



BSI Standards Publication

Video surveillance systems for use in security applications

Part 2-3: Video transmission
protocols — IP interoperability
implementation based on
Web services

National foreword

This British Standard is the UK implementation of EN 62676-2-3:2014. It is identical to IEC 62676-2-3:2013.

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A list of organizations represented on this committee can be obtained on request to its secretary.

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**Video surveillance systems for use in security applications -
Part 2-3: Video transmission protocols -
IP interoperability implementation based on Web services
(IEC 62676-2-3:2013)**

Systèmes de vidéosurveillance destinés à
être utilisés dans les applications de
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Partie 2-3: Protocoles de transmission
vidéo -
Mise en oeuvre de l'interopérabilité IP en
fonction des services Web
(CEI 62676-2-3:2013)

Videoüberwachungsanlagen für
Sicherungsanwendungen -
Teil 2 3: Videoübertragungsprotokolle -
IP-Interoperabilität auf Basis von
Webservices
(IEC 62676-2-3:2013)

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Foreword

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- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2014-09-12
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2016-12-12

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Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
ITU-T G711	-	Pulse code modulation (PCM) of voice frequencies	-	-
ITU-T Recommendation X.680	1997	Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation	-	-
ITU-T Recommendation X.681	1997	Information technology - Abstract Syntax Notation One (ASN.1): Information object specification	-	-
ITU-T Recommendation X.682	1997	Information technology – Abstract Syntax Notation One (ASN.1): Constraint specification	-	-
ITU-T Recommendation X.683	1997	Information technology – Abstract Syntax Notation One (ASN.1): Parameterization of ASN.1 specifications	-	-
ITU-T Recommendation X.690	1997	Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)	-	-
NIST FIPS 180-2	-	Secure Hash Standard	-	-
IETF RFC 1305	-	Network Time Protocol, Version 3 - Specification and Implementation	-	-
IETF RFC 2131	-	Dynamic Host Configuration Protocol	-	-
IETF RFC 2136	-	Dynamic Updates in the Domain Name System (DNS UPDATE)	-	-
IETF RFC 2246	-	The TLS Protocol Version 1.0	-	-
IETF RFC 2326	-	Real time Streaming protocol (RTSP)	-	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IETF RFC 2435	-	RTP Payload Format for JPEG-compressed Video	-	-
IETF RFC 2616	-	Hypertext Transfer Protocol HTTP/1.1.	-	-
IETF RFC 2617	-	HTTP Authentication: Basic and Digest Access Authentication	-	-
IETF RFC 2782	-	A DNS RR for specifying the location of services (DNS SRV)	-	-
IETF RFC 3268	-	Advanced Encryption Standard (AES) Ciphersuites for Transport Layer Security (TLS)	-	-
IETF RFC 3315	-	Dynamic Host Configuration Protocol for IPv6 (DHCPv6)	-	-
IETF RFC 3550	-	A Transport Protocol for Real-Time Applications	-	-
IETF RFC 3551	-	RTP Profile for Audio and Video Conferences with Minimal Control	-	-
IETF RFC 3927	-	Dynamic Configuration of IPv4 Link-Local Addresses	-	-
IETF RFC 3984	-	RTP Payload Format for H.264 Video	-	-
IETF RFC 3986	-	Uniform Resource Identifier (URI): Generic Syntax	-	-
IETF RFC 4514	-	Lightweight Directory Access Protocol (LDAP): String Representation of Distinguished Names	-	-
IETF RFC 4566	-	SDP: Session Description Protocol	-	-
IETF RFC 4571	-	Framing Real-time Transport Protocol (RTP) and RTP Control Protocol (RTCP) Packets over Connection-Oriented Transport	-	-
IETF RFC 4702	-	The Dynamic Host Configuration Protocol (DHCP) Client Fully Qualified Domain Name (FQDN) Option	-	-
IETF RFC 4861	-	Neighbor Discovery for IP version 6 (IPv6)	-	-
IETF RFC 4862	-	IPv6 Stateless Address Autoconfiguration	-	-
W3C SOAP 1.2 Part 1	-	Messaging Framework	-	-
W3C SOAP Version 1.2 Part 2	-	Adjuncts (Second Edition)	-	-
OASIS Web Services Base Notification 1.3	-		-	-
OASIS Web Services Security Username Token Profile 1.0	-		-	-
W3C XML Schema Part 1	-	Structures Second Edition	-	-
W3C XML Schema Part 2	-	Datatypes Second Edition	-	-
W3C XML-binary Optimized Packaging	-		-	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
W3C XML Path Language (XPath) Version 1.0	-		-	-
IEEE 802.11	2007	IEEE Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications	-	-
IEEE 802.1X	-	Port Based Network Access Control	-	-
UDDI Version 2.04	-	API Specification UDDI Committee Specification, 19 July 2002	-	-
UDDI Version 2.03	-	Data Structure Reference UDDI Committee Specification, 19 July 2002	-	-
Web Services Security X.509	-	Certificate Token Profile 1.1	-	-

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INTRODUCTION

The IEC Technical Committee 79 in charge of alarm and electronic security systems together with many governmental organisations, test houses and equipment manufacturers have defined a common framework for video surveillance transmission in order to achieve interoperability between products.

The IEC 62676 series of standards on video surveillance system is divided into 4 independent parts:

- Part 1 System requirements
- Part 2: Video transmission protocols
- Part 3: Analog and digital video interfaces
- Part 4 : Application guidelines (to be published)

Each part has its own clauses on scope, references, definitions and requirements.

This IEC 62676-2 series consists of 3 subparts, numbered parts 2-1, 2-2 and 2-3 respectively:

IEC 62676-2-1, *Video transmission protocols – General requirements*

IEC 62676-2-2, *Video transmission protocols – IP interoperability implementation based on HTTP and REST services*

IEC 62676-2-3, *Video transmission protocols – IP interoperability implementation based on Web services*

This third subpart of IEC 62676-2 covers IP Interoperability Implementation Based Web Services. It is based on the requirements for IP video transmission protocols covered in IEC 62676-2-1, which defines protocol requirements to be fulfilled by any high-level IP video device interface.

