

X-ANALYSIS PROFESSIONAL

TUTORIAL

Software Version: 10.0

**This product requires a security code to activate it.
For Security Code, please call Databorough**

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Welcome to this Tutorial

This tutorial is a handy, stepwise, illustrative guide especially designed to familiarize you with the practical benefits of the X-Analysis product suite.

How this Tutorial is Organized?

The tutorial is divided into different chapters. Chapters 1 and 2 introduce you to the sophisticated X-Analysis software. Chapters 3 to 7 comprise comprehensive details of the X-Analysis solution sets. Chapter 8 offers a glance at what is more to come from X-Analysis.

Chapter 1 Introduction

Get a glimpse of the benefits of using X-Analysis. The chapter outlines the hardware-related prerequisites for installing the advanced software.

Chapter 2 Getting Started With X-Analysis Client

Provides you simple delineation of steps to starting the initialisation process for X-Analysis

Chapter 3 Analysis and Documentation

This chapter explains the latest computing and documenting features of X-Analysis. For better understanding of the features, the chapter uses specific screenshots of the respective windows and dropdown menus.

Chapter 4 Data Modelling

The chapter provides an in-depth, pictorial overview of how Data Modelling helps to understand the application design, in purview of all possible relationships among files.

Chapter 5 Application Areas

The chapter clarifies the necessity of sub-dividing an application into application areas. The chapter also throws light on the diagramming options available with application areas that help in the thorough detailing of the legacy application design.

Chapter 6 Business Rules Analysis

This chapter presents the two tools that make for easy and quick analysis of Business Rules.

Chapter 7 Metrics Analysis

This chapter brings to you advanced computing features and functions of the X-Audit module.

Chapter 8 What's Next

Take a look at the exciting technological days ahead!

Who Should Read This Tutorial

Software professionals—from analysts and developers to architects and operations teams—who intend to analyse, document, or modernize AS/400 IBM i applications—will find this tutorial very useful.

Explore this tutorial and gain insight into the inimitable facets of X-Analysis that equip users with rich understanding of existing legacy applications.

Acronyms Used in This Document

ACRONYM	MEANING
APD	Access Path Diagram
DFD	Data Flow Diagram
DMD	Data Model Diagram
FFD	File Field Details
SCD	Structure Chart Diagram
HSC	Hierarchal Structure Chart

Chapter 1: Introduction to X-Analysis

Get to know X-Analysis – the advanced and easy-to-use analysis tool. Learn about the tool's instant and automated features viz. impact analysis, cross-referencing, and graphical documentation of RPG and COBOL applications. Also, get updated on the hardware prerequisites needed for successful installation of the software.

Benefits of X-Analysis[#]

Databorough's X-Analysis product suite is an essential tool for IBM i application documentation, design recovery, and re-engineering. The X-Analysis software works as a plugin under IBM's RDi / RDp / WDSC and Eclipse, enabling users to browse and visualize applications from a high-level model down to individual lines of code. This globally renowned tool is packed with features like RPG & COBOL as pseudo code, variable level impact analysis, graphical flow/structure charts, graphical data flowcharts, PDF/MS Word and MS Visio documentation wizards. X-Analysis allows technical analysts to navigate graphically through an IBM i application from a Windows PC. Working in a true client-server mode, X-Analysis automatically cross-references databases and ensures that the display is always up to date and a true representation of the application on the IBM i.

Prerequisites*

Before starting this tutorial, the following are required:

- The X-Analysis server and the Client components should be installed to an IBM i server and a Windows PC, respectively.
- The demo library – **XAN4CDEM**, and its cross-reference library – **XAN4CDXA**, should be successfully restored on the IBM i.

[#] X-Analysis release 10.x onwards is digitally signed.

^{*}For details on how to implement these prerequisites, please refer to the X-Analysis User Manual.

Note: This tutorial only teaches the usage of the tool and not topics like Initialisation, Reengineering, etc.*

Note: Since the product is being continuously improved, you might notice some differences in the screens.

Chapter 2: Getting Started with X-Analysis Client

The chapter gives you the sequence of steps to get started with the software. There are simple guidelines that accompany individual screenshots, making the activation process easy to understand.

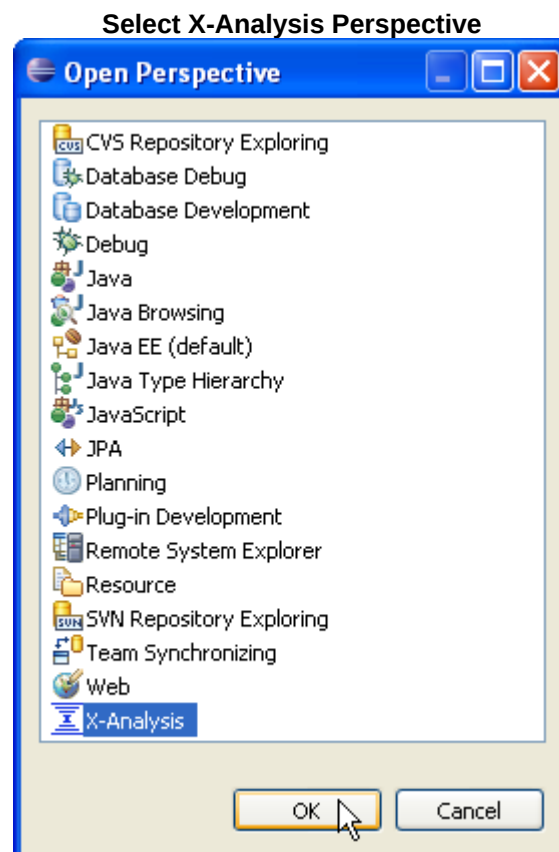
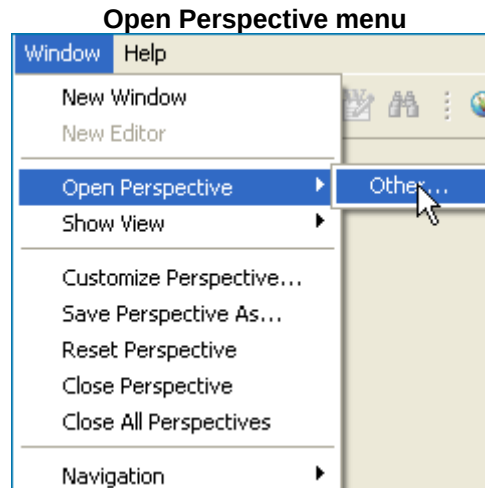
The chapter contains:

- [Take the First Step – Select the X-Analysis Perspective](#)
- [Instructions to fill the X-Analysis Signon dialog](#)
- [Expanded Application Library](#)

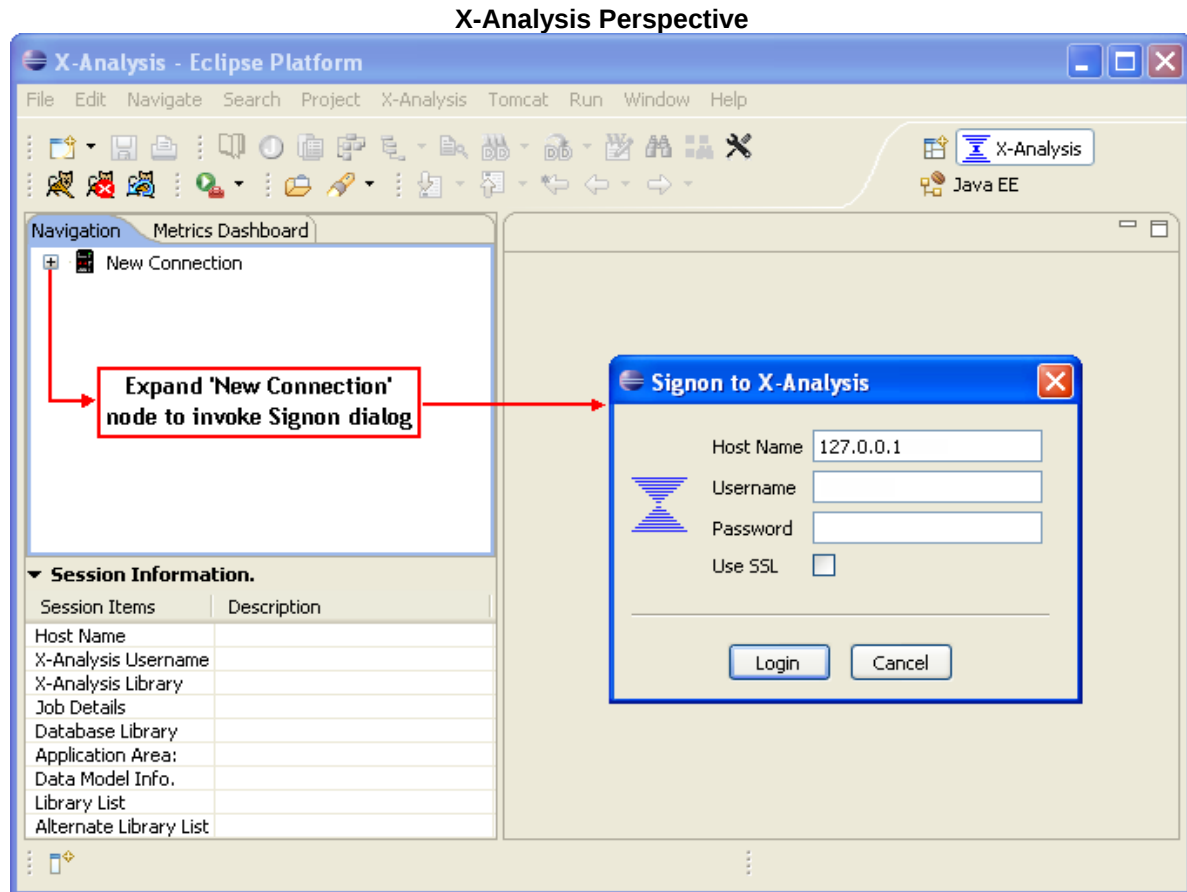
Take the First Step – Select the X-Analysis Perspective

Start IBM's RDi / RDp / WDSC/ or Eclipse 3.2 and above.

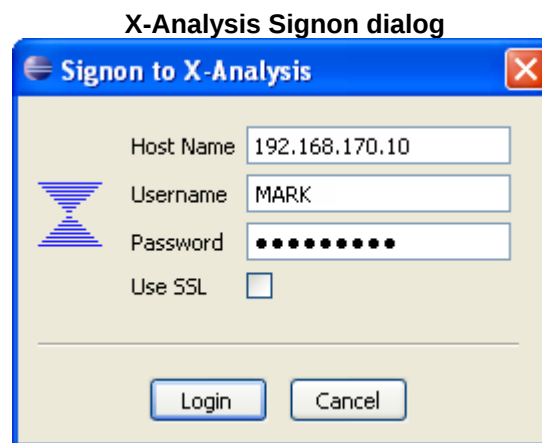
Select **Window > Open Perspective > Other > X-Analysis**



Click the **OK** button to start the X-Analysis Perspective.



Expand **New Connection** node to bring up the **Signon** dialog.



Instructions to fill the Signon dialog

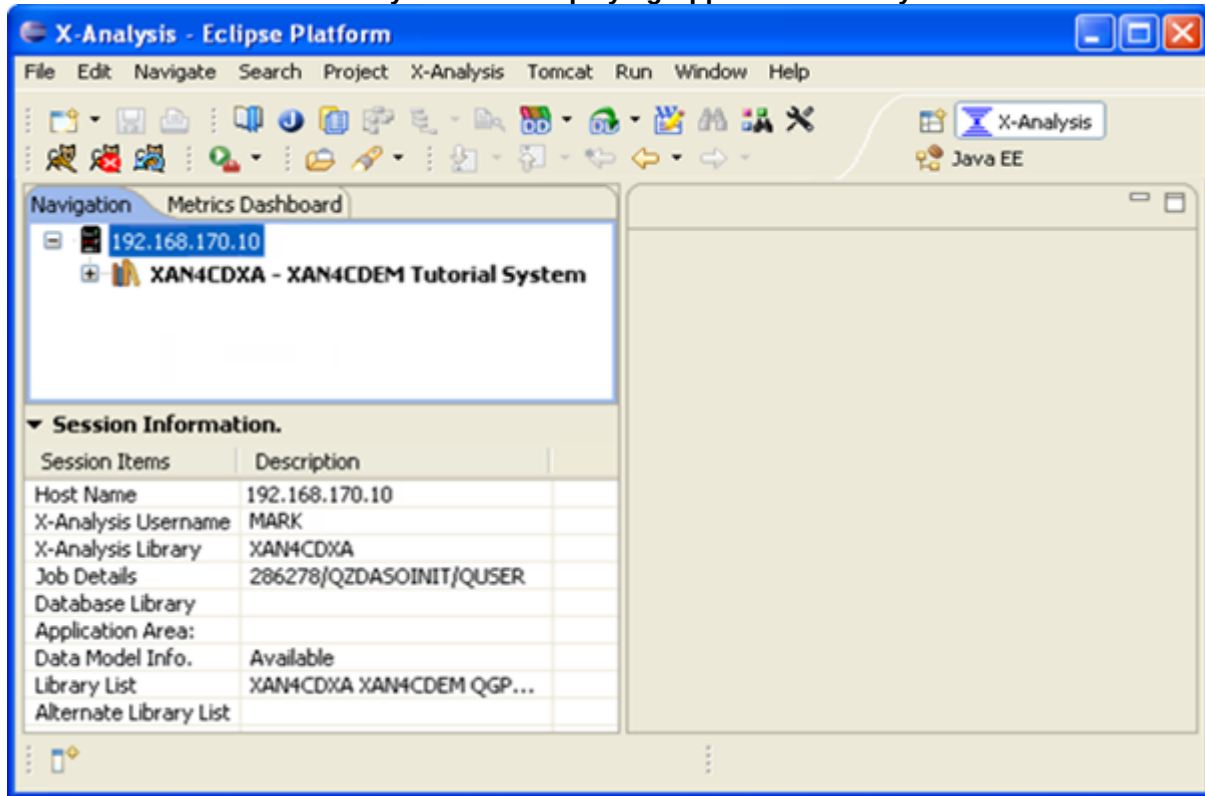
1. Enter TCP/IP address / Computer Name of the IBM i to be accessed.
2. Enter username and password of a valid IBM i profile.
3. Check the 'Use SSL' box for additional security. For details about the feature, refer to the X-Analysis User Manual.
4. Click the **Login** button.

After a successful signon, X-Analysis Client displays a list of application libraries. These libraries are initialised using the master command **X4WRKAPP** on IBM i.

Application Library

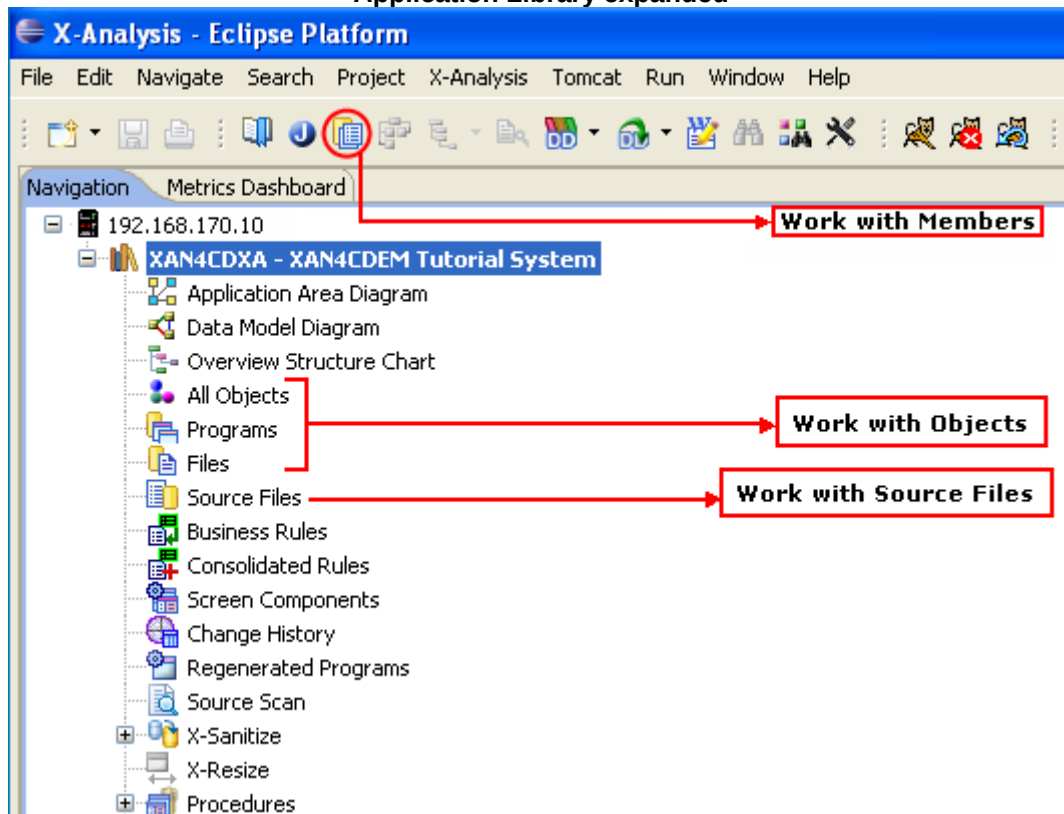
When used for the first time the X-Analysis Client displays only one application library – **XAN4CDXA**.

X-Analysis Client displaying Application Library



Different nodes (options) are available under the cross-reference library node – **XAN4CDXA**. Expand the **XAN4CDXA** node to see the available options.

Application Library expanded



Chapter 3: Analysis & Documentation

Continual technical enhancements, syntax, variations in programming styles, financial and time constraints, absence of original application designers, and/or monolithic application codes are some reasons that necessitate changes in the existent application designs. System analysts or software professionals must be equipped with the technological knowhow for redesigning business applications.

The X-Analysis toolset meets the requirements mentioned above. It is patterned to convert all IBM i applications into the latest format. This software suite has precise tools for conducting advanced application and documentation work.

In this chapter, you will learn about the specialized Analysis & Documentation solution set. The features and options discussed here provide prompt and automated documenting and computing solutions.

The chapter contains:

- » [Chronology of features](#)
- » [Work with Objects](#)
- » [Object Where Used](#)
- » [Export List to PDF/MS Word or MS Excel](#)
- » [Data Flow Diagram](#)
- » [Variable Where Used](#)
- » [Structure Chart Diagram](#)
- » [Detailed Structure Chart](#)
- » [Hierarchal Structure Chart](#)
- » [Document Manager](#)
- » [Source Browser](#)

Chronology of Features

The Analysis & Documentation solution set is a sophisticated tool for instant and automated cross-referencing, impact analysis and graphical documentation of Synon/2E, RPG, and COBOL applications. All the functionality above (and more) is contained in the following separate features, explained in this tutorial:

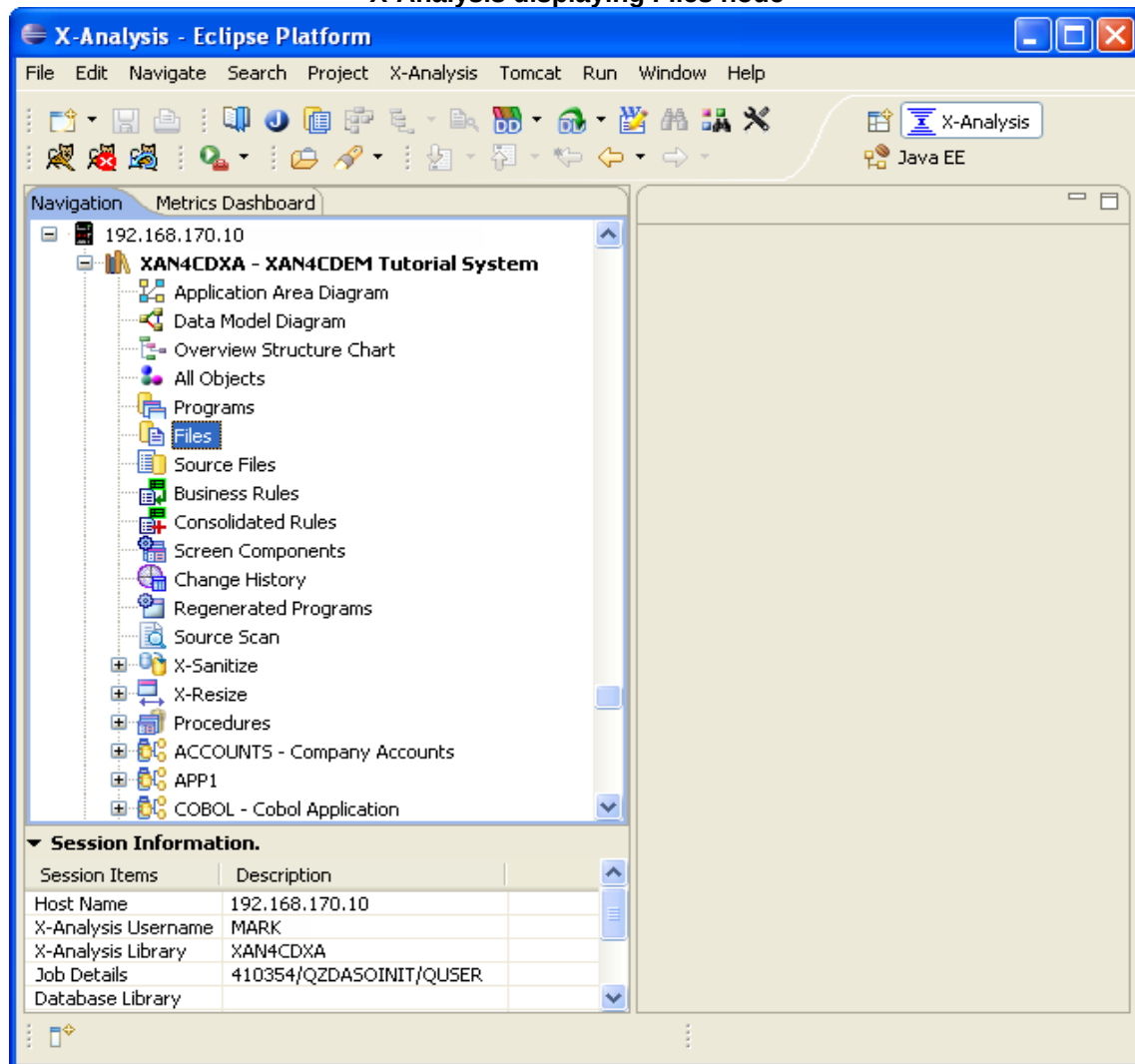
- **Work with Objects** – It is a list of all the objects in a chosen application or application area.
- **Object Where Used** – It is a list of all usage references for an object.
- **Export List to PDF/Microsoft Word or Microsoft Excel** – The option to export data to MS Excel or a PDF/MS Word.
- **Data Flow Diagram** – It is an interactive, colour-coded bus routing block diagram for displaying an object relationship within an application.
- **Variable Where Used** – It is a list of all source lines from the source members, which have references to field/variable of a file or program. This includes lines from device files, and copybooks.
- **Structure Chart Diagram** – It is a graphic display for showing program-to-program relationships.
- **Detailed Structure Chart Diagram** – It is a graphic display for showing program-to-program relationships with files used by each program. It also displays each program's generated program text.
- **Hierarchal Structure Chart Diagram** – Colour-coded bus routing block diagram, which enhances the visual of program-to-program interrelationships. The user gets an exact idea of the hierarchal set-up of the programs.
- **Document Manager** – A utility that automatically generates structured system document in PDF / MS Word format.
- **Source Browser** – It is an interface for system analysis, reviewing, re-factoring, maintaining, and redeveloping in source code.
- **Source Browser Toolbar** – This toolbar contains a list of different options for viewing code within the Source Browser, such as Pseudo Code and Source View Level options etc.
- **Other Source Browser Options** – These are the other essential Source Browser options.

Work with Objects

Work with Objects displays a list of all the objects for a chosen application / application area.

To generate the Object List for all files, double click on the **Files** node available under the application library.

X-Analysis displaying Files node



The double click action invokes the **Work with Objects** dialog with 'Type' set as *FILE and 'Attribute' as PF.

Work with Objects dialog – Files

Work with Objects

Application Area

Name: *NONE | Description: All Members Selected

Object

Library: *ALLUSR

Name: *ALL | Type: *FILE | Attribute: PF

Text:

Function Attributes

Component Status: *ALL | Function Type: *ALL | PF Name: *ALL

Program Type: All | Modality: All

OK Cancel

Click the **OK** button to invoke the Object List window displaying all files.

Object List window displaying all Files (PF)

Object List of *ALLUSR/*ALL/*FILE/PF/*ALL/*ALL, Total Objects: 50

Library	Name	Type	Attribute	Description	Status	Changed	Created
PF XAN4CDEM	ASIMPLTEST	*FILE	PF		*D	05/06/12	30/03/11
PF XAN4CDEM	ASTATUS	*FILE	PF	Status file	*A	05/06/12	01/09/08
PF XAN4CDEM	CNTACS	*FILE	PF	Contacts	*C	05/06/12	01/09/08
PF XAN4CDEM	CONDET	*FILE	PF	Contract Detail	*B	15/08/12	01/09/08
PF XAN4CDEM	CONDETNEW	*FILE	PF	Contract Detail new -?C...	*D	05/06/12	02/02/11
PF XAN4CDEM	CONHDR	*FILE	PF	Contract Header	*B	12/06/12	01/09/08
PF XAN4CDEM	CPYBKSRC	*FILE	PF	Cobol copybooks	*D	05/06/12	10/05/11
PF XAN4CDEM	CUSF	*FILE	PF	Sites	*B	22/06/12	01/09/08
PF XAN4CDEM	CUSGRP	*FILE	PF	Customer Groups	*A	05/06/12	01/09/08
PF XAN4CDEM	CUSTS	*FILE	PF	Purchases	*B	15/08/12	01/09/08
PF XAN4CDEM	DELIVA	*FILE	PF	Delivery Areas	*B	05/06/12	01/09/08

The Object List window is a multicolumn display. In this window, a user can sort a column data with a single click of a column heading.

Object Where Used

The Object Where Used feature generates a list of all usage references for an object.

To make an Object Where Used list for the object CUSF, locate and select the object CUSF from the Object List. Right click on CUSF and select the option **Usage References** from the submenu **Object Where Used**. This brings up the Object Where Used list for the Usage References of the object CUSF.

Object Where Used

Object	Type	Text	Usage
CB906R	*PGM	Back-out account	File Updated By Program
CB906RR	*PGM	Back-out account	File Updated By Program
CONUPD0	*PGM	Revert Back Customer Info	File Updated By Program
CONUPD1	*PGM	Update Customer Info - Version 1	File Updated By Program
CONUPD2	*PGM	Update Customer Info - Version 2	File Updated By Program
CUSCPY	*PGM	Customer Copy	File Read/Written To By Program
CUSFL1	*FILE	Sites by Name	Logical File
CUSFL2	*FILE	Sites by Status	Logical File
CUSFL3	*FILE	Sites by Number	Logical File

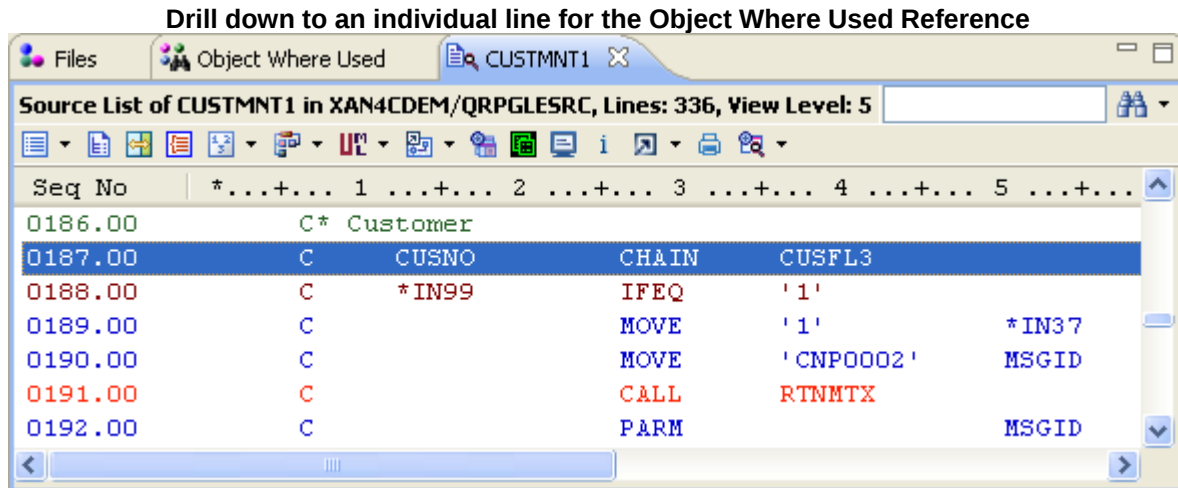
The Object Where Used window is a multicolumn display. The Usage column displays uses of the object CUSF in a particular object. The Object Where Used window also allows a user to drill down to a specific line of code where the object is used.

Scroll down to the object CUSTMNT1 in the Object Where Used window, displayed below.

Object Where Used with CUSTMNT1 selected

Object	Type	Text	Usage
CUSFSELR	*PGM	Customer Site Selection	File Read By Program
CUSLET SQ	*PGM	Update Letter Sequence	File Updated By Program
CUSREAD	*PGM	Test Sequential Read options	File Read By Program
CUSRGZ	*PGM	Reorganize Customer File	File Updated By Program
CUSTMNT1	*PGM	Customer Detail Maintenance	File Read By Program
CUSTMNT1AR	*PGM	Customer Detail Maintenance	File Read By Program
CUSTMNT1BR	*PGM	Customer Detail Maintenance	File Read By Program
CUSTMNT1R	*PGM	Customer Detail Maintenance	File Read By Program
CUSTMNT1_0	*PGM	Customer Detail Maintenance	File Read By Program

Double click on the row displaying **CUSTMNT1**. This retrieves the source member for the object CUSTMNT1 with the highlighted line referring to the object CUSF.

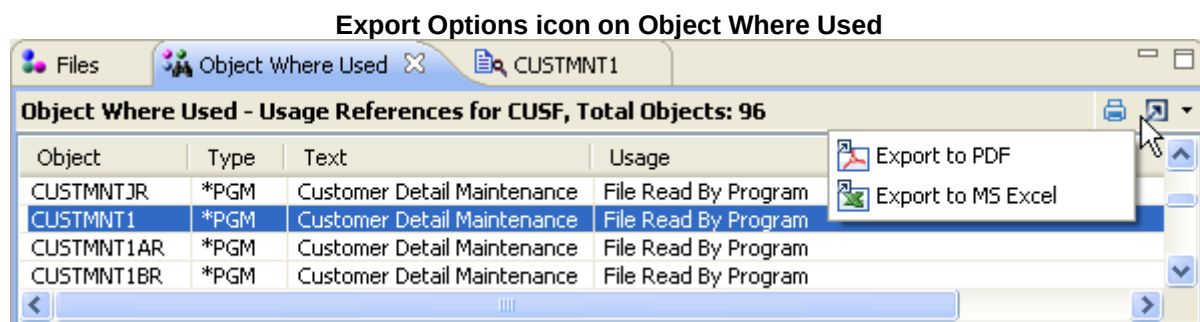


Export List to PDF, Microsoft Word, or Microsoft Excel

X-Analysis provides a facility to export data from any displayed window. The window toolbar on the 'Object Where Used' view has an **Export Options** dropdown button, with **Export to PDF** and **Export to MS Excel** as options.

Select your desired option to export the list into PDF/MS Word or Excel.

The user can set the export option as Export to MS Word using the X-Analysis Preferences. For the settings to take effect, the user must select/unselect the X-Ref.

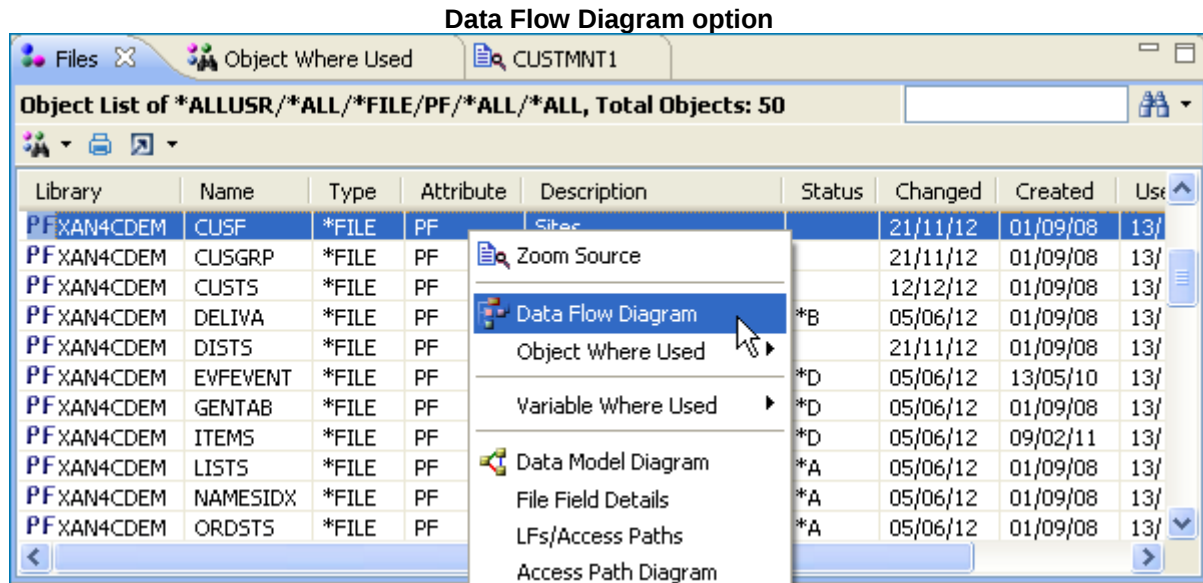


Data Flow Diagram / DFD

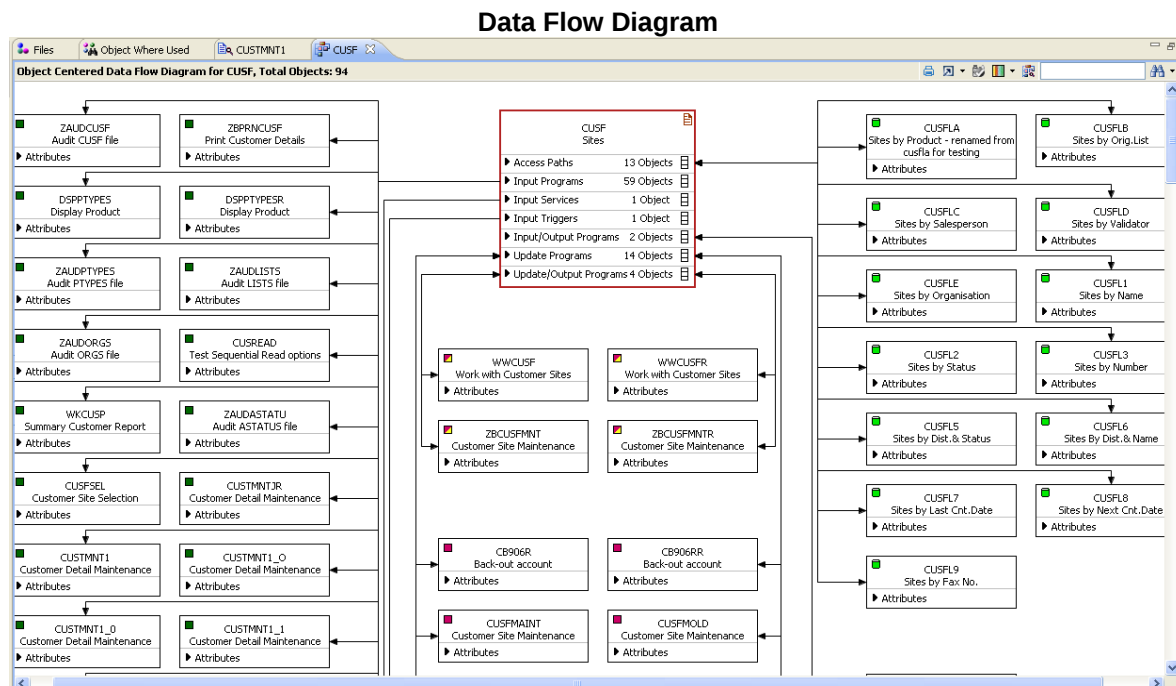
As the name suggests, a Data Flow Diagram or DFD is the diagrammatic representation of the data flow. A DFD depicts all the possible interrelationships among the files and programs contained within a particular application. A colour-coded DFD simultaneously plays the dual role of showing the data flow at high object level, besides providing contextual details regarding specific variables and parameters passed between objects.

The DFD uses bus-routing layout, which offers the user two benefits. One, it gives the user a precise idea of where and how the data that is input affects the output desired; two, it enables the user to visualize how an object within an application correlates with the other objects. The diagrams showing the data flow in neat blocks help even a non-technical user get a clear idea of the object(s) interrelationships.

For generating the DFD, the user has to return to the Object List using the navigation arrows available on the Eclipse toolbar. The user must select the object CUSF, and then choose the **Data Flow Diagram** option from the context menu as shown below:



This brings up the DFD for the object CUSF.

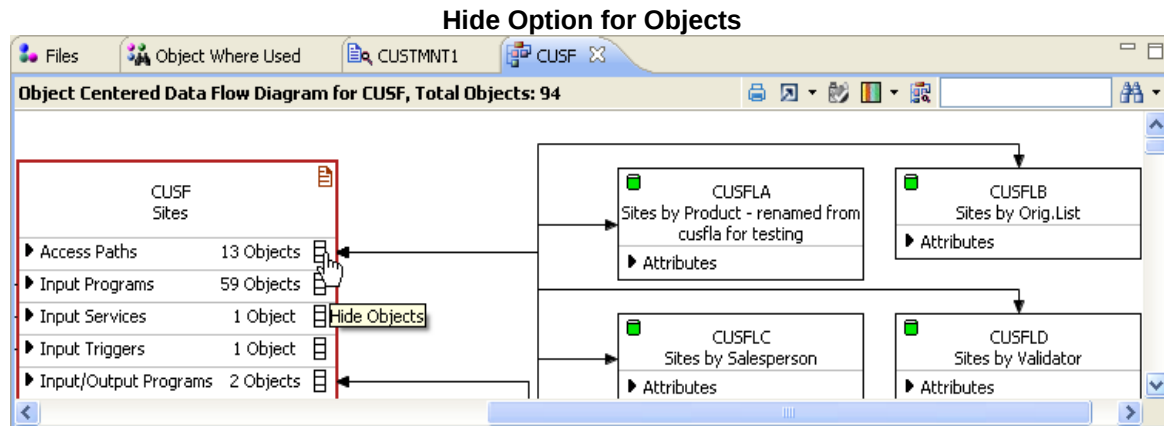


The DFD is also a graphic equivalent of the 'Object Where Used' data. Besides the Logical Views/Access Paths for CUSF, a user can see how CUSF fits into the application (i.e. the programs that update CUSF, programs that use CUSF as an input file and so on).

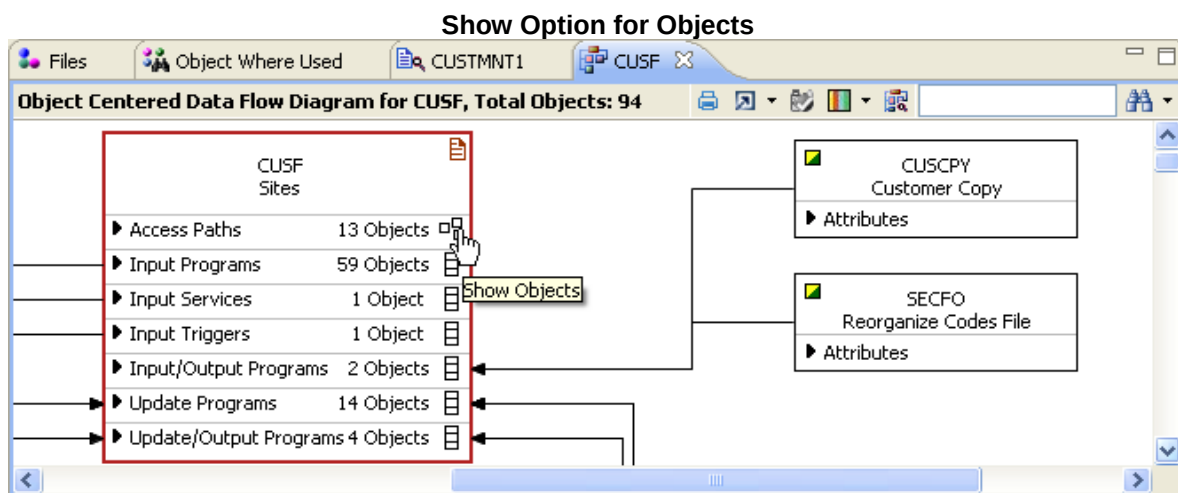
The dynamic and interactive diagram facilitates the user with access to other features contained within an object. There are varied and flexible features and options like Hide/Show Objects, Expand/Collapse Referenced Objects, View Annotation, Attributes – all of these and more are explained in the sections ahead.

Hide/Show Objects

For having a better grasp of object interrelationships, a user may want to hide/show all objects pertaining to programs. A single click action on the icon alongside the objects enables the user to hide/show objects. In the following screenshot, the icon against **Access Paths** is clicked to hide objects.

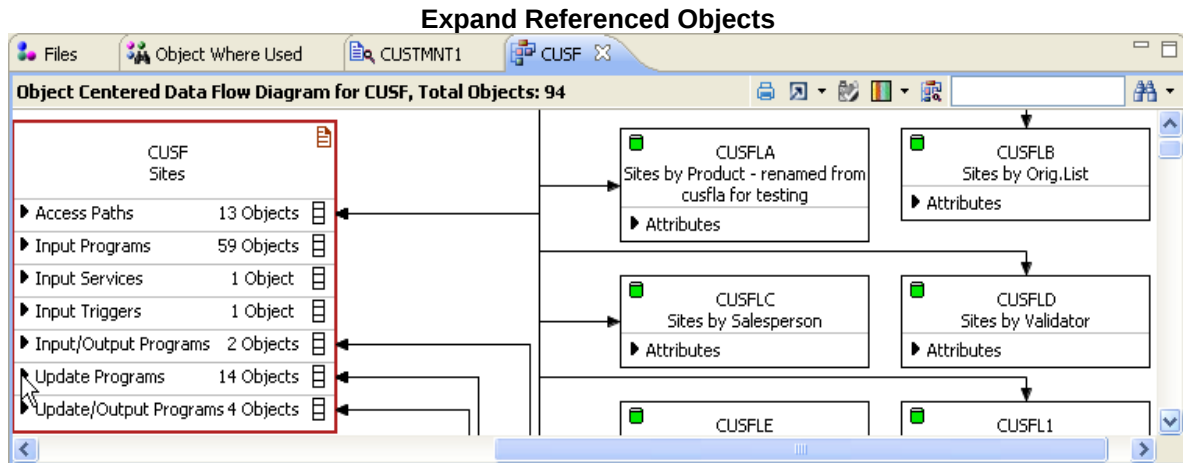


The following screenshot shows how another click displays all the objects within.

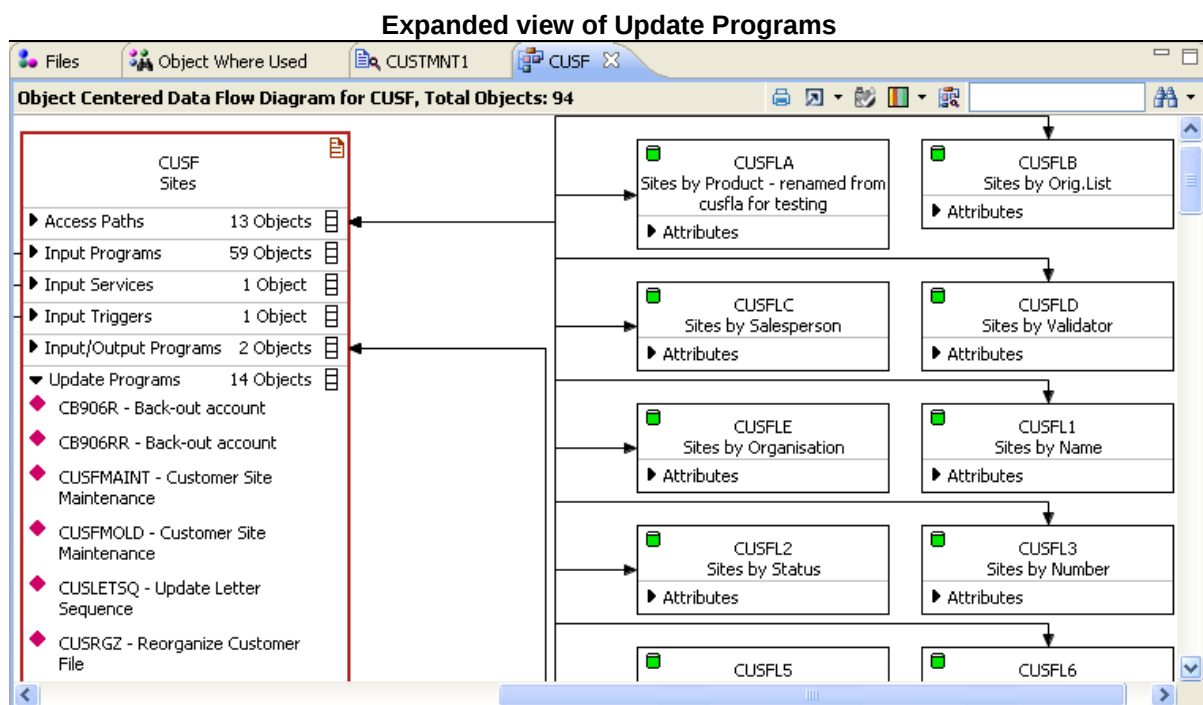


Expand/Collapse Referenced Objects

The DFD takes another dynamic form when the user gets to expand the referenced object(s) on selecting a particular category from the main object's box. The following screenshot displays the action to be performed:

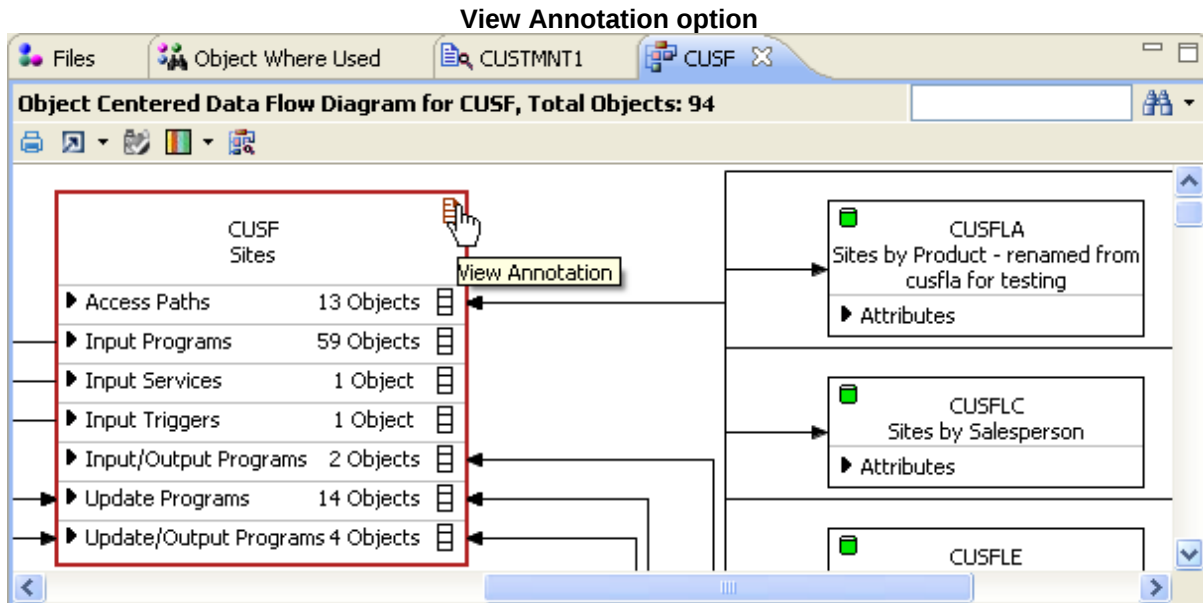


A single click on the arrow icon adjacent to **Update Programs** reveals all objects updating the file CUSF. The following screenshot displays the expanded view of the referenced objects' list:



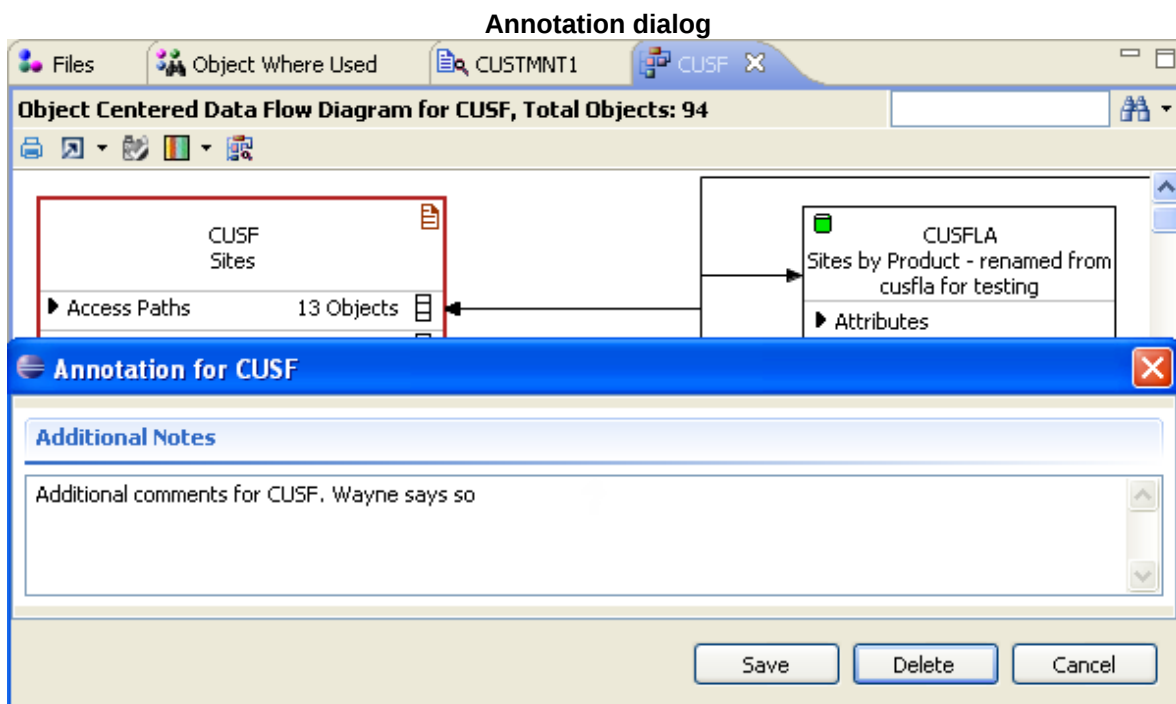
View Annotation

The **View Annotation** option allows the user to see annotation for a specific object. A red icon denoting Annotated text is present on the right side of the Object (see the following screenshot).



