Bionic Buffalo Tech Note #116

Supporting Pegasus/ISA Services in MHP and OCAP Environments

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Introduction

OCAP is a public specification defining middleware software for digital cable television set-top boxes and other digital devices to be deployed by cable operators in North America. MHP is another public specification (upon which OCAP is partly based), used primarily in Europe, defining a viewer terminal, its associated peripherals and the in-home digital network. One of the most significant features of both environments is the portability of software applications in each: compliant MHP applications should run on any MHP platform with little or no modification, and compliant OCAP applications should run on any OCAP platform with little or no modification.

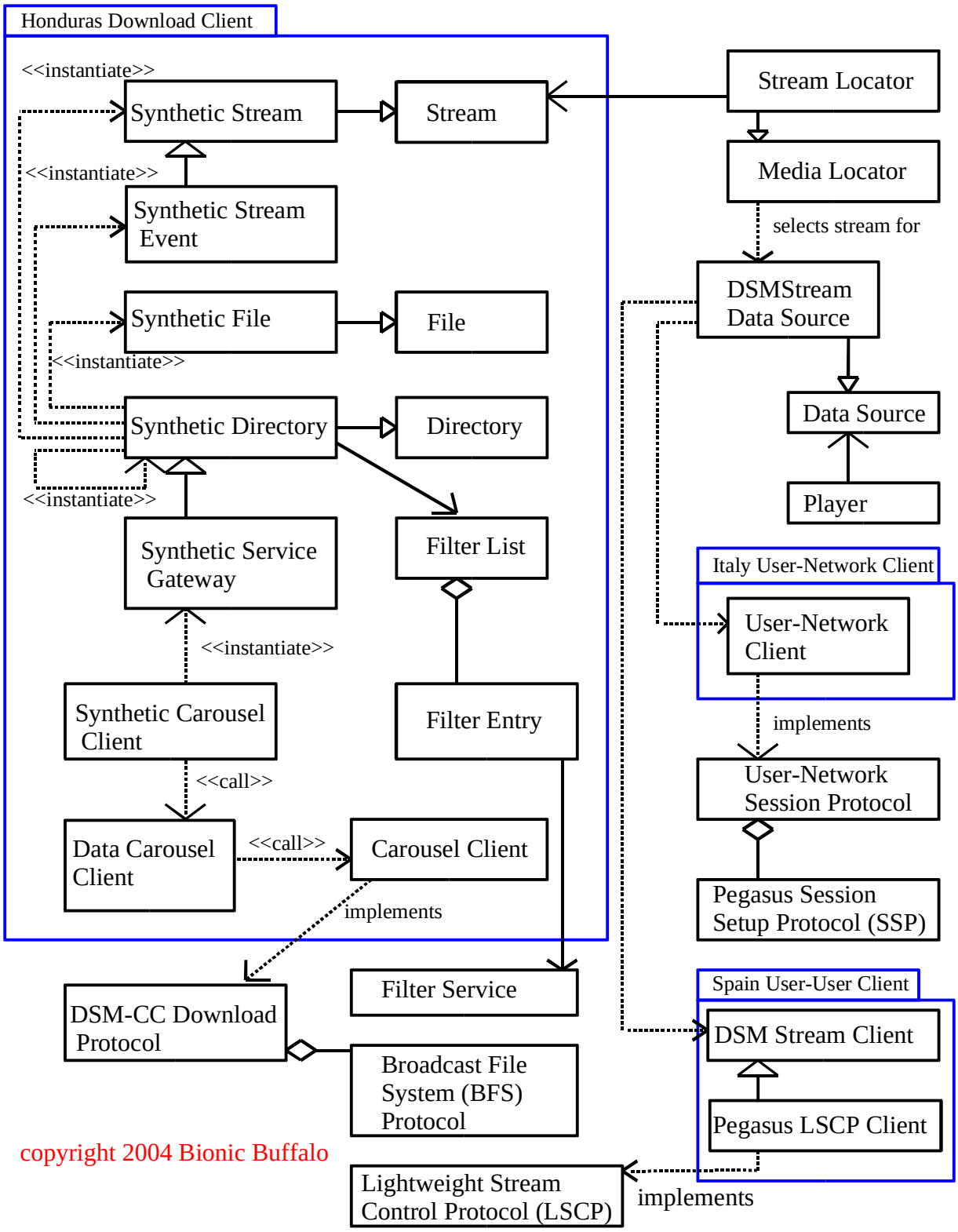
Pegasus and ISA are proprietary specifications describing certain protocols used to deliver some cable services in portions of the North American market. A programming environment (including an API) is defined for servers, but not for set-top boxes. The ISA specification defines portions of the server environment, while the Pegasus specifications define the protocols. Although clients aren't meant to comply with ISA (the server specification), understanding ISA is necessary for client design as part of the overall system context.

