Oracle Tuxedo Application Rehosting Workbench

Users Guide

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Oracle Tuxedo Application Rehosting Workbench , 12*c* Release 2 (12.1.3)

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Appendix C: Oracle Tuxedo Application Rehosting Workbench Logs

CHAPTER 1

Oracle Tuxedo Application Rehosting Workbench Users Guide

This chapter contains the following topics:

Introduction

What is Rehosting?

Rehosting is a way to preserve the expensive investments in business logic and business data trapped in proprietary hardware and software, while opening paths to future modernization by moving to an open and more extensible architecture.

Product Overview

Refine for Z/OS Replatforming package provides automated migration tools to enable customers to replatform COBOL, JCL, DB2, VSAM files and related assets from an IBM DB2 mainframe environment to a UNIX environment with an Oracle Tuxedo transaction processor and an Oracle database.

The objectives of the plug-in are to help address these areas of complexity by providing the following:

- One migration process is organized by an Tuxedo ART Workbench Project. this enables you to navigate project artifacts in the Tuxedo ART Workbench navigator and perform corresponding actions on the selected project.
- Help select and specify parameters and options required to define configuration settings for the project as a whole and for specific tools. Most options in the flat configuration files can be configured and modified in the project properties.
- Execute specific tools/commands required at a particular step in the process, using configuration and other resources for any parameters/options to be specified on the command line. Review output messages in the Tuxedo ART Workbench Console in real time.
- Review catalog generated reports.
- Along with the conversion, a progress monitor shows the source file being converted.
- Guide you through the migration process step-by-step.

Oracle Tuxedo Application Rehosting Workbench

Refine for Z/OS Replatforming and Oracle Tuxedo Application Runtime for CICS and Batch are used within the context of a rehosting project. The process guide gives a global view of rehosting and the use of the conversion and runtime tools in this process. A rehosting project requires the creation of specific test, integration and production environments. The different functions of a rehosting project are typically:

- Plan the project, setting the general requirements and planning the target architecture options.
- Prepare the assets to be converted and install and configure the target environment.
- Convert the assets.
- Integrate the assets in the target environment.

These functions may be performed iteratively, typically a project consists of the following phases:

- Setting project strategy.
- Assessment study.

- Pilot project.
- Implementation.

Each of these phases is made up of different steps, the results of these steps may be tested and the steps reiterated as necessary.

Rehosting Lifecycle Overview

Rehosting is performed within a project organized into phases and steps. Each step produces one or more deliverables. In parallel to the different steps of the rehosting project are a parallel series of test steps that validate the different phases of the project.

A project concerns different people who have different roles and responsibilities within the project. A project is carried out within an environment and it is impossible to describe the different phases and steps of a project without first describing the environment in which they need to be performed.

Project Environment

There are five clearly distinct environments necessary to carry-out a rehosting project. These include two source (pre-migration) environments and three target (post-migration) environments as described below:

1. A current *production source* environment for the assets to be converted.
2. A *test source* environment for storing and isolating the operations extracted from the production environment and for creating a test database.
3. A *test target* environment for running, tuning and testing the converted assets.
4. An *integration target* environment, which is used to host all activities such as integration, operations migration or pre switch-over processing.
5. A *production target* environment for the converted and tested assets.

Table 1-1 Project Environments

Environments	Production	Integration	Test
Source	Production Source		Test Source
Target	Production Target	Integration target	Test Target

Depending on your needs, there may be several occurrences of the same platform to allow teams to work in parallel within the same project.

Project Phase Overview

A project is divided into different phases of work, producing clear deliverables that are validated before proceeding to the next phase of the project. These phases are as follows

Table 1-2 Project Phases

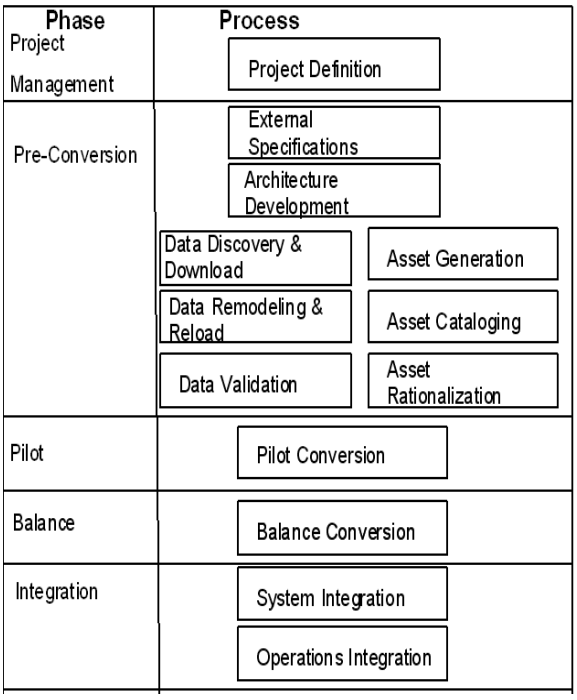
Phase	Migration Steps	Test Step	Environment	Language/ Data
PROJECT MANAGEMENT	Project Definition			
PRE-CONVERSION	Asset Generation		Source Production to Source Test	Both
	Asset Cataloging Asset Rationalization (if necessary)		Source Test	Language
	External Specifications Architecture Development		Planning and preparation for Target environments	
	Data Conversion		Source Test to Target test	Data
TEST PREPARATION		Test Engineering Test Preparation Test Tooling	Source Test	Both
PILOT	Pilot Set Conversion	Pilot Set Testing	Target Test	Language
BALANCE	Balance Conversion	Balance Testing	Target Test	Language
INTEGRATION	System Integration Operations Migration	System Testing Operations Testing	Target Test to Target Integration	Both

Table 1-2 Project Phases

Phase	Migration Steps	Test Step	Environment	Language/ Data
SWITCH-OVER	Maintenance Conversion Maintenance Conversion Testing	Maintenance Testing Dry Runs	Target Test	Both
	Switch-Over		Target Integration to Target Production	
EDUCATION	Education And Training			

Graphically, the different phases may be grouped as shown below:

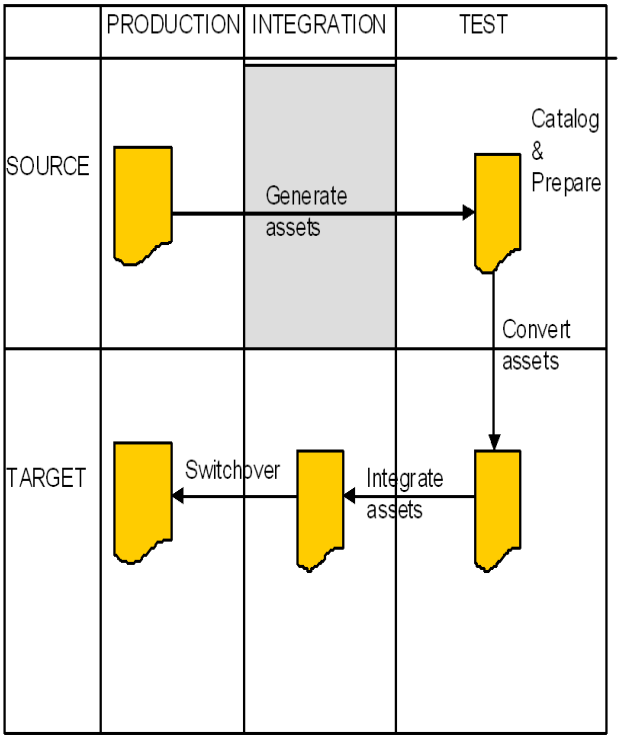
Figure 1-1 Project Phases and Processes



Overview of Using the Product in a Project

Refine for Z/OS Replatforming is used for converting and integrating program components and data. The following diagram shows the use of the program components, and how they are used to prepare source files for migrating to different environments.

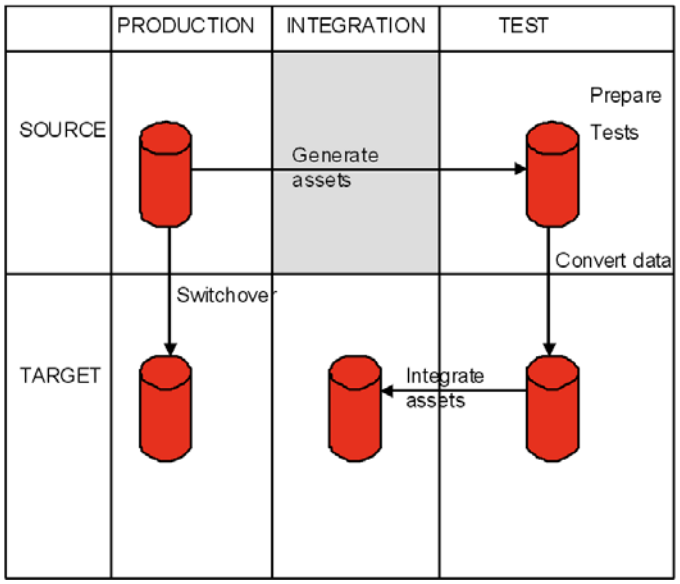
Figure 1-2 Language Migration



Refine for Z/OS Replatforming components are used to convert assets, enabling them after post-conversion adjustments to be moved from the from the source test environment to the target test environment.

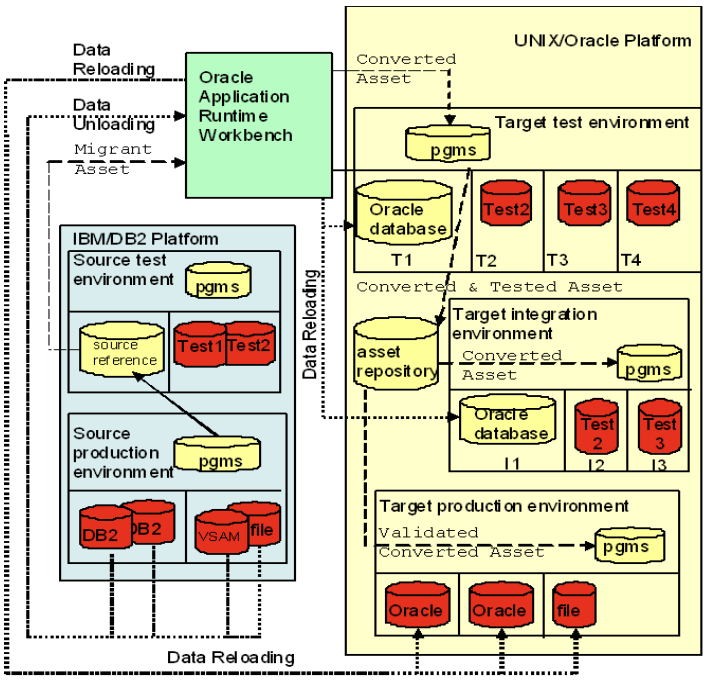
Oracle Tuxedo Application Runtime for CICS and Batch components are used to integrate the converted assets after testing and integration preparation on the target test environment. The COBOL programs, JCL and associated components are integrated with the UNIX, Oracle database and Tuxedo transaction environments. These components are tested to work with the batch and CICS components produced during the conversion process.

Figure 1-3 Data Migration



The assets to be migrated are generated and moved to the source test machine. The migrated assets are then converted and moved to a target test machine containing an Oracle database. After testing, the data is moved to an integration environment where rehosting tools are integrated with the programs to test their quality and performance using the converted data. When switchover occurs the latest data is converted directly from the source production environment to the target production environment.

Figure 1-4 Migration Architecture



Prerequisites

Platform

Linux32/Linux64

Software Environment

JRE 1.6.0 or higher

Eclipse IDE for Java Developers Galileo (3.5) or higher

Perl version 5.8.8 or higher

Skills

The following skills are required.

- Migration Process and Concepts

  You must understand the processes, concepts and terminology used by the Rehosting Workbench Cataloger (i.e., know the inputs, outputs and configuration expected by the Cataloger and how it analyzes all the components separately and together to determine whether the asset is consistent and can be migrated).

- Eclipse Skills

  Eclipse skills are required to perform certain actions accompanying the migration process. You must know:

  – View, Navigator, Perspective etc.

  – A set of operations to open new project wizard, open project properties page and open view.

  – If you are testing the plug-in, you must do the following:

    • Remove the workspace.

    • Run Eclipse using the `"-clean"` option.

Installing the Plug-in

To install the plug-in you must copy the `com.oracle.tuxedo.wbplugin_x.x.x.x.jar` file (located in `utils/eclipse_plugin sub-directory` under the Tuxedo ART Workbench installation directory) to the `$ECLIPSE_HOME/plugins` directory and then restart Eclipse.

Note: You can only use one version of plug-in at one time; you must remove all the previous plug-in versions before installing a new version.

However, when you update version, the new plug-in may not take affect after restarting Eclipse. Use the -clean option as command line arguments when starting Eclipse to force Eclipse to reinitialize these caches.

Component and Layout

The plug-in has an Tuxedo ART Workbench Perspective which organizes Tuxedo ART Workbench views, menus and toolbars around the eclipse. It also has a navigator made for Tuxedo ART Workbench projects.

The plug-in has Cataloger Report View and Process Monitor View to help you analyze the migration process.

- Tuxedo ART Workbench Perspective

- Tuxedo ART Workbench Navigator
- Migration Process Cheat Sheet
- Eclipse Preferences
- Menu Items and Tasks

Tuxedo ART Workbench Perspective

In the Eclipse Platform a Perspective determines the visible actions and views within a window.

The Tuxedo ART Workbench Perspective is made up of the following views:

- Workbench Navigator
- General Navigator
- Problems
- Report
- Progress Monitor

From the Tuxedo ART Workbench Perspective, Tuxedo ART Workbench specific actions/commands are also shown as menu items and toolbar buttons.

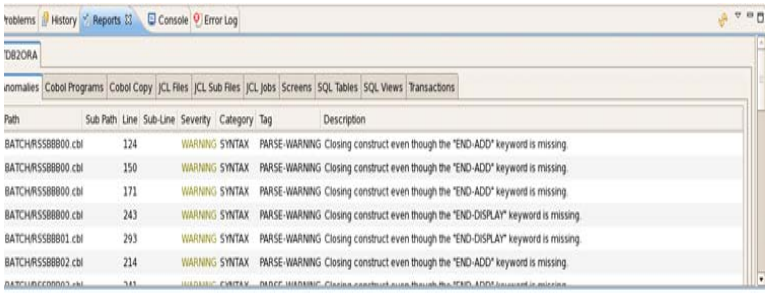
Tuxedo ART Workbench Navigator

The Tuxedo ART Workbench Navigator is very similar to the internal Eclipse General Navigator. The difference is that Tuxedo ART Workbench Navigator only displays ART Projects.

Cataloger Report View

The cataloger output reports are shown in the report view (as shown in Figure 1-5), with tabs for each report. The view is integrated with ART perspective. Click the **Close** button to close it or re-open it from main menu.

Figure 1-5 Report View Example



The report view has following features:

- Sort

  The report contents are organized in a table. You can sort by clicking on the table heading.

- Colored Warning

  The anomaly level of each report is colored by level.

Table 1-3 Color Warning

Anomaly Level	Color
OK	Green
WARING	Yellow
ERROR	Red
FATAL	Red

- Refresh

  The content of report refreshes automatically after the convert operation or create new project operation.

  You can also refresh the content by clicking the **Refresh** button on the menu bar of report view.

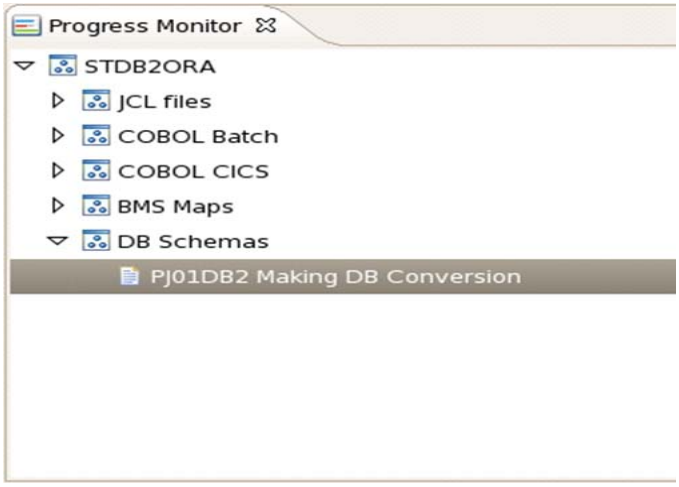
Progress Monitor View

The progress monitor view allows you to see which source file or schema is being processed. A source tree is initially displayed to show the structure of sources or schemas in the current project organized by source types as shown in Figure 1-6.

Along with the Cataloging, JCL conversion and COBOL conversion processes, the current processing source file is highlighted in the source tree.

For DB conversion and File conversion, the current processing db schema or file schema is highlighted in the schema list.

Figure 1-6 Sample of Progress Monitor View



Migration Process Cheat Sheet

The Plug-in has a Migration Process Cheat Sheet to guide you though the conversion tasks step-by-step. To open the cheat sheet click "**Help->Cheat Sheets**" on main menu, and then select the cheat sheet **Create ART migration project for STDB2ORA sample** under ART group.

This cheat sheet demonstrates how to perform Mainframe artifacts migration by using the Tuxedo ART Workbench Eclipse Plug-in. After ART project creation, all Tuxedo ART Workbench functions (including cataloging, converting VSAM files, converting DB2 schemas, converting COBOL and JCL sources), can be done in Eclipse.

Eclipse Preferences

Some Tuxedo ART Workbench global options are set in the Eclipse Preference page. Include following:

Workbench Installation Directory

This global preference will take effect to all ART projects by default.

Menu Items and Tasks

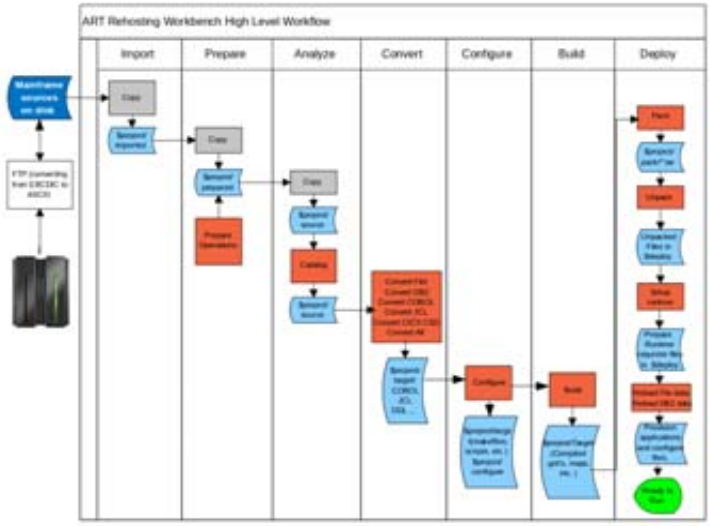
The section provides a general overview of menu items and their associated tasks.

For a more detailed menu item example, see Appendix B: Appendix C: Oracle Tuxedo Application Rehosting Workbench Logs

- Import
- Prepare
- Analyze
- Convert
- Configure
- Build
- Deploy
- Run
- Reset

Figure 1-7 provides an Tuxedo ART Workbench high-level workflow illustration.

Figure 1-7 Tuxedo ART Workbench High-Level Workflow



Import

The process of copying assets into a ART project. User can specify which sub-directory to be imported by using import wizard. These raw files are unchanged in the whole process of the migration.

Prepare

Preparation requires the migration assets are collected and pre-processed for further conversion. It includes the process of updating the format of the original assets, such as file trancoding, remove unrecognized character and file renaming.

Preparation tasks are listed in Table 1-4.

Table 1-4 Preparation Tasks

Task	Description	Source Assets	Output
Execute custom script before prepare steps	Special task customized by user can be executed before preparation process.	User specified scope.	Custom scripts are executed before preparation.
MBCS code page conversions	Convert the multiple-byte characters in EBCDIC encoding to multiple-byte characters in ASCII-based encodings.	All	All files are converted into ASCII-based encodings.
dos2unix conversion	Convert files from DOS format (using 0x0D0A as newline) to UNIX format (using 0x0A as newline).	All	All Windows returns are replaced by UNIX returns.
Rename source file name to UPPER CASE	Change file name (exclude extension) to UPPER CASE.	All	All files are UPPER CASE named with lower case postfix.
Execute custom script after prepare steps	Special task customized by user can be executed after preparation process.	User specified scope	Custom scripts are executed after preparation.

Analyze

Populate the source assets and generate analyze reports.

Analysis tasks are listed in Table 1-5.

Table 1-5 Analysis Tasks

Task	Description	Source assets	Outputs
Configure scope	The detailed configuration items are showed in wizard.	all	Assets description file (named system.desc)

Table 1-5 Analysis Tasks

Task	Description	Source assets	Outputs
Convert COBOL format.	Convert COBOL and COPY BOOKS into free format.	COBOL/COPY BOOKS	Free format files, and ".orig" files
Catalog the source assets	All the source assets defined in file system.desc will be cataloged.	all	POB repository Reports

Convert

Convert phase supports incremental conversion for COBOL conversion and JCL conversion, the incremental conversion is based on the timestamp of a POB file and the corresponding target file, conversion for a POB file is only done when its timestamp is newer than corresponding target file. However, Convert phase doesn't support incremental conversion for RDBMS and FILE conversion because of the difference of underlying mechanism between them.

Conversions tasks are listed in Table 1-6.

Table 1-6 Conversation Tasks

Task	Description	Source assets	Outputs
Convert File Definitions	Generate the components used to migrate z/OS files.	Datamap.re and mapper.re	Unloading and reloading programs.
Convert DB Schema	Generate the components used to migrate z/OS DB2 databases.	POB repository.	Translated DDL scripts. Unloading and reloading programs.
Convert COBOL Components	Convert COBOL programs from z/OS COBOL to Micro Focus COBOL or COBOL-IT.	POB repository.	Translated COBOL programs.
Convert JCL Components	Translates z/OS JCL files into Unix/Linux shell scripts using the Korn shell syntax.	POB repository.	Korn shell programs.
Convert CICS CSD	Convert RDO to resource description.	RDO files	Translated RDO files.

Note: "Convert File Definitions" also include "buffer converter" and "reverse converter". By default, those two converters are disabled; they can be enabled in project properties page.

Configure

In this step, the default build scripts, tuxedo configure file, CICS and Batch runtime environment configure file are generated. It can be customized with user specified option through wizards under configure menu.

Configuration tasks are listed in Table 1-7.

Table 1-7 Configuration Tasks

Task	Description	Configurable Options	Output
Configure build settings	Generate makefiles for each target components directory and a root makefile.	Databases options. COBOL compiler options. ART CICS pre-processor option and so on.	Makefiles under target directory.
Configure tuxedo domain	Generate ubbconfig template	IPC KEY, Machine Name and other ubb configurations.	ubbconfig.em ubbconfig.null ubbconfig.tsam
Configure CICS runtime	Generate ubbconfig and setenv file for CICS runtime	CICS Runtime location and Monitor settings and so on.	ubbconfig, setenv and other files in configure/CICS_RT directory
Configure Batch Runtime	Generate ubbconfig and setenv file for Batch runtime	Batch Runtime location, JESROOT and Monitor settings and so on.	ubbconfig, setenv and other files in configure/BATCH _RT directory
Configure IMS Runtime	Generate ubbconfig and setenv file for IMS runtime	IMS Runtime location, Monitor settings and so on	ubbconfig, setenv and other files in configure/IMS_RT directory

Note: Currently, only the connection to Oracle Database as a client is supported. The connection string is "`sqlplus user/password@connect_identifier`".

Build

In this step, database schema will be created; application components, data reloading programs, data access programs, tuxedo configuration file will be compiled.

Build tasks are listed in Table 1-8.

Table 1-8 Tasks

Task	Description	Outputs
Create database schema	In case of using database, database schema will be created in this step.	Tables and other database objects will be created in the target database.
Build application components	COBOL source files (include Batch and CICS) and BMS files will be compiled.	Binary files under target component directory.
Build data reloading programs	Data reloading programs will be compiled.	Binary files under target reload directory.
Build data access programs	Data access programs will be compiled.	Binary files under target DML directory.
Build tuxedo configuration file	Tuxedo configuration file will be compiled.	Binary tuxedo configuration file (named tuxconfig) under deploy directory (BATCH_RT/config/tux/ and CICS_RT/config/tux)

Deploy

The process of packing the converted asset and un-pack on the target platform if it is the local machine.

Deployment tasks are listed in Table 1-9.

Table 1-9 Deployment Tasks

Task	Description	Outputs
Pack target	Including all of the converted files, generated makefiles, KIX resource files and ARTJES configuration file.	Tar files in pack directory.
Deploy application	Untar the package under the specified directory.	Files in deploy directory.
Setup runtime	Create necessary components for runtime, more specifically, create required directories, create TLOG, create /Q for JES, IMS, etc.	Files in sub-directories IMS_RT, BATCH_RT, and CICS_RT under deploy directory.
Reload file data	Reload file data into specified directory.	Files in location where user specified in the wizard.
Reload DB2 data	Reload db2 data into Oracle database.	Data in Oracle database.

Run

The process of running the converted application on the target platform for testing. Missing "Run tasks are listed in Table 1-10.

Table 1-10 Run Tasks

Task	Description	Outputs
Start/Stop CICS Runtime	Set environment for CICS Runtime. Start/shutdown the Tuxedo domain configured for CICS Runtime.	ART CICS Runtime. Domain starts/stopped.
Start/Stop Batch Runtime, Manipulate Jobs	Set environment for Batch Runtime. Start/shutdown the Tuxedo domain configured for Batch Runtime. Submit/cancel/hold/release/purge/restart jobs, view job log, etc.	ART Batch Runtime. Domain starts/stopped. Job properties are listed
Start/Stop IMS Runtime	Set environment for IMS Runtime. Start/shutdown the Tuxedo domain configured for IMS Runtime.	ART IMS Runtime. Domain starts/stopped.

Reset

Roll back the specified steps. Reset tasks are listed in Table 1-11.

Table 1-11 Reset Tasks

Task	Description
Clean Import	Undo the process "Import". All the files in $project/imported directory will be removed.
Clean Prepare	Undo the process "Prepare". All the files in $project/prepared directory will be removed.
Clean Source	Undo the process "Analyze". All the files in $project/source directory will be removed.

Table 1-11 Reset Tasks

Task	Description
Clean POB Repository	Clean all the pob files in $project/source directory.
Clean Target	Undo the process "Convert". The output of converting steps will be removed.
Clean Configuration	Undo the process "configure". ubbconfig, setenv and other configuration files will be removed.
Clean Build Binaries	Undo the process "build". The output of building steps will be removed.
Clean All	Undo all of the above process. Remove all the files except files in $project/param and $project/scripts.

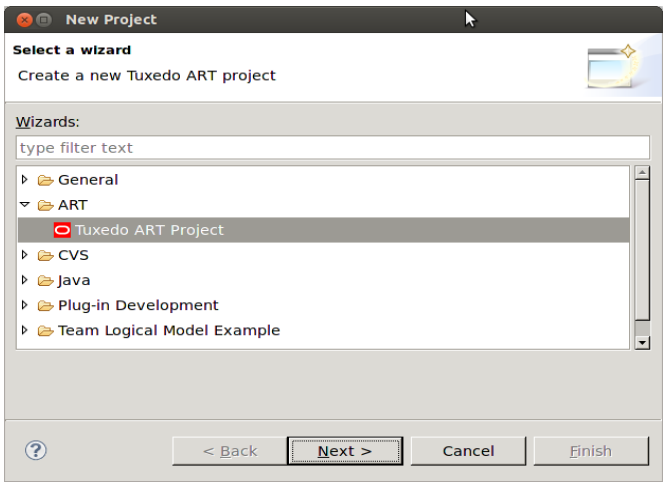
Detailed Rehosting Methodology

Creating an ART Project

You must create a new ART Project though New Project Wizard. Do the following:

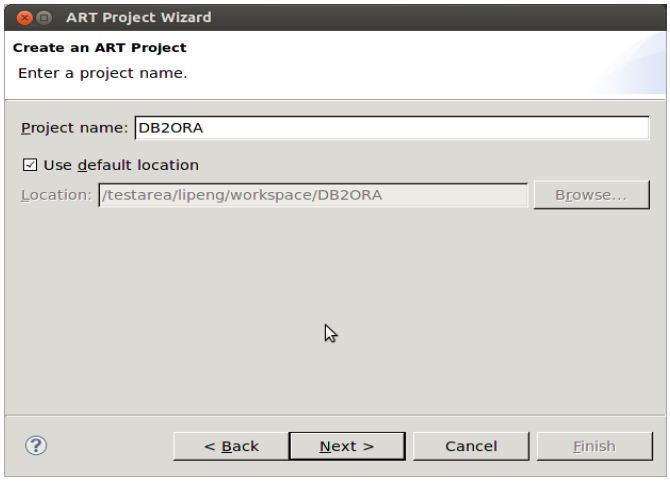
1. Select a wizard as shown in Figure 1-8.

Figure 1-8 Select a Wizard



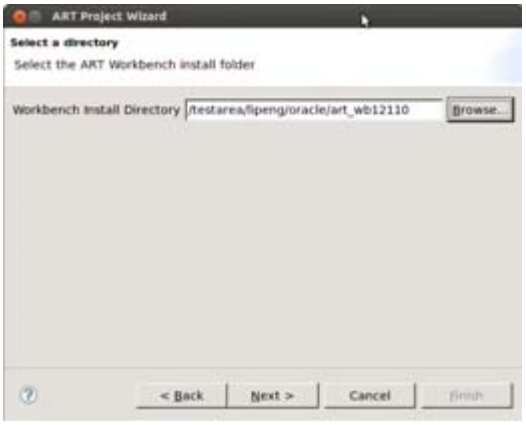
2. Designate the project name as shown in Figure 1-9.

Figure 1-9 Project Name



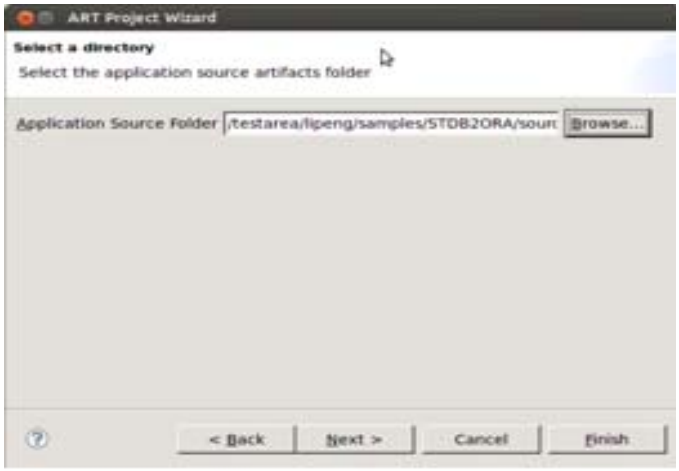
3. Specify the Tuxedo ART Workbench install directory as show in Figure 1-10.

Figure 1-10 Select the Workbench install Directory.



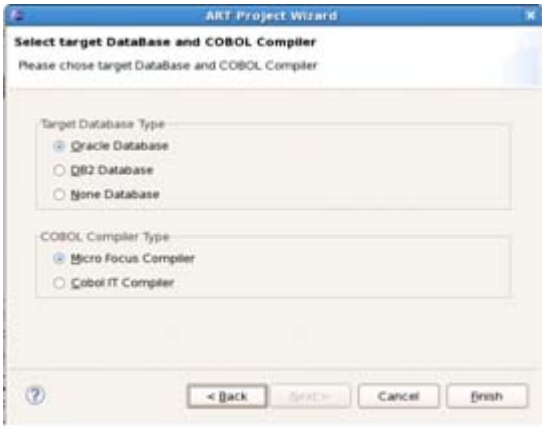
4. Spectify the root directory which contains source files as shown in Figure 1-11.

Figure 1-11 Specify Root Directory Source Files



5. Specify taarget database and COBOL compiler shown in Figure 1-12.

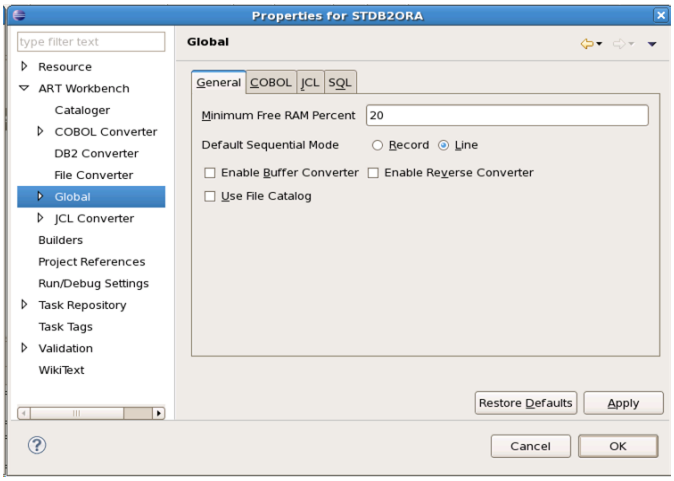
Figure 1-12 Choose Database and Compiler



Configuring Project Properties

After creating a new ART project, you must configure the project properties in the project properties page as shown in Figure 1-13.

Figure 1-13 Project Properties Page



Most of the configurable options in Tuxedo ART Workbench can be configured in the project properties pages. It provides an easy way for to view and modify Tuxedo ART Workbench

configuration options. Those options are organized by type. For more information, see "Description of Configuration Files" in the Tuxedo ART Workbench Reference Guide.

Import

This section provides information how to use the Eclipse plug-in import wizard.

All the sub-directories of the directory which you specified while creating project will be showed in first column of table; you can click second column to import or not import related sub-directory; the last column is the status of importing, it will display "Yes" if this sub-directory has be imported before, otherwise it display "No".

If users have done the analyze and/or convert phases for imported source files, and then re-run the import wizard to import new source files or new sub-directories containing source files, only the later imported source files will be processed in analyze phase, that is incremental processing, unless users have to clean the output of analyze phase.

Prepare

This section provides information and instructions regarding how to use the Eclipse plug-in preparation wizard.

Execute Custom Script Before Prepare Steps

A custom script is automatically executed by the interpreter before the preparation process; it is called using the directory path as an argument.

If multiple directories are selected, the custom script is executed multiple times, using the directory path as the argument each time.

The standard output and standard custom script execution errors are dumped to the logfile.

MBCS Code Page Conversion.

EBCDIC-based encoding is used on IBM mainframes. ASCII-based encoding is used on open systems.

You can use this utility to convert the multiple-byte characters in EBCDIC encoding (e.g., IBM-1390) to multiple-byte characters on open system (e.g., Shift-JIS). The encoding names used in ICU are the same as the ones used by iconv, which is a common utility in UNIX/Linux, so you can retrieve encoding names easily by reading `iconv` online help.