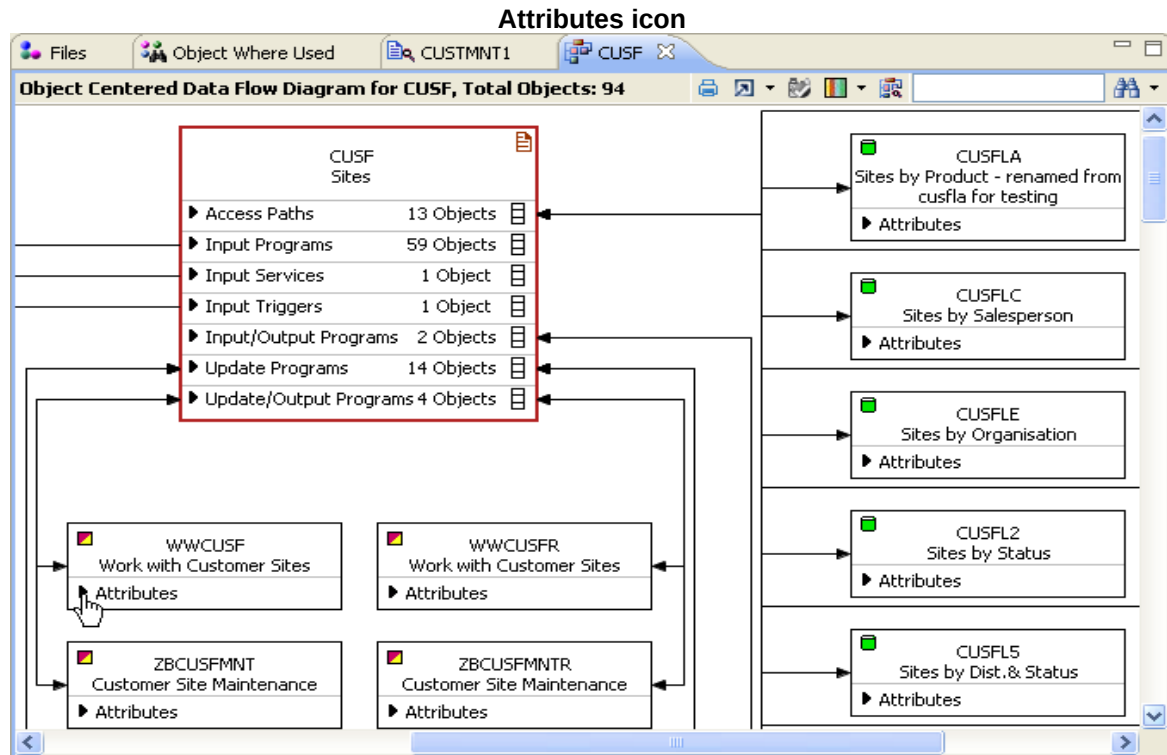
Double clicking on the **View Annotation** icon invokes the **Annotation** dialog box, displaying the notes that were written earlier.

The user can further add/modify notes in the **Annotation** dialog box and click on the **Save** button. These notes will be viewable later using the same option.

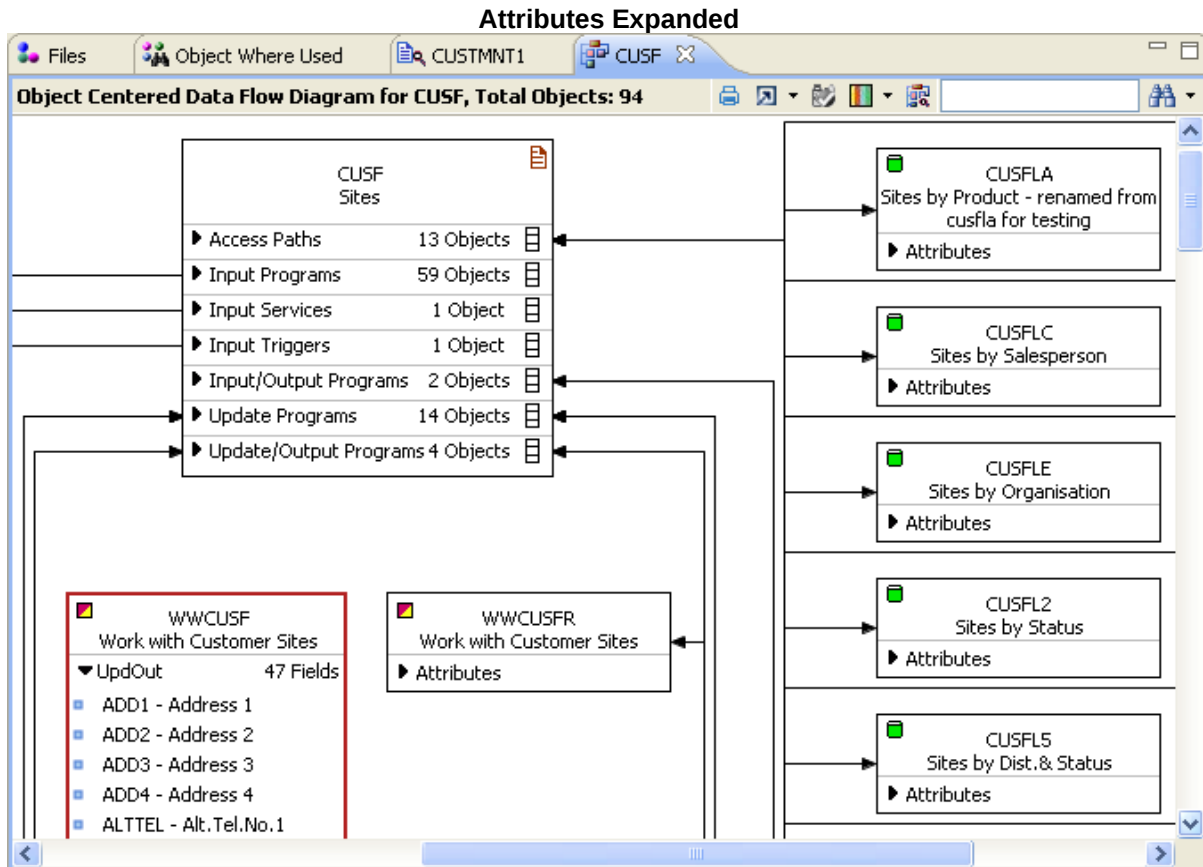


Attributes

The 'Attributes' feature comprises impacted fields of a particular object. Through these fields, the main object is referenced.

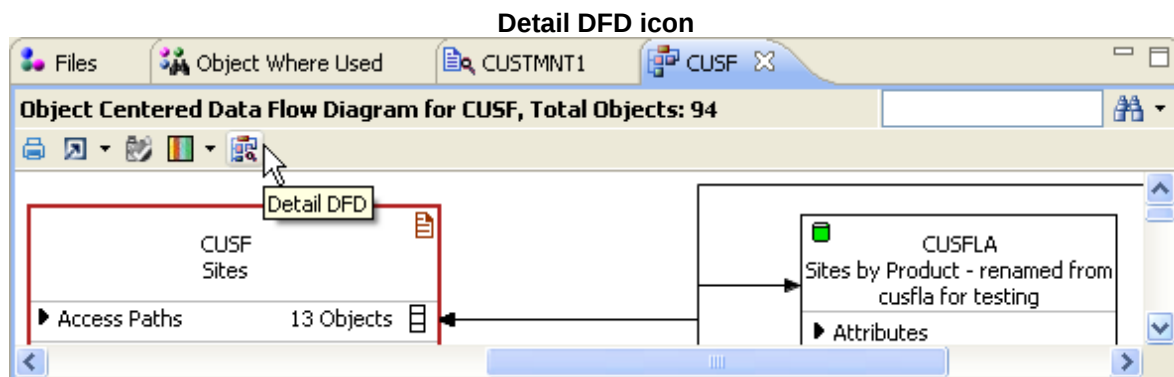


The different objects corresponding to the main object have fields within them. The fields are known as 'Attributes' and these are easily accessible by clicking on the **Attributes** icon. The term 'Attributes' changes to related attribute like Input, Update, Output etc. on expanding the **Attributes** button, as shown below:



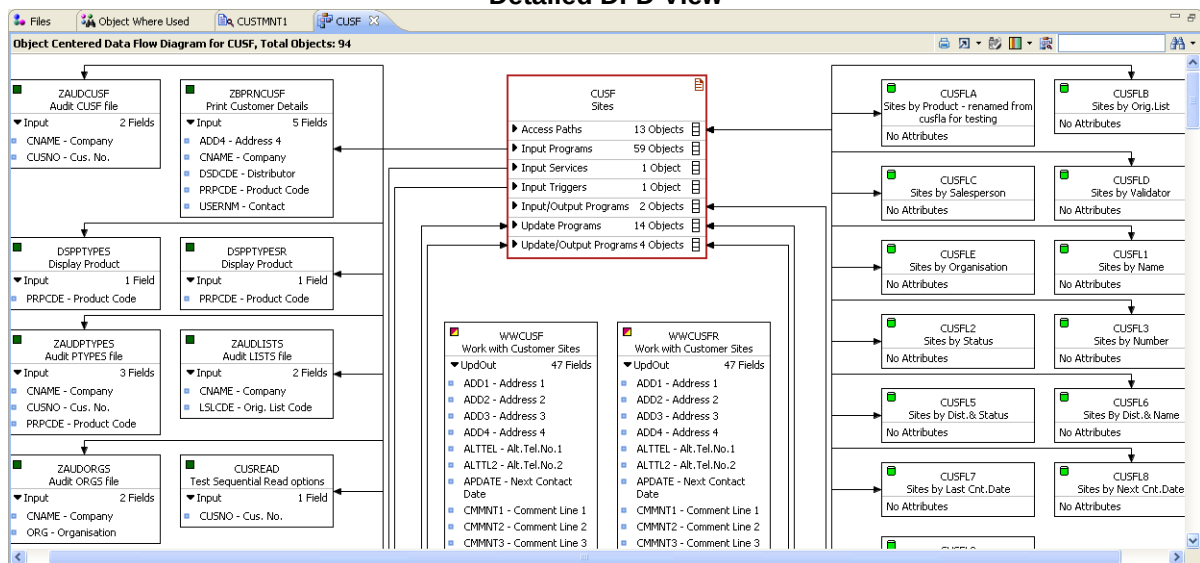
Detail DFD icon

The user can opt for the **Detail DFD** icon from the toolbar for viewing field usage of all the objects.



When the user clicks on the **Detail DFD** icon, the 'Attributes' section of all the objects gets expanded displaying referred fields from all objects. The following screenshot displays the detailed DFD screen:

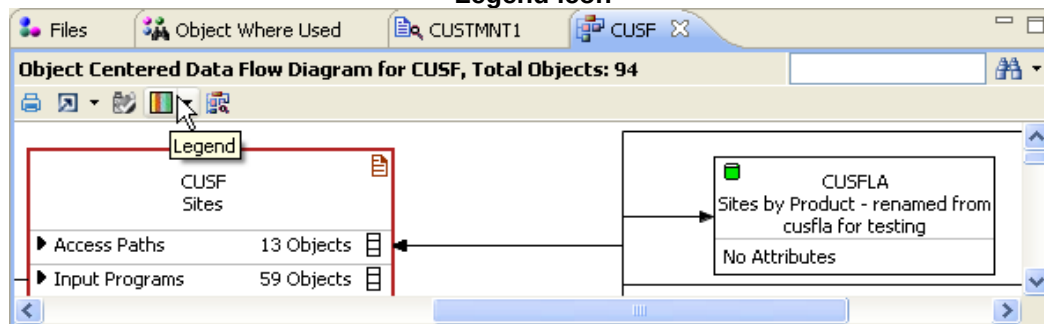
Detailed DFD View



Legend icon

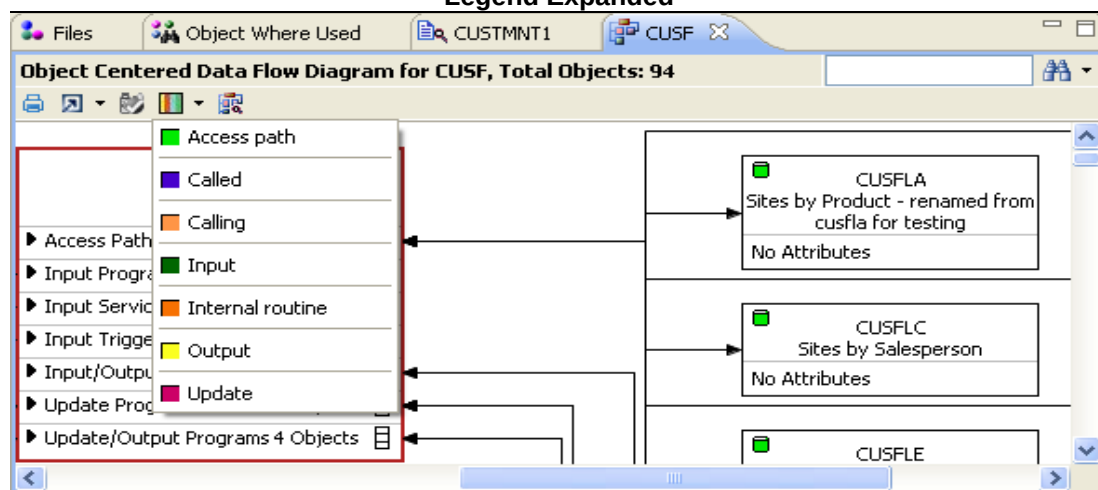
The **Legend** icon on the Eclipse toolbar displays the details of the colour scheme used by a DFD. Click on the **Legend** icon, as shown below:

Legend icon



The colour scheme helps a user understand the reference and association of specific objects.

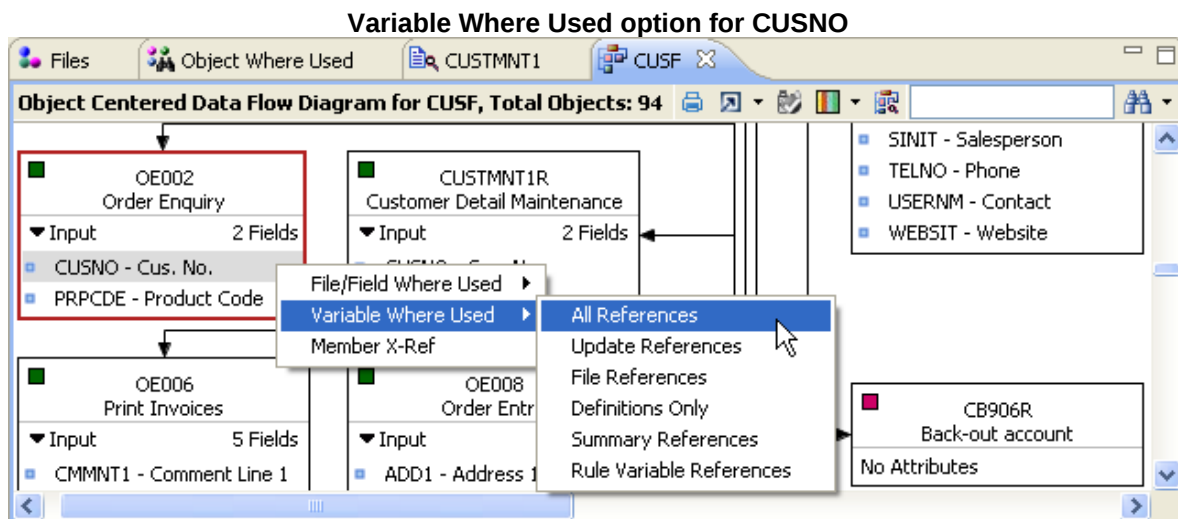
Legend Expanded



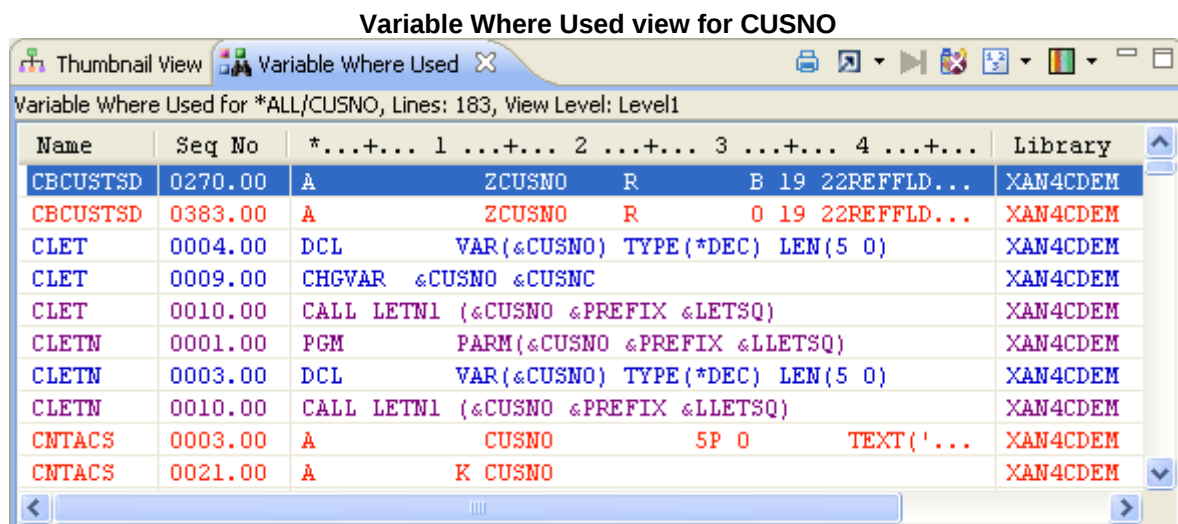
Variable Where Used

This option is specifically useful for conducting impact analysis. It returns all source lines, where field/variable of a file or program is used and/or referenced, in any of the source members. The source members searched also include device files and copybooks.

From the DFD for CUSF, search and select the object OE002. We can clearly see that the fields used by object CUSF are CUSNO and PRPCDE. Select CUSNO and opt for **Variable Where Used** from the context menu, as shown below:

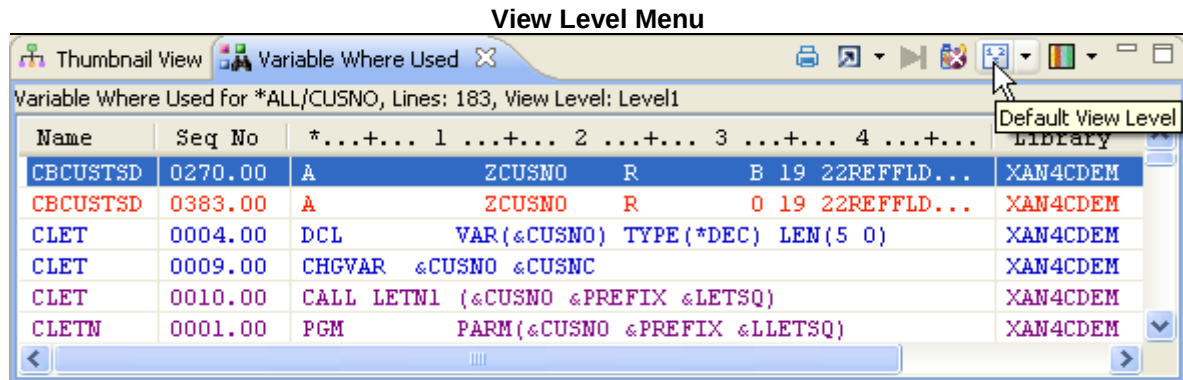


Select the **All References** option to invoke the Variable Where Used window for the field CUSNO.

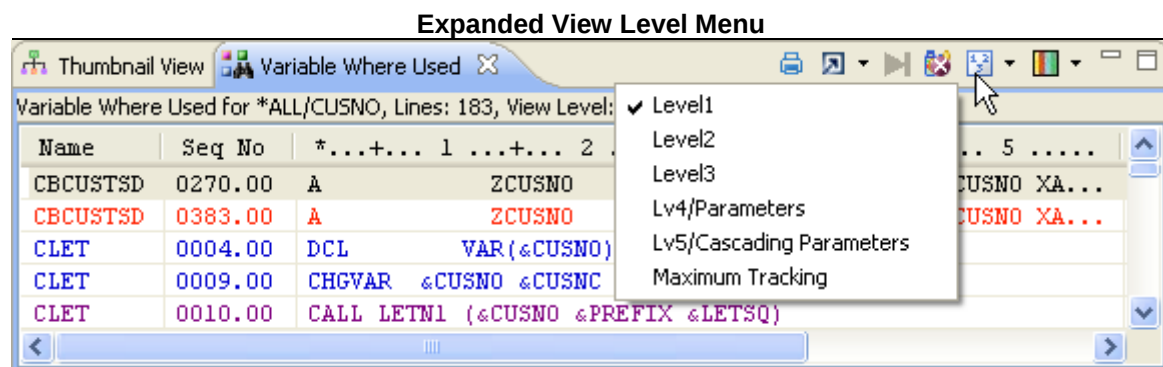


The window displayed above lists all references of field CUSNO from the entire application.

The **View Level** menu icon is located on the X-Analysis toolbar, and the menu allows for six levels of Variable Where Used information.



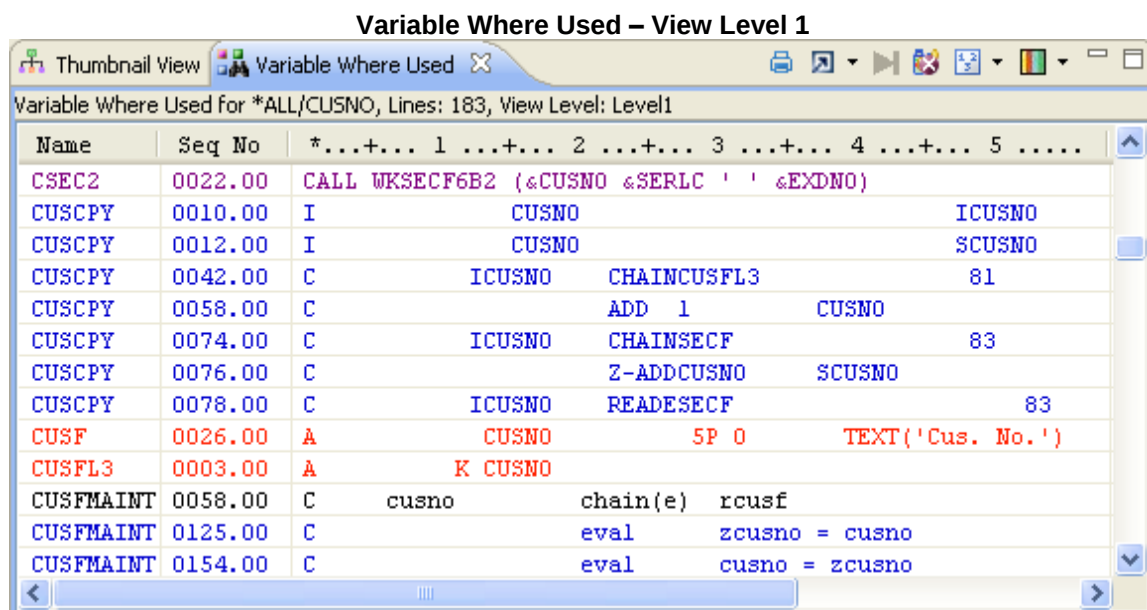
The following image shows the expanded View Level menu of the Variable Where Used information:



The Default View Level for 'Variable Where Used' option can be set using X-Analysis Preferences (General preferences) window.

As an example, let us test the View Levels for the field CUSNO.

Level 1: Level 1 lists all direct references to the CUSNO field.



Level 2: Level 2 adds extra indirect references, “one reference removed,” to the Level 1 list. For example, CUSTOMER is set equal to CUSNO (a direct reference) and then CUSTOMER is a variable in the statement “IF CUSTOMER = ZEROES” (a one reference removed indirect reference).

Variable Where Used – View Level 2

Variable Where Used For *ALL/CUSNO, Lines: 316, View Level: Level2

Name	Seq No	*...+... 1 ...+... 2 ...+... 3 ...+... 4 ...+... 5 ...
CNTCMAINT	0120.00	C eval cusno = zcusno
CNTCMAINT	0247.00	C eval cusno = customer
CNTCMAINT	0257.00	C parm customer
CNTCMAINT	0261.00	C kfld cusno
CNTCMAINTD	0025.00	A ZCUSNO 5Y OB 4 28
CNTLF3	0003.00	A K CUSNO
CNTLF4	0005.00	A K CUSNO
CONUPD0	0014.00	cusno = 50;
CONUPD0	0015.00	setll(e) cusno cusfl3;
CONUPD0	0016.00	reade(e) cusno cusfl3;
CONUPD0	0020.00	reade(e) cusno cusfl3;
CONUPD1	0015.00	cusno = 50;
CONUPD1	0016.00	setll(e) cusno cusfl3;
CONUPD1	0017.00	reade(e) cusno cusfl3;
CONUPD1	0021.00	reade(e) cusno cusfl3;
CONUPD2	0015.00	cusno = 50;
CONUPD2	0016.00	setll(e) cusno cusfl3;
CONUPD2	0017.00	reade(e) cusno cusfl3;
CONUPD2	0021.00	reade(e) cusno cusfl3;
CPDM	0003.00	DCL VAR(&CUSNO) TYPE(*DEC) LEN(5 0)
CPDM	0006.00	DCL VAR(&CUSNC) TYPE(*CHAR) LEN(5)
CPDM	0009.00	CHGVAR &CUSNC &PK
CPDM	0010.00	CHGVAR &CUSNO &CUSNC
CPDM	0011.00	CALL LETN1 (&CUSNO &PREFIX &LETNR)
CPDM	0012.00	CHGVAR &CUSNC &PREFIX
CPDM	0013.00	CHGVAR VAR(&CUSG) VALUE('C' *CAT &CUSNC *cat '*')
CSEC	0003.00	DCL VAR(&CUSNC) TYPE(*CHAR) LEN(5)
CSEC	0004.00	DCL VAR(&CUSNO) TYPE(*DEC) LEN(5 0)
CSEC	0011.00	DCL VAR(&CUSNC) TYPE(*CHAR) LEN(5)
CSEC	0016.00	CHGVAR &CUSNC &PK
CSEC	0017.00	CHGVAR &CUSNO &CUSNC
CSEC	0022.00	CALL WKSECF6B (&CUSNO &SERLC ' ' &EXDNO)
CSEC2	0003.00	DCL VAR(&CUSNC) TYPE(*CHAR) LEN(5)
CSEC2	0004.00	DCL VAR(&CUSNO) TYPE(*DEC) LEN(5 0)
CSEC2	0011.00	DCL VAR(&CUSNC) TYPE(*CHAR) LEN(5)
CSEC2	0016.00	CHGVAR &CUSNC &PK
CSEC2	0017.00	CHGVAR &CUSNO &CUSNC
CSEC2	0022.00	CALL WKSECF6B2 (&CUSNO &SERLC ' ' &EXDNO)
CUSCPY	0010.00	I CUSNO ICUSNO
CUSCPY	0012.00	I CUSNO SCUSNO
CUSCPY	0042.00	C ICUSNO CHAINCUSFL3 81
CUSCPY	0058.00	C ADD 1 CUSNO
CUSCPY	0074.00	C ICUSNO CHAINSECF 83
CUSCPY	0076.00	C Z-ADDCUSNO SCUSNO
CUSCPY	0078.00	C ICUSNO READESECF 83
CUSF	0026.00	A CUSNO 5P 0 TEXT('Cus. No.')
CUSFL3	0003.00	A K CUSNO
CUSFMAINT	0017.00	D customer s 5p 0
CUSFMAINT	0058.00	C cusno chain(e) rcusf
CUSFMAINT	0084.00	C callp(e) wwcccons(zcusno)
CUSFMAINT	0125.00	C eval zcusno = cusno
CUSFMAINT	0154.00	C eval cusno = zcusno
CUSFMAINT	0309.00	C if customer = *zeros
CUSFMAINT	0310.00	C callp(e) cusfsel(customer)
CUSFMAINT	0314.00	C eval cusno = customer
CUSFMAINT	0326.00	C parm customer

Level 3: Level 3 builds on the Level 2 references, adding indirect references that are “one further reference removed.”

Level 4/Parameters: Level 4 further includes fields used as parameters. For example, in the statement “CALL LETN (&CUSNO &PREFIX &LETNR)”, CUSNO is a parameter to call LETN.

Variable Where Used – View Level 4

Name	Seq No	*...+... 1 ...+... 2 ...+... 3 ...+... 4 ...+... 5 ...+...
CLET	0006.00	DCL VAR(&prefix) TYPE(*CHAR) LEN(5)
CLET	0008.00	CHGVAR &CUSNC &PK
CLET	0009.00	CHGVAR &CUSNO &CUSNC
CLET	0010.00	CALL LETN1 (&CUSNO &PREFIX &LETSQ)
CLET	0011.00	CHGVAR &CUSNC &PREFIX
CLET	0014.00	CALL WKCUSL (&CUSNC PREFIX &LETNR)
CLETN	0001.00	PGM PARM(&CUSNO &PREFIX &LLETSQ)
CLETN	0003.00	DCL VAR(&CUSNO) TYPE(*DEC) LEN(5 0)
CLETN	0004.00	DCL VAR(&PREFIX) TYPE(*CHAR) LEN(5)
CLETN	0010.00	CALL LETN1 (&CUSNO &PREFIX &LLETSQ)
CLETN	0012.00	CHGVAR VAR(&CUSNC) VALUE(&PREFIX)
CLETN	0016.00	? WKCUSL ?*CUSNO(&CUSNC) ?*PREFIX(&PREFIX) ??LETNR
CNTACS	0003.00	A CUSNO SP 0 TEXT('Cus. No.')
CNTACS	0021.00	A K CUSNO
CNTMAINT	0021.00	D customer s 5p 0

Level 5/Cascading Parameters: Extending the information in Level 4, Level 5 includes references where CUSNO fields are parameters in a function, called by another function.

Maximum Tracking: Tracks the usage of a variable or a field to its maximum level of indirection.

This is the highest view level also referred as ‘Maximum Tracking’. It displays Variable Where Used information for all the levels mentioned above, as well as any other possible references of the field CUSNO.

The **Variable Where Used** option can be opted over a large variety of items including:

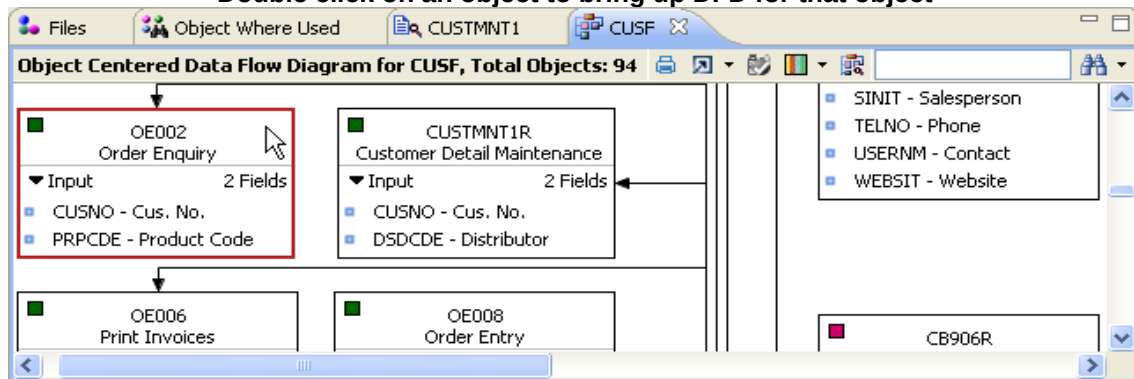
Files, Array Definitions, Data Structures, Sub-Fields of a Data Structure, Indicators, Key Lists, Data Fields, File Formats, Subroutines, Program Variable, Array Elements, Parameter Lists, Parameters, Key Fields, Message Ids, EXCPT Names, etc.

Structure Chart Diagram / SCD

In order to interpret the application design it is important to have an idea about how the control transfers from one program to the next. The Structure Chart Diagram or SCD addresses this need by presenting a graphical diagram. It contains relevant information as per control flow and call structure. In addition, you can view data input objects and avail of a summarized description of each object. Important functional aspects like updates, prints, and displays are colour coded to help you quickly focus on these commonly preferred details.

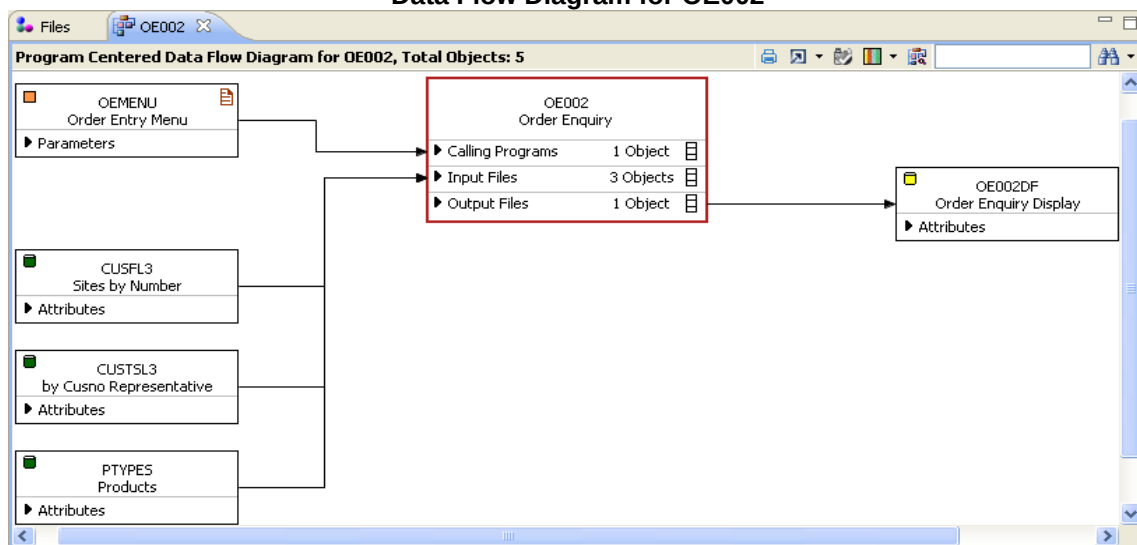
To create a Structure Chart Diagram, first select the object OE002 from the DFD for the object CUSF.

Double click on an object to bring up DFD for that object



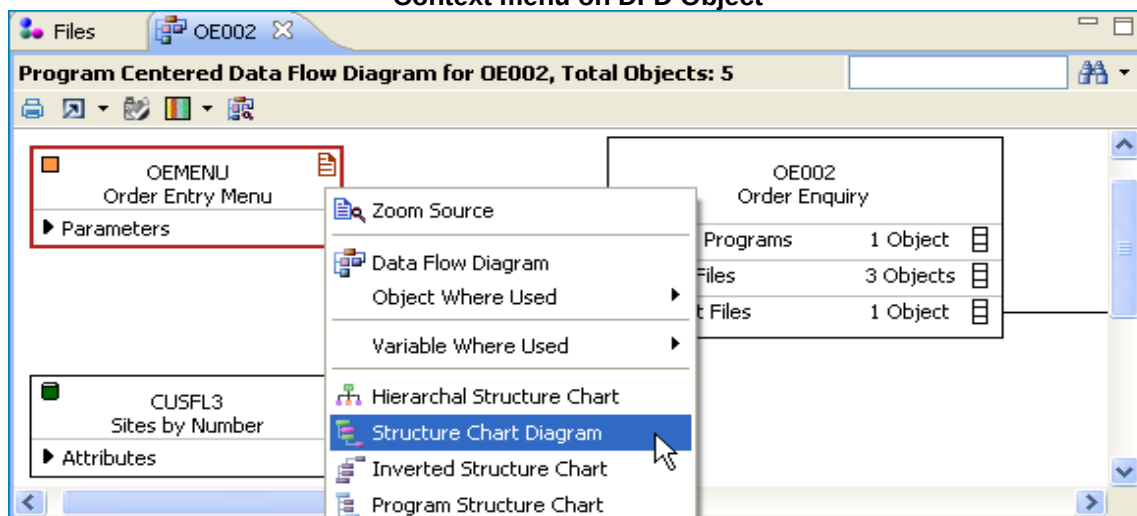
Double click on the object – OE002 to display its Data Flow Diagram.

Data Flow Diagram for OE002

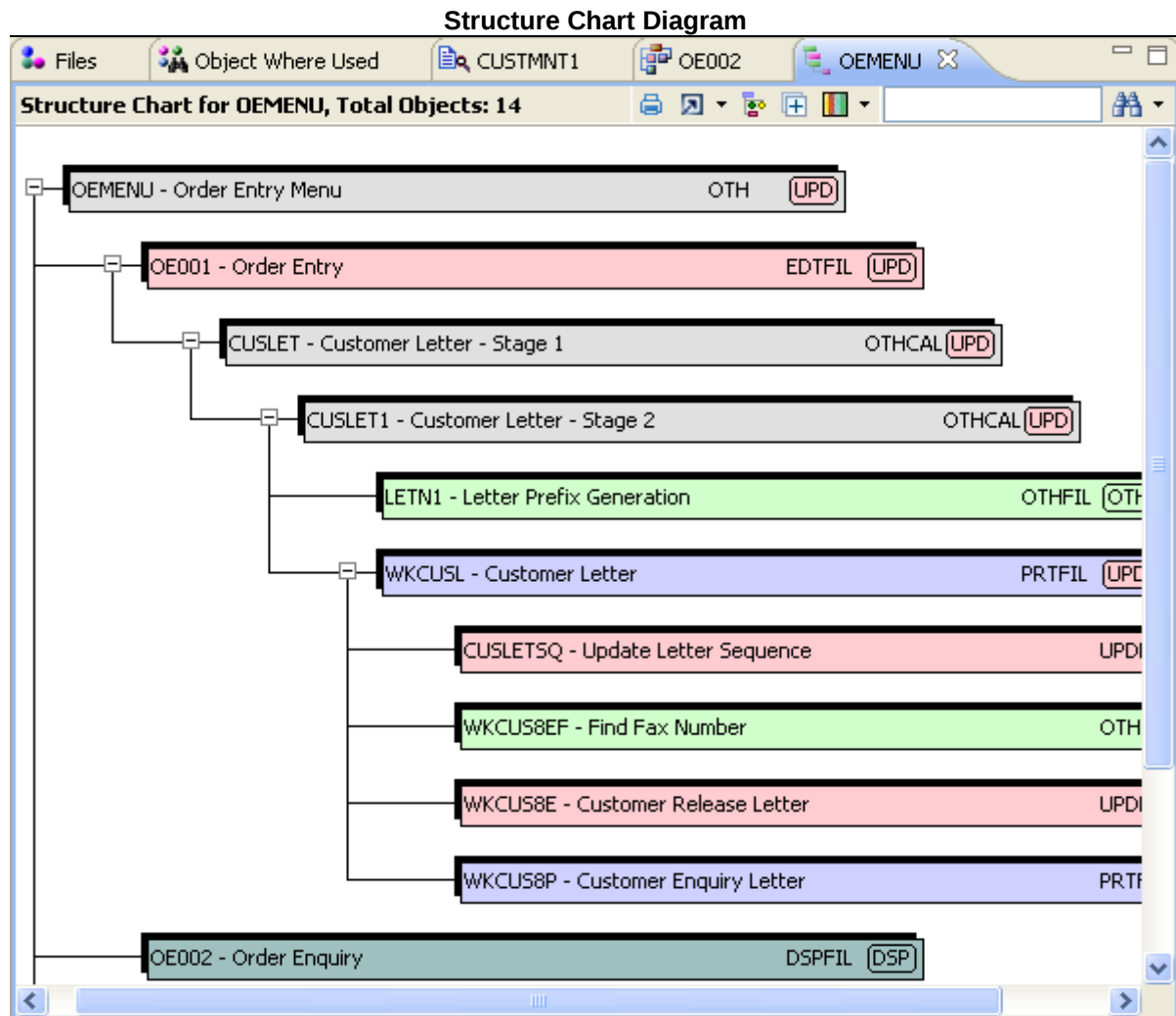


Select OEMENU and opt for the **Structure Chart Diagram** option from the context menu.

Context menu on DFD Object



The Structure Chart Diagram is a nested tree diagram that displays the complete call hierarchy of the 'programs called'.



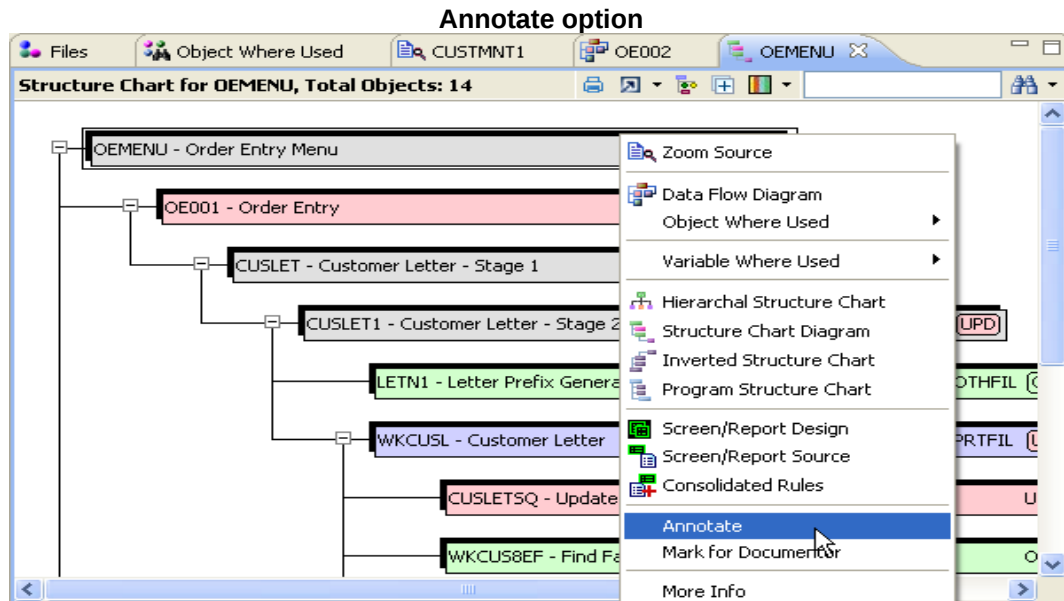
The normal view of a Structure Chart Diagram is shown above. The **Legend** button available on the toolbar helps to interpret the different colours used in the Structure Chart Diagram.

X-Analysis also allows annotation on the Structure Chart.

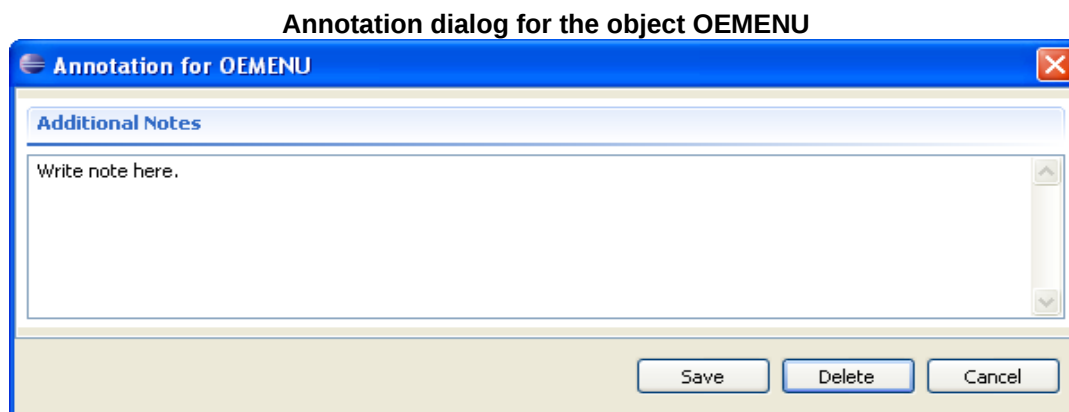
Select an object displayed in the Structure Chart Diagram and opt for the **Annotate** option from the context menu.

SCD Legend

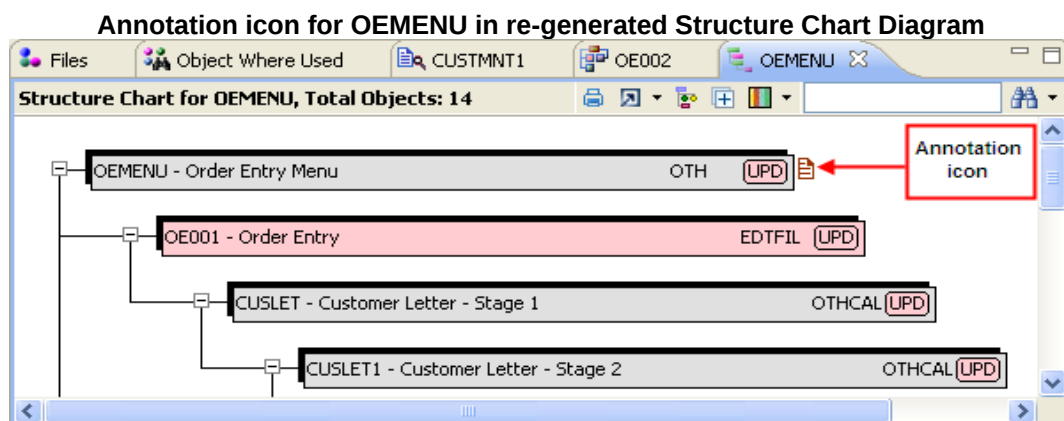
	Update
	Display
	Print
	Input
	Output
	Command
	Others
	Internal Routine
	Indeterminate
	Trigger
	Module



This brings up the **Annotation** dialog. Write your note and click the **Save** button. The annotation is stored in a file available in the cross-reference library.



Re-generate the Structure Chart Diagram to check for any object annotations.



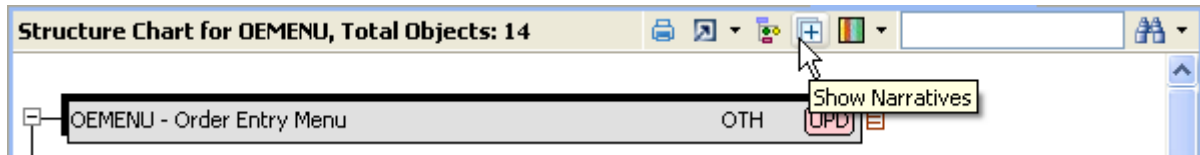
(Double click on the **Annotation** icon to bring up the **Annotation** dialog).

Detailed Structure Chart

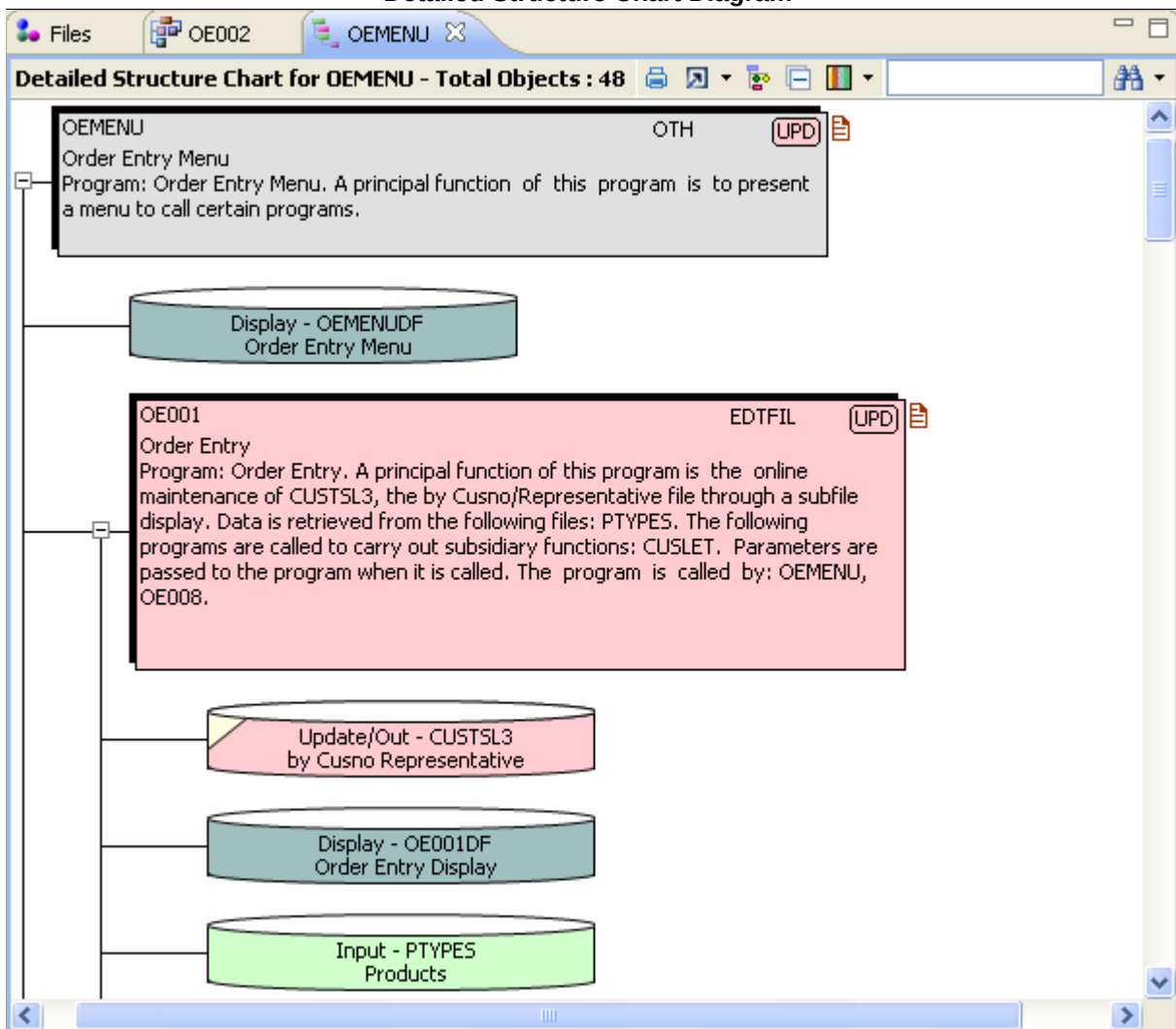
The Detailed Structure Chart Diagram displays files used by each program, together with each program's generated program text. (X-Analysis recovers the generated program text, which describes the purpose of the listed programs, automatically.)

To generate the Detailed Structure Chart Diagram, click the **Show Narratives** icon.

Show Narratives icon on toolbar



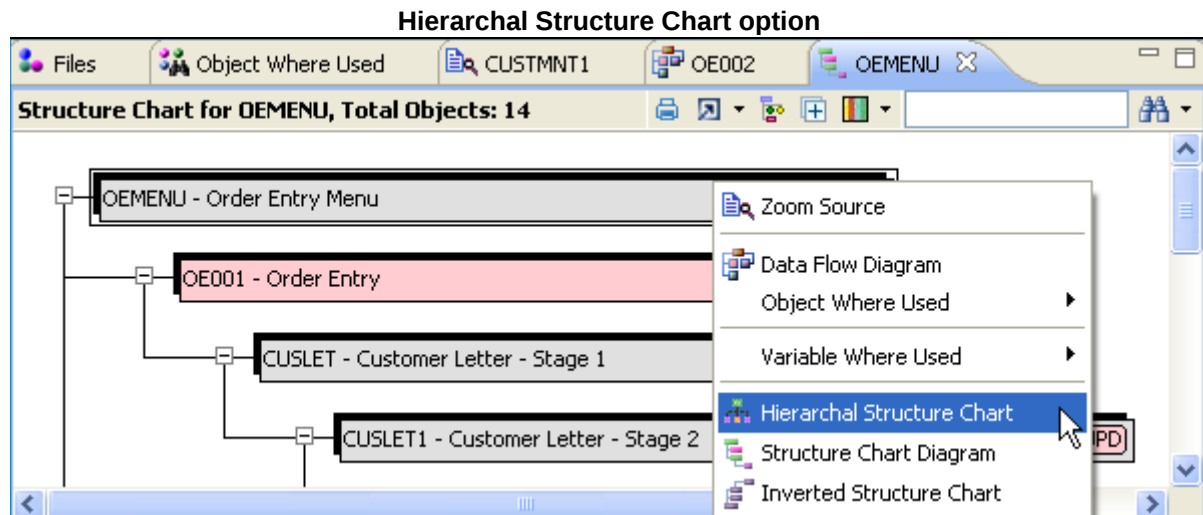
Detailed Structure Chart Diagram



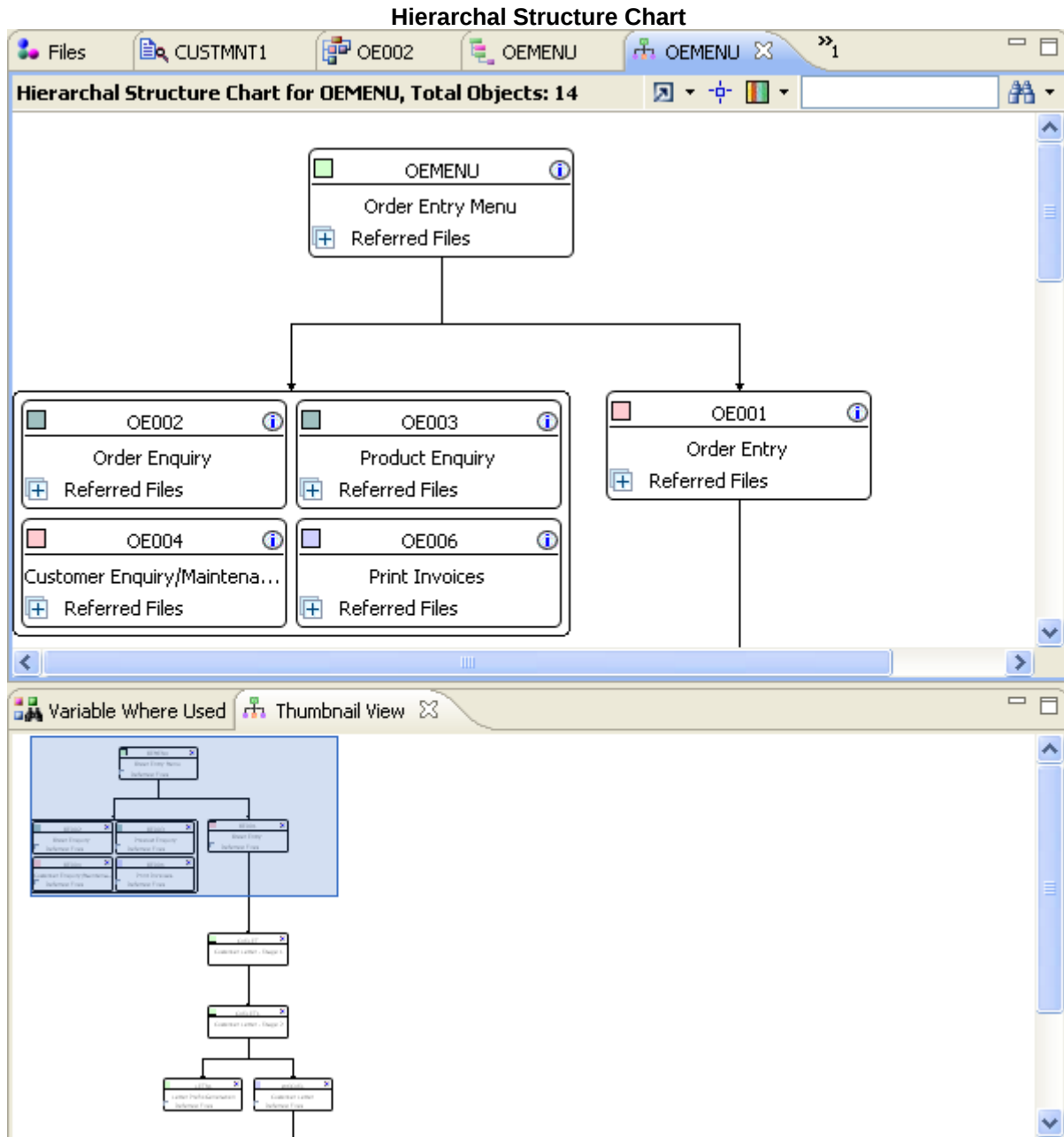
Click the **Normal SCD** icon on the toolbar to switch back to the Normal Structure Chart Diagram.

