ONVIF®

Security Configuration Device Test Specification

Version 23.06

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REVISION HISTORY

Vers.	Date	Description
0.6	Feb 26, 2013	Initial version
0.7	Apr 16, 2013	Adapted document to Advanced Security Service Specification v1.0_RC1
0.7.1	May 8, 2013	Added key store tests
0.8	May 11, 2013	First draft for WG review
0.81	Jun 11, 2013	Minor changes after Singapore F2F
0.82	Jun 13, 2013	Partial fix for ticket #1079
0.9	Jun 14, 2013	Added appendices A.8 to A.11 and modified Sect. 5.3.14.
13.06	Dec, 2013	First issue of Advanced Security Test Specification
14.06	Jun, 2014	New tests were added: Create PKCS#10 – negative test, Delete Certificate – CA – Preserve Public Key, Upload certificate – delete linked key (negative test), Upload certificate – Upload malformed certificate (negative test), Upload certificate – Upload expired certificate, TLS Server Certificate - self-signed, TLS Server Certificate – CA. Annex A.21, A.22 were added.
14.12	Dec, 2014	The following test cases were added: Create PKCS#10 – Subject Test, Create self-signed certificate – Subject Test, Upload Passphrase, Delete Passphrase, Upload PKCS8 – no key pair exists, Upload PKCS8 – decryption fails, Upload PKCS8 – key pair without private key exists, Upload PKCS12 – no key pair exists, Upload PKCS12 – decryption fails, Upload PKCS12 – key pair without private key exists. The following test cases were modified with ID change: Basic TLS Handshake, Basic TLS Handshake after Replace Server Certificate Assignment.

		The following annexes were added: A.23, A.24, A.25, A.26, A.27, A.28, A.29, A.30, A.31, A.32, A.33, A.34, A.35.
15.06	Jun, 2015	The following test cases were added: ADVANCED_SECURITY-3-2-5 Basic TLS Handshake with Replace Server Certification Path and PKCS#12 ADVANCED_SECURITY-6-3-4 Upload PKCS12 - verify key and certificate ADVANCED_SECURITY-2-1-27 CreateSelfSignedCertificate with PKCS#12 ADVANCED_SECURITY-2-1-28 Create PKCS#10 request with PKCS#12 ADVANCED_SECURITY-8-1-1 Upload CRL ADVANCED_SECURITY-8-1-2 Delete CRL ADVANCED_SECURITY-8-1-3 Get CRL ADVANCED_SECURITY-8-1-4 Create certification path validation policy ADVANCED_SECURITY-8-1-5 Get certification path validation policy ADVANCED_SECURITY-8-1-6 Delete certification path validation policy ADVANCED_SECURITY-3-3-1 TLS client authentication – self-signed TLS server certificate with on-device RSA key pair ADVANCED_SECURITY-3-3-2 CRL processing with on-device RSA key pair ADVANCED_SECURITY-3-3-3 Replace certification path validation policy assignment The following test cases were modified: ADVANCED_SECURITY-1-1-3 Check private Key status for an RSA private key ADVANCED_SECURITY-2-1-1 Create PKCS#10 certification requests ADVANCED_SECURITY-2-1-2 Create self-signed certificate ADVANCED_SECURITY-2-1-3 Upload certificate – Keystore contains private key ADVANCED_SECURITY-2-1-6 Get certificate – self-signed ADVANCED_SECURITY-2-1-8 Get all certificates – self signed ADVANCED_SECURITY-2-1-10 Delete Certificate – self signed ADVANCED_SECURITY-2-1-12 Create Certification Path – self-signed

		ADVANCED_SECURITY-2-1-13 Create Certification Path – CA ADVANCED_SECURITY-2-1-14 Get Certification Path – self-signed ADVANCED_SECURITY-2-1-15 Get Certification Path – CA ADVANCED_SECURITY-2-1-16 Get All Certification Paths – self-signed ADVANCED_SECURITY-2-1-17 Get All Certification Paths – CA ADVANCED_SECURITY-2-1-18 Delete Certification Path – self-signed ADVANCED_SECURITY-2-1-19 Delete Certification Path - CA ADVANCED_SECURITY-2-1-20 Create PKCS#10 (negative test) ADVANCED_SECURITY-2-1-22 Upload certificate – delete linked key (negative test) ADVANCED_SECURITY-3-1-1 Add Server Certificate Assignment – self-signed ADVANCED_SECURITY-3-1-2 Add Server Certificate Assignment – CA ADVANCED_SECURITY-3-1-3 Replace Server Certificate Assignment – self-signed ADVANCED_SECURITY-3-1-4 Replace Server Certificate Assignment – CA ADVANCED_SECURITY-3-1-5 Get Assigned Server Certificates – self-signed ADVANCED_SECURITY-3-1-6 Get Assigned Server Certificates – CA ADVANCED_SECURITY-3-1-7 Remove Server Certificate Assignment – self-signed ADVANCED_SECURITY-3-1-8 Remove Server Certificate Assignment – CA ADVANCED_SECURITY-3-2-3 Basic TLS Handshake ADVANCED_SECURITY-3-2-4 Basic TLS Handshake after Replace Server Certificate Assignment ADVANCED_SECURITY-4-1-1 TLS Server Certificate - self-signed ADVANCED_SECURITY-4-1-2 TLS Server Certificate – CA ADVANCED_SECURITY-5-1-1 Advanced Security Service Capabilities ADVANCED_SECURITY-5-1-2 Get Services and Get Advanced Security Service Capabilities Consistency The following annexes were added: A.36, A.37, A.38, A.39, A.40, A.41, A.42, A.43, A.44, A.45, A.46 The following annexes were modified:

		A.4, A.8, A.11, A.13, A.14, A.16, A.18, A.30, A.35
16.06	Mar 2016	The ADVANCED_SECURITY-3-2-4 has been updated.
17.06	Jun 22, 2017	The document formating were updated.
18.06	Mar 14, 2018	timeout1 variable was replaced by operationDelay variable.
18.06	Mar 15, 2018	The following were updated according to #1562: Annex A.47 Remove Server Certificate Assignment (added) Annex A.48 Restore Server Certificate Assignment (added) ADVANCED_SECURITY-3-1-1 Add Server Certificate Assignment – self-signed (steps 3 and 8 were added) ADVANCED_SECURITY-3-1-2 Add Server Certificate Assignment – CA (steps 3 and 8 were added) ADVANCED_SECURITY-3-1-3 Replace Server Certificate Assignment – self-signed (steps 3 and 18 were added) ADVANCED_SECURITY-3-1-4 Replace Server Certificate Assignment – CA (steps 3 and 25 were added) ADVANCED_SECURITY-3-1-5 Get Assigned Server Certificates – self-signed (steps 3 and 12 were added) ADVANCED_SECURITY-3-1-6 Get Assigned Server Certificates – CA (steps 3 and 14 were added) ADVANCED_SECURITY-3-1-7 Remove Server Certificate Assignment – self-signed (steps 3 and 17 were added) ADVANCED_SECURITY-3-1-8 Remove Server Certificate Assignment – CA (steps 3 and 18 were added) ADVANCED_SECURITY-3-2-3 Basic TLS Handshake (steps 3 and 23 were added) ADVANCED_SECURITY-3-2-4 Basic TLS Handshake after Replace Server Certificate Assignment (steps 3 and 39 were added) ADVANCED_SECURITY-3-2-5 Basic TLS Handshake with Replace Server Certification Path and PKCS#12 (steps 3 and 40 were added) ADVANCED_SECURITY-3-3-1 TLS client authentication – self-signed TLS server certificate with on-device RSA key pair (steps 3 and 38 were added) ADVANCED_SECURITY-3-3-2 CRL processing with on-device RSA key pair (steps 3 and 40 were added) ADVANCED_SECURITY-4-1-1 TLS Server Certificate - self-signed (steps 3 and 22 were added) ADVANCED_SECURITY-4-1-2 TLS Server Certificate – CA (steps 3 and 35 were added)
18.06	Mar 15, 2018	The following were updated according to #1586: ADVANCED_SECURITY-1-1-1 Create RSA Key Pair, status through polling (steps 4.3, 4.3.1, 4.4 were updated)

		ADVANCED_SECURITY-1-1-2 Create RSA Key Pair, status through event (steps 6.3, 6.4 were updated) Annex A.7 Create an RSA key pair (steps 4, 4.1, 5 were updated)
18.06	Apr 17, 2018	The following were updated according to #1615: Annex A.4 Provide CA certificate (step 1 added, step 3 updated) Annex A.22 Provide expired CA certificate (step 1 added, step 4 updated)
18.06	Apr 23, 2018	The following were updated according to #1594: ADVANCED_SECURITY-5-1-1 Advanced Security Service Capabilities (step 13.1 were updated)
18.06	May 03, 2018	The following were updated according to #1593: ADVANCED_SECURITY-3-1-1 Add Server Certificate Assignment – self-signed (step 7 was added) ADVANCED_SECURITY-3-1-2 Add Server Certificate Assignment – CA (step 7 was added) ADVANCED_SECURITY-3-1-3 Replace Server Certificate Assignment – self-signed (steps 7, 14 were added) ADVANCED_SECURITY-3-1-4 Replace Server Certificate Assignment – CA (steps 11, 21 were added) ADVANCED_SECURITY-3-1-6 Get Assigned Server Certificates – CA (step 9 was added) ADVANCED_SECURITY-3-1-7 Remove Server Certificate Assignment – self-signed (step 13 was added) ADVANCED_SECURITY-3-1-8 Remove Server Certificate Assignment – CA (steps 9, 16 were added) ADVANCED_SECURITY-3-2-3 Basic TLS Handshake (step 12 was added) ADVANCED_SECURITY-3-2-4 Basic TLS Handshake after Replace Server Certificate Assignment (steps 12, 25 were added) ADVANCED_SECURITY-3-2-5 Basic TLS Handshake with Replace Server Certification Path and PKCS#12 (steps 13, 27, 37 were added) ADVANCED_SECURITY-4-1-1 TLS Server Certificate - self-signed (step 13 was added) ADVANCED_SECURITY-4-1-2 TLS Server Certificate – CA (steps 7, 20 were added) Annex A.12 Remove server certificate assignment with corresponding certification path, certificate and RSA key pair (step 3 was added) Annex A.13 Add server certificate assignment with corresponding certification path, self-signed certificate and RSA key pair (step 4 was added)

		Annex A.20 Remove server certificate assignment with corresponding certification path, certificates and RSA key pairs (step 3 was added) Annex A.47 Remove Server Certificate Assignment (step 8.4 was added) Annex A.48 Restore Server Certificate Assignment (step 1.3 was added)
18.06	May 07, 2018	The following were updated according to #1632: ADVANCED_SECURITY-2-1-20 CreatePKCS10CSR – negative test (step 11 was updated)
18.06	May 16, 2018	The following were updated according to #1619: Annex A.45 Provide CRL for specified certificate (step 1 was changed)
18.06	Jun 21, 2018	Reformatting document using new template
18.12	Oct 1, 2018	The following were updated in the scope of #1599: ADVANCED_SECURITY-2-1-27 CreateSelfSignedCertificate with PKCS#12 (Pre-Requisite updated with new item) ADVANCED_SECURITY-2-1-28 Create PKCS#10 request with PKCS#12 (Pre-Requisite updated with new item) ADVANCED_SECURITY-3-1-3 Replace Server Certificate Assignment - Self-Signed (test procedure updates to create new RSA key pair for second certificate) ADVANCED_SECURITY-3-1-4 Replace Server Certificate Assignment - CA (test procedure updates to create new RSA key pair for second CA-signed certificate) ADVANCED_SECURITY-3-2-4 Basic TLS Handshake after Replace Server Certificate Assignment (test procedure updates to create new RSA key pair for second certificate)
18.12	Nov 12, 2018	The following were updated in the scope of #1653: Title was updated (Advanced Security Test Specification replaced with Security Configuration Device Test Specification) Introduction section was updated (ONVIF Advanced Security Test Specification was replaces with ONVIF Security Configuration Device Test Specification) Scope section was updated (ONVIF Advanced Security Test Specification was replaces with ONVIF Security Configuration Device Test Specification, ONVIF Advanced Security Service replaced with ONVIF Security Configuration Service) Normative references was updated ([ONVIF Advanced Security Service] ONVIF Advanced Security Specifications: replaced with [ONVIF Security Configuration Service] ONVIF Security Configuration Specifications:) Definition was updated (ONVIF Advanced Security Service replaced with ONVIF Security Configuration Service)

		Test Overview\Test Policy\Keystore was updated (Advanced Security Service was replaced with ONVIF Security Configuration Service) Test Overview\Test Policy\Certificate Management was updated (Advanced Security Service was replaced with ONVIF Security Configuration Service) Test Overview\Test Policy\TLS Server was updated (Advanced Security Service was replaced with ONVIF Security Configuration Service) Test Overview\Test Policy\Referential Integrity was updated (Advanced Security Service was replaced with ONVIF Security Configuration Service) Test Overview\Test Policy\Capabilities was updated (Advanced Security Service was replaced with ONVIF Security Configuration Service) Test Overview\Test Policy\Off-Device Key Generation Operations was updated (Advanced Security Service was replaced with ONVIF Security Configuration Service) Test Overview\Test Policy\Certificate-based Client Authentication was updated (Advanced Security Service was replaced with ONVIF Security Configuration Service) Advanced Security Test Cases chapter title was updated with Security Configuration Test Cases For all test cases Pre-Requisites were updated ("Advanced Security Service is received from the DUT." was replaced with "Security Configuration Service is received from the DUT.") For all test cases WSDL References were updated ("advancedsecurity.wsdl" was replaced with "security.wsdl") For all test cases Specification Coverage were updated ("Advanced Security, Keystore – Key Management" was replaced with "Key Management (ONVIF Security Configuration Service Specification)") For all test cases Specification Coverage were updated ("Advanced Security, Key Management" was replaced with "Key Management (ONVIF Security Configuration Service Specification)") For all test cases Specification Coverage were updated ("Advanced Security, Keystore - Certificate Management" was replaced with "Certificate Management (ONVIF Security Configuration Service Specification)") For all test cases Specification Coverage were updated ("Advanced Security, Certificate Management" was replaced with "Certificate Management (ONVIF Security Configuration Service Specification)") For all test cases Specification Coverage were updated ("Advanced Security, TLS Server" was replaced with "TLS Server (ONVIF Security Configuration Service Specification)") For all test cases Specification Coverage were updated ("Advanced Security, Capabilities" was replaced with "Capabilities (ONVIF Security Configuration Service Specification)")

		For all test cases Specification Coverage were updated ("Advanced Security, Passphrase Management" was replaced with "Passphrase Management (ONVIF Security Configuration Service Specification)") For all test cases Specification Coverage were updated ("Advanced Security, Upload Certificate Revocation List" was replaced with "CRL Management (ONVIF Security Configuration Service Specification)") For all test cases Specification Coverage were updated ("Advanced Security, Delete Certificate Revocation List" was replaced with "CRL Management (ONVIF Security Configuration Service Specification)") For all test cases Specification Coverage were updated ("Advanced Security, 7.6.2 Get Certificate Revocation List" was replaced with "CRL Management (ONVIF Security Configuration Service Specification)") For all test cases Specification Coverage were updated ("Advanced Security, Create Certification Path Validation Policy" was replaced with "Certification Path Validation Policy Management (ONVIF Security Configuration Service Specification)") For all test cases Specification Coverage were updated ("Advanced Security, Get Certification Path Validation Policy" was replaced with "Certification Path Validation Policy Management (ONVIF Security Configuration Service Specification)") For all test cases Specification Coverage were updated ("Advanced Security, Delete Certification Path Validation Policy" was replaced with "Certification Path Validation Policy Management (ONVIF Security Configuration Service Specification)") For all test cases Specification Coverage were updated ("Advanced Security, Replace Certification Path Validation Policy" was replaced with "Certification Path Validation Policy Management (ONVIF Security Configuration Service Specification)") Test ADVANCED_SECURITY-5-1-1 was renamed ("Advanced Security Service Capabilities" was replaced with "Security Configuration Service Capabilities") For test ADVANCED_SECURITY-5-1-1 test purpose was updated ("To verify DUT Advanced Security Service Capabilities." was replaced with "To verify DUT Security Configuration Service Capabilities.") Test ADVANCED_SECURITY-5-1-2 was renamed ("Get Services and Get Advanced Security Service Capabilities Consistency" was replaced with "Get Services and Get Security Configuration Service Capabilities Consistency") For test ADVANCED_SECURITY-5-1-2 test purpose was updated ("To verify Get Services and Advanced Security Service Capabilities consistency." was replaced with "To verify Get Services and Security Configuration Service Capabilities consistency.") Feature under test field for tests ADVANCED_SECURITY-5-1-1 and ADVANCED_SECURITY-5-1-2 were updated ("GetServiceCapabilities (for Advanced Security Service)" was replaced with "GetServiceCapabilities (for Security Configuration Service)") Other minor changes in description related to renaming of Advanced Security Service to Security Configuration Service.

18.12	Dec 21, 2018	Switching Hub description in 'Network Configuration for DUT' section was updated according to #1737
19.06	May 06, 2019	The following were updated in the scope of #1799: Security Configuration Test Cases\TLS Versions (added) ADVANCED_SECURITY-9-1-1 TLS Version Management (added) ADVANCED_SECURITY-9-1-2 Disable TLS Version (added) Annex A.49 Configuring HTTPS if Required (added) Annex A.50 Configuring HTTPS using Security Configuration Service (added) Annex A.51 Add server certificate assignment with corresponding certification path, CA certificate and RSA key pair (added) Annex A.52 Basic TLS Handshake With Protocol Version Alert (added) Scope\TLS Versions (added) Test Policy\TLS Versions (added)
20.06	May 13, 2020	Pre-Requisite of the following test cases updated with adding of Pull-Point Notification feature according to #1999: ADVANCED_SECURITY-1-1-2 Create RSA Key Pair, status through event
20.12	Dec 08, 2020	Pre-Requisites of the following test cases were updated with adding of Network Configuration feature according to #2094 ADVANCED_SECURITY-3-1-1 Add Server Certificate Assignment – self-signed ADVANCED_SECURITY-3-1-2 Add Server Certificate Assignment – CA ADVANCED_SECURITY-3-1-3 Replace Server Certificate Assignment – self-signed ADVANCED_SECURITY-3-1-4 Replace Server Certificate Assignment – CA ADVANCED_SECURITY-3-1-5 Get Assigned Server Certificates – self-signed ADVANCED_SECURITY-3-1-6 Get Assigned Server Certificates – CA ADVANCED_SECURITY-3-1-7 Remove Server Certificate Assignment – self-signed ADVANCED_SECURITY-3-1-8 Remove Server Certificate Assignment – CA ADVANCED_SECURITY-3-2-3 Basic TLS Handshake ADVANCED_SECURITY-3-2-4 Basic TLS Handshake after Replace Server Certificate Assignment

		ADVANCED_SECURITY-3-2-5 Basic TLS Handshake with Replace Server Certification Path and PKCS#12 ADVANCED_SECURITY-3-3-1 TLS client authentication – self-signed TLS server certificate with on-device RSA key pair ADVANCED_SECURITY-3-3-2 CRL processing with on-device RSA key pair ADVANCED_SECURITY-4-1-1 TLS Server Certificate - self-signed ADVANCED_SECURITY-4-1-2 TLS Server Certificate – CA ADVANCED_SECURITY-9-1-2 Disable TLS Version
23.06	Feb 20, 2023	The following was updated according #10 ADVANCED_SECURITY-3-2-5 Basic TLS Handshake with Replace Server Certification Path and PKCS#12 (step 8 was added, steps 9, 10, 23, 24 were updated) ADVANCED_SECURITY-6-3-1 Upload PKCS12 – no key pair exists (step 3 was added, steps 4, 5 were updated) ADVANCED_SECURITY-6-3-4 (step 3 was added, steps 4, 5 were updated) Annex HelperCreatePKCS12WithNewCACert was removed and replaced with Annex HelperCreatePKCS12WithNewCACertWithPassphrase Annex HelperCreatePKCS12WithExistingCACert was removed and replaced with Annex HelperCreatePKCS12WithPassphrase Annex HelperUploadPKCS12 (step 1 was added, steps 2, 3 were updated)
23.06	Feb 27, 2023	The following was updated according #11: ADVANCED_SECURITY-3-1-5 Get Assigned Server Certificates – self-signed (step 9 was updated, steps 4, 5, 10 were removed, note was removed) ADVANCED_SECURITY-3-1-6 Get Assigned Server Certificates – CA (step 12 was updated, steps 4, 5, 13 were removed, note was removed) ADVANCED_SECURITY-3-1-7 Remove Server Certificate Assignment – self-signed (step 17 was updated, steps 4,5, 7, 8, 9, 10 were removed, note was removed) ADVANCED_SECURITY-3-1-8 Remove Server Certificate Assignment – CA (step 20 was updated, steps 4,5, 10, 11, 12, 13 were removed, note was removed)
23.06	May 15, 2023	The following test was updated according #116: ADVANCED_SECURITY-5-1-1 Security Configuration Service Capabilities (steps 8.1 and 9.1 were removed) The following tests were removed according #116: ADVANCED_SECURITY-6-2-2 Upload PKCS8 – decryption fails ADVANCED_SECURITY-6-3-2 Upload PKCS12 – decryption fails

		The following tests were added according #116: ADVANCED_SECURITY-6-2-3 Upload Encrypted PKCS8 ADVANCED_SECURITY-6-2-4 Upload Encrypted PKCS8 – Using Passphrase Management ADVANCED_SECURITY-6-3-5 Upload PKCS12 – Decryption Failed ADVANCED_SECURITY-6-3-6 Upload PKCS12 – Using Passphrase Storage
23.06	Jun 22, 2023	The following test was updated according #135: ADVANCED_SECURITY-5-1-1 Security Configuration Service Capabilities (steps 14.4 about MaximumNumberOfCRLs presence was removed)

Table of Contents

1 Introduction

The goal of the ONVIF test specification set is to make it possible to realize fully interoperable IP physical security implementation from different vendors. The set of ONVIF test specification describes the test cases need to verify the [ONVIF Core Specs] and [ONVIF Conformance] requirements. In addition, the test cases are to be basic inputs for some Profile specification requirements. It also describes the test framework, test setup, pre-requisites, test policies needed for the execution of the described test cases.

This ONVIF Security Configuration Device Test Specification acts as a supplementary document to the [ONVIF Network Interface Specs], illustrating test cases need to be executed and passed. In addition, this specification acts as an input document to the development of test tool that will be used to test the ONVIF device implementation conformance towards ONVIF standard. This test tool is referred as ONVIF Client hereafter.

1.1 Scope

This ONVIF Security Configuration Device Test Specification defines and regulates the conformance testing procedure for the ONVIF conformant devices. Conformance testing is meant to be functional black-box testing. The objective of this specification is to provide test cases to test individual requirements of ONVIF devices according to the ONVIF Security Configuration Service, which is defined in [ONVIF Security Configuration Service].

The principal intended purposes are:

- Provide self-assessment tool for implementations.
- Provide comprehensive test suite coverage for [ONVIF Network Interface Specs].

This specification does not address the following:

- Product use cases and non-functional (performance and regression) testing.
- SOAP Implementation Interoperability test i.e. Web Service Interoperability Basic Profile version 2.0 (WS-I BP 2.0).
- Full coverage of network protocol implementation test for HTTP, HTTPS, RTP, RTSP, and TLS protocols.

The set of ONVIF Test Specification will not cover the complete set of requirements as defined in [ONVIF Network Interface Specs]; instead, it will cover its subset.

This ONVIF Security Configuration Device Test Specification covers the ONVIF Security Configuration Service, which is a functional block of [ONVIF Network Interface Specs]. The following section gives a brief overview of each functional block and its scope.

1.1.1 Keystore

The Keystore section covers the test cases needed for storage and management of keys on an ONVIF device.

The scope of this specification section is to cover the following functions:

- Create RSA Key Pair
- Get Key Status
- Get Private Key Status
- Get All Keys
- Delete Key

1.1.2 Certificate Management

The Certificate Management section covers the test cases needed for storage and management of certificates on an ONVIF device.

The scope of this specification section is to cover the following functions:

- Create PKCS#10 Certification Request
- Create Self-Signed Certificate
- Upload Certificate
- Get Certificate
- Get All Certificates
- Delete Certificate
- Create Certification Path
- Get Certification Path
- Get All Certification Paths
- Delete Certification Path

1.1.3 TLS Server

The TLS Server section covers the test cases needed for configuring the TLS server on an ONVIF device.

The scope of this specification section is to cover the following functions:

- Add Server Certificate Assignment
- Remove Server Certificate Assignment
- Replace Server Certificate Assignment
- Get Assigned Server Certificates
- Basic TLS Handshake
- TLS client authentication
- Add certification path validation policies assignment
- Delete certification path validation policies assignment
- Replace certification path validation policy assignment
- Get certification path validation policies assignment

1.1.4 Referential integrity

The Referential integrity section covers the test cases needed for referential integrity checks on an ONVIF device.

1.1.5 Capabilities

The Capabilities section covers the test cases needed for getting capabilities from an ONVIF device.

The scope of this specification section is to cover the following functions:

- Getting capabilities with GetServiceCapabilities command
- Getting capabilities with GetServices command

1.1.6 Off-Device Key Generation Operations

The Off-Device Key Generation Operations section covers the test cases needed for uploading keys to an ONVIF device, potentially along with a certificate for the key, based on the PKCS#8 [RFC 5958] and PKCS#12 [PKCS#12] data structures.

The scope of this specification section is to cover the following functions:

- Upload Passphrase

- Delete Passphrase
- Upload key pair in PKCS#8 data structure
- Upload certificate with private key in PKCS#12 data structure

1.1.7 Certificate-based Client Authentication

The Certificate-based Client Authentication section covers the test cases needed for CRL management on an ONVIF device.

The scope of this specification section is to cover the following functions:

- Upload CRL
- Get All CRLs
- Delete CRL
- Create certification path validation policy
- Get certification path validation policies
- Delete certification path validation policy
- Get certification path validation policy

1.1.8 TLS Versions

The TLS Versions section covers the test cases needed for disabling and enabling TLS versions on an ONVIF device.

The scope of this specification section is to cover the following functions:

- Get list of Enabled TLS Versions
- Set list of Enabled TLS Versions

2 Normative references

- [ONVIF Conformance] ONVIF Conformance Process Specification:

  https://www.onvif.org/profiles/conformance/

- [ONVIF Profile Policy] ONVIF Profile Policy:

  https://www.onvif.org/profiles/

- [ONVIF Network Interface Specs] ONVIF Network Interface Specification documents:

  https://www.onvif.org/profiles/specifications/

- [ONVIF Core Specs] ONVIF Core Specifications:

  https://www.onvif.org/profiles/specifications/

- [ONVIF Security Configuration Service] ONVIF Security Configuration Specifications:

  https://www.onvif.org/profiles/specifications/

- [ONVIF Base Test] ONVIF Base Device Test Specifications:

  https://www.onvif.org/profiles/conformance/device-test/

- [ISO/IEC Directives, Part 2] ISO/IEC Directives, Part 2, Annex H:

  http://www.iso.org/directives

- [ISO 16484-5] ISO 16484-5:2014-09 Annex P:

  https://www.iso.org/obp/ui/#!iso:std:63753:en

- [SOAP 1.2, Part 1] W3C SOAP 1.2, Part 1, Messaging Framework:

  http://www.w3.org/TR/soap12-part1/

- [XML-Schema, Part 1] W3C XML Schema Part 1: Structures Second Edition:

  http://www.w3.org/TR/xmlschema-1/

- [XML-Schema, Part 2] W3C XML Schema Part 2: Datatypes Second Edition:

  http://www.w3.org/TR/xmlschema-2/

- [WS-Security] "Web Services Security: SOAP Message Security 1.1 (WS-Security 2004)", OASIS Standard, February 2006.:

http://www.oasis-open.org/committees/download.php/16790/wss-v1.1-spec-os-SOAPMessageSecurity.pdf

- [RFC 3447] "Public-Key Cryptography Standards (PKCS) #1: RSA Cryptography Specifications Version 2.1", J. Jonsson, B. Kaliski, February 2003.:

  https://www.ietf.org/rfc/rfc3447.txt

- [RFC 5280] "Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile", D. Cooper et. al., May 2008.:

  http://www.ietf.org/rfc/rfc5280.txt

- [RFC 5958] "Asymmetric Key Packages", S. Turner, August 2010.:

  https://tools.ietf.org/html/rfc5958

- [RFC 5959] "Algorithms for Asymmetric Key Package Content Type", S. Turner, August 2010.:

  https://www.ietf.org/rfc/rfc5959.txt

- [PKCS#12] "Personal Information Exchange Syntax v1.0", RSA Laboratories, June 24, 1999.:

3 Terms and Definitions

3.1 Conventions

The key words "shall", "shall not", "should", "should not", "may", "need not", "can", "cannot" in this specification are to be interpreted as described in [ISO/IEC Directives Part 2].

3.2 Definitions

This section defines terms that are specific to the ONVIF Security Configuration Service and tests. For a list of applicable general terms and definitions, please see [ONVIF Base Test].

Key	A key is an input to a cryptographic algorithm. Sufficient randomness of the key is usually a necessary condition for the security of the algorithm. This specification supports RSA key pairs as keys.
Key Pair	A key that consists of a public key and (optionally) a private key.
RSA key pair	A key pair that is accepted as input by the RSA algorithm.
Digital Signature	A digital signature for an object allows to verify the object's authenticity, i.e., to check whether the object has in fact been created by the signer and has not been modified afterwards. A digital signature is based on a key pair, where the private key is used to create the signature and the public key is used for verification of the signature.
Certificate	A certificate as used in this specification binds a public key to a subject entity. The certificate is digitally signed by the certificate issuer (the certification authority) to allow for verifying its authenticity.
Certification Path	A certification path is a sequence of certificates in which the signature of each certificate except for the last certificate can be verified with the subject public key in the next certificate in the sequence.
Certification Authority	A certification authority is an entity that issues certificates to subject entities.
Alias	An alias is a name for an object on the device that is chosen by the client and treated transparently by the device.

3.3 Abbreviations

This section describes abbreviations used in this document.

CA	Certification Authority
CSR	Certificate Signing Request (also called Certification Request)
SHA	Secure Hashing Algorithm

TLS	Transport Layer Security

4 Test Overview

This section provides information the test setup procedure and required prerequisites, and the test policies that should be followed for test case execution.

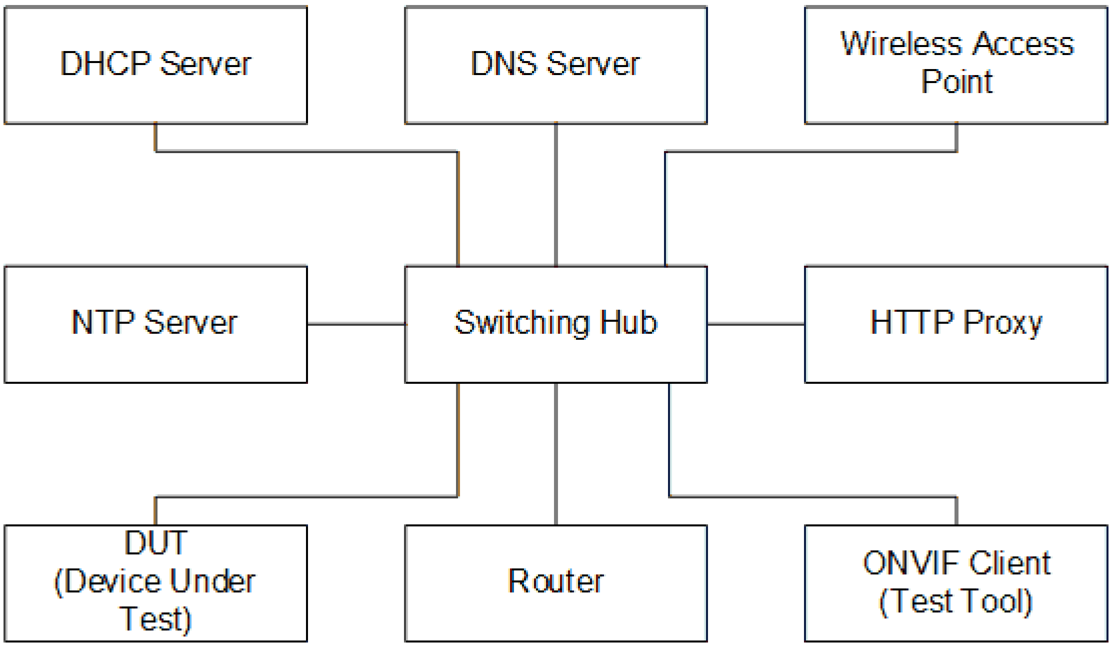
4.1 Test Setup

4.1.1 Network Configuration for DUT

The generic test configuration for the execution of test cases defined in this document is as shown below (Figure 4.1).

Based on the individual test case requirements, some of the entities in the below setup may not be needed for the execution of those corresponding test cases.

Figure 4.1. Test Configuration for DUT



DUT: ONVIF device to be tested. Hereafter, this is referred to as DUT (Device Under Test).

ONVIF Client (Test Tool): Tests are executed by this system and it controls the behavior of the DUT. It handles both expected and unexpected behavior.

HTTP Proxy: provides facilitation in case of RTP and RTSP tunneling over HTTP.