Tip: Type command "`uconv -l`" in the shell lists encoding names.

dos2unix Conversion

The newline marker is different between DOS systems (using `0x0D0A`) and UNIX/Linux systems (using `0x0A`).

You can use this utility to convert text files in DOS format to UNIX/Linux format.

Rename Source File Name to UPPER CASE

It provides a function to change file name (exclude extension) to upper case.

Execute Custom Script after prepare steps

It does the task similar with "Execute Custom Script before prepare steps". The script in here applies on source files which have already been processed by preparation tasks.

Analyze

This section aims to:

- Provide information and instructions about how to use Tuxedo ART Workbench Cataloger.
- Help you to configure and run Tuxedo ART Workbench Cataloger tools.
- Show how to verify the results by interpreting messages and status information.

This guide includes information about the following:

- How to use Tuxedo ART Workbench Cataloger within the whole migration process.
- Best practices on how to prepare assets to be migrated, organize work spaces and effectively use Tuxedo ART Workbench tools.

Note: These practices and methodologies are not part of Tuxedo ART Workbench product but are presented in this guide to help new users. You can proceed otherwise, customize Tuxedo ART Workbench in your own way and develop your own methods.

The Tuxedo ART Workbench Cataloger is described in the following sections:

- Skills
- Requirements & Prerequisites

- Overview of the Cataloger in the Replatforming Process
- Cataloging Steps
- Using the Make Utility
- Clean POB Repository

Skills

Migration Process and Concepts

You should understand the processes, concepts and terminology used by Tuxedo ART Workbench Cataloger; know the inputs, outputs and configuration expected by the Cataloger and how it analyzes all the components separately and together to determine whether the asset is consistent and can be migrated.

The Tuxedo ART Workbench Reference Guide describes precisely all features of the Cataloger. Read at least the three first sections of the Cataloger chapter for an introduction to the concepts, terminology, inputs and outputs, and configuration.

UNIX/Linux Skills

UNIX/Linux skills are required to work correctly on the migration platform environment and perform certain actions accompanying the cataloguing process. You need to know:

- The standard Unix/Linux commands to create, modify, display and delete configuration files and output files.
- The standard Unix/Linux commands and specialized scripts (shells, makefile, cvs) to store and manage the original z/OS asset before and after cataloging.
- A set of commands (shell, makefile) to start, monitor and terminate the execution of Tuxedo ART Workbench Cataloger.

z/OS Skills

You should be able to identify and understand z/OS components and programming languages. General skills in z/OS environment (COBOL, files, DB2, CICS, JCL, utilities) are sufficient.

Requirements & Prerequisites

Preparing the Migration Platform

The migration platform is the platform on which the Tuxedo ART Workbench migration tools execute, including the Cataloger. This platform is based on Linux running on an Intel-compatible hardware platform.

Before performing any action, Tuxedo ART Workbench should be installed and configured according to specifications and requirements detailed in the Oracle Tuxedo Application Rehosting Workbench Installation Guide.

Configure Scope

This section describes the usage of configure scope wizard. All the imported sub-directories will be showed in first column of the table.Plug-in can detect source types automatically in some case, the rules are as follow.

1. (1) Plug-in only identifies the source type of each sub-directory with built-in file suffix.

   `*.cpy` - COPYBOOK

   `*.cbl` - COBOL Source Program, including CICS, Batch and Sub

   `*.jcl` - JCL Script

   `*.bms`, `*.map` - BMS Map

   `*.sql`, `*.ddl`, `*.db2` - SQL Scripts

   `*.sysin` - SYSIN files

   `*.rdo` - RDO files

   `*.proc`, `*incl` - JCL libraries

2. Under each sub-folder of source, it's recommended that there is only one kind of source files with only one known suffix mentioned above, so that the analyze wizard can identify the source type of each sub-directory, otherwise users may need to specify the directory type and the suffix or suffix list of the source files for such sub-folders. The rule for source type detection and the rule for specifying source suffix are described in following items.

Suffix	Type
*.jcl	JCL
*.bms, *.map	BMS
*.ddl, *db2, *.sql	SQL-Script
*.sysin	JCL-Sysin
*.proc	CL-Lib(Proc)
*.incl	JCL-Lib(Include)
*.cpy	COBOL-Library
*.cbl	COBOL-Batch, COBOL-TPR, COBOL-Sub, COBOL-IMS
*.rdo	RDO

Whenever a known suffix is found, the analyze wizard stops searching and determines the source type of the sub-directory as the type corresponding to the found suffix.

3. The source type of a sub-directory will be determined by checking whether there are files with one of the known suffix in following suffix order:

   Whenever a known suffix is found, the analyze wizard stops searching and determines the source type of the sub-directory as the type corresponding to the found suffix.

4. If a sub-directory is given a source type by the analyze wizard based on the rule in item (3), but end users know there are other source files of same type with different suffix, end users need to specify a list of suffix in the analyze wizard. For example, end users can specify "*.ddl, *.sql" to indicate to the analyze wizard that the source files with suffix "ddl" or suffix "sql" are all SQL scripts.

5. If a sub-directory is given a source type by the analyze wizard, but end users know it's not correct. That's, the naming convention of the source assets are not matching with the pre-defined naming rule by ART life cycle. In this case, end users need to specify correct type for the sub-directory and specify which suffixes correspond to this type.

6. If a sub-directory can't be given a source type because it doesn't contain any source files with any one of known suffix, end users have to firstly specify the type of the sub-directory, then

specify one or more suffix so that analyze wizard can identify which source files belong to this type.

7. Normally end users specify a suffix like "*.xxx", it works in most cases. However, if some source files expected to be processed actually don't have suffix, a special pattern, "NULL", has to be used by end users to specify that there is not suffix. Besides, end users need to specify the directory type. Then, source files without suffix will be renamed by adding a suffix according to the specified source type.

   User can enable or disable processing of each sub-directory by clicking the last column of the table.

   There are many options appeared while clicking "Advanced settings for sub-directory". To make the clear meaning of each option, refer to "Cataloger" section in the Oracle Tuxedo Application Rehosting Workbench Reference Guide

Overview of the Cataloger in the Replatforming Process

This section describes the inputs and outputs of the Cataloging step and dependencies with other migration steps in the replatforming process.

Simple Sample Application

In order to illustrate all of the migration activities performed and how to use Tuxedo ART Workbench Cataloger to determine whether the asset is consistent and can be migrated to the target platform, the Simple Application `STFILEORA` will be used. `STFILEORA` is provided with Tuxedo ART Workbench set of tools.

Cataloging Migration Steps

Description of the cataloging operations shown in the graphic:

1. Read the configuration files and the description of the source files prepared for cataloging
2. Parse each of the components in the source asset and create an internal representation called packed object base (with extension .pob). Identify internal inconsistencies in these components (e.g. syntax error or reference to an undeclared variable);
3. Compute cross-reference relationships between these components, such as a CALL statement from a COBOL program to a COBOL sub-program;
4. Identify mutual inconsistencies in these relationships, such as a CALL statement referencing a sub-program missing from the asset, or an SQL table referenced by none of the COBOL programs in the asset (unused component);

5. Create CSV-format reports listing all the components in the asset, together with their status (missing, unused or correct) and all the anomalies (inconsistencies) detected above.

The operations described above are explained in more detail in the next sections.

Cataloging Steps

Building-up an Asset

This step is a pre-requisite for the Cataloger and, as mentioned in the Oracle Tuxedo Application Process Guide that gives an overview of the whole migration process, it is up to the user of Tuxedo ART Workbench to gather these source files on the source platform, transfer them to the migration platform, install them in an appropriate file structure and prepare them for migration.

Building up the asset consists of several steps from getting sources to organizing them to be available as a valid input to the Cataloger tool:

1. Gathering sources to be migrated from z/OS
2. Transfer the sources to Tuxedo ART Workbench platform
3. Dispatch and prepare sources by types as they are expected by the Cataloguer

   Organize components by type: put all CICS programs in one directory that could contain sub-directories, the same applies for COBOL includes, Batch programs, Jobs, etc.
4. Some other actions may be required: such as clean components from certain characters or lines added after the extraction from z/OS or during the transfer.

Initialization and Configuring the Working Environment

As Tuxedo ART Workbench Cataloger is the first tool of the Oracle Tuxedo Application Workbench suite used in the migration process, a general configuration step for the whole project to be performed is explained here.

Configuration Objectives

- Reduce the time needed to prepare the working environment and avoid further possible errors due to configuration.
- Initialize the configuration for other WorkBench tools not only for the Cataloger.
- Recommend a standard organization to facilitate team work.

Recommended File Structure

The more organized and standardized the working space, the more migration tasks will be easier and automated.

In the following sample we illustrate a typical organization and we recommend working with the same structure.

Listing 1-1 Sample Application Hierarchy

```
SampleApp
|-- Logs
|-- param
|   `-- system.desc
|-- source
|   `-- makefile
|-- trf
|-- tools
|-- tmp
```

The contents of each directory are:

- Source

  Contains all sources to be migrated and prepared as input for Tuxedo ART Workbench tools.

  Workspace where all Tuxedo ART Workbench processes can find the source code.

- param

  Contains all configuration files (parameters and hints for use by Tuxedo ART Workbench tools).

- Logs

  Working directory where all Tuxedo ART Workbench tools are launched, all log files are generated

- tools

  Directory to place specific tools developed by the user during the migration process.

- trf

  Directory where conversion results are generated.

- tmp

  Directory where temporary and intermediate files generated during conversion operations are placed.

Setting Environment and Working Variables

It is recommended that each time you work on a project using Tuxedo ART Workbench to set certain environment variables that will be useful later. The only environment variable that is mandatory is `REFINEDISTRIB`; others can be used for simplification reasons.

Table 1-12 explains the usage of proposed variables.

Table 1-12 Rehosting Workbench Environment Variables

Variable	Value	Usage
`REFINEDISTRIB`	`Linux64, or Linux32`	Specifies the architecture of Tuxedo ART Workbench binary files.
`PROJECT`	`${HOME}`	Project root within the workspace. HOME is used for training. But value should be something like /project/SampleApp
`CVSROOT`	`${PROJECT}/CVS_DELIVRY`	CVS repository to use containing the source and configuration files.
`LOGS`	`${PROJECT}/Logs`	Structure where Tuxedo ART Workbench logs are stored
`PARAM`	`${PROJECT}/param`	Directory where the parameter files are stored
`SOURCE`	`${PROJECT}/source`	Structure where the source files to translate are stored
`REFINEDIR`	`/<InstallDir>/refine`	Root of Tuxedo ART Workbench binaries and utilities
`PHOENIX`	`${REFINEDIR}`	Variable used by Tuxedo ART Workbench

Table 1-12 Rehosting Workbench Environment Variables

Variable	Value	Usage
TMPPROJECT	${PROJECT}/tmp	Temporary structure for R4Z Tuxedo ART Workbench
PATH	${PATH}:/platform/Tools	PATH complement

In the Simple Application example project, we use a setting file named $PROJECT/.project that contains all initializations using an export Linux command. This file is to be executed each time a new Linux session is opened to work in the project

Listing 1-2 Extract from Simple Application .project File:

```
echo "Welcome to SampleApp"
export GROUP=refine
export PROJECT=${HOME}/SampleApp
export LOGS=${PROJECT}/Logs
export SOURCE=${PROJECT}/source
export PARAM=${PROJECT}/param
export REFINEDIR=/product/art_wb11gR1/refine
export PHOENIX=${REFINEDIR}
export TMPPROJECT=${PROJECT}/tmp
export REFINEDISTRIB=Linux64
```

Project Initialization Summary

To initialize a new project, proceed as follow:

1. Create a file structure as described above.
2. Copy a sample of the configuration (system.desc, version.mk, options-catalog, etc.) files from Simple Application to `$PROJECT/param` directory to make any necessary modifications.

3. Copy the makefile from the source (SimpleApp) into `$PROJECT/source`.
4. Create a file `.project` under `$PROJECT` and initialize it with variables listed in Setting Environment and Working Variables. Variables in the file are to be exported each time you work on the project.
5. Copy the prepared source files to `$PROJECT/source`
6. Optional: Manage the source and configuration files under CVS.

Configuration

You need to set at least two configuration files, additional configuration files are described in the advanced usage section.

The two configuration files needed by the Cataloger are:

- System description file
- General option file

System Description File

The system description file is the main configuration file for Tuxedo ART Workbench tools.

For the Simple Application example:

- The system-name is SampleApp
- The path where sources to be migrated are stored is `../source`
- To inform the Cataloger of the location of the global options file you can use relative or absolute naming but it is recommended to use an absolute path when you have multiple source environments to migrate.

  `global-options catalog = "../param/options-catalog.desc".`
- Then add entries for each directory containing components to be catalogued.

Listing 1-3 System Description for Simple Application

```
system SampleApp root "../source"

global-options

  catalog="../param/options-catalog.desc",
```

```
  no-END-Xxx.
DBMS-VERSION="8".
% Copies
directory "COPY" type COBOL-Library files "*.cpy".
% DDL
directory "DDL"  type SQL-SCRIPT files "*.ddl".
% Batch
directory "BATCH" type COBOL-Batch files "*.cbl" libraries "COPY". %,
"INCLUDE".
% Cics COBOL Tp
%
directory "CICS" type COBOL-TPR files "*.cbl" libraries "COPY". %,
"INCLUDE".
```

Global Options

The purpose of the Cataloger options file is to give the Cataloger additional information that will influence its behavior.

In the Simple Application example we use only three options, of course other options can be used; see the Tuxedo ART Workbench Reference Guide for a full list of options.

Listing 1-4 Global Options File for the Simple Application

```
%% Options for cataloging the system
job-card-optional.
```

Executing the Cataloger

One Operation

You can launch the Cataloging with one command; all operations are performed sequentially.

The example command line syntax is:

```
${REFINEDIR}/refine r4z-catalog -s $PARAM/system.desc
```

Where:

- `${REFINEDIR}` is the directory where Tuxedo ART Workbench tools are installed.
- `$(CATALOG)` is the version of the Cataloger to be used
- `$(SYSTEM)` is the path of the system description file.

In our sample the command will be:

From directory `$LOGS/catalog` execute the command:

```
${REFINEDIR}/refine r4z-catalog -s $PARAM/system.desc
```

The execution log is printed on the screen and at the same is redirected in log file under the directory from which you lunched the command.

Step by Step

Parsing

Running this step is useful when you want to check specific programs without waiting for the whole cataloging to see the results.

Listing 1-5 Parsing Examples

```
# parse only one program
${REFINEDIR}/refine r4z-preparse-files -s $PARAM/system.desc
CICS/PGMM000.cbl


# parse a list of programs
# build a list that contains programs with path from source
(CICS/PGMM000.cbl)
```

```
${REFINEDIR}/refine r4z-preparse-files -s $PARAM/system.desc -f
list-of-file
```

Analysis

The result of this step is the binary file named `symtab-SampleApp.pob` that represents inter-component information.

Listing 1-6 Analysis Example

```
cd $LOGDIR/catalog
${REFINEDIR}/refine r4z-analyze -s $PARAM/system.desc
```

Print Reports

In this step information stored in binary files is collected and printed in CSV format reports.

Listing 1-7 Print Reports Example

```
cd $LOGDIR/catalog
$REFINEDIR/refine r4z-fast-final -v M2_L3_3 -s $PARAM/system.desc
```

In the Simple Application reports are generated in `$PROJECT/source/Reports-SampleApp`:

- `report-SAMPLEAPP-Anomalies`
- `report-SAMPLEAPP-COBOL-Copy`
- `report-SAMPLEAPP-COBOL-Programs`
- `report-SAMPLEAPP-JCL-Files`
- `report-SAMPLEAPP-JCL-Jobs`
- `report-SAMPLEAPP-JCL-Sub-Files`
- `report-SAMPLEAPP-SQL-Tables`

- `report-SAMPLEAPP-SQL-Views`
- `report-SAMPLEAPP-Transactions`

The different reports are described in the Oracle Tuxedo Application Rehosting Workbench Reference guide.

Result Analysis and Validation

Using the cataloging reports, you can perform different actions in order to create the exact asset set to be migrated and launch Tuxedo ART Workbench steps: COBOL conversion, JCL translation and Data conversion.

Note: This does not mean that cataloging and conversion activities are strictly sequential, they may overlap.

Inventory

After cataloging each Program, Copy, Job, Include is given a status depending on its use.

Table 1-13 Inventory Status

Status	Description
`CORRECT`	Components are present in source and used: • Copybooks used at least by one program, • Programs used at least by one transaction, by at least one jcl or by at least one program • All jobs are considered as used. • JCL sub-file use at least by one Job. Action: Accept it

Table 1-13 Inventory Status

Status	Description
UNUSED	Component present is source but not used: • Copybooks that are not called by a program • Programs that are not called by a transaction, or by a Job and that are not called as a sub-program by a program, • JCL sub-files that are not used by a Job Action: Decide whether to keep the component or to delete it from asset
MISSING	Component is not present in the asset but at least one reference to it has been found: • Copybooks used at least by one program, • Programs used at least by one transaction, by at least one JCL or by at least one program. • JCL sub-files used by at least one Job Action: Decide whether to add missing components or delete calling components that could be unused or unnecessary.

Anomaly Analysis

All the errors reported in the Anomalies Report must be analyzed:

- FATAL and ERROR severity level anomalies make the component or asset unsuitable for conversion, they must be analyzed and fixed.
- NOTICE and WARNING severity level anomalies should also be analyzed and they can be kept if there is no impact on the conversion.

The asset should be free from severe errors before proceeding to conversion.

Completion Criteria

Cataloging can be considered complete once all expected outputs are generated (pob files and cataloging reports).

As a process, it depends on the context of the project, but generally cataloguing is considered as completed when:

- All Unused and Missing components are either fixed or justified.
- All errors are fixed or justified.

Using the Make Utility

make is a UNIX utility intended to automate and optimize the construction of targets (files or actions).

We highly recommend using make to perform the different operations that compose the migration process because this enables you to:

- Have all (executable) processes documented.
- Effectively manage incremental operations and hence save time.
- Control and check the results of processes.

You should have a descriptor file named makefile in the source directory in which all operations are implemented (a makefile is prepared in the source directory during the initialization of a project).

The following two sections describe the make configuration and how to use the Cataloger functions through make.

Make Configuration

Version.mk

The version.mk configuration file in $PARAM is used to set the variables and parameters required by the make utility.

In this file specify where each type of component is installed and their extensions, and the versions of the different tools to be used. This file also describes how the log files are organized.

Listing 1-8 Extract From version.mk for Simple Application

```
 Root =  ${PROJECT}
#
# Define directory Project
#
Find_Jcl = JCL
Find_Prg = BATCH
Find_Tpr = CICS
```

```
Find_Spg =
Find_Map = MAP
SCHEMAS = AV
…
#Logs organisation
#
LOGDIR                := $(LOGS)
CATALDIR              := $(LOGS)/catalog
PARSEDIR              := $(LOGS)/parse
TRADJCLDIR            := $(LOGS)/trans-jcl
TRADDIR               := $(LOGS)/trans-cbl
DATADIR               := $(LOGS)/data
…
```

MakeFile

The contents of the `makefile` summarize the tasks to be performed:

- Including vesion.mk
- Controlling if the main variables are set
- Collecting the value of variables and building the required lists to process.
- Implementing the targets.

The makefile provided with the Simple Application is auto-documented.

Parsing

Parsing All Programs

From the `$SOURCE` directory execute the command:

```
> make pob
```

The log file is generated in `$LOGS/parse`

Check Need to Be Parsed

```
>  make pob VERIF=TRUE
```

```
Check: Parse of BATCH/PGMMB02.cbl Need Process.. To obtain
BATCH/pob/PGMMB02.cbl.pob
```

Parsing of One Program

Sample: parsing the program `BATCH/PGMMB02.cbl`

```
>  make BATCH/pob/PGMMB02.cbl.pob
```

The log file is generated in `$LOGS/parse`

Cataloging

To launch cataloging use:

```
make catalog
```

The log file is generated in `$LOGS/catalog`

Advanced Usage of Make

To Add or Update a Target

You can update the makefile to add some targets or to update existing ones.

For example, if you developed you own script (`report.sh`) to generate a customized report based on basic cataloguing reports, place your script in `$TOOLS` directory.

The makefile can be modified as follow:

- To add a new target to execute the new script:

  ```
  Reporting:
  ```

  ```
  @${TOOLS}/report.sh
  ```

- To update existing catalog target

  ```
  catalog:
  ```

  ```
          @$(REAL_CMD) ${REFINEDIR}/refine r4z-catalog -v $(CATALOG) -s
  $(SYSTEM) $(LOG_FILE_FLAGS_CAT)
  ```

  ```
  @make reporting
  ```

  Your customized report will be updated automatically after each catalog execution.

Debugging the Make Target

Sometimes a command through make cannot work properly because of a lack of configuration.

Proceed as follow:

1. Copy the used makefile to debug copy (makfile.debug), to not disturb current operations.
2. Modify makefile.debug changing `REAL_CMD` to COMMENT

```
catalog:
        @$(COMMENT) ${REFINEDIR}/refine r4z-catalog -v $(CATALOG) -s
$(SYSTEM) $(LOG_FILE_FLAGS_CAT)
```

Using the Command with Option VERIF=TRUE

```
> make catalog VERIF=TRUE -f makefile.debug
```

The command to be executed is printed = after replacement of all variables.

Clean POB Repository

Convert

- File-to-File Migration Process
- The File-to-Oracle Migration Process
- The File-To-Db2/luw (UDB) Migration Process
- The DB2-to-Oracle Migration Process

File-to-File Migration Process

Migrating data files is described in the following sections:

- File Organization
- Initializing the Process
- Preparing the Environment
- Generating the Components

File Organization

When migrating from a z/OS source platform to a target platform, the first question to ask, when VSAM is concerned, is whether to keep a file or migrate the data to an Oracle table.

The Tuxedo ART Workbench File-to-File converter is used for those files that keep their source platform format (sequential, relative or indexed files) on the target platform. On the target platform, these files use a target COBOL (Micro Focus COBOL/COBOL-IT) file organization equivalent to the one on the source platform.

Table 1-14 lists the file organizations handled by z/OS and indicates the organization proposed on the target platform:

Table 1-14 z/OS to UNIX File Organizations

z/OS Source File	UNIX ISAM Target File
QSAM	Line sequential ISAM
VSAM KSDS	Indexed ISAM
VSAM RRDS	Relative ISAM
VSAM ESDS	Line sequential ISAM

Note: The conversion of z/OS files to ISAM UNIX files has no direct link to the conversion of COBOL application programs or the translation of JCL.

PDS File Organization

Files that are part of a PDS are identified as such by their physical file name, for example: METAW00.NIV1.ESSAI(FIC).

An unloading JCL adapted to PDS is generated in this case. The source and target file organizations as indicated in the above table are applied.

GDG File Organization

Generation Data Group (GDG) files are handled specially by the unloading and reloading components in order to maintain their specificity (number of GDG archives to unload and reload). They are subsequently managed as generation files by Oracle Tuxedo Application Runtime Batch (for more information, see the Oracle Tuxedo Application Runtime Batch Reference Guide). On the target platform these files have a LINE SEQUENTIAL organization.

Migration Process Steps

The principle steps in the File-to-File migration process, explained in detail in the rest of this chapter, are:

1. Create an overall list of the files to be migrated.
2. List those files that will not be converted to Oracle tables.
3. For each of these files, create a file description.
4. When necessary, create a list of discrimination rules.
5. Prepare the environment to be used to generate the components.
6. Using Tuxedo ART Workbench generate the components used in the following steps.
7. Unload the data from the source platform.
8. Transfer the data to the target platform.
9. Transcode and reload the data.
10. Check the results.

Initializing the Process

This section describes the steps to be performed before starting the file migration.

Requirements

The migration of z/OS files to UNIX/Linux is dependant on the results of the Tuxedo ART Workbench Cataloger (for more information, see Analyze). It does not have any impact on the conversion of COBOL components or the translation of JCL components.

Listing the Files to Be Migrated

The first task is to list all of the files to be migrated, for example, the permanent files input to processing units that do not come from an Oracle table.

File Descriptions and Managing Files With the Same Structure

For each candidate file for migration, its structure should be described in COBOL format. This description is used in a COBOL copy by the Tuxedo ART Workbench COBOL converter, subject to the limitations described in COBOL Description.

Once built, the list of files to migrate can be purged of files with the same structure in order to save work when migrating the files by limiting the number of programs required to transcode and reload data.

Using the purged list of files, a last task consists of building the files:

- `Datamap-<datamap name>.re`
- `mapper-<mapper name>.re`

Note: The `populate.sh` utility (located in `REFINEDIR/scripts/file/populate.sh`), can be used to help generate these two configuration files automatically. For more information, see `REFINEDIR/scripts/file/README.txt`.

COBOL Description

A COBOL description is related to each file and considered as the representative COBOL description used within the application programs. This description can be a complex COBOL structure using all COBOL data types, including the OCCURS and REDEFINES notions.

This COBOL description will often be more developed than the COBOL file description (FD). For example, an FD field can be described as a PIC X(364) but really contain a three times defined area including, in one case a COMP-3 based numerals table, and in another case a complex description of several characters/digits fields etc.

It is this developed COBOL description which describes the application reality and therefore is used as a base to migrate a specific physical file.

The quality of the file processing execution depends on the quality of this COBOL description. From this point, the COBOL description is not separable from the file and when referring to the file concerned, we mean both the file and its representative COBOL description. The description must be provided in COBOL format, in a file with the following name:

```
<COPY name>.cpy
```

Note: If a copy book on the source platform provides a detailed description of the file, the copy can be directly used and declared in Tuxedo ART Workbench .

COBOL Description Format

The format of the COBOL description must conform to the following rules:

- Only one level 01.
- The word FILLER is not allowed.
- Fields names must be unique.

- Some words are reserved. A list is supplied in the Appendix of the Tuxedo ART Workbench Reference Guide.
- The description should begin in column 1 without any preceding COBOL sequence numbers.
- Comments may be inserted by placing an * in column 1.
- Field level numbers can start from column 2.

Example

Column																									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	..
*	D	E	S	C	R	I	P	T	I	O	N		O	F		F	I	L	E		X	X	X	X	
	0	1		F	V	1	4	.																	
			0	5		F	V	1	4	x	1		P	I	C		X	.							

COBOL Description and Related Discrimination Rules

Within a COBOL description there are several different ways to describe the same memory field, which means to store objects with different structures and descriptions at the same place.

As the same memory field can contain objects with different descriptions, to be able to read the file, we need a mechanism to determine the description to use in order to interpret correctly this data area.

We need a rule which, according to some criteria, generally the content of one or more fields of the record, will enable us to determine (discriminate) the description to use for reading the re-defined area.

In Tuxedo ART Workbench this rule is called a discrimination rule.

Any redefinition inside a COBOL description lacking discrimination rules presents a major risk during the file transcoding. Therefore, any non-equivalent redefined field requests a

discrimination rule. On the other hand, any equivalent redefinition (called technical redefinition) must be subject to a cleansing within the COBOL description (see the example below).

The discrimination rules must be presented per file and highlight the differences and discriminated areas. Regarding the files, it is impossible to reference a field external to the file description.

The following description is a sample of a COPY as expected by Tuxedo ART Workbench :

Listing 1-9 COBOL COPY Sample

```
01 FV14.
       05     FV14-X1       PIC X.
       05     FV14-X2       PIC XXX.
       05     FV14-X3.
              10 FV14-MTMGFA       PIC 9(2).
              10 FV14-NMASMG       PIC X(2).
              10 FV14-FILLER       PIC X(12).
              10 FV14-COINFA       PIC 9(6)V99.
       05 FV14-X4 REDEFINES FV14-X3.
              10 FV14-MTMGFA       PIC 9(6)V99.
              10 FV14-FILLER       PIC X(4).
              10 FV14-IRETCA       PIC X(01).
              10 FV14-FILLER       PIC X(2).
              10 FV14-ZNCERT.
                     15 FV14-ZNALEA       COMP-2.
                     15 FV14-NOSCP1       COMP-2.
                     15 FV14-NOSEC2       COMP-2.
                     15 FV14-NOCERT       PIC 9(4)COMP-3.
                     15 FV14-FILLERPIC X(16).
       05     FV14-X5 REDEFINES FV14-X3.
```

```
            10 FV14-FIL1  PIC X(16).
            10 FV14-MNT1  PIC S9(6)V99.
      05    FV14-X6 REDEFINES FV14-X3.
            10 FV14-FIL3         PIC X(16).
            10 FV14-MNT3         PIC S9(6).
            10 FV14-FIL4         PIC X(2).
```

The discrimination rules are written in the following format:

Listing 1-10 COBOL COPY Discrimination Rules

```
Field FV14-X3
Rule if FV14-X1 = “A”                    then  FV14-X3
elseif FV14-X1 = “B”                     then  FV14-X4
elseif FV14-X1 = “C”                     then  FV14-X5
else                                     FV14-X6
```

Note: In the COBOL description, the field FV14-X3 must be the first field to be redefined. The order of subsequent fields: FV14-X4, FV14-X5 and FV14-X6 is not important.

The copy name of the COBOL description is: `<COPY name>.cpy`

Redefinition Examples

Non-Equivalent Redefinition

Listing 1-11 Non-equivalent Redefinition Example

```
01 FV15.
       05 FV15-MTMGFA             PIC 9(2).
       05 FV15-ZNPCP3.
```

```
            10 FV15-NMASMG       PIC X(2).
            10 FV15-FILLER       PIC X(12).
            10 FV15-COINFA       PIC 9(6)V99.
      05 FV15-ZNB2T REDEFINES FV15-ZNPCP3.
            10 FV15-MTMGFA       PIC 9(4)V99.
            10 FV15-FILLER       PIC X(4).
            10 FV15-IRETCA       PIC X(01).
            10 FV15-FILLER        PIC X(2).
            10 FV15-ZNCERT
                  15 FV15-ZNALEA       COMP-2.
                  15 FV15-NOSCP1       COMP-2.
                  15 FV15-NOSEC2       COMP-2.
                  15 FV15-NOCERT        PIC 9(4)     COMP-3.
                  15 FV15-FILLER        PIC X(16).
```

In the above example, two fields (FV15-ZNPCP3 and FV15-ZNB2T) have different structures: an EBCDIC alphanumeric field in one case and a field composed of EBCDIC data and COMP2, COMP3 data in a second case.

The implementation of a discrimination rule will be necessary to migrate the data to a UNIX platform.

Listing 1-12 Related Discrimination Rules

```
Field FV15-ZNPCP3
Rule if FV15-MTMGFA = 12          then FV15-ZNPCP3
 elseif FV15-MTMGFA = 08 and FV15-NMASMG = "KC" then FV15-ZNB2T
```

Equivalent Redefinition Called Technical Redefinition

Listing 1-13 Technical Redefinition Initial Situation

```
01 FV1.
       05 FV1-ZNPCP3.
              10 FV1-MTMGFA              PIC 9(6)V99.
              10 FV1-NMASMG              PIC X(25).
              10 FV1-FILLER              PIC X(12).
              10 FV1-COINFA              PIC 9(10).
              10 FV2-COINFA REDEFINES FV1-COINFA.
                     15 FV2-ZNALEA       PIC 9(2).
                     15 FV2-NOSCP1       PIC 9(4).
                     15 FV2- FILLER      PIC 9(4).
              10 FV15-MTMGFA             PIC 9(6)V99.
              10 FV15-FILLER             PIC X(4).
              10 FV15-IRETCA             PIC X(01).
              10 FV15-FILLER             PIC X(2).
```

Listing 1-14 Technical Redefinition Potential Expected Results

```
01 FV1.                          01 FV1.
05 FV1-ZNPCP3.                    05 FV1-ZNPCP3.
10 FV1-MTMGFA PIC 9(6)V99.       10 FV1-MTMGFA PIC 9(6)V99.
10 FV1-NMASMG PIC X(25).         10 FV1-NMASMG PIC X(25).
10 FV1-FILLER PIC X(12).         10 FV1-FILLER PIC X(12).
10 FV1-COINFA PIC 9(10).         10 FV2-COINFA.
10 FV15-MTMGFA PIC 9(6)V99.      15 FV2-ZNALEA PIC 9(2).
```

```
10 FV15-FILLER PIC X(4).          15 FV2-NOSCP1 PIC 9(4).
10 FV15-IRETCA PIC X(01).          15 FV2- FILLER PIC X(4).
10 FV15-FILLER PIC X(2).          10 FV15-MTMGFA PIC 9(6)V99.
                                   10 FV15-FILLER PIC X(4).
                                  10 FV15-IRETCA PIC X(01).
                                   10 FV15-FILLER PIC X(2).
```

In the above example, the two descriptions correspond to a simple EBCDIC alphanumeric character string (without binary, packed or signed numeric fields). this type of structure does not require the implementation of a discrimination rule.

Preparing the Environment

This section describes the tasks to perform before generating the components to be used to migrate the data files.

Initializing Environment Variables

Before executing Tuxedo ART Workbench set the following environment variables:

- `export TMPPROJECT=$HOME/tmp`

  — the location for storing temporary objects generated by the process.

  You should regularly clean this directory.

- `export PARAM=$HOME/param`

  — the location of the configuration files.

Implementing the Configuration Files

Three files need to be placed in Tuxedo ART Workbench file structure as described by:

- `$PARAM` for:
  - `db-param.cfg`,
- `$PARAM/file` for:
  - `Datamap-<`*`configuration name`*`>.re`,
  - `mapper-<`*`configuration name`*`>.re`.

For a File-to-File conversion you must create these files yourself.

Note: The Datamap and mapper configuration files must use the same configuration name.

Two other configuration files:

- `file-templates.txt`
- `file-move-assignation.pgm`

are automatically placed in the file structure during the installation of Tuxedo ART Workbench . If specific versions of these files are required for particular z/OS files they will be placed in the `$PARAM/file` file structure.

Configuring the Files

The following examples show the configuration of three files; two QSAM files and one `VSAM KSDS` file. There are no discrimination rules to implement for these files.

Database Parameter File (db-param.cfg)

For the `db-param.cfg` file, the only parameter you may need to modify is the **`target_os`** parameter.

Listing 1-15 db-param.cfg Example

```
# This configuration file is used by FILE & RDBMS converter
# Lines beginning with "#" are ignored
# write information in lower case
# common parameters for FILE and RDBMS
# source information is written into system descriptor file (OS, DBMS=,
# DBMS-VERSION=)
target_rdbms_name:oracle
target_rdbms_version:11
target_os:unix
# optional parameter
target_cobol:cobol_mf
hexa-map-file:tr-hexa.map
```

```
#
# specific parameters for FILE to RDBMS conversion
file:char_limit_until_varchar:29
# specific parameters for RDBMS conversion
rdbms:date_format:YYYY/MM/DD
rdbms:timestamp_format:YYYY/MM/DD HH24 MI SS
rdbms:time_format:HH24 MI SS
# rename object files
# the file param/rdbms/rename-objects-<schema>.txt is automatically loaded
# by the tool if it exists.
```

Mandatory Parameter

`target_os:unix`

Name of the target operating system.