VIDEO SURVEILLANCE SYSTEMS FOR USE IN SECURITY APPLICATIONS –

Part 2-3: Video transmission protocols – IP interoperability implementation based on Web services

1 Scope

This part 2-3 of IEC 62676 defines procedures for communication between network video clients and video transmitter devices based on Web Services. This new set of specifications makes it possible to build network video systems with devices and receivers from different manufacturers using common and well defined interfaces. These interfaces cover functions such as device management, real-time streaming of audio and video, event handling, Pan, Tilt and Zoom (PTZ) control, video analytics as well as control, search and replay of recordings.

The management and control interfaces defined in this standard are described as Web services. This international standard also contains full XML schema and Web Service Description Language (WSDL) definitions for the introduced network video services.

In order to offer full plug-and-play interoperability, the standard defines procedures for device discovery. The device discovery mechanisms in the standard are based on the WS-Discovery specification with extensions. These extensions have been introduced in order to cover the specific network video discovery needs.

This standard is not limited to discovery, configuration and control functions, but defines precise formats for media and metadata streaming in IP networks using suitable profiling of IETF standards. Furthermore, appropriate protocol extensions have been introduced in order to make it possible for network video manufacturers to offer a fully standardized network video transfer solution to its customers and integrators.

A video transmission device supporting compliance to the requirements of this standard with the help of Web services according to the specification of this part is declared as compatible to IEC 62676-2 Web service Interoperability.

The goal of this standard is to realize a fully interoperable network video implementation comprised of products from different network video vendors. This standard describes the network video model, interfaces, data types and data exchange patterns. The standard reuses existing relevant standards where available, and introduces new specifications only where necessary to support the specific requirements for network video surveillance. This is the Open Network Video Interface Forum (ONVIF) core specification. In addition, ONVIF has released the following related specifications:

- ONVIF Schema [see C.15]
- ONVIF Analytics Service WSDL [see C.1]
- ONVIF Analytics Device Service [see C.2]
- ONVIF Device Service WSDL [see C.4]
- ONVIF DeviceIO Service WSDL [see C.3]
- ONVIF Display Service WSDL [see C.5]
- ONVIF Event Service WSDL [see C.6]
- ONVIF Imaging Service WSDL [see C.7]
- ONVIF Media Service WSDL [see C.8]

- ONVIF PTZ Service WSDL [see C.9]
- ONVIF Receiver Service WSDL [see C.10]
- ONVIF Recording Service WSDL [see C.11]
- ONVIF Remote Discovery WSDL [see C.12]
- ONVIF Replay Service WSDL [see C.13]
- ONVIF Search Service WSDL [see C.14]
- ONVIF Topic Namespace XML [see C.16]

The purpose of this standard is to define the ONVIF specification framework, and is divided into the following sections:

Specification overview: Gives an overview of the different specification parts and how they are related to each other.

Web Services Framework: Offers a brief introduction to Web Services and the Web Services basis for the ONVIF specifications.

IP configuration: Defines the ONVIF network video IP configuration requirements.

Device discovery: Describes how devices are discovered in local and remote networks.

Device management: Defines the network video transmitter management commands.

DeviceIO: Defines commands to handle physical inputs and outputs.

Display: Defines commands to deal with display devices.

Imaging and media: Defines the configuration commands related to imaging and media settings.

Real time streaming: Provides requirements for interoperable video, audio and metadata streaming.

Event handling: Defines how to subscribe to and receive data from network video events (notifications).

PTZ control: Provides commands for pan, tilt and zoom control.

Video analytics: Defines the ONVIF analytics model, analytics object description and analytics rules configurations.

Video analytics device: Defines commands to deal with a video analytics device.

Recording control: Defines mechanism for the configuring of recordings.

Recording search and replay control: Provides commands for retrieval of recorded media including metadata.

Security section: Defines the transport and message level security requirements on ONVIF compliant implementations.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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IETF RFC 3550, *RTP: A Transport Protocol for Real-Time Applications*

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IETF RFC 3551, *RTP Profile for Audio and Video Conferences with Minimal Control*

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IETF RFC 3927, *Dynamic Configuration of IPv4 Link-Local Addresses*

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<<http://www.w3.org/TR/2007/REC-soap12-part2-20070427/>>

OASIS Web Services Base Notification 1.3

<http://docs.oasis-open.org/wsn/wsn-ws_base_notification-1.3-spec-os.pdf>

OASIS Web Services Security UsernameToken Profile 1.0

<<http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0.pdf>>

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/>>

W3C XML-binary Optimized Packaging

<<http://www.w3.org/TR/2005/REC-xop10-20050125/>>

W3C XML Path Language (XPath) Version 1.0

<<http://www.w3.org/TR/xpath/>>

IEEE 802.11:2007, *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications*

<<http://standards.ieee.org/getieee802/download/802.11-2007.pdf>>

IEEE 802.1X, Port-Based Network Access Control

[<http://standards.ieee.org/getieee802/download/802.1X-2004.pdf>](http://standards.ieee.org/getieee802/download/802.1X-2004.pdf)

[UDDI API ver2] “*UDDI Version 2.04 API Specification UDDI Committee Specification, 19 July 2002*”, OASIS standard, 19 July 2002

[<http://uddi.org/pubs/ProgrammersAPI-V2.04-Published-20020719.pdf>](http://uddi.org/pubs/ProgrammersAPI-V2.04-Published-20020719.pdf)

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[<http://uddi.org/pubs/DataStructure-V2.03-Published-20020719.pdf>](http://uddi.org/pubs/DataStructure-V2.03-Published-20020719.pdf)

[WS-X.509Token] “*Web Services Security X.509 Certificate Token Profile 1.1*”, OASIS Standard, 1 February 2006.

[<http://www.oasis-open.org/committees/download.php/16785/wss-v1.1-spec-os-x509TokenProfile.pdf>](http://www.oasis-open.org/committees/download.php/16785/wss-v1.1-spec-os-x509TokenProfile.pdf)

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1

ad-hoc network

an independent basic service set

[SOURCE: IEEE 802.11:2007]

3.1.2

basic service set

a set of IEEE 802.11 stations that have successfully joined in a common network

[SOURCE: IEEE 802.11:2007]

3.1.3

capability

ability of a device that allows a client to ask for its services

3.1.4

configuration entity

a network video device media abstract component that is used to produce a media stream on the network

Note 1 to entry: The media stream is a video and/or an audio stream.

