

User Manual



MTS400 Series MPEG Test Systems Carousel Applications 077-0203-00

This document applies to firmware version 1.7
and above.

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

To Avoid Fire or Personal Injury

Use Proper Power Cord. Use only the power cord specified for this product and certified for the country of use.

Connect and Disconnect Properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source.

Ground the Product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Power Disconnect. The power cord disconnects the product from the power source. Do not block the power cord; it must remain accessible to the user at all times.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

Use Proper Fuse. Use only the fuse type and rating specified for this product.

Wear Eye Protection. Wear eye protection if exposure to high-intensity rays or laser radiation exists.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Provide Proper Ventilation. Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

Terms in this Manual

These terms may appear in this manual:



WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*



CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Preface

The MTS400 Series MPEG systems applications are described in three user manuals. The full list of applications can be found in the MTS400 Series Quick Start User Manual. This manual describes the carousel related applications. All applications are available on the following MTS400 Series products:

- MTS415
- MTS430
- MTS4SA
- MTS400P
- MTX100B (where installed)

Table i: Overview of MTS400 Series carousel applications

Application	Desktop Icon
Carousel Analyzer - Data analysis showing structure, bit rate, repetition rate, syntax and semantics of data items.	 Carousel Analyser
Carousel Generator - Provides in-depth, off-line generation of MPEG-2, DVB transport streams containing a range of data broadcast protocols.	 Carousel Generator

Related Documentation

Table ii lists the documentation available for your MTS400 Series instrument:

Table ii: MTS400 Series related documentation

Title	Tektronix part number	Location
MTS400 Series Quick Start User Manual English Japanese	071-2607-xx 071-2608-xx	 +  +  www.Tektronix.com
MTS400 Series Analyzer Application User Manual (This manual)	077-0205-xx	 +  www.Tektronix.com
MTS400 Series Generator Applications User Manual	077-0204-xx	 +  www.Tektronix.com
MTS400 Series Carousel Applications User Manual	077-0203-xx	 +  www.Tektronix.com
MTS400 Series Programmer Manual	077-0206-xx	 +  www.Tektronix.com
MTS400 Series Release Notes	077-0200-xx	 www.Tektronix.com
MTS4EA Compressed Video Elementary Stream Analyzer User Manual	071-1641-xx	 +  +  www.Tektronix.com
MTS4CC Elementary Stream Compliance Checker User Manual	071-2075-xx	 +  +  www.Tektronix.com
MTS400P Quick Start User Manual English Japanese	071-2610-xx 071-2611-xx	 +  +  www.Tektronix.com



Carousel Analyzer

Carousel Analyzer - Getting Started

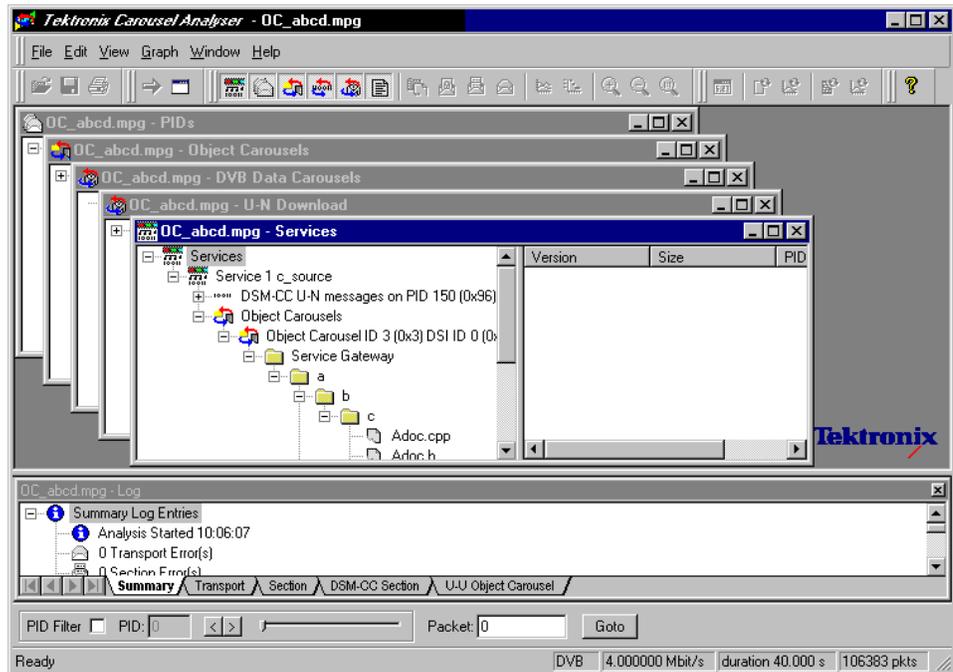
The Digital Storage Media Command and Control (DSM-CC) protocol was originally developed to provide a VCR-like control mechanism for program material delivered in an MPEG2 transport stream. Since then, the standard has evolved to encompass a wide variety of applications including data broadcasting and interactive television. DSM-CC forms a core part of a variety of both closed and open standards such as the DVB MHP (Multimedia Home Platform) standard for European Interactive Television.

The following DTV standards are supported:
(See page 1–97 for details of all references in this section.)

- ISO/IEC 13818-6 Information technology - Generic coding of moving pictures and associated audio information - Part 6: Extension for Digital Storage Media Command and Control [MPEG] (Reference [2])
- EN 301 192 Specification for data broadcasting [DVB] (Reference [4])
- ARIB STD - B24 Data Coding and Transmission Specification for Digital Broadcasting (Reference [11])
- Multimedia Home Platform [DVB] (Reference [12])

A bibliography of DTV standards documentation is given in the *Reference* section.

The Carousel Analyzer has been developed to meet the specific need to analyze and display the content and structure of data broadcasts. The tool provides a variety of ways of looking at a transport stream and its contents including displaying the bit rate, repetition rates, structure, syntax, and semantics of data items.



The program view shows the various services in the transport stream and their associated PIDs and data streams. Object or data (one or two layer) carousels and U-U or U-N messages such as DSM-CC Download can also be displayed with options to view associated, sections, carrier modules, or transport packets for each version as required.

An object carousel in the stream can be viewed by contents as a directory structure containing the underlying objects such as Java classes, picture, or text files. If an object is associated with an installed application then a double-click will launch that program, providing, for example, an easy and quick way to view the contents of a picture file or read a text file.

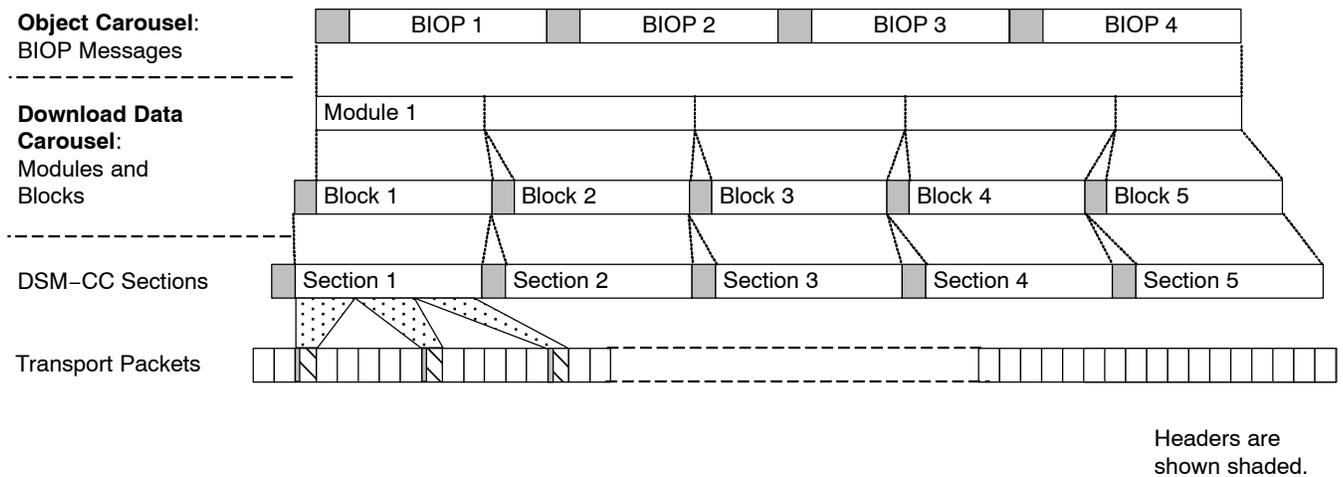
The structure of the U-N download messages can be viewed showing the relationship between DII, modules and blocks. The associated DSI and DII messages contained in the U-N-Download tables can also be viewed in interpreted or hex fashion; these indicate where to find and view the BIOPs that contain a required object in the stream.

The timing relationships between the various components can also be easily shown because the bit rates or the repetition rates of blocks, modules, objects, U-N messages or SI tables can be shown together in a single graphical display.

Data Broadcasting Overview

Data Broadcasting allows data to be transmitted in a similar way to the way in which video and audio services are delivered to end users. Object and Data Carousels are intended for the periodic transmission of information in a transport stream. DVB Data Carousels contain modules of data of unspecified content. ARIB Data Carousels and Object Carousels contain identifiable data objects, for example, JPEG files, text files, and application software. Multimedia Home Platform (MHP) is also supported because the Application Information Table (AIT) and Object Carousels (as specified in the MHP standard) can be viewed.

The diagram below shows how information carried by data and object carousels is subdivided and ultimately carried by the transport stream.



BIOP messages contain a message header, a message sub-header and the message body which contains data. The message body may contain complete data objects.

BIOP messages are broadcast in Modules. A Module is formed from one or more concatenated, complete BIOP messages.

Each Module is fragmented into one or more Download Data Blocks which are in turn transmitted in corresponding DSM-CC Sections.

Sections are transmitted in packets in the Transport Stream.

The Carousel Analyzer enables each layer of the protocol stack to be analyzed and inspected. The following sections provide an overview of how the Carousel Analyzer can be used to locate messages and packets of interest.

Starting the Program

The program can be started by selecting **Start > Programs > Tektronix MTS400 > Analyzers > Carousel Analyzer** or by double clicking on the **Carousel Analyzer** shortcut on the desktop.

Initial Appearance

When the program has started and is ready for use, it will open the Main window, as shown in Figure 1-1:

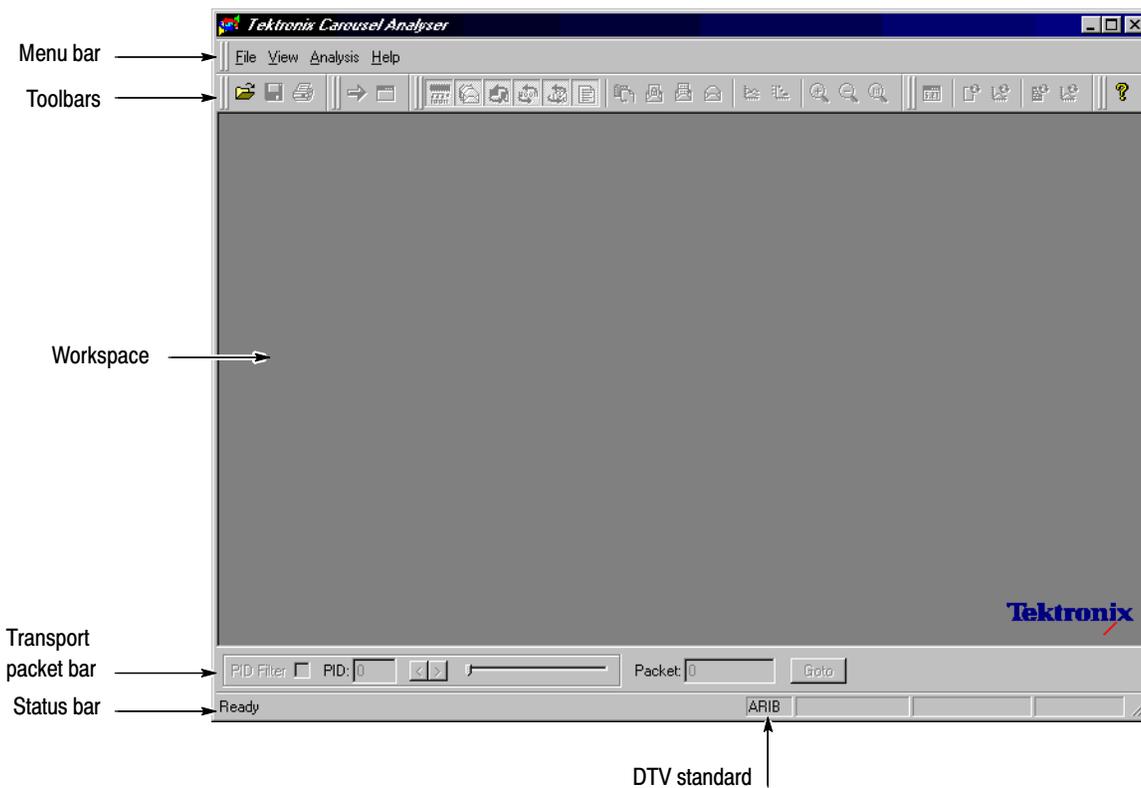


Figure 1-1: Main window - Initial appearance

Elements of the main window can be hidden during a session, but will be restored at start-up.

The Menu Bar contains all options available to the application; disabled options are visible but grayed out. The Toolbars provide shortcuts to the more important menu options; similarly, disabled buttons are visible but grayed out. The Transport Packet Bar provides controls to locate and jump to transport packets. The Status Bar shows stream information and the cursor message field.

Initial Menu Options

The Carousel Analyzer presents different menus and options depending upon whether or not a stream is open for analysis. The menu options available when no stream is open are as follows:

File Menu Options. Table 1–1 lists the options in the initial File menu.

Table 1–1: File menu options

Option	Function
Open...	Opens an MPEG transport stream for analysis. The program opens the file selection dialogue allowing the user to choose the required file.
Print Setup...	Opens a dialog for selecting which printer and associated options to use.
1 <<filename>> 2 <<filename>> 3 <<filename>> 4 <<filename>>	A list of the four most recently analyzed files. If the program has recently been installed, the list may be empty or hold less than four files. Selecting a filename opens that file for analysis.
Exit	Finishes running the program.

View Menu Options. Table 1–2 lists the options in the initial View menu.

Table 1–2: View menu options

Option	Function
Toolbars >	Submenu shows or hides the toolbar.
Transport Packet Bar	Shows or hides the Transport Packet Bar.
Status Bar	Shows or hides the status bar.

Analysis Menu Options. Table 1–3 lists the options in the initial Analysis menu.

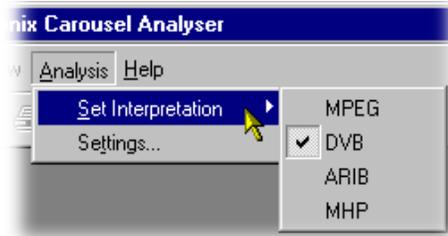
Table 1–3: Analysis menu options

Option	Function
Set Interpretation >	Select the Digital TV standard to be used for stream analysis.
Settings...	Displays a dialog for selecting scripts to be used during analysis.

Stream Interpretation

The DTV standard to be used for analysis must be selected before any streams are opened.

Select the required standard from the submenu.



Script Selection And Manipulation

Scripts are available to the Carousel Analyzer to enable structures to be analyzed successfully.

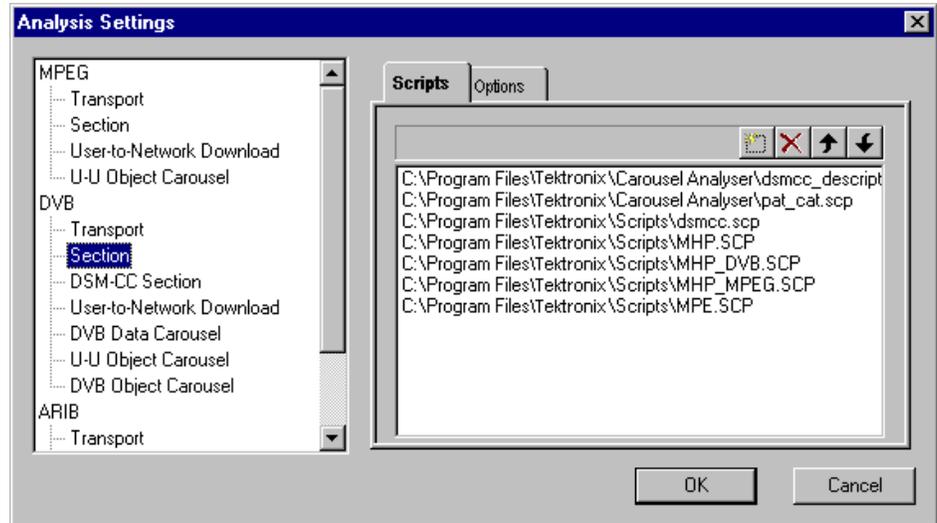
If any script is not selected or enabled, the stream will not fail to be analyzed, but any data normally interpreted by that script would be ignored.

Scripts can only be selected and enabled when no files are open. The option is not available when a file is open.

Handling Script Files. To open the Analysis Settings dialog box, select Settings from the Analysis menu.



The dialog box shown below is displayed:



In the Analysis Settings dialog, the left window shows a tree structure of the test protocols available. The right window shows the scripts currently allocated to the test protocol; in the example, the listed scripts are associated with the DVB - Section protocol. The right window also contains the controls needed to manipulate the scripts.

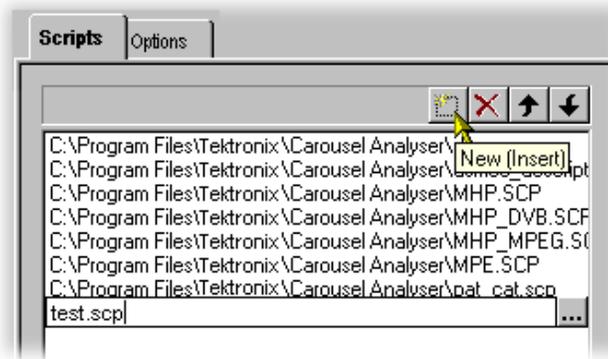
Note that across the standards, the scripts are not hierarchical; that is, each DTV standard must be self-contained in terms of the scripts that it uses.

The currently available script files are listed in the *Reference* section (page 1-97).

The following paragraphs describe the available script manipulation activities. The activities are applied to the currently selected test protocol.

Adding a Script file.

1. With the required test protocol highlighted, select the Add New Script button (Shortcut key: Insert).
2. If the script path/name is known, enter it into the blank field.

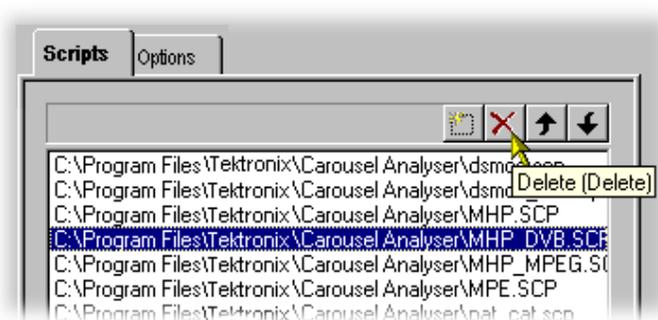


If the script name is unknown, use the browse button at the right side of the blank field to display a standard Windows file Open dialog box.

3. The new script file name will be added at the bottom of the script list. Note that script files are parsed in the order that they are listed, because the file may require moving up in the list – see *Moving Script files in the List* below.

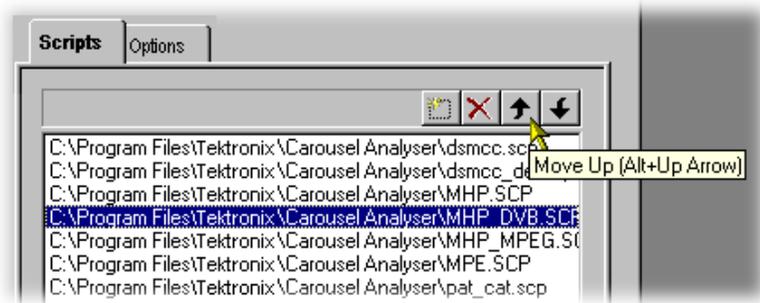
Removing a Script File.

1. Highlight the file to be deleted and select the Delete Script button (Shortcut key: Delete).



Moving Script Files in the List Script files are parsed in the order that they are listed; the file may require moving up in the list

1. Highlight the file to be moved and select either the Move Up or Move Down button (Shortcut keys: Alt-▲ and Alt-▼ respectively). The file will move up or down one place for each press of the button.



Syntax Checking Options

A number of options are available from the Analysis Settings dialog that allow strict syntax checking to be enabled and disabled.

If any option is not enabled, the relevant syntax will not fail to be checked, but will be interpreted more loosely.

Syntax Checking Options can only be selected and enabled when no files are open. The option is not available when a file is open.

Currently, three syntax checking options are available:

Strict private data length/Message length checking. Object: U-U Object Carousel
Disabling this option allows the privateDataLength field where it exists in the DSI to be set to zero. The application will calculate it when required, using the total message length and the position of the private data in the message.
(See reference [2], sections 2 and 7.3.6.)

Strict association tag checking. Object: U-U Object Carousel
The association tag field in the stream_identifier_descriptor is an 8-bit value, while the same field in an object carousel is a 16-bit value. When comparing these two values, the MSB of the 16-bit value should be zero. Disabling this option allows it to take other values.
(See reference [4], 9.3 paragraph 3 and [6], paragraph 4.7.7.3.)

Strict CRC/Checksum checking. Object: DSM-CC Section

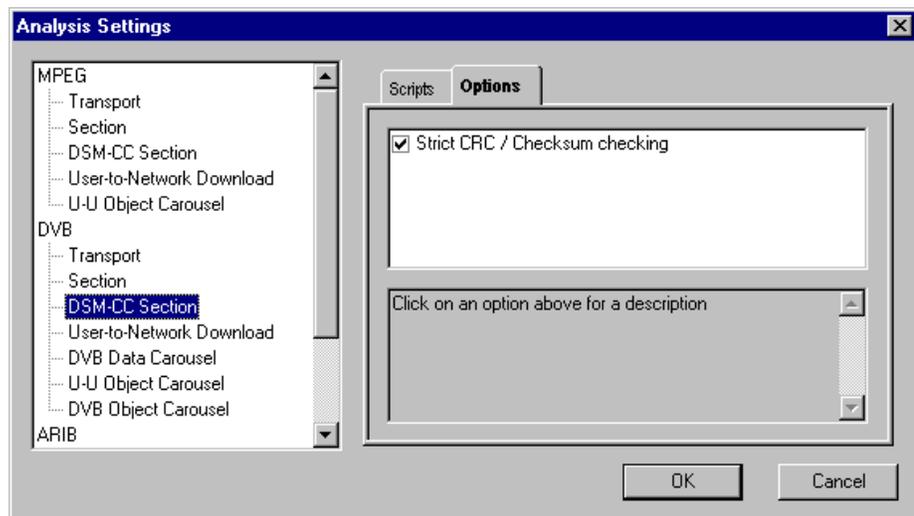
section_syntax_indicator and private_indicator fields should be the complement of each other to determine whether a CRC or checksum is in use. Disabling this option allows them to be the same and allows the application to work out which method should be applied.

(See reference [2], section 9.2.2 paragraphs 3 and 4.)

Enabling a Syntax Checking Option. To open the Analysis Settings dialog box select Settings... from the Analysis menu.



Select the Options tab. The dialog shown below is displayed:

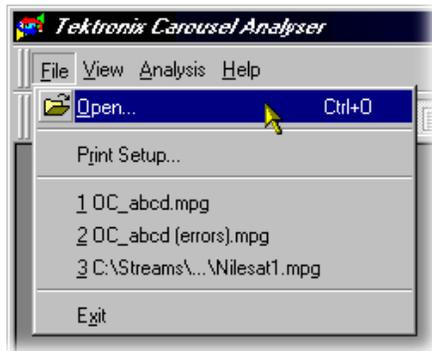


In the Analysis Settings dialog box, the left window shows a tree structure of the test protocols available. The right window shows the options currently allocated to the test protocol; note that currently, options are only applicable to DSM-CC Sections and U-U Object Carousels. Available options are applicable to all standards, for example, an option set in the DVB DSM-CC Section will be applied in the MPEG and ARIB protocols.

Opening a Stream File

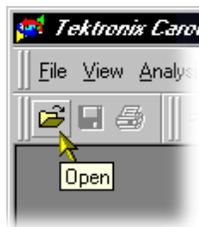
Any Transport Stream file can be opened for browsing by the Carousel Analyzer. However, only those streams containing Data and/or Carousel Objects will provide meaningful results. Tektronix Transport Stream Compliance Analyzer should be used for normal stream analysis. Only one file can be opened at a time.

To open a file, select **File > Open**. If the required file is in the list of recently analyzed files, then it can be opened from the list to save using the open file dialog box.

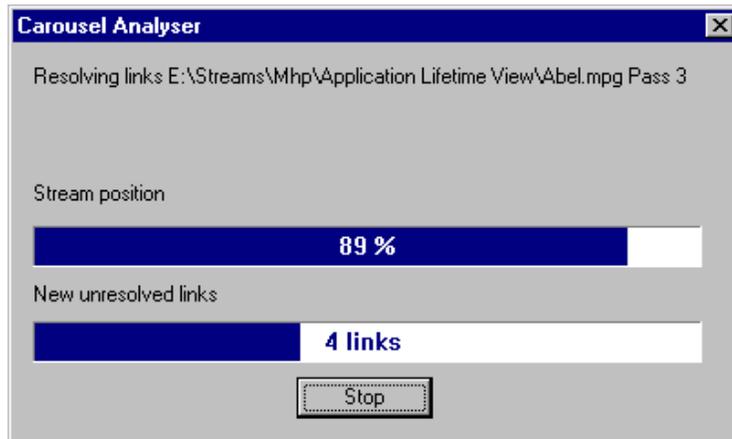


Alternatively, use the Ctrl+O keyboard shortcut.

There is a shortcut button available on the Toolbar for opening a file, which uses the standard file open symbol:

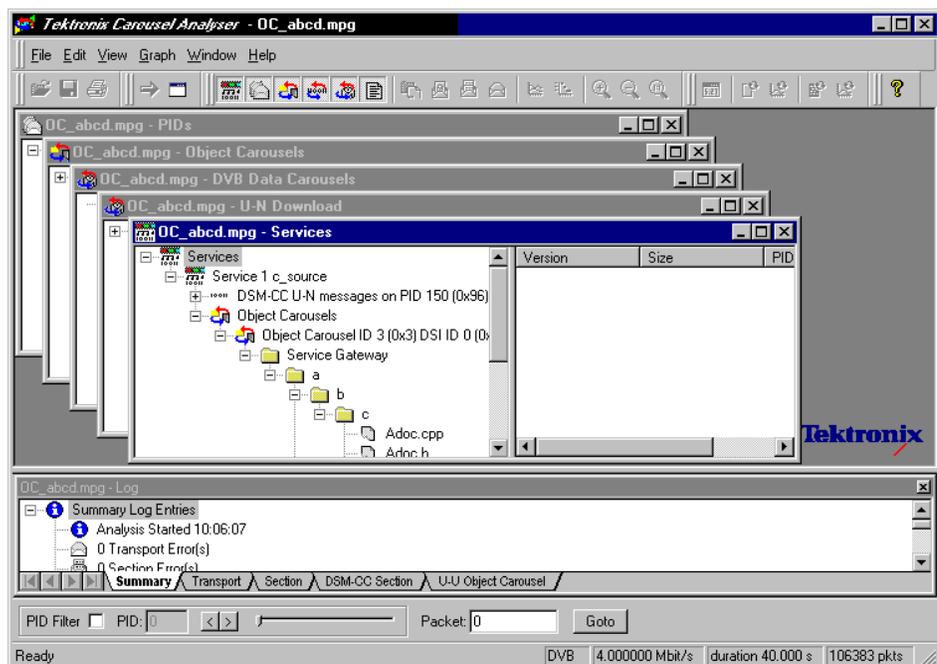


As the file opens, a progress bar is displayed; analysis may require more than one pass through the transport stream file. The current pass number is shown in the title line. After the first pass, a second progress bar (new resolved links) shows the number of unresolved links at each pass.



Analysis can be halted at any time by selecting the **Stop** button in the dialog box; the stream is still opened, but only the elements that have been analyzed so far will be displayed.

By default, the Services window and the Log window open as soon as a stream file opens. Further windows can be opened by using the View Menu or the Toolbar. Note that although the options on the View menu remain the same, they are enabled or disabled according to which protocol element is highlighted at the time.



Menus and Controls

The following pages contain descriptions of the menu options, toolbar controls, status bars, and methods for managing the workspace.

Menu Options

The following pages describe all of the menu options. Since many of the options are context sensitive, they will be available only when their function is appropriate for the selected window or display element. When a menu option is not available, the option is grayed out.

File Menu Options. Table 1–4 shows the options available in the File menu.

Table 1–4: File menu options

Command	Function
Open...	Open an MPEG transport stream for analysis. The program opens the file selection dialogue box allowing the user to choose the required file.
Close	Closes the current file.
Save As...	Saves the file to a new file name.
Print	Opens the Print dialog.
Print Preview	Opens the Print Preview dialog.
Print Setup...	Opens the Print Setup dialog.
Exit	Closes any file that is open and terminates execution of the program.

Edit Menu Options. Table 1–5 shows the options available in the Edit menu.

Table 1–5: Edit menu options

Command	Function
Applications	Opens the Application Management dialog.
Go To Next	Jumps to next occurrence of the structure being viewed. The Packet field in the Transport Packet bar will reflect the change of packet.

View Menu Options. Table 1–6 shows the options available in the View menu.

NOTE. An active (depressed) button next to an option indicates that the window or toolbar is currently visible; an inactive button means that it is hidden.

Table 1–6: View menu options

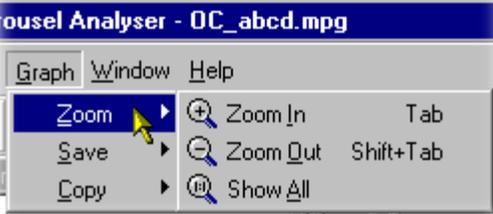
Command	Function
Toolbars >	Submenu shows or hides the toolbar. 
Transport Packet Bar	Shows or hides the Transport Packet Bar.
Status Bar	Shows or hides the Status Bar.

The remaining options in this menu open and close the associated window. The options and windows are described elsewhere in this section.

- Program/Services, U-N Download, Object Carousels, Data Carousels, PIDs and Log.
- BIOP Message, U-N Message, Section, Transport Packet, Transport Packet List, Hex Dump, Timing, Carrier and Resources.
- Repitition and Bitrate.

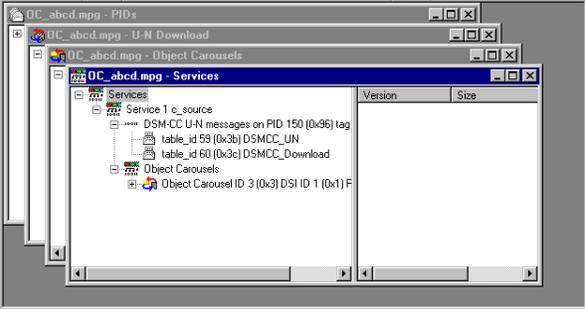
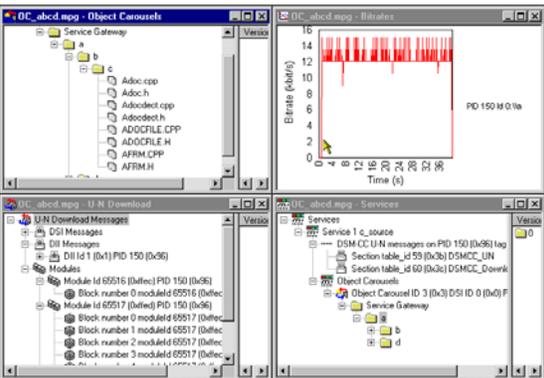
Graph Menu Options. Table 1–7 shows the options available in the Graph menu.

Table 1–7: Graph menu options

Command	Function
<p>Zoom</p>	<p>Applies to Bitrate and Repetition views only.</p>  <p>Zoom In: Maximizes the central 50% (x-axis) of the current graph.</p> <p>Zoom Out: Takes one step back in the Zoom sequence.</p> <p>Show All: Resets the graph to show all points.</p>
<p>Save</p>	<p>Saves the graph in the selected format.</p> 
<p>Copy</p>	<p>Copies the graph to the clipboard in the selected format.</p> 

Window Menu Options. Table 1–8 shows the options available in the Window menu.

Table 1–8: Window menu options

Command	Function
<p>Cascade</p>	<p>Rearranges the windows like this:</p> 
<p>Tile</p>	<p>Tiles the windows. For example, four windows would be tiled like this:</p> 
<p>Arrange Icons</p>	<p>Aligns icons of any minimized windows at the bottom of the program's main window.</p>
<p>1 <<window title>> 2 <<window title>> 3...etc</p>	<p>Makes the named window active, putting it on top of any windows that had been hiding all or part of it.</p>

Help Menu Options. Table 1–9 shows the options available in the Help menu.

Table 1–9: Help menu options

Command	Function
Quick Help	Opens the Quick Help browser window.
About Carousel Analyzer	Opens a message box that displays the program version number and license number. This information will be required if Tektronix Technical Support is contacted.

Toolbars

Quick access buttons are divided between several toolbars: File, Edit, View and Help.

A number of the toolbar functions are context-sensitive; which window is open and which element is highlighted will dictate which buttons are enabled and disabled.

File Toolbar



Open a file. This button is disabled when a file is open.



Save As... - BIOP file messages can be saved to separate files. Structures can also be saved to a separate file.



Print – only available for bit rate and repetition views.

Edit Toolbar



Jumps to next occurrence of the structure being viewed.

View Toolbar The buttons in this toolbar open and close the associated windows. The windows are described elsewhere in this manual.

	View Programs/Services		View Section
	View PIDs		View Transport Packet
	View Object Carousels		View Bitrate
	View Data Carousels		View Repetition Rate
	View U-N Download Messages		View Lifetime
	View Log		Zoom In
	View BIOP Message		Zoom Out
	View U-N Message		Show All

Timing Toolbar

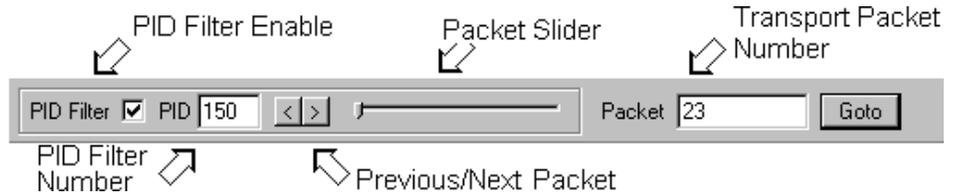
	Edit Application Timing		View Carousel Cycle Time
	View Entity Cycle Time		View Carousel Cycle Time Graph
	View Entity Cycle Time Graph		

Help Toolbar

 **About Carousel Analyzer:** Opens a dialog box which displays the program version number and license number. This information will be required if a **Tektronix** Technical Support is contacted.

Transport Packet Bar

The Transport Packet bar provides a quick method of locating and navigating to transport packets PIDs.



Packet: To locate a particular Transport Packet, enter the Transport Packet number and select Goto.

PID Filter enable: The PID navigation feature can be enabled by selecting the checkbox (as shown).

To navigate to a specific packet: with the PID Filter disabled, enter the packet number and select either the Previous or Next Packet button. If a PID structure view is now requested from a View, the search for the PID will commence with the transport packet number displayed.

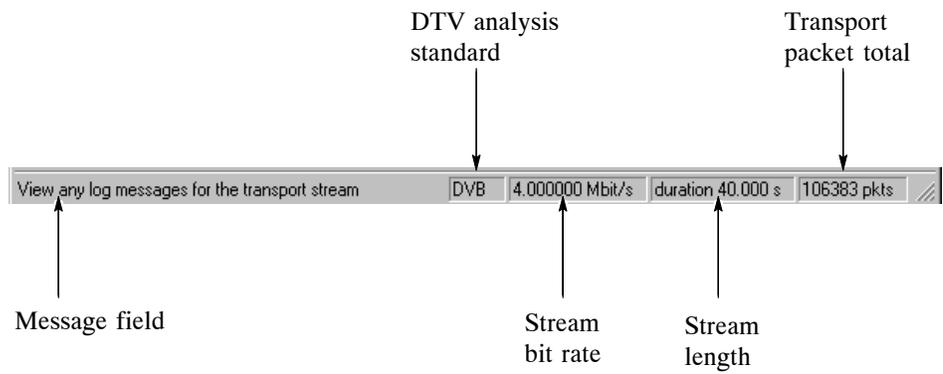
Similarly, with the PID Filter enabled, each press of either the Previous/Next button will display the previous/next transport packet containing the PID number displayed in the PID Number field. If a PID structure view is now requested from a View, the search for the PID will commence with the transport packet number displayed.

NOTE. When a Transport Packet is viewed, the number in the Packet field will increment by one.

The Transport Packet bar can be hidden from view by using the View menu Toolbars option.

Status Bar

The Status bar provides information about the stream that is currently being displayed. A message field gives a description of the button, menu or option that the cursor is resting on; other non-critical messages may also be shown.



Workspace

Window Management

In addition to the generic Cascade and Tile options available from the window menu, management of individual windows is provided through a submenu available by right-clicking the title bar of the individual window.

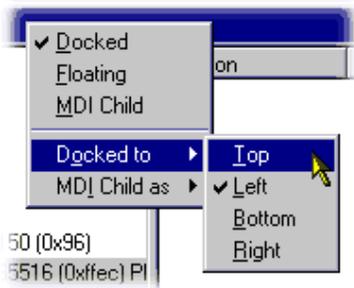
Right-click window title bar:



Each window within the workspace can be designated as Docked, Floating, or as an MDI Child.

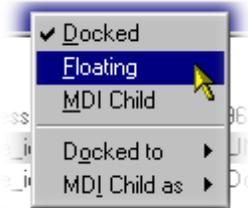
Docked. When docked, a window will be automatically placed against one of the four sides of the workspace.

For example, selecting **Docked > Top** will dock the selected window at the top of the workspace.



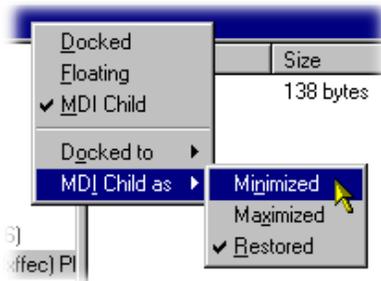
Floating. Designating a window as floating allows it to be moved around on the monitor desktop independently of the Carousel Analyzer interface.

For example, selecting Floating will allow the window to be moved anywhere on the desktop:



MDI Child. Designating a window as an MDI Child allows it to be moved anywhere within the workspace.

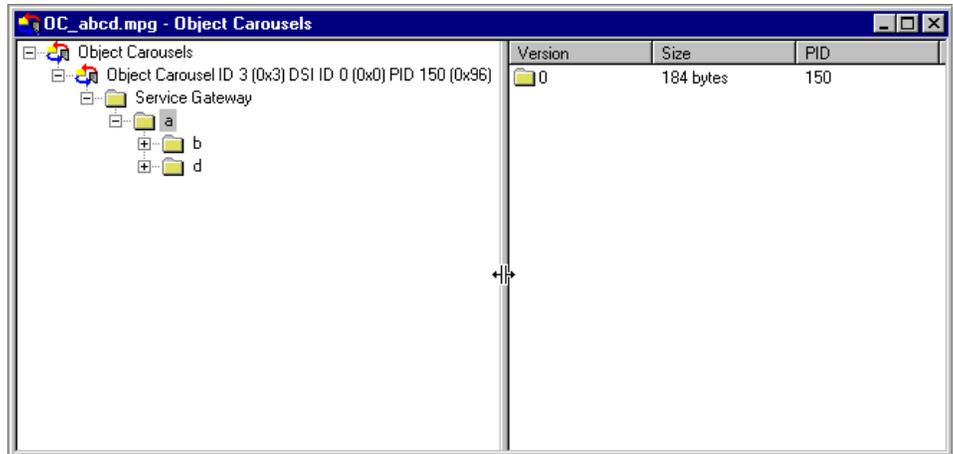
The MDI Child submenu allows the window to be designated as Restored, Minimized or Maximized.



NOTE. When a window is “docked” it can be dragged (and dropped) around the workspace; when it is at an edge it will adopt a docked position. MDI Children do not attempt to dock with the edges of the workspace.

Version/Size Pane Display

Most of the views described later use a split-pane arrangement to display the view data and related version, file size and PID information. The information is displayed in the right pane. However, the default arrangement when opening the view is that the right pane is closed. To open the pane, pass the cursor over the right edge of the view until it changes to the split pane cursor, then move the dividing bar to the desired position.



Content Management

The principles employed in displaying the information in each workspace window are applicable to all windows, although the content will vary from window to window.

Tree Structure. Structures are represented by tree diagrams, with the “root node” or highest level component at the top. Components that contain more information underneath them in the structure are indicated by a + box. Clicking on the + box will display the structure underneath the node. Similarly, if a - box is adjacent to the node, the level of detail immediately below it is already displayed; this detail can be hidden by clicking on the - box. Components that are connected to a branch of the tree without a square box are leaf nodes; they display the lowest and finest level of detail.

Right-clicking on a tree node may open a context sensitive menu.

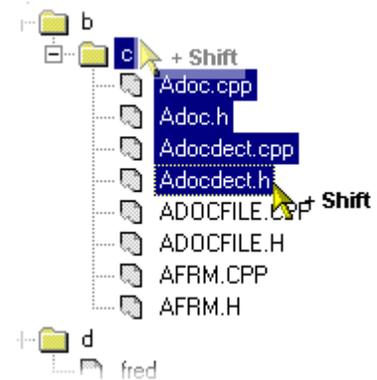
Component Selection. Components can be selected (or highlighted) either singly or in groups. When selected, the views available from the View menu (or a right-click menu) will be those that can be applied to all of the selected components.

Single component selection

Selected by clicking on a component.

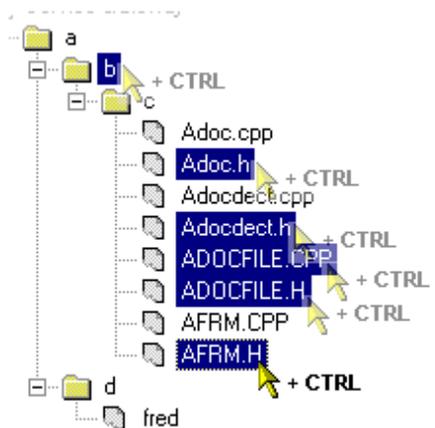
Range selection

Selected by highlighting the first component in the required selection and, while holding the Shift key on the keyboard, clicking on the last component. The selected range will be highlighted.



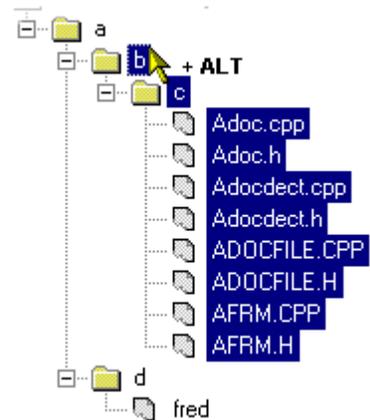
Multiple component selection

Selected by holding the Control key (CTRL) on the keyboard and clicking the required components.



Node selection

Selected by holding the Alt key on the keyboard and clicking the required node; all subcomponents will be selected.



Saving Components. Selected (or highlighted) components can be saved through the right-click menu. However, the manner in which the components were selected (see previous paragraphs) will affect the file structure of the saved components.

If a Node Selection has been made, the directory structure is recreated at the specified location and the subcomponents are saved to their equivalent directories.

If a Range or Multiple selection has been made, all files will be duplicated in the root directory at the specified location in addition to recreating the directory structure and saving the sub-components to their equivalent directories.

Hex Displays. Hex displays follow a common format.

The eight-digit number in the left column is the address of the first (that is, left) byte in the row. The addresses themselves are shown in hexadecimal format.

The center column displays the contents of the structure in hex format.

The right column displays the contents of the structure in ASCII format.

Views

The Carousel Analyzer provides three types of view as a means of inspecting and analyzing information carried in a transport stream.

Static Views:

(Programs/Services, Object Carousel, U-N Download, Data Carousel, PID, Log)
Static views display information derived from the transport stream when it is opened.

Structure Views:

(Transport Packet, U-N Messages, Module, Section, BIOP Messages)
Structure views use Tektronix scripting technology to analyze structures that appear in the transport stream, for example, tp, and BIOP messages. For repeated structures, this view allows all occurrences to be visited.

Chart Views:

(Bitrate, Repetition Rate)
Chart views present timing information in graphical form about one or more structure in the stream.

View	Page	View	Page
Programs/Services View	1-30	Structure Views	1-52
Object Carousel View	1-34	Bitrate View	1-55
U-N-Download View	1-41	Repetition View	1-58
Data Carousel (DVB) View	1-45	PID View	1-61
Data Carousel (ARIB) View	1-46	Log View	1-64
Resource View	1-50	Cycle Times View	1-67

In the following sections, each view is described together with the information accessible from that view.