Optional Parameter

`target_cobol:cobol_mf`
: Name of the COBOL language. Accepted values are "`cobol_mf`" (default value) and "`cobol_it`".
In this example, the language is Micro Focus COBOL.

`hexa-map-file:tr-hexa.map`
: Specifies a mapping table file between EBCDIC (z/OS code set) and ASCII (Linux/UNIX code set) hexadecimal values; if `hexa-map-file` is not specified, a warning will be logged.

Datamap Parameter File (Datamap-<configuration name>.re)

Each z/OS file to be migrated must be listed.

The following parameters must be set:

Table 1-15 Datamap Parameters

Parameter	Value in Example	Set By
`configuration name`	FTFIL001 `(data map FTFIL001-map)`	Freely chosen by user.
`system name`	PROJ001 `(system cat::PROJ001)`	Determined during cataloging in the System Description File.
`file name`	PJ01DDD.DO.QSAM.KBCOI001	z/OS physical file name.
`Organization`	Sequential	Source organization

Note: The description of the different parameters used is provided in the Oracle Tuxedo Application Workbench Reference Guide - File To File Convertor.

In the following example, the first two files are QSAM files, the organization is therefore always sequential. The `PJ01AAA.SS.VSAM.CUSTOMER` file is a `VSAM KSDS` file and the organization is therefore indexed. The parameters, `keys offset 1 bytes length 6 bytes primary`, describe the key. In this example, the key is six bytes long starting in position 1.

Listing 1-16 Example Datamap File: Datamap-FTFIL001.re

```
%% Lines beginning with "%%" are ignored


data map FTFIL001-map system cat::PROJ001
%%
%% Datamap File PJ01DDD.DO.QSAM.KBCOI001
%%
file PJ01DDD.DO.QSAM.KBCOI001
organization Sequential
%%
%% Datamap File PJ01DDD.DO.QSAM.KBCOI002
%%
```

```
file PJ01DDD.DO.QSAM.KBCOI002
organization Sequential
%%
%% Datamap File PJ01AAA.SS.VSAM.CUSTOMER
%%
file PJ01AAA.SS.VSAM.CUSTOMER
  organization Indexed
  keys offset 1 bytes length 6 bytes primary
```

Mapping Parameter File (mapper-<configuration name>.re)

Each z/OS file to be migrated, that is included in the Datamap configuration file, must be listed.

The following parameters must be set:

Table 1-16 Mapping Parameters

Parameter	Value in Example	Set By
configuration name	FTFIL001 (ufas mapper FTFIL001)	Identical to the name used in the datamap configuration file.
file name	PJ01DDD.DO.QSAM.KBCOI001	Name used in the Datamap file.
include	include "#VAR:RECS-SOURCE#/BCOAC01E.cpy"	During the generation, the string #VAR:RECS-SOURCE# will be replaced by the directory name where the copy files are located: $PARAM/file/recs-source The name of the copy file BCOAC01E.cpy is freely chosen by the user when creating the file.
map record	map record REC-ENTREE defined in "#VAR:RECS-SOURCE#/BCOAC01E.cpy"	REC-ENTREE corresponds to the level 01 field name in the copy file.

Table 1-16 Mapping Parameters

Parameter	Value in Example	Set By
`logical name`	logical name FQSAM01	Chosen by the user, maximum eight characters. This name is used for naming the objects (COBOL, JCL) created by the different tools in Tuxedo ART Workbench . **Note:** You cannot use hyphens (-) in logical names.
`converter name`	converter name FQSAM01	Same name and use as logical name.

Notes: The description of the different parameters used is provided in the Oracle Tuxedo Application Workbench Reference Guide - File To File Convertor.

Listing 1-17 Example Mapper File: mapper-FTFIL001.re

```
%% Lines beginning with "%%" are ignored
ufas mapper FTFIL001
%%
%% Desc file PJ01DDD.DO.QSAM.KBCOI001
%%
file PJ01DDD.DO.QSAM.KBCOI001 transferred
include "#VAR:RECS-SOURCE#/BCOAC01E.cpy"
map record REC-ENTREE defined in "#VAR:RECS-SOURCE#/BCOAC01E.cpy"
source record REC-ENTREE defined in "#VAR:RECS-SOURCE#/BCOAC01E.cpy"
logical name FQSAM01
converter name FQSAM01
%%
%% Desc file PJ01DDD.DO.QSAM.KBCOI002
%%
```

```
file PJ01DDD.DO.QSAM.KBCOI002 transferred
include "#VAR:RECS-SOURCE#/BCOAC04E.cpy"
map record REC-ENTREE-2 defined in "#VAR:RECS-SOURCE#/BCOAC04E.cpy"
source record REC-ENTREE-2 defined in "#VAR:RECS-SOURCE#/BCOAC04E.cpy"
logical name FQSAM02
converter name FQSAM02
%%
%% Desc file PJ01AAA.SS.VSAM.CUSTOMER
%%
file PJ01AAA.SS.VSAM.CUSTOMER transferred
include "COPY/ODCSF0B.cpy"
map record VS-ODCSF0-RECORD defined in "COPY/ODCSF0B.cpy"
source record VS-ODCSF0-RECORD in "COPY/ODCSF0B.cpy"
logical name ODCSF0B
converter name ODCSF0B
```

Installing the Copy Files

Create a `$PARAM/file/recs-source` directory to hold the copy files.

Once the COBOL Description files have been prepared, the copy files described in the `mapper-<configuration name>.re` file should be placed in the `$PARAM/file/recs-source` directory.

If you use a COBOL copy book from the source platform to describe a file (see note in COBOL Description), then it is the location of the copy book that is directly used in the mapping parameter file as in the `"COPY/ODCSF0B.cpy"` example above.

Generating the Components

To generate the components used to migrate z/OS files Tuxedo ART Workbench uses the `file.sh` command. This section describes the command.

file.sh

Name

`file.sh` — Generate z/OS migration components.

Synopsis

```
file.sh [ [-g] [-m] [-i <installation directory>] <configuration name> | -s
<installation directory> (<configuration name>,...) ]
```

Description

`file.sh` generates the components used to migrate z/OS files using Tuxedo ART Workbench .

Options

-g <configuration name>
Generation option. The unloading and loading components are generated in `$TMPPROJECT` using the information provided by the configuration files.

-m <configuration name>
Modification option. Makes the generated shell scripts executable. The COBOL programs are adapted to the target COBOL fixed format. When present, the shell script that modifies the generated source files is executed.

-i <installation directory><configuration name>
Installation option. Places the components in the installation directory. This operation uses the information located in the `file-move-assignation.pgm` file.

-s
Not applicable to File-to-File migration except when the `attributes` clause is set to LOGICAL_MODULE_ONLY.
In this case, this option enables the generation of the configuration files and DML utilities used by the COBOL converter. All configuration files are created in $PARAM/dynamic-config and DML files in <trf>/DML directory.

Example

```
file.sh -gmi $HOME/trf FTFIL001
```

Locations of Generated Files

The unloading and loading components generated with the `-i $HOME/trf` option are placed in the following locations:

Table 1-17 Location of Components

Location	Contents
`$HOME/trf/unload/file/<configuration name>`	The JCL used for each unloading are generated for each <configuration name>.
`$HOME/trf/reload/file/<configuration name>`	The programs and KSH used for each loading are generated for each <configuration name>.
`$TMPPROJECT/outputs`	The generation log files Mapper-log-<configuration name> can be used to resolve problems.

Modifying Generated Components

The generated components may be modified using a project's own scripts.These scripts (sed, awk, perl,…) should be placed in:

`$PARAM/file/file-modif-source.sh`

When present, this file will be automatically executed at the end of the generation process. It will be called using the `<configuration name>` as an argument.

Using the Make Utility

Make is a UNIX utility intended to automate and optimize the construction of targets (files or actions).

You should have a descriptor file named makefile in the source directory in which all operations are implemented (a makefile is prepared in the source directory during the initialization of a project).

The next two sections describe configuring a make file and how to use Tuxedo ART Workbench File-To-File Converter functions with a make file.

Configuring a Make File

Version.mk

The `version.mk` configuration file in `$PARAM` is used to set the variables and parameters required by the make utility.

In `version.mk` specify where each type of component is installed and their extensions, as well as the versions of the different tools to be used. This file also describes how the log files are organized.

The following general variables should be set at the beginning of migration process in the `version.mk` file:

- `ROOT_PROJECT`
- `DIR_TRADDATA`
- `TOOLS_DATA`
- `LOGDIR`

In addition, the `FILE_SCHEMAS` variable is specific to file migration, it indicates the different configurations to process.

This configuration should be complete before using the make file.

Make File Contents

The contents of the makefile summarize the tasks to be performed:

- Including vesion.mk
- Controlling if the main variables are set
- Collecting the value of variables and building the required lists to process.
- Implementing the targets.

A `makefile` and a `version.mk` file are provided with Tuxedo ART Workbench Simple Application.

Using a Makefile with Tuxedo ART Workbench File-To-File Converter

The `make FileConvert` command can be used to launch Tuxedo ART Workbench File-To-File Converter. It enables the generation of the components required to migrate z/OS files to a UNIX/Linux target platform.

The make file launches the `file.sh` tool with the `-g`, `-m` and `-i` options, for all configurations contained in the `FILE_SCHEMAS` variable.

The File-to-Oracle Migration Process

File Organization

When migrating `VSAM` files from a source platform to an Oracle UNIX target platform, the first question to ask, when VSAM is concerned, is whether to keep a file or migrate the data to an Oracle table.

The following file organizations handled by z/OS can be migrated using Tuxedo ART Workbench to Oracle databases: `VSAM RRDS`, `ESDS` and `KSDS`.

The Tuxedo ART Workbench File-to-Oracle Converter is used for those files that are to be converted to Oracle tables. For files that remain in file format, see Executing the File-to-File Generated Converter Programs.

Migration Process Steps

The principle steps in the File-To-Oracle migration process, explained in detail in the rest of this chapter, are:

1. Create an overall list of the files to be migrated.
2. List those files that will be converted to Oracle tables.
3. For each of these files, when necessary, create a list of discrimination rules.
4. Prepare the environment to be used to generate the components.
5. Using Tuxedo ART Workbench generate the components used in the following steps.
6. Unload the data from the source platform.
7. Transfer the data to the target platform.

8. Transcode and reload the data.
9. Check the results.
10. Compile the access routines and the generated utilities.
11. Create the Oracle database.

Interaction With Other Oracle Tuxedo Application Rehosting Workbench Tools

The migration of data in VSAM files to Oracle tables is dependant on the results of the Tuxedo ART Workbench Cataloger (for more information, see Analyze). The File-to-Oracle migration impacts the COBOL and JCL conversion and should be completed before beginning the COBOL program conversion work.

Initializing the Process

This section describes the steps to be performed before starting the migration of VSAM files to Oracle tables.

Listing the Files to Be Migrated

The first task is to list all of the VSAM files to be migrated (in conjunction with the use of the File -to-File converter), and then identify those files that should be converted to Oracle tables. For example, permanent files to be later used via Oracle or files that need locking at the record level.

File Descriptions and Managing Files With the Same Structure

For each candidate file for migration, its structure should be described in COBOL format. This description is used in a COBOL copy by Tuxedo ART Workbench COBOL converter, subject to the limitations described in COBOL Description.

Once built, the list of files to migrate can be purged of files with the same structure in order to save work when migrating the files by limiting the number of programs required to transcode and reload data.

From the purged list of files, a last task consists of building the files:

- `Datamap-<configuration name>.re`
- `mapper-<configuration name>.re`

Note: The `populate.sh` utility (located in `REFINEDIR/scripts/file/populate.sh`), can be used to help generate these two configuration files automatically. For more information, see `REFINEDIR/scripts/file/README.txt`.

COBOL Description

A COBOL description is related to each file and considered as the representative COBOL description used within the application programs. This description can be a complex COBOL structure using all COBOL data types, including the `OCCURS` and `REDEFINES` notions.

This COBOL description will often be more developed than the COBOL file description (FD). For example, an FD field can be described as a PIC X(364) but really contain a three times defined area including, in one case a COMP-3 based numerals table, and in another case a complex description of several characters/digits fields etc.

It is this developed COBOL description which describes the application reality and therefore is used as a base to migrate a specific physical file.

The quality of the file processing execution depends on the quality of this COBOL description. From this point, the COBOL description is not separable from the file and when referring to the file concerned, we mean both the file and its representative COBOL description. The description must be provided in COBOL format, in a file with the following name:

```
<COPY name>.cpy
```

Note: If a copy book on the source platform provides a detailed description of the file, the file can be directly used and declared in Tuxedo ART Workbench .

COBOL Description Format

The format of the COBOL description must conform to the following rules:

- Only one level 01.
- The word FILLER is not allowed.
- Fields names must be unique.
- Some words are reserved. A list is supplied in the Appendix of the Oracle Tuxedo Application Rehosting Workbench Reference Guide.
- The description should begin in column 1 without any preceding sequence numbers.
- Comments may be inserted by placing an * in column 1.
- Field level numbers can start from column 2.

Table 1-18 lists the examples of COBOL description format.

Table 1-18 COBOL Description Format

Column																									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	.
*	D	E	S	C	R	I	P	T	I	O	N		O	F		F	I	L	E		X	X	X	X	
	0	1		F	V	1	4	.																	
			0	5		F	V	1	4	x	1		P	I	C		X	.							

COBOL Description and Related Discrimination Rules

Within a COBOL description there are several different ways to describe the same memory field, which means to store objects with different structures and descriptions at the same place.

As the same memory field can contain objects with different descriptions, to be able to read the file, we need a mechanism to determine the description to use in order to interpret correctly this data area.

We need a rule which, according to some criteria, generally the content of one or more fields of the record, will enable us to determine (discriminate) the description to use for reading the re-defined area.

In Tuxedo ART Workbench this rule is called a discrimination rule.

Any redefinition inside a COBOL description lacking discrimination rules presents a major risk during the file transcoding. Therefore, any non-equivalent redefined field requests a discrimination rule. On the other hand, any equivalent redefinition (called technical redefinition) must be subject to a cleansing within the COBOL description (see the example below).

The discrimination rules must be presented per file and highlight the differences and discriminated areas. Regarding the files, it is impossible to reference a field external to the file description.

The following description is a sample of a COPY as expected by Tuxedo ART Workbench :

Listing 1-18 COBOL COPY Example

```
01 FV14.
       05     FV14-X1       PIC X.
       05     FV14-X2       PIC XXX.
       05     FV14-X3.
              10 FV14-MTMGFA       PIC 9(2).
              10 FV14-NMASMG       PIC X(2).
              10 FV14-FILLER       PIC X(12).
              10 FV14-COINFA       PIC 9(6)V99.
       05 FV14-X4 REDEFINES FV14-X3.
              10 FV14-MTMGFA       PIC 9(6)V99.
              10 FV14-FILLER       PIC X(4).
              10 FV14-IRETCA       PIC X(01).
              10 FV14-FILLER       PIC X(2).
              10 FV14-ZNCERT.
                     15 FV14-ZNALEA       COMP-2.
                     15 FV14-NOSCP1       COMP-2.
                     15 FV14-NOSEC2       COMP-2.
                     15 FV14-NOCERT       PIC 9(4)COMP-3.
                     15 FV14-FILLERPIC X(16).
       05     FV14-X5 REDEFINES FV14-X3.
              10 FV14-FIL1  PIC X(16).
              10 FV14-MNT1  PIC S9(6)V99.
       05     FV14-X6 REDEFINES FV14-X3.
              10 FV14-FIL3         PIC X(16).
              10 FV14-MNT3         PIC S9(6).
              10 FV14-FIL4         PIC X(2).
```

The discrimination rules are written in the following format:

Listing 1-19 COBOL COPY Discrimination Rules

```
Field FV14-X3
Rule if FV14-X1 = “A”                    then  FV14-X3
elseif FV14-X1 = “B”                     then  FV14-X4
elseif FV14-X1 = “C”                     then  FV14-X5
else                                     FV14-X6
```

Note: In the COBOL description, the field FV14-X3 must be the first field to be redefined. The order of subsequent fields: FV14-X4, FV14-X5 and FV14-X6 is not important.

The copy name of the COBOL description is: `<COPY name>.cpy`

Redefinition Examples

Non-Equivalent Redefinition

Listing 1-20 Non-equivalent Redefinition Example

```
01 FV15.
       05 FV15-MTMGFA             PIC 9(2).
       05 FV15-ZNPCP3.
              10 FV15-NMASMG      PIC X(2).
              10 FV15-FILLER      PIC X(12).
              10 FV15-COINFA      PIC 9(6)V99.
       05 FV15-ZNB2T REDEFINES FV15-ZNPCP3.
              10 FV15-MTMGFA      PIC 9(4)V99.
```

```
10 FV15-FILLER       PIC X(4).
10 FV15-IRETCA       PIC X(01).
10 FV15-FILLER        PIC X(2).
10 FV15-ZNCERT
       15 FV15-ZNALEA       COMP-2.
       15 FV15-NOSCP1       COMP-2.
       15 FV15-NOSEC2       COMP-2.
       15 FV15-NOCERT        PIC 9(4)     COMP-3.
       15 FV15-FILLER        PIC X(16).
```

In the above example, two fields (`FV15-ZNPCP3` and `FV15-ZNB2T`) have different structures: an EBCDIC alphanumeric field in one case and a field composed of EBCDIC data and COMP2, COMP3 data in a second case.

The implementation of a discrimination rule will be necessary to migrate the data to a UNIX platform.

Listing 1-21 Related Discrimination Rules

```
Field FV15-ZNPCP3
Rule if FV15-MTMGFA = 12          then FV15-ZNPCP3
 elseif FV15-MTMGFA = 08 and FV15-NMASMG = "KC" then FV15-ZNB2T
```

Equivalent Redefinition Called Technical Redefinition

Listing 1-22 Technical Redefinition Initial Situation

```
01 FV1.
       05 FV1-ZNPCP3.
```

```
10 FV1-MTMGFA              PIC 9(6)V99.
10 FV1-NMASMG              PIC X(25).
10 FV1-FILLER              PIC X(12).
10 FV1-COINFA              PIC 9(10).
10 FV2-COINFA REDEFINES FV1-COINFA.
       15 FV2-ZNALEA        PIC 9(2).
       15 FV2-NOSCP1        PIC 9(4).
       15 FV2- FILLER       PIC 9(4).
10 FV15-MTMGFA             PIC 9(6)V99.
10 FV15-FILLER             PIC X(4).
10 FV15-IRETCA             PIC X(01).
10 FV15-FILLER             PIC X(2).
```

Listing 1-23 Technical Redefinition Potential Expected Results

```
01 FV1.                          01 FV1.
05 FV1-ZNPCP3.                    05 FV1-ZNPCP3.
10 FV1-MTMGFA PIC 9(6)V99.       10 FV1-MTMGFA PIC 9(6)V99.
10 FV1-NMASMG PIC X(25).         10 FV1-NMASMG PIC X(25).
10 FV1-FILLER PIC X(12).         10 FV1-FILLER PIC X(12).
10 FV1-COINFA PIC 9(10).         10 FV2-COINFA.
10 FV15-MTMGFA PIC 9(6)V99.      15 FV2-ZNALEA PIC 9(2).
10 FV15-FILLER PIC X(4).         15 FV2-NOSCP1 PIC 9(4).
10 FV15-IRETCA PIC X(01).         15 FV2- FILLER PIC X(4).
10 FV15-FILLER PIC X(2).         10 FV15-MTMGFA PIC 9(6)V99.
                                  10 FV15-FILLER PIC X(4).
                                 10 FV15-IRETCA PIC X(01).
                                  10 FV15-FILLER PIC X(2).
```

In the above example, the two descriptions correspond to a simple EBCDIC alphanumeric character string (without binary, packed or signed numeric fields). this type of structure does not require the implementation of a discrimination rule.

Re-engineering Rules to Implement

This section describes the reengineering rules applied by Tuxedo ART Workbench when migrating data from VSAM files to an Oracle database.

Migration Rules Applied

- Each VSAM file used in CICS becomes an Oracle table.
- Each table name is stipulated in the `mapper-<configuration name>.re` file using the `table name` clause.
- Each elementary field name contained in the copy description of the file becomes a column name in an Oracle table. Hyphens (-) are replaced by underscore (_) characters.
- For sequential `VSAM` files (`VSAM ESDS`):

  Tuxedo ART Workbench adds a technical column: `*_SEQ_NUM NUMBER(8)`.

  This column is incremented each time a new line is added to the table; the column becomes the primary key of the table.

- For relative `VSAM` files (`VSAM RRDS`):

  Tuxedo ART Workbench adds a technical column `*_RELATIVE_NUM`.

  The size of the column is deduced from the information supplied in the Datamap parameter file; the column becomes the primary key of the table.

  The column:

  – is incremented when a sequential write is made to the table, and the relative key is zero.

  – contains the relative key when the relative key is not zero.

- For indexed `VSAM` files (`VSAM KSDS`):

  Tuxedo ART Workbench does not add a technical column unless duplicate keys are accepted; the primary key of the `VSAM` file becomes the primary key of the table.

Rules Applied to Picture Clauses

The following rules are applied to COBOL Picture clauses when migrating data from VSAM files to Oracle tables:

Table 1-19 Picture Clause Re-engineering

COBOL Picture	Oracle format
PIC 9(length) PIC S9(length) PIC 9(length) COMP-3 PIC S9(length) COMP-3	NUMBER(length)
PIC 9(prec,scale) PIC S9(prec,scale) PIC 9(prec,scale) COMP-3 PIC S9(prec,scale) COMP-3	NUMBER(prec+scale, scale)
PIC S9(length) BINARY PIC S9(length) COMP PIC S9(length) COMP-4	NUMBER(real_binary_length) Sample: PIC S9(4) BINARY is migrated as NUMBER(5)
COMP-1 or COMP-2	DATATYPE_DOUBLE
PIC X(…)	Becomes CHAR if length <= 2000 Becomes VARCHAR2 if length > 2000 **Note:** If the parameter: file:char_limit_until_varchar is set in the db-param.cfg file, it takes precedence over the above rule.

Rules Applied to Occurs and Redefines Clauses

For OCCURS and REDEFINES clauses with discrimination rules, three reengineering possibilities are proposed:

- Creation of a sub-table:

  - Redefinitions: each description is associated with a sub-table (one sub-table for each description).
  - Occurs: one sub-table is created containing a technical column that references the element of the array to which the data corresponds.

- Creation of an opaque field:
  - Redefinitions: all the descriptions are stored in an opaque field type CHAR or VARCHAR2.
  - Occurs: all the occurrences are stored in an opaque field type CHAR or VARCHAR2.
- Extended description
  - Redefinitions: all the fields described in the copy file are created as columns in the Oracle table.
  - Occurs: each occurrence of a field in a redefined area is created as a column in the Oracle table, one column for each occurrence in the OCCURS clause.

Example VSAM File Migration to Oracle Table

In the following example, the indexed `VSAM` file described in `ODCSFOB` uses as a primary key the `VS-CUSTIDENT` field.

Listing 1-24 Example VSAM Copy Description

```
* ------------------------------------------------------------
* Customer record description
*  -Record length : 266
* ------------------------------------------------------------
 01 VS-ODCSF0-RECORD.
    05 VS-CUSTIDENT           PIC 9(006).
    05 VS-CUSTLNAME           PIC X(030).
    05 VS-CUSTFNAME           PIC X(020).
    05 VS-CUSTADDRS           PIC X(030).
    05 VS-CUSTCITY            PIC X(020).
    05 VS-CUSTSTATE           PIC X(002).
```

```
    05 VS-CUSTBDATE           PIC 9(008).
    05 VS-CUSTBDATE-G         REDEFINES VS-CUSTBDATE.
     10 VS-CUSTBDATE-CC PIC 9(002).
     10 VS-CUSTBDATE-YY PIC 9(002).
     10 VS-CUSTBDATE-MM PIC 9(002).
     10 VS-CUSTBDATE-DD PIC 9(002).
    05 VS-CUSTEMAIL           PIC X(040).
    05 VS-CUSTPHONE           PIC 9(010).
    05 VS-FILLER              PIC X(100).
* ---------------------------------------------------------
```

Listing 1-25 Oracle Table Generated From VSAM File

```
WHENEVER SQLERROR CONTINUE;
DROP TABLE CUSTOMER CASCADE CONSTRAINTS;
WHENEVER SQLERROR EXIT 3;
CREATE TABLE CUSTOMER (
       VS_CUSTIDENT         NUMBER(6) NOT NULL,
       VS_SEQ_NUM           NUMBER(8) NOT NULL,
       VS_CUSTLNAME         VARCHAR2(30),
       VS_CUSTFNAME         CHAR  (20),
       VS_CUSTADDRS         VARCHAR2(30),
       VS_CUSTCITY          CHAR  (20),
       VS_CUSTSTATE         CHAR  (2),
       VS_CUSTBDATE         NUMBER(8),
       VS_CUSTEMAIL         VARCHAR2(40),
       VS_CUSTPHONE         NUMBER(10),
```

```
       VS_FILLER            VARCHAR2(100),
CONSTRAINT PK_CUSTOMER PRIMARY KEY (
       VS_CUSTIDENT)
CONSTRAINT UK_CUSTOMER UNIQUE (
       VS_SEQ_NUM)
);
```

Note: The copy book `ODCSFOB` contains a field redefinition: `VS-CUSTBDATE-G PIC 9(008)`, as this is a technical field, no discrimination rule is implemented. In this case, only the redefined field is created in the generated table `VS_CUSTBDATE NUMBER(8)`.

Preparing the Environment

This section describes the tasks to perform before generating the components to be used to migrate data from VSAM files to Oracle tables.

Initializing Environment Variables

Before executing Tuxedo ART Workbench set the following environment variables:

- `export TMPPROJECT=$Home/tmp`

  — the location for storing temporary objects generated by the process.

- `export $PARAM=$HOME/param`

  — the location of the configuration files.

Implementing the Configuration Files

Three files need to be placed in Tuxedo ART Workbench file structure as described by:

- `$PARAM` for:
  - `db-param.cfg`,
- `$PARAM/file` for:
  - `Datamap-<configuration name>.re`,
  - `mapper-<configuration name>.re`.

For a File-To-Oracle conversion you must create the `Datamap-<configuration name>.re` and `mapper-<configuration name>.re` files yourself.

Two other configuration files:

- `file-templates.txt`
- `file-move-assignation.pgm`

are automatically generated in the file structure during the installation of Tuxedo ART Workbench . If specific versions of these files are required for particular z/OS files they will be placed in the `$PARAM/file` file structure.

Configuring the Files

Database Parameter File (db-param.cfg)

For the `db-param.cfg` file, only the target and file parameters need to be adapted.

Listing 1-26 db-param.cfg Example

```
# This configuration file is used by FILE & RDBMS converter
# Lines beginning with "#" are ignored
# write information in lower case
# common parameters for FILE and RDBMS
# source information is written into system descriptor file (OS, DBMS=,
# DBMS-VERSION=)
target_rdbms_name:oracle
target_rdbms_version:11
target_os:unix
# optional parameter
target_cobol:cobol_mf
hexa-map-file:tr-hexa.map
#
# specific parameters for FILE to RDBMS conversion
file:char_limit_until_varchar:29
```

```
# specific parameters for RDBMS conversion
rdbms:date_format:YYYY/MM/DD
rdbms:timestamp_format:YYYY/MM/DD HH24 MI SS
rdbms:time_format:HH24 MI SS
# rename object files
# the file param/rdbms/rename-objects-<schema>.txt is automatically loaded
# by the tool if it exists.
```

Mandatory Parameters

- `target_rdbms_name:` *`oracle`*

  name of the target RDBMS.

- `target_rdbms_version:`*`11`*

  version of the target RDBMS.

- `target_os:`*`unix`*

  Name of the target operating system.

- `file:char_limit_until_varchar:`*`29`*

  Indicates the maximum field length of a COBOL alphanumeric (PIC X) field before the field be transformed into an ORACLE VARCHAR data type.

  In this example, fields longer than 29 characters become `VARCHAR`, fields shorter than 30 characters become `CHAR` fields.

Optional Parameters

`target_cobol:cobol_mf`
: Name of the COBOL language. Accepted values are "`cobol_mf`" (default value) and "`cobol_it`".

  In this example, the language is Micro Focus COBOL.

`hexa-map-file:tr-hexa.map`
: Specifies a mapping table file between EBCDIC (z/OS code set) and ASCII (Linux/UNIX code set) hexadecimal values; if `hexa-map-file` is not specified, a warning will be logged.

Datamap Parameter File (Datamap-<configuration name>.re)

Each VSAM file to be migrated must be listed.

The following parameters must be set:

Table 1-20 Datamap Parameters

Parameter	Value in example	Set by
configuration name	STFILEORA `(data map STFILEORA-map)`	Freely chosen by user.
system name	STFILEORA `(system cat::STFILEORA)`	Determined during cataloging in the System Description File.
file name	PJ01AAA.SS.VSAM.CUSTOMER	z/OS physical file name.
Organization	Indexed	Source organization

Note: The description of the different parameters used is provided in the Oracle Tuxedo Application Rehosting Workbench Reference Guide - File To File Convertor.

The `PJ01AAA.SS.VSAM.CUSTOMER` file is a `VSAM KSDS` file and the organization is therefore indexed. The parameters, `keys offset 1 bytes length 6 bytes primary`, describe the key. In this example, the key is six bytes long starting in position1.

Listing 1-27 Example Datamap File: `Datamap-STFILEORA.re`

```
%% Lines beginning with "%%" are ignored
data map STFILEORA-map system cat::STFILEORA
%%
%% Datamap File PJ01AAA.SS.VSAM.CUSTOMER
%%
file PJ01AAA.SS.VSAM.CUSTOMER
  organization Indexed
  keys offset 1 bytes length 6 bytes primary
```

Mapping Parameter File (mapper-<configuration name>.re)

Each z/OS file to be migrated, that is included in the Datamap configuration file, must be listed.

A file parameter and its options must be included for every VSAM file to convert to an Oracle table. The following parameters must be set:

Table 1-21 Mapping Parameters

Parameter	Value in example	Set by
configuration name	STFILEORA (ufas mapper STFILEORA)	Coherent with the name used in the datamap configuration file.
file name	PJ01AAA.SS.VSAM.CUSTOMER	Name used in the Datamap file.
include	include "COPY/ODCSF0B.cpy"	The name and path of the copy file BCOAC01E.cpy is freely chosen by the user when creating the file.
table name	table name CUSTOMER	Provide a name for the Oracle table to be created.
map record	map record VS-ODCSF0-RECORD defined in "COPY/ODCSF0B.cpy"	VS-ODCSF0-RECORD corresponds to the level 01 field name in the copy file.
logical name	logical name ODCSF0B	Chosen by the user, maximum eight characters. This name is used for naming the objects (COBOL, JCL) created by the different tools in Tuxedo ART Workbench .
converter name	converter name ODCSF0B	Same name and use as logical name.

Note: The description of the different parameters used is provided in the Oracle Tuxedo Application Rehosting Workbench Reference Guide - File To File Convertor.

Listing 1-28 Example mapper File: mapper-STFILEORA.re

```
%% Lines beginning with "%%" are ignored

ufas mapper STFILEORA
```

```
%%
%% Desc file PJ01AAA.SS.VSAM.CUSTOMER
%%
file PJ01AAA.SS.VSAM.CUSTOMER transferred converted
   table name CUSTOMER
   include "COPY/ODCSF0B.cpy"
   map record VS-ODCSF0-RECORD defined in "COPY/ODCSF0B.cpy"
   source record VS-ODCSF0-RECORD in "COPY/ODCSF0B.cpy"
   logical name ODCSF0B
   converter name ODCSF0B
   attributes LOGICAL_MODULE_IN_ADDITION
```

Installing the Copy Files

Once the COBOL Description files have been prepared, the copy files described in the `mapper-<configuration name>.re` file should be placed in the `$PARAM/file/recs-source` directory.

If you use a COBOL copy book from the source platform to describe a file (see note in COBOL Description), then it is the location of the copy book that is directly used in the mapping parameter file as in the `"COPY/ODCSF0B.cpy"` example above.

Generating the Components

To generate the components used to migrate data from VSAM file to Oracle tables Tuxedo ART Workbench uses the `file.sh` command. This section describes the command.

file.sh

Name

file.sh — Generate z/OS migration components.

Synopsis

`file.sh [ [-g] [-m] [-i <installation directory>] <configuration name> | -s <installation directory> (<configuration name>,...) ]`

Description

`file.sh` generates the components used to migrate VSAM files by Tuxedo ART Workbench .

Options

-g <configuration name>
Generation option. The unloading and loading components are generated in `$TMPPROJECT` using the information provided by the configuration files.

-m <configuration name>
Modification option. Makes the generated shell scripts executable. The COBOL programs are adapted to the target COBOL fixed format. When present, the shell script that modifies the generated source files is executed.

-i <installation directory> <configuration name>
Installation option. Places the components in the installation directory. This operation uses the information located in the `file-move-assignation.pgm` file.

-s <installation directory> <schema name>,...)
Enables the generation of the configuration files and DML utilities used by the COBOL converter. All configuration files are created in `$PARAM/dynamic-config` and DML files in `<trf>/DML` directory.

Example

```
file.sh -gmi $HOME/trf FTFIL001
```

Using the Make Utility

Make is a UNIX utility intended to automate and optimize the construction of targets (files or actions).

You should have a descriptor file named makefile in the source directory in which all operations are implemented (a makefile is prepared in the source directory during the initialization of a project).

The next two sections describe configuring a make file and how to use Tuxedo ART Workbench File-To-File Converter functions with a make file.

Configuring a Make File

Version.mk

The `version.mk` configuration file in `$PARAM` is used to set the variables and parameters required by the make utility.

In `version.mk` specify where each type of component is installed and their extensions, as well as the versions of the different tools to be used. This file also describes how the log files are organized.

The following general variables should be set at the beginning of migration process in the `version.mk` file:

- `ROOT_PROJECT`
- `DIR_TRADDATA`
- `TOOLS_DATA`
- `LOGDIR`

In addition, the `FILE_SCHEMAS` variable is specific to file migration, it indicates the different configurations to process.

This configuration should be complete before using the make file.

Make File Contents

The contents of the makefile summarize the tasks to be performed:

- Including vesion.mk
- Controlling if the main variables are set
- Collecting the value of variables and building the required lists to process.
- Implementing the targets.

A `makefile` and a `version.mk` file are provided with Tuxedo ART Workbench Simple Application.

Using a makefile with Oracle Tuxedo Application Rehosting Workbench File-To-File Converter

The `make FileConvert` command can be used to launch Tuxedo ART Workbench File-To-File Converter. It enables the generation of the components required to migrate z/OS files to a UNIX/Linux target platform.

The make file launches the `file.sh` tool with the `-g`, `-m` and `-i` options, for all configurations contained in the `FILE_SCHEMAS` variable.