Hierarchal Structure Chart

The Hierarchal Structure Chart is an upgrade on the Structure Chart Diagram. The Hierarchal Structure Chart offers a precise view of all the programs representing their control flow and call structure through neat, colour-coded bus routing block diagrams. Select the **Hierarchal Structure Chart** option from the context menu over OEMENU from the Structure Chart Diagram, as shown below:

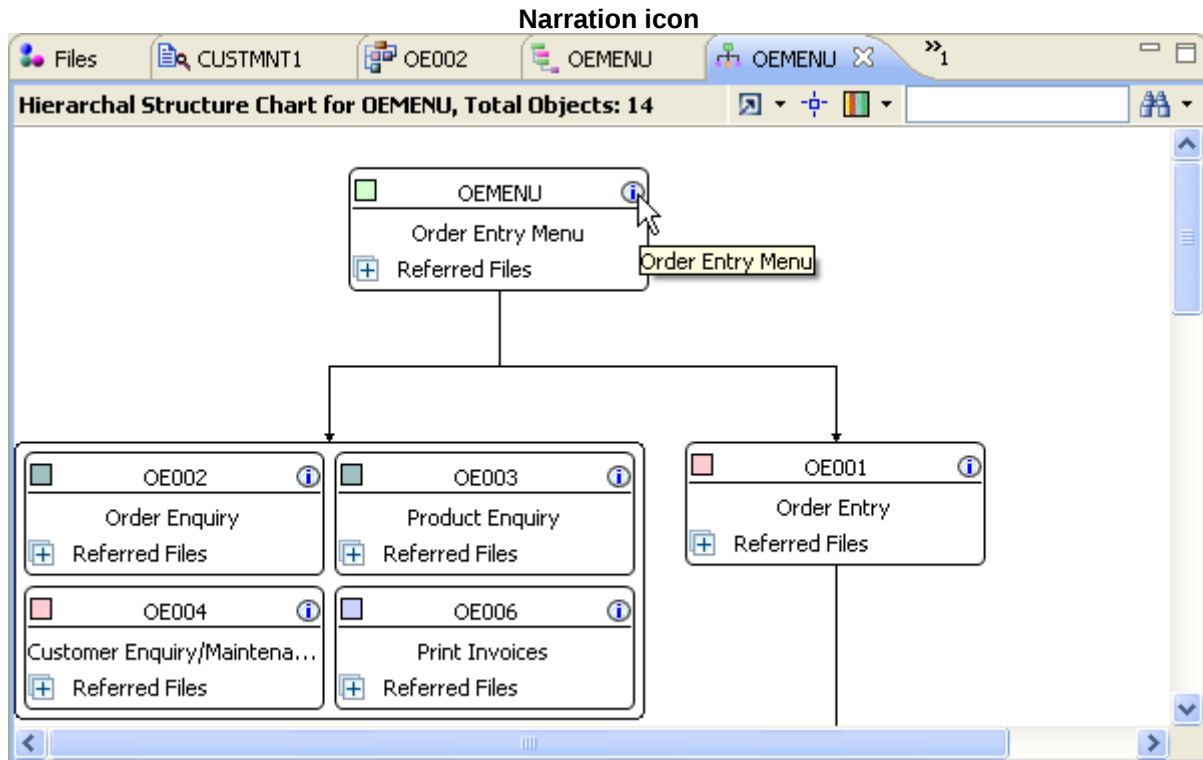


The screenshot below shows the delineation of the main object OEMENU into several blocks of related objects in the order of calling. The colour codes indicate whether a particular object is command-based, or input-based, or print-based and so on.

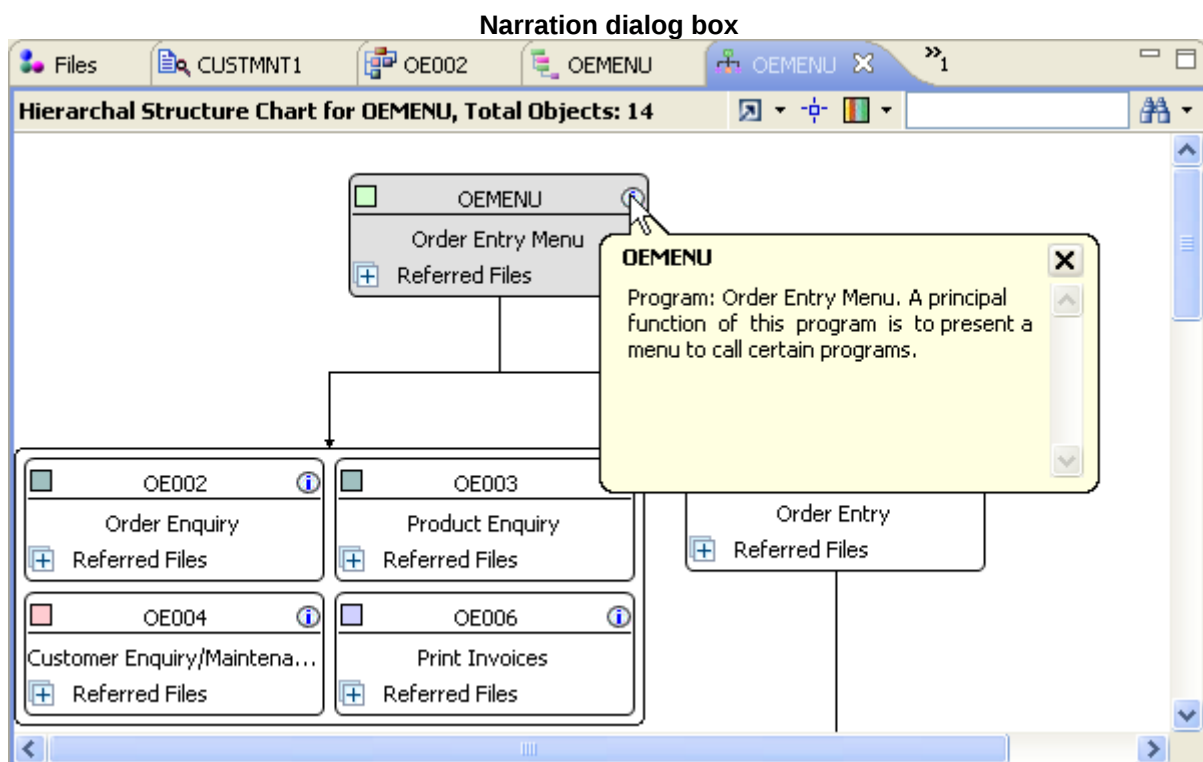


Narration

The user can avail of additional details regarding a specific object via the **Narratives** icon, as shown below:



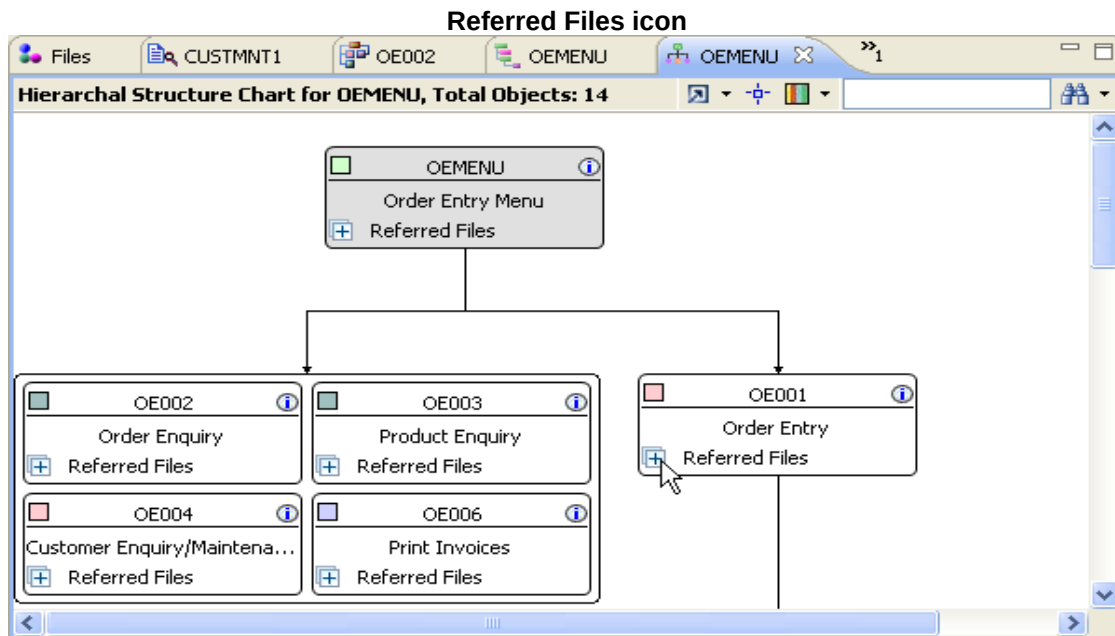
When the user clicks on this, a pop-up window provides the auto-generated narration for the program, as shown below:



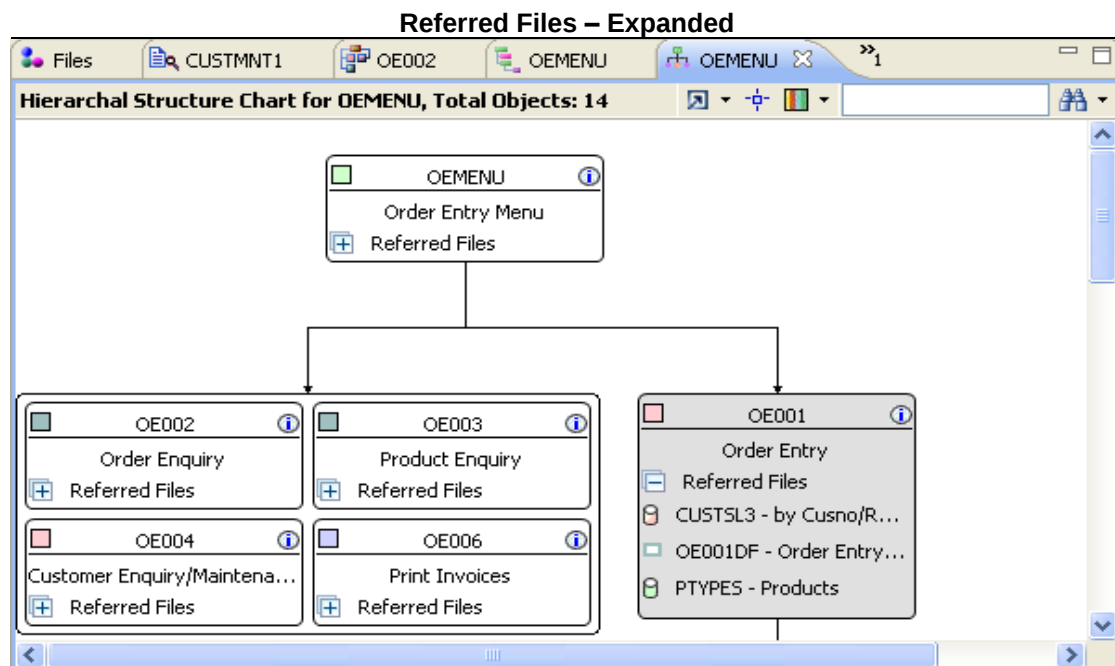
Referred Files

The Hierarchal Structure Chart has a feature to display referred files inline. An expandable icon called **Referred Files** is available in each box as presented in the image below. Clicking on this icon displays list of files belonging to the object.

The following screenshots show how **Referred Files** icon expands to display the files referred by object OE001.

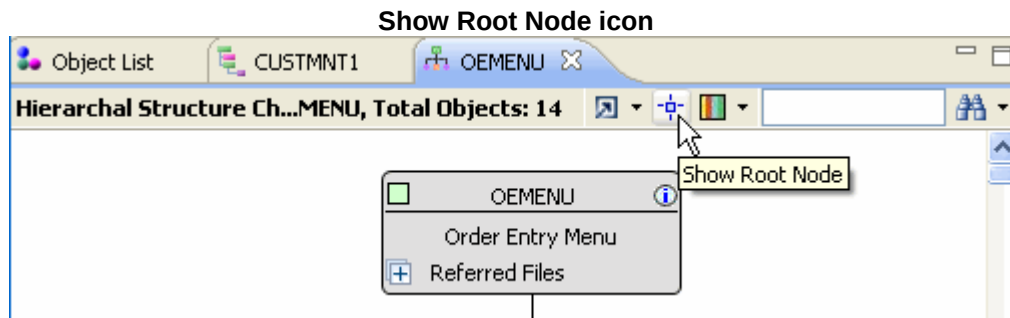


The following screenshot shows the **Referred Files** of the object OE001. The colour-coded geometric shape before the file name indicates the file type.



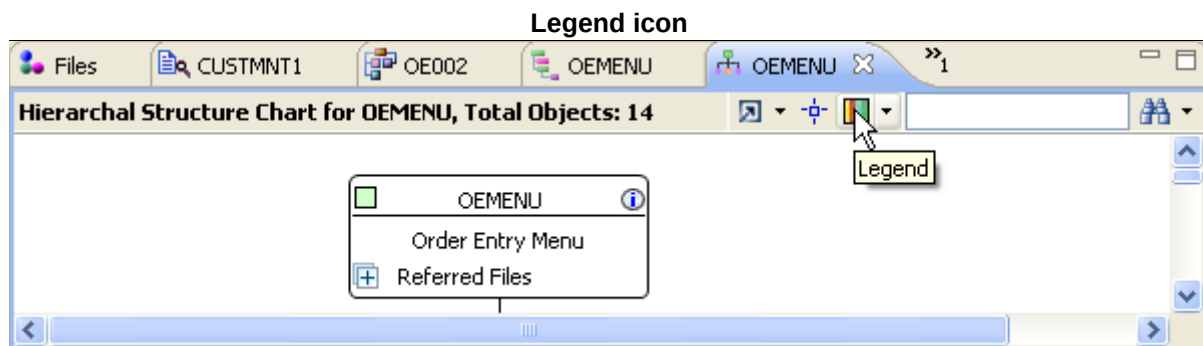
Show Root Node

By clicking on the **Show Root Node** icon, the root node gets displayed:

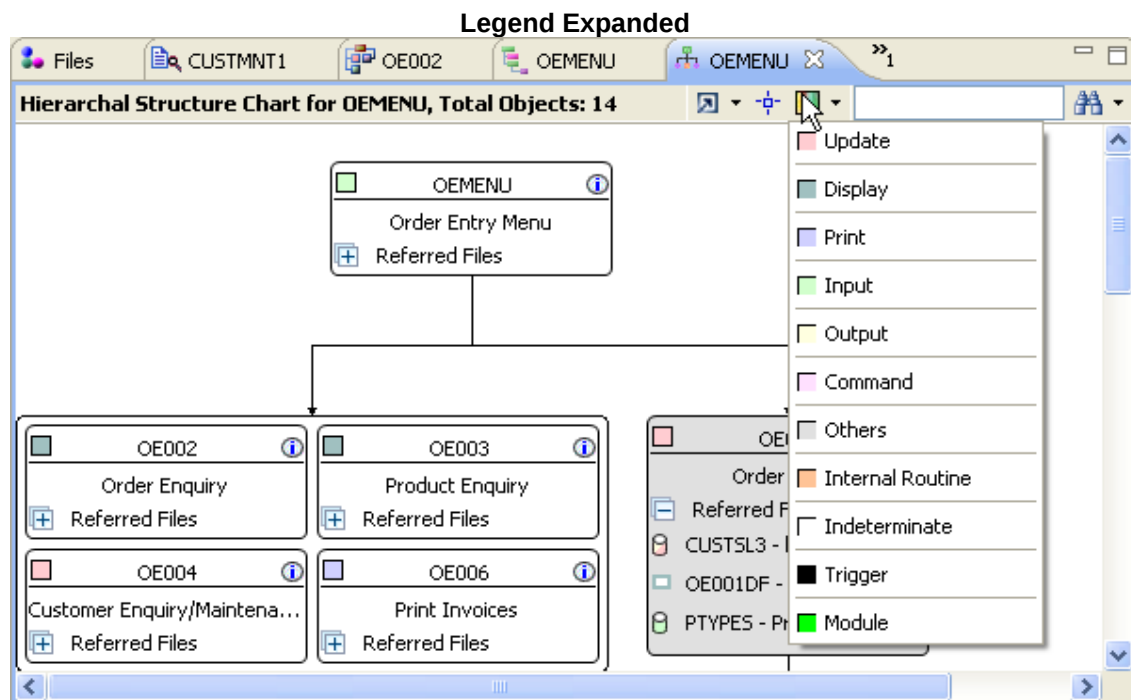


Legend icon

The **Legend** icon on the toolbar presents the colour scheme used by Hierarchal SCD. Click the **Legend** icon, as shown below:



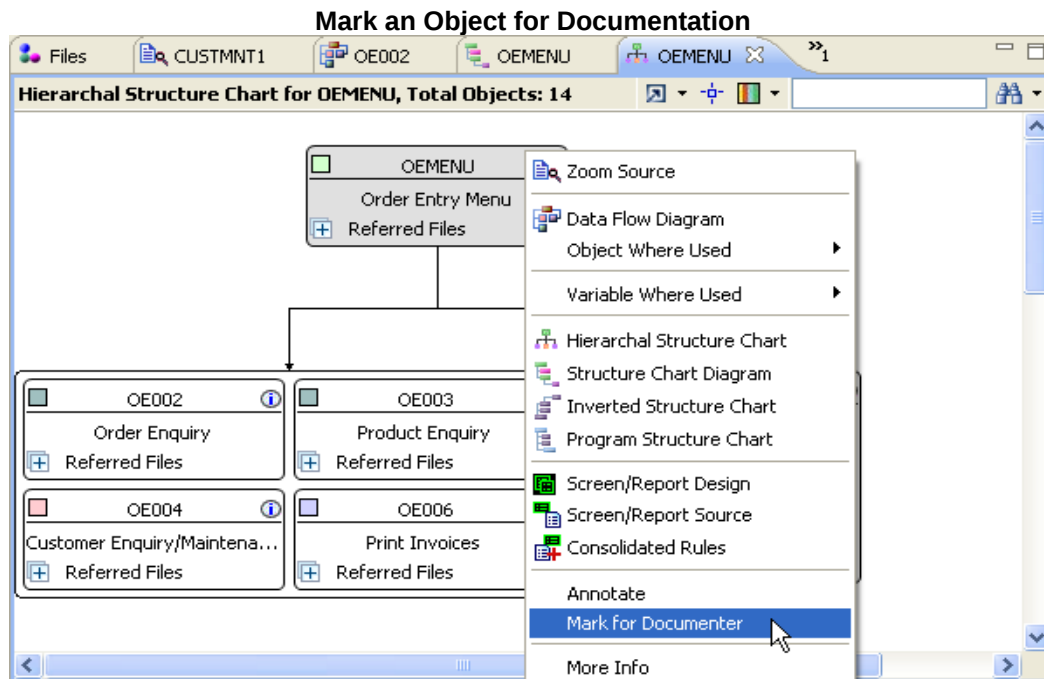
The Legend helps the user to understand the reference and association of specific objects.



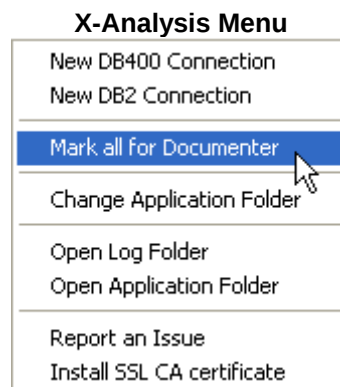
Document Manager

One of the most powerful functionalities of X-Analysis is its ability to generate structured documentation automatically. The inbuilt Document Manager facilitates the generation of PDF / MS Word document containing the system design information for specified objects.

First, the Objects have to be marked for documentation. Select the option **Mark for Documenter** from the context menu over OEMENU.



X-Analysis provides the **Mark all for Documenter** option under the X-Analysis menu. This flags all objects displayed in the diagram.

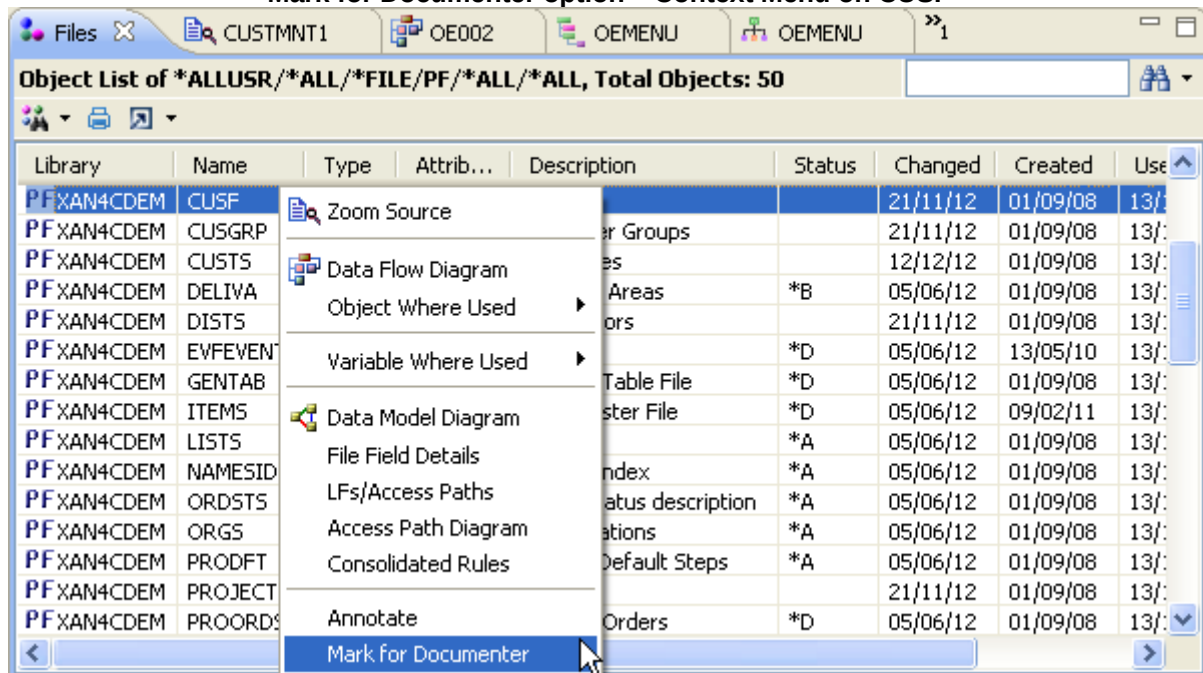


The 'Mark all for Documenter' option is available for all diagrams and lists.

Next, navigate back to the Object List window using the back arrow available on the Eclipse toolbar, and select the object CUSF.

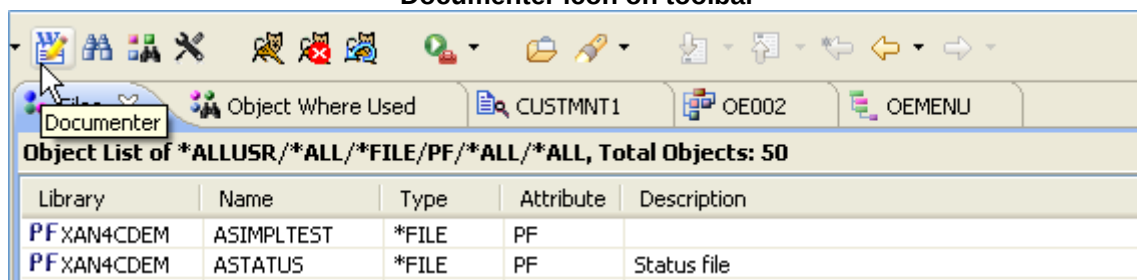
Select the **Mark for Documenter** option from the context menu on the object CUSF.

Mark for Documenter option – Context Menu on CUSF

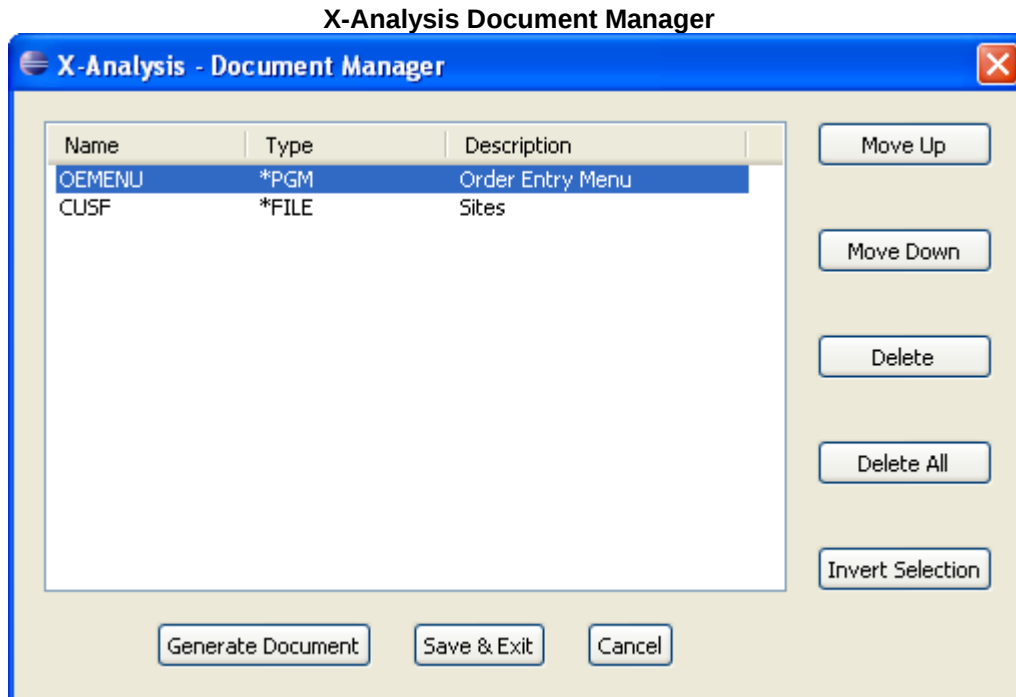


To start the documentation process, click the **Documenter** icon available on the toolbar.

Documenter icon on toolbar



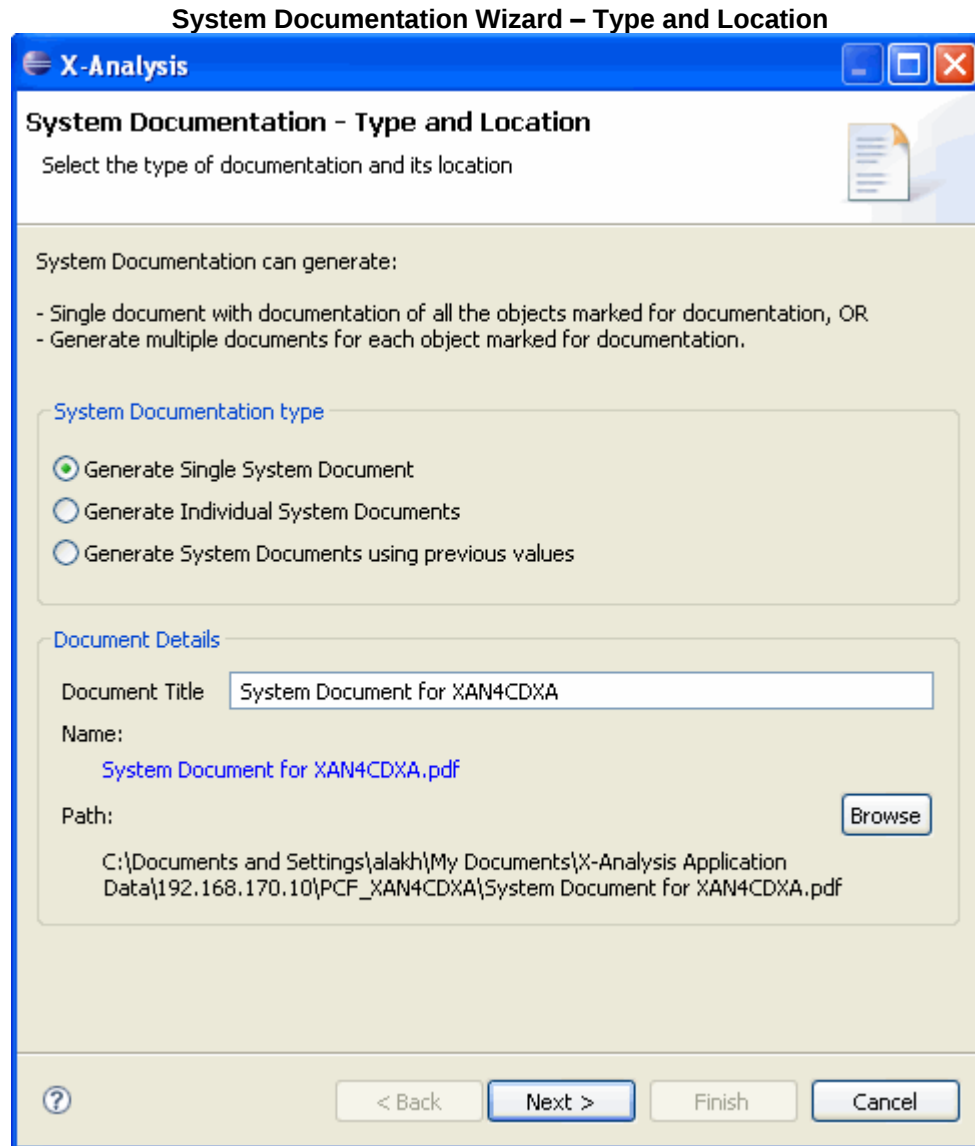
This invokes the **Document Manager** dialog.



The **Document Manager** dialog lists all the marked objects for documentation. Use the **Move Up / Move Down / Delete / Delete All** buttons to organise Objects/Members on the documenter list.

The **Invert Selection** button on the **Document Manager** dialog unselects the selected objects and selects all the un-selected objects.

After having organised the listed objects, click the **Generate Document** button. This invokes a Documenter Wizard.



The **Type and Location** dialog consists of two sections:

- System Documentation type
- Document Details

The System Documentation type section provides facilities to generate the following types of documents:

- **Generate Single System Document:** Generates a single PDF/MS Word document.
- **Generate Individual System Documents:** Generates a PDF/MS Word document for each object.
- **Generate System Documents using previous values:** Generates system documentation using the options selected in previous instance of system documentation. (This option is only available for generated system documents).

Select the **Generate Single System Document** option.

The Document Details section specifies the document title, generated system document name, and its location. A user can specify a different file name for the generated PDF/MS Word document and a different location to save the generated document.

Click the **Next** button.

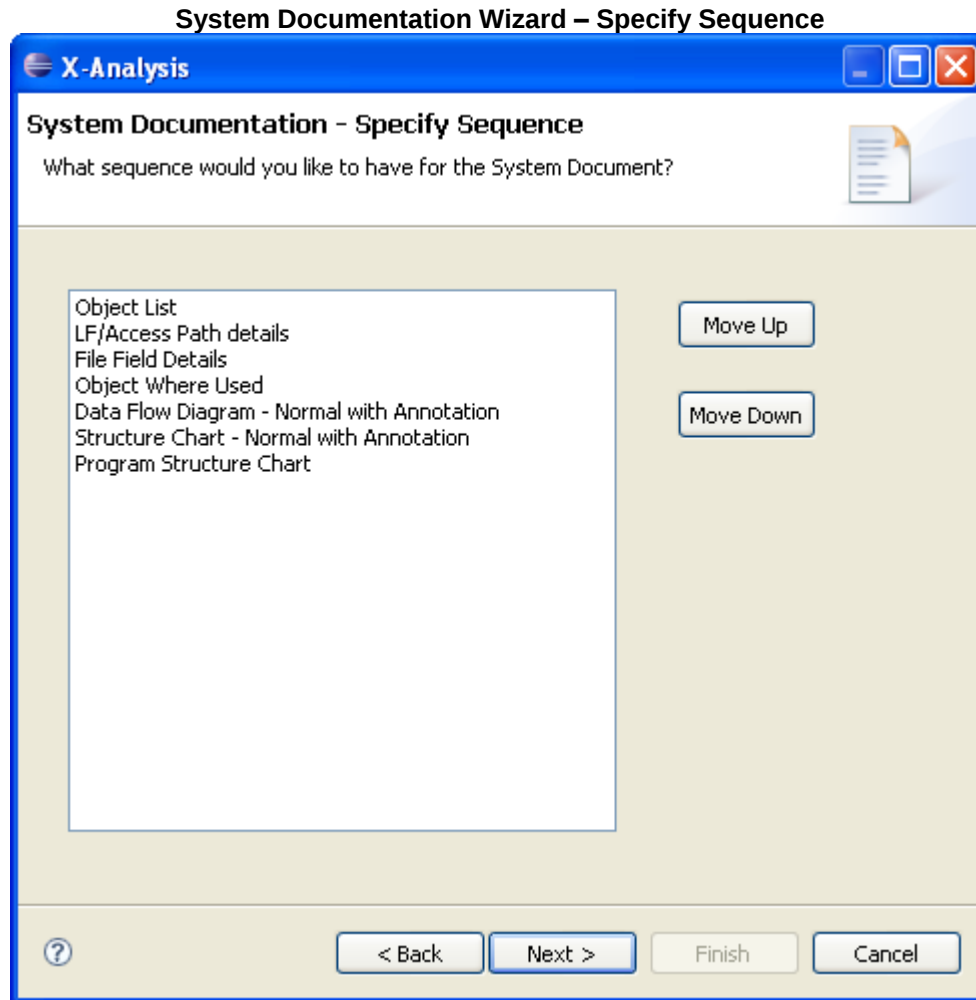
System Documentation Wizard – Specify Contents

System Documentation - Specify Contents
Select features to be included in the System Document

- ☒ Object List
- ☐ Data Model Diagram
 - ☐ Normal ☒ In PDF as Image
 - ☐ Detailed ☐ In Visio ☐ Annotation
- ☒ LF/Access Path details
- ☒ File Field Details ☐ Field Annotation
- ☒ Object Where Used
- ☒ Data Flow Diagram
 - ☒ Normal ☐ Detailed ☒ Annotation
- ☒ Structure Chart
 - ☒ Normal ☐ Expanded ☐ Detailed
 - Depth ☒ Annotation
- ☒ Program Structure Chart ☐ Annotation
- ☐ Screen/Report Layout
 - ☒ Normal ☐ Detailed
- ☐ Business Rules
 - ☒ Summary ☐ Detailed ☐ Export to MS Excel
 - ☐ Include Internal Rtn's
- ☐ Source Source level ☐ Pseudo Code
- ☐ Flowchart Level
- ☐ Residual Logic Level

This System Documentation Wizard dialog allows a user to choose various features/attributes to be included in the system document. Select the features/attributes as shown above.

Click the **Next** button.



Confirm the sequence of the features / attributes selected for system documentation.

Click the **Next** button.

System Documentation Wizard – Finish

 **X-Analysis**



System Documentation – Finish
Define the Page Size and Contention Resolution Option



Selected Sequence
Object List
LF/Access Path details
File Field Details
Object Where Used
Data Flow Diagram - Normal with Annotation
Structure Chart - Normal with Annotation
Program Structure Chart

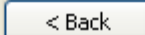
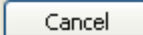
Level Settings
Structure Chart Level 5

Paper Size
☐ Letter (8.5" x 11")
☒ A4 Size (8.27" x 11.69")

Contention Resolution
System Documentation creates documents in Application Folder. If the Application Folder is shared, and documents are created/opened while the documentation is in progress, then this may lead to contention.

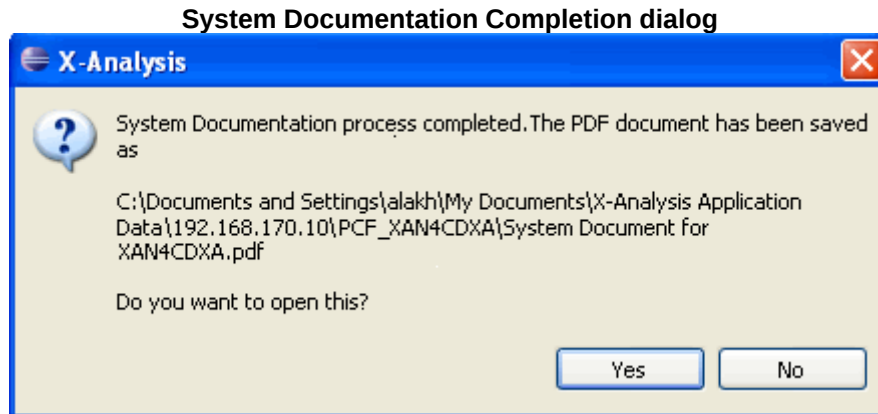
Please select appropriate options to enable resolution:
☐ Do not overwrite
☒ Overwrite if exists, but if in use then

☒ Create document by similar name
☐ Exit/Skip document creation

 < Back Next >  Finish  Cancel

Select the required formatting options available to generate a system document. Click the **Finish** button to end configuring the system document contents and start generation of the document.

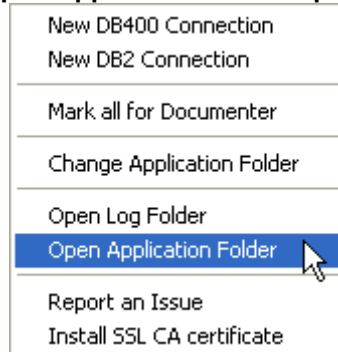
After the system document generation is complete, the following dialog appears:



Click the **Yes** button to open the generated document.

A user can also view a previously generated document. To open a generated document, select the **Open Application Folder** option from the X-Analysis menu.

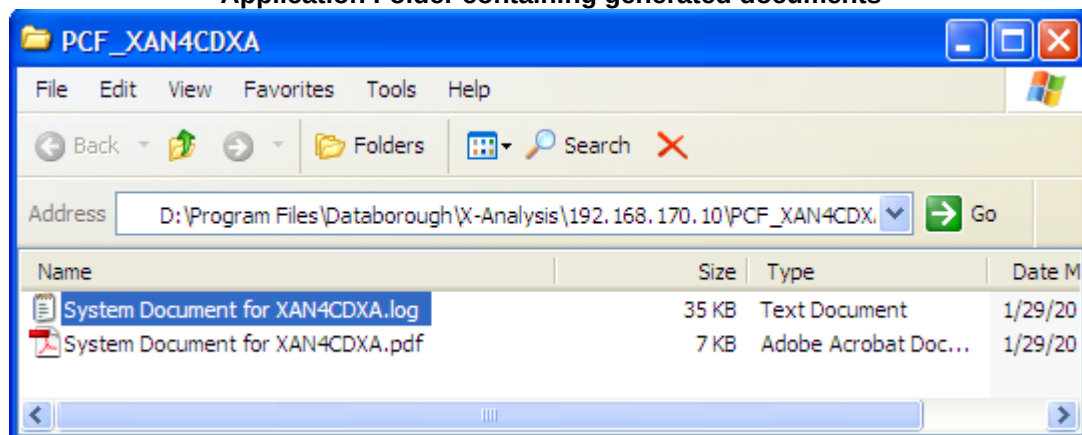
Open Application Folder option

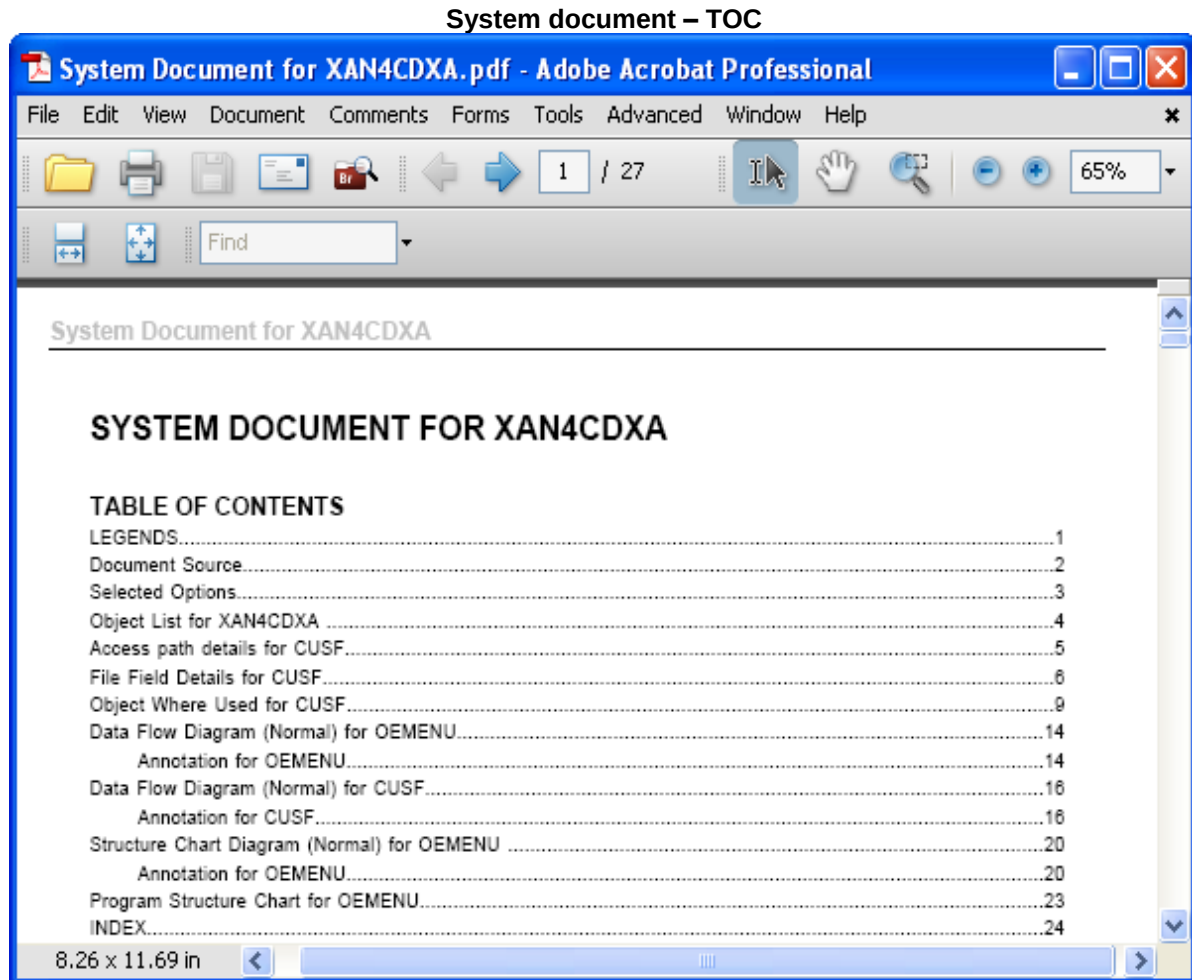


This invokes the Application Folder containing the generated system documents. Double click on a generated document to open it.

X-Analysis also creates a log file under 'Application Folder'. It logs what the 'Document Generator' does in the process of documenting selected objects.

Application Folder containing generated documents





System document – Legends

System Document for XAN4CDXA.pdf - Adobe Acrobat Professional

File Edit View Document Comments Forms Tools Advanced Window Help

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System Document for XAN4CDXA

LEGENDS

Structure Chart Diagram Legends

	Update
	Display
	Print
	Input
	Output
	Command
	Others
	Internal Routine
	Indeterminate
	Trigger
	Module

Data Flow Diagram Legends

	Access path
	Called
	Calling
	Input
	Internal routine
	Output
	Update

Data Model Diagram Legends

	Refer To
	Owned By
	Uni-Directional
	Multiple Rel's
	Internal
	External

Program Structure Chart Diagram Legends

	Blocked Comments
--	------------------

Data Content Diagram Legends

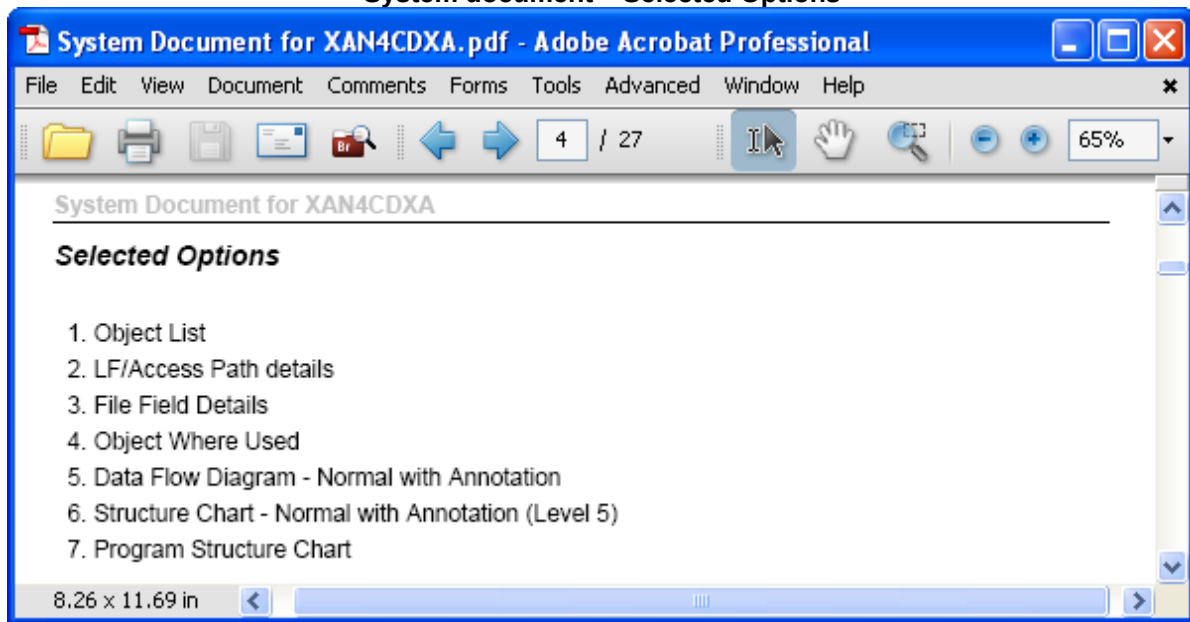
	Main File
	Validation File
	Field
	Field (Navigation Logic)

Screen Action Diagram Legends

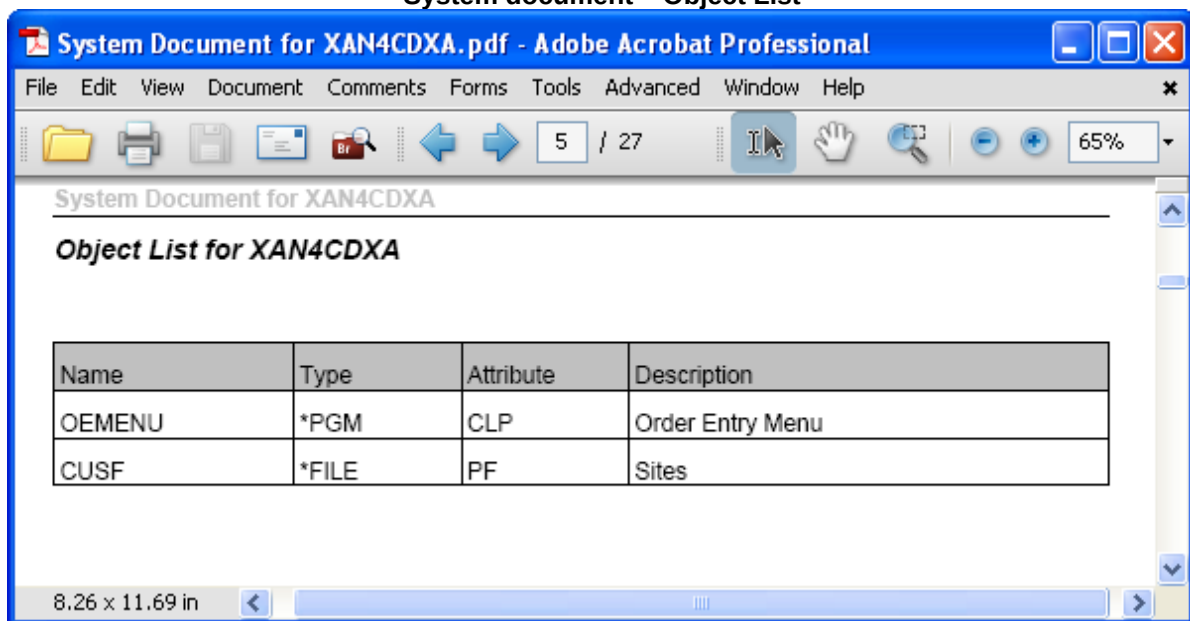
	Function (Same Program)
	Function (Different Program)
	Navigation Logic (Same Program)
	Navigation Logic (Different Program)

8.26 x 11.69 in

System document – Selected Options



System document – Object List



System document – Access Paths

System Document for XAN4CDXA.pdf - Adobe Acrobat Professional

File Edit View Document Comments Forms Tools Advanced Window Help

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System Document for XAN4CDXA

Access path details for CUSF

Access Path	Text	Unique Keys	Select/Omit	Field Names
CUSF	Sites	N	N	
CUSFL1	Sites by Name	N	N	CNAME
CUSFL3	Sites by Number	Y	N	CUSNO
CUSFLA	Sites by Product - renamed from cusfla for testing	N	N	PRPCDE,CNAME
CUSFLB	Sites by Orig.List	N	N	LSLCDE,CNAME
CUSFLC	Sites by Salesperson	N	N	SINIT,CNAME
CUSFLD	Sites by Validator	N	N	VINIT,CNAME
CUSFLE	Sites by Organisation	N	N	ORG,CNAME
CUSFL2	Sites by Status	N	N	STATUS,CNAME
CUSFL5	Sites by Dist.& Status	N	N	DSDCDE,STATUS,CNAME
CUSFL6	Sites By Dist.& Name	N	N	DSDCDE,CNAME
CUSFL7	Sites by Last Cnt.Date	N	Y	LCTDAT,STATUS,CNAME
CUSFL8	Sites by Next Cnt.Date	N	N	APDATE,CNAME
CUSFL9	Sites by Fax No.	N	Y	FAXNO

8.26 x 11.69 in

System Document – DFD Annotation

System Document for XAN4CDXA.pdf - Adobe Acrobat Professional

File Edit View Document Comments Forms Tools Advanced Window Help

17 / 27 65%

System Document for XAN4CDXA

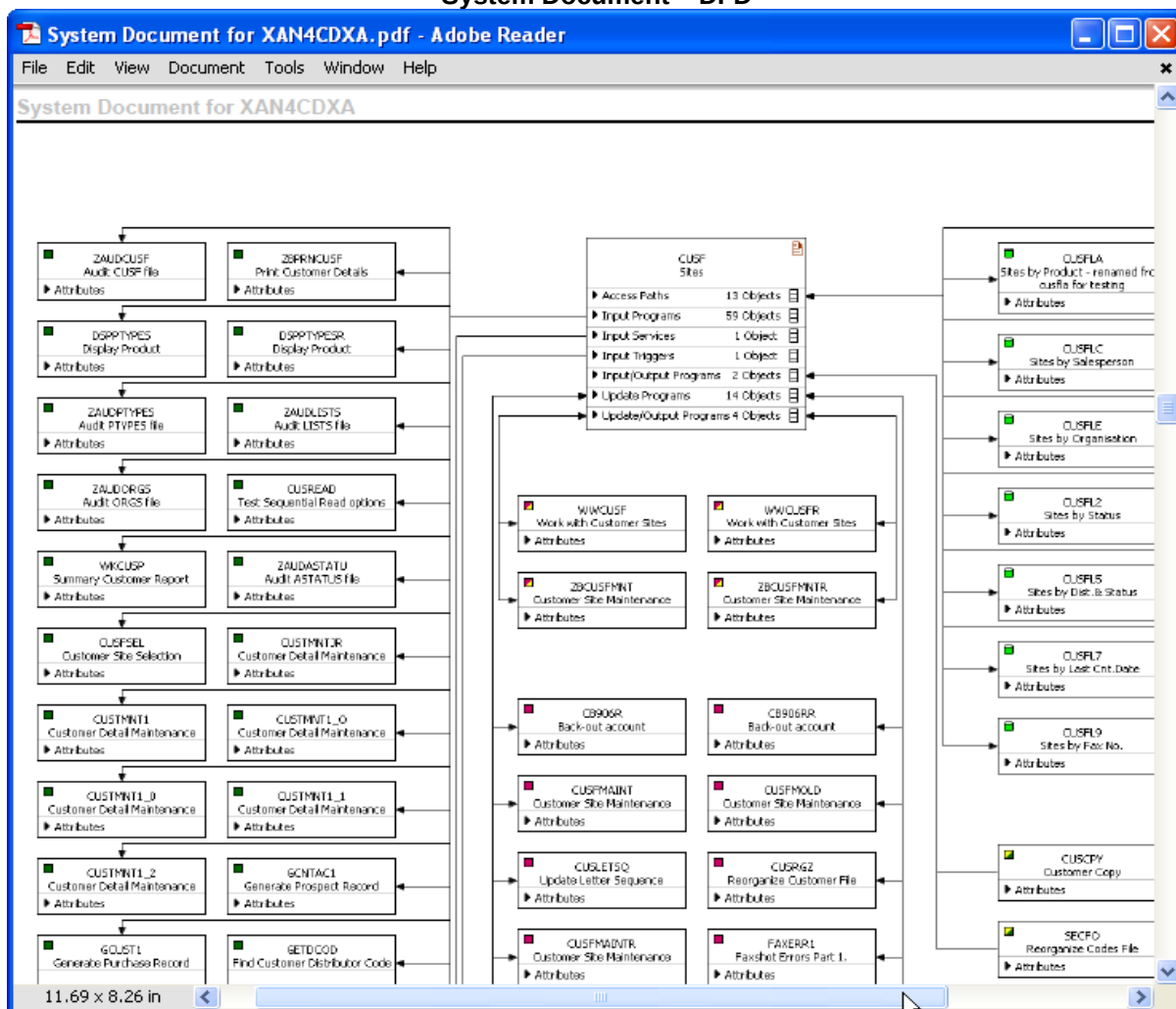
Data Flow Diagram (Normal) for CUSF

1. Annotation for CUSF

Additional comments for CUSF. Wayne says so

11.69 x 8.26 in

System Document – DFD



System document – Index

System Document for XAN4CDXA.pdf - Adobe Acrobat Professional

File Edit View Document Comments Forms Tools Advanced Window Help

25 / 27 65%

System Document for XAN4CDXA

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C

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CBCUSFMNTR, *PGM, Customer Site Maintenance 17, 9

CBCUSTMNT2, *PGM, Customer Detail Maintenance -?Long fields used 17, 9

CBCUSTMNT, *PGM, Customer Detail Maintenance -?Long fields used 18, 9

CBCUSTS, *PGM, Work with customer - Cobol vers. 17, 9

CBCUSTSR, *PGM, Work with customer - Cobol vers. 18, 9

CBTRNHST, *PGM, Work with transaction history 17, 9

CBTRNHSTR, *PGM, Work with transaction history 18, 9

CUSCPY, *PGM, Customer Copy 17, 9

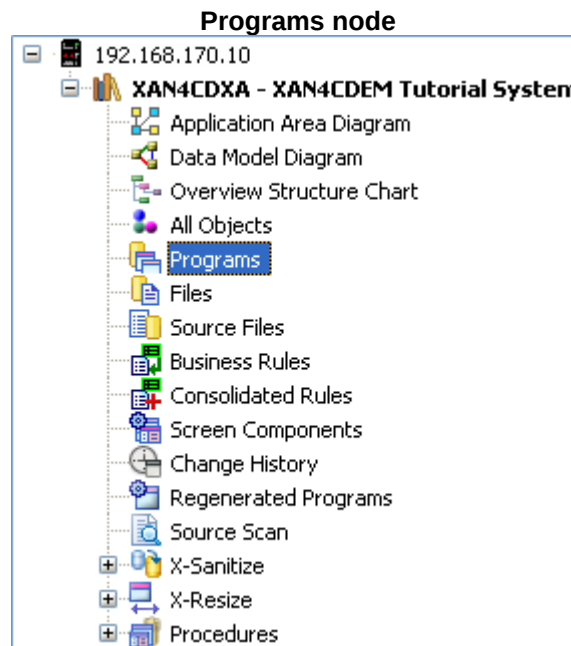
CUSF, *FILE, Sites 17, 4, 5, 6, 9

8.26 x 11.69 in

Source Browser

The process of system analysis, reviewing, re-factoring, maintaining, or redeveloping is incomplete without looking into the source code of the application. X-Analysis supports some very advanced features in its Source Browser.

