IBM Application Discovery for IBM Z Build V5.1.0

User Guide

SC27-8970-06

Contents

Chapter 1. Accessibility Features for IBM Application Discovery for IBM Z

Accessibility features assist users who have a disability, such as restricted mobility or limited vision, to use information technology content successfully.

Overview

IBM® Application Discovery for IBM Z® includes the following major accessibility features:

- Keyboard-only operation
- Operations that use a screen reader

IBM Application Discovery for IBM Z uses the latest W3C Standard, WAI-ARIA 1.0 (www.w3.org/TR/wai-aria/), to ensure compliance with US Section 508 (www.access-board.gov/guidelines-and-standards/communications-and-it/about-the-section-508-standards/section-508-standards) and Web Content Accessibility Guidelines (WCAG) 2.0 (www.w3.org/TR/WCAG20/). To take advantage of accessibility features, use the latest release of your screen reader and the latest web browser that is supported by IBM Application Discovery for IBM Z.

The IBM Application Discovery for IBM Z online product documentation in IBM Knowledge Center is enabled for accessibility. The accessibility features of IBM Knowledge Center are described in the Accessibility section of the IBM Knowledge Center help (https://www.ibm.com/support/knowledgecenter/en/about/releasenotes.html).

Keyboard navigation

This product uses standard navigation keys.

Interface information

For alternative installation using Command Line Installation (CLI), refer to section Alternative Installation for ADDI Using CLI in *IBM AD Installation and Configuration Guide*.

The IBM Application Discovery for IBM Z user interfaces do not have content that flashes 2 - 55 times per second.

The IBM Application Discovery for IBM Z web user interface relies on cascading style sheets to render content properly and to provide a usable experience. The application provides an equivalent way for low-vision users to use system display settings, including high-contrast mode. You can control font size by using the device or web browser settings.

The IBM Application Discovery for IBM Z web user interface includes WAI-ARIA navigational landmarks that you can use to quickly navigate to functional areas in the application.

Related accessibility information

In addition to standard IBM help desk and support websites, IBM has a TTY telephone service for use by deaf or hard of hearing customers to access sales and support services:

TTY service
800-IBM-3383 (800-426-3383)
(within North America)

For more information about the commitment that IBM has to accessibility, see IBM Accessibility (www.ibm.com/able).

Chapter 2. Introduction

IBM Application Discovery for IBM Z (AD) Build Client is an application-oriented **Configuration Management** database (CMDB) that automates application understanding and technical documentation for use in all application management activities. Synchronizing with your source configuration management system, it contains a full inventory of your application components and their details. **IBM AD Build Client** is an indispensable tool for support activities and a precursor to undertaking enhancements and modifications. It is designed for use by all technical staff, having management components for transparency into application metrics.

IBM AD High-Level Architecture Overview

The following diagram illustrates IBM Application Discovery for IBM Z high-level architecture and the relationships among the different components of the suite.

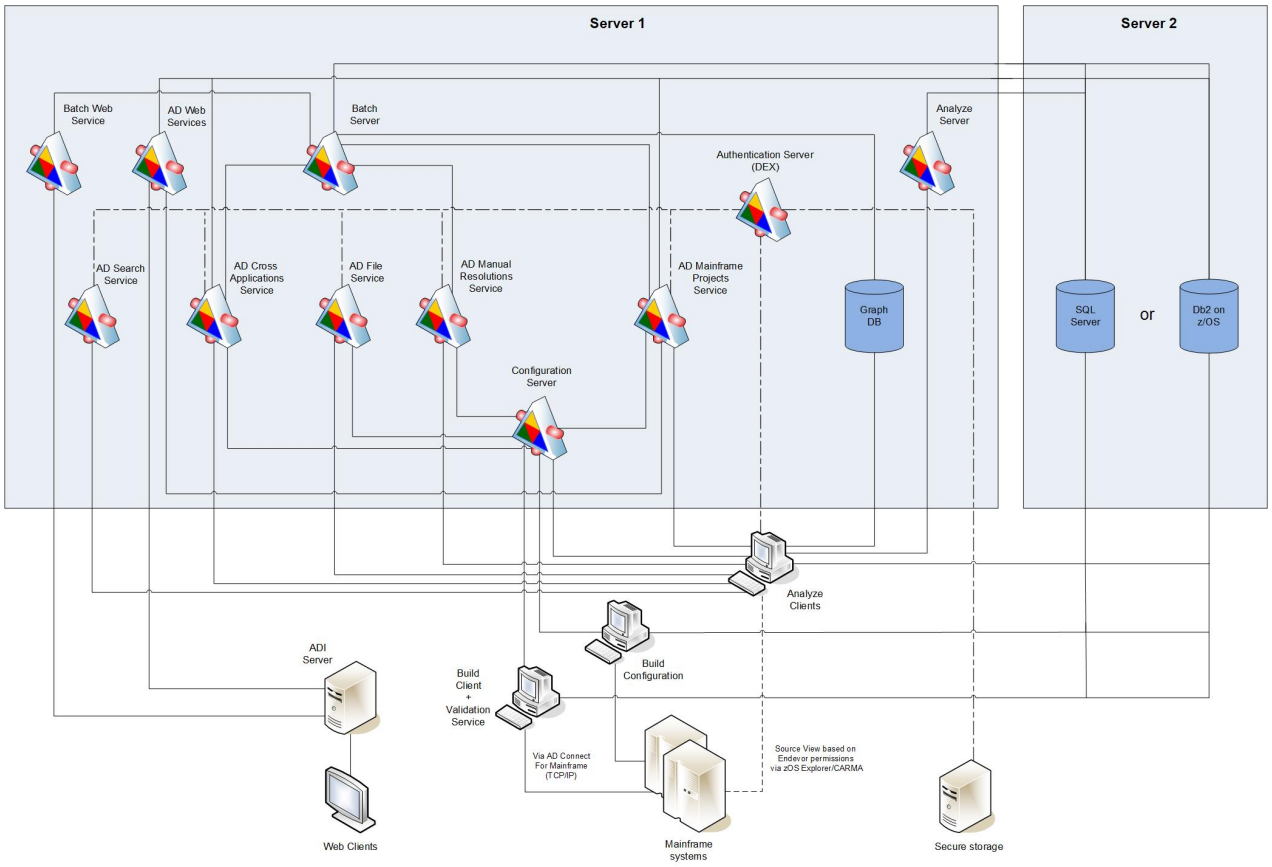


*Figure 1. **IBM AD** high-level architecture*

Following is a brief description of the relationships among the different components of IBM AD.

IBM AD Configuration Server ensures the consistency of the installation parameters throughout an installation and allows the system administrator to manage user access to workspaces.

IBM AD Build - uses data from mainframe systems to build projects. It uses project sources that are brought from z/OS®®, performs a compilation/build process and stores the analysis data to the repository.

IBM AD Validation Service - works with ChangeMan SCM only. Provides coding rule enforcement via synchronization with ChangeMan and upon member staging.

IBM AD Batch Server - imports data from the relational database repository into the GraphDB (OrientDB) repository, automates processes such as report generation and indexing, and manages the creation of the annotations database.

IBM AD Analyze Client - runs over Eclipse or IDz and provides project analysis via graphs reports and usage views. When the analyzed application sources are coming from Endevor, it allows viewing source code per user based on Endevor permissions that are checked via z/OS Explorer/CARMA interface.

IBM AD Mainframe Projects - authorizes the access to the AD projects, by using SSO authentication within AD. This service is mandatory to be configured to use AD, whether the authentication feature is in place or not.

IBM AD File Service - in the context of the authorization/authentication, the access rights of users or users' groups are mapped to a certain folder that contains the source files. Once authenticated and authorized, the user can start the analysis on the source files as long as the user has read access rights.

IBM AD Search Service - is responsible with the access to the indexed data. Whether the authentication feature is in place or not, the folder path in which the indexes are generated needs to be accessible for both **IBM AD Batch Server** and **IBM AD Search Service**.

IBM AD Manual Resolutions Service - manages the manually added resolutions and allows clients that use SSO authentication within AD to ask for user authentication to access these resolutions. This service is mandatory to be configured if you want to use callgraph-based analyzes (graphs or reports), whether authentication feature is in place or not.

Authentication Server (DEX) - is an identity service that uses OpenID Connect and supports OAuth2 protocol in order to allow clients to use SSO authentication within AD. With the credentials provided by the user, it interrogates a **Secure Storage**, through the LDAP protocol. The **Secure Storage** can be an **Active Directory** or any other entity that stores users and groups and can communicate through **LDAP**. This service is mandatory to be installed and configured only when authentication feature is in place.

IBM AD Cross Applications Service - is mandatory to be configured if you want to generate a Cross Applications Callgraph, whether the authentication feature is in place or not.

Batch Web Service - serves the data that is provided by a component of the Batch Server and prepares it for delivery.

IBM AD Web Services - contains the following features: **AD Audit**, **AD Catalog** and **AD BRD REST API**.

Supported Source Components

The standard edition of **IBM AD Build Client** supports the following source components:

- **OS** - z/OS/OS-390z/OS
- **Languages** - zOS Cobol, DT Cobol, Natural, PL/I, ADS, ADS/O, Assembler
- **Databases** - DB2®®, Adabas, IMS/DB, IDMS, Relational, Datacom
- **Transaction Monitor** - CICS®, IMS/DC
- **Mapping Types** - BMS, MFS, NLM, ADS Map
- **Batch Components** - JCL, Proc, Cntrl
- **File types** - ISAM

About This Guide

The objective is to provide the information that is needed to use **IBM AD Build Client**, and to understand the capabilities.

Note: For instructions on how to install IBM AD Build Client, see *IBM AD Installation and Configuration Guide*.

A description of the following sequence of steps and procedures that are typically followed to set up and analyze a system, are described as follows.

1. Setup
   - Create a project.
   - Add files to the project.
   - Update project resources.
2. Analysis
   - Collect information on an application (called a ‘Build’) and store the results in the repository.
   - Make and integrate the current version of a project resource into the built project.
   - Search in project for a specific project resource.

Terms And Conventions

The following terms and conventions are used:

- **Commands** are printed as shown.
- Chapter references are indicated as shown. For page numbers, refer to the Table of Contents.
- `File references` are printed as shown.
- **Button names** and options/functions within a dialog box are printed as shown.

Chapter 3. Installation

IBM AD Connect for Mainframe is a vital component of IBM AD Build Client. This component brings data from the mainframe system. For details on how to install this component, see *IBM AD Connect for Mainframe Configuration Guide*.

IBM AD Build Client uses a relational database as a repository for storing data. If you want to view this data, you need the relational database. The tables and fields in the repository are described in detail in *IBM Application Discovery for IBM Z Repository* document.

Note: The `IBM Application Discovery for IBM Z Repository` document is provided upon request by IBM Support.

Chapter 4. IBM AD Build Client

Following is an overview of the use of **IBM AD Build Client**. It introduces the concepts and capabilities of the product and describes the typical sequence of tasks to be followed for setting up a project and undertaking the analysis. Since the objective is to provide a general picture of the use of **IBM AD Build Client**, not all the capabilities, alternatives, and options available at each stage are described exhaustively. A detailed reference for all aspects of **IBM AD Build Client** is presented in Chapter 5, "IBM AD Build Client Reference," on page 39.

Projects, Folders & Files

Organizational entities for working with **IBM AD Build Client** include projects, folders, and source files. A project corresponds to an application.

A project contains a number of folders, where each folder refers to a specific type of source file that is used by the application. The default folders for a project are determined by the project definition at creation time. For example, a Cobol project has by default folders for COBOL, Copy, BMS, JCL, and Configuration source files. A Natural project has by default folders for Natural programs, Natural Include, Natural Maps and Data Area. Each folder contains a list of the files of the corresponding type that are used by the original application. These files are also used by **IBM AD Build Client**.

Although for each **IBM AD Build Client** project folder a physical folder is created automatically under the project folder on the disk, any file can be added through **IBM AD Build Client** to the project folder without having to physically copy it to the corresponding folder on the disk. The physical folders are created only at the default location where **IBM AD Build Client** looks for files when you add files to the project folders. Files in an **IBM AD Build Client** project folder are references to the original source files somewhere on the disk or on a remote network drive and not physical copies of them.

Note: Starting with the *5.0.4* release, additional folders of specific type can be manually added to a project, if the **Extensibility** feature(s) have been enabled.

Tasks

Working with IBM AD Build Client usually includes the following tasks:

Task	Explanation
1. Starting **IBM AD Build Client**	
2. Starting **IBM AD Build Configuration**	Define the database connection parameters (if applicable).
3. Create Project	Create a project by specifying the project name, project type (single or multi-app), location, environment, languages, DB type, and Map type and the relational database server name.
4. Project Settings	Adjust the project settings.
5. Project Files	Add files to the project.
6. (Re)build	Build the project.

Tasks 2, 3, 4 and 5 are set up and organizational steps. Their purpose is to define the source material to be analyzed. Step 6 (Build) creates and populates the repository, which is the basis for the Analysis step in **IBM AD Analyze**.

The following sections describe the typical tasks that are run in **IBM AD Build Client**. In many cases, you have alternative ways for activating the same **IBM AD Build Client** functions (main menu, menus, keyboard shortcuts, and the main screen toolbar). In **Tasks**, references are mostly made to the main menu commands. The alternatives are described in Chapter 5, "IBM AD Build Client Reference," on page 39.

Starting IBM AD Build Client

When **IBM AD Build Client** is started, the main screen appears. All activity takes place within this screen. It is empty until a new project is created or an existing one loaded.

Creating a Project

About this task

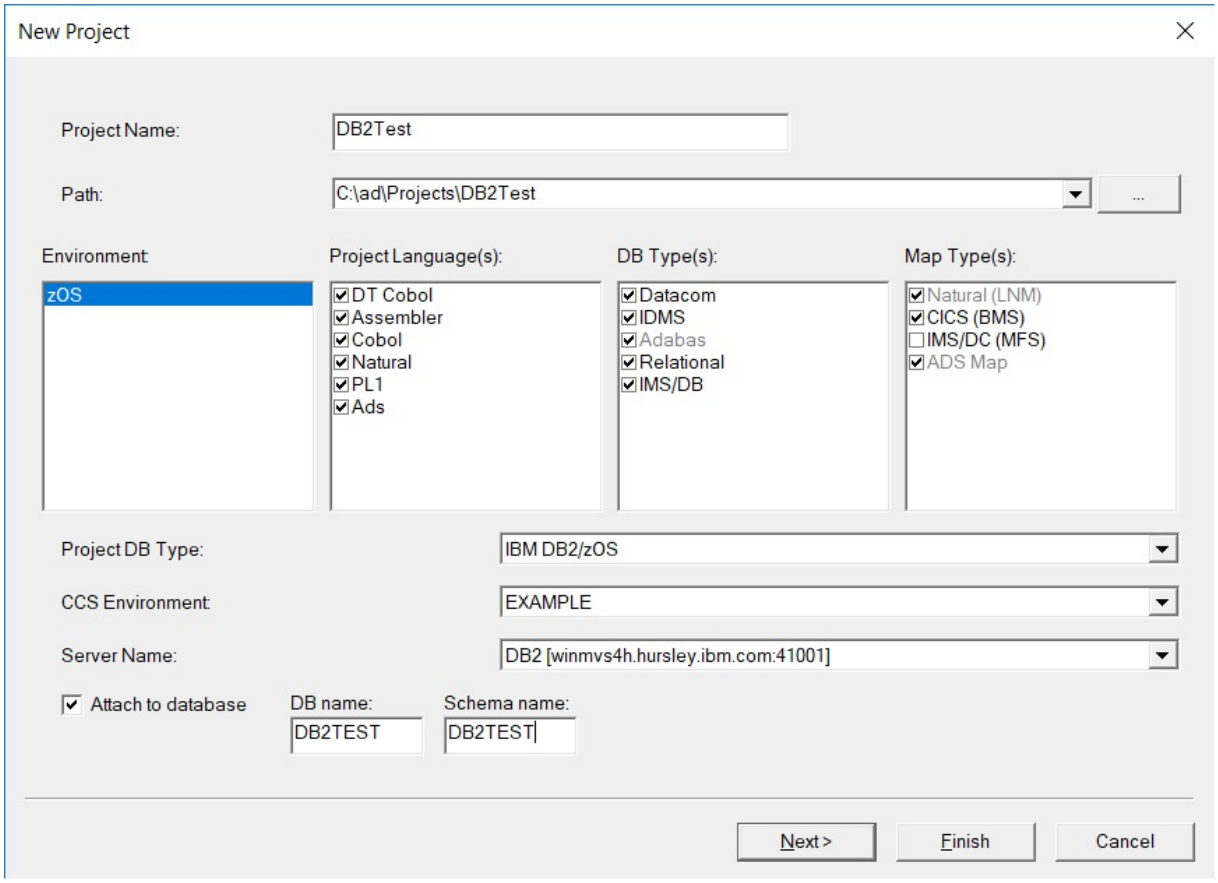
IBM AD Build projects correspond to independent applications. An **IBM AD Build** project can contain references to all application source files or to part of them. The source files are organized into folders that are category lists for the different kinds of files that make up the project/application. For example, program (such as COBOL) source, copy, and BMS files are listed in the project's Program, Copy, and BMS folders. Standard folders are defined and included in the project by default. However, you can define new folders if necessary.

Creating an **IBM AD Build** project creates a project folder on the computer or on a network drive. You can specify the location for this folder.

To create a new project, follow these steps.

Procedure

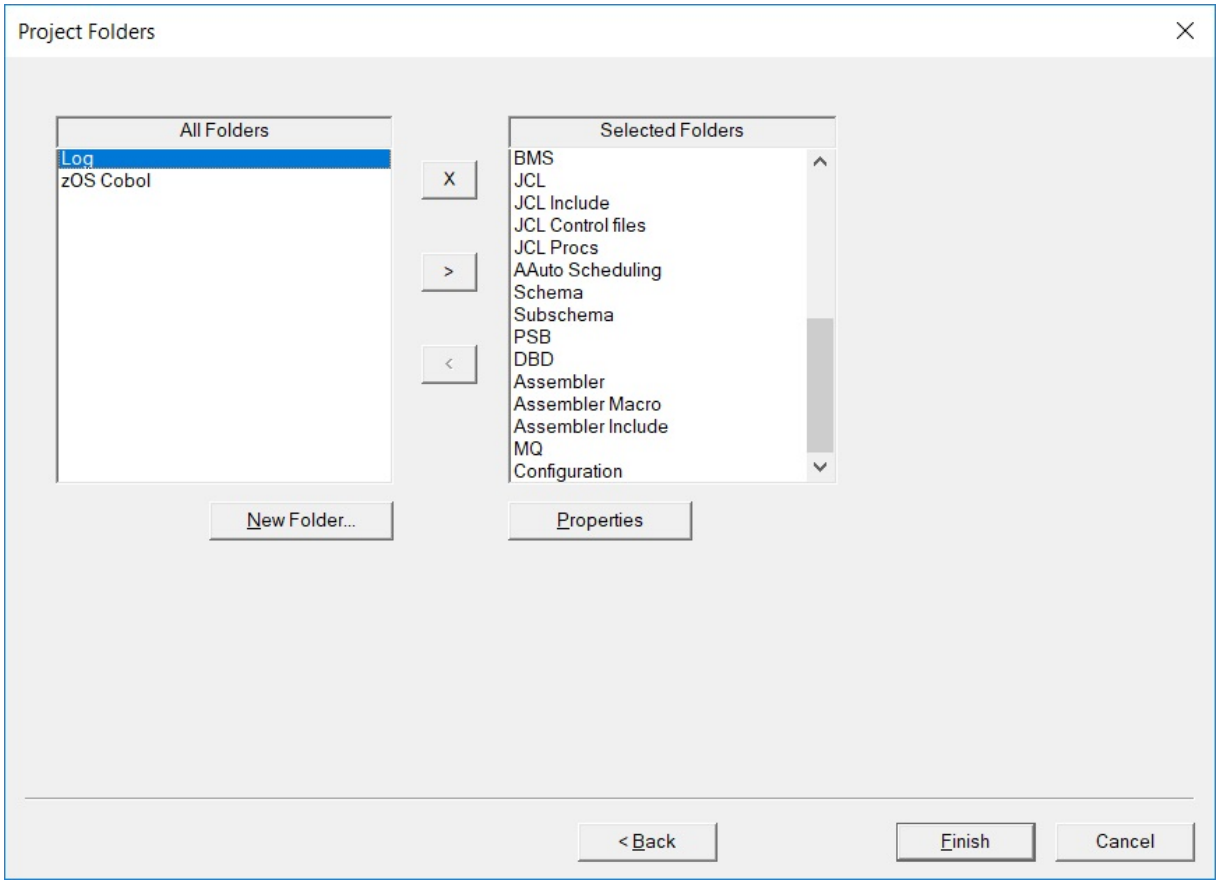
1. Select **File** > **New** > **New Project**. The **New Project** window appears.



Note: The options available in the **New Project** window depend on the version of the purchased application.

2. Enter the name of the new project in the **Project Name** text box.
3. The **Path** field displays the default projects path. To select a different path, click **Browse** and select an alternative location.
4. The Environment, Project Languages, DB Types, and Map Types sections present the default options.
5. From the **Project DB Type** list, select one of the following database types:
   - Microsoft SQL Server
   - IBM Db2® for z/OS

   Note: A new Db2 database and schema can be created by using `DB2_CreateObjects.sql` DDL script. The database can be attached by using **Attach to database** option where the database name and schema need to be introduced manually. For more information, see "Creating Db2 Database Using DDL Script" on page 36.
6. **CCS Environment** field: if in **IBM AD Configuration Server** only one environment was defined, this field displays the name of that environment. If several environments were defined in **IBM AD Configuration Server**, click the arrow button to display a list of available environments and select one. For details on environments, see `IBM AD Configuration Server User Guide`.
7. **Server Name** field: this field displays the name of the relational database server that was associated to the selected environment in **IBM AD Configuration Server**.
8. Click **Next**. The **Project Folders** dialog box appears for selecting and defining project folders. This screen presents different folder names, depending on the environment selected.



9. To accept the default folders without entering the **Project Folders** screen at all, click **Finish** instead of **Next**.
10. Select folders by moving them from the **All Folders** to the **Selected Folder** lists, by using **>**, or clear them using **<**. Default **All Folders** and **Selected Folder** lists are provided. The content of these lists

depends on the project type that is selected in the previous step. For an existing project, you can select **Project** > **New Folder** to open a dialog box for adding more folders.

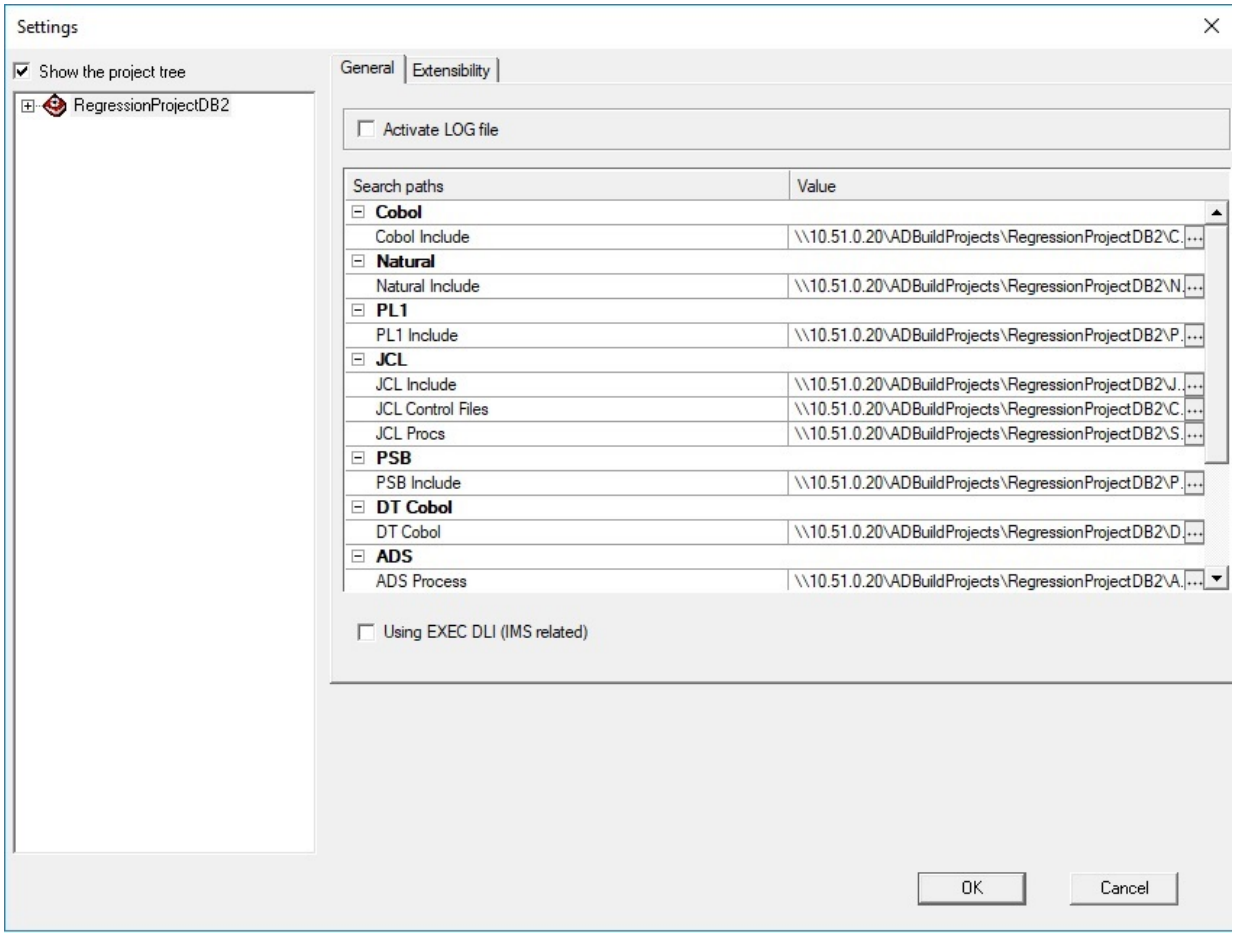
11. Click **Finish**. The new project is created and displayed as a tree in the **Project** pane (left side of the window).
12. Additionally, after a project is created, the **Business Rules Discovery (BRD)** feature can be enabled. For more information, see Enabling Business Rules Discovery in *IBM AD Configuration Server User Guide*.

Adjusting Settings

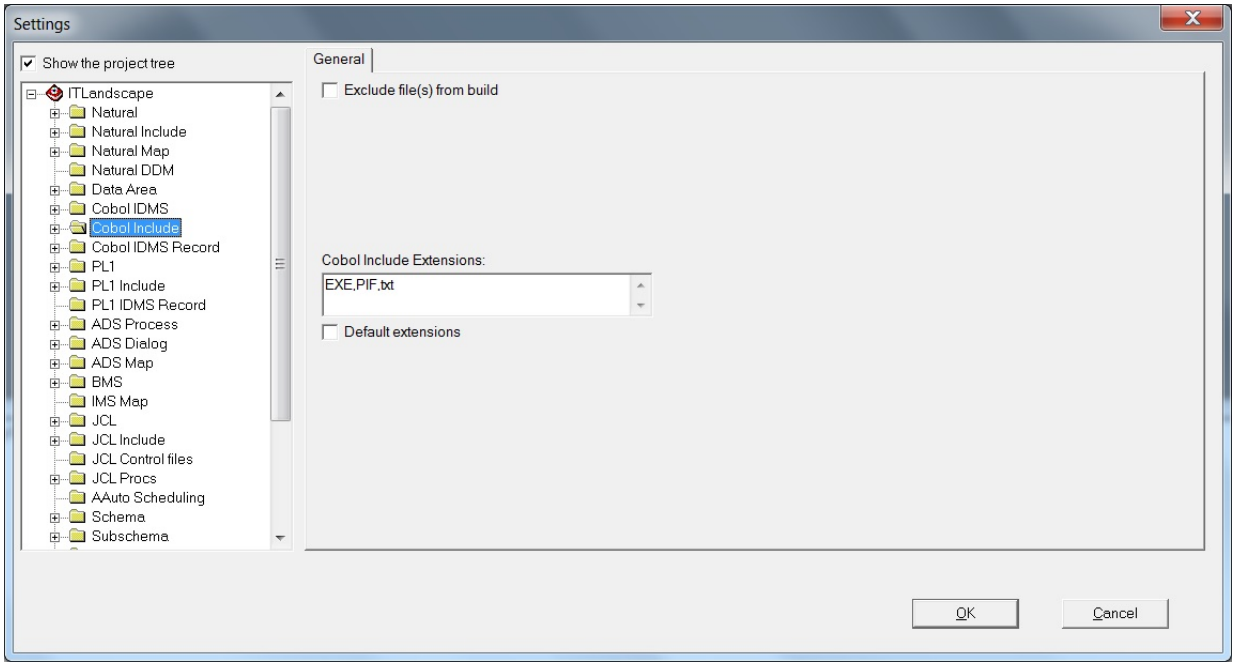
From the **Settings** window, the following actions can be performed.

1. From the **Search Paths Order** window, modify the default search paths, add several search paths for a resource type, and set the order in which these paths are accessed.

   When resources such as COBOL, Natural, PL/I are built in **IBM AD Build Client**, the corresponding `include/copybook`, `control`, `proc`, and `macro` files are searched, according to the default extensions in the default project folders.



2. Generate a log file under each project folder during the build process. This procedure takes up more disk space but allows a detailed inspection of the build process if an error occurs. Keep this option cleared. If you are requested to activate it, a password is supplied by the IBM AD support team.
3. Determine whether a file or all the files from a project folder is included or not in the analysis (Build). For the Include folders (`Natural Include`, `Cobol Include`, `Assembler Include`), use **Settings** to override the default extensions for these files. More parameters are available for each resource type.



4. Set up an **IMS DB Environment** for COBOL programs that use **EXEC DLI** commands and **DL/I** calls.

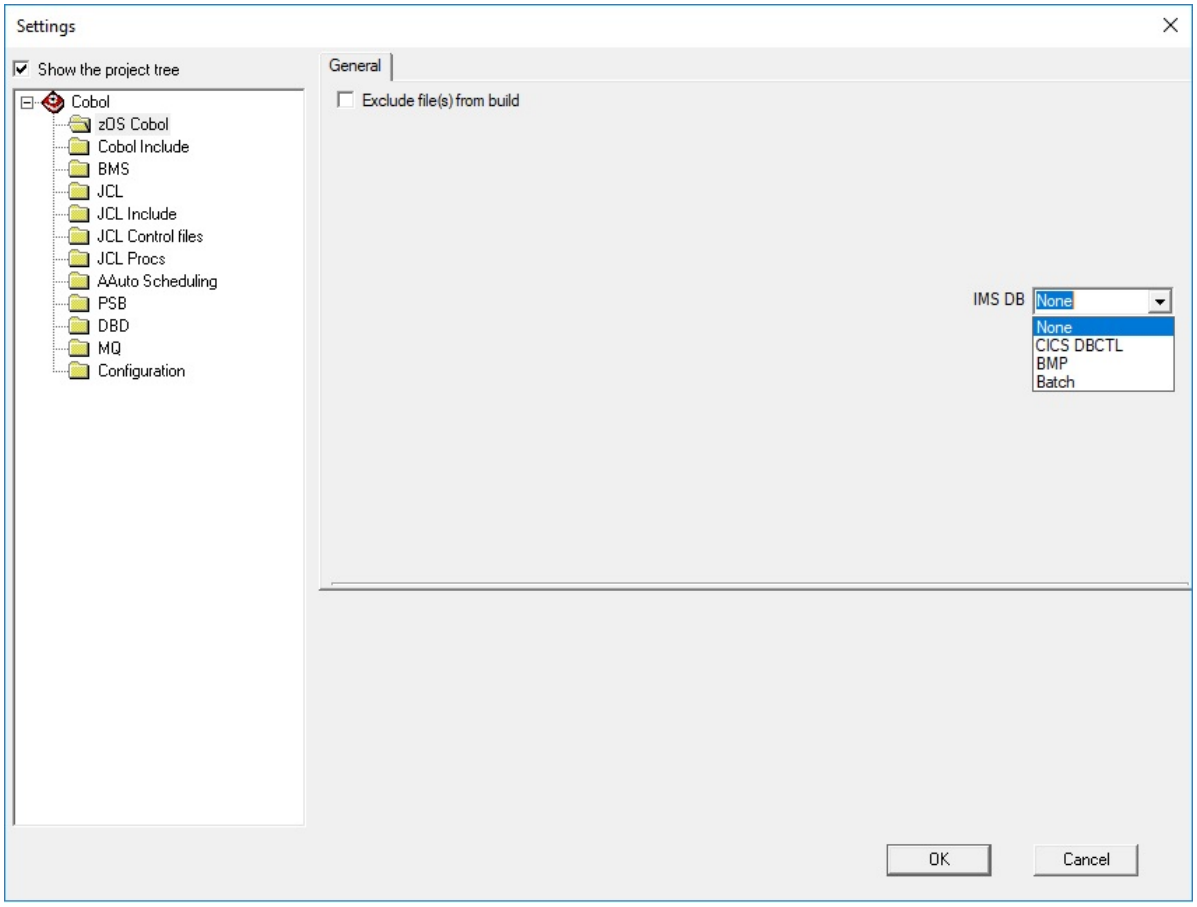
   A corresponding **IMS DB Environment** needs to be set up for the programs that access IMS databases and/or IMS transactions.

   IBM AD Build Client analyzes COBOL programs that use **EXEC DLI** commands and **DL/I** calls. All programs that access IMS databases and/or IMS transactions need to have a corresponding **PSB**, therefore an appropriate environment needs to be set up at the folder's project level.

   To set up an **IMS DB Environment**, follow these steps:

   a. Select **Show the project tree** check box and expand the project tree.

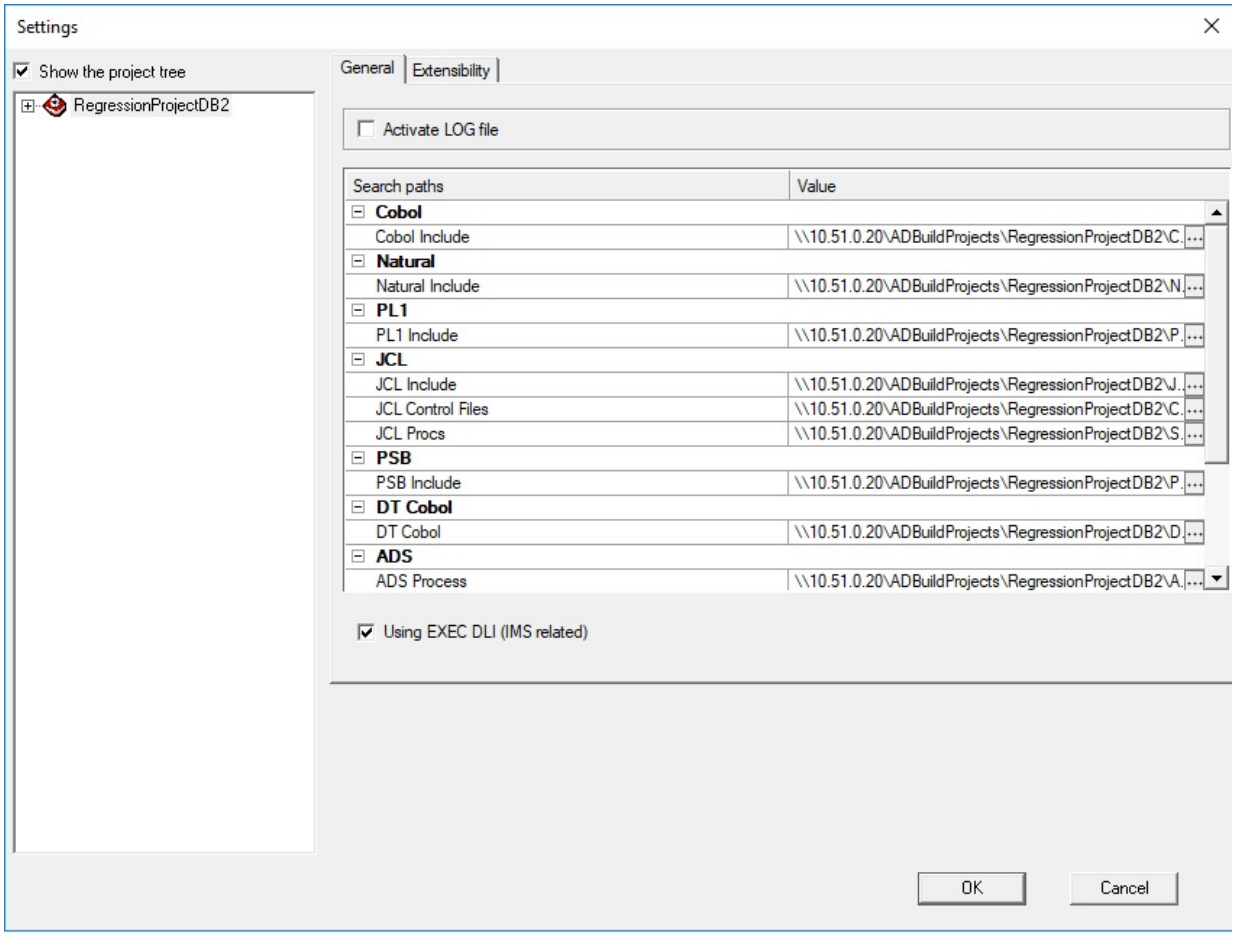
   b. Select **zOS Cobol** folder and choose the appropriate **IMS DB Environment** as in the following image.



