Oracle Tuxedo Application Runtime for IMS

Reference Guide

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The Oracle Tuxedo Application Runtime for IMS (Tuxedo ART for IMS) Reference Guide describes system processes and commands delivered with the Tuxedo ART for IMS software.

This chapter contains the following topics:

- Tuxedo ART for IMS Utilities
- Tuxedo ART for IMS DL/I Support
- Tuxedo ART for IMS Language Environment
- Tuxedo ART for IMS MFS Support
- Tuxedo ART for IMS Non-Terminal Access Support
- Server Configurations
- Security Configuration
- Environment Variables
- Commands and Parameters
- Configuration Files
- COBOL/C Runtime Support

Tuxedo ART for IMS Utilities

Table 1 lists the Tuxedo ART for IMS utilities.

Table 1 Tuxedo ART for IMS Utilities

Name	Description
`chgcobol.sh`	Shell script used to switch between Micro Focus COBOL and COBOL-IT for Tuxedo ART for IMS. It must run under the `IMS_RT` root directory.
`DFSRRC00`	Utility used to activate the `ARTIBMP` server.
`genimsprofile`	Security Profile Generator.
`imsadmin`	TuxedoTuxedoART for IMS Runtime administration tool.
`imsgenconf`	Tuxedo ART for IMS configuration generation tool
`imsperf`	Tuxedo ART for IMS Performance analysis tool
`MFSGEN`	Binary control blocks generator for `ARTICTL`. server.
`odbactl`	A tool on open system used to stop ODBA proxy on z/OS, check status of ODBA proxy on z/OS, show existing connections, and check if PSB is properly defined.
`odbastop`	A tool on open system and it is used to stop ODBA proxy on z/OS.
`prepro-ims.pl`	Utility used to transfer C program on z/OS to the format that could be run in Tuxedo ART for IMS.
`prepro-ims-cobol.pl`	Utility used to transfer EXEC DLI statements in BMP COBOL program to CBLTDLI statements.
`RUNPROXY(z/OS)`	JCL command used to start ODBA proxy on z/OS.
`STOPROXY(z/OS)`	JCL command used to stop ODBA proxy on z/OS.

chgcobol.sh

Name

`chgcobol.sh` - shell script used to switch between Micro Focus COBOL and COBOL-IT for Tuxedo ART for IMS.

Synopsis

`chgcobol.sh [mf|cit]`

Description

You can have both Micro Focus COBOL and COBOL-IT installed at the same host, and can switch from one to the other or back. `chgcobol.sh` is used to switch between Micro Focus COBOL and COBOL-IT. To switch to COBOL runtime, you must first shutdown the Tuxedo ART for IMS application.

`chgcobol.sh` takes the following options:

Without any option
: Shows the current COBOL environment

`cit`
: Change COBOL Runtime to COBOL-IT

`mf`
: Change COBOL Runtime to Micro Focus COBOL

Example(s)

`./chgcobol.sh`
: Output: Current COBOL Runtime is COBOL-IT

`./chgcobol.sh mf`
: Output: COBOL runtime has been changed to Micro Focus COBOL

DFSRRC00

Name

`DFSRRC00` - Utility used to activate the `ARTIBMP` or `ARTIBMPT` server.

Synopsis:

```
DFSRRC00 "BMP,${MBR},${PSB},${IN},,,,,${CKPTID},,,,,,,,,,,,"
```

Description

`DFSRRC00` is used to activate the `ARTIBMP/ARTIBMPT` server which waits for `DFSRRC00` input . The `DFSRRC00` parameter is a string passed from the script converted by workbench from JCL. Currently, only 5 sub-parameters contained in the string are supported : `"BMP, ${MBR}, ${PSB}, ${IN}, ${CKPTID}"` . The remaining sub-parameters in the string are ignored.

If there is no IMS server error, no abend, and the user program has not crashed, the user program return code is the `DFSRRC00` return code.

The `DFSRRC00` client name format is as follows: `"${MBR}-DFSRRC00"`. You can use `tmadmin` to observe currently running BATCH programs.

At the start/end of a transaction/program, a trace line is added to the program invocation log file in the following format: `"transaction name, program name, Sstart time, Eend time, group id, server id"` (note: when used, `"-"` indicates an empty value).

Two duplicated FML32 fields (`IMS_BMP_APPNAME_ROUTE` and `IMS_JOB_NAME_ROUTE`) could be used as routing fields when `DFSRRC00` calls the BMP service. So you could route a specific application program or Batch job to a specific BMP server group. These two FML32 fields are defined in `$IMSDIR/include/ROUTEFML`.

Note: 16 additional parameters are reserved for future use; currently, they are not supported.

Parameter(s)

`BMP`
: A hard-coded string.

`${MBR}`
: Represents the batch program to be called and it is required by both normal BMP and transaction oriented BMP.

`${PSB}`
: Represents the `PSB` name used for the program.

`{IN}`
: Represents the transaction/queue name for a transaction oriented BMP program,

`{CKPTID}`
: Represents the check point ID used in `XRST`.

Notes: When `${MBR}` is empty, `DFSRRC00` exits with error directly.

When `${IN}` is empty, the request is sent to `ARTIBMP`/`ARTIBMP_ORA` to call a `BMP` program.

When `${IN}` is not empty, the request is sent to `ARTIBMPT` to call transaction oriented BMP program whose transaction code is `${IN}`.

genimsprofile

Name

`genimsprofile` - Security Profile Generator

Synopsis:

```
genimsprofile [-f <output_file>]
```

Description

This utility generates the security profile for Tuxedo applications. When the utility is launched, you are prompted to enter the Tuxedo application password, user name and user password. The output is a security profile file which contains the user name and encrypted passwords. The generated security profile file can be used by `imsadmin` , `ARTICTL` and `DFSRRC00` to join to the Tuxedo domain.

Parameter(s)

`-f <output_file>`
: Optional. The location of the generated security profile file. If this option is not specified, the default value is `~/.tuxAppProfile`.

imsadmin

Name

`imsadmin` - Tuxedo ART for IMS Runtime administration tool.

Synopsis:

```
imsadmin      [-p <profile>] -l PGM1, PGM2
imsadmin      [-p <profile>] -u -d <directory>
imsadmin      [-p <profile>] -c -d <directory>
imsadmin       -x flushperf|cleanperf|enableperf|disableperf
                   [-m machine]|[-g groupid [-s serverid] ]
imsadmin       -x settracelevel number [-m machine]|
                   [-g groupid [-sserverid] ]
imsadmin      [-v]
imsadmin      [-h]
imsadmin      -t
```

Description

This utility can be used as an administration tool to make changes to the running IMS system. It allows you to transmit a program reload request to the IMS system (which reloads the modified user COBOL programs). It is also used to verify configuration or reload requests to the IMS system. It can run in test mode to check configuration files and program files.

Parameter(s)

`imsadmin` supports the following options:

`[-p <profile>]`

The name of the security profile file used for authentification. This parameter is needed when Oracle Tuxedo security is enabled. The profile file must be created with `genimsprofile`.

If no file name is provided, it defaults to `~/.tuxAppProfile`.

Note: When security level is set to `MANDANTORY_ACL`, to ensure `imsadmin` successfully transmits reloading request to Tuxedo ART for IMS servers, you must make sure the username in the profile has access permission to the services named "`..IMSADM _grpid_svrid`", where the `grpid/svrid` represents every Tuxedo ART for IMS `MPP/BMP` corresponding group id and server id.

`-l PGM1, PGM2`

Specifies names of the COBOL programs that need to be reloaded. The program names are separated by commas.

Note: The maxi program numbers for one command line is 128. The program maximum name length is 8 bytes.

`-u`

Updates the configuration.

`-c`

Verifies the configuration.

`-d <directory>`

Specifies the directory of the new configuration files. This directory must be on the master machine.

`-x flushperf|cleanperf|enableperf|disableperf`

Used to dynamically control performance trace. Each action function is listed as follows:
`flushperf`: Flushes the performance trace into log files.
`cleanperf`: Cleans up the performance trace log files.

`enableperf`: Enables performance trace.
`disableperf`: Disables performance trace.

`-x settracelevel number`

Specifies the debug trace level.

Number:
`-1`: Trace off
`0`: Function stack trace
`1`: Function stack trace + execution flow trace
`2`: Function stack trace + execution flow trace + data convert trace

`[-m machine]`

Specifies the machine logic name.

`[-g groupid]`

Specifies group id.

`[-s serverid]`

Specifies server id.

If `machine`, `groupid`, and `serverid` parameter are not specified, the action is applied to all applicable servers specified in the `UBBCONFIG SERVERS` section. Once you specify one or more parameters, the action is only applied to the servers specified.

The applicable server includes `ARTIMPP*`/`ARTIBMP*`/`ARTIGW`/`ARTIADM`. Currently, this feature does not support dynamic trace control for `ARTICTL`/`ARTICTLH`.

Notes: If `flushperf` or `cleanperf` are specified, `-m`, `-g` and `-s` are be omitted, since these two actions apply to all applicable servers.

Debug tracing is automatically disabled when performance trace is enabled.

`[-v]`

Displays the `imsadmin` tool version and bit mode.

`[-h]`

Displays usage help information.

`-t`

Runs in test mode to check whether local configuration files are correct and whether specific programs are existed (only checks entry points). All configuration files *except for* `imsresource.desc` and all programs configured in `imsapps.desc` are checked.

Example(s)

- Reload COBOL programs `PGM1` and `PGM2` in all Tuxedo ART for IMS application servers, input the following: `imsadmin -l PGM1,PGM2`.
- When Oracle Tuxedo security is enabled, reload COBOL programs `PGM1` and `PGM2` in all Tuxedo ART for IMS application servers, inpt the following: `imsadmin -p /home/app/imsprofile -l PGM1,PGM2`.
- If IMS configuration is modified and all configuration files are in `/opt/ims_config`, you can verify the new configuration files as follows: `imsadmin -c -d /opt/ims_config`.
- If the new configuration files have passed verification and you want to load the new configuration, input the following: `imsadmin -u -d /opt/ims_config`.
- If you want to change all server debug trace levels to the highest level, input the following: `imsadmin -x settracelevel 2`.
- If you want to close debug trace for a specific server (e.g., where the server id is `3`, and the group id is `6)`, input the following: `imsadmin -x settracelevel -1 -s 3 -g 6`.
- If you want to enable the performance trace of servers which included in the group that groupid is `10`, input the following: `imsadmin -x enableperf -g 10`.
- If you want to disable the performance trace of servers on the machine where `LMID` is `SITE1`, input the following: `imsadmin -x disableperf -m SITE1`.
- If you want to check the performance trace before server shutdown, input the following: `imsadmin -x flushperf`.
- If you want to clean all the history performance trace files, input the following: `imsadmin -x cleanperf`.

imsgenconf

Name

`imsgenconf` - Tuxedo ART for IMS configuration generation tool.

Synopsis

For Tuxedo ART for IMS 12c Release 2 (12.2.2) GA and Rolling Patch 001:

```
imsgenconf -i inputdir [-o outputdir] [-h]
```

For Tuxedo ART for IMS 12c Release 2 (12.2.2) Rolling Patch 002 or later:

```
imsgenconf [-o outputdir] [-h]
```

Description

`imsgenconf` allows you to generate Tuxedo ART for IMS configurations for particular transactions and batch applications.

During the file generating process, `imsgenconf` validates field definitions that Tuxedo ART for IMS uses according to the fields defintion. If the validation fails, the specific error is reported and the configuration file generation stops.

If successful, a report file (`imsgenconf_report)` is generated in the output directory. Currently, transactions with definition file name and line number are included in the report file.

Parameter(s)

`-i inputdir`

Mandatory in Tuxedo ART for IMS 12c Release 2 (12.2.2) GA and Rolling Patch 001. Specifies the top definition directory which contains z/OS definitions, `IMS.WHITE`, or `IMS.BLACK`.

`-i inputdir` is obsoleted by Tuxedo ART for IMS 12c Release 2 (12.2.2) Rolling Patch 002 and later.

`[-o outputdir]`
: Optional. Specifies where the generated Tuxedo ART for IMS directory is put. If this option is not defined, the generated configurations are put under `inputdir`.

`[-h]`
: Print help information.

Environment Variables

For Tuxedo ART for IMS 12c Release 2 (12.2.2) Rolling Patch 002 or later, set the following environment variables before you invoke `imsgenconf` to generate new configuration files. If any variable is not set, it means no value or empty:

`IMS_DBD_DIR`
: Specifies input DBD file direcotry.

`IMS_DBD_SUB_DIR`
: Specifies input direcotry for files that are `COPIED` in DBD file.

`IMS_PSB_DIR`
: Specifies input PSB file direcotry.

`IMS_PSB_SUB_DIR`
: Specifies input direcotry for files that are `COPIED` in PSB file.

IMS_APPL_DIR
: Specifies input tran/appl definition file direcotry. Black and white list file should also be put in this directory.

IMS_DBD_EXT
: Specifies input DBD file extension.

IMS_DBD_SUB_EXT
: Specifies input `COPIED` DBD file extension.

IMS_PSB_EXT
: Specifies input PSB file extension.

IMS_PSB_SUB_EXT
: Specifies input `COPIED` PSB file extension.

IMS_APPL_EXT
: Specifies input tran/appl definition file extension.

imsperf

Name

`imsperf` - Tuxedo ART for IMS Runtime Performance analysis tool

Synopsis

```
imsperf [-d path] [-h]
```

Description

Use this tool to generate transaction and appliction performance reports.

If -`d` option is specified, it searches the performance trace file under the specified path.

If -`d` option is not specified, it searches performance trace first under `$IMS_TRACE_PATH`, then under `$APPDIR/log`. For more information, see Tuxedo ART for IMS Users Guide.

`imsperf` generates transaction/application performance reports in the same directory as the performance trace file; the formats are as follows:

`tranname.csv`

`application.csv`.

The time unit is in microseconds. You can open the report file in CSV format directly. The descriptions for operations in performance report are shown in Table 2.

Table 2 Operations Performance Report

OP	Type	Description
MPP/BMP		
`{MPP|BMP}_TOTAL`	Mixed	Total time spent on the whole transaction/program
`{MPP|BMP}_CPU_USER_TOTAL`	Mixed	Total CPU time in user mode spent on the whole transaction/program
`{MPP|BMP}_CPU_SYSTEM_TOTAL`	Mixed	Total CPU time in system mode spent on the whole transaction/program
`{MPP|BMP}_DLI_TOTAL`	User Program	Total time spent on all DLI calls in current transaction/program
`{MPP|BMP}_BEGIN`	Framework	Time spent on starting the new transaction/program
`{MPP|BMP}_GET_APP_ADDRESS`	Framework	Time spent on loading user COBOL/C program
`{MPP|BMP}_PREPARE_PCB`	Framework	Time spent on preparing PCBs required for current transaction/program
`{MPP|BMP}_DB_PRE`	Framework	Time spent on calling DB plug-in db_pre function
`{MPP|BMP}_TPBEGIN`	Framework	Time spent on calling TUXEDO tpbegin function
`{MPP|BMP}_EXECUTE_PROGRAM`	Mixed	Time spent on launching and executing user program
`{MPP|BMP}_TPCOMMIT`	Framework	Time spent on calling TUXEDO tpcommit function
`{MPP|BMP}_DB_POST`	Framework	Time spent on DB plug-in db_post function
Common		

Table 2 Operations Performance Report

OP	Type	Description
CBL_MF_CALL_PROGRAM	User Program	Time spent on executing user COBOL program
CBL_MF_CREATE_SUBSYS	Framework	Time spent on creating MF subsystem
CBL_MF_DESTROY_SUBSYS	Framework	Time spent on destroying MF subsystem
CBL_MF_SET_ERROR_PROC	Framework	Time spent on setting MF error procedure
CBL_CIT_CANCEL_REGION	Framework	Time spent on canceling CIT region
CBL_CIT_SET_REGION	Framework	Time spent on setting CIT region
CBL_CIT_SET_ERROR_PROC	Framework	Time spent on setting CIT error procedure
CBL_CIT_RESOLVE_PROGRAM	Framework	Time spent on resolving COBOL program
CBL_CIT_CALL_PROGRAM	User Program	Time spent on executing user COBOL program
DLI_TSAMBEGIN	User Program	Time spent on beginning DLI monitoring by TSAM
DLI_TSAMEND	User Program	Time spent on ending DLI monitoring by TSAM
All DLIs(GU,GN,ISRT…….)	User Program	Time spent on the specific DLI call
ODBA_BEGIN	User Program	Time spent on starting an ODBA call
ODBA_BUILD_MESSAGE	User Program	Time spent on building ODBA request message
ODBA_SEND_MESSAGE	User Program	Time spent on sending message to ODBA proxy

Table 2 Operations Performance Report

OP	Type	Description
`ODBA_RECV_MESSAGE`	User Program	Time spent on waiting and receiving response message from ODBA proxy
`ODBA_CONVERT_MESSAGE`	User Program	Time spent on converting data in response message
`ODBA_TOTAL`	User Program	Total time spent on ODBA call
Gateway		
`GW_TOTAL`	Mixed	Time lasts from transaction begins to the response has been sent to TUXEDO client or MQ
`GW_REQUEST_BEGIN`	Framework	Time spent on beginning a new request
`GW_REQUEST_BUILD_MESSAGE`	Framework	Time spent on building transaction request message
`GW_REQUEST_CALL_SERVICE`	Framework	Time spent on calling transaction service
`GW_REQUEST_TPSERVICE_HOOK`	Framework	Time spent on TSAM monitoring
`GW_REQUEST_TSAM_HOOK`	Framework	Time spent on TSAM monitoring
`GW_REPLY_BEGIN`	Framework	Time spent on beginning the reply service
`GW_REPLY_SEND_RESPONSE`	Framework	Time spent on sending response message to TUXEDO client
`GW_MQ_BEGIN`	Framework	Time spent on beginning a new request
`GW_MQ_TPSERVICE_HOOK`	Framework	Time spent on TSAM monitoring
`GW_MQ_BUILD_MESSAGE`	Framework	Time spent on building transaction request message
`GW_MQ_TSAM_HOOK`	Framework	Time spent on TSAM monitoring

Table 2 Operations Performance Report

OP	Type	Description
`GW_MQ_CALL_SERVICE`	Framework	Time spent on calling transaction service
`GW_MQ_REPLY_BEGIN`	Framework	Time spent on beginning the reply service

Options

`imsperf` supports the following options:

`[-d path]`
: The path specified the directory where performance trace file exist. Current user must has the write operation for the path.

`[-h]`
: Displays usage help information.

Example(s)

To generate performance tracing report under /home/oracle/log:

```
imsperf -d /home/oracle/log
```

MFSGEN

Name

`MFSGEN` - Binary control blocks generator for `ARTICTL`. server.

Synopsis

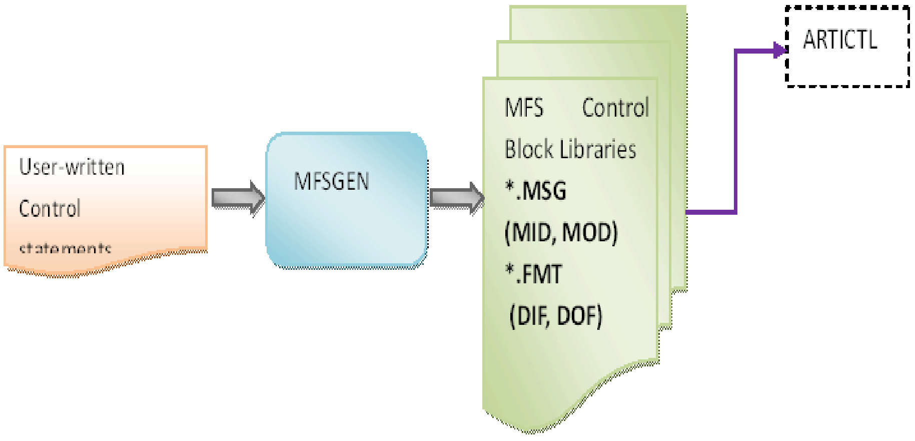
```
mfsgen [-options…] files
```

Description

This utility is meant for ART MFS development. It converts user-written control statements to MFS binary control blocks.

Figure 1shows the `MFSGEN` workflow.

Figure 1 Mfsgen Workflow



Options

The command options are:

`-l`

Generate a listing (`.lst`) file for each input file.

`-d dir`

Specifies an existing directory as the target directory to store all output files, including binary control blocks files (`*.MSG` and `*.FMT`) and listing files.

It is `<current directory>/format` by default.

Files

The `MFSGEN` utility creates the following files:

`FILE.MSG`

One category of binary files for MID and MOD control blocks. The name `"FILE"` should be obtained from input `MSG` definition statements.

`FILE.FMT`

One category of binary files for DIF and DOF control blocks. The name "`FILE`" should be obtained from input FMT definition statements.

`FILE.lst`

Source listing file. Here, `"FILE"` is the same as the base name of input file.

Return code

0
: Success. All input file(s) is/are successfully parsed and converted to control blocks without any errors and warnings.

1
: Success with warnings. All input file(s) is/are successfully parsed and converted to control blocks, but warnings exist.

2
: Fail. Some/All of input file(s) are failed being parsed or converted to control blocks.

Example

To convert the source file file.mfs, use the following command:

```
$mfsgen file1.mfs  file.mfs   file3.mfs
```

Note: the input file `.mfs` suffix is not mandatory.

odbactl

Name

`odbactl` - Open system tool used to stop ODBA proxy on z/OS, check status of ODBA proxy on z/OS, show existing connections, and check if PSB is properly defined.