3.1.5

control plane

plane consisting of media control functions

Note 1 to entry: Media control functions are device control, media configuration and PTZ commands.

3.1.6

digital PTZ

function that diminishes or crops an image to adjust the image position and ratio

3.1.7 **input/output** **IO**

external connectors

EXAMPLES: Digital inputs, relay ports and video/audio inputs/outputs.

3.1.8 **layout**

arrangement of display areas (panes) on a monitor

3.1.9 **media plane**

plane consisting of media stream

Note 1 to entry: The media stream is video, audio and metadata.

3.1.10 **media profile**

set of configurations defining a subset of audio/video source, encoder and decoder settings including PTZ and analytics parameters

3.1.11 **metadata**

set of all streaming data except video and audio, including video analytics results, PTZ position data and other metadata

Note 1 to entry: The other metadata include textual data from POS applications.

3.1.12 **network video transmitter**

network video server that sends media data over an IP network to a client

Note 1 to entry: A network video server is an IP network camera or an encoder device.

3.1.13 **network video display**

network video receiver that receives media data over an IP network from e.g. an NVT

EXAMPE: An IP network video monitor.

3.1.14 **network video storage**

a device that records media and metadata received from a streaming device, such as an NVT, over an IP network to a permanent storage medium

Note 1 to entry: The NVS also enables clients to review the stored data.

3.1.15 **network video analytics**

a device that performs analysis on data received from a streaming device, such as an NVT, or a storage device, such as an NVS

3.1.16 **pane**

area of the physical display

3.1.17 **public Key cryptography standards**

group of public key cryptography standards devised and published by RSA Security

3.1.18

pre shared key

a static key that is distributed to the device

3.1.19

PTZ node

low-level PTZ entity that maps to the PTZ device and its capabilities

3.1.20

pullpoint

resource for pulling messages

Note 1 to entry: By pulling messages, notifications are not blocked by firewalls.

3.1.21

recording

currently stored media (if any) and metadata on the NVS from a single data source

Note 1 to entry: A recording comprises one or more tracks. A recording can have more than one track of the same type e.g. two different video tracks recorded in parallel with different settings.

3.1.22

recording event

an event associated with a recording, represented by a notification message in the APIs

3.1.23

recording job

a job performs the transfer of data from a data source to a particular recording using a particular configuration

3.1.24

remote discovery proxy

remote DP

the remote DP allows a NVT to register at the remote DP and at the NVC to find registered NVTs through the remote DP even if the NVC and NVT resides in different administrative network domains

3.1.25

scene description

metadata output by video analytics describing object location and behaviour

3.1.26

track

an individual data channel consisting of video, audio, or metadata

3.1.27

video analytics

algorithms or programs used to analyze video data and to generate data describing object location and behaviour

3.1.28

Wi-Fi protected access

a certification program created by the Wi-Fi Alliance to indicate compliance with the security protocol covered by the program

3.2 Abbreviations

AAC	Advanced Audio Coding
API	Application Programming Interface
ASCII	7 Bit Character Encoding
ASN	Abstract Syntax Notation
AVP	Audio/Video Profile
AVPF	Audio/Video Profile for rtcp Feedback
BLC	Back Light Compensation
BSSID	Basic Service Set Identifier
CA	Certificate Authority
CBC	Cipher-Block Chaining
CCMP	Counter mode with Cipher-block chaining Message authentication code Protocol
DER	Distinguished Encoding Rules
DHCP	Dynamic Host Configuration Protocol
DHT	Define Huffman Table
DM	Device Management
DNS	Domain Name Server
DQT	Define Quantization Table
DP	Discovery Proxy
DRI	Define Restart Interval
EAP	Extensible Authentication Protocol
EOI	End Of Image
FIPS	Federal Information Processing Standard
FOV	Field Of View
GW	Gateway
HMAC	Hash-based Message Authentication Code
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol over Secure Socket Layer
IO, I/O	Input/Output
IP	Internet Protocol
IPv4	Internet Protocol Version 4
IPv6	Internet Protocol Version 6
Ir	Infrared
JFIF	JPEG File Interchange Format
JPEG	Joint Photographic Expert Group
LAN	Local Area Network
MPEG-4	Moving Picture Experts Group - 4
MTOM	Message Transmission Optimization Mechanism
NAT	Network Address Translation
NFC	Near Field Communication
NTP	Network Time Protocol
NVA	Network Video Analytics Device

NVC	Network Video Client
NVD	Network Video Display
NVT	Network Video Transmitter
NVS	Network Video Storage Device
OASIS	Organization for the Advancement of Structured Information Standards
ONVIF	Open Network Video Interface Forum
PLI	Picture Loss Indication
POSIX	Portable Operating System Interface
PKCS	Public Key Cryptography Standards
PSK	Pre Shared Key
PTZ	Pan/Tilt/Zoom
QVGA	Quarter Video Graphics Array (320 x 240 Pixel)
REL	Rights Expression Language
RSA	Rivest, Sharmir and Adleman
RTCP	RTP Control Protocol
RTP	Realtime Transport Protocol
RTSP	Real Time Streaming Protocol
SAML	Security Assertion Markup Language
SDP	Session Description Protocol
SHA	Secure Hash Algorithm
SOAP	Simple Object Access Protocol
SOI	Start Of Image
SOF	Start Of Frame
SOS	Start Of Scan
SR	Sender Report
SSID	Service Set Identifier
TCP	Transmission Control Protocol
TLS	Transport Layer Security
TKIP	Temporal Key Integrity Protocol
TTL	Time To Live
UDDI	Universal Description, Discovery and Integration
UDP	User Datagram Protocol
URI	Uniform Resource Identifier
URN	Uniform Resource Name
USB	Universal Serial Bus
UDDI	Universal Description Discovery and Integration
UTC	Coordinated Universal Time
UTF	Unicode Transformation Format
UUID	Universally Unique Identifier
WDR	Wide Dynamic Range
WPA	Wi-Fi Protected Access
WS	Web Services
WSDL	Web Services Description Language

WS-I	Web Services Interoperability
XML	eXtensible Markup Language
XPath	XML Path Language

4 Overview

This standard is based on network video use cases covering both local and wide area network scenarios. The specification starts from a core set of interface functions for configuration and operation of network video devices by defining their server side interfaces. The set of network video devices includes Network Video Transmitter (NVT), Network Video Display (NVD), Network Video Storage (NVS) and Network Video Analytics (NVA). The framework is designed to be extended and enhanced in future versions.