Note: The **None** option is selected by default.

For more information about the difference between the environments, go to the PCBs and PSB topic in the IBM IMS documentation.

5. Select the **Using EXEC DLI (IMS related)** check box to analyze COBOL programs with **EXEC DLI** commands that are present in the project.



When **Using EXEC DLI (IMS related)** check box is selected, two builds are triggered, increasing the build operation time.

The second build is triggered when program *"A"* calls subprogram *"B"*, where *"A"* is the main COBOL program that has a corresponding PSB, and *"B"* is the subprogram that contains the **EXEC DLI** commands.

Note: As a result, a message is shown in the output window, informing that **Building programs related to IMS EXEC DLI in subprograms**.

During the first build, a `IMSExecDliInSubprograms.txt` file is generated automatically and has the following format:

```
<called program name "B">, <parameter number 1>, <OffsetStart1>, <OffsetLength1>,
<LinkageSectionVariable1>, <PCBNumber>
```

The generated file is used to resolve the parameters that are parsed from the main COBOL program *"A"* to the subprogram *"B"*.

Examples of the generated `IMSExecDliInSubprograms.txt` file:

- When a program name is called together with the parameters and their positions, where -1 represents the PCB number

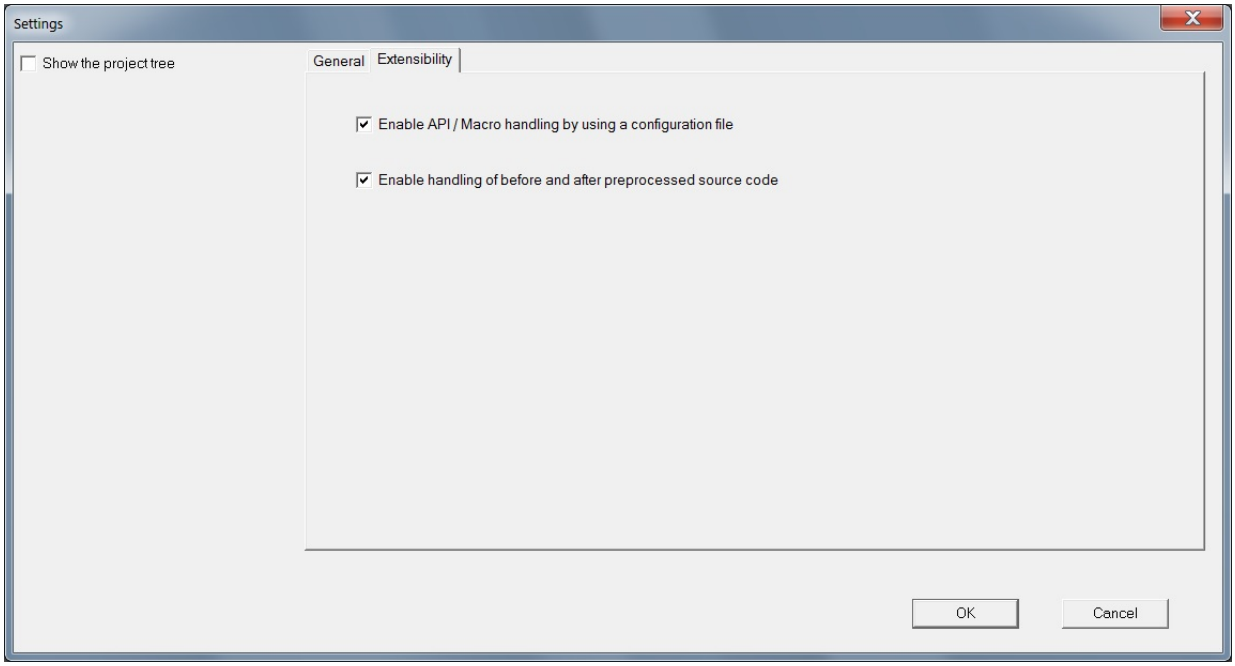
  ```
  B,4,1,2,VAR1-PCB-NUM,-1
  ```

- When a program name is called together with the PCB number, where -1 represents the parameters and their positions

  ```
  B,-1,-1,-1,,11
  ```

6. Enable the **Extensibility** features:

- **Enable API/Macro handling by using a configuration file.**
- **Enable handling of before and after preprocessed source code**.



For more information, see “Using the Settings Option” on page 49.

Adding Files to Project Folders

After you create the project and its folders, the files to be analyzed must be added to the appropriate project folders. Following are the project folders and the sources that can be placed in each one of them.

Note: Project folders depend on the type of selected project at project creation time. Therefore, for some projects, some of the following folders are not available.

The project folders that are created, differ according to the environment selected as shown in the following table:

Environment	Folders- Description
z/OS	• AAuto Scheduling - A-AUTO Dataset Flag Report. • AAuto Scheduling - A-AUTO Scheduling programs. • ADS Dialog - N/A. • ADS Map - N/A. • ADS Process - ADS Process files. • API Config - Files containing configurations for the API calls. • Assembler - Assembler files. • Assembler Include - "Assembler include" files. • Assembler Macro - Assembler macros. • BMS - BMS assembler definitions (relevant only for CICS® projects). • Cobol IDMS - Cobol IDMS files. • Cobol IDMS Record - Cobol IDMS Record files. • Cobol Include - COBOL copybooks and include files. • Configuration - CSD files.

Environment	Folders- Description
	• Configuration - IMS/T PGM • Configuration - PGM Aliases. • Control-M - XML files (exported from Control-M Enterprise Manager) containing jobs and conditions. • Data area - Natural data area that includes Local Data Area, Parameter Data Area, and Global Data Area. • DBD - IMS DBD files. • DT Cobol - Data Type Cobol files. • DT Cobol pre-compiled - Pre-compiled data type Cobol files. • IMS MAP - MFS files (relevant for IMS projects only). • JCL - JCL Jobstream files. • JCL Control files - JCL Control files. • JCL Include - JCL Include files. • JCL Procs - JCL procedure files. • MQ - MQ configuration files. • Natural - Natural programs • Natural DDM - Natural DDM files. • Natural Include - Natural include files. • Natural Map - Natural map definitions. • PL1 - PL/I programs. • PL1 IDMS Record - PL/I IDMS record files. • PL1 Include - PL/I copybooks and include files. • PreProc Before - User's original sources. • PreProc Config - Files containing mappings between the folders of the before, meta and after files. • PreProc MetaData - Files that map the before files with after files. • PSB - IMS PSB files. • Schema - IDMS schema • Subschema - IDMS Sub-schema. • z/OS Cobol - Simple Cobol files.

Some environment files are not added directly to one of the project folders. Instead, they are put under the project directory on the hard disk. The project directory is the location where the project was created, specified in the path field at project creation time. Following is a list of these environment files.

Files under the project directory on the hard disk

Control files

These files can be placed by default into the CTRL directory that is automatically created under the project directory. Control files must not have any extension in order for **IBM AD Build Client** to locate them. In case you have several control files with the same name that are taken from different libraries and used by the JCL files according to the search order, create a directory under the project directory for each library. For example, if two control files with the same name that are taken from two libraries LIB1.MYCTRL and LIB2.MYCTRL, create two directories that are named LIB1.MYCTRL and LIB2.MYCTRL under the default CTRL directory and place each procedure in the corresponding directory. The **IBM AD Build Client** JCL compiler searches for the right folder according to the search order specified in the JCL.

Note: This procedure is needed only if you have two control files with the same name, in which case they cannot be both put in the default directory CTRL.

The Control files (or the PARM files) are the source members referenced in DD cards in the format of DSN=MY.PDS.NAME(CTRLMMBR). These Control files may contain SORT parameters, or SYSIN data, or Db2 command (if in SYSTSIN card for Db2 invocation programs), all depending on the step they are used in and the DD card name.

The JCL include files are files that are included in the JCL source using the INCLUDE command, e.g.//LABEL001 INCLUDE MEMBER=INCFILE1INCFILE1 is the JCL include member. Usually these will have list of DD cards commonly used together in many JCL sources, and put into one shared file to simplify maintenance in case you want to add/remove/change a DD card. They can also contain full steps.

Procedure files (also known as PROCS)

These files, which are referenced from JCL files, can be placed by default into the SYS1.PROCLIB directory that is automatically created under the project directory. Procedure files must not have any extension in order for **IBM AD Build Client** to locate them. In case you have several procedure files with the same name that come from different libraries and used by the JCL files according to the search order, create a directory under the project directory for each library. For example, if two procedure files with the same name that are taken from two libraries LIB1.MYPROC and LIB2.MYPROC, create two directories that are named LIB1.MYPROC and LIB2.MYPROC under the project directory and place each procedure file in the corresponding directory. The **IBM AD Build Client** JCL compiler searches for the right folder according to the search order specified in the JCL.

Note: This procedure is needed only if you have two procedure files or include files with the same name, in which case they cannot be both put in the default directory SYS1.PROCLIB.

PSB files

These files, used only by the **IMS** application, must be placed in a directory that is named PSB under the project directory. This directory is not created automatically and therefore must be created if needed.

The AAuto scheduling folder

This folder can host two types of files: AAuto scheduling files and AAuto Dataset Flag report files.

Before you run the build process, make sure to set the correct type for the AAuto Dataset Flag report file: In the Project pane, right-click on the Dataset flag report file that is loaded in the AAuto Scheduling folder of the project and select **Properties**. In the **File Properties** window, verify that the **Type** is set to **AAuto Dataset Flag Report**. (the file type verification can be done either when the file is loaded in the project or at a later moment, but before the build step is run).

The CICS CSD configuration file

A CICS administrator can use the **LIST** command of CICS utility DFHCSDUP to extract CSD information into a report. The report can be stored under the Configuration virtual folder and can be added to a build project as a CSD type of file. The build process parses the CSD configuration file and stores the information into the MFCICS tables.

The name of the CSD configuration file must have maximum eight characters, because the file name is used as the CICS region name. For more information, see chapter "CICS CSD Information Handling" on page 27.

The IMS transaction mapping file

This configuration file is used to map between IMS transactions and programs. The file must be placed under the Configuration virtual folder in the project. The type of the file must be IMS/T PGM. See the following example of mapping configurations in an IMS transaction mapping file:

```
TRANSACTION(TRAN1) PROGRAM(PROG1) IMS-TM
TRANSACTION(TRAN2) PROGRAM(PROG2) IMS-TM
```

The Pgm_Aliases file

This configuration file for aliases is used to specify external alias names coming from outside the source files. The file will be added in the `Configuration` virtual folder, in the project, with type *PGM Aliases*. The configuration file for aliases is a comma separated file, having the following format:

```
* - a commented line starts with '*'
<optional disambiguation file path>, <procedure/program name defined in file>, <alias name 2>,
<alias name 3>
```

In case the alias name is not configured with a file path, the file format is as following:

```
<program/procedure defined in file>, <alias name 1>, <alias name 2>
* procedure name in case of PLI/I file
```

PGM Aliases (Configuration) Files Example:

```
* this is a commented line
\\shared-resoures-dir\Projects\Pgm_Alias_002\PL1\PLI1, PLI1, PLI01, PLI001
\\shared-resoures-dir\Projects\Pgm_Alias_002\PL1\PLI1_1, PLI01, PLI_1, PLI_01, PLI1
PLI2, PLI002, PLI0002
PLI3, PLI03
```

Note:

- These program aliases, **<program/procedure defined in file>**, **<alias name 2>**, **<alias name 3>**, can be declared in any order, provided **<program/procedure defined in file>** exists among the aliases names. Example: if only **<alias name 2>**, **<alias name 3>** are present and **<alias name 3>** is called, while **<alias name 2>** is not found as a program/procedure definition in any source file, then **<alias name 3>** will not be replaced with **<alias 2>** in the call.
- The first item **<optional disambiguation file path>** which is the fully-qualified-name of the file, is optional and only needed when the same alias name refers to actually different programs: in the example above, the same program alias name **PLI01** refers to two different programs, defined in two different files. If only one fully-qualified-file-names of the two will be present or the two lines meant to be told apart have no alias name in common, the fully qualified file name would not make any difference.
- If disambiguation between two alias groups is needed, the fully-qualified-file-name of a PL/I file must be added in the 1st position, as it shows in **Project** > **Properties**. Example: if the file was added with a network path, the same syntax must be used into the `PGM Aliases` file.
- After adding new alias name(s) into the `PGM Aliases` configuration file, it is recommended to (re)compile both the configuration and the PL/I files, where **<procedure/program name defined in file>** exists, in this order. Example: **configuration file** > **PL/I file**.

  Note: When (re)building the entire project, the configuration file is build first by default.

Important: Currently, the **external alias names** feature is only available for PL/I programs.

The PgmModuleMap file

This file is used to map between load module and the first program that is called in the module (relevant only for batch applications). By default, **IBM AD Build Client** assumes the module name and the name of first program that is called are identical. In case they are not identical, a mapping must be described in the `PgmModuleMap.txt` file, which must be placed under the project directory. Following is an example of the file content:

```
OKC82     OKC8201
OKC75     OKC7501
OJC07     OJC0701
```

On the left side, the module name is specified and on the right side, the first program name is specified.

The PSBmap file

This file is used to link the program and the PSB file names (the format contains: PgmName, PgmType, PSBFileName).

If CBLTDLI and PLITDLI (IMS related) are used, **IBM AD Build Client** assumes the program name and the name of the PSB file are identical. In case they are not identical, a PSBmap.txt file needs to be created and configured to describe the mapping between the program name and the name of the PSB file.

If EXEC DLI (IMS related) is used, **IBM AD Build Client** assumes the program includes the schedule command EXEC DLI SCHD PSB. In case that the EXEC DLI SCHD PSB command is not present in the program, a PSBmap.txt file needs to be created and configured to describe the mapping between the program name and the name of the PSB file.

Important: The PSBmap.txt file needs to be placed in the root of the project's directory, to <Project Path>\<ProjectName>\ folder. The ProjectName folder was created when the project was initially defined in **IBM AD Build Client**. It is located, by default, directly under the **Default project path** filled in **IBM AD Configuration Server** > **Install Configurations** > **IBM AD Discovery Build Client**.

Following is an example of the file content:

```
EDADL3M,Cobol,EDADL3P
EDADM2M,Cobol,EDADM2P
EDADM4M,PL1,EDADM4P
EDADN2M,PL1,EDADN2P
```

On the left side, the program name is specified, in the middle the program type (Cobol or PL1) is specified, and on the right side, the PSB file name is specified. For Cobol programs, in case the PROGRAM-ID and the file name are not identical, PROGRAM-ID name is used to map (link) the Cobol program with the PSB file name.

To add files to a folder, follow these steps:

1. In the **Project** tab, click the folder name, and then select **Project** > **Add Files**. Alternatively, right-click the folder name and choose **Add Files**. A file selection window opens.
2. Locate the files (they can be on any drive and directory) and select them individually or in groups (by using the Windows **SHIFT** key or **CTRL** key mechanism).
3. Click **OK** to add the selected files to the project. The names of the files appear in the expanded file structure in the project tree.
4. Repeat the Add Files procedure to add all necessary files to each of the project folders.
5. If you need to add a long list of files, you can use the option **Add All Files from Folder**. Selecting this option presents you with the following window:

Note: Make sure that the folder path is correct; click **OK** to add all the files from that folder to the corresponding project folder.

6. To save the programs, files, and projects in their current states, select **File** / **Save All**.

Note: It is possible that the process of adding files can take a long time during which you cannot use the application. If you need to use the application, you can run the **Add files** process in the background. To make the **Add files** operation to run in the background, follow these steps:

a. Click **Start**, select **Run** then type **cmd** to open the command window.

b. Go to the folder where your **IBM AD Build Client** is installed and locate the `IBMApplicationDiscoveryBuildClient.exe` file. Drag the `IBMApplicationDiscoveryBuildClient.exe` file into the command window then enter "**/?**" and press **ENTER**. A window is displayed containing detailed instructions about how to make a specific process to run in the background.

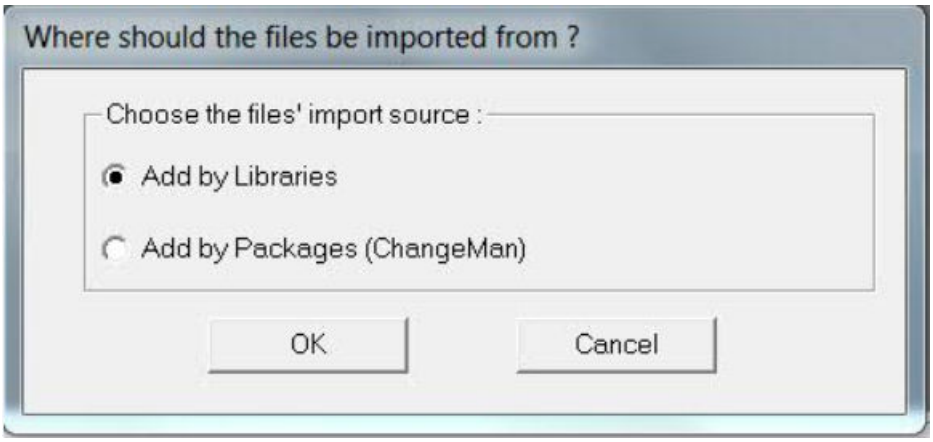
Adding Files From Mainframe Library

About this task

To add files from the mainframe library to your project, some preliminary steps need to be taken in the **IBM AD Build Configuration**. See "The zOS Tab" on page 74 for more details.

Procedure

1. In your **Project** tab select the folder where you want to import files from the mainframe library then right-click to display the menu and from it select **Add Files from Mainframe** to display the following window.



2. A list of imported libraries is displayed. Select the libraries from which you want to import resources then click **Next**: the **Member Files from Mainframe Selected Libraries** window is displayed.

   Note: Only libraries that contain at least one member are displayed.
3. A list of members that are identified within the imported libraries is displayed. For each resource the following data is displayed:
   - The type of the resource (Assembler Macro CICS map BMS, Cobol Program).
   - The source (z/OS).
   - The name of the library where it was found.
4. Select the files that you want to add to your project and click **Finish**. The selected files are added in the current folder of your project: Their respective names indicate their source – z/OS, and the name of the library from where they are imported and their original name.

Adding Files From ChangeMan ZMF Packages

About this task

To add files from the mainframe by using **ChangeMan ZMF Packages**, some preliminary steps need to be taken in the **IBM AD Build Configuration**. For more information, see "The zOS Tab" on page 74 and "Configuring the z/OS Connection" on page 56.

Procedure

1. In your **Project** tab, select the folder where you want to import files from the mainframe then right-click to display the menu and from it select **Add Files from Mainframe** to display the following window.

2. Select **Add by Packages (ChangeMan)** then click **OK** to display the **Add Files from Mainframe Libraries** window. A list of imported packages is displayed.

   Note: Only libraries that contain at least one member are displayed.
3. Select the package from which you want to import resources then click **Next**: the **Member Files from Mainframe Selected Libraries** is displayed. A list of members that are identified within the imported package is displayed. For each resource, the following data is displayed.
   - The method that is used for import (SRC - ChangeMan).
   - The source (z/OS).
   - The name of the package where it was found.
4. Select the files that you want to add to your project and click **Finish**. The selected files are added in the current folder of your project: Their respective names indicate their source – z/OS, and the name of the package from where they are imported and their original name.

Building Projects

About this task

A “build” is the process where IBM AD Build Client reads project sources, places the results in the project repository, and generates the data that is needed to display the graphical representation of the applications’ internal and external program relationships.

The build process can be ran on individual programs in the project, on a batch of selected files and folders or globally on all the resources in the project. Generally, you make a global build, but if, for example, a single source file is changed, a build on that file alone would be appropriate. In that case, only the modified program is analyzed and the project repository is updated accordingly.

Procedure

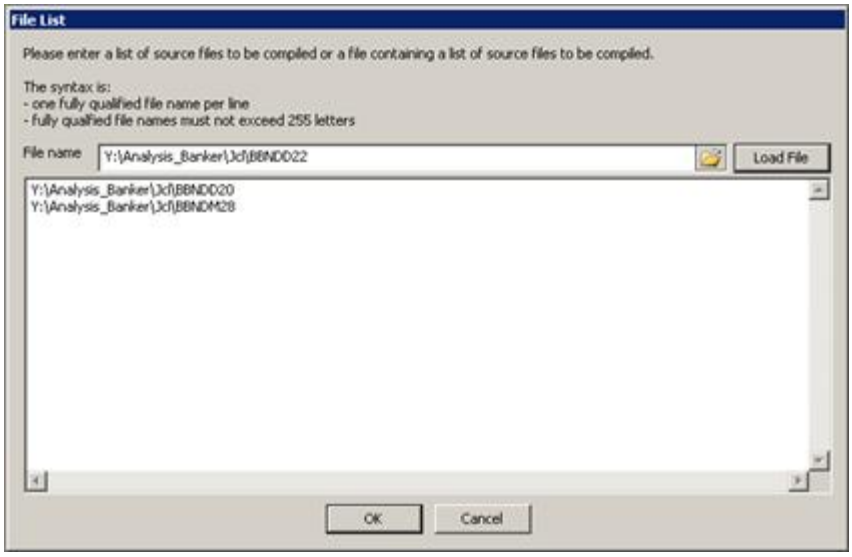
1. To build a project, follow the steps bellow.
   a) **Select Build / Build Project** to start the build process. A warning message alerts you to the fact that this operation erases the database. Click **Yes** to start the build process.
   b) As each file is processed, its name and accompanying notes and messages, including error notifications, are displayed in the **Message** pane
   c) On completion of the build, you can double-click any of these messages to open the corresponding source file at the appropriate line.
2. To build a single program or a folder, follow these steps:
   a) In the **Project** pane, expand the project tree so that the required source program or folder is visible. Click the program icon or the folder to select it then right-click and select **Build**.

b) The **IBM AD Build Client** Message window displays the file name and log messages that are created during the build process. Information about the file and its internal relationships is created and placed into the repository.

3. To build a batch of selected files, follow these steps:

   a) 1. In the **Project** pane, expand the project tree so that the required source programs and folders are visible. Click the programs and folders that you want to include in the build process then right-click and from the menu, select **Build**.

   b) 2. Alternatively, for large batches of files you can create a `*.txt` file that contains the list of resource files that you want to build and then use the **Build Imposed Selection** option from the project node menu to load that file.



   c) Browse to the location of the `*.txt` file then click **Load** to load its contents. The `*.txt` file must contain the FULL PATH to each resource file on a separate line. Extra syntax indications for the `*.txt` file are also available. After the file is loaded, the resource files list is displayed. Click **OK** to start the build process. The **Messages** window displays the file names and log messages that are created during the build process. Information about the files and their relationships is created and placed into the repository.

4. To update the project after several sources are changed:

   a) When several sources are changed, the easiest way to update the project repository is to use the **Make** option. Run **Make** by selecting **Build / Make Project** or by pressing **F7**. **Make** works in the following way: for each source, **IBM AD Build Client** compares the last modified date with the date on the disk and decides whether an update is necessary for the source. This step is called verification.

   b) 2. A **Build** is ran only for the sources that are chosen in the verification step.

   c) 3. A summary of the updated sources is displayed in the **Message** pane.

5. To update files from mainframe library: to make sure that you have the current version of the resources that are brought to your project from mainframe use **Update Modified Mainframe Members** function from the project menu or select **Update Modified Mainframe Members** from **Build** menu.

6. To build only the updated resources – Make: to make a build exclusively with the modified resources use **Make** option. Click **Make** from the toolbar, alternatively you can select **Make** from **Build** menu.

   Note: If you start a **Build** on a project where other users logged in, a warning message appears indicating which users are connected to the project. You need to confirm the operation.

   If another user activates a Build while you are logged in to a project a warning message appears urging you to close the project and wait for a notification that is sent to all users when the build process is completed. During the Build process, the project is locked and cannot be accessed by any user. After the Build is successfully completed, a notification is sent to all users logged in to the project.

It is possible that the **Make** process might take a long time during which you cannot use the application. If you need to use the application, you can run the Make process in the background. To force the **Make** operation to run in the background, follow the steps:

a. Click **Start**, select **Run** then type **cmd** followed by **ENTER** to open the command window.

b. Go to the folder where your **IBM AD Build Client** is installed and locate `IBMApplicationDiscoveryBuildClient.exe` file. Drag the `IBMApplicationDiscoveryBuildClient.exe` file into the command window then enter **/?** and press **ENTER**. A window is displayed containing detailed instructions about how to make a specific process to run in the background. To make the **Add files** operation to run in the background, follow the displayed steps.

Updating Projects

About this task

You can update a project in two ways: manually or automatically. The process of manually updating a project is described as follows. For details on the automatic process, see "V. Setting up Automatic Updates with Windows Scheduler" on page 84. If you want to update the project manually, this procedure takes only two steps from the project menu only.

Procedure

1. Update Modified Mainframe Members.

   This action checks for all project members that originated from the mainframe, if a new version of their source is available.

   All sources that are brought from the mainframe have data about their mainframe origin and last update time, which is stored in the IBM AD repository for the project.

   For sources that were brought from Endevor, this action checks against Endevor if a new version for the file is available, since the last retrieval date. If a new version for the file is available, the member is brought to the mapped virtual folder that matches the Endevor library.

   For PDS members, **IBM AD Build Client** checks the file dates on the mainframe against the last update date from IBM AD repository. If the member on the mainframe is newer, it gets updated on the PC folder that matches the PDS name.

2. Make

   This action effectively updates the IBM AD repository with the information relevant to the modified sources, and keeps it up to date with the code in the sources on the mainframe.

   Make builds a small subset of the whole project, as an incremental build step after which the full project repository is up to date with the minimal effort needed.

   This action starts with checking all the project members on the PC disk folders against their last recorded update dates on the last build time that is stored in the IBM AD repository for the project.

   If a file on the disk is newer than the information recorded in the database, then the file is part of the **Project Make** process that is an incremental build. If the newly updated files are programs or jobs, then they are added to the list of components that must be added to the programs/Jobs to be built in the **Make** process.

   If the newly updated files are copybooks, then **IBM AD Build** checks in the repository for all programs that copy these files, and these programs are added to the programs to be built in the Make process.

   If the new updated files are JCL PROCs, or JCL Include Files, or JCL Control files (PARMLIB files) then **IBM AD Build** checks in the repository for all JCL Jobs that use these files, and these Jobs are added to the programs to be built in the **Make** process.

   After this stage, **IBM AD Build** runs a build for the programs and Jobs that must be updated according to the previous steps, and after these components are built a summary of the number of updated components appears on the **Make** log.

The Make log, just like any Build log, is saved to the disk under the project folder, with the **Make** date time. This method allows viewing past **Make** results and updated components at any time.

You do not need to do anything on **IBM AD Build Configuration** for this update of Endevor and PDS members.

For the CA7 manual update, the way to start the CA7 Data retrieval is by using the **IBM AD Build Configuration**, by using **Querry Environment** > **CA-7 Workload Automation** option.

Synchronize Mainframe Members

The **Synchronize Mainframe Members** feature allows the user to specify whether **IBM AD Build** must update against specific libraries, where to add/remove the related members in/from the project (that is, which virtual folder to use) and also which type of members **IBM AD Build** must use when you add members. The basic assumption is that the specified libraries do not contain members that do not need to be added even though they are there.

The **Synchronize Members** action is run by using a configuration file that specifies what members of what type to be brought into which mapped virtual folder of the project. When you run **Synchronize Members** on a project, only the members that belong to libraries specified in the configuration file for this particular project is synchronized.

The **Synchronize Members** feature is activated from **IBM AD Configuration Server**. For more information, see https://www.ibm.com/support/knowledgecenter/en/SSRR9Q_5.1.0/IBM_AD_Configuration_Server_User_Guide_OUT_KC/fillingthebuildclientconfigurationpage.html.

For details on the syntax of the configuration file and an example, see “Appendix 3 - Synchronize Members Configuration File Examples” on page 91.

After the members’ synchronization process is finished, use **Make** to ensure that the analyses you ran are done on the current version of the mainframe sources (updated, added, or removed).

ChangeMan – IBM AD Validation Process

This feature is relevant only for ChangeManIBM ZMF users and has as must have prerequisites: IBM AD Validation Server and IBM AD Connect for Mainframe.

To have this feature up and running, **IBM AD Validation Server** must be installed and configured. For more information, see STEP 4. (Optional) Configuring IBM AD Validation Service.

If only downloading or synchronizing the mainframe members from ChangeManIBM ZMF is needed, IBM AD Validation Server is not required. IBM AD Validation Server provides coding rule enforcement via synchronization with ChangeManIBM ZMF when a member is staged. Before a source file is staged, you can automatically validate the source code to a certain set of coding rules.

The validation process works as follows.

1. Compile a member in ChangeManIBM ZMF (Cobol Program, Assembler Program for example).
2. IBM AD Validation Service receives an indication that a certain program, part of a package within an application is compiled.
3. IBM AD Validation Service triggers IBM AD Build Client in background mode for the following actions: **Synchronize** and **Build** selection.
4. The **Synchronization** process is described as follows:

   A ChangeManIBM ZMF validation request after is processed by IBM AD Connect for Mainframe contains the program name to be validated and all it's include files. The requested line contains also the PDS library names and their corresponding members of the staged ChangeManIBM ZMF package. The required mainframe members are downloaded from the PDS libraries in batches and contain multiple validation requests.

   In the synchronization process, the `ProjectsMapping.txt` configuration file is used. However, the projects that are present in this configuration file must have a valid z/OS connection, with IP and port

numbers, which is attached and configured. These projects must be used exclusively for validation purposes.

5. The **Build Selection** process is described as follows:

   Build Selection process is optimized in the validation context, by allowing multiple instances of **IBM AD Build Client** to be launched in parallel so that the validation of large batch of files to be faster. The degree of parallelism is configurable in the `ParallelValidationParameters.txt` configuration file. The project names that are used exclusively in the validation context for **Build Selection** are needed to be written down in `ProjectsMappingParallelBuild.txt` configuration file. Based on the load and the two configuration files, several programs are build on a certain instance of **IBM AD Build Client**.

   To build the programs that are added to the project, the **include search paths** needs to contain the paths of the include files that are detected in the previous step.

   Remember:

   - On a certain **IBM AD Build Client** instance the programs are build sequentially, while **IBM AD Build Client** is launched in parallel on different projects.
   - Before the build starts, the project's repository is cleared so these projects cannot be used for analysis. Compiled data that is added in the repository is only needed to generate a validation report on the built programs.
   - The **Build Selection** projects do not have the requirements of the *Validation projects*, but it is required to have the virtual folders from `FoldersMapping.txt` configuration file, as the programs are added in the virtual folders based on their types.

6. After the build selection process finishes, IBM AD Validation Service starts to generate Rules Based reports for the program that was previously staged. IBM AD Validation Service is configured to have different weights for the rules, each rule that is infringed has a value that is defined by the user in the IBM AD Validation Service configuration.
7. Return of the max weight value to ChangeManIBM ZMF. After the report is generated and the maximum weight value is calculated, it is returned to the IBM AD Connect for Mainframe that further passes this information as follows:

   - To ChangeManIBM ZMF in user option 0401.
   - In the user's terminal as a message (where user is the one that initially staged the Cobol Program in ChangeManIBM ZMF). The messages sent to the terminal can be configured in IBM AD Validation Server in the `CompletionCodeVsMessage.txt` configuration file (Refer to *IBM AD Installation and Configuration Guide* for details). In the situation when there's a weight that is not configured in the previous configuration file, then the user sees in the terminal the message `error in flow` and IBM AD Validation Server logs must be investigated for further details.

   The enforcement part from the coding rule enforcement syntagm is developed by the ChangeManIBM ZMF admin. ChangeManIBM ZMF can be configured, based on the returned code, to prevent a package with programs that are violating the coding rules from being staged.

8. Default max weight values and return codes that are currently supported by IBM AD Validation process and IBM AD Connect for Mainframe when you send the information to ChangeManIBM ZMF:

   - 0 - converted to VPAS and sent to ChangeManIBM ZMF in user option 0401.
   - 4 - converted to VWRG and sent to ChangeManIBM ZMF in user option 0401.
   - 8 – converted to VFAL and sent to ChangeManIBM ZMF in user option 0401.

   Any other values (except 99) – converted to NA and sent to ChangeManIBM ZMF in user option 0401.

   Return Code 99 – converted to DISS and sent to ChangeManIBM ZMF in user option 0401. This code is a special return code that is sent only for the situation when something went wrong in the Validation Process flow (such as synchronize failed, build selection that failed, or the report cannot be generated).

Display Build Results

On completion of the build process, you can view the information that was collected and stored in the **IBM AD Build Client** project repository. Functions that can be accessed at this stage include viewing the application's source files. For more information, see "Viewing Source Programs" on page 45.

CICS CSD Information Handling

Online programs that run under CICS require access to external data sources, such as files, tables, and queues, cannot rely on jobs to perform the mapping to physical data source entities. CICS provides a way to define such mapping and saves the mapping information in the CICS System Definition (CSD) file.

To obtain CICS CSD information, the user can choose either of the following two methods:

- Using **IBM AD Connect for Mainframe**
- Using an exported CSD report

It is recommended to choose only one method to obtain CSD information in a project. For example, if the CSD information is obtained by using **IBM AD Connect for Mainframe**, and afterward the user decides to use an exported CSD report, the previous CSD information is automatically deleted. For more information, see "Deleting data from the repository" on page 28.

Using IBM AD Connect for Mainframe

When **IBM AD Connect for Mainframe** is used, the obtained CSD information is stored in the following MFCICS tables: MFCICSFile, MFCICSGroup, MFCICSGroupVsEntity, MFCICSGroupVsEntityLinks, MFCICSInfo, MFCICSInfoFiles, MFCICSList, MFCICSListVsGroup, MFCICSMap, MFCICSProgram, MFCICSTransaction, and MFCICSTransactionPerformance.

The information from the MFCICS tables, of the related database, is shown in graphs, reports, and usages in **IBM AD Analyze**.

Using an exported CSD report

When a CICS administrator wants to use an exported CSD report, a CICS utility, called DFHCSDUP, is used to extract information out of CSD. The result is a report that is generated by the **LIST** command of the DFHCSDUP utility.

The CICS administrator needs to carefully decide which parameters are used when the DFHCSDUP utility is invoked. The format is as follows:

```
         .-All--------------------.
>>-LIst--+------------------------+--+---------+--------------><
         +-Group--(--groupname--)-+  +-Objects-+
         '-LIst--(--listname--)---'  '-Sigsumm-'
```

In some cases, a CICS application uses a specific **LIST**. It is recommended to have a single application in a specific project and to use the appropriate list name when you run the utility. For example, **LIST LIST(listname)** is preferred instead of **LIST ALL OBJECTS**.

When the user specifies **LIST ALL**, the CSD report is parsed to save all the lists in the repository. In this case conflicts can occur. For more information, see "Conflict resolutions" on page 28.

The report is added to an AD project as a CSD type of file. The build process parses the file and stores the information in the MFCICS tables.

