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Microsoft® Win32™ Programmer's Reference

VOLUME 2

System Services, Multimedia, Extensions, and Application Notes

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49.1 About Security

The security provisions of Microsoft Windows NT are available to Windows-based applications automatically. Every application running on the system is subject to the security imposed by the particular configuration of the local implementation of Windows NT.

The security functions in the Win32 application programming interface (API) allow an application to selectively grant and deny access to an object. An application can specify many different kinds of access for particular users and groups of users. The operating system grants or denies access to an object based on a comparison of the security provisions stored with an object with the access rights specified in a token associated with the process or thread requesting the access. These security functions allow an application to query and manipulate the security features of both an object and a process or thread.

The impact of Windows security on most Windows functions is minimal, and a Windows-based application not requiring security functionality usually does not need to incorporate any special code. However, a developer can use the security features of Windows NT to provide a number of services in a Windows-based application. Generally, any application that manipulates a system-wide resource such as the system time, must use the security system to gain access to that resource. A security-aware application might allow the user to query the security attributes of a file, provide specialized feedback when access to a secure file is denied, or customize the security attributes of a file or group of files so that only a subset of other users on a network has access to the information.

The first release of Windows NT is designed to support C2-level security as defined by the US Department of Defense. Some of the most important requirements of C2-level security are shown in the following list.

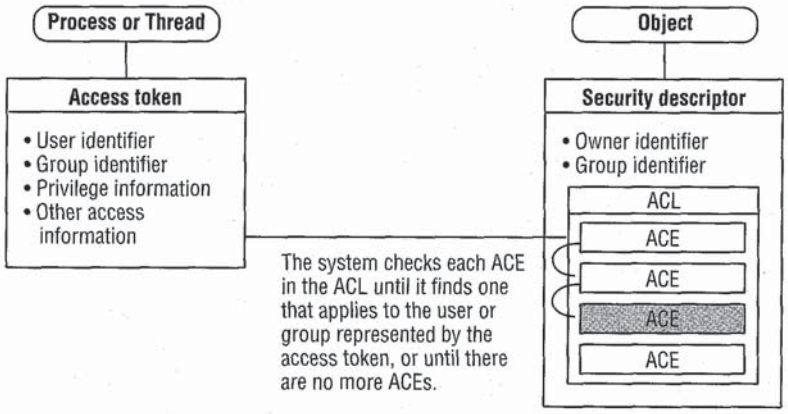
- It must be possible to control access to a resource. This access control must include or exclude individual users or named groups of users.
- Memory must be protected so its contents cannot be read after it is freed by a process.
- Users must identify themselves in a unique manner when they log on. All auditable actions must identify the user performing the action.
- System administrators must be able to audit security-related events. Access to this audit data must be limited to authorized administrators.
- The system must protect itself from external interference or tampering, such as modification of the running system or of system files stored on disk.

49.2 Security Model

All named objects in Windows NT, and some unnamed objects, can be secured. The security attributes of each securable object in Windows are described by a *security descriptor*, that contains information about the owner of the object and by an *access-control list* (ACL), identifying the users and groups allowed or denied access to the object. An ACL contains an entry for each user, global group, or local group (alias) being allowed or denied access to the object. Each of these entries is an *access-control entry* (ACE).

At logon, a user is assigned an *access token* containing identifiers that represent the user and any groups to which the user belongs. Every process run on behalf of this user will have a copy of this particular access token. When a process attempts to use an object, the system compares the security attributes listed in the access token with the ACEs in the object's ACL. The system compares the access token with each ACE until access is either granted or denied or until there are no more ACEs to check. Conceivably, several ACEs could apply to a token. And, if this occurs, the access rights granted by each ACE accumulate. For example, if one ACE grants read access to a group in an access token and another ACE grants write access to the user, who is also a member of the group, the user will have both read and write access to the object when the access check is complete.

The following illustration shows the relationship between these blocks of security information:



Typically, the application protecting an object is a server in that it defines the users and groups with access to the object. The application interacts with clients when they attempt to gain access to the object. Users and groups are identified by *security identifiers* (SIDs). An SID is a structure of variable length that uniquely identifies a user or group. SIDs are stored in a security database that an application can query by calling Win32 functions. With one exception, an SID is

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