The nodes displayed in the views relate to the protocol layers as shown in the diagram below:

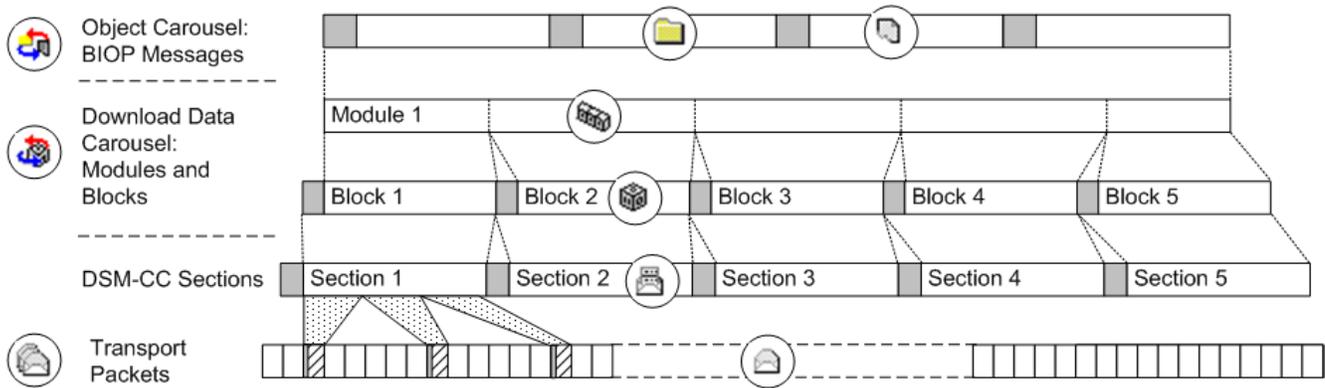


Table 1-10: Key to Tree Nodes

	Service/Program		Active PIDs/PIDs
	Download Block		BIOP Object Directory / ARIB Directory
	U-N Message		BIOP Object / ARIB Resource
	Download Module		Table
	Compressed Download Module		Transport Packet
	Data Carousel		Audio Stream
	Object Carousel		Video Stream
	Stream Object		Data/Other Stream
	Stream Event Object		MHP Applications
	Java Application		HTML Application

Key to Node Overlays. Overlays are used to signify additional information about nodes; the overlays may be used individually or in combination.

 	<p>Absent Objects: Objects referenced but not found, for example, directory object not found. The path in which the absent object is recognized is also marked.</p>
	<p>Unresolved Objects: When an object is found during analysis, but its key is not referred to in the Service Gateway, it is displayed under an Unresolved Objects node.</p>
	<p>Boot Class Objects: Boot class items are identified. The path in which the boot class resides is also indicated.</p>
	<p>Manual Signaling: Indicates that a PID has been subjected to the manual signaling process; used in the carousel and PID views only.</p>

Programs/Services View

Menu Bar: View > Program/Services

Toolbar:



The Programs/Services view gives a static, DVB/ARIB service (or MPEG program) centric view of the transport stream contents. Each program is listed together with the service name (for DVB/ARIB). Expanding a program item will reveal its elemental PIDs and any object (or data) carousels associated with it.

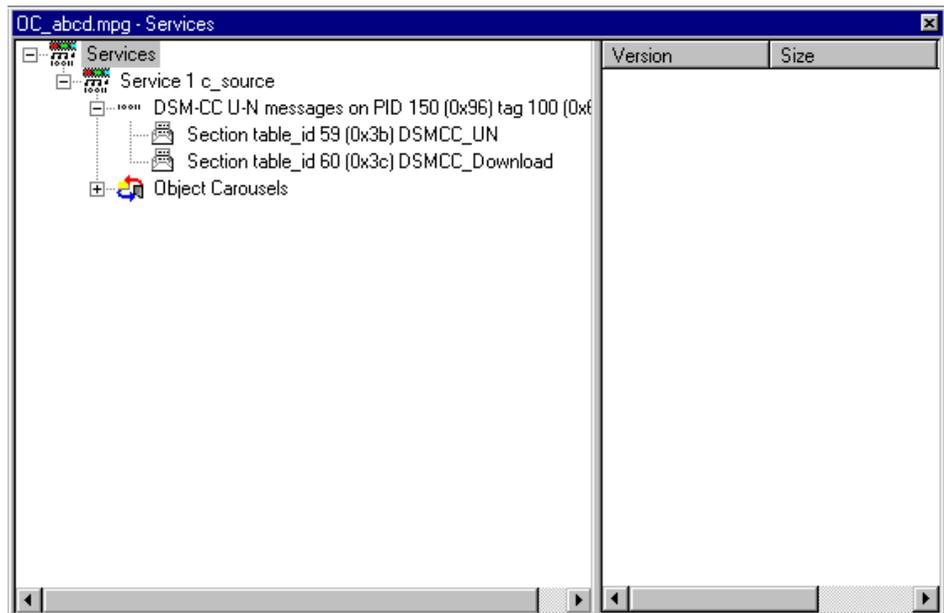


Figure 1-2: DVB programs/services view (typical)

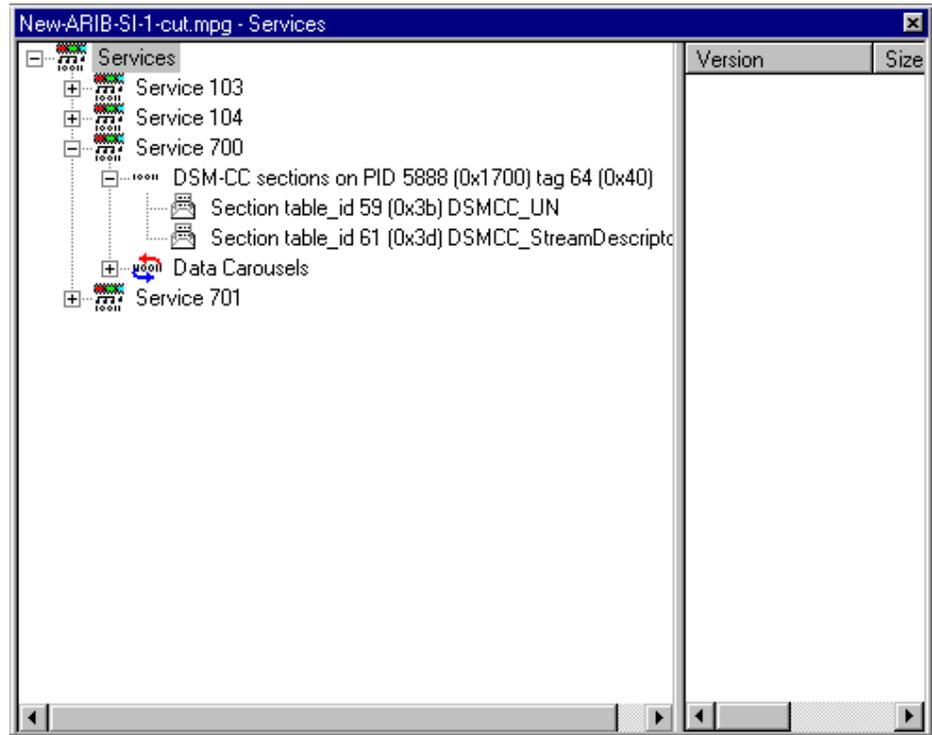
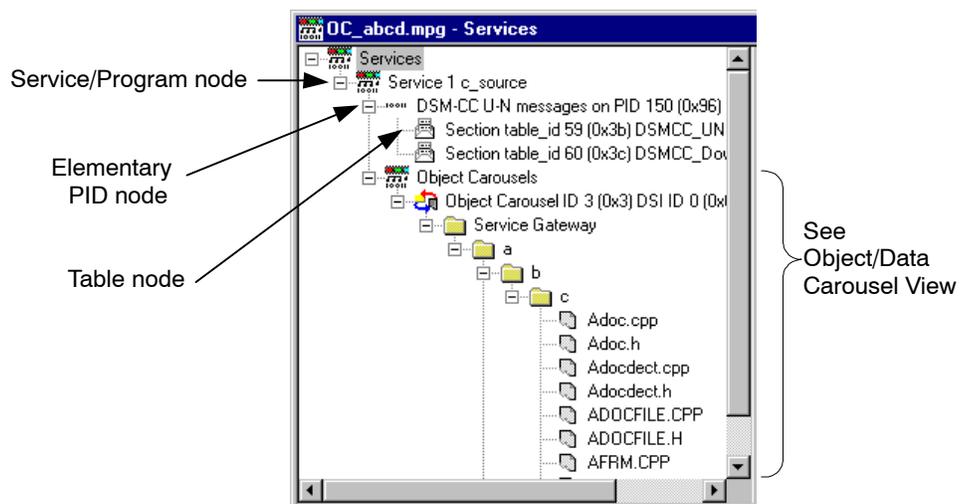


Figure 1-3: ARIB programs/services view (typical)

The diagram below indicates the primary nodes that are accessible from the Program/Services view.



Service/Program Node



This node represents a specific program or service (DVB or ARIB) in a transport stream. If a name for the program is available in the SDT (Service Description Table), it is displayed. Each Elementary PID listed in the PMT (Program Map Table) will have a corresponding node displayed as a child node of the Services/Program node. Similarly, any Object or Data Carousels associated with the Services/Program node are listed as child nodes.

Right-Click Menu Options.

- View PMT** Opens the Section Table view for the PMT.
- View Bitrate** Activates or creates a bit rate view of the sum of the elementary streams that are listed in the PMT for this program.

Elementary PID Node



This node represents a PID referenced by a program. If the PID carries Sections, these are represented as Table nodes.

Right-Click Menu Options.

- View Transport Packet** Displays a structure view of the next transport packet encountered on this PID from the current stream position (as indicated by the Transport Packet number that is displayed in the Transport Packet Bar).
- View Cycle Time** ► Allows either cycle time statistics or graphical view to be selected.
- View Repetition** Activates or creates a view of the repetition rate of this PID in the transport stream.
- View Bitrate** Activates or creates a bit rate view of this PID.

Table Node



This node represents the stream of sections present on a specific PID with a specific table identity.

Right-Click Menu Options.

- View Section** Displays a structure view of the next section with this PID and table identity that can be formed from the current stream position onwards (as indicated by the Transport Packet number displayed in the Transport Packet Bar).
- View Cycle Time** ► Allows either cycle time statistics or graphical view to be selected.
- View Repetition** Activates or creates a view of the repetition rate of this PID with this PID and table identity.
- View Bitrate** Activates or creates a bit rate view of sections with this PID and table identity.

Object Carousel View

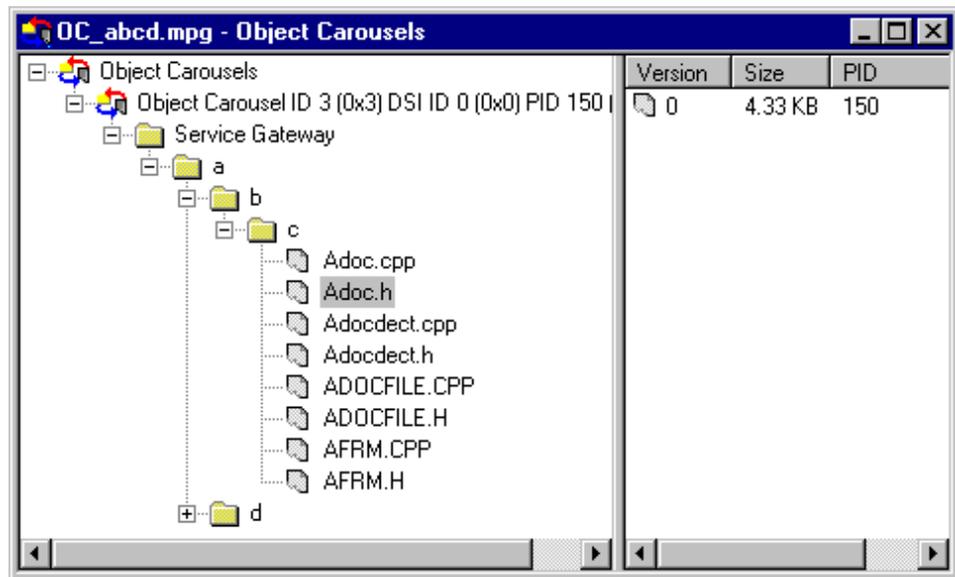
Menu Bar: View > Object Carousels

Toolbar:



The Object Carousel view shows a static view of every object carousel in the transport stream.

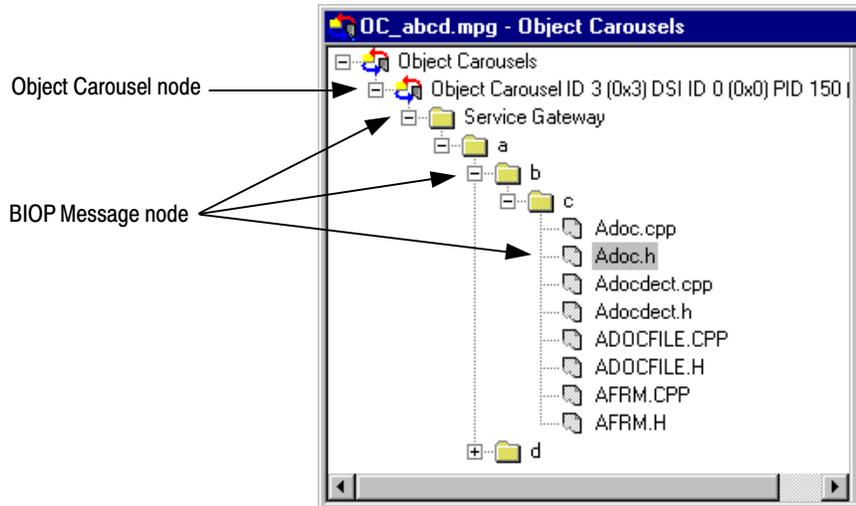
The view is in the style of Windows Explorer. The left pane shows the directory structure of the object carousels, and the right pane lists the versions of the BIOP message currently selected in the left pane.



Double-clicking a file BIOP message can bring up an appropriate viewer application if the operating system can find one (file associations can be set through the Windows Explorer Options). File BIOP messages can also be saved to disk by selecting **File > Save As...**

NOTE. The version number of the BIOP messages represents the version number of the module that carries the BIOP message.

The following diagram indicates the nodes accessible from the Object Carousels view:



Object Carousel node



This node indicates that an object carousel has been signaled in the PSI/SI.

Right-Click Menu Options.

View Application Timing

Opens the Application Management dialog.

View DSI Carrying Carousel IOR

Displays a structure view showing the U-N DSI message that carries the service gateway IOR for this carousel.

BIOP Message node



This node represents a specific BIOP Message. If the node represents a BIOP directory, the directory entries appear as child nodes.

Right-Click Menu Options.

Open

View the message in its native format. This only works for file messages that have an associated viewer application on the PC.

Save As...

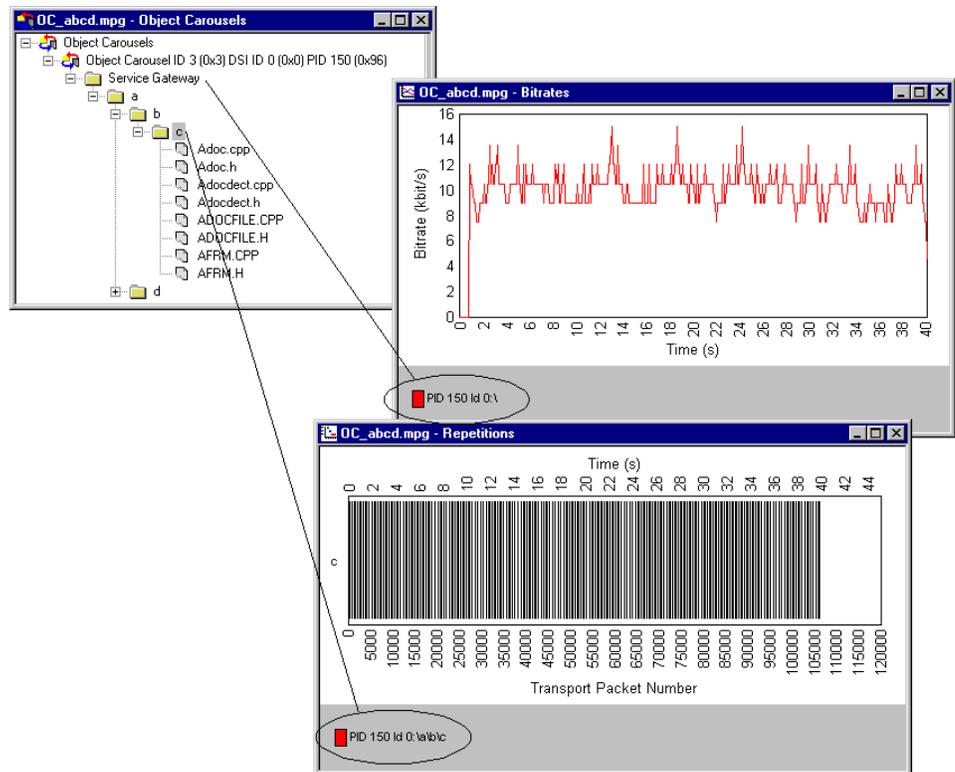
Save the BIOP message to a separate file.

View BIOP Message

Displays a structure view of the next appearance of this BIOP message that can be formed from the current stream position onwards (as indicated by the Transport Packet number displayed in the Transport Packet Bar).

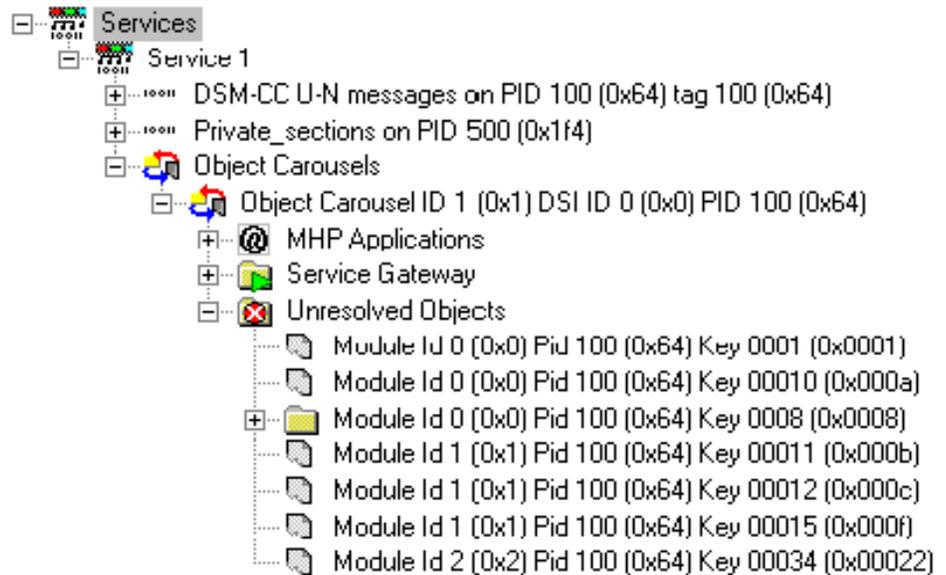
- View Carrier Module** Activates or creates the U-N download view and highlights the module that carries this BIOP message.
- View Cycle Time** ► Allows either cycle time statistics or graphical view of the carousel to be selected.
- View Repetition** Activates or creates a view of the repetition of this BIOP message.
- View Bitrate**
 - > **This BIOP message:** Activates or creates a view of the bit rate of this BIOP message.
 - > **Including nested messages:** View the sum of the bit rates for this BIOP message and all descendant messages (that is, all children and their children). These options are only available for BIOP directory messages.

NOTE. If a Service Gateway is viewed in the Bitrate, Repetition, or Structure view, its name in these views reflects the DSI transaction ID and PID in which it was carried.

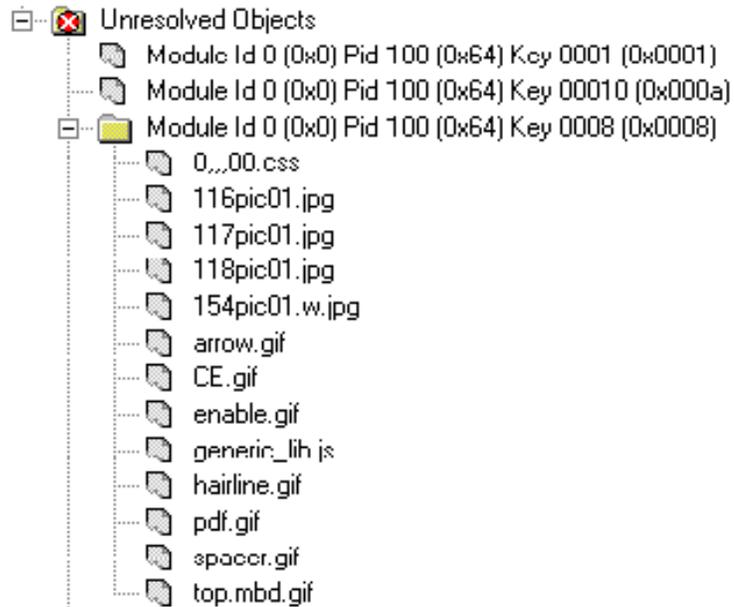


MHP Applications (See *MHP Support*, page 1–91.)

Unresolved Objects When an object is found during analysis, but its key is not referred to in the Service Gateway, it is displayed under an Unresolved Objects node.

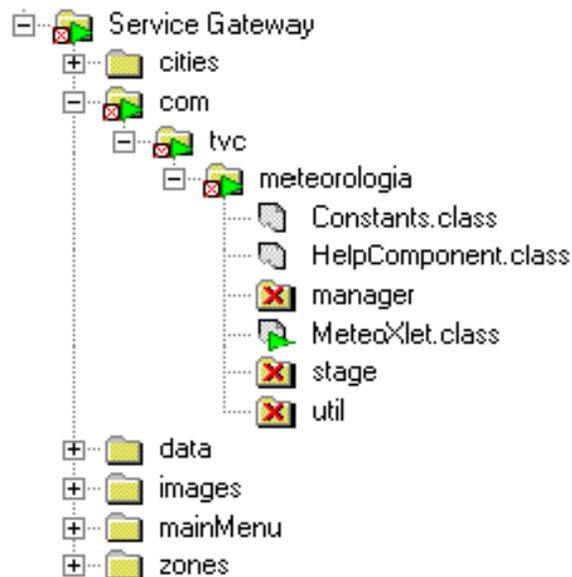


However, when a directory object is found, the keys of its child nodes can be resolved and its tree structure built correctly, even though the directory object itself may still be unresolved.



Absent Objects

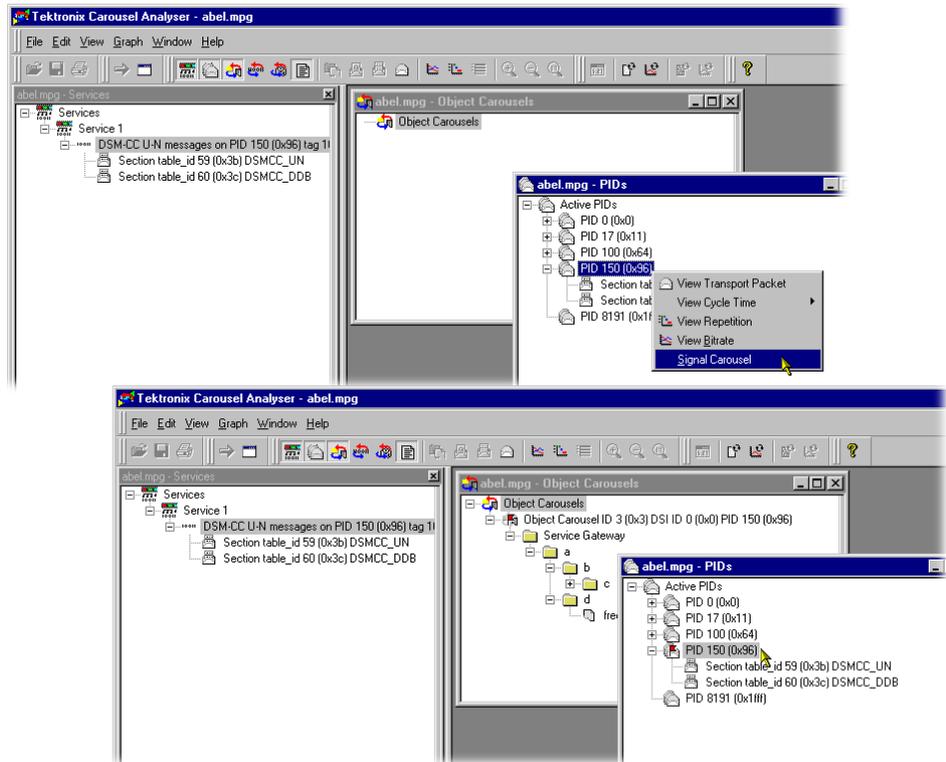
Objects referenced but not found are identified, for example,  - directory object not found. The path in which the absent object is recognized is also marked (.



Manual Signaling

If a carousel is present in a stream, but has not been found during analysis, it can be identified with Manual Signaling from the related PID node.

The Signal Carousel command can be found on the right-click menu associated with each PID node. When this command is selected, the stream will be reprocessed. During processing, only the DSM-CC tables on the selected PID will be analyzed.



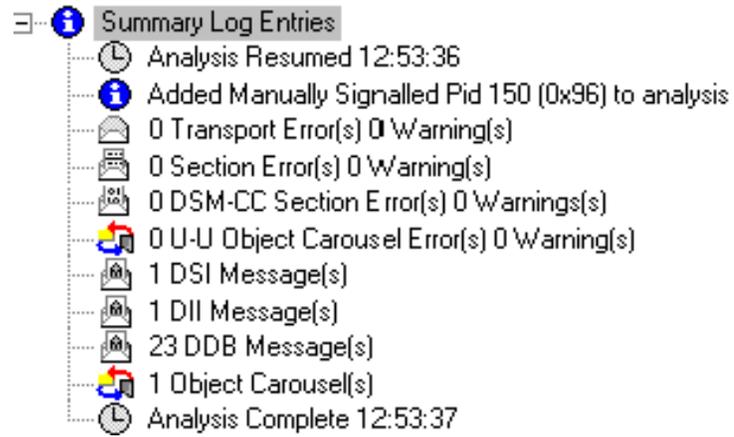
The user interface is updated when the stream has been processed. Any carousels that have been identified are added to the Carousel view. The signal icon, used only in the carousel and PID views, indicates that the PID has been subjected to the manual signaling process.

The PID view will display a list of the table types that were detected during processing.

NOTE. *Carousels that span multiple PIDs will be only partially analyzed. The PID must contain a Service Gateway for any Object Carousel view to be displayed.*

The Log view is refreshed by describing the most recent action, for example, **Added Manually Signalled PID150.**

Any feedback from the Manual Signaling will be displayed in the Summary log.



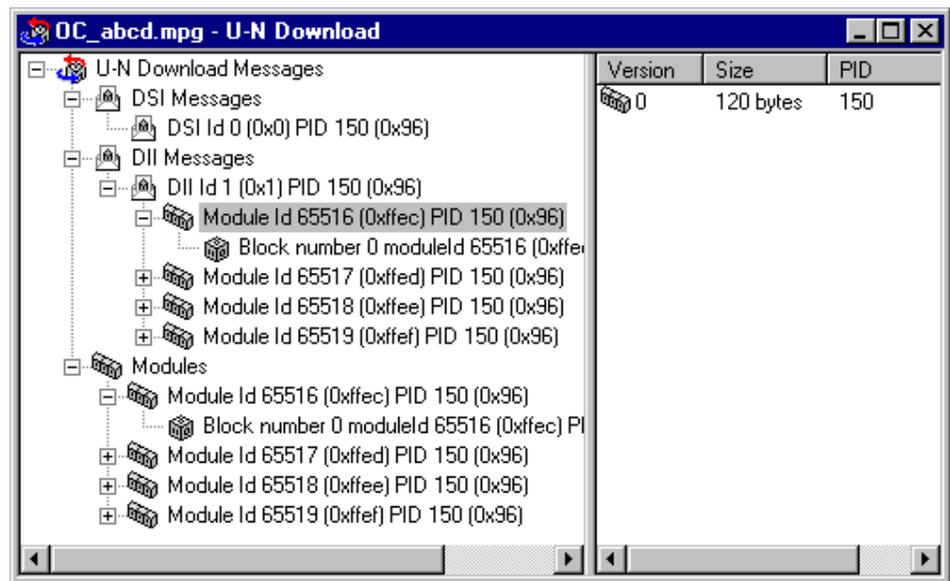
U-N-Download View

Menu Bar: View > U-N-Download

Toolbar: 

This static view shows all the U-N-download (DSM-CC data carousel scenario) messages in the transport stream.

The view is in the style of Windows Explorer. The left pane contains a hierarchical pane on the left and a version pane on the right. The version pane will list the versions of the U-N download message selected in the left pane.

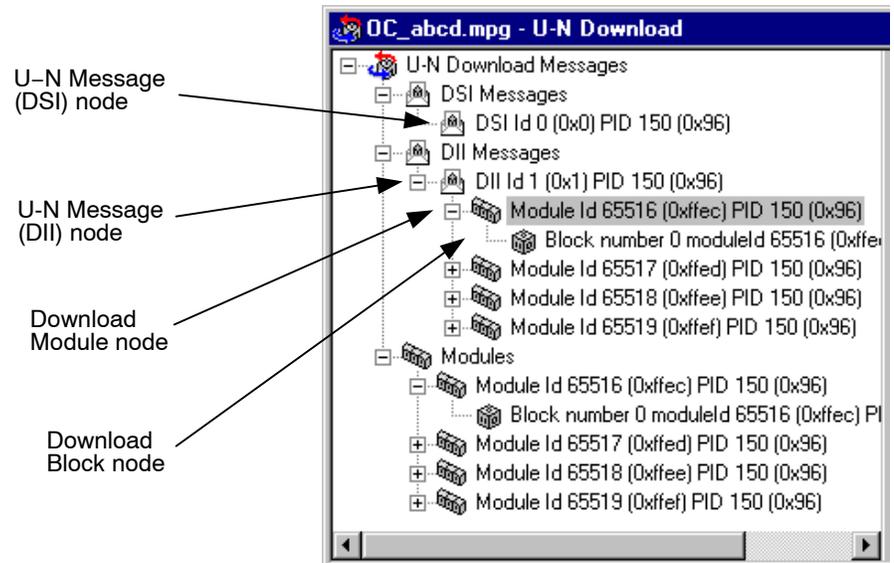


DII items contain module items that the DII message references. All modules are also listed under the “Modules” item.

Modules may be in compressed form; the version of the compressed icon is displayed in the Version column of the right pane. 

Modules are listed independently of DII messages in case the DII does not reference the module correctly; for a compliant stream, each module is listed as a child of the DII node and within the Modules node.

The following illustration indicates the nodes that are accessible from the U-N Download view.



U-N Message (DSI) Node



This node represents a Download Server Initiate message.

Right-Click Menu Options.

- View U-N Message** Displays a structure view of the next appearance of this DSI message that can be formed from the current stream position onwards (as indicated by the Transport Packet number displayed in the Transport Packet Bar).
- View Carrier Section** Displays a structure view of the next appearance of the section that carries this DSI message.
- View Cycle Time >** Allows either cycle time statistics or graphical view of the object to be selected.
- View Repetition** Activates or creates a repetition view of the DSI message.
- View Bitrate** Activates or creates a bit rate view of the DSI message.

U-N Message (DII) Node



This node represents a Download Information Indication message. A DII message may reference modules. If the module reference can be resolved, the DII tree node will contain child Module nodes.

Right-Click Menu Options.

- View U-N Message** Displays a structure view of the next appearance of this DII message that can be formed from the current stream position onwards (as indicated by the Transport Packet number displayed in the Transport Packet Bar).
- View Carrier Section** Displays a structure view of the next appearance of the section that carries this DII message.
- View Cycle Time >** Allows either cycle time statistics or graphical view of the object to be selected.
- View Repetition** Activates or creates a repetition view of the DII message.
- View Bitrate** Activates or creates a bit rate view of the DII message.

Download Module Node



This node represents a U-N Download Module. The download blocks that constitute the module are listed as child nodes.

Right-Click Menu Options.

- View Hex Dump** Displays a data view of the next appearance of this module that can be formed from the current stream position onwards (as indicated by the Transport Packet number displayed in the Transport Packet Bar).
- View Cycle Time >** Allows either cycle time statistics or graphical view of the object to be selected.
- View Repetition** Activates or creates a repetition view of the module.
- View Bitrate** Activates or creates a bit rate view of the module.

Block Node  This node represents a U-N Download Data Block (DDB).

Right-Click Menu Options.

View U-N Message Displays a structure view of the next appearance of this DDB message that can be formed from the current stream position onwards (as indicated by the Transport Packet number displayed in the Transport Packet Bar).

View Carrier Section Displays a structure view of the next appearance of the section that carries this DDB message.

View Cycle Time > Allows either cycle time statistics or graphical view of the object to be selected.

View Repetition Activates or creates a repetition view of the DDB message.

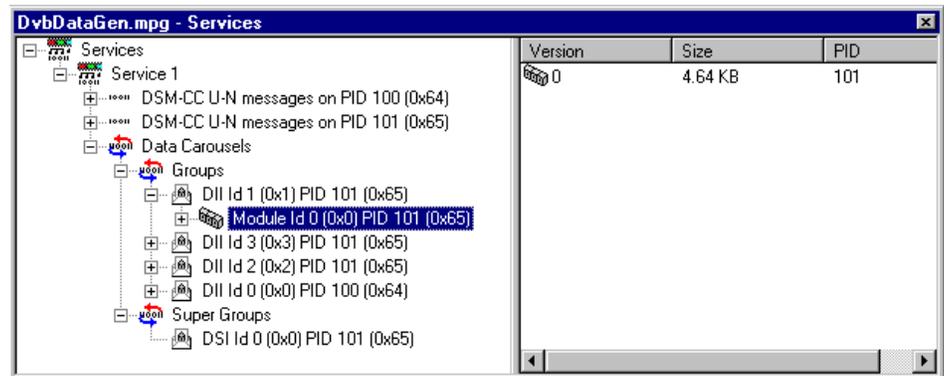
View Bitrate Activates or creates a bit rate view of the DDB message.

Data Carousel (DVB) View

Menu Bar: View > Data Carousel

Toolbar: 

This static view shows all the data carousels in the DVB transport stream. The view is in the explorer style with a hierarchical view in the left pane and a version view in the right.

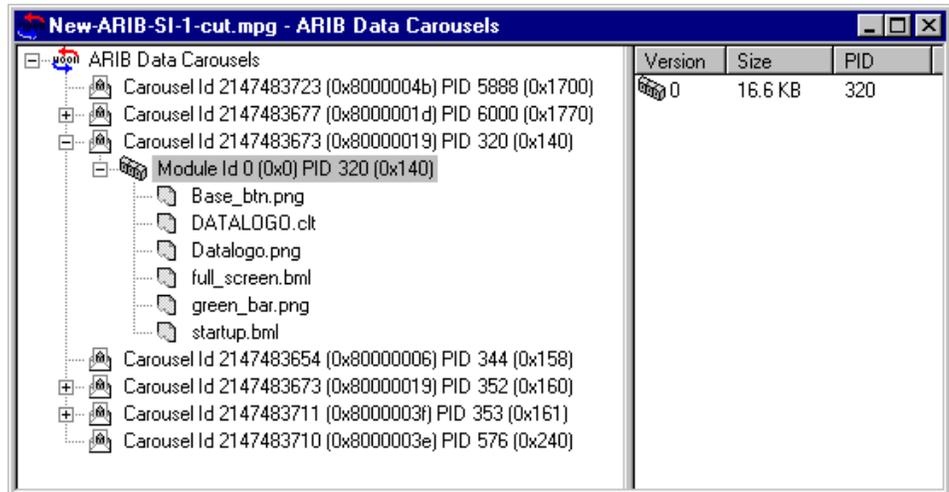


Data Carousel (ARIB) View

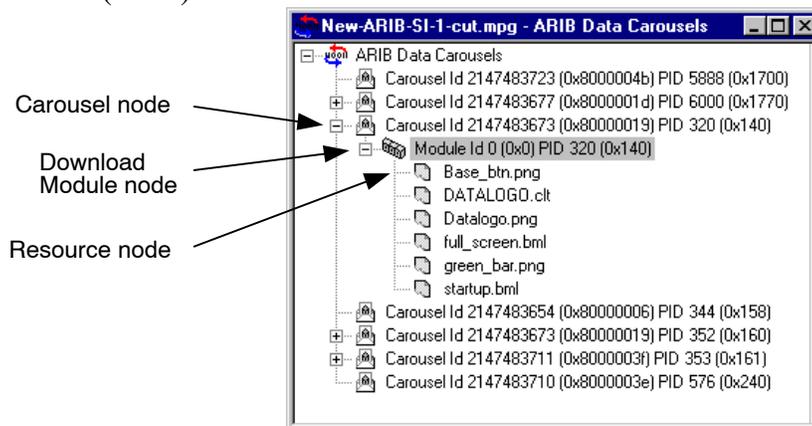
Menu Bar: View > Data Carousel

Toolbar: 

This static view shows all the data carousels in the ARIB transport stream. The view is in the explorer style with a hierarchical view in the left pane and a version view in the right.



The diagram below indicates the nodes that are accessible from the Data Carousel (ARIB) view.



Carousel Node



This node represents a single Data Carousel in the ARIB data carousel structure.

Right-Click Menu Options.

- View U-N Message** Displays a structure view of the next appearance of this DII message that can be formed from the current stream position onwards (as indicated by the Transport Packet number displayed in the Transport Packet Bar).
- View Carrier Section** Displays a structure view of the next appearance of the section that carries this DII message.
- View Cycle Time >** Allows either cycle time statistics or graphical view of the object to be selected.
- View Repetition** Activates or creates a repetition view of the DII message.
- View Bitrate** Activates or creates a bit rate view of the DII message.

Download Module Node



This node contains all of the resources available to a module.

Right-Click Menu Options.

- View Resources** Displays the Resource view of the selected module.
- Save Resources** Saves the resource files to a selected location. The header information is not saved.
- View Cycle Time >** Allows either cycle time statistics or graphical view of the object to be selected.
- View Repetition** Activates or creates a repetition view of the module.
- View Bitrate** Activates or creates a bit rate view of the module.

(See also *ARIB Module Versions*, page 1–49.)

Resource Node



Each Resource node is a leaf node containing one resource file.

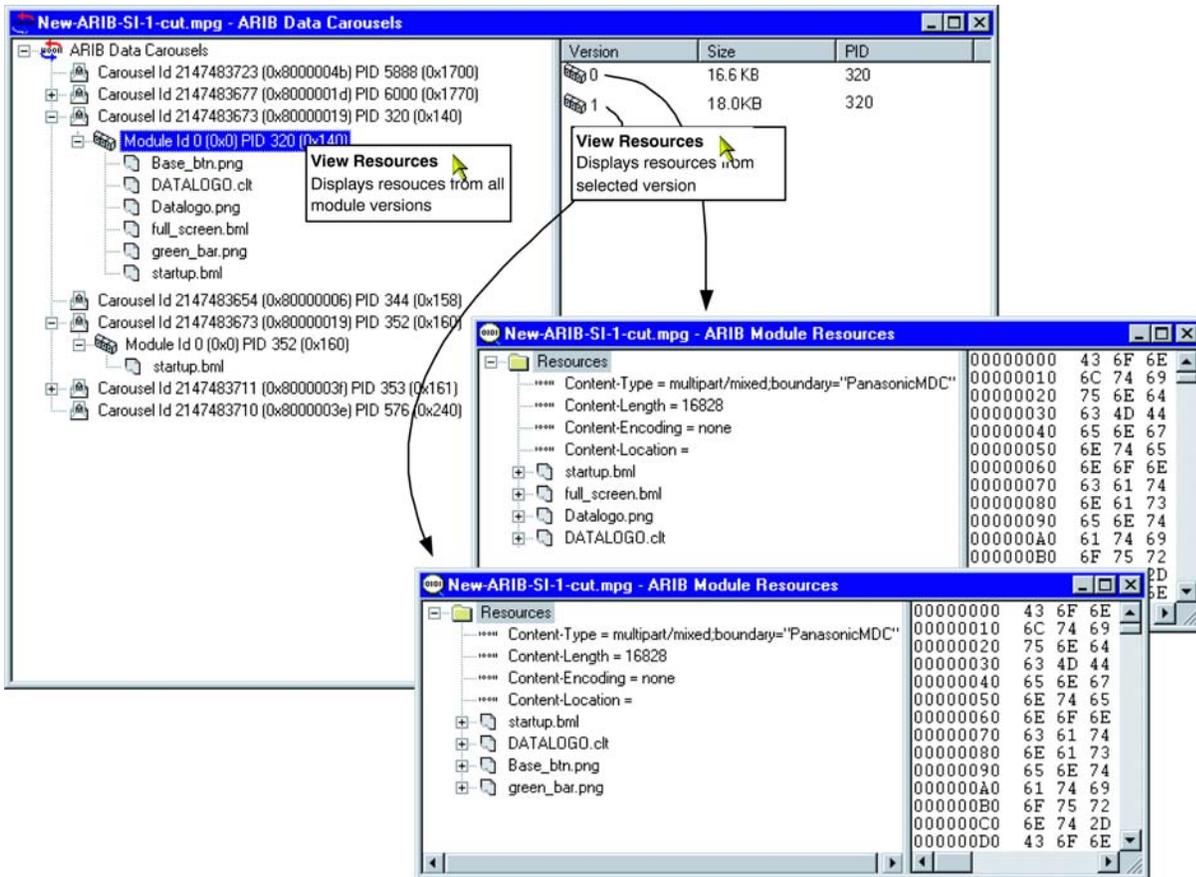
Right-Click Menu Options.

- | | |
|-------------|--|
| Open | Opens the resource in an associated application to allow it to be viewed. If no association has been made with the file type on the host computer, a message is displayed. |
| Save | Saves the resource file to a selected location. The header information is not saved. |
| View | Displays the Resource view. The selected resource is highlighted in the Resource view. |

ARIB Module Versions

Note that there may be multiple versions of a single ARIB module. Each version of the same module can potentially contain different resources. For example, Version 1 may contain resources A, B, and C and Version 2 may contain resources C, D, and E.

When viewing the resources in Data Carousel and Service/Program views, the resources listed under the Module node will be all resources across all versions, for example, A, B, C, D and E. When opening or saving any of these resources from Data Carousel or Service/Program views, the operation will work on the first version encountered in the stream (A, B, and C will come from Version 1 and D and E will come from Version 2). Basically, these two views contain a summary of all the resources encountered in that module regardless of version.

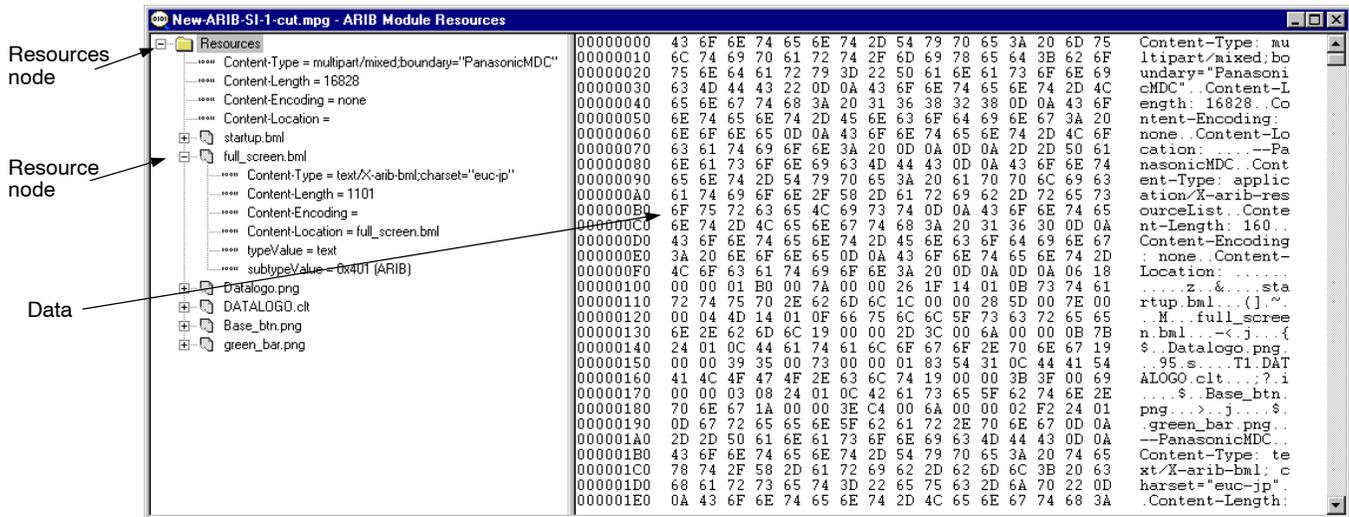


The ARIB Resource view will show only the resources contained in an individual module version - to view resources from different module versions, the user must use the **Go To Next** command or open a different version in ARIB Resource view.

Resource View

Menu Bar: View > Resources

The ARIB Resources view displays a hierarchical and raw data interpretation of the resource structure in Data Carousels. The raw data is presented in hexadecimal and ASCII form in the adjacent pane.



Resources Node

 This Resources node displays a header and the resources associated with one Module.

Right-Click Menu Options.

 **Go To Next** Displays the next occurrence of the Resource node in the transport stream (note the change of **Packet** number in the Status bar).

Save Saves the resource files to a selected location. The header information is not saved.

Resource Node



Each Resource node displays header information and a resource.

Right-Click Menu Options.

Open

Opens the resource in an associated application to allow it to be viewed. If no association has been made with the file type on the host computer, a message is displayed.

Save

Saves the resource file to a selected location. The header information is not saved.

Data

Represents the currently selected tree node.

Right-Click Menu Options.



Save As...

Saves the Module Resource data to a selected location.