Synopsis

```
odbactl -c cmd -l host -p port [PSB=psbname] [DRA=draname]
```

Description

Use `odbactl` on open systems which provides varies functions.

- Stop ODBA proxy on z/OS
- Check ODBA proxy up or down.
- List existing connections.
- Check if PSB is properly defined.

Parameter(s)

`cmd`
: Command to send to ODBA proxy, now. Now ping, chkpsb, shut and listconn can be used. It is mandatory.

`-c ping`
: Checks the ODBA proxy status. With a specified hostname and port, if it is accessible, we assume the proxy is OK; otherwise, we assume the ODBA proxy is down.

`-c chkpsb`
: Checks whether the PSB is defined properly or not.

`-c shut`
: Stops ODBA proxy on z/OS.

`-c listconn`
: Shows information for existing ODBA connection, including server address and peer address.

`host`
: Hostname or ipv4 address of ODBA proxy. It is mandatory.

`port`
: It is the port of ODBA proxy for receiving command if cmd is `ping`, `shut` or `listconn`. It is the port of ODBA proxy for receiving odba request if cmd is `chkpsb`. It is mandatory.

`PSB=psbname`
: PSB name. It is mandatory if command is `chkpsb`.

`DRA=DRA table`
: Name of the DRA table in which the IMS/DB system to be accessed. It is mandatory if command is `chkpsb`.

odbastop

Name

`odbastop` - Open system tool used to stop ODBA proxy on z/OS.

Synopsis

```
odbastop -l host -p port -c cmd
```

Description

Use `odbastop` on open systems to stop ODBA proxy running on z/OS.

Parameter(s)

`host`
: The ODBA proxy hostname or ipv4 address.

`port`
: The ODBA proxy port for receiving ODBA request.

`cmd`
: Only supports `SHUTDOWN`

prepro-ims.pl

Name

`prepro-ims.pl` - Utility used to transfer C program on z/OS to the format that could be run in Tuxedo ART for IMS.

Synopsis:

```
prepro-ims.pl -i source-file -o dest-file [-m yourmakefile]
```

Description

`prepro-ims.pl` is used to transfer C programs on z/OS to a format that can be run in Tuxedo ART for IMS. When file conversion failes, the failure information and lines of source file leading to failure are printed to the `stderr`.When complete, a summary is reported to `stdout`.

Processing rules are as follows:

- Delete

  Comment the "`#pragma runopts`" line and other pragma directives.

  The `env(IMS)` establishes the correct operating environment and `plist(IMS)` establishes the correct parameter list when invoked under IBM IMS. They are not necessary in Tuxedo ART for IMS Runtime and should be removed.

- Re-construct

  Functions `ctdli()/aibtdli()` are reconstructed by adding additional trailing `NULL` to the argument list. This `NULL` is used to mark the end of the Tuxedo ART for IMS argument list. For `aibtdli()`, the `parmcount` parameter is removed.

  The function `main()`argument list is eliminated (including "`argc`", "`argv`" and "`envp`"). On mainframes, IMS uses a global list and a macro to define the list. On Tuxedo ART for IMS, the `__getcb(int)` function is implemented as `GET` method to obtain the PCB list.

The `exit()` function is renamed to `__art_ims_return ()`. According to IBM IMS documentation, when there are no messages for the program to process, the program returns control to IMS by returning from main or by calling `exit()`. To avoid `exit()` unexpectedly exiting the container server, The `__art_ims_return ()` function is used and helps to return control to container server.

Table 2 shows processing rules examples.

Table 2 Processing Rules Examples

Rules	Source	Destination
Delete	`#pragma runopts(env(IMS), plist(IMS))`	`/*#pragma runopts(env(IMS), plist(IMS))*/`
Re-construct	`ctdli(func_GU, io_pcb, msg_seg_io_area);`	`ctdli(func_GU, io_pcb, msg_seg_io_area, NULL);`
	`aibtdli(parmcount, func_GU, io_pcb, msg_seg_io_area);`	`aibtdli(func_GU, io_pcb, msg_seg_io_area, NULL);`
	`main(/* if any argument */)`	`main()`
	`exit(val)`	`__art_ims_return(val);`

Note: `prepro-ims.pl` cannot handle all generic C porting from mainframes to open systems.

Limitations

1. If one program requires multiple source files, the preprocessor performs simple processing on the source file containing the main entry. Users have to modify the `makefile` manually to add other depending C files.
2. Invoking `ctdli/aibtdli` as a function pointer is not supported.
3. The lines with valid a pragma symbol are commented out.
4. The directory of source file must be different from the destination source file.
5. If the input is a directory, its subdirectories will not be processed.

6. Columns 73-80 containing sequence numbers are not supported. These columns should be replaced with blank spaces or left empty.

Dependencies

1. `gmake` should be used for the generated makefile.
2. Before conversion, you must ensure that the C source code is in UNIX format.
3. Some header files provided by IMS, (e.g., `ims.h`), should be copied from mainframes to the open systems.

Parameter(s)

`prepro-ims.pl` parameters, exit codes, and support modesare listed in Table 3, Table 4, and Table 5r espectively.

Table 3 prepro-ims.pl Parameters

Option name	Value range	Comment
`-i`	existing file(s) or directory	It's the original C program file[s] from IBM IMS application project. The suffix of file name must be .c or .h. As well, simple wildcards like '*' and '?' are supported.
`-o`	file or directory	It's the destination file or directory to be written. If the directory doesn't exist it will be created.
`-m`	file	It's the makefile generated for destination programs. It is placed in the destination directory. This file name should not be relative or absolute path.

Table 4 Exit Codes

Exit code	Meaning	Comment
0	Success	
1	Failure	general failure
2	Failure	invalid argument

Table 5 Support Modes

-i	-o	Support?
directory	directory	Y
dir1/file1	dir2/file2	Y
dir1/file1	dir2	Y
dir1/file1 dir2/file2 …	dir3	Y Directories of source files must diff with dir3.

The source program should look like that shown in Listing 1.

Listing 1 Source Program

```
/* #pragma runopts(env(IMS), plist(IMS)) */
#include <ims.h>
#include <stdio.h>
#define n 20  /* I/O area size - Application dependent */
typedef struct {PCB_STRUCT(10)} PCB_10_TYPE;

int main()
{
static const char func_GU[4] = "GU  ";
static const char func_ISRT[4] = "ISRT";
char ssa_name[] = "ORDER ORDER   (ORDERKEY   = 666666)";

int rc;
char msg_seg_io_area[n];
char db_seg_io_area[n];
char alt_msg_seg_out[n];

PCB_STRUCT_8_TYPE *alt_pcb;
PCB_10_TYPE *db_pcb;
IO_PCB_TYPE *io_pcb;

io_pcb = (IO_PCB_TYPE *)__pcblist[0];
alt_pcb = __pcblist[1];
db_pcb = (PCB_10_TYPE *)__pcblist[2];
..
/* get first message segment from message area */
rc = ctdli(func_GU, io_pcb, msg_seg_io_area, NULL);
..
/* get the data from the database having the specified key value */
rc = ctdli(func_GU, db_pcb, db_seg_io_area, ssa_name, NULL);
..
/* build output message in program's I/O area */
rc = ctdli(func_ISRT, alt_pcb, alt_msg_seg_out, NULL);
..
}
```

prepro-ims-cobol.pl

Name

`prepro-ims-cobol.pl` - Utility used to transfer EXEC DLI statements in BMP COBOL program to CBLTDLI statements.

Synopsis:

```
prepro-ims-cobol.pl [-type_output <output type>] input_file
```

Description

`prepro-ims-cobol.pl` converts all EXEC DLI statements in `input_file` to CBLTDLI statements and prints all lines to stdout which can be redirected to a new file. After that the new file could be compiled with COBOL compiler. The environment variable `COBCPY`, which indicates to the Micro Focus COBOL compiler or COBOL-IT compiler where copybooks are stored, must be correctly set to include the IMS copybook path at `$IMS_RT/cpylib` during compilation time.

The preprocessor expects the input COBOL program to have a 6-column left-margin. The output is in fixed format, or an error message should appear.

Parameter(s)

`type_output`

`type_output` determines the way that output is printed; recognized values are:

`debug`

Prints every line with its status (untouched, modified, deleted, created). Always outputs at least one line for every line read.

`orig`

Prints every line, deleted lines are printed as comments. Always outputs at least one line for every line read.

`normal (default)`

Prints every line, except deleted ones. Does not always output at least one line for every line read.

Any other value will be considered as "normal".

Restrictions

- The preprocessor expects the input COBOL program to be in fixed format.
- The preprocessor ignores copies. All statements in copybook will not be translated.
- The two words EXEC and DLI must be on the same line.

RUNPROXY(z/OS)

Name

`RUNPROXY` - Used to start ODBA proxy on z/OS.

Synopsis:

Modifies `USER.ODBA.JCL(RUNPROXY) JCL` and submit it to start ODBA proxy. For more information, see Using ODBA PRoxy in the Oracle Tuxedo Application Runtime for IMS Users Guide.

Description

Use `RUNPROXY` on z/OS to start ODBA proxy on z/OS.

STOPROXY(z/OS)

Name

`STOPROXY` - Used to stop ODBA proxy on z/OS.

Synopsis:

Modify `USER.ODBA.JCL(STOPROXY) JCL` and submit it to stop ODBA proxy. For more information, see Using ODBA PRoxy in the Oracle Tuxedo Application Runtime for IMS Users Guide.

Description

Use `STOPROXY` on z/OS to stop ODBA proxy running on z/OS.

Tuxedo ART for IMS DL/I Support

In Tuxedo ART for IMS, DL/I is implemented in a group of dynamically loaded libraries. The supported DL/I functionalities are as follows:

- Supported DL/I Interfaces
- Message Processing
- Database Operation
- Plug-in Definition for Different Implementation of IMS/DB
- Transaction Management

Supported DL/I Interfaces

Table 6 lists supported DL/I interfaces.

Table 6 Supported DL/I Interfaces

Interfaces Name	Description
CBLTDLI	The 0 entry for DL/I calls in IMS/TM on OS/39
AIBTDLI	AIBTDLI is an entry function for the whole DL/I layer. The essential difference from CBLTDLI is that AIBTDLI uses AIB mask as the first parameter to pass control information in and out.
CTDLI	CTDLI is an entry function for the whole DLI library. Any request to DLI is passed by calling this function. CTDLI can only be called from C programs.

CBLTDLI

Name

CBLTDLI - The 0 entry for DL/I calls in IMS/TM on OS/39.

Description

In Tuxedo ART for IMS, CBLTDLI is a function acting as the entry of DLI library. CBLTDLI calls appropriate function based on the function code passed to it.

Parameter(s)

Function Code, e.g. “GU ”; I/O PCB or alternate PCB, I/O area, MOD

AIBTDLI

Name

AIBTDLI - an entry function for the whole DL/I layer.

Description

AIBTDLI is an entry for DL/I calls in IMS/TM on z/OS. In Tuxedo ART for IMS, AIBTDLI is a function acting as an entry of the DL/I library. AIBTDLI gets the PCB address according to the PCB name specified in AIB mask, then calls appropriate function based on the function code passed to it with the PCB address found.

Parameter(s)

Function Call: e.g. 'GU '; AIB Mask, I/O Area: Input or Output Buffer. Table 7 lists the AIB mask parameters.

Table 7 AIB Mask Parameters

Name	Value	Description	Support
`AIBID`	`X(8)`	AIB Identifier, it must be set to "`DFSAIBbb`". It's for input only	Yes
`AIBLEN`	`X(4)`	AIB Length, the length of the AIB mask. It must be set correctly in the application program and its minimum value is 128. It's for input only.	Yes
`AIBSFUNC`	`X(8)`	AIB subfunction, the subfunction required by some DL/I calls. It must be set correctly by application program if it's required.	Yes. In IMS, we only support INQY subfunction.
`AIBRSNM1`	`X(8)`	This field contains the PCB name. It must be specified by program correctly. For its setting, referring to AIBTDLI section.	Yes
`RESERV1`	`X(16)`	Reserved 16 bytes	No
`AIBOALEN`	`X(4)`	AIB Output Area Length, the length of the I/O area specified for AIBTDLI	Yes
`AIBOAUSED`	`X(4)`	AIB output area used length, the length of returned data in the I/O area. It's valid only in case the I/O area is used as output buffer.	Yes
`RESERV2`	`X(12)`	Reserved 12 bytes	No

Table 7 AIB Mask Parameters

Name	Value	Description	Support
`AIBRETRN`	`X(4)`	AIB Return Code, the return code of AIBTDLI call.	Partial support. Currently, we only support setting this field in the following scenarios: 1. INQY subfunction. 2. DLI call upon DBPCB(excludes GSAM database). For other scenarios, if operation fails, this field is set to 0x0900, You must check the related PCB status. If operation is successful success, this field is set to 0x0000.
`AIBREASN`	`X(4)`	AIB Reason Code, the reason code of AIBTDLI call.	Partial support. Currently, we only support setting this field in the following scenarios: 1. INQY subfunction. 2. DLI call upon DBPCB(excludes GSAM database). If operation is successful success, this field is set to 0x0000.
`AIBERRXT`	`X(4)`	AIB Error Code Extension, contains the additional error information	No

Table 7 AIB Mask Parameters

Name	Value	Description	Support
`AIBRSA1`	X(4)	AIB Resource Address, it's an output field to hold the PCB address corresponding to the PCB name specified in AIBRSNM1. In ART/IMS 64-bit, the PCB address is 8 bytes long, this field occupies actually 8 bytes, the other 4 coming from the first 4 bytes in the following reserved area.	Yes. But on 64bit platform, customer needs to use the AIBRSA1 plus the first 4 bytes in RESERV3 to get the right PCB's address.
`RESERV3`	X(48)	In ART/IMS 64-bit, its firstly 4 bytes are borrowed to store the returned PCB address in combination with AIBRSA1, so it can't be used for any other purpose.	No

The detailed rules for specifying PCB name in AIB mask field `AIBRSNM1` is as follows:

I/O PCB

The name of I/O PCB must be specified as "`IOPCBbbb`",

Alternate PCB

The name of alternate PCB must be configured with `"label="` in `$appname.psb` configuration file, and must be specified correctly in AIB mask, the name (label) of each alternate PCB must be unique in a single PSB (i.e., in a single `$appname.psb` file).

DB PCB

The name of DB PCB must be configured with "`label=`" in `$appname.psb` configuration file, and must be specified correctly in AIB mask, the name (label) of each DB PCB must be unique in a single PSB (i.e., in a single `$appname.psb` file).

CTDLI

Name

`CTDLI` - An entry function for the whole DL/I layer.

Description

In Tuxedo ART for IMS, `CTDLI` is a function acting as the entry of DLI library. `CTDLI` calls appropriate function based on the function code passed to it.

Parameter(s)

Function Call: e.g. 'GU '; PCB: I/O PCB or Alternate PCB, I/O Area: Input or Output Buffer.

The `op` argument specifies the DL/I function to be performed. The `ctdli()` call format depends on the function selected. For more information, see CBLTDLI.

Note: When using CTDLI, SSA parameter must be a pointer parameter.

Message Processing

DL/I is responsible for processing incoming messages and building outgoing messages against PCBs in IMS/TM. In Tuxedo ART for IMS, Tuxedo infrastructure is responsible for the message queue and message delivery, so the processing of incoming messages only involves the current request message. DLI library can retrieve the first and subsequent segments (FML fields) based on the request from any COBOL application. For building outgoing message, each PCB has an associated message buffer (FML) as the intermediate storage area, which holds the message data before the message is sent out. Detailed APIs for message processing are listed in Table 8.

Table 8 Tuxedo ART for IMS DL/I Processes and Commands

Name	Description
`GU`	Used to retrieve the first segment from the message queue in IMS/TM environment.
`GN`	Used to retrieve the subsequent segment from message queue in IMS/TM environment.
`ISRT`	Used to add a segment into the message associated with the specified PCB in IMS/TM.
`PURG`	Used to tell IMS/TM that the message is complete for non-express PCB.
`CHNG`	Used to change the destination in PCB in IMS/TM.
`CMD`	Sends/issues IMS commands, and retrieves the first segment of the response message.
`GCMD`	Retrieves the second and subsequent segments of .the response message of a CMD command.
`GUID`	A fake DL/I used to retrieve the full username under `ARTIMPP` server long username mode.

GU

Name

`GU` - Used to retrieve the first segment from the message queue in IMS/TM environment.

Synopsis

```
I/O PCB or AIB, I/O Area
```

Description

`GU` is used to retrieve the first segment in a message. For conversational transaction, the first segment of a message is always SPA.

In Tuxedo ART for IMS, the simulated GU call is used to get the first field in the FML buffer of the message being processed. For conversational transaction, `GU` call always retrieve the field for SPA, otherwise retrieves the first field for user data.

Parameter(s)

`I/O PCB`

A pointer to the PCB that represents the source of the request

`AIB`

Specifies the application interface block (AIB) that is used for the call. This parameter is an input and output parameter. The following fields must be initialized in the AIB:

AIBID Eyecatcher.

This 8-byte field must contain DFSAIBbb.

AIBLEN AIB lengths.

This field must contain the actual length of the AIB that the application program obtained.

AIBRSNM1 Resource name.

This 8-byte, left-justified field must contain the PCB name `IOPCBbbb`.

AIBOALEN I/O area length.

This field must contain the length of the I/O area that is specified in the call list.

`I/O Area`

Pointer to a buffer to be filled in with the first segment

Result (status code)

‘bb’: successful (two blanks)

‘AB’: segment I/O area not specified

‘AD’: functional parameter invalid: function call not provided to CBLTDLI or invalid function call name provided to CBLTDLI

‘QC’: no input message

‘QF’: segment less than 5 characters

GN

Name

`GN` - Used to retrieve the subsequent segment from message queue in IMS/TM environment.

Synopsis

```
I/O PCB or AIB, I/O Area
```

Description

After the last segment has been retrieved, a `GN` call results in a “`QD`” status code returned in PCB. In Tuxedo ART for IMS, the simulated `GN` call is used to get next field in the FML buffer of the message being processed.

Parameter(s)

`SI/O PCB`

A pointer to the PCB that represents the source of the request.

`AIB`

Specifies the application interface block (AIB) that is used for the call. This parameter is an input and output parameter. The following fields must be initialized in the AIB:

`AIBID` Eyecatcher.

This 8-byte field must contain DFSAIBbb.

`AIBLEN AIB` lengths.

This field must contain the actual length of the AIB that the application program obtained.

`AIBRSNM1` Resource name.

This 8-byte, left-justified field must contain the PCB name IOPCBbbb.

`AIBOALEN I/O` area length.

This field must contain the length of the I/O area that is specified in the call list.

`I/O Area`
A pointer to a buffer to be filled in with the first segment.

Result (Status Code):

'bb': successful (two blanks)

'AB': segment I/O area not specified

'AD': functional parameter invalid: function call not provided to CBLTDLI, invalid function call name provided to CBLTDLI

'QD': no more segments

ISRT

Name

`ISRT` - Used to add a segment into the message associated with the specified PCB in IMS/TM.

Synopsis

```
I/O PCB or alternate PCB or AIB, I/O Area, MOD
```

Description

In Tuxedo ART for IMS, the simulated ISRT call is used to add a field of CARRAY type into the FML buffer associated with the specified PCB. For conversational transaction, the first segment is always SPA. Message segment maximum length is `32767`.

Parameter(s)

`I/O PCB or alternate PCB`
Pointer to the PCB that represents the destination of the outgoing message

`AIB`
Specifies the application interface block (AIB) that is used for the call. This parameter is an input and output parameter. The following fields must be initialized in the AIB:

`AIBID` Eyecatcher.
This 8-byte field must contain `DFSAIBbb`.

`AIBLEN AIB` lengths.
This field must contain the actual length of the AIB that the application program obtained.

`AIBRSNM1` Resource name.

This 8-byte, left-justified field must contain the PCB name `IOPCBbbb` (if the TP PCB is used), or the name of an alternate PCB (if an alternate PCB is used)

`AIBOALEN I/O` area length.

This field must contain the length of the I/O area that is specified in the call list.

`I/O Area`

Pointer to a buffer that holds a segment to be sent. For conversational transaction code, the first segment must be SPA.

`MOD`

Used for the output message, the 8-byte MOD name must be left-justified and padded with blanks as necessary. It can be only accompanied with the first segment into a message.

If MOD equals DFS.EDT or DFS.EDTN, the message bypasses MFS formatting. When MFS is bypassed on output, the application program is responsible for constructing the entire 3270 data stream (beginning with the command code and ending with the last data byte).

Result (Status Code):

'**`bb`**': successful (two blanks)

'**`AB`**': segment I/O area not specified.

'**`AD`**': functional parameter invalid: function call not provided to `CBLTDLI`, invalid function call name provided to `CBLTDLI`.

'**`QF`**': segment less than 5 characters.

'**`QH`**': No destination name in PCB.

'**`XA`**': trying to forward the request to another transaction after responding the request.

'**`XB`**': trying to respond the request after forwarding it to another transaction.

'**`XC`**': Z1 bit is not 0, it is reserved and always kept as 0.

'**`A6`**': Output segment size limit exceeded on call.

PURG

Name

`PURG` - Used to tell IMS/TM that the message is complete for non-express PCB.

Synopsis

`I/O PCB or alternate PCB or AIB, I/O Area (optional), MOD (optional)`

Description

`PURG` call is normally, but not send; or send out the message immediately for an express PCB.

