MANUAL

version 4

TABLE OF CONTENTS

1. INSTALLATION OF ICAREUS PLAYOUT SERVER

The installation of Icareus Playout is divided into the following steps:

1. Operating system and database installation
2. Icareus Playout -software installation
3. Icareus Playout configuration

1.1. PLAYOUT PREREQUISITES

1. HARDWARE REQUIREMENTS

Icareus standard systems ships on DELL R310 server.

In case other hardware is used below is the minimum setup:

- Intel Xeon X3430 Processor (2.40GHz, 4C, 8M Cache, 95W TDP, Turbo), DDR3-1333MHz
- 4GB of 1333MHz Memory
- 250GB SATA 7.2k in RAID1 hard drives
- 3 x Gigabit network cards, preferably on two independent cards for redundant IP output
- PCIe slot for DVB-ASI card
- Redundant power supply is recommended

2. SOFTWARE REQUIREMENTS

Operating system: Centos-6.8 32bit

Database: Postgres

1.1. OPERATING SYSTEM INSTALLATION

BEFORE INSTALLATION

Before installing Centos RAID properties should be checked.

Checking of RAID properties is done by pressing Control-C before BIOS starts. Choose RAID Properties.

In RAID properties should be RAID 1 (IM) and two identical hard drives.

SOURCE

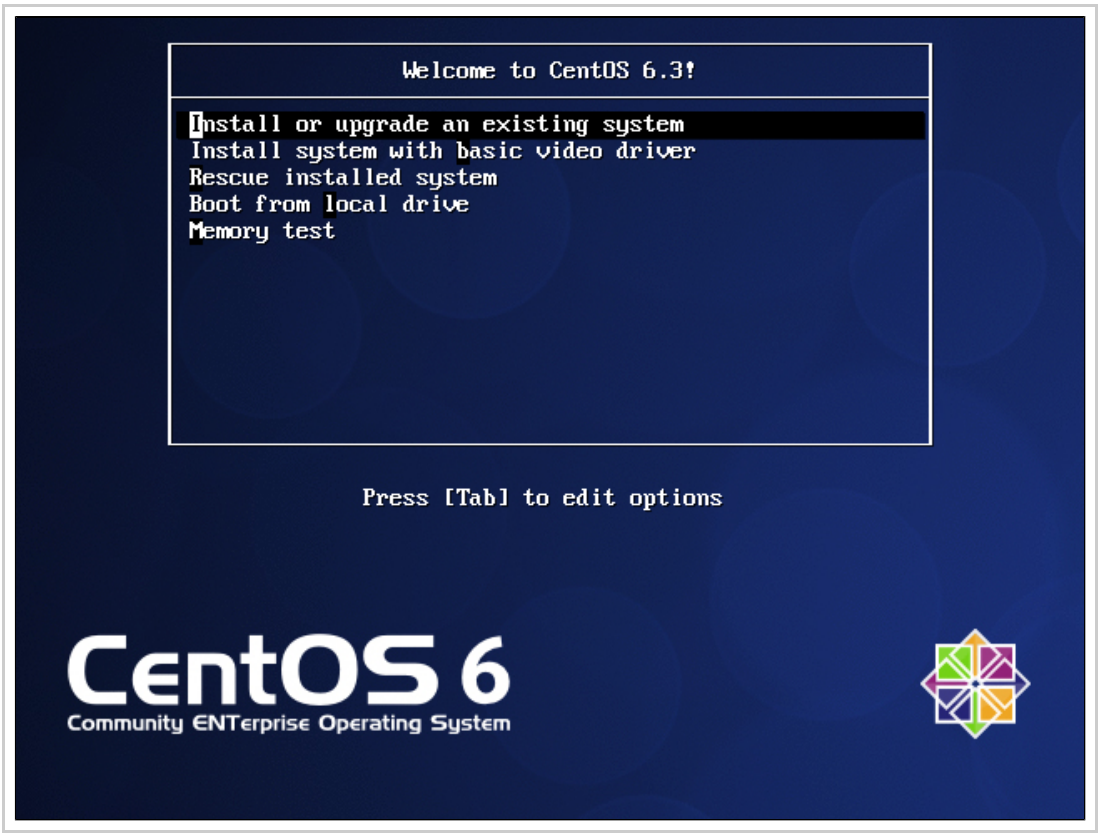
CentOS 6.8 32-bit version can be obtained from the vault: http://mirror.nsc.liu.se/centos-store/6.8/isos/i386/

It is recommended and enough to burn and install just the 1st DVD:
http://mirror.nsc.liu.se/centos-store/6.8/isos/i386/CentOS-6.8-i386-bin-DVD1.iso

INSTALLATION

Note that pictures are from installation of Centos 6.3, but are applicable to Centos 6.8.

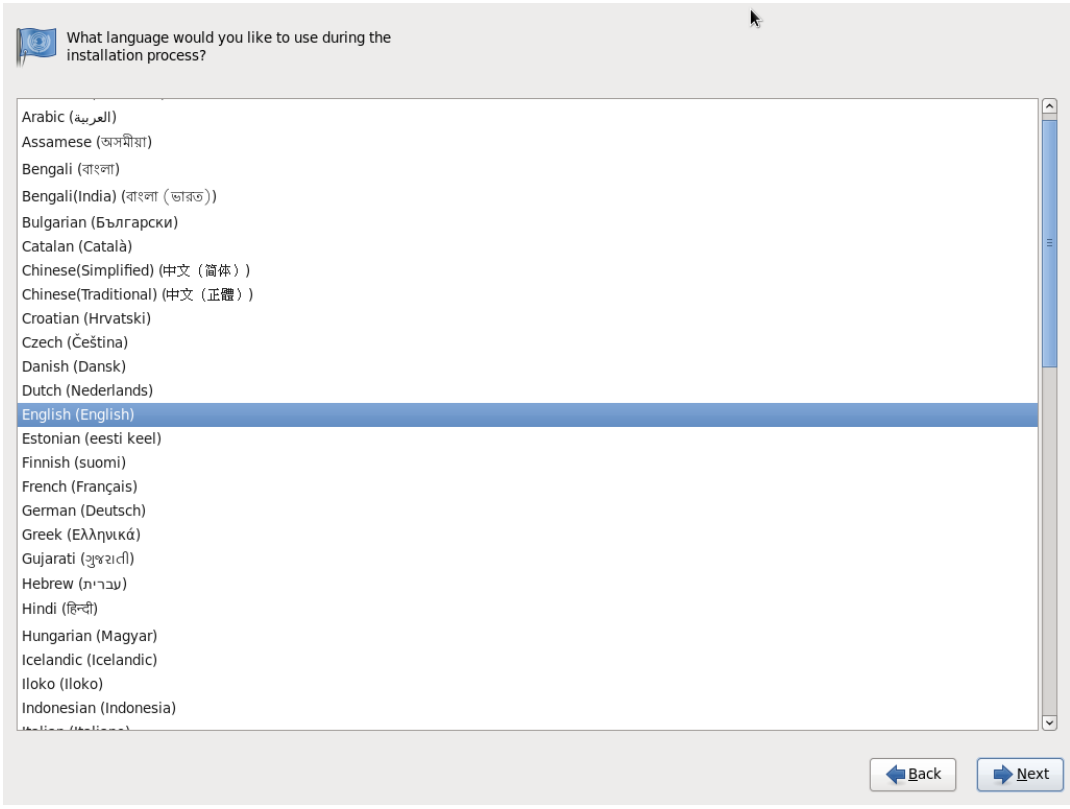
1) Insert the burned DVD to the server and boot from it:



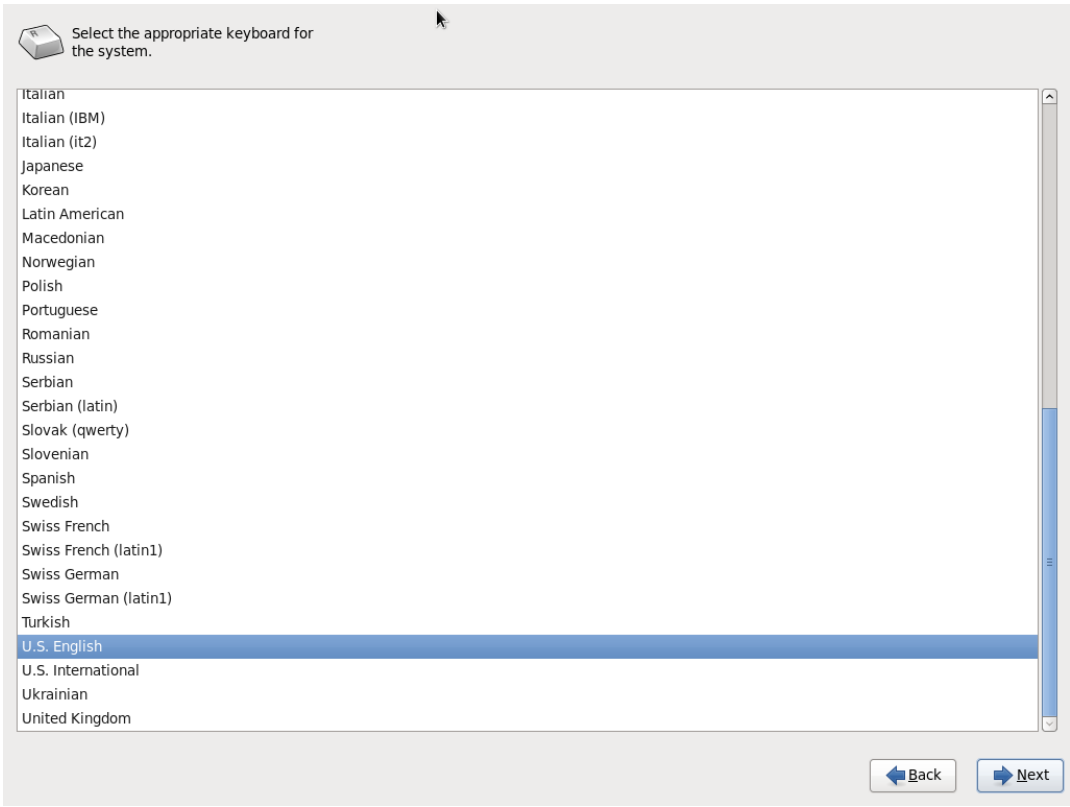
2) Skip the disk test

3) Start the installation procedure

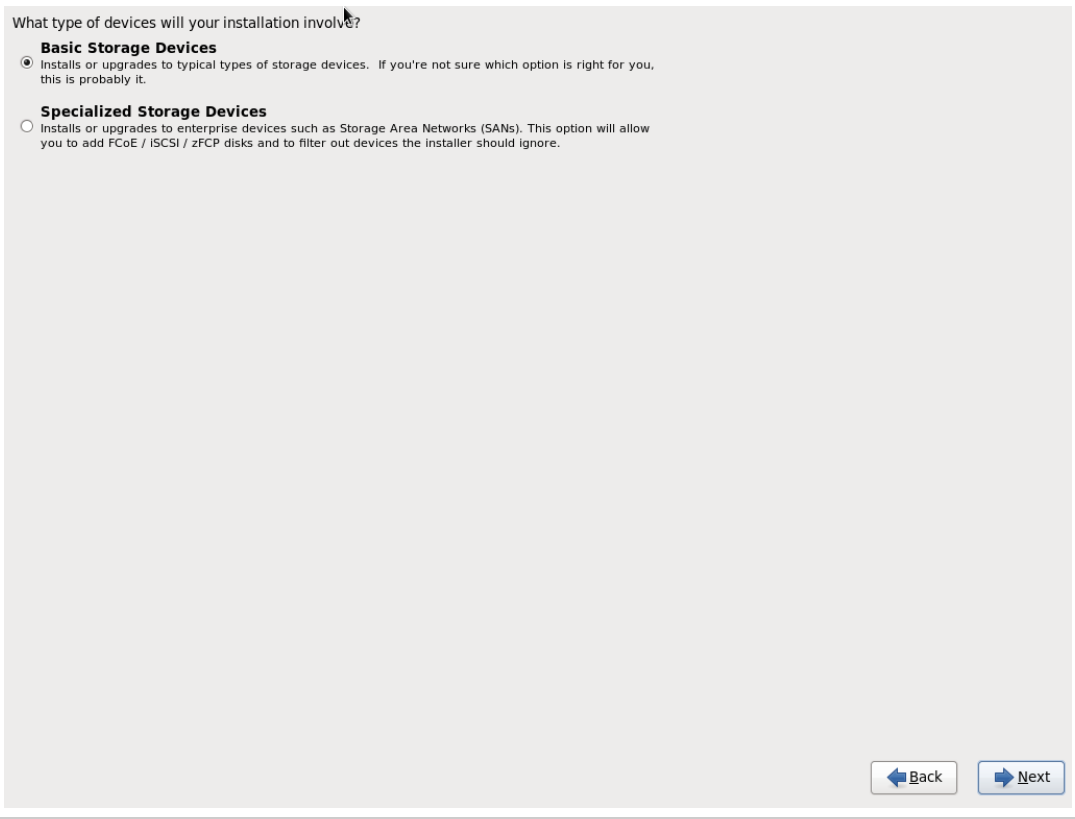
4) Select the language

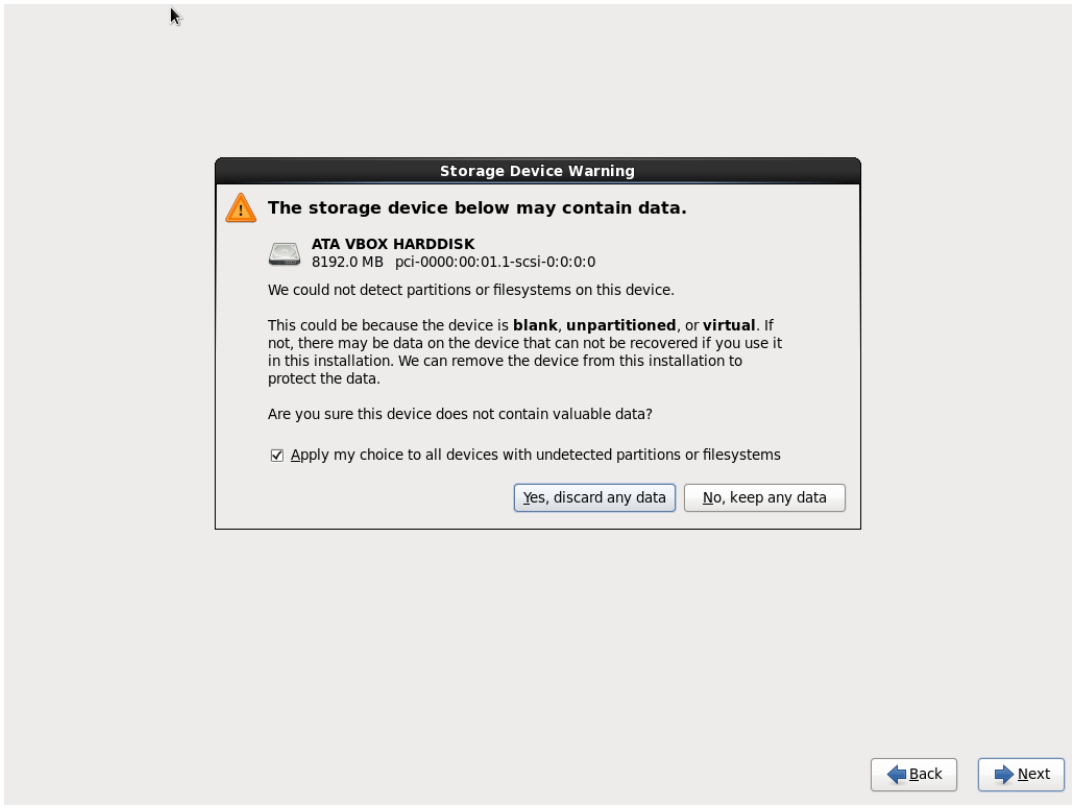


5) Select the keyboard layout

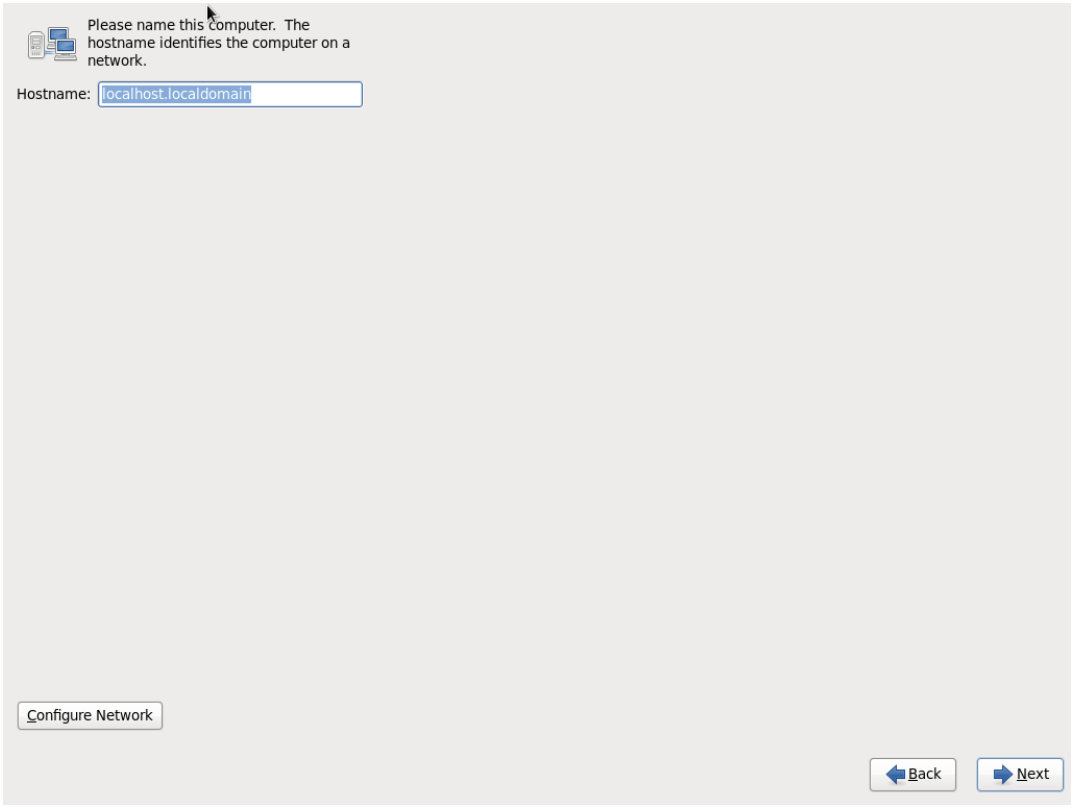


6) Define the storage

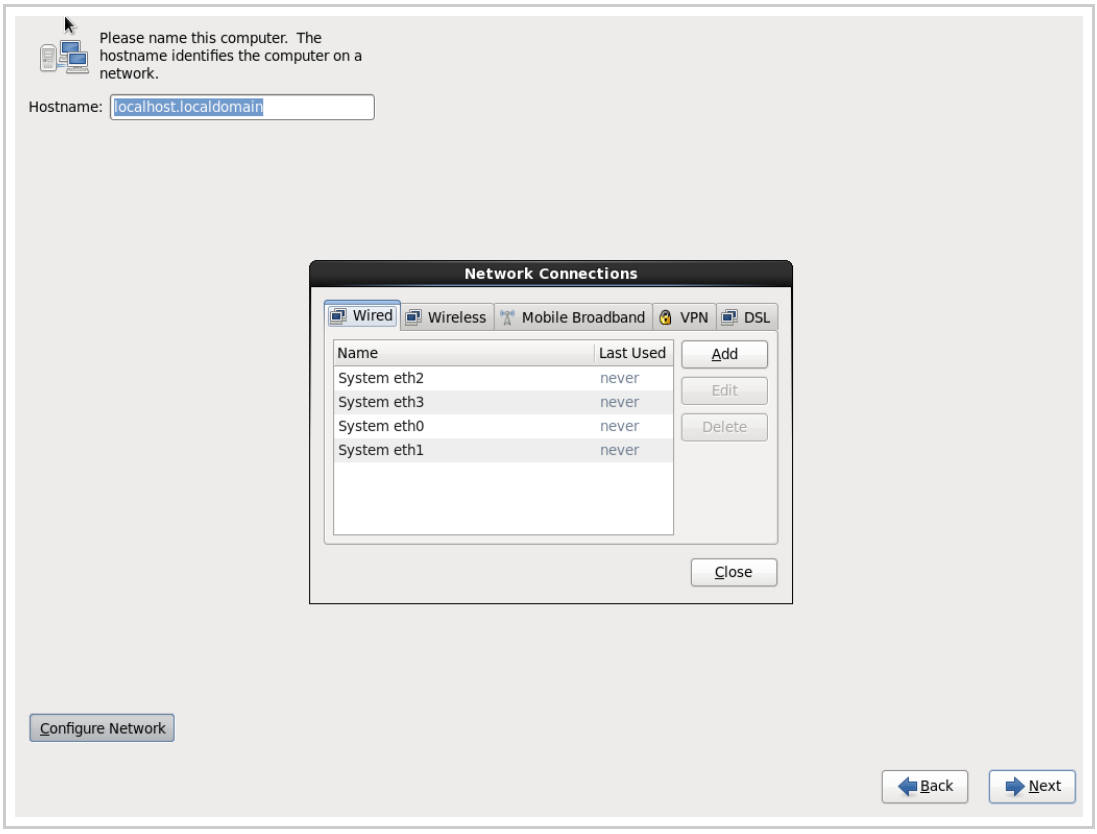


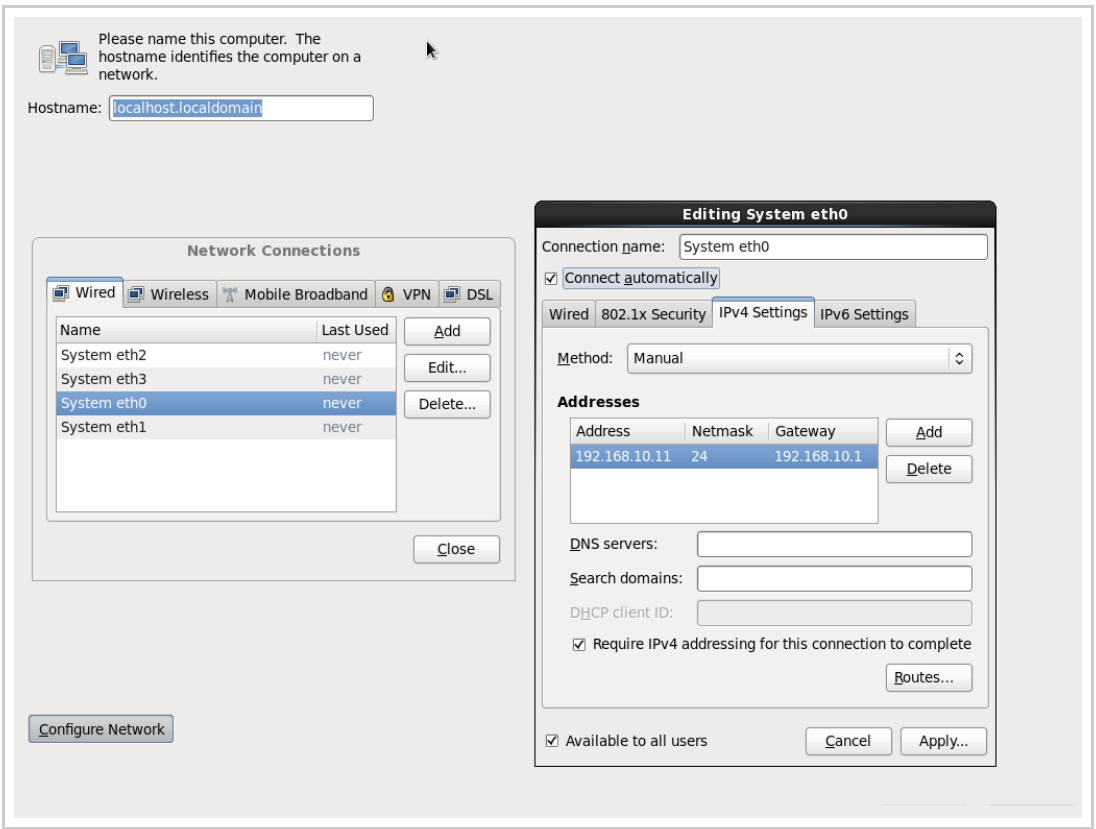


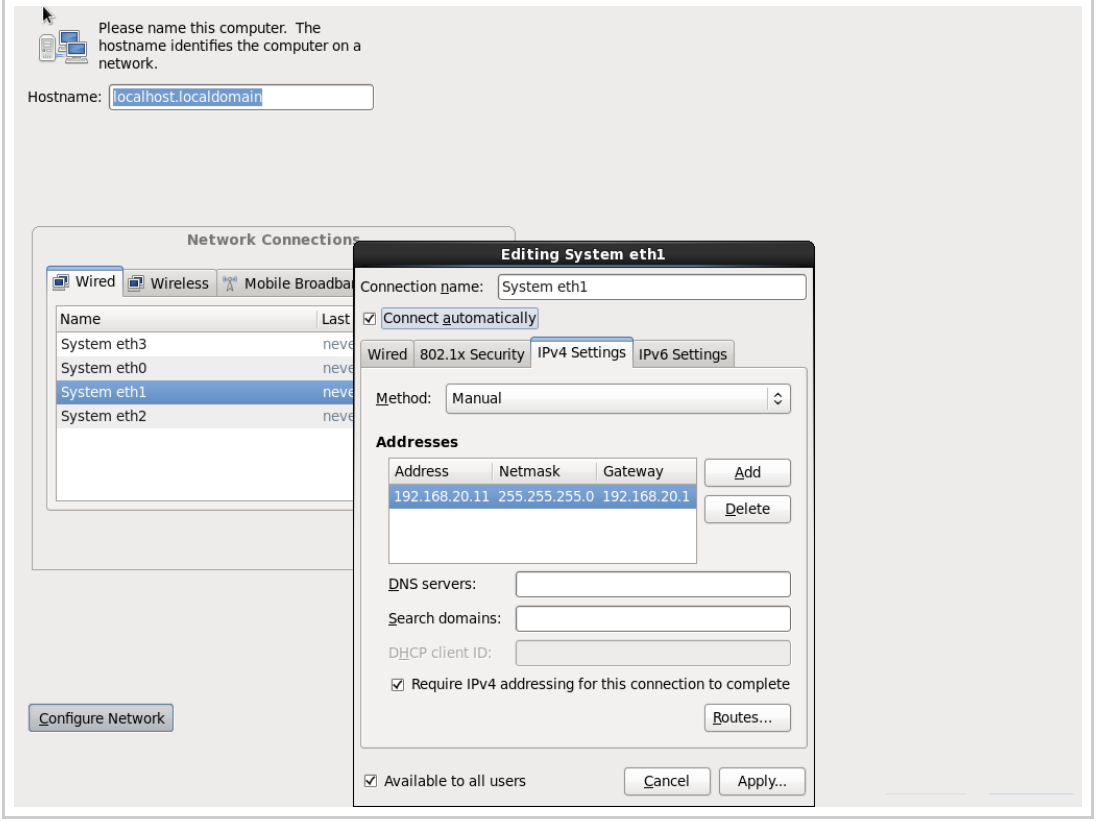
7) Setup the network

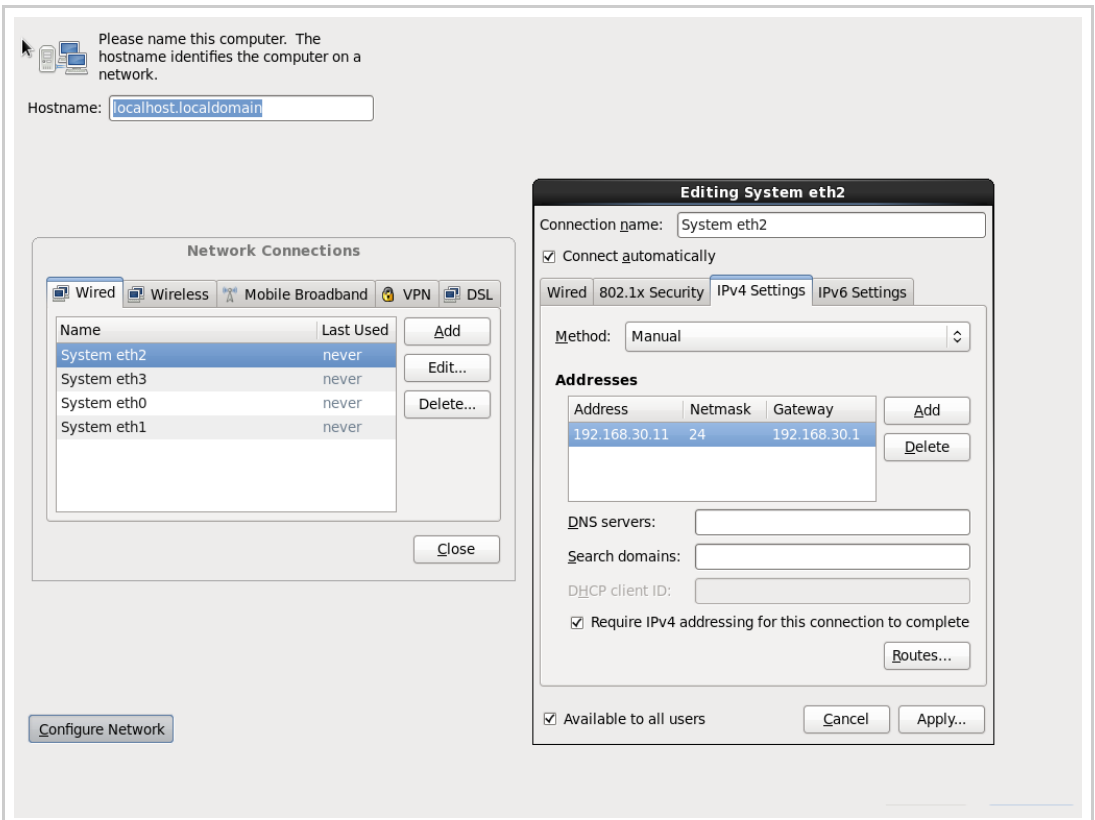


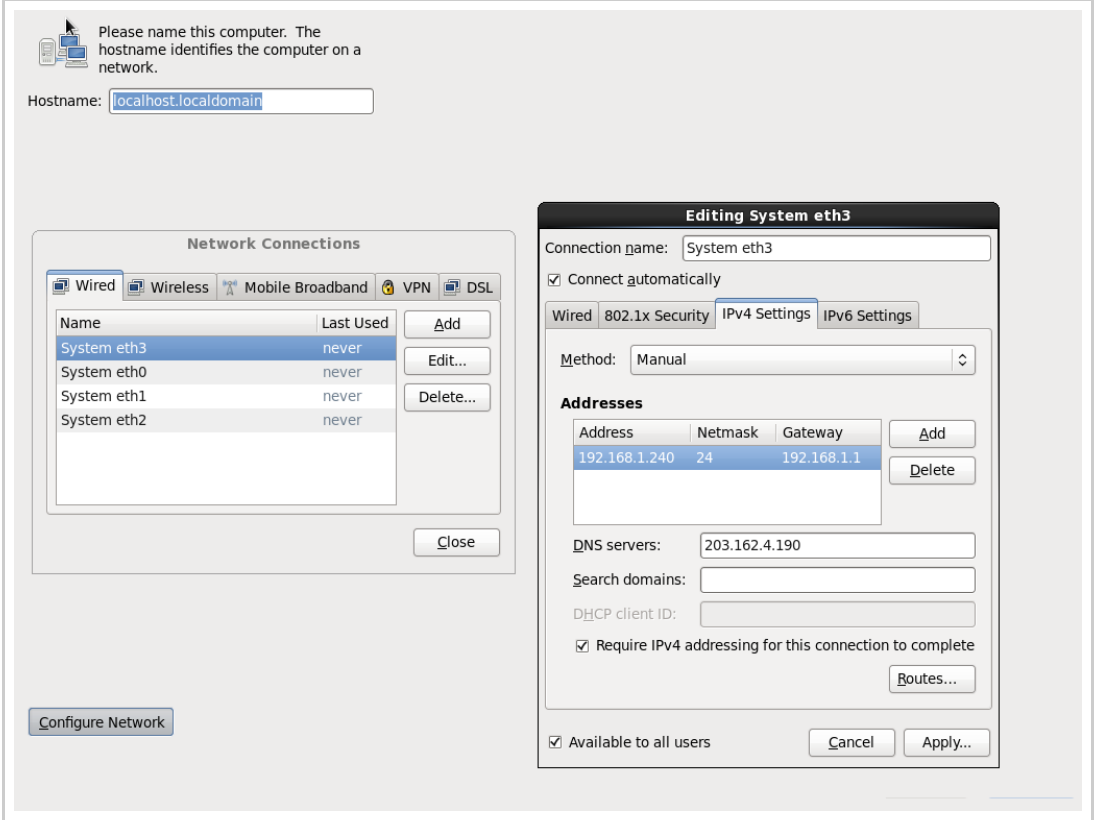
Please, note, that number of network interface cards and network parameters would depend on the server and attached networks. In the provided example NICs eth0, eth1, eth2 are manually set to be used in closed data delivery networks and for redundant server connection.
NIC eth3 takes network parameters from DHCP
and is used for server management.



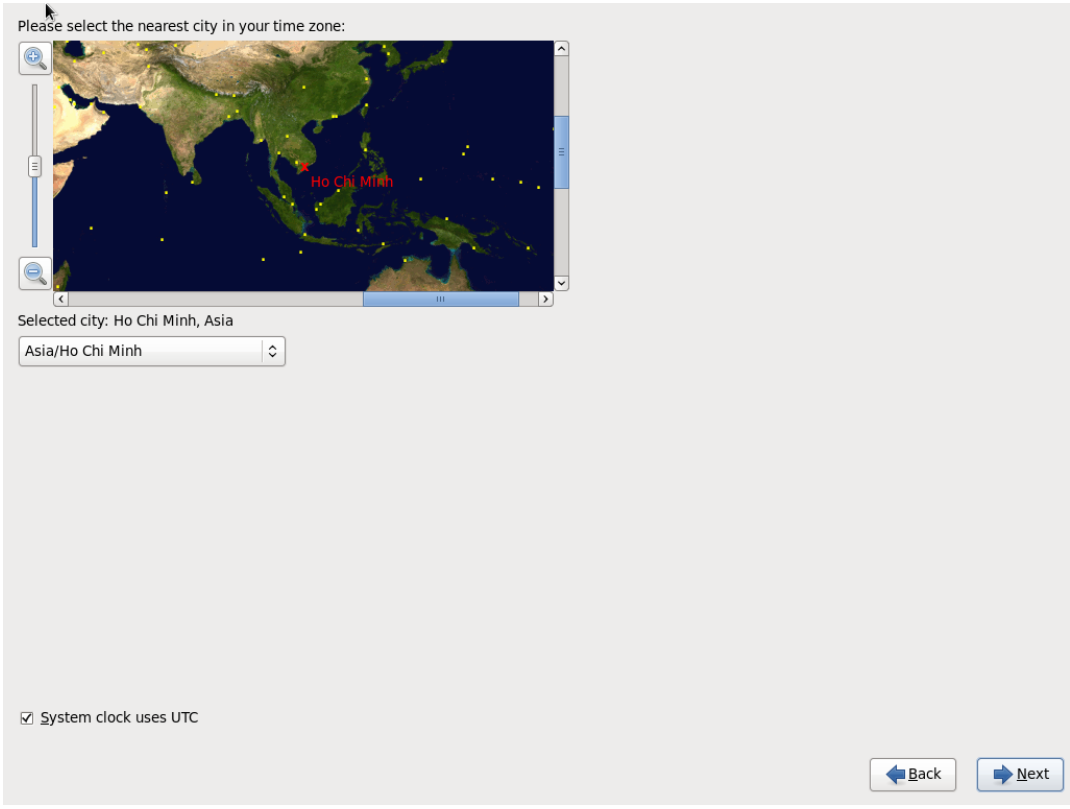




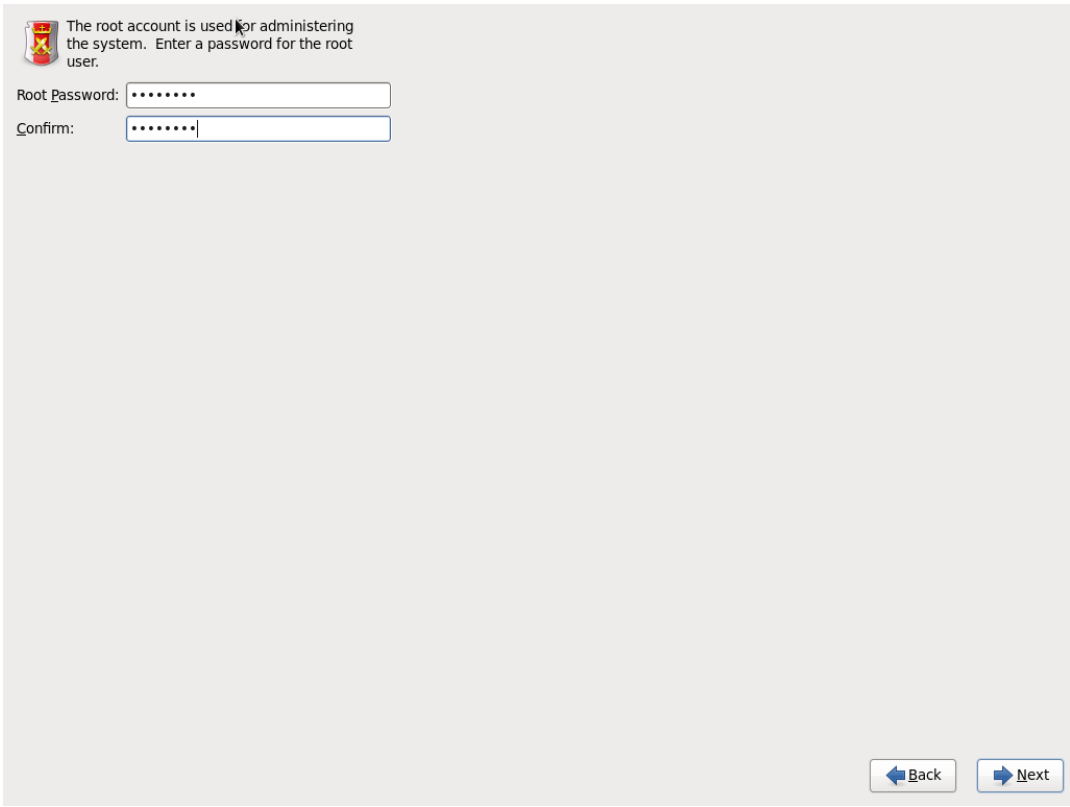




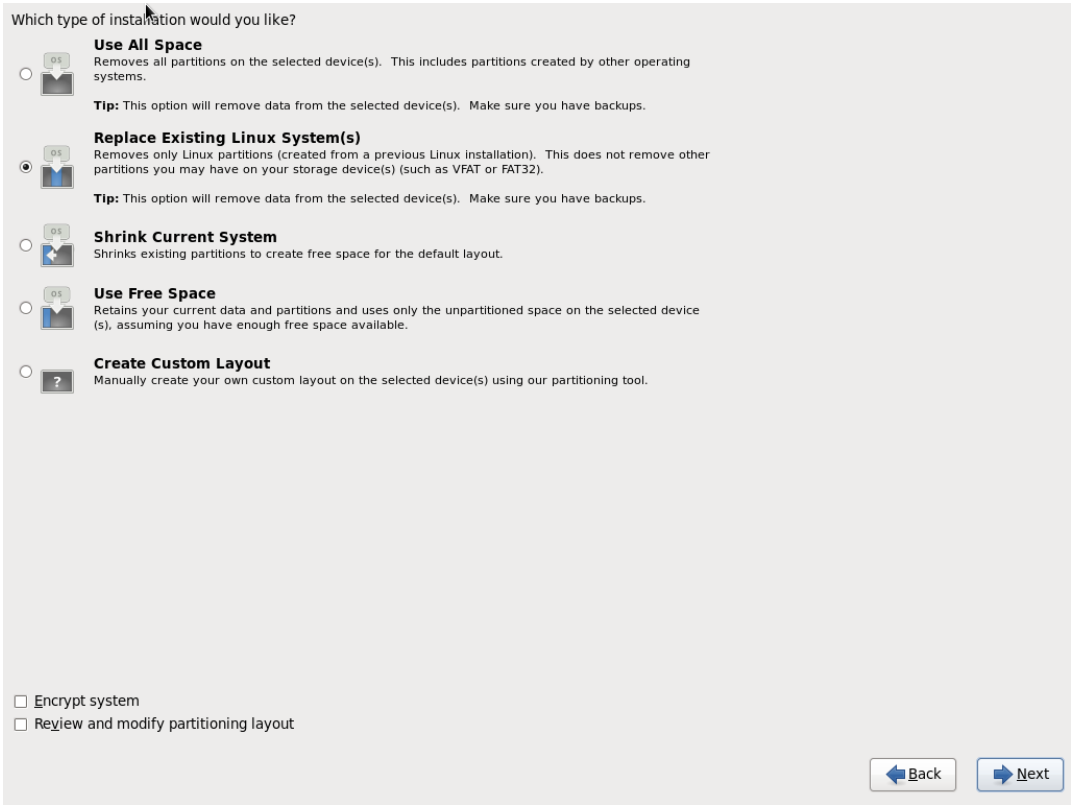
8) Select the time zone

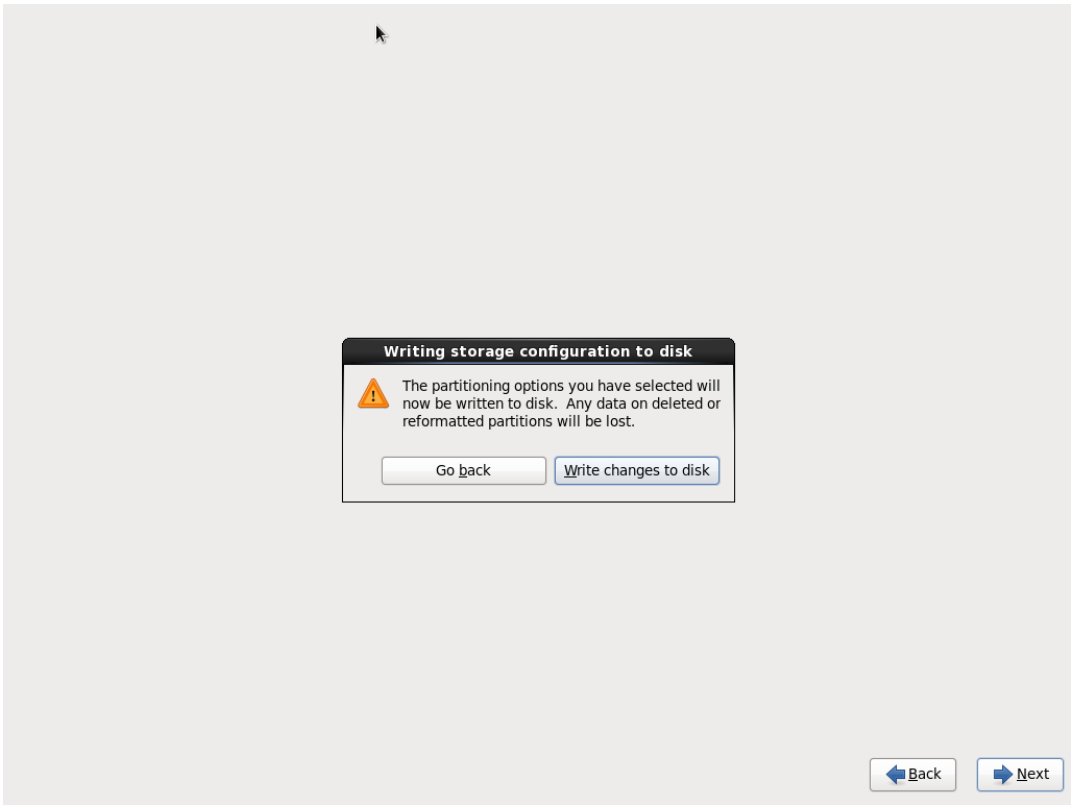


9) Define the root password of the server

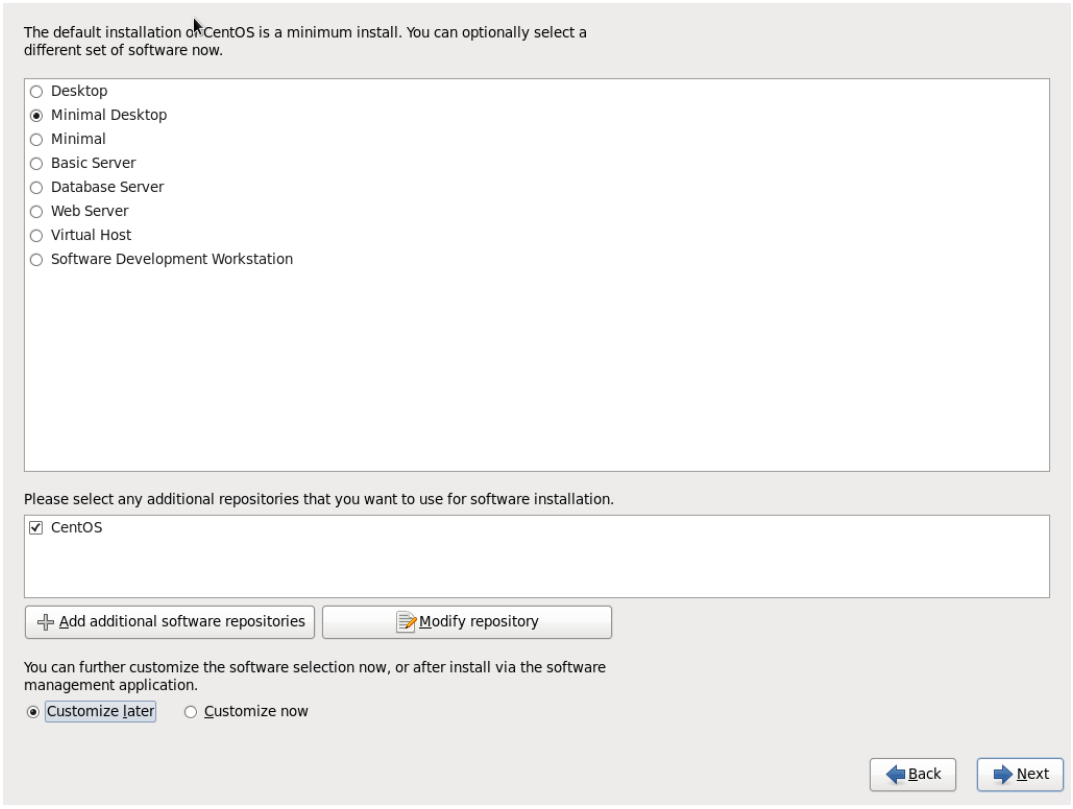


10) Define and format disk partitions

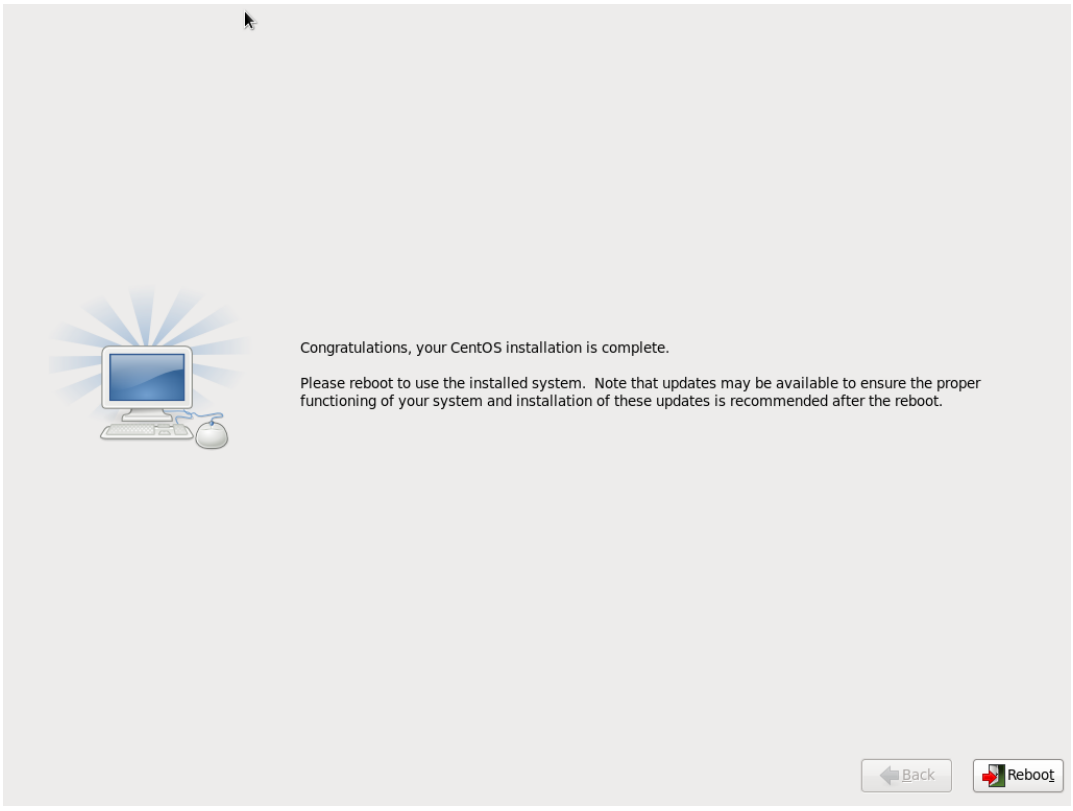




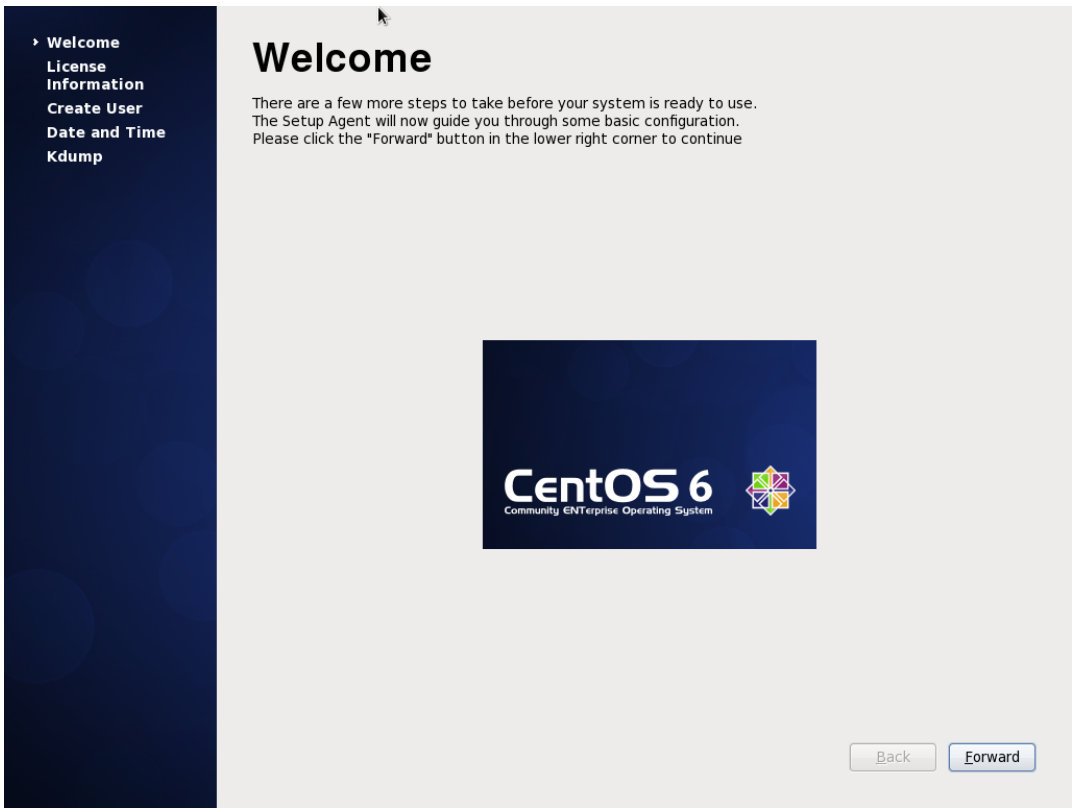
11) Choose the set of packages to install.