Go To Next

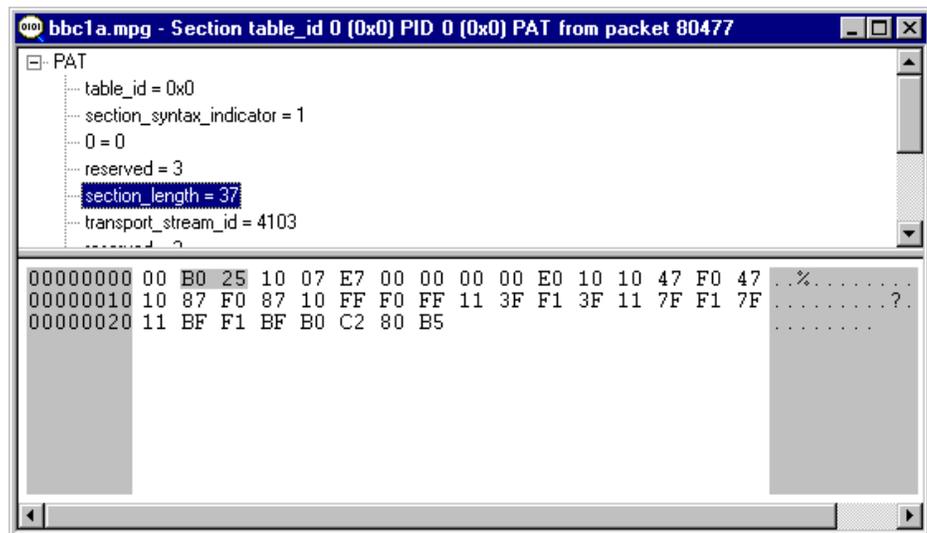
Displays the next occurrence of the Resource node in the transport stream (Note the change of **Packet** number in the Status bar).

View Transport Packet List

Displays the **Transport Packet Contributions** view which lists the transport packets that have contributed to the resources in the module (See *Structure Views*, page 1–52).

Structure Views

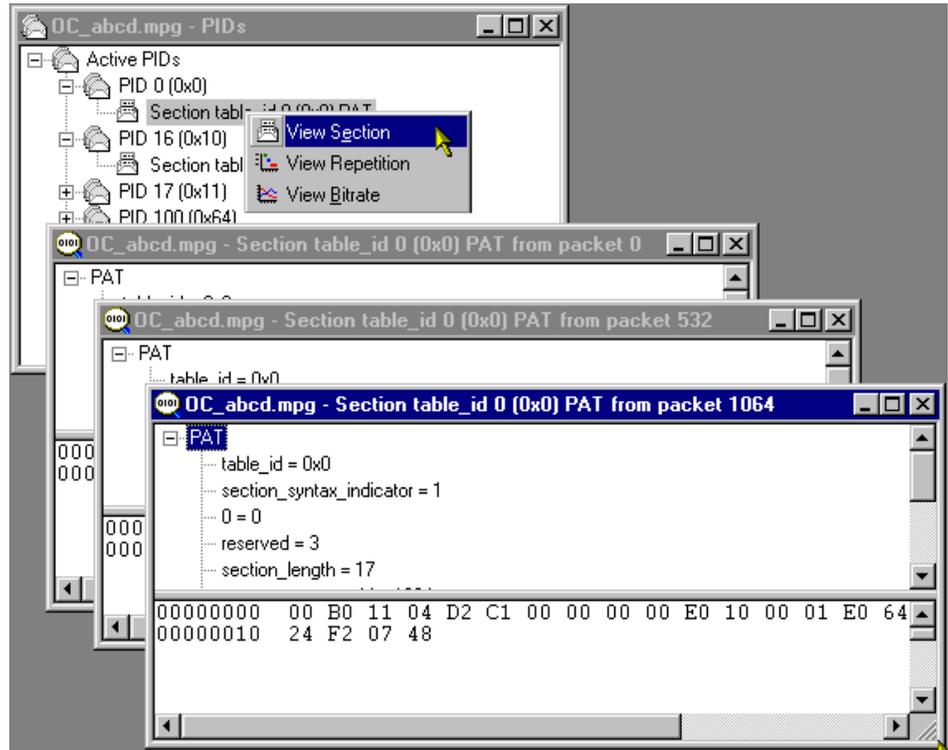
Structure views display a hierarchical and raw data interpretation of a structure (BIOP Message, U-N Message, Module, Section, or Transport Packet). The hierarchical view is based on a script from the script files that are loaded (see *Script Selection and Manipulation*, page 1–6). Raw data is presented in hexadecimal and ASCII format in the lower pane.



Highlighting an element in the table window will automatically highlight the section of the hexadecimal code that contains the selected information.

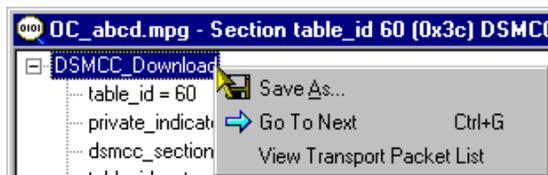
The view will bring up the first appearance of a particular message in the transport stream reading from the current packet position. To view the next appearance, select **Edit > Go to Next**. This will display the next repetition of the message in the open structure view window; if necessary, it will wrap to the first occurrence.

For example, in the screenshot below, the PAT first appears in transport packet 0. Selecting **Go to Next** and viewing the section again will show the next repetition of the PAT on transport packet 532 and so on.



Since the structure view is based on a script, the script can be edited and the presentation of the packet or message changed.

Right-clicking on the any item in the structure view will open this menu:



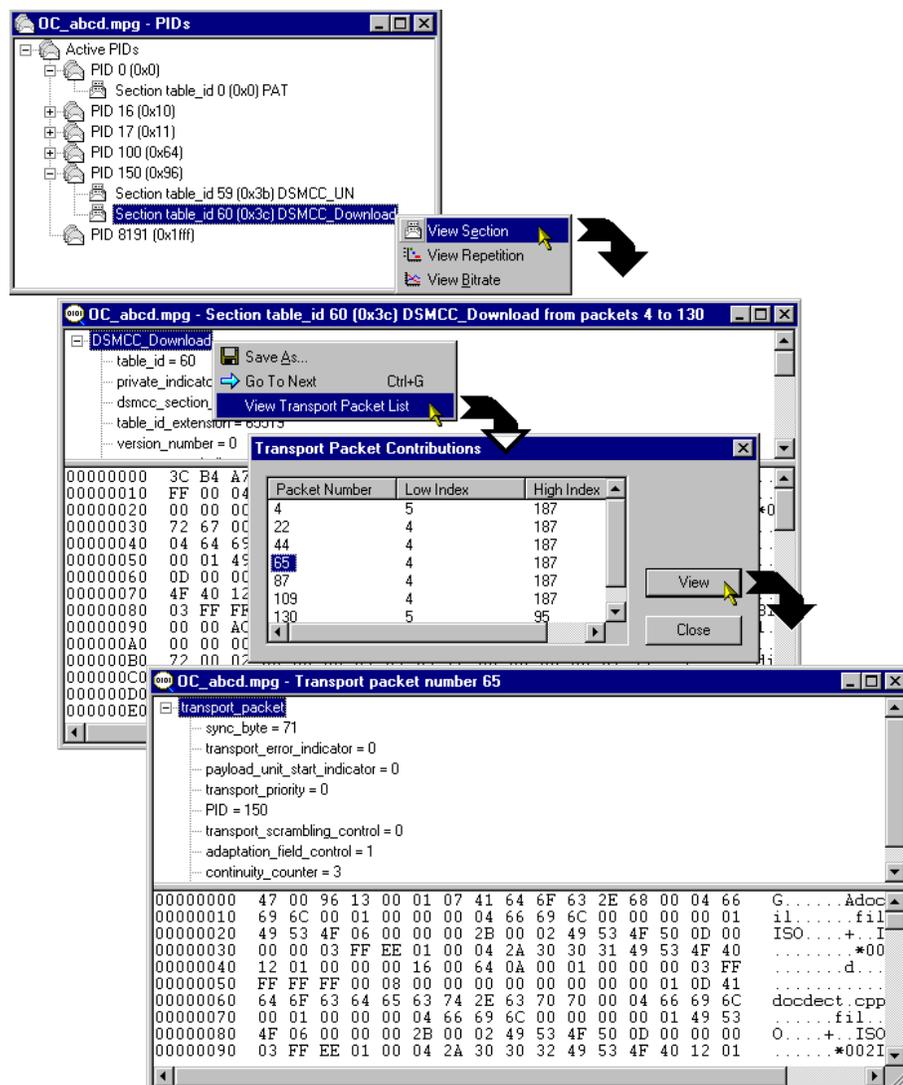
Using the **Save As...** option, the structure can be saved to a separate file.

The **Go To Next** option moves the structure view to the next repetition of the same item. If the current view is the last in the stream, the option will loop back to the first repetition in the stream.

The information displayed by the structure view may be carried in one or more transport packets. By right-clicking the item and selecting **View Transport Packet List**, a list of the transport packets carrying the information will be displayed. Highlighting a **Packet Number** and selecting **View** will display the selected transport packet structure. Several structure views can be opened in this way but the views are not enabled until the **Transport Packet Contributions** dialog is closed.

The Low and High Index entries in the **Transport Packet Contributions** dialog box indicate the first and last byte respectively of the packet that contributes to the structure.

The screenshots below illustrate an example of this sequence of actions:



Bitrate View

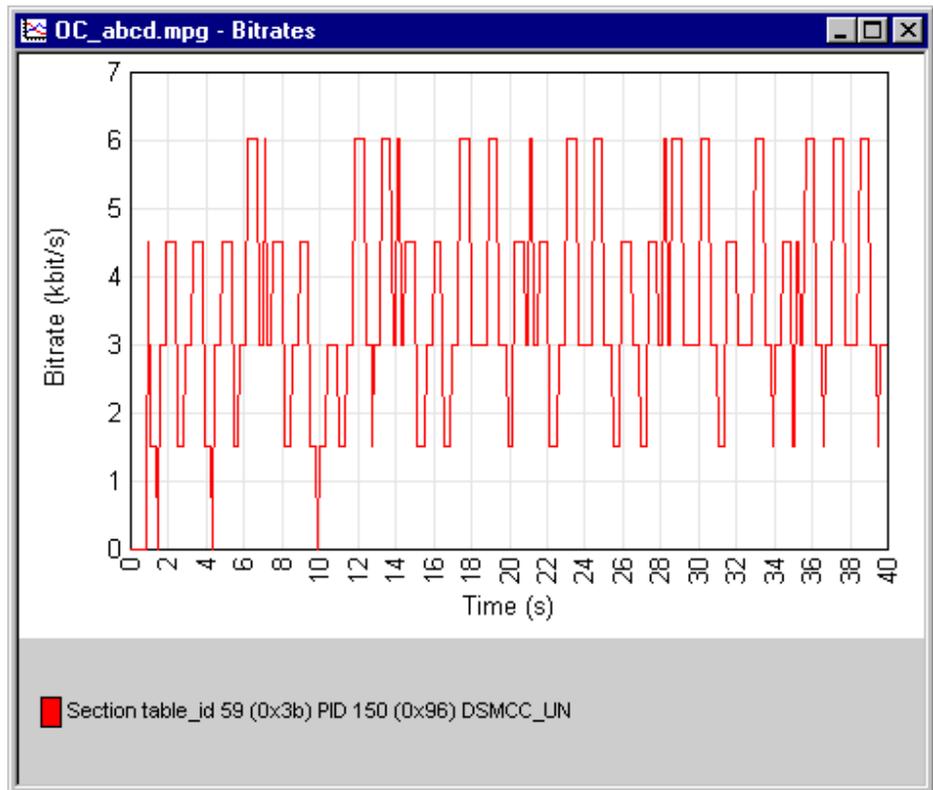
Menu Bar: View > Bitrate

Toolbar: 

This structure view charts the bit rate of a set of transport entities (for example, BIOP message, PID, module). The bit rate calculation is a rolling average. For any transport entity the sum of the transport packets that contribute to that entity in each 100 ms time-slice are summed. The average is calculated every 100 ms using the last 10 time-slices (that is, the bit rate is the average over the last second).

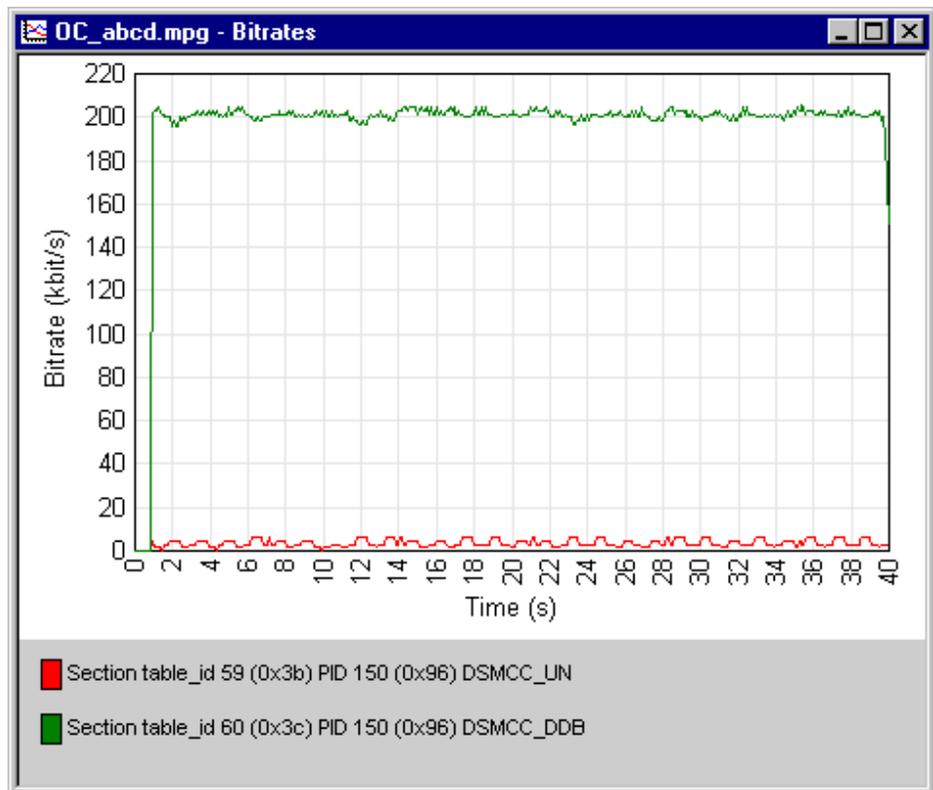
In some cases a choice is offered between displaying the bit rate of the selected element or a composite bit rate of the selected element and its subsidiary (nested) elements.

NOTE. In calculating bit rates, Carousel Analyzer returns to the stream file. For large files, the calculation may take an appreciable amount of time.



The y-axis is automatically scaled to accommodate the maximum bit rate. The name of the element from which the bit rate is derived and the related graph are linked by color; a line (of the same color) is displayed to the right of the element name.

If the bit rate for a second element is requested, it is displayed on the same graph, as shown in the following illustration:



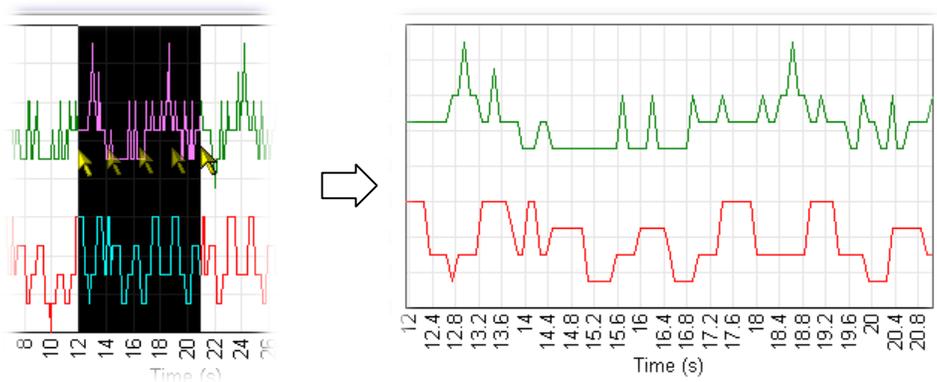
Any number of element bit rates can be displayed; each will be a separate color.

Inspecting Bitrates

It is possible to zoom in on an area of the graph in order to inspect the bit rate in detail.

To zoom in on the central 50% of the displayed graph, use the **Graph > Zoom > Zoom In** menu option (or the Toolbar button: ; or tab key). This action can be repeated.

To zoom in on any area of the bit rate graph, drag the mouse while holding the left-button, to highlight the area required. When the mouse button is released, the highlighted area will be enlarged to fill the graph area.



The menu option **Graph > Zoom > Zoom Out** (Toolbar: ; or shift-tab key) will zoom out one step at a time; a step being the previous zoom in actions.

The menu option **Graph > Zoom > Show All** (Toolbar: ) will redisplay the graph with no zoom factor applied.

Saving/Copying

The graph can be saved or copied in text format or as a picture file (JPEG or bitmap).

Menu Option	Description
Graph > Save	Save the graph to a user defined location.
> Bitmap	Size the graph window before saving.
> JPEG	Size the graph window before saving.
> Table	Tab delimited format.
Graph > Copy	Copy to clipboard, from where it can be pasted into a suitable application:
> Image	
> Table	Tab delimited format.

Repetition View

Menu Bar: View > Repetition

Toolbar: 

This structure view charts the repetition of a set of data broadcast entities. This Gantt style graph displays a row for each transport entity (for example, BIOP message, U-N message etc) selected. A colored block on the row indicates the presence of the message at that point in the transport stream.

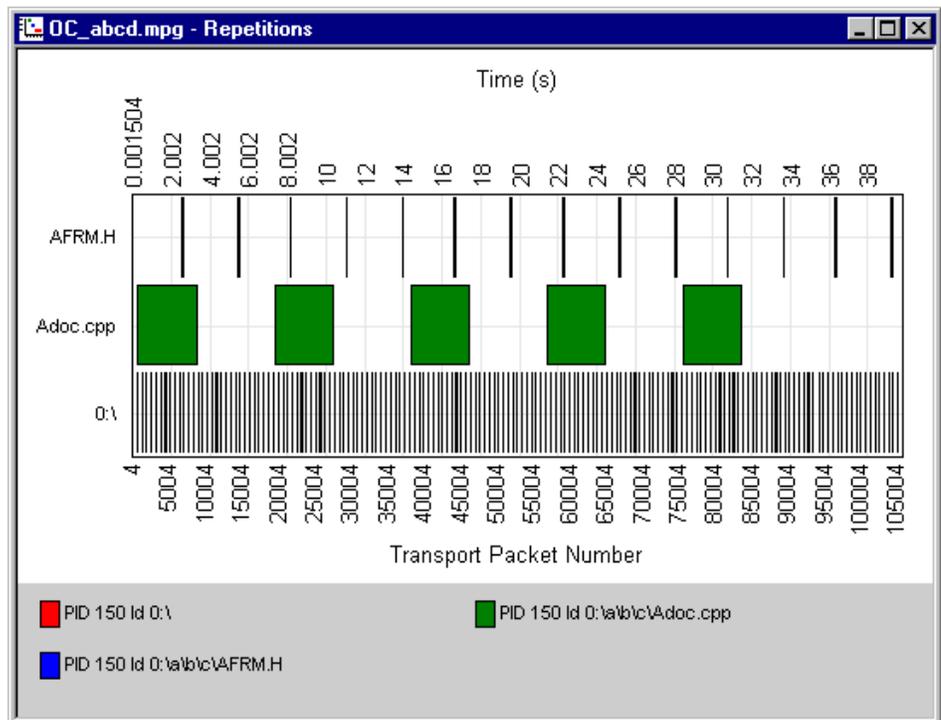
NOTE. In calculating repetition rates, Carousel Analyzer returns to the stream file. For large files, the calculation may take an appreciable amount of time.

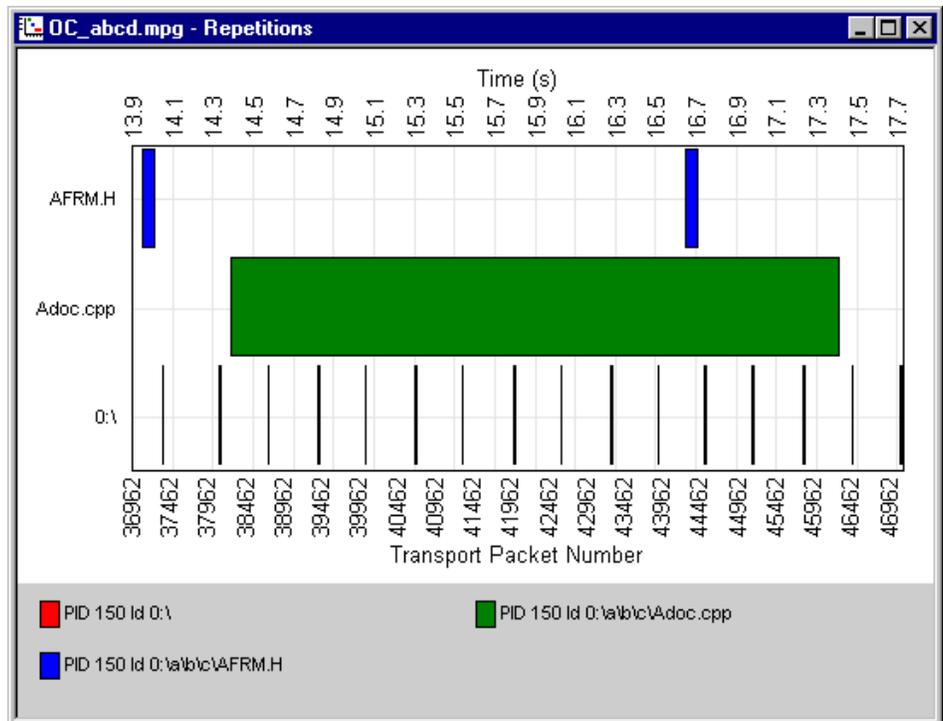
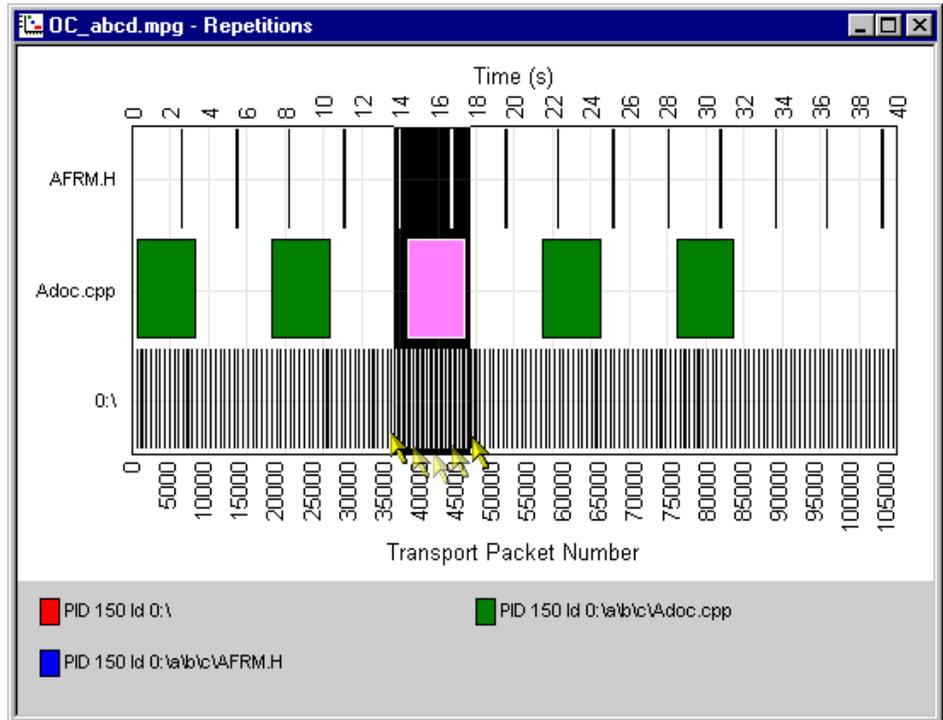
Inspecting Repetition Rates

It is possible to zoom in on an area of the graph in order to inspect the repetition rate in detail.

To zoom in on the central 50% of the displayed graph, use the **View > Zoom > Zoom In** menu option (or the Toolbar button). This action can be repeated.

To zoom in on any area of the repetition rate graph, drag the mouse while holding the left-button, to highlight the area required. When the mouse button is released, the highlighted area will be enlarged to fill the graph area.





The **View > Zoom > Zoom Out** menu option (Toolbar:  or shift-tab key) will zoom out one step at a time; a step being the previous zoom in actions.

The **View > Zoom > Show All** menu option (Toolbar: ) will redisplay the graph with no zoom factor applied.

Tooltips: When the cursor is placed over a block, a tooltip provides the PID, time, and packet number.

Saving/Copying

The graph can be saved or copied in text format or as a picture file (JPEG or bitmap).

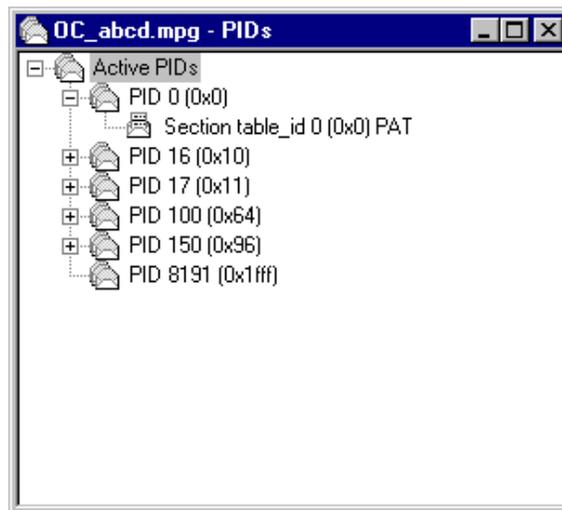
Menu Option	Description
Graph > Save	Save the graph to a user defined location.
> Bitmap	Size the graph window before saving.
> JPEG	Size the graph window before saving.
> Table	Tab delimited format.
Graph > Copy	Copy to clipboard, from where it can be pasted into a suitable application.
> Image	Copy image.
> Table	Tab delimited format.

PID View

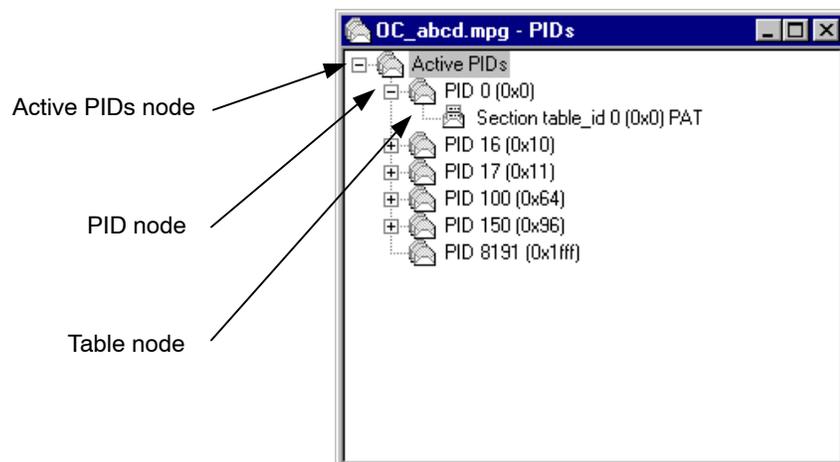
Menu Bar: View > PIDs

Toolbar: 

This static view displays all the active PIDs within the transport stream. A PID carrying sections will have nested items, which detail the table types on that PID. The structure, bit rate, and repetition of transport packets and sections are available from this view.



The following diagram indicates the nodes accessible from the PIDs view.



Active PIDs Node



This node represents all the PIDs found in the current transport stream; the PIDs are listed as child items.

Right-Click Menu Options.

View Transport Packet

Displays a structure view of the packet at the current stream position (as indicated by the Transport Packet number displayed in the Transport Packet Bar).

PID Node



Represents all the transport packets with a particular PID. If the PID carries sections then the PID tree node will have child table tree nodes.

Right-Click Menu Options.

View Transport Packet

Displays a structure view of the next transport packet encountered on this PID from the current stream position (as indicated by the Transport Packet number displayed in the Transport Packet Bar).

View Cycle Time >

Allows either cycle time statistics or graphical view to be selected.

View Repetition

Activates or creates a view of the repetition of this PID in the transport stream.

View Bitrate

Activates or creates a view of the bit rate of this PID.

Table Node



This node represents the stream of sections present on a specific PID with a specific table identity.

Right-Click Menu Options.

- View Section** Displays a structure view of the next section with this PID and table identity that can be formed from the current stream position onwards (as indicated by the Transport Packet number displayed in the Transport Packet Bar).
- View Cycle Time >** Allows either cycle time statistics or graphical view to be selected.
- View Repetition** Activates or creates a view of the repetition rate of this PID with this PID and table identity.
- View Bitrate** Activates or creates a bit rate view of sections with this PID and table identity.
- Signal Carousel** (See *Manual Signaling*, page 1–39.)

Log View

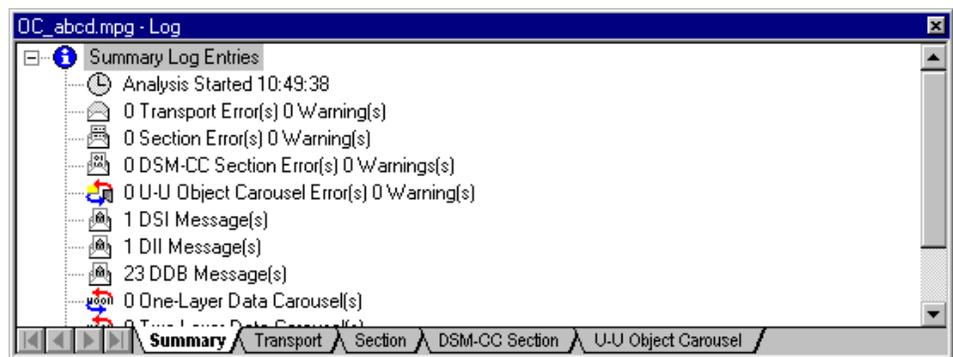
Menu Bar: View > Log

Toolbar:



The log view is a tabbed window with each tab representing information about a particular MPEG-2 layer. Each tab contains any miscellaneous information about the transport stream that has been analyzed. For example, packets that have the transport_error_bit set will have an entry in the transport log tab.

The diagram below indicates the information that is accessible from the Log view.



Summary This view provides a summary of the transport stream analysis.

Transport Packet Log View

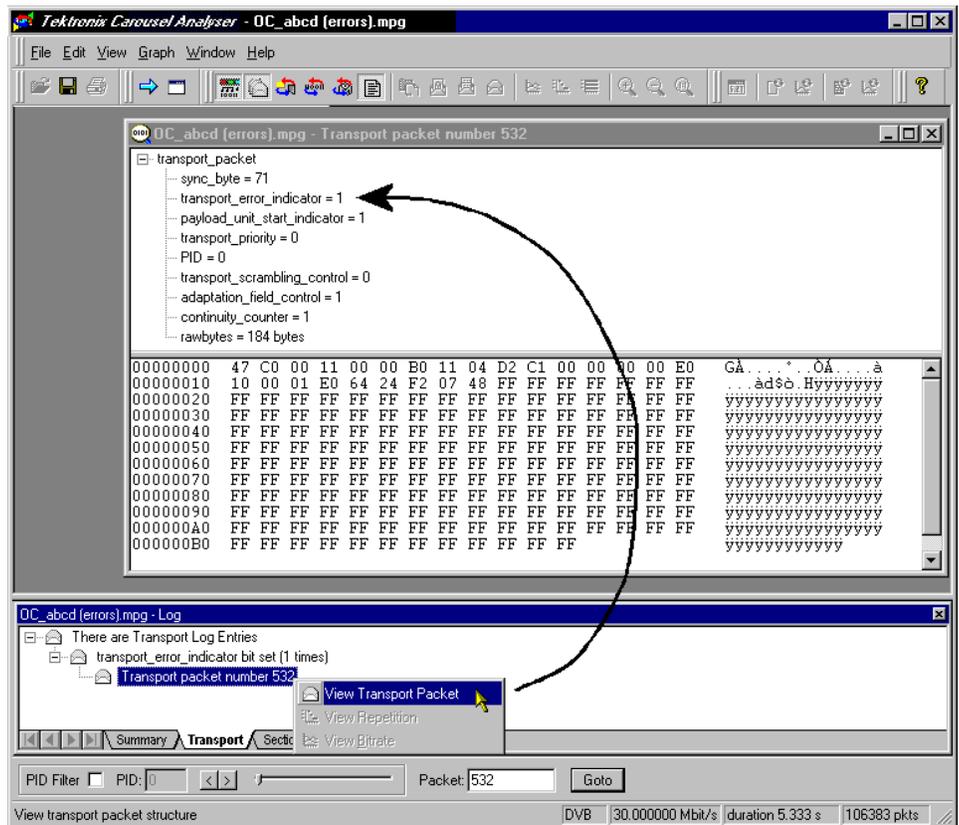


This view displays the errors that have been logged in transport packets during analysis of the stream.

Right-Click Menu Options.

View Transport Packet

Displays a structure view of the highlighted transport packet.



Section Log View



This view displays the errors that have been logged in sections during analysis of the stream.

Right-Click Menu Options.

View Section Displays a view of the highlighted section.

DSM-CC Section Log View

This view displays the errors that have been logged in DSM-CC sections during analysis of the stream.

Right-Click Menu Options.

View Section Displays a view of the highlighted DSM-CC section.

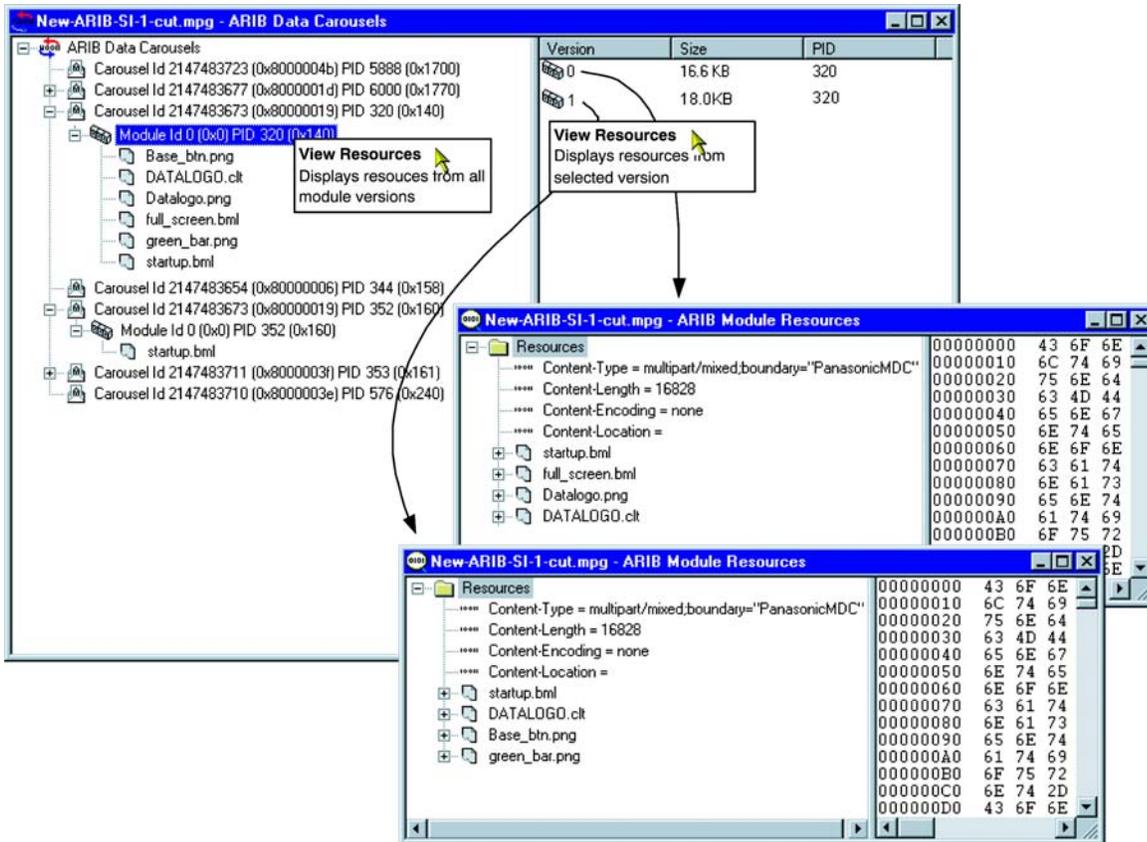
U-U Object Carousel

This view displays the warnings that have been logged in U-U Object sections during analysis of the stream.

Cycle Times View

Cycle times can be calculated for either a carousel (given a starting point) or an entity in the transport stream.

In the following diagram, a carousel is shown carrying objects A, B and C.



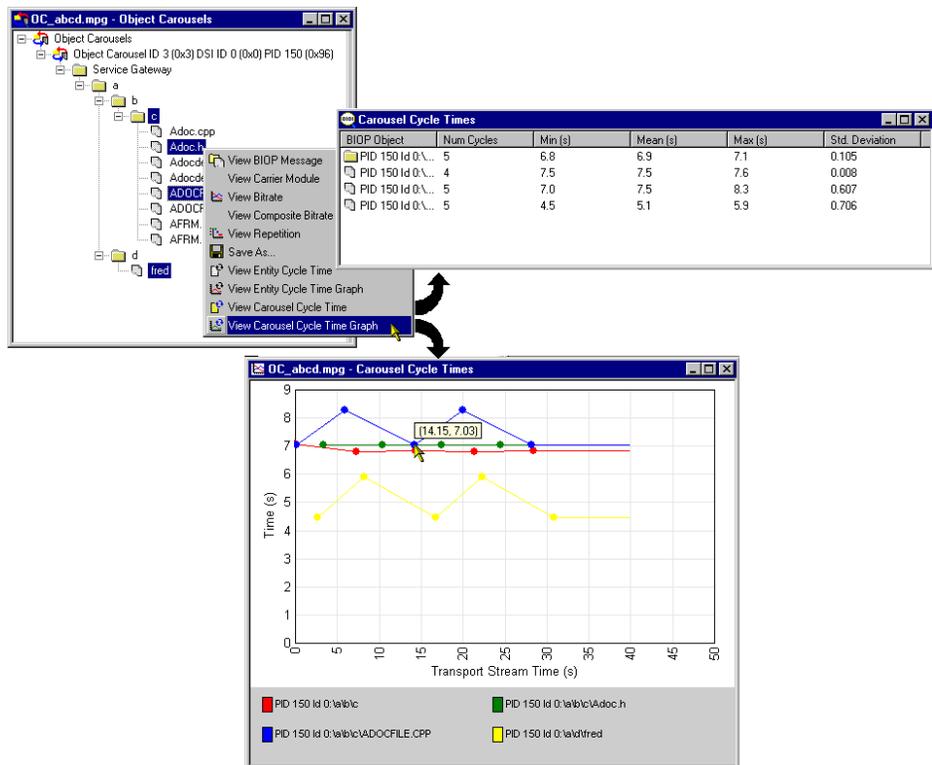
In this example, object B is identified as the starting point for both carousel and entity cycle timing. The cycle time of a carousel is the time taken to receive all of the objects within the carousel given a specified starting point in the carousel. The cycle time of any given entity in the transport stream (including Section, BIOP Object, PID and U-N Message) is the time taken from the start of an instance to the start of the next instance.

The cycle times calculated give the maximum, minimum and mean times for the occurrences of an object in a transport stream in seconds; standard deviation and number of cycles found will also be displayed. The statistics can also displayed in graphical format.

Carousel Cycle Times Statistics

The cycle time of an object carousel is the time taken for all components of the carousel to be received starting with a selected component of the carousel.

Selecting one or more BIOP objects from a carousel and **View Carousel Cycle Time** from the right-click menu generates the **Carousel Cycle Times** statistics window. The information can also be displayed in graphical form by selecting **View Carousel Cycle Time Graph**.



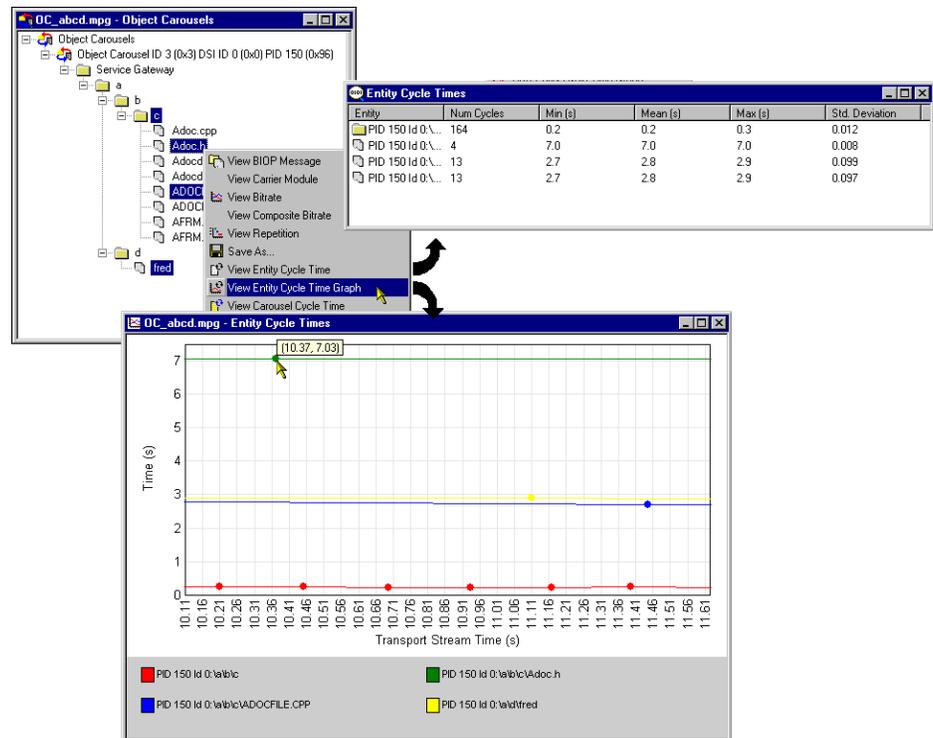
In the Carousel Cycle Times window, the BIOP Object column identifies the PID, Carousel ID and Object that the user identified as a starting point for the test.

The information can also be displayed in graphical form.

Entity Cycle Times Statistics

Similarly, the cycle time of any entity (object) in the transport stream is the time between the start of an instance of the entity and the start of the next instance.

Selecting one or more entities in any view and **View Entity Cycle Time** from the right-click menu generates the **Entity Cycle Times** statistics window. The information can also be displayed in graphical form by selecting **View Entity Cycle Time Graph**.



The Entity column identifies the PID, Carousel ID and Object that the user identified as a starting point for the test.

In both Carousel and Entity statistics windows, further cycle time statistics will be added to the bottom of the list while the window remains active.

Similarly, with one or more entries in a **Cycle Times** window selected, the right-click menu allows the user to display a graph of the cycle times or export cycle time statistics to a text file.

Application Support

Carousel Analyzer provides a means of testing the effects of associating applications with Object Carousels. An application consists of a “boot class” and “assets”. Typically, a boot class will comprise a Java or HTML class; assets may be images or text required by the boot class.

A comprehensive range of tests and measurements is provided in addition to application management tools.

A single Object Carousel may be timed with several applications in the Carousel Analyzer.

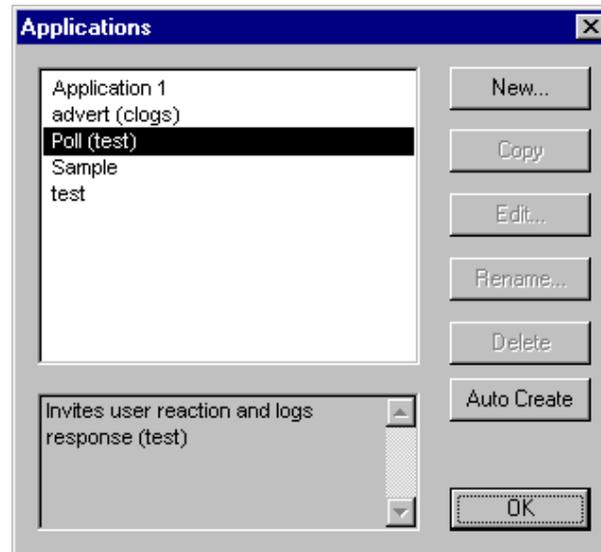
Application Management

The Application management dialog shows the applications currently defined and allows the user to manage them. The user can also create new applications.

When defining an application, it may be done by adding application tree nodes manually using context menus, or by moving parts of currently available object carousels over to the application. It is also possible to move over sub-trees from the hard disk to the application definition.

If an asset is specified as a wildcard, the timing will wait for that asset and all child assets that are found in the transport stream. This means that a directory can be specified as a wildcard asset and any content found underneath it in the transport stream will be treated as an asset, for example, specify `\bin\start-up.class` as the boot class, and `\images\` as a wildcard directory asset. Any content in the `\images\` directory in the carousel will be treated as an asset.

To open the **Applications** management dialog, select **Edit > Applications**. The following dialog box is displayed:



In the Applications management dialog, the main list displays those applications that have already been created. Application data is stored locally in the file C:\Program Files\Tektronix\DataTestSystem\applications.dat; this is the installation directory but it may have been modified by the user. This data file can be copied to other Carousel Analyzer installations if required.

A summary of the highlighted application is displayed below the list; the user should enter this summary when the application is created.

