

# **iSTREAM Installation, Planning and Troubleshooting Guide**

*Version 4.2.0.0*

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## 1. iSTREAM product suite

### 1.1 *iSTREAM packaging and options*

iSTREAM is a Licensed Program for IBM i operating system designed to improve performance characteristics of long running batch processes. Performance improvements are generally achieved by implementation of multiple parallel programming techniques. iSTREAM consists of four main components, Performance Investigator, also known as iSTREAM PI, iSTREAM Accelerator, iSTREAM File Replicator, and a Graphical User Interface in the form of iSTREAM Access for MS Windows. iSTREAM Accelerator includes two subcomponents, iSTREAM CL Command Transformer(CCT) and iSTREAM Generic Multistreaming Toolkit.

All iSTREAM options use the same runtime foundation functions. The iSTREAM Licensed Program contains the following products packaged as options:

- *iSTREAM runtime functions (option \*BASE)*
- *iSTREAM Flash Execution (option 1)*
- *iSTREAM User-defined Command Transformation (option 2)*
- *iSTREAM Rollback for Library Units (option 3)*
- *iSTREAM Generic Multistreaming Toolkit (option 4)*
- *iSTREAM Performance Investigator (option 5)*
- *iSTREAM Access for MS Windows (Option 6)*
- *iSTREAM File Replication (Option 7)*

Options 1, 2 and 3 make use of the common command transformation engine and, taken together, form iSTREAM CL Command Transformer (CCT) tool.

### 1.2 *iSTREAM CCT and library units*

iSTREAM CCT is a suite of tools for IBM i primarily designed to improve performance characteristics of long-running batch processes.

A library unit is a group of IBM i libraries (program and data) representing a logical copy of an application.

iSTREAM CCT can be used to improve performance characteristics of different CL commands by transforming them into other more efficient commands performing similar functions and/or submitting these commands to batch for concurrent execution. iSTREAM CCT can also be used to define flexible recovery policies for applications.

iSTREAM CCT implementation, as a rule, does not involve coding.

A typical approach adopted by iSTREAM CCT assumes transformation of long-running CL commands, such as, for example, CPYF, CPYLIB, SAVLIB, etc. into functionally equivalent but more efficient commands or commands having richer functionality, e.g. SAVRSTOBJ, SAVRSTLIB, SAVLIBBRM and, if required, running them concurrently with the main stream of the batch process being optimised.

IBM save-while-active functionality can dynamically be added to commands being transformed.

iSTREAM CCT approach to recovery (rollback) is to rely not on regular backups but on IBM journal checkpoints and the capability, provided by IBM i system software, of rolling back database and data area changes using IBM journal data. iSTREAM CCT provides a simple interface for creating IBM journal entries that can be used as recovery checkpoints, and another interface – for rolling back all protected objects to any of the previously taken checkpoints. Thus, iSTREAM CCT helps mitigating the risks related to breaking previously solid single-streamed batch processes into a number of concurrent execution streams.

The journal checkpoint rollback solution implemented in iSTREAM CCT makes it possible to submit usually synchronous media backup operations for flash (asynchronous) execution. Thus, a lot of precious time is saved. The mode of generating backups can be changed automatically, without any of the existing programs being modified; IBM save-while-active facility used by iSTREAM CCT guarantees that asynchronous backups generate tapes (or disk files) identical to those created in synchronous mode.

Another iSTREAM CCT feature is the ability to recover High Availability configurations of library units after logical errors in long running batch processes. Without iSTREAM CCT such errors usually require full recovery from backups of both the production and hot standby systems, which can be problematic, especially in case of the hot standby system being geographically remote.

Last but not least, iSTREAM CCT can help hook existing applications using traditional IBM i backup facilities to 3<sup>rd</sup> party (e.g. ROBOT/SAVE) archival and backup management software.

iSTREAM CCT can help in cases when it is desirable to implement a new recovery policy for an existing application without changing the existing application components.

### **1.3        *iSTREAM multistreaming***

iSTREAM Generic Multistreaming Toolkit (Option 4) is an IBM i tool designed to accelerate batch processes by splitting them at run-time into a number of parallel streams. The tool is easy to use. The main properties of the batch process, such as the name of the batch control program, its parameters, and the names of files processed are defined and stored in the toolkit's repository using a simple command interface. The definition is then compiled and the batch process is automatically split-streamed (or multistreamed), i.e. a number of jobs are submitted to perform the actual processing.

Rules for breaking down a single-streamed process into a number of parallel streams (e.g. by values of a certain key or by ranges of relative record numbers) are user-defined.

iSTREAM multistreaming definitions are scoped to a library unit described in Section 1.2. Therefore, different units can have different multistreaming settings.

## **1.4 iSTREAM Performance Investigator**

iSTREAM PI is an application-centric performance analysis and profiling tool for IBM POWER server partitions running IBM i operating system.

iSTREAM PI includes three major components: Performance Data Collector, System Monitor, and Performance Profile Analyser.

Performance Data Collector (PDC) is used to collect performance related information for a job or a group of jobs. PDC actually acts as an orchestration tool using lower level collection services, such as IBM Performance Management Collector, IBM Database Monitor (DBMON), IBM Job Watcher Collector, IBM Disk Watcher Collector, IBM Performance Explorer and iSTREAM PI native collector services to collect the actual statistical data. PDC starts and stops these services as required and stores the statistics produced by them into a single performance data collection repository. If a certain type of statistical data can be collected using an existing IBM service, this service is used. iSTREAM PI native collector service only provides statistics otherwise unavailable, e.g. ODP usage and extended lock conflict statistics.

System Monitor (SYSMON) is a watchdog service collecting information about IBM i jobs breaking user-defined resource utilisation guidelines, such as CPU utilisation, I/O levels or paging rates. If a job breaks any of the established guidelines, an exception record is added to the iSTREAM PI repository and PDC statistics collection for the job is started.

Performance Profile Analyser is the primary interface for performance data analysis. It builds performance profiles from the data collected by PDC agents and presents them to the end user in the form of graphs and reports. Performance Profile Analyser has an open architecture enabling users to easily modify pre-defined graphs and reports. Data selection is performed by IBM Query Manager queries, and, if Option 5 is installed and licensed, graphs and reports are rendered as MS Excel worksheets.

Although iSTREAM PI does have a 5250 interface, its full potential can only be realised using iSTREAM Access for MS Windows as the front end.

## **1.5 iSTREAM Access for MS Windows**

Most of the iSTREAM functionality can be accessed using a standard IBM i 5250 terminal interface. Some functions, however, the most important exception being extended iSTREAM PI analytical reporting, can only be executed using iSTREAM Access for MS Windows software (Option 6).

