OpenMAX™ Integration Layer Application Programming Interface Specification

Version 1.1.2

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Contents

1 Overview

1.1 Introduction

This document details the Application Programming Interface (API) for the OpenMAX Integration Layer (IL). Developed as an open standard by The Khronos Group, the IL serves as a low-level interface for audio, video, and imaging components used in embedded and/or mobile devices. The principal goal of the IL is to give components a degree of system abstraction for the purpose of portability across operating systems and software stacks.

1.1.1 About the Khronos Group

The Khronos Group is a member-funded industry consortium focused on the creation of open standard APIs to enable the authoring and playback of dynamic media on a wide variety of platforms and devices. All Khronos members may contribute to the development of Khronos API specifications, may vote at various stages before public deployment, and may accelerate the delivery of their multimedia platforms and applications through early access to specification drafts and conformance tests. The Khronos Group is responsible for open APIs such as OpenGL ES, OpenML, and OpenVG.

1.1.2 A Brief History of OpenMAX

The OpenMAX set of APIs was originally conceived as a method of enabling portability of components and media applications throughout the mobile device landscape. Brought into the Khronos Group in mid-2004 by a handful of key mobile hardware companies, OpenMAX has gained the contributions of companies and institutions stretching the breadth of the multimedia field. As such, OpenMAX stands to unify the industry in taking steps toward media component portability. Stepping beyond mobile platforms, the general nature of the OpenMAX IL API makes it applicable to all media platforms.

1.2 The OpenMAX Integration Layer

The OpenMAX IL API strives to give media components portability across an array of platforms. The interface abstracts the hardware and software architecture in the system. Each component and relevant transform is encapsulated in a component interface. The OpenMAX IL API allows the user to load, control, connect, and unload the individual components. This flexible core architecture allows the Integration Layer to easily implement almost any media use case and mesh with existing graph-based media frameworks.

1.2.1 Key Features and Benefits

The OpenMAX IL API gives applications and media frameworks the ability to interface with multimedia codecs and supporting components (i.e., sources and sinks) in a unified manner. The components themselves may be any combination of hardware or software and are completely transparent to the user. Without a standardized interface of this nature, component vendors have little alternative than to write to proprietary or closed interfaces to integrate into mobile devices. In this case, the portability of the component is minimal at best, costing many development-years of effort in re-tooling these solutions between systems.

Thus, the IL incorporates a specialized arsenal of features, honed to combat the problem of portability among many vastly different media systems. Such features include:

- A flexible component-based API core
- Ability to easily plug in new components
- Coverage of targeted domains (audio, video, and imaging) while remaining easily extensible by both the Khronos Group and individual vendors
- Capable of being implemented as either static or dynamic libraries
- Retention of key features and configuration options needed by parent software (such as media frameworks)
- Ease of communication between the client and the components and between components themselves
- Standardized definition of key components so all implementations of such “standard components” expose the same external interface (i.e. same inputs, outputs, and controls)

1.2.2 Design Philosophy

As previously stated, the key focus of the OpenMAX IL API is portability of media components. The diversity of existing devices and media implementation solutions necessitates that the OpenMAX IL target the higher level of the media software stack as the key initial user. For many operating systems, this means an existing media framework or some form of multimedia middleware.

Another key target is the OpenMAX AL API which standardizes a higher application level interface companion to OpenMAX IL. OpenMAX AL is designed to be amenable to OpenMAX IL implementations.

Thus, much of the OpenMAX IL API accommodates the needs of multimedia middleware allowing that layer to be as lightweight as possible. The result is an interface that is easily pluggable into most software stacks across operating system and multimedia middleware solutions.

The design of the API also strove to accommodate as many system architectures as possible. The resulting design uses highly asynchronous communications, which allows processing to take place in another thread, on multiple processing elements, or on specialized hardware. In addition, the ability of hardware-accelerated components to communicate directly with one another via tunneling affords implementation architectures even greater flexibility and efficiency.

1.2.3 Software Landscape

In some systems, a user-level media framework already exists. In those without such multimedia middleware, OpenMAX AL may serve to fill the gap. The OpenMAX IL API is designed to easily fit below this layer with little to no overhead between the interfaces. In most cases, a native media framework can be replaced with a thin layer that simply translates the API. Likewise, given the co-operative design of the two APIs, OpenMAX IL can even more seamlessly fit into an OpenMAX AL implementation. Figure 1-1 illustrates the software landscape for the OpenMAX IL API.

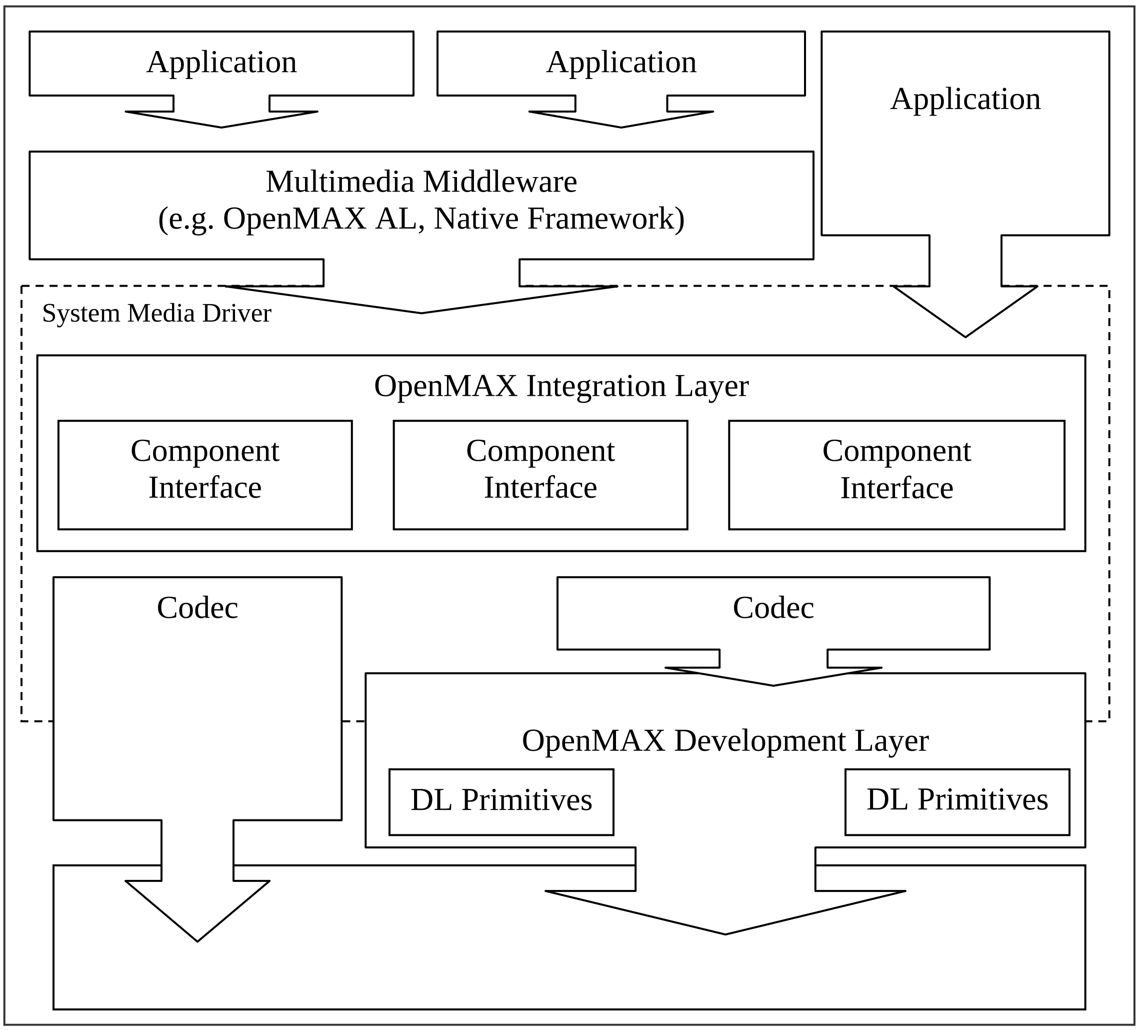


Figure 1-1. OpenMAX IL API Software Landscape

The OpenMAX standard also defines a set of Development Layer (DL) primitives on which components can be built. The DL primitives and their full relationship to the IL are specified in the OpenMAX Development Layer API specification documents.

1.2.4 Stakeholders

A few categories of stakeholders represent the broad array of companies participating in the production of multimedia solutions, each with their own interest in the IL API.

1.2.4.1 Silicon Vendors

Silicon vendors (SV) are responsible for delivering a representative set of OpenMAX IL components that are specific to the vendor's platform. The vendors are anticipated to also supply components that are representative of the capabilities of their platforms.

1.2.4.2 Independent Software Vendors

Independent software vendors (ISV) are anticipated to deliver additional differentiated OpenMAX IL components that may or may not be specific to a given silicon vendor's platform.

1.2.4.3 Operating System Vendors

Operating System Vendors (OSV) are anticipated to deliver software multimedia framework and standard reference OpenMAX IL components that enable integration of the representative silicon vendor's components and ISV components. The OSV is responsible for conformance testing of the standard reference OpenMAX IL components.

1.2.4.4 Original Equipment Manufacturers

Original Equipment Manufacturers (OEM) are anticipated to modify and optimize the integration of OpenMAX IL components provided by SVs, ISVs, and OSVs to their specific product architectures to enable delivery of OpenMAX IL integrated multimedia devices. OEMs may also develop and integrate their own proprietary OpenMAX IL components.

1.2.5 The Interface

The OpenMAX IL API is a component-based media API that consists of two main segments: the core API and the component API.

1.2.5.1 Core

The OpenMAX IL core is used for dynamically loading and unloading components and for facilitating component communication. Once loaded, the API allows the user to communicate directly with the component, which eliminates any overhead for high commands. Similarly, the core allows a user to establish a communication tunnel between two components. Once established, the core API is no longer used and communications flow directly between components.

1.2.5.2 Components

In the OpenMAX Integration Layer, components represent individual blocks of functionality. Components can be sources, sinks, codecs, filters, splitters, mixers, or any other data operator. Depending on the implementation, a component could possibly represent a piece of hardware, a software codec, another processor, or a combination thereof.

The individual parameters of a component can be set or retrieved through a set of associated data structures, enumerations, and interfaces. The parameters include data relevant to the component's operation (i.e., codec options) or the actual execution state of the component.

Buffer status, errors, and other time-sensitive data are relayed to the application via a set of callback functions. These are set via the normal parameter facilities and allow the API to expose more of the asynchronous nature of system architectures.

Data communication to and from a component is conducted through interfaces called ports. Ports represent both the connection for components to the data stream and the buffers needed to maintain the connection. Users may send data to components through input ports or receive data through output ports. Similarly, a communication tunnel between two components can be established by connecting the output port of one component to a similarly formatted input port of another component.

1.3 Definitions

When this specification discusses requirements and features of the OpenMAX IL API, specific words are used to convey their necessity in an implementation. Table 1-1 shows a list of these words.

Table 1-1: Definitions of Commonly Used Words

Word	Definition
May	The stated functionality is an optional requirement for an implementation of the OpenMAX IL API. Optional features are not required by the specification but may have conformance requirements if they are implemented. This is an optional feature as in "The component may have vendor specific extensions."
Shall	The stated functionality is a requirement for an implementation of the OpenMAX IL API. If a component fails to meet a shall statement, it is not considered to conform to this specification. Shall is always used as a requirement, as in "The component designers shall produce good documentation."
Should	The stated functionality is not a requirement for an implementation of the OpenMAX IL API but is recommended or is a good practice. Should is usually used as follows: "The component should begin processing buffers immediately after it transitions to the OMX_StateExecuting state." While this is good practice, there may be a valid reason to delay processing buffers, such as not having input data available.
Will	The stated functionality is not a requirement for an implementation of the OpenMAX IL API. Will is usually used when referring to a third party, as in "the application framework will correctly handle errors."

1.4 Authors

The following individuals, listed alphabetically by company, contributed to the OpenMAX Integration Layer Application Programming Interface Specification.

- Tom Longo (AMD)
- Wilson Kwan (AMD)
- Russell Tillitt (Beatnik)
- Tim Granger (Broadcom)
- Roger Nixon (Broadcom)
- Sriram Divakar (Motorola)
- Yeshwant Muthusamy (Nokia)
- Ukri Niemimuukko (Nokia)
- Gordon Grigor (NVIDIA)
- Jim Van Welzen (NVIDIA)
- Bruno Smets (NXP)
- Diego Melpignano (STMicroelectronics)
- Leo Estevez (Texas Instruments)

1.5 Features New to Version 1.1

A summary of new features included into this release of this specification include:

- The explicit definition of a set of standard components representing the most common pieces of functionality (e.g. specific data sources, sinks, decoders, encoders, transformations for specific formats). All implementations of particular standard component expose the same interface including inputs, outpus, and controls.
- The addition of the ability to append additional information to buffer payloads (e.g. the video quantization data appended to video frames).
- The extension of color format types.
- The extension of buffer payload flags
- The clarification of data transform (e.g. rotate and scale) order
- The introduction media container parsing and creating, including the abstraction of file access (denoted content pipes) and metadata parsing.
- The enhancement of Resource Management to include suspensiont due to unavailable resources (a lightweight alternative to component deinitialization on resource loss), resource Concealment control, dynamic resource allocation.

- The addition of a means to specify an EGL buffer to be used as an OpenMAX IL buffer.
- The addition of MP3 file formats.
- The enhancement of video encoder controls including dynamic frame rate and bit rate,intraframe and macroblock refresh, FMO and Slice selection, IDR and intra period selection, NAL size selection, video profile querying.
- The enhancement of video decoder controls including macroblock error reporting during during decoding and video profile querying.
- The enhancement of image codec controls including more sophisticated controls for for JPEG Huffman and Quantization tables
- The enhancement of camera controls including sophisticated focus control, continuous and single shot control, auto exposure control.

1.6 Backward Compatibility

The OpenMAX IL specification defines components and structures that evolve and improve with subsequent versions of the specification. The version of the specification is indicated with 4 digits Ma.Mi.R.S (Respectively Major, Minor, Revision and Step). Increments of these digits give the following indications:

- An increment of Major indicates a significant number of fundamental non-backward compatible changes.
- An increment of Minor indicates a significant number of functional changes like the addition of new structures and components. Essential corrections may create limited non backward compatible changes. Heterogeneous Minor version implementations should be possible as explained below for 1.0 to 1.1.
- An increment of revision indicates a significant number of corrections and clarifications which should be backward compatible unless stated explicitely. Any component of a later revision should interoperate with components of an earlier revision.
- An increment of step indicates a significant number of editorial corrections.

This specification works to maintain backward compatibility with the OpenMAX Integration Layer Specification 1.0 to aid in the adoption and deployment of the specification.

It is recognized that systems of heterogeneous pieces from prior versions and this version of the specification may exist. As such, new features and modifications to existing features part of this specification need to provide a standardized mechanism for backward compatibility. Thus systems with heterogeneous OpenMAX IL clients, IL core, and IL components can operate together.

Backward compatibility is required on any interfaces where an OpenMAX IL 1.0 piece (i.e. a client, core, or component) connects to an OpenMAX IL 1.1 piece. The cost of backward compatibility is placed on the OpenMAX IL 1.1 pieces. So OpenMAX IL 1.1 components and OpenMAX IL 1.1 cores shall support backward compatibility with OpenMAX IL 1.0.

The specification enables OpenMAX IL 1.1 pieces to support backward compatibility.

This is achieved by providing structures which maintain the same fields as OpenMAX IL 1.0 structures. New fields are added to the end of the structures. Thus an OpenMAX IL 1.0 structure can be interpreted as a clipped OpenMAX IL 1.1 structure if the `nSize` and `nVersion` fields are used to detect the difference.

Versions apply per method call as indicated in the `nVersion` field of structures passed on that call. OpenMAX IL uses the `nVersion` field in structures to allow the same methods to vary from version to version. Functions defined in both versions but that do not pass versioned structures are identical across versions.

In addition, enumerated values remain consistent with enumerated values from OpenMAX IL 1.0.

Lastly parameters to methods defined in OpenMAX IL 1.0 remain unchanged in OpenMAX IL 1.1. Specifically the number and format of the parameter remains unchanged, but additional fields may be added to the contents of the parameters. Method functionality defined in OpenMAX IL 1.0 remains unchanged by default (i.e. a new method or parameter must be used to enable OpenMAX IL 1.1 functionality).

The following section details how heterogeneous pieces operation together. The section simplifies the combinations and permutations of heterogeneous pieces into systems with IL clients using OpenMAX IL 1.0 methods, and IL clients using OpenMAX IL 1.1 methods.

1.6.1 IL Client 1.0

Backward compatibility requires IL clients using OpenMAX IL 1.0 methods to work with a core, and components from OpenMAX IL 1.1. Furthermore, an OpenMAX IL 1.1 core needs to operate with both OpenMAX IL 1.0 and OpenMAX IL 1.1 components.

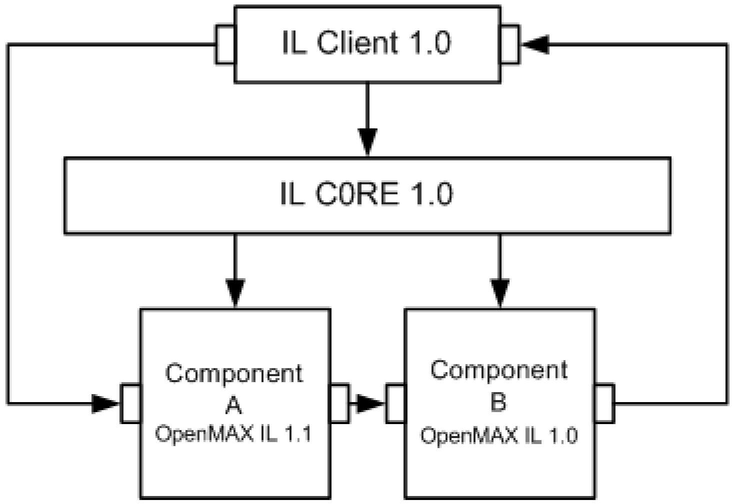


Figure 1-2. OpenMAX IL 1.0 Client Using 1.0 Core and 1.0 & 1.1 Compnents

In the above simple example, an client using OpenMAX IL 1.0 methods is operating with an OpenMAX IL 1.0 core and components from both OpenMAX IL 1.0, and OpenMAX IL 1.1.

The OpenMAX IL 1.1 component A is the only OpenMAX IL 1.1 piece in the system. Component A detects the Core is OpenMAX IL 1.0 by the value 1.0.R.S in the `nVersion` field of the component handle `OMX_COMPONENTTYPE`. Component A uses this version information to set OpenMAX IL 1.0 compatible interfaces for all method pointers in the component handle. Component A further uses this version information to not issue calls to any of the core methods new to OpenMAX IL 1.1 (e.g. content pipes).

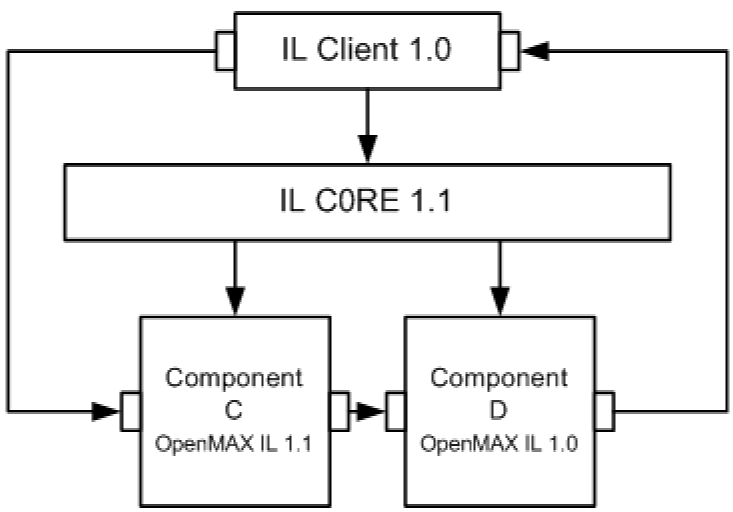


Figure 1-3. OpenMAX IL 1.0 Client Using 1.1 Core and 1.0 & 1.1 Components

In the above complex example, a client using OpenMAX IL 1.0 methods is operating with an OpenMAX IL 1.1 core and components from both OpenMAX IL 1.0, and OpenMAX IL 1.1.

The OpenMAX IL 1.1 core, determines that Component D, is an OpenMAX IL 1.0 component via the `OMX_GetComponentVersion` method. The core should flag component D as OpenMAX IL 1.0, and allocate the component handle in `OMX_COMPONENTTYPE` as an OpenMAX IL 1.0 structure. All subsequent method accesses to Component D from the core shall be restricted to OpenMAX IL 1.0 methods. Furthermore the core shall provide OpenMAX IL 1.0 structures for all methods to component D.

The OpenMAX IL 1.1 component C detects the core is OpenMAX IL 1.1 by the version of the component handle in `OMX_COMPONENTTYPE`. Component C may use OpenMAX IL 1.1 core methods.

Component C, detects per-method that the client is using OpenMAX IL 1.0 methods and structures and responds accordingly.

Lastly Component C detects Component D is OpenMAX IL 1.0 during the `ComponentTunnelRequest` method to setup the tunnel between components C and D, by inspecting the `nVersion` field in the component handle provided in `hTunneledComp`. Component C then uses OpenMAX IL 1.0 methods and structures for the tunnel with Component D.

1.6.2 IL Client 1.1

Clients developed for OpenMAX IL 1.1 have visibility into this version, and prior versions of the specification. It is expected that these clients will use the version information provided by the `OMX_GetComponentVersion` method to determine the version of OpenMAX IL supported by each component.

The Client may use OpenMAX IL 1.0 interfaces for OpenMAX IL 1.0 components. The client should not use OpenMAX IL 1.1 interfaces on a OpenMAX IL 1.0 component. if the client chooses to do so the behavior is not defined.

2 OpenMAX IL Introduction and Architecture

This section of the document describes the OpenMAX IL features and architecture.

2.1 OpenMAX IL Description

The OpenMAX IL layer is an API that defines a software interface used to provide an access layer around software components in a system. The intent of the software interface is to take components with disparate initialization and command methodologies and provide a software layer that has a standardized command set and a standardized methodology for construction and destruction of the components.

2.1.1 Architectural Overview

Consider a system that requires the implementation of four multimedia processing functions denoted as F1, F2, F3, and F4. Each of these functions may be from different vendors or may be developed in house but by different groups within the organization. Each may have different requirements for setup and teardown. Each may have different methods of facilitating configuration and data transfer. The OpenMAX IL API provides a means of encapsulating these functions, singly or in logical groups, into components. The API includes a standard protocol that enables compliant components that are potentially from different vendors/groups to exchange data with one another and be used interchangeably.

The OpenMAX IL API interfaces with a higher-level entity denoted as the IL client, which is typically a functional piece of a filter graph multimedia framework, OpenMAX AL, or an application. The IL client interacts with a centralized IL entity called the core. The IL client uses the OpenMAX IL core for loading and unloading components, setting up direct communication between two OpenMAX IL components, and accessing the component's methods.

An IL client always communicates with a component via the IL core. In most cases, this communication equates to calling one of the IL core's macros, which translates directly to a call on one of the component methods. Exceptions (where the IL client calls an actual core function that works) include component creation and destruction, queries about installed components and the roles they support, and connection via tunneling of two components.

Components embody the media processing function or functions. Although this specification clearly defines the functionality of the OpenMAX IL core, the component provider defines the functionality of a given component. Components operate on four types of data that are defined according to the parameter structures that they export: audio, video, image, and other (e.g., time data for synchronization).

An OpenMAX IL component provides access to a standard set of component functions via its component handle. These functions allow a client to get and set component and port configuration parameters, get and set the state of the component, send commands to the component, receive event notifications, allocate buffers, establish communications with a single component port, and establish communication between two component ports.

Every OpenMAX IL component shall have at least one port to claim OpenMAX IL conformance. Although a vendor may provide an OpenMAX IL-compatible component without ports, the bulk of conformance testing is dependent on at least one conformant port. The four types of ports defined in OpenMAX IL correspond to the types of data a port may transfer: audio, video, and image data ports, and other ports. Each port is defined as either an input or output depending on whether it consumes or produces buffers.

In a system containing four multimedia processing functions F1, F2, F3, and F4, a system implementer might provide a standard OpenMAX IL interface for each of the functions. The implementer might just as easily choose any combination of functions. The delineation for the separation of this functionality is based on ports. Figure 2-1 shows a few possible partitions for an OpenMAX IL implementation that provides these functions.

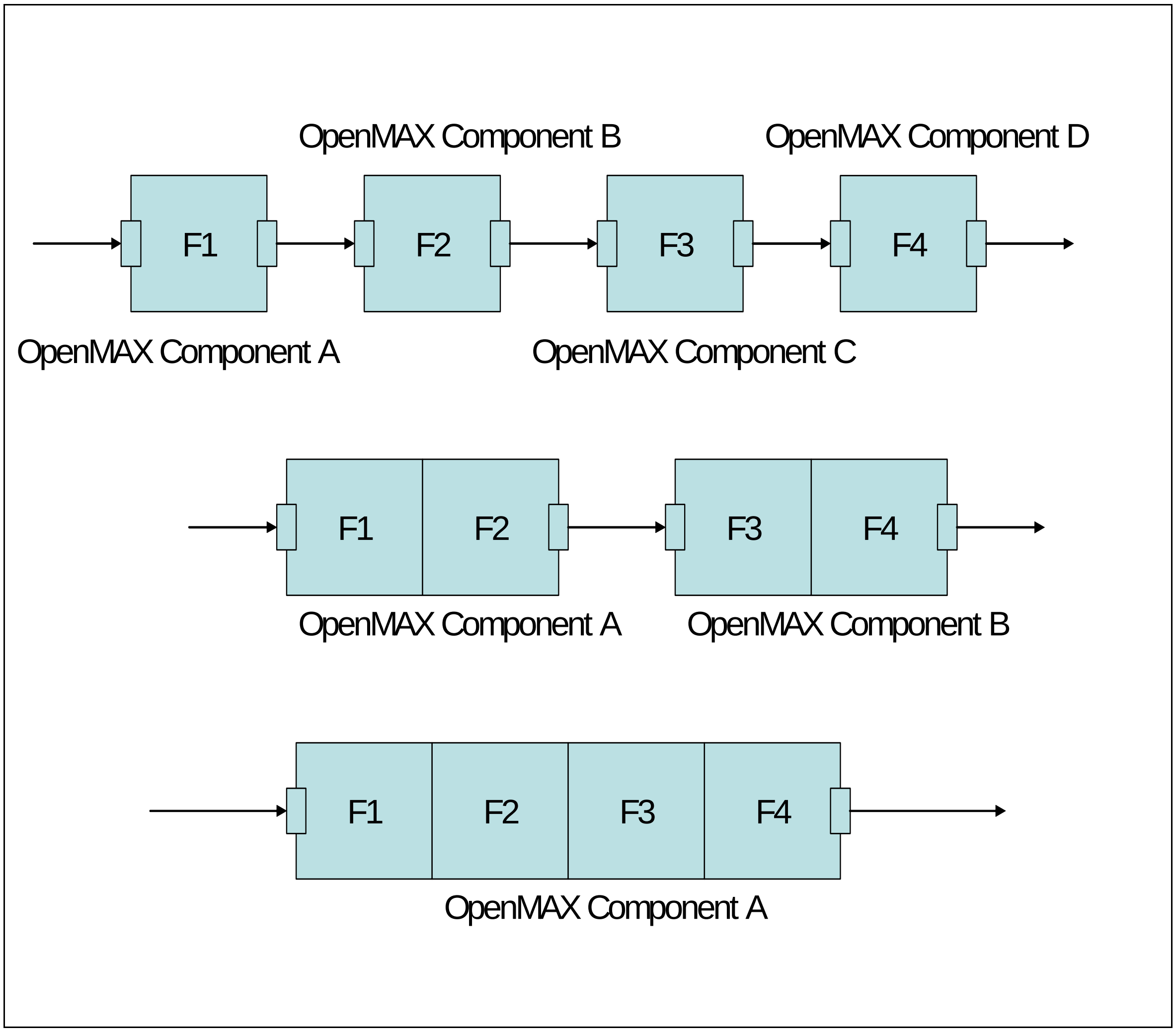


Figure 2-1. Possible Partitions for an OpenMAX IL Implementation

2.1.2 Key Vocabulary

This section describes acronyms and definitions commonly used in describing the OpenMAX IL API.

2.1.2.1 Key Definitions

Table 2-1 lists key definitions used in describing the OpenMAX IL API.

Table 2-1: Key Definitions

Key word	Meaning
Accelerated component	OpenMAX IL components that wrap a function with a portion running on an accelerator.
Accelerator	Hardware designed to speed up processing of some functions. This hardware may also be referred to as accelerated hardware. Note that the accelerator may actually be software running in a different processor and not be hardware at all.
Buffer Supplier	The entity that “owns” the buffer passed into a port.
Container	A format for encapsulating elementary streams of data and associated metadata (e.g. the 3gp file format).
Content Pipe	The abstraction of a means to access (read or write) some content external to OpenMAX IL. Content may manifest itself as a file and a pipe may leverage system file i/o functions, but the abstraction is not limited to these particular types of content or content access.
Component Group	A group of components that are functionally dependent upon one another. If one component of a group is inoperable then all components in a group are inoperable.
Component Suspension	A component is suspended when it lacks a critical resource but holds all other resources so that, if and when the required resource is again available, that component may resume from the point of suspension.
Dynamic resources	Any component resources that are allocated after the initial transition to the idle state. Dynamic resource allocation is discouraged and should only occur when the parameters of the allocation (e.g. the size or number of internal memory buffers) is not known at the preferred times to allocate resources.
Host processor	The processor in a multi-core system that controls media acceleration and typically runs a high-level operating system.
IL client	The layer of software that invokes the methods of the core or component. The IL client may be a layer below the GUI application, such as GStreamer, or may be several layers below the GUI layer. In this document, the application refers to any software that invokes the OpenMAX IL methods.
Main memory	Typically external memory that the host processor and the accelerator share.

Key word	Meaning
OpenMAX IL component	A component that is intended to wrap functionality that is required in the target system. The OpenMAX IL wrapper provides a standard interface for the function being wrapped.
OpenMAX IL core	Platform-specific code that has the functionality necessary to locate and then load an OpenMAX IL component into main memory. The core also is responsible for unloading the component from memory when the application indicates that the component is no longer needed. In general, after the OpenMAX IL core loads a component into memory, the core will not participate in communication between the application and the component.
Resource manager	A software entity that manages hardware resources in the system.
Static resources	Component resources that are allocated as a prerequisite to entering the idle state. Most component resources fall into this category.
Synchronization	A mechanism for gating the operation of one component with another.
Tunnels/Tunneling	The establishment and use of a standard data path that is managed directly between two OpenMAX IL components.

2.1.3 System Components

Figure 2-2 depicts the various types of communication enabled with OpenMAX IL. Each component can have an arbitrary number of ports for data communication. Components with a single output port are referred to as source components. Components with a single input port are referred to as sink components. Components running entirely on the host processor are referred to as host components. Components running on a loosely coupled accelerator are referred to as accelerator components. OpenMAX IL may be integrated directly with an application or may be integrated with multimedia framework components enabling heterogeneous implementations.

Three types of communication are described. Non-tunneled communications defines a mechanism for exchanging data buffers between the IL client and a component. Tunneling defines a standard mechanism for components to exchange data buffers directly with each other in a standard way. Proprietary communication describes a proprietary mechanism for direct data communications between two components and may be used as an alternative when a tunneling request is made, provided both components are capable of doing so.

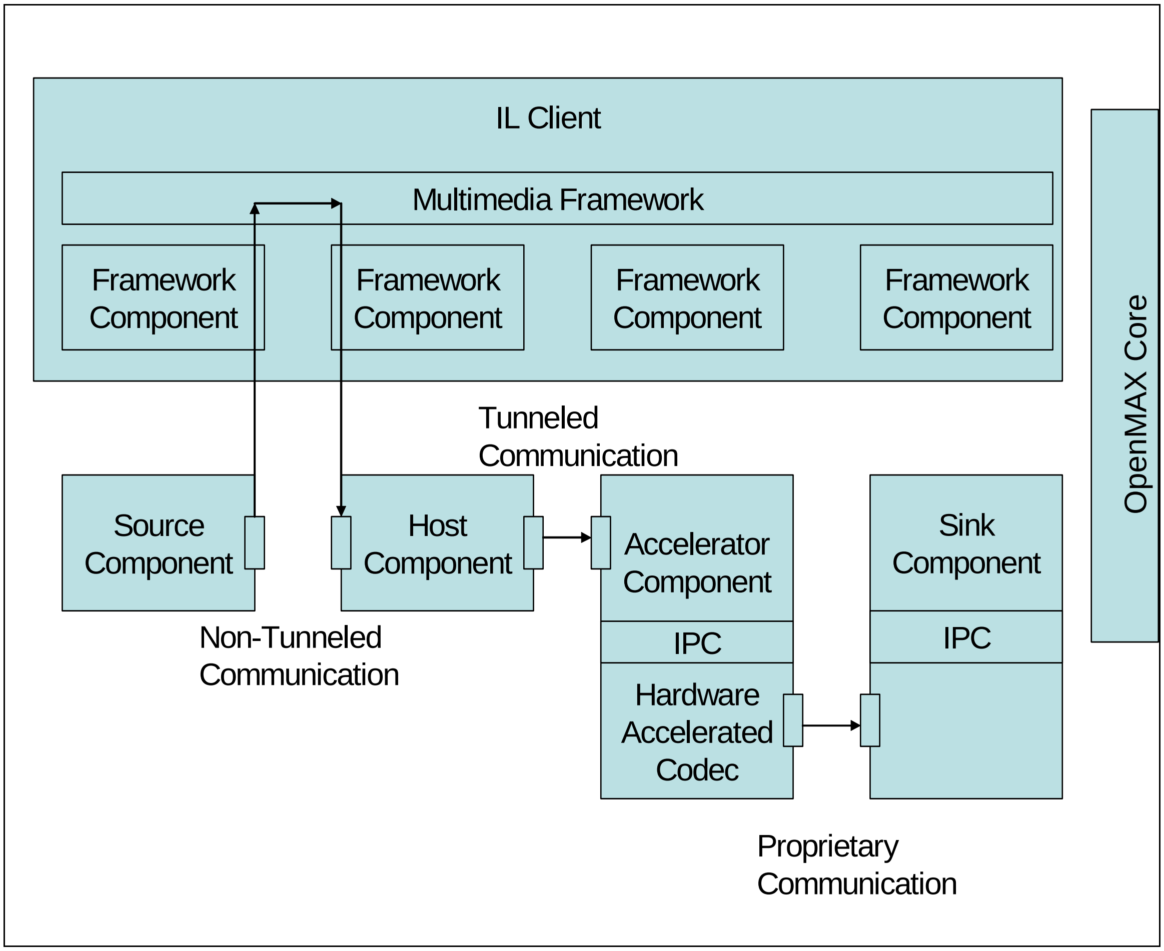


Figure 2-2. OpenMAX IL API System Components

2.1.3.1 Component Profiles

OpenMAX IL component functionality is grouped into two profiles: base profile and interop profile.

The base profile shall support non-tunneled communication. Base profile components may support proprietary communication. Base profile components do not support tunneled communication.

The interop profile is a superset of the base profile. An interop profile component shall support non-tunneled communication and tunneled communication. An interop profile component may support proprietary communication.

The primary difference between the interop profile and the base profile is that the component supports tunneled communication. The base profile exists to reduce the adoption barrier for OpenMAX IL implementers by simplifying the implementation. A base profile component does not need to implement tunneled communication.

Table 2-2: Types of Communication Supported Per Component Profile

Type of Communication	Base Profile Support	Interop Profile Suport
Non-Tunneled Communication	Yes	Yes
Tunneled Communication	No	Yes
Proprietary Communication	Yes	Yes

2.1.4 Component States

Each OpenMAX IL component can undergo a series of state transitions, as depicted in Figure 2-3. Every component is first considered to be unloaded. The component shall be loaded through a call to the OpenMAX IL core. All other state transitions may then be achieved by communicating directly with the component.

A component can enter an invalid state when a state transition is made with invalid data. For example, if the callback pointers are not set to valid locations, the component may time out and alert the IL client of the error. The IL client shall stop, de-initialize, unload, and reload the component when the IL client detects an invalid state. Figure 2-3 depicts the invalid state as enterable from any state, although the only way to exit the invalid state is to unload and reload the component.

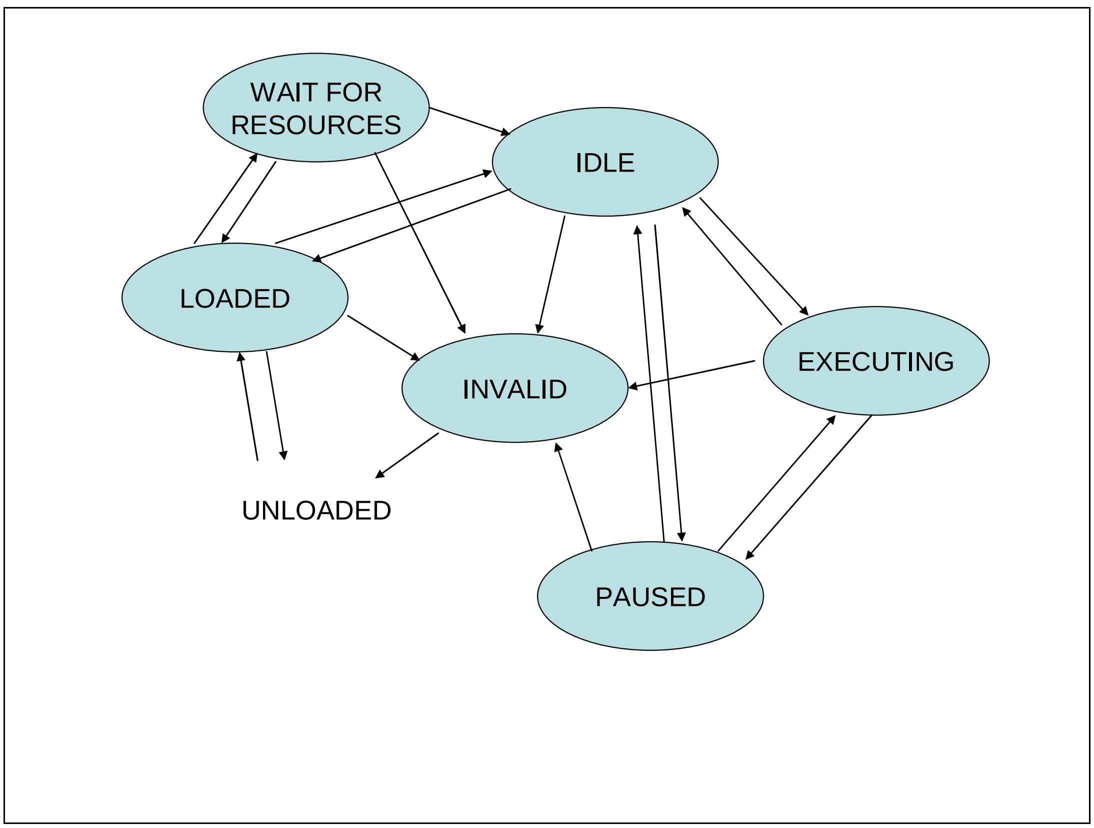


Figure 2-3. Component States

In general, the component shall have all its operational resources when in the IDLE state. There are, however, exceptions when the parameters for the resource allocation are not known at the time of the transition to IDLE. For example, a component that decodes video does not know how many reference frames are required until the data stream is examined yet the component cannot examine the stream prior to transition to IDLE. In these cases the component may defer the allocation of resources until such time as it knows the parameters of allocation. If dynamic allocation fails the component shall suspend itself. Thus we often distinguish between those resources allocated “up front” (e.g. on a transition to IDLE) and those allocated later by calling the former static resources and the latter dynamic resources.

Transitioning into the IDLE state may fail since this state requires allocation of all operational static resources. When the transition from LOADED to IDLE fails, the IL client may try again or may choose to put the component into the WAIT FOR RESOURCES state. Upon entering the WAIT FOR RESOURCE state, the component registers with a vendor-specific resource manager to alert it when resources have become available. The component will subsequently transition into the IDLE state. A command that the IL client sends controls all other state transitions except to INVALID.

The IDLE state indicates that the component has all of its needed static resources but is not processing data. The EXECUTING state indicates that the component is pending reception of buffers to process data and will make required callbacks as specified in section 3. The PAUSED state maintains a context of buffer execution with the component without processing data or exchanging buffers. Transitioning from PAUSED to EXECUTING enables buffer processing to resume where the component left off. Transitioning from EXECUTING or PAUSED to IDLE will cause the context in which buffers were processed to be lost, which requires the start of a stream to be reintroduced. Transitioning from IDLE to LOADED will cause operational resources such as communication buffers to be lost.

2.1.5 Component Architecture

Figure 2-4 depicts the component architecture. Note that there is only one entry point for the component (through its handle to an array of standard functions) but there are multiple possible outgoing calls that depend on how many ports the component has. Each component will make calls to a specified IL client event handler. Each port will also make calls (or callbacks) to a specified external function. A queue for pointers to buffer headers is also associated with each port. These buffer headers point to the actual buffers. The command function also has a queue for commands. All parameter or configuration calls are performed on a particular index and include a structure associated with that parameter or configuration, as depicted in Figure 2-4.

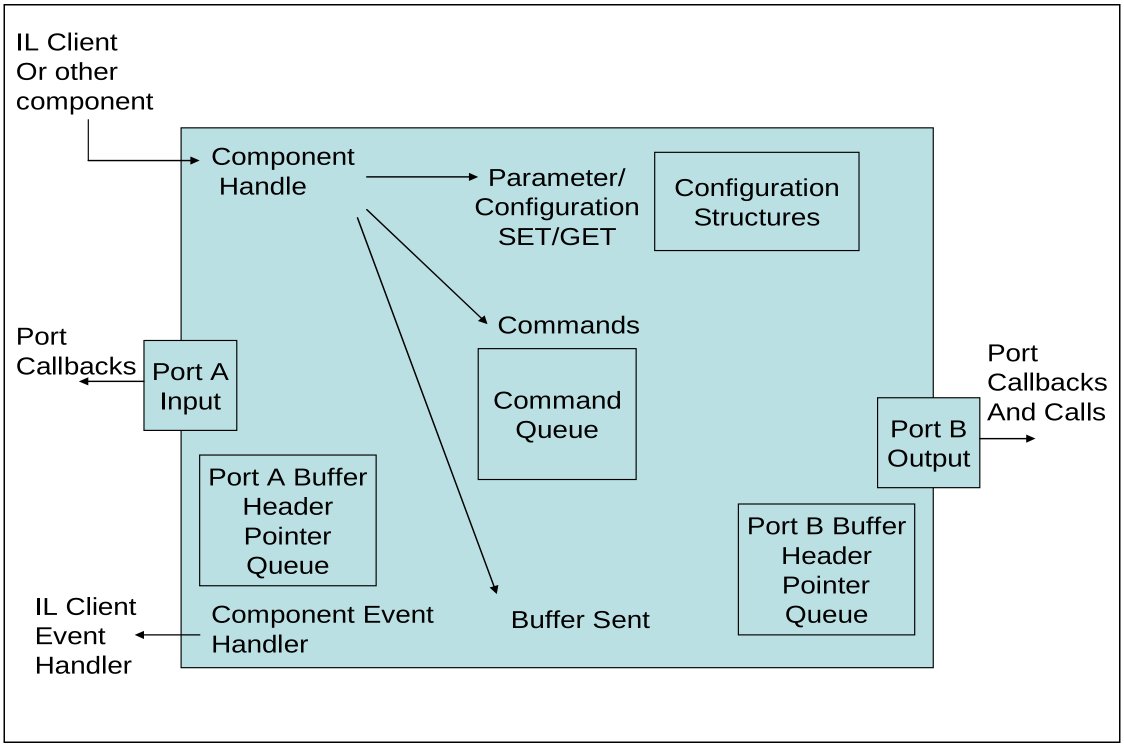


Figure 2-4. OpenMAX IL API Component Architecture

A port shall support callbacks to the IL client and, when part of an interop profile component, shall support communication with ports on other components.

2.1.6 Communication Behavior

Configuration of a component may be accomplished once the handle to the component has been received from the OpenMAX IL core. Data communication calls with a component are non-blocking and are enabled once the number of ports has been configured, each port has been configured for a specific data format, and the component has been put in the appropriate state. Data communication is specific to a port of the component. Input ports are always called from the IL client with `OMX_EmptyThisBuffer` (for more information, see section 3.2.2.17). Output ports are always called from the IL client with `OMX_FillThisBuffer` (for more information, see section 3.2.2.18). In an in-context implementation, callbacks to `EmptyBufferDone` or `FillBufferDone` will be made before the return. Figure 2-5 depicts the anticipated behavior for an in-context versus an out-of-context implementation. Note that the IL client should not make assumptions about return/callback sequences to enable heterogeneous integration of in-context and out-of-context OpenMAX IL components.

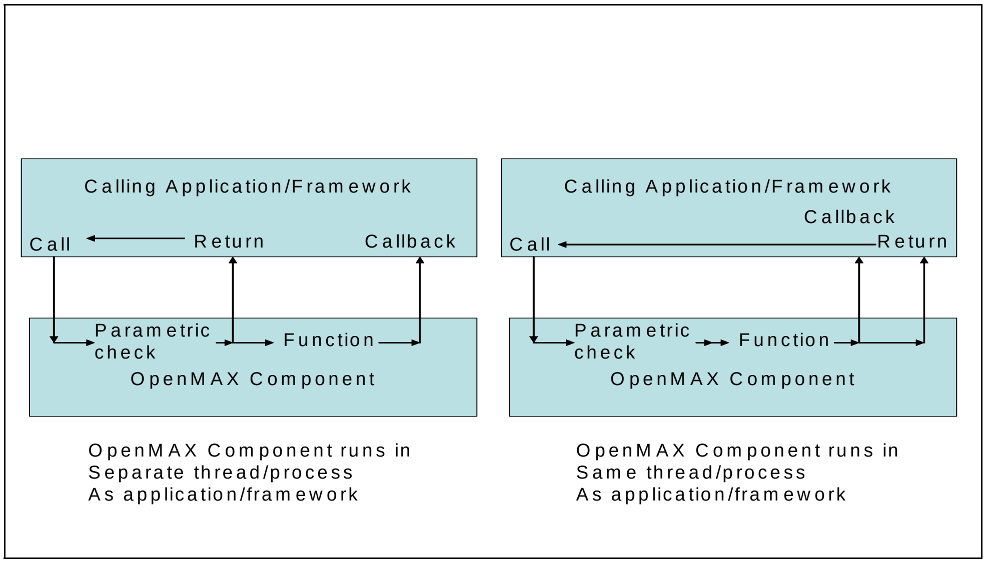


Figure 2-5. Out-of-Context versus In-Context Operation

Data communications with components is always directed to a specific component port. Each port has a component-defined minimum number of buffers it shall allocate or use. A port associates a buffer header with each buffer. A buffer header references data in the buffer and provides metadata associated with the contents of the buffer. Every component port shall be capable of allocating its own buffers or using pre-allocated buffers; one of these choices will usually be more efficient than the other.

2.1.7 Tunneled Buffer Allocation

This section describes buffer allocation for tunneling components. For a given tunnel, exactly one port supplies the buffers and passes those buffers to the non-supplier port. Normally the supplier port of a tunnel also allocates the buffers. Under the right circumstances, however, a tunneling component may choose to re-use buffers from one port on another to avoid memory copies and optimize memory usage. This optional practice, known as buffer sharing is described in detail in Section 10—Implementing Buffer Sharing..

Figure 2-6 illustrates the concepts relevant to tunneled buffer allocation.

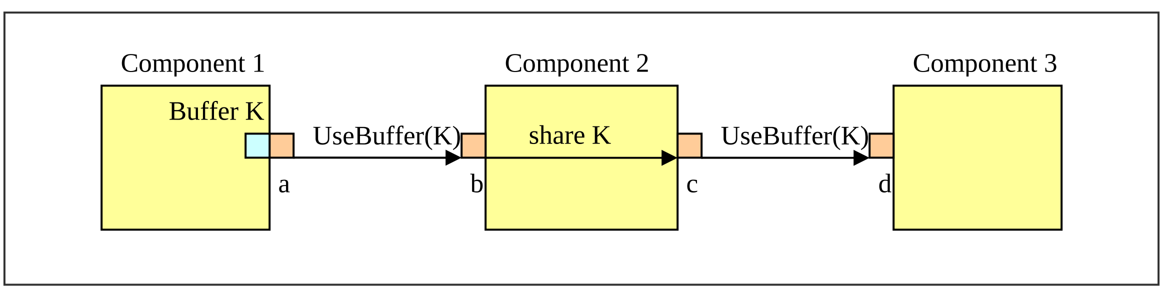


Figure 2-6. Example of Buffer Allocation and Sharing Relationships

Among a pair of ports that are tunneling, the port that calls `UseBuffer` on its neighbor is known as a *supplier port*. A buffer supplier port does not necessarily allocate its buffers; it may re-use buffer from another port on the same component. Ports a and c in Figure 2-6 illustrate supplier ports.

The port that receives the `UseBuffer` calls from its neighbor is known as a *non-supplier port*. Ports b and d Figure 2-6 illustrate non-supplier ports.

A port's *tunneling port* is the port neighboring it with which it shares a tunnel. For example, port b in Figure 2-6 is the tunneling port to port a. Likewise, port a is the tunneling port to port b.

An *allocator port* is a supplier port that also allocates its own buffers. Port a in Figure 2-6 is the only allocator port.

A *sharing port* is a port that re-uses buffers from another port on the same component. For example, port c in Figure 2-6 is a sharing port.

A *tunneling component* is a component that uses at least one tunnel.

The set of *buffer requirements* for a port includes the number of buffers required and the required size of each buffer. The maximum of multiple sets of buffer requirements is defined as the largest number of buffers mandated in any set combined with the largest size mandated in any set. One port retrieves buffer requirements from its tunneled port in a `OMX_PARAM_PORTDEFINITIONTYPE` structure via an `OMX_GetParameter` call on the tunneled port's component. Note that one port may determine buffer requirements from a port that shares its buffers without resorting to an `OMX_GetParameter` call since they are both contained in the same component.

Regardless of whether the component is sharing buffers or not, it is obligated to obey the following external semantics:

- Provide buffers on all of its supplier ports.
- Accurately communicate buffer requirements on its ports.
- Pass a buffer from an output port to an input port with an `OMX_EmptyThisBuffer` call.
- Return a buffer from an input port to an output port with an `OMX_FillThisBuffer` call.

2.1.7.1 IL Client Component Setup

To set up tunneling components, the IL client should perform the following setup operations in this order:

1. Load all tunneling components and set up the tunnels on these components.
2. Command all tunneling components to transition from the loaded state to the idle state.

Note that if an IL client does not operate in this manner when some components are sharing buffers, a tunneling component might never transition to idle because of the possible dependencies between components.

2.1.7.2 Component Transition from Loaded to Idle State

When commanded to transition from loaded to idle, each supplier port of a non-sharing component does the following:

1. Determine the buffer requirements of its tunneled port via an `OMX_GetParameter` call.
2. Allocate buffers according to the maximum of its own requirements and the requirements of the tunneled port.
3. Call `OMX_UseBuffer` on its tunneling port.

2.1.8 Port Reconnection

Port reconnection enables a tunneled component to be replaced with another tunneled component without having to tear down surrounding components. In Figure 2-7, component B1 is to be replaced with component B2. To do this, the component A output port and the component B input port shall first be disabled with the port disable command. Once all allocated buffers have returned to their rightful owner and freed, the component A output port may be connected to component B2. The component B1 output port and the component C input port should similarly be given the port disable command. After all allocated buffers have returned to their owners and freed, the component C input port may be connected to the component B2 output port. Then all ports may be given the enable command. Refer to Section 3.4.4 Port Disablement and Enablement for additional information regarding port disabling and enabling.

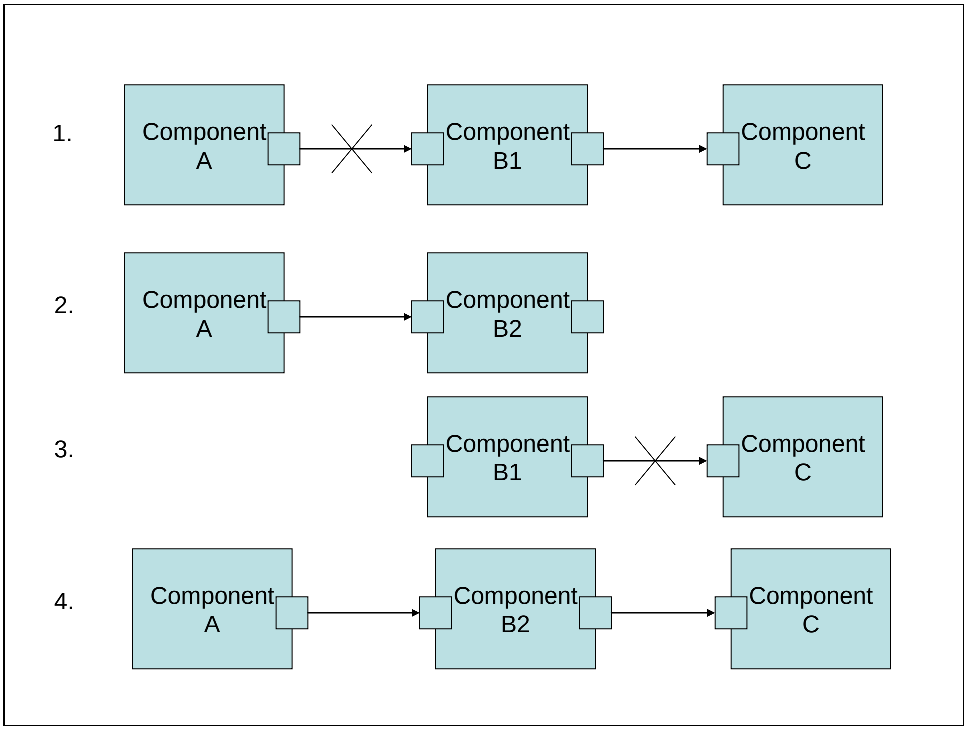


Figure 2-7. Port Reconnection

In some cases such as audio, reconnecting one component to another and then fading in data for one component while fading out data for the original component may be desirable. Figure 2-8 illustrates how this would work. In step 1, component A sends data to component B1, which then sends the data on to component C. Components A and C both have an extra port that is disabled. In step 2, the IL client first establishes a tunnel between component A and B2, then establishes a tunnel between B2 and C, and then enables all ports in the two tunnels. Component C may be able to mix data from components B1 and B2 at various gains, assuming that these are audio components. In step 3, the ports connected to component B1 from components A and C are disabled, and component B1 resources may be de-allocated.

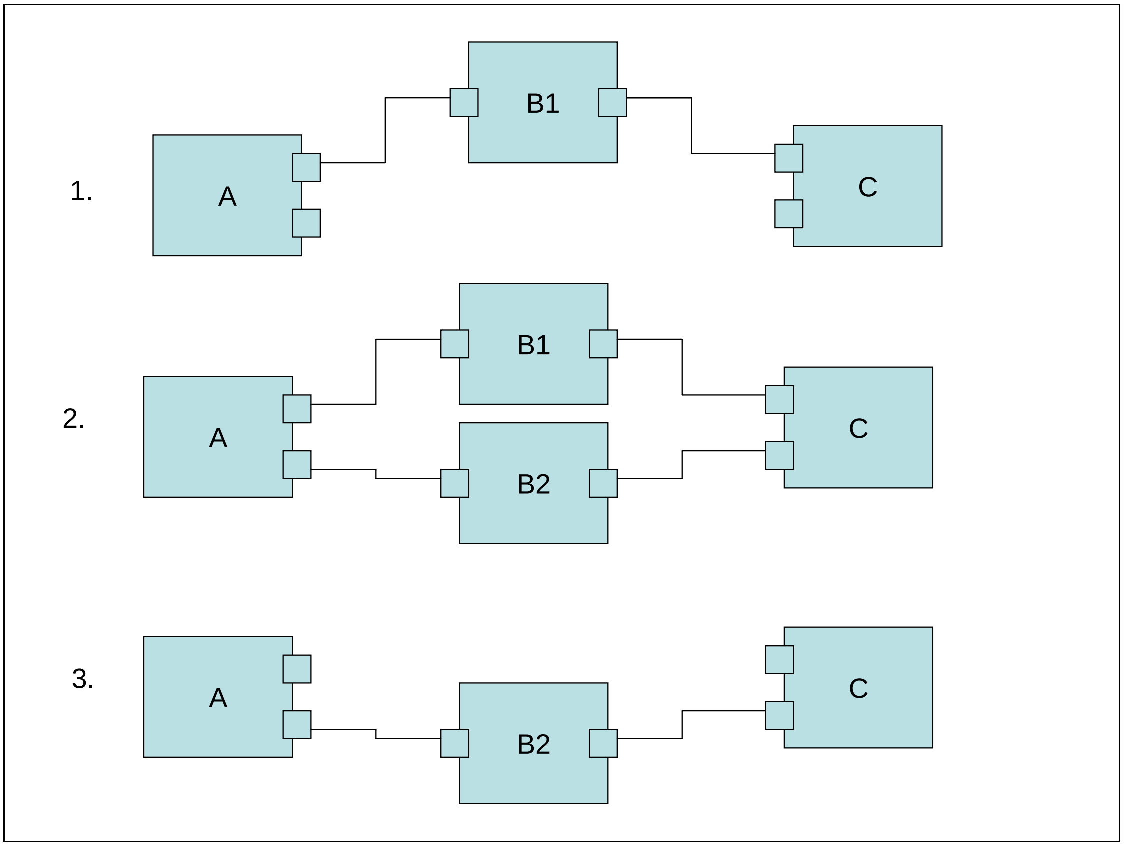


Figure 2-8. Reconnecting Components

2.1.9 Queues and Flush

A separate command queue enables the component to flush buffers that have not been processed and return these buffers to the IL client when using non-tunneled communication, or to the tunneled output port when using tunneled communication. For example, assume that a component has an output port that is using buffers allocated by the IL client. In this example, the client sends a series of five buffers to the component before sending the flush command. Upon processing the flush command, the component returns each unprocessed buffer and triggers its event handler to notify the IL client. Two buffers were already processed before the flush command got processed. The component returns the remaining three buffers unfilled and generates an event. The IL client should wait for the event before attempting to de-initialize the component.

2.1.10 Marking Buffers

An IL client can also trigger an event to be generated when a marked buffer is encountered. A buffer can be marked in its buffer header. The mark is internally transmitted from an input buffer to an output buffer in a chain of OpenMAX IL components. The mark enables a component to send an event to the IL client when the marked buffer is encountered. Figure 2-9 depicts how this works.

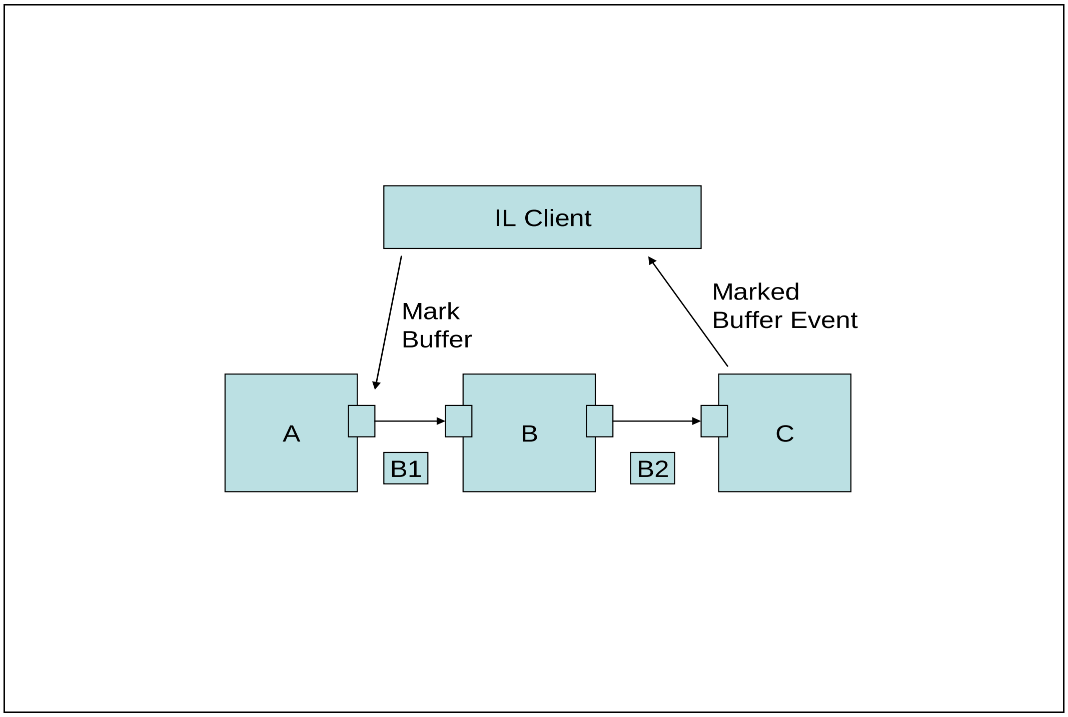


Figure 2-9. Marking Buffers

The IL client sends a command to mark a buffer. The next buffer sent from the output port of the component is marked B1. Component B processes the B1 buffer and provides the results in buffer B2 along with the mark. When component C receives the marked buffer B2 through its input port, the component does not trigger its event handler until it has processed the buffer.

2.1.11 Events and Callbacks

Six kinds of events are sent by a component to the IL client:

- *Error events* are enumerated and can occur at any time
- *Command complete notification events* are triggered upon successful execution of a command.
- *Marked buffer events* are triggered upon detection of a marked buffer by a component.
- A *port settings changed notification event* is generated when the component changes its port settings.
- A *buffer flag event* is triggered when an end of stream is encountered.
- A *resources acquired event* is generated when a component gets resources that it has been waiting for.

Ports make buffer handling callbacks upon availability of a buffer or to indicate that a buffer is needed.

2.1.12 Buffer Payload

The port configuration is used to determine and define the format of the data to be transferred on a component port, but the configuration does not define how that data exists in the buffer.

There are generally three cases that describe how a buffer can be filled with data. Each case presents its own benefits.

In all cases, the range and location of valid data in a buffer is defined by the `pBuffer`, `nOffset`, and `nFilledLen` parameters of the buffer header. The `pBuffer` parameter points to the start of the buffer. The `nOffset` parameter indicates the number of bytes between the start of the buffer and the start of valid data. The `nFilledLen` parameter specifies the number of contiguous bytes of valid data in the buffer. The valid data in the buffer is therefore located in the range `pBuffer + nOffset` to `pBuffer + nOffset + nFilledLen`.

The following cases are representative of compressed data in a buffer that is transferred into or out of a component when decoding or encoding. In all cases, the buffer just provides a transport mechanism for the data with no particular requirement on the content. The requirement for the content is defined by the port configuration parameters.

The shaded portion of the buffer represents data and the white portion denotes no data.

Case 1: Each buffer is filled in whole or in part. In the case of buffers containing compressed data frames, the frames are denoted by f1 to fn.

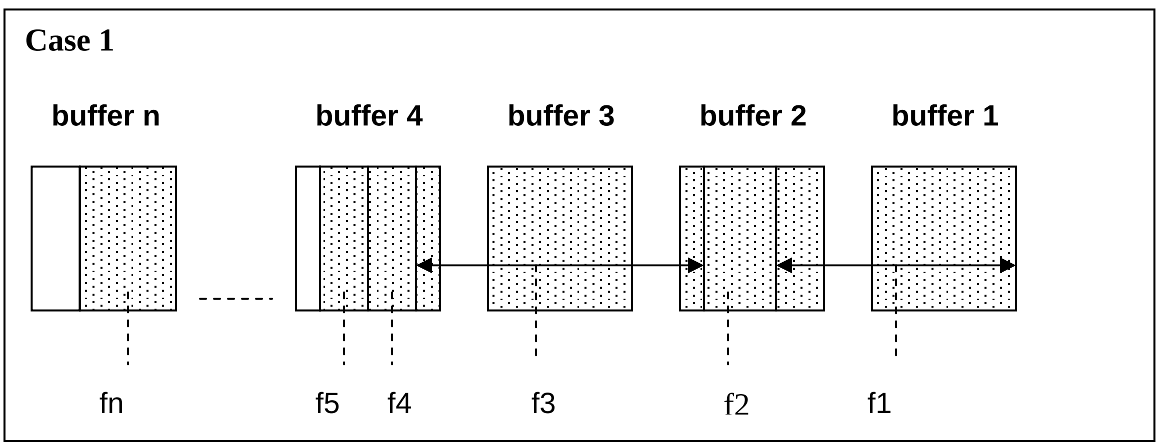


Figure 2-10: Case 1—Each Buffer Filled In Whole or In Part

Case 1 provides a benefit when decoding for playback. The buffer can accommodate multiple frames and reduce the number of transactions required to buffer an amount of data for decoding. However, this case may require the decoder to parse the data when decoding the frames. It also may require the decoder component to have a frame-building buffer in which to put the parsed data or maintain partial frames that would be completed with the next buffer.

Case 2: Each buffer is filled with only complete frames of compressed data.

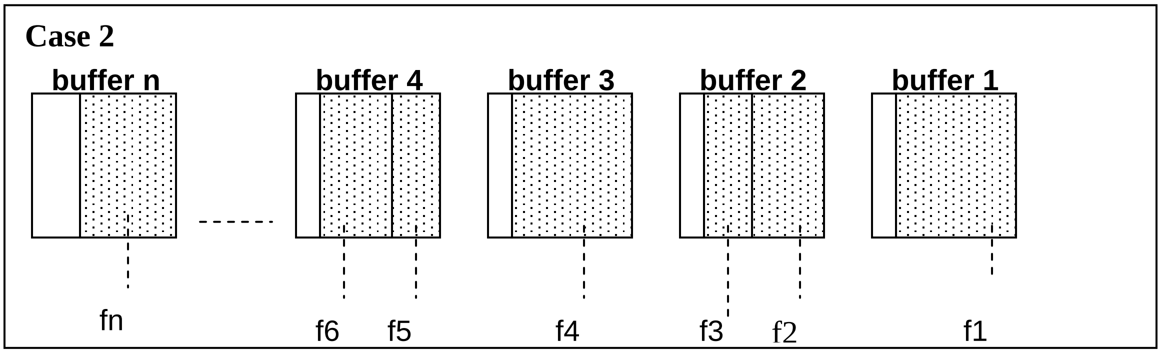


Figure 2-11: Case 2—Each Buffer Filled with Only Complete Frames of Data

Case 2 differs from case 1 because it requires the compressed data to be parsed first so that only complete frames are put in the buffers. Case 2 may also require the decoder component to parse the data for decoding. This case may not require the extra working buffer for parsing frames required in case 1.

Case 3: Each buffer is filled with only one frame of compressed data.

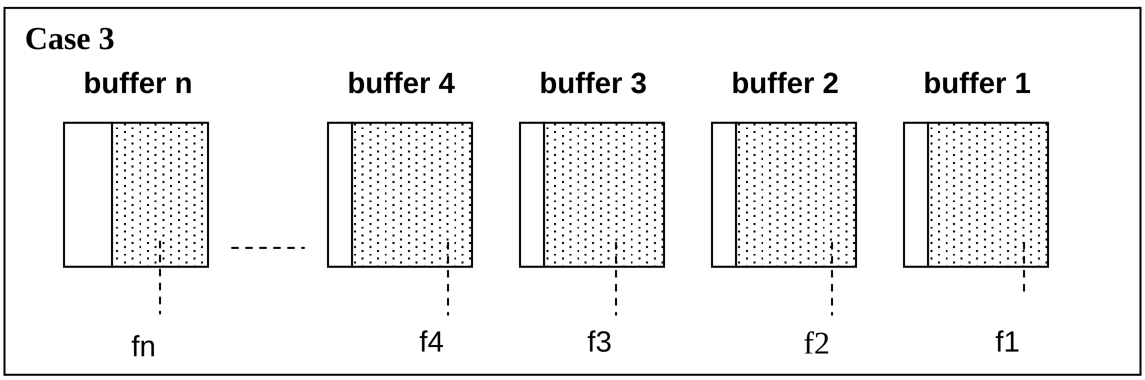


Figure 2-12: Case 3—Each Buffer Filled with Only One Frame of Compressed Data

The benefit in case 3 is that a decoding component does not have to parse the data. Parsing would be required at the source component. However, this method creates a bottleneck in data transfer. Data transfer would be limited to one frame per transfer. Depending on the implementation, one transaction per frame could have a greater impact on performance than parsing frames from a buffer.

At a minimum, a decoder or encoder component would be required to support case 1. By definition, if a codec component can support case 1, then it can support cases 2 and 3, but only if the compression format allows for byte-aligned frame boundaries. Operating in case 2 or 3 may not make sense when, for example, configuring an Adaptive Multi-Rate (AMR) codec for RTP-payload format, bandwidth-efficient mode. The non-byte aligned frames defined by this format would not fit the byte-aligned frame boundaries defined by these cases.

When filling a buffer with compressed data for input to a decoder or output from an encoder, a problem with limiting the filling to complete frames only might arise when frames are not byte aligned. Padding would have to be added outside of any padding defined in the format specification. The padding would then need to be removed, since the data could not be appended as is. This would require knowledge of the padding bits outside of any standard specification. Likewise, if this padding were not in place to maintain compliance with the standards specification for the port configuration, complete frames could not always be placed in the buffers. In either case, specific knowledge of how this situation is handled would be required, and may be different between components.

For interoperability, the content delivered in a buffer should not be assumed or required to be any number of complete frames, although at least one complete unit of data will be delivered in a buffer for uncompressed data formats. Compressed data formats do not place restrictions on the amount of content delivered in each buffer.

2.1.13 Buffer Flags and Timestamps

Buffer flags associate certain properties (e.g., the end of a data stream) with the data contained in a buffer. A buffer timestamp associates a presentation time in microseconds with the data in the buffer used to time the rendering of that data. Once a timestamp is associated with a buffer, no component should alter the timestamp for rate control or synchronization, which are implemented in the clock component.

Buffer metadata (i.e., flags and timestamps) applies to the [first] new logical unit in the buffer. Thus, given the presence of multiple logical units in a buffer, the metadata applies to the logical unit whose starting boundary occurs first in the buffer. [Subsequent logical units in a buffer don't have explicit flags nor timestamps. If explicit flag and timestamps are required on every logical unit, one or less logical unit should be included in each buffer]. Unless otherwise stated (e.g., in a flag definition), a component that receives a logical input unit marked with a flag or timestamp shall copy that metadata to all logical output units that the input contributes to.

2.1.14 Synchronization

Synchronization is enabled by the use of synchronization (sync) ports on a clock component. These ports and the clock component are defined within the "other" domain and operate with the same protocols and calls that regulate data ports. The clock component maintains a media clock that tracks the position in the media stream based on audio and video reference clocks. The clock component transmits buffers containing time information (denoted by a media time update and containing the media clock's current position, scale, and state) to client components via sync ports. A client component may time the execution of an operation (e.g., the presentation of a video frame) to a timestamp by requesting that the clock component send that timestamp when it matches the media clock. In this case, the client component executes the operation when it receives the fulfillment of the request over its sync port. Figure 2-13 illustrates the flow of time and data buffers in an example configuration of components.

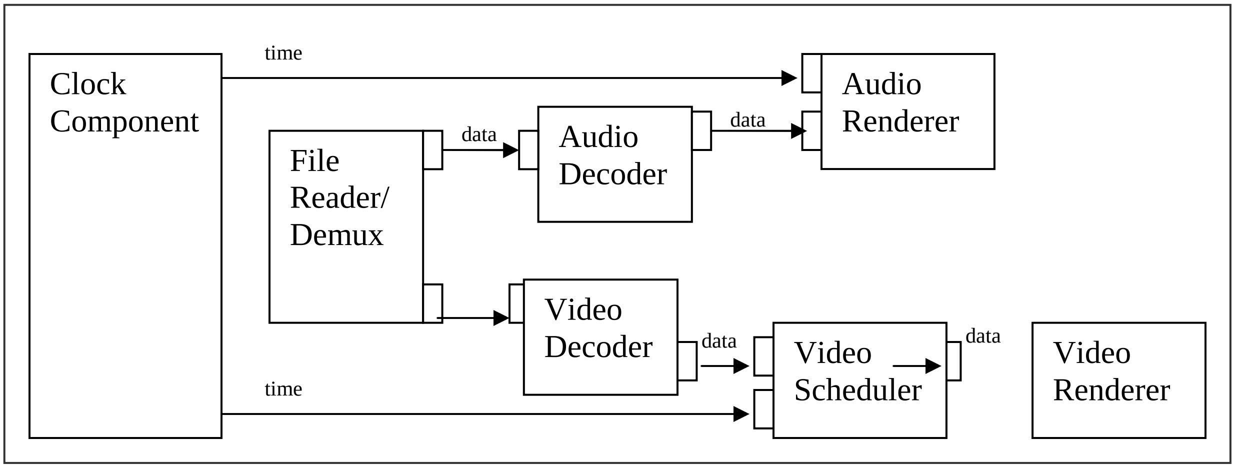


Figure 2-13. Flow of Time and Data Buffers

2.1.15 Rate Control

The clock component also implements all rate control by exposing a set of configurations for controlling its media clock. The IL client may change the scale factor of the media clock (effectively changing the rate and direction that the media clock advances) to implement play, fast forward, rewind, pause, and slow motion trick modes. The IL client may also start and stop the clock by using these configurations to change the state of the media clock. The clock component makes all of its client components aware of a change to the media clock scale and state by sending a media time update with the new scale or state on all sync ports. Although a component may not alter a buffer timestamp in reaction to a scale change, a component may alter its processing accordingly. For instance, an audio component might scale and pitch correct audio during trick modes or cease transmitting output entirely.

2.1.16 Component Registration

How components are registered with a core is generally core specific.

However, if the core supports static linking with components, then it will support a standard compile-time component registration scheme as described in section 3. Vendors can therefore supply components that are suitable for static linking with all cores that support it; this is achieved by placing component information into a data structure that is linked with the component and the core.

A component can be registered statically using this mechanism but have the bulk of its code dynamically loaded.

A component supplies an interface for retieving the standard component roles it supports. The core may leverage this interface for exposing role-related information to the IL client.

2.1.17 Resource Management

This section discusses the role of resource management in the OpenMAX IL API.

2.1.17.1 Need for Resource Management

When a component is not allowed to go to idle state due to lack of resources, the IL client does not know what the limited resource is or which components are using that resource. Therefore, the IL client cannot resolve the resource conflict. These situations necessitate IL resource management.

One of the goals of OpenMAX IL is hardware independence provided by the IL layer to the layers above it. The goal of hardware independence can be achieved by specifying the following requirements regarding resource management:

- An IL client (e.g., a multimedia plug-in that is typically part of a software platform) should not need to know the details of an IL implementation or which resource an IL component is using.
- In case of resource conflicts, an IL client should be able to rely on consistent component behavior across IL implementations and hardware platforms.
- An IL client should not have to interface directly with a hardware vendor-specific resource manager for two reasons.
    - This method violates the goal of hardware independence.
    - This method adds considerable re-work to the IL client, which has an impact on the re-usability of the IL client on multiple hardware platforms.

Although resource management is not fully addressed in OpenMAX IL API version 1.1, “hooks” for resource management have been put in place in the form of behavioral rules, component priorities, and a resource management-related component state. These “hooks” lay the groundwork for full-fledged resource management in later versions of the OpenMAX IL API.

Before proceeding further, the terms resource management and policy are defined for the benefit of the discussion that follows:

- *Resource management* is responsible for managing the access of components to a limited resource. A resource manager will be aware of how much of a specific resource is available, which components are currently using the resource, and how much of the resource the components are using. A resource manager will recommend to policy which components should be pre-empted or resumed based on resource conflicts and availability.
- *Policy* is responsible for managing component chains or streams. Policy is used to determine if a stream can run based on information including resources, system configuration, and other factors.

2.1.17.2 Example Architecture

Figure 2-15 shows a high-level architecture diagram of an exemplar OpenMAX IL-based system. In this example, a multimedia framework with a policy manager exists between the applications and the IL layer. This exemplar system also has multiple hardware platforms that are used by different OpenMAX IL components and that are managed by multiple hardware vendor-specific resource managers. But this system would work just as well with a single, centralized resource manager.

This example architecture is used as a background for the following discussion on component priorities, behavioral rules and hardware-specific resource managers. It is to be noted, however, that this discussion applies to any OpenMAX IL-based architecture.

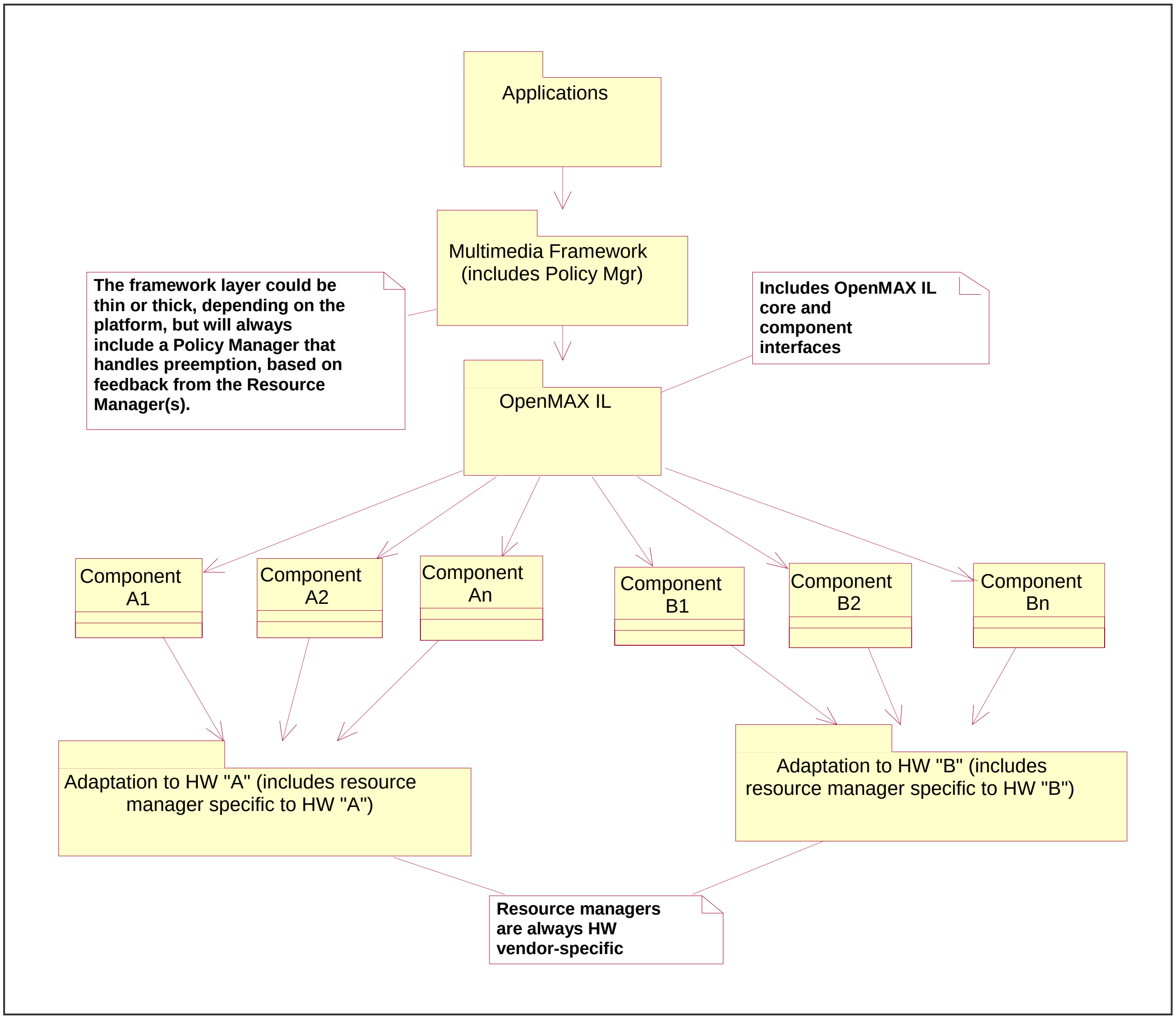


Figure 2-14. Example Architecture

To ensure consistent component behavior in case of resource conflicts, a common definition of component priority and a set of behavioral rules are needed.

2.1.17.3 Component Priorities

Each IL component has a priority value (an `OMX_U32` integer) that the IL client sets.

A descending order of priority is chosen with 0 denoting the highest priority. The following tie-breaking rule also applies: *When comparing components with the same* *priority, components that have acquired the resource most recently should be deemed to be of higher priority than components that have had the resource longer*

IL components may also be assigned a group priority by the IL client. Any component sharing the same group ID maintains the same group priority .

2.1.17.4 Behavioral Rules

The following behavior is defined on the IL layer:

- The `OMX_ErrorInsufficientResources` error is called only on a component that attempts to go to the idle state when there are insufficient resources and sufficient resources cannot be freed by preempting lower priority components.
- A component is not aware that preemption is occurring when it tries to go to the idle state, and the resources it requires need to be freed by preempting lower priority components.
- When a component that has resources which need to be preempted, it will send the `OMX_ErrorResourcesPreempted` error to the IL Client as it moves from the Executing or Paused state to the Idle state. The component will send the `OMX_ErrorResourcesLost` error to the IL client as it moves from the Idle state to the Loaded state once the resources are released.
- In cases where the IL client wants to know when the stream associated with the component can be resumed or started, the IL client shall request to be notified when resources are available. This occurs by putting the component into the OMX_StateWaitForResources state. When the resources become available, the component automatically goes to the idle state. When the client receives the notification that the component is in the idle state, it can try to move the rest of the components in that chain to the idle state as well. This automatic movement to the idle state ensures that in cases where multiple IL clients are waiting for the same resource, the IL client can resume or start the stream as soon as the resource is available. If the component were to automatically move just to the loaded state, then another IL client could grab that resource first.

These behavioral rules are intended to cover only the interactions between the IL client(s) and the IL components.

2.1.17.5 Hardware Vendor-Specific Resource Manager

To implement the behavioral rules, a hardware vendor-specific resource manager may exist and perform the following functions:

- Implement and manage the wait queue(s).
- Keep track of available resources.
- Keep track of each component that has resources and which resources they are using.

- Notify a component or multiple components that they need to give up their resources when a higher priority component requests the resource.
- Notify the highest priority component waiting for a resource when the resource is available.

The actual interactions between the components and the hardware vendor-specific resource manager(s) are vendor-specific and outside the scope of this document. Section 3 provides more details of the parameter structures and use cases related to priority and resource management.

2.1.17.6 Component Suspension

When a component lacks sufficient resources to process data it may elect to suspend itself as a means to enable more optimal dynamic resource management. Component suspension addresses two use cases:

1. Component has lost an essential resource and the resource loss is potentially temporary in nature.
2. Dynamic allocation of essential resources has failed

In the absence of the ability to suspend, the component's only possible reaction to the preemption and loss of a resource is deinitialization via a transition to the Idle and then Loaded states. Such deinitialization causes the state of the data stream to be lost because the buffers have to be returned to their allocator. Suspension allows a component to retain its state so that it may be resumed at the point of suspension after some delay.

Suspension is a property of a component when it is in the idle or paused component states. Specifically a component is "suspended" when it has lost one or more resources that prevent it from processing data. This means that a component cannot be suspended and be in the executing state at the same time (since "executing" implies the component will process or output data whenever that data is available). Therefore, a component may be suspended anytime it is normally holding some resources but not seeking to process data, namely when in the idle or paused states.

Component suspension requires no new component states but adds one new component-initiated state transition, namely a transition from the executing to the paused which an executing component performs on itself upon suspension. IL client may perform any of the normal state transitions on a suspended component with the following exception: a client may not transition a suspended component into the Executing state. Any attempt to do so will fail and return the `OMX_ErrorComponentSuspended` error.

2.1.18 Content Pipes

IL components may leverage content piping to synchronously pull in or push out content (e.g. a filestream) from a source or destination abstracting the platform implementation specifics of the source or destination (e.g. local file, remote file, broadcast, etc). A content pipe is an object that provides content access by implementing the data access abstraction interface defined in the content pipe structure.

The content pipe interface includes functions for conventional content manipulation including:

- opening, closing, and creating content
- seeking to a particular position in the the content
- getting the position in the content
- reading data from the current position
- writing data to the current position

This content pipe interface also includes functions to accommodate content pipe implementations that may be streaming data asynchronously to or from a remote location. In this case the pipe may not be immediately ready to provide data (in the case of reading) or accept data (in the case of writing). Furthermore such pipes may maintain their own data caches. These functions support:

- Checking the pipe for available bytes (either incoming or outgoing) to verify a pipe client may perform a subsequent read or write.
- Reading or writing data via pipe supplied data buffers to avoid unnecessary memory copies between pipe buffers and client buffers.

A component that leverages content pipes (e.g. a container demuxer or muxer) acquires the pipe from IL Core via the `OMX_GetContentPipe` function. Alternatively the IL client may provide a custom content pipe (e.g. if the client implements the content pipe itself) via the `OMX_IndexParamCustomContentPipe` config. The IL client specifies the target content as a URI via the `OMX_IndexParamContentURI` param.

2.1.19 File Parsing

OpenMAX IL 1.1 defines both standard container format demuxers and the mechanisms to facilitate file parsing functionality in such components. These include means:

- For a component to indicate whether or not it successfully detected and supports the datastream format it was given.
- For a component to inspect and select the streams available on each of the components output ports (when there are multiple alternative streams).
- For the IL client to traverse, extract, and filter the metadata a component captures from a data stream.

2.1.20 Video Decoder Error Mapping

A video decoder component has the ability to inform the IL client of any macroblock (MB) errors it encounters while decoding the stream.The client may query the component for a map of the MB errors it has encountered at any time via a dedicated parameter.

One pontential use for this functionality is the Video Telephony use case where the video terminal at one end of the connection generates an encoded bitstream for a remote video terminal. The encoded bitstream might get corrupted during transmission resulting in MB errors when the remote terminal receives and decodes it. An application that can communicate with both may extract the MB error map at the decoding terminal and transmit it to the encoding terminal allowing it to refresh the macroblocks in error with intra macroblocks in a subsequent encoded frame.

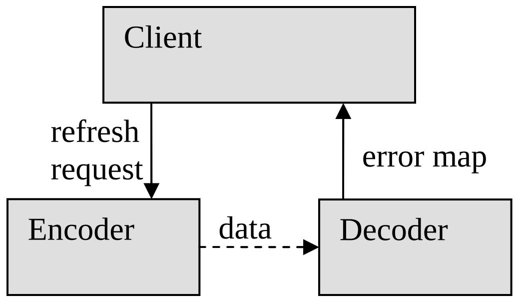


Figure 2-15. Example Use Case for Error Mapping

2.1.21 Buffer Payload Additional Information

Depending on buffer payload types and component requirements, a need may arise where additional supporting information will need to be appended to the end of the buffer to further process the buffer payload content within the next component.

For instance, video deblocking algorithms require macroblock level quantization information in order to perform the deblocking process on the video content.
The existence of additional buffer payload information shall be identified via the "extra data" buffer flag within the buffer header structure, which is described in section 3.1.2.7 — OMX_BUFFERHEADERTYPE.

This additional buffer payload information applies to the first new logical unit in the buffer. Thus, given the presence of multiple logical units in a buffer, the "extra data" flag applies to the logical unit whose starting boundary occurs first in the buffer. Subsequent logical units in a buffer don't have explicit "extra data". If explicit "extra data" are required on every logical unit, one or less logical unit should be included in each buffer.

2.1.21.1 Buffer Data Formatting

When extra data is present, the data attributes like type and size are identified by a corresponding data structure,immediately following the buffer payload and preceding the actual data. Multiple types of extra data may be appended to the end of the normal payload as series of block pairs (supporting data structure and actual data). To terminate this list of extra data sections, a further data structure should be included in the buffer which indicates that this is the terminating item. For more details see Section 4.2.33.

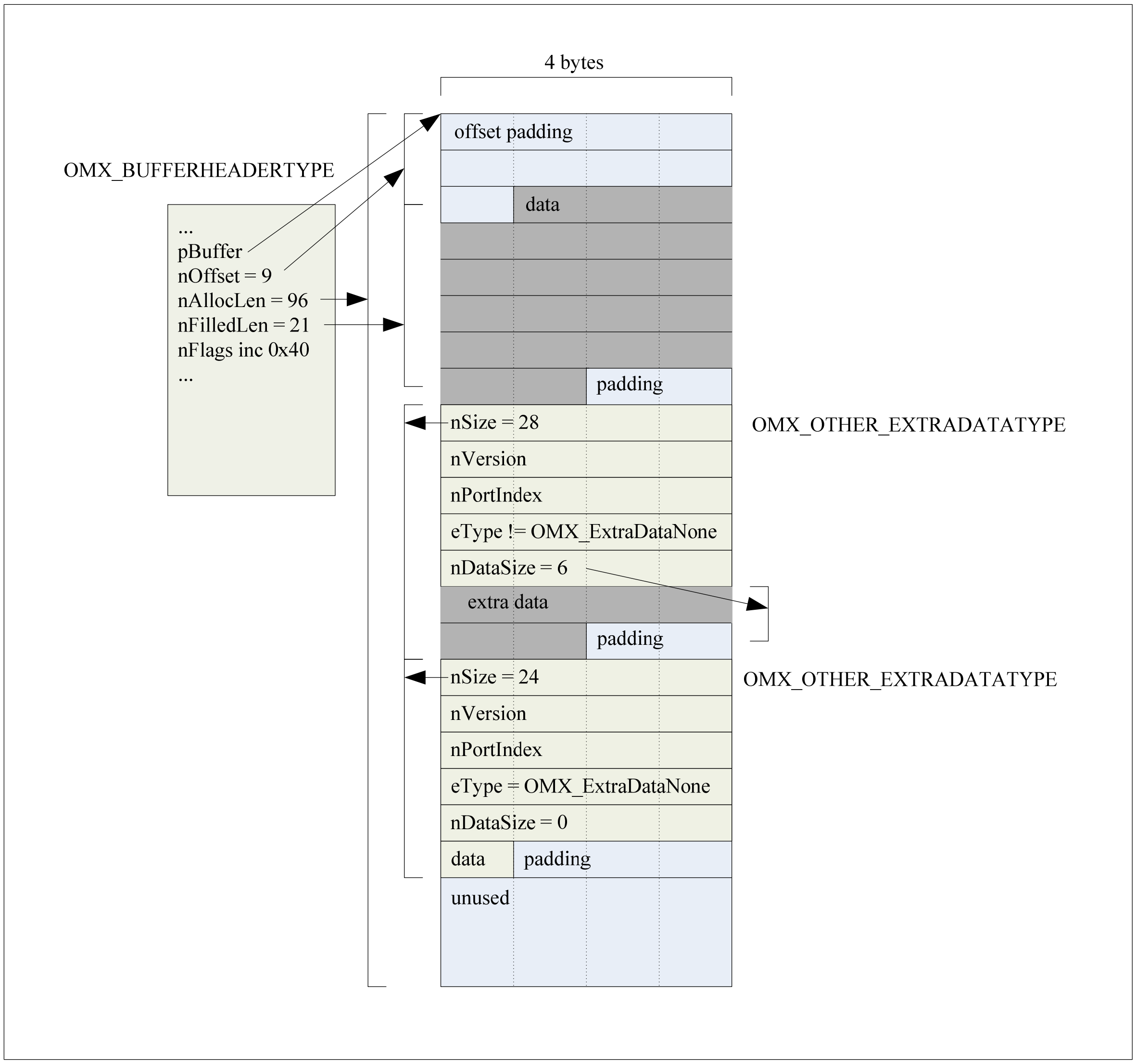


Figure 2-16. Formatting of Extra Buffer Data

2.2 Endianness

The endianness used in the implementation of OpenMAX IL API data structures shall obey the endianness of the platform on which the IL client is running. This requirement includes interfaces used by the IL client and interfaces between components (e.g. functions executed exclusively between two tunneling components). The OpenMAX IL implementation is responsible for any endianness conversions inherent in supporting this requirement; any such conversions are transparent to the IL client and to components using the same endianness as the IL client.

3 OpenMAX Integration Layer Control API

The OpenMAX Integration Layer API allows integration layer clients to control multimedia components in the audio, video and image domains. An “other” domain is also included to provide for extra functionality, such as audio-video (A/V) synchronization. The user of the OpenMAX Integration Layer API is usually a multimedia framework. In the rest of this document, the user of the OpenMAX Integration Layer API will be referred to as the IL client.

The OpenMAX Integration Layer API is defined in a set of header files, namely:

- `OMX_Types.h`: Data types used in the OpenMAX IL
- `OMX_Core.h`: OpenMAX IL core API
- `OMX_Component.h`: OpenMAX IL component API
- `OMX_Audio.h`: OpenMAX IL audio domain data structures
- `OMX_IVCommon.h`: OpenMAX IL structures common to image and video domains
- `OMX_Video.h`: OpenMAX IL video domain data structures
- `OMX_Image.h`: OpenMAX IL image domain data structures
- `OMX_Other.h`: OpenMAX IL other domain data structures (includes A/V synchronization)
- `OMX_Index.h`: Index of all OpenMAX IL-defined data structures
- `OMX_ContentPipe.h`: Content pipe definition

This section describes how the OpenMAX IL core and OpenMAX IL components are configured for operation.

First, the OpenMAX IL data types are introduced. Next, the methods of the OpenMAX IL core are described. The methods that components implement are discussed in section 3.2.3. Finally, section 3.4 shows calling sequences for a few meaningful operations, including component initialization, normal data flow, data tunnel setup, and data flow in the presence of data tunneling. Such sequence diagrams aim at describing the dynamic interactions between the IL client, the IL core, and the OpenMAX IL components.

When documenting functions, the following convention is used for function parameters:

- <param_name> [in] specifies an input parameter, which is set by the function caller and read by the function implementation.
- <param_name> [out] specifies an output parameter, which is set by the function implementation and passed back to the caller. When the function returns, the caller can read the new value of the parameter, which is passed as a reference.

- <param_name> [inout] specifies an input/output parameter, which the function caller can set. The function implementation can modify the parameter before returning it back to the function caller.

This parameter classification can also be found in the OpenMAX IL header files, where the null macros `OMX_IN`, `OMX_OUT` and `OMX_INOUT` are defined. `OMX_IN` corresponds to the function parameter <param_name> [in]. `OMX_OUT` corresponds to the function parameter <param_name> [out], and `OMX_INOUT` corresponds to the function parameter <param_name> [inout].

3.1 OpenMAX IL Types

3.1.1 Enumerations

Five 32-bit integer enumerations are defined in OMX_Core.h:

- `OMX_ERRORTYPE` is returned by each function defined in the OpenMAX Integration Layer API (see section 3.1.1.3).
- `OMX_COMMANDTYPE` includes the possible commands that an IL client can send to an OpenMAX IL component (see section 3.1.1.1).
- `OMX_EVENTTYPE` includes events that can be generated inside an OpenMAX IL component and that are passed to the IL client through a callback function (see section 3.1.1.4).
- `OMX_BUFFERSUPPLIERTYPE` includes all the possibilities for the buffer supplier in the case of tunneled ports. A description of the use of this enumerative type can be found in section 3.1.1.5.
- `OMX_STATETYPE`, which is described in section 3.1.1.2.

3.1.1.1 OMX_COMMANDTYPE

Table 3-1 represents the possible commands that an IL client can send to an OpenMAX IL component. Since commands are non-blocking, the OpenMAX IL component generates a command completion event via a callback function when the command has completed. Callbacks are defined in a dedicated structure; see section 3.1.2.8.

Table 3-1: OpenMAX IL Commands

Field Name	**Description**
`OMX_CommandStateSet`	Change the component state
`OMX_CommandFlush`	Flush the queue(s) of buffers on a port of a component
`OMX_CommandPortDisable`	Disable a port on a component
`OMX_CommandPortEnable`	Enable a port on a component
`OMX_CommandMarkBuffer`	Mark a buffer and specify which other component will raise the event mark received

Table 3-2 describes the parameters to be used for each command.

Table 3-2: Command Syntax

Command code	nParam	pCmdData
`OMX_CommandStateSet`	`OMX_STATETYPE` – state to transition to	NULL
`OMX_CommandFlush`	`OMX_U32` – target port ID	NULL
`OMX_CommandPortDisable`	`OMX_U32` – target port ID	NULL
`OMX_CommandPortEnable`	`OMX_U32` – target port ID	NULL
`OMX_CommandMarkBuffer`	`OMX_U32` – target port ID	`OMX_MARKTYPE*` - mark data and target component

3.1.1.2 OMX_STATETYPE

Figure 3-1 illustrates the transitions among states that occur as a consequence of the IL client calling `OMX_SendCommand(OMX_StateSet`, *<state>*), where the new state for the component is passed as a parameter. A transition name surrounded by “<” and “>” brackets indicates that the transition is not triggered by a command sent by the IL client but is a consequence of internal component events.