The dialog button functions are described as follows:

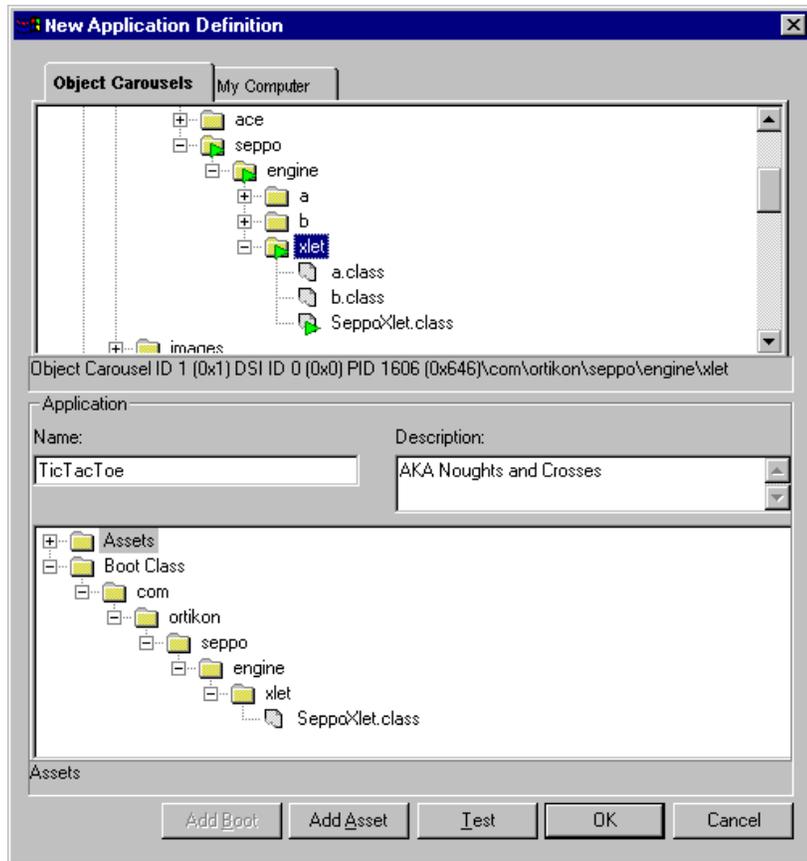
- | | |
|------------------|---|
| New | Allows a new application to be defined in the New Application Definition dialog box.
Keyboard shortcut: Insert . |
| Copy | Creates a copy of the highlighted application. The new application is allocated a modified name (Copy of). |
| Edit... | Allows the highlighted application to be edited in the Edit Application Definition dialog box.
Shortcut: Double-click application name. |
| Rename... | Allows the highlighted application to be renamed.
Keyboard shortcut: F2 . |
| Delete | Deletes the highlighted application after receiving confirmation from the user.
Keyboard shortcut: Delete . |

Auto Create Creates an application definition for each MHP application that is found in the stream. The boot class for each application is also set up.

Select **OK** to close the dialog box. All of the buttons, except **New**, are disabled unless an application is highlighted; **New** is always enabled.

Application Definition

Applications are defined using the **New Application Definition** dialog as shown in the following illustration:

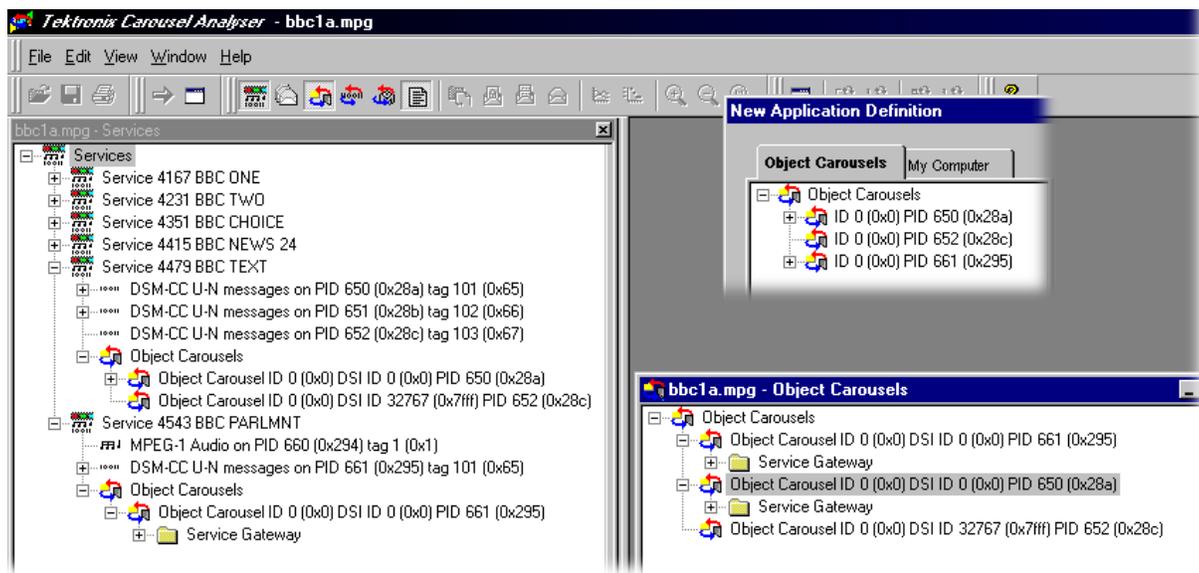


(Initially the Application panes will be empty except for the root nodes (**Boot Class** and **Assets**)).

The elements of the **New Application Definition** dialog box are as follows:

Object Carousels tab: This displays all of the object carousels in the current transport stream. Note that if the current transport stream carries no object carousels, then none will be displayed here.

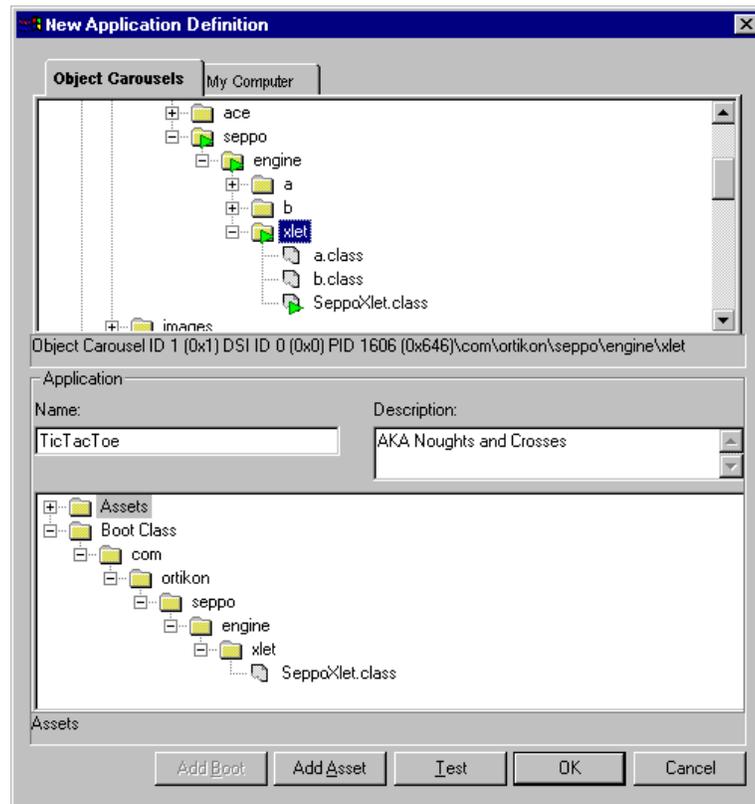
The example screenshot below shows the Object Carousels displayed in the **New Application Definition** dialog box overlaid onto the standard Object Carousel views.



Name Enter the name of the application.

Description An optional field that allows a brief description of the application to be entered.

The boot class and the assets are displayed as parts of a tree structure in the lower pane. The boot class is the object that must be loaded first in an application (an executable image). Assets are data objects to be used by the Boot Class in the same carousel (for example, picture files, and text files).



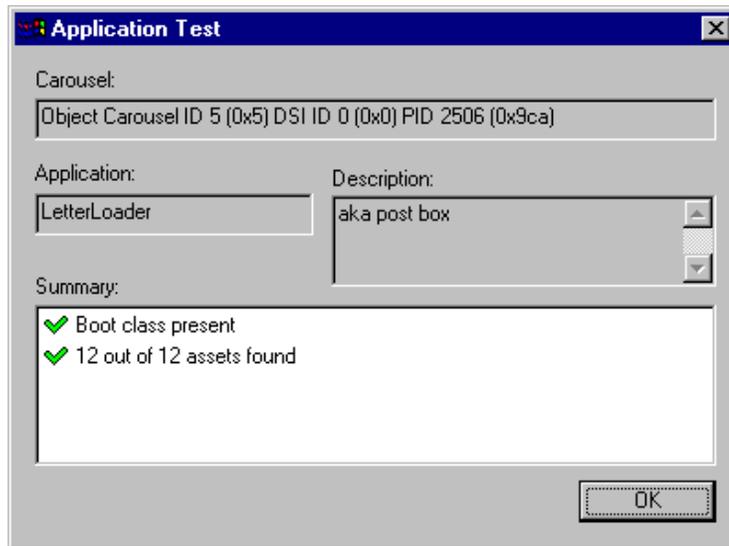
Selecting the **OK** button closes the dialog box and stores the new application data. The action will be refused if a boot class object has not been specified. If a duplicate application name has been entered, it must be renamed.

The boot class must be in the associated carousel; if it is not, the timing test cannot be performed. An asset is a BIOP object in the carousel that is used by the boot class. If the asset is not in the associated carousel, the user will be warned that the assets could not be found and the tests will be performed as if those assets had not been defined.

Selecting the **Cancel** button closes the dialog and discards the new application data.

Testing an Application

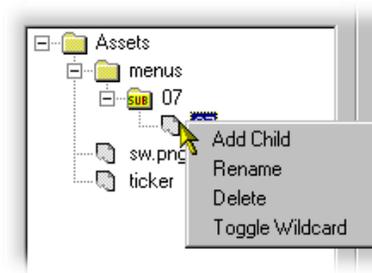
The **Test** button at the bottom of the application dialog box allows items in the application to be tested against the currently selected carousel. This can be used to ensure that the correct carousel has been selected for the application and that all of the objects are present. The results of the test are displayed in the **Application Test** dialog.



Adding Objects to the Application

Objects are moved from the Object Carousel pane to the Boot Class or Asset panes using the **Add Asset** button. To do this, highlight the object in the Object Carousel pane, select **Add Asset**, and note that the object is added to the adjacent application structure.

- Making a node that has children an asset will automatically include all the children as assets. To include every object in a carousel, add the carousel root node to the application.
- The boot class can only contain one object; it may be at any depth in the directory structure.
- Adding an object to the Boot Class will displace any existing object.
- Moving assets from the Object Carousel will automatically recreate the directory structure from the object carousel.
- Moving assets from the hard disk directory tree will only recreate the structure below the source tree node. When moving assets from the directory tree, highlight a node in the asset tree as a target.
- A right-click context menu is available at all nodes in the application structure; available options will depend on the node type.



The context menu options operate on the currently highlighted node in the application structure as follows:

- Add Child** Adds a child node. It can be subsequently renamed to indicate an object.
- Rename** Allows a node to be renamed.
- Delete** Deletes the node.
- Toggle Wildcard** Asset directory nodes can be identified as wildcard entries. A wildcard directory indicates that the directory and all of its children at the time of analysis are defined as assets.

Editing an Application Application editing is similar to creating a new application.

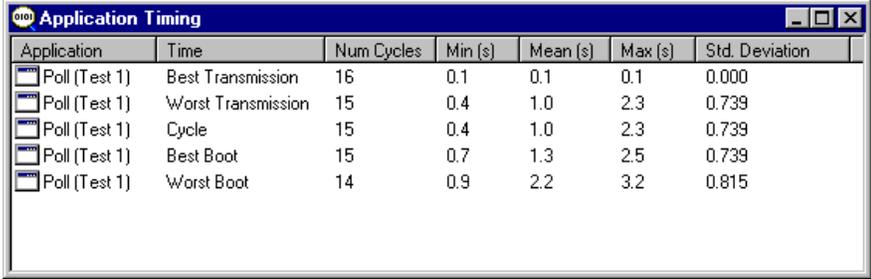
Application Timing

The Application Timing feature allows the user to observe the effect in terms of download time of one or more applications being timed with an object carousel.

In practice, an object carousel is identified and one or more applications are selected from the current application list to be timed with it. As each application is selected, the software will check the availability of the Boot Class and Assets. If the Boot Class cannot be found, the timing operation will fail. If Assets cannot be found, the timing tests can still be performed, but they will not represent the true effect of the application on a particular carousel.

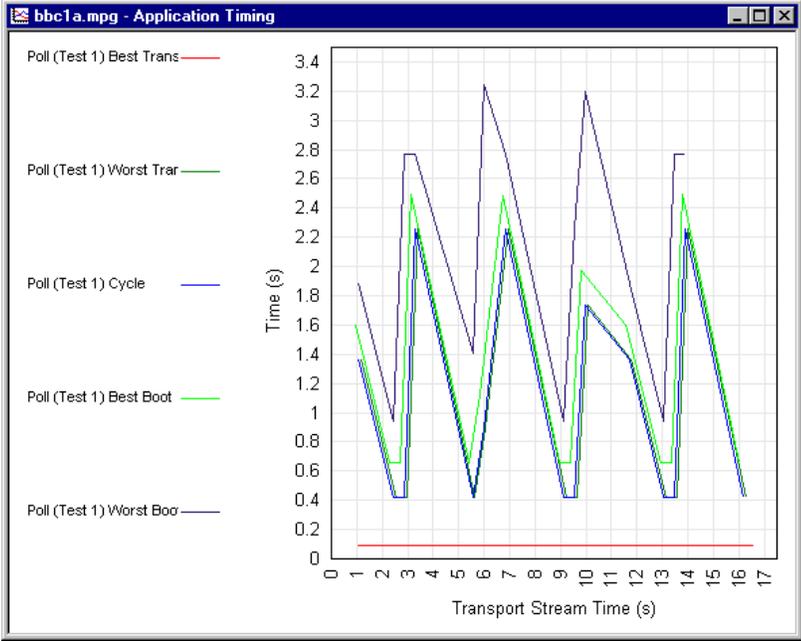
Progress bars are displayed while the tests are being performed.

The results of the application timing tests are presented in tabular form.



Application	Time	Num Cycles	Min (s)	Mean (s)	Max (s)	Std. Deviation
Poll (Test 1)	Best Transmission	16	0.1	0.1	0.1	0.000
Poll (Test 1)	Worst Transmission	15	0.4	1.0	2.3	0.739
Poll (Test 1)	Cycle	15	0.4	1.0	2.3	0.739
Poll (Test 1)	Best Boot	15	0.7	1.3	2.5	0.739
Poll (Test 1)	Worst Boot	14	0.9	2.2	3.2	0.815

Data displayed in tabular form can be displayed in graphical form or exported to a tab separated file.



Explanation of Timing Tests

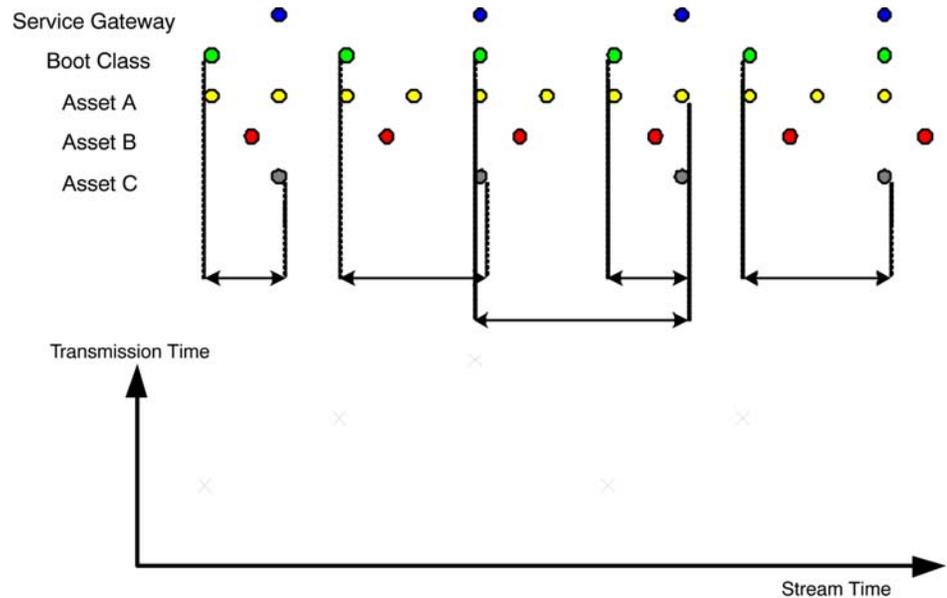
This section gives a graphical explanation of each of the application timing tests.

The calculations assume that control information (DSI/DII; that is, SI/PSI information, for example, PAT, PMT) has been cached.

The boot class must be received before any of the assets can be received. This simulates the STB not knowing which carousel objects the boot class depends on until it has completely received and processed it.

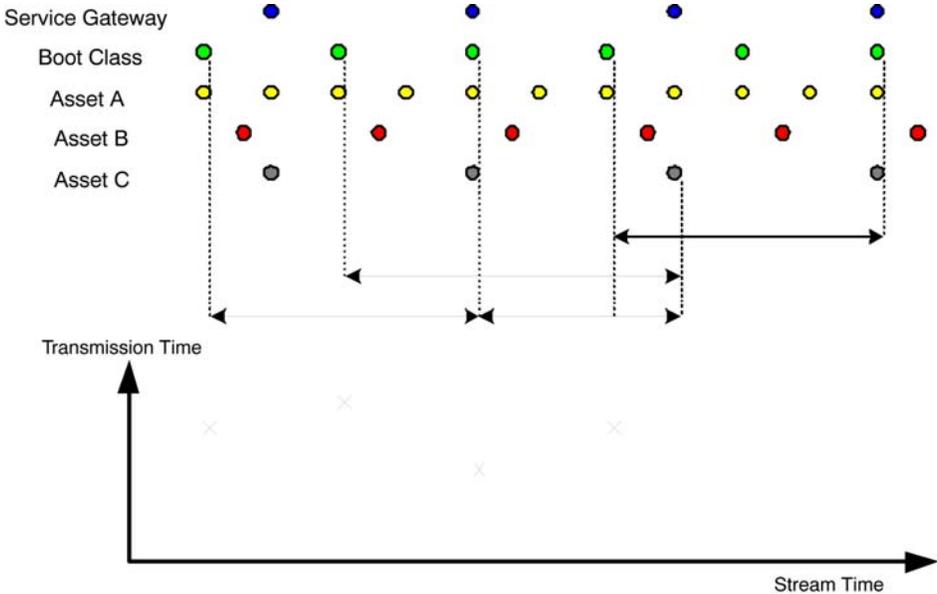
Best Transmission Time. From the start of a boot class to the end of the last asset.

The true application load time is the transmission time plus the time taken by the set-top box (STB) to load the application. The time taken by the STB to load the application is not included in these tests.

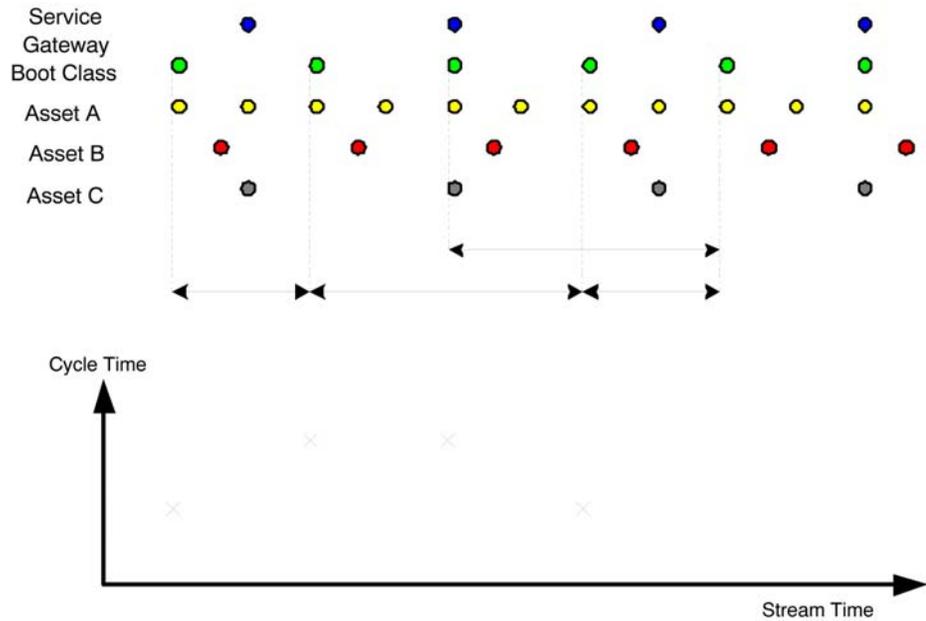


Worst Transmission Time. From the end of a boot class, through the next boot class, to the end of the last asset.

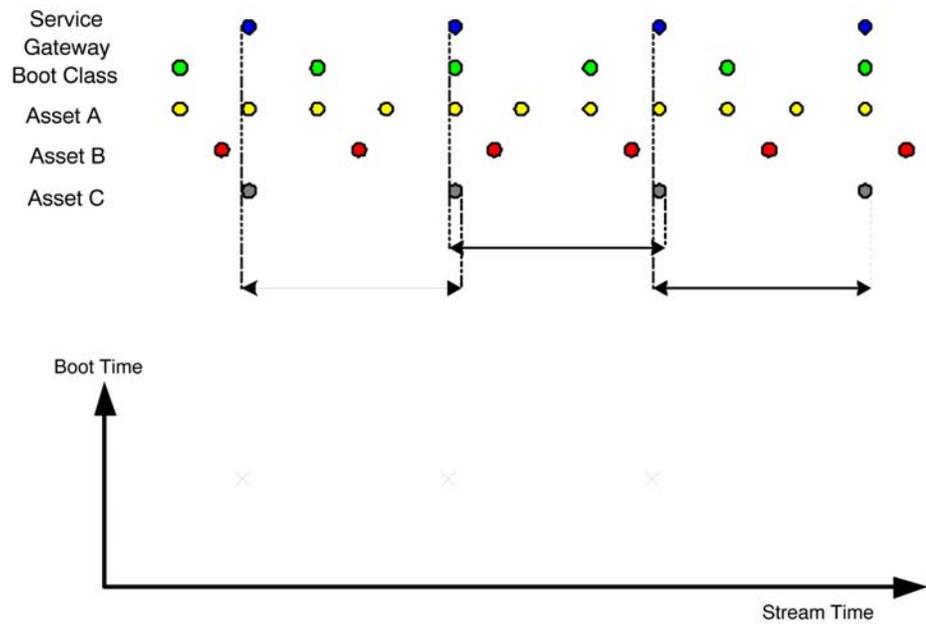
The true application load time is the transmission time plus the time taken by the set-top box (STB) to load the application. The time taken by the STB to load the application is not included in these tests.



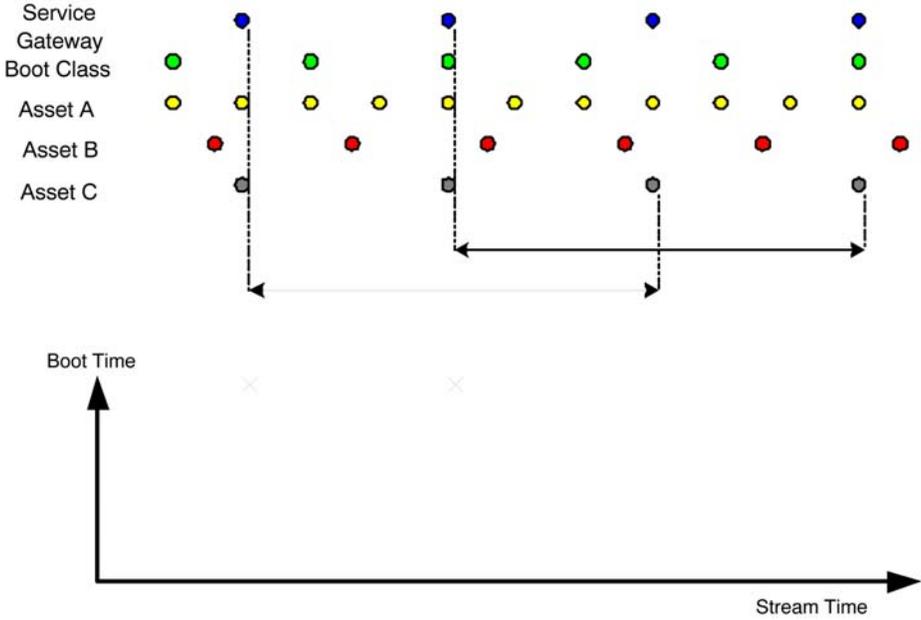
Cycle Time. From the start of a boot class, through the last asset, to the start of the next boot class.



Best Boot Time. From the start of a service gateway, through the next boot class, to the end of the last asset.



Worst Boot Time. From the end of a service gateway, through the next service gateway, through the next boot class, to the end of the last asset.



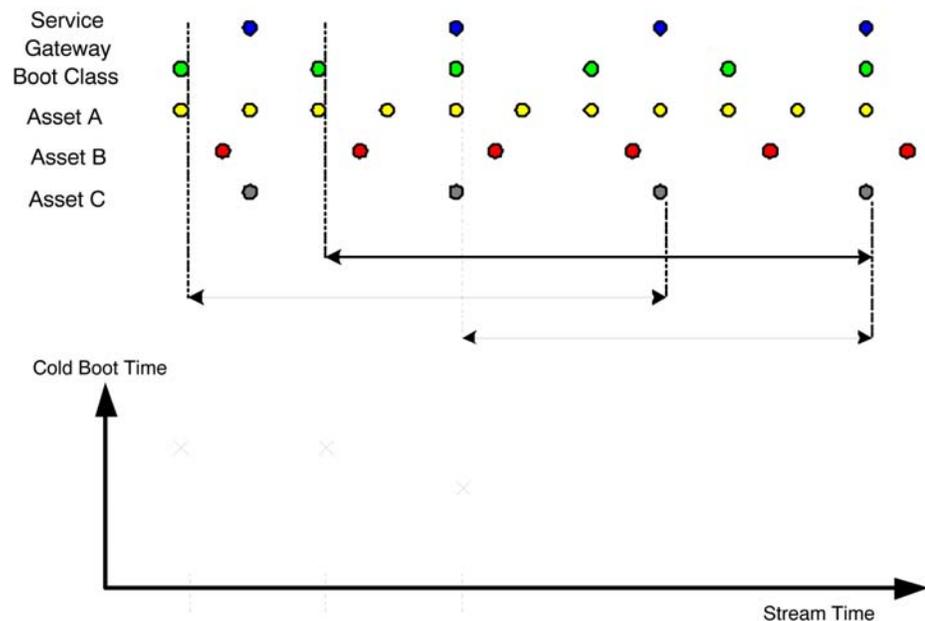
Cold Boot Time. Whereas the other timing methods assume that control information (PAT, PMT, DSM-CC section, etc.) has been cached, this method does not.

The user defines a sampling frequency, which is timed to start the download and observe how long it takes to signal the carousel and download the service gateway, the boot class and all of the assets. For example, in a 60-second stream, a **Start Point** (on the **Cold Boot Time Settings** dialog) of five seconds will sample the download time twelve times. The result is added to the Application Timing results table and graph.

The boot class must be received before any of the assets can be received. This simulates the STB, not knowing which carousel objects the boot class depends on until it has completely received and processed it.

Directories must be received before any child objects can be received in this case. This is because this timing method assumes no signaling caching.

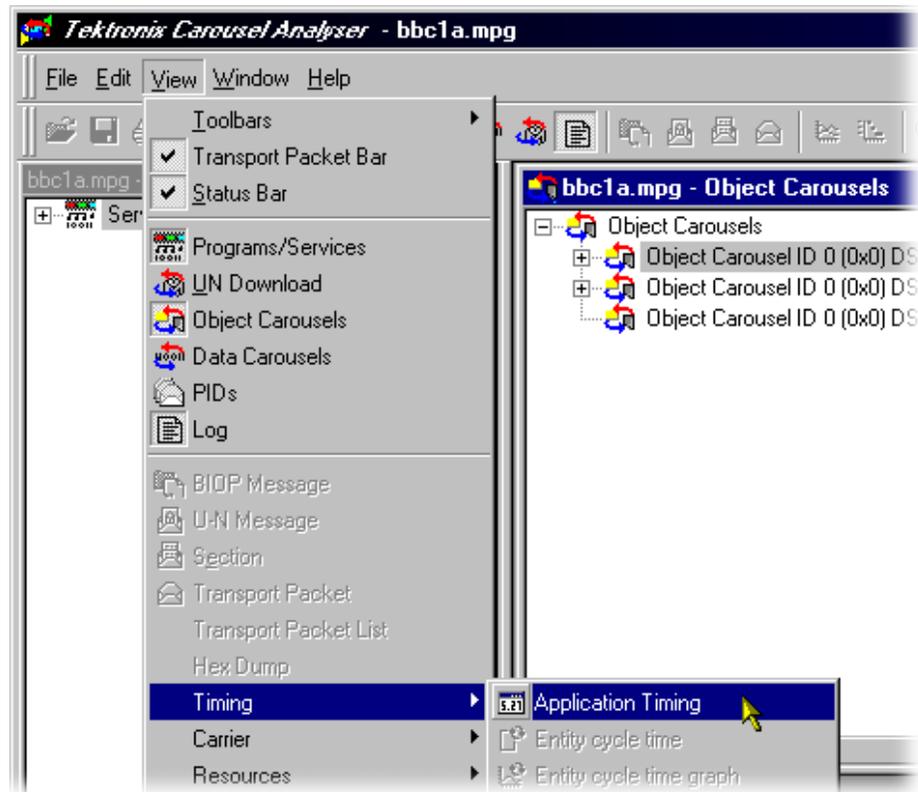
The end of each cycle will be the end of the module containing the last asset. This is an important distinction because an asset may not be the only one in that module.



Setting up a Timing Test

It is assumed that applications have been created as described in the previous section.

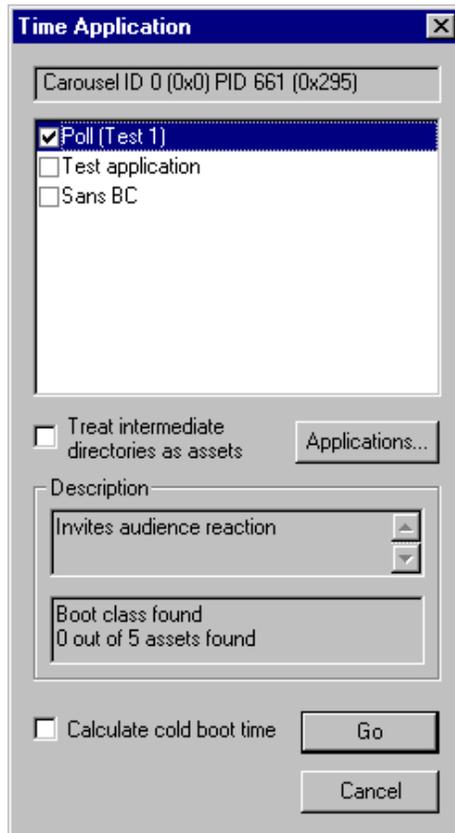
1. With the Object Carousel view active, select **View > Timing > Application Timing**.



Alternatively, highlight an object carousel and select **View Application Timing** from the right-click menu (not shown).

2. The **Timing Application** dialog is displayed:

The dialog displays the selected object carousel identity and the applications that are already defined.



Applications to be associated with the object carousel are selected by enabling the adjacent checkbox.

Highlighting an application name will display its description and a brief report on the availability of the boot class and assets. If the boot class is reported as being not present, the timing operation will be aborted after the first test pass.

Select **Applications...** to open the **Applications** management dialog (see page 1–71).

On first opening this dialog, a simple test is performed to detect the presence of the required boot classes. Applications for which the boot class is found will be enabled.

Subsequently, user selections will be recalled.

Treat Intermediate Directories as Assets:

If this checkbox is enabled, all directories that form part of the asset path are also treated as assets. They must be downloaded as part of the timing test. This will not usually have any significant impact on the results because directories are generally much smaller and transmitted at a higher frequency than files.

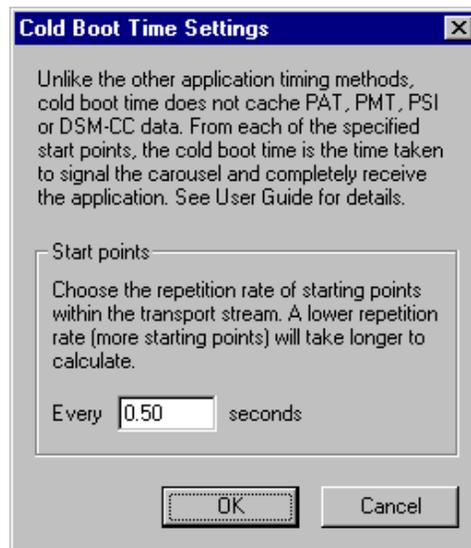
Calculate Cold Boot Time:

If this checkbox is enabled, the Cold Boot timing test will be applied (see page 1–84); this may take some time.

NOTE. *In MHP mode, if the Cold Boot time is to include the AIT acquisition time, the Application Timing selection must be made from an MHP application node (Java or HTML). By selecting an MHP application, the application’s AIT will be automatically included in the Cold Boot timing.*

3. Select Go to start the timing tests.

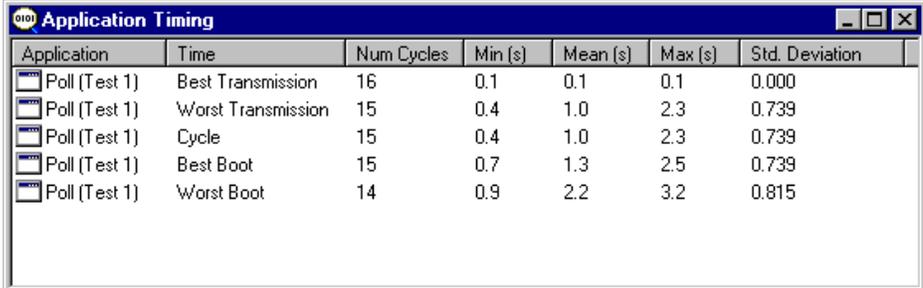
If the Calculate cold boot time checkbox was enabled, the Cold Boot Time Settings dialog is displayed. Enter the starting point repetition rate required.



Select **OK** to continue with the tests.

Progress bars will be displayed while the test is being carried out.

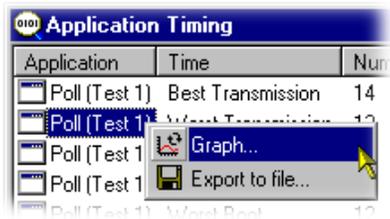
- On completion of the test, the **Application Timing** results table is displayed.



Application	Time	Num Cycles	Min (s)	Mean (s)	Max (s)	Std. Deviation
Poll (Test 1)	Best Transmission	16	0.1	0.1	0.1	0.000
Poll (Test 1)	Worst Transmission	15	0.4	1.0	2.3	0.739
Poll (Test 1)	Cycle	15	0.4	1.0	2.3	0.739
Poll (Test 1)	Best Boot	15	0.7	1.3	2.5	0.739
Poll (Test 1)	Worst Boot	14	0.9	2.2	3.2	0.815

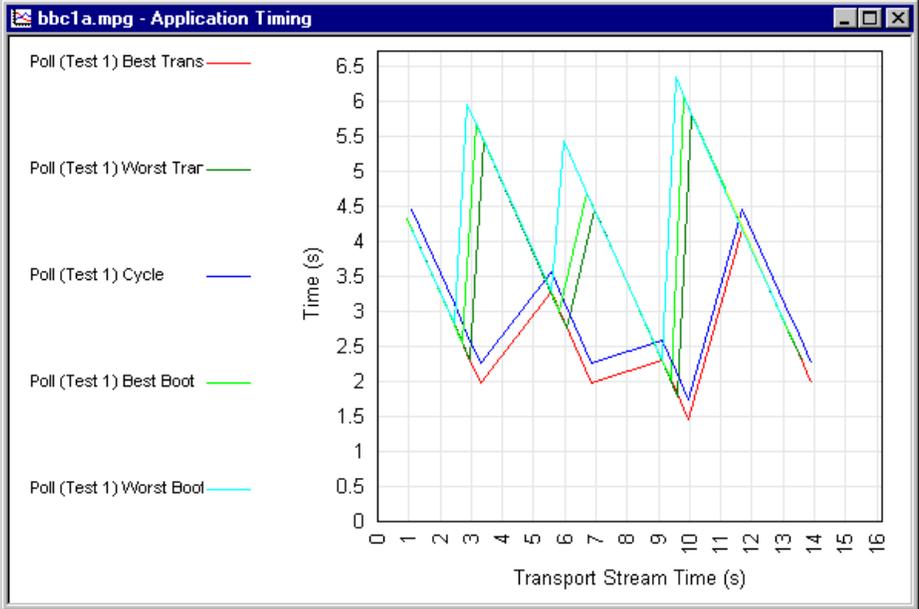
The column headings are largely self-explanatory. **Number of Cycles** shows the number of times that the test could be calculated for the stream.

- To display the results in graphical form, highlight a test name and select **Graph...** from the right-click menu.



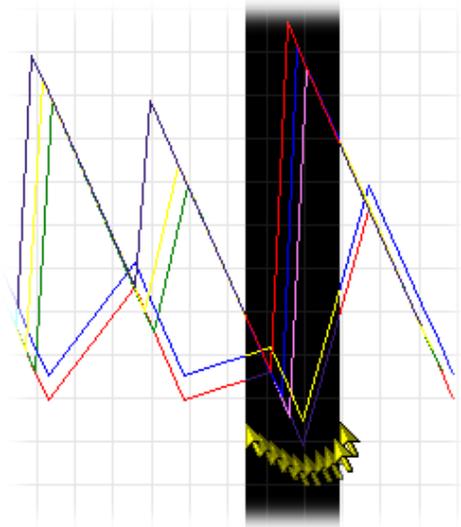
If another test is selected, the results are overlaid. Color coding is used to identify each result.

The screenshot below illustrates a graph showing all five test results (Cold Boot not shown).

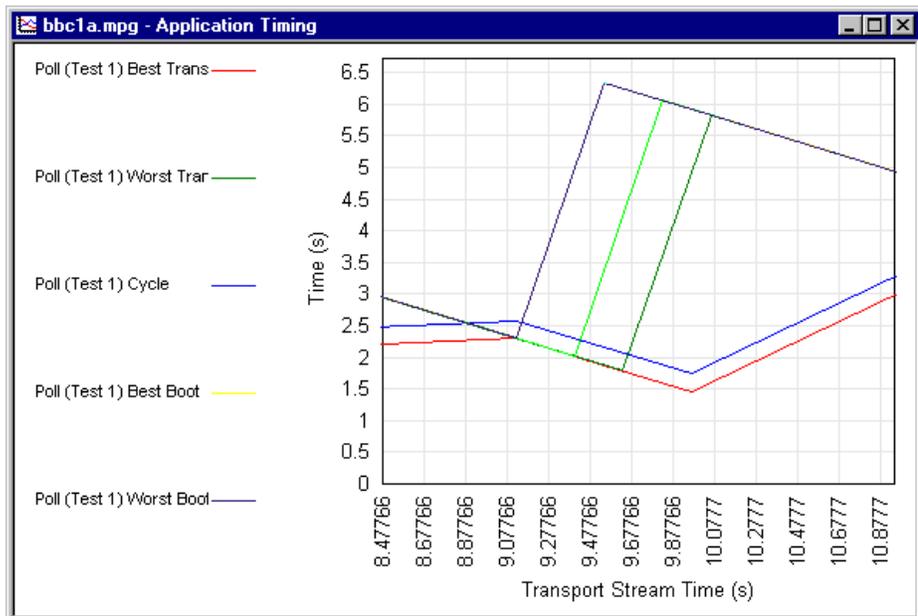


Zoom in and zoom out buttons are provided on the toolbar (or use the tab and shift-tab keys on the keyboard).

Alternatively a precise area can be selected by dragging the mouse over the required range (hold the left-button, move the mouse, release the button).

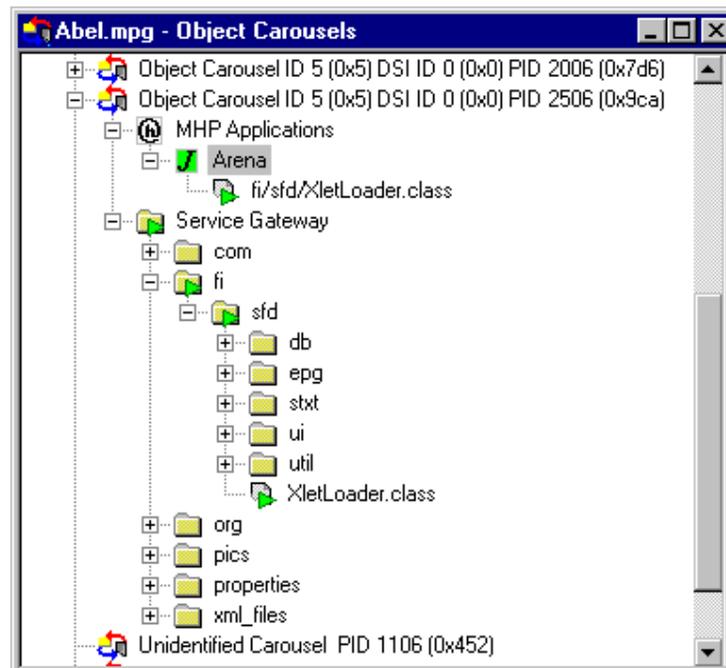


When the mouse button is released, the zoomed area of the graph will be displayed immediately (as shown below).



MHP Support

Although described separately here, MHP Object Carousel support is fully integrated into Carousel Analyzer. MHP applications are displayed in the Services and Object Carousel views. The features described here can be accessed from menu options and right-click context menus.



The MHP application (Ⓜ) is identified by its name in the AIT. If the boot class is found in the Service Gateway, it is attached as a child of the MHP application. As a visual aid, boot class items are identified in the Service Gateway by green triangles overlaying the primary icon. The path in which the boot class resides is also indicated by green triangles.

Applications are designated as Java (Ⓜ) or HTML (Ⓜ). The color of the icon represents the running status of the application when the carousel was recorded; green indicates running, yellow indicates ready and red indicates not running.

Right-Click Menu Options Right-clicking on an MHP application node will display the following menus:

View Application Timing

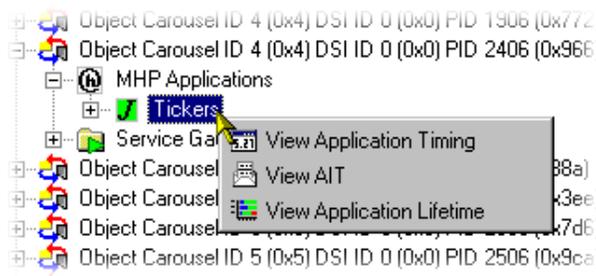
(See *Application Timing*, page 1–78)

View AIT

Opens the AIT structure view (see also *Structure Views*, page 1–52)

View Application Lifetime

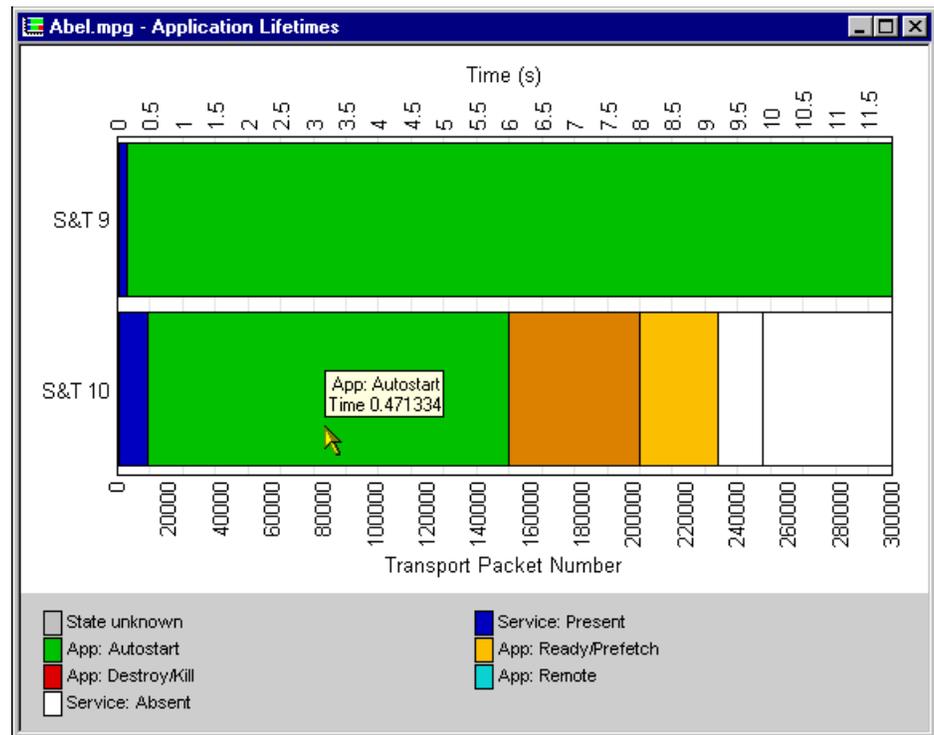
(See *Application Lifetimes*, page 1–93)



Application Lifetimes

This Gantt style graph displays an analysis of the lifetime of an MHP application. Multiple applications can be displayed; each application is subdivided and color-coded to indicate the changing state of the application.

The Applications Lifetimes view can be opened by highlighting an MHP application node and selecting either the toolbar icon or **View Application Lifetime** from the right-click menu.



A key to the color codes is displayed at the bottom of the view. Each application is labeled. Placing the cursor over a color block displays details of the block, including the block start time.

Reference

Script Files

The following scripts (Table 1–11) are shared between the Carousel Analyzer and other Tektronix products. They exist in the Tektronix\Scripts directory.