If an I/O area is provided to `PURG` call, `PURG` call also acts as an ISRT call. That is, `PURG` marks the (current) message associated with the PCB as complete and "`ISRT`" the data in the I/O area as the first segment of the next message. The final result is same as a `PURG` call without I/O area followed by an `ISRT` call.

In Tuxedo ART for IMS, the simulated `PURG` call is used to mark the associated message as complete for a non-express PCB, or send out the associated message for an express PCB. If an I/O buffer is provided, however, it is ignored since multiple pending messages for a single PCB are not supported, therefore the MOD is ignored too. No special status code is added for this case, however, since the status code is checked by customer program.

Parameter(s)

`I/O PCB` or alternate `PCB`

Pointer to the PCB that represents the destination of the outgoing message.

AIB

Specifies the application interface block (AIB) that is used for the call. This parameter is an input and output parameter. The following fields must be initialized in the AIB:

`AIBID` Eyecatcher.

This 8-byte field must contain DFSAIBbb.

`AIBLEN AIB` lengths.

This field must contain the actual length of the AIB that the application program obtained.

`AIBRSNM1` Resource name.

This 8-byte, left-justified field must contain the PCB name `IOPCBbbb` (if the TP PCB is used), or the name of an alternate PCB (if an alternate PCB is used)

`AIBOALEN I/O` area length.

This field must contain the length of the I/O area that is specified in the call list.

`I/O Area`

If provided, is a pointer to a buffer that is to be inserted as the first segment of next message.

MOD

Used for the output message, the 8-byte MOD name must be left-justified and padded with blanks as necessary.

Result (Status Code):

'**bb**': successful (two blanks)

'**AD**': functional parameter invalid: function call not provided to `CBLTDLI`, invalid function call name provided to `CBLTDLI`

'**A3**': a modifiable TP PCB with no destination set but PURG called to it

CHNG

Name

`CHNG` -Used to change the destination in PCB in IMS/TM.

Synopsis

`Alternate PCB or AIB`, destination transaction code

Description

In Tuxedo ART for IMS, the simulated `CHNG` is to specify another service name (only) in an alternate PCB. The destination transaction name is not greater than 8 bytes and is truncated to 8 if the limit is exceeded. The tailing blanks are removed too. The transaction name is evaluated as valid if it exists in the imstrans.desc file and has a legal configuration.

If one transaction code in one Tuxedo domain is designed to switch to another service in a different domain, the transaction code to be switched must be defined in the [imstrans.desc] configuration file as a valid transaction but should NOT be advertised with the control of its class.

For program switch, the new target is another transaction code. For conversational program switch, Tuxedo ART for IMS does not have limitation on the spa sizes of the originating code and the target code.

Parameter(s)

I/O PCB

Pointer to the PCB that represents the destination of the outgoing message destination name is a string that represents the name of another transaction (service).

AIB

Specifies the application interface block (AIB) that is used for the call. This parameter is an input and output parameter. The following fields must be initialized in the AIB:

`AIBID` Eyecatcher.
This 8-byte field must contain `DFSAIBbb`.

`AIBLEN AIB` lengths.
This field must contain the actual length of the AIB that the application program obtained.

`AIBRSNM1` Resource name.
This 8-byte, left-justified field must contain the name of a modifiable alternate PCB.

`AIBOALEN I/O` area length.
This field must contain the length of the I/O area that is specified in the call list

Result (Status Code):

‘**`bb`**’: successful (two blanks).

‘**`AD`**’: functional parameter invalid: destination not provided, functional call invalid.

‘**`A1`**’: PCB is not valid.

‘**`A2`**’: PCB is not modifiable or ISRT operation already done.

‘**`QH`**’: the transaction to be specified in an alternate PCB is blank or invalid.

CMD

Name

`CMD` - Used to enable a program to issue IMS commands.

Synopsis

I/O PCB or AIB, I/O Area

Description

Sends/issues IMS commands, and retrieves the first segment of the response message.

`CMD` is used to issue IMS commands. It forwards the IMS command to an interface which can assumedly process all supported IMS commands. The CMD call waits for the interface to process IMS commands, and get the first field of the response message.

Restrictions

For commands, only "`/DIS TRAN`", "`/DIS PGM`" and "`/DIS USER`" are supported. Once these commands are issued by CMD API, related title segment will be returned through the I/O area, which describes the meaning of each field in subsequent segments.

- "`/DISP TRAN`"

  Transaction-related information that can be retrieved in Tuxedo is returned in I/O area. For "`/DISP TRAN tranname`". TherReturned segment title is (excluding the llzz part): `T70 TRAN CLS ENQCT   QCT   LCT  PLCT CP NP LP SEGSZ SEGNO PARLM RC`.

  If "`tranname`" represents a persistent transaction, only `TRAN`, `CLS`, and `QCT` are supported and will have value in returned segment for `GCMD`. If "tranname" represents a non persistent transaction, only `TRAN`, `CLS` are supported and will have value in returned segment for `GCMD`.

  For "`/DISP TRAN tranname QCNT`", returned segment is (excluding the llzz part): `T70 TRAN GBLQCT`. Only `TRAN` is supported, `GBLQCT` will be always N/A in returned segment for `GCMD`.

  Fields length description is as following:

  `TRAN`: The name of the transaction, 8 bytes.

  `CLS`: The class of the transaction, 3 bytes.

  `ENQCT`: Not supported, 5 bytes

  `QCT`: The left message count(queue count) in queue of the transaction, 5 bytes.

  Note: The queue count may be accurate and reliable only if the following criteria are matched:

  - The `tranname` is only handled by the current Tuxedo ART for IMS server.

  -The `DISPLAY TRAN` is issued after a `CHKP` without an `IOAREA`.

  All non supported fields will be filled with N/A in returned segment for `GCMD`. Every filed is separated with one blank space.

- "`/DISP user`

  user related information that can be retrieved in Tuxedo is returned. Returned segment is (excluding the llzz part): `CUR_USER CUR_TRAN`

- "`/DISP PGM`

program related information that can be retrieved in Tuxedo is returned. Returned segment is (excluding the llzz part): `CUR_PGM CUR_TRAN`

Note: Currently, we ignore all other parameters in above three commands. If other commands than above three supported ones are issued by "CMD" call, we return success status without any response segment.

Parameter(s)

I/O PCB

Represents the source of the request

AIB

Specifies the application interface block (AIB) that is used for the call. This parameter is an input and output parameter. The following fields must be initialized in the AIB:

AIBID Eyecatcher.

This 8-byte field must contain DFSAIBbb.

AIBLEN AIB lengths.

This field must contain the actual length of the AIB that the application program obtained.

AIBRSNM1 Resource name.

This 8-byte, left-justified field must contain the PCB name IOPCBbbb.

AIBOALEN I/O area length.

This field must contain the length of the I/O area that is specified in the call list

I/O Area

Pointer to a buffer, which contains the IMS command with its parameters, and to be filled in with the first segment. The general format of I/O area is:

LLZZ/verb KEYWORD1 P1 KEYWORD2 P2, P3. Comments

LL	Two-byte field containing the length of the command text, including LLZZ
ZZ	Two-byte field reserved for IMS
/	Indicates that an IMS command follows
verb	The command you issued
KEYWORDx	Keywords that apply to the command you issued
Px	Parameters for the keywords you specified
. (period)	End of the command

Result (status code):

'bb': successful (two blanks), but no response segments.

'CC': one or more response segments have been produced.

'AB': segment I/O area not specified

'CH': IMS ignored the CMD call just issued because the AOI command interface detected a system error and was unable to process the command. IMS processing continues.

GCMD

Name

`GCMD` - Retrieves the second and subsequent segments of the response message of a CMD command.

Synopsis

```
I/O PCB or AIB, I/O Area
```

Description

`GCMD` retrieves the second and subsequent response segments from IMS TM when your application program processes IMS commands using the CMD call. Each returned segment contains the fields according to the title segments of above "CMD" Call. After the last segment has been retrieved, a GCMD call results in a "QD" status code returned in PCB.

Parameter(s)

I/O PCB

Pointer to the PCB that represents the source of the request.

AIB

Specifies the application interface block (AIB) that is used for the call. This parameter is an input and output parameter. The following fields must be initialized in the AIB:

AIBID Eyecatcher.

This 8-byte field must contain DFSAIBbb.

AIBLEN AIB lengths.

This field must contain the actual length of the AIB that the application program obtained.

AIBRSNM1 Resource name.

This 8-byte, left-justified field must contain the PCB name IOPCBbbb.

AIBOALEN I/O area length.

This field must contain the length of the I/O area that is specified in the call list

I/O Area

Pointer to a buffer to be filled in with the first segment.

Result (Status Code):

'bb': a segment was retrieved successfully (two blanks)

'AB': segment I/O area not specified

'QD': no more segments

'QE': GCMD request before CMD.

GUID

Name

`GUID` - A fake DL/I used to retrieve the full username under `ARTIMPP` server long username mode.

Synopsis

```
I/O PCB or AIB, I/O Area
```

Description

`GUID` is used to retrieve the full `ARTIMPP` server username only recommended under long username/password mode.

Parameter(s)

I/O PCB

Pointer to the PCB that represents the source of the request.

I/O Area

Pointer to a buffer to be filled in with the full username, besides LLZZ, at least 30 bytes should be prepared.

Result (Status Code):

‘bb': a segment was retrieved successfully (two blanks).

'AB': segment I/O area not specified.

'AD': specified PCB is not I/O PCB.

Database Operation

The DLI library performs the database operations issued from MPP or BMP programs. It can retrieve and hold one specific segment according the specified segment search criteria, updates a specific segment, inserts a segment at a specific position, deletes a specific segment, etc. Detailed APIs for database operation are listed in Table 9.

Table 9 Database Operation Processes and Commands

Name	Description
`GU/GHU`	Retrieves (and Holds) the first segment that satisfies the criteria (if any) from the current position (if any) or the beginning of the database
`GN/GHN`	Retrieves (and Holds) the next segment that satisfies the criteria (if any) from current position
`GNP/GHNP`	Retrieves (and Holds) the next segment that satisfies the criteria from the dependent segments of the established parent
`ISRT`	Used to insert a new occurrence of an existing segment type into a hierarchy database.
`REPL`	Used to update an existing segment
`DLET`	Used to remove a segment and its dependents.
`FLD`	Used to access a field within a segment.
`POS`	A qualified Position (POS) call is used to retrieve the location of a specific sequential dependent segment. An unqualified POS points to the logical end of the sequential dependent segment (SDEP) data.
`OPEN`	Used to explicitly open a GSAM database
`CLSE`	Used to explicitly close a GSAM database

GU/GHU

Name

`GU/GHU` - Retrieves (and Holds) the first segment that satisfies the criteria (if any) from the current position (if any) or the beginning of the database.

Synopsis

`DB PCB,GSAM PCB` or `AIB, I/O Area, and SSA list (optional)` or `RSA (Mandantory for GSAM)`

Description

`GU` is used to retrieve the first segment that satisfies the specified SSA and establishes a starting point for sequential processing. The search start point of `GU` is the beginning of the database (i.e., the root level). After locating the first segment that satisfies the call, the current position is the starting position for sequential processing.

`GHU` locks the segment for sequential write operation (e.g., replace, delete, etc.), in addition to `GU`. `GHU` is not applicable for GSAM.

Parameter(s)

DB PCB

Contains all the DB related information, especially the DB name.

AIB

Specifies the AIB for the call. This parameter is an input and output parameter.

These fields must be initialized in the AIB:

AIBID Eye catcher.

This 8-byte field must contain DFSAIBbb.

AIBLEN AIB lengths.

This field must contain the actual length of the AIB that the application program obtained.

AIBRSNM1 Resource name.

This 8-byte, left-justified field must contain the name of a DB PCB.

AIBOALEN I/O area length.

This field must contain the length of the I/O area specified in the call list

I/O Area

Used to receive the returned segment.

SSA:

Number of SSA is less than or equal to min. (number of hierarchy levels, 15).

RSA:

Specifies the area in your program that contains the record search argument. This required input parameter is only used for GSAM.

Note: The RSA "`00010000`" resets the position to the start of the GSAM.

GN/GHN

Name

`GN/GHN` - Retrieves (and Holds the next segment that satisfies the criteria (if any) from current position.

Synopsis

```
DB PCB,GSAM PCB or AIB, I/O Area, and SSA list (optional) or RSA(opitional
for GSAM)
```

Description

`GN` is used to retrieve the next segment that satisfies the specified SSA, searching from current position. After locating the segment, the current position is updated for sequential processing. If no current position established in the `DB`, `GN` acts like `GU` (i.e., searching from the beginning). Sequential retrieval in hierarchy DB is always from top to bottom and from left to right, i.e. pre-order retrieval in a tree.

`GHN` locks the returned segment for sequential write operation on it, in addition to `GN`. `GHN` is not applicable for `GSAM`.

Parameter(s)

The usage and restriction on parameters of `GN` are similar to `GU`.

RSA:

Specifies the area in your program where the RSA for the record should be returned. This output parameter is used for `GSAM` only and is optional.

GNP/GHNP

Name

`GNP/GHNP` - Retrieves (and Holds) the next segment that satisfies the criteria from the dependent segments of the established parent.

Synopsis

`DB PCB, GSAM PCB or AIB, I/O Area, and SSA list` (optional)

Description

`GNP` is used to retrieve the next qualified segment in the dependent segments of the established parent. The established parent in a hierarchy DB is the lowest-level segment returned in previous successful `GU/GN` call, and is canceled by an unsuccessful `GU/GN` call.

`GHNP` locks the returned segment for sequential write operation in addition to `GNP`.

Parameter(s)

The usage and restriction on parameters of GNP/GHNP are similar to `GU`.

ISRT

Name

`ISRT` - Used to insert a new occurrence of an existing segment type into a hierarchy database.

Synopsis

`DB PCB, GSAM PCB or AIB, I/O Area, and SSA list or RSA(opitional for GSAM)`

Description

`ISRT` is used to insert a new occurrence of an existing segment type into a hierarchy database. The insert location is determined by a series of qualified SSA excluding the level of the segment being inserted, or by current position if no qualified SSA.

Parameter(s)

I/O

Area contains the segment to be added

AIB

Specifies the AIB for the call. This parameter is an input and output parameter. These fields must be initialized in the AIB:

AIBID Eye catcher.

This 8-byte field must contain `DFSAIBbb`.

AIBLEN AIB lengths.

This field must contain the actual length of the AIB that the application program obtained.

AIBRSNM1 Resource name.

This 8-byte, left-justified field must contain the name of a DB PCB.

AIBOALEN I/O area length.

This field must contain the length of the I/O area specified in the call list

SSA

Contains a series of qualified/unqualified SSA to establish the position of the segment being inserted, the lowest-level SSA (i.e. the SSA at the level of the segment being inserted) must be unqualified. An unqualified SSA is satisfied with the first occurrence of the segment type.

RSA

Specifies the area in your program where the RSA should be returned by DL/I.

REPL

Name

`REPL` - Used to update an existing segment.

Synopsis

```
DB PCB or AIB, I/O Area, and SSA list
```

Description

`REPL` is used to update an existing segment. you must firts use a `Get Hold` call to retrieve the segment, then modify the segment and update the segment. The field length of the segment in the I/O area cannot be changed.

Parameter(s)

The usage and restriction on parameters are similar to `GU`.

DLET

Name

`DLET` - Used to remove a segment and its dependents.

Synopsis

`DB PCB or AIB, I/O Area, and SSA list` (optional)

Description

`DLET` call is used to remove a segment and its dependents. It must follow a `Get Hold` call. Qualified SSA must NOT be specified for `DLET` call.

Parameter(s)

The usage and restriction on parameters are similar similar to `GU`.

FLD

Name

FLD - Used to access and change a field within a segment.

Synopsis

`DB PCB or AIB, I/O Area, and SSA list`

Description

`FLD` call is used to access and change a field within a segment.

Parameter(s)

I/O

Area contains the Field Search Argument to locate a specific field.

AIB

Specifies the AIB for the call. This parameter is an input and output parameter. These fields must be initialized in the AIB:

AIBID Eye catcher.

This 8-byte field must contain `DFSAIBbb`.

AIBLEN AIB lengths.
This field must contain the actual length of the AIB that the application program obtained.

AIBRSNM1 Resource name.
This 8-byte, left-justified field must contain the name of a DB PCB.

AIBOALEN I/O area length.
This field must contain the length of the I/O area specified in the call list

SSA
Specifies the SSA used with this call. You can use up to 15 SSAs in this input parameter. The SSA that you supply will point to those data areas that you have defined for the call. This parameter is mandantory for the `FLD` call.

POS

`POS` - A qualified Position (POS) call is used to retrieve the location of a specific sequential dependent segment. An unqualified POS points to the logical end of the sequential dependent segment (SDEP) data.

Synopsis

`DB PCB or AIB, I/O Area, and SSA list` (optional)

Description

`POS` only supports DEDB. In Tuxedo ART for IMS, it has the following limitations:

1. `keyword` parameters are not supported.

2. The LL and corresponding numeric field (Field 4, Field 5) are stored in host byte endian

Parameter(s)

DB PCB
Contains all the DB related information, especially the `DB` name

AIB
Specifies the AIB for the call. This parameter is an input and output parameter. These fields must be initialized in the AIB:

AIBID Eye catcher.
This 8-byte field must contain `DFSAIBbb`.

AIBLEN AIB lengths.
    This field must contain the actual length of the AIB that the application program obtained.

AIBRSNM1 Resource name.
    This 8-byte, left-justified field must contain the name of a DB PCB.

AIBOALEN I/O area length.
    This field must contain the length of the I/O area specified in the call list I/O Area is used to received the returned output.

Because keywords are not supported, the output format of the I/O area is as following:

LL Field 1 Field 2 Field 4 Field 5

LL: This 2 bytes number, indicates the whole length.

Field 1? This 8-byte field contains the ddname from the AREA statement

Field 2: Sequential dependent next to allocate CI.

Field 4: This 4-byte field contains the number of unused control intervals in the

sequential dependent part.

Field 5: This 4-byte field contains the number of unused control intervals in the

independent overflow part

Note: The I/O data area will have 24 bytes of positioning information for every area in the DEDB.

SSA list

Contains a series of qualified/unqualified SSA to establish the position of the segment being inserted, the lowest-level SSA (i.e. the SSA at the level of the segment being inserted) must be unqualified. An unqualified SSA is satisfied with the first occurrence of the segment type.

OPEN

Name

`OPEN` - Used to explicitly open a GSAM database.

Synopsis

```
GSAM PCB or AIB,  i/o area
```

Description

Explicitly opens a GSAM database.The following operation for the GASM database will not open the GSAM database again. If you do not open GSAM database explicitly, other operations open the GSAM database implicitly.

Parameters

GSAM PCB

The GSAM database corresponding PCB.

AIB

Specifies the AIB for the call. This parameter is an input and output parameter. These fields must be initialized in the AIB:

AIBID Eye catcher.

This 8-byte field must contain DFSAIBbb.

AIBLEN AIB lengths.

This field must contain the actual length of the AIB that the application program obtained.

AIBRSNM1Resource name.

This 8-byte, left-justified field must contain the PCB name of a GSAM PCB.

AIBOALENI/O area length.

This field must contain the length of the I/O area specified in the call list. I/O Area.

Specifies the kind of data set you are opening.

Note: This parameter is ignored. In Oracle Implementation for IMS/DB, we simulate GSAM database with local file system, so, I/O area is not used to specify the data set kind. We use the PROCOPT option in $appname.psb to define whether the data set is to be read only or to be get and append.

CLSE

Name

CLSE - Used to explicitly close a GSAM database.

Synopsis

GSAM PCB or AIB

Description

Explicitly closes a GSAM database. If you do not close the GSAM database explicitly, IMS closes the GSAM database implicitly.

Parameters

`GSAM PCB`

The GSAM database's corresponding PCB.

`AIB`

Specifies the AIB for the call. This parameter is an input and output parameter. These fields must be initialized in the AIB:

`AIBID` Eye catcher.
This 8-byte field must contain DFSAIBbb.

`AIBLEN AIB` lengths.
This field must contain the actual length of the AIB that the application program obtained.

`AIBRSNM1` Resource name.
This 8-byte, left-justified field must contain the PCB name of a GSAM PCB.

Plug-in Definition for Different Implementation of IMS/DB

To support different kinds of implementation of IMS/DB, the support for IMS/DB is designed as a dynamically linked library (DLL) that can be plugged into Tuxedo ART for IMS and can be loaded by Tuxedo ART for IMS servers after being plugged. To enable this plug-and-play mechanism, there should be an agreement of what APIs exported by the DLL.

Tuxedo ART for IMS servers (`ARTIMPP` and `ARTIBMP`) are used as a container to run an online or batch COBOL program. To enable database access operations issued by the programs, normally the servers need to do some initialization or configuration for database implementation, need to do something prior to invoking a COBOL program, need to do something after completing the program, and need to do some cleanup before the servers go down. Besides, each database operation through "CBLTDLI" need to be mapped to a specific API.

Data structure Definition for IMS/DB Plug-in

A pointer to DB PCB structure is passed from Tuxedo ART for IMS servers to COBOL programs, and finally to `db_entry()` of plug-in for IMS/DB. To enable the plug-in work properly, the DB PCB structure should be filled in correctly before calling COBOL program each. This section defines the detailed requirement regarding how to fill in DB PCB.

The DB PCB structure example is shown in Listing 2.

