



# Cumulative Changes from Net Express to Micro Focus Visual COBOL for Visual Studio 9.0

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2023-06-19

# Contents

## Cumulative Changes from Net Express to Visual COBOL for Visual Studio

.....	<b>5</b>
About this Guide .....	5
Changes to Compiler Directives, Run-Time Tunables, Library Routines and Environment Variables .....	5
Changes in Alphabetical Order .....	5
Changes in Order of Release .....	11
What was New .....	16
What was New in Visual COBOL 9.0 .....	16
What was New in Visual COBOL 8.0 .....	21
What was New in Visual COBOL 7.0 .....	25
What was New in Visual COBOL 6.0 .....	32
Features Added in Visual COBOL 5.0 .....	39
What was New in Visual COBOL 4.0 .....	44
What was New in Visual COBOL 3.0 .....	50
What was New in Visual COBOL 2.3 Update 2 .....	56
What was New in Visual COBOL 2.3 Update 1 .....	57
What was New in Visual COBOL 2.3 .....	61
What was New in Visual COBOL 2.2 Update 2 .....	68
What was New in Visual COBOL 2.2 Update 1 .....	70
What was New in Visual COBOL 2.2 .....	74
What was New in Visual COBOL 2.1 Update 1 .....	80
What was New in Visual COBOL 2.1 .....	81
What was New in Visual COBOL 2.0 .....	83
What was New in Visual COBOL 2010 .....	87
Significant Changes .....	91
Significant Changes in Visual COBOL 9.0 .....	91
Significant Changes in Visual COBOL 8.0 .....	95
Significant Changes in Visual COBOL 7.0 .....	101
Significant Changes in Visual COBOL 6.0 .....	104
Significant Changes in Visual COBOL 5.0 .....	109
Significant Changes in Visual COBOL 4.0 .....	111
Significant Changes in Visual COBOL 3.0 .....	116
Significant Changes in Visual COBOL 2.3 Update 2 .....	117
Significant Changes in Visual COBOL 2.3 Update 1 .....	118
Significant Changes in Visual COBOL 2.3 .....	120
Significant Changes in Visual COBOL 2.2 Update 2 .....	123
Significant Changes in Visual COBOL 2.2 Update 1 .....	123
Significant Changes in Visual COBOL 2.2 .....	124
Significant Changes in Visual COBOL 2.1 Update 1 .....	128
Significant Changes in Visual COBOL 2.1 .....	128
Significant Changes in Visual COBOL 2.0 .....	130
Unsupported or Deprecated Functionality .....	131
Unsupported or Deprecated at Visual COBOL 9.0 .....	131
Unsupported or Deprecated at Visual COBOL 8.0 .....	131
Unsupported or Deprecated at Visual COBOL 7.0 .....	131
Unsupported or Deprecated at Visual COBOL 6.0 .....	132
Unsupported or Deprecated at Visual COBOL 5.0 .....	132
Unsupported or Deprecated at Visual COBOL 4.0 .....	132
Unsupported or Deprecated at Visual COBOL 3.0 .....	132
Unsupported or Deprecated at Visual COBOL 2.3 Update 2 .....	133

Unsupported or Deprecated at Visual COBOL 2.3 Update 1 .....	133
Unsupported or Deprecated at Visual COBOL 2010 .....	133
Known Errors and Restrictions .....	134
Upgrading from Net Express to Visual COBOL .....	134
An introduction to the process of upgrading your COBOL applications .....	135
Compile at the Command Line Using Existing Build Scripts .....	136
Debugging Without a Project .....	137
Create a project and import source .....	137
Using Visual COBOL for Visual Studio .....	139
Change the Defaults to Replicate Your Existing Project Structure .....	141
Best Practice in Visual COBOL Development .....	142
Modernize Your Applications and Processes .....	143
Procedural COBOL Compared with .NET COBOL .....	144

# Cumulative Changes from Net Express to Visual COBOL for Visual Studio

Welcome to Visual COBOL for Visual Studio. This document combines information on Visual COBOL for Visual Studio releases from the first release, Visual COBOL 2010 R1, to the most recent release. This information is taken from the various releases' Release Notes and other sources, and brought together here for your convenience.

You can use this document:

- If your Visual COBOL installation is up to date, to see the changes made in the latest release.
- If you already use Visual COBOL but your installation is not entirely up to date, to see the changes made over several updates, together in one place.
- If you are migrating from Net Express, to see everything that has changed in the life of Visual COBOL for Visual Studio.

## About this Guide

We recommend that you read all the sections of this publication, looking for information on the release that is most relevant to your needs. The main sections are as follows:

<b>What was New</b>	This section describes new functionality that was introduced in each successive release.
<b>Significant Changes</b>	This section describes, for each successive release, the changes in behavior or usage that could affect the behavior of existing applications or impact the way the tools are used.
<b>Unsupported or Deprecated Functionality</b>	This section describes any functionality that was discontinued or deprecated at a given release.
<b>Known Errors and Restrictions</b>	This section describes known errors affecting the latest release, and restrictions in its use.
<b>Upgrading from Net Express to Visual COBOL</b>	This section gives guidance on upgrading from earlier Micro Focus products.

Within each section, we recommend reading in the reverse chronological order in which it is presented here - that is, reading about the most recent release first, and then going back through the development of the products. That way, you can more easily see if anything was added in an earlier release and subsequently removed.

## Changes to Compiler Directives, Run-Time Tunables, Library Routines and Environment Variables

This section provides an index of items added, deprecated and changes since the first version of Visual COBOL. The changes are presented in a number of tables according to the type of feature involved. The first set of tables lists changes in alphabetical order. A second section lists changes in order of release.

### Changes in Alphabetical Order

The changes are presented in the following tables:

- [Compiler Directives](#)
- [Run-Time Tunables](#)
- [Library Routines](#)
- [Environment Variables](#)

For each change, the table lists:

- The name of feature that changed,
- The type of change,
- The version of Visual COBOL in which the change was introduced,
- A link to more information.

**Table 1: Changes to Compiler Directives**

Name	Change	At Product Version	See
<b>01SHUFFLE</b>	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
<b>64KPARA</b>	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
<b>64KSPECT</b>	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
<b>ACU-UNDERSCORE</b>	New	2.2	<a href="#">What was new in 2.2</a>
<b>ALPHA-LIT-CONT</b>	New	9.0	<a href="#">What was new in 9.0</a>
<b>ANIM</b>	Changed default	5.0	<a href="#">Significant changes in 5.0</a>
<b>AUXOPT</b>	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
<b>CHANGE-MESSAGE</b>	Changed scope	2.2	<a href="#">What was new in 2.2</a>
<b>CHECKDIV</b>	New parameter	4.0	<a href="#">What was new in 4.0</a>
<b>CHECKREFMOD</b>	New parameter	6.0	<a href="#">What was new in 6.0</a>
<b>CHIP</b>	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
<b>COMMAND-LINE-LINKAGE</b>	New	2.3 Update 2	<a href="#">What was new at 2.3 Update 2</a>
<b>COMP1</b>	New	2.1	<a href="#">What was new in 2.1</a>
<b>COMP2</b>	New	2.1	<a href="#">What was new in 2.1</a>
<b>CONVERTRET</b>	Deprecated	3.0	<a href="#">Unsupported or Deprecated at 3.0</a>
<b>DECLARE</b>	New	9.0	<a href="#">What was new in 9.0</a>
<b>DIALECT"RM"</b>	Changed effect	2.2	<a href="#">What was new in 2.2</a>
<b>DISPLAY</b>	New	2.1	<a href="#">What was new in 2.1</a>
<b>DISPLAY-AT</b>	New	6.0	<a href="#">What was new in 6.0</a>
<b>DISPLAY-PICU</b>	New	8.0	<a href="#">What was new in 8.0</a>

Name	Change	At Product Version	See
DISPSIGN	New	4.0	<a href="#">What was new in 4.0</a>
DATALIT	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
DATAMAP	New parameter	2.1	<a href="#">What was new in 2.1</a>
DBSPACE	New parameter	2.3	<a href="#">What was new in 2.3</a>
DPC-IN-DATA	New	6.0	<a href="#">What was new in 6.0</a>
EANIM	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
EBC-COL-SEQ	New	2.3 Update 2	<a href="#">What was new at 2.3 Update 2</a>
EDITOR	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
ENSUITE	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
EOF-1A	New	2.3	<a href="#">What was new in 2.3</a>
EXECSQL-FLAG	New	7.0	<a href="#">What was new in 7.0</a>
EXITPROGRAM	New	2.2	<a href="#">What was new in 2.2</a>
EXPANDDATA	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
FIXING	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
FLAG-CHIP	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
GNTLITLINKSTD	New	4.0	<a href="#">What was new in 4.0</a>
HIDE-MESSAGE	Changed scope	2.2	<a href="#">What was new in 2.2</a>
HOSTSIGNS	Unsupported	3.0	<a href="#">Unsupported or Deprecated at 3.0</a>
IDXFORMAT8	New option	Visual COBOL Base release	
IDXFORMAT12	New option	2.3 Update 1	
IDYSRCPATH	Deprecated	3.0	<a href="#">Unsupported or Deprecated at 3.0</a>
ILCONDITIONPARAM	New	6.0	<a href="#">What was new in 6.0</a>
ILEXPONENTIATION	New	2.2	<a href="#">What was new in 2.2</a>
ILEXPOSEALPHA	New	9.0	<a href="#">What was new in 9.0</a>
ILEXPOSEGROUP	New	9.0	<a href="#">What was new in 9.0</a>
ILCLR"2"	Deprecated	7.0	<a href="#">What was new in 7.0</a>
ILLOADSTRING	New	8.0	
ILMAIN	New	2.3 Update 1	<a href="#">What was new in 2.3 Update 1</a>

Name	Change	At Product Version	See
ILNORMALIZENAMES	New	5.0	<a href="#">What was new in 5.0</a>
ILOBJECTIFY	Deprecated	3.0	<a href="#">Unsupported or Deprecated at 3.0</a>
ILPARAMS	New	2.2 Update 1	<a href="#">What was new in 2.2 Update 1</a>
ILSHOWPERFORMOVERLAP	New	2.2	<a href="#">What was new in 2.2</a>
ILSMARTANNOTATE	New	2.1	<a href="#">What was new in 2.1</a>
ILSMARTRESTRICT	New	2.1	<a href="#">What was new in 2.1</a>
ILSMARTTRIM	New	4.0	<a href="#">What was new in 4.0</a>
ILSTRINGLOAD	New	9.0	<a href="#">What was new in 9.0</a>
INIT-BY-TYPE	New	2.2 Update 1	<a href="#">What was new in 2.2 Update 1</a>
INITIAL	New	9.0	<a href="#">What was new in 9.0</a>
JAVA-CALLABLE	New	9.0	<a href="#">What was new in 9.0</a>
JAVA-GEN-PROGS	New	9.0	<a href="#">What was new in 9.0</a>
JAVA-GEN-STRG	New	9.0	<a href="#">What was new in 9.0</a>
JAVA-OUTPUT-PATH	New	9.0	<a href="#">What was new in 9.0</a>
JAVA-PACKAGE-NAME	New	9.0	<a href="#">What was new in 9.0</a>
JAVA-SHAREABLE	New	9.0	<a href="#">What was new in 9.0</a>
MAINFRAME-FLOATING-POINT	New	4.0	<a href="#">What was new in 4.0</a>
MANAGED-FNC-PARAM-BY	New	9.0	<a href="#">What was new in 9.0</a>
MASM	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
MODEL	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
NATIONAL	New	2.3 Update 2	<a href="#">What was new at 2.3 Update 2</a>
NLS-CURRENCY-LENGTH	New	2.3	<a href="#">What was new in 2.3</a>
NULL-ESCAPE	New	2.3	<a href="#">What was new in 2.3</a>
NUMPROC	New	4.0	<a href="#">What was new in 4.0</a>
	parameter		
OOCTRL	New	2.3 Update 1	<a href="#">What was new in 2.3 Update 1</a>
OOCTRL	New	4.0	<a href="#">What was new in 4.0</a>
	parameter		
OPTIMIZECURSORS	New	3.0	<a href="#">Significant changes in 3.0</a>
OPTION	Deprecated	3.0	<a href="#">Unsupported or Deprecated at 3.0</a>
OPTSIZE	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
OPTSPEED	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
PANVALET-INCLUDES-IN-COMMENTS	New	7.0	<a href="#">What's new in 7.0</a>



Name	Change	At Product Version	See
PARAS	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
PRESERVECASE	Changed scope	2.2	<a href="#">What was new in 2.2</a>
PROTMODE	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
PROTOTYPE	New parameter	6.0	<a href="#">What was new in 6.0</a>
REGPARM	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
RESTRICT-GOTO	New	2.1	<a href="#">What was new in 2.1</a>
RM-FILE-ERRORS	New	7.0	<a href="#">What's new in 7.0</a>
SEGCROSS	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
SEGSIZE	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
SIGNCOMPARE	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
SMALLDD	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
SPZERO	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
TABLESEGCROSS	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
TRICKLE	Deprecated	3.0	<a href="#">Unsupported or Deprecated at 3.0</a>
TRICKLECHECK	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
WB2	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
WB3	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>
WB	Deprecated	Visual COBOL Base release	<a href="#">Unsupported or Deprecated at 2010</a>

Table 2: Changes to Run-time Tunables

Name	Change	At Product Version	See
command_line_linkage	Deprecated	2.3 Update 2	<a href="#">Unsupported or Deprecated at 2.3 Update 2</a>
default_cancel_mode	New default value	2.3	<a href="#">What was new in 2.3 - Tunables</a>

Name	Change	At Product Version	See
	New parameter		
printer_raw_redirection	New	2.0	<a href="#">What was new in 2.0 - Run-time Tunables</a>
reduce_java_signals	New	2.2 Update 2	<a href="#">Significant changes in 2.2 Update 2</a>
subsystem_cancel_mode	New	2.0	<a href="#">What was new in 2.0 - Run-time Tunables</a>
	New parameter	2.3	<a href="#">What was new in 2.3 - Tunables</a>

**Table 3: Changes to Library Routines**

Name	Change	At Product Version	See
CBL_CREATE_CORE	New	5.0	<a href="#">What was new in 5.0</a>
CBL_CODESET_SET_MAPPING	New	2.3 Update 1	<a href="#">What was new in 2.3 Update 1</a>
CBL_GET_DEBUG_START	New	4.0	<a href="#">What was new in 4,0</a>
CBL_GET_DEBUG_STOP	New	4.0	<a href="#">What was new in 4,0</a>
CBL_GET_ERROR_INFO	New	7.0	<a href="#">What's new in 7.0</a>
CBL_GET_EXIT_INFO	Enhanced	6.0	<a href="#">What was new in 6.0</a>
CBL_GET_OS_INFO	New	4.0	<a href="#">What was new in 4,0</a>
CBL_LOCATE_FILE	New parameter	2.3	<a href="#">What was new in 2.3</a>
CBL_MANAGED_SESSION_GET_USERDATA	New	2.3	<a href="#">What was new in 2.3</a>
CBL_MANAGED_SESSION_SET_USERDATA	New	2.3	<a href="#">What was new in 2.3</a>
CBL_RUNTIME_ERROR	New	2.3 Update 1	<a href="#">What was new in 2.3 Update 1</a>
CBL_SEMAPHORE_ACQUIRE	New parameter	2.0	<a href="#">What was new in 2.0</a>
CBL_CREATE_CORE	New	5.0	<a href="#">What was new in 5.0</a>
MFU_GET_FILE	New	6.0	<a href="#">What was new in 6.0</a>
MFUGETF	New	6.0	<a href="#">What was new in 6.0</a>
PC_PRINTER_SET_FONT	Enhanced	8.0	
PC_PRINTER_INFO_DOTNET	New	2.3 Update 1	<a href="#">What was new in 2.3 Update 1</a>

**Table 4: Changes to Environment Variables**

Name	Change	At Product Version	See
ES_CAT_RETRY_COUNT	New	4.0	<a href="#">Configuring Multiple Catalogs</a>
ES_CAT_RETRY_WAIT	New	4.0	<a href="#">Configuring Multiple Catalogs</a>
ES_RDO_MAX_RESOURCES	New	7.0	<a href="#">What's new in 7.0</a>

Name	Change	At Product Version	See
<b>FSWRKDIR</b>	New	3.0	<a href="#">What was new in 3.0</a>
<b>FSCHKLFH</b>	New	3.0	<a href="#">What was new in 3.0</a>
<b>HCOBND</b>	Deprecated	3.0	<a href="#">Unsupported or Deprecated at 3.0</a>
<b>MFALLOC_PCFILE</b>	Default value changes	2.2 Update 2	<a href="#">Significant changes in 2.2 Update 2</a>

## Changes in Order of Release

The changes are presented in the following tables:

- [Compiler Directives](#)
- [Run-Time Tunables](#)
- [Library Routines](#)
- [Environment Variables](#)

For each change, the table lists:

- The version of Visual COBOL in which the change was introduced, starting with the earliest,
- The name of feature that changed,
- The type of change,
- A link to more information.

**Table 5: Changes to Compiler Directives**

At Product Version	Name	Change	See
Visual COBOL Base release	<b>01SHUFFLE</b>	Deprecated	<a href="#">Unsupported or Deprecated at 2010</a>
Visual COBOL Base release	<b>64KPARA</b>	Deprecated	<a href="#">Unsupported or Deprecated at 2010</a>
Visual COBOL Base release	<b>64KSPECT</b>	Deprecated	<a href="#">Unsupported or Deprecated at 2010</a>
Visual COBOL Base release	<b>AUXOPT</b>	Deprecated	<a href="#">Unsupported or Deprecated at 2010</a>
Visual COBOL Base release	<b>CHIP</b>	Deprecated	<a href="#">Unsupported or Deprecated at 2010</a>
Visual COBOL Base release	<b>DATALIT</b>	Deprecated	<a href="#">Unsupported or Deprecated at 2010</a>
Visual COBOL Base release	<b>EANIM</b>	Deprecated	<a href="#">Unsupported or Deprecated at 2010</a>
Visual COBOL Base release	<b>EDITOR</b>	Deprecated	<a href="#">Unsupported or Deprecated at 2010</a>
Visual COBOL Base release	<b>ENSUITE</b>	Deprecated	<a href="#">Unsupported or Deprecated at 2010</a>
Visual COBOL Base release	<b>EXPANDDATA</b>	Deprecated	<a href="#">Unsupported or Deprecated at 2010</a>
Visual COBOL Base release	<b>FIXING</b>	Deprecated	<a href="#">Unsupported or Deprecated at 2010</a>

At Product Version	Name	Change	See
Visual COBOL Base release	<b>FLAG-CHIP</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
Visual COBOL Base release	<b>IDXFORMAT8</b>	New option	
Visual COBOL Base release	<b>MASM</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
Visual COBOL Base release	<b>MODEL</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
Visual COBOL Base release	<b>OPTSIZE</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
Visual COBOL Base release	<b>OPTSPEED</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
Visual COBOL Base release	<b>PARAS</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
Visual COBOL Base release	<b>PROTMODE</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
Visual COBOL Base release	<b>REGPARM</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
Visual COBOL Base release	<b>SEGCROSS</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
Visual COBOL Base release	<b>SEGSIZE</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
Visual COBOL Base release	<b>SIGNCOMPARE</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
Visual COBOL Base release	<b>SMALLDD</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
Visual COBOL Base release	<b>SPZERO</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
Visual COBOL Base release	<b>TABLESEGCROSS</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
Visual COBOL Base release	<b>TRICKLECHECK</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
Visual COBOL Base release	<b>WB2</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
Visual COBOL Base release	<b>WB3</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
Visual COBOL Base release	<b>WB</b>	Deprecated	<i>Unsupported or Deprecated at 2010</i>
2.1	<b>COMP1</b>	New	<i>What was new in 2.1</i>
2.1	<b>COMP2</b>	New	<i>What was new in 2.1</i>
2.1	<b>DISPLAY</b>	New	<i>What was new in 2.1</i>
2.1	<b>DATAMAP</b>	New parameter	<i>What was new in 2.1</i>
2.1	<b>ILSMARTANNOTATE</b>	New	<i>What was new in 2.1</i>
2.1	<b>ILSMARTRESTRICT</b>	New	<i>What was new in 2.1</i>

At Product Version	Name	Change	See
2.1	RESTRICT-GOTO	New	<a href="#">What was new in 2.1</a>
2.2	ACU-UNDERSCORE	New	<a href="#">What was new in 2.2</a>
2.2	CHANGE-MESSAGE	Changed scope	<a href="#">What was new in 2.2</a>
2.2	DIALECT"RM"	Changed effect	<a href="#">What was new in 2.2</a>
2.2	EXITPROGRAM	New	<a href="#">What was new in 2.2</a>
2.2	HIDE-MESSAGE	Changed scope	<a href="#">What was new in 2.2</a>
2.2	ILEXPONENTIATION	New	<a href="#">What was new in 2.2</a>
2.2	ILSHOWPERFORMOVERLAP	New	<a href="#">What was new in 2.2</a>
2.2	PRESERVECASE	Changed scope	<a href="#">What was new in 2.2</a>
2.2 Update 1	ILPARAMS	New	<a href="#">What was new in 2.2 Update 1</a>
2.2 Update 1	INIT-BY-TYPE	New	<a href="#">What was new in 2.2 Update 1</a>
2.3	DBSPACE	New parameter	<a href="#">What was new in 2.3</a>
2.3	EOF-1A	New	<a href="#">What was new in 2.3</a>
2.3	NLS-CURRENCY-LENGTH	New	<a href="#">What was new in 2.3</a>
2.3	NULL-ESCAPE	New	<a href="#">What was new in 2.3</a>
2.3 Update 1	IDXFORMAT12	New option	
2.3 Update 1	ILMAIN	New	<a href="#">What was new in 2.3 Update 1</a>
2.3 Update 1	OOCTRL	New	<a href="#">What was new in 2.3 Update 1</a>
2.3 Update 2	EBC-COL-SEQ	New	<a href="#">What was new at 2.3 Update 2</a>
2.3 Update 2	COMMAND-LINE-LINKAGE	New	<a href="#">What was new at 2.3 Update 2</a>
2.3 Update 2	NATIONAL	New	<a href="#">What was new at 2.3 Update 2</a>
3.0	CONVERTRET	Deprecated	<a href="#">Unsupported or Deprecated at 3.0</a>
3.0	HOSTSIGNS	Unsupported	<a href="#">Unsupported or Deprecated at 3.0</a>
3.0	IDYSRCPATH	Deprecated	<a href="#">Unsupported or Deprecated at 3.0</a>
3.0	IOBJECTIFY	Deprecated	<a href="#">Unsupported or Deprecated at 3.0</a>
3.0	OPTIMIZECURSORS	New	<a href="#">Significant changes in 3.0</a>
3.0	OPTION	Deprecated	<a href="#">Unsupported or Deprecated at 3.0</a>
3.0	TRICKLE	Deprecated	<a href="#">Unsupported or Deprecated at 3.0</a>
4.0	CHECKDIV	New parameter	<a href="#">What was new in 4.0</a>
4.0	DISPSIGN	New	<a href="#">What was new in 4.0</a>
4.0	GNTLITLINKSTD	New	<a href="#">What was new in 4.0</a>
4.0	ILSMARTTRIM	New	<a href="#">What was new in 4.0</a>
4.0	MAINFRAME-FLOATING-POINT	New	<a href="#">What was new in 4.0</a>
4.0	NUMPROC	New parameter	<a href="#">What was new in 4.0</a>