Wireless Access Point: provides wireless connectivity to the devices that support wireless connection.

DNS Server: provides DNS related information to the connected devices.

DHCP Server: provides IPv4 Address to the connected devices.

NTP Server: provides time synchronization between ONVIF Client and DUT.

Switching Hub: provides network connectivity among all the test equipments in the test environment. All devices should be connected to the Switching Hub. When running multiple test instances in parallel on the same network, the Switching Hub should be configured to use filtering in order to avoid multicast traffic being flooded to all ports, because this may affect test stability.

Router: provides router advertisements for IPv6 configuration.

4.2 Prerequisites

The pre-requisites for executing the test cases described in this Test Specification are:

- The DUT shall be configured with an IPv4 address.
- The DUT shall be IP reachable in the test configuration.
- The DUT shall be able to be discovered by the Test Tool.
- The DUT shall be configured with the time, i.e. manual configuration of UTC time and if NTP is supported by the DUT then NTP time shall be synchronized with NTP Server.
- The DUT time and Test tool time shall be synchronized with each other either manually or by a common NTP server.
- The ONVIF Client supports both WS-Security Username Token profile and HTTP digest authentication as authentication functionalities and selects the authentication method to use based on the procedure defined in Sect. 3.3.6 (Authentication method selection as a testing framework) of [ONVIF Base Test Spec].
- The user account that is used by the ONVIF Client for issuing commands to the DUT has administrative rights.
- The ONVIF Client shall have access to a certification authority.
- The DUT shall have enough free storage capacity for RSA key pairs that is required for test cases (see test cases pre-requisites for more information).
- The DUT shall have enough free storage capacity for certificates that is required for test cases (see test cases pre-requisites for more information).
- The DUT shall have enough free storage capacity for certification paths that is required for test cases (see test cases pre-requisites for more information).

- The DUT shall have enough free storage capacity for server certificate assignment that is required for test cases (see test cases pre-requisites for more information).

4.3 Test Policy

This section describes the test policies specific to the test case execution of each functional block.

The DUT shall adhere to the test policies defined in this section.

4.3.1 General Policy

The test policies specific to the test case execution of all functional blocks:

- If a DUT method produces a fault that is not explicitly stated as expected in the test procedure of a test case, the result of the test case shall be FAIL.
- Assertions in a test procedure are defined using the verb verify, e.g., "ONVIF Client verifies that list l contains ID x", with the following semantics:
    - If the assertion holds, the test proceeds with the next step in the test procedure.
    - If the assertion does not hold, the test result shall be FAIL.

4.3.2 Keystore

The test policies specific to the test case execution of Keystore functional block:

- DUT shall give the ONVIF Security Configuration Service entry point by GetServices command, if DUT supports this service. Otherwise, these test cases will be skipped.
- The DUT shall support on-board generation of an RSA key pair.
- The following tests are performed about key management
    - The DUT generates an RSA key pair status handling is done with polling.
    - The DUT generates an RSA key pair status handling is done with event.
    - The DUT returns whether a key pair in the keystore contains a private key.
    - The status of a key in the DUT’s keystore is returned correctly.
    - A key is deleted correctly from the keystore on the DUT.

Please, refer to Section 5.1 for Keystore Test Cases.

4.3.3 Certificate Management

The test policies specific to the test case execution of Certificate Management functional block:

- DUT shall give the ONVIF Security Configuration Service entry point by GetServices command, if DUT supports this service. Otherwise, these test cases will be skipped.
- The DUT shall support generating a PKCS#10 certification request.
- The DUT shall support creating a self-signed certificate.
- The following tests are performed about certificate management
  - The DUT correctly supports external certification for a key pair in the keystore.
  - The DUT correctly generates a self-signed certificate for a key pair in the keystore.
  - The ONVIF Client can upload a certificate to the DUT.
  - A certificate from the keystore on the DUT is correctly returned to the ONVIF client.
  - All certificates in the keystore on the DUT are correctly returned to the ONVIF client.
  - The ONVIF Client can delete a certificate from the keystore on the DUT.
  - Certificates in the keystore on the DUT can be correctly combined to a certification path.
  - A certification path stored in the keystore on the DUT can be correctly deleted.

Please, refer to Section 5.2 for Certificate Management Test Cases.

4.3.4 TLS Server

The test policies specific to the test case execution of TLS Server functional block:

- DUT shall give the ONVIF Security Configuration Service entry point by GetServices command, if DUT supports this service. Otherwise, these test cases will be skipped.
- The DUT shall implement a TLS server.
- The following tests are performed for the TLS server
  - A certification path is assigned to the TLS server.
  - A certification path is received from the TLS server.
  - A certification path assignment is removed from the TLS server.

    - A certification path assignment to the TLS server is replaced by another certification path assignment.
    - Basic TLS Handshake
    - Basic TLS Handshake after Replace Server Certificate Assignment
- The following tests are performed for the TLS server in case certificate along with an RSA private key in a PKCS#12 data structure upload is supported by the DUT
    - Basic TLS Handshake with Replace Server Certification Path and PKCS#12
- The following tests are performed for the TLS server in case TLS client authentication is supported by the DUT
    - TLS client authentication – self-signed TLS server certificate with on-device RSA key pair
    - CRL processing with on-device RSA key pair
    - Replace certification path validation policy assignment

Please, refer to Section 5.3 for TLS Server Test Cases.

4.3.5 Referential Integrity

The test policies specific to the test case execution of Referential integrity functional block:

- DUT shall give the ONVIF Security Configuration Service entry point by GetServices command, if DUT supports this service. Otherwise, these test cases will be skipped.
- The DUT shall implement a TLS server.
- The following tests are performed for the TLS server
    - Referential integrity of certificate assigned to a TLS server.

Please, refer to Section 5.4 for Referential integrity Test Cases.

4.3.6 Capabilities

The test policies specific to the test case execution of Capabilities functional block:

- DUT shall give the ONVIF Security Configuration Service entry point by GetServices command, if DUT supports this service. Otherwise, these test cases will be skipped.
- The following tests are performed

    - Getting capabilities with GetServiceCapabilities command

    - Getting capabilities with GetServices command

Please, refer to Section 5.5 for Capabilities Test Cases.

4.3.7 Off-Device Key Generation Operations

The test policies specific to the test case execution of Off-Device Key Generation Operations functional block:

- DUT shall give the ONVIF Security Configuration Service entry point by GetServices command, if DUT supports this service. Otherwise, these test cases will be skipped.

- The following tests are performed

    - Uploading passphrase with UploadPassphrase command

    - Deleting passphrase with DeletePassphrase command

    - Upload key pair in PKCS#8 data structure with UploadKeyPairInPKCS8 command

    - Upload certificate with private key in PKCS#12 data structure with UploadCertificateWithPrivateKeyInPKCS12 command

Please, refer to Section 5.6 for Off-Device Key Generation Operations Test Cases.

4.3.8 Certificate-Based Client Authentication

The test policies specific to the test case execution of Certificate-based Client Authentication functional block:

- DUT shall give the ONVIF Security Configuration Service entry point by GetServices command, if DUT supports this service. Otherwise, these test cases will be skipped.

- The DUT shall support upload of CRLs.

- The following tests are performed about CRL management

    - The ONVIF Client can upload a CRL to the DUT.

    - A CRL from the storage on the DUT is correctly returned to the ONVIF client.

    - All CRLs in the storage on the DUT are correctly returned to the ONVIF client.

    - The ONVIF Client can delete a CRL from the storage on the DUT.

- The following tests are performed about certification path validation policy management
  - The ONVIF Client can create a certification path validation policy on the DUT.
  - A certification path validation policy from the storage on the DUT is correctly returned to the ONVIF client.
  - All certification path validation policies in the storage on the DUT are correctly returned to the ONVIF client.
  - The ONVIF Client can delete a certification path validation policy from the storage on the DUT.

Please, refer to Section 5.7 for Certificate-based Client Authentication Test Cases.

4.3.9 TLS Versions

The test policies specific to the test case execution of TLS Versions functional block:

- DUT shall give the ONVIF Security Configuration Service entry point by GetServices command, if DUT supports this service. Otherwise, these test cases will be skipped.
- The DUT shall support enabling and disabling specific TLS versions.
- The following tests are performed about enabling and disabling specific TLS versions
  - The ONVIF Client can get list of enabled TLS versions.
  - The ONVIF Client can set list of enabled TLS versions.
  - TLS versions out of enabled TLS versions are rejected by the DUT.

Please, refer to Section 5.8 for TLS Versions Test Cases.

5 Security Configuration Test Cases

5.1 Keystore

5.1.1 Create RSA Key Pair, status through polling

Test Case ID: ADVANCED_SECURITY-1-1-1

Specification Coverage: Key Management (ONVIF Security Configuration Service Specification)

Feature under test: CreateRSAKeyPair, GetKeyStatus

WSDL Reference: security.wsdl

Test Purpose: To test RSA key pair generation with key status retrieval through polling.

Pre-Requisite: Security Configuration Service is received from the DUT. On-board RSA key pair generation is supported by the DUT as indicated by the RSAKeyPairGeneration capability. The DUT shall have enough free storage capacity for one additional RSA key pair.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client gets the service capabilities (out *cap*) by following the procedure mentioned in Annex A.10.
4. For each key length *keyLength* in the RSAKeyLengths capability contained in *cap*.KeystoreCapabilities repeat the following steps:

   4.1. ONVIF Client invokes **CreateRSAKeyPair** with parameter

   - KeyLength := keyLength

   4.2. The DUT responds with **CreateRSAKeyPairResponse** message with parameters

   - KeyID =: *keyID*
   - EstimatedCreationTime =: *duration*

   4.3. Until *operationDelay* + *duration* expires repeat the following steps:

4.3.1. ONVIF Client waits for 5 seconds.

4.3.2. ONVIF Client invokes **GetKeyStatus** with parameters

- KeyID := *keyID*

4.3.3. The DUT responds with **GetKeyStatusResponse** message with parameters

- KeyStatus =: keyStatus

4.3.4. If *keyStatus* is equal to "ok", go to the step 4.5.

4.3.5. If *keyStatus* is equal to "corrupt", FAIL the test, delete the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1 to restore DUT configuration, and skip other steps.

4.4. If *operationDelay* + *duration* timeout expires for step 4.3 and the last *keyStatus* is other than "ok", FAIL the test, delete the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1 to restore DUT configuration and skip other steps.

4.5. ONVIF Client deletes the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- The DUT did not send **CreateRSAKeyPairResponse** message(s).
- The DUT did not send **GetKeyStatusResponse** message(s).

Note: *operationDelay* will be taken from Operation Delay field of ONVIF Device Test Tool.

5.1.2 Create RSA Key Pair, status through event

Test Case ID: ADVANCED_SECURITY-1-1-2

Specification Coverage: Key Management (ONVIF Security Configuration Service Specification)

Feature under test: CreateRSAKeyPair

WSDL Reference:security.wsdl and event.wsdl

Test Purpose: To test RSA key pair generation with key status retrieval through events.

Pre-Requisite: Security Configuration Service is received from the DUT. Event Service was received from the DUT. On-board RSA key pair generation is supported by the DUT as indicated by the RSAKeyPairGeneration capability. The DUT shall have enough free storage capacity for one additional RSA key pair. Device supports Pull-Point Notification feature.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client gets the service capabilities (out *cap*) by following the procedure mentioned in Annex A.10.
4. ONVIF Client invokes **CreatePullPointSubscription** with parameters
   - Filter.TopicExpression := "tns1:Advancedsecurity/Keystore/KeyStatus"
   - Filter.TopicExpression.@Dialect := "http://www.onvif.org/ver10/tev/topicExpression/ConcreteSet"
5. The DUT responds with a **CreatePullPointSubscriptionResponse** message with parameters
   - SubscriptionReference =: *s*
   - CurrentTime =: *ct*
   - TerminationTime =: *tt*
6. For each key length *keyLength* in the RSAKeyLengths capability contained in *cap*.KeystoreCapabilities repeat the following steps:

   6.1. ONVIF Client invokes **CreateRSAKeyPair** with parameter
   - KeyLength := *keyLength*

   6.2. The DUT responds with **CreateRSAKeyPairResponse** message with parameters
   - KeyID =: *keyID*
   - EstimatedCreationTime =: *duration*

   6.3. Until *operationDelay* + *duration* timeout expires repeat the following steps:

6.3.1. ONVIF Client waits for time *t* := min{(*tt*-*ct*)/2, 1 second}.

6.3.2. ONVIF Client invokes **PullMessages** to the subscription endpoint *s* with parameters

- Timeout := PT60S
- MessageLimit := 1

6.3.3. The DUT responds with **PullMessagesResponse** message with parameters

- CurrentTime =: *ct*
- TerminationTime =: *tt*
- NotificationMessage =: *m*

6.3.4. If *m* is not null and the KeyID source simple item in *m* is equal to *keyID* and the NewStatus data simple item in *m* is equal to "ok", go to the step 6.5.

6.3.5. If *m* is not null and the KeyID source simple item in *m* is equal to *keyID* and the NewStatus data simple item in *m* is equal to "corrupt", FAIL the test, delete the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1 to restore DUT configuration and go to the step 7.

6.4. If *operationDelay* + *duration* timeout expires for step 6.3 without Notification with KeyID source simple item equal to *keyID* and the NewStatus data simple item equal to "ok", FAIL the test, delete the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1 to restore DUT configuration and go to the step 7.

6.5. ONVIF Client deletes the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1 to restore DUT configuration.

7. ONVIF Client sends an **Unsubscribe** to the subscription endpoint *s*.

8. The DUT responds with **UnsubscribeResponse** message.

Test Result:

PASS –

- The DUT passes all assertions.

FAIL –

- The DUT did not send **CreatePullPointSubscriptionResponse** message.

- The DUT did not send **CreateRSAKeyPairResponse** message(s).
- The DUT did not send **PullMessagesResponse** message(s).
- The DUT did not send the **UnsubscribeResponse** message.

Note: *operationDelay* will be taken from Operation Delay field of ONVIF Device Test Tool.

5.1.3 Check private Key status for an RSA private key

Test Case ID: ADVANCED_SECURITY-1-1-3

Specification Coverage: Key Management (ONVIF Security Configuration Service Specification)

Feature under test: GetAllKeys

WSDL Reference: security.wsdl

Test Purpose: To test whether the private key status is correctly returned for a key pair with private key.

Pre-Requisite: Security Configuration Service is received from the DUT. On-board RSA key pair generation is supported by the DUT as indicated by the RSAKeyPairGeneration capability. The DUT shall have enough free storage capacity for one additional RSA key pair.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client creates an RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.7.
4. ONVIF Client invokes **GetAllKeys**.
5. The DUT responds with a **GetAllKeysResponse** message with parameters
   - KeyAttribute list =: *keyAttributeList*
6. If *keyAttributeList*[KeyID = *keyID*].hasPrivateKey is not equal to true, FAIL the test and go to the next step.
7. ONVIF Client deletes the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetAllKeysResponse** message.

5.1.4 Get all keys

Test Case ID: ADVANCED_SECURITY-1-1-4

Specification Coverage: Key Management (ONVIF Security Configuration Service Specification)

Feature under test: GetAllKeys

WSDL Reference: security.wsdl

Test Purpose: To test listing of RSA key pairs and appearing of new created RSA key pairs in the list.

Pre-Requisite: Security Configuration Service is received from the DUT. On-board RSA key pair generation is supported by the DUT as indicated by the RSAKeyPairGeneration capability. The DUT shall have enough free storage capacity for one additional RSA key pair.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client invokes **GetAllKeys**.
4. The DUT responds with a **GetAllKeysResponse** message with parameters
   - KeyAttribute list =: *initialKeyList*
5. ONVIF Client creates an RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.7.
6. ONVIF Client invokes **GetAllKeys**.
7. The DUT responds with a **GetAllKeysResponse** message with parameters

- KeyAttribute list =: *updatedKeyList*

8. If *updatedKeyList* does not contain *keyID* and all keys from *initialKeyList*, FAIL the test, and go to the step 10.

9. If *updatedCertificateList* contains keys other than *keyID* or keys from *initialCertificateList*, FAIL the test, and go to the step 10.

10. ONVIF Client deletes the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetAllKeysResponse** message(s).

Note: The DUT may return an empty list at step 4.

5.1.5 Delete Key

Test Case ID: ADVANCED_SECURITY-1-1-5

Specification Coverage: Key Management (ONVIF Security Configuration Service Specification)

Feature under test: DeleteKey

WSDL Reference: security.wsdl

Test Purpose: To test deletion of RSA key pairs

Pre-Requisite: Security Configuration Service is received from the DUT. On-board RSA key pair generation is supported by the DUT as indicated by the RSAKeyPairGeneration capability. The DUT shall have enough free storage capacity for one additional RSA key pair.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.

3. ONVIF Client invokes **GetAllKeys**.
4. The DUT responds with a **GetAllKeysResponse** message with parameters
   - KeyAttribute list =: *initialKeyList*
5. ONVIF Client creates an RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.7.
6. ONVIF Client invokes **GetAllKeys**.
7. The DUT responds with a **GetAllKeysResponse** message with parameters
   - KeyAttribute list =: *updatedKeyList*
8. If *updatedKeyList* does not contain *keyID* and all keys from *initialKeyList*, FAIL the test, delete the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1 to restore DUT configuration, and skip other steps.
9. If *updatedKeyList* contains keys other than *keyID* or keys from *initialKeyList*, FAIL the test, and delete the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1 to restore DUT configuration, and skip other steps.
10. ONVIF Client invokes **DeleteKey** with parameters
    - KeyID =: *keyID*
11. The DUT responds with a **DeleteKeyResponse** message.
12. ONVIF Client invokes **GetAllKeys**.
13. The DUT responds with a **GetAllKeysResponse** message with parameters
    - KeyAttribute list =: *finalKeyList*
14. If *finalKeyList* is not equal *initialKeyList*, FAIL the test.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **DeleteKeyResponse** message.
- DUT did not send **GetAllKeysResponse** message(s).

Note: The DUT may return an empty list at step 4.

5.2 Certificate Management

5.2.1 Create PKCS#10 certification requests

Test Case ID: ADVANCED_SECURITY-2-1-1

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: CreatePKCS10CSR

WSDL Reference: security.wsdl

Test Purpose: To test the creation of a PKCS#10 certification requests.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. The DUT shall have enough free storage capacity for one additional RSA key pair.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client creates an RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.7.
4. ONVIF Client invokes **CreatePKCS10CSR** with parameters
   - Subject := *subject* (see Annex A.2)
   - KeyID := *keyID*
   - CSRAttribute skipped
   - SignatureAlgorithm.algorithm := 1.2.840.113549.1.1.5 (OID of SHA-1 with RSA Encryption algorithm)
5. The DUT responds with a **CreatePKCS10CSRResponse** message with parameters
   - PKCS10CSR =: *PKCS10request*

6. ONVIF Client validates that *PKCS10request* is correctly DER encoded (see Annex A.19).

7. If *PKCS10request* is incorrectly DER encoded, FAIL the test and go to the step 10.

8. ONVIF Client validates that *PKCS10request* contains the correct subject equals to *subject*.

9. If *PKCS10request* contains a wrong subject, FAIL the test and go to the step 10.

10. ONVIF Client deletes the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **CreatePKCS10CSRResponse** message.

5.2.2 Create self-signed certificate

Test Case ID: ADVANCED_SECURITY-2-1-2

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: CreateSelfSignedCertificate

WSDL Reference: security.wsdl

Test Purpose: To test the creation of self-signed certificates.

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.

3. ONVIF Client creates an RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.7.

4. ONVIF Client invokes **CreateSelfSignedCertificate** with parameters

   - X509Version skipped
   - KeyID := *keyID*
   - Subject := *subject* (see Annex A.2)
   - Alias skipped
   - notValidBefore skipped
   - notValidAfter skipped
   - SignatureAlgorithm.algorithm := 1.2.840.113549.1.1.5 (OID of SHA-1 with RSA Encryption algorithm)
   - SignatureAlgorithm.parameters skipped
   - SignatureAlgorithm.anyParameters skipped
   - Extension skipped

5. The DUT responds with a **CreateSelfSignedCertificateResponse** message with parameters

   - CertificateID =: *certID*

6. ONVIF Client deletes the self-signed certificate (in *certID*) and related RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.9 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **CreateSelfSignedCertificateResponse** message.

5.2.3 Upload certificate – Keystore contains private key

Test Case ID: ADVANCED_SECURITY-2-1-3

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: UploadCertificate

WSDL Reference: security.wsdl

Test Purpose: To test the upload of a certificate in case the keystore in the DUT contains a private key for the public key in the certificate.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. Current time of the DUT shall be at least Jan 01, 1970.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding private key (out *privateKey*) by following the procedure described in Annex A.4.
4. ONVIF Client creates a certificate (out *cert*) from the PKCS#10 request with RSA key pair (out *keyID1*) and associated CA certificate (in *CAcert*) and a corresponding private key (in *privateKey*) by following the procedure described in Annex A.14.
5. ONVIF Client invokes **UploadCertificate** with parameters
    - Certificate := *cert*
    - Alias := "ONVIF_Test"
    - PrivateKeyRequired : = true
6. The DUT responds with a **UploadCertificateResponse** message with parameters
    - CertificateID =: *certID*
    - KeyID =: *keyID2*
7. ONVIF Client validates that *keyID2* equal to *keyID1*.

8. If *keyID2* is not equal to *keyID1*, FAIL the test and go to the step 9.
9. ONVIF Client deletes the CA certificate (in *certID*) and related RSA key pair (in *keyID1*) by following the procedure mentioned in Annex A.9 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **UploadCertificateResponse** message.

5.2.4 Upload certificate – Keystore contains private key (negative test)

Test Case ID: ADVANCED_SECURITY-2-1-4

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: UploadCertificate

WSDL Reference: security.wsdl

Test Purpose: To test the upload of a certificate in case the keystore in the DUT does not contain a private key for the public key in the certificate (negative test).

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. The DUT shall have enough free storage capacity for one additional certificate. Current time of the DUT shall be at least Jan 01, 1970.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding private key (out *privateKey*) by following the procedure described in Annex A.4.

4. ONVIF Client invokes UploadCertificate with parameters
   - Certificate := *CAcert*
   - Alias := "ONVIF_Test"
   - PrivateKeyRequired := true
5. The DUT returns env:Receiver/ter:Action/ter:NoMatchingPrivateKey SOAP 1.2 fault.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- The DUT did not send the env:Receiver/ter:Action/ter:NoMatchingPrivateKey SOAP 1.2 fault message.

5.2.5 Upload certificate – Keystore does not contain private key

Test Case ID: ADVANCED_SECURITY-2-1-5

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: UploadCertificate

WSDL Reference: security.wsdl

Test Purpose: To test the upload of a certificate in case the keystore in the DUT does not contain a private key for the public key in the certificate.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. Current time of the DUT shall be at least Jan 01, 1970.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.
3. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding private key (out *privateKey*) by following the procedure described in Annex A.4.
4. ONVIF Client invokes **UploadCertificate** with parameters
   - Certificate := *CAcert*
   - Alias := "ONVIF_Test"
   - PrivateKeyRequired : = false
5. The DUT responds with a **UploadCertificateResponse** message with parameters
   - CertificateID =: *certID*
   - KeyID =: *keyID*
6. ONVIF Client deletes the CA certificate (in *certID*) and related RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.9 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **UploadCertificateResponse** message.

5.2.6 Get certificate – self-signed

Test Case ID: ADVANCED_SECURITY-2-1-6

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: GetCertificate

WSDL Reference: security.wsdl

Test Purpose: To test the retrieval of a self-signed certificate.

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client creates a self-signed certificate (out *certID*) and related RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.8.
4. ONVIF Client invokes **GetCertificate** message with parameters
   - CertificateID := *certID*
5. The DUT responds with a **GetCertificateResponse** message with parameters
   - Certificate =: *X509Cert*
6. ONVIF Client validates that *X509Cert*.CertificateContent is correctly DER encoded (see Annex A.19).
7. If *X509Cert*.CertificateContent is incorrectly DER encoded, FAIL the test and go to the step 10.
8. ONVIF Client validates that *X509Cert*.CertificateContent contains the correct subject equals to subject defined in Annex A.2.
9. If *X509Cert*.CertificateContent contains wrong subject, FAIL the test and go to the step 10.
10. ONVIF Client deletes the self-signed certificate (in *certID*) and related the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.9 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetCertificateResponse** message.

5.2.7 Get certificate – CA

Test Case ID: ADVANCED_SECURITY-2-1-7

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: GetCertificate

WSDL Reference: security.wsdl

Test Purpose: To test the retrieval of a CA certificate.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. Current time of the DUT shall be at least Jan 01, 1970.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.

3. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding private key (out *privateKey*) by following the procedure described in Annex A.4.

4. ONVIF Client uploads a CA certificate (out *certID*, in *CAcert*) and new RSA key pair with the public key from the CA certificate (out *keyID*) by following the procedure described in Annex A.15.

5. ONVIF Client invokes **GetCertificate** message with parameters

   - CertificateID := *certID*

6. The DUT responds with a **GetCertificateResponse** message with parameters

   - Certificate =: *X509Cert*

7. ONVIF Client validates that *X509Cert*.CertificateContent is correctly DER encoded (see Annex A.19).

8. If *X509Cert*.CertificateContent is incorrectly DER encoded, FAIL the test and go to the step 10.

9. If *X509Cert*.CertificateContent contains wrong subject, FAIL the test and go to the step 10.
10. ONVIF Client deletes the CA certificate (in *certID*) and related RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.9 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetCertificateResponse** message.

5.2.8 Get all certificates – self signed

Test Case ID: ADVANCED_SECURITY-2-1-8

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: GetAllCertificates

WSDL Reference: security.wsdl

Test Purpose: To test the retrieval of all certificates tested with self-signed certificates.

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client invokes **GetAllCertificates**.
4. The DUT responds with a **GetAllCertificatesResponse** message with parameters
   - CertificateID list =: *initialCertificateList*

5. ONVIF Client creates a self-signed certificate (out *certID*) and related RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.8.

6. ONVIF Client invokes **GetAllCertificates**.

7. The DUT responds with a **GetAllCertificatesResponse** message with parameters

   - CertificateID list =: *updatedCertificateList*

8. If *updatedCertificateList* does not contain *certID* and all certificates from *initialCertificateList*, FAIL the test, and go to the step 10.

9. If *updatedCertificateList* contains certificates other than *certID* or certificates from *initialCertificateList*, FAIL the test, and go to the step 10.

10. ONVIF Client deletes the self-signed certificate (in *certID*) and related RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.9 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetAllCertificatesResponse** message(s).

Note: The DUT may return an empty list at step 4.

5.2.9 Get All Certificate – CA

Test Case ID: ADVANCED_SECURITY-2-1-9

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: GetAllCertificates

WSDL Reference: security.wsdl

Test Purpose: To test the retrieval of all certificates tested with CA certificates.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. Current time of the DUT shall be at least Jan 01, 1970.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client invokes **GetAllCertificates**.
4. The DUT responds with a **GetAllCertificatesResponse** message with parameters
   - CertificateID list =: *initialCertificateList*
5. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding private key (out privateKey) by following the procedure described in Annex A.4.
6. ONVIF Client uploads a CA certificate (out *certID*, in *CAcert*) and new RSA key pair with the public key from the CA certificate (out *keyID*) by following the procedure described in Annex A.15.
7. ONVIF Client invokes **GetAllCertificates**.
8. The DUT responds with a **GetAllCertificatesResponse** message with parameters
   - CertificateID list =: *updatedCertificateList*
9. If *updatedCertificateList* does not contain *certID* and all certificates from *initialCertificateList*, FAIL the test, and go to the step 10.
10. If *updatedCertificateList* contains certificates other than *certID* or certificates from *initialCertificateList*, FAIL the test, and go to the step 10.
11. ONVIF Client deletes the CA certificate (in *certID*) and related RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.9 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetAllCertificatesResponse** message(s).

Note: The DUT may return an empty list at step 4.

5.2.10 Delete Certificate – self signed

Test Case ID: ADVANCED_SECURITY-2-1-10

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: DeleteCertificate

WSDL Reference: security.wsdl

Test Purpose: To test the deletion of a certificate tested with self-signed certificates.

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.

3. ONVIF Client invokes **GetAllCertificates**.

4. The DUT responds with a **GetAllCertificatesResponse** message with parameters

   - CertificateID list =: *initialCertificateList*

5. ONVIF Client creates a self-signed certificate (out *certID*) and related RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.8.

6. ONVIF Client invokes **GetAllCertificates**.

7. The DUT responds with a **GetAllCertificatesResponse** message with parameters

   - CertificateID list =: *updatedCertificateList*

8. If *updatedCertificateList* does not contain *certID* and all certificates from *initialCertificateList*, FAIL the test, delete the self-signed certificate (in *certID*) and related RSA key pair (in *keyID*)

by following the procedure mentioned in Annex A.9 to restore DUT configuration, and skip other steps.

9. If *updatedCertificateList* contains certificates other than *certID* or certificates from *initialCertificateList*, FAIL the test, delete the self-signed certificate (in *certID*) and related RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.9 to restore DUT configuration, and skip other steps.

10. ONVIF Client invokes **DeleteCertificate** with parameters

    - CertificateID =: *certID*

11. The DUT responds with a **DeleteCertificateResponse** message.

12. ONVIF Client deletes the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1 to restore DUT configuration.

13. ONVIF Client invokes **GetAllCertificates**.

14. The DUT responds with a **GetAllCertificatesResponse** message with parameters

    - CertificateID list =: *finalCertificateList*

15. If *finalCertificateList* is not equal *initialCertificateList*, FAIL the test.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **DeleteCertificateResponse** message.

- DUT did not send **GetAllCertificatesResponse** message(s).

Note: The DUT may return an empty list at step 4.

5.2.11 Delete Certificate – CA

Test Case ID: ADVANCED_SECURITY-2-1-11

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: DeleteCertificate

WSDL Reference: security.wsdl

Test Purpose: To test the deletion of a certificate tested with CA certificates.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. Current time of the DUT shall be at least Jan 01, 1970.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client invokes **GetAllCertificates**.
4. The DUT responds with a **GetAllCertificatesResponse** message with parameters
   - CertificateID list =: *initialCertificateList*
5. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding private key (out privateKey) by following the procedure described in Annex A.4.
6. ONVIF Client uploads a CA certificate (out *certID*, in *CAcert*) and new RSA key pair with the public key from the CA certificate (out *keyID*) by following the procedure described in Annex A.15.
7. ONVIF Client invokes **GetAllCertificates**.
8. The DUT responds with a **GetAllCertificatesResponse** message with parameters
   - CertificateID list =: *updatedCertificateList*
9. If *updatedCertificateList* does not contain *certID* and all certificates from *initialCertificateList*, FAIL the test, delete the CA certificate (in *certID*) and related RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.9 to restore DUT configuration, and skip other steps.
10. If *updatedCertificateList* contains certificates other than *certID* or certificates from *initialCertificateList*, FAIL the test, delete the CA certificate (in *certID*) and related RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.9 to restore DUT configuration, and skip other steps.

11. ONVIF Client invokes **DeleteCertificate** with parameters

    - CertificateID =: *certID*

12. The DUT responds with a **DeleteCertificateResponse** message.

13. ONVIF Client deletes the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1 to restore DUT configuration.

14. ONVIF Client invokes **GetAllCertificates**.

15. The DUT responds with a **GetAllCertificatesResponse** message with parameters

    - CertificateID list =: *finalCertificateList*

16. If *finalCertificateList* is not equal *initialCertificateList*, FAIL the test.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **DeleteCertificateResponse** message.
- DUT did not send **GetAllCertificatesResponse** message(s).

Note: The DUT may return an empty list at step 4.

5.2.12 Create Certification Path – self-signed

Test Case ID: ADVANCED_SECURITY-2-1-12

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: CreateCertificationPath

WSDL Reference: security.wsdl

Test Purpose: To test the creation of a certification path containing a self-signed certificate.

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability.

The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. The DUT shall have enough free storage capacity for one additional certification path.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client creates a self-signed certificate (out *certID*) and related RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.8.
4. ONVIF Client invokes **CreateCertificationPath** with parameters
    - CertficateIDs.CertificateID[0] := *certID*
    - Alias := "ONVIF_Test"
5. The DUT responds with a **CreateCertificationPathResponse** message with parameters
    - CertificationPathID =: *certPathID*
6. ONVIF Client deletes the certification path (in *certPathID*) and related the self-signed certificate (in *certID*) and the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.5 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **CreateCertificationPathResponse** message.

5.2.13 Create Certification Path – CA

Test Case ID: ADVANCED_SECURITY-2-1-13

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: CreateCertificationPath

WSDL Reference: security.wsdl

Test Purpose: To test the creation of a certification path (signed server + CA certificate).