Get the Object List for all programs available in the application library. Double click on the **Programs** node present under the application library.



This action invokes the **Work with Objects** dialog for object type '*PGM'.

Work with Objects dialog – Programs

Work with Objects

Application Area

Name: *NONE Description: All Members Selected

Object

Library: *ALLUSR

Name: *ALL Type: *PGM Attribute: *ALL

Text:

Function Attributes

Component Status: *ALL Function Type: *ALL PF Name: *ALL

Program Type: All Modality: All

OK Cancel

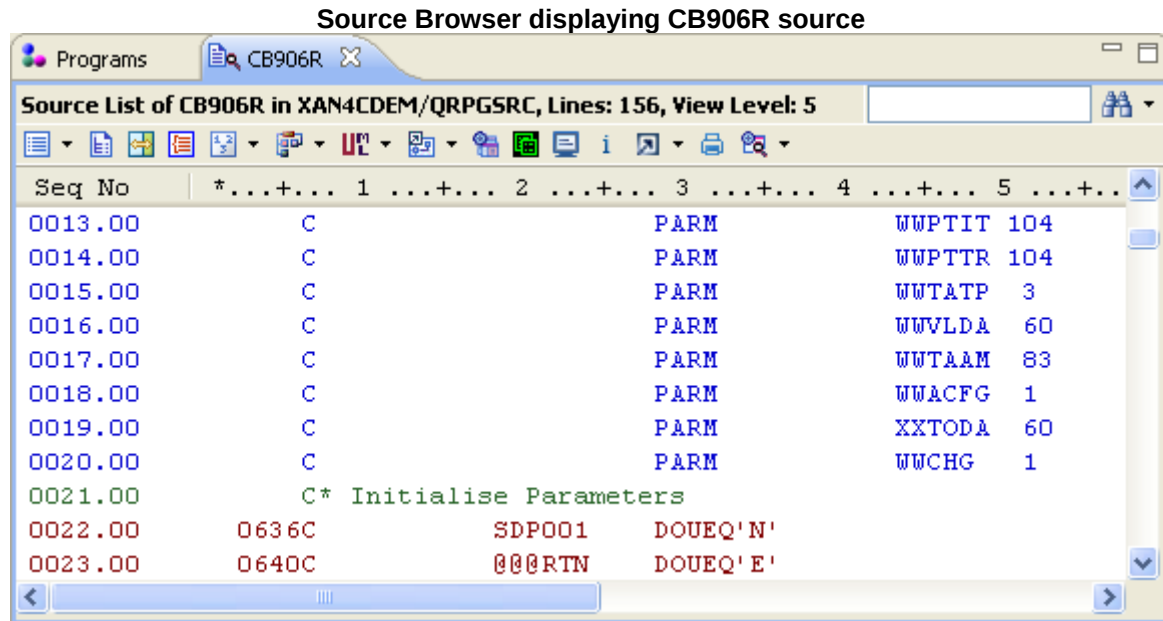
Click the **OK** button to generate the list of program objects.

Object List for all Programs

Object List of *ALLUSR/*ALL/*PGM/*ALL/*ALL/*ALL, Total Objects: 153

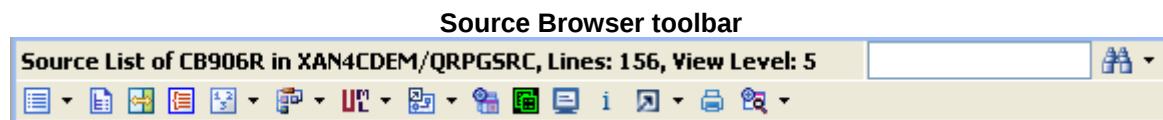
Library	Name	Type	Attribute	Description	Status
CLXAN4CDEM	CBC110	*PGM	CLP	Order Entry System	*A
RPXAN4CDEM	CB906R	*PGM	RPG	Back-out account	*B
CLXAN4CDEM	CLET	*PGM	CLP	Build Customer Letter	*A
CLXAN4CDEM	CLETN	*PGM	CLP	Print Customer Letter	*A
RPXAN4CDEM	CNTCMINT	*PGM	RPGLE	Contacts Maintenance	*A
RPXAN4CDEM	CONUPD0	*PGM	RPGLE	Revert Back Customer Info	*D
RPXAN4CDEM	CONUPD1	*PGM	RPGLE	Update Customer Info - Version 1	*D
RPXAN4CDEM	CONUPD2	*PGM	RPGLE	Update Customer Info - Version 2	*D
RPXAN4CDEM	CON001	*PGM	RPG	Contract Entry	*D
CLXAN4CDEM	CPDM	*PGM	CLP	List Correspondence	*A

Double click the program **CB906R** from the Object List. This calls the Source Browser for the member CB906R.



Source Browser Toolbar

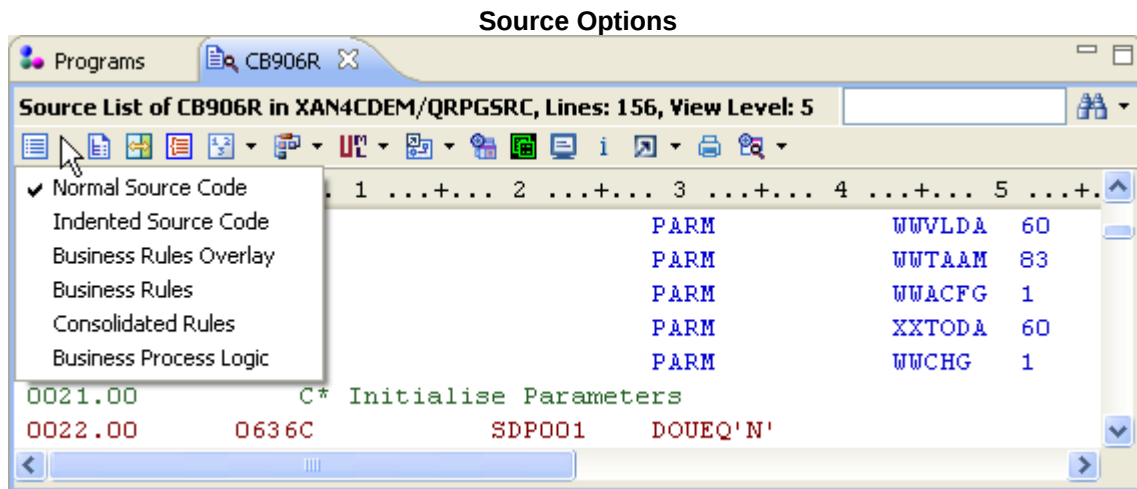
The Source Browser toolbar has the following options:



- Source Options
- Source Outline
- Show Split Panel
- Pseudo Code
- Source level
- Diagram Options
- Generate UML
- Flowchart
- Screen Components
- Screen / Report Design
- Zoom in Lpex (available on WDSr/Rdi only) / SEU option (set XA preferences to select the appropriate option).
- More Info
- Export Options
- Print
- View Code

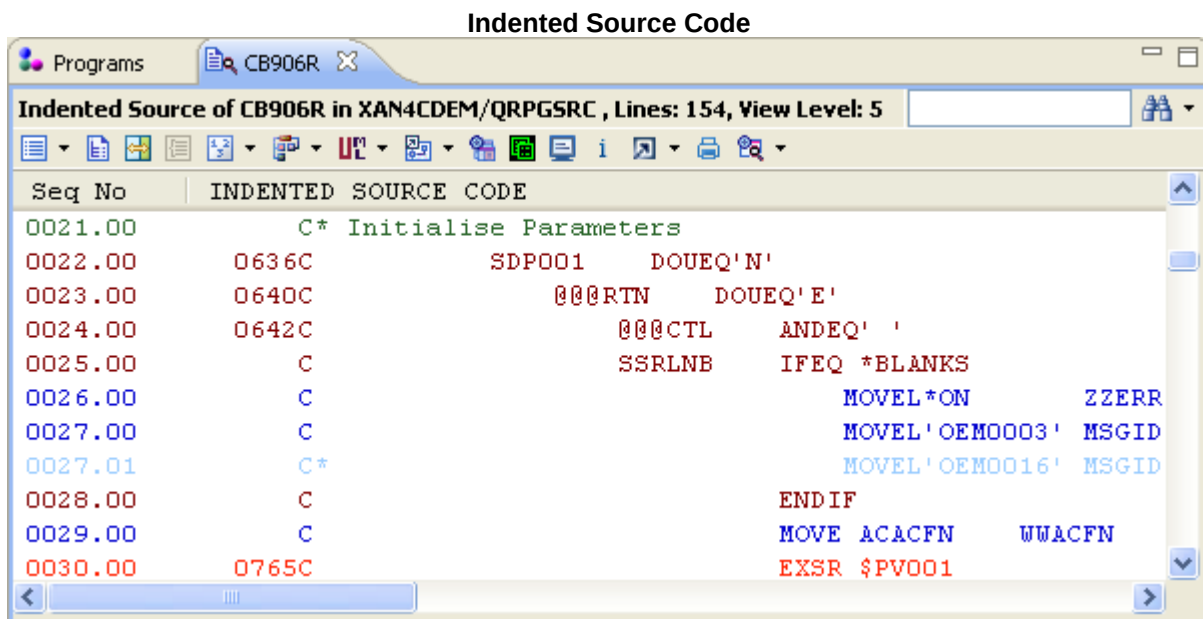
Source Options

The **Source Options** menu allows a user to view source in various modes. The default source view is – **Normal Source Code**.



Indented Source View

Select **Indented Source Code** option from the **Source Options** menu. This displays the Indented Source Code view.

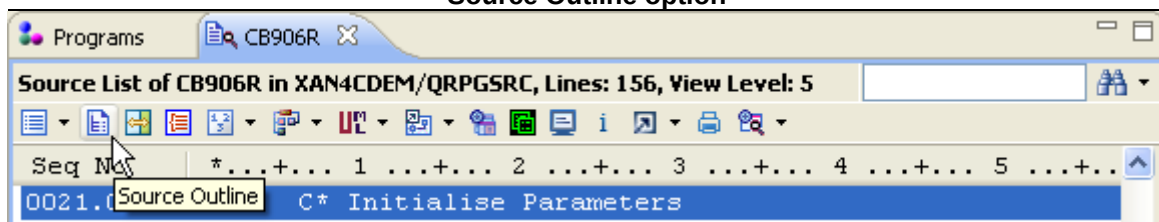


Return to Normal Source Code by selecting the **Normal Source Code** option.

Source Outline

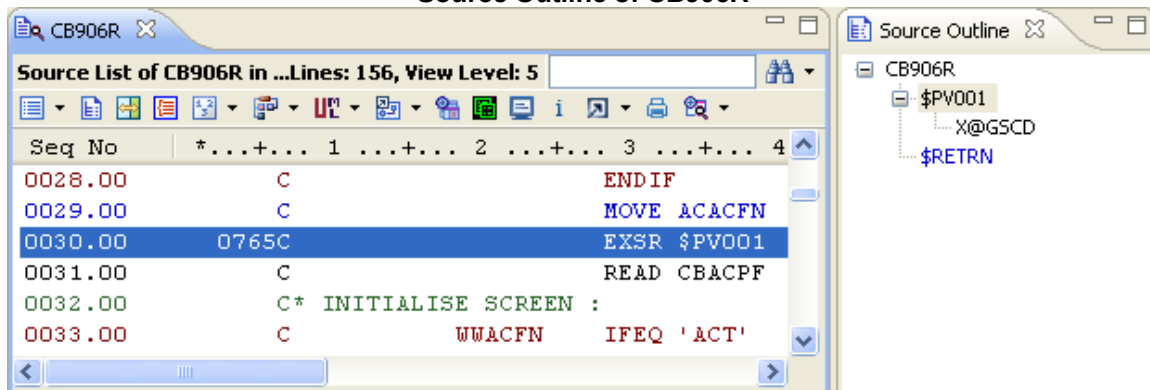
The **Source Outline** feature displays an outline of the source member. The Source Outline view lists all subroutines available in the code.

Source Outline option



Double click on any of the listed subroutines. This positions the cursor on the subroutine inside the source browser.

Source Outline of CB906R

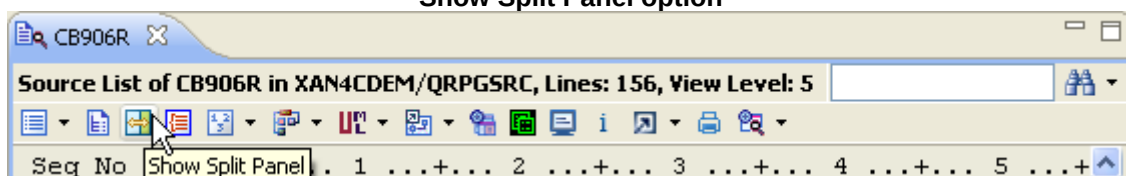


Show Split Panel

X-Analysis has an option to compare the Normal Source Code with its Business Process Logic code. This view helps the user to understand the Business Process Logic code better.

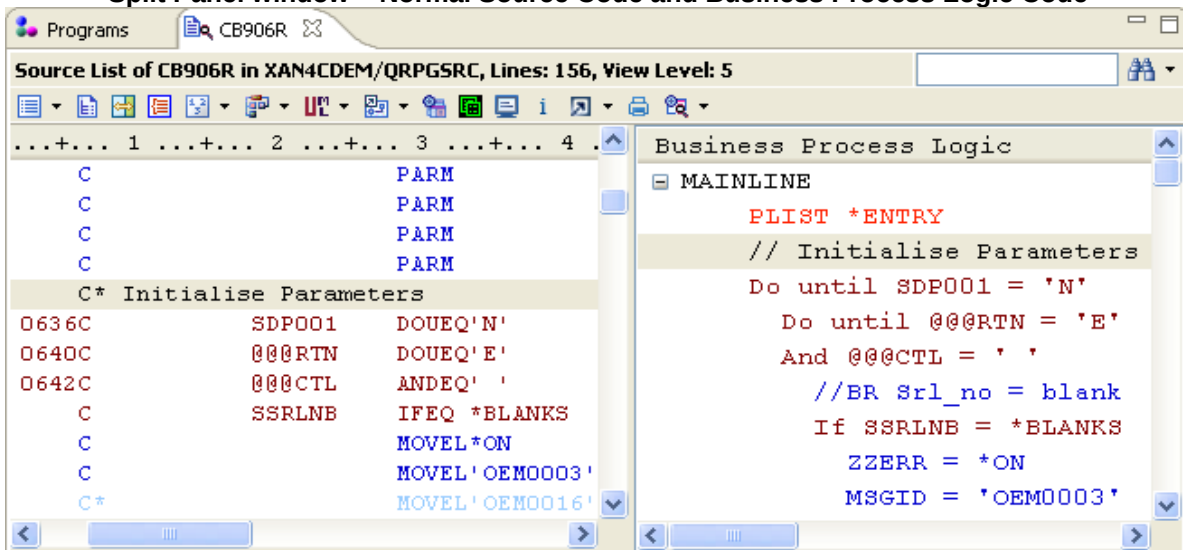
The **Show Split Panel** icon is a toggle button, which invokes a split panel displaying the Normal Source and the Business Process Logic code, simultaneously.

Show Split Panel option



On selecting the **Show Split Panel** option, the following window is displayed:

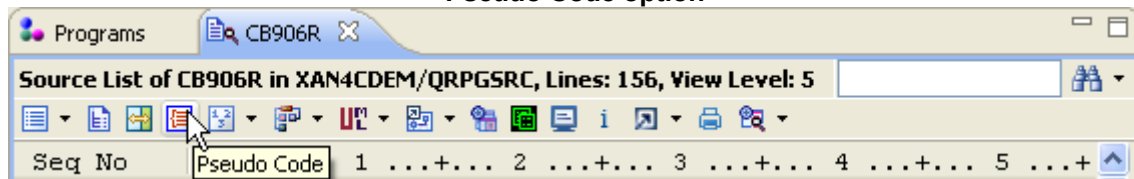
Split Panel window – Normal Source Code and Business Process Logic Code



Pseudo Code

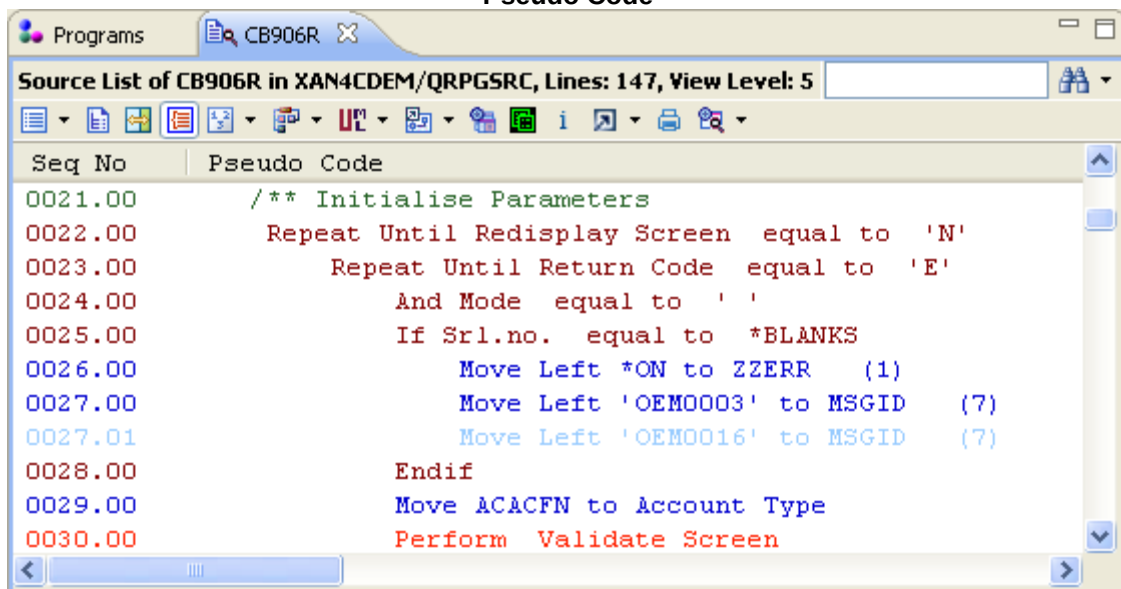
The Pseudo Code or Structured English view helps a non-technical user to understand the code better. Click the **Pseudo Code** icon.

Pseudo Code option



This brings up the Pseudo Code view.

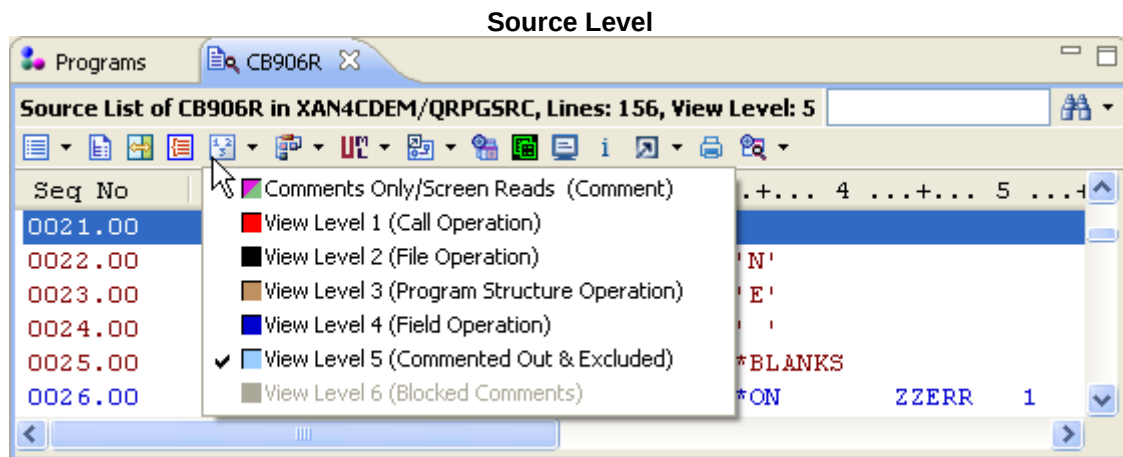
Pseudo Code



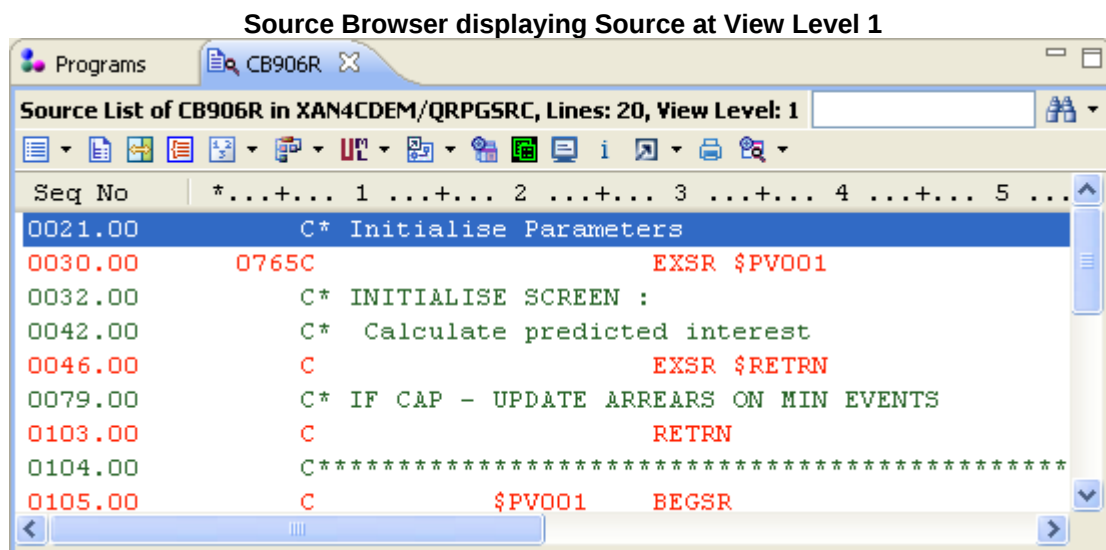
The **Pseudo Code** icon has a behaviour toggle. Click it again to return to Normal Source Code.

Source Level

The **Source Level** icon allows a user to view specific type of source lines by switching to different view levels for easy understanding of the code. By default, the source level is '5'.



Reduce the source level to **View Level 1**. This restricts the Source List to display comments and call operations only.

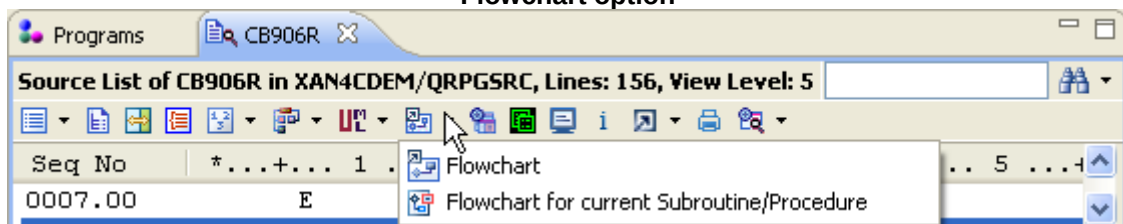


- View Level 2 includes File Operations.
- View Level 3 includes Program Structure Operations.
- View Level 4 includes Field Operation.
- View Level 5 includes the Commented Out code & Exclude.

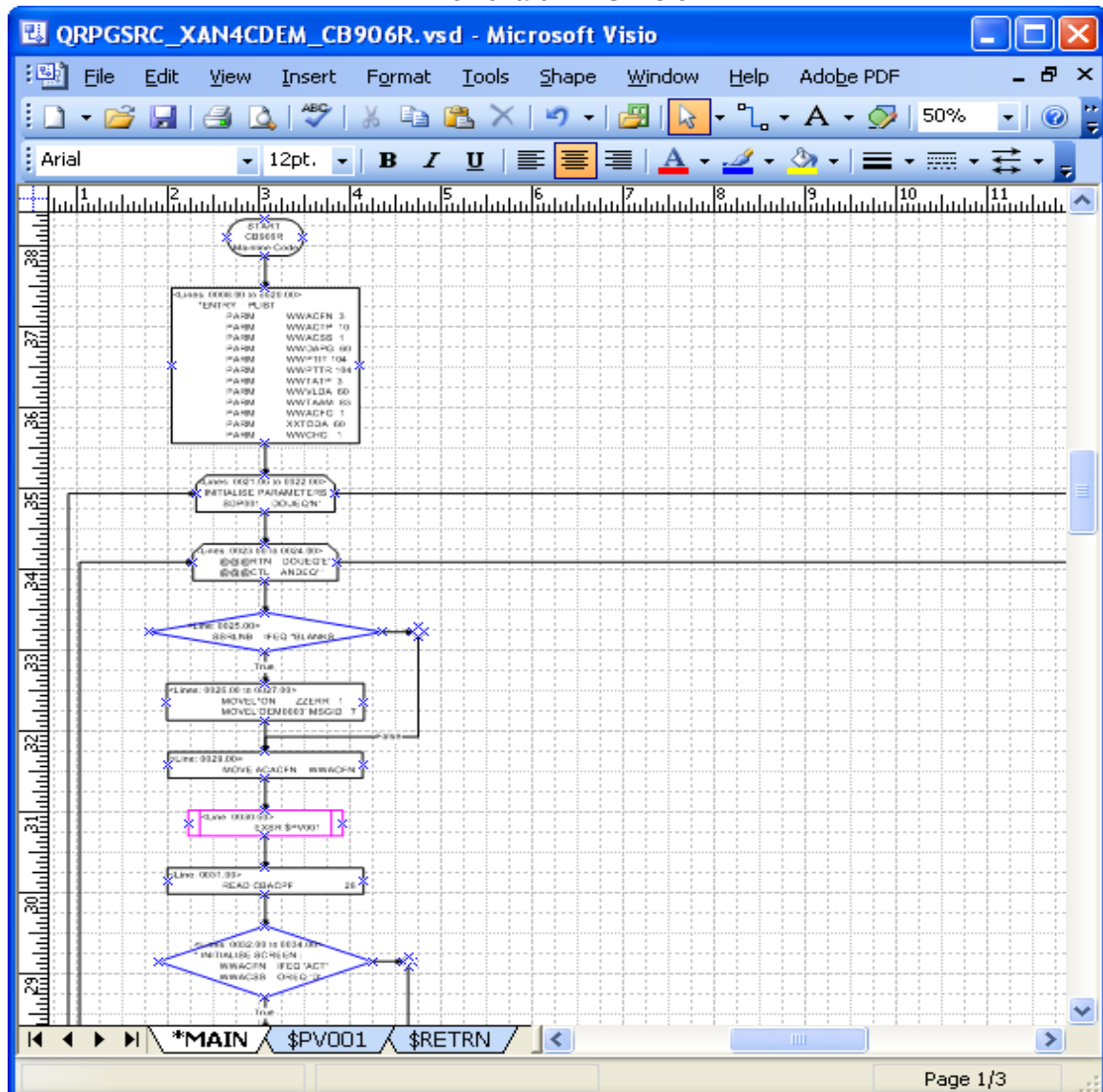
Flowchart

The other way to look at program source code is to check the execution model of that program, which is the Data Flowchart. Opt for the **Flowchart** option from the source browser. This generates Program Flowchart in MS Visio.

Flowchart option

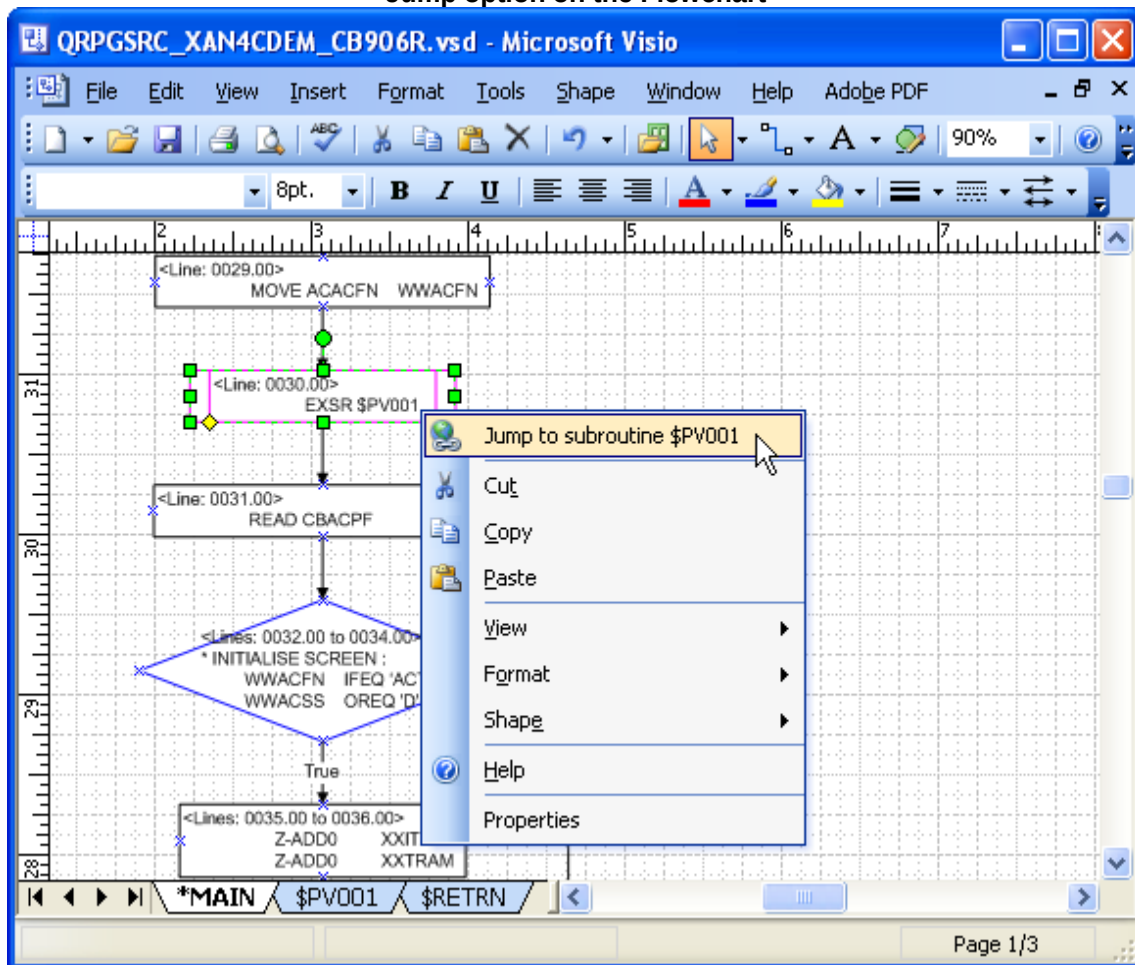


Flowchart in MS Visio

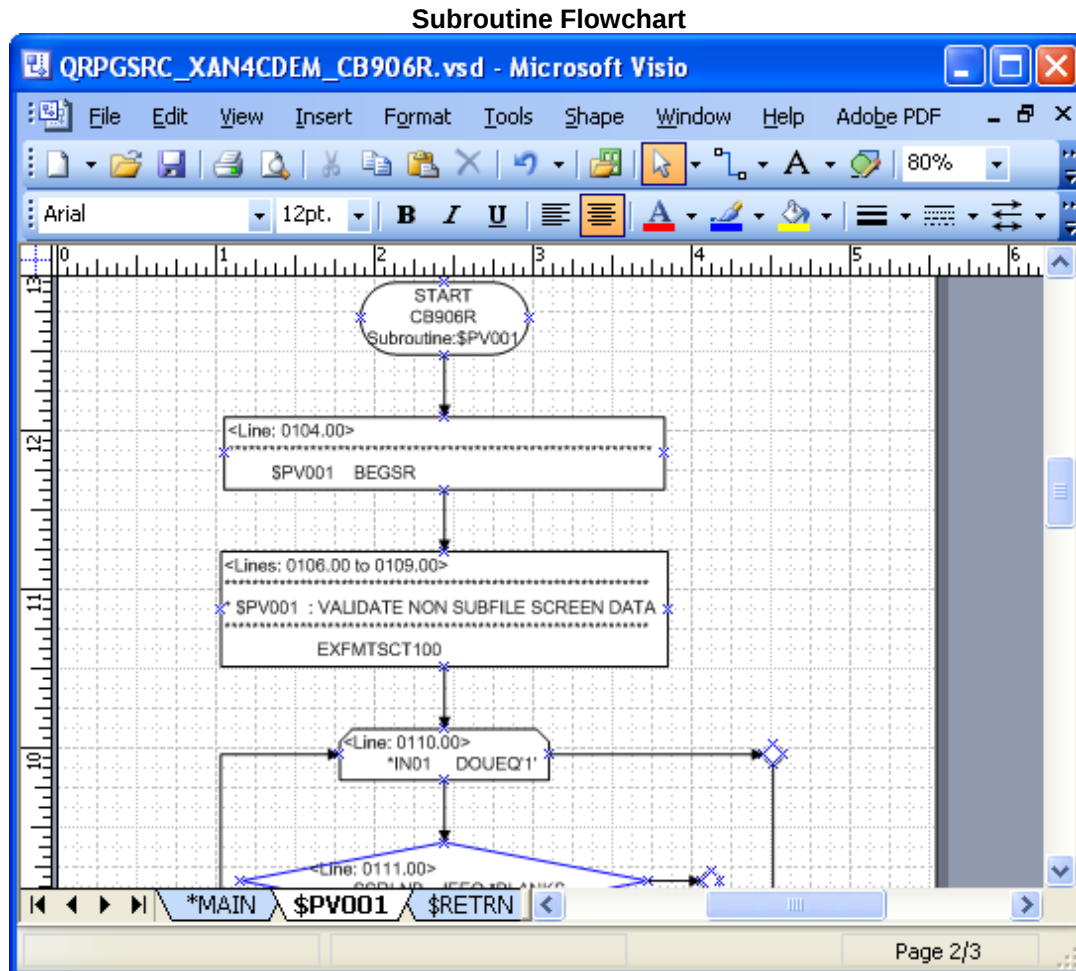


Note that the **Flowchart** option creates an individual flowchart for each subroutine. The first page of the flowchart displays the processing for the Main Procedure. From the Main Procedure, a user can jump to any of the subroutines available in the program.

Jump option on the Flowchart



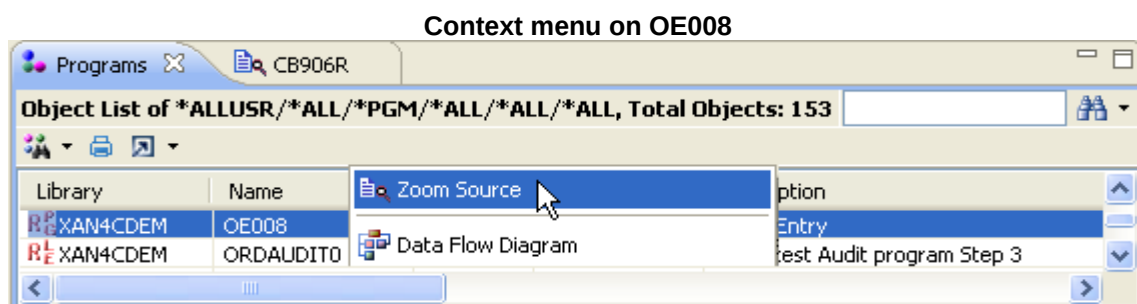
From the context menu, click **Jump to subroutine \$PV0001** option to switch to the flowchart for the subroutine '\$PV0001'.



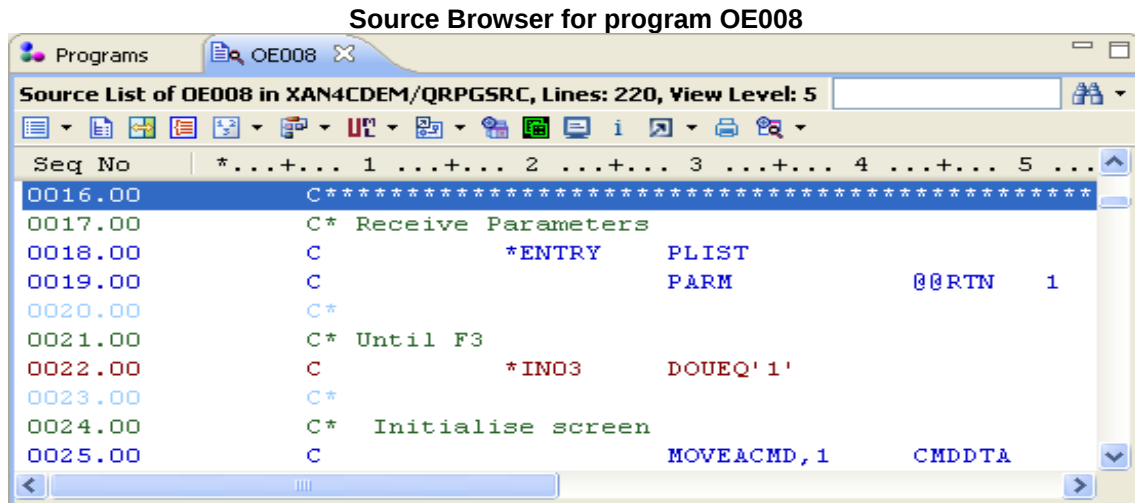
Other Options on the Source Browser

To understand the other options available on the source browser, open the source browser for the program OE008. To call the source browser for OE008, go to the Object List.

From the Object List, locate and select the program OE008. Bring up the context menu for the program OE008 and choose the **Zoom Source** option.



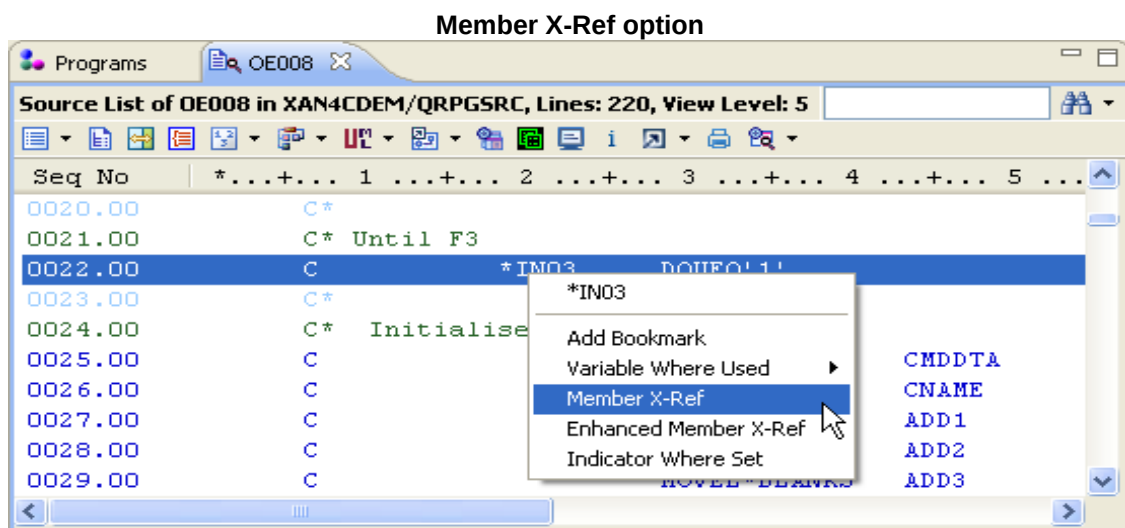
This brings up the source browser for the program OE008:



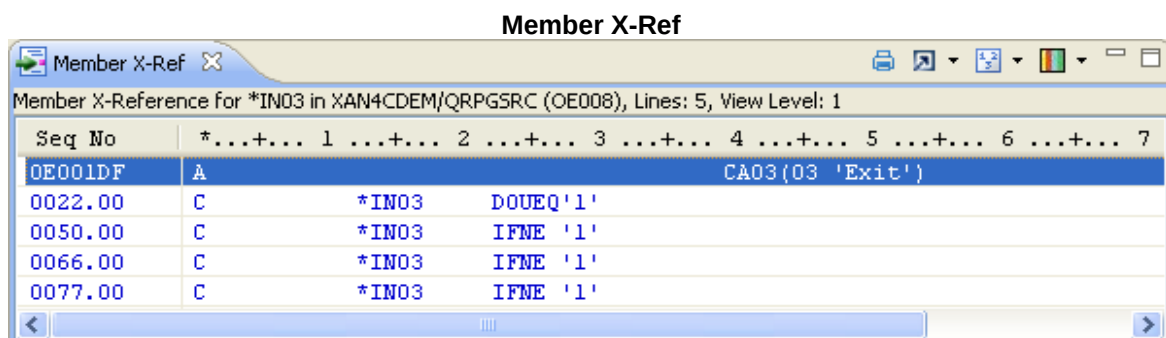
Let us now discuss other important options available on the source browser.

Member X-Reference

On the source browser for the program OE008, select the line number 0022.00 with indicator '*IN03'. From the context menu on '*IN03', select the **Member X-Ref** option.

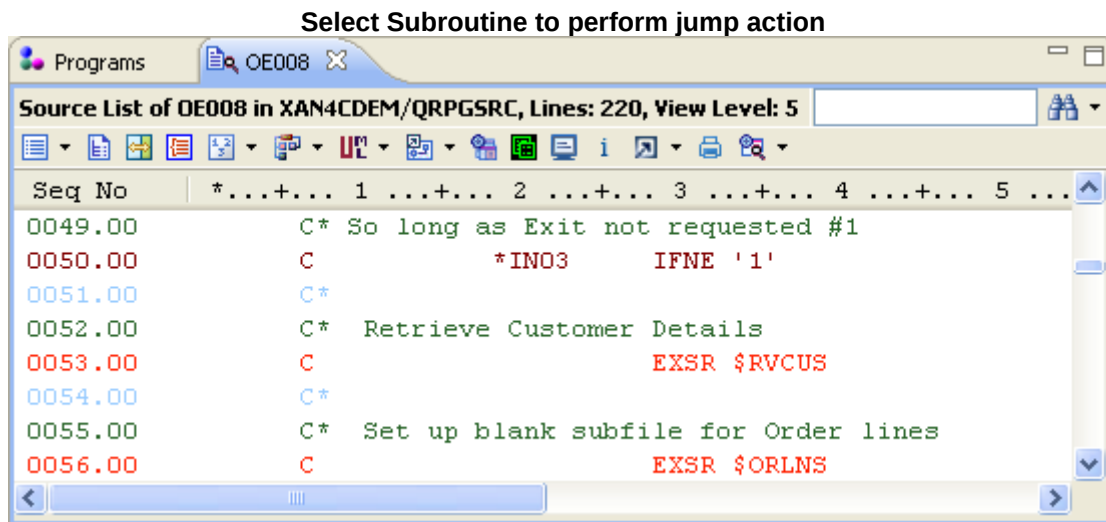


This displays the Member X-Ref view for the selected variable ('*IN03'). The Member X-Ref lists all source lines where the selected Field/Variable has been used / referenced.

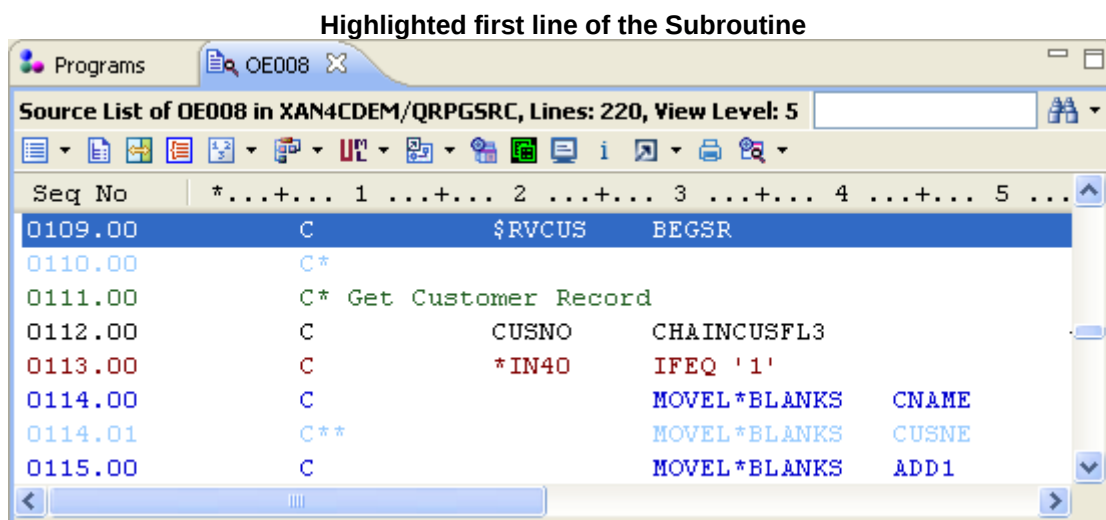


Jump to Subroutine

One of the important features of the source browser is the ability to jump to a subroutine. Double click on one of the subroutines available in the source browser for the program OE008.



Double click on **\$RVCUS**, which positions the cursor to the beginning of the subroutine – \$RVCUS.

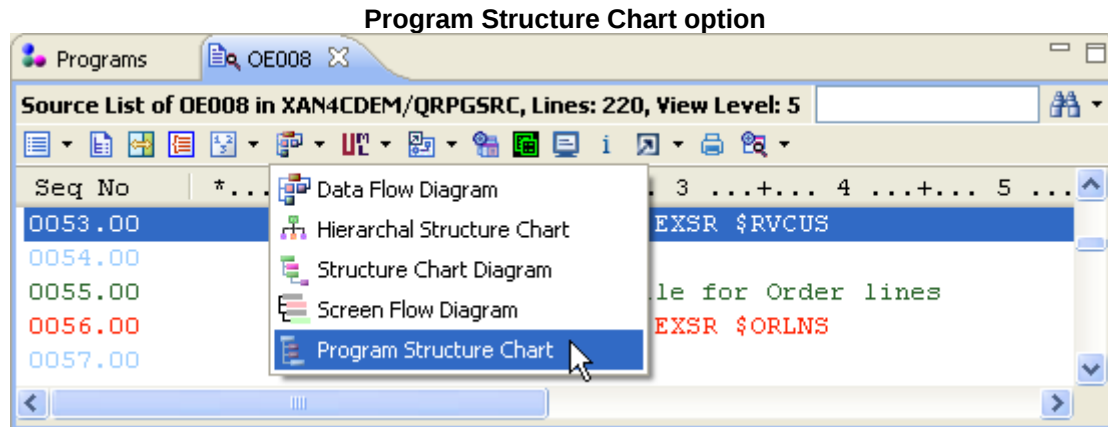


Click the back navigation arrow to return to the line where the subroutine \$RVCUS is called.

