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A Tutorial on Mobile Agents

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Abstract

Mobile agents are intelligent agents that move from one host to another their own choosing to improve performance of their task and/or conserve bandwidth. Not all applications will be ideal to be implemented as mobile agents. It is another attractive tool used by a programmer that could be used or ignored as dictated by the application or its target environment.

1. Introduction

For an agent to migrate across a network, it requires[2]:

- A common execution language
- Process persistence
- Communication mechanism between agent hosts
- Security to protect agents and agent hosts

Common execution language: An interpreted scripting language or emulation of system that is capable of executing machine code solves the problem of common execution language.

Process Persistence: The ability to save the state of the agent before moving on to the next host and be able to start from where it left. The state should be saved in a way that makes it easier to transport over the network. This feature should not be built into the agent. It should be in the mobile agent language or architecture.

Communication mechanism between agent hosts: Communication message must exist to transfer agents between hosts. Agents may be transferred using TCP/IP, RMI, SMTP, HTTP, etc. The executable code must be transferred in whole or code may be shared on hosts in order to use less bandwidth.

Security to protect agents and agent hosts: The agent code should be protected from the host so that it cannot be modified or analyzed. This may be difficult because in scripting language the code has to be decrypted in order for it to run. Only way to protect against this problem is to use trusted hosts.

Agent hosts are safer in comparison as they can choose to accept digitally signed host from trusted sources.

2. Why use mobile Agents?

2.1 Conserve Bandwidth

This is achieved by placing an agent directly at the point of information. This would prevent hundreds of queries across the network. This is based on assumption that the

bandwidth consumed to transport the agent back and forth is less than the bandwidth consumed by the queries.

2.2 Delegate tasks to agents when not connected

Most of the Internet users do not have faster connections. Mobile agents can help these users by collecting information that is relevant to them while they are not connected.

2.3 Enable new types of interaction

The ability of mobile agents to fragment themselves makes them ideal candidates for becoming negotiating agents in an e-commerce application. These agents could travel to the vendors to look for the best deal.

3. Problems with mobile agents

As mentioned above, there is very little security around an agent when it executes on a host machine. Its code is vulnerable to modification. In addition to that, the host can monitor the actions of the agents and this could compromise the privacy of the owner. The queries executed by the agent could also give information about its owner. Therefore, mobile agents seem to very lax in terms of security.

4. Competing Technologies

Message passing systems: Agent need not be mobile to carry out their tasks. Instead they could use other agents to complete the job. Agent can use the Knowledge Query Manipulation Language (KQML) to pass messages between them.

Remote Method Invocation: Allows applications to invoke methods on shared objects that are distributed remotely. This technology could be used to facilitate agent mobility or could be an alternative.

CORBA: Similar to RMI, but is platform independent as the servicing module does not have to be implemented in the same language as the client application.

5. Discussions and Conclusion

Mobile agents do not seem to offer much in terms of benefits when compared to the drawbacks and the additional framework needed to facilitate mobility. It sure has some merits in places such as conserving bandwidth and load sharing across network of agents. However, bandwidth capabilities are improving and more and more people are getting connected to the ADSL or cable modems. The security issues related to mobile agents will make it very difficult for them to be used in a commercial application.

It remains to be seen what future research brings out for mobile agents.

6. References:

- [1] Gray, R. *Introduction to Mobile Agents: Performance, Security and Programming Examples*, Agent Systems and Application/Mobile Agents 2000
- [2] Reilly, D. *Mobile Agents - Process migration and its implications*.
http://www.davidreilly.com/topics/software_agents/mobile_agents/