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Interconnection of Information Technology Equipment
Home Electronic System

Title: DTR 15067-6: Information technology -
Home Electronic System (HES) application model
Part 6: Model of an A/V System for HES, revision 1

Source: United States

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Requested Action: For consideration by WG 1 as PDTR Type 3

Reason: Expand the set of HES application models

Distribution: All WG 1 members

Notes:

This document was composed by Dr. Kenneth Wacks of the United States with inputs from the U.S. Technical Advisory Group. Comments should be directed to Dr. Wacks at +1-781-662-6211, fax: +1-781-665-4311, E-mail: kenn@alum.mit.edu.

TABLE OF CONTENTS

FOREWORD

ISO (the International Organization for Standardization) and the IEC (the International Electrotechnical Commission) form the specialized system for world-wide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

This working draft of a Technical Report ISO/IEC TR 15067-6 was prepared by the U.S. Technical Advisory Group to ISO/IEC JTC 1/SC 25/WG 1, *Interconnection of Information Technology Equipment* / *Home Electronic System*

Technical Report ISO/IEC TR 15067 currently consists of five parts:

- Part 1: Application Services and Protocol
- Part 2: Lighting Model for HES
- Part 3: Model of an Energy Management System for HES
- Part 4: Model of a Security System for HES
- Part 5: Model of an HVAC System for HES

INTRODUCTION

This model of an audio / video system for residences extends the set of HES (Home Electronic System) application models. WG 1 has already developed and SC 25 has accepted models for lighting, energy management, and security. A model for HVAC is pending approval by members of SC 25. These models are intended to facilitate validation of the language being specified for HES in *HES Application Model – Application Services and Protocol*, WG 1 Project 25.01.04.02-01.

WG 1 has developed these models to foster interoperability among products from competing or complementary manufacturers. Product interoperability is essential when using home control standards, such as HES. This document defines a typical audio / video (A/V) system and describes the communications services needed. A high-level model for an A/V system using HES is presented.

Revision 1 is based on inputs from A/V system manufacturers who were asked to review this document. WG 1 appreciates the contributions from Samsung and Thomson Consumer Electronics.

1 Scope

The model presented here for an audio/video (A/V) system is intended to be generic and representative of a wide range of situations. It is difficult for one model to be completely comprehensive. Therefore, it is possible that other models or operating modes may be appropriate in some instances.

2 A Conventional A/V System

2.1 Varieties of Systems

Conventional audio/video systems are available in a variety of formats depending on the operating environment and the cost of the system. Listed are some common options:

- Self-contained system
  - Portable tape / CD / VCR player and recorder.
  - Integrated components supplied by one manufacturer and usually pre-assembled into a cabinet.
- Distributed system
  - Whole-house audio system, usually supplied by one manufacturer
  - Discrete interconnected components assembled from a variety of manufacturers

The self-contained systems generally have no external links to other home systems. There may be connections provided for cable TV, additional speakers, and headphones. The communications links among the components in a distributed system are generally defined and supplied by the manufacturer. Standard connectors may be used (e.g., RCA, DIN) and standard analog levels are common for amplifier inputs and outputs and video sources.

Whole-house audio systems may have multiple control panels managing the distribution of music sources to speakers in various rooms. The communications links are usually simple analog or proprietary.

2.2 Trends in A/V Systems

Audio and video equipment is in transition from analog signal distribution to digital. For example, the digital stream from a CD unit might be sent directly to a DSP (Digital Signal Processing) unit for decoding and shaping. The resulting signal may be sent as a digital stream to a speaker system with built-in conversion to analog, or may be converted to analog in an out-board amplifier.

Video is also going digital in the following formats:

- Over-the-air broadcast in HDTV formats specified in North America, Europe, and Japan.

- Cable TV digital formats, including HDTV, standard TV, and compressed TV (multiple streams within one channel allocated to HDTV), or standard TV.

- Satellite TV, already in digital format.