The framework covers procedures from the network video device deployment and the configuration phase to the real time streaming phase for different network video scenarios.

This standard covers device discovery, device configuration, events, PTZ control, video analytics and real time streaming functionality for live video, as well as search, replay and recording management functionality for recorded video.

All services share a common XML schema and all data types are provided in [ONVIF Schema]. The different services are defined in the respective sections and service WSDL documents.

4.1 Web services

The term Web services is the name of a standardized method of integrating applications using open, platform independent Web Services standards such as XML, SOAP 1.2 [Part 1] and WSDL1.1 over an IP network. XML is used as the data description syntax, SOAP is used for message transfer and WSDL is used for describing the services.

This framework is built upon Web Services standards. All configuration services defined in the standard are expressed as Web Services operations and defined in WSDL with HTTP as the underlying transport mechanism.

Figure 1 gives an overview of the basic principles for development based on Web Services. The service provider (device) implements the ONVIF service or services.

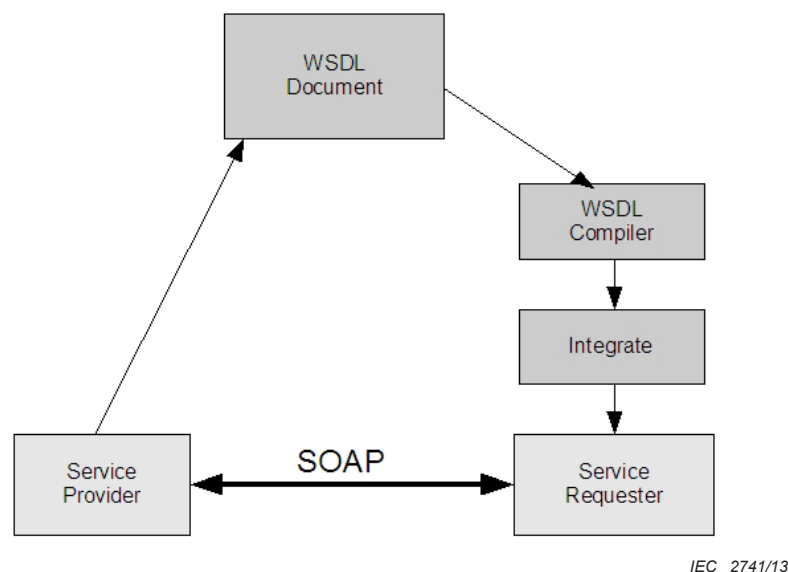


Figure 1 – Web Services based development principles

The service is described using the XML-based WSDL. Then, the WSDL is used as the basis for the service requester (client) implementation/integration. Client-side integration is simplified through the use of WSDL compiler tools that generate platform specific code that can be used by the client side developer to integrate the Web Service into an application.

The Web Service provider and requester communicate using the SOAP message exchange protocol. SOAP is a lightweight, XML-based messaging protocol used to encode the information in a Web Service request and in a response message before sending them over a network. SOAP messages are independent of any operating system or protocol and may be transported using a variety of Internet protocols. This ONVIF standard defines conformant transport protocols for the SOAP messages for the described Web Services.

The Web Service overview section defines the different ONVIF services, the command definition syntax in the specification, error handling principles and the adopted Web Service security mechanisms.

To ensure interoperability, all defined services follow the Web Services Interoperability Organization (WS-I) basic profile 2.0 recommendations and use the document/literal wrapped pattern.

4.2 IP configuration

The IP configuration section defines the IP configuration compliance requirements and recommendations. IP configuration includes:

- IP network communication capability;
- static IP configuration;
- dynamic IP configuration.

4.3 Device discovery

The configuration interfaces defined in this standard are Web Services interfaces that are based on the WS-Discovery standard. This use of this standard makes it possible to reuse a suitable existing Web Service discovery framework, instead of requiring a completely new service or service addressing definition.

This standard introduces a specific discovery behaviour suitable for video surveillance purposes. For example, a fully interoperable discovery requires a well defined service definition and a service searching criteria. The specification covers device type and scopes definitions in order to achieve this.

A successful discovery provides the device service address. Once a client has the device service address it can receive detailed device information through the device service, see 4.5 below.

In addition to the standard web services discovery protocol this standard supports remote discovery proxies to find registered devices through the remote discovery proxy even if the client and the device reside in different administrative network domains.

4.4 Device types

The device type signals the primary function of a device. This standard specifies the following set of device types:

- network Video Transmitter (NVT);
- network Video Display (NVD);
- network Video Storage (NVS);
- network Video Analytics (NVA).

For each device type a number of services are mandatory which are defined in 5.1.2. A device may support other optional services and device signals availability of optional services via the device discovery.

4.5 Device management

Device management functions are handled through the device service. The device service is the entry point to all other services provided by a device. WSDL for the device service is provided in the Device Management WSDL file. The device management interfaces consist of these subcategories:

- capabilities;
- network;
- system;
- security.

4.5.1 Capabilities

The capability commands allow a client to ask for the services provided by a device and to determine which general and vendor specific services are offered by the device. The capabilities are structured as the different device services and are further divided into subcategories (when applicable) as follows:

- analytics,
- device,
 - capabilities,
 - network,
 - system,
 - I/O,
 - security,
- event,
- imaging,

- media,
- PTZ,
- device IO,
- display,
- recording,
- search,
- replay,
- analytics device.

The capabilities for the different categories indicate those commands and parameter settings that are available for the particular service or service subcategory.