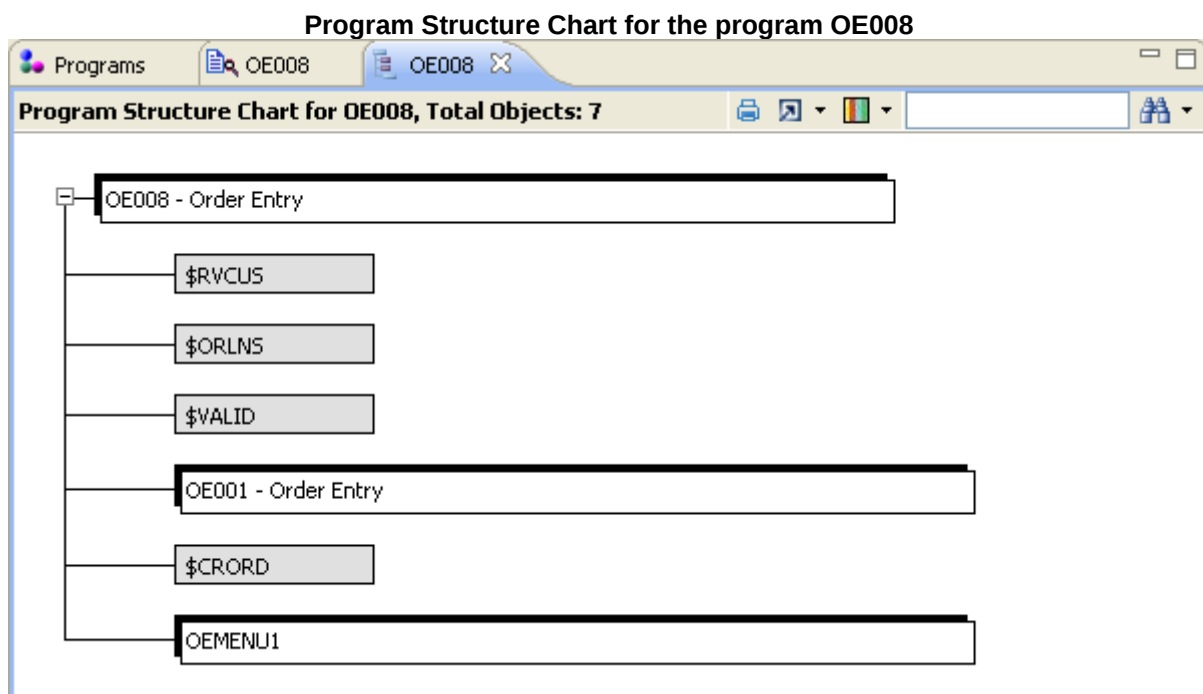
Program Structure Chart

This option provides another way of looking at the structure of the program.

A Program Structure Chart graphically displays the sequence of calls in the program. Click the **Program Structure Chart** option available under the **Diagram Options** dropdown menu on the Source Browser toolbar.



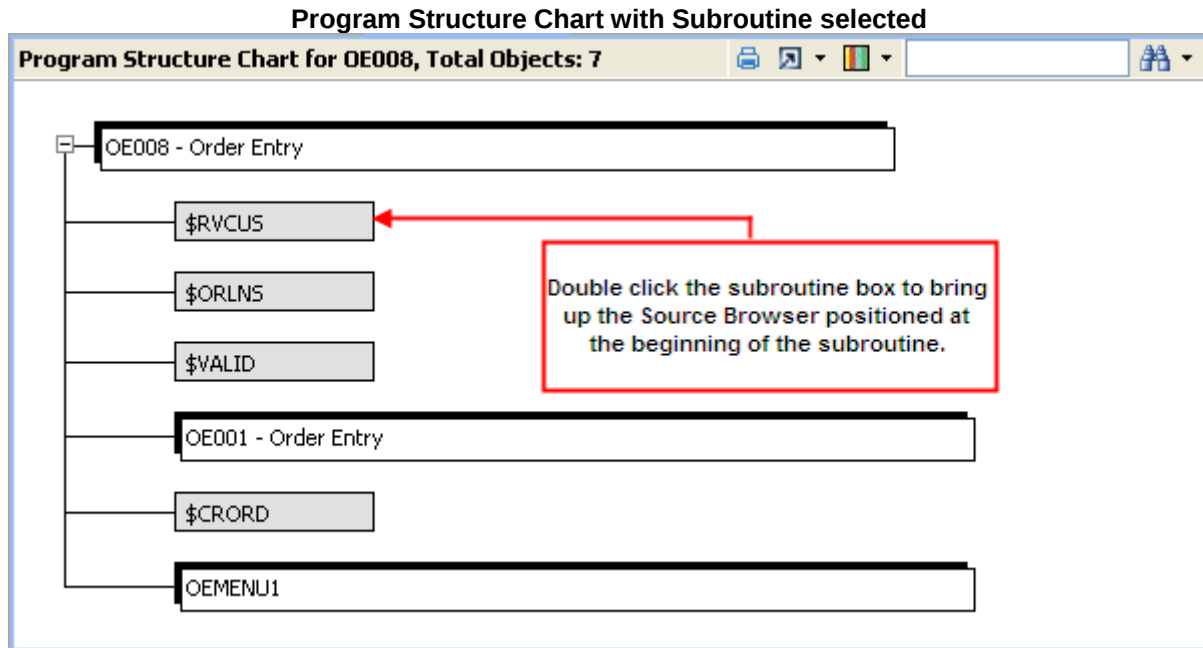
On selecting the **Program Structure Chart** option, a diagram appears displaying the Program Structure Chart for that program.



The Program Structure Chart shows each subroutine as small rectangles with grey background with the name of each subroutine. The object type i.e. the Function Type determines the colouring of all other shapes, Programs, Modules, and Service Programs.

(Boxes, other than the subroutines, are the same size of a program element as used in the Structure Chart Diagram).

On the Program Structure Chart, double click on a subroutine. This initiates the Source Browser for the program OE008 with the subroutine selected.



This displays the Source Browser for program OE008 with the subroutine '\$RVCUS' selected.

Source Browser for program OE008

Seq No	Code	Comments
0053.00	C	EXSR \$RVCUS
0055.00	C*	Set up blank subfile for Order lines
0056.00	C	EXSR \$ORLNS
0058.00	C*	Display Order Entry screen
0059.00	C	MOVEL '1' *IN34
0060.00	C	MOVEL '0' *IN33
0061.00	C	MOVEACMD,3 CMDDTA

Zoom Source to Files defined in File Specification

The program OE008 has files defined in the File Specification:

Files listed on OE008 source

Seq No	*...+... 1	...+... 2	...+... 3	...+... 4	...+... 5
0001.00	FOE001DF	CF	E	WORKSTN	
0002.00	F			@RRN1	K
0003.00	FCUSFL3	IF	E	K	DISK
0004.00	FCUSTSL3	UF	E	K	DISK
0005.00	FPTYPES	IF	E	K	DISK
0006.00	F*				

A user can browse the source codes of associated files by double clicking on them. Alternatively, he can select CUSFL3 from the Source Browser and opt for the context menu. Then, select the **Zoom Source** option.

Source Browser for the file CUSFL3

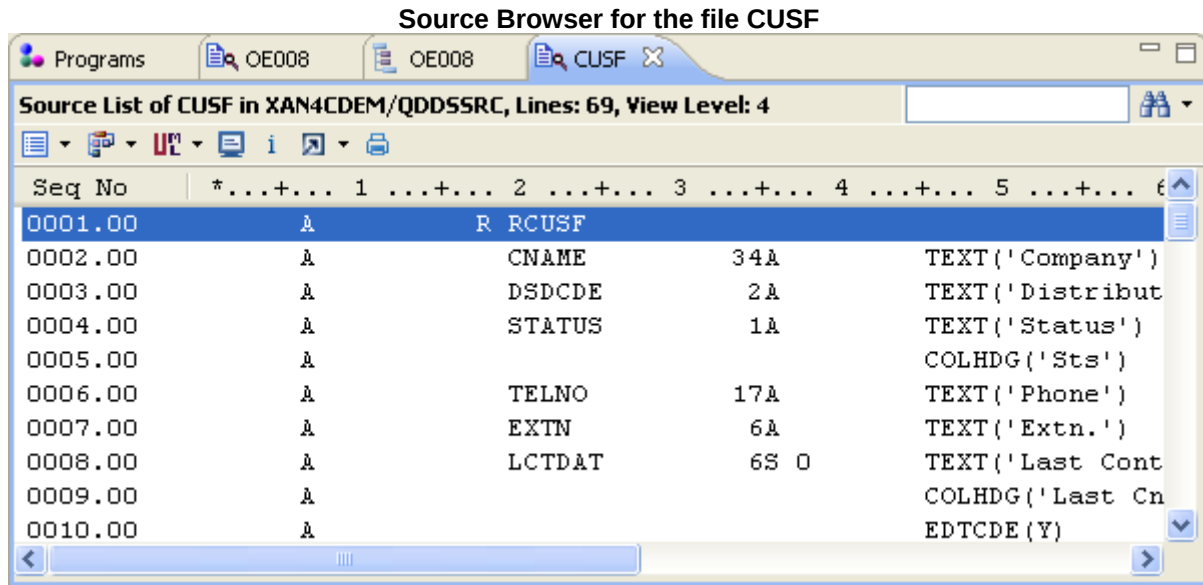
Seq No	*...+... 1	...+... 2	...+... 3	...+... 4	...+... 5
0001.00	A			UNIQUE	
0002.00	A	R RCUSF		PFILE (CUSF	
0003.00	A	K CUSNO			

A user can also further drill down to the source code of associated PFILE (CUSF) of the LF, CUSFL3.

PFILE selected on the Source Browser for CUSFL3

Seq No	*...+... 1	...+... 2	...+... 3	...+... 4	...+... 5
0001.00	A			UNIQUE	
0002.00	A	R RCUSF		PFILE (CUSF)	
0003.00	A	K CUSNO			

Double click on **CUSF** to invoke the Source Browser for the file CUSF.



X-Analysis makes the browsing of an application very easy. The Source Browser display helps the user to navigate and drill down to various related features, thus, supporting better understanding of the application.

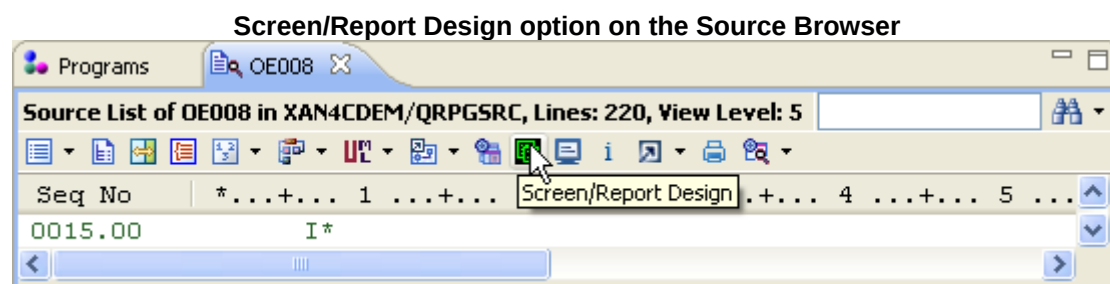
Let us now move on to some other features available on the source browser. Bring up the Source Browser for the program OE008.

Screen/Report Design

Most of the application programs interact either with display files or with printer files (DSPFs/PRTFs). The Source Browser provides a feature to view layout of the associated display/printer files.

Note this feature does not require the execution of an actual program.

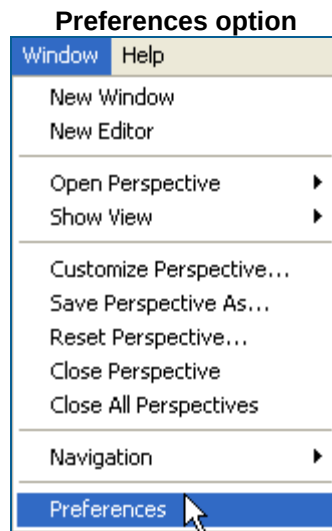
Click the **Screen/Report Design** icon available on the Source Browser.



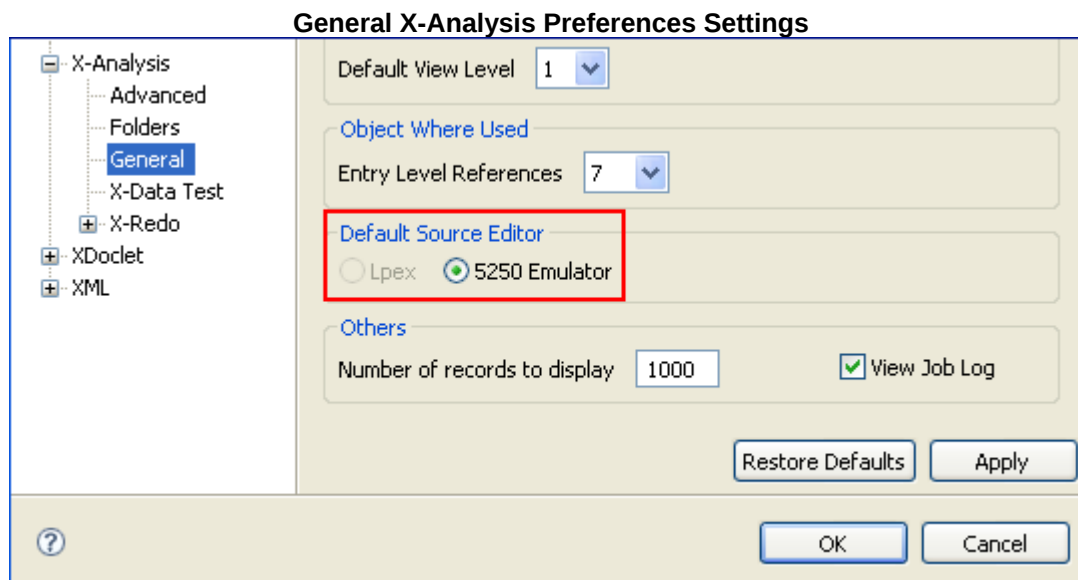
This brings up the Screen Design window for the program OE008.

'Zoom in Lpex' is a default option for all IBM Rational products having an RSE plugin. For all other eclipse products, SEU (5250 Emulator) is the default option. A user can change the default settings using the X-Analysis 'General Preferences' option. Creating an SEU (5250 Emulator) session requires the user XAN4SEU IBM i. Please refer to [Appendix A](#) for creating the user XAN4SEU.

The X-Analysis Plugin comes with default preference settings. To change the preference settings, start IBM's RDi / RDp / WDSC/ or Eclipse 3.2 (and above), then select **Window > Preferences** to display the Preferences dialog.



To view / modify various X-Analysis Preferences, select the **X-Analysis** node.



Chapter 4: Data Modelling

Configuring the design of an application depends on an accurate data model. X-Analysis is fully loaded with the advanced capability of automatically extracting data model from an RPG/COBOL-based application. The data model derived through X-Analysis is viewable as an interactive diagram. The software extends the benefit of perusing the file-centric or application area specific filtering of the diagram.

This chapter highlights the importance of understanding an application design and describes how the Data Modelling solution set helps in deciphering complicated codes of databases, thereby, making data maintenance and development work a less cumbersome process.

The chapter contains:

- » [Generating Data Model Diagram](#)
- » [LFs/Access Paths](#)
- » [File Field Details](#)
- » [Access Path Diagram](#)
- » [View Data](#)

The Data Modelling solution set is an add-on module dedicated to data model extraction. Prior to analyzing a legacy system, it is important for a user to understand the application design. An analyst looks for the Data Model information of the legacy system, which forms the foundation of the application design.

In the context of X-Analysis, the term Data Model not only refers to the physical model of a database design but also refers to the foreign key or the relational model.

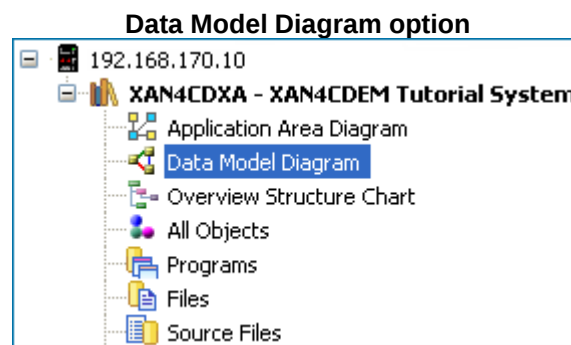
X-Analysis automatically derives an explicit physical & logical data model by analyzing both the actual data and the programs that use that data, to verify the existence of any cross-file relationships. X-Analysis verifies these potential relationships by performing an integrity check to ensure that all data from dependant file validly refers to the data records from the owning file.

A complete data model accurately describing all possible relationships among the files is essential for productive maintenance and development work. Such a model also provides a foundation to automate critical data administration tasks such as referential integrity testing and test data extraction.

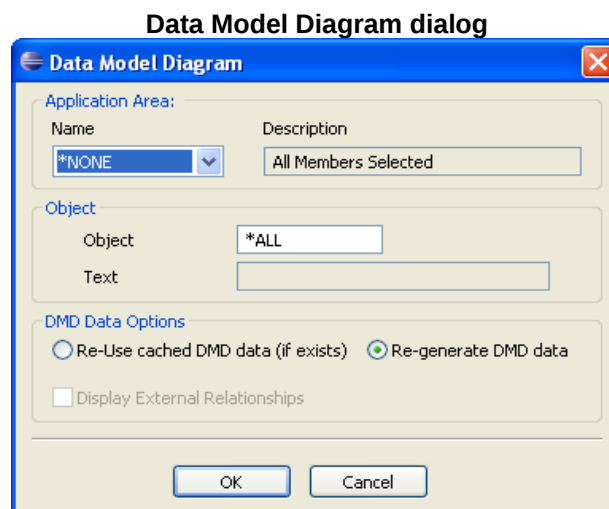
The graphical representation of automatically generated Data Model information in X-Analysis is a Data Model Diagram. The Data Model Diagram displays file relationships for an application or an application area.

Generating Data Model Diagram

Double click on the **Data Model Diagram** node under the cross-reference library, **XAN4CDXA**.



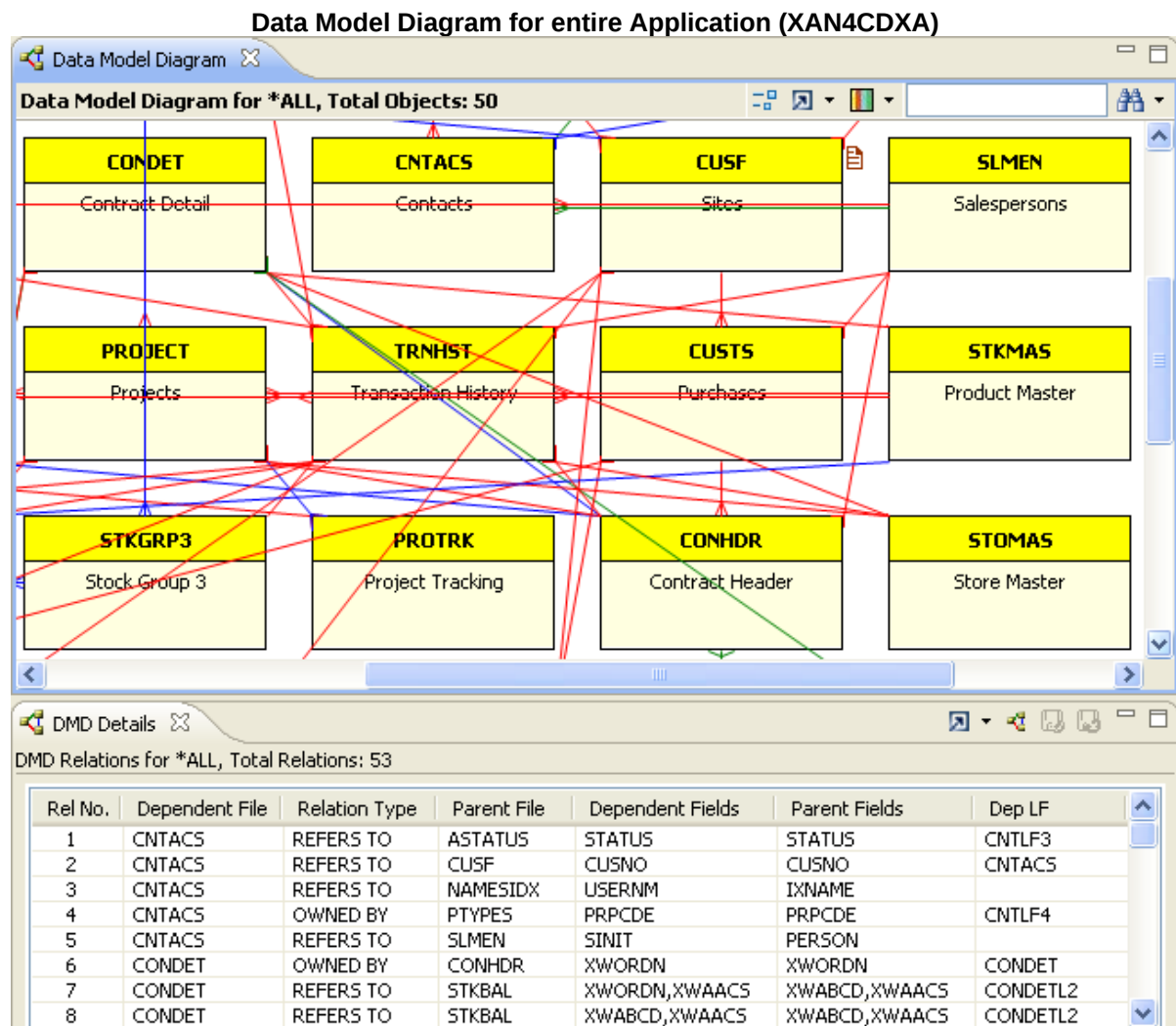
This will invoke the **Data Model Diagram** dialog as shown below:



It prompts a user to input the following:

1. Application Area Name (leave it as *NONE)
2. Object Name (leave it as *ALL)
3. DMD Data Options to re-use cached data or re-generate data (leave it as Re-generate DMD data)
4. Whether to display external relationships (available only when Data Model Diagram opted on Application Area)

Then, click the **OK** button to generate Data Model Diagram for the entire application.



The Data Model Diagram displayed above consists of two halves. The upper half is the Data Model Diagram and the lower half is the DMD Details view. The Data Model Diagram displays a graphical representation of the derived data model information.

The Data Model Diagram toolbar has a **Legend** icon. The different colours on the **Legend** dropdown convey the type of association represented by the coloured lines connecting various files.

DMD Legend

■	Refer To
■	Owned By
■	Uni-Directional
■	Multiple Rels
■	Internal
■	External
■	Extended By

With the help of the **DMD Legend**, a user can easily understand the relations displayed on the Data Model Diagram.

The DMD Details view displays the Files Connection Details. On the DMD Details view, the column 'Relation Type' gives the relationship between the files in the 'Dependent File' column and the files in the 'Parent File' column. The 'Dependent Fields' and the 'Parent Fields' columns list the fields which relate to the 'Dependent File' and the 'Parent File' respectively.

The DMD Details list displays actual names of the listed Files and Fields. The DMD details list provides a toggle button, **Show Description**, to switch the DMD details list to display the description of the listed Files and Fields.

DMD Details view with Show Description icon

Rel No.	Dependent File	Relation Type	Parent File	Dependent Fields	Parent Fields	Dep LF
1	CNTACS	REFERS TO	ASTATUS	STATUS	STATUS	CNTLF3
2	CNTACS	REFERS TO	CUSF	CUSNO	CUSNO	CNTACS
3	CNTACS	REFERS TO	NAMESIDX	USERNM	IXNAME	
4	CNTACS	OWNED BY	PTYPES	PRPCDE	PRPCDE	CNTLF4
5	CNTACS	REFERS TO	SLMEN	SINIT	PERSON	
6	CONDET	OWNED BY	CONHDR	XWORDN	XWORDN	CONDET
7	CONDET	REFERS TO	STKBAL	XWORDN,XWAACS	XWABCD,XWAACS	CONDETL2

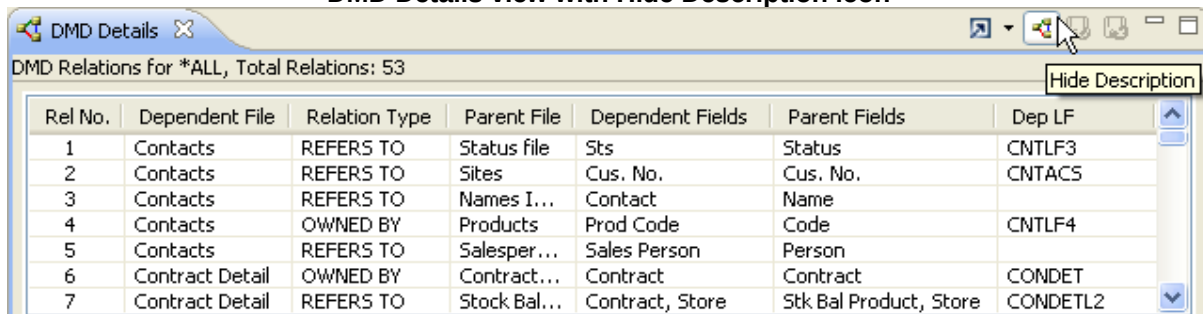
Click the **Show Description** icon to see descriptive names for all the files and the fields.

DMD Details view with Description

Rel No.	Dependent File	Relation Type	Parent File	Dependent Fields	Parent Fields	Dep LF
1	Contacts	REFERS TO	Status file	Sts	Status	CNTLF3
2	Contacts	REFERS TO	Sites	Cus. No.	Cus. No.	CNTACS
3	Contacts	REFERS TO	Names I...	Contact	Name	
4	Contacts	OWNED BY	Products	Prod Code	Code	CNTLF4
5	Contacts	REFERS TO	Salesper...	Sales Person	Person	
6	Contract Detail	OWNED BY	Contract...	Contract	Contract	CONDET
7	Contract Detail	REFERS TO	Stock Bal...	Contract, Store	Stk Bal Product, Store	CONDETL2

Click the **Hide Description** icon to switch back the DMD Details list to the actual names mode.

DMD Details view with Hide Description icon

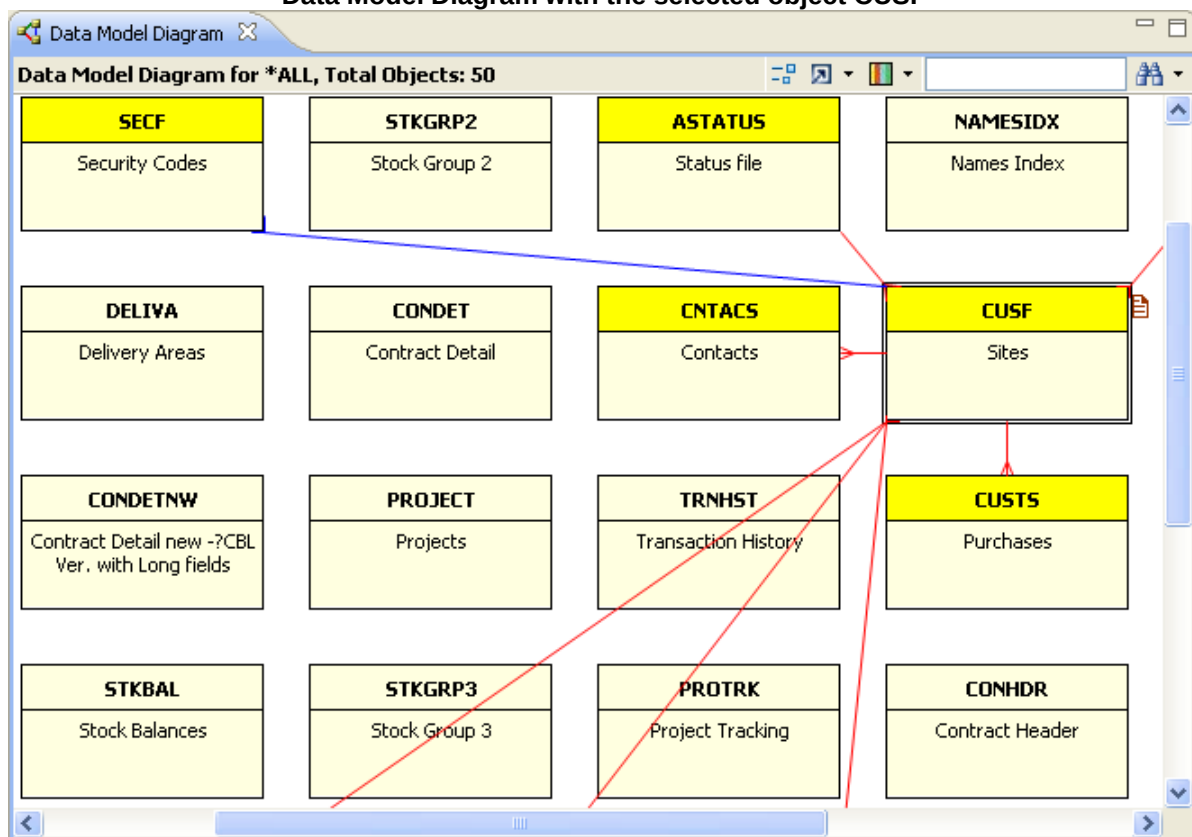


DMD Relations for *ALL, Total Relations: 53

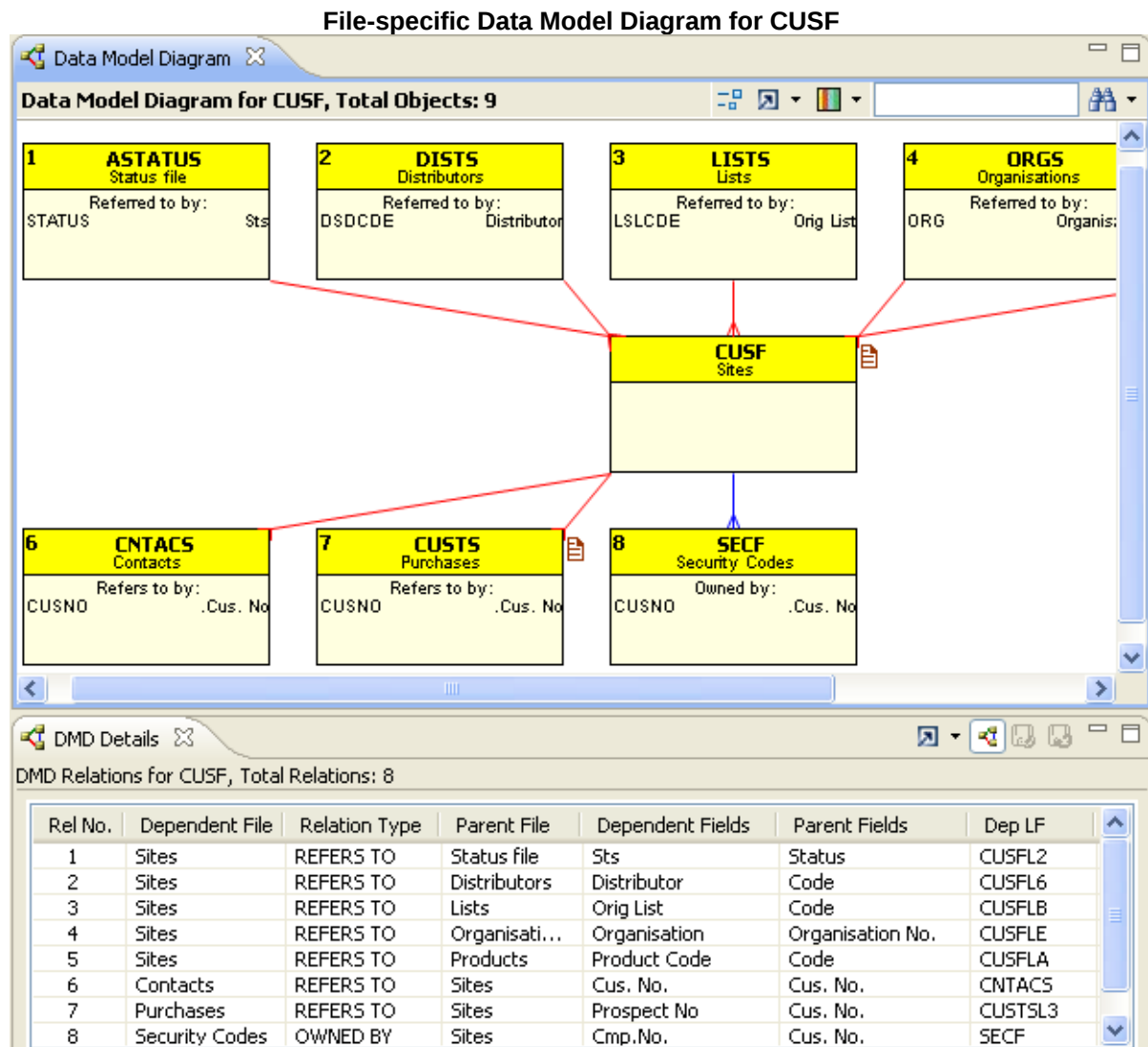
Rel No.	Dependent File	Relation Type	Parent File	Dependent Fields	Parent Fields	Dep LF
1	Contacts	REFERS TO	Status file	Sts	Status	CNTLF3
2	Contacts	REFERS TO	Sites	Cus. No.	Cus. No.	CNTACS
3	Contacts	REFERS TO	Names I...	Contact	Name	
4	Contacts	OWNED BY	Products	Prod Code	Code	CNTLF4
5	Contacts	REFERS TO	Salesper...	Sales Person	Person	
6	Contract Detail	OWNED BY	Contract...	Contract	Contract	CONDET
7	Contract Detail	REFERS TO	Stock Bal...	Contract, Store	Stk Bal Product, Store	CONDETL2

Let us consider another aspect of the Data Model Diagram. A single click on an object displays the references of that object with the other objects in the Data Model Diagram. Click on the object CUSF to view its references.

Data Model Diagram with the selected object CUSF



The screen above displays relations for the file CUSF. This helps a user to make out all the relationships for the selected object. Another way of understanding file relations for any specific file is to have a file-specific Data Model Diagram. A file-specific Data Model Diagram displays the data model information for a given file only. Double click on **CUSF** to get the file-specific Data Model Diagram.



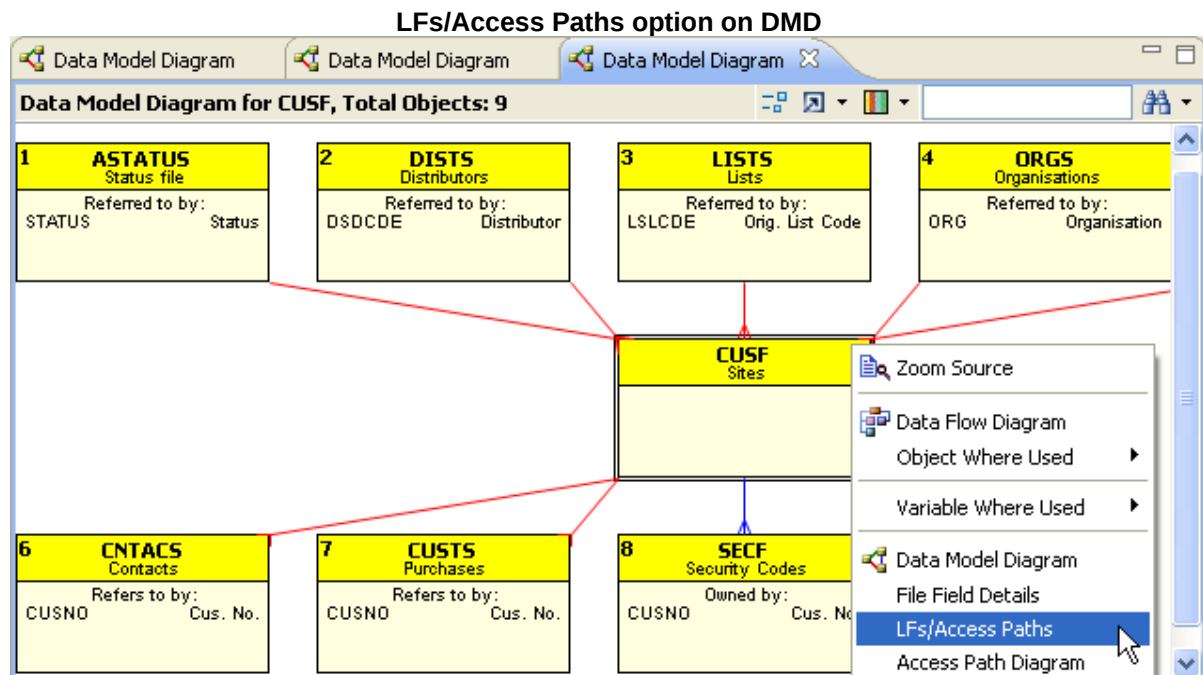
The Data Model Diagram displayed above is the file-specific Data Model Diagram for CUSF. It only has objects related to the file CUSF. Furthermore, the DMD Details list displays only those relationships related to the file CUSF.

With the help of a file-specific Data Model Diagram, a user can view relations for any available files. These relations can be understood better, when we talk about them in the 'View Data' section.

LFs/Access Paths

A user can opt for the **LFs/Access Paths** option for a file from the Data Model Diagram. The **LFs/Access Paths** option shows all access paths associated with a selected file.

Select file CUSF, and then choose the **LFs/Access Paths** option from the context menu.



This brings up the Access Paths list.

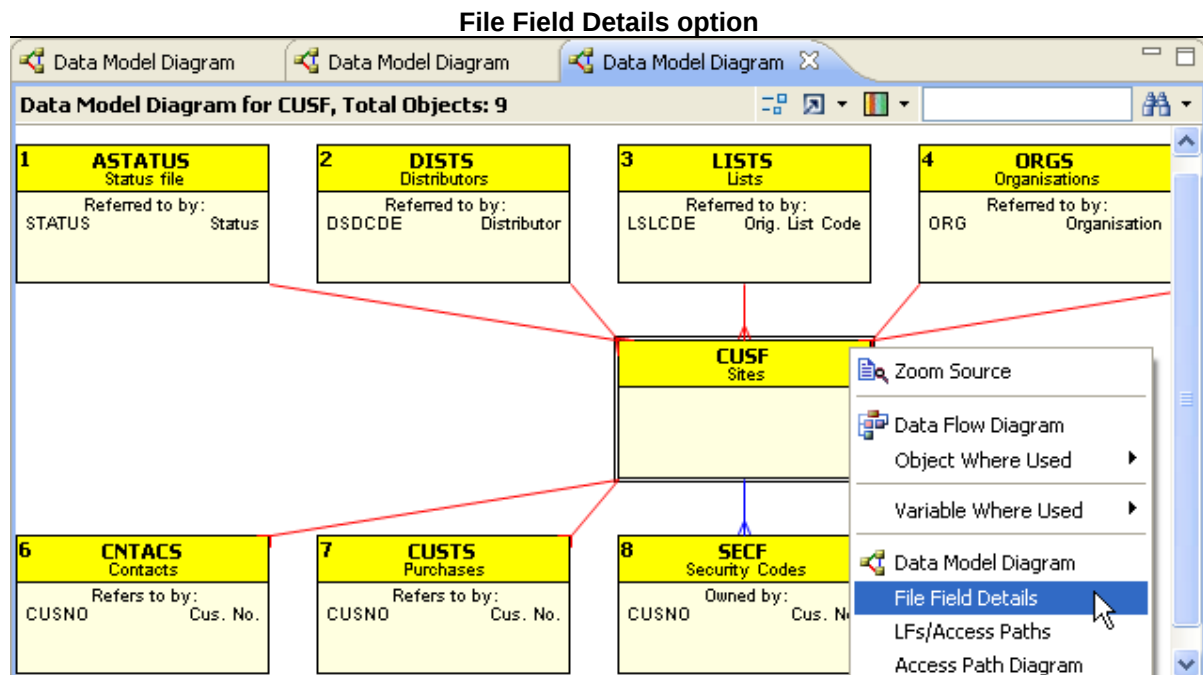
LFs/Access Paths for the file CUSF

LFs/Access Paths for CUSF, Total Objects: 14

Access Path	Text	Unique Keys	Select/Omit	Field Names	LF Seq.	Do Not Display
CUSF	Sites	N	N		00000	N
CUSFLA	Sites by Product - renamed from cusfla for testing	N	N	PRPCDE,CNAME	00003	N
CUSFLB	Sites by Orig.List	N	N	LSLCDE,CNAME	00004	N
CUSFLC	Sites by Salesperson	N	N	SINIT,CNAME	00005	N
CUSFLD	Sites by Validator	N	N	VINIT,CNAME	00006	N
CUSFLE	Sites by Organisation	N	N	ORG,CNAME	00007	N
CUSFL1	Sites by Name	N	N	CNAME	00001	N
CUSFL2	Sites by Status	N	N	STATUS,CNAME	00008	N
CUSFL3	Sites by Number	Y	N	CUSNO	00002	N
CUSFL5	Sites by Dist. & Status	N	N	DSDCDE,STATUS,CNAME	00009	N
CUSFL6	Sites By Dist. & Name	N	N	DSDCDE,CNAME	00010	N
CUSFL7	Sites by Last Cnt.Date	N	Y	LCTDAT,STATUS,CNAME	00011	N
CUSFL8	Sites by Next Cnt.Date	N	N	APDATE,CNAME	00012	N
CUSFL9	Sites by Fax No.	N	Y	FAXNO	00013	N

File Field Details / FFD

For wholesome understanding of the data model of an existing application, a user needs more details of a particular file. A particular file may consist of several fields. The **File Field Details** option helps the user here. By choosing the aforementioned option from the context menu the user gains easy access to particular field details of a selected file, CUSF.



On clicking this option, a new window appears displaying File Field Details information.

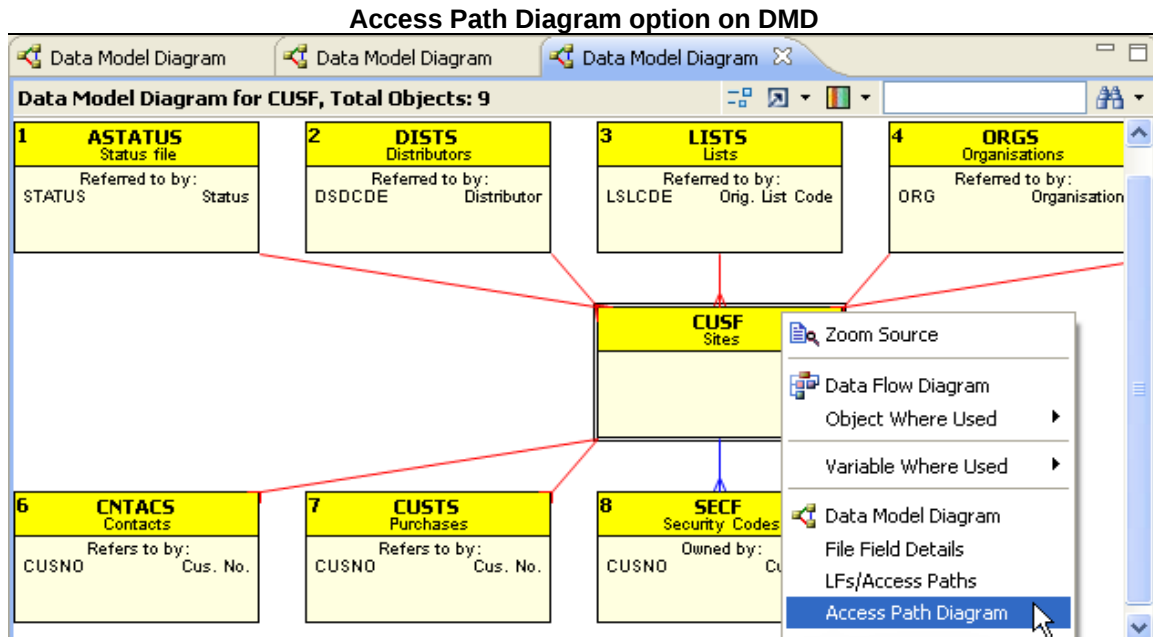
File Fields Details for the file CUSF

The screenshot shows the 'File Field Details for CUSF, Total Fields: 47' window. It displays a table with the following data:

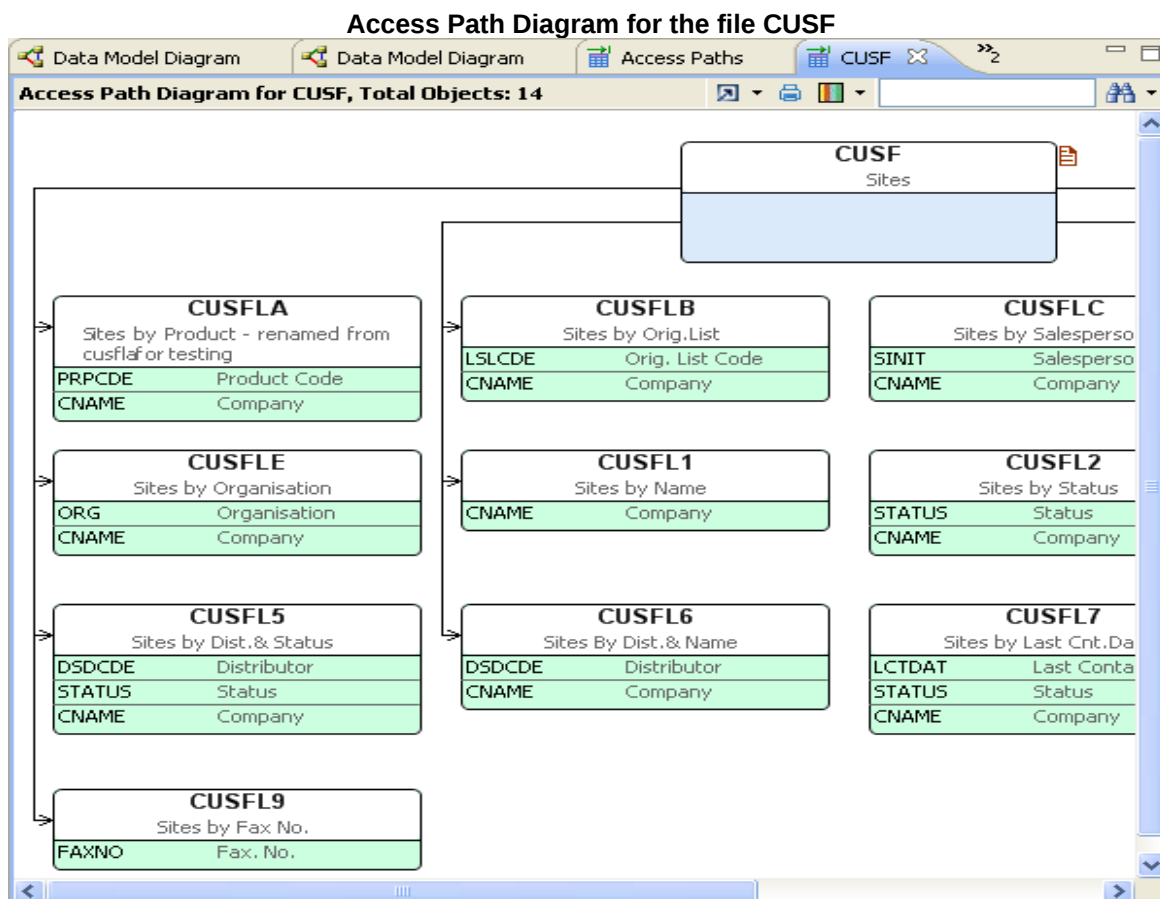
Mnemonic	Long Name	Type	Length	Dec.Pos.	Inp.Buf.Pos.	Display	Grid Seq.	Record Scr...	Headings
CNAME	Company	CHAR	34		1	Y	1.00	2.00	Company
DSDCDE	Distributor	CHAR	2		35	Y	2.00	3.00	Distributor
STATUS	Sts	CHAR	1		37	Y	3.00	4.00	Status
TELNO	Phone	CHAR	17		38	Y	4.00	5.00	Phone
EXTN	Extn	CHAR	6		55	Y	5.00	6.00	Extn.
LCTDAT	Last_Cnt_Date	ZONED	6	0	61	Y	6.00	7.00	Last Contact Date
APDATE	Next_Cnt_Date	ZONED	6	0	67	Y	7.00	8.00	Next Contact Date
USERNM	Contact	CHAR	34		73	Y	8.00	9.00	Contact

Access Path Diagram / APD

The Access Path Diagram is a graphical presentation of all the access paths related to a specific file. The user can generate the diagram by choosing the **Access Path Diagram** option from the context menu over a selected file, CUSF.



This brings up the Access Path Diagram for the file CUSF.

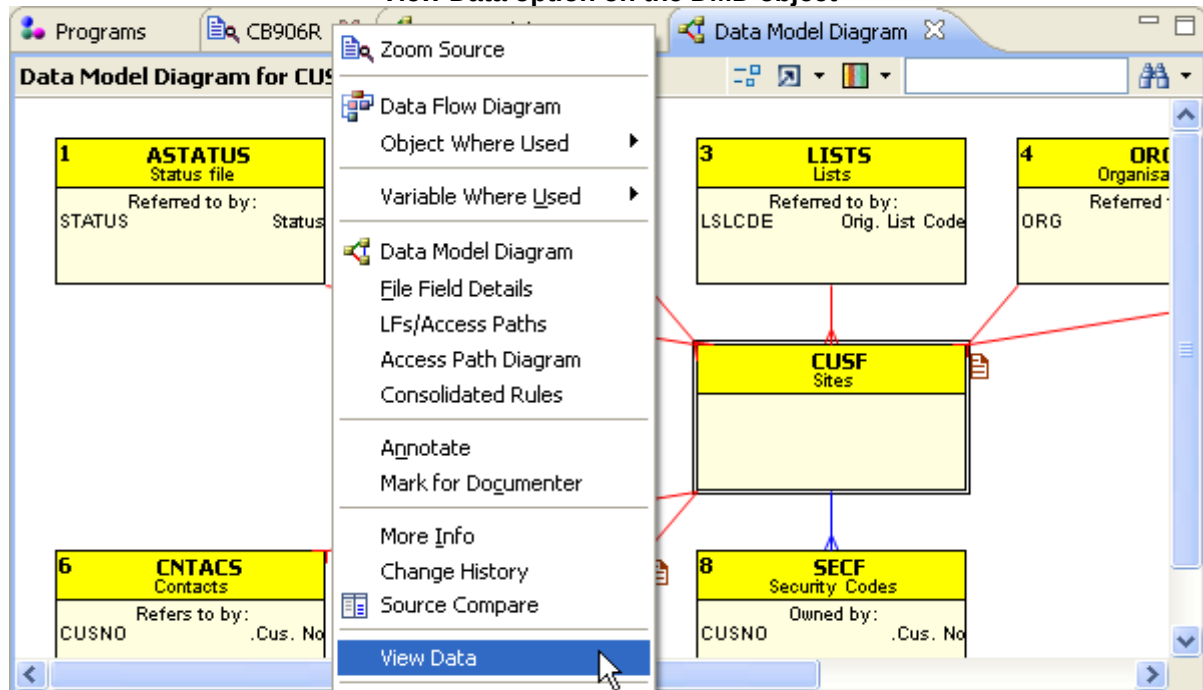


Go back to the Data Model Diagram displaying the file-specific Data Model Diagram for the object CUSF.

View Data

X-Analysis allows a user to view file records from the data model of an application. A user can view the actual records held in PFs using the **View Data** option. The **View Data** option is available on all objects displayed in the Data Model Diagram.

