

The MHP (or Multimedia Home Platform) API was conceived as a common standard for the way in which interactive TV content was developed for, and displayed on, digital TV receivers.

This document seeks to explain the way in which MHP application authors, and system operators, can trial their applications in an offline environment.

The MHP Standard

An MHP-ready receiver has a number of resources that it can make available to interactive applications including such things as:

- Access to button-presses from the TV remote handset
- The ability to overlay text and graphics on the display
- The ability to rescale the video content and select the channel for the TV display
- The rendering on-screen of Vector graphics
- Access to local return path modem hardware
- Local memory within the receiver

Perhaps most importantly of all, the MHP receiver runs a Java Virtual Machine which offers applications a processing engine capable of powerful computation locally in each receiver.

MHP applications are written in Java and compiled into Java Class Files prior to transmission. A typical MHP application will contain a collection of Java, text and graphics files.

As a standard, MHP provides the means to construct and broadcast a wide selection of interactive applications ranging from programme-related background information, advertising teasers, TV quizzes, News & Sports Information, through to TV Shopping and Voting.

Broadcasting MHP Applications

The component parts of a digital TV service such as the video content, the sound and the interactive content are each broadcast in elementary streams (PES Streams), which are multiplexed together, along with service information, to form one or more multi-programme transport stream (MPTS).

The elementary stream used to carry MHP content is constructed using a DSM-CC Object Carousel. The Object Carousel makes file directory structures and file objects available to the receiver by repeatedly transmitting the objects one after the other in a cyclical manner.

Object carousels are built with regard to their total cycle-time (so that the viewer does not have an excessive wait for the application to load) and with regard to the relative frequency of objects (such that file objects critical to the start or operation of an application are transmitted more frequently than others).

There is no theoretical limit to the number of MHP applications that may be transmitted on a single carousel, or to the number of carousels that may be carried in a multi-programme transport stream. Content for one or more MHP applications may be split across different carousels.

DSM-CC Object Carousel Generators

As pre-recorded video programmes are broadcast using tape players or transmission servers, MHP content is broadcast using an Object Carousel Generator (OCG). The OCG gathers up all the file objects to be broadcast and builds an Object Carousel stream ready to be multiplexed into the multi-programme transport stream.

The OCG, such as Softel's **MediaSphere** Carousel Generator, typically provides a number of user-friendly options such as:

- Construct carousel components for each MHP application with regard to the relative broadcast frequency of specified file objects and to the target delivery rate for the application.
- Allow MHP applications to be added to, and removed from, the live carousel dynamically whilst making optimal use of the carousel stream designated bandwidth.
- Allow multiple carousel streams to be generated from the same unit
- Allow MHP applications to be scheduled in advance (by date/time or by synchronising to specified video content).
- The ability to generate DSM-CC stream events (real time triggers that may be used within an MHP application to generate some programmatic reaction on receipt of a live trigger).
- The ability to replace file objects with updated objects versions as soon as they are made available to the OCG.
- An open architecture Windows 2000 hardware platform.
- A standard ASI signal output for connection to a transport stream multiplexer.

Replicating the broadcast chain for MHP application prototyping

MHP applications must be checked extensively before they are broadcast for the first time. The application software can, and will, fail and it has the potential of causing serious problems to the stability of the digital TV receiver. It is therefore important that application developers and digital operators have tools to allow them to trial MHP applications before they are transmitted over air.

This remaining part of this document seeks to explain the various ways in which MHP content may be checked in an offline environment.

Perhaps the most obvious way of verifying applications is to replicate a typical broadcast chain. This would require:

- a) An object carousel generator (eg. **MediaSphere Offline**)
- b) An SI generator (supplied as part of **MediaSphere**)
- c) An RF satellite or Digital Terrestrial Modulator/upconverter
- d) A target receiver

The SI generator is required because a standard digital receiver requires certain service tables to be present before it is able to decode and display MHP applications. The MediaSphere OCG is able to generate compliant SI tables automatically.

The RF modulator converts the raw transport stream into the modulated form used to carry DTV services either by satellite or terrestrially. The output of the RF modulator is then connected to the standard Aerial or L-band connector on the DTV receiver.

Adding Video and Audio services to the trial

Whenever the MHP application shares the TV display with video content (for example, full screen video with overly, or re-scaled video with additional content), the test system must also transmit at least one video channel. This allows the application to be tested in the receiver with full screen or re-scaled video.

Option A – The addition MPEG AV encoder and multiplexer hardware to the test system allows video content (for example, from tape) to be added to the transport stream before it is transmitted to the receiver.

This configuration would be most useful where the MHP application under test related closely to particular video content (for example a TV quiz show), and where the application needed to be checked regularly with updated video content.

The disadvantage is that the video player, video encoder and multiplexer will add considerably to the cost of the test system.

Option B – Loop play a pre-recorded MPEG video elementary stream file (and audio if required). This provides the receiver with a video stream that can be displayed with the MHP application.

Softel's MediaSphere Offline Carousel Generator is supplied with a set of tools that simplify this operation:

- Clip Record – a tool to record a full transport stream containing at video and audio services
- Clip Maker – a tool to convert PC AVI video clips into MPEG elementary stream format
- Clip Player – a tool to merge the OCG and the video streams together to form a full transport stream, and then to loop-play the stream file.