At Product Version	Name	Change	See
4.0	<b>OOCTRL</b>	New parameter	<a href="#">What was new in 4.0</a>
5.0	<b>ILNORMALIZENAMES</b>	New	<a href="#">What was new in 5.0</a>
5.0	<b>ANIM</b>	Changed default	<a href="#">Significant changes in 5.0</a>
6.0	<b>DISPLAY-AT</b>	New	<a href="#">What was new in 6.0</a>
6.0	<b>DPC-IN-DATA</b>	New	<a href="#">What was new in 6.0</a>
6.0	<b>ILCONDITIONPARAM</b>	New	<a href="#">What was new in 6.0</a>
6.0	<b>CHECKREFMOD</b>	New parameter	<a href="#">What was new in 6.0</a>
6.0	<b>PROTOTYPE</b>	New parameter	<a href="#">What was new in 6.0</a>
7.0	<b>EXECSQL-FLAG</b>	New	<a href="#">What's new in 7.0</a>
7.0	<b>ILCLR"2"</b>	Deprecated	<a href="#">What's new in 7.0</a>
7.0	<b>PANVALET-INCLUDES-IN-COMMENTS</b>	New	<a href="#">What's new in 7.0</a>
7.0	<b>RM-FILE-ERRORS</b>	New	<a href="#">What's new in 7.0</a>
8.0	<b>DISPLAY-PICU</b>	New	<a href="#">What was new in 8.0</a>
8.0	<b>ILLOADSTRING</b>	New	
9.0	<b>ALPHA-LIT-CONT</b>	New	<a href="#">What was new in 9.0</a>
9.0	<b>DECLARE</b>	New	<a href="#">What was new in 9.0</a>
9.0	<b>IEXPOSEALPHA</b>	New	<a href="#">What was new in 9.0</a>
9.0	<b>IEXPOSEGROUP</b>	New	<a href="#">What was new in 9.0</a>
9.0	<b>ILSTRINGLOAD</b>	New	<a href="#">What was new in 9.0</a>
9.0	<b>INITIAL</b>	New	<a href="#">What was new in 9.0</a>
9.0	<b>JAVA-CALLABLE</b>	New	<a href="#">What was new in 9.0</a>
9.0	<b>JAVA-GEN-PROGS</b>	New	<a href="#">What was new in 9.0</a>
9.0	<b>JAVA-GEN-STRG</b>	New	<a href="#">What was new in 9.0</a>
9.0	<b>JAVA-OUTPUT-PATH</b>	New	<a href="#">What was new in 9.0</a>
9.0	<b>JAVA-PACKAGE-NAME</b>	New	<a href="#">What was new in 9.0</a>
9.0	<b>JAVA-SHAREABLE</b>	New	<a href="#">What was new in 9.0</a>
9.0	<b>MANAGED-FNC-PARAM-BY</b>	New	<a href="#">What was new in 9.0</a>

**Table 6: Changes to Run-time Tunables**

At Product Version	Name	Change	See
2.0	<b>subsystem_cancel_mode</b>	New	<a href="#">What was new in 2.0 - Run-time Tunables</a>
2.2 Update 2	<b>reduce_java_signals</b>	New	<a href="#">Significant changes in 2.2 Update 2</a>
2.3	<b>default_cancel_mode</b>	New default value	<a href="#">What was new in 2.3 - Tunables</a>

At Product Version	Name	Change	See
		New parameter	
2.3	<b>subsystem_cancel_mode</b>	New parameter	<a href="#">What was new in 2.3 - Tunables</a>
2.3 Update 2	<b>command_line_linkage</b>	Deprecated	<a href="#">Unsupported or Deprecated at 2.3 Update 2</a>

**Table 7: Changes to Library Routines**

At Product Version	Name	Change	See
2.0	<b>CBL_SEMAPHORE_ACQUIRE</b>	New parameter	<a href="#">What was new in 2.0</a>
2.3	<b>CBL_LOCATE_FILE</b>	New parameter	<a href="#">What was new in 2.3</a>
2.3	<b>CBL_MANAGED_SESSION_GET_USERDATA</b>	New	<a href="#">What was new in 2.3</a>
2.3	<b>CBL_MANAGED_SESSION_SET_USERDATA</b>	New	<a href="#">What was new in 2.3</a>
2.3 Update 1	<b>CBL_CODESET_SET_MAPPING</b>	New	<a href="#">What was new in 2.3 Update 1</a>
2.3 Update 1	<b>CBL_RUNTIME_ERROR</b>	New	<a href="#">What was new in 2.3 Update 1</a>
2.3 Update 1	<b>PC_PRINTER_INFO_DOTNET</b>	New	<a href="#">What was new in 2.3 Update 1</a>
4.0	<b>CBL_GET_DEBUG_START</b>	New	<a href="#">What was new in 4,0</a>
4.0	<b>CBL_GET_DEBUG_STOP</b>	New	<a href="#">What was new in 4,0</a>
4.0	<b>CBL_GET_OS_INFO</b>	New	<a href="#">What was new in 4,0</a>
5.0	<b>CBL_CREATE_CORE</b>	New	<a href="#">What was new in 5.0</a>
6.0	<b>CBL_GET_EXIT_INFO</b>	Enhanced	<a href="#">What was new in 6.0</a>
6.0	<b>MFU_GET_FILE</b>	New	<a href="#">What was new in 6.0</a>
6.0	<b>MFUGETF</b>	New	<a href="#">What was new in 6.0</a>
7.0	<b>CBL_GET_ERROR_INFO</b>	New	<a href="#">What was new in 7.0</a>
8.0	<b>PC_PRINTER_SET_FONT</b>	Enhanced	

**Table 8: Changes to Environment Variables**

At Product Version	Name	Change	See
2.2 Update 2	<b>MFALLOC_PCFILE</b>	Default value changes	<a href="#">Significant changes in 2.2 Update 2</a>
3.0	<b>FSWRKDIR</b>	New	<a href="#">What was new in 3.0</a>
3.0	<b>FSCHKLFH</b>	New	<a href="#">What was new in 3.0</a>
3.0	<b>HCOBND</b>	Deprecated	<a href="#">Unsupported or Deprecated at 3.0</a>
4.0	<b>ES_CAT_RETRY_COUNT</b>	New	<a href="#">Configuring Multiple Catalogs</a>
4.0	<b>ES_CAT_RETRY_WAIT</b>	New	<a href="#">Configuring Multiple Catalogs</a>
7.0	<b>ES_RDO_MAX_RESOURCES</b>	New	<a href="#">What was new in 7.0</a>

# What was New

This section describes the new features that were introduced in each successive release of Visual COBOL.

## What was New in Visual COBOL 9.0

### New Features in Visual COBOL 9.0

Enhancements are available in the following areas:

- [.NET Support](#)
- [COBOL Language](#)
- [Compiler Directives](#)
- [Data Modernization Advice](#)
- [Database Connectors for Visual COBOL](#)
- [Debugging](#)
- [Enterprise Server](#)
- [Enterprise Server Common Web Administration \(ESCWA\)](#)
- [Enterprise Server Security](#)
- [Interface Mapping Toolkit](#)
- [Micro Focus COBOL Extension for Visual Studio Code](#)
- [Micro Focus Learn COBOL extension and COBOL course](#)
- [Visual Studio Integration](#)

#### .NET Support

[Back to Top](#)

This release provides the following enhancements to .NET support:

- This release installs several NuGet packages each of which contains the assemblies for a specific Micro Focus functionality. New .NET projects, as well as existing projects you edit or build in 9.0 are linked to a core package, MicroFocus.COBOL.Runtime.Core, that includes the basic functionality for the projects. You need to add any additional packages (such as a specific file handler, COBOL Accept/Display etc.) manually to the projects. The new packages enable better granularity of distributions, and provide more flexibility and control over what is packaged with the application.
- New SDK version - the Micro Focus SDK version has changed to version 2.1. See *Upgrading existing .NET COBOL project files* for details on how to upgrade your existing projects.

#### COBOL Language

[Back to Top](#)

**This release provides the following new features and enhancements to the COBOL language:**

- Double-colon, `::`, qualification is now available as a qualifier for data names and when dereferencing pointers.
- PERFORM frame local variables - variables that are DECLARED are now properly scoped. Reentering the SECTION, whether recursively or after leaving, gives a new instance of such variables. This provides better locality of data, and helps with writing of better structured code.
- Parameterized sections - syntax that allows program sections to accept arguments and return values.
  - PERFORM of a SECTION can now pass arguments to that SECTION.
  - A result can be returned to the code that PERFORMED the SECTION.



- Sections that return a value can be used as functions, in contexts where an identifier is expected.
- Compiler can identify platform at compile time - the compile-time constants `__unix`, `__windows`, `__dotnet`, `__jvm`, and `__native` have been introduced. These can be tested in `$if` statements to tailor code to the platform being used.
- Enhanced `CBL_STRING_CONVERT` intrinsic function - `CBL_STRING_CONVERT` can now convert strings to and from Base64.

**The following enhancements add further support for the IBM Enterprise COBOL version 6.4:**

- User-defined functions - user-defined functions are now available in an Enterprise COBOL dialect for version 6.4 compatibility. Reference the product Help, *General Reference > COBOL Language Reference > Part 3. Additional Topics > Additional Dialect Support > Enterprise COBOL Syntax Support > User-Defined Functions* under ENTCOBOL dialect. A new Compiler directive, `MANAGED-FNC-PARAM-BY`, enables you to specify whether the managed behavior of numeric function parameters should default to `BY VALUE` or `BY REFERENCE`.
- Enhanced mechanism for interoperation between Java and COBOL - The COBOL and Java interoperability has been enhanced to extend the capabilities of your COBOL applications with Java. It removes the need to write object-oriented (OO) COBOL, as your native COBOL and Java programs can now interoperate in the following scenarios:
  - COBOL programs can be marked as `JAVA-CALLABLE`, meaning that they can be called from Java as though they were Java static methods.
  - COBOL program can call Java static methods using the `java.class.method` call.
  - COBOL data can be shared with Java programs by marking it as `JAVA-SHAREABLE`.
- Comprehensive support for automatic conversion between a wide variety of popular Java data types and their corresponding COBOL types so that parameter passing and returned value handling require no special processing in user code.

## Compiler Directives

[Back to Top](#)

This release provides the following enhancements.

### A new mechanism for setting Compiler directives (Technology Preview):

- Common directives files - this release introduces common directives files, `directives.mf` files, that enable you to automatically provide all required directives needed to compile multiple COBOL applications without having to specify the directives individually. This feature is not available for Assembler or IMS.



**Note:** This is a technology preview feature only. It is being made available to allow you to test and provide feedback on this new capability; however, this feature is not intended for production use and it is not supported as such. Furthermore, Micro Focus does not guarantee that this feature will be delivered at a GA level and if it is, then the functionality provided might differ considerably from this technology preview.

### New Compiler directives:

- `ALPHA-LIT-CONT` - determines whether the right margin or the end-of-line is used to delimit the continuation of a non-numeric literal.
- `DECLARE` - defines the behavior of locally declared variables.
- `ILEXPOSEALPHA/ILEXPOSEGROUP` - these two directives can expose alphanumeric or group items passed by value to parameterized sections or methods in .NET COBOL programs as byte arrays (the default is to expose as string objects).
- `ILSTRINGLOAD` - where .NET COBOL programs with a very large number of distinct alphanumeric literals cause internal limits to be exceeded, use this directive to create these literals in a backing file, which can then be converted to strings at run time.
- `MANAGED-FNC-PARAM-BY` - determines whether user-defined function parameters are passed `BY VALUE` or `BY REFERENCE` by default when compiled with `ILGEN`.

- INITIAL - determines how Working-Storage is initialized for programs marked as IS INITIAL.

A family of new Compiler directives has been introduced to support the new mechanism for interoperability between Java and native COBOL:

- JAVA-SHAREABLE - use the JAVA-SHAREABLE ON and JAVA-SHAREABLE OFF directives to bracket one or more WORKING-STORAGE data items to indicate that they are to be made read and write accessible from Java applications interoperating with this COBOL program.
- JAVA-CALLABLE - instructs the Compiler to make the COBOL program automatically callable from Java.
- JAVA-GEN-PROGS, JAVA-GEN-STRG, JAVA-OUTPUT-PATH, and JAVA-PACKAGE-NAME - control the behavior of COBOL programs that interoperate with Java through the JAVA-CALLABLE or JAVA-SHAREABLE directives or by calling Java static methods using the CALL statement.

## Data Modernization Advice

[Back to Top](#)

The product Help now includes advice on moving your COBOL data files, such as flat files, VSAM, indexed or sequential files, etc. to a relational database (RDBMS). The documentation lists the solutions included in Visual COBOL that enable you to achieve this, including advice on the best option for your application as well as performance considerations.

## Database Connectors for Visual COBOL

[Back to Top](#)

This release provides the following enhancements:

- Better control of permissions granted on newly created tables.

When creating a table, the SQL Server interface also creates an index, and grants loose permissions to everyone via the A-MSSQL-GRANT-PERMISSIONS and A-MSSQL-GRANT-USERNAME configuration variables with their default values. If database permissions are not set to allow these loose permissions, the GRANT statement fails, causing OPEN OUTPUT to fail.

See *A-MSSQL-GRANT-PERMISSIONS* and *A-MSSQL-GRANT-USERNAME* for details.

- Increased table and column name sizes for ODBC

To accommodate the number of characters the ODBC driver allows, this release increases the allowable table name and column name sizes for ODBC via two new ODBC configuration file variables. For details, see *A\_ODBC\_MAX\_COLUMNNAME\_LEN* and *A\_ODBC\_MAX\_TABLENAME\_LEN*.

- Support for all currently available versions of the Microsoft SQL Server ODBC Driver, which have been tested through version 18.

See the following *Configuration Variables* topics for details:

```
A_MSSQL_ODBC_DRIVER_NAME
A_MSSQL_ENCRYPT_CONNECTION
A_MSSQL_TRUST_SERVER_CERTIFICATE
A_MSSQL_EXTRA_CONNECTION_INFO
```

- The A\_MSSQL\_IDENTITY\_TYPE configuration variable has been added to enable you to configure the identity column to be a larger type, and to store a 64-bit value internally. Set A\_MSSQL\_IDENTITY\_TYPE to a string value that represents a fully qualified data type for your database. The default is:

```
A_MSSQL_IDENTITY_TYPE="numeric(9,0)"
```

## Debugging

[Back to Top](#)

This release provides the following new feature:

- In Visual Studio, you can now debug .NET COBOL projects in WSL.

## Enterprise Server

[Back to Top](#)

This release provides the following enhancements:

- A new `casverify` command-line utility is available. This utility enables you to verify the configuration of a specified enterprise server region without attempting to start it, and also enables you to create immediate diagnostics information in JSON or human-readable output. Verification stages are modular, enabling you to specify which validation checks to run.
- You can now list job steps to enable users to perform advanced restarts. Job steps can be output to JSON by specifying `casout /%jnumber` or output to a table by specifying `casout /%tnumber`. See `casout` for more information.

## Enterprise Server Common Web Administration (ESCWA)

[Back to Top](#)


Enhancements are available in the following areas:

- Accessibility improvements - provide improved compliance with 508 and WCAG 2.1 standards.
- API, version 2 extensions - includes updated versions of some of the existing API version 1 endpoints, and has been extended to contain more endpoints.
- Merged Archived Spool - you can now configure an enterprise server region to view a merged archived spool in the UI. You can view multiple archived spools from a single region, and view old spool information for multiple jobs that have ran under a previous name
- Page search facility - you can now search for a page that contains a specified search string. This enhancement is part of the WCAG 2.1 requirements for accessibility.
- PAC clients - the ESCWA UI lists all TN3270 clients connected to a PAC. This enables you to administer and monitor clients across the entire PAC from a single PAC region.
- TLS-enabled Redis connections. ESCWA now supports administering and monitoring PACs with a TLS Redis SOR.

## Enterprise Server Security

[Back to Top](#)

This release provides the following new features and enhancements:

- Demo CA - the component has been completely redesigned and is now included as part of Visual COBOL. Demo CA supports multiple installations, uses up-to-date cryptographic support, and generates modern version 3 certificates with SANS, PKIDs, AKIDs, etc. signed by an intermediate CA. Demo CA is now easier to use and has improved interoperability with third-party SSL/TLS systems.  
 **Note:** Micro Focus strongly recommends that Demo CA is only used for SSL/TLS development and testing and is not intended for use in a production environment.
- `esfupdate` support for the Vault Facility - the `esfupdate` utility now supports the use of the Vault Facility for credentials it needs to connect to MFDS.
- OpenSSL 3.0 - OpenSSL has been updated to use the current Long Term Supported OpenSSL cryptographic library.
- VSAM External Security Manager (EAP) - the VSAM ESM Module is a new option for Enterprise Server security which is simpler and more convenient than using LDAP-based security. The VSAM ESM Module provides a security manager for Enterprise Server which keeps security data in COBOL data (VSAM) files. It provides many of the features of the MLDAP ESM Module but does not require an LDAP server or other third-party solution. Security data can be imported from a YAML file, facilitating the securing of Enterprise Server and the modification of its security data.



**Attention:** This feature is in Early Adopter Program (EAP) release status. We intend to provide the finalized feature in a future release. Please contact Micro Focus Customer Care if you require further clarification.

## Interface Mapping Toolkit

[Back to Top](#)


This release provides the following enhancements:

- YAML support is now available for COBOL client generation. OpenAPI schemas can now be in YAML, in addition to JSON format.
- The Interface Mapper user interface for COBOL program-based service interfaces has been updated. The **Interface Fields** pane available in earlier versions is now represented by two panes — **Interface Fields - Input** and **Interface Fields - Output**. The **COBOL Entry Points** pane is situated between these two new panes. The relationships between COBOL entry points and corresponding interface, COBOL assignment, and reusable fields are depicted visually using arrows. The panes can be repositioned for easier viewing of arrow relationships.

## Micro Focus COBOL Extension for Visual Studio Code

[Back to Top](#)

The following features are now available in the Micro Focus COBOL Extension when you use it with Visual COBOL 9.0:

- You can now create COBOL notebooks where you can have text and executable blocks of COBOL code in the same file.
- Colorization is available for COBOL directives files, `cobol.dir`.
- A new button, , **Debug COBOL Program** or **Run COBOL Program** in the top right corner of the editor, is present for the current COBOL program.
- It is now possible to configure custom tab stops in the extension settings.
- It is now possible to enable a Micro Focus COBOL terminal in the TERMINAL pane.
- You can now specify the COBOL main file context for copybooks if a copybooks is referenced in more than one program.

## Micro Focus Learn COBOL Extension and COBOL Course with Visual Studio Code

[Back to Top](#)

Micro Focus has released a new video-based training course in COBOL. The course teaches the fundamentals of the COBOL language, introduces the Micro Focus COBOL syntax, and usage of Micro Focus COBOL tools.

The course is ideal for developers familiar with C, Java, or .NET who want to learn COBOL. It doesn't matter what language you know, as long as you have experience of standard programming concepts, this course is for you.

A new Learn COBOL extension for Microsoft Visual Studio Code is available. The extension comes with the training materials for the COBOL training course. For information about the COBOL course, and the Micro Focus Learn COBOL Extension, visit [www.cobol.com](http://www.cobol.com).

## Visual Studio

[Back to Top](#)

This release provides the following new features:

- Converting JSON data to COBOL classes - you can now copy JSON data and use the **Paste JSON As Classes** command to copy it into a .NET COBOL file. This generates COBOL classes that enable you to deserialize the data in those classes.
- Document Outline window for COBOL files.
- Editor support is available for local variables and parameterized sections.
- Format with code cleanup can now be configured to change any keywords in your code to lowercase or uppercase.

## What was New in Visual COBOL 8.0

### Features Added in Visual COBOL 8.0

Enhancements are available in the following areas:

- [Micro Focus COBOL Extension for Visual Studio Code](#)
- [.NET 6 Support](#)
- [COBOL Language Enhancements](#)
- [Code Analysis](#)
- [Compiler Directives](#)
- [Data File Tools](#)
- [Debugging](#)
- [Enterprise Server](#)
- [Enterprise Server Common Web Administration](#)
- [Enterprise Server Security](#)
- [Micro Focus Unit Testing Framework](#)
- [Open ESQL](#)
- [Visual Studio Integration](#)

#### Micro Focus COBOL Extension for Visual Studio Code

[Back to Top](#)

The Micro Focus COBOL extension for Visual Studio Code provides the following enhancements:

- The use of the Micro Focus COBOL extension with Visual COBOL 8.0 installed on the same machine enables COBOL Language Server support. This offers a rich COBOL editor experience inside Visual Studio Code including IntelliSense, Peek Definition, and Rename.



**Note:** The Micro Focus COBOL extension is available from the Microsoft Visual Studio Marketplace - [click here](#).

#### .NET 6 Support

[Back to Top](#)

This release provides the following enhancement:

- You can create, build and run COBOL projects targeting .NET 6 in Visual Studio 2022. In all other supported environments, you can use the .NET 6 SDK or Visual Studio code to build .NET 6 COBOL projects.

Support for .NET Core 3.1 has been discontinued.

- The Micro Focus .NET Core projects have been renamed to .NET in release 8.0 Patch Update 1.

#### COBOL Language

[Back to Top](#)

The following enhancements have been made to the Micro Focus COBOL language:

- Further support for IBM Enterprise COBOL 6.3:
  - JSON PARSE and JSON GENERATE statements - for JSON GENERATE, anonymous objects can be generated using the OMITTED key word; the SUPPRESS phrase has been enhanced; the CONVERTING phrase is supported. For JSON PARSE, anonymous objects can be parsed using the OMITTED key word; the CONVERTING phrase is supported.
  - Intrinsic functions - the following list of functions is now supported: COMBINED-DATETIME, FORMATTED-CURRENT-DATE, FORMATTED-DATE, FORMATTED-DATETIME, FORMATTED-TIME, INTEGER-OF-FORMATTED-DATE, SECONDS-PAST-MIDNIGHT, SECONDS-FROM-FORMATTED-DATE, TEST-FORMATTED-DATETIME, and UUID4.
  - The AMODE Compiler directive has been enhanced to allow COBOL programs full access to the 64-bit address space (AMODE"64"). This emulates the LP"64" option in Enterprise COBOL.
  - The DYNAMIC LENGTH clause, introduced in the last product release, is now supported in .NET COBOL (as well native COBOL).
- .NET COBOL enhancements:
  - When no explicit type is declared for a variable, but the value is a non-integer numeric (for example `declare var1 = 1.23`), it is assumed to be of type float-long.
  - The NAME OF expression has been introduced. It returns the unqualified name of the type or member specified.

## Code Analysis

[Back to Top](#)

The Application Analysis Server enables you to access either Micro Focus Enterprise Analyzer or COBOL Analyzer from the IDE. This release includes the following enhancements to this feature:

- A generate code search report and a single code search reports are available.
- An improved Get Direct References report.

Enhancements to the Analysis Services include:

- An enhanced Program Flow Graph
- Support for displaying the Data Flow analysis as a Graph.

Enhancements in the Rule-Based analysis include:

- The **Micro Focus Code Analysis** project's properties page, and the **Micro Focus Code Analysis Manager** dialog box now support subfolders in the rulesets.

## Compiler Directives

[Back to Top](#)

The following Compiler directive is new in this release:

- DISPLAY-PICU - defines the way PIC U data items are displayed: either as ANSI or UTF-8.

The following Compiler directive has been enhanced in this release:

- AMODE - a new parameter "64" stores pointers in 64-bit format - see *COBOL Language Enhancements* for more details.

## Data File Tools

[Back to Top](#)

The following enhancement has been made to the Data File Tools:

- The Data File Editor now supports opening and editing KSDS VSAM files stored in an MFDBFH datastore.

## Debugging Applications

[Back to Top](#)

This release includes the following enhancement:

- **Locals** window support for native COBOL - during debugging, the **Locals** window now displays the names of the variables available on the current statement.

## Enterprise Server

[Back to Top](#)

This release provides enhancements in the following areas:

- EZ Sockets now supports up to 4096 sockets on Linux, up from 1024, and enhanced tracing.
  - EZ Sockets applications, including ones that use the CICS listener CSKL (EZACIC02), can have more simultaneous connections.
  - EZ Sockets tracing now has options for logging the recent history only when any error or one of a set of particular errors occurs. This makes it easier to use tracing to diagnose EZ Sockets issues.
- Enterprise Server dataset management - dataset maximum retention period with the ability to alter and create reports:
  - ES\_JES\_ENFORCE\_EXPIRE\_DATE - helps determine whether or not to check the expiration date when deleting a catalogued dataset, and if expired, delete the dataset. If it hasn't expired and the PURGE option has not been specified, the dataset is not removed. The PURGE keyword is required to delete non-expired datasets. PURGE removes the underlying physical dataset file unless it is referenced by another catalog entry. SMS MANAGEMENTCLASS now supports maximum RETAIN days. See *Using SMS MGMT Classes* and the %SMS example command in the same topic.
  - ES\_JES\_LISTCAT\_YMD - helps determine the date format used in the HISTORY report generated when the IDCAMS LISTCAT command specifies the ALL option.
  - The EXPDT entry in a DD statement must be a four-digit year (YYYY); otherwise 1900 is the default, which is in-line with the mainframe processing, and prevents unexpired datasets from being erroneously removed (as was the case with the previous default of 2000). The ALTER command now takes the TO and FOR options to enable specification of the retention period for the entry being altered. The maximum retention period might be limited by the management class. The IDCAMS LISTCAT command ALL parameter now generates a separate HISTORY report that shows the creation date time and job, the last changed date time and Job, and the expiration date.
- HTTP compression - the Communications Server supports compressing large HTTP responses with gzip, and handles gzip-compressed HTTP requests. The Common Client supports gzip-compressed HTTP responses. Some large HTTP responses are compressed automatically if the client supports it. Large HTTP messages can be compressed, saving network bandwidth and improving performance.
- Task-cleanup performance - the performance of post-processing for tasks in MFCS has been improved.
- ICETOOL emulation - now supports the COUNT+*n* and COUNT-*n* syntax during trailer processing, where *n* is a numeric between 0-999. This adds to or subtracts from the COUNT value.
- Enterprise Server configuration - you can now change the recording directory of the dump, trace, HSF, and the `console.log` files of each region..
- Compression on ECI calls via CASBNCC Client - when using the Micro Focus External Call Interface (ECI) over TCP/IP, the request and response data flows are now compressed using RLE.