4.5.2 Network

The following set of network commands allows standardized management of functions:

- get and set hostname;
- get and set DNS configurations;
- get and set NTP configurations;
- get and set dynamic DNS;
- get and set network interface configurations;
- enable/disable and list network protocols;
- get and set default gateway;
- get and set zero configuration;
- get, set, add and delete IP address filter.

4.5.3 System

The system commands are used to manage the following device system settings:

- get device information;
- make system backups;
- get and set system date and time;
- factory default reset;
- upgrade firmware;
- get system log;
- get device diagnostics data (support information);
- reboot;
- get and set device discovery parameters.

4.5.4 Retrieval of system information

System Information, such as system logs, vendor-specific support information and configuration backup images, may be retrieved using either MTOM or HTTP.

The MTOM method is supported by the `GetSystemLog`, `GetSystemSupportInformation` and `GetSystemBackup` commands. The HTTP method is supported by the `GetSystemUri` command; this retrieves URIs from which the files may be downloaded using an HTTP GET operation.

4.5.5 Firmware upgrade

Two mechanisms are provided for upgrading the firmware on a device. The first uses the UpgradeSystemFirmware command to send the new firmware image using MTOM.

The second is a two stage process; first the client sends the StartFirmwareUpgrade command to instruct the device to prepare for upgrade, then it sends the firmware image using HTTP POST.

The HTTP method is designed for resource-limited devices that may not be capable of receiving a new firmware image in its normal operating state.

4.5.6 System restore

The System Restore capability allows a device's configuration to be restored from a backup image. Again two mechanisms are provided. The first uses the RestoreSystem command to send the backup image using MTOM. The second uses the StartSystemRestore command followed by an HTTP POST operation to send the backup image.

4.5.7 Security

The following security operations are used to manage the device security configurations:

- get and set access security policy;
- handle user credentials and settings;
- handle HTTPS server certificates;
- enable/disable HTTPS client authentication;
- key generation and certificate download functions;
- handle IEEE 802.1X supplicant certificate;
- handle IEEE 802.1X CA certificate;
- IEEE 802.1X configuration.

4.6 DeviceIO

The DeviceIO service offers commands to retrieve and configure the settings of physical inputs and outputs of a device.

The DeviceIO service supports the configuration of the following device interfaces:

- VideoOutputs;
- VideoSources;
- AudioOutputs;
- AudioSources;
- RelayOutputs.

The following commands list existing interfaces:

- GetVideoOutputs – gets all existing video outputs of the device;
- GetVideoSources – gets all existing video sources of the device;
- GetAudioOutputs – gets all existing audio outputs of the device;
- GetAudioSources – gets all existing audio sources of the device;
- GetRelayOutputs – gets all existing relay outputs of the device.

For VideoOutputs, VideoSources, AudioOutputs and AudioSources the following commands are supported:

- *Set<device name>Configuration* – modifies the configuration of a specific interface;
- *Get<device name>Configuration* – gets the configuration of a specific interface;
- *Get<device name>ConfigurationOptions* – gets the supported property values for a specific interface.

RelayOutputs supports following commands:

- *SetRelayOutputSettings* – modifies the configuration of a relay output;
- *SetRelayOutputState* – sets the logical state.

WSDL for the DeviceIO service is specified in [Annex C.3].

4.7 Imaging configuration

The imaging service provides configuration and control data for imaging specific properties. WSDL is part of the framework and provided in the Imaging WSDL file.

The service includes the following operations:

- get and set imaging configurations (exposure time, gain and white balance, for example);
- get imaging configuration options (valid ranges for imaging parameters);
- move focus lens;
- stop ongoing focus movement;
- get current position and move status for focus.

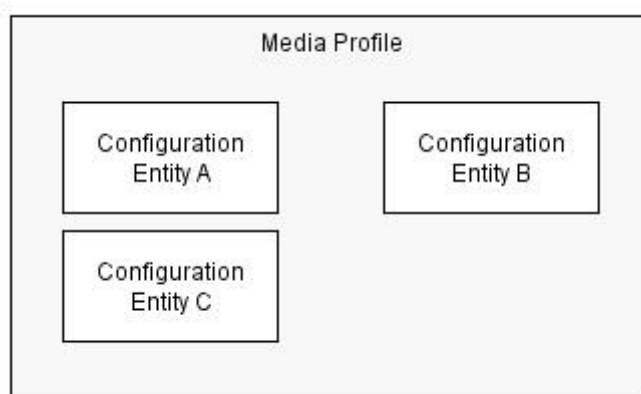
4.8 Media configuration

4.8.1 General

Media configurations are handled through the media service. Media configurations are used to determine the streaming properties of requested media streams as defined in this standard. The device provides media configuration through the media service. WSDL for the media service is provided in the Media WSDL file.

4.8.2 Media profiles

Real-time video and audio streaming configurations are controlled using media profiles. A media profile maps a video and/or audio source to a video and/or an audio encoder, PTZ and analytics configurations (see Figure 2). The NVT presents different available profiles depending on its capabilities (the set of available profiles might change dynamically though).



IEC 2742/13

Figure 2 – A media profile

A device having Media configuration service provides at least one media profile at boot. A device may provide “ready to use” profiles for the most common media configurations that the device offers.