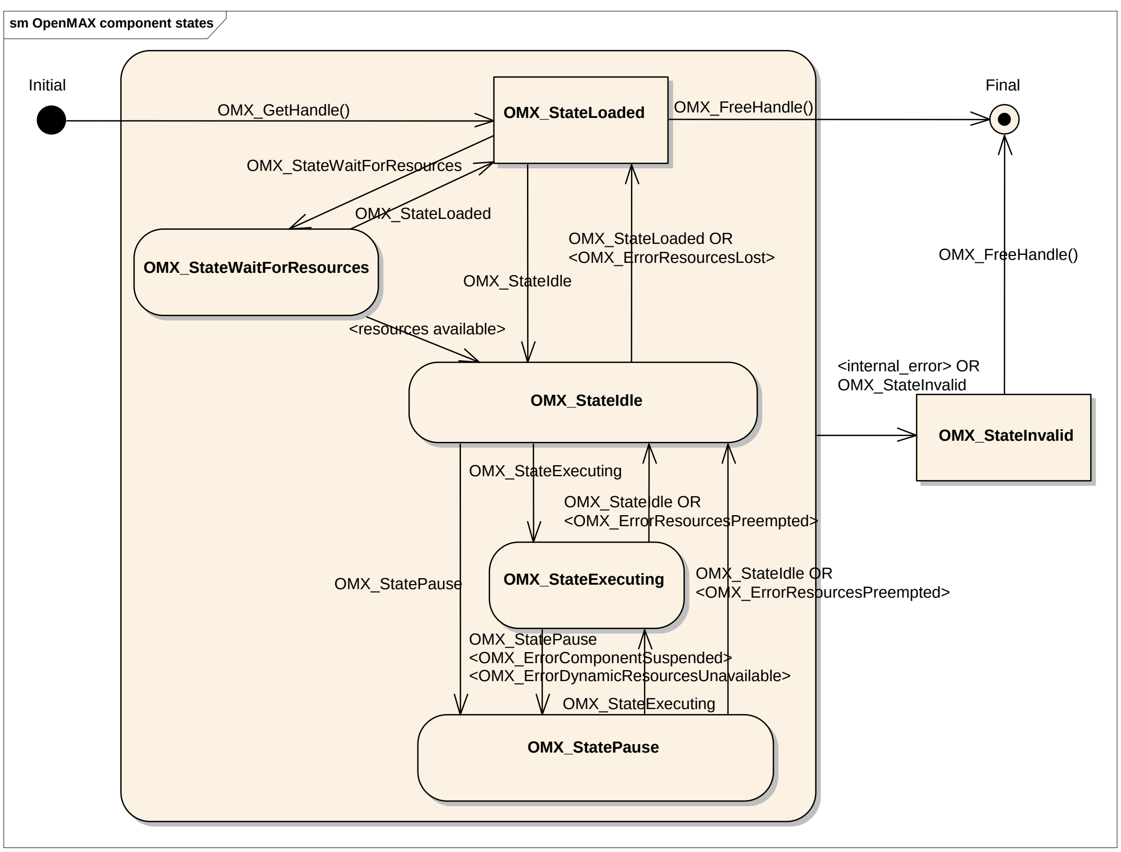


Figure 3-1. OpenMAX IL Component State Transitions

This section describes component states. An IL client commands a component to change states via the `OMX_SendCommand` function using the `OMX_CommandStateSet` command.

Table 3-3 represents the states of an OpenMAX IL component.

Table 3-3: OpenMAX IL Component States

Field Name	**Description**	**Static Resources Allocated**	**Location of buffer**
OMX_StateInvalid	Component is corrupt or has encountered an error from which it cannot recover.	Unknown	Unknown
OMX_StateLoaded	Component has been loaded but has no resources allocated.	No	Not available
OMX_StateIdle	Component has all resources but has not transferred any buffers or begun processing data.	Yes	Supplier only
OMX_StateExecuting	Component is transferring buffers and is processing data (if data is available).	Yes	Supplier or non-supplier
OMX_StatePause	Component data processing has been paused but may be resumed from the point it was paused.	Yes	Supplier or non-supplier
OMX_StateWaitFor Resources	Component is waiting for a resource to become available.	No	Not available

3.1.1.2.1 OMX_StateLoaded

A component is in the OMX_StateLoaded state after it has been created via an `OMX_GetHandle` call and before allocation of its resources. In this state, the IL client may modify the component's parameters via `OMX_SetParameter`, set up data tunnels on the component's ports with `OMX_SetupTunnel`, or transition the component to either the OMX_StateIdle state or the OMX_StateWaitForResources state.

The IL client may elect to transition a component that is currently in the OMX_StateLoaded state into the OMX_StateWaitForResources state if, for example, the component failed to acquire all of its static resources on an attempted transition to the OMX_StateIdle state.

3.1.1.2.1.1 OMX_StateLoaded to OMX_StateIdle

If the IL client requests a state transition from OMX_StateLoaded to OMX_StateIdle, the component shall acquire all of its static resources, including buffers for all enabled ports, before completing the transition. The component does not acquire buffers for any disabled ports. Furthermore, before the transition can complete, the buffer supplier, which is always the IL client when not tunneling, shall ensure that the non-supplier possesses all of its buffers.

For a port connected to the IL client, the IL client may allocate the buffers itself and then pass them to the port via an `OMX_UseBuffer` call on the port, or it may direct the port to perform the allocation via an `OMX_AllocateBuffer` call on the port. For each port, the IL client shall exclusively use OMX_UseBuffer or OMX_AllocateBuffer.

When a port is tunneling, the supplier port either allocates buffers itself or, if the port implements buffer sharing, re-uses buffers from a port on the same component. A tunneling supplier port then passes the buffers to the non-supplier port via an `OMX_UseBuffer` call on the non-supplier.

The number of buffers used on a port is specified in its port definition (see `OMX_IndexParamPortDefinition)`, which defaults to the minimum (specified in the same structure) but which may be modified by the supplier before the sequence of `OMX_UseBuffer` and `OMX_AllocateBuffer` calls via a call to `OMX_SetParameter`.

3.1.1.2.2 OMX_StateIdle

In the OMX_StateIdle state, the component is ready to be used, meaning that all necessary static resources have been properly allocated. However, the suppliers retain all their buffers, and no buffer exchange or processing is taking place. Thus, if this state is entered from an OMX_StateExecuting or OMX_StatePause state, the component shall have returned all buffers it was processing to their respective suppliers. The IL client may transition the component to any states other than the OMX_StateInvalid and OMX_StateWaitForResources states.

3.1.1.2.2.1 OMX_StateIdle to OMX_StateLoaded

On a transition from OMX_StateIdle to OMX_StateLoaded, each buffer supplier shall call `OMX_FreeBuffer` on the non-supplier port for each buffer residing at the non-supplier port. If the supplier allocated the buffer, it shall free the buffer before calling `OMX_FreeBuffer`. If the non-supplier port allocated the buffer, it shall free the buffer upon receipt of an `OMX_FreeBuffer` call. Furthermore, a non-supplier port shall always free the buffer header upon receipt of an `OMX_FreeBuffer` call. When all of the buffers have been removed from the component, the state transition is complete; the component communicates that the initiating `OMX_SendCommand` call has completed via a callback event.

3.1.1.2.2.2 OMX_StateIdle to OMX_StateExecuting

This transition is disallowed when the component is suspended. If the IL client requests a state transition from OMX_StateIdle to OMX_StateExecuting and the component is not suspended, the component shall begin transferring and processing data. If the client requests this transition when the component is suspended the component shall fail the call returning the `OMX_ErrorComponentSuspended` error. For ports that communicate with the IL client, the IL client will initiate buffer transfers via `OMX_EmptyThisBuffer` and `OMX_FillThisBuffer`. Among tunneling ports, any input port that is also a supplier shall transfer its empty buffers to the tunneled output port via `OMX_FillThisBuffer`.

3.1.1.2.3 OMX_StateExecuting

In this state, an OpenMAX IL component is transferring and processing data buffers; the component can therefore not be suspended and in this state. The component shall accept calls to `OMX_EmptyThisBuffer` on its input ports and `OMX_FillThisBuffer` on its output ports. Any port that communicates with the IL client shall call the `EmptyBufferDone` and `FillBufferDone` callbacks to return an empty or full buffer, respectively, back to the IL client. Any tunneling port shall call `OMX_FillThisBuffer` or `OMX_EmptyThisBuffer` on its corresponding tunneled port to return an empty or full buffer, respectively, back to its tunneled port. An IL client may transition a component in the OMX_StateExecuting state to either the OMX_StateIdle state or the OMX_StatePause state.

3.1.1.2.3.1 OMX_StateExecuting to OMX_StateIdle

If the IL client requests a state transition from OMX_StateExecuting to OMX_StateIdle, the component shall return all buffers to their respective suppliers and receive all buffers belonging to its supplier ports before completing the transition. Any port communicating with the IL client shall return any buffers it is holding via `EmptyBufferDone` and `FillBufferDone` callbacks, which are used by input and output ports, respectively. Any non-supplier port shall return all buffers it is holding to the input port or output port it is tunneling with using `OMX_EmptyThisBuffer` or `OMX_FillThisBuffer`, respectively. Likewise, any supplier tunneling port shall wait for all of its buffers to be returned from its tunneled port.

3.1.1.2.3.2 OMX_StateExecuting to OMX_StatePause

A transition from the OMX_StateExecuting state to the OMX_StatePause state occurs under in one of three circumstances:

- When the client explicitly requests the transition
- When the component loses a resource required for execution but may be resumed from the point of resource loss if the resource is reacquired later. In this case the component shall execute the transition automatically and issue an error event with the `OMX_ErrorResourcesSuspended` error.
- When the component is unsuccessful in an attempt to allocate dynamic resources. In this case the component shall execute the transition automatically and issue an error event with the `OMX_ErrorDynamicResourcesUnavailable` error.

3.1.1.2.4 *OMX_StatePause*

In this state, an OpenMAX IL component is not transferring or processing data but buffers are not necessarily returned to their suppliers. From the OMX_StatePause state, execution may be resumed via a transition to OMX_StateExecuting, preferably without dropping data. However, if the client requests this transition when the component is suspended the component shall fail the call returning the `OMX_ErrorResourcesSuspended` error. The component may still accept data buffers at its input, but such buffers will be queued only and not processed further. The IL client may transition a component in the OMX_StatePause state to OMX_StateIdle or OMX_StateExecuting. On a transition from OMX_StatePause to OMX_StateIdle, the component shall return all buffers to their respective suppliers in a manner identical to the OMX_StateExecuting-to-OMX_StateIdle transition described in section 3.1.1.2.3.1.

3.1.1.2.5 *OMX_StateWaitForResources*

In this state, the component is waiting for one or more of its required resources to become available. This state is related to resource management. The assumption is that one or more hardware-specific resource managers exist on the platform to handle available resources. The interaction among OpenMAX IL components and resource managers is outside the scope of this specification.

If a component in the OMX_StateLoaded state fails to enter the OMX_StateIdle state because resources other than buffers are insufficient, the IL client may put the component in the OMX_StateWaitForResources state if the IL client wants to be notified when the needed resources become available. The IL client may command the component to discontinue waiting for resources by transitioning it from the OMX_StateWaitForResources state to the OMX_StateLoaded state. If a component in the OMX_StateWaitForResources state acquires all the resources upon which it is waiting, it shall initiate a transition to the OMX_StateIdle state.

3.1.1.2.5.1 OMX_StateWaitForResources to OMX_StateIdle

When a component initiates a transition from the OMX_StateWaitForResources state to the OMX_StateIdle state, it shall communicate the initiation of this transition to the IL client via an `OMX_EventResourcesAcquired` event. When the IL client receives the `OMX_EventResourcesAcquired` event, it shall call `OMX_UseBuffer` and `OMX_AllocateBuffer` in the manner of a transition from OMX_StateLoaded to OMX_StateIdle. Likewise, the component cannot complete its transition to OMX_StateIdle until it acquires all of its static resources, including buffers.

3.1.1.2.6 *OMX_StateInvalid*

In this state, the component has suffered internal corruption or an error from which it cannot recover. When it detects such a condition, the component transitions itself to OMX_StateInvalid and informs the IL client by generating an `OMX_EventError` event with the value `OMX_ErrorInvalidState`. When the IL client receives `OMX_EventError` indicating a transition to OMX_StateInvalid, it shall free all resources associated with that component and eventually call `OMX_FreeHandle` to release the handle associated with the component.

A component in the OMX_StateInvalid state shall fail every call made upon it and return an `OMX_ErrorInvalidState` error message except for `OMX_GetState`, `OMX_FreeBuffer`, or `OMX_ComponentDeinit`. The IL client may also command a transition to the OMX_StateInvalid state explicitly via `OMX_SendCommand`. A component may transition between any state and the OMX_StateInvalid state.

3.1.1.3 OMX_ERRORTYPE

The `OMX_ERRORTYPE` enumeration shown in Table 3-4 defines the standard OpenMAX IL errors that all functions defined in the OpenMAX IL API return. These errors should cover most of the common failure cases. However, vendors are free to add additional error messages of their own as long as they follow these rules:

- Vendor error messages shall be in the range of 0x90000000 to 0x9000FFFF.
- Vendor error messages shall be defined in a header file provided with the component. No error messages are allowed that are not defined.

Table 3-4: OpenMAX IL Error Codes

Field Name	Description
`OMX_ErrorNone`	The function returned successfully.
`OMX_ErrorInsufficientResources`	There were insufficient resources to perform the requested operation.
`OMX_ErrorUndefined`	There was an error but the cause of the error could not be determined.
`OMX_ErrorInvalidComponentName`	The component name string was invalid.
`OMX_ErrorComponentNotFound`	No component with the specified name string was found.
`OMX_ErrorInvalidComponent`	The component specified did not have a `OMX_ComponentInit` entry point, or the component did not correctly complete the `OMX_ComponentInit` call
`OMX_ErrorBadParameter`	One or more parameters were invalid.
`OMX_ErrorNotImplemented`	The requested function is not implemented.
`OMX_ErrorUnderflow`	The buffer was emptied before the next buffer was ready.
`OMX_ErrorOverflow`	The buffer was not available when it was needed.
`OMX_ErrorHardware`	The hardware failed to respond as expected.
`OMX_ErrorInvalidState`	The component is in the OMX_StateInvalid state.

Field Name	Description
OMX_ErrorStreamCorrupt	The stream is found to be corrupt. OMX IL components processing coded data (typically decoders) may have the ability to detect corruption in the data stream. Also they may have the ability to detect missing frames and perform error concealment. Such components should report these errors to the client using this error code on a frame basis. Note that the components will in most cases continue normal operation.
OMX_ErrorPortsNotCompatible	Ports being set up for tunneled communication are incompatible.
OMX_ErrorResourcesLost	Resources allocated to a component in the OMX_StateIdle state have been lost, which has resulted in the component returning to the OMX_StateLoaded state.
OMX_ErrorNoMore	No more indices can be enumerated.
OMX_ErrorVersionMismatch	The component detected a version mismatch.
OMX_ErrorNotReady	The component is not ready to return data at this time.
OMX_ErrorTimeout	A timeout occurred where the component was unable to process the call in a reasonable amount of time. This could be due to an infinite loop, or busy hardware.
OMX_ErrorSameState	The component tried to transition into the state that it is currently in.
OMX_ErrorResourcesPreempted	Resources allocated to a component in the OMX_StateExecuting or OMX_StatePause states have been pre-empted, causing the component to return to the OMX_StateIdle state.
OMX_ErrorPortUnresponsiveDuringAllocation	The non-supplier port deemed that it had waited an unusually long time for the supplier port to send it an allocated buffer via an `OMX_UseBuffer` call. A non-supplier port sends this error to the IL client via the `EventHandler` callback during the allocation of buffers on a transition from the LOADED to the IDLE state or on a port enable.

Field Name	Description
OMX_ErrorPortUnresponsiveDuringDeallocation	The non-supplier port deemed that it had waited an unusually long time for the supplier port to request the de-allocation of a buffer header via a OMX_FreeBuffer call. A non-supplier port sends this error to the IL client via the EventHandler callback during the de-allocation of buffers on a transition from the IDLE to LOADED state or on a port disablement.
OMX_ErrorPortUnresponsiveDuringStop	The supplier port deemed that it had waited an unusually long time for the non-supplier port to return a buffer via an EmptyThisBuffer or FillThisBuffer call. A supplier port sent this error to the IL client via the EventHandler callback during the disabling of a port, either on a transition from the IDLE to LOADED state or on a port disablement.
OMX_ErrorIncorrectStateTransition	A state transition was attempted that is not allowed.
OMX_ErrorIncorrectStateOperation	A command or method was attempted that is not allowed during the present state.
OMX_ErrorUnsupportedSetting	One or more values encapsulated in the parameter or configuration structure are unsupported.
OMX_ErrorUnsupportedIndex	The parameter or configuration indicated by the given index is unsupported.
OMX_ErrorBadPortIndex	The port index that was supplied is incorrect.
OMX_ErrorPortUnpopulated	The port has lost one or more of its buffers and is thus unpopulated.
OMX_ErrorComponentSuspended	Component suspended due to temporary loss of resources.
OMX_ErrorDynamicResourcesUnavailable	Component suspended due to inability to acquire dynamic resources.
OMX_ErrorMbErrorsInFrame	Errors detected in frame.

Field Name	Description
`OMX_ErrorFormatNotDetected`	OMX IL components performing parsing when reading input buffers or content pipes have the ability to check correct formatting of input data. Such components should report this error to the client (in the form of an OMX_EventError event passed via the EventHandler callback) when it cannot parse or determine the format of the given datastream. This reporting is performed only once in case of file parsing error. In other cases, it is performed on every data unit (e.g. frame) formatting error.
`OMX_ErrorContentPipeOpenFailed`	Opening the Content Pipe failed
`OMX_ErrorContentPipeCreationFailed`	Creating the Content Pipe failed
`OMX_ErrorSeperateTablesUsed`	Attempting to query for single Chroma table when separate quantization tables are used for the Chroma (Cb and Cr) coefficients
`OMX_ErrorTunnelingUnsupported`	Tunneling is not supported by the component

3.1.1.4 OMX_EVENTTYPE

The `OMX_EVENTTYPE` enumeration shown in Table 3-5 includes the event types that an OpenMAX IL component can generate. Section 3.1.2.8 describes events that the OpenMAX IL component generates and passes to the IL client by means of the callback mechanism. Events have associated parameters that are also passed in the callback.

Table 3-5: OpenMAX IL Event Types

Field Name	Description
`OMX_EventCmdComplete`	Component has completed the execution of a command.
`OMX_EventError`	Component has detected an error condition.
`OMX_EventMark`	A buffer mark has reached the target component, and the IL client has received this event with the private data pointer of the mark.
`OMX_EventPortSettingsChanged`	Component has changed port settings. For example, the component has changed port settings resulting from bit stream parsing.
`OMX_EventBufferFlag`	The event that a component sends when it detects the end of a stream.

Field Name	Description
`OMX_EventResourcesAcquired`	The component has been granted resources and is transitioning from the OMX_StateWaitForResources state to the OMX_StateIdle state.
`OMX_EventComponentResumed`	The component has been resumed (i.e. no longer suspended) due to reacquisition of resources.
`OMX_EventDynamicResourcesAvailable`	The component has acquired previously unavailable dynamic resources.

3.1.1.4.1 OMX_EventCmdComplete

A component generates an `OMX_EventCmdComplete` event as soon as a command sent by the IL client has completed its execution, or a component-initiated state transition has occurred. In case of a component state change (whether initiated by the IL client or the component), the new state that the component has entered is returned as an event parameter. A component that transitions to the OMX_StateInvalid state does not generate this event.

3.1.1.4.2 OMX_EventError

A component generates the `OMX_EventError` event when the component detects an error condition; the type of error detected is returned as an event parameter and will use values defined in `OMX_ERRORTYPE`. A component shall send the following errors via `OMX_EventError`:

- A component sends the `OMX_ErrorInvalidState` error if the component transitions to the OMX_StateInvalid state.
- A component sends the `OMX_ErrorResourcesPreempted` error if the component transitions from OMX_StateExecuting or OMX_StatePause to OMX_StateIdle due to the loss of a resource.
- A component sends the `OMX_ErrorResourcesLost` error if the component transitions from OMX_StateIdle to OMX_StateLoaded due to the loss of a resource.

3.1.1.4.3 OMX_EventMark

A component generates the `OMX_EventMark` event when it receives a marked buffer. When a component receives a buffer, it shall compare its own pointer to the `pMarkTargetComponent` field contained in the buffer. If the pointers match, then the component shall send a mark event including `pMarkData` as a parameter, immediately after the component has finished processing the buffer. The IL client can use the mark event to measure the propagation delay of a data buffer through a chain of components, or to notify a component that a particular buffer has reached the given destination.

3.1.1.4.4 OMX_EventPortSettingsChanged

A component generates the `OMX_EventPortSettingsChanged` event as soon as component port settings change. For example, a video decoder may not know *a priori* the output frame size and frame rate, as these parameters are coded in the input bit stream. As soon as such parameters are parsed, the component changes the values of the configuration structures of its output port and sends the `OMX_EventPortSettingsChanged` event to the IL client. If a settings change requires the IL client to either reallocate buffers or recycle the tunnel on the port that generated the `OMX_EventPortSettingsChanged` then that port shall cease transferring data until the IL client takes such action.

3.1.1.4.5 OMX_EventBufferFlag

A component generates the `OMX_EventBufferFlag` event when an output port emits a buffer with the `OMX_BUFFERFLAG_EOS` flag set in the `nFlags` field. The `nData1` field of `EventHandler` specifies the value of the output port's `portindex` field. The `nData2` field of `EventHandler` specifies the unaltered `nFlags` field containing the end-of-stream (EOS) flag.

If a component does not propagate a stream further (e.g., the component is an audio or video sink), then the component shall send an `OMX_EventBufferFlag` event for that stream when it has finished processing a buffer with `OMX_BUFFERFLAG_EOS` set. The `nData1` field of `EventHandler` specifies the input port that received the buffer. The `nData2` field of `EventHandler` specifies the unaltered `nFlags` field containing the EOS flag.

3.1.1.4.6 OMX_EventResourcesAcquired

A component generates the `OMX_EventResourcesAcquired` event when it is in the OMX_StateWaitForResources state, and the resource manager detects that the needed resources are available. When the component generates this event, it is ready to change state into the OMX_StateIdle, and it waits for all the buffers to be allocated and assigned to its ports.

3.1.1.4.7 OMX_EventComponentResumed

A suspended component generates the `OMX_EventComponentResumed` event when the resources it had lost have been reacquired. Upon receipt of this event the component is no longer suspended client may attempt to transition a suspended component into the executing state.

3.1.1.4.8 OMX_EventDynamicResourcesAvailable

A suspended component generates the `OMX_EventDynamicResourcesAvailable` event when some dynamic resource it was formerly unable to allocate has become available. Upon receipt of this event the component is no longer suspended and the client may attempt to transition it into the executing state.

3.1.1.5 OMX_BUFFERSUPPLIERTYPE

The `OMX_BUFFERSUPPLIERTYPE` enumerative type shown in Table 3-6 specifies the port in the tunnel that is the supplier port. A buffer supplier port either may allocate its buffers or reuse buffers provided by another port within the same component.

Table 3-6: OpenMAX IL Buffer Supplier Type For Tunnel Setup

Field Name	Description
`OMX_BufferSupplyUnspecified`	The port supplying the buffers is unspecified, or no supplier is preferred.
`OMX_BufferSupplyInput`	The input port supplies the buffers.
`OMX_BufferSupplyOutput`	The output port supplies the buffer.

3.1.2 Structures

This section discusses the data structures defined in the OpenMAX IL core. The first two fields of each OpenMAX IL data structure denote the size, `nSize`, of the structure and the version of type `OMX_VERSIONTYPE`, `nVersion`, which is defined in section 3.1.2.4. The entity that allocates an OpenMAX IL structure is responsible for filling in these two values. Hereinafter, definitions for these two common fields are omitted in individual structure definitions.

3.1.2.1 OMX_COMPONENTREGISTERTYPE

The `OMX_COMPONENTREGISTERTYPE` structure is used in the case of static linking of components to the core. The core optionally uses it to load the component and run the specific component initialization functifons.

`OMX_COMPONENTREGISTERTYPE` is defined as follows.

```
typedef struct OMX_COMPONENTREGISTERTYPE
{
  const char          * pName;
  OMX_COMPONENTINITTYPE pInitialize;
} OMX_COMPONENTREGISTERTYPE;
```

3.1.2.2 OMX_COMPONENTINITTYPE Type Definition

The `OMX_COMPONENTINITTYPE` type definition is the type of function pointer for the component initialization entry point. The definition is as follows:

```
typedef OMX_ERRORTYPE (* OMX_COMPONENTINITTYPE)(OMX_IN  OMX_HANDLETYPE
hComponent);
```

3.1.2.2.1 Parameter Defintions

- `pName` contains the string name of the component and has limit of 128 bytes (including '\0').
- `pInitialize` contains the pointer to the initialization function of the component.

3.1.2.3 OMX_ComponentRegistered[ ]

Any core that statically links its components shall define this global array containing the list of all registered components in the form of `OMX_COMPONENTREGISTERTYPE` fields.

3.1.2.4 OMX_VERSIONTYPE

The `OMX_VERSIONTYPE` type indicates the version of a component or structure. Each structure uses an `OMX_VERSIONTYPE` field to indicate the OpenMAX IL specification version under which the structure is defined. For OpenMAX IL version 1.0, the specification version is 1.0.R.S with any Revision R and Step S values. For OpenMAX IL version 1.1, the specification version is 1.1.R.S with any Revision R and Step S values. The component structure also includes an `OMX_VERSIONTYPE` field to indicate a vendor-specific component version.

`OMX_VERSIONTYPE` is defined as follows.

```
typedef union OMX_VERSIONTYPE
{
    struct
    {
        OMX_U8 nVersionMajor;
        OMX_U8 nVersionMinor;
        OMX_U8 nRevision;
        OMX_U8 nStep;
    } s;
    OMX_U32 nVersion;


} OMX_VERSIONTYPE;
```

3.1.2.4.1 Parameter Defintions

- `nVersionMajor` identifies the major version number. This byte of the version occurs first.
- `nVersionMinor` identifies the minor version number.
- `nRevision` identifies the revision number.

- nStep identifies the step number. This byte of the version occurs last.

3.1.2.5 OMX_PRIORITYMGMTTYPE

The IL client may use the OMX_IndexConfigPriorityMgmt and OMX_IndexParamPriorityMgmt parameters with the OMX_PRIORITYMGMTTYPE structure. This structure describes the priority assigned to a set of components. A component group identifies a set of co-dependent components associated with the same feature. All components in the same group share the same group ID and priority. If one component in a group loses resources and stops running, the entire feature they collectively contribute to is lost. In this case, the IL Client should transition all of the other components in the same group to OMX_StateLoaded. A component that is the only one with a certain nGroupID acts atomically.

OMX_PRIORITYMGMTTYPE is defined as follows.

```
typedef struct OMX_PRIORITYMGMTTYPE {
      OMX_U32 nSize;
      OMX_VERSIONTYPE nVersion;
      OMX_U32 nGroupPriority;
      OMX_U32 nGroupID;
} OMX_PRIORITYMGMTTYPE;
```

3.1.2.5.1 Parameter Defintions

- nGroupPriority is the priority value associated with a group of components. If a parameter of this type is assigned to a component, that component belongs to the group identified with nGroupID and has a priority equal to nGroupPriority. By definition, the value 0 represents the highest priority for a group of components.

  The exact mechanism to assign priorities to groups of components is outside the scope of this document.

  The group is treated as having the same priority. When the priority of one component in the group is changed, that change effectively applies to all components in the group The IL Client shall update each component’s priority within the group with the same priority. The suspension of one component in a group does not imply the suspension of all components in that group.
- nGroupID is a unique ID for all components in the same component group.

3.1.2.6 OMX_RESOURCECONCEALMENTTYPE

The IL client may use the OMX_IndexParamDisableResourceConcealment parameter with the OMX_RESOURCECONCEALMENTTYPE structure to enable or disable resource concealment in a component.

The definition of OMX_RESOURCECONCEALMENTTYPE is shown as follows:

```
typedef struct OMX_RESOURCECONCEALMENTTYPE
```

```
{
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_BOOL bResourceConcealmentForbidden;
} OMX_RESOURCECONCEALMENTTYPE;
```

3.1.2.6.1 Parameter Defintions

- `bResourceConcealmentForbidden` is a Boolean that shall disallow the use of resource concealment methods by a component to resolve resource conflicts.

3.1.2.6.2 Component Suspension Policy

A component lacking sufficient resources to process data may elect to suspend itself to resolve a temporary resource conflict. Component suspension is ideal when the resource loss is temporary in nature or driven by a requirement for additional runtime dynamic resources.
The IL client specifies the suspension policy of a component via a parameter, `OMX_IndexParamSuspensionPolicy`, where possible suspension policies include:

- Suspension Disabled: The component shall not suspend itself. If an executing loses resource it shall transition through the idle state, into the loaded state as part of its resource loss. This shall be the **default** component behaviour as defined in v1.0.
- Suspension Enabled: Upon detection of a temporary loss of resources a component may suspend processing. No state transitions are triggered if suspension occurs in the paused or idle states. If the component is in the executing state when it suspends, it shall transition to paused..

The `OMX_PARAM_SUSPENSIONPOLICYTYPE` is defined as follows:

```
typedef struct OMX_PARAM_SUSPENSIONPOLICYTYPE {
      OMX_U32 nSize;
      OMX_VERSIONTYPE nVersion;
      OMX_SUSPENSIONPOLICYTYPE ePolicy;
} OMX_PARAM_SUSPENSIONPOLICYTYPE;
```

The parameters for `OMX_PARAM_SUSPENSIONPOLICYTYPE` are defined as follows.

- `ePolicy` specifies to the component to support suspension, `OMX_SuspensionEnabled`, or to disable support for suspension, `OMX_SuspensionDisabled`. The component default shall be `OMX_SuspensionDisabled`.

An IL client may query if the component is suspended using the `OMX_IndexParamComponentSuspended` parameter. The client can use this suspension status of the component to make decisions on how to proceed when a component is suspended. The IL Client may opt to leave the component as-is expecting the suspension to be temporary. The IL Client may opt to transition the component to the loaded state, or perform some alternative processing.

The OMX_PARAM_SUSPENSIONTYPE is defined as follows:

```
typedef struct OMX_PARAM_SUSPENSIONTYPE {
      OMX_U32 nSize;
      OMX_VERSIONTYPE nVersion;
      OMX_SUSPENSIONTYPE eType;
} OMX_PARAM_SUSPENSIONTYPE;
```

The parameters for OMX_PARAM_SUSPENSIONTYPE are defined as follows.

- eType specifies the suspension state of the component where OMX_Suspended indicates suspension and OMX_NotSuspended is the converse.

3.1.2.6.3 Suspension Due to Pre-emption of Resources

The effect of "suspension" on component implementations is minimal, specifically:

- Upon the loss of one or more resources, a component shall decide between either suspending itself (if it is capable of resumption later and its suspension policy allows it) or de-initializing itself via OMX_ErrorResourcesPreempted/Lost (if it is incapable of resumption later or if its suspension policy disallows suspension).
- In the case of suspension the component shall send the OMX_ErrorComponentSuspended error to the IL client. If the component is in the executing state the component shall transition itself to the paused state and send the OMX_EventCmdComplete event to the IL client.
- The component shall support the OMX_IndexParamComponentSuspended parameter.
- Upon a request to transition to Executing the component shall validate that it is not suspended. If it is suspended, the component shall fail the transition with an OMX_ErrorComponentSuspended error.
- Upon reacquisition of resources the component signals the IL client via the OMX_EventComponentResumed event. The component remains in the paused state until the IL client resumes the component by transitioning it back to the executing state.
- Upon the de-allocation of resources, the component shall be aware of which resources have already been de-allocated from a suspension.

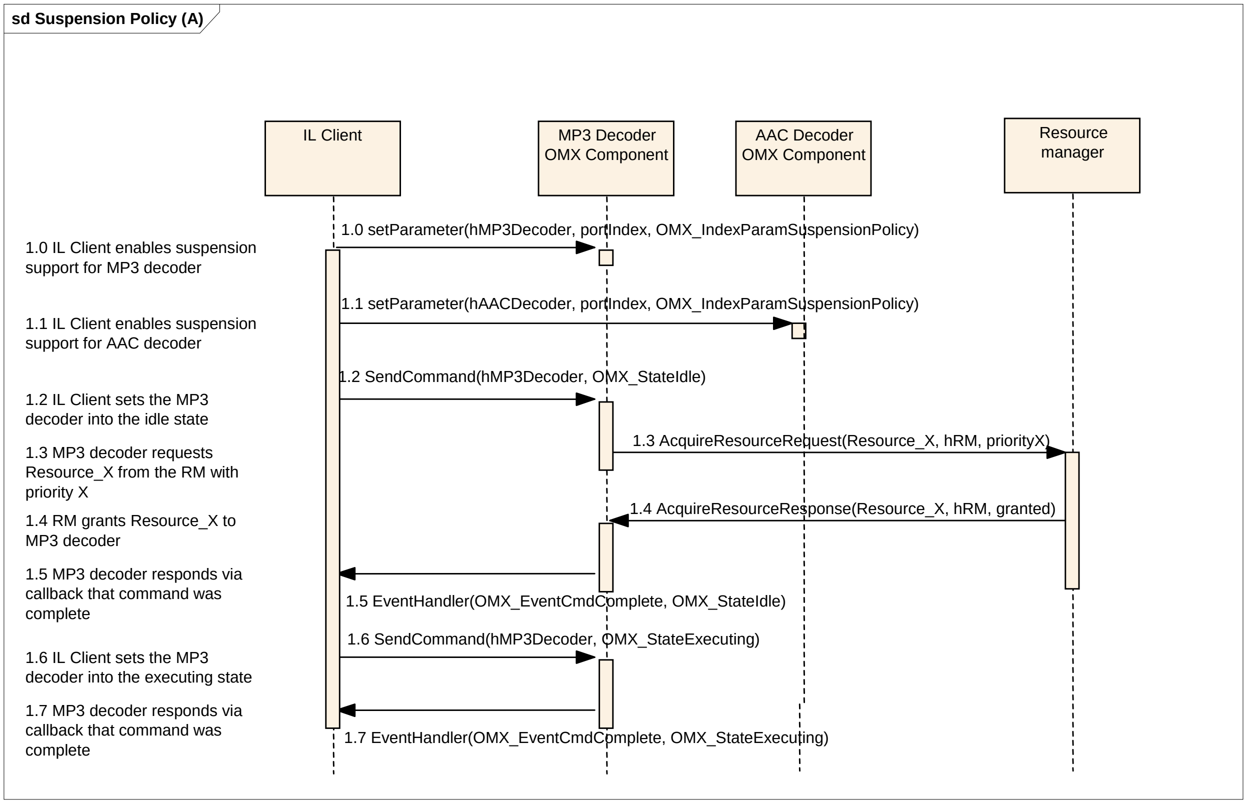


Figure 3-2: Suspension Policy (A)

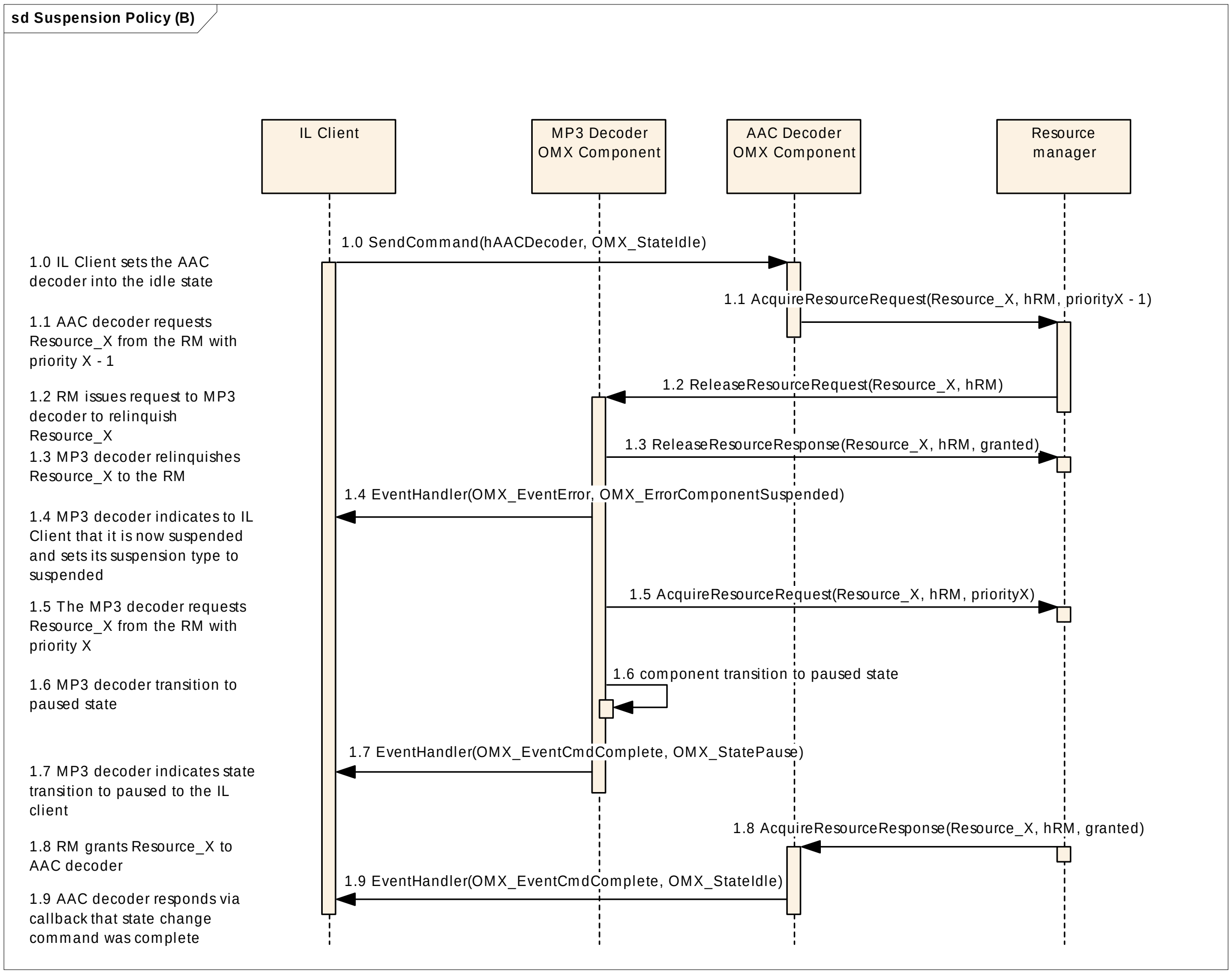


Figure 3-3: Suspension Policy (B)

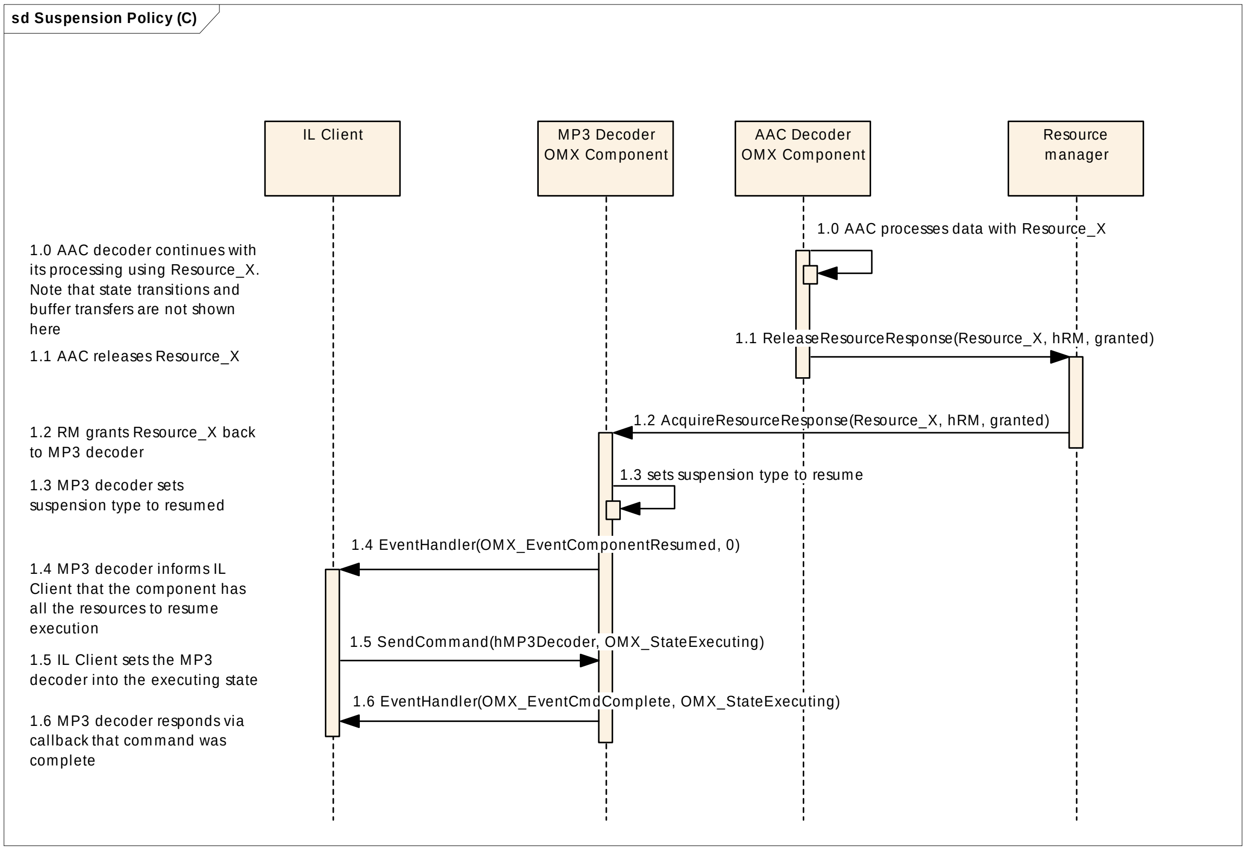


Figure 3-4: Component Suspension Due to Pre-emption of Resources

Figure 3-2, Figure 3-3, and Figure 3-4 comprise an example of two components, MP3 decoder and AAC decoder, requiring access to a common resource. Assume that each component needs to process a set of compressed buffers to be decoded. The IL client sets the components to support the suspension mechanism (1.0 A and 1.1 A) so that any loss of resources while processing the streams can be resumed.

The IL client transitions the MP3 decoder into the idle state (1.2 A). At this time the MP3 decoder issues a request to the resource manager (RM) for Resource_X (1.3 A). The RM responds to the request by granting Resource_X to the MP3 decoder (1.4 A). The MP3 decoder is then transitioned to start processing of stream buffers. (Note the buffer transfers are not shown in the diagram for simplicity).

Next the IL client transitions the AAC decoder into the idle state (1.0 B). The AAC decoder issues a request for Resource_X with as a higher priority client to the RM (1.1 B). The RM in turn issues a request to the MP3 decoder to release Resource_X (1.2 B). The MP3 decoder complies and releases Resource_X to the RM (1.3 B).

The MP3 decoder at this point sends an error to the IL client to indicate that the component is suspended (1.4 B). The MP3 decoder issues an acquire resource request for Resource_x (1.5 B) which of course the RM cannot fulfill since it is a lower priority request but the RM will track this resource request for the MP3 decoder.

The next step for the MP3 decoder is to transition to the paused state (1.6 B) and then emit a command complete paused event to the IL client (1.7 B). At this point the MP3 decoder is in a paused suspension state.

Concurrently, the RM may also grant Resource_X to the AAC decoder after being released by the MP3 decoder (1.7 B).The AAC decoder completes the state change to idle by issuing a command complete to the IL client. Assuming the IL client transitions the AAC decoder to executing and after processing a number of buffers (1.0 C) the AAC decoder releases Resource_X (1.1 C).

The RM then grants Resource_X to the MP3 component (1.2 C) base on its earlier request (1.5 B). The MP3 decoder then sets its suspension type to resume (1.3 C) and then issues an `OMX_EventComponentResumed` message to the IL client (1.4 C). The IL client transitions the MP3 component out of the paused state to executing to resume the stream processing (1.5 C-1.6 C).

3.1.2.6.4 Suspension Due to Unavailable Dynamic Resources

Under certain conditions the size and type of component resources vary within the lifetime of the component. As an example, resource requirements are dependent upon properties of the data stream itself, which are known only after inspection of the stream. This implies a component is in the executing state by which point all resources shall be allocated.

A component in the executing state may attempt to allocate additional resources as a result of increased requirements during processing. This dynamic resource allocation is completely transparent to the client except in the case where the component fails to allocate resources while in OMX_StateExecuting. Upon failure to allocate resources the component issues an error, `OMX_ErrorDynamicResourcesUnavailable`, and transitions to OMX_StatePause if the component suspension policy has been previously enabled by the IL client.

The component upon receiving the dynamic resources issues the event `OMX_EventDynamicResourcesAvailable` to the IL client and remains in OMX_StatePause. The component remains in the paused state until the IL client resumes the component by transitioning it back to the executing state.

The suspension mechanism follows the case where suspension occurs as a result of preemption with the exception of the errors and events presented to the IL client.

3.1.2.7 OMX_BUFFERHEADERTYPE

In the context of a single port, each data buffer has a header associated with it that contains meta-information about the buffer. The IL client shares buffer headers with each port with which it is communicating. Likewise, each pair of tunneling ports share buffer headers; otherwise, the same buffer transferred over multiple ports will have distinct buffer headers associated with it for each port.

The definition of the buffer header is shown as follows.

```
typedef struct OMX_BUFFERHEADERTYPE
{
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U8* pBuffer;
    OMX_U32 nAllocLen;
    OMX_U32 nFilledLen;
    OMX_U32 nOffset;
    OMX_PTR pAppPrivate;
    OMX_PTR pPlatformPrivate;
    OMX_PTR pInputPortPrivate;
    OMX_PTR pOutputPortPrivate;
    OMX_HANDLETYPE hMarkTargetComponent;
    OMX_PTR pMarkData;
    OMX_U32 nTickCount;
    OMX_TICKS nTimeStamp;
    OMX_U32 nFlags;
    OMX_U32 nOutputPortIndex;
    OMX_U32 nInputPortIndex;
} OMX_BUFFERHEADERTYPE;
```

3.1.2.7.1 Parameter Defintions

- `pBuffer` is a pointer to the actual buffer where data is stored but not necessarily the start of valid data; for more information, see the description of `nOffset` below.
- `nAllocLen` is the total size of the allocated buffer in bytes, including valid and unused byte.
- `nFilledLen` is the total size of valid bytes currently in the buffer starting from the location specified by `pBuffer` and `nOffset`. This includes any padding, e.g. the unused bytes at the end of a line of video when stride in bytes is larger than width in bytes.
- `nOffset` is the start offset of valid data in bytes from the start of the buffer. A pointer to the valid data may be obtained by adding `nOffset` to `pBuffer`.
- `pAppPrivate` is a pointer to an IL client private structure.
- `pPlatformPrivate` is a pointer to a private platform-specific structure. For instance, in the case where the IL client allocates the buffer through the platform's memory manager, this structure may contain information the platform's memory manager associates with the buffer.
- `pOutputPortPrivate` is a private pointer of the output port that uses the buffer. If a buffer header is used on an input port communicating with the IL client, the value of the buffer's `pOutputPortPrivate` is undefined.
- `pInputPortPrivate` is a private pointer of the input port that uses the buffer. If a buffer header is used on an output port communicating with the IL client, the value of the buffer's `pInputPortPrivate` is undefined.

- `hMarkTargetComponent` is the handle of the component that should emit an `OMX_EventMark` event upon processing this buffer. A NULL handle indicates that the buffer carries no mark. The `OMX_CommandMarkBuffer` command provides this handle to the marking component. The marking component, in turn, copies this handle to the marked buffer. Each component that is processing a buffer should compare its own handle to this handle and emit the mark if the handles match. A component should propagate this field from an input buffer to its associated output buffer.
- The `pMarkData` pointer refers to IL client-specific data associated with the mark that is sent on `OMX_EventMark` when emitted. Upon receipt of a mark, the IL client may use this data to disambiguate this mark from others. The `OMX_CommandMarkBuffer` command provides this pointer to the marking component. The marking component, in turn, copies this pointer to the marked buffer. A component should propagate this field from an input buffer to its associated output buffer.
- `nTickCount` is an optional entry that the component and IL client can update with a tick count when they access the component; not all components will update it. The value of `nTickCount` is in microseconds. Since this is a value relative to an arbitrary starting point, `nTickCount` cannot be used to determine absolute time.
- `nTimeStamp` is a timestamp corresponding to the sample starting at the first logical sample boundary in the buffer. Timestamps of successive samples within the buffer may be inferred by adding the duration of the preceding buffer to the timestamp of the preceding buffer. A component should propagate this field from an input buffer to its associated output buffer.
- `nFlags` field contains buffer specific flags, such as the EOS flag. A component should propagate this field from an input buffer to its associated output buffer. The list of flags is as follows:

```
#define OMX_BUFFERFLAG_EOS 0x00000001
#define OMX_BUFFERFLAG_STARTTIME 0x00000002
#define OMX_BUFFERFLAG_DECODEONLY 0x00000004
#define OMX_BUFFERFLAG_DATACORRUPT 0x00000008
#define OMX_BUFFERFLAG_ENDOFFRAME 0x00000010
#define OMX_BUFFERFLAG_SYNCFRAME 0x00000020
#define OMX_BUFFERFLAG_EXTRADATA 0x00000040
#define OMX_BUFFERFLAG_CODECCONFIG 0x00000080
```

  - OMX_BUFFERFLAG_EOS A source component (e.g. a demuxer) sets OMX_BUFFERFLAG_EOS when it has reached the end of the stream content on a particular output port. Some examples of this are:
    - End of a stream within a 3GP file,
    - Camera Component stopping the emission of stream data on its capture port. i.e. OMX_IndexAutoPauseAfterCapture support

The emission of the OMX_BUFFERFLAG_EOS does not preclude the possibility of subsequent stream content being emitted on the port in response to an IL client command. In the examples above, a port may emit additional stream content when:

- It receives a seek request to an earlier position earlier in the 3GP file,
- The Camera Component is requested to start emitting additional content via the capture port.

Other components forward the OMX_BUFFERFLAG_EOS in a way that is appropriate for their processing.

OMX_BUFFERFLAG_EOS shall not be emitted in response to a state change command.

- OMX_BUFFERFLAG_STARTTIME The source of a stream (e.g., a de-multiplexing component) sets the OMX_BUFFERFLAG_STARTTIME flag on the buffer that contains the starting timestamp for the stream. The starting timestamp corresponds to the first data that should be displayed at startup or after a seek operation.

  The first timestamp of the stream is not necessarily the start time. For instance, in the case of a seek to a particular video frame, the target frame may be an interframe. Thus the first buffer of the stream will be the intraframe preceding the target frame, and the start time will occur with the target frame along with any other required frames required to reconstruct the target intervening.

  The `OMX_BUFFERFLAG_STARTTIME` flag is directly associated with the buffer timestamp. Thus, the association of the `OMX_BUFFERFLAG_STARTTIME` flag to buffer data and its propagation is identical to that of the timestamp.

  A clock component client that receives a buffer with the STARTTIME flag shall perform an `OMX_SetConfig` call on its sync port using `OMX_ConfigTimeClientStartTime` and pass the timestamp for the buffer.

- OMX_BUFFERFLAG_DECODEONLY The source of a stream (e.g., a de-multiplexing component) sets the OMX_BUFFERFLAG_DECODEONLY flag on any buffer that should be decoded but not rendered. This flag is used, for instance, when a source seeks to a target interframe that requires decoding of frames preceding the target to facilitate reconstruction of the target. In this case, the source would emit the frames preceding the target downstream but mark them as decode only.

  The `OMX_BUFFERFLAG_DECODEONLY` flag is associated with buffer data and propagated in a manner identical to that of the buffer timestamp.

A component that renders data should ignore all buffers with the OMX_BUFFERFLAG_DECODEONLY flag set.

- OMX_BUFFERFLAG_DATACORRUPT flag is set when the IL client identifies the data in the associated buffer as corrupt.
- OMX_BUFFERFLAG_ENDOFFRAME is an optional flag that is set by an output port when the last byte that a buffer payload contains is an end-of-frame. Any component that implements setting the OMX_BUFFERFLAG_ENDOFFRAME flag on an output port shall set this flag for every buffer sent from the output port containing an end-of-frame. No buffer payload can contain data from two separate frames.

  These restrictions enable input ports that receive data from the output port to detect an end-of-frame without requiring additional processing. These restrictions also enable an input port to easily detect if an output port supports this flag by its presence or absence on completion of the first frame.
- The OMX_BUFFERFLAG_SYNCFRAME flag that should be set by an output port to indicate that the buffer content contains a coded synchronization frame. A coded synchronization frame is a frame that can be reconstructed without reference to any other frame information. An example of a video synchronization frame is an MPEG4 I-VOP.

  If the OMX_BUFFERFLAG_SYNCFRAME flag is set then the buffer may only contain one frame.
- The OMX_BUFFERFLAG_EXTRADATA is an optional flag that should be set by an output port when the buffer payload contains additional information appended to the end of the buffer payload. Each extra block of data is preceded by an OMX_OTHER_EXTRADATATYPE structure which provides specific information about the extra data.
- The OMX_BUFFERFLAG_CODECCONFIG is an optional flag that is set by an output port when all bytes in the buffer form part or all of a set of codec specific configuration data. Examples include SPS/PPS nal units for OMX_VIDEO_CodingAVC or AudioSpecificConfig data for OMX_AUDIO_CodingAAC. Any component that for a given stream sets OMX_BUFFERFLAG_CODECCONFIG shall not mix codec configuration bytes with frame data in the same buffer, and shall send all buffers containing codec configuration bytes before any buffers containing frame data that those configurations bytes describe. If the stream format for a particular codec has a frame specific header at the start of each frame, for example OMX_AUDIO_CodingMP3 or OMX_AUDIO_CodingAAC in ADTS mode, then these shall be presented as normal without setting OMX_BUFFERFLAG_CODECCONFIG.

- nOutputPortIndex contains the port index of the output port that uses the buffer. If a buffer header is used on an input port that is communicating with the IL client, the value of nOutputPortIndex is undefined.

- `nInputPortIndex` contains the port index of the input port that uses the buffer. If a buffer header is used on an input port that is communicating with the IL client, the value of `nInputPortIndex` is undefined.

3.1.2.8 OMX_PORT_PARAM_TYPE

A component uses the `OMX_PORT_PARAM_TYPE` structure to identify the number and starting index of ports of a particular domain.

`OMX_PORT_PARAM_TYPE` is defined as follows.

```
typedef struct OMX_PORT_PARAM_TYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPorts;
    OMX_U32 nStartPortNumber;
} OMX_PORT_PARAM_TYPE;
```

3.1.2.8.1 Parameter Defintions

- `nPorts` is the number of ports of a given port domain (audio, video, image, or other) for the component.
- `nStartPortNumber` is the index of the first port of a given port domain (audio, video, image, or other) for the component . Subsequent ports of the given domain are numbered sequentially from `nStartPortNumber`.

3.1.2.9 OMX_CALLBACKTYPE

The OpenMAX IL includes a callback mechanism that allows a component to communicate the following with the IL client:

- An asynchronous command triggered by the IL client has completed successfully or failed and generated an error. Commands include those sent by `OMX_SendCommand` and those implied by IL client calls to `EmptyThisBuffer` or `FillThisBuffer`.
- An error unassociated with a command triggered by the IL client has occurred. For example, the component has suffered an unrecoverable error and is transitioning to the OMX_StateInvalid state.

To accomplish a callback, the OpenMAX IL has three callback functions defined: a generic event handler and two callbacks related to the dataflow (`EmptyBufferDone` and `FillBufferDone`).

The IL client is responsible for filling in an `OMX_CALLBACKTYPE` structure with its callback entry points and passing the structure to the OpenMAX IL core at initialization (init) time, usually in the `OMX_GetHandle` function.

`OMX_CALLBACKTYPE` is defined as follows.

```
  typedef struct OMX_CALLBACKTYPE
```

```
{
    OMX_ERRORTYPE (*EventHandler)(
        OMX_IN OMX_HANDLETYPE hComponent,
        OMX_IN OMX_PTR pAppData,
        OMX_IN OMX_EVENTTYPE eEvent,
        OMX_IN OMX_U32 nData1,
        OMX_IN OMX_U32 nData2,
        OMX_IN OMX_PTR pEventData);
    OMX_ERRORTYPE (*EmptyBufferDone)(
        OMX_IN OMX_HANDLETYPE hComponent,
        OMX_IN OMX_PTR pAppData,
        OMX_IN OMX_BUFFERHEADERTYPE* pBuffer);
    OMX_ERRORTYPE (*FillBufferDone)(
        OMX_IN OMX_HANDLETYPE hComponent,
        OMX_IN OMX_PTR pAppData,
        OMX_IN OMX_BUFFERHEADERTYPE* pBuffer);
} OMX_CALLBACKTYPE;
```

3.1.2.9.1 EventHandler

A component uses the `EventHandler` method to notify the IL client when an event of interest occurs within the component. The `OMX_EVENTTYPE` enumeration defines the set of OpenMAX IL events; refer to the definition of this enumeration for the meaning of each event. `nData1` carries the value of `OMX_COMMANDTYPE` that has been completed or `OMX_ERRORTYPE`. `nData2` carries further event parameters, e.g., `OMX_STATETYPE`. `pEventData` contains event specific data. The `pEventData` pointer may contain additional data associated with the event (e.g., mark-specific data). A call to `EventHandler` is a blocking call, so the IL client should respond within five milliseconds to avoid blocking the component for an excessively long time period.

The `EventHandler` method is defined as follows.

```
OMX_ERRORTYPE(* OMX_CALLBACKTYPE::EventHandler)(
OMX_IN OMX_HANDLETYPE hComponent,
OMX_IN OMX_PTR pAppData,
OMX_IN OMX_EVENTTYPE eEvent,
OMX_IN OMX_U32 nData1,
OMX_IN OMX_U32 nData2,
OMX_IN OMX_PTR pEventData)
```

The parameters are as follows.

Parameter	**Description**
hComponent [in]	The handle of the component that calls this function.
eEvent [in]	The event that the component is communicating to the IL client.
nData1 [in]	The first integer event-specific parameter. See Table 3-7 for the meaning in the context of each event.
nData2 [in]	The second integer event-specific parameter. See Table 3-7 for the meaning in the context of each event. The default value is 0 if not used.

Parameter	Description
pEventData [in]	A pointer to additional event-specific data. See Table 3-7 for the meaning in the context of each event.

Table 3-7 lists the parameters used in each event.

Table 3-7: Event Parameter Usage

eEvent	nData1	nData2	pEventData
OMX_EventCmdComplete	OMX_CommandStateSet	State reached	Null
	OMX_CommandFlush	Port index	Null
	OMX_CommandPort Disable	Port index	Null
	OMX_CommandPort Enable	Port index	Null
	OMX_CommandMark Buffer	Port index	Null
OMX_EventError	Error code	0	Null
OMX_EventMark	0	0	Data linked to the mark, if any
OMX_EventPortSettings Changed	port index	0	Null
OMX_EventBufferFlag	port index	nFlags unaltered	Null
OMX_EventResources Acquired	0	0	Null
OMX_EventDynamic ResourcesAvailable	0	0	Null

3.1.2.9.2 EmptyBufferDone

A component uses the `EmptyBufferDone` callback to pass a buffer from an input port back to the IL client. A component sets the `nOffset` and `nFilledLen` values of the buffer header to reflect the portion of the buffer it consumed; for example, `nFilledLen` is set equal to 0x0 if completely consumed.

In addition to facilitating normal data flow between an executing component and the IL client, a component uses the `EmptyBufferDone` function to return input buffers to the IL client in the following cases:

- The IL client commands a transition from OMX_StateExecuting or OMX_StatePause to OMX_StateIdle or to OMX_StateInvalid.
- The IL client flushes or disables a port.

The `EmptyBufferDone` call is a blocking call that should return from within five milliseconds. Therefore, the IL client may elect not to fill the buffers during this call but queue them for processing outside this call.

The `EmptyBufferDone` call is defined as follows.

```
OMX_ERRORTYPE(* OMX_CALLBACKTYPE::EmptyBufferDone)(
 OMX_OUT OMX_HANDLETYPE hComponent,
 OMX_OUT OMX_PTR pAppData,
 OMX_OUT OMX_BUFFERHEADERTYPE* pBuffer)
```

The parameters are as follows.

Parameter	Description
hComponent [out]	The handle of the component that is calling this function.
pAppData [out]	A pointer to IL client-defined data.
pBuffer [out]	A pointer to an `OMX_BUFFERHEADERTYPE` structure that was consumed or returned.

3.1.2.9.3 FillBufferDone

A component uses the `FillBufferDone` callback to pass a buffer from an output port back to the IL client. A component sets the `nOffset` and `nFilledLen` of the buffer header to reflect the portion of the buffer it filled; for example, `nFilledLen` is equal to 0x0 if it contains no data).

In addition to facilitating normal dataflow between an executing component and the IL client, a component uses this function to return output buffers to the IL client in the following cases:

- The IL client commands a transition from OMX_StateExecuting or OMX_StatePause to OMX_StateIdle or to OMX_StateInvalid.
- The IL client flushes or disables a port.

The `FillBufferDone` call is a blocking call that should return from within five milliseconds. The IL client may elect not to empty the buffers during this call but queue them for consumption outside this call.

`FillBufferDone` is defined as follows.

```
OMX_ERRORTYPE(* OMX_CALLBACKTYPE::FillBufferDone)(
OMX_OUT OMX_HANDLETYPE hComponent,
OMX_OUT OMX_PTR pAppData,
OMX_OUT OMX_BUFFERHEADERTYPE* pBuffer)
```

The parameters are as follows.

Parameter	Description
hComponent [out]	The handle of the component to access. This handle is the component handle returned by the call to the GetHandle function.
pAppData [out]	A pointer to IL client-defined data
pBuffer [out]	A pointer to an OMX_BUFFERHEADERTYPE structure that was filled or returned.

3.1.2.10 OMX_PARAM_BUFFERSUPPLIERTYPE

The OMX_PARAM_BUFFERSUPPLIERTYPE structure is used to communicate buffer supplier settings or buffer supplier preferences.

OMX_PARAM_BUFFERSUPPLIERTYPE is defined as follows.

```
typedef struct OMX_PARAM_BUFFERSUPPLIERTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BUFFERSUPPLIERTYPE eBufferSupplier;
} OMX_PARAM_BUFFERSUPPLIERTYPE;
```

3.1.2.10.1 Parameter Defintions

- nPortIndex represents the port that this structure applies to.
- eBufferSupplier is a field that contains the index of the buffer supplier, if input or output.

3.1.2.11 OMX_TUNNELSETUPTYPE

The ComponentTunnelRequest function uses the OMX_TUNNELSETUPTYPE structure to pass data between two ports when an IL client connects these ports via an OMX_SetupTunnel call.

OMX_TUNNELSETUPTYPE is defined as follows.

```
typedef struct OMX_TUNNELSETUPTYPE  {
    OMX_U32 nTunnelFlags;
    OMX_BUFFERSUPPLIERTYPE eSupplier;
} OMX_TUNNELSETUPTYPE;
```

3.1.2.11.1 Parameter Defintions

- nTunnelFlags is an integer parameter that contains one or more bit flags applied to the port that receives this structure. Flags include:

```
#define OMX_PORTTUNNELFLAG_READONLY 0x00000001
```

If the flag is set as read only, the input port that receives this structure cannot alter the contents of buffers supplied on the tunnel.

- The eSupplier field defines whether the input port or the output port provides the buffers. The exact sequence of calls to set up a tunnel is specified in section 3.4.1.2.

3.1.2.12 OMX_PARAM_PORTDEFINITIONTYPE

The OMX_PARAM_PORTDEFINITIONTYPE structure contains a set of generic fields that characterize each port of the component. Some of these fields are common to all domains while other fields are specific to their respective domains. The IL client uses this structure to retrieve general information from each port.

OMX_PARAM_PORTDEFINITIONTYPE is defined as follows.

```
typedef struct OMX_PARAM_PORTDEFINITIONTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_DIRTYPE eDir;
    OMX_U32 nBufferCountActual;
    OMX_U32 nBufferCountMin;
    OMX_U32 nBufferSize;
    OMX_BOOL bEnabled;
    OMX_BOOL bPopulated;
    OMX_PORTDOMAINTYPE eDomain;
    union {
        OMX_AUDIO_PORTDEFINITIONTYPE audio;
        OMX_VIDEO_PORTDEFINITIONTYPE video;
        OMX_IMAGE_PORTDEFINITIONTYPE image;
        OMX_OTHER_PORTDEFINITIONTYPE other;
    } format;
    OMX_BOOL bBuffersContiguous;
    OMX_U32 nBufferAlignment;
} OMX_PARAM_PORTDEFINITIONTYPE;
```

3.1.2.12.1 Parameter Defintions

- nPortIndex is a read-only field the identifies the port. The value of nPortIndex is a unique 32-bit number for the component. No two ports on a single component may share the same port number, but ports on different components may have the same port number.
- eDir is a read-only field that indicates the direction (OMX_DirInput or OMX_DirOutput) for the port.
- nBufferCountActual represents the number of buffers that are required on this port before it is populated, as indicated by the bPopulated field of this structure. The component shall set a default value no less than nBufferCountMin for this field.
- nBufferCountMin is a read-only field that specifies the minimum number of buffers that the port requires. The component shall define this non-zero default value.

- nBufferSize is a read-only field that specifies the minimum size in bytes for buffers that are allocated for this port. .
- bEnabled is a read-only Boolean field that indicates if the port is enabled. Ports default to bEnabled = OMX_TRUE and are enabled/disabled by sending the OMX_CommandPortEnable and OMX_CommandPortDisable commands with the OMX_SendCommand method. A port shall not be populated when it is not enabled.
- bPopulated is a read-only Boolean field that indicates if a port is populated. A port is populated when all of the buffers indicated by nBufferCountActual with a size of at least nBufferSize have been allocated on the port. A populated port shall be enabled. Enabled ports shall be populated on a transition to OMX_StateIdle and unpopulated on a transition to OMX_StateLoaded.
- eDomain is a read-only field that indicates the domain of the port. This field determines the contents of the format union explained in the next paragraph.
- The format fields are a union of domain-specific parameters. For more information on parameters for audio, video, image, and other domains, see Section 4 - OpenMAX IL Data API.
- bBuffersContiguous is a read-only Boolean field that indicates this port requires each buffer to be in contiguous memory.
- nBufferAlignment is a read-only field that specifies the alignment the port requires for each of its buffers (e.g. a value of 4 denotes that each buffer shall be 4-byte aligned). A value of zero denotes that the port does not have any alignment restrictions.

3.1.3 OMX_PORTDOMAINTYPE

Table 3-8 enumerates the fields used in the OMX_PARAM_PORTDEFINITIONTYPE structure to define the domain of the port.

Table 3-8: Port Domain Names

Field Name	Description
OMX_PortDomainAudio	Specifies that the field format is a structure of the OMX_AUDIO_PORTDEFINITIONTYPE type.
OMX_PortDomainVideo	Specifies that the field format is a structure of the OMX_VIDEO_PORTDEFINITIONTYPE type.
OMX_PortDomainImage	Specifies that the field format is a structure of the OMX_IMAGE_PORTDEFINITIONTYPE type.

Field Name	Description
OMX_PortDomainOther	Specifies that the field format is a structure of the OMX_OTHER_PORTDEFINITIONTYPE type.

3.1.4 OMX_HANDLETYPE

The OMX_HANDLETYPE structure defines the component handle as seen by the IL client. The component handle is used to access all of the public methods of the component. The component handle also contains pointers to the private data area of the component. The OpenMAX IL core allocates and initializes the component handle with help from the component during the process of loading the component. After the component is successfully loaded, the IL client can safely access any of the public functions of the component, although some may return an error because the state is inappropriate for the access.

3.2 OpenMAX IL Core Methods/Macros

The OpenMAX IL core implements the main interface for an IL client that wants to use OpenMAX IL components. For efficiency, OpenMAX IL defines a set of OpenMAX IL core macros that map on one-to-one basis to most OpenMAX IL component methods.

Some macros and methods recommend that the function return within either five milliseconds or 20 milliseconds, depending on the function. The 5-millisecond timeout was deemed by the standards body to be a reasonable response time for commands that may not require buffer processing. The standards body identified the 20-millisecond timeout to be a reasonable response time for commands that may require buffer processing to be completed; the assumption here is that the longest buffer processing would be less than 30 milliseconds, which corresponds to 30-frames per second video. These timeouts are intended primarily to enable component integrators to get a good idea of component response latency via conformance testing.

The macros include the following:

- Get component information (version, capabilities).
- Set/Get component parameters at init time.
- Set/Get component parameters at run time.
- Allocate/De-allocate buffers.
- Send a buffer full of data to an OpenMAX IL component port.
- Send an empty buffer to an OpenMAX IL component port.
- Send commands to a component.
- Get the actual state of the component.
- Get references to OpenMAX IL component-proprietary parameters.

The OpenMAX IL Core also implements methods for the following:

- Initializing/de-initializing the whole OpenMAX IL Core.
- Getting an OpenMAX IL component handle.
- Releasing an OpenMAX IL component handle.
- Detecting all OpenMAX IL components available on the platform at run time.
- Setting up data tunnels among OpenMAX IL components.
- Acquiring content pipes.
- Querying for information on installed standard component implementations.

When a time limit for the execution of a method is specified, it is not intended as a hard restriction for the conformance of the component to the standard, but if the limit is not respected, a note shall appear in the description document related to the component.

3.2.1 Return Codes for the Functions

Table 3-9 lists all of the possible return error codes for each function. A critical error denotes an error from which the component cannot recover. The component should transition to the OMX_StateInvalid state when a critical error occurs. All columns but the last two correspond to errors returned from a call to the component. The rightmost two columns denote errors sent asynchronously as the result of an internal error.

Table 3-9: Error Codes

	OMX_GetComponentVersion	OMX_SendCommand	OMX_GetParameter	OMX_SetParameter	OMX_GetConfig	OMX_SetConfig	OMX_GetExtensionIndex	OMX_GetState	OMX_UseBuffer	OMX_AllocateBuffer	OMX_FreeBuffer	OMX_EmptyThisBuffer	OMX_FillThisBuffer	OMX_ComponentDeInit	OMX_Init	OMX_Deinit	OMX_ComponentNameEnum	OMX_GetHandle	OMX_FreeHandle	OMX_SetupTunnel	OMX_GetContentPipe	OMX_GetComponentsOfRole	OMX_GetRolesOfComponent	Sent with EventHandler	Critical error
OMX_ErrorNone	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					
OMX_ErrorInsufficientResources		X							X	X					X			X						X	
OMX_ErrorUndefined	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X		X	X	X		
OMX_ErrorInvalidComponentName																		X				X	X		
OMX_ErrorComponentNotFound																		X							
OMX_ErrorInvalidComponent	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X		X	X		
OMX_ErrorBadParameter	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X		
OMX_ErrorNotImplemented																				X					
OMX_ErrorUnderflow																								X	
OMX_ErrorOverflow																								X	

	OMX_GetComponentVersion	OMX_SendCommand	OMX_GetParameter	OMX_SetParameter	OMX_GetConfig	OMX_SetConfig	OMX_GetExtensionIndex	OMX_GetState	OMX_UseBuffer	OMX_AllocateBuffer	OMX_FreeBuffer	OMX_EmptyThisBuffer	OMX_FillThisBuffer	OMX_ComponentDeInit	OMX_Init	OMX_Deinit	OMX_ComponentNameEnum	OMX_GetHandle	OMX_FreeHandle	OMX_SetupTunnel	OMX_GetContentPipe	OMX_GetComponentsOfRole	OMX_GetRolesOfComponent	Sent with EventHandler	Critical error
OMX_ErrorHardware																								X	X
OMX_ErrorInvalidState	X	X	X	X	X	X	X		X	X	X	X	X	X						X				X	X
OMX_ErrorStreamCorrupt																								X	
OMX_ErrorPortsNotCompatible																				X					
OMX_ErrorResourcesLost																								X	
OMX_ErrorNoMore			X		X												X								
OMX_ErrorVersionMismatch	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X					
OMX_ErrorNotReady			X		X																				
OMX_ErrorTimeout		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X					
OMX_ErrorSameState																								X	
OMX_ErrorResourcesPreempted																								X	
OMX_ErrorPortUnresponsiveDuringAllocation																								X	
OMX_ErrorPortUnresponsiveDuringDeallocation																								X	
OMX_ErrorPortUnresponsiveDuringStop																								X	
OMX_ErrorIncorrectStateTransition																								X	
OMX_ErrorIncorrectStateOperation				X					X	X		X	X	X						X					
OMX_ErrorUnsupportedSetting				X		X																			
OMX_ErrorUnsupportedIndex			X	X	X	X	X																		
OMX_ErrorBadPortIndex		X	X	X	X	X	X		X	X	X	X	X							X					
OMX_ErrorPortUnpopulated																								X	
OMX_ErrorDynamicResourcesUnavailable																								X	
OMX_ErrorMbErrorsInFrame																								X	
OMX_ErrorFormatNotDetected																								X	
OMX_ErrorSeperateTablesUsed			X																						

3.2.2 Macros

This section describes the OpenMAX IL core macros. Note that some of these calls occur when only the caller is in the appropriate state to make the call (e.g. when tunneling) or when the component is transitioning from one state to another.

Table 3-10 defines which macros may be called on a component in each component state.

Table 3-10: Valid Component Calls

	OMX_GetComponentVersion	OMX_SendCommand	OMX_GetParameter	OMX_SetParameter	OMX_GetConfig	OMX_SetConfig	OMX_GetExtensionIndex	OMX_GetState	OMX_UseBuffer	OMX_AllocateBuffer	OMX_FreeBuffer	OMX_EmptyThisBuffer	OMX_FillThisBuffer	OMX_ComponentDeinit	OMX_SetupTunnel
OMX_StateLoaded	X	X	X	X	X	X	X	X	X	X	X			X	X
OMX_StateIdle	X	X	X		X	X	X	X			X	X	X	X	
OMX_StateExecuting	X	X	X		X	X	X	X			X	X	X	X	
OMX_StatePause	X	X	X		X	X	X	X			X	X	X	X	
OMX_StateWaitForResources	X	X	X	X	X	X	X	X	X	X	X			X	
OMX_StateInvalid								X			X			X	
Disabled Port	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

3.2.2.1 OMX_GetComponentVersion

The `GetComponentVersion` macro will query the component and returns information about it. This is a blocking call. The component should return from this call within five milliseconds.

The macro is defined as follows.

```
#define OMX_GetComponentVersion (
  hComponent,
  pComponentName,
  pComponentVersion,
  pSpecVersion,
  pComponentUUID)
((OMX_COMPONENTTYPE*)hComponent)->GetComponentVersion(     \
        hComponent,                      \
        pComponentName,                  \
        pComponentVersion,               \
        pSpecVersion,
        pComponentUUID)
```

The parameters are as follows.

Parameter	Description
hComponent *[in]*	The handle of the component that executes the command.
pComponentName *[out]*	A pointer to a component name string. Component names are strings limited to a length up to 127 bytes plus the trailing null for a maximum length of 128 bytes. An example of a valid component name is "OMX.<vendor_name>.AUDIO.DSP.MIXER\0". Names are assigned by the vendor, but shall start with "OMX." concatenated to the vendor specified string.
pComponentVersion *[out]*	A pointer to an OpenMAX IL version structure that the component will populate. The component will fill in a value that indicates the component version. Note that the component version is not the same as the OpenMAX IL specification version, which is found in all structures. The vendor of the component defines the component version and establishes its value.
pSpecVersion *[out]*	A pointer to an OpenMAX IL version structure that the component will populate. `SpecVersion` is the version of the specification that the component was built against. Note that this value may or may not match the version of the structure. For example, if the component was built against the version 2.0 specification but the IL client, which creates the structure, was built against the version 1.0 specification, the versions would be different.
pComponentUUID *[out]*	A pointer to an UUID identifier that uniquely identies the component. A component shall not be required to provide this information, it is optional information that a component may choose to provide.

3.2.2.1.1 Prerequisites for This Method

This method has no prerequisites.

3.2.2.1.2 Sample Code Showing Calling Sequence

The following sample code shows a calling sequence.

```
/* detect mismatch between IL client's and component's spec version */
OMX_GetComponentVersion(
      hComp,
      &CompName,
      &CompVersion,
      &CompSpecVersion);
if (CompSpecVersion != IlClientVersion){
      printf("ERROR: version mismatch\n");
}
```

3.2.2.2 OMX_SendCommand

The `OMX_SendCommand` macro will invoke a command on the component. This is a non-blocking call that should, at a minimum, validate command parameters but return within five milliseconds. The component normally executes the command outside the context of the call, though a solution without threading may elect to execute it in context. In either case, the component uses an event callback to notify the IL client of the results of the command once completed. If the component executes the command successfully, the component generates an OMX_EventCmdComplete callback. If the component fails to execute the command, the component generates an OMX_EventError and passes the appropriate error as a parameter.

The component may elect to queue commands for later execution. The only restriction is that the completion shall be done in the same order as the requests arrived.

The macro is defined as follows.

```
#define OMX_SendCommand (
  hComponent,
  Cmd,
nParam,
pCmdData)
 ((OMX_COMPONENTTYPE*)hComponent)->SendCommand(          \
        hComponent,                                         \
        Cmd,                                                \
        nParam,
        pCmdData)
```

The parameters are as follows.

Parameter	Description
hComponent *[in]*	The handle of the component that executes the command
Cmd *[in]*	Command for the component to execute
nParam *[in]*	Integer parameter for the command that is to be executed
pCmdData *[in]*	A pointer that contains implementation-specific data that cannot be represented with the numeric parameter nParam

Section 3.3—OpenMAX IL Component Methods and Structures describes the corresponding function that each component implements.

3.2.2.3 OMX_CommandStateSet

The IL client calls this command to request that the component transition into the state given in nParam. The component shall make the transition between the old state and the new state successfully only if it is a legal transition and all prerequisites for this transition are met. For more information on component states, see Section 3.1.1.2—OMX_STATETYPE.

If the component successfully transitions to the new state, it notifies the IL client of the new state via the OMX_EventCmdComplete event, indicating OMX_CommandStateSet for nData1 and the new state for nData2. If a state transition fails, the component shall notify the IL client of the error that prevented it via OMX_EventError event. Relevant errors include but are not limited to the following:

- OMX_ErrorSameState: The component is already in the state requested.
- OMX_ErrorIncorrectStateTransition: The transition requested is not legal.
- OMX_ErrorInsufficientResources: The transition required the allocation of resources and the component failed to acquire the resources.

3.2.2.4 OMX_CommandFlush

This IL client calls this command to flush one or more component ports. nParam specifies the index of the port to flush. If the value of nParam is OMX_ALL, the component shall flush all ports.

When the IL client flushes a non-tunnelling port, that port shall return all buffers it is holding to the IL client using EmptyBufferDone and FillBufferDone (appropriate for an input port or an output port, respectively) to return the buffers. When tunnelling, the flushed input port uses EmptyThisBuffer or FillThisBuffer (appropriate for an input port or an output port, respectively) to return the buffers to the output port.

For each port that the component successfully flushes, the component shall send an OMX_EventCmdComplete event, indicating OMX_CommandFlush for nData1 and the individual port index for nData2, even if the flush resulted from using a value of OMX_ALL for nParam. If a flush fails, the component shall notify the IL client of the error via an OMX_EventError event.

3.2.2.5 OMX_CommandPortDisable

The OMX_CommandPortDisable command disables a port. nParam specifies the index of the port to disable. If the value of nParam is OMX_ALL, the component shall disable all ports. A disabled port has no buffers and is not connected to either the IL client or another port via a tunnel. A disabled port does not allocate buffers on a transition from OMX_StateLoaded or OMX_StateWaitForResources to OMX_StateIdle. An IL client can change the parameters via OMX_SetParameter of a disabled port or set up a tunnel on it regardless of the component state. Thus the OMX_CommandPortDisable command, in co-operation with OMX_CommandPortEnable, is useful for the dynamic reconfiguration or re-tunneling of a port.

The port shall immediately clear bEnabled in its port definition structure when it receives OMX_CommandPortDisable. If the port that the IL client is disabling is a non-supplier port, the IL client shall return any buffers it is holding to the supplier port via OMX_EmptyThisBuffer/OMX_FillThisBuffer if tunneling or EmptyBufferDone/FillBufferDone if not tunneling. Then, the IL client shall wait for the supplier port to free the buffers via OMX_FreeBuffer before completing the disable command. If the port that the IL client is disabling is a supplier port with buffers allocated, the IL client shall wait for the non-supplier port to return all buffers via

OMX_EmptyThisBuffer or OMX_FillThisBuffer. Then, the IL client shall free the buffers via OMX_FreeBuffer before completing the disable command.

For each port that the component successfully disables, the component shall send an OMX_EventCmdComplete event indicating OMX_CommandPortDisable for nData1 and the individual port index for nData2, even if using a value of OMX_ALL for nParam caused the port to be disabled. If the disable operation fails, the component shall notify the IL client of the error via the OMX_EventError event.

3.2.2.6 OMX_CommandPortEnable

The OMX_CommandPortEnable command enables a port. nParam specifies the index of the port to be enabled. If the value of nParam is OMX_ALL, the component shall enable all ports. An enabled port shall abide by all the requirements of the component's state. Thus, the port shall:

- Have no buffers allocated if the component is in the OMX_StateLoaded state or the OMX_StateWaitForResources state and all buffers are allocated otherwise.
- Allocate buffers on a transition from either the OMX_StateLoaded state or the OMX_WaitForResources state to the OMX_StateIdle.
- Transfer a buffer to facilitate data flow in the OMX_StateExecuting state.
- Disallow modification of its parameters via OMX_SetParameter in all states but OMX_StateLoaded.

The OMX_CommandPortEnable command, in co-operation with OMX_CommandPortDisable, is useful for the dynamic reconfiguration or re-tunneling of a port.

The port shall immediately set bEnabled in its port definition structure when the port receives OMX_CommandPortEnable. If the IL client enables a port while the component is in any state other than OMX_StateLoaded or OMX_StateWaitForResources, then that port shall allocate its buffers via the same call sequence used on a transition from OMX_StateLoaded to OMX_StateIdle. If the IL client enables while the component is in the OMX_StateExecuting state, then that port shall begin transferring buffers.

For each port that the component successfully enables, the component shall send an OMX_EventCmdComplete event, indicating OMX_CommandPortEnable for nData1 and the individual port index for nData2, even if using the value of OMX_ALL for nParam caused the enable operation. If a port enablement operation fails, the component shall notify the IL client of the error via OMX_EventError event.

3.2.2.7 OMX_CommandMarkBuffer

The OMX_CommandMarkBuffer command instructs the given port to mark a buffer. nParam holds the index of the port that will perform the mark. The pCmdData parameter of OMX_SendCommand points to an OMX_MARKTYPE structure. The pMarkTargetComponent field of this structure holds a pointer to the component that will send an event after processing the marked buffer. The pMarkData field of this structure holds a pointer to application-specific data associated with the mark to uniquely identify the mark to the application upon a mark event (denoted the *mark data*).

When instructed to mark a buffer, the component will mark the next buffer that it receives as input after it receives the mark command. The exception is a source component, which will mark the next buffer it adds to its output buffer queue. For components other than source components, the port index value in nParam holds the index of the input port that will mark its next buffer. For source components, the port index value in nParam holds the index of the output port that will mark its next buffer.

In the following cases, multiple marks may compete for a single buffer:

- A component receives two or more mark commands with no intervening buffer(s).
- Two or more input buffers, each with a mark, contribute to an output buffer (e.g., in a mixer).
- A component receives a mark command and the next buffer is already marked.

If multiple marks compete for application to the same buffer, the component uses the first mark received to mark the buffer and applies the remaining marks to subsequent buffers in the order that the component received them. If there are no subsequent buffers, the component may send the remaining marks on one or more empty buffers.

For each port that the component successfully marks a buffer, the component shall send an OMX_EventCmdComplete event indicating OMX_CommandMarkBuffer for nData1 and the individual port index for nData2. If a mark operation fails, the component shall notify the IL client of the error via OMX_EventError event.

A buffer header includes pMarkTargetComponent and the pMarkData fields, whose meaning is identical to those in OMX_MARKTYPE. A component marks a buffer by copying pMarkTargetComponent and the pMarkData fields from the mark command to the buffer headers. Both fields are NULL by default (i.e., before the buffer being marked). A component propagates the mark fields from an input buffer to an output buffer according to the buffer metadata rules established for buffer flags and timestamps. The target component does not propagate the mark but instead clears both fields to NULL.

When a component receives a buffer, it shall compare its own pointer to the pMarkTargetComponent. If the pointers match, the component shall send a mark event, including pMarkData as a parameter, immediately after the buffer exits the component or has been completely processed in the case where it does not exit the component.

OMX_MARKTYPE is defined as follows.

```
typedef struct OMX_MARKTYPE {
    OMX_HANDLETYPE hMarkTargetComponent;
    OMX_PTR pMarkData;
} OMX_MARKTYPE;
```

The parameters are described as follows.

Parameter	Description
hMarkTargetComponent	Identies the component handle that shall generate a mark event upon process the mark.
nMarkData	Application specific data associated with mark sent on a mark event to disambiguate a mark from others.

3.2.2.7.1 Prerequisites for This Method

This method has no prerequisites.

3.2.2.7.2 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* instructs a component port to mark a buffer*/

OMX_MARKTYPE mark;

mark.hMarkTargetComponent = hComp;
mark.pMarkData = appData;

OMX_SendCommand(hComp, OMX_CommandMarkBuffer, portIndex, &mark);
```

3.2.2.8 OMX_GetParameter

The `OMX_GetParameter` macro will get a parameter setting from a component. The `nParamIndex` parameter indicates which structure is requested from the component. The caller shall provide memory for the structure and populate the `nSize` and `nVersion` fields before invoking this macro. If the parameter settings are for a port, the caller shall also provide a valid port number in the `nPortIndex` field before invoking this macro. All components shall support a set of defaults for each parameter so that the caller can obtain the structure populated with valid values.

This call is a blocking call. The component should return from this call within 20 milliseconds.

The `OMX_GetParameter` macro is defined as follows.

```
#define OMX_GetParameter (
  hComponent,
  nParamIndex,
pComponentParameterStructure)
((OMX_COMPONENTTYPE*)hComponent)->GetParameter(          \
        hComponent,                                       \
        nParamIndex,                                      \
        pComponentParameterStructure)
```

The parameters are described as follows.

Parameter	Description
hComponent *[in]*	The handle of the component that executes the call
nParamIndex *[in]*	The index of the structure to be filled. This value is from the `OMX_INDEXTYPE` enumeration.
pComponentParameterStructure *[in,out]*	A pointer to the IL client-allocated structure that the component fills

Section 3.3—OpenMAX IL Component Methods and Structures describes the corresponding function that each component implements.

3.2.2.8.1 Prerequisites for This Method

The macro can be invoked when the component is in any state except the OMX_StateInvalid state.

3.2.2.8.2 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* disable every audio port of a component*/
OMX_GetParameter(hComp, OMX_IndexParamAudioInit, &oParam);
for (i=0;i<oParam.nPorts;i++) {
      OMX_SendCommand(
            hComp,
            OMX_CommandPortDisable,
            oParam.nStartPortNumber + i,
            0);
}
```

3.2.2.8.3 Error Conditions

The following error conditions can occur:

- `OMX_ErrorBadParameter` if one or more fields of the parameter structure are incorrect.
- `OMX_ErrorUnsupportedIndex` when the specified parameter index is unsupported.
- `OMX_ErrorVersionMismatch` when the `nVersion` field of the parameter structure does not match the expected version for the component.
- `OMX_ErrorNotReady` if an `OMX_GetParameter` operation has not completed processing. The caller should retry the `OMX_GetParameter` call.
- `OMX_ErrorNoMore` when the `OMX_GetParameter` function is called with a structure that includes the `nPortIndex` field and the value of `nPortIndex` exceeds the number of ports (of the appropriate domain) for the component.

3.2.2.9 OMX_SetParameter

The `OMX_SetParameter` macro will send a parameter structure to a component. The `nParamIndex` parameter indicates which structure is passed to the component.

The caller shall provide the memory for the correct structure and shall fill in the structure `nSize` and `nVersion` fields in addition to all other fields before invoking this macro. The caller is free to dispose of this structure after the call, as the component is required to copy any data it shall retain.

Some parameter structures contain read-only fields. The `OMX_SetParameter` method will preserve read-only fields, and shall not generate an error when the caller attempts to change the value of a read-only field.

This call is a blocking call. The component should return from this call within 20 milliseconds.

The `OMX_SetParameter` macro is defined as follows.

```
#define OMX_SetParameter (
  hComponent,
  nParamIndex,
pComponentParameterStructure)
((OMX_COMPONENTTYPE*)hComponent)->SetParameter(         \
        hComponent,                                         \
        nParamIndex,                                        \
        pComponentParameterStructure)
```

The parameters are as follows.

Parameter	**Description**
hComponent *[in]*	The handle of the component that executes the call.
nParamIndex *[in]*	The index of the structure that is to be sent. This value is from the `OMX_INDEXTYPE` enumeration.
pComponentParameterStructure *[in]*	A pointer to the IL client-allocated structure that the component uses for initialization.

Section 3.3.6 below describes the corresponding function that each component implements.

3.2.2.9.1 Prerequisites for This Method

The `OMX_SetParameter` macro can be invoked only when the component is in the OMX_StateLoaded state or on a port that is disabled.

3.2.2.9.2 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* force a port to be the supplier */
OMX_GetParameter(hComp, OMX_IndexParamPortDefinition, &oPortDef);
```

```
if (oPortDef.eDir == OMX_DirInput){
      oSupplier.eBufferSupplier = OMX_BufferSupplyInput;
} else {
      oSupplier.eBufferSupplier = OMX_BufferSupplyOutput;
}
oSupplier.nPortIndex = nPortIndex;
OMX_SetParameter(hComp, OMX_IndexParamCompBufferSupplier, &oSupplier);
```

3.2.2.9.3 Error Conditions

The following error conditions can occur:

- `OMX_ErrorIncorrectStateOperation` when the `OMX_SetParameter` function is called and the component is not in the OMX_StateLoaded state, or the port is not disabled.
- `OMX_ErrorBadParameter` if one or more fields of the parameter structure are incorrect.
- `OMX_ErrorUnsupportedIndex` when the specified parameter index is unsupported.
- `OMX_ErrorVersionMismatch` when the `nVersion` field of the parameter structure does not match the expected version for the component.
- `OMX_ErrorUnsupportedSetting` when a field in the parameter structure is unsupported by the component during an `OMX_SetParameter` call.
- `OMX_ErrorNotReady` if an `OMX_SetParameter` operation has not completed processing. The caller should retry the `OMX_SetParameter` call.
- `OMX_ErrorNoMore` when the `OMX_SetParameter` function is called with a structure that includes the `nPortIndex` field and the value of `nPortIndex` exceeds the number of ports (of the appropriate domain) for the component.

3.2.2.10 OMX_GetConfig

The `OMX_GetConfig` macro will get a configuration structure from a component. This macro can be invoked at any time after the component has been loaded. The `nConfigIndex` parameter indicates which structure is being requested from the component. The caller shall provide the memory for the structure and populate the `nSize` and `nVersion` fields before invoking this macro. If the configuration settings are for a port, the caller shall also provide a valid port number in the `nPortIndex` field before invoking this macro. All components shall support a set of defaults for each configuration so that the caller can obtain the structure populated with valid values.

This call is a blocking call. The component should return from this call within five milliseconds.

The `OMX_GetConfig` macro is defined as follows.

```
#define OMX_GetConfig (
```

```
  hComponent,
  nConfigIndex,
pComponentConfigStructure)
((OMX_COMPONENTTYPE*)hComponent)->GetConfig(            \
        hComponent,                                        \
        nConfigIndex,                                      \
        pComponentConfigStructure)
```

The parameters are as follows.

Parameters	Description
hComponent *[in]*	The handle of the component that executes the call.
nConfigIndex *[in]*	The index of the structure to be filled. This value is from the `OMX_INDEXTYPE` enumeration.
pComponentConfigStructure *[in,out]*	A pointer to the IL client-allocated structure that the component fills.

Section 3.3.7 below describes the corresponding function that each component implements.

3.2.2.10.1 Prerequisites for This Method

The macro can be invoked when the component is in any state except the OMX_StateInvalid state.

3.2.2.10.2 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* Wait until a certain playback position */
do {
OMX_GetConfig(hClockComp, OMX_IndexConfigTimeCurrentMediaTime,
            oMediaTime);
} while (oMediaStamp.nTimeStamp < nTargetTimeStamp);
```

3.2.2.10.3 Error Conditions

The following error conditions can occur:

- `OMX_ErrorBadParameter` if one or more fields of the config structure are incorrect.
- `OMX_ErrorUnsupportedIndex` when the specified config index is unsupported.
- `OMX_ErrorVersionMismatch` when the `nVersion` field of the config structure does not match the expected version for the component.
- `OMX_ErrorNotReady` if an `OMX_GetConfig` operation has not completed processing. The caller should retry the `OMX_GetConfig` call.

- OMX_ErrorNoMore when the OMX_GetConfig function is called with a structure that includes the nPortIndex field and the value of nPortIndex exceeds the number of ports (of the appropriate domain) for the component.

3.2.2.11 OMX_SetConfig

The OMX_SetConfig macro will set a component configuration value. This macro can be invoked anytime after the component has been loaded.

The caller shall provide the memory for the correct structure and fill in the structure nSize and nVersion fields in addition to all other fields before invoking this macro. The caller can dispose of this structure after the call, as the component is required to copy any data it shall retain.

Some configuration structures contain read-only fields. The OMX_SetConfig method will preserve read-only fields in configuration structures that contain them, and shall not generate an error when the caller attempts to change the value of a read-only field.

This call is a blocking call. The component should return from this call within five milliseconds.

The OMX_SetConfig macro is defined as follows.

```
#define OMX_SetConfig (
  hComponent,
  nConfigIndex,
  pComponentConfigStructure     )
((OMX_COMPONENTTYPE*)hComponent)->SetConfig(            \
        hComponent,                                       \
        nConfigIndex,                                     \
        pComponentConfigStructure)
```

The parameters are as follows.

Parameter	**Description**
hComponent *[in]*	The handle of the component that executes the call.
nConfigIndex *[in]*	The index of the structure that is to be sent. This value is from the OMX_INDEXTYPE enumeration.
pComponentConfigStructure *[in]*	A pointer to the IL client-allocated structure that the component uses for initialization.

Section 3.3.8 below describes of the corresponding function that each component implements.

3.2.2.11.1 Prerequisites for This Method

The macro can be invoked when the component is in any state except the OMX_StateInvalid state.

3.2.2.11.2 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* Change the time scale of the clock component*/
oScale.xScale = 0x00020000; /*2x*/
OMX_SetConfig(hClockComp, OMX_IndexConfigTimeScale, (OMX_PTR)&oScale);
```

3.2.2.11.3 Error Conditions

The following error conditions can occur:

- `OMX_ErrorBadParameter` if one or more fields of the config structure are incorrect.
- `OMX_ErrorUnsupportedIndex` when the specified config index is unsupported.
- `OMX_ErrorVersionMismatch` when the `nVersion` field of the config structure does not match the expected version for the component.
- `OMX_ErrorUnsupportedSetting` when a field in the config structure is unsupported by the component during an `OMX_SetConfig` call.
- `OMX_ErrorNotReady` if an `OMX_SetConfig` operation has not completed processing. The caller should retry the `OMX_SetConfig` call.
- `OMX_ErrorNoMore` when the `OMX_SetConfig` function is called with a structure that includes the `nPortIndex` field and the value of `nPortIndex` exceeds the number of ports (of the appropriate domain) for the component.

3.2.2.12 OMX_GetExtensionIndex

The `OMX_GetExtensionIndex` macro will invoke a component to translate from a standardized OpenMAX IL or vendor-specific extension string for a configuration or a parameter into an OpenMAX IL structure index. The vendor is not required to support this command for the indexes already found in the `OMX_INDEXTYPE` enumeration, which reduces the memory footprint. The component may support any standardized OpenMAX IL or vendor-specific extension indexes that are not found in the master `OMX_INDEXTYPE` enumeration.

This call is a blocking call. The component should return from this call within five milliseconds.

The `OMX_GetExtensionIndex` macro is defined as follows.

```
#define OMX_GetExtensionIndex (
  hComponent,
  cParameterName,
  pIndexType     )
((OMX_COMPONENTTYPE*)hComponent)->GetExtensionIndex(    \
        hComponent,                                     \
        cParameterName,                                 \
```

```
        pIndexType)
```

The parameters are as follows.

Parameter	Description
hComponent *[in]*	The handle of the component that executes the call.
cParameterName *[in]*	An `OMX_STRING` value that shall be less than 128 characters long including the trailing null byte. The component will translate this string into a configuration index.
pIndexType *[out]*	A pointer to the `OMX_INDEXTYPE` structure that is to receive the index value.

Section 3.3.9 below describes the corresponding function that each component implements.

3.2.2.12.1 Prerequisites for This Method

The macro can be invoked when the component is in any state except the OMX_StateInvalid state.

3.2.2.12.2 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* Set the vendor-specific filename parameter on a reader */
OMX_GetExtensionIndex(
      hFileReaderComp,
      "OMX.CompanyXYZ.index.param.filename",
      &eIndexParamFilename);
OMX_SetParameter(hComp, eIndexParamFilename, &oFileName);
```

3.2.2.13 OMX_GetState

The `OMX_GetState` macro will invoke the component to get the current state of the component and place the state value into the location pointed to by `pState`. The component should return from this call within five milliseconds.