This option is licensed on the IBM i server but installed on the MS Windows system connected to the IBM i server using the Open Source version of the JTOpen library. The latter is included in the iSTREAM for MS Windows distribution package.

iSTREAM Access for MS Windows includes the following main executables:

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- *iSTREAM Licensed Product Management utility. This utility can be used for MS Windows based installation of the server iSTREAM software to the target IBM i partitions.*
- *iSTREAM PTF Management utility. This utility has the purpose of supporting the process of managing iSTREAM PTF sets and individual PTFs.*
- *iSTREAM Accelerator representing a graphical interface to all iSTREAM CCT and Multistreaming Toolkit server functions.*
- *iSTREAM Performance Investigator Graphical User Interface.*

iSTREAM Access for MS Windows therefore is a productivity option helping configure and manage iSTREAM installations in multiple IBM i partitions from a Windows administrator console (dashboard).

### **1.6        *iSTREAM File Replicator***

iSTREAM File Replicator is a low-cost utility design for synchronising groups of files in two libraries of the same IBM i partition. It can be used when an exact copy of the production system files has to be created with minimum delay. The utility supports both journal-based and journal-free data replication methods.





## **2. iSTREAM packaging and licensing**

### **2.1 *iSTREAM licensing framework***

iSTREAM is packaged as seven options of 7S77STR Licensed Program.

Option \*BASE provides framework functionality for other seven options.

Option 1 contains "flash execution" functionality. It allows users running under the protection of \*BASE option to automatically have their CL commands, e.g. backup and restore commands, intercepted and executed asynchronously. Logically, such operations look like instantaneous operations of the flash type.

Option 2 contains configurable command transformation functionality. Using Option 2, it is possible to define complex IBM i command transformation rules. These rules are applied at runtime.

Option 3 contains rollback by journal functionality. Using Option 3, it is possible to program different rollback (recovery) scenarios, including multiple iSTREAM commands, by example and then, when required, invoke those scenarios by simply choosing an option from a menu. Option 3 can also be used to improve performance of the standard IBM i remove journal changes process.

Option 4 represents a generic multistreaming toolkit. Using Option 4, it is possible to multistream (or split-stream) any process executing in the OPM or ILE environment, the main purpose of multistreaming being improvement of the process runtime.

Option 5 can be used for performance investigations. iSTREAM PI is an application-centric performance profiling tool for IBM POWER server partitions running IBM i operating system.

Option 6 includes a Windows GUI for iSTREAM server functions.

Option 7 includes an intra-system file replication(synchronisation) utility.

Option \*BASE has the \*WARNING level licence protection; besides, licences for this option are only checked by the iSTREAM licence key installation process. All other iSTREAM options have \*KEYED protection. It means that a valid key has to be installed for each option in order to release its functionality. Licences for these options are defined as cross-partition CPU-based. Each licence key grants the right of using the given iSTREAM option on a server with the given serial number where the total number of CPUs in all its partitions where this option is installed for concurrent use does not exceed the value defined by the licence.

Each option comes with a trial licence implemented as the IBM i Licensed Product grace period of 90 days. Generally, a grace period is started when the number of "uses" of the Licensed Product exceeds the value defined by the key. For example, if option 2 of iSTREAM is installed and used for the first time with no valid keys entered, the grace period for this option begins. Equally, the grace period begins if the number of processors in all partitions of the server where iSTREAM option 2 is concurrently used exceeds the number defined by the licence



key entered. Once the grace period starts, it cannot be reset without installing a new key.

During the grace period functionality of options 1-3 is not restricted. The initial grace period for option 4 restricts the maximum number of streams for any multistreamed component to 4.

Option 5 (iSTREAM Performance Investigator) also has the initial grace period with restricted functionality. Any performance collection submitted during the grace period cannot exceed 30 minutes.

Option 6 (iSTREAM Access for MS Windows) provides Windows access to the functionality provided by other iSTREAM options. To use such functionality, both Option 6 and the related functional option have to be licensed on the IBM i server. During the grace period functionality of option 6 is not restricted.

Option 7 (iSTREAM File Replication) has a grace period of 90 days. The utility requires Option 1 to be installed and licensed.

Once the grace period ends, iSTREAM switches off the related functionality but does not generate an exception message. This approach is also used in other situations, e.g. the system exceeding the licensed usage by 50%.

90 days after the expiration of the existing licence any attempt to call iSTREAM critical functions packaged with options 1-6 causes the calling process to receive an exception message.

In order to lift the limitations imposed by the grace (trial) period a valid licence has to be obtained.

A separate licence key is provided for each option of the product except option \*BASE. A single set of licence keys for options 1-6 is valid for all partitions of the server with the given serial number. Each licence key authorises the user to implement the related product option across as many partitions of the server as required.

Licences for each option are granted for the specified number of CPUs only. The number of CPUs in the licence covers the total number of CPUs across all partitions of a server with the given serial number where the feature (option) or iSTREAM is used. If at any point in time the number of the processors in the server across all partitions where this or that iSTREAM option is used exceeds the number included in the licence, the related iSTREAM option enters a grace period. Further changes to the number of server processors does not affect the grace period.

Licence expiration warning messages start appearing in the \*SYSOPR message queue 3 weeks before the approaching licence expiration date.

## **2.2      *Licence checking***

The licence checking API CRCVLCK is provided by iSTREAM in library ISTSSYS. This API has two parameters, a 4-character number of the program feature

(5001-5006 for iSTREAM options 1-6 respectively) and a 1-character response code. The latter can have the following values:

- *L: licence granted*
- *G: licence granted, grace period entered*
- *T: licence not granted, iSTREAM functionality will be disabled within the next 21 days*
- *N: licence not granted, iSTREAM, if used, will return an exception*

Since calculation of the licence usage is performed by iSTREAM at runtime, situations may arise when, due to an iSTREAM function invocation in one partition of the server, processes executing in another partition fail.

To prevent this from happening and inform the user of the potential for contravention of the licensed limits, the following facilities are provided:

- *INSISTLIC command for adding iSTREAM licence keys to a partition. This command performs the same functions as the standard ADDLICKEY command, but in addition sets usage limits for the iSTREAM feature 5050 defined with the WARNING type of compliance. INSISTLIC also issues a licence request for this feature, so, should the total number of cores in the partitions where iSTREAM licence keys have been installed on the server using this command exceed the contracted usage limits, a warning message will be generated in QSYSOPR message queue.*
- *CRCVLCK API supports licence request for feature 5050*
- *Use levels for iSTREAM options in a job can be reset using CRCVLRL API having the same parameters as CRCVLCK. The response code in this case is used for reporting general error conditions only.*
- *When a job where a licence request has been earlier executed ends, the related licence is released and the use level is reset automatically.*

Therefore, if a server has been used to test iSTREAM and, after the successful completion of the testing process, another partition is defined to support production, iSTREAM licence usage levels can be reset in the test partition before the iSTREAM-based application goes live. This approach could be used to reduce the licensing level requirements for the given server.

### 3. iSTREAM installation

#### 3.1 *Installation of the licensed program*

iSTREAM LP (7S77STR) is distributed as an image of an IBM i SAVF archive containing RSTIST command object, its processing program, and 8 save files, one for each of the iSTREAM options. The archive has to be FTPed to an IBM i server, all objects restored to QTEMP library and command RSTIST executed from the command line.

