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Threat Analysis and Security Architecture of Mobile Agent based Management Systems

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Abstract

Security issues are very important for the acceptance of mobile agent technology in management. We present a threat analysis and security architecture for these problems.

1. Introduction

Mobile agents are a new paradigm in distributed systems that allow transfering not only simple data but also 'living' code through networks. Therefore, an agent system provides a homogeneous run-time environment for agents by adapting the underlying, heterogeneous host system. Although the main research on mobile agents does not focus on its applicability in management, several publications regard it as a promising approach. For example, mobile agents give a more generic view on some aspects of concepts like Management-by-Delegation.

Despite of these benefits, mobile agents introduce a new dimension of security issues. Automatically executing arbitrary code on any host can be dangerous. Moreover, in order to fulfill their management tasks mobile agents must be able to access and configure security sensitive resources. Solutions to some security issues have been proposed. However, for a high and reliable security, a security architecture must integrate different security techniques and services into an overall secure system.

2. Modelling

Starting with an organizational analysis of distributed management systems integrating mobile agent technology, we find several important **entities** in different roles: *Managers* (management stations) as possible sources of mobile agents; *mid-level-managers* as objects of management operations and source of mobile agents; *managed resources* as objects of management operations; *agent systems* as execution platforms and part of the infrastructure, possibly running on a manager or managed resource; *mobile agents* as mobile units executed by agent systems. Security issues are highly related with **relations** between and to these entities.

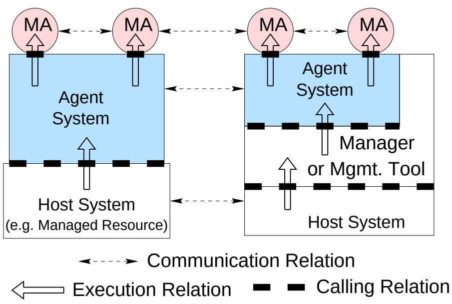

Figure 1 Interaction and components model

Figure 1 gives a closer look on different kinds of relations. **Communication relations** can be considered as transport of messages, e.g. through a network. Both parties run in different environments without direct interference. **Calling relations** are calls of methods or functions at defined interfaces. **Execution relations** is execution of code, e.g. a mobile agent by an agent system. In these last two cases, both parties share an environment.

3. Threat Analysis and Security Architecture

A systematic **threat analysis** uncovers various kinds of attacks and threats that could compromise security. Attacks can be classified in attacks against single entities, e.g. faking a legal identity to connect to an existing entity - masquerade. Attacks against relations try to subvert existing relations, e.g. eavesdropping, alteration or replaying. The threat analysis reveals the requirements for security like authentication, authorization, access control or confidentiality.

All components that deal with these requirements must be integrated into a **security architecture**. The architecture must cover all aspects of design and runtime of components as well as services including the flow of data and the life cycle of agents. Figure 2 sketches out the design of the agent system in relation to the agent life cycle to give an idea of major parts.

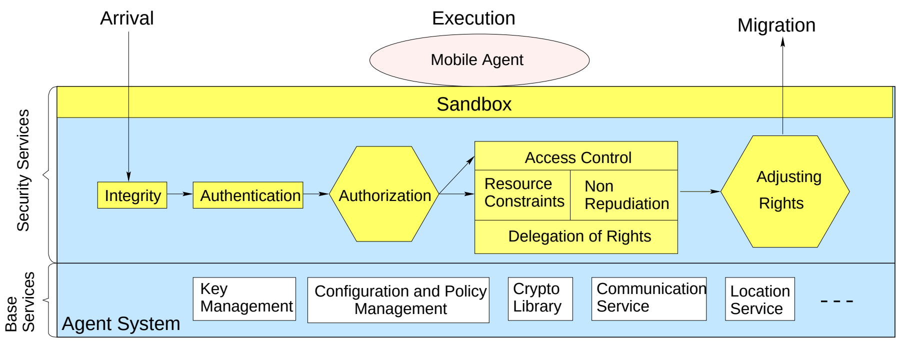

Figure 2 Security Architecture

4. Conclusions

The proposed architecture is a first step towards a comprehensive, integrating security architecture for mobile agent based management systems. First parts have been implemented in our agent system **MASA** (Mobile Agent System Architecture).

References

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