The `OMX_GetState` macro is defined as follows.

```
#define OMX_GetState (
  hComponent,
  pState     )
((OMX_COMPONENTTYPE*)hComponent)->GetState(             \
        hComponent,                                     \
        pState)
```

The parameters are as follows.

Parameter	Definition
hComponent [in]	The handle of the component that executes the call.
pState [out]	A pointer to the location that receives the state. The value returned is one of the `OMX_STATETYPE` members.

Section 3.3.10 below describes the corresponding function that each component implements.

3.2.2.13.1 Prerequisites for This Method

This method has no prerequisites.

3.2.2.13.2 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
OMX_SendCommand(hComp, OMX_CommandStateSet, OMX_StateIdle, 0);
do {
OMX_GetState(hComp, &eState);
} while (OMX_StateIdle != eState);
```

3.2.2.14 OMX_UseBuffer

The `OMX_UseBuffer` macro requests the component to use a buffer already allocated by the IL client or a buffer already supplied by a tunneled component. The `OMX_UseBuffer` implementation shall allocate the buffer header, populate it with the given input parameters, and pass it back via the `ppBufferHdr` output parameter.

When populating fields within the buffer header structure, components are required to correctly initialise both pInputPortIndex and pOutputPortIndex. They are also required to initialise the pAppPrivate field with the pAppPrivate function parameter. The pAppPrivate parameter should also be used to initialise the pInputPortPrivate or pOutputPortPrivate field, when called on an output port or input port respectively.

The `OMX_UseBuffer` macro shall be executed under the following conditions:

- While the component is in the OMX_StateLoaded state and has already sent a request for the state transition to OMX_StateIdle
- While the component is in the OMX_StateWaitForResources state, the resources needed are available, and the component is ready to go to the OMX_StateIdle state
- On a disabled port when the component is in the OMX_StateExecuting, the OMX_StatePause, or the OMX_StateIdle state

This is a blocking call. The component should return from this call within 20 milliseconds.

The `OMX_UseBuffer` macro is defined as follows.

```
#define OMX_UseBuffer(\
     hComponent,\
     ppBufferHdr,\
     nPortIndex,\
     pAppPrivate,\
     nSizeBytes,\
     pBuffer)\
((OMX_COMPONENTTYPE*)hComponent->UseBuffer(\
     hComponent,\
     ppBufferHdr,\
     nPortIndex,\
     pAppPrivate,\
     nSizeBytes,\
     pBuffer)
```

The parameters are as follows.

Parameter	Description
hComponent [in]	The handle of that component that executes the call.
ppBufferHdr [out]	A pointer to a pointer of an `OMX_BUFFERHEADERTYPE` structure that receives the pointer to the buffer header.
nPortIndex [in]	The index of the port that will use the specified buffer. This index is relative to the component that owns the port.
pAppPrivate [in]	A pointer that refers to an implementation-specific memory area that is under responsibility of the supplier of the buffer.
nSizeBytes [in]	The buffer size in bytes.
pBuffer [in]	A pointer to the memory buffer area to be used.

Section 3.3.12 below describes the corresponding function that each component implements.

3.2.2.14.1 Prerequisites for This Method

The component shall be in the OMX_StateLoaded or the OMX_StateWaitForResources state, or the port to which the call applies shall be disabled.

3.2.2.14.2 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* supplier port allocates buffers and pass them to non-supplier */
for (i=0;i<pPort->nBufferCount;i++)
{
      pPort->pBuffer[i] = malloc(pPort->nBufferSize);
     OMX_UseBuffer(pPort->hTunnelComponent,
```

```
                    &pPort->pBufferHdr[i],
                    pPort->nTunnelPort,
                    pPort,
                    pPort->nBufferSize,
                    pPort->pBuffer[j]);
}
```

3.2.2.15 OMX_AllocateBuffer

The `OMX_AllocateBuffer` macro will request that the component allocate a new buffer and buffer header. The component will allocate the buffer and the buffer header and return a pointer to the buffer header.

When populating fields within the buffer header structure, components are required to correctly initialise both pInputPortIndex and pOutputPortIndex. They are also required to initialise the pAppPrivate field with the pAppPrivate function parameter. The pAppPrivate parameter should also be used to initialise the pInputPortPrivate or pOutputPortPrivate field, when called on an output port or input port respectively.

This call is a blocking call that shall be performed under the following conditions:

- While the component is in the OMX_StateLoaded state and has already sent a request for the state transition to OMX_StateIdle.
- While the component is in the OMX_StateWaitForResources state, the resources needed are available, and the component is ready to go to the OMX_StateIdle state.
- On a disabled port when the component is the OMX_StateExecuting, the OMX_StatePause, or the OMX_StateIdle states.

The `OMX_AllocateBuffer` macro allocates buffers on a specific port for communication with the IL client only. This macro cannot be used to allocate buffers for tunneled ports. Buffers allocated before a port was configured for tunneling will result in the component failing `OMX_SetupTunnel` calls to the port.

The component should return from this call within five milliseconds.

The `OMX_AllocateBuffer` macro is defined as follows.

```
#define OMX_AllocateBuffer (
  hComponent,
  pBuffer,
  nPortIndex,
  pAppPrivate,
  nSizeBytes     )
  ((OMX_COMPONENTTYPE*)hComponent)->AllocateBuffer(           \
        hComponent,                                         \
        ppBuffer,                                            \
        nPortIndex,                                         \
        pAppPrivate,                                        \
        nSizeBytes)
     pAppPrivate,\
     nSizeBytes,\
```

```
      pBuffer)
```

The parameter are as follows.

Parameter	Description
hComponent *[in]*	The handle of the component that executes the call.
ppBuffer *[out]*	A pointer to a pointer of an `OMX_BUFFERHEADERTYPE` structure that receives the pointer to the buffer header.
nPortIndex *[in]*	Selects the port on the component that the buffer will be used with. The port can be found by using the `nPortIndex` value as an index into the port definition array of the component.
pAppPrivate *[in]*	Initializes the `pAppPrivate` member of the buffer header structure.
nSizeBytes *[in]*	The size of the buffer to allocate.

Section 3.3.13 below describes the corresponding function that each component implements.

3.2.2.15.1 Prerequisites for This Method

The component shall be in the OMX_StateLoaded or the OMX_StateWaitForResources state, or the port to which the call applies shall be disabled.

3.2.2.15.2 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* IL client asks component to allocate buffers */
for (i=0;i<pClient->nBufferCount;i++)
{
      OMX_AllocateBuffer(hComp,
                        &pClient->pBufferHdr[i],
                        pClient->nPortIndex,
                        pClient,
                        pClient->nBufferSize);
}
```

3.2.2.16 OMX_FreeBuffer

The `OMX_FreeBuffer` macro will release a buffer and buffer header from the component. The component shall free only the buffer header if it allocated only the buffer header. The component shall free both the buffer and the buffer header if it allocated both the buffer and the buffer header. Thus, the component shall track which buffers it allocated so it can perform the corresponding de-allocation.

The call should be performed under the following conditions:

- While the component is in the OMX_StateIdle state and the IL client has already sent a request for the state transition to OMX_StateLoaded (e.g., during the stopping of the component)
- On a disabled port when the component is in the OMX_StateExecuting, the OMX_StatePause, or the OMX_StateIdle state.

The call can be made at any time, but may result in the port sending an OMX_ErrorPortUnpopulated event error if the call is not performed as described.

The call is made from buffer supplier ports when tunneling to release buffer headers from the port that the supplier port is tunneling with.

This call is a blocking call. The component should return from the call within 20 milliseconds.

The `OMX_FreeBuffer` macro is defined as follows.

```
#define OMX_FreeBuffer (
  hComponent,
  nPortIndex,
  pBuffer     )
  ((OMX_COMPONENTTYPE*)hComponent)->FreeBuffer(            \
        hComponent,                                       \
        nPortIndex,
        pBuffer)
     pBuffer)
```

The parameters are as follows.

Parameter	**Description**
hComponent [in]	The handle of the component that executes the call
nPortIndex [in]	The index of the port that is using the specified buffer
pBuffer [in]	A pointer to an `OMX_BUFFERHEADERTYPE` structure used to provide or receive the pointer to the buffer header.

Section 3.3.14 describes the corresponding function that each component implements.

3.2.2.16.1 Prerequisites for This Method

The component should be in the OMX_StateIdle state or the port should be disabled.

3.2.2.16.2 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* supplier port frees buffers */
for (i=0;i<pPort->nBufferCount;i++)
{
      free(pPort->pBuffer[i]);
      pPort->pBuffer[i] = 0;
```

```
      OMX_FreeBuffer(pPort->hTunnelComponent,
                 pPort->nTunnelPort,
                 pPort->pBufferHdr[i]);
      pPort->pBufferHdr[j] = 0;
}
```

3.2.2.17 OMX_EmptyThisBuffer

The `OMX_EmptyThisBuffer` macro will send a filled buffer to an input port of a component. When the buffer contains data, the value of the `nFilledLen` field of the buffer header will not be zero. If the buffer contains no data, the value of `nFilledLen` is 0x0. The `OMX_EmptyThisBuffer` macro is invoked to pass buffers containing data when the component is in or making a transition to the OMX_StateExecuting or in the OMX_StatePause state.

When a port is non-tunneled, buffers sent to `OMX_EmptyThisBuffer` are returned to the IL client with the `EmptyBufferDone` callback once they have been emptied.

When a port is tunneled, buffers sent to `OMX_EmptyThisBuffer` are sent to the tunneled port once they are emptied so long as the component is in the OMX_StateExecuting state. Buffers are returned to the input port that supplied them using `OMX_EmptyThisBuffer` whenever the tunneled port is flushed or disabled. Buffers are also returned to the input port that supplied them when the component calling `OMX_FillThisBuffer` is transitioning from the OMX_StateExecuting state or the OMX_StatePaused state to the OMX_StateIdle state.

This call is a non-blocking call since the component will queue the buffer and return immediately. The buffer will be emptied later at the proper time. If the parameter `nInputPortIndex` in the buffer header does not specify a valid input port, the component returns `OMX_ErrorBadPortIndex.` The component should return from this call within five milliseconds.

The `OMX_EmptyThisBuffer` macro is defined as follows.

```
#define OMX_EmptyThisBuffer (
  hComponent,
  pBuffer     )
  ((OMX_COMPONENTTYPE*)hComponent)->EmptyThisBuffer(      \
        hComponent,                                      \
        pBuffer)
```

The parameters are as follows.

Parameter	**Description**
hComponent *[in]*	The handle of the component that executes the call.
pBuffer *[in]*	A pointer to an `OMX_BUFFERHEADERTYPE` structure that is used to provide or receive the pointer to the buffer header. The buffer header shall specify the index of the input port that receives the buffer

Section 3.3.15 below describes the corresponding function that each component implements.

3.2.2.17.1 Prerequisites for This Method

The component shall be in the appropriate state as shown in Table 3-10.

3.2.2.17.2 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* deliver full buffer */
if (pPort->hTunnelComponent)
OMX_EmptyThisBuffer(pPort->hTunnelComponent, pBuffer);
else
      pCallbacks->FillBufferDone(hComp, pBuffer,
pPort->pCallbackAppData);
```

3.2.2.18 OMX_FillThisBuffer

The `OMX_FillThisBuffer` macro will send an empty buffer to an output port of a component. The `OMX_FillThisBuffer` macro is invoked to pass buffers containing no data when the component is in or making a transition to the OMX_StateExecuting state or is in the OMX_StatePaused state.

When a port is non-tunneled, buffers sent to `OMX_FillThisBuffer` return to the IL client with the `FillBufferDone` callback once they have been filled.

When a port is tunneled, buffers sent to `OMX_FillThisBuffer` are sent to the tunneled port once they are filled so long as the component is in the OMX_StateExecuting state. Buffers are returned to the output port that supplied them using `OMX_FillThisBuffer` whenever the tunneled port is flushed or disabled. Buffers are also returned to the output port that supplied them when the component that calls `OMX_FillThisBuffer` is transitioning from the OMX_StateExecuting state or OMX_StatePaused state to the OMX_StateIdle state.

This call is a non-blocking call since the component will queue the buffer and return immediately. The buffer will be filled later at the proper time. If the parameter `nOutputPortindex` in the buffer header does not specify a valid output port, the component returns `OMX_ErrorBadPortIndex`. The component should return from this call within five milliseconds.

The `OMX_FillThisBuffer` macro is defined as follows.

```
#define OMX_FillThisBuffer (
  hComponent,
  pBuffer     )
  ((OMX_COMPONENTTYPE*)hComponent)->FillThisBuffer(       \
        hComponent,                                     \
        pBuffer)
```

The parameters are as follows.

Parameter	Description
hComponent *[in]*	The handle of the component that executes the call.
pBuffer *[in]*	A pointer to an OMX_BUFFERHEADERTYPE structure used to provide or receive the pointer to the buffer header. The buffer header shall specify the index of the input port that receives the buffer.

Section 3.3.16 below describes the corresponding function that each component implements.

3.2.2.18.1 Prerequisites for This Method

The component shall be in the appropriate state as shown in Table 3-10.

3.2.2.18.2 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* On a port enable, if tunneling and an input and not supplier */
/* then give buffers to supplier port */
if (pPort->hTunnelComponent &&
    (pPort->oPortDef.eDir == OMX_DirInput) &&
    (pPort->eSupplierSetting == OMX_BufferSupplyInput) )
{
   for (i=0;i<pPort->nBuffers;i++){
OMX_FillThisBuffer(pPort->hTunnelComponent,
pPort->ppBufferHdrs[i]);
   }
}
```

3.2.2.19 OMX_UseEGLImage

`OMX_UseEGLImage` enables an OMX IL component to use as a buffer, the image already allocated via EGL. EGLImages are designed for sharing data between rendering based EGL interfaces, such as OpenGL ES and OpenVG. The format of an EGLImage is opaque to the EGL’s client by design, so any memory allocated through this macro are not accessible directly by the IL client.

A method for this interface shall be provided by the component, but may not be implemented, by returning `OMX_ErrorNotImplemented`. Components should inspect the EGLImage provided to the method, and determine if the EGLImage is compatible with the port configuration.

The `OMX_UseEGLImage` macro requests that the component use an EGLImage provided by EGL, in place of using the `OMX_UseBuffer` method. The `OMX_UseEGLImage` implementation shall allocate the buffer header, populate it with the given input parameters, and pass it back via the `ppBufferHdr` output parameter. The `pBuffer` field of the pBufferHdr parameter shall be 0x0, because the format of the EGLImage is opaque to the IL Client.

The `OMX_UseEGLImage` macro shall be executed under the following conditions:

- While the component is in the OMX_StateLoaded state and has already sent a request for the state transition to OMX_StateIdle.
- While the component is in the OMX_StateWaitForResources state, the resources needed are available, and the component is ready to go to the OMX_StateIdle state.
- On a disabled port when the component is in the OMX_StateExecuting, the OMX_StatePause, or the OMX_StateIdle state.

This is a blocking call. The component should return from this call within 20 milliseconds.

The `OMX_UseEGLImage` macro is defined as follows.

```
#define OMX_UseEGLImage(\
      hComponent,\
      ppBufferHdr,\
      nPortIndex,\
      pAppPrivate,\
      eglImage)\
((OMX_COMPONENTTYPE*)hComponent->UseEGLImage(\
      hComponent,\
      ppBufferHdr,\
      nPortIndex,\
      pAppPrivate,\
      eglImage)
```

The parameters are as follows.

Parameter	**Description**
hComponent *[in]*	The handle of that component that executes the call.
ppBufferHdr *[out]*	A pointer to a pointer of an `OMX_BUFFERHEADERTYPE` structure that receives the pointer to the buffer header.
nPortIndex *[in]*	The index of the port that will use the specified buffer. This index is relative to the component that owns the port.
pAppPrivate *[in]*	A pointer that refers to an implementation-specific memory area that is under responsibility of the supplier of the buffer.
eglImage *[in]*	The handle of the `EGLImage` to use as a buffer on the specified port. The component is expected to validate properties of the EGLImage against the configuration of the port to ensure the component can use the `EGLImage` as a buffer.

Section 3.3.19 below describes the corresponding function that each component implements.

3.2.2.19.1 Prerequisites for This Method

The component shall be in the OMX_StateLoaded or the OMX_StateWaitForResources state, or the port to which the call applies shall be disabled.

3.2.3 Functions

This section describes the functions in the OpenMAX IL API.

3.2.3.1 OMX_Init

The `OMX_Init` method initializes the OpenMAX IL core. `OMX_Init` shall be the first call made into OpenMAX IL and should be executed only one time without an intervening `OMX_Deinit` call. If `OMX_Init` is called twice, `OMX_ErrorNone` is returned but the init request is ignored. The core should return from this call within 20 milliseconds.

The usage of `OMX_Init()` is as follows.

```
OMX_API OMX_ERRORTYPE OMX_APIENTRY OMX_Init()
```

3.2.3.1.1 Prerequisites for This Method

This method has no prerequisites.

3.2.3.1.2 Results/Outputs for This Method

If the command successfully executes, the return code will be `OMX_ErrorNone`. Otherwise, the appropriate OpenMAX IL error will be returned. The OpenMAX IL core functions are ready to be used when this function returns successfully.

3.2.3.1.3 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* Initialize OpenMAX IL and create some components */
OMX_Init();
OMX_GetHandle(hMp3Decoder, "OMX.CompanyXYZ.mp3.decoder",
      pAppData, pCallbacks);
OMX_GetHandle(hAudioMixer, "OMX.CompanyXYZ.audio.mixer",
      pAppData, pCallbacks);
```

3.2.3.2 OMX_Deinit

The `OMX_Deinit` method de-initializes the OpenMAX IL core. `OMX_Deinit` should be the last call made into the OpenMAX IL core after all OpenMAX IL-related resources have been released. The core should return from this call within 20 milliseconds. While it may be preferable to have the core command each of the components back to the loaded state and then de-initialize them, doing so may require more than the recommended 20 milliseconds call time. It further requires the OpenMAX IL core to track all component handles, which may add unnecessary complexity for some platforms.

The `OMX_Deinit` method usage is as follows.

```
OMX_API OMX_ERRORTYPE OMX_APIENTRY OMX_Deinit()
```

3.2.3.2.1 Prerequisites for This Method

The use of `OMX_Deinit` requires that all component handles acquired by the IL client in the system have been released, implying that all resources associated with components have been freed.

3.2.3.2.2 Results/Outputs for This Method

The use of `OMX_Deinit` returns `OMX_ERRORTYPE`. If the command successfully executes, the return code will be `OMX_ErrorNone`. Otherwise, the appropriate OpenMAX IL error will return.

3.2.3.2.3 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* Determine if a component of a particular name exists. */
OMX_Init();
eError = OMX_ErrorNone;
for (i=0; OMX_ErrorNone == eError; i++)
{
      eError = OMX_ComponentNameEnum(szCompEnumName, 256, i);
      if ((OMX_ErrorNone == eError) &&
          (!strcmp(szCompEnumName, szComponentName))
      {
            OMX_Deinit();
            return OMX_TRUE;
      }
}
OMX_Deinit();
return OMX_FALSE;
```

3.2.3.3 OMX_ComponentNameEnum

The `OMX_ComponentNameEnum` method will enumerate through all the names of recognized components in the system to detect all the components in the system run-time. There is no strict ordering to the enumeration of component names, although each name shall be enumerated only once. If the OpenMAX IL core supports run-time installation of new components, it is required to detect newly installed components only when the first call to enumerate component names occurs (i.e., when the value of `nIndex` is 0x0).

The `OMX_ComponentNameEnum` method is defined as follows.

```
OMX_API OMX_ERRORTYPE OMX_APIENTRY OMX_ComponentNameEnum(
  OMX_OUT OMX_STRING    cComponentName,
```

```
  OMX_IN OMX_U32        nNameLength,
  OMX_IN OMX_U32        nIndex
 )
```

The parameters are as follows.

Parameter	Description
cComponentName [out]	A pointer to a null-terminated string with the component name. Component names are strings limited to less than 127 bytes in length plus the trailing null for a maximum length of 128 bytes. An example of a valid component name is "OMX.<vendor_name>.AUDIO.DSP.MIXER\0". The name shall start with "OMX." concatenated to a vendor-specified string.
nNameLength [in]	The number of characters in the `cComponentName` string. Since all component name strings are restricted to less than 128 characters, not including the trailing null, the caller should provide an input string of at least 128 characters.
nIndex [in]	A number containing the enumeration index for the component. Multiple calls to `OMX_ComponentNameEnum` with increasing values of `nIndex` will enumerate through the component names in the system until `OMX_ErrorNoMore` returns. The value of `nIndex` is 0 to N-1, where N is the number of installed components in the system.

3.2.3.3.1 Prerequisites for This Method

`OMX_ComponentNameEnum` can be called after the `OMX_Init` function.

3.2.3.3.2 Results/Outputs for This Method

If `OMX_ComponentNameEnum` successfully executes, the return code will be `OMX_ErrorNone`. When the value of `nIndex` exceeds the number of components in the system minus 1, `OMX_ErrorNoMore` will be returned. Otherwise, the appropriate OpenMAX IL error will be returned.

3.2.3.3.3 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* print a list of all components */
eError = OMX_ErrorNone;
for (i=0; OMX_ErrorNoMore != eError; i++)
{
      eError = OMX_ComponentNameEnum(szCompName, 256, i);
      if (OMX_ErrorNone == eError)
            printf("Component %i: %s\n", szCompName);
}
```

3.2.3.4 OMX_GetHandle

The OMX_GetHandle method will locate the component specified by the component name given, load that component into memory, and validate it. If the component is valid, OMX_GetHandle will invoke the component's methods to fill the component handle and set up the callbacks. The OMX_GetHandle method will allocate the actual OMX_HANDLETYPE structure, ensures it is populated correctly, and then updates the value of *pHandle with a pointer to the newly created handle. The component should return from this call within 20 millisecconds.

Each time the OMX_GetHandle function returns successfully, a new component instance is created. The IL client shall configure the newly created component, which is in the OMX_StateLoaded state, before the component can be used.

Since components are requested by name, a naming convention is defined. OpenMAX IL component names are zero terminated strings with the following format:

“OMX.<vendor_name>.<vendor_specified_convention>”.

For example:

OMX.CompanyABC.MP3Decoder.productXYZ

No standardization among component names is dictated across different vendors.

OMX_GetHandle is defined as follows.

```
OMX_API OMX_ERRORTYPE OMX_APIENTRY OMX_GetHandle(
  OMX_OUT OMX_HANDLETYPE *    pHandle,
  OMX_IN OMX_STRING           cComponentName,
  OMX_IN OMX_PTR              pAppData,
  OMX_IN OMX_CALLBACKTYPE *   pCallBacks
 )
```

The parameters are as follows.

Parameter	Description
pHandle *[out]*	A pointer to OMX_HANDLETYPE to be filled in by this method.
cComponentName *[in]*	A pointer to a null-terminated string with the component name. Component names are strings limited to less than 128 bytes in length plus the trailing null for a maximum length of 128 bytes. An example of a valid component name is “OMX.<vendor_name>.AUDIO.DSP.MIXER\0”. The name shall start with “OMX.” concatenated to a vendor-specified string.
pAppData *[in]*	A pointer to an IL client-defined value that will be returned during callbacks so that the IL client can identify the source of the callback.
pCallBacks *[in]*	A pointer to an OMX_CALLBACKTYPE structure containing the callbacks that the component will use for this IL client.

3.2.3.4.1 Prerequisites for This Method

The OpenMAX IL core shall be initialized.

3.2.3.4.2 Results/Outputs for This Method

If successful, the function returns a valid component handle to the IL client.

3.2.3.4.3 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* determine maximum number of instantiations of a component */
eError = OMX_ErrorNone;
for (i=0; OMX_ErrorNone == eError; i++)
{
      eError = OMX_GetHandle(&hComp[i],
                  szComponentName,
                  pAppData,
                  pCallbacks);
}
printf("Created %i instantiations.\n",i);
```

3.2.3.5 OMX_FreeHandle

The `OMX_FreeHandle` method will free a handle allocated by the `OMX_GetHandle` method. The component should return from this call within 20 milliseconds. The IL client should call `OMX_FreeHandle` only when the component is in the OMX_StateLoaded or the OMX_StateInvalid state; calling `OMX_FreeHandle` from any other state may result in the component taking longer than the recommended 20 milliseconds execution time, and is provided only as a failure recovery mechanism.

`OMX_FreeHandle` is defined as follows.

```
OMX_API OMX_ERRORTYPE OMX_APIENTRY OMX_FreeHandle(
   OMX_IN OMX_HANDLETYPE    hComponent   )
```

The single parameter is as follows.

Parameter	Description
hComponent [in]	The handle of the component to be freed.

3.2.3.5.1 Prerequisites for This Method

The component should be in the OMX_StateLoaded or the OMX_StateInvalid state when this method is called.

3.2.3.5.2 Results/Outputs for This Method

All resources associated with the components are freed.

3.2.3.5.3 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* stop executing component and clean up component */
OMX_SendCommand(hComp, OMX_CommandStateSet, OMX_StateIdle, 0);
OMX_SendCommand(hComp, OMX_CommandStateSet, OMX_StateLoaded, 0);
do {
      OMX_GetState(hComp, &eState);
} while (OMX_StateLoaded != eState);
OMX_FreeHandle(hComp);
```

3.2.3.6 OMX_SetupTunnel

The `OMX_SetupTunnel` method sets up tunneled communication between an output port and an input port. This method is an actual method and not a defined macro. The `OMX_SetupTunnel` method will make calls to the component's `ComponentTunnelRequest()` method to set up the tunnel.

When changing an input port to non-tunneled communication, the value of the `hOutput` parameter shall be 0x0. When changing an output port to a non-tunneled communication, the value of the `hInput` parameter shall be 0x0.

When setting up tunneled communication between an output port and an input port, the method first issues a call to `ComponentTunnelRequest()` on the component with the output port. If the call is successful, a second call to `ComponentTunnelRequest()` on the component with the input port is made. Should either call to `ComponentTunnelRequest()` fail, the method will set up both the output and input ports for non-tunneled communication.

The components may negotiate proprietary communication in place of tunneled communication so long as both the output and input ports can support proprietary communication. An IL client cannot disambiguate between tunneled and proprietary communication.

The core should return from this call within 20 milliseconds.

The IL client may use OMX_SetupTunnel to establish proprietary communication between base profile components (given than both components support it) but not to establish a tunnel between them. An IL client may only establish tunnels between Interop profile components.

If this method fails because the OMX_SetupTunnel implementation supports neither tunneling nor proprietary communication then it shall return OMX_ErrorNotImplemented.

If this method fails because OMX_SetupTunnel supports proprietary communication but not tunneling and proprietary communication does not apply to the given components then is shall return OMX_ErrorTunnelingUnsupported.

OMX_SetupTunnel may only return OMX_ErrorNotImplemented or OMX_ErrorTunnelingUnsupported when operating on one or more base profile components; these errors do not apply when operating on two Interop profile components.

For a detailed description of the process to set up a data tunnel between two components, see section 3.4.1.2.

`OMX_SetupTunnel` is defined as follows.

```
OMX_API OMX_ERRORTYPE OMX_APIENTRY OMX_SetupTunnel(
  OMX_IN OMX_HANDLETYPE       hOutput,
  OMX_IN OMX_U32              nPortOutput,
  OMX_IN OMX_HANDLETYPE       hInput,
  OMX_IN OMX_U32              nPortInput
 )
```

The parameters are as follows.

Parameter	Description
hOutput *[in]*	The handle of the component containing the output port used in the tunnel, where the output port is identified by the nPortOutput parameter. By definition, an output port has the direction `OMX_DirOutput`. If the value of this parameter is 0x0, the hPortInput port on the hInput component will be set up for non-tunneled communication.
nPortOutput *[in]*	Indicates the output port of the component specified by hOutput that is to be used for tunneled or proprietary communication.
hInput *[in]*	The handle of the component containing the input port used in the tunnel, where the input port is identified by the nPortInput parameter. By definition, an input port has the direction `OMX_DirInput`. If the value of this parameter is 0x0, the hPortOutput port on the hOutput component will be set up for non-tunneled communication.
nPortInput *[in]*	Indicates the input port of the component specified by hInput that is to be used for tunneled or proprietary communication.

3.2.3.6.1 Prerequisites for This Method

Each component that is being tunneled shall be in the OMX_StateLoaded state, or its port shall be disabled.

3.2.3.6.2 Results/Outputs for This Method

If the method returns successfully when both an output and input component are supplied, tunneled or proprietary communication has been set up between the specified output and input ports. When only an output or an input component is supplied or if an error occurs during processing, the ports are set up for non-tunneled communication.

3.2.3.6.3 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* set up tunnel between two components then transition to idle */
OMX_SetupTunnel(hCompA, nCompAOutPort, hCompB, nCompBInPort);
OMX_SendCommand(hCompA, OMX_CommandStateSet, OMX_StateIdle, 0);
OMX_SendCommand(hCompB, OMX_CommandStateSet, OMX_StateIdle, 0);
```

3.2.3.7 OMX_GetContentPipe

The OMX_GetContentPipe method returns a content pipe capable of manipulating a given piece of content as (specified via URI). The OMX IL Core shall provide this interface and return OMX_ErrorNotImplemented if it is not implemented.

The IL client may also use this function to retrieve content pipes for its own use.

The core should return from this call within 20 milliseconds.

OMX_GetContentPipe is defined as follows.

```
OMX_API OMX_ERRORTYPE OMX_APIENTRY OMX_GetContentPipe (
  OMX_IN OMX_HANDLETYPE    *hPipe,
  OMX IN OMX_STRING szURI  )
```

The parameters are as follows.

Parameter	Description
hPipe *[out]*	The handle of content pipe retrieved.
szURI *[in]*	The name of the content the caller is requesting an associated content pipe for.

3.2.3.7.1 Prerequisites for This Method

None.

3.2.3.7.2 Results/Outputs for This Method

The IL Core populates the hPipe field with a content pipe handle corresponding to the given URI.

3.3 OpenMAX IL Component Methods and Structures

OpenMAX IL components are defined in the OMX_Component.h header file. The structure OMX_COMPONENTTYPE holds the data fields and function entry points for a component.

3.3.1 pComponentPrivate

pComponentPrivate is a pointer to the component private data area. The component allocates and initializes this member when the component is first loaded. The application should not access this data area.

3.3.2 pApplicationPrivate

pApplicationPrivate is a pointer to the application private data area. The component initializes this field during the call to SetCallbacks, as this field is provided back to the IL client when the component issues callbacks.

3.3.3 GetComponentVersion

The IL client calls the GetComponentVersion component method via the OMX_GetComponentVersion core macro. See the definition of OMX_GetComponentVersion in section 3.2.2.1 above for a description of its semantics.

GetComponentVersion is defined as follows.

```
    OMX_ERRORTYPE (*GetComponentVersion)(
            OMX_IN  OMX_HANDLETYPE hComponent,
            OMX_OUT OMX_STRING pComponentName,
            OMX_OUT OMX_VERSIONTYPE* pComponentVersion,
            OMX_OUT OMX_VERSIONTYPE* pSpecVersion);
```

3.3.4 SendCommand

The IL client calls the SendCommand component method via the OMX_SendCommand core macro. See the definition of OMX_SendCommand in section 3.2.2.2 above for a description of its semantics.

SendCommand is defined as follows.

```
    OMX_ERRORTYPE (*SendCommand)(
            OMX_IN  OMX_HANDLETYPE hComponent,
            OMX_IN  OMX_COMMANDTYPE Cmd,
            OMX_IN  OMX_U32 nParam,
            OMX_IN  OMX_PTR pCmdData);
```

3.3.5 GetParameter

The IL client or a tunneled component calls the GetParameter component method via the OMX_GetParameter core macro. See the definition of OMX_GetParameter in section 3.2.2.8 above for a description of its semantics.

GetParameter is defined as follows.

```
    OMX_ERRORTYPE (*GetParameter)(
           OMX_IN  OMX_HANDLETYPE hComponent,
           OMX_IN  OMX_INDEXTYPE nParamIndex,
           OMX_INOUT OMX_PTR pComponentParameterStructure);
```

3.3.6 SetParameter

The IL client or a tunneled component calls the SetParameter component method via the OMX_SetParameter core macro. See the definition of OMX_SetParameter in section 3.2.2.8.3 above for a description of its semantics.

SetParameter is defined as follows.

```
    OMX_ERRORTYPE (*SetParameter)(
            OMX_IN  OMX_HANDLETYPE hComponent,
            OMX_IN  OMX_INDEXTYPE nIndex,
```

```
                OMX_IN  OMX_PTR pComponentParameterStructure);
```

3.3.7 GetConfig

The IL client calls the `GetConfig` component method via the `OMX_GetConfig` core macro. See the definition of `OMX_GetConfig` in section 3.2.2.9.3 above for a description of its semantics.

`GetConfig` is defined as follows.

```
    OMX_ERRORTYPE (*GetConfig)(
                OMX_IN  OMX_HANDLETYPE hComponent,
                OMX_IN  OMX_INDEXTYPE nIndex,
                OMX_INOUT OMX_PTR pComponentConfigStructure);
```

3.3.8 SetConfig

The IL client calls the `SetConfig` component method via the `OMX_SetConfig` core macro. See the definition of `OMX_SetConfig` in section 3.2.2.10.3 above for a description of its semantics.

`SetConfig` is defined as follows.

```
    OMX_ERRORTYPE (*SetConfig)(
                OMX_IN  OMX_HANDLETYPE hComponent,
                OMX_IN  OMX_INDEXTYPE nIndex,
                OMX_IN  OMX_PTR pComponentConfigStructure);
```

3.3.9 GetExtensionIndex

The IL client calls the `GetExtenstionIndex` component method via the `OMX_GetExtensionIndex` core macro. See the definition of `OMX_GetExtensionIndex` in section 3.2.2.1293 for a description of its semantics.

`GetExtensionIndex` is defined as follows.

```
    OMX_ERRORTYPE (*GetExtensionIndex)(
                OMX_IN  OMX_HANDLETYPE hComponent,
                OMX_IN  OMX_STRING cParameterName,
                OMX_OUT OMX_INDEXTYPE* pIndexType);
```

3.3.10 GetState

The IL client calls the `GetState` component method via the `OMX_GetState` core macro. See the definition of `OMX_GetState` in section 3.2.2.13 above for a description of its semantics.

`GetState` is defined as follows.

```
    OMX_ERRORTYPE (*GetState)(
                OMX_IN  OMX_HANDLETYPE hComponent,
                OMX_OUT OMX_STATETYPE* pState);
```

3.3.11 ComponentTunnelRequest

The `ComponentTunnelRequest` method will interact with another OpenMAX IL component to determine if tunneling is possible and to set up the tunneling if it is possible. The return codes for this method can determine if tunneling is not possible or if proprietary communication or tunneling is used.

The interop profile-conformant component shall support tunneling to a component with compatible parameters. The component may also support proprietary communication. If proprietary communication is supported, the negotiation of proprietary communication is performed in a vendor-specific way. The only requirement is that the proper result be returned. The details of the proprietary communication setup are left to the vendor's component implementer.

The `ComponentTunnelRequest` method is invoked on both components that support the tunneling communication. When this method is invoked on the component that provides the output port, the component will do the following:

1. Indicate its supplier preference in `pTunnelSetup`.

When this method is invoked on the component that provides the input port, the component will do the following:

1. Check the data compatibility between the ports using one or more `GetParameter` calls.
2. Review the buffer supplier preferences of the output port and use `OMX_SetParameter` with index `OMX_IndexParamCompBufferSupplier` to inform the output port of which port supplies the buffers.

If this method is invoked with a NULL parameter for the `pTunnelComp` parameter, the port should be set up for non-tunneled communication with the IL client.

The component should return from this call within five milliseconds.

`ComponentTunnelRequest` is defined as follows.

```
OMX_ERRORTYPE (*ComponentTunnelRequest)(
    OMX_IN  OMX_HANDLETYPE hComp,
    OMX_IN  OMX_U32 nPort,
    OMX_IN  OMX_HANDLETYPE hTunneledComp,
    OMX_IN  OMX_U32 nTunneledPort,
    OMX_INOUT  OMX_TUNNELSETUPTYPE* pTunnelSetup);
```

The parameters are as follows.

Parameter	**Description**
hComp *[in]*	The handle of the target component of the `RequestTunnel` call and one of the components that will participate in the tunnel.
nPort *[in]*	The index of the port belonging to `hComp` that will participate in the tunnel.

Parameter	Description
hTunneledComp [in]	The handle of the other component that participates in the tunnel. When this parameter is NULL, the port specified in nPort should be configured for non-tunneled communication with the IL client.
nTunneledPort [in]	The index of the port belonging to `hTunneledComp` that participates in the tunnel.
pTunnelSetup [in,out]	The structure that contains data for the tunneling negotiation between components. The supplier field can be filled by both components; the callbacks field is filled by the output port component. The read-only flag can be applied by both components.

3.3.11.1 Prerequisites for This Method

The component shall be in the OMX_StateLoaded state.

3.3.11.2 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* Translate a SetupTunnel call to two ComponentTunnelRequest calls */
pCompOut = (OMX_COMPONENTTYPE *)hOutput;
pCompIn = (OMX_COMPONENTTYPE *)hInput;
pCompOut->ComponentTunnelRequest(hOutput, nPortOutput, hInput,
      nPortInput, &oTunnelSetup);
pCompIn->ComponentTunnelRequest(hInput, nPortInput, hOutput,
      nPortOutput, &oTunnelSetup);
```

3.3.12 UseBuffer

The IL client or a tunneled component calls the `UseBuffer` component method via the `OMX_UseBuffer` core macro. See the definition of `OMX_UseBuffer` in section 3.2.2.14 above for a description of its semantics.

`UseBuffer` is defined as follows.

```
    OMX_ERRORTYPE (*UseBuffer)(
            OMX_IN OMX_HANDLETYPE hComponent,
            OMX_INOUT OMX_BUFFERHEADERTYPE** ppBufferHdr,
            OMX_IN OMX_U32 nPortIndex,
            OMX_IN OMX_PTR pAppPrivate,
            OMX_IN OMX_U32 nSizeBytes,
            OMX_IN OMX_U8* pBuffer);
```

3.3.13 AllocateBuffer

The IL client calls the `AllocateBuffer` component method via the `OMX_AllocateBuffer` core macro. See the definition of `OMX_AllocateBuffer` in section 3.2.2.15 above for a description of its semantics.

`AllocateBuffer` is defined as follows.

```
    OMX_ERRORTYPE (*AllocateBuffer)(
            OMX_IN OMX_HANDLETYPE hComponent,
            OMX_INOUT OMX_BUFFERHEADERTYPE** pBuffer,
            OMX_IN OMX_U32 nPortIndex,
            OMX_IN OMX_PTR pAppPrivate,
            OMX_IN OMX_U32 nSizeBytes);
```

3.3.14 FreeBuffer

The IL client or a tunneled component calls the `FreeBuffer` component method via the `OMX_FreeBuffer` core macro. See the definition of `OMX_FreeBuffer` in section 3.2.2.16 above for a description of its semantics.

`FreeBuffer` is defined as follows.

```
    OMX_ERRORTYPE (*FreeBuffer)(
            OMX_IN  OMX_HANDLETYPE hComponent,
            OMX_IN  OMX_U32 nPortIndex,
            OMX_IN  OMX_BUFFERHEADERTYPE* pBuffer);
```

3.3.15 EmptyThisBuffer

The IL client or a tunneled component calls the `EmptyThisBuffer` component method via the `OMX_EmptyThisBuffer` core macro. See the definition of `OMX_EmptyThisBuffer` in section 3.2.2.17 above for a description of its semantics.

`EmptyThisBuffer` is defined as follows.

```
    OMX_ERRORTYPE (*EmptyThisBuffer)(
            OMX_IN  OMX_HANDLETYPE hComponent,
            OMX_IN  OMX_BUFFERHEADERTYPE* pBuffer);
```

3.3.16 FillThisBuffer

The IL client or a tunneled component calls the `FillThisBuffer` component method via the `OMX_FillThisBuffer` core macro. See the definition of `OMX_FillThisBuffer` in section 3.2.2.18 above for a description of its semantics.

`FillThisBuffer` is defined as follows.

```
    OMX_ERRORTYPE (*FillThisBuffer)(
            OMX_IN  OMX_HANDLETYPE hComponent,
            OMX_IN  OMX_BUFFERHEADERTYPE* pBuffer);
```

3.3.17 SetCallbacks

The `SetCallbacks` method will allow the core to transfer the callback structure from the IL client to the component. This is a blocking call. The component should return from this call within five milliseconds.

`SetCallbacks` is defined as follows.

```
     OMX_ERRORTYPE (*SetCallbacks)(
            OMX_IN  OMX_HANDLETYPE hComponent,
            OMX_IN  OMX_CALLBACKTYPE* pCallbacks,
            OMX_IN  OMX_PTR pAppData);
```

The parameters are as follows.

Parameter	Description
hComponent [in]	The handle of the component that executes the call.
pCallbacks [in]	A pointer to an `OMX_CALLBACKTYPE` structure that is used to provide the callback information to the component.
pAppData [in]	A pointer to a value that the IL client has defined (for example, a pointer to a data structure) that allows the callback in the IL client to determine the context of the call.

3.3.17.1 Prerequisites for This Method

The component shall be in the OMX_StateLoaded state.

3.3.17.2 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* On GetHandle (for statically linked components):
   create component, initialize it, and set its callbacks */
pComp = (OMX_COMPONENTTYPE *)malloc(sizeof(OMX_COMPONENTTYPE));
hHandle = (OMX_HANDLETYPE)pComp;
pComp->nVersion = version_1_0;
pComp->nSize = sizeof(OMX_COMPONENTTYPE);
OMX_ComponentRegistered[i].pInitialize(hHandle);
pComp->SetCallbacks(hHandle, pCallBacks, pAppData);
```

3.3.18 ComponentDeinit

The core calls the `ComponentDeinit` function when the core needs to dispose of a component.

`ComponentDeinit` is defined as follows.

```
     OMX_ERRORTYPE (*ComponentDeinit)(
            OMX_IN  OMX_HANDLETYPE hComponent);
```

The single parameter is as follows.

Parameter	Description
hComponent [in]	The handle of the component that executes the call.

3.3.18.1 Prerequisites for This Method

There are no prerequisites for this method. The IL client may execute this function regardless of component state so that de-initialization is guaranteed even on components that are unresponsive to state changes. However, executing `ComponentDeinit` when the component is in the OMX_StateLoaded state is recommended for proper shutdown.

3.3.18.2 Sample Code Showing Calling Sequence

The following sample code shows the calling sequence.

```
/* On FreeHandle: de-initialize component and destroy it */
pComp = (OMX_COMPONENTTYPE*)hComponent;
(pComp->ComponentDeinit)(hComponent);
OMX_OSAL_Free(pComp);
```

3.3.19 UseEGLImage

The IL client or a tunneled component calls the `UseEGLImage` component method via the `OMX_UseBuffer` core macro. See the definition of `OMX_UseEGLImage` in section 3.2.2.19 above for a description of its semantics.

`UseEGLImageBuffer` is defined as follows.

```
    OMX_ERRORTYPE (*UseEGLImageBuffer)(
            OMX_IN OMX_HANDLETYPE hComponent,
            OMX_INOUT OMX_BUFFERHEADERTYPE** ppBufferHdr,
            OMX_IN OMX_U32 nPortIndex,
            OMX_IN OMX_PTR pAppPrivate,
            OMX_IN void* pBuffer);
```

3.4 Calling Sequences

This section describes how the IL client, the OpenMAX IL core, and the components dynamically interact in a few meaningful use cases, namely initialization, de-initialization, data flow, data tunneling setup, and data flow in the case of data tunneling and dynamic port reconfiguration. The interaction between the core, the components, and the possible implementation of a resource manager is also described.

3.4.1 Initialization

This section describes the operations for initializing the OpenMAX IL components. The components can be handled directly by the IL client, can be tunneled to each other, or both. The tunneled and non-tunneled cases are distinguished for clarity, but the two cases can be both present in the component framework.

3.4.1.1 Non-tunneled Initialization

Figure 3-5 shows how an IL client should initialize an OpenMAX IL component.

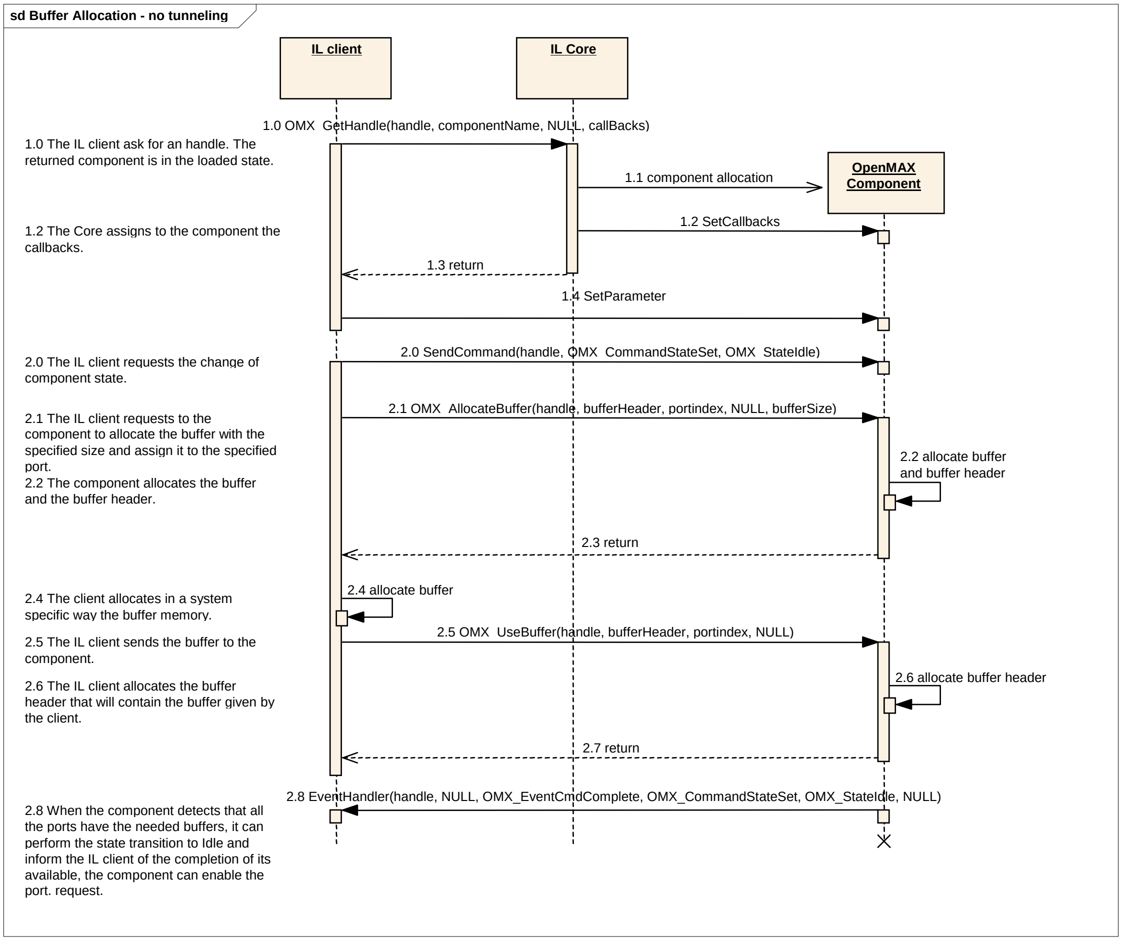


Figure 3-5. Component Initialization

First, the IL client shall call the `OMX_GetHandle` function, which activates the actual component creation (1.1) by the core. Also, all of the configuration resources of the component are loaded into memory. The core passes IL client callback functions to the component by means of the `SetCallbacks` method (1.2). If previous steps are successful, a valid handle is returned in step 1.3 and the component will be in the OMX_StateLoaded state.

The IL client shall configure the component and its ports. For this purpose, the IL core macro `OMX_SetParameter` shall be used; it may be called multiple times (step 1.4) if needed.

When the client has completed the configuration phase, it can request the component to make the state transition to OMX_StateIdle. Only after this request shall the IL client set up buffers for the component to use for all of its ports. The IL client shall use either `OMX_AllocateBuffer` or `OMX_UseBuffer` to set up buffers. If the IL client asks components for a tunnel, it does not allocate setup buffers because the tunneled components allocate any buffers. See section 3.4.1.2 for more details on tunneling.

This process may be repeated multiple times, depending on the number of ports and the total number of buffers needed on each port. If `OMX_UseBuffer` is used, the IL client shall have allocated a buffer and passed it to the component. Alternatively, the IL client may ask the component to allocate a buffer and a buffer header using the `OMX_AllocateBuffer` method. In the latter case, the component will allocate both a buffer and its related header and return it to the IL client by reference.

As soon as these initial configuration steps are completed, the component shall complete the state transition and return an event to the client for the `SendCommand` request completion (step 2.8).

The component is now ready to be used by the IL client.

3.4.1.2 Tunneled Initialization

To avoid moving data buffers back and forth among the IL client and OpenMAX IL components, data tunnels can be set up so that the output buffer of one component is passed directly to the input port of the next component in the chain.

Consider the example shown in Figure 3-6, where an IL client generates data for a chain of three tunneled components identified as A, B, and C. Component C is a sink and does not return data to the IL client.

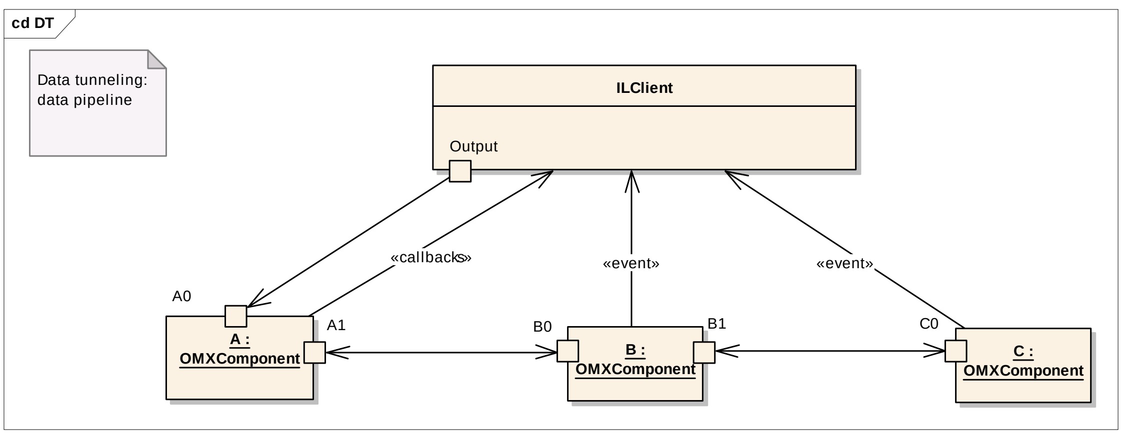


Figure 3-6. Example of Data Tunneling Among OpenMAX IL Components

Note that all callbacks are always directed to and managed by the IL client when ports communicate using proprietary or tunneled communication. The tunneling setup and initialization require a detailed description, based on the following steps:

- The components are constructed with the calls to `OMX_GetHandle`.
- The components are tunneled, linking an output port of the first component to an input port of the second component. The port that shall supply the buffer is decided in this phase.
- The IL client may override the input ports' choice of buffer supplier after `OMX_SetupTunnel` has completed by setting the buffer supplier into the input port, which in turn will reprogram the supplier to the output port.

During the transition from OMX_StateLoaded to OMX_StateIdle, each component shall not transition until the required buffers on all enabled ports have been allocated.

OMX_SetupTunnel shall be executed only when the components are in the OMX_StateLoaded state or when ports are disabled. Figure 3-7 illustrates the setup process:

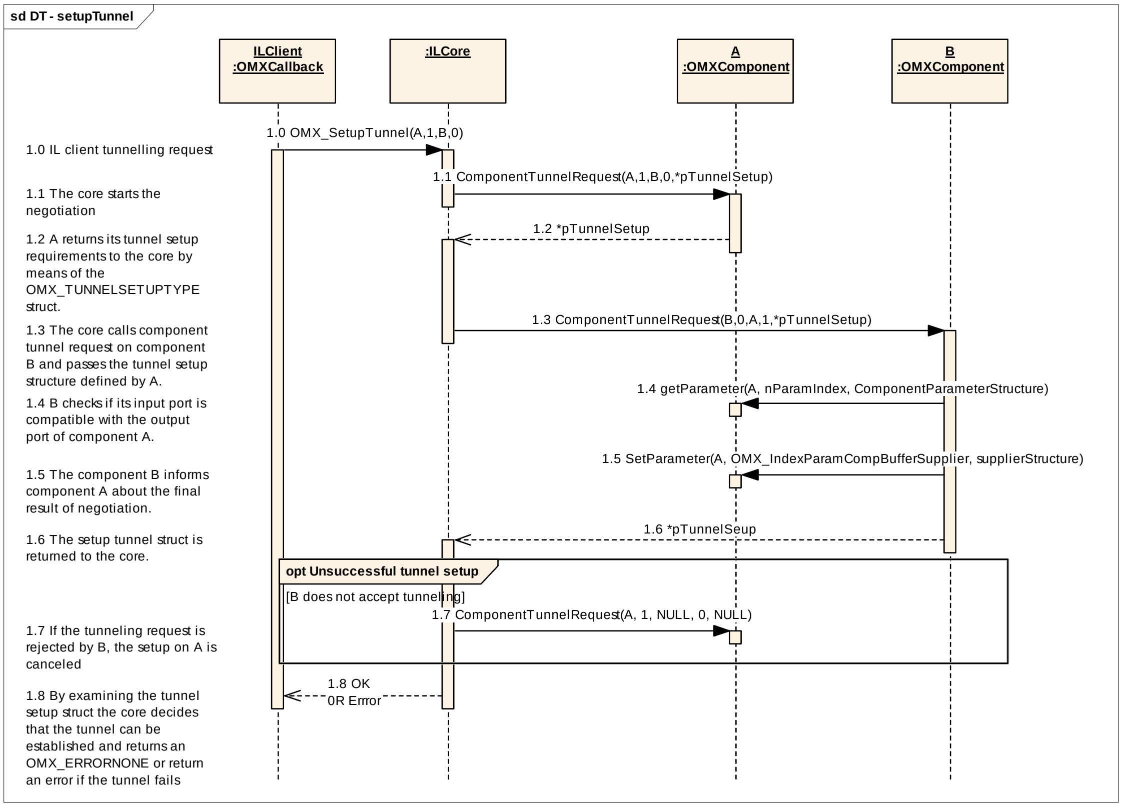


Figure 3-7. Tunnel Setup

The IL client shall start the data setup process by calling the OMX_SetupTunnel function of the IL core when the components that are being tunneled are in the OMX_StateLoaded state (step 1.0).

As a result, the IL core shall call the ComponentTunnelRequest methods of component A and B in sequence. The structure OMX_TUNNELSETUPTYPE defined in section 3.1.2.10 shall be passed by the IL core to the component with the output port first. The component receiving such a call shall fill in the structure and return it to the core. If the ComponentTunnelRequest call returns successfully, the IL core shall call the same function on the second component (1.3), passing the OMX_TUNNELSETUPTYPE structure that was filled in by the first component. The component also shall check that the output port of the peer component is compatible with its input port (i.e., the data type should be the same) (1.4). If the tunnel setup parameters included in the structure are agreed to by the second component, the ComponentTunnelRequest call will send back to the first component the result of negotiation (1.5) and returns successfully (1.6). The IL core shall check that both calls of ComponentTunnelRequest did not return errors. If so, the initial OMX_SetupTunnel will return successfully.

If the call to `ComponentTunnelRequest` on component B fails, component A will be set to not tunnel by a second call to `ComponentTunnelRequest` with a pointer to NULL in place of the component B handle and `pTunnelSetup` parameter.

After the successful tunnel setup, the IL client may override the buffer supplier negotiation with the procedure illustrated in Figure 3-8:

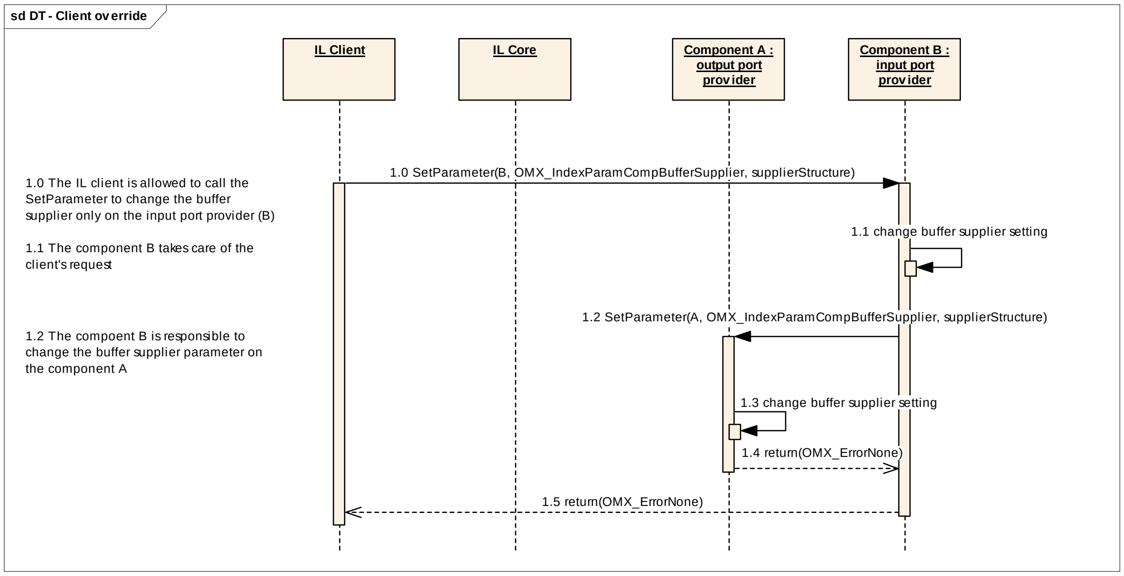


Figure 3-8. IL Client Buffer Supplier Override

If the IL client wants to override the negotiation of tunneled components that specifies which component is the buffer supplier, it shall call the function `SetParameter` on the component that provides the input port. That component is responsible for signaling to the other tunneled component the new buffer supplier, with the same call to `SetParameter`.

The last step of the tunnel initialization phase is the state transition from OMX_StateLoaded to OMX_StateIdle that also involves the buffer allocation and assignment. Figure 3-9 illustrates the state transition behavior in which the tunnels are already created and configured.

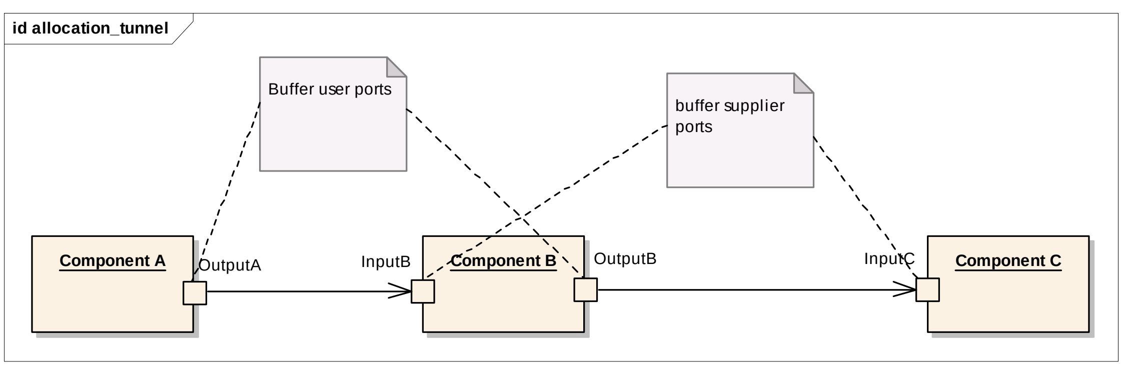


Figure 3-9. Tunneling Example

Component A is tunneled with component B, and component B is the buffer supplier. Component B is tunneled with component C, and component C is the buffer supplier.

Figure 3-10 illustrates the behavior of each tunneled component during the state transition.

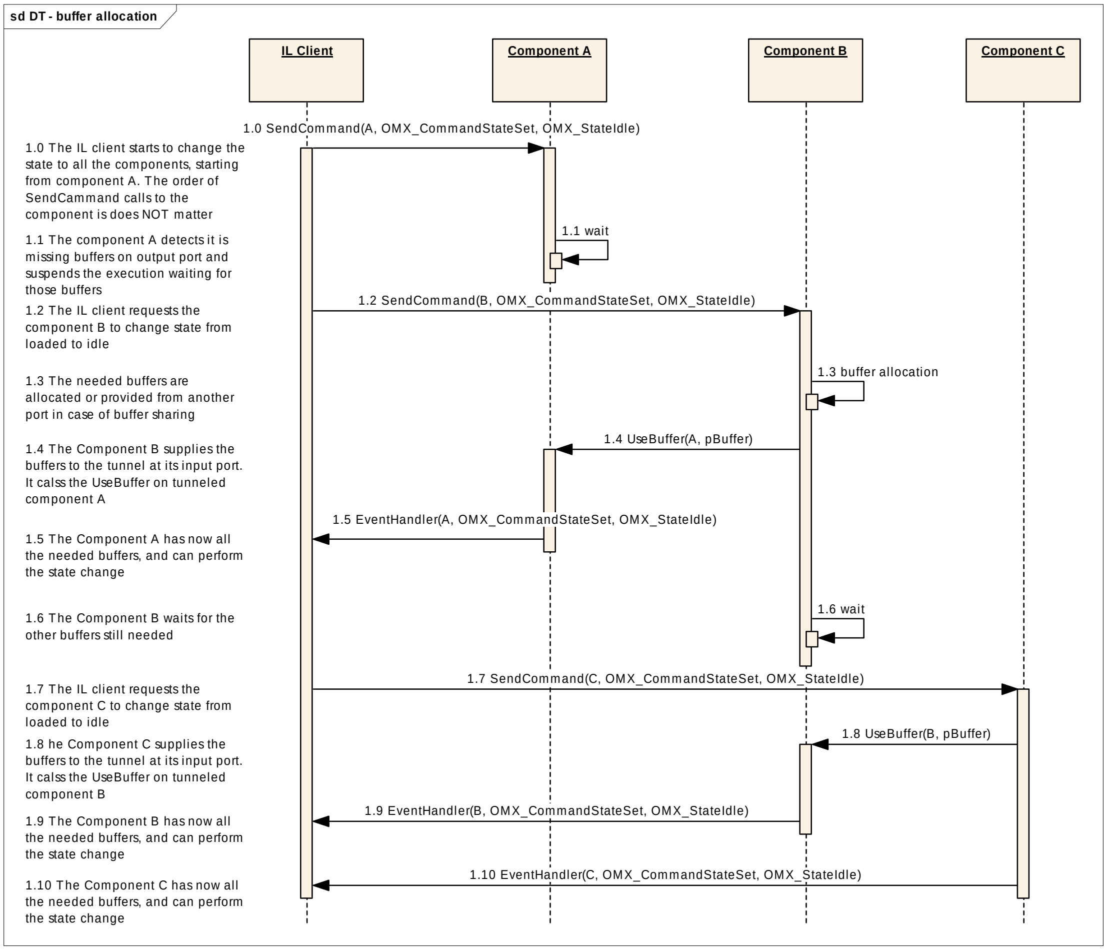


Figure 3-10. State Transition to Idle in the Case of Tunneled Component s

Each supplier port on a component shall pass its buffers to the non-supplier port it is tunneling with via `OMX_UseBuffer`. After all of its supplier ports have passed buffers, the component waits until all of its non-supplier ports have received all of their buffers via `OMX_UseBuffer`.

In Figure 3-10, component A receives the state transition request from the IL client. Component A is tunneled with component B. The input port of B is set as buffer supplier for the tunnel. In this case, component A shall wait until its output port receives all of the needed buffers.

Meanwhile, the IL client asks component B to change its state. In this case, component B has a port that is a buffer supplier, the input port, and it shall call `UseBuffer` on the output port of component A. Then, component B waits for all of the needed buffers on its output port.

Now component A has all of the needed buffers, so it can perform the state transition to OMX_StateIdle. The exact sequence of transitions can be different, since it depends on the platform, the operating system, and the implementation. The only rule is to wait until all the resources are available.

The IL client requests that component C change its state. Component C behaves like component B: Component C gives the buffers needed to component B, and then can change its state, since it does not need any other buffers.

Finally, component B can change its state to OMX_StateIdle since it has obtained all of the needed buffers.

3.4.2 Data Flow

OpenMAX IL defines two means of data communication:

- Tunneled communication, where a port exchanges data directly with a port on another component
- Non-tunneled communication, where a port exchanges data only with the IL client

A port may implement data tunneling via proprietary communication, taking advantage of platform-specific features. The following sections describe the data flow inherent to each means of communication.

3.4.2.1 Non-tunneled Data Flow

An IL client that has a data buffer to deliver to a component input port shall issue an `OMX_EmptyThisBuffer` call.

Conversely, for the component output port, the IL client shall initially provide one or more empty buffers into which the component can write output data; the `OMX_FillThisBuffer` call accomplishes this task. As soon as one buffer is available from the component output port, the component shall send an `FillBufferDone` callback. The component is aware of the callback entry point from the earlier `SetBacks` call.

Note that the IL client is entirely responsible for moving data buffers among components if data tunneling is not used.

Figure 3-11 illustrates the dynamic behavior related to data flow.

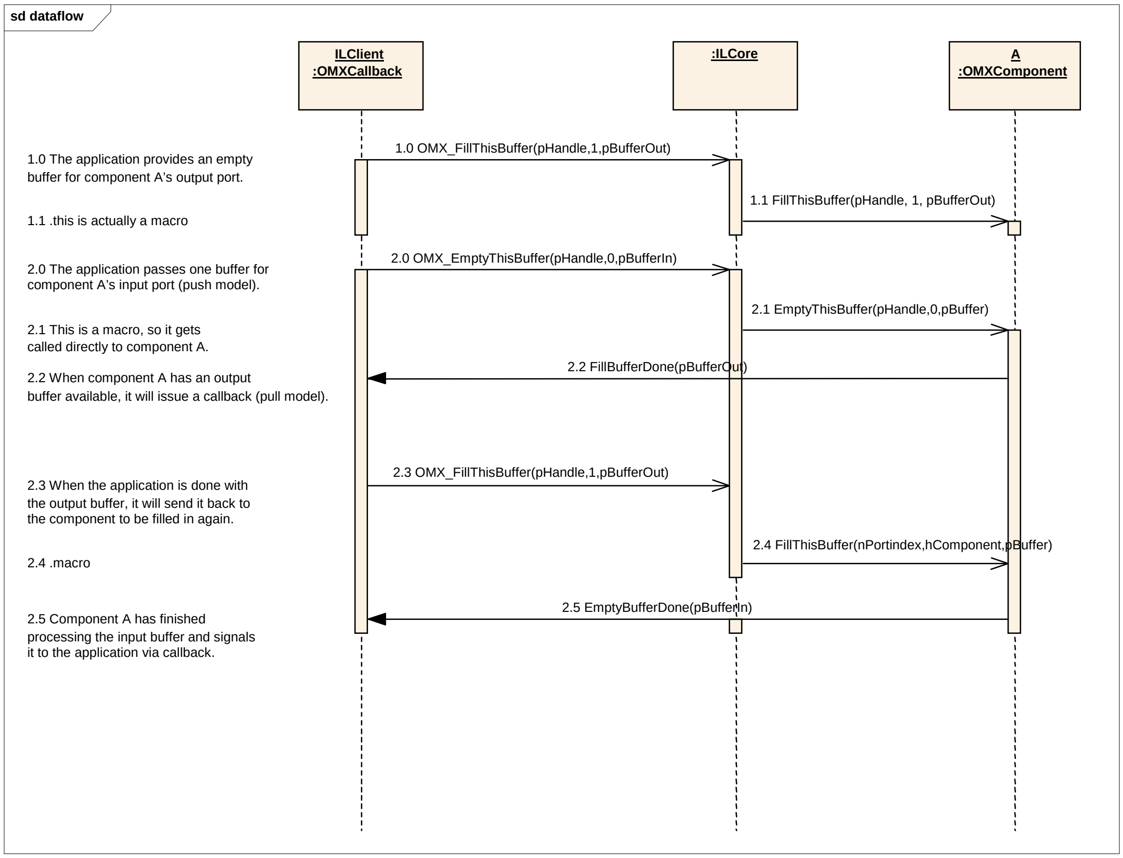


Figure 3-11. Data Flow Between Non-tunneled Components

3.4.2.2 Tunneled Data Flow

In data tunneling, OpenMAX IL components directly pass data buffers among themselves without returning them to the IL client. This data flow uses a different convention from the situation where all data buffers are exchanged with the IL client.

If the buffer supplier is the output component, it shall call `OMX_EmptyThisBuffer` on the other tunneled component to pass the buffer that is to be emptied. When the input component has terminated the operation, it shall return the buffer to the output component by calling `OMX_FillThisBuffer` on it.

If the buffer supplier is the input component, the communication mechanism is the same but is initiated by calling `OMX_FillThisBuffer` on the output component. Figure 3-12 illustrates this process.

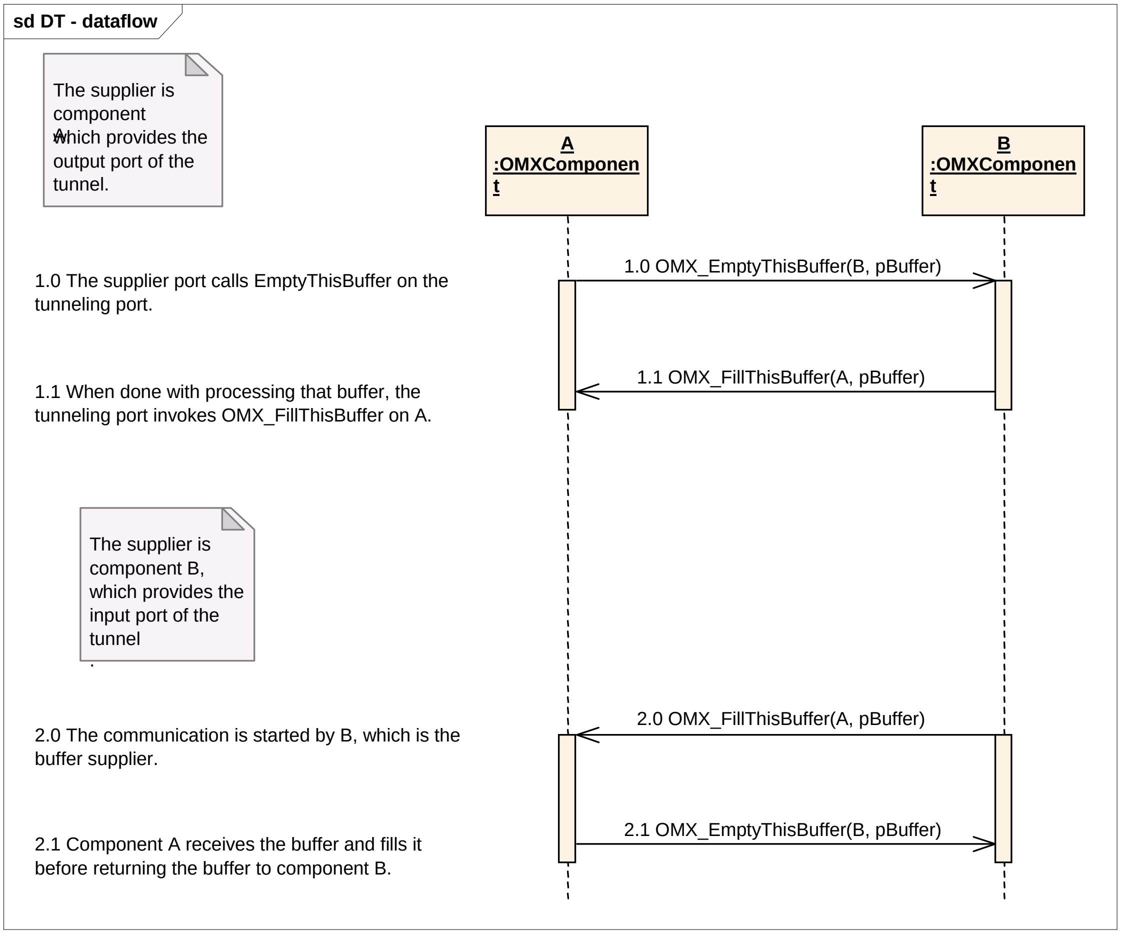


Figure 3-12. Data Flow Between Tunneled Components

3.4.2.3 Proprietary Communication

On some platforms data tunneling among components can be optimized by proprietary communication mechanisms, which can be based on specific hardware such as DMA or shared memory. Such resources are set up in a proprietary manner during the standard data tunneling setup phase. Although the IL client uses the standard `OMX_SetupTunnel` call, platform-specific optimizations can prepare optimized transport channels among components.

Assuming a chain of components A, B, and C that support proprietary communication, the resulting data flow would appear as illustrated in Figure 3-13.

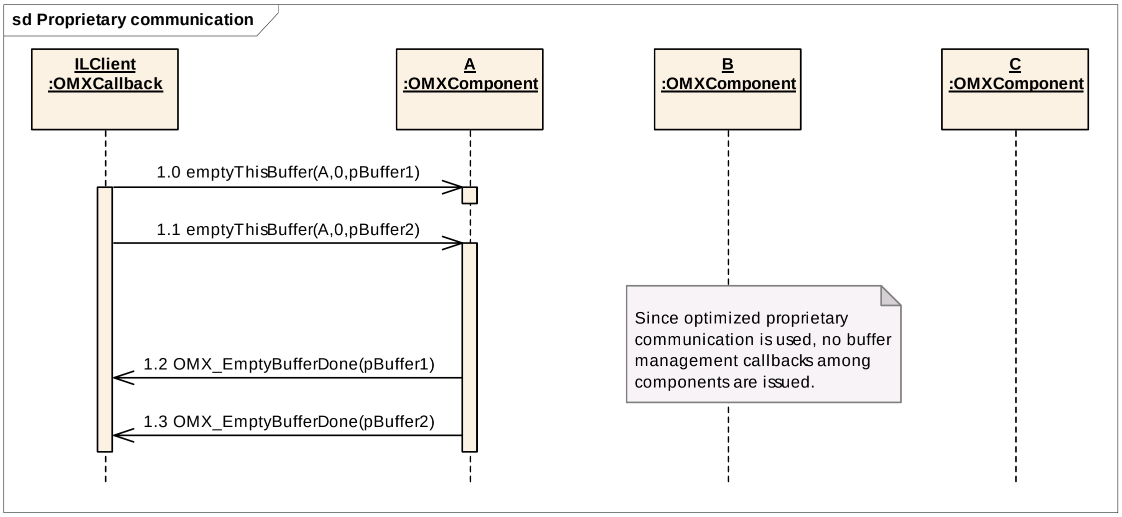


Figure 3-13. Data Flow with Proprietary Communication Between Components

Assuming that all components are in the OMX_StateExecuting state, the IL client sends two buffers to component A using the `OMX_EmptyThisBuffer` call (steps 1.0 and 1.1). Given the data tunnel setup, the output of component A is sent to the input port of component B. The output of component B is sent to the input port of component C, which is the sink.

No callbacks will be invoked since the components will use their proprietary mechanisms to move data.

The `EmptyBufferDone` callback will be issued to the IL client only when component A has finished processing buffers.

Even though buffer-related callbacks are not used in this use case, note that components may still generate events to the IL client using the `EventHandler` callback entry point.

3.4.3 De-Initialization

This section describes tunneled and non-tunneled component de-initialization.

3.4.3.1 Non-tunneled De-initialization

When the IL client decides to stop the execution and dispose of the components, it should first switch the components to the OMX_StateIdle state so that all buffers are returned to their suppliers.

When the transition to OMX_StateIdle is completed, the IL client can request the component to change its state to OMX_StateLoaded. The IL client shall free all of the component's buffers by calling `OMX_FreeBuffer` for each buffer. The `OMX_FreeBuffer` function requires that the component remove the specified buffer from the specified port. If the component allocated the buffer with an `OMX_AllocateBuffer` call, the component shall also free the buffer memory. If the IL client allocated the buffer and assigned it to the component with an

OMX_UseBuffer call, then the IL client shall de-allocate the buffer memory after calling OMX_FreeBuffer.

When all of the buffers have been freed, the component shall complete the state transition. Finally, the IL client calls the OMX_FreeHandle function that disposes of the component.

This procedure is performed for each non-tunneled port. Figure 3-14 illustrates non-tunneled de-initialization.

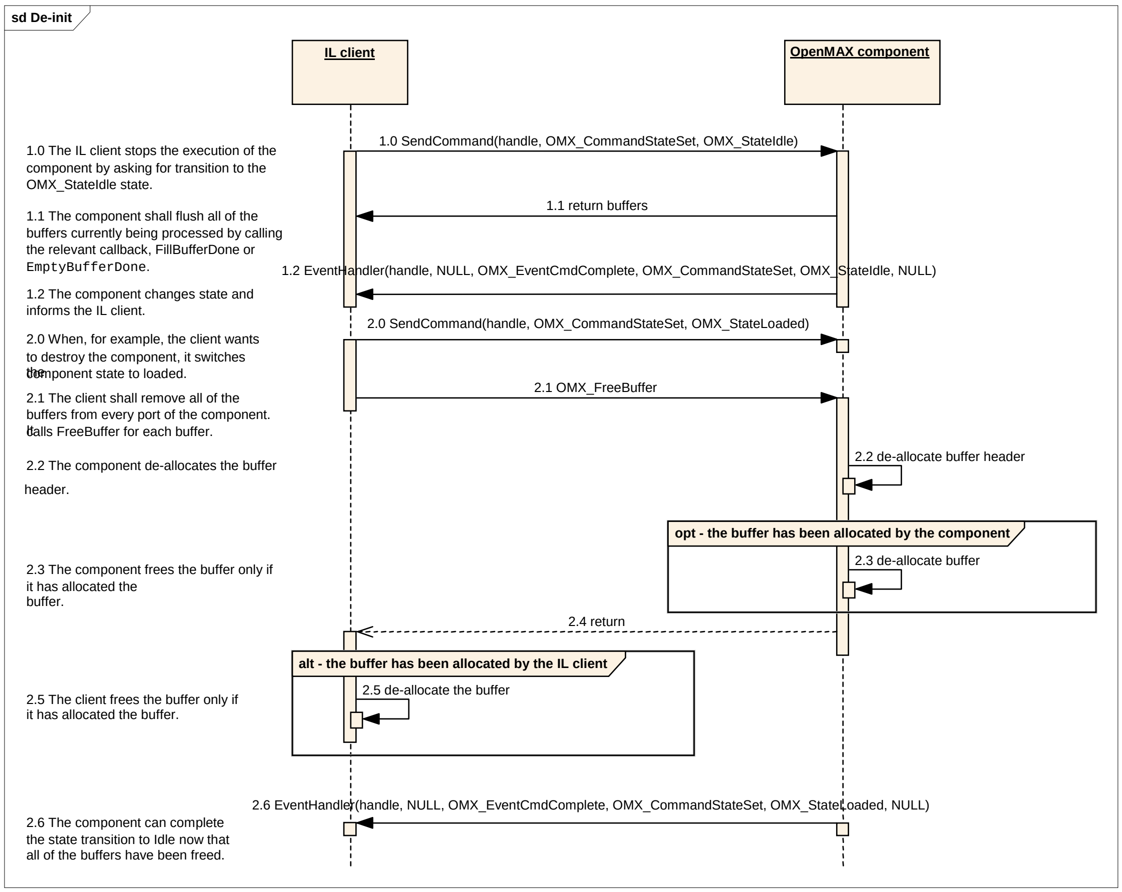


Figure 3-14. De-initialization of Non-tunneled Components

A port that is tunneled shall follow the component de-initialization procedure illustrated in Section 3.4.3.2.

3.4.3.2 Tunneled De-Initialization

Figure 3-15 illustrates the component de-initialization for a port that is tunneled.

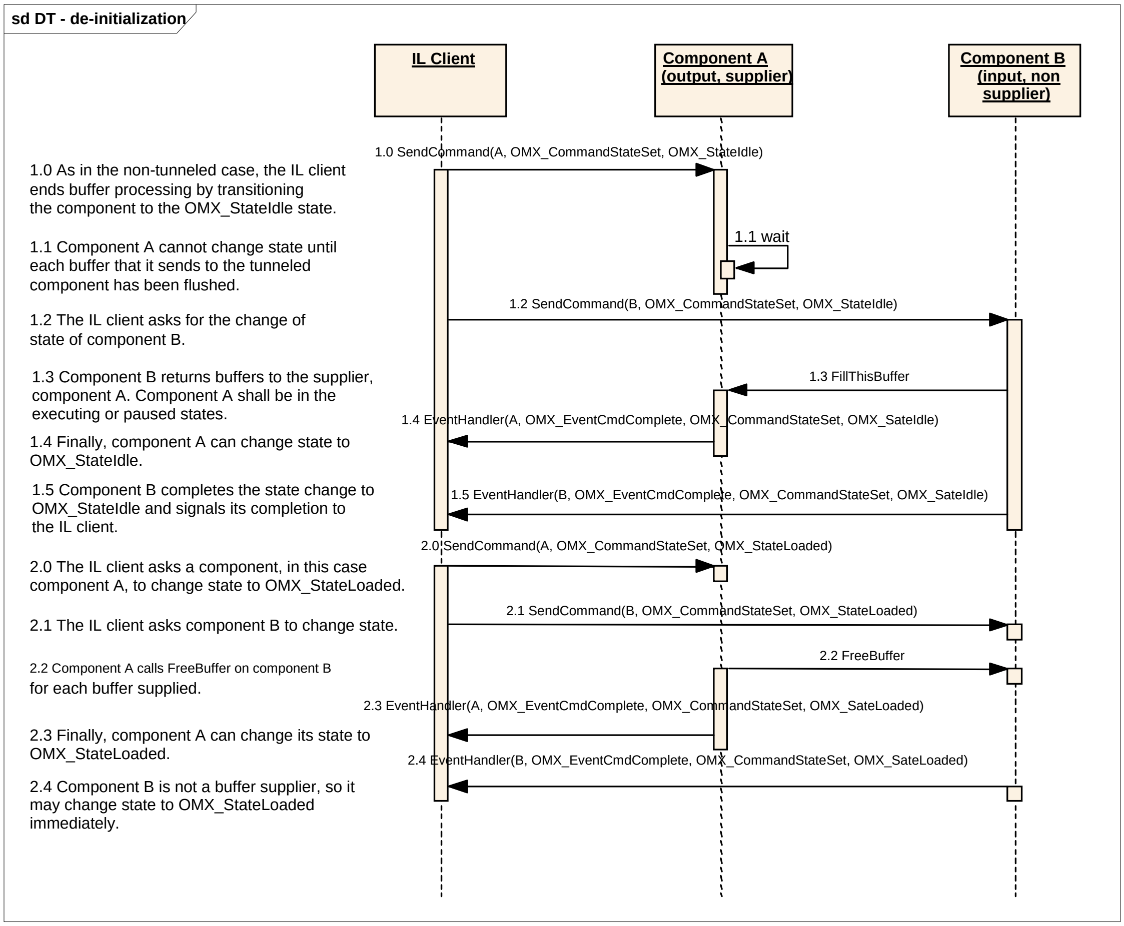


Figure 3-15. De-initialization of Tunneled Components

3.4.4 Port Disablement and Enablement

Disabling a port causes it to behave as if its component transitioned to the OMX_StateLoaded state. Thus, all of the port's buffers are returned to their suppliers, and any buffers the disabled port allocated are freed. The act of enabling a port inverts this process, putting a port that is effectively in the OMX_StateLoaded state into the component's state. Thus, if the component is in a state where its ports have buffers, then an enabled port will acquire buffers. Likewise, if the component is exchanging buffers, an enabled port will begin exchanging buffers.

Note that if a port is disabled when the component is in the OMX_StateLoaded state, the port's effective state is still made disjoint from the component's state. Thus, when a component transitions from OMX_StateLoaded to OMX_StateIdle, any disabled port will not acquire buffers but, instead, will effectively remain in OMX_StateLoaded.

The description of port disablement and enablement is divided into tunneling and non-tunneling cases.

3.4.4.1 Tunneled Ports Disablement and Enablement

Figure 3-16 illustrates the behavior of enabling and disabling tunneled ports.

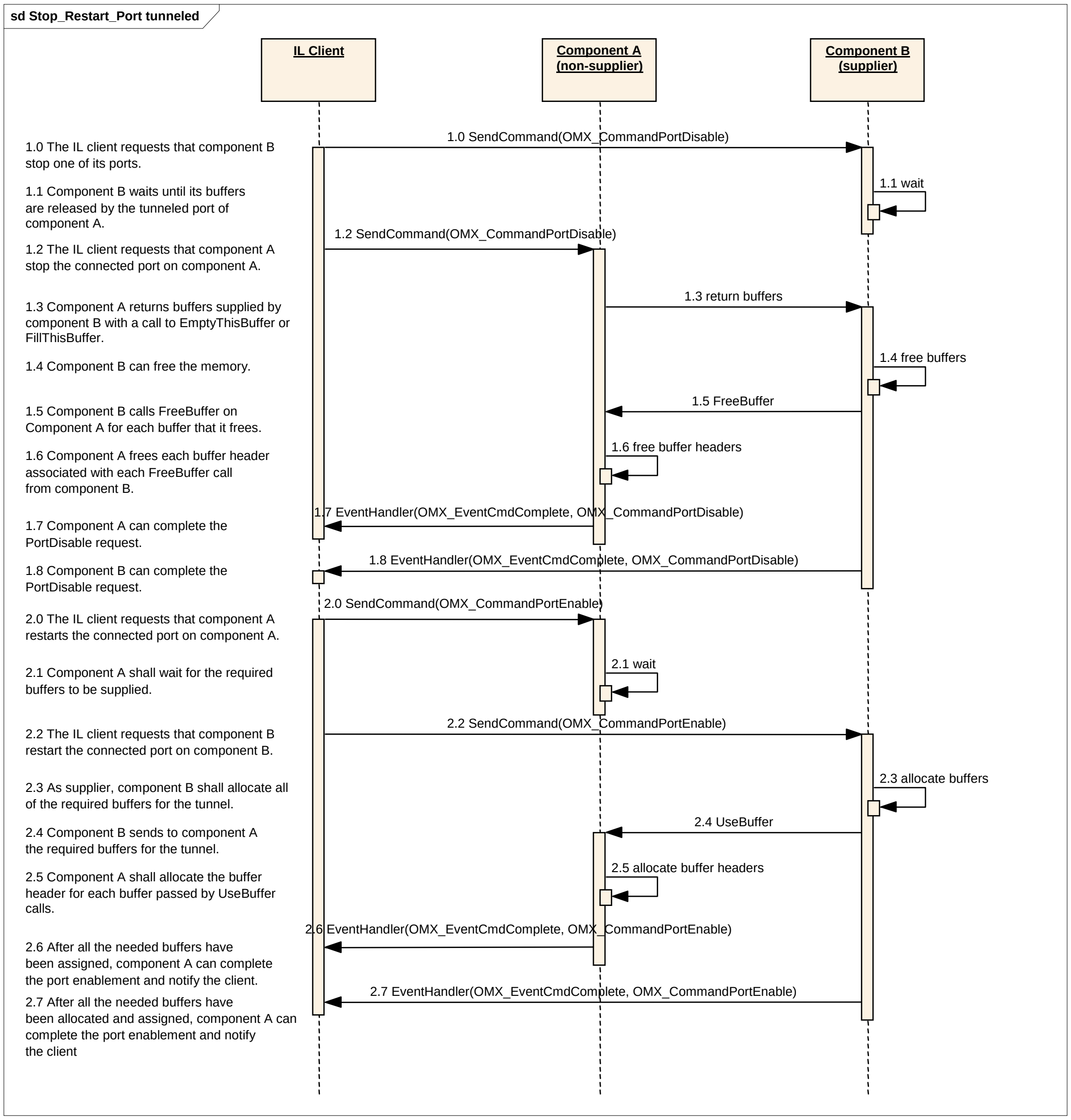


Figure 3-16. Disablement and Enablement of Tunneled Ports

3.4.4.2 Non-tunneled Port Disablement and Enablement

Figure 3-17 illustrates the case of the disablement and enablement procedure for a non-tunneled port. A detailed discussion of `OMX_AllocateBuffer`, `OMX_UseBuffer`, and `OMX_FreeBuffer` is omitted here; for more detailed descriptions of the use of these functions, see sections 3.3.13, 3.3.12, and 3.3.14, respectively.

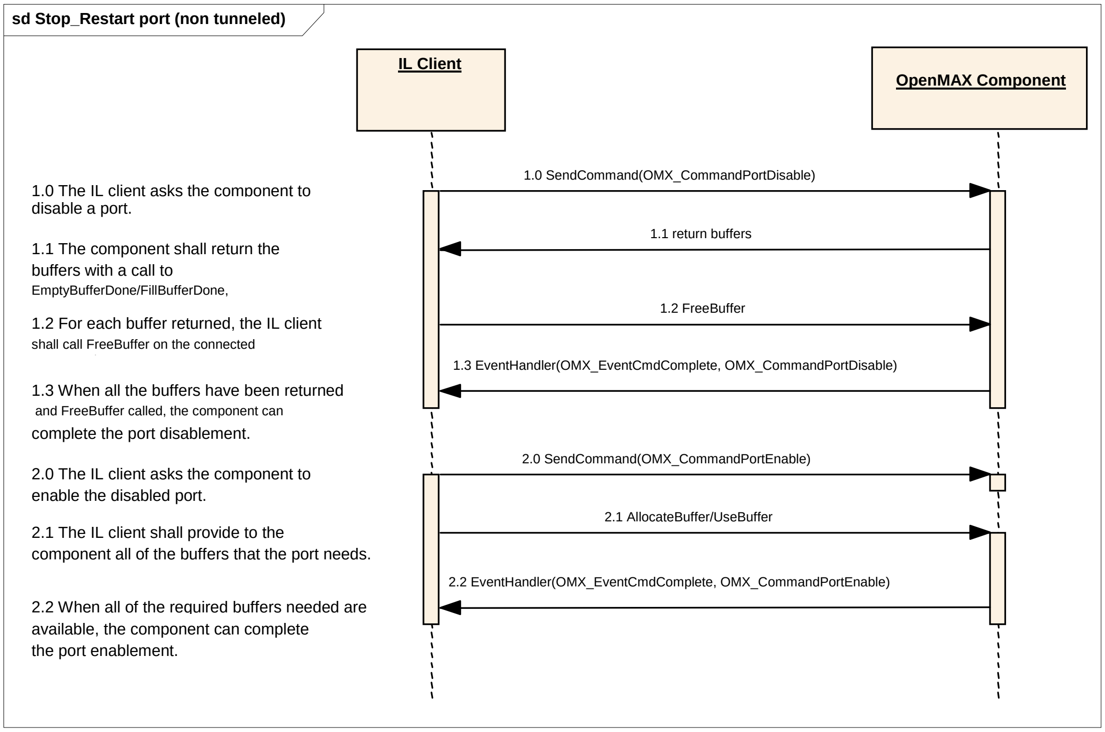


Figure 3-17. Disablement and Enablement of Non-tunneled Ports

3.4.5 Dynamic Port Reconfiguration

This section describes how a component may change its port settings dynamically.

The following examples show where this functionality is typically needed:

- A video decoder parses a sequence header and discovers the frame size of the output pictures, so buffers associated with its output ports shall be rearranged.
- The parameters of an audio stream vary dynamically, and a decoder should change its port settings.

Figure 3-18 shows how a video decoder and a video renderer, both of which exchange data through the IL client, should dynamically change their port settings.

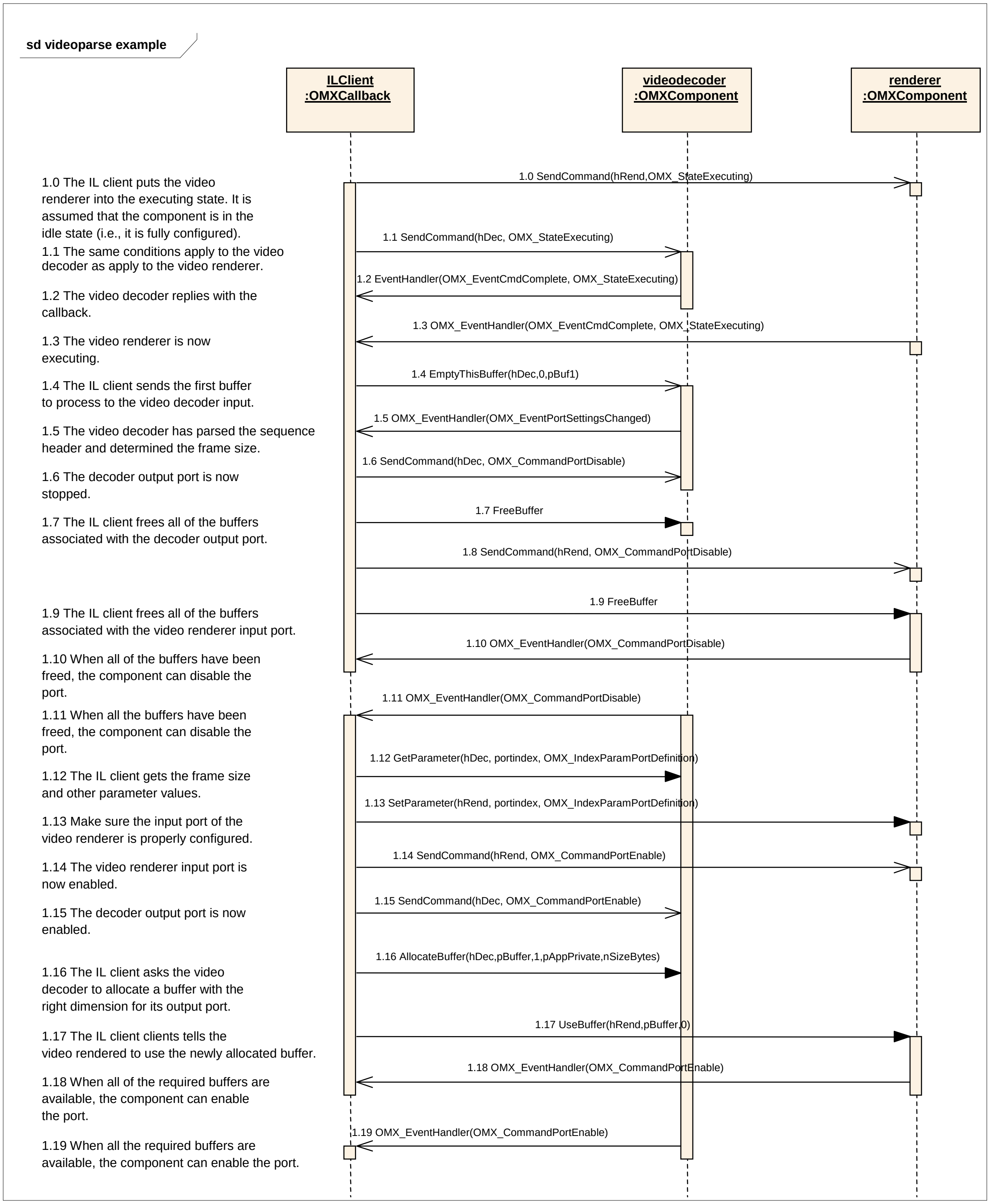


Figure 3-18. Dynamic Port Reconfiguration

The sequence starts with the IL client putting a video renderer and a video decoder in the OMX_StateExecuting state (1.0 through 1.3). At this stage, the output port of the video decoder and the input port of the renderer are not yet configured, since the dimension of the output frame is unknown *a priori*. The decoder needs to start parsing the input bit stream to derive such information.

In fact, the IL client sends the first buffer to the decoder in step 1.4. Assuming that the video sequence header is included in that first buffer, the OpenMAX IL decoder component will parse it and change its output port settings accordingly.

The OpenMAX IL decoder component shall then notify the IL client by generating the `OMX_PortSettingsChanged` event (step 1.5). As soon as the IL client receives this callback, it shall disable the output port of the video decoder and the input port of the video renderer (steps 1.6 through 1.11).

The IL client shall then read the new port settings with `OMX_GetConfig` and allocate one or more buffers with the right dimensions for the output port. Once the buffers are allocated, they will be also communicated to the video renderer using `OMX_UseBuffer` (1.17). The input port of the video renderer shall also be set up with `OMX_SetConfig` (1.18).

Finally, ports can be enabled and normal processing resumes.

3.4.6 Autodetect Port Reconfiguration

This section describes how a component may change its autodetect port settings.

The following example show where this functionality is typically needed:

- A file reader parses a media container such as a 3GPP file and discovers the video and audio decoders required to decode the elementary streams.
- The encoding types of a media container may vary so a file reader should change its port settings once the formats are determined.

Figure 3-19 Autodetect Port Reconfiguration shows how a file reader, an audio decoder and a video decoder should connect after the autodetect ports have determined the required port settings.