Listing 2 DB PCB Structure

```
struct {
    char dbname[8];
    char seglevel[2];
    char stat_code[2];
    char opt[4];
    char res[4];
    char segname[8];
    char keylen[4];
    char segnum[4];
    char keyfa[IMS_FEEDAREA_LEN];
};
```

- **dbname**: If the PCB statement in PSB contains a `PROCSEQ=<name>`, populate dbname with `<name>`. Otherwise, populate `dbname` with the name in `NAME=<name>` from PSB.
- **seglevel**: Populate with NULL
- **stat_code**: Populate with spaces
- **opt**: Populate with value set to `PROCOPT` option from the PCB statement in PSB
- **res**: Do not populate with anything
- **segname**: Populate with NULL
- **keylen**: Do not populate with anything
- **segnum**:Do not populate with anything

- **keyfa**: Populate with NULL

Listing 3 shows the structure definition used for the `get_dbpcbattr` interface. The content is read from th `PSB` file and returned to application through `get_dbpcbattr` interface.

Listing 3 Structure Definition Used for the get_dbpcbattr Interface

```
enum PCBTYPE {IOPCB = 1, ALTPCB = 2, GSAMPCB = 3, DBPCB = 4};

enum SEQUENTIALBUFFERING {NO = 1, COND = 2};

enum PCBPOS {SINGLE = 1, MULTIPLE = 2};

enum SENSITIVITY {READ = 1, UPDATE = 2};

struct __SENFLD {

       char name[8];         /* mandatory, less than 8 filled with blank */

       unsigned short start;/* mandatory, range [1-32767] */

       int replace;          /* optional, default is 1 */

};


struct SSPTR {

       unsigned short pointer; /* range[1-8], default 0 */

       enum SENSITIVITY sens;

};


struct __SENSEG {

       char segname[8]; /* mandatory, less than 8 filled with blank */

       char parent[8];  /* mandatory, less than 8 filled with blank */

       char procopt[4]; /* optional, default filled with blank */

       SSPTR ssptr[8]; /* each slot contains a subset pointer number and
associated sensitivity, pointer of 0 indicates end, totally up to 8 can be
specified */

       char indices[8]; /* optional, default filled with blank */
```

```
        SENFLD * senfld; /* optional, default is NULL */
        unsigned short senfld_num; /* optional, default is 0, up to 255 
SENFLD can be defined for each SENSEG */
};

struct __DB_PCB_ATTR { /* PCB Attributes */
        enum PCBTYPE type; /* mandatory */
        char dbname[8];   /* db name, default filled with blank */
        char pcbname[8]; /* pcb name, optional, default filled with blank */
        char procopt[4]; /* procopt , default filled with blank */
        enum SEQUENTIALBUFFERING sb; /* optional, default is NO */
        enum PCBPOS pos; /* optional, default is SINGLE */
        int keylen; /* optional, default is invalid value 0 */
        char procseq[8]; /* optional, default filled with blank */
        int msdb_commit; /* optional, default is 0 */
        int list; /* optional, default is 1 */
        char *areas; /* area list set by SETR in DFSCTL, no change will be 
applied on it in ART/IMS */
        int senseg_num; /* optional, default is 0 */
        struct SENSEG * senseg; /* optional, default is NULL */
};
```

API Definition for IMS/DB Plug-in

You must do the following steps to define an API for IMS/DB plug-in:

1. Initialization

   ```
   extern "C" int db_init(int argc, char * argv[])
   ```

   Functionality: Initialization for configuration or others required by an implementation

Arguments: parameter list passed from CLOPT of the servers

Return Value: 0 - success, -1 -- failure

Where to use: This API is called while an Tuxedo ART for IMS server starts. If a specific implementation of IMS/DB doesn't need any initialization work, just provide an empty function and make it return 0.

2. Cleanup

   ```
   extern "C" int db_destroy()
   ```

   Functionality: Cleanup for configuration or others required by an implementation

   Arguments: None, because the servers can't provide input for Plug-in

   Return Value: 0 - success, -1 -- failure

   Where to use: This API is called while an Tuxedo ART for IMS server shuts down. If a specific implementation of IMS/DB doesn't need any initialization work, just provide an empty function and make it return 0.

3. Action Prior to Invoking a COBOL program

   ```
   extern "C" int db_pre()
   ```

   Functionality: Pre-Action required by an implementation before invoking a COBOL program which may access IMS/DB implementation

   Arguments: None, because the servers can't provide input for Plug-in

   Return Value: 0 - success, -1 -- failure

   Where to use: This API is called before Tuxedo ART for IMS servers invokes a COBOL program that may access IMS/DB implementation. If a specific implementation of IMS/DB doesn't need any initialization work, just provide an empty function and make it return 0.

4. Action After Invoking a COBOL program

   ```
   extern "C" int db_post()
   ```

   Functionality: Post-Action required by an implementation after invoking a COBOL program which may access IMS/DB implementation

   Arguments: None, because the servers can't provide input for Plug-in

   Return Value: 0 - success, -1 -- failure

   Where to use: This API is called after Tuxedo ART for IMS servers invokes a COBOL program that may access IMS/DB implementation. If a specific implementation of IMS/DB doesn't need any initialization work, just provide an empty function and make it return 0.

5. Database Access Entry

   ```
   extern "C"
   ```

   ```
   int db_entry(const char * op, __DB_PCB * pcb, void * io, char *
   ssa_list[], int ssa_cnt);
   ```

   Functionality: The entry point of accessing the IMS/DB implementation. Each DL/I call for database access issued from a COBOL program is finally handled by it.

   Argument:

   op: function call name, e.g. "GU "

   pcb: pointer to a __DB PCB, which is a superclass of user provided DB PCB.

   io: pointer to a buffer, DB_IO_AREA is defined by the external implementer

   ssa_list: an array of strings, each containing a SSA, the format is up to the external implementer

   ssa_cnt: number of elements in ssa_list, the value range is [0..15]

   Return Value: 0 - success; -1 - failure

   Where to use: DL/I DB call issued by COBOL program

6. Get db pcb attributes

   ```
   extern "C"
   ```

   ```
   const __DB_PCB_ATTR * get_dbpcbattr (struct __DB_PCB * pcbm)
   ```

   Functionality: Used to get additional attributes of db pcb. These attributes are configured in PSB file.

   Argument:

   pcbm: PCB Mask pointer

   Return Value: PCB Attribute pointer, the user can't modify anything contained in the PCB attribute structure returned by this API; If the input is not DB PCB or GSAM PCB, null is returned; If any optional attribute is not configured, default value is returned;No need to free the pointer;

   Where to use: 3rd party DB plugin when called with db pcb.

7. Fill db pcb segment name

   ```
   extern "C"
   ```

   ```
   int fill_dbpcb_segname (struct __DB_PCB * pcb)
   ```

Functionality: Used to get segment name of db pcb. This interface should be provided by DB plugin.

Argument::

pcb: PCB Mask pointer(DB PCB or GSAM PCB), segname in the pcb mask should be filled with correct value;

Return Value: 0 : success, other: failed.

Default Implementation for IMS/DB

Within Tuxedo ART for IMS, a default DLL is provided as an Oracle solution for IMS/DB.

Transaction Management

DLI library performs the transaction management work, i.e .committing the changes that have been made and sending out the messages already built or rolling back all the changes and drop out all the messages, according to the direction passed from COBOL application. If the COBOL application does not issue a clear direction to commit the transaction, `ARTIMPP` commits the transaction.

Table 10 lists the transaction management processes and commands.

Table 10 Transaction Management Processes and Commands

Name	Description
`CHKP (Basic)`	Used to set an explicit commit point.
`CHKP (Symbolic)`	Used to set an explicit commit point. Sets a check point from which the program can be started, saves as many as seven data areas in the program, and records current GSAM DB retrieval position.
`ROLB`	Used to cancel the database updates
`ROLL`	Used to cancel the database updates and return to Tuxedo ART for IMS.
`SYNC`	Commits the changes made by application programs.

Table 10 Transaction Management Processes and Commands (Continued)

Name	Description
`INQY`	Used to request information regarding execution environment, destination type and status, and session status.
`XRST`	Used to enable a program to start normally or to restart from a check point ID specified in a symbolic CHKP call.

CHKP (Basic)

Name

`CHKP` (Basic) - Used to set an explicit commit point.

Description

`CHKP` is used to set an explicit commit point. At a commit point, IMS/TM commits the changes made by application programs, normally database updates, sends out all the message marked as complete (by PURG for non-express PCB), and retrieves the next input message into the IOAREA provided.

In Tuxedo ART for IMS, the simulated `CHKP` is used to commit the changes already made by using `tpcommit()`. The messages that have been marked by complete are sent out. The messages that have not been marked by explicit `PURG` call are sent out too.

If the transaction is persistent transaction and handled by `ARTIMPP` in persistent mode or handled by `ARTIBMPT`, the next message will be retrieved from /Q of this transaction.

If the transaction is not persistent transaction, no next message is retrieved.

Parameter(s)

`I/O PCB or AIB, I/O Area`

I/O PCB

Pointer to the PCB that represents a destination.

AIB

Specifies the application interface block (AIB) that is used for the call. This parameter is an input and output parameter.The following fields must be initialized in the AIB:

AIBID Eye catcher.
: This 8-byte field must contain DFSAIBbb.

AIBLEN AIB lengths.
: This field must contain the actual length of the AIB that the application program obtained.

AIBRSNM1 Resource name.
: This 8-byte, left-justified field must contain the PCB name `IOPCBbbb`.

AIBOALEN I/O area length.
: This field must contain the length of the I/O area that is specified in the call list.

I/O Area

Pointer to a buffer to receive the next input message.The area must be long enough to hold the longest message that can be returned.

Result (Status Code)

‘bb’: successful (two blanks).

‘AD’: functional parameter invalid: function call not provided to `CBLTDLI`, invalid function call name provided to `CBLTDLI`.

‘AB’: no I/O area provided.

‘QC’: no input message.

‘QF’: segment less than 5 characters.

CHKP (Symbolic)

Name

`CHKP` (Symbolic) - Used to set an explicit commit point. Sets a check point from which the program can be started, saves as many as seven data areas in the program, and records current `GSAM DB` retrieval position.

Description

`CHKP` (Symbolic) can be used for recovery purposes. It commits all changes made by the program and, if your application program abends, establishes the point at which the program can be restarted. In addition, the symbolic `CHKP` call can:

- Work with the extended restart (`XRST`) call to restart your program if your program ends.

- Enables you to save as many as seven data areas in your program, which are restored when your program is restarted.

In Tuxedo ART for IMS, the simulated `CHKP` (Symbolic) is used to:

1. Commit the changes already made by using `tpcommit()`, which is the same as basic `CHKP`.
2. Retrieve the next message which is the same as basic `CHKP`.
3. Accept at most 7 data areas and save it with the check pint ID.
4. Record current retrieval position of all related `GSAM DB`.

Note: If `ART BMP` server was restarted after user used symbolic `CHKP` to store data area, but before user uses `XRST` to restart program, the stored data area by symbolic `CHKP` will not be restored by `XRST`.

`CHKP` record will be saved in record log file named “programname.psbname.log”. An environment variable `ART_IMSLOGDIR` is used to specify the directory where the record log files are located. If environment variable `ART_IMSLOGDIR` is not set, its default value is `$APPDIR/IMSLOGDIR`.

For MP mode, if you want to share the record log file among machines, the `ART_IMSLOGDIR` should point to NFS directory which machines in the Tuxedo domain could access. The `CHKP` record is always appended to the record log file by Symbolic `CHKP` and the saved record will not be deleted at any time except the user empty the record log file manually. Duplicate `CHKP` records are be appended to the `CHKP` record file.

The status code of all related `GSAM/DB PCB` is blank after the `CHKP` (symbolic) call.

Parameter(s)

`I/O PCB or AIB, I/O Area, I/O Area Length, IO Area, area length, area, …`

I/O PCB

Pointer to the PCB that represents a destination.

AIB

Specifies the application interface block (AIB) that is used for the call. This parameter is an input and output parameter. The following fields must be initialized in the AIB:

AIBID Eye catcher.

This 8-byte field must contain DFSAIBbb.

AIBLEN AIB lengths.

This field must contain the actual length of the AIB that the application program obtained.

AIBRSNM1 Resource name.

This 8-byte, left-justified field must contain the PCB name IOPCBbbb.

AIBOALEN I/O area length.

This field must contain the length of the I/O area that is specified in the call list.

I/O Area Length

No longer used. For compatibility reasons, this parameter must still be included in the call, and it must contain a valid address.

I/O Area

As an input parameter, used to specify the check point ID (8-bit). As an output parameter, pointer to a buffer to receive the next input message. The area must be long enough to hold the longest message that can be returned.

Area length

Specifies a 4-byte field in your program that contains the length in binary of the first area to checkpoint. This parameter is an input parameter. Up to seven area lengths can be specified. For each area length, you must also specify an area parameter.

Area

Specifies the area in your program that you want IMS to checkpoint. Always specify the area length parameter first, followed by the area parameter.

Result (Status Code)

' bb': successful (two blanks)

'AD': functional parameter invalid: function call not provided by Tuxedo ART for IMS

'AB': no I/O area provided

'QC': no input message

'QF': segment less than 5 characters

ROLB

Name

`ROLB` - Used to cancel the database updates.

Synopsis

`I/O PCB or AIB, I/O Area`

Description

`ROLB` is used to cancel the database updates. It cancels all the messages that were inserted but not available for transmission. For express PCB, the message is made available for transmission when IMS knows that the message is complete (i.e., when a `PURG` call is called. For non-express PCB, the message is not made available for transmission until the program reaches a commit point.

In Tuxedo ART for IMS, the simulated `ROLB` call is used to roll back all the changes made by the application program by using `tpabort()`, and empty the message buffers that have not been sent out.

For persistent transaction (TP or transaction oriented BMP program), if it is handled by `ARTIMPP` in persistent mode or handled by `ARTIBMPT`, `ROLB` will return the first segment of the first message from last commit point to IOAREA, and delete first message from last commit point in /Q.

For non persistent transaction (TP or Transaction oriented batch), Tuxedo ART for IMS only returns the first segment of the current handling message.

Parameter(s)

I/O PCB

Pointer to the PCB that represents a destination.

AIB

Specifies the application interface block (AIB) that is used for the call. This parameter is an input and output parameter.The following fields must be initialized in the AIB:

AIBID Eye catcher.

This 8-byte field must contain DFSAIBbb.

AIBLEN AIB lengths.

This field must contain the actual length of the AIB that the application program obtained.

AIBRSNM1 Resource name.

This 8-byte, left-justified field must contain the PCB name `IOPCBbbb`.

AIBOALEN I/O area length.

This field must contain the length of the I/O area that is specified in the call list.

I/O Area

Pointer to a buffer to receive the first segment of the returned message.

Result (Status Code):

‘bb: successful (two blanks).

‘AD’’ functional parameter invalid: function call not provided to CBLTDLI, invalid function call name provided to CBLTDLI, or PCB not provided.

‘QE’: GU is not called previously when IOAREA is not NULL.

‘QC’: no input message.

‘QF’: segment less than 5 characters.

ROLL

Name

ROLL - Used to cancel the database updates and return to Tuxedo ART for IMS.

Synopsis

```
ROLL
```

Description

`ROLL` is used to cancel the database updates, cancels all the messages that were inserted but not available for transmission. For express PCB, the message is made available for transmission when IMS knows that the message is complete (i.e., when a `PURG` call is called. For non-express PCB, the message is not made available for transmission until the program reaches a commit point.

In Tuxedo ART for IMS, the simulated `ROLL` call is used to roll back all the changes made by the application program by using `tpabort()`, and empty the message buffers that have not been sent out, then it return control to Tuxedo ART for IMS but don't return control to the calling program.

For persistent transaction (TP or transaction oriented BMP program), if it is handled by `ARTIMPP` in persistent mode or handled by `ARTIBMPT`, `ROLL` deletes the current message from last commit point in /Q.

Parameter(s)

The only parameter required for the ROLL call is the call function.

Result (Status Code):

No returned status codes.

SYNC

Name

`SYNC` - Used to commit the changes made by application programs (normally database updates).

Synopsis

```
I/O PCB or AIB
```

Description

In Tuxedo ART for IMS, the simulated SYNC is used to commit the changes already made, not to establish places in your program where you can restart, if your program terminates abnormally.

Parameter(s)

I/O PCB

Pointer to the PCB that represents a destination.

AIB

Specifies the application interface block (AIB) that is used for the call. This parameter is an input and output parameter.The following fields must be initialized in the AIB:

AIBID Eye catcher.

This 8-byte field must contain DFSAIBbb.

AIBLEN AIB lengths.

This field must contain the actual length of the AIB that the application program obtained.

AIBRSNM1 Resource name.

This 8-byte, left-justified field must contain the PCB name IOPCBbbb

INQY

Name

`INQY`-Used to request information regarding execution environment, destination type and status, and session status. INQY is valid only when using the AIBTDLI interface.

Synopsis

```
AIB  I/O Area
```

Description

In IMS, only the following subfunctions are supported: `NULL`, "`FINDbbbb`", "`PROGRAMb`", "`DBQUERYb`".

For `NULL` subfunction, ART/IMS can only return the PCB related information that ART/IMS can support into the I/O area. "Terminal Location" and "Transaction Location" are only supported using "LOCAL".

For "`FINDbbbb`", the PCB address is returned in the AIBRSA1 field.

On 64-bit platform, the first 4 bytes of AIBRES3 is also used because the address length is 8 bytes.

Subfunction "`PROGRAMb`" returns the program name in the first 8 bytes of the I/O area.

For "`DBQUERYb`" subfuntion, if there is no `DBPCB` in defined in PSB, "BJ" is returned in the IO PCB status. Otherwise, the IO PCB status is returned according to database availability.

Parameters

AIB

Specifies the address of the application interface block (AIB) that is used for the call. This parameter is an input and output parameter. The following fields must be initialized in the AIB:

AIBID Eye catcher.

This 8-byte field must contain DFSAIBbb.

AIBLEN AIB lengths.

This field must contain the actual length of the AIB that the application program obtained.

AIBSFUNC Subfunction code.

This field must contain one of the 8-byte subfunction codes as follows:

```
bbbbbbbb (Null)
DBQUERYb
FINDbbbb
PROGRAMb
```

AIBRSNM1 Resource name.

This 8-byte, left-justified field must contain the PCB name of any PCB named in the PSB.

AIBOALEN I/O area length.

This field must contain the length of the I/O area that is specified in the call list. This field is not changed by IMS.

I/O Area

Used to received the returned output.

Result in AIB:

Return code and Reason code is aligned to IBM's return code and reason code description. For "`DBQUERYb`", The database availability status is in the IOPCB status.

' bb' (two blanks): The call is successful and all databases are available.

'BJ': No DB PCB exists in the PSB. Or None of the databases in the PSB are available, or no PCBs exist in the PSB. All database PCBs (excluding GSAM) contain an NA status code as the result of processing the INQY DBQUERY call.

'BK'   At least one of the databases in the PSB is not available or availability is limited. At least one database PCB contains an NA or NU status code as the result of processing the INQY DBQUERY call.

In IMS, after the `"DBQUERYb"` call, status codes in each DB PCB should not be used to check DB status.

XRST

Name

`XRST` - Used to restart your program. If you use the symbolic Checkpoint call in your program, you must use the XRST call.

Description

`XRST` is used to restart your program. If you use the symbolic Checkpoint call in your program, you must use the `XRST` call.

In Tuxedo ART for IMS, the simulated `XRST` is used to recover the data that was saved in the related `CHKP` (symbolic) call. The `GSAM` is repositioned to the recorded position where the `CHKP` (symbolic) call occurs so that all subsequent "`GN`" calls continue with the recovered position. The status codes of all related `GSAM/DB PCB` are blank after the successful `XRST` call (with an existing `CHKPID`).

For specific `CHKP ID`: `XRST` searches the `CHKP` record use the following search key in record log file from the beginning to the end: `Job name + program name + psb name + CHKP ID`. If the first `CHKP` record matches the search key, `XRST` restores the data in this record and returns success. If no `CHKP` record matches the search key, `XRST` abends.

For `CHKP ID 'LAST'`: `XRST` searches the `CHKP` record using the following search key in record log file from the end to the begining: `Job name + program name + psb name`. If the first `CHKP` record match the search key, `XRST` restores the data in this record and return success. If no `CHKP` record matches the search key, `XRST` abends.

Parameter(s)

I/O PCB or AIB, I/O Area, I/O Area Length, IO Area, area length, area, …

I/O PCB

Pointer to the PCB that represents a destination

AIB

Specifies the application interface block (AIB) that is used for the call. This parameter is an input and output parameter.

The following fields must be initialized in the AIB:

AIBID Eye catcher.

This 8-byte field must contain `DFSAIBbb`.

AIBLEN AIB lengths.

This field must contain the actual length of the AIB that the application program obtained.

AIBRSNM1 Resource name.

This 8-byte, left-justified field must contain the PCB name `IOPCBbbb`.

AIBOALEN I/O area length.

This field must contain the length of the I/O area that is specified in the call list. This parameter is not used during the `XRST` call. For compatibility reasons, this parameter must still be coded.

I/O Area Length
: No longer used. For compatibility reasons, this parameter must still be included in the call, and it must contain a valid address.

I/O Area
: Used to specify the check point ID from which the program should be restarted. If the program is to start normally, the first 5 characters of I/O area must be blanks.

Area length
: Specifies a 4-byte field in your program that contains the length in binary of the first area to checkpoint. This parameter is an input parameter. For each area length, you must also specify an area parameter. The number of areas you specify on a XRST call must be less than or equal to the number of areas you specify on the CHKP calls the program issues.