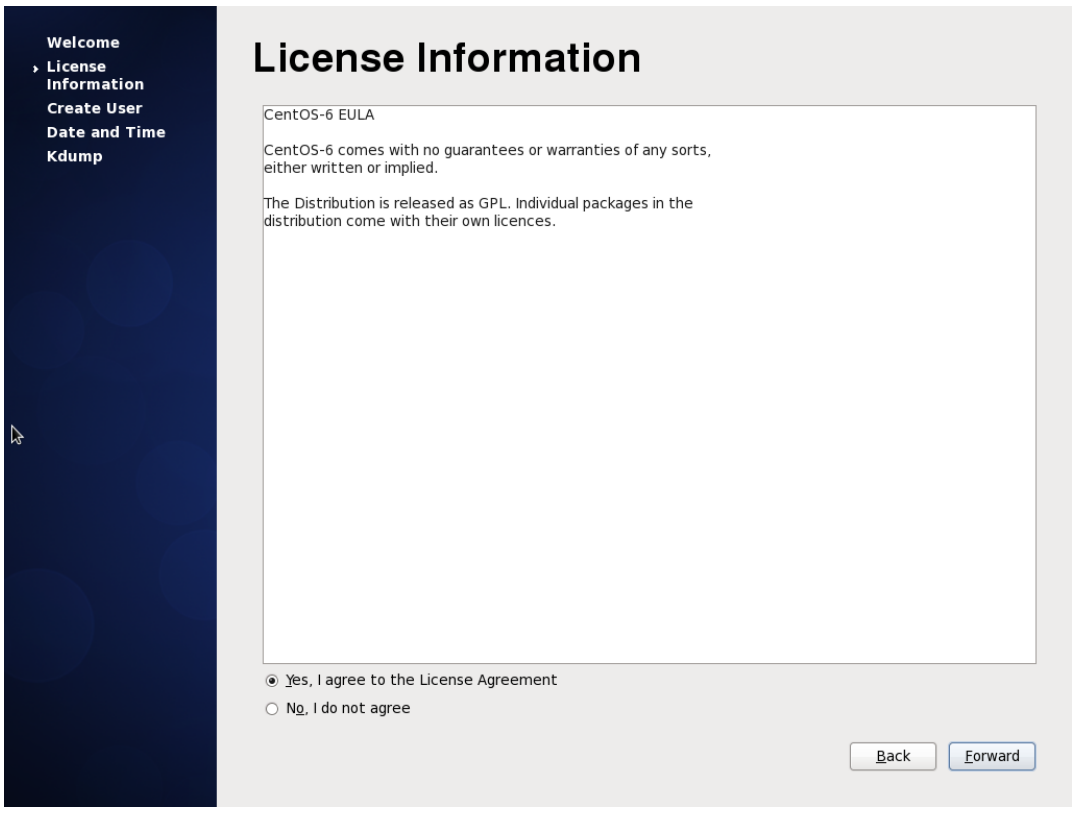


12) Reboot the server

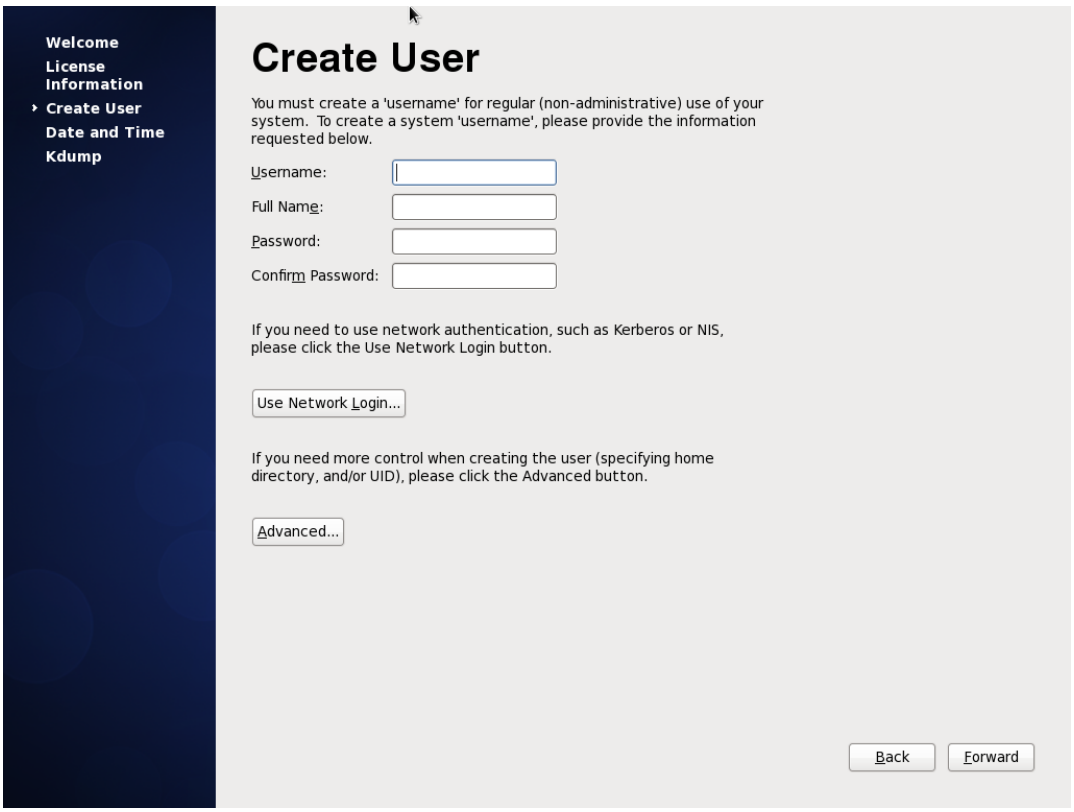


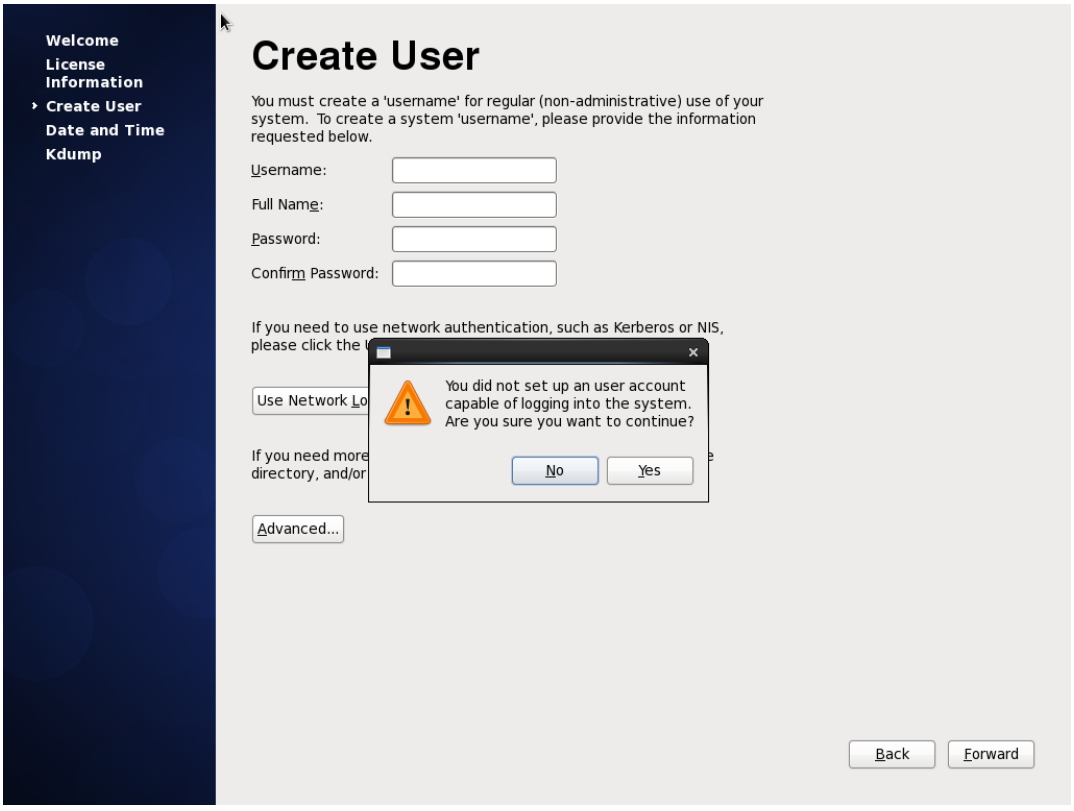
13) Finalize the setup



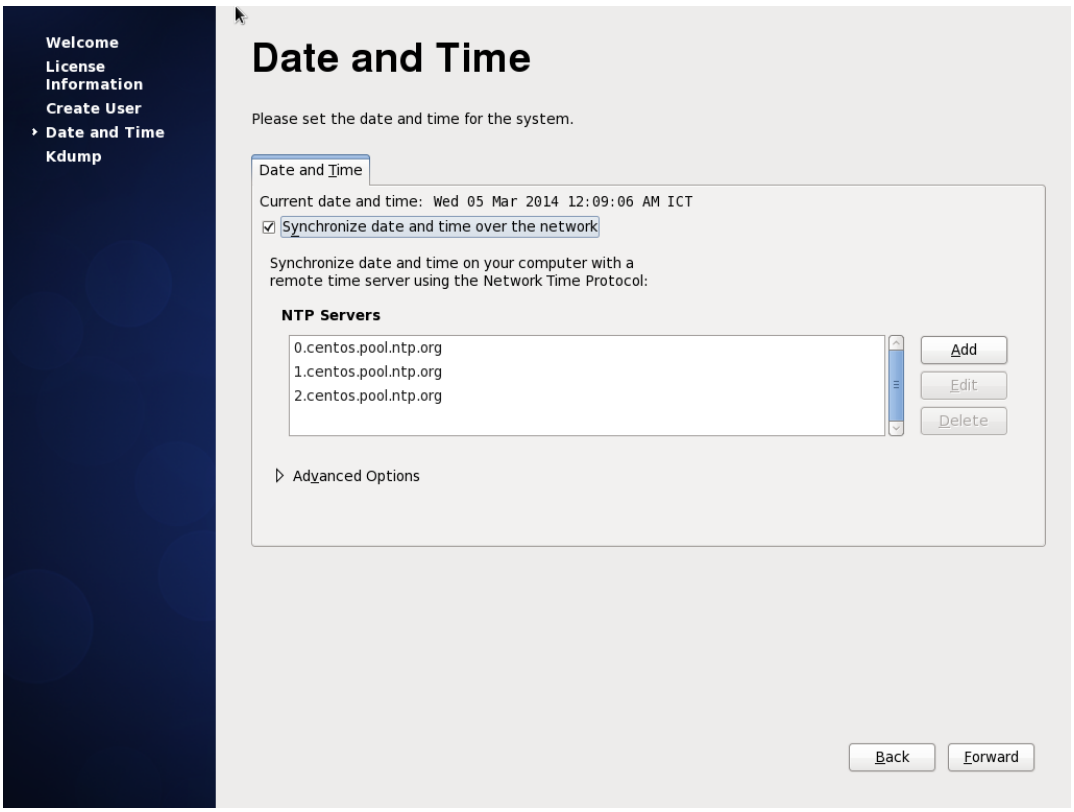


14) There is no need to create additional user

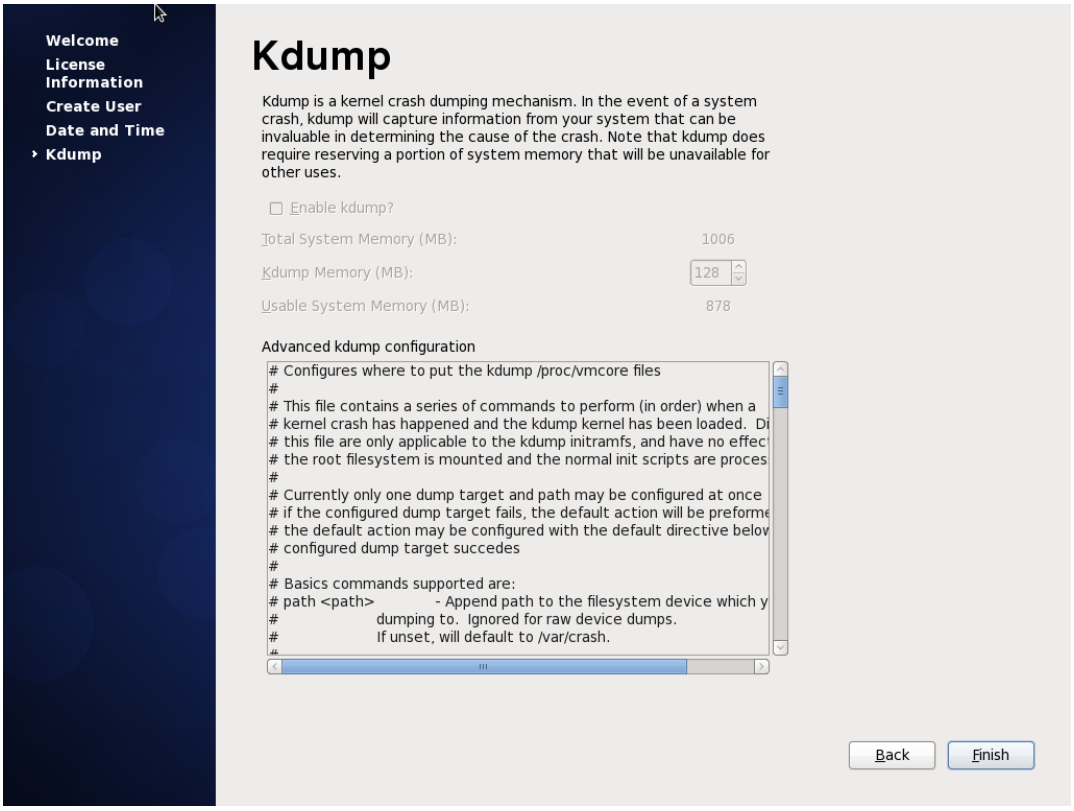




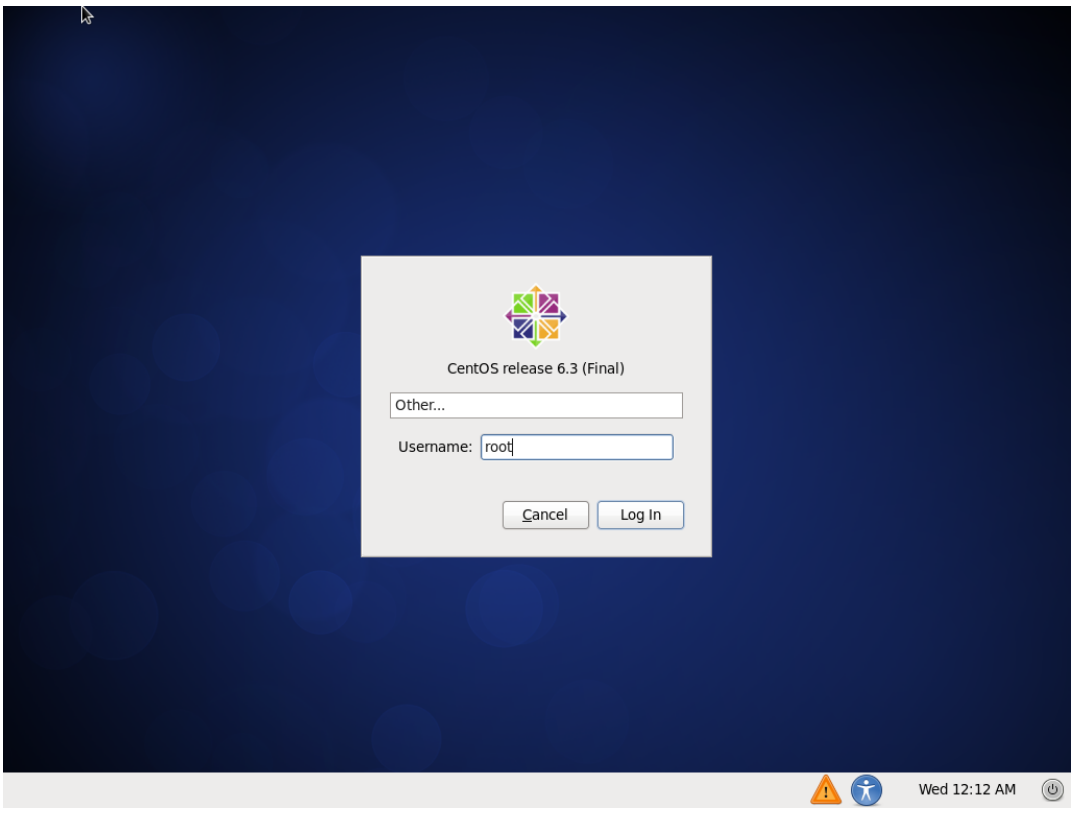
15) Define the time synchronization parameters

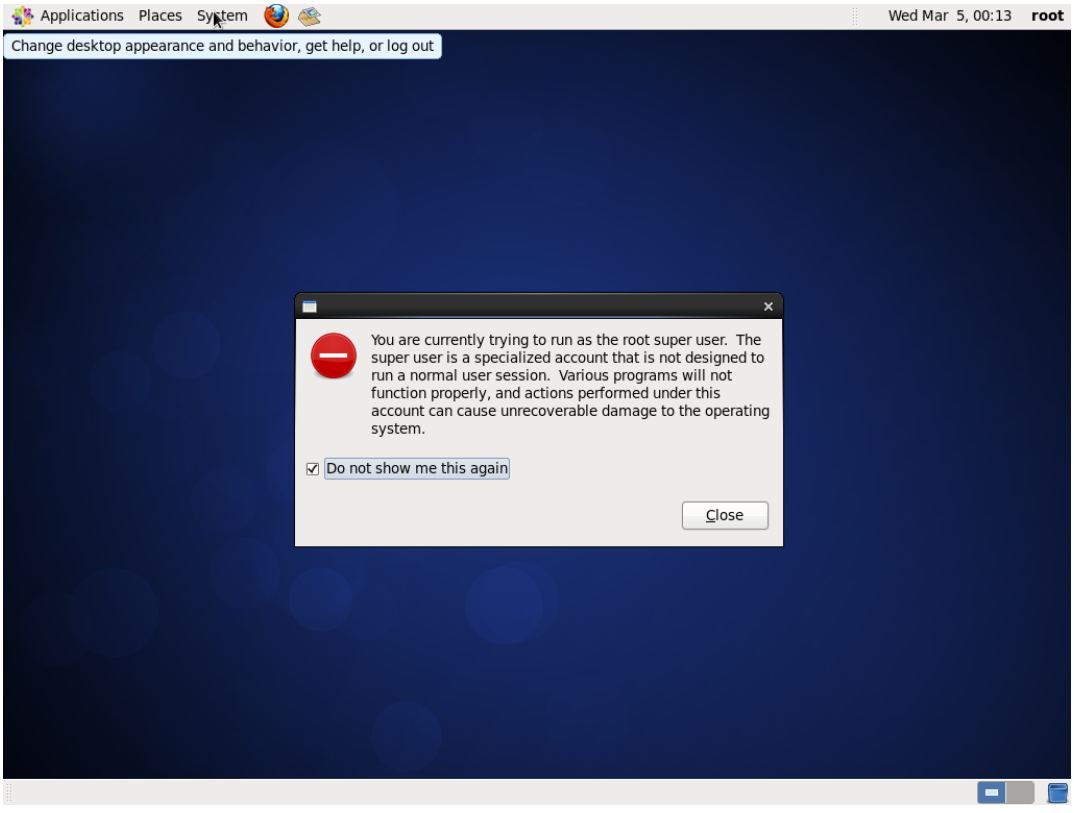


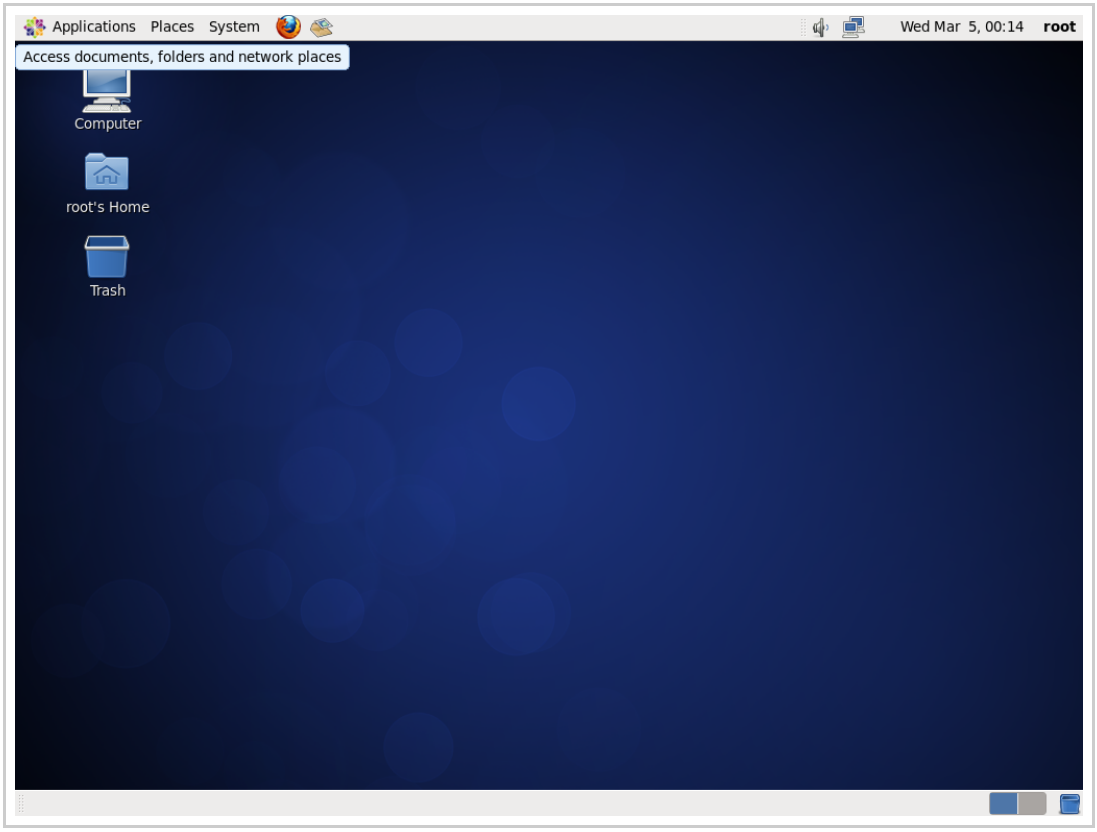
16) There is no need for kdump



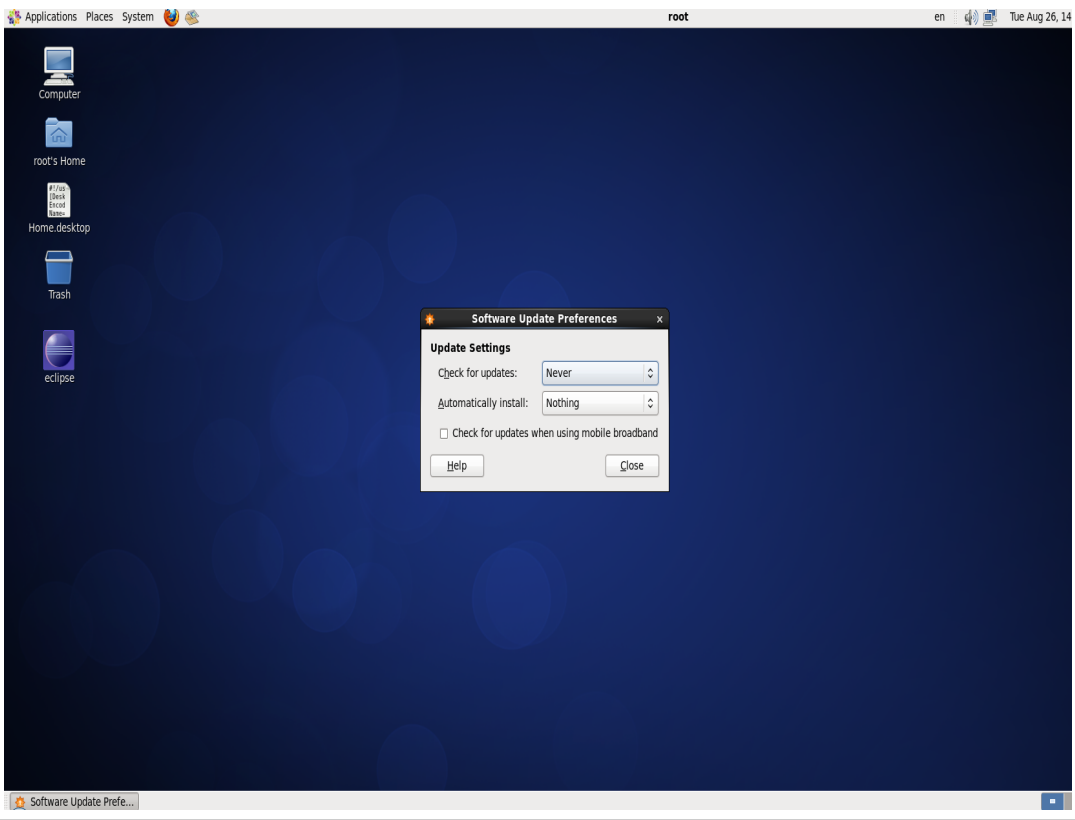
17) Login to the server under the root account







18) Disable automatic updates.
System-> Preferences->Software updates



ADD SUPPORT FOR SNMP.

1.1. OPERATING SYSTEM CONFIGURATION

1. OS INSTALLATION

1.1. DISABLE AUTOMATIC CENTOS UPDATES

Select System->Preferences->Software updates
Check for updates: Never
Automatically install: Nothing

1.2. DISABLE SELINUX

Edit /etc/sysconfig/selinux

Set
SELINUX=disabled
instead of
SELINUX=enforcing

1.3. FIREWALL SETTINGS

We have to open ports to access the Playout server:
- FTP
- SSH
- playout ports

The ports to be opened: 21, 22, 2001, 5000, 5555.

Ports can be opened by entering following lines (if missing) in the file /etc/sysconfig/iptables:

```
-A INPUT -m state --state NEW -m tcp -p tcp --dport 21 -j ACCEPT
-A INPUT -m state --state NEW -m tcp -p tcp --dport 22 -j ACCEPT
-A INPUT -m state --state NEW -m tcp -p tcp --dport 2001 -j ACCEPT
-A INPUT -m state --state NEW -m tcp -p tcp --dport 5000 -j ACCEPT
-A INPUT -m state --state NEW -m tcp -p tcp --dport 5555 -j ACCEPT
```

Also we should provide access fo ftp data connections changing the file /etc/sysconfig/iptables-config:

```
IPTABLES_MODULES="nf_conntrack_ftp"
```

1.4. FOR PLAYOUT SERVER CENTOS 6.8 NEEDS TO BE UPDATED.

1.4.1. MODIFY PROPERTIES OF YUM IN LOCATION

```
/etc/yum.repos.d/CentOS-Base.repo
```

In /etc/yum.repos.d/CentOS-Base.repo-file change urls:

Comment away mirrorlist and change baseurl like this:

BEFORE CHANGE in yum.repos.d/CentOS-Base.repo-file:

```
mirrorlist=http://mirrorlist.centos.org/?release=$releasever&arch=$basearch&repo=os
#baseurl=http://mirror.centos.org/centos/$releasever/os/$basearch/
```

AFTER CHANGE in yum.repos.d/CentOS-Base.repo-file:

for [base] section

```
#mirrorlist=http://mirrorlist.centos.org/?release=$releasever&arch=$basearch&repo=os
baseurl=http://mirror.centos.org/centos-6/6/os/$basearch/
```

for [updates] section

```
#mirrorlist=http://mirrorlist.centos.org/?release=$releasever&arch=$basearch&repo=updates
baseurl=http://mirror.centos.org/centos-6/6/updates/$basearch/
```

etc.

This must be done for all urls in yum.repos.d_CentOS-Base.repo-file.

1.4.2. BEFORE UPDATING CENTOS 6.8 RUN COMMAND:

```
yum clean all
```

1.4.3. UPDATING CENTOS 6.8 IS DONE BY RUNNING COMMAND :

```
yum update
```

1.4.4. REBOOT THE SERVER

1.4.5. RENAME NETWORK INTERFACES. (THIS IS NOT NEEDED IF NETWORK INTERFACES HAVE STANDARD NAMES LIKE ETH0, ETH1, ETC.)

Make a backup of /etc/grub.conf:
a). cp /etc/grub.conf /etc/grub.bak
b). Add biosdevname=0 to the kernel boot arguments in /etc/grub.conf.
c). Rename /etc/sysconfig/network-scripts/ifcfg-em1 to /etc/sysconfig/network-scripts/ifcfg-eth0, changing the line
DEVICE="em1"
to
DEVICE="eth0"
and
NAME="em1"
to
NAME="eth0"

Note: Change all existing network interfaces scripts, except ifcfg-lo as its local interface

d). Delete /etc/udev/rules.d/70-persistent-net.rules (if available)
e). Reboot

1.4.6. DISABLE GRAPHIC UI ON SYSTEM BOOT (IF NEEDED)

OPTIONAL installation:

If you want to use Midnight Commander Tool, run command:

```
yum install mc
```

1.5. 3RD PARTY PACKAGES:

If Playout was not previously installed it is required to install additional packages.

Installation packages are in location:
http://extranet.icareus.com/c/document_library/get_file?uuid=926230ee-3971-4f03-925e-06b8b991000a&group

Download and unzip the file
Note, that if unzip is not installed, you can install it with command

```
yum  install unzip
```

Change to location Packages by command:

```
cd Packages
```

In folder postgres, run command:

```
rpm -ivh pgdg-centos-8.1-5.noarch.rpm
```

Modify file /etc/yum.repos.d/CentOS-Base.repo under base, updates and extras by adding line:

```
exclude=postgresql*
```

Modify file /etc/yum.repos.d/pgdg-81-centos.repo by changing the lines:
Put

```
baseurl=http://yum.pgrpms.org/8.1/redhat/rhel-5-i386
```

instead of

```
baseurl=http://yum.pgrpms.org/8.1/redhat/rhel-$releasever-$basearch
```

Put

```
baseurl=http://yum.pgrpms.org/srpms/8.1/redhat/rhel-5-i386
```

instead of

```
baseurl=http://yum.pgrpms.org/srpms/8.1/redhat/rhel-$releasever-$basearch
```

Next run commands

```
yum install  postgresql  postgresql-server  postgresql-libs postgresql-devel vsftpd
```

```
yum groupinstall 'Development Tools'
```

Check which kernel version is installed, run command

```
cat /proc/sys/kernel/osrelease
```

and check is somewhere in the output is PAE.

If in the system is installed more than 4Gb of RAM Physical Address Extension is enabled then kernel-PAE-devel package should be installed instead of kerne-devel.

In general case run:

```
yum install kernel-devel
```

If installing kernel-PAE-devel-package, run:

```
yum install kernel-PAE-devel
```

Go to folder libstdc++ and run command:

```
rpm -ivh *.rpm
```

Go to folder darwin, run command

```
rpm -ivh *.rpm
```

Go to folder darwin/Installers/DarwinStreamingSrvrlinux-Linux and run command:

```
./Install
```

Go to folder HDD_LInux_USB_daemon and run command:

```
./aksusbd
```

Go to folder openssl and run command:

```
./config
```

```
make
```

```
make test
```

```
make install
```

Check that symbolic links in folder /lib/modules/<kernel version>/ are working. Command:

```
ls -l
```

Symbolic link looks for example like this:

```
build -> ../../../usr/src/kernels/2.6.18-194.32.1.e15-PAE-i686
```

Go to folder Dektec_SDK and run commands:

Dektec installation:

```
./dektec.sh
```

Go to folder additional_packages run command:

```
rpm -ivh *.rpm
```

Note: If some packages are already installed, remove the extra rpm files.

```
# rpm -ivh *.rpm
warning: lame-3.97-4.lvn6.i386.rpm: Header V3 DSA/SHA1 Signature, key ID a109b1ec: NOKEY
Preparing...                ########################################### [100%|100%]
package libicu-4.2.1-9.1.el6_2.i686 is already installed
# rm libicu-4.2.1-9.1.el6_2.i686.rpm
rm: remove regular file `libicu-4.2.1-9.1.el6_2.i686.rpm'? y
# rpm -ivh *.rpm
```

1.1. PLAYOUT SOFTWARE INSTALLATION

1. INSTALLING PLAYOUT

Get the latest playout packages (4.4.1.12):
http://extranet.icareus.com/c/document_library/get_file?uuid=fa132129-0cf0-4cf6-9838-c75d348a24ca&groupId
.

Go to playout folder

Check, that postgresql server is not working by running command:

```
service postgresql status
```

If it is working, stop it by running command:

```
service postgresql stop
```

and then run command:

```
./install.sh
```

Reboot the server and open database configuration file:

```
cat /etc/playout/database.conf
```

Copy the password for the database in the 'dp-passwd=***' line.

Update the password for the database (replace *** with copied password):

```
su - postgres
psql
alter role playout with password '***';
\q
exit
```

Now download the Playout Management Console from location:
http://extranet.icareus.com/c/document_library/get_file?uuid=2cf6f14a-8f7b-431b-89d6-c44f57869abe&groupId

Use the following credentials when installing the PMC:

```
user: playout
password: q1w2e3r4t5
```

on a windows machine and use it to connect to your Playout server.

1.1. PLAYOUT LICENSE FILE AND DONGLE

INTRODUCTION

Icareus Playout requires an license file and an USB security dongle to operate. Each dongle has its uniqued ID to which the license file is bound.

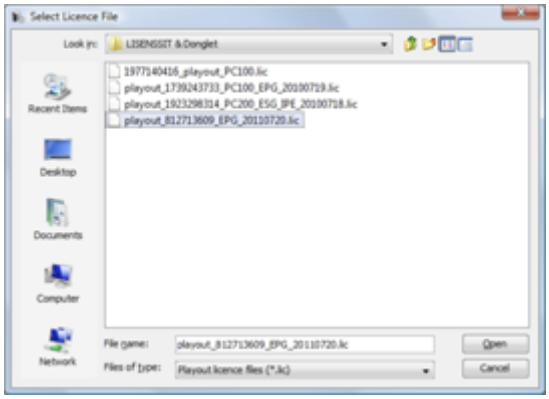
The license file is uploaded to the server using Playout Management Console (PMC) and can be updated at any time. The Playout services must be restarted after the new license file is uploaded.

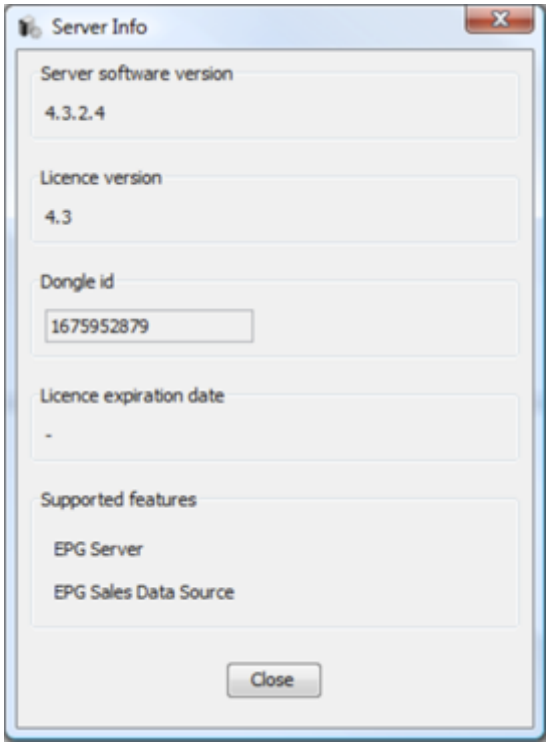
UPDATING PLAYOUT LICENSE

THE PLAYOUT LICENSE FILE MUST BE UPLOADED TO THE SERVER IN ORDER IT TO WORK PROPERLY AND TO OFFER THE CORRECT FEATURES.

TO UPLOAD THE FILE OPEN THE UPLOAD WINDOW BY CHOOSING: *SERVER -> UPDATE LICENSE* IT WILL OPEN AN POP-UP WINDOW SHOWN RIGHT.

THE LICENSE FILE IS CONTAINS INFORMATION ABOUT THE PRODUCT VERSION, SERVER SOFTWARE VERSION AND SECURITY DONGLE ID. IN ORDER TO VIEW THIS INFORMATION, YOU CAN CHOOSE: *SERVER -> INFO.*





1.1. PLAYOUT SOFTWARE UPDATE

ICAREUS PLAYOUT SOFTWARE UPGRADE PROTOCOL

Upgrade needs to be performed separately for all servers in 1+1 setups

Both Icareus Playout server and Playout Mangement Console should be upgraded at the same time to ensure compatibility.

PREREQUISITES

- Older version of Icareus Playout server is already installed.
- New Icareus Playout Server package playout_x.x.x.x.zip is available for the Icareus Playout server to be updated (filename could be e.g. playout_4.5.1.3.zip).
- New Icareus Playout Management Console pmc-x.x.x.x.exe is available in order to configure Icareus Playout server after update (filename could be e.g. pmc-4.5.1.3.exe).

PRELIMINARY WORK

BACKING UP THE EXISTING CONFIGURATION

- Make a backup from the configuration with PMC:

```
Server -> Settings -> Export
```

- In "Export" window select all options in "Export parameters" section and give a desired file name for the xml file to be used for the exported data.
- After exporting is done, put the output file into a safe place in case of needed later.

UPGRADE STEPS

The actual upgrade is done by a script that is provided as part of the software package.

The script takes usually around 5 minutes to run.

Running the upgrade script will stop all output from the server!

The script automatically does the following steps:

1. Stops all Playout services. All outputs from Icareus Playout will stop, via ASI and/or IP depending on the configuration.
2. Updates all playout packages in /opt/playout/bin
3. Makes an database changes as needed by the upgrade
4. Starts all Playout Services. The output from Icareus Playout will be restored.

RUNNING THE UPGRADE SCRIPT

- Place New Icareus playout_x.x.x.x.zip packet on the playout server and unzip using command:

```
unzip playout_x.x.x.x.zip
```

- Go to the playout update folder:

```
cd playout_x.x.x.x/update
```

- If playout is updated from the previous version then run command:

```
./update.sh > output.log
```

- If playout is updated from a older version then run command:

```
./full_update.sh > output.log
```

It is possible, that there would be warnings in the output - that is normal.
The output log file should be provided to Icareus for analysis.

UPGRADING ICAREUS PLAYOUT MANAGEMENT CONSOLE

It is important also to update the Playout Management Console.
Please, install it on some windows machine. It will use the same configuration that was used previously on the same machine.

TESTING

- After update is done for both, Icareus Server and Playout Management Console, try to connect with PMC.
- Check, that configuration is same as before the update process.
- Test that all possible new features and/or bug fixes in a new release works correctly.
- Check with PMC that there are no severe errors in log:

```
Status -> Log
```

1.1. PLAYOUT REDUNDANCY

1. INTRODUCTION

Icareus Playout can be installed as a redundant system with two hardware servers to ensure excellent service level.

There are several redundancy architectures depending on the head-end and desired usage. These options are described in the following chapter to give reader full understanding of building an redundant Icareus Playout deployment.

2. REDUNDANCY ARCHITECTURES

2.1. INTRODUCTION - APPROACHES FOR REDUNDANCY

Icareus Playout enable to build various redundancy architectures such as

1. Manually importing and exporting configurations using Playout Management Console
2. Replicating the database manually or automatically from Main to Back-up server

2.2. ISSUES TO CONSIDER

1. Is it enough to replicate the EIT data and manually manage the services and their parameters
2. Changes in the following configurations will require service restarts that may have to be done manually on both main and backup servers.
3. RTP output IP addresses will be the same on both main and backup servers if database replication is used

2.3. MANUALLY EXPORTING/IMPORTING CONFIGURATIONS

Exporting/importing configuration option allows saving Playout settings to a file. This file can be used to restore the settings for any Playout server.

Note
Only server configuration settings are processed using this option. Service related settings (service definition, EPG information, etc.) are not handled.

PMC (Playout Management Console) should be used to export/import Playout configuration.

Export configuration settings

- Select Server/Settings/Export menu item
- Choose a file to export Playout configuration and press OK button

Import configuration settings

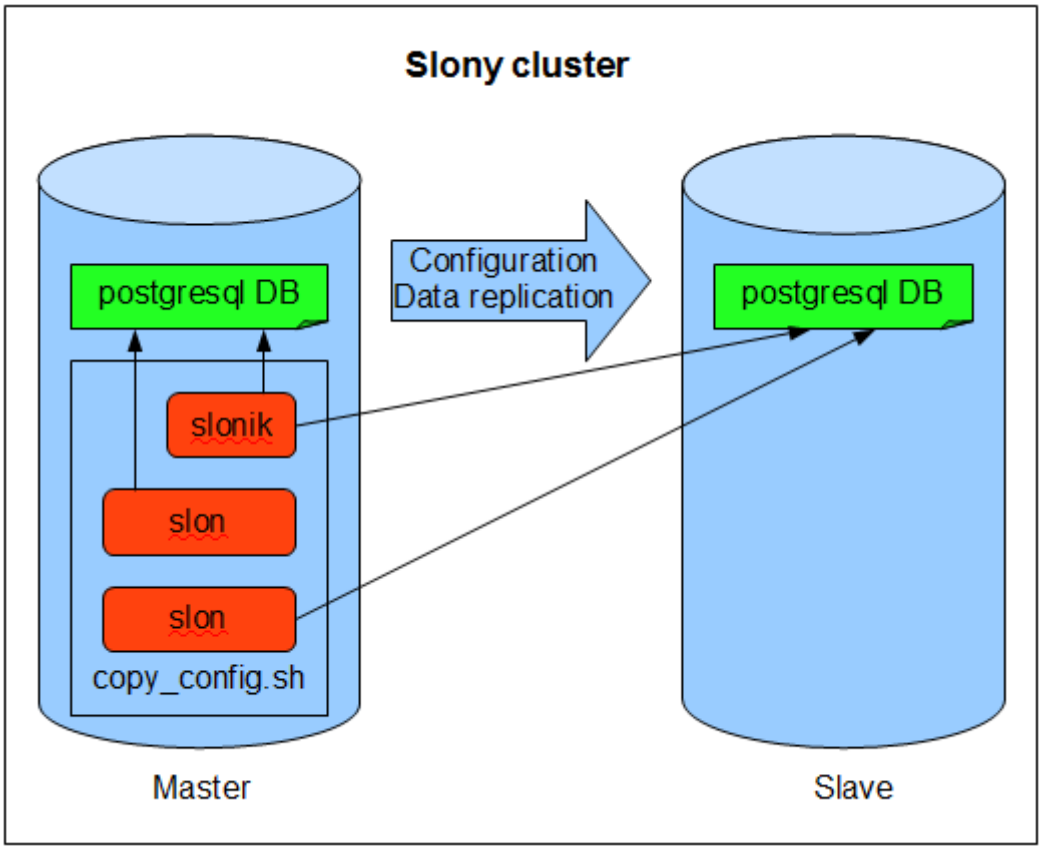
- Select Server/Settings/Import menu item
- Choose a Playout configuration file and press OK button

2.4. DATABASE REPLICATION

A third party tool called Slony-I is used to perform database replication from master to slave machine.

The database replication is done using a system level script that is ran on the Master server that performs

1. Database replication from Master to Back-up
2. Restarting of necessary services on Back-up server



2.4.1. SLONY-I INSTALLATION

Slony-I should be installed on both master and slave machines. Execute the following commands to build and install it.

```
yum install openssl-devel (if needed)
tar -jxf slony1-1.2.23.tar.bz2
cd slony1-1.2.23
./configure
make
make install
```

2.4.2. SYSTEM CONFIGURATION

There are two main components of the system. They are master and slave machines. The following configuration files should be updated for both machines to allow Slony-I perform replication. Remember to connect ethernet cable between eth2 of master and slave machines.

2.4.2.1. INTERFACES CONFIGURATION

NICs configuration

eth0 - data output
eth1 - data output (if needed)
eth2 - redundancy
eth3 - management (Internet connection)

2.4.2.2. /OPT/PLAYOUT/DB/PG_HBA.CONF

Postgresql host-based authentication configuration file should contain permission declaration for localhost and master machine. Applicable for master and slave machines.

```
#TYPE   DATABASE    USER        CIDR-ADDRESS          METHOD
host    all         all         127.0.0.1/32          trust
host    all         all         X.X.X.X/32            trust
host    all         all         Y.Y.Y.Y/32            trust
```

Actual IP address of master machine should be defined instead of X.X.X.X.
Actual IP address of slave machine should be defined instead of Y.Y.Y.Y.

Example:

```
# IPv4 local connections:
local   all         all                               trust
local   playout     playout                           md5
host    all         all         127.0.0.1/32          trust
host all         all         10.30.2.11/32       trust
host    all         all         10.30.2.10/32         trust
```

2.4.2.3. /ETC/SYSCONFIG/IPTABLES

IP tables configuration file should allow listening for incoming connections for port 5432. Applicable for master and slave machines.

If for some reason iptables file does not exist, give command 'setup' , 'Firewall Configuration', 'SSH' and 'FTP' and then give port number '5432' and 'tcp'.

```
-A RH-Firewall-1-INPUT -m state --state NEW -m tcp -p tcp --dport 5432 -j ACCEPT
```

Restart iptables

```
service iptables restart
```

2.4.2.4. /OPT/PLAYOUT/DB/POSTGRESQL.CONF

Postgresql configuration file should allow listening for incoming connections for port 5432. Applicable for master and slave machines.
All parameters of 'Connection Settings' section should be enabled. listen_addresses should be equal to '*'.

```
#------------------------------------------------------------------------------
# CONNECTIONS AND AUTHENTICATION
#------------------------------------------------------------------------------
# - Connection Settings -
listen_addresses = '*'                  # what IP address(es) to listen on;
                                        # comma-separated list of addresses;
                                        # defaults to 'localhost', '*' = all
port = 5432
max_connections = 100
superuser_reserved_connections = 2
unix_socket_directory = ''
unix_socket_group = ''
unix_socket_permissions = 0777          # octal
bonjour_name = ''                       # defaults to the computer name
```

Restart POSTGRESQL

```
service postgresql restart
```

2.4.2.5. SSH CONFIGURATION

It is necessary to generate authentication keys for BOTH slave and master machines to allow the script restart services from the master machine without entering password. The list of instructions to generate the keys are as follows.

A is Master server
B is Slave server
user a is 'root'
user b is 'root'

Note that with default settings SSH without password wont work with root rights! You must ad the line "PermitRootLogin yes" for sshd_config of both master and slave before next steps.

First log in on A as user a and generate a pair of authentication keys. Do not enter a passphrase. No need to input any data, just press 'Enter' every time.

```
a@A:~> cd ~
a@A:~> ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/a/.ssh/id_rsa):
Created directory '/home/a/.ssh'.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/a/.ssh/id_rsa.
Your public key has been saved in /home/a/.ssh/id_rsa.pub.
The key fingerprint is:
3e:4f:05:79:3a:9f:96:7c:3b:ad:e9:58:37:bc:37:e4 a@A
```

Now use ssh to create a directory ~/.ssh as user b on B. (The directory may already exist, which is fine):

```
a@A:~> ssh b@B mkdir -p .ssh
b@B's password:
```

Finally append a's new public key to b@B:.ssh/authorized_keys and enter b's password one last time:

```
a@A:~> cat .ssh/id_rsa.pub | ssh b@B 'cat >> .ssh/authorized_keys'
b@B's password:
```

From now on you can log into B as b from A as a without password:

```
a@A:~> ssh b@B
B
```

Follow the same step as above but this time in the client machine and check that you can login into A without

password.

Scripts for Master and slave machine

Copy all files in master folder (that is zipped in e.g. Z:\Playout\Distr\scripts.zip) to /opt/playout/bin of Master machine. Similarly copy all files in slave folder to /opt/playout/bin of Slave machine.
Copy status.txt and MIBProcessor.jar (that is zipped in e.g. Z:\Playout\Distr\MIBProcessor.zip) to /opt/playout/bin of both master and slave.

/opt/playout/bin/copy_config.sh (Master machine)

MASTER_HOST and SLAVE_HOST should be updated with actual IP addresses of master and slave machines.

copy_config.sh

```
#!/bin/sh

MASTER_HOST=X.X.X.X
SLAVE_HOST=X.X.X.X


...etc...

echo '= Restart playout services ='
ssh root@$SLAVE_HOST 'service playout-eit restart; service playout-eit-update restart; service
playout-muxer restart; service playout-scheduler restart; service playout-sipsi restart'
```

MASTER MACHINE:
Run crontab specified in check_traps.sh and copy_config.sh by copying these command specified at the top of files and giving command 'crontab -e'.

SLAVE MACHINE:

Run crontab specified in check_failover.sh by copying the command specified at the top of file and giving command 'crontab -e'.

Depending on the deployment the database replication script can be modified to meet the specific requirements.

The script should be executed manually on the Master server every time when configuration was updated on the Master server and should be copied to the Slave server.
This script replicates 7 database tables from Master server to Slave server These database tables store EIT, service description and server configuration information. This script also restarts all services on the slave machine.

1.1. INSTALLATION OF PLAYOUT MANAGEMENT CONSOLE

2. CONFIGURATION GUIDE OF ICAREUS PLAYOUT

Configuration Guide shall contain instructions on how to configure the ICAREUS PLAYOUT SYSTEM.

The attached spreadsheet contains the list of basic Icareus Playout configuration parameters to setup a new server. The spreadsheet should be filled in by a customer before server installation procedure.

2.1. CONNECTING TO ICAREUS PLAYOUT

ICAREUS PLAYOUT MANAGEMENT CONSOLE (PMC)

Icareus Playout Management Console is used to configure and manage all Playout servers.

> Please ensure that the used PMC version is compatible with the Playout server that is managed.

The latest release can always be downloaded from Icareus Extranet at http://extranet.icareus.com

To read more about installing PMC please refer to chapter Installation of Playout Management Console

CONNECTING TO SERVER

PMC connects the Server over IP connection. In order to connect the PMC to the server, the following ports should be opened on the server side: 21, 2001, 5555.

After that open the PMC application by choosing it from Windows Program menu or double clicking the icon on desktop.

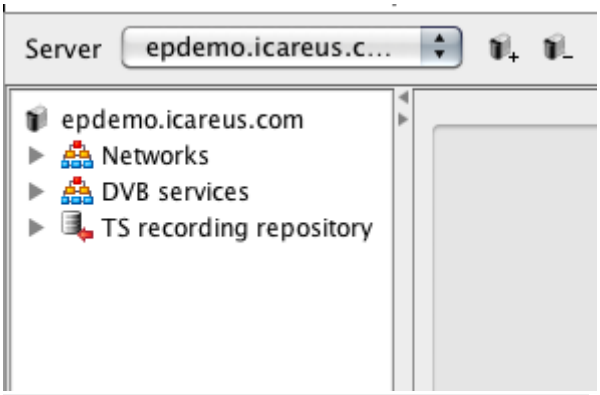
Start using the PMC by first Adding the server. Add a server by clicking the Add server -button top tool bar. It opens a pop-up that can be seen in the image right.

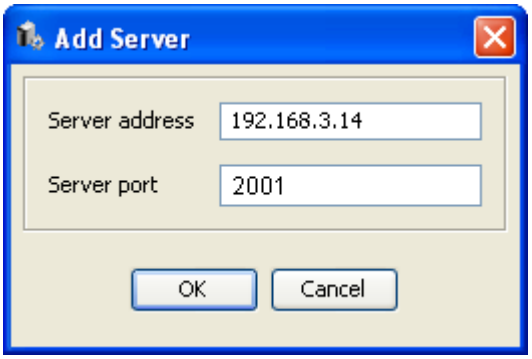
Write the Playout server's IP address to the Server address field. Server port 2001 (which is as default) should be used. Push OK. That should open a Login pop-up. Insert the username and password to pop-up window. Those have been set on the server side.

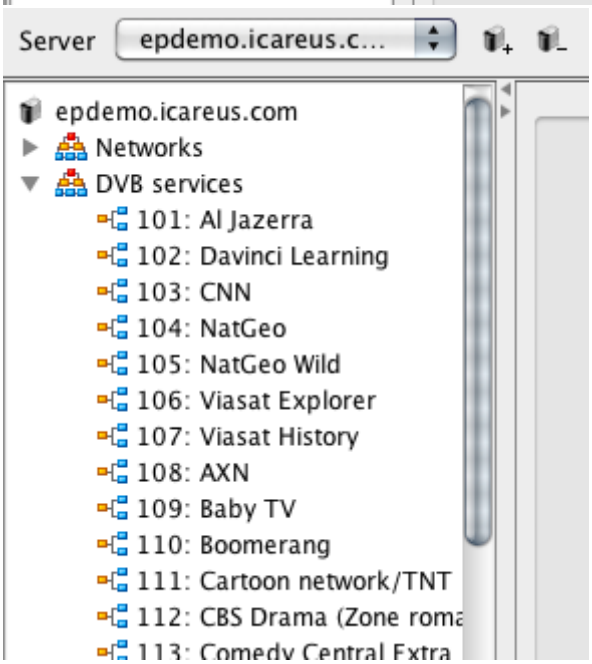
Pushing OK will open the connection to the Icareus Playout server and you should be able to see the available Networks and DVB Services/Channels on the left top window. See image on right. Depending on the features installed on the server it may be possible to other trees as well.

Click DVB Services to see available channels in your system. It opens a list of the services like in the image right showing Icareus 1 – Icareus 14 channels.

If you use several Icareus Playout servers for example EP100, CS100 Carousel Server, CS200 DVB-SSU Server, etc., it is possible to control all of them with single PMC by merelt choosing the server you want to connect from the Server drop down -menu.







2.1. MANAGING NETWORKS

1. INTRODUCTION

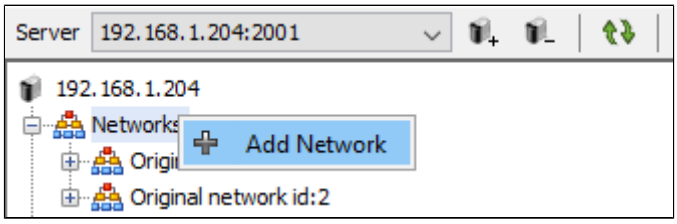
Networks are a key feature of Icareus Playout platform. Each Network contains one or several Actual subnetworks and those in the system represents a individual transport stream with DVB Services, data services, configurations, tables, etc. It basically offers the possibility to get rid of the expensive remuxing of PSI/SI, EIT and data services by defining the (regional) networks/multiplexes/transponders at a single location.

The management of the networks is done with intuitive Networks -tree, which gives easy access to all network parameters.

Defining a Network is usually the first step to do when starting to work with Icareus Playout.

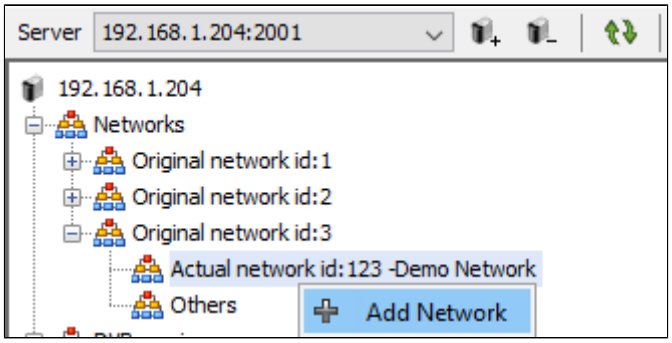
2. ADDING A NETWORK

A Network and it's Actual subnetworks are added using the Networks -tree by right clicking the root of the tree as shown in the image below.

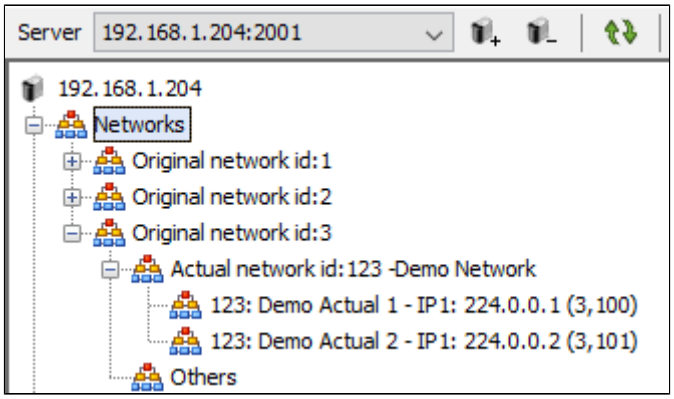


The Actual and Other network nodes are automatically created based on the configuration data.

The Actual and Others subnetworks can be added by right clicking the desired node in the Networks -tree.



In the picture below two Actual subnetworks has been created with transport stream IDs 100 and 101.



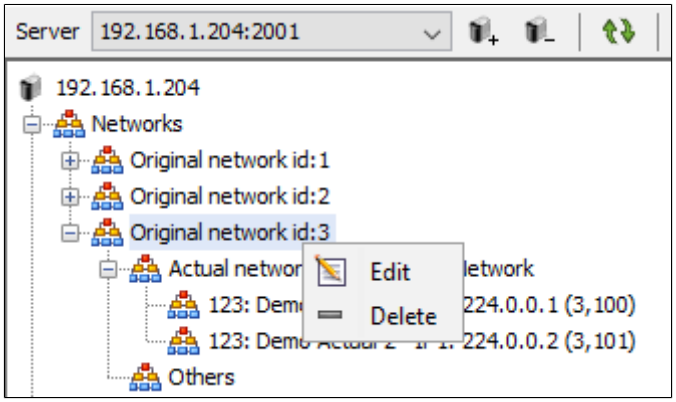
3. BASIC CONFIGURATION OF NETWORKS

When adding the new network, three configuration parameters can be defined:

1. Netwirk name

2. Network id
3. Original network id

These parameters can also be accessed later by right clicking the network name.

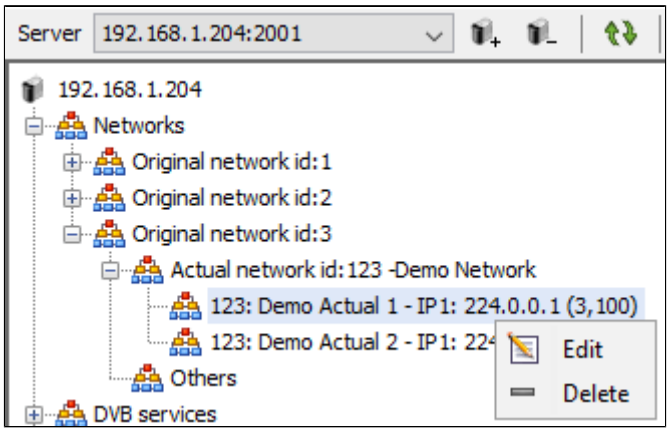


This opens a Dialog with the above parameters that are explained below.

When adding the Actual subnetwork, several configuration parameters can be defined:

1. General (Name, Transport Stream ID, Network ID, ...)
2. Table Generation (PMT, PAT, EIT, ...)
3. Table output repetition rates (PAT, PMT, ...)
4. Output interfaces (IP, ASI)

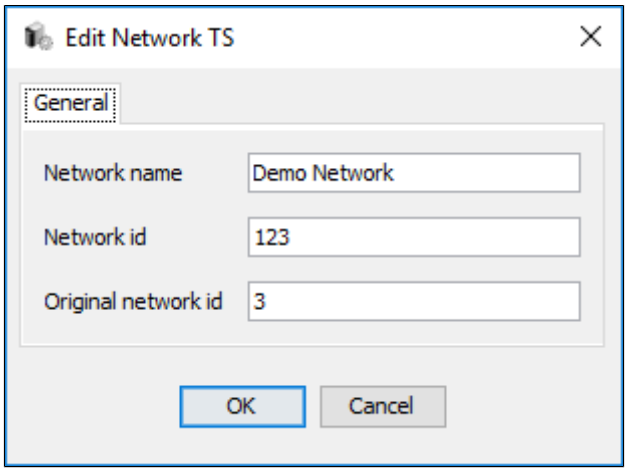
These parameters can also be accessed later by right clicking the Actual subnetwork name.



This opens a Dialog with the above mentioned tabs. These tabs are explained below.

3.1. NETWORK EDIT DIALOG

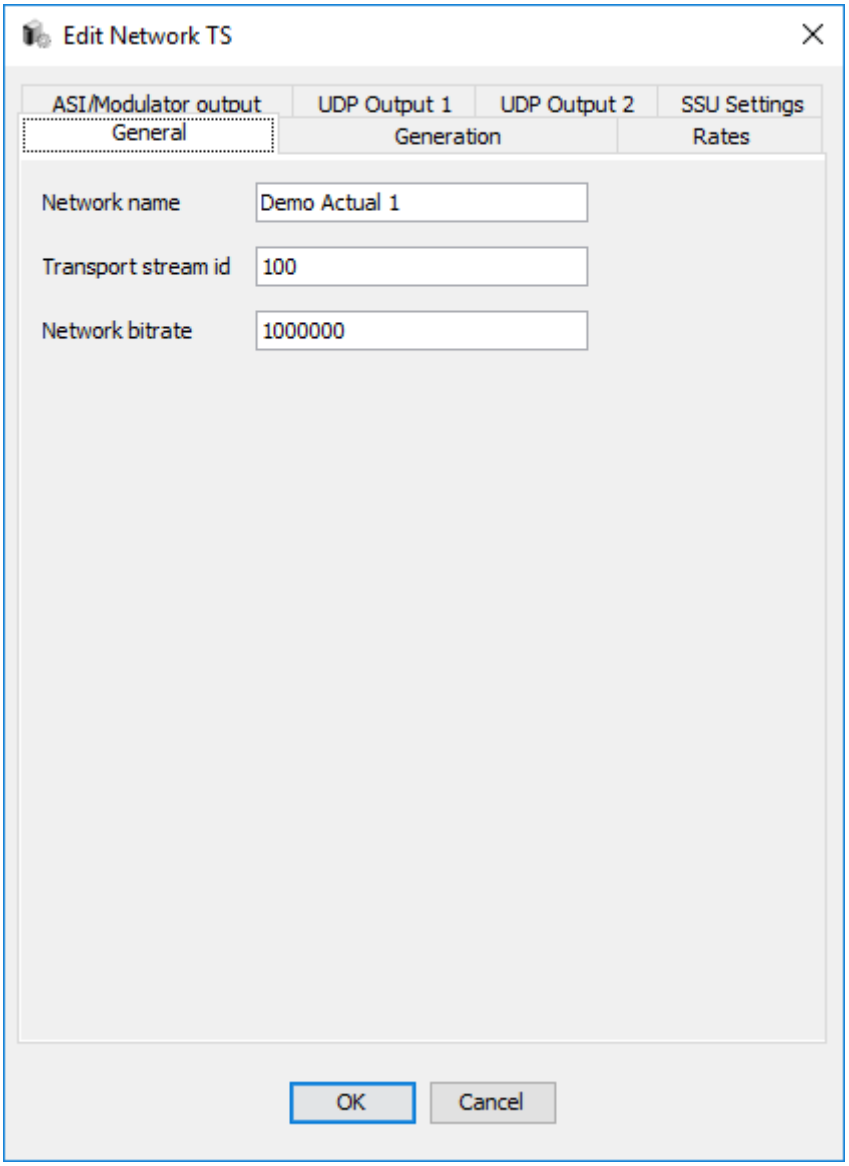
Network Name: The logical name for the network
Network ID: Network id for the network
Original Network ID: Original network id for the network



3.2. ACTUAL SUBNETWORK EDIT DIEALOG, GENERAL -TAB

The general -tab defines basic network related parameters that are however critical to the operation of the receiver.

Network Name: The logical name for the Actual subnetwork
Transport Stream ID: Transport stream id for the Actual subnetwork
Network bitrate: The maximum constant bitrate (CBR) for the selected Actual subnetwork, if null -packet insertion is activated the system will fill the output transport stream to meet this value. Otherwise the system will output a variable bitrate MPEG2 TS based on the PSI/SI and EIT tables and others. However the output may be higher than the defined bitrate if the combined PSI/SI and EIT table size is higher than the defined value. This approach ensures that the receivers will continue to receive valid signalling. There is no limitation set for the bitrates and thus the output purely depends on the capabilities of the hardware.



3.3. TABLE GENERATION -TAB

Table Generation defines the PSI/SI and EIT tables that are generated for this network.

From the tab, it is possible configure different PSI/SI tables generation.
Generate PAT: Enables generating Program Association Table.

Generate PAT reference to NIT: Add PAT reference to NIT

Generate PMT: Enables generation of Program Map Table.

Generate NIT: Enables generating Network Information Table.

Generate NIT descriptors:
If this setting is enabled, the following descriptors will be generated automatically to Network Information Table:

- Network name descriptor
- Delivery descriptor (requires that delivery settings have been set)
- Linkage descriptor with linkage type 0x0B for each IP platform

Generate SDT: Enables generating Service Description Table.

Generate SDT descriptors:
If this setting is enabled, the following descriptors will be generated automatically to Service Description Table:

- Service descriptor for each DVB service
- Data broadcast descriptor for each MPE stream

Generate BAT: Enables generating Bouquet Association Table.

Generate TDT: Enables generating Time and Date Table.