RSTIST command allows to selectively install a set of iSTREAM options. iSTREAM installation requires administrative (\*ALLOBJ and \*SECADM) authorities.

Alternatively, each of the options can be installed separately by executing the following command from the IBM i command line:

```
RSTLICPGM LICPGM(7S77STR)
DEV(*SAVF)
SAVF(QGPL/Q7S77000)
```

for option \*BASE, and

```
RSTLICPGM LICPGM(7S77STR)
DEV(*SAVF)
OPTION(x)
SAVF(QGPL/Q7S7700x)
```

for each of the other options required.

Also available is the ZIPped archive containing 8 images of the distribution save files. The images of the save files can be extracted into the user data folder of the iSTREAM Access for MS Windows installer (exe) in order to use a simple GUI for the software installation. No Option 6 licence is required for that. More detail can be found in the *iSTREAM Access for MS Windows* manual.

If the national library QSYSxxxx is higher than QSYS in the library list, installation of options 1 and 3 may fail. See option note sections for details. To make iSTREAM install and operate in such cases the recommended approach is to create another empty system library adding it to the top of the system library list and copy all command objects mentioned in sections 4.9.1-4.9.6 to the newly created library before the installation.

#### 3.2 *IBM i exit point number range definition*

Some iSTREAM options makes use of QIBM\_QCA\_CHG\_COMMAND and QIBM\_QCA\_RTV\_COMMAND exit points with numbers in the 1882110001-1882110999 range. If any other product makes use of the same entries, iSTREAM options may either fail to install or prevent other products from being installed. In order to avoid such clashes, if they occur, it is possible to change the above default exit point numbers starting value by creating CRCSEID data area in QUSRSYS library. The 10-character data area must contain the first number of the range to be used by 7S77STR installation program (by default, the number used is 1882110001).

If any other product needs a QIBM\_QCA\_CHG\_COMMAND exit points to be defined for the same command that iSTREAM registered this exit for, the external exit point facility can be used. This facility allows definition external exit point data in CRCVSAR file in order to for iSTREAM to invoke the related exit programs at runtime (more detail is available in the iSTREAM CCT Guide).

### 3.3 **iSTREAM upgrades**

Release 4.2.0 of iSTREAM can be slip-installed over the previous releases starting from 3.6.0 For this, the following tables should be manually removed from ISTSSYS library before the upgrade:

- *CRCRJRNF*
- *CRCVLST*
- *CRCVLST2*
- *EANJWTD*
- *EAPYJWIJVM*
- *EAPYJWPRC*
- *EAPYJWTDE*

Data area ISTVVAL, if exists, should be removed from library ISTVQS.

Version 4, generally, cannot be slip-installed over any earlier release. In order to install Version 4 of iSTREAM, modifications V3R5M3 and earlier have to be deleted from the related partition using DLTLICPGM command.

### 3.4 **PTFs and PTF sets**

Program temporary fixes for iSTREAM are distributed as PTF sets. A PTF set is a save file containing an image of an optical disk containing individual PTFs and a PTF directory. Each PTF set save file should be uploaded, e.g. using FTP, to ISTSFIX library as a save file with the name following the Pvvvyymmdd format, where vvv is the modification of iSTREAM, yy, mm and dd are the year, month and day the PTF set was created. If the library does not exist, it must be created.

The description of all currently available PTFs for the latest iSTREAM modification V4R1M2 can be found at [iSTREAM V4R2M0 PTF set instructions](#). Each PTF has a cover letter that can be displayed or printed using DSPPTF command after the PTF set optical disk has been created on the IBM i server.

APYISTPTF command from ISTSSYS library can be used to perform all the iSTREAM PTF related operations, such as creation of the virtual optical disk for the set, application of a group of PTFs or a single PTF from the virtual optical disk created. The command makes use of the PTF set save file copied to library ISTSFIX. APYISTPTF command has the following parameters:

- **ACTION** (\*PTFSRST, \*APPLYGRP, \*APPLYSNG) - to request the virtual disk creation, installation of a PTF group, or a single PTF respectively.
- **APPLYS** - using this parameter, superseded PTFs from the set can optionally be omitted or permanently applied

- **PTFSET** - numeric PTF set identifier (vvvyyymmdd)
- **PTFGRP** (\*DFT, \*HYPER, \*EQDFT) - PTF group identifier
- **PTF** - PTF identifier in case of a single PTF installation request
- **OMIT** - up to 10 PTFs to be omitted during the installation
- **POPT** - additional optional selection of the PTF option the group of PTFs is to be applied to
- **VOPTI** - optical device drive name

By default, the Operating System selects the optical resource name for the newly created drive. It is possible, however, to override it by specifying the name of the resource in PTFOPTRSC data area, if it exists in library ISTSSYS.

PTFs can also be loaded and applied from the pre-created virtual optical disk using IBM LODPTF and APYPTF commands. Option 8 of the IBM i system PTF menu "Install Options for Program Temporary Fixes" can also be used.

Some of the PTFs are distributed as hidden and are only applied by the APYISTPTF command when individually selected. Information about such PTFs can be downloaded using the following link: [iSTREAM V4R2M0 Hidden PTFs](#).

Special instructions should be read and followed before PTFs can be uploaded and installed.

iSTREAM PTFs can also be installed and applied using a GUI included in Option 6 iSTREAM Access for MS Windows. In addition to the standard iSTREAM PTF management feature, iSTREAM Access for MS Windows allows installation of selected PTFs directly from the Cyprolics Ltd. web site. This can be useful for installing new PTFs not yet included in a published set or customised PTFs created by the Cyprolics Ltd. support team.

### **3.5 IBM PTFs and new releases**

If a new IBM PTF is installed or an OS release upgraded in a partition where a release of iSTREAM has already been installed, it may be necessary to refresh a set of system command clone objects in the iSTREAM system library ISTSSYS. The easiest way to achieve this is to execute STRISTMOD command with a non-blank unit name. It is strongly recommended to do this as soon as the installation is over (before taking a post-installation system backup) even if iSTREAM functions are not to be used. Failure to refresh the contents of ISTSSYS library post IBM object installation may cause system errors in IBM modules unrelated to iSTREAM.

## **4. System requirements, configuration and operation**

### **4.1 System requirements**

Different iSTREAM options have different system requirements. For all iSTREAM options the supported operating system environments include IBM i V7R3 or later. iSTREAM installation program (see Section 3) determines the level of OS and installs iSTREAM PI (option 5) only if the pre-requisites are in place.

iSTREAM installation programs add exit points to the IBM Registration Facility. All locks for the Registration Repository have to therefore be released before the software can be installed.

iSTREAM Option 4 is required for all kinds of multistreaming optionally performed by iSTREAM components under the covers, e.g. executing the CLRPFM replacement process in multiple parallel streams. The same applies to the use of "Submit concurrent batch jobs" framework included in the CCT core (see *iSTREAM CL Command Transformer (CCT) Guide* for details).