Table 1–11: Script files - General

Script file name	Purpose
MPEG.scp	Scripts for MPEG sections and descriptors.
DVB.scp	Scripts for DVB sections and descriptors.
ISDB-T.scp	Script for ISDB-T sections and descriptors.
ISDB-S.scp	Script for ISDB-S sections and descriptors.
MHP.scp	Script for AIT table.
MPE.scp	Scripts for DVB datagrams.
DSMCCv2.scp	General purpose DSMCC structures.
DSMCC.scp	Scripts for (DVB) DSM-CC sections.
ISDB_DSMCC.scp	ISDB version of the DSM-CC script.

The following scripts (Table 1–12) are used only by the Carousel Analyzer. They exist in the Tektronix\DataTestSystem\Scripts directory.

Table 1–12: Script files - Carousel analyzer

Script file name	Purpose
Transport.scp	Script for transport packets.
Pat_Cat.scp	Script for PAT and CAT sections.
Biop.scp	Scripts for BIOP messages.
DSMCC_DataCarouselObject.scp	Script for DSM-CC objects, which relate a Data Carousel.
DSMCC_DataCarouselSection.scp	Script for DSM-CC sections, which relate a Data Carousel.
DSMCC_ObjectCarouselObject.scp	Script for DSM-CC objects, which relate an Object Carousel.
DSMCC_ObjectCarouselSection.scp	Script for DSM-CC sections, which relate an Object Carousel.
DSMCC_Object	Script for DSM-CC objects, whose content is not assumed to be either data or objects.

Error Checking

DSM-CC sections have two bit fields called `section_syntax_indicator` and `private_indicator` (Ref 13818-6 section 9.2.2). If the `section_syntax_indicator` field is 1, there is a CRC32 at the end of the section; if set to 0, there is a checksum at the end of the section. The `private_data` field should always be the complement of the `section_syntax_indicator` field.

If both these fields are set to the same value, the application cannot be absolutely sure whether a CRC or a checksum is being used. It therefore attempts to use the CRC method first and then the checksum. If neither method works, the section is rejected.

Currently nothing will be reported in the error logs if these bits are set incorrectly. This issue will be addressed in a future release of Carousel Analyzer.

References

- [1] ISO/IEC 13818-1 Information technology - Generic coding of moving pictures and associated audio information: Systems [MPEG]
- [2] ISO/IEC 13818-6 Information technology - Generic coding of moving pictures and associated audio information - Part 6: Extension for Digital Storage Media Command and Control [MPEG]
- [3] ETS 300 468 Digital broadcasting systems for television, sound and data services; Specification of Service Information in Digital Video Broadcasting [DVB]
- [4] EN 301 192 Specification for data broadcasting [DVB]
- [5] A027 Specification for the transmission of data services in DVB bitstreams [DVB]
- [6] A047 Implementation guidelines for Data Broadcasting [DVB]
- [7] SI-DAT 382 Rev.4 Implementation guidelines for data broadcasting [DVB]
- [8] Digital terrestrial television MHEG5 specification [DTG]
- [9] ISO/IEC 13522-5:1996(E) MHEG-5 IS [MHEG]
- [10] A tutorial introduction to MHEG-5 [Authors: Strategy and Technology Ltd]
- [11] ARIB STD - B24 Data Coding and Transmission Specification for Digital Broadcasting
- [12] Multimedia Home Platform, ETSI TS 101 812 v1.1.1 [DVB]



Carousel Generator

Carousel Generator - Getting Started

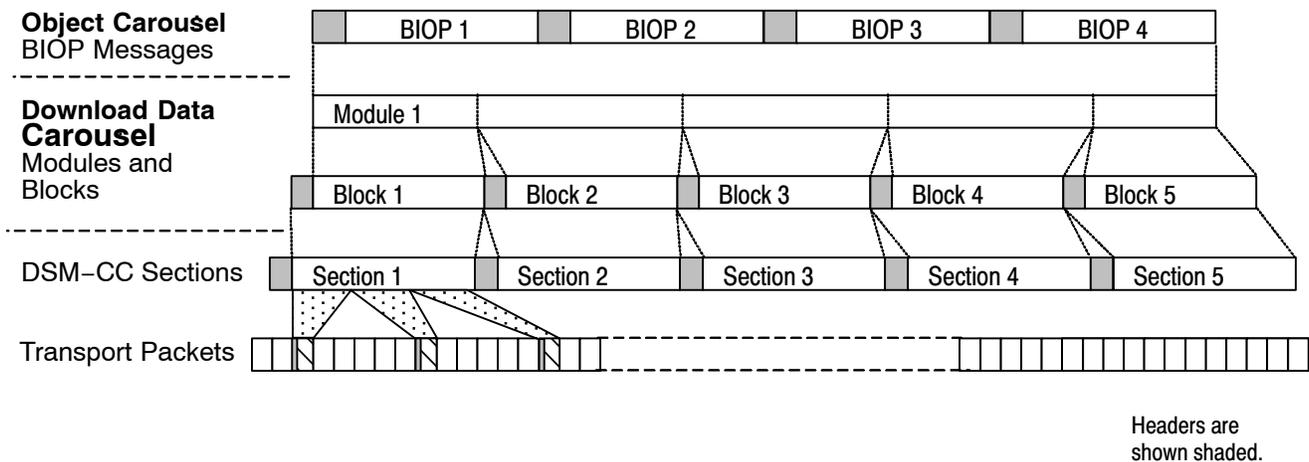
The Carousel Generator is aimed principally at the content provider user who simply wants to create a carousel to deliver content to a set-top box quickly and efficiently. The product also aims to support the more experienced MPEG user who wants to modify a carousel to test the effects on equipment along the broadcast chain. Similarly, the more experienced MPEG user can incorporate a carousel into a transport stream alongside video and audio content.

The assembled transport stream can be saved to an MPEG file.

Data Broadcasting Overview

Data Broadcasting allows data to be transmitted in a similar way to the way in which video and audio services are delivered to end users. Object and Data Carousels are intended for the periodic transmission of information in a transport stream. Data Carousels contain modules of data of unspecified content, whereas Object Carousels contain identifiable data objects, such as JPEG files, text files and, application software. Multimedia Home Platform (MHP) builds on object carousels by defining parameters such as the boot class and application life cycle in the Application Information Table (AIT).

The diagram below shows how information carried by data and object carousels is subdivided and ultimately carried by the transport stream.



BIOP messages contain a message header, a message sub-header and the message body, which contains data. The message body may contain complete data objects.

BIOP messages are broadcast in modules. A module is formed from one or more concatenated, complete BIOP messages.

Each Module is fragmented into one or more Download Data Blocks that are in turn transmitted in corresponding DSM-CC Sections.

Sections are transmitted in packets in the Transport Stream.

Carousel Generator Overview

Activity in the Carousel Generator is referred to as a “session”. During a session, data objects are assembled into one or more carousels. Video and audio content can also be added. Mandatory SI tables are added automatically. The structure of the carousel can be saved in XML format; this definition file can be subsequently reopened in a new session for further edits.

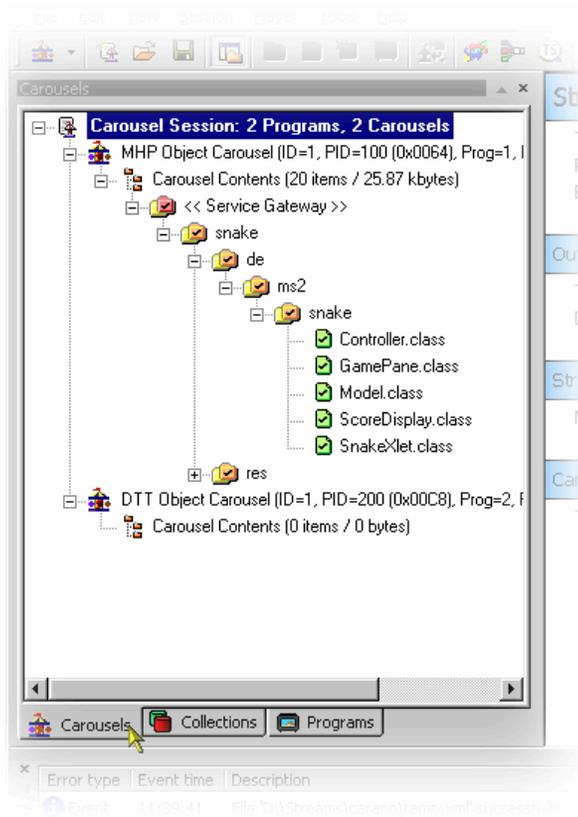
The end result of a session is the creation of a transport stream, which can be saved to a file.

One of the main advantages of Carousel Generator is that many of the more complex concepts in the various Object Carousel standards are hidden from the user for the sake of clarity and user friendliness.

Three views of the assembled stream are offered: Carousels, Collections and Programs. Each view displays aspects of the stream from a single perspective. The three following screenshots show the same stream in each of the views.

Carousels View

The Carousels view lists the carousels and the associated objects that are included in the session.



Carousel Types. The supported carousel types are as follows:

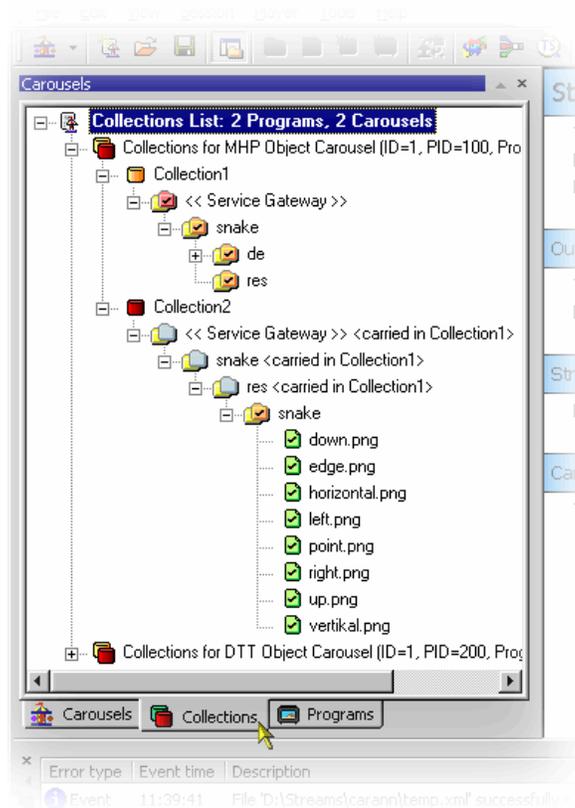
Object Carousels: DSMCC, DVB, DTT, MHP

Object carousels	Reference specification
DSM-CC	Digital Storage Media - Command and Control (MPEG only)
DVB	Digital Video Broadcast
DTT	Digital Terrestrial Television
MHP	Multimedia Home Platform

The type of carousel being edited dictates the available options and user interface elements.

Collections View

Objects associated with a carousel can be grouped together in collections. The properties of each collection can be adjusted to give the most efficient delivery in the transport stream.

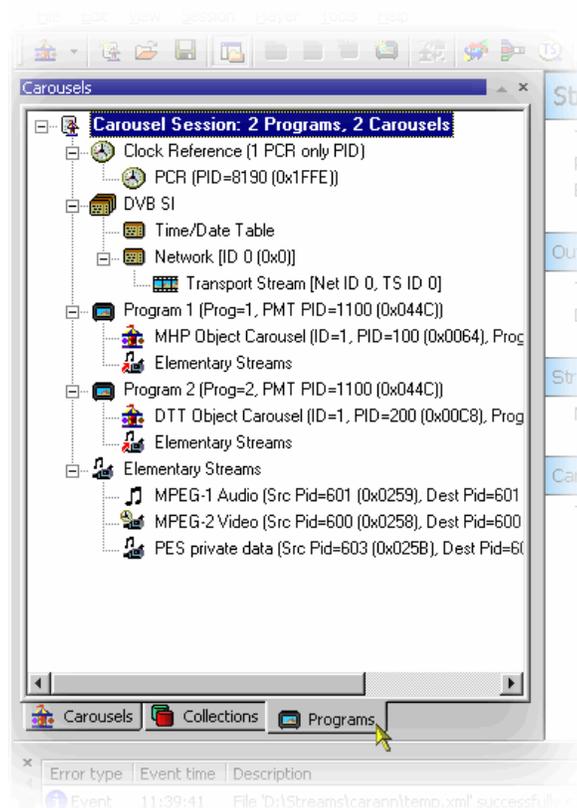


The way that individual objects in a carousel are to be transmitted often varies. Each object in the carousel has properties including its minimum repetition rate (maximum cycle time) and whether it is compressed. Files that need to be transmitted with similar properties or which are logically related can be grouped into a module. As the DSMCC module is a limited size, the process of adding an object to a module would require calculating whether the object would fit into the module's available space (possibly after compression) and if no space is available, generating a new module and feeding this back to the user. This would slow this aspect of the user interface down appreciably.

Consequently, the concept of a collection is used to replace the size-limited DSMCC module, with a "module of unlimited size". Any number of objects can be added to a collection; during stream generation, this may translate to many modules with the same properties.

Programs View

In the Program view, the root is the Carousel Session (as in the other views). Immediately below this are nodes giving access to the supported (mandatory) SI/PSI tables and a listing of PCR PIDs. There is also an Elementary Streams node, which lists all of the imported elementary streams included in the stream and the Program nodes, which show the allocation of carousels and elementary streams to programs.



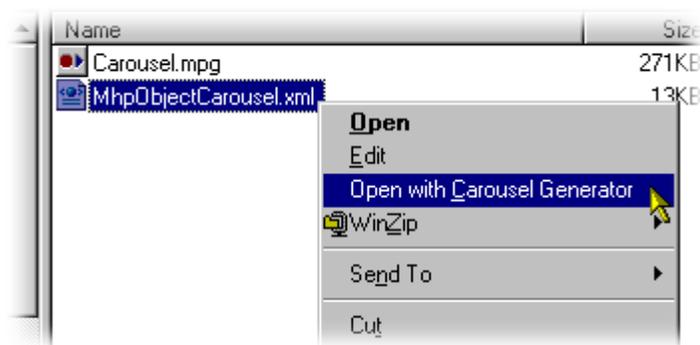
Carousel Definition File

The current state of the Carousel Generator session can be saved to disk at any time during the creation process, using the carousel definition file. The format of the saved file is standard XML and can be viewed in any XML compatible viewer (for example, Internet Explorer 5 and up); editing the XML file directly is not recommended.

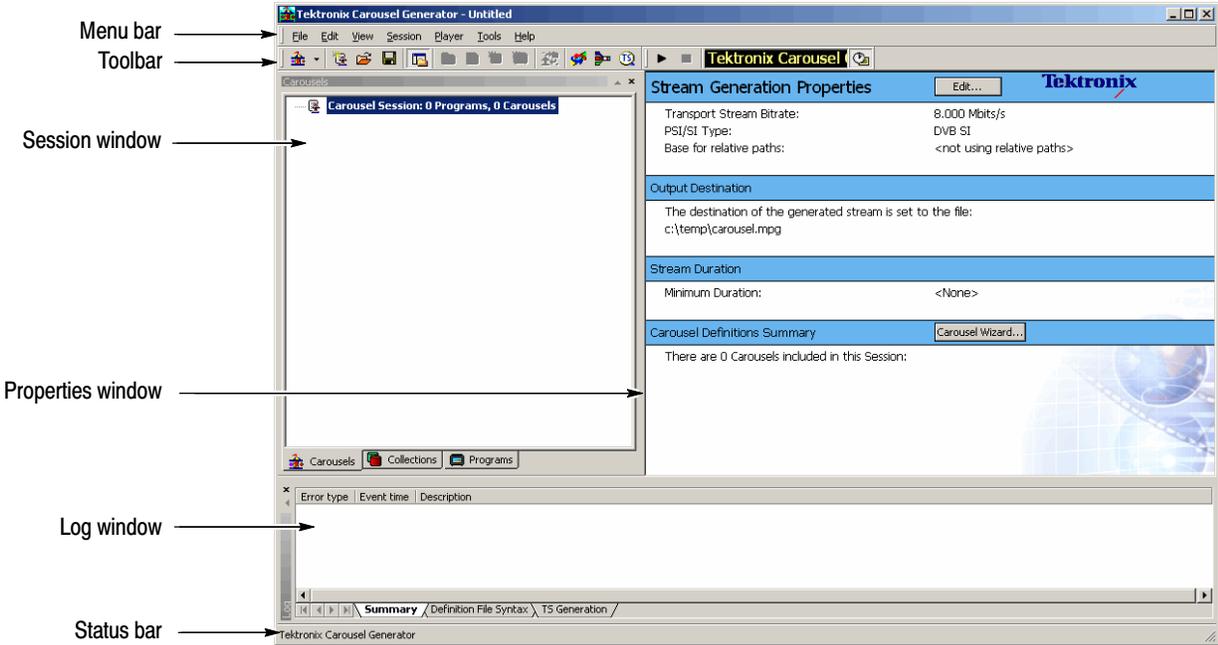
Starting the Application

The application can be started by selecting **Start > Programs > Tektronix MTS400 > Generators > Carousel Generator** or by double-clicking the **Carousel Generator** shortcut on the desktop.

In addition, files with an XML extension have an additional option in the right-click menu (**Open with Carousel Generator**). When this option is selected, Carousel Generator opens and attempts to use the file as a *Carousel Definition File* (see page 2-5).



Initial Appearance



The full range of options available to the Carousel Generator can be accessed by using the Menu Bar. However, the selection of options varies during the stages of carousel creation; unavailable options are normally grayed out. The Toolbar provides shortcuts to the more common options.

The working area of the Carousel Generator screen contains three windows: the Session window, the Properties window and the Log window. The Session window and the Log window can each be either floated (moved to anywhere on the desktop) or docked to one of the four sides of the application window. The content of the Properties window is context-sensitive; it will provide a summary of the properties of the node highlighted in the Session window.

A full description of the Carousel Generator screen components can be found in the *Menus and Controls*, page 2–23.

Session Window. The Session window is the workspace in which carousels and collections are built and manipulated. The window has three tabs: Carousels, Collections and Programs. Each window displays different aspects of the current session in the form of a tree structure.

Carousel Tab The Carousels Session window displays all of the carousels in the current session and the directories and files associated with each carousel. It is in this window that carousels are built and manipulated.

Collections Tab The Collections Session window displays the collections associated with each carousel and the allocation of files and directories within them.

Programs Tab The Program session window displays the contents of the stream from the program or service point of view.

Properties Window. The Properties window provides an immediate view of the parameters and values associated with each node in the Carousels and Collections Session windows. The values displayed are those of the currently selected node.

Log Window. The Log window displays errors and warnings as the carousel building and stream generation progresses.

A full description of the Carousel Generator screen components can be found in the *Menus and Controls*, page 2–23.

Carousel Wizard

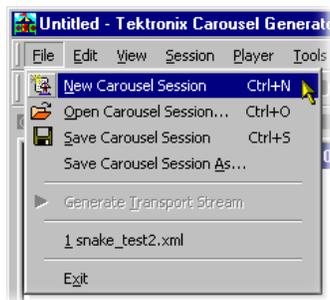
The Carousel Wizard makes the process of creating a single carousel easier. The carousel is added to the current session. The final step of the wizard allows a transport stream to be created using the information in the current session.

Default parameters are provided at all stages of the wizard, but the user can change them either in the wizard screens or subsequently in the various property dialog boxes.

The description in this section provides an overview of the wizard and carousel creation. Individual properties and activities are described in more detail in the *Reference* section. Extensive tooltips are provided with the wizard screens. Place the cursor over any element of a screen to reveal the tooltip.

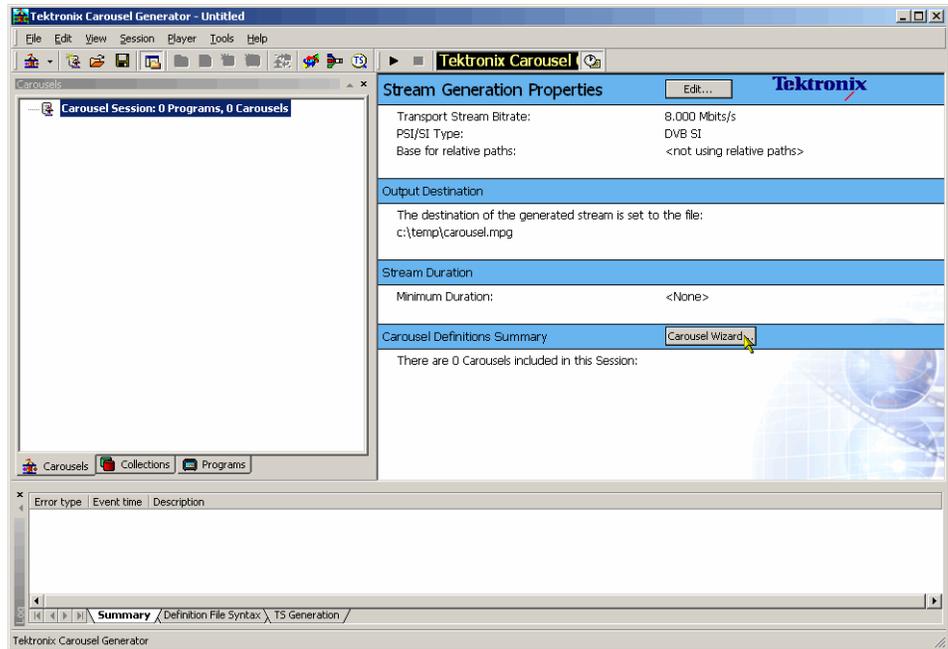
If a carousel session is in progress, the user must decide whether a new session is required or a new carousel is to be added to an existing session.

To start a new carousel session, select **File > New Carousel Session**.



Any open carousel session will be closed with an option to save.

The following screen is displayed:

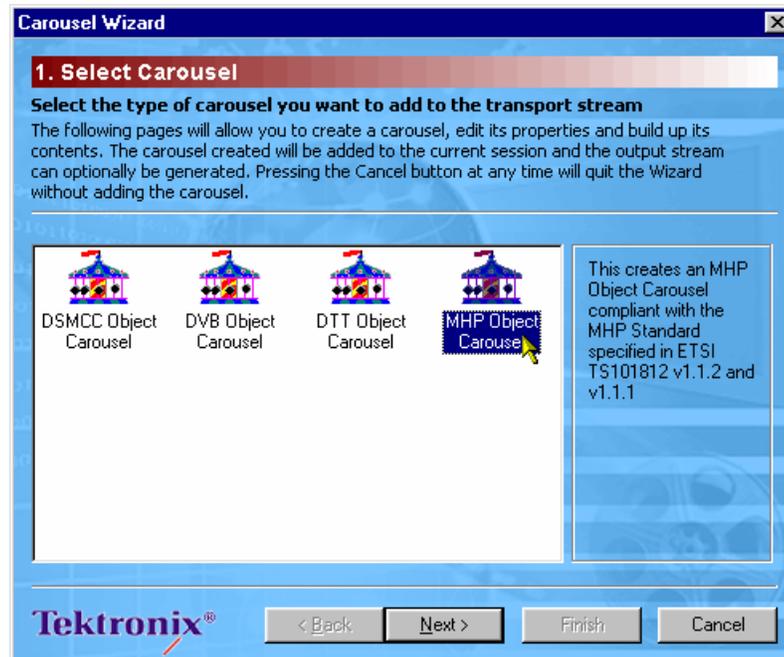


For a new session or adding a carousel to an existing session, the wizard can now be invoked.

Step 1: Select Carousel

1. In the work area select Carousel Wizard... or select **Session > Carousel Wizard**.

Step 1: Select Carousel of the Carousel Wizard is displayed.

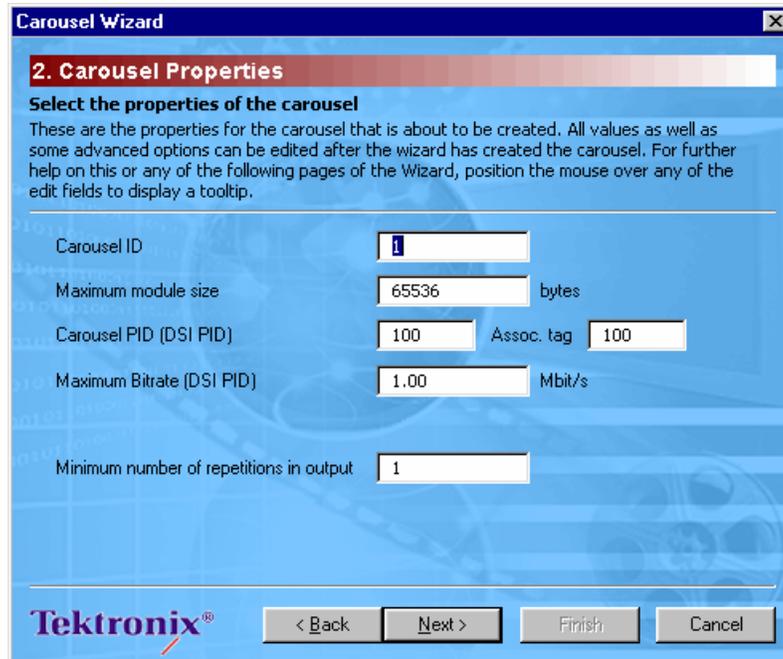


2. Highlight the required Carousel type.

Note that depending on the type selected, some of the subsequent wizard screens will vary in content. The content is dictated by the carousel type selected.

3. Select Next to display *Step 2: Carousel Properties*.

Step 2: Carousel Properties



In Step 2, the Carousel Properties are selected. Defaults are supplied but all properties can be edited. Properties can also be edited after the carousel has been created from the main window.

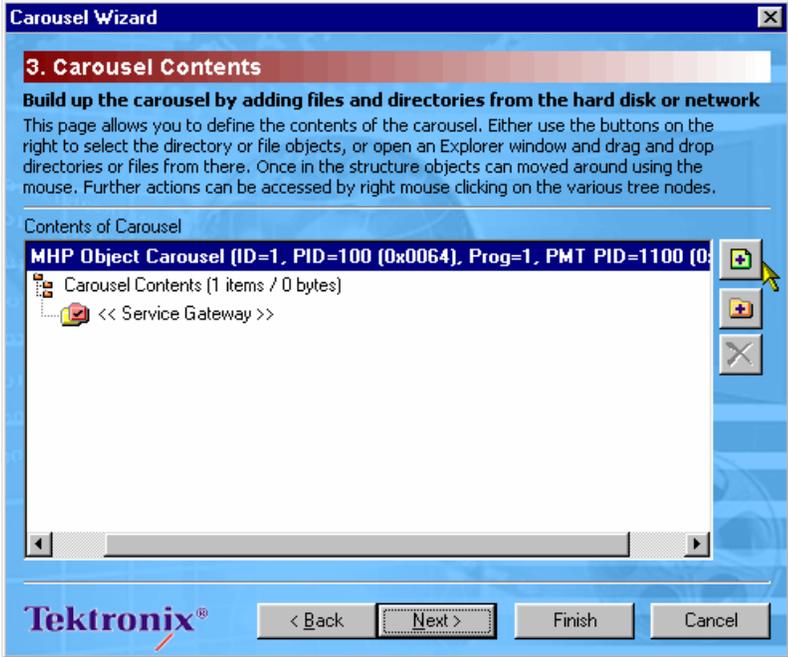
4. Make any required adjustments to the Carousel properties.
5. Select how many times the carousel should appear in the output stream.

NOTE. When using the wizard, only a single carousel is being assembled. However, more than one carousel may be created within a session.

The number of repetitions can be specified for each carousel. The length of the transport stream will be dictated by the carousel that requires the longest time by virtue of its size or the number of requested repetitions. Carousels in the same session requiring less time to fulfill their size/repetition criteria will be repeated.

6. Select Next to display Step 3: Carousel Contents.

Step 3: Carousel Contents



Files and directories containing applications and resources are added to the carousel during this step.

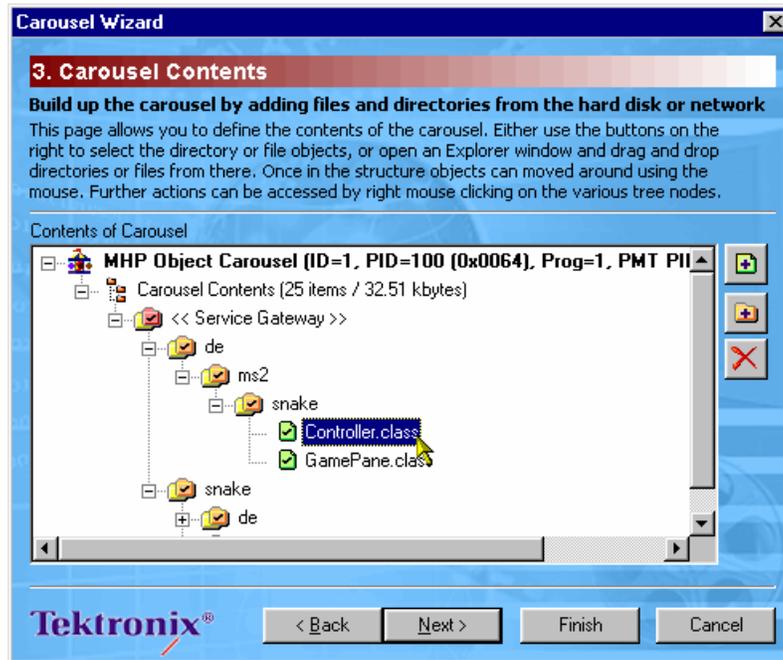
The buttons on the right side of the window allow individual files or complete directory structures to be added to highlighted nodes of the carousel. Files and directories can also be dragged and dropped from Windows Explorer.

Add files:  Add directories: 

Files and directories can be dragged and dropped within the wizard window, to allow final adjustments to be made.

Highlighted files and directories can be also be deleted .

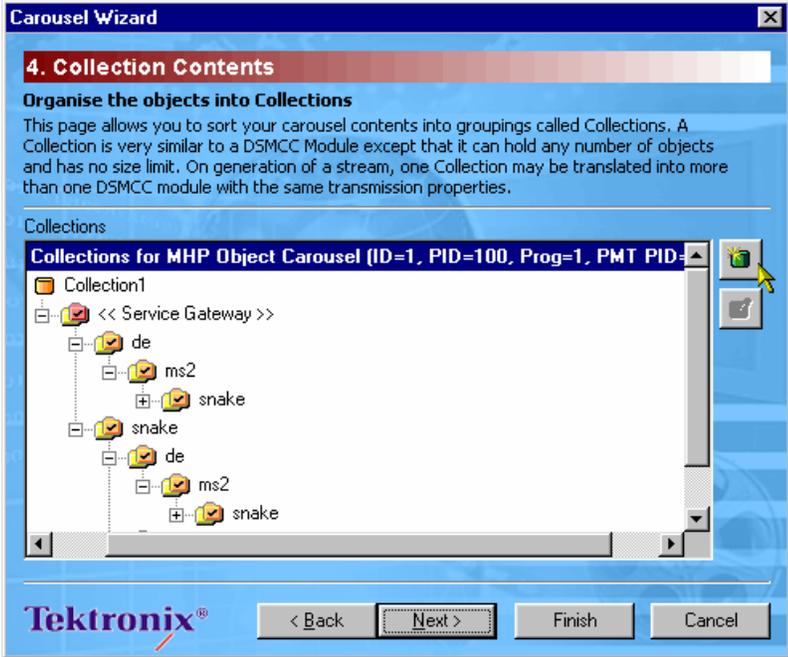
- 7. Build the carousel structure as required.



Highlighting an object and selecting Properties from the right-click menu allows access to the object properties.

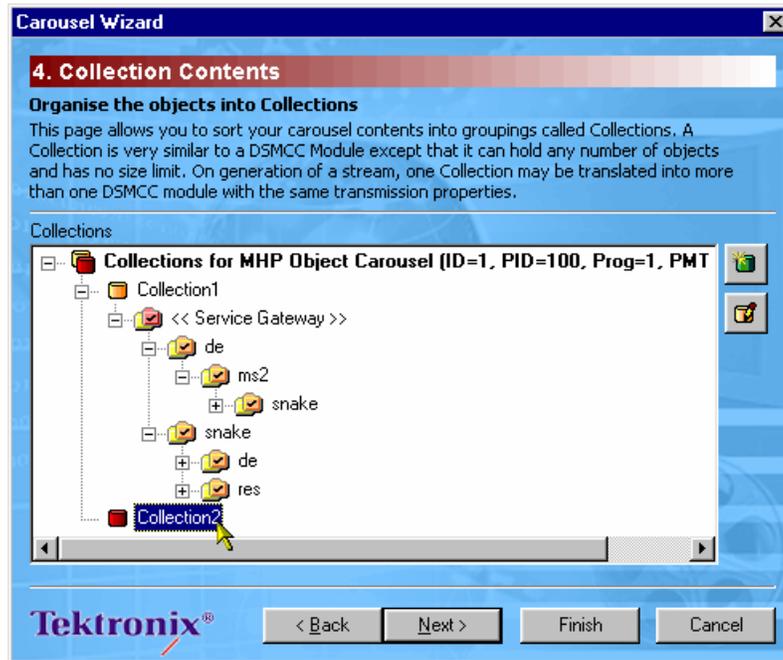
8. Select Next to display *Step 4: Collection Contents*.

Step 4: Collection Contents



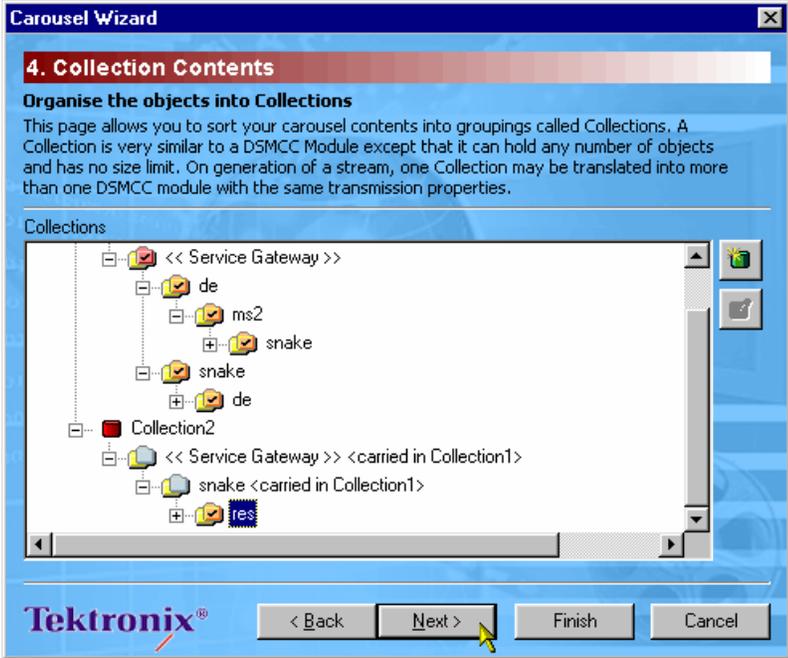
The files added in the previous step are automatically placed in a single default Collection (as shown above). Collections allow objects to share transmission properties including minimum repetition rate (maximum cycle time) and compression. This step allows the user to change the properties of the default Collection, create new Collections, and move files between the various collections.

- 9. Select  to create a new collection header.



10. Highlight a collection node and select  to modify the collection's properties.

NOTE. If the previous wizard step is reselected (Back) and more files added or removed, the Collection assignment is maintained for existing files and new files are placed in the parent directory's collection by default.

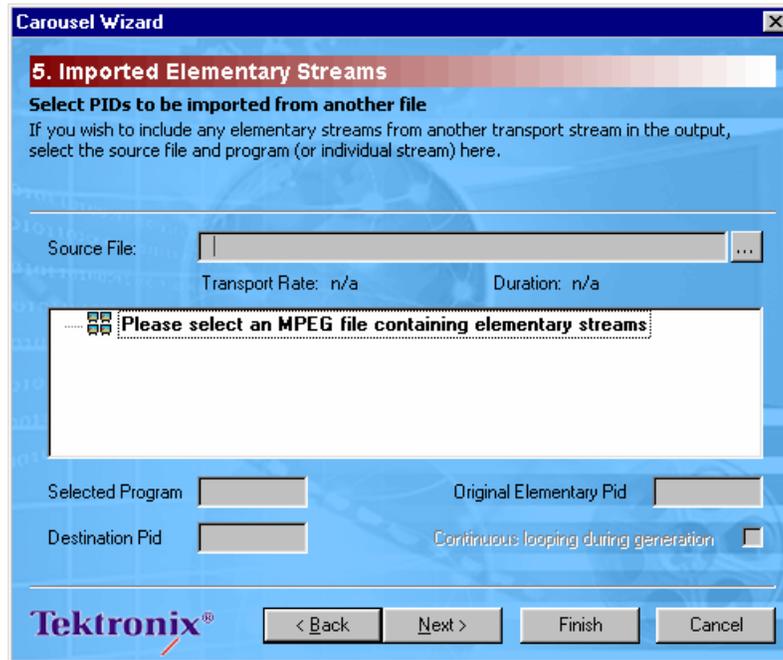


To modify the collection properties, highlight the required Collection node and select Properties from the right-click menu.

- 11. Select Next to display Step 5: Imported Elementary Streams.

Step 5: Imported Elementary Streams

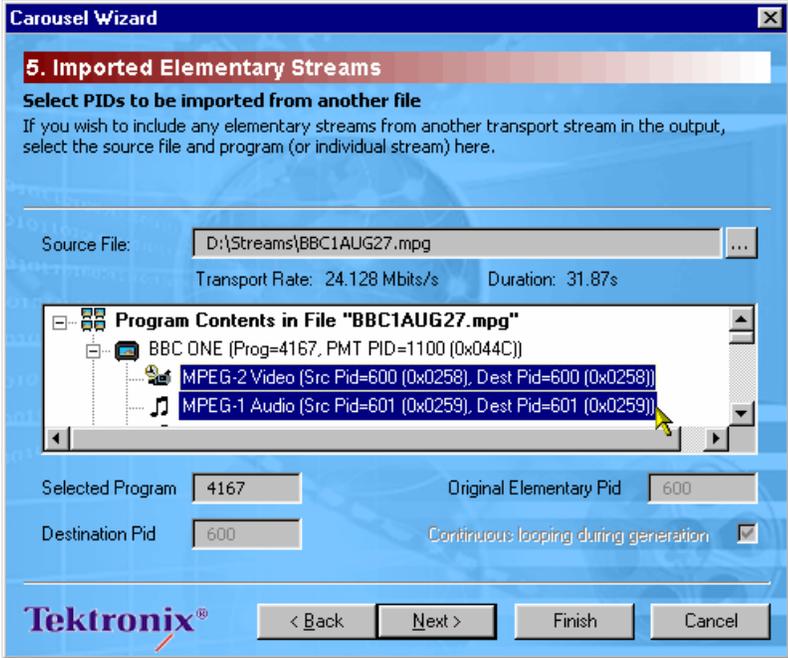
In addition to the carousel objects, elementary streams from a transport stream can be included in the session.



12. Use the Source File:  button to identify and select the transport stream.

The contents of the source file are displayed.

13. Select one or more elements from this tree to import into the current session, or select a program node to import every element contained by the program.



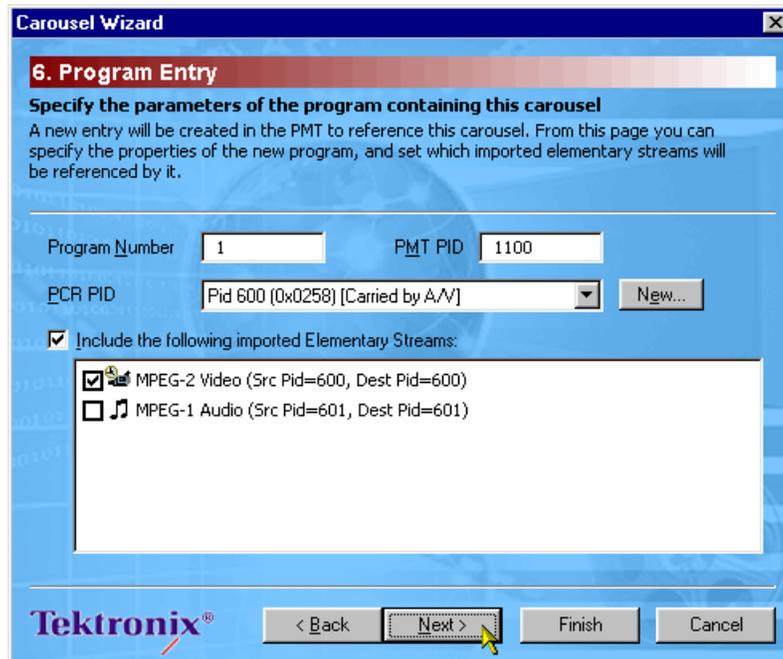
Note that only elements from the same source program can be selected. All elements included in the session will be included in the output stream, whether they are referenced by a program or not.

Where possible, elementary streams will be carried on the same PID used in the source stream; where a conflict within the session occurs, a new PID will be automatically allocated or can be allocated manually.

- 14. Having identified the source stream and the individual elementary streams to be included in the session, select Next to display *Step 6: Program Entry*.

Step 6: Program Entry

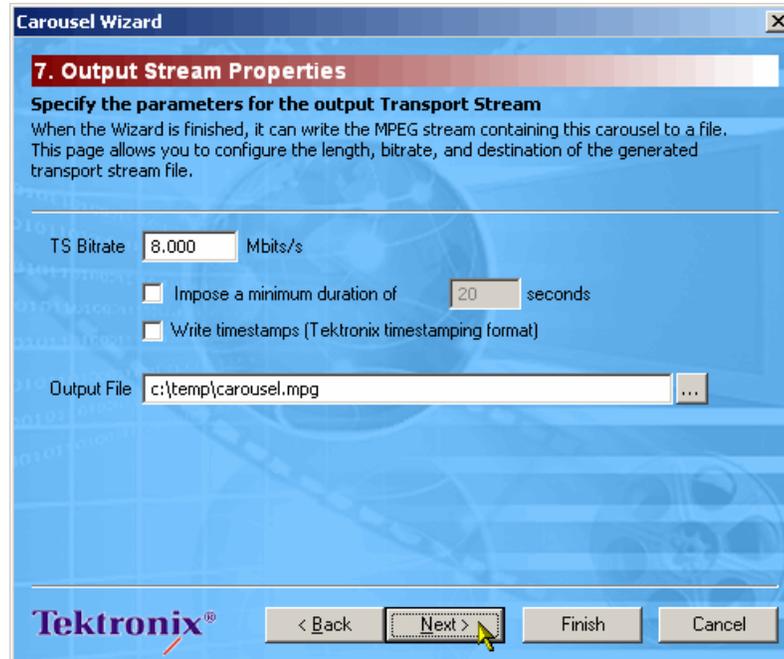
At this step, a new entry will be created in the PMT referencing this carousel. Also, the elementary streams identified in the previous steps can be associated with a new program.



15. Select the elementary streams to be included in the new program.

16. Select Next to display *Step 7: Output Stream Properties*.

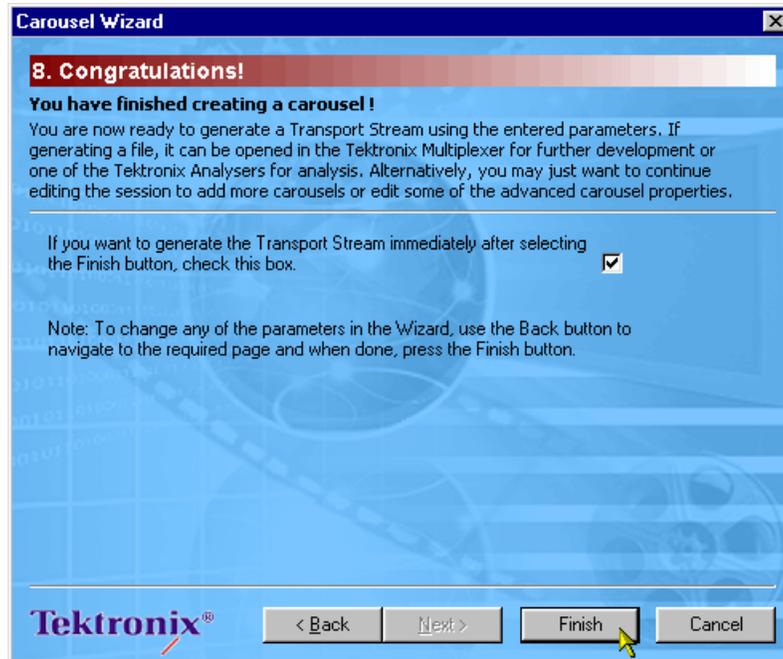
Step 7: Output Stream Properties



Use this screen to specify the name and properties of the transport stream that is to be created.

17. Enter the TS Bitrate.
18. Enter minimum duration for the output transport stream if required.
19. Enter or select () an Output File name.
20. Select Next to display *Step 8: Congratulations*.

Step 8: Congratulations



The carousel is now prepared. If the option to create the transport stream is enabled, then all carousels in the current session will be included. The carousel created with the wizard will be added to the session screen.

21. Select Finish to exit the wizard.

Menus and Controls

The following pages contain descriptions of different menu options, toolbar controls, status bar, log window, and properties window.

Menus Options

The following pages describe all of the menu options. Since many of the options are context sensitive, they will be available only when their function is appropriate for the selected window or display element. When a menu option is not available, the option is grayed out.

File Menu Options

Table 2-1: File menu options

Option	Function
New Carousel Session	Opens a new carousel session. An opportunity to save the current session is offered, if relevant.
Open Carousel Session...	Opens an existing carousel session using a saved carousel definition file.
Save Carousel Session	Saves the current carousel session in the form of a carousel definition file. If the file has not been saved, an opportunity is offered to name it.
Save Carousel Session As...	Allows the current carousel session to be named and saved in the form of a carousel definition file.
Most Recently Used List	Lists the most recently used carousel session files. Click on a file name to reopen it. The number of files displayed is set in the Carousel Generator Options dialog box (Tools > Options).
Exit	Closes the application. An opportunity is offered to save the session if it has not been saved.