OCAP and MHP do not incorporate the Pegasus and ISA protocols. However, there is a large installed base of Pegasus and ISA compatible equipment, and during the transition to OCAP it is desirable that newer OCAP boxes support the legacy Pegasus/ISA protocols in a way that is transparent to compliant OCAP applications. This Tech Note describes the approach taken by Bionic Buffalo to achieve that goal.

This discussion does not include considerations involved in moving Pegasus applications to OCAP environments (porting), or in running Pegasus applications alongside OCAP applications (which simply requires dual APIs).

Note regarding trademarks and acronyms: "OCAP" is an acronym for "OpenCable™ Application Platform Specification". "OpenCable" is a trademark of Cable Television Laboratories, Inc. "MHP" is an acronym for "Multimedia Home Platform", and is one of the specifications in the "Digital Video Broadcasting" (DVB) family of specifications. "MHP" and "DVB" are trademarks of the DVB Project. The Pegasus and ISA (Interactive Services Architecture) specifications are owned and published by

Time Warner Cable.



“Bhutan” is Bionic Buffalo's project name for its OCAP product, and “Palestine” is its project name for its MHP product. As OCAP is built on MHP, the Palestine software is included in the Bhutan software.

Establishing Interactive Sessions

Before any other network interaction takes place, the set-top-box (STB) must establish a session with the network. MHP specifies (Chapter 6, Transport Protocols) the use of a subset of the network-independent protocols defined in ETSI ETS 300 802, which in turn are derived from the DSM-CC User-Network (U-N) protocols specified in ISO/IEC 13818-6.

The Pegasus Session Setup Protocol (SSP) is also a subset and specialization of the same U-N protocols. Therefore, session establishment in Pegasus networks is an easy variation of the same process in MHP/OCAP networks.

Session establishment *per se* is not associated with any defined API, although launching some applications or services might indirectly trigger a new session. (Multiple simultaneous sessions are supported.) MHP/OCAP applications need not be aware of this process, and may at this phase remain oblivious to their use on a Pegasus/ISA network. (Note that although DAVIC 1.4.1, Part 9, Annex N, defines a User-Network API, that API is incomplete and not of much use.)

If the STB's initial session uses SSP, then the only special requirement for the STB middleware is to be configured to establish the initial session accordingly. For secondary sessions, the Palestine software can be configured to recognize certain network addresses and URLs as pertaining to Pegasus/ISA networks, so the use of SSP will be automatic. This is accomplished by calling routines (modifiable by the STB implementor) which decide if a given address or URL is expecting a Pegasus protocol.

Bionic Buffalo recommends, however, that any Pegasus sessions be secondary, initiated from primary MHP/OCAP sessions. This provides more flexibility and functionality to the end-user, and is likely to cost nothing at all since deployment of MHP/OCAP STBs is likely in most cases to be accompanied by some form of new (additional) server to provide enhanced services in conjunction with the deployment.

Minor additional configuration of the STB is necessary to provide some application-specific data to the server. Another callback mechanism (similar to the one used to identify Pegasus network addresses and URLs) is used so the implementor can provide the necessary data to the Palestine middleware.

Service Discovery

In the MHP/OCAP model, *services* are programs provided through the network. Video-on-demand (VOD) is considered a service. The `Service` interface in `javax.tv.service` is the abstract view of a service. MHP (and, therefore, OCAP) extends the `javax.tv.service` definition of services to include various DAVIC services, which, in turn, include some DSM-CC services.