TV manufacturers will be introducing sets that receive and processes these video streams. In some cases, pre-processing in a set-top-box will be required by cable TV operators. Eventually, the functions of a set-top-box, such as scrambled signal decoding, may be built into TVs. The users may be supplied with a type of smart card to insert in the TV for signal decoding. The card would enable access to premium programs.

2.3 Requirements of a Digital A/V

Simple analog coding of signal inputs to audio and video tuners and amplifiers, and outputs to TVs and speakers is being replaced by multiple digital streams. As the options for processing digital signals grows, some manufacturers are planning A/V components that are software-based. Customers will be offered additional features and upgrades to the software in A/V components after the initial purchase. Therefore, an HES model for A/V must support the following features to support the new generation of digital A/V equipment:

- Pathways for multiple high-speed digital streams. (One HDTV signal requires about 20 Mbps.)

- Analog pathways for legacy systems.

- A method for allocating pathways to specific streams and managing the sources (producers) and sinks (consumers) of these streams.

- A control channel for configuring, operating, and upgrading the A/V system.

- Links to other home systems for coordinated actions, e.g., control of lighting and shades.

3 The HES A/V System Model

3.1 A Possible HES A/V System

Figure 1 illustrates an A/V system that could be enabled with a home control infrastructure to offer access to digital streams necessary for supporting the next generation of digital A/V equipment. As shown in Figure 1, each device accesses a wide band channel for audio, video, or other A/V processor data (e.g. programs). In a networked environment, channels may be assigned dynamically. A device would request access through the services of the control channel.

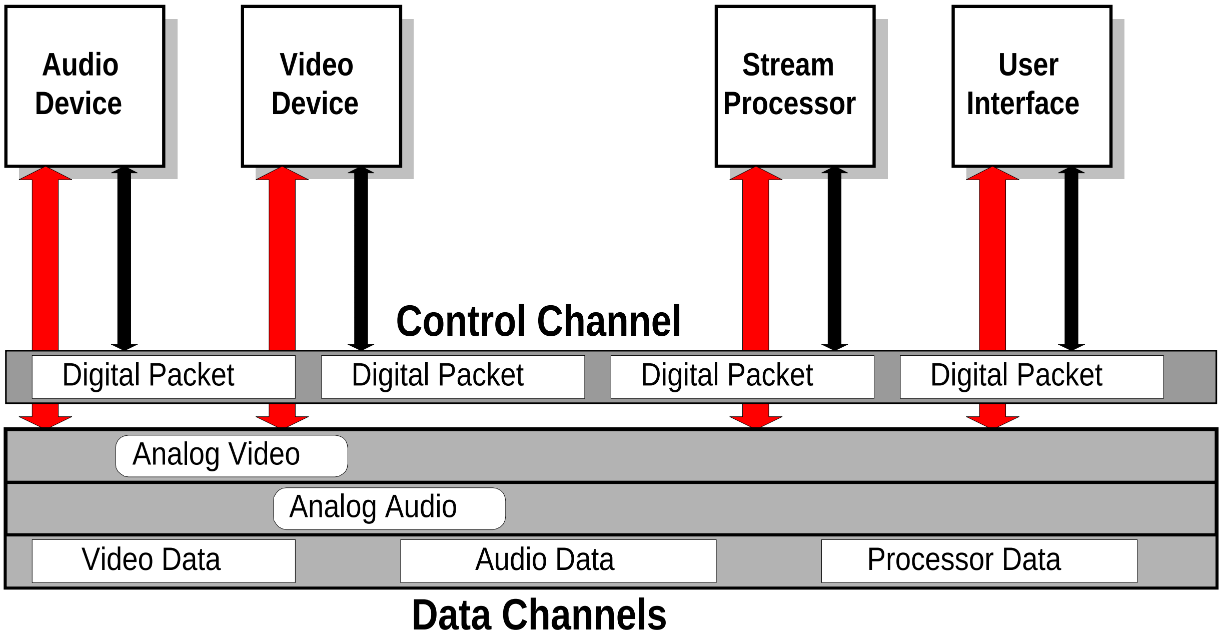

Figure 1 – A/V System with Access to Control and Data Streams

Such a control channel is defined by HES Class 1. The broadband channels for audio and video are defined by HES Class 2 (medium bandwidth) and Class 3 (wide bandwidth). In some home networks, HES Class 2 and 3 channels collectively would be called “data channels.”