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for two additional RSA key pairs. The DUT shall have enough free storage capacity for two additional certificates. The DUT shall have enough free storage capacity for one additional certification path. Current time of the DUT shall be at least Jan 01, 1970.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding private key (out *privateKey*) by following the procedure described in Annex A.4.
4. ONVIF Client creates and uploads a CA-signed certificate (out *certID1*) for RSA key pair (out *keyID1*) and associated CA certificate (in *CAcert*) and a corresponding private key (in *privateKey*) by following the procedure described in Annex A.16.
5. ONVIF Client uploads a CA certificate (out *certID2*, in *CAcert*) and new RSA key pair with the public key from the CA certificate (out *keyID2*) by following the procedure described in Annex A.15.
6. ONVIF Client invokes **CreateCertificationPath** with parameters
   - CertficateIDs.CertificateID[0] =: *certID1*
   - CertficateIDs.CertificateID[1] =: *certID2*
   - Alias := "ONVIF_Test2"
7. The DUT responds with a **CreateCertificationPathResponse** message with parameters
   - CertificationPathID =: *certPathID*
8. ONVIF Client deletes the certification path (in *certPathID*), related CA certificate (in *certID2*) and the RSA key pair (in *keyID2*) and related the CA-signed certificate (in *certID1*) and the RSA key pair (in *keyID1*) by following the procedure mentioned in Annex A.17 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **CreateCertificationPathResponse** message.

5.2.14 Get Certification Path – self-signed

Test Case ID: ADVANCED_SECURITY-2-1-14

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: GetCertificationPath

WSDL Reference: security.wsdl

Test Purpose: To test the retrieval of a certification path containing a self-signed certificate.

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. The DUT shall have enough free storage capacity for one additional certification path.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client creates a certification path (out *certPathID*) based on self-signed certificate (out *certID1*) and related RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.11.
4. ONVIF Client invokes **GetCertificationPath** with parameters
    - CertificationPathID =: *certPathID*

5. The DUT responds with a **GetCertificationPathResponse** message with parameters

    - CertificationPath.CertificateID[0] =: *certID2*

    - CertificationPath.Alias

6. If *certID1* is not equal to *certID2*, FAIL the test and go to the step 7.

7. ONVIF Client deletes the certification path (in *certPathID1*), related the self-signed certificate (in *certID1*) and the RSA key pair (in *keyID1*) by following the procedure mentioned in Annex A.5 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetCertificationPathResponse** message.

5.2.15 Get Certification Path – CA

Test Case ID: ADVANCED_SECURITY-2-1-15

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: GetCertificationPath

WSDL Reference: security.wsdl

Test Purpose: To test the retrieval of a certification path containing a signed server and a CA certificate.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for two additional RSA key pairs. The DUT shall have enough free storage capacity for two additional certificates. The DUT shall have enough free storage capacity for one additional certification path. Current time of the DUT shall be at least Jan 01, 1970.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client creates a certification path (out *certPathID*) based on CA-signed certificate (out *certID1*) and related RSA key pair (out *keyID1*) and a corresponding CA certificate (out *certID2*) and related RSA key pair (out *keyID2*) by following the procedure mentioned in Annex A.18.
4. ONVIF Client invokes **GetCertificationPath** message with parameters
   - CertificationPathID =: *certPathID*
5. The DUT responds with a **GetCertificationPathResponse** message with parameters
   - CertificationPath.CertificateID[0] =: *certID3*
   - CertificationPath.CertificateID[1] =: *certID4*
   - CertificationPath.Alias
6. If *certID1* is not equal to *certID3*, FAIL the test and go to the step 8.
7. If *certID2* is not equal to *certID4*, FAIL the test and go to the step 8.
8. ONVIF Client deletes the certification path (in *certPathID*), related CA certificate (in *certID2*) and the RSA key pair (in *keyID2*) and related the CA-signed certificate (in *certID1*) and the RSA key pair (in *keyID1*) by following the procedure mentioned in Annex A.17 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **CreateCertificationPathResponse** message.
- DUT did not send **GetCertificationPathResponse** message.

5.2.16 Get All Certification Paths – self-signed

Test Case ID: ADVANCED_SECURITY-2-1-16

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: GetAllCertificationPaths

WSDL Reference: security.wsdl

Test Purpose: To test the retrieval off all certification paths (self-signed certificate).

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. The DUT shall have enough free storage capacity for one additional certification path.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.

3. ONVIF Client invokes **GetAllCertificationPaths**.

4. The DUT responds with a **GetAllCertificationPathsResponse** message with parameters

   • CertificationPathID list =: *initialCertificationPathList*

5. ONVIF Client creates a certification path (out *certPathID*) based on self-signed certificate (out *certID1*) and related RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.11.

6. ONVIF Client invokes **GetAllCertificationPaths**.

7. The DUT responds with a **GetAllCertificationPathsResponse** message with parameters

   • CertificationPathID list =: *updatedCertificationPathList*

8. If *updatedCertificationPathList* does not contain *certPathID* and all certification paths from *initialCertificationPathList*, FAIL the test, and go to the step 10.

9. If *updatedCertificationPathList* contains certification paths other than *certPathID* or certification paths from *initialCertificationPathList*, FAIL the test, and go to the step 10.

10. ONVIF Client deletes the certification path (in *certPathID*), related the self-signed certificate (in *certID*) and the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.5 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetAllCertificationPathsResponse** message(s).

Note: The DUT may return an empty list at step 4.

5.2.17 Get All Certification Paths – CA

Test Case ID: ADVANCED_SECURITY-2-1-17

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: GetAllCertificationPaths

WSDL Reference: security.wsdl

Test Purpose: To test the retrieval off all certification paths (CA plus signed certificate).

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for two additional RSA key pairs. The DUT shall have enough free storage capacity for two additional certificates. The DUT shall have enough free storage capacity for one additional certification path. Current time of the DUT shall be at least Jan 01, 1970.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.

3. ONVIF Client invokes **GetAllCertificationPaths**.

4. The DUT responds with a **GetAllCertificationPathsResponse** message with parameters

   - CertificationPathID list =: *initialCertificationPathList*

5. ONVIF Client creates a certification path (out *certPathID*) based on CA-signed certificate (out *certID1*) and related RSA key pair (out *keyID1*) and a corresponding CA certificate (out *certID2*) and related RSA key pair (out *keyID2*) by following the procedure mentioned in Annex A.18.

6. ONVIF Client invokes **GetAllCertificationPaths**.

7. The DUT responds with a **GetAllCertificationPathsResponse** message with parameters

   - CertificationPathID list =: *updatedCertificationPathList*

8. If *updatedCertificationPathList* does not contain *certPathID* and all certification paths from *initialCertificationPathList*, FAIL the test, and go to the step 9.

9. If *updatedCertificationPathList* contains certification paths other than *certPathID* or certification paths from *initialCertificationPathList*, FAIL the test, and go to the step 9.

10. ONVIF Client deletes the certification path (in *certPathID*), related CA certificate (in *certID2*) and the RSA key pair (in *keyID2*) and related the CA-signed certificate (in *certID1*) and the RSA key pair (in *keyID1*) by following the procedure mentioned in Annex A.17 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetAllCertificationPathsResponse** message(s).

Note: The DUT may return an empty list at step 4.

5.2.18 Delete Certification Path – self-signed

Test Case ID: ADVANCED_SECURITY-2-1-18

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: DeleteCertificationPath

WSDL Reference: security.wsdl

Test Purpose: To test the deletion of a certification path (self-signed certificate).

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. The DUT shall have enough free storage capacity for one additional certification path.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.

3. ONVIF Client invokes **GetAllCertificationPaths**.

4. The DUT responds with a **GetAllCertificationPathsResponse** message with parameters

   - CertificationPathID list =: *initialCertificationPathList*

5. ONVIF Client creates a certification path (out *certPathID*) based on self-signed certificate (out *certID*) and related RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.11.

6. ONVIF Client invokes **GetAllCertificationPaths**.

7. The DUT responds with a **GetAllCertificationPathsResponse** message with parameters

   - CertificationPathID list =: *updatedCertificationPathList*

8. If *updatedCertificationPathList* does not contain *certPathID* and all certification paths from *initialCertificationPathList*, FAIL the test, delete the certification path (in *certPathID*) and related self-signed certificate (in *certID*) and related RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.5 to restore DUT configuration, and skip other steps.

9. If *updatedCertificationPathList* contains certification paths other than *certPathID* or certification paths from *initialCertificationPathList*, FAIL the test, delete the certification path (in *certPathID*) and related self-signed certificate (in *certID*) and related RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.5 to restore DUT configuration, and skip other steps.

10. ONVIF Client invokes **DeleteCertificationPath** with parameters
    - CertificationPathID =: *certPathID*
11. The DUT responds with a **DeleteCertificationPathResponse** message.
12. ONVIF Client invokes **GetAllCertificationPaths**.
13. The DUT responds with a **GetAllCertificationPathsResponse** message with parameters
    - CertificationPathID list =: *finalCertificationPathList*
14. If *finalCertificationPathList* is not equal *initialCertificationPathList*, FAIL the test.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **DeleteCertificationResponse** message.
- DUT did not send **GetAllCertificationPathsResponse** message(s).

Note: The DUT may return an empty list at step 4.

5.2.19 Delete Certification Path - CA

Test Case ID: ADVANCED_SECURITY-2-1-19

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: DeleteCertification

WSDL Reference: security.wsdl

Test Purpose: To test the deletion of a certification path (CA plus signed certificate).

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for two additional RSA key pairs. The DUT shall have enough free storage capacity for two additional certificates. The DUT shall have enough free storage capacity for one additional certification path. Current time of the DUT shall be at least Jan 01, 1970.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client invokes **GetAllCertificationPaths**.
4. The DUT responds with a **GetAllCertificationPathsResponse** message with parameters
   - CertificationPathID list =: *initialCertificationPathList*
5. ONVIF Client creates a certification path (out *certPathID*) based on CA-signed certificate (out *certID1*) and related RSA key pair (out *keyID1*) and a corresponding CA certificate (out *certID2*) and related RSA key pair (out *keyID2*) by following the procedure mentioned in Annex A.18.
6. ONVIF Client invokes **GetAllCertificationPaths**.
7. The DUT responds with a **GetAllCertificationPathsResponse** message with parameters
   - CertificationPathID list =: *updatedCertificationPathList*
8. If *updatedCertificationPathList* does not contain *certPathID* and all certification paths from *initialCertificationPathList*, FAIL the test, perform steps 9-12 to restore DUT settings, and skip other steps.
9. If *updatedCertificationPathList* contains certification paths other than *certPathID* or certification paths from *initialCertificationPathList*, FAIL the test, perform steps 9-12 to restore DUT settings, and skip other steps.
10. ONVIF Client invokes **DeleteCertificationPath** with parameters
    - CertificationPathID =: *certPathID*
11. The DUT responds with a **DeleteCertificationPathResponse** message.
12. ONVIF Client deletes the CA certificate (*certID2*) and related RSA key pair (*keyID2*) by following the procedure mentioned in Annex A.9 to restore DUT configuration.
13. ONVIF Client deletes the CA certificate (*certID1*) and related RSA key pair (*keyID1*) by following the procedure mentioned in Annex A.9 to restore DUT configuration.

14. ONVIF Client invokes **GetAllCertificationPaths**.

15. The DUT responds with a **GetAllCertificationPathsResponse** message with parameters

    - CertificationPathID list =: *finalCertificationPathList*

16. If *finalCertificationPathList* is not equal *initialCertificationPathList*, FAIL the test.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetAllCertificationPathsResponse** message(s).
- DUT did not send **DeleteCertificationPathResponse** message.

Note: The DUT may return an empty list at step 4.

5.2.20 CreatePKCS10CSR – negative test

Test Case ID: ADVANCED_SECURITY-2-1-20

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: CreatePKCS10CSR

WSDL Reference: security.wsdl

Test Purpose: To verify env:Sender\ter:InvalidArgVal\ter:InvalidKeyStatus is returned when key pair has status Generating.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PKCS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. The DUT shall have enough free storage capacity for one additional RSA key pair.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.
3. ONVIF Client invokes **GetServiceCapabilities**.
4. The DUT responds with **GetServiceCapabilitiesResponse** message with parameters
   - Capabilities =: *cap*
5. Set *keyLength* := (the smallest key length in the list of supported RSA key lengths (cap.*RSAKeyLengths*) that is greater than or equal to 1024).
6. If there is no such key length, set *keyLength* := (the largest supported RSA key length).
7. ONVIF Client invokes **CreateRSAKeyPair** message with parameters
   - KeyLength =: *keyLength*
8. The DUT responds with a **CreateRSAKeyPairResponse** message with parameters
   - KeyID =: *keyID*
   - EstimatedCreationTime =: *duration*
9. If *duration* is less than 2 sec:
   9.1. ONVIF Client deletes RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1.
   9.2. Set *keyLength* := (the smallest supported RSA key length that is larger than the current *keyLength*)
   9.3. If no such key length exists, log WARNING message, and PASS the test.
   9.4. Go to step 7.
10. ONVIF Client invokes **CreatePKCS10CSR** with parameters
    - Subject =: *subject* (see Annex A.2)
    - KeyID =: *keyID*
    - CSRAttribute skipped
    - SignatureAlgorithm.algorithm := 1.2.840.113549.1.1.5 (OID of SHA-1 with RSA Encryption algorithm)
11. If the DUT returns env:Sender\ter:InvalidArgVal\ter:InvalidKeyStatus SOAP 1.2 fault, go to step 13.

12. If the DUT returns normal **CreatePKCS10CSRResponse** message.:

    12.1. ONVIF Client deletes RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1.

    12.2. Set *keyLength* := (the smallest supported RSA key length that is larger than the current *keyLength*)

    12.3. If no such key length exists, log WARNING message, and PASS the test.

    12.4. Go to step 7.

13. ONVIF Client deletes the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- The DUT did not send env:Sender\ter:InvalidArgVal\ter:InvalidKeyStatus SOAP 1.2 fault.
- DUT did not send **CreateRSAKeyPair** message.

5.2.21 DeleteCertificate – CA – Preserve Public Key

Test Case ID: ADVANCED_SECURITY-2-1-21

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: DeleteCertificate

WSDL Reference: security.wsdl

Test Purpose: To test that the DUT does not delete the public key that is contained in the certificate from the keystore.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PKCS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. The DUT shall have enough free storage capacity for one additional key pair. The DUT shall have enough free storage capacity for one additional certificate. Current time of the DUT shall be at least Jan 01, 1970.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding private key (out *privateKey*) by following the procedure described in Annex A.4.
4. ONVIF Client uploads a CA certificate (out *certID*, in *CAcert*) and new RSA key pair with the public key from the CA certificate (out *keyID*) by following the procedure described in Annex A.15.
5. ONVIF Client invokes **DeleteCertificate** with parameters
   - CertificateID =: *certID*
6. The DUT responds with a **DeleteCertificateResponse** message.
7. ONVIF Client invokes **GetAllKeys**.
8. The DUT responds with a **GetAllKeysResponse** message where KeyAttribute list contains *keyID*.
9. ONVIF Client deletes the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- The **GetAllKeysResponse** message at Step 8 does not contain *keyID* in KeyAttribute list.
- DUT did not send **DeleteCertificateResponse** message.
- DUT did not send **GetAllKeysResponse** message.

5.2.22 Upload certificate – delete linked key (negative test)

Test Case ID: ADVANCED_SECURITY-2-1-22

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: UploadCertificate

WSDL Reference: security.wsdl

Test Purpose: To test the link of a certificate to RSA Key Pair by attempting to delete key of an uploaded certificate.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. Current time of the DUT shall be at least Jan 01, 1970.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.

3. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding private key (out *privateKey*) by following the procedure described in Annex A.4.

4. ONVIF Client creates a certificate (out *cert*) from the PKCS#10 request with RSA key pair (out *keyID1*) and associated CA certificate (in *CAcert*) and a corresponding private key (in *privateKey*) by following the procedure described in Annex A.14.

5. ONVIF Client invokes **UploadCertificate** with parameters

   - Certificate := *cert*

   - Alias := "ONVIF_Test"

   - PrivateKeyRequired : = true

6. The DUT responds with a **UploadCertificateResponse** message with parameters

   - CertificateID =: *certID*

   - KeyID =: *keyID1*

7. ONVIF Client invokes **DeleteKey** with parameters

  - KeyID =: *keyID1*

8. The DUT returns env:Sender\ter:InvalidArgVal\ter:ReferenceExists SOAP 1.2 fault.

9. ONVIF Client deletes the CA certificate (in *certID*) and related RSA key pair (in *keyID1*) by following the procedure mentioned in Annex A.9 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- The DUT did not send env:Sender\ter:InvalidArgVal\ter:ReferenceExists SOAP 1.2 fault.

- DUT did not send **UploadCertificateResponse** message.

- DUT did not send **DeleteKeyResponse** message.

5.2.23 Upload certificate – Upload malformed certificate (negative test)

Test Case ID: ADVANCED_SECURITY-2-1-23

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: UploadCertificate

WSDL Reference: security.wsdl

Test Purpose: To verify that DUT produces InvalidArgVal\BadCertificate fault if UploadCertificate is invoked for a malformed X.509 certificate.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. Current time of the DUT shall be at least Jan 01, 1970.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.

3. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding private key (out *privateKey*) by following the procedure described in Annex A.4.

4. ONVIF Client corrupts *CAcert*.

5. ONVIF Client invokes **UploadCertificate** with parameters

   - Certificate := *CAcert* (malformed)

   - Alias := "ONVIF_Test"

   - PrivateKeyRequired : = false

6. The DUT returns env:Sender\ter:InvalidArgVal\ter:BadCertificate SOAP 1.2 fault.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- The DUT did not send env:Sender\ter:InvalidArgVal\ter:BadCertificate SOAP 1.2 fault.

- DUT did not send **UploadCertificateResponse** message.

5.2.24 Upload certificate – Upload expired certificate

Test Case ID: ADVANCED_SECURITY-2-1-24

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: UploadCertificate

WSDL Reference: security.wsdl

Test Purpose: To verify that DUT does not produce an InvalidArgVal\BadCertificate fault if UploadCertificate is invoked for an expired certificate.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. Current time of the DUT shall be at least Jan 01, 1970.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding private key (out *privateKey*) by following the procedure described in Annex A.22.
4. ONVIF Client invokes **UploadCertificate** with parameters
   - Certificate := *CAcert*
   - Alias := "ONVIF_Test"
   - PrivateKeyRequired : = false
5. The DUT responds with a **UploadCertificateResponse** message with parameters
   - CertificateID =: *certID*
   - KeyID =: *keyID*
6. Check that the DUT does not return env:Sender\ter:InvalidArgVal\ter:BadCertificate SOAP 1.2 fault in **UploadCertificateResponse**.
7. ONVIF Client deletes the CA certificate (in *certID*) and related RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.9 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- The DUT send env:Sender\ter:InvalidArgVal\ter:BadCertificate SOAP 1.2 fault.
- DUT did not send **UploadCertificateResponse** message.

Note: If the DUT sends another SOAP 1.2 fault message, log WARNING message, and PASS the test.

5.2.25 CreateSelfSignedCertificate with PKCS#12

Test Case ID: ADVANCED_SECURITY-2-1-27

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: CreateSelfSignedCertificate

WSDL Reference: security.wsdl

Test Purpose: Verify that DUT correctly handles self-signed certificates that are based on keys uploaded to the DUT with PKCS#12.

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. Certificate along with an RSA private key in a PKCS#12 data structure upload is supported by the DUT as indicated by the PKCS12CertificateWithRSAPrivateKeyUpload capability. The DUT does not indicate that it requires that each certificate with private key has its own unique key as indicated by the NoPrivateKeySharing capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for two additional certificates. The DUT shall have enough free storage capacity for one additional certification path.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding public key (out *publicKey*) in the certificate along with the corresponding private key (out *privateKey*) in the form of a PKCS#12 file (out *PKCS12data*) and uploads it with certification path ID (out *certificationPathID*) and key pair ID (out *keyID*) by following the procedure described in Annex A.34.
4. ONVIF Client invokes **CreateSelfSignedCertificate** with parameters
   - X509Version skipped
   - KeyID := *keyID*
   - Subject := *subject* (see Annex A.32)

- Alias skipped
- notValidBefore skipped
- notValidAfter skipped
- SignatureAlgorithm.algorithm := 1.2.840.113549.1.1.5 (OID of SHA-1 with RSA Encryption algorithm)
- SignatureAlgorithm.parameters skipped
- SignatureAlgorithm.anyParameters skipped
- Extension skipped

5. The DUT responds with a **CreateSelfSignedCertificateResponse** message with parameters
   - CertificateID =: *certID2*
6. ONVIF Client invokes **GetCertificate** message with parameters
   - CertificateID := *certID2*
7. The DUT responds with a **GetCertificateResponse** message with parameters
   - Certificate =: *X509Cert1*
8. If *X509Cert1*.CertificateID is not equal to *certID2*, FAIL the test and go to the step 19.
9. If *X509Cert1*.KeyID is not equal to *keyID*, FAIL the test and go to the step 19.
10. ONVIF Client validates that *X509Cert1*.CertificateContent is correctly DER encoded (see Annex A.19).
11. If *X509Cert1*.CertificateContent is incorrectly DER encoded, FAIL the test and go to the step 19.
12. ONVIF Client verifies that the subject in *X509Cert1*.CertificateContent is equal to *subject*.
13. If *X509Cert1*.CertificateContent contains a wrong subject, FAIL the test and go to the step 19.
14. ONVIF Client invokes **GetAllCertificates**.
15. The DUT responds with a **GetAllCertificatesResponse** message with parameters
   - CertificateID list =: *certificateList1*

16. If *certificateList1* does not contain certificate with Certificate.CertificateID equal to *certID2*, FAIL the test and go to the step 19.

17. Set:

    - *certificateList1*.Certificate[CertificateID = certID2] =: *X509Cert2*

18. If *X509Cert1* is not equal *X509Cert2*, FAIL the test and go to the step 19.

19. ONVIF Client invokes **DeleteCertificate** with parameters

    - CertificateID =: *certID*

20. The DUT responds with a **DeleteCertificateResponse** message.

21. If test did not fail:

    21.1. ONVIF Client invokes **GetAllCertificates**

    21.2. The DUT responds with a **GetAllCertificatesResponse** message with parameters

    - CertificateID list =: *certificateList2*

    21.3. If *certificateList2* contains certificate with Certificate.CertificateID equal to *certID2*, FAIL the test and go to the step 22.

22. ONVIF Client deletes the certification path (in *certificationPathID*) and RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.33 to restore DUT configuration and skip other steps.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **CreateSelfSignedCertificateResponse** message.
- DUT did not send **GetCertificateResponse** message.
- DUT did not send **GetAllCertificatesResponse** message.
- DUT did not send **DeleteCertificateResponse** message.

Note: The following fields are compared at step 18:

- CertificateID

- KeyID
- Alias
- CertificateContent

5.2.26 Create PKCS#10 request with PKCS#12

Test Case ID: ADVANCED_SECURITY-2-1-28

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: CreatePKCS10CSR

WSDL Reference: security.wsdl

Test Purpose: Verify that DUT correctly generates a PKCS#10 request for a key pair that is uploaded with PKCS#12.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. Certificate along with an RSA private key in a PKCS#12 data structure upload is supported by the DUT as indicated by the PKCS12CertificateWithRSAPrivateKeyUpload capability. The DUT does not indicate that it requires that each certificate with private key has its own unique key as indicated by the NoPrivateKeySharing capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for two additional certificates. The DUT shall have enough free storage capacity for one additional certification path.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client creates a CA certificate (out *CAcert1*) and a corresponding public key (out *publicKey1*) in the certificate along with the corresponding private key (out *privateKey1*) in the form of a PKCS#12 file (out *PKCS12data*) and uploads it with certification path ID (out *certificationPathID1*) and key pair ID (out *keyID1*) by following the procedure described in Annex A.34.
4. ONVIF Client invokes **CreatePKCS10CSR** with parameters
   - Subject := *subject* (see Annex A.2)

- KeyID := *keyID1*
- CSRAttribute skipped
- SignatureAlgorithm.algorithm := 1.2.840.113549.1.1.5 (OID of SHA-1 with RSA Encryption algorithm)

5. The DUT responds with a **CreatePKCS10CSRResponse** message with parameters
   - PKCS10CSR =: *PKCS10request*
6. ONVIF Client creates a CA certificate (out *CAcert2*) with subject (in "CN=ONVIF TT2,C=US") and a corresponding public key (out *publicKey2*) in the certificate along with the corresponding private key (out *privateKey2*) by following the procedure described in Annex A.4.
7. ONVIF Client creates a certificate (out *cert*) from the PKCS#10 request (in *PKCS10request*) and an associated CA certificate (in *CAcert2*) with related private key (in *priveteKey2*) by following the procedure described in Annex A.3.
8. ONVIF Client invokes **UploadCertificate** with parameters
   - Certificate := *cert*
   - Alias := "ONVIF_Test"
   - PrivateKeyRequired : = true
9. The DUT responds with a **UploadCertificateResponse** message with parameters
   - CertificateID =: *certID2*
   - KeyID =: *keyID2*
10. If *keyID2* is not equal to *keyID1*, FAIL the test and go to step 24.
11. ONVIF Client invokes **GetCertificate** message with parameters
    - CertificateID := *certID2*
12. The DUT responds with a **GetCertificateResponse** message with parameters
    - Certificate =: *X509Cert1*
13. If *X509Cert1*.CertificateID is not equal to *certID2*, FAIL the test and go to the step 24.
14. If *X509Cert1*.KeyID is not equal to *keyID1*, FAIL the test and go to the step 24.

15. ONVIF Client validates that *X509Cert1*.CertificateContent is correctly DER encoded (see Annex A.19).

16. If *X509Cert1*.CertificateContent is incorrectly DER encoded, FAIL the test and go to the step 24.

17. ONVIF Client verifies that the subject in *X509Cert1*.CertificateContent is equal to "CN=ONVIF TT2,C=US".

18. If *X509Cert1*.CertificateContent contains a wrong subject, FAIL the test and go to the step 24.

19. ONVIF Client invokes **GetAllCertificates**.

20. The DUT responds with a **GetAllCertificatesResponse** message with parameters

    - CertificateID list =: *certificateList1*

21. If *certificateList1* does not contain certificate with Certificate.CertificateID equal to *certID2*, FAIL the test and go to the step 24.

22. Set:

    - *certificateList1*.Certificate[CertificateID = certID2] =: *X509Cert2*

23. If *X509Cert1* is not equal *X509Cert2*, FAIL the test and go to the step 24.

24. ONVIF Client invokes **DeleteCertificate** with parameters

    - CertificateID =: *certID2*

25. The DUT responds with a **DeleteCertificateResponse** message.

26. If test did not fail:

    26.1. ONVIF Client invokes **GetAllCertificates**

    26.2. The DUT responds with a **GetAllCertificatesResponse** message with parameters

    - CertificateID list =: *certificateList2*

    26.3. If *certificateList2* contains certificate with Certificate.CertificateID equal to *certID2*, FAIL the test and go to the step 28.

27. If step 10 failed:

    27.1. ONVIF Client invokes **DeleteKey** with parameters

    - KeyID =: *keyID2*

27.2. The DUT responds with a **DeleteKeyResponse** message.

28. ONVIF Client deletes the certification path (in *certificationPathID1*) and RSA key pair (in *keyID1*) by following the procedure mentioned in Annex A.33 to restore DUT configuration and skip other steps.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **CreatePKCS10CSRResponse** message.
- DUT did not send **UploadCertificateResponse** message.
- DUT did not send **GetCertificateResponse** message.
- DUT did not send **GetAllCertificatesResponse** message.
- DUT did not send **DeleteKeyResponse** message.
- DUT did not send **DeleteCertificateResponse** message.

Note: The following fields are compared at step 23:

- CertificateID
- KeyID
- Alias
- CertificateContent

5.3 TLS Server

5.3.1 Certificate Management

5.3.1.1 Add Server Certificate Assignment – self-signed

Test Case ID: ADVANCED_SECURITY-3-1-1

Specification Coverage: TLS Server (ONVIF Security Configuration Service Specification)

Feature under test: AddServerCertificateAssignment

WSDL Reference: security.wsdl

Test Purpose: To test the assignment of a self-signed certificate to a TLS server.

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional server certificate assignment. Network Configuration is supported by the DUT.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.

3. ONVIF Client disables HTTPS and removes Server Certificate Assignment if required by following the procedure mentioned in Annex A.45 with the following input and output parameters

   - out *initialHTTPSState* - initial HTTPS State

   - out *certPathID* - removed Server Certificate Assignment

4. ONVIF Client creates a certification path (out *certPathID*) based on self-signed certificate (out *certID1*) and related RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.11.

5. ONVIF Client invokes **AddServerCertificateAssignment** with parameters

   - CertificationPathID =: *certPathID*

6. The DUT responds with an **AddServerCertificateAssignmentResponse** message.

7. ONVIF Client waits for time *operationDelay*.

8. ONVIF Client removes server certification assignment and deletes related certification path (in *certPathID*), self-signed certificate (in *certID*) and the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.12 to restore DUT configuration.

9. ONVIF Client restores HTTPS and Server Certificate Assignment if required by following the procedure mentioned in Annex A.46 with the following input and output parameters
   - in *initialHTTPSState* - initial HTTPS State
   - in *certPathID* - removed Server Certificate Assignment

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **AddServerCertificateAssignmentResponse** message.

5.3.1.2 Add Server Certificate Assignment – CA

Test Case ID: ADVANCED_SECURITY-3-1-2

Specification Coverage: TLS Server (ONVIF Security Configuration Service Specification)

Feature under test: AddServerCertificateAssignment

WSDL Reference: security.wsdl

Test Purpose: To test the assignment of a certificate (signed + CA) to a TLS server.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for two additional RSA key pairs. The DUT shall have enough free storage capacity for two additional certificates. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional server certificate assignment. Current time of the DUT shall be at least Jan 01, 1970. Network Configuration is supported by the DUT.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.

3. ONVIF Client disables HTTPS and removes Server Certificate Assignment if required by following the procedure mentioned in Annex A.45 with the following input and output parameters

   - out *initialHTTPSState* - initial HTTPS State

   - out *certPathID* - removed Server Certificate Assignment

4. ONVIF Client creates a certification path (out *certPathID*) based on CA-signed certificate (out *certID1*) and related RSA key pair (out *keyID1*) and a corresponding CA certificate (out *certID2*) and related RSA key pair (out *keyID2*) by following the procedure mentioned in Annex A.18.

5. ONVIF Client invokes **AddServerCertificateAssignment** with parameters

   - CertificationPathID =: *certPathID*

6. The DUT responds with an **AddServerCertificateAssignmentResponse** message.

7. ONVIF Client waits for time *operationDelay*.

8. ONVIF Client removes server certification assignment and deletes related certification path (in *certPathID*), related CA certificate (in *certID2*) and the RSA key pair (in *keyID2*) and related CA-signed certificate (in *certID1*) and RSA key pair (in *keyID1*) by following the procedure mentioned in Annex A.20 to restore DUT configuration.

9. ONVIF Client restores HTTPS and Server Certificate Assignment if required by following the procedure mentioned in Annex A.46 with the following input and output parameters

   - in *initialHTTPSState* - initial HTTPS State

   - in *certPathID* - removed Server Certificate Assignment

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **AddServerCertificateAssignmentResponse** message.

5.3.1.3 Replace Server Certificate Assignment – self-signed

Test Case ID: ADVANCED_SECURITY-3-1-3

Specification Coverage: TLS Server (ONVIF Security Configuration Service Specification)

Feature under test: ReplaceServerCertificateAssignment

WSDL Reference: security.wsdl

Test Purpose: To test the replacement of a self-signed certificate to a TLS server.

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for two additional RSA key pairs. The DUT shall have enough free storage capacity for two additional certificates. The DUT shall have enough free storage capacity for two additional certification paths. The DUT shall have enough free storage capacity for one additional server certificate assignment. Network Configuration is supported by the DUT.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client disables HTTPS and removes Server Certificate Assignment if required by following the procedure mentioned in Annex A.45 with the following input and output parameters
   - out *initialHTTPSState* - initial HTTPS State
   - out *certPathID* - removed Server Certificate Assignment
4. ONVIF Client adds server certification assignment and creates related certification path (out *certPathID1*), the self-signed certificate (out *certID1*) and the RSA key pair (out *keyID1*) by following the procedure mentioned in Annex A.13.
5. ONVIF Client creates a certification path (out *certPathID2*) based on self-signed certificate (out *certID2*) and related RSA key pair (out *keyID2*) by following the procedure mentioned in Annex A.11.
6. ONVIF Client invokes **ReplaceServerCertificateAssignment** with parameters
   - OldCertificationPathID =: *certPathID1*
   - NewCertificationPathID =: *certPathID2*

7. The DUT responds with a **ReplaceServerCertificateAssignmentResponse** message.

8. ONVIF Client waits for time *operationDelay*.

9. ONVIF Client removes server certification assignment and deletes related certification path (*certPathID2*), the self-signed certificate (*certID2*) and the RSA key pair (*keyID2*) by following the procedure mentioned in Annex A.12 to restore DUT configuration.

10. ONVIF Client deletes the certification path (in *certPathID1*) and related the self-signed certificate (in *certID1*) and the RSA key pair (in *keyID1*) by following the procedure mentioned in Annex A.5 to restore DUT configuration.

11. ONVIF Client restores HTTPS and Server Certificate Assignment if required by following the procedure mentioned in Annex A.46 with the following input and output parameters

    - in *initialHTTPSState* - initial HTTPS State

    - in *certPathID* - removed Server Certificate Assignment

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **ReplaceServerCertificateAssignmentResponse** message.