Two such extended services include the `Directory` and `ServiceGateway` interfaces. The former is similar to a tree-structured file system directory, while the latter is an extension of the `Directory` with two added operations, `attach` and `detach`. A ServiceGateway is meant to be used typically as the top-level directory of a server, with `attach` and `detach` used to begin and end sessions with that server. (The concept of a `ServiceGateway` in Time Warner's ISA is similar to that of the DSM-CC concept, but not the same. The ISA `ServiceGateway` has very limited functionality compared to that of DSM-CC. Also, the concept of distributed objects in ISA is limited to the server, so the ISA `ServiceGateway` object isn't directly accessible to STBs.)

Services may be discovered by the STB middleware in an implementation-dependent fashion. For example, they may be found by browsing known content streams, by dereferencing URLs, or by incorporating pre-configured services. The middleware implementation creates a list of such services available to applications.

An application, in turn, may rely upon the service list prepared by the middleware, or it may find new services on its own. (These may, in turn, be passed to other applications.) Applications extend their knowledge of services by using the same techniques as does the middleware (browsing, URLs, and preconfigured or preprogrammed services).

One form of browsing which may be employed by the middleware as well as by applications is directory traversal. Specifically, starting with a `ServiceGateway` or `Directory`, a program can traverse the tree to discover more services. One concrete implementation of a `ServiceGateway` is an object carousel, which is transmitted using any of several protocols from the server to the STB. An object carousel is seen by the application software as a `ServiceGateway`, which is the root of a tree-structured directory of objects.

Pegasus/ISA doesn't use object carousels, but it does have a data carousel, called the Broadcast File System (BFS). The BFS data carousel contains data, not objects. In order to incorporate Pegasus/ISA services into the MHP/OCAP environment, Palestine and its components synthesize MHP/OCAP application objects from BFS data carousels. The data carousel itself is seen by MHP/OCAP applications as an object carousel, so they may be used transparently by compliant applications.

Although Palestine includes software to “translate” to BFS to object format, a STB manufacturer can substitute alternative translation software. Such substitute translators can be used to recognize object references embedded within known data formats. For example, an electronic program guide (EPG, also known as an interactive program guide, or IPG) contains stream information within the data. A custom translator can convert such stream information to stream object references, and an application can take such references (which appear as specializations of `Service` objects) and use them with standard MHP/OCAP APIs. Bionic Buffalo provides libraries for building such translators, including functions which do such things as generate `Stream` object references from the appropriate MPEG transport information.

When objects appear within directories, standard Java, MHP, DVB, and OCAP APIs can be used to manipulate those objects. Usually, such objects have file, stream, or directory interfaces, or the objects might be other applications (perhaps in Java bytecode format). Directory objects also can be mounted

on the Java file system, and accessed using conventional i/o methods. In addition, applications may create other object types if desired, and these can be integrated seamlessly into the programming environment. On the server side, Bionic Buffalo also provides tools to create file, stream, directory or application objects in opaque byte sequence format. These byte sequences subsequently can be inserted into the BFS, and will be recognized as objects by MHP/OCAP applications.

Video-On-Demand Play Control

In MHP/OCAP, some services are objects which represent video-on-demand, audio-on-demand or stored-program content streams.

MHP/OCAP applications use the `javax.media.Player` interface to control playback. The `Player` object isn't the stream itself, but rather the abstraction of the device which plays the stream. An intermediary object, the `DataSource`, is used by the `Player` to manage transfer of the stream. In an MHP/OCAP environment, the `DataSource` object supports the DSM-CC User-User protocol to control interactive stream (`DSM::Stream`) objects.

Palestine (hence Bhutan) also provides an alternative `DataSource` implementation to control Pegasus VOD streams using the Lightweight Stream Control Protocol (LSCP). The alternative, Pegasus-compatible DataSource is employed automatically when LSCP is required. The semantics of LSCP are very similar to those used by DSM-CC U-U, although the syntax is incompatible. This way, an interactive Pegasus stream is practically indistinguishable from a DSM-CC stream to a compliant MHP/OCAP application.

Legacy APIs Remain Available

Bionic Buffalo allows the implementor to configure a STB to include the legacy APIs which more directly control the Pegasus protocols. These may be used when the mapping and translation techniques described above are inadequate for special applications.
