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# REVISION HISTORY

<table>
<thead>
<tr>
<th>Vers.</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
</table>
| 19.06 | Jun 17, 2019 | The following was done according to #309:  
'Validated Feature' section for each feature updated to be synchronized with feature ID used in feature list.  
'Feature Under Test' section for each test case updated to be synchronized with sub-feature ID used in feature list.  
'Validated Feature List' test case section removed. |
| 18.06 | Jun 21, 2018 | Reformatting document using new template                                                                                                   |
| 18.06 | Apr 05, 2018 | 'Required Number of Devices Summary' Annex added according to #241                                                                           |
| 18.06 | Feb 14, 2018 | The following were updated in the scope of #241:  
Feature Level Requirement (updated with new rules)  
Each Feature Level Requirement (updated with Check Condition based on Device Features and Required Number of Devices) |
| 17.12 | Aug 15, 2017 | Requirement level of Profile T of the following features was changed from Mandatory to Conditional according to #220:  
Relay Outputs  
Get Digital Inputs |
| 17.06 | Jun 15, 2017 | Links in Normative references section were updated.                                                                                         |
The following Device IO test cases moved from ONVIF Profile T Client Test Specification according to #194:  
Relay Outputs Using Device IO  
Get Digital Inputs |
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1 Introduction

The goal of the ONVIF Test Specification set is to make it possible to realize fully interoperable IP physical security implementations from different vendors. This specification also acts as an input document to the development of a test tool which will be used to test the ONVIF Client implementation conformance towards ONVIF standard. This Client Test Tool analyzes network communications between ONVIF Devices and Clients being tested and determines whether a specific Client is ONVIF conformant (see ONVIF Conformance Process Specification).

This particular document defines test cases required for testing Device IO Service features of a Client application e.g. Relay Outputs, Digital Inputs. It also describes the test framework, test setup, prerequisites, test policies needed for the execution of the described test cases.

1.1 Scope

This ONVIF Device IO Client Test Specification defines and regulates the conformance testing procedure for the ONVIF conformant Clients in the scope of Device IO Service features. Conformance testing is meant to be black-box network traces analysis and verification. The objective of this specification is to provide the test cases to test individual requirements of ONVIF Clients in the scope of Device IO Service features according to ONVIF Profile Specifications.

The principal intended purposes are:

- Provide self-assessment tool for implementations.
- Provide comprehensive test suite coverage for Device IO Service features.

This specification does not address the following:

- 3rd parties Client use cases
- Non-functional (performance and regression) testing and analysis.
- SOAP Implementation Interoperability test i.e. Web Services Interoperability Basic Profile version 2.0 (WS-I BP2.0).
- Network protocol implementation Conformance test for HTTPS and HTTP protocols.

The following sections cover test cases needed for the verification of relevant features as mentioned in the ONVIF Profile Specifications.

1.2 Relay Outputs Using Device IO

Relay Outputs Using Device IO section specifies Client ability to control of Relay Outputs connected to a device.
1.3 Get Digital Inputs

Get Digital Inputs section specifies Client ability to retrieve of Digital Inputs connected to a device.
2 Normative references

- ONVIF Conformance Process Specification:
  https://www.onvif.org/profiles/conformance/

- ONVIF Profile Policy:
  https://www.onvif.org/profiles/

- ONVIF Core Specifications:
  https://www.onvif.org/profiles/specifications/

- ONVIF Core Client Test Specification:
  https://www.onvif.org/profiles/conformance/client-test/

- ONVIF Device IO Service Specification:
  https://www.onvif.org/profiles/specifications/

- ISO/IEC Directives, Part 2, Annex H:
  http://www.iso.org/directives

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

- WS-BaseNotification:
  http://docs.oasis-open.org/wsn/wsn-ws_base_notification-1.3-spec-os.pdf

- W3C SOAP 1.2, Part 1, Messaging Framework:
  http://www.w3.org/TR/soap12-part1/

- W3C XML Schema Part 1: Structures Second Edition:
  http://www.w3.org/TR/xmlschema-1/

- W3C XML Schema Part 2: Datatypes Second Edition:
  "http://www.w3.org/TR/xmlschema-2/ [http://www.w3.org/TR/xmlschema-2/]"
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 describes terms and definitions used in this document.