View Data option on the DMD object



Data View for the file CUSF

Data View for CUSFL1						
Company	Distributor	Sts	Last Cnt Date	Next Cnt Date	Fax. No.	Cus. No.
Acoustical Turbines Ltd	DS	9	030910	061005	0135 567 678	00077
Air Tickets plc	DT	2	030508	031013		00117
Albatross Trading	IR	8	030408	031006		00136
A1			030514	031025		00233
Bank of Bromley Ltd.	DT	9	030908	031013	0181 678 1234	00031
Bays Engineering Ltd	DT	5	030514	031025	06794 601148	00018
Belmont Bros Bank	DT	3	030514	031025	04582 871482	00068
Bert and Company Plc	DT	3	030514	031025	01702 727201	00089
Berth Ltd	DT	9	030908	031013		00126
Bertwhistle & Company Ltd	DT	5	030514	031025	0121 550 753	00001

Record Display

The View Data window lists records for a selected file. Double click on a record to display the complete record.

Double click on the record – **Bertwhistle & Company Ltd.** This brings up the record display along with its dependent files data.

Record Display with Dependents

Data View for CUSFL1

CNAME	Bertwhistle & Company Ltd	TELNO	0121 550 1841
DSDCDE	DT Databorough Tech	EXTN	556
Sts	5 Status 5	Last Cnt Date	030514
USERNM	Janet Dawson	Next Cnt Date	031025
SALUT	Mrs	FAXNO	0121 550 753
JTITLE	Financial Director	ADD1	Veal House
EMAIL	jdawson@bertco.com	ADD2	34 Wayside
WEBSIT		ADD3	Nelt
CNTRY		ADD4	Surrey
CMMNT1		PSCD	*
CMMNT2		ALTTEL	
CMMNT3		ALTTL2	
PRPCDE		VFDATE	000000
Orig List		CRTNAM	
Spec Req.		CRTDAT	000000
ORG	00000	UPDNAM	

☐

Prod Code	Contact	Email
XC	JOHN SMITH	

The tab at the bottom displays dependent file data. These are any ACCESSES/OWNS/REFERS TO relationships for the file CUSF in the Data Model Diagram.

On the record display, the **Descriptors** button displays the ACCESSED BY / REFERS TO relations. This is similar to a JOIN to a foreign file, to get the description for the code used from the Master/Owning file.

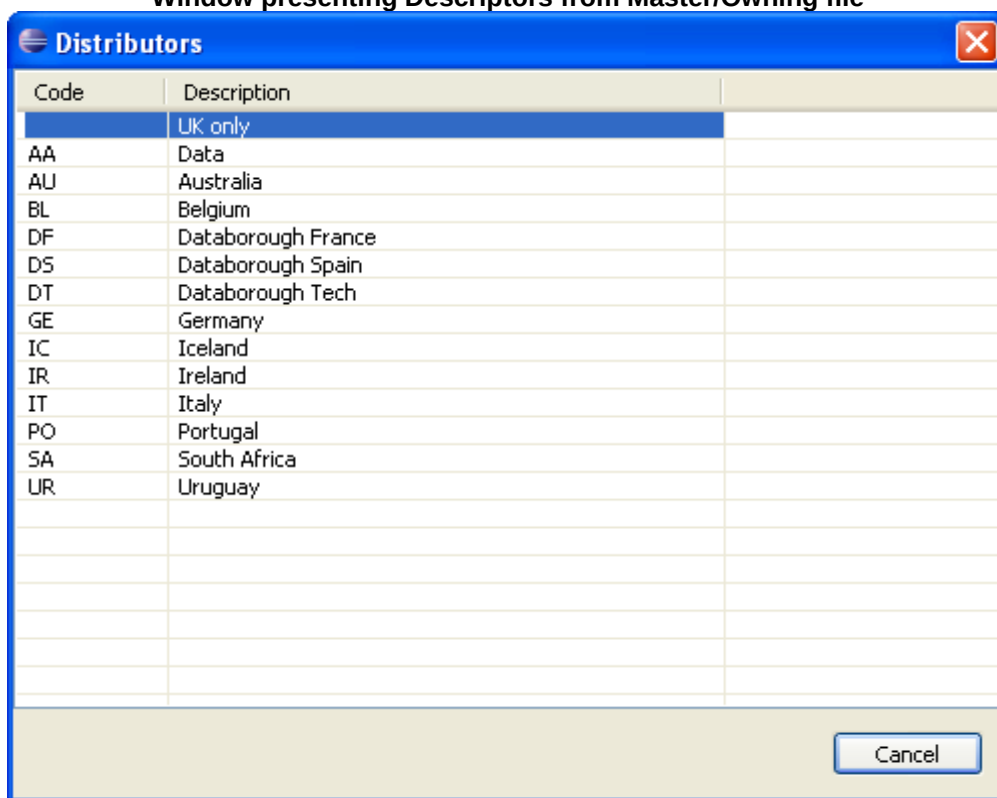
Descriptors button on Record Display

Data View for CUSFL1

CNAME	Bertwhistle & Company Ltd	TELNO	01
DSDCDE	DT Databorough Tech	EXTN	55
Sts	5	Last Cnt Date	03
USERNM	Janet Dawson	Next Cnt Date	03
SALUT	Mrs	FAXNO	01

On clicking the **Descriptors** button, the following window is invoked:

Window presenting Descriptors from Master/Owning file



The screenshot shows a window titled "Distributors" with a blue header bar. Below the header is a table with two columns: "Code" and "Description". The table contains the following data:

Code	Description
	UK only
AA	Data
AU	Australia
BL	Belgium
DF	Databorough France
DS	Databorough Spain
DT	Databorough Tech
GE	Germany
IC	Iceland
IR	Ireland
IT	Italy
PO	Portugal
SA	South Africa
UR	Uruguay

At the bottom right of the window is a "Cancel" button.

Chapter 5: Application Areas

X-Analysis is a diversified toolset, and true to its name and features, it helps in analyzing a monolithic legacy application by breaking it down into different application areas for the ease of working. X-Analysis lets its users further sub-divide the application areas, thereby, initiating thorough understanding of the legacy application.

This chapter guides on how X-Analysis creates various application areas for easy comprehension and analysis of monolithic legacy applications. The chapter also presents the diagrammatic constructs related to the application areas that improve the user's understanding.

The chapter contains:

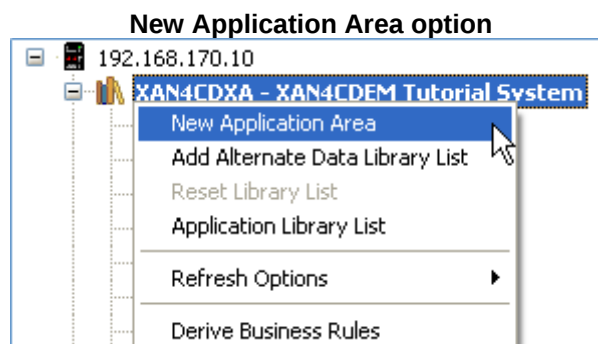
- [Application Areas](#)
- [Application Area Diagram](#)
- [Area Flow Diagram: Application Area Specific](#)
- [Data Model Diagram: Application Area Specific](#)
- [Data Flow Diagram: Application Area Specific](#)

Application Areas

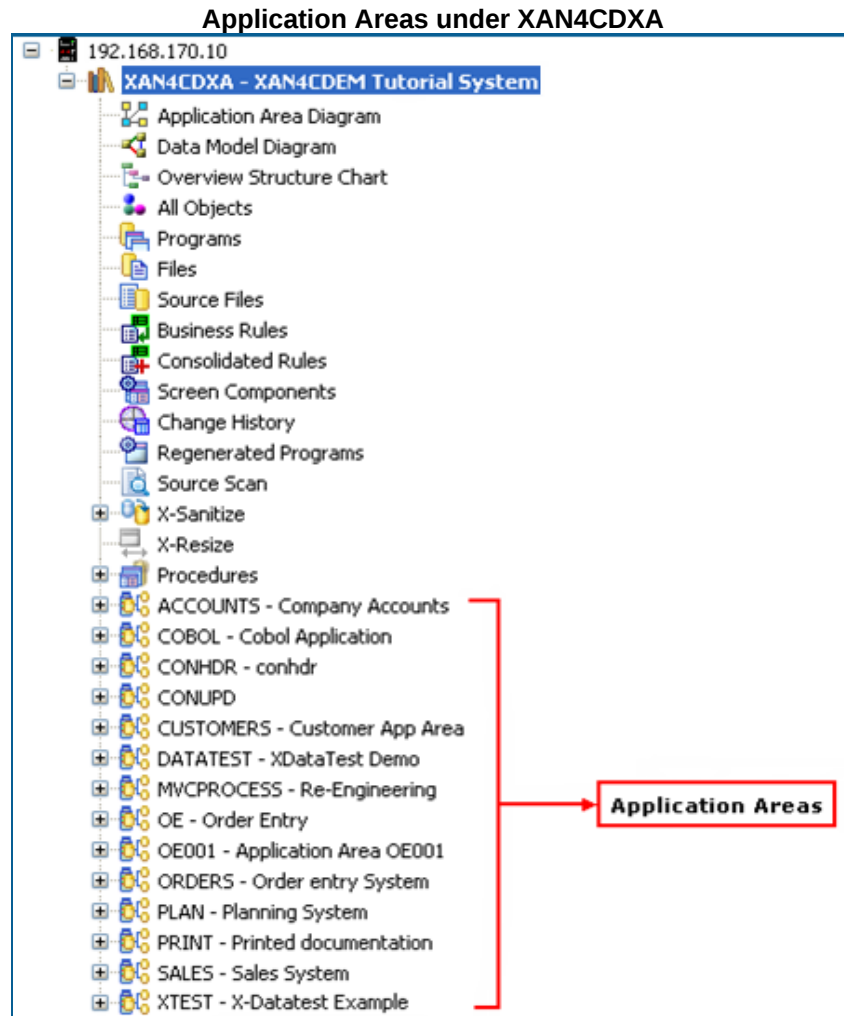
X-Analysis creates application areas, from part of one or multiple systems. Programmatically, it is possible to subdivide an application into logical modules or areas. This can be within the context of a single system or specific parts from multiple systems. For example, a user can have an application area as ORDERS, containing the Order Entry details from an Operational System to represent single system application areas. A user can also have an application area as ACCOUNTS, containing the Order Entry details from an Operational System and the Sales Ledger details from the Financial System, representing the application area as specific parts from multiple systems.

The Application Areas facilitate grouping of an application into different business areas. X-Analysis creates application areas based on certain criteria called Application Area Rules. Hence, Application Area Rules become a useful mechanism to categorize an application into different application areas.

A user can add a new application area by selecting the **New Application Area** option from the context menu in a cross-reference library or in an application area.



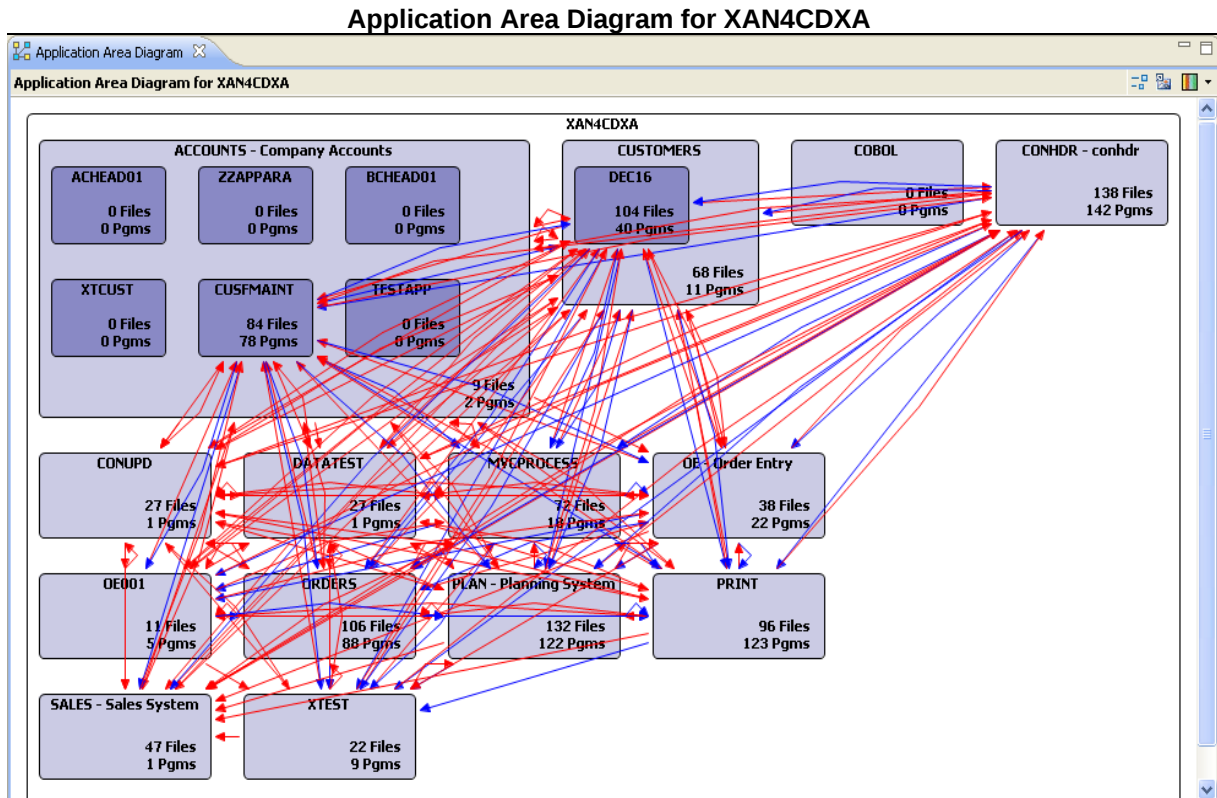
The tutorial application contains pre-configured application areas. The following screenshot displays the available application areas in the tutorial application:



Application Area Diagram

A user can easily sub-divide an application into business areas or application areas using X-Analysis. Similarly, a user can further split application areas into sub-application areas for better application analysis. X-Analysis provides another diagrammatic construct called the Application Area Diagram for enhancing the analysis of application areas.

The Application Area Diagram helps in visualizing relationships between the application areas. When the option **Application Area Diagram** is opted for the entire cross-reference library, it displays all application areas and the sub-application areas (if available). The following screenshot displays the Application Area Diagram for the tutorial application.



Each bluish grey box represents an application area. The box size is indicative of the number of objects it contains. A larger box has more objects as compared to a smaller box.

The diagram also shows relationships among application areas displayed by selecting an application area. Select an application area to test this feature.

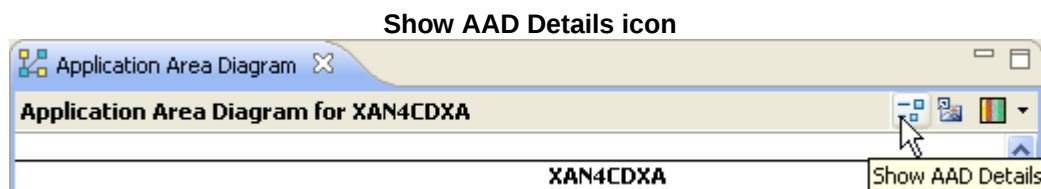
The red and blue-coloured connecting arrows are the relationships among application areas.

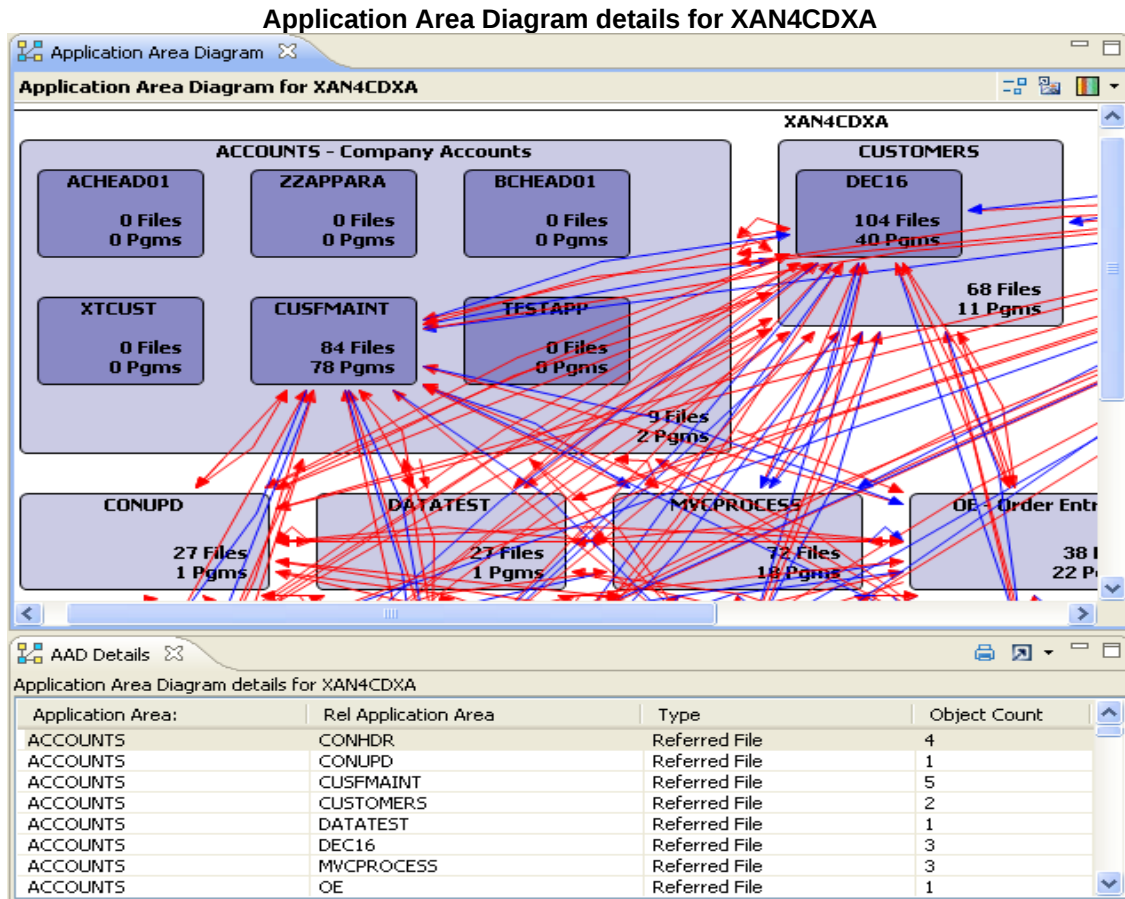
Blue Arrows – Indicate Program-to-Program calls. The blue arrow points towards the application area, which has more calling programs.

Red Arrows – Indicate Program-to-File references.

Application Area Diagram Details

The Application Area Diagram also displays the relationship details for each application area. Click the **Show AAD Details** icon, available on toolbar to invoke the detailed view.

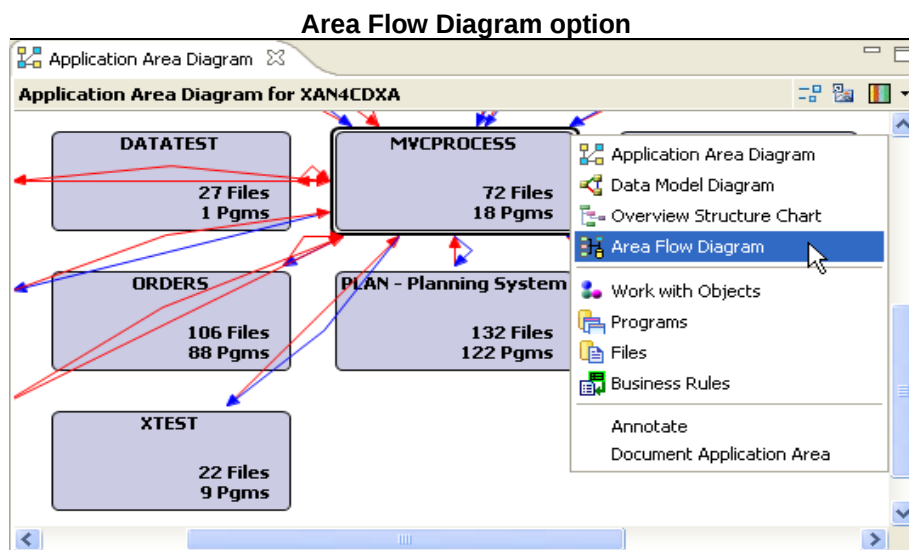




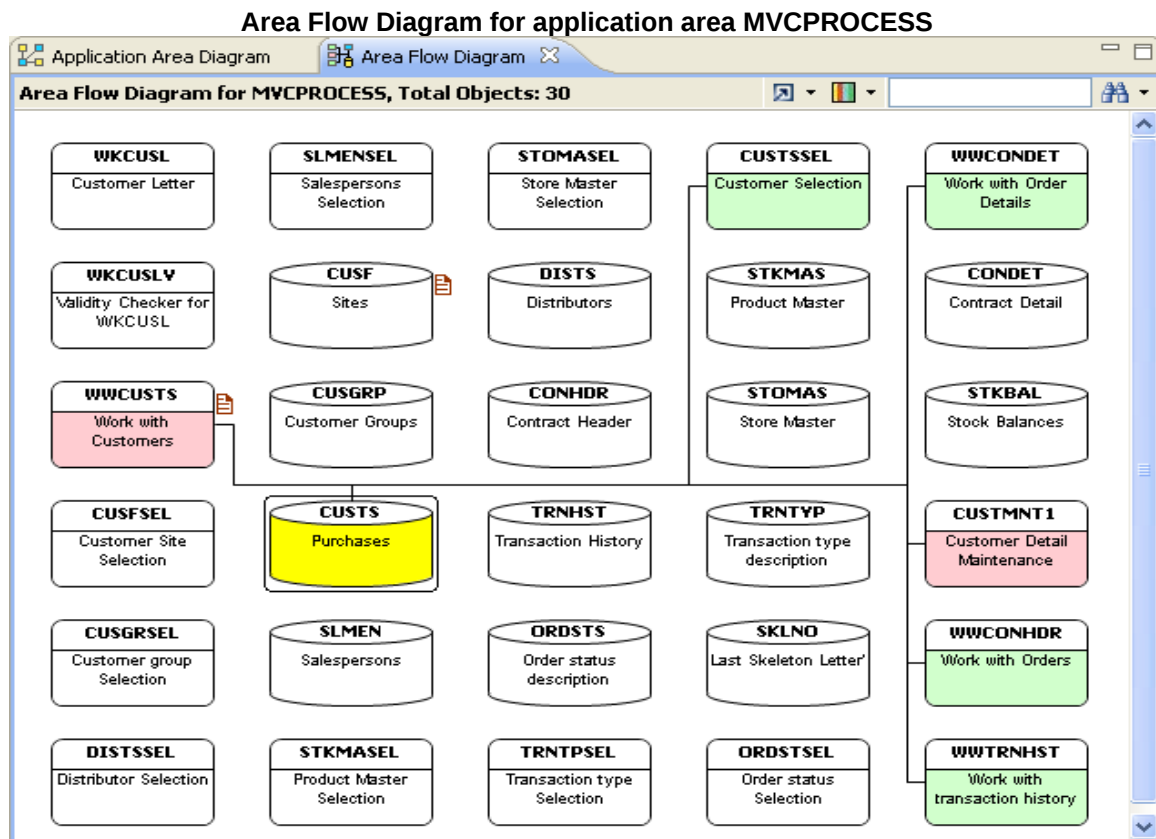
Area Flow Diagram

Another important diagrammatic construct is the Area Flow Diagram. This option is available for application areas only. It displays programs and files available in an application area along with their relations.

Select the **Area Flow Diagram** option from the context menu of the application area, MVCPROCESS.



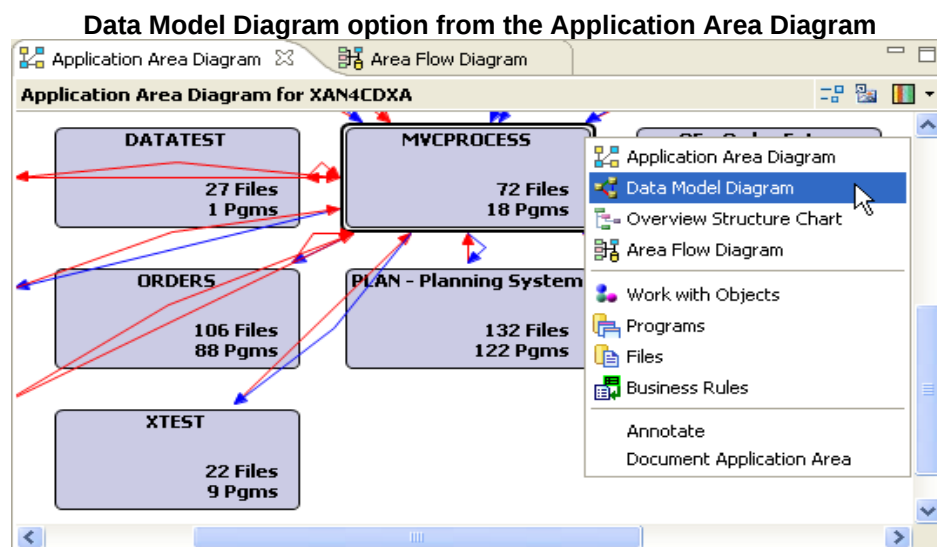
This invokes the Area Flow Diagram for the application area – MVCPROCESS.



The default selection is on the file with the greatest number of programs referring to it.

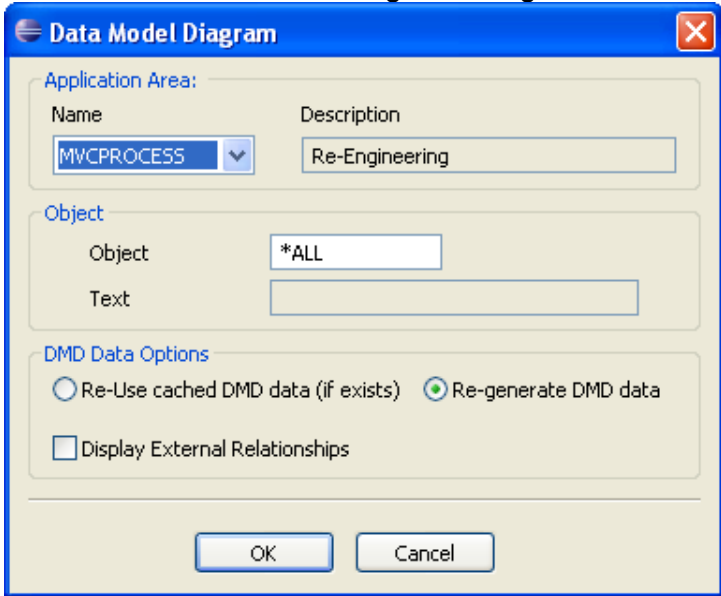
Data Model Diagram – Application Area Specific

The Data Model Diagram for an application area represents relationships among the related objects that belong to that application area only. Select the **Data Model Diagram** option for the application area – MVCPROCESS.



This invokes the **Data Model Diagram** dialog for the application area – MVCPROCESS.

Data Model Diagram dialog

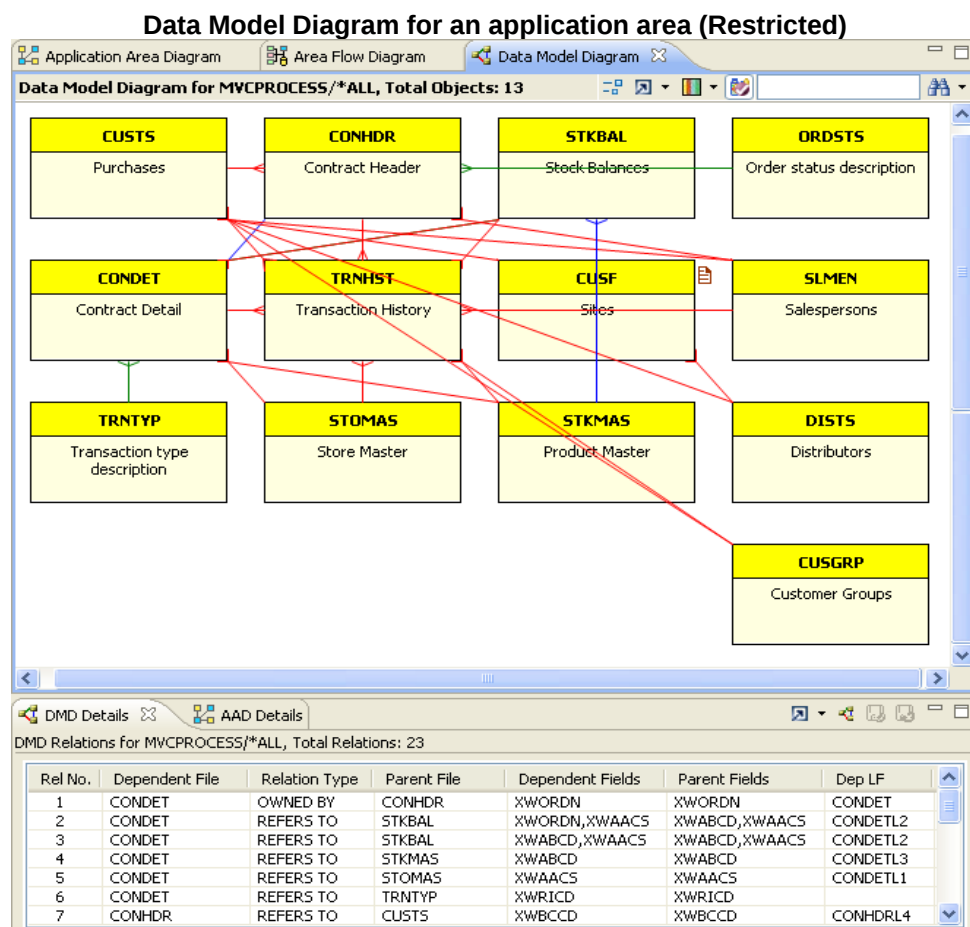


The dialog box is titled "Data Model Diagram" and contains the following sections:

- Application Area:**
 - Name: MVCPROCESS (dropdown menu)
 - Description: Re-Engineering (text field)
- Object:**
 - Object: *ALL (text field)
 - Text: (empty text field)
- DMD Data Options:**
 - ☐ Re-Use cached DMD data (if exists)
 - ☒ Re-generate DMD data
 - ☐ Display External Relationships

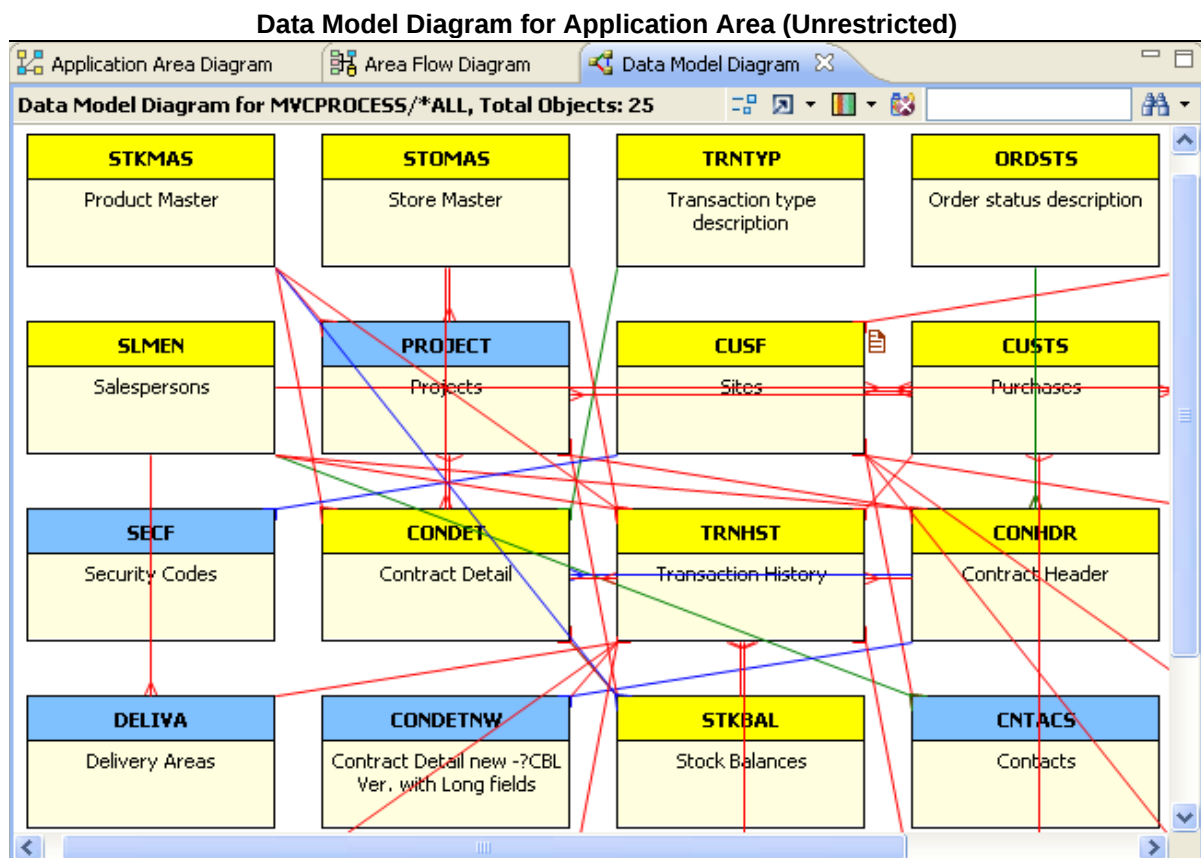
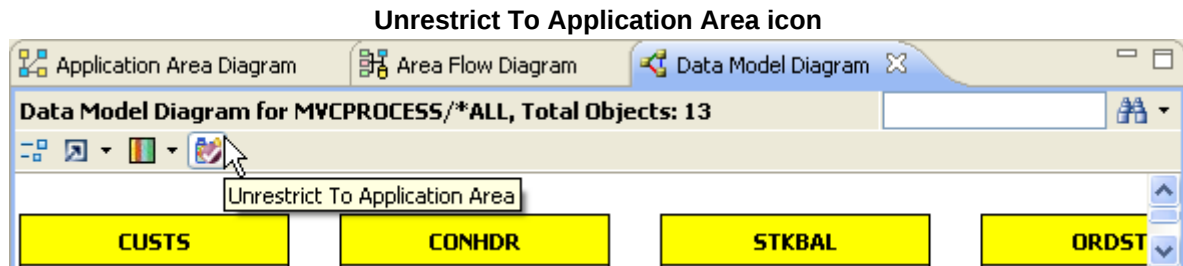
Buttons: OK, Cancel

Click the **OK** button to generate the Data Model Diagram for the selected application area.



The Data Model Diagram displayed above is a restricted Data Model and it only displays the objects which belong to the application area – MVCPROCESS.

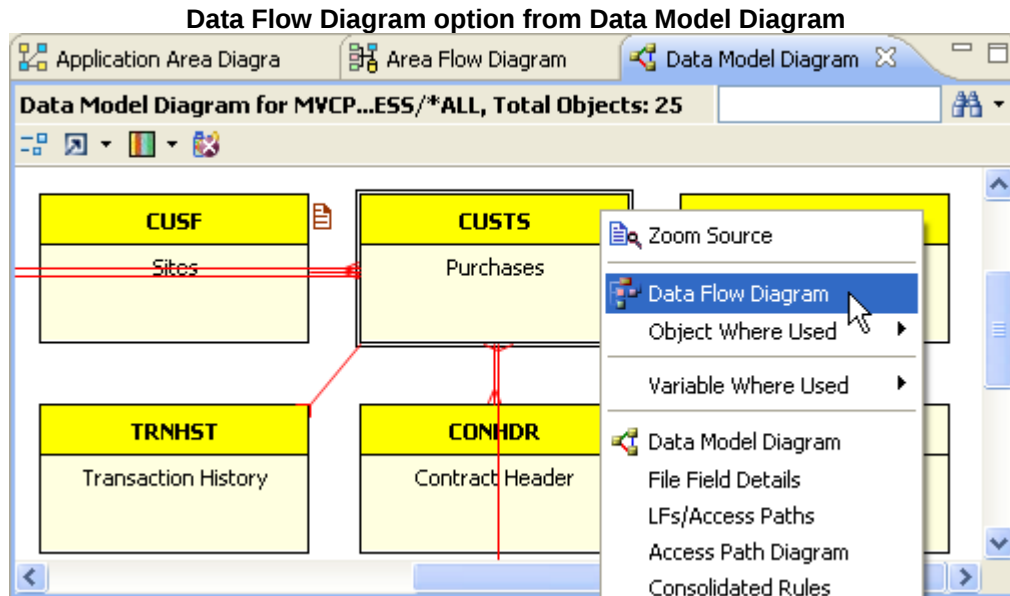
The toolbar on the Data Model Diagram has an option to generate the Un-restricted Data Model Diagram. Click the **Unrestrict To Application Area** icon.



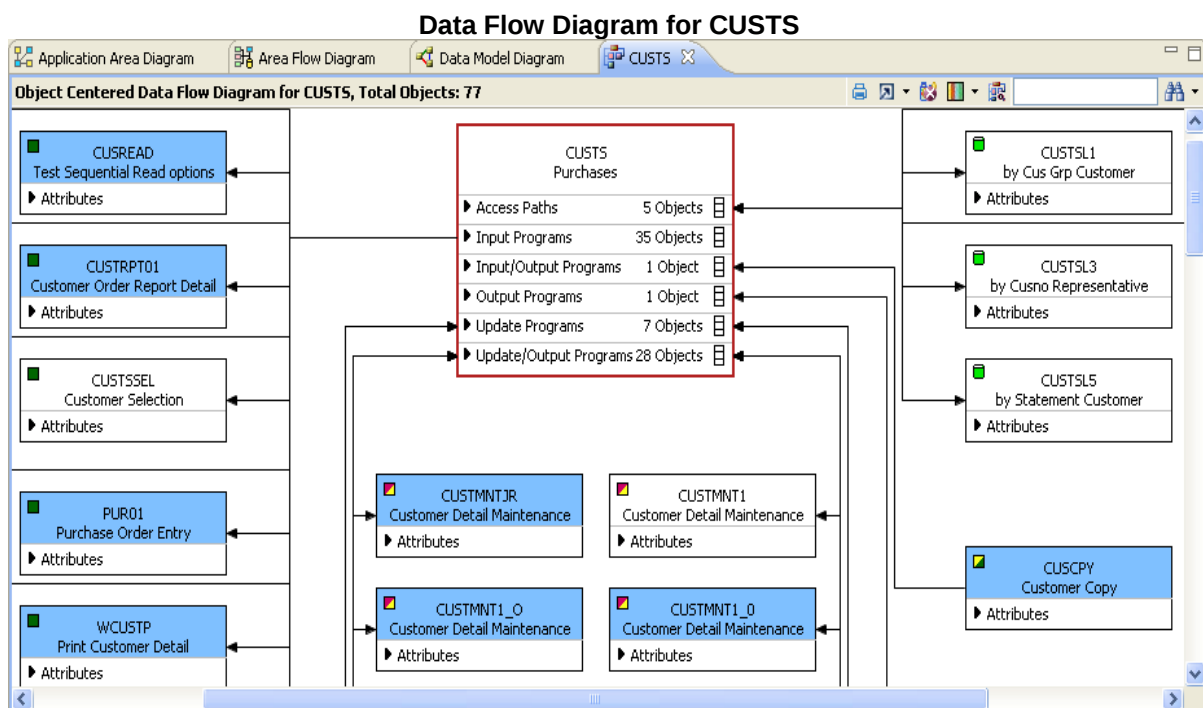
Note the objects displayed in blue are the ones which do not belong to the application area – MVCPROCESS.

Data Flow Diagram – Application Area Specific

The Data Flow Diagram for an application area displays objects that belong only to that application area. From the Data Model Diagram displayed above, right click on the object CUSTS and choose the **Data Flow Diagram** option.



This generates the Data Flow Diagram for the object, CUSTS.



The objects highlighted in blue are those which do not belong to the application area MVCPROCESS, and are referred to as 'External' objects.

Chapter 6: Business Rules Analysis

Deriving business rules is the key to successful conversion of a legacy application into the latest format. The business rules are highly important because they provide critical information for any analyst, architect, or developer who is rebuilding a legacy application.

X-Analysis offers two specific features that help the users access the business rules in quick time. This chapter discusses the features that expedite analysis of business rules.

The chapter contains:

- [Business Rules](#)
- [Business Rules Overlay](#)
- [Consolidated Rules](#)

Business Rules

An application is chiefly characterized by the logic embedded in its source codes and process models. This logic is also collectively referred to as Business Rules. Legacy RPG and COBOL programs suffer from a drawback in which the business rules (logic) get mixed with screen handling, database I/O, and flow control. Retrieving these business rules is a time-consuming, highly specialized, expensive, and labour-intensive exercise.

The task of decoding and configuring the legacy code becomes easier and more cost-effective by using X-Analysis. First, it automatically runs the scan on RPG & COBOL programs and 2E model. Secondly, it separates the rule code from the body of the application, and stores the business rule code into a neatly structured, usable repository. Finally, it provides precise text narratives describing these retrieved rules. The user can check out the derived business rules using the Business Rules view.

Building a repository of business rules is a proactive step. It supports future reengineering/rewrite projects or package replacement projects and also facilitates ongoing legacy maintenance operations.

The overall benefits of extracting business rules are:

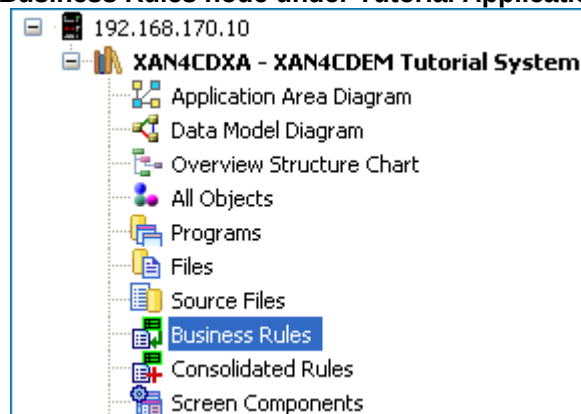
- To help Business Analysts to understand and work with the system
- To communicate system functionality to users and management
- To help developers understand existing functionality, what it is and where it is located
- To improve system quality by facilitating consistency and accuracy
- To increase programmer productivity by enabling code reuse
- To feed the process of reengineering and migration
- To evaluate the suitability of packaged software being considered for purchase

X-Analysis extracts the business rules with the help of a single option – **Derive Business Rules**. This option, which recovers the business rules, is available on the context menu of a cross-reference library, an application area, and a *PGM type object of RPG/RPGLE/CBL attribute.

In the tutorial application, there are some previously derived business rules.

For viewing business rules, the user must double click on the **Business Rules** node under the tutorial application or a selected application area. The following screenshot shows the node under the tutorial application:

Business Rules node under Tutorial Application



This invokes the Business Rules window, displaying all the business rules for the tutorial application.

Business Rules window

Source Member	Rule Number	Field	File	Rule
CB906RR	00001	SSRLNB	SECF	Srl_no = blank
CB906RR	00002	SSRLNB	SECF	Srl_no = blank
CNTCMAINT	00001	CUSNO	CNTACS	Cus_No not found on Contacts
CNTCMAINT	00002	IXNAME	NAMESIDX	Name found on Names_Index
CNTCMAINT	00003	USERNM	CNTACS	Contact = blank
CNTCMAINT	00004	TELNO	CNTACS	Phone <> blank
CNTCMAINT	00005	FAXNO	CNTACS	Fax_No <> blank
CNTCMAINT	00006	SINIT	CNTACS	Sales_Person <> blank
CNTCMAINT	00007	SINIT	CNTACS	Exact match not found for Sales_Person on Contacts
CNTCMAINT	00008	STATUS	CNTACS	Sts <> blank

Scroll down to the object CUSTMNT1 and double click on Rule No. 00002. This zooms in to the business rules of the program CUSTMNT1 with the cursor positioned on the selected business rule.

Business Rules for program CUSTMNT1

Business Rules for CUSTMNT1 in XAN4CDEM/QRPGLSRC, View Level: 2

```

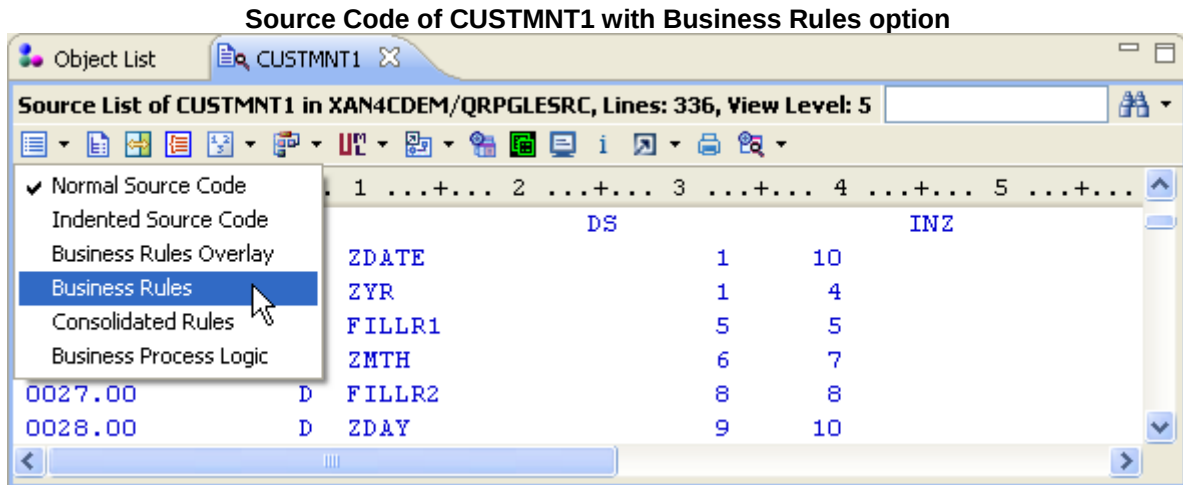
CALL RTNMTX
END
//
R00002 Name = blank
// Customer name
IF XWG4TX = *BLANKS
  *IN32 = *ON
  *IM99 = *ON
MSGID = 'OEM0012'

```

Business Rules

Source Member	Rule Number	Field	File	Rule
CUSGRSEL	00002	XWBNCD	CUSGRP	URSCN__01(S_CNT_1) <> URSCN__N1(S_CNT_1)
CUSLETSQ	00001	CUSNO	CUSF	Cus_No found on Sites
CUSREAD	00001	CUSNO	CUSF	Exact match not found for Cus_No on Sites
CUSRGZ	00001	CUSNO	CUSF	Cus_No found on Sites
CUSTMNT1	00001	XWBCCD	CUSTS	Debtor = blank
CUSTMNT1	00002	XWG4TX	CUSTS	Name = blank
CUSTMNT1	00003	XWBNCD	CUSTS	End of file on CUSGRP and CUSGRP.CusGrp <> blank
CUSTMNT1	00004	PERSON	CUSTS	Rep not found on Salespersons

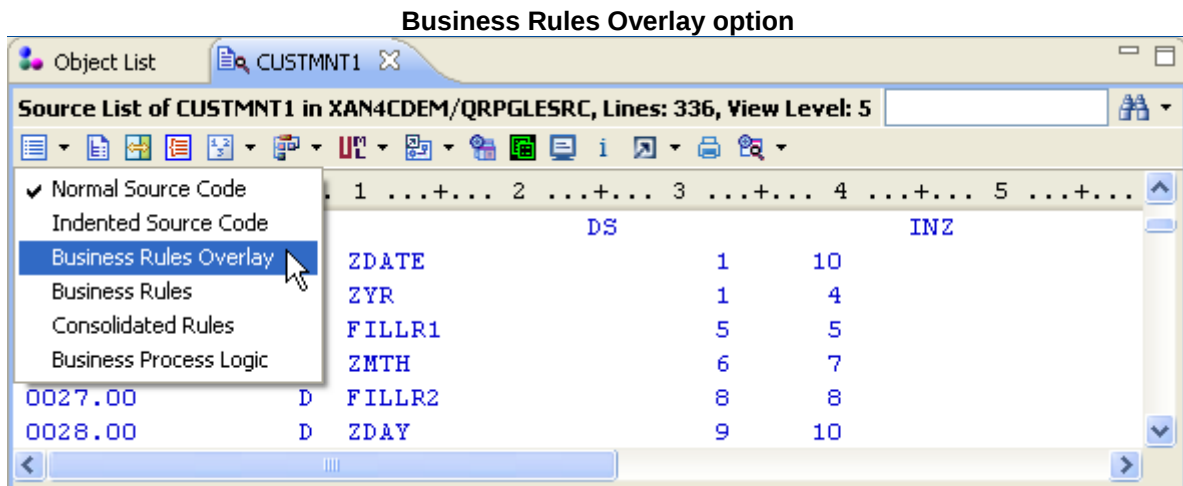
Similarly, the user can view the business rules from the source member display. For this, the user has to select the **Business Rules** option from the **Source Options** dropdown menu as shown in the screen underneath:



On selecting the option, the user can immediately see the business logic within the context of the program as a whole.

Business Rules Overlay

The user can also observe the business rules embedded in the Normal Source Code by choosing the **Business Rules Overlay** option from the **Source Options** dropdown menu shown below:



On selecting the option, the following window is invoked:

Business Rules Overlay window

Business Rules Overlay for CUSTMNT1 ...QRPGLSRC, Lines: 346, View Level: 5

Seq No	*...+... 1	*...+... 2	*...+... 3	*...+... 4	*...+... 5
0101.00	C		eval	*in35 = *off	
0102.00	C		eval	errmsg = *blanks	
0103.00	C*				
0103.98	R00001C*	Debtor = blank			
0104.00	C*	CUSTOMER MUST NOT BE BLANK			
0105.00	C	SWBCCD	IFEQ	*BLANKS	
0106.00	C		MOVE	'1'	*IN99
0107.00	C		MOVE	*ON	*IN31
0108.00	C		MOVE	'OEM0002'	MSGID
0109.00	C		CALL	RTNMTX	

Business Rules

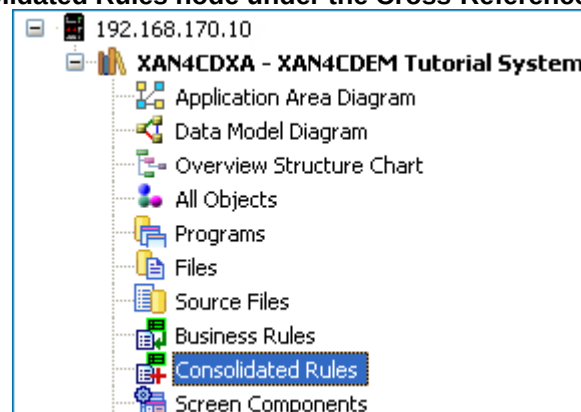
Business Rules for CUSTMNT1, Number of Lines: 13

Source Member	Rule Number	Field	File	Rule
CUSTMNT1	00001	XWBCCD	CUSTS	Debtor = blank
CUSTMNT1	00002	XWG4TX	CUSTS	Name = blank
CUSTMNT1	00003	XWBNCB	CUSTS	End of file on CUSGRP and CUSGRP.CusGrp <> blank
CUSTMNT1	00004	PERSON	CUSTS	Rep not found on Salespersons
CUSTMNT1	00005	DSDCDE	CUSTS	Distributor not found on Distributors
CUSTMNT1	00006	XWGIVA	CUSTS	SDIFF < 0
CUSTMNT1	00007	CUSNO	CUSTS	Cus_No = 0
CUSTMNT1	00008	CUSNO	CUSTS	Cus_No not found on Sites
CUSTMNT1	00009	XWBCCD	CUSTS	Debtor found on Purchases
CUSTMNT1	00010	CUSNO	CUSTS	CUSPRM <> 0
CUSTMNT1	50001	XWE0NB	CUSTS	Field range is from 0 to 999999999.
CUSTMNT1	50002	XWC7ST	CUSTS	Valid field values are: ' ', 'Y', 'N'
CUSTMNT1	50003	CUSNO	CUSTS	Field range is from 0 to 99999.