This option reduces the costs and complexities involved in generating an MHP + Video stream suitable for testing on a receiver.

End to End testing without an RF Modulator

In MHP trialling configurations where portability and/or cost are key criteria, there is a strong incentive to implement an end to end test system that does not require the use of a relatively expensive RF modulator (that is also sometimes tricky to configure!).

Softel have developed an interconnection module that allows a full transport stream to be connected to a target receiver through its DVB common interface (CI) slot. The full CI kit comprises:



- Low cost ASI to parallel transport stream converter
- A plug-in PCMCIA 'PC card' that fits into the CI slot on the receiver
- The necessary cable forms

The target receiver behaves in exactly the same way as if it were receiving an RG input, except that the tuner circuitry is bypassed.

The portable MHP demonstration kit

What is the easiest way to demonstrate MHP applications away from the office?

No problem – all you need is the following items:

- A small PC fitted with a DVB transport stream card
- The CI module
- An MHP set top box
- A TV or Monitor (usually available locally)

You load up the PC with a selection of pre-prepared transport stream files containing whatever video content and MHP applications you want to show. Using a utility such as Clip Player, you can output the transport stream through the CI module into the MHP receiver and demonstrate the application using the set top box handset and the TV display.

The multi-user MHP development & test environment

In a development environment where there are a number of MHP applications developers working on their own projects and who wish to test independently of each other, then the OCG plus RF modulator plus optional video source configuration is the most appropriate.

Softel's MediaSphere Offline OCG unit could be LAN connected to each developer who could take control of his/her own dedicated object carousel stream. The individual carousel streams would be multiplexed, modulated and transmitted around a local RF cable in the development lab. Developers would could use dedicated receivers to test their own applications.

Analysing and debugging an object carousel stream

The screenshot shows the DSM-CC Delivery View interface. At the top, it displays 'PID# 0x28a' and 'Last Error: 26/01/02 18:30:08 Stream Stopped'. Below this is a tree view showing 'DSI' and 'DSI (SRG=DII 4, Mod 63)'. A horizontal bar represents 'DII references: 23 Modules', with individual DII boxes (DII 04 to DII 08) and a 'Mod 63' box. At the bottom, a table lists parameters for the selected object (Module 134).

| Parameter | Value | Instance | Download Start | End | Download Time | Cycle Time |
|-------------------|------------------|----------|------------------|------------------|------------------|------------------|
| Selected object | Module 134 | 1 | 00:17:34:13:3169 | 00:17:34:13:3951 | 00:00:00:00:0391 | |
| Version count | 4 | 2 | 00:17:34:14:1220 | 00:17:34:14:1220 | 00:00:00:00:0000 | 00:00:00:00:8050 |
| Current version | 221 | 3 | 00:17:34:15:2436 | 00:17:34:15:2436 | 00:00:00:00:0000 | 00:00:00:01:1216 |
| Size | 1 object[s] | 4 | 00:17:34:16:3011 | 00:17:34:16:3012 | 00:00:00:00:0000 | 00:00:00:01:0515 |
| Cycle count | 20 | 5 | 00:17:34:17:4278 | 00:17:34:17:4278 | 00:00:00:00:0000 | 00:00:00:01:1266 |
| Avg Download Time | 00:00:00:00:0039 | 6 | 00:17:34:19:0005 | 00:17:34:19:0005 | 00:00:00:00:0000 | 00:00:00:01:5727 |
| Avg Cycle Time | 00:00:00:01:1409 | 7 | 00:17:34:20:1959 | 00:17:34:20:1959 | 00:00:00:00:0000 | 00:00:00:01:1553 |
| | | 8 | 00:17:34:21:0561 | 00:17:34:21:0561 | 00:00:00:00:0000 | 00:00:00:00:5002 |

How do you resolve problems relating to the contents and structure of a carousel stream?

One of the optional plug-ins for Softel's **DVB Transport Stream Analyser (TSA)** is a DSM-CC carousel decoder.

These tools allow the user to record any DVB broadcast and to monitor the files within the carousel.

The broadcast cycle time for each file is displayed alongside its version number and other related information.

Integrating the test tools into an MHP Application Development Environment

Although these carousel building and streaming tools have been described as a number of discrete tools, there are also good reasons why they should be included (perhaps invisibly) within a 3rd party MHP application developers package. Softel is willing to discuss the licensing of **MediaSphere Offline** and the related tools to suitable partners.

MHP application prototyping products available from Softel

Softel seek to establish close working relationships with the MHP authoring community and offer, either to purchase or on 12 month rental, the following products:

| | |
|-------------------------------|---|
| MediaSphere Offline | A fully featured Softel broadcast Object Carousel Generator licensed for offline or pilot trial use |
| MediaSphere Offline Toolkit | A selection of Softel software tools for use with MediaSphere such as the Clip Record, Clip Maker and Clip player utilities |
| RF Modulator | Softel can assist with the choice and supply of suitable satellite or terrestrial modulator hardware |
| AV MPEG Coder and Multiplexer | Softel can assist with the choice and supply of suitable video & audio MPEG coder and multiplexer hardware |
| CI Module | Softel's transport stream interconnection CI module for digital receivers |
| TSA Carousel Analyser | Softel's transport stream and object carousel analyser |