Personal Automation: Combining Personal Information Management Systems and Rule Engines.

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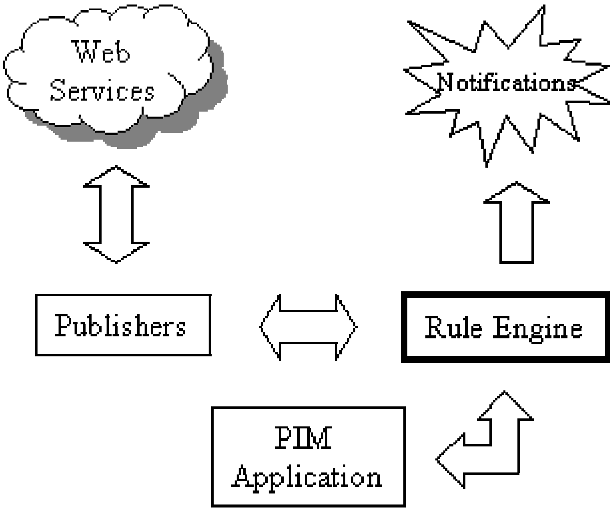

Figure 1. Archtecture overview

ABSTRACT

By the use of declarative rules, automation of tasks can be performed through an electronic personal information management (PIM) application. Rules can be used in a variety of different scenarios, for instance to trigger information retrieval tasks or to send out notifications when a pre-determined set of conditions are satisfied. The technology described is an integral part of the IBM Tempus Fugit [1] research project.

Keywords

PIM, Rule Engines, Java, XML, Messaging, Information Retrieval, AI

1. INTRODUCTION

Several technologies have made it possible for personal information management applications to become “smarter? First of all, emerging groupware standards simplifies access to PIM data on heterogeneous systems, enabling effective exchange of schedules, address books, todo items etc. Secondly, “intelligent? PIM applications can utilize emerging services infrastructures [2] to associate active, context sensitive information such as flight schedules or weather forecasts with scheduled activities.

However, applications that are able to provide the “right information at the right time? and perform automated tasks on behalf of users need to be guided by a specific set of rules. A forward chaining inference rule engine provides a solution that can be used in a variety of different circumstances.

2. ARCHITECTURE AND IMPLEMENTATION

```
<WeatherAlertRule> WeatherAlert(?X, ?Y) <-
        Event_LOCATION(?X, ?LOC)
        AND Event_DTSTART(?X, ?START)
        AND Event_CLIENT(?X, ?Y)
        AND Weather_LOCATION(?W, ?LOC)
        AND Weather_DATE(?W, ?START)
        AND Weather_CHANCE_OF_RAIN(?W, ?PERCENT)
        AND Preference_RAIN_THRESHOLD(?Y, ?P)
        AND greaterThan(?PERCENT, ?P).
```

Listing 1. Weather alert rule for travel events.

Figure 1 shows an architecture overview. Information entered into a PIM application is forwarded to a rule engine, which transforms the information into knowledge (facts). Publishers provide the next step in the chain by periodically querying services on the Web for relevant context sensitive information, incorporating the results into the rule engine knowledge base. Configuration of the publishers is dynamically handled by rules triggering on various application events, such as the scheduling of a new meeting in a calendar. By attaching procedures to the derived conclusions (also called *effectors,* see [3]), tasks can dynamically be performed.

Listing 1 shows an example of how a Weather alert rule is described using Courteous Logic Programs (CLP) [3]. The rule fires if the chance of rain at the destination for a scheduled travel event is higher than user-specified threshold. If a “send-email?procedure is attached to the rule, users will automatically be notified whenever bad weather is forecasted. Facts are represented using an identifier for the type of object described, followed by ‘_?and the name of a particular attribute. For example, ?i>Event_DTSTART? indicates the start date of a scheduled calendar event. Attributes associated with calendar PIM objects comply with the iCalendar [4] naming conventions. The predicates are 2-ary, where the first function symbol contains the unique key for the object instance, and the second contains the value for the attribute described. The *Weather* facts has been created by a weather publisher that periodically accesses online weather services to retrieve the latest weather data.