Edit Menu Options

Table 2-2: Edit menu options

Option	Function
Cut	Cuts the currently highlighted item. The item is stored on the Windows clipboard.
Copy	Copies the currently highlighted item. The item is stored on the Windows clipboard.
Paste	Paste the item currently on the Windows clipboard.
Empty Carousel	(Carousel contents node highlighted.) Deletes the carousel contents.
Delete Collections	(Collection node highlighted.) Deletes the selected collection (The Collection must be empty; the contents must be moved to another collection first).
Delete Program	(Program node highlighted.) Deletes the selected program and the carousel(s) it contains.

View Menu Options

Table 2-3: View menu options

Option	Function
MHP Applications	List MHP applications where they are included in a session.
Carousels; Log; Generator Toolbar; Player Toolbar; Status Bar	Allows the screen elements listed to be shown or hidden.

Session Menu Options

Table 2-4: Session menu options

Option	Function
New Program...	(Program view.) Adds a new program node.
Import Elementary Stream(s)...	(Program view.) Allows elementary streams to be added to the Elementary Streams node.
New Carousel	(Carousel view or Program node.) Allows a new carousel type to be created.
Carousel Wizard	Opens the Carousel Wizard which takes the user through carousel and stream generation step-by-step.
Carousel Properties...	Opens the Carousel Properties dialog box.
Contents	Facilitates the file activities listed below (the menu content is context sensitive): Empty Carousel Empty currently highlighted carousel.
	Delete Object Deletes currently highlighted object (and dependant objects). Add File(s)... Adds one or more files to the selected carousel. Add Directory... Adds a directory to the selected carousel. New Directory... Creates a new directory at the selected node. Move to Collection Moves the selected objects to another collection. HTML Application commands Makes, Removes, and Edits HTML applications. Java Application commands Makes, Removes, and Edits Java applications. These HTML and Java Application commands are only applicable to file objects (when a file is selected).
Synchronize	Synchronizes the carousel contents with the source files.
Delete Carousel	Deletes the selected carousel.
Delete All Carousels	Deletes all carousels in the current session.

Player Menu Options

Table 2-5: Player menu options

Option	Function
Stream Generation Properties...	Opens the Stream Generation Properties dialog box.
Start Payout	Initiates output stream generation using information in the current session.
Stop Payout	Stops output generation.
View Packets/Time	Switches between packet count and time display during payout.

Tools Menu Options

Table 2-6: Tools menu options

Option	Function
Launch Multiplexer	Opens the Multiplexer application.
Launch Carousel Analyzer	Opens the Carousel Analyzer application.
Launch TS Analyzer	Opens the Transport Stream Analyzer application.
Options...	Opens the Carousel Generator options dialog box. This is used to set the basic Carousel Generator and session defaults.

Help Menu Options

Table 2-7: Help menu options

Option	Function
Quick Help	Opens an HTML help page containing summarized help information.
User Guide	Opens the Carousel Generator User Guide in Adobe Acrobat™ (PDF) format.
About Carousel Generator...	Displays information about Carousel Generator, including Software Version and Serial Number. This information will be required if Tektronix support is required.

Toolbars

Two toolbars can be displayed: Generator and Player. The toolbars can be shown or hidden using the View menu or by right-clicking in the toolbar area.

Toolbars provide a set of convenient shortcuts for the more frequently used menu options. The buttons are context-sensitive and are enabled or disabled dependent upon the currently highlighted view or the action being performed.

Generator Toolbar



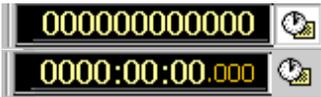
Table 2-8: Generator toolbar icons

Icon	Function	Equivalent Menu Bar Command
	Carousel wizard	Session > Carousel Wizard (Ctrl+W)
	New carousel session	File > New Carousel Session (Ctrl+N)
	Open carousel session	File > Open Carousel Session (Ctrl+O)
	Save carousel session	File > Save Carousel Session (Ctrl+S)
	Toggle workspace view	View > Carousels
	Add directory	Session > Contents > Add Directory...
	Add files	Session > Contents > Add Files...
	New collection	(Right-click on Collection node) > New Collection
	Insert program	Session > New Program...
	Synchronize carousel	Session > Synchronise...
	Launch Carousel Analyzer	Tools > Launch Carousel Analyzer
	Launch Multiplexer	Tools > Launch Multiplexer
	Launch Transport Stream Analyzer	Tools > Launch TS Analyzer

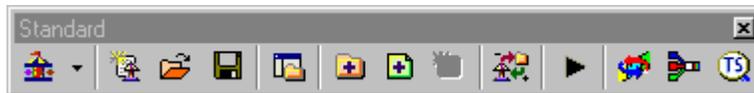
Player Toolbar



Table 2-9: Player toolbar icons

Icon	Function	Equivalent Menu Bar Command
	Playout Carousel	Player > Start Playout
	Stop playout	Player > Stop Playout
	Toggle Packet/Time display	Player > View Packets/Time

Toolbars can be dragged off the edge of the main window into a floating pallet. To do this, place the mouse pointer on the background inside the Toolbar, (not on one of the buttons), hold the left button down, and drag the toolbar into the main window area. The result is a self-contained window that looks like this:



To replace the Toolbar on the window border, drag it over the border until the outline changes shape. It can be placed on the top, bottom, left or right edge.

The Toolbar may be hidden from view - **View > Toolbar**.

Icons. The icons in Session windows are used to provide the user with a graphical indication of status.

Icons incorporating an arrow indicate a shortcut function; for example, elementary streams displayed in a Program node in the Programs view indicate a shortcut to the elementary stream in the Elementary Streams node.

Table 2-10: Session icons

Icon	Function
	Collections node
	Collection node containing the Service Gateway. At least one collection must exist during any session. The collection containing the Service Gateway cannot be deleted.
	Ordinary collection node. Not containing Service Gateway.
	Compressed collection.
	Directory object Included in Carousel; Included in Synchronization.
	Directory object Included in Carousel; Not included in Synchronization.
	Directory object Not included in Carousel; Included in Synchronization.
	Directory object shared.
	File object Included in Carousel.
	File object Not included in Carousel.
	PCR node
	DVB SI / MPEG PSI
	Table node
	Transport Stream node
	Program node
	Carousel object
	Elementary Stream - Audio

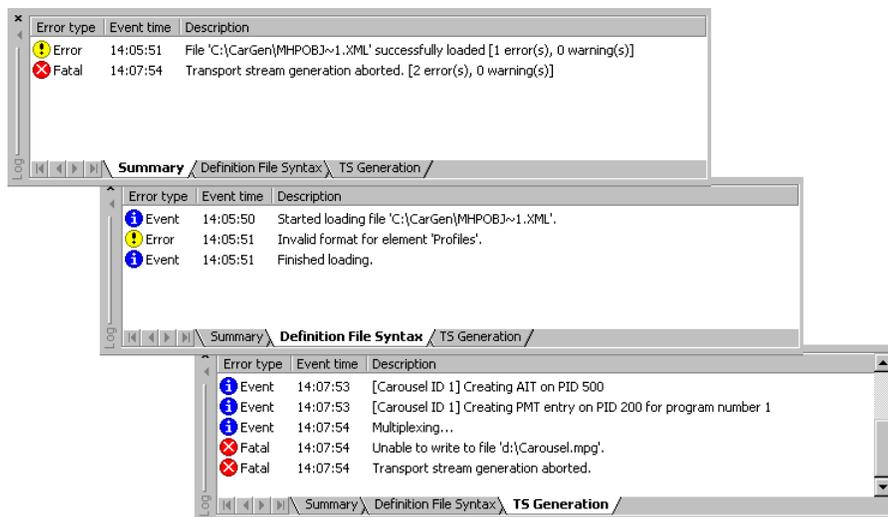
Table 2-10: Session icons (Cont.)

Icon	Function
	Elementary Stream - Video
	Elementary Stream - Private data

Log Window

The Log Window contains three tabbed views:

- The **Summary** log records information on the general activities in the Carousel Generator.
- The **Definition File Syntax** log records information on activities concerning the definition file.
- The **TS Generation** log records information during stream generation activities.



During file loading and saving and the generation of transport streams, error messages are routed to the appropriate Log window tab. More information about each error can be accessed by clicking on the error entry or selecting the **Details...** option from the right-click menu.

The following icons are used to indicate the severity of the error:

-  (Blue) Event Indicates normal processing activity.
-  (Gray) Warning Indicates that information was not available or was invalid. The operation will often be completed.
-  (Yellow) Error Indicates that a sub-operation could not be completed; the overall task may still be completed.
-  (Red) Fatal Indicates that a fatal error has occurred; an activity has failed to reach completion.

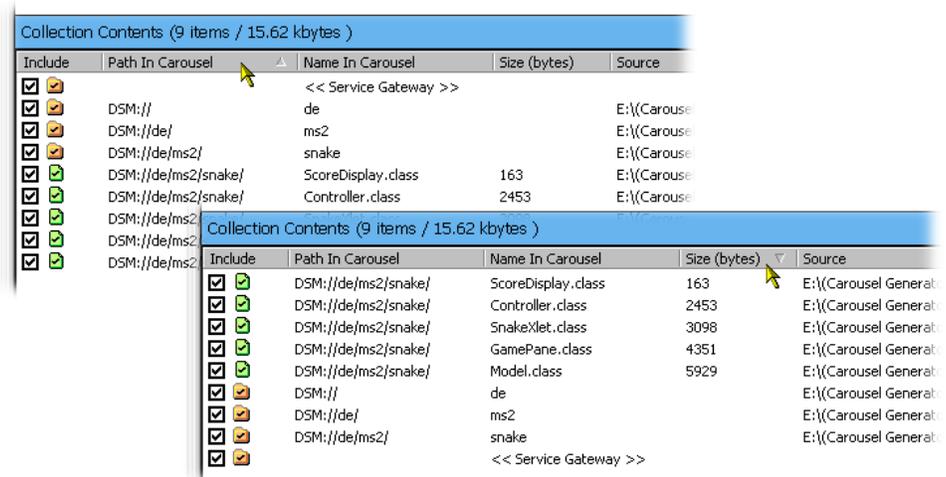
A right-click menu allows the user to clear the displayed log or all logs.

Status Bar

The Status Bar displays tool-tips when the mouse pointer is over active elements of the window, for example, toolbar buttons and menu options.

Properties Window (List Control)

In properties windows that display lists (for example, contents lists), one column can be selected to sort the list into ascending or descending order.



To sort a list, click the key column header. If the same column needs to be sorted in reverse order, click the header again; note that the arrow icon in the header bar indicates the sort direction.

Carousel Generation

This section describes the processes required to create a transport stream containing one or more carousels. In broad terms it echoes the steps outlined in the Wizard, but more background information is provided.

Setting Overall Carousel Generator Properties

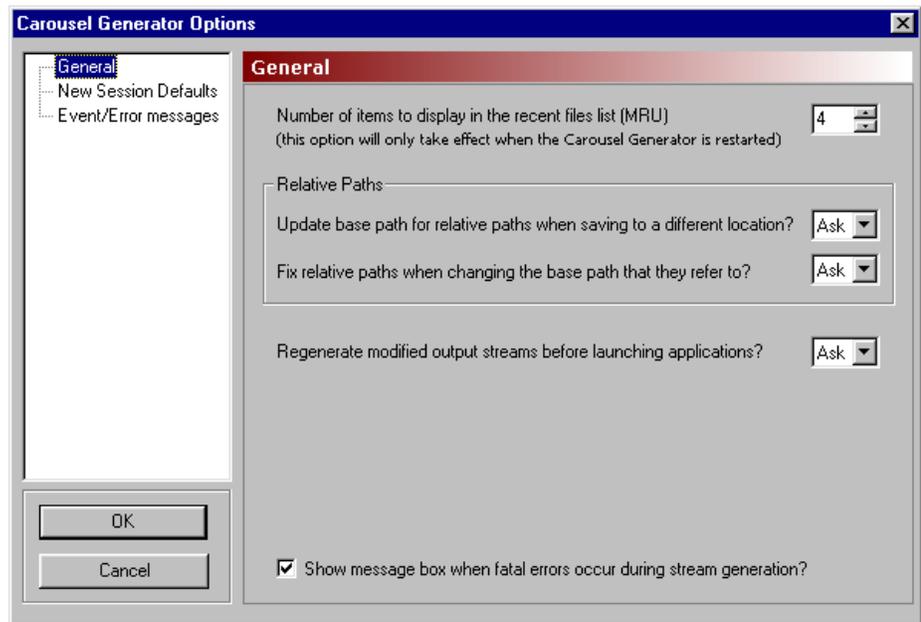
Although not essential during every session, the general properties of the Carousel Generator can be set using the Carousel Generator Options dialog box. Note that settings such as the Output Filename can be overridden in the current session; however, the settings made here will be used as the defaults in any new session.

Select **Tools > Options...** to open the Carousel Generator Options dialog box.

Carousel Generator Options

The following screens are available in this dialog box: **General**, **New Session Defaults** and **Event/Error messages**. To view a screen, click the name in the left panel.

General Screen



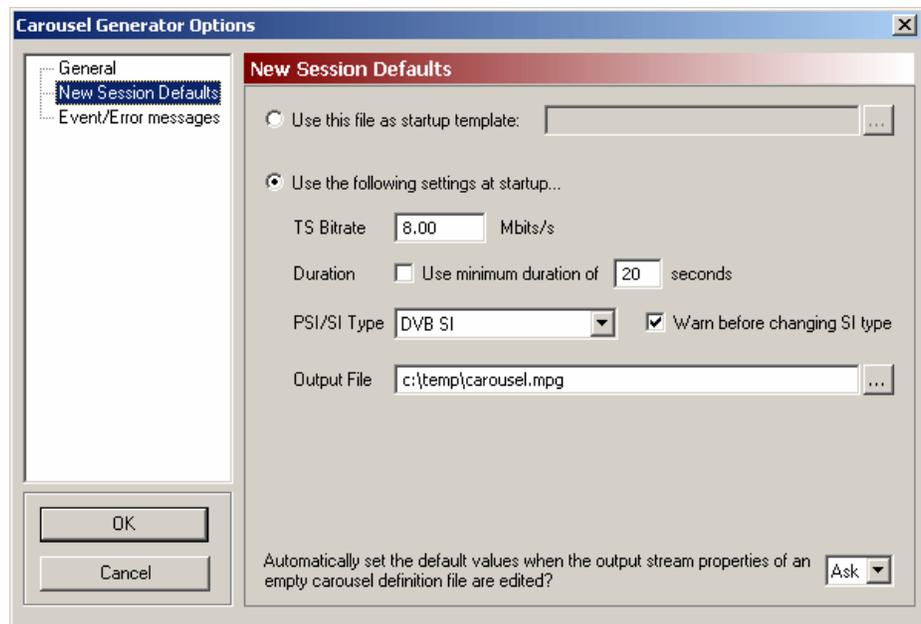
- Number of items...** A list of the most recently used carousel definition files is displayed in the **File** menu. Use this parameter to select how many file names should be displayed.
Range: 0 to 15
- Relative Paths** The paths of source components associated with a carousel file can be stored in relative or absolute format.
- Update base path...** When a carousel definition is saved to a different (new) location, components stored with paths relative to the original carousel definition may no longer be found at the same (relative) location. If **Yes** is selected from the drop-down list, the base path will be modified so that the components can still be found. Select **Ask** to allow the user to make a decision when the carousel definition is saved. If **No** is selected, no modification will be made to the base path; carousel components may no longer be accessible to the definition file.
- Fix relative paths...** When the base path for components referenced by a carousel definition file is changed, the existing relative paths may not refer to the correct locations. If **Yes** is selected from the drop-down list, the relative paths will be adjusted so that they are referenced correctly to the new base path.

- Regenerate...** When enabled, launching Carousel Analyzer, Transport Analyzer or Multiplexer causes the output stream to be regenerated using the current session properties. This ensures that the properties that have been entered in the Carousel Generator are the same as those shown in the Carousel Analyzer, Transport Analyzer or Multiplexer.

- Show message...** When enabled, a message will be displayed during stream generation if an error occurs which causes the stream generation to terminate. The error will always be reported in the TS Generation tab of the Log window.

New Session Defaults Screen

This screen provides default values to be used for all new sessions and consequently in the carousel definition files and generated transport streams. The default values can originate from a template or be set individually. The values can be overridden in individual carousel sessions.



- Startup Template** Select this option and identify a file to be used as a start-up template.

Any carousel session file (XML format) can be used as a template. It can be used primarily to retain settings which are required from session to session, for example, network settings.

Startup Settings. Select the **Use the following settings...** option to set the session defaults locally.

TS Bitrate: The bit rate of the output transport stream.
Range: 0.25 Mbit/s to 90 Mbit/s

Duration: The duration value (in seconds) available when this feature is enabled will dictate the minimum length of the transport stream.

PSI/SI Type: This selection will dictate the tables that are automatically created at startup.

If **MPEG PSI** is selected, only the PAT and PMT will be generated. If **DVB SI** is selected, the mandatory DVB tables (NIT actual, TDT, SDT actual and EIT P/F actual) will also be generated.

Select the **Warn before...** checkbox to display a message when a change to the Stream Generation PSI/SI Type property is attempted (see page 2–40).

Output Settings.

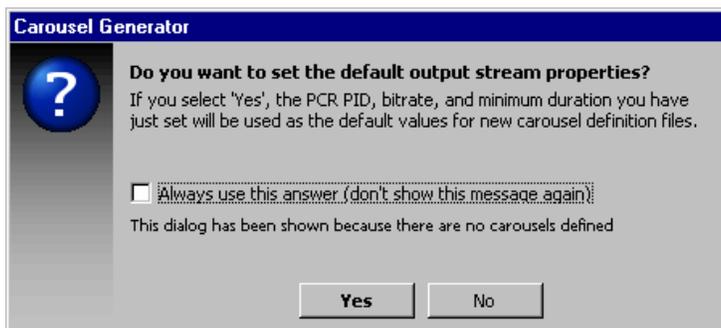
Output File: Enter the filename to be used in generating an output transport stream or browse to find an existing filename.

Automatically set the default values...

If at the start of a session (with no carousels defined), changes are made to the *Stream Generation Properties* (see page 2–40), whether or not the changes are saved as Carousel Generator defaults is dictated by this setting.

The options operate as follows:

Ask: The dialog box shown below will allow the user to choose between using the revised settings as future defaults or to only use them for this session.

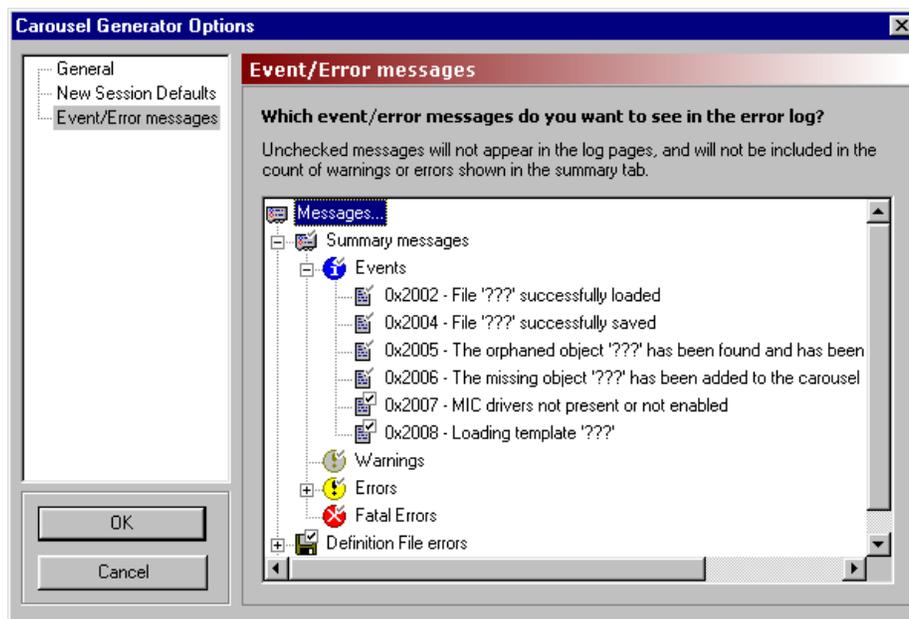


If the **Always use...** checkbox in the dialog box is enabled, the **Automatically set...** option in this screen will be reset to concur.

No: The revised settings will not be used as future defaults.

Yes: The revised settings will be used as future defaults.

Event/Error Messages Screen



The Log view, which can be displayed as part of the main application, displays a series of status and error messages, which advise the user of the progress of carousel and stream generation.

This screen allows the user to indicate which messages should be displayed. The Log view contains three tabbed screens: Summary, Definition File Syntax and TS Generation. These correspond to the message categories Summary messages, Definition File errors and TS Generation errors in this screen.

Each message category contains four levels of severity: Events, Warnings, Errors and Fatal Errors. Individual messages that can be displayed in the Log view are listed at each level.

Message Selection. The checkmarks associated with each message icon indicate the reporting status of the message.



Enabled (permanent): this message type will always be reported in the log view.



Enabled / disabled (toggle): this message type is enabled/disabled by the user. It will only be reported in the log view when enabled.



If one or more of the subsidiary message types in a category (Events, Warnings Errors) is disabled, this icon is displayed.

All messages in the Summary category and Fatal Error messages in all categories are all permanently enabled; they cannot be disabled. The remaining messages in the Carousel Definition File and Stream Generation categories can be enabled and disabled as required by clicking on the message icon.

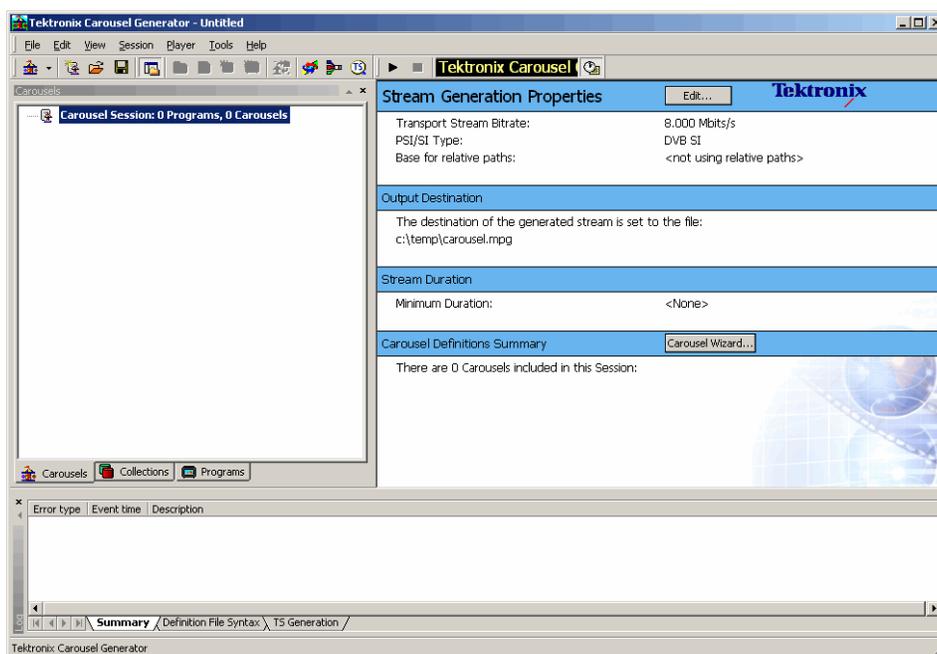
A brief description of a message can be displayed by clicking on the message name.

(See also *Log Window*, page 2–30.)

Creating a Session

A session in Carousel Generator is the activity during which objects are assembled in one or more carousels with a transport stream being the end result.

The initial activity when starting a session is to note the defaults that are already displayed in the Stream Generation Properties screen; these are derived from the Carousel Generator Options. If required, the values can be modified for the current session.

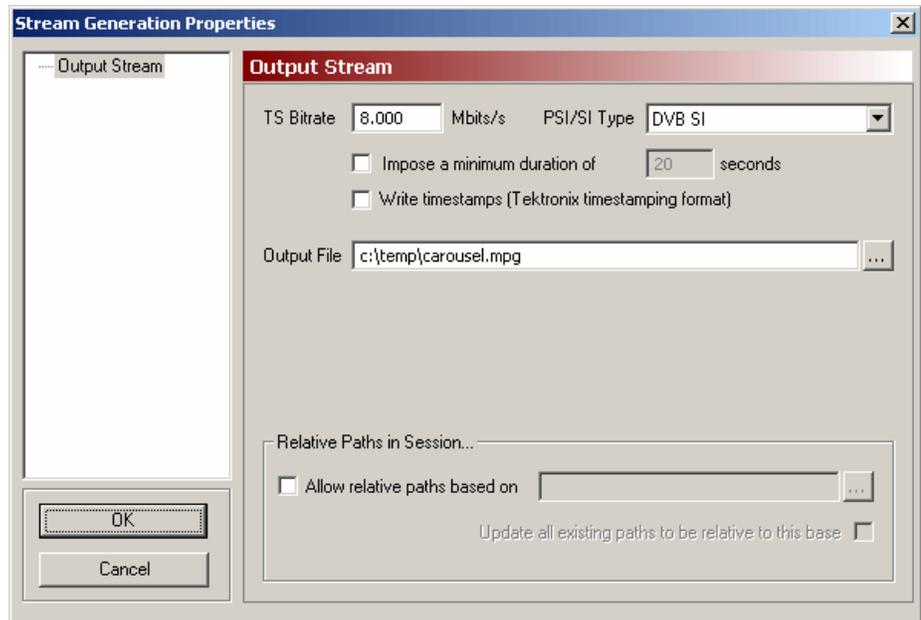


The values may be changed at any time in the session; it may be useful to review these settings at the end of a session, before the transport stream is created.

Select **Player > Stream Generation Properties...** to open the Stream Generation Properties dialog box or select **Edit...** in the properties window or double-click in the properties window.

Stream Generation Properties

This screen provides stream generation values to be used in the current session.



- TS Bitrate:** The bit rate of the output transport stream.
Range: 0.25 Mbit/s to 90 Mbit/s.
- PSI/SI Type:** This selection will dictate the tables that are created in the generated stream. If MPEG PSI is selected, only the PAT and PMT will be present. If DVB SI is selected, the mandatory DVB tables (NIT actual, TDT, SDT actual, and EIT p/f actual) will also be generated.
- A warning may be issued noting that SI settings may be lost (see *New Session Defaults Screen*, page 2–35).
- Output File:** Enter the name and path of the output file. Select to specify a location on local or network drives.
- Relative Paths in Session...**
The paths of source components associated with a carousel file can be stored in relative or absolute format.

Allow relative paths based on

When enabled, Carousel Generator will interpret all incomplete paths as being relative to the base path specified in the adjacent text box.

The specified base path can be an absolute path (such as c:\data) or it can be relative to the current location of the carousel definition file. Note that if '.' is entered in the box, all relative paths are referenced to the current location of the carousel definition file.

Any automatically created paths will also be made relative to the base path, if possible.

If the checkbox is cleared (disabled), only absolute paths will be used.

Update all existing... When enabled, Carousel Generator will attempt to convert all paths used in the session to be relative to the specified base path (where possible).

If the checkbox is cleared (disabled), existing absolute paths will be left unchanged.

Selecting the Carousel Type

There are a number of carousel types available from the various standards authorities. Carousel Generator makes available the types listed in the following table:

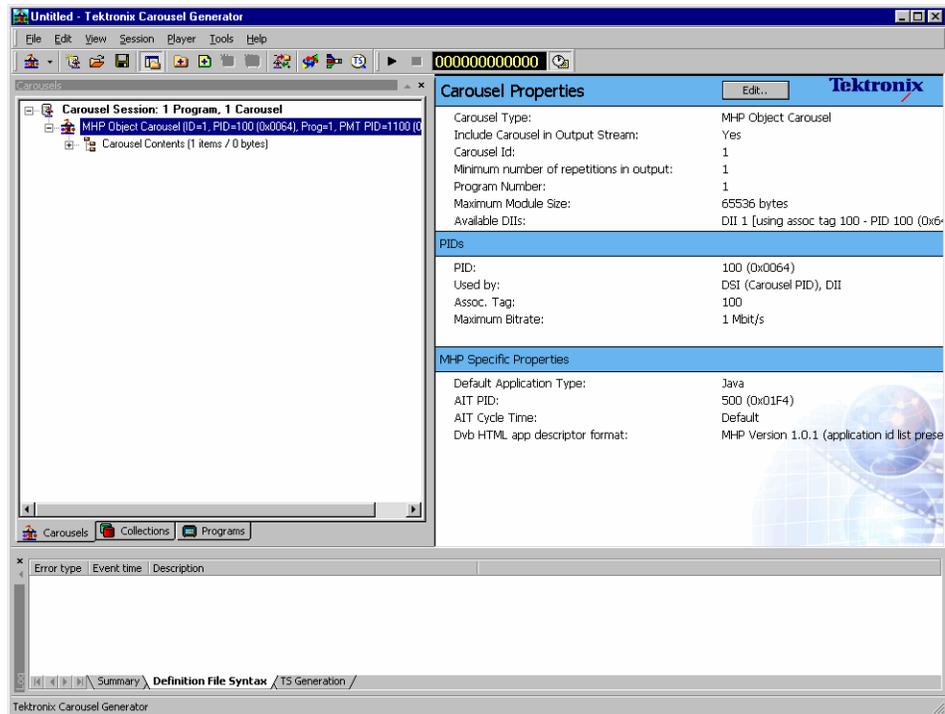
Carousel Type	Guiding Standard
DSMCC Object	ISO/IEC 13818-6: 1998 (MPEG)
DVB Object	DVB EN301 192 V1.2.1
DTT Object	DTG DTT Requirements for Interoperability V3.1
MHP Object	ETSI TS101 812 V1.1.2 & V1.1.1

Select **Session > New Carousel** and click on the required carousel type. A new (empty) carousel of the required type will be added to the session. The carousel will be assigned an identity number (ID) and allocated to a PID automatically.

Additional carousels can be added; successive IDs and PIDs will be allocated.

Modifying the Carousel Properties

The properties of individual carousel can be modified as required. A summary of the carousel properties is displayed in the Properties window.



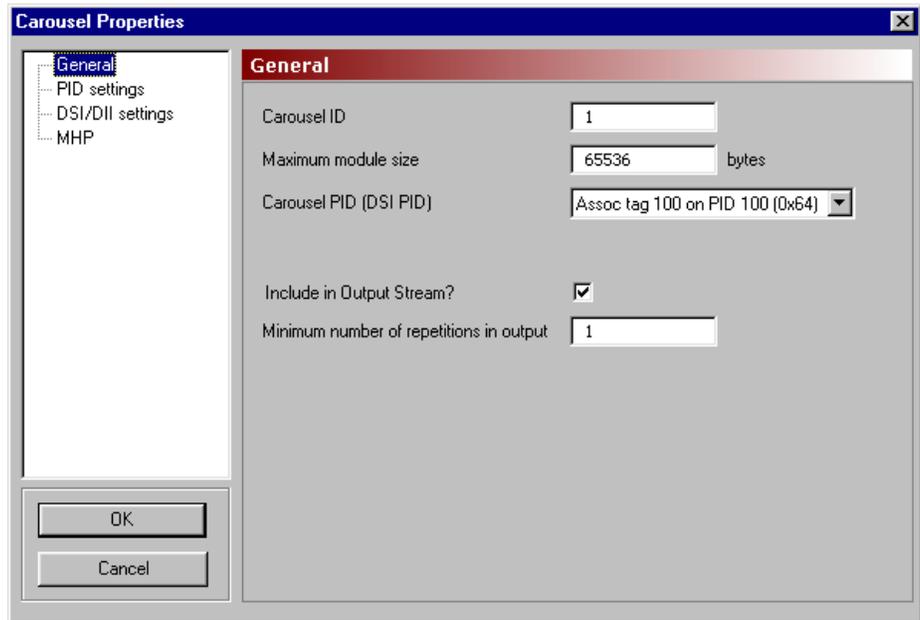
The contents of the carousel are displayed when the Carousel Contents node is highlighted.

To edit individual carousel properties, in the Carousels tab of the Sessions window and with the carousel node highlighted, select **Session > Carousel Properties...** or select **Edit...** in the Properties window. The Carousel Properties dialog box is displayed.

The number of screens available in the Carousel Properties dialog box is dependent on the carousel type selected. In the following notes, screens dedicated to only a single carousel type are identified; all other screens are common to all types.

The Carousel Properties dialog box can display up to four screens: General PID settings, DSI/DII settings, DTT Applications (DTT only), and MHP (MHP only).

General Screen



Carousel ID: Unique carousel identity. The Carousel ID is normally generated automatically but can be changed by the user.
Range: 0 to 4294967295

Maximum module size: The maximum size of the modules used to carry the carousel objects. During output stream generation, if a module has one or more objects and does not have enough space for the next object, a new module will be created. If a module is empty and the object added will exceed the maximum size, the object is still added, but no more objects will be placed in that module.
Range: 0 to 4294967295 Default: 65536

Carousel PID (DSI PID): Select the required Association Tag from the drop-down list.
During carousel creation, a default Association is generated to carry the Carousel/DSI PID. This cannot be removed.

Include in Output... This flag allows the carousel to be included in or excluded from the output stream. If the checkbox is disabled, no reference to this carousel or its contents will appear in the generated output stream.

Minimum number... Enter the minimum number of times that the carousel is to appear in the output stream; this can be repeated for each carousel in the session. The resulting output stream will be long enough to accommodate at least the minimum number of repetitions requested for each carousel.

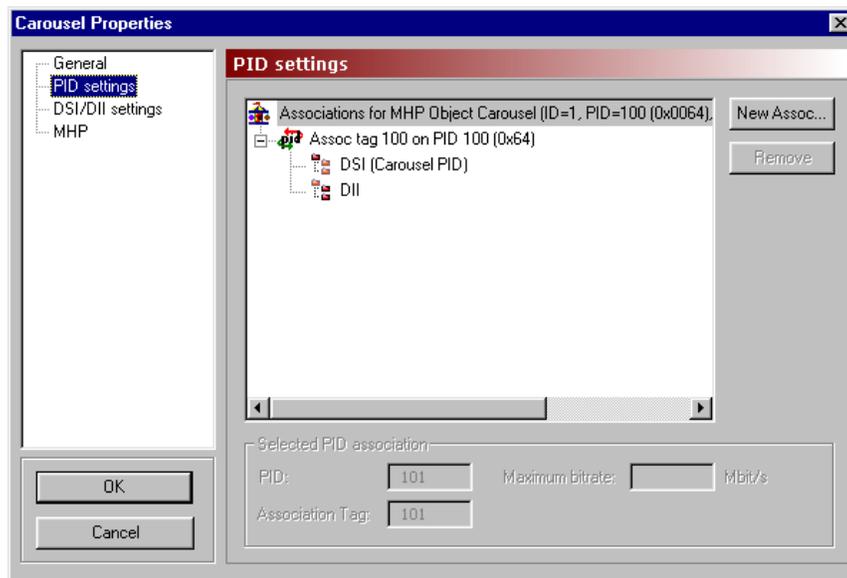
PID Settings Screen

The tree structure in the PID Settings screen shows the PID usage for the selected carousel’s program. The DSI and DII messages carried in the carousel use an Association tag, which allows the BIOP messages in the carousel to be linked to a PID in the stream (see “BS ISO/IEC 13818-6:1998 Information Technology - Generic coding of moving pictures and associated audio information - Part 6: Extensions for DSM-CC).

To place the DII and DSI messages on different Association Tags, use the DSI/DII settings screen (see page 2–46).

During stream generation, each Association Tag specified will result in the following:

- An elementary stream (ES) with a stream type of 11 (DSMCC U-N messages) and the entered PID being added to the PMT ES loop.
- The Association Tag value will be inserted into an association_tag_descriptor inside this ES’s descriptor loop.



Highlighting any of the association nodes will display the PID associations in the Selected PID association panel.

Select New Assoc... to create a new association node in the tree. The PID and Association Tag will be automatically allocated, but they can be changed in the Selected PID association panel.

Selected PID Association

- PID:** This is the PID of the elementary stream (ES) carrying the DII and/or DSI messages.
Range: 0 to 8191 (see *PID Values*, page 2–45).
- Association Tag:** This is the 16 bit value carried in the association_tag_descriptor which is inserted in the ES descriptor loop of the PMT signaling this carousel.
Range: 0 to 65535
- Maximum bitrate...** This is the maximum bit rate allocated in the stream for this PID. If there is not enough bandwidth to support this rate, the actual bit rate will be less.
Range: 0.25 Mbit/s to 90 Mbit/s

PID Values. As stated, the valid range for PIDs is 0 to 8191. However, there are a number of restrictions on the actual values that can be used, since some are reserved or may be used in other carousels. The following table shows the elements that can and cannot share PID values. Unless otherwise noted, “No” indicates the entities in the row and column headers may not share a PID value in any carousel in a single session. ‘Yes’ indicates that the PID value may be shared with other entities in the same session; unless otherwise indicated in the Notes below.

	Reserved	PCR	PMT	AIT	DSI	DII
DII	No	No	No	No	Yes (Same as Carousel)	Yes (Same as Carousel)
DSI	No	No	No	No	No	-
AIT	No	No	No	No	-	-
PMT	No	No	Yes	-	-	-
PCR	No	No	-	-	-	-
Reserved	No	The Reserved PIDs are PIDs 0 to 31 (0x00 to 0x1F) and the Null PID 8191 (0x1FFF)				

NOTE. *PIDs 0 to 15 (0x0000 to 0x000F) are reserved by MPEG; PIDs 16 to 31 (0x0010-0x001F) are additionally reserved by DVB.*

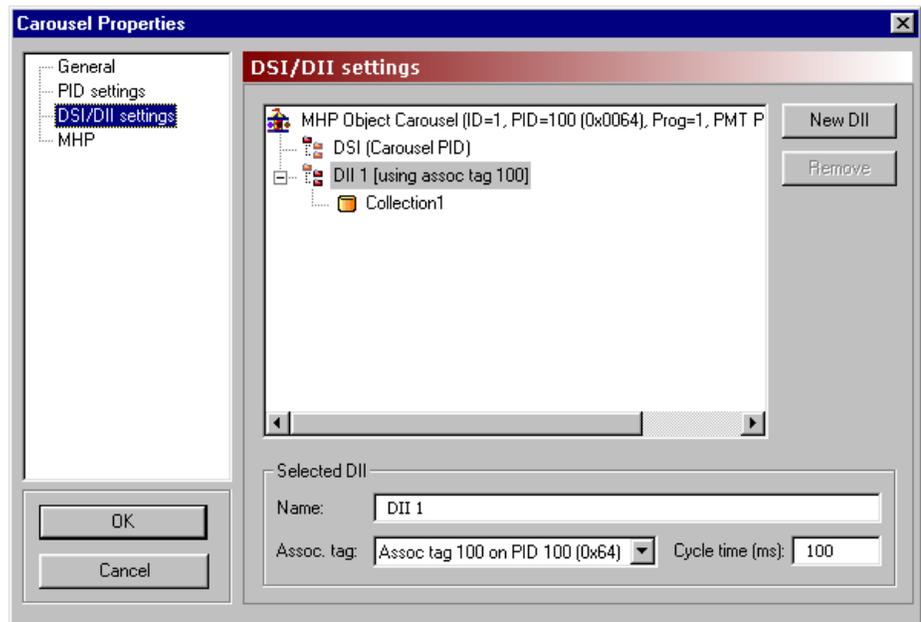
PMTs cannot share PIDs with anything but other PMTs. Multiple PMT sections can be on the same PID, so, if required, every carousel could have its PMT entry on the same PID (usually not done that way, but it can be).

The DIIs belonging to a single carousel can be on the same PID as its DSI or its other DIIs, but not on the same PID as DSIs or DIIs belonging to other carousels.

For example, the yes/no indicators in the PMT row/column indicate that the value of the PID carrying a PMT may not be shared with any other entities in the session. However, in the case of the PMT, see the above note.

DSI/DII Settings Screen

The tree structure in the DSI/DII Settings screen shows the DSI and DIIs that will be generated in the stream for the selected carousel. Each DSI/DII has an Association Tag and a cycle time, and DIIs have a user definable name.



Highlighting any of the DII nodes will display the PID associations in the **Selected DII** panel.

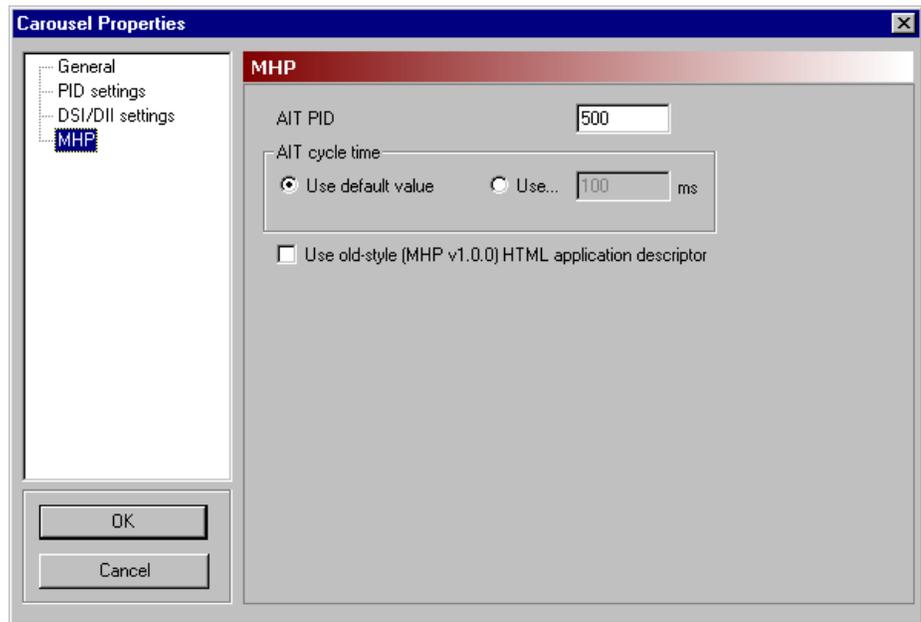
Select **New DII** to create a new DII using default values. The default Association Tag to use is decided by first checking if an existing DII uses the DSI tag. If so, this tag is used, otherwise the tag of the first DII in the list is used.

Selected DII

- Name:** This is a user allocated name for this DII. The name does not appear anywhere in the generated stream, only within the Carousel Generator.
- Assoc. tag:** This is the list of all the currently defined Association tags listed for this carousel. Assigning a different Association Tag to the DII effectively changes the PID that the DII messages will be carried on.
(Association tags can be added from the PID Settings screen.)
- Cycle time (ms):** This option sets the time taken for this DII to be repeated. For example, DIIs referencing boot classes may be given shorter cycle times to speed up the boot process.
Range: 1 ms to 3600 s.

To associate a collection with a DII, first create the DII, giving it a meaningful name, set the Association tag and Cycle time of the DII and close this dialog box. On the Collections tab of the Session window, edit the collection's properties to set the field **Using DII** to the new DII.

MHP



AIT PID

This is the PID that carries the Application Information Table (AIT).
Range: 0 to 8191 (see *PID Values*, page 2–45).

AIT cycle time:

Set the time to be taken for the selected Carousel’s AIT to be repeated. Default: 100 ms.

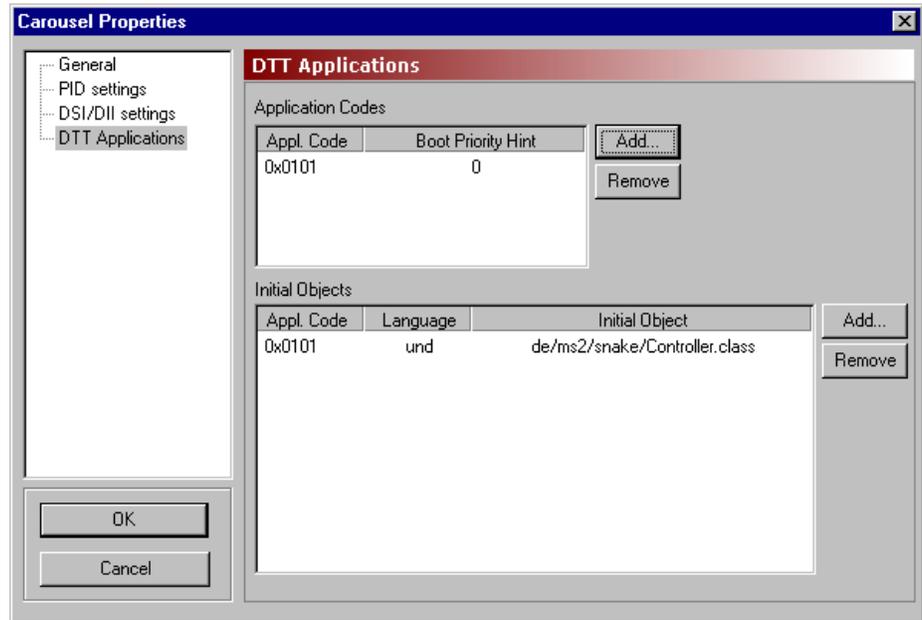
Use... Select this option to allow the AIT cycle time to be set manually. Range: 1 ms to 3600 s.

Use old-style...

If this box is checked, the DVB-HTML application descriptor format as defined by MHP v1.0.0 (see MHP; ETSI 101812, Version 1.1.2 and 1.1.1) will be used.

If this box is not checked, the new format as defined in MHP v1.1.2 (see MHP; ETSI 101812, Version 1.1.2 and 1.1.1) will be used. This will cause the DVB-HTML Application Descriptor to be properly formed and include an empty set of application IDs. To add application IDs to this descriptor, use the HTML Properties page on the MHP File Properties dialog box.

