Beyond the Elves: Making Intelligent Agents Intelligent

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Abstract

The goal of the Electric Elves project (Chalupsky *et al.* 2001; 2002) at the University of Southern California (USC) was to develop software agents to support human organizations. The project was quite successful with very impressive prototypes and many papers on the research. In fact, DARPA, which funded the project, was so enthusiastic about the results that they asked us to deploy a version of the Elves for use at DARPA. The original application of the Elves deployed at USC was for the office environment (called the *Offices Elves*)(Scerri, Pynadath, & Tambe 2002; Pynadath & Tambe 2003) and required detailed information about the calendars of people using the system. Deploying this application at DARPA raised a host of issues including privacy and access to internal services. Thus, we decided to deploy a new application of the Electric Elves, called the *Travel Elves*. This application appeared to be ideal for wider deployment since it could be hosted entirely outside an organization and communication could be performed via wireless devices, such as cell phones.

The mission of the Travel Elves (Ambite *et al.* 2002; Knoblock 2004) was to ensure that once a trip has been planned, that it would execute smoothly. The Elves went beyond simply notifying a traveler of flight delays; an agent would also send faxes to the hotel and car rental agencies to notify them of a delay and ensure that the room and car would be available. Likewise, when a traveler would arrive in a city for a connecting flight, an agent would notify the traveler if there were any earlier connecting flights and provide both arrival and departure gates. Once a ticket had been purchased, an airfare-monitoring agent would track the current price of a flight itinerary. Similarly, a schedule-change agent would keep track of the published schedule for a given flight itinerary and notify a traveler if there were any changes to this itinerary. Finally, an earlier-flight agent would check for flights that would depart before the scheduled flight, giving a traveler the opportunity to leave a meeting early.

Initial deployment of the Travel Elves at DARPA went smoothly. Program managers and office directors began using the system. We trained the DARPA travel administrator on how to enter the travel information into the system. But over time things began to go wrong: agents would fail to execute their assigned tasks, information got delayed or was not sent at all, and in some cases agents failed for no apparent reason. In this talk, I will first review the work on the Travel Elves and describe what worked well and why the Elves were so useful for this task. Then I will describe the real-world problems that arose in deploying this application and the underlying causes of these failures. Finally, I will present some lessons learned on how to build the next generation of the Elves to avoid or respond gracefully to the types of problems that arose.

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