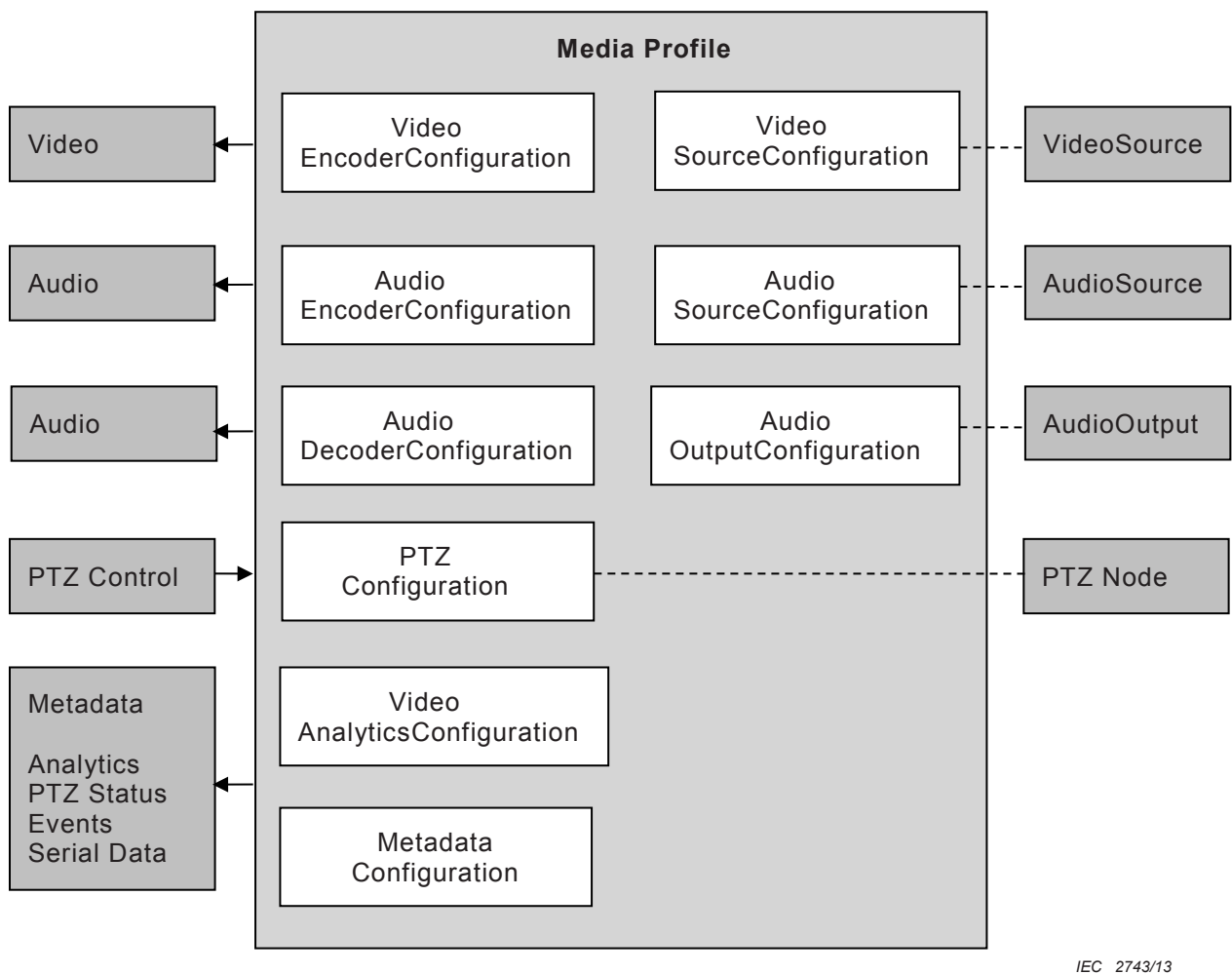
The Profile contains a “fixed” attribute that indicates if a profile can be deleted or not. If a profile is fixed or not is defined by the NVT.

A profile consists of a set of interconnected *configuration entities*. Configurations are provided by the NVT and can be either static or created dynamically by the NVT. For example, the dynamic configurations can be created by the NVT depending on current available encoding resources. A configuration entity is one of the following:

- video source configuration;
- audio source configuration;
- video encoder configuration;
- audio encoder configuration;
- PTZ configuration;
- video analytics configuration;
- metadata configuration;
- audio output configuration;
- audio decoder configuration.

A profile consists of all or a subset of these configuration entities. Depending on the capabilities of the NVT, a particular configuration entity can be part of a profile or not. For example, a profile with an audio source and an audio encoder configuration can exist only in a device with audio support.

An example of a complete profile configuration is illustrated in Figure 3.



IEC 2743/13

Figure 3 – Complete profile configuration

A media profile describes how and what to present to the client in a media stream as well as how to handle PTZ input and Analytics.

The following commands list existing sources:

- *GetVideoSources* – gets all existing video sources in the device;
- *GetAudioSources* – gets all existing audio sources in the device;
- *GetAudioOutputs* – gets all existing audio outputs in the device.

The following commands manage Media Profiles:

- *CreateProfile* – creates a new media profile;
- *GetProfiles* – gets all existing media profiles;
- *GetProfile* – gets a specific media profile;
- *DeleteProfile* – deletes a specific media profile;
- *Add<configuration entity>* – adds a specific configuration entity to the media profile;
- *Remove<configuration entity>* – removes a specific configuration entity from a media profile.

The following commands manage Configuration Entities:

- *Get<configuration entity>Options* – gets the valid property values for a specific configuration entity;
- *Set<configuration entity>* – sets a configuration entity configuration;
- *Get<configuration entity>s* – gets all existing configuration entities of the type;
- *Get<configuration entity>* – gets a specific configuration entity;
- *GetCompatible<configuration entity>s* – gets all configuration entities compatible with a specific media profile,

where *<configuration entity>* is the type of configuration entity. For example, the complete command to get a video encoder configuration is:

GetVideoEncoderConfiguration.