Area
: Specifies the area in your program that you want IMS TM to restore. Always specify the area length parameter first, followed by the area parameter.

Result (Status Code)

' bb': successful (two blanks)

'AD': functional parameter invalid: function call not provided by Tuxedo ART for IMS

Tuxedo ART for IMS Language Environment

CEE3ABD/ART3ABD

`CEE3ABD` requests that Tuxedo ART for IMS terminate the execution of the program with an abend code. There is no return from this function, nor is there any condition associated with it. In Tuxedo ART for IMS you can initiate this function by doing the following:

1. Back out the database updates that the program has made since the most recent program commit point.
2. Cancel the non-express output messages that the program has created since the most recent program commit point.
3. Abort the transaction.

Parameter(s)

`abcode`
: A 4 bytes integer, no greater than 4095, specifying the abend code that is issued .

`clean-up`

Not used.

Note: In a COBOL-IT environment, a COBOL program can call the API using the names "`CEE3ABD/`" or "`ART3ABD`". In a Micro Focus COBOL environment, COBOL program can call the API only using the name `ART3ABD`.

Tuxedo ART for IMS MFS Support

IMS MFS Control Block Support

The definition of message formats and device formats is accomplished with separate hierarchic sets of definition statements. Table 11 shows all the definition statements and their descriptions.

Table 11 Definition Statements and Descriptions

Definition Statement Sets Name	Statement Name	Description
Message Definition Statement Set ---- Used to define message formats.	`MSG`	Initiates and names a message input or output definition.
	`LPAGE`	The optional LPAGE statement defines a group of segments comprising a logical page.
	`PASSWORD`	Identifies a field or fields to be used as an IMS password.
	`SEG`	Identifies a message segment.
	`DO`	Requests iterative processing of the subsequent MFLD statements.
	`MFLD`	The MFLD statement defines a message field as it will be presented to an application program as part of a message output segment. At least one MFLD statement must be specified for each MSG definition.
	`ENDDO`	Terminates iterative processing of the preceding MFLD statements.
	`MSGEND`	Identifies the end of a message definition.

Table 11 Definition Statements and Descriptions

Definition Statement Sets Name	Statement Name	Description
Format Definition Statement Set ---- Used to define device formats.	`FMT`	Identifies the beginning of a format definition.
	`DEV`	Identifies the device type and operational options.
	`DIV`	Identifies the format as input, output, or both.
	`DPAGE`	Identifies a group of device fields corresponding to an LPAGE group of message fields.
	`PPAGE`	Identifies a group of logically related records that can be sent to a remote application program at one time.
	`DO`	Requests iterative processing of the subsequent DFLD statements.
	`DFLD`	Defines a device field. Iterative processing of DFLD statements can be invoked by specifying DO and ENDDO statements. To accomplish iterative processing, the DO statement is placed before the DFLD statements and the ENDDO after the DFLD statements.
	`ENDDO`	Terminates iterative processing of the previous DFLD statements.
	`FMTEND`	Identifies the end of a format definition.
END		Defines the end of the input file.

The “END” statement in above table defines the end of input file. All contents after it will be ignored. If the input file doesn’t have an “END”, `MFSGEN` will give an warning message and add one for the input file.

For each statement name, there are several fields. The detailed field name and value requirements are listed in Table 12 and Table 13. All other statements are assumed unsupported fields currently (listed in Table 14.

Table 12 Message Definition Statement Set Fields

Statement Name	Field	Possible Value	Note
MSG	TYPE	INPUT	Support
		OUTPUT	
	SOR=	(formatname, IGNORE)	"IGNORE" is a mandatory
	OPT=	1 or 2 or 3	Warning
	NXT=	msgcontrolblockname	Support
	PAGE=	No or YES	Warning
	FILL=	C' '	Warning if fill is not space.
		C'c'	
		NULL	
		PT	
LPAGE	SOR=	dpagename	Error
	COND=	(mfldname | mfldname(pp) | Segoffset, > | < | | | = | != , ‘value’)	
	NXT=	msgcontrolblockname	
	PROMPT=	(dfldname,'literal')	
PASSWORD	PASSWORD	blanks	Error
		comments	

Table 12 Message Definition Statement Set Fields

Statement Name	Field	Possible Value	Note
SEG	`EXIT=`	`(exitnum,exitvect)`	Warning
	`GRAPHIC=`	`YES or NO`	Warning
DO	`count`		Support
	`SUF=`	`number`	Support

Table 12 Message Definition Statement Set Fields

Statement Name	Field	Possible Value	Note
MFLD	dfldname		Support
	‘literal’		Support
	G`literal`		Support
	(dfldname, 'literal')		Support
	(dfldname, G'literal')		Support
	(dfldname, system-literal)		Support
	(,SCA)		TBD
	LTH=	1	Support
		nn	Support
		(pp, nn)	Warning
	JUST=	L or R	Support
	ATTR=	YES or NO, nn	Support
	FILL	X'40'	Warning
		X'hh'	Warning
		C'c'	Support only when c=SPACE
		NULL	Warning
	EXIT=	(exitnum, exitvect)	Warning
ENDDO			Support
MSGEND			Support

Note: system-literals include: `TIME`, `DATE1`, `DATE2`, `DATE3`, `DATE4`, `DATE1Y4`, `DATE2Y4`, `DATE3Y4`, `DATE4Y4`, `YYDDD`, `MMDDYY`, `DDMMYY`, `YYMMDD`, `YYYYDDD`, `MMDDYYYY`, `DDMMYYYY`, `YYYYMMDD`, `DATEJUL`, `DATEUSA`, `DATEEUR`, `DATEISO`, `LTSEQ`, `LTNAME`.

For `LTMSG` and `LPAGENO`, a warning message is displayed and will not take any effect. For other strings not in Table 12, a syntax error. is displayed

Table 13 Format Definition Statement Set Fields

Statement Name	Field	Possible Value	Support or Other
`FMT`			Support

Table 13 Format Definition Statement Set Fields

Statement Name	Field	Possible Value	Support or Other
DEV	TYPE=	3270	Support
		3270-A2 | | (3270,2)	Support
		(3270,1) | Other values	Error
	FEAT=	IGNORE	Support
		(CARD | NOCD | PFK | NOPFK | DEKYBD | PEN | NOPEN)	Warning
		1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10	Warning
	PEN=	dfldname	Warning
	CARD=	dfldname	Warning
	SYSMSG=	dfldlabel	Support
	DSCA=	X'value'	Support
		number	Support
	PFK=	(dfldname, 'literal'…)	Support
		(dfldname, integer='literal'…)	Support
		(dfldname, NEXTPP |NEXTMSG | NEXTMSGP | NEXTLP | ENDMPPI ….)	Warning
		(dfldname, integer= NEXTPP |NEXTMSG | NEXTMSGP | NEXTLP | ENDMPPI ….)	Warning
	SUB=	X'hh'	Warning
		C'c'	Warning
	PDB=	pdbname	Warning
DIV	TYPE=	INOUT	Support
		OUTPUT	

Table 13 Format Definition Statement Set Fields

Statement Name	Field	Possible Value	Support or Other
DPAGE	CURSOR=	(lll, ccc) (111,ccc,dfld)	Support; cursor > 1: Warning
	MULT=	YES	Warning
	PD=	pdname	Warning
	FILL=	PT or X'hh'	Warning
		C'c'	Support only when c=SPACE
		NULL	Warning
		NONE	Warning
	ACTVPID=	(for the 3290 in partition formatted mode)	Warning
PPAGE	comments		Error
DO	Count		Support
	1, MAX		Support
	line-inc, column-inc		Support
	Position-inc		Warning
	SUF=	number	Support
	BOUND=	LINE | FIELD	Support

Table 13 Format Definition Statement Set Fields

Statement Name	Field	Possible Value	Support or Other
DFLD	'literal'		Support
	G'literal'		Support
	PASSWORD		Error
	POS=	(lll,ccc)	Support
		(lll,ccc,pp)	Warning
	LTH=	nnn	Support
	PEN=	‘literal	Warning
		NEXTPP	Warning
		NEXTMSG	Warning
		NEXTMSGP	Warning
		NEXTLP	Warning
		ENDMPPI	Warning
	ATTR=	ALPHA|NUM	Support
		NOPROT|PROT	Support
		NODET|DET|IDET	Warning
		NORM|NODISP|HI	Support
		NOMOD|MOD	Support
		STRIP|NOSTRIP	Warning
	OPCTL=	tablename	Warning
	EATTR=	HD | HBLINK | HREV | HUL	Support

Table 13 Format Definition Statement Set Fields

Statement Name	Field	Possible Value	Support or Other
		`CD | BLUE | RED | PINK | GREEN | TURQ | YELLOW | NEUTRAL`	Support
		`PX'00' | PX'hh' | PC'c'`	Warning
		`EGCS | EGCS'hh'`	Support, For EGCS'hh', only 'hh' value of X'00' and X'F8' are supported
		`VDFLD | VMFILL, VMFLD | VMFILL | VMFLD`	Warning
		`OUTL | OUTL'hh' | BOX | RIGHT | LEFT | UNDER | OVER`	Support
		`MIX | MIXD`	Support
`ENDDO`			Support
`FMTEND`			Support

Table 14 Other definition statements and compilation statements which we don't support

Statement Name	Fields	Support or other
END		Support

Table 14 Other definition statements and compilation statements which we don't support

Statement Name	Fields	Support or other
PDB	LUSIZE	WARNINGS
	SYSMSG	
	PAGINGOP	
	LUDEFN	
PD	PID	
	VIEWPORT	
	VIEWLOC	
	PRESPACE	
	WINDOWOF	
	CELLSIZE	
	SCROLLI	
PDBEND	comments	
TABLE	comments	
IF	DATA	
	LENGTH	
	'literal'	
	NOFUNC	
	NEXTP	
	NEXTMSG	
	NEXTMSGP	
	NEXTLP	
	PAGEREQ	
	ENDMPPI	

Table 14 Other definition statements and compilation statements which we don't support

Statement Name	Fields	Support or other
TABLEEND	comments	
ALPHA	'EBCDIC literal character string'	
COPY	member-name	
EQU	number	Error
	alphanumeric identifier	
	literal	
	symbol	
RESCAN	OFF | ON	WARNING
	number	
STACK	ON | OFF	
	id	
UNSTACK	DELETE |KEEP	
	id	
TITLE	literal	
PRINT	ON | OFF	
	GEN | NOGEN	
SPACE	number	
EJECT	comments	

For the last column in above tables, "Support" means the field is supported; "Warning" means the field is not supported, and the tool ignores this field just like it is not specified, meanwhile a warning is generated; "Error" means the field is not supported, the tool reports an error and fails parsing current definition statement set.

Table 15 Message Dynamic Attribute Modification Support

Byte	Bit	Detail	Support
0	0-1	If both bits are on, requests that the cursor be placed on the first position of this field on the device. The first cursor-positioning request encountered in an LPAGE series (first MFLD with cursor attribute or cursor line/column value) that applies to a physical page is honored; these bits must be 00 or 11.	Yes
0	2-7	Must be off	Yes
1	0	Must be on	Yes
1	1	If on, replace If off, addition	Yes
1	2	Protected	Yes
1	3	Numeric	Yes
1	4	High-intensity	Yes
1	5	Non-displayable	Yes
1	6	Detectable	Yes
1	7	Premodified	Yes

Table 16 Message Dynamic Modification of Extended Field Attributes Support

Type	Value	Detail	Support
01	0 – 4 bit Reserved 5 bit Mandatory fill 6 bit Mandatory field 7 bit Reserved	Validation replacement.	No
02	As above	Validation addition	No

Table 16 Message Dynamic Modification of Extended Field Attributes Support

Type	Value	Detail	Support
03	0 – 3 bit Reserved 4 bit Left line 5 bit Over line 6 bit Right line 7 bit Under line X'00' Default (no outline)	Field outlining replacement	Yes
04	As above	Field outlining addition	Yes
05	0 – 6 bit Reserved 7 bit SO/SI creation X'00' Default (no SO/SI creation)	Input control replacement	No
06	As above	Input control addition	No
C1	X'00' Device default X'F1' Blink X'F2' Reverse video X'F4' Underline	Highlighting	Yes
C2	X'00' Device default X'F1' Blue X'F2' Red X'F3' Pink X'F4' Green X'F5' Turquoise X'F6' Yellow X'F7' Neutral	Color	Yes
C3	Valid local ID values are in the range X'40'--X'FE', or X'00' for the device default.	Programmed Symbols	Yes

Table 17 Bit Settings for DSCA Field Support

Byte	Bit	Detail	Support
0	0-7	Should be 0	Yes
1	0	Should be 1	Yes
1	1	Force format write (erase device buffer and write all required data).	Yes
1	2	Erase unprotected fields before write.	Yes
1	3	Sound device alarm.	Yes
1	4	Copy output to candidate pointer.	No
1	5	Bit 1 - protect the screen when output is sent. Bit 1 - do not protect the screen when output is sent.	No
1	6-7	Should be 0	No

Tuxedo ART for IMS Non-Terminal Access Support

To support the Non terminal access to service exported by MPP, and to enable more client to utilize service exported by MPP, this feature enhances Tuxedo ART for IMS to support Non terminal access. User can utilize the Tuxedo ART for IMS MPP service via Non- terminal applications, such as native Oracle Tuxedo client, SALT client and JCA client.

This feature support both non-terminal tuxedo clients (including native Tuxedo client, SALT client, JCA client) and MQ application.

For non-terminal tuxedo clients, programing interface is provided. Client can access the MPP service by following the programing interface.

Different from non-terminal Oracle Tuxedo clients, a WebSphere MQ application is not an Oracle Tuxedo client. The MQ message format and message flow between MQ applications and traditional IMS applications is already defined in the WebSphere MQ Application Programming Guide. In an IMS environment, MQ application utilizes MQ-IMS Bridge to enable implicit MQI support so that tradition IMS applications can be accessed by WebSphere MQ messages, without having to rewrite, recompile, or re-link them. This feature leverages the Oracle Tuxedo MQ Adapter to convert the MQ application to an Oracle Tuxedo client.

Programming Interface

Programming Interface for Non-terminal Oracle Tuxedo Clients

Tuxedo ART for IMS provides a server, `ARTIGW`, working as a bridge between Non-terminal clients and the Tuxedo ART for IMS MPP server. A non-terminal client calls the `ARTIGW` service following the programming interface list below. `ARTIGW` forwards the service request to `ARTMPP`.

The only interface between `ARTIGW` and Non terminal Oracle Tuxedo clients is an FML table.

To run an IMS transaction (for example, TRANS1) with application buffer, do the following steps:

1. The client user must prepare the send buffer containing these FML fields:

   `IMS_SVC_NAME`
   IMS transaction name (i.e., "`TRANS1`").

   `IMS_SVC_FLAG`
   Reserved for future use.

   `IMS_SEG_DATA`
   Application buffer data. LLZZ is not expected in the buffer. The maximum segment length is `32764` (which is the `ARTIMPP` limit).

2. Client issues a `tpcall()/tpacall()` with the buffer prepared in step 1.

   ```
   ret = tpcall(< tuxclt_service_name>, …)
   ```

   Here `< tuxclt_service_name>` is the ARTIGW advertised service; the service name is configurable. For more information, see ARTIGW CONFIGURATION.

3. Client gets the reply. In the reply message, the following FML fields are present:

   `IMS_SVC_RESULT`

   0: `ARTIMPP` processes the request successfully with a response message.

   1: `ARTIMPP` processes the request successfully without a response message.

   -1: `ARTIGW` error

   -2: `ARTIMPP` error

   `IMS_SEG_DATA`
   Buffer contains reply data. LLZZ is not included in the buffer.

   `IMS_SVC_SYSMSG`
   Verbose error message if IMS_SVC_RESULT is a negative integer.

The interface FML Fields table (`ARTIGWFML`) and header file (`ARTIGWFML.h`) can be found under `$IMSDIR/include`. Listing 4 shows the `ARTIGWFML` contents.

Listing 4 ARTIGWFML Contents

```
*base 30000700

#name          rel-number    type     flags     comment
#-----         -----------   ------   -------   ------------------------
IMS_SVC_NAME       181       string
IMS_SVC_FLAG       182       long
IMS_SVC_RESULT     183       long
IMS_SEG_DATA       184       carray
IMS_SVC_SYSMSG     185       carray
```

Supported MQ Messages for MQ Applications

The MQ-Tuxedo ART for IMS Bridge accepts the following message types:

- Messages containing IMS transaction data and an MQIIH structure:

  `MQIIH LLZZ<trancode><data>[LLZZ<data>][LLZZ<data>]`

- Messages containing IMS transaction data but no MQIIH structure:

  `LLZZ<trancode><data>[LLZZ<data>][LLZZ<data>]`

Notes:

1. The square brackets, [ ], represent optional multi-segments.
2. If message contains MQIIH structure, the MQMD structure Format field is set to `MQFMT_IMS`.
3. If message does not contain MQIIH structure, the MQMD structure Format field is set to `MQFMT_IMS_VAR_STRING`.

Configuration

Oracle Tuxedo MQ Adapter Configuration

To support MQ application, user must apply Tuxedo 12cR1 RP17 or later and follow the instruction list below:

1. In the Oracle Tuxedo MQ Adapter configuration file, the `TM_MQI *SERVICE` sections must be defined as follows:

   For message with MQIIH structure:

   ```
   *SERVICE
      NAME=< mq_service_name >
      FORMAT= MQIMS
      TRAN = N
   ```

   For message without MQIIH structure:

   ```
   *SERVICE
      NAME=< mq_service_name>
      FORMAT= MQIMSVS
      TRAN = N
   ```

   Here `< mq_service_name>` is the `ARTIGW` advertised service; the service name is configurable. For more information, see ARTIGW Configuration.

2. In the `TM_MQI` configuration file *`SERVER` section, the following parameters must be specified.

   ```
    *SERVER
           TPESVCFAILDATA=Y
           REPLYONSVCERR=Y
           MSGTYPEONTPFAIL=Y
           IMPORTMQMD=Y
   ```

3. In the `UBBCONFIG` file, `TM_MQI` server must be in a Group configured with TMS Server for the WebSphere MQ Resource Manager.

ARTIGW Configuration

`ARTIGW` is a Tuxedo server working as a bridge between non-terminal client and the `ARTIMPP` server. For more information, see Server Configurations.

Cross Domain Configuration

If `ARTIGW` and `ARTIMPP` are deployed in different domains, `ARTIGW` exports services named as `<tuxclt_service_name>_REPLY_<grpid>_<srvid>` and `<mq_service_name>_REPLY_<grpid>_<srvid>`. The `GRPID` and `SVRID` are 5 characters (starting with 0).

The service names mentioned above should be configured in the `DM_REMOTE_SERVICES` section of the `DMCONFIG` file of every remote domain which `ARTIMPP` belongs to. In addition, make sure correct service names are exported by each domain where `ARTIGW` lives, and make sure there are no service conflicts.

For example, assume that `ARTIGW` is in domain `GW` and `ARTIMPP` is in domain `MPP`. `ARTIGW` is configured to use default service name with `SRVID=101, SRVGRP= GROUP1`. Listing 5 shows an example of the `DMCONFIG` files for `MPP` and `GW` domains.

Listing 5 MPP and GW Domains DMCONFIG Files

- MPP domain:

```
*DM_REMOTE_SERVICES
IMSGW_SVC_REPLY_00001_00101
```

- GW domain:

```
*DM_LOCAL_SERVICES
IMSGW_SVC_REPLY_00001_00101
```

Notes:

1. No data conversion is done by the `ARTIGW` for non-terminal tuxedo clients. The data provided by the client application should be in the format expected by ARTMPP server and application programs.
2. `ARTIGW` is a single thread Tuxedo server. User can deploy multiple instance of `ARTIGW` for performance tuning.

3. The Oracle Tuxedo MQ Adapter is the MQI interface with the MQ application. Due to the different behavior of WebSphere MQ on mainframe and open system, the Tuxedo MQ Adapter behavior may look different either.

For example, if an MQ application puts a message with the `MQPMO_NONE` option on a Mainframe, the Oracle Tuxedo MQ Adapter will not trigger an IMS transaction until `MQCMIT` is called by the MQ application.

Note: On open systems, IMS transaction is triggered immediately.

4. For MQ Applications, if an unexpected event occurs with `ARTIGW` or `ARTIMPP` during message processing, a report message is generated and sent to the reply queue specified by original message. The report message contains no data from the original message, only a string containing the detailed error message

Limitations

Non-Terminal Oracle Tuxedo Client Limitations

1. Global transaction is not supported. If a `tpcall` to the `ARTIGW` is in the global transaction, the `TPNOTRAN` flag must be set.
2. If there is an access control violation when accessing an `ARTIMPP` service, a non-terminal client will not get an error message like "Access control violation" immediately, but waits until a time out occurs You must check `ULOG` to get a detailed error report.

MQ Application Limitations

1. Only Commit mode 0 (`COMMIT_THEN_SEND`) is supported. Tuxedo ART for IMS will always handle the transaction as Commit mode 0 no matter what the Commit mode value is set in `MQIIH`.
2. Authentication with the RACF password or passticket is not supported.
3. MFS transaction is not supported.
4. Conversation is not supported.
5. Transaction code specified in the input message cannot be a command.
6. When Tuxedo MQ Adapter detects an access control violation, it will put original message into Dead Letter Queue. There will be no report message in the reply queue. You can also find the error report in the `ULOG` file.

