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Identity Modules for CoAP
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Abstract

This document defines identity modules based on Secure Elements processing DTLS/TLS stacks for CoAP devices. The expected benefits of these secure microcontrollers are the following :
- Secure storage of pre-share keys or private keys
- Trusted simple or mutual authentication between CoAP devices and CoAP clients.
- The device identity is enforced by a non cloneable chip.
- Trusted cryptographic support.
- Low power consumption for DTLS/TLS processing.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119.

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on June 2017.

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1 Overview

The CoAP [CoAP] protocol MAY be secured by the DTLS protocol [DTLS] over an UDP/IP stack; the TLS support [TLS] is also under definition [CoAP-TLS] over a TCP/IP stack.

According to [CoAP] four security modes are available, NoSec, PreSharedKey, RawPublicKey, and Certificate. When DTLS is used with the PreShareKey or Certificate modes there is a need to store secrets such as symmetric or asymmetric keys, which authenticate the CoAP device.

In that case a Secure Element (SE) MAY be used in order to fully run the DTLS or TLS protocol. According to the data throughput or other security considerations the DTLS/TLS session MAY be exported from the secure element after the exchange of the finished messages.

This class of Secure Element is referred by this draft as an identity module (IdMod).

The expected benefits of identity modules are the following :

- Secure storage of pre-share keys or private keys
- Trusted simple or mutual authentication between the CoAP device and the CoAP client.
- The device identity is enforced by a non cloneable identity module.
- Trusted cryptographic support.
- Low power consumption for DTLS/TLS processing.

2 What is a Secure Element

A Secure Element (SE) is a tamper resistant microcontroller (see figure 1) equipped with host interfaces such as [ISO7816], SPI (Serial Peripheral Interface) or I2C (Inter Integrated Circuit).

The typical area size of these electronic chips is about 5x5 mm2. They comprise CPU (8, 16, 32 bits), ROM (a few hundred KB), non volatile memory (EEPROM, FLASH, a few hundred KB) and RAM (a few ten KB). Security is enforced by multiple hardware and logical countermeasures.

According to the [EUROSMART] association height billion of such secure devices were shipped in 2013. Secure elements are widely deployed for electronic payment (EMV cards), telecommunication (SIM modules), identity (electronic passports), ticketing, and access control (PKCS15 cards).

Most of secure elements include a Java Virtual Machine (JVM) and therefore are able to execute embedded program written in the JAVACARD language. Because these devices are dedicated to security

purposes they support numerous cryptographic resources such as digest functions (MD5, SHA1, SHA2...), symmetric cipher (3xDES, AES) or asymmetric procedures (RSA, ECC).

A set of Global Platform [GP] standards control the lifecycle of embedded software, i.e. application downloading, activation and deletion.

As an illustration a typical low cost Secure Element has the following characteristics:

- JAVACARD operating system;
- Compliant with the GP (Global Platform) standards;
- 160 KB of ROM;
- 72 KB of EEPROM;
- 4KB of RAM;
- Embedded crypto-processor;
- 3xDES, AES, RSA, ECC;
- Certification according to Common Criteria (CC) EAL5+ level;
- Security Certificates from payment operators.

According to the state of art, TLS/DTLS stacks may run in secure elements, for example written as a javacard applications.