CSD report parser

The CSD report parser collects the following information:

- CICS region name.

  When an exported CSD report is used to obtain CSD information, the CICS region name represents the name of the report file. The region name is specified in the CICSName column of the MFCICSInfo table.
- The list of the CICS LIST components.

- The list of the CICS GROUP components and their relationship to the parent LIST.
- The list of the following CICS items:
  - Files
  - Map sets
  - Programs
  - Transactions

Important:

- If a group is not related to any list, it means that the group is not included in the group lists, specified by the CICS system initialization parameter **GRPLIST**, that CICS installs at cold start. This **Orphan Group** is excluded from the parsing and the resources contained by this group are not saved in the repository.
- The parser saves the first mapping relation encountered and ignores the others, when transaction is mapped to multiple programs.

After parsing the CSD report, the following information is used in **IBM AD Analyze**:

- The mapping between transaction and programs. The values are stored in the MFCICSTransaction table.

  Important: Only programs referred (that exists or are used) in the current **IBM AD Build Client** project are taken into account, in the mapping relation.

  The mapping is used/visible in analysis like:

  - **Program/Transaction Callgraph**
  - **Program Flow**
  - **Backward/Forward Call Chains** reports
  - **Explore project** as CICS Transaction, Resource Type
- The mapping between CICS files and their related dataset names, similar as dataset mapping in batch applications. The values are stored in the MFCICSFile table.

  Important: Only files used in existing programs in the current **IBM AD Build Client**project are taken into account, in the mapping relation.

  The mapping is used/visible in analysis like:

  - **Dataset Record Structure** report
  - **Dataset Usage in Programs**
  - **Explore project** as dataset, Resource Type

Deleting data from the repository

Deleting information from a previous region when querying a new one ensures the repository that has information from a single region each time. Whenever an exported CSD report or **IBM AD Connect for Mainframe** is used to import data all previous data from the repository is deleted. The user needs to consider that:

- All lists, inside the report, are considered for the name resolution.
- The region name is the CSD report file name.

Conflict resolutions

Multiple lists

There is the case when a transaction name is mapped to a program, in one list, and to another program, in another list. The CSD parser saves the information that is found in the first list and ignores the other mappings, from the other lists.

Multiple regions

In the context of an application analysis, do not store information from multiple regions in the same repository. The user is advised not to use more than one CSD report per project. It is not recommended to use the CSD report and retrieving operation information from **IBM AD Connect for Mainframe** in the same project. The **IBM AD Build Client** keeps the information from a single CICS region, based on the last **IBM AD Connect for Mainframe** action or CSD report parsing. The region is imported either by **IBM AD Connect for Mainframe** or by the CSD report.

Extensibility

Preprocessing Extensibility

In-house support preprocessors allow customers to view their familiar source code before preprocessing, while having **AD** parse the unfamiliar source code after preprocessing. Language preprocessors (also known as precompilers) are used to convert non-standard COBOL (for example) or non-COBOL code embedded in COBOL, into a form that the compiler can process. A non-integrated preprocessor takes as input a source file (defined as *before files*) reads and parses it then produces a modified source file (defined as *after files*) which is then passed as input to the COBOL compiler.

Note: The preprocessing extensibility feature allows IBM AD users that have their own COBOL preprocessor to see in the AD analysis the unprocessed sources.

IBM AD Build Client can analyze COBOL, PL/I and ASM applications that use preprocessors.

In order to access the **Preprocessing Extensibility** feature, there is an option on the interface after the project creation, named **Enable handling of before and after preprocessed source code** that will create the following required folders.

- New folder for *before files* named `PreProc Before`.
- New folder for *metadata* files named `PreProc MetaData`.
- New folder for *config* files named `PreProc Config`.

To enable the **Preprocessing** feature, **right click on folder tree** > **select Settings** > **click Extensibility tab**. For more details, see “Adjusting Settings” on page 12.

The folders are added as an option after the project is created, so those users not using preprocessing will not get confused.

Additional to the files above, *after files* must also be added. The *after files* will be added in the folder corresponding to their type (such as Cobol, PL/I, Assembler).

Before Files

These files represent the user's original resources.

Metadata Files

The metadata files map the *before files* with *after files*. These files must have the same name as the files to be compiled and the extension specified in the configuration file. The metadata file will have a `JSON` format. For details on the syntax of the JSON file and an example, please see “Preprocessing Extensibility Examples” on page 95.

The following elements from the JSON file, are explained below:

info
Contains information about the **json** format.

version
Version of the format.

metadata
An array that contains metadata elements for the before/after file pair.

pathType
Specifies whether the *before*, *after*, and *copybook* paths are set in mainframe format or local PC/network paths. Valid values for this attribute are *MF* (for mainframe path format) and *PC* (for local/network path format).

beforePath
Path to the original file, before the preprocessing process.

afterPath
Path to the expanded file, after the preprocessing process.

Tip: The **beforePath** and **afterPath** can be specified either in local/network path format or in mainframe format. For the mainframe format, only the PDS format is supported: *libray_name* (member_name). If the users use Changeman or Endevor to retrieve the sources, local network paths are required to be specified in the *beforePath* and *afterPath* values.

diffResolution
An array containing lines/columns mappings between the **beforePath** and **afterPath**, mapping established by the preprocessor.

beforePos
The corresponding position in the original file.

afterPos
The corresponding position in the expanded file. A position is defined with the following attributes:

- **startLine** - start line of the position.
- **endLine** - end line of the position.

If lines from a copybook exist in an after file, the following elements must be added in the corresponding metadata file:

type
Specifies if the lines in the after file are from a copybook. This element is required only when the lines in the after file are from a copybook; the only supported value is INCLUDE.

path
Specifies the path of the copybook that the lines come from. It can be specified in the local path or mainframe format.

includeStmtPos
Contains the following two elements that specify the include command position.

includeStmtPath
Specifies the path of the before file that includes the copybook.

includeStmtLine
Specifies the line number of the include command in the before file.

Note: The file will be added in the `PreProc MetaData` separate virtual folder under the project, so it can be updated from the mainframe if required. For more details about metadata files, see section Extensibility preprocessing JSON schema in appendix 3.

Metadata Files - Error Cases Behavior

The format and content validation will be performed at build start on the corresponding *after file*.

- If the JSON validation fails, the build on the file is stopped and the data in the database is cleared.
- If the *beforePath* or *afterPath* values in the JSON file do not exist on the disk, the build on the file is stopped and the data in the database is cleared.

Configuration Files

The configuration file will contain mappings between the folders of the *before*, *meta* and *after* files and the extensions for each type. When compiling a file from folder X, a search is initiated for a metadata file in the meta folder corresponding to folder X. The metadata file must have the same name as the file being compiled and the extension specified in the configuration file.

Important:

1. The file will be added in the `PreProc Config` separate virtual folder under the project, so it can be updated from the mainframe if required.
2. The paths in the configuration file must be specified in local/network format, not mainframe format.
3. Lines in the configuration file can be commented by adding ***** at line start.

For details on the syntax of the configuration file and examples, please see "Preprocessing Extensibility Examples" on page 95.

Configuration Files - Error Cases Behavior

- *Configuration file format related errors.*

  The configuration file format will be validated at build start:

  1. If the configuration file format is incorrect, the build will not be started nor will affect the data in the database.
  2. If several files of different types are built in the same session (PL/I, Assembler, Cobol and JCL) while the configuration file format is incorrect, the build for JCL will not be affected.
  3. If several configuration files are used, out of which some are incorrect, the behavior is similar to case 1 and error messages will be generated for each incorrect configuration file.

- *Other types of errors.*

  1. If the *after file* is present in the *after folder* while the *meta files* and *before files* are missing from their specific folders (*meta folders*, *before folders*), an error is logged without saving anything in the database about the *after file*.
  2. If the *after file* and *before file* are present in the their specific folders, while the *meta file* is missing from the *meta folder*, an error is logged without saving anything in the database about the *after file* and *before file*.
  3. If the *after file* and *meta file* are present in the their specific folders, while the *before file* is missing from the *before folder*, an error is logged without saving anything in the database about the *after file*.

Note:

1. If two types of resources (requiring / not requiring preprocessing) are available to a project, they must be organized in separate locations on the disk. In case this rule is not applied, the sources that do not require preprocessing will not be built.
2. The validation for the configuration file checks that the specified folders do exist on the disk.

Feature Known Behavior

If for a project, both *metadata file* and *configuration file* are used, the **Make Project** functionality will not be applied for these files. For more information about **Make Project** functionality, please see "Building Projects" on page 22.

API Call/Macro Extensibility

The **Extensibility - API** feature allows customers to access an analysis that reflects their usage of in-house or 3rd party APIs, by using a configuration file, instead of waiting for development support. Using JS0N configuration files, the user describes how each API\Macro call is interpreted by IBM AD.

IBM AD Build Client supports API calls only for:

- COBOL and PL/I programs
- JCL jobs

For more information about the JCL jobs, see section "JCL Call Extensibility Examples" on page 110 in Appendix 4.

API call events can be handled as one of the following types of calls:

- Data access calls

- Inner application program calls
- Cross application calls

Important: The JCL call events can be handled only as inner application program calls.

The following statements are supported for API calls:

- `CALL PROGRAM`
- `EXEC CICS LINK PROGRAM`
- `EXEC CICS XCTL`
- `EXEC PGM` (supported only for JCL calls)

To enable the API macro extensibility feature, click **Project** > **Settings** > **Extensibility**, and then select the **Enable API/Macro handling by using a configuration file** check box. After you click **OK**, a folder with the name `API Config` is created.

In the `API Config` folder, three types of JSON configuration files can be added:

API Config
Specifies the API calls to be analyzed, the API call parameters, and for which one of these parameters, the values are needed.

User Exits Config
Contains a list of API calls and the path to a user exit.

The user exit is a JSON file or a utility that you must create. It contains new resolutions for the API calls. For more information about the user exit JSON files, see section "API/Macro Call Extensibility Examples " on page 98 in Appendix 4.

API Dependency
Allows the user to specify a new type of API extension that can be triggered regardless of any source code. By using dependency, the following mappings can be defined:

- a mapping between programs and generic transactions
- a mapping between programs and generic maps

For more information about the API Dependency, see section "Dependency Extensibility Examples" on page 114 in Appendix 4.

The resolution of the API calls is made by using a module that is called the **API Resolver**, which uses the `User Exists Config` JSON configuration file.

Note:

- After each compilation, a `JVME_Post_Compiler.log` file is created in directory `C:\Users\`*`User_Name`*`\AD\comp\log`.
- The `API Config` configuration file is validated before each build event and in case errors are found, an error message is displayed and the build stops.

The folder is added as an option after the project is created, so users that do not use the **API Macro** feature will not get confused.

Annotations

Starting with IBM AD V5.1.0 release, the API Resolver can add annotations on resolutions. The annotations are present in the `resolution.json` file. For more information, see "JCL Call Extensibility Examples" on page 110 and "Dependency Extensibility Examples" on page 114.

Note: Make sure that Annotations Database configurations from **IBM® AD Configuration Server** are set. For more information, see Configuring the Annotations Database chapter in IBM® AD Configuration Server User Guide.

Examples of annotations that are added by using the `"annText"` and `"annKeyword"` parameters:

- `"annText": "ANNOTATION2"` - specifies the text that users want to add as annotation.

- `"annKeyword" : "API_RESOLUTION"` - specifies the annotation keyword used by the user to identify specific annotations.

Error Cases Behavior

For any project that contains COBOL sources, before any **Build**, **Build Selection** or **Make** processes, the `configuration file` validation starts automatically. You can also manually start the validation sequence, by **right click JSON file** > **Validate**.

1. If the JSON file is valid, the following message is displayed:

   ```
   Validation of the configuration file from 'API Config' folder has succeeded.
   ```

2. If the user tries to upload more than one `API Config` type file, the following error message is displayed:

   ```
   Only one configuration file of each type can exist in "API Config" folder.
   ```

3. If the JSON file is not valid, an error message is displayed. The error message varies, depending on the error type:

   a. If an empty JSON file is added to the project, the error message is:

   ```
   Error parsing data for API Configuration file. Reason: The configuration file from 'API Config' folder is empty.
   ```

   b. If the JSON file has a syntactical error in its structure (ex: a missing bracket, an extra comma, and so on) the following error message is displayed :

   ```
   Error parsing data for API Configuration file. Reason: At line (line number), column (column number)
   ```

   Note: Depending on the syntactical error, **Reason** can be: **not a value**, **not an array**, **not an object**, **not a pair**, **no colon in pair**, **not a string**.

   c. If one of the keys of the JSON file or their values are incorrect, the following error message is displayed:

   ```
   Error parsing data for API Configuration file. Reason: Key '%s' is invalid or has invalid value.
   ```

   d. If any mandatory key is missing for the JSON file or its value is unsupported, the following error message is displayed:

   ```
   Error parsing data for API Configuration file. Reason: Key '%s' does not exist or has unsupported value.
   ```

   e. If the **Api/Macro** feature is enabled, but no JSON file is added to the project, the following error message is displayed:

   ```
   Error parsing data for API Configuration file. Reason: The configuration file from 'API Config' folder is missing.
   ```

   f. If the user sets same values for more than one **apiKey**, the following error message is displayed:

   ```
   Error parsing data for API Configuration file. Reason: The key has a duplicated value.
   ```

   Note: Same behavior occurs for setting same values for more than one **Program "Name"** or **Parameters "label"**.

   g. If an error that is not covered by the previously documented situations is encountered, the following default error message is displayed:

   ```
   Unknown error type.
   ```

Update API Resolutions usage using CLI

IBM AD Build Client can be invoked in batch mode to update **API Resolutions** by using the following command:

```
IBMApplicationDiscoveryBuildClient /uar1 ProjectName
```

Where:

- **/uar1** is the parameter that is used to invoke the update of API Resolutions.
- **ProjectName** is the name of the project where the API Resolutions process is triggered.

Note:

- It is mandatory to have the **API Extensibility** feature *enabled* in **IBM AD Build Client** . To *enable* the **API Extensibility** feature, go to **IBM AD Build Client** > **Project** > **Settings** > **Extensibility** > **Enable API/Macro handling by using a configuration file**.
- The **Update API Resolutions** must be used for the situation when the API Resolution File is modified, so the resolutions must be updated in the repository but without running a full build on the project (which might be time consuming).

The logs for the **Update API Resolutions** usage are available under: **Project's Folder** > **UpdateApiResolutions_timestamp.txt**.

The action that is performed in background, use cases and best practices are also available in HTML format.

1. Click **Start**, select **Run** then type **cmd** to open the command window.
2. Go to the folder where your **IBM AD Build Client** is installed and locate `IBMApplicationDiscoveryBuildClient.exe`.
3. Drag `IBMApplicationDiscoveryBuildClient.exe` into the command window then type **/?** and press **ENTER**.

As a result, a web page is displayed containing detailed information.

Configuring the PL/I Preprocessor

Before you begin

Make sure that **IBM® AD Build Client** is up and running, and a project is available and can be used.

About this task

When working with the PL/I Preprocessor, you can configure parsing options, which drive the way preprocessing is executed, environment variables, encoding, the default library, and other settings. The PL/I Preprocessor configuration options are specified in the `PL1PreprocessorInfo.ini` file. The file follows the general format of `.ini` files where options are specified as *key=value*. You can access and edit the file from **IBM® AD Build Client**.

Procedure

1. Click **Project** > **Settings** and select **Show the project tree**.
2. Select **PL1** from the list and click **Edit Preprocessor Settings**.

   The `PL1PreprocessorInfo.ini` file is displayed in your default text editor.
3. Specify the configuration options to customize the PL/I preprocessor. See "PL/I Preprocessor Configuration File" on page 34 for details about the configuration options you can set and for an example of the PL/I Preprocessor configuration file.

PL/I Preprocessor Configuration File

`PL1PreprocessorInfo.ini` is the PL/I Preprocessor configuration file, which specifies parsing options, environment variables, and other settings that the user sets when working with the PL/I Preprocessor.

The configuration file is generated when a project is created, and is located in the `<ProjectRootDirectory>\ConfigurationExt\` folder.

The file follows the general format of `.ini` files where options are specified as *key=value*.

Sections and groups

Sections denote groups of options that override the options in the previous levels. Sections can be hierarchical, names of the groups must be separated by `/`.

Groups are the virtual folders that are created in the project's structure in **IBM® AD Build Client**.

Parsing Options

The parsing options drive the way preprocessing is executed. The parsing options are described as follows:

- `opts.blank.chars=<character set>`

  Specifies the characters that can be used by the preprocessor. By default, space, tab, newline are blank characters.

- `opts.margins=<true/false>`

  Specifies whether the files can have special margins. If the option is set to `true`, you must specify both the left and right margins.

- `opts.margins.left=<natural number>`

  Specifies the left side margin of the files to process, as a column number. Any text to the left of `opts.margins.left` is ignored. This option must be specified if `opts.margins=true`.

- `opts.margins.right=<natural number>`

  Specifies the right side margin of the files to process, as a column number. Any text to the right of `opts.margins.right` is ignored. This option must be specified if `opts.margins=true`.

- `opts.stringDelim=<character set>`

  Specifies the characters that can be used in text as string delimiters instead of the default `"`.

- `opts.or.chars=<character set>`

  Specifies the characters that can be used as the OR operator in preprocessor directives.

  Note: `opts.or.chars` is also used by the concatenation symbol. For example, if `!` is used as the OR operator, then concatenation symbol is `!!`.

- `opts.not.chars=<character set>`

  Specifies the characters that can be used as the NOT operator in preprocessor directives.

- `opts.extra.lower=<character set>`

  Specifies the extra **lowercase** characters that can be used in preprocessor identifiers.

- `opts.extra.upper=<character set>`

  Specifies the extra **uppercase** characters that can be used in preprocessor identifiers.

  Note: `opts.extra.lower` and `opts.extra.upper` must have the same length. Characters are matched based on their position.

- `opts.include=<non-spaced set of characters>`

  Specifies a custom include directive.

  Note: `<character set>` is a set of characters that are surrounded by any of the following pairs of separators: `{} () >< `` .. ~~ || ++ == __`.

- `opts.library.extensions=<comma-separated list of names>`

  Specifies the extensions of the PL/I includes that are used by the user. For example, if the includes have `.pli` or `.inc` extension, these mentioned extensions are written in the `opts.library.extensions` option.

- `opts.caseInsensitive=<true/false>`

  When the option is set to `true` (default), the compiler option `CASE(UPPER)` is implemented. When it is set to `false`, the compiler option `CASE(ASIS)` is implemented.

Other settings

- `source.encoding=<valid encoding>`

Specifies the encoding that is used to parse files. The default is UTF-8. Valid encoding names are listed in List of supported encodings.

- `default.library=SYSLIB`

  Specifies the default library that the PL/I preprocessor looks for includes.

- `internal.include.flat.layout=<true/false>`

  When the option is set to `true`, it forces the preprocessor to ignore the library in an include directive.

Environment variables do not have a predefined value. Subsequently, a value can be assigned to one of these variables. A variable has the following format:

```
vars.VARIABLENAME='value'
```

Configuration file example

```
[PL1]
source.encoding=UTF-8
opts.include=++INC
opts.stringDelim={"}
opts.extra.lower={@\#$}
opts.extra.upper={@\#$}
opts.margins.right=72
opts.margins.left=1
opts.margins=true
vars.MODE=BATCH
[PL1/Subfolder1]
opts.include=--TST
opts.stringDelim={%}
vars.MODE=CICS
[PL1/Subfolder1/Subfolder2]
opts.margins.right=20
opts.margins.left=7
```

The example configuration file contains folders in hierarchy. If `[PL1/Subfolder1]` and `[PL1/Subfolder1/Subfolder2]` options are used, the actual options are compiled based on hierarchy, overwriting the parsing options present in `[PL1]`:

```
opts.include=--TST
opts.stringDelim={%}
vars.MODE=CICS
opts.margins.right=20
opts.margins.left=7
```

Preparing repository using DDL scripts for Db2 on z/OS projects

Creating Db2 Database Using DDL Script

About this task

A Data Definition Language (DDL) script can be used to create a Db2 database. The `DB2_CreateObjects.sql` DDL script is located in the `<IBM ADDI Installation Folder>\IBM Application Discovery Build Client\Bin\Release\DBScripts` folder.

Procedure

1. Go to `<IBM ADDI Installation Folder>\IBM Application Discovery Build Client \Bin\Release\DBScripts` and open `DB2_CreateObjects.sql` by using a text editor.
2. Locate and set the following parameters in the entire script.
   - `CREATE DATABASE <enter an appropriate name for the database>`
   - `SET CURRENT SCHEMA = 'enter an appropriate name for the schema'`
   - `SET CURRENT PATH = 'enter an appropriate name for the path'`

- SET CURRENT FUNCTION PATH = 'enter an appropriate name for the function path'

Note: The names of the database, schema, path, and function path must have a maximum length of 8 characters. Special characters cannot be used.

3. Run the script.
4. After you create a Db2 database and schema, you can attach it to a new created project. For more information, see “Creating a Project” on page 10.

Results
The desired Db2 database is created.

Deleting Db2 Database Using DDL Script

About this task

A Data Definition Language (DDL) script can be used to delete a Db2 database. The DB2_DeleteObjects.sql DDL script is located in the <IBM ADDI Installation Folder>\IBM Application Discovery Build Client\Bin\Release\DBScripts folder.

Procedure

1. Go to <IBM ADDI Installation Folder>\IBM Application Discovery Build Client \Bin\Release\DBScripts and open DB2_DeleteObjects.sql by using a text editor.
2. Locate and set the following parameters in the entire script.
   - SET CURRENT SCHEMA = 'enter the name of the schema'
   - SET CURRENT PATH = 'enter the name of the path'
   - SET CURRENT FUNCTION PATH = 'enter the name of the function path'
3. Run the script.

Results
The desired Db2 database is deleted.

Creating Annotations Database Using DDL Script

About this task

A Data Definition Language (DDL) script can be used to create **Annotations database**. The DB2_CreateAnnotationDB.sql DDL script is located in the <IBM ADDI Installation Folder> \IBM Application Discovery Build Client\Bin\Release\DBScripts folder.

Procedure

1. Go to <IBM ADDI Installation Folder>\IBM Application Discovery Build Client \Bin\Release\ and open DB2_CreateObjects.sql by using a text editor.
2. Locate and set the following parameters in the entire script.
   - CREATE DATABASE <enter an appropriate name for the database>
   - SET CURRENT SCHEMA = 'enter an appropriate name for the schema'
   - SET CURRENT PATH = 'enter an appropriate name for the path'
   - SET CURRENT FUNCTION PATH = 'enter an appropriate name for the function path'

Note: The default name of the database, schema, path, and function path is EZANNOT. The default name can be changed and can have a maximum length of 8 characters. Special characters cannot be used.

3. Run the script.
4. After you create the **Annotations database**, you must add the related information in **IBM Application Discovery Configuration Server**, under **Environment** > **Configurations** > **Annotations Database**. For more information, see Configuring the Annotations Database.

Results
The desired **Annotations Database** is created.

Chapter 5. IBM AD Build Client Reference

Following chapters contain detailed information about all aspects of **IBM AD Build Client** application. It describes the **IBM AD Build Client** main screen, the menus, and toolbar options. Furthermore, it contains a complete description of all the **IBM AD Build Client** operations.

Main Screen

The main screen that opens when the program is started contains the following elements:

- **Title** Bar.
- **Menu** Bar.
- **Status** Bar.
- The **Project** pane on the left between the toolbar and the status bar.
- The **Display** area on the right between the toolbar and the status bar.
- The **Output** pane across the width of the screen under the **Project** pane and **Display** area.

Main Menu

IBM AD Build Client operations are controlled by choosing commands on the main menu and menus, clicking icons on the toolbar, and keyboard shortcuts. The **Main Menu** commands are summarized in the following table. Equivalent keyboard shortcuts, when available, are also listed.

File	Keyboard shortcut	Description
New Text File	CTRL+N	Creates and opens a new text file.
New Project		Creates and opens a new project.
Open	CTRL+O	Opens the **Windows Open** dialog box, from which any file can be selected and opened.
Close		Closes the active window.
Open Project		Selects and opens an existing **IBM AD Build** project.
Save Project		Saves the current project.
Close Project		Closes the current project.
Save	CTRL+S	Saves the active window.
Save As		Saves the active window under a new name.
Save All		Saves all components of the project.
Print Setup		Opens the **Windows Print Setup** dialog box.
Recent Files		Lists the last six files opened.
Recent Projects		Lists the last six projects opened.
Exit		Exits **IBM AD Build**.

Edit	Keyboard shortcut	Description
Paste	CTRL+V	Pastes the clipboard text to the cursor position.
Find	CTRL+F	Finds the string that is specified in the **Find** command.
Find next	F3	Finds the next occurrence of the string that is specified in the previous **Find** command.
Go To	Go To	Places the cursor at the beginning of the specified line number.

View	Keyboard shortcut	Description
Toolbar		Toggles on/off the toolbar.
Status Bar		Toggles on/off the status bar.
Project	ALT+0	Toggles on/off the project pane.
Output	ALT+2	Toggles on/off the output pane.
Options		Opens **Options** dialog box where you can specify the output parameters.

Project	Keyboard shortcut	Description
Add Files		Adds files to a folder in the active project.
New Folder		Create a folder in the active project and allows specifying the types of files it contains.
Settings		Opens the **Settings** window.

Build	Keyboard shortcut	Description
Make Project	F7	Similar to **Build Project**, but it creates a build operation on components of the project that are modified since the last build was ran.
Build File		Builds the current file.
Build Project	CTRL+B	Builds all files in the active projects.
Stop Build		Stops the current build.
Decisions		Opens the **Decisions** window.

Window	Keyboard shortcut	Description
Cascade		Arranges windows one behind the other in the display area.
Tile Horizontally		Displays all windows, arranged horizontally.
Tile Vertically		Displays all windows, arranged vertically.
Arrange Icons		This option is not currently available.

Help	Keyboard shortcut	Description
About IBM Application Discovery Build		Provides the current **IBM AD Build** version and information on how to access technical support.

Main Screen Toolbar

The main screen toolbar icons enable frequently used menu commands to be run without having to browse through the menu hierarchy. A brief explanation of each is presented in the following table.

Icon	Function	Menu Bar/ keyboard shortcut Equivalent	Explanation
	New File	File / New / Text File Ctrl+N	Creates a text file and opens it.
	Save File	Save File	Saves the current file.
	Save All	File / Save All	Saves the current state of the project and files.
	Previous Window	N/A	Displays the previous window
	Next Window	N/A	N/A
	Print	File / Print Ctrl+P	Prints the selected/displayed file.
	New Project	File / New / New Project	Creates a project.
	Open Project	File / Open Project	Opens an existing project.
	Check Project	N/A	Checks the active selected project for errors.
	Build Files	Build / Rebuild File	(Re)Builds the currently selected files.
	Build Project	Build / Rebuild Active Project	(Re)Builds the active project.
	Stop Build/Check	Build / Stop Build / Check	Stops the current build/check process.
	Make Project	Build / Make Project	Similar to **Build**, runs a build operation only on project parts, which are updated since the last **Build** was run.

Project Tab

The **Project** tab displays tree hierarchy of objects in the project. The tree can be expanded or collapsed by clicking the **+** or **-** signs to the left of each node. The type of each branch is identified by an icon and a text label. In most cases, a node corresponds to a specific line of code in one of the project files and double-clicking the node causes the source file to be displayed in an edit window with the corresponding code line highlighted. Right-clicking a node causes a menu to open, which usually contains commands for displaying the code (similar to the double-clicking the node), for expanding or collapsing the branch represented by the node, or viewing properties of the object.

The **Project** tab contains the following nodes under the main project node:

Node Name	Icon	Description
File Type Folder Node		Each file type folder represents a logical container for source files of the corresponding type that are included in the project. The files list is displayed when the node is expanded.
COBOL Node		Opens the COBOL source file.
Include (Copy) Node		Opens the Include (Copybook) file
BMS Node		Opens the BMS file.
JCL Node		Opens the JCL file.
Configuration Node		Opens a configuration file.

Tab Icons Summary

The following table summarizes the icons that are used in the Project pane:

Icon	Explanation
	Project
	Folder (file type)
	Program file
	Include file
	BMS screen
	JCL
	Configuration file
	Schema (closed)
	Schema (opened)
	Natural Map file
	Copy file
	Screen file
	Printer file
	Object listing / Datasets definition Table definition / Scheduling information / Batch Processes information

Right Click / Shortcut Menus

When you right-click in different locations in **IBM AD Build Client**, different menus are available. These menus are described in the following sections.

Note: The menus might not appear exactly as described here.

Project Tab Shortcut Menu

The project tab right-click menu contains the following options:

Menu Options	Explanation
Add Files	Adds files to the folder.
Add All Files from Folder	Adds all files from the selected folder. For details on how to make this operation that is run in the background see “Adding Files to Project Folders” on page 16.
Delete All Files from this Virtual Folder	Deletes all the files from the current virtual folder.
Add Files from Mainframe Library	Adds files to the folder from the mainframe library. Mainframe libraries are available if **IBM AD Connect for Mainframe** was used previously, by using the **IBM AD Build Configuration (z/OS)**, to scan source libraries on the mainframe. For more information, see “Adding Files From Mainframe Library” on page 21 in **Tasks** and “Bringing data from mainframe libraries (PDS Libraries, Endevor, Librarian, Natural)” on page 70 in **z/OS** tab from **IBM AD Build Configuration**.
New Folder	Creates a folder in the active project. The new folder can have one file type only, which is the same or a subset of the parent folder.
Build	Builds the selected files and folders.
Delete	Deletes the selected folder (only folders, which are not the default ones that are created at project creation time can be deleted).
Settings...	Opens the **Settings** window, focusing on the folder’s settings.
Expand	Expands the folder.
Collapse	Collapses the folder.
Properties	Displays folder properties.

Project Node Shortcut Menu

The project node right-click menu contains the following options:

Menu Option	Explanation
Check	Checks for components that are referenced in the project source code, but missing from the project definition. This option is used to ensure project completeness.
Build	(Re)Builds the project.
Build imposed selection	Builds the selected resources and folders.
Make	Similar to **Build Project**, but only performs a build operation on components of the project, which are modified since the last build was run.
Update API Resolution	This option allows the user to run the resolving mechanism of API calls in case that JSON resolutions, present in the User Exists Config JSON configuration file, have been modified.
Update Modified Mainframe Members/	Updates the resources that are brought in the project from the mainframe and that are changed since the last build. If **Enable Members Synchronization** option is selected, **Update Modified Mainframe Members** changes into **Synchronize Members**. For more

Menu Option	Explanation
Synchronize Members	information, see “Updating Projects” on page 24 and “Synchronize Mainframe Members” on page 25.
New Folder	Defines a new folder, all file types are available for a folder under the project root node.
Delete	Deletes the selected file. When this option is selected, a confirmation message appears asking you to confirm or cancel the delete operation.
Settings...	Opens **Settings** window, focusing on the whole project settings.
Expand	Expands the project tree.
Collapse	Collapses the project tree.
View Repository	This option is not currently available.
Search in Tab (Ctrl+Q)	Searches within the current tab for the specified string.
Search in Tab next	Not available in the current version.
Properties	Displays project properties.

White Space Shortcut Menu

The **White Space** menu appears when you right-click anywhere in the white space of the **Project** pane.

Note: The project tree needs to be collapsed to display the menu.

The white space right-click menu contains the following options:

Menu Options	Explanation
Docking View	Docks/undocks the pane.
Hide Workspace / Hide Window	Hides the **Project** pane. Use **View** / **Project** or **Alt-0** to display it again.

Editing Shortcut Menu

The **Editing** menu contains standard editing commands (**Undo**, **Cut**, **Copy**, **Paste**) and appears when you right-click from within a text file (program).

Output Pane

IBM AD Build Client displays progress and error messages in the **Output** pane. By default, the pane is docked across the entire width of the **IBM AD Build Client** main window. It can be undocked by double-clicking its window border, and docked again by dragging it down. The **Docking View** toggle option is also available on the menu. Double-clicking the name of a resource from the **Output** pane opens the resource in the Editor.

Output Pane Shortcut Menu

Menu Option	Explanation
Copy	Copies the selected text in the output pane to the clipboard.
Clear	Clears the **Output** pane.
Hide	Hides (closes) the **Output** pane. Use **View** / **Output** or **ALT+2** to open it again.

Menu Option	Explanation
Docking View	Switches the window between docked and undocked states. In the docked state, the window is positioned along the entire width of the window (or it is minimized if the status bar is hidden). When the window is undocked, it behaves as a standard **Windows** window.
Save Output File	Saves the current contents of the **Output** pane to a file. The standard **Windows Save As** dialog box opens for specifying the name and location of the file to be saved.
Go to Error	When an error message in the **Output** pane is highlighted (by clicking it), this menu opens the corresponding source file in an **Editor** window at the statement that caused the error. The file can also be opened by double-clicking the error message directly.

Working with IBM AD Build Client Windows

A number of special purpose windows facilitate user interaction. Some of these windows are initially docked to the borders of the display area, but they can be undocked and moved, resized, and hidden (closed). Window names are not shown on docked windows.

Many of the windows have menus that are opened by placing the mouse cursor over the window and right-clicking. In some cases, different menus appear, depending on the exact position of the cursor in the window.

The following **IBM AD Build Client** windows are described in the following sections:

- Decisions
- Editor
- Settings
- Properties.

Viewing Source Programs

About this task

To view the source code for a particular entity, follow these steps:

Procedure

1. Right-click the entity to open a menu, as described in “Right Click / Shortcut Menus” on page 42.
2. Select **View Source**. An **Editor** window opens containing the source listing of the entity.

Building Decisions

About this task

IBM AD Build Client’s Decisions mechanism lets you to overcome syntax problems that might occur at build time in some source dialects. No permanent changes are made to the original code files. Instead, the change information is stored in the repository, so that when an analysis process requires a source file, in effect a temporary internal copy of the file with the modifications is used.

Decisions are essentially specifications for **Find** and **Replace** operations that can be applied locally (at a particular location in a specified file) or globally (throughout the application). This method allows for increased flexibility as decisions can be targeted to specific files.

The folder types that are accepted by the Decisions mechanism are as follows:

- zOS Cobol
- Cobol IDMS

- DT Cobol Pre-compiled
- Cobol IDMS Record

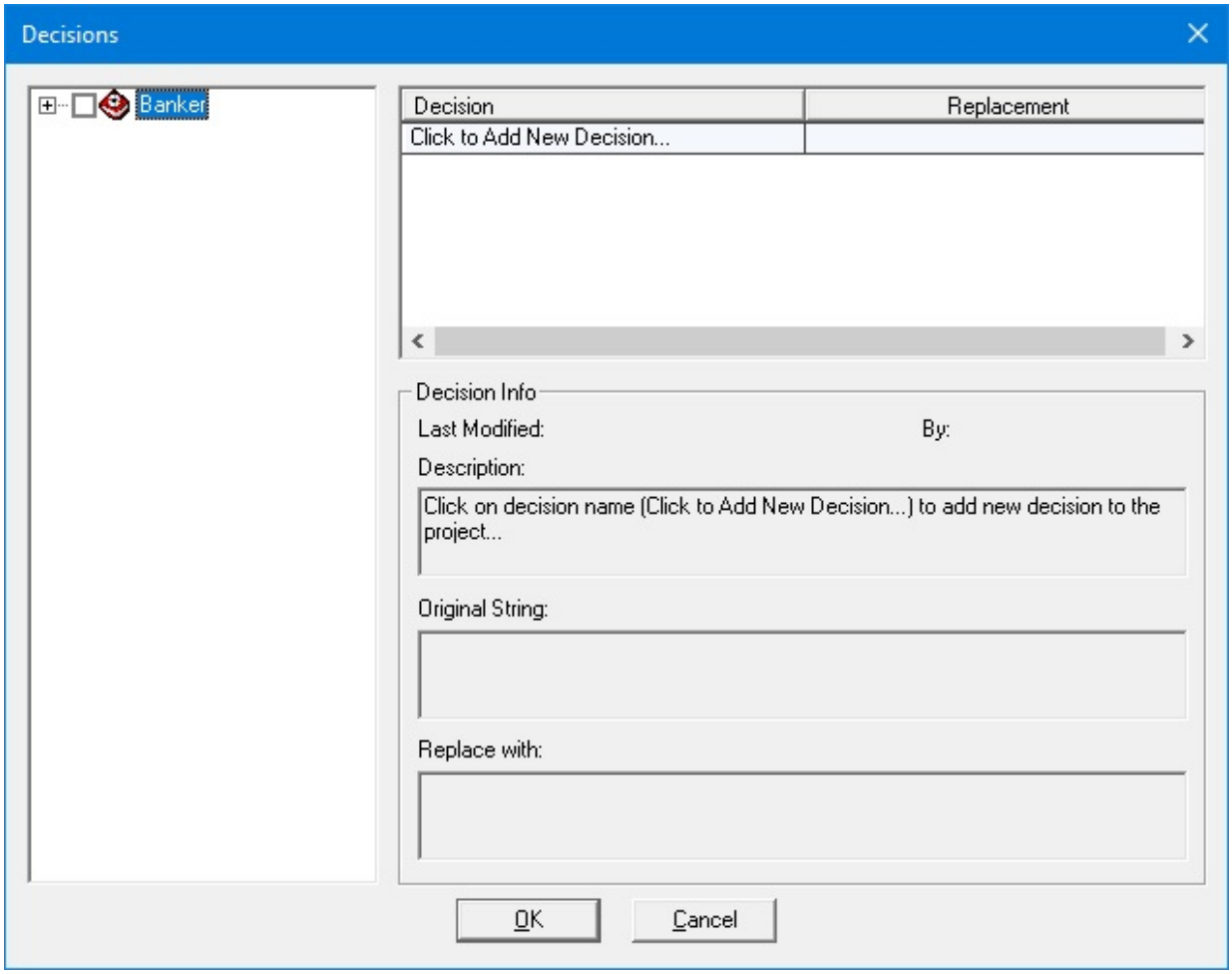
A decision might be implemented for any number of reasons, for example:

- The effects of *modifying* transactions can be studied.
- Build errors can be corrected.
- Unsupported COBOL features can be replaced by alternative code.