Some standards groups and trade associations are defining home networks based on the IEEE-1394 standard. IEEE-1394 logically divides the bandwidth of a twisted-pair wire medium into an asynchronous channel carrying control signals and multiple isochronous channels carrying data. An isochronous channel delivers data packets as does an asynchronous channel. However, an isochronous channel guarantees availability and delivery of a packets periodically within prescribed time intervals.

Among the components of an A/V system are:

- A/V stream sources, such as an antenna, satellite decoder, cable TV drop, and CD juke box.

- Stream sinks, such as loud speakers and recordable media (e.g., CD-read/write, tape).

- A/V stream processors for signal decrypting, decoding (e.g., from a surround sound encoded format), and shaping (e.g., to simulate a particular concert hall).

- User interfaces for configuring the A/V system, making source selections, upgrading the system, and arranging interoperation with other home automation systems.

- A/V controller for implementing the processing chosen by the user. The A/V controller may be contained within an A/V component, such as a signal processor.

3.2 Physical Model

The physical elements of the HES A/V system model are shown schematically in Figure 2. The components were described in the previous subsection of this document. A key decision for manufacturers is whether the HES network forms the basis for linking together all the A/V components. Choices include:

- Fully HES compatible

Every A/V component, user interface, and controller(s) contain an HES interface.

- Partial HES compatible

Some of the A/V components do not conform to the HES standard. To accommodate such devices, a network concentrator may be interposed between these devices and the HES network. A group of A/V components or user interfaces shares this network concentrator. The concentrator includes the HES interface. The concentrators and the controller comprise the HES network.

- Isolated network

Only the A/V controller contains an HES interface. The other components link to the controller via a proprietary network. Thus, Figure 3 is a physical model that accommodates current practice.