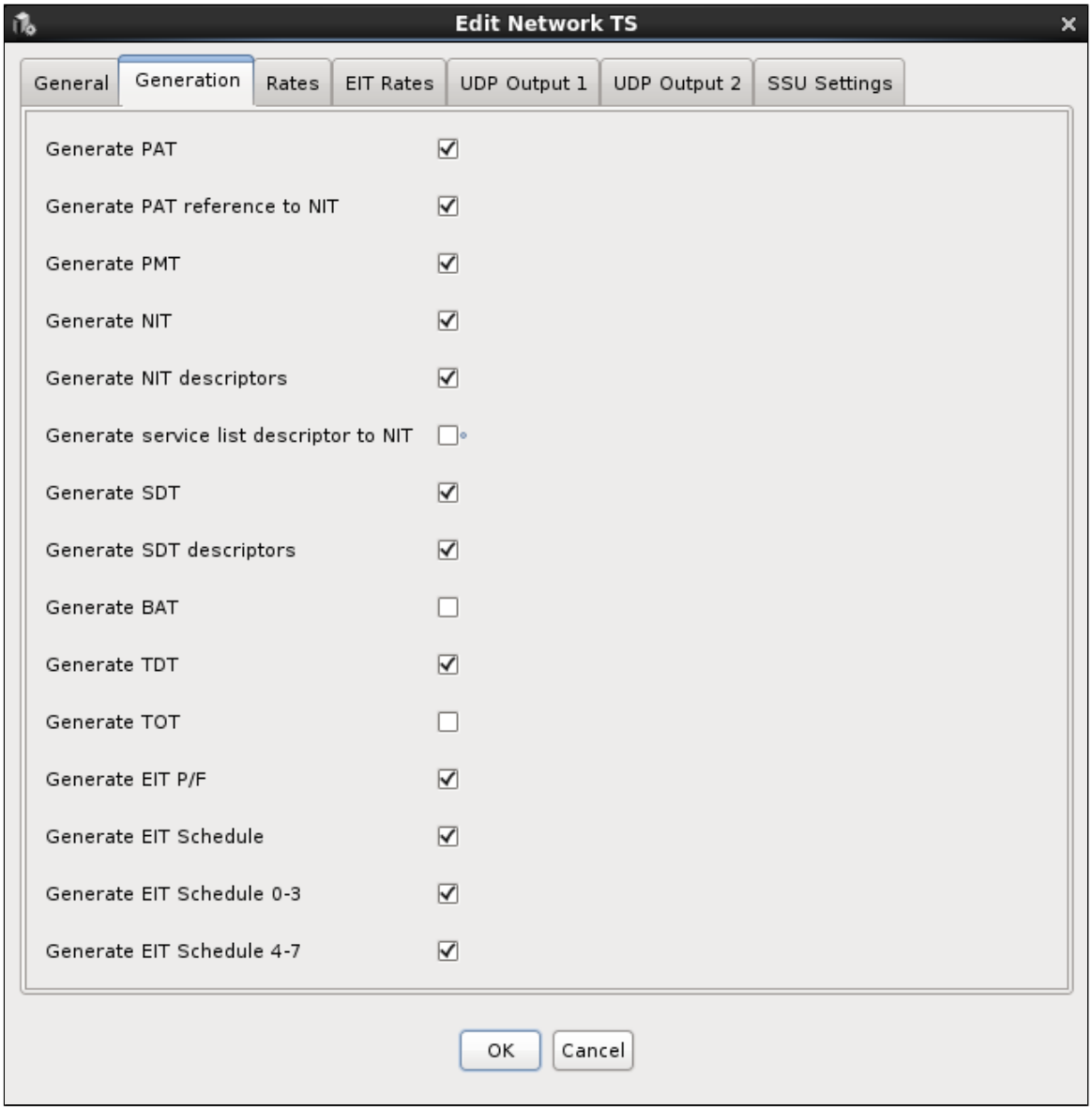
Generate TOT: Enables generating Time Offset Table.

Generate EIT P/F: Enables generating the Event information table present/following

Generate EIT Schedule: Enables generating the Event information table Schedule. Turning this off disables generating the schedule entirely, irrespective of the 2 following options.

Generate EIT Schedule 0-3: Enables partitioning of the Event information table Schedule for days 0-3. The partitioning is defined in the EIT Rates tab. The days 0-3 occupy the first EIT schedule subtable, with table id 0x50 for the actual schedule and 0x60 for the other schedule.

Generate EIT Schedule 4-7: Enables a partition of the Event information table Schedule for days 4-7, and another for the remaining days 8+. If the 0-3 option is selected, but the 4-7 option is not selected, then only days 0-3 will be generated into the schedule. The days 4-7 occupy the second EIT schedule subtable, with table id 0x51 for the actual schedule and 0x61 for the other schedule.



3.4. RATES -TAB

PAT repetition rate: Repetition rate for Program Association Table measured in milliseconds.

PMT repetition rate: Repetition rate for Program Map Table measured in milliseconds.

NIT repetition rate: Repetition rate for Network Information Table measured in milliseconds.

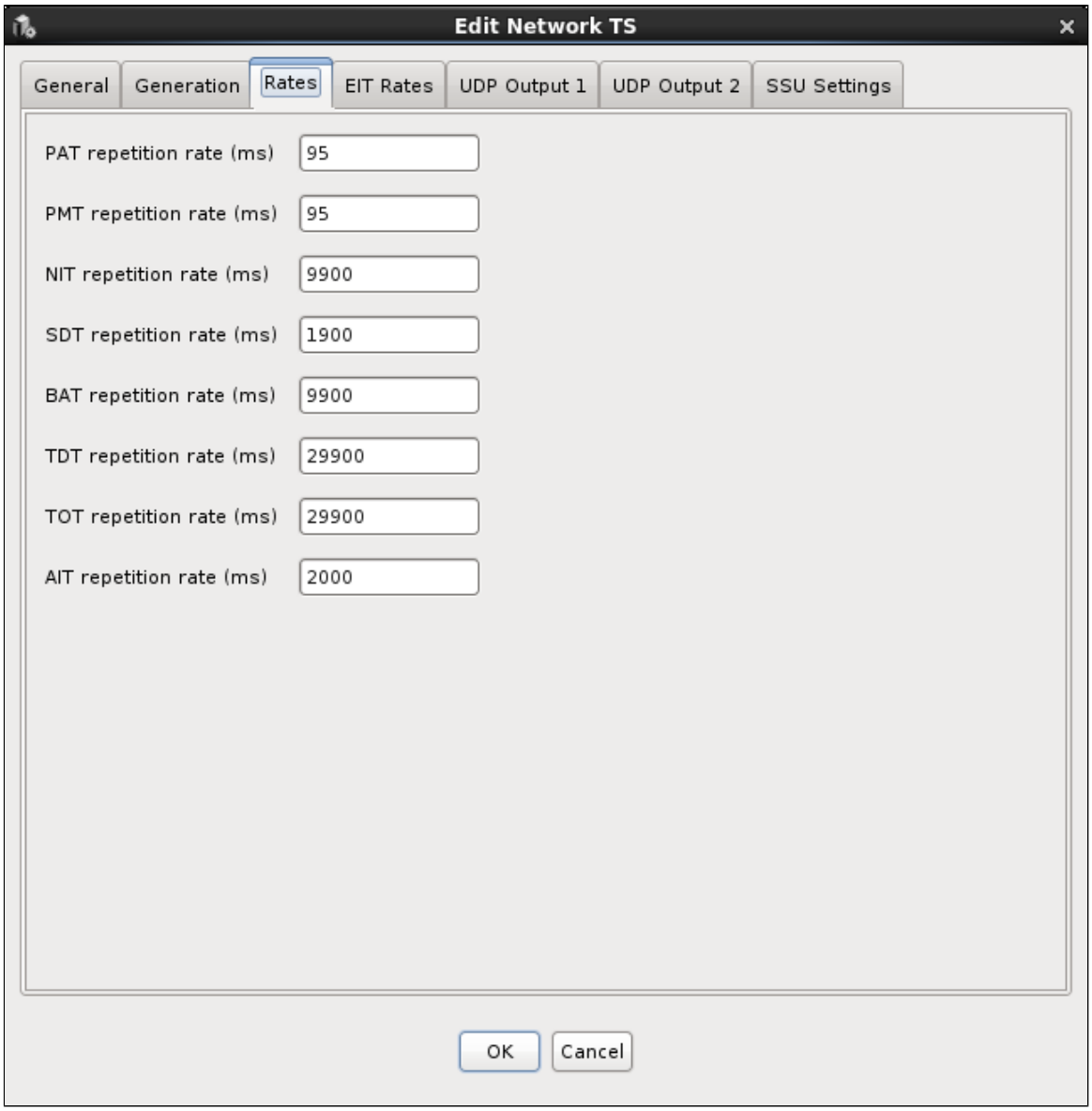
SDT repetition rate: Repetition rate for Service Description Table measured in milliseconds.

BAT repetition rate: Repetition rate for Bouquet Association Table measured in milliseconds.

TDT repetition rate: Repetition rate for Time and Date Table measured in milliseconds.

TOT repetition rate: Repetition rate for Time Offset Table measured in milliseconds.

AIT repetition rate: Repetition rate for Application Information Table measured in milliseconds.



3.5. EIT RATES -TAB

EIT P/F repetition rate:Repetition rate for Event Information Table Present/Following
measured in milliseconds.

EIT Schedule repetition rate: Repetition rate for Event Information Table Schedule
measured in milliseconds. Please note the EIT Schedule bit rate per service -value as repetition rate affects the total amount of EPG data that can be outputted. Also note that when the EIT schedule is partitioned and Generate EIT Schedule 0-3 is and Generate EIT Schedule 4-7 is enabled, this repetition rate is used for the events for days 8+ of the schedule.

EIT Schedule bit rate per service: Maximum output bit rate of service for Event Information Table Schedule measured in bits per second. If the EIT output exceeds this value, EPG events from the EIT Schedule table are dropped from the end to fit this bandwidth and repetition rate configuration. If value is set to 0, the output is unlimited.

EIT sch (0-3) Group Past repetition rate: When Generate EIT Schedule 0-3 is enabled, this is the repetition rate for past Event Information Table Schedule events
measured in milliseconds. In the current implementation, this option does nothing.

EIT sch (0-3) Group 1 repetition rate: When Generate EIT Schedule 0-3 is enabled, this is the repetition rate for the first partition of the Event Information Table Schedule,

measured in milliseconds. The schedule segments that are part of this group must be selected in right column. 8 segments equal one day, so e.g. to specify that the first partition should hold one days worth of EIT events, segments 0-7 must be selected. One segment equals 3 hours of events. To put the 2 first days of events in the first partition, specify segments 0-15. To put the 3 first days of events in the first partition, select 0-23. To put all the 4 first days (0-3) into this partition, select a range of 0-31. When group 1 segments have been configured by selecting from the menu, the focus will move to group 2 and so on. To get back to allocate group 1 again, one has to cycle through all the groups 1-5 after which group 1 segments can again be changed.

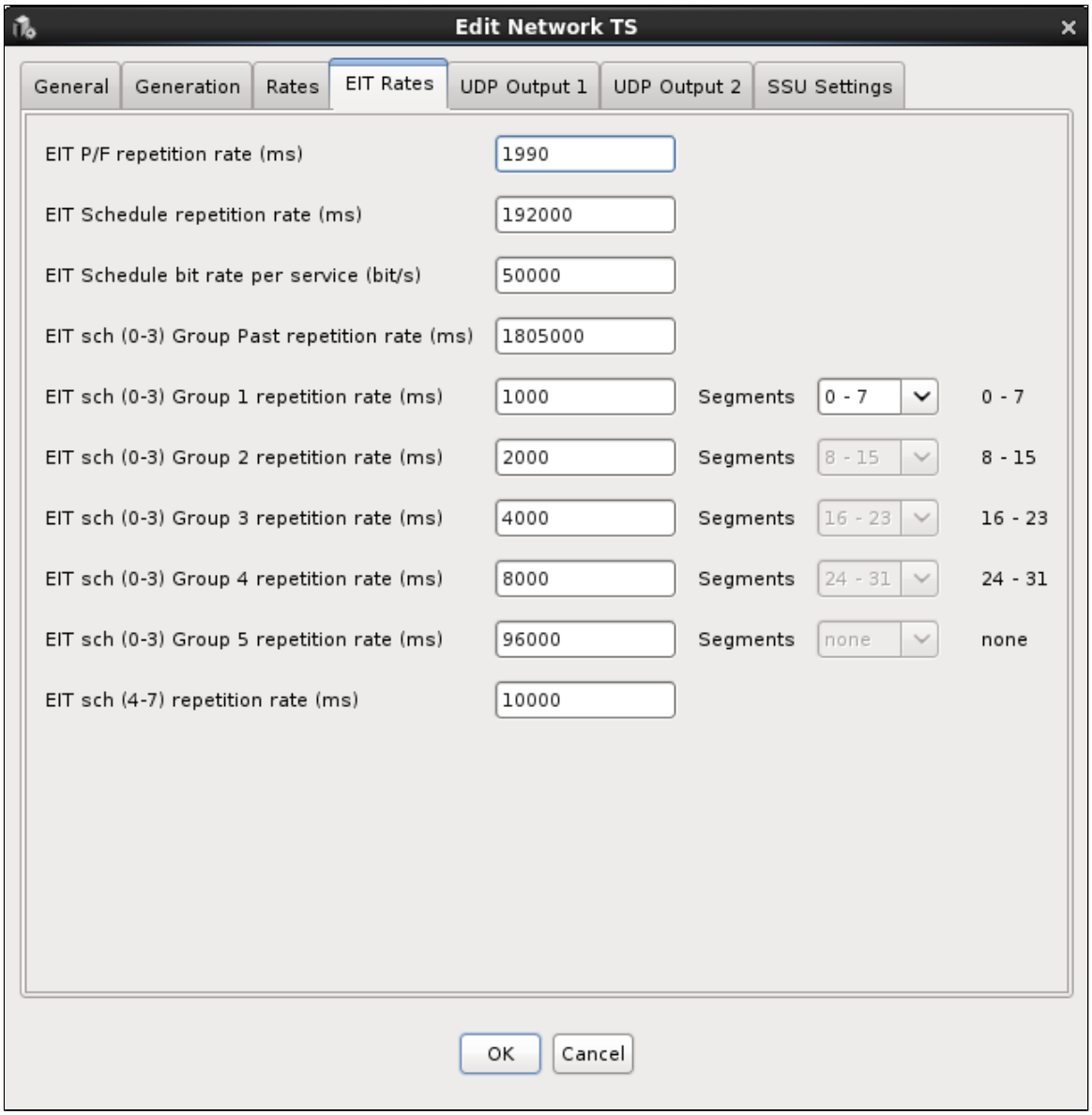
EIT sch (0-3) Group 2 repetition rate: When Generate EIT Schedule 0-3 is enabled, this is the repetition rate for the second partition of the Event Information Table Schedule,
measured in milliseconds. Like in group 1, a range of segments will specify which events will be part of the group. Only remaining segments, after the allocation of group 1 can be selected here as part of the second partition.

EIT sch (0-3) Group 3 repetition rate: When Generate EIT Schedule 0-3 is enabled, this is the repetition rate for the 3rd partition of the Event Information Table Schedule,
measured in milliseconds.

EIT sch (0-3) Group 4 repetition rate: When Generate EIT Schedule 0-3 is enabled, this is the repetition rate for the 4th partition of the Event Information Table Schedule,
measured in milliseconds.

EIT sch (0-3) Group 5 repetition rate: When Generate EIT Schedule 0-3 is enabled, this is the repetition rate for the 5th partition of the Event Information Table Schedule,
measured in milliseconds. If there's any unallocated segments left for days 0-3 after groups 1-4 have been specified, those segments must be put in this group.

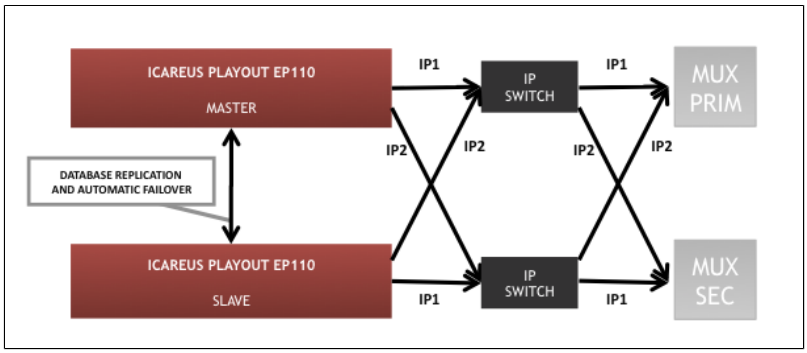
EIT sch (4-7) repetition rate: When Generate EIT Schedule 4-7 is enabled, this is the repetition rate for the partition holding days 4-7 of the Event Information Table Schedule,
measured in milliseconds.



3.6. UDP OUTPUT 1 & 2 -TABS

UDP output -tab defines the transport stream output for the selected Network. Each Network's transport stream can be outputted as IP multicast/unicast from two separate network cards to get as redundant output from a single server as possible.

For redundancy purposes it is recommended that the multicast addresses of the outputs are different as well as the Output devices. The outputs should be then connected to either an IP switch that can monitor the output or to a multiplexer that can do the same. An example is given below.



Enable UDP output:
USE RTP: Use RTP protocol to envelope the UDP stream

IP Address: Multicast address for the MPEG2 TS

Port: IP port in which the multicast should be transmitted

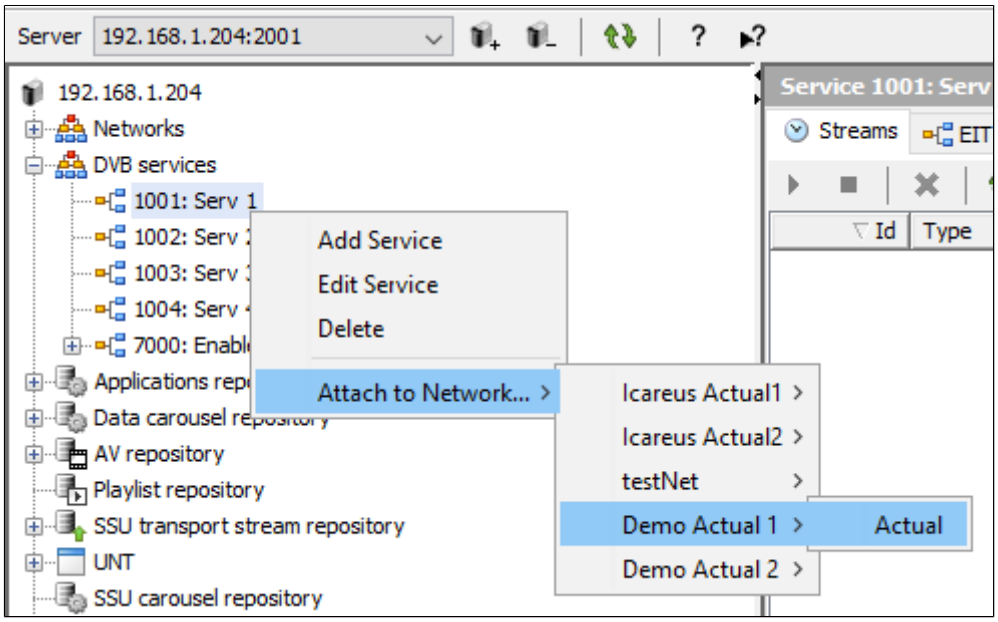
TTL: Time to Live for the IP packets

Output device: Defines the physical network interface card that is used to output the MPEG2 TS for this Network

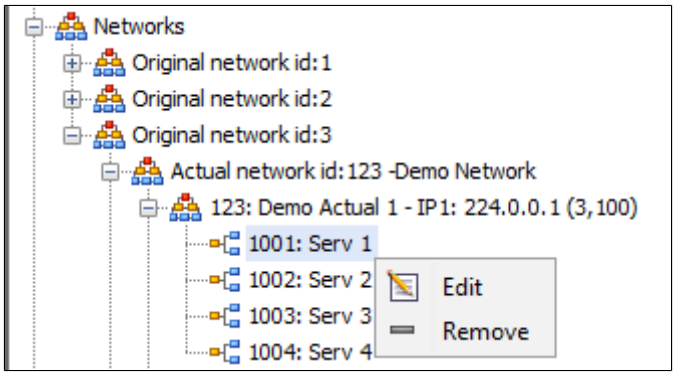
4. ADDING DVB SERVICES TO NETWORKS

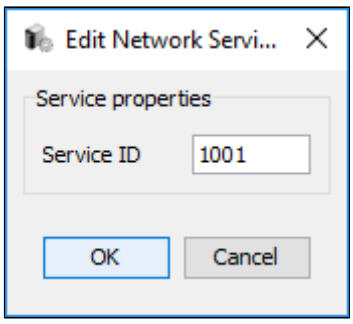
Once the Network is created it is time to add Services to that Network. Refer to chapter "Managing DVB Services " to learn how to add Services to Icareus Playout platform.

A Service is added to a Network from the DVB Services -tree either by drag-and-dropping it to selected Network or by right clicking as illustrated in the image below.



Once the Service has been added to a Network, its ID can be changed by right clicking it as illustrated in the below images.





2.1. MANAGING DVB SERVICES

1. INTRODUCTION

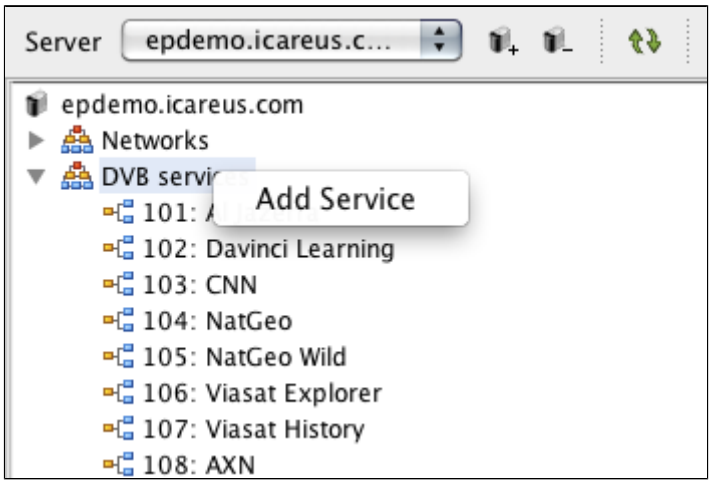
DVB Services in Icareus Playout represent TV or radio channels that are broadcasted. Note, that service properties depend on the included features of the Playout server.

The DVB Services -tree includes Services that have been configured on the server, but not necessary used in any of the outputs. In order to output the PSI/SI, EIT or A/V for a Service it must be added to a Network (within the Networks -tree).

2. ADDING DVB SERVICES

New DVB Services are added by right clicking the root node of DVB Services tree.

It opens an Dialog that enables user to provide the key parameters for a Service as described below.



2.1. SERVICE PROPERTIES

Service id: Unique identifier for the service
Service name: Logical name for the service used by receiver EPG
Service provider name: Provider for the service
Service type: Defines the type of the Service, possible values are

- Digital Television service
- Digital Radio service
- Teletext service
- NVOD reference service
- NVOD time-shifted service
- Mosaic service
- Advanced codec radio service
- Advanced codec mosaic service
- Data broadcast service
- RCS Map
- RCS FLS
- DVB MHP Service

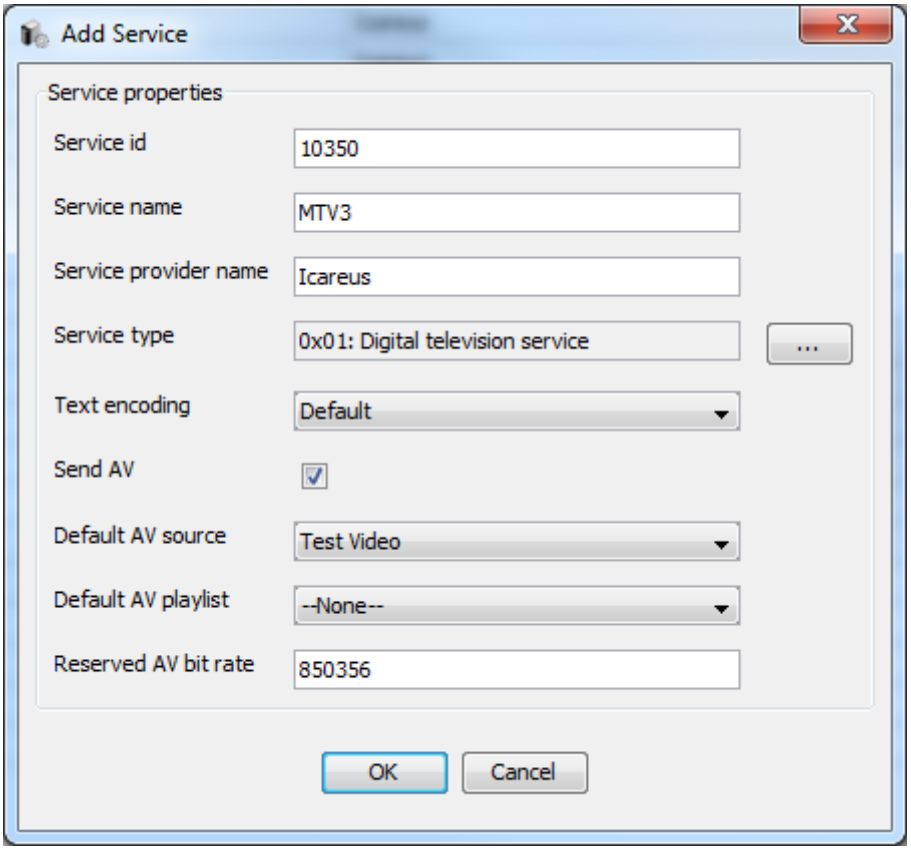
Text Encoding: Defines the text encoding for the service used in EIT

Send AV: Specifies if service should contain Audio/Video stream

Default AV source: Audio/Video source from the 'AV repository'

Default AV playlist: Audio/Video playlist from the 'Playlist repository'

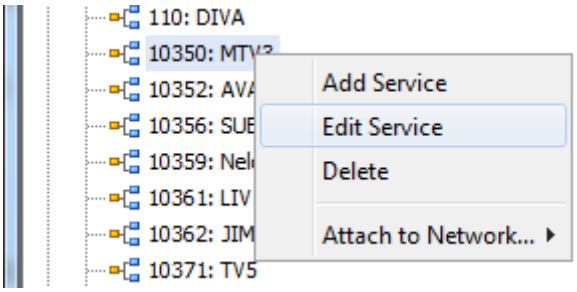
Reserved AV bit rate: Bit rate reserved for the Audio/Video stream



3. EDITING DVB SERVICES

Existing DVB Services are modified by right clicking the service node of DVB Services tree.

It opens an Dialog that enables user to edit the key parameters for a Service as described below.



3.1. SERVICE PROPERTIES

Service id: Unique identifier for the service
Service name: Logical name for the service used by receiver EPG
Service provider name: Provider for the service
Service type: Defines the type of the Service, possible values are

- Digital Television service
- Digital Radio service
- Teletext service
- NVOD reference service
- NVOD time-shifted service
- Mosaic service
- Advanced codec radio service

- Advanced codec mosaic service
- Data broadcast service
- RCS Map
- RCS FLS
- DVB MHP Service

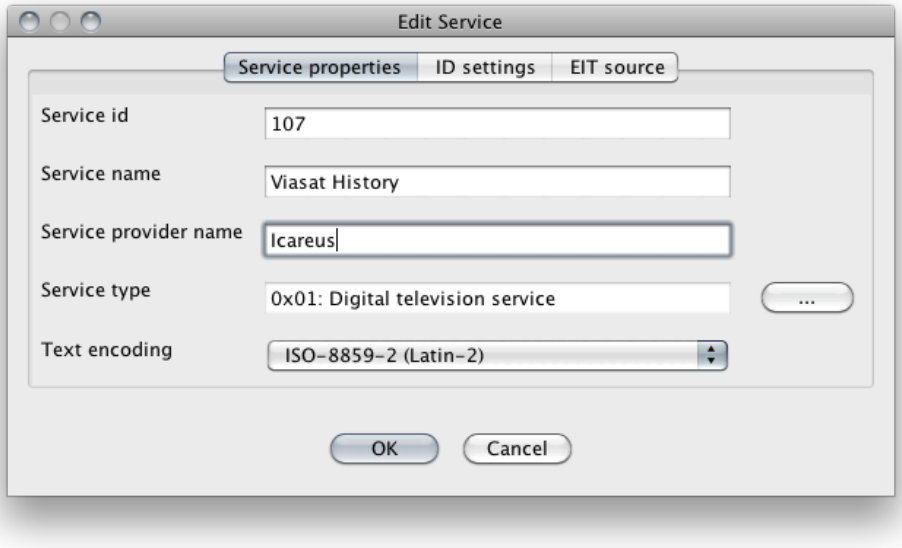
Text Encoding: Defines the text encoding for the service used in EIT

Send AV: Specifies if service should contain Audio/Video stream

Default AV source: Audio/Video source from the 'AV repository'

Default AV playlist: Audio/Video playlist from the 'Playlist repository'

Reserved AV bit rate: Bit rate reserved for the Audio/Video stream



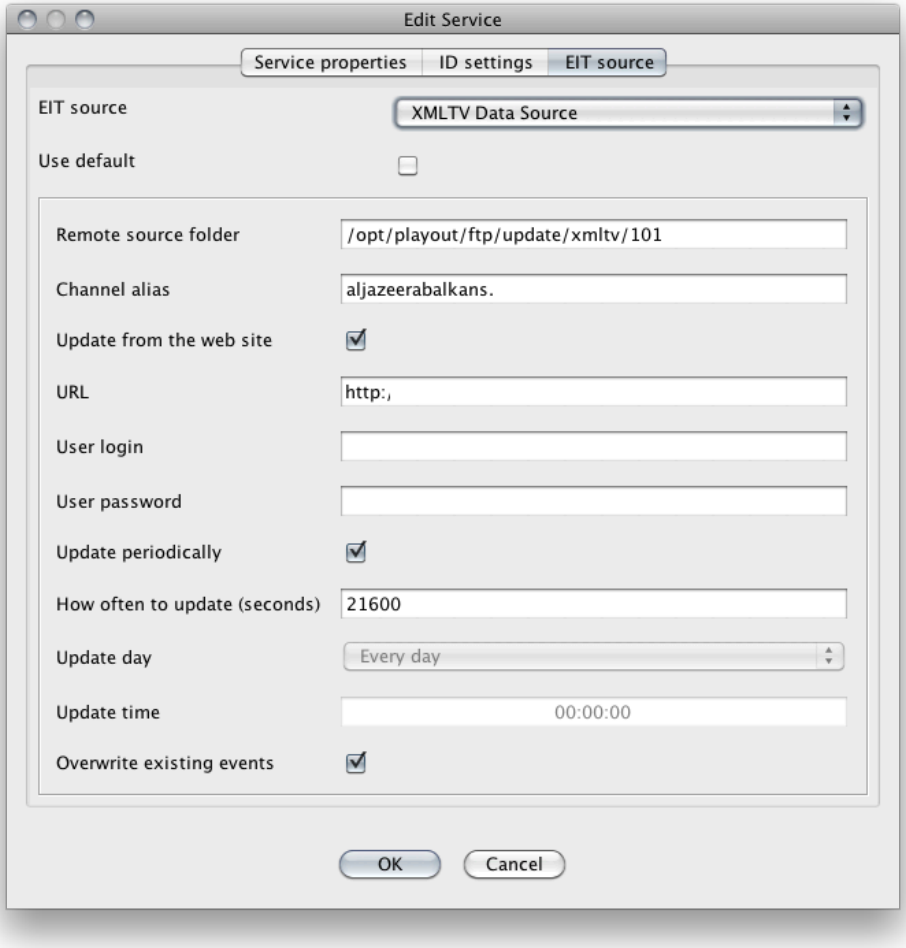
3.2. ID SETTINGS

PMT PID: An Alternate PID for the service used in PMT table

3.3. EIT SOURCE

EIT source is the source for the EPG data for this specific service. It is possible to have different source for each service or rely on the default source for all services. To learn more about various supported sources please refer to chapter Managing EIT.

In the example on right the source is unique for the service and the source type is XML TV.



2.1. MANAGING PSI-SI GENERATION

INTRODUCTION

Icareus Playout server's PSI/SI generation generates all related tables:

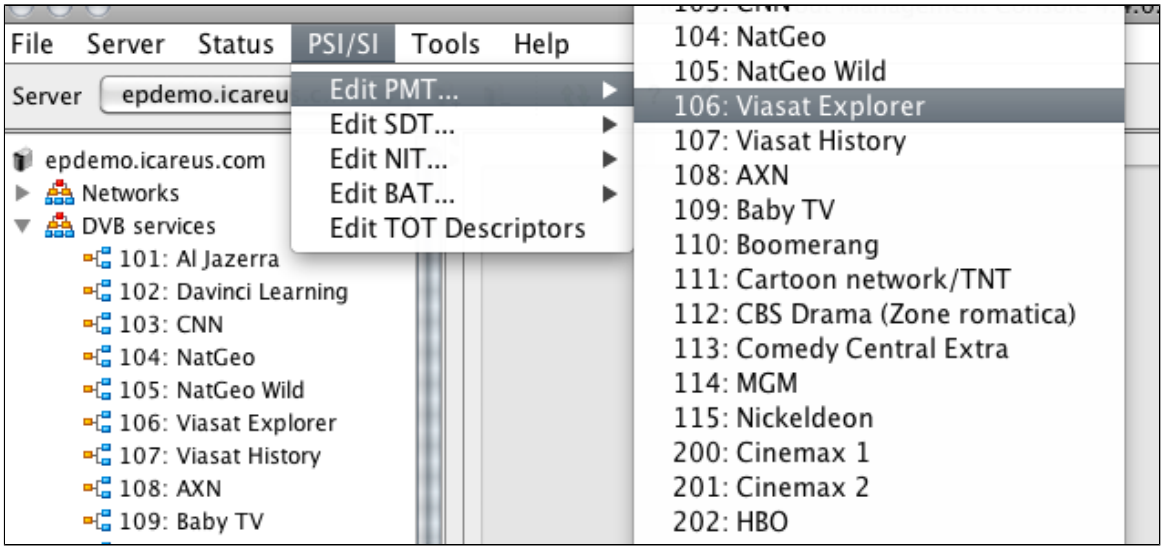
- Program Association Table (PAT)
- Program Map Table (PMT)
- Bouquet Association Table (BAT)
- Event Information Table (EIT)
- IP/MAC Notification Table (INT)
- Network Information Table (NIT)
- Program Association Table (PAT)
- Service Description Table (SDT)
- Update Notification Table (UNT). This table is generated only on the Playout SSU Server.
- Application Information Table (AIT), This table is generated if support for HbbTV, MHP or similar datacasting standard is active

The generation and repetition rates for all the tables are configurable on the Network level and can be edited as described in Managing Networks -chapter. DVB Service specific aspects (like EIT) of table generation is discussed in more detail in Managing DVB Services and Managing EIT -chapters.

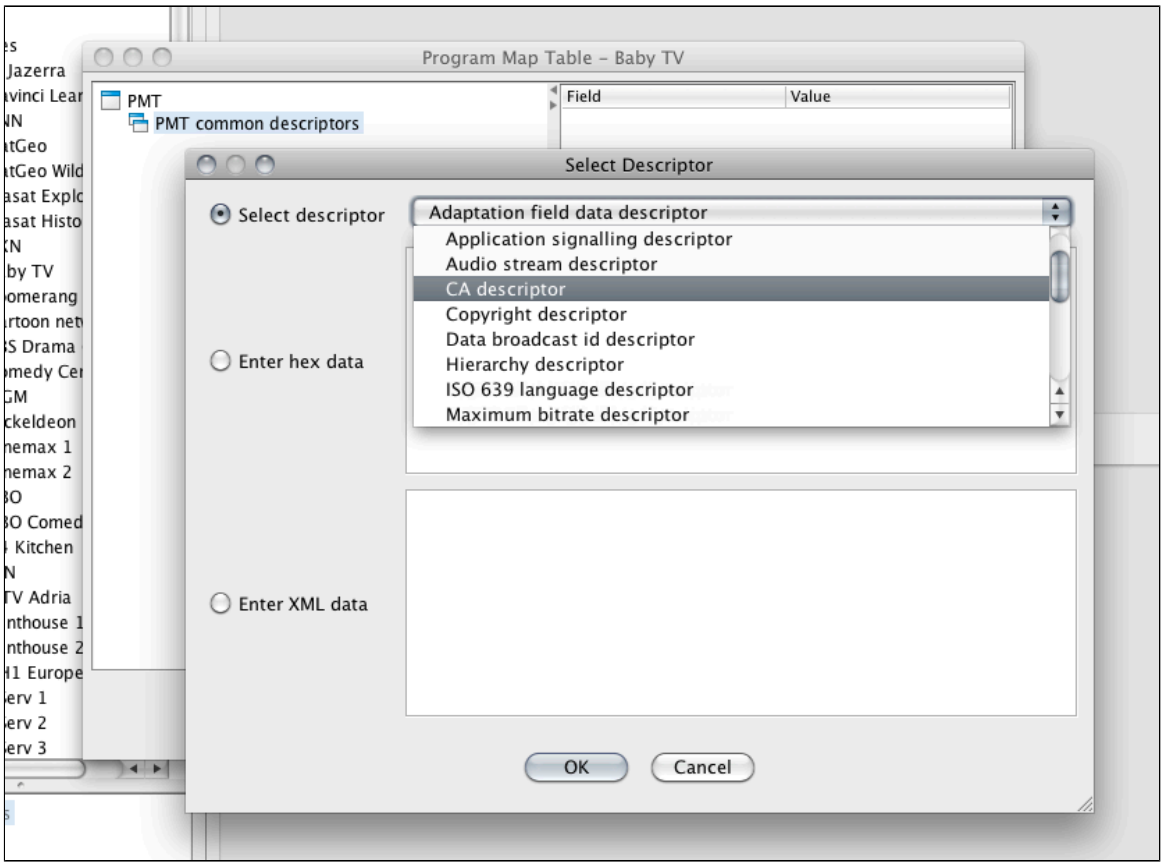
Network name and Transport stream id are added to necessary tables by the system. All mandatory descriptors can also be generated automatically.

MANAGING TABLES IN DETAIL

Icareus Playout offers possiblitiy to manage the tables also manually using the PSI/SI editor found from PMC's toolbar as shown below.

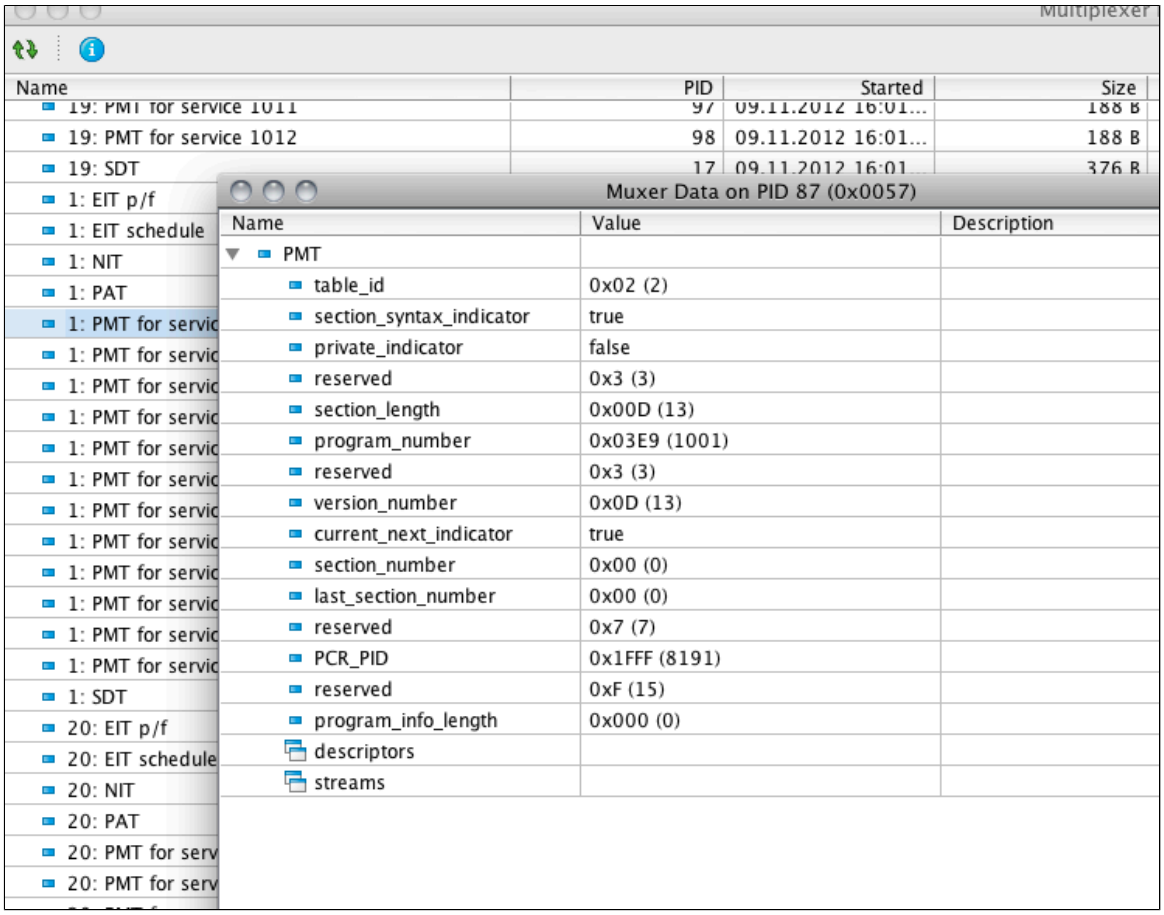


Selecting the desired DVB Service opens a pop-up that gives access to the available descriptors for the table.



MONITORING TABLE OUTPUT

The Playout muxer's output can be viewed by selecting Status -> Multiplexer Info from PMC's Toolbar. More detailed information per output can be accessed by double clicking the desired Network/Service/Table.



2.1. MANAGING EIT

1. INTRODUCTION

Icareus Playout EP100 EPG Server is used to broadcast the TV program information and to generate the necessary service information. It provides many different ways to get the EPG/EIT data:

- Manual input
- Java API input & control
- Program data from EPG Sales™ using HTTP
- Program data from Mediadata™ using FTP
- Program data from Tribune Media Services™ using FTP
- Program data based on Icareus' XML format using FTP or PMC
- Program data based on customer's custom XML format using XSL for transformation

One of the main advantages of Icareus Playout server is in the alternatives, which it provides for EPG/EIT data input and outputs as well as the wide variety of supported XML -formats.

It supports EPG live Input extraction through:

- DVB-ASI
- RF

EPG data Input sources through:

- Manual edition via PMC
- Manual uploads of XML, CSV via PMC
- Http interface
- (S)FTP File Transfers

EPG data Output can be:

- XML to 3rd party systems via FTP

- EIT tables on Services on actual or others -networks

2. HOW IT WORKS

In Icareus Playout there are two aspects that relate to EIT: Networks and DVB Services repository.

EIT is part of the DVB Services, which are then assigned to Networks (Actual or Others). If a DVB Service is assigned to several Networks it uses the same EIT source in all Networks.

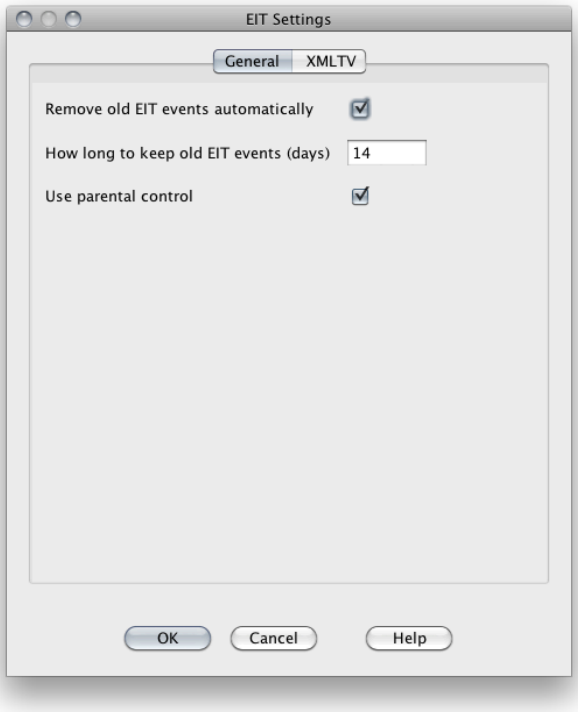
Each DVB Service may use

- A default EIT data source (configured in Server -> Settings)
- A dedicated EIT data source (configured by right clicking the DVB Service in question and selecting)

3. SERVER EIT SETTINGS

3.1. EIT SETTINGS

To manage the general EIT settings of the Icareus Playout server choose Server -> Settings. It will open the following window:



Remove old log messages automatically: Choosing if the log messages will be saved or removed
How long to keep old log messages (days): choose number of days for saving the log messages

Use Parental Control: Defines whether the parental control flag is supported in EIT table

3.2. GENERAL SETTINGS RELATED TO EIT

To manage the general settings of the EP100 server choose Server
Settings General. It will open the following window:

Default character encoding: The options for encoding are:

- DVB default (ISO-6937 + Euro symbol)
- ISO-8859-1 (Latin-1)
- ISO-8859-2 (Latin-2)
- ISO-8859-3 (Latin-3 / South European)
- ISO-8859-4 (Latin-4 / North European)
- ISO-8859-5 (Cyrillic)
- ISO-8859-6 (Arabic)
- ISO-8859-7 (Greek)
- ISO-8859-8 (Hebrew)
- ISO-8859-9 (Latin-5 / Turkish)
- ISO-8859-10 (Latin-6 / Nordic languages)
- ISO-8859-11 (Thai)
- ISO-8859-13 (Latin-7 / Baltic)
- ISO-8859-14 (Latin-8 / Celtic)
- ISO-8859-15 (Latin-9)
- UTF-8
- UTF-16BE
- KSC5601-1987 (Korean)
- GB-2312-1980 (Simplified Chinese)
- Big5 (Traditional Chinese)

Default language: Choosing the default language

Remove old log messages automatically: Choosing if the log messages will be saved or removed
How long to keep old log messages (days): choose number of days for saving the log messages

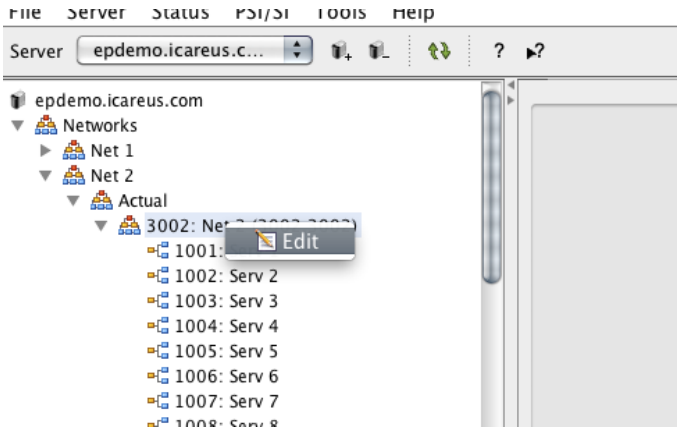
4. NETWORK RELATED EIT SETTINGS

As Icareus Playout enable operators to output several networks as individual transport streams some EIT related aspects may be configured on network level, such as:

- Generation of EIT pf
- Generation of EIT Schedule

- Repetition rate for EIT pf
- Repetition rate for EIT Schedule

These can be accessed by selecting the desired Network from Networks -tree and right clicking it as show in below images.

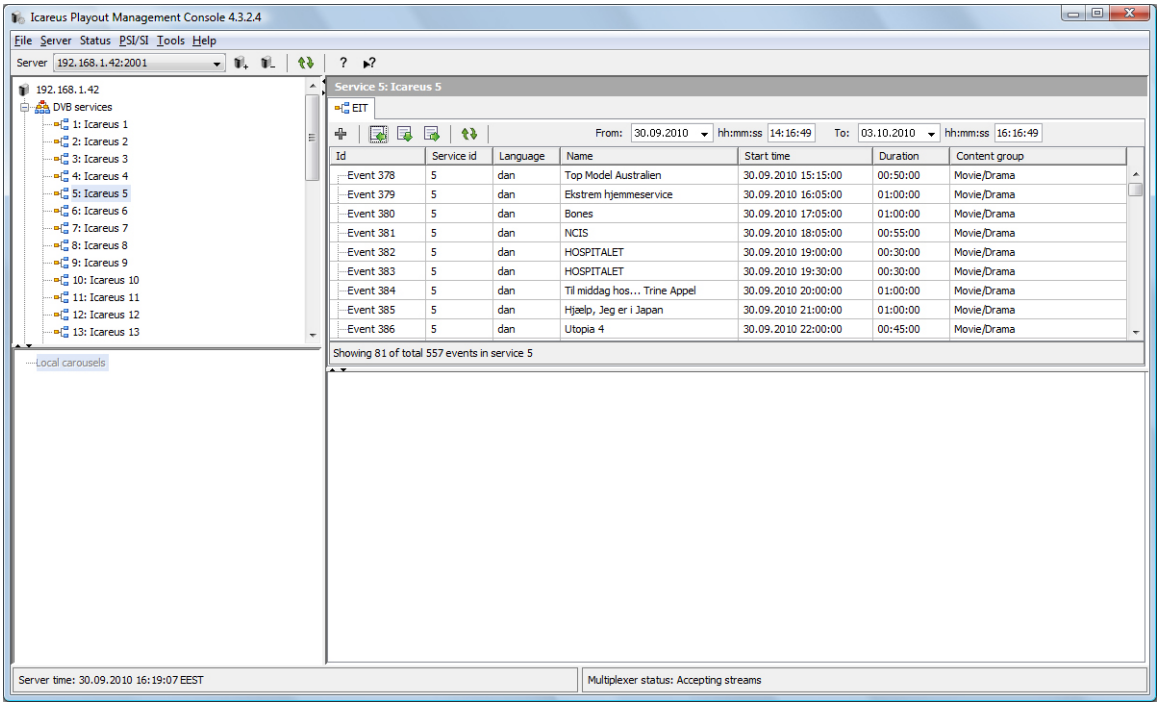


Edit Network from Networks -tree

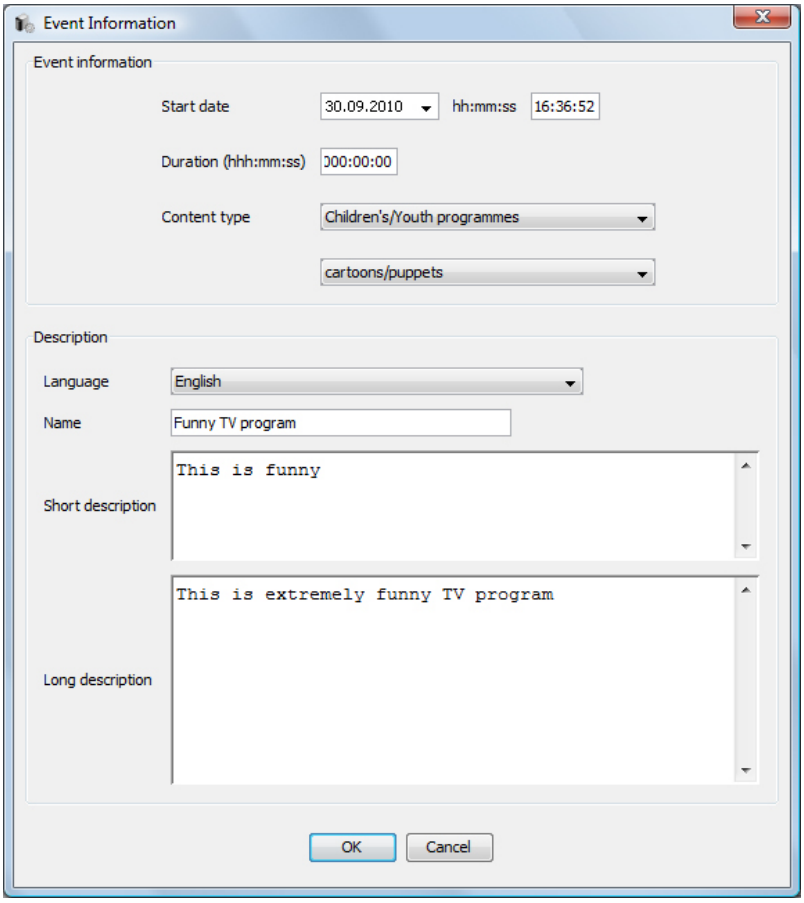
Read more from "Managing Networks" -chapter.

5. MANUAL EIT EDITING USING PMC UI

Playout EPG Server is managed through Playout Management Console (PMC). In order to manage the EPG/EIT data in some channels, choose the correct channel from DVB Services list.



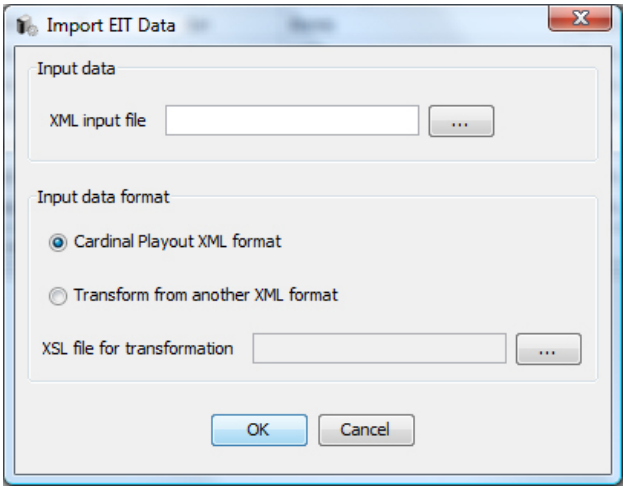
It open the EPG management window, where the user can manage EITs by manually creating those or by importing the XML files.
In order to add EIT data manually press Add EIT event button from the toolbar or select Add EIT event item from the right-click menu.



In the opened dialog the administrator can input all the necessary Event information regarding the program.

6. IMPORTING EIT DATA MANUALLY VIA PMC

PMC offers possibility to upload EIT files (XML or CSV format). To manually upload the files press Import EIT event button from the toolbar.



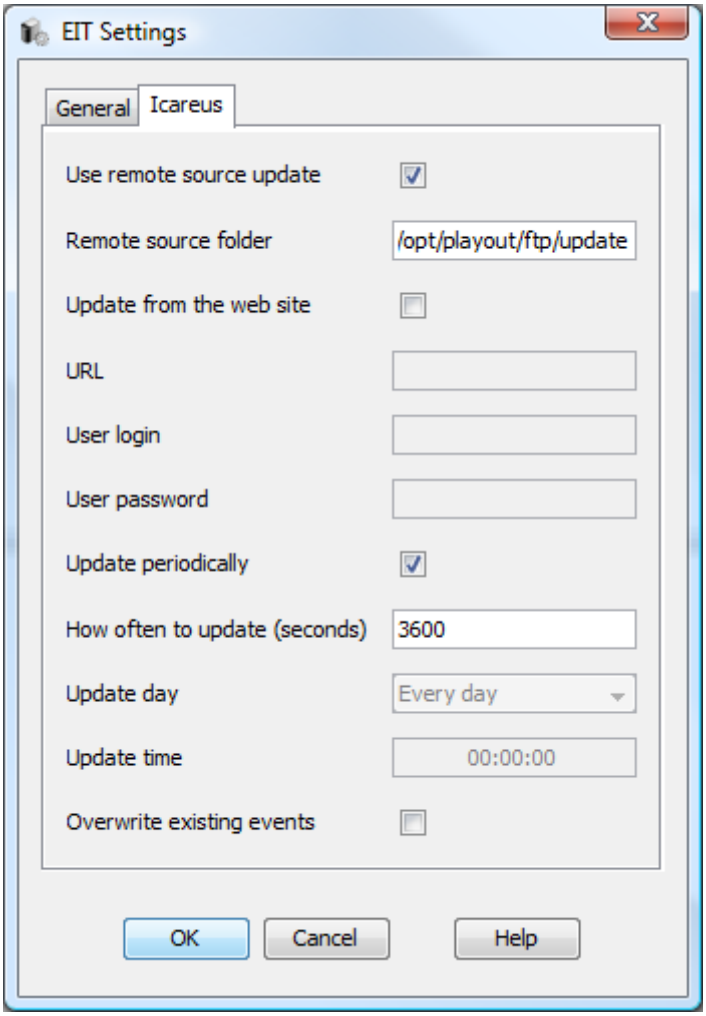
Choose the XML input file in Icareus' XML format to upload the file to the system. To use files in some other XML format it is required to provide also XSL file for transformation to convert the XML file into Icareus' format. Refresh the data and system by pressing the Refresh button.

> ⚠ EPG source file should contain event ids between 0 and 65535. Event id should be unique for a particular service, but not for the database table.

7. EPG DATA UPDATE USING FTP

Icareus Playout server along with our own format supports different 3rd party EPG data source providers, e.g. EPG Sales™ (program data for Scandinavian countries and channels) and Mediadata™ (program data for Baltic countries and channels). Below is a general introduction on how FTP connection works, each datasource is documented separately in detail in the following chapters.

Usually the files with EPG data are uploaded to the server using FTP. The FTP access credentials are exactly the same as used for playout user in PMC. In the EIT configuration on the server there is Remote source folder defined which should be used in FTP file upload. The server monitors content of this folder periodically and updates EPG data if new files appear.

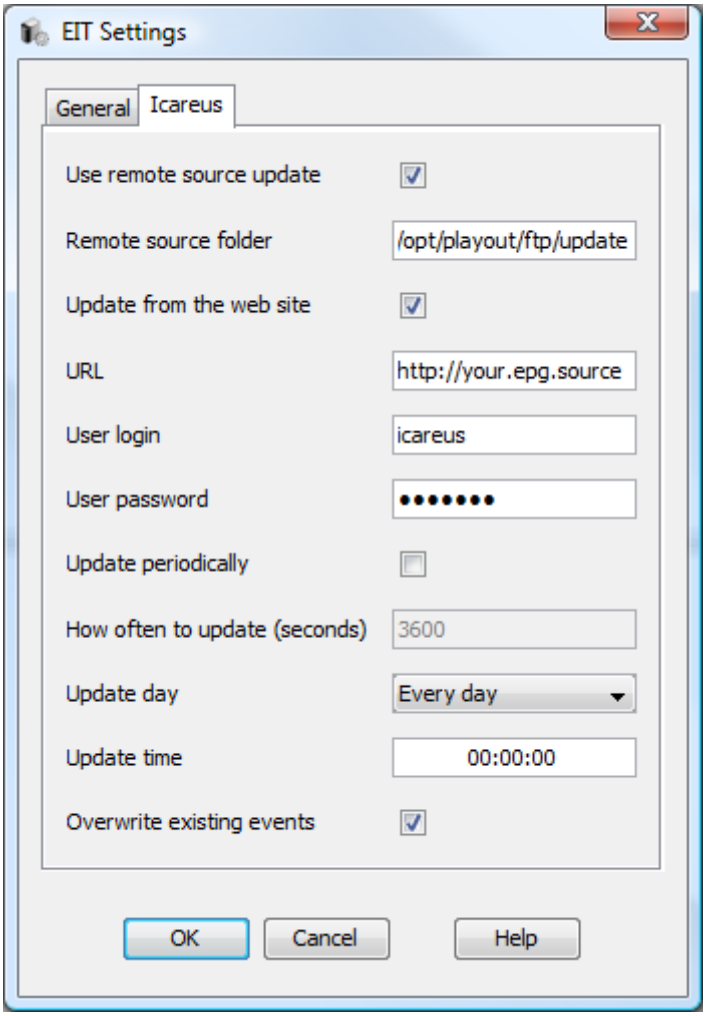


In order to manually update the data from the folder in PMC press Instant update button in the tool bar for the selected service.

> ⚠ EPG source file should contain event ids between 0 and 65535. Event id should be unique for a particular service, but not for the database table.

8. EPG DATA UPDATE USING HTTP

It is possible to retrieve EPG data from some remote web -server. In the EIT configuration on the server there are URL, User login and User password settings that define the web access to the EPG data. The server would try to send HTTP request for each service http://your.epg.source/?username=icareus&password=icareus&service_id=1 and stores the response in the XML file in the folder defined in the Remote source folder settings. After XML files for all services are downloaded, the server parses them and adds EPG data to the database.



In order to manually update the data coming from the remote web -server in PMC press Instant update button in the tool bar for the selected service.

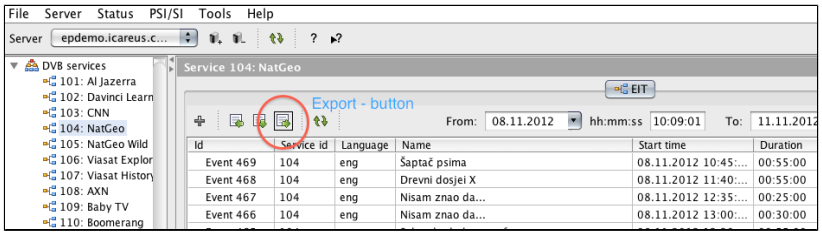
> ⚠ EPG source file should contain event ids between 0 and 65535. Event id should be unique for a particular service, but not for the database table.