## Enterprise Server Common Web Administration (ESCWA)

[Back to Top](#)

This release includes the following enhancements:

- Oracle Coherence is now available as a PAC Scale-Out repository as an alternative to Redis.

- Reduced number of Redis instances required when a PAC incompatible upgrade is performed - it is now possible to have multiple PSORs in one REDIS instance. This allows for the REDIS instances provisioned in the PAC to be reused.
- Enhanced PAC diagnostics via CTF - a new option on the ES Control page is now available to enable or disable CTF for a running region without the need to recycle the region.
- ESCWA API, version 2 - includes updated versions of some of the existing API, version 1 endpoints, with improved JSON property names, more sensible URIs. The version 2 API is a single API standard across API endpoints. It includes a number of usability enhancements, has a better readability and discoverability, and includes an improved API documentation.
- Enterprise Server Configuration Manager
  - A variety of configuration options are available in ESCWA on the **General >Advanced** page for a region.
 

The property grid in ESCWA shows the full list of configurable properties, categorized by group, along with help text and some additional meta-information. Properties marked as dynamic in the property grid can also be updated in a running region.
  - A number of properties that were previously set with environment variables are now available in the ESCWA UI. The environment variables are still supported for backward compatibility.
- Accessibility enhancements - the ESCWA UI includes a number of improvements in the areas of usability with screenreaders, color contrast, and text and icon sizing and alignment. This is to give it an improved compliance with the 508 and WCAG 2.1 standards.

## Enterprise Server Security

[Back to Top](#)

This release includes the following enhancements:

- AWS Secrets Manager - support is available for using an AWS Secrets Manager, mfsecretsaws, as a remote vault.
- Protection for sensitive data - some sensitive data is now protected in the memory. This helps reduce the risk of exposing sensitive data such as passwords in core dumps and similar scenarios.
- An option to update short names - the ESF Update mechanism enables you to change between OS users ("long names") and ES userids ("short names") in running regions. This requires a non-default configuration setting.
- Caching improvements - ESF caching now caches more types of requests. This helps improve the Enterprise Server latency and throughput when external security is configured with caching.
- Support for Argon2 in password history - when Micro Focus passwords are used with the MLDAP ESM Module and password history is enabled, use Argon2 password verifiers in the history to avoid the potential exposure of passwords via weaker verifiers. This helps improve the security of the password-history mechanism.
- The product Help includes a new section, *Securing Enterprise Server*, which provides guidance on improving the security of Enterprise Server installations and the applications they host. This includes information on security and how to reduce security exposure.

## IMS Support

[Back to Top](#)

This release provides the following enhancement:

- The JES aliasing feature can be used with IMS DLI and BMP applications run from JCL.

## Micro Focus Unit Testing Framework

[Back to Top](#)

The following enhancement has been made to the Micro Focus Unit Testing Framework in the IDE:



- IDE support has been added for self-contained tests.

The following enhancement has been made to the command-line version of the Micro Focus Unit Testing Framework:

- You can now use the Micro Focus Unit Testing Framework to build and run test cases from within a .NET 6 environment. Install the NuGet package supplied with Visual COBOL to enable the mfunit extensions to the `dotnet` command line utility.

## OpenESQL

[Back to Top](#)

This release includes the following enhancement:

- The new SQL Error Mapping feature enables you to customize how error information is returned in SQLCODE, SQLSTATE, SQLERR and MFSQLMESSAGETEXT.

## Visual Studio

[Back to Top](#)

- Support is now available for Visual Studio 2022.
- Syntax coloring for COBOL in the editor had been improved for identification divisions, copybooks references using COPY... REPLACE statements, and EXEC blocks.

# What was New in Visual COBOL 7.0

## Features Added in Visual COBOL 7.0

Enhancements are available in the following areas:

- [Micro Focus COBOL Extension for Visual Studio Code](#) on page 25
- [.NET Core Support](#)
- [COBOL Language Enhancements](#)
- [Code Analysis](#)
- [Code Set Support](#)
- [Compiler Directives](#)
- [Containers Support](#)
- [Database Access - OpenESQL](#)
- [Data File Tools](#)
- [Enterprise Server](#)
- [Enterprise Server Common Web Administration](#)
- [Enterprise Server Security](#)
- [Library Routines](#)
- [Licensing Technologies](#)
- [Micro Focus Unit Testing Framework](#)
- [Visual Studio Integration](#)

## Micro Focus COBOL Extension for Visual Studio Code

[Back to Top](#)

The new Micro Focus COBOL extension for Visual Studio Code is available on the Microsoft Visual Studio Marketplace. This provides edit, compile and debug support for Visual COBOL and Enterprise Developer users in Visual Studio Code.



**Note:** The new Micro Focus COBOL extension is not included with the Visual COBOL installer.

## .NET Core Support

[Back to Top](#)

Support has been added for creating, building and running .NET Core projects using the `dotnet` command. This new support is in addition to the ability to work with .NET Core projects in the IDE.

## COBOL Language

[Back to Top](#)

The following enhancements have been made to the Micro Focus COBOL language:

- **.NET COBOL data type to hold strings of utf-8 characters** - support is now available in .NET COBOL for the PIC U data type. This was already available for native COBOL, to support its introduction by IBM in Enterprise COBOL version 6.3.
- The DYNAMIC LENGTH clause, which enables a data item to vary in length at run time, is supported for native COBOL code. Again, this is in response to its introduction by IBM in Enterprise COBOL version 6.3.
- The following date-format-checking intrinsic functions have been added: TEST-DATE-YYYYMMDD and TEST-DAY-YYYYDDD.

## Code Analysis

[Back to Top](#)

This release includes the following enhancements:

- **Get Direct References** command - you can use this command to see if changing a file will affect the other files in your project as well as the files in the whole application. In Visual Studio, you can access this command from the context menu for COBOL files in Solution Explorer or from the **Analysis Server** window.
- The Data Flow Analysis is now available in both a tree and a graph view.
- The Code Analysis functionality is now available for the Procedural Multi-Output Project (.NET Framework) type.

## Code Set Support

[Back to Top](#)

The following enhancements have been made to the integrated code set translation support:

- Arabic support for Enterprise Server applications is available.

If you are building Arabic support into Enterprise Server applications, your terminal emulator must support the Arabic EBCDIC 420 code page.

Support is added by building your applications and configuring your enterprise server regions with the MFCODESET variable set to the supported country code (0420). Your product's in-built code set translation utility performs translations between the ASCII 1256 Arabic code page on your enterprise server region, and a terminal emulator that supports the Arabic EBCDIC 420 code page (for example, IBM's Personal Communications emulator).

There are some considerations when working with a bi-directional language such as Arabic; these are discussed in *Arabic support considerations*.

## Compiler Directives

[Back to Top](#)

The following Compiler directives are new in this release:

- **PANVALET-INCLUDES-IN-COMMENTS** - This directive controls whether `++INCLUDE` statements in comments are actioned or not.
- **EXECSQL-FLAG** - This directive defines whether syntax reporting should emulate that of the DB2 preprocessor, the DB2 coprocessor, or to allow all syntax variations of both.
- **RM-FILE-ERRORS** - This directive generates run-time system errors for certain file conditions, even when a `FILE STATUS` clause is present; this is to emulate RM/COBOL behavior.

The following Compiler directive option has been deprecated:

- **ILCLR(2)** - this is as a result of deprecating support for versions 3.0 and 3.5 of the .NET Framework. Applications that have this option set will produce an E level message when compiled in this release of Visual COBOL.

## Containers Support

[Back to Top](#)

Support for containers in Visual Studio has the following enhancements:

- You can now add a Dockerfile to native Micro Focus Unit Testing projects in Visual Studio and run the tests in a container.
- Projects with Docker support now include an additional **Containers** property page. From it you can:
  - Specify any build, debug and run arguments for the image that will override the arguments specified in the project's dockerfile.
  - See all command-line arguments that will be applied when you build the image.
  - See the arguments that will apply when you run the container, or debug an application running in a container.
- The **Add COBOL Docker Support** dialog box now shows all available images, and supports images provided with a Patch Update release of this product suite.

The versions of the **Runtime Image** and the **Built Tools Image** must match therefore the dialog box only shows the **Built Tools Image** that match the one for the runtime. For example, if you use a Patch Update 1 Build Tools image, the dialog box only shows the relevant Patch Update 1 Runtime image.

The dialog box shows only the images that match the major release version (or a Patch Update of it) of your installed product. They must target the same platform (x64 or x86) as well. If you want to specify images from different major product versions, you need to edit the Dockerfile manually.

## Database Access - OpenESQL

[Back to Top](#)

This release provides the following enhancement:

- New OpenESQL `TRACELEVEL=5` option - native OpenESQL applications can now trace ODBC calls to the database vendor's ODBC driver, recording the start and stop times of each call's execution. OpenESQL tracing can now provide more detail on where an SQL application is spending execution time, in the OpenESQL layer or the underlying ODBC driver layer.

## Data File Tools

[Back to Top](#)

This release includes the following enhancements in the Data File Editor:

- **New Data Explorer for working with data sets** - a new Data Explorer enables you to connect to either an ESCWA service or directly to an enterprise server region to access a catalog when working with data sets in the editor.

- **Multiple record selection**- you can select multiple records and, where appropriate, can perform certain actions on more than one record at once.
- **Cut, copy, and paste functionality** - traditional cut, copy, and paste functionality (including the standard Ctrl+X, Ctrl+C, and Ctrl+V shortcuts) is now available throughout the editor.
- **New filter creation** - a new process for creating filters has been introduced. A filter consists of one or more sets of conditions, and the resulting filter can include or exclude those records selected. The previous filter process is still available, but has been marked as deprecated.
- **Remote filtering** - functionality has gone into Fileshare Server which allows filtering to occur server side when opening data sets on remote enterprise server regions. The filter process results in only those filtered records being downloaded to the data file editor client.
- **Find/replace functionality** - you can search records in a data file to identify specific strings, and then if required, replace them.

## Enterprise Server

[Back to Top](#)

This release includes the following enhancements:

- Multiple Network Interface support - there is improved support for multiple network interfaces in some components, including better awareness of network interfaces and control over networking. This is a partial implementation and will be enhanced in future releases.
- Extended IPv6 support - support is available in Micro Focus Directory Server (MFDS) and in the Micro Focus Communications Server (MFCS) listener for multiple IPv6 addresses.

In release 6.0, you could only configure MFDS and MFCS listeners to listen on a single IPv6 address. In release 7.0, by default, MFDS and MFCS now listen on all configured IPv4 and IPv6 addresses, and can also be configured to listen on a combination of specific addresses.

- HTTP improvements:
  - Additional security measures for HTTP, such as security-related headers.
  - Chunking support for large HTTP messages makes it possible to retrieve very large files from Enterprise Server regions.
- Application Diagnostic Reporting for Enterprise Server - Application diagnostic reporting collects and packages a number of reports, trace, and log files into a single report file. See *Application Diagnostic Reporting for Enterprise Server* for more information.
- Enterprise Server now supports automatic reconnection to the standby Queue manager in an Multi-Instance Queue Manager. See *Reconnecting to an MQ Server in a Multi-instance Queue Manager* and *Enterprise Server XA Reconnect* for more information.
- The casmgr process has been optimized to improve the use of initiators when dispatching jobs across a PAC. In addition, improvements have been made to the way it manages the queue of jobs waiting to be dispatched.
- Information has been added describing the best practice and the recommended approach you should adopt when performing a Patch Update to your PAC environment. See *Performing a Product Upgrade to a PAC Environment* for more information.
- New operating modes , *upgrade* and *quiesce*, have been introduced for Performance and Availability Clusters (PACs). These operating modes can be used to facilitate the installation of product updates that introduce incompatibilities between PSOR data structures. You can check for incompatibilities using the new caspac utility option CheckCompat. An upgrade mode can be set when starting the first enterprise server region in a new PAC using the new casstart utility *start-type* option *u*. This upgrade mode will prevent participating enterprise server regions from processing batch workloads as part of its normal operation, and any EXEC CICS START requests will be rejected. See *casstart* and *caspac* in your product Help for more information.

When enough enterprise server regions have been switched over to the new PAC, the old PAC can be set to operate in the quiesce mode. This prevents further batch workload and EXEC CICS START from being processed.

The new PAC can now be switched to running mode so that batch workload and EXEC CICS START are enabled for processing again.



**Note:** Before setting the new PAC mode to running, you must switch enough enterprise server regions to the new PAC to enable it to service the expected workload.

## Enterprise Server Common Web Administration (ESCWA)

[Back to Top](#)

This release offers the following improvements:

- MFDS User Interface functionality replacement - ESCWA now replaces the MFDS inside the IDE as the engine that provides access to and management of regions. ESCWA provides all the functionality that was previously available from MFDS. This release includes the following enhancements:
  - Delete all regions.
  - Session list.
  - Renew listening addresses.
- ESMAC User Interface functionality replacement - the following ESMAC features have been implemented in ESCWA:
  - Resource Filtering. See *CICS Resources* for more information.
  - Millisecond support. See *Threshold, Monitor, and Active PCT* for more information.
  - Control the scope for all changes to timeouts, trace flags, and memory strategy when applied to regions in a PAC. See *ES Control* for more information.
  - Enable Application Diagnostic reporting. See *ES Control* and *Application Diagnostic Reporting for Enterprise Server* for more information.
  - Submission of local jobs from the JES Control page when CASRDO44\_NEWSUB=OFF has been specified. See *JES Control* for more information.
  - View and reply to pending ACCEPT FROM CONSOLE statements. See *Pending Replies* for more information.
  - The messages after a JCL job has been submitted are now correctly JSON formatted. This page now works in ESCWA when MFJUXIT is enabled.
- Import, export, and copy regions - you can now use the UI to export and import regions in various formats, including use JSON. You can:
  - Copy regions between Directory Servers
  - Import and export regions in JSON, XML or in the .dat legacy format. The legacy format can be converted to a modern format.
- Mainframe Access (MFA) administration - ESCWA provides a modern Web UI and does not require you to use a separate terminal application. Features include:
  - Log in or off from MFA.
  - Change your MFA password.
  - View MFA server tasks.
  - Retrieve the XDBOUT log (Web UI).
  - Retrieve the JES spool files by DD Name (API).
  - Set the MFA and JES tracing level.
  - View the active MFA users.
  - Invalidate active user sessions.
  - View mainframe/MFA statistics.

See *Mainframe* in the Enterprise Server Common Web Administration chapter for more information.

The MFA API library has been exposed to enable you to test and use the requests that are provided. See *MFA Interactive API Library* for more information.

- Scale-Out and PAC administration - you can now:

- Monitor Redis Sentinel and Cluster instances when used for Scale-Out Repositories.
- Specify that all changes to timeouts, trace flags, and memory strategy can be applied to one of three options:

Only the local region.

All members of a PAC except the regions where local changes have been made.

All members of a PAC.

You can configure this in ESCWA with the **Apply Scope** field on the ES CONTROL page.

Alternatively, you can use the `casutl` utility with the `/w` option. See `casutl` for more information.

- Multi-Network Interface Card support - ESCWA now enables you to configure Communications Servers and Listeners to listen on multiple IPv4 and IPv6 addresses. Previously, they were limited to listen on either all IPv4 addresses, or a single IPv4 or IPv6 address. Now a combination of any of the following can be used:
  - One or more specific IPv4 addresses.
  - One or more specific IPv6 addresses.
  - All IPv4 addresses.
  - All IPv6 addresses.
- A new filter field **resFilter** has been added to the following ESCWA and ESMAC resource listing modules:

Every resource in By Type

Every resource in By Start L

Resource lists under Groups

Every active resource type except Locks

This parameter will filter the list of resources displayed by ESCWA and ESMAC. In addition, a new environment variable `ES_RDO_MAX_RESOURCES` has been added that enables you to specify a limit to the number of records displayed. For JSON requests, the list being truncated is indicated by the addition of the JSON property "truncated": true.

## Enterprise Server Security

[Back to Top](#)

This release includes the following enhancements:

- MLDAP ESM caching - the MLDAP ESM Module now implements LDAP search-result caching. This is controlled by the existing Security Manager cache settings, so that many installations will have this activated automatically. See the product Help for details.
- Vault Hashicorp support - support is available for using a Hashicorp KV2 vault server as a local or remote vault.

## Library Routines

[Back to Top](#)

The following library routines are new:

- `CBL_GET_ERROR_INFO` - enables error processing routines to establish the location of the error that occurred to cause the error processing routine to execute. This is available on a restricted range of platforms.

## Licensing

[Back to Top](#)

## AutoPass licensing technology

In this release, Micro Focus brings in the power of the in-house Micro Focus AutoPass licensing technology alongside Sentinel RMS. AutoPass has the following additional benefits compared to Sentinel RMS:

- Usage logging which enables you to monitor the product usage. You need to install the AutoPass License Server in order to do this.
- Ongoing support for all platforms that this product is available for.

Features include:

- Installing this release installs both the AutoPass Daemon and the Sentinel RMS License Manager. Both of them are available in the Micro Focus License Administration tool.
- You can have both AutoPass and Sentinel RMS licenses installed on the same machine. Optionally, you can switch off the licensing technology you do not use.
- If you are an existing user of a Visual COBOL or an Enterprise Developer product, you only need an AutoPass license if you want to utilize usage logging or if you want to use your product on a platform on which Sentinel RMS is not supported.
- If you are a new user of the Micro Focus COBOL products, you will normally be issued an AutoPass license.
- Micro Focus will continue to provide Sentinel RMS in future releases of this product.
- AutoPass licenses should be installed into the existing Micro Focus License Administration tool, and not in the AutoPass License Server.



**Important:** The SafeNet Sentinel licensing system has been deprecated and will be not available in this product starting with the next major release after release 9.0.

The SafeNet Sentinel licenses will not be supported after release 9.0 and you need to use AutoPass licenses if you use these releases.

You can replace your SafeNet Sentinel licenses with AutoPass licenses starting with release 8.0. Contact Micro Focus Customer Care for further information.

## Installing licenses at the command line

On Windows, Micro Focus License Administration is now also available as a command-line utility.

For more about AutoPass and usage logging, and about Micro Focus License Administration, see *Managing Licenses*.

## The Micro Focus Unit Testing Framework

[Back to Top](#)

The following enhancements have been made to the Micro Focus Unit Testing Framework:

- The MFUPP preprocessor has been introduced to provide a seam between your program and a unit test. This seam lets you access the internals of a program under test, allowing you to create granular unit tests from paragraphs or sections. The MFUPP preprocessor also provides the ability to mock programs or stub programs out to create a unit test.

## Visual Studio Integration

[Back to Top](#)

This release includes enhancements in the following areas:

### Editor:

- **Code cleanup** - Visual Studio now supports a variety of code cleanup options for COBOL which you can apply during formatting. These enable you to update any existing code, or enforce rules for new code for specific keywords or operators.

- **EditorConfig file support** - you can now create `.editorconfig` files with the code style settings in the IDE, and share the file within your organization to ensure consistency of the code.

## What was New in Visual COBOL 6.0

### Features Added in Visual COBOL 6.0

Enhancements are available in the following areas:

- [.NET Core](#)
- [COBOL Application Console Size](#)
- [COBOL Language Enhancements](#)
- [Code Analysis](#)
- [Code Analyzer Refactoring](#)
- [Compiler Directives](#)
- [Containers](#)
- [Database Access - DB2 ECM](#)
- [Database Access - OpenESQL](#)
- [Database Access - XA Switch Modules](#)
- [Data File Tools](#)
- [Debugging](#)
- [Enterprise Server](#)
- [Enterprise Server Security](#)
- [Enterprise Server Common Web Administration](#)
- [File Handling](#)
- [Interface Mapping Toolkit](#)
- [Library Routines](#)
- [Micro Focus Unit Testing Framework](#)
- [Microsoft Build Tools and Windows SDK Configuration Utility](#)
- [Multi-Threaded Applications](#)
- [Visual Studio Integration](#)

#### **.NET Core**

[Back to Top](#)

Support has been added for .NET Core 3.1, and a number of new .NET Core project templates have been added.



**Note:** Because Visual COBOL requires .NET version 6 and .NET version 6 is not supported by Visual Studio 2017 and Visual Studio 2019, you must be using Visual Studio 2022 or later to be able to use Visual COBOL to create COBOL applications to be deployed for use with .NET.

#### **COBOL Application Console Size**

[Back to Top](#)

The maximum console size of a COBOL application has increased. It can now be 255 lines by 255 columns, configurable using the `screen_lines` and `screen_cols` run-time tunables.

#### **COBOL Language Enhancements**

[Back to Top](#)

The following enhancements are available:



- **Enterprise COBOL 6.2 Update** - new syntax, library routines, and the respective analysis tooling are available for compatibility with IBM's Enterprise COBOL 6.2 Update:
  - New intrinsic functions are supported: BIT-OF, BIT-TO-CHAR, BYTE-LENGTH, HEX-OF, HEX-TO-CHAR, NUMVAL-F, TEST-NUMVAL, TEST-NUMVAL-C, TEST-NUMVAL-F, and TRIM
  - A number of intrinsic functions now support national data (especially surrogate pairs): REVERSE, ULENGTH, UPOS, USUBSTR, USUPPLEMENTARY, UVALID, and UWIDTH.
  - A LOC phrase has been added to the ALLOCATE statement to define whether memory is allocated above or below the 16MB line.
- **CONSTANT qualifier** - it is now possible to define data items as constants. This improves the code readability and usability, and helps detect programming errors. The ability to create constant items is already in .NET COBOL and JVM COBOL, and many other languages.
- **Local variable declarations in native COBOL** - it is now possible to declare data items inline in the code and not only in a separate DATA DIVISION. This provides better locality of data, making the source code easier to reason about.
- **Native data type to hold strings of utf-8 characters** - in native COBOL, support is now available for the PIC U data type as introduced by IBM in Enterprise COBOL version 6.3. Direct support is available for utf-8 data.
- **Performance improvements** - this release provides various performance improvements, most significantly on 32-bit Intel x86 platforms. When using the highest optimization level, opt(4), the performance of native code generated by the COBOL Compiler has improved. A number of cases are affected, most particularly those where it is beneficial to locate PERFORM ranges inline.

## Code Analysis

[Back to Top](#)

Support is provided in Visual COBOL for accessing the Application Analysis Server which is part of the Micro Focus Enterprise Analyzer and Micro Focus COBOL Analyzer products.

If you have one of these products installed, you can connect to the Application Analysis Server from Server Explorer and access the Enterprise Analyzer web client. Enterprise Analyzer web client provides quick searches for repository objects, detailed code searches, diagrams, reports, and data item impact analysis and other features such as viewing and editing of business rules (separate license required).

## Code Analyzer Refactoring

[Back to Top](#)

Support is now available for extracting program logic from COBOL code and moving it to a new program. The following commands are available from the editor context menu:

- Create program from Section
- Create program from Computation
- Create program from Condition

## Compiler Directives

[Back to Top](#)

The following Compiler directives are new in this release:

- DISPLAY-AT - specifies a default foreground and background color for DISPLAY AT and ACCEPT AT statements that do not specify any color attributes.
- DPC-IN-DATA - controls whether the DECIMAL-POINT IS COMMA clause (if specified) is applied to the output from the XML GENERATE and JSON GENERATE statements.
- ILCONDITIONPARAM - switched on by default. Enables the support for conditional expressions as method parameters.



**Important:** Applications that use the old COBOL syntax for specifying named parameters as custom-attributes will not compile with the `ILCONDITIONPARAM` specified. This can result in any older applications failing to compile in the current version of the product. See `ILCONDITIONPARAM` in your product Help for details about how to work around this issue.