Tuxedo ART for IMS Persistent Message Support

Tuxedo ART for IMS supports persistent message only for programs using `ALT PCB`. For the program switch via `ALT PCB`, when the target transaction is a persistent transaction, the message will be put into the /Q of that transaction. For how to define a persistent transaction, please refer to the imsresource.desc section.

For persistent message support, we differentiate the `ARTIMPP` into two running mode. One is `ARTIMPP` in normal mode, one is `ARTIMPP` in persistent mode. For how to define the two `ARTIMPP` server mode, please refer to `ARTIMPP` configuration section.

`ARTIMPP` in normal mode will advertise transactions as services and handle the normal service request from front end, such as terminal request, request from `ARTIGW`.The service request is scheduled by Tuxedo framework and is passed via Tuxedo IPC queue.

`ARTIMPP` in persistent mode will not advertise any services. It will monitor every /Q for the persistent transaction whose `CLASS` belong meet the" `-l class_list`" parameter of the `ARTIMPP`. It gets the message from the /Q of the persistent transaction and execute corresponding program for the transaction.

`ARTIBMPT` is also a server that is related to persistent message support. The transaction oriented `BMP` program that `ARTIBMPT` serves must only be persistent transaction. For what is "transaction oriented `BMP`“, please refer to `ARTIBMPT` configuration section. In transaction oriented `BMP` program, the GU operation will get message from the /Q of the transaction.

Server Configurations

Table 18 Lists the server configuration processes and commands.

Table 18 Server Configuration Processes and Commands

Name	Description
`ARTICTL`	Used to join 3270 terminal to Tuxedo ART for IMS Runtime
`ARTIMPP`	Service handler and container for TP type COBOL/C programs
`ARTIMPP_ORA`	Same as `ARTIMPP`. However, it requires the Oracle database as RM
`ARTIBMP`	Program container for BATCH type COBOL/C programs.
`ARTIBMP_ORA`	Same as `ARTIBMP`. However, it requires the Oracle database as RM.

Table 18 Server Configuration Processes and Commands (Continued)

Name	Description
ARTIBMPT	An Oracle Tuxedo server that handles transaction oriented batch programs.
ARTIADM	An Oracle Tuxedo server responsible for the administration of Tuxedo ART for IMS Runtime.
ARTITERM	Acts as messenger between `ARTICTL` and `ARTIMPP` located in different domains.
ARTIGW	An Oracle Tuxedo server that acts as a bridge between non-terminal clients and the `ARTIMPP` server.
IMSCONN	Used to join IMS Connect client to Tuxedo ART for IMS Runtime.
ODBAPROX	A socket server on z/OS and is to communicate with Tuxedo ART for IMS servers through TCP/IP.

ARTICTL

Name

`ARTICL` - Used to join 3270 terminal to Tuxedo ART for IMS Runtime.

Synopsis

For Tuxedo ART for IMS 12c Release 2 (12.2.2) GA or Rolling Patch 001:

```
ARTICTL SRVGRP=”identifier”

SRVID=”number”

CLOPT="[servopts options] -- -n netaddr -L pnetaddr [-K seconds][-S ssladdr]
[-m minh] [-M maxh] [-x session-per-handler] [-p profile-name][-z mine] [-Z
maxe][-D [+H handler-number]]"
```

For Tuxedo ART for IMS 12c Release 2 (12.2.2) Rolling Patch 002 or later:

```
ARTICTL SRVGRP=”identifier”

SRVID=”number”

CLOPT="[servopts options] -- -n netaddr -L pnetaddr [-K seconds][-S ssladdr]
[-m minh] [-M maxh] [-x session-per-handler] [-p profile-name][-z mine] [-Z
maxe][-d trace-level]"
```

Description

You must specify the `MAXWSCLIENTS` parameter in the `MACHINES` section of the UBBCONFIG file. `MAXWSCLIENTS` is the only parameter that has special significance for `ARTICTL`. `MAXWSCLIENTS` tells the Oracle ART at boot time how many access slots to reserve exclusively for 3270 terminals.

For `MAXWSCLIENTS`, specify the maximum number of 3270 terminal that may connect to a node. The default is 0. If not specified, terminal may not connect to the machine being described.

The syntax is `MAXWSCLIENTS=number`.

Parameter(s)

`-n netaddr`

This address specifies where TN3270 terminal emulators connect to ARTICTL subsystem. The address is a string in standard internet URL format. For example:

//computer:4000 designates port 4000 on machine computer. Character, 1-256, A-Za-z0-9[/:-]. Mandatory option.

`-L pnetaddr`

This address is used by the ARTICTL subsystem internally between TCPL and CTLH. The address is a string in standard internet URL format. For example: //computer1:4001 designates port 4000 on machine computer. Character, 1-256, A-Za-z0-9[/:-]. Mandatory option.

`[-m minh]`

The minimum number of handler processes that will be started by ARTICTL, minh is a number from 1 to 255, its default value is 1. The actual number of handler processes will always be between `minh` and **`maxh`** based on system load.

Note: Although `minh` is a number from 1 to 255, but it still should be equal to or smaller than (`FD_SETSIZE - 24)` according to the system resources limits. `FD_SETSIZE` means the maximum number of files that a process can have open at any time. The value can be acquired via system command `ulimit -n`.

`[-M maxh]`

The maximum number of handler processes started by `ARTICTL`, `maxh` is a number from 1 to the 1000; the default value is 1000. The actual number of handler processes is always between `minh` and `maxh` based on system load.

Note: Although `maxh` is a number from 1 to 1000, it should be equal to or smaller than (`FD_SETSIZE - 24)` according to the system resources limits. `FD_SETSIZE` means the maximum number of files that a process can have open at any time. The value can be acquired via system command `ulimit -n`.

[-x session-per-handler]

The number of sessions a CTLH can maintain concurrently in ARTICTL subsystem.

Numeric, 1-255. Default value is 32.

[-K seconds]

Specifies the keepalive message interval time, in seconds, between ARTICTL and 3270 terminal. It should be an integer smaller than the idle time that connection's max allows. If `-K` option is not set, no keepalive message will be send.

[-S ssladdr]

Specifies where 3270 terminal emulators connect to ARTICTL via SSL. The address is a string in standard internet URL format. For example: `//computer:5000` designates port 5000 on machine called "computer." Character, `1-256, A-Za-z0-9[/:-].` `[-S ssladdr]` is mandatory if `-n` option is not specified.

[-p profile-name]

The default security profile file name. Please refer to Security configuration for details. The default value is `~/.tuxAppProfile`.

Note: To join Tuxedo domain, `ARTICTL` only uses `APP_PW` stored in the security profile, the username/user password the `ARTICTL` uses comes from 3270 terminal.

-z minencryptbits

This option specifies the minimum level of encryption required when a network link is being established between a terminal and the `ARTICTL` handler. 0 means no encryption, while 40, 56, 128, and 256 specify the length (in bits) of the encryption key. If this minimum level of encryption cannot be met, link establishment fails. The default is 0. This option is ignored if `-s` option is not specified.

–Z maxencryptbits

This option specifies the maximum level of encryption allowed when a network link is being established between a workstation client and the workstationhandler. 0 means no encryption, while 40, 56, 128, and 256 specify the length (in bits) of the encryption key. The default is 128 for LLE and 256 for SSL. This option is available only if Oracle Tuxedo Security (either 56-bit or 128/256-bit) is installed.

This option is ignored if `-s` option is not specified.

[-D [+H handler-number]]

This option applies to Tuxedo ART for IMS 12c Release 2 (12.2.2) GA or Rolling Patch 001.
The `-D` option is used to enable `ARTICTL` server trace log. If not specified, it is disabled. The `+H handler-number` option is used to enable `ARTICTLH` server trace log only for the first booted number of `ARTICTLH` servers enabled handler-numbers. When

handler-number is `0`, trace log is enabled in all `ARTICTLH` servers created from the current `ARTICTL` servers. All trace logs are placed in the `/tmp` directory.

`[-d trace-level]`

This option applies to Tuxedo ART for IMS 12c Release 2 (12.2.2) Rolling Patch 002 or later.

The `-d` option is used to set server's trace level. If not set, the default trace level is `-1`, meaning, only error information will be put to trace log file. Available trace-level value is `0`, `1`, or `2`:

- `0`: Function stack information is logged.
- `1`: Debugging trace information is logged.
- `2`: More detailed data information is logged.

Example(s)

```
*MACHINES
DEFAULT:
MAXWSCLINETS = 20
...
*SERVERS
ARTICTL SRVGRP="MFSGRP"
SRVID=1000
RESTART=Y GRACE=0
CLOPT="-- -n //hostname:4000 -L //hostname:4002 -m 1 -M 10"
```

ARTIMPP

Name

`ARTIMPP` - Service handler and container for TP type COBOL/C programs.

Synopsis:

```
ARTIMPP SRVGRP=”identifier”
                SRVID=”number”
CLOPT="[servopts options] -- -l class_list [-V][-p][-m cobol mode][-D
trace-level][-x parameter list for DB plugin]"
```

Description

ARTIMPP is a Tuxedo server to act as both service handler and container for COBOL/C programs of TP type. There are two running modes for ARTIMPP, one is ARTIMPP in normal mode (without -p in CLOPT), another is ARTIMPP in persistent mode (with -p in CLOPT).

ARTIMPP in normal mode invokes corresponding COBOL/C program according to the service request received from front end (request from terminal, ARTIGW).

ARTIMPP in persistent mode will monitor /Q for persistent transaction whose class is defined in the "-l class_list" parameter in CLOPT for the ARTIMPP. It will get the message from the /Q and invoke corresponding COBOL/C program.

Parameter(s)

[-l class_list]

Specifies a list of transaction class, e.g. “1,3,5”; or a class range, e.g.“1-3”; or all classes, i.e *. The services whose class is specified in the class_list are advertised by ARTIMPP in normal mode.

-p

ARTIMPP is in persistent mode.ARTIMPP in persistent mode will not advertise any services/transactions.

-v

Enables performance tracing for the server.

[-m cobol mode]

Specifies user COBOL program invocation method. For more information, see "ARTIMS_COBOL_MODE" in Environment Variables.

[-D trace-level]

This option is used to set server's trace level, the available trace-level value includes 0,1,2. If not set, the default trace level is -1, only error info will be put to trace log file. Trace level is defined as follows:

0 : function stack info is logged.

1 : debugging trace info is logged.

2 : more detailed data info islogged.

[-x]

Indicates the server where the Database plug-in is to be used, the remaining parameter list following "-x" is passed to db_init().

For the Oracle IMS/DB solution, the parameter list is as follows:

`-o host:port:dra`

This is the parameter required by Oracle plug-in for IMS/DB.

`host`
: Hostname or ipv4 address of ODBA proxy to connect to.

`port`
: Port of ODBA proxy for receiving ODBA request.

`dra`
: Name of the DRA table in which the IMS/DB system to be accessed is defined. E.g., `CLOPT="-A --  -x -o zosmachine:1234:BEA1"`

Notes: When `ARTIMPP` server is configured in persistent mode in the `UBBCONFIG` file and persistent transaction is configured in `imsresource.desc`, `TMQUEUE` server must also be configured (before `ARTIMPP`), in the `UBBCONFIG` file according to the /Q configuration in `imsresource.desc`.

Before starting Tuxedo ART for IMS, you must also create /Q according to the information in `imsresource.desc`.

Limitation(s)

For a persistent transaction that may issue `ROLB` or `ROLL`, the transaction could only be handled by one `ARTIMPP` in persistent mode server. That is, the `CLASS` definition of the transaction (defined in `imstrans.desc`) could only match one `ARTIMPP` in persistent mode server `-l` parameter.

ARTIMPP_ORA

Description

`ARTIMPP_ORA` has all the functionalities of `ARTIMPP`. It can also support an Oracle database used as an external resource manager (RM). It uses on some libraries provided by Oracle database. In order to use this environment variable it with an Oracle database, the RM section must be configured correctly in the `UBBCONFIG` file.

ARTIBMP

Name

`ARTIBMP` - Program container for BATCH type COBOL/C programs.

Synopsis:

```
ARTIBMPSRVGRP=”identifier”
                    SRVID=”number”
CLOPT="[servopts options] -- [-V][-m cobol mode][-D trace-level][-x
parameter list for DB plugin] "
```

Description

`ARTIBMP` is an Oracle Tuxedo server to act as the program container for COBOL/C programs of BATCH type, it invokes corresponding COBOL/C program according to the program name received. If there is no error, no abend, and the user program has not crashed, the user program return code is returned to `DFSRRC00`.

Parameter(s)

`-V`

Enables performance tracing for the server.

`[-m cobol mode]`

Specifies user COBOL program invocation method. For more information, see "`ARTIMS_COBOL_MODE`" in Environment Variables.

`[-D trace-level]`

This option is used to set server's trace level, the available trace-level value includes 0,1,2. If not set, the default trace level is -1, only error info will be put to trace log file. Trace level is defined as follows:

`0` : function stack info is logged.

`1` : debugging trace info is logged.

`2` : more detailed data info islogged.

`[-x]`

Indicates the server where the Database plug-in is to be used, the remaining parameter list following "-x" is passed to `db_init()`.

For the Oracle IMS/DB solution, the parameter list is as follows:

`-o host:port:dra`

This is the parameter required by Oracle plug-in for IMS/DB.

`host`

Hostname or ipv4 address of ODBA proxy to connect to.

`port`

Port of ODBA proxy for receiving ODBA request.

`dra`

Name of the DRA table in which the IMS/DB system to be accessed is defined. E.g., `CLOPT="-A --  -x -o zosmachine:1234:BEA1"`

ARTIBMPT

Name

`ARTIBMPT` - An OracleTuxedo server that handles transaction oriented batch programs.

Synopsis

```
ARTIMPP SRVGRP="identifier" SRVID="number"
CLOPT="[servopts options] -- -l class_list [-m cobol mode][-D trace-level]
[-x parameter list for DB plugin] "
```

Description

A transaction oriented `BMP` program should be served by `ARTIBMPT` and triggered via `DFSRRC00` with `${IN}` parameter. A transaction oriented `BMP` program is a program that is defined in `imstrans.desc` and also defined in `imsapps.desc` with a `TYPE=BATCH`.

The transaction oriented `BMP` program must be a persistent transaction and must be defined in `imsresource.desc`. `ARTIBMPT` server only handles transaction oriented BMP programs.

If there is no error, no abend, and the user program has not crashed, the user program return code is returned to `DFSRRC00`.

Parameter(s)

`[-l class_list]`

Specifies a list of transaction class, e.g. "1,3,5"; or a class range, e.g."1-3"; or all classes, i.e *. The services whose class is specified in the `class_list` are advertised by `ARTIBMPT`.

`[-m cobol mode]`

Specifies user COBOL program invocation method. For more information, see "`ARTIMS_COBOL_MODE`" in Environment Variables.

`[-D trace-level]`

This option is used to set server's trace level, the available trace-level value includes 0,1,2. If not set, the default trace level is -1, only error info will be put to trace log file. Trace level is defined as follows:

`0` : function stack info is logged.

`1` : debugging trace info is logged.

`2` : more detailed data info islogged.

`[-x]`

Indicates the server where the Database plug-in is to be used, the remaining parameter list following "-x" is passed to `db_init()`.

For the Oracle IMS/DB solution, the parameter list is as follows:

`-o host:port:dra`

This is the parameter required by Oracle plug-in for IMS/DB.

`host`

Hostname or ipv4 address of ODBA proxy to connect to.

`port`

Port of ODBA proxy for receiving ODBA request.

`dra`

Table name which specifies the IMS/DB to connect to; this parameter is optional; if it's configured, all the DB operations are performed through ODBA, otherwise all DB operations are through actual DB implementation on open systems. The DRA table name must be uppercase and 4 bytes long.

Note: When `ARTIBMPT` is configured in `UBBCONFIG` file and there is transaction oriented `BMP` transaction which is configured in `imsresource.desc`, `TMQUEUE` server must be also configured in `UBBCONFIG` file according to the /Q'configuration in `imsresource.desc`.

Limitation(s)

For a transaction oriented `BMP` program that may issue `ROLB` or `ROLL`, the program could only be handled by one `ARTIBMPT` server.

That is, the `CLASS` definition of the transaction (defined in imstrans.desc) could only match one `ARTIBMPT` server "`-l class_list`" parameter.

ARTIBMP_ORA

Description

`ARTIBMP_ORA` has all the functionalities of `ARTIBMP`. It can also support an Oracle database used as an external resource manager (RM). It uses on some libraries provided by Oracle database. In order to use this environment variable it with an Oracle database, the RM section must be configured correctly in the `UBBCONFIG` file.

ARTIADM

Name

`ARTIADM` - An Oracle Tuxedo server responsible for the administration of Tuxedo ART for IMS Runtime.

Synopsis

```
ARTIADM SRVGRP=”identifier”
               SRVID=”number”
CLOPT="[servopts options]--[-D trace-level]"
```

Description

In a distributed target environment, this server can be configured on each node to achieve the configuration propagation. With these servers, the configuration files only need to be configured on the master node, and the administration servers propagate the configuration files to each slave node.

When starting up, the administration server running on the master node reads in all the configuration files located in directory `${ART_IMS_CONFIG}`. When each administration server running on a slave node starts up, it communicates with the administration server on the master node and fetches the contents of the configuration files.

The administration server on the slave node then writes to the corresponding configuration files in directory `${ART_IMS_CONFIG}` on the slave node. New configuration files are created if none exist. Configuration file synchronization function is optional, by default this function is disabled

Parameter(s)

`[-D trace-level]`

This option is used to set server's trace level, the available trace-level value includes 0,1,2. If not set, the default trace level is -1, only error info will be put to trace log file. Trace level is defined as follows:

`0` : function stack info is logged.

`1` : debugging trace info is logged.

`2` : more detailed data info islogged.

ARTITERM

Name

ARTITERM - Acts as messenger between ARTICTL and ARTIMPP located in different domains.

Synopsis:

```
ARTITERM SRVGRP=”identifier”

SRVID=”number”

CLOPT=””
```

Description

In cross-domain environment, ARTITERM server is used to act as messenger between ARTICTL and ARTIMPP located in different domains. ARTITERM provides a special service for ARTIMPP so that ARTIMPP can pass data to ARTITERM, which in turn passes the data to ARTICTL.

ARTIGW

Name

ARTIGW - An Oracle Tuxedo server working as a bridge between non-terminal client and the ARTIMPP server.

Synopsis:

```
ARTIGWSRVGRP="identifier"

SRVID="number"

CLOPT="[servopts options] [-m mq_service_name] [-s tuxclt_service_name]
[-V][-D trace-level]"
```

Description

ARTIGW is an Oracle Tuxedo server that acts as a bridge between non-terminal clients and the ARTIMPP server. Its main duties are as follows:

- Advertises separated services to handle the requests from non-terminal Oracle Tuxedo clients and requests from MQ applications.
- Message Mapping.

For MQ application request messages, it converts an MQ message to a format that can be used by `ARTIMPP`. For reply messages, it converts an `ARTIMPP` reply message to an MQ message.

For non-terminal Oracle Tuxedo client request messages, `ARTIGW` plays a role in transferring client FML32 buffers to a message format that the program needs and sends the message to MPP. It then decodes the MPP message and then sends a standard FML32 buffer to the client.

- Session Management.

  Session management is used to associate the asynchronous `ARTIMPP` reply with the original `ARTIGW` client requests.

- Session Management.

  A session management is used to associate the asynchronous reply from `ARTIMPP` with original request from clients of `ARTIGW`.

Parameter(s)

`mq_service_name`
: Specifies the service name advertised by server, which is dedicated for message handling for MQ application. It is an optional parameter, no default service name `<IMSGW_MQ_SVC>` is advertised if this parameter is not present.

`tuxclt_service_name`
: specifies the service name advertised by server, which is dedicated for message handling for non-terminal tuxedo client. It is an optional parameter, no default service name `<IMSGW_MQ_SVC>` is advertised if this parameter is not present.

`-V`
: Enables performance tracing for the server.

`[-D trace-level]`
: This option is used to set server's trace level, the available trace-level value includes 0,1,2. If not set, the default trace level is -1, only error info will be put to trace log file. Trace level is defined as follows:

  `0` : function stack info is logged.

  `1` : debugging trace info is logged.

  `2` : more detailed data info islogged.

Note: Both the `mq_service_name` and `tuxclt_service_name` cannot begin with `"<domainid>_"`. Otherwise `ARTIGW` cannot obtain the correct response message. In this instance, `<domainid>` is the ID of the domain which `ARTIMPP` belongs to.

IMSCONN

Name

`IMSCONN` - Used to join IMS Connect client to Tuxedo ART for IMS Runtime.

Synopsis:

```
IMSCONN SRVGRP="identifier"
SRVID="number"
CLOPT="[servopts options] -- -n netaddr -L pnetaddr [-K seconds][-S ssladdr]
[-m minh] [-M maxh] [-x session-per-handler] [-z mine] [-Z maxe] [-d
trace-level]"
```

Description

You must specify the `MAXWSCLIENTS` parameter in the `MACHINES` section of the `UBBCONFIG` file. `MAXWSCLIENTS` is the only parameter that has special significance for `IMSCONN`. `MAXWSCLIENTS` tells the Oracle ART at boot time how many access slots to reserve exclusively for IMS Connect clients.

For `MAXWSCLIENTS`, specify the maximum number of IMS Connect clients that may connect to a node. The default is 0. If not specified, IMS Connect client may not connect to the machine being described.

The syntax is `MAXWSCLIENTS=number`.

Parameters:

`-n netaddr`

This address specifies where IMS Connect clients connect to ARTICTL subsystem. The address is a string in standard internet URL format. For example: `//computer:4000 designates port 4000 on machine computer`.