DTT Applications



Application Codes. The entries in this list will be added to the data_broadcast_id_descriptor in the elementary stream descriptor loop of the PMT. This descriptor lists the application types that can be booted from the elementary stream with which it is associated. The Boot Priority Hint is an indication of the application that should be booted in the case of more than one in the list being supported. The application with the highest Boot Priority Hint, in the range 0 to 255, will be booted first.

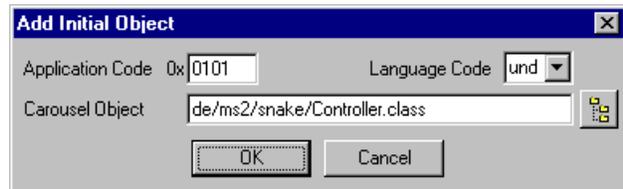
Add Displays the **Add Application Code** dialog box.



Remove Removes the highlighted Application Code.

Initial Objects. The Initial Object list allows different languages to have different boot objects. On stream generation, entries here will appear in the ServiceContextList part of the Service Gateway object.

Add Displays the **Add Initial Object** dialog box.

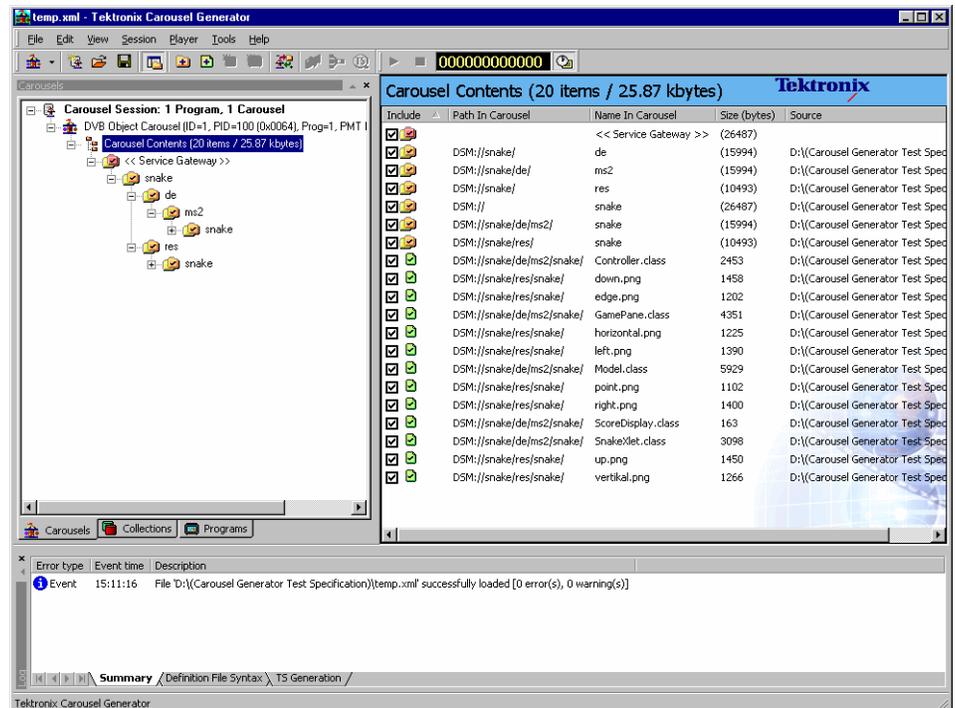


The **Application Code** should correspond to a code that is already listed in the **Application Codes** panel. A **Language Code** can be selected from the drop-down list. The object can be given a name in the **Carousel Object** field. If objects have already been associated with the carousel, the adjacent button will display the contents of the carousel, from which an object can be selected.

Remove Removes the highlighted Initial Object.

Carousel Contents

Each carousel initially contains two subnodes: Carousel Contents and Service Gateway. The carousel will eventually contain all of the objects associated with a particular function or feature. These objects can be arranged in a hierarchy of directories and files all displayed beneath the Service Gateway node.



Files and directories can be manipulated in a variety of ways:

- All commands are accessible via the Menu Bar or context sensitive right-click menus.
- Files and directories can be dragged and dropped within Carousel Generator.
- Files and directories can be dragged from Windows Explorer.

The properties of files and directories can be edited after they have been incorporated into a carousel.

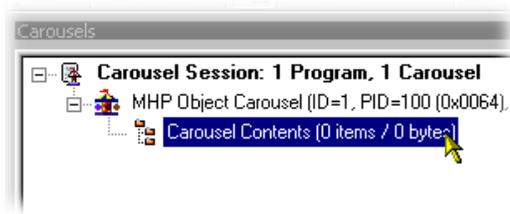
Adding an Object (File/Directory)

Individual files or complete directory structures can be added to a carousel. New directories can be created.

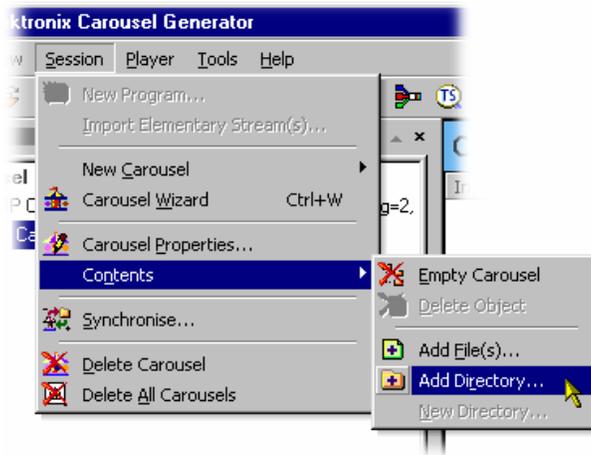
The location that an object is to be added to should be highlighted.

Adding Directories.

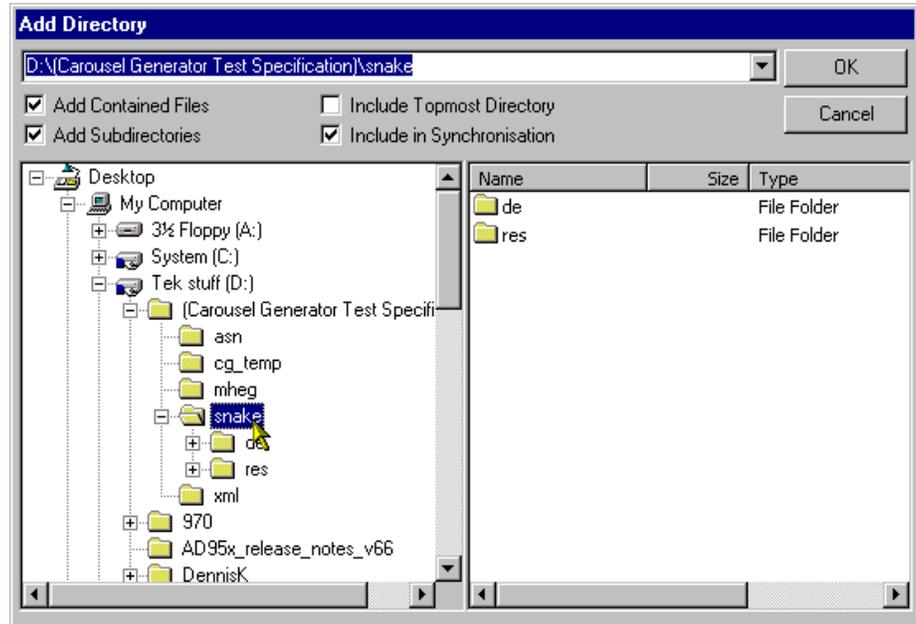
1. Highlight the node in the carousel where the directory is to be added.



2. Select **Carousel > Contents > Add Directory...**



The **Add Directory** dialog box is displayed.



The **Add Directory** allows the user to select any available directory. The directory path is shown in the top field; the most recently accessed directories are available in the drop-down list. The adjacent checkboxes have the following functions:

Add Contained Files: All files contained in the selected directory (and any subdirectories if **Add Subdirectories** is enabled) will be added to the carousel.

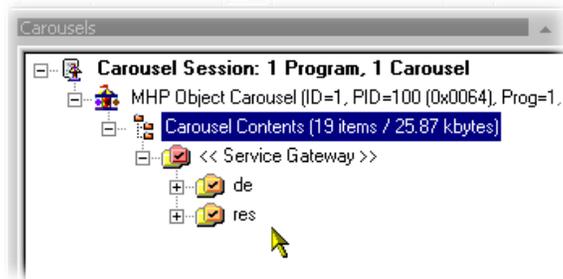
Add Subdirectories: All subdirectories of the selected directory will be added to the carousel.

Include Topmost Directory: The selected directory will be added to the carousel (not just the files and/or subdirectories).

Include in Synchronization: The selected directory will be synchronized with its source directory (see page 2–65).

3. Select the required directory and enable the required checkbox options. Select **OK** to add the directory to the carousel.

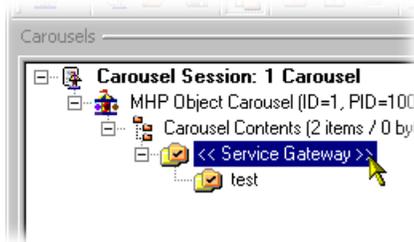
4. The new directory is added below the highlighted node.



NOTE. When directories are dragged and dropped from Windows Explorer, all subdirectories and files will be included. If the Shift key is held down during this action, the topmost directory name is not included.

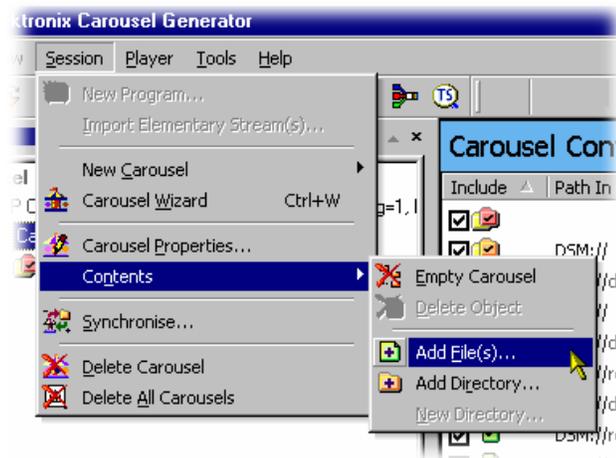
Adding Files.

1. Highlight the directory node in the carousel where the file is to be added.



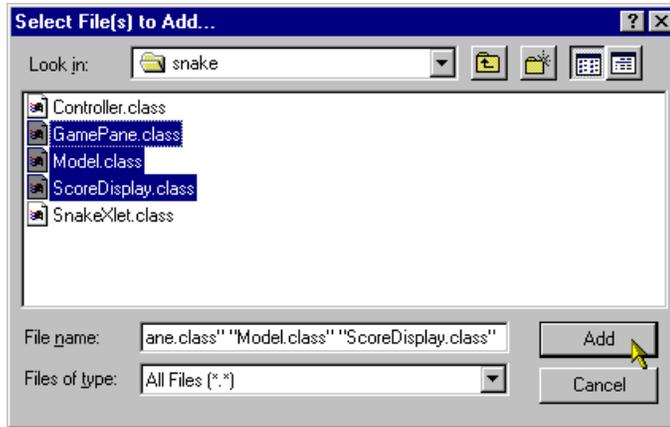
2. Select **Carousel > Contents > Add file(s)...**

The **Select File(s) to Add** dialog box is displayed.

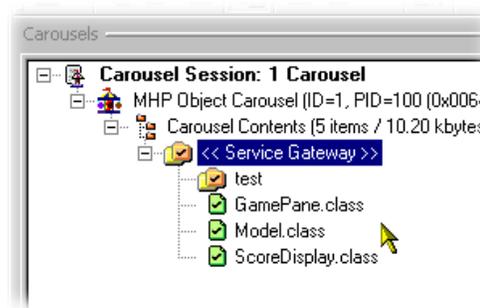


3. Select the file(s) to be added.

4. Select **OK** to add the files to the carousel.

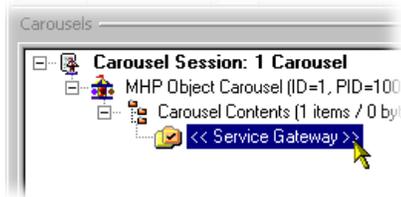


5. The new file(s) are added to the selected directory node.

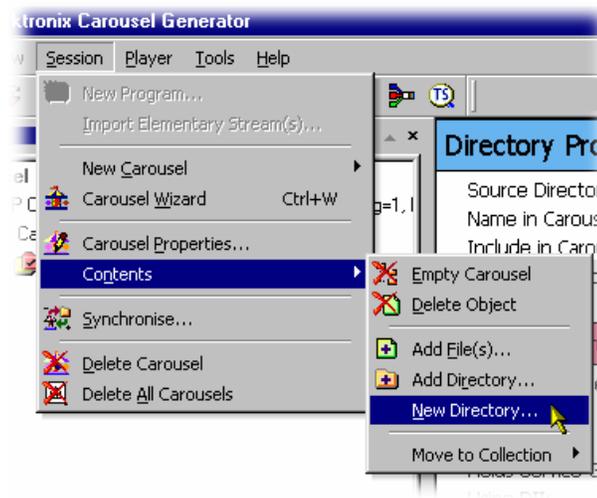


Creating a New Directory.

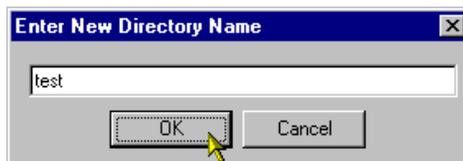
1. Highlight the node in the carousel where the directory is to be created. (In this screenshot, the new directory is the first object to be created.)



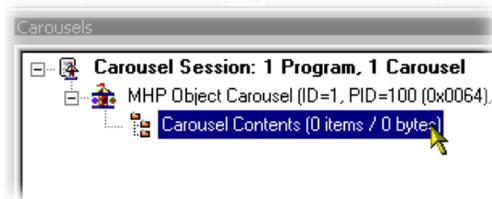
2. Select **Carousel > Contents > New Directory...**



3. Enter the name of the new directory and select **OK** to create the directory.



4. The new directory is created below the highlighted node.



Moving an Object

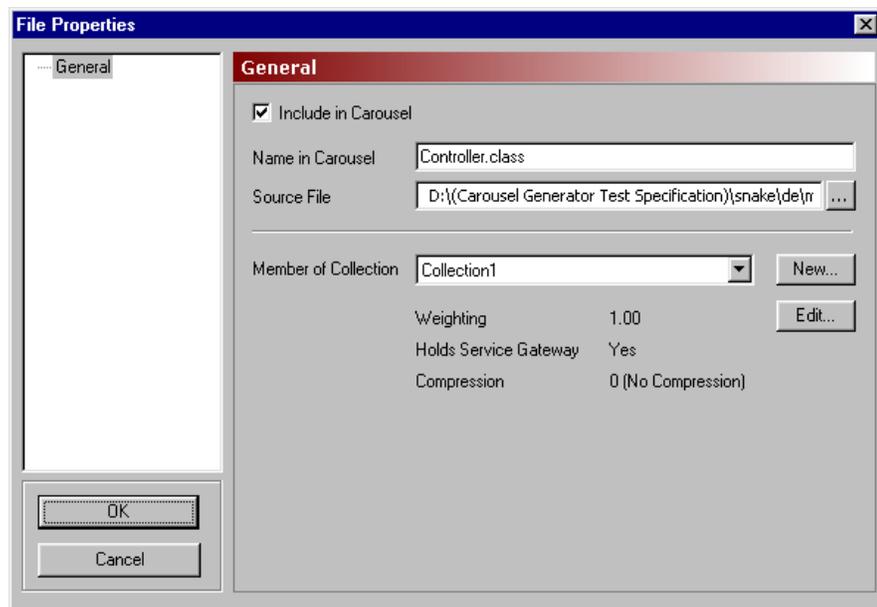
Files and directories are moved within a carousel using standard Windows commands and techniques, such as Copy, Cut and Paste and Drag, and Drop.

Removing an Object

Files and directories are removed from a carousel using standard Windows commands and techniques.

File Properties

When a file is highlighted, the properties of that file are summarized in the Properties window. The properties can be viewed in detail and edited by selecting **Edit...** and displaying the **File Properties** dialog box.

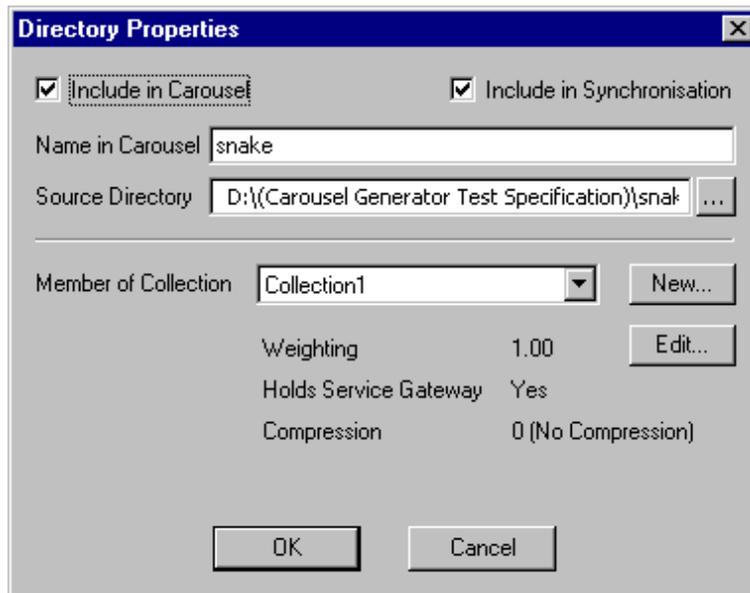


The File Properties dialog boxes for files contained in all types of carousel are similar. However, for the MHP carousel type, if a file is designated as an application (Java or HTML), there are additional properties; these are described in the following sections.

- Include in Carousel:** If this box is checked, the file object will be included in the generated carousel. If not checked, the file object will not be included in the generated carousel.
- Name in Carousel:** This is the name of the object as it will appear in the BIOP message in the output stream.
 Range: 254 characters maximum (specified by the DSMCC specification. Additional characters will be truncated.)
 ASCII character set excluding: \ : / * ? " < > |.
- Source File:** This field is set when the object is added to the carousel and can be edited to point to another object if required. This field does not appear in the output stream and is limited to 260 characters.
- Member of Collection:** This is a list of all the collections currently included in this carousel. Selecting a different collection effectively put this object into a different module possibly with different cycle times and compression characteristics. In the case of a directory object, all child objects below it are also moved to the selected collection.
- New** Create a new collection (see page 2–66).
- Collection Properties:** Displays a summary of the properties of the collection that the object is a member of. The properties can be edited by using the **Edit...** button to open the collection Properties dialog box (see page 2–68).

Directory Properties

When a directory is highlighted, the properties of that directory are summarized in the Properties window. The properties can be viewed in detail and edited by selecting **Edit...** and displaying the **Directory Properties** dialog box.



Include in Carousel: If this box is checked, the directory object will be included in the generated carousel. If not checked, the directory object will not be included in the generated carousel.

Include in Synchronization

If this box is checked, the source directory will be included in the Synchronization process which aims to match the source directory structure with the carousel structure, removing and adding file and directory objects as necessary.

If this box is cleared, this directory will not be compared to the source directory and neither will any subdirectories, regardless of their individual settings.

Name in Carousel: This is the name of the object as it will appear in the BIOP message in the output stream.

Range: 254 characters maximum (specified by the DSMCC specification. Additional characters will be truncated);

ASCII character set excluding: \ : / * ? " < > |.

Source Directory: This field is set when the directory is added to the carousel and can be edited to point to another directory if required. Newly created directories may not initially have a correct source directory, but this can be edited if desired. This field does not appear in the output stream and is limited to 260 characters.

The Source Directory will be used when the carousel is synchronized only if the **Include in Synchronization** box is checked (see also page 2–65).

Member of Collection: This is a list of all the collections currently included in this carousel. Selecting a different collection effectively put this object into a different module with possibly different cycle times and compression characteristics. In the case of a directory object, all child objects below it are also moved to the selected collection.

New Create a new collection (see page 2–66).

Collection Properties: This panel displays a summary of the properties of the collection of which the object is a member. The properties can be edited by using the **Edit...** button to open the Collection Properties dialog box (see page 2–68).

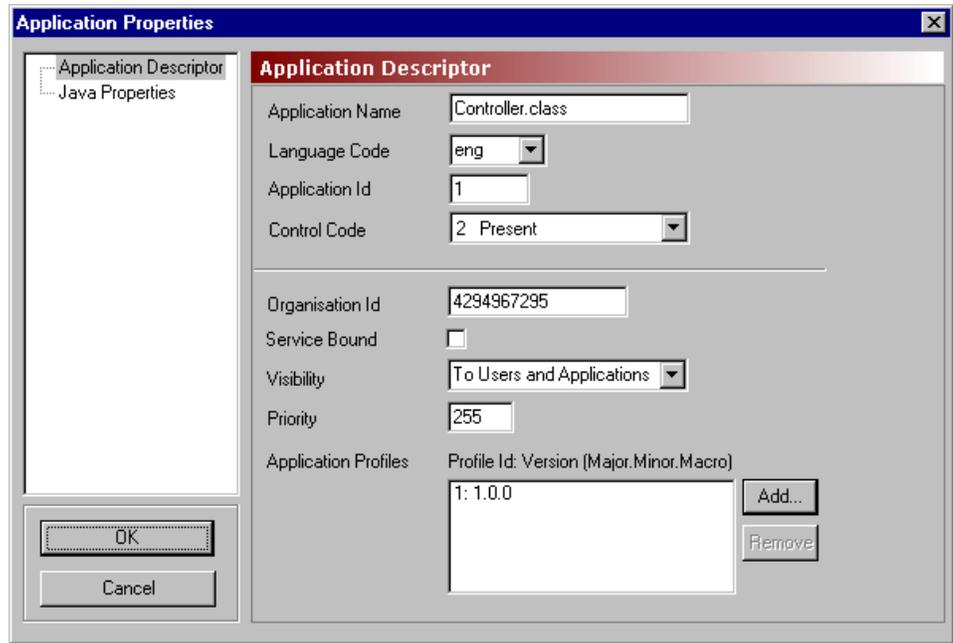
Applications

In MHP, applications are transmitted in object carousels. Applications can be written in Java or HTML. All files that make up the application should be added to the carousel. However, the receiver must be made aware of the entry point into the application and certain other information about the characteristics of the application. This information is sent in the Application Information Table (AIT), which the receiver must process before it can start any application.

To define an application entry point and other application information, highlight a file and select **Carousel > Contents > Make Java Application** or **Make HTML Application**. The **Application Properties** dialog box will be displayed. The components of the Application Properties screens are described in the following paragraphs. Note that when the file properties of an application are viewed, the File Properties **General** screen is also displayed.

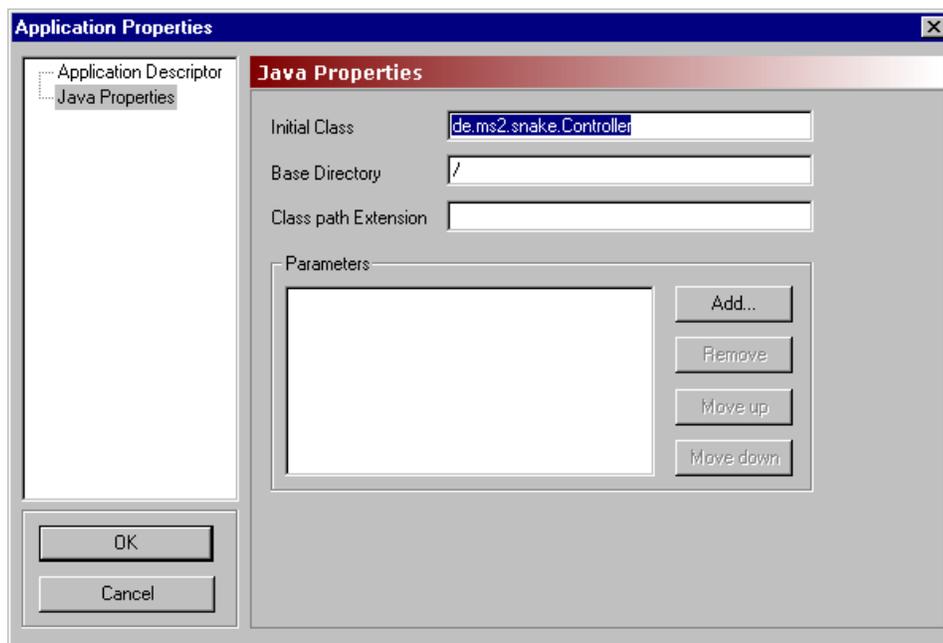
Application Descriptor screen. The Application Descriptor screen is common to both Java and HTML applications.

All the properties on this screen are described in the Application Signaling section of the MHP specification; TS 101 812 v1.1.1, Section 10, Application Signaling.



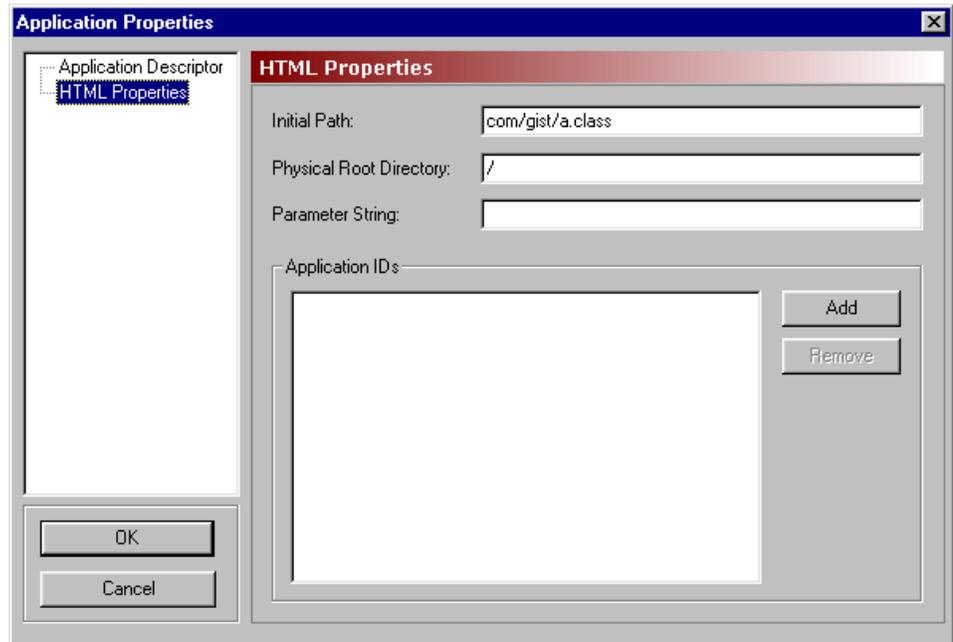
Application Descriptor Name	TS 101 812 identity
Application Name:	Application Name Descriptor
Language Code:	Application Name Descriptor
Application ID:	Application Identifier
Control Code:	application_control_code
Origination ID:	Application Identifier
Service Bound:	Application Descriptor
Visibility:	Application Descriptor
Priority:	Application Descriptor
Application Profiles:	Application Descriptor

Java Properties screen. All the properties on this screen are described in the DVB-HTML Specific descriptors of the MHP specification; TS 101 812 v1.1.1, Section 10, Application Signaling.



Application Descriptor Name	TS 101 812 identity
Initial Class:	DVB-J Application Location Descriptor
Base Directory:	DVB-J Application Location Descriptor
Class Path Extension:	DVB-J Application Location Descriptor
Parameters	DVB-J Application Descriptor

HTML Properties screen. All the properties on this page are described in the DVB-Java Specific descriptors of the MHP specification: TS 101 812 v1.1.1, Section 10, Application Signaling.

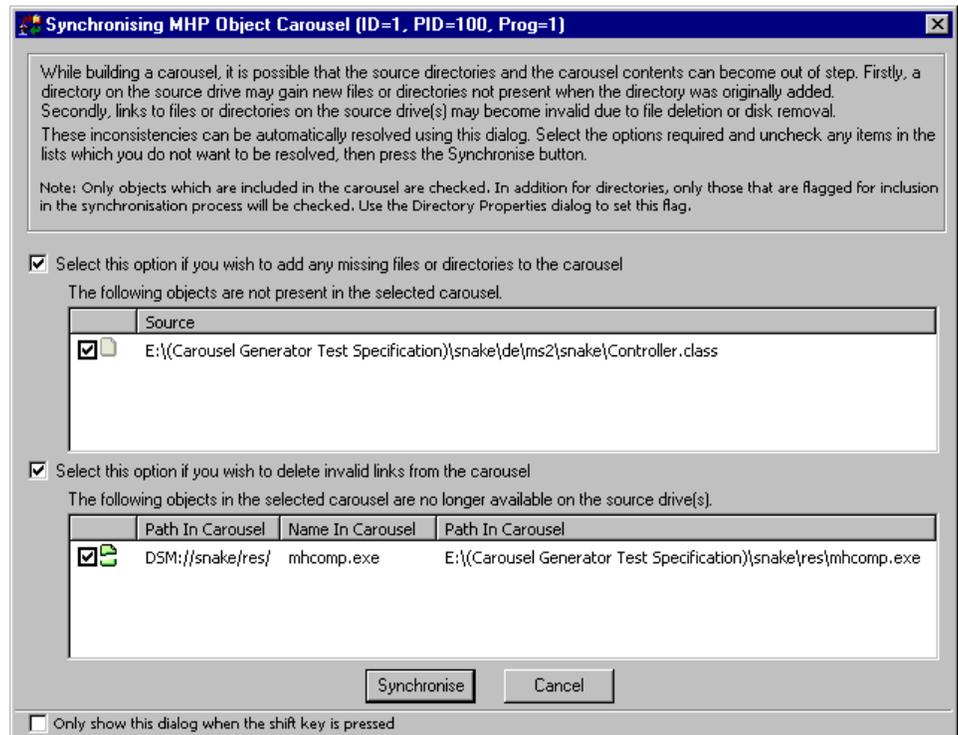


Application Descriptor Name	TS 101 812 identity
Initial Path:	DVB-HTML Application Location Descriptor
Physical Root Drive:	DVB-HTML Application Location Descriptor
Parameter String:	DVB-HTML Application Descriptor

Synchronicity

Directory objects included in carousels are simply references to directories that exist elsewhere; for example, a PC hard drive.

If the **Include in Synchronization** checkbox is enabled for a directory, the directory will be included in the Synchronization process. When **Session > Synchronise...** is selected, the source directory structure is matched with the carousel directory structure. Any objects missing from either the source directory structure or the carousel directory structure are listed in the Synchronizing MHP Object Carousel dialog box (as shown in the following screenshot).



Files or directories available at source but not currently included in the carousel can be automatically added to the carousel by enabling the checkbox (**Select this option if you wish to add any missing files or directories to the carousel**). Individual files and directories listed in the panel can be included or excluded from the activity by enabling or disabling the adjacent checkbox.

Files or directories listed in the carousel but not available at the source can be automatically removed from the carousel by enabling the checkbox (**Select this option if you wish to delete invalid links from the carousel**). Individual files and directories listed in the panel can be included or excluded from the activity by enabling or disabling the adjacent checkbox.

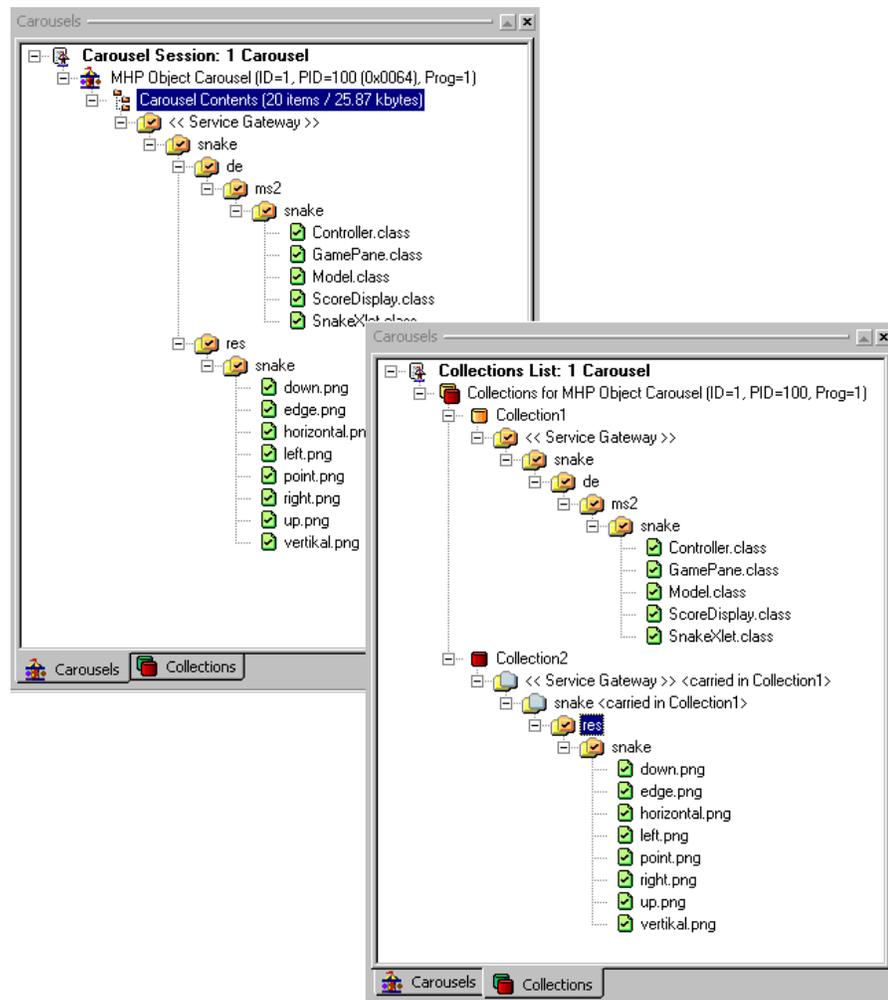
Select **Synchronise** to synchronize the carousel with the source files in accordance with the checkbox selections.

NOTE. If the *Include in Synchronization* checkbox is disabled for a directory, this directory will not be compared to the source directory and neither will any subdirectories, regardless of their individual settings.

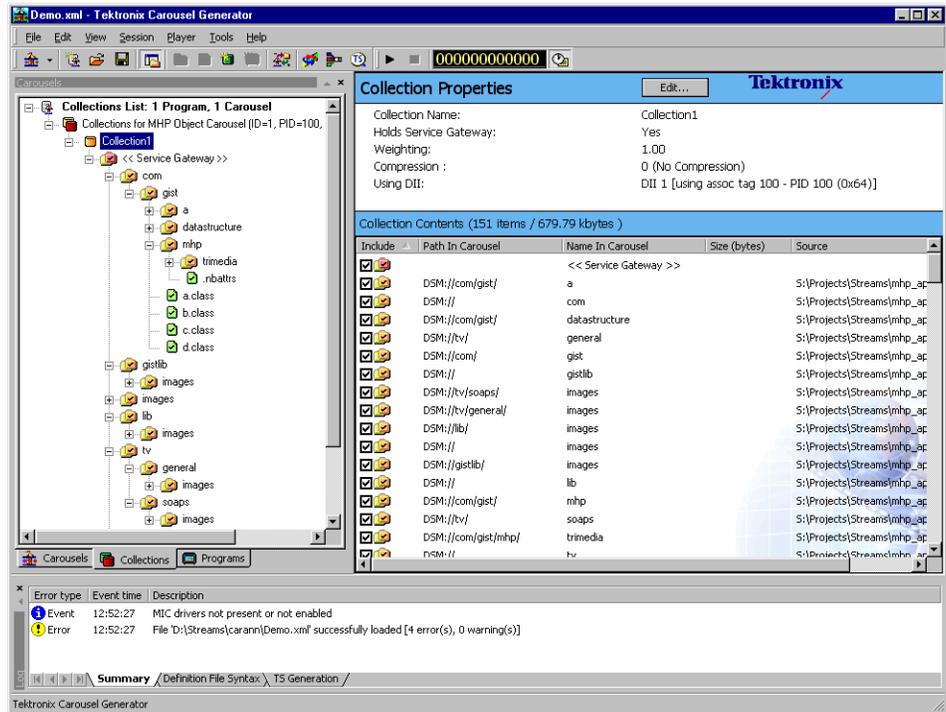
Collections

(See *Carousel Generator Overview*, page 2–2)

Collections provide a means by which objects can be grouped and transmitted in a single carousel with differing properties, such as repetition rate and compression. Each collection can have different properties; all objects in a collection are transmitted with the same properties.



Collections can be viewed by selecting the **Collections** tab in the Session window.



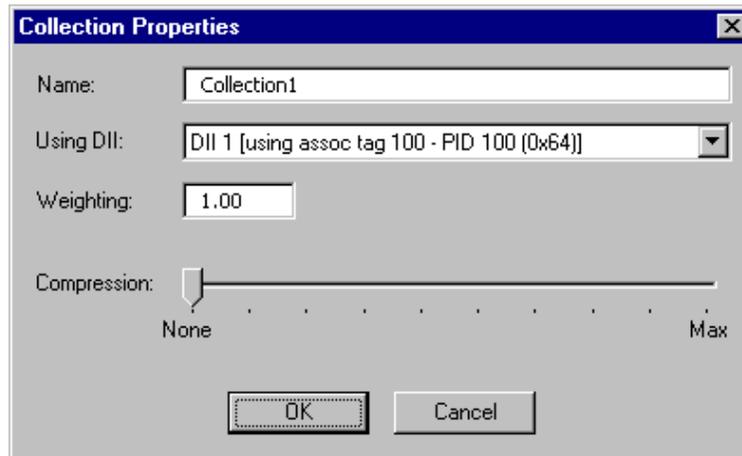
A summary of a collection’s properties is displayed in the Properties window. With a collection node highlighted, the contents of the collection can be viewed.

Three icons are used at the Collection node:

-  (orange) Collection containing the Service Gateway.
At least one collection must exist during any session.
The collection containing the Service Gateway cannot be deleted
-  (red) Ordinary collection.
-  Compressed collection.

To open the Collection properties dialog box, select **Edit** in the Collection Properties bar.

Collection Properties



Name: Enter the required name.

Using DII: This is the list of all the DIIs in the carousel. The Collections in the carousel (and therefore the generated DSMCC modules) can be distributed among several DIIs or all be referenced by a single DII. This enables, for example, a minimal collection containing just the objects needed for booting to be referenced in a DII with a short cycle time.

Weighting: This is the relative priority of the collections in a single carousel. For example, the objects in a collection with a weighting of 1.5 will be repeated half as often as those in a collection with a weighting of three.

This enables, for example, boot classes in a collection to be given a higher weighting than the other files in a carousel. The weighting is a floating point value so virtually any ratio can be achieved.

Range: 0 to 10000

A value of 0 signifies the objects will not appear in the stream.

Compression:  The modules can be optionally compressed to decrease module size. There are 10 levels of compression ranging from 0 (no compression) to 9 (maximum compression). Compression is applied to the complete collection, although compression can be applied via any of the property dialog boxes. The collection node icon in the Collections view will indicate that compression is to be applied.

Adding a New Collection

To add a new collection, right-click on the collections node in the Collections Session window and select **New Collection**. The properties of the new collection can be modified as required.

Removing a Collection

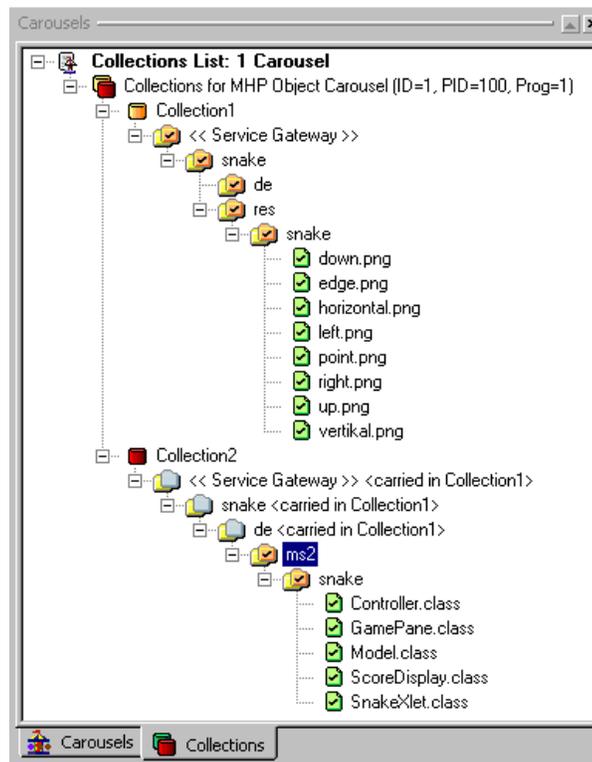
To delete a collection, highlight the collection node and select **Edit > Delete Collection**. However, note that a collection cannot be deleted while it contains objects or while it contains the Service Gateway. These objects must be deleted or moved to another collection.

Moving Objects Between Collections

Objects can be dragged and dropped or cut and pasted between collections in the same carousel.

When dragging and dropping directories, pressing the Shift key down while the object is moved will move only the directory, not the contained items. If the Shift key is not used, the directory and its contents are moved.

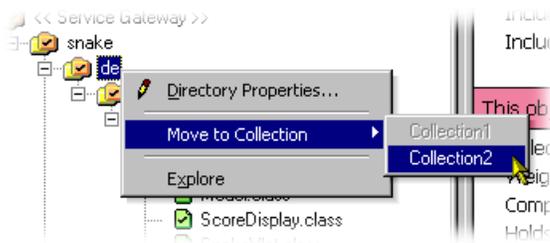
When items (file or directory) that are part of a tree structure are moved between collections, the complete path, from the Service Gateway is shown. The icons above the moved object are grayed out to indicate that they are carried in another collection (in the screenshot, they are the directory icons without a check mark or a cross within them).



The node description indicates the owning collection.

NOTE. When an object is not included in the synchronization process, the icon changes from  to  (see also Synchronicity, page 2–65).

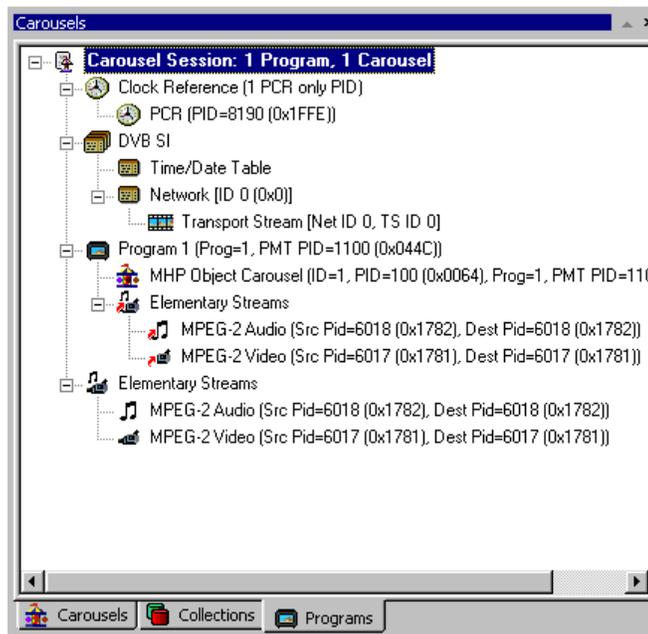
Objects can also be moved between collections in the same carousel by right-clicking on the object to be moved and selecting the collection from the **Move to Collection** list. All current collections will be included in the list.



Programs

(See *Carousel Generator Overview*, page 2–2)

Programs allow audio and video content to be added to the carousel-carrying stream. An example of the Program view follows:



Note that the Carousel Session is still the ‘root’ of the view, but in this view, the program content is also shown; this includes tables and streams.

PCR PID references are displayed under the Clock Reference node.

Mandatory PSI/SI information is created by default and included in the generated stream. Changes made to the stream content are reflected in the PSI/SI information. Individual settings are accessible in the various Programs properties dialog boxes.

The **PSI/SI** node displays either MPEG or DVB service information that cannot be easily included elsewhere.

- For MPEG PSI, only the Transport Stream ID, which is carried in the PAT, is displayed.
- For DVB SI, the Transport Stream ID is augmented by mandatory DVB SI (NIT, SDT (actual), EIT (actual present/following) and TDT.) The TDT (**Time/Date Table**) and the NIT (**Network**) are the only entries under the PSI/SI node. Parameters for the other tables are available in other dialog boxes.

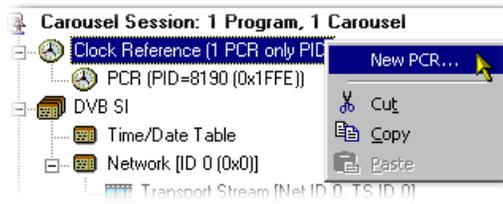
Under each **Program** node is a list of all the program components - Carousels and video and audio elementary streams.

The **Elementary Streams** node lists the elementary streams that are included in the stream. These can be associated with one or more programs. Note that the elementary streams will be included in the generated stream even if they are not associated with a program.

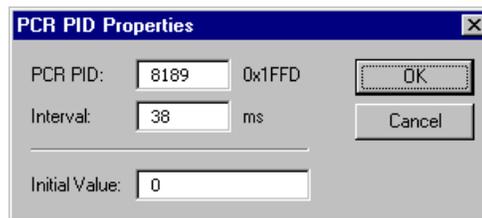
Clock Reference This node indicates which PIDs are carrying PCRs.

Adding a PCR.