The following Compiler directives have new options:

- `CHECKREFMOD` - now takes an additional parameter (`NOZEROLENGTH`), which acts as `CHECKREFMOD`, but does not permit reference modifier lengths of zero.
- `PROTOTYPE` - now supports options that specify whether prototypes are required, and the severity of error messages issued for prototype mismatches.

## Containers

[Back to Top](#)

Support has been added to enable you to work with containers from the IDE. In particular you can now create a Dockerfile for a COBOL project, and build, debug and run a COBOL project in a container, all from the IDE.

## Database Access - DB2 ECM

[Back to Top](#)

Support for the following has been added to this release:

- Multi-row fetch (MRF) and insert (MRI) statements with or without the `FOR ROWS` clause
- Array update and delete statements



### Notes:

- These new features are supported for DB2 LUW version 11.1 Mod 4 Fix Pack or newer. Currently, IBM does not support either of these features with DB2 LUW 11.5.
- For coding examples, see the IBM DB2 LUW documentation: [Embedded SQL/COBOL Support for MRI and MRF](#).

## Database Access - OpenESQL

[Back to Top](#)

Support for the following has been added to this release:

- .NET Core 3.1 with the COBOL .NET Core project templates "Console Application" and "Class Library" using OpenESQL directive `DBMAN=ADO`.

## Database Access - XA Switch Modules

[Back to Top](#)



**Restriction:** This feature applies only when the Enterprise Server feature is enabled.

Support for the following has been added to this release:

- XA switch modules have been enhanced to enable storage of sensitive information in the Micro Focus Vault Facility. This new functionality includes a customizable program, `ESXAEXTCFG.CBL`, you can use to obfuscate xa-open strings by storing them as secrets.

## Data File Tools

[Back to Top](#)

The following enhancements have been made to the Data File Editor:

- Double-byte character sets are now supported within the editor.
- Insert mode is now available when editing a formatted record, except for numeric fields.
- When editing DBCS data in EBCDIC files, the required Shift-out and Shift-in characters are automatically added when editing a formatted record and you are editing in Insert mode.
- You can now load and unload structure files for an open data file.
- A ruler at the top of the editing pane can be toggled on/off.

## Debugging

[Back to Top](#)

The following enhancements are available:

- **Debug profiles** - COBOL projects now support debug profiles, a feature of Visual Studio, where a debug profile stores a set of properties which specify how to start debugging the application. You can create and manage multiple debug profiles available on the **Debug** tab in the project's properties.
- **Expressions** - you can now specify complex expressions in the **Watch** window. The supported expressions are: normal numeric arithmetic expression with intrinsic functions and the single use of alphanumeric intrinsic functions. See *Watch Window* for details.

## Enterprise Server

[Back to Top](#)

The following enhancements are available:

- **IPv6 support (EAP)** - This feature is in Early Adopter Program (EAP) release status. Some Enterprise Server components and features now support Internet Protocol version 6 (IPv6) network addressing and connectivity. Due to limitations with IPv4, IPv6 is becoming more common within corporate networks and on the public Internet. In some cases, the use of IPv6 can improve interoperability and simplify network configuration.
- **Administrative Commands** - the `add` command in `cascertreg` now contains new options (`-cwi` setting, `-dcas` setting, `-issuer`, and `-subject`).

## Enterprise Server Security

[Back to Top](#)

This release provides the following enhancements:

- **Micro Focus Secrets file storage permissions**

The Micro Focus Secrets feature (also known as the Vault feature) provides centralized storage for sensitive information such as passwords, with some protection against accidental disclosure or discovery by unauthorized users. Prior to this release, the only supported storage mechanism was a conventional file containing encrypted data. In this release, the permissions on the storage file and on the Secrets configuration file are set more restrictively to help protect the secrets.

- **Certificate wildcard support**

The X.509 digital certificates used to identify servers when making TLS (SSL) connections permit the use of fully-qualified domain names with wildcards for some parts of the name. This enables administrators to use a single certificate issued to, for example, `*.mycorp.com` for any number of servers with fully-qualified names like `www.mycorp.com`, `server1.mycorp.com`, and so on. These wildcard-bearing certificates are now supported by client programs using Micro Focus communication technology when validating a server's certificate.

- **Improved ACL wildcard support**

In the Access Control Lists used for resource access control with LDAP-based security in Enterprise Server, the `".**"` wildcard sequence now behaves more similarly to mainframe RACF. A number of additional options for wildcard processing are also available.

- **PKIX compliance for TLS certificate validation**

The standard for using X.509 digital certificates to authenticate servers when making TLS (SSL) connections is known as PKIX, for Public Key Infrastructure (X.509). It is defined by a series of IETF RFC documents, currently RFC 5280 and others. In previous releases, the certificate validation performed by this product did not conform to PKIX in a number of ways, most notably in using DNS address-to-name resolution in an attempt to match a certificate to a host. With this release, clients using Micro Focus Common Client technology, such as COBOL web service proxy programs, CAS utility programs, and customer applications that use the CICS Web Services Interface feature, will by default, use stricter procedures for validating certificates which more closely conform to PKIX. This improves TLS security and interoperability.

- **Security improvements for XML parsing**

In this release the third-party components used for parsing XML data have been updated, or have had bug fixes integrated into the version used by Micro Focus, to address published security vulnerabilities. Also, XML external-entity support has been disabled except where it is required by a particular product feature; this prevents XML External Entity (XXE) attacks on customer systems by attackers who can trick a customer application into parsing a malicious XML document.

## Enterprise Server Common Web Administration (ESCWA)

[Back to Top](#)

This release offers the following new features and improvements:

- **MFDS User Interface functionality replacement** - ESCWA can now communicate with remote MFDS instances, and displays the equivalent pages of MFDS. Configuring regions, and their IMS, PL/I, MQ, and XA options, and security, is now available.
- **ESMAC User Interface functionality replacement** - ESCWA can communicate with remote ESMAC instances, and can replicate functionality and display all the information provided by ESMAC.
- **Configurable User Interface access** - you can now configure the ESCWA security manager to control user and group access to certain aspects of the user interface, such as, native, and security menu items.
- **Usability improvements**
  - Starting and stopping regions from the navigation tree.
  - The native menu items are not displayed if the region features are not configured correctly.
  - Configuration of the display colors for MFDS hosts and regions to distinguish them with ease.
- **Scale-Out support** - ESCWA has improved the way it displays a Scale-Out Repositories (SORs) association with its PAC and member regions.
- **Redis support** - Redis is supported as a SOR when running this product in a PAC. Features include:
  - Redis cluster support
  - A Mfredis configuration file - enables you to configure reconnection when any network errors occurs. You can also use the file to configure Lua scripts tracing on servers.
  - Authentication support for the standalone Redis server.

## File Handling

[Back to Top](#)

Fileshare password files can now be stored in the Vault Facility, ensuring that sensitive user credentials are encrypted. Firstly, create the password file in the usual way, and then upload it, with a path of `microfocus/fh`, using the `mfsecretsadmin` utility.

To ensure the Fileshare server uses the file stored in the vault, start the server with the `/uv` option.

## Interface Mapping Toolkit

[Back to Top](#)

Improvements are available in the following areas:

- **Resource-based REST APIs** - the following enhancements enable the creation of resource-based REST APIs:
  - Operations in JSON RESTful Web services can now have a customizable URI path that identifies a resource. Operation paths have support for dynamic templating.
  - API resources can now be automatically identified from COBOL groups in a COBOL program, and a set of operations can be generated for each API resource.
  - It is now possible to specify the location of interface fields in the service request or response. An interface field can either be a parameter in the URI path, a query parameter, or be in the JSON message body.
- **Summary support for OpenAPI** - the IMTK now supports the OpenAPI Specification (originally called Swagger) which is the most widely-accepted format for REST API specifications. Features include:
  - Consumption of OpenAPI 3.0 and Swagger 2.0 files for purposes of client and service generation.
  - Generation of OpenAPI 3.0 files to describe the APIs of a JSON RESTful Web service.
- **REST service output filtering and field selection** - Enterprise Server JSON RESTful Web services now include the following features:
  - Automatic filtering of the JSON response body of a Web service by path and query parameters received in the request URI.
  - A special query parameter "\$fields" that can be used to indicate that the JSON response body is to contain only certain specified fields, and to exclude all other fields.
- **REST API discovery** - Enterprise Server API discovery is now supported. For a JSON RESTful Web service, a list of all its available operations, and their URI paths, can be retrieved. This enables a client to efficiently navigate an Enterprise Server REST Web service without having information about the service's operations ahead of time.

## Library Routines

[Back to Top](#)

The following library routines are new:

- **MFU\_GET\_FILE** and **MFUGETF** - both these routines are used with data-driven tests in the Micro Focus Unit Testing Framework. If the `.csv` file under test references external data in one of its cells (using the `@file-name` notation), use either of these routines to load that external file into memory before such tests are run.

The following library routine contains new functionality:

- **CBL\_GET\_EXIT\_INFO** - this library routine has been enhanced to better detect the circumstances in which an exit procedure has been invoked.

## The Micro Focus Unit Testing Framework

[Back to Top](#)

The following enhancements have been made to the Micro Focus Unit Testing Framework:

- You can now run unit tests against an executable file from the command line. Before you run such tests from the command line, you must initially rebuild the executable in order to link it into the testing framework.
- You can now produce a report file that can be opened and viewed in Microsoft Visual Studio. Use the `-report:trx` command line option to generate a `.trx` file.
- The `.csv` source files used in data-driven tests can now reference external data: use the `@file-name` notation in a cell to use the contents of `file-name` in the tests. The external source files must be loaded into memory, using the `MFU_GET_FILE` or `MFUGETF` library routines, before the tests are run.

- Two new elements are available for data-driven tests: a data-driven setup and a data-driven teardown. Conventional setup and teardown entry points would run multiple times during a data-driven test; these two entry points run only once per test run.

## The Microsoft Build Tools and Windows SDK Configuration Utility

[Back to Top](#)

On Windows, the Visual COBOL setup file now installs the Microsoft Build Tools and the Windows SDK packages, as these are dependencies for a number of features and operations of the product.

You can use the Microsoft Build Tools and Windows SDK configuration utility to view the package versions in use in your COBOL environment. You can also use this utility to set the environment to use other versions of these packages that you have installed.

## Multi-Threaded Applications

[Back to Top](#)

This release includes the following improvements:

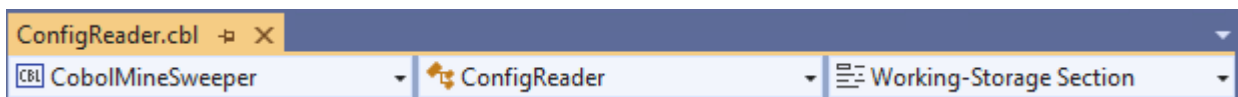
- Thread local storage optimizations - the thread termination in applications with many threads has been optimized.

## Visual Studio Integration

[Back to Top](#)

The following enhancements are available:

- Support for the Visual Studio CodeLens feature (Visual Studio 2019 and later only) - CodeLens is a clickable visual adornment (🔍, 🟢) above entry points or number of references above class, section, or paragraph names.  
In Run Units, CodeLens provides the number of entry points, and also enables you to run and debug directly from the editor.
- New formatting options - you can now specify different indents for the parent and child items in group item data in **Tools > Options > Text Editor > Micro Focus COBOL > Formatting > Data Division**.
- Tooltips for END delimiters - tooltips are available for END delimiters such as end-if, end-perform, or end-of-statement period. The tooltips show the opening statements.
- Code style preferences - a new category of preferences, **Tools > Options > Text editor > Micro Focus COBOL > Code Style**, combines all Visual Studio preferences for the format and style of your COBOL code.
- Lightbulbs - quick actions are available for inserting an end-of-scope terminator (such as END-IF), and for extracting sections to new programs.
- Snippets - a new snippet for indexers is available.
- Editor navigation bar - now shows the project that includes the file opened in the editor:



- Uppercase mode in the COBOL editor - to toggle uppercase mode, click **aa** (**Force upper case in the editor**) in the COBOL toolbar, or enable it from **Tools > Options > Text Editor > Micro Focus COBOL > Text Casing**. With this option enabled, code you insert or paste in the editor, including snippets, is forced to upper case. This functionality must not be used with .NET COBOL.
- QuickInfo - information in the QuickInfo details is now colorized.
- Copybook properties - the **Properties** window now displays the full path for copybooks that are stored outside of the project.

# Features Added in Visual COBOL 5.0

Visual COBOL 5.0 provided enhancements in the following areas:

- [COBOL Formatting](#)
- [Code Analysis](#)
- [Enterprise Server Common Web Administration](#)
- [COBOL Language Enhancements](#)
- [Compiler Directives](#)
- [Consolidated Trace Facility](#)
- [Data File Tools](#)
- [Database Access](#)
- [Database Connectors](#)
- [Debugging](#)
- [Enterprise Server Security](#)
- [Micro Focus Unit Testing Framework](#)
- [Platform Support](#)
- [Product Documentation](#)
- [Visual Studio Integration](#)

## COBOL Formatting

[Back to Top](#)

You can now reformat your COBOL code in the editor according to your preference and standards. Formatting sets the indentation based on the configuration options which you can set in **Tools > Options > Text Editor > Micro Focus COBOL > Formatting > Indentation** (for Visual Studio).

You can find the COBOL formatting features on the **Edit > Advanced** menu (for Visual Studio) menu.

## Code Analysis

[Back to Top](#)

You can now create the following views for your code:

- Program Flow Graph - enables you to view the overall structure of the COBOL program with nodes representing sections and paragraphs. PERFORM statements between them which affect the program flow are represented by links joining the nodes. External calls to other programs are shown but cannot be expanded in the Program Flow Graph view. Hovering over the nodes shows a tooltip containing the code representing the respective sections or paragraph. Clicking a node or a link joining said nodes positions the code editor to that point in the source, allowing quick and easy navigation of the program.
- Data Flow Analysis Tree - enables you to select a data item and then either statically trace what might change its value or what other data items it might affect.

## Enterprise Server Common Web Administration

[Back to Top](#)



**Note:** This feature is in Early Adopter Program (EAP) release status.

Visual COBOL now includes a new Enterprise Server Common Web Administration interface (ESCWA). ESCWA is a web user interface and server for modern administration, monitoring and control of Enterprise Server. It offers improved usability that consolidates the different Enterprise Server user interfaces so that native and managed regions, and security stores can be managed in one place. Features include:

- Administering directory servers across multiple hosts.
- Monitoring and control of Enterprise Server instances.
- Configuring and administering a security store, defined in an LDAP-compatible security manager such as Microsoft Active Directory or OpenLDAP.
- Administering the Scale-Out features - enable you to specify logical groups of Enterprise Server instances, and configure and run Performance Availability Clusters (PACs) and their related Scale-Out Repositories (SORs).
- Administering, monitoring and control of Enterprise Server for .NET regions and listeners.
- The use of current web frameworks that have a greater focus on security.
- (Included with 5.0 Patch Update 2 ) - support for Enterprise Server XA, MQ and PL/I configuration and monitoring. This includes support for XA resources, configuring MQ, Listeners and Writers, PL/I, MFCS console, Region Trace options, displaying the current ESMs on logon page and Local/loopback connections warning changes.

## COBOL Language Enhancements

[Back to Top](#)

The following enhancements have been made to the COBOL syntax:

- ISO2002 conditional compilation - an additional mechanism for conditional compilation, the ISO2002 Conditional Compilation method, is now available. This has been implemented as part of the support for Enterprise COBOL 6.2.

The following compiler directing statements are supported:

```
>>DEFINE
```

```
>>IF/>>ELSE/>>END-IF
```

```
>>EVALUATE/>>WHEN/>>WHEN OTHER/>>END-EVALUATE
```

- The JSON PARSE statement enables you to convert JSON text into COBOL data formats. This has been implemented as part of the support for Enterprise COBOL 6.2.
- Async and await syntax (.NET COBOL only) - support is available for asynchronous programming in .NET COBOL using the async and await syntax.
- INSPECT statement - the performance of INSPECT... CONVERTING has been improved, particularly for cases where `source-alphabet` is long.
- Support has been added for the portable syntax for SET - `set[string]`.

## Compiler Directives

[Back to Top](#)

The following Compiler directives are new in this release:

**ILNORMALIZENAMES** Determines the program elements that are normalized when a program is compiled to .NET or JVM COBOL. Normalization in this context results in replacing all \$ and - (hyphen) characters with \_ (underscore) characters in the name of the generated class file.

## Consolidated Trace Facility (CTF)

[Back to Top](#)

This release provides the following enhancements:

- Dynamic CTF - it is now possible to configure the CTF dynamically from outside the process being traced.

Using a new command line utility - `cb1ctd` - you can alter the tracing events of running applications that already have CTF tracing enabled. You can alter trace levels, add or remove components to or from the trace, and also configure the emitters in effect.



Additionally, there is also a new component that you can trace - mf.mfdbfh enables you to trace activity of the Micro Focus Native Database File Handler.

## Data File Tools

[Back to Top](#)

This release provides the following enhancements:

- The Data File Editor now includes a Compare Files tool that enables you to compare the contents of two data files side-by-side.
- Structure files, and the layouts within them, can now be created within the Data File Editor; you no longer need to use the Classic Data File Tools utility to manage your layouts.
- When connecting to a VSAM dataset stored in an enterprise server region, you can store any passwords required for access, for the duration of your current session.
- You can view archived JES spool jobs that have been merged into one spool file using the merging archived spool files process.
- You can now quickly duplicate records in non-indexed files, using the Duplicate Record option.

## Database Access

[Back to Top](#)

Enhancements are available in the following areas:

### OpenESQL ADO.NET Connection Editor Toolbar

- A new "i" (information) button is available that provides all the details of any installed .NET provider. Provides additional information mitigating resource definition and use within the ADO.NET Connection editor
- Static XA switch modules "Reconnect" - At the beginning of a global transaction, the XA switch will attempt to reconnect temporarily broken connections to the database. If there is a temporary disconnect to the database, there is no need to manually re-enable the XA switch to run transactions.

## Database Connectors

[Back to Top](#)

You can now create an identity column in your database by using a new XFD directive - IDENTITY\_COLUMN. This must be specified on a numeric field.

## Debugging

[Back to Top](#)

This release includes the following enhancements:

- COBOL Visualizer - a new window in Visual Studio enables you to view and edit a data item during debugging in either text or HEX forms. You invoke the window from the DataTip for the data item.
- Conditional watchpoints - you can now specify conditions and hit counts for COBOL watchpoints. A condition can be in the form of an expression or it can be a hit count (for the number of times memory associated with a data item has been updated). The condition is evaluated each time the data item being watched changes. If the condition evaluates to true, then program execution stops. This enables more fine-tuning of the current watchpoint support and is useful when debugging large, complex programs.
- Dynamic core dumps - you can now invoke a core dump programmatically and continue execution of your program. A new library routine, CBL\_CREATE\_CORE, enables you to produce a core file for the current process or a process owned by the same user that owns the current process.

- Improved visibility of the PERFORM stack - the PERFORM stack and PERFORM range names are visible in system debuggers such as gdb in many cases on 32-bit Linux with Intel architecture and Solaris with Intel architecture. This was already the case on AIX, 64-bit Solaris-Intel, and all other Linux platforms (including 64-bit Linux-Intel).
- In order to include source line numbers in run-time error messages, which makes the diagnosis of issues in your program easier, the COBOL compiler now produces `.idy` files by default when building from the command line, unless the NOANIM directive is specified. You can safely remove `.idy` files after compilation if you do not need them; they do not need to be distributed with your application unless you want to debug your code. However, unless you specify the ANIM directive, generated executables such as `.dll` and `.gnt` will not be debuggable, which is consistent with prior behavior.



**Note:** Behavior has not changed if you are using an IDE or build scripts generated by an IDE.

## Enterprise Server Security

[Back to Top](#)

This release includes the following enhancements:

- Security - security features can now be employed when developers and administrators install new COBOL services (web services and EJBs) into an enterprise server instance over the network. There are a number of authentication and authorization options that can be enabled. See *Deployment Listeners* and *The .mfdeploy File*.
- Vault Facility - a new security feature has been added that enables some Enterprise Server components to keep certain sensitive information in a form of storage defined as a vault, accessible via a configurable vault provider. The default vault provider stores data in encrypted format on disk.
- OpenSSL 1.1.1 - the OpenSSL security provider has been updated to OpenSSL version 1.1.1.

This is the stable Long Term Support version of OpenSSL.

- Added support for the ratified TLS protocol version 1.3. TLS 1.3 benefits include:
  - Much shorter initial connection negotiation sequence. This reduces the time taken to establish a link before starting to transmit data.
  - Using only the most secure ciphers and hash methods.
  - TLS 1.3 will be negotiated in preference to the older TLS protocols.
- Added support for new Ciphers and Key Exchange groups in line with TLS 1.3 requirements.
- The default security level for previously configured endpoints has been moved from Security Level 0 to Security Level 1. This removes the ability to accidentally make use of known-weak elements such as SSL3 and MD5. Similar changes to the default Security Level have recently happened to Java, Chrome, Firefox, and other systems providing secure connections.
- Fileshare Security - the Fileshare Secure TCP/IP transport provider now supports the trusted use of X509 certificates bearing the name of the Fileshare service as the Common Name element of the certificate.

In previous releases, a secure connection to a Fileshare server was made using a certificate that represented the network location upon which the Fileshare service was located. This method is still supported, but does not distinguish between the exact Fileshare server that is being connected to when more than one service can exist on a single host system. With this change, individual Fileshare services can identify themselves by using a unique certificate. While running on the same host and registered with the same network endpoint.

- Support for Active Directory user groups and group name mapping - the Enterprise Server External Security Facility's MLDAP ESM Module can now use Active Directory user group objects for Enterprise Server user groups. Also, the module can now map long group names to the 8-character-maximum names required for mainframe emulation.
- Selective auditing - administrators can audit only security activity of particular interest, reducing audit overhead and the volume of events. The Enterprise Server External Security Facility's MLDAP ESM Module can now enable ESF Audit events only for particular users, groups, and resources.

- Improved interaction with LDAP client libraries resulting in fewer LDAP-related issues and easier diagnostics - the Enterprise Server External Security Facility's MLDAP ESM Module has improved interoperability with LDAP client libraries:
  - The client library vendor and version information is logged after the library is loaded
  - The module has better heuristics for loading the correct library supplied by the OS vendor, so the "provider" configuration option can generally be omitted
  - For OpenLDAP, the module sets its proprietary "connect timeout" option
- SNI support (requires 5.0 Patch Update 1 or later) - support has been added in Patch Update 1 for the Server Name Identification (SNI) extension to TLS. This helps to avoid connectivity issues related to a growing number of Web services being hosted on SNI servers.

## Enterprise Server for .NET

[Back to Top](#)

This release includes the following enhancements:

- Improved CICS compatibility - CICS EIBRCODE handling in Enterprise Server for .NET now matches the mainframe specification. CICS BMS support in Enterprise Server for .NET now matches the behavior on the mainframe and in native Enterprise Server more closely.
- MMC administration UI support for ESF security - the MMC snap-in for Enterprise Server for .NET administration now supports the External Security Facility. This means you can use LDAP-based or custom security solutions to provide administrator authentication and access control.
- TLS (SSL) support - the seelister utility now supports TLS (also known as SSL) for its TCP communications channels. These include all channel types except MQ. The Enterprise Server for .NET client classes also have been enabled for TLS. For example, the seeout utility can now be used with a TLS-enabled MFBINP channel.
- Performance improvements - this release comes with an improved performance in WCF, system database operations, and VSAM database operations.

## Micro Focus Unit Testing Framework

[Back to Top](#)

This release provides support for the following functionality:

- Data-driven unit tests - a new type of test suited to testing data where values read from a source are passed through the same tests.
- Test output colorization - test output can now include basic colorization for supported terminal emulations. This feature must be run from the command line.

## Platform Support

[Back to Top](#)

Support is now available for the following additional or updated operating systems:

- SUSE (Power) 11 SP3, 12
- Red Hat (Power) 7.2, 7.3
- Windows Server 2019

For a full list of supported platforms, check [HTTPS://SUPPORTLINE.MICROFOCUS.COM/PRODAVAIL.ASPX](https://supportline.microfocus.com/prodavail.aspx).

## Product Documentation

[Back to Top](#)

The following is new in this release:

- Online context help in Visual Studio - online context Help is now the default setting for Visual COBOL and opens the documentation available on Micro Focus SupportLine.

Visual COBOL local help is still supported and can be installed manually, if required. See *After Installing* for details.