Character, 1-256, A-Za-z0-9[/:-]. Mandatory option.

`-L pnetaddr`

This address is used by the `IMSCONN` subsystem internally between `IMSCONN` and `IMSCONNH`. The address is a string in standard internet URL format. For example: `//computer1:4001 designates port 4000 on machine computer`.

Character, 1-256, A-Za-z0-9[/:-]. Mandatory option.

[-K seconds]

Specifies the keepalive message interval time, in seconds, between `IMSCONN` and IMS Connect client. It should be an integer smaller than the idle time that connection's max allows. If `-K` option is not set, no keepalive message will be sent.

[-m minh]

The minimum number of handler processes that will be started by `IMSCONN`. `minh` is a number from 1 to 255; its default value is 1. The actual number of handler processes will always be between `minh` and `maxh` based on system load.

Note: Although minh is a number from 1 to 255, it should be equal to or smaller than `(FD_SETSIZE - 24)` according to system resources limits. `FD_SETSIZE` means the maximum number of files that a process can have open at any time. The value can be acquired via system command `ulimit -n`.

[-M maxh]

The maximum number of handler processes started by `IMSCONN`. `maxh` is a number from 1 to the 1000; the default value is 1000. The actual number of handler processes is always between `minh` and `maxh` based on system load.

Note: Although maxh is a number from 1 to 1000, it should be equal to or smaller than `(FD_SETSIZE - 24)` according to the system resources limits. `FD_SETSIZE` means the maximum number of files that a process can have open at any time. The value can be acquired via system command `ulimit -n`.

[-x session-per-handler]

The number of sessions an `IMSCONNH` can maintain concurrently in `IMSCONN` subsystem.

Numeric, 1-255. Default value is 32.

[-S ssladdr]

Specifies where IMS Connect clients connect to `IMSCONN` via SSL. The address is a string in standard internet URL format. For example: `//computer:5000 designates port 5000 on machine called "computer"`.

Character, 1-256, A-Za-z0-9[/:-]. `[-S ssladdr]` is mandatory if `-n` option is not specified.

-z minencryptbits

This option specifies the minimum level of encryption required when a network link is being established between an IMS Connect client and the `IMSCONN` handler. 0 means no encryption, while 40, 56, 128, and 256 specify the length (in bits) of the encryption key. If this minimum level of encryption cannot be met, link establishment fails. The default is 0. This option is ignored if `-s` option is not specified.

- Z maxencryptbits

This option specifies the maximum level of encryption allowed when a network link is being established between an IMS Connect client and the `IMSCONN` handler. 0 means no encryption, while 40, 56, 128, and 256 specify the length (in bits) of the encryption key. The default is 128 for LLE and 256 for SSL. This option is available only if Oracle Tuxedo security (either 56-bit or 128/256-bit) is installed.

This option is ignored if `-s` option is not specified.

[-d trace-level]

The `-d` option is used to set server's trace level. If not set, the trace level is -1 by default, meaning, only error information will be put to trace log file. Available trace-level value is 0, 1, or 2:

- 0: Function stack information is logged.
- 1: Debugging trace information is logged.
- 2: More detailed data information is logged.

Example(s)

```
*MACHINES

DEFAULT:

MAXWSCLINETS = 20

...

*SERVERS

IMSCONN SRVGRP="MFSGRP"

SRVID=1000

RESTART=Y GRACE=0

CLOPT="-- -n //hostname:4000 -L //hostname:4002 -m 1 -M 10"
```

ODBAPROX

Name

`ODBAPROX` - is a socket server on z/OS and is to communicate with `Tuxedo ART for IMS` servers through TCP/IP.

Synopsis:

```
ODBAPROX -h host -l command_port -p odba_port -n max_handler_num [-D]
```

Description

ODBA proxy is a socket server to communicate with Tuxedo ART for IMS servers through TCP/IP. ODBAPROX is developed to communicate with the programs in Tuxedo ART for IMS and perform database operations on behalf of these programs

Parameters:

[-h]
: Specifies the host (hostname or ipv4 address) where the ODBA proxy is running.

[-l]
: Specifies the port for receiving command from external utility.

[-p]
: Specifies the port for receiving odba request.

[-n]
: Specifies the maximum number of handlers to be started.

[-D]
: Enables debugging info be printed in stdout

For more information, see Using ODBA Proxy in the Oracle Tuxedo Application Runtime for IMS Users Guide.

Security Configuration

Authentication configuration

In Tuxedo, each type of security mechanism requires that every user provide an application password as part of the process of joining the Tuxedo ATMI application, but In Tuxedo ART for IMS, it has been removed in order to keep the same behavior as IMS resides on z/OS. User should keep application password as NULL. For more information on how to configure Tuxedo application password, please refer to Tuxedo documentation. The USER_AUTH and ACL/Mandatory ACL security mechanism requires that each user must provide a valid username and password to join the Tuxedo ART for IMS runtime. The per-user password must match the password associated with the user name stored in a file named tpusr. Client name is not used. The checking of per-user password against the password and user name in tpusr is carried out by the Tuxedo authentication service AUTHSVC, which is provided by the Tuxedo authentication server AUTHSVR. For more information on how to configure Tuxedo USER_AUTH and ACL/Mandatory ACL authentication, please refer to Tuxedo documentation.

For more information, see Using Security in ATMI Applications, in the Oracle Tuxedo Users Guide.

SSL Configuration

Tuxedo ART for IMS uses the following existing `UBBCONFIG` file parameters to configure information about SSL identification strings and the location of SSL certificate encryption passwords:

- `SEC_PRINCIPAL_NAME`
- `SEC_PRINCIPAL_LOCATION`
- `SEC_PRINCIPAL_PASSVAR`

For more information, see Using Security in ATMI Applications, in the Oracle Tuxedo Users Guide.

Environment Variables

- `ART_IMS_CONFIG`

  An environment variable required by Tuxedo ART for IMS to specify the absolute path where the configuration files are located, such as `*.desc` and `*.psb`. This environment variable is manadtory for: `ARTIMPP`, `ARTIMPP_ORA`, `ARTIBMP`, `ARTIBMP_ORA`, `ARTIBMPT`, `ARTIADM`.

- `ART_IMS_DB`

  Container path where GSAM files are located.

- `ART_IMS_FMT`

  An environment variable required by `ARTICTL` to specify the absolute path where the control block files which generated via `MFSGEN` are located. It is a series of paths similar to `PATH` environment variable, the separator is `":"`. If this variable is not specified, the `PATH APPDIR` is used. It is a mandatory environment variable for `ARTICTL` if MFS is used.

- `ART_IMSLOGDIR`

  Specify the directory where all the record log files are located. Record log file is used by `CHKP (Symbolic)` and `XRST`. If not specified, the `ART_IMSLOGDIR` default value is `$APPDIR/IMSLOGDIR`. In MP mode, if the program wants to share the record log file among machines in an Oracle Tuxedo domain, ART_IMSLOGDIR should point to an NFS directory which can be accessed by machines in the Oracle Tuxedo domain.

- ARTIMS_CAPITAL_USERID

  An environment variable required by ARTICTL to specify whether to translate user name to upper case or not. If it is set to Y, all user name characters are translated to upper case. If it is set to N or if it is not set, there is no translation.

- ARTIMS_COBOL_MODE

  Specifies user COBOL program invocation/cancel method (Micro Focus COBOL only). For COBOL-IT, it is ignored. The available values and descriptions are listed in Table 19. If not set, its default value is MF_SUBSYS.

Table 19 ARTIMS_COBOL_MODE Values

Value	Description
MF_SUBSYS	Use SUBSYSTEM method.
MF_COBFUNC	Use COBFUNC method.
MF_DEFAULT_CANCEL	Use cobcall with default CANCEL behavior.
MF_PHYSICAL_CANCEL	Use cobcall with physical CANCEL behavior.
MF_LOGICAL_CANCEL_STANDARD	Use cobcall with logical CANCEL behavior, and physically cancel .dll code and shared object code as part of a logical cancel operation.
MF_LOGICAL_CANCEL_SPECIAL	Use cobcall with logical CANCEL, and do not physically cancel .dll code and shared object code as part of a logical cancel operation.
MF_NOCANCEL	Use cobcall without CANCEL behavior.

- ARTIMS_DYNAMIC_BMP

  Specifies dynamic BMP setting. The value can be set to "Y" or "N".

  If set to "Y", BMP server exits after executing a BMP program. If set to "N", BMP server remains live after executing a BMP program.

  If not set, the default is "N".

- ART_IMS_EXCEPTION_TO_CATCH

  Specifies the list of signal numbers that you want to catch for application exception. Each number is separated by comma (e.g., ART_IMS_EXCEPTION_TO_CATCH=8,11,4).

  If this environment variable is not set, the default list (SIGSEGV,SIGILL,SIGBUS,SIGFPE), is used. If an illegal signal number is specified, it is ignored and a warning message is written in the ULOG file. If a legal signal number which can't be caught is specified (e.g., SIGKILL or SIGSTOP), the server boot fails and warning message is written in the ULOG file.

- ARTIMS_EXCEPTION_HANDLING

  Specifies server behavior when a severe exception is generated by a user application is caught. The value can be set to KEEP or ABORT.

  If set to ABORT, server MPP/BMP aborts when an exception from the user application is caught the core file of the server may or may not be generated based on the system configuration.

  If set to KEEP, the server is kept alive. If not set, the default value is KEEP.

- ARTIMS_LOGON_SCREEN

  Specifies the logon screen directory, which must be a sub-directory in $IMSDIR. If not set, the default value is sysmap, which means the logon screen in $IMSDIR/sysmap is used. There is another logon screen defined in $IMSDIR/sysmap2; the only difference between sysmap2 and sysmap is the positions for user name and password input fields. For more information about user defined logon screen, see the readme file in $IMSDIR/sysmap2.

- COBPATH

  An environment variable required by Micro Focus COBOL environment. It defines one or more directories to search COBOL programs to be loaded dynamically. Its usage is similar to UNIX PATH. It is a mandatory environment variable for Micro Focus COBOL.

- COB_LIBRARY_PATH

  If you are using COBOL-IT, COB_LIBRARY_PATH is required by COBOL-IT to define the search order for COBOL programs. It defines one or more directories to search COBOL programs to be loaded dynamically. Its usage is similar to Unix PATH. It is a mandatory environment variable for COBOL-IT.

- DFSRRC00_TIMEOUT_SEC

  Used for DFSRRC00 to specify the timeout second value for DFSRRC00 to wait for the BMP/BMPT program response. It uses the following rules:

  - If not defined, or its value is set to 0 or negative value, or bigger than 0xFFFFFFFF, no timeout is allowed. DFSRRC00 will wait until it receives a response from BMP/BMPT.
  - If its value is set to a positive value smaller than 0xFFFFFFFF, DFSRRC00 will wait until the specified timeout value is reached, or receives a response from BMP/BMPT within the timeout value.

- EXTERCODE

  Specifies which encoding type of outbound data is used. The value could be any EBCDIC encoding type used in z/OS platform. If this variable is not specified, IBM-37 will be used. If this variable is specified, then INTERCODE should be specified as well.

- IMS_DUMP_TYPE

  Specifies the program dump type. The dump file is generated when any of the following conditions are met:

  - CEE3ABD/ART3ABD is called (except when CEE3ABD is called in an MF environment).
  - DLI ROLL is called.
  - Signal specified in ART_IMS_EXCEPTION_TO_CATCH or in default signal list (ART_IMS_EXCEPTION_TO_CATCH is not set), is caught.

  The available values and descriptions are listed in Table 20.

Table 20 IMS_DUMP_TYPE Values

IMS_DUMP_TYPE	Description
NONE	No dump.
SYSTEM_DUMP	dump process using system utility
COBOL_DUMP	dump COBOL program using COBOL runtime dump method , only available for COBOL program in CIT environment now
BOTH	dump two files using both system utility and COBOL runtime dump method

If IMS_DUMP_TYPE is not configured, the default value is NONE - but if ARTIMS_EXCEPTION_HANDLING is set to ABORT, SYSTEM_DUMP is enabled when the signal is caught. The dump types for all combinations are listed in Table 21.

Table 21 Real Effect Dump Type

ARTIMS_EXCEPTION_HANDLING	Dump Condition	IMS_DUMP_TYPE	Real Effect Dump Type		
			C Program	MF-COBOL Program	CIT-COBOL Program
KEEP or ABORT	ABEND or ROLL	NONE	NONE	NONE	NONE
		SYSTEM_DUMP	SYSTEM_DUMP	SYSTEM_DUMP	SYSTEM_DUMP
		COBOL_DUMP	NONE	NONE	COBOL_DUMP
		BOTH	SYSTEM_DUMP	SYSTEM_DUMP	SYSTEM_DUMP COBOL_DUMP
KEEP	Signal Caught	NONE	NONE	NONE	NONE
		SYSTEM_DUMP	SYSTEM_DUMP	SYSTEM_DUMP	SYSTEM_DUMP
		COBOL_DUMP	NONE	NONE	COBOL_DUMP
		BOTH	SYSTEM_DUMP	SYSTEM_DUMP	SYSTEM_DUMP COBOL_DUMP
ABORT	Signal Caught	NONE	SYSTEM_DUMP	SYSTEM_DUMP	SYSTEM_DUMP
		SYSTEM_DUMP	SYSTEM_DUMP	SYSTEM_DUMP	SYSTEM_DUMP
		COBOL_DUMP	SYSTEM_DUMP	SYSTEM_DUMP	SYSTEM_DUMP COBOL_DUMP
		BOTH	SYSTEM_DUMP	SYSTEM_DUMP	SYSTEM_DUMP COBOL_DUMP

Requirementsa to generate dump file are listes in Table 22

Table 22 Dump File Requirements

IMS_DUMP_TYPE	Requirements	
	LINUX	AIX
COBOL_DUMP	In CIT environment, COBOL programs must be compiled with `-g` or `-fmem-info` or `-debug` flag.	
SYSTEM_DUMP	gcore could be invoked;	gencore could be invoked; system configuration core file size is big enough
BOTH	Both above `COBOL_DUMP` and `SYSTEM_DUMP` requirements.	

All dump files are located at `$APPDIR`.

The process dump file name is `core.${server name}.${timestamp}.${pid}`.

The CIT dump file name is `CIT.core.${program name}.${timestamp)`.

- `IMS_ENV_LIST`

  Used for `DFSRRC00` to specify all the environment variable names that need to be sent to `ARTIBMP` server except all those environment variables with prefix "`DD_`". All the environment variable's name should be separated with a comma. It should be set before `DFSRRC00` is launched.

- `IMS_LONG_USERNAME`

  ARTIMS supports login IMS from terminal using the traditional 8-byte username/password, and also supports max 30 bytes username/password. This environment variable is used to switch between the traditional username/password and long username/password. The default mode is traditional 8-byte username/password.

  If `IMS_LONG_USERNAME` is set to be `"Y"`, the max 30 bytes username/password is used; otherwise, the traditional 8-byte username/password is used.

- `IMS_PERF_ENABLE`

  A global switch for performance tracing. If `IMS_PERF_ENABLE` is set to `Y/N`, it controls turning performance tracing on/off, and takes precedent over the `UBBCONFIG` file setting.

  If `IMS_PERF_ENABLE` is not set, the performance behavior is set by using the `UBBCONFIG` file `-V` option.

- `IMS_PRO_LOG`

  A global switch for program invocation log. If `IMS_PRO_LOG` is set to `Y/N`, it controls turning program invocation log on/off.

  If set to `Y`, at the start/end of a transaction/program in MPP/BMP servers a trace line is added to the program invocation log file in the following format: `transaction name`, `program name`, `Sstart time`, `Eend time`, `group id`, `server id`.

  Note: When used, "-" indicates an empty value.

  If not set, the default value is `N`.

- `IMS_STAT_IPCKEY`

  Specify `IPCKEY` to create a share memory for collecting IMS status information. Only when `IPCKEY` is set to a valid IPC value can `ARTIMSAGENT` get real time information from IMS domain.

- `IMS_TRACE_PATH`

  Specifies the path where debug trace, program invocation log, and performance tracing reports are located. Tuxedo ART for IMS server must have both write and execute permissions for this directory.

  If not specified, by default, they are located at `$APPDIR/log`.

- `IMSDIR`

  An environment variable containing the root path (absolute path), of the installed Tuxedo ART for IMS subsystem. It is a mandatory environment variable if `ARTICTL` is used to be connected from terminal.

- `INTERCODE`

  Specifies which encoding type of inbound data is used. The value could be any encoding type used in universal platform. If this variable is not specified, ASCII is used. If this variable is specified, then `EXTERCODE` should be specified as well.

Commands and Parameters

Table 23 lists the commands and associated parameters that can be input on 3270 terminal and be processed by Tuxedo ART for IMS.

Table 23 3270 Terminal Commands and Parameters

Command	Shortening	Parameter
`/EXIT`	`/EXI`	`None`

`/Format`	`/Forma,`
	`/Form,`
	`/For`
		`modname`

`/Sign`	`/Sig`	`None`
		`Userid Passwd`
		`On`
		`On Userid Passwd`
		`Off`

Configuration Files

All the configuration files in this section are case insensitive for key and non-literal values, for example `bool (yes|no)` and `enum`. Literal values and their cases are kept. Comment line should be prefixed with "*". If there are errors in the configuration files, or the configuration files are not consistent, servers may fail to boot.

The configuration files are as follows:

- Transaction Definition - imstrans.desc
- Application Definition - imsapps.desc
- Persistent Transaction Definition - imsresource.desc
- Database Definition - imsdbs.desc
- PSB Definition - $appname.psb
- Segments Definition - segments.desc
- Segment Definition - $segname.desc
- Debug Definition - imsdebug.desc
- z/OS Transaction Definition - zostrans.desc

- White List - IMS.WHITE
- Black List - IMS.BLACK

The general format for configuration files is as follows.

Listing 6 General Configuration File Format

```
[section name]
Field1=value1
Field2=value2
….
[section name]
….
[section name]
…
```

Transaction Definition - imstrans.desc

Table 24 shows an example configuration file with field names mapped from TRANSACT MACRO of IMS on z/OS

Table 24 Section Name: [imstran]

Field	Type	Value	Description	Field in TRANSACT
NAME	X(1..8)	Mandatory	Transaction Code	CODE
SPA_SIZE	Integer	[16..32767]	SPA size	SPA
RESPONSE	Bool	Yes|No	Whether response is required for the transaction code specified in "NAME" field, default is No	MSGTYPE
EDIT	enum	UC/ULC	Whether the messages are converted to upper case automatically, default is UC	EDIT

Table 24 Section Name: [imstran]

Field	Type	Value	Description	Field in TRANSACT
APPNAME	X(1..8)	Mandatory	The name of the COBOL application program that processes the transaction code specified in "NAME" field	N/A
CLASS	Integer	[1..999]	The class of the transaction code, default is 1	MSGTYPE
MODE	enum	SNGL|MULT	Transaction mode, default is MULT	MODE

Application Definition - imsapps.desc

Table 25 shows an example configuration file with field names mapped from APPLCTN MACRO of IMS on z/OS.

Table 25 Section Name: [imsapp]

Field	Type	Value	Description	Source in APPLCTN
NAME	X(1..8)	Mandatory	Application Name	N/A
PGMTYPE	Enum	TP|BATCH	TP for MPP, BATCH for BMP and BMPT, default is TP	PGMTYPE
LANG	Enum	COBOL|C	COBOL for COBOL program, C for c program, default is COBOL	LANG

Persistent Transaction Definition - imsresource.desc

Every transaction that is defined in this file is a persistent transaction. Messages for the persistent transaction via program switch is put into /Q. You must create the /Q for every persistent transaction in corresponding queue space configured in this file with the queue name equal to the transaction name before Tuxedo ART for IMS is booted. Table 26 list the `imsresource.desc` field names.

Table 26 Section Name: [imsresource]

Field	Type	Value	Description	Field in TRANSACT
QSPACE	X(1..16)	Mandatory	Qspace name	
TRANNAMES	X(1..1024)	Mandatory	The persistent transaction names. The transaction name could be separated by comma, e.g: TRAN1, TRAN2. Every transaction name could not exceeds 8 bytes.	N/A

Listing 7 shows a script example to create queue space and queues for your reference; you can customerize the script to adapt to the real requirement. For more information, see Oracle Tuxedo /Q guides.

Listing 7 Create Queue Space Example Script

```
qmadmin ${ARTIMS QSPACE_DEVICE} <<!end
crdl . . .
qspacecreate . . .
qcreate TRAN11 fifo none 2 30 80% 0 ""
qcreate TRAN12 fifo none 2 30 80% 0 ""
!end
--->
qmadmin ${ARTIMS QSPACE_DEVICE} <<!
echo
crdl ${ARTIMS QSPACE_DEVICE} 0 10000
qspacecreate
${QUEUE_SPACENAME}
22839
5000
50
```

```
1000
1000
10000
errque
y
16
qopen ${QUEUE_SPACENAME}
qcreate TRAN11 fifo none 2 30 80% 0% ""
qcreate TRAN12 fifo none 2 30 80% 0% ""
qcreate errque fifo none 2 30 80% 0% ""
q
!
```

For persistent transactions that issue `ROLB` or `ROLL`, the retry count for creating the transaction queue should be set to a relatively large number (up to `2147483647`).

Note: It is suggested that you set the retry count to a number that is more than twice the number that a particular message enters a persistent transaction.

Database Definition - imsdbs.desc

`imsdbs.desc` is located under `$ART_IMS_CONFIG`.