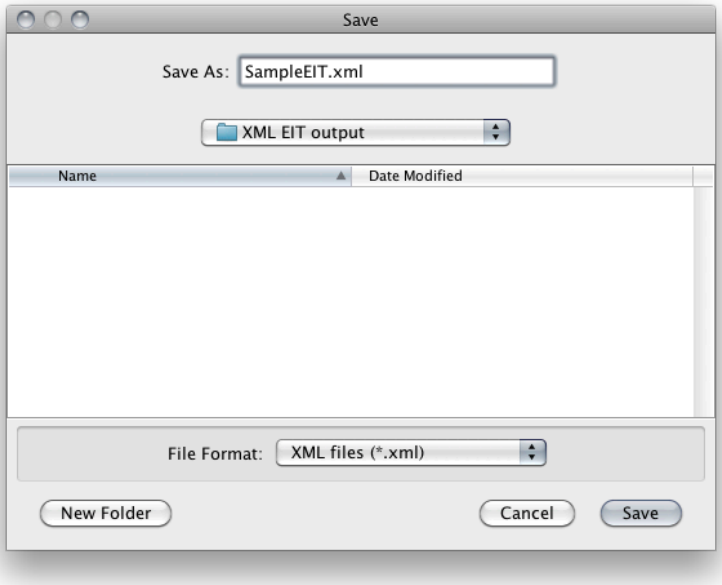
EXPORTING EIT DATA

Icareus Playout supports exporting EIT data manuallyto Playout XML -format.

To export EIT/EPG data user should

1. select the desired DVB Service from the list
2. Select the EIT -tab
3. Click the Export EIT data -button, show in the first image right
4. Save the export into XML file as illustrated in the second image right





ICAREUS XML DATASOURCE

Icareus XML Format is described in the eit.dtd file:

```
<!ELEMENT eit (event*)>
<!ATTLIST eit
    total-events CDATA #IMPLIED>

<!ELEMENT event (id, info?, description*, rating*)>

<!ELEMENT id EMPTY>
<!ATTLIST id
    event-id CDATA #REQUIRED
    service-id CDATA #REQUIRED>

<!ELEMENT info (start-time, duration, content-type, free-ca-mode)>

<!ELEMENT description (language-code, name, short-description, long-description)>

<!-- must be in XML DateTime format "YYYY-MM-DDThh:mm:ss" with time zone -->
<!ELEMENT start-time (#PCDATA)>

<!-- in seconds -->
<!ELEMENT duration (#PCDATA)>

<!-- content type, see ETSI EN 300 468 V1.12.1, table 28 -->
<!ELEMENT content-type (#PCDATA)>

<!-- 1, if conditional access is enabled -->
<!ELEMENT free-ca-mode (#PCDATA)>

<!-- three character language codes as defined in ISO 639-2 -->
<!ELEMENT language-code (#PCDATA)>

<!-- less than 256 characters -->
<!ELEMENT name (#PCDATA)>

<!-- less than 256 characters -->
<!ELEMENT short-description (#PCDATA)>

<!ELEMENT long-description (#PCDATA)>

<!-- parental rating, see ETSI EN 300 468 V1.12.1, 6.2.28 -->
<!ELEMENT rating EMPTY>
<!ATTLIST rating
    country_code CDATA #REQUIRED
    rating CDATA #REQUIRED
    position CDATA #REQUIRED>
```

Example of EPG data in Icareus' XML format:

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!DOCTYPE eit SYSTEM "eit.dtd">
<eit total-events="2">
    <event>
        <id event-id="773" service-id="1"/>
        <info>
            <start-time>2010-09-30T13:00:00Z</start-time>
            <duration>600</duration>
            <content-type>32</content-type>
            <free-ca-mode>0</free-ca-mode>
        </info>
        <description>
            <language-code>dan</language-code>
            <name>DR Update - nyheder og vejr</name>
            <short-description>DR Update med seneste nyt og dagens vejr.</short-description>
            <long-description>Se flere nyheder på dr.dk/update</long-description>
        </description>
    </event>
    <event>
        <id event-id="1014" service-id="2"/>
        <info>
            <start-time>2010-09-30T14:30:00Z</start-time>
            <duration>1800</duration>
            <content-type>20</content-type>
            <free-ca-mode>0</free-ca-mode>
        </info>
        <description>
            <language-code>eng</language-code>
            <name>News</name>
            <short-description>Daily news</short-description>
            <long-description></long-description>
        </description>
    </event>
</eit>
```

XML DateTime format is specified in the following form "YYYY-MM-DDThh:mm:ss" where all components are required:

- YYYY indicates the year
- MM indicates the month
- DD indicates the day
- T indicates the start of the required time section
- hh indicates the hour
- mm indicates the minute
- ss indicates the second

To specify a time zone, you can either enter a dateTime in UTC time by adding a "Z" behind the time or you can specify an offset from the UTC time by adding a positive or negative time behind the time:

```
<start-time>2002-05-30T09:30:10Z</start-time>
<start-time>2002-05-30T09:30:10-06:00</start-time>
<start-time>2002-05-30T09:30:10+06:00</start-time>
```

The content type is defined in ETSI EN 300 468 V1.12.1 table 28. The values are represented in hexadecimal format:

```
<contenttypes>
    <group name="">
        <type value="0" name=""/>
    </group>
    <group name="Movie/Drama">
        <type value="10" name="general"/>
        <type value="11" name="detective/thriller"/>
        <type value="12" name="adventure/western/war"/>
        <type value="13" name="science fiction/fantasy/horror"/>
        <type value="14" name="comedy"/>
        <type value="15" name="soap/melodrama/folkloric"/>
        <type value="16" name="romance"/>
        <type value="17" name="serious/classical/religious/historical movie/drama"/>
        <type value="18" name="adult/movie"/>
    </group>
    <group name="News/Current affairs">
```

```
        <type value="20" name="general"/>
        <type value="21" name="news/weather report"/>
        <type value="22" name="news magazine"/>
        <type value="23" name="documentary"/>
        <type value="24" name="discussion/interview/debate"/>
    </group>
    <group name="Show/Game show">
        <type value="30" name="general"/>
        <type value="31" name="game show/quiz/contest"/>
        <type value="32" name="variety show"/>
        <type value="33" name="talk show"/>
    </group>
    <group name="Sports">
        <type value="40" name="general"/>
        <type value="41" name="special events"/>
        <type value="42" name="sports magazines"/>
        <type value="43" name="football/soccer"/>
        <type value="44" name="tennis/squash"/>
        <type value="45" name="team sports"/>
        <type value="46" name="athletics"/>
        <type value="47" name="motor sport"/>
        <type value="48" name="water sport"/>
        <type value="49" name="winter sports"/>
        <type value="4A" name="equestrian"/>
        <type value="4B" name="martial sports"/>
    </group>
    <group name="Children's/Youth programmes">
        <type value="50" name="general"/>
        <type value="51" name="pre-school children's programmes"/>
        <type value="52" name="entertainment programmes for 6 to 14"/>
        <type value="53" name="entertainment programmes for 10 to 16"/>
        <type value="54" name="informational/educational/school programmes"/>
        <type value="55" name="cartoons/puppets"/>
    </group>
    <group name="Music/Ballet/Dance">
        <type value="60" name="general"/>
        <type value="61" name="rock/pop"/>
        <type value="62" name="serious music/classical music"/>
        <type value="63" name="folk/traditional music"/>
        <type value="64" name="jazz"/>
        <type value="65" name="musical/opera"/>
        <type value="66" name="ballet"/>
    </group>
    <group name="Arts/Culture">
        <type value="70" name="general"/>
        <type value="71" name="performing arts"/>
        <type value="72" name="fine arts"/>
        <type value="73" name="religion"/>
        <type value="74" name="popular culture/traditional arts"/>
        <type value="75" name="literature"/>
        <type value="76" name="film/cinema"/>
        <type value="77" name="experimantal film/video"/>
        <type value="78" name="broadcasting/press"/>
        <type value="79" name="new media"/>
        <type value="7A" name="arts/culture magazines"/>
        <type value="7B" name="fashion"/>
    </group>
    <group name="Social/Political issues/Economics">
        <type value="80" name="general"/>
        <type value="81" name="magazines/reports/documentary"/>
        <type value="82" name="economics/social advisory"/>
        <type value="83" name="remarkable people"/>
    </group>
    <group name="Educational/Science/Factual topics">
        <type value="90" name="general"/>
        <type value="91" name="nature/animals/environment"/>
        <type value="92" name="technology/natural sciences"/>
        <type value="93" name="medicine/physiology/psychology"/>
        <type value="94" name="foreign countries/expeditions"/>
        <type value="95" name="social/spiritual sciences"/>
        <type value="96" name="further education"/>
        <type value="97" name="languages"/>
    </group>
    <group name="Leisure hobbies">
        <type value="A0" name="general"/>
        <type value="A1" name="tourism/travel"/>
        <type value="A2" name="handicraft"/>
        <type value="A3" name="motoring"/>
        <type value="A4" name="fitness and health"/>
        <type value="A5" name="cooking"/>
        <type value="A6" name="advertisement/shopping"/>
        <type value="A7" name="gardening"/>
```

```
</group>
<group name="Special characteristics">
    <type value="B0" name="original language"/>
    <type value="B1" name="black and white"/>
    <type value="B2" name="unpublished"/>
    <type value="B3" name="live broadcast"/>
```

```
        <type value="B4" name="plano-stereoscopic"/>
    </group>
</contenttypes>
```

Three character language codes are defined in ISO 639-2:

```
<languages>
    <language id="abk" name="Abkhazian"/>
    <language id="ace" name="Achinese"/>
    <language id="ach" name="Acoli"/>
    <language id="ada" name="Adangme"/>
    <language id="aar" name="Afar"/>
    <language id="afh" name="Afrihili"/>
    <language id="afr" name="Afrikaans"/>
    <language id="afa" name="Afro-Asiatic (Other)"/>
    <language id="aka" name="Akan"/>
    <language id="akk" name="Akkadian"/>
    <language id="alb" name="Albanian" secondary="sqi"/>
    <language id="ale" name="Aleut"/>
    <language id="alg" name="Algonquian languages"/>
    <language id="tut" name="Altaic (Other)"/>
    <language id="amh" name="Amharic"/>
    <language id="apa" name="Apache languages"/>
    <language id="ara" name="Arabic"/>
    <language id="arc" name="Aramaic"/>
    <language id="arp" name="Arapaho"/>
    <language id="arn" name="Araucanian"/>
    <language id="arw" name="Arawak"/>
    <language id="arm" name="Armenian" secondary="hye"/>
    <language id="art" name="Artificial (Other)"/>
    <language id="asm" name="Assamese"/>
    <language id="ath" name="Athapascan languages"/>
    <language id="map" name="Austronesian (Other)"/>
    <language id="ava" name="Avaric"/>
    <language id="ave" name="Avestan"/>
    <language id="awa" name="Awadhi"/>
    <language id="aym" name="Aymara"/>
    <language id="aze" name="Azerbaijani"/>
    <language id="nah" name="Aztec"/>
    <language id="ban" name="Balinese"/>
    <language id="bat" name="Baltic (Other)"/>
    <language id="bal" name="Baluchi"/>
    <language id="bam" name="Bambara"/>
    <language id="bai" name="Bamileke languages"/>
    <language id="bad" name="Banda"/>
    <language id="bnt" name="Bantu (Other)"/>
    <language id="bas" name="Basa"/>
    <language id="bak" name="Bashkir"/>
    <language id="baq" name="Basque" secondary="eus"/>
    <language id="bej" name="Beja"/>
    <language id="bem" name="Bemba"/>
    <language id="ben" name="Bengali"/>
    <language id="ber" name="Berber (Other)"/>
    <language id="bho" name="Bhojpuri"/>
    <language id="bih" name="Bihari"/>
    <language id="bik" name="Bikol"/>
    <language id="bin" name="Bini"/>
    <language id="bis" name="Bislama"/>
    <language id="bra" name="Braj"/>
    <language id="bre" name="Breton"/>
    <language id="bug" name="Buginese"/>
    <language id="bul" name="Bulgarian"/>
    <language id="bua" name="Buriat"/>
    <language id="bur" name="Burmese" secondary="mya"/>
    <language id="bel" name="Byelorussian"/>
    <language id="cad" name="Caddo"/>
    <language id="car" name="Carib"/>
    <language id="cat" name="Catalan"/>
    <language id="cau" name="Caucasian (Other)"/>
    <language id="ceb" name="Cebuano"/>
    <language id="cel" name="Celtic (Other)"/>
    <language id="cai" name="Central American Indian (Other)"/>
    <language id="chg" name="Chagatai"/>
    <language id="cha" name="Chamorro"/>
    <language id="che" name="Chechen"/>
    <language id="chr" name="Cherokee"/>
```

```
<language id="chy" name="Cheyenne"/>
<language id="chb" name="Chibcha"/>
<language id="chi" name="Chinese" secondary="zho"/>
<language id="chn" name="Chinook jargon"/>
<language id="cho" name="Choctaw"/>
<language id="chu" name="Church Slavic"/>
<language id="chv" name="Chuvash"/>
<language id="cop" name="Coptic"/>
<language id="cor" name="Cornish"/>
<language id="cos" name="Corsican"/>
<language id="cre" name="Cree"/>
<language id="mus" name="Creek"/>
<language id="crp" name="Creoles and Pidgins (Other)"/>
<language id="cpe" name="Creoles and Pidgins, English-based (Other)"/>
<language id="cpf" name="Creoles and Pidgins, French-based (Other)"/>
<language id="cpp" name="Creoles and Pidgins, Portuguese-based (Other)"/>
<language id="hrv" name="Croatian"/>
<language id="cus" name="Cushitic (Other)"/>
<language id="ces" name="Czech" secondary="cze"/>
<language id="dak" name="Dakota"/>
<language id="dan" name="Danish"/>
<language id="del" name="Delaware"/>
<language id="din" name="Dinka"/>
<language id="div" name="Divehi"/>
<language id="doi" name="Dogri"/>
<language id="dra" name="Dravidian (Other)"/>
<language id="dua" name="Duala"/>
<language id="dut" name="Dutch" secondary="nla"/>
<language id="dum" name="Dutch, Middle (ca. 1050-1350)"/>
<language id="dyu" name="Dyula"/>
<language id="dzo" name="Dzongkha"/>
<language id="efi" name="Efik"/>
<language id="egy" name="Egyptian (Ancient)"/>
<language id="eka" name="Ekajuk"/>
<language id="elx" name="Elamite"/>
<language id="eng" name="English"/>
<language id="enm" name="English, Middle (ca. 1100-1500)"/>
<language id="ang" name="English, Old (ca. 450-1100)"/>
<language id="esk" name="Eskimo (Other)"/>
<language id="epo" name="Esperanto"/>
<language id="est" name="Estonian"/>
<language id="ewe" name="Ewe"/>
<language id="ewo" name="Ewondo"/>
<language id="fan" name="Fang"/>
<language id="fat" name="Fanti"/>
<language id="fao" name="Faroese"/>
<language id="fij" name="Fijian"/>
<language id="fin" name="Finnish"/>
<language id="fiu" name="Finno-Ugrian (Other)"/>
<language id="fon" name="Fon"/>
<language id="fra" name="French" secondary="fre"/>
<language id="frm" name="French, Middle (ca. 1400-1600)"/>
<language id="fro" name="French, Old (842- ca. 1400)"/>
<language id="fry" name="Frisian"/>
<language id="ful" name="Fulah"/>
<language id="gaa" name="Ga"/>
<language id="gae" name="(Scots)" secondary="gdh"/>
<language id="glg" name="Gallegan"/>
<language id="lug" name="Ganda"/>
<language id="gay" name="Gayo"/>
<language id="gez" name="Geez"/>
<language id="geo" name="Georgian" secondary="kat"/>
<language id="deu" name="German" secondary="ger"/>
<language id="gmh" name="German, Middle High (ca. 1050-1500)"/>
<language id="goh" name="German, Old High (ca. 750-1050)"/>
<language id="gem" name="Germanic (Other)"/>
<language id="gil" name="Gilbertese"/>
<language id="gon" name="Gondi"/>
<language id="got" name="Gothic"/>
<language id="grb" name="Grebo"/>
<language id="grc" name="Greek, Ancient (to 1453)"/>
<language id="ell" name="Greek, Modern (1453-)" secondary="gre"/>
<language id="kal" name="Greenlandic"/>
<language id="grn" name="Guarani"/>
<language id="guj" name="Gujarati"/>
<language id="hai" name="Haida"/>
<language id="hau" name="Hausa"/>
<language id="haw" name="Hawaiian"/>
<language id="heb" name="Hebrew"/>
<language id="her" name="Herero"/>
<language id="hil" name="Hiligaynon"/>
<language id="him" name="Himachali"/>
```

```
<language id="hin" name="Hindi"/>
<language id="hmo" name="Hiri Motu"/>
<language id="hun" name="Hungarian"/>
<language id="hup" name="Hupa"/>
<language id="iba" name="Iban"/>
<language id="ice" name="Icelandic" secondary="isl"/>
<language id="ibo" name="Igbo"/>
<language id="ijo" name="Ijo"/>
<language id="ilo" name="Iloko"/>
<language id="inc" name="Indic (Other)"/>
<language id="ine" name="Indo-European (Other)"/>
<language id="ind" name="Indonesian"/>
<language id="ina" name="Interlingua (International Auxiliary language Association)"/>
<language id="ine" name="Interlingue"/>
<language id="iku" name="Inuktitut"/>
<language id="ipk" name="Inupiak"/>
<language id="ira" name="Iranian (Other)"/>
<language id="gai" name="Irish" secondary="iri"/>
<language id="sga" name="Irish, Old (to 900)"/>
<language id="mga" name="Irish, Middle (900 - 1200)"/>
<language id="iro" name="Iroquoian languages"/>
<language id="ita" name="Italian"/>
<language id="jpn" name="Japanese"/>
<language id="jav" name="Javanese" secondary="jaw"/>
<language id="jrb" name="Judeo-Arabic"/>
<language id="jpr" name="Judeo-Persian"/>
<language id="kab" name="Kabyle"/>
<language id="kac" name="Kachin"/>
<language id="kam" name="Kamba"/>
<language id="kan" name="Kannada"/>
<language id="kau" name="Kanuri"/>
<language id="kaa" name="Kara-Kalpak"/>
<language id="kar" name="Karen"/>
<language id="kas" name="Kashmiri"/>
<language id="kaw" name="Kawi"/>
<language id="kaz" name="Kazakh"/>
<language id="kha" name="Khasi"/>
<language id="khm" name="Khmer"/>
<language id="khi" name="Khoisan (Other)"/>
<language id="kho" name="Khotanese"/>
<language id="kik" name="Kikuyu"/>
<language id="kin" name="Kinyarwanda"/>
<language id="kir" name="Kirghiz"/>
<language id="kom" name="Komi"/>
<language id="kon" name="Kongo"/>
<language id="kok" name="Konkani"/>
<language id="kor" name="Korean"/>
<language id="kpe" name="Kpelle"/>
<language id="kro" name="Kru"/>
<language id="kua" name="Kuanyama"/>
<language id="kum" name="Kumyk"/>
<language id="kur" name="Kurdish"/>
<language id="kru" name="Kurukh"/>
<language id="kus" name="Kusaie"/>
<language id="kut" name="Kutenai"/>
<language id="lad" name="Ladino"/>
<language id="lah" name="Lahnda"/>
<language id="lam" name="Lamba"/>
<language id="oci" name="Langue d'Oc (post 1500)"/>
<language id="lao" name="Lao"/>
<language id="lat" name="Latin"/>
<language id="lav" name="Latvian"/>
<language id="ltz" name="Letzeburgesch"/>
<language id="lez" name="Lezghian"/>
<language id="lin" name="Lingala"/>
<language id="lit" name="Lithuanian"/>
<language id="loz" name="Lozi"/>
<language id="lub" name="Luba-Katanga"/>
<language id="lui" name="Luiseno"/>
<language id="lun" name="Lunda"/>
<language id="luo" name="Luo (Kenya and Tanzania)"/>
<language id="mac" name="Macedonian" secondary="mak"/>
<language id="mad" name="Madurese"/>
<language id="mag" name="Magahi"/>
<language id="mai" name="Maithili"/>
<language id="mak" name="Makasar"/>
<language id="mlg" name="Malagasy"/>
<language id="may" name="Malay" secondary="msa"/>
<language id="mal" name="Malayalam"/>
<language id="mlt" name="Maltese"/>
<language id="man" name="Mandingo"/>
<language id="mni" name="Manipuri"/>
```

```
<language id="mno" name="Manobo languages"/>
<language id="max" name="Manx"/>
<language id="mao" name="Maori" secondary="mri"/>
<language id="mar" name="Marathi"/>
<language id="chm" name="Mari"/>
<language id="mah" name="Marshall"/>
<language id="mwr" name="Marwari"/>
<language id="mas" name="Masai"/>
<language id="myn" name="Mayan languages"/>
<language id="men" name="Mende"/>
<language id="mic" name="Micmac"/>
<language id="min" name="Minangkabau"/>
<language id="mis" name="Miscellaneous (Other)"/>
<language id="moh" name="Mohawk"/>
<language id="mol" name="Moldavian"/>
<language id="mkh" name="Mon-Kmer (Other)"/>
<language id="lol" name="Mongo"/>
<language id="mon" name="Mongolian"/>
<language id="mos" name="Mossi"/>
<language id="mul" name="Multiple languages"/>
<language id="mun" name="Munda languages"/>
<language id="nau" name="Nauru"/>
<language id="nav" name="Navajo"/>
<language id="nde" name="Ndebele, North"/>
<language id="nbl" name="Ndebele, South"/>
<language id="ndo" name="Ndongo"/>
<language id="nep" name="Nepali"/>
<language id="new" name="Newari"/>
<language id="nic" name="Niger-Kordofanian (Other)"/>
<language id="ssa" name="Nilo-Saharan (Other)"/>
<language id="niu" name="Niuean"/>
<language id="non" name="Norse, Old"/>
<language id="nai" name="North American Indian (Other)"/>
<language id="nor" name="Norwegian"/>
<language id="nno" name="Norwegian (Nynorsk)"/>
<language id="nub" name="Nubian languages"/>
<language id="nym" name="Nyamwezi"/>
<language id="nya" name="Nyanja"/>
<language id="nyn" name="Nyankole"/>
<language id="nyo" name="Nyoro"/>
<language id="nzi" name="Nzima"/>
<language id="oji" name="Ojibwa"/>
<language id="ori" name="Oriya"/>
<language id="orm" name="Oromo"/>
<language id="osa" name="Osage"/>
<language id="oss" name="Ossetic"/>
<language id="oto" name="Otomian languages"/>
<language id="pal" name="Pahlavi"/>
<language id="pau" name="Palauan"/>
<language id="pli" name="Pali"/>
<language id="pam" name="Pampanga"/>
<language id="pag" name="Pangasinan"/>
<language id="pan" name="Panjabi"/>
<language id="pap" name="Papiamento"/>
<language id="paa" name="Papuan-Australian (Other)"/>
<language id="fas" name="Persian" secondary="per"/>
<language id="peo" name="Persian, Old (ca 600 - 400 B.C.)"/>
<language id="phn" name="Phoenician"/>
<language id="pol" name="Polish"/>
<language id="pon" name="Ponape"/>
<language id="por" name="Portuguese"/>
<language id="pra" name="Prakrit languages"/>
<language id="pro" name="Provencal, Old (to 1500)"/>
<language id="pus" name="Pushto"/>
<language id="que" name="Quechua"/>
<language id="roh" name="Rhaeto-Romance"/>
<language id="raj" name="Rajasthani"/>
<language id="rar" name="Rarotongan"/>
<language id="roa" name="Romance (Other)"/>
<language id="ron" name="Romanian" secondary="rum"/>
<language id="rom" name="Romany"/>
<language id="run" name="Rundi"/>
<language id="rus" name="Russian"/>
<language id="sal" name="Salishan languages"/>
<language id="sam" name="Samaritan Aramaic"/>
<language id="smi" name="Sami languages"/>
<language id="smo" name="Samoan"/>
<language id="sad" name="Sandawe"/>
<language id="sag" name="Sango"/>
<language id="san" name="Sanskrit"/>
<language id="srd" name="Sardinian"/>
<language id="sco" name="Scots"/>
```

```
<language id="sel" name="Selkup"/>
<language id="sem" name="Semitic (Other)"/>
<language id="scr" name="Serbo-Croatian"/>
<language id="srr" name="Serer"/>
<language id="shn" name="Shan"/>
<language id="sna" name="Shona"/>
<language id="sid" name="Sidamo"/>
<language id="bla" name="Siksika"/>
<language id="snd" name="Sindhi"/>
<language id="sin" name="Singhalese"/>
<language id="sit" name="Sino-Tibetan (Other)"/>
<language id="sio" name="Siouan languages"/>
<language id="sla" name="Slavic (Other)"/>
<language id="ssw" name="Siswant"/>
<language id="slk" name="Slovak" secondary="slo"/>
<language id="slv" name="Slovenian"/>
<language id="sog" name="Sogdian"/>
<language id="som" name="Somali"/>
<language id="son" name="Songhai"/>
<language id="wen" name="Sorbian languages"/>
<language id="nso" name="Sotho, Northern"/>
<language id="sot" name="Sotho, Southern"/>
<language id="sai" name="South American Indian (Other)"/>
<language id="esl" name="Spanish" secondary="spa"/>
<language id="suk" name="Sukuma"/>
<language id="sux" name="Sumerian"/>
<language id="sun" name="Sudanese"/>
<language id="sus" name="Susu"/>
<language id="swa" name="Swahili"/>
<language id="ssw" name="Swazi"/>
<language id="sve" name="Swedish" secondary="swe"/>
<language id="syr" name="Syriac"/>
<language id="tgl" name="Tagalog"/>
<language id="tah" name="Tahitian"/>
<language id="tgk" name="Tajik"/>
<language id="tmh" name="Tamashek"/>
<language id="tam" name="Tamil"/>
<language id="tat" name="Tatar"/>
<language id="tel" name="Telugu"/>
<language id="ter" name="Tereno"/>
<language id="tha" name="Thai"/>
<language id="bod" name="Tibetan" secondary="tib"/>
<language id="tig" name="Tigre"/>
<language id="tir" name="Tigrinya"/>
<language id="tem" name="Timne"/>
<language id="tiv" name="Tivi"/>
<language id="tli" name="Tlingit"/>
<language id="tog" name="Tonga (Nyasa)"/>
<language id="ton" name="Tonga (Tonga Islands)"/>
<language id="tru" name="Truk"/>
<language id="tsi" name="Tsimshian"/>
<language id="tso" name="Tsonga"/>
<language id="tsn" name="Tswana"/>
<language id="tum" name="Tumbuka"/>
<language id="tur" name="Turkish"/>
<language id="ota" name="Turkish, Ottoman (1500 - 1928)"/>
<language id="tuk" name="Turkmen"/>
<language id="tyv" name="Tuvinian"/>
<language id="twi" name="Twi"/>
<language id="uga" name="Ugaritic"/>
<language id="uig" name="Uighur"/>
<language id="ukr" name="Ukrainian"/>
<language id="umb" name="Umbundu"/>
<language id="und" name="Undetermined"/>
<language id="urd" name="Urdu"/>
<language id="uzb" name="Uzbek"/>
<language id="vai" name="Vai"/>
<language id="ven" name="Venda"/>
<language id="vie" name="Vietnamese"/>
<language id="vol" name="Volap&#252;k"/>
<language id="vot" name="Votic"/>
<language id="wak" name="Wakashan languages"/>
<language id="wal" name="Walamo"/>
<language id="war" name="Waray"/>
<language id="was" name="Washo"/>
<language id="cym" name="Welsh" secondary="wel"/>
<language id="wol" name="Wolof"/>
<language id="xho" name="Xhosa"/>
<language id="sah" name="Yakut"/>
<language id="yao" name="Yao"/>
<language id="yap" name="Yap"/>
<language id="yid" name="Yiddish"/>
```

```
<language id="yor" name="Yoruba"/>
<language id="zap" name="Zapotec"/>
<language id="zen" name="Zenaga"/>
<language id="zha" name="Zhuang"/>
```

```
    <language id="zul" name="Zulu"/>
    <language id="zun" name="Zuni"/>
</languages>
```

Parental rating defines the age limitation for a given country and is defined in ETSI EN 300 468 V1.12.1 6.2.28.
Position attribute defines the order by which the raitings are taken into account.
Rating attribute gives the recommended minimum age in years of the end user and values are represented in hexadecimal format:

- 00 - undefined
- 01 - 4 years
- 02 - 5 years
- 03 - 6 years
- 04 - 7 years
- 05 - 8 years
- 06 - 9 years
- 07 - 10 years
- 08 - 11 years
- 09 - 12 years
- 0A - 13 years
- 0B - 14 years
- 0C - 15 years
- 0D - 16 years
- 0E - 17 years
- 0F - 18 years
- 10 - defined by the broadcaster

Country code identifies a country using the 3-character code as specified in ISO 3166 and ETR 162:

```
<field name="country_code">
        <!-- country group codes from ETR 162 -->
        <namedvalue value="900" description="Scandinavia"/>
        <namedvalue value="901" description="North America"/>
        <namedvalue value="902" description="All countries"/>
        <namedvalue value="903" description="South America"/>
        <namedvalue value="904" description="Latin America"/>
        <namedvalue value="905" description="Europe"/>
        <namedvalue value="906" description="Middle East"/>
        <namedvalue value="907" description="North Africa"/>
        <namedvalue value="908" description="Oceania"/>
        <namedvalue value="909" description="Central America"/>
        <namedvalue value="910" description="Africa"/>
        <namedvalue value="911" description="Asia"/>
        <!-- country codes from ISO 3166 -->
        <namedvalue value="AFG" description="Afghanistan"/>
        <namedvalue value="ALA" description="&#197;land islands"/>
        <namedvalue value="ALB" description="Albania, People's Socialist Republic of"/>
        <namedvalue value="DZA" description="Algeria, People's Democratic Republic of"/>
        <namedvalue value="ASM" description="American Samoa"/>
        <namedvalue value="AND" description="Andorra, Principality of"/>
        <namedvalue value="AGO" description="Angola, Republic of"/>
        <namedvalue value="AIA" description="Anguilla"/>
        <namedvalue value="ATA" description="Antarctica (the territory South of 60 deg S)"/>
        <namedvalue value="ATG" description="Antigua and Barbuda"/>
        <namedvalue value="ARG" description="Argentina, Argentine Republic"/>
        <namedvalue value="ARM" description="Armenia"/>
        <namedvalue value="ABW" description="Aruba"/>
        <namedvalue value="AUS" description="Australia, Commonwealth of"/>
        <namedvalue value="AUT" description="Austria, Republic of"/>
        <namedvalue value="AZE" description="Azerbaijan, Republic of"/>
        <namedvalue value="BHS" description="Bahamas, Commonwealth of the"/>
        <namedvalue value="BHR" description="Bahrain, Kingdom of"/>
        <namedvalue value="BGD" description="Bangladesh, People's Republic of"/>
        <namedvalue value="BRB" description="Barbados"/>
        <namedvalue value="BLR" description="Belarus"/>
        <namedvalue value="BEL" description="Belgium, Kingdom of"/>
        <namedvalue value="BLZ" description="Belize"/>
        <namedvalue value="BEN" description="Benin, People's Republic of"/>
        <namedvalue value="BMU" description="Bermuda"/>
        <namedvalue value="BTN" description="Bhutan, Kingdom of"/>
        <namedvalue value="BOL" description="Bolivia, Republic of"/>
        <namedvalue value="BIH" description="Bosnia and Herzegovina"/>
```

```
<namedvalue value="BWA" description="Botswana, Republic of"/>
<namedvalue value="BVT" description="Bouvet Island (Bouvetoya)"/>
<namedvalue value="BRA" description="Brazil, Federative Republic of"/>
<namedvalue value="IOT" description="British Indian Ocean Territory (Chagos Archipelago)"/>
<namedvalue value="VGB" description="British Virgin Islands"/>
<namedvalue value="BRN" description="Brunei Darussalam"/>
<namedvalue value="BGR" description="Bulgaria, People's Republic of"/>
<namedvalue value="BFA" description="Burkina Faso"/>
<namedvalue value="BDI" description="Burundi, Republic of"/>
<namedvalue value="KHM" description="Cambodia, Kingdom of"/>
<namedvalue value="CMR" description="Cameroon, United Republic of"/>
<namedvalue value="CAN" description="Canada"/>
<namedvalue value="CPV" description="Cape Verde, Republic of"/>
<namedvalue value="CYM" description="Cayman Islands"/>
<namedvalue value="CAF" description="Central African Republic"/>
<namedvalue value="TCD" description="Chad, Republic of"/>
<namedvalue value="CHL" description="Chile, Republic of"/>
<namedvalue value="CHN" description="China, People's Republic of"/>
<namedvalue value="CXR" description="Christmas Island"/>
<namedvalue value="CCK" description="Cocos (Keeling) Islands"/>
<namedvalue value="COL" description="Colombia, Republic of"/>
<namedvalue value="COM" description="Comoros, Union of the"/>
<namedvalue value="COD" description="Congo, Democratic Republic of"/>
<namedvalue value="COG" description="Congo, People's Republic of"/>
<namedvalue value="COK" description="Cook Islands"/>
<namedvalue value="CRI" description="Costa Rica, Republic of"/>
<namedvalue value="CIV" description="Cote D'Ivoire, Ivory Coast, Republic of the"/>
<namedvalue value="CUB" description="Cuba, Republic of"/>
<namedvalue value="CYP" description="Cyprus, Republic of"/>
<namedvalue value="CZE" description="Czech Republic"/>
<namedvalue value="DNK" description="Denmark, Kingdom of"/>
<namedvalue value="DJI" description="Djibouti, Republic of"/>
<namedvalue value="DMA" description="Dominica, Commonwealth of"/>
<namedvalue value="DOM" description="Dominican Republic"/>
<namedvalue value="ECU" description="Ecuador, Republic of"/>
<namedvalue value="EGY" description="Egypt, Arab Republic of"/>
<namedvalue value="SLV" description="El Salvador, Republic of"/>
<namedvalue value="GNQ" description="Equatorial Guinea, Republic of"/>
<namedvalue value="ERI" description="Eritrea"/>
<namedvalue value="EST" description="Estonia"/>
<namedvalue value="ETH" description="Ethiopia"/>
<namedvalue value="FRO" description="Faeroe Islands"/>
<namedvalue value="FLK" description="Falkland Islands (Malvinas)"/>
<namedvalue value="FJI" description="Fiji, Republic of the Fiji Islands"/>
<namedvalue value="FIN" description="Finland, Republic of"/>
<namedvalue value="FRA" description="France, French Republic"/>
<namedvalue value="GUF" description="French Guiana"/>
<namedvalue value="PYF" description="French Polynesia"/>
<namedvalue value="ATF" description="French Southern Territories"/>
<namedvalue value="GAB" description="Gabon, Gabonese Republic"/>
<namedvalue value="GMB" description="Gambia, Republic of the"/>
<namedvalue value="GEO" description="Georgia"/>
<namedvalue value="DEU" description="Germany"/>
<namedvalue value="GHA" description="Ghana, Republic of"/>
<namedvalue value="GIB" description="Gibraltar"/>
<namedvalue value="GRC" description="Greece, Hellenic Republic"/>
<namedvalue value="GRL" description="Greenland"/>
<namedvalue value="GRD" description="Grenada"/>
<namedvalue value="GLP" description="Guadaloupe"/>
<namedvalue value="GUM" description="Guam"/>
<namedvalue value="GTM" description="Guatemala, Republic of"/>
<namedvalue value="GIN" description="Guinea, Revolutionary People's Rep'c of"/>
<namedvalue value="GNB" description="Guinea-Bissau, Republic of"/>
<namedvalue value="GUY" description="Guyana, Republic of"/>
<namedvalue value="HTI" description="Haiti, Republic of"/>
<namedvalue value="HMD" description="Heard and McDonald Islands"/>
<namedvalue value="VAT" description="Holy See (Vatican City State)"/>
<namedvalue value="HND" description="Honduras, Republic of"/>
<namedvalue value="HKG" description="Hong Kong, Special Administrative Region of China"/>
<namedvalue value="HRV" description="Hrvatska (Croatia)"/>
<namedvalue value="HUN" description="Hungary, Hungarian People's Republic"/>
<namedvalue value="ISL" description="Iceland, Republic of"/>
<namedvalue value="IND" description="India, Republic of"/>
<namedvalue value="IDN" description="Indonesia, Republic of"/>
<namedvalue value="IRN" description="Iran, Islamic Republic of"/>
<namedvalue value="IRQ" description="Iraq, Republic of"/>
<namedvalue value="IRL" description="Ireland"/>
<namedvalue value="ISR" description="Israel, State of"/>
<namedvalue value="ITA" description="Italy, Italian Republic"/>
<namedvalue value="JAM" description="Jamaica"/>
<namedvalue value="JPN" description="Japan"/>
<namedvalue value="JOR" description="Jordan, Hashemite Kingdom of"/>
```

```
<namedvalue value="KAZ" description="Kazakhstan, Republic of"/>
<namedvalue value="KEN" description="Kenya, Republic of"/>
<namedvalue value="KIR" description="Kiribati, Republic of"/>
<namedvalue value="PRK" description="Korea, Democratic People's Republic of"/>
<namedvalue value="KOR" description="Korea, Republic of"/>
<namedvalue value="KWT" description="Kuwait, State of"/>
<namedvalue value="KGZ" description="Kyrgyz Republic"/>
<namedvalue value="LAO" description="Lao People's Democratic Republic"/>
<namedvalue value="LVA" description="Latvia"/>
<namedvalue value="LBN" description="Lebanon, Lebanese Republic"/>
<namedvalue value="LSO" description="Lesotho, Kingdom of"/>
<namedvalue value="LBR" description="Liberia, Republic of"/>
<namedvalue value="LBY" description="Libyan Arab Jamahiriya"/>
<namedvalue value="LIE" description="Liechtenstein, Principality of"/>
<namedvalue value="LTU" description="Lithuania"/>
<namedvalue value="LUX" description="Luxembourg, Grand Duchy of"/>
<namedvalue value="MAC" description="Macao, Special Administrative Region of China"/>
<namedvalue value="MKD" description="Macedonia, the former Yugoslav Republic of"/>
<namedvalue value="MDG" description="Madagascar, Republic of"/>
<namedvalue value="MWI" description="Malawi, Republic of"/>
<namedvalue value="MYS" description="Malaysia"/>
<namedvalue value="MDV" description="Maldives, Republic of"/>
<namedvalue value="MLI" description="Mali, Republic of"/>
<namedvalue value="MLT" description="Malta, Republic of"/>
<namedvalue value="MHL" description="Marshall Islands"/>
<namedvalue value="MTQ" description="Martinique"/>
<namedvalue value="MRT" description="Mauritania, Islamic Republic of"/>
<namedvalue value="MUS" description="Mauritius"/>
<namedvalue value="MYT" description="Mayotte"/>
<namedvalue value="MEX" description="Mexico, United Mexican States"/>
<namedvalue value="FSM" description="Micronesia, Federated States of"/>
<namedvalue value="MDA" description="Moldova, Republic of"/>
<namedvalue value="MCO" description="Monaco, Principality of"/>
<namedvalue value="MNG" description="Mongolia, Mongolian People's Republic"/>
<namedvalue value="MSR" description="Montserrat"/>
<namedvalue value="MAR" description="Morocco, Kingdom of"/>
<namedvalue value="MOZ" description="Mozambique, People's Republic of"/>
<namedvalue value="MMR" description="Myanmar"/>
<namedvalue value="NAM" description="Namibia"/>
<namedvalue value="NRU" description="Nauru, Republic of"/>
<namedvalue value="NPL" description="Nepal, Kingdom of"/>
<namedvalue value="ANT" description="Netherlands Antilles"/>
<namedvalue value="NLD" description="Netherlands, Kingdom of the"/>
<namedvalue value="NCL" description="New Caledonia"/>
<namedvalue value="NZL" description="New Zealand"/>
<namedvalue value="NIC" description="Nicaragua, Republic of"/>
<namedvalue value="NER" description="Niger, Republic of the"/>
<namedvalue value="NGA" description="Nigeria, Federal Republic of"/>
<namedvalue value="NIU" description="Niue, Republic of"/>
<namedvalue value="NFK" description="Norfolk Island"/>
<namedvalue value="MNP" description="Northern Mariana Islands"/>
<namedvalue value="NOR" description="Norway, Kingdom of"/>
<namedvalue value="OMN" description="Oman, Sultanate of"/>
<namedvalue value="PAK" description="Pakistan, Islamic Republic of"/>
<namedvalue value="PLW" description="Palau"/>
<namedvalue value="PSE" description="Palestinian Territory, Occupied"/>
<namedvalue value="PAN" description="Panama, Republic of"/>
<namedvalue value="PNG" description="Papua New Guinea"/>
<namedvalue value="PRY" description="Paraguay, Republic of"/>
<namedvalue value="PER" description="Peru, Republic of"/>
<namedvalue value="PHL" description="Philippines, Republic of the"/>
<namedvalue value="PCN" description="Pitcairn Island"/>
<namedvalue value="POL" description="Poland, Polish People's Republic"/>
<namedvalue value="PRT" description="Portugal, Portuguese Republic"/>
<namedvalue value="PRI" description="Puerto Rico"/>
<namedvalue value="QAT" description="Qatar, State of"/>
<namedvalue value="REU" description="Reunion"/>
<namedvalue value="ROU" description="Romania, Socialist Republic of"/>
<namedvalue value="RUS" description="Russian Federation"/>
<namedvalue value="RWA" description="Rwanda, Rwandese Republic"/>
<namedvalue value="SHN" description="St. Helena"/>
<namedvalue value="KNA" description="St. Kitts and Nevis"/>
<namedvalue value="LCA" description="St. Lucia"/>
<namedvalue value="SPM" description="St. Pierre and Miquelon"/>
<namedvalue value="VCT" description="St. Vincent and the Grenadines"/>
<namedvalue value="WSM" description="Samoa, Independent State of"/>
<namedvalue value="SMR" description="San Marino, Republic of"/>
<namedvalue value="STP" description="Sao Tome and Principe, Democratic Republic of"/>
<namedvalue value="SAU" description="Saudi Arabia, Kingdom of"/>
<namedvalue value="SEN" description="Senegal, Republic of"/>
<namedvalue value="SCG" description="Serbia and Montenegro"/>
<namedvalue value="SYC" description="Seychelles, Republic of"/>
```

```
<namedvalue value="SLE" description="Sierra Leone, Republic of"/>
<namedvalue value="SGP" description="Singapore, Republic of"/>
<namedvalue value="SVK" description="Slovakia (Slovak Republic)"/>
<namedvalue value="SVN" description="Slovenia"/>
<namedvalue value="SLB" description="Solomon Islands"/>
<namedvalue value="SOM" description="Somalia, Somali Republic"/>
<namedvalue value="ZAF" description="South Africa, Republic of"/>
<namedvalue value="SGS" description="South Georgia and the South Sandwich Islands"/>
<namedvalue value="ESP" description="Spain, Spanish State"/>
<namedvalue value="LKA" description="Sri Lanka, Democratic Socialist Republic of"/>
<namedvalue value="SDN" description="Sudan, Democratic Republic of the"/>
<namedvalue value="SUR" description="Suriname, Republic of"/>
<namedvalue value="SJM" description="Svalbard &amp;amp; Jan Mayen Islands"/>
<namedvalue value="SWZ" description="Swaziland, Kingdom of"/>
<namedvalue value="SWE" description="Sweden, Kingdom of"/>
<namedvalue value="CHE" description="Switzerland, Swiss Confederation"/>
<namedvalue value="SYR" description="Syrian Arab Republic"/>
<namedvalue value="TWN" description="Taiwan, Province of China"/>
<namedvalue value="TJK" description="Tajikistan"/>
<namedvalue value="TZA" description="Tanzania, United Republic of"/>
<namedvalue value="THA" description="Thailand, Kingdom of"/>
<namedvalue value="TLS" description="Timor-Leste, Democratic Republic of"/>
<namedvalue value="TGO" description="Togo, Togolese Republic"/>
<namedvalue value="TKL" description="Tokelau (Tokelau Islands)"/>
<namedvalue value="TON" description="Tonga, Kingdom of"/>
<namedvalue value="TTO" description="Trinidad and Tobago, Republic of"/>
<namedvalue value="TUN" description="Tunisia, Republic of"/>
<namedvalue value="TUR" description="Turkey, Republic of"/>
<namedvalue value="TKM" description="Turkmenistan"/>
<namedvalue value="TCA" description="Turks and Caicos Islands"/>
<namedvalue value="TUV" description="Tuvalu"/>
<namedvalue value="VIR" description="US Virgin Islands"/>
<namedvalue value="UGA" description="Uganda, Republic of"/>
<namedvalue value="UKR" description="Ukraine"/>
<namedvalue value="ARE" description="United Arab Emirates"/>
<namedvalue value="GBR" description="United Kingdom of Great Britain &amp;amp; N. Ireland"/>
<namedvalue value="UMI" description="United States Minor Outlying Islands"/>
<namedvalue value="USA" description="United States of America"/>
<namedvalue value="URY" description="Uruguay, Eastern Republic of"/>
<namedvalue value="UZB" description="Uzbekistan"/>
<namedvalue value="VUT" description="Vanuatu"/>
<namedvalue value="VEN" description="Venezuela, Bolivarian Republic of"/>
<namedvalue value="VNM" description="Viet Nam, Socialist Republic of"/>
<namedvalue value="WLF" description="Wallis and Futuna Islands"/>
<namedvalue value="ESH" description="Western Sahara"/>
<namedvalue value="YEM" description="Yemen"/>
```

```
        <namedvalue value="ZMB" description="Zambia, Republic of"/>
        <namedvalue value="ZWE" description="Zimbabwe"/>
    </field>
```

XMLTV DATASOURCE

INTRODUCTION

More about XMLTV can be found from:http://en.wikipedia.org/wiki/XMLTV

XMLTV DTD

XMLTV DTD: http://xmltv.cvs.sourceforge.net/viewvc/xmltv/xmltv/xmltv.dtd

This is an example of xmltv format.

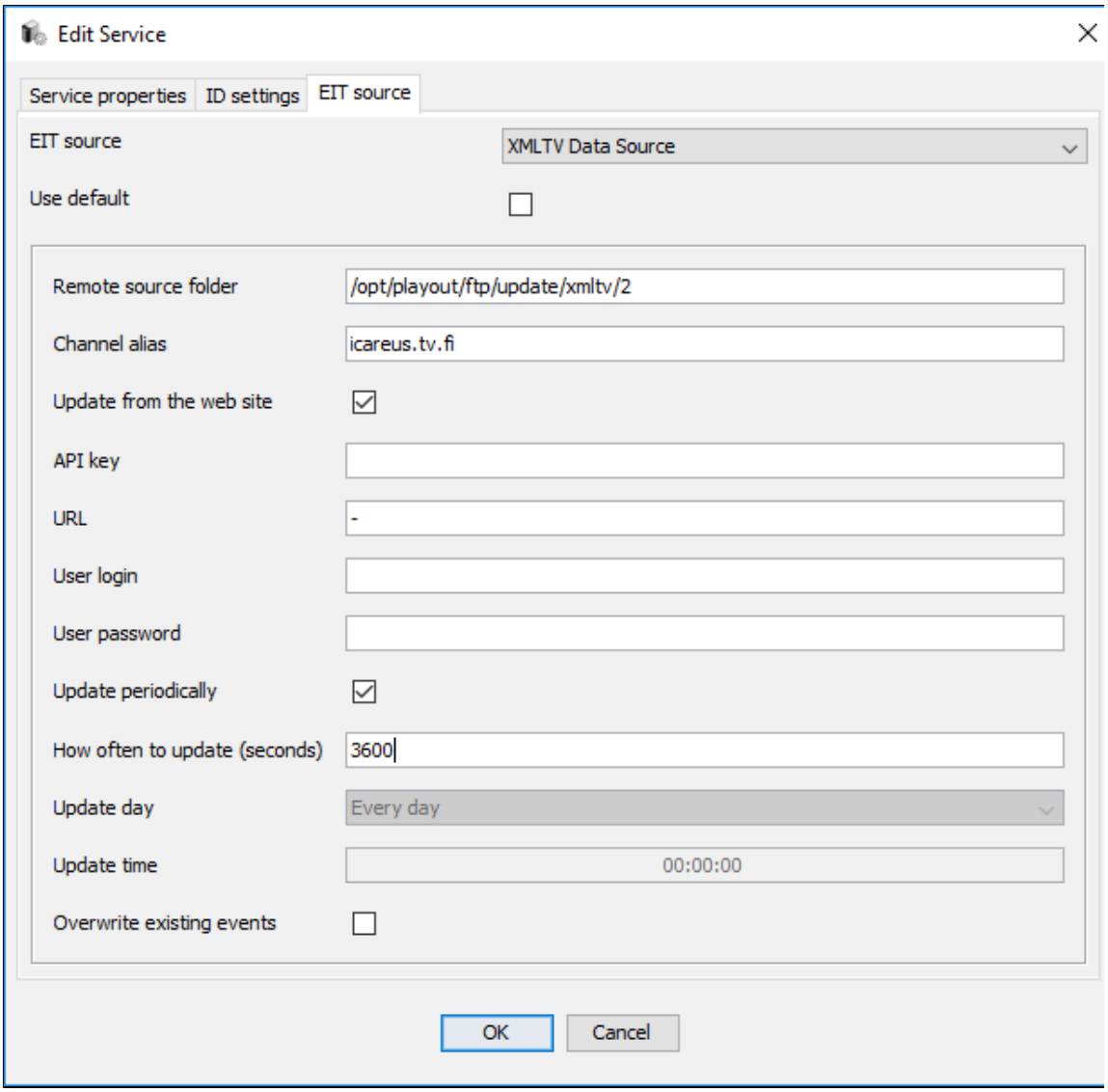
```
<?xml version="1.0" encoding="utf-8"?>
<\!DOCTYPE tv SYSTEM "xmltv.dtd">
<tv>
 <programme start="201210050032 \+0100" stop="201210050128       \+0100"
channel="penthouse1hd.epg.electra.hr">
   <title lang="en">Lov na lososе u       Jemenu</title>
   <sub-title lang="en">Salmon Fishing in the       Yemen</sub-title>
   <desc lang="en">Nakon &#353;to se njezino prvo       seksualno iskustvo pretvori u poku&#353;aj
silovanja,       17-godi&#353;nja Lana (Iskra Jirsak) bje&#382;i od momka       Igora (&#381;ivko
Ano&#269;i&#263\;). U no&#263;nom       klubu susre&#263;e vr&#353;njakinju Irenu (Nika
Mi&#353;kovi&#263\;), problemati&#269;nu curu u potrazi       za drogom. Niz okolnosti, od policijske
racije nadalje, spaja Lanu       i Irenu u lutanju kroz zagreba&#269;ku       no&#263;...</desc>
   <rating>
      <value>15</value>
   </rating>
 </programme>
</tv>
```

MAPPING XMLTV TO ICAREUS EIT DATABASE

1. Start time - 'start' attribute
2. Duration - ('stop'-'start') attributes
3. Language - 'lang' attribute of 'title', 'sub-title' and 'desc' tags
4. name - 'title' tag
5. Short description - 'sub-title' tag
6. Long description - 'desc' tag
7. Free CA mode - not possiblt to configure using xmltv, always set to 0
8. Parental control - 'value' tag in 'rating' tag

XMLTV CONFIGURATION FOR SERVICE

- select a service that is meant to provide an EPG information
- press right hand side mouse button and selec "Edit Service" from pop up menu
- select "EIT source" tab
- select XMLTV Data Source from "EIT source" combo box
- unselect the "Use default" check box
- type the path for xml data file e.g. /opt/playout/ftp/update/xmltv/2 (here number 2 is the service id) to "Remote source folder"
- type the channel id value (e.g. <channel id="> from XML file) to the "Channel alias" -edit field
- select the "Update from the web site" -check box
- in case of fetching the xml data file from web, it is possible to type API key in case of wendor requiring it
- in case of fetching the xml data file from web type the correct URL to the "URL" -edit field
- in case of uploading the xml data file with .e.g. ftp type just "-" to the "URL" -edit field
- select the "Update periodically" -check box and type suitable period to the "How often to update (seconds)" -edit field
- in case of updating the EPG information once per day unselect the "Update periodically" check box, but leave some value to the edit -field mentioned above
- type suitable clock time when the EPG data should be read from xml file
- select "Overwrite existing events" -check box if the date from XML file is waned to replace the previous data in database



EPGS.COM DATASOURCE

INTRODUCTION

More information can be found at http://www.epgs.com

EPGS FORMAT

EPGS DTD: http://epgs.com/feeds/xml/epg.dtd

This is an example of EPGS format.

```
<?xml version="1.0" encoding="UTF-8" ?>
<!DOCTYPE note SYSTEM "http://epgs.com/feeds/xml/epg.dtd">
<tv generator-info-name="epgs.com" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://epgs.com/feeds/xml http://epgs.com/feeds/xml/epg.xsd">
    <channel id="10350" lang="fi" region="fi" slug="mtv3" license="0">
        <name lang="fi">MTV3</name>
        <category>MIXED</category>
        <logo>http://epgs.com/imgs/logo/mtv3_fi_big.png</logo>
        <icon>http://epgs.com/imgs/logo/mtv3_fi.png</icon>
        <programmes>
         <programme id="256206676" series-id="0" channel="10350" start="20150306052500 +0100"
stop="20150306080500 +0100" live="false" rerun="false">
                <title lang="fi">Huomenta Suomi</title>
                <genre lang="fi" generic="Magazine">Aikakausilehti</genre>
                <date>20150306</date>
            </programme>
            <programme id="256206677" series-id="0" channel="10350" start="20150306080500 +0100"
stop="20150306083000 +0100" live="false" rerun="false">
                <title lang="fi">Studio55.fi</title>
                <desc lang="fi">Markku Veijalaisen vieraina Supernaiset Pirkko Mannola, Vieno Kekkonen ja
Marjatta Leppänen.</desc>
                <genre lang="fi" generic="Magazine">Aikakausilehti</genre>
                <date>20150306</date>
            </programme>
            <programme id="256206678" series-id="0" channel="10350" start="20150306083000 +0100"
stop="20150306084000 +0100" live="false" rerun="false">
                <title lang="fi">Huomenta Suomen Uutiset</title>
                <category>news</category>
                <date>20150306</date>
            </programme>     </programmes>
    </channel>
</tv>
```

MAPPING EPGS TO ICAREUS EIT DATABASE

Icareus	Node	Attribute	Notes
service id	channel	id	
start date/time	programme	start	
duration	-	-	start date/time - stop date/time (stop date/time is defined by attribute 'stop' of 'programme' node)
content type	category	-	EPGS<-> DVB content type mapping: movie - 0x10 (Movie/Drama) serie - 0x10 (Movie/Drama) sport - 0x40 (Sport) news - 0x20 (News/Current affairs) documentary - 0x90 (Educational/Science/Factual topics) show - 0x30 (Show/Game show) entertainment - 0x30 (Show/Game show) music - 0x60 (Music/Ballet/Dance) kids - 0x50 (Children's/Youth programmes) science - 0x90 (Educational/Science/Factual topics) reality - 0x70 (Arts/Culture)
free CA mode	-	-	always set to 0
language code	channel	lang	converted from ISO 639-1 to ISO 639-2
name	title	-	
short description	sub-title	-	
long description	desc	-	
PG rating	-	-	Not defined

TRIBUNE MEDIA DATASOURCE

INTRODUCTION

TMS EPG data is collected using 3 different files. These files are schedules.xml, programs.xml and sources.xml. Only schedules.xml file should be specified as a data source. Other files are processed automatically.

TMS resources: http://www.TMSResource.com

DOCUMENTATION

The following documents are attached:

General product overview

Schedules schema documentation

Programs schema documentation

Sources schema documentation

Schedules schema

Program schema

Sources schema

MAPPING TMS TO ICAREUS EIT DATABASE

Icareus	File	Node	Attribute	Notes
service id	sources.xml	name	-	service id is defined from the list of configured services based on the source name.
start date	schedules.xml	event	date	
start time	schedules.xml	time	-	The first available value is used.
duration	schedules.xml	tv	dur	
content type	programs.xml	genre	genreId	The first available id is used. Please, refer to the attached spreadsheet to check TMS genres <-> DVB content types mapping.
free CA mode	-	-	-	always set to 0
language code	programs.xml	title	lang	converted from ISO 639-1 to ISO 639-2
name	programs.xml	titles	-	
short description	programs.xml	descriptions	-	The shortest one is used.
long description	programs.xml	descriptions	-	The longest one is used.
PG rating	schedules.xml	tvRating	-	Only 'USA Parental Rating' type is processed.

NOTES

TMS data files can be too big. As a result, it may take up to 1-2 hours to parse all the data.

SAMPLE FILES

schedules.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<on xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="on_schedules_2.0.xsd" schemaVersion="2.0">
<header>
<content>On(r) TV: Schedules</content>
<created>2012-10-05</created>
<copyright>Copyright 2012 Tribune Media Services. All rights reserved.</copyright>
<start>2012-10-05T00:00:00</start>
<period>P14D</period>
</header>
<schedules type="tv">
<schedule sourceId="10021" prgSvcId="10021">
<event TMSId="EP000000211476" date="2012-10-05">
<times>
<time>00:00</time>
</times>
<tv dur="PT01H00M">
</tv>
<tvRating body="USA Parental Rating">TVPG</tvRating>
<quals>CC|Stereo|Premiere|HDTV</quals>
</event>
<event TMSId="EP000000211477" date="2012-10-05">
<times>
<time>01:00</time>
</times>
<tv dur="PT01H00M">
</tv>
</event>
</schedule>
</schedules>
</on>
```

programs.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<on xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="on_programs_2.0.xsd" schemaVersion="2.0">
<header>
<content>On(r) TV: Programs</content>
<created>2012-10-05</created>
<copyright>Copyright 2012 Tribune Media Services. All rights reserved.</copyright>
<start>2012-10-05T00:00:00</start>
<period>P14D</period>
</header>
<programs>
<program TMSId="EP000000211476" rootId="9503060" connectorId="SH000000210000" seriesId="184299">
<titles>
<title size="120" type="full" lang="en">20/20</title>
</titles>
<descriptions>
<desc size="255" type="plot" lang="en">Victims of stalker and murderer Waseem Daker discuss his
conviction.</desc>
<desc size="100" type="plot" lang="en">Victims of stalker and murderer Waseem Daker discuss his
conviction.</desc>
<desc size="60" type="plot" lang="en">Victims of stalker and murderer Waseem Daker speak out.</desc>
<desc size="40" type="plot" lang="en">Waseem Daker&amp;apos;s victims speak out.</desc>
</descriptions>
<cast>
<member personId="68086" ord="01">
<role>Anchor</role>
<name nameId="68086">
<first>Elizabeth</first>
<last>Vargas</last>
</name>
</member>
<member personId="354875" ord="02">
<role>Anchor</role>
<name nameId="363749">
<first>Chris</first>
<last>Cuomo</last>
</name>
</member>
</cast>
<progType>Series</progType>
<genres>
<genre genreId="157">Newsmagazine</genre>
</genres>
<origAirDate>2012-10-05</origAirDate>
<colorCode>Color</colorCode>
<episodeInfo>
<title size="150" type="full" lang="en">Stalked</title>
</episodeInfo>
<sourceType>Network</sourceType>
</program>
<program TMSId="EP000000211477" rootId="9503065" connectorId="SH000000210000" seriesId="184299">
<titles>
<title size="120" type="full" lang="en">20/20</title>
</titles>
<cast>
<member personId="68086" ord="01">
<role>Anchor</role>
<name nameId="68086">
<first>Elizabeth</first>
<last>Vargas</last>
</name>
</member>
<member personId="354875" ord="02">
<role>Anchor</role>
<name nameId="363749">
<first>Chris</first>
<last>Cuomo</last>
</name>
</member>
</cast>
<progType>Series</progType>
<genres>
<genre genreId="157">Newsmagazine</genre>
</genres>
<origAirDate>2012-10-12</origAirDate>
<colorCode>Color</colorCode>
<sourceType>Network</sourceType>
</program>
</programs>
</on>
```

sources.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<on xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="on_sources_2.0.xsd" schemaVersion="2.0">
<header>
<content>On(r) TV: Sources</content>
<created>2012-10-05</created>
<copyright>Copyright 2012 Tribune Media Services. All rights reserved.</copyright>
<start>2012-10-05T00:00:00</start>
<period>P14D</period>
</header>
<sources>
<prgSvcs>
<prgSvc sourceId="10002" prgSvcId="10002">
<name>3 Angels</name>
<address>
<city>West Frankfort</city>
<state>IL</state>
<postalCode>62896</postalCode>
<country>USA</country>
</address>
<type>Satellite</type>
<timeZone>Central Observing</timeZone>
<callSign>3ANGELS</callSign>
<edLangs>
<edLang>en</edLang>
</edLangs>
<bcastLangs>
<bcastLang>en</bcastLang>
</bcastLangs>
<URL>www.3abn.org/</URL>
<images>
<image type="image/png" width="360" height="270" primary="true" category="Logo">
<URI>h3/NowShowing/10002/s10002_h3_aa.png</URI>
</image>
<image type="image/png" width="90" height="67" primary="true" category="Logo">
<URI>h4/NowShowing/10002/s10002_h4_aa.png</URI>
</image>
<image type="image/png" width="180" height="135" primary="true" category="Logo">
<URI>h5/NowShowing/10002/s10002_h5_aa.png</URI>
</image>
</images>
</prgSvc>
<prgSvc sourceId="10021" prgSvcId="10021">
<name>AMC</name>
<address>
<city>Jericho</city>
<state>NY</state>
<postalCode>11753</postalCode>
<country>USA</country>
</address>
<type>Satellite</type>
<timeZone>Eastern Observing</timeZone>
<callSign>AMC</callSign>
<edLangs>
<edLang>en</edLang>
</edLangs>
<bcastLangs>
<bcastLang>en</bcastLang>
</bcastLangs>
<URL>www.amctv.com</URL>
<images>
<image type="image/png" width="360" height="270" category="Logo">
<URI>h3/NowShowing/10021/s10021_h3_ba.png</URI>
</image>
<image type="image/png" width="90" height="67" category="Logo">
<URI>h4/NowShowing/10021/s10021_h4_ba.png</URI>
</image>
<image type="image/png" width="90" height="67" primary="true" category="Logo">
<URI>h4/NowShowing/10021/s10021_h4_aa.png</URI>
</image>
<image type="image/png" width="360" height="270" primary="true" category="Logo">
<URI>h3/NowShowing/10021/s10021_h3_aa.png</URI>
</image>
<image type="image/png" width="180" height="135" primary="true" category="Logo">
<URI>h5/NowShowing/10021/s10021_h5_aa.png</URI>
</image>
<image type="image/png" width="180" height="135" category="Logo">
```

```
<URI>h5/NowShowing/10021/s10021_h5_ba.png</URI>
</image>
</images>
</prgSvc>
```

```
</prgSvcs>
</sources>
</on>
```

MS EXCEL DATASOURCE

INTRODUCTION

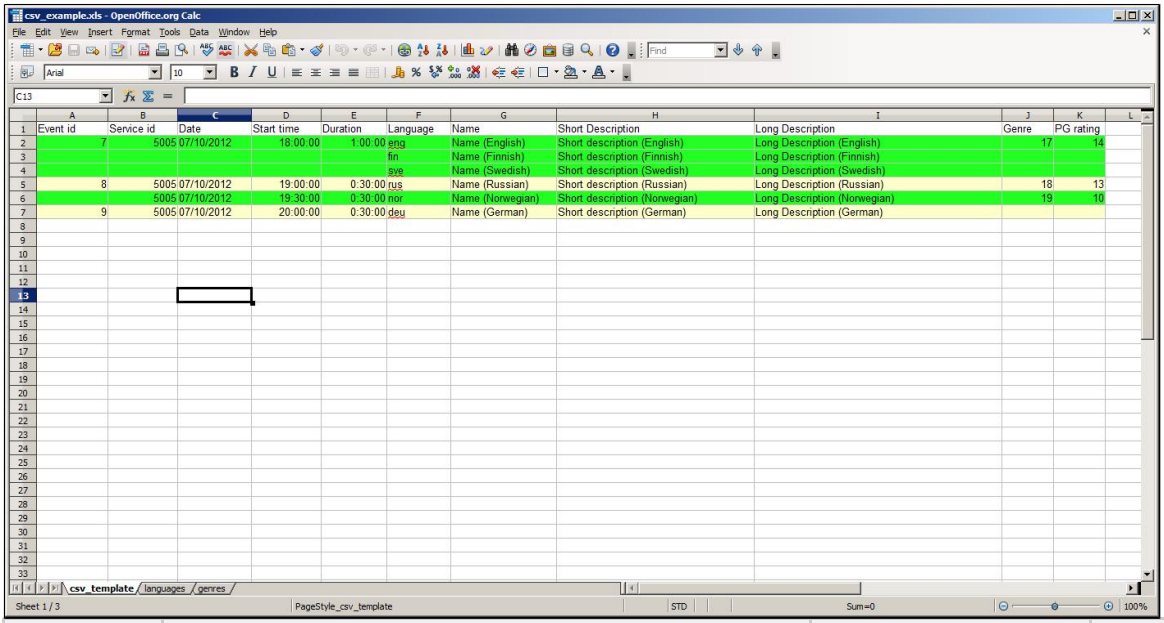
It is possible to use Microsoft Excel as a tool for managing the EPG data.