Locations of Generated Files

The unloading and loading components generated with the `-i $HOME/trf` option are placed in the following locations:

Table 1-22 Location of Components

Location	Contents
`$HOME/trf/unload/file/<configuration name>`	The programs and JCL used for each unloading are generated for each <configuration name>.
`$HOME/trf/reload/file/<configuration name>`	The programs and KSH used for each loading are generated for each <configuration name>. Example: `loadfile-ODCSF0.ksh RELFILE-ODCSF0.cbl`
`$TMPPROJECT/outputs`	The generation log files Mapper-log-<configuration name> can be used to resolve problems.
`$HOME/trf/SQL/file/<schema name>`	Location of the SQL scripts for creating tables and the Korn shell scripts used to perform various technical operations for the Oracle tables generated.
`$HOME/trf/DML`	Location of the COBOL and PRO*COBOL access routines. These routines are executed by the COBOL programs instead of the access verbs used for the VSAM file migrated to Oracle tables.

Examples of Generated Components

For the example used in this chapter, the following scripts are generated.

The SQL script used to create the CUSTOMER table is named:

- ODCSF0B.sql

The scripts used for the different technical operations are named:

- cleantable-ODCSF0B.ksh
- createtable-ODCSF0B.ksh

- droptable-ODCSF0B.ksh
- ifemptytable-ODCSF0B.ksh
- ifexisttable-ODCSF0B.ksh

Nine COBOL programs are generated, their usage is described in the Oracle Tuxedo Application Rehosting Workbench Reference Guide.

- `ASG_ODCSF0B.cbl`
- `close_all_files_STFILEORA.cbl`
- `dml_locking.cbl`
- `init_all_files.cbl`
- `UL_ODCSF0B.cbl`
- `close_all_files.cbl`
- `DL_ODCSF0B.cbl`
- `getfileinfo.cbl`
- `init_all_files_STFILEORA.cbl`

One PRO*COBOL program for accessing the ORACLE CUSTOMER table is generated:

- RM_ODCSF0B.pco

Modifying Generated Components

The generated components may be modified using a project's own scripts. these scripts (sed, awk, perl,…) should be placed in:

`$PARAM/file/file-modif-source.sh`

When present, this file will be automatically executed at the end of the generation process. It will be called using the `<configuration name>` as an argument.

Migrating data files is described in the following sections:

The File-To-Db2/luw (UDB) Migration Process

- File Organization
- Initializing the Process
- Re-engineering Rules to Implement

- Preparing the Environment
- Generating the Components

File Organizations

When migrating VSAM files from a source platform to an DB2/Luw(udb) UNIX target platform, the first question to ask, when VSAM is concerned, is whether to keep a file or migrate the data to a DB2/Luw(udb) table.

The following file organizations handled by z/OS can be migrated using Tuxedo ART Workbench to Oracle databases: `VSAM RRDS`, `ESDS` and `KSDS`.

The Tuxedo ART Workbench File-To-File Converter is used for those files that are to be converted to Oracle tables. For files that remain in file format, the Oracle Tuxedo Application Workbench Reference Guide, File-to-File Converter.

Migration Process Steps

The principle steps in the File-To-Db2/luw (UDB) migration process, explained in detail in the rest of this chapter, are:

1. Create an overall list of the files to be migrated.
2. List those files that will be converted to DB2/Luw(udb) tables.
3. For each of these files, when necessary, create a list of discrimination rules.
4. Prepare the environment to be used to generate the components.
5. Using Tuxedo ART Workbench generate the components used in the following steps.
6. Unload the data from the source platform.
7. Transfer the data to the target platform.
8. Transcode and reload the data.
9. Check the results.
10. Compile the access routines and the generated utilities.
11. Create the Oracle database.

Interaction With Other Oracle Tuxedo Application Rehosting Workbench Tools

The migration of data in VSAM files to DB2/Luw(udb) tables is dependant on the results of the Cataloger. The File-To-Db2/luw (UDB) migration impacts the COBOL and JCL conversion and should be completed before beginning the COBOL program conversion work.

Initializing the Process

This section describes the steps to be performed before starting the migration of `VSAM` files to DB2/Luw(udb) tables.

Listing the Files to Be Migrated

The first task is to list all of the VSAM files to be migrated (in conjunction with the use of the File-to-File converter), and then identify those files that should be converted to DB2/Luw(udb) tables. For example, permanent files to be later used via DB2/Luw or files that need locking at the record level.

File Descriptions and Managing Files With the Same Structure

For each candidate file for migration, its structure should be described in COBOL format. This description is used in a COBOL copy by Tuxedo ART Workbench COBOL converter, subject to the limitations described in COBOL Description.

Once built, the list of files to migrate can be purged of files with the same structure in order to save work when migrating the files by limiting the number of programs required to transcode and reload data.

From the purged list of files, a last task consists of building the files:

- `Datamap-<configuration name>.re`
- `mapper-<configuration name>.re`

Note: The `populate.sh` utility (located in `REFINEDIR/scripts/file/populate.sh`), can be used to help generate these two configuration files automatically. For more information, see `REFINEDIR/scripts/file/README.txt`.

COBOL Description

A COBOL description is related to each file and considered as the representative COBOL description used within the application programs. This description can be a complex COBOL structure using all COBOL data types, including the OCCURS and REDEFINES notions.

This COBOL description will often be more developed than the COBOL file description (FD). For example, an FD field can be described as a PIC X(364) but really contain a three times

defined area including, in one case a COMP-3 based numerals table, and in another case a complex description of several characters/digits fields etc.

It is this developed COBOL description which describes the application reality and therefore is used as a base to migrate a specific physical file.

The quality of the file processing execution depends on the quality of this COBOL description. From this point, the COBOL description is not separable from the file and when referring to the file concerned, we mean both the file and its representative COBOL description. The description must be provided in COBOL format, in a file with the following name:

```
<COPY name>.cpy
```

Note: If a copy book on the source platform provides a detailed description of the file, the file can be directly used and declared in Tuxedo ART Workbench .

COBOL Description Format

The format of the COBOL description must conform to the following rules:

- Only one level 01.
- The word FILLER is not allowed.
- Fields names must be unique.
- Some words are reserved. A list is supplied in the Appendix of the Oracle Tuxedo Application Rehosting Workbench Reference Guide.
- The description should begin in column 1 without any preceding sequence numbers.
- Comments may be inserted by placing an * in column 1.
- Field level numbers can start from column 2.

Example

Column																									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	.
*	D	E	S	C	R	I	P	T	I	O	N		O	F		F	I	L	E		X	X	X	X	
	0	1		F	V	1	4	.																	

Column																									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	.
			0	5		F	V	1	4	x	1		P	I	C		X	.							

COBOL Description and Related Discrimination Rules

Within a COBOL description there are several different ways to describe the same memory field, which means to store objects with different structures and descriptions at the same place.

As the same memory field can contain objects with different descriptions, to be able to read the file, we need a mechanism to determine the description to use in order to interpret correctly this data area.

We need a rule which, according to some criteria, generally the content of one or more fields of the record, will enable us to determine (discriminate) the description to use for reading the re-defined area. In Tuxedo ART Workbench this rule is called a discrimination rule.

Any redefinition inside a COBOL description lacking discrimination rules presents a major risk during the file transcoding. Therefore, any non-equivalent redefined field requests a discrimination rule. On the other hand, any equivalent redefinition (called technical redefinition) must be subject to a cleansing within the COBOL description (see the example below).

The discrimination rules must be presented per file and highlight the differences and discriminated areas. Regarding the files, it is impossible to reference a field external to the file description.

The following description is a sample of a COPY as expected by Tuxedo ART Workbench :

Listing 1-29 COBOL COPY Sample

```
01 FV14.
       05     FV14-X1       PIC X.
       05     FV14-X2       PIC XXX.
```

```
05     FV14-X3.
       10 FV14-MTMGFA       PIC 9(2).
       10 FV14-NMASMG       PIC X(2).
       10 FV14-FILLER       PIC X(12).
       10 FV14-COINFA       PIC 9(6)V99.
05 FV14-X4 REDEFINES FV14-X3.
       10 FV14-MTMGFA       PIC 9(6)V99.
       10 FV14-FILLER       PIC X(4).
       10 FV14-IRETCA       PIC X(01).
       10 FV14-FILLER       PIC X(2).
       10 FV14-ZNCERT.
              15 FV14-ZNALEA       COMP-2.
              15 FV14-NOSCP1       COMP-2.
              15 FV14-NOSEC2       COMP-2.
              15 FV14-NOCERT       PIC 9(4)COMP-3.
              15 FV14-FILLERPIC X(16).
05     FV14-X5 REDEFINES FV14-X3.
       10 FV14-FIL1  PIC X(16).
       10 FV14-MNT1  PIC S9(6)V99.
05     FV14-X6 REDEFINES FV14-X3.
       10 FV14-FIL3         PIC X(16).
       10 FV14-MNT3         PIC S9(6).
       10 FV14-FIL4         PIC X(2).
```

The discrimination rules are written in the following format:

Listing 1-30 COBOL COPY Discrimination Rules

```
Field FV14-X3
Rule if FV14-X1 = “A”                    then  FV14-X3
elseif FV14-X1 = “B”                     then  FV14-X4
elseif FV14-X1 = “C”                     then  FV14-X5
else                                     FV14-X6
```

Note: In the COBOL description, the field FV14-X3 must be the first field to be redefined. The order of subsequent fields: FV14-X4, FV14-X5 and FV14-X6 is not important.

The copy name of the COBOL description is: <COPY name>.cpy

Redefinition Examples

Non-Equivalent Redefinition

Listing 1-31 Non-equivalent Redefinition Example

```
01 FV15.
       05 FV15-MTMGFA             PIC 9(2).
       05 FV15-ZNPCP3.
              10 FV15-NMASMG      PIC X(2).
              10 FV15-FILLER      PIC X(12).
              10 FV15-COINFA      PIC 9(6)V99.
       05 FV15-ZNB2T REDEFINES FV15-ZNPCP3.
              10 FV15-MTMGFA      PIC 9(4)V99.
              10 FV15-FILLER      PIC X(4).
              10 FV15-IRETCA      PIC X(01).
              10 FV15-FILLER       PIC X(2).
              10 FV15-ZNCERT
```

```
                    15 FV15-ZNALEA       COMP-2.
                    15 FV15-NOSCP1       COMP-2.
                    15 FV15-NOSEC2       COMP-2.
                    15 FV15-NOCERT        PIC 9(4)     COMP-3.
                    15 FV15-FILLER        PIC X(16).
```

In the above example, two fields (FV15-ZNPCP3 and FV15-ZNB2T) have different structures: an EBCDIC alphanumeric field in one case and a field composed of EBCDIC data and COMP2, COMP3 data in a second case.

The implementation of a discrimination rule will be necessary to migrate the data to a UNIX platform.

Listing 1-32 Related Discrimination Rules

```
Field FV15-ZNPCP3
Rule if FV15-MTMGFA = 12           then FV15-ZNPCP3
 elseif FV15-MTMGFA = 08 and FV15-NMASMG = "KC" then FV15-ZNB2T
```

Equivalent Redefinition Called Technical Redefinition

Listing 1-33 Technical Redefinition Initial Situation

```
01 FV1.
       05 FV1-ZNPCP3.
              10 FV1-MTMGFA              PIC 9(6)V99.
              10 FV1-NMASMG              PIC X(25).
              10 FV1-FILLER              PIC X(12).
              10 FV1-COINFA              PIC 9(10).
```

```
10 FV2-COINFA REDEFINES FV1-COINFA.
       15 FV2-ZNALEA        PIC 9(2).
       15 FV2-NOSCP1        PIC 9(4).
       15 FV2- FILLER       PIC 9(4).
10 FV15-MTMGFA              PIC 9(6)V99.
10 FV15-FILLER              PIC X(4).
10 FV15-IRETCA              PIC X(01).
10 FV15-FILLER              PIC X(2).
```

Listing 1-34 Technical Redefinition Potential Expected Results

```
01 FV1.
05 FV1-ZNPCP3.
10 FV1-MTMGFA PIC 9(6)V99.
10 FV1-NMASMG PIC X(25).
10 FV1-FILLER PIC X(12).
10 FV1-COINFA PIC 9(10).
10 FV15-MTMGFA PIC 9(6)V99.
10 FV15-FILLER PIC X(4).
10 FV15-IRETCA PIC X(01).
10 FV15-FILLER PIC X(2).01 FV1.
05 FV1-ZNPCP3.
10 FV1-MTMGFA PIC 9(6)V99.
10 FV1-NMASMG PIC X(25).
10 FV1-FILLER PIC X(12).
10 FV2-COINFA.
15 FV2-ZNALEA PIC 9(2).
15 FV2-NOSCP1 PIC 9(4).
15 FV2- FILLER PIC X(4).
```

```
  10 FV15-MTMGFA PIC 9(6)V99.
  10 FV15-FILLER PIC X(4).
  10 FV15-IRETCA PIC X(01).
  10 FV15-FILLER PIC X(2).
```

```
01 FV1.
       05 FV1-ZNPCP3.
             10 FV1-MTMGFA PIC
9(6)V99.
             10 FV1-NMASMG PIC
X(25).
             10 FV1-FILLER PIC
X(12).
             10 FV1-COINFA PIC
9(10).
             10 FV15-MTMGFA PIC
9(6)V99.
             10 FV15-FILLER PIC
X(4).
             10 FV15-IRETCA PIC
X(01).
             10 FV15-FILLER PIC
X(2).
```

```
01 FV1.
       05 FV1-ZNPCP3.
             10 FV1-MTMGFA PIC
9(6)V99.
             10 FV1-NMASMG PIC
X(25).
             10 FV1-FILLER PIC
X(12).
             10 FV2-COINFA.
                   15 FV2-ZNALEA
PIC 9(2).
                   15 FV2-NOSCP1
PIC 9(4).
                   15 FV2-
FILLER PIC X(4).
             10 FV15-MTMGFA PIC
9(6)V99.
             10 FV15-FILLER PIC
X(4).
             10 FV15-IRETCA PIC
X(01).
             10 FV15-FILLER PIC
X(2).
```

In the above example, the two descriptions correspond to a simple EBCDIC alphanumeric character string (without binary, packed or signed numeric fields). this type of structure does not require the implementation of a discrimination rule.

Re-Engineering Rules to Implement

This section describes the reengineering rules applied by Tuxedo ART Workbench when migrating data from VSAM files to a DB2/Luw(udb) database.

Migration Rules Applied

- Each VSAM file used in CICS becomes an DB2/Luw(udb) table.
- Each table name is stipulated in the `mapper-<configuration name>.re` file using the `table name` clause.
- Each elementary field name contained in the copy description of the file becomes a column name in an Oracle table. Hyphens (-) are replaced by underscore (_) characters.
- For sequential `VSAM` files (`VSAM ESDS`):

  Tuxedo ART Workbench adds a technical column: `*_SEQ_NUM NUMERIC(8).`

  This column is incremented each time a new line is added to the table; the column becomes the primary key of the table.

- For relative `VSAM` files (`VSAM RRDS`):

  Tuxedo ART Workbench adds a technical column `*_RELATIVE_NUM`.

  The size of the column is deduced from the information supplied in the Datamap parameter file; the column becomes the primary key of the table.

  The column:

  – is incremented when a sequential write is made to the table, and the relative key is zero.

  – contains the relative key when the relative key is not zero.

- For indexed `VSAM` files (`VSAM KSDS`):

  Tuxedo ART Workbench does not add a technical column unless duplicate keys are accepted; the primary key of the `VSAM` file becomes the primary key of the table.

Rules Applied to Picture Clauses

The following rules are applied to COBOL Picture clauses when migrating data from VSAMfiles to Oracle tables

Table 1-23 Picture Clause Re-engineering

COBOL Picture	Oracle format
PIC 9(length) PIC S9(length) PIC 9(length) COMP-3 PIC S9(length) COMP-3	NUMERIC(length)
PIC 9(prec,scale) PIC S9(prec,scale) PIC 9(prec,scale) COMP-3 PIC S9(prec,scale) COMP-3	NUMERIC(prec+scale, scale)
PIC S9(length) BINARY PIC S9(length) COMP PIC S9(length) COMP-4	NUMERIC(real_binary_length) Example: PIC S9(4) BINARY is migrated as NUMERIC(5)
COMP-1	REAL
COMP-2	DOUBLE
PIC X(…)	Becomes CHAR if length <= 255 Becomes VARCHAR if length > 255 **Note:** If the parameter: file:char_limit_until_varchar is set in the db-param.cfg file, it takes precedence over the above rule.

Rules Applied to Occurs and Redefines Clauses

For OCCURS and REDEFINES clauses with discrimination rules, three reengineering possibilities are proposed:

- Creation of a sub-table:
  - Redefinitions: each description is associated with a sub-table (one sub-table for each description).
  - Occurs: one sub-table is created containing a technical column that references the element of the array to which the data corresponds.
- Creation of an opaque field:
  - Redefinitions: all the descriptions are stored in an opaque field type CHAR or VARCHAR.
  - Occurs: all the occurrences are stored in an opaque field type CHAR or VARCHAR.
- Extended description
  - Redefinitions: all the fields described in the copy file are created as columns in the Oracle table.
  - Occurs: each occurrence of a field in a redefined area is created as a column in the Oracle table, one column for each occurrence in the OCCURS clause.

Example VSAM File Migration to DB2/Luw(udb) Table

In the following example, the indexed VSAM file described in `ODCSFOB` uses as a primary key the `VS-CUSTIDENT` field.

Listing 1-35 Example VSAM Copy Description

```
* ------------------------------------------------------------
* Customer record description
*  -Record length : 266
* ------------------------------------------------------------
 01 VS-ODCSF0-RECORD.
    05 VS-CUSTIDENT           PIC 9(006).
    05 VS-CUSTLNAME           PIC X(030).
    05 VS-CUSTFNAME           PIC X(020).
    05 VS-CUSTADDRS           PIC X(030).
    05 VS-CUSTCITY            PIC X(020).
```

```
    05 VS-CUSTSTATE           PIC X(002).
    05 VS-CUSTBDATE           PIC 9(008).
    05 VS-CUSTBDATE-G         REDEFINES VS-CUSTBDATE.
     10 VS-CUSTBDATE-CC PIC 9(002).
     10 VS-CUSTBDATE-YY PIC 9(002).
     10 VS-CUSTBDATE-MM PIC 9(002).
     10 VS-CUSTBDATE-DD PIC 9(002).
    05 VS-CUSTEMAIL           PIC X(040).
    05 VS-CUSTPHONE           PIC 9(010).
    05 VS-FILLER              PIC X(100).
* -------------------------------------------------------
```

Listing 1-36 Oracle Table Generated From VSAM File

```
DROP TABLE CUSTOMER ;
COMMIT ;
CREATE TABLE CUSTOMER (
     VS_CUSTIDENT               NUMERIC (6) NOT NULL,
     VS_CUSTLNAME               VARCHAR (30),
     VS_CUSTFNAME               CHAR    (20),
     VS_CUSTADDRS               VARCHAR (30),
     VS_CUSTCITY                CHAR    (20),
     VS_CUSTSTATE               CHAR    (2),
     VS_CUSTBDATE               NUMERIC (8),
     VS_CUSTEMAIL               VARCHAR (40),
     VS_CUSTPHONE               NUMERIC (10),
     VS_FILLER                  VARCHAR (100),
```

```
     CONSTRAINT PKCUSTOMER PRIMARY KEY (
        VS_CUSTIDENT)) ;
COMMIT ;
```

Note: The copy book `ODCSFOB` contains a field redefinition: `VS-CUSTBDATE-G PIC 9(008)`, as this is a technical field, no discrimination rule is implemented. In this case, only the redefined field is created in the generated table `VS_CUSTBDATE NUMBER(8)`.

Preparing the Environment

This section describes the tasks to perform before generating the components to be used to migrate data from VSAM files to DB2/Luw(udb) tables.

Initializing Environment Variables

Before executing Tuxedo ART Workbench set the following environment variables:

- `export TMPPROJECT=$Home/tmp`

  — the location for storing temporary objects generated by the process.

  You should regularly clean this directory.

- `export $PARAM=$HOME/param`

  — the location of the configuration files.

Implementing the Configuration Files

Three files need to be placed in Tuxedo ART Workbench file structure as described by:

- `$PARAM` for:
  - `db-param.cfg`,
- `$PARAM/file` for:
  - `Datamap-<`*`configuration name`*`>.re`,
  - `mapper-<`*`configuration name`*`>.re`.

For a File-To-Db2/luw (UDB) conversion you must create the `Datamap-<`*`configuration name`*`>.re` and `mapper-<`*`configuration name`*`>.re` files yourself.

Two other configuration files:

- `file-templates-db2luw.txt`
- `file-move-assignation-db2luw.pgm`

are automatically generated in the file structure during the installation of Tuxedo ART Workbench . If specific versions of these files are required for particular z/OS files they will be placed in the `$PARAM/file` file structure.

Configuring the Files

Database Parameter File (db-param.cfg)

For the `db-param.cfg` file, only the target and file parameters need to be adapted.

Listing 1-37 db-param.cfg Example

```
# This configuration file is used by FILE & RDBMS converter
# Lines beginning with "#" are ignored
# write information in lower case
# common parameters for FILE and RDBMS
# source information is written into system descriptor file (OS, DBMS=,
# DBMS-VERSION=)
target_rdbms_name:udb
target_rdbms_version:9
target_os:unix
# optional parameter
target_cobol:cobol_mf
hexa-map-file:tr-hexa.map
#
# specific parameters for FILE to RDBMS conversion
file:char_limit_until_varchar:29
# specific parameters for RDBMS conversion
rdbms:date_format:YYYY/MM/DD
```

```
rdbms:timestamp_format:YYYY/MM/DD HH24 MI SS FF6

rdbms:time_format:HH24 MI SS

# rename object files

# the file param/rdbms/rename-objects-<schema>.txt is automatically loaded
# by the tool if it exists.
```

Mandatory Parameters

- `target_rdbms_name`: *udb*

  Name of the target RDBMS.

- `target_rdbms_version`:*9*

  Version of the target RDBMS.

- `target_os`:*unix*

  Name of the target operating system.

- `file:char_limit_until_varchar`:*29*

  Indicates the maximum field length of a COBOL alphanumeric (PIC X) field before the field be transformed into an `DB2/Luw(udb) VARCHAR` data type.

  In this example, fields longer than 29 characters become `VARCHAR`, fields shorter than 30 characters becomes `CHAR` fields.

Optional Parameters

`target_cobol:cobol_mf`
: Name of the COBOL language. Accepted values are "`cobol_mf`" (default value) and "`cobol_it`".

  In this example, the language is Micro Focus COBOL.

`hexa-map-file:tr-hexa.map`
: Specifies a mapping table file between EBCDIC (z/OS code set) and ASCII (Linux/UNIX code set) hexadecimal values; if `hexa-map-file` is not specified, a warning will be logged.

Datamap Parameter File (Datamap-<configuration name>.re)

Each `VSAM` file to be migrated must be listed.

The following parameters must be set:

Table 1-24 Datamap Parameters

Parameter	Value in example	Set by
`configuration name`	STFILEUDB `(data map STFILEUDB-map)`	Freely chosen by user.
`system name`	STFILEUDB `(system cat::STFILEUDB)`	Determined by the System Description File in the Cataloger.
`file name`	PJ01AAA.SS.VSAM.CUSTOMER	z/OS physical file name.
`Organization`	Indexed	Source organization

Note: The description of the different parameters used is provided in the Tuxedo ART Workbench Reference Guide, File To File Convertor.

The PJ01AAA.SS.VSAM.CUSTOMER file is a VSAM KSDS file and the organization is therefore indexed. The parameters, `keys offset 1 bytes length 6 bytes primary`, describe the key. In this example, the key is six bytes long starting in position1.

Listing 1-38 Example Datamap File: Datamap-STFILEUDB.re

```
%% Lines beginning with "%%" are ignored
data map STFILEUDB-map system cat::STFILEUDB
%%
%% Datamap File PJ01AAA.SS.VSAM.CUSTOMER
%%
file PJ01AAA.SS.VSAM.CUSTOMER
  organization Indexed
  keys offset 1 bytes length 6 bytes primary
```

Mapping Parameter File (mapper-<configuration name>.re)

Each z/OS file to be migrated, that is included in the Datamap configuration file, must be listed.

A file parameter and its options must be included for every `VSAM` file to convert to an DB2/Luw(udb) table. The following parameters must be set:

Table 1-25 Mapping Parameters

Parameter	Value in example	Set by
`configuration name`	STFILEUDB `(ufas mapper STFILEUDB)`	Coherent with the name used in the datamap configuration file.
`file name`	PJ01AAA.SS.VSAM.CUSTOMER	Name used in the Datamap file.
`include`	`include "COPY/ODCSF0B.cpy"`	The name and path of the copy file `BCOAC01E.cpy` is freely chosen by the user when creating the file.
`table name`	table name CUSTOMER	Provide a name for the DB2/Luw(udb) table to be created.
`map record`	`map record VS-ODCSF0-RECORD defined in "COPY/ODCSF0B.cpy"`	`VS-ODCSF0-RECORD` corresponds to the level 01 field name in the copy file.
`logical name`	logical name ODCSF0B	Chosen by the user, maximum eight characters. This name is used for naming the objects (COBOL, JCL) created by the different tools in Tuxedo ART Workbench .
`converter name`	converter name ODCSF0B	Same name and use as logical name.

Note: The description of the different parameters used is provided in the Oracle Tuxedo Application Rehosting Workbench Reference Guide - File To File Convertor.

Listing 1-39 Example Mapper File: mapper-STFILEUDB.re

```
%% Lines beginning with "%%" are ignored

ufas mapper STFILEUDB
```

```
%%
%% Desc file PJ01AAA.SS.VSAM.CUSTOMER
%%
file PJ01AAA.SS.VSAM.CUSTOMER transferred converted
   table name CUSTOMER
   include "COPY/ODCSF0B.cpy"
   map record VS-ODCSF0-RECORD defined in "COPY/ODCSF0B.cpy"
   source record VS-ODCSF0-RECORD in "COPY/ODCSF0B.cpy"
   logical name ODCSF0B
   converter name ODCSF0B
   attributes LOGICAL_MODULE_IN_ADDITION
```

Installing the Copy Files

Once the COBOL Description files have been prepared, the copy files described in the `mapper-<configuration name>.re` file should be placed in the `$PARAM/file/recs-source directory`.

If you use a COBOL copy book from the source platform to describe a file (see note in COBOL Description), then it is the location of the copy book that is directly used in the mapping parameter file as in the `"COPY/ODCSF0B.cpy"` example above.

Generating the Components

To generate the components used to migrate data from VSAM file to DB2/Luw(udb) tables Tuxedo ART Workbench uses the `file.sh` command. This section describes the command.

file.sh

Name

file.sh — Generate z/OS migration components.

Synopsis

```
file.sh [ [-g] [-m] [-i <installation directory>] <configuration name> | -s
<installation directory> (<configuration name>,...) ]
```

Description

`file.sh` generates the components used to migrate `VSAM` files by Tuxedo ART Workbench .

Options

-g <configuration name>
Generation option. The unloading and loading components are generated in `$TMPPROJECT` using the information provided by the configuration files.

-m <configuration name>
Modification option. Makes the generated shell scripts executable. The COBOL programs are adapted to the target COBOL fixed format. When present, the shell script that modifies the generated source files is executed.

-i <installation directory> <configuration name>
Installation option. Places the components in the installation directory. This operation uses the information located in the `file-move-assignation-db2luw.pgm` file.

-s <installation directory> <schema name>,...)
Enables the generation of the configuration files and DML utilities used by the COBOL converter. All configuration files are created in `$PARAM/dynamic-config` and DML files in `<trf>/DML` directory.

Example

```
file.sh -gmi $HOME/trf FTFIL001
```

Using the Make Utility

Make is a UNIX utility intended to automate and optimize the construction of targets (files or actions).

You should have a descriptor file named makefile in the source directory in which all operations are implemented (a makefile is prepared in the source directory during the initialization of a project).

The next two sections describe configuring a make file and how to use Tuxedo ART Workbench File-To-File Converter functions with a make file.

Configuring a Make File

Version.mk

The `version.mk` configuration file in `$PARAM` is used to set the variables and parameters required by the make utility.

In `version.mk` specify where each type of component is installed and their extensions, as well as the versions of the different tools to be used. This file also describes how the log files are organized.

The following general variables should be set at the beginning of migration process in the `version.mk` file:

- `ROOT_PROJECT`
- `DIR_TRADDATA`
- `TOOLS_DATA`
- `LOGDIR`

In addition, the `FILE_SCHEMAS` variable is specific to file migration, it indicates the different configurations to process.

This configuration should be complete before using the make file.

Make File Contents

The contents of the makefile summarize the tasks to be performed:

- Including vesion.mk
- Controlling if the main variables are set
- Collecting the value of variables and building the required lists to process.
- Implementing the targets.

A `makefile` and a `version.mk` file are provided with Tuxedo ART Workbench Simple Application.

Using a makefile with Tuxedo ART Workbench File-To-File Converter

The `make FileConvert` command can be used to launch Tuxedo ART Workbench File-To-File Converter. It enables the generation of the components required to migrate z/OS files to a UNIX/Linux target platform.

The make file launches the `file.sh` tool with the `-g`, `-m` and `-i` options, for all configurations contained in the `FILE_SCHEMAS` variable.

Locations of Generated Files

The unloading and loading components generated with the `-i $HOME/trf` option are placed in the following locations:

Table 1-26 Location of Components

Location	Contents
`$HOME/trf/unload/file/<configuration name>`	The programs and JCL used for each unloading are generated for each `<configuration name>`.
`$HOME/trf/reload/file/<configuration name>`	The programs and KSH used for each loading are generated for each `<configuration name>`. Example: `loadtable-ODCSF0.ksh RELTABLE-ODCSF0.sqb`
`$TMPPROJECT/outputs`	The generation log files `Mapper-log-<configuration name>` can be used to resolve problems.
`$HOME/trf/SQL/file/<schema name>`	Location of the SQL scripts for creating tables and the Korn shell scripts used to perform various technical operations for the DB2/luw (udb) tables generated.
`$HOME/trf/DML`	Location of the COBOL and Embedded SQL access routines. These routines are executed by the COBOL programs instead of the access verbs used for the VSAM file migrated to DB2/luw (udb) tables.

Examples of Generated Components

For the example used in this chapter, the following scripts are generated.

The SQL script used to create the CUSTOMER table is named:

- ODCSF0B.sql

The scripts used for the different technical operations are named:

- `cleantable-ODCSF0B.ksh`
- `createtable-ODCSF0B.ksh`
- `droptable-ODCSF0B.ksh`
- `ifemptytable-ODCSF0B.ksh`
- `ifexisttable-ODCSF0B.ksh`

Nine COBOL programs are generated, their usage is described in the Oracle Tuxedo Application Rehosting Workbench Reference Guide.

- `ASG_ODCSF0B.cbl`
- `close_all_files_STFILEUDB.cbl`
- `dml_locking.cbl`
- `init_all_files.cbl`
- `UL_ODCSF0B.cbl`
- `close_all_files.cbl`
- `DL_ODCSF0B.cbl`
- `getfileinfo.cbl`
- `init_all_files_STFILEUDB.cbl`

One Embedded-SQL program for accessing the DB2/luw (udb) CUSTOMER table is generated:

- `RM_ODCSF0B.sqb`

Modifying Generated Components

The generated components may be modified using a project's own scripts. these scripts (sed, awk, perl,…) should be placed in:

`$PARAM/file/file-modif-source.sh`

When present, this file will be automatically executed at the end of the generation process. It will be called using the `<configuration name>` as an argument.

The DB2-to-Oracle Migration Process

File Organization

When migrating from a z/OS DB2 source platform to an Oracle UNIX target platform, the first question to ask is, which tables should be migrated? When not all DB2 tables are to be migrated, a DB2 DDL representing the sub-set of objects to be migrated should be built.

Migration Process Steps

The principle steps in the DB2- to-Oracle migration process, explained in detail in the rest of this chapter, are:

1. Create an overall list of the tables to be migrated. When not all of the DB2 tables are to be migrated, build a DB2 DDL for those tables to be migrated; otherwise take the entire DB2 DDL used by the site.
2. Prepare the environment to be used to generate the components.
3. Using Tuxedo ART Workbench generate the components used in the following steps.
4. Unload the tables from the source platform.
5. Transfer the data to the target platform.
6. Transcode and reload the data.
7. Check the results.
8. Build the Oracle database.

Interaction With Other Oracle Tuxedo Application Rehosting Workbench Tools

The DB2-to-Oracle migration is dependent on the results of the Cataloger; the DB2-to-Oracle migration impacts the COBOL conversion and should be completed before beginning the program conversion work.

Re-Engineering Rules to Implement

This section describes the reengineering rules applied by Tuxedo ART Workbench when migrating data from a DB2 database to an Oracle database.

Migration Rules Applied

The list of DB2 objects that are included in the migration towards Oracle are described in Creating the Generated Oracle Objects.

Migrated DB2 objects keep their names when migrated to Oracle except for the application of Tuxedo ART Workbench renaming rules (see Preparing and Implementing Renaming Rules).

DB2-to-Oracle Data Type Migration Rules

Table 1-27 DB2 to Oracle Data Types

DB2 z/OS data type	Oracle format
`CHAR(length)`	Becomes CHAR if length <= 2000 bytes Becomes VARCHAR2 if length > 2000 bytes
`VARCHAR(length)`	VARCHAR2 (length)
`DECIMAL(…)`	NUMBER(…)
`NUMERIC(…)`	NUMBER(…)
`DEC(…)`	NUMBER(…)
`SMALLINT`	NUMBER(5)
`INTEGER`	NUMBER(10)
`TIMESTAMP`	TIMESTAMP
`TIMESTMP`	TIMESTAMP
`DATE`	DATE
`TIME`	DATE
`DOUBLE`	BINARY_DOUBLE
`FLOAT(prec)`	BINARY_DOUBLE

Table 1-27 DB2 to Oracle Data Types

DB2 z/OS data type	Oracle format
REAL	BINARY_DOUBLE
CLOB	CLOB
BLOB	BLOB

DB2-to-Oracle Column Property Migration Rules

A column property can change the behavior of an application program.

The following table shows all of the DB2 column properties and how they are converted for the target Oracle database.

Table 1-28 DB2 to Oracle Column Properties

DB2 column properties	Oracle format	Notes
WITH DEFAULT	`DEFAULT <value>`	`<value>` depends on DB2/z/OS data type.
WITH DEFAULT ''	`CHAR: DEFAULT ' '` `VARCHAR2: DEFAULT ' '`	A zero byte length in DB2 becomes a NULL flag on Oracle.
WITH DEFAULT '<value>'	`DEFAULT '<value>'`	
NOT NULL	`NOT NULL`	
IDENTITY	Create a Sequence Create a Trigger	As the IDENTITY attribute does not exist on Oracle, Tuxedo ART Workbench replaces the attribute by Sequence and Trigger objects.
FOR SBCS …	Attribute ignored	

Preparing and Implementing Renaming Rules

Oracle Tuxedo Application Rehosting Workbench permits the modification of the different names in the DDL source file (table name, column name).