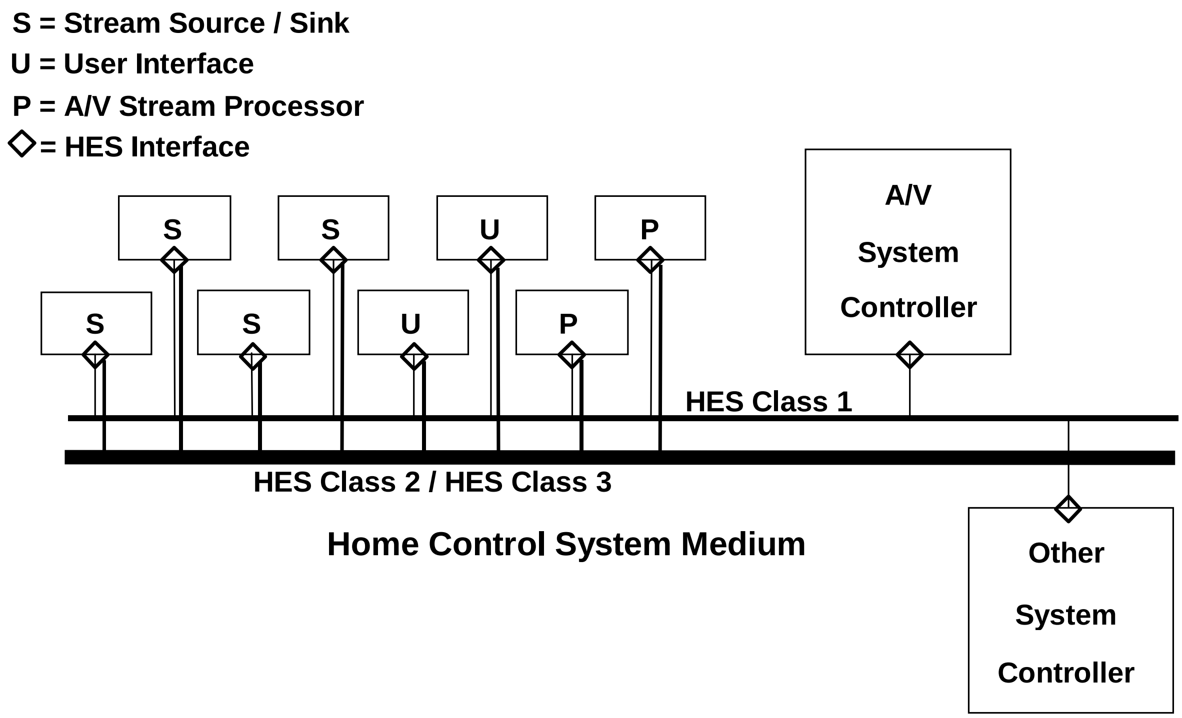

Figure 2 – Physical HES A/V System Model

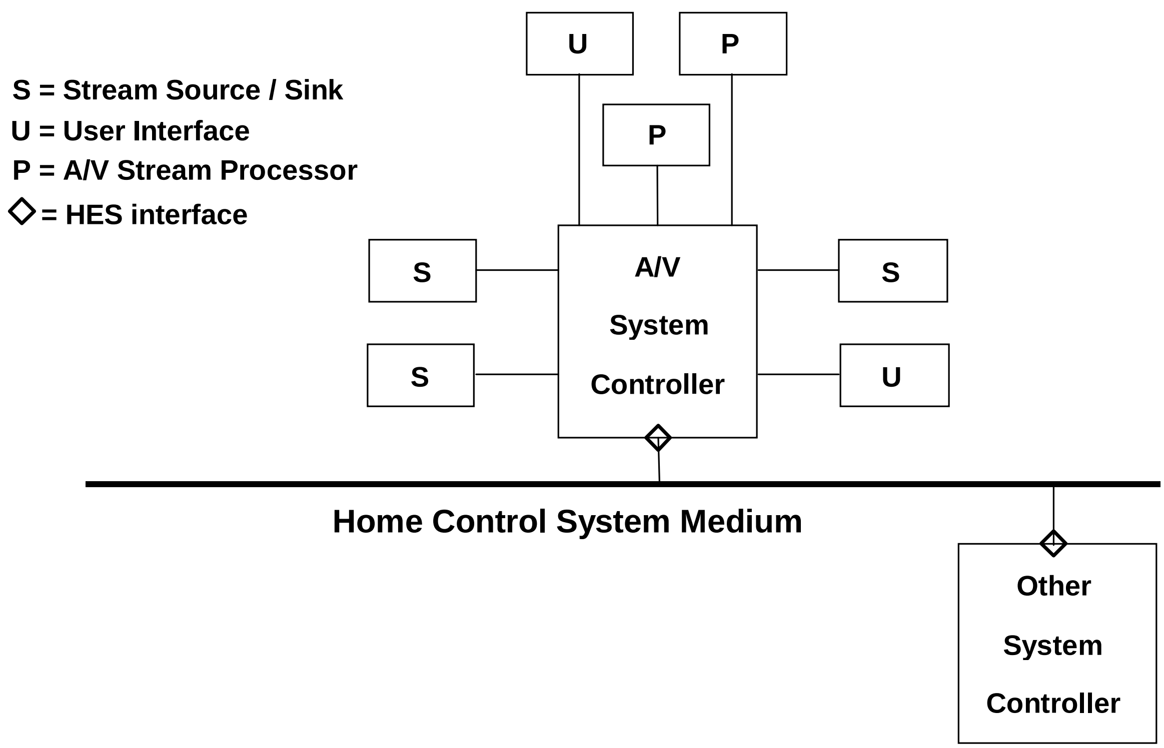

Figure 3 – Physical HES A/V System Model with Isolated Components

3.3 Logical Model

The logical relationship among these components is illustrated in Figure 4. If the physical model of Figure 3 is implemented, the controller may make the attached components logically visible to the HES network, so Figure 4 still applies.