**Profile**
See ONVIF Profile Policy.

**ONVIF Device**
Computer appliance or software program that exposes one or multiple ONVIF Web Services.

**ONVIF Client**
Computer appliance or software program that uses ONVIF Web Services.

**Conversation**
A Conversation is all exchanges between two MAC addresses that contains SOAP request and response.

**Network**
A network is an interconnected group of devices communicating using the Internet protocol.

**Network Trace Capture file**
Data file created by a network protocol analyzer software (such as Wireshark). Contains network packets data recorded during a live network communications.

**SOAP**
SOAP is a lightweight protocol intended for exchanging structured information in a decentralized, distributed environment. It uses XML technologies to define an extensible messaging framework providing a message construct that can be exchanged over a variety of underlying protocols.

**Client Test Tool**
ONVIF Client Test Tool that tests ONVIF Client implementation towards the ONVIF Test Specification set.

**Configuration Entity**
A network video device media abstract component that produces or consumes a media stream on the network, i.e. video and/or audio stream.

**Reference Token**
Token provided by the device to uniquely reference an instance of a physicalIO.

**Input/Output (I/O)**
Currently relay ports and Video/Audio Inputs/Outputs are handled.

3.3 Abbreviations

This section describes abbreviations used in this document.

**XML**
eXtensible Markup Language.
HTTP Hyper Text Transport Protocol.

HTTPS Hyper Text Transport Protocol over Secure Socket Layer.

URI Uniform Resource Identifier.

WSDL Web Services Description Language.

XML eXtensible Markup Language.

3.4 Namespaces

Prefix and namespaces used in this test specification are listed in Table 1. These prefixes are not part of the standard and an implementation can use any prefix.

Table 3.1. Defined namespaces in this specification

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Namespace URI</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>soapenv</td>
<td><a href="http://www.w3.org/2003/05/soap-envelope">http://www.w3.org/2003/05/soap-envelope</a></td>
<td>Envelope namespace as defined by SOAP 1.2 [SOAP 1.2, Part 1]</td>
</tr>
<tr>
<td>xs</td>
<td><a href="http://www.w3.org/2001/XMLSchema">http://www.w3.org/2001/XMLSchema</a></td>
<td>Instance namespace as defined by XS [XML-Schema, Part1] and [XMLSchema, Part 2]</td>
</tr>
<tr>
<td>tns1</td>
<td><a href="http://www.onvif.org/ver10/topics">http://www.onvif.org/ver10/topics</a></td>
<td>The namespace for the ONVIF topic namespace</td>
</tr>
<tr>
<td>tt</td>
<td><a href="http://www.onvif.org/ver10/schema">http://www.onvif.org/ver10/schema</a></td>
<td>ONVIF XML schema descriptions</td>
</tr>
<tr>
<td>tmd</td>
<td><a href="http://www.onvif.org/ver10/deviceIO/wsdl">http://www.onvif.org/ver10/deviceIO/wsdl</a></td>
<td>The namespace for the WSDL DeviceIO service</td>
</tr>
</tbody>
</table>
4 Test Overview

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

An ONVIF client compliant to Device IO features supports for control of Digital Inputs, and Relay Outputs.

An ONVIF Profile is described by a fixed set of functionalities through a number of services that are provided by the ONVIF standard. A number of services and functionalities are mandatory for each type of ONVIF Profile. An ONVIF Device and ONVIF Client may support any combination of Profiles and other optional services and functionalities.

4.1 General

Test Cases are grouped depending on features. Each Test Cases group provides description of feature requirement level for Profiles, expected scenario under test and related test cases:

- Feature Level Normative Reference
- Expected Scenarios Under Test
- List of Test Cases

4.1.1 Feature Level Requirement

Feature Level Requirement item contains a feature ID, check condition based on Device features, required number of Devices and feature requirement level for the Profiles, which will be used for Profiles conformance.

To claim this Feature as supported Client shall pass Expected Scenario Under Test:

- for each Device, which supports Device Features defined in Check Condition Based on Device Features
- for at least with number of Devices specified in Required Number of Devices

If Feature Level Requirement is defined as Mandatory for some Profile, Client shall support this Feature to claim this Profile Conformance.

4.1.2 Expected Scenarios Under Test

Expected Scenarios Under Test item contains expected scenario under test, conditions when the feature will be defined as supported and as not supported.
4.1.3 Test Cases

Test Case items contain list of test cases which are related to feature. Test cases provide exact procedure of testing feature support conditions.