The process for that is:

1. Manage EPG with the Excel tool and the excel format given by Icareus
2. Save the Excel (.xls) files as CSV (*.csv) files
3. Use the manual uploading the CSV file to the Playout/http/ftp server
4. Refresh the system

FORMAT

For managing the EPG data with Excel use the format shown in the image below:



Column	Description	Format	Mandatory
Event id	Unique identifier of an event	text/number	No
Service id	Service identifier of an event	number	Yes
Date	Event's start date in UTC	dd/mm/yyyy	Yes
Time	Event's start time in UTC	hh:mm:ss	Yes
Duration	Event's duration	hh:mm:ss	Yes
Language	Language definition for the event's Name/Short description/Long descriptions. It is possible to define more than one language for each event. Separate lines should be used for different languages.	text (see attachment)	Yes
Name	Event's name	text (New lines are not allowed)	Yes
Short description	Event's short description	text (New lines are not allowed)	No

Long description	Event's long description	text (New lines are not allowed)	No
Genre	Event's genre	number (see attachment)	No
PG rating	Parental guide rating	number (age limit: 4-18)	No

Three character language codes are defined in ISO 639-2:

```
<languages>
    <language id="abk" name="Abkhazian"/>
    <language id="ace" name="Achinese"/>
    <language id="ach" name="Acoli"/>
    <language id="ada" name="Adangme"/>
    <language id="aar" name="Afar"/>
    <language id="afh" name="Afrihili"/>
    <language id="afr" name="Afrikaans"/>
    <language id="afa" name="Afro-Asiatic (Other)"/>
    <language id="aka" name="Akan"/>
    <language id="akk" name="Akkadian"/>
    <language id="alb" name="Albanian" secondary="sqi"/>
    <language id="ale" name="Aleut"/>
    <language id="alg" name="Algonquian languages"/>
    <language id="tut" name="Altaic (Other)"/>
    <language id="amh" name="Amharic"/>
    <language id="apa" name="Apache languages"/>
    <language id="ara" name="Arabic"/>
    <language id="arc" name="Aramaic"/>
    <language id="arp" name="Arapaho"/>
    <language id="arn" name="Araucanian"/>
    <language id="arw" name="Arawak"/>
    <language id="arm" name="Armenian" secondary="hye"/>
    <language id="art" name="Artificial (Other)"/>
    <language id="asm" name="Assamese"/>
    <language id="ath" name="Athapascan languages"/>
    <language id="map" name="Austronesian (Other)"/>
    <language id="ava" name="Avaric"/>
    <language id="ave" name="Avestan"/>
    <language id="awa" name="Awadhi"/>
    <language id="aym" name="Aymara"/>
    <language id="aze" name="Azerbaijani"/>
    <language id="nah" name="Aztec"/>
    <language id="ban" name="Balinese"/>
    <language id="bat" name="Baltic (Other)"/>
    <language id="bal" name="Baluchi"/>
    <language id="bam" name="Bambara"/>
    <language id="bai" name="Bamileke languages"/>
    <language id="bad" name="Banda"/>
    <language id="bnt" name="Bantu (Other)"/>
    <language id="bas" name="Basa"/>
    <language id="bak" name="Bashkir"/>
    <language id="baq" name="Basque" secondary="eus"/>
    <language id="bej" name="Beja"/>
    <language id="bem" name="Bemba"/>
    <language id="ben" name="Bengali"/>
    <language id="ber" name="Berber (Other)"/>
    <language id="bho" name="Bhojpuri"/>
    <language id="bih" name="Bihari"/>
    <language id="bik" name="Bikol"/>
    <language id="bin" name="Bini"/>
    <language id="bis" name="Bislama"/>
    <language id="bra" name="Braj"/>
    <language id="bre" name="Breton"/>
    <language id="bug" name="Buginese"/>
    <language id="bul" name="Bulgarian"/>
    <language id="bua" name="Buriat"/>
    <language id="bur" name="Burmese" secondary="mya"/>
    <language id="bel" name="Byelorussian"/>
    <language id="cad" name="Caddo"/>
    <language id="car" name="Carib"/>
    <language id="cat" name="Catalan"/>
    <language id="cau" name="Caucasian (Other)"/>
    <language id="ceb" name="Cebuano"/>
    <language id="cel" name="Celtic (Other)"/>
    <language id="cai" name="Central American Indian (Other)"/>
```

```
<language id="chg" name="Chagatai"/>
<language id="cha" name="Chamorro"/>
<language id="che" name="Chechen"/>
<language id="chr" name="Cherokee"/>
<language id="chy" name="Cheyenne"/>
<language id="chb" name="Chibcha"/>
<language id="chi" name="Chinese" secondary="zho"/>
<language id="chn" name="Chinook jargon"/>
<language id="cho" name="Choctaw"/>
<language id="chu" name="Church Slavic"/>
<language id="chv" name="Chuvash"/>
<language id="cop" name="Coptic"/>
<language id="cor" name="Cornish"/>
<language id="cos" name="Corsican"/>
<language id="cre" name="Cree"/>
<language id="mus" name="Creek"/>
<language id="crp" name="Creoles and Pidgins (Other)"/>
<language id="cpe" name="Creoles and Pidgins, English-based (Other)"/>
<language id="cpf" name="Creoles and Pidgins, French-based (Other)"/>
<language id="cpp" name="Creoles and Pidgins, Portuguese-based (Other)"/>
<language id="hrv" name="Croatian"/>
<language id="cus" name="Cushitic (Other)"/>
<language id="ces" name="Czech" secondary="cze"/>
<language id="dak" name="Dakota"/>
<language id="dan" name="Danish"/>
<language id="del" name="Delaware"/>
<language id="din" name="Dinka"/>
<language id="div" name="Divehi"/>
<language id="doi" name="Dogri"/>
<language id="dra" name="Dravidian (Other)"/>
<language id="dua" name="Duala"/>
<language id="dut" name="Dutch" secondary="nla"/>
<language id="dum" name="Dutch, Middle (ca. 1050-1350)"/>
<language id="dyu" name="Dyula"/>
<language id="dzo" name="Dzongkha"/>
<language id="efi" name="Efik"/>
<language id="egy" name="Egyptian (Ancient)"/>
<language id="eka" name="Ekajuk"/>
<language id="elx" name="Elamite"/>
<language id="eng" name="English"/>
<language id="enm" name="English, Middle (ca. 1100-1500)"/>
<language id="ang" name="English, Old (ca. 450-1100)"/>
<language id="esk" name="Eskimo (Other)"/>
<language id="epo" name="Esperanto"/>
<language id="est" name="Estonian"/>
<language id="ewe" name="Ewe"/>
<language id="ewo" name="Ewondo"/>
<language id="fan" name="Fang"/>
<language id="fat" name="Fanti"/>
<language id="fao" name="Faroese"/>
<language id="fij" name="Fijian"/>
<language id="fin" name="Finnish"/>
<language id="fiu" name="Finno-Ugrian (Other)"/>
<language id="fon" name="Fon"/>
<language id="fra" name="French" secondary="fre"/>
<language id="frm" name="French, Middle (ca. 1400-1600)"/>
<language id="fro" name="French, Old (842- ca. 1400)"/>
<language id="fry" name="Frisian"/>
<language id="ful" name="Fulah"/>
<language id="gaa" name="Ga"/>
<language id="gae" name="(Scots)" secondary="gdh"/>
<language id="glg" name="Gallegan"/>
<language id="lug" name="Ganda"/>
<language id="gay" name="Gayo"/>
<language id="gez" name="Geez"/>
<language id="geo" name="Georgian" secondary="kat"/>
<language id="deu" name="German" secondary="ger"/>
<language id="gmh" name="German, Middle High (ca. 1050-1500)"/>
<language id="goh" name="German, Old High (ca. 750-1050)"/>
<language id="gem" name="Germanic (Other)"/>
<language id="gil" name="Gilbertese"/>
<language id="gon" name="Gondi"/>
<language id="got" name="Gothic"/>
<language id="grb" name="Grebo"/>
<language id="grc" name="Greek, Ancient (to 1453)"/>
<language id="ell" name="Greek, Modern (1453-)" secondary="gre"/>
<language id="kal" name="Greenlandic"/>
<language id="grn" name="Guarani"/>
<language id="guj" name="Gujarati"/>
<language id="hai" name="Haida"/>
<language id="hau" name="Hausa"/>
<language id="haw" name="Hawaiian"/>
```

```
<language id="heb" name="Hebrew"/>
<language id="her" name="Herero"/>
<language id="hil" name="Hiligaynon"/>
<language id="him" name="Himachali"/>
<language id="hin" name="Hindi"/>
<language id="hmo" name="Hiri Motu"/>
<language id="hun" name="Hungarian"/>
<language id="hup" name="Hupa"/>
<language id="iba" name="Iban"/>
<language id="ice" name="Icelandic" secondary="isl"/>
<language id="ibo" name="Igbo"/>
<language id="ijo" name="Ijo"/>
<language id="ilo" name="Iloko"/>
<language id="inc" name="Indic (Other)"/>
<language id="ine" name="Indo-European (Other)"/>
<language id="ind" name="Indonesian"/>
<language id="ina" name="Interlingua (International Auxiliary language Association)"/>
<language id="ine" name="Interlingue"/>
<language id="iku" name="Inuktitut"/>
<language id="ipk" name="Inupiak"/>
<language id="ira" name="Iranian (Other)"/>
<language id="gai" name="Irish" secondary="iri"/>
<language id="sga" name="Irish, Old (to 900)"/>
<language id="mga" name="Irish, Middle (900 - 1200)"/>
<language id="iro" name="Iroquoian languages"/>
<language id="ita" name="Italian"/>
<language id="jpn" name="Japanese"/>
<language id="jav" name="Javanese" secondary="jaw"/>
<language id="jrb" name="Judeo-Arabic"/>
<language id="jpr" name="Judeo-Persian"/>
<language id="kab" name="Kabyle"/>
<language id="kac" name="Kachin"/>
<language id="kam" name="Kamba"/>
<language id="kan" name="Kannada"/>
<language id="kau" name="Kanuri"/>
<language id="kaa" name="Kara-Kalpak"/>
<language id="kar" name="Karen"/>
<language id="kas" name="Kashmiri"/>
<language id="kaw" name="Kawi"/>
<language id="kaz" name="Kazakh"/>
<language id="kha" name="Khasi"/>
<language id="khm" name="Khmer"/>
<language id="khi" name="Khoisan (Other)"/>
<language id="kho" name="Khotanese"/>
<language id="kik" name="Kikuyu"/>
<language id="kin" name="Kinyarwanda"/>
<language id="kir" name="Kirghiz"/>
<language id="kom" name="Komi"/>
<language id="kon" name="Kongo"/>
<language id="kok" name="Konkani"/>
<language id="kor" name="Korean"/>
<language id="kpe" name="Kpelle"/>
<language id="kro" name="Kru"/>
<language id="kua" name="Kuanyama"/>
<language id="kum" name="Kumyk"/>
<language id="kur" name="Kurdish"/>
<language id="kru" name="Kurukh"/>
<language id="kus" name="Kusaie"/>
<language id="kut" name="Kutenai"/>
<language id="lad" name="Ladino"/>
<language id="lah" name="Lahnda"/>
<language id="lam" name="Lamba"/>
<language id="oci" name="Langue d'Oc (post 1500)"/>
<language id="lao" name="Lao"/>
<language id="lat" name="Latin"/>
<language id="lav" name="Latvian"/>
<language id="ltz" name="Letzeburgesch"/>
<language id="lez" name="Lezghian"/>
<language id="lin" name="Lingala"/>
<language id="lit" name="Lithuanian"/>
<language id="loz" name="Lozi"/>
<language id="lub" name="Luba-Katanga"/>
<language id="lui" name="Luiseno"/>
<language id="lun" name="Lunda"/>
<language id="luo" name="Luo (Kenya and Tanzania)"/>
<language id="mac" name="Macedonian" secondary="mak"/>
<language id="mad" name="Madurese"/>
<language id="mag" name="Magahi"/>
<language id="mai" name="Maithili"/>
<language id="mak" name="Makasar"/>
<language id="mlg" name="Malagasy"/>
<language id="may" name="Malay" secondary="msa"/>
```

```
<language id="mal" name="Malayalam"/>
<language id="mlt" name="Maltese"/>
<language id="man" name="Mandingo"/>
<language id="mni" name="Manipuri"/>
<language id="mno" name="Manobo languages"/>
<language id="max" name="Manx"/>
<language id="mao" name="Maori" secondary="mri"/>
<language id="mar" name="Marathi"/>
<language id="chm" name="Mari"/>
<language id="mah" name="Marshall"/>
<language id="mwr" name="Marwari"/>
<language id="mas" name="Masai"/>
<language id="myn" name="Mayan languages"/>
<language id="men" name="Mende"/>
<language id="mic" name="Micmac"/>
<language id="min" name="Minangkabau"/>
<language id="mis" name="Miscellaneous (Other)"/>
<language id="moh" name="Mohawk"/>
<language id="mol" name="Moldavian"/>
<language id="mkh" name="Mon-Kmer (Other)"/>
<language id="lol" name="Mongo"/>
<language id="mon" name="Mongolian"/>
<language id="mos" name="Mossi"/>
<language id="mul" name="Multiple languages"/>
<language id="mun" name="Munda languages"/>
<language id="nau" name="Nauru"/>
<language id="nav" name="Navajo"/>
<language id="nde" name="Ndebele, North"/>
<language id="nbl" name="Ndebele, South"/>
<language id="ndo" name="Ndongo"/>
<language id="nep" name="Nepali"/>
<language id="new" name="Newari"/>
<language id="nic" name="Niger-Kordofanian (Other)"/>
<language id="ssa" name="Nilo-Saharan (Other)"/>
<language id="niu" name="Niuean"/>
<language id="non" name="Norse, Old"/>
<language id="nai" name="North American Indian (Other)"/>
<language id="nor" name="Norwegian"/>
<language id="nno" name="Norwegian (Nynorsk)"/>
<language id="nub" name="Nubian languages"/>
<language id="nym" name="Nyamwezi"/>
<language id="nya" name="Nyanja"/>
<language id="nyn" name="Nyankole"/>
<language id="nyo" name="Nyoro"/>
<language id="nzi" name="Nzima"/>
<language id="oji" name="Ojibwa"/>
<language id="ori" name="Oriya"/>
<language id="orm" name="Oromo"/>
<language id="osa" name="Osage"/>
<language id="oss" name="Ossetic"/>
<language id="oto" name="Otomian languages"/>
<language id="pal" name="Pahlavi"/>
<language id="pau" name="Palauan"/>
<language id="pli" name="Pali"/>
<language id="pam" name="Pampanga"/>
<language id="pag" name="Pangasinan"/>
<language id="pan" name="Panjabi"/>
<language id="pap" name="Papiamento"/>
<language id="paa" name="Papuan-Australian (Other)"/>
<language id="fas" name="Persian" secondary="per"/>
<language id="peo" name="Persian, Old (ca 600 - 400 B.C.)"/>
<language id="phn" name="Phoenician"/>
<language id="pol" name="Polish"/>
<language id="pon" name="Ponape"/>
<language id="por" name="Portuguese"/>
<language id="pra" name="Prakrit languages"/>
<language id="pro" name="Provencal, Old (to 1500)"/>
<language id="pus" name="Pushto"/>
<language id="que" name="Quechua"/>
<language id="roh" name="Rhaeto-Romance"/>
<language id="raj" name="Rajasthani"/>
<language id="rar" name="Rarotongan"/>
<language id="roa" name="Romance (Other)"/>
<language id="ron" name="Romanian" secondary="rum"/>
<language id="rom" name="Romany"/>
<language id="run" name="Rundi"/>
<language id="rus" name="Russian"/>
<language id="sal" name="Salishan languages"/>
<language id="sam" name="Samaritan Aramaic"/>
<language id="smi" name="Sami languages"/>
<language id="smo" name="Samoan"/>
<language id="sad" name="Sandawe"/>
```

```
<language id="sag" name="Sango"/>
<language id="san" name="Sanskrit"/>
<language id="srd" name="Sardinian"/>
<language id="sco" name="Scots"/>
<language id="sel" name="Selkup"/>
<language id="sem" name="Semitic (Other)"/>
<language id="scr" name="Serbo-Croatian"/>
<language id="srr" name="Serer"/>
<language id="shn" name="Shan"/>
<language id="sna" name="Shona"/>
<language id="sid" name="Sidamo"/>
<language id="bla" name="Siksika"/>
<language id="snd" name="Sindhi"/>
<language id="sin" name="Singhalese"/>
<language id="sit" name="Sino-Tibetan (Other)"/>
<language id="sio" name="Siouan languages"/>
<language id="sla" name="Slavic (Other)"/>
<language id="ssw" name="Siswant"/>
<language id="slk" name="Slovak" secondary="slo"/>
<language id="slv" name="Slovenian"/>
<language id="sog" name="Sogdian"/>
<language id="som" name="Somali"/>
<language id="son" name="Songhai"/>
<language id="wen" name="Sorbian languages"/>
<language id="nso" name="Sotho, Northern"/>
<language id="sot" name="Sotho, Southern"/>
<language id="sai" name="South American Indian (Other)"/>
<language id="esl" name="Spanish" secondary="spa"/>
<language id="suk" name="Sukuma"/>
<language id="sux" name="Sumerian"/>
<language id="sun" name="Sudanese"/>
<language id="sus" name="Susu"/>
<language id="swa" name="Swahili"/>
<language id="ssw" name="Swazi"/>
<language id="sve" name="Swedish" secondary="swe"/>
<language id="syr" name="Syriac"/>
<language id="tgl" name="Tagalog"/>
<language id="tah" name="Tahitian"/>
<language id="tgk" name="Tajik"/>
<language id="tmh" name="Tamashek"/>
<language id="tam" name="Tamil"/>
<language id="tat" name="Tatar"/>
<language id="tel" name="Telugu"/>
<language id="ter" name="Tereno"/>
<language id="tha" name="Thai"/>
<language id="bod" name="Tibetan" secondary="tib"/>
<language id="tig" name="Tigre"/>
<language id="tir" name="Tigrinya"/>
<language id="tem" name="Timne"/>
<language id="tiv" name="Tivi"/>
<language id="tli" name="Tlingit"/>
<language id="tog" name="Tonga (Nyasa)"/>
<language id="ton" name="Tonga (Tonga Islands)"/>
<language id="tru" name="Truk"/>
<language id="tsi" name="Tsimshian"/>
<language id="tso" name="Tsonga"/>
<language id="tsn" name="Tswana"/>
<language id="tum" name="Tumbuka"/>
<language id="tur" name="Turkish"/>
<language id="ota" name="Turkish, Ottoman (1500 - 1928)"/>
<language id="tuk" name="Turkmen"/>
<language id="tyv" name="Tuvinian"/>
<language id="twi" name="Twi"/>
<language id="uga" name="Ugaritic"/>
<language id="uig" name="Uighur"/>
<language id="ukr" name="Ukrainian"/>
<language id="umb" name="Umbundu"/>
<language id="und" name="Undetermined"/>
<language id="urd" name="Urdu"/>
<language id="uzb" name="Uzbek"/>
<language id="vai" name="Vai"/>
<language id="ven" name="Venda"/>
<language id="vie" name="Vietnamese"/>
<language id="vol" name="Volap&amp;#252;k"/>
<language id="vot" name="Votic"/>
<language id="wak" name="Wakashan languages"/>
<language id="wal" name="Walamo"/>
<language id="war" name="Waray"/>
<language id="was" name="Washo"/>
<language id="cym" name="Welsh" secondary="wel"/>
<language id="wol" name="Wolof"/>
<language id="xho" name="Xhosa"/>
```

```
<language id="sah" name="Yakut"/>
<language id="yao" name="Yao"/>
<language id="yap" name="Yap"/>
<language id="yid" name="Yiddish"/>
<language id="yor" name="Yoruba"/>
<language id="zap" name="Zapotec"/>
<language id="zen" name="Zenaga"/>
<language id="zha" name="Zhuang"/>
```

```
    <language id="zul" name="Zulu"/>
    <language id="zun" name="Zuni"/>
</languages>
```

Genres:

```
<group name="">
        <type value="0" name=""/>
    </group>
    <group name="Movie/Drama">
        <type value="16" name="general"/>
        <type value="17" name="detective/thriller"/>
        <type value="18" name="adventure/western/war"/>
        <type value="19" name="science/fiction"/>
        <type value="20" name="comedy"/>
        <type value="21" name="soap/melodrama/folkloric"/>
        <type value="22" name="romance"/>
        <type value="23" name="serious/classical/religious/historical movie/drama"/>
        <type value="24" name="adult/movie"/>
    </group>
    <group name="News/Current affairs">
        <type value="32" name="general"/>
        <type value="33" name="news/weather report"/>
        <type value="34" name="news magazine"/>
        <type value="35" name="documentary"/>
        <type value="36" name="discussion/interview/debate"/>
    </group>
    <group name="Show/Game show">
        <type value="48" name="general"/>
        <type value="49" name="game show/quiz/contest"/>
        <type value="50" name="variety show"/>
        <type value="51" name="talk show"/>
    </group>
    <group name="Sports">
        <type value="64" name="general"/>
        <type value="65" name="special events (Olympic Games, World Cup etc.)"/>
        <type value="66" name="sports magazines"/>
        <type value="67" name="football/soccer"/>
        <type value="68" name="tennis/squash"/>
        <type value="69" name="team sports (excluding football)"/>
        <type value="70" name="athletics"/>
        <type value="71" name="motor sport"/>
        <type value="72" name="water sport"/>
        <type value="73" name="winter sports"/>
        <type value="74" name="equestrian"/>
        <type value="75" name="martial sports"/>
    </group>
    <group name="Children's/Youth programmes">
        <type value="80" name="general"/>
        <type value="81" name="pre-school children's programmes"/>
        <type value="82" name="entertainment programmes from 6 to 14"/>
        <type value="83" name="entertainment programmes from 10 to 16"/>
        <type value="84" name="informational/educational/school programmes"/>
        <type value="85" name="cartoons/puppets"/>
    </group>
    <group name="Music/Ballet/Dance">
        <type value="96" name="general"/>
        <type value="97" name="rock/pop"/>
        <type value="98" name="serious music/classical music"/>
        <type value="99" name="folk/traditional music"/>
        <type value="100" name="jazz"/>
        <type value="101" name="musical/opera"/>
        <type value="102" name="ballet"/>
    </group>
    <group name="Arts/Culture (without music)">
        <type value="112" name="general"/>
        <type value="113" name="performing arts"/>
        <type value="114" name="fine arts"/>
        <type value="115" name="religion"/>
        <type value="116" name="popular culture/traditional arts"/>
        <type value="117" name="literature"/>
        <type value="118" name="film/cinema"/>
        <type value="119" name="experimantal film/video"/>
        <type value="120" name="broadcasting/press"/>
        <type value="121" name="new media"/>
        <type value="122" name="arts/culture magazines"/>
```

```
    <type value="123" name="fashion"/>
</group>
<group name="Social/Political issues/Economics">
    <type value="128" name="general"/>
    <type value="129" name="magazines/reports/documentary"/>
    <type value="130" name="economics/social advisory"/>
    <type value="131" name="remarkable people"/>
</group>
<group name="Educational/Science/Factual topics">
    <type value="144" name="general"/>
    <type value="145" name="nature/animals/environment"/>
    <type value="146" name="technology/natural sciences"/>
    <type value="147" name="medicine/physiology/psychology"/>
    <type value="148" name="foreign countries/expeditions"/>
    <type value="149" name="social/spiritual sciences"/>
    <type value="150" name="further education"/>
    <type value="151" name="languages"/>
</group>
<group name="Leisure hobbies">
    <type value="160" name="general"/>
    <type value="161" name="tourism/travel"/>
    <type value="162" name="handicraft"/>
    <type value="163" name="motoring"/>
    <type value="164" name="fitness &amp;amp; health"/>
    <type value="165" name="cooking"/>
    <type value="166" name="advertisement/shopping"/>
    <type value="167" name="gardening"/>
</group>
<group name="Special characteristics">
    <type value="176" name="original language"/>
    <type value="177" name="black &amp;amp; white"/>
```

```
        <type value="178" name="unpublished"/>
        <type value="179" name="live broadcast"/>
    </group>
```

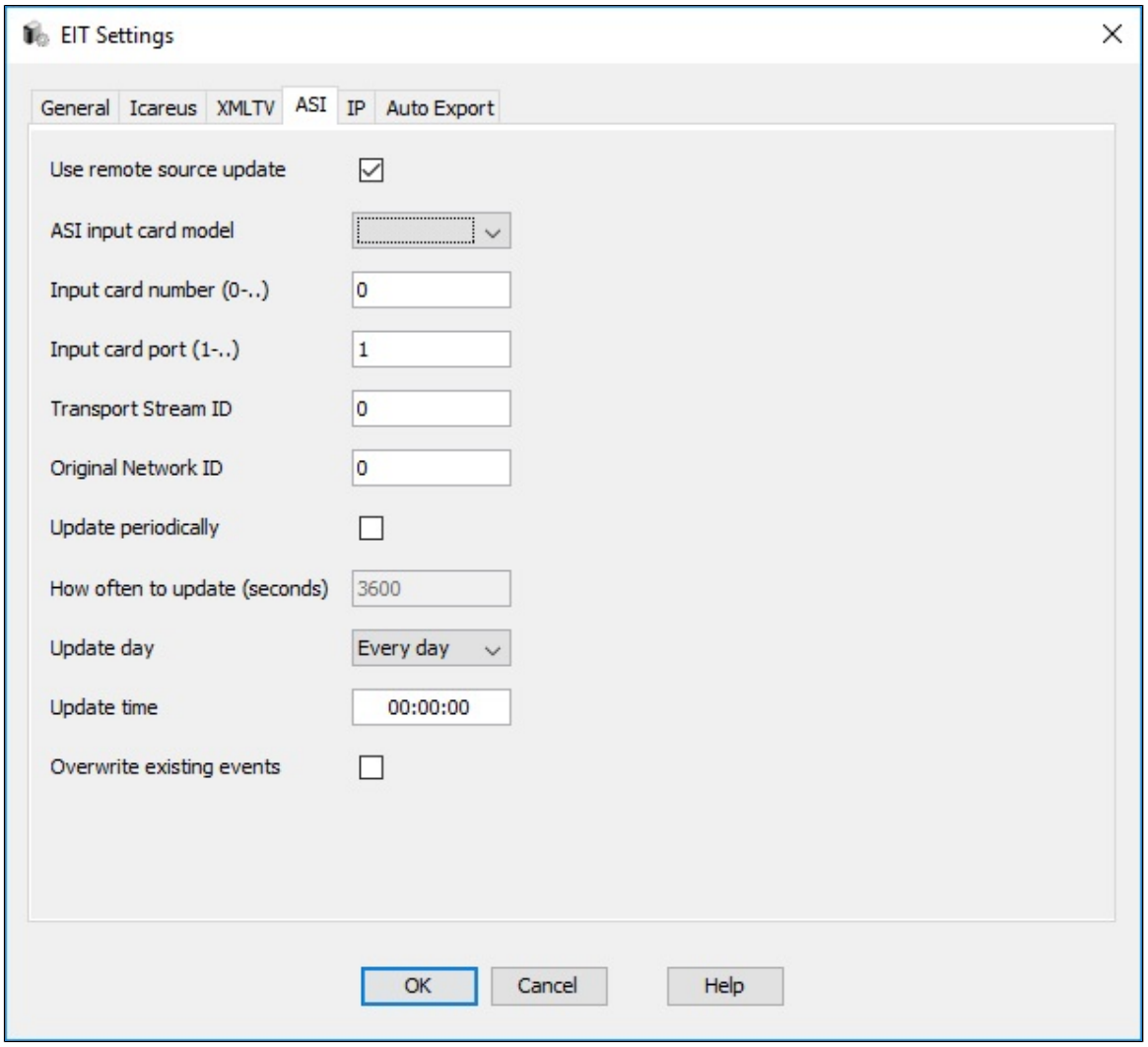
ASI INPUT DATASOURCE

INTRODUCTION

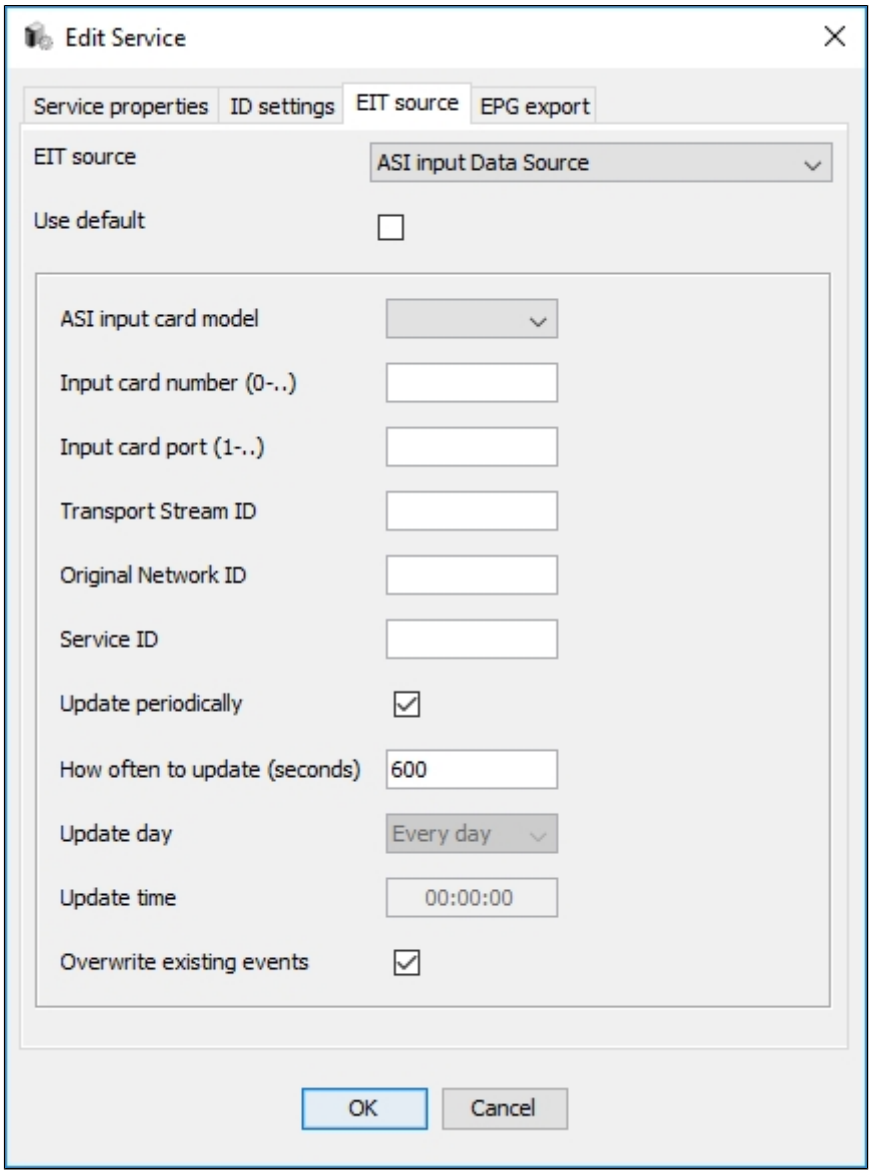
It is possible to fetch EIT events directly from a transport stream sent sent to the Dektec ASI card. A Dektec card with a ASI input port is required for that: e.g. DTA-2144B.

SETTINGS

To define general settings for the ASI Input Data source select menu "Server -> Settings -> EIT -> ASI":



To define settings separately for each service right click on the service and select "Edit Service -> EIT source -> ASI input Data Source":



The parameters are:

- ASI input card model - a Dektec card that supports ASI-input feature
- Input card number (0-..) - if there are several similar cards installed, it is possible to define which exactly card to use
- Input card port (1-..) - if there are several ports on the card, it is possible to define which port to use
- Transport Stream ID - The ID of the transport stream that should be used
- Original Network ID - The ID of the original network that should be used
- Service ID - The ID of the service from the transport stream to use
- Port (1-..) - The port number used for transport stream transmission
- Update periodically - this flag defines if events should be fetched periodically
- How often to update (seconds) - the period of the update measured in seconds
- Update day - the day of a week to fetch events
- Updae time - the time of a day to fetch events
- Overwrite existing events - this flag defines if received events should overwrite existing events

IP INPUT DATA SOURCE

INTRODUCTION

It is possible to fetch EIT events directly from a transport stream sent over IP network using UDP or RTP. A Dektec card with a network port is required for that: DTA-160, DTA-2160 or DTA-2162. This network card should be configured beforehand in the operating system and should be connected to the network.

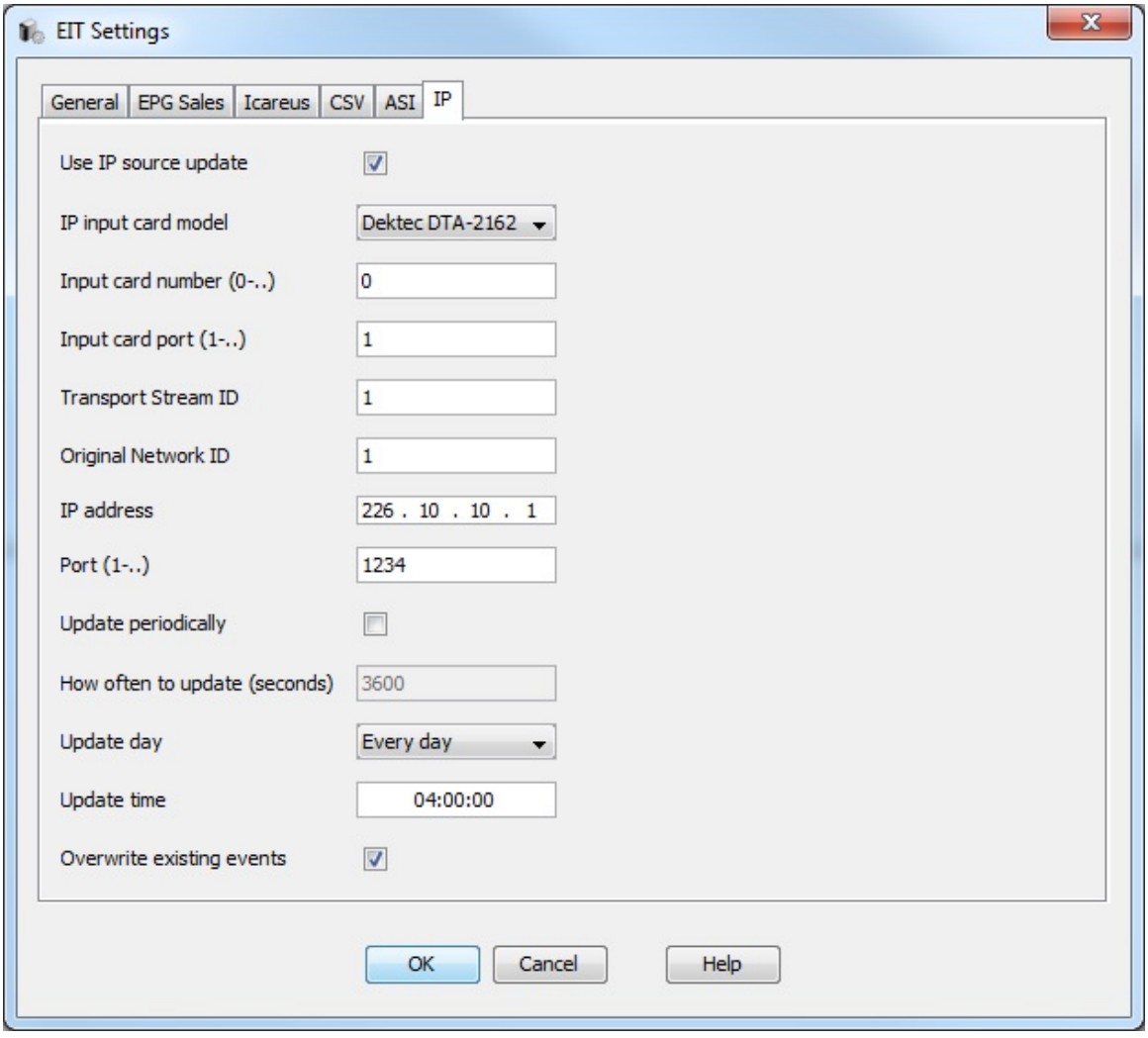
⚠ This configuration help assumes that user has verified and configured that the incoming multicast is received by the Dektec card.

Please refer to separate chapter of Icareus Playout manual.

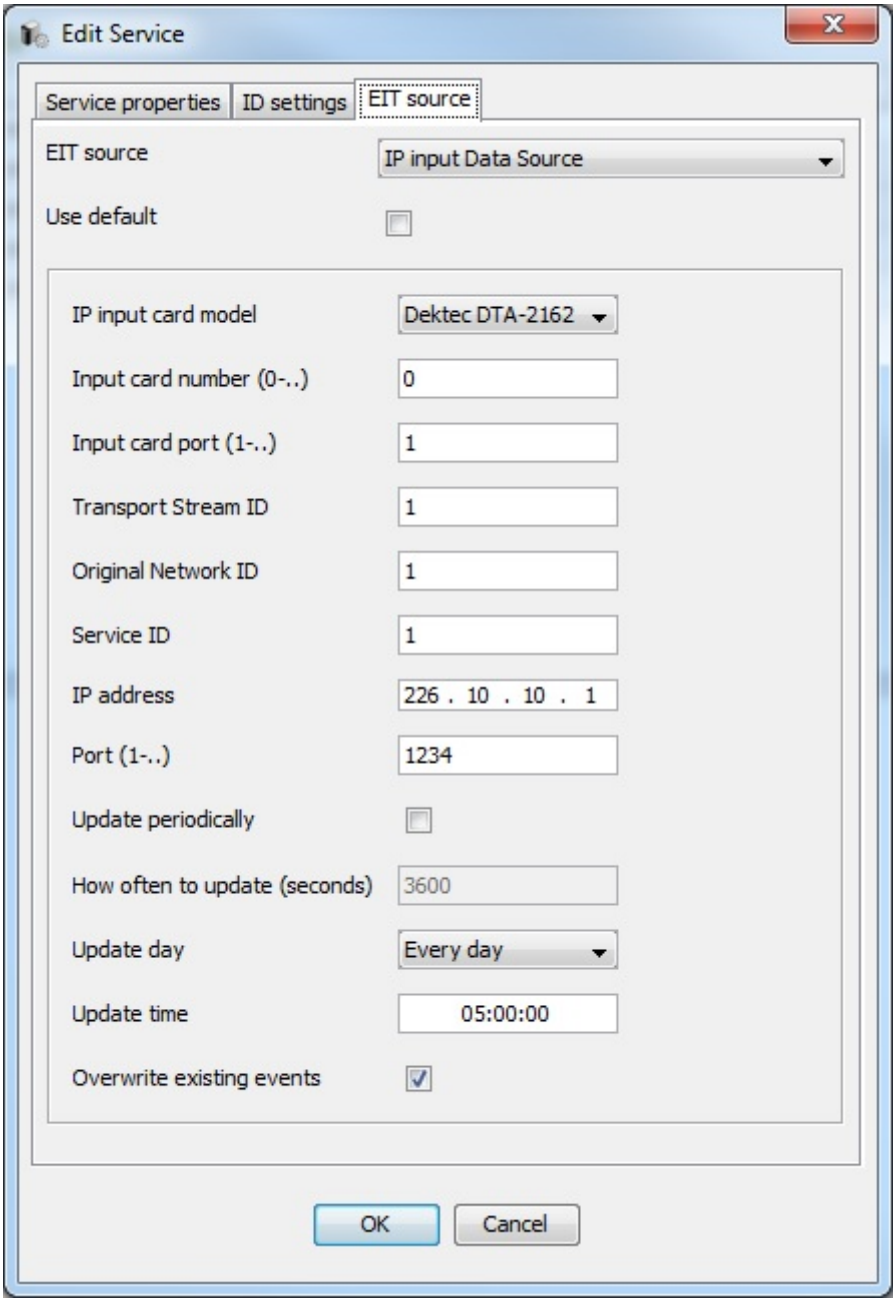
SETTINGS

To define general settings for the IP Input Data source select menu "Server -> Settings -> EIT -> IP".

ℹ This configuration requires that the channel/service ID in Icareus PLayout matches the channel ID found from the incoming transport stream.



To define settings separately for each service right click on the service and select "Edit Service -> EIT source -> IP input Data Source":



The parameters are:

- IP input card model - a Dektec card that supports TS-over-IP feature
- Input card number (0-..) - if there are several similar cards installed, it is possible to define which exactly card to use
- Input card port (1-..) - if there are several ports on the card, it is possible to define which port to use
- Transport Stream ID - The ID of the incoming transport stream that should be used
- Original Network ID - The ID of the incoming original network that should be used
- Service ID - The ID of the incoming service from the transport stream to use
- IP address - The multicast IP address that is used to deliver the incoming transport stream
- Port (1-..) - The port number used for transport stream transmission
- Update periodically - this flag defines if events should be fetched periodically
- How often to update (seconds) - the period of the update measured in seconds
- Update day - the day of a week to fetch events
- Updae time - the time of a day to fetch events
- Overwrite existing events - this flag defines if received events should overwrite existing events

EPG EVENT STRUCTURE

Name	Description	Comments	
General event data			
start_time	This field contains the start time of the event		Mandatory
duration	This field contains the duration of the event in hours, minutes, seconds		Mandatory
content_type	This field defines content identifier	Content type codes	Mandatory
image_icon	The image icon carries inline icon data or a URL that identifies the location of an icon file.		Optional
running_status	This field indicates the status of the event	Field value is defined automatically. Possible values are: • 0 - undefined • 1 - not running • 2 - starts in a few seconds • 4 - running	Mandatory
free_CA_mode	This field, when set to '0' indicates that all the component streams of the event are not scrambled. When set to '1' it indicates that access to one or more streams is controlled by a CA system.		Mandatory
Event titles description		It is possible to define titles for one or more different languages.	
language_code	This field identifies the language of the following text fields	Language codes	Mandatory
name	This field contains the name of the event		Mandatory
short-description	This field contains the short description of the event		Mandatory
long-description	This field contains the long description of the event		Mandatory
Parental control		It is possible to define parental control values for zero or more different countries.	Optional
country_code	This field identifies a country for parental control	Country codes	
rating	This field is coded based on the recommended minimum age in years of the end user	Values: 0x00 - undefined 0x01 to 0x0F - minimum age = rating + 3 years 0x10 to 0xFF - defined by the broadcaster	
Notification message		This field allows broadcasters to provide receivers with a textual message which the receiver may display to the user at appropriate times.	Optional
country_code	This field contains the ISO 639-2 three character language code of the language of the textual message.	Country codes	

text	This is a field containing a string of characters specifying the text to be displayed.		

EIT MANAGEMENT VIA PLAYOUT API

Icareus Playout provides an open Java API and IP based protocol that can be used to integrate to any 3rd party system. It enables full real-time control of the EIT table generation and content updates.

To read more see the chapter related to Playout API.

BARCOXML DATASOURCE

SAMPLE FILE

```
<?xml version='1.0' encoding='utf-8'?>
<ProgramGuide>
    <Service id='103' name='Animal Planet'>
        <ScheduleDay date='2013/12/31'>
            <Event id='21366427'>
                <IdentificationName>Bizarre Animal ER</IdentificationName>
                <StartDateTime>2013-12-31T17:45:00</StartDateTime>
                <EndDateTime>2013-12-31T18:10:00</EndDateTime>
                <ShortEventDescription>
                    <LanguageCode>ENG</LanguageCode>
                    <LanguageName>English</LanguageName>
                    <EventName>Bizarre Animal ER</EventName>
                    <EventDescription />
                </ShortEventDescription>
                <ExtendedEventDescription>
                    <LanguageCode>ENG</LanguageCode>
                    <LanguageName>English</LanguageName>
                    <EventDescription>Includes a dog that glued its mouth shut by accident, a foal with a
freaky fang growing out of its forehead, and stick insects that were seemingly resuscitated after a house
fire.
</EventDescription>
                </ExtendedEventDescription>
            </Event>
        </ScheduleDay>
    </Service>
</ProgramGuide>
```

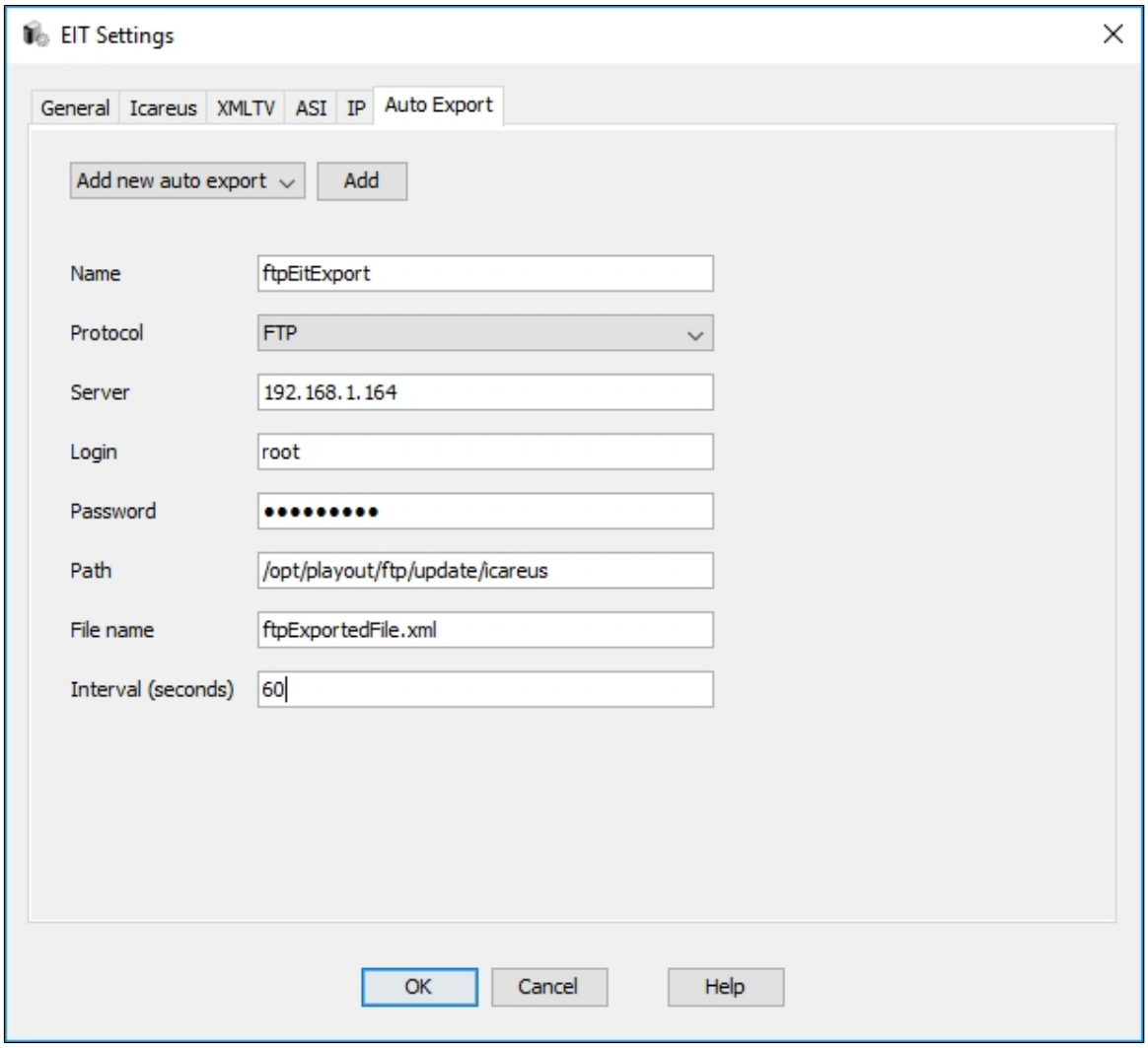
AUTO EXPORT EIT DATA

INTRODUCTION

Icareus Playout supports exporting EIT data automatically as Playout XML and Excel style text -format.

SETTINGS

To add a new configuration for the auto export select menu "Server -> Settings -> EIT -> Auto Export":



The parameters are:

- Add new auto export in combo box - this must always selected when adding the new configuration for auto exporting
- Add - press this button after configuring of the the new auto export is done
- Name - name for the auto export configuration
- Protocol - FTP or SFTP are the options
- Login - the login name for the remote server
- Password - the password for the previous login for the remote server
- Path - the path in remote server where exported file is transfered to
- File name - the name of the file for the exported EIT data
- Interval (seconds) - the period of the file exporting measured in seconds
- OK - after pressing this button, the Playout asks the root password that must be given

Remember to to press the "Add" button before pressing the "OK" button in order not to loose all the given data.

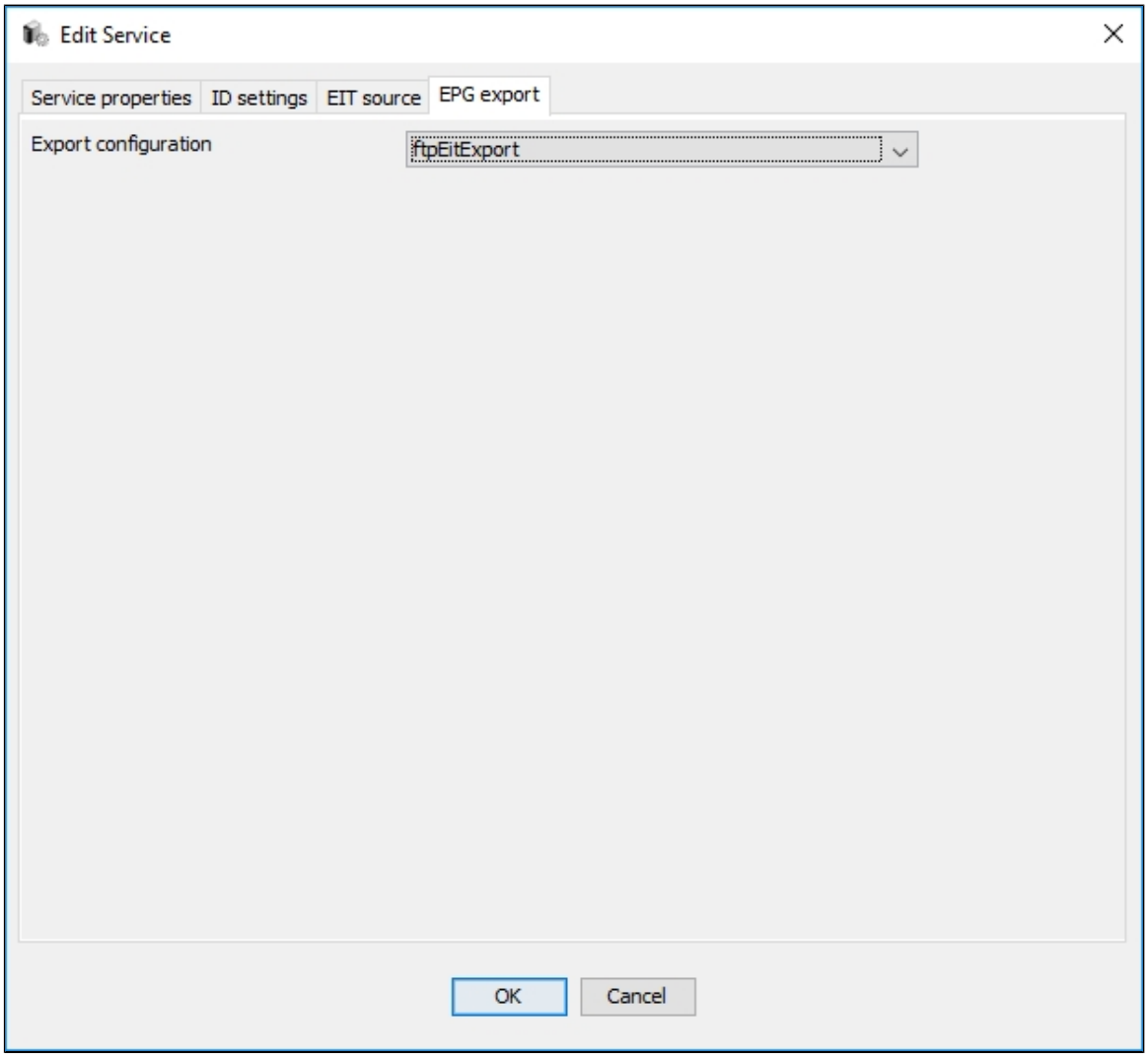
If an old configuration is selected from the combo box in upper left corner, there are "Update" and "remove" buttons instead of "Add" button. If you update old values, please remember to press the Update -button before pressing the OK -button in order not to loose the changed data.

If an option "SFTP" is selected from "Protocol" combo box, it would be good to check if the command "ssh <login>@<address>" from Playout server to the target server is successful. If not, then remove the line for that target server from the file "/root/.ssh/known_hosts" and run the previous command again. When asked "Are you sure you want to continue connecting", type "yes" and press "enter". After that you must type the password for given login for of the target server and press one more time "enter". This way we can trust that the SFTP file transfer is possible.

If an option "FTP" is selected from "Protocol" combo box, it would be good to check the files /etc/vsftpd/ftpusers and /etc/vsftpd/user_list. If e.g. login root is used, that user should be commented out from those files with # -character. After this the command "service vsftpd restart should be run". This way we can trust that the FTP file transfer is possible.

The "Path" for the exported file should be proportional to the home folder of ftp/sftp user.

To define settings separately for each service right click on the service and select "Edit Service -> EPG export. In this tab you see the combo box "Export configuration". Choose e.g the configuration that you just created, or some other configuration.



After pressing "OK" button, the desired auto export configuration is linked to the selected service and exporting

starts to run as configured in chosen auto export configuration.

TVPPOLONIA DATA SOURCE

INTRODUCTION

This XML data source is used by Telespazio. XML sources can be found from http://www.tvp.pl/prasa/TVPPOLONIA/xml_OMI/.

