ONVIF™
Display Service Specification

Version 2.1
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CONTENTS

1   Scope

This document defines the web service interface for configuration of the display of a Video rendering device with optional Audio support. Additionally the associated events are defined.

Web service usage is outside of the scope of this document. Please refer to the ONVIF core specification.

2   Normative references

ONVIF Core Specification

<http://www.onvif.org/specs/core/ONVIF-Core-Spec-v210.pdf>

ONVIF Receiver Service Specification

<http://www.onvif.org/specs/srv/rcv/ONVIF-Receiver-Service-Spec-v210.pdf>

ONVIF DeviceIO Service Specification

<http://www.onvif.org/specs/srv/io/ONVIF-DeviceIo-Service-Spec-v210.pdf>

3   Terms and Definitions

3.1   Definitions

Layout	Defines the arrangement of display areas (panes) on a monitor
Pane	Defines an area on a physical display.

3.2   Abbreviations

RTSP	Real Time Streaming Protocol

4   Overview

The display service provides functions to enable a client to control and configure display devices. The service introduces panes, each of which occupies an area of the physical display. The configuration of the pane maps audio inputs and outputs to a video output. The configuration also references a Receiver Object which receives the data to be displayed. Functions to retrieve and configure the configuration of a pane are provided.
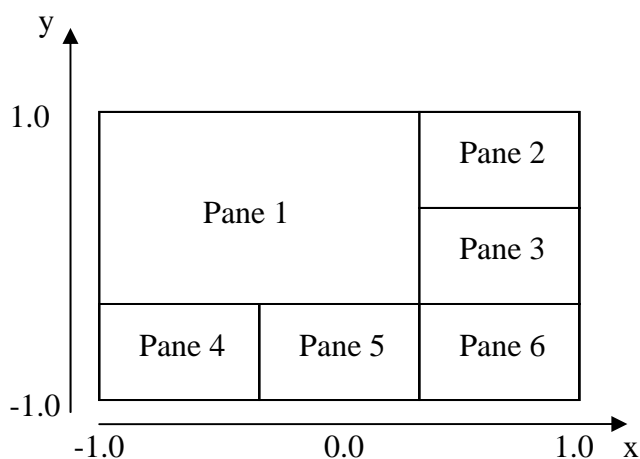

Figure 1: Example layout with six panes and coordinate system

A layout defines how these panes are visible on the display (e.g single view or quad view). The service introduces commands to retrieve the current layout of a display and change the layout.

The service also introduces commands to request the encoding and decoding capabilities of a video output as well as the layout options.

WSDL for the display service is specified in http://www.onvif.org/ver10/display.wsdl.

5   Display Service

A display device has a fixed number of video outputs, each of which may be attached to a monitor. A client can request the video outputs of the device using the DeviceIO service. Each of these outputs is configured with a layout (e.g. single view or split screen). The layout defines a number of video panes, each of which occupies an area of the physical display.

A network video display may also have fixed number of audio inputs and audio outputs. Each of these outputs may be associated with a pane. Associating an audio input or output with a pane maps the audio and video streams from a transmitter device automatically to the correct outputs. The pane also contains a pointer to a receiver where the necessary information to connect the display device to a transmitter is stored.

The Display Service offers functions to configure the Panes and describe and change the layout of the display device. The possible layouts and coding capabilities of a video output can be requested.

A display device shall support the Display Service as defined in [DisplayService.wsdl].

5.1 Panes

A Pane is a display area on the monitor that is attached to a video output. A pane has a PaneConfiguration that describes which entities are associated with the pane. The PaneConfiguration includes:

Pane Token: A unique identifier in the display device.

Pane Name: Configuration name.

AudioOutputToken: A pointer to the audio output that is associated with the pane. A client can retrieve the available audio outputs of a device using the GetAudioOutputs command of the DeviceIO service.

AudioSourceToken: A pointer to the audio source that is associated with this pane. The audio connection from a display device to the NVT is established using the backchannel mechanism. A client can retrieve the available audio sources of a device using the GetAudioSources command of the DeviceIO service.

AudioEncoderConfiguration: The configuration of the audio encoder including codec, bitrate and sample rate.

ReceiverToken: A pointer to a receiver as defined in the ONVIF Recevier Service Specification that has the necessary information to receive Data from a Transmitter. This Receiver can be connected and the network video display displays the received data on the specified outputs. A client can

retrieve the available Receivers using the GetReceivers command of the Receiver Service.

