A

Der FIPA Standard

The nicest thing about standards is that there are so many of them to choose from.
K. Olsen

Die FIPA („Foundation for Intelligent Physical Agents“) ist eine nichtkommerzielle Organisation, die 1996 mit dem Ziel gegründet wurde, industrierelevante Standards für heterogene und iteragierende Agentensysteme festzulegen. Zu ihren internationalen Mitgliedern gehören Vertreter aus Industrie und Wirtschaft sowie Vertreter aus dem universitären Umfeld. Beispielsweise sind industrieseitig British/France/Italian Telecom, Fujitsu, IBM, Mitsubishi Electric, Motorola, Boing, Toshiba und Siemens involviert (Stand April 2004). Im Folgenden werden einige zentrale Aspekte der FIPA-Standardisierungsbemühungen herausgestellt.

Spezifikationszyklus

Generell besitzt jeder Standardisierungsvorschlag genau einen der folgenden Stati: „vorläufig/preliminary“ (initiale Konzeption), „experimentell/experimental“ (stabil über einen längeren Zeitraum), „angenommen/standard“ (in ausreichend vielen Implementierungen bewährt und für breite Verwendung uneingeschränkt geeignet), „mißbilligt/deprecated“ (möglicherweise unnötig z.B. aufgrund technologischer Entwicklungen) und „veraltet/obsolete“ (unnötig). Das Durchlaufen verschiedener Stati – typischerweise von „vorläufig“ über „experimentell“ zu „standardisiert“ – wird als FIPA Spezifikationszyklus bezeichnet.

Spezifikationen im Überblick

Die Standardisierungsbemühungen der FIPA betreffen grundsätzlich alle Aspekte, die für die industrielle und kommerzielle Akzeptanz von agentenorientierten Systemen von Bedeutung sind. Im April 2004 lagen drei vorläufige, 14 experimentelle und 25 angenommene Standardisierungsvorschläge vor; die von diesen Vorschlägen betroffenen Aspekte sind in Abbildung A.1 zusammengefasst.

Agentenplattform

Die zentrale Grundlage für FIPA-Konformität bildet das FIPA Agent Management Reference Model – oder kurz das Agenten-

Management of Agents

➢ *basic specification*: agent management

Communication among Agents

➢ *basic specifications*: message structure, ontology services

➢ *Interaction Protocols* (Request, Query, English Auction, Dutch Auction, Brokering, Recruiting, Iterated Contract Net, usw.)

➢ *Communicative Acts* (Communicative Act Library)

➢ *Content Languages* (SL, CLL, KIF, RDF)

Transport of Agent Messages

➢ *basic specifications*: message transport service, messaging interoperability service

➢ *ACL Representations* (Bit Efficient, String, XML)

➢ *Envelope Representations for Transport via MTP* (Bit Efficient, XML)

➢ *Transport Protocols* (IIOP, WAP, HTTP)

Abstract Architecture

➢ *basic specifications*: Architecture, Domains, Policies

Example Applications

➢ *basic specifications*: Nomadic applications, Personal travel assistance, Audio-visual entertainment, Network management, etc.

Abb. A.1. FIPA Standardisierungsbemühungen: Behandelte Aspekte im Überblick (Stand Juli 2003)

plattform-Referenzmodell – dar (siehe Abbildung A.2). Die Komponenten dieses Referenzmodells lassen sich wie folgt charakterisieren:

➤ *Agent Management System* (AMS). Verwaltung der Agenten. Jeder Agent, der neu auf die Plattform kommt, muss sich beim AMS registrieren und erhält von ihm einen Plattform-übergreifend eindeutigen *Agent Identifier* (AI) zugeteilt. Das AMS überwacht den Lebenszyklus aller Agenten auf der Plattform und ist auch für die Migration von Agenten auf andere Plattformen zuständig, sofern die Plattform die Mobilität von Agenten unterstützt. Je Plattform ist genau ein AMS erforderlich und erlaubt.