DATA SOURCE FORMAT

The data souce example looks like this:

```
<APCData date="2017-01-20" time="22:33:46" creator="KOLSZEWSKI" version="1.0" encoding="UTF-8">
<prrecord id="POZ-78372184F">
<PR_CODE>78372184</PR_CODE>
<PR_WEEKNUM>4</PR_WEEKNUM>
<PR_YEARNUM>2017</PR_YEARNUM>
<PR_AIRDATE>2017-01-22</PR_AIRDATE>
<REAL_DATE_TIME>2017-01-22 06:40:00</REAL_DATE_TIME>
<DAY>1</DAY>
<SENDER>TVPL</SENDER>
<SENDER_REG>TVPL</SENDER_REG>
<START>06:40:00</START>
<JAHR>2016</JAHR>
<MIN>49</MIN>
<TEIL>7</TEIL>
<TVON>12</TVON>
<CREATDATE>2016-12-13</CREATDATE>
<CREATTIME>17:31:09</CREATTIME>
<MODIFDATE>2017-01-20</MODIFDATE>
<MODIFTIME>17:33:12</MODIFTIME>
<GZDSTATUS>0</GZDSTATUS>
<PICCOUNT>0</PICCOUNT>
<TITEL>Night of the Proms - (1)</TITEL>
<STITEL>(1)</STITEL>
<TYP>koncert</TYP>
<PLRATING>0</PLRATING>
<RLANG>polski</RLANG>
<RTITEL>Night of the Proms</RTITEL>
<PRODUZ>MUSIC EVENTS POLAND Sp. z o.o.</PRODUZ>
<LTEXT>
<BR/>Opis<BR/>Night of the Proms to jedna z najwa?niejszych halowych imprez muzycznych na ?wiecie, która
narodzi?a si? <BR/>ponad 30 lat temu w Belgii. G?ówn? ide? tego przedsi?wzi?cia jest unikatowe po??czenie
muzyki klasycznej <BR/>z popularn? muzyk? rozrywkow? w wykonaniu najwi?kszych gwiazd. To interaktywna
zabawa z publiczno?ci?, <BR/>podczas której nowy wymiar przebojom muzyki pop nadaje kilkudziesi?cioosobowa
orkiestra symfoniczna <BR/>oraz chór. <BR/>Night of the Proms od wielu lat regularnie odbywa si? m.in. w
Belgii, Holandii, Niemczech, Danii, Francji i USA. <BR/>Na scenach pojawia?y si? takie gwiazdy, jak:
Sting, Andrea Bocelli, James Brown, Joe Cocker, Seal i wielu innych. <BR/>W Polsce impreza po raz pierwszy
odby?a si? w 2014 roku. Wyst?pili wówczas: THE OMD, Amy Macdonald, <BR/>John Miles oraz Natalia Kukulska.
W kolejnych latach w ramach Night of the Proms Polsk? odwiedzili tak?e Katie Melua<BR/>i Kim Wilde w 2015
r. , Zucchero i Lisa Stansfield w 2016 r. ??czna widownia wszystkich polskich koncertów <BR/>przekroczy?a
20 tysi?cy osób. <BR/>Piosenki: Don't You, Senza una donna, Over my Shoulder, Shout, I'm Outta Love, Blame
it on the Boogie, <BR/>Wish I Didn't Miss You, Dreadlock Holiday oraz utwory instrumentalne: Il Trovatore,
5th of Beethoven. <BR/><BR/>
</LTEXT>
<EPG>
Night of the Proms to jedna z najwa?niejszych halowych imprez muzycznych na ?wiecie, która narodzi?a si?
ponad 30 lat temu w Belgii. G?ówn? ide? tego przedsi?wzi?cia jest unikatowe po??czenie muzyki klasycznej z
popularn? muzyk? rozrywkow? w wyk. gwiazd.
</EPG>
<CATEGORIES>
<CELE>
<CEL>ROZRYWKA</CEL>
</CELE>
<FORMY>
<FORMA>KONCERT</FORMA>
</FORMY>
<TEMATYKI>
<TEMATYKA>MUZYKA POPULARNA/ROZRYWKOWA</TEMATYKA>
</TEMATYKI>
<ODBIORCY>
<ODBIORCA>OGÓ? PUBLICZNO?CI</ODBIORCA>
</ODBIORCY>
</CATEGORIES>
<ID_SZARP_CYKL>AUC-1306632U</ID_SZARP_CYKL>
<ID_SZARP_AUD>AUD-1659117E</ID_SZARP_AUD>
<AD>N</AD>
<JM>N</JM>
<NT>N</NT>
<PTITEL>Night of the Proms - (1)</PTITEL>
<PASMO>1</PASMO>
<INT>N</INT>
</prrecord>
</APCData>
```

Please note that it is important for Playout's EIT parser, that the time zone of server is the same as is meant to be in EIT source data. In other words, the server local time must be the same as the time used in EIT source data. This is due to the fact that the EIT source data does not include any information about used time zone.

2.1. MANAGING AIT AND DSM-CC CAROUSELS

INTRODUCTION

Icareus Playout Carousel Server is a playout system for delivery of DSM-CC object carousels, DSM-CC data carousels and related tables (e.g. AIT) over DVB services. Object carousels can be used for delivering MHP, hbbtv, tru2way or mheg-5 applications.

Icareus Playout CS100 Carousel Server allows the building and supervision of high quality value-added television services by multiplexing data in real-time. The data can be received from multiple sources: DVB-ASI feeds and IP-networks. All carousels are generated in real-time, and both the carousel content and AIT application signaling can be updated dynamically.

The server features a carousel repository that can be updated and read from concurrently. CS100 Carousel Server can in this way act as a carousel 'proxy server', and output carousels at a faster bitrate than they are being updated.

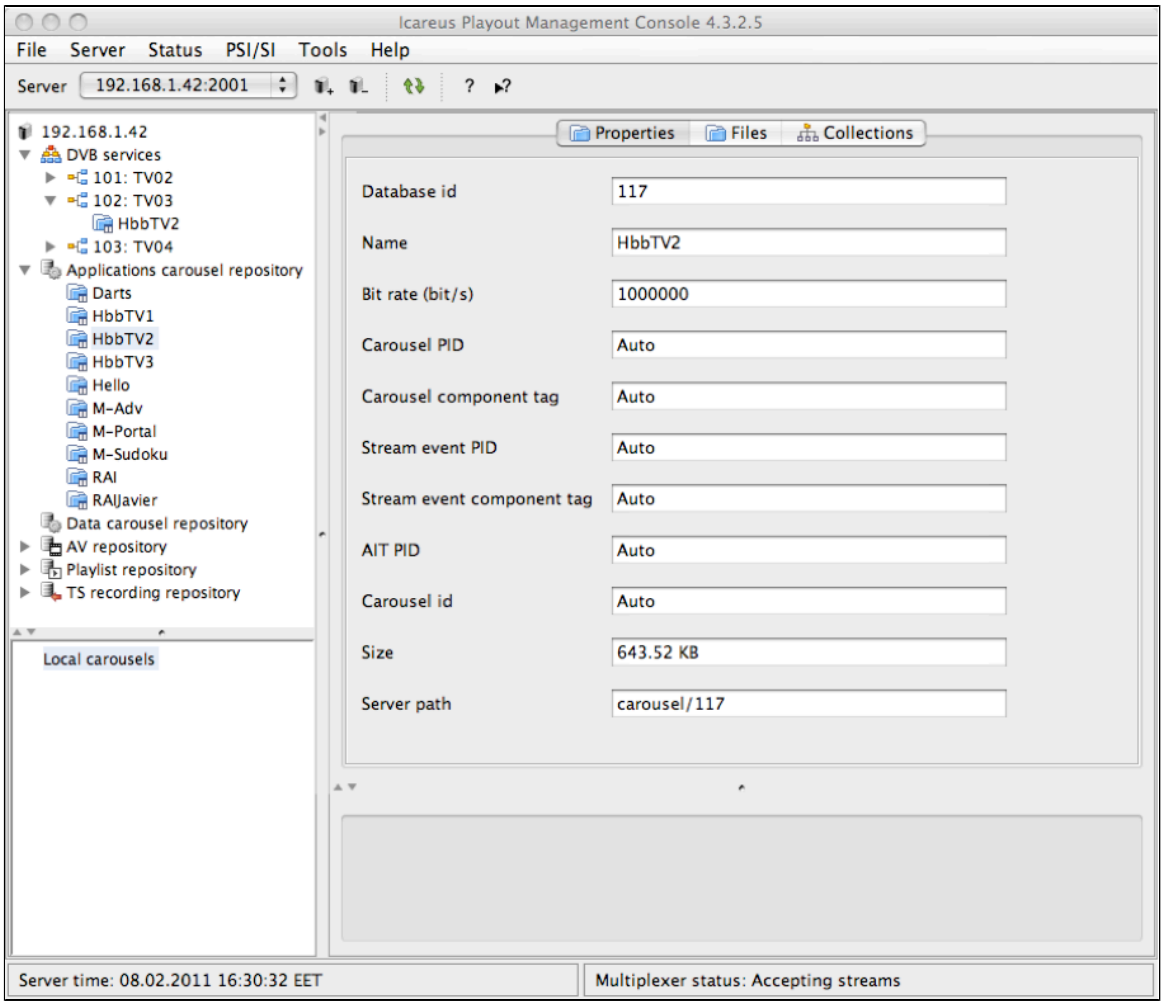
For carousel description, Playout Carousel Server uses a common Object Carousel Interoperability Format (OBCIG). OBCIG XML defines an interoperability format to support transfer of carousel content between content providers and broadcasting environments.

All Playout servers are equipped with a PID Server allocating identifier values to various tables and elementary streams. Icareus Playout CS100 Carousel Server can automatically assign ID values to all stream content it generates, either using the internal PID server process or from a common PID server within the network.

PLAYOUT MANAGEMENT CONSOLE

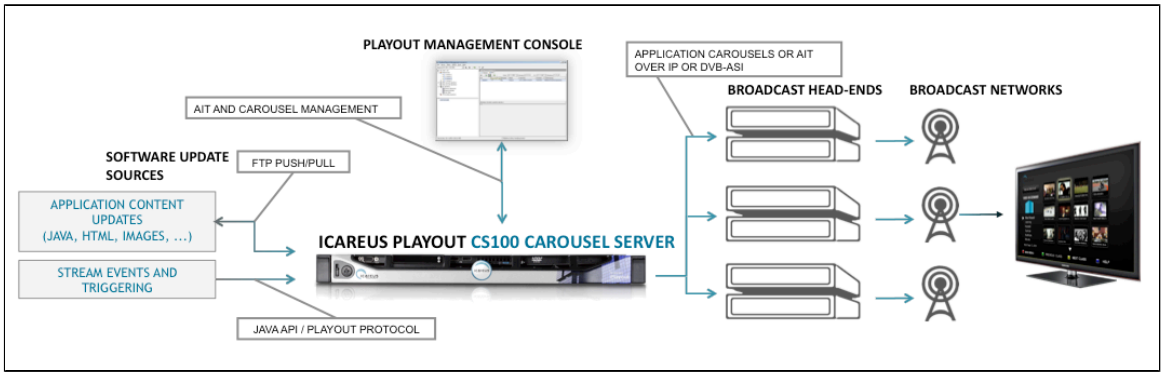
Playout Server is managed through Playout Management Console (PMC).

Below image shows Playout Management Console with TV Applications and an example configuration for a carousel.



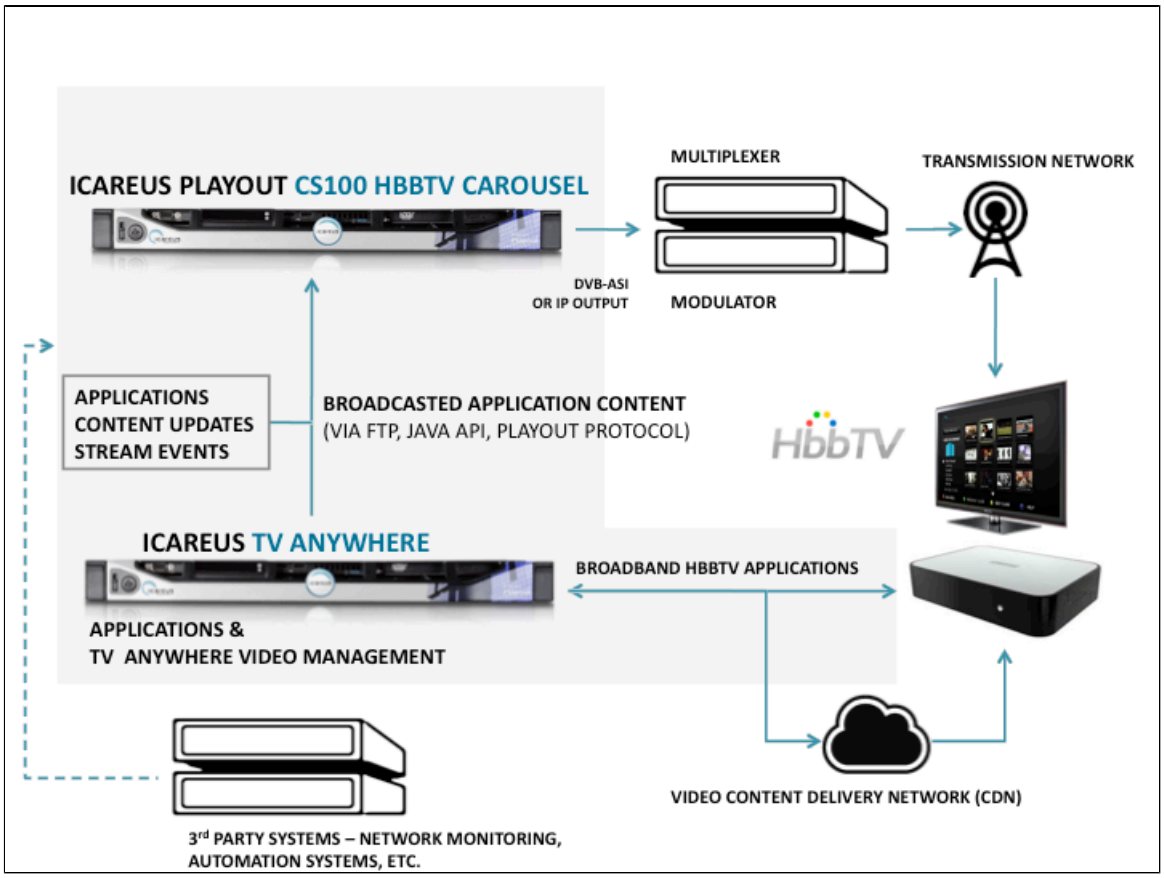
ARCHITECTURES

PLAYOUT CS100 HEAD-END DEPLOYMENT



EXAMPLE HEAD-END ARCHITECTURE FOR ICAREUS PLAYOUT CS CAROUSEL SERVER

EXAMPLE HEAD-END ARCHITECTURE WITH TV ANYWHERE



EXAMPLE HEAD-END ARCHITECTURE FOR HBBTV

KEY TERMS

APPLICATIONS

There are several standards for TV Applications, which are based on the same underlying delivery technology called DSM-CC datacarousels. Quite the contradictory is the front-end and application development technologies, which differ on different standards.

Icareus Carousel support the following standards for TV Applications

- HbbTV
- MHP
- MHEG-5
- Ginga
- Tru2Way

AIT

Application Information Table (AIT) is stream meta-data containing information about applications in a carousel.

DSM-CC CAROUSELS

Object carousels are the file system streams in which applications are sent to a receiver. When an application is running, the Playout Server streams the application directory, sending each file in the directory structure at time, starting from the first file again after last sent file.

NETWORKS AND OUTPUT

INTRODUCTION

The multinetwork feature in Icareus Playout opens the possibility to output several Networks (or Transport Streams over IP) from a single Playout server. Each Network may have it's own set of configuration parameters

as well as datacasting services.

The basic idea is to add DVB Services to a Network and by selecting Carousels and AITs for these DVB Services manage the distribution of TV Applications on different Networks. To output a e.g. HbbTV Application the following steps need to be done:

1. Create and configure a Network
2. Create a DVB Service and add it the the Network
3. Create a Application Carousel and add it to the DVB Service

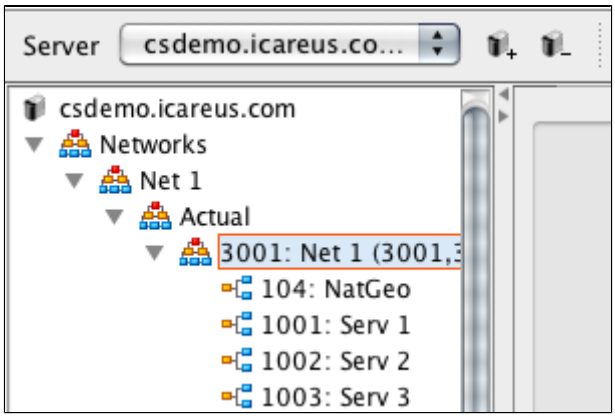
This gives the full flexibility to either have one DVB Service (and TV Applications) on one Network or to have separate DVB Service for each Network, thus deciding where and when each TV Application should be distributed.

Additionally it opens the possibility to regionalise the same Application for different parts of the actual Network by having e.g. regional news distributed over-the-air.

For service operators the value comes from the fact that a single server can be shared by many broadcasters, even in different multiplexes/transponders.

NETWORKS AND DVB SERVICES

Networks are managed in the Networks -tree. Each Network has its own output on the server and the configuration can be accessed by right clicking the Network and select _UDP1 (2) output -_tab as shown on screenshots 1 and 2 right.



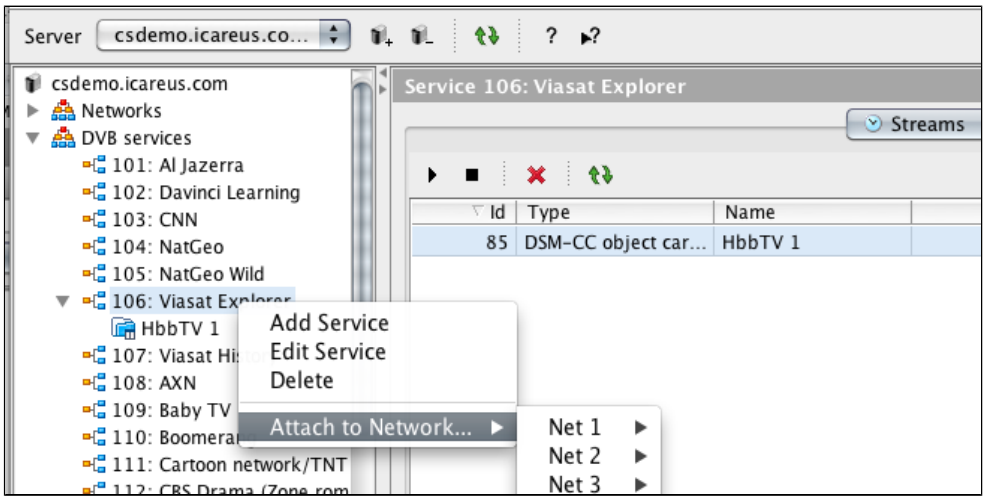
Screenshot 1.

Screenshot 2.

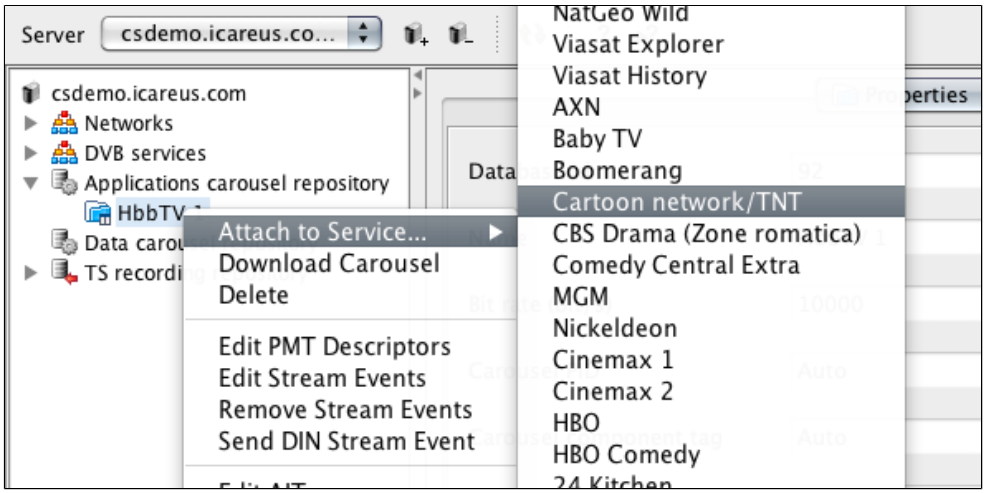
ATTACHING CAROUSELS TO NETWORKS

DVB Services hold the actual TV Applications (HbbTV, MHP, MHEG-5,...) and they should be added to a Network from the DVB Services -tree. See the screenshot 3 on right.

Attaching Carousels with AIT and Applications to DVB Services is also done by right clicking the desired Carousel as shown on screenshot 4 right.



Screenshot 3.



Screenshot 4.

GENERAL DSM-CC OUTPUT SETTINGS

This dialogue allows you to edit DSM-CC object carousel (i.e. HbbTV or MHP carousel) and DSM-CC data carousel related settings.

Default caching transparency

Default caching transparency for object carousel modules, used when creating new carousels in PMC.

Default priority

Default priority for object carousel modules, used when creating new carouselsin PMC.

Compress modules by default

If this setting is enabled, object carousel modules will be compressed by default when creating new carousels in PMC.

DSI and DII repetition rate

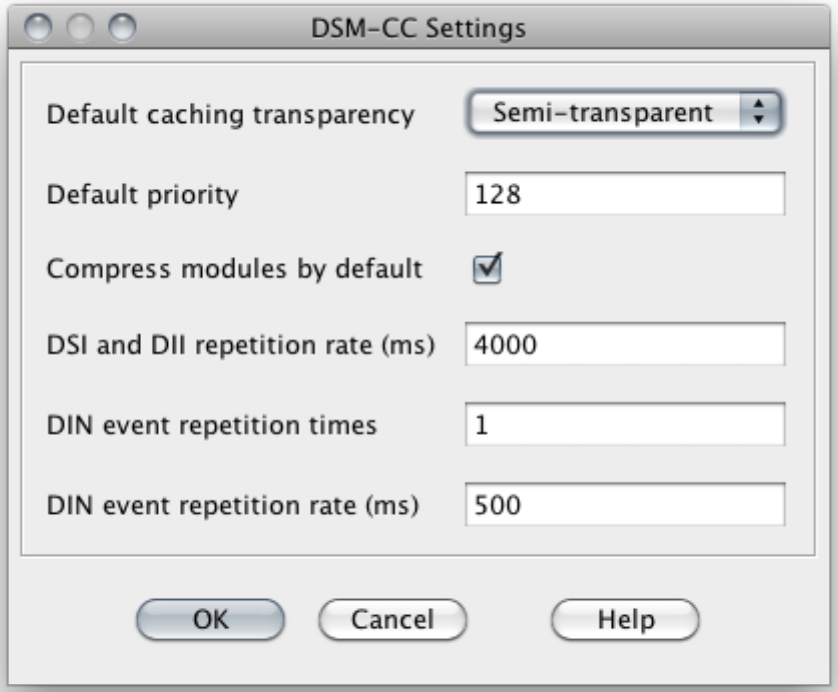
Repetition rate of Download Server Initiate and Download Info Indication in data and object carousels, measured in milliseconds.

DIN event repetition times

How many times to repeat "Do it now" stream events in carousels.

DIN event repetition rate

Repetition interval for "Do it now" stream events in MHP carousels, measured in milliseconds.



MANAGING CAROUSELS AND APPLICATIONS

1. INTRODUCTION

On Icareus Playout Applications are managed as part of DSM-CC Carousel. Once carousel by default contains one Application, although it is possible to add Applications to a carousel by editing the AIT table of that carousel.

This approach has been adopted to give more freedom in the configuration of the AIT and Applications. It for example enable operators and broadcasters to send completely different kind of AIT tables for each DVB Service or Network to meet the various technical requirements.

Object carousels are the file system streams in which applications are sent to a receiver. When an application is running, the Playout Server streams the application directory, sending each file in the directory structure at time, starting from the first file again after last sent file.

The broadcasting of the Carousels is managed per DVB Service and utilizing timers it may be fully automated and controlled also from 3rd party systems.

2. ADDING AN APPLICATION

Applications and Carousels are managed in Applications Carousel repository.

There are three ways to add an application:

1. Clicking the "+" -sign within the Carousel Repository on right
2. Right Clicking on the Applications Carousel Repository -tree on left
3. Dragging your local carousel from the Local Carousel Repository

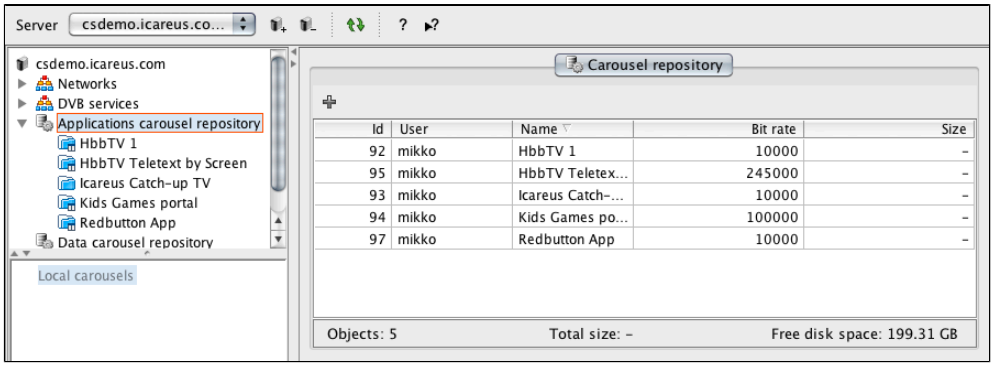
Carousels or Applications must be uploaded to the server before they can be used.
You must enter the name of the carousel, the bit rate at which it is streamed (bits per second) and three id values: PID (Packet ID), carousel id and component tag, see figure 4.2. Id values are assigned automatically by the server when the auto check box is checked.To create an AIT you must enter the minimum set of information that is needed to create a working AIT. This includes the name of the application, PID, initial class (for example application. TheXlet), application base directory and component tag. If the Autostart check box is checked,

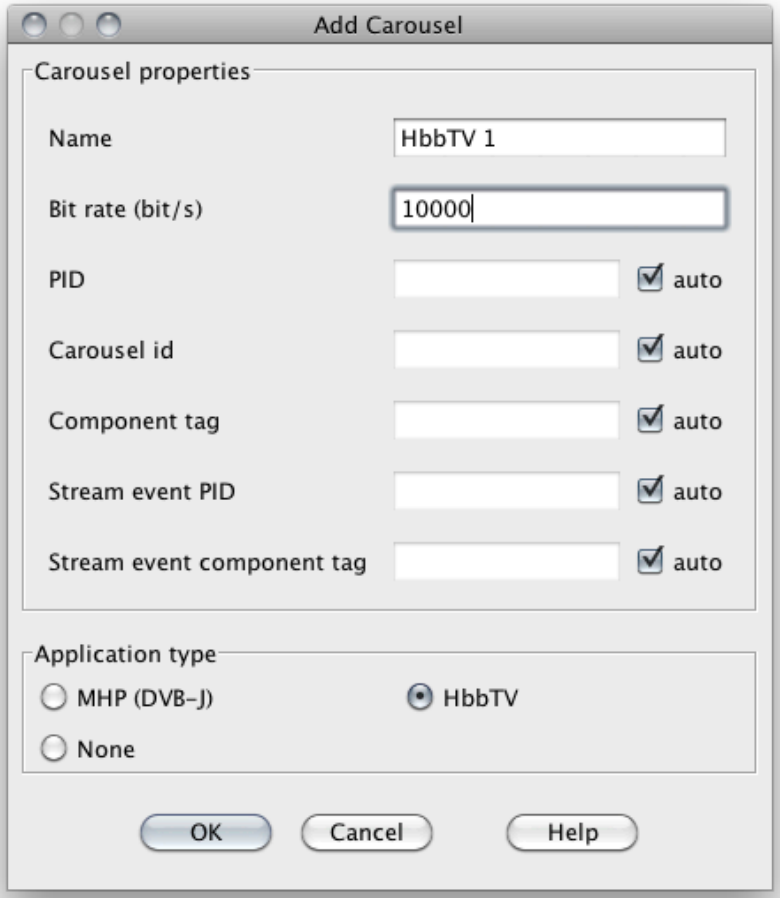
application will be started automatically, otherwise it will be present, but not autostarted. AIT PID is assigned automatically by the server if the auto check box is checked.
For further information about AIT, see AIT Chapter.

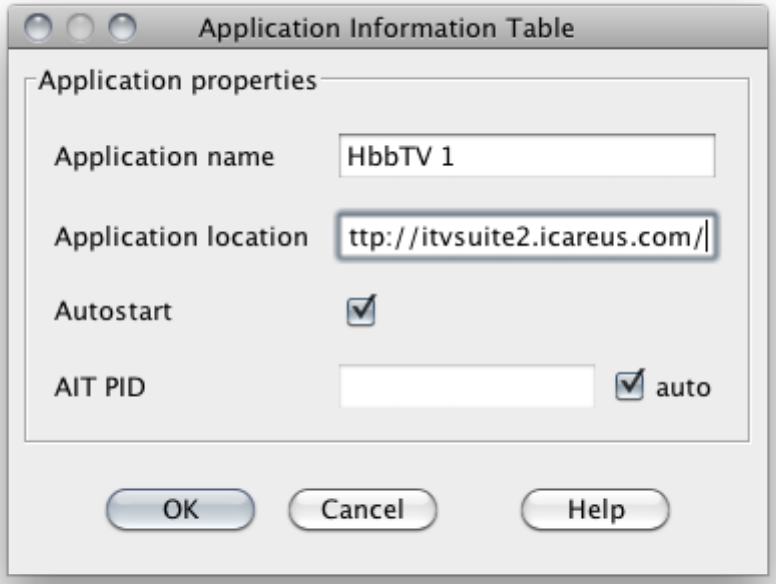
You can modify carousel's settings by right clicking the carousel in the carousel repository and selecting Properties. It enables you manually configure all possible properties of an application and carousel.

By right clicking an carousel you can also edit AIT, which enables you change many additional properties of an carousel.

It is advaisable to use just manually selected component values OR values with auto check box. If both styles are used with same carousel, there can be some unique PID issues.







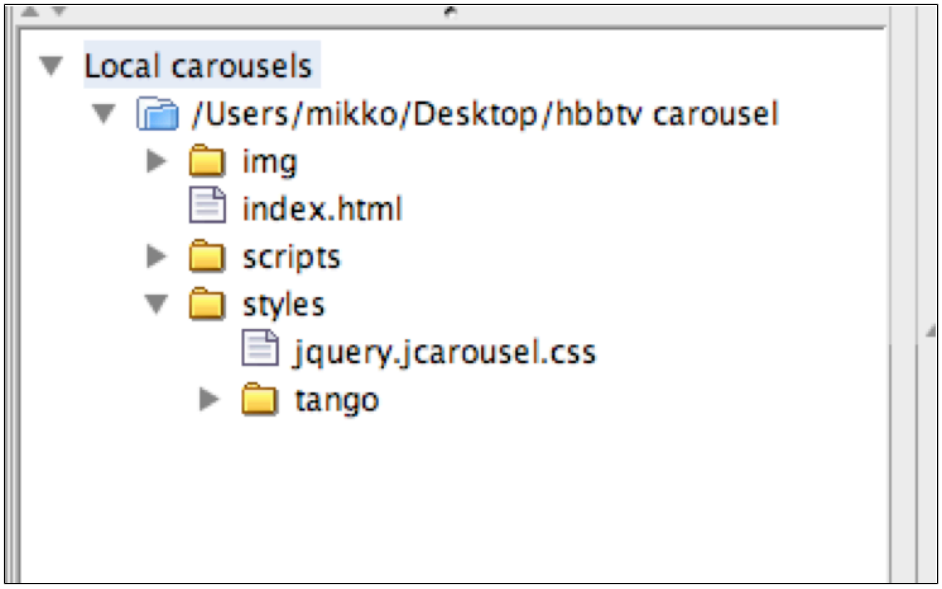
3. LOCAL CAROUSELS

A very common scenario is that one application is used frequently over the time.

It is thus handy to have a location where one can collect these frequently used carousels. This place, called carousel tree, is shown in the lower left corner of the window.

To add an application to the carousel tree, right click the tree and select New carousel. A dialogue appears that prompts you to point the root directory of the carousel. The other way of adding an application is to drag a directory from your file manager and drop it over the carousel tree.

You can remove carousels from the tree by right clicking the carousel and selecting Remove carousel. This does not remove the files from the file system, only from this favourite list.



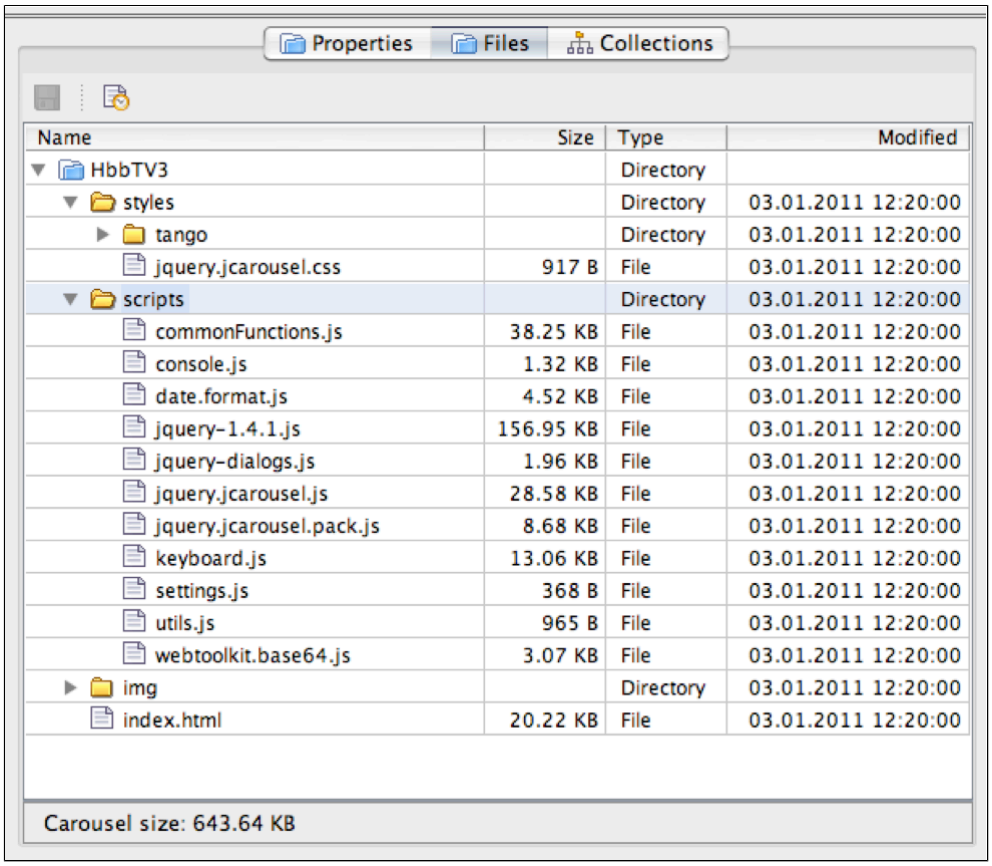
4. UPDATING CAROUSEL CONTENT

You can update a carousel by updating all of the files in the carousel or by adding, removing and modifying single files and directories. To update all files, drag the carousel root folder from a file explorer to the carousel content tree. You will have to restart the carousel for the changes to take effect.

It is also possible to update files within the carousel via FTP. You can usea ny FTP client to connect to the Playout server and in the FTP root folder you will find carousel --folder that contains all application carousels.

The Database id is used as the folder name. Database id can be found by selecting the application carousel repository in PMC.

To ensure the consistency of the carousel the updates in the FTP will not have affect unless the carousel is updated manually or by scheduling a periodic update using PMC



4.1. ADDING, MODIFYING AND REMOVING FILES

To add a file, right click on a directory in the carousel content tree and select Add File. You will be prompted to select the new file.

To add a directory, right click on a directory in the carousel content tree and select Add Directory. You will be prompted for a name for the new directory.

To update the contents of a file, right click on a file in the carousel content tree and select Update File Content. You will be prompted for the new file. Note that the name of the original file will not be changed.

To remove a file or a directory, right click on it and select Remove File or Remove Directory. Directories are removed recursively.

4.2. UPDATING CACHED CHANGES

All modifications are cached in PMC until you apply them. This can be done by right clicking on the carousel content tree and selecting Save Changes. Files and directories with cached modifications are shown with a grey background.

4.3. SCHEDULING A PERIODICAL UPDATE

Sometimes it is necessary to update a carousel periodically.

A ticker application, for example, might update its news content every 15 minutes. To automate this kind of periodical updating, PMC offers a scheduled update system for carousels. To edit scheduled updates for a carousel, right click the carousel content tree and select Schedule Carousel Update.

In the upper part you can configure the period of updates, given in various time units. In the lower part you can select the files that are to be scheduled for updating. The list to the left contains all files in the carousel, the list to

the right the selected files that are going to be scheduled. To add files to the selection, select a file (or a whole directory) and press the button marked with arrow pointing right. The files are added on the right. To remove files from the selected list, select them and press button marked with arrow pointing left.

5. EDITING CAROUSEL COLLECTIONS

You can edit carousel collections by selecting a carousel in the repository and selecting Collections tab from the right side panel.
Collection editor allows user to define collections to describe a group of one or more files having similar attributes and repetition parameters. Collections have the following properties:

- Compression: If on, files in the collection will be compressed.
- Caching transparency: Transparency level that shall be used by the terminal if it caches objects contained in this collection. The possible values are Transparent, Semi-transparent and Static caching. For more information, see e.g. MHP specification [5] section B.5.2, "Transparency levels of caching".
- Priority: Indicates the caching priority for the objects within this collection. A higher value indicates more importance for caching. Priority must be between 0 and 255, default is 128.

By default there is only one collection named Default.

To add a new collection, right click the module tree, select Add collection from the pop-up menu and enter a name for the collection. To move files from one collection to another, select the files you want to move, right click the files and select Move to collection from the pop-up menu.

To save the changes you have made, press the Save changes -button.

6. ENABLE/DISABLE CAROUSEL PACKETS

It is possible to configure if carousel packets are not sent for http based applications. The following commands allow configuring this.

```
#su - postgres
#psql
#\c playout
#select * from config where name='send-carousel-for-http-apps';   // check current value
#update config set value='1' where name='send-carousel-for-http-apps';    // change the value: 1 means
carousel packets are sent, 0 means carousel packets are not sent
#\q
#exit
```

All applications should be restarted to use new configuration value. Two options are available.

1. Restart all services using menu: Server->Service Management->Restart All
2. Restart every application separately: Right click application name in the DVB services node and select 'Restart' menu item

BROADCASTING APPLICATIONS

1. INTRODUCTION

Carousels (or Streams) once attached to a Service, can be broadcasted, or streamed actually, either manually or using timers.

Streams are transport stream sources (DSM-CC carousels etc.) that have been attached to a DVB service. A stream is required in order to start a source and to add it to Playout server's internal transport stream multiplexer.

2. STREAMS TABLE

2.1. STARTING AND STOPPING STREAMS

When you select a service or a single stream, streams and their timers are shown on the right side of the PMC window under the Streams tab.

To start a stream manually, select it from the server tree and you will see the stream and its timers on the right. Right click on the stream and select Start from the menu. The stream will now run until it is stopped manually.

> Note that manual starting and stopping may not work for a stream that has timers depending on how the timers have been scheduled.

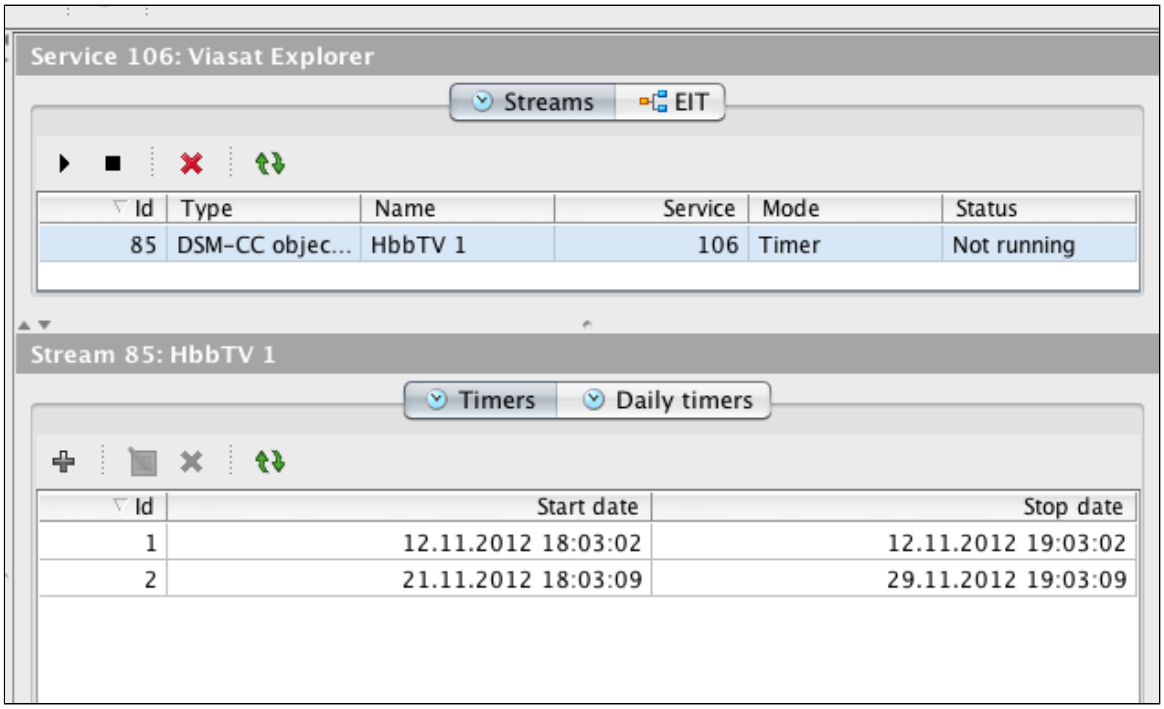
Mode column in the stream table indicates if the stream has been started or not. On indicates that the stream is set to run at all times, Off indicates that the stream will only be started by a timer.

Status column indicates the actual running status of the stream. If the stream is running normally, it will show the text Running with a green background. If there was an error last time the stream was started, it will show the text Error with a red background.

2.2. CREATING TIMERS

A timer can be created by right clicking on a stream under the Streams tab and selecting Add Timer. You can set the start and stop times for the timer (see figure 5.2).

> Note that if the stream has already been started manually, you should stop it before adding timers for it.



2.3. EDITING AND DELETING TIMERS

Timers can be edited by right clicking on the timer and selecting Edit timer from the menu.

A timer can be deleted by right clicking on the timer and selecting Delete timer from the menu.

AIT (APPLICATION INFORMATION TABLE)

1. AIT COMPONENTS

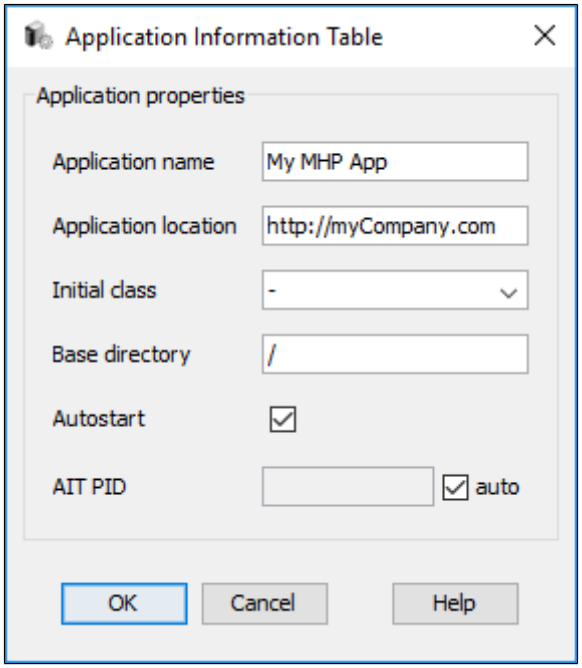
Each carousel can have an AIT that describes some basic parameters for applications in the carousel. AIT consists of three components:

1. Fields
2. Descriptors
3. Loops

Fields are either string or integer values with a short name. Integer values are shown as hexadecimal numbers. A field is shown in the AIT editor as A descriptor is a structure that can have fields and loops in it.

For example, a descriptor application_identifier has organisation_id and application_id fields. A descriptor is shown as A loop contains a list of loop items. For example, an item in loop application_name_loop has an integer field named ISO_639_language_code and a string field named application_name.

2. ADDING AIT TO CAROUSELS



When a carousel is attached to a service, PMC asks the user whether he/she wishes to create an AIT for the carousel. AIT can also be created later by right clicking on a carousel and selecting Create AIT from the menu. In either case, a simple dialogue appears:
This is the minimum set of information that is needed to create the AIT.

It includes the name of the application, AIT PID, initial class (for example application.TheXlet) for Java Applications, base directory for the application, component tag and an autostart option.

Now also MHP applications can be fetched from URL as an application location, like it has been with HbbTV.

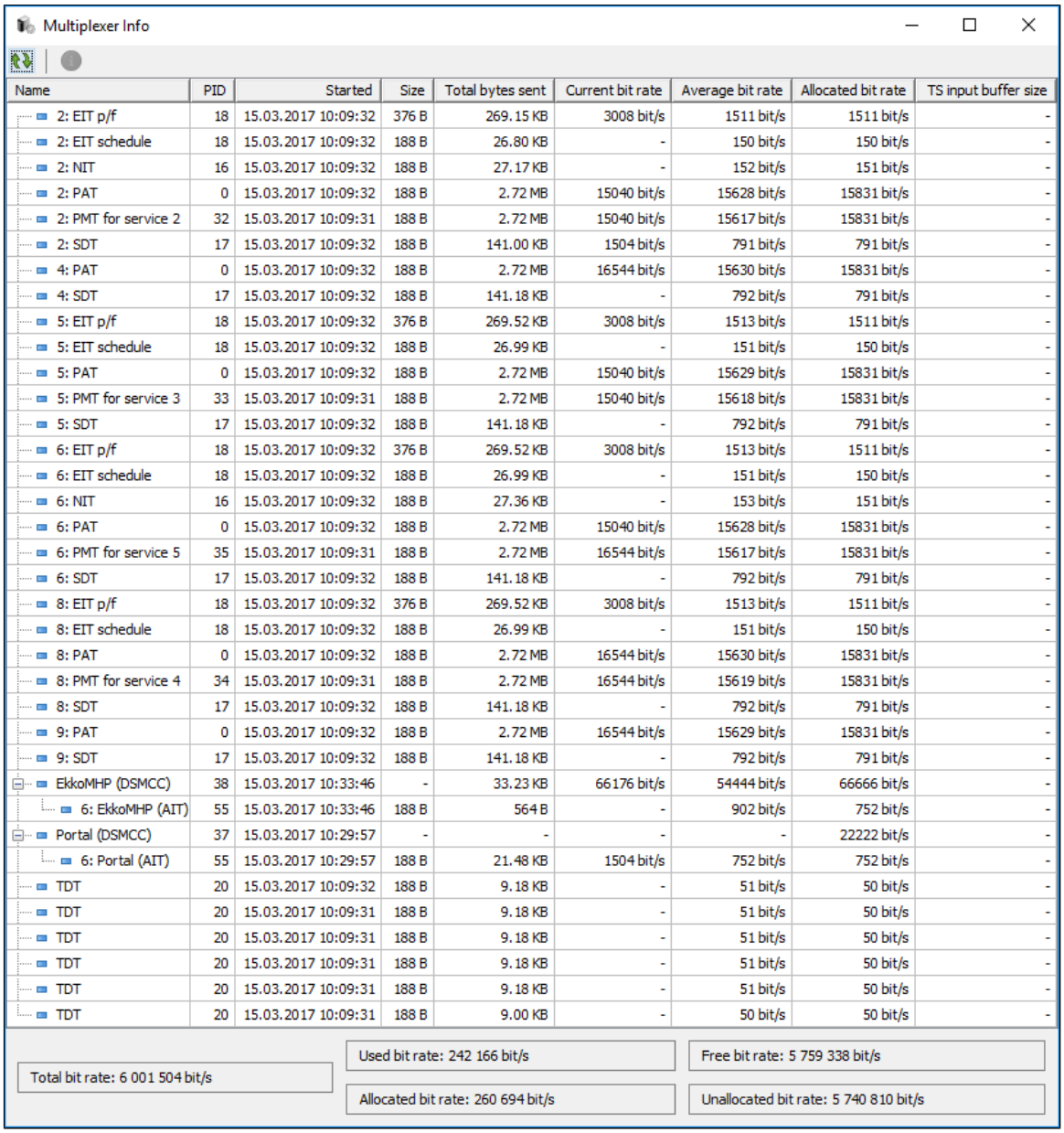
Now it is also possible to use same AIT PID for HbbTV and MHP carousels under same service. If this feature is used, it is not possible to stop just one of them. This means, that if e.g. HbbTV carousel is wanted to be restarted, it must be done so that MHP carousel with the same AIT PID in same service is also stopped if it is running. In this case "restart" operation must not be used.

In case of MHP application, one must put some character to the Initial class -field, even if an URL is used. E.g.Space is good enough in this kind of case.

3. MULTIPLEXER INFO FOR CAROUSELS

After applications are atatched to sevice(s) and started, it is possible to see some useful data about them by opening "Multiplexer Info" dialog; Status -> Multiplexer Info.

Here is an example of this dialog for case where HbbTV and MHP applications share the same AIT PID and are running under same service:



Name	PID	Started	Size	Total bytes sent	Current bit rate	Average bit rate	Allocated bit rate	TS input buffer size
2: EIT p/f	18	15.03.2017 10:09:32	376 B	269.15 KB	3008 bit/s	1511 bit/s	1511 bit/s	-
2: EIT schedule	18	15.03.2017 10:09:32	188 B	26.80 KB	-	150 bit/s	150 bit/s	-
2: NIT	16	15.03.2017 10:09:32	188 B	27.17 KB	-	152 bit/s	151 bit/s	-
2: PAT	0	15.03.2017 10:09:32	188 B	2.72 MB	15040 bit/s	15628 bit/s	15831 bit/s	-
2: PMT for service 2	32	15.03.2017 10:09:31	188 B	2.72 MB	15040 bit/s	15617 bit/s	15831 bit/s	-
2: SDT	17	15.03.2017 10:09:32	188 B	141.00 KB	1504 bit/s	791 bit/s	791 bit/s	-
4: PAT	0	15.03.2017 10:09:32	188 B	2.72 MB	16544 bit/s	15630 bit/s	15831 bit/s	-
4: SDT	17	15.03.2017 10:09:32	188 B	141.18 KB	-	792 bit/s	791 bit/s	-
5: EIT p/f	18	15.03.2017 10:09:32	376 B	269.52 KB	3008 bit/s	1513 bit/s	1511 bit/s	-
5: EIT schedule	18	15.03.2017 10:09:32	188 B	26.99 KB	-	151 bit/s	150 bit/s	-
5: PAT	0	15.03.2017 10:09:32	188 B	2.72 MB	15040 bit/s	15629 bit/s	15831 bit/s	-
5: PMT for service 3	33	15.03.2017 10:09:31	188 B	2.72 MB	15040 bit/s	15618 bit/s	15831 bit/s	-
5: SDT	17	15.03.2017 10:09:32	188 B	141.18 KB	-	792 bit/s	791 bit/s	-
6: EIT p/f	18	15.03.2017 10:09:32	376 B	269.52 KB	3008 bit/s	1513 bit/s	1511 bit/s	-
6: EIT schedule	18	15.03.2017 10:09:32	188 B	26.99 KB	-	151 bit/s	150 bit/s	-
6: NIT	16	15.03.2017 10:09:32	188 B	27.36 KB	-	153 bit/s	151 bit/s	-
6: PAT	0	15.03.2017 10:09:32	188 B	2.72 MB	15040 bit/s	15628 bit/s	15831 bit/s	-
6: PMT for service 5	35	15.03.2017 10:09:31	188 B	2.72 MB	16544 bit/s	15617 bit/s	15831 bit/s	-
6: SDT	17	15.03.2017 10:09:32	188 B	141.18 KB	-	792 bit/s	791 bit/s	-
8: EIT p/f	18	15.03.2017 10:09:32	376 B	269.52 KB	3008 bit/s	1513 bit/s	1511 bit/s	-
8: EIT schedule	18	15.03.2017 10:09:32	188 B	26.99 KB	-	151 bit/s	150 bit/s	-
8: PAT	0	15.03.2017 10:09:32	188 B	2.72 MB	16544 bit/s	15630 bit/s	15831 bit/s	-
8: PMT for service 4	34	15.03.2017 10:09:31	188 B	2.72 MB	16544 bit/s	15619 bit/s	15831 bit/s	-
8: SDT	17	15.03.2017 10:09:32	188 B	141.18 KB	-	792 bit/s	791 bit/s	-
9: PAT	0	15.03.2017 10:09:32	188 B	2.72 MB	16544 bit/s	15629 bit/s	15831 bit/s	-
9: SDT	17	15.03.2017 10:09:32	188 B	141.18 KB	-	792 bit/s	791 bit/s	-
EkkoMHP (DSMCC)	38	15.03.2017 10:33:46	-	33.23 KB	66176 bit/s	54444 bit/s	66666 bit/s	-
6: EkkoMHP (AIT)	55	15.03.2017 10:33:46	188 B	564 B	-	902 bit/s	752 bit/s	-
Portal (DSMCC)	37	15.03.2017 10:29:57	-	-	-	-	22222 bit/s	-
6: Portal (AIT)	55	15.03.2017 10:29:57	188 B	21.48 KB	1504 bit/s	752 bit/s	752 bit/s	-
TDT	20	15.03.2017 10:09:32	188 B	9.18 KB	-	51 bit/s	50 bit/s	-
TDT	20	15.03.2017 10:09:31	188 B	9.18 KB	-	51 bit/s	50 bit/s	-
TDT	20	15.03.2017 10:09:31	188 B	9.18 KB	-	51 bit/s	50 bit/s	-
TDT	20	15.03.2017 10:09:31	188 B	9.18 KB	-	51 bit/s	50 bit/s	-
TDT	20	15.03.2017 10:09:31	188 B	9.18 KB	-	51 bit/s	50 bit/s	-
TDT	20	15.03.2017 10:09:31	188 B	9.00 KB	-	50 bit/s	50 bit/s	-

4. EDITING AIT

When adding an AIT for a carousel, the PMC asks only basic information about the application and fills the rest of the AIT with default values. Sometimes in advanced use it is necessary to edit the AIT by hand. This can be accomplished by right clicking carousel in the carousel repository and then selecting Edit AIT from the menu.

AIT tree can be navigated using UP and DOWN. Levels can be expanded and collapsed using RIGHT and LEFT. Menu can be opened by pressing INSERT and hidden by pressing ESC.

Editing Fields Each field in the AIT is shown as . A field can be edited several ways:

• Select the field from the tree and press ENTER.

• Double-click the field from the tree.

• Select the field from the table beside the tree.

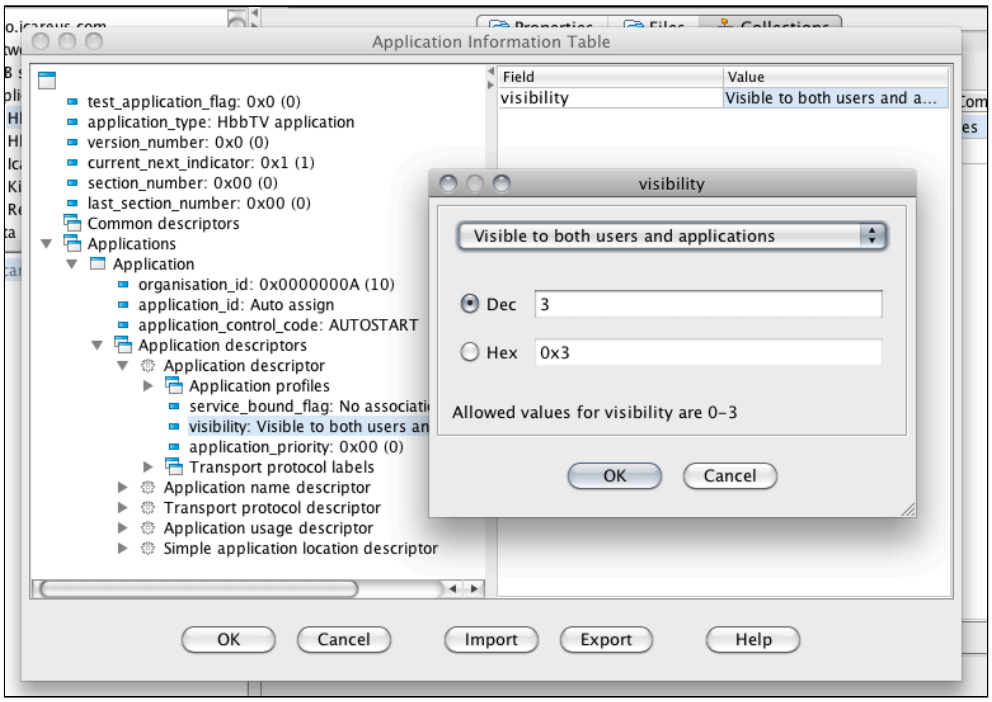
Regardless the way choose, a dialogue appears that prompts you to give a new value for the field. Additional information, such as proper value ranges for the field, may also be shown. If the value you enter is not within that range, PMC prompts you to enter another value.

Adding Loop Items Sometimes it is necessary to add new items to a loop. For example, one could want to add a

new parameter to the descriptor dvb_j_application_descriptor, thus wanting to add a new loop item in the loop dvb_j_parameters. To add an item into a loop, you can do any of the following:

• In the tree view right click the loop to which you want to add the item and select Add a new item.

• In the tree view move the cursor to the loop to which you want to add the item using arrow keys. Press INSERT and select Add a new item.



