



Chapter XXII

Taxonomies of User-Authentication Methods in Computer Networks

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Abstract

This chapter outlines classifications of user-authentication methods based on five different taxonomies. The outlined taxonomies are: user identification-based taxonomy, authentication methodology-based taxonomy, authentication quality-based taxonomy, authentication complexity-based taxonomy, and authentication scope-based taxonomy. Administration of user authentication is briefly discussed. A technical survey of different user-authentication methods and elements of a user-authentication method is also given. User-identification methods such as passwords, tokens, and biometric methods are described. Proposed and implemented user-authentication protocols to overcome security weaknesses of the basic password authentication are surveyed. New user-authentication protocols such as PANA and SOLA are also included. Protocols and software for user registration as well as centralized user authentication are presented and compared.

Introduction

User authentication is a process where a computer, computer program, or another user attempts to confirm that a user trying to set up a communication, is the person he or she claims to be. The definition of authentication is often mixed with the closely related definitions for identification and authorization. Identification is a way of providing a user with a unique identifier for an automated system. During the authentication process, the system validates the authenticity of the claimed user identity by comparing identification data with data stored in a user registry. Authorization is a process of assigning rights to an authenticated user to perform certain actions in the system.

Implementation of secure user-authentication mechanisms is essential when designing computer networks. In a local computer network, such as a corporate *local area network* (LAN) containing highly confidential data, it is important that only authorized users have access to the network. If the user-authentication mechanisms are incomplete, an intruder can steal an authorized user's identity and obtain confidential company information. User authentication is a particularly critical issue in *wireless LANs* (WLANs) where data is transmitted through the air across *radio frequency* (RF) communication channels. In WLANs, physical security measures, such as door locks, identity cards, and security personnel, are ineffective since the connectivity is hard to limit to a certain room or building. User authentication is also very important in public network service systems, such as e-commerce systems and Internet bank systems. If an intruder could access another person's bank account over the Internet, the consequences would be disastrous.

Abbreviations used in this chapter are listed in the Appendix.

Authentication Taxonomy Options

A taxonomy defines a hierarchical structure for an object set. Many taxonomies can be defined for the same object set. A taxonomy is most useful for the management of an object. The classical example of a generally acknowledged and widely used scientific taxonomy is the taxonomy defined by Carolus Linnaeus for classification of living organisms.

User authentication is a very important network security issue. The set of proposed, used, developed, and possible user-authentication methods is already quite large and rich in features. Much benefit would be gained from well-defined taxonomies in network security design and administration. A taxonomy of some current authentication and/or authorization systems is presented in Lopez Montenegro, Oppliger, and Pernul (2004). This taxonomy establishes four categories:

- **General scope solutions** for all network scenarios. These solutions are based on the Kerberos authentication protocol and/or on certificate authentication schemes.

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