To define a decision, follow these steps:

Procedure

1. Click **Build** / **Decisions** to open the **Decisions** window. If decisions are defined previously, they are listed in the window, otherwise the window is empty.

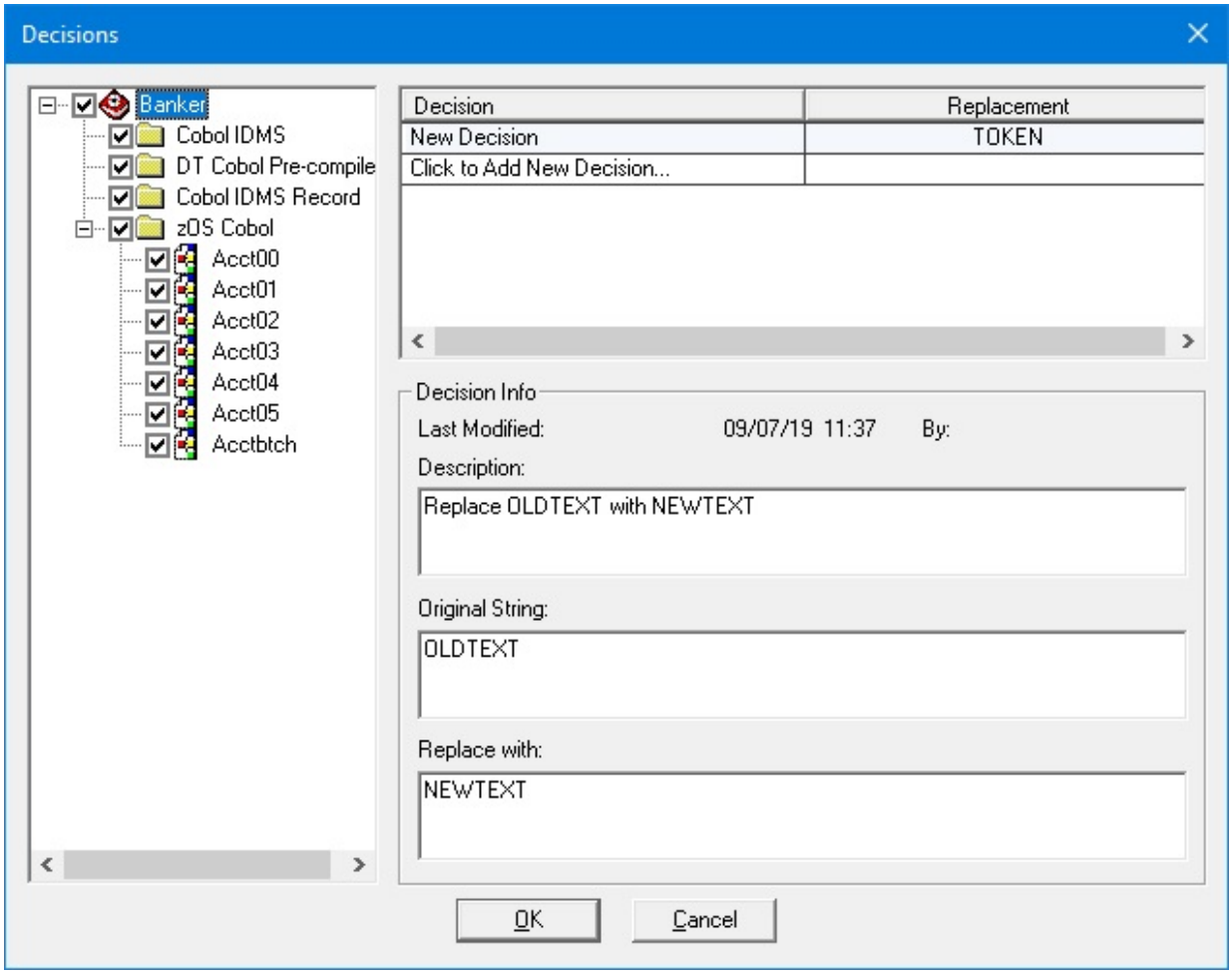


2. In the **Decision** pane at the upper right part of the window, click the text **Click to Add New Decision** (the **Decision** column) to create a new decision. This pane contains two columns and a row for each decision. When you click **Click to Add New Decision**, a new row is added for the new decision. Overwrite **Click to Add New Decision** with a name for the decision, and then click in the Replacement field and select **TOKEN** or **PATTERN** from the list menu box.

   The replacement type refers to the method that is used for search and replace operations. In this aspect, **IBM AD Build Client** follows COBOL copy that replaces the rules. In **PATTERN** search, the search string is replaced wherever it appears, while for **TOKEN** only complete words are replaced. For example, if the string **OLD TEXT** is to be replaced by the string **SOME NEW TEXT** using **PATTERN** search, a part of the string **BOLD TEXT** would be replaced by **SOME NEW TEXT** resulting in **BSOME NEW TEXT**.

For **TOKEN** searches, the string to be replaced must contain one word only and only complete words are replaced. Thus, if OLD is to be replaced by **NEW**, under **TOKEN** search the word **BOLD** would not be replaced. For **TOKEN** search, the string **OLD TEXT** would be disregarded since it comprises two tokens.

After the replacement mode is selected, a tree diagram of the project will appear in the left pane of the window (see the next image). If necessary, expand the tree.



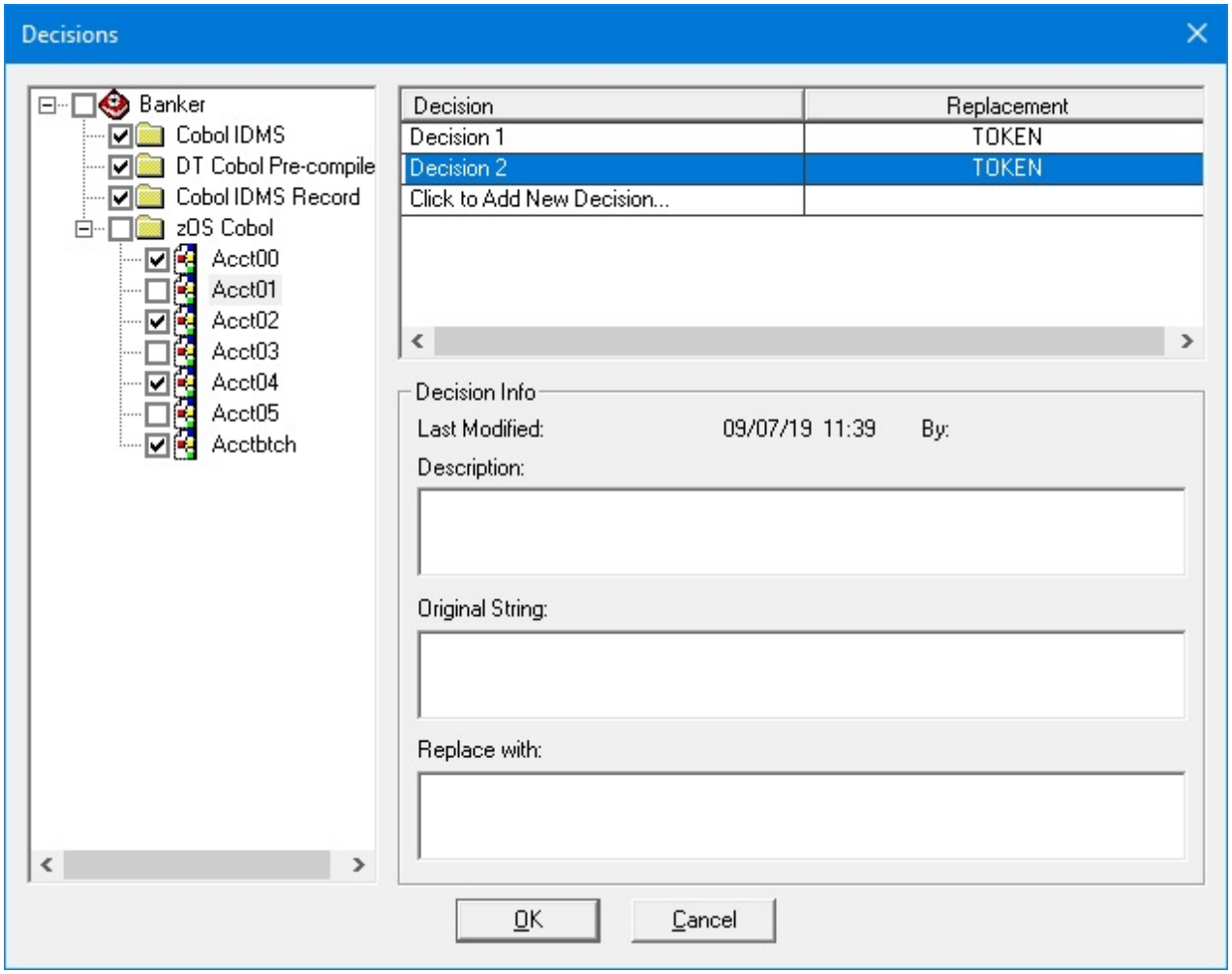
3. Enter a description of the decision in the **Description** text entry box, the string (or token) to be replaced in the **Original String** box, and the replacement string in the Replace with box.
4. Expand the project tree in the left pane to show its folders and files. Set the check boxes of the files that are to be included in the Search and replace operation. Some folders do not support decisions and therefore, their respective check boxes are disabled. (In the example that is shown before, the replacements are to be made in all the sources).
5. Click the check boxes next to the file name that is to accept the decision. A check mark appears. The decision is now attached to the *checked* file. Repeat for all the files or folders to which the decision is to be attached.

Additional Decisions

Each decision is represented by a row in the **Decision** pane, and have its own description, original string, replacement string, and program tree that specifies the files to which the decision is to be applied.

Information including the date of the last modification to the decision and the user name of the person who made the modification is displayed.

When you click a row to select it, the information in the other controls of the window changes. The following figure shows the decision information for two decisions.



Deleting a Decision

After you define the decisions, they remain active until they are deleted or until all check boxes in the project tree for the decision are cleared. In other words, if a decision is not associated with any files (all check boxes in the project tree for that decision are cleared), then the replacement it defines is not implemented, but the decision is still available for later use. To permanently delete a decision, select it and click **DELETE** on your keyboard.

Applying Decisions

After you define or modify decisions, the project (or the files that are affected by the decisions) must be rebuilt.

Note: A source opened in the text editor does not show applied decisions, since these decisions are applied only at build time on a temporary copy of the source code.

Using the Editor

About this task

IBM AD Build Client includes an integrated text editor that can be used to view files.

To open a file in the **Editor**, follow these steps:

Procedure

1. **Main Menu** > **File/Open** to open the standard **Windows Open File** dialog box. Any file can be opened in this way, including files unrelated to **IBM AD Build Client** activities.

2. Double-Click **Source File** Icons. In the tree diagram of the **Project** pane, double-clicking an icon that represents a source code file or statement causes the corresponding file to open in an **Editor** window, often with the appropriate statement highlighted.
3. **Shortcut Menus**. Most menusmenus that are associated with program/statement icons in the **Project** pane have a **View Source** option.
4. • Double-Clicking **Compilation Error** messages in the **Output** Pane. If errors occur during a build, they are listed in the **Output** pane. Double-clicking the error notification causes the corresponding source file to be opened in an editor window with the erroneous statement highlighted.

Using the Settings Option

About this task

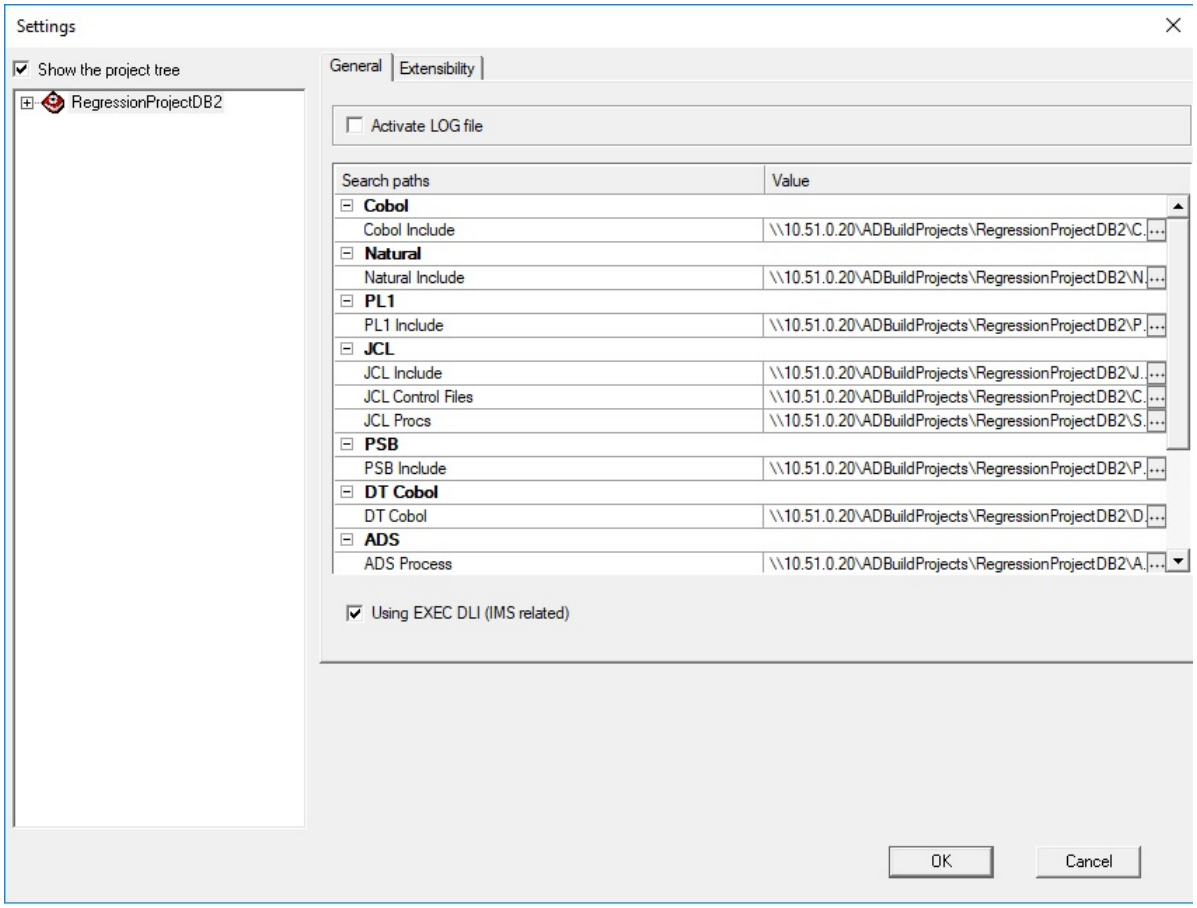
Use the **Settings** option to change the default search paths that are used for the build operation to exclude program components from the build analysis, to set custom component extensions, and to select different analysis parameters according to the resource type.

To open the **Settings** window for a resource, follow these steps:

Procedure

1. To open the **Settings** window for a resource, follow these steps:
   a. On the **Project tree** diagram, right-click the component that you want to exclude from the analysis.
   b. In the menu that opens, select **Settings**. In the **Settings** window select **Show** the project tree. The project tree is displayed showing the selected resource (you can select several resources if needed).
   c. If you select **Exclude File(s)** from **Build**, the selected files are excluded from subsequent builds. The parameter can be set for any individual file in the project, for a set of files within a folder or for an entire project folder, by selecting the folder node in the tree.

   Note: The options that are shown in the **Settings** window depend on the type of resource selected.
2. To open the **Settings** window for a project, follow these steps:
   a. Select the **Project** node in the **Project** pane.
   b. Go to **Project**, then select **Settings** to display the **Settings** window as in the following image.



In the **General** tab of the **Settings** window, after the **Show the project tree** check box is selected, the following check boxes, fields, or options are available:

Project / Folder	**Check Box / Field / Option**	**What it does**
Project node	Activate LOG file	Creates a log file of errors/warnings. This check box is password that is protected for administrator use only.
	Search Paths area	Displays the default search paths that are used during the **Build** operation. Allows the user to change the default search paths if needed. When you click **Explore**, the **Search Paths Order** window is displayed. Use the available buttons to either create an entry, to delete the selected entry, or to change the position of the selected entry in the list. The build operation is run in the order set in this window.
All folder nodes, individual resources	Exclude files from build	Excludes the select files or folder from build operation.
Natural	Indent size	Determines the column number where the text must start (in the source code).
Natural	Compiler Mode-Structured mode/ Report mode	Sets either the **Structured** or the **Report mode** for the compiler.

Project / Folder	Check Box / Field / Option	What it does
All include folders	(Cobol, Natural) Include Extensions or Default extensions	Allows the user to enter custom include extensions or use the default ones.
Data Area (in Natural projects)	Data Area file format- Format 1 or Format 2	Allows the user to select either **Format 1** or **Format 2** for the Data Area resources' processing. The option that is selected by default is **Format 2**.
PL1	PL1 Line Settings- Line Offset, Free Text format.	Allows the user to select the column number where the text must start (in the source code) or choose the **Free Text Format** option.

From the **Settings** window, an **IMS DB Environment** can be set up for COBOL programs that use **EXEC DLI** commands and **DL/I** calls. Fore more information, see step 4 from Adjusting Settings section.

From the **Settings** window, select the **Using EXEC DLI (IMS related)** check box to analyze COBOL programs with **EXEC DLI** commands that are present in the project. Fore more information, see step 5 from Adjusting Settings section.

The following check boxes are available in the **Extensibility** tab from the **Settings** window:

- **Enable API/Macro handling by using a configuration file.**
- **Enable handling of before and after preprocessed source code**.

The Options Window

This function from the **View** menu opens **Options** dialog box where you can specify the output parameters.

Specify the maximum number of output lines, whether warning messages must be displayed in the **Output** pane and if the build results must be automatically saved then click **OK** to apply the options.

The Properties Window

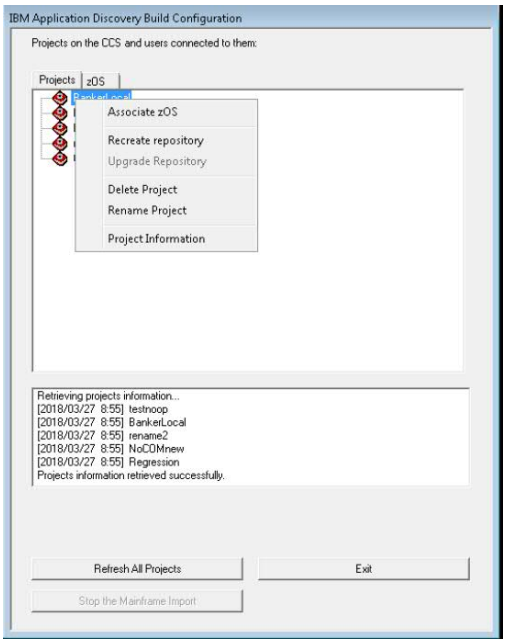
The **Properties** window displays information about the files in a project. The window can be opened from the menu of the items in the tree of the **Project** pane only. The labels and title of the window differ slightly according to the object type.

Chapter 6. IBM AD Build Configuration

You can perform the following actions in **IBM AD Build** using the Configuration Tool:

- View existing projects.
- Delete a project.
- Rename a project.
- Re-create a repository.
- Upgrade a repository.
- Display the users who are currently using a project.
- Create and configure a z/OS connection to a remote computer.

To open **IBM AD Build Configuration**, click **Start** > **Programs** > **IBM Application Discovery Build Client** > **IBM Application Discovery Build Configuration**.



Viewing Project Information

About this task

To view project information, follow these steps:

Procedure

1. In the **IBM Application Discovery Build Configuration** window - right-click on the project and choose **Project Information**.
2. A window is displayed showing the **Project Path**, **Project Database Connection String**, **Project Creation Information**, and **Authentication Information**.
3. If you are working in multi-user mode, under each project a list of users who are currently logged in is displayed.

Deleting a Project

About this task

Deleting a project can be done in two ways:

Procedure

In the **IBM Application Discovery Build Configuration** window.

a) Select the project to be deleted from the list of projects.

b) Right-click to display the menu and select **Delete Project**.

c) You are asked to confirm the deletion request.

d) If other users are logged in to the project, a warning message appears listing all the users who are connected to the project.

Renaming a Project

About this task

To rename a project, goto the **IBM Application Discovery Build Configuration** window and follow these steps:

Procedure

1. Select the project to be renamed.
2. Right-click to display the menu, select **Rename project**.
3. A window is displayed waiting you to confirm the operation.
4. The project with the new name is displayed in the projects list.

   Note: It is highly recommended to perform a build after you rename the IBM AD project. For more information, see “Building Projects” on page 22.

Associating a z/OS Access Point to a Project

About this task

Note: For details on how to define a z/OS node, see “The zOS Tab” on page 74.

To associate a z/OS source to a project, follow these steps:

Procedure

1. Goto the **IBM Application Discovery Build Configuration** window.
2. 1. Select the project to which you want to associate a z/OS.
3. Right-click to display the menu and select **Associate z/OS**. The **Associate z/OS** instance-to-project window is displayed.

   A list of z/OS access points that are defined is presented and you can select the one(s) you want to associate to your project. After you select at least one z/OS node from the list, click **OK** to return to the initial **Projects** tab. The selected z/OS node is displayed under your project.

   If you are working in multi-user mode and other users are logged in to the project, a warning message informs the other users about the operation about to be run.

Recreate a Repository

About this task

To re-create a repository in case the current repository was deleted or got corrupted, follow these steps:

Note: Recreate Repository is not available for projects that are attached to an existing Db2 on z/OS database when they are created.

Procedure

1. From **IBM AD Build Configuration** window, right-click the selected project and choose **Recreate Repository**.
2. A warning message appears, waiting for you to confirm the recreation. After you confirm the recreation, the repository is re-created, and a full build can be done by using an **IBM Application Discovery Build Client** to allow analysis for the project.
3. If other users are logged in to the project, a warning message informs the other users about the operation about to be run.

Upgrade a Repository

About this task

If other users are logged in to the project, a warning message informs the other users about the operation about to be run.

Procedure

1. To upgrade the repository for a single project, follow these steps:
   a) In the **IBM Application Discovery Build Configuration** window, right-click the selected project and choose **Upgrade repository** if available.
   b) A warning message appears, waiting for you to confirm the upgrade. After you confirm, the repository is upgraded to the current version.
   c) A warning message appears, waiting for you to confirm the upgrade. After you confirm, the repository is upgraded to the current version.
2. To upgrade the repository for a list of projects, follow these steps:
   a) First, create a text file by specifying the list of projects to be included in the repository upgrade operation.

      Important: Each project name must appear on a separate line in the text file.

   b) Open the command prompt and enter the following command:

      ```
      C:\Program Files\IBM Application Discovery Build Client\Bin\Release\IBMApplicationDiscoveryBuildClient.exe"/ ru <fully qualified LOG file name>
      <fully qualified projects file name>
      ```

      Where,

      - <fully qualified LOG file name> is, the log file that is created detailing the results of the upgrade operation.
      - <fully qualified projects file name> contains the file name with the projects to be upgraded, one per line.

      If <fully qualified projects file name> is not present, all projects are upgraded.

      Tip: This operation runs in the background.

Stop the Mainframe Import

This function is used to cancel the library scanning, query environment and get files operations.

If other users are logged in to the project, a warning message informs the other users about the operation about to be run.

Configuring the z/OS Connection

About this task

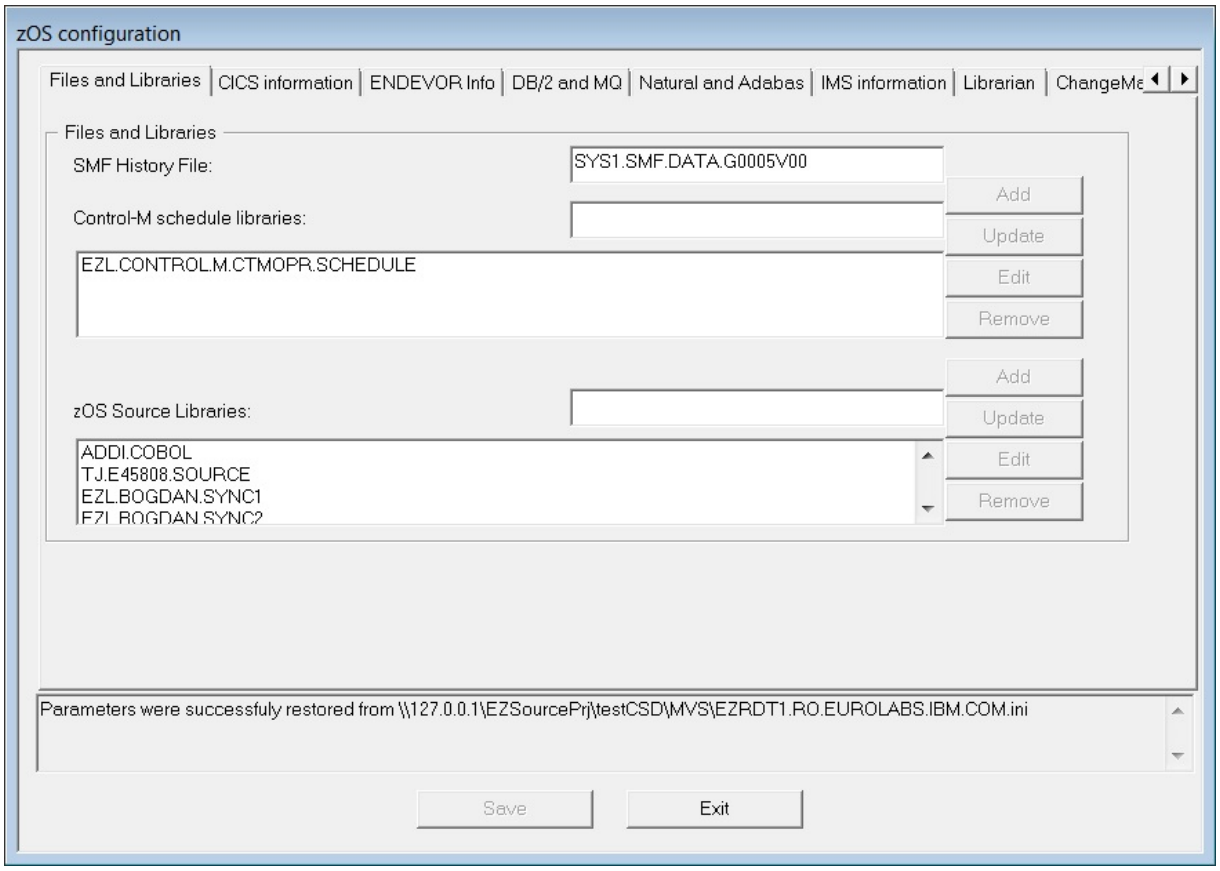
You can use this option to specify different settings for the **z/OS Connection** and the names of the libraries that contain the resources you want to import in your project. You can enter all the data that you consider relevant in a dedicated tab, for each type of resource.

Important: Authentication with proper credentials through Carma/Endevor is enforced before one can read/obtain any source file, regardless of method used for obtaining these sources:

1. By downloading from mainframe (Endevor)
2. Otherwise provided. These sources can only be viewed if they are shared over the network. Read only access is required.

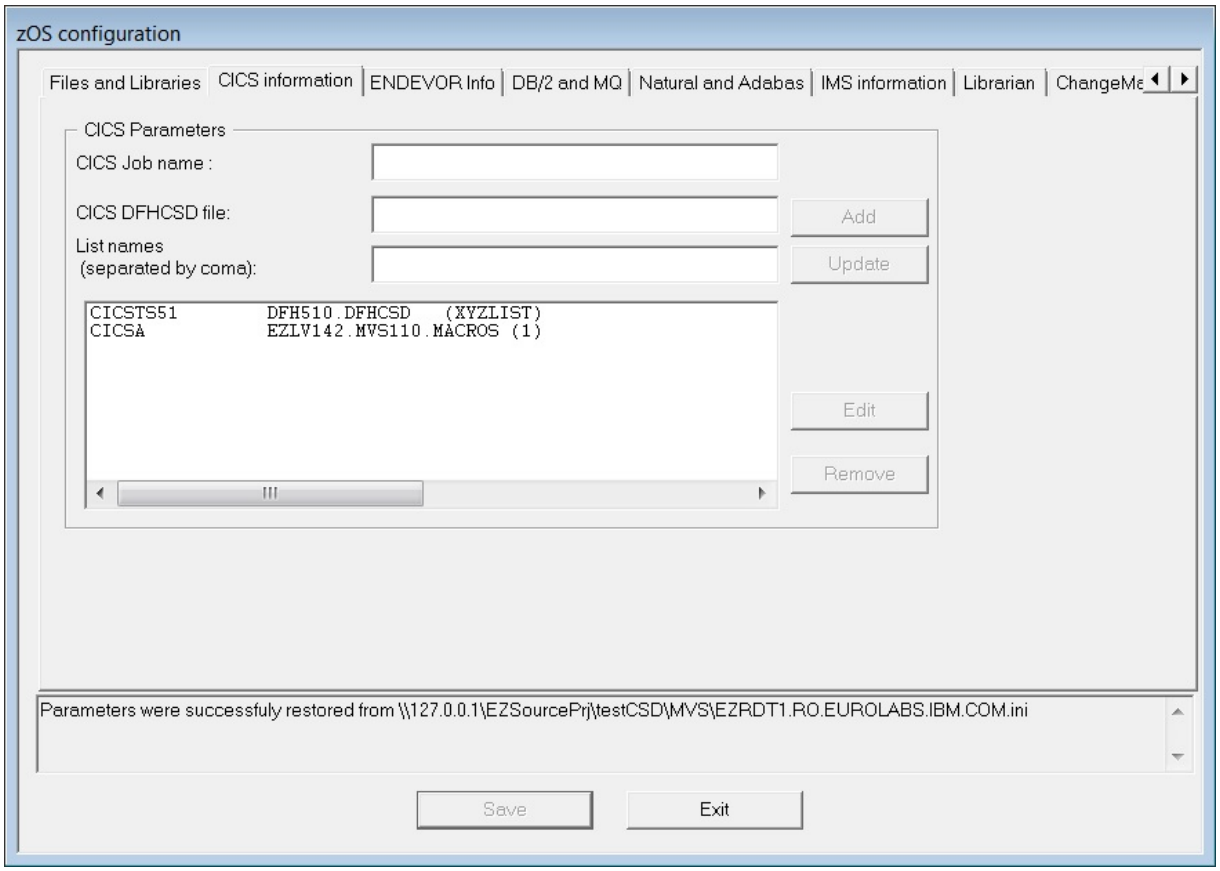
Procedure

1. Goto **IBM Application Discovery Build Configuration**, **Projects** tab and select the project then the corresponding z/OS node, then right-click to display the menu. Select **Configure connection** to display the following window.



2. Complete the settings or the names of the libraries that contain the resources you want, according to the type of resource you need to import.

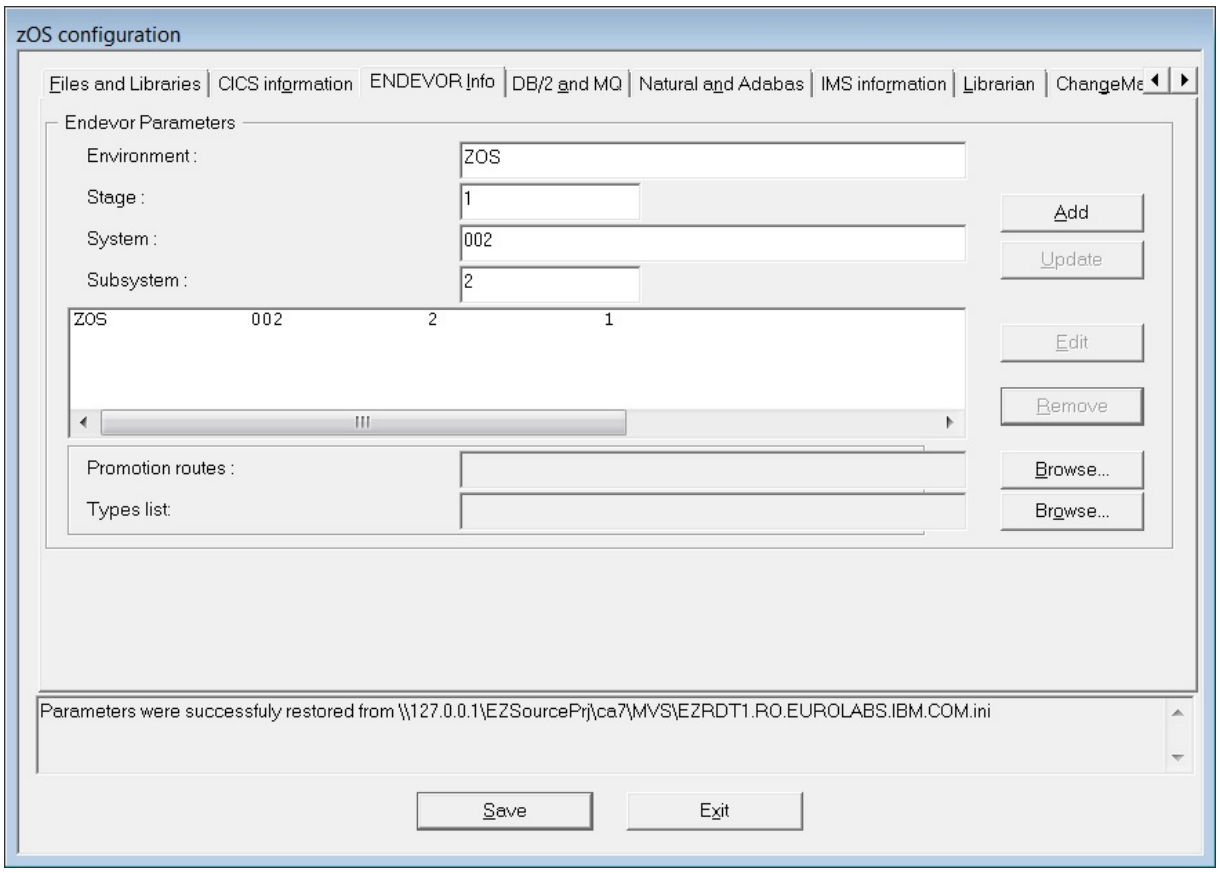
3. To add a library, enter its name in the corresponding field, then click **Add**. The name of the new library is displayed in the library list. Use the **Update**, **Edit**, and **Remove** to modify the list of libraries or the name of an existing library.
4. Next, select the **CICS information** tab to enter the CICS information library details.