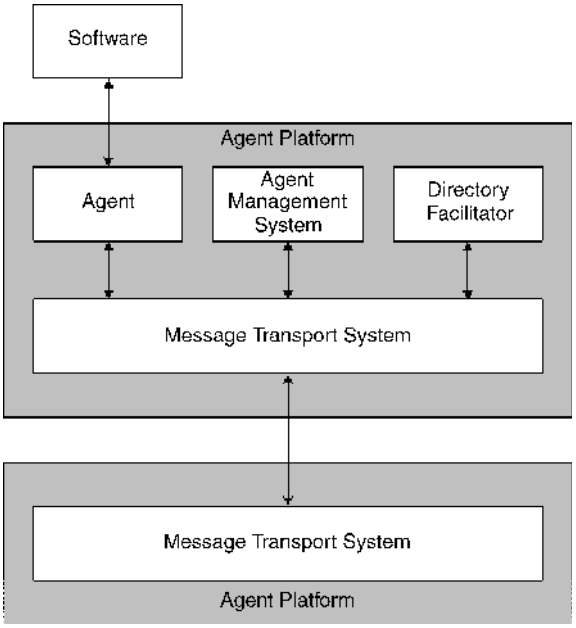

Abb. A.2. FIPA Standard: Plattform-Referenzmodell [110]

- *Message Transport System* (MTS). Transport von ACL Nachrichten. Zum Zweck des Nachrichtentransportes wird ein *Agent Communication Channel* (ACC) als Transportmedium für den Nachrichtenaustausch zwischen Agenten aufbaut. Die Nachrichten selbst werden mittels eines *Message Transport Protocol* übertragen, das für die plattforminterne Kommunikation frei gewählt werden kann. Für die Kommunikation zwischen Agenten auf verschiedenen Plattformen muss dagegen eines der Protokolle, die in den FIPA Standardisierungen hierfür vorgesehen sind, verwendet werden (u.a. HTTP und IIOP).
- *Directory Facilitator* (DF). Verwaltung von Services, vorstellbar als ein "Gelbe-Seiten-Service". Agenten können die Services, die sie anbieten, beim DF registrieren lassen; weiterhin können Agenten beim DF anfragen, ob ein gewünschter Service von anderen Agenten angeboten wird. DF ist eine optionale Komponente; auf einer Plattform dürfen mehrere DFs gleichzeitig existieren.

Lebenszyklus eines Agenten

Das Management von Agenten basiert auf einer zustandsorientierten Agentensicht. Wie die Abbildung A.3 zeigt, kann sich ein Agent in fünf verschiedenen Zuständen befinden, wobei die Ver-

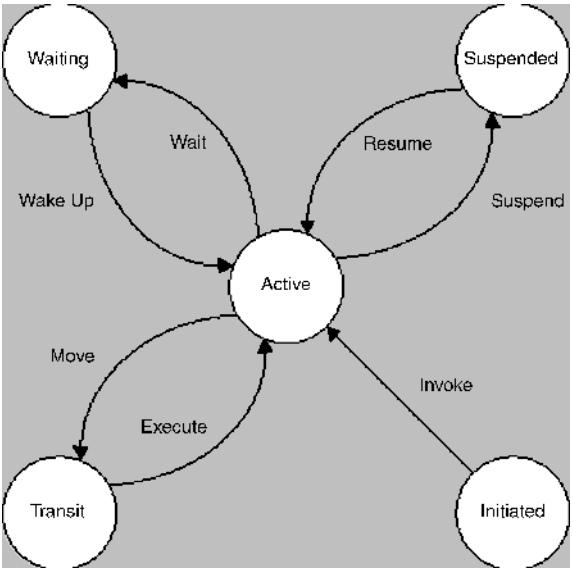

Abb. A.3. FIPA Standard: Lebenszyklus eines Agenten [110]

antwortlichkeiten des Agent Management System zustandsensitiv sind und sich folgendermaßen zusammenfassen lassen:

- „active“: das MTS stellt Nachrichten ganz gewöhnlich bereit.
- „initiated/waiting/suspended“: das MTS (i) buffert Nachrichten, bis der Agent wieder aktiv ist, oder (ii) forwarded Nachrichten (sofern ein Forward für den betreffenden Agenten eingerichtet).
- „transit“ (betrifft nur mobile Agenten): das MTS buffert eingehende Nachrichten oder forwarded sie.
- „unknown“: das MTS buffert oder verwirft eingehende Nachrichten, je nach Transportpolitik des MTS und nach Anforderungen der zuzustellenden Nachricht.

Weitere Informationen

Die obigen Anmerkungen sollen lediglich eine erste Vorstellung von den FIPA-Standardisierungsbemühungen geben. Details zu allen FIPA Spezifikationen und weitere FIPA-relevante Publikationen finden sich auf der FIPA Webseite [113].

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