APPLICATION RECORDING DESCRIPTOR

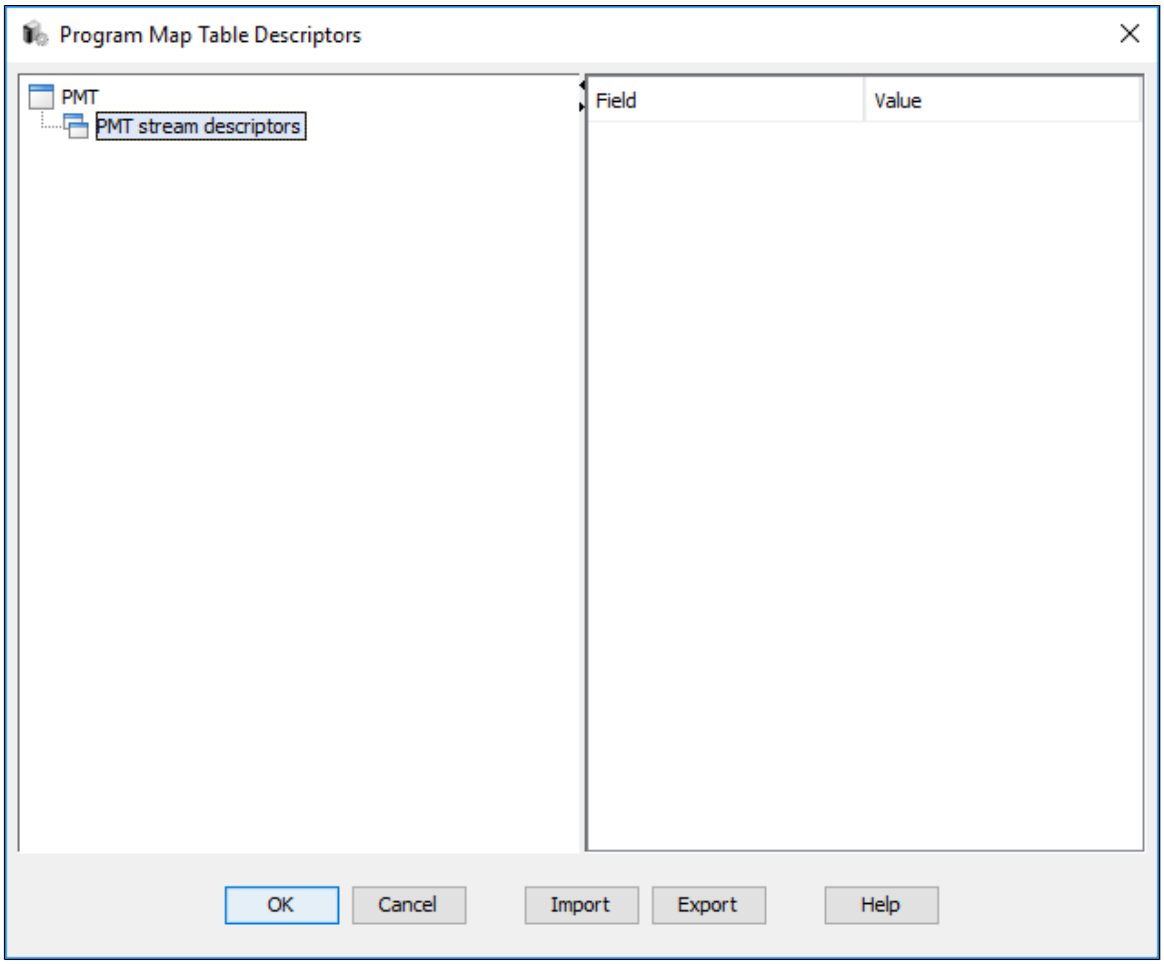
Application recording descriptor

```
<!DOCTYPE data PUBLIC "" "si.dtd">
<data>
<descriptor name="Application recording descriptor">
 <field name="descriptor_tag" visible="false" value="6" type="ulong" bitcount="8"/>
 <length bitcount="8" target="total"/>
 <field name="scheduled_recording_flag " value="0" type="ulong" bitcount="1"/>
 <field name="trick_mode_aware_flag " value="0" type="ulong" bitcount="1"/>
 <field name="time_shift_flag " value="0" type="ulong" bitcount="1"/>
 <field name="dynamic_flag" value="0" type="ulong" bitcount="1"/>
 <field name="av_synced_flag" value="0" type="ulong" bitcount="1"/>
 <field name="initiating_replay_flag" value="0" type="ulong" bitcount="1"/>
 <field name="reserved" visible="false" value="0" type="ulong" bitcount="2"/>
</descriptor>
</data>
```

PMT (PROGRAM MAP TABLE)

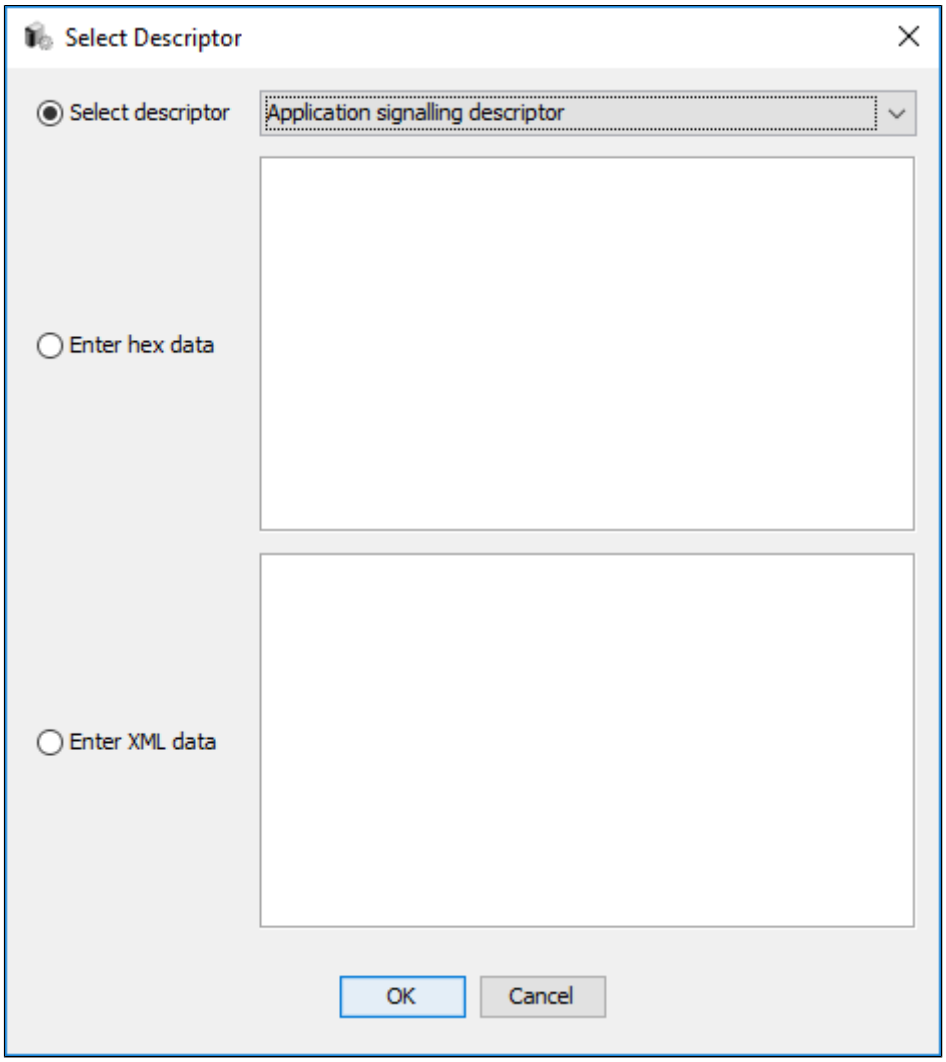
Now it is also possible to edit a value of so called "magic-bit". This can be done by editing PMT descriptors of carousel. The Program Map Table Descriptors -dialog can be opened from popup menu that is displayed when pressing right hand mouse button for carousel.

The dialog looks like this:

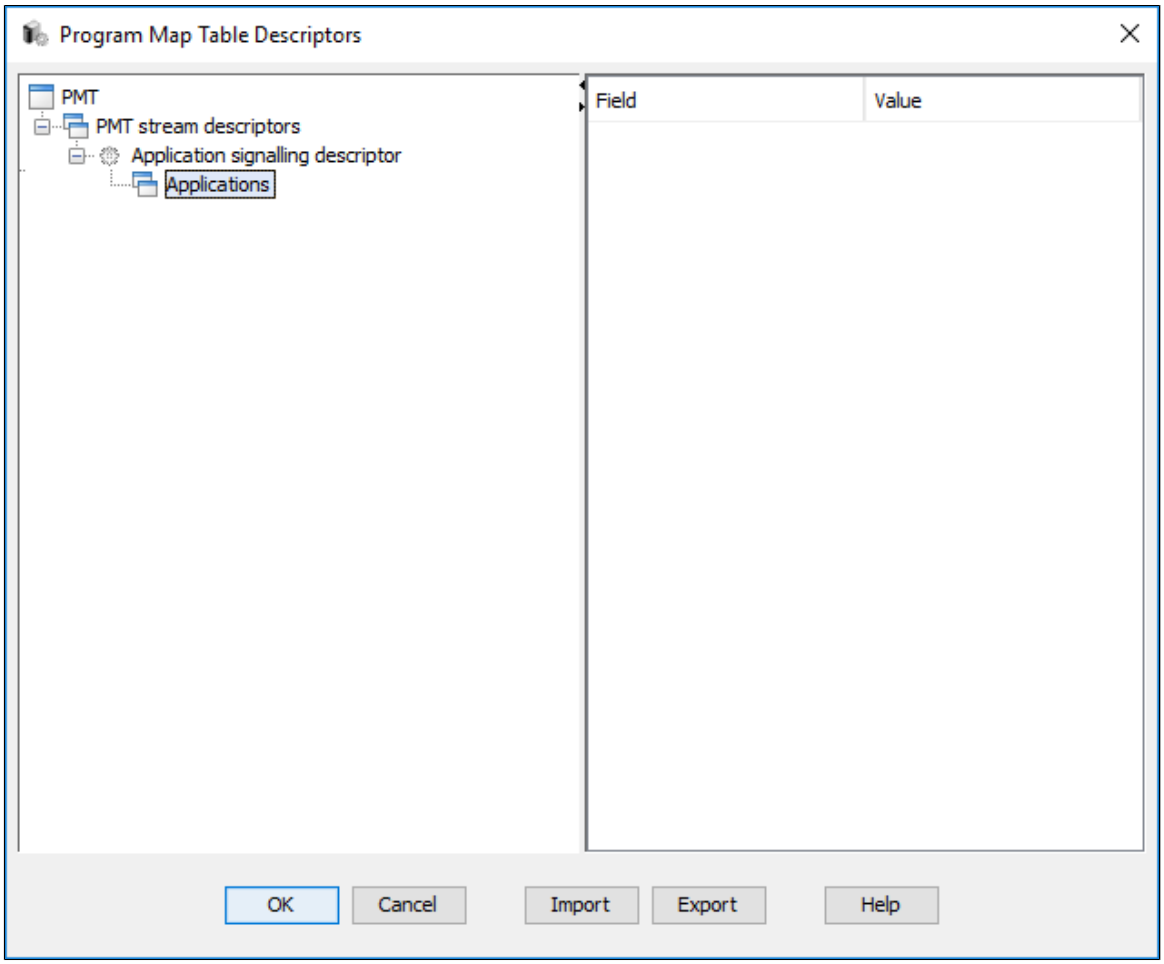


Now the "magic-bit" can be edited by adding an "Application signalling descriptor". That can be done by pressing right hand mouse buttong for "PMT stream descriptots" and choosing "Add descriptor" from popup.

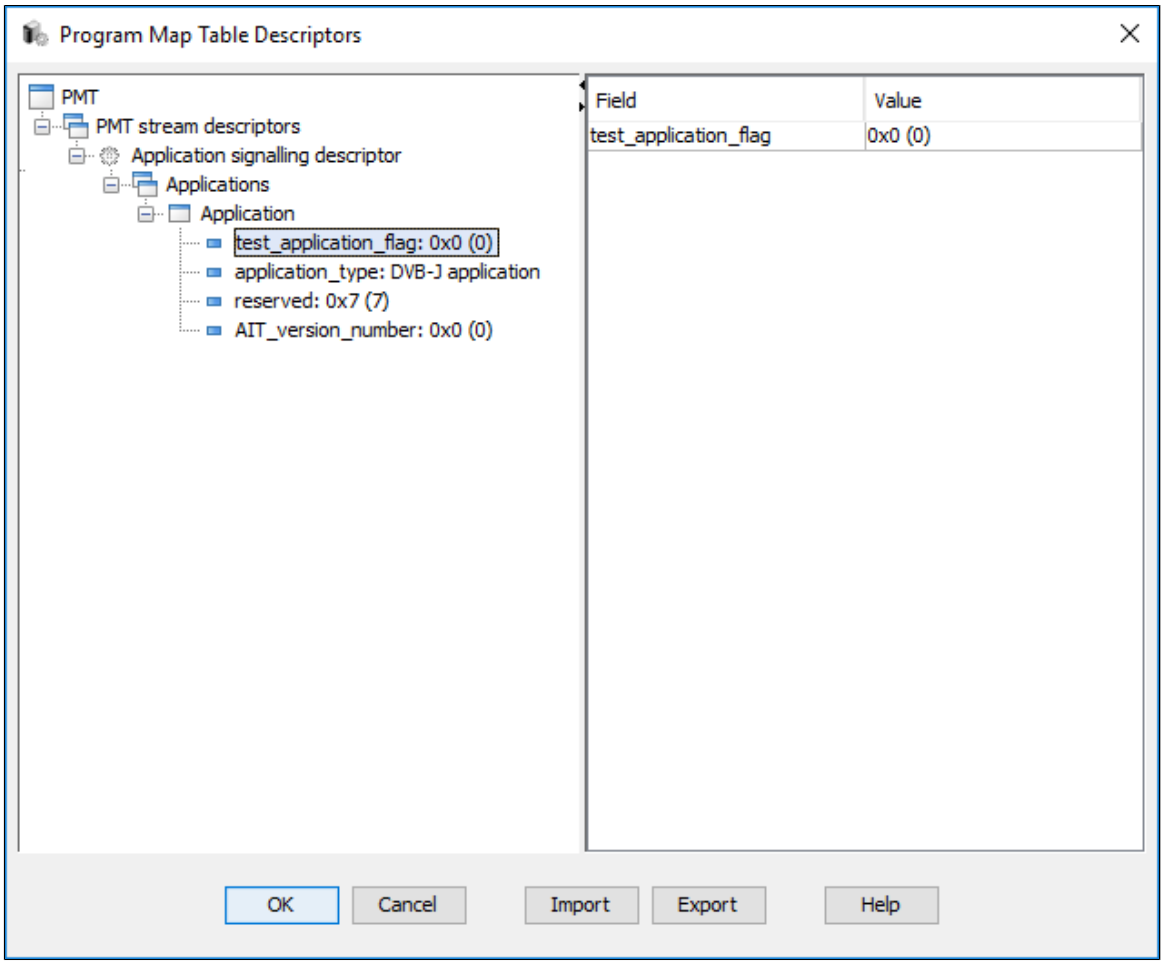
The "Select Descriptor" -dialog looks like this:



After pressing "OK" you should see this view:



Now you must add an application with popup menu. After that you should see this kind of settings:

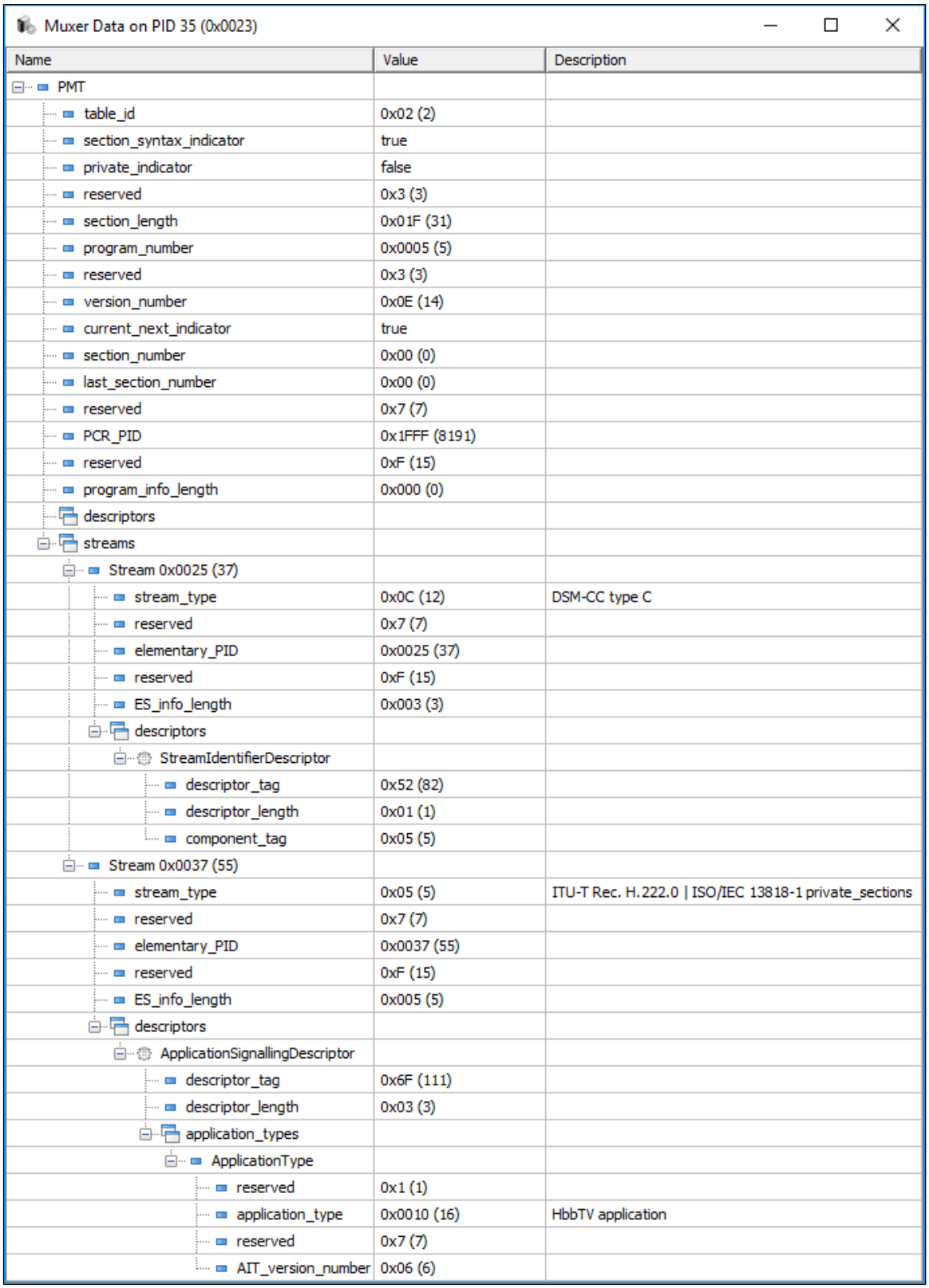


The descriptor "test_application_flag" is actually the "magic-bit". The value for this can be set to zero or 1.

The value of this descriptor can be seen with folowing steps:

- Open PMC's Multiplexer Info dialog (Status -> Multiplexer Info)
- Double click the line "PMT for service <service that has the running application> e.g. "PMT for service 5"
- See streams -> Stream <AIT PID of application> -> desciptors -> ApplicationSignallingDescriptor -> application_types -> ApplicationType -> reserved
- The value of this should be the same that was set for "test_application_flag" in "Program Map Table Descriptors" dialog

The information PMT dialog for selected service looks like this:



Name	Value	Description
PMT		
table_id	0x02 (2)	
section_syntax_indicator	true	
private_indicator	false	
reserved	0x3 (3)	
section_length	0x01F (31)	
program_number	0x0005 (5)	
reserved	0x3 (3)	
version_number	0x0E (14)	
current_next_indicator	true	
section_number	0x00 (0)	
last_section_number	0x00 (0)	
reserved	0x7 (7)	
PCR_PID	0x1FFF (8191)	
reserved	0xF (15)	
program_info_length	0x000 (0)	
descriptors		
streams		
Stream 0x0025 (37)		
stream_type	0x0C (12)	DSM-CC type C
reserved	0x7 (7)	
elementary_PID	0x0025 (37)	
reserved	0xF (15)	
ES_info_length	0x003 (3)	
descriptors		
StreamIdentifierDescriptor		
descriptor_tag	0x52 (82)	
descriptor_length	0x01 (1)	
component_tag	0x05 (5)	
Stream 0x0037 (55)		
stream_type	0x05 (5)	ITU-T Rec. H.222.0 | ISO/IEC 13818-1 private_sections
reserved	0x7 (7)	
elementary_PID	0x0037 (55)	
reserved	0xF (15)	
ES_info_length	0x005 (5)	
descriptors		
ApplicationSignallingDescriptor		
descriptor_tag	0x6F (111)	
descriptor_length	0x03 (3)	
application_types		
ApplicationType		
reserved	0x1 (1)	
application_type	0x0010 (16)	HbbTV application
reserved	0x7 (7)	
AIT_version_number	0x06 (6)	

2.1. MANAGING STREAM EVENTS

1. INTRODUCTION

Stream events are used to synchronise an application with an MPEG stream.

There are two types of stream events, Do it now events and NPT events. NPT events require an NPT stream that is used for synchronising an application with NPT of a media clip and they require the carousel to be synchronised with an AV stream. Do it now events are fired manually and do not require an NPT stream. The timestamp generator feature is also supported with DIN events.

2. EDITING STREAM EVENTS

To edit stream events for a carousel, righ-click on a carousel in the carousel repository and select Edit Stream Events from the pop-up menu. The stream event editor will open (see figure 7.1).

To add a stream event you have to create a stream object for the event and add an event to the object. One stream object can contain several stream events.

To add a stream object click Add object and enter a name for the object. The name must be unique in the carousel.

To add an event to a stream object, click Add event. Enter a name for the event (it must be unique in the stream object) and select a type for the stream event, either din (Do it now) or NPT.

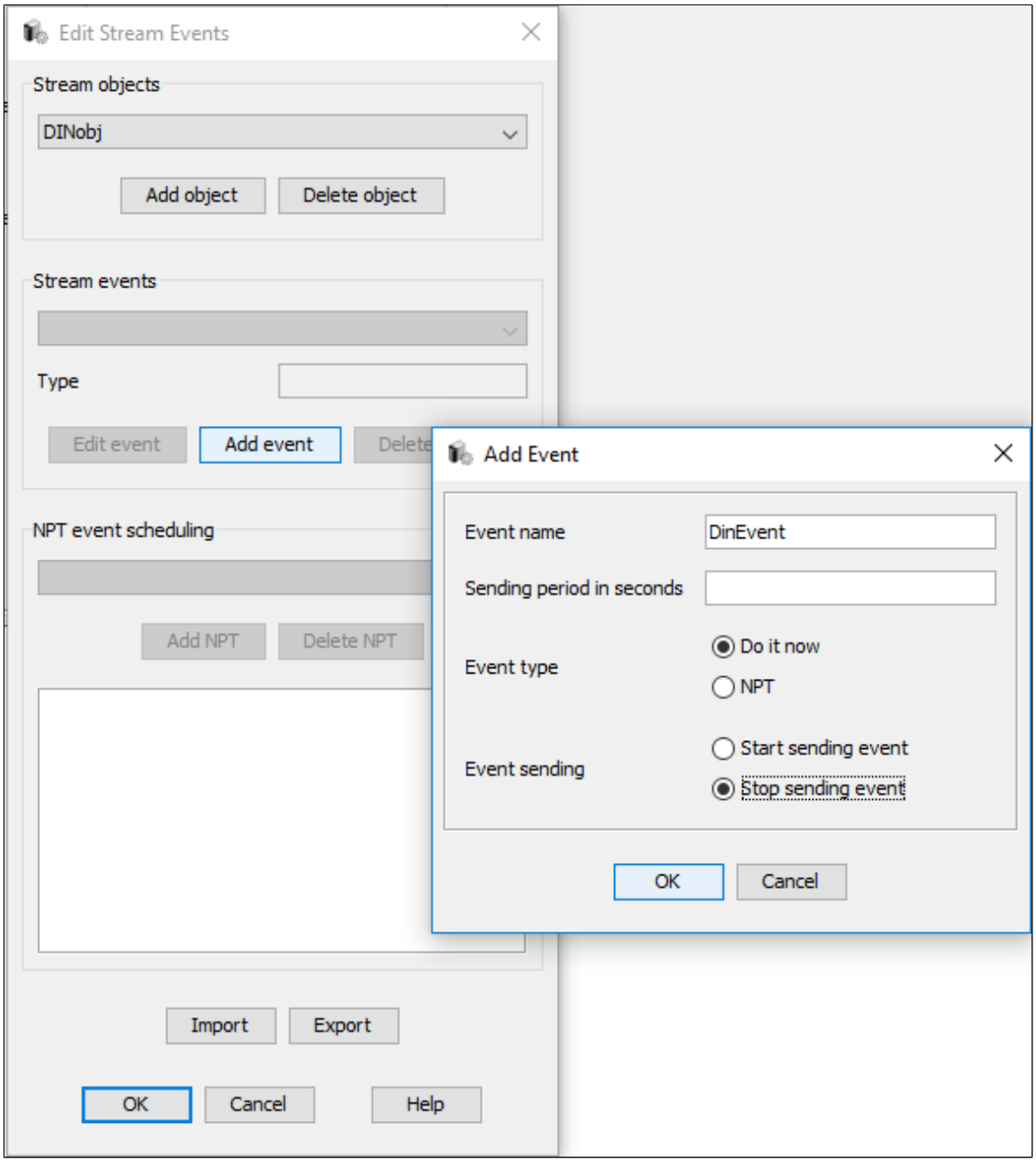
If you add an NPT event you can also define one or more NPT times when it will be fired. Click ADD NPT to do that.

If "Do it now" option is selected, it is possible to type a value in "Sending period in seconds" edit field. If some value is typed for this field, and "Start sending event" is selected, the Playout server

starts to send DIN events with timestamp (UNIX Epoch time) repeatedly with given interval. It can be stopped by selecting "Stop sending event".

Changes in carousel stream events will be applied when the carousel is restarted.

Figure 7.1: Stream event editor



3. SENDING STREAM EVENTS

To send a "Do it now" stream event for a carousel, right click on a carousel in the carousel repository and select Send DIN Stream Event. Select an event to fire from the drop down box and set a payload for it, if necessary.

Payload can be loaded from a file or entered to the text area. Click Send event to fire the selected event. If no streams are running for this carousel, an error message is shown.

AV SYNCHRONISATION

Icareus Playout can generate an NPT (Normal Play Time) stream for testing NPT stream events. To generate an NPT stream do the following:

1. Right click on a carousel and select Edit Stream Events
2. Add one or more NPT events for the carousel
3. Start a stream for the AV file
4. Start a stream for the carousel

2.1. MANAGING SSU UPDATES

UNT UPDATE NOTIFICATION TABLE

SSU server can generate multiple UNT sub tables that each have a unique OUI (i.e. two sub tables can't use the same OUI value). Currently all UNT sub tables are sent on a single PID. To edit UNT PID, select UNT from server tree and click on the Set UNT PID button in the tool bar.

A data broadcast id descriptor is generated automatically to PMT for the UNT PID. OUI of each UNT sub table will be listed in the descriptor and version information for each OUI in the descriptor will be generated using the version number of the corresponding UNT sub table. Additional PMT descriptors can be added for the UNT PID by clicking on Edit PMT descriptors in the UNT sub tables tab.

The following information for an enhanced profile SSU data carousel will be inserted to the selected UNT sub table when a stream for the data carousel is started:

- Compatibility descriptor for each carousel group. This is equal to the compatibility descriptor that is inserted to the DSI group info of the DSM- CC data carousel.
- Target and operational descriptors for each carousel group.
- SSU location descriptor for each carousel group. This will associate the group to a data carousel PID using carousel's component tag.

For more information about starting carousels, see Managing DSM-CC Carousels -chapter.

ADDING SUB TABLES

To add a new UNT sub table, select UNT from server tree and click on the Add UNT sub table button in the tool bar. A dialogue (see figure 3.1) is presented with the following options:

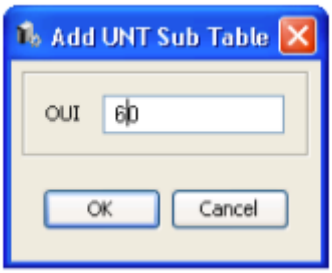


Figure: Adding a UNT sub table

- OUI: IEEE OUI value that will be used for this sub table. OUI value is unique (i.e. two sub tables can't use the same OUI value).

EDITING COMMON DESCRIPTORS

Each UNT sub table has a list of descriptors that will be inserted to the common descriptor loop of the sub table. To edit this descriptor list, first select UNT from server tree. Then right click on a sub table in the list under the UNT sub tables tab and select Edit Common Descriptor. A dialogue that allows you to modify the descriptor list is presented.

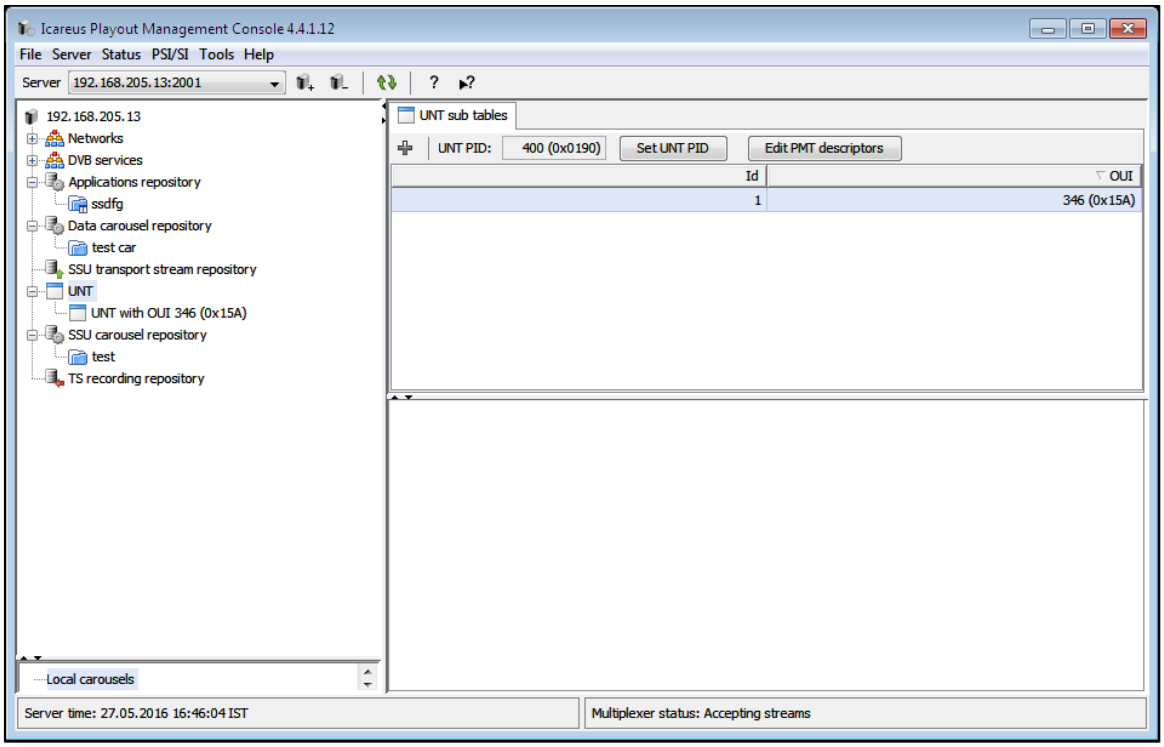


Figure: UNT sub tables

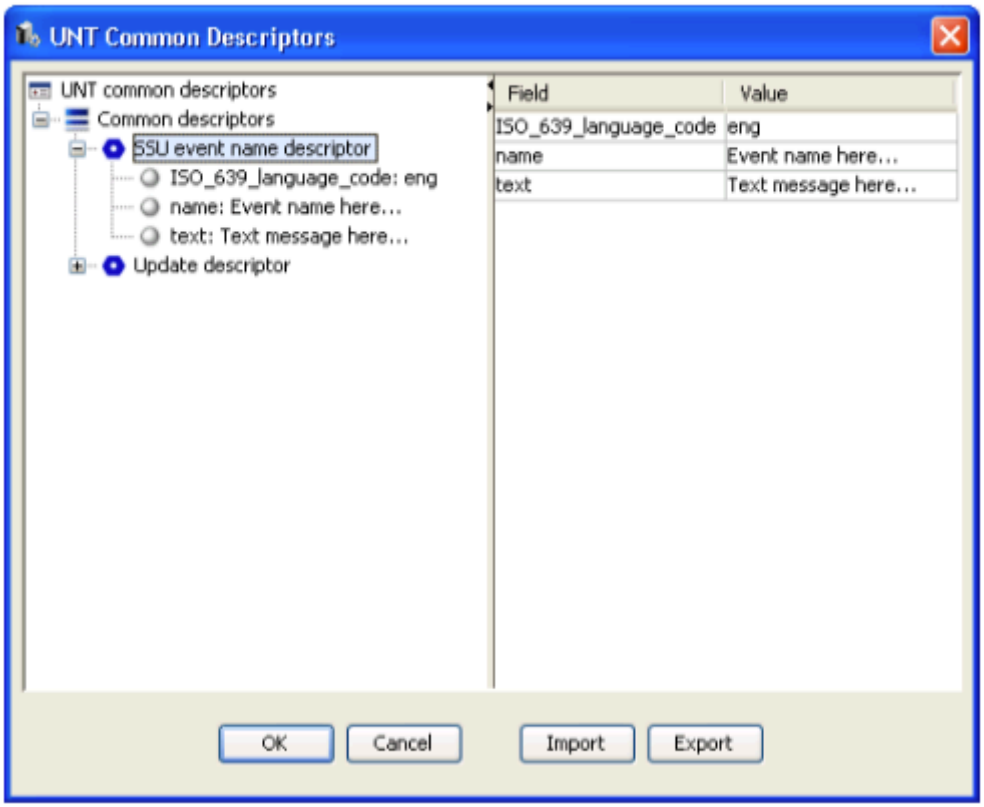


Figure: Editing UNT common descriptor loop

For more information about using the editor, see Editing PSI/SI Data Structures.

SSU DATA CAROUSELS

SSU data carousel is a two-layered DSM-CC data carousel that is sent on a single PID. Carousel consists of groups that contain the carousel files.

4.1 ADDING CAROUSELS

To add a new SSU carousel, select SSU carousel repository from server tree and click on the Add new carousel button in the tool bar. A dialogue (see figure 4.1) is presented with the following options:

- Name: A descriptive name that is used only in PMC. Name must be unique, i.e. two carousels may not have the same name.
- Scheduled: If this checkbox is selected when creating the SSU carousel, the groups of that SSU carousel are deactivated be default and are activated by scheduler. In the UNT Operational Descriptors -window (for group) it is possible to add Scheduling descriptor and edit its parameters.
- SSU profile: Simple profile or UNT enhanced profile. UNT information is generated only for enhanced profile carousels.
- Bit rate: Transport stream bit rate for the DSM-CC data carousel in bits per second.
- PID: Transport stream PID for the DSM-CC data carousel. If auto is selected, PID will be automatically assigned when the carousel is started.
- Componenttag:Component tag that is used in UNT and PMT tosignal this carousel. If auto is selected, component tag will be automatically assigned when the carousel is started.

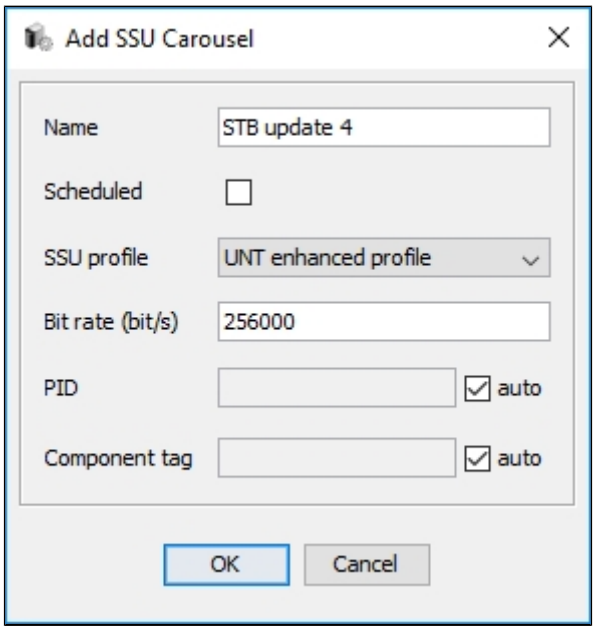


Figure: Add new SSU carousel

4.2 ADDING GROUPS

Every file in an SSU carousel must belong to a group. Each group corresponds to a group in the DSM-CC carousel's download server initiate (DSI) message as well as to a DSM-CC download info indication (DII) message. All data in a group is typically for one manufacturer, but one manufacturer can have multiple groups for multiple updates.

To add a new SSU carousel group, select a carousel from server tree, then select the Groups tab and click on the Add group button in the tool bar. A dialogue (see figure below) is presented with the following options:

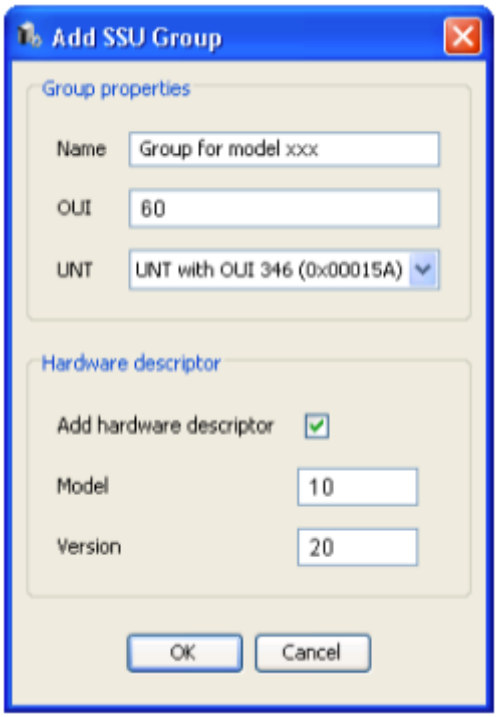


Figure: Adding a group to an enhanced profile SSU carousel

- Name: A descriptive name that is used only in PMC.
- OUI: OUI value used in DSI group info.
- UNT: UNT sub table where this carousel will be signalised. This option is shown only for UNT enhanced profile carousels.

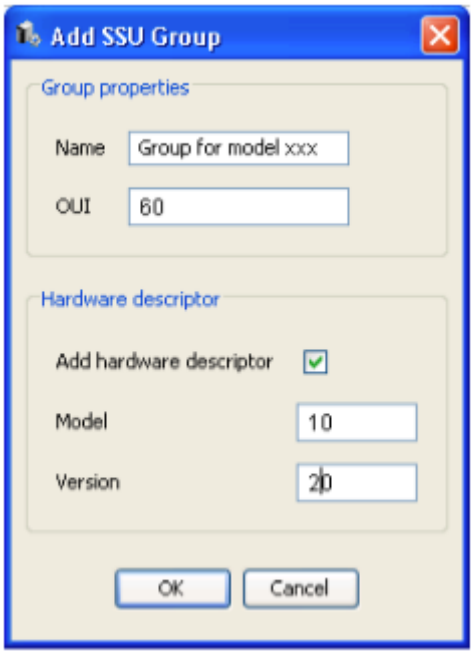


Figure: Add Simple Profile SSU Group

- Add hardware descriptor: Check this if you want to add a hardware descriptor to DSI compatibility descriptor. Compatibility descriptor can also be edited later, for more information see Editing Compatibility Descriptor on page 23.
- Model: Value of the model field in DSI compatibility descriptor.
- Version: Value of the version field in DSI compatibility descriptor.

EDITING COMPATIBILITY DESCRIPTOR

To edit compatibility descriptor for an SSU carousel group, select the carousel from server tree and then select the Groups tab. Right click on a group and select Edit Compatibility Descriptor. An editor dialogue will appear, for more information about using the editor, see Editing PSI/SI Data Structures on page 32.

EDITING UNT DESCRIPTORS

To edit UNT target and operational descriptors for an SSU carousel group, select the carousel from server tree and then select the Groups tab. Right click on a group and select Edit Target Descriptors or Edit Operational Descriptors. An editor dialogue will appear, for more information about using the editor, see Editing PSI/SI Data Structures.

ADDING FILES

To add a new SSU carousel file, select a carousel from server tree, then select the Files tab and click on the Add file button in the tool bar. A dialogue (see figure below) is presented with the following options:

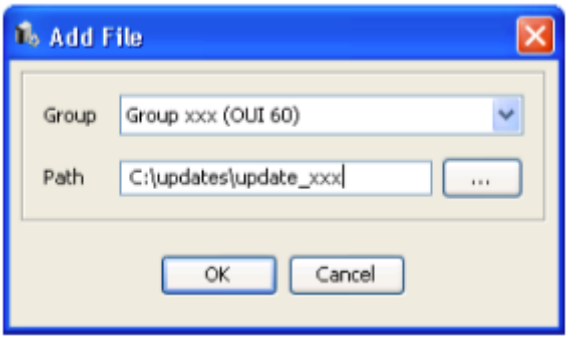


Figure: Adding an SSU carousel file

- Group: group where this file will be added.
- Path: local path for the file to upload to the server.

EDITING MODULE INFO DESCRIPTORS

To edit DII module info descriptors for an SSU carousel file, select the carousel from server tree and then select the Files tab. Right click on a file and select Edit. An editor dialogue will appear, for more information about using the editor, see Editing PSI/SI Data Structures.

For more information about using the editor, see Editing PSI/SI Data Structures.

RUNNING CAROUSELS

To start a carousel, you have to attach it to a service, i.e. create a stream for it. To create a stream, right click on a carousel in the server tree and select Attach to Service.... For more information about streams, see Managing DSM-CC Carousels.

SSU TRANSPORT STREAMS

SSU transport stream files are externally generated transport stream files that are played out from the Playout SSU server.

ADDING TRANSPORT STREAM FILES

To add a new SSU transport stream file, select SSU transport stream repository from server tree and click on the Upload transport stream file button in the tool bar. You are prompted to select a transport stream file that will be uploaded to the server. When you have selected the file, a dialogue (see figure below) is presented with the following options:

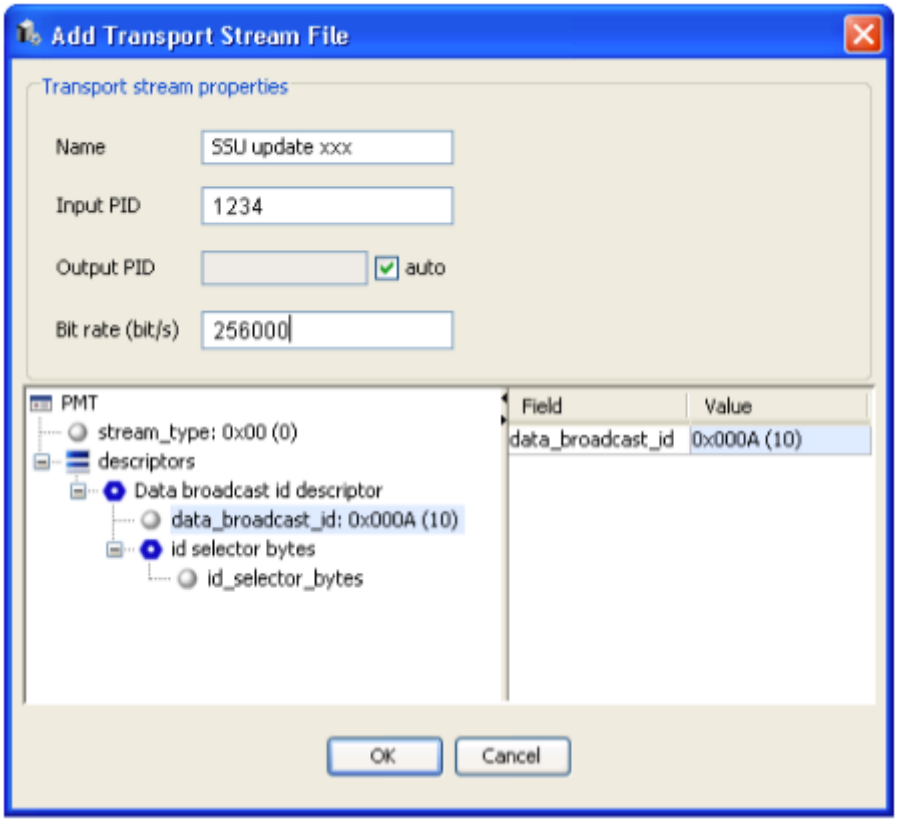


Figure: Adding a transport stream file

- Name: A descriptive name that is used only in PMC. Name must be unique, i.e. two transport stream files may not have the same name.
- Input PID: Data PID in the input file.
- Output PID: PID that will be used when sending the file. If auto is selected, PID will be automatically assigned when the carousel is started.
- Bit rate: Transport stream output bit rate in bits per second.
- PMT descriptors: Descriptors that will be added to PMT when this file is started. For more information about using the editor, see Editing PSI/SI Data Structures.

RUNNING SSU TRANSPORT STREAMS

To start a sending transport stream file, you have to attach it to a service, i.e. create a stream for it. To create a stream, right click on a transport stream file in the server tree and select Attach to Service.... For more information about streams, see Streams and Timers.

2.1. MANAGING VIDEO PLAYOUT

MANAGING PLAYLISTS

1. INTRODUCTION

Each DVB service has a playlist containing the items that are queued to be played in that service (also known as an active playlist). If an active playlist is empty, the default video is played until new items are added to the playlist. Playlists can also be created in the playlist repository for later use. Playlist items are either AV files or empty time, i.e. time when the default video is played.

2. ADDING NEW PLAYLISTS

To add a new playlist to the playlist repository, right click on the Playlist repository icon and select Add Playlist.

3. EDITING PLAYLISTS

Note that you can not edit the first two items in an active playlist (currently playing item and queued item).
To add new item to a playlist, select a playlist from the repository or a service from the server tree if you are editing an active playlist. Contents of the playlist is shown in the playlist panel on the right. Right click on the playlist panel and select Insert File to insert a single file or Insert Playlist to insert the contents of another playlist. You will be prompted for the file or playlist to insert.
To insert empty time to a playlist, right click on the playlist panel and select Insert Empty Time. You will be prompted to enter the length of empty time to insert. Default video for the service will be played for the duration of the empty time.
You can split part of an existing playlist to a new playlist. To do this, right click on the item you want to be the first item in the new playlist and select Split Playlist from the popup menu. Playlist items will be removed from the playlist and added to a new playlist.
To delete an item in a playlist, right click on it in the playlist panel and select Delete.

4. SKIPPING ITEMS

You can skip the currently playing item in an active playlist by right clicking on the playlist panel and selecting Skip Current Item from the pop-up menu.

ENCODING VIDEO FILES

1. MPEG-2

Use the following parameters when you encode MPEG-2 files to be used with Icareus Playout. Receivers may support various other settings as well, but these should work with most of them.
• MPEG-2 profile and level: Main level and main profile.
• Video size: 720 x 576 for PAL (or 720 x 480 for NTSC).
• Video frame rate: 25 Hz for PAL (or 29.97 Hz for NTSC).
• Video aspect ratio: 4:3, 16:9 or 2,21:1
• Video data rate: Use constant bit rate (CBR).
• Video sequence headers: Insert sequence header in every GOP (Group Of Pictures). (Decreasing the frequency of sequence headers will increase channel hopping time.)
• Audio format: Use MPEG Layer I or Layer II audio (Layer II is preferred).

2.1. CAS SUPPORT

1. INTRODUCTION

Conditional access (CA) is a technology used to control access to digital television services to authorized users by encrypting the transmitted programming. The content scrambling algorithm is used to encrypt content. The algorithm operates on the payload of a Transport Stream (TS) packet in the case of TS-level scrambling. A structuring of PES packets is used to implement PES-level scrambling with the same scrambling algorithm. Icareus server allows configuring the following PSI/SI tables parameters to define scrambled content.

CA_descriptor: The conditional access (CA) descriptor is used to specify both system-wide conditional access management information such as EMMs and elementary stream-specific information such as ECMs.

free_CA_mode field: This 1-bit field, when set to "0" indicates that all the component streams of the service are not scrambled. When set to "1" it indicates that access to one or more streams may be controlled by a CA system.

CA_identifier_descriptor: The CA identifier descriptor indicates whether a particular bouquet, service or event is associated with a conditional access system and identifies the CA system type by means of the CA_system_id.

2. CONFIGURATION

2.1. BOUQUET ASSOCIATION TABLE (BAT)

It is possible to add a CA_identifier_descriptor to a BAT and specify CA_system_id for the descriptor.

- Select PSI/SI->Edit BAT...->'Bouquet Descriptors' menu item
- Bouquet Information Table dialog should appear
- Right-click 'Bouquet descriptors' node and select 'Add descriptor' menu item
- Choose 'CA Identifier descriptor' in a drop-down list and press OK button
- Expand 'CA identifier descriptor' node
- Right-click CA_system_ids node and select 'Add CA_system_id' menu item
- Expand CA_system_id node
- Double-click CA_system_id field to update its value
- Press OK to save the changes and close the dialog

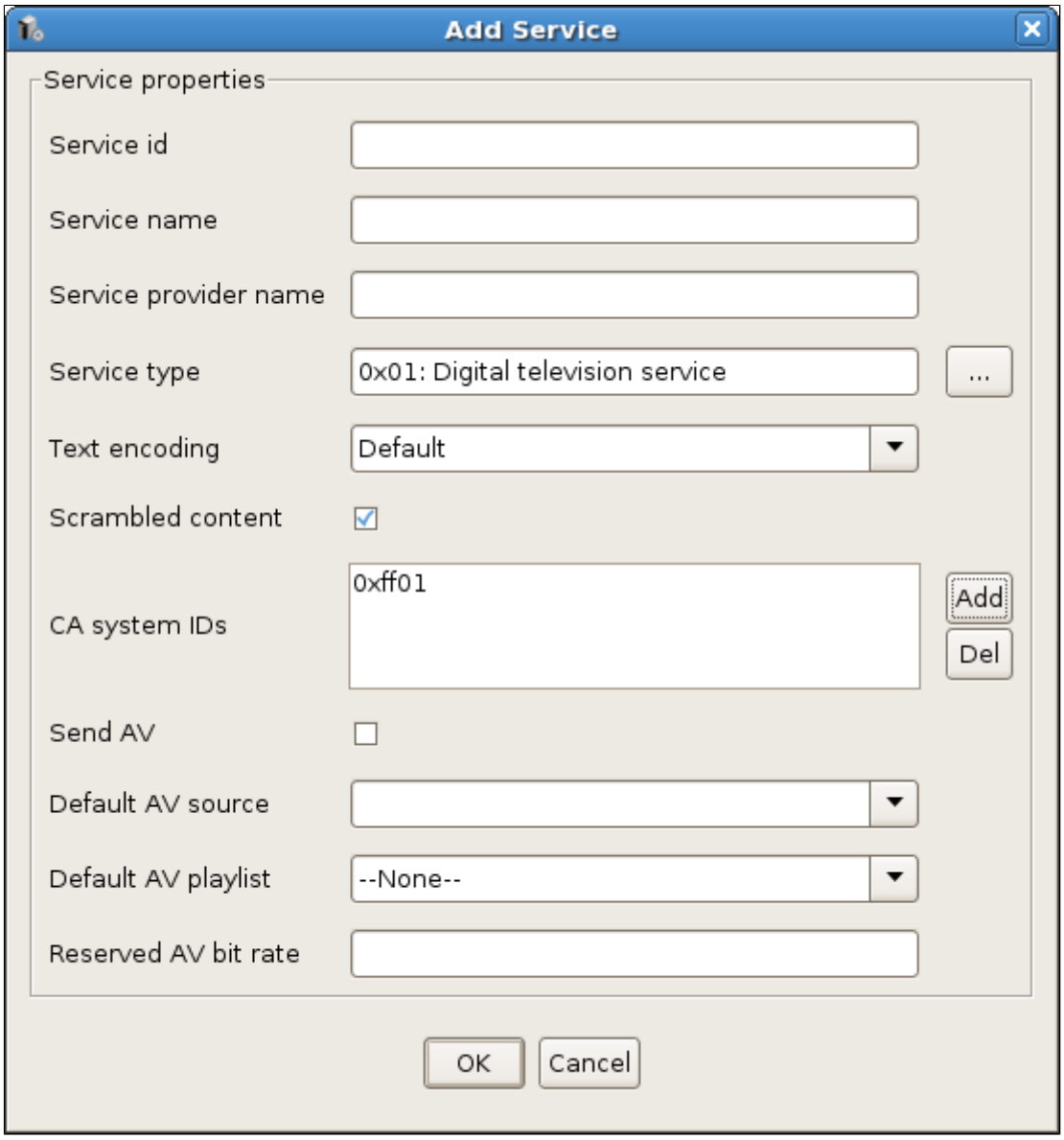
2.2. PROGRAM MAP TABLE (PMT)

It is possible to add one or more CA_descriptor to a particular service in PMT.

- Select PSI/SI->Edit PMT...->'Service Name' menu item
- Program Map Table dialog should appear for the selected service
- Right-click 'PMT common descriptors' node and select 'Add descriptor' menu item
- Choose 'CA descriptor' in a drop-down list and press OK button
- Expand 'CA descriptor' node
- Double-click any descriptor's field to update its value
- Press OK to save the changes and close the dialog

2.3. SERVICE DESCRIPTION TABLE (SDT)

It is possible to add a CA_identifier_descriptor to a particular service and specify CA_system_id for the descriptor. These parameters can be specified for a newly created service.



Select 'Scrambled content' option to set free_CA_mode flag to 1 for a service. Once the option is selected, it is possible to specify a set of CA system ids for the service. A CA identifier descriptor will be added to the service with the list of CA system ids defined in this dialog.

The same options are available for updating using 'Edit service' scenario.

Another approach to add CA identifier descriptor to a service is editing SDT descriptors directly.

- Select PSI/SI->Edit SDT...->'Service Name' menu item
- Service Description Table dialog should appear for the selected service
- Right-click 'Service descriptors' node and select 'Add descriptor' menu item
- Choose 'CA identifier descriptor' in a drop-down list and press OK button
- Expand 'CA identifier descriptor' node
- Right-click CA_system_ids node and select 'Add CA_system_id' menu item
- Expand CA_system_id node
- Double-click CA_system_id field to update its value
- Press OK to save the changes and close the dialog

2.4. EVENT INFORMATION TABLE (EIT)

free_CA_mode field is automatically set to 1 for a particular event if the event is defined for a service that is declared as one that has scrambled content. Otherwise, it is set to 0.

3. APPENDIX

Conditional Access identifier descriptor sample (XML format)

```
<!DOCTYPE data PUBLIC "" "si.dtd">
<data>
 <descriptor name="CA identifier descriptor">
  <field bitcount="8" name="descriptor_tag" type="ulong" value="53" visible="false"/>
  <length bitcount="8" target="total"/>
  <list item="CA_system_id" name="CA_system_ids">
   <listitem name="CA_syctem_id">
    <field bitcount="16" name="CA_system_id" type="ulong" value="508" visible="true"/>
   </listitem>
  </list>
 </descriptor>
</data>
```

2.1. PLAYOUT GENERAL SETTINGS

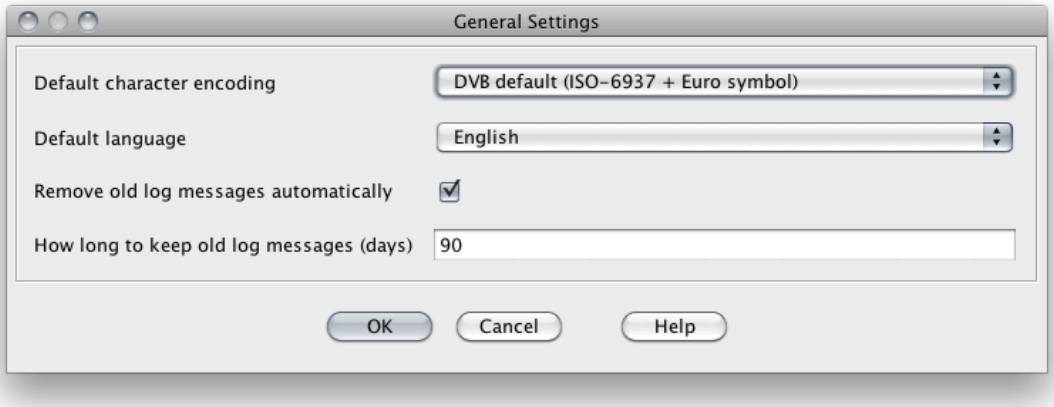
1. INTRODUCTION

In this chapter we go through the server wide settings of Playout server.

All general configuration is done from Server -> Settings

There may be other settings available from Server -> Settings -menu, but these always relate to a specific Playout module and are discussed in the corresponding chapter.

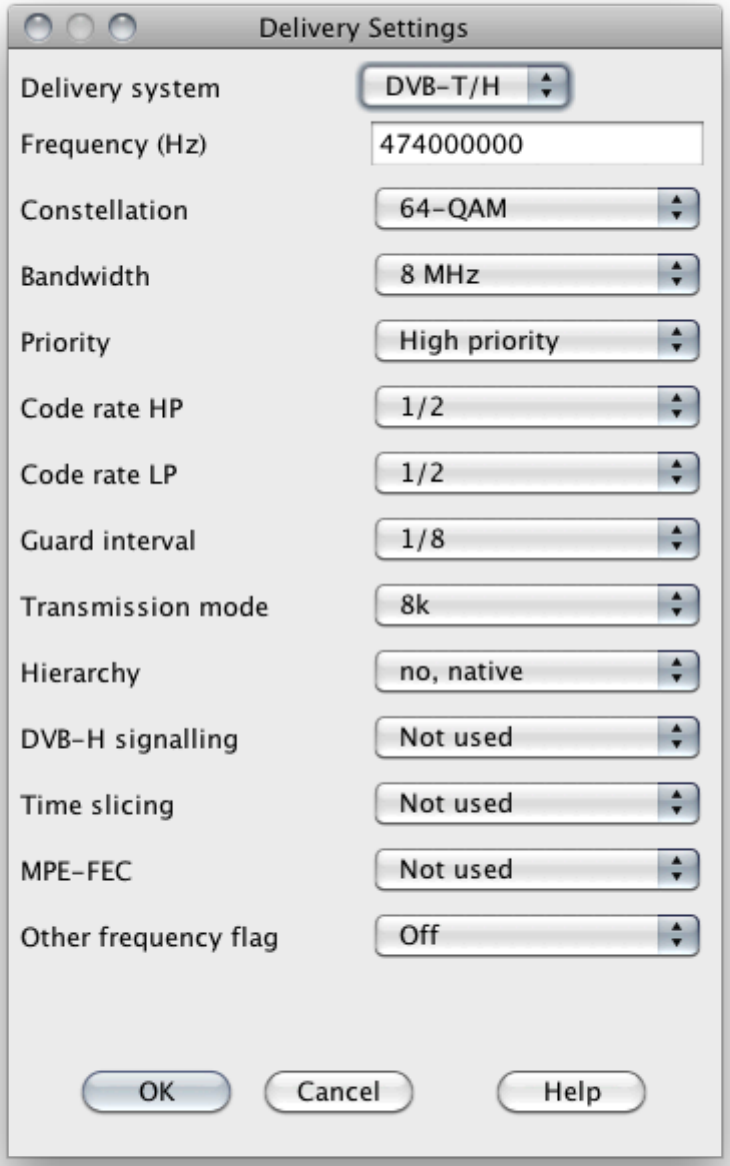
2. GENERAL SETTINGS



3. DELIVERY SETTINGS

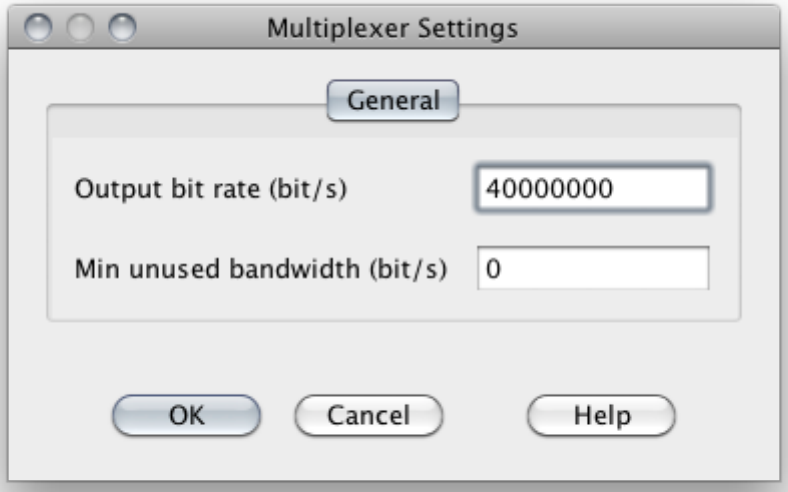
If there is a modulation card attached to Icareus Playout, it is possible to define the modulation parameters in Server -> Delivery Settings.

