CORBA based DSM-CC Extention for MHEG-5 Applications

Abstract: In this paper, we extend DSM-CC for distribution of applications and providing additional services based on MHEG-5. Proposed extension defines mapping between MHEG-5 to CORBA. It can support user and resource controls, real distribution of application servers and providing additional multimedia service facilities.

1. Introduction

Network technologies and multimedia are being popular. There are new requirements for mechanism to interchange and present multimedia and hypermedia information on the network. Also we have required mechanism to process real-time user interactions. The MHEG (Multimedia Hypermedia Encoding Expert Group) standard defines the representation and encoding of multimedia and hypermedia information for interchange between various applications [ISO97].

The MHEG-5 standard is the fifth subset of the MHEG standard. It defines some classes in detail. Those classes are appropriate to some applications such as video on demand, audio on demand, interactive TV and hypermedia navigation [ISO97].

As defining only final form for transmission and representation, MHEG-5 currently is used as simple interactive multimedia presentation. Regard of its various application areas, an MHEG-5 application will require formal distribution of contents and additional security services such as billing, authentication, authorization, etc.

OMG (Object Management Group)'s CORBA (Common Object Request Broker Architecture) [OMG98] can provides those facilities for MHEG-5 applications. In this paper, we define mapping between MHEG-5 to CORBA. We extend DSM-CC (Digital Storage Media Command & Control) [ISO98] for distribution of applications and providing additional services based on MHEG-5.

2. Consideration of International Standards

In this chapter, we consider the international standards, CORBA, MHEG and DSM-CC, for distribution of interactive multimedia applications.

2.1 OMG's CORBA

The CORBA (Common Object Request Broker Architecture) is structured to allow integration of a wide variety of object systems [OMG98]. Figure 1 shows the structure of an individual Object Request Broker.

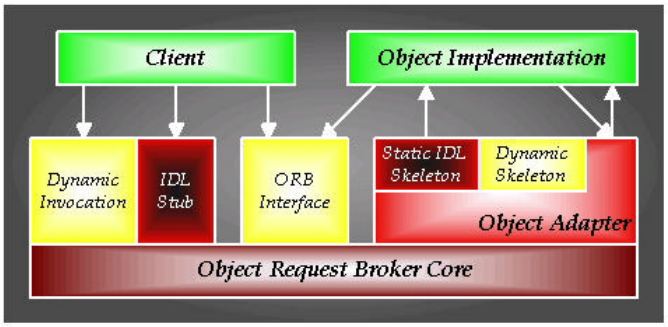

Figure 1. The CORBA architecture

The Client is the entity that wishes to perform an operation on the object and the Object Implementation is the code and data that actually implements the object. The ORB is responsible for all of the mechanisms required to find the object implementation for the request, to prepare the object implementation to receive the request, and to communicate the data making up the request.

The interface the client sees is completely independent of where the object is located, what programming language it is implemented in, or any other aspect which is not reflected in the object's interface. To make a request, the Client can use the Dynamic Invocation interface or an OMG IDL stub. The Client can also directly interact with the ORB for some functions. The Object Implementation receives a request as an up-call either through the OMG IDL generated skeleton or through a dynamic skeleton. The Object Implementation may call the Object Adapter and the ORB while processing a request or at other times.

2.2 The MHEG standard

MHEG-5 provides a framework for the distribution of interactive multimedia applications across minimal resource platforms of different types. An MHEG-5 application resides on a server, and as portions of the application are needed, they will be downloaded to the client. In a broadcast environment, this download mechanism could rely, for instance, on cyclic re-broadcasting of all the application [ISO95].

A minimal MHEG-5 runtime environment has to provide an entity for decoding of the MHEG data structures and an entity called MHEG engine, which parses and interprets the MHEG-5 objects. The engine also communicates with the local presentation environment and the MHEG-5 objects. It responds to the events initiated by the application or the user in the application specific way. A MHEG application is always event driven.