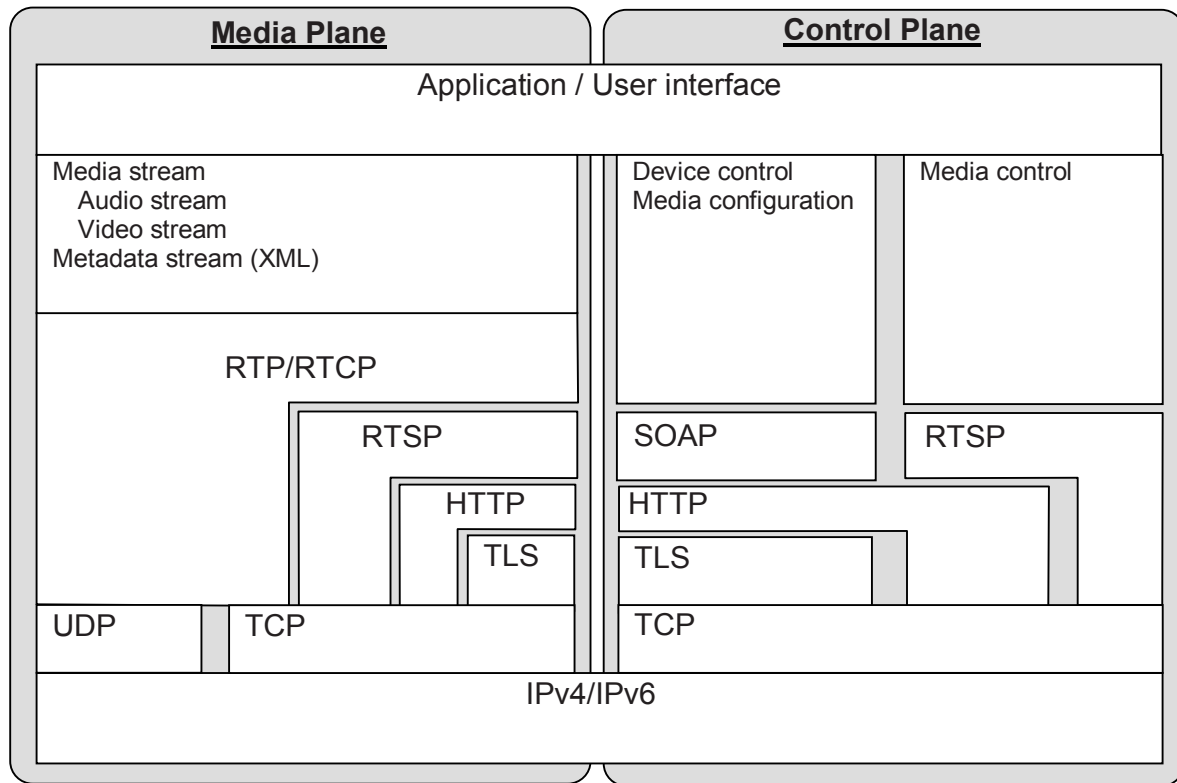
The following commands initiate and manipulate a video/audio stream:

- *GetStreamUri* – requests a valid RTSP or HTTP stream URI for a specific media profile and protocol;
- *StartMulticastStreaming* – starts multicast streaming using a specified media profile;
- *StopMulticastStreaming* – stops a multicast stream;
- *SetSynchronizationPoint* – inserts a synchronization point (I-frame, etc) in active streams;
- *GetSnapshotUri* – requests a valid HTTP URI for a specific media profile that can be used to obtain a JPEG snapshot.

Refer to Clause 5 for examples of how the profiles are used in a client implementation.

4.9 Real-time streaming

This standard defines media streaming options and formats. A distinction is made between *media plane* and *control plane*, as illustrated in Figure 4. A set of media streaming (audio, video and meta data) options, all based on RTP [RFC 3550], are described in order to provide interoperable media streaming services.



IEC 2744/13

Figure 4 – Layer structure

The metadata streaming container format allows well-defined, real-time streaming of analytics, PTZ status and notification data.

Media configuration is done over SOAP/HTTP and is covered by the media configuration service as discussed in 4.8.

Media control is accomplished over RTSP as defined in RFC 2326. This standard utilizes RTP, RTCP and RTSP profiling, as well as JPEG over RTP extensions and multicast control mechanisms.

The standard introduces extensions to the RTSP standard to allow bi-directional streaming connections.

Streaming configurations for the following video codecs are provided:

- JPEG (over RTP), see 12.1.3;
- MPEG-4, Simple Profile (SP) [ISO/IEC 14496-2];
- MPEG-4, Advanced Simple Profile (ASP) [ISO/IEC 14496-2];
- H.264, baseline [ISO/IEC 14496-10];

- H.264, main [ISO/IEC 14496-10];
- H.264, extended [ISO/IEC 14496-10];
- H.264, high [ISO/IEC 14496-10];

and for the following audio codecs:

- G.711 [ITU-T G.711];
- G.726 [ITU-T G.726];
- AAC [ISO/IEC 14496-3].

4.10 Event handling

Event handling is based on the OASIS WS-BaseNotification and WS-Topics specifications. These specifications allow the reuse of a rich notification framework without the need to redefine event handling principles, basic formats and communication patterns.

Firewall traversal, according to WS-BaseNotification, is handled through a *PullPoint* notification pattern. This pattern, however, does not allow real-time notification. Hence, this standard defines an alternative *PullPoint* communication pattern and service interface. The *PullPoint* pattern allows a client residing behind a firewall to receive real-time notifications while utilizing the WS-BaseNotification framework.

A fully standardized event requires standardized notifications. However, the notification topics will, to a large extent, depend on the application needs. This standard defines a set of basic notification topics that a device is recommended to support, see Annex A. In addition, for some services, this standard extends the basic notification topics with mandatory events.

WSDL for the event service including extensions is provided in the Event WSDL file.

4.11 PTZ control

The PTZ service is used to control a Pan Tilt and Zoom (PTZ) video encoder device. WSDL for the PTZ service is provided in the PTZ WSDL file.

The PTZ control principle follows the *MediaProfile* model (see 4.8) and consists of three major blocks:

- PTZ Node – low-level PTZ entity that maps to the PTZ device and its capabilities;
- PTZ Configuration – holds the PTZ configuration for a specific PTZ Node;
- PTZ Control Operation – PTZ, preset and status operations.

The relationship of the three items mentioned above is depicted in Figure 5.