Each Test Case contains the following parts:

- Test Label - Unique label for each test
- Test Case ID - Unique ID for each test
- Profile Normative References - Normative Reference level for the feature under test is defined in Profile Specification. This reference is informative and will not be used in conformance procedure.
- Feature Under Test - Feature which is under current test. Typically a particular command or an event.
- Test Purpose - The purpose of current test case.
- Pre-Requisite - The pre-requisite defines when the test should be performed. In case if pre-requisite does not match, the test result will be NOT DETECTED.
- Test Procedure - scenario expected to be reflected in network trace file.
- Test Result - Passed and failed criteria of the test case. Depending on these criteria test result will be defined as PASSED or FAILED.

4.2 Test Setup

Collect Network Traces files required by the test cases.

Collect Feature List XML files for Devices detected in the Network Trace files.

Client shall support all mandatory and conditional features listed in the Device Feature List XML file supplied for the Profiles supported by the Client.

For ONVIF compatibility, the ONVIF Client shall follow the requirements of the conformance process. For details please see the latest ONVIF Conformance Process Specification.

4.3 Prerequisites

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

The Device shall be configured with an IPv4 address.
The Device shall be able to be discovered by the Client.
5 Relay Outputs Using Device IO Test Cases

5.1 Feature Level Normative Reference:

**Validated Feature:** Relay Outputs (RelayOutputsUsingDeviceIO)

**Check Condition based on Device Features:** Relay Outputs (Device IO Service) is supported by Device.

**Required Number of Devices:** 1

**Profile T Requirement:** Conditional

5.2 Expected Scenarios Under Test:

1. Client connects to Device to control of Relay Outputs connected to a device.

2. Client is considered as supporting Relay Outputs if the following conditions are met:
   - Client is able to retrieve available Relay Outputs using `GetRelayOutputs` operation (Device IO Service) AND
   - Client is able to control Relay Output state using `SetRelayOutputState` operation (Device IO Service).

3. Client is considered as NOT supporting Relay Outputs if ANY of the following is TRUE:
   - No valid response to `GetRelayOutputs` request (Device IO Service) OR
   - No valid response to `SetRelayOutputState` request (Device IO Service).

5.3 GET RELAY OUTPUTS USING DEVICE IO

**Test Label:** Relay Output - Get Relay Outputs

**Test Case ID:** RELAYOUTPUTSUSINGDEVICEIO-1

**Feature Under Test:** Get Relay Outputs (RelayOutputsUsingDeviceIO_GetRelayOutputsUsingDeviceIO)

**Profile T Normative Reference:** Conditional

**Test Purpose:** To verify that relay outputs provided by Device is received by Client using the `GetRelayOutputs` operation.
Pre-Requisite:

- The Network Trace Capture files contains at least one Conversation between Client and Device with GetRelayOutputs operation for Device IO Service present.
- Device supports RelayOutputs for Device IO Service (RelayOutputs).
- Client supports Capabilities feature.
- The Client Test Tool retrieves Device IO Service address from device's response on GetServices or GetCapabilities Client request.

Test Procedure (expected to be reflected in network trace file):

1. Client invokes GetRelayOutputs request message to Device IO Service to retrieve relay outputs from the Device.

2. Device responds with code HTTP 200 OK and GetRelayOutputsResponse message.

Test Result:

PASS -

- Client GetRelayOutputs request messages to Device IO Service are valid according to XML Schemas listed in Namespaces AND
- Client GetRelayOutputs request to Device IO Service in Test Procedure fulfills the following requirements:
  - [S1] soapenv:Body element has child element tds:GetRelayOutputs AND
- Device response on the GetRelayOutputs request fulfills the following requirements:
  - [S2] It has HTTP 200 response code AND

FAIL -

- The Client failed PASS criteria.

5.4 SET RELAY OUTPUT STATE USING DEVICE IO

Test Label: Relay Output - Set Relay Output State

Test Case ID: RELAYOUTPUTSUSINGDEVICEIO-2
Feature Under Test: Set Relay Output
(RelayOutputsUsingDeviceIO_SetRelayOutputStateUsingDeviceIO)

Profile T Normative Reference: Conditional

Test Purpose: To verify that Client is able to trigger a relay output using the SetRelayOutputState operation.