5.3.1.4 Replace Server Certificate Assignment – CA

Test Case ID: ADVANCED_SECURITY-3-1-4

Specification Coverage: TLS Server (ONVIF Security Configuration Service Specification)

Feature under test: ReplaceServerCertificateAssignment

WSDL Reference: security.wsdl

Test Purpose: To test the replacement of a signed and CA certificate to a TLS server.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for three additional RSA key pairs. The DUT shall have enough free storage capacity for three additional certificates. The DUT shall have enough free storage capacity for two additional certification paths. The DUT shall have enough free storage capacity for one additional server certificate assignment. Current time of the DUT shall be at least Jan 01, 1970. Network Configuration is supported by the DUT.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client disables HTTPS and removes Server Certificate Assignment if required by following the procedure mentioned in Annex A.45 with the following input and output parameters
   - out *initialHTTPSState* - initial HTTPS State
   - out *certPathID* - removed Server Certificate Assignment
4. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding private key (out *privateKey*) by following the procedure described in Annex A.4.
5. ONVIF Client uploads a CA certificate (out *certID1*, in *CAcert*) and new RSA key pair with the public key from the CA certificate (out *keyID1*) by following the procedure described in Annex A.15.
6. ONVIF Client creates and uploads a CA-signed certificate (out *certID2*) for RSA key pair (out *keyID2*) and associated CA certificate (in *CAcert*) and a corresponding private key (in *privateKey*) by following the procedure described in Annex A.16.
7. ONVIF Client invokes **CreateCertificationPath** with parameters
   - CertficateIDs.CertificateID[0] := *certID2*
   - CertficateIDs.CertificateID[1] := *certID1*
   - Alias := "ONVIF_TestPath1"
8. The DUT responds with a **CreateCertificationPathResponse** message with parameter
   - CertificationPathID =: *certPathID1*
9. ONVIF Client invokes **AddServerCertificateAssignment** with parameter
   - CertificationPathID := *certPathID1*

10. The DUT responds with an **AddServerCertificateAssignmentResponse** message.

11. ONVIF Client waits for time *operationDelay*.

12. ONVIF Client creates and uploads a CA-signed certificate (out *certID3*) for RSA key pair (out *keyID3*) and associated CA certificate (in *CAcert*) and a corresponding private key (in *privateKey*) by following the procedure described in Annex A.16.

13. ONVIF Client invokes **CreateCertificationPath** with parameters

    - CertficateIDs.CertificateID[0] := *certID3*

    - CertficateIDs.CertificateID[1] := *certID1*

    - Alias := "ONVIF_TestPath2"

14. The DUT responds with a **CreateCertificationPathResponse** message with parameter

    - CertificationPathID =: *certPathID2*

15. ONVIF Client invokes **ReplaceServerCertificateAssignment** with parameters

    - OldCertificationPathID := *certPathID1*

    - NewCertificationPathID := *certPathID2*

16. The DUT responds with a **ReplaceServerCertificateAssignmentResponse** message.

17. ONVIF Client waits for time *operationDelay*.

18. ONVIF Client deletes the certification path (in *certPathID1*) and related the self-signed certificate (in *certID2*) and the RSA key pair (in *keyID2*) by following the procedure mentioned in Annex A.5 to restore DUT configuration.

19. ONVIF Client removes server certification assignment and deletes related certification path (in *certPathID2*), related CA certificate (in *certID1*) and RSA key pair (in *keyID1*) and related CA-signed certificate (in *certID3*) and RSA key pair (in *keyID3*) by following the procedure mentioned in Annex A.20 to restore DUT configuration.

20. ONVIF Client restores HTTPS and Server Certificate Assignment if required by following the procedure mentioned in Annex A.46 with the following input and output parameters

    - in *initialHTTPSState* - initial HTTPS State

    - in *certPathID* - removed Server Certificate Assignment

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **AddServerCertificateAssignmentResponse** message.
- DUT did not send **CreateCertificationPathResponse** message(s).
- DUT did not send **ReplaceServerCertificateAssignmentResponse** message.

5.3.1.5 Get Assigned Server Certificates – self-signed

Test Case ID: ADVANCED_SECURITY-3-1-5

Specification Coverage: TLS Server (ONVIF Security Configuration Service Specification)

Feature under test: GetAssignedServerCertificates

WSDL Reference: security.wsdl

Test Purpose: To test the retrieval of a self-signed certificate assignment to a TLS server

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional server certificate assignment. Network Configuration is supported by the DUT.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client disables HTTPS and removes Server Certificate Assignment if required by following the procedure mentioned in Annex A.45 with the following input and output parameters

- out *initialHTTPSState* - initial HTTPS State
- out *certPathID* - removed Server Certificate Assignment

4. ONVIF Client adds server certification assignment and creates related certification path (out *certPathID*), the self-signed certificate (out *certID*) and the RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.13.
5. ONVIF Client invokes **GetAssignedServerCertificates**.
6. The DUT responds with a **GetAssignedServerCertificatesResponse** message with parameters
   - CertificationPathID list =: *updatedCertificationPathList*
7. If *updatedCertificationPathList* does not contain *certPathID*, FAIL the test, and go to the step 8.
8. ONVIF Client removes server certification assignment and deletes related certification path (in *certPathID*), self-signed certificate (in *certID*) and RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.12 to restore DUT configuration.
9. ONVIF Client restores HTTPS and Server Certificate Assignment if required by following the procedure mentioned in Annex A.46 with the following input and output parameters
   - in *initialHTTPSState* - initial HTTPS State
   - in *certPathID* - removed Server Certificate Assignment

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetAssignedServerCertificatesResponse** message(s).

5.3.1.6 Get Assigned Server Certificates – CA

Test Case ID: ADVANCED_SECURITY-3-1-6

Specification Coverage: TLS Server (ONVIF Security Configuration Service Specification)

Feature under test: GetAssignedServerCertificates

WSDL Reference: security.wsdl

Test Purpose: To test the retrieval of certificate (signed + CA) assignment to a TLS server.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for two additional RSA key pairs. The DUT shall have enough free storage capacity for two additional certificates. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional server certificate assignment. Current time of the DUT shall be at least Jan 01, 1970. Network Configuration is supported by the DUT.

Test Configuration:ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client disables HTTPS and removes Server Certificate Assignment if required by following the procedure mentioned in Annex A.45 with the following input and output parameters
    - out *initialHTTPSState* - initial HTTPS State
    - out *certPathID* - removed Server Certificate Assignment
4. ONVIF Client creates a certification path (out *certPathID*) based on CA-signed certificate (out *certID1*) and related RSA key pair (out *keyID1*) and a corresponding CA certificate (out *certID2*) and related RSA key pair (out *keyID2*) by following the procedure mentioned in Annex A.18.
5. ONVIF Client invokes **AddServerCertificateAssignment** with parameters
    - CertificationPathID =: *certPathID*
6. The DUT responds with an **AddServerCertificateAssignmentResponse** message.
7. ONVIF Client waits for time *operationDelay*.
8. ONVIF Client invokes **GetAssignedServerCertificates**
9. The DUT responds with a **GetAssignedServerCertificatesResponse** message with parameters

- CertificationPathID list =: *updatedCertificationPathList*

10. If *updatedCertificationPathList* does not contain *certPathID*, FAIL the test, and go to the step 11.

11. ONVIF Client removes server certification assignment and deletes related certification path (in *certPathID*), related CA certificate (in *certID2*) and RSA key pair (in *keyID2*) and related CA-signed certificate (in *certID1*) and RSA key pair (in *keyID1*) by following the procedure mentioned in Annex A.20 to restore DUT configuration

12. ONVIF Client restores HTTPS and Server Certificate Assignment if required by following the procedure mentioned in Annex A.46 with the following input and output parameters

    - in *initialHTTPSState* - initial HTTPS State

    - in *certPathID* - removed Server Certificate Assignment

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetAssignedServerCertificatesResponse** message(s).

- DUT did not send **AddServerCertificateAssignmentResponse** message.

5.3.1.7 Remove Server Certificate Assignment – self-signed

Test Case ID: ADVANCED_SECURITY-3-1-7

Specification Coverage: TLS Server (ONVIF Security Configuration Service Specification)

Feature under test: RemoveServerCertificateAssignment

WSDL Reference:security.wsdl

Test Purpose: To test the removal of a self-signed certificate assignment on a TLS server.

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for one additional

RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional server certificate assignment. Network Configuration is supported by the DUT.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client disables HTTPS and removes Server Certificate Assignment if required by following the procedure mentioned in Annex A.45 with the following input and output parameters
   - out *initialHTTPSState* - initial HTTPS State
   - out *certPathID* - removed Server Certificate Assignment
4. ONVIF Client adds server certification assignment and creates related certification path (out *certPathID*), the self-signed certificate (out *certID*) and the RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.13.
5. ONVIF Client invokes **RemoveServerCertificateAssignment** .
   - CertificationPathID =: *certPathID*
6. The DUT responds with a **RemoveServerCertificateAssignmentResponse** message.
7. ONVIF Client waits for time *operationDelay*.
8. ONVIF Client deletes the certification path (in *certPathID*) and related the self-signed certificate (in *certID*) and the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.5 to restore DUT configuration.
9. ONVIF Client invokes **GetAssignedServerCertificates**.
10. The DUT responds with a **GetAssignedServerCertificatesResponse** message with parameters
    - CertificationPathID list =: *finalCertificationPathList*
11. If *finalCertificationPathList* contains *certPathID*, FAIL the test.
12. ONVIF Client restores HTTPS and Server Certificate Assignment if required by following the procedure mentioned in Annex A.46 with the following input and output parameters

- in *initialHTTPSState* - initial HTTPS State
- in *certPathID* - removed Server Certificate Assignment

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **RemoveServerCertificateAssignmentResponse** message.
- DUT did not send **GetAssignedServerCertificatesResponse** message(s).

5.3.1.8 Remove Server Certificate Assignment – CA

Test Case ID: ADVANCED_SECURITY-3-1-8

Specification Coverage: TLS Server (ONVIF Security Configuration Service Specification)

Feature under test: RemoveServerCertificateAssignment

WSDL Reference: security.wsdl

Test Purpose: To test the removal of certificate (signed + CA) assignment to a TLS server.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for two additional RSA key pairs. The DUT shall have enough free storage capacity for two additional certificates. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional server certificate assignment. Current time of the DUT shall be at least Jan 01, 1970. Network Configuration is supported by the DUT.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.

3. ONVIF Client disables HTTPS and removes Server Certificate Assignment if required by following the procedure mentioned in Annex A.45 with the following input and output parameters

   - out *initialHTTPSState* - initial HTTPS State
   - out *certPathID* - removed Server Certificate Assignment

4. ONVIF Client creates a certification path (out *certPathID*) based on CA-signed certificate (out *certID1*) and related RSA key pair (out *keyID1*) and a corresponding CA certificate (out *certID2*) and related RSA key pair (out *keyID2*) by following the procedure mentioned in Annex A.18.

5. ONVIF Client invokes **AddServerCertificateAssignment** with parameters

   - CertificationPathID =: *certPathID*

6. The DUT responds with an **AddServerCertificateAssignmentResponse** message.

7. ONVIF Client waits for time *operationDelay*.

8. ONVIF Client invokes **RemoveServerCertificateAssignment** with parameters

   - CertificationPathID =: *certPathID*

9. The DUT responds with a **RemoveServerCertificateAssignmentResponse** message.

10. ONVIF Client waits for time *operationDelay*.

11. ONVIF Client deletes the certification path (in *certPathID*), related CA certificate (in *certID2*) and the RSA key pair (in *keyID2*) and related the CA-signed certificate (in *certID1*) and the RSA key pair (in *keyID1*) by following the procedure mentioned in Annex A.17 to restore DUT configuration.

12. ONVIF Client invokes **GetAssignedServerCertificates**.

13. The DUT responds with a **GetAssignedServerCertificatesResponse** message with parameters

    - CertificationPathID list =: *finalCertificationPathList*

14. If *finalCertificationPathList* contains *certPathID*, FAIL the test.

15. ONVIF Client restores HTTPS and Server Certificate Assignment if required by following the procedure mentioned in Annex A.46 with the following input and output parameters

    - in *initialHTTPSState* - initial HTTPS State

- in *certPathID* - removed Server Certificate Assignment

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **RemoveServerCertificateAssignmentResponse** message.
- DUT did not send **GetAssignedServerCertificatesResponse** message.
- DUT did not send **AddServerCertificateAssignmentResponse** message.

5.3.2 TLS Handshaking

5.3.2.1 Basic TLS Handshake

Test Case ID: ADVANCED_SECURITY-3-2-3

Specification Coverage: TLS Server (ONVIF Security Configuration Service Specification)

Feature under test: execute Basic TLS Handshake

WSDL Reference: security.wsdl

Test Purpose: Check TLS handshake with certificate.

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional server certificate assignment. Network Configuration is supported by the DUT.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.

3. ONVIF Client disables HTTPS and removes Server Certificate Assignment if required by following the procedure mentioned in Annex A.45 with the following input and output parameters
   - out *initialHTTPSState* - initial HTTPS State
   - out *certPathID* - removed Server Certificate Assignment
4. ONVIF Client invokes **GetNetworkProtocols** to retrieve configured network protocols of the DUT.
5. The DUT responds with a **GetNetworkProtocolsResponse** message with parameters
   - NetworkProtocols list =: *networkProtocolsList*
6. If *networkProtocolsList* does not contain network protocol with NetworkProtocols.Name is equal to "HTTPS", FAIL the test and skip other steps.
7. ONVIF Client creates a certification path (out *certPathID*) based on self-signed certificate (out *certID*) and related RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.11.
8. ONVIF Client invokes **GetCertificate** message with parameters
   - CertificateID := *certID*
9. The DUT responds with a **GetCertificateResponse** message with parameters
   - Certificate =: *X509Cert*
10. ONVIF Client invokes **AddServerCertificateAssignment** with parameters
    - CertificationPathID := *certPathID*
11. The DUT responds with an **AddServerCertificateAssignmentResponse** message.
12. ONVIF Client waits for time *operationDelay*.
13. If HTTPS protocol with NetworkProtocols.Name is equal to "HTTPS" from *networkProtocolsList* has NetworkProtocols.Enabled equal to true, go to the step 17.
14. ONVIF Client invokes **SetNetworkProtocols** message with parameters
    - NetworkProtocols[0].Name := HTTPS
    - NetworkProtocols[0].Enabled := true
    - NetworkProtocols[0].Port := 443

- NetworkProtocols[0].Extension skipped

15. The DUT responds with a **SetNetworkProtocolsResponse** message.

16. ONVIF Client waits for time *operationDelay*.

17. ONVIF Client checks that HTTPS protocol Port is open. If HTTPS protocol *portHTTPS* is not open, FAIL the test and go to the step 19.

18. ONVIF Client verifies basic TLS handshake with expecting Server Certificate (in *certPathID*) using specified port (in *portHTTPS*) by following the procedure mentioned in Annex A.21.

19. If HTTPS protocol with NetworkProtocols.Name is equal to "HTTPS" from *networkProtocolsList* has NetworkProtocols.Enabled equal to true, go to the step 23.

20. ONVIF Client invokes **SetNetworkProtocols** message with parameters

    - NetworkProtocols list := *networkProtocolsList*

21. The DUT responds with a **SetNetworkProtocolsResponse** message.

22. ONVIF Client waits for time *operationDelay*.

23. ONVIF Client removes server certification assignment and deletes related certification path (in *certPathID*), self-signed certificate (in *certID*) and the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.12 to restore DUT configuration.

24. ONVIF Client restores HTTPS and Server Certificate Assignment if required by following the procedure mentioned in Annex A.46 with the following input and output parameters

    - in *initialHTTPSState* - initial HTTPS State

    - in *certPathID* - removed Server Certificate Assignment

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetNetworkProtocolsResponse** message(s).

- DUT did not send **GetCertificateResponse** message(s).

- DUT did not send **AddServerCertificateAssignmentResponse** message(s).

- The DUT did not provide Basic TLS handshake at step 18.

Note: The corresponding to HTTPS port number (*portHTTPS*) from *networkProtocolsList* shall be used in case HTTPS protocol was enabled in *networkProtocolsList*. Otherwise, 443 port number shall be used.

Note: If the DUT presents Certificate which is not equal to *X509Cert* during the Annex A.21 execution, log WARNING message.

Note: *operationDelay* will be taken from Operation Delay field of ONVIF Device Test Tool.

5.3.2.2 Basic TLS Handshake after Replace Server Certificate Assignment

Test Case ID: ADVANCED_SECURITY-3-2-4

Specification Coverage: TLS Server (ONVIF Security Configuration Service Specification)

Feature under test: ReplaceServerCertificateAssignment

WSDL Reference: security.wsdl

Test Purpose: Check TLS handshake with replaced certificate.

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for two additional RSA key pairs. The DUT shall have enough free storage capacity for two additional certificates. The DUT shall have enough free storage capacity for two additional certification paths. The DUT shall have enough free storage capacity for one additional server certificate assignment. There is no server certificate assignment at the device. Network Configuration is supported by the DUT.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client disables HTTPS and removes Server Certificate Assignment if required by following the procedure mentioned in Annex A.45 with the following input and output parameters
    - out *initialHTTPSState* - initial HTTPS State

- out *certPathID* - removed Server Certificate Assignment

4. ONVIF Client invokes **GetNetworkProtocols** to retrieve configured network protocols of the DUT.

5. The DUT responds with a **GetNetworkProtocolsResponse** message with parameters

   - NetworkProtocols list =: *networkProtocolsList*

6. If *networkProtocolsList* does not contain network protocol with NetworkProtocols.Name is equal to "HTTPS", FAIL the test, restore the DUT state, and skip other steps.

7. ONVIF Client adds server certification assignment and creates related certification path (out *certPathID1*), the self-signed certificate (out *certID1*) and the RSA key pair (out *keyID1*) by following the procedure mentioned in Annex A.13.

8. ONVIF Client invokes **GetCertificate** message with parameters

   - CertificateID := *certID1*

9. The DUT responds with a **GetCertificateResponse** message with parameters

   - Certificate =: *X509Cert1*

10. If HTTPS protocol with NetworkProtocols.Name is equal to "HTTPS" from *networkProtocolsList* has NetworkProtocols.Enabled equal to true, go to the step 14.

11. ONVIF Client invokes **SetNetworkProtocols** message with parameters

    - NetworkProtocols[0].Name := HTTPS

    - NetworkProtocols[0].Enabled := true

    - NetworkProtocols[0].Port := 443

    - NetworkProtocols[0].Extension skipped

12. The DUT responds with a **SetNetworkProtocolsResponse** message.

13. ONVIF Client waits for time *operationDelay*.

14. ONVIF Client checks that HTTPS protocol Port is open. If HTTPS protocol *portHTTPS* is not open, FAIL the test, restore the DUT state, and skip other steps.

15. ONVIF Client verifies basic TLS handshake with expecting Server Certificate (in *certPathID1*) using specified port (in *portHTTPS*) by following the procedure mentioned in Annex A.21.

16. ONVIF Client creates a certification path (out *certPathID2*) based on self-signed certificate (out *certID2*) and related RSA key pair (out *keyID2*) by following the procedure mentioned in Annex A.11.

17. ONVIF Client invokes **ReplaceServerCertificateAssignment** with parameters

    - OldCertificationPathID =: *certPathID1*

    - NewCertificationPathID =: *certPathID2*

18. The DUT responds with a **ReplaceServerCertificateAssignmentResponse** message.

19. ONVIF Client waits for time *operationDelay*.

20. ONVIF Client invokes **GetCertificate** message with parameters

    - CertificateID := *certID2*

21. The DUT responds with a **GetCertificateResponse** message with parameters

    - Certificate =: *X509Cert2*

22. ONVIF Client verifies basic TLS handshake with expecting Server Certificate (in *certPathID2*) using specified port (in *portHTTPS*) by following the procedure mentioned in Annex A.21

23. ONVIF Client selects network protocol with Name ="HTTPS" in *networkProtocolsList* (received in step 5) and saves this protocol in *HTTPProtocol* variable.

24. ONVIF Client invokes **SetNetworkProtocols** message with parameters

    - NetworkProtocols[0] := *HTTPProtocol*

25. The DUT responds with a **SetNetworkProtocolsResponse** message.

26. ONVIF Client removes server certification assignment and deletes related certification path (*certPathID2*), the self-signed certificate (*certID2*) and the RSA key pair (*keyID2*) by following the procedure mentioned in Annex A.12 to restore DUT configuration.

27. ONVIF Client deletes the certification path (in *certPathID1*) and related the self-signed certificate (in *certID1*) and the RSA key pair (in *keyID1*) by following the procedure mentioned in Annex A.5 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetNetworkProtocolsResponse** message.
- DUT did not send **GetCertificateResponse** message.
- DUT did not send **ReplaceServerCertificateAssignmentResponse** message.
- The DUT did not provide Basic TLS handshake at step 15.
- The DUT did not provide Basic TLS handshake at step 22.

Note: The corresponding to HTTPS port number (*portHTTPS*) from *networkProtocolsList* shall be used in case HTTPS protocol was enabled in *networkProtocolsList*. Otherwise, 443 port number shall be used.

Note: If the DUT presents Certificate which is not equal to *X509Cert* during the Annex A.21 execution, log WARNING message.

Note: *operationDelay* will be taken from Operation Delay field of ONVIF Device Test Tool.

5.3.2.3 Basic TLS Handshake with Replace Server Certification Path and PKCS#12

Test Case ID: ADVANCED_SECURITY-3-2-5

Specification Coverage: TLS Server (ONVIF Security Configuration Service Specification)

Feature under test: UploadCertificateWithPrivateKeyInPKCS12, AddServerCertificateAssignment, ReplaceServerCertificateAssignment, GetAssignedServerCertificates

WSDL Reference: security.wsdl

Test Purpose: Verify that DUT correctly performs TLS handshake after replace of server certification path with PKCS#12.

Pre-Requisite: Security Configuration Service is received from the DUT. Certificate along with an RSA private key in a PKCS#12 data structure upload is supported by the DUT as indicated by the PKCS12CertificateWithRSAPrivateKeyUpload capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for two additional certificates. The DUT shall have enough free storage capacity for two additional certification paths. The DUT shall have enough free storage capacity for one additional server certificate assignment. There is no server certificate assignment at the device. Network Configuration is supported by the DUT.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.

3. ONVIF Client disables HTTPS and removes Server Certificate Assignment if required by following the procedure mentioned in Annex A.45 with the following input and output parameters

   - out *initialHTTPSState* - initial HTTPS State

   - out *certPathID* - removed Server Certificate Assignment

4. ONVIF Client invokes **GetNetworkProtocols** to retrieve configured network protocols of the DUT.

5. The DUT responds with a **GetNetworkProtocolsResponse** message with parameters

   - NetworkProtocols list =: *networkProtocolsList*

6. If *networkProtocolsList* does not contain network protocol with NetworkProtocols.Name is equal to "HTTPS", FAIL the test and skip other steps.

7. Set

   - *portHTTPS* =: *networkProtocolsList*.NetworkProtocols[Name = "HTTPS"].Port

8. ONVIF Client generates an encryption passphrase *passphrase1* (see Annex A.24).

9. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding public key (out *publicKey*) in the certificate along with the corresponding private key (out *privateKey*) in the form of a PKCS#12 file (out *PKCS12data*) with given passphrase (in *passphrase1*) by following the procedure described in Annex A.30.

10. ONVIF Client invokes **UploadCertificateWithPrivateKeyInPKCS12** message with parameters

    - CertWithPrivateKey := *PKCS12data1*

    - CertificationPathAlias := "ONVIF_CertificationPath_Test"

    - KeyAlias := "ONVIF_Key_Test"

    - IgnoreAdditionalCertificates skiped

- IntegrityPassphraseID skipped
- EncryptionPassphraseID skipped
- Passphrase := *passphrase1*

11. The DUT responds with an **UploadCertificateWithPrivateKeyInPKCS12Response** message with parameters
    - CertificationPathID =: *certPathID1*
    - KeyID =: *keyID1*
12. ONVIF Client invokes **AddServerCertificateAssignment** with parameters
    - CertificationPathID := *certPathID1*
13. The DUT responds with an **AddServerCertificateAssignmentResponse** message.
14. ONVIF Client waits for time *operationDelay*.
15. If HTTPS protocol with NetworkProtocols.Name is equal to "HTTPS" from *networkProtocolsList* has NetworkProtocols.Enabled equal to true, go to the step 20.
16. ONVIF Client invokes **SetNetworkProtocols** message with parameters
    - NetworkProtocols[0].Name := HTTPS
    - NetworkProtocols[0].Enabled := true
    - NetworkProtocols[0].Port := 443
    - NetworkProtocols[0].Extension skipped
17. The DUT responds with a **SetNetworkProtocolsResponse** message.
18. ONVIF Client waits for time *operationDelay*.
19. Set
    - *portHTTPS* =: 443
20. ONVIF Client checks that HTTPS protocol Port is open. If HTTPS protocol *portHTTPS* is not open, FAIL the test and go to the step 40.
21. ONVIF Client verifies basic TLS handshake with expecting Server Certificate (in *certPathID1*) using specified port (in *portHTTPS*) by following the procedure mentioned in Annex A.21.

22. If the DUT presents Certificate which is not equal to *PKCS12data1* during the Annex A.21 execution, FAIL the test and go to the step 40.

23. ONVIF Client creates a CA certificate (out *CAcert2*) with subject (in "CN=ONVIF TT2,C=US") and a corresponding public key (out *publicKey2*) in the certificate along with the corresponding private key (out *privateKey2*) in the form of a PKCS#12 file (out *PKCS12data2*) with given passphrase (in *passphrase1*) by following the procedure described in Annex A.30.

24. ONVIF Client invokes **UploadCertificateWithPrivateKeyInPKCS12** message with parameters

    - CertWithPrivateKey := *PKCS12data2*
    - CertificationPathAlias := "ONVIF_CertificationPath_Test2"
    - KeyAlias := "ONVIF_Key_Test2"
    - IgnoreAdditionalCertificates skipped
    - IntegrityPassphraseID skipped
    - EncryptionPassphraseID skipped
    - Passphrase := *passphrase1*

25. The DUT responds with an **UploadCertificateWithPrivateKeyInPKCS12Response** message with parameters

    - CertificationPathID =: *certPathID2*
    - KeyID =: *keyID2*

26. ONVIF Client invokes **ReplaceServerCertificateAssignment** with parameters

    - OldCertificationPathID =: *certPathID1*
    - NewCertificationPathID =: *certPathID2*

27. The DUT responds with a **ReplaceServerCertificateAssignmentResponse** message.

28. ONVIF Client waits for time *operationDelay*.

29. ONVIF Client invokes **GetAssignedServerCertificates**.

30. The DUT responds with a **GetAssignedServerCertificatesResponse** message with parameters

- CertificationPathID list =: *certificationPathIDList*

31. If *certificationPathIDList* contains certification path with CertificationPathID equal to *certPathID1*, FAIL the test and go to the step 39.

32. If *certificationPathIDList* does not contain certification path with CertificationPathID equal to *certPathID2*, FAIL the test and go to the step 39.

33. ONVIF Client checks that HTTPS protocol Port is open. If HTTPS protocol *portHTTPS* is not open, FAIL the test and go to the step 36.

34. ONVIF Client verifies basic TLS handshake with expecting Server Certificate (in *certPathID2*) using specified port (in *portHTTPS*) by following the procedure mentioned in Annex A.21.

35. If the DUT presents Certificate which is not equal to *X509Cert* during the Annex A.21 execution, FAIL the test and go to the step 36.

36. ONVIF Client invokes **RemoveServerCertificateAssignment** with parameters

    - CertificationPathID := *certPathID2*

37. The DUT responds with a **RemoveServerCertificateAssignmentResponse** message.

38. ONVIF Client waits for time *operationDelay*.

39. ONVIF Client deletes the certification path (in *certPathID2*) and RSA key pair (in *keyID2*) by following the procedure mentioned in Annex A.33 to restore DUT configuration.

40. ONVIF Client deletes the certification path (in *certPathID1*) and RSA key pair (in *keyID1*) by following the procedure mentioned in Annex A.33 to restore DUT configuration.

41. ONVIF Client invokes **SetNetworkProtocols** message with parameters

    - NetworkProtocols := *networkProtocolsList*

42. The DUT responds with a **SetNetworkProtocolsResponse** message.

43. ONVIF Client waits for time *operationDelay*.

44. ONVIF Client restores HTTPS and Server Certificate Assignment if required by following the procedure mentioned in Annex A.46 with the following input and output parameters

    - in *initialHTTPSState* - initial HTTPS State

    - in *certPathID* - removed Server Certificate Assignment

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetNetworkProtocolsResponse** message.
- DUT did not send **SetNetworkProtocolsResponse** message.
- DUT did not send **UploadCertificateWithPrivateKeyInPKCS12Response** message.s.
- DUT did not send **AddServerCertificateAssignmentResponse** message.s.
- DUT did not send **ReplaceServerCertificateAssignmentResponse** message.
- DUT did not send **GetAssignedServerCertificatesResponse** message.
- DUT did not send **RemoveServerCertificateAssignmentResponse** message.
- The DUT did not provide Basic TLS handshake at Step 21.
- The DUT did not provide Basic TLS handshake at Step 34.

Note: The corresponding to HTTPS port number (*portHTTPS*) from *networkProtocolsList* shall be used in case HTTPS protocol was enabled in *networkProtocolsList*. Otherwise, 443 port number shall be used.

Note: *operationDelay* will be taken from Operation Delay field of ONVIF Device Test Tool.

5.3.3 TLS client authentication

5.3.3.1 TLS client authentication – self-signed TLS server certificate with on-device RSA key pair

Test Case ID: ADVANCED_SECURITY-3-3-1

Specification Coverage: TLS Server (ONVIF Security Configuration Service Specification)

Feature under test: GetClientAuthenticationRequired, SetClientAuthenticationRequired, AddCertPathValidationPolicyAssignment

WSDL Reference: security.wsdl

Test Purpose: To test the assignment of a self-signed certificate to a TLS server.

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. TLS client authentication is supported by the DUT as indicated by the TLSClientAuthSupported capability. The DUT shall have enough free storage capacity for two additional RSA key pairs. The DUT shall have enough free storage capacity for two additional certificates. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional server certificate assignment. The DUT shall have enough free storage capacity for one additional certification path validation policy. The DUT shall have enough free storage capacity for one additional certification path validation policy assignment. Network Configuration is supported by the DUT.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.

3. ONVIF Client disables HTTPS and removes Server Certificate Assignment if required by following the procedure mentioned in Annex A.45 with the following input and output parameters

   - out *initialHTTPSState* - initial HTTPS State

   - out *certPathID* - removed Server Certificate Assignment

4. ONVIF Client invokes **GetNetworkProtocols** to retrieve configured network protocols of the DUT.

5. The DUT responds with a **GetNetworkProtocolsResponse** message with parameters

   - NetworkProtocols list =: *networkProtocolsList*

6. If *networkProtocolsList* does not contain network protocol with NetworkProtocols.Name is equal to "HTTPS", FAIL the test and skip other steps.

7. Set

   - *portHTTPS* =: *networkProtocolsList*.NetworkProtocols[Name = "HTTPS"].Port

8. ONVIF Client invokes **GetClientAuthenticationRequired**.

9. The DUT responds with a **GetClientAuthenticationRequiredResponse** message with parameters

   - clientAuthenticationRequired =: *clientAuthenticationRequired*

10. ONVIF Client adds server certification assignment and creates related certification path (out *certPathID0*), the self-signed certificate (out *certID0*) and the RSA key pair (out *keyID0*) by following the procedure mentioned in Annex A.13.

11. ONVIF Client creates a CA certificate (out *CAcert1*) with subject (in "CN=ONVIF1 TT,C=US") and a corresponding public key (out *publicKey1*) in the certificate along with the corresponding private key (out *privateKey1*) by following the procedure described in Annex A.4.

12. ONVIF Client uploads a CA certificate (out *certID1*, in *CAcert1*) and new RSA key pair with the public key from the CA certificate (out *keyID1*) by following the procedure described in Annex A.15.

13. ONVIF Client creates a certificate (out *cert2*) signed by private key (in *privateKey1*) of the CA-certificate (in *CAcert1*) with subject (in "CN=ONVIF2 TT,C=US") and a corresponding public key (out *publicKey2*) in the certificate along with the corresponding private key (out *privateKey2*) by following the procedure described in Annex A.41.

14. ONVIF Client creates a CA certificate (out *CAcert3*) with subject (in "CN=ONVIF3 TT,C=US") and a corresponding public key (out *publicKey3*) in the certificate along with the corresponding private key (out *privateKey3*) by following the procedure described in Annex A.4.

15. ONVIF Client creates a certificate (out *cert4*) signed by private key (in *privateKey3*) of the CA-certificate (in *CAcert3*) with subject (in "CN=ONVIF4 TT,C=US") and a corresponding public key (out *publicKey4*) in the certificate along with the corresponding private key (out *privateKey4*) by following the procedure described in Annex A.41.

16. ONVIF Client creates certification path validation policy (out *certPathValidationPolicyID*) with specified alias (in "Test CertPathValidationPolicy Alias") and the certificate identifier (in *certID1*) for trust anchor by following the procedure mentioned in Annex A.42.

17. ONVIF Client invokes **AddCertPathValidationPolicyAssignment** with parameters

   - CertPathValidationPolicyID := *certPathValidationPolicyID*

18. The DUT responds with an **AddCertPathValidationPolicyAssignmentResponse** message.

19. If HTTPS protocol with NetworkProtocols.Name is equal to "HTTPS" from *networkProtocolsList* has NetworkProtocols.Enabled equal to true, go to the step 24.