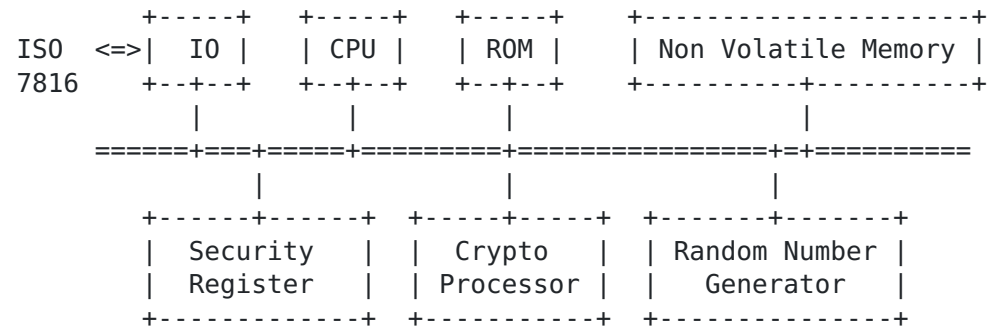

Figure 1. A typical hardware architecture of a Secure Element

3 Identity Module for CoAP

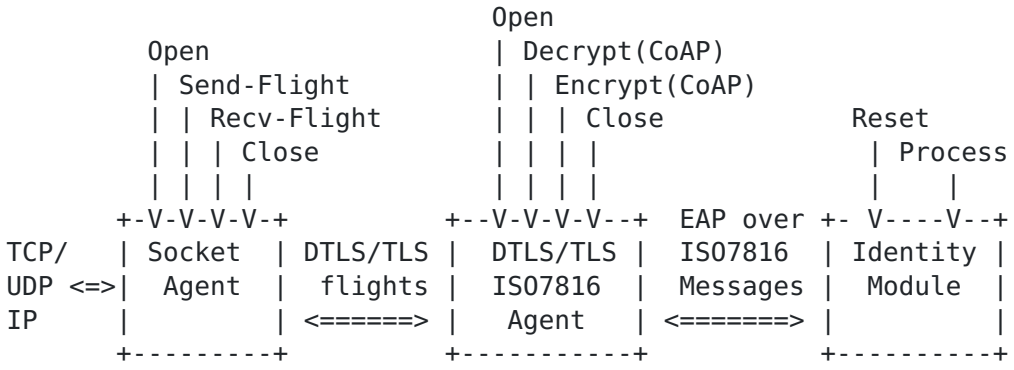

Figure 2. CoAP Identity module framework

ISO7816 interface for Secure Elements providing TLS/DTLS stacks are detailed in [DTLS/TLS-SM]. The Identity module MUST support two commands Reset and Process.

TLS/DTLS packets are transported by the EAP protocol over ISO7816 messages. This mechanism previously detailed by [EAPSC] provides a double segmentation procedure thanks to EAP and ISO7816 facilities.

A DTLS/TLS-ISO7816 software agent sends and receives DTLS/TLS flights to/from sockets over EAP/ISO7816 messages to/from the identity module. Conceptually this component interface SHOULD have four procedures Open, Close, Encrypt and Decrypt.

A socket software agent extracts and send DTLS/TLS flights from/to UDP/TCP packets. Conceptually this component interface SHOULD have four procedures Open, Close, Recv-Flight, Send-Flight.

4 DTLS/TLS profile for CoAP security modules

To be done.

5 IANA Considerations

This draft does not require any action from IANA.

6 References

6.1 Normative References

[TLS] Dierks, T., Rescorla, E., "The Transport Layer Security (TLS) Protocol Version 1.1", RFC 5746, August 2008

[DTLS] Rescorla, E. and N. Modadugu, "Datagram Transport Layer Security Version 1.2", RFC 6347, January 2012.

[RFC7252] Shelby, Z., Hartke, K., and C. Bormann, "The Constrained Application Protocol (CoAP)", RFC 7252, June 2014.

[CoAP-TLS] A TCP and TLS Transport for the Constrained Application Protocol (CoAP), draft-ietf-core-coap-tcp-tls-02, April 2016.

[ISO7816] ISO 7816, "Cards Identification - Integrated Circuit Cards with Contacts", The International Organization for Standardization (ISO).

6.2 Informative References

[GP] Global Platform Standards, http://www.globalplatform.org

[EUROSMART] The EUROSMART association, http://www.eurosmart.com

[DTLS/TLS-SM] Urien, P., "TLS and DTLS Security Modules", draft-urien-uta-tls-dtls-security-module-03.txt, December 2016

[EAPSC] Urien, P., "EAP Support in Smartcard", draft-urien-eap-smartcard-32.txt, December 2016

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