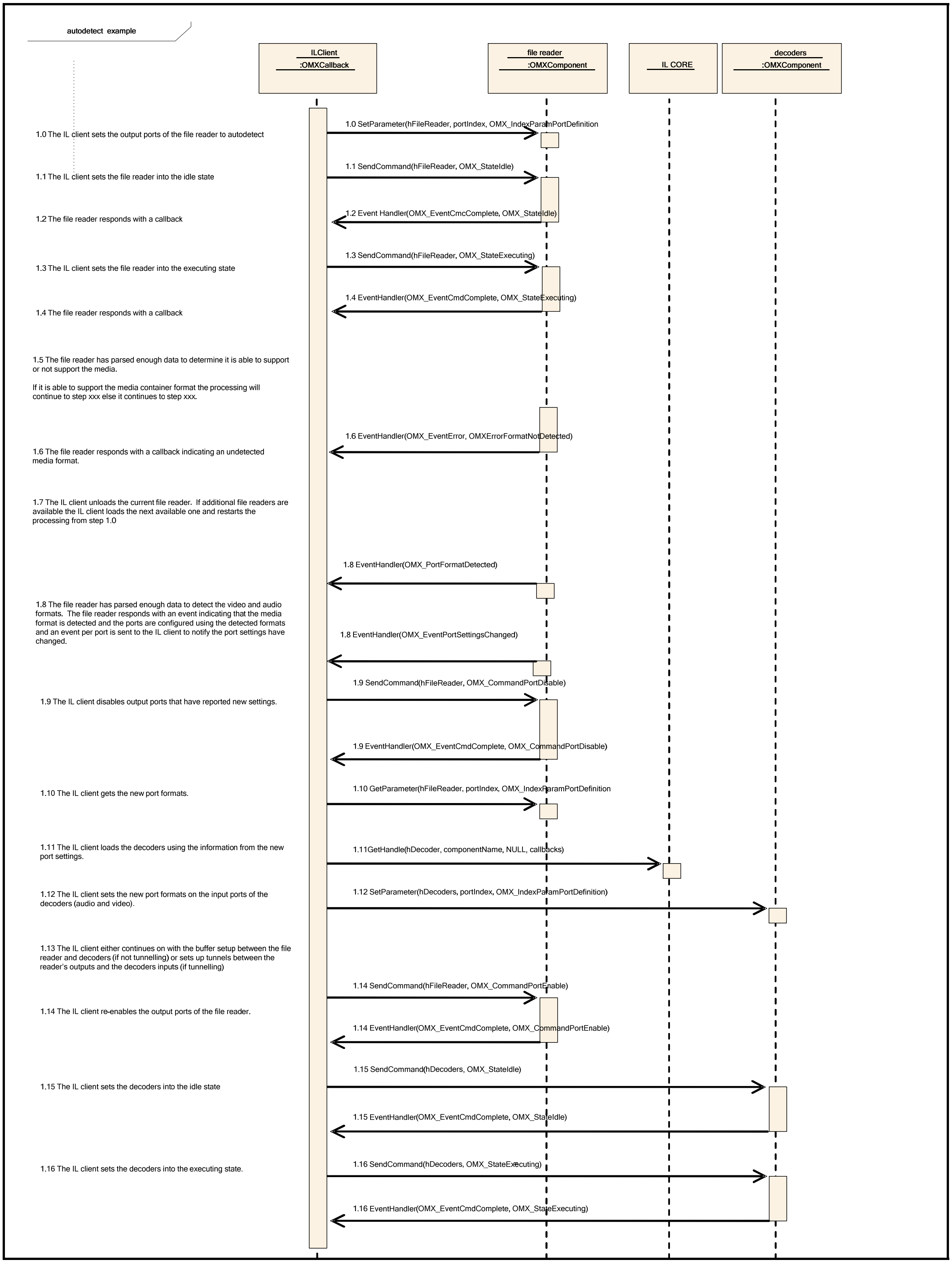


Figure 3-19 Autodetect Port Reconfiguration

The sequence starts with the IL client setting the output port formats (OMX_IndexParamVideoPortFormat and OMX_IndexParamAudioPortFormat) of the file reader to autodetect.

Initially only the IL client instantiates only the file reader, lets all output ports communicate with the IL client, and sets all output ports to autodectect. The IL client then commands the file reader to transition into the idle state (OMX_StateIdle) thereby allocating all of its buffers. The IL client then commands the file reader to transition into the executing state (OMX_StateExecuting).

The file reader now reads and parses data until it determines if it is able to detect the format of the media container. If the file reader is not able to detect the media container format it will notify the IL client by generating an OMX_ErrorFormatNotDetected error (step 1.6). Since the media container format was not detected, the IL client can return to step 1.0 with another file reader component and execute the same sequence. This continues until either the media container format is detected or no more file reader components exist that have not attempted to detect the media container format.

If the file reader is able to detect the media container format and the the format of the streams it will emit on the output ports, the file reader component will change its output port settings accordingly and notify the IL client by generating the OMX_EventPortFormatDetected and OMX_PortSettingsChanged events (step 1.8) for each output port where the format has been changed. As soon as the IL client receives this callback, it shall disable the changed output ports of the file reader (step 1.9).

The IL client shall then read the new file reader port settings for all output ports whose settings have changed with OMX_GetConfig. Based on the these settings the IL client shall select appropriate decoder components and call the OMX_GetHandle function for each. If previous step is successful, valid handles are returned in step 1.11 and the decoder components will be in the OMX_StateLoaded state.

The IL client shall configure the decoder components and its ports (including the format settings discovered from the parser). For this purpose, the IL core macro OMX_SetParameter shall be used; it may be called multiple times (step 1.12) if needed.

At this point the IL client may setup the components for either non-tunneled communication (by setting up the buffers itself) or tunneled communication (by setting up tunnels and and letting the components set up the buffers)

Finally the IL client re-enables the reader’s output ports and transitions the decoders into the idle state (OMX_StateIdle) then the executing state (OMX_StateExecuting). At this point processing resumes.

3.4.7 Resource Management

This section describes the entry points for resource management. The interface between components and the resource manager are presented only as an example. Only the interface between the IL client and the components is part of the OpenMAX IL standard definition. An IL client may use the resource manager entry points.

Figure 3-20 proposes the behavior of an IL client is agnostic of the resource manager. The resource manager handles the component internally only, and the IL client has to take no special action.

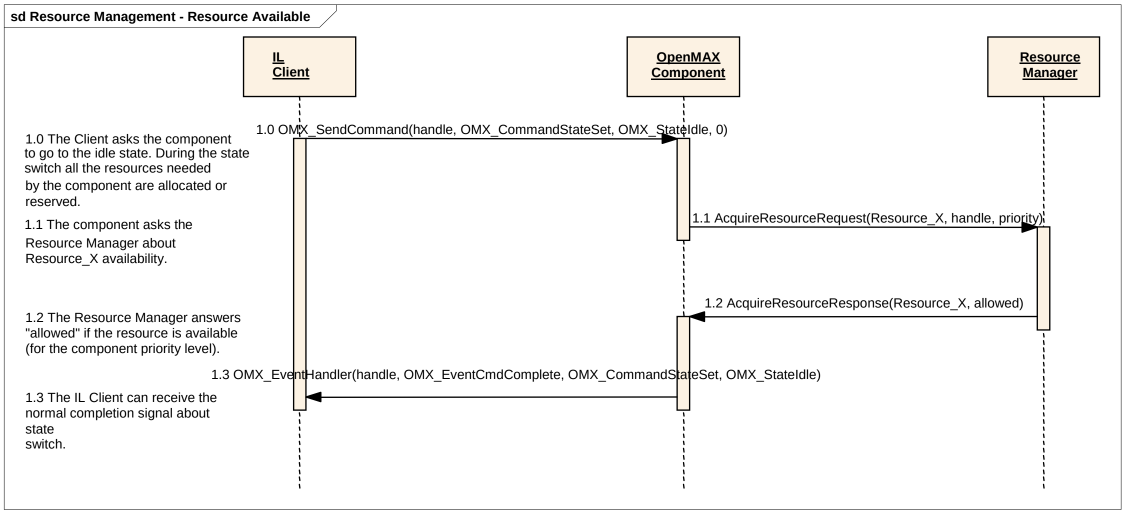


Figure 3-20. Transition from Loaded to Idle with Resource Management

In Figure 3-20, the IL client is unaware of the existence of a resource manager. In the implementation of the OpenMAX IL component, an asynchronous call to the resource manager is implemented.

The OpenMAX IL component provides a callback to the resource manager, which receives the signal for the completion of the request.

Figure 3-20 represents a possible implementation of a resource manager, and shows how it can be transparent to the client. The functions `AcquireResourceRequest` and `AcquireResourceResponse` are examples. This specification is concerned only about the interface between the IL client and the components. Details of the interactions between the components and the vendor/specific manager(s) are outside the scope of this specification.

Figure 3-21 presents a more complex use case.

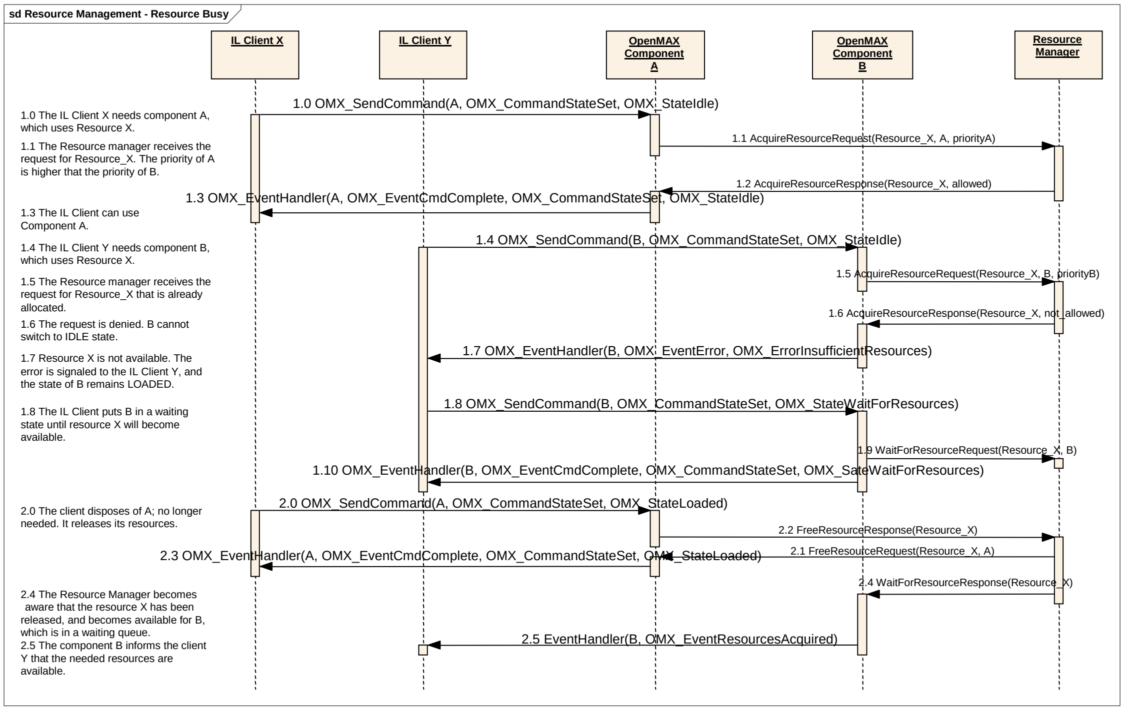


Figure 3-21. Busy Resource Management

In Figure 3-21, two different OpenMAX IL components, A and B, need the same resource to work, and they have different priorities. Here, as in the preceding example, the IL clients use the standard transition from Loaded to Idle to set up the component and allocate all of the required resources.

The first component, component A, takes ownership of the resource, requesting it from the resource manager. Component A switches to the idle state and is ready to execute.

The second component, component B, asks for the same resource, but in this case the resource manager denies it since a higher priority component, component A, has that resource. This event is reported to the IL client with an error message including the value `OMX_ErrorInsufficientResources`. If IL client Y decides that it needs to be notified when this resource becomes available again, it may direct component B to change state to OMX_StateWaitForResources. This action puts component B in a waiting queue until the resource X will become available. Alternatively, IL client Y may request component B to switch back to the Loaded state.

Figure 3-21 also shows the behavior of components when resource X becomes available. Component A changes state to Loaded and releases all of the resources. The resource manager becomes aware of the available resource and calls Component B, which is already in the waiting queue.

When the resource manager provides the component with all the resources it is waiting on, the component informs the IL client that all resources needed are available with an `OMX_EventResourcesAcquired` event. The IL client shall now provide all of the needed buffers to the component. Then, the component can change state by itself to OMX_StateIdle and alert the client about the state change. This waiting queue represents a unique case of automatic state change.

In Figure 3-21, the priorities of components A and B are not compared within the IL layer, and no preemption mechanism is implemented or proposed; an external policy manager, which should communicate with the resource manager, should have this responsibility. The description of such a policy manager is outside the scope of this document and the OpenMAX IL standard in general.

Figure 3-22 presents an example of a client that actively uses the resource management API.

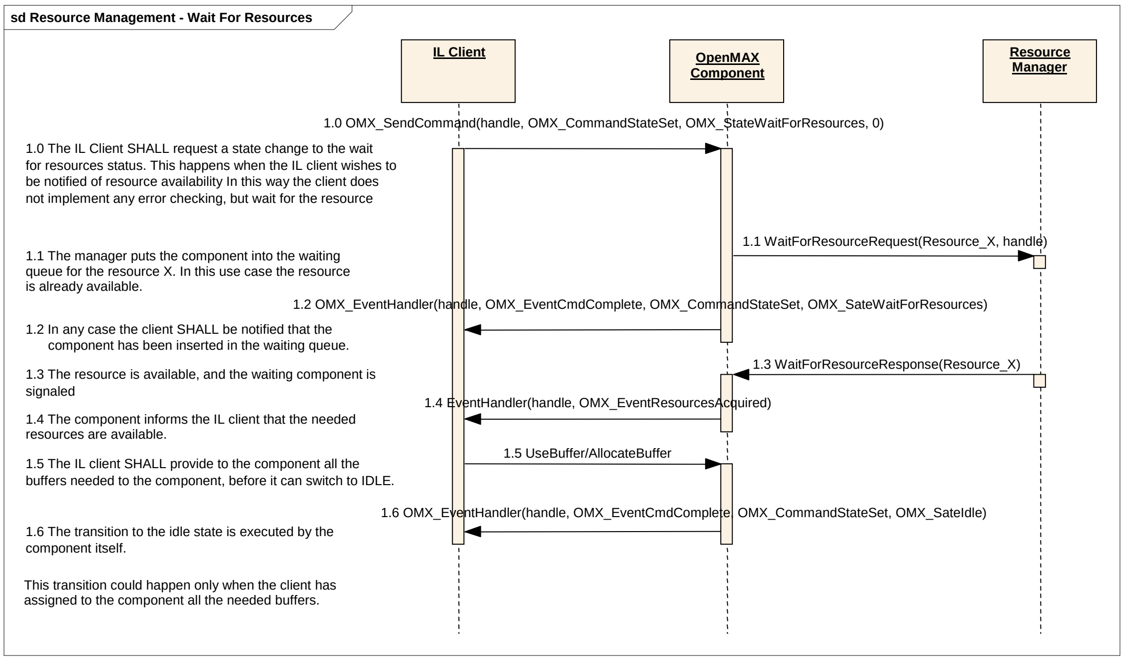


Figure 3-22. State Change from Loaded to WaitForResources

The IL client may request a state change from OMX_StateLoaded to OMX_StateWaitForResources in case the IL client wants to be notified when the resource becomes available again. For an explanation of OMX_StateWaitForResources, see section 3.1.1.2.5.

In this case, the client puts the component into a waiting queue, handled by the resource manager; the change to the idle state happens effectively when the resource will become available or if it is available immediately. In any case, the client receives two different `EventHandler` callbacks that correspond to two different state changes.

The two functions `WaitForResourceRequest` and `WaitForResourceResponse` in Figure 3-22 are not defined in this specification but are examples of an interaction between components and the resource manager.

The IL client may decide to stop waiting at a certain time. In this case, it shall request the component to change state back to Loaded, as shown in Figure 3-23.

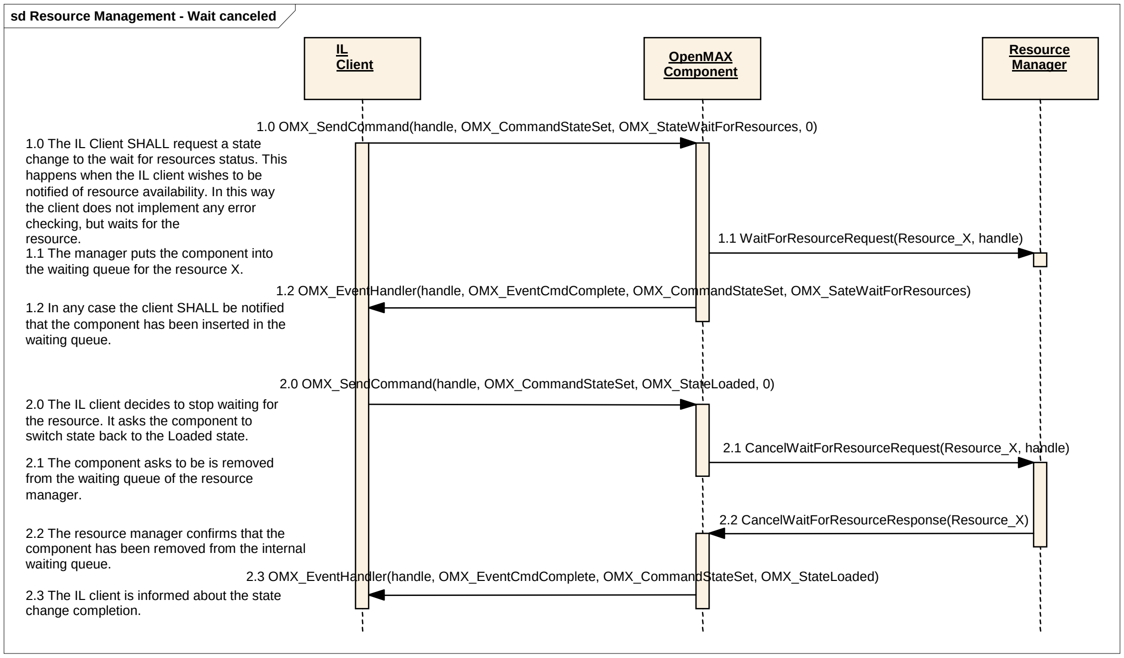


Figure 3-23. Remove Component from Waiting Status

4 OpenMAX IL Data API

This section describes the typical component usage for the audio, video, image, and other domains. This section also details all of the structures, parameters, and configurations that apply to ports for each of the domains and provides use case examples where appropriate.

4.1 Audio

This section describes the structures, parameters, and configuration details for ports in the audio domain. These parameter and configurations details are specified in the OMX_Audio.h header.

4.1.1 Audio Use Case Examples

Figure 4-1 illustrates an example of an audio playback processing chain. Two sound sources are played simultaneously and are mixed with effects added to both the individual processing paths and the mixed signal. Only OpenMAX IL standard components are shown in this example.

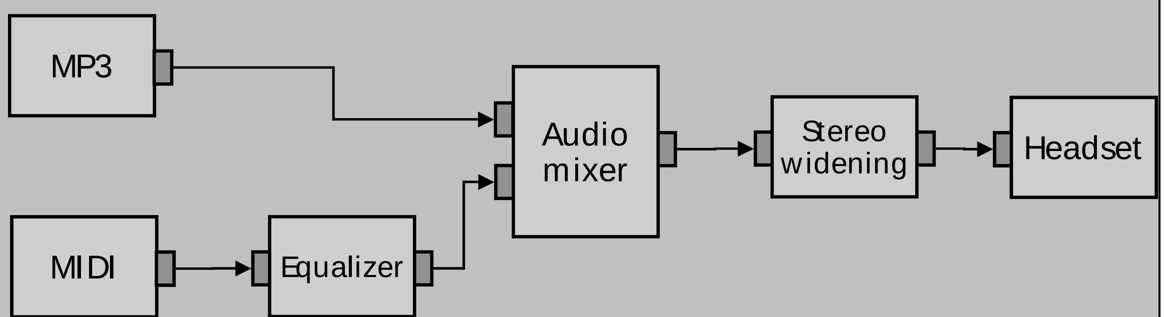


Figure 4-1. Audio Playback Processing Chain

Figure 4-2 illustrates a simple example of speech processing chains with echo cancellation added for an uplink speech path. Speech codecs can be any specified OpenMAX IL codecs.

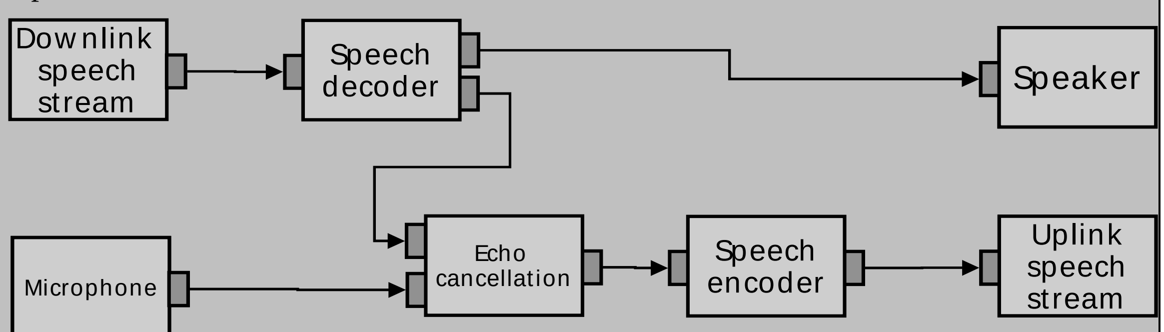


Figure 4-2. Speech Processing Chain

4.1.2 Special Issues

Some audio formats have special or unique requirements that are different from other audio formats, or even from other domains. These issues are described in the following sections.

4.1.2.1 Minimum Buffer Payload Size for Uncompressed Data

OpenMAX IL has specified a minimum buffer payload sizes for all types of uncompressed data. The minimum payload size for pulse code modulation (PCM) audio is five milliseconds. This means that an output port of a PCM component shall produce at least five milliseconds of audio data for each buffer. The minimum payload size is applied only for PCM (i.e., `OMX_AUDIO_CodingPCM`) and not for any other formats.

4.1.2.2 Whole-file Buffering for MIDI Formats

Most MIDI content formats contain multiple parallel tracks of media data that appear in the file in serial track order rather than interleaved in real-time execution order. In addition, the MIDI state is deterministic only from the beginning of file playback, and thus seeks within any MIDI file require that at least some part of the file be re-processed from the beginning. For these reasons, callers shall provide the full length of the MIDI file data to the MIDI OpenMAX IL component using the `nFileSize` field of the `OMX_AUDIO_PARAM_MIDITYPE` structure. For more information on the `OMX_AUDIO_PARAM_MIDITYPE` structure, see section 4.1.31.

4.1.3 General Enumerations

`OMX_AUDIO_CODINGTYPE` is the enumeration used to define the possible audio coding. If `OMX_AUDIO_CodingUnused` is selected, the coding selection shall be done in a vendor-specific way. Table 4-1 shows the contents of `OMX_AUDIO_CODINGTYPE`.

Table 4-1: Audio Coding Types

Field Name	Description	References to Standard(s)
`OMX_AUDIO_CodingUnused`	Placeholder value when coding is not available	Not available
`OMX_AUDIO_CodingAutoDetect`	Auto detection of audio format	Not available
`OMX_AUDIO_CodingPCM`	Any variant of PCM coding	PCM
`OMX_AUDIO_CodingADPCM`	Any variant of ADPCM encoded data	ADPCM
`OMX_AUDIO_CodingAMR`	Any variant of AMR encoded data	AMR-NB , AMR-WB

Field Name	Description	References to Standard(s)
OMX_AUDIO_CodingGSMFR	Any variant of GSM Full-Rate (i.e., GSM610)	GSM-FR
OMX_AUDIO_CodingGSMEFR	Any variant of GSM Enhanced Full-Rate encoded data	GSM-EFR
OMX_AUDIO_CodingGSMHR	Any variant of GSM Half-Rate encoded data	GSM-HR
OMX_AUDIO_CodingPDCFR	Any variant of PDC Full-Rate encoded data	PDC-FR
OMX_AUDIO_CodingPDCEFR	Any variant of PDC Enhanced Full-Rate encoded data	PDC-EFR
OMX_AUDIO_CodingPDCHR	Any variant of PDC Half-Rate encoded data	PDC-HR
OMX_AUDIO_CodingTDMAFR	Any variant of TDMA Full-Rate encoded data (TIA/EIA-136-420)	TDMA-FR
OMX_AUDIO_CodingTDMAEFR	Any variant of TDMA Enhanced Full-Rate encoded data (TIA/EIA-136-410)	TDMA-EFR
OMX_AUDIO_CodingQCELP8	Any variant of QCELP 8 kbps encoded data	QCELP8
OMX_AUDIO_CodingQCELP13	Any variant of QCELP 13 kbps encoded data	QCELP13
OMX_AUDIO_CodingEVRC	Any variant of EVRC encoded data	EVRC
OMX_AUDIO_CodingSMV	Any variant of SMV encoded data	SMV
OMX_AUDIO_CodingG711	Any variant of G.711 encoded data	G.711

Field Name	Description	References to Standard(s)
OMX_AUDIO_CodingG723	Any variant of G.723.1 encoded data	G.723.1
OMX_AUDIO_CodingG726	Any variant of G.726 encoded data	G.726
OMX_AUDIO_CodingG729	Any variant of G.729 encoded data	G.729
OMX_AUDIO_CodingAAC	Any variant of AAC encoded data	MPEG-2 AAC , MPEG-4 AAC HE-AAC v1 , HE-AAC v2
OMX_AUDIO_CodingMP3	Any variant of MP3 encoded data	MPEG-1 Audio , MPEG-2 Audio
OMX_AUDIO_CodingSBC	Any variant of SBC encoded data	SBC
OMX_AUDIO_CodingVORBIS	Any variant of VORBIS encoded data	VORBIS
OMX_AUDIO_CodingWMA	Any variant of WMA encoded data	WMA
OMX_AUDIO_CodingRA	Any variant of RA encoded data	RA
OMX_AUDIO_CodingMIDI	Any variant of MIDI encoded data	SP-MIDI, DLS 1, DLS 2 General MIDI, General MIDI 2 , GM Lite , XMF type 0 and 1, Mobile XMF

4.1.4 Parameter and Configuration Indexes

The header OMX_Index.h contains the enumeration `OMX_INDEXTYPE`, which contains all standard index values used with the core functions `OMX_GetParameter`, `OMX_SetParameter`, `OMX_GetConfig`, and `OMX_SetConfig`. Table 4-2 shows the index values that relate to audio.

Table 4-2: Audio Coding Types by Index

OpenMAX IL Indices (OMX_Index.h)	Corresponding OpenMAX IL Audio Structures (OMX_Audio.h)
OMX_IndexParamAudioPortFormat	OMX_AUDIO_PARAM_PORTFORMATTYPE
OMX_IndexParamAudioPcm	OMX_AUDIO_PARAM_PCMMODETYPE
OMX_IndexParamAudioMp3	OMX_AUDIO_PARAM_MP3TYPE
OMX_IndexParamAudioAac	OMX_AUDIO_PARAM_AACPROFILETYPE
OMX_IndexParamAudioVorbis	OMX_AUDIO_PARAM_VORBISTYPE
OMX_IndexParamAudioWma	OMX_AUDIO_PARAM_WMATYPE
OMX_IndexParamAudioRa	OMX_AUDIO_PARAM_RATYPE
OMX_IndexParamAudioSbc	OMX_AUDIO_PARAM_SBCTYPE
OMX_IndexParamAudioAdpcm	OMX_AUDIO_PARAM_ADPCMTYPE
OMX_IndexParamAudioG723	OMX_AUDIO_PARAM_G723TYPE
OMX_IndexParamAudioG726	OMX_AUDIO_PARAM_G726TYPE
OMX_IndexParamAudioG729	OMX_AUDIO_PARAM_G729TYPE
OMX_IndexParamAudioAmr	OMX_AUDIO_PARAM_AMRTYPE
OMX_IndexParamAudioGsm_FR	OMX_AUDIO_PARAM_GSMFRTYPE
OMX_IndexParamAudioGsm_EFR	OMX_AUDIO_PARAM_GSMEFRTYPE
OMX_IndexParamAudioGsm_HR	OMX_AUDIO_PARAM_GSMHRTYPE
OMX_IndexParamAudioTdma_FR	OMX_AUDIO_PARAM_TDMAFRTYPE
OMX_IndexParamAudioTdma_EFR	OMX_AUDIO_PARAM_TDMAEFRTYPE
OMX_IndexParamAudioPdc_FR	OMX_AUDIO_PARAM_PDCFRTYPE
OMX_IndexParamAudioPdc_EFR	OMX_AUDIO_PARAM_PDCEFRTYPE
OMX_IndexParamAudioPdc_HR	OMX_AUDIO_PARAM_PDCHRTYPE
OMX_IndexParamAudioQcelp8	OMX_AUDIO_PARAM_QCELP8TYPE
OMX_IndexParamAudioQcelp13	OMX_AUDIO_PARAM_QCELP13TYPE
OMX_IndexParamAudioEvrc	OMX_AUDIO_PARAM_EVRCTYPE
OMX_IndexParamAudioSmv	OMX_AUDIO_PARAM_SMVTYPE
OMX_IndexParamAudioMidi	OMX_AUDIO_PARAM_MIDITYPE
OMX_IndexParamAudioMidiLoadUserSound	OMX_AUDIO_PARAM_MIDILOADUSERSOUNDTYPE
OMX_IndexConfigAudioMidiImmediateEvent	OMX_AUDIO_CONFIG_MIDIIMMEDIATEEVENTTYPE
OMX_IndexConfigAudioMidiSoundBankProgram	OMX_AUDIO_CONFIG_MIDISOUNDBANKPROGRAMTYPE
OMX_IndexConfigAudioMidiControl	OMX_AUDIO_CONFIG_MIDICONTROLTYPE
OMX_IndexConfigAudioMidiStatus	OMX_AUDIO_CONFIG_MIDISTATUSTYPE

OpenMAX IL Indices (OMX_Index.h)	Corresponding OpenMAX IL Audio Structures (OMX_Audio.h)
OMX_IndexConfigAudioMidiMetaEvent	OMX_AUDIO_CONFIG_MIDIMETAEVENTTYPE
OMX_IndexConfigAudioMidiMetaEventData	OMX_AUDIO_CONFIG_MIDIMETAEVENTDATATYPE
OMX_IndexConfigAudioVolume	OMX_AUDIO_CONFIG_VOLUMETYPE
OMX_IndexConfigAudioChannelVolume	OMX_AUDIO_CONFIG_CHANNELVOLUMETYPE
OMX_IndexConfigAudioBalance	OMX_AUDIO_CONFIG_BALANCETYPE
OMX_IndexConfigAudioMute	OMX_AUDIO_CONFIG_MUTETYPE
OMX_IndexConfigAudioChannelMute	OMX_AUDIO_CONFIG_CHANNELMUTETYPE
OMX_IndexConfigAudioLoudness	OMX_AUDIO_CONFIG_LOUDNESSTYPE
OMX_IndexConfigAudioBass	OMX_AUDIO_CONFIG_BASSTYPE
OMX_IndexConfigAudioTreble	OMX_AUDIO_CONFIG_TREBLETYPE
OMX_IndexConfigAudioEqualizer	OMX_AUDIO_CONFIG_EQUALIZERTYPE
OMX_IndexConfigAudioStereoWidening	OMX_AUDIO_CONFIG_STEREOWIDENINGTYPE
OMX_IndexConfigAudioChorus	OMX_AUDIO_CONFIG_CHORUSTYPE
OMX_IndexConfigAudioReverberation	OMX_AUDIO_CONFIG_REVERBERATIONTYPE
OMX_IndexConfigAudioEchoCancelation	OMX_AUDIO_CONFIG_ECHOCANCELATIONTYPE
OMX_IndexConfigAudioNoiseReduction	OMX_AUDIO_CONFIG_NOISEREDUCTIONTYPE

4.1.5 OMX_AUDIO_PORTDEFINITIONTYPE

The OMX_AUDIO_PORTDEFINITIONTYPE structure is used to define all of the parameters necessary for the compliant component to set up an input or an output audio path. If additional information is needed to define the parameters of the port, such as frequency, additional structures such as the OMX_AUDIO_PARAM_PCMMODETYPE structure shall be sent to supply the extra parameters for the port. The number of audio paths for input and output will vary by the type of the audio component.

OMX_Component.h contains common port definition structures for all media domains.

The OMX_AUDIO_PORTDEFINITIONTYPE structure can query the current or default definition of an audio port or set the definition of an audio port for a component. The OMX_AUDIO_PORTDEFINITIONTYPE structure is included as part of the OMX_PARAM_PORTDEFINITIONTYPE structure, it is accessed via the OMX_GetParameter function or the OMX_GetParameter function using the OMX_IndexParamPortDefinition index.

OMX_AUDIO_PORTDEFINITIONTYPE is defined as follows.

```
typedef struct OMX_AUDIO_PORTDEFINITIONTYPE {
    OMX_STRING cMIMEType;
    OMX_NATIVE_DEVICETYPE pNativeRender;
    OMX_BOOL bFlagErrorConcealment;
    OMX_AUDIO_CODINGTYPE eEncoding;
} OMX_AUDIO_PORTDEFINITIONTYPE;
```

The parameters for OMX_AUDIO_PORTDEFINITIONTYPE are defined as follows.

- cMIMEType is the MIME type of data for the port. If a MIME type string buffer is not supplied this parameter shall be set to NULL.
- pNativeRender is the platform-specific reference for an output device; otherwise this field is 0.
- bFlagErrorConcealment turns on error concealment if it is supported by the OpenMAX IL component.
- eEncoding is the type of data expected for this port (e.g., PCM, AMR, MP3, and so forth).

4.1.6 OMX_AUDIO_PARAM_PORTFORMATTYPE

OMX_AUDIO_PARAM_PORTFORMATTYPE is the structure for the port format parameter. This structure enumerates the various data input/output formats that the port supports.

This parameter call can be used with both OMX_GetParameter and OMX_SetParameter. In the OMX_GetParameter case, the caller specifies all fields and the OMX_GetParameter call returns the value of eEncoding. The value of nIndex goes from 0 to N-1, where N is the number of formats supported by the port. The port does not need to report N as the caller can determine N by enumerating all the formats supported by the port. Each port shall support at least one format. If there are no more formats, OMX_GetParameter returns OMX_ErrorNoMore (i.e., nIndex is supplied where the value is N or greater). Ports supply formats in order of preference: Higher preference formats are provided with lower values of nIndex.

For OMX_SetParameter, the field is nIndex ignored. If the format is supported, it is set as the format of the port, and the default values for the format are programmed into the port definition type as a side effect. This allows the caller to query the default values for the format without having to know them in advance.

OMX_AUDIO_PARAM_PORTFORMATTYPE is defined as follows.

```
typedef struct OMX_AUDIO_PARAM_PORTFORMATTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nIndex;
```

```
    OMX_AUDIO_CODINGTYPE eEncoding;
} OMX_AUDIO_PARAM_PORTFORMATTYPE;
```

The parameters for `OMX_AUDIO_PARAM_PORTFORMATTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nIndex` indicates the enumeration index for the format from 0x0 to N-1.
- `eEncoding` is the type of data expected for this port (e.g., PCM, AMR, MP3, and so forth).

4.1.7 OMX_AUDIO_PARAM_PCMMODETYPE

The `OMX_AUDIO_PARAM_PCMMODETYPE` structure is used to set or query the current or default settings for PCM audio using the `OMX_GetParameter` function. It is also used to set the parameters for PCM audio using the `OMX_SetParameter` function. When calling either the `OMX_GetParameter` or the `OMX_SetParameter` functions, the index specified for this structure is `OMX_IndexParamAudioPcm`.

Note that the minimum buffer payload size is applied to all modes of PCM audio. The payload size is defined by `OMX_MIN_PCMPAYLOAD_MSEC` and is five milliseconds.

`OMX_AUDIO_PARAM_PCMMODETYPE` is defined as follows.

```
 typedef struct OMX_AUDIO_PARAM_PCMMODETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_NUMERICALDATATYPE eNumData;
    OMX_ENDIANTYPE eEndian;
    OMX_BOOL bInterleaved;
    OMX_U32 nBitPerSample;
    OMX_U32 nSamplingRate;
    OMX_AUDIO_PCMMODETYPE ePCMMode;
    OMX_AUDIO_CHANNELTYPE eChannelMapping[OMX_AUDIO_MAXCHANNELS];
} OMX_AUDIO_PARAM_PCMMODETYPE;
```

4.1.7.1 Parameter Definitions

The parameters for `OMX_AUDIO_PARAM_PCMMODETYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nChannels` is the number of channels of audio (mono, stereo, multi-channel).
- `eNumData` indicates whether the PCM data is signed or unsigned.
- `eEndian` indicates whether PCM data is in little- or big-endian order.
- `bInterleaved` indicates whether the data is normal interleaved or non-interleaved. True represents normal interleaved data, and false represents non-interleaved data such as block data.

- `nBitPerSample` is the number of bits per sample.
- `nSamplingRate` is the sampling rate of the source data. Use the value 0 for variable or unknown sampling rate.
- `ePCMMode` is the PCM mode enumeration. Table 4-3 identifies the PCM mode.

Table 4-3: PCM Mode

Field Name	Description
`OMX_AUDIO_PCMModeLinear`	Linear PCM encoded data
`OMX_AUDIO_PCMModeALaw`	A law PCM encoded data (G.711)
`OMX_AUDIO_PCMModeMULaw`	µ law PCM encoded data (G.711)

- `eChannelMapping` is the audio channel mapping enumeration. A component will indicate the order of the audio channels as shown in Table 4-4. A component should use the default channel mapping (standard RIFF/WAV mapping as present in standard multi-channel WAV files: FRONT_LEFT FRONT_RIGHT FRONT_CENTER LOW_FREQUENCY BACK_LEFT BACK_RIGHT .) if possible.

Table 4-4: Audio Channel Mapping

Field Name	Description
`OMX_AUDIO_ChannelNone`	Unused or empty
`OMX_AUDIO_ChannelLF`	Left front
`OMX_AUDIO_ChannelRF`	Right front
`OMX_AUDIO_ChannelCF`	Center front
`OMX_AUDIO_ChannelLS`	Left surround
`OMX_AUDIO_ChannelRS`	Right surround
`OMX_AUDIO_ChannelLFE`	Low frequency effects
`OMX_AUDIO_ChannelCS`	Back surround
`OMX_AUDIO_ChannelLR`	Left rear
`OMX_AUDIO_ChannelRR`	Right rear

4.1.7.2 Functionality

The `OMX_AUDIO_PARAM_PCMMODETYPE` structure sets the parameters of PCM audio.

4.1.8 OMX_AUDIO_PARAM_MP3TYPE

The `OMX_AUDIO_PARAM_MP3TYPE` structure is used to set or query the current or default settings for the MPEG Layer-3 (MP3) codec component using the `OMX_GetParameter` function. It is also used to set the parameters of the MP3 codec component using the `OMX_SetParameter` function. The index specified for this structure is OMX_IndexParamAudioMp3 when calling either the OMX_GetParameter or the OMX_SetParameter functions.

OMX_AUDIO_PARAM_MP3TYPE is defined as follows.

```
 typedef struct OMX_AUDIO_PARAM_MP3TYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_U32 nBitRate;
    OMX_U32 nSampleRate;
    OMX_U32 nAudioBandWidth;
    OMX_AUDIO_CHANNELMODETYPE eChannelMode;
    OMX_AUDIO_MP3STREAMFORMATTYPE eFormat;
} OMX_AUDIO_PARAM_MP3TYPE;
```

4.1.8.1 Parameter Definitions

The parameters for OMX_AUDIO_PARAM_MP3TYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nChannels is the number of channels of audio (mono, stereo, multi-channel).
- nBitRate is the bit rate of the encoded MP3 audio. If the bit rate is variable or unknown, this parameter has the value 0.
- nSampleRate is the sample rate of the encoded or decoded audio.
- nAudioBandWidth is the audio bandwidth in Hz to which an encoder should limit the audio signal. Use the value 0 to let encoder decide.

Mode	**Description**
OMX_AUDIO_ChannelModeStereo	Two channels. The bit rate allocation between the two channels changes according to each channel’s information.
OMX_AUDIO_ChannelModeJointStereo	A mode that takes advantage of what is common between the two channels for higher compression gain.

Mode	Description
OMX_AUDIO_ChannelModeDual	Two mono channels. Each channel is encoded with half the bit rate of the overall bit rate.
OMX_AUDIO_ChannelModeMono	Mono channel mode.

Field Name	Description
OMX_AUDIO_MP3StreamFormatMP1Layer3	MPEG1 Layer 3 stream format.
OMX_AUDIO_MP3StreamFormatMP2Layer3	MPEG2 Layer 3 stream format.
OMX_AUDIO_MP3StreamFormatMP2_5Layer3	MPEG2.5 Layer 3 stream format.

4.1.8.2 Functionality

The OMX_AUDIO_PARAM_MP3TYPE structure sets the parameters of the MP3 codec.

4.1.9 OMX_AUDIO_PARAM_AACPROFILETYPE

The OMX_AUDIO_PARAM_AACPROFILETYPE structure is used to set or query the current or default settings for the MPEG AAC codec component using the OMX_GetParameter function. It is also used to set the parameters of the AAC codec component using the OMX_SetParameter function. The index specified for this structure is OMX_IndexParamAudioAac when calling either the OMX_GetParameter or the OMX_SetParameter functions.

OMX_AUDIO_PARAM_AACPROFILETYPE is defined as follows.

```
 typedef struct OMX_AUDIO_PARAM_AACPROFILETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_U32 nSampleRate;
    OMX_U32 nBitRate;
    OMX_U32 nAudioBandWidth;
    OMX_U32 nFrameLength;
    OMX_U32 nAACtools;
    OMX_U32 nAACERtools;
    OMX_AUDIO_AACPROFILETYPE eAACProfile;
    OMX_AUDIO_AACSTREAMFORMATTYPE eAACStreamFormat;
    OMX_AUDIO_CHANNELMODETYPE eChannelMode;
} OMX_AUDIO_PARAM_AACPROFILETYPE;
```

4.1.9.1 Parameter Definitions

The parameters for the `OMX_AUDIO_PARAM_AACPROFILETYPE` structure are defined as follows.

- `nPortIndex` is a read-only value containing the index of the port.
- `nChannels` is the number of channels of audio (mono, stereo, multi-channel).
- `nSampleRate` is the sample rate of the encoded or decoded audio.
- `nBitRate` is the bit rate of the encoded AAC audio. If the bit rate is variable or unknown, this parameter has the value 0.
- `nAudioBandWidth` is the audio bandwidth in Hz to which an encoder should limit the audio signal. Use the value 0 to let the encoder decide.
- `nFrameLength` is the frame length of the codec in audio samples per channel. The value can be 1024 (AAC) or 960 (AAC-LC), 2048 (HE-AAC), 512 or 480 (AAC-LD). Use the value 0 to let encoder decide.

Define Name	Description
`OMX_AUDIO_AACToolNone`	No AAC tools allowed (encoder configuration) or active (optional decoder information output).
`OMX_AUDIO_AACToolMS`	Mid/Side (MS) joint coding tool.
`OMX_AUDIO_AACToolIS`	Intensity Stereo (IS) tool.
`OMX_AUDIO_AACToolTNS`	Temporal Noise Shaping (TNS) tool.
`OMX_AUDIO_AACToolPNS`	MPEG-4 Perceptual Noise Substitution (PNS) tool.
`OMX_AUDIO_AACToolLTP`	MPEG-4 Long Term Prediction (LTP) tool.
`OMX_AUDIO_AACToolAll`	All AAC tools allowed or active.

Define Name	Description
OMX_AUDIO_AACERNone	No AAC ER tools allowed/used
OMX_AUDIO_AACERVCB11	Virtual Code Books for AAC section data (VCB11)
OMX_AUDIO_AACERRVLC	Reversible Variable Length Coding (RVLC)
OMX_AUDIO_AACERHCR	Huffman Codeword Reordering (HCR)
OMX_AUDIO_AACERAll	All AAC ER tools allowed/used

Field Name	Description
OMX_AUDIO_AACObjectNull	Null - not used
OMX_AUDIO_AACObjectMain	AAC Main object/profile
OMX_AUDIO_AACObjectLC	AAC Low Complexity object/profile (MPEG-4: AAC profile)
OMX_AUDIO_AACObjectSSR	AAC Scalable Sample Rate object/profile
OMX_AUDIO_AACObjectLTP	AAC Long Term Prediction object
OMX_AUDIO_AACObjectHE	High Efficiency AAC (object type SBR, MPEG-4: HE-AAC profile)
OMX_AUDIO_AACObjectScalable	AAC Scalable object
OMX_AUDIO_AACObjectERLC	ER AAC Low Complexity object (Error Resilient AAC-LC)
OMX_AUDIO_AACObjectLD	AAC Low Delay object (Error Resilient)
OMX_AUDIO_AACObjectHE_PS	AAC High Efficiency with Parametric Stereo coding (HE-AAC v2, object type PS)

Field Name	Description
OMX_AUDIO_AACStreamFormatMP2ADTS	MPEG-2 AAC Audio Data Transport Stream format
OMX_AUDIO_AACStreamFormatMP4ADTS	MPEG-4 AAC Audio Data Transport Stream format
OMX_AUDIO_AACStreamFormatMP4LOAS	Low Overhead Audio Stream format
OMX_AUDIO_AACStreamFormatMP4LATM	Low Overhead Audio Transport Multiplex
OMX_AUDIO_AACStreamFormatADIF	Audio Data Interchange Format
OMX_AUDIO_AACStreamFormatMP4FF	AAC inside MPEG-4/ISO File Format
OMX_AUDIO_AACStreamFormatRAW	AAC Raw Format (access units)

4.1.9.2 Functionality

The OMX_AUDIO_PARAM_AACPROFILETYPE structure sets the parameters of the AAC codec.

4.1.10 OMX_AUDIO_PARAM_VORBISTYPE

The OMX_AUDIO_PARAM_VORBISTYPE structure is used to set or query the current or default settings for the Vorbis codec component of the Ogg Vorbis format using the OMX_GetParameter function. It is also used to set the parameters of the Vorbis codec component using the OMX_SetParameter function. The index specified for this structure is OMX_IndexParamAudioVorbis when calling either the OMX_GetParameter or the OMX_SetParameter functions.

OMX_AUDIO_PARAM_VORBISTYPE is defined as follows.

```
typedef struct OMX_AUDIO_PARAM_VORBISTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_U32 nBitRate;
    OMX_U32 nMinBitRate;
    OMX_U32 nMaxBitRate;
    OMX_U32 nSampleRate;
    OMX_U32 nAudioBandWidth;
    OMX_S32 nQuality;
    OMX_BOOL bManaged;
    OMX_BOOL bDownmix;
} OMX_AUDIO_PARAM_VORBISTYPE;
```

4.1.10.1 Parameter Definitions

The parameters for OMX_AUDIO_PARAM_VORBISTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nChannels is the number of channels of audio (mono, stereo, multi-channel).
- nBitRate is the bit rate of the encoded Vorbis audio. If the bit rate is variable or unknown, this parameter has the value 0. Encoding is set to the bit rate closest to the specified value in bits per second (bps).
- nMinBitRate sets the minimum bit rate in bps.
- nMaxBitRate sets the maximum bit rate in bps.
- nSampleRate is the sample rate of the encoded or decoded audio. Use the value 0 for variable or unknown sampling rate.
- nAudioBandWidth is the audio bandwidth in Hz to which an encoder should limit the audio signal. Use the value 0 to let encoder decide.
- nQuality sets the encoding quality between -1 (low) and 10 (high). In the default mode of operation, the quality level is 3. The normal quality range is 0-10.
- bManaged sets the bit rate management mode. This turns off the normal variable bit rate (VBR) encoding but allows the encoder to enforce hard or soft bit rate constraints. This mode can be slower and may also be of lower quality; it is primarily useful for streaming.
- bDownmix sets the downmix input from stereo to mono. This parameter has no effect on non-stereo streams. This parameter is useful for lower bit-rate encoding.

4.1.10.2 Functionality

The OMX_AUDIO_PARAM_VORBISTYPE structure sets the parameters of the Vorbis codec.

4.1.11 OMX_AUDIO_PARAM_WMATYPE

The OMX_AUDIO_PARAM_WMATYPE structure is used to set or query the current or default settings for the Windows Media® audio codec component using the OMX_GetParameter function. It is also used to set the parameters of the Windows Media audio codec component using the OMX_SetParameter function. When calling either the OMX_GetParameter or the OMX_SetParameter functions, the index specified for this structure is OMX_IndexParamAudioWma.

OMX_AUDIO_PARAM_WMATYPE is defined as follows.

```
typedef struct OMX_AUDIO_PARAM_WMATYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
```

```
    OMX_U16 nChannels;
    OMX_U32 nBitRate;
    OMX_AUDIO_WMAFORMATTYPE eFormat;
    OMX_AUDIO_WMAPROFILETYPE eProfile;
    OMX_U32 nSamplingRate;
    OMX_U16 nBlockAlign;
    OMX_U16 nEncodeOptions;
    OMX_U32 nSuperBlockAlign;
} OMX_AUDIO_PARAM_WMATYPE;
```

4.1.11.1 Parameter Definitions

The parameters for `OMX_AUDIO_PARAM_WMATYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nChannels` is the number of channels of audio (mono, stereo).
- `nBitRate` is the bit rate of the encoded Windows Media audio. If the bit rate is variable or unknown, this parameter has a value 0.

Field Name	Description
`OMX_AUDIO_WMAFormatUnused`	The version of the Windows Media audio codec is either not applicable or is unknown.
`OMX_AUDIO_WMAFormat7`	Windows Media audio version 7.
`OMX_AUDIO_WMAFormat8`	Windows Media audio version 8.
`OMX_AUDIO_WMAFormat9`	Windows Media audio version 9.
`OMX_AUDIO_WMAFormatMax`	For future versions of Windows Media audio codecs.

Field Name	Description
`OMX_AUDIO_WMAProfileUnused`	The profile of the Windows Media audio codec is either not applicable or is unknown.
`OMX_AUDIO_WMAProfileL1`	Windows Media audio version 9 profile L1.
`OMX_AUDIO_WMAProfileL2`	Windows Media audio version 9 profile L2.
`OMX_AUDIO_WMAProfileL3`	Windows Media audio version 9 profile L3.

- `nSamplingRate` is the sampling rate of the source data.
- `nBlockAlign` is the block alignment, or block size, in bytes of the audio codec.
- `nEncodeOptions` is WMA Type-specific data.

- `nSuperBlockAlign` is WMA Type-specific data.

4.1.12 OMX_AUDIO_PARAM_RATYPE

The `OMX_AUDIO_PARAM_RATYPE` structure is used to set or query the current or default settings for the RealAudio® codec component using the `OMX_GetParameter` function. It is also used to set the parameters of the codec component using the `OMX_SetParameter` function. When calling either the `OMX_GetParameter` or the `OMX_SetParameter` functions, the index specified for this structure is `OMX_IndexParamAudioRa`.

`OMX_AUDIO_PARAM_RATYPE` is defined as follows.

```
 typedef struct OMX_AUDIO_PARAM_RATYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_U32 nSamplingRate;
    OMX_U32 nBitsPerFrame;
    OMX_U32 nSamplePerFrame;
    OMX_U32 nCouplingQuantBits;
    OMX_U32 nCouplingStartRegion;
    OMX_U32 nNumRegions;
    OMX_AUDIO_RAFORMATTYPE eFormat;
} OMX_AUDIO_PARAM_RATYPE;
```

4.1.12.1 Parameter Definitions

The parameters for `OMX_AUDIO_PARAM_RATYPE` are defined as follows.

- `nPortIndex`: is the read-only value containing the index of the port.
- `nChannels` is the number of audio channels.
- `nSamplingRate` is the sampling rate of the source data.
- `nBitsPerFrame` is the value for bits per frame.
- `nSamplePerFrame` is the value for samples per frame.
- `nCouplingQuantBits` is the number of coupling quantization bits in the stream.
- `nCouplingStartRegion` is the coupling start region in the stream.
- `nNumRegions` is the number of regions value.

Field Name	RA Format Descriptions
OMX_AUDIO_RAFormatUnused	Format unused or unknown
OMX_AUDIO_RA8	RealAudio 8 audio codec
OMX_AUDIO_RA9	RealAudio 9 audio codec
OMX_AUDIO_RA10_AAC	MPEG-4 AAC codec for bitrates of more than 128kbps
OMX_AUDIO_RA10_CODEC	RealAudio codec for bitrates less than 128 kbps
OMX_AUDIO_RA10_LOSSLESS	RealAudio Lossless
OMX_AUDIO_RA10_MULTICHANNEL	RealAudio Multichannel
OMX_AUDIO_RA10_VOICE	RealAudio Voice for bitrates below 15 kbps.

4.1.12.2 Functionality

The OMX_AUDIO_PARAM_RATYPE structure sets the parameters of the RealAudio codec.

4.1.13 OMX_AUDIO_PARAM_SBCTYPE

The Subband codec (SBC) is a mandatory audio codec for applications that support the Bluetooth™ Advance Audio Distribution Profile (A2DP). The A2DP codec algorithm is designed to obtain high quality audio at medium bit rates with a low computational complexity.

The OMX_AUDIO_PARAM_SBCTYPE structure is used to set or query the current or default settings for the codec component using the OMX_GetParameter function. It is also used to set the parameters of the codec component using the OMX_SetParameter function. When calling either the OMX_GetParameter or the OMX_SetParameter functions, the index specified for this structure is OMX_IndexParamAudioSbc.

OMX_AUDIO_PARAM_SBCTYPE is defined as follows.

```
 typedef struct OMX_AUDIO_PARAM_SBCTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_U32 nBitRate;
    OMX_U32 nSampleRate;
    OMX_U32 nBlocks;
    OMX_U32 nSubbands;
    OMX_U32 nBitPool;
    OMX_BOOL bEnableBitrate;
    OMX_AUDIO_CHANNELMODETYPE eChannelMode;
    OMX_AUDIO_SBCALLOCMETHODTYPE eSBCAllocType;
} OMX_AUDIO_PARAM_SBCTYPE;
```

4.1.13.1 Parameter Definitions

The parameters for OMX_AUDIO_PARAM_SBCTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nChannels is the number of audio channels.
- nBitRate is the bit rate of the encoded SBC audio. If the bit rate is variable or unknown, this parameter has the value 0.
- nSampleRate is the sample rate of the source data. If the sample rate is variable or unknown, this parameter has the value 0.
- nBlocks is the block length with which the stream has been encoded.
- nSubbands is the number of frequency subbands.
- nBitPool is the size of the bit allocation pool used for encoding the stream.
- bEnableBitrate is the Boolean value to use nBitRate or nBitPool.
- eChannelMode is the audio channel mode.

Field Name	Description
OMX_AUDIO_SBCAllocMethodLoudness	Loudness allocation method
OMX_AUDIO_SBCAllocMethodSNR	Signal-to-noise ratio (SNR) allocation method

4.1.13.2 Functionality

This OMX_AUDIO_PARAM_SBCTYPE structure configures the parameters of the SBC codec.

4.1.14 OMX_AUDIO_PARAM_ADPCMTYPE

Adaptive Differential PCM (ADPCM) is a waveform coding generic algorithm. It can be implemented in many ways and with different rates.

The OMX_AUDIO_PARAM_ADPCMTYPE structure is used to set or query the current or default settings for the ADPCM codec component using the OMX_GetParameter function. It is also used to set the parameters of the ADPCM codec component using the OMX_SetParameter function. When calling either the OMX_GetParameter or the OMX_SetParameter functions, the index specified for this structure is OMX_IndexParamAudioAdpcm.

OMX_AUDIO_PARAM_ADPCMTYPE is defined as follows.

```
typedef struct OMX_AUDIO_PARAM_ADPCMTYPE {
```

```
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_U32 nBitsPerSample;
    OMX_U32 nSampleRate;
} OMX_AUDIO_PARAM_ADPCMTYPE;
```

4.1.14.1 Parameter Definitions

The parameters for OMX_AUDIO_PARAM_ADPCMTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nChannels is the number of channels of audio (mono, stereo).
- nBitsPerSample is the number of bits per sample of audio.
- nSampleRate is the sampling rate of the source data. Use the value 0 for variable or unknown sampling rate.

4.1.14.2 Functionality

The OMX_AUDIO_PARAM_ADPCMTYPE structure sets the parameters of a generic ADPCM codec.

4.1.15 OMX_AUDIO_PARAM_G723TYPE

ITU G.723.1 is a standard speech codec that has two rates, 5.3 and 6.3 kbps, and is used in video telephony. The input sampling rate is 8 kHz.

The OMX_AUDIO_PARAM_G723TYPE structure is used to set or query the current or default settings for the codec component using the OMX_GetParameter function. It is also used to set the parameters of the codec component using the OMX_SetParameter function. When calling either the OMX_GetParameter or the OMX_SetParameter functions, the index specified for this structure is OMX_IndexParamAudioG723.

OMX_AUDIO_PARAM_G723TYPE is defined as follows.

```
typedef struct OMX_AUDIO_PARAM_G723TYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_BOOL bDTX;
    OMX_AUDIO_G723RATE eBitRate;
    OMX_BOOL bHiPassFilter;
    OMX_BOOL bPostFilter;
} OMX_AUDIO_PARAM_G723TYPE;
```

4.1.15.1 Parameter Definitions

The parameters of OMX_AUDIO_PARAM_G723TYPE are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nChannels` is the number of channels of audio (mono, stereo).
- `bDTX` enables Discontinuous Transmission according to Annex A of the standard.

Field Name	Description
OMX_AUDIO_G723ModeUnused	Rate unused or unknown
OMX_AUDIO_G723ModeLow	5.3 kbps
OMX_AUDIO_G723ModeHigh	6.3 kbps

- `bHiPassFilter` enables high-pass filter preprocessing in the encoder.
- `bPostFilter` enables post filter processing.

4.1.15.2 Functionality

The `OMX_AUDIO_PARAM_G723TYPE` structure sets the parameters of the ITU-G.723.1 codec.

4.1.16 OMX_AUDIO_PARAM_G726TYPE

ITU G.726 is a standard ADPCM waveform codec having four rates. The rate of 32 kbps is the most used rate and identical to an older standard, ITU G.721. The input sampling rate is 8 kHz.

The `OMX_AUDIO_PARAM_G726TYPE` structure is used to set or query the current or default settings for the codec component using the `OMX_GetParameter` function. It is also used to set the parameters of the codec component using the `OMX_SetParameter` function. When calling either the `OMX_GetParameter` or the `OMX_SetParameter` functions, the index specified for this structure is `OMX_IndexParamAudioG726`.

`OMX_AUDIO_PARAM_G726TYPE` is defined as follows.

```
 typedef struct OMX_AUDIO_PARAM_G726TYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
     OMX_AUDIO_G726MODE eG726Mode;
} OMX_AUDIO_PARAM_G726TYPE;
```

4.1.16.1 Parameter Definitions

The parameters of `OMX_AUDIO_PARAM_G726TYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.

- `nChannels` is the number of channels of audio (mono, stereo).

Field Name	Description
OMX_AUDIO_G726ModeUnused	Rate unused or unknown
OMX_AUDIO_G726Mode16	16 kbps
OMX_AUDIO_G726Mode24	24 kbps
OMX_AUDIO_G726Mode32	32 kbps (equals G.721)
OMX_AUDIO_G726Mode40	40 kbps

4.1.16.2 Functionality

The `OMX_AUDIO_PARAM_G726TYPE` structure sets the parameters of the ITU-G.726 codec.

4.1.17 OMX_AUDIO_PARAM_G729TYPE

ITU G.729 is a standard speech codec with a coding rate of 8 kbps that is used in various applications. The input sampling rate is 8 kHz. A bit-compatible, low-complexity version is called G.729 appendix A (or G.729A). Support for DTX is described in annex B of the G.729 standard.

The `OMX_AUDIO_PARAM_G729TYPE` structure is used to set or query the current or default settings for the codec component using the `OMX_GetParameter` function. It is also used to set the parameters of the codec component using the `OMX_SetParameter` function. When calling either the `OMX_GetParameter` or the `OMX_SetParameter` functions, the index specified for this structure is `OMX_IndexParamAudioG729`.

`OMX_AUDIO_PARAM_G729TYPE` is defined as follows.

```
 typedef struct OMX_AUDIO_PARAM_G729TYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_BOOL bDTX;
    OMX_AUDIO_G729TYPE eBitType;
} OMX_AUDIO_PARAM_G729TYPE;
```

4.1.17.1 Parameter Definitions

The parameters of `OMX_AUDIO_PARAM_G729TYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nChannels` is the number of channels of audio (mono, stereo).

- bDTX enables Discontinuous Transmission when Annex B of the standard is used.

Field Name	Description
OMX_AUDIO_G729	G.729 without annexes
OMX_AUDIO_G729A	G.729 with annex A
OMX_AUDIO_G729B	G.729 with annex B
OMX_AUDIO_G729AB	G.729 with annexes A and B

4.1.17.2 Functionality

The OMX_AUDIO_PARAM_G729TYPE structure sets the parameters of the ITU-G.729 codec.

4.1.18 OMX_AUDIO_PARAM_AMRTYPE

The Adaptive Multi-Rate coder is defined in 3GPP standards as having two main versions:

- Narrow Band (AMR-NB), where the sampling rate is 8 kHz. It is defined in standards 26.07x and 26.09x. This version is used in cellular phones and other wireless devices mainly for speech conversation.
- Wide Band (AMR-WB), where the sampling rate is 16 kHz. It is defined in standards 26.17x and 26.19x, and in ITU G.722.2. This version is used in cellular phones and other wireless devices mainly for streaming and voice-over-IP (VoIP) communication.

The OMX_AUDIO_PARAM_AMRTYPE structure is used to set or query the current or default settings for the codec component using the OMX_GetParameter function. It is also used to set the parameters of the codec component using the OMX_SetParameter function. When calling either the OMX_GetParameter or the OMX_SetParameter functions, the index specified for this structure is OMX_IndexParamAudioAmr.

OMX_AUDIO_PARAM_AMRTYPE is defined as follows.

```
 typedef struct OMX_AUDIO_PARAM_AMRTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_U32 nBitRate;
    OMX_AUDIO_AMRBANDMODETYPE eAMRBandMode;
    OMX_AUDIO_AMRDTXMODETYPE  eAMRDTXMode;
    OMX_AUDIO_AMRFRAMEFORMATTYPE eAMRFrameFormat;
} OMX_AUDIO_PARAM_AMRTYPE;
```

4.1.18.1 Parameter Definitions

The parameters of OMX_AUDIO_PARAM_AMRTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nChannels is the number of channels of audio (mono, stereo).
- nBitrate is the bit rate of the encoded AMR audio. This parameter is a read only parameter used to query the current bitrate of the audio. If the bit rate is variable or unknown, this parameter has the value 0.

Field Name	Description
OMX_AUDIO_AMRBandModeUnused	Rate unused or unknown
OMX_AUDIO_AMRBandModeNB0	4.75 kbps
OMX_AUDIO_AMRBandModeNB1	5.15 kbps
OMX_AUDIO_AMRBandModeNB2	5.9 kbps
OMX_AUDIO_AMRBandModeNB3	6.7 kbps
OMX_AUDIO_AMRBandModeNB4	7.4 kbps
OMX_AUDIO_AMRBandModeNB5	7.95 kbps
OMX_AUDIO_AMRBandModeNB6	10.2 kbps
OMX_AUDIO_AMRBandModeNB7	12.2 kbps
OMX_AUDIO_AMRBandModeWB0	6.6 kbps
OMX_AUDIO_AMRBandModeWB1	8.85 kbps
OMX_AUDIO_AMRBandModeWB2	12.65 kbps
OMX_AUDIO_AMRBandModeWB3	14.25 kbps
OMX_AUDIO_AMRBandModeWB4	15.85 kbps
OMX_AUDIO_AMRBandModeWB5	18.25 kbps
OMX_AUDIO_AMRBandModeWB6	19.85 kbps
OMX_AUDIO_AMRBandModeWB7	23.05 kbps
OMX_AUDIO_AMRBandModeWB8	23.85 kbps

- eAMRDTXMode identifies the AMR Discontinuous Transmission mode and voice activity detection (VAD) type. Table 4-19 describes the modes and types.

Table 4-19: Adaptive Multi-Rate Discontinuous Transmission Mode and VAD Type

Field Name	Description
OMX_AUDIO_AMRDTXModeUsed	DTX used or unused
OMX_AUDIO_AMRDTXModeOnVAD1	Use Type 1 VAD
OMX_AUDIO_AMRDTXModeOnVAD2	Use Type 2 VAD

Field Name	Description
OMX_AUDIO_AMRDTXModeOnAuto	VAD type automatic
OMX_AUDIO_AMRDTXasEFR	DTX frames as EFR (3GPP 26.101, frame type equals 8,9,10)

- eAMRFrameFormat identifies the encoded frame format. Table 4-20 shows the frame formats.

Table 4-20: Encoded Frame Format

Field Name	Description
OMX_AUDIO_AMRFrameFormatConformance	Standard test-sequence format (3GPP 26.074)
OMX_AUDIO_AMRFrameFormatIF1	Interface format 1 (NB- 3GPP 26.101, sec. 4 WB- 3GPP 26.201, sec. 4)
OMX_AUDIO_AMRFrameFormatIF2	Interface format 2 (NB- 3GPP 26.101, annex A WB- 3GPP 26.201, annex A)
OMX_AUDIO_AMRFrameFormatFSF	File Storage format (RFC 3267, sec. 5)
OMX_AUDIO_AMRFrameFormatRTPPayload	RTP payload format (RFC 3267, sec. 4)
OMX_AUDIO_AMRFrameFormatITU	ITU frame format

4.1.18.2 Functionality

The OMX_AUDIO_PARAM_AMRTYPE structure sets the parameters of the AMR codec.

4.1.19 OMX_AUDIO_PARAM_GSMFRTYPE

The GSM Full-Rate codec is defined in ETSI standards 06.1x and 06.3x, which became 3GPP standards 26.01x and 26.03x.

The GSM Full-Rate coder is used in legacy GSM cellular phones. The sampling rate is 8 kHz. The encoded speech has a rate of 13 kbps, or 260 bits per frame of 20 milliseconds. The coding algorithm is RPE-LTP.

The OMX_AUDIO_PARAM_GSMFRTYPE structure is used to set or query the current or default settings for the codec component using the OMX_GetParameter function. It is also used to set the parameters of the codec component using the OMX_SetParameter function. When calling either the OMX_GetParameter or the OMX_SetParameter functions, the index specified for this structure is OMX_IndexParamAudioGsm_FR.

OMX_AUDIO_PARAM_GSMFRTYPE is defined as follows.

```
typedef struct OMX_AUDIO_PARAM_GSMFRTYPE {
   OMX_U32 nSize;
```

```
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bDTX;
    OMX_BOOL bHiPassFilter ;
} OMX_AUDIO_PARAM_GSMFRTYPE;
```

4.1.19.1 Parameter Definitions

The parameters for `OMX_AUDIO_PARAM_GSMFRTYPE` as defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `bDTX` enables Discontinuous Transmission (3GPP 46.031, 46.032).
- `bHiPassFilter` enables high-pass filter processing

4.1.19.2 Functionality

The `OMX_AUDIO_PARAM_GSMFRTYPE` structure sets the parameters of the GSM Full-Rate codec.

4.1.20 OMX_AUDIO_PARAM_GSMEFRTYPE

The GSM Enhanced Full-Rate codec is defined in ETSI standards 06.5x, 06.6x, and 06.8x; these standards became 3GPP standards 26.05x, 26.06x, and 26,08x.

The GSM Enhanced Full-Rate codec is used in GSM cellular phones. The sampling rate is 8 kHz. The encoded speech has a rate of 12.2 kbps, or 244 bits per frame of 20 milliseconds. Each coded frame is augmented by 16 error-protection bits that provide the complement of 260 bits, which is the same as the Full Rate codec. However this augmentation is performed outside of the speech coder. The coding algorithm is ACELP.

The `OMX_AUDIO_PARAM_GSMEFRTYPE` structure is used to set or query the current or default settings for the codec component using the `OMX_GetParameter` function. It is also used to set the parameters of the codec component using the `OMX_SetParameter` function. When calling either the `OMX_GetParameter` or the `OMX_SetParameter` functions, the index specified for this structure is `OMX_IndexParamAudioGsm_EFR`.

`OMX_AUDIO_PARAM_GSMEFRTYPE` is defined as follows.

```
 typedef struct OMX_AUDIO_PARAM_GSMEFRTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bDTX;
    OMX_BOOL bHiPassFilter;
} OMX_AUDIO_PARAM_GSMEFRTYPE;
```

4.1.20.1 Parameter Definitions

The parameters for `OMX_AUDIO_PARAM_GSMEFRTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `bDTX` enables Discontinuous Transmission (3GPP 46.041, 46.042).
- `bHiPassFilter` enables High-Pass filter preprocessing in the encoder.

4.1.20.2 Functionality

The `OMX_AUDIO_PARAM_GSMEFRTYPE` structure sets the parameters of the GSM Enhanced Full-Rate codec.

4.1.21 OMX_AUDIO_PARAM_GSMHRTYPE

The GSM Half-Rate codec is defined in ETSI standards 06.2x and 06.4x; these standards became 3GPP standards 26.02x and 26.04x.

The GSM Half-Rate codec is used in GSM cellular phones. The sampling rate is 8 kHz. The encoded speech has a rate of 5.6 kbps, or 112 bits per frame of 20 milliseconds. The coding algorithm is VSELP.

The `OMX_AUDIO_PARAM_GSMHRTYPE` structure is used to set or query the current or default settings for the codec component using the `OMX_GetParameter` function. It is also used to set the parameters of the codec component using the `OMX_SetParameter` function. When calling either the `OMX_GetParameter` or the `OMX_SetParameter` functions, the index specified for this structure is `OMX_IndexParamAudioGsm_HR`.

`OMX_AUDIO_PARAM_GSMHRTYPE` is defined as follows.

```
 typedef struct OMX_AUDIO_PARAM_GSMHRTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bDTX;
    OMX_BOOL bHiPassFilter;
} OMX_AUDIO_PARAM_GSMHRTYPE;
```

4.1.21.1 Parameter Definitions

The parameters for `OMX_AUDIO_PARAM_GSMHRTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `bDTX` enables Discontinuous Transmission (3GPP 46.041, 46.042).
- `bHiPassFilter` enables High-Pass filter preprocessing in the encoder.

4.1.21.2 Functionality

The `OMX_AUDIO_PARAM_GSMHRTYPE` structure sets the parameters of the GSM Half-Rate codec.

4.1.22 OMX_AUDIO_PARAM_TDMAFRTYPE

The TDMA Full-Rate codec is defined in theTIA/EIA-136-420 American cellular standard, also referred to as IS-136. It is a legacy codec used in the American cellular standard known as DAMPS.

The sampling rate is 8 kHz. The encoded speech has a rate of 7.95 kbps, or 159 bits per frame of 20 milliseconds. The coding algorithm is VSELP.

The `OMX_AUDIO_PARAM_TDMAFRTYPE` structure is used to set or query the current or default settings for the codec component using the `OMX_GetParameter` function. It is also used to set the parameters of the codec component using the `OMX_SetParameter` function. When calling either the `OMX_GetParameter` or the `OMX_SetParameter` functions, the index specified for this structure is `OMX_IndexParamAudioTdma_FR`.

`OMX_AUDIO_PARAM_TDMAFRTYPE` is defined as follows.

```
 typedef struct OMX_AUDIO_PARAM_TDMAFRTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_BOOL bDTX;
    OMX_BOOL bHiPassFilter;
} OMX_AUDIO_PARAM_TDMAFRTYPE;
```

4.1.22.1 Parameter Definitions

The parameters of `OMX_AUDIO_PARAM_TDMAFRTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nChannels` is the number of audio channels.
- `bDTX` enables Discontinuous Transmission.
- `bHiPassFilter` enables High-Pass filter preprocessing in the encoder.

4.1.22.2 Functionality

The `OMX_AUDIO_PARAM_TDMAFRTYPE` structure sets the parameters of the TDMA Full-Rate codec.

4.1.23 OMX_AUDIO_PARAM_TDMAEFRTYPE

The TDMA Enhanced Full-Rate codec is defined in the TIA/EIA-136-410 American cellular standard, which is also referred to as IS-641, DAMPS-EFR. It is the codec used in the American cellular standard known as DAMPS.

The sampling rate is 8 kHz. The encoded speech has a rate of 7.4 kbps, or 148 bits per frame of 20 milliseconds. The coding algorithm is ACELP.

The OMX_AUDIO_PARAM_TDMAEFRTYPE structure is used to set or query the current or default settings for the codec component using the OMX_GetParameter function. It is also used to set the parameters of the codec component using the OMX_SetParameter function. When calling either the OMX_GetParameter or the OMX_SetParameter functions, the index specified for this structure is OMX_IndexParamAudioTdma_EFR.

OMX_AUDIO_PARAM_TDMAEFRTYPE is defined as follows.

```
typedef struct OMX_AUDIO_PARAM_TDMAEFRTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_BOOL bDTX;
    OMX_BOOL bHiPassFilter;
} OMX_AUDIO_PARAM_TDMAEFRTYPE;
```

4.1.23.1 Parameter Definitions

The parameters for OMX_AUDIO_PARAM_TDMAEFRTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nChannels is the number of audio channels.
- bDTX enables Discontinuous Transmission.
- bHiPassFilter enables High-Pass filter preprocessing in the encoder.

4.1.23.2 Functionality

The OMX_AUDIO_PARAM_TDMAEFRTYPE structure sets the parameters of the TDMA Enhanced Full-Rate codec.

4.1.24 OMX_AUDIO_PARAM_PDCFRTYPE

The PDC Full-Rate codec is defined in ARIB standard RCR-27B. It is the legacy codec used in the Japanese cellular system.

The sampling rate is 8 kHz. The encoded speech has a rate of 6.7 kbps, or 134 bits per frame of 20 milliseconds. The coding algorithm is VSELP.

The OMX_AUDIO_PARAM_PDCFRTYPE structure is used to set or query the current or default settings for the codec component using the OMX_GetParameter function. It is also used to set the parameters of the codec component using the OMX_SetParameter function. When calling either the OMX_GetParameter or the OMX_SetParameter functions, the index specified for this structure is OMX_IndexParamAudioPdc_FR.

OMX_AUDIO_PARAM_PDCFRTYPE is defined as follows.

```
typedef struct OMX_AUDIO_PARAM_PDCFRTYPE {
    OMX_U32 nSize;
```

```
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_BOOL bDTX;
    OMX_BOOL bHiPassFilter;
} OMX_AUDIO_PARAM_PDCFRTYPE;
```

4.1.24.1 Parameter Definitions

The parameters for `OMX_AUDIO_PARAM_PDCFRTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nChannels` is the number of audio channels.
- `bDTX` enables Discontinuous Transmission.
- `bHiPassFilter` enables High-Pass filter preprocessing in the encoder.

4.1.24.2 Functionality

The `OMX_AUDIO_PARAM_PDCFRTYPE` structure sets the parameters of the PDC Full-Rate codec.

4.1.25 OMX_AUDIO_PARAM_PDCEFRTYPE

The PDC Full-Rate codec is defined in ARIB standard RCR-27H. The codec is used in the Japanese cellular system.

The sampling rate is 8 kHz. The encoded speech has a rate of 6.7 kbps, or 134 bits per frame of 20 milliseconds. The coding algorithm is ACELP.

The `OMX_AUDIO_PARAM_PDCEFRTYPE` structure is used to set or query the current or default settings for the codec component using the `OMX_GetParameter` function. It is also used to set the parameters of the codec component using the `OMX_SetParameter` function. When calling either the `OMX_GetParameter` or the `OMX_SetParameter` functions, the index specified for this structure is `OMX_IndexParamAudioPdc_EFR`.

`OMX_AUDIO_PARAM_PDCEFRTYPE` is defined as follows.

```
 typedef struct OMX_AUDIO_PARAM_PDCEFRTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_BOOL bDTX;
    OMX_BOOL bHiPassFilter;
} OMX_AUDIO_PARAM_PDCEFRTYPE;
```

4.1.25.1 Parameter Definitions

The parameters of `OMX_AUDIO_PARAM_PDCEFRTYPE` are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nChannels is the number of audio channels.
- bDTX enables Discontinuous Transmission.
- bHiPassFilter enables High-Pass filter preprocessing in the encoder.

4.1.25.2 Functionality

The OMX_AUDIO_PARAM_PDCEFRTYPE structure sets the parameters of the PDC Enhanced Full-Rate codec.

4.1.26 OMX_AUDIO_PARAM_PDCHRTYPE

The PDC Full-Rate codec is defined in ARIB standard RCR-27C. The codec is used in the Japanese cellular system.

The sampling rate is 8 kHz. The encoded speech has a rate of 3.45 kbps, or 138 bits per frame of 40 milliseconds. The coding algorithm is PSI-CELP.

The OMX_AUDIO_PARAM_PDCHRTYPE structure is used to set or query the current or default settings for the codec component using the OMX_GetParameter function. It is also used to set the parameters of the codec component using the OMX_SetParameter function. When calling either the OMX_GetParameter or the OMX_SetParameter functions, the index specified for this structure is OMX_IndexParamAudioPdc_HR.

OMX_AUDIO_PARAM_PDCHRTYPE is defined as follows.

```
 typedef struct OMX_AUDIO_PARAM_PDCHFRTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_BOOL bDTX;
    OMX_BOOL bHiPassFilter;
} OMX_AUDIO_PARAM_PDCHFRTYPE;
```

4.1.26.1 Parameter Definitions

The parameters of OMX_AUDIO_PARAM_PDCHRTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nChannels is the number of audio channels.
- bDTX enables Discontinuous Transmission.
- bHiPassFilter enables High-Pass filter preprocessing in the encoder.

4.1.26.2 Functionality

The OMX_AUDIO_PARAM_PDCHRTYPE structure sets the parameters of the PDC Full-Rate codec.

4.1.27 OMX_AUDIO_PARAM_QCELP8TYPE

The QCELP (lower rate) variable rate codec is defined in the TIA/EIA-96 standard. It is the legacy codec used in the CDMA cellular standard, mainly in Korea and North America.

The sampling rate is 8 kHz. The encoded speech has a maximal rate called Rate 1 of 8 kbps, or 160 bits per frame of 20 milliseconds. The codec can work on lower rates, namely Rates 1/2, 1/4, and 1/8, depending on the speech activity and channel capacity. Rate 1 adds 11 parity bits per frame, so its rate becomes 8.55 kbps.

The coding algorithm is QCELP.

The OMX_AUDIO_PARAM_QCELP8TYPE structure is used to set or query the current or default settings for the codec component using the OMX_GetParameter function. It is also used to set the parameters of the codec component using the OMX_SetParameter function. When calling either the OMX_GetParameter or the OMX_SetParameter functions, the index specified for this structure is OMX_IndexParamAudioQcelp8.

OMX_AUDIO_PARAM_QCELP8TYPE is defined as follows.

```
 typedef struct OMX_AUDIO_PARAM_QCELP8TYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_u32 nChannels;
    OMX_U32 nBitRate;
    OMX_AUDIO_CDMARATETYPE eCDMARate;
    OMX_U32 nMinBitRate;
    OMX_U32 nMaxBitRate;
} OMX_AUDIO_PARAM_QCELP8TYPE;
```

4.1.27.1 Parameter Definitions

The parameters for OMX_AUDIO_PARAM_QCELP8TYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nChannels is the number of audio channels.
- nBitRate is the bit rate of the audio stream. If the bit rate is unknown, this parameter has the value 0.
- eCDMARate is the frame rate or type. Table 4-21 shows the frame rate values.

Table 4-21: QCELP8 Frame Rate Values

Field Name	Description
OMX_AUDIO_CDMARateBlank	Blank frame
OMX_AUDIO_CDMARateFull	Rate 1
OMX_AUDIO_CDMARateHalf	Rate ½
OMX_AUDIO_CDMARateQuarter	Rate ¼
OMX_AUDIO_CDMARateEighth	Rate 1/8
OMX_AUDIO_CDMARateErasure	Erasure frame (due to channel errors)

- nMinBitRate is the minimal restriction on the encoder for the current frame. The value is 1, 2, 3, or 4. The default value is 1.
- nMaxBitRate is the maximal restriction on the encoder for the current frame. The value is 1, 2, 3, or 4. This value shall be greater than or equal to the minimal rate. The default value is 4.

4.1.27.2 Functionality

The OMX_AUDIO_PARAM_QCELP8TYPE structure sets the parameters of the QCELP8 codec.

4.1.28 OMX_AUDIO_PARAM_QCELP13TYPE

The QCELP (high-rate) variable rate codec is defined in the TIA/EIA-733 standard. It is the codec that is used in the high-rate service option of CDMA cellular standard, mainly in Korea and North America.

The sampling rate is 8 kHz. The encoded speech has a maximal rate called Rate 1 of 13.3 kbps, or 266 bits per frame of 20 milliseconds. The codec can work on lower rates, namely Rates 1/2, 1/4, and 1/8, depending on the capacity of the speech activity channel.

The coding algorithm is QCELP.

The OMX_AUDIO_PARAM_QCELP13TYPE structure is used to set or query the current or default settings for the codec component using the OMX_GetParameter function. It is also used to set the parameters of the codec component using the OMX_SetParameter function. When calling either the OMX_GetParameter or the OMX_SetParameter functions, the index specified for this structure is OMX_IndexParamAudioQcelp13.

OMX_AUDIO_PARAM_QCELP13TYPE is defined as follows.

```
typedef struct OMX_AUDIO_PARAM_QCELP13TYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_AUDIO_CDMARATETYPE eCDMARate;
    OMX_U32 nMinBitRate;
```

```
    OMX_U32 nMaxBitRate;
} OMX_AUDIO_PARAM_QCELP13TYPE;
```

4.1.28.1 Parameter Definitions

The parameters for OMX_AUDIO_PARAM_QCELP13TYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nChannels is the number of audio channels.
- eCDMARate is the frame rate or type. Table 4-22 shows the frame rate values.

Table 4-22: QCELP13 Frame Rate Values

Field Name	Description
OMX_AUDIO_CDMARateBlank	Blank frame
OMX_AUDIO_CDMARateFull	Rate 1
OMX_AUDIO_CDMARateHalf	Rate ½
OMX_AUDIO_CDMARateQuarter	Rate ¼
OMX_AUDIO_CDMARateEighth	Rate 1/8
OMX_AUDIO_CDMARateErasure	Erasure frame (due to channel errors)

- nMinBitRate is the minimal restriction on the encoder for the current frame. The value is 1, 2, 3, or 4. The default value is 1.
- nMaxBitRate is the maximal restriction on the encoder for the current frame. The value is 1, 2, 3, or 4. The value shall be greater than or equal to the minimal rate. The default value is 4.

4.1.28.2 Functionality

The OMX_AUDIO_PARAM_QCELP13TYPE structure sets the parameters of the QCELP13 codec.

4.1.29 OMX_AUDIO_PARAM_EVRCTYPE

The Enhanced Variable Speech Coder is defined in the TIA/EIA-127 standard. It is the codec used in the CDMA cellular standard, mainly in Korea and North America.

The sampling rate is 8 kHz. The encoded speech has a maximal rate, called Rate 1, of 8.55 kbps, or 171 bits per frame of 20 milliseconds. The codec can work on lower rates, namely Rate 1/2 and 1/8, depending on the speech activity and the channel capacity.

The coding algorithm is RCELP.

The OMX_AUDIO_PARAM_EVRCTYPE structure is used to set or query the current or default settings for the codec component using the OMX_GetParameter function. It is also used to set the parameters of the codec component using the OMX_SetParameter function. When calling either the `OMX_GetParameter` or the `OMX_SetParameter` functions, the index specified for this structure is `OMX_IndexParamAudioEvrc`.

`OMX_AUDIO_PARAM_EVRCTYPE` is defined as follows.

```
 typedef struct OMX_AUDIO_PARAM_EVRCTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_AUDIO_CDMARATETYPE eCDMARate;
    OMX_BOOL bRATE_REDUCon;
    OMX_U32 nMinBitRate;
    OMX_U32 nMaxBitRate;
    OMX_BOOL bHiPassFilter;
    OMX_U32 bNoiseSuppressor;
    OMX_BOOL nPostFilter;
} OMX_AUDIO_PARAM_EVRCTYPE;
```

4.1.29.1 Parameter Definitions

The parameters for `OMX_AUDIO_PARAM_EVRCTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nChannels` is the number of audio channels.
- `eCDMARate` is the frame rate or type. Table 4-23 shows the frame rate values.

Table 4-23: Enhanced Variable Speech Frame Rate Values

Field Name	Description
`OMX_AUDIO_CDMARateBlank`	Blank frame
`OMX_AUDIO_CDMARateFull`	Rate 1
`OMX_AUDIO_CDMARateHalf`	Rate ½
`OMX_AUDIO_CDMARateEighth`	Rate 1/8
`OMX_AUDIO_CDMARateErasure`	Erasure frame (due to channel errors)

- `bRATE_REDUCon` specifies if rate reduction is required
- `nMinBitRate` is the minimal restriction on the encoder for the current frame. The value is 1, 3, or 4. The default value is 1.
- `nMaxBitRate` is the maximal restriction on the encoder for the current frame. The value is 1, 3, or 4. The value shall be greater than or equal to the minimal rate. The default value is 4.
- `bHiPassFilter` enables high-pass filter processing.
- `bNoiseSuppressor` enables the encoder's noise suppressor preprocessing as a part of the encoder.
- `bPostFilter` enables post filter processing.

4.1.29.2 Functionality

The `OMX_AUDIO_PARAM_EVRCTYPE` structure sets the parameters of the Enhanced Variable Speech Coder (EVRC) speech codec.

4.1.30 OMX_AUDIO_PARAM_SMVTYPE

The Selectable Mode Vocoder (SMV) is defined in 3GPP2 standard C.S0030-2. It is the codec used in the CDMA2000 cellular standard.

The sampling rate is 8 kHz. The encoded speech has a maximal rate, called Rate 1, of 8.55 kbps, or 171 bits per frame of 20 milliseconds. It can work on lower rates, namely Rates 1/2, 1/4, and 1/8, depending on the speech activity and the channel capacity.

The coding algorithm is eX-CELP.

The `OMX_AUDIO_PARAM_SMVTYPE` structure is used to set or query the current or default settings for the codec component using the `OMX_GetParameter` function. It is also used to set the parameters of the codec component using the `OMX_SetParameter` function. When calling either the `OMX_GetParameter` or the `OMX_SetParameter` functions, the index specified for this structure is `OMX_IndexParamAudioSmv`.

`OMX_AUDIO_PARAM_SMVTYPE` is defined as follows.

```
typedef struct OMX_AUDIO_PARAM_SMVTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannels;
    OMX_AUDIO_CDMARATETYPE eCDMARate;
    OMX_BOOL bRATE_REDUCon;
    OMX_U32 nMinBitRate;
    OMX_U32 nMaxBitRate;
    OMX_BOOL bHiPassFilter;
    OMX_U32 bNoiseSuppressor;
    OMX_BOOL nPostFilter;
} OMX_AUDIO_PARAM_SMVTYPE;
```

4.1.30.1 Parameter Definitions

The parameters for `OMX_AUDIO_PARAM_SMVTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nChannels` is the number of audio channels.
- `eCDMARate` is the frame rate or type. Table 4-24 identifies the frame rate values.

Table 4-24: Selectable Mode Vocoder Frame Rate Values

Field Name	**Description**
`OMX_AUDIO_CDMARateBlank`	Blank frame
`OMX_AUDIO_CDMARateFull`	Rate 1

Field Name	Description
OMX_AUDIO_CDMARateHalf	Rate ½
OMX_AUDIO_CDMARateEighth	Rate 1/8
OMX_AUDIO_CDMARateErasure	Erasure frame (due to channel errors)

- bRATE_REDUCon specifies if rate reduction is required
- nMinBitRate is the minimal restriction on the encoder for the current frame. The value is 1, 3, or 4. The default value is 1.
- nMaxBitRate is the maximal restriction on the encoder for current frame. The value is 1, 3, or 4. The value shall be greater than or equal to the minimal rate. The default value is 4.
- bHiPassFilter enables high-pass filter processing.
- bNoiseSuppressor enables the encoder's noise suppressor preprocessing as a part of the encoder.
- bPostFilter enables post filter processing.

4.1.30.2 Functionality

The OMX_AUDIO_PARAM_SMVTYPE structure sets the parameters of the Selectable Mode Vocoder codec.

4.1.31 OMX_AUDIO_PARAM_MIDITYPE

The OMX_AUDIO_PARAM_MIDITYPE structure is used to set or query the initial basic parameters of the MIDI engine. The parameters define the number of output channels of PCM audio, the maximum polyphony that the device supports, and whether the default soundbank is loaded at initialization.

OMX_AUDIO_PARAM_MIDITYPE is defined as follows.

```
typedef struct OMX_AUDIO_PARAM_MIDITYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nFileSize;
    OMX_BU32 sMaxPolyphony;
    OMX_BOOL bLoadDefaultSound;
    OMX_AUDIO_MIDIFORMATTYPE eMidiFormat;
} OMX_AUDIO_PARAM_MIDITYPE;
```

4.1.31.1 Parameter Definitions

The parameters for OMX_AUDIO_PARAM_MIDITYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.

- nFileSize is the size of the MIDI file data in bytes. This field shall be specified by the IL client or the component configuring this port before data is accepted.
- sMaxPolyphony specifies the range of simultaneous polyphonic voices that are supported. Since this parameter is of type OMX_BU32 (a bounded, unsigned 32-bit integer; see OMX_Types.h), it allows the querying and setting of minimum, nominal, and maximum values. A value of zero indicates that the default polyphony of the device is used.
- bLoadDefaultSound is a Boolean value that indicates whether the default soundbank is it to be loaded at initialization.
- eMidiFormat is an enumeration for the format of the MIDI file. Table 4-25 shows the MIDI file format.

Table 4-25: MIDI File Format

Field Name	Description
OMX_AUDIO_MIDIFormatUnknown	MIDI format is unknown or not used.
OMX_AUDIO_MIDIFormatSMF0	Standard MIDI File format 0
OMX_AUDIO_MIDIFormatSMF1	Standard MIDI File format 1
OMX_AUDIO_MIDIFormatSMF2	Standard MIDI File format 2
OMX_AUDIO_MIDIFormatSPMIDI	SP-MIDI
OMX_AUDIO_MIDIFormatXMF0	XMF type 0
OMX_AUDIO_MIDIFormatXMF1	XMF type 1
OMX_AUDIO_MIDIFormatMobileXMF	Mobile XMF (XMF type 2)
OMX_AUDIO_MIDIFormatMax	Allowance for expansion in the number of MIDI file formats

4.1.32 OMX_AUDIO_PARAM_MIDILOADUSERSOUNDTYPE

The OMX_AUDIO_PARAM_MIDILOADUSERSOUNDTYPE structure is used to set or query the parameters required for loading and unloading user-specified MIDI downloadable soundbanks (DLS). This structure contains a major exception to the memory rules used in OpenMAX IL: It includes a pointer to data, namely the DLS, which is outside the structure. This is because DLS soundbanks can grow to upwards of 400 kB in some cases. Without this exception, the implementations would be forced to make redundant copies of these large soundbanks, wasting valuable system resources.

OMX_AUDIO_PARAM_MIDILOADUSERSOUNDTYPE is defined as follows.

```
typedef struct OMX_AUDIO_PARAM_MIDILOADUSERSOUNDTYPE {
  OMX_U32 nSize;
  OMX_VERSIONTYPE nVersion;
  OMX_U32 nPortIndex;
  OMX_U32 nDLSIndex;
  OMX_U32 nDLSSize;
  OMX_PTR pDLSData;
  OMX_AUDIO_MIDISOUNDBANKTYPE eMidiSoundBank;
OMX_AUDIO_MIDISOUNDBANKLAYOUTTYPE eMidiSoundBankLayout;
} OMX_AUDIO_PARAM_MIDILOADUSERSOUNDTYPE;
```

4.1.32.1 Parameter Definitions

The parameters for `OMX_AUDIO_PARAM_MIDILOADUSERSOUNDTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nDLSIndex` is the DLS file index to be loaded.
- `nDLSSize` is the size of the DLS in bytes.
- `pDLSData` is the pointer to the DLS file data.
- `eMidiSoundBank` is an enumeration for the various types of MIDI DLS soundbanks. Table 4-26 identifies the MIDI soundbanks.

Table 4-26: MIDI Soundbanks

Field Name	Description
OMX_AUDIO_MIDISoundBankUnused	Unused/unknown soundbank type
OMX_AUDIO_MIDISoundBankDLS1	DLS 1
OMX_AUDIO_MIDISoundBankDLS2	DLS 2
OMX_AUDIO_MIDISoundBankMobileDLSBase	Mobile DLS, using the base functionality
OMX_AUDIO_MIDISoundBankMobile DLSPlusOptions	Mobile DLS, using the specification-defined optional feature set
OMX_AUDIO_MIDISoundBankMax	Allowance for expansion in the number of soundbank types

- `eMidiSoundBankLayout` is an enumeration for the various layouts of MIDI DLS soundbanks. Bank layout describes how the bank most significant bit (MSB) and least significant bit (LSB) are used in the DLS instrument definitions soundbank Table 4-27 shows the MIDI soundbank layouts.

Table 4-27: MIDI Soundbank Layouts

Field Name	Description
OMX_AUDIO_MIDISoundBankLayoutUnused	Unknown/unused soundbank layout type.
OMX_AUDIO_MIDISoundBankLayoutGM	GS layout based on bank MSB 0x00.
OMX_AUDIO_MIDISoundBankLayoutGM2	General MIDI 2 layout using MSB 0x78/0x79, LSB 0x00.

Field Name	Description
OMX_AUDIO_MIDISoundBankLayoutUser	Does not conform to any bank numbering standards.
OMX_AUDIO_MIDISoundBankLayoutMax	Allowance for expansion in the number of soundbank layout types.

4.1.33 OMX_AUDIO_CONFIG_MIDIIMMEDIATEEVENTTYPE

The OMX_AUDIO_CONFIG_MIDIIMMEDIATEEVENTTYPE structure is used to set the parameters for live MIDI events and Maximum Instantaneous Polyphony (MIP) messages, which are part of the SP-MIDI standard. The OMX_AUDIO_CONFIG_MIDIIMMEDIATEEVENTTYPE structure does not specify the format of MIDI events or MIP messages; it simply provides an array for the MIDI events or the MIP message buffer. The MIDI engine can parse this array and process it appropriately.

OMX_AUDIO_CONFIG_MIDIIMMEDIATEEVENTTYPE is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_MIDIIMMEDIATEEVENTTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nMidiEventSize;
    OMX_U8 nMidiEvents[1];
} OMX_AUDIO_CONFIG_MIDIIMMEDIATEEVENTTYPE;
```

4.1.33.1 Parameter Definitions

The parameters for OMX_AUDIO_CONFIG_MIDIIMMEDIATEEVENTTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nMidiEventSize is the size of the immediate MIDI events or MIP message in bytes.
- nMidiEvents is the MIDI event array to be rendered immediately, or an array for the MIP message buffer, where the size is indicated by nMidiEventSize.

4.1.33.2 Post-processing Conditions

The live MIDI event array is rendered by the MIDI engine, or the MIP message contained in the buffer is processed.

4.1.34 OMX_AUDIO_CONFIG_MIDISOUNDBANKPROGRAMTYPE

The OMX_AUDIO_CONFIG_MIDISOUNDBANKPROGRAMTYPE structure is used to query and set the parameters for soundbank/program pairs in a given MIDI channel. It will be called once for each of the 16 MIDI channels. Note that the entire MIDI stream goes to a single port. One-to-one mapping does not occur between ports and MIDI channels.

OMX_AUDIO_CONFIG_MIDISOUNDBANKPROGRAMTYPE is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_MIDISOUNDBANKPROGRAMTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannel;
    OMX_U16 nIDProgram;
    OMX_U16 nIDSoundBank;
    OMX_U32 nUserSoundBankIndex;
} OMX_AUDIO_CONFIG_MIDISOUNDBANKPROGRAMTYPE;
```

4.1.34.1 Parameter Definitions

The parameters for OMX_AUDIO_CONFIG_MIDISOUNDBANKPROGRAMTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nChannel refers to a MIDI channel. Valid channel values are 1 to 16.
- nIDProgram refers to a MIDI program. Valid program ID range is 1 to 128.
- nIDSoundBank is the soundbank ID.
- nUserSoundBankIndex is the user soundbank index. The index makes access to soundbanks easier if multiple banks are present.

4.1.34.2 Post-processing Conditions

The specified MIDI channel has a soundbank and program associated with it.

4.1.35 OMX_AUDIO_CONFIG_MIDICONTROLTYPE

The OMX_AUDIO_CONFIG_MIDICONTROLTYPE structure is used to query and set the parameters for controlling the rate and the looping (repeated playback) of MIDI playback.