20. ONVIF Client invokes **SetNetworkProtocols** message with parameters

    - NetworkProtocols[0].Name := HTTPS
    - NetworkProtocols[0].Enabled := true
    - NetworkProtocols[0].Port := 443
    - NetworkProtocols[0].Extension skipped

21. The DUT responds with a **SetNetworkProtocolsResponse** message.

22. ONVIF Client waits for time *operationDelay*.

23. Set

    - *portHTTPS* := 443.

24. If *clientAuthenticationRequired* is equal to false:

    24.1. ONVIF Client invokes **SetClientAuthenticationRequired** with parameters

    - clientAuthenticationRequired := true

    24.2. The DUT responds with a **SetClientAuthenticationRequiredResponse** message.

25. ONVIF Client invokes **GetClientAuthenticationRequired** through HTTPS using the client certificate *cert2* and port *portHTTPS*.

26. The DUT responds with a **GetClientAuthenticationRequiredResponse** message with parameters

    - clientAuthenticationRequired =: *clientAuthenticationRequired1*

27. ONVIF Client invokes **GetClientAuthenticationRequired** through HTTPS using the client certificate *cert4* and port *portHTTPS*.

28. The DUT does not establish a TLS connection.

29. If *clientAuthenticationRequired* is equal to false:

    29.1. ONVIF Client invokes **SetClientAuthenticationRequired** with parameters

    - clientAuthenticationRequired := false

    29.2. The DUT responds with a **SetClientAuthenticationRequiredResponse** message.

30. ONVIF Client invokes **SetNetworkProtocols** message with parameters

    - NetworkProtocols := *networkProtocolsList*

31. The DUT responds with a **SetNetworkProtocolsResponse** message.

32. ONVIF Client waits for time *operationDelay*.

33. ONVIF Client invokes **RemoveCertPathValidationPolicyAssignment** with parameters

    - CertPathValidationPolicyID := *certPathValidationPolicyID*

34. The DUT responds with a **RemoveCertPathValidationPolicyAssignmentResponse** message.

35. ONVIF Client deletes the certification path validation policy (in *certPathValidationPolicyID*) by following the procedure mentioned in Annex A.38 to restore DUT configuration.

36. ONVIF Client deletes the CA certificate (in *certID1*) and related RSA key pair (in *keyID1*) by following the procedure mentioned in Annex A.9 to restore DUT configuration.

37. ONVIF Client removes server certification assignment and deletes related certification path (in *certPathID0*), self-signed certificate (in *certID0*) and RSA key pair (in *keyID0*) by following the procedure mentioned in Annex A.12 to restore DUT configuration.

38. ONVIF Client restores HTTPS and Server Certificate Assignment if required by following the procedure mentioned in Annex A.46 with the following input and output parameters

    - in *initialHTTPSState* - initial HTTPS State

    - in *certPathID* - removed Server Certificate Assignment

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **RemoveCertPathValidationPolicyAssignmentResponse** message.

- DUT did not send **SetNetworkProtocolsResponse** message.

- DUT did not send **SetClientAuthenticationRequiredResponse** message.

- The DUT establishes a TLS connection for step 28.

- DUT did not send **GetClientAuthenticationRequiredResponse** message.
- DUT did not send **AddCertPathValidationPolicyAssignmentResponse** message.
- DUT did not send **GetNetworkProtocolsResponse** message.

Note: *operationDelay* will be taken from Operation Delay field of ONVIF Device Test Tool.

5.3.3.2 CRL processing with on-device RSA key pair

Test Case ID: ADVANCED_SECURITY-3-3-2

Specification Coverage: TLS Server (ONVIF Security Configuration Service Specification)

Feature under test: GetClientAuthentication, SetClientAuthenticationRequired

WSDL Reference: security.wsdl

Test Purpose: To test the assignment of a self-signed certificate to a TLS server.

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. CRLs supported by the DUT as indicated by the MaximumNumberOfCRLs capability. TLS client authentication is supported by the DUT as indicated by the TLSClientAuthSupported capability. The DUT shall have enough free storage capacity for two additional RSA key pairs. The DUT shall have enough free storage capacity for two additional certificates. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional server certificate assignment. The DUT shall have enough free storage capacity for one additional certification path validation policy. The DUT shall have enough free storage capacity for one additional CRL. The DUT shall have enough free storage capacity for one additional certification path validation policy assignment. Network Configuration is supported by the DUT.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client disables HTTPS and removes Server Certificate Assignment if required by following the procedure mentioned in Annex A.45 with the following input and output parameters

- out *initialHTTPSState* - initial HTTPS State
- out *certPathID* - removed Server Certificate Assignment

4. ONVIF Client invokes **GetNetworkProtocols** to retrieve configured network protocols of the DUT.
5. The DUT responds with a **GetNetworkProtocolsResponse** message with parameters
   - NetworkProtocols list =: *networkProtocolsList*
6. If *networkProtocolsList* does not contain network protocol with NetworkProtocols.Name is equal to "HTTPS", FAIL the test and skip other steps.
7. Set
   - *portHTTPS* =: *networkProtocolsList*.NetworkProtocols[Name = "HTTPS"].Port
8. ONVIF Client invokes **GetClientAuthenticationRequired**.
9. The DUT responds with a **GetClientAuthenticationRequiredResponse** message with parameters
   - clientAuthenticationRequired =: *clientAuthenticationRequired*
10. ONVIF Client adds server certification assignment and creates related certification path (out *certPathID0*), the self-signed certificate (out *certID0*) and the RSA key pair (out *keyID0*) by following the procedure mentioned in Annex A.13.
11. ONVIF Client creates a CA certificate (out *CAcert1*) with subject (in "CN=ONVIF1 TT,C=US") and a corresponding public key (out *publicKey1*) in the certificate along with the corresponding private key (out *privateKey1*) by following the procedure described in Annex A.4.
12. ONVIF Client uploads a CA certificate (out *certID1*, in *CAcert1*) and new RSA key pair with the public key from the CA certificate (out *keyID1*) by following the procedure described in Annex A.15.
13. ONVIF Client creates a certificate (out *cert2*) signed by private key (in *privateKey1*) of the CA-certificate (in *CAcert1*) with subject (in "CN=ONVIF2 TT,C=US") and a corresponding public key (out *publicKey2*) in the certificate along with the corresponding private key (out *privateKey2*) by following the procedure described in Annex A.41.
14. ONVIF Client creates a certificate (out *cert3*) signed by private key (in *privateKey1*) of the CA-certificate (in *CAcert1*) with subject (in "CN=ONVIF3 TT,C=US") and a corresponding

public key (out *publicKey3*) in the certificate along with the corresponding private key (out *privateKey3*) by following the procedure described in Annex A.41.

15. ONVIF Client creates a CRL (out *crl*) for certificate revocation (in *cert3*) signed by private key (in *privateKey1*) by following the procedure mentioned in Annex A.43.

16. ONVIF Client uploads a CRL (in *crl*) with alias (in "ONVIF_CRL_Test") identifier (out *crlID*) by following the procedure described in Annex A.37.

17. ONVIF Client creates certification path validation policy (out *certPathValidationPolicyID*) with specified alias (in "Test CertPathValidationPolicy Alias") and the certificate identifier (in *certID1*) for trust anchor by following the procedure mentioned in Annex A.42.

18. ONVIF Client invokes **AddCertPathValidationPolicyAssignment** with parameters

    - CertPathValidationPolicyID := *certPathValidationPolicyID*

19. The DUT responds with an **AddCertPathValidationPolicyAssignmentResponse** message.

20. If HTTPS protocol with NetworkProtocols.Name is equal to "HTTPS" from *networkProtocolsList* has NetworkProtocols.Enabled equal to true, go to the step 25.

21. ONVIF Client invokes **SetNetworkProtocols** message with parameters

    - NetworkProtocols[0].Name := HTTPS
    - NetworkProtocols[0].Enabled := true
    - NetworkProtocols[0].Port := 443
    - NetworkProtocols[0].Extension skipped

22. The DUT responds with a **SetNetworkProtocolsResponse** message.

23. ONVIF Client waits for time *operationDelay*.

24. Set

    - *portHTTPS* := 443.

25. If *clientAuthenticationRequired* is equal to false:

    25.1. ONVIF Client invokes **SetClientAuthenticationRequired** with parameters

    - clientAuthenticationRequired := true

    25.2. The DUT responds with a **SetClientAuthenticationRequiredResponse** message.

26. ONVIF Client invokes **GetClientAuthenticationRequired** through HTTPS using the client certificate *cert2* and port *portHTTPS*.

27. The DUT responds with a **GetClientAuthenticationRequiredResponse** message with parameters

    - clientAuthenticationRequired =: *clientAuthenticationRequired1*

28. ONVIF Client invokes **GetClientAuthenticationRequired** through HTTPS using the client certificate *cert3* and port *portHTTPS*.

29. The DUT does not establish a TLS connection.

30. If *clientAuthenticationRequired* is equal to false:

    30.1. ONVIF Client invokes **SetClientAuthenticationRequired** with parameters

    - clientAuthenticationRequired := false

    30.2. The DUT responds with a **SetClientAuthenticationRequiredResponse** message.

31. ONVIF Client invokes **SetNetworkProtocols** message with parameters

    - NetworkProtocols := *networkProtocolsList*

32. The DUT responds with a **SetNetworkProtocolsResponse** message.

33. ONVIF Client waits for time *operationDelay*.

34. ONVIF Client invokes **RemoveCertPathValidationPolicyAssignment** with parameters

    - CertPathValidationPolicyID := *certPathValidationPolicyID*

35. The DUT responds with a **RemoveCertPathValidationPolicyAssignmentResponse** message.

36. ONVIF Client deletes the certification path validation policy (in *certPathValidationPolicyID*) by following the procedure mentioned in Annex A.38 to restore DUT configuration.

37. ONVIF Client deletes the CRL (in *crlID*) by following the procedure mentioned in Annex A.36 to restore DUT configuration.

38. ONVIF Client deletes the CA certificate (in *certID1*) and related RSA key pair (in *keyID1*) by following the procedure mentioned in Annex A.9 to restore DUT configuration.

39. ONVIF Client removes server certification assignment and deletes related certification path (in *certPathID0*), self-signed certificate (in *certID0*) and RSA key pair (in *keyID0*) by following the procedure mentioned in Annex A.12 to restore DUT configuration.

40. ONVIF Client restores HTTPS and Server Certificate Assignment if required by following the procedure mentioned in Annex A.46 with the following input and output parameters

    - in *initialHTTPSState* - initial HTTPS State

    - in *certPathID* - removed Server Certificate Assignment

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **RemoveCertPathValidationPolicyAssignmentResponse** message.
- DUT did not send **SetNetworkProtocolsResponse** message.
- DUT did not send **SetClientAuthenticationRequiredResponse** message.
- The DUT establishes a TLS connection for step 29.
- DUT did not send **GetClientAuthenticationRequiredResponse** message.
- DUT did not send **AddCertPathValidationPolicyAssignmentResponse** message.
- DUT did not send **GetNetworkProtocolsResponse** message.

Note: *operationDelay* will be taken from Operation Delay field of ONVIF Device Test Tool.

5.3.3.3 Replace certification path validation policy assignment

Test Case ID: ADVANCED_SECURITY-3-3-3

Specification Coverage: Certification Path Validation Policy Management (ONVIF Security Configuration Service Specification)

Feature under test: ReplaceCertPathValidationPolicyAssignment, GetAssignedCertPathValidationPolicies

WSDL Reference: security.wsdl

Test Purpose: Verify that DUT correctly supports replacing certification path validation policy assignments.

Pre-Requisite: Security Configuration Service is received from the DUT. Certification path validation policy supported by the DUT as indicated by the

MaximumNumberOfCertificationPathValidationPolicies capability. TLS client authentication is supported by the DUT as indicated by the TLSClientAuthSupported capability. The DUT shall have enough free storage capacity for two additional certification path validation policies. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. The DUT shall have enough free storage capacity for one additional certification path validation policy assignment.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client creates certification path validation policy identifier (out *certPathValidationPolicyID1*) with specified alias (in "Test CertPathValidationPolicy1 Alias"), related certificate (out *certID*), RSA key pair (out *keyID*) and certification path if any (out *certificationPathID*) by following the procedure mentioned in Annex A.40.
4. ONVIF Client creates certification path validation policy identifier (out *certPathValidationPolicyID2*) with specified alias (in "Test CertPathValidationPolicy2 Alias") and the certificate identifier (in *certID*) for trust anchor by following the procedure mentioned in Annex A.42.
5. ONVIF Client invokes **AddCertPathValidationPolicyAssignment** with parameters
   - CertPathValidationPolicyID := *certPathValidationPolicyID1*
6. The DUT responds with an **AddCertPathValidationPolicyAssignmentResponse** message.
7. ONVIF Client invokes **ReplaceCertPathValidationPolicyAssignment** with parameters
   - OldCertPathValidationPolicyID := *certPathValidationPolicyID1*
   - NewCertPathValidationPolicyID := *certPathValidationPolicyID2*
8. The DUT responds with a **ReplaceCertPathValidationPolicyAssignmentResponse** message.
9. ONVIF Client invokes **GetAssignedCertPathValidationPolicies**.
10. The DUT responds with a **GetAssignedCertPathValidationPoliciesResponse** message with parameters

- CertPathValidationPolicyID list =: *certPathValidationPolicyIDList*

11. If *certPathValidationPolicyIDList* contains CertPathValidationPolicyID equal to *certPathValidationPolicyID1*, FAIL the test and go to the step 14.

12. If *certPathValidationPolicyIDList* does not contain CertPathValidationPolicyID equal to *certPathValidationPolicyID2*, FAIL the test and go to the step 19.

13. Go to the step 17.

14. ONVIF Client invokes **RemoveCertPathValidationPolicyAssignment** with parameters

    - CertPathValidationPolicyID := *certPathValidationPolicyID1*

15. The DUT responds with a **RemoveCertPathValidationPolicyAssignmentResponse** message.

16. Go to the step 19.

17. ONVIF Client invokes **RemoveCertPathValidationPolicyAssignment** with parameters

    - CertPathValidationPolicyID := *certPathValidationPolicyID2*

18. The DUT responds with a **RemoveCertPathValidationPolicyAssignmentResponse** message.

19. ONVIF Client invokes **DeleteCertPathValidationPolicy** with parameters

    - CertPathValidationPolicyID := *certPathValidationPolicyID2*

20. DUT responds with a **DeleteCertPathValidationPolicyResponse** message.

21. ONVIF Client deletes the certification path validation policy (in *certPathValidationPolicyID1*) by following the procedure mentioned in Annex A.38 to restore DUT configuration.

22. If *certificationPathID* is null:

    22.1. ONVIF Client deletes the self-signed certificate (in *certID*) and related the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.9.

    22.2. Skip other steps.

23. If *certificationPathID* is not null:

    23.1. ONVIF Client deletes the certification path (in *certificationPathID*) and RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.33 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **AddCertPathValidationPolicyAssignmentResponse** message.
- DUT did not send **ReplaceCertPathValidationPolicyAssignmentResponse** message.
- DUT did not send **GetAssignedCertPathValidationPoliciesResponse** message.
- DUT did not send **RemoveCertPathValidationPolicyAssignmentResponse** message.
- DUT did not send **DeleteCertPathValidationPolicyResponse** message.

5.4 Referential Integrity

5.4.1 TLS Server Certificate - self-signed

Test Case ID: ADVANCED_SECURITY-4-1-1

Specification Coverage: Key Management (ONVIF Security Configuration Service Specification), Certificate Management (ONVIF Security Configuration Service Specification), TLS Server (ONVIF Security Configuration Service Specification)

Feature under test: DeleteKey, DeleteCertificate. DeleteCertificationPath

WSDL Reference: security.wsdl

Test Purpose: To test the referential integrity of certificate assigned to a TLS server.

Pre-Requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional server certificate assignment. Network Configuration is supported by the DUT.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.

3. ONVIF Client disables HTTPS and removes Server Certificate Assignment if required by following the procedure mentioned in Annex A.45 with the following input and output parameters

   - out *initialHTTPSState* - initial HTTPS State

   - out *certPathID* - removed Server Certificate Assignment

4. ONVIF Client adds server certification assignment and creates related certification path (out *certPathID*), the self-signed certificate (out *certID*) and the RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.13.

5. ONVIF Client invokes **DeleteKey** with parameters

   - KeyID =: *keyID*

6. The DUT returns env:Sender/ter:InvalidArgVal/ter:ReferenceExists SOAP 1.2 fault.

7. ONVIF Client invokes **DeleteCertificate** with parameters

   - CertificateID =: *certID*

8. The DUT returns env:Sender/ter:InvalidArgVal/ter:ReferenceExists SOAP 1.2 fault.

9. ONVIF Client invokes **DeleteCertificationPath** with parameters

   - CertificationPathID =: *certPathID*

10. The DUT returns env:Sender/ter:InvalidArgVal/ter:ReferenceExists SOAP 1.2 fault.

11. ONVIF Client invokes **RemoveServerCertificateAssignment** .

    - CertificationPathID =: *certPathID*

12. The DUT responds with a **RemoveServerCertificateAssignmentResponse** message.

13. ONVIF Client waits for time *operationDelay*.

14. ONVIF Client invokes **DeleteKey** with parameters

    - KeyID =: *keyID*

15. The DUT returns env:Sender/ter:InvalidArgVal/ter:ReferenceExists SOAP 1.2 fault.

16. ONVIF Client invokes **DeleteCertificate** with parameters
    - CertificateID =: *certID*
17. The DUT returns env:Sender/ter:InvalidArgVal/ter:ReferenceExists SOAP 1.2 fault.
18. ONVIF Client invokes **DeleteCertificationPath** with parameters
    - CertificationPathID =: *certPathID*
19. The DUT responds with a **DeleteCertificationPathResponse** message.
20. ONVIF Client invokes **DeleteKey** with parameters
    - KeyID =: *keyID*
21. The DUT returns env:Sender/ter:InvalidArgVal/ter:ReferenceExists SOAP 1.2 fault.
22. ONVIF Client deletes the self-signed certificate (in *certID*) and related RSA key pair (in *keyID*) by following procedure mentioned in Annex A.9 to restore DUT configuration.
23. ONVIF Client restores HTTPS and Server Certificate Assignment if required by following the procedure mentioned in Annex A.46 with the following input and output parameters
    - in *initialHTTPSState* - initial HTTPS State
    - in *certPathID* - removed Server Certificate Assignment

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **DeleteCertificationPathResponse** message.
- DUT did not send **RemoveServerCertificateAssignmentResponse** message.
- The DUT did not send the env:Receiver/ter:Action/ter:NoMatchingPrivateKey SOAP 1.2 fault message(s).

5.4.2 TLS Server Certificate – CA

Test Case ID: ADVANCED_SECURITY-4-1-2

Specification Coverage: Key Management (ONVIF Security Configuration Service Specification), Certificate Management (ONVIF Security Configuration Service Specification), TLS Server (ONVIF Security Configuration Service Specification)

Feature under test: DeleteKey, DeleteCertificate. DeleteCertificationPath

WSDL Reference: security.wsdl

Test Purpose: To test the referential integrity of certificate assigned to a TLS server.

Pre-Requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for two additional RSA key pairs. The DUT shall have enough free storage capacity for two additional certificates. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional server certificate assignment. Current time of the DUT shall be at least Jan 01, 1970. Network Configuration is supported by the DUT.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client disables HTTPS and removes Server Certificate Assignment if required by following the procedure mentioned in Annex A.45 with the following input and output parameters
   - out *initialHTTPSState* - initial HTTPS State
   - out *certPathID* - removed Server Certificate Assignment
4. ONVIF Client creates a certification path (out *certPathID*) based on CA-signed certificate (out *certID1*) and related RSA key pair (out *keyID1*) and a corresponding CA certificate (out *certID2*) and related RSA key pair (out *keyID2*) by following the procedure mentioned in Annex A.18.
5. ONVIF Client invokes **AddServerCertificateAssignment** with parameters
   - CertificationPathID := *certPathID*
6. The DUT responds with an **AddServerCertificateAssignmentResponse** message.

7. ONVIF Client waits for time *operationDelay*.

8. ONVIF Client invokes **DeleteKey** with parameters

    - KeyID =: *keyID1*

9. The DUT returns env:Sender/ter:InvalidArgVal/ter:ReferenceExists SOAP 1.2 fault.

10. ONVIF Client invokes **DeleteKey** with parameters

    - KeyID =: *keyID2*

11. The DUT returns env:Sender/ter:InvalidArgVal/ter:ReferenceExists SOAP 1.2 fault.

12. ONVIF Client invokes **DeleteCertificate** with parameters

    - CertificateID =: *certID1*

13. The DUT returns env:Sender/ter:InvalidArgVal/ter:ReferenceExists SOAP 1.2 fault.

14. ONVIF Client invokes **DeleteCertificate** with parameters

    - CertificateID =: *certID2*

15. The DUT returns env:Sender/ter:InvalidArgVal/ter:ReferenceExists SOAP 1.2 fault.

16. ONVIF Client invokes **DeleteCertificationPath** with parameters

    - CertificationPathID =: *certPathID*

17. The DUT returns env:Sender/ter:InvalidArgVal/ter:ReferenceExists SOAP 1.2 fault.

18. ONVIF Client invokes **RemoveServerCertificateAssignment** .

    - CertificationPathID =: *certPathID*

19. The DUT responds with a **RemoveServerCertificateAssignmentResponse** message.

20. ONVIF Client waits for time *operationDelay*.

21. ONVIF Client invokes **DeleteKey** with parameters

    - KeyID =: *keyID1*

22. The DUT returns env:Sender/ter:InvalidArgVal/ter:ReferenceExists SOAP 1.2 fault.

23. ONVIF Client invokes **DeleteKey** with parameters

    - KeyID =: *keyID2*

24. The DUT returns env:Sender/ter:InvalidArgVal/ter:ReferenceExists SOAP 1.2 fault.

25. ONVIF Client invokes **DeleteCertificate** with parameters

    - CertificateID =: *certID1*

26. The DUT returns env:Sender/ter:InvalidArgVal/ter:ReferenceExists SOAP 1.2 fault.

27. ONVIF Client invokes **DeleteCertificate** with parameters

    - CertificateID =: *certID2*

28. The DUT returns env:Sender/ter:InvalidArgVal/ter:ReferenceExists SOAP 1.2 fault.

29. ONVIF Client invokes **DeleteCertificationPath** with parameters

    - CertificationPathID =: *certPathID*

30. The DUT responds with a **DeleteCertificationPathResponse** message.

31. ONVIF Client invokes **DeleteKey** with parameters

    - KeyID =: *keyID1*

32. The DUT returns env:Sender/ter:InvalidArgVal/ter:ReferenceExists SOAP 1.2 fault.

33. ONVIF Client invokes **DeleteKey** with parameters

    - KeyID =: *keyID2*

34. The DUT returns env:Sender/ter:InvalidArgVal/ter:ReferenceExists SOAP 1.2 fault.

35. ONVIF Client deletes the self-signed certificate (in *certID1*) and related RSA key pair (in *keyID1*) by following the procedure mentioned in Annex A.9 to restore DUT configuration.

36. ONVIF Client deletes the self-signed certificate (in *certID2*) and related RSA key pair (in *keyID2*) by following the procedure mentioned in Annex A.9 to restore DUT configuration.

37. ONVIF Client restores HTTPS and Server Certificate Assignment if required by following the procedure mentioned in Annex A.46 with the following input and output parameters

    - in *initialHTTPSState* - initial HTTPS State

    - in *certPathID* - removed Server Certificate Assignment

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **DeleteCertificationPathResponse** message.
- DUT did not send **RemoveServerCertificateAssignmentResponse** message.
- DUT did not send **AddServerCertificateAssignmentResponse** message.
- The DUT did not send the env:Receiver/ter:Action/ter:NoMatchingPrivateKey SOAP 1.2 fault message(s).

5.5 Capabilities

5.5.1 Security Configuration Service Capabilities

Test Case ID: ADVANCED_SECURITY-5-1-1

Specification Coverage: Capabilities (ONVIF Security Configuration Service Specification)

Feature under test: GetServiceCapabilities (for Security Configuration Service)

WSDL Reference: security.wsdl

Test Purpose: To verify DUT Security Configuration Service Capabilities.

Pre-Requisite: Security Configuration Service is received from the DUT.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client invokes **GetServiceCapabilities**.
4. The DUT responds with a **GetServiceCapabilitiesResponse** message with parameters
   - Capabilities =: *cap*
5. If *cap*.KeystoreCapabilities.MaximumNumberOfCertificates > 0:

   5.1. If *cap*.KeystoreCapabilities.MaximumNumberOfKeys <= 0 or skipped, FAIL the test.
6. If *cap*.KeystoreCapabilities.MaximumNumberOfCertificationPaths > 0:

6.1. If *cap*.KeystoreCapabilities.MaximumNumberOfCertificates < 2 or skipped, FAIL the test.

7. If *cap*.KeystoreCapabilities.RSAKeyPairGeneration = true:

   7.1. If *cap*.KeystoreCapabilities.RSAKeyLenghts is empty or skipped, FAIL the test.

   7.2. If *cap*.KeystoreCapabilities.MaximumNumberOfKeys <= 0 or skipped, FAIL the test.

8. If *cap*.KeystoreCapabilities.PKCS8RSAKeyPairUpload = true:

   8.1. If *cap*.KeystoreCapabilities.MaximumNumberOfKeys < 1 or skipped, FAIL the test.

   8.2. If *cap*.KeystoreCapabilities.RSAKeyLenghts is empty or skipped, FAIL the test.

   8.3. If *cap*.KeystoreCapabilities.PasswordBasedEncryptionAlgorithms is empty or skipped, FAIL the test.

   8.4. If *cap*.KeystoreCapabilities.PasswordBasedEncryptionAlgorithms does not contain "pbeWithSHAAnd3-KeyTripleDES-CBC" item, FAIL the test.

9. If *cap*.KeystoreCapabilities.PKCS12CertificateWithRSAPrivateKeyUpload = true:

   9.1. If *cap*.KeystoreCapabilities.MaximumNumberOfKeys < 2 or skipped, FAIL the test.

   9.2. If *cap*.KeystoreCapabilities.MaximumNumberOfCertificates < 2 or skipped, FAIL the test.

   9.3. If *cap*.KeystoreCapabilities.MaximumNumberOfCertificationPaths <= 0 or skipped, FAIL the test.

   9.4. If *cap*.KeystoreCapabilities.SignatureAlgorithms list is empty, FAIL the test.

   9.5. If *cap*.KeystoreCapabilities.RSAKeyLenghts is empty or skipped, FAIL the test.

   9.6. If *cap*.KeystoreCapabilities.PasswordBasedEncryptionAlgorithms is empty or skipped, FAIL the test.

   9.7. If *cap*.KeystoreCapabilities.PasswordBasedEncryptionAlgorithms does not contain "pbeWithSHAAnd3-KeyTripleDES-CBC" item, FAIL the test.

   9.8. If *cap*.KeystoreCapabilities.PasswordBasedMACAlgorithms is empty or skipped, FAIL the test.

   9.9. If *cap*.KeystoreCapabilities.PasswordBasedMACAlgorithms does not contain "hmacWithSHA256" item, FAIL the test.

9.10. If *cap*.KeystoreCapabilities.X509Versions is empty or skipped, FAIL the test.

9.11. If *cap*.KeystoreCapabilities.X509Versions does not contain "3" item, FAIL the test.

9.12. If *cap*.KeystoreCapabilities.SignatureAlgorithms list does not contain item with algorithm = "1.2.840.113549.1.1.5" (OID of SHA-1 with RSA Encryption algorithm), FAIL the test.

9.13. If *cap*.KeystoreCapabilities.SignatureAlgorithms list does not contain item with algorithm = "1.2.840.113549.1.1.11" (OID of SHA-256 with RSA Encryption algorithm), FAIL the test.

10. If *cap*.KeystoreCapabilities.PKCS10ExternalCertificationWithRSA = true:

10.1. If (*cap*.KeystoreCapabilities.RSAKeyPairGeneration = false or skipped) and (*cap*.KeystoreCapabilities.PKCS8RSAKeyPairUpload = false or skipped) and (*cap*.KeystoreCapabilities.PKCS12CertificateWithRSAPrivateKeyUpload = false or skipped), FAIL the test.

10.2. If *cap*.KeystoreCapabilities.SignatureAlgorithms list is empty, FAIL the test.

10.3. If *cap*.KeystoreCapabilities.MaximumNumberOfKeys < 2 or skipped, FAIL the test.

10.4. If *cap*.KeystoreCapabilities.MaximumNumberOfCertificates < 2 or skipped, FAIL the test.

10.5. If *cap*.KeystoreCapabilities.MaximumNumberOfCertificationPaths <= 0 or skipped, FAIL the test.

10.6. If *cap*.KeystoreCapabilities.SignatureAlgorithms list does not contain item with algorithm = "1.2.840.113549.1.1.5" (OID of SHA-1 with RSA Encryption algorithm), FAIL the test.

10.7. If *cap*.KeystoreCapabilities.SignatureAlgorithms list does not contain item with algorithm = "1.2.840.113549.1.1.11" (OID of SHA-256 with RSA Encryption algorithm), FAIL the test.

11. If *cap*.KeystoreCapabilities.SelfSignedCertificateCreationWithRSA = true:

11.1. If (*cap*.KeystoreCapabilities.RSAKeyPairGeneration = false or skipped) and (*cap*.KeystoreCapabilities.PKCS8RSAKeyPairUpload = false or skipped) and (*cap*.KeystoreCapabilities.PKCS12CertificateWithRSAPrivateKeyUpload = false or skipped), FAIL the test.

11.2. If *cap*.KeystoreCapabilities.MaximumNumberOfCertificates <= 0 or skipped, FAIL the test.

11.3. If *cap*.KeystoreCapabilities.SignatureAlgorithms list is empty, FAIL the test.

11.4. If *cap*.KeystoreCapabilities.SignatureAlgorithms list does not contain item with algorithm = "1.2.840.113549.1.1.5" (OID of SHA-1 with RSA Encryption algorithm), FAIL the test.

11.5. If *cap*.KeystoreCapabilities.SignatureAlgorithms list does not contain item with algorithm = "1.2.840.113549.1.1.11" (OID of SHA-256 with RSA Encryption algorithm), FAIL the test.

12. If *cap*.KeystoreCapabilities.MaximumNumberOfCertificationPathValidationPolicies > 0:

12.1. If (*cap*.KeystoreCapabilities.SelfSignedCertificateCreationWithRSA = false or skipped) and (*cap*.KeystoreCapabilities.PKCS10ExternalCertificationWithRSA = false or skipped) and (*cap*.KeystoreCapabilities.PKCS12CertificateWithRSAPrivateKeyUpload = false or skipped), FAIL the test.

13. If *cap*.TLSServerCapabilities.TLSServerSupported is not empty:

13.1. If *cap*.TLSServerCapabilities.TLSServerSupported does not contain at least one value, FAIL the test.

13.2. If *cap*.KeystoreCapabilities.MaximumNumberOfCertificationPaths < 2 or skipped, FAIL the test.

13.3. If *cap*.TLSServerCapabilities.MaximumNumberOfTLSCertificationPaths <= 0 or skipped, FAIL the test.

13.4. If (*cap*.KeystoreCapabilities.PKCS10ExternalCertificationWithRSA = false or skipped) and (*cap*.KeystoreCapabilities.SelfSignedCertificateCreationWithRSA = false or skipped), FAIL the test.

14. If *cap*.TLSServerCapabilities.TLSClientAuthSupported = true:

14.1. If *cap*.TLSServerCapabilities.TLSServerSupported is empty, FAIL the test.

14.2. If *cap*.KeystoreCapabilities.MaximumNumberOfCertificationPathValidationPolicies < 2 or skipped, FAIL the test.

14.3. If *cap*.TLSServerCapabilities.MaximumNumberOfTLSCertificationPathValidationPolicies <= 0 or skipped, FAIL the test.

15. If *cap*.TLSServerCapabilities.MaximumNumberOfTLSCertificationPathValidationPolicies > 0:

    15.1. If *cap*.KeystoreCapabilities.MaximumNumberOfCertificationPathValidationPolicies <= 0 or skipped, FAIL the test.

16. If *cap*.TLSServerCapabilities.TLSServerSupported is not empty and *cap*.KeystoreCapabilities.PKCS10ExternalCertificationWithRSA = true:

    16.1. If *cap*.KeystoreCapabilities.MaximumNumberOfCertificates < 3 or skipped, FAIL the test.

17. If *cap*.TLSServerCapabilities.MaximumNumberOfTLSCertificationPaths > 0:

    17.1. If *cap*.KeystoreCapabilities.MaximumNumberOfCertificationPaths <= 0 or skipped, FAIL the test.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetServiceCapabilitiesResponse** message.

5.5.2 Get Services and Get Security Configuration Service Capabilities Consistency

Test Case ID: ADVANCED_SECURITY-5-1-2

Specification Coverage: Capability exchange (ONVIF Core Specification), Capabilities (ONVIF Security Configuration Service Specification)

Feature under test: GetServices, GetServiceCapabilities (for Security Configuration Service)

WSDL Reference: devicemgmt.wsdl, security.wsdl

Test Purpose: To verify Get Services and Security Configuration Service Capabilities consistency.