A client has to configure the pane according to the connection to be established by setting the AudioOutput and/or AudioSourceToken. If a Token is not set, the corresponding session will not be established.

Changing the PaneConfiguration or the parameters of a referenced receiver shall not affect the RTSP connection. If a client intends to apply the new parameters it shall restart the RTSP connection.

The pane layout (see 5.2) of the video output defines if and where (position, size) a Pane is currently visible. The receiver should only establish an RTSP connection to receive data if the pane is visible. Layout changes shall not affect running streams.

5.1.1 GetPaneConfigurations

This command list all currently defined Panes of a device for a specified video output (regardless if this pane is visible at a moment). A display device shall support the retrieval of its configured panes through this command.

Table 1: GetPaneConfigurations

GetPaneConfigurations	Access Class: READ_MEDIA
Message name	**Description**
GetPaneConfigurationsRequest	*The **VideoOutput** element specifies the Video Output whose PaneConfigurations are requested.* tt:ReferenceToken **VideoOutput**[1][1]
GetPaneConfigurationsResponse	*Contains a list of defined Panes of the specified VideoOutput. Each VideoOutput has at least one PaneConfiguration.* tt:PaneConfiguration **PaneConfiguration** [1][unbounded]
Fault codes	**Description**
env:Sender ter:InvalidArgVal ter:NoVideoOutput	*The requested Video Output does not exist*

5.1.2 GetPaneConfiguration

If the pane token is already known this command can be used to get the pane configuration. A display device shall support the retrieval of a specific pane configuration through this command.

Table 2: GetPaneConfiguration

GetPaneConfiguration	Access Class: READ_MEDIA
Message name	**Description**

GetPaneConfigurationRequest	*This message contains the token of the pane whose configuration is requested. It also conatins a* **VideoOutput** *token that specifies the Video Output that contains the requested pane.* tt:ReferenceToken **VideoOutput**[1][1] tt:ReferenceToken **Pane**[1][1]
GetPaneConfigurationResponse	*Contains the requested PaneConfiguration* tt:PaneConfiguration **PaneConfiguration** [1][1]
Fault codes	**Description**
env:Sender ter:InvalidArgVal ter:NoPane	*The requested pane does not exist*
env:Sender ter:InvalidArgVal ter:NoVideoOutput	*The requested Video Output does not exist*

5.1.3 SetPaneConfigurations

This command changes the Configuration of all existing panes in one step. The message contains all PaneConfigurations (modified and not modified ones) of the video output. A display device shall support the modification of its panes configuration through this command.

Table 3: SetPaneConfigurations

SetPaneConfigurations	Access Class: ACTUATE
Message name	**Description**
SetPaneConfigurationsRequest	*This message contains the configuration of all panes of the specified VideoOutput.* *The PaneConfiguration element contains the modified configuration.* tt:ReferenceToken **VideoOutput**[1][1] tt:PaneConfiguration **PaneConfiguration**[1][unbounded]
SetPaneConfigurationsResponse	*This message is empty*
Fault codes	**Description**
env:Sender ter:InvalidArgVal ter:invalidConfig	*The configuration is not possible to set*
env:Sender ter:InvalidArgVal ter:NoVideoOutput	*The requested Video Output does not exist*

5.1.4 SetPaneConfiguration

This command changes the Configuration of a single pane. A display device shall support the modification of a single pane configuration through this command.

Table 4: SetPaneConfiguration

SetPaneConfiguration	Access Class: ACTUATE
Message name	**Description**
SetPaneConfigurationRequest	This message contains the token of the video output and the new PaneConfiguration . tt:ReferenceToken **VideoOutput**[1][1] tt:PaneConfiguration **PaneConfiguration**[1][1]
SetPaneConfigurationResponse	This message is empty
Fault codes	**Description**

env:Sender
  ter:InvalidArgVal
    ter:NoPane
	The requested pane does not exist

env:Sender
  ter:InvalidArgVal
    ter:NoVideoOutput
	The requested Video Output does not exist

env:Sender
  ter:InvalidArgVal
    ter:InvalidConfig
	The configuration is not possible to set

5.1.5 CreatePaneConfiguration

This command creates a pane configuration. A display device that supports dynamic creation of panes shall support the creation of a pane configuration through this command.

A service implementation is free to choose any suitable token for the PaneConfiguration and may ignore the content of the token field.