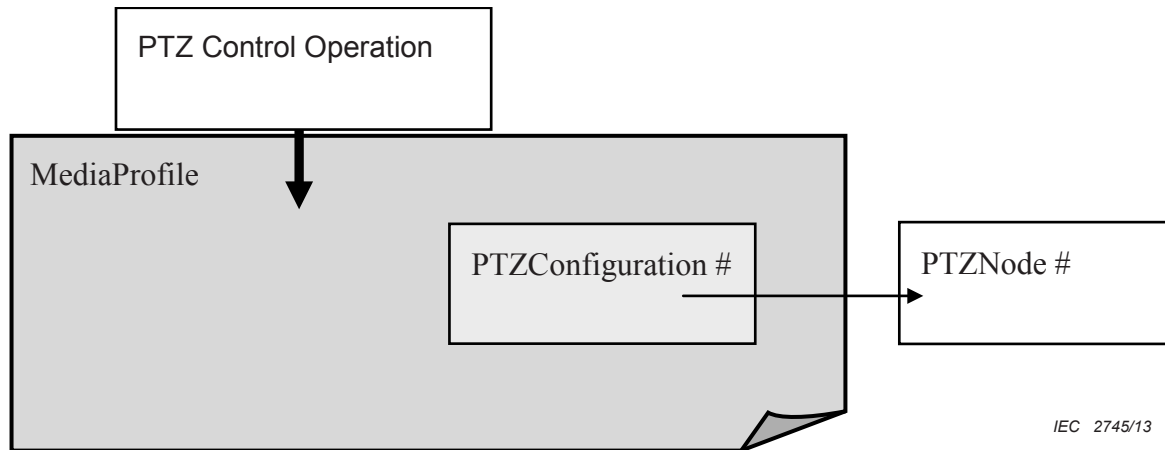


Figure 5 – PTZ control model

A PTZ capable NVT may have one or many PTZ nodes. The PTZ node may be a mechanical PTZ driver, an uploaded PTZ driver on a video encoder or a digital PTZ driver. The PTZ node is the lowest level entity of the PTZ Control and it specifies the supported PTZ capabilities.

PTZ configurations are set *per media profile* and are handled through these configuration commands:

- get and set configurations for pan, tilt and zoom;
- get configuration options for pan, tilt and zoom.

This standard defines the following PTZ control operations:

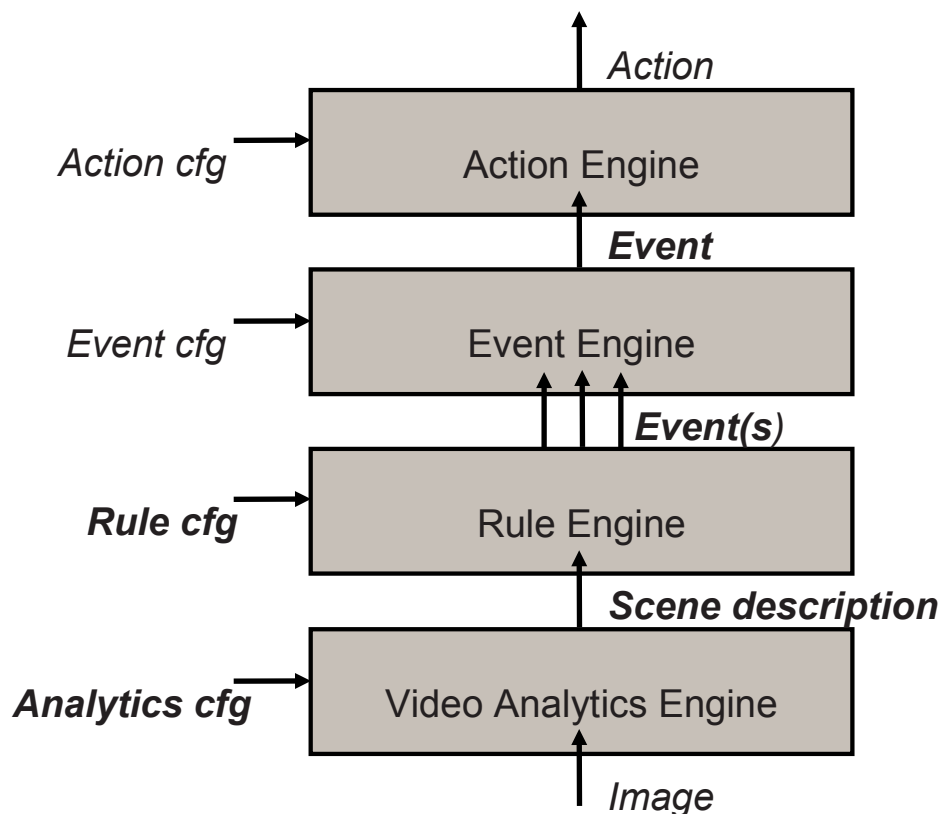
- PTZ absolute, relative and continuous move operations;
- stop operation;
- get PTZ status information (position, error and move status, for example);
- get, set, remove and move to preset position;
- get, set and move to home position.

4.12 Video analytics

Video analytic applications are divided into image analysis and application-specific parts. The interface between these two parts produces an abstraction that describes the scene based on the objects present. Video analytic applications are reduced to a comparison of the scene descriptions and of the scene rules (such as virtual lines that are prohibited to cross, or polygons that define a protected area). Other rules may represent intra-object behaviour such as objects following other objects (to form a tailgating detection). Such rules can also be used to describe prohibited object motion, which may be used to establish a speed limit.

These two separate parts, referred to as the video analytics engine and as the rule engine, together with the events and actions, form the video analytics architecture according to this standard as illustrated in Figure 6.

The video analytics architecture consists of elements and interfaces. Each element provides a functionality corresponding to a semantically unique entity of the complete video analytics solution. Interfaces are unidirectional and define an information entity with a unique content. Only the interfaces are subject to this specification. Central to this architecture is the ability to distribute any elements or sets of adjacent elements to any device in the network.



IEC 2746/13

Figure 6 – Video analytics architecture

The following interfaces are defined in this standard:

- analytics configuration interface;
- scene description;
- rule configuration interface;
- event interface.

The standard defines a configuration framework for the Video Analytics Engine. This framework enables a client to ask the device for supported analytics modules responsible for their configurations. Configurations of such modules can be dynamically added, removed or modified by a client, allowing a client to run multiple Video Analytics Modules in parallel if supported by the device.

The output from the Video Analytics Engine is called a *Scene Description*. The Scene Description represents the abstraction of the scene in terms of the objects, either static or dynamic, that are part of the scene. This standard defines an XML-based Scene Description Interface including data types and data transport mechanisms.

Rules describe how the scene description is interpreted and how to react on that information. The standard defines standard rule syntax and methods to communicate these rules from the application to the device.

An event signals the state of the analysis of the scene description and the associated rules. The event interface is both the input and the output of the event engine element. The event interface is handled through the general notification and topics framework (see 4.10).