Pre-Requisite: None.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client invokes **GetServices**.
   - IncludeCapability =: true
4. The DUT responds with a **GetServiceCapabilitiesResponse** message with parameters
   - Services list =: *servicesList*
5. ONVIF Client selects Service with Service.Namespace = "http://www.onvif.org/ver10/advancedsecurity/wsdl":
   - Services list [Namespace = "http://www.onvif.org/ver10/advancedsecurity/wsdl"] =: *securityConfigurationService*
6. ONVIF Client invokes **GetServiceCapabilities**.
7. The DUT responds with a **GetServiceCapabilitiesResponse** message with parameters
   - Capabilities =: *cap*
8. If cap differs from *securityConfigurationService*.Capabilities.Capabilities, FAIL the test.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetServiceCapabilitiesResponse** message.

Note: The following fields are compared at step 8:

- KeystoreCapabilities:
  - SignatureAlgorithms

        - algorithm
        - parameters
    - MaximumNumberOfKeys
    - MaximumNumberOfCertificates
    - MaximumNumberOfCertificationPaths
    - RSAKeyPairGeneration
    - RSAKeyLengths
    - PKCS10ExternalCertificationWithRSA
    - SelfSignedCertificateCreationWithRSA
    - X509Versions
    - MaximumNumberOfPassphrases
    - PKCS8RSAKeyPairUpload
    - PKCS12CertificateWithRSAPrivateKeyUpload
    - PasswordBasedEncryptionAlgorithms
    - PasswordBasedMACAlgorithms
    - MaximumNumberOfCRLs
    - MaximumNumberOfCertificationPathValidationPolicies
    - EnforceTLSWebClientAuthExtKeyUsage
- TLSServerCapabilities
    - TLSServerSupported
    - MaximumNumberOfTLSCertificationPaths
    - TLSClientAuthSupported
    - MaximumNumberOfTLSCertificationPathValidationPolicies

5.6 Off-Device Key Generation Operations

5.6.1 Passphrase Management

5.6.1.1 Upload Passphrase

Test Case ID: ADVANCED_SECURITY-6-1-1

Specification Coverage: Passphrase Management (ONVIF Security Configuration Service Specification)

Feature under test: UploadPassphrase (for Security Configuration Service)

WSDL Reference: security.wsdl

Test Purpose: To verify whether passphrases can be uploaded correctly.

Pre-Requisite: Security Configuration Service is received from the DUT. Passphrase handling is supported by the DUT as indicated by the MaximumNumberOfPassphrases > 0 capability. The DUT shall have enough free storage capacity for one additional passphrase.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client generates an encryption passphrase *passphrase1* (see Annex A.24).
4. ONVIF Client invokes **UploadPassphrase** with parameters
   - Passphrase =: *passphrase1*
   - KeyAlias := "ONVIF_Passphrase_Test"
5. The DUT responds with a **UploadPassphraseResponse** message with parameters
   - PassphraseID =: *passphraseID*
6. ONVIF Client invokes **GetAllPassphrases**.
7. The DUT responds with a **GetAllPassphrasesResponse** message with parameters
   - PassphraseAttribute list =: *passphraseAttributeList*

8. If *passphraseAttributeList* does not contain passphrase with PassphraseID equal to *passphraseID*, FAIL the test, and go to the step 10.

9. If passphrase with PassphraseID equal to *passphraseID* from *passphraseAttributeList* has Alias skipped or other than "ONVIF_Passphrase_Test", FAIL the test, and go to the step 10.

10. ONVIF Client deletes the passphrase (in *passphraseID*) by following the procedure mentioned in Annex A.23 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **UploadPassphraseResponse** message.
- DUT did not send **GetAllPassphrasesResponse** message.

5.6.1.2 Delete Passphrase

Test Case ID: ADVANCED_SECURITY-6-1-2

Specification Coverage: Passphrase Management (ONVIF Security Configuration Service Specification)

Feature under test: DeletePassphrase

WSDL Reference: security.wsdl

Test Purpose: To verify that a passphrase can be deleted correctly.

Pre-Requisite: Security Configuration Service is received from the DUT. Passphrase handling is supported by the DUT as indicated by the MaximumNumberOfPassphrases > 0 capability. The DUT shall have enough free storage capacity for one additional passphrase.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.

3. ONVIF Client generates an encryption passphrase *passphrase1* (see Annex A.24).

4. ONVIF Client invokes **UploadPassphrase** with parameters
   - Passphrase =: *passphrase1*
   - KeyAlias := "ONVIF_Passphrase_Test"
5. The DUT responds with a **UploadPassphraseResponse** message with parameters
   - PassphraseID =: *passphraseID*
6. ONVIF Client invokes **DeletePassphrase** with parameters
   - PassphraseID =: *passphraseID*
7. The DUT responds with a **DeletePassphraseResponse** message.
8. ONVIF Client invokes **GetAllPassphrases**.
9. The DUT responds with a **GetAllPassphrasesResponse** message with parameters
   - PassphraseAttribute list =: *passphraseAttributeList*
10. If *passphraseAttributeList* contains passphrase with PassphraseID equal to *passphraseID*, FAIL the test.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **UploadPassphraseResponse** message.
- DUT did not send **GetAllPassphrasesResponse** message.
- DUT did not send **DeletePassphraseResponse** message.

5.6.2 Key Management

5.6.2.1 Upload PKCS8 – no key pair exists

Test Case ID: ADVANCED_SECURITY-6-2-1

Specification Coverage: Key Management (ONVIF Security Configuration Service Specification)

Feature under test: UploadKeyPairInPKCS8

WSDL Reference: security.wsdl

Test Purpose: To verify that a PKCS#8 data structure with new public key and private key can be uploaded correctly.

Pre-Requisite: Security Configuration Service is received from the DUT. RSA key pair in a PKCS#8 data structure upload is supported by the DUT as indicated by the PKCS8RSAKeyPairUpload capability. The DUT shall have enough free storage capacity for one additional RSA key pair.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client generates a PKCS#8 data structure (out *keyPairInPKCS8*) with new RSA key pair (pubic key (out *publicKey*) and private key (out *privateKey*)) by following the procedure mentioned in Annex A.25.
4. ONVIF Client invokes **UploadKeyPairInPKCS8** with parameters
   - KeyPair := *keyPairInPKCS8*
   - Alias := "ONVIF_Test"
   - EncryptionPassphraseID skipped
5. The DUT responds with a **UploadKeyPairInPKCS8Response** message with parameters
   - KeyID =: *keyID*
6. ONVIF Client invokes **GetAllKeys**.
7. The DUT responds with a **GetAllKeysResponse** message with parameters
   - KeyAttribute list =: *keyList*
8. If *keyList* does not contain KeyAttribute.KeyID =: *keyID*, FAIL the test, and go to the step 11.
9. If KeyAttribute from *keyList* with KeyAttribute.KeyID =: *keyID* has KeyAttribute.hasPrivateKey element that is not equal to *true* or missed, FAIL the test, and go to the step 11.
10. If KeyAttribute from *keyList* with KeyAttribute.KeyID =: *keyID* has KeyAttribute.KeyStatus value other than "ok", FAIL the test, and go to the step 11.

11. ONVIF Client deletes the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **UploadKeyPairInPKCS8Response** message.
- DUT did not send **GetAllKeysResponse** message.

5.6.2.2 Upload Encrypted PKCS8

Test Case ID: ADVANCED_SECURITY-6-2-3

Specification Coverage: Key Management (ONVIF Security Configuration Service Specification)

Feature under test: UploadKeyPairInPKCS8

WSDL Reference: security.wsdl

Test Purpose: To verify that PKCS#8 data structure can be uploaded correctly if passphrase specified. To verify that a DecryptionFailed fault is produced when wrong decryption passphrase is used.

Pre-Requisite: Security Configuration Service is received from the DUT. RSA key pair in a PKCS#8 data structure upload is supported by the DUT as indicated by the PKCS8RSAKeyPairUpload capability. The DUT shall have enough free storage capacity for one additional RSA key pair.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client generates an encryption passphrases *passphrase1* and *passphrase2* (see Annex A.24)
4. ONVIF Client generates a PKCS#8 data structure (out *keyPairInPKCS8*) with new RSA key pair (pubic key (out *publicKey*) and private key (out *privateKey*)) with encryption passphrase (in *passphrase1*) by following the procedure mentioned in Annex A.28.

5. ONVIF Client invokes **UploadKeyPairInPKCS8** with parameters

   - KeyPair := *keyPairInPKCS8*
   - Alias := "ONVIF_Test"
   - EncryptionPassphrase := *passphrase2*

6. The DUT returns **env:Sender/ter:InvalidArgVal/ter:DecryptionFailed** SOAP 1.2 fault.

7. ONVIF Client invokes **UploadKeyPairInPKCS8** with parameters

   - KeyPair := *keyPairInPKCS8*
   - Alias := "ONVIF_Test"
   - EncryptionPassphrase := *passphrase1*

8. The DUT responds with a **UploadKeyPairInPKCS8Response** message with parameters

   - KeyID

9. ONVIF Client restores DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- The DUT did not send the **env:Sender/ter:InvalidArgVal/ter:DecryptionFailed** SOAP 1.2 fault message at step 6.
- DUT did not send **UploadKeyPairInPKCS8Response** message at step 8.

5.6.2.3 Upload Encrypted PKCS8 – Using Passphrase Management

Test Case ID: ADVANCED_SECURITY-6-2-4

Specification Coverage: Key Management (ONVIF Security Configuration Service Specification)

Feature under test: UploadKeyPairInPKCS8, UploadPassphrase

WSDL Reference: security.wsdl

Test Purpose: To verify that PKCS#8 data structure can be uploaded correctly if passphrase specified. To verify that a DecryptionFailed fault is produced when wrong decryption passphrase is used. To verify work of UploadKeyPairInPKCS8 with passphrase management.

Pre-Requisite: Security Configuration Service is received from the DUT. RSA key pair in a PKCS#8 data structure upload is supported by the DUT as indicated by the PKCS8RSAKeyPairUpload capability. Passphrase Management is supported by the DUT as indicated by the MaximumNumberOfPassphrases capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for two additional passphrases.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client generates an encryption passphrases *passphrase1* and *passphrase2* (see Annex A.24)
4. ONVIF Client generates a PKCS#8 data structure (out *keyPairInPKCS8*) with new RSA key pair (pubic key (out *publicKey*) and private key (out *privateKey*)) with encryption passphrase (in *passphrase1*) by following the procedure mentioned in Annex A.28.
5. ONVIF Client invokes **UploadPassphrase** with parameters
   - Passphrase := *passphrase1*
   - KeyAlias := "ONVIF_Passphrase_Test1"
6. The DUT responds with a **UploadPassphraseResponse** message with parameters
   - PassphraseID =: *passphraseID1*
7. ONVIF Client invokes **UploadPassphrase** with parameters
   - Passphrase := *passphrase2*
   - KeyAlias := "ONVIF_Passphrase_Test2"
8. The DUT responds with a **UploadPassphraseResponse** message with parameters
   - PassphraseID =: *passphraseID2*
9. ONVIF Client invokes **UploadKeyPairInPKCS8** with parameters

- KeyPair := *keyPairInPKCS8*
- Alias := "ONVIF_Test"
- EncryptionPassphraseID := *passphraseID2*

10. The DUT returns **env:Sender/ter:InvalidArgVal/ter:DecryptionFailed** SOAP 1.2 fault.

11. ONVIF Client invokes **UploadKeyPairInPKCS8** with parameters

    - KeyPair := *keyPairInPKCS8*
    - Alias := "ONVIF_Test"
    - EncryptionPassphraseID := *passphraseID1*

12. The DUT responds with a **UploadKeyPairInPKCS8Response** message with parameters

    - KeyID

13. ONVIF Client restores DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **UploadPassphraseResponse** message.
- The DUT did not send the **env:Sender/ter:InvalidArgVal/ter:DecryptionFailed** SOAP 1.2 fault message at step 10.
- DUT did not send **UploadKeyPairInPKCS8Response** message at step 12.

5.6.3 Certificate Management

5.6.3.1 Upload PKCS12 – no key pair exists

Test Case ID: ADVANCED_SECURITY-6-3-1

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: UploadCertificateWithPrivateKeyInPKCS12

WSDL Reference: security.wsdl

Test Purpose: To verify that a PKCS#12 data structure with new public key and private key can be uploaded correctly.

Pre-Requisite: Security Configuration Service is received from the DUT. Certificate along with an RSA private key in a PKCS#12 data structure upload is supported by the DUT as indicated by the PKCS12CertificateWithRSAPrivateKeyUpload capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client generates an encryption passphrase *passphrase1* (see Annex A.24).
4. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding public key (out *publicKey*) in the certificate along with the corresponding private key (out *privateKey*) in the form of a PKCS#12 file (out *PKCS12data*) with given passphrase (in *passphrase1*) by following the procedure described in Annex A.30.
5. ONVIF Client invokes **UploadCertificateWithPrivateKeyInPKCS12** with parameters
   - CertWithPrivateKey := *PKCS12data*
   - CertificationPathAlias := "ONVIF_Certification_Path_Test"
   - KeyAlias := "ONVIF_Key_Test"
   - IgnoreAdditionalCertificates := true
   - IntegrityPassphraseID skipped
   - EncryptionPassphraseID skipped
   - Passphrase := *passphrase1*
6. The DUT responds with a **UploadCertificateWithPrivateKeyInPKCS12Response** message with parameters
   - CertificationPathID =: *certPathID*

- KeyID =: *keyID*

7. ONVIF Client invokes **GetAllKeys**.
8. The DUT responds with a **GetAllKeysResponse** message with parameters
   - KeyAttribute list =: *keyList*
9. If *keyList* does not contain key with KeyID equal to *keyID*, FAIL the test, and go to the step 19.
10. If key with KeyID equal to *keyID* from *keyList* has hasPrivateKey equal to false or has skipped hasPrivateKey, FAIL the test, and go to the step 19.
11. If key with KeyID equal to *keyID* from *keyList* has Alias skipped or other than "ONVIF_Key_Test", FAIL the test, and go to the step 19.
12. If key with KeyID equal to *keyID* from *keyList* has KeyStatus other than "ok", FAIL the test, and go to the step 19.
13. ONVIF Client invokes **GetAllCertificationPaths**.
14. The DUT responds with a **GetAllCertificationPathsResponse** message with parameters
    - CertificationPathID list =: *certPathList*
15. If *certPathList* does not contain certification path with CertificationPathID equal to *certPathID*, FAIL the test, and go to the step 19.
16. ONVIF Client invokes **GetCertificationPath** message with parameters
    - CertificationPathID =: *certPathID*
17. The DUT responds with a **GetCertificationPathResponse** message with parameters
    - CertificationPath.CertificateID[0] =: *certID*
    - CertificationPath.Alias =: *CertPathAlias*
18. If *CertPathAlias* Alias skipped or other than "ONVIF_CertificationPath_Test", FAIL the test, and go to the step 20.
19. If received CertificationPath contains more than one CertificateID item, FAIL the test, and go to the step 20.
20. ONVIF Client deletes the certification path (in *certPathID*) and RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.33 to restore DUT configuration and finish the test.

21. ONVIF Client deletes the certification path (in *certPathID*) and related CA certificate (in *certID*) and RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.5 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **UploadCertificateWithPrivateKeyInPKCS12Response** message.
- DUT did not send **GetAllKeysResponse** message.
- DUT did not send **GetAllCertificationPathsResponse** message.
- DUT did not send **GetCertificationPathResponse** message.

5.6.3.2 Upload PKCS12 - verify key and certificate

Test Case ID: ADVANCED_SECURITY-6-3-4

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: UploadCertificateWithPrivateKeyInPKCS12, GetKeyStatus, GetCertificate, GetAllCertificates

WSDL Reference: security.wsdl

Test Purpose: Verify that the DUT correctly integrates keys and certificates, which have been uploaded in a PKCS#12 data structure, into the keystore.

Pre-Requisite: Security Configuration Service is received from the DUT. Certificate along with an RSA private key in a PKCS#12 data structure upload is supported by the DUT as indicated by the PKCS12CertificateWithRSAPrivateKeyUpload capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. The DUT shall have enough free storage capacity for one additional certification path.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.
3. ONVIF Client generates an encryption passphrase *passphrase1* (see Annex A.24).
4. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding public key (out *publicKey*) in the certificate along with the corresponding private key (out *privateKey*) in the form of a PKCS#12 file (out *PKCS12data*) with given passphrase (in *passphrase1*) by following the procedure described in Annex A.30.
5. ONVIF Client invokes **UploadCertificateWithPrivateKeyInPKCS12** with parameters
   - CertWithPrivateKey := *PKCS12data*
   - CertificationPathAlias := "ONVIF_Certification_Path_Test"
   - KeyAlias := "ONVIF_Key_Test"
   - IgnoreAdditionalCertificates skipped
   - IntegrityPassphraseID skipped
   - EncryptionPassphraseID skipped
   - Passphrase := *passphrase1*
6. The DUT responds with a **UploadCertificateWithPrivateKeyInPKCS12Response** message with parameters
   - CertificationPathID =: *certPathID*
   - KeyID =: *keyID*
7. ONVIF Client invokes **GetKeyStatus** with parameters
   - KeyID := *keyID*
8. The DUT responds with **GetKeyStatusResponse** message with parameters
   - KeyStatus =: *keyStatus*
9. If *keyStatus* is not equal to "ok", FAIL the test, and go to the step 23.
10. ONVIF Client invokes **GetCertificationPath** message with parameters
    - CertificationPathID =: *certPathID*
11. The DUT responds with a **GetCertificationPathResponse** message with parameters
    - CertificationPath.CertificateID list =: *certIDList*

- CertificationPath.Alias

12. If *certIDList* contains more item than one, FAIL the test and go to the step 23.

13. ONVIF Client invokes **GetAllCertificates**.

14. The DUT responds with a **GetAllCertificatesResponse** message with parameters

    - CertificateID list =: *certificateList*

15. If *certificateList* does not contain certificate with Certificate.CertificateID equal to *certIDList*[0], FAIL the test and go to the step 23.

16. Set:

    - *certificateList*.Certificate[CertificateID = *certIDList*[0] =: *X509Cert*

17. If *X509Cert*.KeyID is not equal to *keyID*, FAIL the test and go to the step 23.

18. If *X509Cert*.CertificateContent is not equal to *CAcert*, FAIL the test and go to the step 23.

19. ONVIF Client invokes **GetCertificate** message with parameters

    - CertificateID := *certIDList*[0]

20. The DUT responds with a **GetCertificateResponse** message with parameters

    - Certificate =: *X509Cert*

21. If *X509Cert*.CertificateID is not equal to *certIDList*[0], FAIL the test and go to the step 23.

22. If *X509Cert*.KeyID is not equal to *keyID*, FAIL the test and go to the step 23.

23. If *X509Cert*.CertificateContent is not equal to *CAcert*, FAIL the test and go to the step 23.

24. ONVIF Client deletes the certification path (in *certPathID*) and RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.33 to restore DUT configuration and skip other steps.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **UploadCertificateWithPrivateKeyInPKCS12Response** message.

- DUT did not send **GetKeyStatusResponse** message.
- DUT did not send **GetCertificationPathResponse** message.
- DUT did not send **GetAllCertificatesResponse** message.
- DUT did not send **GetCertificateResponse** message.

5.6.3.3 Upload PKCS12 – Decryption Failed

Test Case ID: ADVANCED_SECURITY-6-3-5

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: UploadCertificateWithPrivateKeyInPKCS12

WSDL Reference: security.wsdl

Test Purpose: To verify that a DecryptionFailed fault is produced when wrong decryption passphrase is used.

Pre-Requisite: Security Configuration Service is received from the DUT. Certificate along with an RSA private key in a PKCS#12 data structure upload is supported by the DUT as indicated by the PKCS12CertificateWithRSAPrivateKeyUpload capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client generates an encryption passphrases *passphrase1* and *passphrase2* (see Annex A.24).
4. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding public key (out *publicKey*) in the certificate along with the corresponding private key (out *privateKey*) in the form of a PKCS#12 file (out *PKCS12data*) encrypted with passphrase (in *passphrase1*) by following the procedure described in Annex A.30.
5. ONVIF Client invokes **UploadCertificateWithPrivateKeyInPKCS12** message with parameters

- CertWithPrivateKey := *PKCS12data*
- CertificationPathAlias := "ONVIF_CertificationPath_Test"
- KeyAlias := "ONVIF_Key_Test"
- IgnoreAdditionalCertificates := false
- IntegrityPassphraseID skipped
- EncryptionPassphraseID skipped
- Passphrase := *passphrase2*

6. The DUT returns **env:Sender\ter:InvalidArgVal\ter:DecryptionFailed** SOAP 1.2 fault.
7. ONVIF Client restores DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **UploadPassphrase** message.
- DUT did not send **env:Sender\ter:InvalidArgVal\ter:DecryptionFailed** SOAP 1.2 fault at step 6.

5.6.3.4 Upload PKCS12 – Using Passphrase Storage

Test Case ID: ADVANCED_SECURITY-6-3-6

Specification Coverage: Certificate Management (ONVIF Security Configuration Service Specification)

Feature under test: UploadCertificateWithPrivateKeyInPKCS12, UploadPassphrase

WSDL Reference: security.wsdl

Test Purpose: To verify that a PKCS#12 data structure can be uploaded correctly if passphrase specified. To verify that a DecryptionFailed fault is produced when wrong decryption passphrase is used. To verify work of UploadCertificateWithPrivateKeyInPKCS12 with passphrase management.

Pre-Requisite: Security Configuration Service is received from the DUT. Certificate along with an RSA private key in a PKCS#12 data structure upload is supported by the DUT as indicated by the

PKCS12CertificateWithRSAPrivateKeyUpload capability. Passphrase Management is supported by the DUT as indicated by the MaximumNumberOfPassphrases capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. The DUT shall have enough free storage capacity for two additional passphrases.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client generates an encryption passphrases *passphrase1* and *passphrase2* (see Annex A.24).
4. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding public key (out *publicKey*) in the certificate along with the corresponding private key (out *privateKey*) in the form of a PKCS#12 file (out *PKCS12data*) encrypted with passphrase (in *passphrase1*) by following the procedure described in Annex A.30.
5. ONVIF Client invokes **UploadPassphrase** with parameters
    - Passphrase =: *passphrase1*
    - KeyAlias := "ONVIF_Passphrase_Test1"
6. The DUT responds with a **UploadPassphraseResponse** message with parameters
    - PassphraseID =: *passphraseID1*
7. ONVIF Client invokes **UploadPassphrase** with parameters
    - Passphrase =: *passphrase2*
    - KeyAlias := "ONVIF_Passphrase_Test2"
8. The DUT responds with a **UploadPassphraseResponse** message with parameters
    - PassphraseID =: *passphraseID2*
9. ONVIF Client invokes **UploadCertificateWithPrivateKeyInPKCS12** message with parameters
    - CertWithPrivateKey := *PKCS12data*
    - CertificationPathAlias := "ONVIF_CertificationPath_Test"

- KeyAlias := "ONVIF_Key_Test"
- IgnoreAdditionalCertificates := false
- IntegrityPassphraseID skipped
- EncryptionPassphraseID =: *passphraseID2*

10. The DUT returns **env:Sender\ter:InvalidArgVal\ter:DecryptionFailed** SOAP 1.2 fault.

11. ONVIF Client invokes **UploadCertificateWithPrivateKeyInPKCS12** message with parameters

    - CertWithPrivateKey := *PKCS12data*
    - CertificationPathAlias := "ONVIF_CertificationPath_Test"
    - KeyAlias := "ONVIF_Key_Test"
    - IgnoreAdditionalCertificates := false
    - IntegrityPassphraseID skipped
    - EncryptionPassphraseID =: *passphraseID1*

12. The DUT responds with a **UploadCertificateWithPrivateKeyInPKCS12Response** message with parameters

    - CertificationPathID
    - KeyID

13. ONVIF Client restores DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **UploadPassphrase** message.
- DUT did not send **UploadCertificateWithPrivateKeyInPKCS12** message at step 12.
- DUT did not send **env:Sender\ter:InvalidArgVal\ter:DecryptionFailed** SOAP 1.2 fault at step 10.

5.7 Certificate-based Client Authentication

5.7.1 Upload CRL

Test Case ID: ADVANCED_SECURITY-8-1-1

Specification Coverage: CRL Management (ONVIF Security Configuration Service Specification)

Feature under test: UploadCRL, GetAllCRLs

WSDL Reference: security.wsdl

Test Purpose: Verify that CRLs can be uploaded to the DUT.

Pre-Requisite: Security Configuration Service is received from the DUT. CRLs supported by the DUT as indicated by the MaximumNumberOfCRLs capability. The DUT shall have enough free storage capacity for one additional CRL.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client creates a CRL (out *crl*) by following the procedure mentioned in Annex A.35.
4. ONVIF Client invokes **UploadCRL** with parameter
    - Crl =: *crl*
    - Alias := "ONVIF_CRL_Test"
    - anyParameters skipped
5. The DUT responds with a **UploadCRLResponse** message with parameters
    - CrlID =: *crlID*
6. ONVIF Client invokes **GetAllCRLs**
7. The DUT responds with a **GetAllCRLsResponse** message with parameters
    - CrlID list =: *crlList*
8. If *crlList* does not contain *crlID*, FAIL the test, and go to the step 11.

9. If *crlList*[CRLID = *crlID*].Alias is not equal to "ONVIF_CRL_Test", FAIL the test, and go to the step 11.

10. If *crlList*[CRLID = *crlID*].CRLContent is not equal to *crl*, FAIL the test, and go to the step 11.

11. ONVIF Client deletes the CRL (in *crlID*) by following the procedure mentioned in Annex A.36 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **UploadCRLResponse** message.
- DUT did not send **GetAllCRLsResponse** message.

5.7.2 Delete CRL

Test Case ID: ADVANCED_SECURITY-8-1-2

Specification Coverage: CRL Management (ONVIF Security Configuration Service Specification)

Feature under test: DeleteCRL, GetAllCRLs

WSDL Reference: security.wsdl

Test Purpose: Verify that CRLs can be deleted from the DUT.

Pre-Requisite: Security Configuration Service is received from the DUT. CRLs supported by the DUT as indicated by the MaximumNumberOfCRLs capability. The DUT shall have enough free storage capacity for one additional CRL.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.

2. Start the DUT.

3. ONVIF Client creates a CRL (out *crl*) by following the procedure mentioned in Annex A.35.

4. ONVIF Client uploads a CRL (in *crl*) with alias (in "ONVIF_CRL_Test") identifier (out *crlID*) by following the procedure described in Annex A.37.

5. ONVIF Client invokes **DeleteCRL** with parameters
   - CrlID =: *crlID*
6. The DUT responds with a **DeleteCRLResponse** message.
7. ONVIF Client invokes **GetAllCRLs**
8. The DUT responds with a **GetAllCRLsResponse** message with parameters
   - CrlID list =: *crlList*
9. If *crlList* contains *crlID*, FAIL the test

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **DeleteCRLResponse** message.
- DUT did not send **GetAllCRLsResponse** message.

5.7.3 Get CRL

Test Case ID: ADVANCED_SECURITY-8-1-3

Specification Coverage: CRL Management (ONVIF Security Configuration Service Specification)

Feature under test: GetCRL

WSDL Reference: security.wsdl

Test Purpose: Verify that CRLs can be retrieved from the DUT.

Pre-Requisite: Security Configuration Service is received from the DUT. CRLs supported by the DUT as indicated by the MaximumNumberOfCRLs capability. The DUT shall have enough free storage capacity for one additional CRL.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.

3. ONVIF Client creates a CRL (out *crl*) by following the procedure mentioned in Annex A.35.
4. ONVIF Client uploads a CRL (in *crl*) with alias (in "ONVIF_CRL_Test") identifier (out *crlID*) by following the procedure described in Annex A.37.
5. ONVIF Client invokes **GetCRL** with parameters
   - CrlID =: *crlID*
6. The DUT responds with a **GetCRLResponse** message with parameters
   - Crl =: *crl*
7. If *crl*.CRLID is not equal to *crlID*, FAIL the test, and go to the step 10.
8. If *crl*.Alias is not equal to "ONVIF_CRL_Test", FAIL the test, and go to the step 10.
9. If *crl*.CRLContent is not equal to *crl*, FAIL the test, and go to the step 10.
10. ONVIF Client deletes the CRL (in *crlID*) by following the procedure mentioned in Annex A.36 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetCRLResponse** message.

5.7.4 Create certification path validation policy

Test Case ID: ADVANCED_SECURITY-8-1-4

Specification Coverage: Certification Path Validation Policy Management (ONVIF Security Configuration Service Specification)

Feature under test: CreateCertPathValidationPolicy, GetAllCertPathValidationPolicies

WSDL Reference: security.wsdl

Test Purpose: Verify that a certification path validation policy can be created on the DUT.

Pre-Requisite: Security Configuration Service is received from the DUT. Certification path validation policy supported by the DUT as indicated by the MaximumNumberOfCertificationPathValidationPolicies capability. The DUT shall have enough free storage capacity for one additional certification path validation policy. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client prepares certificate (out *certID*), related RSA key pair (out *keyID*) and certification path if any (out *certificationPathID*) by following the procedure mentioned in Annex A.39.
4. ONVIF Client invokes **CreateCertPathValidationPolicy** with parameter
    - Alias := "ONVIF_CertPathValidationPolicy_Test"
    - Parameters.RequireTLSWWWClientAuthExtendedKeyUsage skipped
    - Parameters.UseDeltaCRLs = true
    - Parameters.anyParameters skipped
    - TrustAnchor[0].CertificateID := *certID*
    - anyParameters skipped
5. The DUT responds with **CreateCertPathValidationPolicyResponse** message with parameters
    - CertPathValidationPolicyID =: *certPathValidationPolicyID*
6. ONVIF Client invokes **GetAllCertPathValidationPolicies**.
7. The DUT responds with a **GetAllCertPathValidationPoliciesResponse** message with parameters
    - CertPathValidationPolicy list =: *certPathValidationPolicyList*
8. If *certPathValidationPolicyList* does not contain *certPathValidationPolicyID*, FAIL the test, and go to the step 13.
9. If *certPathValidationPolicyList*[CertPathValidationPolicyID = *certPathValidationPolicyID*].Alias is not equal to "ONVIF_CertPathValidationPolicy_Test", FAIL the test, and go to the step 13.

10. If *certPathValidationPolicyList*[CertPathValidationPolicyID = *certPathValidationPolicyID*].Parameters.RequireTLSWWWClientAuthExtendedKeyUsage is equal to true, FAIL the test, and go to the step 13.

11. If *certPathValidationPolicyList*[CertPathValidationPolicyID = *certPathValidationPolicyID*].Parameters.UseDeltaCRLs is not equal to true, FAIL the test, and go to the step 13.

12. If *certPathValidationPolicyList*[CertPathValidationPolicyID = *certPathValidationPolicyID*]. TrustAnchor does not contain one and only one element with CertificateID equal to *certID*, FAIL the test, and go to the step 13.

13. ONVIF Client deletes the certification path validation policy (in *certPathValidationPolicyID*) by following the procedure mentioned in Annex A.38 to restore DUT configuration.

14. If *certificationPathID* is null:

    14.1. ONVIF Client deletes the self-signed certificate (in *certID*) and related the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.9.

    14.2. Skip other steps.

15. If *certificationPathID* is not null:

    15.1. ONVIF Client deletes the certification path (in *certificationPathID*) and RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.33 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **CreateCertPathValidationPolicyResponse** message.
- DUT did not send **GetAllCertPathValidationPoliciesResponse** message.

5.7.5 Get certification path validation policy

Test Case ID: ADVANCED_SECURITY-8-1-5

Specification Coverage: Certification Path Validation Policy Management (ONVIF Security Configuration Service Specification)

Feature under test: CreateCertPathValidationPolicy, GetCertPathValidationPolicy

WSDL Reference: security.wsdl

Test Purpose: Verify that certification path validation policies can be retrieved from the DUT.

Pre-Requisite: Security Configuration Service is received from the DUT. Certification path validation policy supported by the DUT as indicated by the MaximumNumberOfCertificationPathValidationPolicies capability. The DUT shall have enough free storage capacity for one additional certification path validation policy. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client creates certification path validation policy identifier (out *certPathValidationPolicyID*) with specified alias (in "Test CertPathValidationPolicy Alias"), related certificate (out *certID*), RSA key pair (out *keyID*) and certification path if any (out *certificationPathID*) by following the procedure mentioned in Annex A.40.
4. ONVIF Client invokes **GetCertPathValidationPolicy** with parameters
   - CertPathValidationPolicyID =: *certPathValidationPolicyID*
5. The DUT responds with a **GetCertPathValidationPolicyResponse** message with parameters
   - CertPathValidationPolicy =: *certPathValidationPolicy*
6. If *certPathValidationPolicy*.CertPathValidationPolicyID is not equal to *certPathValidationPolicyID*, FAIL the test, and go to the step 11.
7. If *certPathValidationPolicy*.Alias is not equal to "Test CertPathValidationPolicy Alias", FAIL the test, and go to the step 11.
8. If *certPathValidationPolicy*.Parameters.RequireTLSWWWClientAuthExtendedKeyUsage is equal to true, FAIL the test, and go to the step 11.
9. If *certPathValidationPolicy*.Parameters.UseDeltaCRLs is not equal to true, FAIL the test, and go to the step 11.

10. If *certPathValidationPolicy*.TrustAnchor does not contain one and only one element with CertificateID equal to *certID*, FAIL the test, and go to the step 11.