Pre-Requisite:

- Device supports RelayOutputs for Device IO Service (RelayOutputs).
- The Network Trace Capture files contain at least one Conversation between Client and Device with SetRelayOutputState operation for Device IO Service present.
- Client supports Capabilities feature.
- The Client Test Tool retrieves Device IO Service address from device's response on GetServices or GetCapabilities Client request.

Test Procedure (expected to be reflected in network trace file):

1. Client invokes SetRelayOutputState request message to Device IO Service to trigger a relay output on the Device.
2. Device responds with code HTTP 200 OK and SetRelayOutputStateResponse message.

Test Result:

PASS -

- Client SetRelayOutputState request messages to Device IO Service are valid according to XML Schemas listed in Namespaces AND

- Client SetRelayOutputState request to Device IO Service in Test Procedure fulfills the following requirements:
  - [S1] soapenv:Body element has child element tds:SetRelayOutputState AND

- Device response on the SetRelayOutputState request fulfills the following requirements:
  - [S2] It has HTTP 200 response code AND

FAIL -

- The Client failed PASS criteria.
6 Get Digital Inputs Test Cases

6.1 Feature Level Normative Reference:

Validated Feature: Get Digital Inputs (GetDigitalInputs)

Check Condition based on Device Features: Digital Inputs (Device IO Service) is supported by Device.

Required Number of Devices: 1

Profile T Requirement: Conditional

6.2 Expected Scenarios Under Test:

1. Client connects to Device to retrieve of Digital Inputs connected to a device using GetDigitalInputs operation.

2. Client subscribes to device messages using CreatePullPointSubscription operation to get tns1:Device/Trigger/DigitalInput notifications.

3. Client uses Pull Point event mechanism to retrieve notification events from Device.

4. Client is considered as supporting Digital Inputs if the following conditions are met:
   - Client is able to retrieve available Digital Inputs using GetDigitalInputs operation AND
   - Client supports EventHandling_Pullpoint feature AND
   - Client is able to monitor the state of the input pins using tns1:Device/Trigger/DigitalInput event if device supports DigitalInputs feature.

5. Client is considered as NOT supporting Digital Inputs if ANY of the following is TRUE:
   - No valid response to GetDigitalInputs request OR
   - Client does not support EventHandling_Pullpoint feature OR
   - Client does not support tns1:Device/Trigger/DigitalInput event.

6.3 GET DIGITAL INPUTS

Test Label: Get Digital Inputs

Test Case ID: GETDIGITALINPUTS-1
Feature Under Test: Get Digital Inputs (GetDigitalInputs_GetDigitalInputsRequest)

Profile T Normative Reference: Conditional

Test Purpose: To verify that digital inputs provided by Device is received by Client using the GetDigitalInputs operation.

Pre-Requisite:

- The Network Trace Capture files contains at least one Conversation between Client and Device with GetDigitalInputs operation present.
- Device supports Digital Inputs feature (DigitalInputs).

Test Procedure (expected to be reflected in network trace file):

1. Client invokes GetDigitalInputs request message to retrieve digital inputs from the Device.

Test Result:

PASS -

- Client GetDigitalInputs request messages are valid according to XML Schemas listed in Namespaces AND
- Client GetDigitalInputs request in Test Procedure fulfills the following requirements:
  - [S1] soapenv:Body element has child element tmd:GetDigitalInputs AND
- Device response on the GetDigitalInputs request fulfills the following requirements:
  - [S2] It has HTTP 200 response code AND

FAIL -

- The Client failed PASS criteria.
Annex A Test for Appendix A

A.1 Required Number of Devices Summary

Required number of devices and Device feature dependency used in this test specification are listed in the Table.

Table A.1. Required Number of Devices Summary

<table>
<thead>
<tr>
<th>Feature ID</th>
<th>Feature Name</th>
<th>Required Number of Devices</th>
<th>Check Condition based on Device Features</th>
<th>Check Condition based on Device Features ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>tc.RelayOutputsUsingDeviceIO</td>
<td>Relay Outputs Using Device IO</td>
<td>1</td>
<td>Relay Outputs (Device IO Service) is supported by Device.</td>
<td>RelayOutputs</td>
</tr>
<tr>
<td>tc.GetDigitalInputs</td>
<td>Get Digital Inputs</td>
<td>1</td>
<td>Digital Inputs (Device IO Service) is supported by Device.</td>
<td>DigitalInputs</td>
</tr>
</tbody>
</table>