Consolidated Rules

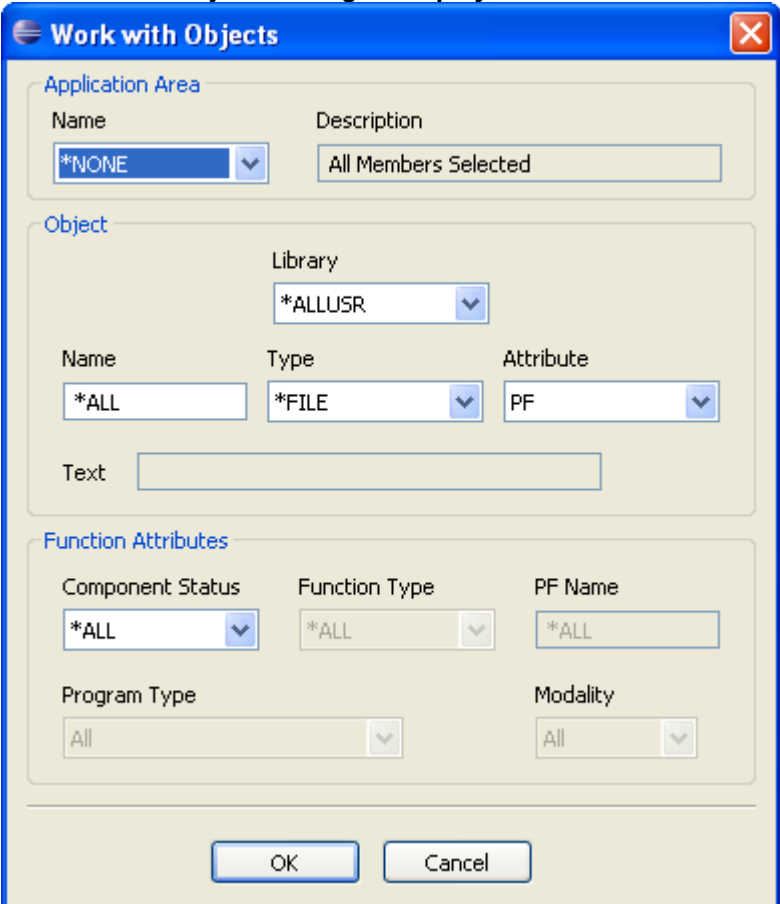
X-Analysis provides an important feature related to file-fields and their business rules. A user can view all the business rules related to a file-field combination. Select the **Consolidated Rules** node available under the cross-reference library.

Consolidated Rules node under the Cross-Reference Library



Double click on **Consolidated Rules** to invoke the **Work with Objects** dialog.

Work with Objects dialog to display Consolidated Rules



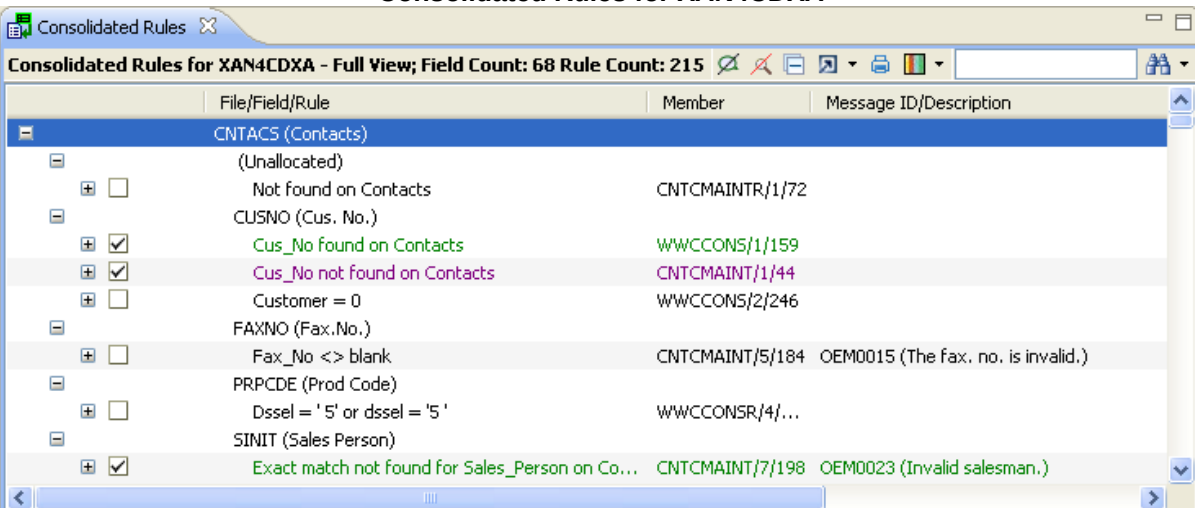
The dialog box is titled "Work with Objects" and contains the following sections:

- Application Area:**
 - Name: *NONE (dropdown)
 - Description: All Members Selected (text box)
- Object:**
 - Library: *ALLUSR (dropdown)
 - Name: *ALL (text box)
 - Type: *FILE (dropdown)
 - Attribute: PF (dropdown)
 - Text: (empty text box)
- Function Attributes:**
 - Component Status: *ALL (dropdown)
 - Function Type: *ALL (dropdown)
 - PF Name: *ALL (text box)
 - Program Type: All (dropdown)
 - Modality: All (dropdown)

Buttons: OK, Cancel

Click the **OK** button to invoke a new window displaying the Consolidated Rules.

Consolidated Rules for XAN4CDXA

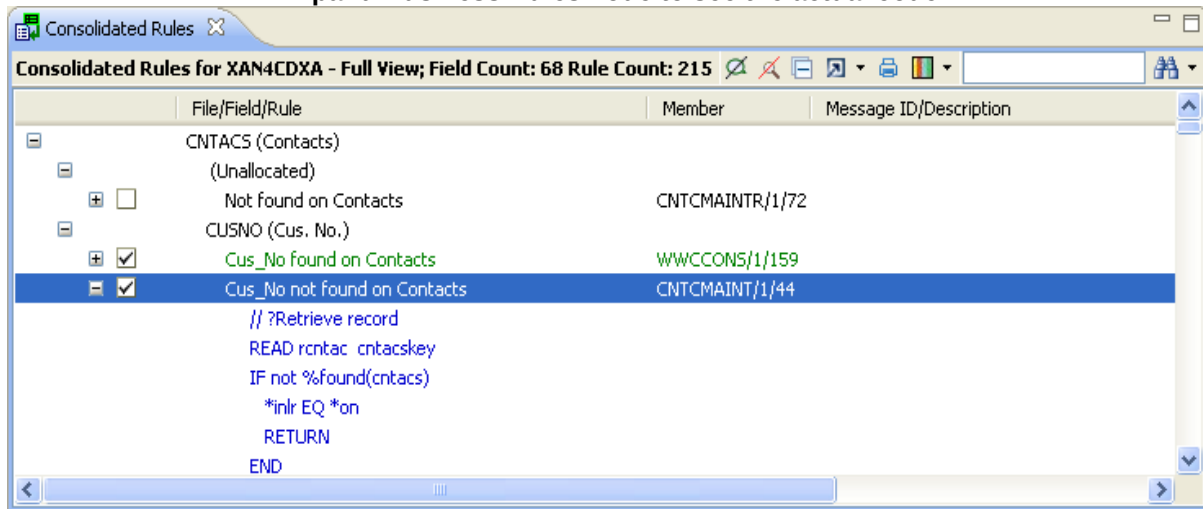


The window displays a table of consolidated rules for XAN4CDXA. The table has three columns: File/Field/Rule, Member, and Message ID/Description. The rules are listed under the heading "CNTACS (Contacts)".

File/Field/Rule	Member	Message ID/Description
CNTACS (Contacts)		
(Unallocated)		
Not found on Contacts	CNTCMAINTR/1/72	
CUSNO (Cus. No.)		
Cus_No found on Contacts	WWCCONS/1/159	
Cus_No not found on Contacts	CNTCMAINT/1/44	
Customer = 0	WWCCONS/2/246	
FAXNO (Fax.No.)		
Fax_No <> blank	CNTCMAINT/5/184	OEM0015 (The fax. no. is invalid.)
PRPCDE (Prod Code)		
Dssel = '5' or dssel = '5'	WWCCONS/4/...	
SINIT (Sales Person)		
Exact match not found for Sales_Person on Co...	CNTCMAINT/7/198	OEM0023 (Invalid salesman.)

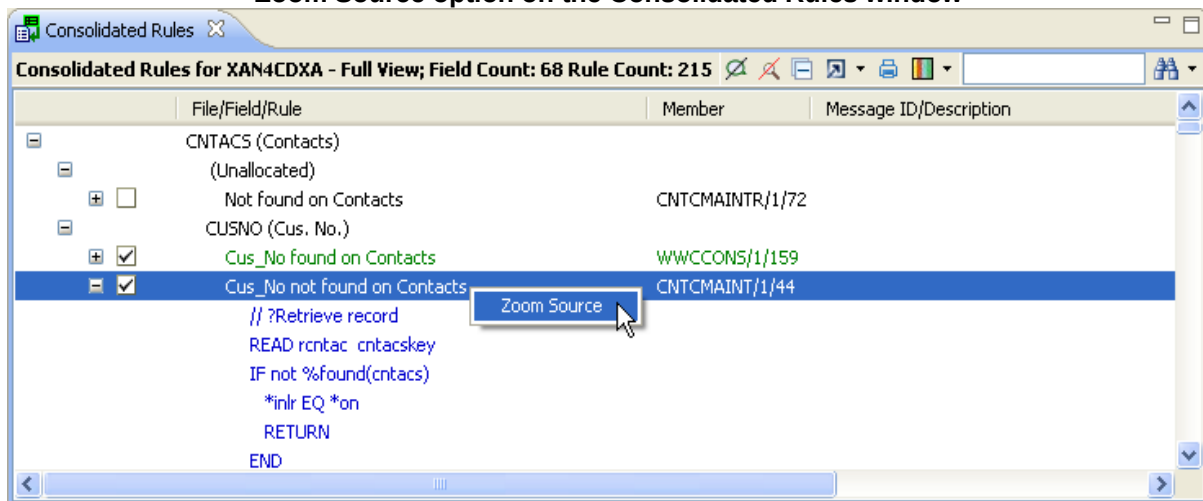
Select a business rule listed under a file and expand the business rules node to see the actual business rules code.

Expand Business Rules node to see the actual code



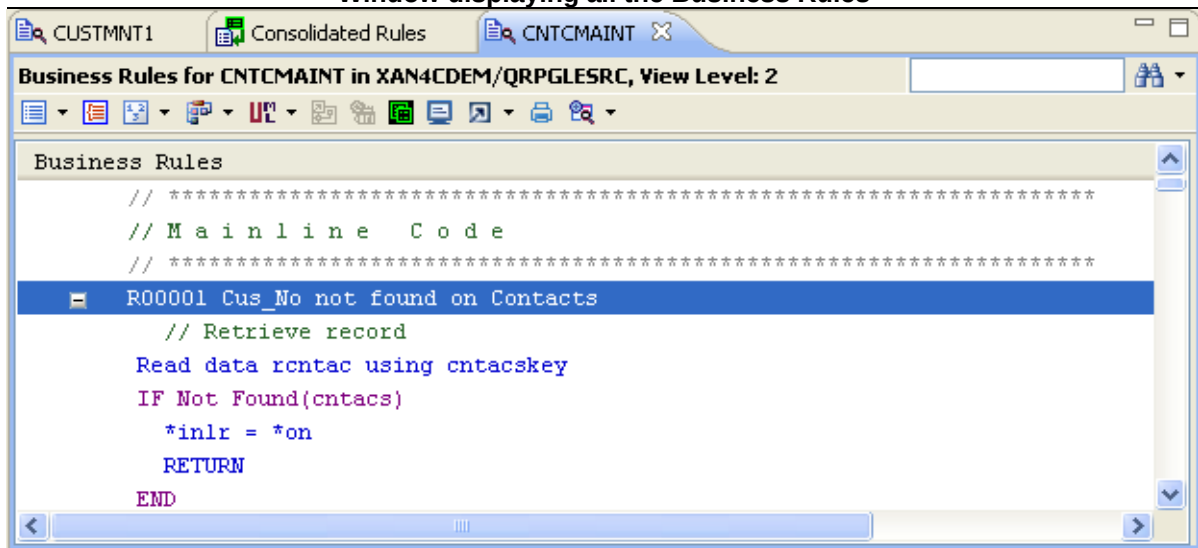
The user has the choice to view the business rules of a particular function displayed in the Consolidated Rules window. For this, he must select a function and right click on it for the **Zoom Source** option, as shown below:

Zoom Source option on the Consolidated Rules window



Clicking the **Zoom Source** option will invoke the following window displaying all the business rules related to the selected file-field.

Window displaying all the Business Rules



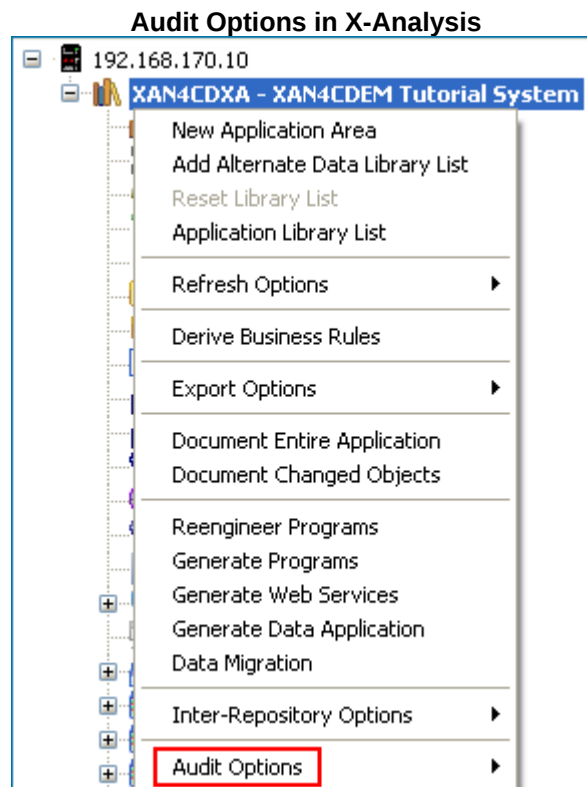
Chapter 7: Metrics Analysis

The chapter presents another powerful option known as Metrics Analysis, which addresses the advanced computing requirements of today.

The chapter contains:

- » [Metrics Analysis](#)
- » [Metrics History](#)
- » [Screen Metrics](#)
- » [File Metrics](#)
- » [Business Process Logic Metrics](#)
- » [Specialised Analysis](#)
- » [Problem Analysis](#)
- » [Object Allocation](#)
- » [Database Summary](#)
- » [Summary Report](#)
- » [Initialize Source Archiving](#)
- » [Generate Metrics Analysis](#)
- » [Generate Problem Analysis](#)

The Metrics Analysis solution set comprises the X-Audit module. The module provides quality and complexity metrics for development and analytical purposes. The X-Analysis Client provides options related to the X-Audit module called **Audit Options**.



Audit Options

The **Audit Options** submenu is available on the context menu of application library and application areas. The following menu options are available under **Audit Options**:

- Metrics Analysis
- Screen Metrics
- File Metrics
- Business Process Logic Metrics
- Specialized Analysis
- Problem Analysis
- Object Allocation
- Database Summary
- Summary Report
- Initialize Source Archiving
- Generate Metrics Analysis
- Generate Problem Analysis

Metrics Analysis

“As a system evolves, its complexity increases, unless steps are taken to reduce it.”

Professor Meir Lehman

Metrics Analysis contains advanced computing solutions because X-Analysis understands the importance of monitoring, measuring, and managing the complexity and changes to databases of legacy applications.

Metrics Analysis simplifies the procedure by classifying each program based on low, average, and high complexity. It uses mathematical formulae to ascertain the complexity level. The user has to assign weights in the range of 1 - 6 as per each file usage per program. If the sum total of weights is:

>20 – it indicates High complexity
10-20 – it indicates Average complexity
<10 – it indicates Low complexity

Under the Metrics Analysis, we have other parameters as well like Halstead, Maintainability Index etc.

Halstead – This is calculated using four different values (N1, N2, n1 and n2) obtained from the source code of each subroutine. These values show numbers of different op codes or number of different variables used in the subroutines, whether once or multiple times. Measurements are calculated thus:

Module length = N1 + N2
Module vocabulary = n1 + n2
Halstead Volume = N *log(2)n
Difficulty = (n1/2) * (N2/n2)
Effort = Volume * Difficulty

Maintainability Index – Hewlett-Packard engineers propound this formula. According to this, a number derived is directly proportional to the maintainability factor. This means the lower the number, the less maintainable the code will be and vice-versa. This calculation is also performed at the subroutine level. It uses four numbers as input:

HV – Halstead volume from above
CC – Cyclomatic Complexity from above
LOC – Lines of actual code in the subroutine
COM – Lines of non-blank comments in the subroutine (beginning after the previous ENDSR)
MI = 5.2*naturallog (HV) – 0.23*CC – 16.2naturallog (LOC) + 50.0*sin (square root (2.46*COM))

The **Metrics Analysis** option provides low, medium, and high complexity classification of each program, based on the following attributes of a program:

- Source Type
- Source Lines
- Cyclomatic Complexity
- Halstead
- Maintainability Index
- Files
- Device files comprising Display Files and Printer Files
- Called Programs
- Calling Programs

The Metrics information is broken down at the highest level into the following categories:

- Batch programs
- Interactive programs

These two highest levels are then further sub-categorised as High, Average, and Low.

The user-specified values determine where a program fits into these sub-categories. By default, these preferences are blank, so every program is 'Low' complexity until the values have been set. Check the [Metrics Preferences](#) section (below) to set these values.

Note: Please execute the Generate Metrics Analysis option before choosing the Metrics Analysis option.

The following screen displays the Metrics information for the cross-reference library, XAN4CDXA.

Metrics Analysis for XAN4CDXA

Complexity Level	Units	Source Type	Source Li...	Cyc. Compl...	Halstead	Maint. Index	Files	Device Files	Called Programs	Calling Programs
Grand Total	127		11,826	1,750	90,333	7065	222	51	168	194
Interactive Source Members	50		9,842	1,594	81,830	5694	163	51	136	113
High Total	5		3,543	435	21,583	850	34	5	31	14
Average Total	13		4,036	374	20,036	1962	46	13	46	20
Low Total	32		2,263	785	40,211	2882	83	33	59	79
Batch Source Members	77		1,984	156	8,503	1371	59	0	32	81
High Total	0		0	0	0	0	0	0	0	0
Average Total	1		421	33	3,408	99	4	0	1	3
Low Total	76		1,563	123	5,095	1272	55	0	31	78
Application Area Breakdown										
ACCOUNTS (+)	32		5,728	571	29,941	178	74	17	48	52
High Total	0		0	0	0	0	0	0	0	0
Average Total	1		266	23	1,240	178	3	1	1	0
Low Total	0		0	0	0	0	0	0	0	0

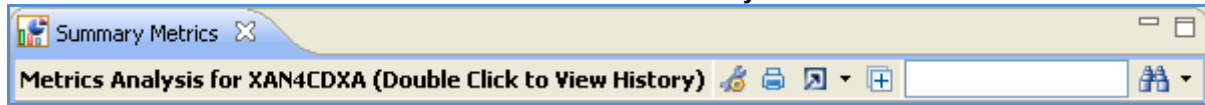
The Metrics information displayed above has the following columns:

1. **Complexity Level:** For each attribute, e.g. each file usage = 1, etc. The sum total of these per program will be calculated and the Complexity level for the program worked out, e.g. Points <10 - LOW, 10-20 - AVERAGE, >20 - HIGH. If desired a user can allocate values for each complexity classification using the Metrics Preferences option.
2. **Units:** When collapsed, it displays total number of programs. When expanded, it displays name of program.
3. **Source Type:** Informs about the type of source.
4. **Source Lines:** It is total number of Source Lines in a source member.
5. **Cyclomatic Complexity:** Measures amount of decision logic in a program. Shows total number of conditional statements used.
6. **Halstead:** Displays program's complexity directly from source code based upon the operators and operands used.
7. **Maintainability Index:** The maintainability index calculated with certain formulae from lines-of-code measures, Cyclomatic Complexity and Halstead complexity measures.
8. **Files:** It is total number of Files used by a source member.
9. **Device Files:** Total number of Display and Printer Files used by source member.
10. **Called Programs:** It display total number of called programs from a source member.
11. **Calling Programs:** It display total number of calling programs from a source member.

Metrics Toolbar

The Metrics toolbar comprises various options.

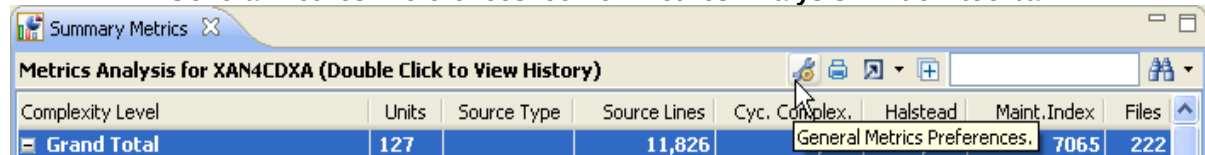
Toolbar available on Metrics Analysis window



Metrics Preferences

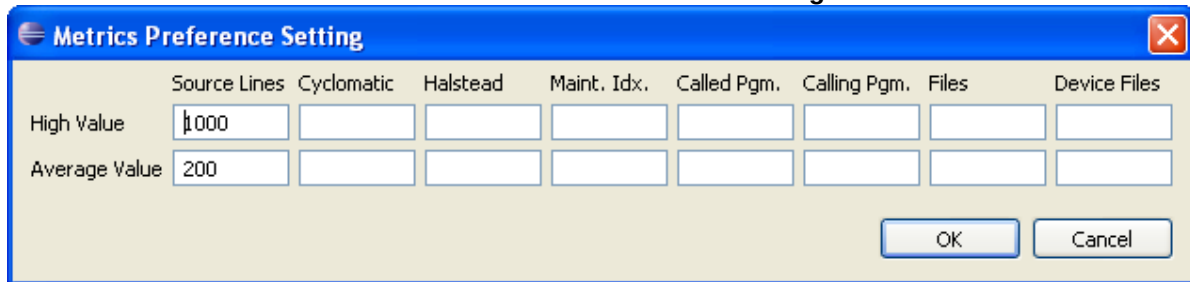
A user can set the Metrics Preferences as per requirements.

General Metrics Preferences icon on Metrics Analysis window toolbar



Click the **General Metrics Preferences** icon to invoke the relevant dialog:

General Metrics Preferences dialog

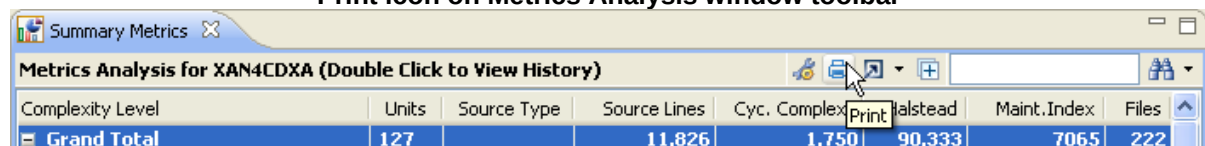


Specify a high value, so that any value above this will determine that program is of higher complexity. Any program that falls below an average setting will be indicative of lower complexity.

Print Metrics

To print the Metrics information, click the **Print** button.

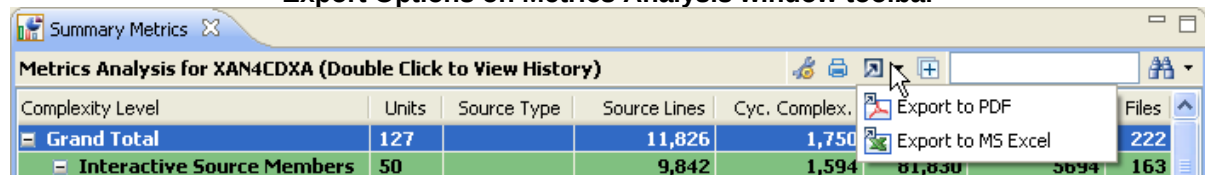
Print icon on Metrics Analysis window toolbar



Export Metrics

Select **PDF** or **MS Excel** option as required, from the **Export Options** icon.

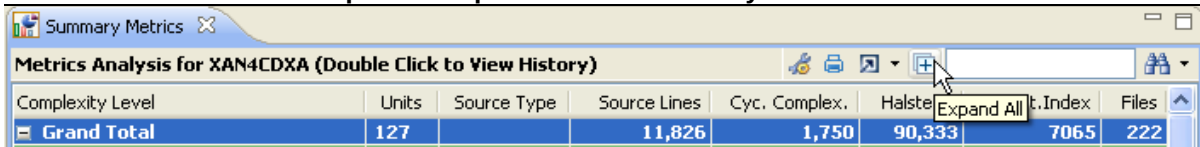
Export Options on Metrics Analysis window toolbar



Expand All

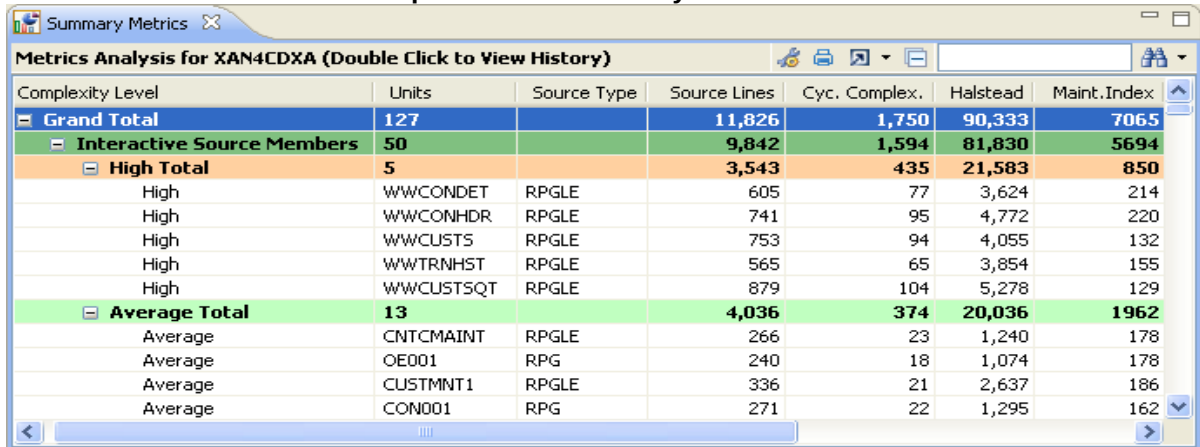
Click the **Expand All** icon to expand all the data:

Expand All option on Metrics Analysis toolbar



Complexity Level	Units	Source Type	Source Lines	Cyc. Complex.	Halstead	Maint.Index	Files
Grand Total	127		11,826	1,750	90,333	7065	222

Expanded Metrics Analysis window



Complexity Level	Units	Source Type	Source Lines	Cyc. Complex.	Halstead	Maint.Index
Grand Total	127		11,826	1,750	90,333	7065
Interactive Source Members	50		9,842	1,594	81,830	5694
High Total	5		3,543	435	21,583	850
High	WWCONDET	RPGLE	605	77	3,624	214
High	WWCONHDR	RPGLE	741	95	4,772	220
High	WWCUST5	RPGLE	753	94	4,055	132
High	WWTRNHST	RPGLE	565	65	3,854	155
High	WWCUST5QT	RPGLE	879	104	5,278	129
Average Total	13		4,036	374	20,036	1962
Average	CNTCMAINT	RPGLE	266	23	1,240	178
Average	OE001	RPG	240	18	1,074	178
Average	CUSTOMT1	RPGLE	336	21	2,637	186
Average	CON001	RPG	271	22	1,295	162

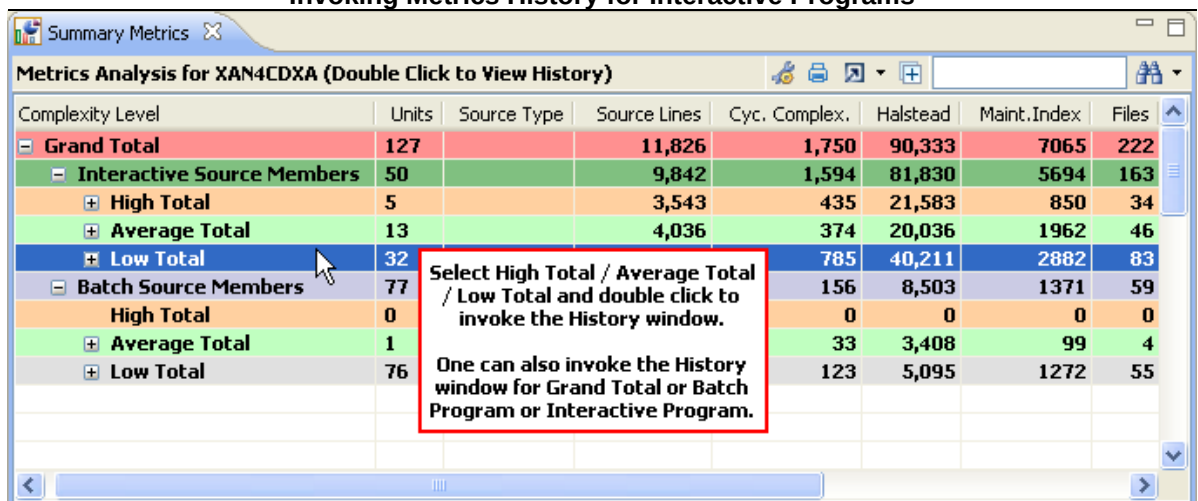
Metrics History

The Metrics History displays all previous instances of the generated metrics data. The Metrics History data will be available only when the metrics data is generated more than once.

The Metrics History can be generated for all the individual levels – High, Average & Low Totals for Batch / Interactive Programs and for the Grand Total.

Double click on the **Interactive Source Members** row to generate the history.

Invoking Metrics History for Interactive Programs



Complexity Level	Units	Source Type	Source Lines	Cyc. Complex.	Halstead	Maint.Index	Files
Grand Total	127		11,826	1,750	90,333	7065	222
Interactive Source Members	50		9,842	1,594	81,830	5694	163
High Total	5		3,543	435	21,583	850	34
Average Total	13		4,036	374	20,036	1962	46
Low Total	32			785	40,211	2882	83
Batch Source Members	77			156	8,503	1371	59
High Total	0			0	0	0	0
Average Total	1			33	3,408	99	4
Low Total	76			123	5,095	1272	55

Select High Total / Average Total / Low Total and double click to invoke the History window.

One can also invoke the History window for Grand Total or Batch Program or Interactive Program.

Double click on the **Low Total** row to invoke the Metrics History window.

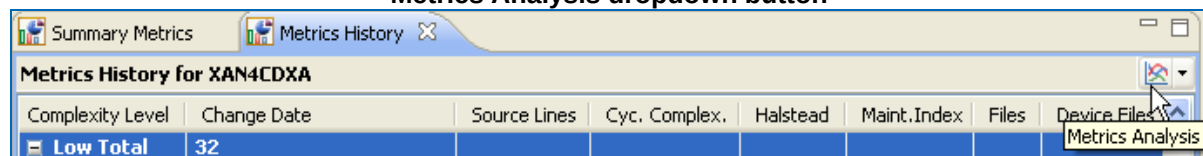
Metrics History window for Interactive Programs

Complexity Level	Change Date	Source Lines	Cyc. Complex.	Halstead	Maint.Index	Files	Device Files
Low Total	32						
	Current State	2,263	785	40,211	2882	83	33
+	Total 20 months back (2011-08-19)	2,263	784	40,206	2882	83	33
+	Total 23 months back (2011-06-04)	1,904	713	39,027	2599	73	29
+	Total 34 months back (2010-07-02)	1,910	709	39,382	3057	73	29
+	Total 39 months back (2010-02-08)	2,465	751	45,971	6674	73	29
+	Total 42 months back (2009-11-14)	2,618	757	47,340	7644	73	29

Metrics History Chart

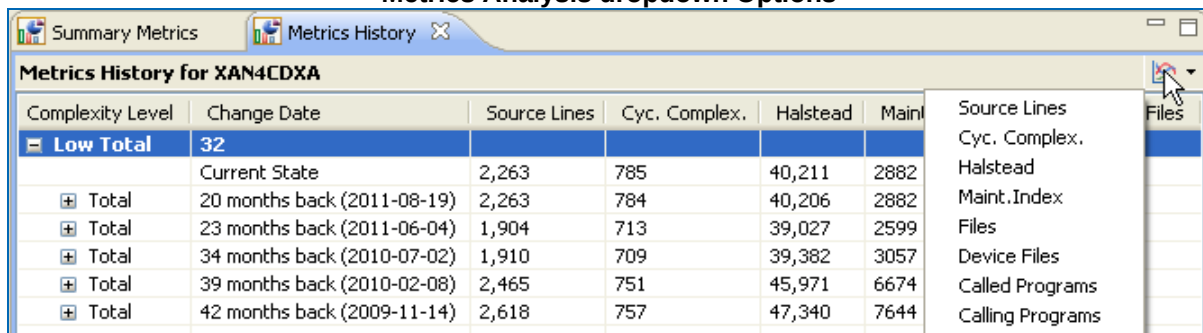
X-Analysis can also display Metrics History in chart form for all the individual parameters. The Metrics History toolbar contains a dropdown button called **Metrics Analysis**.

Metrics Analysis dropdown button



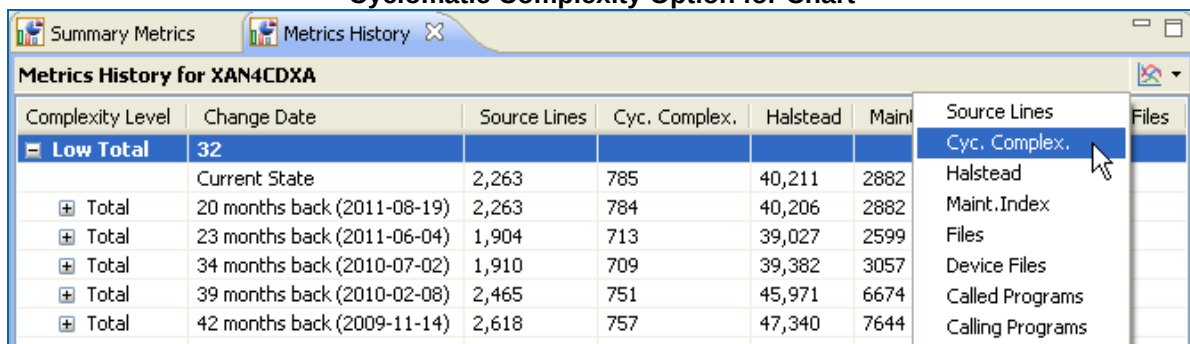
The **Metrics Analysis** dropdown button contains a list of parameters against which a chart can be generated.

Metrics Analysis dropdown Options

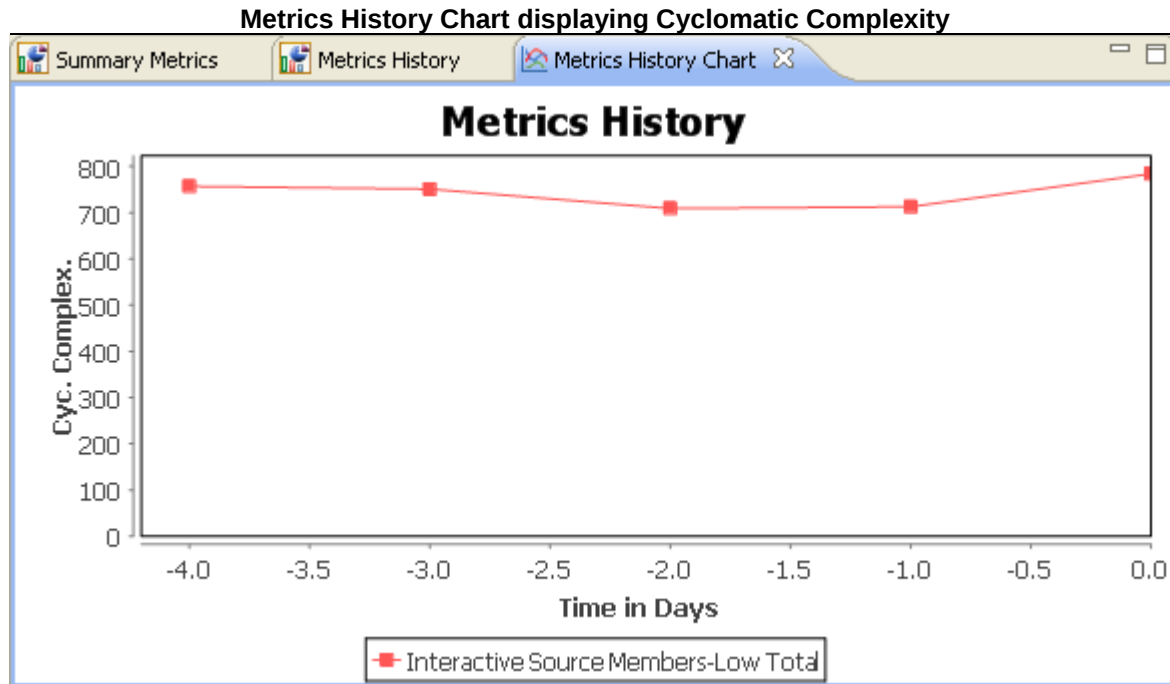


Select **Cyc. Complex.** option from the dropdown menu:

Cyclomatic Complexity Option for Chart



This invokes the Metrics History chart displaying Cyclomatic Complexity:



Similarly, a user can generate charts for all the other parameters.

A user can check Metrics History for all the Interactive / Batch Programs and Grand Total from the Metrics window.

Source code tracking

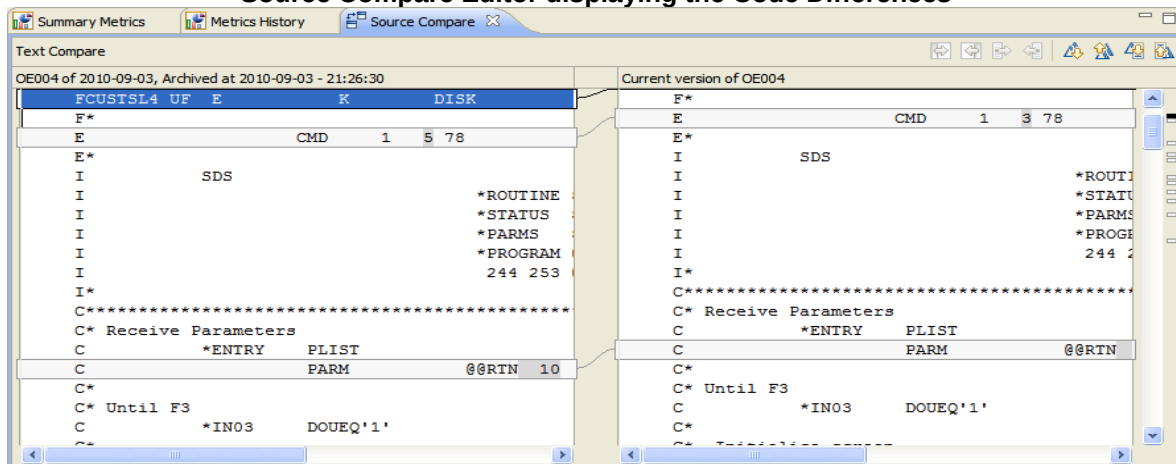
The Metrics History also provides a facility to see changes in the source code. To invoke a Source Compare editor, expand one of the listed programs from the Metrics History list.

Program selected for Source Code Comparison

Complexity Level	Change Date	Source Lines	Cyc. Complex.	Halstead	Maint.Index
Low Total	32				
	Current State	2,263	785	40,211	2882
+	Total 20 months back (2011-08-19)	2,263	784	40,206	2882
+	Total 23 months back (2011-06-04)	1,904	713	39,027	2599
+	Total 34 months back (2010-07-02)	1,910	709	39,382	3057
	OE004 (CHG 2010-09-03[21:26:30])				
	OE002 (CHG 2010-08-27[21:27:39])				
+	Total 39 months back (2010-02-08)	2,465	751	45,971	6674
+	Total 42 months back (2009-11-14)	2,618	757	47,340	7644

Double click on the selected program to invoke the Source Compare editor.

Source Compare Editor displaying the Code Differences



Screen Metrics

There are various screen functions of a specific program. Screen Metrics is a display of these screen functions for a complete application and for all the application areas.

Screen Metrics are designed to help re-facing projects and UI rewrites. They describe designs, uses and relationships of file complexities, thus, helping to measure the database complexities.

The Complexity Level on Screen Metrics displays two groups i.e. the Grand Total and Application Area totals. Hereafter, all functions in application areas or cross-reference application are grouped on a dual level – complexity and type of function.

The **Screen Metrics** option provides low, medium, and high complexity classification of the available screen functions. The Screen Metrics information is displayed for the complete application and its application areas.

The Screen Metrics information displayed under the following headings:

- Grid type functions
- Record type functions
- Other functions

The following screen displays the Screen Metrics information for the cross-reference library **XAN4CDXA**:

Screen Metrics for cross-reference library XAN4CDXA

Screen Metrics for XAN4CDXA								
Complexity Level	Units	Files	Database Fields	Work Fields	Outgoing Calls	Incoming Calls	Function Keys	Conditioning Fields
Grand Total	88	131	664	324	64	30	36	734
High	6	6	55	13	6	0	6	48
Average	71	114	590	309	58	30	30	685
Low	11	11	19	2	0	0	0	1
Application Area Breakdown								
ACCOUNTS	63	106	576	276	56	22	31	612
High	1	1	7	5	0	0	0	12
Average	0	0	0	0	0	0	0	0
Low	0	0	0	0	0	0	0	0
CUSFMAINT	62	105	569	271	56	22	31	600

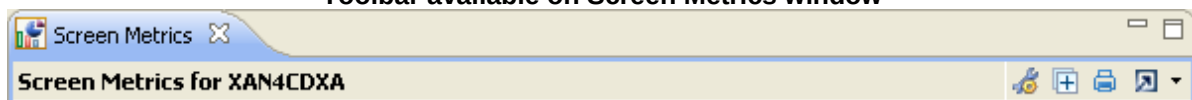
The Metrics information displayed above has the following columns:

1. **Complexity Level:** This shows various groups. The topmost group is either Grand Total, or App area totals. All functions in application area or cross-reference application are then grouped based on complexity, and then on type of function
2. **Units:** Shows the number of functions in the group
3. **Files:** Total number of Files used by screen function
4. **Database Fields:** Total number of screen fields which are read from database fields
5. **Work Fields:** Total number of work fields in the group
6. **Outgoing Calls:** Number of functions called by this function
7. **Incoming Calls:** Number of functions calling this function
8. **Function Keys:** Total number of Function key-based actions called by functions in this group
9. **Conditioning Fields:** Number of fields on which there is a conditioning logic

Screen Metrics Toolbar

The Screen Metrics toolbar comprises various options discussed below.

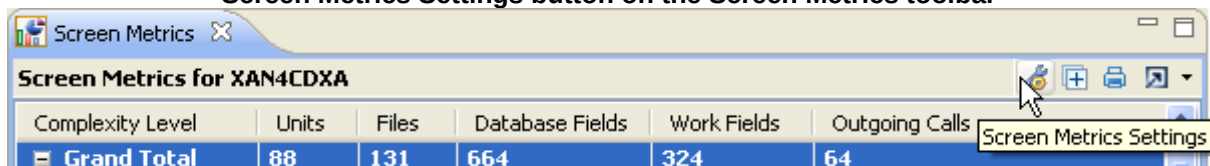
Toolbar available on Screen Metrics window



Screen Metrics Settings

Each user can set the **Screen Metrics Settings** as per his requirements.

Screen Metrics Settings button on the Screen Metrics toolbar



Click the **Screen Metrics Settings** icon to invoke the relevant dialog:

Screen Metrics Preference Setting dialog

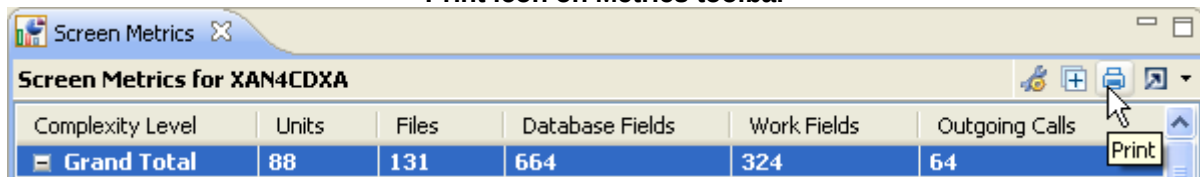
	Files	Database Fields	Work Fields	Int. Calls	Fun Keys
High Value	3		3	4	
Average Value	1		1	1	

The user can set the criteria for High / Average using the above dialog.

Print Screen Metrics

To print the Screen Metrics information, click the **Print** button available on the toolbar.

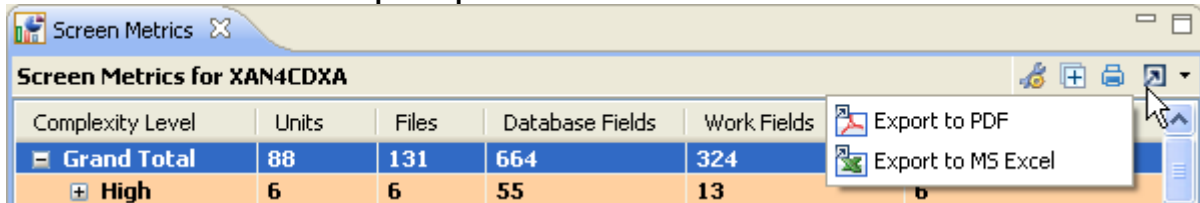
Print icon on Metrics toolbar



Export Screen Metrics

Select the **PDF** or **MS Excel** option, as required under the **Export Options** icon.

Export Options on Screen Metrics toolbar



File Metrics

The File Metrics is a display of metrics-related information on all the files. One can overview metrics data for the complete application and/or for all the application areas.

The File Metrics displays information under the following headings:

1. **Units:** Displays total number of Files
2. **Fields:** Displays the total number of fields available in the file
3. **Access Paths:** The total number of access paths for the file
4. **Creating Programs:** The number of programs creating records in this file
5. **Reading Programs:** The number of programs reading this file
6. **Updating Programs:** The number of programs updating records in this file
7. **Deleting Programs:** The number of programs deleting records from this file
8. **Total References:** The total number of programs referencing this file (in effect total of 3 - 6)

The following screen displays the File Metrics information for the cross-reference library, **XAN4CDXA**:

Window displaying File Metrics for the cross-reference library XAN4CDXA

The screenshot shows the 'File Metrics for XAN4CDXA' window. The table displays metrics for various files. The 'Grand Total' row is highlighted in blue, and the individual file rows are highlighted in green.

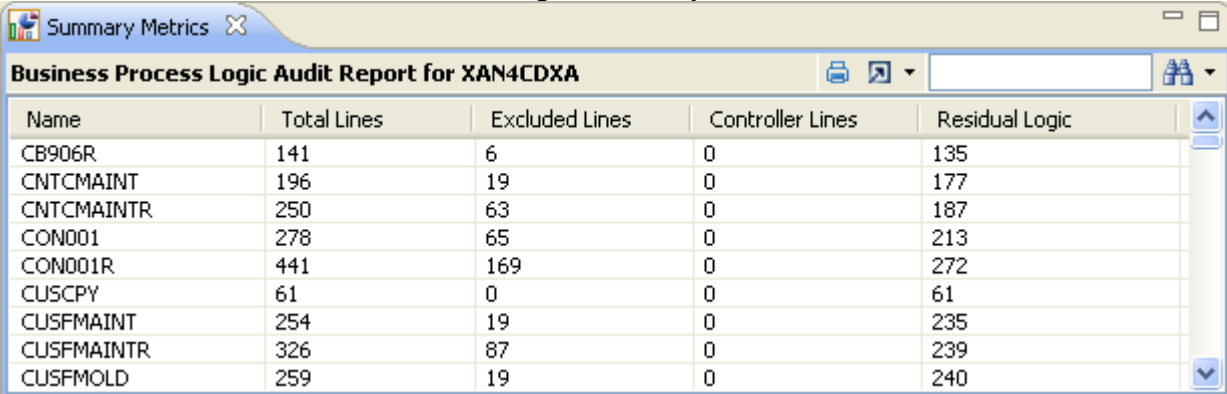
Name	Units	Fields	Access Paths	Creating Pgms	Reading Pgms	Updating Pgms	Deleting Pgms	Total References
Grand Total	39	5561	80	3	156	29	22	210
ACCOUNTS	3	16	5	0	3	0	0	3
CONHDR	16	175	66	3	150	28	20	201
CONUPD	3	100	28	2	97	25	14	138
CUSFMAINT	11	156	45	2	106	28	17	153
CUSTOMERS	13	154	51	2	143	28	19	192

Business Process Logic Metrics

The Business Process Logic Metrics report displays the migrated logic data in metrics form - Total Lines, Excluded Lines, Controller Lines, and Process Logic.

The following screen displays the Business Process Logic Audit Report for **XAN4CDXA**:

Business Process Logic Audit Report for XAN4CDXA



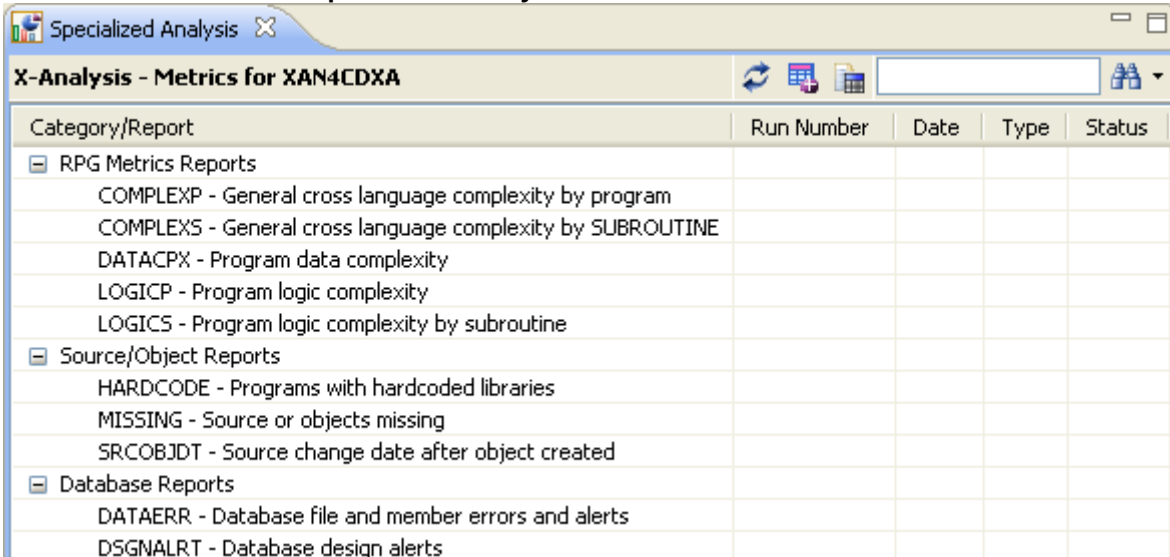
Name	Total Lines	Excluded Lines	Controller Lines	Residual Logic
CB906R	141	6	0	135
CNTCMAINT	196	19	0	177
CNTCMAINTR	250	63	0	187
CON001	278	65	0	213
CON001R	441	169	0	272
CUSCPY	61	0	0	61
CUSFMAINT	254	19	0	235
CUSFMAINTR	326	87	0	239
CUSFMOLD	259	19	0	240

Specialized Analysis

Measuring and managing the quality and complexity of a code base is the topmost priority for a systems analyst. Specialized Analysis is an invaluable feature that allows a user complete freedom to create customized reports using the full metrics database in the defined system repository. One can choose to view the report as a Static Report or a Difference Report. The latter plots changes in values over a period, thus giving a better idea of measurement.