An MHEG-5 application consists of Scene objects and objects that are common to all Scene within an Application object. At most one Scene is active at any one time. This is the part of the application that has to be loaded on the clients' system. Navigation in an application is done by transitioning between Scenes. A Scene contains a group of objects, called Ingredients, which represent information. The content data is typically not part of the encoded Scene object. Instead, content data can be referenced and stored externally.

2.3 Digital Storage Media Command & Control, DSM-CC

DSM-CC systems are composed of client using service, SRM(Session and Resource Manager) managing needed session and resource when it is provided with service, and server providing service [ISO98]. The composing entities have U-N (User–Network) signal that connect client and SRM, server and SRM and U-U (User–User)

signal. DSM-CC describes a command for control of digital storing medium and concrete procedure. Primitive defined by DSM-CC is able to divide U-N (User-Network) and U-U (User-User) primitive. Figure 2 displays DSM-CC client/server system architecture.

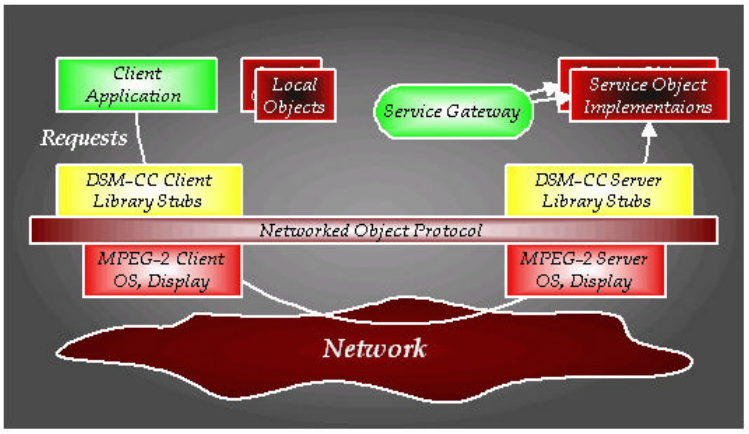

Figure 2. DSM-CC client/server architecture

3. System Design

Figure 3 displays composition of multimedia service system including extended DSM-CC protocol. Extended DSM-CC protocol is able to use event, security, transaction, life cycle, and naming service.

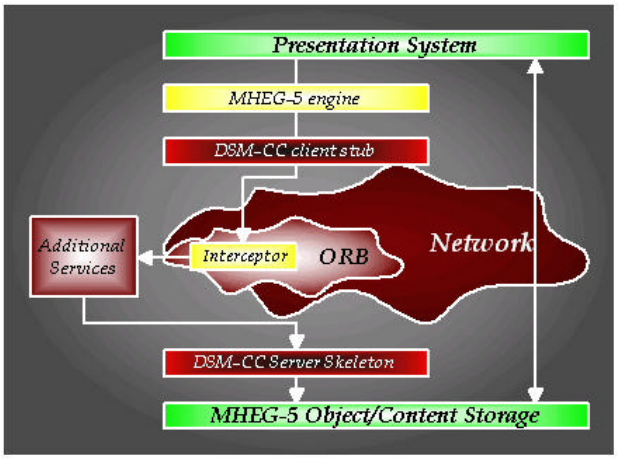

Figure 3. Proposed architecture

3.1 Interface Design

DSM-CC U-U primitives can operate on the CORBA system environment and support RPC and defines OMG IDL to operate language and protocol independently. Client applications provide server environment with independent interface using DSM-CC library and connect service gateway of server. Table 1 defines interface and primitives of DSM-CC U-U.

Table 1. DSM-CC U-U primitives

Interface	primitive	Interface	primitive
dsm.Service	open	dsm.Stream	open
	close		close
dsm.Directory	open		play
	close		pause
	read		scanForward
	clean		scanBackward
dsm.File	open		jump
	close		status
	read	dsm.DBClass	list
	write		getSchema
	getData	dsm.DBField	getValue
	getSize	dsm.DBSQL	exec

User-User interface separate the essential functions, which are a minimum, demand item and the optional extended function. On the proposed architecture, extend function of life cycle, security, and event use CORBA service. As DSM-CC U-U primitive has service connection, directory service, stream, file, and database access, directory service among these uses Naming Service of CORBA.

