

# Automating NL Appointment Scheduling with COSMA\*

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## Abstract

Appointment scheduling is a problem faced daily by many individuals and organizations. Cooperating agent systems have been developed to partially automate this task. In order to extend the circle of participants as far as possible we advocate the use of natural language transmitted by e-mail. We demonstrate COSMA, a fully implemented German language server for existing appointment scheduling agent systems. COSMA can cope with multiple dialogues in parallel, and accounts for differences in dialogue behaviour between human and machine agents.

## 1 Motivation

Appointment scheduling is a problem faced daily by many individuals and organizations, and typically solved using communication in natural language (NL) by phone, fax or by mail. In general, cooperative interaction between several participants is required.

Systems available on the market allow for calendar and contact management. However, as (Busemann and Merget, 1995) point out in a market survey, all planning and scheduling activity remains with the user. Cooperative agent systems developed in the field of Distributed AI are designed to account for the scheduling tasks. Using distributed rather than centralized calendar systems, they not only guarantee a maximum privacy of calendar information but also offer their services to members or employees in external organizations. Although agent systems allow users to automate their scheduling tasks to a con-

siderable degree, the circle of participants remains restricted to users with compatible systems.

To overcome this drawback we have designed and implemented COSMA, a novel kind of NL dialogue system that serves as a German language front-end to scheduling agents. Human language makes agent services available to a much broader public. COSMA allows human and machine agents to participate in appointment scheduling dialogues via e-mail. We are concerned with meetings all participants should attend and the date of which is negotiable.

## 2 The Systems

COSMA is organized as a client/server architecture. The server offers NL dialogue service to multiple client agent systems. The scheduling agent systems act for their respective users. The agents systems use a calendar management system for displaying to their owners the results of the appointment negotiations. The users can enter their appointment constraints via a graphical user interface and receive the results either by e-mail or via their electronic calendar. Agent systems are thus hooked up to e-mail, to a calendar manager and to the dialogue server.

The server interface is command-driven. A client may connect to the server and open up a dialogue (see Figure 1 in (Busemann et al., 1997)). During the dialogue, the client may request texts to be analyzed or semantic descriptions to be verbalized. When given a text, the server returns the semantic representation, and vice versa. The client ensures that the server has available to it linguistically relevant information about the interlocutors, such as names, sexes etc.

The user agents may access the dialogue server via Internet. They use the server as their NL front end to human participants. Machine agents interact with each other in their own formal language. This interaction remains unnoticed by the dialogue server. As a consequence, the dialogues modeled

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within the server represent only part of the complete multi-participant negotiation. More precisely, only utterances between a human and a machine agent are modeled.

The agent system used is a further development of the PASHA system (Schmeier and Schupeta, 1996). NL analysis in the server is based on a shallow parsing strategy implemented in the SMES system (Neumann et al., 1997). The use of SMES in COSMA, semantic analysis and inference, the dialogue model mapping between human and machine dialogue structures, utterance generation, the architectural framework of the server, and the PASHA agent system are described in (Busemann et al., 1997). Both papers can be found in the ANLP '97 conference proceedings.

We demonstrate extended versions of the systems described in (Busemann et al., 1997). In particular, the systems to be demonstrated can process counter-proposals, which form an important part of efficient and cooperative scheduling dialogues.

### 3 The Demonstration Scenario

The demonstration scenario includes three participants. Two are using autonomous agent systems that partially automate the negotiation of appointment scheduling and manage their users' private electronic calendars. The third person plans his appointments himself and interacts with other participants through NL e-mail messages. His calendar is managed outside the scope of the systems.

Dialogues can be initiated by the human participant or by one of the agent systems. In the former case, the users of the agent systems usually are not involved in the negotiation. They see the result when it is entered into their electronic calendars. In the latter case, the user starts his agent by entering via a graphical interface the appointment constraints to be used in the negotiation. The basic constraints include the time interval within which the appointment must be fixed, the duration of the meeting, and the participants.

For demonstration purposes, e-mail is exchanged between different accounts on a local host, which the server is running on as well. In principle, each participant and the server could reside on a different site in the Internet.

The NL server is implemented in Common Lisp and C with a graphical surface written in Tcl/Tk. The PASHA agent system is implemented in DFKI-Oz (Smolka, 1995). The systems are demonstrated on a Sun workstation under Unix.

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