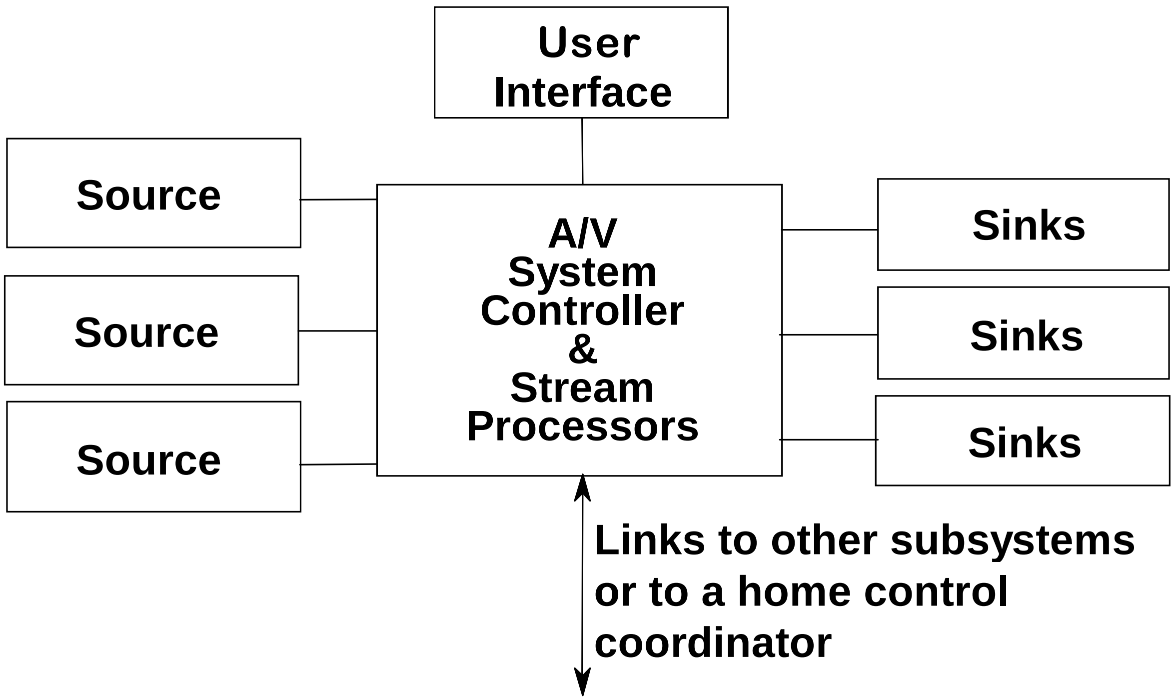

Figure 4 – Logical Model for HES A/V System

A/V is one of many systems possible in a home control network. As shown in Figure 4, the A/V Controller may be linked to other home control systems, such as a lighting system, and to a home control coordinator. The coordinator might be responsible for providing common scheduling and system interaction. This coordination function may be distributed among the subsystem controllers through sophisticated software, thereby eliminating the coordinating controller.

3.4 HES Objects for Data Stream Management

3.4.1 Real-time Data Streams

On an abstract level, a digital A/V system is responsible for managing and transforming data streams in real time. Thus, an A/V system is effectively a specialized computer for processing inputs, storing and retrieving data, and generating output. The distinguishing feature of an A/V system compared to a personal computer is the requirement for real-time processing to maintain an output flow that is continuous, as perceived by the listener / viewer.

3.4.2 Allocating Data Streams

To support an A/V system, HES Class 1 requires messages and objects that manage HES Class 2 and 3 channels. Data channel objects include:

– Data channel receiver object.

Establishes a receive-only connection to a data channel(s) on a specific medium. The medium for the receiver is fixed by the product. An error status is returned if the object is not capable of using the channel requested.

