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Part 1AR: Secure device identity

Télécommunications et échange entre systèmes informatiques — Exigences pour les réseaux locaux et métropolitains —

Partie 1AR: Identité de dispositif sécurisé

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IEEE Std 802.1AR-2018
(Revision of
IEEE Std 802.1AR-2009)

IEEE Standard for
Local and Metropolitan Area Networks—

Secure Device Identity

Sponsor

LAN/MAN Standards Committee
of the
IEEE Computer Society

Approved 14 June 2018

IEEE-SA Standards Board

Abstract: A Secure Device Identifier (DevID) is cryptographically bound to a device and supports authentication of the device's identity. An Initial Device Identifier (IDevID) provide by the supplier of a device can be supplemented by Local Device Identifiers (LDevIDs) facilitating enrollment (provisioning of authentication and authorization credentials) by local network administrators.

Keywords: access control, authentication, authorization, certificate, IEEE 802.1AR, LANs, local area networks, MAC security, MANs, metropolitan area networks, PKI, port-based network access control, secure association, Secure Device Identifier, security, X.509

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Introduction

This introduction is not part of IEEE Std 802.1AR-2018, IEEE Standard for Local and Metropolitan Area Networks—Secure Device Identity.

This standard specifies Secure Device Identifiers (DevIDs) for use with IEEE Std 802.1X™ [B1][1] and other industry standards and protocols that authenticate, provision, and authorize communicating devices.

Each DevID comprises an RFC 5280 conformant X.509 certificate that identifies the subject device and can include authorization information signed by the certificate's issuer, a secret private key that corresponds to the certificate's subject public key, and any certificate chain required to facilitate the certificate's use. A device's DevID module stores each of its DevID secrets securely and supports signing operations that prove possession of the secret (and thus that the device is the subject of the associated DevID certificate), while ensuring that the secret remains confidential so the device cannot be impersonated by others.

An Initial Device Identifier (IDevID) provided by a device's supplier can be supplemented by one or more Local Device Identifiers (LDevIDs), each using an existing or a freshly generated secret, facilitating enrollment (provisioning of authentication and authorization credentials to authenticated devices) by a local network administrator.

The first edition of IEEE Std 802.1AR was published in 2009. This revision added the ECDSA P-384/SHA-384 signature suite option; removed the RSA-2048/OPAQUE option (that permitted the use of an undisclosed hash function); restructured the document to enable future signature suite changes, for clarity (particularly in conformance statements and the PICS), and revised the MIB. A DevID module can now implement more than one signature suite (facilitating interoperability and the use of a device in different authentication environments) and additional service operations (that do not conflict with mandatory requirements) as long as these are disclosed (facilitating backwards compatibility and support of DevID functionality by other modules, e.g., TPM).

[1]Numbers in brackets correspond to entries in the Bibliography in Annex C.

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IEEE Standard for
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Secure Device Identity

1. Overview

IEEE 802® Local Area Networks (LANs) are often deployed in networks that provide publicly accessible service access or that cannot be completely physically secured. The protocols that configure, manage, and regulate access to these networks and network-based services and applications typically run over the networks themselves. Secure and predictable operation of such networks depends on authenticating each device attached to and participating in the network, so that the degree of trust and authorization to be accorded to that device by its communicating peers can be determined.

Authentication of a human user, through a credential known to or possessed by that user, is often used to authenticate users of devices such as laptop personal computers. However many of the devices that compose a network are designed for unattended autonomous operation and might not support user authentication. These include the routers and bridges that interconnect and provide access to the LANs. Moreover, failure to provide devices that access the network with the mutual guarantee that they are connected to legitimate network access points allows malicious devices to interpose themselves between the network and its authenticated and authorized users, and effectively make use of the credentials of the latter. For these reasons a secure device identifier, i.e., one that embodies an authentication credential that cannot be easily removed or copied for use in a device under the control of someone who wishes to gain unauthorized access to or attack the operation of a network, is highly desirable.