### **4.2 Compatibility**

iSTREAM version 4 is not fully compatible with previous releases. The objects generated by version 3 releases as part of the user-defined command transformation and multistreaming configurations are not compatible with the new version and have to be recreated.

For the user-defined command transformation facility it means manually executing CMPCMDTFM for the library units required. In the case of multistreaming, all the definitions for the unit (DFNSPTPRM and DFNMSFRSPC commands) must be executed again, the related objects compiled using CMPSTDFN command, and all the custom code recreated and recompiled. RTVSPTDFN command could be used to retrieve the source of the original definitions from the iSTREAM unit repository.

Although VFYFDLCK command is still available, it is no longer used by the RLBTCKPA automated rollback procedure. A new CHKOBJLCK command is used instead. The automated rollback configurations created in previous releases may no longer work correctly and have to be recreated using ENARLBUNT command.

STRFLSSRV (STRASYEXE) and ENDFLSSRV (ENDASYEXE) are no longer included in the iSTREAM distribution, because the flash server function is always started and ended automatically.

### **4.3 Security settings**

Installation of the iSTREAM Licensed Program must be performed by a profile having \*ALLOBJ , \*SECADM, \*JOBCTL and \*SPLCTL special authorities.



The following command can therefore be used to re-install, for example, option 1:

```
RSTLICPGM LICPGM(7S77STR)
      OPTION(1)
      DEV(*SAVF)
      SAVF(QGPL/Q7S77001)
```

During the installation of iSTREAM option \*BASE IST@OWNER profile is created and service programs are set to adopt authorities of IST@OWNER. IST@OWNER default profile setting should not be changed. IST@OWNE2 profile is also created as the owner of iSTREAM PI (Option 5) objects.

PTF installation has to be performed by a profile with \*ALLOBJ , \*SECADM, \*JOBCTL and \*SPLCTL special authorities.

By default, all iSTREAM commands are available for any system user. Some of them require additional authorities. For example, many iSTREAM PI commands based on the native IBM i performance capabilities require the same authorities that would normally be granted to the system performance analyst and system administrator. Selective enablement and disablement of IBM i commands for transformation also requires additional authorities \*ALLOBJ and \*SECADM due to the underlying IBM i function implementation.

iSTREAM system value CMDACC (see description of CHGDFTIST command) can be used to configure more granular access control to iSTREAM commands to prevent the iSTREAM configuration from being intentionally or unintentionally corrupted by unauthorised staff. The default value of CMDACC system value is \*STANDARD. When it is changed to \*SECURE, public access to all sensitive command objects in ISTSSYS library is revoked; two group profiles created as part of the installation, ISTOPR and ISTPGMR, can then be used to control access to the iSTREAM operator and programmer commands respectively.

STRISTMOD command in the \*SECURE setting is protected, since it can be used to change iSTREAM unit configurations. It is recommended to start using STRISTMUD (Start iSTREAM mode with unit defaults) command instead.

iSTREAM programs store objects in the following libraries: ISTVQS (iSTREAM synchronisation work library), hot and control libraries for iSTREAM units. These libraries are created, as required, by different iSTREAM components. By default, all objects in ISTVQS library, including unit and command transformation configuration data areas and files, are created with AUT(\*CHANGE) and CRTAUT(\*CHANGE) parameters to avoid authorisation problems in case of multi-user access to iSTREAM functions. In the \*SECURE setting, however, command transformation enablement object public access authority is changed to \*EXCLUDE, and public object authority for all unit configuration objects - to PUBLIC(\*USE). iSTREAM functions can still update these objects, but the risk of accidental deletion or corruption of such objects is thus reduced.

To execute iSTREAM functions that update unit configurations or change command defaults using multiple profiles, it's recommended to assign new objects created by these profiles to the group profile (OWNER(\*GRPPRF)). In this case access to iSTREAM configuration objects will be transparently provided.



Library ISTVQS must be added to the list of libraries with user domain user spaces allowed using QALWUSRDMN system value.

---

**Warning:** Execution of a few iSTREAM administrative functions requires authorisation to IBM i programs and commands not granted by default. A convenient way of resolving this issue is creation of a group profile similar to ISTOPR for all users involved in iSTREAM administration. This profile can be granted private (or authorisation list based) access to the restricted IBM I objects.

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#### 4.4 iSTREAM system variables

Some of the iSTREAM features can be configured by changing default values if iSTREAM system variables using CHGDFTIST command. It has the following parameters.

- *CMDACC: iSTREAM command security. This parameter is discussed in detail in section 4.3.*
- *ENAEXTREG: CRCVSAR file in ISTVQS data library can be used to define Registration facility exit points external to iSTREAM for commands used for CCT transformation. Disabling this facility can improve performance, so if CRCVSAR file is not used to define any external exit points, it is recommended to switch the facility off (\*NO value). This facility, however, can also be used to improve iSTREAM command transformation performance. If, for example, under certain conditions the application does not require the command transformation to process specific commands, a user exit may be defined to suppress the transformation (see iSTREAM CCT manual for the details regarding the used of CRCVSAR facility).*
- *FLSTIMOUT: this value is used as the SAVACTWAIT object lock timeout set of values for flash (save-while-active) requests generated by Option 1 of CCT.*
- *HOTLIBL: this value controls the position of the hot library entry (see iSTREAM Generic Multistreaming Toolkit manual for details) in the job library for iSTREAM mode. If the hot library of a unit is added to the user portion of the library list, placing any application system libraries higher in the library list, e.g. to SYSTEM, CURRENT or PRODUCT portions, may compromise iSTREAM functionality.*
- *ISTLIBL: this value is used to control the position of ISTSYS entry in the job library when jobs are entering iSTREAM mode. If ISTSSYS system is added to the user portion of the library list, iSTREAM functionality could potentially be compromised by the libraries preceding it in the library list. Specifically, care must be taken to prevent any of such libraries containing a copy of SBMJOB command with CPYENVVAR(\*NO) default.*

*If ISTLIBL value is set to \*SYS, then the library-related condition of the iSTREAM mode is for ISTSSYS library to be part of the system option of the library list. If ISTLIBL value is set to \*USER, then the library-related condition of the iSTREAM mode is for ISTSSYS library to be part of the system, user, or current library portions of the library list.*