11. ONVIF Client deletes the certification path validation policy (in *certPathValidationPolicyID*) by following the procedure mentioned in Annex A.38 to restore DUT configuration.

12. If *certificationPathID* is null:

    12.1. ONVIF Client deletes the self-signed certificate (in *certID*) and related the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.9.

    12.2. Skip other steps.

13. If *certificationPathID* is not null:

    13.1. ONVIF Client deletes the certification path (in *certificationPathID*) and RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.33 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetCertPathValidationPolicyResponse** message.

5.7.6 Delete certification path validation policy

Test Case ID: ADVANCED_SECURITY-8-1-6

Specification Coverage: Certification Path Validation Policy Management (ONVIF Security Configuration Service Specification)

Feature under test: DeleteCertPathValidationPolicy, GetAllCertPathValidationPolicies

WSDL Reference: security.wsdl

Test Purpose: Verify that a certification path validation policy can be deleted from DUT.

Pre-Requisite: Security Configuration Service is received from the DUT. Certification path validation policy supported by the DUT as indicated by the MaximumNumberOfCertificationPathValidationPolicies capability. The DUT shall have enough free storage capacity for one additional certification path validation policy. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client creates certification path validation policy identifier (out *certPathValidationPolicyID*) with specified alias (in "Test CertPathValidationPolicy Alias"), related certificate (out *certID*), RSA key pair (out *keyID*) and certification path if any (out *certificationPathID*) by following the procedure mentioned in Annex A.40.
4. ONVIF Client invokes **DeleteCertPathValidationPolicy** with parameters
   - CertPathValidationPolicyID =: *certPathValidationPolicyID*
5. The DUT responds with a **DeleteCertPathValidationPolicyResponse** message.
6. ONVIF Client invokes **GetAllCertPathValidationPolicies**.
7. The DUT responds with a **GetAllCertPathValidationPoliciesResponse** message with parameters
   - CertPathValidationPolicy list =: *certPathValidationPolicyList*
8. If *certPathValidationPolicyList* contains *certPathValidationPolicyID*, FAIL the test, and go to the step 9.
9. If *certificationPathID* is null:

   9.1. ONVIF Client deletes the self-signed certificate (in *certID*) and related the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.9.

   9.2. Skip other steps.
10. If *certificationPathID* is not null:

    10.1. ONVIF Client deletes the certification path (in *certificationPathID*) and RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.33 to restore DUT configuration.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **DeleteCertPathValidationPolicyResponse** message.
- DUT did not send **GetAllCertPathValidationPoliciesResponse** .

5.8 TLS Versions

5.8.1 TLS Version Management

Test Case ID: ADVANCED_SECURITY-9-1-1

Specification Coverage: SetEnabledTLSVersions (ONVIF Security Configuration Service Specification), GetEnabledTLSVersions (ONVIF Security Configuration Service Specification)

Feature under test: SetEnabledTLSVersions, GetServiceCapabilities (Security Configuration), GetEnabledTLSVersions

WSDL Reference: security.wsdl

Test Purpose: Verify that TLS Versions settings could be changes by SetEnabledTLSVersions request and recieved by GetEnabledTLSVersions request. Verify that TLS Versions settings are consistant with capabilities.

Pre-Requisite: Security Configuration Service is received from the DUT. Enabling and disabling specific TLS versions supported by the DUT as indicated by the EnabledVersionsSupported capability.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client retrieves Security Configuration Service Capabilities by following the procedure mentioned in Annex A.10 with the following input and output parameters
   - out *cap* - Security Configuration Service Capabilities
4. ONVIF Client invokes **GetEnabledTLSVersions** request.
5. The DUT responds with **GetEnabledTLSVersionsResponse** message with parameters

- Versions list =: *initialVersionList*

6. If *initialVersionList* does not contains any items, FAIL the test, restore the DUT state, and skip other steps.
7. If *cap*.TLSServerCapabilities.TLSServerSupported does not contains all items from *initialVersionList* list, FAIL the test, restore the DUT state, and skip other steps.
8. ONVIF Client invokes **SetEnabledTLSVersions** request with parameters
   - Versions list := *cap*.TLSServerCapabilities.TLSServerSupported
9. The DUT responds with **SetEnabledTLSVersionsResponse** message.
10. ONVIF Client invokes **GetEnabledTLSVersions** request.
11. The DUT responds with **GetEnabledTLSVersionsResponse** message with parameters
    - Versions list =: *updatedVersionList1*
12. If *updatedVersionList1* is not equal to *cap*.TLSServerCapabilities.TLSServerSupported list (the order of the items shall be ignored during comparition), FAIL the test, restore the DUT state, and skip other steps.
13. ONVIF Client invokes **SetEnabledTLSVersions** request with parameters
    - Versions list := empty list
14. The DUT returns **env:Sender/ter:InvalidArgVal/ter:EmptyList** SOAP 1.2 fault.
15. ONVIF Client invokes **GetEnabledTLSVersions** request.
16. The DUT responds with **GetEnabledTLSVersionsResponse** message with parameters
    - Versions list =: *updatedVersionList2*
17. If *updatedVersionList2* is not equal to *cap*.TLSServerCapabilities.TLSServerSupported list (the order of the items shall be ignored during comparition), FAIL the test, restore the DUT state, and skip other steps.
18. If *cap*.TLSServerCapabilities.TLSServerSupported list contains more than one item:

    18.1. ONVIF Client invokes **SetEnabledTLSVersions** request with parameters
    - Versions list := first item from *cap*.TLSServerCapabilities.TLSServerSupported list

    18.2. The DUT responds with **SetEnabledTLSVersionsResponse** message.

18.3. ONVIF Client invokes **GetEnabledTLSVersions** request.

18.4. The DUT responds with **GetEnabledTLSVersionsResponse** message with parameters

- Versions list =: *updatedVersionList3*

18.5. If *updatedVersionList3* contains more than one item, FAIL the test, restore the DUT state, and skip other steps.

18.6. If *updatedVersionList3* does not contain first item from *cap*.TLSServerCapabilities.TLSServerSupported list, FAIL the test, restore the DUT state, and skip other steps.

18.7. ONVIF Client invokes **SetEnabledTLSVersions** request with parameters

- Versions list := last item from *cap*.TLSServerCapabilities.TLSServerSupported list

18.8. The DUT responds with **SetEnabledTLSVersionsResponse** message.

18.9. ONVIF Client invokes **GetEnabledTLSVersions** request.

18.10. The DUT responds with **GetEnabledTLSVersionsResponse** message with parameters

- Versions list =: *updatedVersionList4*

18.11. If *updatedVersionList4* contains more than one item, FAIL the test, restore the DUT state, and skip other steps.

18.12. If *updatedVersionList4* does not contain last item from *cap*.TLSServerCapabilities.TLSServerSupported list, FAIL the test, restore the DUT state, and skip other steps.

19. Restore the DUT state.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetEnabledTLSVersionsResponse** message at steps 9, 17.2, 17.8.
- DUT did not send **SetEnabledTLSVersionsResponse** message.

- DUT did not send the **env:Sender/ter:InvalidArgVal/ter:EmptyList** SOAP 1.2 fault message at step 14.

5.8.2 Disable TLS Version

Test Case ID: ADVANCED_SECURITY-9-1-2

Specification Coverage: SetEnabledTLSVersions (ONVIF Security Configuration Service Specification), GetEnabledTLSVersions (ONVIF Security Configuration Service Specification)

Feature under test: SetEnabledTLSVersions, GetEnabledTLSVersions

WSDL Reference: security.wsdl

Test Purpose: Verify that TLS Versions settings were applied.

Pre-Requisite: Security Configuration Service is received from the DUT. CRLs supported by the DUT as indicated by the MaximumNumberOfCRLs capability. Network Configuration is supported by the DUT.

Test Configuration: ONVIF Client and DUT

Test Procedure:

1. Start an ONVIF Client.
2. Start the DUT.
3. ONVIF Client retrieves Security Configuration Service Capabilities by following the procedure mentioned in Annex A.10 with the following input and output parameters
   - out *cap* - Security Configuration Service Capabilities
4. If *cap*.TLSServerCapabilities.TLSServerSupported contains only one item, skip other steps.
5. ONVIF Client configures HTTPS if required by following the procedure mentioned in Annex A.47.
6. ONVIF Client invokes **SetEnabledTLSVersions** request with parameters
   - Versions list := all items from *cap*.TLSServerCapabilities.TLSServerSupported list except lowest version
7. The DUT responds with **SetEnabledTLSVersionsResponse** message.
8. ONVIF Client verifies basic TLS handshake by following the procedure mentioned in Annex A.50 with the following input and output parameters.

- in lowest version from *cap*.TLSServerCapabilities.TLSServerSupported list - disabled TLS version

9. ONVIF Client verifies basic TLS handshake by following the procedure mentioned in Annex A.21.

10. Restore the DUT state.

Test Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **SetEnabledTLSVersionsResponse** message.

Annex A Helper Procedures and Additional Notes

A.1 Delete an RSA key pair

Name: HelperDeleteRSAKeyPair

Procedure Purpose: Helper procedure to delete an RSA key pair.

Pre-requisite: Security Configuration Service is received from the DUT. On-board RSA key pair generation is supported by the DUT as indicated by the RSAKeyPairGeneration capability.

Input: The identifier of the key pair (*keyID*) to delete.

Returns: None

Procedure:

1. ONVIF Client invokes **DeleteKey** with parameters
    - KeyID := *keyID*
2. DUT responds with a **DeleteKeyResponse** message.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **DeleteKeyResponse** message.

A.2 Subject for a server certificate

Use the following subject for test cases:

- Subject.Country := "US"
- Subject.CommonName := <DUT IP-address>

A.3 Creating a certificate from a PCKS#10 request

Name: HelperCreateCertificateFromPKCS10CSR

Procedure Purpose: Helper procedure to create an X.509 certificate from a PKCS#10 certification request.

Pre-requisite: None.

Input: PKCS#10 request (*pkcs10*) and associated CA certificate (*CAcert*) and a corresponding private key (*privateKey*).

Returns: An [RFC 5280] compliant X.509 certificate (*certResult*) from the PKCS#10 request signed with the public key in the CA certificate.

Procedure:

1. Create an [RFC 5280] compliant X.509 certificate (*certResult*) from the PKCS#10 request (*pkcs10*) with the following properties:
    - version:= v3
    - signature := sha1-WithRSAEncryption
    - subject := subject from the PKCS#10 request (*pkcs10*)
    - subject public key := subject public key in the PKCS#10 request (*pkcs10*)
    - validity := not before 19700101000000Z and not after 99991231235959Z
    - certificate signature is generated with the private key (*privateKey*) in the CA certificate (*CAcert*)
    - certificate extensions := the X.509v3 extensions from the PKCS#10 request (*pkcs10*)

A.4 Provide CA certificate

Name: HelperCreateCACertificate

Procedure Purpose: Helper procedure to create an X.509 CA certificate.

Pre-requisite: None.

Input: The subject (*subject*) of certificate (optional input parameter, could be skipped).

Returns: An X.509 CA certificate (*CAcert*) that is compliant to [RFC 5280] and a corresponding private key (*privateKey*) and public key (*publicKey*).

Procedure:

1. ONVIF Client determines the length of the key to generate (out *length*) by following the procedure mentioned in Annex A.6.
2. If *subject* is skipped set:

- *subject* := "CN=ONVIF TT,C=US"

3. ONVIF Client creates an X.509 self-signed CA certificate that is compliant to [RFC 5280] and has the following properties:

   - version := v3
   - signature := sha1-WithRSAEncryption
   - validity := not before 19700101000000Z and not after 99991231235959Z
   - subject := *subject*
   - length of the key to be used := *length*

Note: ONVIF Client may return the same CA certificate in subsequent invocations of this procedure for the same subject.

A.5 Delete a certification path with corresponding certificate and RSA key pair

Name: HelperDeleteCertificationPath

Procedure Purpose: Helper procedure to delete certification path and related certificate and RSA key pair.

Pre-requisite: Security Configuration Service is received from the DUT. Create self-signed certificate by the DUT as indicated by the SelfSignedCertificateCreationWithRSA or PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSAcapability. TLS is supported by the DUT as indicated by the TLSServerSupported capability.

Input: The identifier of the certification path (*certPathID*), certificate (*certID*) and RSA key pair (*keyID*) to delete.

Returns: None

Procedure:

1. ONVIF Client invokes **DeleteCertificationPath** request with parameters

   - CertificationPathID := *certPathID*

2. The DUT responds with a **DeleteCertificationPathResponse** message.

3. ONVIF Client deletes the self-signed certificate (in *certID*) and related the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.9.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **DeleteCertificationPathResponse** message.

A.6 Determine RSA key length

Name: HelperDetermineRSAKeyLength

Procedure Purpose: Helper procedure to determine the RSA key length to use during testing.

Pre-requisite: Security Configuration Service is received from the DUT. On-board RSA key pair generation is supported by the DUT as indicated by the RSAKeyPairGeneration capability.

Input: None

Returns: The smallest supported RSA key length (*keyLength*).

Procedure:

1. ONVIF Client gets the service capabilities (out *cap*) by the following the procedure mentioned in Annex A.10.
2. ONVIF Client loops through the supported Key length list (*cap*.RSAKeyLengths) and selects the smallest supported key length (*keyLength*).

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- No supported key length was found at step 2.

A.7 Create an RSA key pair

Name: HelperCreateRSAKeyPair

Procedure Purpose: Helper procedure to create an RSA key pair

Pre-requisite: Security Configuration Service is received from the DUT. On-board RSA key pair generation is supported by the DUT as indicated by the RSAKeyPairGeneration capability. The DUT shall have enough free storage capacity for one additional RSA key pair.

Input: None

Returns: The identifier of the new key pair (*keyID*).

Procedure:

1. ONVIF Client determines the length of the key to generate (out *length*) by following the procedure mentioned in Annex A.6.
2. ONVIF Client invokes **CreateRSAKeyPair** with parameter
   - KeyLength := *length*
3. The DUT responds with **CreateRSAKeyPairResponse** message with parameters
   - KeyID =: *keyID*
   - EstimatedCreationTime =: *duration*
4. Until *operationDelay* + *duration* expires repeat the following steps:

   4.1. ONVIF Client waits for 5 seconds.

   4.2. ONVIF Client invokes **GetKeyStatus** with parameters
   - KeyID := *keyID*

   4.3. The DUT responds with **GetKeyStatusResponse** message with parameters
   - KeyStatus =: *keyStatus*

   4.4. If *keyStatus* is equal to "ok", *keyID* will be return as a result of the procedure, other steps will be skipped.

   4.5. If *keyStatus* is equal to "corrupt", FAIL the procedure and deletes the RSA key pair (*keyID*) by following the procedure mentioned in Annex A.1.
5. If *operationDelay* + *duration* expires for step 4 and the last *keyStatus* is other than "ok", FAIL the procedure and deletes the RSA key pair (*keyID*) by following the procedure mentioned in Annex A.1.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **CreateRSAKeyPairResponse** message.
- DUT did not send **GetKeyStatusResponse** message(s).

Note: *operationDelay* will be taken from Operation Delay field of ONVIF Device Test Tool.

A.8 Create a self-signed certificate

Name: HelperCreateSelfSignedCertificate

Procedure Purpose: Helper procedure to create a self-signed certificate.

Pre-requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate.

Input: None

Returns: The identifier of the new certificate (*certID*) and RSA key pair (*keyID*).

Procedure:

1. ONVIF Client creates an RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.7.
2. ONVIF Client invokes **CreateSelfSignedCertificate** with parameters
   - X509Version skipped
   - KeyID := *keyID*
   - Subject := subject (see Annex A.2)
   - Alias skipped
   - notValidBefore skipped
   - notValidAfter skipped
   - SignatureAlgorithm.algorithm := 1.2.840.113549.1.1.5 (OID of SHA-1 with RSA Encryption algorithm)

- SignatureAlgorithm.parameters skipped
- SignatureAlgorithm.anyParameters skipped
- Extension skipped

3. The DUT responds with **CreateSelfSignedCertificateResponse** message with parameters
   - CertificateID =: *certID*

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **CreateSelfSignedCertificateResponse** message.

A.9 Delete a certificate with corresponding RSA key pair

Name: HelperDeleteCertWithKey

Procedure Purpose: Helper procedure to delete a certificate and related RSA key pair.

Pre-requisite: Security Configuration Service is received from the DUT. Create self-signed certificate by the DUT as indicated by the SelfSignedCertificateCreationWithRSA or PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSAcapability.

Input: The identifier of the certificate (*certID*) and RSA key pair (*keyID*) to delete.

Returns: None

Procedure:

1. ONVIF Client invokes **DeleteCertificate** with parameters
   - CertificateID := *certID*
2. The DUT responds with **DeleteCertificateResponse** message.
3. ONVIF Client deletes the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **DeleteCertificateResponse** message.

A.10 Get service capabilities

Name: HelperGetServiceCapabilities

Procedure Purpose: Helper procedure to get service capabilities.

Pre-requisite: Security Configuration Service is received from the DUT.

Input: None

Returns: The service capabilities (*cap*).

Procedure:

1. ONVIF Client invokes **GetServiceCapabilities**
2. The DUT responds with **GetServiceCapabilitiesResponse** message with parameters
   - Capabilities =: *cap*

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetServiceCapabilitiesResponse** message.

A.11 Create a certification path based on self-signed certificate

Name: HelperCreateCertificationPath_SelfSigned

Procedure Purpose: Helper procedure to create a certification path based on self-signed certificate.

Pre-requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the

TLSServerSupported capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. The DUT shall have enough free storage capacity for one additional certification path.

Input: None

Returns: The identifier of the new certification path (*certPathID*), certificate (*certID*) and RSA key pair (*keyID*).

Procedure:

1. ONVIF Client creates a self-signed certificate (out *certID*) and related RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.8.
2. ONVIF Client invokes **CreateCertificationPath** request with parameters
   - CertficateIDs.CertificateID[0] := *certID*
   - Alias := "ONVIF_Test"
3. The DUT responds with **CreateCertificationPathResponse** message with parameters
   - CertificationPathID =: *certPathID*

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **CreateCertificationPathResponse** message.

A.12 Remove server certificate assignment with corresponding certification path, certificate and RSA key pair

Name: HelperRemoveServerCertificateAssignment

Procedure Purpose: Helper procedure to remove server certificate assignment with corresponding certification path, certificate and RSA key pair.

Pre-requisite: Security Configuration Service is received from the DUT. Create self-signed certificate by the DUT as indicated by the SelfSignedCertificateCreationWithRSA or PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSAcapability. TLS supported by the DUT as indicated by the TLSServerSupported capability.

Input: The identifier of certification path (*certPathID*), certificate (*certID*) and RSA key pair (*keyID*) to delete.

Returns: None

Procedure:

1. ONVIF Client invokes **RemoveServerCertificateAssignment** with parameters
   - CertificationPathID := *certPathID*
2. The DUT responds with **RemoveServerCertificateAssignmentResponse** message.
3. ONVIF Client waits for time *operationDelay*.
4. ONVIF Client deletes the certification path (in *certPathID*) and related certificate (in *certID*) and the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.5.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **RemoveServerCertificateAssignmentResponse** message.

A.13 Add server certificate assignment with corresponding certification path, self-signed certificate and RSA key pair

Name: HelperAddServerCertAssign_SSCertificate

Procedure Purpose: Helper procedure to add server certificate assignment with corresponding certification path, self-signed certificate and RSA key pair.

Pre-requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. The DUT shall have enough free storage capacity for one additional certification path.

Input: None

Returns: The identifiers of the new certification path (*certPathID*), certificate (*certID*) and RSA key pair (*keyID*).

Procedure:

1. ONVIF Client creates a certification path (out *certPathID*) based on self-signed certificate (out *certID*) and related RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.11.
2. ONVIF Client invokes **AddServerCertificateAssignment** with parameters
   - CertificationPathID := *certPathID*
3. The DUT responds with **AddServerCertificateAssignmentResponse** message.
4. ONVIF Client waits for time *operationDelay*.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **AddServerCertificateAssignmentResponse** message.

A.14 Create a CA-signed certificate for RSA key pair

Name: HelperCreateCASignedCertificate

Procedure Purpose: Helper procedure to create a CA-signed certificate for RSA key pair.

Pre-requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. The DUT shall have enough free storage capacity for one additional RSA key pair. Current time of the DUT shall be at least Jan 01, 1970.

Input: CA certificate (*CAcert*) and a corresponding private key (*privateKey*).

Returns: The identifier of the new key pair (*keyID*), a CA-signed certificate (*cert*).

Procedure:

1. ONVIF Client creates an RSA key pair (*keyID*) by following the procedure mentioned in Annex A.7.

2. ONVIF Client invokes **CreatePKCS10CSR** with parameters

   - Subject := *subject* (see Annex A.2)
   - KeyID := *keyID*
   - CSRAttribute skipped
   - SignatureAlgorithm.algorithm := 1.2.840.113549.1.1.5 (OID of SHA-1 with RSA Encryption algorithm)

3. The DUT responds with **CreatePKCS10CSRResponse** message with parameters

   - PKCS10CSR =: *PKCS10request*

4. ONVIF Client creates a certificate (out *cert*) from the PKCS#10 request (in *PKCS10request*) and an associated CA certificate (in *CAcert*) with related private key (in *privateKey*) by following the procedure described in Annex A.3.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **CreatePKCS10CSRResponse** message.

A.15 Upload a certificate without Private Key Assignment

Name: HelperUploadCertificate

Procedure Purpose: Helper procedure to upload a certificate without private key assignment.

Pre-requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate.

Input: Certificate (*cert*).

Returns: The identifier of the new RSA key pair (*keyID*) and a certificate identifier (*certID*).

Procedure:

1. ONVIF Client invokes **UploadCertificate** with parameters

- Certificate := *cert*
- Alias := "ONVIF_Test"
- PrivateKeyRequired : = false

2. DUT responds with a **UploadCertificateResponse** message.
   - Certificate := *certID*
   - KeyID := *keyID*

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **UploadCertificateResponse** message.

A.16 Create and upload a CA-signed certificate for private key

Name: HelperUploadCASignedCertificate

Procedure Purpose: Helper procedure to create and upload a CA-signed certificate for private key

Pre-requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. Current time of the DUT shall be at least Jan 01, 1970.

Input: CA certificate (*CAcert*) and a corresponding private key (*privateKey*).

Returns: The identifier of the new RSA key pair (*keyID*), a certificate identifier (*certID*).

Procedure:

1. ONVIF Client creates a certificate (out *cert*) from the PKCS#10 request with RSA key pair (out *keyID*) and associated CA certificate (in *CAcert*) and a corresponding private key (in *privateKey*) by following the procedure described in Annex A.14.
2. ONVIF Client invokes **UploadCertificate** with parameters

- Certificate := *cert*
- Alias := "ONVIF_Test1"
- PrivateKeyRequired := true

3. The DUT responds with **UploadCertificateResponse** with parameters
    - CertificateID =: *certID*
    - KeyID =: *keyID*

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **UploadCertificateResponse** message.

A.17 Delete a certification path with corresponding two certificates and RSA key pairs

Name: HelperDeleteCertificationPath2

Procedure Purpose: Helper procedure to delete certification path and related certificates and RSA key pairs.

Pre-requisite: Security Configuration Service is received from the DUT. Create self-signed certificate by the DUT as indicated by the SelfSignedCertificateCreationWithRSA or PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSAcapability. TLS is supported by the DUT as indicated by the TLSServerSupported capability.

Input: The identifier of the certification path (*certPathID*), certificate (*certID1*) and RSA key pair (*keyID1*), certificate (*certID2*) and RSA key pair (*keyID2*) to delete.

Returns: None

Procedure:

1. ONVIF Client invokes **DeleteCertificationPath** request with parameters
    - CertificationPathID := *certPathID*

2. The DUT responds with **DeleteCertificationPathResponse** message.

3. ONVIF Client deletes the CA certificate (*certID2*) and related RSA key pair (*keyID2*) by following the procedure mentioned in Annex A.9.

4. ONVIF Client deletes the CA certificate (*certID1*) and related RSA key pair (*keyID1*) by following the procedure mentioned in Annex A.9.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **DeleteCertificationPathResponse** message.

A.18 Create certification path with CA-signed certificate and associated CA certificate

Name: HelperCreateCertificationPath_CACertificates

Procedure Purpose: Helper procedure to create a certification path based on CA-signed certificate and associated CA certificate.

Pre-requisite: Security Configuration Service is received from the DUT. Create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability. RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability. TLS is supported by the DUT as indicated by the TLSServerSupported capability. The DUT shall have enough free storage capacity for two additional RSA key pairs. The DUT shall have enough free storage capacity for two additional certificates. The DUT shall have enough free storage capacity for one additional certification path. Current time of the DUT shall be at least Jan 01, 1970.

Input: None

Returns: The identifier of the new certification path (*certPathID*) and two related certificates: CA-signed certificate (*certID1*) and related key (*keyID1*) and associated CA certificate (*certID2*) and related key (*keyID2*).

Procedure:

1. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding private key (out *privateKey*) by following the procedure described in Annex A.4.

2. ONVIF Client creates and uploads a CA-signed certificate (out *certID1*) for RSA key pair (out *keyID1*) and associated CA certificate (in *CAcert*) and a corresponding private key (in *privateKey*) by following the procedure described in Annex A.16.

3. ONVIF Client uploads a CA certificate (out *certID2*, in *CAcert*) and new RSA key pair with the public key from the CA certificate (out *keyID2*) by following the procedure described in Annex A.15.

4. ONVIF Client invokes **CreateCertificationPath** with parameters

    - CertficateIDs.CertificateID[0] =: *certID1*
    - CertficateIDs.CertificateID[1] =: *certID2*
    - Alias := "ONVIF_Test2"

5. The DUT responds with **CreateCertificationPathResponse** message with parameters

    - CertificationPathID =: *certPathID*

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **CreateCertificationPathResponse** message.

A.19 Validate DER encoding

Name: HelperValidateDEREncoding

Procedure Purpose: Helper procedure to validate DER encoding.

Pre-requisite: None.

Input: DER encoded data (*dataDER*).

Returns: None.

Procedure:

1. ONVIF Client tries to decode DER encoded data *dataDER*. If decoding was failed, then *dataDER* is not valid encoded, FAIL the procedure and skip other steps.

2. ONVIF Client DER encodes the result from previous step (*dataDER2*).

3. ONVIF Client compares *dataDER* and *dataDER2*. If they are not equal, then dataDER is not valid encoded, FAIL the procedure.

Procedure Result:

PASS –

- DUT passes all assertions.

A.20 Remove server certificate assignment with corresponding certification path, certificates and RSA key pairs

Name: HelperRemoveServerCertificateAssignment2

Procedure Purpose: Helper procedure to remove server certificate assignment with corresponding certification path, certificates and RSA key pairs.

Pre-requisite: Security Configuration Service is received from the DUT. Create self-signed certificate by the DUT as indicated by the SelfSignedCertificateCreationWithRSA or PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSAcapability. TLS is supported by the DUT as indicated by the TLSServerSupported capability.

Input: The identifier of certification path (*certPathID*), certificate (*certID1*) and RSA key pair (*keyID1*), certificate (*certID2*) and RSA key pair (*keyID2*) to delete.

Returns: None

Procedure:

1. ONVIF Client invokes **RemoveServerCertificateAssignment** with parameters
   - CertificationPathID =: *certPathID*
2. The DUT responds with **RemoveServerCertificateAssignmentResponse** message.
3. ONVIF Client waits for time *operationDelay*.
4. ONVIF Client deletes the certification path (in *certPathID*), related the CA certificate (in *certID2*) and the RSA key pair (in *keyID2*) and related the CA-signed certificate (in *certID1*) and the RSA key pair (in *keyID1*) by following the procedure mentioned in Annex A.17.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **RemoveServerCertificateAssignmentResponse** message.

A.21 Basic TLS handshake

Name: HelperBasicTLSHandshakeCheck

Procedure Purpose: Helper procedure to verify basic TLS handshake.

Pre-requisite: TLS is supported by the DUT as indicated by the TLSServerSupported capability. TLS is configured. HTTPS protocol is enabled.

Input: TLS server certification path ID (*certPathID*).

Returns: None

Procedure:

1. ONVIF Client invokes **ClientHello** with parameters
    - ClientVersion := 3,1
    - Random number := *ClientRandom[32]*, that is 4-byte number that consists of the client's date and time plus a 28-byte randomly generated number
    - CipherSuites := list of common CipherSuites used by TLS 1.0, SSL 2.0 and 3.0
    - Compression methods list := NONE
    - <SessionID> skipped
2. The DUT TLS server responds with a **ServerHello** message with parameters
    - Version =: the highest version number supported by both sides
    - Random number =: *ServerRandom[32]*, that is 4-byte number that consists of the client's date and time plus a 28-byte randomly generated number
    - CipherSuite =: the strongest cipher that both the client and server support
    - Compression method =: NONE
    - Session ID =: *SessionID*
3. The DUT TLS server responds **Certificate** message with parameters
    - Certificate.CertificateID =: *CertificateID*

- Certificate.KeyID =: *KeyID*

4. The DUT TLS server responds a **ServerHelloDone** message.
5. ONVIF Client invokes **ClientKeyExchange** message with parameter
   - Premaster Secret := *PreMasterSecret* encrypted with *KeyID*
6. ONVIF Client computes *MasterSecret* using *ClientRandom[32]*, *ServerRandom[32]* and *PreMasterSecret*.
7. The DUT TLS server computes *MasterSecret* using *ClientRandom[32]*, *ServerRandom[32]* and *PreMasterSecret*.
8. ONVIF Client invokes **ChangeCipherSpec** message.
9. ONVIF Client invokes encrypted **Finished** message, containing a hash := *hash1* and MAC := *MAC1* over the previous handshake messages.
10. The DUT TLS server decrypts the client's *Finished* message and verify the hash and MAC.
11. The DUT TLS server responds **ChangeCipherSpec**.
12. The DUT TLS server responds its encrypted **Finished** message, containing a hash =: *hash2* and MAC =: *MAC2* over the previous handshake messages.
13. If *hash1* is not equal to *hash2*, FAIL the test.
14. If *MAC1* is not equal to *MAC2*, FAIL the test.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **ServerHello** message.
- DUT did not send **Certificate** message.
- DUT did not send **ServerHelloDone** message.
- DUT did not send **ChangeCipherSpec** message.
- DUT did not send **Finished** message.

- The DUT TLS server sends Alert Message.

A.22 Provide expired CA certificate

Name: HelperCreateExpiredCACertificate

Procedure Purpose: Helper procedure to create an expired X.509 CA certificate.

Pre-requisite: None.

Input: None

Returns: An X.509 CA certificate (*CAcert*) that is compliant to [RFC 5280] and a corresponding private key (*privateKey*).

Procedure:

1. ONVIF Client determines the length of the key to generate (out *length*) by following the procedure mentioned in Annex A.6.
2. ONVIF Client invokes **GetSystemDateAndTimeRequest**.
3. The DUT responds with **GetSystemDateAndTimeResponse** with parameters
   - UTCDateTime =: *DUTCurrentTime*
4. ONVIF Client creates an X.509 self-signed CA certificate that is compliant to [RFC 5280] and has the following properties:
   - version := v3
   - signature := sha1-WithRSAEncryption
   - validity := not before 19700101000000Z and not after [*DUTCurrentTime* - 1 day]
   - length of the key to be used := *length*

Note: ONVIF Client may return the same CA certificate in subsequent invocations of this procedure.

A.23 Delete a passphrase

Name: HelperDeletePassphrase

Procedure Purpose: Helper procedure to delete a passphrase.

Pre-requisite: Security Configuration Service is received from the DUT. Passphrase handling is supported by the DUT as indicated by the MaximumNumberOfPassphrases > 0 capability.

Input: The identifier of the passphrase (*passphraseID*) to delete.

Returns: None

Procedure:

1. ONVIF Client invokes **DeletePassphrase** with parameters
   - PassphraseID := *passphraseID*
2. The DUT responds with a **DeletePassphraseResponse** message.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **DeletePassphraseResponse** message.

A.24 Passphrases for test cases

Use the following passphrases for test cases (20 ASCII characters):

- *passphrase1* := "Passphrase for ONVIF"
- *passphrase2* := "AdditionalPassphrase"

A.25 Creating a PKCS#8 data structure with new public key and private key without passphrase

Name: HelperCreatePKCS8WithNewKeyPair

Procedure Purpose: Helper procedure to create a PKCS#8 data structure with new public key and private key without passphrase.

Pre-requisite: None.

Input: None.

Returns: A [RFC 5958, RFC 5959] compliant PKCS#8 data structure (*keyPairInPKCS8*) with new public key (*publicKey*) and private key (*privateKey*).

Procedure:

1. ONVIF Client generates RSA key pair with public key (out *publicKey*) and private key (out *privateKey*) by following the procedure mentioned in Annex A.26.

2. ONVIF Client generates a PKCS#8 data structure (out *keyPairInPKCS8*) with existing pubic key (in *publicKey*) and private key (in *privateKey*) by following the procedure mentioned in Annex A.27.

A.26 Generating an RSA key pair

Name: HelperGenerateRSAKeyPair

Procedure Purpose: Helper procedure to generate an RSA key pair.

Pre-requisite: None.

Input: None.

Returns: A [RFC 3447] compliant RSA key pair with new public key (*publicKey*) and private key (*privateKey*).