- The *Comparison of COBOL with Other Managed Languages* document has been updated to reflect the recent enhancements in the .NET and JVM COBOL support.

## Visual Studio Integration

[Back to Top](#)

This release includes enhancements in the following areas:

### COBOL editor:

- Code snippets - new snippets are available for `$if` and `$region` statements, and for specifying `*cblformat off` which indicates the area of code that is unaffected by formatting.
- Collapsible regions - outlining is now available for IF, EVALUATE and PERFORM statements.
- **Peek Definition** context menu command - this invokes a pop-up window, embedded in the editor, showing the data item definition. You can use the feature both while editing and while debugging.
- IntelliSense suggestions - IntelliSense suggestions for the COPY statement now include directories to add.
- (Introduced in 5.0 Patch Update 1) Choosing a separator for qualified field names - you can configure IntelliSense to either use OF or IN as a separator in qualified field names - e.g. A-COUNT OF A-WORK-1 or A-COUNT IN A-WORK-1. You can specify this in **Tools > Options > Text Editor > Micro Focus COBOL > IntelliSense**, and on the **Completion Lists** page.
- Find All References - the **Find All References** output window for COBOL has been enhanced, so you can now filter results, group results, order results and search results.
- Quick actions - the editor now displays light bulbs for creating a missing section or a paragraph, for adding and sorting \$ILUSING statements, and for removing or commenting out dead code.

### Visual Studio tool windows:

- The **Error List** window now includes a column for the **Sequence Number**.
- You can use Visual Studio's **Find All References** tool window to search for references in your COBOL projects.

### New settings in the project property pages:

- The **Debug** project properties page for managed projects now includes settings for either generating a portable symbol file (.PDB) or for embedding the portable symbol information directly in the assembly.
- The **Smart Linkage** section in the properties of managed projects now offers two new settings for enabling the ILSMARTTRIM and ILSMARTANNOTATE Compiler directives.

### New project template categories:

- The COBOL project templates are organized in a new set of categories that better represent the tasks and workloads used in modern development. Some of the categories, such as Azure or .NET Core, only show if you have installed the support for these features in Visual Studio. For more information, see *To install missing features from the IDE*.

## What was New in Visual COBOL 4.0

This release provides enhancements in the following areas:

- [Integration with Visual Studio](#)
- [Application Server JCA Support for Enterprise Server](#)
- [Build Tools for Windows](#)

- [Code Coverage](#)
- [Codeset support](#)
- [Compiler directives](#)
- [Data File Tools](#)
- [Database Connectors](#)
- [Debugging](#)
- [Docker](#)
- [Documentation on working with large applications](#)
- [Enterprise Server](#)
- [File Handler](#)
- [Library routines](#)
- [Micro Focus Unit Test Framework](#)
- [OpenESQL](#)
- [Platform support](#)

## Integration with Visual Studio

[Back to Top](#)

This release includes the following editor improvements:

- Inline rename refactoring - overwriting a variable name directly in the editor now invokes rename refactoring so you no longer need to select **Refactor** from the editor context menu.
- **Extract to section** - a new quick action (Visual Studio 2015 and later only) is available in the editor. It enables you to refactor your code by adding more sections in the code. This can help you create more entry points that you can use during unit testing.
- Automatic insertion of END-EXEC, END-TRY and END-PERFORM statements - the closing statements are now automatically inserted after you have typed the opening statements.
- IntelliSense filters (Visual Studio 2017 and later only) - when IntelliSense displays a list of suggestions, a number of icons at the bottom of the IntelliSense window now enable you to filter the suggestions.

Working with files:

- Copybook graphs - a context menu command, **Show Copybook Graph**, in Solution Explorer enables you to display the graphical representation of the copybook dependencies of COBOL programs.
- **Open Folder** mode (Visual Studio 2017 only) - support is now available for editing, compiling and debugging files opened in Solution Explorer in Open Folder mode without having to create projects.
- The file property pages now display a list of all Compiler directives that apply to the file.

New IDE configuration option:

- You can use the **Limit IntelliSense Search Scope** setting in **Tools > Options > Text Editor > Micro Focus COBOL > Advanced** that helps improve the editor performance.

Relinking existing applications:

- You can now configure Visual COBOL to check whether applications created with older releases must be relinked. If the application uses an older version of the C run-time, Visual COBOL can automatically relink the existing executable or .dll to the new version of the C run-time without the need to recompile the application first.

If a project needs relinking, Visual Studio displays a message in the status bar (Visual Studio 2015 and 2017) or a dialog box (Visual Studio 2013) providing an option for you to choose and relink the project.

For more information see [Related Information](#) at the end of this topic.

## Application Server JCA Support for Enterprise Server

[Back to Top](#)

This release includes the following enhancements:

- COBOL Resource Adapters now support WebSphere 9.0 and WebLogic 12.2.1.
- Tomcat 7.0 support for servlet generation with J2SEBeans.
- NullSearch utility - for COBOL resource adapters, this new utility provides assistance in locating NULL fields in mappings passed to Enterprise Server. When a large number of arguments is provided in the parameters passed to Enterprise Server, it is difficult to locate NULL fields, which are not allowed. The NullSearch utility isolates NULL fields, so the Java application can be corrected.

For more information see [Related Information](#) at the end of this topic.

## Build Tools for Windows

[Back to Top](#)

This release includes Visual COBOL Build Tools for Windows, a separately-installable component of Visual COBOL that has been designed to be used in environments where you want to work with your COBOL projects but you don't want the overheads associated with the Visual Studio IDE.

Build Tools provide a lightweight, easy-to-install development environment that is well-suited for use in Docker containers and continuous integration or continuous delivery systems.

For more information see [Related Information](#) at the end of this topic.

## Code coverage

[Back to Top](#)

This release provides the following enhancements:

- In Visual Studio, the Micro Focus Code Coverage window now offers a File View in addition to the existing Program View.

For more information see [Related Information](#) at the end of this topic.

## Codeset support

[Back to Top](#)

Support has been added to enable codeset mapping to additionally be configured to use IBM's Conversion Tables directly instead of the Micro Focus supplied tables. You need to download IBM's conversion tables from IBM's Web site. Then you can use the MFCODESET environment variable to convert between IBM's CCSIDs.

For more information see [Related Information](#) at the end of this topic.

## Compiler directives

[Back to Top](#)

The following Compiler directives are new in this release:

- **DISPSIGN** - determines the display output of numeric fields with included signs, under an IBM mainframe dialect only.
- **GNTLITLINKSTD** - stops the suppression of call-convention 8 when both call-convention 2 and call-convention 8 are in effect for a `.gnt` file in an Intel x86 32-bit environment.
- **ILSMARTANNOTATE** - adds attributes to the items generated by ILSMARTLINKAGE, based on their data type, which can be used to identify the size or range of the item in COBOL.
- **ILSMARTTRIM** - trims any trailing spaces from a string item returned by the get property associated with an alphanumeric item processed by ILSMARTLINKAGE.
- **MAINFRAME-FLOATING-POINT** - specifies the format of a program's floating point data items: either IBM hexadecimal format or IEEE format. This directive is supported in managed code only.

The following Compiler directives contain new parameters in this release:

- **CHECKDIV** - a new parameter 'ACOS' now emulates a divide by zero operation on an ACOS mainframe system: the quotient and the remainder are set to the value of the dividend.
- **OOCTRL** - a new parameter, **L**, specifies whether to include directory location comments in `.cls` and `.ins` inheritance files.
- **NUMPROC** - a new parameter 'ACOS' provides partial compatibility with the behavior of NEC ACOS COBOL processing of invalid data in USAGE DISPLAY data items and invalid sign information in USAGE COMP-3 data items.

For more information see [Related Information](#) at the end of this topic.

## Data File Tools

[Back to Top](#)

It is now possible to export any filtered results. When filtering a data file, you can use the results to create a new data file - click **Search > Export Results** when a filter is applied to save the filtered records to a new file. You can:

- Save the filtered records to a new file.
- Save the records that match the specified filter (such as customer information or orders).
- Download a subset of the data from a remote file.
- Save a small portion of the data for testing purposes.

For more information see [Related Information](#) at the end of this topic.

## Database Connectors

[Back to Top](#)

### Database Connectors for Microsoft SQL Server

The following enhancements have been made to Database Connectors for Microsoft SQL Server:

- Database Connectors for MSSQL is now available on Linux/UNIX platforms where MSSQL server is supported; see the Microsoft SQL Server support web pages for an up-to-date list of specific supported platforms.

With Database Connectors for Microsoft SQL Server, you can connect to both an instance running on a Linux machine, or an instance running on a Windows machine. You can also use it to connect to an instance of SQL Server running on Linux from a Windows client. (Note that setting up SQL Server on a Linux machine is beyond the scope of our documentation.)

See *To install Database Connectors for Microsoft SQL Server* for more information.

- Database Connectors for MSSQL now supports connecting to a Microsoft SQL Server running a multi-subnet failover cluster. To use this feature requires changes to the connection string sent to the server, which is accomplished by using the following 4 new configuration variables:
  - `A_MSSQL_MULTI_SUBNET_FAILOVER` - set to `TRUE` to enable a connection that supports multisubnet failover support. If set to `FALSE` (the default) support is not enabled, and the other configuration variables have no effect.
  - `A_MSSQL_FAILOVER_PARTNER` - the name of the failover partner used. Refer to your SQL Server documentation for valid values.
  - `A_MSSQL_FAILOVER_PARTNER_SPN` - the name of the failover partner SPN used. Refer to your SQL Server documentation for valid values.
  - `A_MSSQL_SERVER_SPN` - the name of the Server SPN. Refer to your SQL Server documentation for valid values.
- Database Connectors for MSSQL now supports columns of type GUID for existing SQL tables. A new configuration variable, `A_MSSQL_IGNORE_GUID_COLUMNS`, determines the behavior when handling existing tables that contain a column of this type.



**Note:** Database Connectors for MSSQL cannot create a new column of this type.

## Database Connectors for ODBC

- Database Connectors for ODBC is now available, allowing you to use ODBC connectivity to access supported databases from your COBOL programs. See *Database Connectors for ODBC* for more information.

For more information see [Related Information](#) at the end of this topic.

## Debugging

[Back to Top](#)

This release includes the following enhancements:

- Enhanced .NET debugging in Visual Studio 2017 - a number of advanced debug features are now available when debugging .NET COBOL code. Features include support for performance tips, backwards debugging, an expression evaluator, integration with the Diagnostic Tools window, remote debugging of .NET COBOL applications, as well as support for IntelliSense in the debug windows (such as the Immediate, Watch, and QuickWatch windows).

For more information see [Related Information](#) at the end of this topic.

## Docker

[Back to Top](#)

This release provides support to enable you to run your COBOL applications in Docker containers, taking advantage of the many benefits offered by the Docker platform such as portability, performance, agility, isolation, and scalability.

For more information see [Related Information](#) at the end of this topic.

## Documentation on working with large applications

[Back to Top](#)

The product help now includes a new section, *Working with a Large Code Base*, that includes recommendations and best practices for working with large applications inside the IDE. It includes tips on how to structure your projects, how to optimize the performance of the IDEs, and step-by-step workflow showing how to move an existing legacy application into Visual COBOL.

For more information see [Related Information](#) at the end of this topic.

## Enterprise Server

[Back to Top](#)

The following enhancements have been made to Enterprise Server:

- Conversation filtering - the Enterprise Server Communications Process (MFCS) can now restrict access to listeners by client address. You can specify any permitted or forbidden addresses either by IP address, network mask, or domain name, and use wildcards. Filters can be applied to individual listeners, communications processes, or to entire regions. More specific filter rules override any general ones.
- The Enterprise Server Security Facility now starts throttling Verify requests when it receives more than 100 requests per second.

This can be used to limit the effectiveness of denial-of-service and brute force attacks. You can configure the value where throttling occurs. See *Verify Request Throttling* for more information.



- (Technology Preview only) Support for adding, deleting, and modifying XA resources in a live Enterprise Server region.

It is now possible to add, edit, or delete XA resources while an enterprise server instance is running. Any changes made come into effect after any in-flight transactions have completed. The ability to make these changes in a live environment comes under the control of the existing enterprise server permissions.

- XA-compliant Resources (XARs) - this release provides enhanced CTF tracing that allows more flexible reporting of warnings and errors on the RM switch module level.
- A new Communications Server resource class - enables you to control the access to the Enterprise Server Console Log and Communications Server Log when external security is in effect for an enterprise server region; see *Resource Classes for Communications Server* for more information.
- Improved catalog availability - there is now an improved resilience to temporary communication issues with the catalog and error reporting enabling a region to stay active if a region has multiple catalogs defined and one of the catalogs is not available.
- Enhanced SSL/TLS certificate support - for communications with TLS (formerly SSL), additional certificate and key file formats are supported. Servers may now be configured with both an RSA and an ECC key and certificate.
- Enhanced SSL/TLS cipher configuration - for communications with TLS (formerly SSL), the permitted cipher suites and their preferred order can now be configured. The minimum size of Diffie-Hellman groups for DH key exchange can also be configured. The defaults have been made more secure.
- The Historical Statistics Facility (HSF) now enables you to write user-defined data to the records produced within a `.CSV` file. Use the `ES_WRITE_CUSTOM_HSF` or `ESCSTHSF` library routines within your COBOL programs to define the custom data, and use the `ES_HSF_CFG` environment variable to configure up to five custom fields in the generated record.
- You can also use the `ES_HSF_CFG` environment variable to configure the number of CICSF, TSQ, and TDQ fields that are written to the record.

For more information see [Related Information](#) at the end of this topic.

## File Handler

[Back to Top](#)

This release provides the following enhancements:

- The DFSORT and SYNCSORT emulations now support the NULLOFL parameter of the OUTFIL statement.
- The **ASCIISOSI** configuration option is now available. It adds the required SOSI characters to the relevant EBCDIC DBCS character strings in order for them to be displayed or written out correctly.

For more information see [Related Information](#) at the end of this topic.

## Library routines

[Back to Top](#)

The following library routines contain new functionality:

- **CBL\_GET\_OS\_INFO** - this library routine can now detect if the program is running within a Docker container: `cblte-osi-rts-capabilities` parameter, bit 7.

For more information see [Related Information](#) at the end of this topic.

## Micro Focus Unit Test Framework

[Back to Top](#)

This release provides support for the following functionality:

- Generation of unit test stubs for selected entry points within your program.
- Support has been added to Visual Studio for unit testing of managed procedural projects.

For more information see [Related Information](#) at the end of this topic.

## OpenESQL

[Back to Top](#)

This release provides the following new features:

- Support for SQL Server 2017.
- The SQL(TRANSACTION) compiler directive has been enhanced to clearly define transaction boundaries.
- A new SQL(NOWHERECURRENT) compiler directive that allows you to define updateable cursors that do not do positioned updates or deletes with PostgreSQL or MySQL.
- Larger communication area (PID) that accommodates longer plan and program names.
- SQL(OPTIMIZECURSORS) has been enhanced for consistent and better cursor performance across all OpenESQL backends.

For more information see [Related Information](#) at the end of this topic.

## Platform support

[Back to Top](#)

Note the following changes in platform support for this release:

- Windows 8 and Windows Server 2012 are no longer supported for developing applications. They are still supported for deployment.

For more information see [Related Information](#) at the end of this topic.


# What was New in Visual COBOL 3.0

Visual COBOL 3.0 provided enhancements in the following areas:

- [Integration with Visual Studio](#)
- [Application Server JCA support for Enterprise Server](#)
- [Azure support](#)
- [Building applications](#)
- [COBOL language enhancements](#)
- [Code analysis](#)
- [Code coverage](#)
- [Compiler control](#)
- [Data File Tools](#)
- [Database access - DB2](#)
- [Database access - MySQL](#)
- [Database access - OpenESQL](#)
- [Documentation](#)
- [Enterprise Server](#)
- [Interface Mapping Toolkit](#)
- [Micro Focus Unit Testing Framework](#)
- [XML processing](#)

## Integration with Visual Studio

Visual COBOL 3.0 provided enhancements in the following areas:

- Integration with Microsoft's Visual Studio 2017, the most recent version of the world's most popular integrated development environment (IDE) for the Windows platform, offering significant benefits for developers and businesses developing software for Windows.
- COBOL Editor:
  - Brace completion - a closing quote mark or bracket is automatically inserted when you type the opening quote mark or bracket at the end of a line.
  - Brace matching for IF and EVALUATE statements - clicking on any of the clauses of these statements highlights the opening and closing statements and all clauses. Use **CTRL + ]** to move the cursor to the next clause in the statement.
  - Collapse to definitions - closes all sections, entry points and methods in an open file. Use the **Outlining > Collapse to Definitions** editor context menu command.
  - Colorization is now available for QuickInfo, completion tooltips and signature help.
  - Completion of statements - IF and EVALUATE statements are now automatically aligned and completed.
  - Indentation - smart indentation is now available to control how lines indent within IF and PERFORM statements and after continuation statements.
  - Locate definition, , on the COBOL toolbar enables you to search for data items and identifiers by specifying any string of characters that might be part of their name. This command replaces **Edit > Go To Location**.
  - Outlining - outlining is now available for 01 level group items (for expanding and collapsing the entire group)
  - Quick actions - Visual COBOL now supports Visual Studio's quick actions for rename refactoring, and finding or creating missing copybooks.
  - Tooltips are now available for managed COBOL members.
- COBOL toolbar - the commands on the COBOL toolbar have been updated in order to optimize your editing experience. A number of commands (renumber and unnumber) have been removed from the context menu in the editor and are now only available from the toolbar.
- Directives determination - there is now a preview dialog box when the IDE scans your sources for Compiler directives. This enables you to review and approve the directives before they are set.
- Error reporting - you can now sort the errors and warnings in the **Error List** window by their COBOL error code.
- Import, export and synchronization of the IDE options - you can now export a number of the COBOL global options as a Visual Studio .settings file. You can import the file into other instances of Visual COBOL.

Visual COBOL for Visual Studio 2015 and later now supports the automatic synchronization of a number of COBOL settings across the copies of Visual Studio installed on different machines. The settings are synchronized through your MSDN account. See the MSDN for more details and for information on any restrictions to the functionality.

- **Project Details** window - provides a number of enhancements, including performance improvement. It is now possible to filter on project or solution, perform a search, and sync with Solution Explorer. Tooltips are available in the Overrides column to show the override directives.
- Net Express import wizard - provides a new option for including copybooks in a project.
- Rename refactoring - this release introduces rename refactoring for COBOL code that can help to improve the readability of COBOL elements or make their purpose clearer. You can rename elements such as variables and identifiers, section and paragraph names, classes, and methods across a program or a solution.
- Support for standalone files - various improvements have been made to how you work with files that are not part of a project:
  - When you first open a standalone file, the editor displays an alert bar with options to browse for a symbols (.idz) file to use to compile the standalone file or to configure the Compiler directives.

- You can now use the file's properties window to edit the Compiler directives and to specify options for debugging.

In previous versions of Visual COBOL, standalone files were known as "single files". References to "single files" in the IDE and the product help have been changed to "standalone files".

### Application Server JCA support for Enterprise Server



**Restriction:** This feature applies only when the Enterprise Server feature is enabled.

In Visual COBOL 3.0, EJBGEN has been updated to generate an EAR file as a part of the COBOL deployment process, which enables you to deploy EJBs to Java Application Server.

### Azure support

Visual COBOL now supports the following versions of Microsoft Azure SDK - version 2.9.6 with Visual Studio 2013 and version 3.0 with Visual Studio 2015 and later.

### Building applications

Visual COBOL 3.0 provided the following improvements:

- Support for faster, parallel building on multi-CPU machines - support has been added for multi-processor compilation of the sources in native COBOL projects on multi-CPU machines.

You can specify the maximum number of concurrent compilations from the IDE preferences - **Tools > Options > Micro Focus > Projects**. In Visual Studio, multi-processor compilation must also be enabled in the project's properties.

### COBOL language enhancements

Visual COBOL 3.0 includes the following enhancements to the COBOL syntax:

- The DISPLAY-OF and NATIONAL-OF intrinsic functions are now able to process conversions using any IBM CCSID value. See *To install a CCSID Table* for details on installing the required CCSID table.

The following enhancements are available in managed COBOL:

- To avoid an exception being thrown if an explicit conversion fails, use the AS IF syntax, which results in the target object being set to null and no exception thrown. See *cast expressions* in the *Expressions* topic for more information.

### Code analysis

Visual COBOL 3.0 provided the following improvements:

- A new group of predefined rule sets for 64-bit readiness is now included in Visual COBOL.
- Support for importing code analysis reports produced with one of Micro Focus's advanced tools for code analysis, Enterprise Analyzer or COBOL Analyzer.

### Code coverage

The following improvements are available within the IDE:

- Information about unexecuted programs - the code coverage reports in the **Code Coverage** window now show the unexecuted programs.
- Code coverage support for standalone COBOL files - you can import existing code coverage reports in the **Code Coverage** window and use it to supply code coverage information for standalone files.

If you are using Test Coverage from the command line, you can now use the following features:

- A new Compiler directive, `COLLECTION` - the directive enables test coverage to gather information about unexecuted programs. In the IDE, this directive is automatically set on a project when you enable code coverage for it.
- A new command line utility, `tcutil` - the utility enables you to convert the test coverage binary results file into XML format.
- It is now possible to integrate test coverage in a Continuous Integration (CI) system. You can use `tcutil` and an XSLT processor to transform test coverage data into a format suitable for including in a CI.

### Compiler control

The following Compiler directives are new in this release:

- `COLLECTION` - provides a mechanism for code coverage to identify unexecuted programs.
- `ILSTDLIB` - helps you to ensure that your .NET COBOL code compiles with the correct version of the .NET Framework Microsoft Common Object assembly `mscorlib.dll`. When building from Visual Studio or using `MSBuild` to compile a COBOL project, the `NOILSTDLIB` directive is set, and an `ILREF` is generated pointing at the version of `mscorlib` appropriate for the target framework selected in the project's properties.

The following Compiler directives have been updated:

- `ALIGN` - this directive has new parameters (`FIXED` and `OPT`) that can be used in conjunction with the integer taken, which can aid performance. The default is `ALIGN"8 OPT"`; see the Comments section of the `ALIGN` Compiler directive topic for details of its affect on memory boundaries.
- `ARITH` - this directive emulates the IBM mainframe option of the same name. Defines the maximum number of digits for numeric data items.
- `FASTINIT` - this directive is now on by default when setting the MF dialect; it remains not set by default for other dialects.
- `SSRANGE` - this directive now has an additional option (`3`), which permits zero-length reference modified items at run time when bounds checking.
- `XMLPARSE` - includes a change in the way entities are processed when `XMLPARSE"COMPAT"` is set

### Data File Tools

The Data File Tools editor previously provided (from Visual COBOL 2.3) as a Technology Preview item was supported at GA level from Visual COBOL 3.0.

Visual COBOL 3.0 provided the following enhancements to Data File Tools:

- Opening files in shared mode - it is now possible to switch between read-only shared and edit modes. While a file is open in shared mode, others users can only open it in shared mode to ensure data consistency between users.
- Enterprise Server-level of security when accessing files - there is an improved level of security when exchanging data between Data File Tools and the targeted enterprise server instance. Users must now provide a user ID, group and a password when they try to access and view datasets in enterprise server instances. These are used for authentication and authorization checks to provide the same access level as Enterprise Server.
- Opening datasets using SSL - communication to a region is now possible using SSL. To enable the SSL communication, you need to provide a Java trust store which contains either a CA root certificate or a self-signed certificate of the region that it is communicating to. Java and the targeted region SSL configurations need to meet each other's standards in order for the communication to succeed.

This feature enables you to secure the information exchange between Data File Tools and the targeted enterprise server.

- Auditing of access and updates on datasets - Audit Manager now audits the access and updates on datasets via Data File Tools.
- Support for existing `.pro` files - enables you to use your existing editor profiles.
- Support for existing `.str` files - enables you to use your existing COBOL structure files.

- Automatic timeout - if no internal operations or external actions (such as a mouse click) have been detected for 30 minutes, Data File Tools now displays a countdown message. If the user does not take any decision within the specified period, Data File Tools closes all opened files.

### **Database access - DB2**

Visual COBOL 3.0 provided a new DB2"QUALIFY-CALL" Compiler directive that enables stored procedure invocations to include a schema name.

### **Database access - MySQL**

Visual COBOL 3.0 provided support for MySQL with ODBC.