- *JITCMPTFM: Command transformation conditions can be compiled manually using CMPCMDTFM command. This system value allows to also turn on or off just-in-time compilation. If it is enabled and transformation definition have changed since last compilation, the transformation conditions are recompiled using JIT. Disabling JIT improves performance but may cause runtime errors, if the updated definitions are not manually compiled.*
- *MTHACT: Controls iSTREAM behaviour when a thread unsafe command executed in a multithreaded job is enabled for iSTREAM transformation.*
- *MTHRDBG: This parameter can be used to activate the multithreaded rollback debug mode. In this mode journal record images for the files being rolled back using the parallel multithreaded mechanism are copied to library ISTRunt. where unt is the name of the unit. These files can then be used for troubleshooting, should the rollback process fail.*
- *PVCH: the special character used in the names of substitution variables in the body of transformation definitions (by default, '@') can be redefined using this parameter.*
- *RGZCPYFACT: This parameter can be used to define the action taken by iSTREAM option 3 programs responsible for transformation of RGZPFM command. For simple physical file reorganisation requests iSTREAM implements a special recoverable (by journal) reorganisation based on CPYF command. If RGZPFM parameters request enhanced reorganisation functionality (see iSTREAM CCT manual for the list of enhanced RGZPFM functions), iSTREAM processor either ignores RGZPFM command (\*IGNORE) or executes standard system reorganisation (\*FORCE).*
- *RPLSP: Special character used as the prefix (by default, @) for replication group job and checkpoint names. Names of group replication jobs have the format @EGRPnn where @ is the special character defined by this parameter and nn - the number of the stream. Names of special checkpoints begin with the same character.*
- *SAVCKPWAIT: This parameter is only relevant in the remote flash scenario and can be used to define the amount of time iSTREAM waits for the flash process on the remote system to take the save-while-active checkpoint. The value of the parameter defined on the remote system is used.*

- **VRBLOG:** by default, the value is \*NO, meaning that the number of messages generated in the job log by iSTREAM programs called as IBM user exits generate is significantly reduced. Changing VRBLOG value to \*YES can be useful for troubleshooting, as more information is added to the log. For example, CL command logging (LOGCLP) for iSTREAM programs requires setting the value of VRBLOG to \*YES. Values \*SW1-8 can be used to selectively define the verbose mode for system jobs having the related switches (SWS) set to '1'. When the VRBLOG value is changed, it may not immediately become available to the already active jobs.

In order to update iSTREAM system values the user must have \*ALLOBJ and \*SECADM special authorities.

#### 4.5 **SBMJOB command modification**

If ISTLIBL system variable value is set to \*USER using CHGDFTIST command, iSTREAM modifies copies of SBJJOB command in all QSYS\* libraries to use CPYENVVAR(\*YES) as the default. The same modification is automatically performed when iSTREAM functionality is used after a new OS release is installed.

If a copy of SBJJOB command object is restored or copied into any of the system libraries, CRCVUPR utility must be executed from the command line as follows:

```
CALL ISTSSYS/CRCVUPR PARM('@@@' 'Y')
```

Care should be taken to not explicitly specify CPYENVVAR(\*NO) parameter for target SBJJOB commands in any user-defined command transformations.

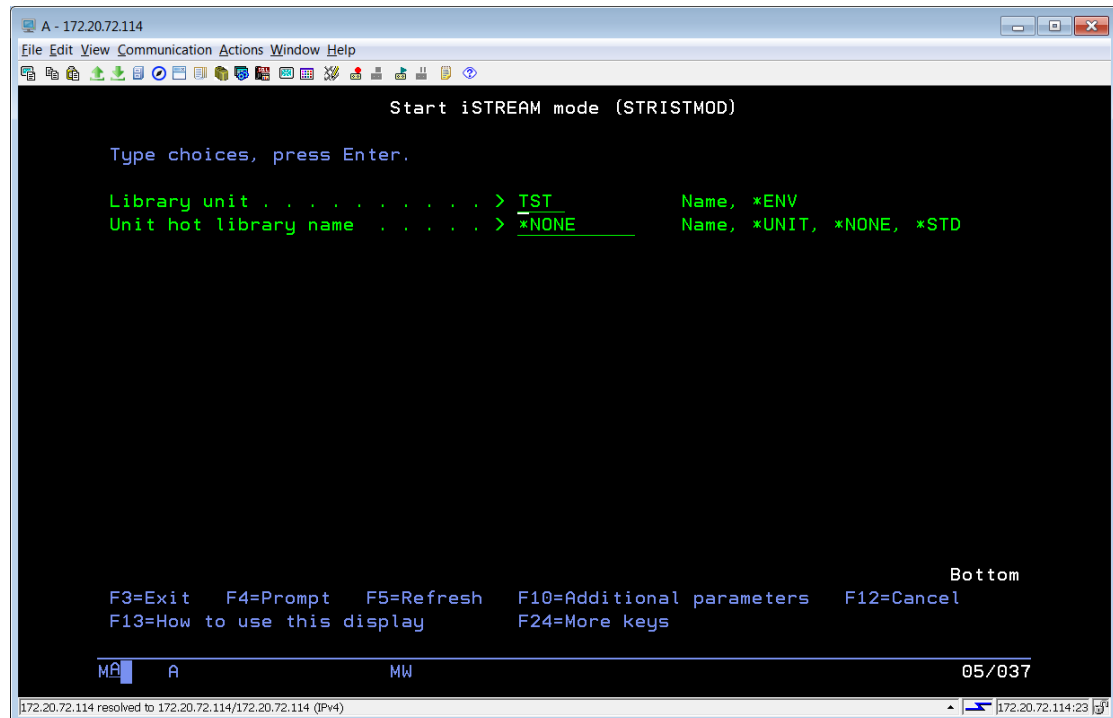
#### 4.6 **Unit configuration (STRISTMOD command)**

iSTREAM system configuration is based on the notion of a unit. The detailed description of this concept can be found in the iSTREAM feature manuals, but on a high level a unit is a copy of an application with its programs and files arranged as a set of libraries. To make use of iSTREAM it is therefore necessary to define application units. Configuration data set for a unit includes such information as library names and optimisation switches specific to that unit. Units in iSTREAM are defined by means of STRISTMOD command. This command has multiple parameters relevant to different optimisation scenarios. In some cases in order to avoid confusion it may be desirable to stop unused parameters from appearing on any configuration screens. The best way to achieve that is to delete irrelevant iSTREAM options using DLTLICPGM, e.g.

```
DLTLICPGM LICPGM(7S77STR)  
OPTION(1)
```

If an option is thus uninstalled, all related parameters no longer appear when STRISTMOD command is prompted. For example, if iSTREAM batch multistreaming capability is the primary reason for iSTREAM implementation, removal of options 1, 2 and 3 from the default installation results in STRISTMOD list of parameters being reduced to the following form.

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STRISTMUD (Start iSTREAM Mode with Unit Defaults) command can be used instead of STRISTMOD command with \*UNIT parameters referencing earlier defined values.

### 4.7 ISTV utilities

iSTREAM functionality being based on IBM exit points it is important to be absolutely sure not only of what exit points have been defined for iSTREAM options, but also whether the exit points defined are actually invoked by the system software.

System command objects can be enabled for iSTREAM flash(asynchronous) execution (option 1), iSTREAM user-defined command transformation (option 2) and/or iSTREAM rollback (option 3). When a command object is being enabled for any of the above a related entry is added to the IBM QIBM\_QCA\_CHG\_COMMAND exit point.

If any of the iSTREAM functions does not seem to be working properly, the first thing to check is whether all QIBM\_QCA\_CHG\_COMMAND definitions are correct and accepted by the system.