OMX_AUDIO_CONFIG_MIDICONTROLTYPE is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_MIDICONTROLTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BS32 sPitchTransposition;
    OMX_BU32 sPlayBackRate;
    OMX_BU32 sTempo ;
    OMX_U32 nMaxPolyphony;
    OMX_U32 nNumRepeat;
    OMX_U32 nStopTime;
    OMX_U16 nChannelMuteMask;
    OMX_U16 nChannelSoloMask;
    OMX_U32 nTrack0031MuteMask;
```

```
    OMX_U32 nTrack3263MuteMask;
    OMX_U32 nTrack0031SoloMask;
    OMX_U32 nTrack3263SoloMask;
} OMX_AUDIO_CONFIG_MIDICONTROLTYPE;
```

4.1.35.1 Parameter Definitions

The parameters for `OMX_AUDIO_CONFIG_MIDICONTROLTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `sPitchTransposition` is the pitch transposition in semitones, stored as Q22.10 format, based on the Java MMAPI (JSR-135) requirement. As it is a bounded value type (`OMX_BS32`), it allows the querying and setting of a range of values, including minimum, actual, and maximum.
- `sPlayBackRate` is the relative playback rate, stored as a Q14.17 fixed-point number based on the JSR-135 requirement. As it is a bounded value type (`OMX_BU32`), it allows the querying and setting of a range of values, including minimum, actual, and maximum.
- `sTempo` is the tempo in beats per minute (BPM), stored as a Q22.10 fixed-point number based on the JSR-135 requirement. As it is a bounded value type (`OMX_BS32`), it allows the querying and setting of a range of values, including minimum, actual, and maximum.
- `nMaxPolyphony` specifies the maximum number of simultaneous polyphonic voices, which is the maximum run-time polyphony. A value of zero indicates that the default polyphony of the device is used.
- `nNumRepeat` specifies the number of times to repeat the playback.
- `nStopTime` is the time in milliseconds to indicate when playback will stop automatically. This value is set to zero if not used.
- `nChannelMuteMask` is a 16-bit mask for channel mute status.
- `nChannelSoloMask` is a 16-bit mask for channel solo status.
- `nTrack0031MuteMask` is a 32-bit mask for track mute status for tracks 0-31.
- `nTrack3263MuteMask` is a 32-bit mask for track mute status for tracks 32-63.
- `nTrack0031SoloMask` is a 32-bit mask for track solo status for tracks 0-31.
- `nTrack3263SoloMask` is a 32-bit mask for track mute status for tracks 32-63.

4.1.35.2 Post-processing Conditions

In case of a `OMX_SetConfig` call using the `OMX_AUDIO_CONFIG_MIDICONTROLTYPE` structure, the parameters required to control MIDI playback are set. In case of a `OMX_GetConfig` call using the

OMX_AUDIO_CONFIG_MIDICONTROLTYPE structure, the MIDI IL client can determine the parameters controlling MIDI playback.

4.1.36 OMX_AUDIO_CONFIG_MIDISTATUSTYPE

The OMX_AUDIO_CONFIG_MIDISTATUSTYPE structure is used to query the current status of the MIDI playback. As such, it can be used only by an OMX_GetConfig call. The OMX_AUDIO_CONFIG_MIDISTATUSTYPE structure returns all of the parameters that characterize the current status of the MIDI engine.

OMX_AUDIO_CONFIG_MIDISTATUSTYPE is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_MIDISTATUSTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U16 nNumTracks;
    OMX_U32 nDuration;
    OMX_U32 nPosition;
    OMX_BOOL bVibra;
    OMX_U32 nNumMetaEvents;
    OMX_U32 nNumActiveVoices;
    OMX_AUDIO_MIDIPLAYBACKSTATETYPE eMIDIPlayBackState;
} OMX_AUDIO_CONFIG_MIDISTATUSTYPE;
```

4.1.36.1 Parameter Definitions

The parameters for OMX_AUDIO_CONFIG_MIDISTATUSTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nNumTracks is a read-only field that identifies the number of MIDI tracks in the file. Note that this parameter will have a valid value only when the entire file has been parsed and buffered. An OMX_GetConfig call issued before the entire file has been processed will not contain the correct number of MIDI tracks.
- nDuration is the length of the currently open MIDI resource in milliseconds. As with nNumTracks, this parameter will have a meaningful value only after the entire file has been buffered.
- nPosition is the current position in milliseconds of the MIDI resource being played.
- bVibra is a Boolean value that indicates if a vibra track exists in the file. This parameter will return a meaningful value only after the entire file has been buffered. The value returned when in the middle of the file cannot be relied upon.
- nNumMetaEvents is the total number of MIDI meta events in the currently open MIDI resource. This parameter will return a valid value only after the entire file is buffered. The value returned when in the middle of the file cannot be relied upon.

- `nNumActiveVoices` is the number of active voices in the currently playing MIDI resource, or the current polyphony level. This parameter may not return a meaningful value until the entire file is parsed and buffered.
- `eMIDIPlayBackState` is the enumeration for the MIDI playback state. Table 4-28 describes the payback states.

Table 4-28: MIDI Playback States

Field Name	Description
`OMX_AUDIO_MIDIPlayBackStateUnknown`	Unknown/unused MIDI playback state, or state does not map to one of the defined states.
`OMX_AUDIO_MIDIPlayBackStateClosedEngaged`	No MIDI resource is currently open. The MIDI engine is currently processing MIDI events.
`OMX_AUDIO_MIDIPlayBackStateParsing`	A MIDI resource is open and is being primed. The MIDI engine is currently processing MIDI events.
`OMX_AUDIO_MIDIPlayBackStateOpenEngaged`	A MIDI resource is open and primed but not playing. The MIDI engine is currently processing MIDI events. The transition to this state is only possible from the OMX_AUDIO_MIDIPlayBackStatePlaying state when the 'playback head' reaches the end of media data or the playback stops due to a stop time setting.
`OMX_AUDIO_MIDIPlayBackStatePlaying`	A MIDI resource is open and currently playing. The MIDI engine is currently processing MIDI events.
`OMX_AUDIO_MIDIPlayBackStatePlayingPartially`	Best-effort playback due to SP-MIDI/DLS resource constraints
`OMX_AUDIO_MIDIPlayBackStatePlayingSilently`	Due to system resource constraints and SP-MIDI content constraints, there is currently no audible MIDI content during playback. The situation may change if resources are freed later.
`OMX_AUDIO_MIDIPlayBackStateMax`	Allowance for expansion in the number of playback states.

4.1.37 OMX_AUDIO_CONFIG_MIDIMETAEVENTTYPE

MIDI meta events are like audio metadata, except that they are interspersed with the MIDI content throughout the file and not localized in the header. As such, it is necessary to retrieve information about these meta-events from the engine as it encounters these meta events within the MIDI content. Component vendors are not required to enumerate all types of meta events; vendors can choose the meta events they want to support. Meta events are enumerated in the same order that they are detected in the MIDI file. Meta event data will always be provided as binary data, as it is present in the MIDI file.

The OMX_AUDIO_CONFIG_MIDIMETAEVENTTYPE structure is used to query the meta event, its track number, and the size of the meta event data using OMX_GetConfig. This allows the application to quickly determine meta events of interest. If the application requires the meta event data, the OMX_AUDIO_CONFIG_MIDIMETAEVENTDATATYPE structure, which is defined in section 4.1.38, needs to be used in a second OMX_GetConfig call.

OMX_AUDIO_CONFIG_MIDIMETAEVENTTYPE is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_MIDIMETAEVENTTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nIndex;
    OMX_U8 nMetaEventType;
    OMX_U32 nMetaEventSize;
    OMX_U32 nTrack;
    OMX_U32 nPosition;
} OMX_AUDIO_CONFIG_MIDIMETAEVENTTYPE;
```

4.1.37.1 Parameter Definitions

The parameters for OMX_AUDIO_CONFIG_MIDIMETAEVENTTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nIndex is the index of the meta event. Meta events will be numbered 0 to N-1, where N is the number of meta events that the MIDI decoder reports.
- nMetaEventType is the meta event type. The values are 0-127.
- nMetaEventSize is the size of the meta event in bytes.
- nTrack is the track number for the meta event.
- nPosition is the position of the meta event in milliseconds.

4.1.38 OMX_AUDIO_CONFIG_MIDIMETAEVENTDATATYPE

The OMX_AUDIO_CONFIG_MIDIMETAEVENTDATATYPE structure is typically used by the IL client via an OMX_GetConfig call to retrieve the meta event data, after the type, size and track number of the meta event have been determined by a previous OMX_GetConfig call using the OMX_AUDIO_CONFIG_MIDIMETAEVENTTYPE structure defined in section 4.1.37 above. The IL client is responsible for sizing the structure appropriately so that it can hold the meta event data.

`OMX_AUDIO_CONFIG_MIDIMETAEVENTDATATYPE` is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_MIDIMETAEVENTDATATYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nIndex;
    OMX_U32 nMetaEventSize;
    OMX_U8 nData[1];
} OMX_AUDIO_CONFIG_MIDIMETAEVENTDATATYPE;
```

4.1.38.1 Parameter Definitions

The parameters for `OMX_AUDIO_CONFIG_MIDIMETAEVENTDATATYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nIndex` is the index of the meta event. Meta events are numbered 0 to N-1, where N is the number of meta events that the MIDI decoder reports.
- `nMetaEventSize` is the size of the meta event in bytes.
- `nData` is an array of one or more bytes of meta data as indicated by the `nMetaEventSize` field.

4.1.39 OMX_AUDIO_CONFIG_VOLUMETYPE

The `OMX_AUDIO_CONFIG_VOLUMETYPE` structure is used to adjust the audio volume for a port.

`OMX_AUDIO_CONFIG_VOLUMETYPE` is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_VOLUMETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bLinear;
    OMX_BS32 sVolume;
} OMX_AUDIO_CONFIG_VOLUMETYPE;
```

4.1.39.1 Parameter Definitions

The parameters for `OMX_AUDIO_CONFIG_VOLUMETYPE` are defined as follows.

- `nPortIndex`: is the read-only value containing the index of the port.
- `bLinear` is a Boolean to indicate if the volume is to be set on a linear (0-100) or a logarithmic scale (millibel, which is abbreviated mB). This is a read-only parameter.
- `sVolume` is the linear volume setting in the range 0-100, or the logarithmic volume setting for this port. The values for volume are in millibel (abbreviated mB, where 1 millibel = 1/100 decibel) relative to a gain of 1 (i.e., the output is the

same as the input level). Values are in mB from nMax (maximum volume) to nMin (minimum volume, typically negative). Since the volume is voltage and not a power, it takes a setting of -600 mB to decrease the volume by half. If a component cannot accurately set the volume to the requested value, it shall set the volume to the closest value below the requested value. When getting the volume setting, the current actual volume shall be returned.

4.1.40 OMX_AUDIO_CONFIG_CHANNELVOLUMETYPE

The `OMX_AUDIO_CONFIG_CHANNELVOLUMETYPE` structure is used to adjust the audio volume for a channel via the `OMX_IndexConfigAudioChannelVolume` config.

`OMX_AUDIO_CONFIG_CHANNELVOLUMETYPE` is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_CHANNELVOLUMETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannel;
    OMX_BOOL bLinear;
    OMX_BS32 sVolume;
    OMX_BOOL bIsMIDI;
} OMX_AUDIO_CONFIG_CHANNELVOLUMETYPE;
```

4.1.40.1 Parameter Definitions

The parameters for `OMX_AUDIO_CONFIG_CHANNELVOLUMETYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nChannel` is the channel to select in the range 0 to N-1 using OMX_ALL to apply volume settings to all channels.
- `bLinear` is the volume to be set on a linear scale (0-100) or a logarithmic scale (mB).
- `sVolume` is the linear volume setting in the range 0-100 or the logarithmic volume setting for this port. The values for volume are in millibel (abbreviated mB, where 1 millibel = 1/100 dB) relative to a gain of 1 (i.e., the output is the same as the input level). Values are in mB from nMax (maximum volume) to nMin (minimum volume, typically negative). Since the volume is voltage and not a power, it takes a setting of -600 mB to decrease the volume by half. If a component cannot accurately set the volume to the requested value, it shall set the volume to the closest value below the requested value. When getting the volume setting, the current actual volume shall be returned.
- `bIsMIDI` is OMX_TRUE if `nChannel` refers to a MIDI channel, or OMX_FALSE otherwise.

4.1.41 OMX_AUDIO_CONFIG_BALANCETYPE

The OMX_AUDIO_CONFIG_BALANCETYPE structure defines the audio left-right balance adjustment for a port.

OMX_AUDIO_CONFIG_BALANCETYPE is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_BALANCETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_S32 nBalance;
} OMX_AUDIO_CONFIG_BALANCETYPE;
```

4.1.41.1 Parameter Definitions

The parameters for OMX_AUDIO_CONFIG_BALANCETYPE are as follows.

- nPortIndex is the read-only value containing the index of the port. Select the input port to set just that port's balance. Select the output port to adjust the master balance.
- nBalance is the balance setting for this port. The values are -100 to 100, where -100 indicates all left, and no right.

4.1.42 OMX_AUDIO_CONFIG_MUTETYPE

The OMX_AUDIO_CONFIG_MUTETYPE structure adjusts the audio mute for a port.

OMX_AUDIO_CONFIG_MUTETYPE is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_MUTETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bMute;
} OMX_AUDIO_CONFIG_MUTETYPE;
```

4.1.42.1 Parameter Definitions

The parameters for OMX_AUDIO_CONFIG_MUTETYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port. Select the input port to set just that port's mute setting. Select the output port to adjust the master mute.
- bMute identifies whether the port is muted (OMX_TRUE) or playing normally (OMX_FALSE).

4.1.43 OMX_AUDIO_CONFIG_CHANNELMUTETYPE

The OMX_AUDIO_CONFIG_CHANNELMUTETYPE structure adjusts the audio mute for a channel.

OMX_AUDIO_CONFIG_CHANNELMUTETYPE is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_CHANNELMUTETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nChannel;
    OMX_BOOL bMute;
    OMX_BOOL bIsMIDI;
} OMX_AUDIO_CONFIG_CHANNELMUTETYPE;
```

4.1.43.1 Parameter Definitions

The parameters for OMX_AUDIO_CONFIG_CHANNELMUTETYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port. Select the input port to set just that port's mute setting. Select the output port to adjust the master mute.
- nChannel is the channel to select in the range 0 to N-1. Use OMX_ALL to apply volume settings to all channels.
- bMute identifies whether port is muted (OMX_TRUE) or playing normally (OMX_FALSE).
- bIsMIDI identifies whether the channel is a MIDI channel. The values are OMX_TRUE if nChannel refers to a MIDI channel, OMX_FALSE if otherwise.

4.1.44 OMX_AUDIO_CONFIG_LOUDNESSTYPE

The OMX_AUDIO_CONFIG_LOUDNESSTYPE structure is used to enable or disable the loudness audio effect, which boosts the bass and the high frequencies to compensate for the limited hearing range of humans at the extreme ends of the audio spectrum. The setting can be changed using the OMX_SetConfig function. The current state can be queried using the OMX_GetConfig function. When calling either OMX_SetConfig or OMX_GetConfig, the index specified for this structure is OMX_IndexConfigAudioLoudness.

OMX_AUDIO_CONFIG_LOUDNESSTYPE is defined as follows.

```
 typedef struct OMX_AUDIO_CONFIG_LOUDNESSTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bLoudness;
} OMX_AUDIO_CONFIG_LOUDNESSTYPE;
```

4.1.44.1 Parameter Definitions

The parameters for OMX_AUDIO_CONFIG_LOUDNESSTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- bLoudness enable the loudness if set to OMX_TRUE or disables the loudness effect if set to OMX_FALSE.

4.1.45 OMX_AUDIO_CONFIG_BASSTYPE

The OMX_AUDIO_CONFIG_BASSTYPE structure is used to enable or disable the low-frequency level (bass) audio effect, and to set or query the current bass level. The setting can be changed using the OMX_SetConfig function, and the current state can be queried using the OMX_GetConfig function. When calling either function, the index specified for this structure is OMX_IndexConfigAudioBass.

OMX_AUDIO_CONFIG_BASSTYPE is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_BASSTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bEnable;
    OMX_S32 nBass;
} OMX_AUDIO_CONFIG_BASSTYPE;
```

4.1.45.1 Parameter Definitions

The parameters for OMX_AUDIO_CONFIG_BASSTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- bEnable enables the bass-level setting if set to OMX_TRUE or disables the bass-level setting if set to OMX_FALSE.
- nBass is the bass-level setting for the port, as a continuous value from -100 to 100. The value –100 means minimum bass level, zero means no change in level, and 100 represents the maximum low-frequency boost.

4.1.46 OMX_AUDIO_CONFIG_TREBLETYPE

The OMX_AUDIO_CONFIG_TREBLETYPE structure is used to enable or disable the high-frequency level (treble) audio effect, and to set or query the current level. The setting can be changed using the OMX_SetConfig function, and the current state can be queried using the OMX_GetConfig function. When calling either function, the index specified for this structure is OMX_IndexConfigAudioTreble.

OMX_AUDIO_CONFIG_TREBLETYPE is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_TREBLETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bEnable;
    OMX_S32  nTreble;
```

```
} OMX_AUDIO_CONFIG_TREBLETYPE;
```

4.1.46.1 Parameter Definitions

The parameters for OMX_AUDIO_CONFIG_TREBLETYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- bEnable enables the treble level setting if set to OMX_TRUE or disables the treble level setting if set to OMX_FALSE.
- nTreble is the treble-level setting for the port, as a continuous value from -100 to 100. The value -100 means minimum high-frequency level, zero means no change in level, and 100 represents the maximum high-frequency boost.

4.1.47 OMX_AUDIO_CONFIG_EQUALIZERTYPE

The OMX_AUDIO_CONFIG_EQUALIZERTYPE structure is used to set or query the current parameters of the graphic equalizer (EQ) effect. The settings can be changed using the OMX_SetConfig function, and the current state can be queried using the OMX_GetConfig function. When calling either function, the index specified for this structure is OMX_IndexConfigAudioEqualizer.

An equalizer modifies the audio signal by frequency-dependent amplification or attenuation. A graphic EQ typically lets the user control the character of sound by controlling the levels of several fixed-frequency bands. The bands are characterized by their center and crossover frequencies.

In practice, the calling application or framework is often first interested in the number of bands that the EQ implementation supports. This number can be queried by a single call to OMX_GetConfig with sBandIndex set to zero. The query results in the same data structure with the maximum value of sBandIndex filled with N-1, where N is the number of frequency bands. The same structure will also contain the frequency and level limits for the first band. Similar queries for the rest of the bands yield the information needed, for example, to construct a user interface for the equalizer.

OMX_AUDIO_CONFIG_EQUALIZERTYPE is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_EQUALIZERTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bEnable;
    OMX_BU32 sBandIndex;
    OMX_BU32 sCenterFreq;
    OMX_BS32 sBandLevel;
} OMX_AUDIO_CONFIG_EQUALIZERTYPE;
```

4.1.47.1 Parameter Definitions

The parameters for OMX_AUDIO_CONFIG_EQUALIZERTYPE are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `bEnable` enables the EQ effect if set to OMX_TRUE or disables the EQ effect if set to OMX_FALSE.
- `sBandIndex` is the index of the band to be set or retrieved. The upper limit is N-1, where N is the number of bands. The lower limit is 0.
- `sCenterFreq` is the center frequencies in Hz. This is a read-only element and is used by the caller to determine the lower, center, and upper frequency of this band.
- `sBandLevel` is the band level in millibels.

4.1.48 OMX_AUDIO_CONFIG_STEREOWIDENINGTYPE

The `OMX_AUDIO_CONFIG_STEREOWIDENINGTYPE` structure is used to enable or disable the stereo widening audio effect, and to set or query the current strength of the effect. The setting can be changed using the `OMX_SetConfig` function, and the current state can be queried using the `OMX_GetConfig` function. When calling either function, the index specified for this structure is `OMX_IndexConfigAudioStereoWidening`.

Stereo widening is a special case of the “audio virtualizer” effect, and is designed to remove the inside-the-head effect in headphone listening, or to extend the stereo image beyond the physical loudspeaker span in loudspeaker reproduction.

`OMX_AUDIO_CONFIG_STEREOWIDENINGTYPE` is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_STEREOWIDENINGTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bEnable;
    OMX_AUDIO_STEREOWIDENINGTYPE eWideningType;
    OMX_U32 nStereoWidening;
} OMX_AUDIO_CONFIG_STEREOWIDENINGTYPE;
```

4.1.48.1 Parameter Definitions

The parameters for `OMX_AUDIO_CONFIG_STEREOWIDENINGTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `bEnable` enables the stereo widening effect if set to OMX_TRUE or disables the stereo widening effect if set to OMX_FALSE.
- `eWideningType` is the stereo widening processing type, as shown in Table 4-29.

Table 4-29: Stereo Widening Processing Type

Field Name	Description
OMX_AUDIO_StereoWideningHeadphones	Stereo widening for headphones.
OMX_AUDIO_StereoWideningLoudspeakers	Stereo widening for two closely spaced loudspeakers.
OMX_AUDIO_StereoWideningMax	Allowance for expansion in the number of stereo widening types.

- nStereoWidening is the stereo widening setting for the port, as a continuous value from 0 (minimum effect) to 100 (maximum effect). If the component can implement only a discrete set of presets (say, only on or off), it may round the value to a nearest available setting. When getting the setting, the exact current value shall be returned.

4.1.49 OMX_AUDIO_CONFIG_CHORUSTYPE

The OMX_AUDIO_CONFIG_CHORUSTYPE structure is used to enable or disable the chorus audio effect, and to set or query the current parameters of the effect. The settings can be changed using the OMX_SetConfig function, and the current state can be queried using the OMX_GetConfig function. When calling either function, the index specified for this structure is OMX_IndexConfigAudioChorus.

Chorus is an audio effect that presents a sound, such as a vocal track, as though it was performed by two or more singers simultaneously. The effect is produced by feeding the sound through one or more delay lines with time-variant lengths, and summing the delayed signals with the original, non-delayed sound. The length of each delay line is modulated by a low-frequency signal. Modulation waveform and stereo output details are implementation dependent.

OMX_AUDIO_CONFIG_CHORUSTYPE is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_CHORUSTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bEnable;
    OMX_BU32 sDelay;
    OMX_BU32 sModulationRate;
    OMX_U32 nModulationDepth;
    OMX_BU32 nFeedback;
} OMX_AUDIO_CONFIG_CHORUSTYPE;
```

4.1.49.1 Parameter Definitions

The parameters for OMX_AUDIO_CONFIG_CHORUSTYPE are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `bEnable` enables the chorus effect if set to OMX_TRUE or disables the chorus effect if set to OMX_FALSE.
- `sDelay` is the average delay in milliseconds.
- `sModulationRate` is the rate of modulation in mHz.
- `nModulationDepth` is the depth of modulation as a percentage of delay zero-to-peak. The range of values is 0-100.
- `nFeedback` is the feedback from the chorus output to the input in percentage.

4.1.50 OMX_AUDIO_CONFIG_REVERBERATIONTYPE

The `OMX_AUDIO_CONFIG_REVERBERATIONTYPE` structure is used to enable or disable the reverberation effect, and to set or query the current parameters of the effect. The settings can be changed using the `OMX_SetConfig` function, and the current state can be queried using the `OMX_GetConfig` function. When calling either function, the index specified for this structure is `OMX_IndexConfigAudioReverberation`.

The reverberation effect models the effect of a room (room response) to the sound. The room response is divided into three sections: direct path, early reflections, and late reverberation. This division and the effect parameters are essentially the same as used in the Interactive 3D Audio Rendering Guidelines – Level 2.0 by the Interactive Audio Special Interest Group (IASIG) of the MIDI Manufacturers Association (MMA). For more information on this specification, see http://www.iasig.org/pubs/3dl2v1a.pdf.

`OMX_AUDIO_CONFIG_REVERBERATIONTYPE` is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_REVERBERATIONTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bEnable;
    OMX_BS32 sRoomLevel;
    OMX_BS32 sRoomHighFreqLevel;
    OMX_BS32 sReflectionsLevel;
    OMX_BU32 sReflectionsDelay;
    OMX_BS32 sReverbLevel;
    OMX_BU32 sReverbDelay;
    OMX_BU32 sDecayTime;
    OMX_BU32 nDecayHighFreqRatio;
    OMX_U32 nDensity;
    OMX_U32 nDiffusion;
    OMX_BU32 sReferenceHighFreq;
} OMX_AUDIO_CONFIG_REVERBERATIONTYPE;
```

4.1.50.1 Parameter Definitions

The parameters for `OMX_AUDIO_CONFIG_REVERBERATIONTYPE` are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- bEnable enables the reverberation effect if set to OMX_TRUE or disables the reverberation effect if set to OMX_FALSE.
- sRoomLevel is the intensity level for the whole room effect, including both early reflections and late reverberation, in millibels.
- sRoomHighFreqLevel is the attenuation in millibels at high frequencies relative to the intensity at low frequencies.
- sReflectionsLevel is the intensity level of early reflections, which are relative to the room level value, in millibels.
- sReflectionsDelay is the time delay in milliseconds of the first reflection relative to the direct path.
- sReverbLevel is the intensity level in millibels of late reverberation relative to the room level.
- sReverbDelay is the time delay in milliseconds from the first early reflection to the beginning of the late reverberation section.
- sDecayTime is the late reverberation decay time in milliseconds at low frequencies, defined as the time needed for the reverberation to decay by 60 dB.
- nDecayHighFreqRatio is the ratio of high-frequency decay time relative to low-frequency decay time as percentage in the range 0–100.
- nDensity is the modal density in the late reverberation decay as a percentage. The range of values is 0-100.
- nDiffusion is the echo density in the late reverberation decay as a percentage. The range of values is 0-100.
- sReferenceHighFreq is the reference high frequency in Hertz. This is the frequency used as the reference for all of the high-frequency parameter settings.

4.1.51 OMX_AUDIO_CONFIG_ECHOCANCELATIONTYPE

The OMX_AUDIO_CONFIG_ECHOCANCELATIONTYPE structure is used to enable or disable echo canceling, which removes undesired echo from speech or audio. The setting can be changed using the OMX_SetConfig function, and the current state can be queried using the OMX_GetConfig function. When calling either function, the index specified for this structure is OMX_IndexConfigAudioEchoCancelation.

OMX_AUDIO_CONFIG_ECHOCANCELATIONTYPE is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_ECHOCANCELATIONTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
```

```
    OMX_AUDIO_ECHOCANTYPE eEchoCancelation;
} OMX_AUDIO_CONFIG_ECHOCANCELATIONTYPE;
```

4.1.51.1 Parameter Definitions

The parameters for OMX_AUDIO_CONFIG_ECHOCANCELATIONTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- eEchoCancelation is the enumeration for enabling/disabling echo cancellation and selecting the mode, as shown in Table 4-30.

Table 4-30: Echo Cancellation Values

Field Name	Description
OMX_AUDIO_EchoCanOff	Echo cancellation is disabled.
OMX_AUDIO_EchoCanNormal	Echo cancellation normal operation; echo from handset plastics and face.
OMX_AUDIO_EchoCanHFree	Echo cancellation optimized for hands-free operation.
OMX_AUDIO_EchoCanCarKit	Echo cancellation optimized for car kit (longer echo).
OMX_AUDIO_EchoCanMax	Allowance for expansion with additional types.

4.1.52 OMX_AUDIO_CONFIG_NOISEREDUCTIONTYPE

The OMX_AUDIO_CONFIG_NOISEREDUCTIONTYPE structure is used to enable or disable noise reduction processing, which removes undesired noise from audio. The setting can be changed using the OMX_SetConfig function, and the current state can be queried using the OMX_GetConfig function. When calling either function, the index specified for this structure is OMX_IndexConfigAudioNoiseReduction.

OMX_AUDIO_CONFIG_NOISEREDUCTIONTYPE is defined as follows.

```
typedef struct OMX_AUDIO_CONFIG_NOISEREDUCTIONTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bNoiseReduction;
} OMX_AUDIO_CONFIG_NOISEREDUCTIONTYPE;
```

4.1.52.1 Parameter Definitions

The parameters for OMX_AUDIO_CONFIG_NOISEREDUCTIONTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.

- `bNoiseReduction` enables noise reduction processing if set to OMX_TRUE or disables noise reduction processing if set to OMX_FALSE.

4.2 Image and Video Common

This section describes the parameter and configuration details for ports in the video and image domains. These parameter and configurations details are specified in the OMX_IVCommon.h header.

4.2.1 Uncompressed Data Formats

Both image and video ports operate on compressed and uncompressed data. The formats for uncompressed pixel data are common to both image and video. Table 4-31 lists the uncompressed formats.

Table 4-31: Uncompressed Data Formats

OMX_COLOR_FORMATTYPE	**Description**
`OMX_COLOR_FormatUnused`	Placeholder value when format is unknown, or specified using a vendor-specific means.
`OMX_COLOR_FormatMonochrome`	1 bit per pixel monochrome.
`OMX_COLOR_FormatL2`	2 bit per pixel luminance.
`OMX_COLOR_FormatL4`	4 bit per pixel luminance.
`OMX_COLOR_FormatL8`	8 bit per pixel luminance.
`OMX_COLOR_FormatL16`	16 bit per pixel luminance.
`OMX_COLOR_FormatL24`	24 bit per pixel luminance.
`OMX_COLOR_FormatL32`	32 bit per pixel luminance.
`OMX_COLOR_Format8bitRGB332`	8 bits per pixel RGB format with colors stored as Red 7:5, Green 4:2, and Blue 1:0.
`OMX_COLOR_Format12bitRGB444`	12 bits per pixel RGB format with colors stored as Red 11:8, Green 7:4, and Blue 3:0.
`OMX_COLOR_Format16bitARGB4444`	16 bits per pixel ARGB format with colors stored as Alpha 15:12, Red 11:8, Green 7:4, and Blue 3:0.
`OMX_COLOR_Format16bitARGB1555`	16 bits per pixel ARGB format with colors stored as Alpha 15, Red 14:10, Green 9:5, and Blue 4:0.
`OMX_COLOR_Format16bitRGB565`	16 bits per pixel RGB format with colors stored as Red 15:11, Green 10:5, and Blue 4:0.

OMX_COLOR_FORMATTYPE	Description
OMX_COLOR_Format16bitBGR565	16 bits per pixel BGR format with colors stored as Blue 15:11, Green 10:5, and Red 4:0.
OMX_COLOR_Format18bitRGB666	18 bits per pixel RGB format with colors stored as Red 17:12, Green 11:6, and Blue 5:0.
OMX_COLOR_Format18BitBGR666	18 bits per pixel BGR format with colors stored as Blue 17:12, Green 11:6, and Red 5:0.
OMX_COLOR_Format18BitARGB1665	18 bits per pixel ARGB format with colors stored as Alpha 17, Red 16:11, Green 10:5, and Blue 4:0.
OMX_COLOR_Format19BitARGB1666	19 bits per pixel ARGB format with colors stored as Alpha 18, Red 17:12, Green 11:6, and Blue 5:0.
OMX_COLOR_Format24bitRGB888	24 bits per pixel RGB format with colors stored as Red 23:16, Green 15:8, and Blue 7:0.
OMX_COLOR_Format24bitBGR888	24 bits per pixel BGR format with colors stored as Blue 23:16, Green 15:8, and Red 7:0.
OMX_COLOR_Format24bitARGB1887	24 bits per pixel ARGB format with colors stored as Alpha 23, Red 22:15, Green 14:7, and Blue 6:0.
OMX_COLOR_Format24bitARGB6666	24 bits per pixel ARGB format with colors stored as Alpha 23:18, Red 17:12, Green 11:6, and Blue 5:0
OMX_COLOR_Format24bitABGR6666	24 bits per pixel ARGB format with colors stored as Alpha 23:18, Blue 17:12, Green 11:6, and Red 5:0
OMX_COLOR_Format25bitARGB1888	25 bits per pixel ARGB format with colors stored as Alpha 24, Red 23:16, Green 15:8, and Blue 7:0.
OMX_COLOR_Format32bitBGRA8888	32 bits per pixel ARGB format with colors stored as Alpha 31:24 Red 23:16, Green 15:8, and Blue 7:0.
OMX_COLOR_Format32bitARGB8888	24 bits per pixel ABGR format with colors stored as Alpha 31:24, Blue 23:16, Green 15:8, and Red 7:0.

OMX_COLOR_FORMATTYPE	Description
OMX_COLOR_FormatYUV411Planar	YUV planar format, organized with three separate planes for each color component, namely Y, U, and V appearing in this order. U and V pixels are sub-sampled by a factor of four both horizontally and vertically.
OMX_COLOR_FormatYUV411PackedPlanar	YUV planar format, organized with three separate planes for each color component, namely Y, U, and V. U and V pixels are sub-sampled by a factor of four both horizontally and vertically. This format differs from OMX_COLOR_FormatYUV411Planar in that each slice of data shall contain a plane of Y, U, and V data in this order, whereas the OMX_COLOR_FormatYUV411Planar format transfers each plane in its entirety.
OMX_COLOR_FormatYUV420Planar	YUV planar format, organized with three separate planes for each color component, namely Y, U, and V appearing in this order. U and V pixels are sub-sampled by a factor of two both horizontally and vertically.
OMX_COLOR_FormatYUV420PackedPlanar	YUV planar format, organized with three separate planes for each color component, namely Y, U, and V. U and V pixels are sub-sampled by a factor of two both horizontally and vertically. This format differs from OMX_COLOR_FormatYUV420Planar in that each slice of data shall contain a plane of Y, U, and V data in this order, whereas the OMX_COLOR_FormatYUV420Planar format transfers each plane in its entirety.
OMX_COLOR_FormatYUV420SemiPlanar	YUV planar format, organized with a first plane containing Y pixels, and a second plane containing U and V pixels interleaved with the first U value first. U and V pixels are sub-sampled by a factor of two both horizontally and vertically.

OMX_COLOR_FORMATTYPE	Description
`OMX_COLOR_FormatYUV420PackedSemiPlanar`	YUV planar format, organized with a first plane containing Y pixels, and a second plane containing U and V pixels interleaved with the first U value first. U and V pixels are sub-sampled by a factor of two both horizontally and vertically. This format differs from OMX_COLOR_FormatYUV420SemiPlanar in that each slice of data shall contain a plane of Y, U and V data, whereas the OMX_COLOR_FormatYUV420SemiPlanar format transfers each plane in its entirety.
`OMX_COLOR_FormatYUV422Planar`	YUV planar format, organized with three separate planes for each color component, namely Y, U, and V appearing in this order.
`OMX_COLOR_FormatYUV422PackedPlanar`	YUV planar format, organized with three separate planes for each color component, namely Y, U, and V. This format differs from `OMX_COLOR_FormatYUV422Planar` in that each slice of data shall contain a plane of Y, U, and V data in this order, whereas the `OMX_COLOR_FormatYUV422Planar` format transfers each plane in its entirety.
`OMX_COLOR_FormatYUV422SemiPlanar`	YUV planar format, organized with a first plane containing Y pixels and a second plane containing U and V pixels interleaved with the first U value first.

OMX_COLOR_FORMATTYPE	Description
`OMX_COLOR_FormatYUV422PackedSemiPlanar`	YUV planar format, organized with a first plane containing Y pixels, and a second plane containing U and V pixels interleaved with the first U value first. U and V pixels are sub-sampled by a factor of two horizontally. This format differs from OMX_COLOR_FormatYUV422SemiPlanar in that each slice of data shall contain a plane of Y, U and V data, whereas the OMX_COLOR_FormatYUV422SemiPlanar format transfers each plane in its entirety.
`OMX_COLOR_FormatYCbYCr`	16 bits per pixel YUV interleaved format organized as YUYV (i.e., YCbYCr).
`OMX_COLOR_FormatYCrYCb`	16 bits per pixel YUV interleaved format organized as YVYU (i.e., YCrYCb).
`OMX_COLOR_FormatCbYCrY`	16 bits per pixel YUV interleaved format organized as UYVY (i.e., CbYCrY).
`OMX_COLOR_FormatCrYCbY`	16 bits per pixel YUV interleaved format organized as VYUY (i.e., CrYCbY).
`OMX_COLOR_FormatYUV444Interleaved`	12 bits per pixel YUV format with colors stores as Y 11:8, U 7:4, and V 3:0.
`OMX_COLOR_FormatRawBayer8bit`	SMIA 8-bit raw Bayer pattern camera format.
`OMX_COLOR_FormatRawBayer10bit`	SMIA 10-bit raw Bayer pattern camera format.
`OMX_COLOR_FormatRawBayer8bitcompressed`	SMIA compressed 8-bit camera output format.

4.2.2 Minimum Buffer Payload Size for Uncompressed Data

Uncompressed image and video data have a minimum buffer payload size. The minimum buffer payload size is determined by the `nSliceHeight` and `nStride` fields of the port definition structure. `nStride` indicates the width of a span in bytes; when negative, it indicates the data is bottom-up instead of the top-down). `nSliceHeight` indicates the number of spans in a slice.

The minimum buffer payload size can be easily calculated as the absolute value of `(nSliceHeight * nStride)`.

4.2.3 Buffer Payload Requirements for Uncompressed Data

Each image or video port on a component shall meet several requirements for buffer payloads of uncompressed image and video data. These requirements are in place to enable components from different vendors to inter-operate together correctly, and are collectively referred to as *inter-op*.

The requirements are as follows:

- Each non-empty buffer payload shall contain at least one full slice, unless it contains the end of the image (which may not be aligned to a integer multiple of slice height). For example, if the image height is 100 and the slice height is 16, the last slice of the image will contain only four spans.
- Each non-empty buffer payload shall contain an integer multiple of slice height.
- When the uncompressed image data format is planar, data from two different planes cannot reside in the same buffer payload. This means that a component shall pass a full plane in its entirety in one or more buffers, followed by another plane starting in a different buffer.
- An exception to the above requirement exists for the packed planar uncompressed formats, `OMX_COLOR_FormatYUV420PackedPlanar`, `OMX_COLOR_FormatYUV420PackedSemiPlanar`, `OMX_COLOR_FormatYUV411PackedPlanar`, `OMX_COLOR_FormatYUV422PackedPlanar`, and `OMX_COLOR_FormatYUV422PackedSemiPlanar`. For each of these uncompressed formats, each buffer payload contains a slice of the Y, U, and V planes. The slices are always ordered Y, U, and V. The `nSliceHeight` refers to the slice height of the Y plane. The slice height of the U and V planes are derived from the slice height for the Y plane based upon for the format. For example, for `OMX_COLOR_FormatYUV420PackedPlanar` with a `nSliceHeight` of 16, a buffer payload shall contain 16 spans of Y followed by 8 spans of U (half the stride) and 8 spans of V (half the stride). This enables ports that process planar data in slices to operate on all three planes simultaneously, instead of forcing the ports to buffer the entire image before processing can begin.

4.2.4 Parameter and Configuration Indexes

The header OMX_Index.h contains the enumeration `OMX_INDEXTYPE`, which contains all of the standard index values used with the functions `OMX_GetParameter`, `OMX_SetParameter`, `OMX_GetConfig`, and `OMX_SetConfig`. Table 4-32 describes the index values that relate to video.

Table 4-32: Index Values for Video

Index	Description
OMX_IndexParamCommonDeblocking	Used with OMX_GetParameter and OMX_SetParameter to access OMX_PARAM_DEBLOCKINGTYPE. De-blocking reduces the appearance of block-like artifacts that appear in compressed images or video streams.
OMX_IndexParamCommonSensorMode	Used with OMX_GetParameter and OMX_SetParameter to access OMX_PARAM_SENSORMODETYPE. The mode of the sensor controls the resolution and frame rate of data captured by a camera.
OMX_IndexParamCommonInterleave	Used with OMX_GetParameter and OMX_SetParameter to access OMX_PARAM_INTERLEAVETYPE. This feature is used to interleave plane or input port data.
OMX_IndexConfigCommonColorFormatConversion	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_COLORCONVERSIONTYPE. Color conversion programs the coefficients used when converting pixel data from RGB to YUV and visa-versa.
OMX_IndexConfigCommonScale	Used with OMX_GetConfig and OMX_SetConfig to access the OMX_CONFIG_SCALEFACTORTYPE. Scaling stretches or shrinks a rectangular region of pixels.
OMX_IndexConfigCommonImageFilter	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_IMAGEFILTERTYPE. Image filtering applies digital effects to a video or image stream.
OMX_IndexConfigCommonColorEnhancement	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_COLORENHANCEMENTTYPE. Color enhancement replaces U and V values of a YUV image with specified constant values to apply a color effect to an image or video stream.

Index	Description
OMX_IndexConfigCommonColorKey	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_COLORKEYTYPE. Color keying performs per-pixel selection between two sources with mixing image or video data.
OMX_IndexConfigCommonColorBlend	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_COLORBLENDTYPE. Color blending performs arithmetic operations between two sources.
OMX_IndexConfigCommonFrame Stabilisation	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_FRAMESTABTYPE.
OMX_IndexConfigCommonRotate	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_ROTATIONTYPE. Rotation rotates video or image frames clockwise by a specified angle.
OMX_IndexConfigCommonMirror	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_MIRRORTYPE. Mirroring reflects video or image frames along the horizontal and vertical axes.
OMX_IndexConfigCommonOutputPosition	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_POINTTYPE. The output position indicates the location of a video or image stream relative to another image or video stream. The output position is also used to indicate the location of a video or image stream relative to an output device such as an LCD display.
OMX_IndexConfigCommonInputCrop	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_RECTTYPE. Crops the image or video stream to the specified rectangle.
OMX_IndexConfigCommonOutputCrop	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_RECTTYPE. Crops the image or video stream to the specified rectangle.

Index	Description
OMX_IndexConfigCommonDigitalZoom	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_SCALEFACTORTYPE. Digital zoom implements a camera zoom feature digitally.
OMX_IndexConfigCommonOpticalZoom	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_SCALEFACTORTYPE. Optical zoom “zooms” an image in or out using a lens on a camera.
OMX_IndexConfigCommonWhiteBalance	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_WHITEBALCONTROLTYPE. White balance performs color correction so that a white object appears truly white and not a tint of the color of the light source.
OMX_IndexConfigCommonExposure	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_EXPOSURECONTROLTYPE. Exposure controls the image sensor exposure when capturing images or streaming video.
OMX_IndexConfigCommonContrast	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_CONTRASTTYPE. Contrast controls the relative difference between pixels in video or image data.
OMX_IndexConfigCommonBrightness	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_BRIGHTNESSTYPE. Brightness controls the luminosity of the pixels in video or image data.
OMX_IndexConfigCommonBacklight	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_BACKLIGHTTYPE. Backlight controls the strength of the backlight, and the time that the backlight is turned on.
OMX_IndexConfigCommonGamma	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_GAMMATYPE. Gamma corrects for the non-linear intensity of pixels on a display relative to the digital value of the pixel for video or image data.

Index	Description
OMX_IndexConfigCommonSaturation	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_SATURATIONTYPE. Saturation controls the hue intensity of video or image data.
OMX_IndexConfigCommonLightness	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_LIGHTNESSTYPE. Lightness controls the non-linear response to the brightness of pixels in video or image data.
OMX_IndexConfigCommonExclusionRect	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_RECTTYPE. This feature enables a component to exclude a specific region from rendering to save on processing, resulting in higher performance and lower power consumption. This configuration is often used in video conferencing where a section of the decoded input stream is covered by a preview of the viewer's image.
OMX_IndexConfigCommonPlaneBlend	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_PLANEBLENDTYPE. This feature controls the blending of multiple input sources or ports into a single destination.
OMX_IndexConfigCommonTransitionEffect	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_TRANSITIONEFFECTTYPE.
OMX_IndexConfigCommonDithering	Used with OMX_GetConfig and OMX_SetConfig to access OMX_CONFIG_DITHERTYPE. Dithering is used when performing color space conversion from a color format that has a higher precision to a color format with a lower precision.
OMX_IndexConfigCommonExposureValue	OMX_CONFIG_EXPOSUREVALUETYPE. Query or config the exposure value of the camera.

Index	Description
OMX_IndexConfigCommonOutputSize	OMX_FRAMESIZETYPE. Query or config the frame size of an output video sink region.
OMX_IndexParamCommonExtraQuantData	OMX_OTHER_EXTRADATATYPE Used to enable or query the generation of extra payload information consisting of quantization information.
OMX_IndexConfigCaptureMode	OMX_CONFIG_CAPTUREMODETYPE Query or config the capture mode of a camera.
OMX_IndexAutoPauseAfterCapture	OMX_CONFIG_BOOLEANTYPE Query or config the auto pause mechanism after capturing is complete for a camera.
OMX_IndexConfigCapturing	OMX_CONFIG_BOOLEANTYPE. Query a component if it is capturing data.
OMX_IndexConfigCommonFocusRegion	OMX_CONFIG_FOCUSREGIONTYPE Query or config the focus regions of interest.
OMX_IndexConfigCommonFocusStatus	OMX_CONFIG_FOCUSSTATUSTYPE Query the focus status of the individual focus regions.

4.2.5 OMX_PARAM_DEBLOCKINGTYPE

De-blocking is used to reduce the appearance of block-like artifacts that appear in compressed images or video streams.

OMX_PARAM_DEBLOCKINGTYPE is defined as follows.

```
typedef struct OMX_PARAM_DEBLOCKINGTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bDeblocking;
} OMX_PARAM_DEBLOCKINGTYPE;
```

4.2.5.1 Parameters

The parameters for OMX_PARAM_DEBLOCKINGTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- bDeblocking is a Boolean value that enables or disables de-blocking.

4.2.6 OMX_PARAM_INTERLEAVETYPE

Interleaving is used to interleave or de-interleave pixel data between multiple ports. When interleaving, a component uses pixel data from multiple input ports to merge into a single output port. When de-interleaving, a component uses pixel data from a single input port, splitting the color channels into separate output ports.

For example, a input port receiving 16-bit RGB can de-interleave R, G, and B color channels to three separate output ports, where the output ports are formatted as monochrome.

Similarly, a component could interleave three luminance ports containing Y, U, and V data into a single output port formatted as YUV420.

The `OMX_PARAM_INTERLEAVETYPE` structure interleaves pixel data. `OMX_PARAM_INTERLEAVETYPE` is defined as follows.

```
typedef struct OMX_PARAM_INTERLEAVETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bEnable;
    OMX_U32 nInterleavePortIndex;
} OMX_PARAM_INTERLEAVETYPE;
```

4.2.6.1 Parameters

The parameters for `OMX_PARAM_INTERLEAVETYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `bEnable` is a Boolean value that enables interleaving.
- `nInterleavePortIndex` indicates the port to interleave or de-interleave with. When `nPortIndex` is an input port, `nInterleavePortIndex` contains the output port to interleave with. When `nPortIndex` is an output port, `nInterleavePortIndex` contains the input port to de-interleave with.

4.2.7 OMX_PARAM_SENSORMODETYPE

The sensor mode is used to specify the frame rate and resolution that an image sensor or camera uses to capture image or video. The sensor mode is distinctly separate from the port on a video source, which may modify the resolution of the data produced by the image sensor.

`OMX_PARAM_SENSORMODETYPE` is defined as follows.

```
typedef struct OMX_PARAM_SENSORMODETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nFrameRate;
```

```
    OMX_BOOL bOneShot;
    OMX_FRAMESIZETYPE sFrameSize;
} OMX_PARAM_SENSORMODETYPE;
```

4.2.7.1 Parameters

The parameters for `OMX_PARAM_SENSORMODETYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nFrameRate` is the frame rate is in frames per second. This value is represented in Q16 format. The value 0x0 is used to indicate the frame rate is unknown, variable, or is not needed.
- `bOneShot` is a Boolean value that enables or disables one shot mode.
- `sFrameSize` is the resolution of the image sensor mode.

4.2.8 OMX_CONFIG_COLORCONVERSIONTYPE

Color conversion is used to specify the coefficients when converting image or video pixel data from YUV to RGB and visa-versa.

Converting from RGB to YUV format uses the following standard formulae:

$$Y = 0.299R + 0.587G + 0.114B$$

$$U = -0.147R - 0.289G + 0.436B$$

$$V = 0.615R - 0.515G - 0.100B$$

Converting from YUV to RGB format uses the following standard formulae:

$$R = Y + 1.140V$$

$$G = Y - 0.395U - 0.581V$$

$$B = Y + 2.032U$$

The color matrix and color offset specified in the color conversion allow for the coefficients used when converting from RGB to YUV and visa-versa to be programmed explicitly.

`OMX_CONFIG_COLORCONVERSIONTYPE` is defined as follows.

```
typedef struct OMX_CONFIG_COLORCONVERSIONTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_S32 xColorMatrix[3][3];
    OMX_S32 xColorOffset[4];
}OMX_CONFIG_COLORCONVERSIONTYPE;
```

4.2.8.1 Parameters

The parameters for `OMX_CONFIG_COLORCONVERSIONTYPE` are defined as follows.

- `nPortIndex` is the read-only field indicating the index of the port.
- `xColorMatrix[3][3]` is the color conversion matrix when converting from RGB to YUV in Q16 format with the following standard formulae:

  *Y = Yr*R + Yg*G + Yb*B*
  *U = Ur*R – Ug*G + Ub*B*
  *V = Vr*R – Vg*G – Vb*B*

  Each constant is represented in the 3x3 matrix as:

  Yr Yg Yb
  Ur Ug Ub
  Vr Vg Vb

  Y constants are in the first row, followed by U and V constants in subsequent rows. All constants multiplied against red color values are in the first column followed by green and blue color constants, as follows

```
xColorMatrix[1][1] = Yr
xColorMatrix[3][3] = Vb,
xColorMatrix[1][3] = Yb
```

- `xColorOffset[4]` is the color conversion vector when converting from YUV to RGB in Q16 format. The standard formulae are as follows:

  *R = Y + C1*U*
  *G = Y – C2*U – C3*V*
  *B = Y – C4*V*

  Each constant is represented in the array:

  C1 C2 C3 C4

4.2.9 OMX_CONFIG_SCALEFACTORTYPE

Scaling is used to stretch or shrink video or image data on the specified input or output port.

`OMX_CONFIG_SCALEFACTORTYPE` is defined as follows.

```
typedef struct OMX_CONFIG_SCALEFACTORTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_S32 xWidth;
    OMX_S32 xHeight;
}OMX_CONFIG_SCALEFACTORTYPE;
```

4.2.9.1 Parameters

The parameters for `OMX_CONFIG_SCALEFACTORTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.

- `xWidth` is the scaling in the horizontal direction in Q16 format (i.e., signed 15.16 fixed pointed format). For example, a scaling factor of 0x10000 would not change the width, but a scaling factor of 0x8000 would scale the width by 50%.
- `xHeight` is the scaling in the vertical direction in Q16 format (i.e., signed 15.16 fixed pointed format). For example, a scaling factor of 0x10000 would not change the height, but a scaling factor of 0x20000 would scale the height by 200%.

4.2.10 OMX_CONFIG_IMAGEFILTERTYPE

Image filtering is used to apply digital effects to video or image data on the specified port.

`OMX_CONFIG_IMAGEFILTERTYPE` is defined as follows.

```
typedef struct OMX_CONFIG_IMAGEFILTERTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_IMAGEFILTERTYPE eImageFilter;
} OMX_CONFIG_IMAGEFILTERTYPE;
```

4.2.10.1 Parameters

The parameters for `OMX_CONFIG_IMAGEFILTERTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `eImageFilter` is the enumerated valued indicating the image filter used. Table 4-33 details the values that can be selected for the image filter.

Table 4-33: Image Filter Values

OMX_IMAGEFILTERTYPE Enumerated Value	**Description**
OMX_ImageFilterNone	Used to disable image filtering.
OMX_ImageFilterNoise	Filters data to remove noise from the image.
OMX_ImageFilterEmboss	Filters data to give an embossed appearance (stamped from the rear for a raised effect along edges).
OMX_ImageFilterNegative	Filters data to negate colors.
OMX_ImageFilterSketch	Filters data to give the appearance of having been sketched by an artist.
OMX_ImageFilterOilPaint	Filters data to appear as if it were hand painted using a brush with oil paints.
OMX_ImageFilterHatch	Filters data to appear as if it were printed on a material with a grain.
OMX_ImageFilterGpen	Filters data to appear as if it were drawn with a pen.
OMX_ImageFilterAntialias	Filters data to anti-alias pixels so as to sharpen edges in the image or video stream.

OMX_IMAGEFILTERTYPE Enumerated Value	**Description**
OMX_ImageFilterDeRing	Filters data to remove erroneous artifacts introduced by inherent limitations of the numerical processing of digital image data.
OMX_ImageFilterSolarize	Filters data to create a solarization effect.

4.2.11 OMX_CONFIG_COLORENHANCEMENTTYPE

Color enhancement is applied to image or video data in YUV formats, where the U and V color components of each pixel are replaced with the specified values. Replacement occurs for each pixel and every frame. This enables a component to add specified color hues to the data. For example, this configuration can be used to convert color image or video data to sepia tone.

OMX_CONFIG_COLORENHANCEMENTTYPE is defined as follows.

```
typedef struct OMX_CONFIG_COLORENHANCEMENTTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bColorEnhancement;
    OMX_U8 nCustomizedU;
    OMX_U8 nCustomizedV;
 } OMX_CONFIG_COLORENHANCEMENTTYPE;
```

4.2.11.1 Parameters

The parameters for OMX_CONFIG_COLORENHANCEMENTTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- bColorEnhancement is the Boolean value that enables or disables color enhancement.
- nCustomizedU is a value for replacing the U color component of each pixel. The range of values is 0-255. Practical values are in the range of 16-240.
- nCustomizedV is the value for replacing the V color component of each pixel. The range of values is 0-255. Practical values are in the range of 16-240.

4.2.12 OMX_CONFIG_COLORKEYTYPE

Color keying is used to perform per-pixel selection between two sources when mixing image or video data.

OMX_CONFIG_COLORKEYTYPE is defined as follows.

```
typedef struct OMX_CONFIG_COLORKEYTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nARGBColor;
    OMX_U32 nARGBMask;
} OMX_CONFIG_COLORKEYTYPE;
```

4.2.12.1 Parameters

The parameters for `OMX_CONFIG_COLORKEYTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nARGBColor` indicates a 32-bit color used for keying, where bits 0-7 are blue, bits 15-8 are green, bits 24-16 are red, and bits 31-24 are for alpha. The 32-bit ARGB color is converted to the RGB color format of the port before performing keying operations.
- `nARGBMask` indicates a 32-bit logical AND mask, which is converted to the RGB color format of the port before performing keying operations.

4.2.13 OMX_CONFIG_COLORBLENDTYPE

Color blending is used to perform arithmetic operations between two sources when mixing image or video data. If more than one input port (representing a plane) on a component is using this config, it should be used in conjunction with OMX_CONFIG_PLANEBLENDTYPE to specify the Z-order of the different ports via the nDepth field.

OMX_CONFIG_COLORBLENDTYPE is defined as follows.

```
typedef struct OMX_CONFIG_COLORBLENDTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nRGBAlphaConstant;
    OMX_COLORBLENDTYPE eColorBlend;
} OMX_CONFIG_COLORBLENDTYPE;
```

4.2.13.1 Parameters

The parameters for OMX_CONFIG_COLORBLENDTYPE are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nRGBAlphaConstant` is the 32-bit per color channel constant alpha value for blending when the `eColorBlend` is set to OMX_ColorBlendAlphaConstant on an input port. If defined on an output port, the `nRGBAlphaConstant` value is written as the per pixel alpha value in the composed image (if the output format

supports per pixel alpha). If `eColorBlend` is OMX_ColorBlendAlphaPerPixel is defined, the `nRGBAlphaConstant` value is ignored and the alpha coefficients for the output buffer are taken from the corresponding alpha values of the lowest nDepth (=highest value) input plane.
A value of 0 means fully transparent and a value of 1 (0xFFFFFFFF) means opaque.

- `eColorBlend` is the enumerated value indicating the color blend operation used. `eColorBlend` is only valid when set on ports representing the image source input (highest nDepth (=lowest value) plane) or on the composed plane. If set on an output port, assuming the output format supports per pixel alpha, the nRGBAlphaConstant value is taken (with eColorBlend = OMX_ColorBlendAlphaConstant) or the alpha value of the lowest nDepth plane is taken (eColorBlend = OMX_ColorBlendAlphaPerPixel), as per pixel alpha value in the composed image. Note in the latter case a) if the input (alpha) format does not equal the composed image (alpha) format, the implicit color space conversion takes care of re-calculating the alpha value, and b) if the input format does not have an alpha value, the per pixel alpha value of the composed plane is set to non-transparant. Table 4-34 details the values that can be selected for color blending.

Table 4-34: Color Blending Values

OMX_COLORBLENDTYPE Enumerated Value	Description
`OMX_ColorBlendNone`	Disables color blending.
`OMX_ColorBlendAlphaConstant`	Blends source and destination using the function (alpha_constant * source) + ((1 – alpha_constant) * destination), where the alpha constant is specified for the entire operation.
`OMX_ColorBlendAlphaPerPixel`	Blends source and destination using the function (alpha * source) + ((1 – alpha) * destination), where the alpha value is per pixel.
`OMX_ColorBlendAlternate`	Alternates between selecting source and destination pixels (i.e., checkerboard of source and destination pixels)..
`OMX_ColorBlendAnd`	Combines source and destination pixels using the function (source & destination).
`OMX_ColorBlendOr`	Combines source and destination pixels using the function (source | destination).
`OMX_ColorBlendInvert`	Combines source and destination pixels using the function ~(source).

4.2.14 OMX_FRAMESIZETYPE

Frame size is a generic structure used to indicate the size of a frame. This structure is referred to by the OMX_PARAM_SENSORMODETYPE structure.

OMX_FRAMESIZETYPE is defined as follows.

```
typedef struct OMX_FRAMESIZETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nWidth;
    OMX_U32 nHeight;
} OMX_FRAMESIZETYPE;
```

4.2.14.1 Parameters

The parameters for OMX_FRAMESIZETYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nWidth is the width of the rectangle in pixels.
- nHeight is the height of the rectangle in pixels.

4.2.15 OMX_CONFIG_ROTATIONTYPE

Rotation is applied to image or video data on a specified port. Components may support rotation only on right angles such as 0°, 90°, 180°, and 270°, although components may support arbitrary rotation angles. Values are interpreted as clockwise.

OMX_CONFIG_ROTATIONTYPE is defined as follows.

```
typedef struct OMX_CONFIG_ROTATIONTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_S32 nRotation;
} OMX_CONFIG_ROTATIONTYPE;
```

4.2.15.1 Parameters

The parameters for OMX_CONFIG_ROTATIONTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nRotation is an integer value that represents the angle of rotation. Some components may only support rotation on right angles such as 0°, 90°, 180°, and 270°. Rotation is clockwise.

4.2.16 OMX_CONFIG_MIRRORTYPE

Mirroring is applied to pixel or image data on a specified port. The data can be mirrored in the horizontal direction, vertical direction, or both horizontal and vertical directions.

OMX_CONFIG_MIRRORTYPE is defined as follows.

```
typedef struct OMX_CONFIG_MIRRORTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_MIRRORTYPE eMirror;
} OMX_CONFIG_MIRRORTYPE;
```

4.2.16.1 Parameters

The parameters for OMX_CONFIG_MIRRORTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- eMirror contains the enumerated values indicating the mirroring applied to image or video data. OMX_MirrorNone is used to disable mirroring or have no mirroring. Table 4-35 identifies the mirroring values.

Table 4-35: Mirror Type Values

OMX_MIRRORTYPE Enumerated Value	Description
OMX_MirrorNone	Disables mirroring (i.e., no mirroring).
OMX_MirrorHorizontal	Mirrors pixels in the horizontal direction. Hence, pixel at 0,1 is swapped with pixel W,1 where W is the width of the image.
OMX_MirrorVertical	Mirrors pixels in the vertical direction. Hence, pixel at 1,0 is swapped with pixel 1,H where H is the height of the image.
OMX_MirrorBoth	Mirrors pixels in the horizontal and vertical directions. Hence, pixel at 0, 0 is swapped with pixel W,H where W is the width of the image and H is the height of the image.

4.2.17 OMX_CONFIG_POINTTYPE

A point is used to specify the location of image or video data on a port relative to another source image or video stream.

OMX_CONFIG_POINTTYPE is defined as follows.

```
typedef struct OMX_CONFIG_POINTTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_S32 nX;
    OMX_S32 nY;
} OMX_CONFIG_POINTTYPE;
```

4.2.17.1 Parameters

The parameters for OMX_CONFIG_POINTTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nX is the X-coordinate location in pixels in the horizontal direction.
- nY is the Y-coordinate location in pixels in the vertical direction.

4.2.18 OMX_CONFIG_RECTTYPE

Rectangles are used with several configuration types to indicate orientation, position, inclusion, or exclusion.

OMX_CONFIG_RECTTYPE is defined as follows.

```
typedef struct OMX_CONFIG_RECTTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_S32 nLeft;
    OMX_S32 nTop;
    OMX_U32 nWidth;
    OMX_U32 nHeight;
} OMX_CONFIG_RECTTYPE;
```

4.2.18.1 Parameters

The parameters for OMX_CONFIG_RECTTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nLeft is the leftmost coordinate of the rectangle.
- nTop is the topmost coordinate of the rectangle.
- nWidth is the width of the rectangle in pixels.
- nHeight is the height of the rectangle in pixels.

4.2.19 OMX_CONFIG_FRAMESTABTYPE

Frame stabilization reduces motion blur during image capture or video recording. Frame stabilization is most often associated with camera sensor source components, a camera sensor filter, or a digital signal processor (DSP).

The frame stabilization feature compensates for the extremely unsteady nature of cameras on handheld devices such as a cell phone or personal digital assistant (PDA).

OMX_CONFIG_FRAMESTABTYPE is defined as follows.

```
typedef struct OMX_CONFIG_FRAMESTABTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bStab;
} OMX_CONFIG_FRAMESTABTYPE;
```

4.2.19.1 Parameters

The parameters for `OMX_CONFIG_FRAMESTABTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `bStab` is the Boolean value that enables or disables frame stabilization.

4.2.20 OMX_CONFIG_WHITEBALCONTROLTYPE

White balance control is used with camera sensors to adjust the color temperature of the image so that pure white appears as white in the image. This adjustment can be controlled automatically or manually.

`OMX_CONFIG_WHITEBALCONTROLTYPE` is defined as follows.

```
typedef struct OMX_CONFIG_WHITEBALCONTROLTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_WHITEBALCONTROLTYPE eWhiteBalControl;
} OMX_CONFIG_WHITEBALCONTROLTYPE;
```

4.2.20.1 Parameters

The parameters for `OMX_CONFIG_WHITEBALCONTROLTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `eWhiteBalControl` is the enumerated valued indicating the type of white balance control used. Table 4-36 details the values that can be selected for white balance control.

Table 4-36: White Balance Control

OMX_WHITEBALCONTROLTYPE Enumerated Value	Description
`OMX_WhiteBalControlOff`	Disables exposure control.
`OMX_WhiteBalControlAuto`	Automatic white balance control. The color temperature of the captured image or video stream is adjusted per frame using a white reference from within each frame.
`OMX_WhiteBalControlSunLight`	Manual white balance control when the sun provides the light source.

OMX_WHITEBALCONTROLTYPE Enumerated Value	Description
OMX_WhiteBalControlCloudy	Manual white balance control when the sun provides the light source through clouds.
OMX_WhiteBalControlShade	Manual white balance control when the light source is the sun and the scene is in the shade.
OMX_WhiteBalControlTungsten	Manual white balance control when the light source is tungsten.
OMX_WhiteBalControlFluorescent	Manual white balance control when the light source is fluorescent.
OMX_WhiteBalControlIncandescent	Manual white balance control when the light source is incandescent.
OMX_WhiteBalControlFlash	Manual white balance control when the light source is a flash.
OMX_WhiteBalControlHorizon	Manual white balance control when the light source is the sun on the horizon.

4.2.21 OMX_CONFIG_EXPOSURECONTROLTYPE

Exposure is used to control the image sensor exposure when capturing images or streaming video.

OMX_CONFIG_EXPOSURECONTROLTYPE is defined as follows.

```
typedef struct OMX_CONFIG_EXPOSURECONTROLTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_EXPOSURECONTROLTYPE eExposureControl;
} OMX_CONFIG_EXPOSURECONTROLTYPE;
```

4.2.21.1 Parameters

The parameters for OMX_CONFIG_EXPOSURECONTROLTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- eExposureControl is an enumerated value that selects the type of exposure used. Table 4-37 details the values that can be selected for exposure.

Table 4-37: Exposure Control

OMX_EXPOSURECONTROLTYPE Enumerated Value	Description
OMX_ExposureControlOff	Disables exposure control
OMX_ExposureControlAuto	Automatic exposure
OMX_ExposureControlNight	Exposure at night

OMX_EXPOSURECONTROLTYPE Enumerated Value	Description
OMX_ExposureControlBackLight	Exposure with backlight illuminating the subject
OMX_ExposureControlSpotlight	Exposure with a spotlight illuminating the subject
OMX_ExposureControlSports	Exposure for sports
OMX_ExposureControlSnow	Exposure for the subject in snow
OMX_ExposureControlBeach	Exposure for the subject at a beach
OMX_ExposureControlLargeAperture	Exposure when using a large aperture on the camera
OMX_ExposureControlSmallApperture	Exposure when using a small aperture on the camera

4.2.22 OMX_CONFIG_CONTRASTTYPE

Contrast controls the relative difference between the pixels. Contrast is applied to image or video data on the specified port.

OMX_CONFIG_CONTRASTTYPE is defined as follows.

```
typedef struct OMX_CONFIG_CONTRASTTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_S32 nContrast;
 } OMX_CONFIG_CONTRASTTYPE;
```

4.2.22.1 Parameters

The parameters for OMX_CONFIG_CONTRASTTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nContrast is the value for contrast. The range of values is -100 to 100. The value 0x0 indicates no contrast change to pixel data.

4.2.23 OMX_CONFIG_BRIGHTNESSTYPE

Brightness controls the luminosity of the pixels in the video or image data. Brightness is applied to the image or video data on the specified port.

OMX_CONFIG_BRIGHTNESSTYPE is defined as follows.

```
typedef struct OMX_CONFIG_BRIGHTNESSTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nBrightness;
} OMX_CONFIG_BRIGHTNESSTYPE;
```

4.2.23.1 Parameters

The parameters for OMX_CONFIG_BRIGHTNESSTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nBrightness is the value for brightness in the range 0% to 100%, where 0% produces all black pixels and 100% produces entirely white.

4.2.24 OMX_CONFIG_BACKLIGHTTYPE

The backlight of a flat panel type of display such as a liquid crystal display (LCD) or a thin film transistor (TFT) panel can be controlled using this configuration setting. The IL client sets the percentage brightness of the backlight and the timeout before the backlight automatically turns off.

OMX_CONFIG_BACKLIGHTTYPE is defined as follows.

```
typedef struct OMX_CONFIG_BACKLIGHTTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nBacklight;
    OMX_U32 nTimeout;
} OMX_CONFIG_BACKLIGHTTYPE;
```

4.2.24.1 Parameters

The parameters for OMX_CONFIG_BACKLIGHTTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nBacklight is a value that represents the backlight brightness. The range of values is 0% to 100%, where 0% is completely off and 100% is full backlight intensity.
- nTimeout is the number of milliseconds before the backlight automatically turns off. A value of 0x0 forces the backlight to remain on.

4.2.25 OMX_CONFIG_GAMMATYPE

Gamma is applied to the image or pixel data on the specified port to correct for the non-linear response to the brightness of pixels on a display relative to the digital value of the pixel. Gamma correction is typically applied when data is captured digitally by a camera source, or when data is shown on a display device such as a panel, CRT, or TV.

OMX_CONFIG_GAMMATYPE is defined as follows.

```
typedef struct OMX_CONFIG_GAMMATYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_S32 nGamma;
} OMX_CONFIG_GAMMATYPE;
```

4.2.25.1 Parameters

The parameters for `OMX_CONFIG_GAMMATYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nGamma` is the display gamma expressed in Q16 format (usually in the 2.0 to 4.0 range). The value 0 is not allowed. The details of how gamma correction is done is implementation-specific.

  In general, an exponential relationship between the input and output pixel intensities is assumed (i.e. Vout = Vin^nGamma) and the gamma correction component is assumed to apply an inverse transfer function (i.e. Vgamma = Vin^(1/nGamma)). It is also assumed that the same nGamma value applies to all three color channels.

4.2.26 OMX_CONFIG_SATURATIONTYPE

Saturation is applied to image or pixel data on the specified port to control the hue intensity.

`OMX_CONFIG_SATURATIONTYPE` is defined as follows.

```
typedef struct OMX_CONFIG_SATURATIONTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_S32 nSaturation;
} OMX_CONFIG_SATURATIONTYPE;
```

4.2.26.1 Parameters

The parameters for `OMX_CONFIG_SATURATIONTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nSaturation` is the value for saturation. The range of values is -100 to 100. The value 0x0 indicates no saturation change to pixel data. A value of -100 produces all black pixels, and a value of 100 produces all white pixels.

4.2.27 OMX_CONFIG_LIGHTNESSTYPE

Lightness is applied to image or pixel data on the specified port to control the non-linear response to the brightness of pixels.

`OMX_CONFIG_LIGHTNESSTYPE` is defined as follows.

```
typedef struct OMX_CONFIG_LIGHTNESSTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_S32 nLightness;
} OMX_CONFIG_LIGHTNESSTYPE;
```

4.2.27.1 Parameters

The parameters for `OMX_CONFIG_LIGHTNESSTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nLightness` is the value for lightness. The range of values is -100 to 100. The value 0x0 indicates no lightness change to pixel data. A value of -100 produces all black pixels, and a value of 100 produces all white pixels.

4.2.28 OMX_CONFIG_PLANEBLENDTYPE

Plane blending is used to blend pixels from multiple sources into a single destination. The plane depth is specified such that planes with lower numbers are on top of planes with higher numbers. The blending of two planes with the same depth is undefined.

OMX_CONFIG_PLANEBLENDTYPE is defined as follows.

```
typedef struct OMX_CONFIG_PLANEBLENDTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nDepth;
    OMX_U32 nAlpha;
} OMX_CONFIG_PLANEBLENDTYPE;
```

4.2.28.1 Parameters

The parameters for OMX_CONFIG_PLANEBLENDTYPE are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nDepth` is the depth of the plane for the port. Lower values indicate higher planes, and higher values indicate lower planes. By default, the depth value is the same as the value of `nPortIndex`. The `nDepth` is only valid when set on an input port and ignored when applied to an output port.
- `nAlpha` indicates the alpha value used when blending planes, if the blending operation uses global alpha. When defined on an input port, the default blending operation is (source_alpha * source_color) + ((1 – source_alpha) * destination_color)), where the source is the plane associated with the config and the destination is the blended result of all lower planes. If `OMX_CONFIG_COLORBLENDTYPE` is defined on the output port, the associated `eColorBlend` variable is used to determine the blending equation. For information on blending operations, see section 4.2.13. If defined on an output port, the `nAlpha` value is written as the per pixel alpha value in the end image (if the output format supports per pixel alpha), after performing the regular alpha calculations from the input ports if defined in combination.

4.2.29 OMX_CONFIG_DITHERTYPE

Dithering is used when performing color format conversion where the source color format has higher precision than the destination color format. Two standard types of dithering are supported: `OMX_DitherOrdered` and `OMX_DitherErrorDiffusion`. `OMX_DitherOther` provides a means for vendor-specific dithering algorithms.

`OMX_CONFIG_DITHERTYPE` is defined as follows.

```
typedef struct OMX_CONFIG_DITHERTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_DITHERTYPE eDither;
 } OMX_CONFIG_DITHERTYPE;
```

4.2.29.1 Parameters

The parameters for `OMX_CONFIG_DITHERTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `eDither` is the type of dithering used when performing color format conversion. Table 4-38 details the values that can be selected for dithering.

Table 4-38: Dithering Values

`OMX_DITHERTYPE` Enumerated Value	**Description**
`OMX_DitherNone`	Disables dithering
`OMX_DitherOrdered`	Enables ordered dithering
`OMX_DitherErrorDiffusion`	Enables error diffusion dithering
`OMX_DitherOther`	Enables a vendor specific dithering algorithm

4.2.30 OMX_CONFIG_EXPOSUREVALUETYPE

Exposure is the amount of light which falls upon the sensor of a digital camera. Shutter speed, sensitivity, and aperature are adjusted to achieve optimal exposure of a scene. Most digital cameras offer a variety of exposure modes, from fully-automatic to semi-automatic to full manual mode.

`OMX_CONFIG_EXPOSUREVALUETYPE` is defined as follows.

```
typedef struct OMX_CONFIG_EXPOSUREVALUETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_METERINGTYPE eMetering;
    OMX_S32 xEVCompensation;
    OMX_U32 nApertureFNumber;
    OMX_BOOL bAutoAperture;
    OMX_U32 nShutterSpeedMsec;
```

```
    OMX_BOOL bAutoShutterSpeed;
    OMX_U32 nSensitivity;
    OMX_BOOL bAutoSensitivity;
} OMX_CONFIG_EXPOSUREVALUETYPE;
```

4.2.30.1 Parameters

The parameters for OMX_CONFIG_EXPOSUREVALUETYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- eMetering is the metering type to be used. Table 4-39 lists the valid metering modes that can be used.

Table 4-39: Metering Modes

OMX_METERINGTYPE Enumerated Value	**Description**
OMX_MeteringModeAverage	Center weight average metering
OMX_MeteringModeSpot	Spot (partial) metering
OMX_MeteringModeMatrix	Matrix or evaluative metering

- xEVCompensation is the Exposure Value compensation defined in Q16 format.
- nApertureFNumber is the aperture f-stop setting defined in Q16 format. A value of 2 implies a "f/2" setting. This setting is only valid for SetConfig if auto aperature mode is not set.
- bAutoAperture is a Boolean value indicating if auto-aperture is to be enabled and applied.
- nShutterSpeedMsec is the shutter speed specified in units of milliseconds. This setting is only valid for SetConfig if auto shutter speed is not set.
- bAutoShutterSpeed is a Boolean value indicating if auto shutter speed is to be enabled and applied.
- nSensitivity is the ISO sensitivity setting. A value of 100 implies a "ISO 100" setting. This setting is only valid for SetConfig if auto sensitivity is not set.
- bAutoSensitivity is a Boolean value indicating if auto sensitivity is to be enabled and applied.

4.2.31 OMX_CONFIG_CAPTUREMODETYPE

Capture mode configuration is used to instruct the camera component how it shall behave during the course of capturing: continous versus frame count limited capturing operations.

OMX_CONFIG_CAPTUREMODETYPE is defined as follows.

```
typedef struct OMX_CONFIG_CAPTUREMODETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
```

```
    OMX_U32 nPortIndex;
    OMX_BOOL bContinuous;
    OMX_BOOL bFrameLimited;
    OMX_U32 nFrameLimit;
 } OMX_CONFIG_CAPTUREMODETYPE;
```

4.2.31.1 Parameters

The parameters for `OMX_CONFIG_CAPTUREMODETYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `bContinuous` is a Boolean used to indicate the frame rate emission. If true then ignore the port frame rate setting and emit captured frame data as quickly as possible otherwise obey the port’s frame rate setting.
- `bFrameLimited` is a Boolean used to indicate if capturing shall be terminated after the specified number of frames if true frame limited capture is enabled; otherwise the port does not terminate capturing until instructed to do so by the client.
- `nFrameLimit` is the limit on number of frames emitted during capturing, this parameter is only valid if `bFrameLimited` is enabled.

4.2.32 OMX_CONFIG_BOOLEANTYPE

The `OMX_CONFIG_BOOLEANTYPE` structure contains generic Boolean configuration information that may be used to set component level configuration settings rather than port level configuration settings.

`OMX_CONFIG_BOOLEANTYPE` is defined as follows.

```
typedef struct OMX_CONFIG_BOOLEANTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_BOOL bEnabled;
} OMX_CONFIG_BOOLEANTYPE;
```

4.2.32.1 Parameters

The parameters for `OMX_CONFIG_BOOLEANTYPE` are defined as follows.

- `bEnabled` is a Boolean used to indicate if a configuration is to be enabled. The configuration setting to be enabled is typically inherent in the name of the configuration or parameter indice used with this structure.

For example, the `OMX_IndexAutoPauseAfterCapture` index will use the `OMX_CONFIG_BOOLEANTYPE` structure to enable or disable the auto pause mechanism after a capture request is completed.

4.2.33 OMX_OTHER_EXTRADATATYPE

The OMX_OTHER_EXTRADATATYPE structure is used to describe the additional buffer payload information included within the buffer. A buffer may contain multiple blocks of extra data and thus multiple instances of this structure.

Each additional EXTRADATATYPE structure shall be required to be 32 bit address aligned, and padding bytes may need to inserted in order to ensure this alignment.

The order of the additional information is not required to be pre-determined since a component is expected to traverse the OMX_OTHER_EXTRADATATYPE structures to determine the additional information of interest.

OMX_OTHER_EXTRADATATYPE is defined as follows.

```
typedef struct OMX_OTHER_EXTRADATATYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_EXTRADATATYPE eType;
    OMX_U32 nDataSize;
    OMX_U8 data[1];
} OMX_OTHER_EXTRADATATYPE;
```

4.2.33.1 Parameters

The parameters for OMX_OTHER_EXTRADATATYPE are defined as follows.

- nSize is the size of the structure including data bytes and any padding necessary to ensure 32bit alignment of the next OMX_OTHER_EXTRADATATYPE structure.
- nPortIndex is the read-only value containing the index of the port.
- eType identifies the extra data payload type.

Table 4-40: Extra Data Payload Type Enumerated values

Enumerated Value	Description
OMX_ExtraDataNone	Indicates that this terminates the list of extra data sections.
OMX_ExtraDataQuantization	Indicates that the data payload contains quantization data.

- nDataSize identifies the size of supporting data in units of bytes. For the OMX_OTHER_EXTRADATATYPE structure that terminates the list of extra data sections, nDataSize will be zero.
- data is an array of one or more bytes of data as indicated by the nDataSize field.

4.2.33.2 Sample code

The following diagram shows the arrangement of extra data sections in a buffer.

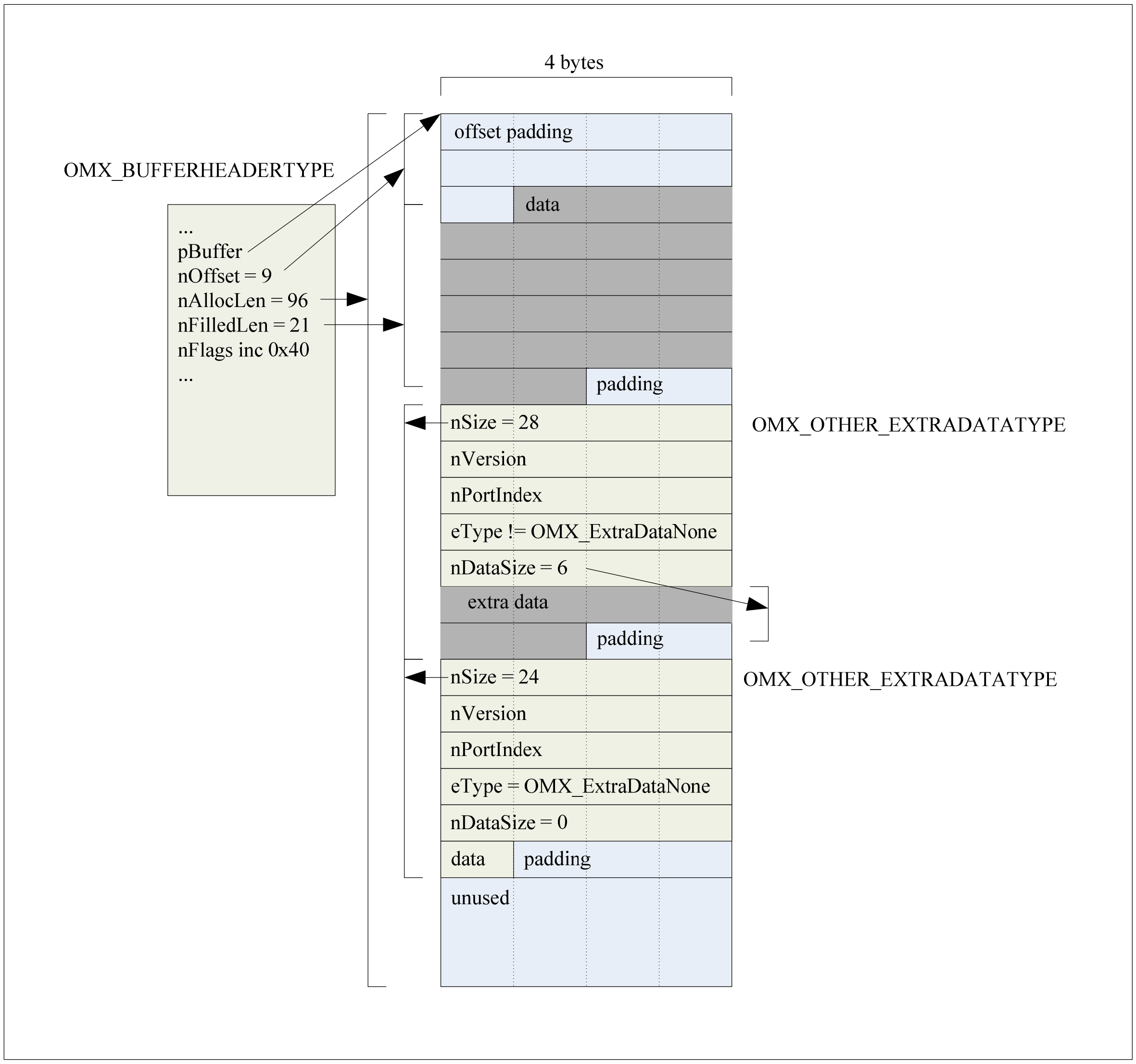


Figure 4-3. Formatting of Extra Buffer Data

The following code sequence shows traversing the list of extra data sections.

```
/* Traverse the list of extra data sections */
  OMX_OTHER_EXTRADATATYPE *pExtra;
  OMX_U8 *pTmp = pBufferHdr->pBuffer + pBufferHdr->nOffset +
pBufferHdr->nFilledLen + 3;

  pExtra = (OMX_OTHER_EXTRADATATYPE *) (((OMX_U32) pTmp) & ~3);

  while(pExtra->eType != OMX_ExtraDataNone)
  {
      pExtra = (OMX_OTHER_EXTRADATATYPE *) (((OMX_U8 *) pExtra) +
pExtra->nSize);
  }
```

4.2.34 OMX_CONFIG_FOCUSREGIONTYPE

OMX_CONFIG_FOCUSREGIONTYPE is used to define the focus region of interest.

The OMX_CONFIG_FOCUSREGIONTYPE can be used with OMX_IMAGE_CONFIG_FOCUSCONTROLTYPE to define the focus control for a specific focus region of interest.

OMX_CONFIG_FOCUSREGIONTYPE is defined as follows.

```
typedef struct OMX_CONFIG_FOCUSREGIONTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bCenter;
    OMX_BOOL bLeft;
    OMX_BOOL bRight;
    OMX_BOOL bTop;
    OMX_BOOL bBottom;
    OMX_BOOL bTopLeft;
    OMX_BOOL bTopRight;
    OMX_BOOL bBottomLeft;
    OMX_BOOL bBottomRight;
} OMX_CONFIG_FOCUSREGIONTYPE;
```

4.2.34.1 Parameters

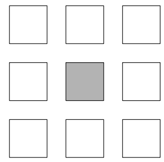
The parameters for OMX_CONFIG_FOCUSREGIONTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- bCenter specifies if the center region is to be used as the region of interest.
- bLeft specifies if the left region is to be used as the region of interest.
- bRight specifies if the right region is to be used as the region of interest.
- bTop specifies if the top region is to be used as the region of interest.
- bBottom specifies if the bottom region is to be used as the region of interest.
- bTopLeft specifies if the top left region is to be used as the region of interest.
- bTopRight specifies if the top right region is to be used as the region of interest.
- bBottomLeft specifies if the bottom left region is to be used as the region of interest.
- bBottomRight specifies if the bottom right region is to be used as the region of interest.

The FocusRegions should be interpreted as a direction. If more than 9 regions are available by the hardware, the regions are mapped on the booleans above by combining regions together according implementation choice. Therefore the IL-client should see the region as a focus direction.

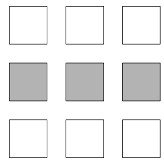
As an example, assume there are 9 focus measurement points, 3 in horizontal and 3 in vertical direction.

Central direction:



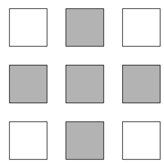
bCenter = true

Horizontal direction:



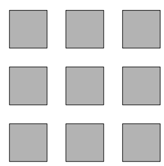
bLeft, bCenter, bRight = true

Horizontal and vertical (cross) direction:



bLeft, bCenter, bRight, bTop, bBottom = true

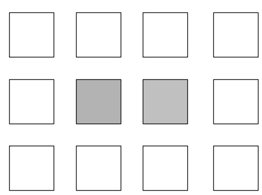
All directions:



All Booleans are true

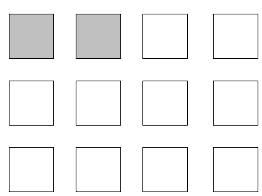
As an example, assume there are 12 focus measurement points, 4 in horizontal and 3 in vertical direction.

Central direction:



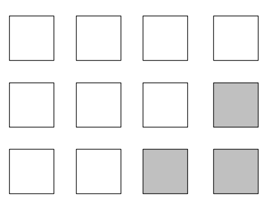
bCenter = true

Top left direction



bTopLeft = true

Right and bottom direction:



bRight, bBottomRight = true

4.2.35 OMX_PARAM_FOCUSSTATUSTYPE

`OMX_PARAM_FOCUSSTATUSTYPE` is used to retrieve the focus status, including detailed information on the region of interest. This structure is used in conjunction with `OMX_CONFIG_FOCUSREGIONTYPE`.

OMX_PARAM_FOCUSSTATUSTYPE is defined as follows.

```
typedef struct OMX_PARAM_FOCUSSTATUSTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_FOCUSSTATUSTYPE eFocusStatus;
    OMX_BOOL bCenterStatus;
    OMX_BOOL bLeftStatus;
    OMX_BOOL bRightStatus;
    OMX_BOOL bTopStatus;
    OMX_BOOL bBottomStatus;
    OMX_BOOL bTopLeftStatus;
    OMX_BOOL bTopRightStatus;
    OMX_BOOL bBottomLeftStatus;
    OMX_BOOL bBottomRightStatus;
} OMX_PARAM_FOCUSSTATUSTYPE;
```

4.2.35.1 Parameters

The parameters for OMX_CONFIG_FOCUSREGIONTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- eFocusStatus specifies the image focus status.

Table 4-41: eFocus Status Types

Focus Status	Focus Status Description
OMX_FocusStatusOff	Focus request is disabled
OMX_FocusStatusRequest	Focus request is currently being processed.
OMX_FocusStatusReached	Focus has been reached.
OMX_FocusStatusUnableToReach	Focus is unreachable, the maximum is too close to the average noise
OMX_FocusStatusLost	Focus has been lost, the main subject has moved in the scene

- bCenterStatus specifies the focus status for the center region of interest.
- bLeftStatus specifies the focus status for the left region of interest.
- bRightStatus specifies the focus status for the right region of interest.
- bTopStatus specifies the focus status for the top region of interest.
- bBottomStatus specifies the focus status for the bottom region of interest
- bTopLeftStatus specifies the focus status for the top left region of interest
- bTopRightStatus specifies the focus status for the top right region of interest
- bBottomLeftStatus specifies the focus status for the bottom left region of interest

- bBottomRightStatus specifies the focus status for the bottom right region of interest

4.2.36 OMX_CONFIG_TRANSITIONEFFECTTYPE

A component may support producing output image or video frames based on two input frames, where the sequence of the output frames forms a transition from one input frame to the next.

OMX_CONFIG_TRANSITIONEFFECTTYPE is defined as follows.

```
typedef struct OMX_CONFIG_TRANSITIONEFFECTTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_TRANSITIONEFFECTTYPE eEffect;
} OMX_CONFIG_TRANSITIONEFFECTTYPE;
```

4.2.36.1 Parameters

The parameters for OMX_CONFIG_TRANSITIONEFFECTTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the output port
- eEffect is the enumerated value indicating the transition effect to be used to generate the output frames.

Table 4-42: eEffect Values

OMX_TRANSITIONEFFECTTYPE value	Transition Description
OMX_EffectNone	Used to disable or cancel the current transition effect.
OMX_EffectFadeFromBlack	Fades from a solid black frame to the desired input frame.
OMX_EffectFadeToBlack	Fades from the desired input frame to a solid black frame.
OMX_EffectUnspecifiedThroughConstantColor	A vendor specific effect from the first input frame to the second using a constant color frame mid transition.
OMX_EffectDissolve	Dissolves from the first input frame to the second.
OMX_EffectWipe	Wipes from the first input frame to the second.

OMX_TRANSITIONEFFECTTYPE value	Transition Description
OMX_EffectUnspecifiedMixOfTwoScenes	A vendor specific effect from the first input frame to the second. If multiple vendor effects are available, a random one may be chosen.

4.3 Video

This section describes the parameter and configuration details for ports in the video domain. These parameter and configuration details are specified in the omx_video.h header.

4.3.1 General Enumerations

The OMX_VIDEO_CODINGTYPE enumeration defines the video coding types supported.. If OMX_VIDEO_CodingUnused is selected, then the coding selection shall be done in a vendor-specific way. Table 4-43 shows the OpenMAX IL-supported video compression formats.

Table 4-43: Supported Video Compression Formats

Field Name	Coding Type Descriptions	References to Standards
OMX_VIDEO_CodingUnused	No coding applied. Use eColorFormat	Not available
OMX_VIDEO_CodingAutoDetect	Auto-detection by the OpenMAX IL component	Not available
OMX_VIDEO_CodingMPEG2	MPEG-2, also known as H.262 video format	MPEG2
OMX_VIDEO_CodingH263	ITU H.263 video format	H263
OMX_VIDEO_CodingMPEG4	MPEG-4 video format	MPEG4
OMX_VIDEO_CodingWMV	All versions of the Windows Media video format	WMV
OMX_VIDEO_CodingRV	All versions of the RealVideo® format	RV
OMX_VIDEO_CodingAVC	ITU H.264/AVC video format	H264
OMX_VIDEO_CodingMJPEG	Motion JPEG video format	MJPEG
OMX_VIDEO_CodingMax	Maximum value	N/A

The OMX_VIDEO_PICTURETYPE enumeration defines the video picture types supported. Table 4-44 describes the supported video picture types.

Table 4-44: Supported Video Picture Types

Field Name	Picture Type Descriptions
OMX_VIDEO_PictureTypeI	General I-frame type
OMX_VIDEO_PictureTypeP	General P-frame type
OMX_VIDEO_PictureTypeB	General B-frame type
OMX_VIDEO_PictureTypeSI	H.263 SI-frame type
OMX_VIDEO_PictureTypeSP	H.263 SP-frame type
OMX_VIDEO_PictureTypeEI	H.264 EI-frame type
OMX_VIDEO_PictureTypeEP	H.264 EP-frame type
OMX_VIDEO_PictureTypeS	MPEG-4 S-frame type
OMX_VIDEO_PictureTypeMax	Maximum value

4.3.2 Parameter and Configuration Indices

The header `OMX_Index.h` contains the enumeration `OMX_INDEXTYPE`, which contains all of the standard index values used with the OpenMAX IL core functions `OMX_GetParameter`, `OMX_SetParameter`, `OMX_GetConfig`, and `OMX_SetConfig`.

The index values that relate to video are described in this section. For example, `OMX_IndexParamVideoPortFormat` index is used with `OMX_GetParameter` and `OMX_SetParameter` to access the `OMX_VIDEO_PARAM_PORTFORMATTYPE`. Table 4-45 identifies the video indices.

Table 4-45: Video Indices

OpenMAX IL Indices (**OMX_Index.h**)	Corresponding OpenMAX IL Video Structures (**OMX_Video.h**)
OMX_IndexParamVideoPortFormat	OMX_VIDEO_PARAM_PORTFORMATTYPE
OMX_IndexParamVideoQuantizationTable	OMX_VIDEO_PARAM_QUANTIZATIONTYPE
OMX_IndexParamVideoFastUpdate	OMX_VIDEO_PARAM_VIDEOFASTUPDATETYPE
OMX_IndexParamVideoBitrate	OMX_VIDEO_PARAM_BITRATETYPE
OMX_IndexParamVideoMotionVector	OMX_VIDEO_PARAM_MOTIONVECTORTYPE
OMX_IndexParamVideoIntraRefresh	OMX_VIDEO_PARAM_INTRAREFRESHTYPE
OMX_IndexParamVideoErrorCorrection	OMX_VIDEO_PARAM_ERRORCORRECTIONTYPE
OMX_IndexParamVideoVBSMC	OMX_VIDEO_PARAM_VBSMCTYPE
OMX_IndexParamVideoMpeg2	OMX_VIDEO_PARAM_MPEG2TYPE
OMX_IndexParamVideoMpeg4	OMX_VIDEO_PARAM_MPEG4TYPE
OMX_IndexParamVideoWmv	OMX_VIDEO_PARAM_WMVTYPE
OMX_IndexParamVideoRv	OMX_VIDEO_PARAM_RVTYPE
OMX_IndexParamVideoAvc	OMX_VIDEO_PARAM_AVCTYPE
OMX_IndexParamVideoH263	OMX_VIDEO_PARAM_H263TYPE

OpenMAX IL Indices (`OMX_Index.h`)	Corresponding OpenMAX IL Video Structures (`OMX_Video.h`)
OMX_IndexParamVideoProfileLevelQuerySupported	OMX_VIDEO_PARAM_PROFILELEVELTYPE
OMX_IndexParamVideoProfileLevelCurrent	OMX_VIDEO_PARAM_PROFILELEVELTYPE
OMX_IndexConfigVideoBitrate	OMX_VIDEO_CONFIG_BITRATETYPE
OMX_IndexConfigVideoFramerate	OMX_CONFIG_FRAMERATETYPE
OMX_IndexConfigVideoIntraVOPRefresh	OMX_CONFIG_INTRAREFRESHVOPTYPE
OMX_IndexConfigVideoIntraMBRefresh	OMX_CONFIG_MACROBLOCKERRORMAPTYPE
OMX_IndexConfigVideoMBErrorReporting	OMX_CONFIG_MBERRORREPORTINGTYPE
OMX_IndexParamVideoMacroblocksPerFrame	OMX_PARAM_MACROBLOCKSTYPE
OMX_IndexConfigVideoMacroBlockErrorMap	OMX_CONFIG_MACROBLOCKERRORMAPTYPE
OMX_IndexParamVideoSliceFMO	OMX_VIDEO_PARAM_AVCSLICEFMO
OMX_IndexConfigVideoAVCIntraPeriod	OMX_VIDEO_CONFIG_AVCINTRAPERIOD
OMX_IndexConfigVideoNalSize	OMX_VIDEO_CONFIG_NALSIZE

4.3.3 Video Use Case Examples

Figure 4-4 depicts one possible set of components as well as the tunneling of ports for

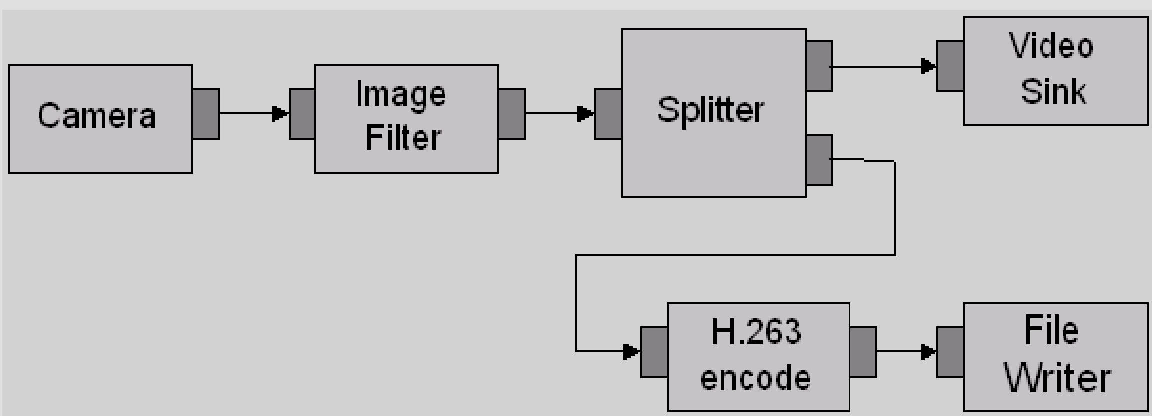


Figure 4-4. H.263 Video Encode Use Case

Figure 4-4 shows six components, namely the camera, the image filter, the splitter, the

Figure 4-5 shows a more complex use case, which is video conferencing. This use case

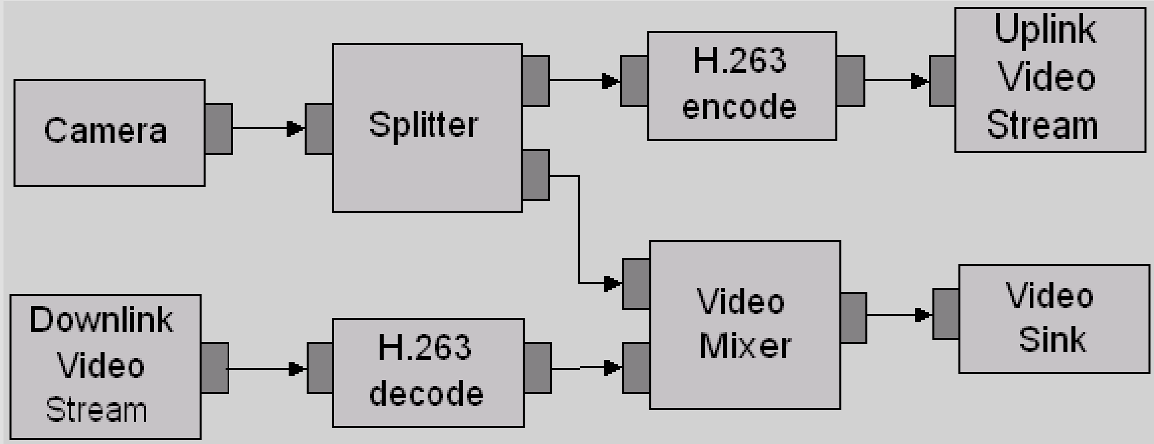


Figure 4-5. Video Conferencing Use Case

Raw video is encoded to H.263 format and then transmitted via a video uplink to the far-side conferencing participant. At the same time, a H.263 video stream is received from the far-side participant via a video downlink and decoded to raw video format before being mixed into a pre-determined presentation layout via the video mixer such that both the local participant's video and far-side participant's video are displayed via the local video sink.