### **Database access - OpenESQL**

Visual COBOL 3.0 provided the following new features:

- Statement prefixes for the SQL"CHECK" Compiler directive that enable the creation of temporary tables and other SQL objects at compile time, ensuring full SQL syntax checking during compilation.
- SQL"OPTIMIZECURSORS" Compiler directive that enhances processing for traditional embedded SQL cursors that use WITH HOLD and FOR UPDATE clauses.
- SQL"CLOSE\_ON\_COMMIT" Compiler directive to leave cursors open for further result set processing after a commit.
- SQL"GEN-SQLCA" Compiler directive that generates an SQLCA similar to the z/OS DB2 directive STDSQL"YES".

### **Documentation**

The following new section have been added to the product help:

- *Where do I start?* - located on the launch page of the product help, this section provides the information you need in order to get started depending on which aspects of the product you need to get to grips with first.

### **Enterprise Server**

Improvements are available in the following areas:

#### **Integration with Visual Studio**

- Exporting an enterprise server definition from the IDE in XML format.
- Importing an enterprise server into the IDE using its definition file.
- In Visual Studio, it is now possible to configure an enterprise server to produce a core dump file directly from the IDE, from the server properties.

#### **iFileshare**

iFileshare is no longer considered an Early Adopter Program, and contains the following enhancements in this release:

- An improved failover and recovery process. iFileshare now supports full recovery of nodes in the group. For high availability (HA-VSAM) groups, servers can now rejoin the group without the entire group having to be restarted. In addition:
  - A primary failover now results in a takeover from the most suitable node.
  - If configured, external clients will automatically reconnect to the new primary and will issue a notification if the transaction has been lost.
  - A failed node, when restarted, will rejoin the group, recover its files and request a log update from the current primary. Once this task has completed it will be considered an active hot-standby and will continue to process replication requests as normal.

- Users will experience a higher level of uptime/availability with their Fileshare configuration and will be able to recover from errors more easily.
- A new exit procedure, `ifsexitproc.cbl`, can be configured to automate some aspects of iFileshare behavior.
- The iFileshare Control page in ESMAC contains details of the current iFileshare high availability group.
- The following new iFileshare-specific environment variables are available:
  - `FSWRKDIR` - enables you to specify the Fileshare working directory, overriding the default, which is the system directory of the region.
  - `FSCHKLFH` - determines if a check is performed when a high availability group is started, to test the consistency of the data files within the group.
- The database reference file (`dbase.ref`) now supports wildcard matching for filenames, allowing you to perform operations on multiple files at once; for example: `fs /d dbase.ref /f data\*` adds the entire contents of the data directory to the database reference file.

#### **Long user IDs and passwords:**

- Enterprise Server now supports user IDs and passwords of up to 100 characters. It is possible to map IDs from long to short (or vice versa) to enable compatibility with programs that do not support long names.

#### **SHA-256 support in DemoCA:**

- By default, the Demonstration Certificate Authority (CA) now signs certificates with SHA-256. This ensures that the demonstration or evaluation certificates will be accepted by modern browsers and other software that has enhanced security requirements.

#### **Syslog auditing:**

- Enterprise Server now supports auditing using syslog events, which can be consumed by a wide range of Security Information and Event Management (SIEM) products. This replaces the Audit Manager auditing solution. Syslog auditing provides a much more efficient auditing mechanism, with significantly less impact on overall speed.

#### **Interface Mapping Toolkit**

The Interface Mapping Toolkit (IMTK) contains the following enhancements in Visual COBOL 3.0:

- Cross Origin Resource Sharing (CORS) support for REST Web services, enabling Web service access from a CORS-supported Web browser.

#### **The Micro Focus Unit Testing Framework**

The Micro Focus Unit Testing Framework is now available from within the IDE. It includes much of the architecture you would expect of an xUnit framework to create, compile, run and debug unit tests, including the following features:

- A unit test project template.
- A test creation wizard that enables you to generate tests from your source code.
- Code snippets for each element of a test case.
- Support for running tests with Code Coverage enabled.
- The Micro Focus Unit Testing window, where you can manage your test runs and view test output.

There has been a number of enhancements to the command line version of the Micro Focus Unit Testing Framework. Support has been added for:

- Generating NUnit-style reports.
- Running test fixture files using Apache Ant.
- Applying traits to your test cases, then performing a test run based on those traits.

- Applying a high, medium, or low priority to test cases, which affects the order in which they are run.
- Adding coded command line options directly into your test code.
- Using a test run-specific configuration file, in which you can set environment variables.

### XML processing

XML PARSE now works in a purely managed COBOL environment. It is now supported in JVM COBOL and, in both .NET and JVM COBOL, it has a fully managed implementation. XML PARSE working without calling out to native code ensures it can be used in restricted rights environments.

## What was New in Visual COBOL 2.3 Update 2

Visual COBOL 2.3 Update 2 provided enhancements in the following areas:

- [Integration with the Visual Studio IDE](#)
- [Building applications](#)
- [COBOL language enhancements](#)
- [Classic Data File Tools](#)
- [Compiler directives](#)
- [Debugging applications](#)
- [Dialog System GUI](#)
- [File handling](#)
- [Library routines](#)

### Integration with the Visual Studio IDE

Visual COBOL 2.3 update 2 provided the following enhancements in the integration of Micro Focus COBOL with the Visual Studio IDE:

- A new menu command **SQL Option for DB2** on the **Tools** menu enables you to access all the SQL Option for DB2 utilities.
- It is now possible to specify options for compiling native resource files (.rc) by accessing the file's properties from within the IDE.
- Editor improvements:
  - Colorization of the code in the ToolTips for collapsed regions in the COBOL editor has been added.
  - The Time and Date Warp options are now available on the **Run-Time Configuration** tab when editing an application configuration file for native COBOL projects.
  - **Go To Next Method** and **Go To Previous Method** editor context menu commands are now available for native Object-Oriented and for managed COBOL code.

### Building applications

It is now possible to use the 64-bit version of MSBuild to build COBOL projects.

### COBOL language enhancements

Numeric, edited and external floating point items can now specify USAGE NATIONAL when the NATIONAL"2" Compiler directive is in effect. Signed numeric items must be specified with the SIGN IS SEPARATE clause.

### Classic Data File Tools

A new command line utility is available which enables you to initiate the following actions: open data files, create or open record layout files, create or open segment layout files, and open IMS databases using a DBD or PSB file. Note that although you can initiate these actions from the command line, you must complete them from within the IDE.



## Compiler directives

The following Compiler directives are new in this release:

- **COMMAND-LINE-LINKAGE** - enables you to call a program and pass the command line to the main program as a parameter to be accessed via the Linkage Section. This offers equivalent functionality to the `command_line_linkage` tunable, which has now been deprecated.
- **EBC-COL-SEQ** - controls the behavior of an EBCDIC collating sequence, specified in a `NATIVE"EBCDIC"` program. `EBC-COL-SEQ"1"` (the default) maintains use of the long-standing fixed (platform-independent) EBCDIC collating sequence. `EBC-COL-SEQ"2"` prompts use of the latest CODESET table, which varies according to platform and user-controlled MFCODESET environment variable setting.
- **NATIONAL** - enables you to specify numeric, edited and external floating point items as `USAGE NATIONAL`.

## Debugging applications

- You can configure the debug tooltip for subscripted **OCCURS** items to either display the elements of arrays or to display the value of the current expression. To do this, right-click in the editor, click **COBOL Debug Tooltip Style** and either enable or disable **Show COBOL OCCURS or reference modification value**.

For more information see *Related Information* at the end of this topic.

## Dialog System GUI

Installing the version of the Compatibility AddPack for Visual COBOL provided with this release adds a new menu item, **Micro Focus Dialog System**, to the **Tools** menu of Visual Studio for starting the Dialog System GUI from within the IDE.

For more information see *Related Information* at the end of this topic.

## File handling

MFJSORT ICETOOL now supports the `USING` parameter in the `SELECT` operator.

For more information see *Related Information* at the end of this topic.

## Library routines

The following library routine contains new functionality:

- `CBL_GET_PROGRAM_INFO` - a new function (function 10) has been added for native COBOL which returns the path and program name, or the program name only of a particular program.

For more information see *Related Information* at the end of this topic.

# What was New in Visual COBOL 2.3 Update 1

Visual COBOL 2.3 Update 1 provided enhancements in the following areas:

- [Integration with the Visual Studio IDE](#)
- [Code Analysis](#)
- [Code Coverage](#)
- [Compiler directives](#)
- [Database Access - OpenESQL](#)
- [Data File Tools](#)
- [Debugging applications](#)
- [Dialog System Applications](#)

- [Editor writing assistance](#)
- [Enterprise COBOL 5.2](#)
- [File Handling](#)
- [Library routines](#)
- [Managed COBOL Syntax](#)
- [Native COBOL Syntax](#)
- [RM/COBOL compatibility](#)
- [Rosetta Stone for COBOL, .NET and Java Developers](#)
- [Windows Azure](#)

## Integration with the Visual Studio IDE

Visual COBOL 2.3 Update 1 provides the following enhancements in the integration of Micro Focus COBOL with the Visual Studio IDE:

- The **Go To location** and **Go To Procedure Division** commands are now available from the **Edit** menu. In addition, the **Go To Procedure Division** has a shortcut key - **Ctrl+K, Ctrl+J**.
- Object Browser - now provides support for .NET COBOL code. You can view the members of objects in your project and the definition of classes and methods as specified by the XML documentation comments in your code. The window also provides support for the **Go To Definition** command.
- A new search option, **Current COBOL Program**, has been added to the **Find in Files** dialog box. This enables you to search in the COBOL program currently opened in the editor and in any copybooks referenced by that program.
- Solution Explorer - a new context menu command, **Add Folder to Copybook Paths**, is now available for the subfolders of your projects. This enables you to add the subfolders to the copybook path of the project.

### Editor improvements:

- Line numbers - a new option for configuring the increment for the COBOL and the standard line numbers when you use Renumber and Unnumber has been added. You can specify the increment from **Tools > Options > Text Editor > Micro Focus COBOL > Line Numbering**.
- Outlining - a new IDE option enables you to switch outlining in the COBOL editor on or off. See the **Enable Outlining** option available on the **Advanced** page in **Tools > Options > Text Editor > Micro Focus COBOL**.
- Program breakpoints - a new context menu command, **Add COBOL Program Breakpoint**, enables you to set program breakpoints directly from the editor.

## Code Analysis

This release provides support for performing code analysis at the command line using Microsoft's MSBuild utility which enables the integration of code analysis in CI frameworks.

Support is available for various MSBuild parameters. You can use MSBuild with the /p switch and with the following Micro Focus-specific command line options:

- `RunMicroFocusCodeAnalysisAfterBuild` - controls whether code analysis is performed with MSBuild or not regardless of what code analysis options are specified the project's properties.
- `ActiveRulesets` - specifies which rule sets should be used when running code analysis from the command line.

## Code coverage

The code coverage reports are now integrated with the IDE and with the editor. Features include:

- A new Code Coverage window showing the statistics of what percentage of the code has executed.
- Navigation from the Code Coverage window to the missed and covered blocks in the editor.

- Colorization in the editor of blocks that were executed (covered blocks) or not (missed blocks).

## Compiler directives

The following Compiler directives are new in this release:

- **ILMAIN** - you now specify the main entry point for the executable program, which can be specified either as `class-name::method-name`, or just as `method-name`. For example, `ILMAIN"classA::methodB"` or `ILMAIN"methodB"`. The first format can be used to distinguish between multiple methods with the same name in different classes.
- **OOCTRL** - a new parameter, `+/-A`, as been added. Set this parameter to `-A` to allow ActiveX controls in your COBOL application to use classes and methods in the OLE class library. The default is `+A`, which does not allow it

## Database Access - OpenESQL

This release provides the following new features:

- Demonstrations for using OpenESQL in .NET applications. To view these demos, see the *SQL demonstrations* in the Visual COBOL Samples browser.
- Support for the Oracle fully managed ODP.NET driver.

## Data File Tools

This release provided improved security and increased support for more file types. Features include:

- Certain aspects of Enterprise Server security are honored when you attempt to access data sets. If the Enterprise Server region has security enabled, logon details must be authenticated before you can access the data set. If the details are unable to be authenticated, access is denied.
- When using a record layout, certain data is now validated at field level (to ensure the contents is compatible with its picture string ) and record level (to ensure the record length matches the layout size).
- Full editing support has been added for variable block sequential files and relative files. Full editing is also available for line sequential files, as long as they do not contain any binary data

## Debugging applications

- You can configure the debug tooltip for subscripted OCCURS items to either display the elements of arrays or to display the value of the current expression. To do this, right-click in the editor, click **COBOL Debug Tooltip Style** and either enable or disable **Show COBOL OCCURS or reference modification value**.

## Dialog System Applications

The version of the Compatibility AddPack for Visual COBOL released with Visual COBOL 2.3 Update 1 enables you to give your Dialog System applications a refreshed user interface. Features include:

- Support for a modern look and feel for Dialog System applications.

Dialog System now supports Microsoft's visual styles for controls and fonts to give your existing Dialog System applications a modern look that is native to the Windows version the applications are running on.

You use a new environment variable, `MFVSSW`, to switch the visual styles on. Alternatively, for applications that compile to an executable, to switch the new styles, you can add an application manifest file to the applications' project files.

See the section *Modernizing Dialog System Applications* in your product help for details on how to enable the visual styles, and for information about any possible changes in behavior or appearance of the common controls.

- A modern look and feel of the Dialog System painter.

There are new configuration options in the Dialog System painter for applying the visual styles and fonts to the painter.

- Visual Studio project templates for creating Dialog System applications with a modern look out-of-the box.

The Compatibility AddPack for Visual COBOL now installs the following new project templates:

- **Dialog System Application (Modern)** for creating Dialog System applications that use Microsoft's visual styles by default.
- **Dialog System Application (Classic)** for creating Dialog System applications that use the classic fonts and look.
- Additional samples:

All of the Dialog System samples previously available with Net Express are now included with the Compatibility AddPack for Visual COBOL. The samples have been converted to Visual Studio solutions.

### Editor writing assistance

Visual COBOL 2.3 Update 1 provides the following enhancements in the editor in Eclipse:

- Colorization of conditional compilation regions - by default, inactive code is now colored the same as Compiler directive elements. Inactive code is defined as code within conditional blocks that do not evaluate with the applied Compiler settings.
- \$REGION statement - support is provided for the \$REGION Compiler-control statement. You can use \$REGION - \$END-REGION to surround blocks of code that you want to fold or expand in the editor.
- AutoCorrect - you can configure the editor to automatically fix the most frequently misspelled words. You use the IDE preferences to specify a list of words that you sometimes mistype, and the correct spellings for them. Whenever you misspell that word, the editor automatically replaces it with correct version. This feature is enabled by default and can be configured from a new preference page in **Window > Preferences > Micro Focus > COBOL > Editor > AutoCorrect**.

### Enterprise COBOL 5.2

With the introduction of Enterprise COBOL 5.2, the following features were supported:

- The VOLATILE keyword is supported within the data entry description; although, this is treated as documentary. It has also become a reserved word when under the ENTCOBOL dialect.
- Format 2 of the SORT statement no longer treats the COLLATING SEQUENCE clause as documentary-only.
- The SUPPRESS clause of the XML GENERATE statement has been enhanced.
- The IBM z/OS JSON parser API, as documented for the IBM z/OS client web enablement toolkit.

### File Handling

- A new indexed file format, IDXFORMAT12, has been introduced to improve file maintenance and recovery procedures when using the rebuild utility. This file format is similar in structure and use to IDXFORMAT8. Where the two formats differ is that an IDXFORMAT12 file has an accompanying side file (.idx file) containing the indexed key information.

You can use this type of file with the new `rebuild /q` option. This rebuild process is considerably quicker than other rebuild processes such as a data scrape or `rebuild /p`.

- Faster SORT operations for fixed block records - when using the DFSORT emulation, the performance when sorting fixed block records has greatly improved.

### Library routines

The following library routine were new at this release:

- CBL\_CODESET\_SET\_MAPPING - enables you to change the codeset in effect.
- CBL\_RUNTIME\_ERROR - forces an application to terminate with a run-time error condition.
- PC\_PRINTER\_INFO\_DOTNET (.NET COBOL only) - enables the access to the native Hdc for a printer.

### Managed COBOL syntax

The following enhancements have been made to the managed COBOL syntax:

- You can now create generic iterators.
- You can now use the Profiler utility to obtain detailed statistics on the run-time performance of managed COBOL applications.

### Native COBOL Syntax

The following items are new features of the native COBOL syntax:

**Class condition tests** New and updated class condition tests are available for DBCS, KANJI, and JAPANESE.

### RM/COBOL compatibility

The RM/Panels syntax is now supported in Micro Focus COBOL applications.

### Rosetta Stone for COBOL, .NET and Java Developers

The product Help now includes a quick and easy to use syntax guide for developers who need to learn OO COBOL syntax when modernizing COBOL applications for the Java or .NET platforms. The guide includes side-by-side equivalent syntax for COBOL, C#, VB and Java.

### Windows Azure

Visual COBOL support on Microsoft Azure has been updated to version 2.8 of the Microsoft Azure SDK.



#### Important:

- Starting with this release, versions of the Microsoft Azure SDK earlier than version 2.8 are no longer supported.
- Support for the Microsoft Azure SDK is no longer provided in Visual COBOL for Visual Studio 2012. If you have COBOL Azure projects created with earlier versions of Visual COBOL for Visual Studio 2012, to maintain them, use Visual COBOL for Visual Studio 2013 or 2015.

## What was New in Visual COBOL 2.3

Visual COBOL 2.3 provided enhancements in the following areas:

- [General IDE enhancements](#)
- [Building applications in Visual Studio](#)
- [COBOL editor in Visual Studio](#)
- [Code analysis](#)
- [Code coverage](#)
- [Command Line Compilation and Linkage](#)
- [Compiler directives](#)
- [Converting additional directives to project's properties](#)
- [Data File Structure command line utility](#)
- [Data File Tools \(Technology Preview\)](#)
- [Database access](#)

- [File handling](#)
- [Library routines](#)
- [Managed COBOL syntax](#)
- [Micro Focus Unit Testing Framework](#)
- [Microsoft Azure](#)
- [Preprocessors](#)
- [Profiler](#)
- [REST service interfaces](#)
- [RM/COBOL Compatibility](#)
- [Single file support](#)
- [Tunables](#)
- [Updated run-time system](#)

## General IDE enhancements

In Visual Studio:

- Menu items - the following Micro Focus utilities were previously available under the **Tools > Micro Focus** menu and have been moved as follows:
  - **ADO.NET Connection Editor** - now accessed from **View > Micro Focus SQL Tools**.
  - **OpenESQL Assistant** - now accessed from **View > Micro Focus SQL Tools**.
  - **OpenESQL Configuration Utility** - now accessed from **View > Micro Focus SQL Tools**.
  - **Web Service Client** - now accessed by creating a new project of type "Web Service Client Application from JSON/REST" - click **File > New > Project > COBOL > Native > Web Service Client Application from JSON/REST**.
- Managed COBOL project properties - a new setting, **Expose group linkage items to managed code**, is now available on the **COBOL** tab in the properties of managed COBOL projects. Checking this sets the ILSMARTLINKAGE directive that specifies that group linkage items in your code are to be exposed as properties of a class. A related button, **Options**, enables you to also specify whether to remove specific prefixes from the names of COBOL data items, whether to make the new classes serializable, expose Linkage Section items as nested classes of the program class or to limit the property generation to non-redefining elementary items.
- Resetting the file properties - a new button, **Use Project Defaults**, on the file property pages of COBOL files in native projects now enables you to reset the file properties of COBOL files in native COBOL projects.

## Building applications

Visual COBOL now supports Visual Studio's parallel builds for COBOL projects. Parallel building enables you to build multiple projects faster on multi-CPU machines. Following this change, in order for your multi-project solutions to build in parallel successfully, ensure that the project dependencies and build order are set correctly for your solution using **Project > Project Dependencies**. For more information about parallel building, see *Tips on Building COBOL* in your product help and your product Release Notes.



**Note:** Parallel builds are not supported with Personal Edition licensing.

## COBOL editor

The COBOL editor includes the following enhancements and new features:

- Improved Intellisense writing assistance for COBOL in both native and managed COBOL:
  - Context sensitive suggestions - IntelliSense only shows suggestions that are relevant for the position of the cursor in the code or for the type of project.
  - Enhanced completion lists - lists include any relevant COBOL verbs, clauses and words, copybooks, code templates, data items and section and paragraph names.

- Intelligent assistance with completing statements - when you have entered a COBOL verb, IntelliSense shows suggestions for the relevant clauses and identifiers that you can use to complete the statement.
- Automatic completion for single items - IntelliSense automatically inserts single suggestions in the code.
- Qualifying non-unique names - IntelliSense qualifies data items whose names are not unique.
- Configuration preferences for IntelliSense - enable you to configure what suggestions appear in the completion lists, whether suggestions are added in insert or overwrite mode, and the case of the inserted words.
- Snippets - code snippets are now included in the IntelliSense suggestions.
- \$IF-\$ELSE-\$END statement colorization - parts of a \$IF Compiler-control statement that are not executed are now colored in grey.
- \$REGION statement - support is provided for the \$REGION Compiler-control statement. You can use \$REGION - \$END-REGION to surround blocks of code that you want to folded or expand in the editor.
- Copybook glyphs (📄) in the left-hand margin on a copy line - indicate that a copybook can be expanded inline.
- Creating copybooks from a selection of code - a new context menu command, **Extract to Copybook** in the editor enables you to move a selection of COBOL code into a new copybook file. The file is added to the project and the code in the original program is replaced with a COPY statement that refers to the new copybook.
- Expanded copybook view - provides indicators for read-only copybooks
- Outlining - outlining is now available on comment blocks, paragraphs and on \$REGION and \$IF statements.
- Task List comments - the COBOL editor now provides support for Visual Studio-style Task List comments in COBOL. Typing TODO, HACK or UNDONE in the code immediately after the declaration of the COBOL comment (\*>, \*>> or \* in column 7) creates a task that appears in the **Task List** window.

## Code analysis

Visual COBOL now offers more advanced code analysis features and enables you to run various analysis queries (rules and groups of rules called rule sets) against your code to ensure adherence to standards such as standards for coding or performance.

You can run analysis rules against programs in a project in the IDE at user request or you can run analysis rules at the end of a project's build.

## Code coverage

Visual COBOL now provides support for code coverage of native COBOL applications directly from within the IDE where code coverage uses the Test Coverage functionality. You can produce code coverage reports for applications running in the COBOL run-time and for applications that run in Enterprise Server.

To produce reports, you need to enable code coverage in a project's properties, compile your application and then run your application with code coverage to produce the relevant reports. For applications that require an Enterprise Server instance, you start the enterprise server with code coverage.

## Command Line Compilation and Linkage

When using the `cbllink` command to compile and link, there is a new `-y` option. Use this option to create an executable that includes support to be able to run on Windows XP and Windows Server 2003.

## Compiler directives

The following Compiler directives are new in this release:

**EOF-1A** Treats a 0x1a character in the source file as the end of file.

<b>NLS-CURRENCY-LENGTH</b>	Specifies the number of bytes to allocate for the currency symbol in a PIC field.
<b>NULL-ESCAPE</b>	Treats a 0x00 character in the source file as an escape character for other non-printable characters in the source code.

The following Compiler directives contain new parameters in this release:

**DBSPACE** The new parameter "MIXED" extends the DBSPACE directive to be able to evaluate data items in programs that contain a mix of single-byte and double-byte strings.


### Converting additional directives to project's properties

The **Update Project Properties** utility allows you to convert additional directives in your project to project properties. This option is presented on opening a project. You can select to not show this dialog again by unchecking **Check Additional Directives for project properties** in **Tools > Options > Micro Focus > General**.

### Data File Structure command line utility

The Data File Structure Command Line (DFSTRCL) utility is a DOS-based command line utility that enables you to create record layout (.str) files from COBOL debug information (.idy) files. You can use the utility to process a single .idy file or batch process up to 100 .idy files.

### Data File Tools (Technology Preview)

 **Note:** This is a technology preview feature only. It is being made available to allow you to test and provide feedback on this new capability; however, this feature is not intended for production use and it is not supported as such. Furthermore, Micro Focus does not guarantee that this feature will be delivered at a GA level and if it is, then the functionality provided might differ considerably from this technology preview.

The Data File Tools (Technology Preview) is a new standalone text editor in which you can create and edit data files. By nature of it being a 'technology preview' product, it does not currently include all the functionality that was available in the previous version of Data File Tools - now referred to as Classic Data File Tools. If you require any of the functionality not provided in this version, you can still use the classic version by accessing it in the usual way.