The variables in this object include:

- Medium: Medium to which the receiver is connected
- Default Channel: The default channel used by this object on the medium
- Current Channel: The channel currently in use by the receiver

If the object is not capable of data channel “agility” on the medium (“Current Channel” is always the same as “Default Channel”), or is not capable of using the requested channel then an error status is returned upon writing to “Current Channel” and “Current Channel” is unchanged.

Names or codes need to be specified for the allowed values of these variables. The valid range of names or values is implementation dependent.

– Data channel transmitter object.

Establishes a transmitter connection to a data channel(s) on a specific medium. The medium for the transmitter is fixed by the product for a particular instance of this object. The transmitter gains permission to transmit on the desired channel. An error status is returned if the object is not capable of using the channel requested.

The variables in this object include:

- Medium: The medium to which the transmitter is connected
- Default Channel: The default channel used by this object on the medium
- Current Channel: The channel currently in use by the receiver.
- Carrier Type: The carrier type of the signal on the data channel.

The carrier types is a code for the particular analog or digital format supported on the channel. Examples of this code might include AM, FM, VSB, 1394, ATM, etc. Additional parameters may be necessary to describe the carrier type.

The messages necessary to support these objects are read and write, already defined in HES.

3.4.3 Organizing Data Streams

In traditional A/V the broadcaster or producer of the CD defines and packages the data stream. For example, a video tape includes the audio and video signal, plus management data for operating the TV, typically timing data. In a generalized A/V system, the components necessary to deliver programming to the occupant may be processed in a digital A/V system as separate flows of data. The signal for a TV may consist of multiple video flows (for picture-inside-picture), an audio flow, data flow for text and graphics overlaying the video, and another data flow for a World Wide Web page displayed adjacent to the video on the same screen (picture-outside-picture). Flows within a stream may be managed separately or together. Annex A presents an example of work by the Object Management Group (OMG) in defining stream objects.

Annex A – Stream Object Definition by OMG

A.1 Introduction to OMG

The Object Management Group (OMG) is a non-profit corporation founded in 1989 to develop “technically excellent, commercially viable and vendor independent specifications for the software industry.” [www.omg.org] Some of the OMG work has been provided to JTC 1 as a formal standard through the PAS (Publicly Available Specification) fast-track process. OMG was formed to create a component-based software marketplace by hastening the introduction of standardized object software. The charter of the organization includes the establishment of industry guidelines and detailed object management specifications to provide a common framework for application development. Conformance to these specifications will make it possible to develop a heterogeneous computing environment across all major hardware platforms and operating systems. OMG has established CORBA (Common Object Request Broker Architecture) as the “Middleware that's Everywhere.”

A.2 OMG Streaming

OMG[1] has defined and standardized the Media Streaming Framework. This work addresses:

- Definition of components of streams
- Definitions of stream control and management services
- Definition of a distributed media streaming framework
- Mechanisms for expressing transport and media properties
- Mechanisms for extending definitions.

Figure 5 illustrates some of the key elements of the OMG Media Streaming Framework.

[1] The U.S. delegation is grateful to Mr. Robert Wallace of Motorola for providing information about OMG and for supplying the figure and table describing the issues addressed by the OMG Media Streaming Framework.