4.3.4 OMX_VIDEO_PORTDEFINITIONTYPE

The PortDefinition structure defines all of the parameters necessary for the compliant component to set up an input or an output video path. If additional information is needed to define the parameters of the port such as frame rate and bit rate, additional structures shall be sent. For example, to change the bit rate, send the `OMX_VIDEO_PARAM_BITRATETYPE` structure to supply the extra parameters for the port. The number of video paths for input and output will vary by the type of the video component.

The `OMX_VIDEO_PORTDEFINITIONTYPE` structure can query the current or default definition of a video port or set the definition of a video port for a component. The `OMX_VIDEO_PORTDEFINITIONTYPE` structure is included as part of the `OMX_PARAM_PORTDEFINITIONTYPE` structure, it is accessed via the `OMX_GetParameter` function or the `OMX_GetParameter` function using the OMX_IndexParamPortDefinition index.

`OMX_VIDEO_PORTDEFINITIONTYPE` is defined as follows.

```
typedef struct OMX_VIDEO_PORTDEFINITIONTYPE {
    OMX_STRING cMIMEType;
    OMX_NATIVE_DEVICETYPE pNativeRender;
    OMX_U32 nFrameWidth;
    OMX_U32 nFrameHeight;
    OMX_S32 nStride;
    OMX_U32 nSliceHeight;
    OMX_U32 nBitrate;
    OMX_U32 xFramerate;
    OMX_BOOL bFlagErrorConcealment;
```

```
    OMX_VIDEO_CODINGTYPE eCompressionFormat;
    OMX_COLOR_FORMATTYPE eColorFormat;
    OMX_NATIVE_WINDOWTYPE pNativeWindow;
} OMX_VIDEO_PORTDEFINITIONTYPE;
```

4.3.4.1 Parameters

The parameters for `OMX_VIDEO_PORTDEFINITIONTYPE` are defined as follows.

- `cMIMEType` is the MIME type of data for the port. If a MIME type string buffer is not supplied this parameter shall be set to NULL.
- `pNativeRender` is a platform specific reference for a render object. When the port is on a display sink component, this field is interpreted as a platform specific native display object when non-NULL. If NULL, the component uses the `pNativeWindow` field.
- `nFrameWidth` is the width of the data in pixels. If the value is 0x0 for an input port, the component will automatically detect and configure the width. For output ports, the width will be detected during `OMX_SetupTunnel`.
- `nFrameHeight` is the height of the data in pixels. If the value is 0x0 for an input port, the component will automatically detect and configure the height. For output ports, the height will be detected during `OMX_SetupTunnel`.
- `nStride` is a read-write field indicating the number of bytes per span of an image, where `nStride` is the amount added to go from span N to span N+1. A negative value for `nStride` indicates that the data is stored bottom-to-top instead of top-to-bottom. The value for `nStride` shall not be 0x0.

  The `nStride` default shall be determined by the component. There are cases however when the default value for `nStride` does not match the stride requirements of a used buffer, or that of a tunneled port.

  Components shall validate the stride parameter when the port is enabled, or when the component is commanded from the loaded state to the idle state. The component may fail the transition if the specified stride is not supported.
- `nSliceHeight` is a read-only field containing the slice height parameter used when processing uncompressed image data. Buffers received on the port shall contain integer multiples of slices. For more information on the minimum buffer payload for uncompressed data, see section 4.2.2.
- `nBitrate` is the bit rate in bits per second of the frame to be used on the port if the data is compressed. The value 0x0 is used if the bit rate is unknown, variable or is not needed.
- `xFramerate` is the frame rate is in frames per second. This value is represented in Q16 format. The frame rate specified is that used on the port if the data is not compressed. The value 0x0 is used to indicate the frame rate is unknown, variable, or is not needed.

- bFlagErrorConcealment is a Boolean value that enables or disables error concealment if it is supported by the port.
- eCompressionFormat is the compression format used on the port. If the coding is being used to specify the ENCODE type, then additional work shall be done to configure the exact flavor of the compression to be used. For decode cases where the user application cannot differentiate between MPEG-4 and H.264 bit streams, the codec is responsible for the compression format. When OMX_VIDEO_CodingUnused is specified, the eColorFormat field is valid. For possible coding types, see Table 4-43.
- eColorFormat is the color format of the data for the port. This field is invalid unless the eCompressionFormat is OMX_VIDEO_CodingUnused. For more information on color format types, see Table 4-35.
- pNativeWindow is a platform specific reference for a windows object when being processed as part of a video sink component, otherwise this field is 0.

4.3.5 OMX_VIDEO_PARAM_PORTFORMATTYPE

OMX_VIDEO_PARAM_PORTFORMATTYPE is the structure for the port format parameter. It enumerates the various data input/output formats supported by the port.

OMX_VIDEO_PARAM_PORTFORMATTYPE can be used with both OMX_GetParameter and OMX_SetParameter. In the OMX_GetParameter case, the caller specifies all fields and the OMX_GetParameter call returns the value of eFormat. The value of nIndex is the range 0 to N-1, where N is the number of formats supported by the port. There is no need for the port to report N, as the caller can determine N by enumerating all the formats supported by the port. Each port shall support at least one format. If there are no more formats, OMX_GetParameter returns OMX_ErrorNoMore (i.e., nIndex is supplied where the value is N or greater). Ports supply formats in order of preference, which means that higher preference formats are provided with lower values of nIndex.

On OMX_SetParameter, the field in nIndex is ignored. If the format is supported, it is set as the format of the port, and the default values for the format are programmed into the port definition type as a side effect. This allows the caller to query the default values for the format without having to know them in advance.

OMX_VIDEO_PARAM_PORTFORMATTYPE is defined as follows.

```
typedef struct OMX_VIDEO_PARAM_PORTFORMATTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nIndex;
    OMX_VIDEO_CODINGTYPE eCompressionFormat;
    OMX_COLOR_FORMATTYPE eColorFormat;
    OMX_U32 xFramerate;
} OMX_VIDEO_PARAM_PORTFORMATTYPE;
```

4.3.5.1 Parameters

The parameters for OMX_VIDEO_PARAM_PORTFORMATTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nIndex indicates the enumeration index for the format from 0x0 to N-1.
- eCompressionFormat is the compression format used on the port. If the coding is being used to specify the ENCODE type, then additional work shall be done to configure the exact flavor of the compression to be used. For decode cases where the user application cannot differentiate between MPEG-4 and H.264 bit streams, the codec is responsible for the compression format. When OMX_VIDEO_CodingUnused is specified, the eColorFormat field is valid. For possible coding types, see Table 4-43.
- eColorFormat is the color format of the data for the port. This field is invalid unless the eCompressionFormat is OMX_VIDEO_CodingUnused. For more information on color format types, see Table 4-31: Uncompressed Data Formats
- xFramerate indicates the desired full frame rate is frames per second. This value is represented in Q16 format

4.3.6 OMX_VIDEO_PARAM_QUANTIZATIONTYPE

Quantization controls the compression used during the discrete cosine transform (DCT) step of video encoding. This generic structure is shared between several video standards. The structure allows independent settings of quantization factors for I, P, and B video frames. The structure is not applicable to variable bit rate encoding or constant rate encoding. Not all video standards support independent settings of quantization factors for different frame types.

OMX_VIDEO_PARAM_QUANTIZATIONTYPE is defined as follows.

```
typedef struct OMX_VIDEO_PARAM_QUANTIZATIONTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nQpI;
    OMX_U32 nQpP;
    OMX_U32 nQpB;
} OMX_VIDEO_PARAM_QUANTIZATIONTYPE;
```

4.3.6.1 Parameters

The parameters for OMX_VIDEO_PARAM_QUANTIZATIONTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nQpI is the quantization parameter for I frames.

- nQpP is the quantization parameter for P frames.
- nQpB is the quantization parameter for bi-directional (B) frames).

4.3.6.2 Dependencies

This parameter is only applicable to certain video encoders, which include MPEG-2 and MPEG-4.

4.3.7 OMX_VIDEO_PARAM_VIDEOFASTUPDATETYPE

Video fast update is a shared parameter between multiple video encoding standards (for example, H.261 and H.263) that specifies fast update parameters for the video encoder.

OMX_VIDEO_PARAM_VIDEOFASTUPDATETYPE is defined as follows.

```
typedef struct OMX_VIDEO_PARAM_VIDEOFASTUPDATETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bEnableVFU;
    OMX_U32 nFirstGOB;
    OMX_U32 nFirstMB;
    OMX_U32 nNumMBs;
} OMX_VIDEO_PARAM_VIDEOFASTUPDATETYPE;
```

4.3.7.1 Parameters

The parameters for OMX_VIDEO_PARAM_VIDEOFASTUPDATETYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- bEnableVFU is a Boolean value that enables or disables video fast update.
- nFirstGOB contains the number of the first row of macroblocks
- nFirstMB is the location of the first macroblock row relative to the first group of blocks (GOB).
- nNumMBs The number of macroblocks to be refreshed from the nFirstGOB and nFirstMB.

4.3.7.2 Dependencies

This parameter is only applicable to certain video encoders, such as H.261 and H.263.

4.3.8 OMX_VIDEO_PARAM_BITRATETYPE

Video encode bit rate control for variable bit rate video encoders is shared between multiple video encode standards, and is specified before starting video encoding.

OMX_VIDEO_PARAM_BITRATETYPE is defined as follows.

```
typedef struct OMX_VIDEO_PARAM_BITRATETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_VIDEO_CONTROLRATETYPE eControlRate;
    OMX_U32 nTargetBitrate;
} OMX_VIDEO_PARAM_BITRATETYPE;
```

4.3.8.1 Parameters

The parameters for `OMX_VIDEO_PARAM_BITRATETYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `eControlRate` is an enumerated value that sets the bit rate control. If enabled, the type of bit rate control is specified as constant, variable, constant with frame skipping, or variable with frame skipping. Table 4-46 enumerates the possible video bit rate control types for `OMX_VIDEO_CONTROLRATETYPE`.

Table 4-46: Supported Video Bit Rate Control Types

Field Name	Bit Rate Control Descriptions
`OMX_Video_ControlRateDisable`	Disable – in this mode the encoder will ignore `nTargetBitrate` setting and use the appropriate Qp (nQpI, nQpP, nQpB) values for encoding
`OMX_Video_ControlRateVariable`	Variable bit rate
`OMX_Video_ControlRateConstant`	Constant bit rate – the encoder can modify the Qp values to meet the `nTargetBitrate` target
`OMX_Video_ControlRateVariableSkipFrames`	Variable bit rate with frame skipping
`OMX_Video_ControlRateConstantSkipFrames`	Constant bit rate with frame skipping – the encoder cannot modify the Qp values to meet the `nTargetBitrate` target. Instead, the encoder can drop frames to achieve `nTargetBitrate`
`OMX_Video_ControlRateMax`	Maximum value

- `nTargetBitrate` is the target bit rate for video encoding in units of bits per second.

4.3.8.2 Dependencies

This parameter is only applicable to certain video encoders. For some video encode standards, the bit rate is specified as part of the standard and is not programmable (i.e., value can only be queried).

4.3.9 OMX_VIDEO_PARAM_MOTIONVECTORTYPE

The motion vector parameters used during video encoding are programmable for certain video standards. These parameters can be shared between multiple video standards algorithms, although certain fields only pertain to particular video standards.

`OMX_VIDEO_PARAM_MOTIONVECTORTYPE` is defined as follows.

```
typedef struct OMX_VIDEO_PARAM_MOTIONVECTORTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_VIDEO_MOTIONVECTORTYPE eAccuracy;
    OMX_BOOL bUnrestrictedMVs;
    OMX_BOOL bFourMV;
    OMX_S32 sXSearchRange;
    OMX_S32 sYSearchRange;
} OMX_VIDEO_PARAM_MOTIONVECTORTYPE;
```

4.3.9.1 Parameters

The parameters for `OMX_VIDEO_PARAM_MOTIONVECTORTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `eAccuracy` is an enumerated value that specifies the pixel accuracy of the motion vector search during video encode. Accuracy is 1, 1/2, 1/4, or 1/8 pixel. The `eAccuracy` setting indicates that all larger value motion vector search ranges are also used (i.e., a value of 1/4 indicates motion vectors are also searched on 1 and 1/2 intervals). Table 4-47 enumerates the possible video motion vector types for `OMX_VIDEO_MOTIONVECTORTYPE`.

Table 4-47: Supported Video Motion Vector Types

Field Name	Motion Vector Descriptions
`OMX_Video_MotionVectorPixel`	Full pixel motion vectors
`OMX_Video_MotionVectorHalfPel`	Half pixel motion vectors
`OMX_Video_MotionVectorQuarterPel`	Quarter pixel motion vectors
`OMX_Video_MotionVectorEighthPel`	Eighth pixel motion vectors
`OMX_Video_MotionVectorMax`	Maximum value

- `bUnrestrictedMVs` is a Boolean value that enables unrestricted motion vectors.
- `bFourMV` is a Boolean value enables using four motion vectors.
- `sXSearchRange` is the search range of the X motion vector in pixels for video encoders where this is programmable. For example, a search range of 4 indicates a ±4 search area both horizontally and vertically.

- sYSearchRange is the search range of the Y motion vector in pixels for video encoders where this is programmable. For example, a search range of 4 indicates a ±4 search area both horizontally and vertically.

4.3.9.2 Dependencies

This parameter is only applicable to certain video encoders, which include MPEG2 and MPEG4.

4.3.10 OMX_VIDEO_PARAM_INTRAREFRESHTYPE

OMX_VIDEO_PARAM_INTRAREFRESHTYPE contains common parameters for controlling the intra-refresh rate for macroblocks during video encoding. Refresh causes macroblocks of a video stream to be regularly encoded as reference macroblocks. This enables a video decoder to eventually reconstruct a good video image from multiple frames when data is lost or corrupted without receiving a new intra-coded frame.

OMX_VIDEO_PARAM_INTRAREFRESHTYPE is defined as follows.

```
typedef struct OMX_VIDEO_PARAM_INTRAREFRESHTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_VIDEO_INTRAREFRESHTYPE eRefreshMode;
    OMX_U32 nAirMBs;
    OMX_U32 nAirRef;
    OMX_U32 nCirMBs;
} OMX_VIDEO_PARAM_INTRAREFRESHTYPE;
```

4.3.10.1 Parameters

The parameters for OMX_VIDEO_PARAM_INTRAREFRESHTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- eRefreshMode is the enumeration for the type of intra-refresh mode. Table 4-48 shows the possible values for OMX_VIDEO_INTRAREFRESHTYPE.

Table 4-48: Supported Video Intra-Refresh Types

Field Name	Intra-Refresh Descriptions
OMX_VIDEO_IntraRefreshCyclic	Cyclic intra-refresh
OMX_VIDEO_IntraRefreshAdaptive	Adaptive intra-refresh
OMX_VIDEO_IntraRefreshBoth	Cyclic and Adaptive intra-refresh
OMX_VIDEO_IntraRefreshMax	Maximum value

- nAirMBs is the minimum number of macroblocks to refresh in a frame when adaptive intra-refresh (AIR) is enabled.

- `nAirRef` is the number of times a motion marked macroblock has to be intra-coded.
- `nCirMBs` is the number of consecutive macroblocks to be coded as intra when cyclic intra-refresh (CIR) is enabled.

4.3.10.2 Dependencies

This parameter is only applicable to certain video encoders, which includes MPEG4.

4.3.11 OMX_VIDEO_PARAM_ERRORCORRECTIONTYPE

`OMX_VIDEO_PARAM_ERRORCORRECTIONTYPE` contains common video encoding standard parameters for handling error correction during video encoding.

`OMX_VIDEO_PARAM_ERRORCORRECTIONTYPE` is defined as follows.

```
typedef struct OMX_VIDEO_PARAM_ERRORCORRECTIONTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bEnableHEC;
    OMX_BOOL bEnableResync;
    OMX_U32  nResynchMarkerSpacing;
    OMX_BOOL bEnableDataPartitioning;
    OMX_BOOL bEnableRVLC;
} OMX_VIDEO_PARAM_ERRORCORRECTIONTYPE;
```

4.3.11.1 Parameters

The parameters for `OMX_VIDEO_PARAM_ERRORCORRECTIONTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `bEnableHEC` is a Boolean value that enables or disables header extension codes.
- `bEnableResync` is a Boolean value that enables or disables resynchronization markers.
- `nResynchMarkerSpacing` is the resynchronization marker interval in bits applied to the stream.
- `bEnableDataPartitioning` is a Boolean value that enables or disables data partitioning.
- `bEnableRVLC` is a Boolean value that enables or disables reversible variable-length coding.

4.3.11.2 Dependencies

This parameter is only applicable to certain video encoders, which includes MPEG4.

4.3.12 OMX_VIDEO_PARAM_VBSMCTYPE

OMX_VIDEO_PARAM_VBSMCTYPE contains common video encoding standard parameters for selecting variable block size motion compensation during video encoding.

OMX_VIDEO_PARAM_VBSMCTYPE is defined as follows.

```
typedef struct OMX_VIDEO_PARAM_VBSMCTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL b16x16;
    OMX_BOOL b16x8;
    OMX_BOOL b8x16;
    OMX_BOOL b8x8;
    OMX_BOOL b8x4;
    OMX_BOOL b4x8;
    OMX_BOOL b4x4;
} OMX_VIDEO_PARAM_VBSMCTYPE;
```

4.3.12.1 Parameters

The parameters for OMX_VIDEO_PARAM_VBSMCTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- b16x16 is a Boolean value that enables or disables inter-block search in a 16 by 16 region of pixels
- b16x8 is a Boolean value that enables or disables inter-block search in a 16 by 8 region of pixels
- b8x16 is a Boolean value that enables or disables inter-block search in a 8 by 16 region of pixels
- b8x8 is a Boolean value that enables or disables inter-block search in a 8 by 8 region of pixels
- b8x4 is a Boolean value that enables or disables inter-block search in a 8 by 4 region of pixels
- b4x8 is a Boolean value that enables or disables inter-block search in a 4 by 8 region of pixels
- b4x4 is a Boolean value that enables or disables inter-block search in a 4 by 4 region of pixels

4.3.12.2 Dependencies

This parameter is only applicable to certain video encoders, which include MPEG4 and other derivations of MPEG4.

4.3.13 OMX_VIDEO_PARAM_H263TYPE

H.263 is a video standard defined by the ITU. Parameters for this video standard are controlled using the OMX_VIDEO_PARAM_H263TYPE structure.

OMX_VIDEO_PARAM_H263TYPE is defined as follows.

```
typedef struct OMX_VIDEO_PARAM_H263TYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nPFrames;
    OMX_U32 nBFrames;
    OMX_VIDEO_H263PROFILETYPE eProfile;
    OMX_VIDEO_H263LEVELTYPE eLevel;
    OMX_BOOL bPLUSPTYPEAllowed;
    OMX_U32 nAllowedPictureTypes;
    OMX_BOOL bForceRoundingTypeToZero;
    OMX_U32 nPictureHeaderRepetition;
    OMX_U32 nGOBHeaderInterval;
} OMX_VIDEO_PARAM_H263TYPE;
```

4.3.13.1 Parameters

The parameters for OMX_VIDEO_PARAM_H263TYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nPFrames is the number of P frames between I frames.
- nBFrames is the number of B frames between I frames.
- eProfile is the profile type supported for encoding and decoding H.263 content. Table 4-49 shows the possible H.263 video profile types for OMX_VIDEO_H263PROFILETYPE.

Table 4-49: Supported H.263 Profile Types

Field Name	H.263 Profile Descriptions
OMX_VIDEO_H263ProfileBaseline	H.263 Baseline Profile: H.263 (V1), no optional modes
OMX_VIDEO_H263ProfileH320Coding	H.263 Coding Efficiency (H.320) Backward Compatibility Profile: H.263+ (V2), includes annexes I, J, L.4, and T
OMX_VIDEO_H263ProfileBackwardCompatible	H.263 BackwardCompatible: Backward Compatibility Profile: H.263 (V1), includes annex F
OMX_VIDEO_H263ProfileISWV2	H.263 Interactive Streaming Wireless Profile: H.263+ (V2), includes annexes I, J, K, and T
OMX_VIDEO_H263ProfileISWV3	H.263 Interactive Streaming Wireless Profile: H.263++ (V3), includes profile 3 and annexes V and W.6.3.8

Field Name	H.263 Profile Descriptions
OMX_VIDEO_H263ProfileHigh Compression	H.263 Conversational High Compression Profile: H.263++ (V3), includes profiles 1 and 2 and annexes D and U
OMX_VIDEO_H263ProfileInternet	H.263 Conversational Internet Profile: H.263++ (V3), includes profile 5 and annex K
OMX_VIDEO_H263ProfileInterlace	H.263 Conversational Interlace Profile: H.263++ (V3), includes profile 5 and annex W.6.3.11
OMX_VIDEO_H263ProfileHighLatency	H.263 High Latency Profile: H.263++ (V3), includes profile 6 and annexes O.1 and P.5
OMX_VIDEO_H263ProfileMax	Maximum value

- `eLevel` is the maximum processing level that an encoder or decoder supports for a particular profile. Table 4-50 shows the possible H.263 video level types.

Table 4-50: Supported H.263 Level Types

Field Name	H.263 Level Descriptions
OMX_VIDEO_H263Level10	H.263 level 10
OMX_VIDEO_H263Level20	H.263 level 20
OMX_VIDEO_H263Level30	H.263 level 30
OMX_VIDEO_H263Level40	H.263 level 40
OMX_VIDEO_H263Level45	H.263 level 45
OMX_VIDEO_H263Level50	H.263 level 50
OMX_VIDEO_H263Level60	H.263 level 60
OMX_VIDEO_H263Level70	H.263 level 70
OMX_VIDEO_H263LevelMax	Maximum value

- `bPLUSPTYPEAllowed` is a Boolean value that enables or disables indication of whether PLUSPTYPE (specified in the 1998 version of H.263) is allowed. This applies to custom picture sizes or clock frequencies.
- `nAllowedPictureTypes` determines whether picture types are allowed in the bit stream. For more information on picture types, see Table 4-44.
- `bForceRoundingTypeToZero` determines whether the value of the RTYPE bit (bit 6 of MPPTYPE) is not constrained. Change the value of the RTYPE bit for each reference picture in error-free communication.
- `nPictureHeaderRepetition` is the frequency of picture header repetition.
- `nGOBHeaderInterval` is the interval of non-empty GOB headers in units of GOBs. A value of zero for this parameter indicates that all GOB headers will be empty.

4.3.13.2 Dependencies

This parameter is only applicable when the port is configured for H.263.

4.3.14 OMX_VIDEO_PARAM_MPEG2TYPE

OMX_VIDEO_PARAM_MPEG2TYPE contains MPEG2 video parameters for controlling MPEG2 video encode.

OMX_VIDEO_PARAM_MPEG2TYPE is defined as follows.

```
typedef struct OMX_VIDEO_PARAM_MPEG2TYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nPFrames;
    OMX_U32 nBFrames;
    OMX_VIDEO_MPEG2PROFILETYPE eProfile;
    OMX_VIDEO_MPEG2LEVELTYPE eLevel;
} OMX_VIDEO_PARAM_MPEG2TYPE;
```

4.3.14.1 Parameters

The parameters for OMX_VIDEO_PARAM_MPEG2TYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nPFrames is the number of P frames between I frames.
- nBFrames is the number of B frames between I frames.
- eProfile is the maximum processing level that an encoder or decoder supports for a particular profile. Table 4-51 shows the possible MPEG-2 video profile types in OMX_VIDEO_MPEG2PROFILETYPE.

Table 4-51: Supported MPEG-2 Profile Types

Field Name	MPEG-2 Profile Descriptions
OMX_VIDEO_MPEG2ProfileSimple	Simple profile
OMX_VIDEO_MPEG2ProfileMain	Main profile
OMX_VIDEO_MPEG2Profile422	4:2:2 profile
OMX_VIDEO_MPEG2ProfileSNR	SNR profile
OMX_VIDEO_MPEG2ProfileSpatial	Spatial profile
OMX_VIDEO_MPEG2ProfileHigh	High profile
OMX_VIDEO_MPEG2ProfileMax	Maximum value

- eLevel is the maximum processing level that an MPEG-2 encoder or decoder supports for a particular profile. Table 4-52 shows the possible MPEG-2 video level types in OMX_VIDEO_MPEG2LEVELTYPE.

Table 4-52: Supported MPEG-2 Level Types

Field Name	MPEG-2 Level Descriptions
OMX_VIDEO_MPEG2LevelLL	Low level
OMX_VIDEO_MPEG2LevelML	Main level
OMX_VIDEO_MPEG2LevelH14	High 1440 level
OMX_VIDEO_MPEG2LevelHL	High level
OMX_VIDEO_MPEG2LevelMax	Maximum level

4.3.14.2 Dependencies

This parameter is only applicable when the port is configured for MPEG-2.

4.3.15 OMX_VIDEO_PARAM_MPEG4TYPE

OMX_VIDEO_PARAM_MPEG4TYPE contains the MPEG-4 video parameters for controlling MPEG-4 video encoding and decoding.

OMX_VIDEO_PARAM_MPEG4TYPE is defined as follows.

```
typedef struct OMX_VIDEO_PARAM_MPEG4TYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nSliceHeaderSpacing;
    OMX_BOOL bSVH;
    OMX_BOOL bGov;
    OMX_U32 nPFrames;
    OMX_U32 nBFrames;
    OMX_U32 nIDCVLCThreshold;
    OMX_BOOL bACPred;
    OMX_U32 nMaxPacketSize;
    OMX_U32 nTimeIncRes;
    OMX_VIDEO_MPEG4PROFILETYPE eProfile;
    OMX_VIDEO_MPEG4LEVELTYPE eLevel;
    OMX_U32 nAllowedPictureTypes;
    OMX_U32 nHeaderExtension;
    OMX_BOOL bReversibleVLC;
} OMX_VIDEO_PARAM_MPEG4TYPE;
```

4.3.15.1 Parameters

The parameters for OMX_VIDEO_PARAM_MPEG4TYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nSliceHeaderSpacing is the number of macroblocks in a slice (H263+ Annex K). This value shall be zero if not used.
- bSVH is a Boolean value that enables or disables short header mode.

- `bGov` is a Boolean value that enables or disables group of VOP (GOV), where VOP is the abbreviation for video object planes.
- `nPFrames` is the number of P frames between I frames.
- `nBFrames` is the number of B frames between I frames.
- `nIDCVLCThreshold` is the value of the intra-DC variable-length coding (VLC) threshold.
- `bACPred` is the Boolean value that enables or disables AC prediction.
- `nMaxPacketSize` is the maximum size of the packet in bytes.
- `nTimeIncRes` is the VOP time increment resolution for MPEG-4. This value is interpreted as described in the MPEG-4 standard.
- `eProfile` is the profile used for MPEG-4 encoding or decoding. Table 4-53 shows the possible MPEG-4 video profile types in `OMX_VIDEO_MPEG4PROFILETYPE`.

Table 4-53: Supported MPEG-4 Profile Types

Field Name	MPEG-4 Profile Descriptions
`OMX_VIDEO_MPEG4ProfileSimple`	MPEG-4 Simple Profile, Levels 1-3
`OMX_VIDEO_MPEG4ProfileSimpleScalable`	MPEG-4 Simple Scalable Profile, Levels 1-2
`OMX_VIDEO_MPEG4ProfileCore`	MPEG-4 Core Profile, Levels 1-2
`OMX_VIDEO_MPEG4ProfileMain`	MPEG-4 Main Profile, Levels 2-4
`OMX_VIDEO_MPEG4ProfileNbit`	MPEG-4 N-bit Profile, Level 2
`OMX_VIDEO_MPEG4ProfileScalableTexture`	MPEG-4 Scalable Texture Profile, Level 1
`OMX_VIDEO_MPEG4ProfileSimpleFace`	MPEG-4 Simple Face Animation Profile, Levels 1-2
`OMX_VIDEO_MPEG4ProfileSimpleFBA`	MPEG-4 Simple Face and Body Animation (FBA) Profile, , Levels 1-2
`OMX_VIDEO_MPEG4ProfileBasicAnimated`	MPEG-4 Basic Animated Texture Profile, Levels 1-2
`OMX_VIDEO_MPEG4ProfileHybrid`	MPEG-4 Hybrid Profile, Levels 1-2
`OMX_VIDEO_MPEG4ProfileAdvancedRealTime`	MPEG-4 Advanced Real Time Simple Profiles, Levels 1-4
`OMX_VIDEO_MPEG4ProfileCoreScalable`	MPEG-4 Core Scalable Profile, Levels 1-3
`OMX_VIDEO_MPEG4ProfileAdvancedCoding`	MPEG-4 Advanced Coding Efficiency Profile, Levels 1-4
`OMX_VIDEO_MPEG4ProfileAdvancedCore`	MPEG-4 Advanced Core Profile, Levels 1-2

Field Name	MPEG-4 Profile Descriptions
OMX_VIDEO_MPEG4ProfileAdvancedScalable	MPEG-4 Advanced Scalable Texture, Levels 2-3
OMX_VIDEO_MPEG4ProfileAdvancedSimple	MPEG-4 Advanced Simple Profile
OMX_VIDEO_MPEG4ProfileMax	Maximum value

- eLevel is the maximum processing level that an encoder or decoder supports for a particular MPEG-4 profile. Table 4-54 shows the possible MPEG-4 video level types in OMX_VIDEO_MPEG4LEVELTYPE.

Table 4-54: Supported MPEG-4 Level Types

Field Name	MPEG-4 Level Descriptions
OMX_VIDEO_MPEG4Level0	Level 0
OMX_VIDEO_MPEG4Level0b	Level 0b
OMX_VIDEO_MPEG4Level1	Level 1
OMX_VIDEO_MPEG4Level2	Level 2
OMX_VIDEO_MPEG4Level3	Level 3
OMX_VIDEO_MPEG4Level4	Level 4
OMX_VIDEO_MPEG4Level4a	Level 4a
OMX_VIDEO_MPEG4Level5	Level 5
OMX_VIDEO_MPEG4LevelMax	Max level

- nAllowedPictureTypes identifies the picture types allowed in the bit stream. For more information on picture types, see Table 4-44: Supported Video Picture Types.
- nHeaderExtension specifies the number of consecutive video packets between header extension codes (conversely, insert a header extension code every nHeaderExtension number of packets).
- bReversibleVLC is a Boolean value that enables or disables the use of reversible variable-length coding

4.3.15.2 Dependencies

This parameter is only applicable when the port is configured for MPEG-4.

4.3.16 OMX_VIDEO_PARAM_WMVTYPE

OMX_VIDEO_PARAM_WMVTYPE contains common standard video decoder parameters that control Windows Media formats, including WMV7, WMV8, and WMV9.

OMX_VIDEO_PARAM_WMVTYPE is defined as follows.

```
typedef struct OMX_VIDEO_PARAM_WMVTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
```

```
    OMX_U32 nPortIndex;
    OMX_VIDEO_WMVFORMATTYPE eFormat;
} OMX_VIDEO_PARAM_WMVTYPE;
```

4.3.16.1 Parameters

The parameters for OMX_VIDEO_PARAM_WMVTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- eFormat is the enumerated format of the data stream. Table 4-55 shows the possible Windows Media video format types for OMX_VIDEO_WMVFORMATTYPE.

Table 4-55: Supported Windows Media Video Format Types

Field Name	Windows Media Video Format Descriptions
OMX_VIDEO_WMVFormatUnused	Format unused or unknown
OMX_VIDEO_WMVFormat7	Windows Media video format 7
OMX_VIDEO_WMVFormat8	Windows Media video format 8
OMX_VIDEO_WMVFormat9	Windows Media video format 9
OMX_VIDEO_WMVFormatMax	Maximum level

4.3.16.2 Dependencies

This parameter is only applicable when the port is configured for Windows Media video.

4.3.17 OMX_VIDEO_PARAM_RVTYPE

OMX_VIDEO_PARAM_RVTYPE contains common standard video decoder parameters that control RealVideo formats, including RealVideo 8 and RealVideo 9.

OMX_VIDEO_PARAM_RVTYPE is defined as follows.

```
typedef struct OMX_VIDEO_PARAM_RVTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_VIDEO_RVFORMATTYPE eFormat;
    OMX_U16 nBitsPerPixel;
    OMX_U16 nPaddedWidth;
    OMX_U16 nPaddedHeight;
    OMX_U32 nFrameRate;
    OMX_U32 nBitstreamFlags;
    OMX_U32 nBitstreamVersion;
    OMX_U32 nMaxEncodeFrameSize;
    OMX_BOOL bEnablePostFilter;
```

```
    OMX_BOOL bEnableTemporalInterpolation;
    OMX_BOOL bEnableLatencyMode;
} OMX_VIDEO_PARAM_RVTYPE;
```

4.3.17.1 Parameters

The parameters for `OMX_VIDEO_PARAM_RVTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `eFormat` is the video format. Table 4-56 shows the possible RealVideo video format types in `OMX_VIDEO_RVFORMATTYPE`.

Table 4-56: Supported RealVideo Format Types

Field Name	RV Format Descriptions
OMX_VIDEO_RVFormatUnused	Format unused or unknown
OMX_VIDEO_RVFormat8	RealVideo 8 format
OMX_VIDEO_RVFormat9	RealVideo 9 format
OMX_VIDEO_RVFormatG2	RealVideo G2 format

- `nBitsPerPixel` is the number of bits per pixel coded in the frame.
- `nPaddedWidth` is the padded width in pixels of a video frame.
- `nPaddedWidth` is the padded width in pixels of a video frame.
- `nFrameRate` is the rate of the video in frames per second as a 32-bit fixed point value in which the upper 16 bits are the integer part and the lower 16 bits are the fractional part.
- `nBitstreamFlags` is a 32 bit integer containing flags which provide internal information about the bitstream to the codec. These will be interpreted differently depending on the bitstream format and version.
- `nBitstreamVersion` is a 32 bit integer containing the bitstream version.
- `nMaxEncodeFrameSize` is the size in bytes of the largest encoded frame (defined only for OMX_VIDEO_RVFormat9).
- `bEnablePostFilter` is a Boolean value that enables or disables the post filter.
- `bEnableTemporalInterpolation` a Boolean value that enables or disables the temporal interpolation.
- `bEnableLatencyMode` is a Boolean value that enables or disables the decoder from displaying a decoded frame until it has detected that no enhancement layer frames or dependent B frames will be coming. This detection usually occurs when a subsequent non-B frame is encountered.

4.3.17.2 Dependencies

This parameter is only applicable when the port is configured for RealVideo.

4.3.18 OMX_VIDEO_PARAM_AVCTYPE

MPEG4 P10 Advanced Video Coding (AVC) is commonly referred to as H.264 which is a video standard defined by the Joint Video Team (JVT). Parameters for this video standard are controlled using the `OMX_VIDEO_PARAM_AVCTYPE` structure.

`OMX_VIDEO_PARAM_AVCTYPE` is defined as follows.

```
typedef struct OMX_VIDEO_PARAM_AVCTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nSliceHeaderSpacing;
    OMX_U32 nPFrames;
    OMX_U32 nBFrames;
    OMX_BOOL bUseHadamard;
    OMX_U32 nRefFrames;
    OMX_U32 nRefIdx10ActiveMinus1;
    OMX_U32 nRefIdx11ActiveMinus1;
    OMX_BOOL bEnableUEP;
    OMX_BOOL bEnableFMO;
    OMX_BOOL bEnableASO;
    OMX_BOOL bEnableRS;
    OMX_VIDEO_AVCPROFILETYPE eProfile;
    OMX_VIDEO_AVCLEVELTYPE eLevel;
    OMX_U32 nAllowedPictureTypes;
    OMX_BOOL bFrameMBsOnly;
    OMX_BOOL bMBAFF;
    OMX_BOOL bEntropyCodingCABAC;
    OMX_BOOL bWeightedPPrediction;
    OMX_U32 nWeightedBipredicitonMode;
    OMX_BOOL bconstIpred ;
    OMX_BOOL bDirect8x8Inference;
    OMX_BOOL bDirectSpatialTemporal;
    OMX_U32 nCabacInitIdc;
    OMX_VIDEO_AVCLOOPFILTERTYPE eLoopFilterMode;

} OMX_VIDEO_PARAM_AVCTYPE;
```

4.3.18.1 Parameters

The parameters for `OMX_VIDEO_PARAM_AVCTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nSliceHeaderSpacing` is the number of macroblocks in a slice. This value is set to 0x0 when not used.
- `nPFrames` is the number of P frames between I frames.
- `nBFrames` is the number of B frames between I frames.

- `bUseHadamard` is a Boolean value that enables or disables the Hadamard transform.
- `nRefFrames` is the number of reference frames in the range 1 to 16 that are used for inter-motion search.
- `nRefIdx10ActiveMinus1` is the picture parameter set reference frame index, which is the index into the reference frame buffer of the trailing frames list. This value supports B frames.
- `nRefIdx11ActiveMinus1` is the picture parameter set reference frame index, which is the index into the reference frame buffer of the forward frames list. This value supports B frames.
- `bEnableUEP` is a Boolean value that enables or disables unequal error protection. This parameter is only applicable if data partitioning is enabled.
- `bEnableFMO` is a Boolean value that enables or disables flexible macroblock ordering.
- `bEnableASO` is a Boolean value that enables or disables for arbitrary slice ordering.
- `bEnableRS` is a Boolean value enables or disables sending redundant slices.
- `eProfile` is the profile used for the types of AVC encoding or decoding that are supported. Table 4-57 shows the possible AVC video profile types in `OMX_VIDEO_AVCPROFILETYPE`.

Table 4-57: Supported AVC Profile Types

Field Name	AVC Profile Descriptions
`OMX_VIDEO_AVCProfileBaseline`	Baseline profile
`OMX_VIDEO_AVCProfileMain`	Main profile
`OMX_VIDEO_AVCProfileExtended`	Extended profile
`OMX_VIDEO_AVCProfileHigh`	High profile
`OMX_VIDEO_AVCProfileHigh10`	High 10 profile
`OMX_VIDEO_AVCProfileHigh422`	High 4:2:2 profile
`OMX_VIDEO_AVCProfileHigh444`	High 4:4:4 profile
`OMX_VIDEO_AVCProfileMax`	Maximum value

- `eLevel` is the maximum processing level that an AVC encoder or decoder supports for a particular profile. Table 4-58 shows the possible AVC video level types in `OMX_VIDEO_AVCLEVELTYPE`.

Table 4-58: Supported AVC Level Types

Field Name	AVC Level Descriptions
`OMX_VIDEO_AVCLevel1`	AVC level 1
`OMX_VIDEO_AVCLevel1b`	AVC level 1b

Field Name	AVC Level Descriptions
OMX_VIDEO_AVCLevel11	AVC level 1.1
OMX_VIDEO_AVCLevel12	AVC level 1.2
OMX_VIDEO_AVCLevel13	AVC level 1.3
OMX_VIDEO_AVCLevel2	AVC level 2
OMX_VIDEO_AVCLevel21	AVC level 2.1
OMX_VIDEO_AVCLevel22	AVC level 2.2
OMX_VIDEO_AVCLevel3	AVC level 3
OMX_VIDEO_AVCLevel31	AVC level 3.1
OMX_VIDEO_AVCLevel32	AVC level 3.2
OMX_VIDEO_AVCLevel4	AVC level 4
OMX_VIDEO_AVCLevel41	AVC level 14.1
OMX_VIDEO_AVCLevel42	AVC level 4.2
OMX_VIDEO_AVCLevel5	AVC level 5
OMX_VIDEO_AVCLevel51	AVC level 5.1
OMX_VIDEO_AVCLevelMax	Maximum value

- `nAllowedPictureTypes` identifies the allowed picture types in the bit stream.
- `bFrameMBsOnly` is a Boolean value indicating that every coded picture of the coded video sequence is a coded frame containing only frame macroblocks.
- `bMBAFF` is a Boolean value that enables or disables macroblock adaptive frame and field (MBAFF) support within a picture.
- `bEntropyCodingCABAC` is a Boolean value that enables or disables the entropy decoding method.
- `bWeightedPPrediction` is a Boolean value that enables or disables weighted prediction applied to P and SP slices.
- `nWeightedBipredicitonMode` is the default weighted prediction applied to B slices.
- `bconstIpred` is a Boolean value that enables or disables intra-prediction.
- `bDirect8x8Inference` specifies the method used in the derivation process for luma motion vectors for `B_Skip`, `B_Direct_16x16`, and `B_Direct_8x8` as specified in subclause 8.4.1.2 of the AVC spec.
- `bDirectSpatialTemporal` is a flag that indicates the spatial or temporal direct mode used in B-slice coding, which is related to `bDirect8x8Inference` . Spatial direct mode is the default.
- `nCabacInitIdx` is the index used to initialize Context-based Adaptive Binary Arithmetic Coding (CABAC) contexts.

- `eLoopFilterMode` enables or disables the AVC loop filter. Table 4-59 shows the possible AVC video coding loop filter types in `OMX_VIDEO_AVCLOOPFILTERTYPE`.

Table 4-59: Supported AVC Loop Filter Types

Field Name	AVC Loop Filter Level Descriptions
OMX_VIDEO_AVCLoopFilterEnable	Enables AVC loop filter
OMX_VIDEO_AVCLoopFilterDisable	Disables AVC loop filter
OMX_VIDEO_AVCLoopFilterDisableSliceBoundary	Disables AVC loop filter on slice boundary
OMX_VIDEO_AVCLevelMax	Maximum level

4.3.18.2 Dependencies

This parameter is only applicable when the port is configured for AVC.

4.3.19 OMX_VIDEO_CONFIG_BITRATETYPE

The video encoder's bit rate setting may be updated while the video encoder is actively encoding, the `OMX_VIDEO_CONFIG_BITRATETYPE` structure contains the parameters for updating the video bit rate.

`OMX_VIDEO_CONFIG_BITRATETYPE` is defined as follows.

```
typedef struct OMX_VIDEO_CONFIG_BITRATETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nEncodeBitrate;
} OMX_VIDEO_CONFIG_BITRATETYPE;
```

4.3.19.1 Parameters

The parameters for `OMX_VIDEO_CONFIG_BITRATETYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nEncodeBitrate` is the target bit rate for the video encoding in units of bits per sencond.

4.3.20 OMX_CONFIG_FRAMERATETYPE

The video encoder's frame rate setting may be updated while the video encoder is actively encoding, the `OMX_CONFIG_FRAMERATETYPE` structure contains the parameters for updating the video frame rate.

`OMX_CONFIG_FRAMERATETYPE` is defined as follows.

```
typedef struct OMX_CONFIG_FRAMERATETYPE {
    OMX_U32 nSize;
```

```
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 xEncodeFramerate;
} OMX_CONFIG_FRAMERATETYPE;
```

4.3.20.1 Parameters

The parameters for OMX_CONFIG_FRAMERATETYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- xEncodeFramerate is the frame rate for the video encoding in units of frames per second. This value is represented in Q16 format

4.3.21 OMX_CONFIG_INTRAREFRESHVOPTYPE

The OMX_CONFIG_INTRAREFRESHVOPTYPE structure is used to force the next video frame to be encoded as an I-VOP.

OMX_CONFIG_INTRAREFRESHVOPTYPE is defined as follows.

```
typedef struct OMX_CONFIG_INTRAREFRESHVOPTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL IntraRefreshVOP;
} OMX_CONFIG_INTRAREFRESHVOPTYPE;
```

4.3.21.1 Parameters

The parameters for OMX_CONFIG_INTRAREFRESHVOPTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- IntraRefreshVOP is a Boolean value used to indicate if the next frame is to be encoded as an I VOP.

4.3.22 OMX_CONFIG_MACROBLOCKERRORMAPTYPE

The OMX_CONFIG_MACROBLOCKERRORMAPTYPE structure is used to force some of all of the macroblocks within the next video frame to be encoded as Intra macroblocks.

Typically the map of the macroblocks requested to be refreshed as intra macroblocks correlates to macroblock decoding errors encountered during a video telephony use case on the remote device.

OMX_CONFIG_MACROBLOCKERRORMAPTYPE is defined as follows.

```
typedef struct OMX_CONFIG_MACROBLOCKERRORMAPTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
```

```
    OMX_U32 nErrMapSize;
    OMX_U8 ErrMap[1];
} OMX_CONFIG_MACROBLOCKERRORMAPTYPE;
```

4.3.22.1 Parameters

The parameters for `OMX_CONFIG_MACROBLOCKERRORMAPTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nErrMapSize` is the size of the macroblock map containing the refresh information, this parameter is specified in units of bytes.
- `ErrMap` contains the map of the macroblocks within the frame that are to be refreshed as intra macroblocks. The array contains one or more bytes as indicated by the `nErrMapSize` field

  The format of the macroblock map is a bit mapped string of values that corresponds to each macroblock within the video frame, when the bit value is set it indicates that the corresponding macroblock is to be refreshed as an intra macroblock.

  As an example, a video frame having a resolution of 176x144 contains 99 macroblocks thus the macroblock map will contain 99 bit mapped values identifying each and every macroblock within the frame (the `nErrMapSize` parameter will contain a size of 13 – rounded up to the nearest byte boundary). Bit 0 of the macroblock map refers to macroblock 0 within the video frame, bit 1 refers to macroblock 1 and so on.

  The error map information is cumulative between frames; it is to be cleared:

  - Upon each `OMX_GetConfig` request.
  - Each time an Intra Frame is detected. The error map information is to include any macroblock errors found within the Intra frame.

4.3.22.2 Dependencies

The parameter may only be used to get the macroblock error map information using `OMX_GetConfig` at any time that the component is in the OMX_StateExecuting state.

4.3.22.3 Error Conditions

On processing the `OMX_CONFIG_MACROBLOCKERRORMAPTYPE` structure, the following error conditions can occur:

- `OMX_ErrorMbErrorsInFrame` when macroblock errors are found within a frame.

When macroblock errors are encountered during the processing, the component will issue an `OMX_EventError` event with the value `OMX_ErrorMbErrorsInFrame` notifying the IL client of this occurrence.

4.3.23 OMX_PARAM_MACROBLOCKSTYPE

The `OMX_PARAM_MACROBLOCKSTYPE` structure is used to report the number of macroblocks available within the current video stream's frame.

`OMX_PARAM_MACROBLOCKSTYPE` is defined as follows.

```
typedef struct OMX_PARAM_MACROBLOCKSTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nMacroblocks;
} OMX_PARAM_MACROBLOCKSTYPE;
```

4.3.23.1 Parameters

The parameters for `OMX_PARAM_MACROBLOCKSTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nMacroblocks` is the number of macroblocks available within the video frame.

4.3.23.2 Dependencies

The parameter may only be used to query the number of macroblocks within the video frame using `OMX_GetParameter` at any time that the component is in the OMX_StateExecuting state.

4.3.24 OMX_CONFIG_MBERRORREPORTINGTYPE

The `OMX_CONFIG_MBERRORREPORTINGTYPE` structure is used to enable or disable the macroblock error reporting support.

The macroblock error map information is queryied from the video decoder with `OMX_GetConfig` using `OMX_IndexConfigVideoMacroBlockErrorMap` and the `OMX_CONFIG_MACROBLOCKERRORMAPTYPE` structure.

`OMX_CONFIG_MBERRORREPORTINGTYPE` is defined as follows.

```
typedef struct OMX_CONFIG_MBERRORREPORTINGTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_BOOL bEnabled;
} OMX_CONFIG_MBERRORREPORTINGTYPE;
```

4.3.24.1 Parameters

The parameters for OMX_CONFIG_MBERRORREPORTINGTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- bEnabled is a Boolean value indicating to enable to disable the macroblock error reporting support.

4.3.25 OMX_VIDEO_PARAM_PROFILELEVELTYPE

The OMX_VIDEO_PARAM_PROFILELEVELTYPE structure is used to query the video encoders and decoders for their supported profiles and associated levels when used with the OMX_IndexParamVideoProfileLevelQuerySupported.

In addition the structure may also be used to query or set the profile and level of the video stream that is currently being processed, this is achieved using OMX_IndexParamVideoProfileLevelCurrent

OMX_VIDEO_PARAM_PROFILELEVELTYPE is defined as follows.

```
typedef struct OMX_VIDEO_PARAM_PROFILELEVELTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 eProfile;
    OMX_U32 eLevel;
    OMX_U32 nProfileIndex;
} OMX_VIDEO_PARAM_PROFILELEVELTYPE;
```

4.3.25.1 Parameters

The parameters for OMX_VIDEO_PARAM_PROFILELEVELTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- eProfile is the profile setting as associated with the eCompressionFormat parameter.
- eLevel is the profile level setting as associated with the eCompressionFormat and eProfile parameters.

  The caller is required to type cast both the eProfile and eLevel parameters to the proper data enumeration types prior to interpreting the parameter information. The type casting is to be based on the eCompressionFormat parameter defined as per the port definition.Table 4-60 shows the profile and level type casting parameters.

Table 4-60: Profile and Level Type Casting

Coding Type	Profile Type	Level Type
OMX_VIDEO_CodingMPEG2	OMX_VIDEO_MPEG2PROFILETYPE	OMX_VIDEO_MPEG2LEVELTYPE

Coding Type	Profile Type	Level Type
OMX_VIDEO_CodingH263	OMX_VIDEO_H263PROFILETYPE	OMX_VIDEO_H263LEVELTYPE
OMX_VIDEO_CodingMPEG4	OMX_VIDEO_MPEG4PROFILETYPE	OMX_VIDEO_MPEG4LEVELTYPE
OMX_VIDEO_CodingWMV	OMX_VIDEO_WMVFORMATTYPE	Not Applicable
OMX_VIDEO_CodingRV	OMX_VIDEO_RVFORMATTYPE	Not Applicable
OMX_VIDEO_CodingAVC	OMX_VIDEO_AVCPROFILETYPE	OMX_VIDEO_AVCLEVELTYPE

- `eProfileIndex` is used to enumerate the supported profiles. The caller specifies all fields and the `OMX_GetParameter` call returns the value of the supported profile and level. The value of `nProfileIndex` goes from 0 to N-1, where N is the number of profiles supported by the port. The port does not need to report N as the caller can determine N by enumerating all the formats supported by the port. Each port shall support at least one profile. If there are no more profiles, `OMX_GetParameter` returns `OMX_ErrorNoMore.`

Table 4-61: ProfileLevel Call Details

Action	Index	Description
Query for supported profiles and levels	`OMX_IndexParamVideoProfileLevelQuerySupported`	Multiple calls with increasing values of nProfileIndex will enumerate the supported profiles until `OMX_ErrorNoMore` is returned. With each successful call, a supported profile will be identified with the maximum supported associated level setting.
Query the profile and level for the current stream	`OMX_IndexParamVideoProfileLevelCurrent`	`eCompressionFormat`, `eProfile` and `eLevel` will return the current stream's information. The `nProfileIndex` parameter is an ignored parameter.
Configure the encoder to use a specific profile and level for the current stream	`OMX_IndexParamVideoProfileLevelCurrent`	`eCompressionFormat`, `eProfile` and `eLevel` will contain the requested settiins to be used as part of the encoding. The `nProfileIndex` parameter is an ignored parameter.

4.3.25.2 Dependencies

The parameter using the index OMX_IndexParamVideoProfileLevelCurrent may be queried using OMX_GetParameter or set using OMX_SetParameter at any time that the component is initialized.

4.3.26 OMX_VIDEO_PARAM_AVCSLICEFMO

The OMX_VIDEO_PARAM_AVCSLICEFMO structure is used to enable and configure the Flexible Macroblock Ordering (FMO) slice modes within the AVC video encoder.

OMX_VIDEO_PARAM_AVCSLICEFMO is defined as follows.

```
typedef struct OMX_VIDEO_PARAM_AVCSLICEFMO {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U8 nNumSliceGroups;
    OMX_U8 nSliceGroupMapType;
    OMX_VIDEO_SLICEMODETYPE eSliceMode;
} OMX_VIDEO_PARAM_AVCSLICEFMO;
```

4.3.26.1 Parameters

The parameters for OMX_VIDEO_PARAM_AVCSLICEFMO are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nNumSliceGroups specifies the number of slice groups that can be supported in the encode session. This parameter is enabled when FMO mode is enabled, refer to OMX_VIDEO_PARAM_AVCTYPE for enabling FMO mode support.

  The setting information for this parameter is direcly related to the functionality as specified within the ITU H.264/AVC specification and is dependent on the video profile currently in use.

  The currently defined parameter range settings are listed in Table 4-62.

Table 4-62: AVC Parameter Range Settings

Video Profile	Range
OMX_VIDEO_AVCProfileBaseline	0 to 7
OMX_VIDEO_AVCProfileMain	0
OMX_VIDEO_AVCProfileExtended	0 to 7
OMX_VIDEO_AVCProfileHigh	0
OMX_VIDEO_AVCProfileHigh10	0
OMX_VIDEO_AVCProfileHigh422	0
OMX_VIDEO_AVCProfileHigh444	0

- nSliceGroupMapType specifies the type of slice groupings that is to be used during encoding.

The setting information for this parameter is direcly related to the functionality as specified within the ITU H.264/AVC specification.

The currently defined parameter settings are:

Table 4-63: Slice Group Map Type Values

Slice Group Map Value	Description
0	Indicates interleaves slices.
1	Indicates a dispersed macroblock allocation
2	Indicates to explicitly assign a slice group to each macroblock in raster scan order
3	Indicates one or more “foreground” slice groups and a “leftover” slice group
4	Indicates changing slice groups.
5	Indicates changing slice groups.
6	Indicates changing slice groups.

- `eSliceMode` specifies the type of slice that is to be used for encoding the frame.

Table 4-64: Slice Mode Type Casting

Slice Mode	AVC Slice Mode Description
OMX_VIDEO_SLICEMODE_AVCDefault	Normal frame encoding, one slice per frame
OMX_VIDEO_SLICEMODE_AVCMBSlice	NAL mode based on number of macroblocks per slice
OMX_VIDEO_SLICEMODE_AVCByteSlice	NAL Mode based on number of bytes per slice.

4.3.27 OMX_VIDEO_CONFIG_AVCINTRAPERIOD

The `OMX_VIDEO_CONFIG_AVCINTRAPERIOD` structure is used to enable and configure the IDR and Intra periodicity for the AVC encoder during an encoding session.

`OMX_VIDEO_CONFIG_AVCINTRAPERIOD` is defined as follows.

```
typedef struct OMX_VIDEO_CONFIG_AVCINTRAPERIOD {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nIDRPeriod;
    OMX_U32 nPFrames;
} OMX_VIDEO_CONFIG_AVCINTRAPERIOD;
```

4.3.27.1 Parameters

The parameters for `OMX_VIDEO_CONFIG_AVCINTRAPERIOD` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.

- nIDRPeriod defines the periodicity of IDR occurrence. This specifies coding a frame as IDR after every nPFrames of intra frames. If this parameter is set to 0, only the first frame of the encode session is an IDR frame.
- nPFrames sprecifies coding of a frame as Intra (non-inclusive of the first frame) after every nPFrames of Inter frames.

4.3.28 OMX_VIDEO_CONFIG_NALSIZE

The OMX_VIDEO_CONFIG_NALSIZE structure is used to specify the size of a NAL unit for the AVC encoder during an encoding session.

OMX_VIDEO_CONFIG_NALSIZE is defined as follows.

```
typedef struct OMX_VIDEO_CONFIG_NALSIZE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nNaluBytes;
} OMX_VIDEO_CONFIG_NALSIZE;
```

4.3.28.1 Parameters

The parameters for OMX_VIDEO_CONFIG_NALSIZE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- nNaluBytes specifies the number of bytes of data to be contained in the current NAL Units.

4.4 Image

This section describes the parameter and configuration details for components and ports in the image domain. These parameter and configuration details are specified in the OMX_Image.h header file.

4.4.1 Parameter and Configuration Indices

The header OMX_Index.h contains the enumeration OMX_INDEXTYPE, which contains all standard index values used core functions OMX_GetParameter, OMX_SetParameter, OMX_GetConfig, and OMX_SetConfig. Table 4-65 shows the index values that relate to imaging.

Table 4-65: Image Indices

OpenMAX IL Indices (OMX_Index.h)	Corresponding OpenMAX IL Image Structures (OMX_Image.h)
OMX_IndexParamImagePortFormat	OMX_IMAGE_PARAM_PORTFORMATTYPE
OMX_IndexParamImageInit	OMX_PORT_PARAM_TYPE
OMX_IndexParamFlashControl	OMX_IMAGE_PARAM_FLASHCONTROLTYPE

OpenMAX IL Indices (OMX_Index.h)	Corresponding OpenMAX IL Image Structures (OMX_Image.h)
OMX_IndexConfigFlashControl	OMX_IMAGE_PARAM_FLASHCONTROLTYPE
OMX_IndexConfigFocusControl	OMX_IMAGE_CONFIG_FOCUSCONTROLTYPE
OMX_IndexParamQFactor	OMX_IMAGE_PARAM_QFACTORTYPE
OMX_IndexParamQuantizationTable	OMX_IMAGE_PARAM_QUANTIZATIONTABLETYPE
OMX_IndexParamHuffmanTable	OMX_IMAGE_PARAM_HUFFMANTTABLETYPE

For example, `OMX_IndexParamImagePortFormat` index is used with `OMX_GetParameter` and `OMX_SetParameter` to access `OMX_IMAGE_PARAM_PORTFORMATTYPE`.

4.4.2 Image Use Case Example

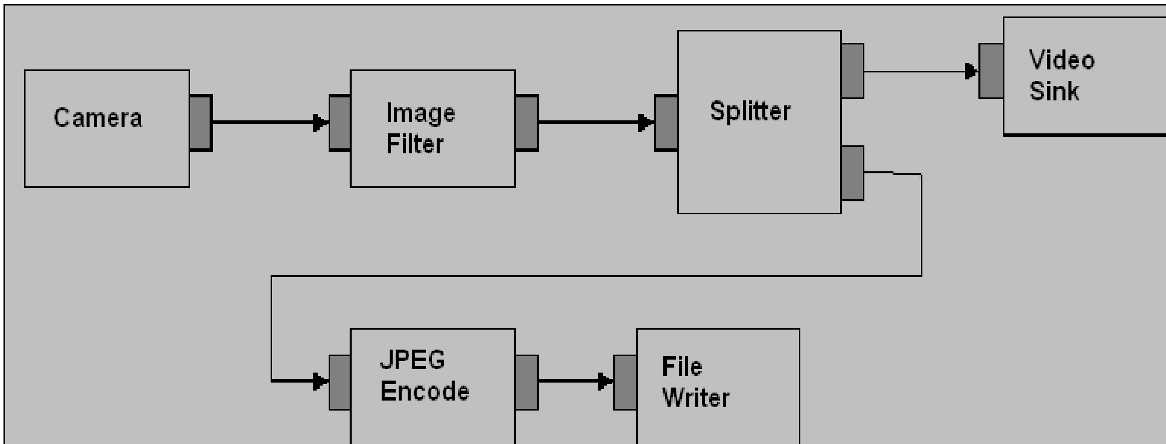


Figure 4-6 depicts one possible set of tunneled components and associated ports to

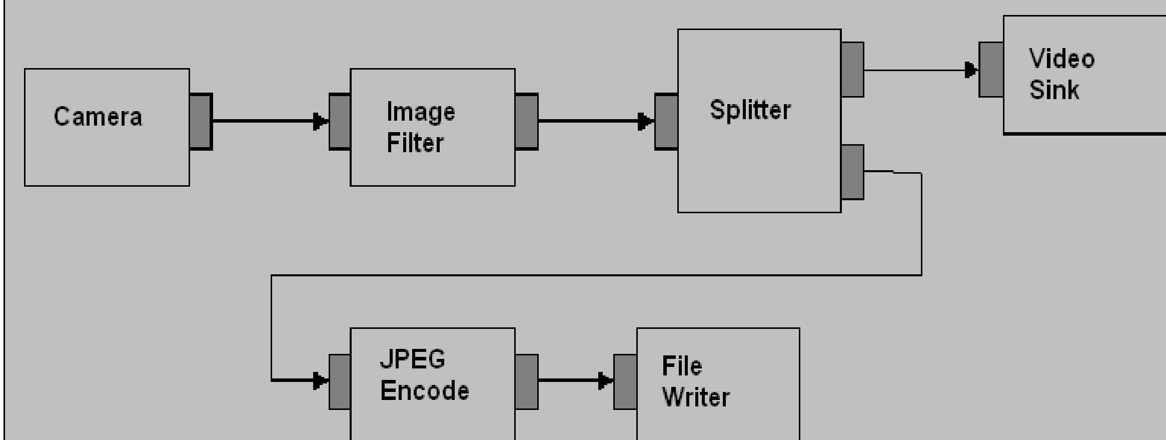


Figure 4-6. Image Filtering and JPEG Encoding Use Case

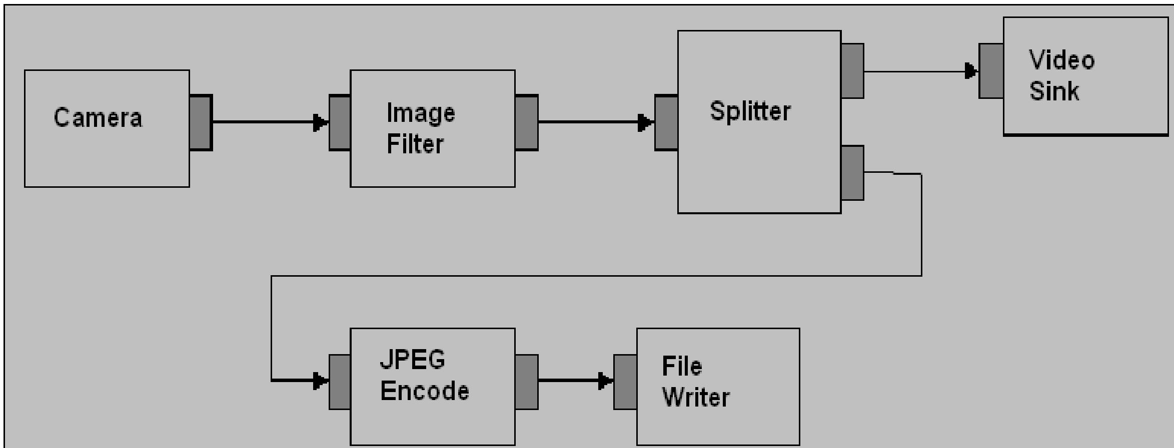


Figure 4-6 shows six components, namely the camera, the image filter, the splitter, the

4.4.3 OMX_IMAGE_PORTDEFINITIONTYPE

`OMX_IMAGE_PORTDEFINITIONTYPE` is the data structure that is used to define an image path. The number of image paths for input and output will vary by the type of the image component:

- Input (also known as source) has zero inputs and one output.
- Splitter has one input and two or more outputs.
- Processing element has one input and one output.
- Mixer has two or more inputs and one output.
- Output (also known as sink) has one input and zero outputs.

The `OMX_IMAGE_PORTDEFINITIONTYPE` structure can query the current or default definition of an image port or set the definition of an image port for a component. The `OMX_IMAGE_PORTDEFINITIONTYPE` structure is included as part of the `OMX_PARAM_PORTDEFINITIONTYPE` structure, it is accessed via the `OMX_GetParameter` function or the `OMX_GetParameter` function using the OMX_IndexParamPortDefinition index.

`OMX_IMAGE_PORTDEFINITIONTYPE` is defined as follows.

```
typedef struct OMX_IMAGE_PORTDEFINITIONTYPE {
    OMX_STRING cMIMEType;
    OMX_NATIVE_DEVICETYPE pNativeRender;
    OMX_U32 nFrameWidth;
    OMX_U32 nFrameHeight;
    OMX_S32 nStride;
    OMX_U32 nSliceHeight;
    OMX_BOOL bFlagErrorConcealment;
    OMX_IMAGE_CODINGTYPE eCompressionFormat;
    OMX_COLOR_FORMATTYPE eColorFormat;
    OMX_NATIVE_WINDOWSTYPE pNativeWindow;
} OMX_IMAGE_PORTDEFINITIONTYPE;
```

4.4.3.1 Parameters

The parameters for `OMX_IMAGE_PORTDEFINITIONTYPE` are defined as follows.

- `cMIMEType` is the multipurpose Internet mail extensions (MIME) type of data on the port. If a MIME type string buffer is not supplied this parameter shall be set to NULL.
- `pNativeRender` is the read-only platform specific reference for a display synchronization; otherwise this field is 0. This parameter is ignored on `OMX_SetParameter` calls.
- `nFrameWidth` is the width of frame to be used on the port if uncompressed format is used. Use 0 for unknown, no preference, or variable.
- `nFrameHeight` is the height of the frame to be used on the port if uncompressed format is used. Use 0 for unknown, no preference, or variable.
- `nStride` is a field containing the number of bytes per span of an image, which indicates the number of bytes to get from span N to span N+1. A negative value for `nStride` indicates the data is stored bottom-to-top instead of top-to-bottom.

  Normally the stride parameter is determined by the component, there are cases however when the stride parameter may need to be updated based on external buffer stride requirements.

  An example of such a case includes when IL clients submit buffers to the component for processing, the IL client may have differing stride requirements from the component port.

  By allowing the flexibility for the stride to be modified, the component and ILclient may negotiate a common stride setting to suit each other needs and in turn possibly improve the performance of processing the buffer.
- `nSliceHeight` is a read-only field containing the slice height parameter used when processing uncompressed image data. Buffers received on the port shall contain integer multiples of slices. For more information on minimum buffer payload for uncompressed data, see section 4.2.2.
- `bFlagErrorConcealment` is a flag indicating that the OpenMAX IL component supports error concealment. This flag is returned by a component upon invoking `OMX_GetParameter`; it is ignored on `OMX_SetParameter` calls.
- `eCompressionFormat` is the enumeration describing the compression format used on the port. When `OMX_IMAGE_CodingUnused` is specified, the `eColorFormat` field is valid. Table 4-66 shows the supported image compression formats.

Table 4-66: Supported Image Compression Formats

Field Name	Compression Format Description	Reference to Standard
OMX_IMAGE_CodingUnused	No coding applied, use eColorFormat	Not available
OMX_IMAGE_CodingAutoDetect	Auto detection by the OpenMAX IL component	Not available
OMX_IMAGE_CodingJPEG	JPEG/JFIF image format	JPEG
OMX_IMAGE_CodingJPEG2K	JPEG 2000 image format	JPEG2K
OMX_IMAGE_CodingEXIF	EXIF image format	EXIF
OMX_IMAGE_CodingTIFF	TIFF image format	TIFF
OMX_IMAGE_CodingGIF	Graphics image format	GIF
OMX_IMAGE_CodingPNG	PNG image format	PNG
OMX_IMAGE_CodingLZW	LZW image format	LZW
OMX_IMAGE_CodingBMP	Windows Bitmap format	BMP
OMX_IMAGE_CodingMax	Maximum value	Not available

- `eColorFormat` is the decompressed color format used for the port. This field is valid only when the `eCompressionFormat` field is set to `OMX_IMAGE_CodingUnused`.
- `pNativeWindow` is a platform specific reference for a windows object when being processed within as part of a video sink component, otherwise this field is 0 and ignored.

4.4.4 *OMX_IMAGE_PARAM_PORTFORMATTYPE*

`OMX_IMAGE_PARAM_PORTFORMATTYPE` is used to enumerate the various data input/output format supported by the port.

`OMX_IMAGE_PARAM_PORTFORMATTYPE` is defined as follows.

```
typedef struct OMX_IMAGE_PARAM_PORTFORMATTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nIndex;
    OMX_IMAGE_CODINGTYPE eCompressionFormat;
    OMX_COLOR_FORMATTYPE eColorFormat;
} OMX_IMAGE_PARAM_PORTFORMATTYPE;
```

4.4.4.1 Parameters

The parameters for `OMX_IMAGE_PARAM_PORTFORMATTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nIndex` indicates the enumeration index for the format from 0x0 to N-1.

- eCompressionFormat is an enumeration describing the compression format used on the port. When OMX_IMAGE_CodingUnused is specified, the eColorFormat field is valid. For enumerations regarding OMX_IMAGE_CODINGTYPE, see Table 4-66.
- eColorFormat is the decompressed color format used for the port. This field is valid only when the eCompressionFormat field is set to OMX_IMAGE_CodingUnused. For enumerations on OMX_COLOR_FORMATTYPE, see section 4.2.

4.4.5 OMX_IMAGE_PARAM_FLASHCONTROLTYPE

The OMX_IMAGE_PARAM_FLASHCONTROLTYPE structure defines the mode of operation for flash control and configuration.

OMX_IMAGE_PARAM_FLASHCONTROLTYPE is defined as follows.

```
typedef struct OMX_IMAGE_PARAM_FLASHCONTROLTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_IMAGE_FLASHCONTROLTYPE eFlashControl;
} OMX_IMAGE_PARAM_FLASHCONTROLTYPE;
```

4.4.5.1 Parameters

The parameters for OMX_IMAGE_PARAM_FLASHCONTROLTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- eFlashControl is an enumeration for the flash control modes. Table 4-67 shows the supported image flash controls.

Table 4-67: Supported Image Flash Controls

Field Name	Flash Control Description
OMX_IMAGE_FlashControlOn	Strobe at every shot
OMX_IMAGE_FlashControlOff	Strobe off
OMX_IMAGE_FlashControlAuto	Strobe according to environment light
OMX_IMAGE_FlashControlRedEyeReduction	Pre-shot strobes
OMX_IMAGE_FlashControlFillin	Flash for background/ foreground effect
OMX_IMAGE_FlashControlTorch	Flash is always on
OMX_IMAGE_FlashControlMax	Maximum value

4.4.6 OMX_IMAGE_CONFIG_FOCUSCONTROLTYPE

OMX_IMAGE_CONFIG_FOCUSCONTROLTYPE controls the focus mode and range. This structure can be used with OMX_CONFIG_FOCUSREGIONTYPE to specify thye focus regions of interest.

OMX_IMAGE_CONFIG_FOCUSCONTROLTYPE is defined as follows.

```
typedef struct OMX_IMAGE_CONFIG_FOCUSCONTROLTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_IMAGE_FOCUSCONTROLTYPE eFocusControl;
    OMX_U32 nFocusSteps;
    OMX_U32 nFocusStepIndex;
} OMX_IMAGE_CONFIG_FOCUSCONTROLTYPE;
```

4.4.6.1 Parameters

The parameters for OMX_IMAGE_CONFIG_FOCUSCONTROLTYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- eFocusControl is an enumeration that specifies the image focus controls. Table 4-68 shows the supported image focus controls.

Table 4-68: Supported Image Focus Controls

Field Name	Focus Control Description
OMX_IMAGE_FocusControlOn	Focus control On Focus adjustments are being performed manually by the user. Focus status determination is performed by the component and status is provided via OMX_PARAM_FOCUSSTATUSTYPE (OMX_IndexConfigCommonFocusStatus)

Field Name	Focus Control Description
OMX_IMAGE_FocusControlOff	Focus control off Focus adjustments are being performed manually by the user. Focus status determination is performed manually (visually inspection via viewfinder) by the user.
OMX_IMAGE_FocusControlAuto	Auto focus control on Focus adjustments are being performed automatically and continuously by the component until a capture request is issued. Focus status determination is performed by the component and status is provided via OMX_PARAM_FOCUSSTATUSTYPE (OMX_IndexConfigCommonFocusStatus)
OMX_IMAGE_FocusControlAutoLock	Auto focus control with lock support on Focus adjustment is locked to the current focus adjustment setting. Focus status determination is performed by the component and status is provided via OMX_PARAM_FOCUSSTATUSTYPE (OMX_IndexConfigCommonFocusStatus). The focus status request for this mode continually reflects the focus status upon receiving this lock focus request.

Note: the IL-client can use `OMX_IndexConfigCommonFocusRegion` to change the focus area in any of the above modes.

- `nFocusSteps` is a value that specifies the number of steps that the focus can take on. The range is 0 mm to infinity.
- `nFocusStepIndex` defines the current position of the focus.

4.4.7 OMX_IMAGE_PARAM_QFACTORTYPE

`OMX_IMAGE_PARAM_QFACTORTYPE` determines the quality factor for JPEG compression, which controls the tradeoff between image quality and size. Q Factor provides a simpler means of controlling the JPEG compression quality than directly programming quantization tables for chroma and luma.

`OMX_IMAGE_PARAM_QFACTORTYPE` is defined as follows.

```
typedef struct OMX_IMAGE_PARAM_QFACTORTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nQFactor;
} OMX_IMAGE_PARAM_QFACTORTYPE;
```

4.4.7.1 Parameters

The parameters for `OMX_IMAGE_PARAM_QFACTORTYPE` are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nQFactor` is a compression quality factor value in the range 1–100. A factor of 1 produces the smallest, worst quality images, and a factor of 100 produces the largest, best quality images. A typical default is 75 for small, good quality images.

4.4.8 OMX_IMAGE_PARAM_QUANTIZATIONTABLETYPE

`OMX_IMAGE_PARAM_QUANTIZATIONTABLETYPE` provides JPEG quantization tables, which are used to determine DCT compression for YUV data. `OMX_IMAGE_PARAM_QUANTIZATIONTABLETYPE` is an alternative to specifying Q factor, providing exact control of compression.

`OMX_IMAGE_PARAM_QUANTIZATIONTABLETYPE` is defined as follows.

```
typedef struct OMX_IMAGE_PARAM_QUANTIZATIONTABLETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_IMAGE_QUANTIZATIONTABLETYPE eQuantizationTable;
    OMX_U8 nQuantizationMatrix[64];
} OMX_IMAGE_PARAM_QUANTIZATIONTABLETYPE;
```

4.4.8.1 Parameters

The parameters for `OMX_IMAGE_PARAM_QUANTIZATIONTABLETYPE` are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- eQuantizationTable is an enumeration for the quantization table type, which defines luma or chroma table types. Table 4-69 shows the supported image quantization table types.

Table 4-69: Supported Image Quantization Table Types

Field Name	Quantization Table Description
OMX_IMAGE_QuantizationTableLuma	Quantization table for the luma coefficients
OMX_IMAGE_QuantizationTableChroma	Quantization table for both the Cb and Cr chroma coefficients
OMX_IMAGE_QuantizationTableChromaCb	Quantization table for Cb chroma coefficients only
OMX_IMAGE_QuantizationTableChromaCr	Quantization table for Cr chroma coefficients only
OMX_IMAGE_QuantizationTableMax	Max value

- nQuantizationMatrix is the JPEG quantization table of coefficients stored in increasing columns and then by rows of data (i.e., row 1,… row 8). Quantization values are in the range 0–255 and are stored in linear order (i.e., the component will zigzag the quantization table data internally if required).

4.4.8.2 Error Conditions

On processing the OMX_IMAGE_PARAM_QUANTIZATIONTABLETYPE structure, the following error conditions can occur:

- OMX_ErrorSeperateTablesUsed when OMX_GetParameter function is called using OMX_IMAGE_QuantizationTableChroma and separate quantization tables are used for the Chroma (Cb and Cr) coefficients.

This error indicates that separate OMX_GetParameter function calls need to be issued using OMX_IMAGE_QuantizationTableChromaCb and OMX_IMAGE_QuantizationTableChromaCb to query for the separate chroma coefficient quantization tables.

4.4.9 OMX_IMAGE_PARAM_HUFFMANTTABLETYPE

The OMX_IMAGE_PARAM_HUFFMANTTABLETYPE structure is used to set the Huffman variable code length type used for JPEG.

OMX_IMAGE_PARAM_HUFFMANTTABLETYPE is defined as follows.

```
typedef struct OMX_IMAGE_PARAM_HUFFMANTTABLETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_IMAGE_HUFFMANTABLETYPE eHuffmanTable;
```

```
    OMX_U8 nNumberOfHuffmanCodeOfLength[16];
    OMX_U8 nHuffmanTable[256];
}OMX_IMAGE_PARAM_HUFFMANTTABLETYPE;
```

4.4.9.1 Parameters

The parameters for OMX_IMAGE_PARAM_HUFFMANTTABLETYPE are defined as follows.

- nPortIndex is the read-only value containing the index of the port.
- eHuffmanTable is an enumeration for the Huffman table types. Table 4-70 shows the supported Huffman table types.

Table 4-70: Supported Huffman Table Types

Field Name	Huffman Table Description
OMX_IMAGE_HuffmanTableAC	Huffman table to be applied to Luma and Chroma AC coefficients
OMX_IMAGE_HuffmanTableDC	Huffman table to be applied to Luma and Chroma DC coefficients
OMX_IMAGE_HuffmanTableACLuma	Huffman table to be applied to Luma AC coefficients only
OMX_IMAGE_HuffmanTableACChroma	Huffman table to be applied to Chroma AC coefficients only
OMX_IMAGE_HuffmanTableDCLuma	Huffman table to be applied to Luma DC coefficients only
OMX_IMAGE_HuffmanTableDCChroma	Huffman table to be applied to Chroma DC coefficients only
OMX_IMAGE_HuffmanTableMax	Maximum value

- nNumberOfHuffmanCodeOfLength is a value in the range of 0–16 that represents the number of Huffman codes of each possible length.
- nHuffmanTable is a value in the range of 0–255. The table sizes used for AC and DC Huffman tables are 16 and 162.

4.4.9.2 Error Conditions

On processing the OMX_IMAGE_PARAM_HUFFMANTTABLETYPE structure, the following error conditions can occur:

- OMX_ErrorSeperateTablesUsed when the OMX_GetParameter function is called using OMX_IMAGE_HuffmanTableAC or OMX_IMAGE_HuffmanTableDC and separate Huffman tables are used for the Luma and Chroma coefficients.

This error indicates that separate OMX_GetParameter function calls need to be issued using OMX_IMAGE_HuffmanTableACLuma and

OMX_IMAGE_HuffmanTableACChroma to obtain the AC coefficient information and separate OMX_GetParameter function calls need to be issued using OMX_IMAGE_HuffmanTableDCLuma and OMX_IMAGE_HuffmanTableDCChroma to obtain the DC coefficient information.

4.5 “Other” Domain

This section describes the concepts, structures, and configurations for the domain designated as “other” and moniker distinguishing it from the audio, video and image domains. The OMX_Other.h header specifies the parameters and configurations in detail.

Presently the other domain formalizes only a “time” data format and its associated operation though other data formats may be formalized in the future. The time data format exists to facilitate synchronization. To provide context to the definition of the time data format, the following section explains OpenMAX IL’s synchronization mechanisms.

4.5.1 Parameters and Config Indexes

The header OMX_Index.h contains the enumeration `OMX_INDEXTYPE`, which contains all of the standard index values used with the functions `OMX_GetParameter`, `OMX_SetParameter`, `OMX_GetConfig`, and `OMX_SetConfig`. Table 4-71 describes the index values that relate to Other Domain.

Table 4-71: Index Values for Other Domain

Index	**Description**
`OMX_IndexConfigTimeScale`	Used with `OMX GetConfig` and `OMX_SetConfig` to access a `OMX_TIME_CONFIG_SCALETYPE` structure denoting the scale of the media clock.
`OMX_IndexConfigTimeClockState`	Used with `OMX_GetConfig` and `OMX_SetConfig` to access a `OMX_TIME_CONFIG_CLOCKSTATETYPE` structure denoting the state of the media clock.
`OMX_IndexConfigTimeActiveRefClock`	Used with `OMX_GetConfig` and `OMX_SetConfig` to access a `OMX_TIME_CONFIG_ACTIVEREFCLOCKTYPE` structure denoting the active reference clock.
`OMX_IndexConfigTimeCurrentMediaTime`	Used with `OMX_GetConfig` to query a `OMX_TIME_CONFIG_TIMESTAMPTYPE` structure denoting the current media time.
`OMX_IndexConfigTimeCurrentWallTime`	Used with `OMX_GetConfig` to query a `OMX_TIME_CONFIG_TIMESTAMPTYPE` structure denoting the current wall clock time.

Index	Description
OMX_IndexConfigTimeCurrentAudioReference	Used with OMX_SetConfig to set the OMX_TIME_CONFIG_TIMESTAMPTYPE structure denoting the current audio reference clock time time.
OMX_IndexConfigTimeCurrentVideoReference	Used with OMX_SetConfig to set the OMX_TIME_CONFIG_TIMESTAMPTYPE structure denoting the current video reference clock time time.
OMX_IndexConfigTimeMediaTimeRequest	Used with OMX_SetConfig to request a clock component operation using a OMX_TIME_CONFIG_MEDIATIMEREQUESTTYPE structure.
OMX_IndexConfigTimeClientStartTime	Used with OMX_SetConfig to set the start time of the given client stream using the OMX_TIME_CONFIG_TIMESTAMPTYPE structure.
OMX_IndexConfigTimePosition	Used with OMX_GetConfig and OMX_SetConfig to access a OMX_TIME_CONFIG_SCALETYPE structure denoting the current position in time.
OMX_IndexConfigTimeSeekMode	Used with OMX_GetConfig and OMX_SetConfig to access a OMX_TIME_CONFIG_SCALETYPE structure denoting the current seek mode.

4.5.2 OMX_TIME_CONFIG_SEEKMODETYPE

A component's seek mode defines the semantics it follows when an IL client requests a change in position (via the OMX_IndexConfigTimePosition configuration).

OMX_TIME_CONFIG_SEEKMODETYPE is defined as follows.

```
typedef struct OMX_TIME_CONFIG_SEEKMODETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_TIME_SEEKMODETYPE eType;
} OMX_TIME_CONFIG_SEEKMODETYPE;
```

4.5.2.1 Parameters

The parameters for OMX_TIME_CONFIG_SEEKMODETYPE are defined as follows.

- `eType` is seek mode and must be a value from the `OMX_TIME_SEEKMODETYPE` enumeration

Table 4-72: Seek Modes Defined by `OMX_TIME_SEEKMODETYPE`

Field Name	**Description**
`OMX_TIME_SeekFast`	Prefer seeking to an approximation of the requested seek position over the actual seek position if it results in a faster seek.
`OMX_TIME_SeekAccurate`	Prefer seeking to the actual seek position over an approximation of the requested seek position even if it results in a slower seek.

4.5.3 OMX_TIME_CONFIG_TIMESTAMPTYPE

A timestamp represents a position in time relative to some clock. The `OMX_IndexConfigTimeCurrentWallTime`, `OMX_IndexConfigTimeCurrentMediaTime`, `OMX_IndexConfigTimeCurrentAudioReference`, and `OMX_IndexConfigTimeCurrentVideoReference` configurations leverage this structure.

OMX_TIME_CONFIG_TIMESTAMPTYPE is defined as follows.

```
typedef struct OMX_TIME_CONFIG_TIMESTAMPTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_TICKS nTimestampeType;
} OMX_TIME_CONFIG_TIMESTAMPTYPE;
```

4.5.3.1 Parameters

The parameters for OMX_TIME_CONFIG_TIMESTAMPTYPE are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `nTimestampType` holds the actual timestamp value.

4.5.4 OMX_TIME_CONFIG_MEDIATIMEREQUESTTYPE

The media time request respresents a request for notification at the media time specified.

OMX_TIME_CONFIG_MEDIATIMEREQUESTTYPE is defined as follows.

```
typedef struct OMX_TIME_CONFIG_MEDIATIMEREQUESTTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_PTR pClientPrivate;
    OMX_TICKS nMediaTimestamp;
    OMX_TICKS nOffset;
} OMX_TIME_CONFIG_MEDIATIMEREQUESTTYPE;
```

4.5.4.1 Parameters

The parameters for OMX_TIME_CONFIG_MEDIATIMEREQUESTTYPE are defined as follows.

- `nPortIndex` is the read-only value containing the index of the port.
- `pClientPrivate` client private data to disambiguate this media time from others.
- `nMediaTimestamp` media time requested.
- `nOffset` amount of wall clock time by which this request should be fulfilled early.

4.5.5 OMX_TIME_CONFIG_MEDIATIMETYPE

The media time structure is sent to a port either to fulfill a media time request or when the clock state or scale has changed.

OMX_TIME_CONFIG_MEDIATIMETYPE is defined as follows.

```
typedef struct OMX_TIME_MEDIATIMETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nClientPrivate;
    OMX_TIME_UPDATETYPE eUpdateType;
    OMX_TICKS nMediaTimestamp;
    OMX_TICKS nOffset;
    OMX_TICKS nWallTimeAtMediaTime;
    OMX_S32 xScale;
    OMX_TIME_CLOCKSTATE eState;
} OMX_TIME_MEDIATIMETYPE;
```

4.5.5.1 Parameters

The parameters for OMX_TIME_CONFIG_MEDIATIMETYPE are defined as follows.

- `pClientPrivate` client private data to disambiguate this media time from others.

- eUpdateType designates reason for the this update was sent and must be a value from the OMX_TIME_UPDATETYPE enumeration

Table 4-73: Media Time Update Types Defined by OMX_TIME_UPDATETYPE

Field Name	Description
OMX_TIME_UpdateRequestFulfillment	Update is the fulfillment of a media time request.
OMX_TIME_UpdateScaleChanged	Update to indicate the clock scale has changed.
OMX_TIME_UpdateStateChanged	Update to indicate the clock state has changed.

- nMediaTimeStamp denotes the media time requested.
- nOffset designates amount of wall clock time by which this request was actually fulfilled early.
- nWallTimeAtMediaTime denotes the wall time corresponding to nMediaTimeStamp.
- xScale designates the current media time scale in Q16 format.
- eState designates the clock state and must be a value from the OMX_TIME_CLOCKSTATE enumeration

Table 4-74: Clock States Defined by OMX_TIME_CLOCKSTATE

Field Name	Description
OMX_TIME_ClockStateRunning	Clock is running.
OMX_TIME_ClockStateWaitingForStartTime	Clock is waiting until the prescribed clients emit their start time.
OMX_TIME_ClockStateStopped	Clock is stopped.

4.5.6 OMX_TIME_CONFIG_SCALETYPE

The clock scale config represents the current clock scale. It allows the IL client to query and set the clock scale.

OMX_TIME_CONFIG_SCALETYPE is defined as follows.

```
typedef struct OMX_TIME_CONFIG_SCALETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_S32 xScale;
} OMX_TIME_CONFIG_SCALETYPE;
```

4.5.6.1 Parameters

The parameters for OMX_TIME_CONFIG_SCALETYPE are defined as follows.

- `xScale` the scale of the media time in Q16 format.

4.5.7 OMX_TIME_CONFIG_CLOCKSTATETYPE

The clock state config represents the current state of the media clock. It allows the IL client to set and query the clock state.

OMX_TIME_CONFIG_CLOCKSTATETYPE is defined as follows.

```
 typedef struct OMX_TIME_CONFIG_CLOCKSTATETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_TIME_CLOCKSTATE eState;
    OMX_TICKS nStartTime;
    OMX_TICKS nOffset;
    OMX_U32 nWaitMask;
} OMX_TIME_CONFIG_CLOCKSTATETYPE;
```

4.5.7.1 Parameters

The parameters for OMX_TIME_CONFIG_CLOCKSTATETYPE are defined as follows.

- `eState` denotes the state of the media clock and must be a value in the OMX_TIME_CLOCKSTATE enumeration.
- `nStartTime` designates the media time the media clock is inialized to.
- `nOffset` designates the time to offset the media time by.
- `nOffset` specifies a mask of OMX_CLOCKPORT values designating which ports, if any, to wait on.

Table 4-75: Possible Clock Port Values

Field Name	Value
OMX_CLOCKPORT0	0x00000001
OMX_CLOCKPORT1	0x00000002
OMX_CLOCKPORT2	0x00000004
OMX_CLOCKPORT3	0x00000008
OMX_CLOCKPORT4	0x00000010
OMX_CLOCKPORT5	0x00000020
OMX_CLOCKPORT6	0x00000040
OMX_CLOCKPORT7	0x00000080

4.5.8 OMX_TIME_CONFIG_ACTIVEREFCLOCKTYPE

The active reference clock structure represents the clock currently being used as a reference for the media clock. It allows the IL client to set and query the currently active reference clock.

OMX_TIME_CONFIG_ACTIVEREFCLOCKTYPE is defined as follows.

```
  typedef struct OMX_TIME_CONFIG_ACTIVEREFCLOCKTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_TIME_REFCLOCKTYPE eClock;
} OMX_TIME_CONFIG_ACTIVEREFCLOCKTYPE;
```

4.5.8.1 Parameters

The parameters for OMX_TIME_CONFIG_ACTIVEREFCLOCKTYPE are defined as follows.

- `eClock` denotes the currently active reference clock and must be a value in the OMX_TIME_REFCLOCKTYPE enumeration.

Table 4-76: Reference Clock Enumeration

Field Name	Value
`OMX_TIME_RefClockNone`	No active reference clock.
`OMX_TIME_RefClockAudio`	The audio clock is the active reference clock.
`OMX_TIME_RefClockVideo`	The video clock is the active reference clock.

5 OpenMAX IL Component Extension APIs

5.1 Description of the Extension Process

An OpenMAX IL component may support any setting defined in the OpenMAX IL specification. Vendors can add to the list of parameters and configurations not included in the standard header files. These additions are referred to as *extensions*.

Any extensions approved by Khronos are considered OpenMAX IL extensions. Any extensions not approved by Khronos are vendor-defined extensions.

OpenMAX IL extensions are defined in a predefined set of extension header files, namely:

- OMX_CoreExt.h: OpenMAX IL core extension API
- OMX_ComponentExt.h: OpenMAX IL component extension API
- OMX_AudioExt.h: OpenMAX IL audio domain extension data structures
- OMX_IVCommonExt.h: OpenMAX IL extension structures common to image and video domains
- OMX_VideoExt.h: OpenMAX IL video domain extension data structures
- OMX_ImageExt.h: OpenMAX IL image domain extension data structures
- OMX_OtherExt.h : OpenMAX IL other domain extension data structures (includes A/V synchronization extensions)
- OMX_IndexExt.h: Index of all OpenMAX IL extension data structures
- OMX_ContentPipeExt.h: Content pipe defined extensions

Any vendor that develops OpenMAX IL components may add to the list of standard indexes a collection of one or more custom parameters or configuration indexes. Each vendor-specific index shall have a value greater than the value of `OMX_IndexVendorStartUnused` and less than the value of `OMX_IndexMax - 1`. Each OpenMAX IL extension index has a value greater than the value of OMX_IndexKhronosExtension and less than the value of OMX_IndexVendorStartUnused – 1.

Each extension parameter or configuration index may apply to one of the four existing domains, namely audio, video, image, and “other”. It may also apply a parameter or configuration that does not belong to any known domain.

A vendor-specific extension index to a parameter or configuration may be defined by a string and be reported in the component description documentation. The IL client may obtain the index related to this property using the component function `OMX_GetExtensionIndex`. This function provides a numeric index from a string

The numeric index can be used with the functions OMX_GetParameter and OMX_SetParameter if the index regards a parameter, or with the functions OMX_GetConfig and OMX_SetConfig if the index is a configuration index. The nature of the parameter or configuration value should be documented in the extension section of the component documentation. Khronos, or its designee, will maintain a publicly-accessible registry of OpenMAX IL extensions. These extensions are baselined to a version of an OpenMAX IL specification and may be promoted to a subsequent release of the OpenMAX IL specification.

5.1.1 GetExtensionIndex

The OMX_GetExtensionIndex method will translate a vendor-specific configuration or parameter string into an OpenMAX IL structure index. There is no requirement for the component to support this command for the indexes already found in the OMX_INDEXTYPE enumeration or in the anynomous enumeration in OMX_IndexExt.h, thus reducing a component's memory footprint. The component may support all vendor-supplied extension indexes not found in the OMX_INDEXTYPE enumeration that it supports. This is a blocking call. The component should return from this call within five milliseconds.

The parameters for the OMX_GetExtensionIndex method are defined as follows.

Parameter	Description
hComponent *[in]*	The handle of the component to be accessed. This component handle is returned by the call to the GetHandle function.
cParameterName *[in]*	The string that the component will translate into a 32-bit index. OMX_STRING shall be less than 128 characters long including the trailing null byte.
pIndexType *[out]*	A pointer to OMX_INDEXTYPE that receives the index value.

5.1.1.1 Prerequisites for This Method

This macro can be invoked when the component is in any state except the OMX_StateInvalid state.

5.1.1.2 Method Implementation

The following code defines the method implementation.

```
    OMX_ERRORTYPE (*GetExtensionIndex)(
            OMX_IN  OMX_HANDLETYPE hComponent,
            OMX_IN  OMX_STRING cParameterName,
            OMX_OUT OMX_INDEXTYPE* pIndexType);
```

5.1.2 Custom Data Structures

Each index refers to a structure or a memory area that stores the data for the parameter or configuration. The vendor shall provide a data container that is a vendor-specific structure within a vendor-specific header file. Khronos shall provide a data container that is an OpenMAX IL extensions structure within one of the OpenMAX IL extension header files. The header file is to be included by the component that implements the extension feature, and by the IL client that uses the extension feature.

If the data container is simply a pointer to a memory area, the IL client shall know how to manage the data. Each extension parameter shall be described in the component description document and follows the convention of standard OpenMAX IL data structures.

Each vendor-specific feature shall be documented in the component specifications, which describe the relationship between the string that defines a property, which is used with the `GetExtensionIndex` function, and the related data structure that corresponds to the index returned from `GetExtensionIndex` for the string.

5.1.3 Enumerations

OpenMAX IL enumeration types, as specified in the standard OpenMAX IL header files, may be extended using anonymous enum declarations in the OpenMAX IL extension or vendor-specific header files.

Each OpenMAX IL extension enumeration has a value greater than `OMX_KhronosExtensions` and smaller than `OMX_VendorStartUnused – 1`. Each Vendor specific extension enumeration has a value greater than `OMX_VendorStartUnused` and smaller than `OMX_<enum>Max`.

It may be necessary to cast the anonymous enum values to the standard OpenMAX IL enumeration types explicitly to avoid compilation errors.

5.1.4 Promoting extensions to specification

Extensions may be promoted to the OpenMAX-IL specification in subsequent releases of the OpenMAX-IL interface.

After promotion, the standard OpenMAX-IL header shall include a new standard enumeration value, as well as the extended enumeration value that remains in the OpenMAX IL extension file. It may be that both enumeration values point to the same feature.

5.2 Examples of Using Extension Querying API

This section shows sample code for extension APIs.

5.2.1 Sample Code Showing Calling Sequence

The following sample code shows an example of calling an extension API.

```
/* Set the vendor-specific filename parameter
   on a reader */
OMX_U32 eIndexParamFilename;
OMX_PTR oFileName;

OMX_GetExtensionIndex(
hFileReaderComp,
"OMX.CompanyXYZ.index.param.filename",
&eIndexParamFilename);
OMX_SetParameter(hComp, eIndexParamFilename, &oFileName);
```

This following code sample shows how to use a vendor-specific parameter. The code passes a file name to a component. The file name string does not belong to any OpenMAX IL domain; it used only for this example.

```
/* Get the vendor-specific mp3 faster
   decoding feature settings */
OMX_U32 eIndexParamFasterDecomp;
OMX_CUSTOM_AUDIO_STRUCTURE oFasterDecompParams;

OMX_GetExtensionIndex(
hMp3DecoderComp,
"OMX.CompanyXYZ.index.param.fasterdecomp",
&eIndexParamFasterDecomp);
OMX_GetParameter(hMp3DecoderComp, eIndexParamFasterDecomp,
      &oFasterDecompParams);
```

In this second example, a special parameter of an MP3 decoder is presented. The index `eIndexParamFasterDecomp` is retrieved, and the related data structure is stored in the `oFasterDecompParams` structure by the `GetParameter` function.

6 Synchronization

This section specifies synchronization functionality including seeking and clock component behavior.

6.1 Seeking Component

A component may be designated as a *seeking component* if it can change and report on its position in the data stream that it is processing. For instance, an IL client may command a seeking source component that retrieves an audio/video stream from a repository (for example, a local or remote file) to begin emitting data from a different location in the audio/video stream. Furthermore, an IL client may query the position that the source is currently emitting.

6.1.1 Seeking Configurations

A seeking component shall support the following configurations:

- `OMX_IndexConfigTimePosition,` which passes `OMX_TIME_CONFIG_TIMESTAMPTYPE` as a parameter. `OMX_GetConfig` returns the timestamp of the data that the component is currently emitting. `OMX_SetConfig` commands the component to seek the given timestamp.
- `OMX_IndexConfigTimeSeekMode`, which defines the manner in which the seek component performs the seek. Table 6-1 shows the seek modes.

Table 6-1: Seek Modes

Seek Mode	Interpretation
`OMX_TIME_SeekModeFast`	Prefers seeking an approximation of the requested seek position over the actual seek position if it results in a faster seek.
`OMX_TIME_SeekModeAccurate`	Prefers seeking to the requested seek position over an approximation of the requested seek position even if it results in a slower seek.

An arbitrary seek in a stream may request a target position whose data depends on data that precedes it. For example, consider the case where an IL client requests seeking an interframe in a video stream. Some amount of data prior to the target interframe shall be decoded to reconstruct the target frame starting with the first intraframe preceding the target. If fast mode is set, the seeking component may use the intraframe as an approximation of the target and start displaying frames immediately at that intraframe. If accurate mode is set, the seeking component decodes frames starting with the intraframe but does not display frames until the target position.

6.1.2 Seeking Buffer Flags

A seeking component communicates the role of certain buffers in the context of seeking to its downstream components via special buffer flags. A buffer flag corresponds to the first new logical data unit in a buffer, which is the first unit with its starting boundary occurring in the buffer.

The special buffer flags of note are as follows.