To run Data File Tools (Technology Preview), type `mfdatatools2` from Visual COBOL's command prompt or a terminal.

To use the new editor directly from the Visual Studio IDE, clear the **Use classic data file tools** check box, available from **Tools > Options > Micro Focus > Data File Tools**. When cleared, the Data File Tools (Technology Preview) version is used, when possible. When this editor does not support the action you are attempting to complete, Classic Data File Tools is used instead. This check box is selected by default.

### Database Access

Visual COBOL version 2.3 provides the following enhancements to database access:

- COBSQL** Visual COBOL version 2.3 provides:
- Selection and configuration of the Oracle Pro\*COBOL preprocessor for compiling COBSQL applications in project properties on the **SQL** tab.
  - Support for COBOL directives SOURCEFORMAT=TERMINAL and SOURCEFORMAT=VARIABLE for Pro\*COBOL applications.

**HCO for DB2 LUW** Visual COBOL version 2.3 provides:



- Support for MFHCO mode across all platforms by default via the new HCO "NOHCO" DB2 compiler directive option. See the *HCO* DB2 compiler directive option topic for details.
- A new DB2 compiler directive option, OPTPER "NOOPTPER", that enhances performance for CHARSET EBCDIC processing. See the *OPTPER* DB2 compiler directive option topic for details.
- A new DB2 directive option, BINDDIR, which specifies an alternative directory in which to write the DBRM file created during compilation. See the *BINDDIR* DB2 compiler directive option topic for details.

## OpenESQL

### ADO.NET Connection Editor

In this release:

- The ADO.NET Connection Editor has been redesigned using a series of Wizards that guide you through the processes of adding, copying, and removing connections.
- Context Help is now provided for the main window, and each Wizard page and dialog box.

### Date/Time Processing

This release provides streamlined datetime processing for ODBC and ADO.NET.

### Performance

This release includes a new SQL compiler directive option, OPTPER "NOOPTPER", that enhances performance for CHARSET EBCDIC processing. See the *OPTPER* SQL compiler directive option topic for details.

### PL/I

This version provides 64-bit support for PL/I on appropriate platforms. See *Additional Software Requirements* for details.

### PostgreSQL

In this release, PostgreSQL 9.4 has been tested with OpenESQL and OpenESQL Assistant with the following PostgreSQL software:

**Server software** PostgreSQL EnterpriseDB version 9.4.1-3

- Client software**
- psqLODBC driver version 09.03.04.00
  - Npgsql ADO.NET 4.0 driver version 2.2.5

PostgreSQL 9.4 has been tested with OpenESQL and OpenESQL Assistant on the following Windows platforms:

- Windows 32-bit
- Windows 64-bit



**Note:** Micro Focus provides compatibility for PostgreSQL but does not directly contribute to or support the PostgreSQL open source project. Any issues relating to PostgreSQL functionality should be addressed through an open source support vendor.

### SQL Server

Visual COBOL version 2.3 provides support for the SQL Server OUTPUT clause.

## XA Switch Modules

In this release, the XA interface has been redesigned to provide:

- Consistent look and feel for SQL Server, DB2, and Oracle user personalization
- Consistent look and feel for both RM dynamic and static registration (SQL Server, DB2, Oracle, generic one-phase commit)

- Additional support for two instances of the same switch module using Web Services applications via the new XAID compiler directive
- Using a specified XA resource only with batch applications executing under Enterprise Server

## File handling

This release contains the following new configuration options:

**ACUFH** Enables or disables the use of the ACU file handler (ACUFH), which is required to handle Vision and RM/COBOL indexed files.

**ESACUFH** Enables or disables the use of the ACU file handler (ACUFH) for file handling operations running under Enterprise Server. ACUFH must also be enabled for this option to take effect.

## Library routines

The following library routines are new in this release:

**CBL\_MANAGED\_SESSION\_GET\_USERDATA** Retrieves user data saved in the current RunUnit.

**CBL\_MANAGED\_SESSION\_SET\_USERDATA** Sets user data in the current RunUnit.

The following library routines contain new parameters in this release:

**CBL\_LOCATE\_FILE** You can now specify a file name that is a null-terminating string, which has resulted in three new values available for the `user-mode` parameter.

## Managed COBOL syntax

The following enhancements have been made to the managed COBOL syntax:

- The `TYPE OF type-name[ANY...]` syntax enables you to obtain the `System.Type (.NET)` or `java.lang.Class (JVM)` object for a generic class, interface, or delegate.
- The `self::` or `super::` syntax is no longer required to access inherited data within a subclass.
- The `ATTRIBUTE-ID` syntax enables you to define new attribute types, which can be used in various contexts.

## Micro Focus Unit Testing Framework



**Note:** This is a technology preview feature only. It is being made available to allow you to test and provide feedback on this new capability, but it is not intended for production use and is not supported as such. Furthermore, Micro Focus does not guarantee that this feature will be delivered at a GA level and if it is, then the functionality provided might differ considerably from this technology preview. During the preview, you are encouraged to share your feedback and experiences via the Micro Focus community forum - <https://community.microfocus.com/t5/Enterprise-Developer-User/bd-p/forumid-9>.

The Micro Focus Unit Testing Framework is an xUnit style testing framework, available from the command line, for procedural COBOL applications.

It includes much of the architecture you would expect in an xUnit framework. The test runner is a 32- or 64-bit executable that you run from a Visual COBOL command prompt. A test fixture or suite is a COBOL program compiled to `.dll` that can include the setup, the test case code, and the teardown associated with the test case.

Test results are available in a number of formats. By default, results are displayed to screen and to a `.txt` file, but you can use additional parameters on the command line to produce reports in JUnit format.

## Microsoft Azure support

Visual COBOL support for Microsoft Azure has been updated to version 2.6 of the Microsoft Azure SDK.

Support has been added to the product for making any future versions of the Microsoft Azure SDK available before the next major release of Visual COBOL. Micro Focus will deliver support for these only upon customers' requests.



### Note:

**2.3 HotFix 1 update:** This HotFix provides support for version 2.7 of the Microsoft Azure SDK in Visual COBOL for Visual Studio 2013 and 2015.

## Preprocessors

Support has been added in the IDE for enabling and using multiple preprocessors with your projects.

A new page, **Preprocessors**, has been added to the project's and the files' properties of native COBOL applications to enable you to choose one or more preprocessors to use when building your application and to specify their order of execution.

New reporting capability is now available for user preprocessors: resp-main code 18 indicates that a buffer contains a data name to be marked as modified by the immediately preceding preprocessed line. The data name may be qualified and resp-more contains the column information for the reference.

## Profiler

Visual COBOL now provides support for Profiler for native COBOL applications directly from within the IDE. To produce reports, you need to:

1. Enable Profiler in the COBOL property page for a project.
2. Compile your application to apply the changes.
3. Run your application with Profiler to produce the relevant reports.

## REST service interfaces

RESTful service interfaces utilizing JSON as the media type in request and response messages are now supported using the Interface Mapping Toolkit. This enables you to extend COBOL applications using modern transport payloads and protocols.

## RM/COBOL Compatibility

This release includes improved support for RM dialect applications. Please consult with Micro Focus before considering a transition from RM/COBOL to Visual COBOL.

## Single file support

The recommended way to work with files within Visual COBOL is to include them in a project. For situations where you might want to quickly open edit a single file, Visual COBOL now provides support for native COBOL files in the IDE when the file is not opened as part of a project. There is limited support for the IDE editing, compiling and debugging features as full support requires a project file.

To enable full IDE support for single files, Visual COBOL provides a path for creating projects from them - right-click such files in the editor, and click **Create COBOL Project**.

## Tunables

Visual COBOL version 2.3 contains the following updates to tunables:

**default\_cancel\_mode** A new parameter, and default, has been introduced for this tunable; see *default\_cancel\_mode* for more information.

**subsystem\_cancel\_mode** A new parameter has been introduced for this tunable; see *subsystem\_cancel\_mode* for more information.

### Updated run-time system

COBOL Server has been updated to provide an execution environment capable of running applications that were each built using different development products. A consequence of this is that If your application has a main COBOL executable (.exe) that was built with a previous version of Visual COBOL, you should ensure that the executable is rebuilt and packaged with the new run-time system. You can rebuild from the IDE or the command line.

Other COBOL subprograms built with previous versions of Visual COBOL are not required to be rebuilt.

## What was New in Visual COBOL 2.2 Update 2

Visual COBOL 2.2 Update 2 provided enhancements in the following areas:

- [Visual Studio](#)
- [Character Set Enhancements](#)
- [Code Analysis](#)
- [Database Access](#)
- [Micro Focus COBOL enhancements](#)
- [External Security Facility \(ESF\)](#)
- [Enterprise Server MQ-IMS Bridge](#)
- [Tunables](#)

### Visual Studio

Visual COBOL 2.2 Update 2 provides enhancements in the following areas:

- Call Hierarchy - support for the Call Hierarchy window has been enhanced and it now shows types and members across the entire solution.
- Debugging enhancements - includes enhanced support for the Autos windows for native and managed COBOL, support for querying EBCDIC data in managed code, and support for the standard visualizers for data items and groups in native COBOL.
- Find All References - you can now configure the scope of the Find All References command. The default behavior is to search for references in the current COBOL project and now, you can enable Find All References to search for matches in all managed COBOL projects that are part of your solution.
- Net Express Project Import wizard - now includes a number of usability enhancements.
- Run-time configuration - you can now use the application configuration file, `Application.config`, in native COBOL projects to set all run-time tunables.

### Character Set Enhancements

The following character sets, available using the MFCODESET environment variable, have been enhanced or added in this release:

- Thai Extended (0066) - new
- Korean (0082)
- Simplified Chinese (0086)
- Traditional Chinese (0886)

There are also a number of double-byte character sets that are now capable of mixed single-byte and double-byte character conversion; see the definition of MFCODESET in *Environment Variables in Alphabetical Order* for more information.

## Code Analysis

Visual COBOL for Visual Studio can produce the following COBOL reports:

- Dead Code - finds unreferenced items or any piece of code that can't be reached during execution.
- Unreferenced Data - finds any data items that are not explicitly referenced in the Procedure Division of a program.
- Undeclared Procedures - finds any procedures that are referred to but not defined.
- Copybook Structure - displays the hierarchy of any copybooks defined in a program.
- Program Statistics - provides general information, such as number of source code lines, number of data items, and size of data items.
- Unexecuted Procedures - finds any procedures that are defined but not referred to.

## Database Access

The following new features are available in database access support:

### COBSQL

In Visual Studio:

- Pro\*COBOL support - you can now select and configure the Pro\*COBOL COBSQL preprocessor for compiling COBSQL applications on the **SQL** tab in the project's properties.
- KEEPCOMP - the new KEEPCOMP directive resolves COMP/COMP-5 issues with Oracle applications on little-endian platforms.

### HCO for DB2 LUW

Visual COBOL version 2.2 Update 2 introduces GEN-HV-FROM-GROUP - a new DB2 ECM compiler directive option, that generates host variables for all elementary data items when a multiple-level group variable is used in a FETCH or singleton SELECT DB2 statement.

### OpenESQL

This version provides the following new OpenESQL features:

- Support for SQL Server 2014.
- New SQL Compiler directive options:
  - DETECTDATE=SERVER - resolves host variables alignment with column data types in an SQL table.
  - GEN-HV-FROM-GROUP - generates host variables for all elementary data items when a multiple-level group variable is used in a FETCH or singleton SELECT SQL statement.
- Sample applications - the following native COBOL SQL sample applications are new with this version:
  - Get Diagnostics - demonstrates how to use GET DIAGNOSTICS EXEC SQL calls to get diagnostic information from various DBMSs.
  - LOB Data Types - Demonstrates how to INSERT and SELECT LOB data in a native application using various DBMSs.

### XA switch modules



**Restriction:** This feature applies only when the Enterprise Server feature is enabled.

The following XA switch module updates are available in this version:

- Oracle switch module:
  - Supports User Impersonation when statically registered.
  - Enables you to specify which XA resource definitions use User Impersonation.
  - Now compiled with one source file, rather than two.
- SQL Server switch module:

- Enables you to specify which XA resource definitions use User Impersonation.
- Now compiled with one source file, rather than two.

### Micro Focus COBOL enhancements

The following enhancements have been made to Micro Focus COBOL:

- The following phrases have been added to the XML GENERATE statement:
  - NAME
  - TYPE
  - SUPPRESS
- The following intrinsic functions have been added:
  - ULENGTH
  - UPOS
  - USUBSTR
  - USUPPLEMENTARY
  - UVALID
  - UWIDTH

### External Security Facility (ESF)

The Enterprise Server External Security Facility (ESF) now supports caching the results of some security queries. This can improve the performance of enterprise server instances and of the MFDS when they are configured to use external security.

To enable caching, you need to set non-zero values for the **Cache limit** (maximum size of the cache) and **Cache TTL** (Time To Live, or how long before a cached result expires) settings on the **MFDS Security** tab, the **Default ES Security** tab, or on the **Security** tab for an individual enterprise server. (Currently, the cache settings for Security Managers have no effect; you need to set cache parameters on one of the three Security pages mentioned earlier.)

For more information, see <http://supportline.microfocus.com/examplesandutilities/doxygen/caching.html>.

### Enterprise Server MQ-IMS Bridge

At Visual COBOL 2.2 Update 2 the Enterprise Server MQ-IMS Bridge was supported at GA level. It had previously (from Visual COBOL 2.2 Update 1) been available as a Technology Preview item only.

### Tunables

Visual COBOL 2.2 Update 2 includes the following new tunable:

- `reduce_java_signals` - specifies the options that are passed to a JVM when mixing Java and COBOL.

## What was New in Visual COBOL 2.2 Update 1

Visual COBOL 2.2 Update 1 provided enhancements in the following areas:

- [Visual Studio IDE](#)
- [Micro Focus Heartbleed Update](#)
- [ACUCOBOL-GT Compatibility](#)
- [COBOL Source Information](#)
- [Compare and Synchronization Monitor](#)
- [Compiler Directives](#)
- [Database Access](#)

- [Enterprise Server Integration in the IDE](#)
- [Enterprise Server MQ-IMS Bridge \(Technology Preview\)](#)
- [Environment Variables](#)
- [Fileshare Recovery](#)
- [Line Numbering for COBOL Programs](#)
- [Managed COBOL Syntax](#)
- [Rumba Integration with Visual Studio](#)
- [Run-time Launch Configuration Files](#)

## Visual Studio IDE

Visual COBOL 2.2 Update 1 provided the following enhancements to COBOL support in the IDE:

<b>Find All References</b>	The Find All References functionality now works for managed OO COBOL code.
<b>Navigation</b>	<p>You can now use <b>Alt+Shift+Up Arrow</b> (or Down Arrow) to navigate the variables in the editor.</p> <p>You can use the drop-down types and members to navigate to the different sections (Linkage section, File section etc.) in your source files.</p>
<b>Project Details Window</b>	The <b>Project Details Window</b> now includes columns showing the COBOL dialect of the files and the SQL properties set on them.
<b>Run-Time Configuration</b>	<ul style="list-style-type: none"> <li>• You can now use the application configuration file (<code>application.config</code>) in native COBOL projects to specify some additional settings such as the search order for called programs, command line handling, or file handling. You can do this from the new <b>Run-Time Configuration</b> tab.</li> <li>• When an executable is built using the IDE, the application configuration file is automatically copied to the output folder and is renamed as <code>&lt;executable-base-name&gt;.exe.mfgcf</code>.</li> </ul>
<b>Samples</b>	<p>Visual COBOL 2.2 Update 1 includes the following new samples:</p> <ul style="list-style-type: none"> <li>• Airport Demo (managed) - shows how to create a COBOL WCF REST service and then use a client application to consume it.</li> <li>• Airport Demo (native) - a basic lookup program that reads the information about airports from a .dat file and outputs the distance between two airports.</li> </ul> <p>The Sandcastle sample has been updated and now uses Sandcastle Help File Builder v1.9.8.0.</p>

## Micro Focus Heartbleed Update

The OpenSSL library used in this product was updated to version 1.0.1g to fix the "Heartbleed" vulnerability with TLS heartbeat requests.

## ACUCOBOL-GT Compatibility

The following ACUCOBOL-GT support has been added in this release:

- Di compiler option** The -Di compiler option, which initializes Working-Storage data items based in their type, is now supported.

## COBOL Source Information

The **Quick Browse** option is now available as a context menu command in the editor.

## Compare and Synchronization Monitor

With the release of Visual COBOL 2.2 Update 1, the Compare and Synchronization Monitor has been updated to version 2.

Version 2 is greatly improved in terms of performance, especially during initial checkout of partitioned data sets or when synchronizing a large number of members. Also, the user interface has been improved, and some of the functions available in the old version have now changed or become obsolete.

## Compiler Directives

The following Compiler directives have been added in this release:

**ILPARAMS** Determines the way in which you call a method that contains an array as its last receiving parameter.

**INIT-BY-TYPE** Initializes Working-Storage Section data items to a default value, according to their type.

- Alphabetic, alphanumeric, alphanumeric edited, and numeric edited items are initialized to spaces.



**Note:** For an OSVS dialect, numeric edited items are initialized to zeroes.

- Numeric items are initialized to zero.
- Pointer items are initialized to null.
- Index items are initialized to the value 1.

## Database Access

The following new features have been added as part of database access support:

- DB2 ECM**
- Support added for DB2 LUW version 10.5.
  - Enhanced RETURN-CODE processing.

- OpenESQL**
- Enhanced internationalization support for UNICODE, DBCS and MBCS.
  - Enhanced GET DIAGNOSTICS statement support.
  - Enhanced LOB support for CLOB, BLOB and DBCLOB data types.
  - ADO.NET connection editor now provides context help.
  - Enhanced IDE support for OPTION directives.
  - Now provides support for the creation of save points and rolling back to save points.

**XA Switch Modules**



**Restriction:** This feature applies only when the Enterprise Server feature is enabled.

- New two-phase commit module for SQL Server based on Microsoft's XA switch. This provides support for xa\_recover.
- Support for DB2 LUW version 10.5.
- Support for Oracle version 12.1.

## Enterprise Server Integration in the IDE

You can now use the context menu for the servers in Server Explorer to enable the display of the Enterprise Server log information in the Output window.



## Enterprise Server MQ-IMS Bridge (Technology Preview)



**Note:** At Visual COBOL 2.2 Update 1 this was provided as a technology preview feature only. It was made available to allow you to test and provide feedback on this new capability; however, this feature was not intended for production use and was not supported as such.

Visual COBOL version 2.2 Update 1 provided support that enables WebSphere MQ applications to communicate with IMS applications in an Enterprise Server region.

## Environment Variables

The following environment variable has been added in this release:

**strictvsam** strictvsam enables strict mainframe emulation when processing VSAM files.

When set to ON and running under mainframe emulation, file status 37 is returned for an existing VSAM file when opened for OUTPUT if the file has data or previously had data written to it, or if the file is of a different format to the file on disk. When set to OFF, file status 0 is returned and a new file is created when an existing VSAM file is opened for OUTPUT. This variable is set to OFF by default.

## Fileshare Recovery

Recovery of Fileshare data files has been enhanced.

Rollback recovery is a faster process that aims to fix the files from their failed state.

This process cannot be used in all scenarios, but a new user exit has also been introduced that allows you to programmatically control which files you wish to recover with this process.

Hot backups are also a new introduction, which allow you to perform a backup without having to shut down Fileshare.

## Line Numbering for COBOL Programs

Visual COBOL version 2.2 Update 1 provided options for auto-inserting or removing line numbers in source files open the editor. Features include:

- COBOL numbering - line numbers are inserted in the sequence area of the code (columns 1 - 6), starting by default at 000100 at the first line, incrementing by 100 by default.

Micro Focus recommends that you use COBOL numbering only if your files are in fixed or variable source format.

- Standard numbering - line numbers are inserted immediately to the right of area B, in columns 73 - 80, starting by default at 00000100 at the first line, incrementing by 100 by default.

Micro Focus recommends that you use Standard numbering only if your files are in fixed format.

- The **Renumber** and **Unnumber** commands available from the context menu in the editor.

## Managed COBOL Syntax

Visual COBOL version 2.2 Update 1 includes the following enhancements to the managed COBOL syntax:

**Specifying parameters in the method signature** You can now specify passing parameters and returning items in the method signature, instead of using a Procedure Division header. This applies to methods, indexers, iterators, constructors and delegates.

**CONSTANT keyword** Use the CONSTANT keyword on a field to protect it from being altered.

**Operations on string fields** You can now use the STRING, UNSTRING and INSPECT statements on fields of type string.

## Rumba Integration with Visual Studio

Visual Studio now offers context menu commands for launching the Rumba mainframe display (Desktop or embedded) from Solution Explorer or from Server Explorer. The embedded Rumba display now provides keyboard mapping and color settings.

You can use the display of choice both in debugging and when running applications.

## Run-time Launch Configuration Files

Use a run-time launch configuration file to ensure an application can be launched when it is deployed in a separate location to the run-time system (in the case of dynamically bound applications), or when the licensing daemon is not already running.

# What was New in Visual COBOL 2.2

Visual COBOL 2.2 provided enhancements in the following areas:

- [Enhancements for Visual COBOL 2.2 for Visual Studio 2012](#)
- [ACUCOBOL-GT Compatibility](#)
- [RM/COBOL Compatibility](#)
- [Application Configuration](#)
- [COBOL Source Information \(CSI\)](#)
- [Compiler Directives](#)
- [Consolidated Tracing Facility](#)
- [Converting Net Express Projects](#)
- [Enhanced Accept and Display Statements](#)
- [Debugging](#)
- [Grouping Files in Virtual Folders in Solution Explorer](#)
- [File Handling](#)
- [Interface Mapping Toolkit](#)
- [Managed COBOL](#)
- [Searching in Copybooks](#)
- [COBOL Editor Enhancements](#)
- [Upgrading from Net Express to Visual COBOL](#)
- [WCF REST Service Application projects](#)
- [Microsoft Windows Azure](#)
- [XML Extensions](#)

## Enhancements for Visual COBOL 2.2 for Visual Studio 2012

The following enhancements are applicable to Visual COBOL for Visual Studio 2012:

- Copybook Dependencies - Solution Explorer shows a tree view of the dependencies of the COBOL programs and copybooks on copybooks in a project to help you navigate easily around the source code.
- Expanded Copybook View: Technical Preview - The COBOL editor supports showing the contents of copybooks inline at the place where they are referenced in a program or a copybook. Features include:
  - Support for copybooks referenced using any of the following statements - COPY, -INC, ++INCLUDE, EXEC SQL INCLUDE.
  - Support for editing copybooks in the expanded copybook view (except for copybooks shown with replaced values or such for which the user does not have write access).
  - For copybooks referenced using a COPY... REPLACING statement, you can show either the original contents of the copybook file or show its contents with replaced values. The expanded copybook view with replaced values is read-only which is indicated by a yellow background color.



**Note:** You can configure the background color of the read-only view from **Tools > Options > Environment > Fonts and Colors**, and changing the background color for the **COBOL Read-Only Background** item.

- **Go To Definition, Find All References**, navigation using the drop-down types and members, and navigating to an error from the **Error List** window all find results or locate information in the expanded copybook view.
- Support for Intellisense and code snippets when editing copybooks in the expanded copybook view.
- Support for the Visual Studio outlining feature (collapsing and expanding regions of code) within the expanded copybook view and for regions that include expanded copybooks.



**Note:** The following limitations apply to the expanded copybook view:

- The expanded copybook view displays bookmarks in copybooks and commands for bookmarks such as enable or disable are supported. However, using Next/Previous and the Bookmark window will open the standalone copybook file rather than inline view.
- It is not possible to edit copybooks referenced through a COPY... REPLACING statement in expanded copybook view when the view shows the replaced values. In this case, the expanded copybook view is read-only.
- The read-only status of expanded copybooks is not preserved when you close the project. Next time you open the project, the copybook is shown in the Expanded Copybook view but not as read-only.
- If you used the OF or IN phrases with a COPY statement, it is not possible to show the corresponding copybook in the Expanded Copybook view or open it using the **Open "CopybookName" in New Window** command if the copybook is stored in a library file (where you have used the COPYLBR Compiler directive).
- Navigating to items in the expanded copybook view is not supported from the **Class View** or using the **Navigate To** command.
- References to file locations in the output windows such as pointing to the build output, or in the results received by **Find in Files**, do not point to items in the expanded copybook view.
- Selecting the currently selected statement in the call stack in an expanded copybook may show the actual copybook. You can use the **Show Next Statement** command of the debugger to return the actual expanded copybook position.
- The Breakpoints window always shows the line number of a breakpoint within the file containing it, not the line number within expanded copybook view.
- The **Call Stack, Threads** and **IntelliTrace** windows all display line numbers corresponding to the file containing the statement, not the line number within expanded copybook view.
- If you move the caret to an invalid position in the expanded copybook view, the **Set Next Statement** command will display an 'Unable to set the next statement to this location' error message and the copybook will be opened as a separate document.
- When stepping through .NET COBOL code, if the next statement to step onto is within the same class or program, and on the same line number, but in a different source file, the debugger steps over that statement. For example, if you try to step from line 10 of `Program1.cbl` to line 10 of `Copybook1.cpy`, the debugger steps over the statement in the copybook.