Procedure:

1. ONVIF Client determines the length of the key to generate (out *length*) by following the procedure mentioned in Annex A.6.

2. Create an [RFC 3447] compliant RSA key pair with new public key (out *publicKey*) and private key (out *privateKey*) with the following properties:

   • KeyLength := *length*

A.27 Creating a PKCS#8 data structure with existing public key and private key without passphrase

Name: HelperCreatePKCS8WithExistingKeyPair

Procedure Purpose: Helper procedure to create a PKCS#8 data structure with existing public key and private key without passphrase.

Pre-requisite: None.

Input: A [RFC 3447] compliant RSA key pair with public key (*publicKey*) and private key (*privateKey*).

Returns: A [RFC 5958, RFC 5959] compliant PKCS#8 data structure (*keyPairInPKCS8*) for provided RSA key pair.

Procedure:

1. Create an [RFC 5958, RFC 5959] compliant PKCS#8 data structure (*keyPairInPKCS8*) with the following properties:
   - PrivateKeyInfo
     - version:= v2
     - privateKeyAlgorithm := rsaEncryption
     - privateKey := *privateKey*
     - attributes
       - publicKey := *publicKey*

A.28 Creating a PKCS#8 data structure with new public key and private key with passphrase

Name: HelperCreatePKCS8WithNewKeyPairWithPassphrase

Procedure Purpose: Helper procedure to create a PKCS#8 data structure with new public key and private key with passphrase.

Pre-requisite: None.

Input: The passphrase (*passphrase*) to use in encryption.

Returns: A [RFC 5958, RFC 5959] compliant PKCS#8 data structure (*keyPairInPKCS8*) with new public key (*publicKey*) and private key (*privateKey*).

Procedure:

1. ONVIF Client generates RSA key pair with public key (out *publicKey*) and private key (out *privateKey*) by following the procedure mentioned in Annex A.26.
2. ONVIF Client generates a PKCS#8 data structure (out *keyPairInPKCS8*) with existing pubic key (in *publicKey*) and private key (in *privateKey*) with encryption passphrase (in *passphrase*) by following the procedure mentioned in Annex A.29.

A.29 Creating a PKCS#8 data structure with existing public key and private key with passphrase

Name: HelperCreatePKCS8WithExistingKeyPairWithPassphrase

Procedure Purpose: Helper procedure to create a PKCS#8 data structure with existing public key and private key with passphrase.

Pre-requisite: None.

Input: A [RFC 3447] compliant RSA key pair with public key (*publicKey*) and private key (*privateKey*). The passphrase (*passphrase*) to use in encryption.

Returns: A [RFC 5958, RFC 5959] compliant PKCS#8 data structure (*keyPairInPKCS8*) for provided RSA key pair.

Procedure:

1. Use the current PrivateKeyInfo data:
    - PrivateKeyInfo
        - version := v2
        - privateKeyAlgorithm := rsaEncryption
        - privateKey := *privateKey*
        - attributes
            - publicKey := *publicKey*
2. Create an [RFC 5958, RFC 5959] compliant PKCS#8 data structure (*keyPairInPKCS8*) with the following properties:
    - EncryptedPrivateKeyInfo
        - encryptionAlgorithm := pbeWithSHAAnd3-KeyTripleDES-CBC
        - encryptedData := encrypted with *passphrase* PrivateKeyInfo data

A.30 Creating a PKCS#12 data structure with new CA-signed certificate signed by new public key and private key with passphrase

Name: HelperCreatePKCS12WithNewCACertWithPassphrase

Procedure Purpose: Helper procedure to create CA certificate and a corresponding public key in the certificate along with the corresponding private key and encryption passphrase in the form of a PKCS#12 file.

Pre-requisite: None.

Input: The passphrase (*passphrase*) to use in encryption.

Returns: A [PKCS#12] compliant PKCS#12 data structure (*PKCS12data*) with CA certificate (*CAcert*) and a corresponding public key (*publicKey*) in the certificate along with the corresponding private key (*privateKey*) encrypted with passphrase (*passphrase*).

Procedure:

1. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding public key (out *publicKey*) in the certificate along with the corresponding private key (out *privateKey*) by following the procedure described in Annex A.4.

2. ONVIF Client creates a CA certificate (in *CAcert*) and a corresponding public key (in *publicKey*) in the certificate along with the corresponding private key (in *privateKey*) encrypted with passphrase (in *passphrase*) in the form of a PKCS#12 file (out *PKCS12data*) by following the procedure described in Annex A.31.

A.31 Creating a PKCS#12 data structure with existing CA-signed certificate and a corresponding public key and private key with passphrase

Name: HelperCreatePKCS12WithPassphrase

Procedure Purpose: Helper procedure to create a PKCS#12 data structure with existing CA-signed certificate and a corresponding public key and private key with passphrase.

Pre-requisite: None.

Input: An X.509 CA certificate (*CAcert*) that is compliant to [RFC 5280] and a corresponding private key (*privateKey*) and public key (*publicKey*), and passphrase (*passphrase*).

Returns: A [PKCS#12] compliant PKCS#12 data structure (*PKCS12data*).

Procedure:

1. Use the current PrivateKeyInfo data:

    - PrivateKeyInfo

        - version := v2

        - privateKeyAlgorithm := rsaEncryption

    - privateKey := *privateKey*
    - publicKey := *publicKey*

2. Create an EncryptedPrivateKeyInf data structure with the following properties:
   - EncryptedPrivateKeyInfo
     - encryptionAlgorithm := pbeWithSHAAnd3-KeyTripleDES-CBC
     - encryptedData := encrypted with *passphrase* PrivateKeyInfo data
3. Create an [PKCS#12] compliant PKCS#12 data structure *PKCS12data*) with the following properties:
   - version := v3
   - authSafe
     - SafeBag
       - Pkcs-12-PKCS9ShroudedKeyBag := EncryptedPrivateKeyInfo
       - PKCS12AttrSet
         - friendlyName := "testAlias"
     - SafeBag
       - Pkcs-12-CertBag := *CAcert*
       - PKCS12AttrSet
         - friendlyName := "testAlias"

A.32 Subject for a server certificate (all DN-attributes)

Use the following subject for test cases:

- Subject.Country := "US"
- Subject.Organization := "ONVIF Test"
- Subject.OrganizationalUnit := "Unit test"
- Subject.DistinguishedNameQualifier := "DN Qualifier Test"
- Subject.StateOrProvinceName := "State Name Test"

- Subject.CommonName := "Common Name Test"
- Subject.SerialNumber := "000000000000"
- Subject.Locality := "LA"
- Subject.Title := "Mr"
- Subject.Surname := "SurnameTest"
- Subject.GivenName := "GivenNameTest"
- Subject.Initials := "AS"
- Subject.Pseudonym := "Pseudonym Test"
- Subject.GenerationQualifier := "GenerationQualifier Test"
- Subject.GenericAttribute.Type := "string"
- Subject.GenericAttribute.Value := "Test GenericAttribute"
- Subject.MultyValueRDN.Attribute.Type := "string"
- Subject.MultyValueRDN.Attribute.Value := "Test MultyValueRDN"

A.33 Delete a certification path with corresponding certificate and RSA key pair when CertificateID is unknown

Name: HelperDeleteCertificationPath3

Procedure Purpose: Helper procedure to delete certification path and related certificate and RSA key pair when CertificateID is unknown.

Pre-requisite: Security Configuration Service is received from the DUT. Create self-signed certificate by the DUT as indicated by the SelfSignedCertificateCreationWithRSA or PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSAcapability. TLS is supported by the DUT as indicated by the TLSServerSupported capability.

Input: The identifier of the certification path (*certPathID*) and RSA key pair (*keyID*) to delete.

Returns: None

Procedure:

1. ONVIF Client invokes **GetCertificationPath** request with parameters

- CertificationPathID =: *certPathID*

2. The DUT responds with **GetCertificationPathResponse** with parameters
   - CertificationPath.CertificateID list =: *certificateIDList*
   - CertificationPath.Alias =: *CertPathAlias*
3. If the DUT did not send a **GetCertificationPathResponse** message, FAIL the test and go to step 9.
4. ONVIF Client invokes **DeleteCertificationPath** message with parameters
   - CertificationPathID =: *certPathID*
5. The DUT responds with empty **DeleteCertificationPathResponse** message.
6. If the DUT did not send a **DeleteCertificationPathResponse** message, FAIL the test and go to step 8.
7. For each CertificateID (*certificateID*) in *certificateIDList*:

   7.1. ONVIF Client invokes **GetCertificate** message with parameters
   - CertificateID := *certID*

   7.2. The DUT responds with a **GetCertificateResponse** message with parameters
   - Certificate =: *X509Cert*

   7.3. ONVIF Client invokes **DeleteCertificate** with parameters
   - CertificateID =: *certificateID*

   7.4. The DUT responds with a **DeleteCertificateResponse** message.

   7.5. ONVIF Client deletes the RSA key pair (in *X509Cert*.KeyID) by following the procedure mentioned in Annex A.1 to restore DUT configuration.
8. Skip other steps.
9. ONVIF Client deletes the RSA key pair (in *keyID*) by following the procedure mentioned in Annex A.1 to restore DUT configuration.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetCertificationPathResponse** message.
- DUT did not send **DeleteCertificationPathResponse** message.
- DUT did not send **DeleteCertificateResponse** message.
- DUT did not send **GetCertificateResponse** message.

A.34 Upload PKCS#12 – no key pair exists

Name: HelperUploadPKCS12

Procedure Purpose: Helper procedure to create and upload PKCS#12 data structure with new public key and private key.

Pre-requisite: Security Configuration Service is received from the DUT. Certificate along with an RSA private key in a PKCS#12 data structure upload is supported by the DUT as indicated by the PKCS12CertificateWithRSAPrivateKeyUpload capability. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. The DUT shall have enough free storage capacity for one additional certification path.

Input: None

Returns: A [PKCS#12] compliant PKCS#12 data structure (*PKCS12data*) with CA certificate (*CAcert*) and a corresponding public key (*publicKey*) in the certificate along with the corresponding private key (*privateKey*) and certification path ID (*certificationPathID*) with corresponding key pair ID (*keyID*) for uploaded PKCS#12 data structure.

Procedure:

1. ONVIF Client generates an encryption passphrase *passphrase1* (see Annex A.24).
2. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding public key (out *publicKey*) in the certificate along with the corresponding private key (out *privateKey*) in the form of a PKCS#12 file (out *PKCS12data*) with given passphrase (in *passphrase1*) by following the procedure described in Annex A.30.
3. ONVIF Client invokes **UploadCertificateWithPrivateKeyInPKCS12** with parameters
   - CertWithPrivateKey := *PKCS12data*

- CertificationPathAlias := "ONVIF_Certification_Path_Test"
- KeyAlias := "ONVIF_Key_Test"
- IgnoreAdditionalCertificates skipped
- IntegrityPassphraseID skipped
- EncryptionPassphraseID skipped
- Passphrase := *passphrase1*

4. The DUT responds with a **UploadCertificateWithPrivateKeyInPKCS12Response** message with parameters
   - CertificationPathID =: *certificationPathID*
   - KeyID =: *keyID*

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **UploadCertificateWithPrivateKeyInPKCS12Response** message.

A.35 Provide CRL

Name: HelperCreateCRL

Procedure Purpose: Helper procedure to create CRL.

Pre-requisite: None.

Input: None.

Returns: A CRL (*crl*) that is compliant to [RFC 5280].

Procedure:

1. ONVIF Client creates a CRL that is compliant to [RFC 5280] and has the following properties:
   - tbsCertList[0].version := v2
   - tbsCertList[0].signature.algorithm := sha1-WithRSAEncryption

- tbsCertList[0].issuer := "CN=ONVIF TT,C=US"
- tbsCertList[0].thisUpdate := [current time]
- tbsCertList[0].nextUpdate skipped
- tbsCertList[0].revokedCertificates[0].userCertificate := [any certificate number]
- tbsCertList[0].revokedCertificates[0].revocationDate := [current time]
- signatureAlgorithm.algorithm := sha1-WithRSAEncryption
- signatureValue := sha1-WithRSAEncryption signature

Note: ONVIF Client may return the same CRL in subsequent invocations of this procedure.

A.36 Delete a CRL

Name: HelperDeleteCRL

Procedure Purpose: Helper procedure to delete a CRL.

Pre-requisite: Security Configuration Service is received from the DUT. CRLs supported by the DUT as indicated by the MaximumNumberOfCRLs capability.

Input: The identifier of CRL (*crlID*) to delete.

Returns: None

Procedure:

1. ONVIF Client invokes **DeleteCRL** request with parameters
   - CrlID =: *crlID*
2. The DUT responds with **DeleteCRLResponse** message.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **DeleteCRLResponse** message.

A.37 Upload a CRL

Name: HelperUploadCRL

Procedure Purpose: Helper procedure to upload a CRL.

Pre-requisite: Security Configuration Service is received from the DUT. CRLs supported by the DUT as indicated by the MaximumNumberOfCRLs capability. The DUT shall have enough free storage capacity for one additional CRL.

Input: The CRL alias (*alias*) and the CRL (*crl*).

Returns: The CRL identifier (*crlID*).

Procedure:

1. ONVIF Client invokes **UploadCRL** with parameters
   - Crl =: *crl*
   - Alias := "Test CRL Alias"
   - anyParameters skipped
2. The DUT responds with **UploadCRLResponse** message with parameters
   - CrlID =: *crlID*

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **UploadCRLResponse** message.

A.38 Delete a certification path validation policy

Name: HelperDeleteCertPathValidationPolicy

Procedure Purpose: Helper procedure to delete a certification path validation policy.

Pre-requisite: Security Configuration Service is received from the DUT. Certification path validation policy supported by the DUT as indicated by the MaximumNumberOfCertificationPathValidationPolicies capability.

Input: The identifier of certification path validation policy (*certPathValidationPolicyID*) to delete.

Returns: None

Procedure:

1. ONVIF Client invokes **DeleteCertPathValidationPolicy** request with parameters
   - CertPathValidationPolicyID =: *certPathValidationPolicyID*
2. The DUT responds with **DeleteCertPathValidationPolicyResponse** message.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **DeleteCertPathValidationPolicyResponse** message.

A.39 Prepare certificate on the DUT

Name: HelperPrepareCertificate

Procedure Purpose: Helper procedure to create or upload certificate on the DUT.

Pre-requisite: Security Configuration Service is received from the DUT. Create self-signed certificate supported by the DUT as indicated by the SelfSignedCertificateCreationWithRSA capability and RSA key pair generation supported by the DUT as indicated by the RSAKeyPairGeneration capability or create PCKS#10 supported by the DUT as indicated by the PKCS10ExternalCertificationWithRSA capability or certificate along with an RSA private key in a PKCS#12 data structure upload is supported by the DUT as indicated by the PKCS12CertificateWithRSAPrivateKeyUpload capability. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate.

Input: None.

Returns: The identifier of the new certificate (*certID*), RSA key pair (*keyID*) and certification path if any (*certificationPathID*).

Procedure:

1. ONVIF Client gets the service capabilities (out *cap*) by following the procedure mentioned in Annex A.10.

2. If *cap*.KeystoreCapabilities.PKCS10ExternalCertificationWithRSA:

   2.1. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding private key (out *privateKey*) by following the procedure described in Annex A.4.

   2.2. ONVIF Client uploads a CA certificate (out *certID*, in *CAcert*) and new RSA key pair with the public key from the CA certificate (out *keyID*) by following the procedure described in Annex A.15.

   2.3. Set:

   - *certificationPathID* := null

   2.4. Skip other steps.

3. If *cap*.KeystoreCapabilities.SelfSignedCertificateCreationWithRSA and *cap*.KeystoreCapabilities.RSAKeyPairGeneration:

   3.1. ONVIF Client creates a self-signed certificate (out *certID*) and related RSA key pair (out *keyID*) by following the procedure mentioned in Annex A.8.

   3.2. Set:

   - *certificationPathID* := null

   3.3. Skip other steps.

4. If *cap*.KeystoreCapabilities.PKCS12CertificateWithRSAPrivateKeyUpload:

   4.1. ONVIF Client creates a CA certificate (out *CAcert*) and a corresponding public key (out *publicKey*) in the certificate along with the corresponding private key (out *privateKey*) in the form of a PKCS#12 file (out *PKCS12data*) and uploads it with certification path ID (out *certificationPathID*) and key pair ID (out *keyID*) by following the procedure described in Annex A.34.

   4.2. ONVIF Client invokes **GetCertificationPath** message with parameters

   - CertificationPathID =: *certificationPathID*

   4.3. The DUT responds with a **GetCertificationPathResponse** message with parameters

   - CertificationPath.CertificateID[0] =: *certID*

   - •CertificationPath.Alias

5. If (*cap*.KeystoreCapabilities.PKCS10ExternalCertificationWithRSA = false or skipped) and (*cap*.KeystoreCapabilities.SelfSignedCertificateCreationWithRSA = false or skipped or *cap*.KeystoreCapabilities.RSAKeyPairGeneration = false or skipped) and (*cap*.KeystoreCapabilities.PKCS12CertificateWithRSAPrivateKeyUpload = false or skipped), FAIL the test and skip other steps.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetCertificationPathResponse** message.

A.40 Create a certification path validation policy

Name: HelperCreateCertPathValidationPolicy

Procedure Purpose: Helper procedure to create a certification path validation policy.

Pre-requisite: Security Configuration Service is received from the DUT. Certification path validation policy supported by the DUT as indicated by the MaximumNumberOfCertificationPathValidationPolicies capability. The DUT shall have enough free storage capacity for one additional certification path validation policy.

Input: The certification path validation policy alias (*alias*).

Returns: The certification path validation policy identifier (*certPathValidationPolicyID*), related certificate (*certID*), RSA key pair (*keyID*) and certification path if any (out *certificationPathID*).

Procedure:

1. ONVIF Client prepares certificate (out *certID*), related RSA key pair (out *keyID*) and certification path if any (out *certificationPathID*) by following the procedure mentioned in Annex A.39.

2. ONVIF Client creates certification path validation policy identifier (out *certPathValidationPolicyID*) with specified alias (in *alias*) and the certificate identifier (in *certID*) for trust anchor by following the procedure mentioned in Annex A.42.

Procedure Result:

PASS –

- DUT passes all assertions.

A.41 Provide certificate signed by private key of other certificate

Name: HelperCreateSignedCertificate

Procedure Purpose: Helper procedure to create an X.509 certificate signed by private key of other certificate.

Pre-requisite: None.

Input: The subject (*subject*) of certificate and private key (*inputPrivateKey*) of the CA-certificate (*cert*).

Returns: An X.509 certificate (*cert*) signed by input private key that is compliant to [RFC 5280] and a corresponding private key (*privateKey*) and public key (*publicKey*).

Procedure:

1. ONVIF Client creates an X.509 certificate signed by *inputPrivateKey* that is compliant to [RFC 5280] and has the following properties:
   - version:= v3
   - signature := sha1-WithRSAEncryption
   - validity := validity from *cert*
   - subject := *subject*
   - issuerDN := subjectDN from *cert*

Note: ONVIF Client may return the same certificate in subsequent invocations of this procedure for the same subject and private key.

A.42 Create a certification path validation policy with provided certificate identifier

Name: HelperCreateCertPathValidationPolicyWithCertID

Procedure Purpose: Helper procedure to create a certification path validation policy with provided certificate identifier.

Pre-requisite: Security Configuration Service is received from the DUT. Certification path validation policy supported by the DUT as indicated by the

MaximumNumberOfCertificationPathValidationPolicies capability. The DUT shall have enough free storage capacity for one additional certification path validation policy.

Input: The certification path validation policy alias (*alias*) and the certificate identifier (*certID*) for trust anchor.

Returns: The certification path validation policy identifier (*certPathValidationPolicyID*).

Procedure:

1. ONVIF Client invokes **CreateCertPathValidationPolicy** with parameters
   - Alias := *alias*
   - Parameters.RequireTLSWWWClientAuthExtendedKeyUsage skipped
   - Parameters.UseDeltaCRLs = true
   - Parameters.anyParameters skipped
   - TrustAnchor[0].CertificateID := *certID*
   - anyParameters skipped
2. The DUT responds with **CreateCertPathValidationPolicyResponse** message with parameters
   - CertPathValidationPolicyID := *certPathValidationPolicyID*

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **CreateCertPathValidationPolicyResponse** message.

A.43 Provide CRL for specified certificate

Name: HelperCreateCRLForCertificate

Procedure Purpose: Helper procedure to create CRL for specified certificate signed with specified key.

Pre-requisite: None.

Input: The certificate for revocation (*cert*) and private key for signature (*privateKey*).

Returns: A CRL (*crl*) that is compliant to [RFC 5280].

Procedure:

1. ONVIF Client creates a CRL that is compliant to [RFC 5280] signed signed by private key *privateKey* and has the following properties:
   - tbsCertList[0].version := v2
   - tbsCertList[0].signature.algorithm := sha1-WithRSAEncryption
   - tbsCertList[0].issuer := "ONVIF_DTT"
   - tbsCertList[0].thisUpdate := [current time] - 1 day
   - tbsCertList[0].nextUpdate skipped
   - tbsCertList[0].revokedCertificates[0].userCertificate := *cert*
   - tbsCertList[0].revokedCertificates[0].revocationDate := [current time] - 1 day - 1 hour
   - signatureAlgorithm.algorithm := sha1-WithRSAEncryption
   - signatureValue := sha1-WithRSAEncryption signature

Note: ONVIF Client may return the same CRL in subsequent invocations of this procedure.

A.44 Upload a passphrase

Name: HelperUploadPassphrase

Procedure Purpose: Helper procedure to upload a passphrase.

Pre-requisite: Security Configuration Service is received from the DUT. Passphrase handling is supported by the DUT as indicated by the MaximumNumberOfPassphrases capability. The DUT shall have enough free storage capacity for one additional passphrase.

Input: The passphrase (*passphrase*) and passphrase alias (*alias*).

Returns: The passphrase identifier (*passphraseID*).

Procedure:

1. ONVIF Client invokes **UploadPassphrase** with parameters
   - Passphrase := *passphrase*

    - PassphraseAlias := *alias*

2. The DUT responds with **UploadPassphraseResponse** message with parameters

    - PassphraseID =: *passphraseID*

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **UploadPassphraseResponse** message.

A.45 Remove Server Certificate Assignment

Name: HelperPreparationRemoveServerCertificateAssignment

Procedure Purpose: Helper to disable HTTPS and remove Server Certificate Assignment if required.

Pre-requisite: Security Configuration Service is received from the DUT. TLS is supported by the DUT as indicated by the TLSServerSupported capability.

Input: None.

Returns: Initial HTTPS State (*initialHTTPSState*). Removed Server Certificate Assignment (*certPathID*).

Procedure:

1. ONVIF Client invokes **GetNetworkProtocols** to retrieve configured network protocols of the DUT.
2. The DUT responds with a **GetNetworkProtocolsResponse** message with parameters

    - NetworkProtocols list =: *networkProtocolsList*

3. If *networkProtocolsList* does not contain network protocol with NetworkProtocols.Name is equal to HTTPS, FAIL the test and skip other steps.
4. If HTTPS protocol with NetworkProtocols.Name is equal to HTTPS from *networkProtocolsList* has NetworkProtocols.Enabled equal to true:

4.1. Set *initialHTTPSState* := NetworkProtocols value for HTTPS from *networkProtocolsList*.

4.2. ONVIF Client invokes **SetNetworkProtocols** message with parameters

- NetworkProtocols[0].Name := HTTPS
- NetworkProtocols[0].Enabled := false
- NetworkProtocols[0].Port := *initialHTTPSState*.Port
- NetworkProtocols[0].Extension skipped

4.3. The DUT responds with a **SetNetworkProtocolsResponse** message.

4.4. ONVIF Client waits for time *operationDelay*.

4.5. Set *HTTPSStateChangedFlag* := true.

5. ONVIF Client gets the service capabilities by following the procedure mentioned in Annex A.10 with the following input and output parameters

- out *cap* - Security Configuration Service Capabilities

6. ONVIF Client invokes **GetAssignedServerCertificates**.

7. The DUT responds with a **GetAssignedServerCertificatesResponse** message with parameters

- CertificationPathID list =: *initialCertificationPathList*

8. If number of items in *initialCertificationPathList* = *cap*.TLSServerCapabilities.MaximumNumberOfTLSCertificationPaths:

8.1. Set *certPathID* := *initialCertificationPathList*[0].

8.2. ONVIF Client invokes **RemoveServerCertificateAssignment** .

- CertificationPathID =: *certPathID*

8.3. The DUT responds with a **RemoveServerCertificateAssignmentResponse** message.

8.4. ONVIF Client waits for time *operationDelay*.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetNetworkProtocolsResponse** message.
- DUT did not send **SetNetworkProtocolsResponse** message.
- DUT did not send **GetAssignedServerCertificatesResponse** message.
- DUT did not send **RemoveServerCertificateAssignmentResponse** message.

Note: *operationDelay* will be taken from Operation Delay field of ONVIF Device Test Tool.

A.46 Restore Server Certificate Assignment

Name: HelperRestoreServerCertificateAssignment

Procedure Purpose: Helper to restore HTTPS and Server Certificate Assignment if required.

Pre-requisite: Security Configuration Service is received from the DUT. TLS is supported by the DUT as indicated by the TLSServerSupported capability.

Input: Initial HTTPS State (*initialHTTPSState*). Removed Server Certificate Assignment (*certPathID*).

Returns: None.

Procedure:

1. If *certPathID* specified:

   1.1. ONVIF Client invokes **AddServerCertificateAssignment** with parameters

   - CertificationPathID =: *certPathID*

   1.2. The DUT responds with an **AddServerCertificateAssignmentResponse** message.

   1.3. ONVIF Client waits for time *operationDelay*.

2. If *initialHTTPSState* specified:

   2.1. ONVIF Client invokes **SetNetworkProtocols** message with parameters

   - NetworkProtocols[0] := *initialHTTPSState*

   2.2. The DUT responds with a **SetNetworkProtocolsResponse** message.

2.3. ONVIF Client waits for time *operationDelay*.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **AddServerCertificateAssignmentResponse** message.
- DUT did not send **SetNetworkProtocolsResponse** message.

Note: *operationDelay* will be taken from Operation Delay field of ONVIF Device Test Tool.

A.47 Configuring HTTPS if Required

Name: HelperCheckAndConfigureHTTPS

Procedure Purpose: Helper Procedure to check and configure HTTPS using Security Configuration Service if required.

Pre-requisite: RTP/RTSP/HTTPS feature is supported by DUT. HTTPS is configured on the DUT, if TLS Server is not supported by DUT. Security Configuration Service is received from the DUT, if TLS Server is supported by DUT.

Input: None.

Returns: None.

Procedure:

1. ONVIF Client invokes **GetNetworkProtocols** request.
2. The DUT responds with **GetNetworkProtocolsResponse** with parameters
   - NetworkProtocols list =: *networkProtocolsList*
3. If *networkProtocolsList* contains item with Name = HTTPS and Enabled = true, return to the test and skip other procedure steps.
4. If the DUT does not support TLS Server, FAIL the test and skip other steps.
5. ONVIF Client configures HTTPS by following the procedure mentioned in Annex A.48.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **GetNetworkProtocolsResponse** message.

A.48 Configuring HTTPS using Security Configuration Service

Name: HelperConfigureHTTPS

Procedure Purpose: Helper Procedure to configure HTTPS using Security Configuration Service.

Pre-requisite: Security Configuration Service is received from the DUT. TLS Server is supported by the DUT. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional server certificate assignment. Current time of the DUT shall be at least Jan 01, 1970.

Input: None

Returns: None

Procedure:

1. ONVIF Client invokes **GetAssignedServerCertificates**.
2. The DUT responds with a **GetAssignedServerCertificatesResponse** message with parameters
   - CertificationPathID list =: *initialCertificationPathList*
3. If number of items in *initialCertificationPathList* >= 1, go to the step 6.
4. If Create self-signed certificate is supported by the DUT:
   - 4.1. ONVIF Client adds server certification assignment and creates related certification path, the self-signed certificate and the RSA key pair by following the procedure mentioned in Annex A.13.
   - 4.2. Go to the step 6.
5. ONVIF Client creates a certification path based on CA-signed certificate and related RSA key pair and a corresponding CA certificate and related RSA key pair by following the procedure mentioned in Annex A.49.

6. ONVIF Client invokes **SetNetworkProtocols** request with parameters
   - NetworkProtocols[0].Name := HTTPS
   - NetworkProtocols[0].Enabled := true
   - NetworkProtocols[0].Port := 443
   - NetworkProtocols[0].Extension skipped
7. The DUT responds with **SetNetworkProtocolsResponse** message.
8. ONVIF Client waits until *operationDelay* timeout expires.
9. ONVIF Client checks that HTTPS protocol Port 443 is open. If HTTPS protocol port 443 is not open, FAIL the test and skip other steps.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **SetNetworkProtocolsResponse** message.

Note: *operationDelay* will be taken from Operation Delay field of ONVIF Device Test Tool.

A.49 Add server certificate assignment with corresponding certification path, CA certificate and RSA key pair

Name: HelperAddServerCertAssign_CACertificate

Procedure Purpose: Helper Procedure to configure HTTPS using Security Configuration Service.

Pre-requisite: Security Configuration Service is received from the DUT. TLS Server is supported by the DUT. Create PCKS#10 supported by the DUT. RSA key pair generation is supported by the DUT. The DUT shall have enough free storage capacity for one additional RSA key pair. The DUT shall have enough free storage capacity for one additional certificate. The DUT shall have enough free storage capacity for one additional certification path. The DUT shall have enough free storage capacity for one additional server certificate assignment.

Input: None

Returns: The identifiers of the new certification path (*certPathID*), certificate (*certID*) and RSA key pair (*keyID*).

Procedure:

1. ONVIF Client creates an RSA key pair by following the procedure mentioned in Annex A.7 with the following input and output parameters
   - out *keyID* - RSA key pair
2. ONVIF Client invokes **CreatePKCS10CSR** with parameter
   - Subject := subject (see Annex A.2)
   - KeyID := *keyID*
   - CSRAttribute skipped
   - SignatureAlgorithm.algorithm := 1.2.840.113549.1.1.5 (OID of SHA-1 with RSA Encryption algorithm)
3. The DUT responds with **CreatePKCS10CSRResponse** message with parameters
   - PKCS10CSR =: *pkcs10*
4. ONVIF Client creates an CA certificate by following the procedure mentioned in Annex A.4 with the following input and output parameters
   - out *CAcert* - CA certificate
   - out *privateKey* - private key for the CA certificate
   - out *publicKey* - public key for the CA certificate
5. Create an [RFC5280] compliant X.509 certificate (*cert*) from the PKCS#10 request (*pkcs10*) with the following properties:
   - version:= v3
   - signature := sha1-WithRSAEncryption
   - subject := subject from the PKCS#10 request (*pkcs10*)
   - subject public key := subject public key in the PKCS#10 request (*pkcs10*)
   - validity := not before 19700101000000Z and not after 99991231235959Z
   - certificate signature is generated with the private key (*privateKey*) in the CA certificate (*CAcert*)
   - certificate extensions := the X.509v3 extensions from the PKCS#10 request (*pkcs10*)

6. ONVIF Client invokes **UploadCertificate** with parameters
   - Certificate := *cert*
   - Alias := "ONVIF_Test1"
   - PrivateKeyRequired := true
7. The DUT responds with a **UploadCertificateResponse** message with parameters
   - CertificateID =: *certID*
   - KeyID =: *keyID*
8. ONVIF Client invokes **CreateCertificationPath** with parameters
   - CertficateIDs.CertificateID[0] := *certID*
   - Alias := "ONVIF_Test2"
9. The DUT responds with a **CreateCertificationPathResponse** message with parameters
   - CertificationPathID =: *certPathID*
10. ONVIF Client invokes **AddServerCertificateAssignment** with parameters
    - CertificationPathID := *certPathID*
11. The DUT responds with an **AddServerCertificateAssignmentResponse** message.
12. ONVIF Client waits for time *operationDelay*.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **CreatePKCS10CSRResponse** message.
- DUT did not send **UploadCertificateResponse** message.
- DUT did not send **CreateCertificationPathResponse** message.
- DUT did not send **AddServerCertificateAssignmentResponse** message.

Note: *operationDelay* will be taken from Operation Delay field of ONVIF Device Test Tool.

A.50 Basic TLS Handshake With Protocol Version Alert

Name: HelperBasicTLSHandshakeProtocolVersionAlert

Procedure Purpose: Helper procedure to verify basic TLS handshake in case of "protocol_version" alert message.

Pre-requisite: TLS is supported by the DUT as indicated by the TLSServerSupported capability. TLS is configured. HTTPS protocol is enabled.

Input: Disabled TLS version (*disabledTLSVersion*).

Returns: None

Procedure:

1. ONVIF Client invokes **ClientHello** with parameters
   - ClientVersion := *disabledTLSVersion*
   - Random number := *ClientRandom[32]*, that is 4-byte number that consists of the client's date and time plus a 28-byte randomly generated number
   - CipherSuites := list of common CipherSuites used by TLS 1.0, SSL 2.0 and 3.0
   - Compression methods list := NONE
   - <SessionID> skipped
2. The DUT TLS server responds with a **protocol_version** alert message and close connection.

Procedure Result:

PASS –

- DUT passes all assertions.

FAIL –

- DUT did not send **protocol_version** alert message.