Table 5: CreatePaneConfiguration

CreatePaneConfiguration	Access Class: ACTUATE
Message name	**Description**
CreatePaneConfigurationRequest	This message contains the token of the video output and the new PaneConfiguration tt:ReferenceToken **VideoOutput**[1][1] tt:PaneConfiguration **PaneConfiguration**[1][1]
CreatePaneConfigurationResponse	This message contains the token of the the new PaneConfiguration. tt:ReferenceToken **PaneToken**[1][1]
Fault codes	**Description**

env:Sender
  ter:InvalidArgVal
    ter:MaxNumberOfPane
	The maximum number of panes is reached

env:Sender
  ter:InvalidArgVal
    ter:NoVideoOutput
	The requested Video Output does not exist

env:Sender
  ter:InvalidArgVal
    ter:InvalidConfig
	The configuration is not possible to set

5.1.6 DeletePaneConfiguration

This command deletes a pane configuration. A display device that supports dynamic deletion of panes shall support the deletion of a pane configuration through this command.

Table 6: DeletePaneConfiguration

DeletePaneConfiguration	Access Class: ACTUATE
Message name	**Description**
DeletePaneConfigurationRequest	*This message contains the token of the video output and the PaneConfiguration.* tt:ReferenceToken **VideoOutput**[1][1] tt:ReferenceToken **PaneToken**[1][1]
DeletePaneConfigurationResponse	*This message is empty*
Fault codes	**Description**

env:Sender
  ter:InvalidArgVal
    ter:FixedPane
	It is not possible to delete this pane configuration

env:Sender
  ter:InvalidArgVal
    ter:NoVideoOutput
	The requested Video Output does not exist

env:Sender
  ter:InvalidArgVal
    ter:NoPane
	The requested pane configuration does not exist.

5.2 Layout

The Layout assigns a pane configuration to a certain area of the display. The layout settings directly affect a specific video output. The layout consists of a list of PaneConfigurations and their associated display areas. If the device supports overlapping panes then the order the panes are displayed on the monitor is defined by the order of the PaneConfigurations in the list. The first Pane in the list is the one that is displayed in the foreground.

A device may either provide a fixed number of supported layouts or it is possible to configure the layout free.

5.2.1 GetLayout

This command returns the current layout of a video output. A display device shall support the retrieval of its layout through this command.

Table 7: GetLayout

GetLayout	Access Class: READ_MEDIA
Message name	**Description**
GetLayoutRequest	*Contains the VideoOutputToken of the output the display is connected to.* tt:ReferenceToken **VideoOutput**[1][1]
GetLayoutResponse	*Contains the current layout of the VideoOutput* tt:Layout **Layout**[1][1]
Fault codes	**Description**

env:Sender
  ter:InvalidArgVal
    ter:NoVideoOutput
	*The requested Video Output indicated with **VideoOutput** does not exist.*

5.2.2 SetLayout

The SetLayout operation can be used to change the layout of a display (e.g. change from single view to split screen view). A display device shall support the change of layout through this command.

A device implementation shall be tolerant against rounding errors when matching a layout against its fixed set of layouts by accepting differences of at least one percent.

Table 8: SetLayout

SetLayout	Access Class: ACTUATE
Message name	**Description**
SetLayoutRequest	*This message contains the token of the video output and the modified layout* tt:ReferenceToken **VideoOutput** [1][1] tt:Layout **Layout**[1][1]
SetLayoutResponse	*This message is an empty message*
Fault codes	**Description**

env:Sender
  ter:InvalidArgVal
    ter:InvalidLayout
	It is not possible to set the layout

env:Sender
  ter:InvalidArgVal
    ter:NoVideoOutput
	*The requested Video Output indicated with **VideoOutput** does not exist.*

5.3   Display Options

The Display Options contain the supported layouts (LayoutOptions) and the decoding and encoding capabilities (CodingCapabilities) of the device. The GetDisplayOptions command returns both, Layout and Coding Capabilities, of a VideoOutput.

LayoutOptions

The LayoutOptions describe the fixed and predefined layouts of a device. If the device does not offer fixed layouts and allows setting the layout free this element is empty.

Coding Capabilities

The network video display is able to decode audio and video streams using suitable decoding algorithms. The network video display supports any audio and video decoders, bitrates and resolution according to the manufacturer's choice.

In order to ensure interoperability between the different devices, this specification mandates the following decoder profiles:

The NVD shall support JPEG QVGA.

The NVD shall support G.711μ Law (if it supports audio)

These are the same codecs that are mandatory for the NVT.

There are no parameters to configure a decoder; a decoder shall decode all content (according to its capabilities) it receives. In case of decoding errors the decoder should try to request a synchronization point and try to continue decoding. It shall generate an event as defined in section 5.4.1.