Existing CICS information libraries are listed in the central part of the tab.

- To add a *CICS information library*, enter the details in the corresponding fields then click **Add**. The new library is displayed in the list in the central part of the screen.
- To edit the details of an existing library, select it from the list and click **Edit**. The corresponding details are displayed. Make the changes then click **Update**.
- To remove a library from the list, select it then click **Remove**.

5. Next, select the **ENDEVOR Info** tab to display it as in the following image:



Fill the available fields with the required data then click **Add**. The parameters file is added to the list in the central part of the tab.

- To edit the details of an entry, select it and then click **Edit**. The corresponding details are displayed. Make the changes then click **Update**.
- To remove a parameters file from the list, select it then click **Remove**.

Configurations for the **ENDEVOR Info** tab:

- **Endevor Parameters**

  Each entry in the list has four parameters. These parameters represent a state for which **IBM AD** collects sources. Whenever **IBM AD** looks up for a member on Endevor for an entry in the list, the member is searched in the starting location according to these four parameters, and if not found, it continues to move forward on the promotion route by looking for the member until no forward movement can be done on the route. The four parameters are:

  – **Environment**

    Represents the functional area within an organization, for example: development, test, or production. There can be as many environments as needed within Endevor.

  – **Stage**

    Represents the stage of the software lifecycle and it is always associated with an environment that can have either 1 or 2 stages. Each stage has an ID that identifies whether it is the first or the second stage in the environment. It means that the ID is either 1 or 2 and it is unique only within the related environment.

  – **System**

    The user must define a system to each environment in which it is planned to be used. An additional usage is to define more than one system name to a mainframe application. It means that two systems can describe the same application in different environments and stages.

- **Subsystem**

  This is a subcomponent of a system. A system must have a minimum of one subsystem. The subsystem name for a mainframe application or component can be changed across environments and stages.

- **Promotion routes**

  The **Promotion routes** can be defined by using a configuration file. The **Promotion routes** file is optional, and if omitted then **IBM AD** does not trace the members forward on the promotion routes. A route represents a collection of maps, where a map is an indication of the current Environment + Stage + System + Subsystem, and the next Environment + Stage + System + Subsystem.

  The format of the configuration file is:

  ```
  [<From Environment>,<From Stage>,<From System>,<From Subsystem>]:[<To Environment>,<To
  Stage>,<To System>,<To Subsystem>]
  ```

  Example of the configuration file:

  ```
  [DEV1,UNIT,SYS1,SUBSYS1]:[DEV1,INT,SYS1,SUBSYS1]
  [DEV1,INT,SYS1,SUBSYS1]:[QA,QA,SYS1,SUBSYS1]
  [QA,QA,SYS1,SUBSYS1]:[QA,HOLD,SYS1,SUBSYS1]
  [QA,HOLD,SYS1,SUBSYS1]:[PROD,PROD,SYS1,SUBSYS1]
  [DEV2,UNIT,SYS1,SUBSYS1]:[DEV2,INT,SYS1,SUBSYS1]
  [DEV2,INT,SYS1,SUBSYS1]:[QA,QA,SYS1,SUBSYS1]
  [DEV3,UNIT,SYS1,SUBSYS1]:[DEV3,INT,SYS1,SUBSYS1]
  [DEV3,INT,SYS1,SUBSYS1]:[QA,QA,SYS1,SUBSYS1]
  [QFIX,TSTFIX,SYS1,SUBSYS1]:[QFIX,PREPROD,SYS1,SUBSYS1]
  [QFIX,PREPROD,SYS1,SUBSYS1]:[PROD,PROD,SYS1,SUBSYS1]
  ```

  From the **Promotion routes** field, click **Browse** and select the <PromotionRoutes> configuration file that contains the promotion routes. Make sure that you have access to the location where the <PromotionRoutes> configuration file is stored.

- **Types list**

  The **Types list** points to the file from which **IBM AD** reads all required types for the project. These types are categories of source code (COBOL, COPYBOOK, JCL, and so on). Types are defined to each system/stage in which the user plans to use them.

  The format of the types list file is:

  ```
  Type1,Type2,Type3, and so on
  ```

  Examples of the types list file:

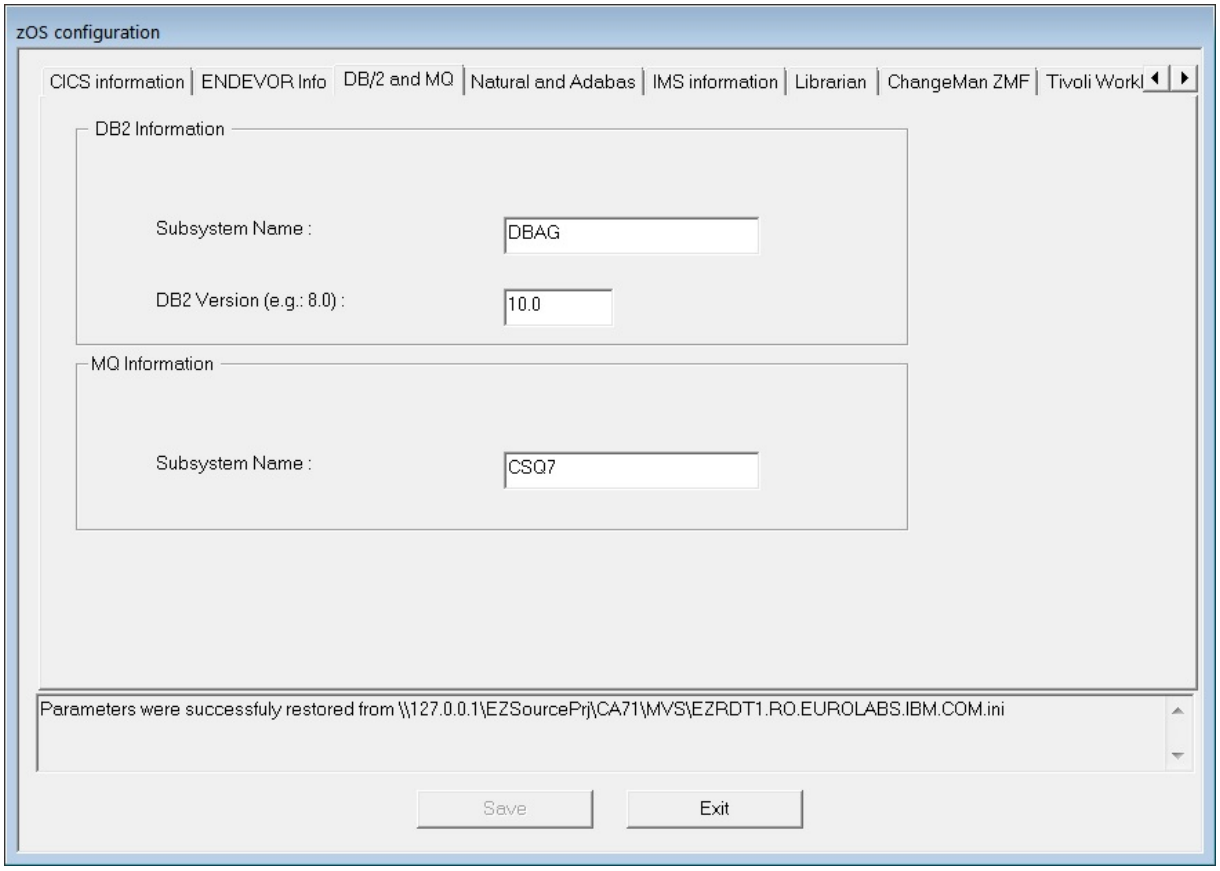
  ```
  COBOL,JCL,COPYBOOK
  ```

  ```
  MACRO,JCL,ASSEM,PL1
  ```

  From the **Types list** field, click **Browse** and select the <TypesList> file that contains all Endevor supported file types that can be imported into the project. Make sure that you have access to the location where the <TypesList> file is stored.

  A sample file is available at the following location: <IBM AD Build Client installation folder>\Bin\Release\Samples\EndevorTypesList.txt.

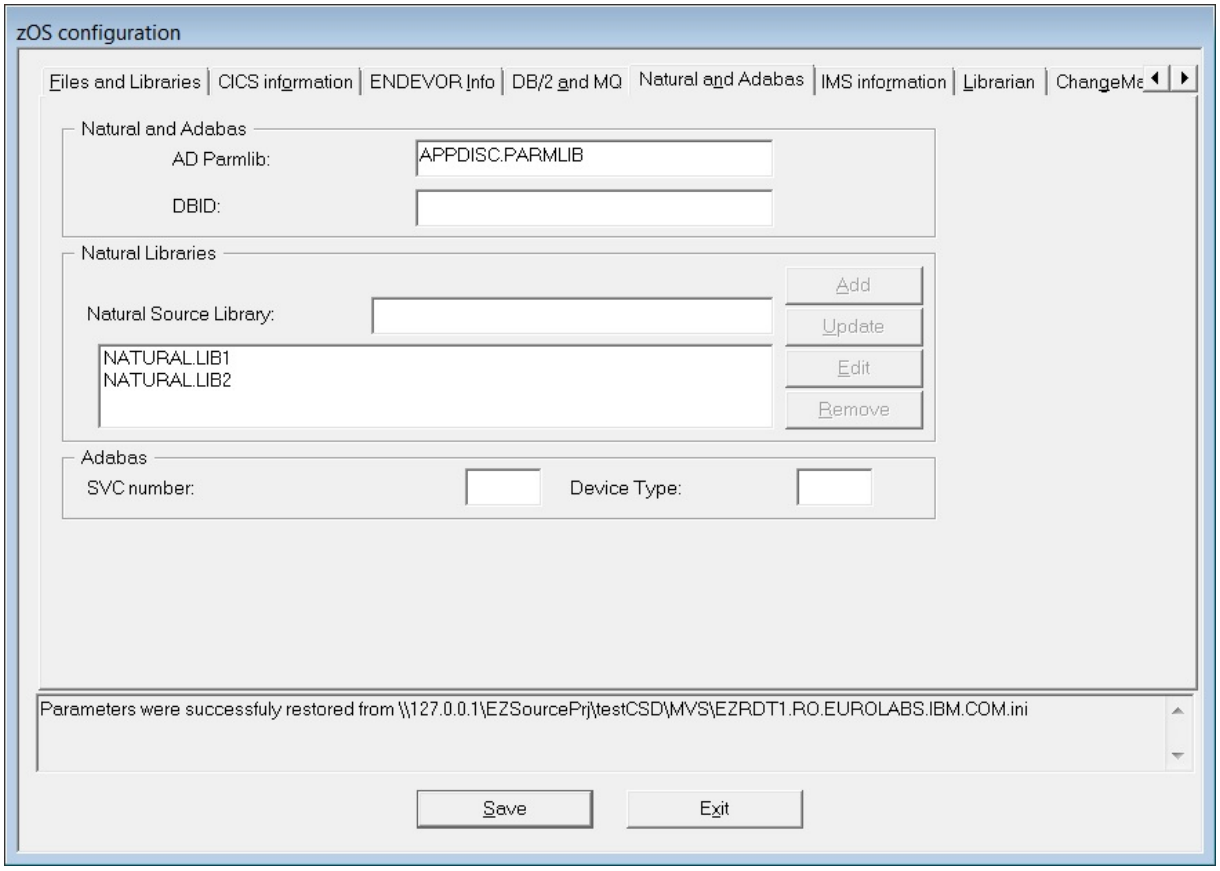
6. Next, select the **DB2** and **MQ** tab to display it as in the following image:



Enter the corresponding **DB2** and **MQ** subsystem names in the associated fields and the corresponding **DB2** version.

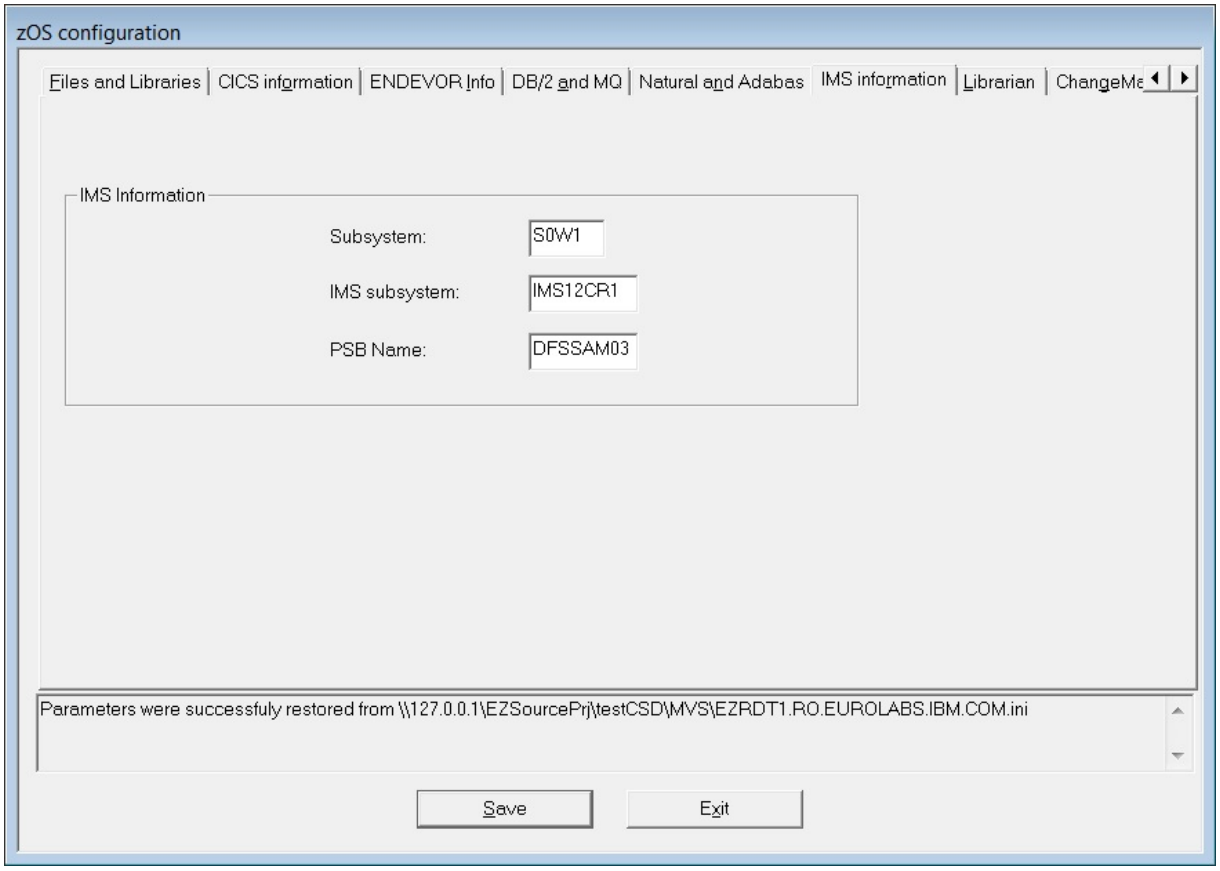
When configuring **DB2** on IBM AD Build Client, there are associated configurations that must be performed on the mainframe. Fore more information, see Db2 Checklist in Appendix 5.

7. Next, select the **Natural** and **Adabas** tab to display it as in the following image.



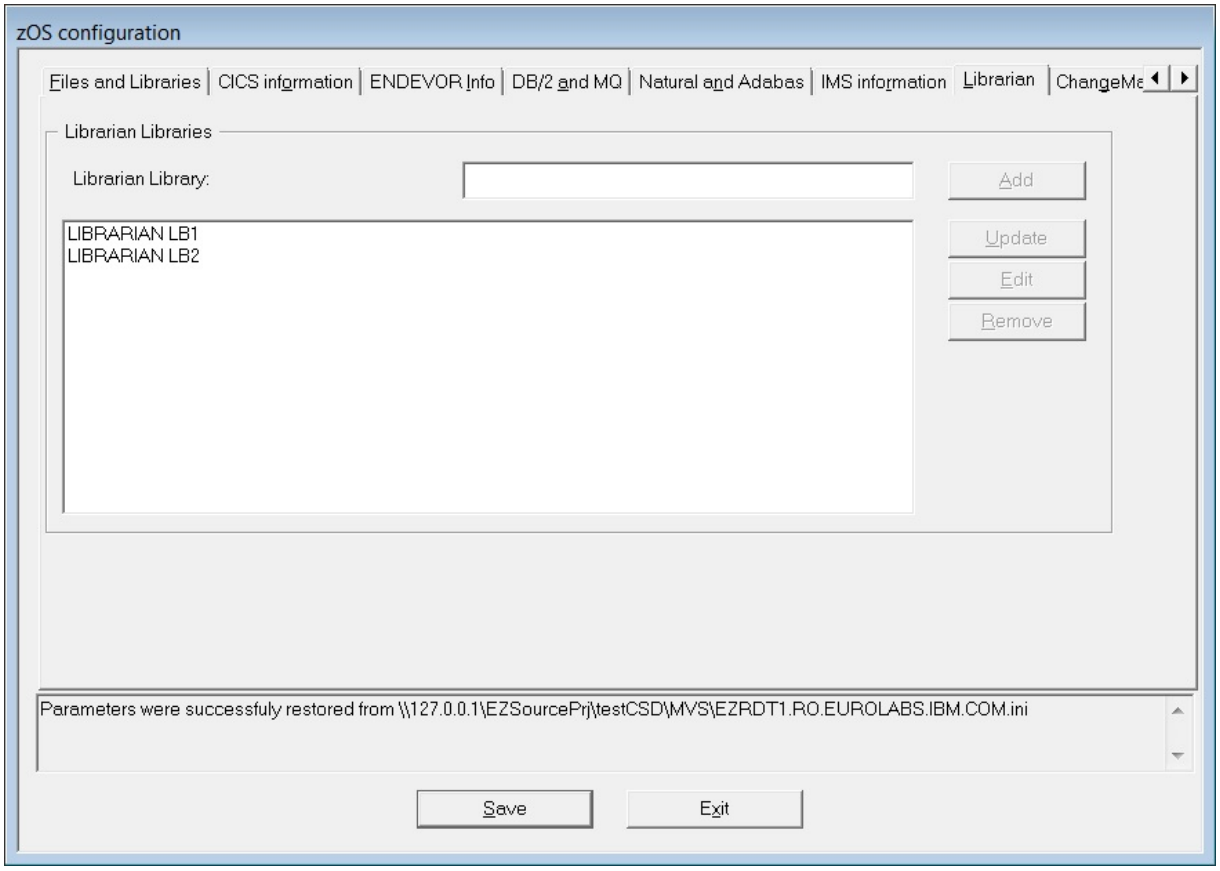
Complete the required settings information for the **Natural** and **Adabas** libraries. Use the prior procedure to add, edit, update, and remove libraries.

8. Next, select the **IMS Information** tab to display it as in the following image:



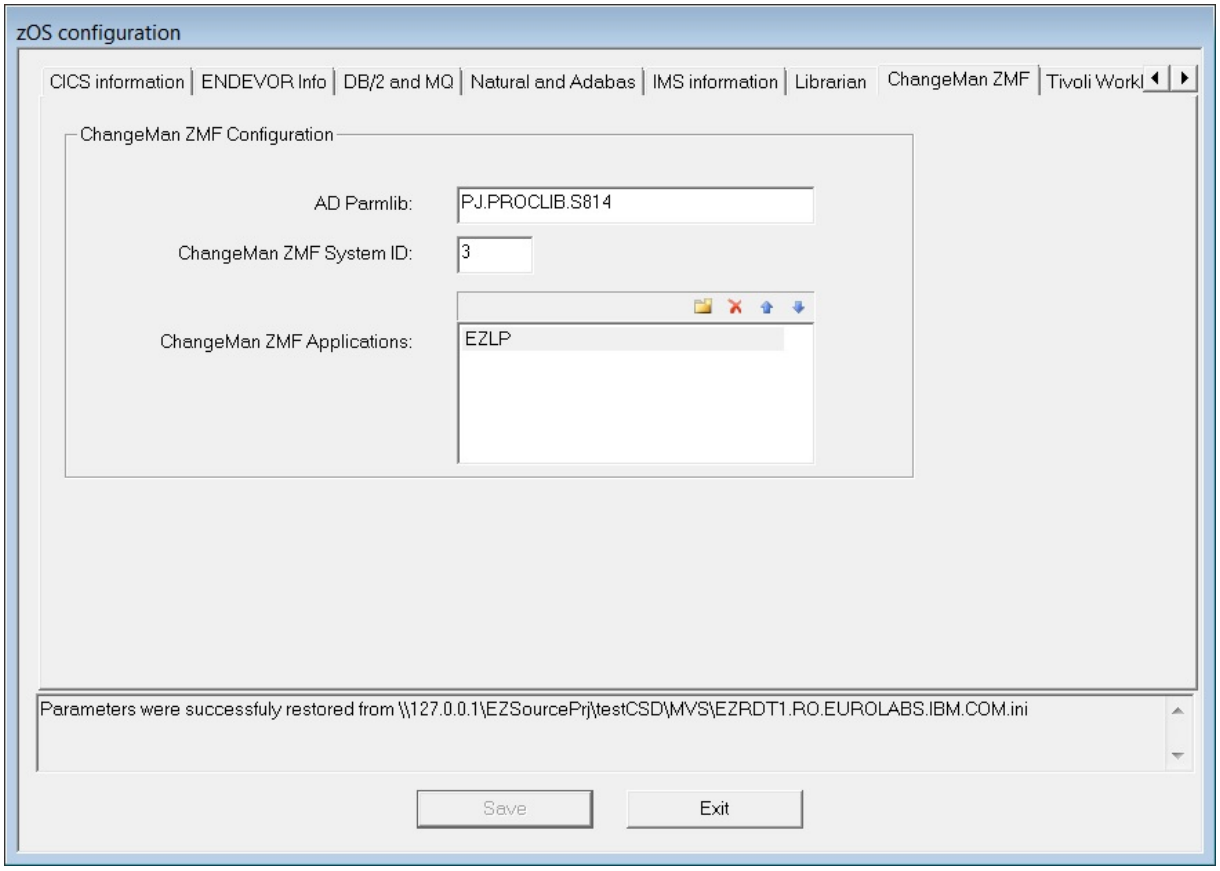
Complete the required settings for the IMS libraries.

9. Select the **Librarian** tab to display it as in the following image:



Add the names of the required libraries and use **Add**, **Edit**, **Update**, and **Remove** to manage these libraries.

10. Select the **ChangeMan ZMF** tab to display it as in the following image:



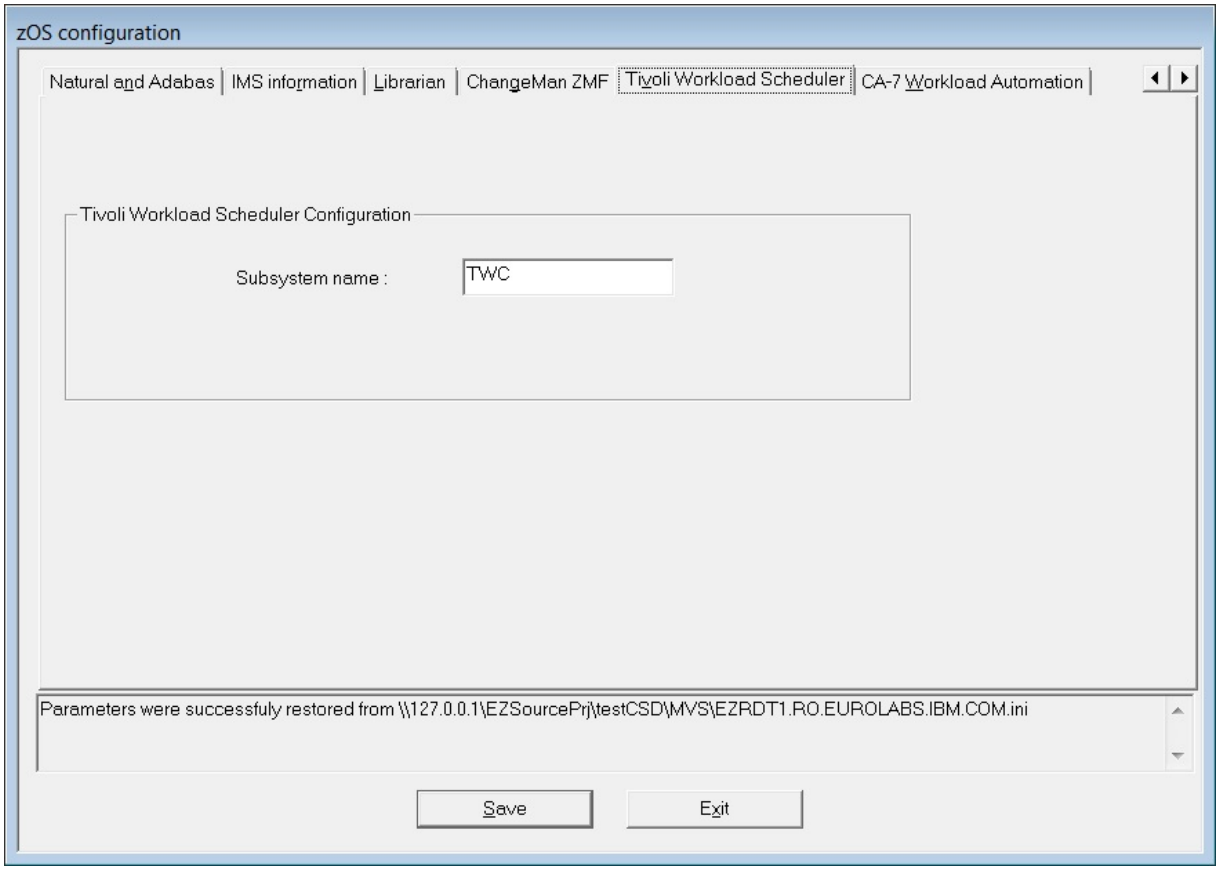
Complete the name of the IBM ParmLib library and then enter the number of the **ChangeMan ZMF Subsystem**.

In the **ChangeMan ZMF Applications** field, click  to add an application name to the list. Click  to remove the selected application from the list. Use  and  to change the position of the selected application in the applications list.

Note: If no **ChangeMan ZMF Applications** are mentioned, the members are scanned/retrieved only from packages.

When configuring **ChangeMan ZMF** on IBM AD Build Client, there are associated configurations that must be performed on the mainframe. Fore more information, see ChangeMan® ZMF Checklist in Appendix 5.

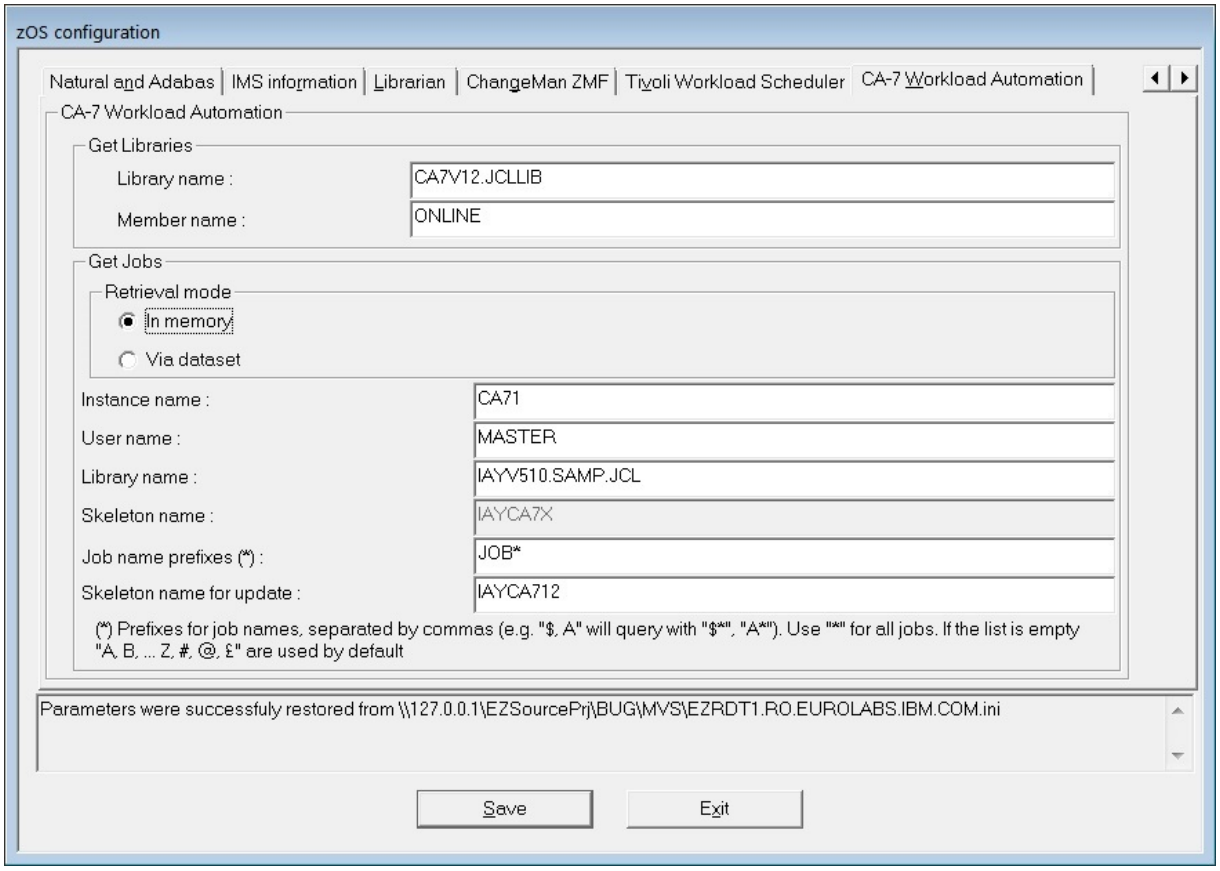
11. Select the **Tivoli Workload Scheduler** tab to display it as in the following image:



Complete the Subsystem name of the TWS controller. After you finish, click **Save**.

12. Select the **CA-7 Workload Automation** tab to display it as in the following image. Select a retrieval mode, and specify values in the fields.

    If the settings in the CA-7 Workload Automation pane are changed, run a full import, instead of an update, to assure the consistency of the information in the repository with the one from the mainframe.



Library name
The name of the library where the INIT deck is located.

Member name
The name of the INIT deck member that lists all the libraries, in which CA-7 must look for to find and submit jobs.

In the CA-7 documentation, the INIT deck is sometimes referred to as the CA-7 Initialization file. To find this library (PDS) and member combination for your system, refer to the JCL for the CA7ONL procedure at your site. It is referenced in this JCL by DD name UCC7IN.

Note: If you do not have access to this JCL, ask your CA-7 administrator for the information.

In memory
The default retrieval mode. It uses CA Common Communications Interface (CAICCI) to get job information. The results are retrieved directly from CA-7 into the memory address space of the agents and transferred back to IBM AD Build.

Via dataset
The alternative retrieval mode. It uses Batch Terminal Interface (BTI) to get job information. The results are delivered by CA-7 into a data set. Then the agents read the data and transfer it back to IBM AD Build.

Instance name
The CA-7 instance name.

User name
The name of the user under which the agents are running.

Library name
The name of the library that contains the AD skeleton. This library is a member that is delivered as part of the installation if the CA-7 access through BTI is required.

Skeleton name
The name of the AD skeleton that is used for accessing CA-7 through BTI. This skeleton is submitted by the agents. The job uses the BTI interface to get the information back to the data set.

Note:

- This field is available only if the **Via dataset** retrieve mode is selected.
- The value in this field is used when **Full CA-7 import** is selected when you retrieve operational information.

Job name prefixes
The name prefixes of the jobs to be retrieved. Separate multiple job name prefixes by commas. If this value is not specified, all the jobs with a name that starts with any of the following characters are to be retrieved:

A-Z # @ £

Note: This field is available only if the **In memory** retrieve mode is selected.

Skeleton name for update
The name of the AD skeleton that is used for accessing CA-7 through BTI. This skeleton is submitted by the agents. The job uses the BTI interface to get the information back to the data set.

Note: The value in this field is used when **Update CA-7 information with the differences since the last import** is selected when you retrieve operational information.

Bringing Operational Information

About this task

To retrieve operational information, follow these steps:

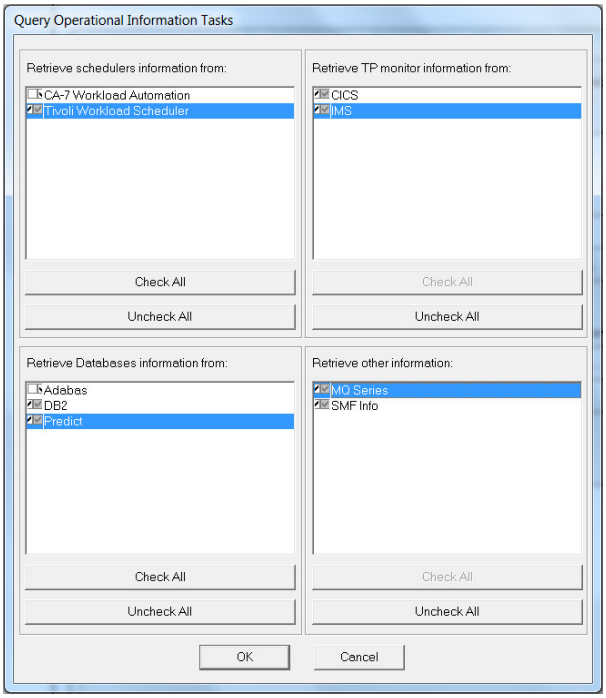
Procedure

1. Configure the z/OS connection (for details see “Configuring the z/OS Connection” on page 56)
2. Retrieve operational information.

Retrieve Operational Information

Note: Before you retrieve operational information, you must configure the z/OS connection. If you associate the z/OS connection to a project only but you do not configure it, you cannot retrieve the data. For more information, see topic “Configuring the z/OS Connection” on page 56.

Go to **IBM Application Discovery Build Configuration**, select the **Projects** tab, select the project, select the z/OS node, right-click to display the menu, and select the **Retrieve Operational Information** option to display the following window.



Note: If you do not configure the z/OS connection for the selected task, a warning message is presented, indicating the entries for which the configuration is missing.

A list of available tasks is presented grouped by categories: You can choose to **Retrieve schedulers information**, **Retrieve TP monitor information**, **Retrieve Database information**, or **Retrieve other information**. Make the selections then click **OK** to run **Query Operational Information**.

Note: The available options depend on the type of project you create.

Following is a list of entities/objects for which **Connect for mainframe** brings information:

- Adabas

  The **Connect for mainframe** gives information about a total of three entities:

  1. Adabas Database.
  2. Adabas File.
  3. Adabas Field.

  The information refers to physical allocations, defined files that include file fields.

- CA Workload Automation CA 7 Edition

  The **Connect for mainframe** gives information about a total of two entities:

  1. CA 7 Jobs.
  2. Datasets.

  The information refers to triggering and dependencies.

  The following two options are provided for CA-7 Workload Automation:

  Full CA-7 import
  Removes the existing information that is stored in the repository, and then imports the information from the mainframe into the repository as configured.

  Update CA-7 information with the differences since the last import
  Import only the changes from the mainframe into the repository as configured.

  Note: A full import must be run before an update. Otherwise, the update will not have the correct results.

For more information about the CA-7 configuration in AD Connect for Mainframe, see IBM AD Connect for Mainframe Configuration Guide.

- CSD (CICS)

  The **Connect for mainframe** gives information about a total of seven entities:

  1. CICS Region
  2. CICS Group
  3. CICS List
  4. CICS File
  5. CICS Map
  6. CICS Program
  7. CICS Transaction

  The information refers to all CICS regions, including defined programs\transactions\maps\files, hierarchy of groups and lists, and performance information for transactions such as **Elapsed time**, **IO count**, and **DB2 count**.

