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## Preface

Many existing natural language and spoken language dialogue systems are either very limited in the scope of domain functionality or require a rather cumbersome interaction. With an increasing number of application domains, ranging from unified messaging to trip planning and appointment scheduling, it seems to be obvious that the current interfaces need to be rendered more efficient.

The possibility to construct and to manage complex tasks and interdependencies with these applications requires a high cognitive burden from the user, which may be dangerous in certain environments (e.g., the well-known driver distraction problem in cars). Rather than preventing the use of such applications, however, it seems necessary to relieve the user as much as possible from the need to manage the complexities involved alone in his mind.

We argue that the system should serve as an integrated assistant to the user, i.e., it should be able to collaborate with the user to find a solution that fits the user's requirements and constraints and that is consistent with the system's world knowledge. In particular, the system's world model should include knowledge about dependencies between certain domains: In a travelling sales person scenario, for instance, the system could automatically calculate route durations and check for parking space depending on the user's calendar.

In this book we describe a logic-based reasoning component for spoken language dialogue systems. This component, called *Problem Assistant* is responsible for processing constraints on a possible solution obtained from various sources, namely the user's and the system's domain-specific information. The core processing is finite model generation. This inference technique attempts to find solutions that fit both the user's constraints and that are consistent with the Problem Assistant's rule base. Since the assistant interactively generates transparent information about its inference process, our approach provides the basis for incremental explanation dialogues and collaborative conflict resolution.

We also present findings on the implementation of a dialogue management interface to the Problem Assistant. The dialogue system supports simple

mixed-initiative planning interactions in an application domain including logistics, evacuation and emergency planning. Although limited in terms of the number of entities modelled, this is still a relatively complex domain involving a number of logical constraints and relations. In our view, these logical constraints and relations form the basis for the collaborative problem solving behaviour that drives the dialogue.

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