Protocols for configuring, managing and regulating access to a network depend on the existence of a device identifier or human authentication of initial access to associate a device with an authentication credential. This can result in a “chicken-and-egg” scenario, wherein these credentials must be installed during an expensive “pre-provisioning” process before actual deployment. Even when device credentials are deployed in-place, the process is often interactive, involving a physically secured connection to the device being deployed and a knowledgeable system administrator.

Secure Device Identifiers (DevIDs) are designed to be used as interoperable secure device authentication credentials with Extensible Authentication Protocol (EAP [B4]) and other industry standard authentication and provisioning protocols.[1] A standardized device identity facilitates interoperable secure device authentication that helps simplify and standardize secure deployment and management of devices. A device is any entity in an IEEE 802 LAN that seeks to obtain services from the network or provide services on the network.

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A device with DevID capability incorporates a globally unique manufacturer provided Initial Device Identifier (IDevID), stored in a way that protects it from modification. The device may support the creation of Locally Significant Device Identifiers (LDevIDs) by a network administrator. Each LDevID is bound to the device in a way that makes it infeasible for it to be forged or transferred to a device with a different IDevID without knowledge of the private key used to effect the cryptographic binding. LDevIDs can incorporate, and fully protect, additional information specified by the network administrator to support local authorization conventions. LDevIDs can also be used as the sole identifier (by disabling the IDevID) to assure the privacy of the user of a DevID and the equipment in which it is installed.

Multiple logical or physical devices, each with its own unique DevID can be contained within an aggregate device. The selection of a DevID for the aggregate device can depend on the context in which it is to be identified. This standard assumes that any such selection has been made and addresses device requirements independent of their simple or aggregate nature.

1.1 Scope

This standard specifies unique per-device identifiers (DevID) and the management and cryptographic binding of a device to its identifiers, the relationship between an initially installed identity and subsequent locally significant identities, and interfaces and methods for use of DevIDs with existing and new provisioning and authentication protocols.

1.2 Purpose

This standard defines a standard identifier for IEEE 802 devices that is cryptographically bound to that device, and defines a standard mechanism to authenticate a device's identity. This facilitates secure device provisioning.

1.3 Relationship to other standards

This standard specifies an identifier that is generally useful across IEEE 802 networks. It draws on and is informed by other standards that have been developed elsewhere for different purposes. Where possible, it attempts compatibility with the following:

a) Trusted Platform Module (TPM)

NOTE—TPM Keys for Platform Identity [B13] describes how TPM 1.2 can be used to provide DevID functionality, superseding IEEE Std 802.1AR-2009 Annex B.

b) Extensible Authentication Protocol-Transport Layer Security (EAP-TLS [B6])

IETF RFC 7030 [B9] (Enrollment over Secure Transport) describes a certificate management protocol for Public Key Infrastructure (PKI) clients that need to acquire client certificates and associated Certification Authority (CA) certificates. A client can use an IDevID, as defined by this standard, to participate in the enrollment protocol which supports both client generated and CA generated public/private key pairs (LDevIDs).

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2. Normative references

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IEEE Std 802.1AC™, IEEE Standard for Local and metropolitan area networks—Media Access Control (MAC) Service Definition.[2, 3]

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IETF RFC 6933, Entity MIB (Version 4), Bierman, A., Romascanu, D., Quittek, J., Chandramouli, M., May 2013.

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ISO/IEC 8825-1 Information technology—ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER).[6]

NIST FIPS 180-4, Secure Hash Standard (SHS), August 2015.[7]

NIST FIPS 186-4, Digital Signature Standard (DSS), July 2013.

NIST Special Publication 800-90A, Revision 1, Recommendation for Random Number Generation Using Deterministic Random Bit Generators, E. Barker, J. Kelsey, June 2015.

[6]ISO/IEC publications are available from the ISO Central Secretariat, Case Postale 56, 1 rue de Varembé, CH-1211, Genève 20, Switzerland/Suisse (http://www.iso.ch/). ISO/IEC publications are also available in the United States from Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112, USA (http://global.ihs.com/).

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