- DB/2

  Connect for mainframe brings information about a total of 14 entities:

  1. Db2 Database.
  2. Db2 Table.
  3. Db2 Column.
  4. Db2 Index.
  5. Db2 Key.
  6. Db2 Package.
  7. Db2 Package List.
  8. Db2 Plan.
  9. Db2 Storage Group.
  10. Db2 Stored Procedure.
  11. Db2 Table Space.
  12. Db2 Trigger.
  13. Db2 View.
  14. Db2 Volume.

  The information refers to all databases, tables, columns, table spaces, triggers, views, plans storage groups.

- Devices and Physical files

  The **Connect for mainframe** gives information about the following entities:

  1. Physical files
  2. Devices

  The information refers to all devices connected to the LPAR, and all physical data sets on disk devices.

- Hardware

  The **Connect for mainframe** gives information about a one entity:

  1. CPU

- IMS

  The **Connect for mainframe** gives information about a total of three entities:

  1. IMS Database.

2. IMS Transaction.
3. IMS Program.

The information refers to databases, programs, and transactions of IMS.

- LPAR and SYSPLEX

  The **Connect for mainframe** gives information about a total of two entities:

  1. LPAR Information.
  2. Sysplex Information.

  The information refers to LPARS, SYSPLEXS, the relationships, and links to other entities (CPU, installed software)

- MQ Series

  The **Connect for mainframe** gives information about a total of three entities:

  1. Queue Manager
  2. Queue
  3. Channel

  The information refers to Queue Managers, Queues, and Channels.

- Predict

  The **Connect for mainframe** gives information about a total of two entities:

  1. Predict file.
  2. Predict field.

  The information refers to predict files and fields.

- SMF

  The **Connect for Mainframe** gives information about a total of three entities:

  1. SMF JCL information.
  2. SMF JCL Step information.
  3. SMF JCL Step IO.

  The information refers to scheduled jobs, including total CPU consumption, IO count, and CPU count per steps, and used physical files.

- Tivoli® Workload Scheduler

  The **Connect for mainframe** gives information about a total of two entities:

  1. TWS Applications.
  2. TWS Jobs.

  The information refers to TWS defined applications, jobs, and their dependencies.

  Before you retrieve the information, a confirmation window is displayed. Click **Yes** to start the selected query operation.

  After the operation is finished, 2 log files are generated: One containing the errors (if applicable), the other detailing the operations undertaken. These log files are stored in the following location: `project name/z0S/logs/z0S name`.

Retrieve operational information in the background

IBM AD Build Client provides an option to retrieve operational information in the background. To force the retrieve operation information to run in the background, follow the steps:

1. Click **Start**, select **Run** then type **cmd** followed by **ENTER** to open the command window.

2. Go to the folder where your IBM AD Build Client is installed and locate `IBMApplicationDiscoveryBuildConfiguration.exe`.
3. Drag `IBMApplicationDiscoveryBuildConfiguration.exe` file into the command window then type **/?** and press **ENTER**. A window is displayed containing detailed instructions about how to retrieve operational information in the background. In the command prompt enter the following command:

```
C:\Program Files\IBM Application Discovery Build Client\Bin\Release
\IBMApplicationDiscoveryBuildConfiguration.exe /ba <fully qualified file name>
```

The *<fully qualified file name>* points to an INI file that contains information about actions that are executed in headless mode.

A sample for the configuration INI file is found in `C:\Program Files\IBM Application Discovery Build Client\Bin\Release\Samples\BuildConfigurationBASample.ini`. You can use the sample INI file or create a new configuration file.

The format of *<fully qualified file name>* is as follows:

```
[OperationalInformation]
;CA7IMPORT=[<ProjectName1>, <zOSConnectionName1>],[<ProjectName2>, <zOSConnectionName2>]...
;CA7UPDATE=[<ProjectName1>, <zOSConnectionName1>],[<ProjectName2>, <zOSConnectionName2>]...
;TWS=[<ProjectName1>, <zOSConnectionName1>],[<ProjectName2>, <zOSConnectionName2>]...
;CSD=[<ProjectName1>, <zOSConnectionName1>],[<ProjectName2>, <zOSConnectionName2>]...
;IMS=[<ProjectName1>, <zOSConnectionName1>],[<ProjectName2>, <zOSConnectionName2>]...
;Adabas=[<ProjectName1>, <zOSConnectionName1>],[<ProjectName2>, <zOSConnectionName2>]...
;DB2=[<ProjectName1>, <zOSConnectionName1>],[<ProjectName2>, <zOSConnectionName2>]...
;Predict=[<ProjectName1>, <zOSConnectionName1>],[<ProjectName2>, <zOSConnectionName2>]...
;SMF=[<ProjectName1>, <zOSConnectionName1>],[<ProjectName2>, <zOSConnectionName2>]...
;MQ=[<ProjectName1>, <zOSConnectionName1>],[<ProjectName2>, <zOSConnectionName2>]...
```

Attention: In order for the operational information to be taken into account, the comment tag **;** must be removed.

Predefined values for *<Operational task>*:

- Schedulers information: CA7IMPORT, CA7UPDATE, TWS
- TP monitor information: CSD, IMS
- Databases information: ADABAS, DB2, Predict
- Other information: MQ, SMF

4. A log file is generated in `C:\Program Files\IBM Application Discovery Build Client\Bin\Release\Log` folder. The name of the log file is `ADBuildConfiguration_datetime.log`.

Bringing data from mainframe libraries (PDS Libraries, Endevor, Librarian, Natural)

1. Associate a z/OS connection to project (for details see “Associating a z/OS Access Point to a Project” on page 54).
2. Configure the z/OS connection (for details see “Configuring the z/OS Connection” on page 56).
3. Query the environment.
4. Scan files.
5. Scan libraries.

Following is the detailed description of the steps 3-5.

Note: IBM AD Connect for Mainframe uses z/OS Unicode services to convert character data from one code page to another. There are two settings that tell IBM AD Connect for Mainframe which code page to use for the host and the client:

1. HOST CODE PAGE
2. CLIENT CODE PAGE

Each variable is a five digit number, denoted by a Coded Character Set Identifier (CCSID) and established by the Character Data Representation Architecture (CDRA). Usually the CCSID is the same as the code page number used in the informal use. In case there is a doubt in using the correct CCSID, see z/OS Unicode Services User's Guide and Reference, Appendix A. Description of CCSIDs.

Retrieving Source Code Information

About this task

Warning: Before you retrieve the source code information, you must configure the z/OS connection. If you associate the z/OS connection to a project only but you do not configure it, then you cannot retrieve the data.

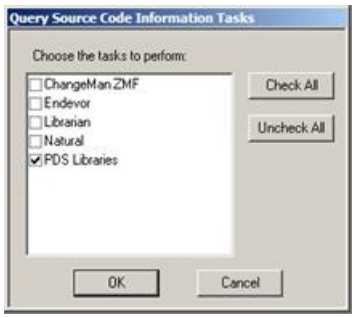
This step reads the contents of the sources (either auto-discovered or manually added) configured as presented in "Configuring the z/OS Connection" on page 56.

Goto **IBM Application Discovery Build Configuration**, select **Projects** tab, then select the project, then select the z/OS node, and then right-click to display the menu.

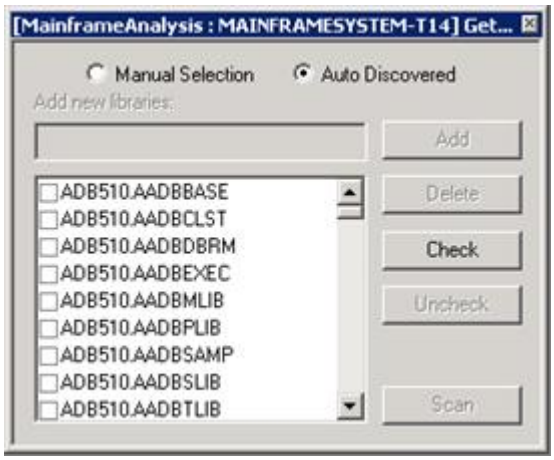
Note: You can run this operation on several projects simultaneously through several z/OS connections. Select all the z/OS connections that you want to use (several connections that are defined for the same project or for different projects) then right-click to display the menu and select the scanning operation that you want to apply. If the scan operation cannot be completed on one or more of the selected z/OS connections, a warning message is displayed but the scanning operation continues for the rest of the selected connections. Also, for each z/OS connection a dialog box offers the possibility of individually selecting the libraries to be scanned.

Procedure

1. Select the **Retrieve Source Code Information** option to display the following window:



If libraries are found on the remote computer, a list of libraries that are automatically discovered are presented.



To scan the libraries added manually, select the **Manual Selection** option. The list is updated to present only those libraries. Select the libraries that you want to include in the scanning process, then press **Scan**. Alternatively, you can manually add a library to the list.

Note: The **Delete** option becomes available if you select a manually added library.

2. If the **PDS Library** option is selected,
   Connect for mainframe brings information about a total of three entities:

   a. Source Library

   b. Source Member

   c. User

   The information refers to libraries and members within the libraries, including member creation date, modification date, and users who modified members.

3. If the **Endevor** option is selected, the scanning window displays a list of libraries that are selected for the scanning operation.
   Connect for mainframe brings information about the following CA Endevor entities:

   a. Endevor members.

   b. Endevor Systems.

   c. Endevor Subsystems.

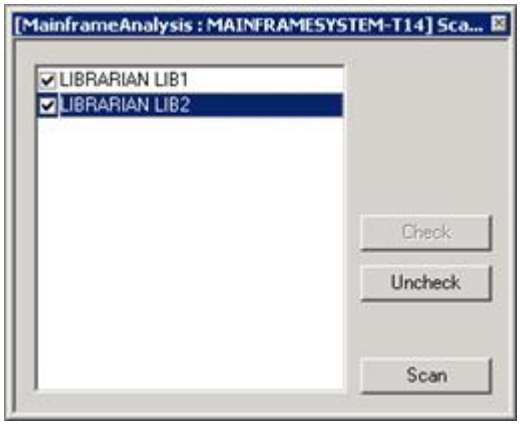
   d. Endevor Environments.

   e. Endevor Stages.

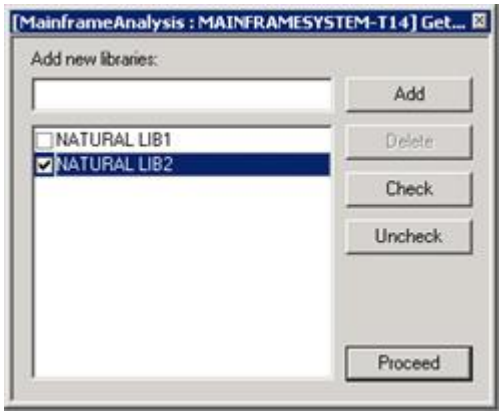
   f. Endevor Types.

   The information refers to System, Subsystem, Environment, Stage, and type.

4. If the **Scan Librarian Libraries** option is selected, the scanning window is displayed.



5. If the **Scan Natural Libraries** option is selected, the scanning window is displayed.



From the list, select the Natural libraries that you want to scan, then click **Proceed**. Alternatively, you can use the **Add new libraries** field to add new libraries to the list of existing ones.

Connect for mainframe brings information about the following Natural entities:

a. Natural Library

b. Natural Member

The information refers to last update date, version, and user name.

6. Before scanning, a confirmation window is displayed: Click **Yes** to start scanning the selected libraries.

   Note: After the operation is finished, 2 log files are generated: One containing the errors (if applicable) the other detailing the operations that are undertaken. These log files are stored in `project name/z0S/logs/z0S name`.

7. Repeat the procedure to scan all the libraries.

Bringing Data From Mainframe Using ChangeMan® ZMF

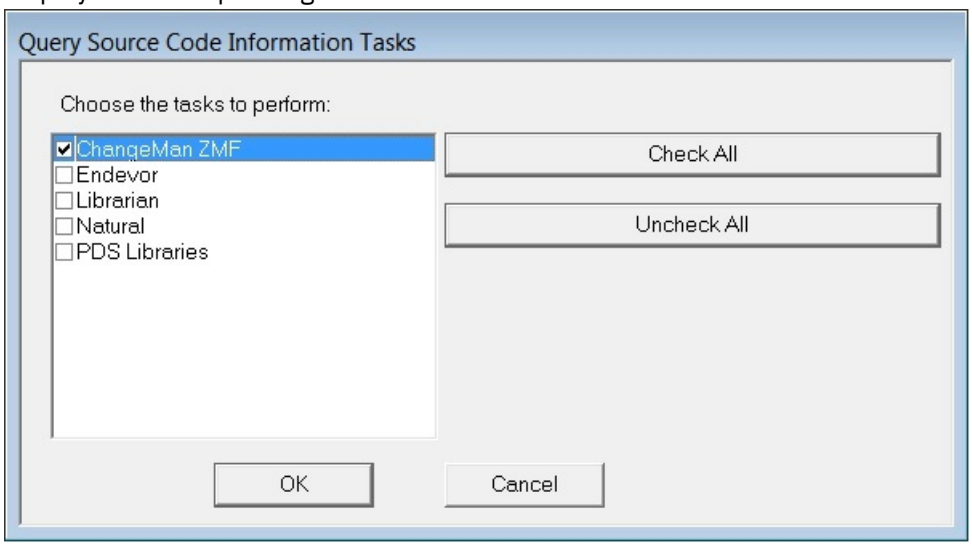
1. Associate a z/OS connection to project (for details see "Associating a z/OS Access Point to a Project" on page 54)
2. Configure the z/OS connection (for details see "Configuring the z/OS Connection" on page 56)
3. Retrieve ChangeMan information.

Following is the description of the step 3.

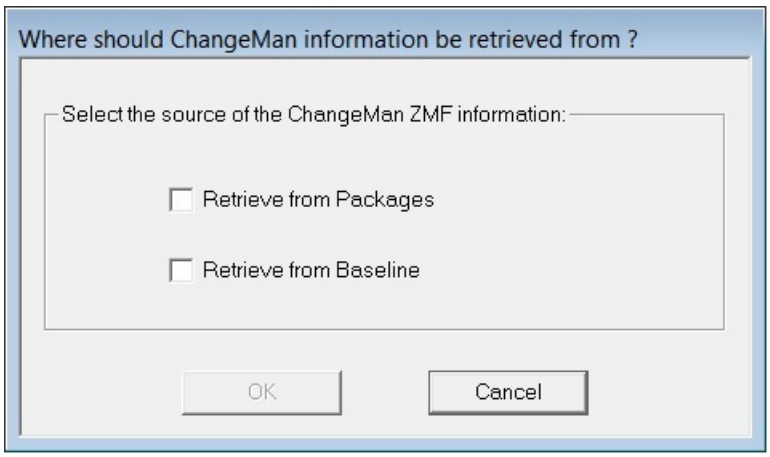
Retrieving ChangeMan® Information

Procedure

1. In the **IBM Application Discovery Build Configuration**, select the project and then right-click to display the corresponding menu. Click **Retrieve source code information**.



2. If applications are configured in the **z/OS Configuration** > **ChangeMan ZMF**, then the next screen is displayed after you click **OK**.



Select **Retrieve from Packages** or **Retrieve from Baseline** or both.

ChangeMan ZMF

The **Connect for Mainframe** brings information about a total of four entities:

a. ZMF Applications.

b. ZMF Components.

c. ZMF Libraries.

d. ZMF Packages.

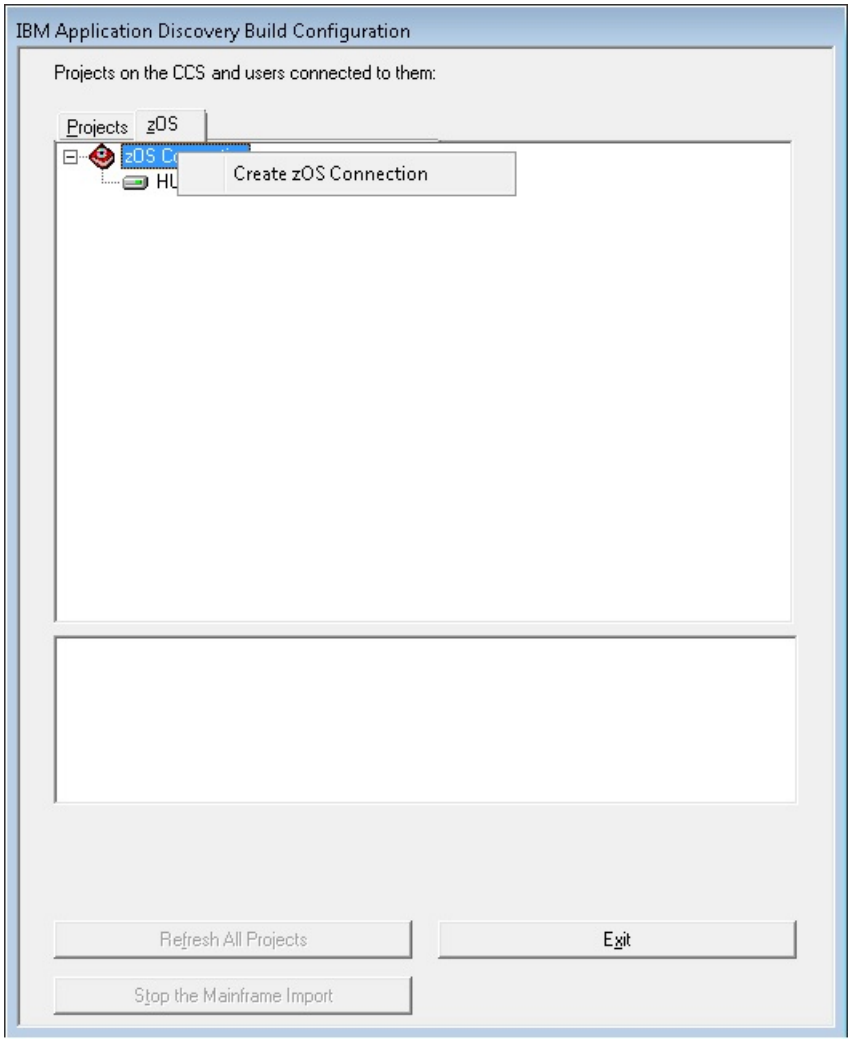
The information refers to Applications, Components, Libraries and Packages, including relationships such as Library to Component, Package to Component, Packages to Application.

If applications are not configured in the **z/OS Configuration** > **ChangeMan ZMF** (**ChangeMan ZMF** tab), a warning message is displayed after you click **OK**.

The zOS Tab

When you work on a project, you might want to use resources that are on a mainframe machine. You can set up your remote connections and associate them to your project, by using the **zOS** option.

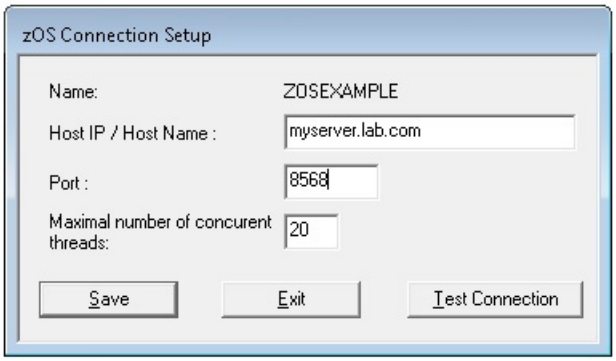
The **zOS** tab presents a list of all the **zOS** connections that are defined and you can modify the existing ones or create new connections.



Create a new zOS Connection

To create a new zOS Connection, follow the steps:

1. Go to **zOS** tab in **IBM AD Build Configuration**, right-click on the **zOS Connection** root and select **Create zOS Connection**. The **Mainframe Access Point Connection** window is displayed.
2. Enter the name for the new **zOS Connection**, then click **OK**.
3. The **z/OS Connection Setup** window is displayed.



Enter the host IP or host name, the port number, and the maximal number of concurrent threads in the corresponding fields, then click **Test Connection** to check the connection to the new Mainframe access point. If the parameters you entered are correct, a confirmation window is displayed.

Note: An existing zOS Connection can be edited or deleted.

Automatic Messaging

When multiple users are connected to the same project and one user changes the folder structure of the project or attempts one of the following operations: **Delete project**, **Associate z/OS**, **Recreate repository**, **Upgrade repository**, **Restart Application Server**, all the other users receive an automatic notification.

Chapter 7. IBM AD Build Client and IBM AD Build Configuration CLI Commands

I. Overview

In the following sections, a list of **IBM AD Build Client** and **IBM AD Build Configuration** batch commands is presented. These commands are used to cover a set of actions such as **Create Projects**, **Upgrade Repositories Structures**, **Build Projects**, **Synchronize Projects**, using CLI commands.

The list of actions that can be performed in the background, use cases and best practices are also available in HTML format.

1. Click **Start**, select **Run** then type **cmd** to open the command window.
2. Go to the folder where your **IBM AD Build Client** is installed and locate `IBMApplicationDiscoveryBuildClient.exe`.
3. Drag `IBMApplicationDiscoveryBuildClient.exe` into the command window then type **/?** and press **ENTER**.

As a result, a web page is displayed containing detailed information.

II. Description of the IBM AD Build Client Batch Commands

1. Creating a new project in background

IBM AD Build Client can be invoked by using two parameters as follows:

```
IBMApplicationDiscoveryBuildClient.exe /np Full path to the .ini configuration file
```

Where:

- **/np** is the parameter responsible for creating a new project.
- The **.ini configuration file** is the file in which the details for creating a new project are defined. The full path to the `.ini` file must be used as a parameter.

The content of the `.ini` file is defined as follows:

```
[ADNewProj]
ProjectName = "name of the project"
Path = "full path of the project including the project's name"
Environment = "zOS"
ProjectLanguages = "DT Cobol,Assembler,Cobol,Natural,PL1,Ads"
DBTypes = "Datacom,IDMS,Adabas,Relational,IMS/DB"
MapTypes = "Natural (LNM),CICS (BMS), IMS/DC (MFS),ADS Map"
ProjectDBType = "SQL/DB2"
CCSEnvironment = "Environment name"
DBServerName = "DB Server Name "blank space" [ip/name:port]"
AttachToDB = "Y/N"
DBName = "dbName"
SchemaName = "schemaName"
```

Notes®:

1. **[ADNewProj]** is the section name and under any circumstances it must **not** be modified.
2. The **Lines** from the `.ini` file can be commented by adding "**;**" (semicolon) at the beginning of each line.
3. The **names** of the following parameters must **not** be modified:

- ProjectName
- Path
- Environment
- ProjectLanguages
- DBTypes
- MapTypes
- ProjectDBType
- CCSEnvironment
- DBServerName
- AttachToDB
- DBName
- SchemaName

4. The **values** for all the parameters must be added between double quotation marks.
5. The **Path** parameter must contain **as value** the full path of the project (the project name included in the path).
6. The **CCSEnvironment** parameter takes as value the **Environment name** as defined in **IBM AD Configuration Server** at the following location: **Home Page** > **Configuration server name** > **Environments** > **"MyEnvironmentName"**.
7. The **DBServerName** parameter takes as value the **Relational database server name** and the **host name or the IP of the computer, including the port** as defined in **IBM AD Configuration Server**. The **DBServerName** parameter has the following format:

   `"Relational Database Server Name "`*`a mandatory blank space`*`" [ip/hostname:port]"`

   Where:

   - **Relational Database Server Name** is defined in **IBM AD Configuration Server** at the following location: **Home Page** > **Configuration server name** > **Environments** > **"MyEnvironment"** > **Relational Database Servers**.
   - **[ip/hostname:port]** is defined in **IBM AD Configuration Server** at the following location: **Home Page** > **Configuration server name** > **Environments** > **"MyEnvironment"** > **Relational Database Servers** > **"MyRelationalDBServer"**. The information is present under the **Host** and **Port** entries.

   Example:

   ```
   DBServerName = "SQLPROD [SQL.PROD.HOST:1433]"
   ```

8. The **AttachToDB** parameter can be set to *Y* or *N* as follows:
   - **Must be set to N** when you create a project on:
     - SQL Server.
     - Db2 on Z, where the project's database doesn't exist and needs to be created.
   - **Must be set to Y** when you use **Db2 on z/OS as a relational database server** and the project you are about to create has a Database and a Schema already created. In this case, you must enter the corresponding values for the **DBName** and **SchemaName** parameters.

For a better understanding and examples, see the Use Cases and Best Practices section.

A sample for the **New Project** `.ini` file is available at the following location: `<IBM AD Build Client installation folder>\Bin\Release\Samples\newProjectBASample.ini`.

The logs for **New project in background** are available at the following location: `<IBM AD Build Client installation folder>\Bin\Release\NewProjInBackLog_timestamp.log`.

2. Repository upgrade

IBM AD Build Client can be invoked in batch mode to upgrade the project's repository (the database's structure) using the following command:

```
IBMApplicationDiscoveryBuildClient.exe /ru  LOG file name  optional parameter: full path to a
file that contains the list of the projects
```

Where:

- **/ru** is the parameter responsible for upgrading the project's repositories (Upgrade Repository).
- **LOG File Name** is the full path of the log file responsible to show the status and progress for the **Repository Upgrade** process. This log file can have any name and may be in any given path (as long as you have read/write access to that path).
- **Optional Parameter: Full path to a file that contains the list of the projects to be upgraded** is the parameter that must be used only when a given number of projects must be upgraded (not all projects are upgraded). This file must contain the name of the projects (as defined in **IBM AD Build Client**) that get their repositories upgraded (one project per line).

  Example for how the optional parameter file looks like:

  ```
  Project1
  Project2
  Project3
  ```

  Note: If the optional parameter is not set, then all of the existing projects will have their repositories upgraded.

For a better understanding and examples, see the Use Cases and Best Practices section.

A sample for the **Repository Upgrade** optional parameter file (list of projects) is available at the following location: `<IBM AD Build Client installation folder>\Bin\Release\Samples \repositoryUpgradeBASample.txt`.

The logs for **Repository Upgrade** are available in the location that is mentioned in the description of **LOG File Name**.

3. Build project in background

IBM AD Build Client can be invoked in batch mode to run a build (full build) by using the following command:

```
IBMApplicationDiscoveryBuildClient.exe /fb ProjectName
```

Where:

- **/fb** is the parameter that is used to invoke the build action.
- **ProjectName** is the name of the project where full build is triggered.

For a better understanding and examples, see the Use Cases and Best Practices section.

The log for **Build in background** is similar to Build in GUI mode. The log can be found under the project's folder as project's name and timestamp. Example: `MyProject1_timestamp.txt`.

4. Periodic Updates for IBM AD Build Projects

IBM Application Discovery projects must be kept up-to-date in terms of the source code and the information that is stored in the repository. For such a use case, **IBM AD Build Client** can be invoked in batch mode by using two different commands as follows:

4.1 To keep the source code up-to-date in the projects by using the **Synchronization** process.

```
IBMApplicationDiscoveryBuildClient /umm1 ProjectName
```

Where:

- **/umm1** is the parameter that is used to invoke the Synchronization process.
- **ProjectName** is the name of the project where the Synchronization process is triggered.

Note: It is mandatory to have the **Synchronize** feature *enabled* in **IBM AD Configuration Server** and the synchronization file configured. To *enable* the **Synchronize** feature, go to **Home Page** > **Install Configurations** > **IBM Application Discovery Build Client** > **Enable Members Synchronization**.

For a better understanding and examples, see the Use Cases and Best Practices section.

A sample for the **Synchronization** file is available at the following location: `<IBM AD Build Client installation folder>\Bin\Release\Samples\synchronizeBASample.txt`.

The logs for **Synchronize** are available under: **Project's Folder** > **Synchronize**.

4.2 To keep the information stored in repository up-to-date by using the **Make** process.

```
IBMApplicationDiscoveryBuildClient /m1 ProjectName /m2 y /m3 y
```

Where:

- **/m1** is the parameter that is used to invoke the Make process.
- **ProjectName** is the name of the project where the Make process is triggered.
- **/m2 (y/n)** refers to whether the make process is forced or not as follows:
  - **/m2 y** means that if another **AD Component is using the project in read mode**, the process starts.
  - **/m2 n** means that if another **AD Component is using the project in read mode**, the process does not start until the project is released.
- **/m3 (y/n)** refers to whether the status of the Make process is logged or not as follows:
  - **/m2 y** means that the **status log file `BatchMakeStatusFile_timestamp.txt`** is generated under the **project's folder**.
  - **/m2 n** means that the **status log file** is not generated.

For a better understanding and examples, see the Use Cases and Best Practices section.

The logs for the **Make** process in background can be found under the project's folder as `BatchMakeStatusFile_timestamp.txt` and `Project'sName_timestamp.text`.

5. Automatically map/add sources from a PC local folder to a virtual folder in IBM AD Build Client

IBM AD Build Client can automatically add all files from a given physical folder to a virtual one (similar to Add all files from folder option that can be found in GUI Mode) by using the following command:

```
IBMApplicationDiscoveryBuildClient.exe /u1 ProjectName /u2 Full path to the .ini file (where
there's the mapping between Virtual and Physical folders
```

Where:

- **/u1** is the parameter that is used to invoke this process.
- **ProjectName** is the project where this process is triggered.
- **/u2** is the full path to the `.ini` file where there's the mapping between virtual and physical folders.

The content of the `.ini` file is defined as follows:

```
Virtual Folder Name as displayed in IBM AD Build Client = Full Path to the physical folder
```

A sample file is available for this process at the following location: `<IBM AD Build Client installation folder>\Bin\Release\Samples\addFilesFromLocalFolderBASample.txt`.

The logs for this process are available under: **Project's Folder** > **UpdateInBackgroundLog_timestamp.txt**.

6. Update API Resolutions usage

IBM AD Build Client can be invoked in batch mode to update **API Resolutions** by using the following command:

```
IBMApplicationDiscoveryBuildClient /uar1 ProjectName
```

Where:

- **/uar1** is the parameter that is used to invoke the update of API Resolutions.
- **ProjectName** is the name of the project where the API Resolutions process is triggered.

Note:

- It is mandatory to have the **API Extensibility** feature *enabled* in **IBM AD Build Client** . To *enable* the **API Extensibility** feature, go to **IBM AD Build Client** > **Project** > **Settings** > **Extensibility** > **Enable API/Macro handling by using a configuration file**.
- The **Update API Resolutions** must be used for the situation when the API Resolution File is modified, so the resolutions must be updated in the repository but without running a full build on the project (which might be time consuming).

The logs for the **Update API Resolutions** usage are available under: **Project's Folder** > **UpdateApiResolutions_timestamp.txt**.

III. Description of the IBM AD Build Configuration Batch Commands

IBM AD Build Configuration can be invoked in batch mode by using the following command:

```
IBMApplicationDiscoveryBuildClient.exe /ba Full path to the corresponding .ini configuration
file
```

Where:

- **/ba** is the parameter that is used to invoke it in batch mode.
- The **.ini configuration file** is the file in which the actions that are executed in batch mode are defined. The full path to the `.ini` file must be used as a parameter.

The content of the `.ini` file is defined as follows:

```
[ProjectsActions]
DeleteProject=PjName1,PjName2
AssociatezOS=[PjName1, zOSConnName1],[PjName2, zOSConnName2]
[OperationalInformation]
CA7IMPORT=[PjName1, zOSConnName1],[PjName2, zOSConnName2]...
CA7UPDATE=[PjName1, zOSConnName1],[PjName2, zOSConnName2]...
TWS=[PjName1, zOSConnName1],[PjName2, zOSConnName2]...
CSD=[PjName1, zOSConnName1],[PjName2, zOSConnName2]...
IMS=[PjName1, zOSConnName1],[PjName2, zOSConnName2]...
Adabas=[PjName1, zOSConnName1],[PjName2, zOSConnName2]...
DB2=[PjName1, zOSConnName1],[PjName2, zOSConnName2]...
Predict=[PjName1, zOSConnName1],[PjName2, zOSConnName2]...
SMF=[PjName1, zOSConnName1],[PjName2, zOSConnName2]...
MQ=[PjName1, zOSConnName1],[PjName2, zOSConnName2]...
```

Notes:

1. **[ProjectsActions]** and **[OperationalInformation]** are the section names and under any circumstances they must **not** be modified.
2. The **Lines** from the `.ini` file can be commented by adding "**;**" (semicolon) at the beginning of each line.
3. The **names** of the following parameters must **not** be modified:
   - DeleteProject
   - AssociatezOS

- CA7IMPORT
- CA7UPDATE
- TWS
- CSD
- IMS
- Adabas
- DB2
- Predict
- SMF
- MQ

4. All the parameters that are mentioned in step 3 accept the following values:
   - **PJName()** is the name of the project.
   - **zOSConnName()** is the z/OS Connection's name that is associated to the project in **IBM AD Build Configuration**.
5. For the parameters that accept two values, such as Associate z/OS and all Operational Information, it is mandatory to keep "**[ ]**" (square brackets) as described in the above template.

For a better understanding and examples, see the Use Cases and Best Practices section.

A sample for the `.ini` file is available at the following location: `<IBM AD Build Client installation folder>\Bin\Release\Samples\BuildConfigurationBASample.ini`.

The logs for **IBM AD Build Configuration** batch commands are available at the following location: `<IBM AD Build Client installation folder>\Bin\Release\Log \ADBuildConfiguration_timestamp.log`.

IV. Use Cases and Best Practices

Make sure that **IBM Application Discovery** is **installed, configured, and up and running** before you get into these use cases.

All the **configurations (files)** that are considered as prerequisites to run the batch commands are put in place and below you can find some best practices and samples that can be applied in any environment.

Details on how and when to use these batch commands are provided and **you can use any scripting method to invoke and execute**, entirely based on your needs.

Note: It is important to follow the same order as shown below when you invoke the **IBM Application Discovery** batch commands.

1. Scheduling periodic updates for IBM AD Build Client projects

Create a batch file that triggers the following actions:

- **Synchronize** (update, add, delete) the existing members in projects **MyProject1**, **MyProject2** , and **MyProject3** so that they are up-to-date.
- Run the **Make** process so that only the modified members (changed, added) are build and the information is refreshed in the repository.

The content of the `.bat` file:

```
IBMApplicationDiscoveryBuildClient.exe /umm1 MyProject1
IBMApplicationDiscoveryBuildClient.exe /umm1 MyProject2
IBMApplicationDiscoveryBuildClient.exe /umm1 MyProject3
IBMApplicationDiscoveryBuildClient.exe /m1 MyProject1 /m2 y /m3 y
IBMApplicationDiscoveryBuildClient.exe /m1 MyProject2 /m2 y /m3 y
IBMApplicationDiscoveryBuildClient.exe /m1 MyProject3 /m2 y /m3 y
```

Note:

- **The `.bat` file can be scheduled** by using, for example, Windows Scheduler, so that it can be triggered on a daily, weekly, or monthly basis (depending on how often the source is changed and needs to be updated). For more information, see "V. Setting up Automatic Updates with Windows Scheduler" on page 84.
- **The Synchronize and Make processes**, depending on the number of changes that are processed, they may be time consuming, therefore, based on your environment, set the scheduler to run when the users are not using the projects for analysis.

2. Automatically upgrade projects repositories and run a build as soon as a new version of IBM AD Build Client is installed

Create a batch file that triggers the following actions:

- **Upgrade the repository** for projects **MyProject1**, **MyProject2**, and **MyProject3** (found in the `RepListofProjects.txt` configuration file).
- **Execute a build (full build)** on the mentioned projects.

The content of the `.bat` file:

```
IBMApplicationDiscoveryBuildClient.exe /ru  "\\AppServer\IBMAD\Conf\Logs\RepUpgrade.log" "\
\AppServer\IBMAD\Conf\RepListofProjects.txt"
IBMApplicationDiscoveryBuildClient.exe /fb MyProject1
IBMApplicationDiscoveryBuildClient.exe /fb MyProject2
IBMApplicationDiscoveryBuildClient.exe /fb MyProject3
```

3. End to end flow in IBM AD Build: Create new projects, associate an existing z/OS Connection to projects, get the source code based on the host in PDS libraries and Endevor SCM (by using the Synchronize feature), build projects

Create a batch file that triggers the following actions:

- **Create three new projects**: **MyProject4**, **MyProject5**, and **MyProject6** (as configured in `MyProject4.ini`, `MyProject5.ini` and `MyProject6.ini`).
- **Associate the existing z/OS Connection**: **Lpar1** to the newly created projects (as defined in `zOSConf.ini`).
- **Get the source code from the host** for the mentioned projects by using the **Synchronization** feature (as configured in `SyncProjectConf.txt`).
- **Run a build (full build)** on the mentioned projects.