Renaming rules can be implemented for the following cases:

- When Oracle reserved words are found in the DB2 DDL source file.
- When there is a desire to perform a reengineering of the DDL source file.

Note: If, when executing Tuxedo ART Workbench , an Oracle reserved word is found in the DDL source, an error is reported and Tuxedo ART Workbench continues the analysis of the DDL.

Renaming rules should be placed in a file named `rename-objects-<schema name>.txt`. This file should be placed in the directory indicated by the `$PARAM/rdbms` parameter.

Renaming rules have the following format:

- table:

```
table;<schema name>;<DB2 table name>;<Oracle table name>
```

- column:

```
Column;<schema name>;<DB2 table name>;<DB2 column name>;<Oracle column name>
```

Comments can be added as following: `% Text`.

Example:

```
% Modification applied to the AUALPH0T table
column;AUANPR0U;AUALPH0T;NUM_ALPHA;MW_NUM_ALPHA
```

Preparing and Implementing LOBS Data Type Migration

Tuxedo ART Workbench permits the download of CLOB and BLOB data types. The DB2 unloading utility downloads each row of CLOB or BLOB columns into a separate file (PDS or HFS dataset type). This utility (`DSNUTILB`) downloads data of all columns and NULL technical flags into a unique MVS member file, excepted for CLOB or BLOB columns which are replaced by the file name of the CLOB or BLOB separate file.

A PDS dataset type does not allow some files depending on your MVS system configuration, you may need to choose another dataset type for downloading CLOB or BLOB columns.

Based on those two constraints, you should set correct parameters in `db-param.cfg` configuration file (see Implementing the Configuration Files).

Preparing and Implementing MBCS Data Migration

Tuxedo ART Workbench provides the transcoding for single byte data. However, if your DB2 data contains MBCS characters, you should choose `DSNUPROC` unloading utility and set `csv` data format. The MBCS transcoding is done by the transfer tools.

Based on this constraint, you have to set correct parameters in `db-param.cfg` configuration file (see Implementing the Configuration Files).

Example of a Migration of DB2 Objects

In this example, the DB2 DDL contains a table named ODCSF0 with a primary key and a unique index named `XCUSTIDEN`:

Listing 1-40 DDL Example Before Migration

```
DROP TABLE ODCSF0;
  COMMIT;
  CREATE TABLE ODCSF0
         (CUSTIDENT DECIMAL(6, 0)  NOT NULL,
          CUSTLNAME CHAR(030)      NOT NULL,
          CUSTFNAME CHAR(020)      NOT NULL,
          CUSTADDRS CHAR(030)      NOT NULL,
          CUSTCITY  CHAR(020)      NOT NULL,
          CUSTSTATE CHAR(002)      NOT NULL,
          CUSTBDATE DATE           NOT NULL,
          CUSTEMAIL CHAR(040)      NOT NULL,
          CUSTPHONE CHAR(010)      NOT NULL,
          PRIMARY KEY(CUSTIDENT))
         IN DBPJ01A.TSPJ01A
         CCSID EBCDIC;
  COMMIT;
  CREATE UNIQUE INDEX XCUSTIDEN
                  ON ODCSF0
                  (CUSTIDENT ASC) USING STOGROUP SGPJ01A;
  COMMIT;
```

After applying the migration rules, and without implementing any renaming rules the following Oracle objects are obtained:

Listing 1-41 Oracle Table Example After Migration

```
WHENEVER SQLERROR CONTINUE;
DROP TABLE ODCSF0 CASCADE CONSTRAINTS;
WHENEVER SQLERROR EXIT 3;
CREATE TABLE ODCSF0 (
  CUSTIDENT NUMBER(6) NOT NULL,
  CUSTLNAME CHAR(30) NOT NULL,
  CUSTFNAME CHAR(20) NOT NULL,
  CUSTADDRS CHAR(30) NOT NULL,
  CUSTCITY CHAR(20) NOT NULL,
  CUSTSTATE CHAR(2) NOT NULL,
  CUSTBDATE DATE NOT NULL,
  CUSTEMAIL CHAR(40) NOT NULL,
  CUSTPHONE CHAR(10) NOT NULL);
```

Listing 1-42 Oracle Index Example After Migration

```
WHENEVER SQLERROR CONTINUE;
DROP INDEX XCUSTIDEN;
WHENEVER SQLERROR EXIT 3;
CREATE UNIQUE INDEX XCUSTIDEN ON ODCSF0
  (
     CUSTIDENT ASC
   );
```

Listing 1-43 Oracle Constraint Example After Migration

```
WHENEVER SQLERROR CONTINUE;

ALTER TABLE ODCSF0 DROP CONSTRAINT CONSTRAINT_01;

WHENEVER SQLERROR EXIT 3;

ALTER TABLE ODCSF0 ADD

  CONSTRAINT CONSTRAINT_01 PRIMARY KEY (CUSTIDENT);
```

Preparing the Environment

This section describes the tasks to perform before generating the components to be used to migrate the DB2 data to Oracle.

Implementing the Cataloging of the DB2 DDL Source Files

The DB2 DDL source files to be migrated are located when preparing for the catalog operations. During the migration process, all valid DB2 syntaxes are accepted, although only the SQL CREATE command is handled and migrated to Oracle.

system.desc File Parameters

For a DB2-To-Oracle migration, a parameter must be set in the `system.desc` System Description File in the Cataloger that is used by all of Tuxedo ART Workbench tools:

- `DBMS-VERSION="8".`

  Indicates the version of the RDBMS to migrate.

Schemas

A schema should consist of a coherent set of objects (for example there should be no CREATE INDEX for a table that does not exist in the schema).

By default, if the SQL commands of the DB2 DDL are prefixed by a qualifier or an authorization ID, the prefix is used by Tuxedo ART Workbench as the name of the schema—for example, CREATE TABLE <*qualifier or authorization ID*>.table name.

The schema name can also be determined by Tuxedo ART Workbench using the global-options clause of the `system.desc` file.

For example:

```
system STDB2ORA root ".."
global-options
  catalog="..",
  sql-schema=<schema name>.
```

The schema name can also be determined for each DDL directory by Tuxedo ART Workbench using the `directory options` clause of the system.desc file. For more information, see options-clause in Cataloger.

```
directory "DDL"  type SQL-SCRIPT
                 files "*.sql"
                 options SQL-Schema = "<schema name>".
```

Implementing the Configuration Files

Only one file needs to be placed in Tuxedo ART Workbench file structure as described by $PARAM:

- `db-param.cfg`,

Two other configuration files:

- `rdbms-templates.txt`
- `rdbms-move-assignation.pgm`

are automatically generated in the file structure during the installation of Tuxedo ART Workbench . If specific versions of these files are required, they will be placed in the `$PARAM/rdbms` file structure.

Initializing Environment Variables

Before executing Tuxedo ART Workbench set the following environment variables:

- export `TMPPROJECT=/$home/tmp`

  — the location for storing temporary objects generated by the process.

  You should regularly clean this directory.

- `export PARAM=$HOME/param`

  — the location of the configuration files.

Generation Parameters

Listing 1-44 Example db-param.cfg File

```
#
# This configuration file is used by FILE & RDBMS converter
# Lines beginning by "#" are ignored
# write information in lower case
#
# common parameters for FILE and RDBMS
# source information is written into system descriptor file (OS, DBMS=,
# DBMS-VERSION=)
target_rdbms_name:oracle
target_rdbms_version:11
target_os:unix
# optional parameter
target_cobol:cobol_mf
hexa-map-file:tr-hexa.map
#
# specific parameters for FILE to RDBMS conversion
file:char_limit_until_varchar:29
# specific parameters for RDBMS conversion
rdbms:date_format:YYYY/MM/DD
rdbms:timestamp_format:YYYY/MM/DD HH24 MI SS FF6
rdbms:time_format:HH24 MI SS
rdbms:lobs_fname_length:75
```

```
rdbms:jcl_unload_lob_file_system:pds

rdbms:jcl_unload_utility_name:dsnutilb

#rdbms:jcl_unload_format_file:csv

# rename object files

# the file param/rdbms/rename-objects-<schema>.txt is automatically loaded
by # the tool if it exists.
```

Only the parameters `target_<xxxxx>` and `rdbms:<xxxxx>` need to be adapted.

Mandatory Parameters

- `target_rdbms_name:` *`oracle`*

  name of the target RDBMS.

- `target_rdbms_version:`*`11`*

  version of the target RDBMS.

- `target_os:unix`

  Name of the target operating system.

Optional Parameters

`target_cobol:cobol_mf`
: Name of the COBOL language. Accepted values are "`cobol_mf`" (default value) and "`cobol_it`".

  In this example, language is Micro Focus COBOL.

`hexa-map-file:tr-hexa.map`
: Specifies a mapping table file between EBCDIC (z/OS code set) and ASCII (Linux/UNIX code set) hexadecimal values; if `hexa-map-file` is not specified, a warning will be logged.

Optional Parameters in Case of DATE, TIME and TIMESTAMP Data Types

The following `rdbms` parameters indicate the date, timestamp, and time formats used by z/OS DB2 and stored in DSNZPARM:

- `rdbms:date_format:` *`YYYY/MM/DD`*

- rdbms:timestamp_format:*YYYY/MM/DD HH24 MI SS FF6*
- rdbms:time_format:*HH24 MI SS*

These parameters impact the reloading operations, COBOL date, and time manipulations. They are optional and only necessary if the DB2 database contains the DATE, TIME or TIMESTAMP fields.

WARNING: Correct setting of these parameters is *essential*.

Optional Parameters in Case of CLOB or BLOB Data Types

The following rdbms parameters are optional and only necessary if the DB2 schema contains CLOB or BLOB data types.

WARNING: A correct setting of these parameters is essential.

- rdbms:jcl_unload_lob_file_system:pds / hfs

  The number of member files that can be created on a PDS is limited. As the DB2 unloading utility creates a new member file for each CLOB/BLOB column and row, which may exceed the maximum number allowed for LOBS files to be created on a PDS dataset type, in that case you need to choose HFS dataset type. Contact your DB2 MVS administrator for more helps. By default, use "pds".

- rdbms:lobs_fname_length:75

  You need to calculate the maximum length of the CLOB or BLOB file name as written by the DB2 unloading JCL in the table data file:

  – pds

    If the length of target MVS dataset name is equal to "MIGR.SCH1.TAB1.COLUMN1" (22 characters), the maximum length of the string created by the JCL would be 32: 22 + 2 (parenthesis characters) + 8 (member name).

  – HFS

    If the length of target MVS directory name is equal to "/LOB/SCHEMA2/TABLE2/SECOND2" (27 characters), the maximum length of the string created by the JCL would be 36: 27 + 1 (slash character) + 8 (file name).

Note: You should set value "dsnutilb" for rdbms:jcl_unload_utility_name parameter.

Optional Parameters for JCL Unloading Utility

The following parameters are optional:

- `rdbms:jcl_unload_utility_name:dsnutilb`
- `rdbms:jcl_unload_format_file:binary`

You can also change the value depending on the presence of DB2 unloading utility on the MVS.

Note:

- The first parameter is necessary if the DB2 schema contains CLOB or BLOB data types.
- The second parameter can be set to "`csv`" only if the `jcl_unload_utility_name` is set to "`dsnuproc`".
- If the database contains MBCS characters, you should choose `"dsnuproc"` as the unloading utility and `"csv"` as the unloading format.

Generating the Components

To generate the components used to migrate data from DB2 databases to Oracle databases, Tuxedo ART Workbench uses the `rdbms.sh` command. This section describes the command.

rdbms.sh

Name

rdbms.sh — Generate DB2 to Oracle database migration components.

Synopsis

```
rdbms.sh [ [-c|-C] [-g] [-m] [-r] [-i <installation directory>] <schema
name> ] -s <installation directory> (<schema name>,...) ]
```

Description

`rdbms.sh` generates Tuxedo ART Workbench components used to migrate z/OS DB2 databases to UNIX Oracle databases.

Options

Generation Options

-C <schema name>

The following components are generated in `$TMPPROJECT: DDL` Oracle, the `SQL*LOADER CTL` files, the XML file used by the COBOL converter, and configuration files (`mapper.re` and `Datamap.re`). If an error or warning is encountered, the process will not abort.

See Executing the Transcoding and Reloading Scripts for information about the SQL scripts created during the generation operation.

-c <schema name>

This option has the same result as the `-C` option except the process will abort if an error or warning is generated.

-g <schema name>

The unloading and loading components are generated in `$TMPPROJECT` using the information provided by the configuration files. You should run the `rdbms.sh` command with `-C` or `-c` command before this option.

Modification Options

-m <schema name>

Makes the generated shell scripts executable. The COBOL programs are adapted to the target COBOL fixed format. When present, the shell script that modifies the generated source is executed.

-r <schema name>

Removes the schema name from the generated objects (create table, table name, CTL file for SQL*LOADER, KSH). When this option is used, the name of the schema can also be removed from the COBOL components by using the option: `sql-remove-schema-qualifier` located in the `config-cobol` file (COBOL conversion configuration file) used when converting the COBOL components.

Installation Option

-i <installation directory> <schema name>

Places the components in the installation directory. This operation uses the information located in the `rdbms-move-assignation.pgm` file.

Generate Configuration Files for COBOL Conversion

-s <installation directory> <schema name>,...)

Enables the generation of the COBOL convertor configuration file. This file takes all of the unitary XML files of the project. All these files are created in `$PARAM/dynamic-config`.

Example: `rdbms-conv.txt  rdbms-conv-PJ01DB2.xml`

Example

```
rdbms.sh -Cgrmi $HOME/trf PJ01DB2
```

Using the Make Utility

Make is a UNIX utility intended to automate and optimize the construction of targets (files or actions).

You should have a descriptor file named makefile in the source directory in which all operations are implemented (a makefile is prepared in the source directory during the initialization of a project).

The next two sections describe configuring a make file and how to use Tuxedo ART Workbench File-To-File Converter functions with a make file.

Configuring a Make File

Version.mk

The `version.mk` configuration file in `$PARAM` is used to set the variables and parameters required by the make utility.

In `version.mk` specify where each type of component is installed and their extensions, as well as the versions of the different tools to be used. This file also describes how the log files are organized.

The following general variables should be set at the beginning of migration process in the `version.mk` file:

- `ROOT_PROJECT`
- `DIR_TRADDATA`
- `TOOLS_DATA`
- `LOGDIR`

In addition, the `RDBMS_SCHEMAS` variable is specific to DB2 migration, it indicates the different schemas to process.

This configuration should be complete before using the make file.

Make File Contents

The contents of the makefile summarize the tasks to be performed:

- Including vesion.mk
- Controlling if the main variables are set
- Collecting the value of variables and building the required lists to process.

- Implementing the targets.

A `makefile` and a `version.mk` file are provided with Tuxedo ART Workbench Simple Application.

Using a Makefile With Oracle Tuxedo Application Rehosting Workbench File-To-File Converter

The `make RdbmsConvert` command can be used to launch Tuxedo ART Workbench File-To-File Converter. It enables the generation of the components required to migrate a DB2 database to Oracle.

The make file launches the `rdbms.sh` tool with the `-C`, `-g`, `-r`, `-m` and `-i` options, for all schemas contained in the `RDBMS_SCHEMAS` variable.

Locations of Generated Files

The unloading and loading components generated with the `-i $HOME/trf` option are placed in the following locations:

Table 1-29 Location of Components

Location	Contents
`$HOME/trf/unload/rdbms/<schema name>`	The JCL used for each unloading are generated for each <schema name>.
`$HOME/trf/SQL/rdbms/<schema name>`	Location by <schema name> of the SQL scripts used to create the Oracle objects. For the example used in this chapter there are three scripts: • `INDEX-ODCSF0.sql` • `TABLE-ODCSF0.sql` • `CONSTRAINT-ODCSF0.sql`
`$HOME/trf/reload/rdbms/<schema name>/src`	Location by <schema name> of the COBOL transcoding programs. For the example in this chapter, there is one program: • `MOD_ODCSF0.cbl` and another program in case of CLOB data type: • CLOB_<table>_<column>.cbl

Table 1-29 Location of Components

Location	Contents
`$HOME/trf/reload/rdbms/<schema name>/ctl`	Location by <schema name> of the CTL files used by SQL*LOADER. For the example in this chapter, there is one CTL: • `ODCSF0.ctl`
`$HOME/trf/reload/rdbms/<schema name>/ksh`	Location by <schema name> of the reloading Korn shell scripts. For the example in this chapter, there is one script: • `loadrdbms-ODCSF0.ksh`
`$TMPPROJECT/outputs/<schema name>`	The generation log files produced when using the -c or -C options. rdbms-converter-<schema name> can be used to resolve problems.

`trf/DSNUTILS/<schema name>`	Location by `<schema name>` of the COBOL programs for DB load/unload. For the example in this chapter, there're two programs:
	`PJ01DB2-ODCSF0-L.pco`
	`PJ01DB2-ODCSF0-U.pco`

Modifying Generated Components

The generated components may be modified using a project's own scripts. these scripts (sed, awk, perl,…) should be placed in:

`$PARAM/rdbms/rdbms-modif-source.sh`

When present, this file will be automatically executed at the end of the generation process. It will be called using the <*schema name*> as an argument.

COBOL Conversion

Migrating data files is described in the following sections:

- Requirements & Prerequisites
- Overview of the COBOL Converter in the Replatforming Process

Requirements & Prerequisites

Cataloguing Requirements

Cataloguing is mandatory before running the COBOL converter in order to check the consistency of the assets to be migrated and fix any errors related either to syntax or to the coherency (missing or unused components) of the asset.

Data Conversion

The data migration process must have been performed before the COBOL conversion is started. This dependency is because the data migration tools generate some of the configuration files read by the COBOL converter. The configuration files from data conversion are documented in the Oracle Tuxedo Application Rehosting Workbench Reference Guide.

Overview of the COBOL Converter in the Replatforming Process

The inputs to Tuxedo ART Workbench COBOL converter process are:

- The abstract syntax trees of the COBOL programs stored in the pob files produced by Tuxedo ART Workbench Cataloger.
- A set of configuration files, some of them are produced by the data conversion tools that specifies information about file-to-RDBMS conversion and relational DBMS conversion (from DB2to Oracle).

Conversion Steps

Building and Setting the Configuration Files

The main configuration file for translation is `config-COBOL`. It references other additional configuration files including:

- `keywords-file`
- `tr-hexa.map`
- `rename-call-map-file`

Samples of all the needed configuration files are given in the Simple Application. You only need to check and adapt the values if necessary.

All of the configuration files that the COBOL Converter uses are described in the COBOL Converter chapter of the Oracle Tuxedo Application Rehosting Workbench Reference Guide.

Configuring config-COBOL

After preparing the prerequisites for the COBOL conversion, prepare the main configuration file using the following example as a model.

Note: The following files can be used:

- `post-translation-file` used when there is a need to perform some specific transformations. This file is to write manually.
- `rdbms-conversion-file` used when migrating DB2 to an Oracle database. This file is generated by the DB2-to-Oracle Convertor.
- `conv-ctrl-list-file` used when there are files to be converted to Oracle tables. This file should be generated by the File-to-File Converter.

Listing 1-45 config-cobol File

```
Config:
    "Config version 1.0"
# sql-rules : none.
/* GENERAL */
  target-dir:   "../trf/".
  keywords-file: "../param/keywords-file".
  rename-call-map-file: "../param/rename-call-map-file".
  accept-date : MW-DATE.
  accept-day  : MW-DAY.
# post-translation-file: "../param/renov.desc".
  hexa-map-file: "../param/tr-hexa.map".
#  rdbms-conversion-file : "dynamic-config/rdbms-conv.txt".
  conv-ctrl-list-file :  "dynamic-config/Conv-ctrl.txt".
```

```
on-size-error-call : "ABORT".

dcrp.                          /* Without reconcilation of copies files */
end
```

keywords-file

The keywords-file is a hint file for the COBOL Converter to help rename specific variables including reserved keywords probably not renamed systematically by Tuxedo ART Workbench COBOL Converter.

This is a reengineering mechanism offered by the WorkBench to perform a (mass-change) renaming operation for the customer's own purposes, even when the variables are not Micro Focus COBOL or COBOL-IT reserved keywords.

Place the following entry in the main configuration file config-cobol:

```
keywords-file: "../param/keywords-file"
```

Listing 1-46 Sample Keywords File

```
( TAB . MW-TAB )
 ( DOUBLE . MW-DOUBLE )
 ( POS . MW-POS )
)
```

In this example each occurrence of the item TAB will be replaced by MW-TAB.

tr-hexa.map

The `tr-hexa.map` file is a mapping table between EBCDIC (z/OS code set) and ASCII (Linux/UNIX code set) hexadecimal values.

Place the following entry in the main configuration file config-cobol:

```
hexa-map-file: "../param/tr-hexa.map"
```

This file is used by some translation rules like Tr-Hexa-Map and may help the user to solve problems related to differences between EBCDIC and ASCII codes in values and strings that could lead to different behavior in sorting and in string comparisons.

Note: hexa-map-file is an optional item; if it is not specified, a warning will be logged.

Generated hexa-map-file with convert-hexa-copy-to-map.sh script

This script is located in `REFINEDIR/scripts/convert-hexa-copy-to-map.sh`.

Syntax

```
REFINEDIR/scripts/convert-hexa-copy-to-map.sh convertmw_copy_file
convertmw_copy_file: location of the CONVERTMW.cpy file
```

The script generates a `tr-hexa.map` file inside the current directory (it should be the PARAM directory).

Hexadecimal Code for Space Example

The hexadecimal code for space in z/OS is 40 and the hexadecimal code for space in UNIX is 20.

The statement in the source platform code is:

```
01  VarName             pic X       value X'40'.
```

This is translated as:

Listing 1-47 Hexadecimal Code Translation

```
*{ Tr-Hexa-Map 1.4.2.1
*01  VarName             pic X       value X'40'.
*--
 01  VarName             pic X       value X'20'.
*}
```

Listing 1-48 Sample of tr-hexa.map

```
00;00
```

```
01;01
02;02
03;03
37;04
2d;05
2e;06
2f;07
...
40;20
...
```

rename-call-map-file

The `rename-call-map-file` is a mapping file between the old call name and the new one.

It is used by some translation rules like `Tr-Rename-External-Call` and allows the user to make specific changes if needed.

Place the following entry in the main configuration file `config-cobol`:

```
rename-call-map-file: "../param/rename-call-map-file"
```

Listing 1-49 Example rename-call-map-file

```
(
 ("MQGET" . "MWMQGET")
 ("KIX-ABEND" . "KIX_ABEND")
 ("KIX-ASKTIME" . "KIX_ASKTIME")
)
```

In this example all calls to `MQGET` are changed to `MWMQGET`.

Conversion

There are many possibilities allowed by the conversion command options (for more information, see theOracle Tuxedo Application Workbench Reference Guide). In this section the following examples are described:

- Translate Batch programs and CICS programs.
- Translate a list of programs.
- Translate one program.

The distinction between programs (Batch and CICS) and sub-programs is mandatory; the option `-cobol-type` takes the following values:

- Batch programs: `batch`
- CICS programs: `tpr`
- Sub-programs: `sub`

In the following command lines, the following working variables are set:

Table 1-30 Conversion Variables

Variable	Value
REFINEDIR	/product/art_wb11gR1/refine
PROJECT	$(HOME)/ simpleapp
PARAM	$PROJECT/param
SOURCE	$PROJECT/source
LOGS	$PROJECT/Logs

Translation of Batch, CICS Programs and Sub-Programs

The command lines are:

- To translate all batch programs:

```
$REFINEDIR/refine cobol-convert -v version -loop -limit=50 -s
$PARAM/system.desc   -c $PARAM/config-cobol -cobol-type batch
```

The COBOL Converter knows which are the batch programs to be translated from the system description file which describes all components. Where `version` is the release version, for example `M2_L5_7`

- To translate all CICS programs invoke the command:

```
$REFINEDIR/refine cobol-convert -v version -loop -limit=50 -s
$PARAM/system.desc   -c $PARAM/config-cobol -cobol-type tpr
```

- To translate one program, for example the CICS program `PGMM002.cbl`, invoke the command:

```
$REFINEDIR/refine cobol-convert -v version -loop -limit=50 -s
$PARAM/system.desc   -c $PARAM/config-cobol -cobol-type tpr
CICS/PGMM002.cbl
```

- To translate all sub-programs files invoke the following command:

```
$REFINEDIR/refine cobol-convert -v version -loop -limit=50 -s
$PARAM/system.desc   -c $PARAM/config-cobol -cobol-type sub
```

- To translate all CICS programs invoke the command:

```
$REFINEDIR/refine cobol-convert -v version -loop -limit=50 -s
$PARAM/system.desc -c $PARAM/config-cobol -cobol-type tpr -cics
```

The log file is generated in the directory from where the command line is executed. If you want to have logs in a specific directory or file use `-log-file-base` followed by the path and name of the file to store the execution logs.

```
$REFINEDIR/refine cobol-convert -v version -loop -limit=50 -s
$PARAM/system.desc -log-file-base
$LOGS/trans-cbl/translate-cobol-datetime -c $PARAM/config-cobol
-cobol-type sub
```

In this example, the logs file will be generated in `$LOGS/trans-cbl/translate-cobol-datetime`. The logs directory should be previously created.

Reconciling Copybooks

Reconciliation of copybooks can be executed implicitly by the COBOL Converter or can be performed separately (through usage of the dcrp option, see Configuring config-COBOL) after all

programs have been generated.

To apply reconciliation separately, you should execute the following script from the directory where converted programs are located, (in the case of the Simple Application, from the $PROJECT/trf directory:

Listing 1-50 Copy Reconciliation

```
for file in `find  *  -name '*-copies'`
do
    $REFINEDIR/scripts/reconcil-copy-opt-imbr $PROJECT/trf  $file  .cbl
done
```

Checking Results

To check conversion results, verify that:

- All expected programs are generated.
- There are no empty programs.
- There are no truncated programs.
- There are no multi-versions for copybooks (reconciliation completed properly).

For empty or truncated programs, the user can refer to execution logs generated in $Logs to analyze errors encountered during the conversion.

Compiling

Compilation is a validation step for conversion. A program cannot be considered fully converted if it has not compiled successfully.

Compilation Options and Settings

You need to check that the compilation environment is configured correctly for Micro Focus COBOL or COBOL-IT compilation according to the following variables:

Table 1-31 Compilation Variables

Variable	Value	Usage
COBDIR	/Product/microfocus/cobol	COBOL product access
COBOLITDIR	/product/COBOL-IT	COBOL-IT product access
Other COBOL-IT environment variables	source $COBOLITDIR/bin/cobol-it-setup.sh	Initializes environment variables (PATH.LD_LIBRARY_PATH...)
PATH	$COBDIR/bin: ${PATH}	Add Cobdir to PATH variable
LD_LIBRARY_PATH	/usr/lib:$COBDIR/lib:${ORACLE_HOME}/lib:${JAVA_HOME}/lib	Defined LD_LIBRARY_PATH
COBCPY	../DML:../Master-copy/COPY:../fixed-copy:.	Indicates where programs can find includes
PCCINCLUDE	"include=../Master-copy/COPY, include=../../fixed-copies, include=.	Indicates where programs can find includes

A compilation options file must be prepared. The compilation options used for the Simple Application are:

Listing 1-51 MF Compilation Options Example

```
SOURCEFORMAT"FREE"

DEFAULTBYTE"00"

ADDRSV"COMP-6"

COMP-6"2"

ALIGN"8"

NOTRUNCCALLNAME

NOTRUNCCOPY
```

```
NOCOPYLBR
COPYEXT"cpy,cbl"
RWHARDPAGE
PERFORM-TYPE"OSVS"
NOOUTDD
INDD
NOTRUNC
HOSTARITHMETIC
NOSPZERO
INTLEVEL"4"
SIGN"EBCDIC"
ASSIGN"EXTERNAL"
NOBOUND
SETTINGS
REPORT-LINE"256"
WARNING"2"
TRACE
LIST()
```

For more information, see the Oracle Tuxedo Application Rehosting Workbench Reference Guide.

Compilation Command

The command to compile the programs `BATCH/PGMMB00.cbl`:

Listing 1-52 MF Compilation Example

```
# From $PROJECT/trf/BATCH
cd $PROJECT/trf/BATCH
```

```
export COBCPY=../DML:../Master-copy/COPY:../fixed-copy:.

export PCCINCLUDE="include=../Master-copy/COPY, include=../fixed-copies,
include=."

cob -ug PGMMB00.cbl -C "use(../../compil_tools/opt.dir)" -C
"list(PGMMB00.lst)" -C XREF -C SETTINGS 2> PGMMB00.err
```

Where:

- opt.dir is a file where the compilation options are specified.
- Compilation errors are generated in PGMMB00.err.
- Compilation is listed in PGMMB00.lst.
- Compilation is successful if GMMB00.gnt is generated.

Note: The best way to compile programs is to use a compilation makefile, you can set compilation options and a required configuration and perform compilation procedure using a make tool designed for these operations

For the Simple Application example, there is a compilation makefile that can be used for other projects. See Using a make File.

Using a make File

Configuration

The makefile delivered with the Simple Application example implements all conversion operations and can be used in any other project with the following adaptations:

- Set the required working variables.
- Update the `version.mk` configuration file according to your project properties and organization.

This configuration is supplementary to the preceding configuration started in the cataloging step.

Before using the make commands, the user should check the values in the `version.mk` supplied with the Simple Application:

Listing 1-53 version.mk Example

```
#
# Defined extensions converted files
#
ext_trad = cbl
ext_trad_copy = cpy
ext_trad_ksh = ksh
ext_trad_map = bms

#
# Define Version variables
# Information
# with GLOBAL_VERSION=CURRENT all -v option in the makefile are ignored
#
GLOBAL_VERSION = M2_L3_5
CATALOG = $(GLOBAL_VERSION)
TRAD = $(GLOBAL_VERSION)
TRAD_JCLZ = $(GLOBAL_VERSION)
DATA_TOOLS = $(GLOBAL_VERSION)
RECONCIL_COPY = $(GLOBAL_VERSION)
TIMEOUT = 900
TIMEOUT_PARSE = 300

#
# Define Config and opt files
#
FILE_TRAD_JCL = "$(PARAM)/config-trad-JCL.desc"
```

```
FILE_TRAD_COBOL = "$(PARAM)/config-cobol"
COMM_TRADJCL = "-c $(FILE_TRAD_JCL)"

COMM_RECONCIL_COPY = "reconcil-copy-opt-imbr"
```

COBOL Conversion

To perform the COBOL conversion the following commands are run from `$SOURCE`:

- To translate all programs in the source directory

  ```
  make trad
  ```

- To translate batch programs only:

  ```
  make trad_batch
  ```

- To translate CICS programs only:

  ```
  make trad_cics
  ```

- To translate sub-programs:

  ```
  make trad_sub
  ```

Reconciling Copybooks

To reconcile copybooks invoke the following command from `$SOURCE`:

```
make reconcil_copy
```

Troubleshooting the COBOL Converter

During translation you may encounter error messages or the COBOL Converter may abort. Certain errors are shown below as examples of how to proceed when errors occur.

Configuration File Does Not Exist

Particularly at the beginning of the conversion process, some configuration files could be missing, the COBOL Converter then aborts showing the following error:

Message

```
Parsing config /home2/wkb7/simpleapp/param/config-cobol...
```

```
*FATAL*: Hexa-map-file: this file
'/home2/wkb7/simpleapp/param/tr-hexa.map' does not exist


Error: Uncaught throw of :MESSAGE-ERROR to :MESSAGE-ERROR.
  1 (abort) Quit process.


Type :b for backtrace, :c <option number> to proceed,  or :? for other
options
```

Solution

Add the missing configuration file or disable the line in the main configuration file if the file requested (in this example, `tr-hexa.map`) is unnecessary.

Missing POB file

Message

```
Parsing config /home2/wkb7/simpleapp/param/config-cobol...

Creating target file /home2/wkb7/simpleapp/trf/CICS/PGMM002.cbl ...

*FATAL INTERNAL ERROR*: Can't find POB file
/home2/wkb7/simpleapp/source/CICS/pob/PGMM002.cbl.pob; please
re-catalog the system.

FIN

Rest in peace, Refine...
```

Solution

Either the programs is not catalogued yet or the `.pob` file was wrongly deleted. Recatalog to generate the requested file.

POB File Too Old

Message

```
Creating target file /home2/wkb7/simpleapp/trf/CICS/PGMM002.cbl ...

*FATAL INTERNAL ERROR*: POB file
/home2/wkb7/simpleapp/source/CICS/pob/PGMM002.cbl.pob is less recent
than source file /home2/wkb7/simpleapp/source/CICS/PGMM002.cbl; please
re-catalog the system.
```

Solution

This error occurs if the modification date of the source program is more recent than its corresponding POB file. Sometimes the POB file is generated but the source program is updated later, recatalog the program to ensure you have the latest changes.

Parsing error encountered

A program containing parsing errors is not translated, especially programs with fatal errors during cataloging. Generally, COBOL Converter can translate programs containing errors with severities less than FATAL.

Message

```
Program name is PGMM002
Warning:-- Parse-Error at line 163
*FATAL*: file CICS/PGMM002.cbl contains true parse errors, ABORTING!


FIN
Rest in peace, Refine...
```

Solution

Check the source code of the program and fix any errors, catalog the program and convert again.

More details about the parsing errors can be found in the cataloging reports and logs. In principle, you should not start conversion work before fixing errors identified during the cataloging step.

JCL Conversion

Translating JCL is described in the following sections:

- Requirements & Prerequisites
- Overview of the COBOL Converter in the Replatforming Process
- Conversion Steps
- Using a make File

Requirements & Prerequisites

Cataloguing Requirements

Cataloguing is mandatory before running the JCL translator in order to check the consistency of the assets to be migrated and fix any errors related either to syntax or to the coherency (missing or unused components) of the asset.

Data Conversion

The data migration process must have been performed before the JCL translation is started. This dependency is because the file migration tools generate some of the configuration files read by the JCL Translator. The configuration files from data conversion are documented in the Oracle Tuxedo Application Rehosting Workbench Reference Guide.

Overview of the JCL Translator in the Replatforming Process

The inputs to Tuxedo ART Workbench JCL Translator process are:

- The abstract syntax trees of the JCL stored in the pob files produced by the Cataloger.
- A set of configuration files produced by the data conversion tools that specifies information about the File-to-File Converter conversion and the DB2-to-Oracle Convertor conversion.
- A set of configuration files which are either:
  - Generated by other Oracle Tuxedo Application Rehosting Workbench tools, the DB2-to-Oracle Convertor provides the JCL translator with the list of files to be converted to Oracle tables
  - Supplied together with Tuxedo ART Workbench and customizable.