3.2 DSM-CC mapping to MHEG-5 operation

First MHEG-5 application is began, service gateway of DSM-CC is activated, and is made name space inside of application object. This name space can be mapped DSM-CC directory, and a directory can be included other directory, file, and stream. If these objects are included in a application, DSM-CC directory service become to get the only object reference. Using these methods, MHEG-5 engine can access a various objects of server's application.

MHEG-5 object is identified by ObjectReference composed of GroupIdentifier and ObjectNumber. GroupIdentifier is mapped DSM-CC, and ObjectNumber gives unique value in their object. ContentReference referenced actual content of Ingredient object is mapped the same method in ObjectReference.

As StreamEvent interface of DSM-CC can transfer private data using PrivateDataByte field, this field is mapped StreamEventData of StreamEvent to each other. Also, CounterPosition which is inner attribute of MHEG-5 Stream class is mapped NormalPlayTime of their stream to each other.

Table 2 defines the mapping between MHEG-5 actions and DSM-CC U-U primitives.

Table 2. Mapping MHEG-5 actions to DSM-CC U-U primitives

Object type	MHEG-5 action	DSM-CC U-U primitive
Application	Launch	dsm.Directory.open() dsm.File.read()
Scene, etc.	Prepare	dsm.Directory.open() dsm.File.read()
Video, Audio	Run	dsm.Directory.open() dsm.Stream.play()
Stream	SetSpeed(0)	dsm.Stream.pause()
	SetSpeed(1)	dsm.Stream.resume()
	Stop	dsm.Stream.close()
	StreamTimer	dsm.Stream.getNormalPlayTime()

3.3 Additional Services

In this section, we' ll discuss about extension of DSM-CC for additional multimedia service offering. If DSM-CC implements the general RPC, the extension of service or the distribution of different mechanism cannot considered. On the CORBA based implementation, it is able to use the existing defined CORBA service as previously stated, service extension using interceptor who defines CORBA standard is easy. Figure 4 displays the service extension example using interceptor.

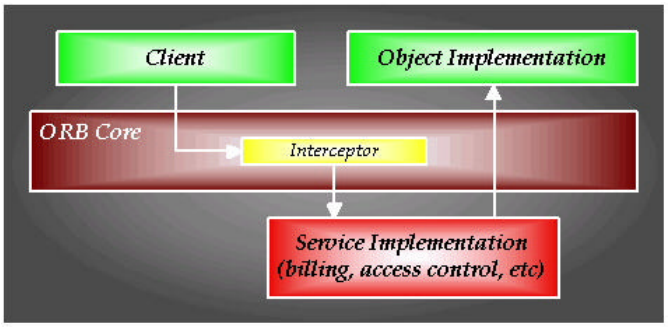

Figure 4. Interceptor & service extension

Extensible service using these mode are billing service that is adaptable in service of VoD, AoD, home shopping, and Digital Interactive TV, the user competence control function for the distributed multimedia framework, and can complete distribution of service using CORBA.

4. Conclusion

In this paper, we proposed new architecture for MHEG based distributed multimedia system. It appears as an extension of DSM-CC, the digital media control protocol. It is based on OMG's CORBA, mapped into CORBA interfaces and MHEG-5 objects' behavior.

Proposed design has several advancements that are impossible in pure MHEG standard. User and resource controls, real distribution of application servers and providing additional multimedia service facilities.

References

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[ISO97] ISO/IEC IS 13522-5 Coding of Multimedia and Hypermedia Information - Part 5: Support for Base-Level Interactive Applications, 1997.

[ISO98] ISO/IEC IS 13818-6 Information technology - Generic coding of moving pictures and associated audio information - Part 6: Extensions for DSM-CC, 1998

[OMG9] OMG, The Common Object Request Broker Architecture and Specification Revision 2.3, OMG Document, 1997