Some `imsdbs.desc` field configurations are mapped from some DBD statement of IMS on z/OS. For persistent transactions that issue `ROLB` or `ROLL`, the retry count for creating the transaction queue should be set to a relatively large number (the largest number could up to 2147483647).

Note: It is suggested that the retry count is set to a number that is more than twice the number that a particular message enters a persistent transaction.

Table 27 Section Name: [imsdb]

Field	Type	Value	Description	Source in DBD
NAME	X(1..8)	database name	database Name	NAME
ACCESS	Enum	GSAM|MSDB|DEDB|HDAM|HIDAM|HISAM|HSAM|PHDAM|PHIDAM|PSINDEX|SHSAM|SHISAM	GSAM means GSAM DB	ACCESS
Following fields are only applicable to ACCESS=GSAM, will be ignored if ACCESS != GSAM				
DD1	X(1..8)	Literal String	Input File Name. If this name is defined in JCL with the same DD name, the real input file is decided by the DSNNAME associated with the DD name in JCL. Otherwise, the real input file is $ART_IMS_DB/Input file name.	N/A
DD2	X(1..8)	Literal String	Output File Name.If this name is defined in JCL with the same DD name, the real output file is decided by the DSNNAME associated with the DD name in JCL. Or else, the real output file is $ART_IMS_DB/Output File Name.	N/A
MINRECORD	Integer	Positive Integer	Minimum record length if RECFM=V, its value range is 1~268435455.	N/A
MAXRECORD	Integer	Positive Integer	Maximum record length if RECFM=V, its value range is 1~268435455.	N/A

Table 27 Section Name: [imsdb]

Field	Type	Value	Description	Source in DBD
`RECFM`	`Enum`	`F|V`	F: Fixed Record Length V: Variable Record Length	N/A
`RECORD`	`Integer`	`Positive Integer`	Record Length if `RECFM=F`, its value range is `2~32579`	N/A

PSB Definition - $appname.psb

`$appname is` the name of a COBOL application program with type of TP defined in imsapps.desc, `$appname.psb` is the PSB definition file corresponding to it. For application program with type of BATCH, `$appname.psb` is not used and the PSB must be provided by the script that calls `DFSRRC00`.

The number of [`imspcb`] sections with `LIST=YES` can be (at most) 31. The maximum PCB numbers including `IOPCB` is 32.

Note: The [`imspcb`] sections with `LIST=NO` are not counted.

Table 28 shows an example configuration file with field names mapped from PCB statement for IMS on z/OS.

Table 28 Section Name: [imspcb]

Field	Type	Value	Description	Source in PCB
`NAME`	`X(1..8)`	`blank or transaction code name`	If the type is TP, this field represents a Transaction Code, only transaction code is supported for alternate PCB It is mandatory if `modify = no`, and optional if `modify = yes`. If the type is DB, this field represents the DB name. This field must be configured for a `GSAM PCB`, but optional for a DB PCB, please refer to `PROCSEQ` field for details.	`NAME`
`TYPE`	`enum`	`TP|GSAM|DB`	TP means Alternate PCB, GSAM means PCB for GSAM DB DB means PCB for DEDB	`TYPE`
`LIST`	`Bool`	`Yes|No`	Specifies whether the named PCB is included in the PCB list passed to the application program at entry, must together with the `LABER=` parameter	`LIST`
Following fields are only applicable to TYPE=TP, i.e. alternate PCB, will be ignored if configured but `TYPE!=TP`				
`MODIFY`	`Bool`	`Yes|No`	Whether this PCB is modifiable, default is no	`MODIFY`
`EXPRESS`	`Bool`	`Yes|No`	Whether it is an express PCB, default is no	`EXPRESS`
`LABEL`	`X(8)`	`YES`	This parameter is required for DB PCBs while using ODBA, and also required for alternate PCBs if AIBTDLI interface is used to call DL/I.	`PCBNAME`

Table 28 Section Name: [imspcb]

Field	Type	Value	Description	Source in PCB
PROCSEQ	X(8)	Indexing Database name	If this field is configured, it should be filled in the first 8 bytes of DB PCB; otherwise, the value specified by `NAME=` should be filled in the first 8 bytes of DB PCB. At least one of NAM= and `PROCSEQ`= must be configured for a DB PCB.	PROCSEQ
PROCOPT	X(4)	GSAM: one of G|L|GS|LS DEDB: One or Combination of A|G|I|R|D|P|O|N|T|E|L|GS|LS|H	This field defines the access permission for the associated database. This field is only valid when `TYPE=GSAM|DB`, and is ignored if configured but `TYPE=TP`. `GSAM: G|GS` - Get Only; `L|LS` - Get and Append DEDB: TBD DEDB: Tuxedo ART for IMS servers do not check the validity of `PROCOPT`, which is migrated from IMS on z/OS and only used by DB plug-in	PROCOPT
Following fields are only applicable to `TYPE=DB`, i.e. `GSAM PCB`, will be ignored if configured but `TP!=DB`				
SB	Enum	COND|NO	Specifies whether this PCB should be buffered.	SB
POS	Enum	SINGLE|MULTIPLE	Specifies single or multiple positioning for the logical data structure.	POS
KEYLEN	int	Positive integer	Specifies bytes of the longest concatenated key for a hierarchic path of sensitive segments.	KEYLEN
MSDB	bool	YES|NO	Specifies the `MSDB` commit view.	VIEW
SENSEG	X(8)	Literal String	Specifies the `SENSEG` name belongs to this pcb, must be unique in current PSB file.	

Table 28 Section Name: [imspcb]

Field	Type	Value	Description	Source in PCB
Section Name: [$SEGSEG]			The section name is defined in imspcb section through SENSEG item.	
NAME	X(8)	Literal String	Specifies segment name.	SENSEG - NAME
PARENT	X(8)	Literal String|0	The name of the segment parent.	SENSEG - PARENT
PROCOPT	X(4)	One or Combination of A|G|I|R|D|P|O|E|L|GS|LS|H	Indicates the processing options valid for use of this sensitive segment, the SENSEG PROCOPT overrides the PCB PROCOPT	SENSEG - PROCOPT
SSPTR	Struct array	One or Combination of interger ,R|U linked with semicolon	Specifies the subset pointer number and the sensitivity for the pointer.	SENSEG - SSPTR
INDICES	X(8)	Literal String	Specifies which secondary indexes contain search fields that are used to qualify SSAs for an indexed segment type.	SENSEG - INDICES
SENFLD	X(8)	Literal String	Specifies the SENFLD name belongs to this senseg, must be unique in current PSB file.	
Section Name: [$SENFLD]	X(8)		The section name is defined in senseg section through SENFLD item.	

Table 28 Section Name: [imspcb]

Field	Type	Value	Description	Source in PCB
NAME	X(8)	Literal String	Specifies field name.	SENFLD - NAME
START	Int	Positive integer [1-32767]	Specifies the starting position of this field relative to the beginning of the segment.	SENFLD - START
REPLACE	bool	YES|NO	Specifies whether or not this field can be altered on a replace call.	SENFLD - REPLACE

Segments Definition - segments.desc

segments.desc defines the segments within a database. One database (except the GSAM database), has one segments.desc, which is under `$ART_IMS_CONFIG/db/$dbname`.

The fields in segments.desc are mapped from SEGM statement of DBD.

Table 29 segments.desc

[segm]Field	Type	Value	Description	Source in SEGM
NAME	X(1..8)	Mandatory	Segment Name	NAME
BYTES	Integer	Mandatory	Maximum Length of the segment, 4~32760	BYTES
SEGPGM_A2E	X(1..128)	Optional	COBOL Program name used to convert segment data from open system to Mainframe	N/A
SEGPGM_E2A	X(1..128)	Optional	COBOL Program name used to convert segment data from Mainframe to open system	N/A

Table 29 segments.desc

[segm]Field	Type	Value	Description	Source in SEGM
SSAPGM_A2E	X(1..128)	Optional	COBOL Program name used to convert qualified SSA for the segment from open system to Mainframe	N/A
KFAPGM_E2A	X(1..128)	Optional	COBOL Program name used to convert Key Feedback area for the segment from Mainframe to open system	N/A

Notes: For variable length segment, the BYTES definition is mapped from SEGM statement (e.g., `BYTES= (max bytes,min bytes))`, max bytes must be greater or equal to min bytes. A variable length segment must starts with a 2-byte field, which defines the length of the segment including the 2-byte length field.

For `SEGPGM_A2E`, `SEGPGM_E2A` and `SSAPGM_A2E`, `KFAPGM_E2A`:

1. If any of the upper four parameters is not defined in segments.desc, $segname.desc must exist and $segname.desc will be used to do data converting as described later.

2. `SEGPGM_A2E` and `SEGPGM_E2A`.

`SEGPGM_A2E` and `SEGPGM_E2A` must be both defined or both not defined together. When `SEGPGM_A2E` and `SEGPGM_E2A` are defined, the ODBA Plugin uses `SEGPGM_A2E`/ `SEGPGM_E2A` to do segment data converting, not use the `$segname.desc` to perform segment data converting even if there is `$segname.desc`.

When `SEGPGM_A2E` and `SEGPGM_E2A` are not defined, the ODBA plug-in uses the FIELDS definition in `$segname.desc` to perform segment data converting.

3. `SSAPGM_A2E`

When `SSAPGM_A2E` is defined, the ODBA plug-in uses the defined COBOL program to do qualified SSA converting for this segment.

When `SSAPGM_A2E` is not defined, the ODBA Program uses the `KEY` Field type definition in `$segname.desc` to convert the `KEY` value in the SSA for this segment.

4. `KFAPGM_E2A`.

When KFAPGM_E2A is defined, the ODBA plug-in uses the defined COBOL program to do data converting for Key Feedback area for this segment.

If KFAPGM_E2A is not defined, ODBA program uses the FBAFIELD definition in $segname.desc to do data converting for Key feedback area for this segment.

For how to generate and compile the upper COBOL programs, please refer to buffer converting in Oracle Tuxedo Application Rehosting Workbench User Guide and Oracle Tuxedo Application Rehosting Workbench Reference Guide.

Put the compiled converting program under COBPATH (for Micro Focus COBOL) or COB_LIBRARY_PATH (for CIT) before booting Tuxedo ART for IMS servers.

Segment Definition - $segname.desc

$segname.desc defines the fields within a segment. $segname.desc only exist for databases with access type of neither GSAM nor MSDB defined in imsdbs.desc, $segname.desc is located under $ART_IMS_CONFIG/db/$dbname.

Table 30 $segname.desc

[imsdb]Field	Type	Value	Description	Source in SEGM
NAME	X(1..8)	Mandatory	Field Name	NAME
START	Integer	Mandatory	Offset of the field, inside the segment, 0~length of segment - 4	START
BYTES	Integer	Mandatory	Length of the field, 4~32760	BYTES

Table 30 $segname.desc

[imsdb]Field	Type	Value	Description	Source in SEGM
`TYPE`	`Enum`	`Mandatory`	C: Alpha-Numeric string, requires conversion. P: Packed Decimal, conversion not required. X: Hexadecimal, requires conversion. M: Mixed type, used when a FIELD contains different types of sub pieces. Requires conversion.	`TYPE`

Table 30 $segname.desc

[imsdb]Field	Type	Value	Description	Source in SEGM
`FORMAT`	`X(1...512)`	`Optional`	Only needed (mandatory) for `TYPE=M`. The configuration rule for this format is as follows: `format=PIECE1-LEN,PIECE1-TYPE;PIECE2-LEN,PIECE2-TYPE;PIECE3-LEN,PIECE3-TYPE`. For example: `format=3,P;4,C;3,p`. Please note the following: 1. The `PIECE-TYPE` must be `C/P/X`. 2. Tailing - is not allowed. 3. The format string must cover all bytes in the field.	`N/A`

The field’s type definition is not only from FIELD statement of DBD, user also needs to define the field’s type according to its usage in COBOL program.

If you do not define the type for a field, the default field type is C

Table 31 shows the Field Definition mapping table according to field usage in the COBOL program.

Table 31 Field Definition Mapping Table

COBOL Picture	Description	IMS Type
PIC X	Alph-numeric character display	C
PIC 9	Numeric display	C
PIC S9	Signed numeric display	C
PIC S9 COMP-3	Packed decimal	P
PIC S9 COMP; PIC S9 COMP-4	Binary	X

The conversation/translating rule is as follows:

- Type C, requires ASCII/EBCDIC translation.
- Type P, does not require translation. (Both ASCII/EBCDIC translation and endian translation are not done. This for COMP-3 data area.)
- Type X, requires endian translation.

At the completion of a retrieval or `ISRT` call, the Key Feedback Area is returned from ODBA Proxy. We reserve one special FIELD whose name is `FBAFIELD` to convert Key Feedback Area in DB PCB.

A segment concatenated key is made up of the keys of each of its parents and its own key. Key formats are positioned left to right, starting with the key format of the root segment and following the hierarchic path.

This special `FIELD(FBAFIELD)` defined in `$segment` must defined the format of the concatenated key of the segment. The Key FeedBack Area will be converted according to the definition of this field for the segname.

Listing 8 shows an example definition in `$segname.desc`.

Listing 8 Example Definition

```
[field]
NAME=FBAFIELD
START=0
BYTES=11
TYPE=M
FORMAT=5,P;6,C
```

`START` should be 0.

`BYTES` defines the total length of the KEY FeedBack Area, that is the concatenated key total length.

`TYPE` defines the concatenated key's type. If the concatenated key has different type, the `TYPE` should be set to `M`.

`FORMAT` should define the concatenate. key format if the `TYPE=M`.

If the special `FIELD(FBAFIELD)` is not defined in `$ segname.desc`, the KEY FeedBack Area is converted as `TYPE C` by default for the segname.

Note: For search key field in SSA, its field name must be the same as the Search KEY FIELD name defined in DBD and the name used in the SSA.

Debug Definition - imsdebug.desc

`imsdebug.desc` defines all program debugging info. (currently for COBOL program debugging only).

Table 32 Section Name: [debug]

Field	Type	Value	Description
`USER`	`X(8) or X(30)`	`Optional`	User ID who is to be diagnosed, 8 bytes for traditional IMS, 30 bytes for long user name.
`LANG`	`String`	`Optional`	Only COBOL is supported, default value is `COBOL`.

Table 32 Section Name: [debug]

Field	Type	Value	Description
`TRANNAME`	`X(8)`	`Mandatory for MPP`	Transaction that is to be diagnosed, only for MPP server
`APPNAME`	`X(8)`	`Mandatory for BMP/BMPT`	Program that is to be diagnosed, must be the entry COBOL program, only for BMP/BMPT server.
`DEBUGID`	`X(40) or 1 ~ 999999999`	`Mandatory`	For Micro Focus COBOL application programs, `DEBUGID` is a string that is required for enabling animation in COBOL. It is a character string of up to 40 characters. The string can have alphanumeric characters and the underscore characterr. For COBOL-IT COBOL application programs, `DEBUGID` is a number ranging from 1 to 999999999

z/OS Transaction Definition - zostrans.desc

`zostrans.desc` file defines all transactions remaining on z/OS. All these transactions should only be called as sub-transactions, and only non-conversational transactions are supported now.

Table 33 Section Name: [zostran]

Field	Type	Value	Description
`NAME`	`X(1..8)`	`Mandatory`	z/OS transaction name
`CONV`	`X(1..128)`	`Optional`	Transaction input message's buffer converter program. ART for Workbench can generate it based on a copybook describing the input message/segment structure. It handles the data conversion before calling sub-transaction on Z/OS. If `CONV` is not specified, ART for IMS, by default, only converts ASCII to EBCDIC, meaning all bytes in the input message are treated as characters. For how to generate the converter program, see *Oracle Tuxedo Application Rehosting Workbench Reference Guide*.

White List - IMS.WHITE

`imsgenconf` creates configurations for the transaction/applications listed in `IMS.WHITE` Its format is as follows:

Listing 9 IMS.WHITE Format

```
[TRANCODE]

TRAN1

TRAN2

TRAN3

[APPPSB]

PSB1

PSB2

PSB3
```

[TRANCODE] section: Defines the transaction codes in the black/white list. Each transaction key has at most 8 characters.

[APPPSB] section: Defines the PSB name for batch application programs in the black/white list. Each PSB key has at most 8 characters.

Black List - IMS.BLACK

imsgenconf creates configurations for the transaction/applications that are not defined in IMS.BLACK. Its format is as follows:

Listing 10 IMS.BLACK Format

```
[TRANCODE]

TRAN1

TRAN2

TRAN3

[APPPSB]

PSB1

PSB2

PSB3
```

- [TRANCODE] section:

  Defines the transaction codes in the the black/white list. Each transaction key has at most 8 characters.

- [APPPSB] section:

  Defines the PSBNAME for batch application programs in the black/white list. Each PSB key has at most 8 characters.

COBOL/C Runtime Support

SYSIN/SYSOUT Handling

Tuxedo ART for IMS supports `SYSIN/SYSOUT` redirection for `ACCEPT/DISPLAY` statement in Tuxedo ART for IMS batch COBOL program in Micro Focus COBOL environment. To support this, Tuxedo ART for IMS adds a new file handler named "`ARTEXTFH`" (located at `$IMSDIR/coblib_mf/BMP`).

There is another file handler with the same name `ARTEXTFH` for `ARTIMPP` servers, and its behavior is the same as Micro Focus COBOL default file handler.

This file handler is at `$IMSDIR/coblib_mf/MPP`. All these two file handler will be loaded by `ARTIBMP` or `ARTIMPP` servers. If the default file handler behavior is not suitable for special case, user could switch these two file handler files or replace with user specified file handler.

Note: Currently, this feature is not supported with COBOL-IT.

To use this feature, do the following steps:

1. While compiling user COBOL program with Micro Focus COBOL compiler, the following options should be added:

   ```
   INDD

   OUTDD

   CALLFH("ARTEXTFH")
   ```

2. Before running a batch program, environment variables `DD_SYSIN` and `DD_SYSOUT` should be set and used to specify `SYSIN/SYSOUT` files. If artbatch is used to trigger an IMS job, this usually would be set.

STDIN/STDOUT Redirection

In C programs, `STDIN/STDOUT/STDERR` are redirected to the `SYSIN/SYSOUT/SYSOUT` file. If `SYSIN` is not defined or not accessiable, redirection is not initiated.

If `SYSOUT` is not defined or not accessiable, `STDOUT/STDERR` is redirected to the `$APPDIR/SYSOUT` file.

COBOL Mode

For COBOL-IT, only `SUBSYS` mode is supported. For Microfocus, there are seven supported COBOL modes:

- MF_SUBSYS
- MF_COBFUNC
- MF_NOCANCEL
- MF_DEFAULT_CANCEL
- MF_PHYSICAL_CANCEL
- MF_LOGICAL_CANCEL_STANDARD
- MF_LOGICAL_CANCEL_SPECIAL

The default value is `MF_SUBSYS`. For more information, see Environment Variables.

These COBOL modes are set through the environment variable `ARTIMS_COBOL_MODE`, or set in the `CLOPT` of each `BMP/MPP` server in the `UBBCONFIG` file. The `CLOPT` parameter is `-m COBOL_MODE` (for example, `-m MF_SUBSYS`).

There are four COBOL mode configuration combination rules:

1. No environment variable setting, `CLOPT`. `MF_SUBSYS` is the default.
2. When only using environment variable settings, all servers must be controlled by the environment variable.
3. When only using `CLOPT`, everything is controlled by `CLOPT`.
4. When using an environment variable and `CLOPT`, `CLOPT` takes precedent.

COBOL Program Debugging

- Debugging with Micro Focus COBOL
- Debugging with COBOL-IT COBOL

ART IMS supports user COBOL program debugging for Micro Focus COBOL and COBOL-IT COBOL. You can use "anim" tool to debug Micro Focus COBOL programs and use "deet" tool to debug COBOL-IT COBOL programs.You can configure all the transaction/program you need to debug in the configuration file `imsdebug.desc`. Only those transactions/programs configured in this file could be debugged. You could change this configuration file and then use `imsadmin` tool to enable it for online system.

To support COBOL debug, all COBOL programs must be compiled to output with debug info, for MF, the `.idy` file must exist.

Debugging with Micro Focus COBOL

To debug using Micro Focus COBOL, do the following steps:

1. Create or modify the `imsdebug.desc` configuration file at `${ART_IMS_CONFIG}`.
2. Restart your servers by using `tmshutdown/tmboot` or use "`imsadmin`" to reload configurations for online system.
3. Start "`anim`" in the current or a new terminal; the "`anim`" should remain in waiting state.
4. Start your transaction/program. This causes "`anim`" to atach to the to the COBOL program. and is ready for debugging.

Note: When finished debugging, you may need to detach from the debugged program.

Debugging with COBOL-IT COBOL

To debug using COBOL-IT COBOL, do the following steps:

1. Create or modify the `imsdebug.desc` configuration file at `${ART_IMS_CONFIG}`.
2. Restart your servers by using `tmshutdown/tmboot` or use "`imsadmin`" to reload configurations for online system.
3. Next, start your transaction/program. It pause before the COBOL program runs and waits for you to start debugging.
4. You can use `vncserver` to start a VNC environment.

   In VNC xterm, start debugging using the `deet -p yourDEBUGID` command. It starts the Deet graphic UI and attaches the COBOL program.

   For information about the Deet graphic UI, see COBOL-IT COBOL documentation.

Note: When finished debugging, you may need to detach from the debugged program.

See Also

- Oracle Tuxedo ART for IMS Users Guide