Translation Steps

This section provides information and procedures for:

Building and Setting the Configuration Files

Translation Steps

Checking Results

Building and Setting the Configuration Files

In addition to the AST of the JCL(s) to convert produced by the Cataloger, Tuxedo ART Workbench JCL Translator takes as input a main configuration file that specifies various aspects of the translation, such as:

- Customizable top skeleton and bottom skeleton;
- Root pathname for migrated data files, temporary files and spool files;
- The list of data files converted to Oracle tables;
- The sort utility to use on the target platform;
- Component and data-file renaming information;
- Program-launcher configuration;

This file is very easy to write using any standard text editor, or to generate from other sources of information. below, we comment a sample of configuration file written to translate JCL files in the simple application STFILEORA provided with Tuxedo ART Workbench tools.

The main configuration file also refers to separate sub-files which are either:

- Generated by other Tuxedo ART Workbench tools
- Supplied together with Tuxedo ART Workbench (and customizable)
- Wholly written by the user.

Tuxedo ART Workbench comes with examples of configuration files.

The main configuration file for the JCL translation is called `config-trad-JCL.desc` in this guide for use with the Simple Application application.

The following sections describe the different configuration parameters and configuration sub-files and gives a full sample at the end of this section.

Top Skeleton and Bottom Skeleton

The sub-files specified by the two options `top-skeleton` and `bottom-skeleton` represent respectively a header file and a footer file for the generated script. You can customize these files.

Listing 1-54 Top Skeleton and Bottom Skeleton Entries in the Main Configuration File

```
top-skeleton = "../param/top-ksh.txt"
```

bottom-skeleton = "../param/bottom-ksh.txt"

Listing 1-55 Example of top-ksh.txt Prolog Code

```
#@(#)-----------------------------------------------------------------
#@(#)- SCRIPT NAME    ==  $[JOBNAME].ksh          --- VERSION OF $[DATE]
#@(#)- AUTHOR        ==
#@(#)- TREATMENT     ==
#@(#)- OBSERVATIONS  == MAINFRAME MIGRATION
#@(#)-      …..
```

Where:

`JOBNAME`
: Will take the name of the current JOB after translation.

`DATE`
: Is the generation date of the KSH script.

List of Data Files Converted to Oracle Tables

When files are converted to Oracle tables, the main configuration file must reference a `sub-configuration` file such as:

```
file-list-in-table = "../param/dynamic-config/File-in-table.txt"
```

This sub-file is generated by the File-to-File Converter. This file indicates to the JCL Translator, which are the files that will be converted to Oracle tables in order to correctly translate the steps involving these files. In our example `PJ01AAA.SS.VSAM.CUSTOMER` is the file to be converted.

For example, when the JCL source involves files that will be converted to Oracle tables, the corresponding shell script uses the Batch Runtime function `m_ProgramExec` with the `-b` option to execute a COBOL program. The `-b` option indicates a connection to the database must be opened before executing the program. For example:

```
m_ProgramExec -b RSSABB01
```

Post-Translation

The sub-file specified by the option post-translation-file contains a sequence of rules which are used to automatically perform post-translation after Tuxedo ART Workbench Converter. See the Post-Translation Configuration File in Workbench Reference Guide.

The Post-Translation entry in the main configuration file is as follows:

```
post-translation-file = "../param/renov.desc"
```

Full Example Configuration

The general options root-skeleton, target-proc, label-end, management of FSN, etc. are described in the JCL Translator section of the Oracle Tuxedo Application Workbench Reference Guide.

Listing 1-56 JCL Translator Configuration File for STFILEORA Simple Application (config-trad-JCL.desc):

```
% config.desc :
%
root-skeleton =                "../trf-jcl/"
target-proc   =         "../trf-jcl/Master-Proc"
use-sort=mf-sort
%
var-dataroot = "${DATA}/"
var-tmp = "${TMP}/"
var-spool = "${SPOOL}/"

% Ksh heading
%
top-skeleton = "../param/top-ksh.txt"

% KSH footer
%
bottom-skeleton = "../param/bottom-ksh.txt"
```

```
% Files passed in tables
file-list-in-table = "../param/dynamic-config/File-in-table.txt"
% Post-Translation Configuration File
post-translation-file = "../param/renov.desc"

% Suffix of translated ksh  du ksh traduit
suffix-skeleton = "ksh"

% Management of FSN to keep
set-no-delete-fsn = SORTIE ( ZIP390 ),
                    ENTREE ( ZIP390 ),
                    * ( DB2CMD,CSQUTIL ),
                    CFTIN ( CFTUTIL ),
                    SYSUT1 ( DUMMY ),
                    * ( ADRDSSU ).

% Management of FSN to delete
set-delete-fsn = SYSOUT ( IDCAMS ),
                 SYSEXEC ( CSCOLMVS ),
                 SYSTSIN ( * ),
                 SYSPUNCH ( * ),
                 TOOLIN ( * ),
                 SYSUDUMP ( * ),
                 SYSDBOUT ( * ),
                 SYSABOUT ( * ),
                 SYSTSPRT ( * ),
```

```
SORTLIB ( * ),
OPLIB ( * ),
STEPLIB ( * ),
JOBLIB ( * ).
```

Launchers Configuration

This file describes how to interpret the source JCL to find for instance the program to be launched, and how this launch operation should be translated; predefined configuration for IKJEFT01, DLIBATCH and other standard launchers.

Listing 1-57 Launcher Entry in Main Configuration File

```
global-options jclz-launcher-spec-file = "launchers".
```

Listing 1-58 Example of Launcher Code

```
LAUNCHER DFSRRC00
IndexProg : 2,
IndexPSB : 3
END
LAUNCHER DB2BATCH
IndexProg : 2,
IndexPSB : 3
END
LAUNCHER SWCP7110
IndexProg : 2,
IndexParm : 4,
Separator : ";"
```

END

Full Example Configuration

The general options `root-skeleton`, `target-proc`, `label-end`, etc. are described in the JCL Translator section of the Oracle Tuxedo Application Rehosting Workbench Reference Guide.

Listing 1-59 JCL Converter Configuration File for Simple Application (config-trad-JCL.desc)

```
%
% config.desc :
%
%
root-skeleton =                 "../trf-jcl/"
target-proc   =         "../trf-jcl/Master-Proc"
use-sort=mf-sort
%
%
var-dataroot = "${DATA}/"
var-tmp = "${TMP}/"
var-spool = "${SPOOL}/"

%
% Ksh heading
------------------------------------------------------------------------
%

top-skeleton = "../param/top-ksh.txt"
```

```
% Ksh heading
-------------------------------------------------------------------------


%
% KSH footer
-------------------------------------------------------------------------
%
bottom-skeleton = "../param/bottom-ksh.txt"
%
% KSH footer
-------------------------------------------------------------------------


%
% File passed in table
%
file-list-in-table = "../param/dynamic-config/File-in-table.txt"

% Suffix of translated ksh
suffix-skeleton = "ksh"

% Management of FSN to keep
set-no-delete-fsn = SYSIN ( DSNUTILB ),
                    OUTPUT ( ZIP390 ),
                    INPUT ( ZIP390 ),
                    * ( DB2CMD,CSQUTIL ),
                    CFTIN ( CFTUTIL ),
                    SYSUT1 ( DUMMY ),
                    * ( ADRDSSU ).
```

```
% Management of FSN to delete
set-delete-fsn = SYSOUT ( IDCAMS ),
                 SYSEXEC ( CSCOLMVS ),
                 SYSTSIN ( * ),
                 SYSIN ( IDCAMS,XMFSORT,ICEMAN,SPOOL,SORT ),
                 SYSPUNCH ( * ),
                 TOOLIN ( * ),
                 SYSUDUMP ( * ),
                 SYSDBOUT ( * ),
                 SYSABOUT ( * ),
                 SYSTSPRT ( * ),
                 SORTLIB ( * ),
                 OPLIB ( * ),
                 STEPLIB ( * ),
                 JOBLIB ( * ).
```

Translation Steps

The Tuxedo ART Workbench JCL Translator executes on a migration platform (Linux) and can automatically translate a single job file, a series of jobs files or the entire system content.

Set Environment Variables

Before executing the translator the following variables must be set:

Table 1-32 Translator Variables

Variable	Value	Usage
REFINEDIR	/product/art_wb11gR1/refine	Tuxedo ART Workbench product file structure.
PROJECT	$(HOME)/ simpleapp	Project location.
PARAM	$PROJECT/param	Location of configuration files.
SOURCE	$PROJECT/source	Location of source files.
LOGS	$PROJECT/Logs	Location of source files.

Translation Commands

The following commands can be used to execute the translation. Logs file are generated in $LOGS/trad-jcl.

Command Line to Translate One JCL File

To create a Korn shell script with the same name as the input file except with a .ksh suffix.

Listing 1-60 Single JCL Translation Script

```
cd $LOGS/trans-jcl

$REFINEDIR/refine jclz-unix -v version -s $PARAM/system.desc -c
$PARAM/config-trad-JCL.desc JCL/defvcust.jcl
```

Command Line to Translate a List of JCL Files

To translate a list of JCL files invoke following command:

Listing 1-61 List of JCL Translation Script

```
  cd $LOGS/trans-jcl
```

```
$REFINEDIR/refine jclz-unix -v version -s $PARAM/system.desc -c
$PARAM/config-trad-JCL.desc -f jcl-files-list
```

Command Line to Translate All JCL Files

To translate all JCL files invoke a command:

Listing 1-62 All JCL Translation Script

```
cd $LOGS/trans-jcl
$REFINEDIR/refine jclz-unix -v version -s $PARAM/system.desc -c
$PARAM/config-trad-JCL.desc
```

JCL Post-translation Steps

Due to the limitations of the JCL translation or when site-specific translation is needed, there is a possibility to perform repetitive post-translation tasks automatically.

The post-translation mechanism allows you to change one block of lines by another.

Post-Translation Example

To illustrate post-translation usage the following example add a comment after line containing `m_ProgramExec IEFBR14 ""` in the /`prtvcust.ksh` JCL script.

1. Write the following rule in `renov-jcl.desc`:

```
# by user John Doe on YY/MM/DD
regle add-comment-1
filtre [
+JCL/prtvcust.ksh
]
transform [
     m_FileAssign -m R -a R -d SHR VKSDCUST ${DATA}/METAW00.VSAM.CUSTOMER
       m_ProgramExec PGMMB01 ""
]
into [
```

```
      m_FileAssign -m R -a R -d SHR VKSDCUST ${DATA}/METAW00.VSAM.CUSTOMER
        m_ProgramExec PGMMB01 ""
# Added comment
```

2. Invoke a command line:

```
$REFINEDIR/M2_L3_5/scripts/post-trans  -c=\#META-RENOV\#
-r=$PROJECT/param/renov-jcl.desc JCL/prtvcust.ksh < JCL/prtvcust.ksh >
JCL/prtvcust.ksh.renov

grep -v "#META-RENOV#" JCL/prtvcust.ksh.renov > JCL/prtvcust.ksh
```

Checking Results

To check conversion results, verify that:

- All expected files are generated.
- All corresponding ksh scripts are generated.
- All procs and includes are extracted.
- There are no empty scripts.
- There are no truncated scripts.

Check the error messages; the JCL translator prints error messages encountered during the translation in the generated script. Check if any messages are present by searching for the following keywords: " UNDEFINED ", " NIL ", " UNTRANSLATED ". The complete list of error messages along with their explanation can be found in the Oracle Tuxedo Application Rehosting Workbench Reference Guide.

- Control the procedures
- Control the Batch RunTime functions.
- Check that there are no unjustified warning messages.

Using a Make File

The use of makefiles when using Tuxedo ART Workbench is recommended because it enables you to:

- Document all (executable) processes
- Effectively manage incremental operations and thereby save time.

- Control and check the results of processes

A makefile should be placed in the source directory in which the operations are implemented at the initialization of a project.

Configuration

See “Make Configuration” in the Cataloger.

JCL Translation

To translate all the JCL in the `$SOURCE` file system

From the `$SOURCE` directory launch the command:

```
make trad_jcl
```

The JCLs are translated sequentially one by one.

Configure

Database, Compiler, and Others

In order to compile sources, we need collect some information. You can input these information in the configure wizard.

If you choose COBOL-IT as target COBOL compiler and you would use ISAM files in open system, you must set "BDB DbHome Location"; it must point to a directory where the database and log files will be stored. For more information, see "Oracle Berkeley DB" part in "COBOL-IT Compiler Suite Enterprise Edition - Reference Manual" or "The Berkeley DB Environment" part in "Berkeley DB Programmer's Reference Guide".

After building is complete, the root makefile and sub makefile would be generated under related subdirectory. It will also copy entire "fixed-copy" directory from workbench installed directory to build directory.

Tuxedo

Main function of Tuxedo wizard is to generate ubbconfig file for Batch runtime and CICS runtime.

The configurable items include Tuxedo location, IPC KEY, Machine Name, APPDIR and so on. For more information, see Oracle 12c Release 2 (12.1.3)

CICS

Main function of CICS wizard is to generate setenv file for CICS runtime. The configurable items include CICS runtime location,IPC key for common work area and monitor settings.

For more information, see Oracle Tuxedo Application Runtime for CICS and Batch 12c Release 2 (12.1.3).

Batch

Main function of Batch wizard is to generate jesconfig and `setenv` file for Batch runtime. The configurable items include Batch runtime location, JESROOT and so on.

For more information, see Oracle Tuxedo Application Runtime for CICS and Batch 12c Release 2 (12.1.3).

IMS

Main function of IMS wizard is to generate setenv file for IMS runtime. The configurable items include IMS runtime location, and so on.

For more information, see Oracle Tuxedo Application Runtime for IMS 12c Release 2 (12.1.3).

Build

Build step guide users to build application components, data reloading programs, data access programs and tuxedo configuration files.

Gmake utility will be used when do the building task. Related makefiles are generated in previous step.

Deploy

Pack Target

Generate three tar files, which contain all the files under deploy directory. This tar files are ready for deployment.

Deploy Application

Unpack tar files to the location that user specify.

Setup Runtime

Setup Batch runtime environment

Prepare the environment of Batch runtime. For more information, see Oracle Tuxedo Application Runtime for CICS and Batch 12c Release 2 (12.1.3).

Setup CICS runtime environment

Prepare the environment of CICS runtime. For more information, see Oracle Tuxedo Application Runtime for CICS and Batch 12c Release 2 (12.1.3).

Setup IMS runtime environment

Prepare the environment of IMS runtime. For more information, see Oracle Tuxedo Application Runtime for IMS 12c Release 2 (12.1.3).

Reload File Data

All the defined files will be displayed in the table. Files under the source location will be list while clicking last column of the table.

After click "Finish", all the result of reloading will be placed in the location which user specify.

Reload DB2 Data

This step is similar to previous step, except result data will be placed into database instead of file path user specified.

Run

CICS Runtime

Boot or shutdown ART CICS runtime.

Batch Runtime

Boot or shutdown the ART Batch runtime, and manipulate jobs of ART Batch Runtime.

IMS Runtime

Boot or shutdown the ART IMS runtime.

Reset

Cleanup output from the corresponding steps.

Performing the Data Migration

Executing the File-to-File Generated Converter Programs

This section describes the tasks of unloading, transfer and reloading using the components generated using Tuxedo ART Workbench (see Generating the Components).

Preparation

Configuring the Environments and Installing the Components

Installing the Unloading Components Under z/OS

The components used for the unloading (generated in `$HOME/trf/unload/file`) should be installed on the source z/OS platform. The generated JCL may need adapting to specific site constraints including JOB cards, library access paths and access paths to input and output files (Data Set Name – DSN).

Installing the Reloading Components on Target Platform

The components used for the reloading (generated in `$HOME/trf/reload/file`) should be installed on the target platform (Runtime).

The following environment variables should be set on the target platform:

Table 1-33 Variables and Their Target Platform

Variable	Value
`DATA_SOURCE`	The name of the directory containing the files transferred from z/OS to be reloaded.
`BIN`	The location of the generic reload and control scripts (`$HOME/trf/reload/bin`)
`TMPPROJECT`	The temporary directory.
`MT_LOG`	Directory to contain execution logs.

Table 1-33 Variables and Their Target Platform

Variable	Value
DATA	Directory containing the output files from the transcoding and reloading processes. These are the files ready to be used on the target platform.
COB_EXTFH_INDEXED COB_EXTFH_LIB	If you choose COBOL-IT as target COBOL compiler and you use BDB as ISAM files in an open system, you must set these two environment variables, so that BatchRT can generate BDB format file, otherwise Micro Focus COBOL compatible file will be generated: export COB_EXTFH_INDEXED=BDBEXTFH export COB_EXTFH_LIB=/path_to_Cobol-IT/lib/libbdbextfh.so For example: export COB_EXTFH_LIB=/opt/cobol-it-64/lib/libbdbextfh.so

Unloading JCL

An unloading JCL is generated for each z/OS file listed in the Datamap Parameter File (Datamap-<configuration name>.re). These unloading JCLs are named *<logical file name>*.jclunload

Note: The .jclunload extension should be deleted for execution under z/OS.

Transferring the Files

Files should be transferred between the source z/OS platform and the target platform in binary format using the file transfer tools available at the site (CFT, FTP, …).

Compiling the Transcoding Programs

The generated COBOL programs used for transcoding and reloading are named:

RELFILE-<logical file name>

For the example provided in Mapping Parameter File (mapper-<configuration name>.re), the generated programs are:

- RELFILE-FQSAM01.cbl,

- RELFILE-FQSAM02.cbl,
- RELFILE-ODCSF0B.cbl.

Sequential Files (VSAM ESDS, QSAM, Generation Data Set)

When migrating a sequential file, a target COBOL LINE SEQUENTIAL output file is generated:

Listing 1-63 FILE CONTROL Example – Extract From Program: RELFILE-FQSAM01.cbl:

```
…
SELECT SORTIE
       ASSIGN TO "SORTIE"
              ORGANIZATION IS LINE SEQUENTIAL
              FILE STATUS IS IO-STATUS.
…
```

VSAM KSDS Files

When migrating a VSAM KSDS file, an INDEXED output file will be generated:

Listing 1-64 FILE CONTROL Example – Extract From Program: RELFILE-ODCSF0B.cbl:

```
…
       SELECT MW-SORTIE
              ASSIGN TO "SORTIE"
              ORGANIZATION IS INDEXED
              ACCESS IS DYNAMIC
              RECORD KEY IS VS-CUSTIDENT
              FILE STATUS IS IO-STATUS.
…
```

These COBOL programs should be compiled with the target COBOL compiler using the options described in the COBOL converter section of the Tuxedo ART Workbench Reference Guide.

Executing the Transcoding and Reloading Scripts

The transcoding and reloading scripts use the following parameters:

Synopsis

```
loadfile-<logical file name>.ksh [-t/-l] [-c <method>]
loadgdg-<logical file name>.ksh [-t/-l] [-c <method>]
```

Options

-t

Transcode and reload the file.

-l

Transcode and reload the file (same action as -t).

-c ftp:<…>:<…>

Implement the verification of the transfer (see Checking the Transfers).

Examples

For the example provided in Mapping Parameter File (mapper-<configuration name>.re), the generated scripts are:

- `loadfile-FQSAM01.ksh,`
- `loadfile-FQSAM02.ksh`
- `loadfile-ODCSF0B.ksh.`

Files

By default, the input file is located in the directory indicated by `$DATA_SOURCE`, and the output file is placed in the directory indicated by `$DATA`.

These files are named with the logical file name used in the Mapping Parameter File (mapper-<configuration name>.re).

An execution log is created in the directory indicated by `$MT_LOG`.

A return code different from zero is produced when a problem is encountered.

Checking the Transfers

This check uses the following option of the `loadfile-<logical file name>.ksh`

```
-c ftp:<name of transferred physical file>:<name of FTP log under UNIX>
```

Note: This option verifies, after the reloading, that the physical file transferred from z/OS and the file reloaded on the target platform contain the same number of records. This check is performed using the FTP log and the execution report of the reloading program. If the number of records is different, an error message is produced.

Troubleshooting

This section describes problems resulting from usage errors that have been encountered when migrating files from the source to target platform.

Overview

When executing any of Tuxedo ART Workbench tool users should check:

- If any error messages are displayed on the screen.
- If the `Mapper-log-<configuration name>` file contains any errors (see Common Problems and Solutions).

Error messages and associated explanations are listed in the appendix of the Oracle Tuxedo Application Rehosting Workbench Reference Guide.

Common Problems and Solutions

Error: Unknown file organization *UNDEFINED*

When executing `file.sh -gmi $HOME/trf STFILEORA` the following message appears:

```
Refine error...
```

Log

The contents of the `Mapper-log-STFILEORA` log file include:

```
file PJ01AAA.SS.QSAM.CUSTOMER.REPORT loaded/unloaded
  file logical name MW-SYSOUT
*** Unknown file organization : *UNDEFINED*
  mapping record MW-SYSOUT
```

```
  record MW-SYSOUT: logical name MW-SYSOUT
  record MW-SYSOUT: logical name MW-SYSOUT
```

Explanation

A file to be migrated is present in the `mapper-<configuration name>.re` file and absent from the `Datamap.<configuration name>.re` file.

Error: Record... not found

When executing `file.sh -gmi $HOME/trf STFILEORA1` the following message appears:

```
Refine error...
```

Log

The contents of the `Mapper-log-STFILEORA1` log file include:

```
file PJ01AAA.SS.QSAM.CUSTOMER.REPORT loaded/unloaded
  file logical name MW-SYSOUT
file is sequential: no primary key
  *** record `MW-SYSOUT in COPY/MW_SYSOU2T.cpy' not found ***
  *** ERROR: all records omitted ***
  mapping records
```

Explanation

The copy file is unknown.

Error: Record... not found

When executing `file.sh -gmi $HOME/trf STFILEORA2` the following message appears:

```
Refine error...
```

Log

The contents of the `Mapper-log-STFILEORA2` log file include:

```
file PJ01AAA.SS.QSAM.CUSTOMER.REPORT loaded/unloaded
  file logical name MW-SYSOUT
file is sequential: no primary key
  *** record `MW-SYSOUTTT in COPY/MW_SYSOUT.cpy' not found ***
```

```
  record MW-SYSOUT reselected (all records omitted)
  mapping record MW-SYSOUT
  record MW-SYSOUT: logical name MW-SYSOUT
```

Explanation

The RECORD name (level 01 field) is unknown.

Error: External Variable PARAM is not set

When executing `file.sh -gmi  $HOME/trf  STFILEORA3` the following message appears:

```
Refine error...
```

Log

The contents of the `Mapper-log-STFILEORA3` log file include:

```
*=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-==-=-=-=-=-=-=-=-=-=-=-=-
=-
##########################################################################
##
 Control of schema STFILEORA3
External Variable PARAM is not set!
ERROR : Check directive files for schema STFILEORA3
```

Explanation

The variable `$PARAM` has not been set.

Executing File-to-Oracle Generated Converter Programs

This section describes the tasks of unloading, transfer and reloading using the components generated using Tuxedo ART Workbench (see Generating the Components).

Preparation

Configuring the Environments and Installing the Components

Installing the Unloading Components Under z/OS

The components used for the unloading (generated in `$HOME/trf/unload/file`) should be installed on the source z/OS platform. The generated JCL may need adapting to specific site constraints including JOB cards, library access paths and access paths to input and out put files (Data Set Name – DSN).

Installing the Reloading Components Under UNIX

The components used for the reloading (generated in `$HOME/trf/reload/file`) should be installed on the target platform (runtime).

Installing the Oracle Object Creation Components

The components used for creating the Oracle objects (generated in `$HOME/SQL/file/<schema name>`) should be installed on the target platform (runtime).

Setting the Target Platform Environment Variables

Table 1-34 lists environment variables that should be set on the target platform.

Table 1-34 Environment Variables and Their Platform

Variable	Value
`DATA_SOURCE`	The name of the directory containing the files transferred from z/OS to be reloaded.
`DATA`	The name of the directory containing the physical files converted to ASCII format and ready to be loaded to Oracle tables.
`BIN`	The location of the generic reload and control scripts (`$HOME/trf/reload/bin`)
`TMPPROJECT`	The temporary directory.
`MT_LOG`	Directory to contain execution logs.
`NLS_LANG`	Set according to the instructions in the Oracle documentation.
`DDL`	The location of the SQL scripts used to create Oracle objects (`$HOME/trf/SQL/file/<schema name>`).

The following variable should be set according to the information in the Oracle Tuxedo Application Rehosting Workbench Installation Guide:

- `MT_DB_LOGIN`.

Unloading the JCL

An unloading JCL is generated for each z/OS file listed in the Datamap Parameter File (Datamap-<configuration name>.re). These unloading JCLs are named `<logical file name>.jclunload`. These JCL use the REPRO function of the IDCAMS utility to unload the files.

Note: The `.jclunload` extension should be deleted for execution under z/OS.

Transferring the Files

Files should be transferred between the source z/OS platform and the target UNIX platform in binary format using the file transfer tools available at the site (CFT, FTP, …).

Compiling the Transcoding Programs

The generated COBOL programs used for transcoding and reloading are named:

`RELTABLE-<logical file name>`

Example:

```
RELTABLE-ODCSF0.pco
```

These COBOL programs should be compiled with the target COBOL compiler using the options described in the COBOL converter section ofOracle Tuxedo Application Workbench Reference Guide.

Each program produces an output file that is then read by the SQL*LOADER utility.

Executing the Oracle Object Creation Scripts

The option **`-d`** of the `loadtable-<…>.ksh` scripts enables the creation of the Oracle objects.

Executing the Transcoding and Reloading Scripts

The transcoding and reloading scripts have the follow parameters:

Synopsis

```
loadtable-<logical file name>.ksh [-d] [-t/-l] [-c <method>]
```

Options

-d
Create the Oracle objects.

-t
Transcode and reload the file.

-l
Transcode and reload the file (same action as -t).

-c ftp:<…>:<…>
Implement the verification of the transfer (see Checking the Transfers).

Examples

For the example provided in Mapping Parameter File (mapper-<configuration name>.re), the generated script is:

- loadtable-ODCSF0B.ksh

Files

By default, the input file is located in the directory indicated by `$DATA_SOURCE`, and the output file is placed in the directory indicated by `$DATA`.

These files are named with the logical file name used in the Mapping Parameter File (mapper-<configuration name>.re) configuration file.

An execution log is created in the directory indicated by `$MT_LOG`.

A return code different from zero is produced when a problem is encountered.

Checking the Transfers

This check uses the following option of the `loadtable-<logical file name>.ksh`

```
-c ftp:<name of transfered physical file>:<name of FTP log under UNIX>
```

Note: This option enables the verification after the reloading that the physical file transferred from z/OS and the file reloaded on the target platform contain the same number of records. This check is performed using the FTP log and execution report of the reloading program. If the number of records is different, an error message is produced.

Compiling the Access Routines and Utilities

The COBOL and PRO*COBOL access routines should be compiled using the target COBOL compilation options described in the Oracle Tuxedo Application Rehosting Workbench Reference Guide.

Troubleshooting

This section describes problems resulting from usage errors that have been encountered when migrating files from the source to target platform.

Overview

When executing any of Tuxedo ART Workbench tool users should check:

- If any error messages are displayed on the screen.
- If the `Mapper-log-`*`<configuration name>`* file contains any errors (see Common Problems and Solutions).

Error messages and associated explanations are listed in the appendix of the Oracle Tuxedo Application Rehosting Workbench Reference Guide.

Common Problems and Solutions

Error: External Variable PARAM is not set

When executing `file.sh -gmi  $HOME/trf STFILEORA` the following message appears:

*=-==-=-=-=-=-=-=-=-=-=-=-=-=-

##

Control of configuration STFILEORA

External Variable PARAM is not set!

ERROR: Check directive files for configuration STFILEORA

Abort

Explanation

The variable `$PARAM` has not been set.

Error: Target directory does not exist

When executing `file.sh -gmi  $HOME/trf STFILEORA1` the following message appears:

```
*=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-==-=-=-=-=-=-=-=-=-=-=-

Target output directory /home2/wkb9/trf is missing
```

```
Check parameters: -i <output_directory> <schema>
ERROR : usage : file.sh [ [-g] [-m] [-i <output_directory>] <schema_name> |
-s <output_directory> (<schema>,...) ]
abort
```

Error: Unknown file organization

When executing `file.sh -gmi  $HOME/trf  STFILEORA2` the following message appears:

Refine error...

Log

The contents of the `Mapper-log-STFILEORA2 log file` include:

```
file PJ01AAA.SS.VSAM.CUSTOMER Oracle
  file logical name ODCSF0B
*** Unknown file organization : INDEXD
  mapping record VS-ODCSF0-RECORD
  record VS-ODCSF0-RECORD: logical name VS
  record VS-ODCSF0-RECORD: logical name VS
    record VS-ODCSF0-RECORD REDEFINES:
      field VS-CUSTBDATE as opaque (default strategy)
    record VS-ODCSF0-RECORD REDEFINES:
      field VS-CUSTBDATE as opaque (default strategy)
```

Explanation

The file is configured with a file organization of INDEXD instead of INDEXED.

Error: The illegal text is: "converted

When executing: `file.sh -gmi $HOME/trf STFILEORA` the following message appears:

```
*=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-==-=-=-=-=-=-=-=-=-=-=-=-
##########################################################################
 Control of configuration STFILEORA
##############################
 Control of templates
```

```
OK: Use Default Templates list file
File name is /REFINE/convert-data/default/file/file-templates.txt
##############################
 Control of Mapper
##############################
 COMPONENTS GENERATION

…

Parsing mapper file /home2/wkb9/tmp/mapper-STFILEORA.re.tmp ...
Parse error at character position 1346 in file:
   /home2/wkb9/tmp/mapper-STFILEORA.re.tmp.
The illegal text is: "converrted
   table name CUSTOMER
   include \"COPY/ODCSF0B.cpy\"
   map record VS-ODCSF0-RECORD defin"
While parsing in grammar UFAS-CONVERTER::MAPPER-INPUT-GRAMMAR,
CONVERRTED is a symbol, which is not a legal token
at this point in the input. The legal tokens at this point are:

  :END  "templates"  "filler"  "field"  "file"  "one-for-n"  "multi-record"
"table"  "transferred"  "mode-tp"  ... [14 others]
*ERROR*: parse error is found in /home2/wkb9/tmp/mapper-STFILEORA.re.tmp.
Refine error...
/tmp/refine-exit-status.snICMmElNYF25625
ERROR: generation aborted
abort
```

Explanation

A typing error in the word 'CONVERTED' was made in the mapping file.

Error: Cannot find file in file table named PJ01AAA.SS.VSAM.CUSTOMERS

When executing: `file.sh -gmi $HOME/trf STFILEORA` the following message appears:

```
*=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-==-=-=-=-=-=-=-==-=-=-=
##########################################################################
 Control of configuration STFILEORA
##############################
 Control of templates
   Project Templates list file is missing
/home2/wkb9/param/file/file-templates.txt
   OK: Use Default Templates list file
       File name is
/Qarefine/release/M2_L4_1/convert-data/default/file/file-templates.txt
##############################
 Control of Mapper
##############################
 COMPONENTS GENERATION

…

Point 1 !!
Warning: Can't find file in file table named PJ01AAA.SS.VSAM.CUSTOMERS
 Point 2 !!

…

Refine error...
```

```
/tmp/refine-exit-status.IvmFDYsYDdr31956
ERROR : generation aborted

Abort
```

Explanation

The name of the file to convert to an Oracle table does not correspond to the name present in the `Datamap` file.

Executing File-to-UDB (formerly DB2/Luw) Converter Programs

This section describes the tasks of unloading, transfer and reloading using the components generated using Tuxedo ART Workbench (see Generating the Components).

Preparation

Configuring the Environments and Installing the Components

Installing the Unloading Components Under z/OS

The components used for the unloading (generated in `$HOME/trf/unload/file`) should be installed on the source z/OS platform. The generated JCL may need adapting to specific site constraints including JOB cards, library access paths and access paths to input and out put files (Data Set Name – DSN).

Installing the Reloading Components Under UNIX

The components used for the reloading (generated in `$HOME/trf/reload/file`) should be installed on the target platform (runtime).

Installing the DB2/luw (udb) Object Creation Components

The components used for creating the Oracle objects (generated in `$HOME/SQL/file/<schema name>`) should be installed on the target platform (runtime).

Setting the Target Platform Environment Variables

The following environment variables should be set on the target platform

Table 1-35 Environment Variables on Target Platform

Variable	Value
DATA_SOURCE	The name of the directory containing the files transferred from z/OS to be reloaded.
DATA	The name of the directory containing the physical files converted to ASCII format and ready to be loaded to Oracle tables.
BIN	The location of the generic reload and control scripts (`$HOME/trf/reload/bin`)
TMPPROJECT	The temporary directory.
MT_LOG	Directory to contain execution logs.
NLS_LANG	Set according to the instructions in the Oracle documentation.
DDL	The location of the SQL scripts used to create Oracle objects (`$HOME/trf/SQL/file/<schema name>`).
PATH	This UNIX/Linux variable has to contain the directory of `Oracle Tuxedo Application Runtime for Batch utilities`

The following variable should be set according to the information in the Oracle Tuxedo Application Rehosting Workbench Installation Guide:

- `MT_DB_DBNAME.`
- `MT_DB_USER.`
- `MT_DB_PWD.`

Unloading the JCL

An unloading JCL is generated for each z/OS file listed in the Datamap Parameter File (Datamap-<configuration name>.re). These unloading JCLs are named `<logical file name>.jclunload`. These JCL use the REPRO function of the IDCAMS utility to unload the files.

Note: The `.jclunload` extension should be deleted for execution under z/OS.

Transferring the Files

Files should be transferred between the source z/OS platform and the target UNIX platform in binary format using the file transfer tools available at the site (CFT, FTP, …).

Compiling the Transcoding Programs

The generated COBOL programs used for transcoding and reloading are named:

`RELTABLE-<logical file name>`

Example:

```
RELTABLE-ODCSF0.sqb
```

These COBOL programs should be compiled with the target COBOL compiler using the options described in the COBOL converter section of Tuxedo ART Workbench Reference Guide.

Each program produces an output file that is then read by the SQL*LOADER utility.

Executing the Oracle Object Creation Scripts

The option **`-d`** of the `loadtable-<…>.ksh` scripts enables the creation of the Oracle objects.

Executing the Transcoding and Reloading Scripts

The transcoding and reloading scripts have the follow parameters:

Synopsis

```
loadtable-<logical file name>.ksh [-d] [-t/-l] [-c <method>]
```

Options

-d

Create the DB2/luw (udb) objects.

-t

Transcode and reload the file.

-l

Transcode and reload the file (same action as -t).

-c ftp:<…>:<…>

Implement the verification of the transfer (see Checking the Transfers).