For that, **ISTVCMT** utility command can be used. The command checks the related functionality and returns a list of command objects that have been earlier defined for flash(asynchronous) execution, transformation or rollback but failed the test. If such objects are found the best course of action is to run all the appropriate iSTREAM disable commands (DISxxxxxx) for that object and then re-enable it again, as required.

Also, in case of QIBM\_QCA\_CHG\_COMMAND definition errors two additional utility commands, **ISTVRTP** and **ISTVRTC** may be executed. The former is used to retrieve existing CCT transformation definitions, the latter - rerun the definitions effectively fixing any exit point registration abnormalities. **ISTVRTP** utility requires the user to have \*ALLOBJ and \*SECAMD authorities.

Alternatively, errors in all IBM exit point definitions created by iSTREAM can be detected and fixed by using CHKCMDENA command.

**ISTVQSC** utility program can be used to clean up stale work structures in ISTVQS library. Such structures, including data areas and message queues, are sometimes left behind by abnormally terminated multistreaming processes. ISTVQS should be executed only when there is no other iSTREAM-related activity in the partition.

**RQSUNTDMP** command can be used to generate a service dump of the unit configuration. The dump is stored in '/QIBM/UserData/iSTREAM\_Backup' IFS directory under the name TRBunt.sav where unt is the name of the unit.

#### **4.8 Backup and restore unit configuration**

A complete unit configuration including all the earlier defined command defaults, rollback configuration objects, command transformation enablement definitions, command transformation source file and the hot library (Option 4) can be backed up to the specified save file. A copy of the configuration is also stored in '/QIBM/UserData/iSTREAM\_Backup' IFS directory under the name CFGunt.sav where unt is the name of the unit.

This configuration can later be restored to the same or a different IBM i partition. For this, both the command line (RSTUNTCFG) and Java front-end interfaces are also available. When restored, the earlier saved configuration replaces the unit configuration, if the latter is found in the target partition.

The above backup is either requested using SAVUNTCFG command from the 5250 command line or as a front-end menu option. When the front-end interface is used the configuration save file is additionally copied to (to be then restored from) the Windows folder system.

The earlier saved configuration objects are restored to the target partition as follows:

- *configuration data areas are restored to ISTVQS library replacing objects with the same names*
- *checkpoint file is not saved, but is recreated during restore, if control library is defined*
- *checkpoint definitions are not saved or restored*
- *the entire hot library (option 4) is saved and restored replacing objects in the library with the same name, if the latter exists in the target partition*

- *The command transformation source file is saved but is not necessarily restored to the same library (a library with this name may not even exist in the target partition). The name of the file may also change. The file, if defined for the backed up unit, is restored into ISTVQS library under the name CRCVCMDunt, where unt is the name of the unit*
- *Optionally, command transformation enablement definitions can also be restored from the backup copy. In this case, however,*
  - *all command objects enabled for transformations in the target partition at the time of the restore are explicitly disabled;*
  - *a saved copy of ISTVCMD file containing the enablement definitions from the source partition is restored to ISTVQS library and transformations are enabled for the same commands.*

*As a result, some or all of the transformation enablement definitions in the target partition may be redefined or lost. Restore may end up in error if the source and target partitions have different iSTREAM options installed.*

## **4.9 Option notes**

### **4.9.1 Option 1 notes**

All background backup processes are executed under the profile of the job that submits them. Therefore, it is highly recommended to start these processors from a job running under a profile authorised to perform backups of the unit libraries.

To be able to use transformation conditions (see description of CMPCMDTFM command in *iSTREAM CL Command Transformer* manual) the user profile configured to run IBM Toolbox connections for Java (QZDASOINIT jobs) must be given authority to the related objects, e.g. command transformation configuration file and library). By default, the name of this profile is QUSER.

Option 1 processes may not function correctly if SAVxxx, RSTxxx, CHKTAP and DSPTAP commands reside in the national library QSYSxxxxx being higher than QSYS in the library list.

When Option 1 is being installed, iSTREAM attempts to redefine the existing exit programs for QIBM\_QCA\_CHG\_COMMAND exit point. In the case of a new installation, ENAFLSEXE command is executed by the installation process with parameter \*ISTDFT (iSTREAM defaults). This may be undesirable, for example, if exit programs for this point are already defined by other applications. To suppress the automatic enablement of command exit programs, a single character data area containing the value "N" can be created in QUSRSYS library under the name ENAISTDFT.



#### 4.9.2 Option 2 notes

If QAUDTCL system value list contains \*OBJAUD setting iSTREAM generates an audit trail record for each successful command transformation. The entry is sent to QAUDJRN system audit journal and has the entry code '4F'.

#### 4.9.3 Option 3 notes

The operator profile must have \*JOBCTL special authority.

Option 3 processes may not function correctly if CPYxxx, DSPxxx, RGZPFM and RUNQRY commands reside in the national library QSYSxxxxx being higher than QSYS in the library list.

When Option 3 is being installed, iSTREAM attempts to redefine the existing exit programs for QIBM\_QCA\_CHG\_COMMAND exit point. In the case of a new installation, ENAFLSEXE command is executed by the installation process with parameter \*ISTDFT (iSTREAM defaults). This may be undesirable, for example, if exit programs for this point are already defined by other applications. To suppress the automatic enablement of command exit programs, a single character data area containing the value "N" can be created in QUSRSYS library under the name ENAISTDFT.

#### 4.9.4 Option 4 notes

The spool merge facility of Option 4 creates new spool files under the name of the current user of the batch process being multistreamed. The spool merger job itself runs under the owner profile of iSTREAM, IST@OWNER. Therefore, the merged spool files should be created as part of QPRTJOB job for the current user of the batch process. In certain cases, however, the spool file is created as part of the spool merge controller job. This is caused by an inconsistency in IBM i print APIs.

To be able to compile split definitions (see description of CMPSPTDFN command in *iSTREAM Generic Multistreaming Toolkit* manual) the user profile configured to run IBM Toolbox connections for Java (QZDASOINIT jobs) must be given authority to the related objects, e.g. hot library for the unit). By default, the name of this profile is QUSER.

#### 4.9.5 Option 5 notes

iSTREAM PI makes use of the multiple IBM APIs including Job Watcher APIs.

All iSTREAM PI data collection jobs run under QSRV system profile.

To execute some of the iSTREAM PI functions it is also necessary to obtain special Job Watcher function authority. This authority is automatically added to QSRV profile during the product installation procedure (ADDJWAUT command).

iSTREAM PI product should be installed and uninstalled by a user with \*ALLOBJ and \*SECADM authorities. During iSTREAM PI installation a special user profile (IST@OWNE2) is created. This profile has no sign-on capability but is used as the



source of adopted authorities for some of the iSTREAM PI components. Default setting of IST@OWNE2 profile should not be changed.

#### *4.9.6 Option 6 notes*

Option 6 includes a Windows component distributed as a MS Windows App. The installation process of this App is described in the *iSTREAM Access for MS Windows* functional manual.

