FIPA - Agents Meet the Semantic Web?

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Agenda

- Introduction
- Agents – what are they?
- Overview to FIPA
- Agentcities
- FIPA Technology
- FIPA & Web Services
Introduction

Definition: The Semantic Web is the abstract representation of data on the World Wide Web, based on the RDF standards and other standards to be defined. It is being developed by the W3C, in collaboration with a large number of researchers and industrial partners.

"The Semantic Web is an extension of the current web in which information is given well-defined meaning, better enabling computers and people to work in cooperation." — Tim Berners-Lee, James Hendler, Ora Lassila, The Semantic Web, Scientific American, May 2001

Same business - different viewpoints

Agents – What are they?

- Autonomous problem-solving entities
  - complex, dynamic environments (physical or software)
  - no permanent guidance from the user
- Intelligent Agents
  - Perceive and interpret ‘sensor’-data
  - Reflect events in their environment
  - Take actions to achieve given goals
Agents – What are they?

- Autonomy
- Proactive
- Goal-oriented
- Collaborative
- Communicative
- Adaptivity
- Mobile
- Temporal continuity

FIPA overview

**FIPA mission**

The promotion of technologies and interoperability specifications that facilitate the end-to-end interworking of intelligent agent systems in modern commercial and industrial settings.

In short: **Interoperability among autonomous systems**
FIPA overview

- FIPA specifications
  - Application-oriented
    - Personal Assistant
    - Personal Travel Assistance
    - Audio/Visual Entertainment and Broadcasting
    - Network Management
    - Nomadic Application Support

FIPA Overview

- FIPA specifications
  - Technology-oriented
    - Message transport
    - Agent communication languages
    - Semantic content languages
    - Interaction protocols (dialogues, conversations)
    - Platform management (white and yellow pages)
FIPA Overview

- FIPA implementations
  - Agent Development Kit
  - April Agent Platform (AAP)
  - Comtec Agent Platform
  - FIPA-OS
  - Grasshopper
  - JACK Intelligent Agents
  - Java Agent Development Environment (JADE)
  - Lightweight Extensible Agent Platform (LEAP)
  - ZEUS
  - Genius

Agentcities

- Mission Statement
  - “To facilitate a worldwide, open, heterogeneous and interoperable environment in which autonomous services can be defined, deployed and utilised in a dynamic, composable and value added way”

- I.e. Focus on
  - Deployment, usage, coordination of the live network
  - Contribute to its evolution, take up and transition to commercial use
FIPA Technology

- Agent management reference model

Diagram:

- Software
- Agent Platform
- Agent
- Agent Management System
- Directory Facilitator
- Message Transport System

- Conversation Layer
  - FIPA-query, FIPA-request, ...

- Ontology
  - FIPA Ontology Service, QoS Ontology, Management Ontology, ...
  - ontologies: FIPA-PTA, FIPA-VPN-Provisioning

- Content Language
  - FIPA SL, KIF, RDF, ...

- Agent Communication Language
  - FIPA ACL, KQML, ...

- Message Envelope
  - FIPA Message Envelope, ...

- Message Transport
  - GIOP, HTTP, ...

- Transport and Signaling Protocol
  - TCP/IP, WAP, SMS, ...

22/10/2002 Towards the Semantic Web and Web Services
FIPA Technology

- Message transport service
- Transport protocol
  - HTTP
- Message transport envelope
  - XML representation

Example: Request communicative act

\[
\langle i, \text{request}(j, a) \rangle
\]

FP: FP(a) \land B, Agent(j, a) \land \neg B, PG, Done(a)

RE: Done(a)

\(i\) = sender, \(j\) = receiver, \(a\) = action to perform
Done(a) = action performed

B, Agent(j, a) = agent \(i\) believes that \(j\) can perform \(a\)
\neg B, PG, Done(a) = \(i\) does not believe that Done(a) is \(j\)'s persistent goal
FIPA Technology

- FIPA ACL
- XML representation

```xml
<!-- Document Type: XML DTD
Document Purpose: Encoding of FIPA ACL messages in XML
(see [FIPA00067] and http://www.fipa.org/)
Last Revised: 2000/03/07
-->

<!ENTITY % communicative-acts
"accept-proposal|agree|cancel|cfp|confirm|disconfirm|failure|inform|not-understood|propose|query-if|query-ref|refuse|reject-proposal|request|request-when|request-whenever|subscribe|inform-if|inform-ref|proxy|propagate">

<!ENTITY % msg-param
"receiver|sender|content|language|content-language-encoding|ontology|protocol|reply-with|in-reply-to|reply-by|reply-to|conversation-id">

```

- FIPA Content languages
- RDF

Enhancements: how to express

- **Objects** which are constructs that represent an identifiable entity (be it abstract or concrete) in the domain of discourse,
  - == RDF resource
- **Propositions** which are statements expressing that some sentence in a language is true or false,
  - how express belief and disbelief?
- **Actions** which try to express an activity that can be carried out by an object.
  - == RDF statement
FIPA Technology

- **FIPA Content languages**
  - **RDF**
    - Enhancements: how to express
      - Propositions
      - belief

```xml
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:fipa=http://www.fipa.org/schemas/fipa-rdf0#">
  <fipa:Proposition>
    <rdf:subject>TCP/IP Illustrated</rdf:subject>
    <rdf:predicate rdf:resource="http://description.org/schema#author"/>
    <rdf:object>W. Richard Stevens</rdf:object>
    <fipa:belief>true</fipa:belief>
  </fipa:Proposition>
</rdf:RDF>
```

- **FIPA Interaction Protocols**
  - Specify agent communication patterns
  - Example:
    - fipa-request-protocol
FIPA Technology

- FIPA Interaction Protocols
  - Request
  - Query
  - Request When
  - Contract Net
  - Iterated Contract Net
  - English Auction
  - Dutch Auction
  - Brokering
  - Subscribe
  - Brokering
  - Propose

Currently working on

- Semantics
  - Semantics of ACL
  - Contracts
    - constraints on behaviour
  - Policies

- Services
  - Agents & Web services

- Ontologies
  - Relation of ontologies to the FIPA communication stack
  - Manipulation of ontological structures
  - Sharing of ontologies
  - Guidelines on how to test ontological interoperability
  - Co-operation with Semantic Web - DAML+OIL
FIPA and Web Services

- Working items:
  - How to expose a Web Service (WS) in a FIPA Agent environment
    - Three options:
      - Map all WS information (SOAP, WSDL, UDDI) into a df-agent-description
      - Map a reference to the WS into a df-agent-description
      - Build a WS – Agent Service gateway
  - Mapping between DF and UDDI
    - Soap transport
    - Service description

Summary

- Same objectives – different viewpoints
- Agents will play important role in the Semantic Web
- FIPA agent technology and Web Services & Semantic Web technologies will be interoperable ....
Thank you

For your attention