Examples

For the example provided in Mapping Parameter File (mapper-<configuration name>.re), the generated script is:

- loadtable-ODCSF0B.ksh

Files

By default, the input file is located in the directory indicated by `$DATA_SOURCE`, and the output file is placed in the directory indicated by `$DATA`.

These files are named with the logical file name used in the Mapping Parameter File (mapper-<configuration name>.re) configuration file.

An execution log is created in the directory indicated by `$MT_LOG`.

A return code different from zero is produced when a problem is encountered.

Checking the Transfers

This check uses the following option of the `loadtable-<logical file name>.ksh`

```
-c ftp:<name of transfered physical file>:<name of FTP log under UNIX>
```

Note: This option enables the verification after the reloading that the physical file transferred from z/OS and the file reloaded on the target platform contain the same number of records. This check is performed using the FTP log and execution report of the reloading program. If the number of records is different, an error message is produced.

Compiling the Access Routines and Utilities

The COBOL and Embedded-SQL access routines should be compiled using the target COBOL compilation options described in the Oracle Tuxedo Application Rehosting Workbench Reference Guide.

Troubleshooting

This section describes problems resulting from usage errors that have been encountered when migrating files from the source to target platform.

Overview

When executing any of Tuxedo ART Workbench tool users should check:

- If any error messages are displayed on the screen.
- If the `Mapper-log-<configuration name>` file contains any errors (see Common Problems and Solutions).

Error messages and associated explanations are listed in the appendix of the Oracle Tuxedo Application Rehosting Workbench Reference Guide.

Common Problems and Solutions

Error: External Variable PARAM is not set

When executing `file.sh -gmi $HOME/trf STFILEUDB` the following message appears:

*=-==-=-=-=-=-=-=-=-=-=-=-=-=-

##

Control of configuration STFILEUDB

External Variable PARAM is not set!

ERROR: Check directive files for configuration STFILEUDB

Abort

Explanation

The variable `$PARAM` has not been set.

Error: Target directory does not exist

When executing `file.sh -gmi $HOME/trf STFILEUDB1` the following message appears:

```
*=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-==-=-=-=-=-=-=-=-=-=-=-=-

Target output directory /home2/wkb9/trf is missing

Check parameters: -i <output_directory> <schema>

ERROR : usage : file.sh [ [-g] [-m] [-i <output_directory>] <schema_name> |
-s <output_directory> (<schema>,...) ]

abort
```

Error: Unknown file organization

When executing `file.sh -gmi $HOME/trf STFILEUDB2` the following message appears:

Refine error...

Log

The contents of the `Mapper-log-STFILEUDB2` log file include:

```
file PJ01AAA.SS.VSAM.CUSTOMER Oracle
  file logical name ODCSF0B
*** Unknown file organization : INDEXD
  mapping record VS-ODCSF0-RECORD
  record VS-ODCSF0-RECORD: logical name VS
  record VS-ODCSF0-RECORD: logical name VS
    record VS-ODCSF0-RECORD REDEFINES:
      field VS-CUSTBDATE as opaque (default strategy)
    record VS-ODCSF0-RECORD REDEFINES:
      field VS-CUSTBDATE as opaque (default strategy)
```

Explanation

The file is configured with a file organization of INDEXD instead of INDEXED.

Error: The illegal text is: "converted

When executing: `file.sh -gmi $HOME/trf STFILEUDB` the following message appears:

```
*=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-==-=-=-=-=-=-=-=-=-=-=-
##########################################################################
 Control of configuration STFILEUDB
##############################
 Control of templates
OK: Use Default Templates list file
File name is /REFINE/convert-data/default/file/file-templates-db2luw.txt
##############################
 Control of Mapper
##############################
 COMPONENTS GENERATION
```

…

```
Parsing mapper file /home2/wkb9/tmp/mapper-STFILEUDB.re.tmp ...
Parse error at character position 1346 in file:
   /home2/wkb9/tmp/mapper-STFILEUDB.re.tmp.
The illegal text is: "converrted
   table name CUSTOMER
   include \"COPY/ODCSF0B.cpy\"
   map record VS-ODCSF0-RECORD defin"
While parsing in grammar UFAS-CONVERTER::MAPPER-INPUT-GRAMMAR,
CONVERRTED is a symbol, which is not a legal token
at this point in the input. The legal tokens at this point are:

  :END  "templates"  "filler"  "field"  "file"  "one-for-n"  "multi-record"
"table"  "transferred"  "mode-tp"  ... [14 others]
*ERROR*: parse error is found in /home2/wkb9/tmp/mapper-STFILEUDB.re.tmp.
Refine error...
```

/tmp/refine-exit-status.snICMmElNYF25625

ERROR: generation aborted

abort

Explanation

A typing error in the word ‘CONVERTED’ was made in the mapping file.

Error: Cannot find file in file table named PJ01AAA.SS.VSAM.CUSTOMERS

When executing: `file.sh -gmi $HOME/trf STFILEORA` the following message appears:

```
*=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-==-=-=-=-=-=-=-==-=-=-=
##########################################################################
```

```
 Control of configuration STFILEUDB
################################
 Control of templates
   Project Templates list file is missing
/home2/wkb9/param/file/file-templates.txt
   OK: Use Default Templates list file
       File name is
/Qarefine/release/M2_L4_1/convert-data/default/file/file-templates.txt
################################
 Control of Mapper
################################
 COMPONENTS GENERATION

…

Point 1 !!
Warning: Can't find file in file table named PJ01AAA.SS.VSAM.CUSTOMERS
 Point 2 !!

…

Refine error...
/tmp/refine-exit-status.IvmFDYsYDdr31956
ERROR : generation aborted

Abort
```

Explanation

The name of the file to convert to an DB2/luw (udb) table does not correspond to the name present in the `Datamap` file.

Executing DB2-to-Oracle Generated Converter Programs

This section describes the tasks of unloading, transfer and reloading using the components generated using Tuxedo ART Workbench (see Generating the Components).

Preparation

Configuring the Environments and Installing the Components

Installing the Unloading Components Under z/OS

The components used for the unloading (generated in `$HOME/trf/unload/rdbms`) should be installed on the source z/OS platform. The generated JCL may need adapting to specific site constraints including JOB cards, library access paths and access paths to input and output files (Data Set Name – DSN).

Installing the COBOL programs for DB Load/Unload on target platform.

The COBOL programs for DB Load/Unload (generated in `$HOME/trf/DSNUTILS/<schema name>`) should be compiled and installed on the target platform (runtime).

Installing the Reloading Components on the Target Platform

The components used for the reloading (generated in `$HOME/trf/reload/rdbms`) should be installed on the target platform (runtime).

Table 1-36 lists environment variables that should be set on the target platform.

Table 1-36 Variables and Their Platform

Variable	Value
`DATA_SOURCE`	The name of the directory containing the unloaded DB2 tables transferred from z/OS to be reloaded into Oracle tables.
`BIN`	The location of the generic reload and control scripts (`$HOME/trf/reload/bin`)
`TMPPROJECT`	The temporary directory.

Table 1-36 Variables and Their Platform

Variable	Value
MT_LOG	Directory to contain execution logs.
CTL	Directory containing the <*table name*>.ctl files used by the SQL*LOADER ($HOME/trf/reload/rdbms/<*schema name*>/ctl).
DATA_TRANSCODE	Temporary directory used by the DB2 binary data transcoding script (contains temporary files in ASCII format). **Note:** In case of CLOB or BLOB data type migration, this directory could contain a sub-directory named <column_name>.
NLS_LANG	Set according to the instructions in the Oracle documentation.
NLS_SORT NLS_COMP	Set according to the instructions in Oracle Tuxedo Application Workbench Reference Guide and other Oracle documentation.
NLS_DATE_FORMAT NLS_TIMESTAMP_FORMAT NLS_TIME_FORMAT	Set according to the instructions in Oracle Tuxedo Application Workbench Reference Guide and other Oracle documentation.

The following variable should be set according to the information in the Oracle Tuxedo Application Rehosting Workbench Installation Guide:

- MT_DB_LOGIN.

The reloading script loadrdbms-<table name>.ksh uses the SQL*LDR Oracle utility. Because this utility can access to ORACLE servers only, this script should be used in ORACLE servers and not with client connection. This variable should not contain an @<oracle_sid> string, especially for this reloading step.

Installing the MWDB2ORA Package Component on the Target Platform

The package functions called by COBOL programs (converted by the COBOL Converter) should be installed on the target platform (runtime).

The packages are located in REFINEDIR/convert-data/fixed-components/MWDB2ORA.plb and REFINEDIR/convert-data/fixed-components/MWDB2ORA_CONST.plb. You should

adapt the `MWDB2ORA_CONST.plb` package and install these packages under SQLPLUS as documented in the DB2-to-Oracle Convertor.

Unloading JCL

To unload each DB2 table, a JCL using the IBM unloading utility is executed. Generally, the unloading utility creates three files for each table:

- a data file,
- a log file,
- a SYSPUNCH file.

If the table contains a CLOB or BLOB data types, the unloading utility creates:

- a data file for each column and row.

  These files are written in another dataset or directory if the parameter `rdbms:jcl_unload_lob_file_system` is respectively set to `pds` or `hfs`.

These unloading JCLs are named `<table name>.jclunload`

If the table name is longer than eight characters, Tuxedo ART Workbench attributes an eight-character name to the z/OS JCL as close as possible to the original. The renaming process maintains the uniqueness of each table name.

- Example:`ODCSF0X1.jclunload`

In the example used in this chapter, the table named ODCSF0 is lengthened to ODCSF0X1 when naming the z/OS JCL.

Transferring the Files

The unloaded data files should be transferred between the source z/OS platform and the target UNIX platform in binary format using the file transfer tools available at the site (CFT, FTP, …).

The LOG and SYSPUNCH files should be transferred in text mode.

The files transferred to the target UNIX platform should be stored in the `$DATA_SOURCE` directory.

The CLOB and BLOB data files should be transferred in binary mode and stored in the `$DATA_SOURCE/<schema_name>.<column_name>` directory.

The MBCS data files should be transferred in text mode and properly transcoded by transfer tools. For more information, see Oracle Tuxedo Application Workbench Reference Guide.

Note: On MVS, the Rehosting Workbench attributes a six-character name to <column_name> to the dataset or directory, added with a digit number (1 for the first CLOB or BLOB column of the table, 2 for the second, ...). On UNIX/Linux platform, the loadrdbms.sh script uses the real column_name.

Creating the Generated Oracle Objects

The scripts creating Oracle objects (tables, index, constraints, …) are created in the $HOME/trf/SQL/rdbms/<*schema name*> directory. They should be executed in the target Oracle instance.

The <schema name>.lst file contains the names of all of the tables in hierarchical sequence (parent table then child tables).

Table 1-37 lists the DB2 objects managed by Tuxedo ART Workbench and the name of the script used to create them:

Table 1-37 DB2 Objects

Object Type	File name	Notes
TABLE	TABLE-<target_table_name>.sql	One file per Table. The file contains the table construction, with column names, data type and attribute(s). Constraints, except NULL/NOT NULL attributes, are not written in this file
INDEX	INDEX-<target_table_name>.sql	This file contains all the CREATE INDEXes associated with the table <target_table_name>. This file will not be generated if there are no indexes defined on the table <target_table_name> Indexes are: unique or not Unique constraint
CONSTRAINT	CONSTRAINT-<target_table_name>.sql	This file contains all constraints associated with the table <target_table_name>. This file will not be generated if there are no constraints defined on the table <target_table_name> Constraints are: Primary Key, Unique, Check and Foreign key

Table 1-37 DB2 Objects

Object Type	File name	Notes
COMMENT	COMMENT-<target_table_name>.sql	Contains all comments for table and columns. One file per table
VIEW	VIEW-<schema_name>.sql	This file contains all the Views created in the source database/schema. In this release, the Select statements are not automatically converted into the target database language.
SEQUENCE	SEQUENCE-<schema_name>.sql	This file contains all the CREATE SEQUENCEs already created on the source Database.
SYNONYM	SYNONYMS-<schema_name>.sql	This file contains all the CREATE SYNONYMs already created on the source Database.
IDENTITY	IDENTITY-<target_table_name>.sql	In case of IDENTITY when migrating from DB2 to ORACLE, Tuxedo ART Workbench creates a Sequence and a Trigger object.

Compiling the Transcoding Programs

The generated COBOL programs used for transcoding are named:

`MOD_<table name>.cbl`

For the example used in this chapter the generated program is:

- `MOD_ODCSF0.cbl`

The programs should be compiled using the target COBOL compiler and the options documented in the Oracle Tuxedo Application Rehosting Workbench Reference Guide.

The programs produce `RECORD SEQUENTIAL` files on output that will then be read by the `SQL*LOADER` utility.

Listing 1-65 FILE CONTROL Example – Extracted from Program: `MOD_ODCSF0.cbl`

```
SELECT MW-SORTIE
```

```
ASSIGN TO "SORTIE"
ORGANIZATION IS RECORD SEQUENTIAL
ACCESS IS SEQUENTIAL
FILE STATUS IS IO-STATUS.
```

The generated COBOL programs used for transcoding CLOB columns are named:

`CLOB_<table name>_<column_name>.cbl`

Executing the Transcoding and Reloading Scripts

The scripts enabling the transcoding and reloading of data are generated in the directory:

`$HOME/trf/reload/rdbms/<schema name>/ksh`

The format of the script names is:

`loadrdbms-<table name>.ksh`

In the example used in this chapter, the script is named:

`loadrdbms-ODCSF0.ksh`

Each script launches the COBOL program that performs the transcoding and then the SQL*LOADER utility. The CTL files used by SQL*LOADER are named:

`<table name>.ctl.`

The CTL file used for the example in this chapter is named:

`ODCSF0.ctl`

Transcoding and Reloading Command

The transcoding and reloading scripts have the following parameters:

Synopsis

`loadrdbms-<table name>.ksh [-t | [-O|-T]] [-l] [-c: <method>]`

Options

-t

Transcodes the file and all BLOB or CLOB files if exist.

-T

Transcodes the file associated to the table only (except for CLOB and BLOB files). This option is used when a table contains CLOB or BLOB columns.

-O

For BLOB columns: creates only an UNIX link to all binary BLOB transferred files.

For CLOB columns: transcodes only all binary CLOB transferred files.

-l

Reloads the data into Oracle table.

-c rows:

Implement the verification of the transfer (see Checking the Transfers).

Examples

For the example provided in Example of a Migration of DB2 Objects, the generated script is:

- `loadrdbms-ODCSF0.ksh`

Checking the Transfers

This check uses the following option of the `loadrdbms-<table name>.ksh`

```
-c rows
```

Note: This option verifies after the reloading that the reloaded Oracle table contains the same number of records as the equivalent table unloaded from z/OS by the DB2 unloading utility. If the number of records is different, an error message is produced.

Troubleshooting

This section describes problems resulting from usage errors that have been encountered when migrating data from a source DB2 database to a target Oracle database.

Overview

When executing any of Tuxedo ART Workbench tools, users should check:

- If any error messages are displayed on the screen.
- If the `rdbms-converter-<schema name>.log` file contains any errors (see Common Problems and Solutions).

Error messages and associated explanations are listed in the appendix of the Oracle Tuxedo Application Rehosting Workbench Reference Guide.

Common Problems and Solutions

Error: RDBMS-0105

When executing `$REFINEDIR/$VERS/rdbms.sh -Cgrmi $HOME/trf PJ01DB2 STFILEORA` the following message appears:

```
Fatal RDBMS error.

Error: RDBMS-0105: Catalog for /home2/wkb9/param/system.desc is out of date

and needs to be updated externally.

Refine error...
```

Explanation

Changes have been made to the DDL, re-perform the cataloging operation.

Error: conversion aborted. Can not read

When executing `$REFINEDIR/$VERS/rdbms.sh -Cgrmi $HOME/trf SCHEMA` the following message appears:

```
Refine error...

/tmp/refine-exit-status.MOaZwgTphIN14075

ERROR : conversion aborted . Can not read
/home2/wkb9/tmp/outputs/SCHEMA/rdbms-converter-SCHEMA.log log file

abort
```

Explanation

The schema name is not known.

Error: Configuration file /db-param.cfg is missing!

When executing `$REFINEDIR/$VERS/rdbms.sh -Cgrmi $HOME/trf PJ01DB2` the following message appears:

```
*=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-==-=-=-=-=-=-=-=-=-=--=-

##########################################################################

CONVERSION OF DDLs and CTL files and GENERATION of directive files

ERROR : Configuration file /db-param.cfg is missing !
```

```
ERROR : Error in reading configuration file

Abort
```

Explanation

The external variable PARAM is not set.

Error: Target output directory... is missing

When executing `$REFINEDIR/$VERS/rdbms.sh -Cgrmi $HOME/bad-directory PJ01DB2` the following message appears:

```
*=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-==-=-=-=-=-=-=-=-=-=-=-

Target output directory /home2/wkb9/bad-directory is missing

Check parameters: -i <output_directory> <schema>

ERROR : usage : rdbms.sh [ [-c|-C] [-g] [-m] [-r] [-i <output_directory>]
<schema_name> ] -s <output_directory> (<schema>,...) ]

abort
```

Explanation

The target directory does not exist.

Error: Abort when using -c option... in case of unsupported features

When executing `$REFINEDIR/$VERS/rdbms.sh -c WWARN` the following message appears:

```
*=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-==-=-=-=-=-=-=-=-=-

WARNING: some unsupported db2 objects have been ignored by this tool.

Check file /home2/wkb9/tmp/outputs/WWARN/unsupported-WWARN.log to see a
detail of those objects.

ERROR:

RDBMSWB-0199: conversion aborted due to 26 Warning message(s). Check
previous error messages and try -C option instead of -c

abort
```

Explanation

The DDL contains some unsupported features. Check the warning files. You can ignore this abort by replacing the `-c` option with `-C` option.

Executing DB2-to-UDB Generated Converter Programs

See Also

- Tuxedo ART Workbench Reference Guide
- Tuxedo ART for Batch Users Guide
- Tuxedo ART for CICS Users Guide
- Tuxedo ART for IMS Users Guide
- Appendix A: Oracle Tuxedo Application Rehosting Workbench MBCS Support
- Appendix B: The Simple App Application
- Appendix C: Oracle Tuxedo Application Rehosting Workbench Logs

APPENDIX A

Appendix A: Oracle Tuxedo Application Rehosting Workbench MBCS Support

This chapter contains the following topics:

Purpose

Oracle Tuxedo Application Rehosting Workbench (Tuxedo ART Workbench) supports Multiple-Byte Character Set (MBCS) for code conversion, which includes (but not limited to) Japanese, Chinese and Korean. Variable names with MBCS support for code conversion and MBCS support for data conversion are not supported.

Procedures

Converting the Code Containing the MBCS Characters

Following are the typical procedures to convert code which includes MBCS using Tuxedo ART Workbench:

1. Fetch the source code assets (including COBOL, COPYBOOK, JCL, MAP) from mainframe using FTP tool with binary mode.

2. Use code page conversion utility (e.g. ICU `uconv`) to convert the multiple-byte characters in EBCDIC encoding (e.g. IBM-1390) in the source assets to multiple-byte characters in encoding on open system (e.g.,. Shift-JIS).
3. Use other tools provided by Tuxedo ART Workbench to convert the source code assets, e.g. COBOL Converter, JCL Converter.

Migrating the Data Containing the MBCS Characters

The typical procedures for migrating DB2 data (which includes MBCS characters) using Tuxedo ART Workbench are as follows:

1. Set the following `db-param.cfg` parameters to generate the unload scripts which unloads the db2 data in "`csv`" format:

   ```
   rdbms:jcl_unload_utility_name:dsnuproc
   rdbms:jcl_unload_format_file:csv
   ```

2. Invoke the Tuxedo ART Workbench on migration platform and upload the unload scripts into the source platform.
3. Log in the source platform and unload DB2 data that contains MBCS characters.
4. Run "`tso ftp`" command to connect the target platform.
5. Set the transfer options using ftp commands:

   ```
   locsite encoding=MBCS
   locsite mbdataconn=(file_system_codepage, network_transfer_codep)
   locsite mbsendeol=CRLF
   ```

   `file_system_codepage` and `network_transfer_codepagee` are the corresponding Mainframe code pairs to your target MBCS. For example, for Simplified Chinese character set, choose `IBM-5488` as `file_system_codepage` and `IMB-1388` or `UTF-8` as `network_transfer_codepage`.
6. Run "`ftp put`"command to transfer the data file to target platform.
7. Set `NLS_LANG` environment parameter and reload the data file without transcoding. For example, `export NLS_LANG="SIMPLIFIED CHINESE_CHINA.XXXX"`

For information about the typical procedure of converting the data file containing MBCS from DB2 on Mainframe, refer to the Tuxedo ART Workbench Reference Guide.

Utility

ICU uconv utility is recommended to convert the multiple-byte characters in EBCDIC encoding in the source assets to multiple-byte characters in encoding on open system.

The typical usage of uconv utility is as following:

```
uconv -f [source_encoding] -t [dest_encoding] -o [output_file_name]
source_file_name
```

For example, the following command converts the input.bms file which is encoded in IBM-1390 to output.bms file which is encoded in Shift-JIS:

```
uconv -f ibm-1390 -t shift-jis -o output.bms input.bms
```

APPENDIX B

Appendix B: The Simple App Application

This chapter contains the following topics:

Introduction

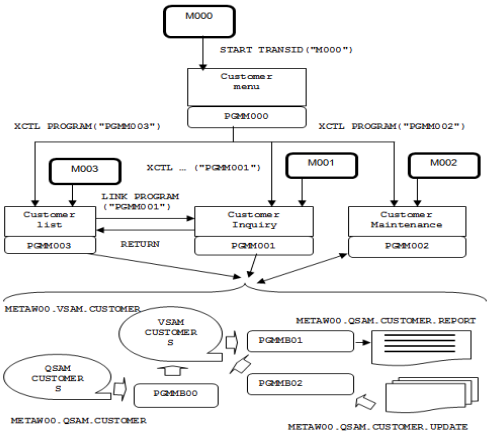
This chapter is intended to be a step by step guide to rehosting the Simple App Application. It will walk you through each step in using the Oracle Tuxedo Application Rehosting Workbench (Tuxedo ART Workbench) to rehost the application. In order to begin any rehosting project you must obtain the source code located on the mainframe. Appendix 4 - Extracting and Transferring Mainframe Components is a guide to achieving this. The source code and data was copied to your machine during the installation of the Oracle Tuxedo Application Rehosting Workbench. By default it will be in …/art_wb12cR1/samples/STFILEORA. It is recommended that you copy this directory to a work area before using the Workbench so that you will have a clean copy that you can always go back to should something go wrong during the rehosting process or if you or

somebody else would like to do the sample rehosting again. For the purpose of this exercise, we will assume that …/art_wb12cR1/samples/STFILEORA has been copied to /lab.

Description of the Simple App Components

This section describes the Simple App component architecture and the online and batch interactions.

Figure 0-1 Simple App Component Architecture



List of Components by Type

CICS Screens

Name	Description
MAPM000	Customer maintenance entry menu.
MAPM001	Customer data inquiry screen.
MAPM002	Customer data maintenance screen (new customer, update and delete customer).
MAPM003	Customer list screen.

CICS Programs

Name	Description
PGMM000	Customer maintenance entry program.
PGMM001	Customer data inquiry program.
PGMM002	Customer data maintenance program (new customer, update and delete customer).
PGMM003	Customer list program.

Batch Programs

Name	Description
PGMMB00	Initial load of the VSAM file. This file is loaded from a QSAM file.
PGMMB01	This program produces a list of the customers stored in the VSAM customer file.
PGMMB02	This program accesses a QSAM file containing commands and data used to update the main VSAM customers file.

Transaction Codes

Name	Description
M000	Main entry transaction code (program PGMM000).
M001	Customer inquiry (program PGMM001).
M002	Customer maintenance (program PGMM002).
M003	Customer list (program PGMM003).

Jobs

Name	Description
DEFVCUST	This job runs an IDCAMS utility in order to DELETE & DEFINE the VSAM customer file.
CHKVCUST	This job runs an IDCAMS utility and REPRO the VSAM file into a QSAM which can be easily read and checked.
LODVCUST	This job runs the PGMMB00 batch program which reads a sequential file containing data to be stored in the newly defined VSAM customer file.
PRTVCUST	This job runs the PGMMB01 batch program which produces a report of the customers referenced in the VSAM file.
UPDVCUST	This job runs the PGMMB02 batch program which contains data used to update the VSAM customer file.

Map Descriptions

Listing 0-1 MAPM000 - Simple App Main Menu

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8
MAPM000             Simple sample application                       07/17/2009
M000
--------------------------------------------------------------------------------
    Customer’s identifier: àààààà
    PF04 – Customer’s List
    PF05 – Add a new customer
    PF06 – Modify an existing customer
    PF07 – Delete an existing customer
    PF08 – Customer’s inquiry
    PF03 – Quit application
--------------------------------------------------------------------------------
        Info: Type a customer number, select an action and press Enter.
--------------------------------------------------------------------------------
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
```

Listing 0-2 MAPM003 - Customer List

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8
MAPM003             Customers list                                  07/17/2009
M003

-------------------------------------------------------------------------------
Sel ID        Last name                      First name            Birth date
-------------------------------------------------------------------------------

@  @@@@@@@@@@ @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@ @@@@@@@@@@@@@@@@@@@@ @@/@@/@@@@
@  @@@@@@@@@@ @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@ @@@@@@@@@@@@@@@@@@@@ @@/@@/@@@@
@  @@@@@@@@@@ @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@ @@@@@@@@@@@@@@@@@@@@ @@/@@/@@@@
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-------------------------------------------------------------------------------
   -PF7: Page up -PF8: page down -PF3: return to previous menu
   -Info: Enter a non blank character and press enter to view customer's data
-------------------------------------------------------------------------------
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
```

Listing 0-3 MAPM001 - Customer Detailed Information

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8
MAPMM01             Customer's detailed information                  07/17/2009
M001

--------------------------------------------------------------------------------
    Customer's identifier: àààààà
--------------------------------------------------------------------------------
  -Last name_____: àààààààààààààààààààààààààà
  -First name____: àààààààààààààààààà
  -Address_______: àààààààààààààààààààààààààà
  -City__________: àààààààààààààààààà
  -State_________: àà
  -Birth date____: àà/àà/àààà
  -Email_________: àààààààààààààààààààààààààààààààààààààà
  -Phone number__: àààààààààà

--------------------------------------------------------------------------------
     -PF03: return to previous screen
--------------------------------------------------------------------------------
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
```

Listing 0-4 MAPM002 - Customer Maintenance

```
....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8
MAPM002            Customer's maintenance                          07/17/2009
M002

--------------------------------------------------------------------------------
    Customer's identifier: àààààà           Action: @@@@@@
--------------------------------------------------------------------------------

  -Last name_____: àààààààààààààààààààààààààà
  -First name____: àààààààààààààààààà
  -Address_______: àààààààààààààààààààààààààà
  -City__________: àààààààààààààààààà
  -State_________: àà
  -Birth date____: àà/àà/àààà
  -Email_________: àààààààààààààààààààààààààààààààààààà
  -Phone number__: àààààààààà

