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# Identity Management in Agent Systems<sup>1</sup>

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Agent technology is a promising and enabling technology in open distributed environments. Agents are autonomous entities that interact with each other and with (web-) services, for which digital identity management (DIDM) is a prerequisite: the rights and obligations of all entities in an agent system need to be secured.

A framework for evaluation of DIDM in agent systems is proposed. Four computational entities in an agent system are distinguished: agent platforms, hosts, agents and services. These four entities are analysed with respect to four aspects of DIDM: representation, confidentiality, integrity and availability.

For each computational entity the following identity information is specified: a) name(s), b) address(es), c) look-up services, d) related principals, e) meta-data, and f) access regulation. *Names* are associated with each entity, e.g., unique identifiers and/or pseudonyms. *Addresses* specify an entity's point(s) of access and message delivery [2]. *Look-up services* provide information about other entities. *Related principals* are roles associated to a computational entity: Admin, Auditor, Creator, Developer, Owner, Publisher and User. These roles are often not explicitly represented. *Meta-data* describes the characteristics of an entity and its functions, e.g. information stored in a look-up service. *Access regulation* information, e.g. access rights.

The four aspects of DIDM of information stored and maintained in an agent system, are comparable to those found in other systems. A *representation* is a creation that is a visual or tangible rendering of someone or something. Representations are useful to store identity information. *Confidentiality* is related to information privacy. Any information that could possibly lead to the identification of a specific entity needs to be protected [3], e.g. user profiles, traces of transactions, and logs of interactions. In agent systems both the entities and their data need to be protected so that “only authorized entities

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can see protected data” [3, 4]. Maintaining *integrity* includes [5]: a) Preventing unauthorized users from making modifications; b) Maintaining internal and external consistency; c) Preventing authorized users from making improper modifications. *Availability* can be defined as “ensuring that information and information processing resources both remain readily accessible to their authorized users” [5]. In agent systems, agents, for example, need to be able to find other agents and services. White- and Yellow page services can serve this purpose.

Two agent system development frameworks, JADE-S and AgentScape, are used to illustrate the potential of this framework with respect to analysis, evaluation, design and development of agent systems. The framework provides a basis for further consideration of issues concerning privacy, anonymity, traceability and accountability.

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