The CodingCapabilities Element gives an indication about the decoding and encoding capabilities of the device.

5.3.1 GetDisplayOptions

This command lists layout and coding capabilities of a video output. A display device shall support the retrieval of its DisplayOptions through this command.

Table 9: GetDisplayOptions

GetDisplayOptions	Access Class: READ_MEDIA
Message name	**Description**
GetDisplayOptionsRequest	*This message contains the token of the video output for which the information is requested.* tt:ReferenceToken **VideoOutput[**1][1]
GetDisplayOptionsResponse	*Message containing the available layouts as well as codings for the VideoOutput.* tt:LayoutOptions **LayoutOptions**[0][1] tt:CodingCapabilities **CodingCapabilities**[1][1]
Fault codes	**Description**
env:Sender ter:InvalidArgVal ter:NoVideoOutput	*The requested VideoOutputToken does not exist*

5.4 Events

The display service shall dispatch events through the event service.

5.4.1 Decoding error event

The device shall be capable of generating the following event whenever it receives a bitstream that it is not able to decode.

There are several reasons why a decoder is not able to decode the bitstream. The following error codes are defined and shall be used by the device to inform the client about decoder errors:

1) "unsupported codec or unsupported codec profile" – The device is not able to decode the bitstream, because the codec or the profile is not supported by the device. The client should the try to reconfigure the transmitter according to the CodingCapabilities of the device.

2) "packet error" – there are missing or unexpected packets in the bitstream.

 Other vendor specific codes are also allowed.

```
Topic: tns1:VideoDecoder/DecodingError
<tt:MessageDescription IsProperty="false">
     <tt:Source>
          <tt:SimpleItemDescription Name="VideoOutputToken"
     Type="tt:ReferenceToken"/>
```

```
        </tt:Source>
        <tt:Data>
            <tt:SimpleItemDescription Name="PaneReference"
    Type="tt:ReferenceToken"/>
            <tt:SimpleItemDescription Name="Error" Type="xs:string"
    minOccurs="0"/>
        </tt:Data>
</tt:MessageDescription>
```

5.4.2 Layout changed event

This event shall be generated whenever a layout is changed. Typical reason is a call to SetLayout? resulting in an layout change.

```
Topic: tns1:VideoOutput/Layout/LayoutChanged
<tt:MessageDescription IsProperty="false">
  <tt:Source>
    <tt:SimpleItemDescription Name="VideoOutputToken"
                Type="tt:ReferenceToken"/>
  </tt:Source>
</tt:MessageDescription>
```

5.5   Capabilities

The capabilities reflect optional functions and functionality of a service. The information is static and does not change during device operation. The following capabilites are available:

FixedLayout: Indication that the SetLayout command supports only predefined layouts.

Table 10: GetServiceCapabilities command

GetServiceCapabilities		Access Class: PRE_AUTH
Message name	**Description**	
GetServiceCapabilitiesRequest	*This message contains a request for device capabilities.*	
GetServiceCapabilitiesResponse	*The capability response message contains the requested service capabilities using a hierarchical XML capability structure.* tls:Capabilities **Capabilities** [1][1]	
Fault codes	**Description**	
	No command specific faults!	

5.6   Service specific data types

5.6.1 CodingCapabilities

This type contains the Audio and Video coding capabilities of a display service.

```
<xs:complexType name="CodingCapabilities">
   <xs:sequence>
```

```
    <xs:element name="AudioEncodingCapabilities" type=
            "tt:AudioEncoderConfigurationOptions minOccurs="0"/>
    <xs:element name="AudioDecodingCapabilities" type=
            "tt:AudioDecoderConfigurationOptions minOccurs="0"/>
    <xs:element name="VideoDecodingCapabilities" type=
            "tt:VideoDecoderConfigurationOptions/>
  </xs:sequence>
</xs:complexType>
```

AudioEncodingCapabilities

> If the device supports audio encoding this section describes the supported codecs and their configuration.

AudioDecodingCapabilities

> If the device supports audio decoding this section describes the supported codecs and their settings.

VideoDecodingCapabilities

> This section describes the supported video codesc and their configuration.

5.6.2 Layout

A layout describes a set of Video windows that are displayed simultaniously on a display.

```
<xs:complexType name="Layout">
  <xs:sequence>
    <xs:element name="PaneLayout" type="tt:PaneLayout"
            maxOccurs="unbounded"/>
  </xs:sequence>
</xs:complexType>
```

PaneLayout

> List of the currently visible pane areas on the monitor.