--------------------------------------------------------------------------------
     -PF11: clear screen
     -PF12: confirm action
     -PF03: return to previous screen
--------------------------------------------------------------------------------
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
```

Program Descriptions

CICS Program Descriptions

PGMM000 (customer maintenance main menu)

PGMM000 is the Simple Sample Application (access) main menu program. From this screen, one may access the following functions:

- Customer list
- Customer detailed information inquiry
- Customer data maintenance:
  - Add a new customer
  - Update customer information
  - Delete an existing customer

Each function can be reached by entering a specific function key. At the end of the called function, a return is performed back to this main menu.

Controls:

This program checks that a valid customer identification number is entered when accessing the inquiry and maintenance functions.

PGMM001 (customer detailed information inquiry)

This program receives – thru the communication area – a customer identification number. The program accesses the VSAM customer file in order to display the customer data when known.

Controls:

Assuming that no data can be modified by this program, no control is performed.

PGMM002 (customer data maintenance)

This program enables the maintainance of the VSAM customers file:

- Creating a new customer
- Updating an existing customer
- Deleting an existing customer

PGMM002 receives an action code and, when needed, a customer identification number. The action to be performed is displayed on the screen (CREATE, UPDATE or DELETE).

Controls:

The controls carried-out depend on the action to perform.

When creating a new customer, the programs checks that:

- The Customer identification number is not null, is numeric and not already used in the customer VSAM file.
- Last name, first name, address, city, email address and birth date are not equal to spaces.
- Phone number, if not equal to zero, must be numeric.

When updating an existing customer, the controls are the same as the ones used when creating a customer except for the customer identification number, which cannot be modified.

There is no control performed on a customer deletion request.

PGMMM03 (customer list)

This program lists the customers stored in the VSAM file. A limited number of customers are displayed on each screen – the PF7 and PF8 keys give access to the previous and next pages. A non-blank character at the beginning of a customer's line gives access to the detailed customer information screen (see program PGMM001).

Batch Program Descriptions

PGMMB00 (VSAM file initial load)

This batch program reads a sequential file containing data to be stored in the VSAM file. For each record in the entry file, a VSAM record is created. The VSAM file must have been DELETED and DEFINED prior to executing this program. All data from the entry file is supposed to be valid: hence, no control is performed within this program.

PGMMB01 (customer report)

PGMMB01 reads all the customer record from the VSAM file and produces a report. An example of the report produced is included in this document.

PGMMB02 (batch customer maintenance program)

Each input sequential file record contains a three characters action code (ADD, UPD or DEL) and the customer data required when creating a new customer or updating an existing one. Each input line updates the VSAM customer file. Customer data from the sequential file is supposed to be valid so that no control is performed by the PGMMB02 batch program.

Using Oracle Tuxedo Application Rehosting Workbench to Rehost the Simple App

Create Project

The Tuxedo ART Workbench Plug-in is an add-in to Eclipse which was installed along with the other components of the Oracle Tuxedo Application Rehosting Workbench. The Workbench is started by clicking on the Tuxedo ART Eclipse IDE icon on your desktop.

If you not in the "Tuxedo ART Workbench and Runtime" perspective, you can switch it manually, Click Window->Open Perspective->Other, and then select "Tuxedo ART Workbench and Runtime", then click "OK".

To create a new ART project click File>New>Project and choose "ART->Tuxedo ART Project" in the list, then click Next.

On the Create an ART Project screen enter the name of your project and either leave Use default location checked or uncheck it and enter the location of the work area that the Workbench will use for the project, then click Next.

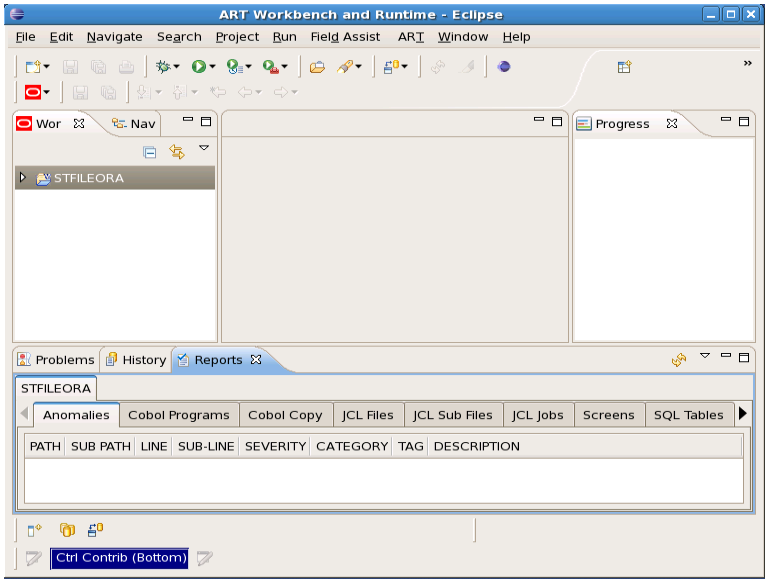
On the next screen enter the Workbench Install Directory if it is different from the default already shown and click Next.

On the next screen enter the location of the Application Source Folder. This is the location that you copied the provided application source and data to as outlined in the Introduction above. You can use the Browse button to locate the source directory. Append the directory "source" to this location to indicate where the actual source files are located and click Next.

On the next screen the "Target Database Type" and "COBOL Compiler Type" are shown. These can be modified if necessary, we user the default value in the case. Click Finish to continue.

Once you click Finish, the ART Project Wizard will create a new project and populate the work area which was specified. The Workbench also creates additional working directories and populates them with parameter files and scripts. The structure of the work area is shown below.

Figure B-1 Work Area Structure

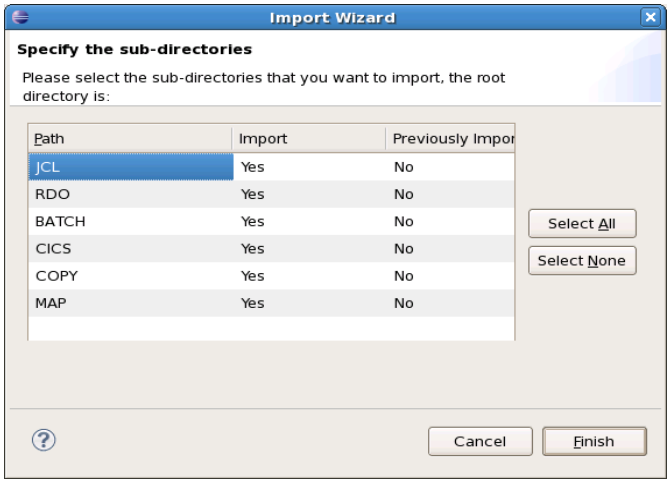


The Create Project phase is now complete.

Import

The import phase copy source files into the project. All the sub-directories of the directory which you specified while creating project will be showed in the table as shown below.

Figure B-2 Import Wizard



Select all of them, then click "Finish". All the selected sub-directories will be imported into project.

Prepare

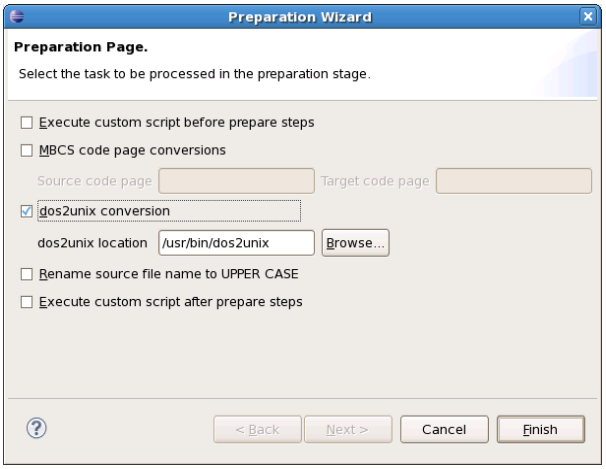
The Prepare phase makes the source ready for further processing by the other components of the Workbench. Since source from different mainframes may have been gathered in various ways, the Prepare process allows you to choose the proper processing for your source. If after going through the prepare process you realize that something is still not correct, you can execute ART>Reset>Clean Prepare, which will be discussed later, to delete the output of the Prepare phase and execute it again with different options.

To execute the Prepare phase, from the menu bar click ART>Prepare…

The Preparation Page will be displayed. On this screen you can check MBCS code page conversion if required. For details on MBCS please reference the Appendix 3 - Tuxedo ART Workbench MBCS Support. If during file transfer from the mainframe, <CR> characters were inserted before the end of each line, you can check dos2unix conversion to remove these.

This is typically the case when the source files are transferred to a Windows machine. Check Rename source file name to UPPER CASE, all the source file's base name will be change to upper case . Since none of this preparation is necessary for this application, click "Finish" to complete.

Figure B-3 Preparation Wizard



Analyze

The Analyze phase reads all of the sources and searches for missing components, dependencies, and creates an abstract representation of the source which is used in the Migrate step that follows. Reports are generated for each component type highlighting areas which must be addressed before executing the Migrate phase.

Before executing the Analyze phase, you must define the data migration required for the application. To do this, go to the STFILEORA Properties page by right clicking STFILEORA then clicking Properties. Click File Converter,and complete the table below as follows (The table we need to be scrolled to the left to show all fields.):

The Simple APP Application includes two files as described in the Data Description section of the Simple App Functionalities section above. Their names are

- `PJ01AAA.S2.QSAM.CUSTOMER`
- `PJ01AAA.S2.QSAM.CUSTOMER.UPDATE`

`"QS-ODCSF0-RECORD"` and `"QS-ODCSFU-RECORD"` respectively are the **Record Names** specified in the COPYBOOK.

`"ODCSF0"` and `"ODCSFU"` respectively are the **Logical Names** used by Tuxedo ART Workbench internally.

The Organization of `PJ01AAA.S2.QSAM.CUSTOMER` is Indexed. The **Organization** of `PJ01AAA.S2.QSAM.CUSTOMER.UPDATE` is "sequential". The Key Offset and Key Length for `PJ01AAA.S2.QSAM.CUSTOMER` are 0 and 6 respectively. Since `PJ01AAA.S2.QSAM.CUSTOMER.UPDATE` is a QSAM file, there is no key.

The **Converted** property is True if the file will be migrated to an Oracle table or False when it is left as a file.

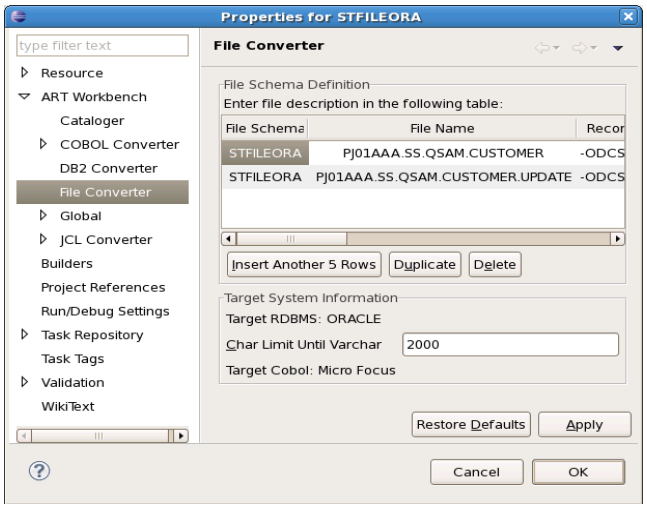
The **Transferred** property means it's a permanent file with data that needs to be transferred from mainframe to open system. When set to True, Workbench will generate unload JCL, EBCDIC-to-ASCII transcoding programs, and reloading scripts.

The record structures of these files are defined in two COBOL copybooks and are entered in the Include field:

- `COPY/ODCSF0.cpy`
- `COPY/ODCSFU.cpy`

Once these properties are entered, click Apply. The status of the **Properties for STFILEORA** are shown below.

Figure B-4 Properties Page



All information in the table is required to generated the datamap file and mapper file used by file converter.

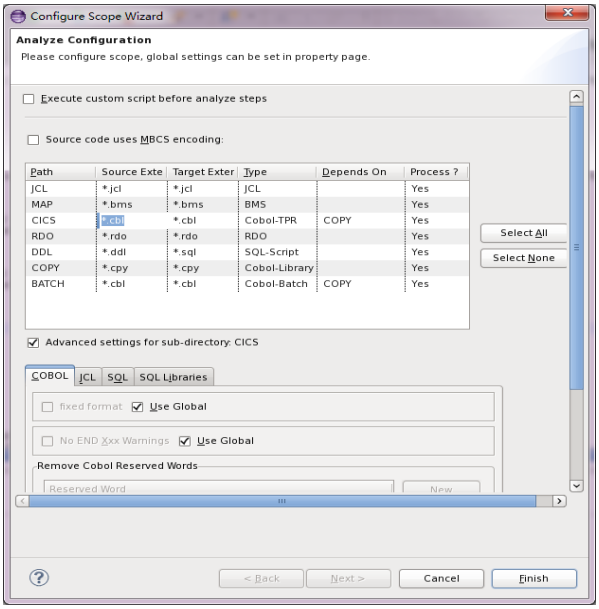
To make the clear meaning of each column in the table, refer to "Datamap file" and "mapper file" section in the Oracle Tuxedo Application Rehosting WorkbenchReference Guide.

Before executing catalog, we must configure scope.

Click ART->Analyze->Configure Scope, all the source files are recognized successfully, and all of them will be process default.

Let's configure the library path of COBOL programs. Select "BATCH" and click "Advanced settings for sub-directory: BATCH", click "Libraries" tab-folder, click "New" to add a library, change it to "COPY". Similar to above steps, we set "COPY" as the "Library" of sub-directory "CICS".

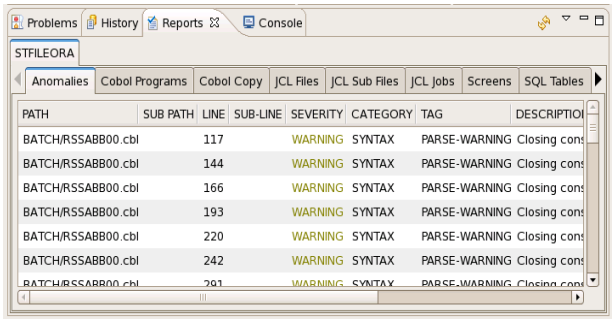
Figure B-5



To execute the Analyze phase, from the menu bar click ART>Analyze>Catalog.

When the Catalog process is complete, review the console logs and the generated reports in the Reports window as shown below. The reports are also available in CSV Format in the …/workspace/STFILEORA/Reports directory.

Figure B-6 Reports View



If it is necessary to rerun the Cataloger, it is necessary to delete the generated POB files. This can be accomplished by clicking ART>Analyze>Clean POB Repository from the menu bar.

Convert

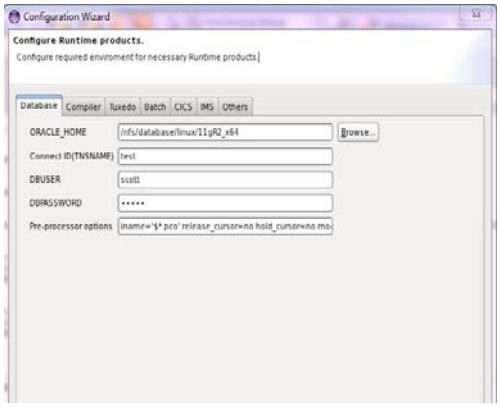
This phase converts the COBOL programs and other source artifacts so that they will be ready for compilation and execution. It uses the abstract representation created during the Catalog phase. It also creates JCL decks for unloading data on the mainframe and various scripts for future steps in the rehosting process. You can Convert individual types of components or all components at once. To execute the Migrate phase, from the menu bar click ART->Convert ->Convert Components, and choose components to convert as need.

The Convert process will execute incrementally as additional files are added to or modified in the source directory. However, if it is necessary to rerun the Convert phase, all of the target files created can be deleted by clicking ART>Convert>Clean Target from the menu bar.

Configure

The Configure phase provides the capabilities to create makefiles for compiling components and configuration files for the Oracle Tuxedo Application Runtime for CICS and Batch. It provides options to create configuration for Tuxedo, CICS, and Batch independently. To execute the Configure phase, from the menu bar click ART>Configure as shown in following wizard.

Figure B-7 Configuration Wizard



The Configure Wizard is used to create the required configuration files. Including makefiles which will ultimately be used to build the rehosted application, the data migration utilities created during the Migrate phase, and files to setup the environment.

"Database" tab allows you to specify the target database; "Compiler" tab allows you to specify the COBOL compiler options and PDKSH location; "Others" tab allows you to specify the ART CICS Pre-compiler and the ART CICS mapgen configuration. "MBCS Translate" can also be configured here.

The Tuxedo/CICS/Batch/IMS tabs allow you to either choose the default configuration or customize for your environment.

For more information, see Oracle Tuxedo Domain/CICS Runtime/Batch Runtime documentation.

Build

This phase compiles application components and data reloading programs and so on. To execute the build phase, from the menu bar click ART->Build then choose one or more of the build options. You can convert individual types of components or all components at once.

Deploy

The Deploy phase creates tar files of all of the programs, scripts, JCLs and configuration files that were created in the previous steps and are now ready for Deployment. You can also choose Local Deploy to compile and execute the rehosted application on the machine where the Workbench has been running. The Deploy phase also reloads data into file or database. Deployment to a different machine requires some manual intervention, the scope of which is beyond this section. To execute the Deploy phase, from the menu bar click ART>Deploy then choose one of the Deploy options.

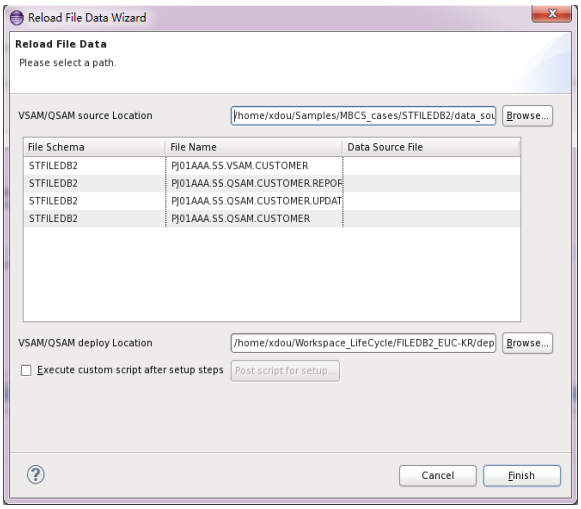
Click "ART->Deploy->Pack and Deploy", “Pack“ generates four tar files which will be placed to pack directory under project.

“Deploy Application" will un-tar the tar files into deploy directory.

Click "ART->Deploy->Setup Runtime" to setup BATCH, CICS, and IMS runtime environment.

Click "ART->Deploy->Reload File Data" to launch the wizard. Choose the data source location, for example "/home/artuser/oracle/art_wb12110/samples/STFILEORA/data_source", then click the "Data Source File" column in the table, all the files in the front path will be listed, choose the matched one. Choose the deploy location, then click "Finish" as show below.

Figure B-8 Reload File Data



Run

Click "ART->Batch Runtime->Start" to start Batch runtime. You can manipulate jobs by further clicking "ART->Batch Runtime->Manipulate Jobs".

Click "ART->CICS Runtime->Start" to start CICS runtime. You can open 3270 terminal to connect CICS runtime and invoke your transaction.

Click "ART->IMS Runtime->Start" to start IMS runtime. You can open 3270 terminal to connect IMS runtime and invoke your transaction.

Simple App Functionalities

Batch Processing

Batch programs and utilities are used to populate, update and list the VSAM customer file that hosts the data managed within the application. Five jobs are delivered with the application. This chapter describes how they are used.

VSAM Customers File Initial Load

1. Step 1: VSAM file definition

   First, define the VSAM customer file thru the IDCAMS utility using DELETE/DEFINE commands.

2. Step 2: VSAM file initial load

   The batch program PGMMB00 is used to populate the VSAM file.

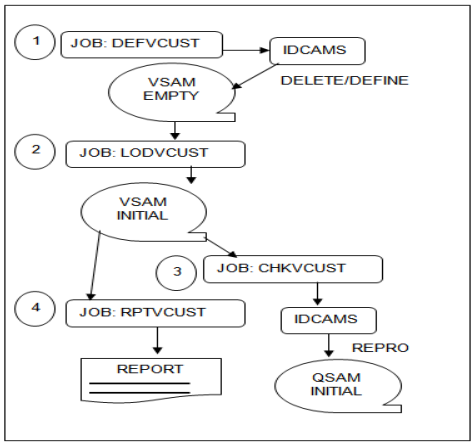
3. Step 3: VSAM file check

   IDCAMS is used to REPRO the VSAM file into a sequential file which can easily be read in the z/OS environment.

4. Step 4: VSAM file report

   Batch program PGMMB01 produces a list of the customers stored in the VSAM customer file.

Figure 0-2 VSAM Customers File Initial Load



VSAM Customer File Update

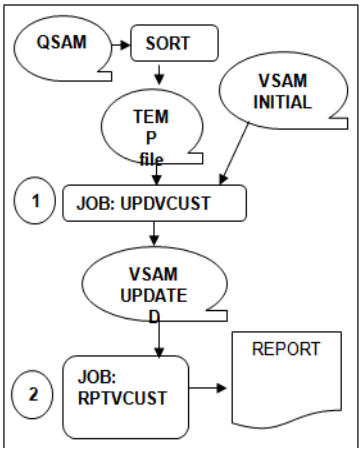
1. Step 1: VSAM file update

   Batch program PGMMB02 reads a sequential file containing updates to be performed on VSAM customers file. The input file is sorted by the IBM standard sort utility.

2. Step 2: VSAM file report

   Batch program PGMMB02 is used again in order to check that the updates were correctly applied to the VSAM customers file.

Figure 0-3 VSAM File Update



Data Description

Simple Sample Application relies on only one VSAM main customer file. In order to keep the migration process as simple as possible, the data is stored in displayable formats (in COBOL syntax, this means that only "X" and "9" USAGE DISPLAY pictures are used).

The VSAM customer file contains the following information:

Table 0-1 VSAM Customer Fle Description

Name	Type	Length	Description
CUSTIDENT	Num.	6	Customer identification number
CUSTLNAME	Alpha	30	Customer last name
CUSTFNAME	Alpha	20	Customer first name
CUSTADDRS	Alpha	30	Customer address (street…)
CUSTCITY	Alpha	20	City
CUSTSTATE	Alpha	2	State
CUSTBDATE	Num.	8	Customer birth date

Table 0-1 VSAM Customer Fle Description

Name	Type	Length	Description
CUSTEMAIL	Alpha	40	Customer email address
CUSTPHONE	Num.	10	Customer phone number

This VSAM file is a Key Sequenced Data Set (KSDS) based on the customer's identification number. Each record contains 266 characters and the key is stored from position 1 to position 6.

VSAM Customer File COBOL Description

Listing 0-5 VSAM Customer File COBOL Description

```
01  ODCSF0-RECORD.
    05  CUSTIDENT    PIC 9(006).
    05  CUSTLNAME    PIC X(030).
    05  CUSTFNAME    PIC X(020).
    05  CUSTADDRS    PIC X(030).
    05  CUSTCITY     PIC X(020).
    05  CUSTSTATE    PIC X(002).
    05  CUSTBDATE    PIC 9(008).
    05  CUSTBDATE-G  REDEFINES CUSTBDATE.
     10 CUSTBDATE-CC PIC 9(002).
     10 CUSTBDATE-YY PIC 9(002).
     10 CUSTBDATE-MM PIC 9(002).
     10 CUSTBDATE-DD PIC 9(002).
    05  CUSTEMAIL    PIC X(040).
    05  CUSTPHONE    PIC 9(010).
    05  FILLER       PIC X(100).
```

Report Layouts

The following report is produced by program PGMMB01 that lists the customers from the VSAM file (METAW00.VSAM.CUSTOMER) after the initial load.

Listing 0-6 Simple App Initial Report

```
PGMMB01                Simple Sample Application                          07/16/2009

   _ ID _ _ LAST NAME    _ _    FIRST NAME    _ _    CITY     _ _ PHONE  _ _B. DATE _
    ------ ---------------------------------- ------------------- ---------- ----------
         1 Richardson            Bobby          New Orleans      5553557901 09/07/1961
         2 Roberts               Sammy          San Francisco    5559827383 01/24/1973
         3 Douglas               Burt           Atlanta          5556531100 10/12/1981
         4 Ewing                 Samantha       New York         5558762763 07/27/1962
         5 Prince                Anne           Fresno           5553410156 12/25/1991

PGMMB01            Simple Sample Application                                07/16/2009

   _ ID _ _    LAST NAME    _ _    FIRST NAME    _ _    CITY     _ _ PHONE  _ _B. DATE _
  ------ ------------------------------ ------------------- -------------------- -------
       6 Colombus             Christopher     Colombus          5557811021 07/27/1962
       7 Raul                 Menedez         Fresno            5558981572 07/27/1962
       8 Doors                Bill            Seattle           5553122000 01/01/1958
       9 Awing                Charles         San antonio       5559990123 06/29/1929
```

The following report is based upon the updated customer file.

Listing 0-7 Simple App Updated Customer File Report

```
PGMMB01                Simple Sample Application                          07/16/2009

   _ ID _ _ LAST NAME    _ _    FIRST NAME    _ _    CITY     _ _ PHONE  _ _B. DATE _
    ------ ---------------------------------- ------------------- ---------- ----------
```

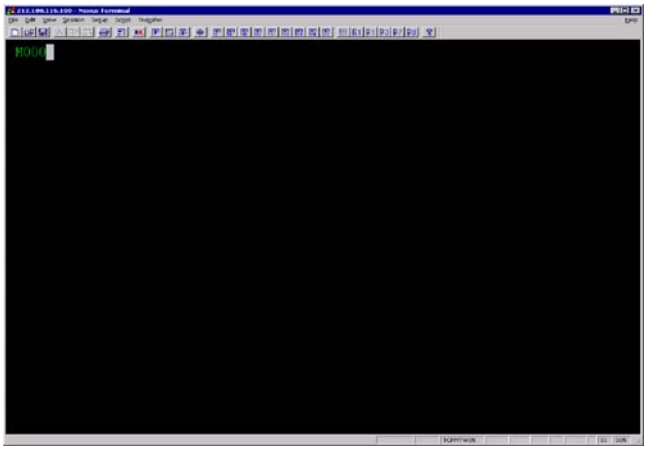
```
     1 Richardson            Bobby          New Orleans      5553557901 09/07/1961
     2 Roberts               Sammy Jr       San Francisco    5559827383 01/24/1973
     3 Douglas               Burt           Atlanta          5556531100 10/12/1981
     4 Ewing                 Samantha       New York         5558762763 07/27/1962
     5 Prince                Anne           Fresno           5553410156 12/25/1991
 _ ID _ _ LAST NAME    _ _    FIRST NAME    _ _    CITY      _ _ PHONE  _ _B. DATE _
------ ---------------------------------- -------------------- ---------- ----------
     6 Colombus              Christopher    Colombus         5557811021 07/27/1950
     8 Doors                 Bill           Seattle          5553122000 01/01/1958
     9 Awing                 Charles        San antonio      5559990123 06/29/1929
    10 Simms                 Arthur         New Orleans      5551298373 01/17/1969
    11 LaFayette             Eric           Plesanton        5554653213 02/12/1995
    12 Jackson               Mic            Fresno           5559800727 01/01/1959
```

Using the Simple App Application

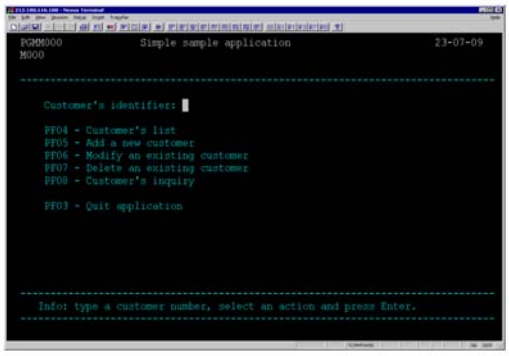
This section provides an example use of the Simple App Application in order to illustrate how to use the application.

Viewing A Customer Record

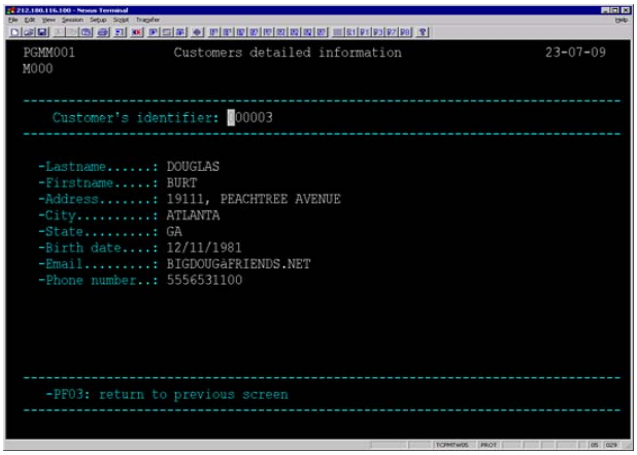
1. Access your CICS environment and enter the Simple App main transaction code `M000` to connect to the application.



2. The `Main` menu is displayed. Enter `000003` in the Customer identifier field and press the PF08 key to inquire on the customer.

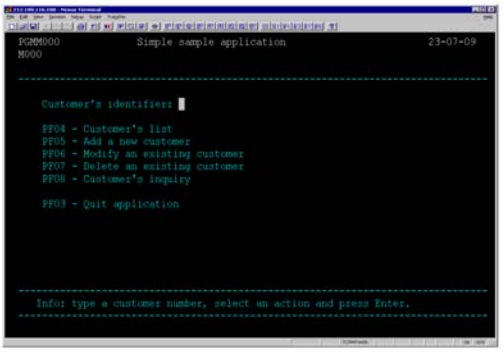


3. The customer record of Douglas Burt is displayed. Press PF03 to return to the `Main` menu.

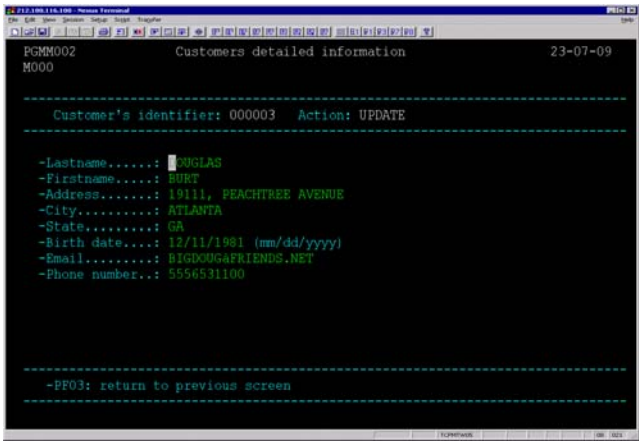


Updating A Customer Record

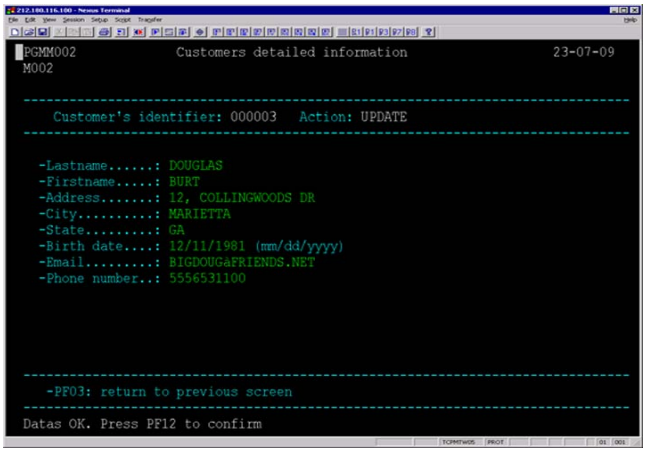
1. From the `Main` menu enter `000003` in the Customer identifier field and press the PF06 key to update customer information.



2. In the update screen all data may be modified. The screen header shows the action `UPDATE`. Change the customer's address and press `ENTER`.

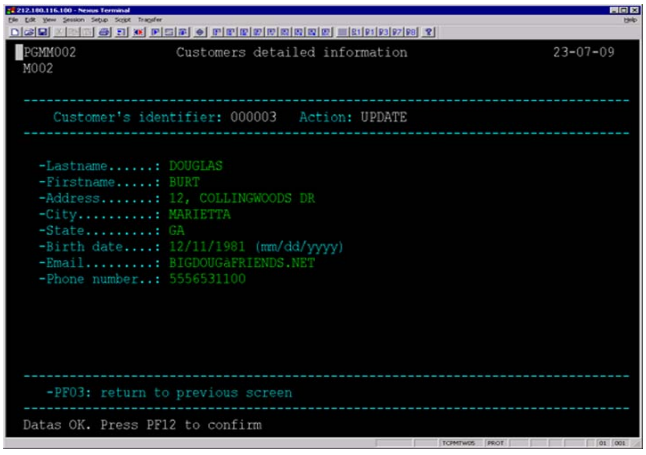


3. Press PF12 to confirm the updates. A `Maintenance OK` message is displayed in the screen footer. To cancel your input, press `PF03` in order to return to the `Main` menu.



Printing Customer Reports

1. From the `Main` menu, press PF04 to access the Customer List first page.

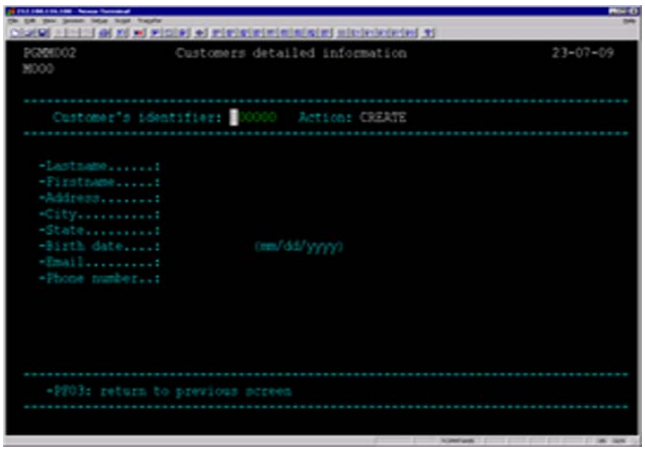


2. Press PF08 to display the next page in the list. Press PF07 to display a previous page in the list.

Note: You can perform a customer inquiry by entering any non-blank character in the selection (Sel) column to the left of each customer.

Adding New Customers

1. From the `Main` menu press PF05, the following screen is displayed.



`Action` is set to CREATE in the screen header and fields are unprotected.

2. Enter the new customer data including a valid non-existing identifier, and press ENTER.

   The program validates the record; when no errors are found, a confirmation message is displayed.

3. Press PF12 to create a new customer record.

   A New customer added message is displayed.

4. Press PF03 to return to the main menu.

Simple App APIs

This section lists the CICS APIs which are used within the Simple App application programs.

MAP APIs

SEND

```
EXEC CICS
     SEND MAP('MAPM000') MAPSET('MAPM000') ERASE
END-EXEC.
EXEC CICS
     SEND MAP('MAPM000') MAPSET('MAPM000') CURSOR ERASE
END-EXEC.
EXEC CICS
     SEND MAP('MAPM001') MAPSET('MAPM001') FROM(MAPM001O) ERASE
END-EXEC.
```

RECEIVE

```
EXEC CICS
     RECEIVE MAP('MAPM000') MAPSET('MAPM000')
END-EXEC.
EXEC CICS
```

```
     RECEIVE MAP('ORDMAP1') MAPSET('ORDSET1') INTO(ORDMAP1)
END-EXEC.
```

NAVIGATION APIs

RETURN

```
EXEC CICS
     RETURN
END-EXEC.
EXEC CICS
     RETURN TRANSID('M000') COMMAREA(COMM-RECORD)
                            LENGTH(LENGTH OF COMM-RECORD)
END-EXEC.
```

XCTL

```
EXEC CICS
     XCTL PROGRAM(PGM-DEST) COMMAREA(COMM-RECORD)
                            LENGTH(LENGTH OF COMM-RECORD)
END-EXEC.
```

ABEND

```
EXEC CICS
     ABEND ABCODE('META')
END-EXEC.
```

VSAM APIs

STARTBR

```
EXEC CICS STARTBR DATASET ('ODCSF0')
                  RIDFILD (CUST-FILE-KEY)
```

```
                EQUAL
                RESP    (RESPONSE-CODE)
END-EXEC.
EXEC CICS STARTBR DATASET ('ODCSF0')
                RIDFILD (CUST-FILE-KEY)
                GTEQ
                RESP    (RESPONSE-CODE)
END-EXEC.
```

READ

```
EXEC CICS
    READ FILE('ODCSF0')
         INTO(VS-ODCSF0-RECORD)
         RIDFLD(CUST-FILE-KEY)
         LENGTH(LENGTH OF VS-ODCSF0-RECORD)
         EQUAL
         RESP(RESPONSE-CODE)
END-EXEC.
EXEC CICS READ DATASET ('ODCSF0')
               INTO    (READ-ODCSF0-RECORD)
               LENGTH  (LENGTH OF READ-ODCSF0-RECORD)
               RIDFLD  (CUST-FILE-KEY)
               EQUAL
               UPDATE
               RESP    (RESPONSE-CODE)
END-EXEC.
```

WRITE

```
EXEC CICS WRITE DATASET   ('ODCSF0')
                FROM      (MAJ-ODCSF0-RECORD)
                LENGTH    (LENGTH OF MAJ-ODCSF0-RECORD)
                RIDFLD    (MAJ-CUSTIDENT)
                KEYLENGTH (6)
                RESP      (RESPONSE-CODE)
END-EXEC.
```

REWRITE

```
EXEC CICS REWRITE DATASET ('ODCSF0')
                  FROM    (READ-ODCSF0-RECORD)
                  LENGTH  (LENGTH OF READ-ODCSF0-RECORD)
                  RESP    (RESPONSE-CODE)
END-EXEC.
```

READNEXT

```
EXEC CICS READNEXT DATASET ('ODCSF0')
                   INTO    (CLT-ODCSF0-RECORD)
                   LENGTH  (LENGTH OF CLT-ODCSF0-RECORD)
                   RIDFLD  (CUST-FILE-KEY)
                   RESP    (RESPONSE-CODE)
END-EXEC.
```

READPREV

```
EXEC CICS READPREV DATASET ('ODCSF0')
                   INTO    (CLT-ODCSF0-RECORD)
                   LENGTH  (LENGTH OF CLT-ODCSF0-RECORD)
                   RIDFLD  (CUST-FILE-KEY)
```

```
                  RESP    (RESPONSE-CODE)
END-EXEC.
```

ENDBR

```
EXEC CICS ENDBR DATASET ('ODCSF0')
END-EXEC.
```

DELETE

```
EXEC CICS DELETE FILE    ('ODCSF0')
                 RIDFLD  (CUST-FILE-KEY)
                 RESP    (RESPONSE-CODE)
END-EXEC.
```

MISCELLEANOUS APIs

TIME

```
EXEC CICS
     ASKTIME ABSTIME(ABS-TIME)
END-EXEC.
EXEC CICS
     FORMATTIME ABSTIME(ABS-TIME)
                DDMMYY(VDATEO) DATESEP('-')
END-EXEC.
```

HANDLE CONDITIONS

```
EXEC CICS
     IGNORE CONDITION   MAPFAIL
END-EXEC.
EXEC CICS
     HANDLE CONDITION PGMIDERR(PGM-NOTFOUND)
```

```
END-EXEC.
```

Simple App Documentation References

You may find a detailed description of the CICS APIs at the following address:

http://publib.boulder.ibm.com/infocenter/cicsts/v3r1/index.jsp?topic=/com.ibm.cics.ts31.doc/dfhp4/topics/dfhp4_commands.htm

Detailed Description of the CICS APIs

The following CICS APIs are used in the Simple App application.

Table 0-2 Simple App CICS APIs

API	Description
ASKTIME	Request current date and time of day.
DELETE	Delete a record from a file - VSAM KSDS, VSAM RRDS, and data tables only.
ENDBR	End browse of a file.
FORMATTIME	Transform absolute date and time into a specified format.
LINK	Link to another program expecting return. The external CICS interface (EXCI) provides a LINK command that performs all six commands of the interface in one invocation. See the CICS External Interfaces Guide for information about the EXCI.
READ	Read a record from a file.
READNEXT	Read next record during a browse of a file.
READPREV	Read previous record during a file browse; VSAM and data tables only.
RECEIVE MAP	Receive screen input into an application data area. For further information about BMS, see the
RETURN	Return program control.
REWRITE	Update a record in a file.
SEND MAP	Send mapped output data to a terminal. The keywords are separated into those supported by minimum, standard, and full BMS. For further information about BMS, see the CICS Application Programming Guide.

Table 0-2 Simple App CICS APIs

API	Description
START	Start task at a specified time.
STARTBR	Start browse of a file.
WRITE	Write a record.
XCTL	Transfer program control.

This document is based upon the following reference guide: CICS Transaction Server for z/OS Application Programming Reference

APPENDIX A

Appendix C: Oracle Tuxedo Application Rehosting Workbench Logs

This chapter contains the following topics:

Purpose

Oracle Tuxedo Application Rehosting Workbench (Tuxedo ART Workbench) Logs are printed on screen to show the running status of Workbench.

Procedures

Controlling Output of Logs

The environment variable `WBLOGLEVEL` is introduced to define what level log will be output; i.e., all Workbench logs that are prior than `WBLOGLEVEL` will be output. Valid `WBLOGLEVEL` value can be one of `ERROR`, `WARN`, `INFO`, `DEBUG`, `TRACE`; all other values will be directed to default value.

The default `WBLOGLEVEL` is `INFO` that is meaning all logs whose level is `INFO`, `WARN`, `ERROR` will be output, others will be discard.

For example, if `WBLOGLEVEL` is set as `WARN`, only Error and Warn Logs are printed on screen.

export WBLOGLEVEL=WARN

[19:31:56] WARN :(r4z-catalog) Line 25: Reference to unqualified undeclared data name: Wk-Aidcount

[19:31:56] WARN :(r4z-catalog) This program contains errors, some of which may not appear here.

Controlling Exit When Error Log Occurs

The environment variable `WBEXITONERROR` is introduced to define whether Workbench should continue or quit when an ERROR level log is met. There are two directions when an ERROR log is met, to continue execute or to stop execute after reporting this error.

The default `WBEXITONERROR` value is `YES`, i.e,. Workbench will quit when an ERROR log is met.

`WBEXITONERROR` can be set to `NO/FALSE`, to stop quit. (All others values will be directed to default `YES`).