The content of the `.bat` file:

```
IBMApplicationDiscoveryBuildClient.exe /np "\\AppServer\IBMAD\Conf\MyProject4.ini"
IBMApplicationDiscoveryBuildClient.exe /np "\\AppServer\IBMAD\Conf\MyProject5.ini"
IBMApplicationDiscoveryBuildClient.exe /np "\\AppServer\IBMAD\Conf\MyProject6.ini"
IBMApplicationDiscoveryBuildConfiguration.exe /ba "\\AppServer\IBMAD\Conf\zOSConf.ini"
IBMApplicationDiscoveryBuildClient.exe /umm1 MyProject4
IBMApplicationDiscoveryBuildClient.exe /umm1 MyProject5
IBMApplicationDiscoveryBuildClient.exe /umm1 MyProject6
IBMApplicationDiscoveryBuildClient.exe /fb MyProject4
IBMApplicationDiscoveryBuildClient.exe /fb MyProject5
IBMApplicationDiscoveryBuildClient.exe /fb MyProject6
```

4. Delete one or a set of projects in batch mode

Run as standalone or create a batch file that deletes projects **MyProject4** and **MyProject6** (as configured in `DeletePj.ini`).

```
IBMApplicationDiscoveryBuildConfiguration.exe /ba "\\AppServer\IBMAD\Conf\DeletePj.ini"
```

V. Setting up Automatic Updates with Windows Scheduler

About this task

The Windows Scheduler can be used to run automatic, periodic updates to make sure that the resources you are working on are always up-to-date.

Procedure

1. To set up the automatic updates in **Windows Scheduler**, select **Start** > **Control Panel** > **Administrative Tools** > **Task Scheduler**. If you're prompted for an administrator password or confirmation type the password or provide the confirmation.
2. Select the **Action** menu then click the **Create Basic Task**. Type a name for the task and an optional description then click **Next**.
3. Do one of the following actions.
   - To select a schedule based on the calendar, click **Daily**, **Weekly**, **Monthly**, or **One time**, click **Next**; specify the schedule that you want to use, and then click **Next**.
   - To select a schedule based on common recurring events, click **When the computer starts** or **When I log on**, and then click **Next**.
   - To select a schedule based on specific events, click **When a specific event is logged**, then click **Next**. Specify the event log and other information by using the menu lists, and then click **Next**.
4. To schedule a program to start automatically, click **Start a program**, and then click **Next**.
5. Click **Browse** to find the program you want to start, and then click **Next**. Click **Finish**.

   Note: The `*.bat` file present in the "IV. Use Cases and Best Practices" on page 82 section can be used in the scheduler.

Appendix 1 - API Extensibility Tutorial

This tutorial shows you how the analysis of an API call is supported by the extensibility feature with sample files. You can also learn how to enable API call analysis for your own projects.

API Extensibility Sample Files

To help you get started with the API extensibility feature, the following sample files are provided in the AD installation package:

COBOL program files

The sample COBOL programs that contain API calls. You can find the program files in the `Cobol` folder.

`SQLCALL1.cbl`

The main COBOL program. The SQLCALL1 program calls the SQLGET program to perform calls based on program IDs 1, 2, 3, and 4.

`SQLGET.cbl`

The API program that performs a call to retrieve the program name of a specific program according to the program ID. The information that the SQLGET program needs to determine the called program is stored in a database table.

Java™ utility files

The sample Java utilities that are used to resolve the API call in sample programs SQLCALL1 and SQLGET. You can find the utility files in the `\Java User Exit\src\com\ibm\ez\resolver \utility` folder.

`ResolveCallUtility.java`

The Java utility that is used as a user exit to resolve the API call. This utility performs the following actions:

1. Parsing the input JSON file that is automatically generated at run time. For the schema of the input JSON file, see the `\Input and Output JSON Schema\utility-input-schema.json` file.
2. Using the SqlDataAccess utility to retrieve data.
3. Generating the output JSON file that contain the resolution of the API call. For the schema of the output JSON file, see the `\Input and Output JSON Schema\utility-output-schema.json` file.
4. Storing the input and output JSON files.

`SqlDataAccess.java`

The Java utility that is used to retrieve data from an SQL server according to the program ID. A database that is named DynamicCallPgms and a table that is named ProgramToCall are used. The following image shows the values in the ProgramToCall table:

Results | Messages

	ProgramID	ProgramName
1	1	Program1
2	2	Program2
3	3	Program3
4	4	Program4

JAR files

The sample JAR files that are used to resolve the API call in sample programs SQLCALL1 and SQLGET: `sqljdbc42.jar` and `json-simple-1.1.1.jar`.

`Build.bat`
The sample file that can be used to compile sample Java utilities ResolveCallUtility and SqlDataAccess. You can find the file in the `Java User Exit` folder.

API extensibility configuration files
The sample JSON files that are used to configure the API extensibility settings. Two types of the configuration files are required to enable the API extensibility feature: API Config and User Exits Config. You can find the configuration files in the `AD Extensibility JSONs` folder.

`Api_Config.json`
The sample API Config configuration file that specifies the API program name, which is SQLGET, and the following two parameters that are required:

programKey
The value that is passed to the SQLGET program at run time through the *PGM-TOCALL-ID* variable to resolve the called program.

data
The value that is passed to the SQLGET program at run time through the *PGM-DATA* variable to resolve the called program.

`ue-config.json`
The User Exits Config configuration file that specifies the following user-exit-related settings:

- The ResolveCallUtility Java utility, which is used as a user exit to resolve the API call.
- The class path of the `sqljdbc42.jar` and `json-simple-1.1.1.jar` JAR files.
- The *###* notation that is replaced with a dynamically generated input JSON file name for each call at run time.
- The path to store the automatically generated input JSON files. The input files are parsed and stored by the ResolveCallUtility utility. This setting is optional and for debug purposes.
- The path to store the output JSON files that are generated by the ResolveCallUtility utility.

Input JSON files
The sample input files that are automatically generated at run time, and parsed by the sample Java utility ResolveCallUtility to retrieve the program IDs. You can find the input files in the `Input and Output JSON samples` folder.

Output JSON files
The sample output files that are generated by the sample Java utility ResolveCallUtility to specify the called program names. You can find the output files in the `Input and Output JSON samples` folder.

Schema JSON files
The files that describe the schemas of the sample input and output JSON files. You can find the schema files in the `Input and Output JSON Schema` folder.

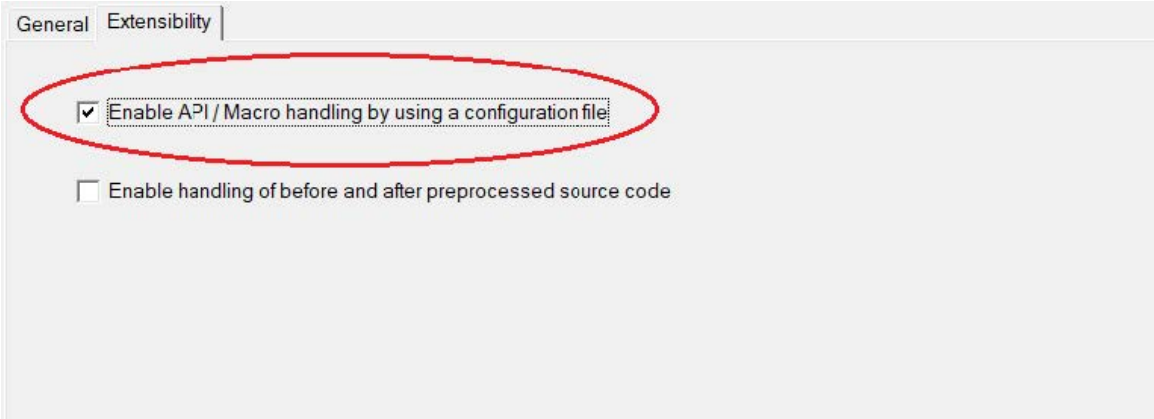
Setting Up a Build with Sample Files

The API call analysis is supported by the AD extensibility feature. You can try out the feature by setting up a build with the API extensibility sample files. For more information about the sample files, see topic "API Extensibility Sample Files" on page 85.

Procedure

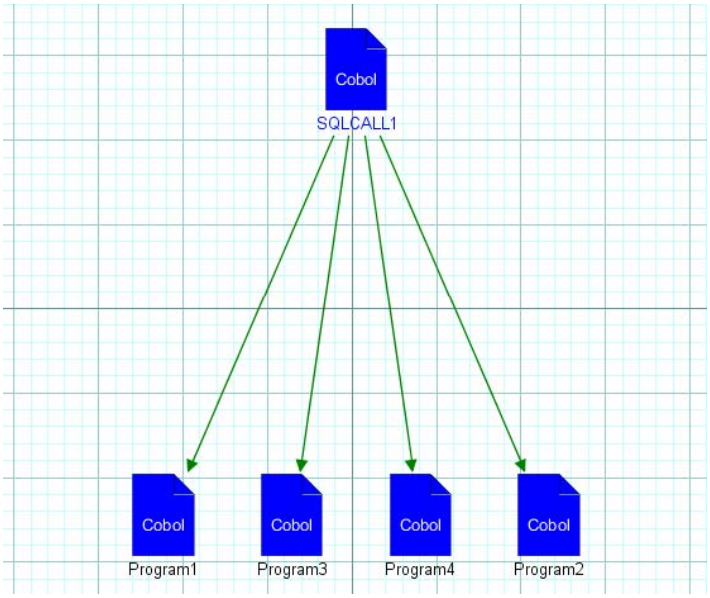
1. Create an AD project, and add the sample program files `SQLCALL1.cbl` and `SQLGET.cbl` into the project.
   - For more information about creating a project, see topic "Creating a Project" on page 10.
   - For more information about adding files into a project, see topic "Adding Files to Project Folders" on page 16.

2. Enable the API extensibility feature. After the API extensibility feature is enabled, the `API Config` virtual folder is added into the project. This folder is used to store the extensibility configuration files.
   a. Click **Project > Settings > Extensibility**.
   b. In the **Extensibility** pane, select the "Enable API/Macro handling by using a configuration file" check box.

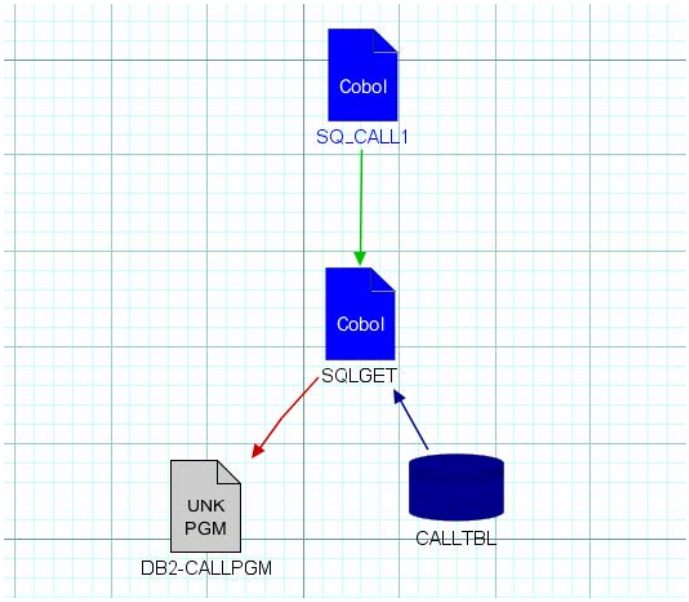


   c. Click **OK**.
3. Add the following two sample files into the `API Config` virtual folder of the project. The files are the API extensibility configuration files.
   - `Api_Config.json`
   - `ue-config.json`
4. Modify the paths in the `ue-config.json` file according to your settings.
   - Modify the class path of the sample JAR files according to your local environment.
   - Specify a path to store the input JSON files. This setting is optional and for debug purposes.
   - Specify a path to store the output JSON files.
5. Build the project. For more information about building an AD project, see topic "Building Projects" on page 22.

With the API extensibility feature enabled, after a project build is completed, the following callgraph is generated for the SQLCALL1 program. In addition to the standard output log file, an extensibility log file is generated by the build process and stored in the *<User folder name>*`\AD\comp\log` folder.



Without the API extensibility feature enabled, after a project build is completed, the following callgraph is generated for the SQLCALL1 program:



Extending from Sample Files to Your Projects

To support API call analysis for your own projects, you must create a user exit and API extensibility configuration files. The API extensibility sample files are provided as examples. Follow the steps in topic "Setting Up a Build with Sample Files" on page 86 to set up, but replace the sample files with your own project files. For more information about the sample files, see topic "API Extensibility Sample Files" on page 85.

Creating a user exit

The following functions must be implemented in your user exit:

- Reading and parsing an input JSON file.
- Resolving the API call by using the input JSON file and any additional metadata that is needed.
- Returning an output JSON file that specifies the resolution.

Creating API extensibility configuration files

Two types of the configuration files are required to enable the API extensibility feature: API Config and User Exits Config.

API Config
Specifies the API calls to be analyzed, the API call parameters, and for which one of these parameters, the values are needed.

User Exits Config
Contains a list of API calls and the path to your user exit.

Appendix 2 - Log Files Location

IBM AD Build Configuration

The log files for **IBM AD Build Configuration** are available at the following locations and have these name formats:

- **Installation Log**
  - `<Installation Path> \install.log`
- **COM+ Applications**
- **Event Viewer**

IBM AD Build Client

The log files for **IBM AD Build Client** are available at the following locations and have these name formats:

- **Installation Log**
  - `<Installation Path>\Log`
- Error messages that are displayed in **IBM AD Build Client**.
- **Build log**.
  - `<Project Path>\<ProjectName>\<ProjectName>.txt`
- **Event Viewer**.
- **Mainframe process (z/OS Logs)**.
  - **Scan Libraries**.
    - <z/OS Connection Data Path>\Logs\<z/OS name>\MF_Import.log and MF_Errors.log
  - **Add/Update files from Mainframe**.
    - `< Path for the retrieved members>\ Mainframe Library Members\ <z/OS name> \GetMFMemberSources.log`, `UpdateMFMemberSources.log`.
    - `< Path for the retrieved members>\ Mainframe Library Members\ SummaryGetMFMemberSources.log`, `SummaryUpdateMFMemberSources.log`.
- **Background Actions**
  - **Make Project**.
    - `<Project Path>\<ProjectName>\ BatchMakeStatusFile.txt`

      This log file is generated when valid command line parameters are used.
    - `<IBM Application Discovery Build Client installation folder>\Bin\Release\ BatchMakeErrFile.txt`

      This log file is generated when invalid command line parameters are used.
  - **Update Project**
    - `<Project Path>\<ProjectName>\ UpdateInBackgroundLog.txt`
  - Update Modified Mainframe Members.
    - `< Path for the retrieved members >\ Mainframe Library Members\ BackgroundUpdateMFMemberSources.log`

Synchronize Members Process Log Files

The following log files are generated:

- `<Project Folder>\ Synchronize\SynchronizeMembersProgress_<timestamp>.log`

  This log records the actual progress of the process (parsing the configuration file, validating the configuration file). This method is useful when the process is run in background.

- `<Project Folder>\ Synchronize\SynchronizeMembersSummary_<timestamp>.log`

  This log is generated at the end of the process and records the modified, added, and deleted member files.

- `<Project Folder>\ Synchronize\SynchronizeMembersExtendedInfo_<timestamp>.log`

  This log is generated at the end of the process and consolidates detailed log files. See "Detailed Log Files Location" on page 90 for the source logs.

Detailed Log Files Location

The log files are available at the following locations:

- **Scan libraries** - `<Project Folder>\<z/OS>\<Logs>\<z/OS name>\MF_Import_<timestamp>.log`.
- **Scan libraries** - `<Project Folder>\<z/OS>\<Logs>\<z/OS name>\MF_Errors_<timestamp>.log`.
- **Update mainframe members** - `<Path For The Retrieved Members>\Mainframe Library Members\SummaryUpdateMFMemberSources_<timestamp>.log`.
- **Update mainframe members** - `<Path For The Retrieved Members>\Mainframe Library Members\<z/OS name>\UpdateMFMemberSources_<timestamp>.log`.
- **Update mainframe members** - `<Path For The Retrieved Members>\Mainframe Library Members\<z/OS name>\BackgroundUpdateMFMemberSources_<timestamp>.log`.
- **Add/Remove files from project** - `<Project Folder>\UpdateInBackgroundLog_<timestamp>.txt`.
- **Configuration file validation** - `<Project Folder>\Synchronize\ConfigFileValidation_<timestamp>.log`.

Appendix 3 - Synchronize Members Configuration File Examples

The configuration file is intended to instruct **IBM AD Build Client** on whether it needs to update against specific libraries, where to add/remove the related members in/from the project (that is, which virtual folder to use) and also which type of members **IBM AD Build Client** must use when you add members. The basic assumption is that the specified libraries do not contain members that do not have to be added even though they are there.

The configuration file must contain the following parameters:

<Project name>, <Library type >, <Library name>, <Mapped virtual folder>, <Members type >, <z/OS> ,Application

Project name
The name of the project that needs to be synchronized with the mainframe system.

Library type
The type of the library from which members are added.

Library name
The name of the library against which the synchronization takes place.

Mapped virtual folder
The name of the project folder where the members are added/updated/deleted.

Members type
The type of the members that are synchronized. The allowed types are presented in the **Member types names** table.

z/OS
The name of the connection to the mainframe system, as defined in the **zOS** tab of the **IBM Application Discovery Build Configuration** window. For more information, see “The zOS Tab” on page 74.

Application
The name of the application as defined for ChangeMan ZMF in **zOS Configuration** screen.

Following are some examples for configuration files, based on Library types.

Note: Each line in the configuration file must contain a unique <Project name>, <Library type >, <Library name>, <Mapped virtual folder>, <z/OS> tuple. If not, the configuration file is invalidated. Also, if the synchronization process runs for more than one Library/Project, a unique line must be added for each project that needs synchronization.

To comment a line in the configuration file, add ***** at the beginning of that line.

PDS Library- <PROJECT>, PDS(MVS™), ITLS.COBOL.II, z/OS Cobol, COBOL_MVS, zOSCONN

Endevor- <PROJECT>, Endevor, SMPLTEST.EZLPROJ.EZLCOMP.COBOL.T, z/OS Cobol, COBOL_MVS, zOSCONN

ChangeMan Baseline- <PROJECT>, SERENA CHANGEMAN BASELINE, EZL.SERENA.SYNC.EZLX.COB, z/OS Cobol, COBOL_MVS, zOSCONN, EZLX

ChangeMan Package- <PROJECT>, SERENA CHANGEMAN PACKAGE, EZLX000020, z/OS Cobol, COBOL_MVS, zOSCONN

Available library and SCM types- PDS(MVS), Endevor, SERENA CHANGEMAN BASELINE, SERENA CHANGEMAN PACKAGE

Member types names:

Virtual Folder	FileTypeName
AAuto Scheduling	AAUTO_SCHEDULING
AAuto Scheduling	AAUTO_DS_FLAG_REPORT
ADS Dialog	ADS_DIALOG
ADS Map	ADS_MAP
ADS Process	ADS
Assembler	ASSEMBLER
Assembler Include	ASSEMBLER_INCLUDE
Assembler Macro	ASM_MACRO
BMS	BMS
Cobol IDMS	COBOL_IDMS
Cobol IDMS Record	COBOL_IDMS_RECORD
Cobol Include	COPY
Configuration	CSD
Configuration	IMST_PGM
Configuration	JCL_PGM
Configuration	PGM_ALIAS
Data Area	LDA
DBD	DBD
IMS Map	MFS
JCL	JCL
JCL Control files	JCL_CTRL
JCL Include	JCL_INCLUDE
JCL Processes	JCL_PROCLIB
Log	LOG
MQ	MQ_CONFIG
Natural	NATURAL
Natural Include	NATURALINCLUDE
Natural Map	NATURALMAP
PL1	PL1
PL1 IDMS Record	PL1_IDMS_RECORD
PL1 Include	PL1_INCLUDE
PSB	PCB
Schema	SCHEMA
Subschema	SUBSCHEMA
zOS Cobol	COBOL_MVS

Virtual Folder	FileTypeName
PreProc Before	EXTENS_PREPROC_BEFORE
PreProc MetaData	EXTENS_PREPROC_META
PreProc Config	EXTENS_PREPROC_CONFIG

Validation configuration files examples.

`ProjectMapping.txt`

This file is the configuration file for defining the Project Name, Serena Application Name, and the Subsystem that is used for the validation process. Valid means that the format is correct and the Project does exist.

```
<Project Name>, <Serena Application Name>, <Subsystem> (comma separated values)
```

`IncludesOrder.txt`

This file is the configuration file for defining the Baseline Libraries types and the order, of Cobol Includes locations. This configuration file is used later on while you set up the path for the Cobol Include folders.

```
<type>,<type1>,….<typen>
```

Note: It is EXTREMELY important to add the types in the order in which the include files must be looked after.

`FoldersMapping.txt`

This file is the configuration file for defining a mapping between a Logical Folder of the project and the type of a member that is part of the validation process. This configuration file is used during the validation stage of the Synchronize Members process.

```
<Member Type>,<Logical folder>
```

`ServicePort.txt`

This file is the configuration file for defining the Service's port. If you use a firewall, make sure that the port is added as an exception.

```
<Port Number>
```

Appendix 4 - Extensibility JSON/Configuration File Examples

Schema JSON files and examples of creating configuration JSON files are provided in this appendix.

Preprocessing Extensibility Examples

Examples are provided to show how metadata JSON files and configuration files must be created to integrate their business-specific cases in the analysis.

The following use case is for the situation when a user uses the `%Call using CICS XCTL` and #Copybook macros in a before file.

Before file example: PREPROC.bef

```
       IDENTIFICATION DIVISION.
       PROGRAM-ID.
PREPROC.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
        01  FIRST-NAME PIC X(09).
        01  COMMAREA-FOR-PROG2 PIC X(09).
       PROCEDURE DIVISION.
          MOVE 'TEST-NAME' TO FIRST-NAME.
      CALL 'PROG1'
                USING FIRST-NAME.
         %Call using CICS XCTL
             #Copybook
```

After file example: PREPROC.cbl

```
       IDENTIFICATION DIVISION.
       PROGRAM-ID.
PREPROC.

       DATA DIVISION.
       WORKING-STORAGE SECTION.
        01  FIRST-NAME PIC X(09).
        01  COMMAREA-FOR-PROG2 PIC X(09).
       PROCEDURE DIVISION.
          MOVE 'TEST-NAME' TO FIRST-NAME.
          CALL 'PROG1'
                USING FIRST-NAME.
           EXEC CICS XCTL PROGRAM('PROG2')
               COMMAREA(COMMAREA-FOR-PROG2)
               LENGTH(38) END-EXEC.
          CALL 'PROG3'
                USING FIRST-NAME.
```

The following lines in the after file are from Copybook:

```
          CALL 'PROG3'
                USING FIRST-NAME.
```

JSON file used for mapping: PREPROC.meta

```
{
    "info":
    {
        "version":"1.0.0"
    },

    "metadata":
    [
```

```
        {
            "pathType": "PC",
            "beforePath":"C\\BeforeFolder\\PREPROC.bef",
            "afterPath":" C\\AfterFolder \\PREPROC.cbl",

          "diffResolution":
          [

            {
              "afterPos":
              {
                "startLine": 1,

                "endLine": 10

              },

              "beforePos": {
                "startLine": 1,

                "endLine": 10

              }

            },

            {
              "afterPos": {
                "startLine": 11,

                "endLine": 13

              },

              "beforePos":
              {
                "startLine": 11,

                "endLine": 11
              }

            },
                       {
              "afterPos":
              {
                "startLine": 14,

                "endLine": 15

              },

              "beforePos": {
                "startLine": 1,

                "endLine": 2
                },
              "type": "INCLUDE",
              "path": "C\\CopybooksFolder\\Copybook",
              "includeStmtPos": {

                "includeStmtPath": " C\\BeforeFolder\\PREPROC.bef",
                "includeStmtLine": 12

              }

            }

          ]
        }
    ]
}
```

Configuration file example

The configuration file contains the information of the mappings between before files, metadata files, after files, and the extensions for each type of the files:

```
"C\BeforeFolder1\" | "C\MetaFolder1\" | " C\AfterFolder1\" | ".bef" | ".meta" | ".cbl"
"C\BeforeFolder2\" | "C\MetaFolder2\" | "C\AfterFolder2\" | ".cbl" | ".meta" | ".after"
"C\BeforeFolder3\" | "C\MetaFolder3\" | "C\AfterFolder3\" | ".cbl" | ".meta" | ".after"
```

Extensibility preprocessing JSON schema

```
{
  "$schema": "http://json-schema.org/draft-06/schema#",
  "title": "AD Extensibility preprocessing definition file",
  "type": "object",

  "properties": {
    "info": {
      "type": "object",
      "properties": {
        "version": {
          "type": "string",
          "description": "Version of the preprocessing metadata format",
          "pattern": "^[0-9]+\\.[0-9]+\\.[0-9]+\\."
        }
      },
      "required": [ "version" ],
      "additionalProperties": false
    },

    "metadata": {
      "type": "array",
      "items": {
        "type": "object",
        "properties": {
          "pathType": {
            "type": "string",
            "description": "Format of the before and after file paths: local or mainframe",
            "enum": [
              "PC",
              "MF"
            ]
          },
          "beforePath": {
            "type": "string",
            "description": "Path of the original source",
            "minLength": 1
          },
          "afterPath": {
            "type": "string",
            "description": "Path of the preprocessed source",
            "minLength": 1
          },
          "diffResolution": {
            "type": "array",
            "description": "Ordered list of correspondences between lines in the after file and lines in the before file",
            "items":
            {
              "oneOf": [
                        {
                            "$ref": "#/definitions/diffResolutionType1"
                        },
                        {
                            "$ref": "#/definitions/diffResolutionType2"
                        }
                    ]
            }
          }
        },

        "required": [ "pathType", "beforePath", "afterPath", "diffResolution" ],
        "additionalProperties": false
      }
    }
  },

  "required": [
    "info",
    "metadata"
  ],

    "definitions":
  {
    "position": {
      "type": "object",
      "description": "Interval of lines in the source file",
      "properties": {
        "startLine": {
          "type": "integer",
          "description": "Starting line of the interval",
          "minimum": 1
        },
        "endLine": {
          "type": "integer",
          "description": "Ending line of the interval",
          "minimum": 1

        }
      },
      "required": [ "startLine", "endLine" ],
      "additionalProperties": false
    },
```

```
    "diffResolutionType1":
    {
      "type": "object",
      "properties": {
        "type": {
          "type": "string",
          "description": "The type of line mapping, if a special mapping is required",
          "enum": [
            "INCLUDE"
          ]
        },
         "includeStmtPos" : {
          "description": "Position of the include statement",
          "type": "object",
          "properties":
          {
            "includeStmtPath": {
              "type": "string",
              "description": "Path of the statement occurence",
              "minimum": 1
            },
            "includeStmtLine": {
              "type": "integer",
              "description": "Line of the statement occurence",
              "minimum": 1

            }
          },
          "required": [ "includeStmtPath", "includeStmtLine" ],
          "additionalProperties": false
        },
        "path": {
          "type": "string",
          "description": "Path to the source of the lines, if a special type of mapping was specified",
          "minLength": 1
        },

        "beforePos": {
          "description": "Position in the before file source",
          "$ref": "#/definitions/position"
        },
        "afterPos": {
          "description": "Position in the after file source",
          "$ref": "#/definitions/position"
        }
      },

      "required": [ "type", "path", "beforePos", "afterPos" , "includeStmtPos"],
      "additionalProperties": false
    },

    "diffResolutionType2": {
      "type": "object",
      "properties": {
        "beforePos": {
          "description": "Position in the before file source",
          "$ref": "#/definitions/position"
        },
        "afterPos": {
          "description": "Position in the after file source",
          "$ref": "#/definitions/position"
        }
      },

      "required": [ "beforePos", "afterPos" ],
      "additionalProperties": false
    }
  }
}
```

API/Macro Call Extensibility Examples

API Call/Macro Extensibility Use Cases

The purpose of this chapter is to help users understand how the Configuration files must be created in order to integrate their business specific cases in the analysis.

API Programs for calling utilities Use case

This use case is created to cover the situation when the API programs are used to call a program that is defined through one of the initial call parameters. The following represents the **Sample1** Cobol program:

```
IDENTIFICATION DIVISION.
       PROGRAM-ID. Sample1.
      *
       ENVIRONMENT DIVISION.
      *
       DATA DIVISION.
      *
       WORKING-STORAGE SECTION.
        01 VAR1 PIC X(06).
        01 VAR2 PIC X(06).
        01 VAR3 PIC X(08).
```

```
        01 VAR4 PIC X(08).
        01 X PIC X(08).

       PROCEDURE DIVISION.
          MOVE  'VALUE1'  TO VAR1
        MOVE  'VALUE2'  TO VAR2
       CALL 'API1' USING VAR1, VAR2, VAR3, VAR4.
```

The **Sample1** Cobol program contains a call to a specific API program named **API1**.

In case a call to the **API1** program has to be interpreted as a call to the value of the first call parameter (**VALUE1**) , the following Configuration Files containing the rules for the new resolution are to be used.

Note: The `API_Config.json` file specifies that the fist parameter has to be saved with its value while for the rest of parameters there is no need for their values.

```
{
    "info":
   {
       "version":"5.0.4.1"
   },
    "extensions":
    [
        {
           "apiKey": "a1",
           "name": "API1",
           "type": "call",
           "parameters":
           [
              {
                 "position":1,
                 "label": "program",
                 "resolve": true
              },
              {
                 "position":2,
                 "label": "accessType",
                 "resolve": false
              },
           {
                "position":3,
                "label": "outputVariable",
                "resolve": false
              },
              {
                "position":4,
                "label": "inputVariable",
                "resolve": false
              }
           ]
        }
    ]
}
```

The `ue-config.json` file specifies the type of user exit file (for v5.0.4, only `.Json` file is supported) and the path where the user exit file is located.

```
{
  "schemaVersion":"1.0.1",
  "documentVersion":"1.0.1",
  "ueConfig" :[
   {"name": "uejson",
    "type":"file-json",
    "location":"location/of/the/file/which/contains/the/resolution.json",
    "appliesTo":["a1"]
   }
]
}
```

The `resolution.json` file specifies that the API1 call is replaced with a call to a Cobol program, it's name is resolved in the first parameter and parameters 2, 3 and 4 are only referred.

```
{
    "schemaVersion": "1.0.1",
    "documentVersion": "1.0.1",
    "entries": [{
```

```
        "input": {
            "apiKey": "a1",
            "apiText": "API1",
            "params": [{
                    "paramKey": "program",
                    "paramMode": "byValue"
                },
                {
                    "paramKey": "accessType",
                    "paramMode": "byRef"
                },
                {
                    "paramKey": "outputVariable",
                    "paramMode": "byRef"
                },
                {
                    "paramKey": "inputVariable",
                    "paramMode": "byRef"
                }
            ]
        },
        "resolutions": [{
            "action": "call",
                    "target": {
                "resourceType": "CobolProgram",
                "paramKey": "program",
                "paramMode": "byValue",
                "read": true
            },
            "resources": [{
                    "resourceType": "Variable",
                    "paramKey": "accessType",
                    "paramMode": "byRef",
                    "read": true
                },
                {
                    "resourceType": "Variable",
                    "paramKey": "outputVariable",
                    "paramMode": "byRef",
                    "read": true
                },
                {
                    "resourceType": "Variable",
                    "paramKey": "inputVariable",
                    "paramMode": "byRef",
                    "read": true
                }
            ]
        }]
    }]
}
```

API Programs for Data Access Use Case

This use case is created to cover the situation when the API programs are used to perform SQL Select and SQL Delete on specified fields from TABLE1 and TABLE2 SQL tables defined in the Cobol program. The following represents the **Sample2** Cobol program.

```
IDENTIFICATION DIVISION.
       PROGRAM-ID. Sample2.
      *
       ENVIRONMENT DIVISION.
      *
       DATA DIVISION.
       WORKING-STORAGE SECTION.

        EXEC SQL DECLARE TABLE1 TABLE
           ( COL11                          CHAR(7),
             COL12                         CHAR(10)
           )END-EXEC.

        EXEC SQL DECLARE TABLE2 TABLE
           ( COL21                          CHAR(7),
             COL22                         CHAR(10)
           )END-EXEC.

       01  VALUE1-DATA.
         03 VALUE1-DATA  PIC S9(6).
       01  VALUE2-DATA.
      03 VALUE2-DATA  PIC S9(6).
```

```
       01  FIRST-PARAM.
         03 ACCESS-ID PIC S9(6).

       PROCEDURE DIVISION.

        MOVE 'VALUE1' TO ACCESS-ID
        MOVE 'AAAAAA' TO VALUE1-DATA
        CALL 'API2' USING FIRST-PARAM
                          VALUE1-DATA.

        MOVE 'VALUE2' TO ACCESS-ID
        MOVE 'AAAAAA' TO VALUE2-DATA
        CALL 'API2' USING FIRST-PARAM
                          VALUE2-DATA.
```

The first call to the API2 program has to be interpreted as an SQL Select performed on fields *COL11* and *COL12* from **TABLE1 SQL** table. This action is specified by the value of the second API call parameter **VALUE1**.

The second call to the API2 program has to be interpreted as an SQL Delete performed on fields from **TABLE SQL** table. This action is specified by the value of the second API call parameter **VALUE2**.

The second call to the API2 program has to be interpreted as an SQL Delete performed on fields from **TABLE SQL** table. This action is specified by the value of the second API call parameter **VALUE2**.

```
{
    "info":
   {
      "version":"5.0.4.1"
   },
    "extensions":
    [
        {
           "apiKey":"a1",
           "name":"API2",
           "type": "call",
           "parameters":
           [  {
                "position":1,
                "label": "p1",
                "resolve": true,
                "locator":{
                "offset":1,
                "length":9
                  }
                  },
                  {
                "position":2,
                "label": "p2",
                "resolve": true,
                "locator":{
                "offset":1,
                "length":9
                  }
                  },
                  {
                "position":2,
                "label": "p3",
                "resolve": false
                  },
                  {
                "position":2,
                "label": "p4",
                "resolve": false
                  }
           ]
        }
    ]
}
```

The `ue-config.json` file specifies the type of user exit file (for v5.0.4, only `.Json` file is supported) and the path where the user exit file is located.

```
{
  "schemaVersion":"1.0.1",
  "documentVersion":"1.0.1",
  "ueConfig" :[
```

```
   {"name": "uejson",
    "type":"file-json",
    "location":"location from disk/resolution.json",
    "appliesTo":["a1"]
   }
]
}
```

The `resolution.json` file specifies:

- if **VALUE1** is found in parameter values the API2 call will become a SQL Select on *COL11* and *COL12* fields from **TABLE1 SQL** Table.
- if **VALUE2** is found in parameter values the API2 call will become a SQL Delete on *COL21* field from **TABLE2 SQL** Table.

```
{
    "schemaVersion": "1.0.1",
    "documentVersion": "1.0.1",
    "entries": [{
        "input": {
                    "apiKey": "a1",
          "apiText": "API2",
          "params": [
        {
          "value": "VALUE1"
        },
        {
          "paramKey": "p2",
          "paramMode": "byRef"
        },
        {
          "paramKey": "p3",
          "paramMode": "byRef"
        },
        {
          "paramKey": "p4",
          "paramMode": "byRef"
        }
      ]
      },
     "resolutions": [
       {
         "action": "SQLSelect",
         "resources": [
           {
             "resourceType": "SQLTable",
             "value": "TABLE1",
             "read": true
           }
         ],
         "clauses": [
           {
             "clause": "into",
             "from":
               {
                 "resourceType": "SQLField",
                 "qualifiers": [
                   "TABLE1"
                 ],
                 "value": "COL11",
                 "read": true
               },
              "to": {
                 "resourceType": "Variable",
                 "paramKey": "p2",
                 "paramMode": "byRef",
                 "read": false
               }
           },
           {
             "clause": "into",
             "from":
               {
                 "resourceType": "SQLField",
                 "qualifiers": [
                   "TABLE1"
                 ],
                 "value": "COL12",
```

```
                "read": true
               },
              "to": {
                 "resourceType": "Variable",
                 "paramKey": "p3",
                 "paramMode": "byRef",
                 "read": false
               }
            },
            {
              "clause": "where",
              "from":
               {
                 "resourceType": "SQLField",
                 "qualifiers": [
                   "TABLE1"
                 ],
                 "value": "COL11",
                 "read": false
               },
               "to":{
                 "resourceType": "Variable",
                 "paramKey": "p4",
                 "paramMode": "byRef",
                 "read": true
               }
            }
          ]
    }]
},{
       "input": {
           "apiKey": "a1",
           "apiText": "API2",
           "params": [
         {
           "value": "VALUE2"
         },
         {
           "paramKey": "p2",
           "paramMode": "byRef"
         },
         {
           "paramKey": "p3",
           "paramMode": "byRef"
         },
         {
           "paramKey": "p4",
           "paramMode": "byRef"
         }
        ]
        },
      "resolutions": [
        {
          "action": "SQLDelete",
          "resources": [
            {
              "resourceType": "SQLTable",
              "value": "TABLE2",
      "read": true
            }
          ],
          "clauses": [
            {
              "clause": "where",
              "from":
               {
                 "resourceType": "SQLField",
                 "qualifiers": [
                   "TABLE2"
                 ],
                 "value": "COL21",
                 "read": false
               },
               "to":{
                 "resourceType": "Variable",
                 "paramKey": "p4",
                 "paramMode": "byRef",
                 "read": false
               }
       }]
    }]
```

```
}]
}.
```

The following *json* schemas might help you create the configurations files.