Icareus Playout currently supports for DVB-T, DVB-S/S2, DVB-C and DVB-H modulation cards from Decktec.



4. MULTIPLEXER SETTINGS

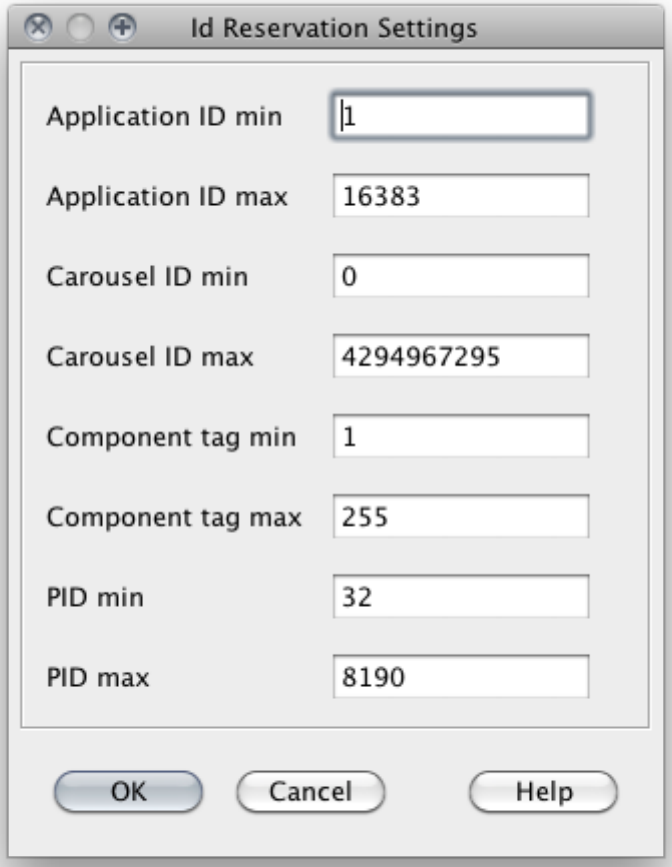
The most important setting for the output is to define Multiplexer settings. That is possible to do by choosing Server -> Settings -> Multiplexer menu. It will open a new window:



The general settings include:
Output bit rate (bit/s): the total output bitrate of the generated MPEG-2 transport stream.
Min unused bandwidth (bit/s): reserved bandwidth which is filled with null packets.

5. ID RESERVATION

Id Reservation settings enable user to define the ID's that may be used for different elements within Playout.



6. DVB-T2 DESCRIPTOR

DVB-T2 descriptor

```
<!DOCTYPE data PUBLIC "" "si.dtd">
<data>
 <descriptor name="T2 delivery system descriptor">
  <field bitcount="8" name="descriptor_tag" type="ulong" value="7f" visible="false"/>
  <length bitcount="8" target="total"/>
  <field bitcount="8" name="descriptor_tag_extension" type="ulong" value="04" visible="false"/>
  <field bitcount="8" name="plp_id" type="ulong" value="0"/>
  <field bitcount="16" name="T2_system_id" type="ulong" value="0"/>
  <field bitcount="2" name="SISO/MISO" type="ulong" value="0"/>
  <field bitcount="4" name="bandwidth" type="ulong" value="0"/>
  <field bitcount="2" name="reserved" type="ulong" value="0" visible="false"/>
  <field bitcount="3" name="guard_interval" type="ulong" value="2"/>
  <field bitcount="3" name="transmission_mode" type="ulong" value="1"/>
  <field bitcount="1" name="other_frequency_flag" type="ulong" value="0"/>
  <field bitcount="1" name="tfs_flag" type="ulong" value="0"/>
  <field bitcount="16" name="cell_id" type="ulong" value="0"/>
  <field bitcount="32" name="centre_frequency" type="ulong" unit="10 Hz" value="1C40AA80"/>
  <field bitcount="8" name="subcell_info_loop_length" type="ulong" value="0"/>
 </descriptor>
</data>
```

DVB TRANSMISSION PARAMETERS

DVB-T2

DVB-T2 descriptor

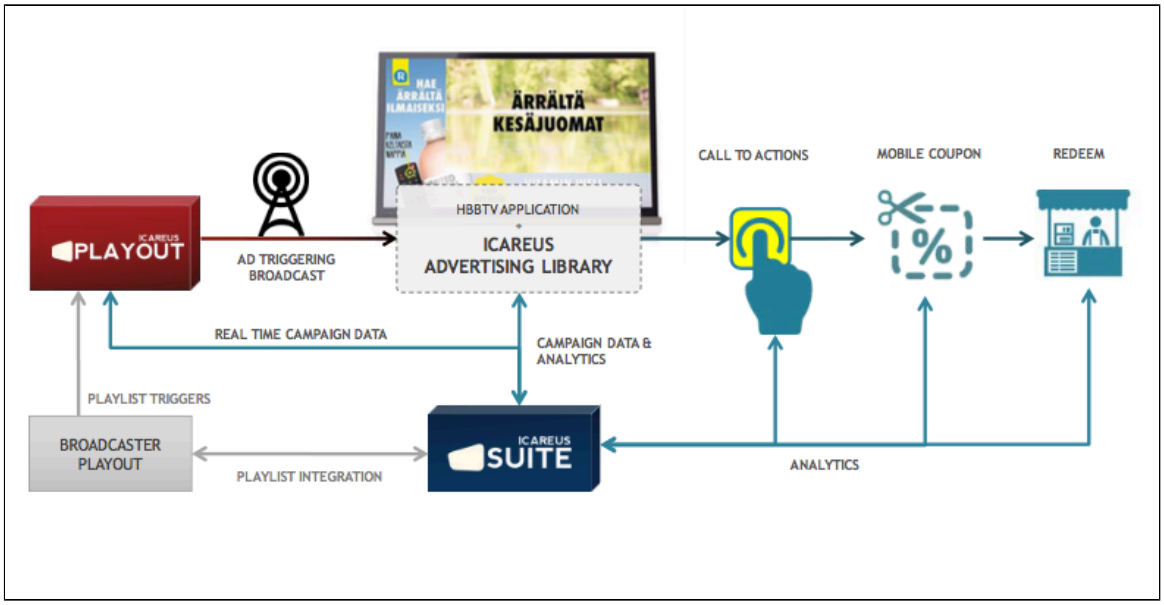
```
<!DOCTYPE data PUBLIC "" "si.dtd">
<data>
 <descriptor name="T2 delivery system descriptor">
  <field bitcount="8" name="descriptor_tag" type="ulong" value="7f" visible="false"/>
  <length bitcount="8" target="total"/>
  <field bitcount="8" name="descriptor_tag_extension" type="ulong" value="04" visible="false"/>
  <field bitcount="8" name="plp_id" type="ulong" value="0"/>
  <field bitcount="16" name="T2_system_id" type="ulong" value="0"/>
  <field bitcount="2" name="SISO/MISO" type="ulong" value="0"/>
  <field bitcount="4" name="bandwidth" type="ulong" value="0"/>
  <field bitcount="2" name="reserved" type="ulong" value="0" visible="false"/>
  <field bitcount="3" name="guard_interval" type="ulong" value="2"/>
  <field bitcount="3" name="transmission_mode" type="ulong" value="1"/>
  <field bitcount="1" name="other_frequency_flag" type="ulong" value="0"/>
  <field bitcount="1" name="tfs_flag" type="ulong" value="0"/>
  <field bitcount="16" name="cell_id" type="ulong" value="0"/>
  <field bitcount="32" name="centre_frequency" type="ulong" unit="10 Hz" value="1C40AA80"/>
  <field bitcount="8" name="subcell_info_loop_length" type="ulong" value="0"/>
 </descriptor>
</data>
```

2.1. ADDRESSABLE TV MANAGEMENT

INTRODUCTION

Icareus Playout has a key role in executing Addressable TV advertising in HbbTV environment. It interacts closely with Icareus Suite and Broadcasters traffic management or playout system to generate necessary triggers to synchronise advertising with the linear broadcast.

Overall architecture is depicted in the below image as example of ActiveAd Concept.



The Playout HbbTV campaign management is part of playout-admin process that allows customer to display banners and video ads to TV viewers.

Icareus Suite Addressable TV module provides information about active campaigns to Icareus Playout to ensure that all campaigns are in-sync. Data is polled from Icareus Suite to Playout.

RUNNING ADDRESSABLE TV MANAGEMENT MODULE

Module is part of playout-admin process and runs automatically if configured properly.

R THE CONFIGURING IS DONE THE PLAYOUT-ADMIN PROCESS MUST BE RESTARTED IN R TO GET THE NEW VALUES INTO USE. SEE COMMAND BELOW:

```
[root@admin ~]# service playout-admin restart
```

CONFIGURATION

The configuration for both ActiveAd and VideoSwap is done in a file /opt/playout/conf/campaignhandler.conf.

Below is table that describes the configuration file parameters

Name	Value	Example	Requirement	Description

sourceIdChannel	database ID, <channel>, port number, port type, trigger delay, additional delay, trigger stream event	14 <Nelonen> 12000 tcp 6000 0 true	Mandatory	A property sourceIdChannel starts all channel specific configuration lines. A database id is an automatically generated id for the HbbTV application which is assigned to the <channel> (e.g. Nelonen) and it is unique for one Playout server. This value of this tag can be seen from application's parameters tab using PMC (Playout Management Console). A port number and port type defines a number and type of port that receives TCP/UDP/http triggers in the Playout server. A <channel> is a name of the channel that will receive the stream event based on the trigger received by Playout server. A trigger delay (in milliseconds) indicates how long Playout server will wait after receiving a trigger before it sends a payload stream. An additional delay (in milliseconds) indicates how long Playout server will wait before sending a POST request to postUrl. NOTE: this value is optional! A trigger stream event is a boolean value that defines whether an actual stream event to suitePayloadIP, or just a POST request to postUrl will be sent after getting the trigger. NOTE: this value is optional! NOTE: The format allowes user to configure several sourceIDChannel parameters in the configuration file to support multiple channels.
suitePollerIP	IP address | DNS name	suite.icareus.com	Mandatory	A property suitePollerIP describes the URL from where the json data of active campaigns is fetched.

suiteProtcol	http | https	https	Mandatory	A property suiteProtocol describes the used protocol for suitePayloadIP.
suitePayloadIP	url	suite.icareus.com	Mandatory	A property suitePayloadIP describes the address of the application server sent in payload stream. NOTE: the url needs to be URL encoded
organizationId	number	36131	Mandatory	A property organizationId describes the id of an organization that must be given to Suite when the json data of active campaigns is fetched.
postUrl	url	http://suite.icareus.com:8085/status	Optional	A property postUrl is the URL to use to update channel statuses (if applicable).

Example of a configuration file

```
sourceIdChannel 21 <Estradi> 12000 tcp 3000 1 false
sourceIdChannel 22 <Estradi DNA> 12000 udp 2000 0 true
sourceIdChannel 24 <MTV3> 11000 tcp 4000
sourceIdChannel 34 <Estradi HD> 8080 http 4000
suitePollerIP suiterc.icareus.com
suitePayloadIP suiterc.icareus.com
suiteProtcol http
organizationId 103709
```

It is also possible to configure different channels to listen the same trigger from the same port. This could be handy when e.g. cable and terrestrial version of a channel requires different delay.

SUPPORTED INCOMING TRIGGER FORMATS

It is possible to use all port types (tcp, udp and http) for all kind of triggers (switchin, videoswap and activead). Below is some examples about differet triggers.

banner TCP trigger with key value:

```
29843299
```

generic http trigger with key value:

```
http://192.168.1.100:8080/triggerhandler?channel=Sub&lyid=250621
```

generic http trigger without a key (empty trigger):

```
http://192.168.1.100:8080/triggerhandler?channel=Sub
```

custom http trigger for certain customer with key value:

```
http://192.168.1.100:8080/campaignhandler/mtv?channel=Sub&lyid=41179177
```

custom http trigger for certain customer without a key (empty trigger):

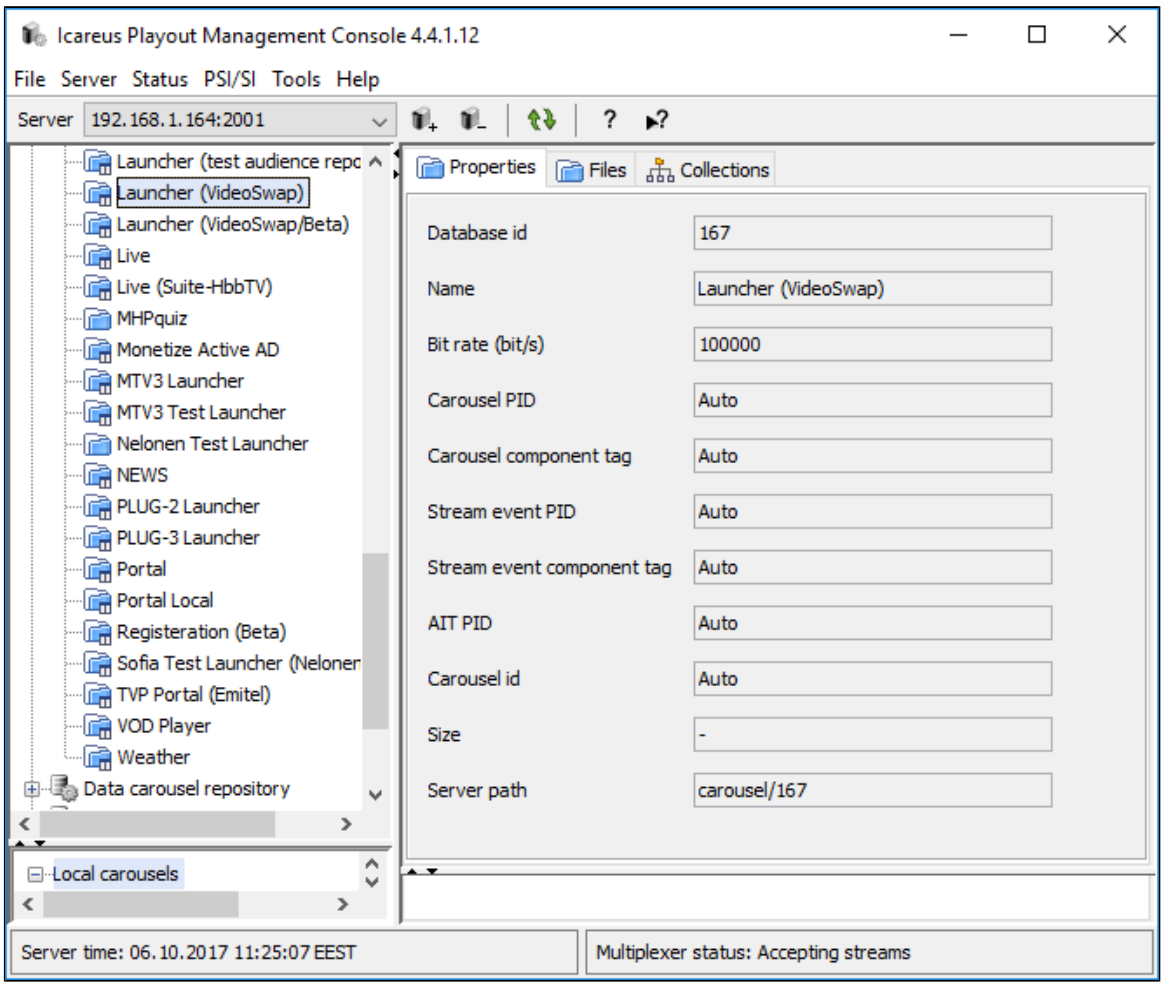
```
http://192.168.1.100:8080/videoswap/nelonen?channel=Ava
```

video swap UDP trigger with key value:

```
1211212336
```

CREATING A LAUNGHER APPLICATION

The launcher application is needed for sending the stream-event for broadcasting. Here is a picture of example launcher application:



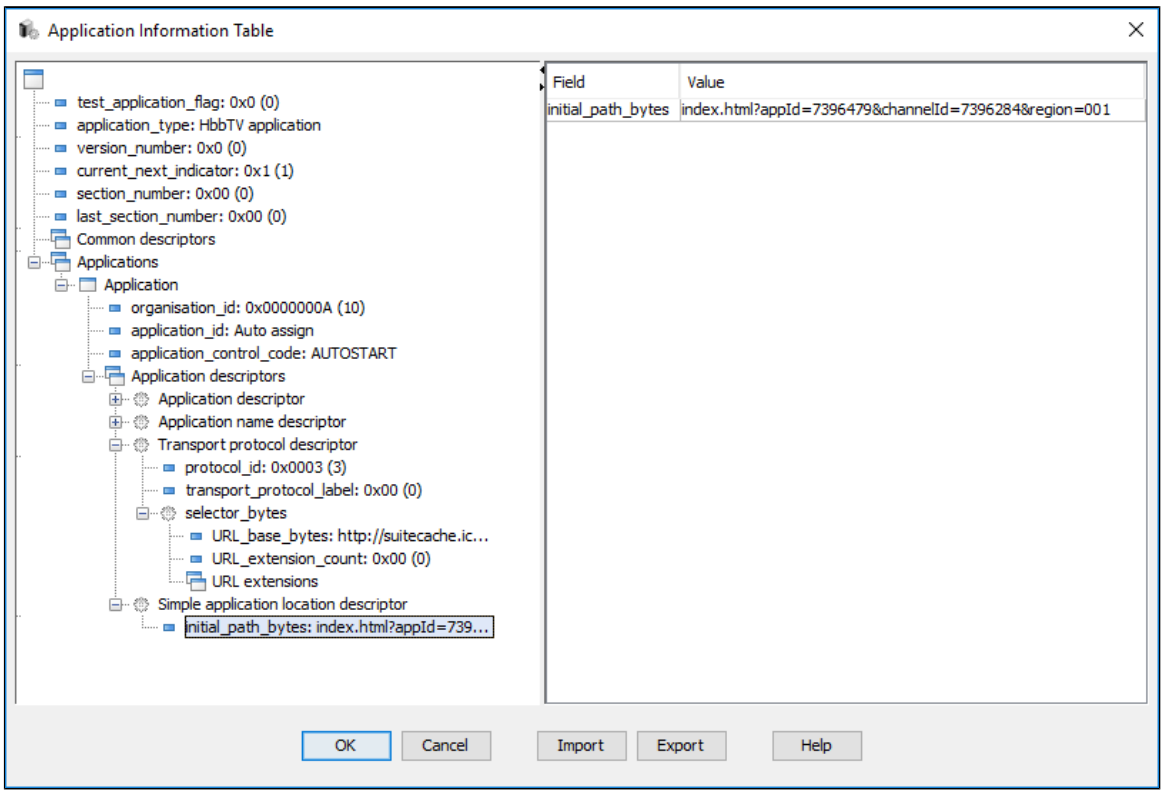
After a launcher application is created, the AIT table should be configured based on the channel and launcher application configuration in Icareus Suite.
The picture below shows what field must be set and with what value.

The value for parameter "URL_base_bytes" should be copied from field "URL" in tab "Info" of Launcher application in Icareus Suite.

> The part from index.html must be left out in this phase.

!LauncherURLbase.png|border=1!The value for parameter"initial_path_bytes" should be taken from the index.html part of that same URL, and add also a channelId (and in case of Video Swap, also a region).

A "channelId" is a "System Id" of channel used in Icareus Suite Addressable TV.



EXAMPLE OF A STREAM-EVENT PAYLOAD URLS

ACTIVE AD

DOWNLOAD DATA STREAM-EVENT WITH DELAY INFORMATION

```
scheme:http,address:suite.icareus.com,path:/api/campaign,param_triggerAction:download,param_action:getCampaig
```

TRIGGER THE AD STREAM-EVENT

```
param_triggerAction:trigger,param_campaignType:bannerAdCampaign,param_timestamp:1506939172845
```

VIDEO SWAP

DOWNLOAD DATA STREAM-EVENT WITH DELAY INFORMATION

```
param_triggerAction:download,param_delay:5000,param_campaignType:videoAdCampaign,param_breakId:1006010000,par
```

TRIGGER THE VIDEO SWAP STREAM-EVENT

```
param_triggerAction:trigger,param_campaignType:videoAdCampaign,param_timestamp:1507206507667
```

SENDING TRIGGERS MANUALLY

PREPARATIONS

- Open Playout Management Console (PMC)
- Right click the application, add/edit stream events. Add stream object called “suite_ads”. Add event called “ad_trigger” (type is do it now event)

- Attach the application to the intended service. Click on the attached application and note the "Database/Carousel Id" of it (from the panel on the right) and note it down.
- On PMC open "Status" menu and go to "Reserved Ids" > "Component Tags". There check the ID of "dsmcc-carousel" && "dsmcc-stream-event" for the application above. Note these and send them to Icaerus.

> Two mechanisms are defined for referencing sources of stream events from applications:
> • By referencing a DSM-CC stream event object in an object carousel. This requires the service to contain an
> object carousel as well as the elementary stream carrying the stream event messages.
> • By referencing an XML file containing equivalent information to the DSM-CC stream event object. This enables synchronization to services carrying the stream event messages but not
> containing an object carousel.
>
> Currently we support just the latter approach.

SENDING TRIGGERS

It is mandatory to generate two different campaign trigger URLs. First one is "download the data" and second is "trigger the ad". The example payloads for these are shown above.

Note, the channel name above should also exactly match the channel name set on Playout

To trigger stream events via playout:

http://<ip/address of playout server>:8080/event?Source-Id=<DB/Carousel ID noted above>&Object-Name=suite_ads&Event-Name=ad_trigger&Payload=<Payload URLs defined above to trigger campaign>

Number of campaign shows & daily shows can be checked by clicking the campaign in Suite.

MONITORING/TROUBLESHOOTING

The Playout logs with useful information can be viewed /var/log/messages. When playout-admin process is started, all information related to sourceIdChannel tag are logged. After that all ports that have been started to be listen to are also logged. Every time the trigger is received to some of these ports, the key and port number are logged.

It is also logged whether received key did or didn't match to any of the key list. When the received key matches to some on the list, payload URL is sent to the Suite an the URL is also logged.

When new key list is fetched from Suite, the number of keys of that list is also logged.

3. OPERATIONS GUIDE OF ICAREUS PLAYOUT

Operations Guide shall contain instructions on how to run every day operational tasks on the DVB EPG system, as well as basic troubleshooting information.

3.1. SETTING PLAYOUT TIME

1. INTRODUCTION

The time for the set-top boxes and TVs is sent in TDT (Time Definition Table), which is generated by Icareus Playout. Time is transmitted in UTC -time.
It is possible to double check the current value from Status->Multiplexer Info->TDT (by double clicking on it)

Additionally it is possible to use TOT (Time Offset Table) to define an offset for the UTC time frim PSI/SI->Edit TOT Descriptors
In practice this enables network operators to force a local time setting for the network, e.g. Poland's local time offset.

It is recommend to use NPT servers to sychronize Playout servers clock.

2. PLAYOUT SERVER TIME

NOTE: The Playout's multiplexer service must be restarted after changing servers time

2.1. PLAYOUT NTP CLIENT CONFIGURATION

It is not required to install any NTP packages to Playout server. They are installed by default and NTP time synchronization is activated

NOTE: Internet connection is required to use external NTP servers

2.2. UPDATING PLAYOUT SERVER TIME MANUALLY:

1) Update timezone
There are a number of predefined time zone values in /usr/share/zoneinfo directory. It is necessary to create a symbolic link to one of those files to define a time zone.

```
# mv /etc/localtime /etc/localtime.bak
# ln -s /usr/share/zoneinfo/Europe/Helsinki /etc/localtime
# date
Sun Mar 21 16:07:58 EET 2010
```

The above code sample moves current time zone info to a backup file, creates a symbolic link to a Helsinki time zone and calls "date" command to check current system time zone.

2) Update current date and time
It is necessary to run the following command to update these parameters.

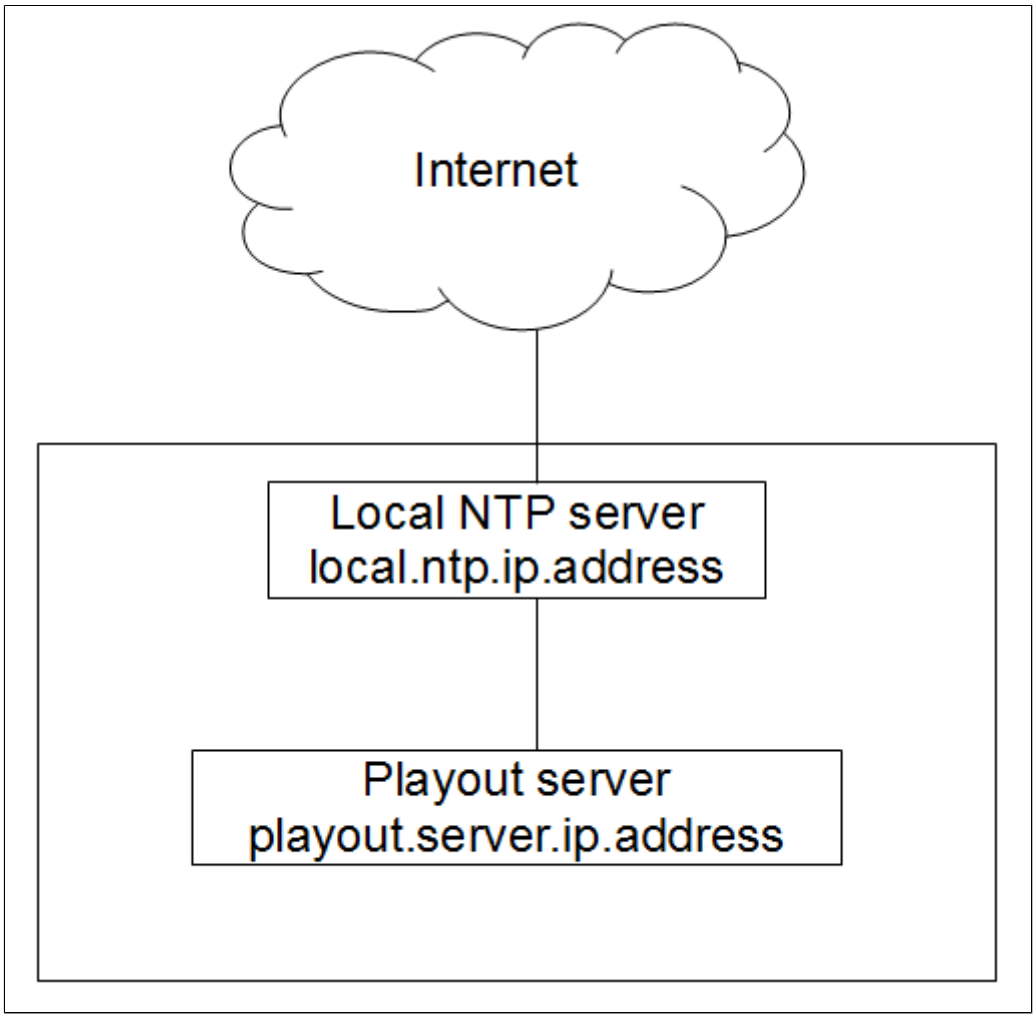
```
#date -s "21 MAR 2010 17:00:00"
```

The string parameter is date and time that will be set.

2.3. CONFIGURING LOCAL NTP SERVER AND CLIENT

2.3.1. INSTALLING LOCAL NTP SERVER

In case the servers do not have Internet access, it is necessary to setup dedicated NTP server in a local network. This NTP server should have Internet access to perform time synchronization. All other servers should be configured with this local NTP server IP address.



There are a lot of web resources that have description of NTP server setup procedure.

RedHat:
http://docs.redhat.com/docs/en-US/Red_Hat_Enterprise_Linux/6/html/Deployment_Guide/sect-Date_and_Time_

Windows: http://www.satsignal.eu/ntp/setup.html

After NTP server is configured, please make sure

- port 123 is not blocked by Firewall
- local NTP server is configured to accept connections from playout.server.ip.address. However, usually default NTP server configuration allows any connections from local network.

2.3.2. CONFIGURING PLAYOUT'S NTP CLIENT

It is necessary to update NTP client configuration with local NTP sever IP address.

1). Open /etc/ntp.conf file

```
#vi /etc/ntp.conf
```

2). Replace

```
server 0.centos.pool.ntp.org

server 1.centos.pool.ntp.org

server 2.centos.pool.ntp.org

with

server local.ntp.ip.address
```

where local.ntp.ip.address is actual IP address of the local NTP server.

3). Restart ntp service

```
#service ntpd restart
```

4). Set NTP service as start up service in the system.

```
#chkconfig ntpd on
```

5). Restart Playout server: Server->Service Management->Restart All

2.4. TIME SHOWN ON PLAYOUT MANAGEMENT CONSOLE

Playout Management console retrieves the time from Icareus Playout server once the connection to the server is established. After this it starts its own clock, thus the time shown on Playout Management console may have offset to the actual server time.

3. COMMON ISSUES

If the time or program starting times are incorrect on the receiver it may be that

- Multiplexer overwrites TDT -table in the stream
- Time settings on the receiver should be checked, there is usually both manual and automatic options. The time in EIT events is UTC, so it's the task for the receiver to find correct event for the current time.

4. HOWTO

Q: How to manually synchronize the server time (once)?
A: Use the ntpdate command and the appropriate NTP server:

```
#service ntpd stop
#ntpdate 0.centos.pool.ntp.org    // 0.centos.pool.ntp.org is your NTP server address
Output: 10 Oct 13:48:39 ntpdate[28375]: adjust time server 194.100.2.194 offset -0.002503 sec
#service ntpd start
```

- ntpdate is part of the ntp package which must be installed to run the command and
- make sure that firewall won't block the outgoing ntp traffic to internet

Q: How to install ntp package on CentOS?
A: Find the correct package by listing packages using the yum package manager:

1. yum list ntp
   A: Install the ntp package that is listed:
2. yum install ntp.x86_64
3. install the correct ntp package - could have different name on 32-bit OS

Q: How to automatically synchronize the server time?
A: Use the ntpd service to keep the server time synchronized - start the service by executing:

1. service ntpd start
2. yum package manager typically installs the necessary service to /etc/init.d/ntpd
3. make sure that firewall won't block the outgoing ntp traffic to internet

Q: How to make NTP service automatically start on server boot?

A: Use chkconfig to make the service start automatically:

1. chkconfig --add ntpd

Q: How to configure the NTP server(s) with which the time is automatically synchronized?
A: Edit the ntp configuration file using for example the vi editor:

1. vi /etc/ntp.conf
   A: Locate the line(s) starting with "server" and replace the server names with your own choosing (press i to enter text edit mode, press ESC to enter command mode)
   A: Type ":wq" in command mode to save your changes and exit the editor
   A: Restart the ntpd service:
2. service ntpd restart

3.1. MANAGING PLAYOUT OS SERVICES

3.1. PLAYOUT MULTIPLEXER OUTPUT

LOG

If there is a need to follow the service processes, Icareus Playout server provides a Log feature for that use.

Choose Status à Log [Ctrl + L] to open the Log window. It is shown like the image below.

3.1. PLAYOUT JAVA API

Icareus Playout servers can be controlled through a Java API. It allows users to write Java applications for handling carousels, streams, timers and other items on a Playout server. This API communicates with the server over a TCP/IP network connection using the Playout Control Protocol.

Playout Server API classes are located in cardinalplayout.jar in the API directory under Playout Management Console installation directory. Using the API requires Java version 1.4 or greater. See JavaDoc documentation for a detailed description of available classes and methods. Sample code for the API can be found in the api/sample directory under PMC installation directory.

Icareus provides the Javadocs for the customers the make able to use the API. The first pages of Icareus Playout API Specification is presented in image below. For further information or to receive Javadocs please, contact support@icareus.com or sales@icareus.com.

3.1. PLAYOUT CONTROL PROTOCOL

1. INTRODUCTION

Icareus Playout platform uses a custom protocol to exchange information with 3rd party management systems as well as with Icareus Playout Management Console. The main usages for the protocol are:

- retrieve information of the status of the server
- to control and manage the server

The Icareus Playout Java API is a java library that "wraps" this protocol to give an abstraction layer for programmers. The Protocol can naturally be used directly as well.

The protocol is described in the following chapters and examples are given how to use it.

2. DESCRIPTION

TCP connection (SSL) should be established with Icareus Server to perform any communications.

Several Playout modules are responsible for processing Playout Protocol commands. The below table specifies TCP ports for each module. These ports should be used to connect to a particular module for command execution.

Port	Module
2001	playout-scheduler

5000	eit-update
5555	playout-admin

Commands are plain text strings transmitted as a sequence of bytes representing UTF-8 encoding.
The command structure is as follows:

```
COMMAND_NAME<\r\n>
HeaderParamName1: HeaderParamValue1<\r\n>
HeaderParamName2: HeaderParamValue2<\r\n>
HeaderParamNameN: HeaderParamValueN<\r\n>
Content-Length: value<\r\n>
<\r\n>
BODY<\r\n>
<\r\n>
```

The response structure is as follows:

```
STATUS_CODE STATUS_MESSAGE<\r\n>
HeaderParamName1: HeaderParamValue1<\r\n>
HeaderParamName2: HeaderParamValue2<\r\n>
HeaderParamNameN: HeaderParamValueN<\r\n>
Content-Length: value<\r\n>
<\r\n>
BODY<\r\n>
<\r\n>
```

Status codes description:

Status code	Description
200	OK
220	Service is ready
400	The request could not be understood by the server due to malformed syntax
401	Client authentication failed
402	The requested feature is not supported on the server.
403	Request was syntactically correct, but contained invalid data
404	The requested resource was not found on the server
408	The client did not produce a request within the time that the server was prepared to wait
409	The request could not be completed due to a conflict with the current state of the resource
410	Clip processing error
453	Client requested more bandwidth than is available
500	The server encountered an unexpected condition which prevented it from fulfilling the request
501	The requested feature is not implemented on the server

The first message Icareus Server sends back to a client is the welcome message.
The welcome message example:

```
220 Playout playout-admin
Version: 4.4.0.4
```

That is successful reply from playout-admin module of version 4.4.0.4.

Here is a Java example of retriving server information:

```
javax.net.ssl.SSLContext sslContext = javax.net.ssl.SSLContext.getInstance("SSL");
// class PMCTrustManager implements javax.net.ssl.X509TrustManager
sslContext.init(null, new javax.net.ssl.TrustManager[]{new PMCTrustManager()}, null);
javax.net.ssl.SSLSocketFactory sslSocketFactory = sslContext.getSocketFactory();
// host is the address of the Playout server, 5555 is the playout-admin module port
java.net.Socket socket = sslSocketFactory.createSocket(host, 5555);
java.io.InputStream inStream = socket.getInputStream();
java.io.OutputStream outStream = socket.getOutputStream();
outStream.write(("GET_SERVER_INFO\r\n\r\n").getBytes());
outStream.flush();
java.io.ByteArrayOutputStream receive = new java.io.ByteArrayOutputStream();
int i;
while ((i = inStream.read()) != -1) receive.write(i);
String str = new String(receive.toByteArray(), "UTF-8");
System.out.println("Response: " + str);
```

3. RETRIEVING THE ACTUAL STATUS OF THE EP100 SERVER.

Playout-admin module is responsible for processing this command.
Command:

```
GET_SERVER_INFO
```

Response example:

```
200 Sending server info
License-Features: 1,3,5,16
Dongle-Id: 264020675
Expiration-Date: 2012-12-12 00:00:00
Licence-Version: 4.4
Service: playout-admin,1,1,4.4.0.2
Service: playout-av-input,0,0,4.4.0.2
Service: playout-dsmcc-dc-input,0,0,4.4.0.2
Service: playout-dsmcc-input,0,0,4.4.0.2
Service: playout-dvbh-esg,0,0,4.4.0.2
Service: playout-eit,1,1,4.4.0.2
Service: playout-eit-update,1,1,4.4.0.2
Service: playout-flute-streamer,0,0,4.4.0.2
Service: playout-ip-input,0,0,4.4.0.2
Service: playout-ip-streamer,0,0,4.4.0.2
Service: playout-media-storage,0,0,4.4.0.2
Service: playout-meta-admin,1,1,4.4.0.2
Service: playout-mpeg-record,0,0,4.4.0.2
Service: playout-muxer,1,1,4.4.0.2
Service: playout-scheduler,1,1,4.4.0.2
Service: playout-sipsi,1,1,4.4.0.2
Service: playout-ts-input,0,0,4.4.0.2
Service: playout-vdcp,0,0,4.4.0.2
Service: playout-esgen-player,0,0,4.4.0.2
Service: playout-esgen-middle,0,0,4.4.0.2
Is-Installation: 0
```

Response parameters description:

Parameter	Description
License-Features	Playout License Features
Dongle-Id	dongle identification key installed on the server
Expiration-Date	Server license expiration date
Licence-Version	Server license version

Service	service status Parameter 1 - service name Parameter 2 - 1 if the service is running, 0 otherwise Parameter 3 - 1 if the service is enabled on system boot, 0 otherwise Parameter 4 - service version
Is-Installation	1 if server installation procedure is in progress, 0 otherwise.

3.1. RECORDING AND PLAYING TS

INTRODUCTION

Icareus Playout server can be used as a TS player and recorder to help in debugging or to playout pre-recorded transport stream files. Transport stream files are shown in PMC in the Recording repository. Icareus Playout server can be used as a TS player, i.e. for playing pre-recorded transport stream files to server's ASI or IP output. Files can be uploaded to the server or recorded from Playout server's transport stream output (multiplexer). When a transport stream file is being played in the multiplexer, it will not accept any streams, i.e. no streams or timers can be started.

Status bar will show multiplexer status, Accepting streams in the normal mode or Playing TS file when multiplexer is playing transport stream from a file.

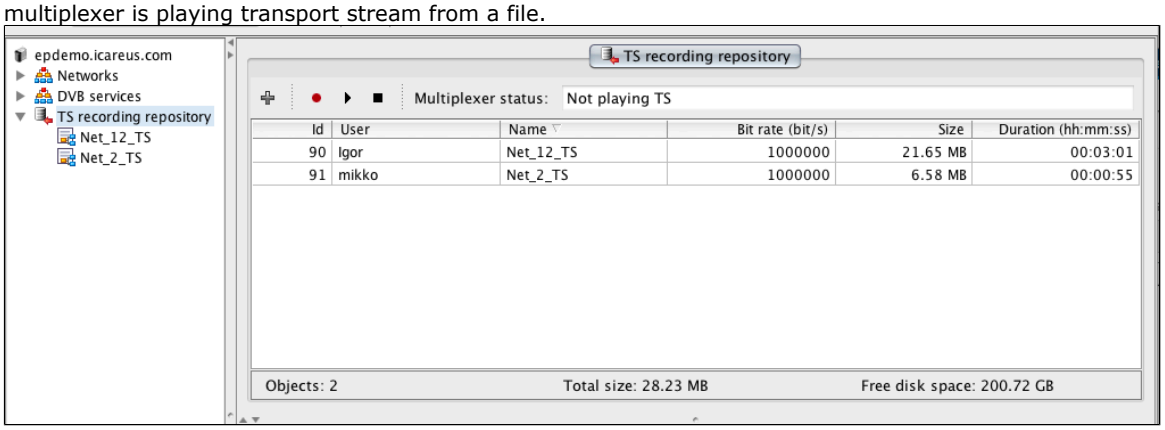


Figure: TS Recording repository with 2 files

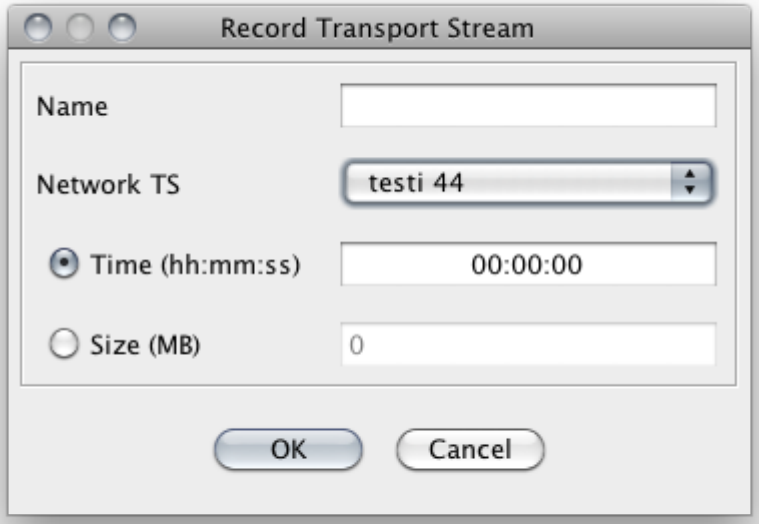
PLAYING TS FILES

To start playing transport stream from the repository, select Tools à Play Transport Stream or click on the play button under the Recording repository tab.

To stop playing transport stream, select Tools à Stop Playing Transport Stream or click on the stop button under the Recording repository tab.

RECORDING TS FILES

To record a transport stream file from Playout server's transport stream output, select Tools à Record Transport Stream or click on the record button under the Recording repository tab. It will open a pop-up window shown



below:
The recording is indicated as progress bar as seen below.

3.1. MONITORING

1. SKYLINE DATAMINER

Skyline Dataminer monitoring system has been integrated with Icareus PLayout and can be used to monitor it using driver DMS-DRV-2173.

2. SNMP FUNCTIONALITY

2.1. INTRODUCTION

Simple Network Management Protocol (SNMP) is an "Internet-standard protocol for managing devices on IP networks." Devices that typically support SNMP include routers, switches, servers, workstations, printers, modem racks, and more." It is used mostly in network management systems to monitor network-attached devices for conditions that warrant administrative attention.

SNMP exposes management data in the form of variables on the managed systems, which describe the system configuration. These variables can then be queried (and sometimes set) by managing applications.

SNMP itself does not define which information (which variables) a managed system should offer. Rather, SNMP

uses an extensible design, where the available information is defined by management information bases (MIBs). MIBs describe the structure of the management data of a device subsystem; they use a hierarchical namespace containing object identifiers (OID). Each OID identifies a variable that can be read or set via SNMP.

2.2. OIDS

Playout supports GET operation specified in SNMP standard. It allows retrieving a variable value using a variable name. The list of available variables are defined in the playout MIB file.

2.3. SNMP ALARMS

It is possible to configure Playout server to send SNMP Alarms. The following events are processed:

- plyout-eit module is down
- plyout-eit-update module is down
- playout-muxer module is down
- playout-scheduler module is down
- playout-sipsi module is down
- plyout-eit module is up
- plyout-eit-update module is up
- playout-muxer module is up
- playout-scheduler module is up
- playout-sipsi module is up

Alarms may be delayed up to 1 minute.

2.4. CONFIGURING SNMP

SNMP is configured on the system level on Icareus Playout, thus cannot be done via Playout Management Console. The configuration requires either local or SSH access to the underlying Linux system.

Install these two packets:

sudo yum install -y net-snmp-5.5-41.el6_3.1

sudo yum install -y net-snmp-utils-5.5-41.el6_3.1

Make a backup from original snmpd.conf:
mv /etc/snmp/snmpd.conf /etc/snmp/snmpd.conf.bak

Copy template snmpd.conf from Storage(\\192.168.1.220)\Playout\Distr (could be e.g. Z:\Playout\Distr) to /etc/snmp/

Find the following Line:

```
com2sec  mynetwork 192.0.0.0/8     icareus
```

and replace with

```
com2sec  mynetwork xxx.0.0.0/8     icareus
```

where xxx is customer's network

> Note that customer must use "icareus" as a community value in their snmp server.

Copy file pass_playout from the same storage than snmpd.conf to folder /opt/playout/bin/ and make sure it is an executable.

MANAGERS parameter should be updated with the actual customer's SNMP manager IP address for the following scripts:

Master server: /opt/playout/bin/check_traps.sh
Slave server: /opt/playout/bin/check_failover.sh

In case of non protected configuration update the check_traps.sh. If it is missing, copy it from same location

than previous files.

It is possible to define more than one SNMP manager.

```
MANAGERS=(192.168.1.230 192.168.1.231)
```

Check that the file /opt/playout/bin/MIBProcessor.jar exists. If it is missing, copy the MIBProcessor.zip from same location than previous files and unzip it to the location /opt/playout/bin/. Make sure that it is an executable.

Make sure that all scripits are executables.

In check_traps.sh there is a line starting as "allUp". Update this line like this:

```
allUp='interface_eth0 1\|interface_eth1 1\|interface_eth2 1\|interface_eth3 1'
```

Remove those eth ports that are not used for UDP output or management. After this this line could be like:

```
allUp='interface_eth0 1\|interface_eth1 1\|interface_eth3 1'
```

run service snmpd start

To make sure that snmpd is started automatically after e.g. server reboot, run a command

chkconfig snmpd on

2.5. UPDATE FIREWALL FOR SNMP

Update the file /etc/sysconfig/iptables by adding these two lines:

```
-A INPUT -m state --state NEW -m udp -p udp --dport 161 -j ACCEPT
```

```
-A INPUT -m state --state NEW -m udp -p udp --dport 162 -j ACCEPT
```

run service iptables restart

2.6. PLAYOUT MIB

Playout-MIB.mib

```
-- Playout-MIB { iso org(3) dod(6) internet(1) private(4)
--    enterprises(1) icareus(39982) }

Playout-MIB DEFINITIONS ::= BEGIN

IMPORTS
   enterprises            FROM RFC1155-SMI
   DisplayString                              FROM RFC1213-MIB
   OBJECT-TYPE                                FROM RFC-1212;

icareus                      OBJECT IDENTIFIER ::=  { enterprises 39982 }

products                     OBJECT IDENTIFIER ::=  { icareus 1 }

playout                      OBJECT IDENTIFIER ::=  { products 1 }

playoutServerStatus OBJECT-TYPE
   SYNTAX INTEGER
   ACCESS read-only
   STATUS mandatory
   DESCRIPTION
      "Getting this variable will return the Playout server state.
   If the server is available, 1 will be returned, otherwise
   0 will be returned."
   ::= { playout 1 }
```

```
playoutServerVersion OBJECT-TYPE
   SYNTAX DisplayString
   ACCESS read-only
   STATUS mandatory
   DESCRIPTION
      "Getting this variable will return the Playout server version
   value. Playout version format is 'X.X.X.X', where X is a number."
   ::= { playout 2 }

playoutEitStatus OBJECT-TYPE
   SYNTAX INTEGER
   ACCESS read-only
   STATUS mandatory
   DESCRIPTION
      "Getting this variable will return the Playout EIT service state.
   If the service is running, 1 will be returned, otherwise
   0 will be returned."
   ::= { playout 3 }

playoutEitUpdateStatus OBJECT-TYPE
   SYNTAX INTEGER
   ACCESS read-only
   STATUS mandatory
   DESCRIPTION
      "Getting this variable will return the Playout EIT update service
   state. If the service is running, 1 will be returned, otherwise
   0 will be returned."
   ::= { playout 4 }

playoutMuxerStatus OBJECT-TYPE
   SYNTAX INTEGER
   ACCESS read-only
   STATUS mandatory
   DESCRIPTION
      "Getting this variable will return the Playout Muxer service state.
   If the service is running, 1 will be returned, otherwise
   0 will be returned."
   ::= { playout 5 }

playoutSchedulerStatus OBJECT-TYPE
   SYNTAX INTEGER
   ACCESS read-only
   STATUS mandatory
   DESCRIPTION
      "Getting this variable will return the Playout Scheduler service state.
   If the service is running, 1 will be returned, otherwise
   0 will be returned."
   ::= { playout 6 }

playoutSipsiStatus OBJECT-TYPE
   SYNTAX INTEGER
   ACCESS read-only
   STATUS mandatory
   DESCRIPTION
      "Getting this variable will return the Playout SIPSI service state.
   If the service is running, 1 will be returned, otherwise
   0 will be returned."
   ::= { playout 7 }

playoutLicenseFeatures OBJECT-TYPE
   SYNTAX DisplayString
   ACCESS read-only
   STATUS mandatory
   DESCRIPTION
   "Getting this variable will return the list of features
   currently supported by the Playout server.
   The format of this variable is 'X,X,X,...' ,
   where X is a number that represents a particular feature."
   ::= { playout 8 }

playoutLicenseVersion OBJECT-TYPE
   SYNTAX DisplayString
   ACCESS read-only
   STATUS mandatory
   DESCRIPTION
      "Getting this variable will return the Playout license version
   value. Playout license format is 'X.X', where X is a number."
   ::= { playout 9 }

playoutDongleId OBJECT-TYPE
   SYNTAX DisplayString
```

```
   ACCESS read-only
   STATUS mandatory
   DESCRIPTION
      "Getting this variable will return the Playout Dongle Id
   value."
   ::= { playout 10 }

playoutLicenseExpiration OBJECT-TYPE
   SYNTAX DisplayString
   ACCESS read-only
   STATUS mandatory
   DESCRIPTION
      "Getting this variable will return the Playout license
   expiration date. The format is YYYY-MM-DD.
   It returns '-' if expiration date is not defined."
   ::= { playout 11 }


-- TRAPS

playoutEitDown NOTIFICATION-TYPE
 STATUS current
    OBJECTS { playoutEitStatus }
 DESCRIPTION "Eit status notification"
        ::= { playout 21 }

playoutEitUpdateDown NOTIFICATION-TYPE
 STATUS current
    OBJECTS { playoutEitUpdateStatus }
 DESCRIPTION "EitUpdate status notification"
        ::= { playout 23 }

playoutMuxerDown NOTIFICATION-TYPE
 STATUS current
    OBJECTS { playoutMuxerStatus }
 DESCRIPTION "Muxer status notification"
        ::= { playout 25 }

playoutSchedulerDown NOTIFICATION-TYPE
 STATUS current
    OBJECTS { playoutSchedulerStatus }
 DESCRIPTION "Scheduler status notification"
        ::= { playout 27 }

playoutSipsiDown NOTIFICATION-TYPE
 STATUS current
    OBJECTS { playoutSipsiStatus }
 DESCRIPTION "Sipsi status notification"
        ::= { playout 29 }


playoutEitUp NOTIFICATION-TYPE
 STATUS current
    OBJECTS { playoutEitStatus }
 DESCRIPTION "Eit status notification"
        ::= { playout 22 }

playoutEitUpdateUp NOTIFICATION-TYPE
 STATUS current
    OBJECTS { playoutEitUpdateStatus }
 DESCRIPTION "EitUpdate status notification"
        ::= { playout 24 }

playoutMuxerUp NOTIFICATION-TYPE
 STATUS current
    OBJECTS { playoutMuxerStatus }
 DESCRIPTION "Muxer status notification"
        ::= { playout 26 }

playoutSchedulerUp NOTIFICATION-TYPE
 STATUS current
    OBJECTS { playoutSchedulerStatus }
 DESCRIPTION "Scheduler status notification"
        ::= { playout 28 }

playoutSipsiUp NOTIFICATION-TYPE
 STATUS current
    OBJECTS { playoutSipsiStatus }
 DESCRIPTION "Sipsi status notification"
        ::= { playout 30 }
```

```
END
```

3.1. DEBUG

1. INTRODUCTION

This dialogue allows you to get more debug information from the server.

DSM-CC debug When this option is on, the MHP carousel generator software creates files on the server containing detailed information about the generated carousel data.

These files are found in the /tmp directory, and are named ``dsmccX_Y.dump'', where X = AIT id and Y = running counter. The running counter is incremented whenever the carousel has been modified as a result of an update command,e.g. removing/adding/modifying files while the carousel is being sent.

2. STREAM EVENT DEBUG

This option, when on, causes information concerning MHP stream events to be logged, allowing the debugging of problems, particularly concerning NPT events and STB's implementation of them.

3.1. ADDING SFTP SUPPORT FOR PLAYOUT USER

Edit a file /etc/ssh/sshd_config. Change the end of file to be like this:

```
# override default of no subsystems
#Subsystem      sftp    /usr/libexec/openssh/sftp-server
Subsystem sftp internal-sftp

# Example of overriding settings on a per-user basis
#Match User anoncvs
#       X11Forwarding no
#       AllowTcpForwarding no
#       ForceCommand cvs server
#DenyUsers playout

Match User Playout
    ChrootDirectory /opt/playout/ftp
    ForceCommand internal-sftp
```

Run a command

```
service sshd restart
```

Now you should be able to make a sftp connection with e.g. FileZilla using same playout user credentials as with ftp connection.

3.1. PLAYOUT JSON API

1. APPLICATIONS API

1.1. EVENTS

1.1.1. SENDING DIN EVENTS

Port: 8080

Path: /event

Parameters:

Name	Description
Source-Id	'Database id' from the application properties
Object-Name	Stream object to use
Event-Name	Stream event to use
Payload	Text to send (it should be URL encoded, check http://en.wikipedia.org/wiki/Percent-encoding#Percent-encoding_reserved_characters)

Response:

Status	Response
OK	{"status":"ok","message":"OK"}
ERORR	{"status":"error","message":"No such stream event found"}

Example:

```
http://192.168.1.219:8080/event?Source-Id=50&Object-Name=TestObject&Event-Name=TestEvent&Payload=Hello%20ther
```

3.1. WORKING WITH IP MULTICAST

SOLVING ISSUES WITH MULTICAST

If you are unable to receive multicast on your server via Dektec card please follow the steps below. It is most likely related to reverse path filtering - this is a feature of the kernel that blocks multicast from addresses from which there is no route.

Reverse path filtering is a mechanism adopted by the Linux kernel, as well as most of the networking devices out there to check whether a receiving packet source address is routable.
So in other words, when a machine with reverse path filtering enabled receives a packet, the machine will first check whether the source of the received packet is reachable through the interface it came in.

STEPS TO VERIFY MULTICAST

1. Check and install Dektec driver and DtuNw versions
2. Find dectek cards nics:

```
ip maddr show
```

3. Assign static IP addresses for Dectek's ports.
4. Activate multicast on the NIC:

```
ifconfig [Dectek's port1 and port2 name] multicast
```

5. Test if you are receiving multicast:

```
a. tcpdump -c 10 dst host [source_multicast_address] and port
   [source_multicast_port] and multicast -i [Dektec's port1 NIC name]
```

   b. e.g. tcpdump -c 10 dst host 224.171.25.26 and port 2526 and multicast -i eth3
6. if not:
   a. check reverse filters: sysctl -a | grep .rp_filter
   b. check RP filter for dectek card nic (should be 0):

```
cat /proc/sys/net/ipv4/conf/[nic_name]/rp_filter
```

c. and set temporarily:

```
echo 0 > /proc/sys/net/ipv4/conf/[nice_name]/rp_filter
```

d. To permanently set rp filters modify /etc/sysctl.conf### # Controls source route verification (previously 1)### net.ipv4.conf.default.rp_filter = 0
e. restart you NICs: ifconfig eth3 down / up

7. if still not,
   a. turn off your firewall and repeat above point 5
8. if still not; make sure that you are sending the multicast to Icareus Playout server
9. test that ffprobe can receive you multicast (https://ffmpeg.org/ffprobe-all.html)

a.
```
./ffprobe
udp://[source_multicast_address]:[source_multicast_port]?localaddr=[Dectek_port
-loglevel 56 -show_error -protocol_whitelist udp
```

b. e.g.: ./ffprobe udp://224.171.25.26:2526?localaddr=192.168.214.77 -loglevel 56 -show_error -protocol_whitelist udp

c.
```
ffprobe version 3.2.3-static http://johnvansickle.com/ffmpeg/  Copyright (c) 2007-2017 the FFmpeg develo
  built with gcc 5.4.1 (Debian 5.4.1-5) 20170205
  configuration: --enable-gpl --enable-version3 --enable-static --disable-debug --disable-ffplay --disab
sndio --disable-outdev=sndio --cc=gcc-5 --enable-fontconfig --enable-frei0r --enable-gnutls --enable-gra
e-libass --enable-libfreetype --enable-libfribidi --enable-libmp3lame --enable-libopencore-amrnb --enabl
core-amrwb --enable-libopenjpeg --enable-libopus --enable-librtmp --enable-libsoxr --enable-libspeex --e
theora --enable-libvidstab --enable-libvo-amrwbenc --enable-libvorbis --enable-libvpx --enable-libwebp -
ibx264 --enable-libx265 --enable-libxvid --enable-libzimg
  libavutil      55. 34.101 / 55. 34.101
  libavcodec     57. 64.101 / 57. 64.101
  libavformat    57. 56.101 / 57. 56.101
  libavdevice    57.  1.100 / 57.  1.100
  libavfilter     6. 65.100 /  6. 65.100
  libswscale      4.  2.100 /  4.  2.100
  libswresample   2.  3.100 /  2.  3.100
  libpostproc    54.  1.100 / 54.  1.100
[udp @ 0xb6ccd80] end receive buffer size reported is 131072
Probing mp3 score:1 size:2048
Probing mpegts score:50 size:2048
[mpegts @ 0xb6cc6c0] Format mpegts probed with size=2048 and score=50
score: 44, dvhs_score: -2, fec_score: 0
[mpegts @ 0xb6cc6c0] Filter: pid=0x11 type=1
[mpegts @ 0xb6cc6c0] Filter: pid=0x0 type=1
[mpegts @ 0xb6cc6c0] PAT:
[mpegts @ 0xb6cc6c0] sid=0x1422 pid=0x1422
[mpegts @ 0xb6cc6c0] new_program: id=0x1422
[mpegts @ 0xb6cc6c0] Filter: pid=0x1422 type=1
[mpegts @ 0xb6cc6c0] PMT: len 76
[mpegts @ 0xb6cc6c0] sid=0x1422 sec_num=0/0 version=6 tid=2
[mpegts @ 0xb6cc6c0] pcr_pid=0xb3a
[mpegts @ 0xb6cc6c0] Filter: pid=0xb4e type=0
[mpegts @ 0xb6cc6c0] stream=0 stream_type=3 pid=b4e prog_reg_desc=
[mpegts @ 0xb6cc6c0] tag: 0x0a len=4
[mpegts @ 0xb6cc6c0] Filter: pid=0xb62 type=0
[mpegts @ 0xb6cc6c0] stream=1 stream_type=3 pid=b62 prog_reg_desc=
[mpegts @ 0xb6cc6c0] tag: 0x0a len=4
```

RECORDING IP MULTICAST

USING PYTHON SCRIPT

#> python multicast_to_file.py

out: <output_file_name_here>
ip: <multicast_ip_here>
port: <multicast_port_here>

press Ctrl + C to stop the recording

Download: multicast_to_file.py

```
import socket
import struct

filename = raw_input ("out: ")
ip = raw_input ("ip: ")
port = int (input ("port: "))


sock = socket.socket (socket.AF_INET, socket.SOCK_DGRAM, socket.IPPROTO_UDP)
sock.setsockopt (socket.SOL_SOCKET, socket.SO_REUSEADDR, 1)
sock.bind (('', port))

multicast_request = struct.pack ("4sl", socket.inet_aton (ip), socket.INADDR_ANY)
sock.setsockopt (socket.IPPROTO_IP, socket.IP_ADD_MEMBERSHIP, multicast_request)

out = open (filename, "wb")
while (True):
    try:
        data = sock.recv (4096)
        print (ip + ":" + str (port) + " -> " + "data (" + str (len (data)) + "bytes)")
        out.write (data)

    except KeyboardInterrupt:
        out.close ()
        sock.close ()
        print ("Done")
        exit (0)
```

CHECKING MULTICAST MPEG-TS WITH FFPROBE

#> ffprobe udp://<multicast_ip>:<multicast_port>