobile adhoc environments, adhoc and P2P technologies can also be used as mechanisms for agent (platform) societies in the fixed network.

**FIPA's Approach for Mobile Adhoc Computing** The development of dynamic service discovery technologies is still an ongoing research topic. It is not yet presumable which technology will finally be widely adopted and be the leading one. All of them have specific advantages and disadvantages and do not completely fit all requirements. E.g., some are not dealing well with MAN's spontaneity of the peer communication and fast changing service provisioning, while others are not dealing well with the scalability for a huge amount of services and users.

However, FIPA recognized the big potential of adhoc computing and decided to be one of the first adopters of current dynamic service discovering technologies. FIPA has created a Technical Committee "Adhoc" in February 2002 with the mission to develop solutions enabling agents to interoperate in mobile adhoc environments.

There are tree levels of interest in the current discussions of the TC:

- Which extensions / changes to the FIPA architecture are needed?
- How do FIPA agent services have to be represented for various service discovery technologies? Which discovery technologies should FIPA use / adopt?
- Which other related mechanisms does FIPA have to consider in order to work in these environments (e.g. policy definitions for service announcements, security problems)?

Currently the TC is writing a Whitepaper in order to collect and structure all technical contributions received. Based on the Whitepaper, the TC will come up with a first draft of a preliminary specification.

If you are interested in participating in that work, please contact the TC-Chair Michael Berger [m.berger@siemens.com] or the co-chair Heikki Helin [heikki.j.helin@sonera.com]. Information can also be found on our website http://www.fipa.org/activities/ad_hoc.html.

*M. Berger*

# Service descriptions for next generation of *smart service access*

*Smart service access* requires an infrastructure to support a rich definition of service, that enables and eases the use of domain ontologies, and provides clear representation of the notion of service of those domain ontologies, using a rich enough representation language for handling some form of service constraints for service co-ordination.

There is no one single solution on offer for modelling domain services, and there will be a number of solutions, meaning that a service framework will need to support some form of translation between service descriptions and their domains. Having defined semantically a set of shareable terms and knowledge about a particular domain, the creation of a service using that domain, has a service representation (this representation may well be an ontology model itself) stating the types of actions, tasks, queries that this service can handle and the type of results, replies a result will generate, including the representation language and protocols used.

The purpose of a service description is to enable another service or user to find that service and interoperate with the service. A common approach to service registry using a service repository and service description standards are those provided by UDDI (universal description, discovery and integration) and WSDL (Web-service description language): The service discovery function uses a UDDI repository and a simple matchmaking algorithm for business discovery. The service invocation and interoperability is possible by exchange of SOAP messages, the specifications of such exchanges are detailed in the WSDL description of the service, however part of this must be hand coded. For Service aggregation there is currently no solution for dynamic service composition, however, a service workflow representation through WSFL has started to form some initial features for this. This approach lacks interoperability between services and a flexible communication between services, which are the necessary building blocks for dynamic service aggregation. Also, the matchmaking is based on a weak service description.

Many developers building agent-based services are using DAML-S as a possible solution to some of the weaknesses currently in the web-services model. The DAML-S initiative considers not only access to static information but also to allow a computation to effect some action or change in the world. In order to do this the service description model must be computationally interpretable by the agent system and ideally a common way to access this. To summarise DAML-S lacks both a repository for finding a DAML service and a communication language. Also the grounding of the conditions at this stage is not well defined and there a number of uses of the architecture which may reduce interoperability of services. However, it does defined a good semantic description of services, providing a more structured matchmaking proposition for smart services than other current activities and a useful process description for service composition.

From an agent-based perspective a service can be considered as any operations (functions) that can be provided by an agent and offer to other agents as a service. A service Agent must register to the Directory facilitator Agent. This description provides simply the type of service available, its name, and the ontology the service uses. To summarize the key approach and drawbacks from agent technology:

- Agents use ontologies for their interactions (ACL language).
- Lack of agreement for an explicit standard semantic description of services
- Flexible communication between services
- Possible interoperability optimisation using the reasoning capacity of an agent
- Many research solutions to co-ordinating distributed service systems

A policy-based service model provides the necessary extension for enabling the development of service validation (e.g. commitment), open co-ordination of services, dynamic service composition and team formation. When an agent provides a service, it must share with potential users of the service, the constraints and the interactions required. It must also share its commitments. A policy model helps to relate the service level to the agent level. When a user asks for a composed service, this service is described as social policy and potential candidates for the service aggregation can be identified according to the constraints and requirements of the policy. This approach matches well with defining constraints and conditions that enhance the DAML-S definition of post and pre-conditions for service matching. Taking these developments into account, the next generation of a smart service access architecture design needs are:

- A better description of services that can use DF reasoning capabilities for service discovery.
- A proposition to enable service aggregation through social policies and a team formation architecture
- A meta-layer for services to detect at the type level inconsistencies, before communication with agents.
- A meta-layer to link at a high level services to their potential users through the use of stereotypes, user models and services.

