A Business View Regarding the Selection Of Agent Development Toolkits

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In today's rapidly changing application development arena, it's becoming increasingly clear that a strong alignment between the academic, development, and commercial environments is required in order to be competitive. The lag time between conception and deployment of a software tool is narrowing as each day passes. New offerings seem to spur new demands, which ultimately places a greater emphasis on the requirement for a common understanding between the environments. A basic understanding of each other's needs and offerings can help to alleviate the stresses inherent in this ever-narrowing window. This paper attempts to achieve this goal from a business' point of view.

Fannie Mae, the nation's largest source of conventional mortgage funds, has stated a desire to develop internal experience specializing in the development and use of intelligent agent technology. The increasing volume and complexity of applications, network traffic, and architectures are compounded by the need for improved response time. Under these conditions, the act of maintaining traditional control mechanisms over remote processes seems to be untenable and costly. Hence, the offloading and distributing of this control in the form of intelligent agents seems to be a natural and progressive step. This move will hopefully enhance the efficient management of the company's business processes. Specifically, agent technology could be offered as a shared service to the business units that request it, and development/consulting services will be provided accordingly. An ultimate goal of the company would be to optimize the construction and delivery process of intelligent agents, which will require the use of robust and well-supported toolkits. Fannie Mae views the term "toolkit" as something that comprises more than what is immediately visible. The following tangible and intangible factors that will be considered should be viewed as goals, not as absolutes. The content of this paper is aimed at both the academic and vendor populations, for purposes of attaining a mutual understanding.

Business Issues

Ease of Use. The toolkit should ideally have features and services that facilitate the initial installation, configuration, and optimization of the product at the client site. Ideally, templates and skeletons of different classes of agents could be available, and the functions and features could be configured through a graphic user interface or well-documented programming environment. Periodic version and patch updates should be integrated with minimal effort. Thus, the agent's critical attributes and behavior that have the highest probability of being affected by new releases should not be too deeply embedded in its construction. At best, Fannie would like to achieve the highest return on agent performance with the least amount of time and expense required by the development and maintenance effort. This will always be the overriding priority in the selection process.

Vendor Support. The availability of on-site consulting and training for the initial "burn-in" period will set the stage for subsequent relationships. Technical support and business alliances emphasizing mentoring over exploitation are tantamount to the longevity of the relationship. Much knowledge is gained from a product's installation base and associated developer groups, whereby features and quirks can be formally and informally documented. New releases and patches should be seamless with regards to timeliness, installation, and backward integration with the toolkit. Labor rates for available developers usually become more competitive when the vendor focuses on standards and popular programming languages. Finally, a historical profile of the vendor and the product will be taken into account so that longevity of the relationship can be assured.

Integration and Interoperability. The addition of other toolkits and/or third party add-ons should be possible, and preferably seamless. If a chosen suite does not accommodate all of the current development needs or new requirements surface that extend beyond the toolkit's ability to meet them, another product or component should be "swapped" or integrated in. In this case, the vendor's involvement with standards movements and partnerships with other vendors will play an important role.

Technical Issues

Analysis and Design Facility. Since the intelligent agent paradigm seems to embrace both object-oriented and rule-based computing, a new analysis and design toolkit should address the embedding of objects with rational behavior (preferably rules-driven), in addition to attributes and methods. Perhaps a third rules-based component of OOP should be included.

Mobility. Due to the nature of Fannie's network traffic, the trade-off between stationary and migratory agent behavior will need to be addressed. Some uses such as user interface and session mediation will probably have to require the agent to be stationary. Other uses such as information gathering will require migratory behavior. The optimal product should offer both. In any case, the

company will want to minimize the agent's impact on network traffic. Flexible and/or adaptive migration itineraries and persistence of the agent's execution state between "hops" will be considered.

Adaptability. A toolkit should support options between fixed and adaptable behavior, through the use of some learning paradigm or algorithm. Criteria or rules of appropriate behavior should be configured in the agent, and firing of these rules should trigger changes in subsequent behavior based on previous experience.

Autonomy. Ideally, the toolkit should provide the agent with both fixed and dynamic itineraries. For example, agendas can be either procedure or rules-driven, or could be manually adjusted in the midst of performing a series of assignments, possibly through interactive communication with a user.

Auditing and Tracking. Information as to the agent's activity should be accessible through some sort of auditing tool: logging via fixed file, messages to consoles, email, interactive querying via GUIs, etc. In the case of a collaborative environment, the exchange of commands, actions, facts and rules between active agents should be audited, preferably in real-time. In case of mobility, migratory behavior that's internal and/or external to the network or web should be subject to the same observance.

Security. Password authentication required for access to gathered information, embedded alerts regarding access violations or attempts thereof, alerts for bottlenecks and obstructions, etc. should be offered.

Architecture Independence. Heterogeneity regarding operating on different platforms and operating systems in the company should be addressed. Part of this involves communication protocol independence, so that auditing and tracking can be facilitated.

Scalability. The toolkit should accommodate the migration of the agent to larger or more complex operating environments. It should also allow for the reconfiguration of an agent's migratory or goal-directed behavior when the environment changes.

Sociability. Templates or class skeletons should support team and individual behavior of constructed agents. Ideally, team behavior of multiple agents should be configurable through the toolkit, and strictly controlled. The sensible allocation of roles or "talents" in a collaborative environment could be a valuable feature in a design and analysis toolkit.

Practical Issues

User Interface and Session Mediation. Initially, a primary use of agent technology could revolve around using an intelligent agent to monitor and mediate a user session with an application. Violations and alerts from a rules-based agent could be displayed to the user with proper warnings. Personalization of applications on the network or Intranet through the use of a "learning" agent is also an area of possibility.

Information Filtering and Translation. Another practical use could be a goal-directed agent or group of agents assigned the task of gathering information about the company's state through access to the various MIS resources and files internal and external to the company. Neural net technology could be used to discern undesirable business patterns or trends as indicated in the MIS environment. Inferences could be made, stored, routed, and presented at completion of the mission. Results could be monitored in mid-stream of the mission or at its completion. Ideally, a GUI interface could be used as a tool for auditing and presentation purposes. Graphics, drill-down reporting, security, and user customization would also be important.

Network Traffic Management. Agents specializing in load balancing and packet rerouting could optimize the use of network resources.

Electronic Commerce Negotiation. Predefined negotiating criteria and behavior could facilitate the remote negotiation of loan purchases from mortgage lenders. Search agents specializing in the location of these desirable lenders could also play an important part.

Comments on Terminology

Much of the current literature contains references to agent personality traits such as "antagonistic", "evasive", "dominant", "controlling", and the like. In general, these can be interpreted in the greater business environment as special "reserve" words that should be used sparingly. As an alternative, the terms "goal-directed", "persistent", "adaptive", "deliberate", and "rational" may be more appropriate terms to use when assuming a marketing posture towards Corporate America.

Conclusion

Fannie Mae sees a tremendous potential and opportunity in the field of intelligent agents, and wishes to pursue the development of its internal expertise and consulting skills. The intelligent agent concept may well be the conduit that AI needs in order to be brought into the corporate mainstream. The introduction of the proper toolkits and vendor organizations is critical to the success of this effort. The product that can best approach the ideals above has the highest likelihood of selection. The more products that can make inroads into the business environment, the more the development capital that will be made available to research efforts. This could enable the technology to be funded outside of the traditional academic and government arenas, and be able to advance accordingly. It's imperative that theory be aligned with necessity, since the two are not mutually exclusive and do not exist in a vacuum. This workshop paper has attempted to outline the goals and desires of an active business enterprise, hoping to inform the academic and product development community of some lucrative needs.