1. Highlight the Clock Reference node in the Programs view.
2. From the right-click menu select **New PCR**.



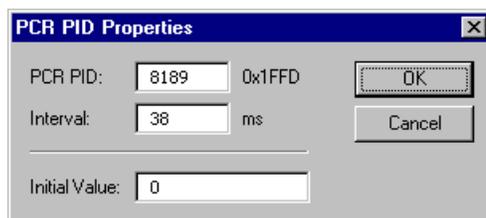
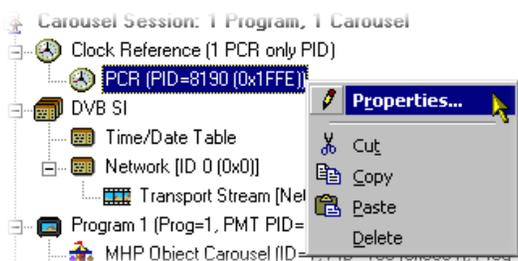
3. In the **PCR PID Properties** dialog box, make the changes required and select **OK**.



Note that the new PCR is added to the Clock Reference node.

Also available on the Clock Reference right-click menu are Cut, Copy, and Paste. These operations follow normal Windows conventions. Messages will be displayed where conflicts arise between existing PCRs and proposed new or pasted PCRs.

PCR Edit. The **PCR PID Properties** dialog box of an existing PCR PID can be opened by highlighting the PCR PID and selecting **Properties** from the right-click menu.



PSI/SI The content of the SI node will depend on the SI Type selected: MPEG or DVB.

SI Type. SI Type is normally set in the Stream Generation properties (see page 2–40). However, a change can be made at any time before generation of the stream.

Switching SI types may involve some loss of data or some creation of default values. When switching from MPEG PSI to DVB SI, default values are applied to the TDT and Network information; the Transport Stream ID will be copied. Switching from DVB SI to MPEG PSI requires only the Transport Stream ID to be copied. In this phase, any user changes to the default values in the DVB SI properties will be lost and will need to be reentered if the SI type is changed back to DVB, or a new session is created.

The EIT and SDT information is maintained between switching SI type as it is stored in the Program Properties. The tables will simply not be generated if the type is MPEG.

To switch between SI types during a session, highlight the **SI** node in the Programs view and select the required **SI Type** from the right-click menu.

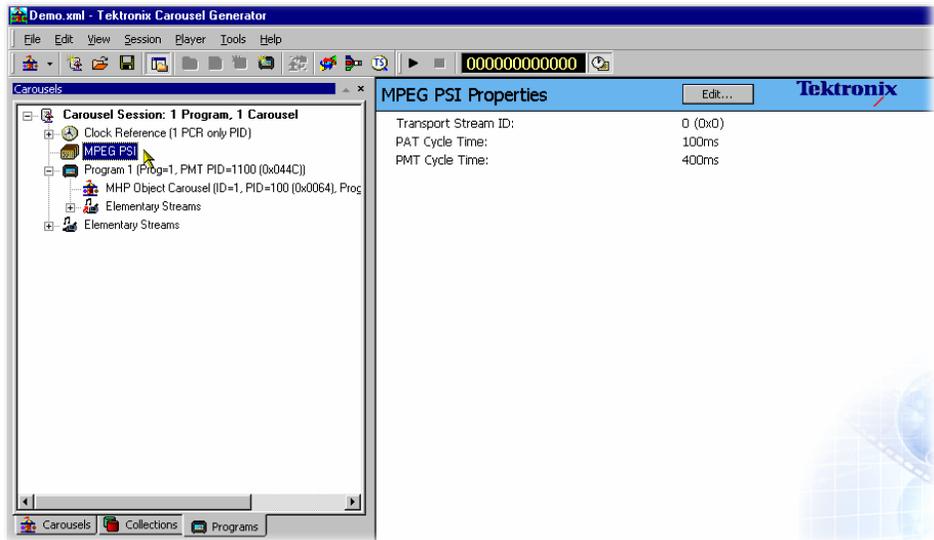


Figure 2-1: MPEG PSI

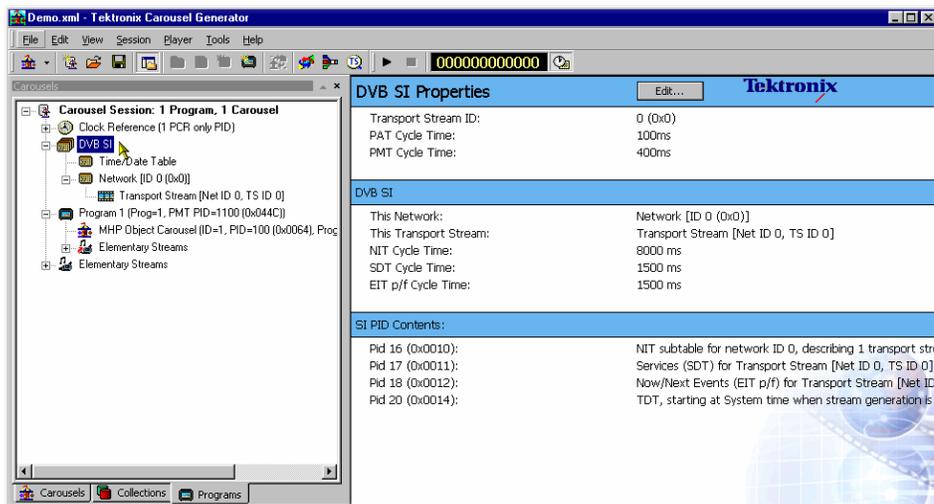
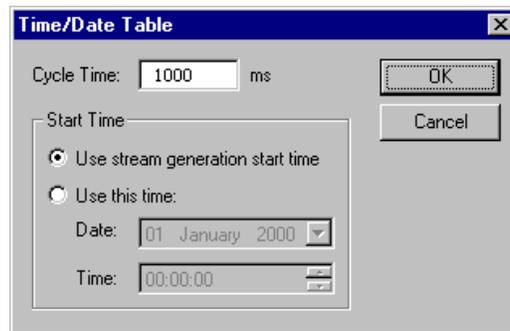
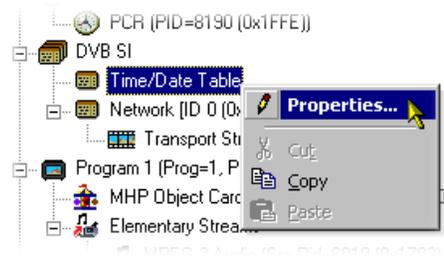


Figure 2-2: DVB SI

Time/Date Table (DVB Only). The Time/Date Table carries a UTC time in the stream, which is set to a starting value when the stream is generated. It is then continually updated throughout the stream to reflect the passing of time. The default setting of the initial value will be the time the generation is started, but this can be changed to any user defined value.

To edit the Time/Date Table parameters, highlight the **Time/Date Table** node and select **Properties** from the right-click menu. The Time/Date Table Properties dialog box is displayed.



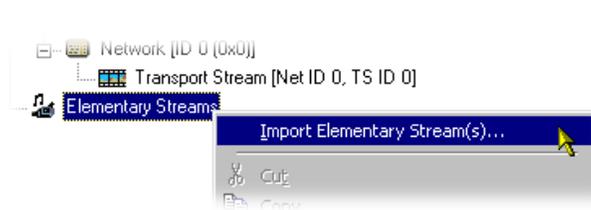
Cycle Time gives the frequency at which the time and date information should be repeated in the generated stream.

Elementary Streams and Programs

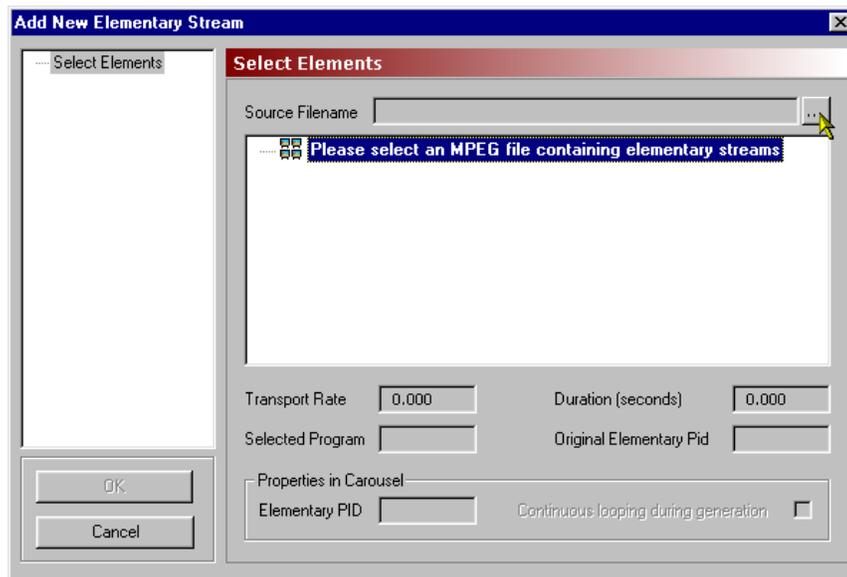
Audio and video elementary can be imported and incorporated into the generated stream. Subsequently, the imported streams can be associated with one or more programs.

Importing Elementary Streams.

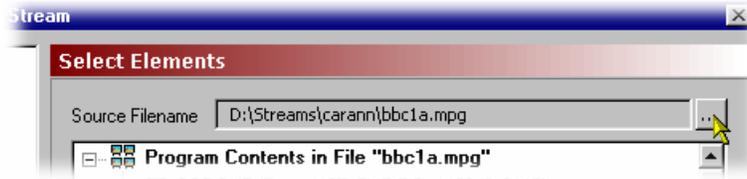
1. In the Programs view, highlight the **Elementary Streams** node and select **Import Elementary Stream(s)** from the right-click menu.



The **Add New Elementary Stream** dialog box is displayed:



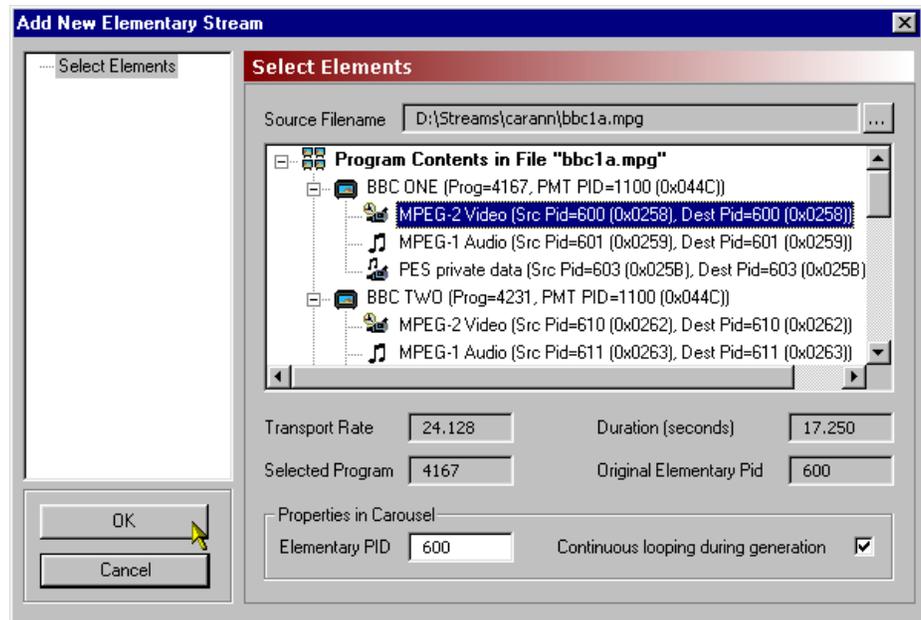
2. Use the browse button to select the source file (mpg) from which the elementary streams are to be imported:



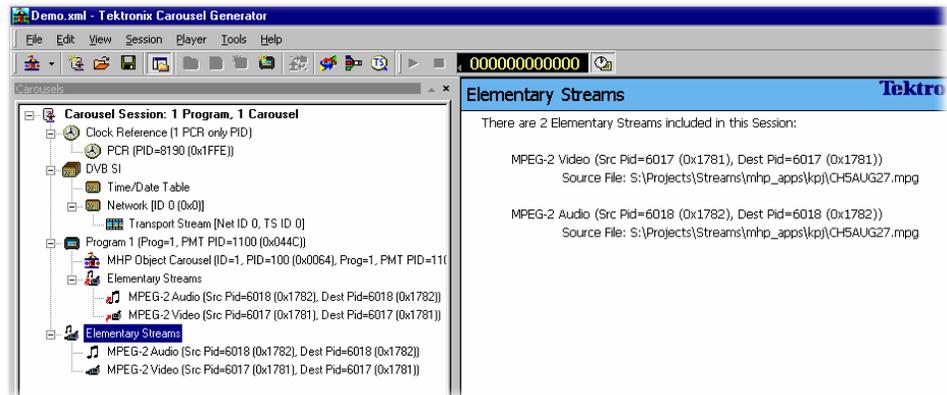
All programs in the source file are displayed, but only one program, or the elementary streams from one program, can be imported into a session.

3. Highlight the program or elementary stream(s) to be imported.

Select **OK** to import the program/stream(s).



Note that selected elementary streams are displayed under the **Elementary Streams** node in the Programs view.



Elementary Stream Properties. Imported elementary streams are allocated to the same PID used in the source program. If there is any conflict with existing PIDs in the session, a warning is displayed and an opportunity offered to make changes.

The elementary stream properties dialog box allows the PID to be changed. A warning will be displayed if a conflict with an existing PID occurs. Continuous looping of the stream during generation can also be enabled.

To select the Elementary Stream Properties dialog box, highlight the elementary stream and select **Elementary Stream Properties** from the right-click menu.

Linking Elementary Streams to Programs. When a carousel is created, a Program node is automatically created. If the Carousel Wizard is used, elementary streams can be added during the process. Streams can also be added from a selected program as required.

Streams are added to the Program node(s) by dragging and dropping them from the Elementary Stream node. Note that in this case, they are simply linked to the Elementary Stream entry; if they are deleted from the program, they will continue to be listed under the Elementary Stream node. However, if an elementary stream is deleted from the Elementary Streams node, it will also be deleted from the programs in which it is used.

Note also that the Elementary Streams Properties dialog box (when accessed via the Program entry) allows descriptors to be added to the elementary stream information loop in the PMT.

Output Stream Generation

To start generating the output stream, select **Player > Start Payout**. The parameters used are part of the Stream Generation properties (page 2–40).

Errors occurring during stream generation are reported in the **TS Generation** tab of the Log view.

Carousel Definition File

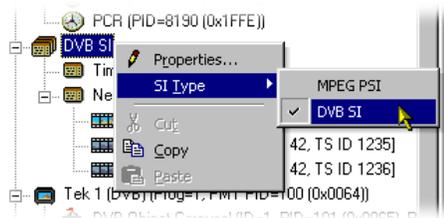
The current state of the carousel generator session can be saved to disk at any time during the creation process using the **File > Save Carousel Session** or **File > Save Carousel Session As...** options. This can then be reloaded at any time using the **File > Open Carousel Session...** option. The format of the saved file is standard XML and can be viewed in any XML compatible viewer (for example, Internet Explorer 5 and up); editing the XML file is not recommended. Errors in the syntax of the XML file will be reported in the Definition File Syntax tab of the Log view; errors are summarized on the Summary tab of the Log view.

PSI and SI in the Carousel Generator Output Stream

The Carousel Generator creates various PSI and SI tables while generating its output stream. The exact contents of the PSI and SI depends on many user settings; this section describes most of the auto-generated content and which options or properties affect that content. Note that all PSI/SI related properties can be accessed through nodes in the program tab.

PSI/SI Mode Settings

There is one field that has a huge effect on the PSI and SI tables that Carousel Generator produces – the Session’s ‘PSI/SI type’ field. This can be accessed from the Stream Generation Properties dialog box (**Player > Stream Generation Properties**), or by right-clicking on the SI node in the program tab, selecting the **SI Type** sub-menu, and selecting one of the two options.



MPEG PSI

PAT, PMT, and AIT (for MHP carousels) will be generated.

DVB SI

In addition to the standard MPEG tables, Carousel Generator will output NIT actual, SDT actual, EIT present/following actual and TDT sections.

MPEG PSI tables

Table 2–11: Program Association Table (PAT)

Table Syntax	CG Value	Comment
program_association_section() {		
table_id	0x00	
section_syntax_indicator	1	
‘0’	0	
reserved	0x3	
section_length	auto	
transport_stream_id	user	SI node > Properties... > (MPEG SI page) ‘Transport Stream ID’ field.
reserved	0x3	
version_number	0	CG does not support table versioning.
current_next_indicator	1	
section_number	auto	depends on the number of programs.
last_section_number	auto	depends on the number of programs.
for (i=0; i<n; i++) {		
program_number	user	Program node > Properties... > (PMT entry page) ‘Program Number’ field.
reserved	0x7	
if (program_number == 0) {		CG does not specify the network PID.
network_PID	n/a	13818-1 describes it as ‘optional’.
}		
else {		
program_map_PID	user	Program node > Properties... > (PMT entry page) ‘PMT PID’ field.
}		
}		
CRC_32	auto	
}		

(ISO/IEC 13818-1 (Systems) section 2.4.4.3)

Table 2–12: Program Map Table (PMT)

Table Syntax	CG Value	Comment
TS_program_map_section() {		
table_id	0x02	
section_syntax_indicator	1	
'0'	0	
reserved	0x3	
section_length	auto	
program_number	user	Program node > Properties... > (PMT entry page) 'Program Number' field.
reserved	0x3	
version_number	0	CG does not support table versioning.
current_next_indicator	1	
section_number	0	
last_section_number	0	
reserved	0x7	
PCR_PID	user	Program node > Properties... > (PMT entry page) 'PCR PID' dropdown menu.
reserved	0xF	
program_info_length	auto	
for (i=0; i<program_info_length; i++) {		
descriptor()	auto + user	Auto generation depends on carousel type. See 'carousel descriptors' note below. User can add additional descriptors via Program node > Properties... > (Program Descriptors page)
}		
for (i=0; i<N1; i++) {		Carousel Generator will add elementary streams as required. Streams include carousel data, AITs, and imported PIDs.
stream_type	auto	Stream type 11 for carousel data, stream type 5 for AIT data, and the source stream type of any imported PIDs.
reserved	0x7	
elementary_PID	user	User editable – edit method depends on the type of stream.
reserved	0xF	
ES_info_length	auto	
for (i=0; i<N2; i++) {		
descriptor()	auto + user	Auto generation depends on stream type and carousel type.

Table 2-12: Program Map Table (PMT) (Cont.)

Table Syntax	CG Value	Comment
}		
}		
CRC_32	auto	
}		
(ISO/IEC 13818-1 section 2.4.4.8)		

Carousel Descriptors in the PMT

The various standards supported by the Carousel Generator have differing signaling requirements, so the type and content of descriptors added to the PMT depend on the carousel types contained in a program.

DSM-CC Object Carousels (ISO/IEC 13818-6 defined). The basic 13818-6 standard only supports a single carousel per program, and requires that a carousel_identifier_descriptor be inserted in the program_info loop (first descriptor loop) of the PMT section for a program carrying a DSM-CC carousel.

Table 2-13: DSM-CC object carousels - Carousel identifier descriptor

Descriptor Syntax	CG Value	Comment
carousel_identifier_descriptor {		
descriptor_tag	0x13	
descriptor_length	auto	
carousel_identifier	user	Carousel node > Properties... > (General) Carousel ID
for (n=0; n<N; n++) {		
private_data_byte	n/a	These bytes are not used when signaling
}		a basic DSM-CC Object Carousel
}		
(ISO/IEC 13818-6 (Extensions for DSM-CC) section 11.4.1)		

DSM-CC Object Carousels are carried on one or more PIDs referenced by the PMT with stream type 11. The ES_info loop for each of these streams contains an association_tag_descriptor which maps the association_tag used by DSM-CC messages to a particular PID.

Table 2-14: DSM-CC object carousels - Association tag descriptor

Descriptor Syntax ⁴	CG Value	Comment
association_tag_descriptor {		
descriptor_tag	0x14	
descriptor_length	auto	
association_tag	user	Carousel node > Properties... > (PID Settings) Association tag
use	auto	0 if the PID is used for a DSI, 1 otherwise
selector_byte_length	auto	
for (n=0; n<N1; n++) {		
selector_byte	auto	not used if 'use' is 1, otherwise follows the use_0_selector_bytes format
}		
for (n=0; n<N2; n++) {		
private_data_byte	n/a	not used
}		
}		
use_0_selector_bytes {		
transaction_id	auto	Matches the transaction id of the DSI
timeout	0xFFFFFFFF	timeout unknown
}		
(ISO/IEC 13818-6 section 11.4.2)		

DVB Object Carousels (ETSI EN 301 192 defined). Although not mentioned in the DVB data standard (ETSI EN 301 192: Specification for the transmission of data services in DVB bitstreams), the DVB implementation guidelines for data broadcasting allow support for multiple Object Carousels per program, by allowing the carousel_identifier_descriptor to be transmitted in the second descriptor loop of the PMT.

“DVB Guideline: The carousel_identifier_descriptor() shall be inserted in the second descriptor loop of the PMT (ES_info) corresponding to the elementary stream carrying the DSI of the object carousel. This allows more than one object carousel per MPEG-program and implicitly identifies the PID on which each carousel should be booted from.”
(TR 101 202 (Implementation Guidelines for Data Broadcasting) section 4.7.7.1)

Carousel Generator therefore transmits a carousel_identifier_descriptor for every DVB Object Carousel in a program, as specified by this implementation guideline.

DVB also extends the carousel_identifier_descriptor slightly, by defining the contents of the private_data_byte section further with what it calls a FormatSpecifier. However, CarouselGenerator only uses the required parts of this extension - it sets the FormatId to zero, which indicates that no format specifier is provided.

Table 2-15: DVB object carousels - Private_data_byte syntax

Private_data_byte syntax	CG Value	Comment
carousel_identifier::private_data_bytes {		
FormatId	0	0 indicates no FormatSpecifier present
FormatSpecifier() {		
FormatSpecifier_byte	n/a	Not used by Carousel Generator
}		
for (n=0; n<N1; n++) {		
private_data_byte	n/a	Not used by Carousel Generator
}		
}		

TR 101 202 (Implementation Guidelines for Data Broadcasting) section 4.7.7.1

An association_tag_descriptor is added to the ES_info loop in exactly the same way as for DSM-CC object carousels.

Two more descriptors are also added to the ES_info loop for streams carrying DVB object carousels – the data_broadcast_id_descriptor and the stream_identifier_descriptor. Both are defined in EN300 468 (Specification for Service Information in DVB systems).

Table 2-16: DVB object carousels - Descriptors

Descriptor Syntax	CG Value	Comment
stream_identifier_descriptor {		
descriptor_tag	0x52	
descriptor_length	1	
component_tag	user	LSB of the association_tag for this stream
}		
data_broadcast_id_descriptor {		
descriptor_tag	0x66	
descriptor_length	2	

Table 2–16: DVB object carousels - Descriptors (Cont.)

Descriptor Syntax	CG Value	Comment
data_broadcast_id	7	DVB Object Carousel code
for (i=0; i<N; i++) {		
id_selector_byte	n/a	DVB Object Carousels do not use these
}		selector bytes
}		

DTT Object Carousels (DTG D-Book (DTT Requirements for Interoperability)). Most of the PMT signaling for DTT Object Carousels is the same as for DVB Object Carousels. However, the D-Book does specify the contents of the id_selector_byte section of the data_broadcast_id_descriptor, and also requires that the data_broadcast_id value in that descriptor is 262 (0x106).

Table 2–17: DTT object carousels

DTT id_selector_bytes Syntax	CG Value	Comment
for (i=0; i<descriptor_length-2; i++) {		
application_type_code	user	DTT Object Carousel node > Properties... > (DTT Applications page). Application codes list contains the app codes used.
boot_priority_hint	user	Boot priorities accessed as above.
app_specific_data_length (N2)	0	
for (j=0; j<N2; j++) {		
app_specific_data_byte	n/a	Not used.
}		
}		

(UK DTG D-Book (Digital Terrestrial Television Requirements for Interoperability) section 18.5.2.1)

MHP Object Carousels (ETSI TS 101 812). MHP uses an additional table, the AIT, for most of its signaling requirements. The location of the AIT table for a program is identified through an elementary stream PID entry in the PMT with stream type 5. The ES_info loop for the AIT PID also carries an application_signaling descriptor (AIT information is given in the DVB SI Tables section of this appendix):

Table 2–18: MHP object carousels - Application signaling

Descriptor Syntax	CG Value	Comment
application_signaling_descriptor {		
descriptor_tag	0x6F	
descriptor_length	auto	
for (i=0; i<descriptor_length; i++) {		
application_type	auto	An entry for application_type 1 will be present if any Java apps are defined in the carousel, and an entry for type 2 will be present if any HTML apps are defined in the carousel.
reserved_future_use	0x7	
AIT_version_number	0	CG does not support table versioning – all tables have version number 0.
}		
}		

(ETSI TS 101 812 (Multimedia Home Platform (MHP) specification) section 10.7.1)

The PMT signaling for MHP carousel carrying streams is very similar to that for DVB Object Carousels. The only difference is that, like DTT, MHP defines additional content for the data_broadcast_id_descriptor's data_broadcast_id value and id_selector bytes. The MHP data_broadcast_id value is 240 (0xF0), and the id_selector bytes are as defined below:

Table 2–19: MHP object carousels - ID selector

MHP id_selector_bytes Syntax	CG Value	Comment
for (i=0; i<descriptor_length-2; i++) {		
application_type	auto	An entry for application_type 1 will be present if any Java apps are defined in the carousel, and an entry for type 2 will be present if any HTML apps are defined in the carousel.

(ETSI TS 101 812 section 10.7.2.2)

DVB SI Tables

The following SI is only generated when the session's SI type is set to DVB SI. All user-editable properties of these tables can be accessed through nodes in the Programs tab.

Network Information Table (NIT)

The Carousel Generator only generates NIT actual sections, and the contents of the NIT can be accessed by editing the properties of the Network node and its children.

Table 2-20: Network information table

Table Syntax	CG Value	Comment
<code>network_information_section() {</code>		
<code>table_id</code>	0x40	NIT actual – CG does not generate NIT other sections.
<code>section_syntax_indicator</code>	1	
<code>reserved_future_use</code>	1	
<code>reserved</code>	0x3	
<code>section_length</code>	auto	
<code>network_id</code>	user	Network node > Properties... > 'Network ID' field
<code>reserved</code>	0x3	
<code>version_number</code>	0	CG does not support table versioning
<code>current_next_indicator</code>	1	
<code>section_number</code>	auto	
<code>last_section_number</code>	auto	
<code>reserved_future_use</code>	0xF	
<code>network_descriptors_length</code>	auto	
<code>for (i=0;i<N;i++) {</code>		A <code>network_name_descriptor</code> will always be added, with the name
<code>descriptor()</code>	auto + user	Specified in the Network Properties > 'Name' field.
<code>}</code>		The user can add custom descriptors to this loop by editing the descriptor list in the Network Properties dialog box.
<code>reserved_future_use</code>	0xF	
<code>transport_stream_loop_length</code>	auto	
<code>for (i=0; i<N; i++) {</code>		CG will always add at least one transport stream to this loop (the 'actual' transport stream' but the user can add additional transport streams (by right-clicking on the network node).
<code>transport_stream_id</code>	user	Transport Stream node > Properties... > (Transport Stream page) Transport Stream ID field

Table 2-20: Network information table (Cont.)

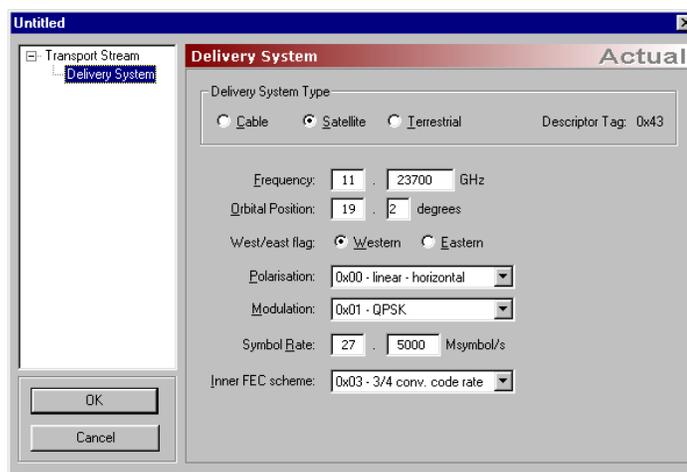
Table Syntax	CG Value	Comment
original_network_id	user	As above > Original Network ID field
reserved_future_use	0xF	
transport_descriptors_length	auto	
for (j=0; j<N; j++) {		One of the three delivery system descriptors will always be present (see 'Delivery System Descriptors' below)
descriptor()	auto + user	The user can also add custom descriptors via Transport Stream node > Properties... > (Transport Stream page) Descriptors list
}		
}		
CRC_32	auto	
}		

(ETSI EN 300 468 (Specification for Service Information in DVB systems) section 5.2.1)

Delivery System Descriptors

Every transport stream listed in the NIT will contain at least one descriptor – one of either the cable delivery system descriptor (ETSI EN 300 468 section 6.2.12.1), the satellite delivery system descriptor (ETSI EN 300 468 section 6.2.12.2) or the terrestrial delivery system descriptor (ETSI EN 300 468 section 6.2.12.3). The type of descriptor used, and the contents of all its fields, are edited through the Transport Stream node > **Properties...** > **Delivery System** page.

All of the delivery system descriptor fields defined in EN 300 468 can be modified.



Service Description Table (SDT)

Table 2-21: Service Description Table (SDT)

Table Syntax	CG Value	Comment
service_description_section() {		
table_id	0x42	SDT actual – CG does not generate SDT other sections.
section_syntax_indicator	1	
reserved_future_use	1	
reserved	0x3	
section_length	auto	
transport_stream_id	user	Matches the transport_stream_id of the actual transport stream
reserved	0x3	
version_number	0	CG does not support table versioning
current_next_indicator	1	
section_number	auto	
last_section_number	auto	
original_network_id	user	Matches the original_network_id of the actual transport stream
reserved_future_use	0xFF	
for (i=0; i<N; i++) {		CG auto-generates an entry for every program in the session.
service_id	auto	Matches the program number
reserved_future_use	0x3F	
EIT_schedule_flag	0	EIT schedule tables not supported.
EIT_present_following_flag	user	Transmission of an EIT_pf is user-controllable per service. See the EIT section below.
running_status	0x4	Always set to 4 – Running
free_ca_mode	0	Always set to 0 – No scrambling
descriptors_loop_length	auto	
for (j=0; j<N; j++) {		
descriptor()	auto	A service_descriptor is always added, and depending on the carousel content of the program, data_broadcast_descriptor(s) may be added.
}		
}		
CRC_32	auto	
}		

(ETSI EN 300 468 section 5.2.3)

Service_descriptor

Table 2-22: Service descriptor

Descriptor Syntax	CG Value	Comment
service_descriptor() {		All of the properties in this descriptor are accessed via the Program node that is associated with the service. Program node > Properties... > Additional SI page
descriptor_tag	0x48	
descriptor_length	auto	
service_type	user	> Service Type dropdown
service_provider_name_length	auto	
for (i=0; i<N; i++) {		
char	user	> Service Provider field
}		
service_name_length	auto	
for (i=0; i<N; i++) {		
char	user	> Service Name field
}		
}		

(ETSI EN 300 468 section 6.2.30)

Data_broadcast_descriptor

The data_broadcast_descriptor is a DVB defined descriptor that can be used in either the SDT or EIT to indicate that a carousel is associated with a service or event. Carousel Generator only supports associating a carousel with a service, so will only add the data_broadcast_descriptor to the SDT.

Table 2-23: Data broadcast descriptor

Descriptor Syntax	CG Value	Comment
data_broadcast_descriptor() {		
descriptor_tag	0x64	
descriptor_length	auto	
data_broadcast_id	auto	depends on the type of carousel
component_tag	user	LSB of the assoc_tag of the PID carrying the carousel's DSI
selector_length	auto	
for (i=0; i<selector_length; i++) {		
selector_byte	auto	depends on the type of carousel

Table 2-23: Data broadcast descriptor (Cont.)

Descriptor Syntax	CG Value	Comment
}		
ISO_639-2[3]_language_code	"und"	CG does not use the text field, so the language code is set to "undefined"
text_length	0	
for (i=0; i<text_length; i++) {		
text_char	n/a	Not used
}		
}		
(ETSI EN 300 468 section 6.2.10)		

The use of the data_broadcast_descriptor, and the contents of the data_broadcast_id and selector_bytes fields depend on the type of carousel(s) in the program.

DSM-CC Object Carousel. The DSM-CC standard does not define the data_broadcast_descriptor, and so a data_broadcast_descriptor is not added to the service entry for a program containing a DSM-CC object carousel.

MHP Object Carousels. MHP uses the AIT for all its signaling requirements, and so does not require the use of the data_broadcast_descriptor.

DVB Object Carousels. A data_broadcast_descriptor is added for every DVB Object Carousel contained in a program. The data_broadcast_id is set to 7, and the selector_byte format is as follows:

Table 2-24: DVB object carousel

DVB selector_bytes Syntax	CG Value	Comment
Carousel_type_id	0x2	
Reserved	0x3F	
Transaction_id	auto	Matches the carousel DSI transaction ID
time_out_value_DSI	0xFFFFFFFF	not used
time_out_value_DII	0xFFFFFFFF	not used
Reserved	0x3	
leak_rate	0	
for (i=0; i<N; i++) {		

Table 2-24: DVB object carousel (Cont.)

DVB selector_bytes Syntax	CG Value	Comment
ISO_639_language_code	n/a	The object names loop is not used by the Carousel Generator.
object_name_length	n/a	
for (j=0; j<object_name_length; j++) {		
object_name_char	n/a	
}		
}		

(ETSI EN 300 468 section 6.2.10)

DTT Object Carousels. The DTG D-Book requires that there only be a single data_broadcast_descriptor per service, to identify the application type carried in that service. The Carousel Generator uses the first Carousel it encounters in a program that has at least one application id set as the carousel referenced by the data_broadcast_descriptor. Generally, only one of the DTT Object Carousels in a program should have any application IDs set.

Because only a single data_broadcast_descriptor is allowed per service, the component_tag value of the descriptor is set to zero – the descriptor does not identify any particular stream as carrying a carousel.

The data_broadcast_id for the descriptor is set to 262 (0x106), and the selector_bytes format is as follows:

Table 2-25: DTT object carousel

DTT selector_bytes Syntax	CG Value	Comment
for (i=0; i<selector_byte_length;i++) {		
application_type_code	user	The first application id defined in a DTT carousel contained in the service.
number_languages	0	
for (j=0; j<number_languages;j++) {		
ISO_639_language_code	n/a	Not used
}		
application_specific_data_length	0	
for (j=0; j<a_s_d_length; j++) {		
application_specific_data_byte	n/a	Not used
}		

Table 2-25: DTT object carousel (Cont.)

DTT selector_bytes Syntax	CG Value	Comment
}		
(UK DTG D-Book section)		

Event Information Table (EIT)

The Carousel Generator only supports the creation of EIT present following information, for the actual transport stream. The presence of EIT p/f sections for a particular service is user controllable, but where transmitted, information will only be included for the present (now) event. The following (next) event section will always be empty. If an EIT p/f is present for a particular service, the relevant EIT_present_following_flag in the SDT will be set.

Table 2-26: Event Information Table (EIT)

Table Syntax	CG Value	Comment
service_description_section() {		
table_id	0x4E	EIT actual present/following – CG does not generate any other form of EIT.
section_syntax_indicator	1	
reserved_future_use	1	
reserved	0x3	
section_length	auto	
service_id	auto	
reserved	0x3	
version_number	0	CG does not support table versioning
current_next_indicator	1	
section_number	auto	section 0 is present event, 1 is following event
last_section_number	1	
transport_stream_id	user	Matches the transport_stream_id of the actual transport stream
original_network_id	user	Matches the original_network_id of the actual transport stream
segment_last_section_number	1	p/f table is not segmented
last_table_id	0x4E	Only table id 0x4E is used
for (i=0; i<N; i++) {		The present event section (section 0) will always contain a single event, while the following event section (section 1) will not contain any events. The following fields are therefore only used in section 0 of the EIT.
event_id	0	Event ID is always set to zero

Table 2-26: Event Information Table (EIT) (Cont.)

Table Syntax	CG Value	Comment
start_time	user	The start time will match the start time of the TDT.
duration	99:59:59	
running_status	0x4	Always set to 4 – Running
free_CA_mode	0	Always set to 0 – No scrambling
descriptors_loop_length	auto	CG always adds a single descriptor
for (i=0; i<N; i++) {		to the event descriptors loop, the
descriptor()	auto	short_event_descriptor.
}		
}		
CRC_32	auto	
}		

(ETSI EN 300 468 section 5.2.4)

Short_event_descriptor

The fields of the short_event_descriptor for the present event are all accessed through Program Node > **Properties...** > **Additional SI** page. This page also contains the checkbox (**Include EIT present/following section for this service**) that controls whether an EIT will be transmitted for a particular service.

Table 2-27: Short event descriptor

Descriptor Syntax	CG Value	Comment
short_event_descriptor() {		
descriptor_tag	0x4D	
descriptor_length	auto	
ISO_639-2[3]_language_code	user	> Language Code dropdown
event_name_length	auto	
for (i=0; i<event_name_length;i++) {		
event_name_char	user	Set to match the service name field
}		
text_length	auto	
for (i=0; i<text_length; i++) {		
text_char	user	> Description field
}		
}		

(ETSI EN 300 468 section 6.2.33)

Time and Date Table (TDT) The TDT is accessed through the Time/Date Table node under the DVB SI node in the program tab. It carries current time information, and the user can specify whether that information will be filled with the current system time, or start at a time specified by the user and increment in real time.

Table 2-28: Time and date table

Table Syntax	CG Value	Comment
time_date_section() {		
table_id	0x70	
section_syntax_indicator	0	
reserved_future_use	1	
reserved	0x3	
section_length	5	
UTC_time	auto/user	This value starts at the time specified by the user (Time/Date Table node > Properties... > Start Time) and increments appropriately during stream output.
}		
(ETSI EN 300 468 section 5.2.4)		

Application Information Table (AIT) The AIT (ETSI TS 101 812 section 10.4) is the main signaling component of the MHP standard, and the Carousel Generator will generate an AIT for every program that carries one or more MHP carousels containing applications. Note that if the MHP carousel(s) in a program do not have any applications defined an AIT will not be generated for that program.

The AIT is split into subtables based on the application_type value. The current MHP spec defines two application types, Java and HTML, and Carousel Generator supports both. If only Java applications are present in the carousels in a program, only the Java subtable will be generated, and the same is true for HTML applications. If both application types are present in the carousel(s) in a program, both subtables of the AIT will exist for that program.

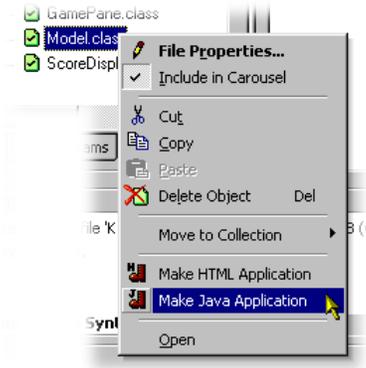


Table 2–29: Application information table

Table Syntax	CG Value	Comment
application_information_section() {		
table_id	0x74	
section_syntax_indicator	1	
reserved_future_use	1	
reserved	0x3	
section_length	auto	
application_type	auto	
reserved	0x3	
version_number	0	CG does not support table versioning
current_next_indicator	1	
section_number	auto	
last_section_number	auto	
reserved_future_use	0xF	
common_descriptors_length	0	
for (i=0; i<c_d_length; i++) {		
descriptor()	n/a	
}		
DVB_reserved_future_use	0xF	
application_loop_length	auto	
for (i=0; i<app_loop_length; i++) {		Carousel Generator will add applications as defined in the carousel. To create an application, right-click on the file and select Make HTML Application or Make Java Application.
application_identfier() {		
organisation_id	user	File node > Properties... > (Application Descriptor page) Organization ID field

Table 2-29: Application information table (Cont.)

Table Syntax	CG Value	Comment
application_id	user	File node > Properties... > (Application Descriptor page) Application ID field
}		
application_control_code	user	File node > Properties... > (Application Descriptor page) Control Code dropdown
app_descriptors_loop_length	auto	
for (j=0; j<a_d_l_length; j++) {		
descriptor()	auto/user	Carousel Generator creates the appropriate descriptors for each application type automatically. However, fields in the properties pages allow the contents of these descriptors to be edited. See 'application descriptors' note below.
}		
}		
CRC_32	auto	
}		

Application Descriptors in the AIT

Every application listed in the AIT will have five descriptors in the app_descriptors_loop, but two of these depend upon the type of application (Java or HTML). The three common descriptors are the application_descriptor, application_name_descriptor and transport_protocol_descriptor, and the two app specific descriptors will either be dvb_j_application_descriptor and dvb_j_application_location_descriptor (for Java apps) or dvb_html_application_descriptor and dvb_html_application_location_descriptor (for HTML apps).

Common Application Descriptors.

Table 2-30: Application descriptor

Descriptor Syntax	CG Value	Comment
application_descriptor {		Note. All of the user editable fields are accessed through File > Properties... > Application Descriptor page
descriptor_tag	0x00	
descriptor_length	auto	
application_profiles_length		
for (i=0; i<N; i++) {		> Application profiles list
application_profile	user	
version.major	user	

Table 2-30: Application descriptor (Cont.)

Descriptor Syntax	CG Value	Comment
version.minor	user	
version.micro	user	
}		
service_bound_flag	user	> Service Bound checkbox
visibility	user	> Visibility dropdown
reserved_future_use	0x1F	
application_priority	user	> Priority
for (i=0; i<N; i++) {		
transport_protocol_label	auto	Matches the transport_protocol_label value in the transport_protocol_descriptor.
}		
}		
(ETSI TS 101 812 section 10.7.3)		

Table 2-31: Application name descriptor

Descriptor Syntax	CG Value	Comment
application_name_descriptor {		Accessed through the same page as described.
descriptor_tag	0x01	
descriptor_length	auto	
for (i=0; i<descriptor_length; i++) {		
ISO_639_language_code	user	> Language Code dropdown
app_name_length	auto	
for (i=0; i<a_n_length;i++){		
app_name_char	user	> Application Name field
}		
}		
}		
(ETSI TS 101 812 section 10.7.4)		

Table 2-32: Transport protocol descriptor

Descriptor Syntax	CG Value	Comment
transport_protocol_descriptor {		
descriptor_tag	0x02	
descriptor_length	auto	
protocol_id	0x0001	Transport via OC
transport_protocol_label	auto	Set to match the component tag value
remote_connection	0	CG does not support remote carousels
component_tag	auto	Matches the component tag in the stream_identifier_descriptor for the DSI of the MHP Object Carousel that contains this application.
}		
(ETSI TS 101 812 section 10.8.1)		

Java Application Descriptors.

Table 2-33: Java application descriptor

Descriptor Syntax	CG Value	Comment
dvb_j_application_descriptor {		This descriptor specifies the Java application parameters, and is accessed on the Java app file > Properties... > Java Properties page. The parameter list is edited by using the Parameters list box and buttons.
descriptor_tag	0x03	
descriptor_length	auto	
for (i=0; i<N; i++) {		
parameter_length	auto	
for (j=0; j<parameter_length; j++) {		
parameter_byte	user	
}		
}		
}		
(ETSI TS 101 812 section 10.9.1)		

Table 2-34: Java application location descriptor

Descriptor Syntax	CG Value	Comment
dvb_j_application_location_descriptor {		This descriptor specifies the Java application path, and is accessed via Java app file > Properties... > Java Properties page.
descriptor_tag	0x04	
descriptor_length	auto	
base_directory_length	auto	
for (i=0; i<base_directory_length; i++) {		
base_directory_byte	user	> Base Directory field
}		
classpath_extension_length	auto	
for (i=0; i<classpath_ext_length; i++) {		
classpath_extension_byte	user	> Classpath extension field
}		
for (i=0; i<N; i++) {		
initial_class_byte	user	> Initial class field
}		
(ETSI TS 101 812 section 10.9.2)		

HTML Application Descriptors.

Table 2-35: HTML application descriptor

Descriptor Syntax	CG Value	Comment
dvb_html_application_descriptor {		This descriptor specifies the HTML application parameters, and is accessed via HTML app file > Properties... > HTML Properties page.
Descriptor_tag	0x03	
descriptor_length	auto	
appid_set_length	auto	
for (i=0; i<appid_set_length; i++) {		
application_id	user	> Application IDs list box
}		
for (j=0; j<N; j++) {		
parameter_bytes	auto	> Parameter String edit box
}		

Table 2-35: HTML application descriptor (Cont.)

Descriptor Syntax	CG Value	Comment
}		
(ETSI TS 101 812 section 10.10.1)		

NOTE. The *dvb_html_application_descriptor* format shown above is that defined in TS 101 812 v1.1.2 (MHP v1.0.1) – previous versions of the standard did not have the *application_id* loop. Carousel Generator can be made to revert to the older version of the descriptor (v1.0.0) for a particular carousel by checking the *MHP Object Carousel node > Properties... > (MHP page) Use old style (MHP v1.0.0) HTML application descriptor* checkbox.

Table 2-36: HTML application location descriptor

Descriptor Syntax	CG Value	Comment
<i>dvb_html_application_location_descriptor</i> {		This descriptor specifies the HTML application path, and is accessed on the HTML app file > Properties... > HTML Properties page.
<i>descriptor_tag</i>	0x04	
<i>descriptor_length</i>	auto	
<i>physical_root_length</i>	auto	
for (i=0; i< <i>physical_root_length</i> ; i++) {		
<i>physical_root_bytes</i>	user	> Physical Root Directory field
}		
for (i=0; i<N; i++) {		
<i>initial_path_bytes</i>	user	> Initial Path field
}		
(ETSI TS 101 812 section 10.10.2)		

Summary

Carousel Generator v2.0 is designed to generate enough SI to create a fully DVB conformant stream, which should be enough to drive most set-top boxes. If any additional SI is required, another suitable tool (the Tektronix Multiplexer) should be used to insert the extra information into the generated stream.