- `OMX_BUFFERFLAG_DECODEONLY`: The seeking component sets this flag on a buffer if the buffer shall be decoded but not displayed. In the example above, if the seeking component is in accurate mode, it would set this flag on all frames preceding the target interframe. A decoder component decodes but does not propagate downstream a buffer marked decode only. A component that renders data shall ignore any buffer with this flag set.
- `OMX_BUFFERFLAG_STARTTIME`: The seeking component sets this flag on the buffer that carries the starting timestamp of the data stream. In the example above, the seeking component would set this flag on the intraframe (i.e., the approximation) when in fast seek mode and on the interframe (i.e., the original target) when in accurate seek mode. When a clock component client receives a buffer with this flag set, it performs an `OMX_SetConfig` call with `OMX_IndexConfigTimeClientStartTime` on the clock component that is sending the buffer's timestamp. The transmission of the start time informs the clock component that the client's stream is ready for presentation and the timestamp of the first data to be presented.

6.1.3 Seek Event Sequence

To implement a seek on a chain of components, an IL client shall perform the following operations in order:

1. Pause the component through the use of `OMX_SendCommand` requesting a state transition to OMX_StatePause.
2. Stop the clock component's media clock through the use of `OMX_SetConfig` on `OMX_TIME_CONFIG_CLOCKSTATETYPE` requesting a transition to OMX_TIME_ClockStateStopped.
3. Seek to the desired location through the use of `OMX_SetConfig` on `OMX_IndexConfigTimePosition` requesting the desired timestamp.
4. Flush all components.
5. Start the clock component's media clock through the use of `OMX_SetConfig` on `OMX_TIME_CONFIG_CLOCKSTATETYPE` requesting a transition to either OMX_TIME_ClockStateRunning or OMX_TIME_ClockStateWaitingForStartTime.
6. Un-pause the component through the use of `OMX_SendCommand` requesting a state transition to OMX_StateExecuting.

If the IL client requests a transition to OMX_TIME_ClockStateRunning, the clock component immediately starts the media clock using the designated start time. This is a simpler transition than going to OMX_TIME_ClockStateWaitingForStartTime but may compromise synchronization at the start of playback after a seek operation since it ignores the start times of the individual media streams.

If the IL client requests a transition to OMX_TIME_ClockStateWaitingForStartTime, it designates which clock component clients to wait for. The clock component then waits for these clients to send their start times via the `OMX_IndexConfigTimeClientStartTime` configuration. Once all required clients have responded, the clock component starts the media clock using the earliest client start time. This approach ensures the following:

- All clients are ready to render data, eliminating any initial drift between streams.
- The media clock start time reflects the clocks of all clients and any adjustment made by the seeking component.

6.2 Clock Component

OpenMAX IL defines a special component denoted the *clock component* to facilitate the smooth and synchronized delivery or capture of audio and video streams as well as rate control. The clock component takes one audio and one video reference clock as input, from which it derives a media clock. The clock component shares the media time with the clients with whom it is connected via clock ports (one clock port per client). The clock component also exposes a mechanism for controlling the media clock and makes clients aware of the rate control events via their clock ports.

6.2.1 Timestamps

All timestamps and durations are expressed as `OMX_TICKS` values as shown in the following structure.

```
typedef struct OMX_TICKS
      {
         OMX_U32 nLowPart;
         OMX_U32 nHighPart;
} OMX_TICKS;
```

This structure shall be interpreted as a signed 64-bit value representing microseconds. This representation accommodates the following:

- Positive and negative time values. Examples of negative time values include pre-roll timestamp and time deltas.
- High-resolution timestamps (e.g., MPEG2 presentation timestamps based on a 90 kHz clock) and allow more accurate and synchronized delivery (e.g., individual audio samples delivered at 192 kHz).
- A large dynamic range of approximately plus or minus 26 million days; 32-bit resolution provides a range of only about plus or minus 35 minutes.

Implementations with limited precision may convert the signed 64-bit value to a signed 32-bit value internally but risk loss of precision.

6.2.2 Media Clock

The clock component maintains a media clock that tracks the current position in the media stream. The instantaneous media time is represented as the timestamp, relative to the start of the stream, of the data being delivered or captured at that instant (e.g., the current audio sample). Consequently, media time increases (corresponding to playing or fast forwarding), decreases (corresponding to rewinding), or holds at some constant (corresponding to pausing) according to the rate control applied to the media clock.

The clock component can be queried for the current media clock time using `OMX_GetConfig` with the read-only index `OMX_IndexConfigTimeCurrentMediaTime` and structure `OMX_TIME_CONFIG_TIMESTAMPTYPE`. The current media clock time is written into the nTimestamp field. This index must be used with the nPortIndex field as `OMX_ALL`, since the media clock is not specific to any port.

6.2.2.1 Media Clock Scale

The clock component maintains the media time's current scale factor, which corresponds directly to the rate control applied on it. The scale is a Q16 value relative to a 1X forward advancement of the media clock. Thus, scale ranges map to modes of playback, as shown in Figure 6-1.

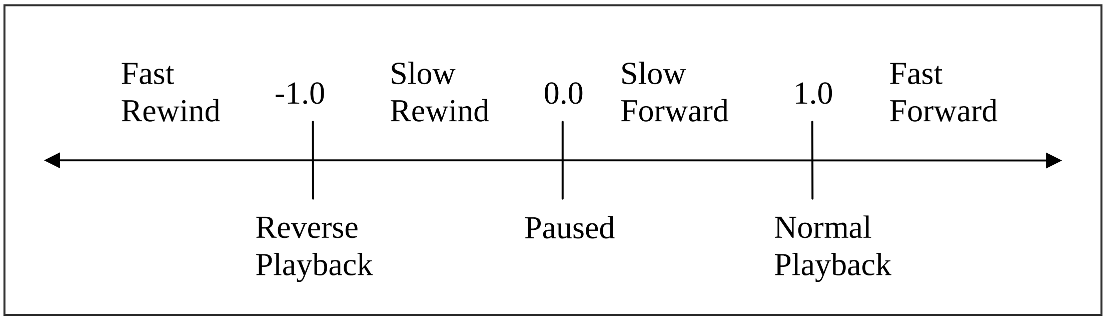


Figure 6-1. Mapping Time Scale Factors to Trick Modes

The IL client queries and sets the media clock's scale via the `OMX_IndexConfigTimeScale` configuration, passing the following structure:

```
typedef struct OMX_TIME_CONFIG_SCALETYPE {
OMX_U32 nSize;
            OMX_VERSIONTYPE nVersion;
            OMX_S32 xScale;
} OMX_TIME_CONFIG_SCALETYPE;
```

The clock component's client components are notified of changes in scale via their clock ports (see Clock Ports section for details).

6.2.2.2 Client Start Time

When a client is sent a start time (i.e., the timestamp of a buffer marked with the `OMX_BUFFERFLAG_STARTTIME` flag), it sends the start time to the clock component via `OMX_SetConfig` on `OMX_IndexConfigTimeClientStartTime`. This action communicates to the clock component the following information about the client's data stream:

- The stream is ready.
- The starting timestamp of the stream, either at startup or after a seek.

The clock component maintains a start time for every client component via a set of `OMX_TIME_CONFIG_TIMESTAMPTYPE` structures. When transitioned to OMX_TIME_ClockStateWaitingForStartTime, the clock component waits on all start times prescribed by the transition. This ensures proper synchronization at the beginning of playback.

6.2.2.3 Media Clock State

The following structure represents the state of the clock component's media clock:

```
typedef struct OMX_TIME_CONFIG_CLOCKSTATETYPE {
      OMX_U32 nSize;
      OMX_VERSIONTYPE nVersion;
      OMX_TIME_CLOCKSTATE eState;
      OMX_TICKS nStartTime;
      OMX_TICKS nOffset;
OMX_U32 nWaitMask;
} OMX_TIME_CONFIG_CLOCKSTATETYPE;
```

The `nStartTime` field specifies the media time when the clock was started or will be started.

The `nWaitMask` field is a bit mask specifying the client components that the clock component will wait on in the OMX_TIME_ClockStateWaitingForStartTime state. Bit masks are defined as `OMX_CLOCKPORT0` through `OMX_CLOCKPORT7`.

The `nOffset` field specifies the time by which to offset the media time. The clock component factors this value into the calculation of media time, effectively adding the offset to the media time reported to its clients. For example, a `nOffset` value of –x implies a pre-roll of duration x.

The `eState` field contains one of the possible clock state values shown in Table 6-2:

Table 6-2: Clock State Values

OMX_TIME_CLOCKSTATE Value	Interpretation
`OMX_TIME_ClockStateRunning`	The media clock is running.
`OMX_TIME_ClockStateWaitingForStartTime`	The media clock is waiting to run until all designated clients emit their start time.
`OMX_TIME_ClockStateStopped`	The media clock is stopped.

An OMX_GetConfig execution using index OMX_IndexConfigTimeClockState and structure OMX_TIME_CONFIG_CLOCKSTATETYPE queries the current clock state.

An OMX_SetConfig execution using index OMX_IndexConfigTimeClockState and structure OMX_TIME_CONFIG_CLOCKSTATETYPE commands the clock component to transition to the given state, effectively providing the IL client a mechanism for starting and stopping the media clock. Figure 6-2 shows the clock state transitions.

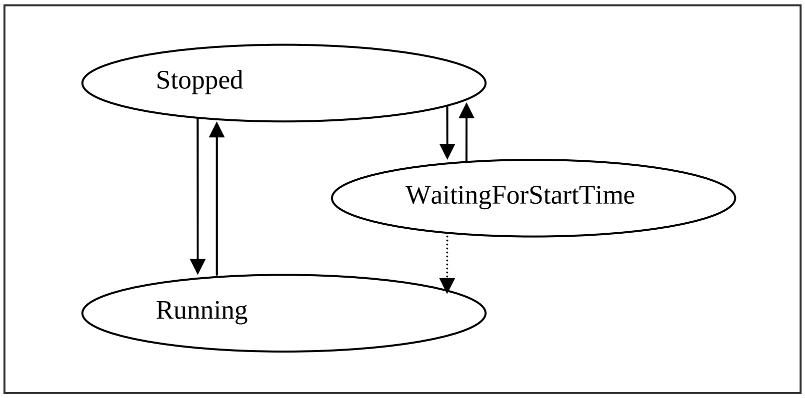


Figure 6-2. Clock State Transitions

Upon receiving OMX_SetConfig from the IL client that requests a transition to the given state, the clock component will do the following:

- OMX_TIME_ClockStateStopped: Immediately stop the media clock, clear all pending media time requests, clear and all client start times, and transition to the stopped state. This transition is valid from all other states.
- OMX_TIME_ClockStateRunning: Immediately start the media clock using the given start time and offset, and transition to the running state. This transition is valid from all other states.
- OMX_TIME_ClockStateWaitingForStartTime: Transition immediately to the waiting state, wait for all clients specified in nWaitMask to report their start time, start the media clock using the minimum of all client start times and transition to OMX_TIME_ClockStateRunning. This transition is only valid from the OMX_TIME_ClockStateStopped state.

6.2.3 Wall Clock

The clock component maintains its own free running wall clock. It uses the wall clock to extrapolate media time values from the periodic updates from the reference clock. An IL client may query the current wall time via the OMX_IndexConfigTimeCurrentWallTime configuration.

6.2.4 Reference Clocks

The clock component can accept both a video and an audio reference clock, supplied respectively by a video component and an audio component. Each reference clock tracks the media time at its associated component (i.e., the timestamp of the data currently being processed at that component) and provides periodic references to the clock component via `OMX_SetConfig` using `OMX_IndexConfigTimeCurrentAudioReference` and `OMX_IndexConfigTimeCurrentVideoReference` and passing the following structure:

```
typedef struct OMX_TIME_CONFIG_TIMESTAMPTYPE {
            OMX_U32 nSize;
            OMX_VERSIONTYPE nVersion;
            OMX_U32 nPortIndex;
            OMX_TICKS nTimestamp;
} OMX_TIME_CONFIG_TIMESTAMPTYPE;
```

When the clock component receives a reference, it updates its internally maintained media time with the reference. This action synchronizes the clock component with the component that is providing the reference clock.

The IL client controls which reference clock the clock component uses (if any) via the `OMX_IndexConfigTimeActiveRefClock` configuration and the following structure:

```
typedef struct OMX_TIME_CONFIG_ACTIVEREFCLOCKTYPE {
            OMX_U32 nSize;
            OMX_VERSIONTYPE nVersion;
            OMX_TIME_REFCLOCKTYPE eClock;
} OMX_TIME_CONFIG_ACTIVEREFCLOCKTYPE;
```

Possible `eClock` values include those shown in Table 6-3:

Table 6-3: Reference Clock Values

OMX_TIME_REFCLOCKTYPE Value	Interpretation
`OMX_TIME_RefClockNone`	Not using a reference clock
`OMX_TIME_RefClockAudio`	Using audio reference clock.
`OMX_TIME_RefClockVideo`	Using video reference clock

In general, any time audio is rendered or captured, the IL client should prefer the audio reference clock. Otherwise, the IL client should prefer the video reference.

6.2.4.1 Media Time Updates

A clock component sends a client a media time update, as either the fulfillment of a request or a scale change notification, over its clock port via the following structure:

```
typedef struct OMX_TIME_MEDIATIMETYPE {
      OMX_U32 nSize;
      OMX_VERSIONTYPE nVersion;
      OMX_U32 nClientPrivate;
      OMX_TIME_UPDATETYPE eUpdateType;
      OMX_TICKS nMediaTimestamp;
      OMX_TICKS nOffset;
      OMX_TICKS nWallTimeAtMediaTime;
      OMX_S32 xScale;
      OMX_TIME_CLOCKSTATE eState;
```

```
} OMX_TIME_MEDIATIMETYPE;
```

- If the `eUpdateType` field indicates this is a request fulfillment message, the `nClientPrivate` field contains the value of `pClientPrivate` from the OMX_TIME_CONFIG_MEDIATIMEREQUESTTYPE structure used to signal the request that this message is fulfilling. If the `eUpdateType` field indicates this is scale or state change notification, the `nClientPrivate` field will be zero.
- `eUpdateType` indicates the reason for the update and as one of the values shown in Table 6-4:

Table 6-4: Update Types

OMX_TIME_UPDATETYPE Value	**Interpretation**
OMX_TIME_UpdateRequestFulfillment	Fulfillment of a media time request.
OMX_TIME_UpdateScaleChanged	Notification of a scale change.
OMX_TIME_UpdateClockStateChanged	Notification of a clock state change.

- The `nMediaTimestamp` field specifies the target media timestamp (if this is a request fulfillment).
- The `nOffset` field specifies the distance in walltime between the current time and the target time (if this is a request fulfillment).
- The `nWallTimeAtMediaTime` field specifies the walltime corresponding to the target media timestamp (if this is a request fulfillment).
- The `xScale` field contains the scale of the media clock when the structure was completed.
- The `eState` field contains the clock state of the media clock when the structure was completed.

6.2.4.2 Media Time Request

A client requests the transmission of a particular timestamp via `OMX_SetConfig` on its clock port using the `OMX_IndexConfigTimeMediaTimeRequest` configuration. The following structure encapsulates a request:

```
typedef struct OMX_TIME_CONFIG_MEDIATIMEREQUESTTYPE {
      OMX_U32 nSize;
      OMX_VERSIONTYPE nVersion;
      OMX_U32 nPortIndex;
      OMX_PTR pClientPrivate;
      OMX_TICKS nMediaTimestamp;
      OMX_TICKS nOffset;
} OMX_TIME_CONFIG_MEDIATIMEREQUESTTYPE;
```

The client's request includes a timestamp, which is usually associated with some operation (e.g., the presentation of a frame) that the client shall execute at that time.

Conceptually, the clock component fulfills the request when the media time matches the timestamp specified.

In practice, the client component may need the request fulfilled slightly earlier than the timestamp specified. In this case, the client specifies the earlier time need of the fulfillment via the `nOffset` field. `nOffset` specifies the desired difference between the wall time when the timestamp actually occurs and the wall time when the request is to be fulfilled. (The `nOffset` value should represent a relatively small interval, on the order of a few milliseconds.) Note that, due to the way scale modifies the progression of media time, a client cannot simply subtract the offset from the timestamp requested.

The request also includes a pointer to any private data that the client wants to associate with it (e.g., a pointer to the frame to deliver at the given timestamp).

6.2.4.3 Media Time Request Fulfillment

When fulfilling a request, the `OMX_TIME_MEDIATIMETYPE` structure contains the requested media time, the wall time that corresponds to that media time, and the offset in wall time between when the media time will actually occur and when the request was actually fulfilled.

Since some clock component implementations may have difficulty fulfilling the request at exactly the time specified, the fulfillment may occur slightly earlier, leading to a fulfillment offset larger than the one requested. The clock component shall fulfill the request as close to the requested time as possible without being late. Figure 6-3 shows the timeline for the request and fulfillment of a media time update.

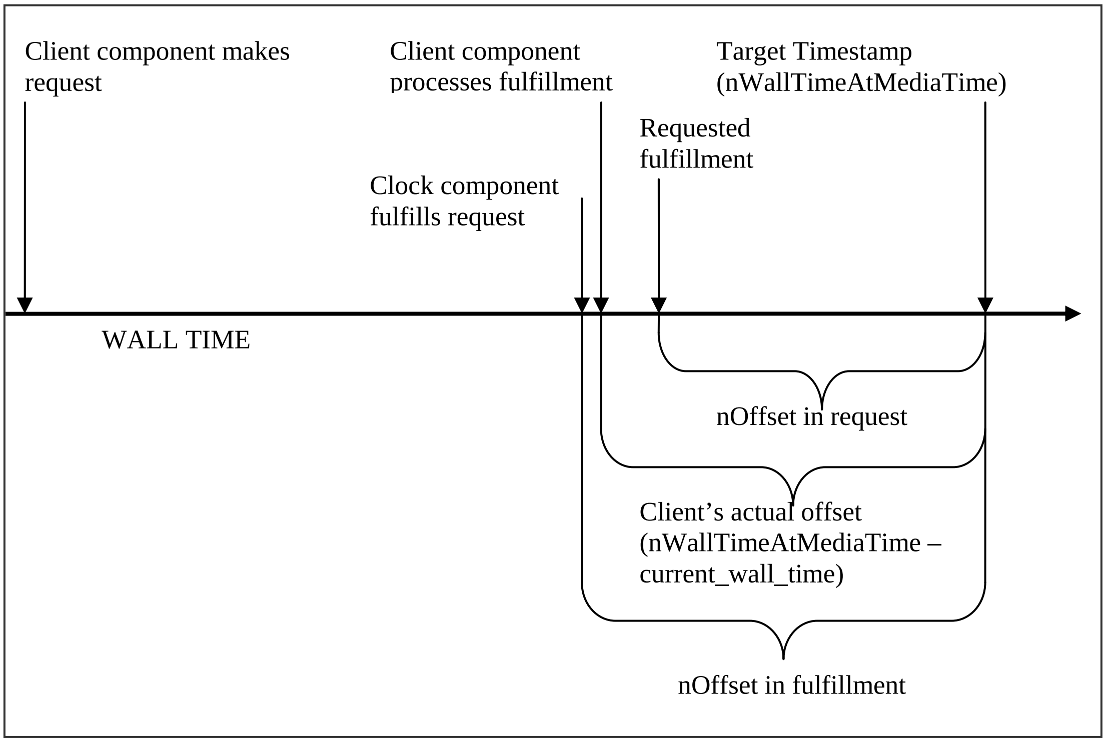


Figure 6-3. Timeline for Request and Fulfillment of Media Time Update

When a client receives the fulfillment of a request, it may time any associated operation (e.g., frame delivery) more precisely by waiting any of the remaining interval until the timestamp itself. The client may estimate the interval until the timestamp actually occurs by using `nOffset` directly, although this does not account for any delay between when the clock component fulfilled the request and when the client began processing the fulfillment. A client may obtain a more accurate estimate for this interval by taking the difference between `nWallTimeAtMediaTime` and the clock component's current wall time, which is obtained via `OMX_GetConfig` on `OMX_IndexConfigTimeCurrentWallTime`.

This interval should be small enough for the client to use its own wall clock to implement the wait. The effect of any scale change during the interval or any drift between the clock component's wall clock and the client's wall clocks should be negligible for so short a duration.

6.2.4.4 Scale Change Notifications

A `eUpdateType` value of `OMX_TIME_UpdateScaleChanged` identifies a media time update as a scale change notification.

The clock component alerts its clients to scale changes via media time updates for optimization and data correction. For instance, during fast forward, a video component might skip intra frames and an audio component might scale and pitch correct its samples or drop them entirely. Nevertheless, components should never alter the presentation timestamp associated with a media sample. Time scaling is always applied to the media time, not the media samples.

A component that provides a reference clock shall watch for scale changes and behave accordingly. In particular, it shall:

- Cease all data delivery and its reference clock when the scale is zero (i.e., paused).
- Resume data delivery and its reference clock when the scale changes to non-zero (i.e., unpaused).

The `xScale` field contains the new scale. The `nMediaTimestamp` and `nWallTimeAtMediaTime` fields contain the media and wall time, respectively, when the scale change occurred. `nOffset` should reflect the difference, if any, between the wall time of the scale change and the wall time of the transmission of the corresponding media time update.

6.2.4.5 Clock State Change Notifications

A `eUpdateType` value of `OMX_TIME_UpdateClockStateChanged` identifies a media time update as a scale change notification.

The clock component alerts its clients to clock state transitions via media time updates so that they may take any action appropriate in that clock state. In particular:

- Any rendering component shall cease data delivery when the media clock transitions into the stopped state.

- Any client providing a reference clock shall use a media time request to time the resumption of data delivery and, hence, its reference clock when the media clock transitions into the running state

The `eState` field contains the new clock state. The `nMediaTimestamp` and `nWallTimeAtMediaTime` fields contain the media and wall time, respectively, when the clock change occurred. `nOffset` should reflect the difference, if any, between the wall time of the state change and the wall time of the transmission of the corresponding media time update.

6.2.5 Clock Component Implementation

The clock component is responsible for implementing the semantics described in this section. Specifically the clock component should implement the following:

- Queries of its wall or media clock
- Queries of or changes to its media clock's state or scale
- Queries of or changes to its active reference clock
- Client notification of scale changes
- Fulfillment of media time requests
- Updates from the reference clocks

This following discussion describes aspects of these obligations that are not implicit in the preceding description of clock component semantics.

6.2.5.1 Deriving Media Time

The clock component derives the media time from the reference clock and the wall clock. When the reference clock sends the clock component a time reference, R_{now}, the clock component queries the wall clock for its current value, W_{now}. If an IL client specified an offset when it started the clock component (e.g., to implement a pre-roll), then the clock component adds this offset as W_{now} + Offset. The clock component stores the ultimate reference/wall time pair, representing the base of extrapolation, for later use as $<R_{base}, W_{base}>$ where:

$$R_{base} = R_{now}$$

$$W_{base} = W_{now} + Offset$$

The clock component calculates the instantaneous media time, M_{now}, by querying the wall clock, W_{now}, and extrapolating from the last reference, modulated by the current scale, *Scale*, as follows:

$$M_{now} = R_{base} + Scale * (W_{now} - W_{base})$$

6.2.5.2 Scale Changes

Upon invocation of a scale factor, *Scale*, the clock component first establishes a new base of extrapolation by querying the current media time, M_{now}, and the current wall time, W_{now}:

$$R_{base} = M_{now}$$

$$W_{base} = W_{now}$$

The clock component then notifies all client components of the new scale via a media time update. It fills in the fields of the corresponding `OMX_TIME_MEDIATIMETYPE` structure as follows:

- `nClientPrivate` = NULL
- `nMediaTimestamp` = M_{now}
- `nWallTimeAtMediaTime` = W_{now}
- `xScale` = *Scale*

6.2.5.3 Fulfilling Media Time Requests

A clock component's approach to servicing media time requests is implementation specific. Certain operating system constructs (e.g., timers) may be useful in avoiding the expense of the spin locks associated with comparing requested times with the current media time. Nevertheless, clock component implementers should be wary of any skew between the clock component and the clock used by the operating system constructs that compromise the timely, accurate fulfillment of requests.

The clock component shall account for any offset specified by the request. Assume a requested timestamp of $M_{request,}$ an offset $Offset_{request}$, and a scale factor of *Scale*. Instead of comparing against $M_{request}$, the clock component should compare against the following:

$$M_{request} - (Offset_{request} * Scale)$$

Furthermore, the comparison between requested times and media time differ between forward playback, backward, and paused playback. Specifically, the comparisons shown in Table 6-5 should be used according to scale:

Table 6-5: Media Time Request Scale

Scale	Fulfill request when
> 0.0 (forward playback)	$M_{now} >= (M_{request} - (Offset_{request} * Scale))$
< 0.0 (backward playback)	$M_{now} <= (M_{request} - (Offset_{request} * Scale))$
0.0 (paused)	Never

6.2.6 Audio-Video File Playback Example Use Case

As an example, examine the playback of a file containing synchronized audio and video as illustrated in **Error! Reference source not found.**. This example assumes that each audio or video frame has a presentation timestamp associated with it. In this construction, a file reader/de-multiplexing component feeds compressed audio and video streams to a pair of decoders. The decoders send uncompressed data to an audio renderer and video scheduler. The audio renderer delivers data to the hardware and the video scheduler will send the data to the video renderer which will send the data to the hardware.

The audio renderer and video scheduler coordinate with the clock component to implement smooth synchronized audio-video delivery. The audio renderer, video scheduler and file demuxer are clients of the clock component (connected on their respective clock ports) so they may watch for scale changes. The video scheduler also uses the clock component to time delivery of video frames via media time requests.

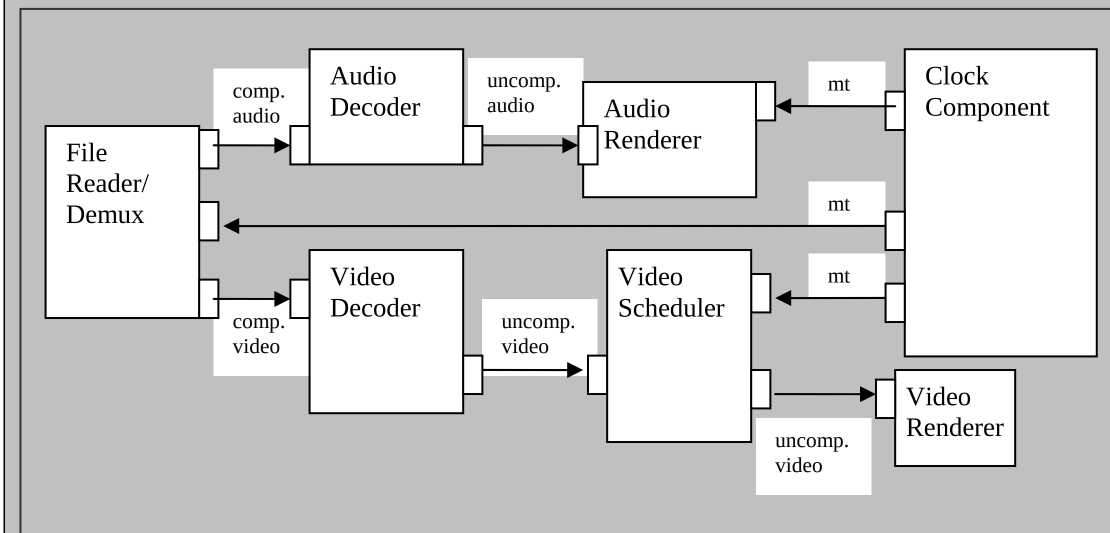


Figure 6-4. Example Use Case of Audio-Video File Playback

The audio renderer and video scheduler act as the audio and video reference clocks, each sending their reference times to the clock component as they deliver data.

In this example, the IL client uses the audio renderer as the reference clock at any time audio data is being delivered during normal playback. Thus, the IL client does not need to use the clock component to coordinate the delivery of audio data. It simply feeds new data to the audio device whenever it can, provided that the current scale allows it. When the audio device is presenting an audio buffer, the audio renderer emits the timestamp of that buffer as a reference.

The video scheduler, however, shall coordinate with the clock component when delivering video frames. For each frame that the video scheduler will deliver the frame to the video renderer at a particular timestamp, the following occurs:

1. The video scheduler submits a media time request, referencing the frame data in the private pointer and specifying fulfillment slightly earlier that the timestamp.

2. The clock component fulfills the request when it becomes current via a media time update to the video scheduler that references the original timestamp and includes the private pointer.
3. The video scheduler receives the media time update, de-references the private pointer to obtain the frame data, and delivers the frame to the video renderer. The video scheduler uses an implementation-specific mechanism to wait the remainder of the time until the timestamp before delivery (e.g., schedules a hardware flip with the video driver).

The IL client controls the clock component via specialized configurations to start and stop the media clock. To implement trick modes, the IL client sets the scale factor configuration. When the clock component applies the scale to the calculation of media time, it sends a media time update with the scale change to all of its clients.

The client components react to that scale change appropriately. When the scale is 0 (i.e., the media clock is paused), the audio renderer silences audio and ceases sending data. Furthermore, in this example, the file demuxer might elect to ignore input during non-1X playback.

If audio is effectively silenced during trick modes, the IL client may switch the active reference clock from the audio reference to the video reference.

Finally, the IL client may query the current media time from the clock component to, for instance, update the user interface such as through a progress bar.

7 Container Parsing

This section describes container parsing including access to available streams and metadata.

7.1 Parameter and Configuration Indexes

The header `OMX_Index.h` contains the enumeration `OMX_INDEXTYPE`, which contains all of the standard index values used with the functions `OMX_GetParameter`, `OMX_SetParameter`, `OMX_GetConfig`, and `OMX_SetConfig`. Table 7-1 describes the index values that relate to file parsing.

Table 7-1: Index Values for File Parsing

Index	Description
`OMX_IndexParamNumAvailableStreams`	Specifies the number of alternative streams available on a given output port. The corresponding structure is OMX_PARAM_U32TYPE.
`OMX_IndexParamActiveStream`	Specifies the active stream (among those available) on a given output port. The corresponding structure is OMX_PARAM_U32TYPE.
`OMX_IndexParamMetadataKeyFilter`	Specifies whether a key (or all keys) are enabled or disabled with respect to the metadata filter. An enabled key is in the filter and metadata with this key is retained for future potential querying. The corresponding structure is OMX_PARAM_METADATAFILTERTYPE.
`OMX_IndexConfigMetadataItemCount`	Specifies number of metadata items associated with a resource contained within a media file at a specific scope. The corresponding structure is OMX_CONFIG_METADATAITEMCOUNTTYPE.
`OMX_IndexConfigMetadataItem`	Specifies the contents of the metadata item indicated by the given index or key. The corresponding structure is OMX_CONFIG_METADATAITEMTYPE.

Index	Description
`OMX_IndexConfigContainerNodeCount`	Specifies the number of child nodes a given node contains. The corresponding structure is OMX_CONFIG_CONTAINERNODECOUNTTYPE.
`OMX_IndexConfigCounterNodeID`	Specifies the node id of specific node. The corresponding structure is OMX_CONFIG_CONTAINERNODEIDTYPE,
`OMX_IndexParamMetadataFilterType`	Specifies the filters to be applied for the meta data accesses

7.2 Format Detection

A particular container parser implementation supports a finite set of container formats, yet the component might not definitively determine support for a particular datastream until it attempts to parse the datastream. Therefore OpenMAX IL introduces the following mechanisms for a parser to communicate its ability or inability to recognize the format of a given datastream:

- The `OMX_ErrorFormatNotDetected` error. A component sends the client this error (in the form of an `OMX_EventError` event passed via the `EventHandler` callback) when it cannot parse or determine the format of the given datastream.
- The `OMX_EventPortFormatDetected` event. A component sends the client this event (via the `EventHandler` callback) when it has successfully recognized a format and determined that it can support it.

The IL client may use these mechanisms (perhaps in conjuction with autodetect ports) to determine whether a given parser is appropriate for a given datastream.

7.3 Port Streams

When parsing a datastream a component may discover multiple alternative streams suitable for emission as output on a given output port. For instance, when parsing a video stream muxed with synchronized audio, a parser component may discover the container datastream includes several alternative languages represented as different audio streams each a candidate for output out the same audio output port.

A port exposes the set of candidate streams as a “port stream”. If a port supports port streams (e.g. a parser output port), discovering the port streams is part of that port’s autodetect process. When the autodetect is completed (i.e. the component issues a `OMX_EventPortSettingsChanged` event) such a port be ready to service queries and writes on the following configs:

- The OMX_IndexParamNumAvailableStreams config. This read only parameter denotes the number of streams available on the port.
- The OMX_IndexParamActiveStream config. This read/write parameter denotes the currently selected stream for the port.

The port populates its settings according to the currently selected stream. An IL client may use thus use the OMX_IndexParamActiveStream parameter to both browse the settings associated with each available streams and to ultimately select the final stream for playback.

This may be performed by the IL client in the following way:

1. Instantiate the component and set any relevant configs/parameters (e.g. identifying the target content)
2. Set all output ports where the IL client desires stream discovery to autodetect and put the component into the OMX_StateExecuting state.
3. Wait until the port generates an OMX_EventPortSettingsChanged event. This event indicates it has parser enough data to have discovered the alternative streams.
4. Query the number of available streams for that port via OMX_IndexParamNumAvailableStreams. For each possible stream set that stream as active via OMX_IndexParamActiveStream. This will cause the port to populate its settings according to the active stream. The IL client may then discover the properties of the stream by reading the appropriate port parameters.
5. After reading the properties of each stream, the IL client may select the one it desires via OMX_IndexParamActiveStream.

7.4 Metadata Extraction

OpenMAX IL supports retrieving metadata items captured by a component. A metadata item is defined as a key/value pair, where both key and value are buffers formatted using specified character sets. OpenMAX IL enables an IL Client to perform the following operations with regards to metadata:

- Specify an client-defined set of keys to filters which metadata items will be captured by the component
- Scope a metadata query to seek particular elements of the content, inclusive of the entire content
- Determine the number of distinct metadata items available at any given scope
- Retrieve all metadata items by iterating through all metadata items by available at any given scope by index
- Retrieve a metadata value for a specific metadata key

7.4.1.1 Key/Value Query

OpenMAX IL supports the querying of key/value pair data captured by a component that parses metadata via a set of component configs. The purpose of these configs is to enable an IL Client client to determine how many metadata items are present at a given scope, iterate through the items by index to retrieve the key/value data and query values for specific keys.

7.4.1.2 Node Traversal

OpenMAX IL supports the traversal of metadata nodes captured by a component that parses metadata via a set of component configs.

The purpose of these configs is to define a mechanism for obtaining a set of specifiers which can be used to uniquely scope metadata searches to atomic elements, or ‘nodes’, of data within a media file. Each node has a component-defined 'node ID' that the component can use to uniquely locate the node within the media file. Note that a node ID should be considered an opaque ID, therefore it need not have any intrinsic value or meaning; it need only be a value that the component can use to uniquely set the scope of a metadata search.

All media files contain exactly one 'root node’ whose node ID always has value OMX_ALL; this represents the 'top-level' metadata associated with the media file. The root node is the only node without a parent node. All other nodes have exactly one parent.

In general, the node traversal configs uses the term ‘node’ is used to represent a node for which one wants to know the ID value, and the term ‘parent node’ is used to represent the parent of one or more nodes for which one wants to know the ID value(s).

7.4.1.3 Key Filtering

OpenMAX IL supports the filtering of metadata captured by a component that parses metadata via the `OMX_IndexParamMetadataKeyFilter` parameter. This parameter allows the client to add or remove keys from the filter before the component begins processing the data. A component will retain all metadata associated with keys in the filter (so the IL client may query them later) and may safely ignore all keys not in the filter.

7.4.1.4 Specifying Language/Country

The concepts of Language and Country for a metadata item exist in some but not all file format metadata schemes. Where they do exist, most formats have only Language (including ID3v2), whereas others combine Language and Country together into a single, compound specifier. Only 3GPP has a standard metadata key that uses a Country specifier but no Language (in ‘locl’ metadata items).

Because of the relatively rare usage of these features, at the API level we combine Language and Country into a single compound Language-Country specifier, where Language comes first and Country is optional, as per the HTTP specification (RFC 2068). This approach accommodates all use cases; for example, “en” indicates English language content for all countries, “en-US” indicates English language content for the US, “en-UK” indicates English language content for the UK, etc.

Individual requirements for Language and Country follow.

7.4.1.4.1 Language Codes

When accessing the value of a metadata item for which a language is specified, the client shall be given the language specifier. When creating a metadata item for which a language may be specified, or when changing its value, the client shall be able to indicate the language used in the supplied value. This is necessary because some file formats allow some metadata items to include a language specifier (this is usually limited to text, though not necessarily; for example, images and sounds can also be in a particular language). In some cases, there may be multiple, alternative versions of the same metadata item in different languages, and in these cases the language specifier allows the client application to select and present just the most appropriate version.

Public standards for Language specifiers include RFC 1766 / ISO 639.

7.4.1.4.2 Country Codes

Similar to the Language requirement: When accessing the value of a metadata item for which a Country (geographic location) is specified, the client shall be given the Country specifier. When creating a metadata item for which a Country may be specified, or when changing its value, the client shall be able to indicate the Country to which the supplied value applies.

Public standards for Country specifiers include ISO 3166.

7.5 Types and Structures

7.5.1 OMX_PARAM_U32TYPE

Parameters represented by unsigned 32 bit values (e.g. `OMX_IndexParamActiveStream`) use the `OMX_PARAM_U32TYPE` which is defined as follows:

```
typedef struct OMX_PARAM_U32TYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U32 nPortIndex;
    OMX_U32 nU32;
} OMX_PARAM_U32TYPE;
```

7.5.2 OMX_METADATACHARSETTYPE

The `OMX_METADATACHARSETTYPE` enumeration defines the range of possible character sets (e.g. where a particular character is used to represent a metadata key).

Table 7-2: Supported Metadata Characterset Types

Value Name	Character Set Description
OMX_MetadataCharsetUnknown	Unknown character encoding
OMX_MetadataCharsetASCII	ASCII
OMX_MetadataCharsetBinary	Binary
OMX_MetadataCharsetCodePage1252	Microsoft Code Page 1252
OMX_MetadataCharsetUTF8	Unicode UTF-8
OMX_MetadataCharsetJavaConformantUTF8	Unicode UTF-8 (Java Conformant)
OMX_MetadataCharsetUTF7	Unicode UTF7
OMX_MetadataCharsetImapUTF7	Unicode UTF-7 per IETF RFC 2060
OMX_MetadataCharsetUTF16LE	Unicode UTF-16 (Little Endian)
OMX_MetadataCharsetUTF16BE	Unicode UTF-16 (Big Endian)
OMX_MetadataCharsetGB12345	GB 12345 (Chinese)
OMX_MetadataCharsetHZGB2312	HZ GB 2312 (Chinese)
OMX_MetadataCharsetGB2312	GB 2312 (Chinese)
OMX_MetadataCharsetGB18030	GB 18030 (Chinese)
OMX_MetadataCharsetGBK	GBK (CP936) (Chinese)
OMX_MetadataCharsetBig5	Big 5 (Chinese)
OMX_MetadataCharsetISO88591	ISO-8859-1 (Latin1 – West European languages)
OMX_MetadataCharsetISO88592	ISO-8859-2 (Latin2 – East European)
OMX_MetadataCharsetISO88593	ISO-8859-3 (Latin3 – South European)
OMX_MetadataCharsetISO88594	ISO-8859-4 (Latin4 – North European)
OMX_MetadataCharsetISO88595	ISO-8859-5 (Cyrillic)
OMX_MetadataCharsetISO88596	ISO-8859-6 (Arabic)
OMX_MetadataCharsetISO88597	ISO-8859-7 (Greek)
OMX_MetadataCharsetISO88598	ISO-8859-8 (Hebrew)
OMX_MetadataCharsetISO88599	ISO-8859-9 (Latin5 - Turkish)
OMX_MetadataCharsetISO885910	ISO-8859-10 (Latin6 – Nordic)
OMX_MetadataCharsetISO885913	ISO-8859-13 (Latin7 – Baltic Rim)
OMX_MetadataCharsetISO885914	ISO-8859-14 (Latin8 - Celtic)
OMX_MetadataCharsetISO885915	ISO-8859-15 (Latin9 – updates to Latin1)
OMX_MetadataCharsetShiftJIS	Shift-JIS (Japanese)
OMX_MetadataCharsetISO2022JP	ISO-2022-JP (Japanese)
OMX_MetadataCharsetISO2022JP1	ISO-2022-JP-1 (Japanese)
OMX_MetadataCharsetISOEUCJP	ISO EUC-JP (Japanese)
OMX_MetadataCharsetSMS7Bit	SMS 7-bit

7.5.3 OMX_METADATASCOPETYPE

The OMX_METADATASCOPETYPE structure is used to identify the type of the metadata search scope that is being specified. A scope type value is used in conjunction with a scope specifier value to identify the type of said specifier.

Table 7-3: Supported Metadata ScopeTypes

Value Name	Client usage	Component action
OMX_MetadataScopeAllLevels	Search entire piece of content—scope specifier is ignored	Search entire piece of content for matching metadata.
OMX_MetadataScopeTopLevel	Limit search scope to root level—scope specifier is ignored	Search only at the content's root level for matching metadata. Root level is defined as the only container level with no logical parent.
OMX_MetadataScopePortLevel	Limit search scope to port level—scope specifier is the port index for an output port	Search for matches only among those metadata items associated with the media resource being emitted from the indicated port. If multiple streams can be emitted from the indicated port, the component will only search for matching metadata associated with the currently active stream, as determined using the port streams mechanism.
OMX_MetadataScopeNodeLevel	Limit search scope to container file node level—scope specifier is a node ID.	Search for matches only among those metadata items explicitly associated with the specified container node and exclusive of sub-nodes of the specified container node.

7.5.4 OMX_CONFIG_METADATAITEMCOUNTTYPE

The IL Client uses the OMX_IndexConfigMetadataItemCount and the OMX_CONFIG_METADATAITEMCOUNTTYPE structure to query a component for the number of metadata items associated with a resource contained within a media file at a specific scope.

OMX_CONFIG_METADATAITEMCOUNTTYPE is defined as follows.

```
typedef struct OMX_CONFIG_METADATAITEMCOUNTTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_METADATASCOPETYPE eScopeMode;
    OMX_U32 nScopeSpecifier;
```

```
    OMX_U32 nMetadataItemCount;
} OMX_CONFIG_METADATAITEMCOUNTTYPE;
```

7.5.4.1 Parameter Definitions

The parameters for OMX_CONFIG_METADATAITEMCOUNTTYPE are defined as follows.

- eScopeMode defines the type of scope being specified. See Section 10—Implementing Buffer Sharing for usage.
- nScopeSpecifier is the value of the scope specifier. See Section 10—Implementing Buffer Sharing for usage.
- nMetadataItemCount is the number of metadata items found at the scope being queried.

7.5.4.2 Dependencies

The OMX_CONFIG_METADATAITEMCOUNTTYPE structure may be queried at any time as generally allowed when calling OMX_GetConfig. However, it is possible the count of metadata items at a given scope may change as the data being processed by the component changes.

7.5.4.3 Functionality

The OMX_CONFIG_METADATAITEMCOUNTTYPE structure identifies the number of metadata items in a particular scope.

7.5.4.4 OMX_METADATASEARCHMODETYPE

The OMX_METADATASEARCHMODETYPE enumeration lists the types of queries that can be performed using the OMX_CONFIG_METADATAITEMTYPE structure.

As such the search mode specifies the usage of the other fields (input and output) of this configuration structure.

Table 7-4: Supported Metadata Search Types

Value Name	Client usage	Component action
OMX_MetadataSearchValueSizeByIndex	Get metadata value size by index nMetadataItemIndex = valid index for the given scope	nValueMaxSize = number of bytes needed to hold value of the found metadata item (No actual Key or Value data are returned, only the size.)

Value Name	Client usage	Component action
OMX_MetadataSearchItemByIndex	Get metadata key and value by index nMetadataItemIndex = valid index for the given scope nValueMaxSize = size in bytes of nValue buffer. nValue = empty buffer at least nValueMaxSize bytes long (Key buffer has fixed size.)	eKeyCharset = charset of key data in nKey nKeySizeUsed = number of bytes used in nKey nKey = buffer containing key data from the found metadata item eValueCharset = charset of value data in nValue nValueSizeUsed = number of bytes used in nValue nValue = buffer containing value data from the found metadata item
OMX_MetadataSearchNextItemByKey	Get value of first, nth, or next metadata item matching a given key nMetadataItemIndex = Valid index for the given scope. To obtain the Nth occurrence of the key, set to N - 1. To obtain the first occurrence of the key, set to OMX_ALL. eKeyCharset = charset of key data in nData nKeySizeUsed = number of bytes used in nKey nKey = buffer containing the key data to match nValueMaxSize = size in bytes of allocated by client to receive value data nValue = empty buffer at least nValueSize bytes long	nMetadataItemIndex = index of matching/found metadata item eValueCharset = charset of value data in nValue nValueSizeUsed = number of bytes used in nValue nValue = buffer containing value data from the found metadata item

7.5.5 OMX_CONFIG_METADATAITEMTYPE

The IL Client uses the OMX_IndexConfigMetadataItem and the OMX_CONFIG_METADATAITEMTYPE structure to query a component for one metadata item. It can be used to retrieve a metadata item either by index or by key, or to get the size of a metadata item by index.

```
typedef struct OMX_CONFIG_METADATAITEMTYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_METADATASCOPETYPE eScopeMode;
    OMX_U32 nScopeSpecifier;
    OMX_U32 nMetadataItemIndex;
    OMX_METADATASEARCHMODETYPE eSearchMode;
    OMX_METADATACHARSETTYPE eKeyCharset;
    OMX_U8 nKeySizeUsed;
    OMX_U8 nKey[128];
    OMX_METADATACHARSETTYPE eValueCharset;
    OMX_STRING sLanguageCountry;
    OMX_U32 nValueMaxSize;
    OMX_U32 nValueSizeUsed;
    OMX_U8 nValue[1];
} OMX_CONFIG_METADATAITEMTYPE;
```

7.5.5.1 Parameter Definitions

The parameters for `OMX_CONFIG_METADATAITEMTYPE` are defined as follows.

- `eScopeMode` defines the type of scope being specified.
- `nScopeSpecifier` is the value of the scope specifier.
- `nMetadataItemIndex` is the index of the metadata item being queried.
- `eSearchMode` is the type of query being performed.
- `eKeyCharset` is the `OMX_METADATACHARSETTYPE` of the key data within `nKey`.
- `nKeySizeUsed` is number of bytes within `nKey` that are populated with key data.
- `nKey` is the buffer of key data.
- `eValueCharset` is the `OMX_METADATACHARSETTYPE` of the value data within `nValue`.
- `sLanguageCountry` is the combined language and country specifier.
- `nValueMaxSize` is the size in bytes of the `nValue` buffer. ***Note:*** when `nValueMaxSize` is an input parameter and is a value less than the size of the metadata value, an `OMX_ErrorInsufficientResources` error will be returned and no output parameters will be populated.
- `nValueSizeUsed` is the number of bytes within `nValue` that are populated with value data.
- `nValue` is the buffer of value data.

7.5.5.2 Dependencies

The OMX_CONFIG_METADATAITEMTYPE structure may be queried at any time as generally allowed when calling OMX_GetConfig. However, it can be possible that the metadata item being sought may not yet be accessible if the corresponding portion of content has not yet been processed by the component.

7.5.5.3 Functionality

The OMX_CONFIG_METADATAITEMTYPE structure identifies a particular metadata item in a particular scope. The type of query performed by OMX_GetParameter is defined by the eSearchMode field. Refer to Section 7.5.4.4 above for details.

7.5.6 OMX_PARAM_METADATAFILTERTYPE

The IL Client uses the OMX_IndexParamMetadataFilterType and OMX_PARAM_METADATAFILTERTYPE parameter structure to specify the inclusion or exclusion of a particular key, or of all keys using a given character set, in a component's filter of metadata keys. An IL client leverages writes to this parameter to enable or disable a particular key or key character set, which effectively includes or excludes that key or key character set from the set of metadata retained by the component for querying later. An IL client may also leverage reads of this parameter to query the for the inclusion/exclusion of keys from this filter. Metadata items may also be optionally filtered for Language/Country code in combination with a particular key or key character set.

```
typedef struct OMX_PARAM_METADATAFILTERTYPE
{
      OMX_U32 nSize;
      OMX_VERSIONTYPE nVersion;
      OMX_BOOL bAllKeys;
      OMX_METADATACHARSETTYPE eKeyCharset;
      OMX_U32 nKeySizeUsed;
      OMX_U8   nKey [128];
      OMX_U32 nLanguageCountrySizeUsed;
      OMX_U8  nLanguageCountry[ 128 ];
      OMX_BOOL bEnabled;
} OMX_PARAM_METADATAFILTERTYPE;
```

7.5.6.1 Parameter Definitions

The parameters for OMX_PARAM_METADATAFILTERTYPE are defined as follows.

- nVersion is the version of the structure.
- nSize is the size of the structure in bytes. This value shall be specified when this structure is used as either an input to or output from a function.
- bAllKeys

If this field is false, then only the particular specified key is included in the filter, and the filter matches metadata items with the indicated language/country code (if present). None of the other fields are ignored.

If this field is true and nKeySizeUsed is zero and eKeyCharset is MetadataCharsetUnknown, then this structure refers to all possible keys in all possible eKeyCharsets, and matches metadata items with the indicated language/country codes (if present). The nKey field is ignored.

If this field is true and nKeySizeUsed is zero and eKeyCharset is not MetadataCharsetUnknown, then this structure refers to all possible keys in the specified eKeyCharset, and matches metadata items with the indicated language/country code (if present). The nKey field is ignored.

- eKeyCharset – If nKeySizeUsed in not zero, then this must be used to indicate the OMX_METADATACHARSETTYPE of the key data within nKey. If nKeySizeUsed is zero, then all keys with this character set will be added to the filter; the value MetadataCharsetUnknown will match all key character sets.
- nKeySizeUsed is number of bytes within nKey that are populated with key data. If zero, there is no key associated with this metadata filter item (just an eKeyCharset and/or language/country code). If this is not zero, then the eKeyCharset must indicate the encoding of the key data in nKey.
- nKey is the buffer of key data.
- nLanguageCountrySizeUsed is the number of bytes within nLanguageCountry that are populated with Language / Country code data. If zero, there is no Language/Country code associated with this metadata filter item (just a key).
- nLanguageCountry is the buffer of Language/Country code data.
- bEnabled if true then key is part of filter (e.g. retained for query later). If false then key is not part of filter is the buffer of key data.

7.5.6.2 Dependencies

The OMX_PARAM_METADATAFILTERTYPE structure may be queried at any time that the component is not in the OMX_StateInvalid state. The structure may be set using OMX_SetParameter only when the component is in the OMX_StateLoaded state.

7.5.6.3 Functionality

The OMX_PARAM_METADATAFILTERTYPE structure identifies whether a particular metadata key or language/country code (or all metadata keys) are in the metadata filter (that is, they are retained by the parser for potential querying later). An IL client may thus leverage this structure and the OMX_IndexParamMetadataKeyFilter parameter to set or get filter settings.

Table 7-5: Meta Data Key Access Use Cases

Use case	Function	`bAllKeys`	`eKeyCharset` `nKeySizeUsed` `nKey`, `nLanguageCountrySizeUsed`, `nLanguageCountry`	`bEnabled`
Add a key and/or language/country code to the filter	`SetParameter`	OMX_FALSE	Specifies particular key (and its encoding) being added to filter, with optional language/country code	OMX_TRUE
Add all keys to the filter (also matches language/country code, if any); if `eKeyCharset` is a known encoding, then only keys with that encoding are included in the filter	`SetParameter`	OMX_TRUE	Required: `eKeyCharset`Optional: `nLanguageCountrySizeUsed`, `nLanguageCountry`. Others are not applicable/ignored	OMX_TRUE
Remove a key and/or language/country code from the filter	`SetParameter`	OMX_FALSE	Specifies particular key (and its encoding)being removed from filter, with optional language/country code	OMX_FALSE
Remove all keys from the filter (also matches language/country code, if any) ; if `eKeyCharset` is a known encoding, only keys with that encoding are included in the filter	`SetParameter`	OMX_TRUE	Required: `eKeyCharset`, Optional: `nLanguageCountrySizeUsed`, `nLanguageCountry`. Others are not applicable/ignored	OMX_FALSE
Query whether a key and/or language/country code is part of the filter	`GetParameter`	Not applicable/ignored	Specifies particular key (and its encoding) being queried, with optional language/country code	Output field filled in by `GetParameter`

7.5.6.4 Post-processing Conditions

The changes specified to the component's metadata filter (i.e. the enabling or disabling of keys) are applied upon the return of a OMX_SetParameter call when used with the OMX_CONFIG_METADATAITEMTYPE structure. The component retains only the cumulative set of keys specified as enabled in the filter.

7.5.7 OMX_CONFIG_CONTAINERNODECOUNTTYPE

The IL Client uses the OMX_IndexConfigContainerNodeCount and the OMX_CONFIG_CONTAINERNODECOUNTTYPE structure to query a parent node for the number of nodes it contains.

```
typedef struct OMX_CONFIG_CONTAINERNODECOUNTTYPE
{
      OMX_U32 nSize;
      OMX_VERSIONTYPE nVersion;
      OMX_BOOL bAllKeys;
      OMX_U32 nParentNodeID;
      OMX_U32 nNumNodes;
} OMX_CONFIG_CONTAINERNODECOUNTTYPE;
```

7.5.7.1 Parameter Definitions

The parameters for OMX_CONFIG_CONTAINERNODECOUNTTYPE are defined as follows.

- nParentNodeID is the node ID for the node being queried. To specify the media file's root node, use the value OMX_ALL
- nNumNodes is the number of nodes contained by the indicated parent node.

7.5.7.2 Dependencies

The OMX_CONFIG_CONTAINERNODECOUNTTYPE structure may be queried at any time as generally allowed when calling OMX_GetConfig. However, it is possible that the count of nodes returned by this query may change if the component is actively processing data.

7.5.7.3 Functionality

The OMX_CONFIG_CONTAINERNODECOUNTTYPE structure identifies the node count on given a node ID.

7.5.8 OMX_CONFIG_CONTAINERNODEIDTYPE

The IL Client uses the OMX_IndexConfigCounterNodeID and the OMX_CONFIG_CONTAINERNODEIDTYPE structure to obtain information about a specific node.

```
typedef struct OMX_CONFIG_CONTAINERNODEIDTYPE
{
      OMX_U32 nSize;
      OMX_VERSIONTYPE nVersion;
      OMX_BOOL bAllKeys;
      OMX_U32 nParentNodeID;
      OMX_U32 nNodeIndex;
      OMX_U32 nNodeID;
      OMX_STRING cNodeName;
      OMX_BOOL bIsLeafType;
} OMX_CONFIG_CONTAINERNODEIDTYPE;
```

7.5.8.1 Parameter Definitions

The parameters for `OMX_CONFIG_CONTAINERNODEIDTYPE` are defined as follows.

- `nParentNodeID` is the node ID for the node being queried. To specify the media file's root node, use the value OMX_ALL
- `nNodeIndex` is the index of this node.
- `nNodeID` is the node ID for this node.
- `cNodeName` name of this node. It is an OMX_STRING less than 128 characters long including the trailing null byte.
- `bIsLeafType` indicates whether this node may be a parent to other nodes. If the component does not know whether this node is a parent or not, the component will return OMX_FALSE.

7.5.8.2 Dependencies

The `OMX_CONFIG_CONTAINERNODEIDTYPE` structure may be queried at any time as generally allowed when calling `OMX_GetConfig`. However, it is possible that if the underlying data has changed the node being sought may no longer be accessible.

7.5.8.3 Functionality

The `OMX_CONFIG_CONTAINERNODEIDTYPE` structure identifies the properties of the node which is the specified child of the specified parent node.

8 Standard Components

In the interest of facilitating strict component portability, OpenMAX IL defines a set of standard components. Each standard component definition associates specific interface criteria and functionality to the named standard component. To the extent these definitions are adhered to by clients and components, this allow one IL client to operate seamlessly with component implementations from multiple vendors and allows one component to operate seamlessly across multiple IL clients.

This section defines the set of OpenMAX IL standard components including:

- The hierarchy of standard component definitions.
- The mechanism for exposing standard components to an IL client.
- The definition of all standard classes and standard components.

8.1 Hierarchy of Standard Component Definition

OpenMAX IL establishes two constructs for the hierarchical definition of the set of standard components:

- Standard component class: a category of standard components that share the same ports and high level functionality.
- Standard component: an instance of a standard component class that has the same ports and high level functionality as the class but that specifies the supported formats, parameters, and configs on those ports as well as the specific functionality of the component.

Thus OpenMAX IL divides the set of all standard components into classes of similar components, formally defining the characteristics of each class in terms of the ports it exposes and its overall function. Within each class, OpenMAX IL identifies specific standard components, formally definining the formats, parameters, and config operations supported on each port as well the specific type of functionality the individual component supports.

For instance, OpenMAX IL defines an audio_decoder class that represents all components that receive encoded audio on a single audio input port and emit decoded audio on single audio output. Furthermore, the audio_decoder class contains a standard component definition for each audio format: audio_decoder.aac, audio_decoder.amr, audio_decoder.amr, etc.

The difference in functionality between components in the previous example is the specific format of audio decoding implemented. However, the differences between components in a single class may also be distinguished in terms of their specific functionality. Each component in the audio_processing class, for example, operates on the same format (i.e. pcm audio) but implements different effects, e.g. `audio_processing.pcm.stereo_widening_loudspeakers`.

Thus, generally speaking, a component class defines a category of functionality and each component in that class implements one specific type of functionality within that category.

8.1.1 Standard Component Class Definition

The definition of a standard component class consists of:

- *Name:* The name of the standard component class.
- *Description:* Descrition of high level functionality.
- The set of ports exposed including the following information for each port:
    - *Index:* the index of the port.
    - *Domain:* the port's domain (audio, video, image, or other).
    - *Direction:* the ports direction (input or output).
    - *Description:* a description of the port's functionality relative to the component.

8.1.2 Standard Components Definition

The definition of a standard component consists of:

- *Name*: The name of the standard component.
- *Description:* Description of the specific functionality implemented by the component.
- For each port:
    - *Index:* The index of the described port.
    - *Description:* Description of the functionality implemented by the port relative to the component.
    - *Parameters and Configs:* A list of supported OpenMAX IL parameters and configs including including the following information for each.
        - *Index:* The index value of the parameter or config used from the `OMX_INDEXTYPE` enumeration.
        - *Access:* The read/write access of the parameter/config which is a any combination of the following:
            - *Read*: IL client is querying a component value via `GetParameter` or `GetConfig`. The component will fill in the appropriate fields of the structure passed.
            - *Write*: IL client is setting a component value via `SetParameter` or `SetConfig`. The IL client will fill in the appropriate fields of the structure passed.

- *Description:* Description of the parameter or config's function relative to the port.

8.2 Component Role

A component implementation may support one or more roles. We define a role as the behavior of component acting according to a particular standard component definition. The name of the standard component defining the behavior identifies the role.

For example a given component implementation named "OMX.CompanyXYZ.MyAudioDecoder" might support the following roles:

audio_decoder.mp3

audio_decoder.aac

audio_decoder.amr

When this component implementation is in the audio_decoder.mp3 role it obeys the definition of the audio_decoder.mp3 standard component. It shall, for example, expose the defined audio input and output ports, support the mandated configs and parameter on those ports, and populate the mandated defaults on those configs and parameters.

Via the mechanisms defined the below, the core extracts information about which roles are supported by which component implementation and, using this information, provides two convenient functions for the IL client to query about such support. Furthermore, a component implementation allows an IL client to select the role which defines its behavior.

8.2.1 ComponentRoleEnum

The `ComponentRoleEnum` component function allows the IL core to query a component for all the roles it supports. This function allows the IL Core to service `OMX_GetComponentsOfRole` and `OMX_GetRolesOfComponent` calls. An efficient IL Core will likely cache the role information it extracts from components (e.g. at installation) to avoid instantiating a component during `OMX_GetComponentsOfRole` and `OMX_GetRolesOfComponent` calls.

`ComponentRoleEnum` enumerates (one role at a time) the component roles that a component supports.

```
OMX_ERRORTYPE (*ComponentRoleEnum)(
            OMX_IN OMX_HANDLETYPE hComponent,
            OMX_OUT OMX_STRING cRole,
            OMX_IN U32 nIndex);
```

Parameters include:

- `hComponent` : The handle of the component that executes the call
- `cRole`: The name of the specified role. The role name string has a limit of 128 bytes (including '\0').

- `nIndex`: The index of the role being queried.

8.2.2 OMX_PARAM_COMPONENTROLETYPE

The `OMX_PARAM_COMPONENTROLETYPE` structure represents the current role of the component that may be queried and set via the `OMX_IndexParamStandardComponentRole` parameter. This enables the IL client to set the role of the component. The component populates defaults according to the specified role:

```
typedef struct OMX_PARAM_COMPONENTROLETYPE {
   OMX_U32 nSize;
   OMX_VERSIONTYPE nVersion;
   OMX_U8 cRole[OMX_MAX_STRINGNAME_SIZE];
}OMX_PARAM_COMPONENTROLETYPE;
```

Parameters include:

- `cRole`: name of the role (i.e. name of the standard component defining current behavior).

  OMX_MAX_STRINGNAME_SIZE is defined to have a value of 128.

8.2.3 OMX_GetRolesOfComponent

The function that enables the IL client to query all the roles fulfilled by a given a component.

```
OMX_ERRORTYPE OMX_GetRolesOfComponent (
      OMX_STRING compName,
      OMX_U32 *pNumRoles,
      OMX_U8  **roles);
```

Parameters include:

- `compName`: This is the name of the component being queried about.
- `pNumRoles`: This is used both as input and output. On input it bounds the size of the input structure. On output it specifies how many roles were retrieved.
- `roles`: This is a list of the names of all standard components implemented on the specified physical component name. If this pointer is NULL this function populates the `pNumRoles` field with the number of roles the component supports and ignores the roles field. This allows the client to properly size the roles array on a subsequent call.

8.2.4 OMX_GetComponentsOfRole

The `OMX_GetComponentsOfRole` function that enables the IL client to query the names of all installed components that support a given role.

```
OMX_ERRORTYPE OMX_GetComponentsOfRole (
      OMX_STRING role,
```

```
OMX_U32 *pNumComps,
OMX_STRING **compNames);
```

Parameters include:

- `role`: The name of the specified role.
- `pNumComps`: This is used both as input and output. On input it bounds the size of the input structure. On output it specifies how many names were retrieved.
- `compNames`: This is a list of the names of all physical components that implement the specified standard component name. If this pointer is NULL this function populates the `pNumComps` field with the number of components that support the given role and ignores the `compNames` field. This allows the client to properly size the `compNames` field on a subsequent call.

8.3 Mandatory Port Parameters

Across all standard components, OpenMAX IL 1.1 mandates support for certain parameters. Specifically:

- All standard components shall support the following parameters:
  - `OMX_IndexParamPortDefinition`
  - `OMX_IndexParamCompBufferSupplier`
  - `OMX_IndexParamAudioInit`
  - `OMX_IndexParamImageInit`
  - `OMX_IndexParamVideoInit`
  - `OMX_IndexParamOtherInit`
- All *audio* ports on a standard component shall support the following parameters:
  - `OMX_IndexParamAudioPortFormat`
- All *video* ports on a standard component shall support the following parameters
  - `OMX_IndexParamVideoPortFormat`
- All *image* ports on a standard component shall support the following parameters:
  - `OMX_IndexParamImagePortFormat`
- All *other* ports on a standard component shall support the following parameters:
  - `OMX_IndexParamOtherPortFormat`

These requirements apply to all component described in this section though, for the sake of brevity, they have not been repeated for each standard class and component specification.

8.4 Notation Used

The standard component definitions use certain conventions in their notation. Specifically:

- "APB" denotes the audio port base which is defined to be the `nStartPortNumber` value returned on a query of the `OMX_IndexParamAudioInit` param.
- "IPB" denotes the image audio port base which is defined to be the `nStartPortNumber` value returned on a query of the `OMX_IndexParamImageInit` param.
- "VPB" denotes the video port base which is defined to be the `nStartPortNumber` value returned on a query of the `OMX_IndexParamVideoInit` param.
- "OPB" denotes the other port base which is defined to be the `nStartPortNumber` value returned on a query of the `OMX_IndexParamOtherInit` param.

Furthermore, when a field of a parameter or config is specified all the listed values in the 'Description' column shall be supported and the *italisized* value shall be the default. A component that supports multiple standard component roles shall populate its fields with default settings according to the current role.

All parameter and config settings specified indicate the minimum settings that the components shall support to be catergorized as a standard components.

8.5 Video and Image Order of Operations

As part of the Video and Image domain, features have been defined that will apply data transform operations to data payloads. These data transforms consist of cropping, rotation, mirroring and scaling.

Depending on the ordering of the transforms applied to the data payload varying results will be produced. In order for the IL Client to deterministically achieve a desired output among standard components that support such operations, the order of the these transforms applied to the data payload on a per port basis shall be as follows:

1. Cropping
2. Rotation
3. Mirroring
4. Scaling

This order is to be applied by components that support all or a subset of transforms.

For example:

- If a port within standard component A supports all four transforms then the order will be cropping followed by rotation followed by mirroring followed by scaling

- If a port within standard component B supports just three of the transforms – cropping, rotation and scaling – then the order will be cropping followed by rotation followed by scaling

Implementations of standard components supporting these transforms are not required to internally implement these transforms as outlined, rather the standard component implementations need to apply the operations to the payload in the logical order outlined such that a deterministic output is achieved.

This ordering of operations provides consistency for the IL client between different standard component implementations. It does not dictate the implementation of those components.

8.6 Standard Audio Components

8.6.1 Audio Decoder Class

Name	audio_decoder			
Description	Decodes the given compressed audio stream into an uncompressed audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts encoded audio.
	APB+1	audio	output	Emits decoded audio.

8.6.1.1 AAC Decoder Component

Name	audio_decoder.aac			
Description	Decodes the given compressed audio stream into an uncompressed audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts encoded audio.
	APB+1	audio	output	Emits decoded audio.

Port Index	APB+0		
Description	Accepts encoded audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingAAC
	`OMX_IndexParamAudioPortFormat`	r/w	eEncoding = OMX_AUDIO_CodingAAC

Port Index	APB+0		
	OMX_IndexParamAudioAac	r/w	nChannels = *2 (stereo)* 1 (mono) nSampleRate = 8000 11025 12000 16000 22050 24000 32000 44100 48000 nBitRate = up to 288Kbps per channel eAACProfile = *OMX_AUDIO_AACObjectLC* OMX_AUDIO_AACObjectHE OMX_AUDIO_AACObjectHE_PS eAACStreamFormat = *OMX_AUDIO_AACStreamFormatMP2ADTS* OMX_AUDIO_AACStreamFormatMP4ADTS OMX_AUDIO_AACStreamFormatADIF OMX_AUDIO_AACStreamFormatRAW (headerless) eChannelMode = *OMX_AUDIO_ChannelModeStereo* OMX_AUDIO_ChannelModeMono

Port Index	APB+1		
Description	Emits decoded audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	OMX_IndexParamPortDefinition	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingPCM
	OMX_IndexParamAudioPortFormat	r/w	eEncoding = OMX_AUDIO_CodingPCM

Port Index	APB+1		
	OMX_IndexParamAudioPcm	r/w	nChannels = *2 (stereo)* 1 (mono) eNumData = *OMX_NumericalDataSigned* nSampleRate = *48000* 8000 11025 12000 16000 22050 24000 32000 44100 48000 ePCMMode = *OMX_AUDIO_PCMModeLinear* nBitPerSample = *16*

8.6.1.2 AMR-NB Decoder Component

Name	audio_decoder.amrnb			
Description	Decodes the given compressed audio stream into an uncompressed audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts encoded audio.
	APB+1	audio	output	Emits decoded audio.

Port Index	APB+0		
Description	Accepts encoded audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	OMX_IndexParamPortDefinition	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingAMR
	OMX_IndexParamAudioPortFormat	r/w	eEncoding = OMX_AUDIO_CodingAMR

Port Index	APB+0		
	OMX_IndexParamAudioAmr	r/w	nChannels = *1* nBitRate = 4750 5150 5900 6700 7400 7950 10200 12200 OMX_AUDIO_PARAM_AMRTYPE:: OMX_AUDIO_AMRBANDMODETYPE = OMX_AUDIO_AMRBandModeNB0 OMX_AUDIO_AMRBandModeNB1 OMX_AUDIO_AMRBandModeNB2 OMX_AUDIO_AMRBandModeNB3 OMX_AUDIO_AMRBandModeNB4 OMX_AUDIO_AMRBandModeNB5 OMX_AUDIO_AMRBandModeNB6 OMX_AUDIO_AMRBandModeNB7 eAMRDTXMode = OMX_AUDIO_AMRDTXModeOff OMX_AUDIO_AMRDTXModeOnVAD1 OMX_AUDIO_AMRDTXModeOnVAD2 eAMRFrameFormat = OMX_AUDIO_AMRFrameFormatConformance OMX_AUDIO_AMRFrameFormatIF1 OMX_AUDIO_AMRFrameFormatIF2 OMX_AUDIO_AMRFrameFormatFSF OMX_AUDIO_AMRFrameFormatRTPPayload

Port Index	APB+1		
Description	Emits decoded audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	OMX_IndexParamPortDefinition	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingPCM

Port Index	APB+1		
	`OMX_IndexParamAudioPortFormat`	r/w	eEncoding = OMX_AUDIO_CodingPCM
	`OMX_IndexParamAudioPcm`	r/w	nChannels = *1 (mono)* eNumData = *OMX_NumericalDataSigned* nSampleRate = 8000 ePCMMode = *OMX_AUDIO_PCMModeLinear* nBitPerSample = *16*

8.6.1.3 AMR-WB Decoder Component

Name	audio_decoder.amrwb			
Description	Decodes the given compressed audio stream into an uncompressed audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts encoded audio.
	APB+1	audio	output	Emits decoded audio.

Port Index	APB+0		
Description	Accepts encoded audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingAMR
	`OMX_IndexParamAudioPortFormat`	r/w	eEncoding = OMX_AUDIO_CodingAMR

Port Index	APB+0		
	OMX_IndexParamAudioAmr	r/w	nChannels = *1* nBitRate = 6600 8850 12650 14250 15850 18250 19850 23050 23850 OMX_AUDIO_PARAM_AMRTYPE:: OMX_AUDIO_AMRBANDMODETYPE = OMX_AUDIO_AMRBandModeWB0 OMX_AUDIO_AMRBandModeWB1 OMX_AUDIO_AMRBandModeWB2 OMX_AUDIO_AMRBandModeWB3 OMX_AUDIO_AMRBandModeWB4 OMX_AUDIO_AMRBandModeWB5 OMX_AUDIO_AMRBandModeWB6 OMX_AUDIO_AMRBandModeWB7 OMX_AUDIO_AMRBandModeWB8 eAMRDTXMode = OMX_AUDIO_AMRDTXModeOff OMX_AUDIO_AMRDTXModeOnVAD1 OMX_AUDIO_AMRDTXModeOnVAD2 eAMRFrameFormat = OMX_AUDIO_AMRFrameFormatConformance OMX_AUDIO_AMRFrameFormatIF1 OMX_AUDIO_AMRFrameFormatIF2 OMX_AUDIO_AMRFrameFormatFSF OMX_AUDIO_AMRFrameFormatRTPPayload

Port Index	APB+1		
Description	Emits decoded audio.		
Required	**Index**	**Access**	**Description**

Port Index	APB+1		
Parameters/ Configs	`OMX_IndexParamPortDefinition`	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingPCM
	`OMX_IndexParamAudioPortFormat`	r/w	eEncoding = OMX_AUDIO_CodingPCM
	`OMX_IndexParamAudioPcm`	r/w	nChannels = *1 (mono)* eNumData = *OMX_NumericalDataSigned* nSampleRate = 16000 ePCMMode = *OMX_AUDIO_PCMModeLinear* nBitPerSample = *16*

8.6.1.4 MP3 Decoder Component

Name	audio_decoder.mp3			
Description	Decodes the given compressed audio stream into an uncompressed audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts encoded audio.
	APB+1	audio	output	Emits decoded audio.

Port Index	APB+0		
Description	Accepts encoded audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingMP3
	`OMX_IndexParamAudioPortFormat`	r/w	eEncoding = OMX_AUDIO_CodingMP3

Port Index	APB+0		
	`OMX_IndexParamAudioMp3`	r/w	nChannels = *2 (stereo)* 1 (mono) nSampleRate = 32000 44100 48000 nBitRate = 80000 to 320000 eChannelMode = *OMX_AUDIO_ChannelModeStereo* OMX_AUDIO_ChannelModeJointStereo OMX_AUDIO_ChannelModeDual OMX_AUDIO_ChannelModeMono eFormat = *OMX_AUDIO_MP3StreamFormatMP1Layer3*

Port Index	APB+1		
Description	Emits decoded audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingPCM
	`OMX_IndexParamAudioPortFormat`	r/w	eEncoding = OMX_AUDIO_CodingPCM

Port Index	APB+1		
	OMX_IndexParamAudioPcm	r/w	nChannels = *2 (stereo)* 1 (mono) eNumData = *OMX_NumericalDataSigned* nSampleRate = 32000 44100 48000 ePCMMode = *OMX_AUDIO_PCMModeLinear* nBitPerSample = *16*

8.6.1.5 Real Audio Decoder Component

Name	audio_decoder.ra			
Description	Decodes the given compressed audio stream into an uncompressed audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts encoded audio.
	APB+1	audio	output	Emits decoded audio.

Port Index	APB+0		
Description	Accepts encoded audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	OMX_IndexParamPortDefinition	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingRA
	OMX_IndexParamAudioPortFormat	r/w	eEncoding = OMX_AUDIO_CodingRA

Port Index	APB+0		
	OMX_IndexParamAudioRa	r/w	nChannels = *2 (stereo)* 1 (mono) nBitRate = 8000 to 96000 bps nSamplingRate = 8000, 11025, 22050 44100 nSample PerFrame = 256, 512, 1024 eFormat = *OMX_AUDIO_RA10_CODEC*

Port Index	APB+1		
Description	Emits decoded audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	OMX_IndexParamPortDefinition	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingPCM
	OMX_IndexParamAudioPortFormat	r/w	eEncoding = OMX_AUDIO_CodingPCM
	OMX_IndexParamAudioPcm	r/w	nChannels = *2 (stereo)* 1 (mono) eNumData = *OMX_NumericalDataSigned* nSampleRate = *44100* 8000 11025 22050 ePCMMode = *OMX_AUDIO_PCMModeLinear* nBitPerSample = *16*

8.6.1.6 WMA Decoder Component

Name	audio_decoder.wma

Name	audio_decoder.wma			
Description	Decodes the given compressed audio stream into an uncompressed audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts encoded audio.
	APB+1	audio	output	Emits decoded audio.

Port Index	APB+0		
Description	Accepts encoded audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingWMA
	`OMX_IndexParamAudioPortFormat`	r/w	eEncoding = OMX_AUDIO_CodingWMA
	`OMX_IndexParamAudioWma`	r/w	nChannels = *2 (stereo)* 1 (mono) nBitRate = 5000 to 385000 bps eFormat = *OMX_AUDIO_WMAFormat9* OMX_AUDIO_WMAFormat8 OMX_AUDIO_WMAFormat7 nSamplingRate = 8000 11025 12000 16000 22050 24000 32000 44100 48000

Port Index	APB+1		
Description	Emits decoded audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingPCM
	`OMX_IndexParamAudioPortFormat`	r/w	eEncoding = OMX_AUDIO_CodingPCM

Port Index	APB+1		
	OMX_IndexParamAudioPcm	r/w	nChannels = *2 (stereo)* 1 (mono) eNumData = *OMX_NumericalDataSigned* nSampleRate = *48000* 8000 11025 12000 16000 22050 24000 32000 44100 48000 ePCMMode = *OMX_AUDIO_PCMModeLinear* nBitPerSample = *16*

8.6.2 Audio Encoder Class

Name	audio_encoder			
Description	Encodes the giiven audio stream into a compressed audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts audio for encoding.
	APB+1	audio	output	Emits encoded audio.

8.6.2.1 AAC Encoder Component

Name	audio_encoder.aac			
Description	Encodes the giiven audio stream into a compressed audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts audio for encoding.
	APB+1	audio	output	Emits encoded audio.

Port Index	APB+0		
Description	Accepts audio for encoding.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	OMX_IndexParamPortDefinition	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingPCM

Port Index	APB+0		
	OMX_IndexParamAudioPortFormat	r/w	eEncoding = OMX_AUDIO_CodingPCM
	OMX_IndexParamAudioPcm	r/w	Specify/query the sampling rate and number of channels. nChannels = *2 (Stereo)* 1 (Mono) eNumData = *OMX_NumericalDataSigned* bInterleaved = *OMX_TRUE* nBitPerSample = *16* nSamplingRate = 8000 11025 12000 16000 22050 24000 32000 44100 48000 ePCMMode = *OMX_AUDIO_PCMModeLinear*

Port Index	APB+1		
Description	Emits encoded audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	OMX_IndexParamPortDefinition	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingAAC
	OMX_IndexParamAudioPortFormat	r/w	eEncoding = OMX_AUDIO_CodingAAC

Port Index	APB+1		
	`OMX_IndexParamAudioAac`	r/w	nChannels = *2 (stereo)* 1 (mono) nSampleRate = 8000 11025 12000 16000 22050 24000 32000 44100 48000 nBitRate = at least 288Kbps per channel nAudioBandWidth = *0* nFrameLength = *0* eAACProfile = *OMX_AUDIO_AACObjectLC* OMX_AUDIO_AACObjectHE OMX_AUDIO_AACObjectHE_PS eAACStreamFormat = *OMX_AUDIO_AACStreamFormatMP2ADTS* OMX_AUDIO_AACStreamFormatMP4ADTS OMX_AUDIO_AACStreamFormatADIF OMX_AUDIO_AACStreamFormatRAW (headerless) eChannelMode = *OMX_AUDIO_ChannelModeStereo* OMX_AUDIO_ChannelModeMono

8.6.2.2 AMR-NB Encoder Component

Name	audio_encoder.amrnb			
Description	Encodes the giiven audio stream into a compressed audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts audio for encoding.
	APB+1	audio	output	Emits encoded audio.

Port Index	APB+0		
Description	Accepts audio for encoding.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingPCM
	`OMX_IndexParamAudioPortFormat`	r/w	eEncoding = OMX_AUDIO_CodingPCM
	`OMX_IndexParamAudioPcm`	r/w	Specify/query the sampling rate and number of channels. nChannels = 1 (Mono) eNumData = *OMX_NumericalDataSigned* bInterleaved = *OMX_TRUE* nBitPerSample = *16* nSamplingRate = 8000 ePCMMode = *OMX_AUDIO_PCMModeLinear*

Port Index	APB+1		
Description	Emits encoded audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingAMR
	`OMX_IndexParamAudioPortFormat`	r/w	eEncoding = OMX_AUDIO_CodingAMR

Port Index	APB+1		
	OMX_IndexParamAudioAmr	r/w	nChannels = *1* nBitRate = 4750 5150 5900 6700 7400 7950 10200 12200 OMX_AUDIO_PARAM_AMRTYPE:: OMX_AUDIO_AMRBANDMODETYPE = OMX_AUDIO_AMRBandModeNB0 OMX_AUDIO_AMRBandModeNB1 OMX_AUDIO_AMRBandModeNB2 OMX_AUDIO_AMRBandModeNB3 OMX_AUDIO_AMRBandModeNB4 OMX_AUDIO_AMRBandModeNB5 OMX_AUDIO_AMRBandModeNB6 OMX_AUDIO_AMRBandModeNB7 eAMRDTXMode = OMX_AUDIO_AMRDTXModeOff OMX_AUDIO_AMRDTXModeOnVAD1 OMX_AUDIO_AMRDTXModeOnVAD2 eAMRFrameFormat = OMX_AUDIO_AMRFrameFormatConformance OMX_AUDIO_AMRFrameFormatIF1 OMX_AUDIO_AMRFrameFormatIF2 OMX_AUDIO_AMRFrameFormatFSF OMX_AUDIO_AMRFrameFormatRTPPayload OMX_AUDIO_AMRFrameFormatRTPPayload

8.6.2.3 AMR-WB Encoder Component

Name	audio_encoder.amrwb			
Description	Encodes the giiven audio stream into a compressed audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts audio for encoding.

Name	audio_encoder.amrwb			
	APB+1	audio	output	Emits encoded audio.

Port Index	APB+0		
Description	Accepts audio for encoding.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingPCM
	`OMX_IndexParamAudioPortFormat`	r/w	eEncoding = OMX_AUDIO_CodingPCM
	`OMX_IndexParamAudioPcm`	r/w	Specify/query the sampling rate and number of channels. nChannels = 1 (Mono) eNumData = *OMX_NumericalDataSigned* bInterleaved = *OMX_TRUE* nBitPerSample = *16* nSamplingRate = 16000 ePCMMode = *OMX_AUDIO_PCMModeLinear*

Port Index	APB+1		
Description	Emits encoded audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingAMR
	`OMX_IndexParamAudioPortFormat`	r/w	eEncoding = OMX_AUDIO_CodingAMR

Port Index	APB+1		
	`OMX_IndexParamAudioAmr`	r/w	nChannels = *1* nBitRate = 6600 8850 12650 14250 15850 18250 19850 23050 23850 OMX_AUDIO_PARAM_AMRTYPE:: OMX_AUDIO_AMRBANDMODETYPE = OMX_AUDIO_AMRBandModeWB0 OMX_AUDIO_AMRBandModeWB1 OMX_AUDIO_AMRBandModeWB2 OMX_AUDIO_AMRBandModeWB3 OMX_AUDIO_AMRBandModeWB4 OMX_AUDIO_AMRBandModeWB5 OMX_AUDIO_AMRBandModeWB6 OMX_AUDIO_AMRBandModeWB7 OMX_AUDIO_AMRBandModeWB8 eAMRDTXMode = OMX_AUDIO_AMRDTXModeOff OMX_AUDIO_AMRDTXModeOnVAD1 OMX_AUDIO_AMRDTXModeOnVAD2 eAMRFrameFormat = OMX_AUDIO_AMRFrameFormatConformance OMX_AUDIO_AMRFrameFormatIF1 OMX_AUDIO_AMRFrameFormatIF2 OMX_AUDIO_AMRFrameFormatFSF OMX_AUDIO_AMRFrameFormatRTPPayload OMX_AUDIO_AMRFrameFormatRTPPayload

8.6.2.4 MP3 Encoder Component

Name	audio_encoder.mp3
Description	Encodes the giiven audio stream into a compressed audio stream.

Name	audio_encoder.mp3			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts audio for encoding.
	APB+1	audio	output	Emits encoded audio.

Port Index	APB+0		
Description	Accepts audio for encoding.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingPCM
	`OMX_IndexParamAudioPortFormat`	r/w	eEncoding = OMX_AUDIO_CodingPCM
	`OMX_IndexParamAudioPcm`	r/w	Specify/query the sampling rate and number of channels. nChannels = *2 (Stereo)* 1 (Mono) eNumData = *OMX_NumericalDataSigned* bInterleaved = *OMX_TRUE* nBitPerSample = *16* nSamplingRate = 32000 44100 48000 ePCMMode = *OMX_AUDIO_PCMModeLinear*

Port Index	APB+1		
Description	Emits encoded audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingMP3
	`OMX_IndexParamAudioPortFormat`	r/w	eEncoding = OMX_AUDIO_CodingMP3

Port Index	APB+1		
	`OMX_IndexParamAudioMp3`	r/w	nChannels = *2 (stereo)* 1 (mono) nBitRate = 80000 to 320000 bps nSampleRate = 32000 44100 48000 nAudioBandWidth = *0* eChannelMode = *OMX_AUDIO_ChannelModeStereo* OMX_AUDIO_ChannelModeJointStereo OMX_AUDIO_ChannelModeDual OMX_AUDIO_ChannelModeMono

8.6.3 Audio Mixer Class

The PCM format endianness is left to be native, meaning it can be either big endian or little endian depending on the underlying hardware. Endianness conversions, if needed, are left outside the standard audio post processing components.

Name	audio_mixer			
Description	Accetps multiple (N) audio streams, mixes them into a single stream, and emits the resulting stream as output.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	output	Emits audio stream resulting from mixing.
	APB+1 to APB+N	audio	input	Accepts audio stream for mixing.

8.6.3.1 PCM Mixer Component

Name	audio_mixer.pcm			
Description	Performs mixing of multiple audio input channels to 1 audio output mixing.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	output	Emits audio stream resulting from mixing.
	APB+1 to APB+N	audio	input	Accepts audio stream for mixing.

Port Index	APB+0

Port Index	APB+0		
Description	Emits audio stream resulting from mixing.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the audio port settings. eEncoding = OMX_AUDIO_CodingPCM
	`OMX_IndexParamAudioPortFormat`	r/w	eEncoding = OMX_AUDIO_CodingPCM
	`OMX_IndexParamAudioPcm`	r/w	Specify/query the sampling rate and number of channels. nChannels = *2 (Stereo)* 1 (Mono) eNumData = *OMX_NumericalDataSigned* eEndian = « Native » bInterleaved = *OMX_TRUE* nBitPerSample = *16* nSamplingRate = 8000, 11025 12000 16000 22050 24000 32000 44100 48000 ePCMMode = *OMX_AUDIO_PCMModeLinear* eChannelMapping[0]= *OMX_AUDIO_ChannelLF (stereo)* OMX_AUDIO_ChannelCF (mono) eChannelMapping[1]= *OMX_AUDIO_ChannelRF (stereo)*
	`OMX_IndexConfigAudioVolume`	r/w	bLinear = *OMX_FALSE* sVolume = *Configurable*
	`OMX_IndexConfigAudioMute`	r/w	bMute = *OMX_FALSE* OMX_TRUE

<table>
<tr><td>Port Index</td><td colspan="3">APB+1 to APB+N</td></tr>
<tr><td>Description</td><td colspan="3">Accepts audio for mixing.</td></tr>
<tr><td rowspan="5">Required Parameters/ Configs</td><td>Index</td><td>Access</td><td>Description</td></tr>
<tr><td><code>OMX_IndexParamPortDefinition</code></td><td>r/w</td><td>Specify/query the audio port settings.
eEncoding = OMX_AUDIO_CodingPCM</td></tr>
<tr><td><code>OMX_IndexParamAudioPortFormat</code></td><td>r/w</td><td>eEncoding = OMX_AUDIO_CodingPCM</td></tr>
<tr><td><code>OMX_IndexParamAudioPcm</code></td><td>r/w</td><td>Specify/query the sampling rate and number of channels.

nChannels =
2 (Stereo)
1 (Mono)

eNumData = OMX_NumericalDataSigned

eEndian = « Native »

bInterleaved = OMX_TRUE

nBitPerSample = 16

nSamplingRate =
8000,
11025
12000
16000
22050
24000
32000
44100
48000

ePCMMode = OMX_AUDIO_PCMModeLinear

eChannelMapping[0]=
OMX_AUDIO_ChannelLF (stereo)
OMX_AUDIO_ChannelCF (mono)
eChannelMapping[1]=
OMX_AUDIO_ChannelRF (stereo)</td></tr>
<tr><td><code>OMX_IndexConfigAudioVolume</code></td><td>r/w</td><td>bLinear = OMX_FALSE
sVolume = Configurable</td></tr>
</table>

Port Index	APB+1 to APB+N		
	OMX_IndexConfigAudioMute	r/w	bMute = *OMX_FALSE* OMX_TRUE

8.6.4 Audio Reader Class

Name	audio_reader			
Description	Reads an audio filestream and emits contained audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	output	Emits audio stream found in filestream.

8.6.4.1 Binary Audio Reader Class

Name	audio_reader.binary			
Description	Blindly reads any audio filestream (e.g. an MP3 file) irrespective of format and emits contained elementary audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	output	Emits audio stream found in filestream.

8.6.5 Audio Renderer Class

The PCM format endianness is left to be native, meaning it can be either big endian or little endian depending on the underlying hardware. Endianness conversions, if needed, are left outside the standard audio post processing components.

Name	audio_renderer			
Description	Renders a given audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts audio for presentation.
	OPB+0	other/time	input	Accepts time updates

8.6.5.1 PCM Renderer Component

Name	audio_renderer.pcm			
Description	Renders a given audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts audio for presentation.
	OPB+0	other/time	input	Accepts time updates

Port Index	APB+0		
Description	Accepts audio for rendering.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	OMX_IndexParamPortDefinition	r/w	Specify/query the audio port settings. eEncoding = *OMX_AUDIO_CodingPCM*
	OMX_IndexParamAudioPortFormat	r/w	eEncoding = *OMX_AUDIO_CodingPCM*

Port Index	APB+0		
	`OMX_IndexParamAudioPcm`	r/w	Specify/query the sampling rate and number of channels. nChannels = *2 (Stereo)* 1 (Mono) eNumData = *OMX_NumericalDataSigned* eEndian = « Native » bInterleaved = *OMX_TRUE* nBitPerSample = *16* nSamplingRate = 8000 11025 12000 16000 22050 24000 32000 44100 48000 ePCMMode = *OMX_AUDIO_PCMModeLinear* eChannelMapping[0]= *OMX_AUDIO_ChannelLF (stereo)* OMX_AUDIO_ChannelCF (mono) eChannelMapping[1]= *OMX_AUDIO_ChannelRF (stereo)*
	`OMX_IndexConfigAudioVolume`	r/w	bLinear = *OMX_FALSE* sVolume = *Configurable*
	`OMX_IndexConfigAudioMute`	r/w	bMute = *OMX_FALSE* OMX_TRUE

Port Index	OPB+0
Description	Accepts media time updates. Provides mechanism for audio renderer component to query for media time. Audio renderer can provide the audio reference clock to the clock component which facilitates synchronization of other processing (e.g. video rendering) to audio rendering..

8.6.6 Audio Writer Class

Name	audio_writer			
Description	Writes given audio stream to an audio filestream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts audio stream to be written to the audio filestream.

8.6.6.1 Binary Audio Writer Class

Name	audio_writer.binary			
Description	Blindly writes given elementary audio stream to an audio filestream (e.g. an MP3 file) irrespective of format.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts audio stream to be written to the audio filestream.

8.6.7 Audio Capturer Class

The PCM format endianness is left to be native, meaning it can be either big endian or little endian depending on the underlying hardware. Endianness conversions, if needed, are left outside the standard audio post processing components.

Name	audio_capturer			
Description	Emits an audio stream from an audio source.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	output	Emits source's audio stream.
	OPB+0	other/time	input	Receives media time updates/provides access to clock component.

8.6.7.1 PCM Audio Capturer

Name	audio_capturer.pcm			
Description	Emits an audio stream from an audio source.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	output	Emits source's audio stream.
	OPB+0	other/time	input	Receives media time updates/provides access to clock component.

Port Index	APB+0		
Description	Accepts audio for rendering.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortFormat`	r/w	Specify/query the sampling rate and number of channels. eEncoding = *OMX_AUDIO_CodingPCM*
	`OMX_IndexParamPortDefinition`	r/w	eEncoding = *OMX_AUDIO_CodingPCM*

Port Index	APB+0		
	`OMX_IndexParamAudioPcm`		Specify/query the sampling rate and number of channels. nChannels = *2 (Stereo)* 1 (Mono) eNumData = *OMX_NumericalDataSigned* eEndian = « Native » bInterleaved = *OMX_TRUE* nBitPerSample = *16* nSamplingRate = 8000 11025 12000 16000 22050 24000 32000 44100 48000 ePCMMode = *OMX_AUDIO_PCMModeLinear* eChannelMapping[0]= *OMX_AUDIO_ChannelLF (stereo)* OMX_AUDIO_ChannelCF (mono) eChannelMapping[1]= *OMX_AUDIO_ChannelRF (stereo)*
	`OMX_IndexConfigAudioVolume`	r/w	bLinear = *OMX_FALSE* sVolume = *Configurable*
	`OMX_IndexConfigAudioMute`	r/w	bMute = *OMX_FALSE* OMX_TRUE

Port Index	OPB+0
Description	Accepts media time updates. Provides mechanism for audio capturer component to query for media time. Audio capturer can provide the audio reference clock to the clock component which facilitates synchronization of other processing (e.g. video capture) to audio capture.

8.6.7.2 Audio Capture Use Case

An IL client using an audio source to capture an audio stream may do so via the following steps:

1. Instantiate the audio source component and any co-operating components
2. Set audio source settings:
3. Set the desired characteristics of the captured audio stream (e.g. sampling rate, channels)
4. Set the gain via the volume/mute controls
5. Establish any necessary tunnels between the audio source component and other components (e.g. an audio encoder tunneling with the capture port).
6. Select the clock component's active reference clock. In a use case with audio capture this is normally the audio clock as provided by the audio capturer.
7. Transition all components to the OMX_StateIdle state. Then transition the audio source component to the OMX_StatePause state, and transition all other components to the OMX_StateExecuting state. Although all other components are ready for capture, the audio source's output port is not yet emitting data.
8. To initiate capture transition the audio source component to the OMX_StateExecuting state. If using a clock component start the clock component. The audio source component will begin emitting captured audio of the prescribed characteristics.
9. To terminate capture transition the audio source component to the OMX_StatePause state. The audio source component will cease emitting captured audio.

8.6.8 Audio processor class

Name	audio_processor			
Description	Processes a raw audio stream			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts raw audio.
	APB+1	audio	output	Emits raw audio

8.6.8.1 Properties that apply to all audio processing components

Sample rate conversions are not mandated. When the sampling rate of the input port is changed, the output port sampling rate shall automatically change to the same value.

The PCM format endianness is left to be native, meaning it can be either big endian or little endian depending on the underlying hardware. Endianness conversions, if needed, are left outside the standard audio post processing components.

Port Index	APB+0		
Description	Accepts raw audio.		
Required	**Index**	**Access**	**Description**

Port Index	APB+0		
Parameters/ Configs	OMX_IndexParamPortDefinition	r/w	eDomain = OMX_PortDomainAudio format.eEncoding = OMX_AUDIO_CodingPCM
	OMX_IndexParamAudioPortFormat	r/w	eEncoding = OMX_AUDIO_CodingPCM
	OMX_IndexParamAudioPcm	r/w	nChannels = 2 (Stereo) eNumData = OMX_NumericalDataSigned eEndian = <native> bInterleaved = True nBitPerSample = 16 ePCMMode = OMX_AUDIO_PCMModeLinear eChannelMapping = OMX_AUDIO_ChannelLF, OMX_AUDIO_ChannelRF

Port Index	APB+1		
Description	Emits raw audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	OMX_IndexParamPortDefinition	r	eDomain = OMX_PortDomainAudio format.eEncoding = OMX_AUDIO_CodingPCM
	OMX_IndexParamAudioPortFormat	r	eEncoding = OMX_AUDIO_CodingPCM

Port Index	APB+1		
	OMX_IndexParamAudioPcm	r	nChannels = 2 (Stereo) eNumData = OMX_NumericalDataSigned eEndian = <native> bInterleaved = True nBitPerSample = 16 ePCMMode = OMX_AUDIO_PCMModeLinear eChannelMapping = OMX_AUDIO_ChannelLF, OMX_AUDIO_ChannelRF

8.6.8.2 Stereo widening loudspeakers

Headphone and loudspeaker versions of this standard component are separated to better support multi-components and to allow vendors to implement just one of the two algorithm variations.

In case the implementation supports only one single value for the `nStereoWidening` field of the `OMX_AUDIO_CONFIG_STEREOWIDENINGTYPE` structure, that value shall be 100, and the component shall always return 100 as the value for the field for all `OMX_GetConfig` calls. See Section 4.1.48—`OMX_AUDIO_CONFIG_STEREOWIDENINGTYPE`.

Name	audio_processor.pcm.stereo_widening_loudspeakers			
Description	Adds stereo widening to a raw audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts raw audio.
	APB+1	audio	output	Emits raw audio

Port Index	APB+0		
Description	Accepts raw audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	OMX_ IndexParamAudioPcm	r/w	nBitPerSample = *16* nSamplingRate = 16000, 22050, 24000, 32000, 44100, *48000* Hz

Port Index	APB+1		
Description	Emits raw audio.		
Required	**Index**	**Access**	**Description**

Port Index	APB+1		
Parameters/ Configs	`OMX_IndexConfigAudioStereoWidening`	r/w	bEnable = *False*, True eWideningType = OMX_AUDIO_StereoWideningLoudspeakers
	`OMX_IndexParamAudioPcm`	r	nBitPerSample = *16* nSamplingRate = 16000, 22050, 24000, 32000, 44100, *48000* Hz

8.6.8.3 Stereo widening headphones

In case the implementation supports only one single value for the `nStereoWidening` field of the `OMX_AUDIO_CONFIG_STEREOWIDENINGTYPE` structure, that value shall be 100, and the component shall always return 100 as the value for the field for all `OMX_GetConfig` calls. See Section 4.1.48—`OMX_AUDIO_CONFIG_STEREOWIDENINGTYPE`.

Name	audio_processor.pcm.stereo_widening_headphones			
Description	Adds stereo widening to a raw audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts raw audio.
	APB+1	audio	output	Emits raw audio

Port Index	APB+0		
Description	Accepts raw audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamAudioPcm`	r/w	nBitPerSample = *16* nSamplingRate = 16000, 22050, 24000, 32000, 44100, *48000* Hz

Port Index	APB+1		
Description	Emits raw audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexConfigAudioStereoWidening`	r/w	bEnable = *False*, True eWideningType = OMX_AUDIO_StereoWideningHeadphones
	`OMX_IndexParamAudioPcm`	r	nBitPerSample = *16* nSamplingRate = 16000, 22050, 24000, 32000, 44100, *48000* Hz

8.6.8.4 Reverberation

Name	audio_processor.pcm.reverberation			
Description	Adds reverberation to a raw audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts raw audio.