Schema for `API_Config.json`

```
{
    "$schema": "http://json-schema.org/draft-04/schema#",
    "title": "AD Extensebility extensions definition file",
    "type": "object",
    "properties": {
        "info": {
            "type": "object",
            "properties": {
                "version": {
                    "type": "string",
                    "description": "The extension file version",
                    "pattern": "^[0-9]+\\.[0-9]+\\.[0-9]+"
                }
            },
            "required": [
                "version"
            ]
        },
        "extensions": {
            "type": "array",
            "minItems": 1,
            "items": {
                "$ref": "#/definitions/Extension"
            }
        }
    },
    "required": [
        "info",
        "extensions"
    ],
    "definitions": {
        "Extension": {
            "oneOf": [
                {
                    "$ref": "#/definitions/ExtensionType1"
                },
                {
                    "$ref": "#/definitions/ExtensionType2"
                },
                {
                    "$ref": "#/definitions/ExtensionType3"
                }
            ]
        },
        "LocatorType1": {
            "type": "object",
            "description": "Locator specifying the parameter value from a record's child",
            "properties": {
                "name": {
                    "type": "string",
                    "description": "Name of the record child from which to take the parameter value",
                    "minLength": 1
                }
            },
            "required": [
                "name"
            ],
            "additionalProperties": false
        },
        "LocatorType2": {
            "type": "object",
            "description": "Locator specifying the parameter value by offset and length",
            "properties": {
                "offset": {
                    "type": "integer",
                    "description": "Starting offset for the value",
                    "minimum": 0
                },
                "length": {
                    "type": "integer",
                    "description": "Length of the value to be read",
                    "minimum": 0
                }
            },
            "required": [
                "offset",
                "length"
            ],
            "additionalProperties": false
        },
        "ExtensionType1": {
            "type": "object",
            "properties": {
                "apiKey": {
                    "type": "string",
                    "minLength": 1
                },
                "name": {
                    "type": "string",
                    "minLength": 1
                },
                "type": {
                    "type": "string",
                    "enum": [
                        "call"
                    ],
                    "description": "Extension for call statements",
                    "minLength": 1
```

```
            },
            "parameters": {
                "type": "array",
                "minItems": 1,
                "items": {
                    "$ref": "#/definitions/ParameterType1"
                }
            }
        },
        "required": [
            "apiKey",
            "name",
            "type",
            "parameters"
        ],
        "additionalProperties": false
    },
    "ExtensionType2": {
      "type": "object",
      "properties": {
        "apiKey": {
          "type": "string",
          "minLength": 1
        },
        "name": {
          "type": "string",
          "minLength": 1
        },
        "type": {
          "type": "string",
          "enum": [
            "cics"
          ],
          "description": "Extension for cics statements",
          "minLength": 1
        },
        "parameters": {
          "type": "array",
          "minItems": 1,
          "items": {
            "$ref": "#/definitions/ParameterType2"
          }
        }
      },
      "required": [
        "apiKey",
        "name",
        "type",
        "parameters"
      ],
      "additionalProperties": false
    },
     "ExtensionType3": {
      "type": "object",
      "properties":
      {
        "apiKey":
        {
          "type": "string",
          "minLength": 1
        },
        "name":
        {
          "type": "string",
          "minLength": 1
        },
        "type": {
          "type": "string",
          "enum": [
            "JclPgmCall"
          ],
          "description": "Extension for JCL call statements",
          "minLength": 1
        },
        "parameters": {
          "type": "array",
          "minItems": 1,
          "items": {
            "$ref": "#/definitions/ParameterType3"
          }
        }
      },
        "required": [
            "apiKey",
            "name",
            "type",
            "parameters"
        ],
        "additionalProperties": false
      },
    "ParameterType1": {
        "type": "object",
        "description": "Parameter for call statements",
        "properties": {
            "position": {
                "type": "integer",
                "description": "Position of the parameter in the call",
                "minimum": 1
            },
            "label": {
                "type": "string",
                "description": "Identifier for the parameter",
                "minLength": 1
            },
            "resolve": {
                "type": "boolean",
                "description": "Specify whether to determine the values of the parameter or not",
                "default": true
            },
```

```
                "optional": {
                    "type": "boolean",
                    "description": "Specify whether the parameter is optional or not",
                    "default": false
                },
                "locator": {
                    "oneOf": [
                        {
                            "$ref": "#/definitions/LocatorType1"
                        },
                        {
                            "$ref": "#/definitions/LocatorType2"
                        }
                    ]
                }
            },
            "required": [
                "position",
                "label",
                "resolve"
            ],
            "additionalProperties": false
        },
        "ParameterType2": {
            "type": "object",
            "description": "Parameter for CICS statements",
            "properties": {
                "name": {
                    "type": "string",
                    "description": "Name of the parameter in the CICS statement",
                    "minLength": 1
                },
                "label": {
                    "type": "string",
                    "description": "Identifier for the parameter",
                    "minLength": 1
                },
                "resolve": {
                    "type": "boolean",
                    "description": "Specify whether to determine the values of the parameter or not",
                    "default": true
                },
                "optional": {
                    "type": "boolean",
                    "description": "Specify whether the parameter is optional or not",
                    "default": false
                },
                "locator": {
                    "oneOf": [
                        {
                            "$ref": "#/definitions/LocatorType1"
                        },
                        {
                            "$ref": "#/definitions/LocatorType2"
                        }
                    ]
                }
            },
            "required": [
                "name",
                "label",
                "resolve"
            ],
            "additionalProperties": false
        },

        "ParameterType3": {
            "type": "object",
            "description": "Parameter for JCL calls",
            "properties": {
              "name":
              {
                "type": "string",
                "description": "Name of the parameter in the JCL call",
                "minLength": 1
              },
              "label":
              {
                "type": "string",
                "description": "Identifier for the parameter",
                "minLength": 1
              },
             "optional": {
                    "type": "boolean",
                    "description": "Specify whether the parameter is optional or not",
                    "default": false
             }
            },
            "required": [
                "name",
                "label"
            ],
            "additionalProperties": false
        }
    }
}
```

Schema for `ue-config.json`

```
{
    "$schema": "http://json-schema.org/draft-04/schema#",
    "version": "1.0.1",
    "type": "object",
    "description": "An ordered list of user exits",
    "properties": {
        "schemaVersion": {
            "description": "This json schema version",
            "$ref": "#/definitions/versionDef"
```

```
        },
        "documentVersion": {
            "description": "The user exit json file version",
            "$ref": "#/definitions/versionDef"
        },
        "ueConfig": {
            "type": "array",
            "description": "An array which contains user exit configurations",
            "items": {
                "type": "object",
                "description": "An user exit configuration object.",
                "properties": {
                    "name": {
                        "type": "string",
                        "description": "A name for this user exit configuration."
                    },
                    "type": {
                        "type": "string",
                        "description": "The user exit type",
                        "enum": [
                            "file-json",
                            "utility",
                            "dependency-file-json",
                            "dependency-utility",
                            "jcl-file-json",
                            "jcl-utility"
                        ]
                    },
                    "location": {
                        "type": "string",
                        "description": "The path of the file containing the resolutions (applies for file-json type only)."
                    },
                    "appliesTo": {
                        "type": "array",
                        "description": "An array of API (defined in API config json) to which this user-exit is applied.",
                        "items": {
                            "type": "string",
                            "description": "An extensibility API key as defined in the API config json file."
                        },
                        "minItems": 1,
                        "uniqueItems": true
                    },
                    "command": {
                        "type": "array",
                        "description": "An array of strings used to call an external utility in order to obtain the user exit resolutions.",
                        "items": {
                            "type": "string"
                        }
                    }
                },
                "required": [
                    "name",
                    "type",
                    "appliesTo"
                ],
                "uniqueItems": true
            }
        }
    },
    "required": [
        "ueConfig",
        "schemaVersion",
        "documentVersion"
    ],
    "definitions": {
        "versionDef": {
            "type": "string",
            "description": "Schema/Document versioning pattern",
            "pattern": "^[0-9]{1,3}\\.[0-9]{1,3}(\\.[0-9]{1,3})?$"
        }
    }
}
```

Schema for `resolution.json`

```
{
    "$schema": "http://json-schema.org/draft-04/schema#",
    "version": "1.0.2",
    "type": "object",
    "description": "The json schema for a file-json based AD resolutions.",
    "properties": {
        "schemaVersion": {
            "description": "This json schema version.",
            "$ref": "#/definitions/versionDef"
        },
        "documentVersion": {
            "description": "The user exit json file version.",
            "$ref": "#/definitions/versionDef"
        },
        "entries": {
            "type": "array",
            "description": "An array containing the user exit content.",
            "items": {
                "type": "object",
                "description": "A user exit content object.",
                "properties": {
                    "resolutions": {
                        "type": "array",
                        "description": "An array which contains the user exit resolution objects.",
                        "items": {
                            "anyOf": [
                                {
                                    "$ref": "#/definitions/localResolutionDef"
                                },
                                {
                                    "$ref": "#/definitions/externalResolutionDef"
                                },
                                {
                                    "$ref": "#/definitions/callLocalResolutionDef"
                                },
                                {
                                    "$ref": "#/definitions/callExternalResolutionDef"
                                }
                            ]
                        }
                    },
                    "input": {
                        "type": "object",
                        "description": "An object which contains the inputs for the user exit.",
                        "properties": {
                            "apiKey": {
                                "type": "string",
                                "description": "The parameter key as defined in the API config json."
                            },
                            "apiText": {
                                "type": "string",
                                "description": "The name of the API program as defined in the API config json."
                            },
```

```
                            "params": {
                                "type": "array",
                                "description": "An array of 'value' objects definitions. The number and the order of the items MUST be the same with the
number and the order of the parameters defined in the API config json",
                                "items": {
                                    "anyOf": [
                                        {
                                            "$ref": "#/definitions/paramValue"
                                        },
                                        {
                                            "$ref": "#/definitions/directValue"
                                        },
                                        {
                                            "$ref": "#/definitions/optionalValue"
                                        }
                                    ]
                                }
                            }
                        },
                        "required": [
                            "apiKey",
                            "params"
                        ],
                        "additionalProperties": false
                    }
                },
                "additionalProperties": false,
                "required": [
                    "resolutions",
                    "input"
                ]
            }
        }
    },
    "required": [
        "entries",
        "schemaVersion",
        "documentVersion"
    ],
    "definitions": {
        "versionDef": {
            "type": "string",
            "description": "A schema/document versioning pattern.",
            "pattern": "^[0-9]{1,3}\\.[0-9]{1,3}(\\.[0-9]{1,3})?$"
        },
        "externalActionsDef": {
            "description": "",
            "type": "string",
            "enum": [
                "CICSStart",
                "CICSReturn",
                "IMSStartTransaction"
            ]
        },
        "localActionsDef": {
            "description": "",
            "type": "string",
            "enum": [
                "CICSStart",
                "CICSReturn",
                "SQLSelect",
                "SQLInsert",
                "SQLDelete",
                "SQLUpdate",
                "FileRead",
                "FileWrite",
                "FileRewrite",
                "FileDelete",
                "FileSort",
                "CICSFileRead",
                "CICSFileWrite",
                "CICSFileRewrite",
                "CICSFileDelete",
                "CICSSendMap",
                "CICSReceiveMap",
                "IMSSendMap",
                "IMSReceiveMap",
                "IMSStartTransaction",
                "IMSDBRead",
                "IMSDBReadNext",
                "IMSDBInsert",
                "IMSDBDelete",
                "IMSDBUpdate"
            ]
        },
        "paramValue": {
            "type": "object",
            "description": "A generic 'value' object which allows the user exit to define values for the resolution or the input values with references
to the paramKey.",
            "properties": {
                "paramKey": {
                    "type": "string",
                    "description": "The parameter key as defined in the API config json file."
                },
                "paramMode": {
                    "type": "string",
                    "description": "A marker which defines how the parameter value is read by the resolver.",
                    "enum": [
                        "byValue",
                        "byRef"
                    ]
                }
            },
            "additionalProperties": false,
            "required": [
                "paramKey",
                "paramMode"
            ]
        },
        "directValue": {
            "type": "object",
            "description": "A generic 'value' object which allows the user exit to define values for the resolution or the input values without
referering to a specific paramKey.",
            "properties": {
                "value": {
                    "type": "string",
                    "description": "The value for this 'value' object."
                }
            },
            "additionalProperties": false,
            "required": [
                "value"
            ]
        },
        "optionalValue": {
            "type": "object",
            "description": "A generic 'value' object which allows the user exit to define values for the input values which will be ignored by the AD
Resolver",
            "properties": {
                "ignore": {
                    "type": "boolean",
```

```
                    "description": "If true the 'value' object MUST be ignored by the AD Resolver."
                }
            },
            "additionalProperties": false,
            "required": [
                "ignore"
            ]
        },
        "resourceTypeDef": {
            "type": "object",
            "description": "An object which will contain a resource type definition for resolutions.",
            "properties": {
                "read": {
                    "type": "boolean",
                    "description": "A marker for the resource behavior (true: the resource is read, false - the resource is written.)"
                },
                "resourceType": {
                    "type": "string",
                    "description": "The resource type",
                    "enum": [
                        "CobolProgram",
                        "PL/1Program",
                        "AssemblerProgram",
                        "Variable",
                        "CICSTran",
                        "SQLTable",
                        "SQLField",
                        "File",
                        "CICSMap",
                        "IMSMessageDescriptor",
                        "IMSTransaction",
                        "IMSDBSegment"
                    ]
                },
                "paramKey": {
                    "type": "string",
                    "description": "The parameter key as defined in the API config json file."
                },
                "paramMode": {
                    "type": "string",
                    "description": "A marker which defines how the parameter value is read by the resolver.",
                    "enum": [
                        "byValue",
                        "byRef"
                    ]
                },
                "qualifiers": {
                    "type": "array",
                    "description": "The strings will be used to qualify the resource. It is required for resourceType SQLField, IMSMessageDescriptor,
IMSDBSegment",
                    "items": {
                        "type": "string",
                        "description": "A string qualifier."
                    }
                },
                "value": {
                    "type": "string",
                    "description": "A string value for the resource type."
                },
                "annText": {
                        "type": "string",
                        "description": "A string which defines the text of the annotation."
                },
                "annKeyword": {
                        "type": "string",
                        "description": "A string which defines the key of the annotation."
                }
            },
            "additionalProperties": false
        },
        "clausesDef": {
            "type": "array",
            "description": "An array containing SQL statements related options.",
            "items": {
                "type": "object",
                "description": "",
                "properties": {
                    "clause": {
                        "type": "string",
                        "description": "The relationship between the 'from' and the 'to' 'value' objects.",
                        "enum": [
                            "into",
                            "where",
                            "set"
                        ]
                    },
                    "from": {
                        "description": "A SQLField value object",
                        "$ref": "#/definitions/resourceTypeDef"
                    },
                    "to": {
                        "description": "A host variable 'value' object.",
                        "$ref": "#/definitions/resourceTypeDef"
                    }
                },
                "additionalProperties": false
            }
        },
        "targetDef": {
            "description": "The targeted resource (if any). Will be deprecated in the next versions.",
            "$ref": "#/definitions/resourceTypeDef"
        },
        "localResolutionDef": {
            "properties": {
                "action": {
                    "$ref": "#/definitions/localActionsDef"
                },
                "resources": {
                    "type": "array",
                    "description": "An array containing the user exit values for the given resolution.",
                    "items": {
                        "description": "",
                        "$ref": "#/definitions/resourceTypeDef"
                    }
                },
                "clauses": {
                    "$ref": "#/definitions/clausesDef"
                }
            },
            "additionalProperties": false,
            "required": [
                "action"
            ]
        },
        "externalResolutionDef": {
            "properties": {
                "action": {
                    "$ref": "#/definitions/externalActionsDef"
                },
                "location": {
                    "type": "string",
```

```
                "description": "A string which defines the location (another AD project or a CICS region) where the API action is performed."
            },
            "locationType": {
                "type": "string",
                "description": "The AD project name or a CICS region.",
                "enum": [
                    "application",
                    "CICSRegion"
                ]
            },
            "resources": {
                "type": "array",
                "description": "An array containing the user exit values for the given resolution.",
                "items": {
                    "description": "",
                    "$ref": "#/definitions/resourceTypeDef"
                }
            }
        },
        "additionalProperties": false,
        "required": [
            "action", "location", "locationType"
        ]
    },
    "callLocalResolutionDef": {
        "properties": {
            "action": {
                "enum": [
                    "call"
                ]
            },
            "target": {
                "$ref": "#/definitions/targetDef"
            },
            "resources": {
                "type": "array",
                "description": "An array containing the user exit values for the given resolution.",
                "items": {
                    "description": "",
                    "$ref": "#/definitions/resourceTypeDef"
                }
            }
        },
        "additionalProperties": false,
        "required": [
            "action",
            "target"
        ]
    },
    "callExternalResolutionDef": {
        "properties": {
            "action": {
                "enum": [
                    "call"
                ]
            },
            "location": {
                "type": "string",
                "description": "A string which defines the location (another AD project or a CICS region) where the API action is performed."
            },
            "locationType": {
                "type": "string",
                "description": "The AD project name or a CICS region.",
                "enum": [
                    "application",
                    "CICSRegion"
                ]
            },
            "target": {
                "$ref": "#/definitions/targetDef"
            },
            "resources": {
                "type": "array",
                "description": "An array containing the user exit values for the given resolution.",
                "items": {
                    "description": "",
                    "$ref": "#/definitions/resourceTypeDef"
                }
            }
        },
        "additionalProperties": false,
        "required": [
            "action",
            "location",
            "locationType",
            "target"
        ]
    }
  }
}
```

JCL Call Extensibility Examples

JCL Call Extensibility Use Case

The purpose of this chapter is to help users understand how the Configuration files must be created in order to integrate their business-specific cases in the analysis.

This use case is created to cover the situation when a JCL Call to an API program is translated into calls to other programs, based on the parameter value received by the API program. The following represents the **JOBSAMPLE** JCL job:

```
//JOBSAMPLE JOB  ,'DAIICHI LIFE SUPPORT',
//             CLASS=C,
//             MSGCLASS=P,
//             COND=(4,LT),
//             REGION=4096K
//STP010   EXEC  PGM=APIJCL
//DDOUT1   DD  DSN=PJ.ABC.DATASET1,
```

```
//             UNIT=(MTLIB,,DEFER),
//             DISP=(NEW,KEEP),
//             DCB=TRTCH=C,
//             LABEL=(,SL),
//             VOL=SER=DXXXXX
//APIPARAM    DD *
1111 ABC --TEST-- VALUE
//
```

The **JOBSAMPLE** JCL job contains a call to a specific API program named **APIJCL**.

To resolve the Call to "APIJCL", the JCL_Config.json file specifies that it is necessary to resolve the value of the **APIPARAM** parameter.

Note: This JSON contains as parameters the corresponding name of the JCL DD card used in the JCL Call.

```
{
  "info": {
    "version": "5.0.3"
  },
    "extensions":
    [
       {
          "apiKey":"a1",
          "name": "APIJCL",
          "type": "JclPgmCall",

           "parameters":
           [
            {
              "name": "APIPARAM",
              "label": "param1"
            }
           ]
        }

    ]
}
```

The ue-config.json file specifies the type of user exit file and the path where the user exit file for a certain API is located.

```
{
  "schemaVersion":"1.0.1",
  "documentVersion":"1.0.1",
  "ueConfig" :[
   {"name": "uejson",
    "type":"jcl-file-json",
    "location":"D:/EZSourceBuildProjects/API_JCL_PROJECTS/DOC_JCL_DEP/API Config/Resolutions/
resolutionJCL.json",
    "appliesTo":["a1"]
   }
]
}
```

The resolutionJCL.json file specifies that, if the value of the received parameter is *"1111 ABC--TEST--VALUE"*, the JCL Call to "APIJCL" is replaced with calls to **PROGRAM1** and **PROGRAM2** COBOL programs.

Note:

- The values of the parameters present in the resolutionJCL.json file must be identical to the values of the corresponding DD cards in the JCL, considering a maximum of 71 characters on the line.
- The values of the DD cards can come either inline DD * or from a controlled file DD DSN=<file path>.

The following annotations are present in the resolutionJCL.json file:

- For **PROGRAM1** - annotation "annText": "ANNOTATION1" and annotation keyword "annKeyword" : "API_RESOLUTION".

- For **PROGRAM2** - annotation `"annText": "ANNOTATION2"` and annotation keyword `"annKeyword" : "API_RESOLUTION"`.

```
{
    "schemaVersion": "1.0",
    "documentVersion": "1.0",
    "entries": [{
        "input": {
            "apiKey": "a1",
            "apiText": "APIJCL",
            "params": [{
                    "value": "1111 ABC--TEST--VALUE"
                }

            ]
        },
        "resolutions": [{
                "action": "call",
                "target": {
                    "resourceType": "CobolProgram",
                    "value": "PROGRAM1",
                    "read": true
                },
                "annText": "ANNOTATION1",
                "annKeyword" : "API_RESOLUTION"
            },
            {
                "action": "call",
                "target": {
                    "resourceType": "CobolProgram",
                    "value": "PROGRAM2",
                    "read": true
            },
                "annText": "ANNOTATION2",
                "annKeyword" : "API_RESOLUTION"
            }]
    }
    ]
}
```

JSON Schemas

The `API_Config.json` schema, present in “API/Macro Call Extensibility Examples ” on page 98 introduces a new API type `"type":"JclPgmCall"`.

The `ue-config.json` schema, present in “API/Macro Call Extensibility Examples ” on page 98 introduces a new API type `"type":"jcl-file-json"`.

Schema for JCL `resolutionJCL.json`

```
{
    "$schema": "http://json-schema.org/draft-04/schema#",
    "version": "1.0.0",
    "type": "object",
    "description": "The json schema for a jcl-json based AD resolutions.",
    "properties": {
        "schemaVersion": {
            "description": "This json schema version.",
            "$ref": "#/definitions/versionDef"
        },
        "documentVersion": {
            "description": "The user exit json file version.",
            "$ref": "#/definitions/versionDef"
        },
        "entries": {
            "type": "array",
            "description": "An array containing the user exit content.",
            "items": {
                "type": "object",
                "description": "A user exit content object.",
                "properties": {
                    "resolutions": {
                        "type": "array",
                        "description": "An array which contains the user exit resolution objects.",
                        "items": { "$ref": "#/definitions/callLocalResolutionDef" }
                    },
                    "input": {
                        "type": "object",
                        "description": "An object which contains the inputs for the user exit.",
                        "properties": {
                            "apiKey": {
                                "type": "string",
                                "description": "The parameter key as defined in the JCLAPI config json."
                            },
                            "apiText": {
                                "type": "string",
                                "description": "The name of the API program as defined in the JCLAPI config json."
                            },
                            "params": {
                                "type": "array",
                                "description": "An array of 'value' objects definitions. The number and the order of the items MUST be the same with the
number and the order of the parameters defined in the API config json",
                                "items": {
                                    "anyOf": [
```

```
                                    {
                                        "$ref": "#/definitions/paramValue"
                                    },
                                    {
                                        "$ref": "#/definitions/directValue"
                                    }
                                ]
                            }
                        }
                    },
                    "required": [
                        "apiKey",
                        "params"
                    ],
                    "additionalProperties": false
                }
            },
            "additionalProperties": false,
            "required": [
                "resolutions",
                "input"
            ]
        }
    }
},
"required": [
    "entries",
    "schemaVersion",
    "documentVersion"
],
"definitions": {
    "versionDef": {
        "type": "string",
        "description": "A schema/document versioning pattern.",
        "pattern": "^[0-9]{1,3}\\.[0-9]{1,3}(\\.[0-9]{1,3})?$"
    },
    "paramValue": {
        "type": "object",
        "description": "A generic 'value' object which allows the user exit to define values for the resolution or the input values with references
to the paramKey.",
        "properties": {
            "paramKey": {
                "type": "string",
                "description": "The parameter key as defined in the API config json file."
            },
            "paramMode": {
                "type": "string",
                "description": "A marker which defines how the parameter value is read by the resolver.",
                "enum": [
                    "byValue",
                    "byRef"
                ]
            }
        },
        "additionalProperties": false,
        "required": [
            "paramKey",
            "paramMode"
        ]
    },
    "directValue": {
        "type": "object",
        "description": "A generic 'value' object which allows the user exit to define values for the resolution or the input values without
referering to a specific paramKey.",
        "properties": {
            "value": {
                "type": "string",
                "description": "The value for this 'value' object."
            }
        },
        "additionalProperties": false,
        "required": [
            "value"
        ]
    },
    "resourceTypeDef": {
        "type": "object",
        "description": "An object which will contain a resource type definition for resolutions.",
        "properties": {
            "read": {
                "type": "boolean",
                "description": "A marker for the resource behavior (true: the resource is read, false - the resource is written.)"
            },
            "resourceType": {
                "type": "string",
                "description": "The resource type",
                "enum": [
                    "CobolProgram",
                    "PL/1Program",
                    "AssemblerProgram"
                ]
            },
            "paramKey": {
                "type": "string",
                "description": "The parameter key as defined in the JCLAPI config json file."
            },
            "paramMode": {
                "type": "string",
                "description": "A marker which defines how the parameter value is read by the resolver.",
                "enum": [
                    "byValue",
                    "byRef"
                ]
            },
            "qualifiers": {
                "type": "array",
                "description": "An array of strings. The strings will be used to qualify the resource.",
                "items": {
                    "type": "string",
                    "description": "A string qualifier."
                }
            },
            "value": {
                "type": "string",
                "description": "A string value for the resource type."
            },
            "annText": {
                    "type": "string",
                    "description": "A string which defines the key of the annotation."
            },
            "annKeyword": {
                    "type": "string",
                    "description": "A string which defines the text of the annotation."
            }
        },
        "additionalProperties": false
    },
    "targetDef": {
        "description": "The targeted resource (if any). Will be deprecated in the next versions.",
        "$ref": "#/definitions/resourceTypeDef"
    },
```

```
        "callLocalResolutionDef": {
            "properties": {
              "action": {
                   "enum": [
                       "call"
                   ]
               },
               "target": {
                   "$ref": "#/definitions/targetDef"
               }
            },
            "additionalProperties": false,
            "required": [
                "action",
                "target"
            ]
        }
    }
}
```

Dependency Extensibility Examples

Dependency Extensibility Use Case

The purpose of this use case is to help users understand how the Configuration files must be created to integrate their business-specific cases in the analysis.

This use case is created to cover the situation when a user creates mappings between transactions and programs.

The `API_Dependency.json` file specifies the APIs that return mappings between resources.

Note: Each API has a name and label. The APIs for dependencies have the attribute `"type":"post_build".`

```
{
    "info":
   {
      "version":"5.1.0"
   },
    "extensions":
    [
        {
          "apiKey":"a2",
          "name":"MAPPING_TRAN",
          "type":"post_build"
        }
    ]
}
```

The `ue-config.json` file specifies the type of user exit file and the path where the user exit file for a certain dependency API is located.

```
{
  "schemaVersion":"1.0.1",
  "documentVersion":"1.0.1",
  "ueConfig" :[
   {"name": "uejson",
    "type":"dependency-file-json",
    "location":"D:/EZSourceBuildProjects/API_JCL_PROJECTS/DOC_JCL_DEP/API Config/Resolutions/
resolutionDEP.json",
    "appliesTo":["a2"]
   }
]
}
```

The `resolutionDEP.json` file contains the mapping of resources that are returned by the `"MAPPING_TRAN"` API. In this specific case the mappings are as follows:

- Transaction `"TRAN1"` to program `"PROGRAM1"`
- Transaction `"TRAN2"` to program `"PROGRAM2"`

The following annotations are present in the `resolutionDEP.json` file:

- For **PROGRAM1** - annotation `"annText": "ANNOTATION3"` and annotation keyword `"annKeyword" : "API_RESOLUTION"`.

- For **PROGRAM2** - annotation `"annText": "ANNOTATION4"` and annotation keyword `"annKeyword" : "API_RESOLUTION"`.

The AD analysis shows the links between the mentioned resources.

```
{
    "schemaVersion": "1.0.0",
    "documentVersion": "1.0.0",
    "entries": [{
        "input": {
            "apiKey": "a2",
            "apiText": "MAPPING_TRAN"
        },
        "resolutions": [{
            "action": "dependency",
            "source": {
                "resourceType": "GenericTransaction",
                "value": "TRAN1"
            },
            "target": {
                "resourceType": "CobolProgram",
                "value": "PROGRAM1",
                "annText": "ANNOTATION3",
                "annKeyword" : "API_RESOLUTION"
            }
        },{
            "action": "dependency",
            "source": {
                "resourceType": "GenericTransaction",
                "value": "TRAN2"
            },
            "target": {
                "resourceType": "CobolProgram",
                "value": "PROGRAM2",
                "annText": "ANNOTATION4",
                "annKeyword" : "API_RESOLUTION"
            }
        } ]
    }]
}
```

JSON Schemas

Schema for Dependency `API_Dependency.json`

A new configuration file is introduced. The API for dependency has a new type of attribute `"type": "post_build"`.

```
{
    "$schema": "http://json-schema.org/draft-04/schema#",
    "title": "AD Extensibility dependencies definition file",
    "type": "object",
    "properties": {
        "info": {
            "type": "object",
            "properties": {
                "version": {
                    "type": "string",
                    "description": "The extension file version",
                    "pattern": "^[0-9]+\\.[0-9]+\\.[0-9]+"
                }
            },
            "required": [
                "version"
            ]
        },
        "extensions": {
            "type": "array",
            "minItems": 1,
            "items": {
                "$ref": "#/definitions/Extension"
            }
        }
    },
    "required": [
        "info",
        "extensions"
    ],
    "definitions": {
      "Extension":
      {
        "type": "object",
        "properties": {
          "apiKey": {
            "type": "string",
            "minLength": 1
          },
          "name": {
            "type": "string",
            "minLength": 1
          },
          "type": {
            "type": "string",
            "enum": [
              "post_build"
```

```
            ],
            "description": "Extension for dependencies",
            "minLength": 1
          }
        },
        "required": [
          "apiKey",
          "name",
          "type"
        ],
        "additionalProperties": false
      }
    }
}
}
```

The `ue-config.json` schema, present in the “API/Macro Call Extensibility Examples ” on page 98 introduces a new API type `"type":"dependency-file-json"`.

Schema for Dependency `resolution.json`

```
{
    "$schema": "http://json-schema.org/draft-04/schema#",
    "version": "1.0.0",
    "type": "object",
    "description": "The json schema for a file-json based AD dependency resolutions.",
    "properties": {
        "schemaVersion": {
            "description": "This json schema version.",
            "$ref": "#/definitions/versionDef"
        },
        "documentVersion": {
            "description": "The user exit dependency json file version.",
            "$ref": "#/definitions/versionDef"
        },
        "entries": {
            "type": "array",
            "description": "An array containing the user exit dependency content.",
            "items": {
                "type": "object",
                "description": "A user exit dependency content object.",
                "properties": {
                    "input": {
                        "type": "object",
                        "description": "An object which contains the inputs for the user exit dependency.",
                        "properties": {
                            "apiKey": {
                                "type": "string",
                                "description": "The parameter key as defined in the API config json."
                            },
                            "apiText": {
                                "type": "string",
                                "description": "The name of the API_NOT_SOURCE as defined in the API config json."
                            }
                        },
                        "required": [
                            "apiKey"
                        ],
                        "additionalProperties": false
                    },
                    "resolutions": {
                        "type": "array",
                        "description": "An array which contains the user exit resolution objects.",
                        "properties": {
                            "action": {
                                "type": "string",
                                "description" : "The name of the action, expect dependency.",
                                "enum": [
                                    "dependency"
                                ]
                            },
                            "source": {
                                "$ref": "#/definitions/sourceDef"
                            },
                            "target": {
                                "$ref": "#/definitions/targetDef"
                            }
                        }
                    }
                },
                "additionalProperties": false,
                "required": [
                    "resolutions",
                    "input"
                ]
            }
        }
    },
    "required": [
        "entries",
        "schemaVersion",
        "documentVersion"
    ],
    "definitions": {
        "versionDef": {
            "type": "string",
            "description": "A schema/document versioning pattern.",
            "pattern": "^[0-9]{1,3}\\.[0-9]{1,3}(\\.[0-9]{1,3})?$"
        },
        "sourceDef": {
            "properties": {
                "resourceType": {
                        "type": "string",
                        "description": "A string which defines the source type of the resource from depedency relation."
                },
                "value": {
                        "type": "string",
                        "description": "A string which defines the source name of the resource from depedency relation."
                },
                "qualifier": {
                    "type": "string",
                    "description": "A string which defines the qualifier of the resource from depedency relation."
                }
            },
            "required": [
                "resourceType",
                "value"
            ]
        },
        "targetDef": {
            "properties": {
                "resourceType": {
                        "type": "string",
                        "description": "A string which defines the target type of the resource from depedency relation."
                },
```

```
                "value": {
                        "type": "string",
                        "description": "A string which defines the target name of the resource from depedency relation."
                },
                "annText": {
                        "type": "string",
                        "description": "A string which defines the key of the annotation."
                },
                "annKeyword": {
                        "type": "string",
                        "description": "A string which defines the text of the annotation."
                }
            }
        }
    }
}
```

Appendix 5 - z/OS Subsystem and Third-Party Product Configuration Checklists

The purpose of this appendix is to provide checklists for configuring IBM Application Discovery to interact with common z/OS subsystems and third-party tools. These configurations require changes both to IBM AD Build Configuration and IBM AD Connect for Mainframe on z/OS.

Db2 Checklist

The following steps must be performed to enable IBM AD to interact with Db2 on z/OS:

1. Add the primary Db2 installation load library to the z/OS Connector/Listener procedure JCL. For more information, see Configuring the Listener PROC.
2. Customize and submit the Db2 bind jobs.

   Note: You can create a DBRM-based plan, or a more current package-based plan (recommended).
3. Configure the IBM AD Build Server to access Db2 (Db2 subsystem name/level of Db2).
4. Manually access Db2 information through IBM AD Build Configuration.

For detailed information about the above-mentioned steps, check the **IBM Application Discovery Connect for Mainframe** documentation.

ChangeMan® ZMF Checklist

The following steps must be performed to configure ChangeMan® ZMF:

1. Modify the sample JCL member **IAYXMLRQ**.
2. Allocate the **XMLIN** data sets.
3. Allocate the **XMLOUT** data sets.
4. Additionally, set up **Continuous Rule Validation**.
5. Follow the steps from “Bringing Data From Mainframe Using ChangeMan® ZMF” on page 73.

For detailed information about the above-mentioned steps, check the **IBM Application Discovery Connect for Mainframe** documentation.

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