5.6.3 LayoutOptions

The LayoutOptions describe the fixed and predefined layouts of a device.

```
<xs:complexType name="LayoutOptions">
  <xs:sequence>
    <xs:element name="PaneLayoutOptions" type="tt:PaneLayoutOptions"
            maxOccurs="unbounded"/>
  </xs:sequence>
</xs:complexType>
```

PaneLayoutOptions

> Lists the possible Pane Layouts of the Video Output.

5.6.4 PaneLayoutOptions

Description of a pane layout describing a complete display layout.

```
<xs:complexType name="PaneLayoutOptions">
  <xs:sequence>
    <xs:element name="Area" type="tt:Rectangle" maxOccurs="unbounded"/>
  </xs:sequence>
```

```
</xs:complexType>
```

Area

> List of areas assembling a layout. Coordinate values are in the range [-1.0, 1.0].

5.6.5 PaneConfiguration

Configuration of the streaming and coding settings of a Video window.

```
<xs:complexType name="PaneConfiguration">
  <xs:sequence>
    <xs:element name="PaneName" type="xs:string" minOccurs="0"/>
    <xs:element name="AudioOutputToken" type="tt:ReferenceToken"
          minOccurs="0"/>
    <xs:element name="AudioSourceToken" type="tt:ReferenceToken"
          minOccurs="0"/>
    <xs:element name="AudioEncoderConfiguration"
          type="tt:AudioEncoderConfiguration" minOccurs="0"/>
    <xs:element name="ReceiverToken" type="tt:ReferenceToken"
          minOccurs="0"/>
    <xs:element name="Token" type="tt:ReferenceToken"/>
  </xs:sequence>
</xs:complexType>
```

PaneName

> Optional name of the pane configuration.

AudioOutputToken

> If the device has audio outputs, this element contains a pointer to the audio output that is associated with the pane. A client can retrieve the available audio outputs of a device using the GetAudioOutputs command of the DeviceIO service.

AudioSourceToken

> If the device has audio sources, this element contains a pointer to the audio source that is associated with this pane. The audio connection from a decoder device to the NVT is established using the backchannel mechanism. A client can retrieve the available audio sources of a device using the GetAudioSources command of the DeviceIO service.

AudioEncoderConfiguration

> The configuration of the audio encoder including codec, bitrate and sample rate.

ReceiverToken

> A pointer to a Receiver that has the necessary information to receive data from a Transmitter. This Receiver can be connected and the network video decoder displays the received data on the specified outputs. A client can retrieve the available Receivers using the GetReceivers command of the Receiver Service.

Token

> A unique identifier in the display device.

5.6.6 PaneLayout

A layout describes a set of Video windows that are displayed simultaniously on a display.

```
<xs:complexType name="PaneLayout">
 <xs:sequence>
   <xs:element name="Pane" type="tt:ReferenceToken"/>
   <xs:element name="Area" type="tt:Rectangle"/>
 </xs:sequence>
</xs:complexType>
```

Pane

> Reference to the configuration of the streaming and coding parameters.

Area

> Describes the location and size of the area on the monitor. The area coordinate values are espressed in normalized units [-1.0, 1.0].

5.7 Service specific fault codes

Table 11 lists the display service specific fault codes.

The specific faults are defined as subcode of a generic fault. The parent generic subcode is the *subcode* at the top of each row below and the specific fault *subcode* is at the bottom of the cell.

Table 11: Service specific fault codes

Fault Code	Parent Subcode	Fault Reason	Description
	Subcode		
env:Sender	ter:InvalidArgVal	The Video Output does not exist	The requested Video Output does not exist
	ter:NoVideoOutput		
env:Sender	ter.InvalidArgVal	The PaneConfiguration is fixed.	It is not possible to delete this pane configuration
	ter:FixPane		
env:Sender	ter:InvalidArgVal	The maximum number of panes is reached.	It is not possible to create a Pane because the maximum number of panes is reached
	ter:MaximumNumberOfPanes		
env:Sender	ter:InvalidArgVal	The PaneConfiguration does not exist	The requested Pane Configuration does not exist.
	ter:NoPane		
envSe:nder	ter:InvalidArgVal	It is not possible to set the configuration	The requested configuration is not supported by the device
	ter:InvalidConfig		

env:Sender	ter:Action	It is not possible to set the layout	The requested layout is not supported by the device
	ter:InvalidLayout		