*P. Charlton and M. Ribiere*

# Member Profile—Human & Machine Cognition (IHMC)

The Institute for the Interdisciplinary Study of Human & Machine Cognition (IHMC) was established in 1990 as an interdisciplinary research unit of the University of West Florida http://www.coginst.uwf.edu. Since that time, IHMC has grown into one of the nation's premier research institutes with more than 100 researchers and staff representing a broad interdisciplinary range.

IHMC researchers receive funding (current funding in force exceeds $21,000,000) from a wide range of government and private sources. Much of the research effort at IHMC is focused on what has become known as human-centered computing. This approach is focused less on stand-alone exemplars of mechanical cognitive talent, and more with computational aids designed to amplify human cognitive and perceptual abilities. Essentially these are cognitive prostheses, computational systems that leverage and extend human intellectual capacities, just as eyeglasses are a sort of ocular prosthesis.

Under funding from the DARPA Ultra*Log Program, we are developing agent services to assure the robustness and survivability of logistics functionality in the face of information warfare attacks or severely constrained or compromised computing and network resources. With sponsorship from the DARPA Control of Agent-Based Systems (CoABS) program, we have been leading the US-side of a Coalition Agents Experiment (CoAX) currently involving eighteen participating teams from four nations. IHMC's KAoS agent domains and NOMADS mobility and resource control services are being developed to allow for the specification, management, conflict resolution, and enforcement of policies within the specific contexts established by complex military organizational structures. As part of the Army Research Lab Advanced Decision Architectures Consortium, we have been investigating technologies to enable soldiers in the field to use agents from handheld devices to perform tasks such as dynamically tasking sensors and customizing information retrieval.

With grants from the NASA Cross-Enterprise Program and the NASA Intelligent Systems Program, we are investigating issues in human-robotic teamwork and adjustable autonomy for highly-interactive autonomous systems such as the Personal Satellite Assistant (PSA), a softball-sized flying robot that is being designed to operate onboard spacecraft in pressurized microgravity environments. The same approach is also being generalized for use in other testbeds, such as in conjunction with Johnson Space Center's Robonaut and Mini-AERCam, and for Agent Control of Unmanned Vehicles for NavSea. Under funding from DARPA's Augmented Cognition Program, we are taking this approach one step further as we investigate whether a general approach to the development of cognitive prostheses can be formulated, where human-agent teaming could be so natural and transparent that robotic and software agents could appear to function as direct extensions of human cognitive, kinetic, and sensory capabilities.

*J. Bradshaw*

# Member Profile—Communication Technologies

Communication Technologies was established on 1st October 2000 with a management buyout of Comtec Corporation. Ex Comtec Corporation, founded in 1985, had been known in the Japanese IT industry as a brave and bold 'early adopter' of new technologies such as Unix, RDB, client-server model, distributed objects, internet and Java in mission-critical enterprise application systems. (Well, those technologies were at one time considered useless for real business applications!) In 1996, Comtec aimed at intelligent multi-agents as a next challenge in information systems and joined FIPA. Communication Technologies inherited the FIPA membership from Comtec as well as all of the customers, employees, intellectual properties and offices.

The company is headquartered in Sendai, the capital city of the northeastern region of Japan, where the 22nd FIPA meeting was hosted in July 2001. Four sales people are based in the Tokyo branch, whereas thirty developers work at Sendai HQ. Luckily, the company has been profitable from the beginning to date notwithstanding the severe economic conditions in Japan.

Currently, the business of Communication Technologies consists of two parts: traditional (once cutting-edge) systems integration of enterprise applications is the mainstream and agent-related research and development is another. Although we believe that agents will be a fundamental element of information systems in the near future, we are not yet applying the agent technology to real enterprise systems. Most of our agent business is either prototyping or government-funded research projects until now. There are a couple of reasons why agents are not used in real enterprise environment:

- Our customers, mostly small and medium-sized companies, do not need a large-scale solution that agents promise such as semantic interoperation of heterogeneous distributed systems.
- In other words, most of their requirements can be satisfied with current and matured technologies.
- The customers need a natural evolution of existing solutions like Web Services but they do not want a radical revolution of technologies and engineering practices.

Will FIPA and related activities such as Agentcities and Java Agent Services change the situation? We are not sure; but as Alan Kay encourages us, "The best way to predict the future is to invent it," we are pretty sure we have a lot of things to invent and a lot of things to promote!

*H. Suguri*

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If you have a story or article that may be of interest to the agent or FIPA community, please submit it to **inform@fipa.org** for inclusion in future issues of FIPA Inform!

*(Continued from Page 1)*

sound framework should account for the issues raised in security and system integrity.

TC Ontologies focused on some of the technical issues involved in actually referencing multiple ontologies in agent communication and on the relationship of standards such as DAML+OIL for representing ontologies.

TC Ad Hoc continued in its efforts to account for agents interacting in the environment typically found with mobile services: agents have to discover each other and interact without much prior knowledge of each others' existence. They will prepare a white paper on the architectural guidelines to support this environment.

TC Services recognized the importance of web services as a deployment platform and addressed some of the modeling issues involved in mapping agent interaction to current web service technologies. Web Services is a globally important area that FIPA must address promptly and effectively.

*F. McCabe*