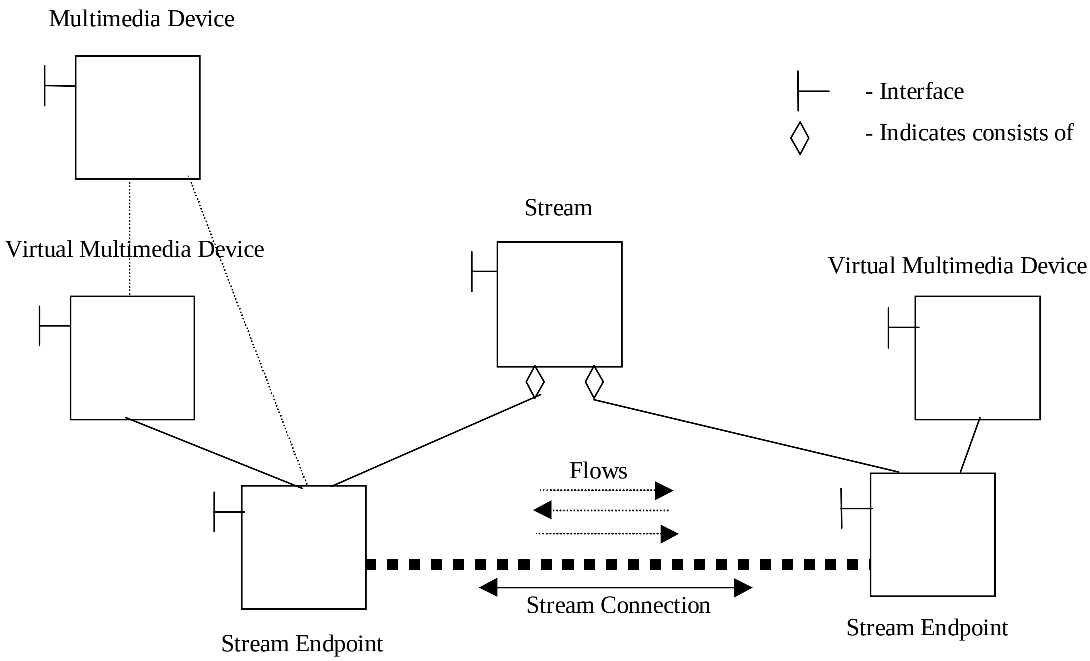

Figure 5 – High Level Model of OMG Media Streaming Framework

In the OMG Media Streaming Framework, a stream represents continuous media transfer, usually between two or more virtual multimedia devices. A stream endpoint terminates a stream. Properties are used extensively to describe devices, streams, flows, and their endpoints.

A multimedia device abstracts one or more items of multimedia hardware and acts as a processor for virtual multimedia devices. A multimedia device may support more than one stream simultaneously. For example, a CD player device may send separate audio streams to each of two speaker devices using separate non-multicast connections. For each stream connection requested, the multimedia device creates a stream endpoint and a virtual multimedia device.

The OMG Media Streaming Framework is built on the OMG object model which allows the basic interfaces defined in the specification to be extended in an object oriented manner to support application specific needs.

Specific issues addressed by the OMG are presented in the following table:

Issues Addressed by the OMG Media Streaming Framework	
Topologies	Allow for one-to-one, one-to-many, many-to-one and many-to-many source and sinks to be configured in the same stream binding.
Multiple flows	Allow for flows to be aggregated within a stream, such that joint operations can be performed.
Stream description and typing	Allow a stream interface, and its constituent flow end-points, to be described and typed.
Stream interface identification and reference	Allow a stream interface and its flow end-points to be unambiguously named and identified by other.
Stream setup and release	Allow for the establishment and tear-down, of bindings between stream interfaces and flow end-points. Establishment may include the negotiation of QoS (Quality of Service) parameters, and error handling capabilities if QoS is not successfully negotiated.
Stream modification	Allow for a stream to be reconfigured during its lifetime. This may include adding and removing end-points, and QoS re-negotiation.
Stream termination	Allow for flow end-points to be terminated either in hardware or software
Multiple protocols	Streams should not be restricted to being implemented on particular network technologies, or be restricted in the use of transport protocols.
Quality of service	Allow for quality of service to be expressed and monitored. Bandwidth, delay, jitter and loss are example

Issues Addressed by the OMG Media Streaming Framework	
	parameters.
Flow synchronization	Allow for the transmission or delivery of data in different flows to be synchronized within a stream.
Interoperability	Allow a stream to be established, modified and released where the source is situated on a device from one vendor and the sink is situated on a device from another vendor.
Security	Allow for the expression of Quality of Protection to enable the establishment of secure flows.