#### *4.9.7 Option 7 notes*

Option 7 includes a file replication (synchronisation) utility. It has a pre-requisite of iSTREAM Option 1 to be installed and licensed in the same IBM i partition.



## 5. Migration of iSTREAM configurations

When iSTREAM V4R2M0 is slip-installed over an existing iSTREAM release a number of manual actions are expected to be performed in order to update previously created library unit configurations. These actions mainly depend on the version of the iSTREAM software being replaced. While iSTREAM line commands are usually backward compatible, the code and objects generated by different iSTREAM functional features sometimes is not, so recreation of service objects and recompilation of functional definitions may be required.

The current manual describes the process of migration in relation to the currently supported releases of iSTREAM. Migration of configurations created by iSTREAM release V3R5 and earlier is usually a bespoke exercise that required direct involvement of Cyprolics Ltd. consultants.

### 5.1 Migration of unit configurations created by iSTREAM Version 3

#### 5.1.1 Option \*BASE. System variables

System variables can only be re-entered using CHGDFTIST command. The existing values can be retrieved from the software being upgraded by typing ISTSSYS/CFGDFTIST in the command line and pressing F4.

It is also recommended to execute STRISTMOD command for each library unit using prompting (F4). This is a good way to make sure that the unit configuration has not been inadvertently modified or deleted during the upgrade process.

#### 5.1.2 Option 1 - flash execution

The configuration of iSTREAM Option 1 includes transformation enablement commands. The current configuration can be retrieved using RTVCMDENA command. This command generates a source file member containing all transformation enablement commands (not just those related to flash). ENACMDFLS commands from the generated source member have to be executed after the new iSTREAM release has been installed. In certain cases the required transformation enablement commands may be automatically entered as part of the installation procedure. In this is the case, the attempt to manually execute the same commands will end with the message

*RCV1037 Function already enabled for command*

#### 5.1.3 Option 2 - user-defined command transformation

Transformation enablement commands may have to be re-entered after the iSTREAM release installation using the same approach as described in section 5.1.2. The transformation definition file does not have to be modified, but to make sure that it is linked to the library unit in its previous capacity, it is recommended to use CRTTFMFIL command specifying this file as a parameter. Once this has been done, transformation definitions need to be recompiled using CMPCMDTFM command.

#### 5.1.4 Option 3 - rollback for library units

Transformation enablement commands may have to be re-entered after the iSTREAM release installation using the same approach as described in section 5.1.2.

#### 5.1.5 Option 4 - multistreaming

Multistreaming (hot) libraries are not affected by the iSTREAM software upgrade process. However, all split definitions have to be re-entered using DFNSPTPRM and DFNMSFSPC commands, and compiled. The split service objects compiled by iSTREAM Version 3 software are not compatible with the Version 4 runtime - hence the need for recompilation.

The original DFNSPTPRM and DFNMSFSPC commands used to create the existing split definitions can be retrieved into source file members using RTVSPTDFN command. This should be done before the iSTREAM release upgrade. The commands saved in the target source file members will then have to be re-executed, once the upgrade process ends. The newly created definitions will also have to be recompiled.

Spilt range files residing in hot libraries do not have to be changed. Nor do VFF files created by iSTREAM Version 6 software.

#### 5.1.6 Option 5 - Performance Investigator

Data collection parameter sets created by iSTREAM Version 3 are compatible with Version 4. However, some parameter interdependencies have changed at Version 4. Therefore, it is recommended to check the saved parameter sets with the iSTREAM V4R2M0 documentation before use.

#### 5.1.7 Option 6 - iSTREAM Access for Windows

This feature does not have any user configurations.

#### 5.1.8 Option 7 - iSYNC file data replication

This feature was only introduced in release V4R1M0.

### 5.2 Migration of unit configurations created by iSTREAM Version 4

In this section migration of configurations created by iSTREAM V4R1M1 and V4R1M2 only are discussed. All other Version 4 based releases are out of support and require a bespoke migration process.

#### 5.2.1 Option \*BASE

No migration process is required.

#### 5.2.2 Option 1 - flash execution

No migration process is required.

#### 5.2.3 Option 2 - user-defined command transformation

Once the new iSTREAM release has been installed, CMPCMDTFM command should be used to recompile the existing unit transformation definitions.

#### *5.2.4 Option 3 - rollback for library units*

No migration process is required.

#### *5.2.5 Option 4 - multistreaming*

Once the new iSTREAM release has been installed, CMPSPTDFN command should be used to recompile all existing split definitions.

#### *5.2.6 Option 5 - Performance Investigator*

No migration process is required.

#### *5.2.7 Option 6 - iSTREAM Access for Windows*

No migration process is required.

#### *5.2.8 Option 7 - iSYNC file data replication*

All existing replication definitions have to be refreshed by executing DFNRPLUNT command. By default, all definitions will be assigned to replication set \*PRIM of the related unit and given the type \*SYNC. After that, replication definitions will have to be recompiled for all the files included.

## 6. iSTREAM CCT thread safety and multithreaded jobs

Most iSTREAM CCT functions are not thread-safe; therefore, it is not recommended to configure and use CCT (options 1-3) with multithreaded jobs, such as IBM WebSphere Application Server. Also, additional threads can be created in a job defined as single-threaded by the operating system, for example, for SQL server jobs calling user-defined RPGLE functions. If a multithreaded IBM i job attempts to invoke any command from ISTSSYS iSTREAM system library, an error message will be generated and the transformation fail. Using CHGDFTIST command's parameter MTHACT these error messages may be ignored.

## **7. iSTREAM CCT performance considerations**

In order to use iSTREAM CCT Rollback functions all database tables and data areas in the libraries of the unit must be journaled with option \*BOTH to the same IBM journal known as the unit journal. Objects not journaled to the unit journal cannot be rolled back. Journaling of multiple database and data area objects can significantly slow down batch processes updating the unit objects. Therefore, it is highly recommended to consider installing "5770SS1 42 HA Journal Performance" optional feature of the IBM Operating System. This feature, when installed and enabled for the unit journal, allows to significantly reduce processing delays caused by object journaling.

## **8. ASP considerations and iASP compatibility**

By default, iSTREAM components create libraries, e.g. unit control library or hot library, in the system ASP. iSTREAM unit configuration has no parameter that would allow creation of those libraries in other ASPs. Such libraries, however, can be pre-created in the desired ASPs. Then, iSTREAM unit configuration would simply use such libraries, provided they are accessible from the job's environment.

Work libraries configured for use by a multistreaming component can also be pre-created. If they do not exist at the time the split is executed, they are created in the ASP related to the first thread of the current job.

## **9. PI collector performance, NLS considerations and help panels**

### **9.1 *PI collector performance***

iSTREAM PI data collection facilities do not consume significant amount of system resource. Up to 100 parallel iSTREAM PI profiling agents cause no noticeable performance degradation.

