# 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 cdlaboration with a large number of researchers and industrial partners.

"The Semantic Web is an extension of the current web in which in formation 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

**ACTOR**

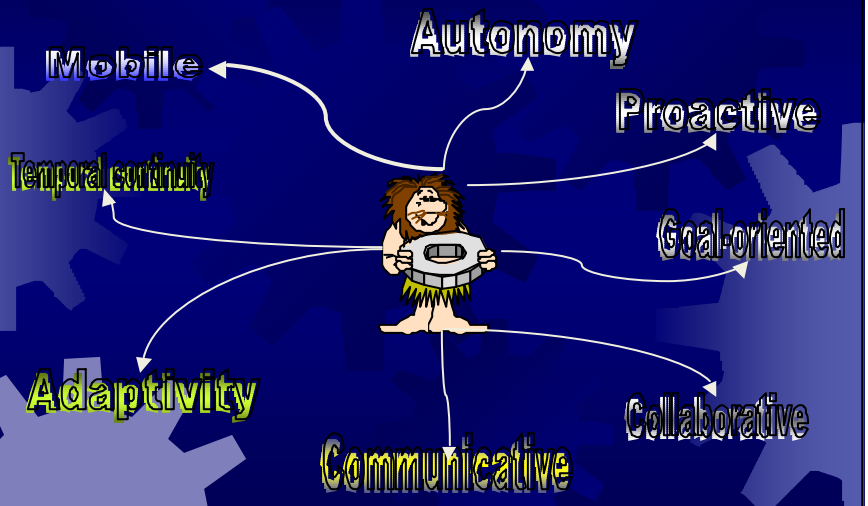
**Knowledge representation**



# 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?






# 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**

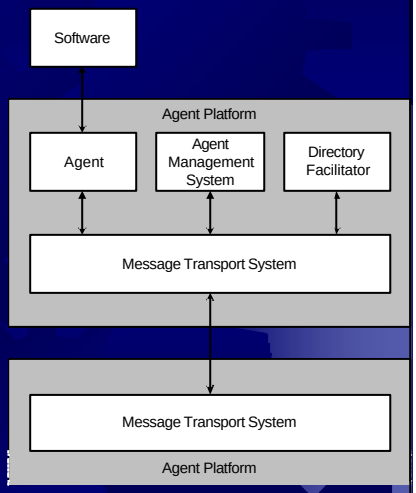


# Agentcities

- 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






# FIPA Technology

| |
|---|
| **Domains and Policies** |
| Obligations, delegations, cooperations, trust, ... |
| **Conversation Layer** |
| FIPA-query, FIPA-request, ... |
| **Ontology** |
| FIPA Ontology Service, QoS Ontology, Management Ontology, .... application 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, ... |

# FIPA Technology

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

```
<?xml version="1.0"?>
<envelope>
  <params index="1">
  <to>
    <agent-identifier>
      <name>receiver@foo.com</name>
      <addresses>
        <url>http://foo.com/acc</url>
      </addresses>
      <resolvers>
        <agent-identifier>
          <name>resolver@bar.com</name>
          <addresses>
            <url>http://bar.com/acc1</url>
            <url>http://:///bar.com/acc2</url>
            <url>http://bar.com/acc3</url>
          </addresses>
        </agent-identifier>
      </resolvers>
    </agent-identifier>
  </to>

  <from>
    <agent-identifier>
      <name>sender@bar.com</name>
      <addresses>
        <url>http://bar.com/acc</url>
      </addresses>
      <resolvers>
        <agent-identifier>
          <name>resolver@foobar.com</name>
          <addresses>
            <url>http://foobar.com/acc1</url>
            <url>http://foobar.com/acc2</url>
            <url>http://foobar.com/acc3</url>
          </addresses>
        </agent-identifier>
      </resolvers>
    </agent-identifier>
  </from>

<acl-representation>fipa.acl.rep.xml.std
</acl-representation>
```



# FIPA Technology

- FIPA ACL
  - Model from speech act theory

Example: Request communicative act

<*i*, request( *j*, a )>

FP: FP(a) [i\j] $\wedge$ $B_i$ Agent( *j*, a ) $\wedge$ $\neg B_i$ $PG_j$ Done(a)

RE: Done(a)

i = sender, j = receiver, a = action to perform

Done(a) = action performed

$B_i$ Agent( *j*, a ) = agent i believes that j can perform a

$\neg B_i$ $PG_j$ Done(a) = i does not believe that Done(a) is j 's persistent goal

# FIPA Technology

- FIPA ACL
  - **XML representation**

```
<!-- 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
-->

<!-- Possible FIPA Communicative Acts. See [FIPA00037] for a
     full list of valid performatives.
-->
<!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">

<!-- The FIPA message root element, the communicative act is
     an attribute - see below and the message itself is a list
     of parameters. The list is unordered. None of the elements
     should occur more than once except receiver.
-->
<!ENTITY %msg-param
        "receiver|sender|content|language|content-language-encoding|ontology|
         protocol|reply-with|in-reply-to|reply-by|reply-to|conversation-id">
.........................
```



# FIPA Technology

- 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

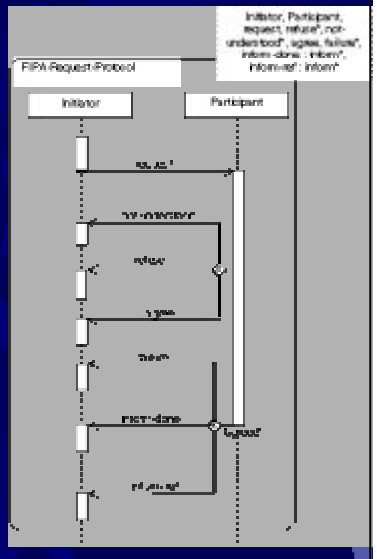
```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
         xmlns:fipa=http://www.fipa.org/schemas/fipa-rdf0#">

  <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 Technology

- 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



# FIPA Technology

- 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 ....


sonera
Thank you
For your attention
22/10/2002
Towards the Semantic Web and Web Services