Opt for the **Specialized Analysis** option from the submenu **Audit Options**. The following screen displays the Specialized Analysis window:

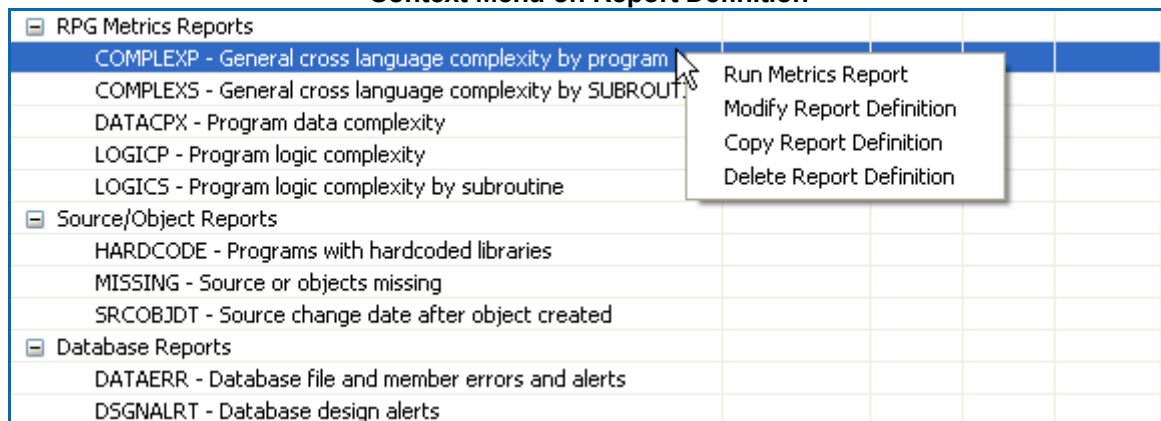
Specialized Analysis window for XAN4CDXA



Category/Report	Run Number	Date	Type	Status
RPG Metrics Reports				
COMPLEX - General cross language complexity by program				
COMPLEXS - General cross language complexity by SUBROUTINE				
DATA CPX - Program data complexity				
LOGICP - Program logic complexity				
LOGICS - Program logic complexity by subroutine				
Source/Object Reports				
HARDCODE - Programs with hardcoded libraries				
MISSING - Source or objects missing				
SRCOBJDT - Source change date after object created				
Database Reports				
DATAERR - Database file and member errors and alerts				
DSGNALRT - Database design alerts				

The user has an option to generate the pre-configured reports. Select any report from the listed category and opt for the context menu, as shown below:

Context Menu on Report Definition



Run Metrics Report

When the user selects this option, the pre-configured report dialog invokes:

Report Definition dialog

X-Analysis Metrics: Report Specification and Submission

Report Name:

Report Title:

Report category:

Application Area:

Object Name:

Select Report Columns and Options

Column	Metrics	VarName	Subr
OBJNAM	Object and Source ID Data		
OBJATR	Object Library	OBJLIB	
CYC	Object Name	OBJNAM	
HAL	Object Type	OBJTYP	
MI	Object Attribute	OBJATR	
SRCLINSTM	Object creation date	OBJCRTDAT	
	Object last used date	OBJLSUDAT	
	Source File	OBJSRCFIL	
	Source Library	OBJSRCLIB	
	Source file change date	OBJSRCFCHD	
	Source Code Metrics		

☐ Show report data at subroutine level

Filter:

Search variables:

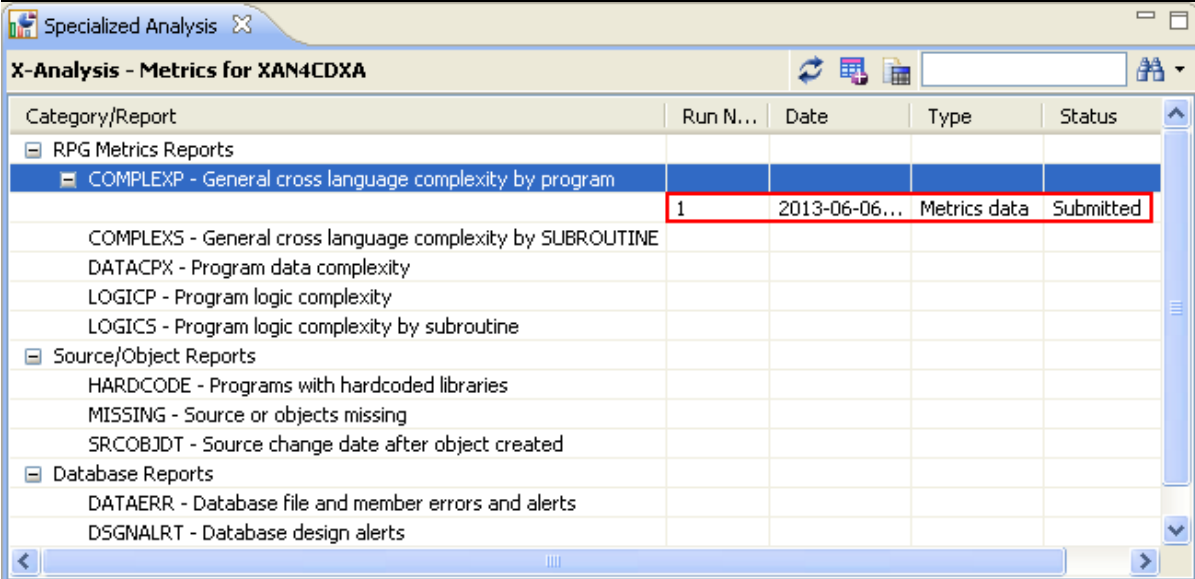
User metric formula:

User program:

Outfile: XAN4CDXA "/XM" COMPLE

Click the **Submit Report** button to generate the report. A batch job is submitted and on its completion, the Specialized Analysis window updates itself:

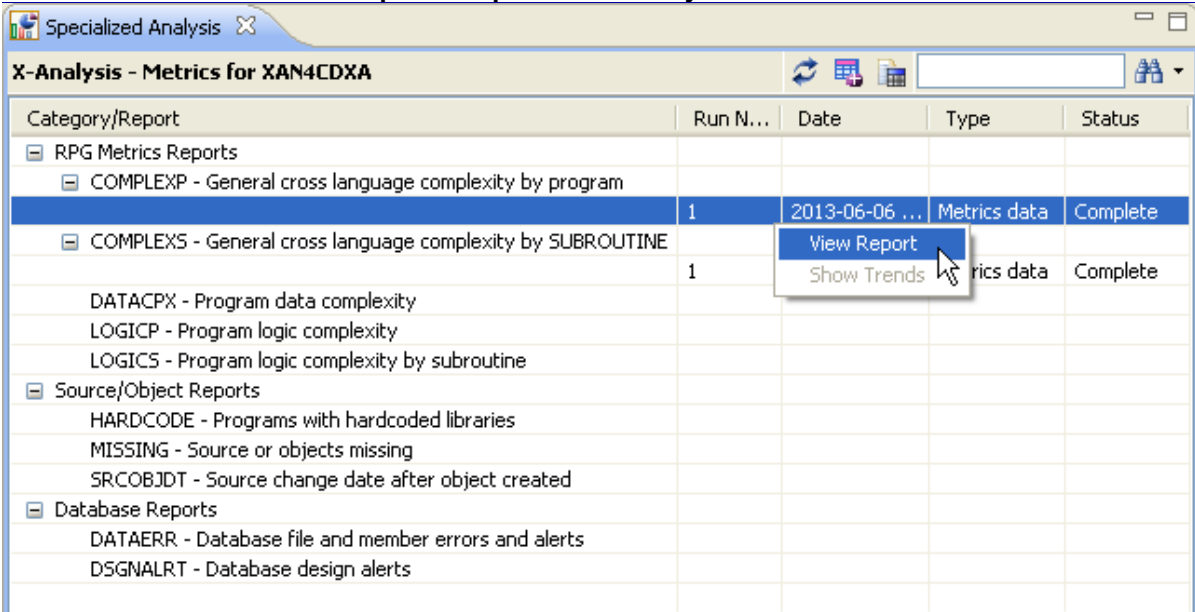
Specialized Analysis window



Category/Report	Run N...	Date	Type	Status
RPG Metrics Reports				
COMPLEX - General cross language complexity by program	1	2013-06-06...	Metrics data	Submitted
COMPLEXS - General cross language complexity by SUBROUTINE				
DATAEXP - Program data complexity				
LOGICP - Program logic complexity				
LOGICS - Program logic complexity by subroutine				
Source/Object Reports				
HARDCODE - Programs with hardcoded libraries				
MISSING - Source or objects missing				
SRCOBJDT - Source change date after object created				
Database Reports				
DATAERR - Database file and member errors and alerts				
DSGNALRT - Database design alerts				

To view the generated report, click the report row and opt for the **View Report** option from the context menu.

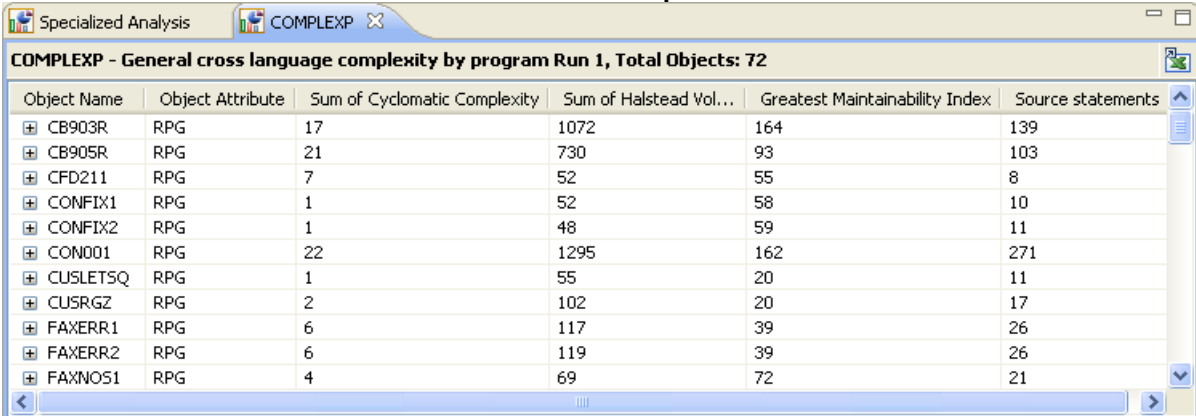
Updated Specialized Analysis window



Category/Report	Run N...	Date	Type	Status
RPG Metrics Reports				
COMPLEX - General cross language complexity by program	1	2013-06-06 ...	Metrics data	Complete
COMPLEXS - General cross language complexity by SUBROUTINE	1		Metrics data	Complete
DATAEXP - Program data complexity				
LOGICP - Program logic complexity				
LOGICS - Program logic complexity by subroutine				
Source/Object Reports				
HARDCODE - Programs with hardcoded libraries				
MISSING - Source or objects missing				
SRCOBJDT - Source change date after object created				
Database Reports				
DATAERR - Database file and member errors and alerts				
DSGNALRT - Database design alerts				

The report will be displayed as under:

COMPLEX Report



COMPLEX - General cross language complexity by program Run 1, Total Objects: 72

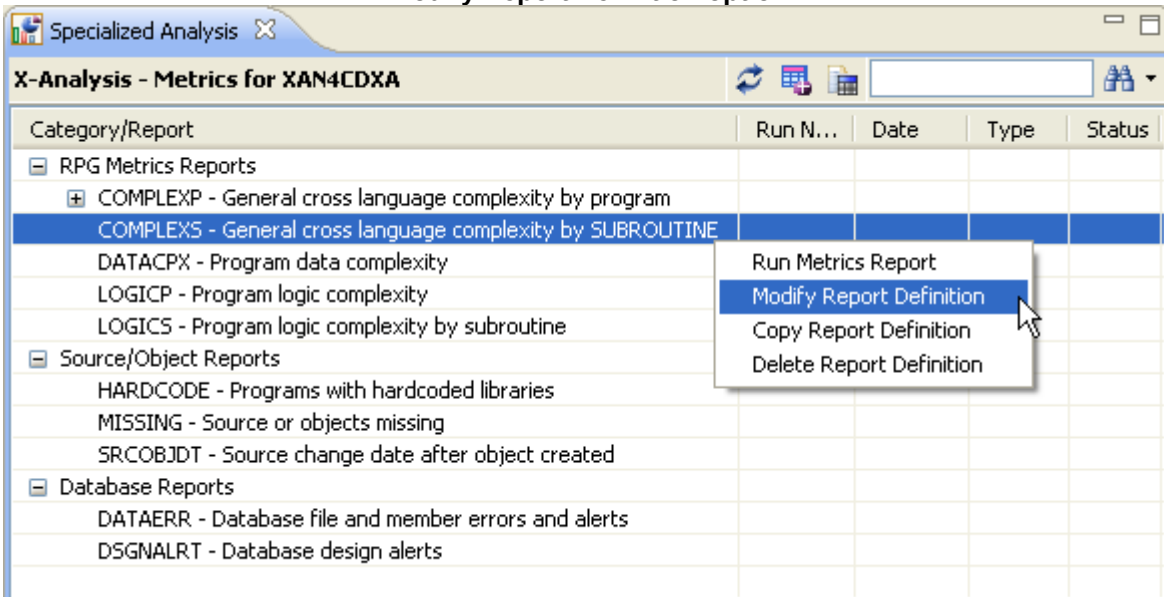
Object Name	Object Attribute	Sum of Cyclomatic Complexity	Sum of Halstead Vol...	Greatest Maintainability Index	Source statements
CB903R	RPG	17	1072	164	139
CB905R	RPG	21	730	93	103
CFD211	RPG	7	52	55	8
CONFIX1	RPG	1	52	58	10
CONFIX2	RPG	1	48	59	11
CON001	RPG	22	1295	162	271
CUSLET5Q	RPG	1	55	20	11
CUSRGZ	RPG	2	102	20	17
FAXERR1	RPG	6	117	39	26
FAXERR2	RPG	6	119	39	26
FAXN051	RPG	4	69	72	21

If required, the user can export this report to MS Excel.

Modify Report Definition

The user has the option to modify an existing Report Definition.

Modify Report Definition option



X-Analysis - Metrics for XAN4CDXA

Category/Report	Run N...	Date	Type	Status
[-] RPG Metrics Reports				
+ COMPLEX - General cross language complexity by program				
COMPLEXS - General cross language complexity by SUBROUTINE				
DATACPX - Program data complexity				
LOGICP - Program logic complexity				
LOGICS - Program logic complexity by subroutine				
[-] Source/Object Reports				
HARDCODE - Programs with hardcoded libraries				
MISSING - Source or objects missing				
SRCOBJDT - Source change date after object created				
[-] Database Reports				
DATAERR - Database file and member errors and alerts				
DSGNALRT - Database design alerts				

Context Menu Options:

- Run Metrics Report
- Modify Report Definition**
- Copy Report Definition
- Delete Report Definition

Select the **Modify Report Definition** option to invoke the report configuration dialog:

Report Definition dialog

X-Analysis Metrics: Report Specification and Submission ✕

Report Name:

Report Title:

Report category: Edit categories

Application Area: All Members Selected

Object Name:

Select Report Columns and Options

Column	Metrics	VarName	Subr
☐ OBJNAM	Object and Source ID Data		
☐ OBJSUBNAM	Object Library	OBJLIB	
☐ OBJATR	Object Name	OBJNAM	
☐ CYC	Object Type	OBJTYP	
☐ HAL	Object Attribute	OBJATR	
☐ MI	Object creation date	OBJCRTDAT	
☐ SRCLINSTM	Object last used date	OBJLSUDAT	
	Source File	OBJSRCFIL	
	Source Library	OBJSRCLIB	
	Source file change date	OBJSRCFCHD	
	Source Code Metrics		

☒ Show report data at subroutine level

Filter:

Search variables:

User metric formula:

User program:

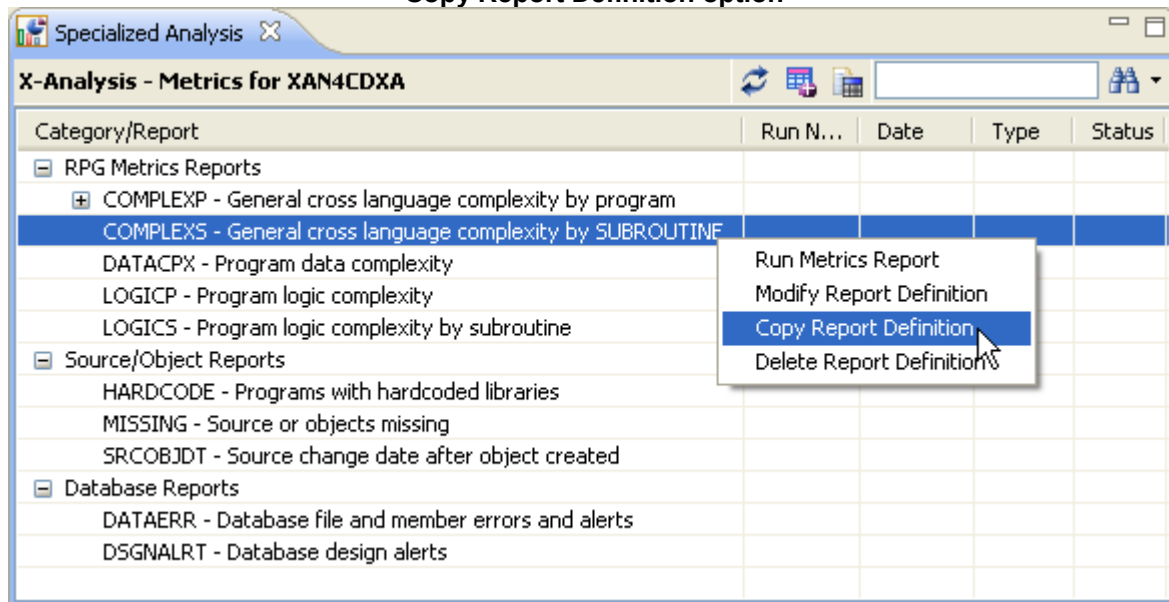
Outfile: XAN4CDXA "/>

After changing the report definition, click the **Save Definition Only** button. The user can click the **Save and Submit Report** button to generate a report.

Copy Report Definition

The user has the option to copy an existing Report Definition. On selecting this option, the user will retain an existing report besides the customised report.

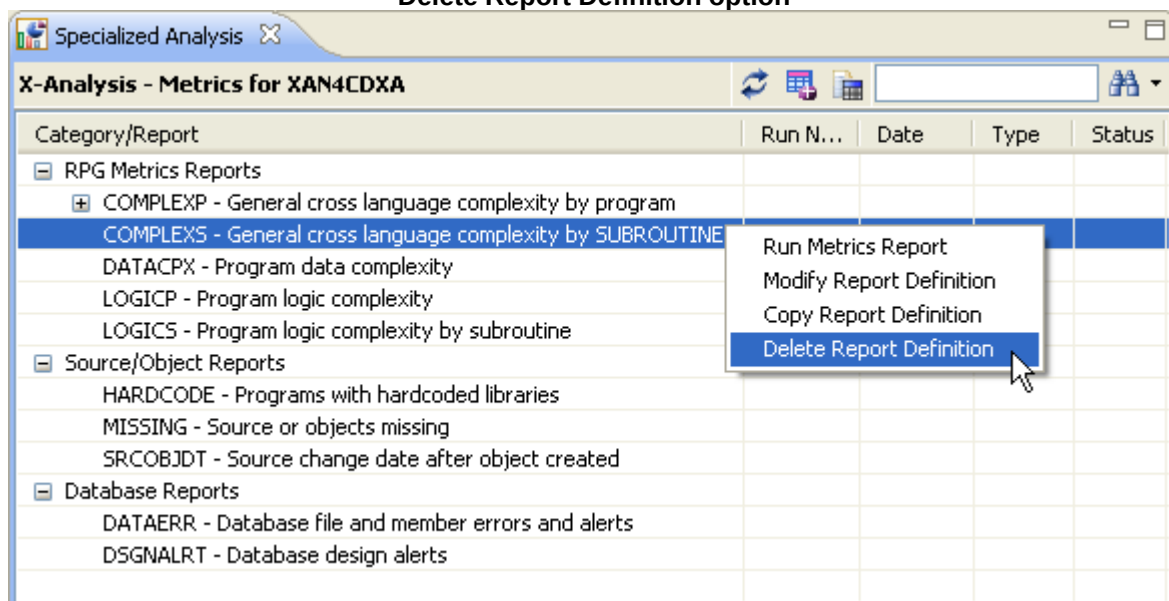
Copy Report Definition option



Delete Report Definition

If required, the user can delete an existing Report Definition.

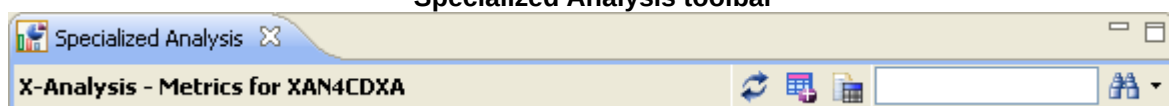
Delete Report Definition option



Specialized Analysis Toolbar

The Specialized Analysis toolbar comprises various options discussed below.

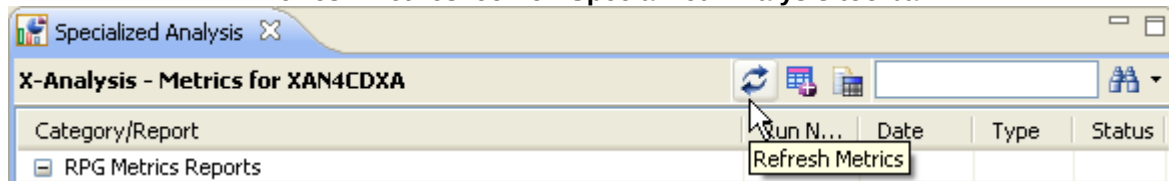
Specialized Analysis toolbar



Refresh Metrics

The **Refresh Metrics** icon performs the refresh function.

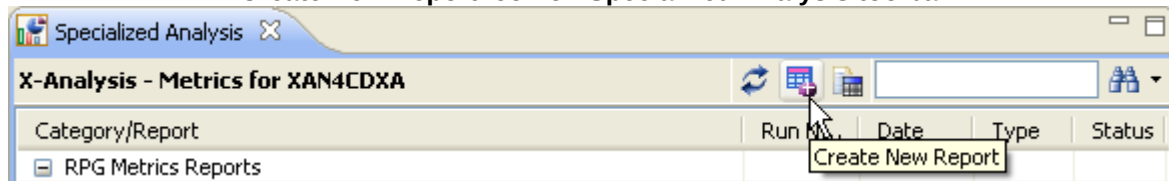
Refresh Metrics icon on Specialized Analysis toolbar



Create New Report

If required, the user can create a customised report. Use the **Create New Report** icon for this.

Create New Report icon on Specialized Analysis toolbar



The **Create New Report** icon invokes the report definition dialog.

Create New Report dialog

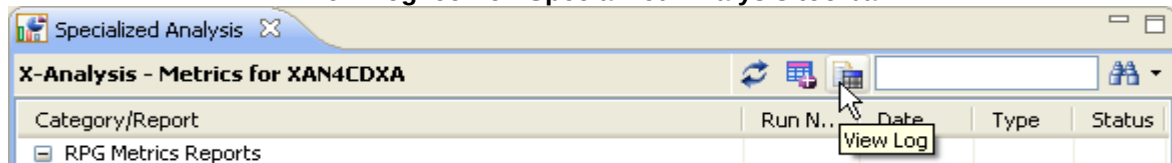
The screenshot shows the 'X-Analysis Metrics: Report Specification and Submission' dialog box. It contains the following fields and controls:

- Report Name: [Text input field]
- Report Title: [Text input field]
- Report category: [Dropdown menu showing 'RPGMET'] with an 'Edit categories' button.
- Application Area: [Dropdown menu showing '*ALL'] with an 'All Members Selected' button.
- Object Name: [Text input field]
- Select Report Columns and Options:
 - A list of metrics: Object and Source ID Data, Object Library, Object Name, Object Type, Object Attribute, Object creation date, Object last used date, Source File, Source Library, Source file change date, Source Code Metrics.
 - Each metric has a 'VarName' and 'Subr' column.
 - Buttons for adding and removing metrics from the list.
- ☐ Show report data at subroutine level
- Filter: [Text input field]
- Search variables: [Text input field]
- User metric formula: [Text input field]
- User program: [Text input field]
- Outfile: XAN4CDXA "/XM"
- Buttons: Save and Submit Report, Save Definition Only, Cancel.

View Log

The **View Log** icon shows the log related to the Metrics processing.

View Log icon on Specialized Analysis toolbar



Click the **View Log** icon to check the log.

View Log window

The screenshot shows a window titled 'View Log' with a sub-tab 'Log Report, Number of Lines: 3738'. The window contains a table with three columns: 'Log Time', 'Report name', and 'Log text'. The table lists various log entries with timestamps, report names, and descriptions of the log events.

Log Time	Report name	Log text
2013-06-06 11:56:05.480000	COMPLEXS	SQLSTT :01567 SQLERM :
2013-06-06 11:56:05.337000	COMPLEXS	Create table XAN4CDXA/XMCOMPLEXS (runrptnam varcha...
2013-06-06 11:56:05.335000	COMPLEXS	Execution started for run number: 1
2013-06-06 11:56:04.876000	COMPLEXP	SQLSTT :01567 SQLERM :
2013-06-06 11:56:04.746000	COMPLEXP	Create table XAN4CDXA/XMCOMPLEXP (runrptnam varcha...
2013-06-06 11:56:04.699000	COMPLEXP	Execution started for run number: 1
2013-06-06 11:56:04.438000	!XMETGEN	DLTHST(*NO)-- New metrics data not generated because...
2013-06-06 08:58:58.070765	COMPLEXS	Data report submitted for run number 1 with Job details:
2013-06-06 08:34:29.783832	COMPLEXP	Data report submitted for run number 1 with Job details:
2013-06-04 17:45:34.573000	!XREFRESH	24 programs logged with metrics and/or source changes.
2013-06-03 12:55:36.852000	!XREFRESH	0 programs logged with metrics and/or source changes.

Problem Analysis

The quality of analytical procedures improves if there is prior information of the existent inaccuracies in the data. Issues like object with no source and vice-versa, or source change after object creation date, or duplicate logical files can hamper advanced analyses.

The Problem Analysis feature warns the user about any such discrepancies in the data. The feature has an expandable Problem Category section, which gives names of the individual files having a particular problem.

To display the Problem Analysis data, select the **Problem Analysis** option from **Audit Options** under the context menu on **XAN4CDXA**.

Problem Analysis for cross-reference library XAN4CDXA

Problem Analysis data for XAN4CDXA - Total Problems: 476			
Alert/Category/Object	Total	Description	Further Details
Source/Object Alerts	12		
+ Source member changed after devicefile created	21		
+ No file found for existing source member	6		
+ No source member for file	1		
+ No program object found for source member	17		
+ No source member for program	17		
+ Source member changed after file created	67		
+ No device file found for existing source member	8		
+ No source member for device file	4		
+ Referenced data area does not exist	4		
+ Referenced device file does not exist	1		
+ Referenced program object does not exist	18		
No source member for copy book	0		
+ Database Alerts	3		
+ Program Code Alerts	7		
+ Migration Alerts	2		
+ File has Select/Omit rules	10		
File has Triggers	0		
+ Others	4		

Expand the 'Problem Category' section to view the objects having problem.

Object Allocation

The Object Allocation window displays the information about all the objects along with the application area names to which they belong. The following screen displays the Object Allocation window:

Object Allocation for XAN4CDXA

Allocation of Objects for XAN4CDXA, Total Objects: 432					
Name	Description	Type	Attribute	Application Area:	Library
ASIMPLTEST		*FILE	PF		XAN4CDEM
ASTATUS	Status file	*FILE	PF	XXX *	XAN4CDEM
BALANCEPRD	Balance by Product	*QMORY	SQL		XAN4CDEM
BALANCEPRD	Balance by Product	*QMFORM	QUERY MGR		XAN4CDEM
BALANCESTO	Balance by Store	*QMORY	SQL		XAN4CDEM
BALANCESTO	Balance by Store	*QMFORM	QUERY MGR		XAN4CDEM
CBCUSTSD	Work with Customers	*FILE	DSPF	2EUG *	XAN4CDEM
CBCUSTSD0	Work with Customers	*FILE	DSPF		XAN4CDXA
CBC110	Order Entry System	*PGM	CLP		XAN4CDEM
CB906R	Back-out account	*PGM	RPG	XXX *	XAN4CDEM
CB906RD	Order Entry display file	*FILE	DSPF	XXX *	XAN4CDEM
CB906RDXL1		*FILE	DSPF	XXX *	XAN4CDXA
CB906RR	Back-out account	*PGM	RPG	XXX *	XAN4CDXA

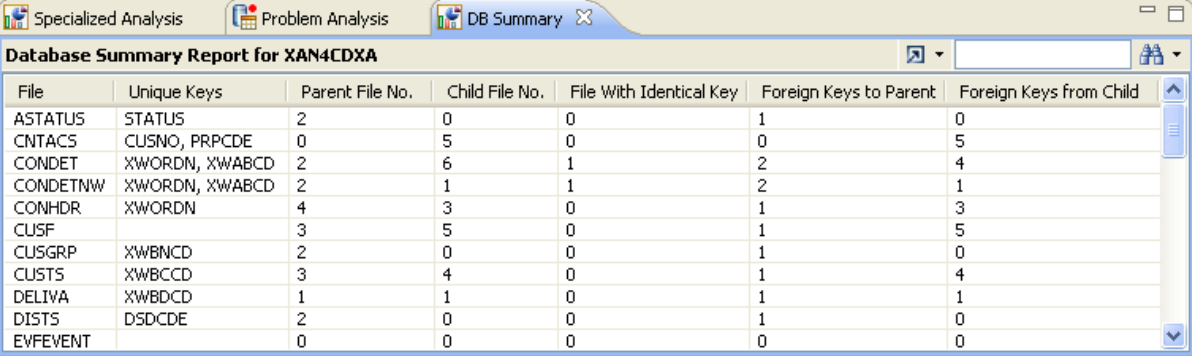
The above screen lists all objects from the application library **XAN4CDXA** and provides information about the application area. Note that some rows are blank under the application area column, which

means that the object does not belong to any application area. Similarly note the '*' sign, which means that the object belongs to multiple application areas.

Database Summary

The **Database Summary** option gives the user access to the summarized database report for the entire cross-reference library. The report contains information related to files, their unique keys and other necessary file-related details. On clicking the option, the following window is displayed:

Database Summary Report window

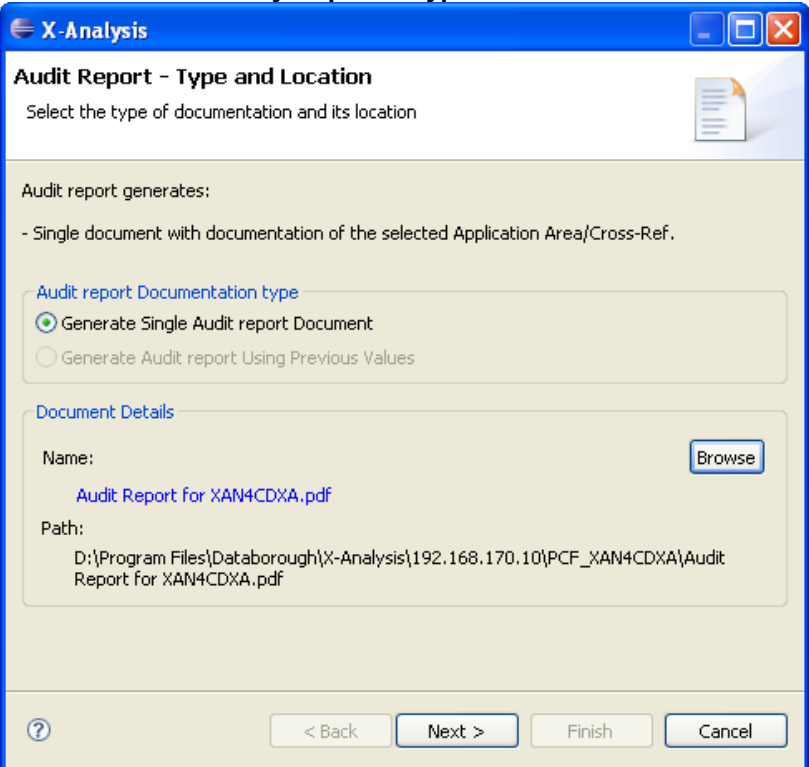


File	Unique Keys	Parent File No.	Child File No.	File With Identical Key	Foreign Keys to Parent	Foreign Keys from Child
ASTATUS	STATUS	2	0	0	1	0
CNTACS	CUSNO, PRPCDE	0	5	0	0	5
CONDET	XWORDN, XWABCD	2	6	1	2	4
CONDETNW	XWORDN, XWABCD	2	1	1	2	1
CONHDR	XWORDN	4	3	0	1	3
CUSF		3	5	0	1	5
CUSGRP	XWBNC	2	0	0	1	0
CUSTS	XWBCCD	3	4	0	1	4
DELIVA	XWBDCD	1	1	0	1	1
DISTS	DSDCDE	2	0	0	1	0
EVFEVENT		0	0	0	0	0

Summary Report

The **Summary Report** option generates structured report for the Metrics Analysis and the Problem Analysis as a PDF / MS Word document. Select the **Summary Report** option, available under the submenu, **Audit Options** from the context menu on **XAN4CDXA**. This invokes the following Documentation Wizard:

Summary Report – Type and Location



Audit Report – Type and Location

Select the type of documentation and its location

Audit report generates:

- Single document with documentation of the selected Application Area/Cross-Ref.

Audit report Documentation type

☒ Generate Single Audit report Document

☐ Generate Audit report Using Previous Values

Document Details

Name: Browse

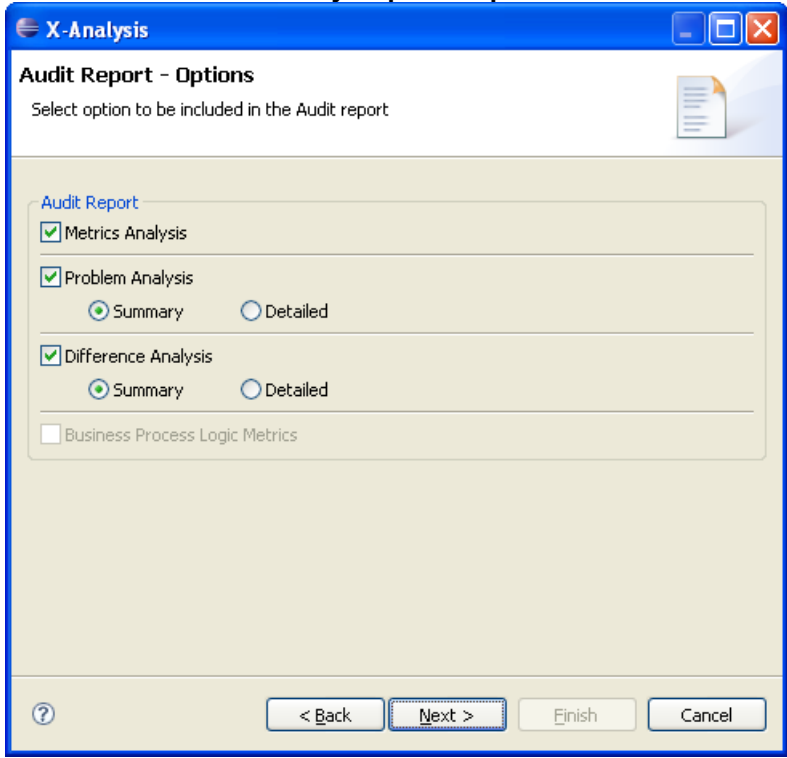
Audit Report for XAN4CDXA.pdf

Path:

D:\Program Files\Databorough\X-Analysis\192.168.170.10\PCF_XAN4CDXA\Audit Report for XAN4CDXA.pdf

Specify the 'Type and Location' information and click the **Next** button.

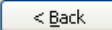
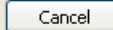
Summary Report – Options



Audit Report - Options
Select option to be included in the Audit report

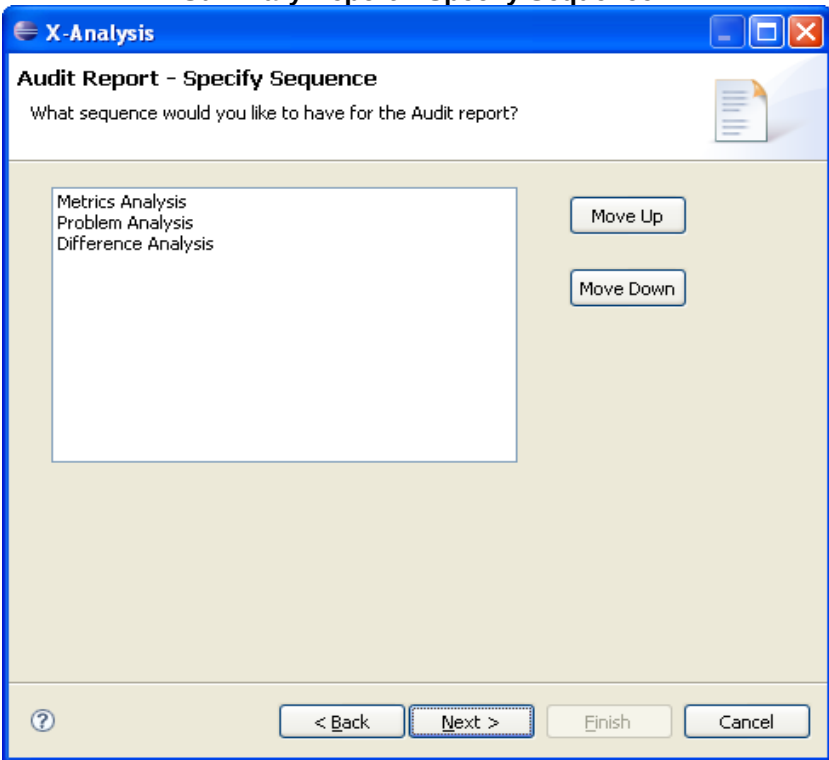
Audit Report

- ☒ Metrics Analysis
- ☒ Problem Analysis
 - ☒ Summary ☐ Detailed
- ☒ Difference Analysis
 - ☒ Summary ☐ Detailed
- ☐ Business Process Logic Metrics

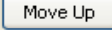
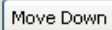
Mark the options to be included in the Audit Report and click the **Next** button.

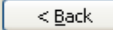
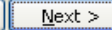
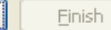
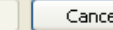
Summary Report – Specify Sequence



Audit Report - Specify Sequence
What sequence would you like to have for the Audit report?

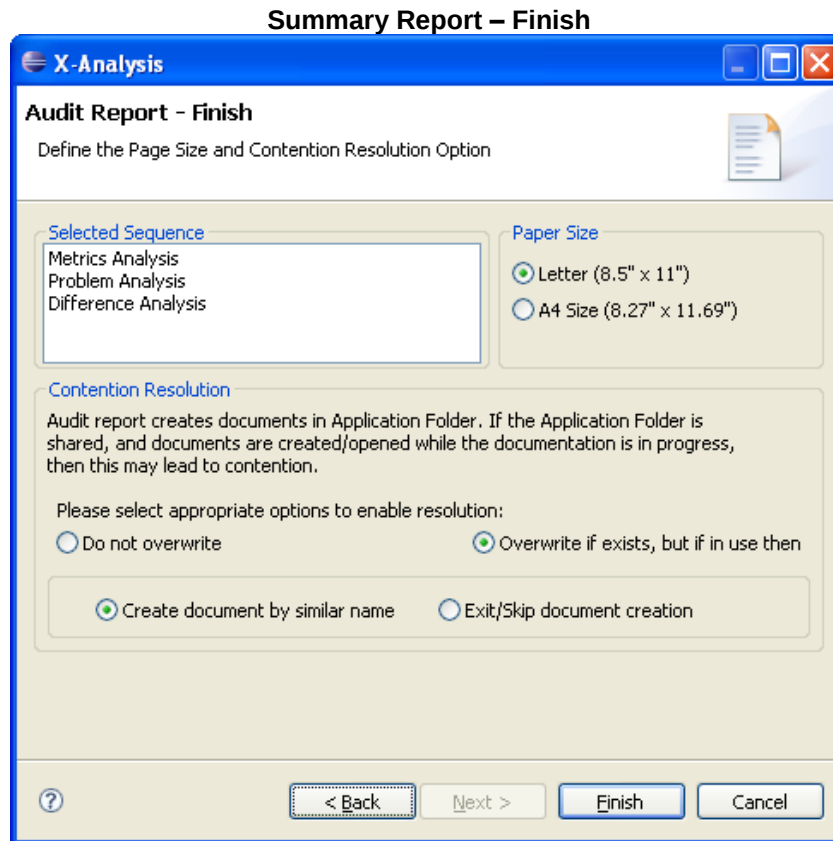
Metrics Analysis
Problem Analysis
Difference Analysis

Specify the sequence of the contents for the Audit Report and click the **Next** button.

Summary Report – Finish



Audit Report - Finish
Define the Page Size and Contention Resolution Option

Selected Sequence
Metrics Analysis
Problem Analysis
Difference Analysis

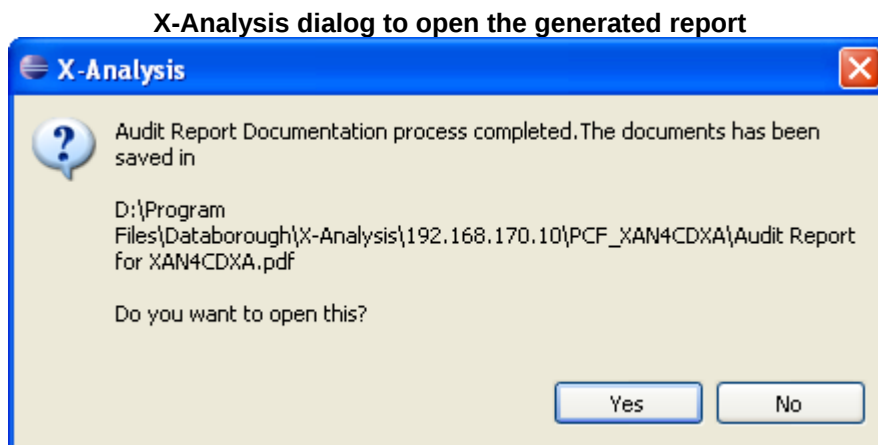
Paper Size
☒ Letter (8.5" x 11")
☐ A4 Size (8.27" x 11.69")

Contention Resolution
Audit report creates documents in Application Folder . If the Application Folder is shared, and documents are created/opened while the documentation is in progress, then this may lead to contention.
Please select appropriate options to enable resolution:
☐ Do not overwrite ☒ Overwrite if exists, but if in use then
☒ Create document by similar name ☐ Exit/Skip document creation

< Back Next > Finish Cancel

Choose the desired settings for the Audit Report and click the **Finish** button to end the report configuration and generate the report. When the report generation is over, the following dialog appears:

X-Analysis dialog to open the generated report



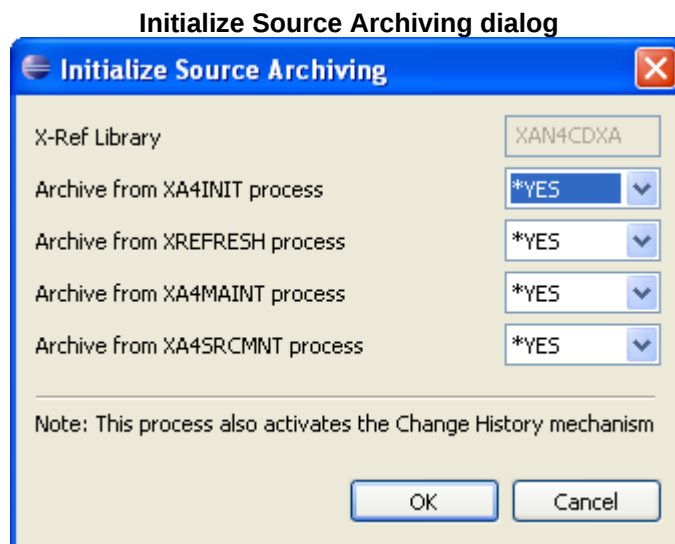
X-Analysis

Audit Report Documentation process completed. The documents has been saved in
D:\Program Files\Databorough\X-Analysis\192.168.170.10\PCF_XAN4CDXA\Audit Report for XAN4CDXA.pdf
Do you want to open this?

Yes No

Initialize Source Archiving

The **Initialize Source Archiving** option is available for the cross-reference library and the application areas. A user can run the option independently of metrics. On selecting this option, the following dialog is invoked:



Source archiving is started by command XACVINI, which sets up a controlling *DTAARA in the XA library and makes an initial copy of all source codes. If archiving is deactivated, and then restarted later, the initial archived copy is not made. Source archiving can be deactivated by XACVEND, which optionally clears all source archives and controlling data. This command can only be run on the server.

Files

All archived source versions are recorded in XAACVSR, whose data is only ever purged when XACVEND DLTHISTO(*YES) is run (whereas metrics can be purged independently, which clears XMETOBJ). When archiving is active, the source date-time of the latest version archived is recorded in XAACVHDR. Archiving handles all the source types (whereas metrics only records for CL, RPG and CBL).

Source archiving continues to maintain data in XMETOBJ/XMETOBJH, if necessary. The data in XMETOBJ/XMETOBJH is not necessary to the source archiving process itself, but is used by the PC client to locate the change history. If data is written to XMETOBJ by source archiving, the SRCACT field is set to the value 'A'.

Processing

Source archiving is invoked from XA4INIT, XREFRESH, XA4MAINT and XA4SRCMNT, which all call the wrapper program, XRACVMBR.

The archive processing itself is done in *srvpgm XACV, in procedure XACV_ArchiveMember(). This procedure checks the source update date-time against the date-time recorded in XAACVHDR. If there is a difference, archiving takes place i.e. copy the source, write out to XAACVSR, update XAACVHDR, and write out to XMETOBJ/XMETOBJH, if appropriate data is not already present in these files.

The wrapper command/program XACVMBR/XRACVMBR first checks whether metrics is active, then performs either:

a) if metrics are active, writes out a record to XMETCHGS, which will cause metrics processing to take place when XRMETCHGS is called, which is the case in XREFRESH, XA4INIT and XA4SRCMNT or

b) if metrics are not active, calls procedure XACV_ArchiveMember().

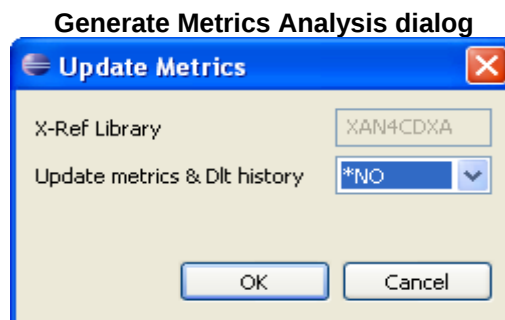
If metrics is active, then the source archiving call is made from metrics processing, which will call XACV_ArchiveMember(). This is so that metrics will write the appropriate XMETOBJ/XMETOBJH records before source archive processing takes place.

Purge

A purge process (command XACVPRG) will move source to a user-specified library, and record the location in XAACVSRC. Purge is by cut-off date, as compared to the archive timestamp in XAACVSRC. The purge process always leaves one source version in place, even if the timestamp is older than the cut-off date.

Generate Metrics Analysis

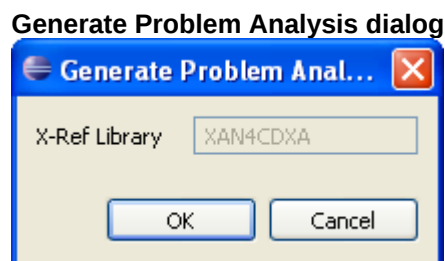
The **Generate Metrics Analysis** option generates the Metrics data. The dialog shown below invokes, when a user opts for the **Generate Metrics Analysis** option:



When the user clicks the **OK** button, related batch job initiates.

Generate Problem Analysis

The Generate Problem Analysis analyzes the application database files and reports problems. Select **Generate Problem Analysis** option, available under the submenu **Audit Options** from the context menu on **XAN4CDXA**. This invokes the following dialog:



Click the **OK** button to invoke the related batch job command.

Chapter 8: What's Next

Over two decades of dedicated research and development has rewarded us with a sophisticated software solution like X-Analysis. Built to meet the requirements of advanced computing and analysis, X-Analysis and its varied features make working of a legacy application easy to understand. We also experienced how X-Analysis helps in analyzing one big application as smaller logical business areas. Its enhanced Data Modelling feature not only exposes the Business Rules implicit in the data and the process models of an application, but also digs out the vast amount of business logic buried inside the source code of the programs.

Today, we are at that exciting phase from where we can look forward to being more progressive and introduce futuristic Re-engineering or Re-architecting tools and solutions. The X-Redo module is one such innovate.

As we already know, X-Analysis dissects legacy application programs to decouple screens from embedded business logic. This componentization can be leveraged by the X-Redo module to generate JSFs, JavaBeans and ORM objects, thereby assisting in re-architecting a legacy application in J2EE.

Having seen the X-Analysis solution set in action, you are now equipped to get on with the application redevelopment.

Appendix A – Enabling the SEU Interface

Create User Profile XAN4SEU

When browsing source code using the AS400 SEU, it is necessary to be logged in as user **XAN4SEU**. The following gives instructions for creating the correct user profile.

- Step 1** Login as QSECOFR.
Step 2 Create user profile **XAN4SEU**.

Use the **CRTUSRPRF** command to create the user profile **XAN4SEU**. Make sure that the following parameters are set:

User Password : XAN4SEU
User Class : *PGMR
Initial Program : XSEUCLP
Library : XAOBJ

```

                                Create User Profile (CRTUSRPRF)

Type choices, press Enter.

User profile . . . . . > XAN4SEU      Name
User password . . . . . *USRPRF      Name, *USRPRF, *NONE
Set password to expired . . . . . *NO  *NO, *YES
Status . . . . . *ENABLED            *ENABLED, *DISABLED
User class . . . . . > *PGMR          *USER, *SYSOPR, *PGMR...
Assistance level . . . . . *SYSVAL    *SYSVAL, *BASIC, *INTERMED...
Current library . . . . . *CRTDFT     Name, *CRTDFT
Initial program to call . . . . . > XSEUCLP  Name, *NONE
Library . . . . . > XAOBJ              Name, *LIBL, *CURLIB
Initial menu . . . . . MAIN           Name, *SIGNOFF
Library . . . . . *LIBL              Name, *LIBL, *CURLIB
Limit capabilities . . . . . *NO      *NO, *PARTIAL, *YES
Text 'description' . . . . . > 'X-Analysis - SEU User'

More...

F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
  
```

Press F10 and Page Down

Set Special Authorities:

*ALLOBJ
 *JOBCTL
 *SAVSYS

```

Change User Profile (CHGUSRPRF)

Type choices, press Enter.

Additional Parameters

Special authority . . . . . *ALLOBJ      *SAME, *USRCLS, *NONE...
                             *JOBCTL
                             *SAVSYS
Special environment . . . . . *SYSVAL      *SAME, *SYSVAL, *NONE, *S36
Display sign-on information . . *SYSVAL      *SAME, *NO, *YES, *SYSVAL
Password expiration interval . . *SYSVAL      1-366, *SAME, *SYSVAL, *NOMAX
Limit device sessions . . . . . *SYSVAL      *SAME, *NO, *YES, *SYSVAL
Keyboard buffering . . . . . *SYSVAL      *SAME, *SYSVAL, *NO...
Maximum allowed storage . . . . *NOMAX        Kilobytes, *NOMAX
Highest schedule priority . . . 3            0-9
Job description . . . . . QDFTJOB      Name
  Library . . . . . QGPL            Name, *LIBL, *CURLIB
Group profile . . . . . *NONE        Name, *NONE

More...
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
  
```

Step 3 Logoff

Appendix B – License Code Request Form



License Code Request Form

Kindly complete and confirm the details below and fax this form to: **+44 1932 859211**

Alternatively, this can be emailed to admin@databorough.com

Company	
Contact name	
Contact email	
Telephone	
Fax	
Address	
Post Code	
Country	
AS/400 Serial No.	
Model	
Processor Group (WRKLICINF)	
Purchase Order No.	
Agent or Distributor	
Comments	

If software is required to be sent and the AS/400 is not located at the same address as indicated above please provide the appropriate delivery address and contact details below.

AS/400 Contact			
Contact email			
Telephone			
AS/400 Address			
Post Code		Country	

Requested By	Date
--------------	------

Position _____

Appendix C – License Transfer Request Form



License Transfer Request Form

Kindly complete and confirm the details below and fax this form to: +44 **1932 859211**

Alternatively, this can be emailed to admin@databorough.com

Company	
Contact name	
Contact email	
Telephone	
Fax	
Address	
County	
Post Code	
Country	
Current System i Serial No.	
Processor Group (WRKLICINF)	
Feature Code	

Please indicate the details of the new machine below.

New System i Serial No.	
Processor Group (WRKLICINF)	
New Feature Code	
Purchase Order No.	

A minimum administration fee of £1,500 is charged for any license transfer. An additional fee may be charged on the basis of the upgrade of the original processor band.

Declaration:

I/We hereby confirm that with effect of _____ (MM/DD/YY) the license purchased for system _____ will be transferred to system _____ and subsequently completely removed from the old system.

Requested and confirmed by	Date
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Position _____

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 Company Registration Number: 01795263 VAT number: 492 6942 05