There are two exceptions to the above rule. First, if iSTREAM PI is used to trigger IBM tool tracing, e.g. PEX or STRDBMON, performance impact of the profile collectors can be more or less substantial depending on the profile definitions used and the number of jobs being profiled. Second, if wildcard or thread-level profiling is requested (see iSTREAM PI command descriptions for details) consumption of system resources may increase as the number of profiling agents (or threads being profiled) increases and the polling interval decreases.

iSTREAM PI default values can to a certain extent influence the amount of resource consumed. Such values can be changed using CHGDFTPI command.

iSTREAM PI profile analysis component, being based on complex SQL queries, can consume considerable amount of CPU. Therefore, it is not recommended to conduct iSTREAM PI data analysis concurrently with mission critical applications running in the same logical partition.

### **9.2 *National Language Support (NLS)***

iSTREAM PI displays and messages are only provided in English. There are certain rules to follow, however, if the main language of the system iSTREAM PI is installed in is not English. To avoid corruption of IBM Performance Collector information displayed by certain iSTREAM PI reports it is recommended to change QYPSJOB job description specifying the English language versions of system libraries in the system library list parameter. This change would have a side effect of all performance collection messages always generated in English, wherever IBM Performance Collector is started from.

If a new release of the IBM operating system is installed or if QCCSID system value is changed, it may be beneficial to reinstall iSTREAM LP. All the options could be slip-installed, i.e. installed without uninstalling the already installed release.

Running iSTREAM functions from profiles with the CCSID parameter set to 65535 may yield unpredictable results.

### **9.3 *Help panels***

iSTREAM command help panels contain more detailed information regarding the command parameters and the mode of execution.

## **10. Windows 10 and later compatibility considerations**

If iSTREAM staging application is installed into the "Program Files" or "Program Files (x86)" folder of a Windows 10 system, all GUI executables (BA.exe, BA-debug.exe, PI.exe and PI-debug.exe) must be run with Administrator authority. Otherwise, help texts for remote System i commands may be displayed incorrectly. This is due to specifics of the Remote Command implementation in JTOpen System i access framework for Java.



## 11. Troubleshooting

This section contains general troubleshooting instructions for different iSTREAM options. The definition of the related concepts, such as multistreaming, rollback, flash copy, etc. can be found in the appropriate iSTREAM feature manuals.

### 11.1 *Service interfaces*

If an iSTREAM service does not behave the way it should, it is possible to collect the entire unit configuration and submit it to Cyprolics Ltd. for analysis. There are two ways to do this.

The first is to use RQSUNTDM (Request Unit Service Dump) command from either the command line or ISERV 5250 menu. This command collects the related information including partition-level data, unit journal entries, the content of the hot library and a few unit configuration objects from ISTVQS library and packages the collection into /QIBM/UserData/iStream\_Backup IFS folder.

The second is to use SAVUNTCFG command from the 5250 interface or the related Administration menu entry from the iSTREAM BA Windows front end.

In either case running the related function from the GUI interface would allow the data collection to be saved to a Windows system drive.

### 11.2 *Troubleshooting applications using iSTREAM features*

Due to the high degree of processing parallelism introduced by iSTREAM troubleshooting for the solutions using it could be less straightforward than for those running in the single-stream mode.

The best starting point of any troubleshooting procedure is the joblog of the failing process. Then, dumps and other print queue files could be analysed. With iSTREAM, however, care must be taken to identify the actual background process (job) causing the problem. If, for example, a program multistreamed using the iSTREAM multistreaming feature fails the error message may appear in the main job with the actual problem (and the message identifying the root cause) actually hiding in the joblog of one of the submitted stream jobs.

Generally, the joblog of the original batch process with CL tracing enabled (LOGCLP(\*YES)) has to be searched for CRCVSB command entries – that's a copy of the SBMJOB command used by iSTREAM to submit background service (or stream) jobs.

iSTREAM spawns parallel background streams to perform the following operations:

- a) Multistream batch processes defined to the system using DFNSPTPRM command
- b) Perform parallel rollback of the unit data files (tables) and areas
- c) Perform parallel clearing of data files (tables) when executing commands enabled for rollback, e.g. CLRPFM.

Finding the names of the jobs may, however, not be enough, for the logging parameters of such jobs are often defined to limit the amount of information saved and even to delete the logs once the jobs end.

For troubleshooting the logging parameters of the jobs should be set to LOG (4 00 \*SECLVL) LOGCLPGM(\*YES) and the content of ISTSSYS/LOGCLP data changed to \*YES. In order to change these parameters the appropriate job descriptions have to be updated. The job descriptions used by different iSTREAM mechanisms are listed below.

a) Customer-defined multistreaming. The names of job descriptions are defined by JDPATTERN parameter of DFNSPTPRM command. This parameter can be used to define a pattern rather than a static name, so that the actual processing stream jobs might, for example, use job description objects BATCH001, BATCH002, etc. depending on the number of the stream. By default the job description used by DFNSPTPRM is QDFTJOB. The description objects must be available via \*LIBL at runtime.

b) Rollback. RLBTCKP command processor attempts to use job descriptions with names having the pattern CRCVRJDxxx. Xxx is the number of the stream for all the streams with numbers smaller than 1000. For the job with the number 1000 xxx would have the value BMM; all the following jobs would have the lexicographically increasing suffixes: BMN, BMO...BNA, etc. The description objects will be located via \*LIBL at runtime. If the object with the required name is not found QBATCH job description is used.

c) Commands enabled for rollback. If any such command invokes CLRPFM command under the covers and the unit settings require the target file "protection", multiple record delete streams are submitted instead to perform the required "clear" operation. An attempt will be made to use CRCVCLR job description located via \*LIBL for all the stream jobs. If this job description is not found QBATCH will be used instead.

The other iSTREAM functional enhancement submitting jobs for background execution is flash execution. When a command enabled for flash (asynchronous) execution is encountered by the command processor in the batch job running in the iSTREAM mode this command can be submitted to the background for execution. Two job descriptions are ordinarily used in such cases: ISTREAM@@1 and ISTREAM@@2. Both reside in ISTVQS library, the former used to process sequential, the latter – independent requests. It is possible to override the selection algorithm specifying the name of the job description to be used in PARMJOB data area in QTEMP. This job description, however, has to reside in ISTVQS library.

If there is a suspicion of a problem related to the flash functionality, the first thing to attempt is to use DSPFLSRQS command. This command would display all the flash requests for the unit irrespectively of their status. If a request has failed, there will be a red entry on the DSPFLSRQS display. With the recommended settings for the job descriptions involved DSPFLSRQS would allow to see the job logs of the related jobs.

If the error has been found and corrected, the failed entries must be deleted from the DSPFLSRQS list before retrying the requests.

Apart from the above, IBM ObjectConnect could add to the complexity of the troubleshooting process. Any SAVRSTxxx process submits a background job that should usually be analysed in case of unexpected errors. The best way to troubleshoot in such situations is to enable job logging of the submitted jobs by changing the parameters of the appropriate job description. In most cases the job description can be identified by looking at the QSOCCT job entry in the list of communication entries for the QCMN subsystem. The value \*USRPRF in the entry means that the job description parameters of the job executing SAVRSTxxx command is used.