2.1 Implementation

Tempus Fugit is a Web based electronic calendar hosted on an application server (see screenshots in Figure 2). The system provides the traditional PIM functionalities, such as calendaring and email, but also has the ability to tie in additional context sensitive information and provide the users with such information “just-in-time? In the current implementation, the system is able to provide company profile information, including recent company news, and attaches such information with scheduled company visits in a calendar. The news items are also sent out via email starting a couple of days before the scheduled event, so that the users can be properly “briefed?about their upcoming visit.

Tempus Fugit also uses rules to send out notifications to meeting attendees at scheduling time, giving attendees the ability to respond to invitations. Other uses of the rules is for performing system administration tasks, for instance deleting expired information or sending out notifications to the administrators reporting user activities. Rule authors can relatively easily implement new features and support new requirements by adding rules or modifying existing rules

3. FUTURE DIRECTIONS

An overview has been given of how rules and rule engines can successfully be integrated into a personal information management system or groupware application. There is much to be gained by externalizing parts of the application logic into rules, for instance the possibility of automating tasks that traditionally have been taken care of by agent based technologies. The Tempus Fugit research project is continuing to investigate these technologies, with the goal of one day automating and supporting many of the tedious tasks that people face daily.

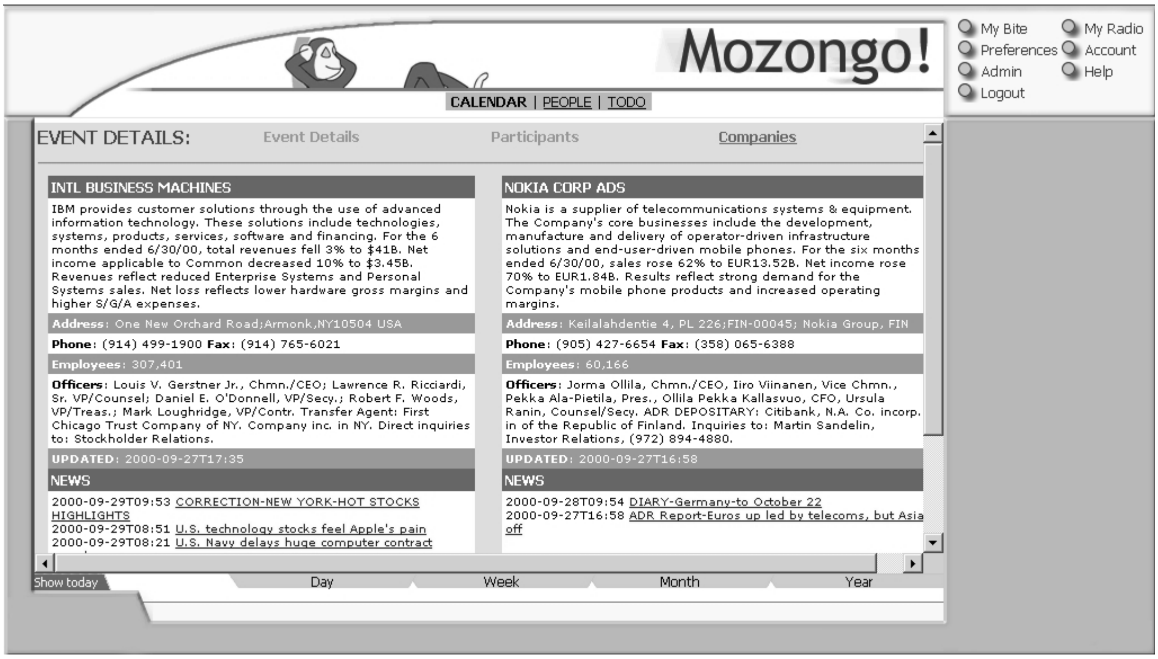

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Figure 2. The Tempus Fugit Web calendar. The screenshot shows company profile information associated with a meeting scheduled in a calendar. Mozongo! is the external name of the Tempus Fugit Web site.

4. ACKNOWLEDGMENTS

I would like to thank the people in my group who has helped out the project, including Daniel Ford, Joann Ruvolo, Jussi Myllymaki, James Kaufman, Martin Gerlach, Steffen Lassahn, Jared Jackson and Norm Pass.

5. REFERENCES

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