Name	audio_processor.pcm.reverberation			
	APB+1	audio	output	Emits raw audio

Port Index	APB+0		
Description	Accepts raw audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamAudioPcm`	r/w	nBitPerSample = *16* nSamplingRate = 44100, *48000* Hz

Port Index	APB+1		
Description	Emits raw audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexConfigAudioReverberation`	r/w	bEnable = *False*, True
	`OMX_IndexParamAudioPcm`	r	nBitPerSample = *16* nSamplingRate = 44100, *48000* Hz

8.6.8.5 Chorus

Name	audio_processor.pcm.chorus			
Description	Adds chorus to a raw audio stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts raw audio.
	APB+1	audio	output	Emits raw audio

Port Index	APB+0		
Description	Accepts raw audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamAudioPcm`	r/w	nBitPerSample = *16* nSamplingRate = 44100, *48000* Hz

Port Index	APB+1		
Description	Emits raw audio.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexConfigAudioChorus`	r/w	bEnable = *False*, True
	`OMX_IndexParamAudioPcm`	r	nBitPerSample = *16* nSamplingRate = 44100, *48000* Hz

8.6.8.6 Equalizer

Equalizer band count is encoded into the name for convenience, so that the IL Client can choose the preferred equalizer, if multiple exists, without loading the components.

Name	audio_processor.pcm.equalizer			
Description	Does equalization on a raw audio stream.			
Ports	Index	Domain	Direction	Description
	APB+0	audio	input	Accepts raw audio.
	APB+1	audio	output	Emits raw audio

Port Index	APB+0		
Description	Accepts raw audio.		
Required Parameters/ Configs	Index	Access	Description
	`OMX_IndexParamAudioPcm`	r	nBitPerSample = *16* nSamplingRate = 44100, *48000* Hz

Port Index	APB+1		
Description	Emits raw audio.		
Required Parameters/ Configs	Index	Access	Description
	`OMX_IndexConfigAudioEqualizer`	r/w	bEnable = *False*, True sBandLevel = [-1200, 1200]
	`OMX_IndexParamAudioPcm`	r	nBitPerSample = *16* nSamplingRate = 44100, *48000* Hz
	`OMX_IndexConfigAudioLoudness`	r/w	bLoudness = *False*, True
	`OMX_IndexConfigAudioBass`	r/w	bEnable = *False*, True nBass = [-100, 100]
	`OMX_IndexConfigAudioTreble`	r/w	bEnable = *False*, True nTreble = [-100, 100]

8.7 Standard Image Components

8.7.1 Image Decoder Class

Name	image_decoder			
Description	Decodes the given compressed image data stream into an uncompressed image data stream..			
Ports	Index	Domain	Direction	Description
	IPB+0	image	input	Accepts encoded image data.
	IPB+1	image	output	Emits decoded image data.

8.7.1.1 JPEG Decoder

Name	image_decoder.JPEG			
Description	Decodes the given compressed image data stream into an uncompressed image data stream..			
Ports	Index	Domain	Direction	Description
	IPB+0	image	input	Accepts encoded image data.
	IPB+1	image	output	Emits decoded image data.

Port Index	IPB+0

Port Index	IPB+0		
Description	Accepts encoded image data.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the image port settings. nFrameWidth = *640* nFrameHeight = *480* eCompressionFormat = *OMX_IMAGE_CodingJPEG* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamImagePortFormat`	r/w	Specify/query the image format. eCompressionFormat = *OMX_IMAGE_CodingJPEG* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamQuantizationTable`	r/w	eQuantizationTable= *OMX_IMAGE_QuantizationTableLuma* OMX_IMAGE_QuantizationTableChroma nQuantizationMatrix = *configureable*
	`OMX_IndexParamHuffmanTable`	r/w	eHuffmanTable = *OMX_IMAGE_HuffmanTableAC* OMX_IMAGE_HuffmanTableDC nNumberOfHuffmanCodeOfLength = *configurable* nHuffmanTable = *configurable*

Port Index	IPB+1		
Description	Emits decoded image data.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the image port settings. nFrameWidth = *640* nFrameHeight = *480* eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*

Port Index	IPB+1		
	OMX_IndexParamVideoPortFormat	r/w	Specify/query the image format. eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*

8.7.2 Image Encoder Class

Name	image_encoder			
Description	Encodes the given image data stream into a compressed format.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	IPB+0	image	input	Accepts image data for encoding.
	IPB+1	image	output	Emits compressed image data.

8.7.2.1 JPEG Encoder

Name	image_encoder.JPEG			
Description	Encodes the given image data stream into a compressed format.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	IPB+0	image	input	Accepts image data for encoding.
	IPB+1	image	output	Emits compressed image data.

Port Index	IPB+0		
Description	Accepts image data for encoding.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	OMX_IndexParamPortDefinition	r/w	Specify/query the image port settings. nFrameWidth = *640* nFrameHeight = *480* eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*
	OMX_IndexParamVideoPortFormat	r/w	Specify/query the image format. eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*

Port Index	IPB+1		
Description	Emits compressed image data.		
Required	**Index**	**Access**	**Description**

Port Index	IPB+1		
Parameters/ Configs	`OMX_IndexParamPortDefinition`	r/w	Specify/query the image port settings. nFrameWidth = *640(same as input)* nFrameHeight = *480(same as input)* eCompressionFormat = *OMX_IMAGE_CodingJPEG* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamImagePortFormat`	r/w	Specify/query the image format. eCompressionFormat = *OMX_IMAGE_CodingJPEG* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamQuantizationTable`	r/w	eQuantizationTable= *OMX_IMAGE_QuantizationTableLuma* OMX_IMAGE_QuantizationTableChroma nQuantizationMatrix = *configureable*

8.7.3 Image Reader Class

Name	image_reader			
Description	Read an image filestream and emits the contained image stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	IPB+0	image	output	Emits image stream found in filestream.

8.7.3.1 Binary Image Reader Class

Name	image_reader.binary			
Description	Blindly reads any image filestream (e.g. a JPG file) irrespective of the format and emits contained elementary image stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	IPB+0	image	output	Emits image stream found in filestream.

8.7.4 Image Writer Class

Name	image_writer			
Description	Writes given image stream to an image filestream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	IPB+0	image	input	Accepts image stream to be written to the image filestream.

8.7.4.1 Binary Image Writer Class

Name	image_writer.binary			
Description	Blindly writes given elementary image stream to an image filestream (e.g. a JPG file) irrespective of format.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	IPB+0	image	input	Accepts image stream to be written to the image filestream.

8.8 Standard Video Components

8.8.1 Video Decoder Class

Name	video_decoder			
Description	Decodes the given compressed video stream into an uncompressed video stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Accepts encoded video.
	VPB+1	video	output	Emits decoded video.

8.8.1.1 H.263 Decoder Component

Name	video_decoder.h263			
Description	Decodes the given compressed video stream into an uncompressed video stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Consumes compressed video content.
	VPB+1	video	output	Produces uncompressed raw video.

Port Index	VPB+0		
Description	Consumes compressed video content.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the video port settings. nFrameWidth = *176* nFrameHeight = *144* nBitRate = *64000* xFrameRate = *15* eCompressionFormat = *OMX_VIDEO_CodingH263* eColorFormat = *OMX_COLOR_FormatUnused*

Port Index	VPB+0		
	`OMX_IndexParamVideoPortFormat`	r/w	Specify/query the video format. eCompressionFormat = *OMX_VIDEO_CodingH263* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamVideoH263`	r	eProfile = *OMX_VIDEO_H263ProfileBaseline* eLevel= *OMX_VIDEO_H263Level10* bPLUSPTYPEAllowed = *OMX_FALSE* bForceRoundingTypeToZero = *OMX_TRUE*
	`OMX_IndexParamVideoProfileLevelQuerySupported`	r	Query supported profile/level pair by index.
	`OMX_IndexParamVideoProfileLevelCurrent`	r	Query current profile/level pair.

Port Index	VPB+1		
Description	Produces uncompressed raw video.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the video port settings. nFrameWidth = *176* nFrameHeight = *144* eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*
	`OMX_IndexParamVideoPortFormat`	r/w	Specify/query the video format. eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*

8.8.1.2 AVC Decoder Component

Name	video_decoder.avc			
Description	Decodes the given compressed video stream into an uncompressed video stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Consumes compressed video content.
	VPB+1	video	output	Produces uncompressed raw video.

Port Index	VPB+0		
Description	Consumes compressed video content.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the video port settings. nFrameWidth = *176* nFrameHeight = *144* nBitRate = *64000* xFrameRate = *15* eCompressionFormat = *OMX_VIDEO_CodingAVC* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamVideoPortFormat`	r/w	Specify/query the video format. eCompressionFormat = *OMX_VIDEO_CodingAVC* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamVideoAvc`	r	eProfile = *OMX_VIDEO_AVCProfileBaseline* eLevel = *OMX_VIDEO_AVCLevel1*
	`OMX_IndexParamVideoProfileLevelQuerySupported`	r	Query supported profile/level pair by index.
	`OMX_IndexParamVideoProfileLevelCurrent`	r	Query current profile/level pair.

Port Index	VPB+1		
Description	Produces uncompressed raw video.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the video port settings. nFrameWidth = *176* nFrameHeight = *144* eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*

Port Index	VPB+1		
	`OMX_IndexParamVideoPortFormat`	r/w	Specify/query the video format. eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*

8.8.1.3 MPEG4 Video Decoder Component

Name	video_decoder.mpeg4			
Description	Decodes the given compressed video stream into an uncompressed video stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Consumes compressed video content.
	VPB+1	video	output	Produces uncompressed raw video.

Port Index	VPB+0		
Description	Consumes compressed video content.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the video port settings. nFrameWidth = *176* nFrameHeight = *144* nBitRate = *64000* xFrameRate = *15* eCompressionFormat = *OMX_VIDEO_CodingMPEG4* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamVideoPortFormat`	r/w	Specify/query the video format. eCompressionFormat = *OMX_VIDEO_CodingMPEG4* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamVideoMpeg4`	r/w	eProfile = *OMX_VIDEO_MPEG4ProfileSimple* eLevel = *OMX_VIDEO_MPEG4Level1*
	`OMX_IndexParamVideoProfileLevelQuerySupported`	r	Query supported profile/level pair by index.
	`OMX_IndexParamVideoProfileLevelCurrent`	r	Query current profile/level pair.

Port Index	VPB+1		
Description	Produces uncompressed raw video.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the video port settings. nFrameWidth = *176* nFrameHeight = *144* eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*
	`OMX_IndexParamVideoPortFormat`	r/w	Specify/query the video format. eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*

8.8.1.4 Real Video Decoder Component

Name	video_decoder.rv			
Description	Decodes the given compressed video stream into an uncompressed video stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Consumes compressed video content.
	VPB+1	video	output	Produces uncompressed raw video.

Port Index	VPB+0		
Description	Consumes compressed video content.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the video port settings. nFrameWidth = *176* nFrameHeight = *144* nBitRate = *64000* xFrameRate = *15* eCompressionFormat = *OMX_VIDEO_CodingRV* eColorFormat = *OMX_COLOR_FormatUnused*

Port Index	VPB+0		
	`OMX_IndexParamVideoPortFormat`	r/w	Specify/query the video format. eCompressionFormat = *OMX_VIDEO_CodingRV* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamVideoRv`	r/w	Specify/query Real Video specific parameters. eFormat = OMX_VIDEO_RVFormat8 *OMX_VIDEO_RVFormat9* bEnablePostFilter = OMX_TRUE *OMX_FALSE* bEnableLatencyMode = OMX_TRUE *OMX_FALSE*

Port Index	VPB+1		
Description	Produces uncompressed raw video.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the video port settings. nFrameWidth = *176* nFrameHeight = *144* eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*
	`OMX_IndexParamVideoPortFormat`	r/w	Specify/query the video format. eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*

8.8.1.5 WMV Decoder Component

Name	video_decoder.wmv			
Description	Decodes the given compressed video stream into an uncompressed video stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Consumes compressed video content.

Name	video_decoder.wmv			
	VPB+1	video	output	Produces uncompressed raw video.

Port Index	VPB+0		
Description	Consumes compressed video content.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the video port settings. nFrameWidth = *176* nFrameHeight = *144* nBitRate = *64000* xFrameRate = *15* eCompressionFormat = *OMX_VIDEO_CodingWMV* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamVideoPortFormat`	r/w	Specify/query the video format. eCompressionFormat = *OMX_VIDEO_CodingWMV* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamVideoWmv`	r/w	Specify/query Real Video specific parameters. eFormat = OMX_VIDEO_WMVFormat7 OMX_VIDEO_WMVFormat8 *OMX_VIDEO_WMVFormat9*

Port Index	VPB+1		
Description	Produces uncompressed raw video.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the video port settings. nFrameWidth = *176* nFrameHeight = *144* eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*

Port Index	VPB+1		
	`OMX_IndexParamVideoPortFormat`	r/w	Specify/query the video format. eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*

8.8.2 Video Encoder Class

Name	video_encoder			
Description	Encodes the given uncompressed video stream into a compressed format.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Accepts video for encoding.
	VPB+1	video	output	Emits encoded video.

8.8.2.1 H.263 Encoder Component

Name	video_encoder.h263			
Description	Encodes the given uncompressed video stream into a compressed format.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Consumes the uncompressed raw video content.
	VPB+1	video	output	Produces compressed video.

Port Index	VPB+0		
Description	Consumes compressed video content.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the video port settings. nFrameWidth = *176* nFrameHeight = *144* eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*
	`OMX_IndexParamVideoPortFormat`	r/w	Specify/query the video format. eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*

Port Index	VPB+1		
Description	Produces cmpressed video.		
Required	**Index**	**Access**	**Description**

Port Index	VPB+1		
Parameters/ Configs	`OMX_IndexParamPortDefinition`	r/w	Specify/query the video port settings. nFrameWidth = *176* nFrameHeight = *144* nBitRate = *64000* xFrameRate = *15* eCompressionFormat = *OMX_VIDEO_CodingH263* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamVideoPortFormat`	r/w	Specify/query the video format. eCompressionFormat = *OMX_VIDEO_CodingH263* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamVideoBitrate`	r/w	eControlRate = *OMX_Video_ControlRateConstant* OMX_Video_ControlRateDisable OMX_Video_ControlRateVariable nTargetBitrate = *64000*
	`OMX_IndexParamVideoErrorCorrection`	r/w	bEnableHEC = *OMX_TRUE* bEnableResync = *OMX_TRUE* nResynchMarkerSpacing = *Configureable(0 to 0xFFFFFFFF)*
	`OMX_IndexParamVideoH263`		eProfile = *OMX_VIDEO_H263ProfileBaseline* eLevel= *OMX_VIDEO_H263Level10* nPFrames = 0 to 0xffffffff bPLUSPTYPEAllowed = *OMX_FALSE* bForceRoundingTypeToZero = *OMX_TRUE* nGOBHeaderInterval = 1 to 9
	`OMX_IndexConfigVideoFramerate`	r/w	Specify/query target framerate xFrameRate = *15*

Port Index	VPB+1		
	OMX_IndexConfigVideoBitrate	r/w	Specify/query target bitrate nBitRate = *64000*
	OMX_IndexParamVideoProfileLevelQuerySupported	r	Query supported profile/level pair by index.
	OMX_IndexParamVideoProfileLevelCurrent	r/w	Specify/query current profile/level pair.

8.8.2.2 AVC Encoder Component

Name	video_encoder.avc			
Description	Encodes the given uncompressed video stream into a compressed format.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Consumes the uncompressed raw video content.
	VPB+1	video	output	Produces compressed video.

Port Index	VPB+0		
Description	Consumes compressed video content.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	OMX_IndexParamPortDefinition	r/w	Specify/query the video port settings. nFrameWidth = *176* nFrameHeight = *144* eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*
	OMX_IndexParamVideoPortFormat	r/w	Specify/query the video format. eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*

Port Index	VPB+1		
Description	Produces cmpressed video.		
Required	**Index**	**Access**	**Description**

Port Index	VPB+1		
Parameters/ Configs	`OMX_IndexParamPortDefinition`	r/w	Specify/query the video port settings. nFrameWidth = *176* nFrameHeight = *144* nBitRate = *64000* xFrameRate = *15* eCompressionFormat = *OMX_VIDEO_CodingAVC* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamVideoPortFormat`	r/w	Specify/query the video format. eCompressionFormat = *OMX_VIDEO_CodingAVC* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamVideoBitrate`	r/w	eControlRate = *OMX_Video_ControlRateConstant* OMX_Video_ControlRateDisable OMX_Video_ControlRateVariable nTargetBitrate = *64000*
	`OMX_IndexParamVideoAvc`	r/w	eProfile = *OMX_VIDEO_AVCProfileBaseline* eLevel = *OMX_VIDEO_AVCLevel1* nSliceHeaderSpacing = *Configureable* nPFrames = 0 to 0xffffffff bUseHadamard = *OMX_TRUE* nRefFrames = *1* bEnableFMO = *OMX_FALSE* bEnableASO = *OMX_FALSE* bWeightedPPrediction= *OMX_FALSE* bconstIpred = *OMX_FALSE*

Port Index	VPB+1		
	`OMX_IndexConfigVideoFramerate`	r/w	Specify/query target framerate xFrameRate = *15*
	`OMX_IndexConfigVideoBitrate`	r/w	Specify/query target bitrate nBitRate = *64000*
	`OMX_IndexParamVideoProfileLevelQuerySupported`	r	Query supported profile/level pair by index.
	`OMX_IndexParamVideoProfileLevelCurrent`	r/w	Specify/query current profile/level pair.

8.8.2.3 MPEG4 Video Encoder Component

Name	video_encoder.mpeg4			
Description	Encodes the given uncompressed video stream into a compressed format.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Consumes the uncompressed raw video content.
	VPB+1	video	output	Produces compressed video.

Port Index	VPB+0		
Description	Consumes compressed video content.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the video port settings. nFrameWidth = *176* nFrameHeight = *144* eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*
	`OMX_IndexParamVideoPortFormat`	r/w	Specify/query the video format. eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*

Port Index	VPB+1		
Description	Produces cmpressed video.		
Required	**Index**	**Access**	**Description**

Port Index	VPB+1		
Parameters/ Configs	`OMX_IndexParamPortDefinition`	r/w	Specify/query the video port settings. nFrameWidth = *176* nFrameHeight = *144* nBitRate = *64000* xFrameRate = *15* eCompressionFormat = *OMX_VIDEO_CodingMPEG4* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamVideoPortFormat`	r/w	Specify/query the video format. eCompressionFormat = *OMX_VIDEO_CodingMPEG4* eColorFormat = *OMX_COLOR_FormatUnused*
	`OMX_IndexParamVideoBitrate`	r/w	eControlRate = *OMX_Video_ControlRateConstant* OMX_Video_ControlRateDisable OMX_Video_ControlRateVariable nTargetBitrate = *64000*
	`OMX_IndexParamVideoMpeg4`	r/w	eProfile = *OMX_VIDEO_MPEG4ProfileSimple* eLevel = *OMX_VIDEO_MPEG4Level1* nSliceHeaderSpacing = *Configureable* bSVH = *OMX_FALSE* bGov = *Configureable* nPFrames = 0 to 0xffffffff nIDCVLCThreshold = *0* bACPred = *OMX_TRUE* nHeaderExtension = 1 to 99 bReversibleVLC = *OMX_FALSE*

Port Index	VPB+1		
	OMX_IndexConfigVideoFramerate	r/w	Specify/query target framerate xFrameRate = *15*
	OMX_IndexConfigVideoBitrate	r/w	Specify/query target bitrate nBitRate = *64000*
	OMX_IndexParamVideoProfileLevelQuerySupported	r	Query supported profile/level pair by index.
	OMX_IndexParamVideoProfileLevelCurrent	r/w	Specify/query current profile/level pair.

8.8.3 *Video Reader Class*

Name	video_reader			
Description	Reads a video filestream and emits the contained video stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	output	Emits video stream found in filestream.

8.8.3.1 Binary Video Reader Component

Name	video_reader.binary			
Description	Blindly reads any video filestream (e.g. a M4V file) irrespective of format and emits contained elementary video stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	output	Emits video stream found in filestream.

8.8.4 *Video Scheduler Class*

Name	video_scheduler			
Description	Times the delivery of video frames according to their timestamps.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Accepts video.
	VPB+1	video	output	Emits timed video.
	OPB+0	other/time	input	Accepts time updates.

8.8.4.1 Video Scheduler Component

Name	video_scheduler.binary			
Description	Times the delivery of video frames according to their timestamps.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Accepts video.
	VPB+1	video	output	Emits timed video.
	OPB+0	other/time	input	Accepts time updates.

Port Index	OPB+0
Description	Accepts media time updates to facilitate accurate emission of a frame at the timestamp for the frame (i.e. in the buffer header). Also provides mechanism for video scheduler to query for media time.

8.8.5 Video Writer Class

Name	video_writer			
Description	Writes given video stream to a video filestream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Accepts video stream to be written to the video filestream.

8.8.5.1 Binary Video Writer Class

Name	video_writer.binary			
Description	Blindly writes given elementary video stream to an video filestream (e.g. an M4V file) irrespective of format.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Accepts video stream to be written to the video filestream.

8.9 Other Standard Components

8.9.1 Camera Class

Name	camera			
Description	Emits preview/viewfinder video and captured video according to settings.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	output	Emits preview/viewfinder video.
	VPB+1	video	output	Emits captured video.
	OPB+0	other/time	input	Receives media time update/provides access to clock component.

8.9.1.1 YUV Camera Component

Name	camera.yuv			
Description	Emits preview/viewfinder video and captured video according to settings.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	output	Emits preview/viewfinder video.
	VPB+1	video	output	Emits captured video.
	OPB+0	other/time	input	Receives media time update/provides access to clock component.

Port Index	OMX_ALL		
Description	Properties that apply to all ports.		
Required	**Index**	**Access**	**Description**

Port Index	OMX_ALL		
Parameters/ Configs	`OMX_IndexParamCommonSensorMode`	r/w	Specifies the sensor mode. The bOneShot field indicates whether the camera will emit a single frame or a stream of frames when capturing. The camera resolution should be left as the default value. So the camera may set the resolution according to resolution of output ports.
	`OMX_IndexConfigCommonWhiteBalance`	r/w	Specifies white balance
	`OMX_IndexConfigCommonDigitalZoom`	r/w	Specifies digital zoom
	`OMX_IndexConfigCommonExposureValue`	r/w	Specifies exposure value compensation
	`OMX_IndexConfigCapturing`	r/w	Specifies whether the camera is emitting captured data or not.
	`OMX_IndexAutoPauseAfterCapture`	r/w	Specifies whether the camera will automatically transition to OMX_StatePaused after the Capturing boolean is cleared (e.g. to facilitate a frozen viewfinder).

Port Index	VPB+0		
Description	Emits preview/viewfinder video when the camera component is executing.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specifies preview's resolution and framerate. nFrameWidth = *320* nFrameHeight = *240* nStride = 320 nSliceHeight = *16* eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*
	`OMX_IndexParamVideoPortFormat`	r/w	eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*

Port Index	VPB+1

Port Index	VPB+1		
Description	Emits captured video when the camera component is capturing where the number of output frames depends on the sensor mode. If the sensor mode is set to one shot then this port only emits a one frame per capture. Output may be interpreted as raw image.		
Formats	OMX_VIDEO_CodingUnused		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specifies emitted video's resolution and framerate. nFrameWidth = *640* nFrameHeight = *480* nStride = 640 nSliceHeight = *16* eCompressionFormat = OMX_VIDEO_CodingUnused eColorFormat = *OMX_COLOR_FormatYUV420Planar*

Port Index	OPB+0
Description	Accepts media time updates. Provides mechanism for camera component to query for media time. Camera component can detect drift between camera clock and media clock (which may use the audio capturer as a master) and correct timestamps on outgoing frames to compensate. In use case where two cameras are used (e.g. one pointed at user and one pointed away) this provides a consistent media time for timestamps across switches between cameras during capture.

8.9.1.2 Video Capture Use Case

An IL client using a camera to capture a video stream may do so via the following steps:

1. Instantiate the camera component and any co-operating components.
2. Set camera parameters:
    a. Set capture port resolution and frame-rate according to desired values of captured stream
    b. Set viewfinder port resolution and frame-rate (e.g. according to desired values of preview window)
    c. Clear the one shot bit of the sensor mode to indicate that the camera should emit a stream of multiple frames, i.e. a video stream. The IL client should leave the sensor resolution at the default allowing the camera to

pick a sensor resolution appropriate to the resolution settings of the viewfinder and capture ports.

d. Set other camera settings (e.g. exposure value compensation, white balance, zoom, etc).

e. Set or clear auto pause after capture accordingly. If auto pause is set the component will pause and the viewfinder will freeze after a capture.

3. Establish any necessary tunnels between the camera component and other components (e.g. a display component tunneling with the viewfinder port or a video encoder tunneling with the capture port).

4. Select the clock component’s active reference clock. If the camera is used in concert with an audio capturer the audio clock will be the active reference clock (i.e. be the master clock) to facilitate synchronized audio/video capture. Otherwise the video clock provided by the camera will be the active reference clock.

5. Transition all components to the OMX_StateIdle state and then to the OMX_StateExecuting state. The viewfinder port should now be actively emitting preview frames.

6. To initiate video capture set the capturing bit. The capture port will emit captured frames at the frame rate specified. If using a clock component start the clock component. Timestamps applied to video frames will follow the media time to facilitate consistent timestamp authoring between audio and video capture. The viewfinder will continue to emit frames.

7. To terminate video capture clear the capturing bit. The capture port will cease the emission of frames. If set to auto pause the component will pause and the viewfinder will cease the emission of frames. This effectively freezes any associated preview window to the last frame emitted which should be identical to the last frame emitted by the capture port. If auto pause is clear then the viewfinder continues emitting preview frames.

8. If the component is paused and the viewfinder is frozen after a capture then the IL client manually unfreezes the viewfinder by transitioning the component to OMX_StateExecuting when appropriate (e.g. after the captured video has been stored by the application).

Note that this sequence of calls can also be used to implement a sequence of consecutive image captures. In the case of a sequence of stills the IL client simply sets the frame rate on the capture port to accommodate the desired interim between captured stills, uses a JPEG encoder instead of an MPEG encoder, and terminates the capture after the desired number of stills have been captured.

8.9.1.3 Still Image Capture

An IL client using a camera to capture an image may do so via the following steps:

1. Instantiate the camera component and any co-operating components

2. Set camera parameters:
   a. Set capture port resolution according to desired values of captured image.
   b. Set viewfinder port resolution and frame-rate (e.g. according to desired values of preview window).
   c. Set the one shot bit of the sensor mode to indicate that the camera should emit a single frame, i.e. an image frame. The IL client should leave the sensor resolution at the default allowing the camera to pick a sensor resolution appropriate to the resolution settings of the viewfinder and capture ports.
   d. Set other camera settings (e.g. exposure value compensation, white balance, zoom, etc).
   e. Set or clear auto pause after capture accordingly. If auto pause is set the component will pause and the viewfinder will freeze after a capture.
3. Establish any necessary tunnels between the camera component and other components (e.g. a display component tunneling with the viewfinder port or a image encoder tunneling with the capture port).
4. Transition all components to the OMX_StateIdle state and then to the OMX_StateExecuting state. The viewfinder port should now be actively emitting preview frames and the capture port is not transmitting any frames, it is paused.
5. With the viewfinder port enabled, the IL client now has the opportunity to performaing any zoom and focus related actions.
6. To signal image capture set the capturing bit. The capture port will emit a single captured frame and then the component will immediately clear the capturing bit. If set to auto pause after capture the component will transition itself to the OMX_StatePaused state and the viewfinder will cease the emission of frames. This effectively freezes any associated preview window to the captured image frame. If auto pause is clear then the viewfinder continues emitting preview frames.
7. If the component is paused and the viewfinder is frozen after a capture then the IL client manually unfreezes the viewfinder by transitioning the component to OMX_StateExecuting when appropriate (e.g. after the captured image has been stored by the application).

8.9.2 Clock Class

Name	clock			
Description	Implements the OpenMAX IL clock component (add reference to existing section in spec describing the clock component), the component may expose support for 1 to N ports.			
Ports	**Index**	**Domain**	**Direction**	**Description**

Name	clock			
	OPB+0 to (OPB+N-1)	other/time	output	Emits time updates.

8.9.2.1 Clock Component

Name	clock.binary
Description	Implements the OpenMAX IL clock component.

Port Index	OPB+0 to (OPB+N-1)		
Description	Emits time updates.		
Formats	OMX_OTHER_FormatTime		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexConfigTimeScale`	Read, write	Query or set current scale applied to the media time.
	`OMX_IndexConfigTimeClockState`	Read, write	Query or set current clock state.
	`OMX_IndexConfigTimeActiveRefClock`	Read, write	Query or set the active reference clock.
	`OMX_IndexConfigTimeCurrentMediaTime`	Read	Query current media time.
	`OMX_IndexConfigTimeCurrentWallTime`	Read	Query current wall clock time.
	`OMX_IndexConfigTimeCurrentAudioReference`	Write	Set the instantaneous audio reference clock value.
	`OMX_IndexConfigTimeCurrentVideoReference`	Write	Set the instantaneous video reference clock value.
	`OMX_IndexConfigTimeMediaTimeRequest`	Write	Make a media time request.
	`OMX_IndexConfigTimeClientStartTime`	Write	Set the start time of a client stream.

8.9.3 Container Demuxer Class

Name	container_demuxer			
Description	Parses a container filestream, demuxes its elementary streams, and emits them as independent video, image and audio streams.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	output	Emits demuxed audio stream.
	VPB+0	video	output	Emits demuxed video stream.
	OPB+0	other/time	input	Receives media time upates/provides access to clock component.

Port Index	OMX_ALL
Description	Properties that apply to all ports.

Port Index	OMX_ALL		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexConfigTimePosition`	r/w	Specifies the position in the container format content.
	`OMX_IndexConfigTimeSeekMode`	r/w	Specifies the manner in which a seek will be carried out (quickly or precisely).
	`OMX_IndexParamContentURI`	r/w	Specify/query the current target content.

Port Index	APB+0		
Description	Emits demuxed audio stream.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the characteristics of the audio stream.
	`OMX_IndexParamNumAvailableStreams`	r	Query the number of available audio streams for this port given current content.
	`OMX_IndexParamActiveStream`	r/w	Specify/query the active audio stream by index where indices are numbered from 0 to the number of available streams.

Port Index	VPB+0		
Description	Emits demuxed video stream.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the characteristics of the video stream.
	`OMX_IndexParamNumAvailableStreams`	r	Query the number of available video streams for this port given current content.
	`OMX_IndexParamActiveStream`	r/w	Specify/query the active video stream by index where indices are numbered from 0 to the number of available streams.

Port Index	OPB+0
Description	Accepts media time updates. Provides mechanism for component to query for media time. The demuxer obeys changes in the media time to implement trick modes. For instance a negative media time scale factor indicates rewind which implies the demuxer shall retrieve data in reverse order.

8.9.3.1 Playback Use Case

An IL client using a container parser to playback content may do so via the following steps:

1. Instantiate the container demuxer component.
2. Set any relevant container demuxer settings:
3. Specify the target content
4. set all outputs to autodetect
5. Execute the component until all each port generates an `OMX_EventPortSettingsChanged` event. For each port that generates this event:
   a. Query the number of available streams for that port and examine the properties of each available stream by making each active and reading the port parameters.
   b. Make the desired stream active.
6. Instantiate the set of co-operating components appropriate to the format settings of the parser's output ports.
7. Establish any necessary tunnels between the container parser and component and other components (e.g. an audio decoder tunneling with the audio port or a video decoder tunneling with the video port).
8. Select the clock component's active reference clock. In a use case with audio this is normally the audio clock as provided by the audio renderer.
9. Transition all components to the OMX_StateIdle state then the OMX_Executing state. If using a clock component start the clock component. The container demuxer will emit the relevant elementary streams facilitating playback.
10. To change the playback rate (i.e. facilitate trick modes) change the media clock scale factor to the appropriate value (e.g. 2.0 implies 2x forward playback and -1.0 implies 1x reverse playback). The clock component will inform the container demuxer of the scale change and the demuxer will retrieve and emit data in a manner appropriate the scale (e.g. in reverse for negative scales or skipping interframes in extreme fast forward).
11. To seek to a particular location the IL client sets the position on the container demux.

8.9.3.2 3GP Demuxer Component

The standard 3GP demuxer component shall support Release 6 of the 3GP format including basic profile (all other profiles are optional).

8.9.3.3 ASF Demuxer Component

The standard ASF demuxer component shall support ASF version 1.2, Revision 1.20.03 (dated December 2004)

8.9.3.4 Real Demuxer Component

The standard Real Demuxer shall support parsing of the Real container format.

8.9.4 Container Muxer Class

Name	container_muxer			
Description	Given independent video, image, and audio streams muxes them into a container filestream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	APB+0	audio	input	Accepts audio stream for muxing.
	VPB+0	video	input	Accepts video stream for muxing.

Port Index	OMX_ALL		
Description	Properties that apply to all ports.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamContentURI`	r/w	Specify/query the current target content.

8.9.4.1 3GP Muxer Component

The standard 3GP muxer component shall support Release 6 of the 3GP format including basic profile (all other profiles are optional).

8.9.5 Image/Video Processor Class

Name	iv_processor			
Description	Performs some processing on a raw image/video stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Accepts video for processing.
	VPB+1	video	output	Emits processed video.

8.9.5.1 YUV Image/Video Processor

Name	iv_processor.yuv			
Description	Performs some processing on a raw image/video stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Accepts video for processing.
	VPB+1	video	output	Emits processed video.

Port Index	VPB+0

Port Index	VPB+0		
Description	Accepts video for processing.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the characteristics of the video stream. nFrameWidth = *640* nFrameHeight = *480* eCompressionFormat = *OMX_VIDEO_CodingUnused* eColorFormat = *OMX_COLOR_FormatYUV420Planar*
	`OMX_IndexParamVideoPortFormat`	r/w	eCompressionFormat = *OMX_VIDEO_CodingUnused* eColorFormat = *OMX_COLOR_FormatYUV420Planar*

Port Index	VPB+1		
Description	Emits processed video.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the characteristics of the video stream. nFrameWidth = *640* nFrameHeight = *480* (output width and height imply scale if different then input width and height) eCompressionFormat = *OMX_VIDEO_CodingUnused* eColorFormat = *OMX_COLOR_FormatYUV420Planar*
	`OMX_IndexParamVideoPortFormat`	r/w	eCompressionFormat = *OMX_VIDEO_CodingUnused* eColorFormat = *OMX_COLOR_FormatYUV420Planar*
	`OMX_IndexConfigCommonRotate`	r/w	Specify/query rotation. Rotation is always performed prior to mirror. nRotation = *0* 90 (-270) 180 (-180) 270 (-90)

Port Index	VPB+1		
	`OMX_IndexConfigCommonMirror`	r/w	eMirror = *OMX_MirrorNone* OMX_MirrorVertical OMX_MirrorHorizontal OMX_MirrorBoth
	`OMX_IndexConfigCommonInputCrop`	r/w	Cropping shall be specified within frame boundaries: 0<= nLeft <= frame width -1 0<= nTop <= frame height -1 0<= nWidth <= frame width 0<= nHeight <= frame height Cropping is 16-byte aligned.

8.9.6 Image/Video Renderer Class

Name	iv_renderer			
Description	Displays a given raw image/video stream.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Accepts video for display.

Common to all renderers:

Port Index	VPB+0		
Description	Accepts video rendering.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexConfigCommonRotate`	r/w	Specify/query rotation. Rotation is always performed prior to mirror. nRotation = *0* 90 (-270) 180 (-180) 270 (-90)
	`OMX_IndexConfigCommonMirror`	r/w	eMirror = *OMX_MirrorNone* OMX_MirrorVertical OMX_MirrorHorizontal OMX_MirrorBoth
	`OMX_IndexConfigCommonScale`	r/w	xWidth = downscale factors of 2 xHeight = downscale factors of 2
	`OMX_IndexConfigCommonInputCrop`	r/w	Cropping shall be specified within frame boundaries: 0<= nLeft <= frame width -1 0<= nTop <= frame height -1 0<= nWidth <= frame width 0<= nHeight <= frame height Cropping is 16-byte aligned.

8.9.6.1 YUV Overlay Image/Video Renderer

Name	iv_renderer.yuv.overlay			
Description	Displays a given raw yuv image/video stream using overlays.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Accepts video for display.

Port Index	VPB+0		
Description	Accepts video rendering.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the characteristics of the video stream. nFrameWidth = *176* nFrameHeight = 220 nStride = 176 nSliceHeight = *16* eCompressionFormat = *OMX_VIDEO_CodingUnused* eColorFormat = *OMX_COLOR_FormatYUV420Planar*
	`OMX_IndexParamVideoPortFormat`	r/w	eCompressionFormat = *OMX_VIDEO_CodingUnused* eColorFormat = *OMX_COLOR_FormatYUV420Planar*

8.9.6.2 YUV BLTter Image/Video Renderer

Name	iv_renderer.yuv.blter			
Description	Displays a given raw yuv image/video stream via bitBLTs.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Accepts video for display.

Port Index	VPB+0		
Description	Accepts video rendering.		
Required	**Index**	**Access**	**Description**

Port Index	VPB+0		
Parameters/ Configs	`OMX_IndexParamPortDefinition`	r/w	Specify/query the characteristics of the video stream. nFrameWidth = *176* nFrameHeight = 220 nStride = 176 nSliceHeight = *16* eCompressionFormat = *OMX_VIDEO_CodingUnused* eColorFormat = *OMX_COLOR_FormatYUV420Planar*
	`OMX_IndexParamVideoPortFormat`	r/w	eCompressionFormat = *OMX_VIDEO_CodingUnused* eColorFormat = *OMX_COLOR_FormatYUV420Planar*

8.9.6.3 RGB Overlay Image/Video Renderer

Name	iv_renderer.rgb.overlay			
Description	Displays a given raw rgb image/video stream using overlays.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Accepts video for display.

Port Index	VPB+0		
Description	Accepts video rendering.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the characteristics of the video stream. nFrameWidth = *176* nFrameHeight = 220 nStride = *352 (176 pixels @ 16 bpp)* nSliceHeight = *16* eCompressionFormat = *OMX_VIDEO_CodingUnused* eColorFormat = *OMX_COLOR_Format16bitRGB565*

Port Index	VPB+0		
	`OMX_IndexParamVideoPortFormat`	r/w	eCompressionFormat = *OMX_VIDEO_CodingUnused* eColorFormat = *OMX_COLOR_Format16bitRGB565*

8.9.6.4 RGB BLTter Image/Video Renderer

Name	iv_renderer.rgb.blter			
Description	Displays a given raw rgb image/video stream vis bitBLTS.			
Ports	**Index**	**Domain**	**Direction**	**Description**
	VPB+0	video	input	Accepts video for display.

Port Index	VPB+0		
Description	Accepts video rendering.		
Required Parameters/ Configs	**Index**	**Access**	**Description**
	`OMX_IndexParamPortDefinition`	r/w	Specify/query the characteristics of the video stream. nFrameWidth = *176* nFrameHeight = 220 nStride = *352 (176 pixels @ 16 bpp)* nSliceHeight = *16* eCompressionFormat = *OMX_VIDEO_CodingUnused* eColorFormat = *OMX_COLOR_Format16bitRGB565*
	`OMX_IndexParamVideoPortFormat`	r/w	eCompressionFormat = *OMX_VIDEO_CodingUnused* eColorFormat = *OMX_COLOR_Format16bitRGB565*

9 Content Pipes

9.1 Rationale

Streaming media processing requires efficient data flow in and out of a media processing object.

For instance, in the playback use case a container format parser/demuxer typically pulls source data in a manner that assumes reads on a local file. Likewise, in the recording use case, a container format combiner/muxer typically pushes final data in a manner that assumes writes on a local file. Such “file access” is usually synchronous and includes some high frequency reads/writes of small size as well as random access.

In some cases, the content from which source data is pulled from or which final data is pushed to is not local or is not from a file. This conventional approach to this use case, often referred to as “data” streaming, leverages queues of large input or output buffers of linear data transferred asynchronously. This model is at odds with the model parsers and combiners expect. If conventional streaming is used then reconciling the two transfer models involves inefficient (and unnecessary) memory copies, waiting, and complexity.

9.2 Concept

We eliminate the inconsistency of these models by constructing a data access abstraction interface for pulling source data and pushing final data that lends itself to the needs of parsers and combiners. Rather than restricting ourselves to “file access” and the connotations it implies we use a more generalized notion of “content piping”.

A “content pipe” is an abstraction for any mechanism of accessing content data (i.e. pulling content data in or pushing content data out). This abstraction is not tied any particular implementation. A pipe may be implemented, for example, as a local file, a remote file, a broadcast stream, memory buffers, intermediate data from derived from persistent data, etc. A pipe needn’t be limited to a single method of providing access. For instance a single pipe may provide via both local files and remote files, or through multiple transport protocols. A system may include one or many pipes.

9.3 Implementation

Since content pipe functions are synchronous, the implementation of the pipe interface is local even if the content itself is remote. This may entail a local agent acting as a broker between asynchronously pushed buffers from remote content and a pipe client (e.g. a parser) that must synchronously pull in data of varying sizes. Such an agent would maintain both the complex/elastic connection between the remote content and a local cache (which entails careful synchronization) as well as the simple/rigid connection between the local cache and the parser (which as a pull interface lacks complex synchronization).

Note that the synchronous pull based transfer implied by content pipe interface implies neither that the physical connection to the content nor the propagation of the data beyond the client be synchronous and pull-based. For example consider the example of an OpenMAX IL parser component reading from either a remote file or a local one. The parser is provided the interface it requires, the mechanism to satisfy the pipe is completely abstracted and may actually use asynchronous data transfers, and the downstream data transfer is completely unaffected.

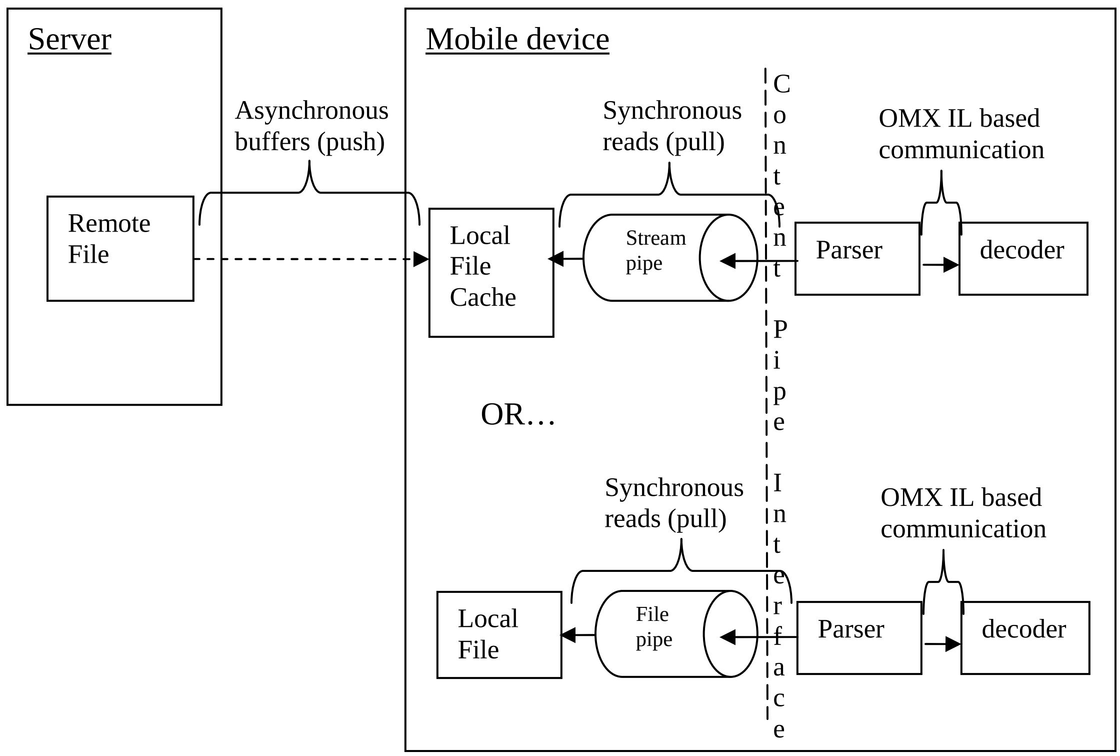


Figure 9-1. Content Pipe Operation

9.4 Definition

9.4.1 Content Access and Manipulation

The pipe interface includes functions for opening, creating and closing content handles:

```
CPResult (*Open)( CPhandle *hContent, CPstring szURI, CP_ACCESSTYPE eAccess );
CPResult (*Close)( CPhandle hContent );
CPResult (*Create)( CPhandle *hContent, CPstring szURI );
```

Because content parsers and muxers operate as though they are accessing files directly, a pipe's data access functions are modeled on conventional file access. These include functions for reading and writing data using client buffers and setting/retrieving the read/write position within the content:

```
CPResult (*SetPosition)( CPhandle hContent, CPint nOffset, CP_ORIGINTYPE
eOrigin);
```

```
CPResult (*GetPosition)( CPhandle hContent, *pPosition);
```

```
CPResult (*Read)( CPhandle hContent, CPbyte *pData, CPuint nSize);
```

```
CPResult (*Write)( CPhandle hContent, CPbyte *pData, CPuint nSize);
```

9.4.2 Streaming Support

This proposal recognizes that the source content may be remotely located and streamed during processing to a position of local accessibility (e.g. a local cache of remote content). The pipe interface includes a set of functions to accommodate such scenarios.

The `CheckAvailableBytes` function queries if a given number of bytes are available. This allows the client to check for the availability of enough bytes to satisfy a large section of parsing prior to beginning the parsing. This allows a pipe implementation to stream data to a local cache.

```
CPResult (*CheckAvailableBytes)( CPhandle hContent, CPuint nBytesRequested,
CP_CHECKBYTESRESULTTYPE *eResult);
```

If the bytes are not immediately available the pipe will call the client via the provided callback when they are. This callback mechanism also includes events for data overflow and a pipe disconnection (e.g. if the connection with a remote source is lost). See the `CP_EVENTTYPE` enumeration for details.

The ReadBuffer function reads a large area of data using the pipe implementation's memory. If a pipe implementation is streaming remote data to a local cache the desired data will already reside in local memory prior to a call on this function. This function avoids the memory copy that would be required if the client provided the memory pointer. Instead, this function allows the pipe implementation to provide the memory pointer.

```
CPResult (*ReadBuffer)( CPhandle hContent, CPbyte **ppBuffer, CPuint *nSize,
CPbool bForbidCopy);
```

This necessitates a `ReleaseReadBuffer` function to release a buffer acquired via `ReadBuffer`

```
CPResult (*ReleaseReadBuffer)(CPhandle hContent, CPbyte *pBuffer);
```

The `WriteBuffer` function to writes a large area of data using the pipe implementation's memory without imposing an unnecessary copy.

```
CPResult (*GetWriteBuffer)( CPhandle hContent, CPbyte **ppBuffer, CPuint
nSize);
```

This necessitates the `GetWriteBuffer` function to acquire a write buffer for use with `WriteBuffer`.

```
CPResult (*WriteBuffer)( CPhandle hContent, CPbyte *pBuffer, CPuint
nFilledSize);
```

9.4.3 Enumerations

9.4.3.1 CP_ORIGINTYPE

The CP_ORIGINTYPE enumeration defines all the origin types used by the SetPosition method of the CP_PIPETYPE from which the indicated position is relative.

Table 9-1: Content Pipe Origin Types

Value	Description
CP_OriginBegin	Origin is the beginning of content, specifically the first byte of the content's data stream.
CP_OriginCur	Origin is the current position within the content.
CP_OriginEnd	Origin is the beginning of content, specifically the last byte of the content's data stream.

9.4.3.2 CP_ACCESSTYPE

The CP_ACCESSTYPE enumeration defines all the access types used by the Open method of the CP_PIPETYPE.

Table 9-2: Content Pipe Access Types

Value	Description
CP_AccessRead	Access type is read only.
CP_AccessWrite	Access type is write only.
CP_AccessReadWrite	Access type is both read and write.

9.4.3.3 CP_CHECKBYTESRESULTTYPE

The CP_CHECKBYTESRESULTTYPE enumeration defines all possible results of a call to the CheckAvailableBytes method of the CP_PIPETYPE.

Table 9-3: Content Pipe CheckAvailableBytes Result Types

Value	Description
CP_CheckBytesOk	There are at least the requested number of bytes available.
CP_CheckBytesNotReady	The pipe is still retrieving bytes and presently lacks sufficient bytes. Client will be called when sufficient bytes are available.
CP_CheckBytesInsufficientBytes	The pipe has retrieved all bytes but those available are less than those requested.
CP_CheckBytesAtEndOfStream	The pipe has reached the end of the stream and no more bytes are available.
CP_CheckBytesOutOfBuffers	All read/write buffers are currently in use.

9.4.3.4 CP_EVENTTYPE

The CP_EVENTTYPE enumeration defines events a content pipe may send to its client via a registered ClientCallback function.

Table 9-4: Content Pipe Event Types

Value	Description
CP_BytesAvailable	Bytes requested in a CheckAvailableBytes call which were formally unavailable are now available. The iParam parameter of the callback contains the number of bytes currently available.
CP_Overflow	The pipe has more data than it has space to store. The iParam parameter of the callback is unused.
CP_PipeDisconnected	The pipe been disconnected. The iParam parameter of the callback is unused.

9.4.4 CP_PIPETYPE Methods

The CP_PIPETYPE structures includes the methods below expressed as function pointers. Since OpenMAX IL shares the content pipe definition with other APIs (e.g. OpenMAX AL), the content pipe methods return OpenKODE error codes.
Thus CPResult may the value zero indicating success or one the values defined in Appendix B.

9.4.4.1 Open

The Open method opens the specified content stream with the specified access type:

```
CPresult (*Open)(
    CPHandle* hContent,
    CPstring szURI,
    CP_ACCESSTYPE eAccess);
```

This is a blocking call. The pipe should return from this call within 20 milliseconds. Relevant errors include: KD_EACCES, KD_EBADF, KD_EHOSTUNREACH, KD_EINVAL, KD_EIO, KD_EISDIR, KD_EMFILE, and KD_ENOENT.

The parameters are as follows.

Parameter	Description
hContent *[out]*	Pointer receiving the new content handle corresponding to the specified URI opened with the specified access type.
szURI *[in]*	URI specifying the location of the content.
eAccess *[in]*	Desired access to the content.

9.4.4.2 Close

The `Close` method closes the specified content handle:

```
CPresult (*Close)(
    CPHandle hContent);
```

This is a blocking call. The pipe should return from this call within 20 milliseconds. Relevant errors include: `KD_EINVAL, and KD_EIO.`

The parameters are as follows.

Parameter	Description
hContent [in]	Content handle to be closed.

9.4.4.3 Create

The `Create` method creates the specified content stream and returns a handle to it:

```
CPresult (*Create)(
    CPHandle* hContent,
    CPstring szURI);
```

This is a blocking call. The pipe should return from this call within 20 milliseconds. Relevant errors include: `KD_EACCES, KD_EBADF, KD_EHOSTUNREACH, KD_EINVAL, KD_EIO, KD_EISDIR, KD_EMFILE, KD_ENOENT, and KD_EEXIST.`

The parameters are as follows.

Parameter	Description
hContent [out]	Pointer receiving the new content handle corresponding to the specified URI opened with the specified access type.
szURI [in]	URI specifying the desired location of the content.

9.4.4.4 CheckAvailableBytes

The `CheckAvailableBytes` method verifies that the specified number of bytes are available for reading or writing depending on access type.

```
CPresult (*CheckAvailableBytes)(
    CPHandle hContent,
    Cpuint nBytesRequested,
    CP_CHECKBYTESRESULTTYPE *eResult);
```

This is a blocking call. The pipe should return from this call within 20 milliseconds. Relevant errors include: `KD_EINVAL, and KD_EIO.`

The parameters are as follows.

Parameter	Description
hContent *[in]*	Handle of content to check.
nBytesRequested *[in]*	The desired number of bytes. Result will depend on whether this number of bytes is actually available currently.
eResult *[out]*	Result of check (see definition of `CP_CHECKBYTERESULTTYPE`).

9.4.4.5 SetPosition

The `SetPosition` method moves the pipe's byte position within a piece of content to the specified location.

```
CPresult (*SetPosition)(
    CPhandle hContent,
    CPint nOffset,
    CP_ORIGINTYPE eOrigin);
```

This is a blocking call. The pipe should return from this call within 20 milliseconds although returning from this function does not necessarily imply data from the new position is immediately available. Relevant errors include: `KD_EINVAL, and KD_EIO.`

The parameters are as follows.

Parameter	Description
hContent *[in]*	Handle of content.
nOffset *[in]*	Offset of desired byte position relative to the specified origin.
eOrigin *[in]*	Origin from relative to which the offset applies.

9.4.4.6 GetPosition

The `GetPosition` method returns the pipe's byte position within a piece of content.

```
CPresult (*GetPosition)(
    CPhandle hContent,
    CPuint *pPosition);
```

This is a blocking call. The pipe should return from this call within 5 milliseconds. Relevant errors include: `KD_EINVAL, and KD_EIO.`

The parameters are as follows.

Parameter	Description
hContent *[in]*	Handle of content.

Parameter	Description
pPosition *[out]*	Current byte position of the pipe within the specified content.

9.4.4.7 Read

The `Read` method retrieves data of the specified size from the content stream and advances the content pointer by the size of the data. Note that the pipe client provides the pointer to accept the data. This function is therefore appropriate for small high frequency reads.

```
CPresult (*Read)(
    CPhandle hContent,
    CPbyte *pData,
    CPuint nSize);
```

This is a blocking call. The pipe should return from this call within 20 milliseconds. Relevant errors include: `KD_EINVAL, and KD_EIO.`

The parameters are as follows.

Parameter	Description
hContent *[in]*	Handle of content.
pData *[out]*	Client specified pointer to receive data.
nSize *[in]*	Number of bytes to read.

9.4.4.8 ReadBuffer

The `ReadBuffer` method retrieves a buffer allocated by the pipe containing the requested number of bytes from the content stream. The content pointer advances by the number of bytes read. Note that the pipe itself provides the pointer to the data. This function is therefore appropriate for large low frequency reads. The client shall call `ReleaseReadBuffer` when done with the buffer to return it to the pipe.

In some cases he requested block might not reside in contiguous memory within the pipe implementation. For instance, if the pipe leverages a circular buffer then the requested block might straddle the boundary of the circular buffer. By default a pipe implementation performs a copy in this case to provide the block to the pipe client in one contiguous buffer. If, however, the client sets `bForbidCopy`, then the pipe returns only those bytes preceding the memory boundary. Here the client may retrieve the data in segments over successive calls.

```
CPresult (*ReadBuffer)(
    CPhandle hContent,
    CPbyte **ppBuffer,
    CPuint *nSize,
```

```
    CPbool bForbidCopy);
```

This is a blocking call. The pipe should return from this call within 20 milliseconds. Relevant errors include: `KD_EINVAL, and KD_EIO.`

The parameters are as follows.

Parameter	Description
hContent *[in]*	Handle of content.
ppBuffer *[out]*	Pointer to receive pipe supplied data buffer.
nSize *[in/out]*	Prior to call: number of bytes to read. After call: number of bytes actually read.
bForbidCopy *[in]*	If set the pipe shall never perform a copy opting instead to provide less bytes than in requested.

9.4.4.9 ReleaseReadBuffer

The `ReleaseReadBuffer` returns a buffer previously acquired via a ReadBuffer.

```
CPresult (*ReleaseReadBuffer)(
    CPhandle hContent,
    CPbyte *pBuffer);
```

This is a blocking call. The pipe should return from this call within 20 milliseconds. Relevant errors include: `KD_EINVAL, and KD_EIO.`

The parameters are as follows.

Parameter	Description
hContent *[in]*	Handle of content.
pBuffer *[in]*	Pipe supplied read buffer being released (i.e. returned to pipe).

9.4.4.10 Write

The `Write` method writes data of the specified size to the content stream and advances the content pointer by the size of the data. Note that the pipe client provides the pointer to accept the data. This function is therefore appropriate for small high frequency writes.

```
CPresult (*Write)(
    CPhandle hContent,
    CPbyte *data,
    CPuint nSize);
```

This is a blocking call. The pipe should return from this call within 20 milliseconds. Relevant errors include: `KD_EINVAL, KD_EACCES, and KD_EIO.`

The parameters are as follows.

Parameter	Description
hContent *[in]*	Handle of content.
pData *[out]*	Client specified pointer to data.
nSize *[in]*	Number of bytes to write.

9.4.4.11 GetWriteBuffer

The `GetWriteBuffer` method acquires a buffer allocated by the pipe corresponding to the next set of bytes to be written to the content and of the specified size. Note that the pipe itself provides the pointer to the data. This function is therefore appropriate for large low frequency writes. The client shall call `WriteBuffer` when done with the buffer to commit the write and return the buffer to the pipe.

```
CPresult (*GetWriteBuffer)(
    CPhandle hContent,
    CPbyte **ppBuffer,
    CPuint *nSize);
```

This is a blocking call. The pipe should return from this call within 20 milliseconds. Relevant errors include: `KD_EINVAL, KD_EACCES, and KD_EIO.`

The parameters are as follows.

Parameter	Description
hContent *[in]*	Handle of content.
ppBuffer *[out]*	Pointer to receive pipe supplied data buffer.
nSize *[in]*	Size of requested write buffer in bytes.

9.4.4.12 WriteBuffer

The `WriteBuffer` method commits a write buffer previously acquired via a `GetWriteBuffer`, returns the write buffer to the pipe, and advances the write pointer by the size of the committed data.

```
CPresult (*WriteBuffer)(
    CPhandle hContent,
    CPbyte *pBuffer,
    CPuint nFilledSize);
```

This is a blocking call. The pipe should return from this call within 20 milliseconds. Relevant errors include: `KD_EINVAL, KD_EACCES, and KD_EIO.`

The parameters are as follows.

Parameter	Description
hContent [in]	Handle of content.
pBuffer [in]	Pipe supplied data buffer containing data to commit.
nFilledSize [in]	Size of actual bytes to commit (from beginning of buffer).

```
/** Register a per-handle client callback with the content pipe. */
    CPresult (*RegisterCallback)( CPhandle hContent, CPresult
(*ClientCallback)(CP_EVENTTYPE eEvent, CPuint iParam));
```

9.4.4.13 RegisterCallback

The `RegisterCallback` method registers an client event callback for a given content handle with the pipe.

```
CPresult (*RegisterCallback)(
    CPhandle hContent,
    CPresult (*ClientCallback)(
    CP_EVENTTYPE eEvent,
    CPuint iParam));
```

This is a blocking call. The pipe should return from this call within 20 milliseconds. Relevant errors include: `KD_EINVAL, and KD_EIO.`

The parameters are as follows.

Parameter	Description
hContent [in]	Handle of content.
ClientCallback [in]	Event callback to register.

9.5 Acquiring a Content Pipe

We define a content pipe is defined as an interface so that more than one pipe may be implemented on a system and so that pipes may be passed from one part of the system to another. A media processing object uses a pipe as a mechanism to access content (as identified via a URI). The media processing object acquires a content pipe either through the system or from the client.

9.5.1 Indexes

The header OMX_Index.h contains the enumeration OMX_INDEXTYPE, which contains all standard index values used with the the functions OMX_GetParameter, OMX_SetParameter. Table 9-5 describes the index values that relate to Content Pipes.

Table 9-5: Index Values for Content Pipe

Index	Description
OMX_IndexParamContentURI	OMX_PARAM_CONTENTURITYPE. Specifies the content by URI.
OMX_IndexParamCustomContentPipe	OMX_PARAM_CONTENTPIPETYPE. Specifies the client content pipe.

9.5.2 OMX_PARAM_CONTENTURITYPE

An OpenMAX IL component parameter which specifies the URI of a component's target content.

OMX_PARAM_CONTENTURITYPE is defined as follows.

```
typedef struct OMX_PARAM_CONTENTURITYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_U8 contentURI[1];
} OMX_PARAM_CONTENTURITYPE;
```

9.5.2.1 Parameters

The parameters for OMX_PARAM_CONTENTURITYPE are defined as follows.

- contentURI specifies the URI name, including any terminating bytes(s).

Note: The nSize parameters indicates the total size of the structure including the size of the contentURI parameter.

9.5.3 OMX_PARAM_CONTENTPIPETYPE

An OpenMAX IL component parameter which specifies the content pipe used by the component to access content:

OMX_PARAM_CONTENTPIPETYPE is defined as follows.

```
typedef struct OMX_PARAM_CONTENTPIPETYPE {
    OMX_U32 nSize;
    OMX_VERSIONTYPE nVersion;
    OMX_HANDLETYPE hPipe;
} OMX_PARAM_CONTENTPIPETYPE;
```

9.5.3.1 Parameters

The parameters for `OMX_PARAM_CONTENTPIPETYPE` are defined as follows.

- `hPipe` specifies handle of the custome content pipe.

9.5.4 Acquiring a Content Pipe from the IL Core

A OpenMAX IL Core method for acquiring a content pipe for a given URI. A component that requires a content pipe should always retrieve the pipe via this method unless the OpenMAX IL Client overrides the content pipe with a OMX_SetParameter call using the OMX_IndexParamCustomContentPipe parameter.

`FillBufferDone` is defined as follows.

```
OMX_ERRORTYPE OMX_GetContentPipe(
    OMX_OUT OMX_HANDLETYPE *hPipe,
    OMX_IN OMX_STRING szURI)
```

The parameters are as follows.

Parameter	**Description**
hPipe *[out]*	The handle of the content pipe being retrieved.
szURI *[in]*	A URI string that associates the content pipe to be retrieved.

9.5.5 Content Pipe Related Errors

A set of OpenMAX IL error codes dedicated to failures associated with accessing content:

Error	**Description**
`OMX_ErrorContentPipeOpenFailed`	`The content pipe open operation failed.`
`OMX_ErrorContentPipeCreationFailed`	`The content pipe creation operation failed.`

9.6 Example Use Cases

9.6.1 Playback/Parser Use Case:

Consider the playback use case where a media processing object is responsible for parsing data from piece of source content. The following steps occur:

1. The client specifies the source content to the object, e.g. by URI.

2. The client *optionally* specifies the mechanism for accessing the source content (i.e. the content pipe) to the object.
3. If the client does not specify the content pipe to the object, the object must acquire a pipe itself (e.g. via an OpenMAX IL Core function or some implementation specific mechanism).
4. At the appropriate time the object opens the content specified by the client using the content pipe.
5. The object performs reads on the source content using the content pipe, parses that content, and plays it.
6. At the appropriate time the object closes the content using the content pipe.

9.6.2 Recording/Combiner Use Case:

Consider the recording use case where a media processing object is responsible for emitting final data (perhaps muxed and packaged by a "combiner") to a piece of content. The following steps occur:

1. The client specifies the destination content to the object, e.g. by URI.
2. The client *optionally* specifies the mechanism for accessing the destination content (i.e. the content pipe) to the object.
3. If the client does not specify the content pipe to the object, the object must acquire a pipe itself (e.g. via an OpenMAX IL Core function or some implementation specific mechanism).
4. At the appropriate time the object opens the content specified by the client using the content pipe.
5. The object performs writes on the destination content using the content pipe sending muxed/packaged data to it after capture said data.
6. At the appropriate time the object closes the content using the content pipe.

10 Implementing Buffer Sharing

Buffer sharing is implemented on a tunnel within a component and is transparent to other components. The non-supplier port is unaware whether the supplier's component allocated the buffers itself or re-used buffers from another of its ports. Furthermore, the supplier is unaware of whether the non-supplier's component will re-use the buffers that the supplier provided.

A tunnel between any two ports represents a dependency between those ports. Buffer sharing extends that dependency so that all ports that share the same set of buffers form an implicit dependency chain. Exactly one port in that dependency chain allocates the buffers shared by all of them.

If a component chooses to share buffers, its implementation may fulfill the tunnels requirements by doing the following:

- Provide re-used buffers on some supplier ports.
- Account for the needs of shared ports when communicating buffer requirements on ports.
- Internally pass a buffer from an input port to an output port between an `OMX_EmptyThisBuffer` call and its corresponding `EmptyBufferDone` call.

OpenMAX IL defines external component semantics to be compatible with sharing, although it does not explicitly require that a component support sharing. This section discusses the implementation of those semantics in the context of buffer sharing. If no components are sharing buffers, the implementation reduces to a simpler set of steps and obligations.

10.1.1.1 Component Transition from Loaded to Idle State with Sharing

During the `OMX_SetupTunnel` call, the two ports of a tunnel establish which port (input or output) will act as the buffer supplier. Thus, when a component is commanded to transition from loaded to idle, it is aware of the roles of all its supplier or non-supplier ports.

When commanded to transition from loaded to idle, a component performs the following operations in this order:

1. The component determines what buffering sharing it will implement, if any. The following rules apply:
   a) A component may re-use a buffer only from one of its one input ports on one or more of its output ports or from one of its output ports on one of its input ports.
   b) Only a supplier port may re-use the buffers from another port.
   c) A component sharing buffers over multiple output ports requires read-only output port as shown in Figure 10-1.

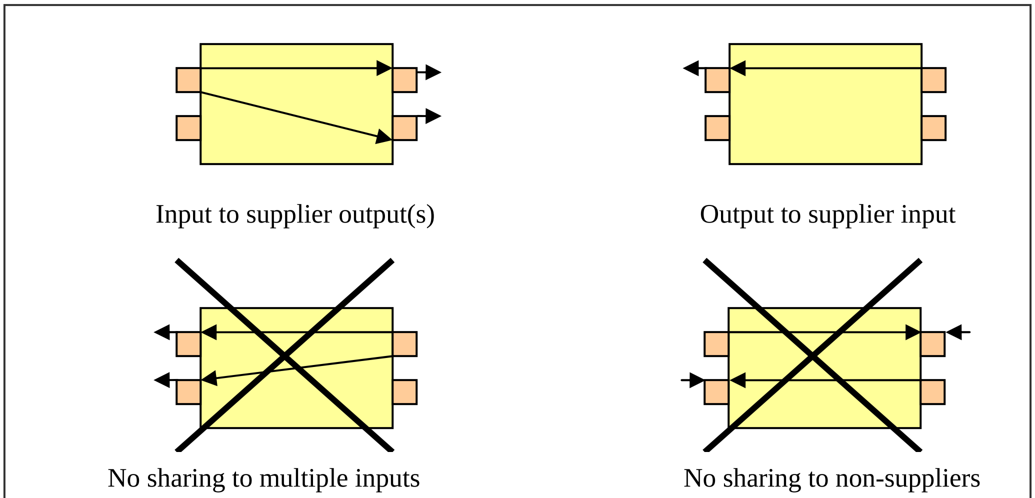


Figure 10-1. Possible Sharing Relationships

2. The component determines which of its supplier ports, if any, are also allocator ports. A supplier port is also an allocator port only if it does not re-use buffers from a non-supplier port on the same component (i.e., is not a sharing port).

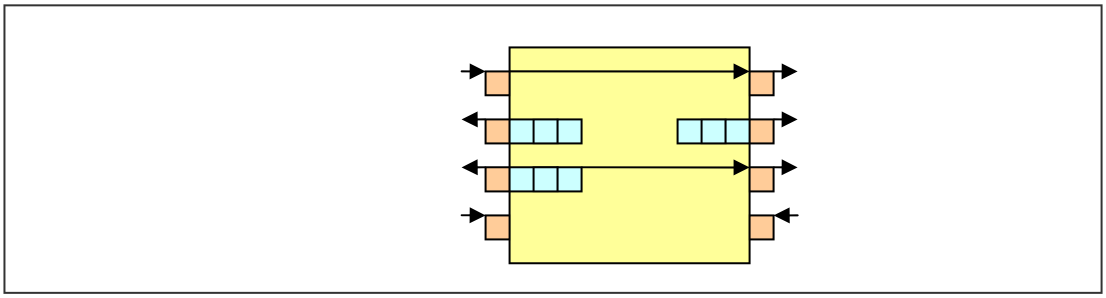


Figure 10-2. Determining Allocators: a supplier port is a port with an arrow pointing away. A non-supplier port is a port with an arrow pointing toward it. An arrow from one port represents a sharing relationship. A port with boxes (buffers) adjacent to it represents an allocator port.

3. The component allocates its buffers for each of its allocator ports as follows:
   a) For each port that re-uses the allocator ports buffer, the allocator port determines the buffer requirements of the sharing port. See obligation A below.
   b) The allocator port determines the buffer requirements of its tunneled port via an `OMX_GetParameter` call. See obligation B below.
   c) The allocator port allocates buffers according to the maximum of its own requirements, the requirements of the tunneled port, and the requirement of all of the sharing ports.
   d) The allocator port informs the non-supplier port that it is tunneling with of the actual number of buffers via an `OMX_SetParameter` call on

OMX_IndexParamPortDefinition by setting the value of nBufferCountActual appropriately. See obligation E below.

e) The allocator port shares its buffers with each sharing port that re-uses its buffers. See obligation D below.

f) For every allocated buffer, the allocator port calls OMX_UseBuffer on its tunneling port. See obligation C below.

A component shall also fulfill the following obligations:

A. For a sharing port to determine its requirements, the sharing port shall first call OMX_GetParameter on its tunneled port to query for requirements and then return the maximum of its own requirements and the requirements of the tunneled ports.

B. When a non-supplier port receives an OMX_GetParameter call querying its buffer requirements, the non-supplier port shall first determine the requirements of all ports that re-use its buffers (see obligation A) and then return the maximum of its own requirements and those of its ports.

C. When a non-supplier port receives an OMX_UseBuffer call from its tunneled port, the non-supplier port shall share the buffer with all ports on that component that re-use it.

D. When a port A shares a buffer with a port B on the same component where port B re-uses the buffer of port A, then port B shall call OMX_UseBuffer and pass the buffer on its tunneled port.

E. When a non-supplier port receives a OMX_SetParameter call on OMX_IndexParamPortDefinition from its tunneled port, the non-supplier port shall pass the nBufferCountActual field to any port that re-uses its buffers. Likewise, each supplier port that receives the nBufferCountActual field in this way shall pass the nBufferCount to its tunneled port by performing an OMX_SetParameter call on OMX_IndexParamPortDefinition. The actual number of buffers used throughout the dependency chain is propagated in this way.

A component may transition from loaded to idle when all enabled ports have all the buffers they require.

In practice, there could be a direct mapping between the following:

- Steps 1–3 discussed earlier and code in the loaded-to-idle case in the state transition handler
- Obligation A and a subroutine to determine a shared ports buffer requirements
- Obligation B and the OMX_GetParameter implementation
- Obligation C and the OMX_UseBuffer implementation
- Obligation D and a subroutine to share a buffer from one port to another

To clarify why conformity to these steps and obligations leads to proper buffer allocation, consider the example illustrated in Figure 10-3. Note that this example is contrived to exercise every step and obligation outlined above, and is therefore more complex then most real use cases.

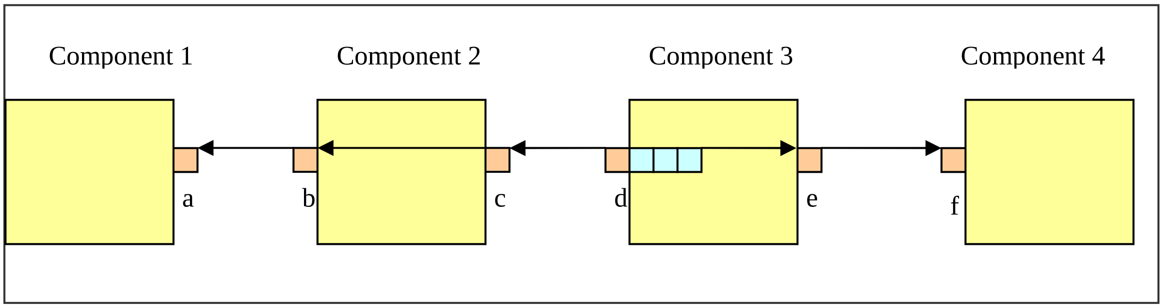


Figure 10-3. Example of Buffer Allocation with Sharing

This discussion focuses only on the transition of component 3 to idle; similar operations occur inside the other components.

When the IL client commands component 3 to transition from loaded to idle, it follows the following prescribed steps:

1. Component 3 notices that it can re-use port d's buffers since port e is a supplier port. Component 3 establishes a sharing relationship from port d to port e.
2. Component 3 decides that since port d is a supplier port that does not re-use buffers, port d shall be an allocator port.
3. Component 3 allocates and distributes port d's buffers:
    a) Since port e will re-use the buffer of port d, component 3 determines the buffer requirements of port e. In accordance with obligation A, port e calls `OMX_GetParameter` on port f to determine its buffer requirements and reports the requirements as the maximum between its own and those of port f.
    b) Port d calls `OMX_GetParameter` on port c to determine its buffer requirements. In accordance with obligation B, port c shall determine the buffer requirements of port b. In accordance with obligation A, port b returns the maximum of its own requirements and the requirement of port a (retrieved via `OMX_GetParameter`) when queried. Port c then returns the maximum of its own requirements and the requirements that port b returns.
    c) Port d allocates buffers according to the maximum of its own requirements and the requirements that ports c and e return. The resulting buffers are effectively allocated according to the maximum requirements of ports a, b, c, d, e, and f, all of which use the buffers of port d.
    d) Since port e will re-use the buffers of port d, component 3 shares these buffers with port e. In accordance with obligation D, port e calls `OMX_UseBuffer` on port f for every buffer that is shared.

e) For each buffer allocated, port d calls OMX_UseBuffer on port c. In accordance with obligation C, port c shares each buffer with port b. Port b, in turn, obeys obligation D and calls OMX_UseBuffer on port a with the buffer.

Since all ports of all components now have their buffers, all components may transition to idle.

10.1.1.2 Protocol for Using a Shared Buffer

When an input port receives a shared buffer via an OMX_EmptyThisBuffer call, the input port may re-use that buffer on an output port that it is sharing with the output port by obeying the following rules:

- The output port calls OMX_EmptyThisBuffer on its tunneling port before the input port sends the corresponding EmptyBufferDone call to its tunneling port.
- The input port does not call EmptyBufferDone until all output ports on which the buffer is shared (i.e., via OMX_EmptyThisBuffer calls) return EmptyBufferDone.

11 Appendix A – References

This appendix identifies provides references to documentation on standards and formats presented in this document. The hyperlinks provide access to documents stored on various websites. The references are organized according to the applicable type of media.

11.1 SPEECH

11.1.1 3GPP

AMR-NB	3G TS 26.071 "AMR speech Codec; General Description", Generation Partnership Project (3GPP). And references therein.
AMR-WB	3G TS 26.171 "AMR Wideband Speech Codec; General Description", Generation Partnership Project (3GPP). And references therein.
GSM-EFR	3G TS 46.051 "Enhanced Full Rate (EFR) speech processing functions; General description", Generation Partnership Project (3GPP). And references therein.
GSM-FR	3G TS 46.001 "Full rate speech; Processing functions", Generation Partnership Project (3GPP). And references therein.
GSM-HR	3G TS 46.002 "Half rate speech; Processing functions", Generation Partnership Project (3GPP). And references therein.

11.1.2 3GPP2

SMV	3GPP2-SMV, "Selectable Mode Vocoder (SMV) Service Option for Wideband Spread Spectrum Communication Systems", 3GPP2 C.S0030-0, 2004.

11.1.3 ARIB

PDC-EFR	RCR-27 EFR, "RCR-27-1: Personal Digital Cellular Telecommunication System," sec. 5.4, 2003.
PDC-FR	RCR-27 FR, "RCR-27-1: Personal Digital Cellular Telecommunication System," sec. 5.1, 2003.
PDC-HR	RCR-27 HR, "RCR-27-1: Personal Digital Cellular Telecommunication System," sec. 5.2, 2003.

11.1.4 ITU

G.711	ITU-G711, "Pulse code modulation (PCM) of voice frequencies ", 1988.
G.723.1	ITU-G.723.1, "Dual rate speech coder for multimedia communications transmitting at 5.3 and 6.3 kbit/s", 1996.
G.726	ITU-G.726, "40, 32, 24, 16 kbit/s adaptive differential pulse code modulation (ADPCM)", 1990.

G.729	ITU-G.729, “Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear-prediction (CS-ACELP)”’, 1996.

11.1.5 IETF

RFC3267	RFC3267: Real-Time Transport Protocol (RTP) Payload Format and File Storage Format for the Adaptive Multi-Rate (AMR) and Adaptive Multirate Wideband (AMR WB) Audio Codecs.

11.1.6 TIA

EVRC	ANSI/TIA-127-A-2004, “Enhanced Variable Rate Codec Speech Service Option 3 for Wideband Spread Spectrum Digital Systems,” 2004.
QCELP8	ANSI/TIA/EIA-96-C-98, “Speech Service Option Standard for Wideband Spread Spectrum Systems,” 1998.
QCELP13	ANSI/TIA-733-A-2004, “High Rate Speech Service Option 17 for Wideband Spread Spectrum Communications Systems,” 2004.
TDMA-EFR	ANSI/TIA/EIA-136-410-1-2001, “TDMA Cellular PCS - Radio Interface - Enhanced Full-Rate Voice Codec, Addendum 1,” 2001.
TDMA-FR	ANSI/TIA/EIA-136-420-99, “TDMA Cellular PCS, VSELP,” 1999.

11.2 AUDIO

11.2.1 ISO

HE-AAC v1	ISO/IEC JTC1/SC29/WG11 MPEG, International Standard IS 14496-3 “Coding of Audio-Visual Objects—Part 3: Audio, Amendment 1: Bandwidth extension”, November 2003.
HE-AAC v2	ISO/IEC JTC1/SC29/WG11 MPEG, International Standard IS 14496-3 “Coding of Audio-Visual Objects—Part 3: Audio, Amendment 2: Parametric coding for high-quality audio”, August 2004.
MPEG-1 Audio	ISO/IEC JTC1/SC29/WG11 MPEG, International Standard IS 11172-3 "Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbit/s, Part 3: Audio", 1993.
MPEG-2 Audio	ISO/IEC JTC1/SC29/WG11 MPEG, International Standard IS 13818-3 “Information Technology - Generic Coding of Moving Pictures and Associated Audio, Part 3: Audio", 1998.
MPEG-2 AAC	ISO/IEC JTC1/SC29/WG11 MPEG, International Standard IS 13818-7 "Information Technology - Generic Coding of Moving Pictures and Associated Audio, Part 7: MPEG-2 AAC", 2004.
MPEG-4 AAC	ISO/IEC JTC1/SC29/WG11 MPEG, International Standard IS 14496-3 “Coding of Audio-Visual Objects—Part 3: Audio”, 2d Edition, December 2001.

11.2.2 MISC

I3DL2 Interactive 3-D Audio Rendering Guidelines - Level 2.0, Revision 1.0a. Interactive Audio Special Interest Group, September 20, 1999.

SBC de Bont, F., Groenewegen, M., and Oomen, W., “A High Quality Audio Coding System at 128 kb/s”, 98th AES Convention, Feb. 25-28, 1995.

WMA Windows Media Audio

VORBIS Vorbis codec

RA Real Audio 10 Codec

PCM Pulse-code Modulation

ADPCM Adaptive Differential PCM

RFC 1766 Tags for the Identification of Languages (http://www.ietf.org/rfc/rfc1766.txt)

ISO 639 Codes for the Representation of Names of Languages (http://www.iso.org/iso/en/StandardsQueryFormHandler.StandardsQueryFormHandler?scope=CATALOGUE&keyword=&isoNumber=639&sortOrder=ISO&title=true&search_type=ISO&search_term=639&languageCode=en)

ISO 3166 Codes for the Representation of Names of Countries and their Subdivisions (http://www.iso.org/iso/en/StandardsQueryFormHandler.StandardsQueryFormHandler?scope=CATALOGUE&keyword=&isoNumber=3166&sortOrder=ISO&title=true&search_type=ISO&search_term=3166&languageCode=en)

11.3 SYNTHETIC AUDIO

11.3.1 MIDI

DLS 1 Downloadable Sounds Level 1 Specification, Version 1.1a, RP-016. MIDI Manufacturers Association, Los Angeles, CA, USA, January 1999.

DLS 2 Downloadable Sounds Level 2 Specification, Version 1.0c, RP-025. MIDI Manufacturers Association, Los Angeles, CA, USA, July 14 1999.
Downloadable Sounds Level 2.1 Specification (RP-025/Amd1), MIDI Manufacturers Association, Los Angeles, CA, USA, January 2001.

General MIDI The Complete MIDI 1.0 Detailed Specification, Document version 96.1, MIDI Manufacturers Association, Los Angeles, CA, USA, 1996 (Contains MIDI 1.0 Detailed Specification, MIDI Time Code, Standard MIDI Files 1.0, General MIDI System Level 1, MIDI Show Control 1.1, and MIDI Machine Control)

General MIDI 2 General MIDI Level 2 Specification (Recommended Practice), v 1.1 (updated), RP-024. MIDI Manufacturers Association, Los Angeles, CA, USA, September 2003.

GM Lite	General MIDI Lite Specification and Guidelines for Use in Mobile Applications, Version 1.0, RP-033. MIDI Manufacturers Association, Los Angeles, CA, USA, October 5, 2001.
Mobile DLS	Mobile DLS Specification, RP-041, MIDI Manufacturers Association, Los Angeles, CA, USA, 2003.
Mobile XMF (XMF type 2)	Mobile XMF Content Format Specification, RP-042. MIDI Manufacturers Association, Los Angeles, CA, USA, September 2004. XMF Meta File Format 2.0, RP-043. MIDI Manufacturers Association, Los Angeles, CA, USA, September 2004.
SP-MIDI	Scalable Polyphony MIDI Specification, Version 1.0, RP-034. MIDI Manufacturers Association, Los Angeles, CA, USA, February 2002 Scalable Polyphony MIDI Device 5-24 Voice Profile for 3GPP, Version 1.0, RP-035. MIDI Manufacturers Association, Los Angeles, CA, USA, February 2002.
XMF type 0 and 1	Type 0 and 1 XMF Files, RP-031. MIDI Manufacturers Association, Los Angeles, CA, USA, 2001. XMF Meta File Format, Version 1.00b, RP-030. MIDI Manufacturers Association, Los Angeles, CA, USA, October 2001. XMF Meta File Format Updates v1.01, RP-039. MIDI Manufacturers Association, Los Angeles, CA, USA, July 2003.

11.4 IMAGE

11.4.1 IETF

RFC804 IETF/RFC 804, "ITU Group 3 encoding: Modified Huffman and Modified Read compression algorithms."

RFC1314 IETF/RFC 1314, "A File Format for the Exchange of Images in the Internet," 1992.

RFC2035 IETF/RFC 2305, "RTP Payload Format for JPEG-compressed Video," 1996.

RFC2083 IETF/RFC 2083, "PNG (Portable Network Graphics) Specification Version 1.0," 1997.

RFC2160 IETF/RFC 2160, "Carrying PostScript in X.400 and MIME," 1998.

RFC2302 IETF/RFC 2302, "Tag Image File Format (TIFF), image/tiff MIME Sub-type Registration," 1998.

RFC2306 IETF/RFC 2306, "Tag Image File Format (TIFF), F Profile for Facsimile," 1998.

RFC3250 IETF/RFC 3250, "Tag Image File Format Fax Extended (TIFF-FX), image/tiff-fx MIME Sub-type Registration," 2002.

RFC3302 IETF/RFC 3302, "Tag Image File Format (TIFF) - image/tiff MIME Sub-type Registration," 2002.

RFC3362 IETF/RFC 3362, "Real-time Facsimile (T.38), image/t38 MIME Sub-type Registration," 2002.

RFC3745 IETF/RFC 3745, "MIME Type Registrations for JPEG 2000 (ISO/IEC 15444)," 2004.

RFC3950 IETF/RFC 3950, "Tag Image File Format Fax Extended (TIFF-FX), image/tiff-fx MIME Sub-type Registration," 2005.

11.4.2 ISO

JPEG v1 ISO/IEC JTC1/SC29/WG1 JPEG, International Standard IS 10918-1, "Digital compression and coding of continuous-tone still images: Requirements and guidelines," 1994.

JPEG v2 ISO/IEC JTC1/SC29/WG1 JPEG, International Standard IS 10918-1/Cor 1, "JPEG patent information update," 2005.

JPEG v3 ISO/IEC JTC1/SC29/WG1 JPEG, International Standard IS 10918-3, "Digital compression and coding of continuous-tone still images: Extensions," 1997.

JPEG v4 ISO/IEC JTC1/SC29/WG1 JPEG, International Standard IS 10918-3/Amd 1, "Provisions to allow registration of new compression types and versions in the SPIFF header," 1999.

JPEG v5 ISO/IEC JTC1/SC29/WG1 JPEG, International Standard IS 10918-4, "Digital compression and coding of continuous-tone still images: Registration of JPEG profiles, SPIFF profiles, SPIFF tags, SPIFF colour spaces, APPnmarkers, SPIFF compression types and Registration Authorities (REGAUT)," 1999.

JPEG v6 ISO/IEC JTC1/SC29/WG1 JPEG, International Standard IS 11544, "Coded representation of picture and audio information, Progressive bi-level image compression," 1993.

JPEG LS v1 ISO/IEC JTC1/SC29/WG1 JPEG LS, International Standard IS 14495-1, "Lossless and near-lossless compression of continuous-tone still images: Baseline," 1999.

JPEG LS v2 ISO/IEC JTC1/SC29/WG1 JPEG LS, International Standard IS 14495-2, "Lossless and near-lossless compression of continuous-tone still images: Extensions," 2003.

JPEG 2000 v1 ISO/IEC JTC1/SC29/WG1 JPEG 2000, International Standard IS 15444-1, "JPEG 2000 image coding system: Core coding system," Ed. 2, 2004.

JPEG 2000 v2 ISO/IEC JTC1/SC29/WG1 JPEG 2000, International Standard IS 15444-2, "JPEG 2000 image coding system: Extensions," Ed. 1, 2004.

JPEG 2000 v3 ISO/IEC JTC1/SC29/WG1 JPEG 2000, International Standard IS 15444-6, "JPEG 2000 image coding system, Part 6: Compound image file format," Ed. 1, 2003.

JPEG 2000 v4 ISO/IEC JTC1/SC29/WG1 JPEG 2000, International Standard IS 15444-12, "JPEG 2000 image coding system, Part 12: ISO base media file format," Ed. 2, 2005.

11.4.3 ITU

T81 ITU-T T.81, "Digital compression and coding of continuous-tone still images, Requirements and guidelines," 1992.

T82 ITU-T T.82, "Coded representation of picture and audio information, Progressive bi-level image compression," 1993.

T84 v1 ITU-T T.84, "Digital compression and coding of continuous-tone still images:

	Extensions," 1996.
T84 v2	ITU-T T.84/Amd 1, "Provisions to allow registration of new compression types and versions in the SPIFF header," 1999.
T85	ITU-T T.85, "Application profile for Recommendation T.82, Progressive bi-level image compression (JBIG coding scheme) for facsimile apparatus," 1995.
T86	ITU-T T.86, "Digital compression and coding of continuous-tone still images: Registration of JPEG Profiles, SPIFF Profiles, SPIFF Tags, SPIFF colour Spaces, APPn Markers, SPIFF Compression types and Registration Authorities (REGAUT)," 1998.
T87	ITU-T T.87, "Lossless and near-lossless compression of continuous-tone still images, Baseline," 1998.
T88 v1	ITU-T T.88, "Coded representation of picture and audio information, Lossy/lossless coding of bi-level images," 2000.
T88 v2	ITU-T T.88/Amd 1, "Encoder," 2003.
T88 v3	ITU-T T.88/Amd 2, "Extension of adaptive templates for halftone coding," 2003.
T89	ITU-T T.89, "Application profiles for Recommendation T.88, Lossy/lossless coding of bi-level images (JBIG2) for facsimile," 2001.

11.4.4 JEITA

EXIF	JEITA, Japanese Electronics and Information Technology Industries Association, "EXIF (Exchangeable Image File Format) 2.2", 2002.

11.4.5 MIPI

CSI	MIPI Camera WG, "CSI 2.0 Protocol Specification v.0.41", 2005.
DSI	MIPI Display WG, "DSI Specification v.0.45", 2005.

11.4.6 Miscellaneous

BMP	Microsoft Windows Bitmap (BMP) Format.
GIF87A	GIF 87a, "Graphics Interchange Format, Version 87a," 1987.
GIF89A	GIF 89a, "Graphics Interchange Format, Version 89a," 1989.
TIFF	TIFF V.6.0, "Tagged Image File Format (TIFF) Specification, Version 6.0".

11.4.7 SMIA

SMIA CCP2	SMIA CCP2, "Compact Camera Port 2 (CCP2) Specification 1.0."
SMIA CCP2/ER1	SMIA 1.0 CCP2/ER1, "Errata, Part 2 CCP2 Specification."
SMIA FUNC	SMIA Functional, "Functional specification 1.0."
SMIA FUNC/ER1	SMIA Functional 1.0/ER1, "Errata for Part 1 Functional Specification."

SMIA CHAR SMIA Characterisation 1.0/V.A, "Characterisation Specification 1.0, Rev A."

SMIA SW/AP SMIA Software And Application 1.0, "Software And Application Specification 1.0."

11.4.8 W3C

PNG Portable Network Graphics (PNG) Specification (Second Edition), "Computer graphics and image processing, Portable Network Graphics (PNG): Functional specification," 2003.

11.5 VIDEO

11.5.1 3GPP

MBMS v1 3GPP TS 26.346 "MBMS Protocols and Codecs," v.1.5.0.

MBMS v2 3GPP TS 22.146 "Technical Specification Group Services and System Aspects; Multimedia Broadcast/Multicast Service." v.6.6.0.

11.5.2 AVS

AVS-M v1 AVS-M: Part 6 Video-Mobility, Stage 1: MMS service

AVS-M v2 AVS-M: Part 6 Video-Mobility, Stage 2: Streaming and conversational services

11.5.3 DLNA

HNv1.0 DLNA HNv1.0, "Home Networked Device Interoperability Guidelines v1.0," 2004.

11.5.4 ETSI

DVB-H v1 ETSI EN 302 304 V.1.1.1, DEN/JTC-DVB-155, "Digital Video Broadcasting (DVB), Transmission System for Handheld Terminals (DVB-H)," 2004.

DVB-H v2 ETSI ETS 300 468, RE/JTC-DVB-18, "Digital Video Broadcasting (DVB), Specification for Service Information (SI) in DVB systems," 1997.

DVB-H v3 ETSI EN 301 192 V.1.4.1, REN/JTC-DVB-157, "Digital Video Broadcasting (DVB), DVB specification for data broadcasting," 2004.

DVB-H v4 ETSI TS 101 154 V.1.7.1, RTS/JTC-DVB-170, "Digital Video Broadcasting (DVB), Implementation guidelines for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream," 2005.

DVB-H v5 ETSI TS 101 154 V.1.5.1, RTS/JTC-DVB-122, "Digital Video Broadcasting (DVB), Implementation guidelines for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream," 2004.

DVB-H v6 ETSI TS 102 005 V.1.1.1, DTS/JTC-DVB-124, "Digital Video Broadcasting (DVB), Specification for the use of video and audio coding in DVB services delivered directly over IP," 2005.

DVB-H v7 ETSI TS 102 154 V.1.2.1, RTS/JTC-DVB-123, "Digital Video Broadcasting (DVB), Implementation guidelines for the use of Video and Audio Coding in Contribution and Primary Distribution Applications based on the MPEG-2 Transport Stream," 2004.

11.5.5 IETF

RFC1889 IETF RFC 1889, "RTP: A Transport Protocol for Real-Time Applications," 1996.

RFC2032 IETF RFC 2032, "RTP Payload Format for H.261 Video Streams," 1996.

RFC2038 IETF RFC 2038, "RTP Payload Format for MPEG1/MPEG2 Video," 1996.

RFC2190 IETF RFC 2190, "RTP Payload Format for H.263 Video Streams," 1997.

RFC2250 IETF RFC 2250, "RTP Payload Format for MPEG1/MPEG2 Video," 1998.

RFC2429 IETF RFC 2429, "RTP Payload Format for the 1998 Version of ITU-T Rec. H.263 Video (H.263+)," 1998.

RFC2431 IETF RFC 2431, "RTP Payload Format for BT.656 Video Encoding," 1998.

RFC2435 IETF/RFC 2435, "RTP Payload Format for JPEG-compressed Video," 1998.

RFC3189 IETF RFC 3189, "RTP Payload Format for DV (IEC 61834) Video," 2002.

RFC3497 IETF RFC 3497, "RTP Payload Format for Society of Motion Picture and Television Engineers (SMPTE) 292M Video", 2003.

RFC3551 IETF RFC 3551, "RTP Profile for Audio and Video Conferences with Minimal Control," 2003.

RFC3984 IETF RFC 3984, "RTP Payload Format for H.264 Video", 2005.

11.5.6 ISO

MPEG-1 Visual ISO/IEC JTC1/SC29/WG11 MPEG, International Standard IS 11172-2, "Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s, Part 2: Video," Ed. 1, 1993.

MPEG-2 Visual ISO/IEC JTC1/SC29/WG11 MPEG, International Standard IS 13818-2, "Generic coding of moving pictures and associated audio information, Part 2: Video," Ed. 2, 2000.

MPEG-4 Visual v1 ISO/IEC JTC1/SC29/WG11 MPEG, International Standard IS 14496-1/Amd 7, "Use of AVC (Advanced Video Coding) in MPEG-4 systems," Ed. 1, 2004.

MPEG-4 Visual v2 ISO/IEC JTC1/SC29/WG11 MPEG, International Standard IS 14496-2, "Coding of audio-visual objects, Part 2: Visual," Ed. 3, 2004.

MPEG-4 Visual v3 ISO/IEC JTC1/SC29/WG11 MPEG, International Standard IS 14496-10, "Coding of audio-visual objects, Part 10: Advanced Video Coding," Ed. 2, 2004.

MPEG-4 Visual v4 ISO/IEC JTC1/SC29/WG11 MPEG, International Standard IS 14496-15, "Coding of audio-visual objects, Part 15: Advanced Video Coding (AVC) file format," Ed. 1, 2004.

MPEG-21 Visual ISO/IEC JTC1/SC29/WG11 MPEG, International Standard IS TR 21000-1, "Vision, Technologies and Strategy, Part 1," 2001.

MJPEG-2000 ISO/IEC JTC1/SC29/WG1 MJPEG, International Standard IS 15444-3,

v1	"JPEG 2000 image coding system, Part 3: Motion JPEG 2000," Ed. 1, 2002.
MJPEG-2000 v2	ISO/IEC JTC1/SC29/WG1 MJPEG, International Standard IS 15444-3/Amd 2, "Motion JPEG 2000 derived from ISO base media file format," Ed. 1, 2003.

11.5.7 ITU

H.261	ITU-T H.261, "Video codec for audiovisual services at p x 64 kbit/s," 1993.
H.262	ITU-T H.262, "Generic coding of moving pictures and associated audio information: Video," 2000.
H.263	ITU-T H.263, "Video coding for low bit rate communication," 2005.
H.264	ITU-T H.264, "Advanced video coding for generic audiovisual services," 2005.

11.5.8 MISC

RV	Real Video 10 Codec
WMV	Windows Media Video

11.6 JAVA

11.6.1 Multimedia

JSR-135	JCP/JSR-135: Mobile Media API 1.1, 2003
JSR-234	JCP/JSR-234: Advanced Multimedia Supplements, 2005

11.6.2 Broadcast

JSR-272	JCP/JSR-272: Mobile Broadcast Service API for Handheld Terminals, 2005

12 Appendix B – OpenKODE Error Codes

Since OpenMAX IL shares the content pipe definition with other APIs (e.g. OpenMAX AL), the content pipe methods return OpenKODE error codes. This appendix provides a reference of OpenKODE error codes.

Table 12-1: OpenKODE Error Codes

Value	Description
KD_EACCES	Permission denied.
KD_EADDRINUSE	Address in use.
KD_EAGAIN	Resource unavailable, try again.
KD_EBADF	Bad file descriptor.
KD_EBUSY	Device or resource busy.
KD_ECONNREFUSED	Connection refused.
KD_ECONNRESET	Connection reset.
KD_EDEADLK	Resource deadlock would occur.
KD_EDESTADDRREQ	Destination address required.
KD_ERANGE	Mathematics argument out of range.
KD_EEXIST	File exists.
KD_EFBIG	File too large.
KD_EHOSTUNREACH	Host is unreachable.
KD_EINVAL	Invalid argument.
KD_EIO	I/O error.
KD_EISCONN	Socket is connected.
KD_EISDIR	Is a directory.
KD_EMFILE	Too many open files.
KD_ENAMETOOLONG	Filename too long.
KD_ENOENT	No such file or directory.
KD_ENOMEM	Not enough space.
KD_ENOSPC	No space left on device.
KD_ENOSYS	Function not supported.
KD_ENOTCONN	The socket is not connected.
KD_EPERM	Operation not permitted.
KD_ETIMEDOUT	Connection timed out.
KD_EILSEQ	Illegal byte sequence.

OpenMAX IL 1.1.1 specified a number of OpenKODE error codes to be relevant that were not retained in version 1.0 of OpenKODE specification. These error codes have been deprecated in the 1.1.2 version of this specification. These error codes are:

Table 12-1: Depricated OpenKODE Error Codes

Value	Description
KD_ECONNABORTED	Connection aborted.
KD_ENETDOWN	Network is down.
KD_ENETUNREACH	Network unreachable.
KD_ENOTSUP	Not supported.