## ACUCOBOL-GT Compatibility

The following enhancements are applicable to Visual COBOL:

- Accessing data files through AcuServer - You can now access your ACUCOBOL-GT data files, both sequential and Vision files, through AcuServer.
- Standard library routines - Support for the following library routines has been added:
  - C\$GETPID
  - C\$JUSTIFY
  - C\$LIST-DIRECTORY

- C\$LOCKPID
- C\$REGEXP
- C\$RUN
- C\$SLEEP
- C\$SYSTEM
- C\$TOLOWER
- C\$TOUPPER
- I\$IO
- Using Vision files with Micro Focus Data File Tools - You can now use some of the Data File Tools functionality with Vision files. You can:
  - Convert Vision files to Micro Focus format using the Data File Converter and the DFCONV command line utility.
  - Edit Vision files using the Data File Editor.



**Note:** For more information about the **Data File Tools** utility, see *Data Tools*.

### RM/COBOL Compatibility

The following support has been added to Visual COBOL in this release:

- Subprograms - Support for the following subprograms (referred to as library routines in Visual COBOL) has been added:
  - C\$OSLockInfo
  - C\$SecureHash
- recover1 - The recover1 utility, RM/COBOL's indexed file recovery utility, is now distributed with Visual COBOL. Refer to the *RM/COBOL File Handling* section of *RM/COBOL Compatibility* for details of its use.

### Application Configuration

You can now set environment variables for when you run native projects from within the IDE from the project's properties - click **Environment** on the **Application** tab in the project properties.

### COBOL Source Information (CSI)

COBOL Source Information (CSI) provides a quick and easy way of providing you with information about your program when you are working on it. You enter a query in the CSI query control and CSI returns the results of the query in the Micro Focus Code Analysis window.

### Compiler Directives

The following Compiler directives are new:

<b>ACU-UNDERSCORE</b>	This directive treats underscores in COBOL words as hyphens.
<b>ILSHOWPERFORMOVERLAP</b>	This managed COBOL-only directive generates a warning when an overlapping PERFORM range is detected in the program.
<b>ILEXPONENTIATION</b>	This managed COBOL-only directive enables you to optimize exponential arithmetic operations by specifying the calculation method used.
<b>EXITPROGRAM</b>	This directive determines how the EXIT PROGRAM statement is executed.

The following Compiler directives have changed

- CHANGE-MESSAGE** The scope of this directive has been widened to allow you to change the severity of different types of error messages, not just syntax checking messages.
- DIALECT"RM"** DIALECT"RM" now sets PERFORM-TYPE"RM". If you recompile an application that uses DIALECT"RM", the behavior may change for nested PERFORM statements. If that is the case, explicitly set PERFORM-TYPE"MF" after DIALECT"RM" to continue with the previous behavior.
- HIDE-MESSAGE** The scope of this directive has been widened to allow you to hide different types of error messages, not just syntax checking messages.
- PRESERVECASE** This directive now defaults to PRESERVECASE when compiling native COBOL; managed COBOL compilation already defaults to PRESERVECASE. This results in externally visible identifiers preserving their case instead of being converted to uppercase.

### Consolidated Tracing Facility

The following changes have been made to the Consolidated Tracing Facility (CTF):

**New properties and variables for existing emitters** The following support has been added to existing emitters.

**Properties** The following property has been added to the BINFILE emitter:

Property	Description
RunUnitID	Controls whether the RunUnit information is included in the trace.

**Variables** Four new pseudo-variables for the FILE property have been added to the BINFILE and TEXTFILE emitters:

pseudo-variable	Description
\$(PLATFORM)	A platform specific constant, useful when two run-time systems are in the same process, and you require separate trace files
\$(RUNUNIT)	A unique number that represents the managed RunUnit ID
\$(RUNUNIT_SESSIONNAME)	The session name passed to the managed RunUnit
\$(RUNUNIT_GUID)	The globally unique identifier associated with the managed RunUnit

### Converting Net Express Projects

Conversion of Net Express projects has been enhanced. You now use the Visual Studio conversion wizard to import and convert Net Express projects (.app files) to Visual Studio solutions.

### Enhanced Accept and Display Statements

Two of the existing Enhanced ACCEPT and DISPLAY settings available through Adis have additional values, which are aimed at RM/COBOL users migrating their source code to Visual COBOL. The new values are:

- Emulation of RM/COBOL-85 style data entry for numeric data entry on ACCEPT statements.

- Emulation of an RM/COBOL backspace in free format fields when in replacement editing mode, in that deleted characters are removed and characters to the right are shifted left, the same as when in insertion editing mode.

For more information on how to set these values, refer to *Configuring Enhanced ACCEPT and DISPLAY*.

## Debugging

**Displaying debug information for managed applications** You can set the DEBUG constant for managed COBOL projects on the **COBOL** tab in the project properties. This enables you to use the System.Diagnostics.Debug class in your applications to ensure they write diagnostic information in the Output window for projects compiled for Debug but not for projects compiled for Release.

**Changing the display format for individual items in the Watch window** It is now possible to change the display format for individual items in the Watch window in COBOL. To do this, click a row, press **F2**, and type: *Variable,h* or *Variable,x* to always display the values in hexadecimal format; *Variable,d* to always display the values of variables in decimal format, and of strings - as text.

## Grouping Files in Virtual Folders in Solution Explorer

Visual COBOL now provides a Virtual View of a project within Solution Explorer. In the Virtual View you use virtual folders to improve navigation by logically grouping the files that make up the project. You can also create your own virtual folders to group files of your choice (a file can only belong to one virtual folder). The files can be of different file types.

## File Handling

New features include:

- Converting and editing Vision and RM/COBOL indexed data files using the Data File tools is now supported.
- Access to data files (either sequential or indexed) through AcuServer is now supported.
- Access to Vision and RM/COBOL indexed data files through Enterprise Server is now supported.

## Interface Mapping Toolkit

Visual COBOL now supports the creation and deployment of COBOL program-based services using the Interface Mapping Toolkit (IMTK).

## Managed COBOL

**Documentation** A guide that provides a basic introduction to Object-Oriented Programming (OOP) for COBOL developers, *An Introduction to Object-Oriented Programming for COBOL Developers*, with examples is now available from the *Product Documentation* section on the [Micro Focus Customer Support Documentation Web site](#).

**Procedural Multi-Output Project type** A new .NET managed project template, Procedural Multi-Output Project, is now available. The project compiles procedural programs to individual managed assemblies or executables as opposed to the standard managed project templates that produce a single assembly. This project type is useful when you are moving existing procedural applications that consist of multiple programs to Visual COBOL and to managed code. When calling a subprogram, the COBOL run-time system can locate the assembly using the name of the called program which will match the assembly file name. In this case, the assembly does not have to be preloaded. See *Types of COBOL Project Templates* for more details and for a list of the limitations of this project type.

## Named and optional parameters

Two new types of parameter have been introduced for use during method invocation:

### Named parameters

As part of the invocation expression, you can define a value for a parameter named in the method definition. The named argument must be specified after any positional arguments, and must not correspond to any of those preceding arguments.

### Optional parameters

Optional parameters are parameters defined with a default value in the procedure division header of the invoked method. If none of the arguments passed in during invocation correspond to this parameter, the default value is used in the method; if an argument does correspond, the value that was passed in is used.

## Delegates and events

A number of new features have been added that relate to delegates and events:



**Note:** Some of these features were also available in previous versions of Visual COBOL.

### The ATTACH and DETACH statements

Use these statements to attach or detach a delegate, method group or an anonymous method to or from an event.

### The RUN statement

Use this statement to invoke a delegate once it has been created.

### Combining delegates

Use the '+' operator to add a method group, anonymous method or another delegate to a delegate, and use the '-' operator to remove a method or another delegate from a delegate.

### Method groups conversions

Use the METHOD keyword to specify a compatible method from a method group, and convert it to a delegate.

## Searching in Copybooks

The search in copybook files has been enhanced. Visual Studio's **Find in Files** now enables you to perform a search in all copybooks - the ones that are part of the project, and in the ones that are found in the paths defined on the **Dependency Paths** tab in the project's properties. To do so, set the search scope in the **Find and Replace** dialog to **COBOL Project Copybook Paths**.

## COBOL Editor Enhancements

Navigating in the editor is now more similar to the editor navigation in Net Express. You can configure things like word wrap and indentation, the movement of the cursor using the **Home** and **End** keys, the style of the ruler and the colors of the text and the margins:

### Smart editing mode

The default mode in the editor is now Smart edit mode. It controls the word wrapping and the indentation in the different COBOL areas. You can configure the Smart edit mode from the **Tools > Options > Text Editor > Micro Focus COBOL > Margins** page. To toggle the mode, click in the COBOL toolbar.

### Home and End keys navigation

You can configure how the **Home** and **End** keys move the cursor in the editor on the **Tools > Options > Text Editor > Micro Focus COBOL > Margins** page. To toggle the mode, click in the COBOL toolbar.

### Configuring the ruler

You can specify whether to display the horizontal ruler in the editor and also choose its style, a default style or a mainframe style for which the ruler indicates COBOL area A/B, from **Tools > Options > Text Editor > Micro Focus COBOL > Margins** and check **Show ruler**.

## Support for SOA



**Restriction:** This topic applies only when the Enterprise Server feature is enabled.

Visual COBOL now includes support for creating Web service and Enterprise Java Bean applications using the Interface Mapping Toolkit (IMTK) in conjunction with Enterprise Server. If you are upgrading to this release from an earlier version of Visual COBOL, you may need to apply for a new authorization code in order to access the functionality - please contact Micro Focus Customer Care to receive an updated authorization code. Note that the Visual COBOL Personal Edition license does not support the IMTK functionality.

## Upgrading from Net Express to Visual COBOL

A new section in the product help, *Upgrading from Net Express to Visual COBOL for Visual Studio 2017*, provides guidance on how to move existing applications either developed or debugged in the Net Express IDE into the Visual Studio IDE.

## WCF REST Service Application projects

Visual COBOL now provides a project template for creating COBOL WCF REST Application services. The requirements are - Visual Studio Professional, Premium, or Ultimate (Visual Studio Shell does not support WCF applications), and versions of the .NET Framework 4.0 and later. For more information about WCF and REST, check Microsoft's MSDN.

## Microsoft Windows Azure

Visual COBOL for Visual Studio now enables you to create, build, debug, run, and package COBOL applications for use with Windows Azure. It provides:

- Project template for a COBOL cloud service. This creates a solution containing a project for the cloud service and projects for the web and worker roles you specify.
- Demonstration projects, showing a web and worker role in COBOL, with the business logic remaining in unchanged COBOL programs.
- Help. This includes a tutorial that shows how to create a simple cloud service for COBOL and how to deploy and run the service as an off-premises Microsoft Azure instance.

This functionality was previously available as an AddPack but is now integrated into Visual COBOL.

## XML Extensions

You can now use XML Extensions in your managed COBOL projects.

Use XML Extensions to import and export XML documents to and from COBOL working storage. Specifically, XML Extensions allows data to be imported from an XML document by converting data elements (as necessary) and storing the results into a matching COBOL data structure. Similarly, data is exported from a COBOL data structure by converting the COBOL data elements (as necessary) and storing the results in an XML document.

While importing or exporting data to or from XML documents, you can apply XSLT transforms to the data by using XSLT stylesheets.

For more information, refer to the *XML Extensions User's Guide*.

# What was New in Visual COBOL 2.1 Update 1

Visual COBOL 2.1 Update 1 provided enhancements in the following areas:

- [Compiler Directives](#)
- [DB2 ECM](#)



- [Copybooks Enhancements](#)
- [Enterprise Server](#)
- [Debugging Enhancements](#)

### Compiler Directives

You can now set SQL Compiler directives and their values more easily, using a table of tick boxes in a project's Properties dialog box.

### DB2 ECM

- Support for 64-bit DB2 ECM
- Support for 64-bit compile and runtime
- Support for DB2 10.1
- New DB2 SQL compiler directive option, BGP, to enable background parsing

### Copybooks Enhancements

For variables in a copybook that are modified by COPY... REPLACING statements in your code, the Autos window displays all values defined in the source code. When there are multiple COBOL programs in your project that perform a COPY... REPLACING in a copybook, the Autos window only uses the replacing values found in the first COBOL program. In addition, a new command, **Open copybook with replaced values**, is now available from the editor for the copybooks that the COPY... REPLACING statements modify.

### Enterprise Server

The following new features and enhancements are available:

<b>Clustering</b>	COBOL Server Clustering allows the scaling-out of work units, so that an increased number of operating system images can share the workload, resulting in high-performance, multi-system data sharing across all platforms.
<b>Historical Statistics Facility</b>	The Historical Statistics Facility has been extended to include the generation of JCL file records, increasing the amount of information customers have available to assist them in monitoring and tuning their COBOL Server installations.
<b>Recovery of in-doubt XA transactions</b>	Some events in XA environments can result in 'in-doubt' transactions, where all parts of a composite transaction are not committed through all participating resource managers. The recovery of such in-doubt transactions is now supported.
<b>SSL Support for the CICS Web Interface</b>	COBOL Server now allows clients and servers to identify themselves through X.509 certificates and participate in SSL-enabled conversations.

### Debugging Enhancements

For variables in a copybook that are modified by COPY... REPLACING statements in your code, the Autos window displays all values defined in the source code. When there are multiple COBOL programs in your project that perform a COPY... REPLACING in a copybook, the Autos window only uses the replacing values found in the first COBOL program. In addition, a new command, **Open copybook with replaced values**, is now available from the editor for the copybooks that the COPY... REPLACING statements modify.

## What was New in Visual COBOL 2.1

Visual COBOL 2.1 provided enhancements in the following areas:

- [ACUCOBOL-GT Data Types in Managed Code](#)
- [ACUCOBOL-GT Library Routines in Managed Code](#)
- [Associating file extensions with the COBOL language](#)
- [Compiler Directives](#)
- [.int, .gnt and .lbr File Types Support](#)
- [Managed code enhancements](#)
- [OpenESQL](#)

### **ACUCOBOL-GT Data Types in Managed Code**

ACUCOBOL-GT data types and sign() variants that were previously only available in native code are now supported in managed code. Use the Compiler directives COMP1 and COMP2 to set ACUCOBOL-GT behavior for those particular data types.

### **ACUCOBOL-GT Library Routines in Managed Code**

ACUCOBOL-GT library routines that were previously only available in native code are now supported in managed code.

### **Associating file extensions with the COBOL language**

This release includes enhancements to the way you associate file extensions and extensionless files with the COBOL language.

If you are importing existing COBOL applications into Visual Studio, it is recommended that you create associations with COBOL within the IDE for any extensions that are not traditionally used in COBOL.

### **Compiler Directives**

The following new Compiler directives are now available:

<b>DISPLAY</b>	Defines the default behavior of standard DISPLAY statements.
<b>COMP1</b>	Specifies the behavior of a COMP-1 data item.
<b>COMP2</b>	Specifies the behavior of a COMP-2 data item.
<b>RESTRICT-GOTO</b>	Generates a syntax error for GO TO statements that transfer control to outside of the current section.
<b>ILSMARTRESTRICT</b>	Limits the generation of properties in ILSMARTLINKAGE classes to non-redefining elementary items.

The following Compiler directive has changed:

- **DATAMAP** - Two new parameters allow you to display either the address or offset values for data items in your program.

### **.int, .gnt and .lbr File Types Support**

Support has been added within the IDE for compiling native COBOL applications to the Micro Focus legacy formats .int and .gnt, and to package these files as a Micro Focus library file (.lbr). Improvements include:

- An option to compile all native COBOL projects to .int and .gnt code. You can set this on the Application page in your project's properties.
- A new native COBOL project template, Micro Focus INT/GNT.
- An option to package the .int and .gnt files produced by the project as a Micro Focus .lbr library files.
- Improvements to the Net Express Project Import wizard that enable you to convert existing Net Express projects to Visual COBOL projects that compile to .int and .gnt code.

## Managed code enhancements

<b>Delegates and Events</b>	This release provides support for combining delegates, using the METHOD keyword to specify method groups, and implicit conversion from a method group or an anonymous method to the suitable delegate type.
<b>Handling Invalid Numeric Data</b>	The handling of invalid numeric data is controlled by a number of Compiler directives: HOSTNUMMOVE, HOSTNUMCOMPARE and SIGNFIXUP. These directives were previously only available in native code but are now supported in managed code.
<b>Resolving Types</b>	<p>In this release, the Compiler attempts to resolve types to those defined in the current compilation unit wherever possible. The Compiler will attempt to resolve such types to an external name only if no suitable type exists in the current compilation unit. For example:</p> <pre>\$set ilusing"System" class-id MyNamespace.EventHandler. 01 o type EventHandler. end class.</pre> <p>In this release, <code>01 o type EventHandler.</code> resolves to <code>MyNamespace.EventHandler</code> and not to <code>System.EventHandler</code>.</p>
<b>Specifying Properties</b>	In previous versions of the products, properties declared using the PROPERTY keyword on a data item were generated as final properties. Starting with this release, they are generated as virtual properties by default. In order to make the properties final, you need to specify the word FINAL following PROPERTY. This change may affect the generation of Proxy classes, for example, if you are using WCF.

## OpenESQL

<b>ODBC</b>	Added support for a generic one-phase commit for ODBC XA switch module.										
<b>SQL Compiler Directive Options</b>	<p>OpenESQL has been enhanced to support the following new SQL compiler directive options:</p> <table><tr><td><b>DATE</b></td><td>Controls the reformatting of date values in output parameters and in input parameter character host variables when DETECTDATE is also specified.</td></tr><tr><td><b>TIME</b></td><td>Controls the reformatting of date values in output parameters and in input parameter character host variables when DETECTDATE is also used.</td></tr><tr><td><b>DATEDELIM</b></td><td>Specifies a single character as the delimiter between the year, month, and day components to override the default delimiter determined by the HCOSS DIALECT or DATE directive specification.</td></tr><tr><td><b>TIMDELIM</b></td><td>Specifies a single character as the delimiter between the hour, minute, and second components to override the default delimiter determined by the HCOSS DIALECT or TIME directive specification.</td></tr><tr><td><b>TSTAMPSEP</b></td><td>Specifies a single character as the separator between the date and time parts of timestamp and date/time data.</td></tr></table>	<b>DATE</b>	Controls the reformatting of date values in output parameters and in input parameter character host variables when DETECTDATE is also specified.	<b>TIME</b>	Controls the reformatting of date values in output parameters and in input parameter character host variables when DETECTDATE is also used.	<b>DATEDELIM</b>	Specifies a single character as the delimiter between the year, month, and day components to override the default delimiter determined by the HCOSS DIALECT or DATE directive specification.	<b>TIMDELIM</b>	Specifies a single character as the delimiter between the hour, minute, and second components to override the default delimiter determined by the HCOSS DIALECT or TIME directive specification.	<b>TSTAMPSEP</b>	Specifies a single character as the separator between the date and time parts of timestamp and date/time data.
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<b>TIMDELIM</b>	Specifies a single character as the delimiter between the hour, minute, and second components to override the default delimiter determined by the HCOSS DIALECT or TIME directive specification.										
<b>TSTAMPSEP</b>	Specifies a single character as the separator between the date and time parts of timestamp and date/time data.										
<b>OpenESQL Assistant</b>	OESQL Assistant now supports updateable cursors.										
<b>SQL Server</b>	We now support Microsoft SQL Server 2012.										

## What was New in Visual COBOL 2.0

Visual COBOL 2.0 provided enhancements in the following areas:

- [Building Projects to Multiple Output Files](#)
- [Compiler Directives](#)
- [Debugging Enhancements](#)
- [Library Routines](#)
- [Managed COBOL Language Features](#)
- [Data Access](#)
- [Run-Time Tunables](#)
- [Samples](#)
- [Vision Data File Searching](#)
- [XML Support](#)

## Building Projects to Multiple Output Files

You can now build your native Link Library projects to multiple output files. To configure this, you need to go in the project properties and set **Output To to Multiple Libraries**.

## Compiler Directives

The following new directives are now available:

- COPYSEARCH - enables you to specify how copybooks are located. You can choose between usual Micro Focus COBOL behavior or usual RM/COBOL behavior.
- ILSMARTNEST - enables you to nest ILSMARTLINKAGE classes inside the program class in which they are defined. This makes it possible to have multiple programs in a single compilation unit that include linkage records with the same name.

The following directives have been changed:


- DIALECT(RM) - now accepts a new parameter, RM, which enables the RM-compatible functionality that the RM directive used to enable.
- ILUSING - when set on a single file using the SET statement, `$set ilusing`, the directive only affects that file.

## Debugging Enhancements

Visual COBOL 2.0 provides the following enhancements to debugging:

**Core dump files** On Windows, the core dump files created by this product are Microsoft minidump files. If you have a mixed-language application, you can use the minidump file to debug the other languages involved.

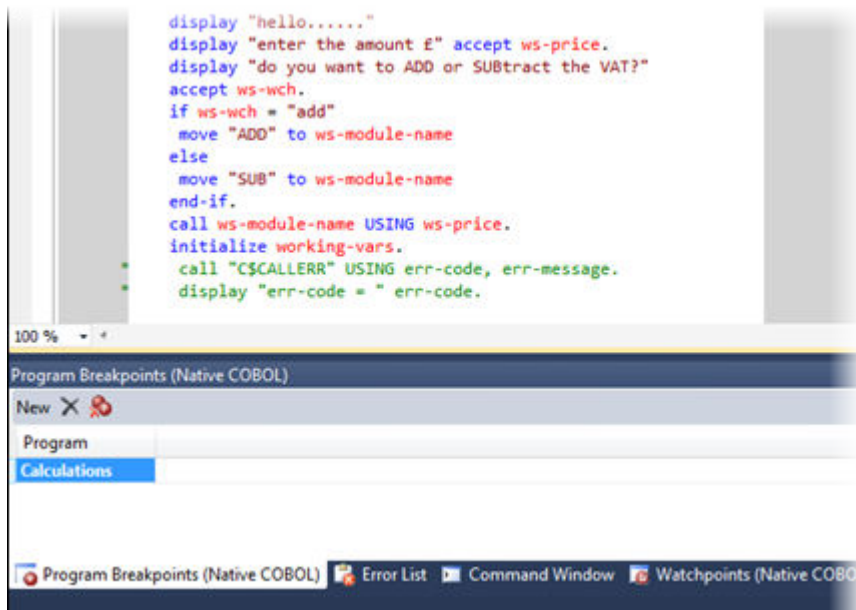
**Debugging native COBOL Link Library projects** You can now debug native COBOL link library projects that get built to a single .dll file.

**Program Breakpoints**  **Note:** Program breakpoints are supported in native COBOL only, and are not supported with nested programs.

Use the **Program Breakpoints (Native COBOL)** window to add program breakpoints to your applications. When a program breakpoint is set the application breaks whenever the program or one of its entry points is called.

In the **Program Breakpoints (Native COBOL)** window, click **New** and type the name of the source file, without the extension. For multi-program source files, to set a break for a sub-program, use its program-id.

To display the **Program Breakpoints (Native COBOL)** window, click **Debug > Windows > Program Breakpoints (Native COBOL)**.



**Step out of OSVS perform statements** You can now step out of a perform statement when PERFORM-TYPE(OSVS) or DIALECT(OSVS) is set.

**Support for debug attaching to programs launched by services** Visual COBOL now supports debugging of native CGI applications by waiting for attachment on a directory.

**Wait for debuggable attachment option for native COBOL** **Wait for debuggable attachment** on the Debug page in the properties of native properties has been enhanced. You can now specify one the following options for it - Wait for any program, Wait for directory, and Wait for ID.

## Library Routines

The following routine has been enhanced:

- The CBL\_SEMAPHORE\_ACQUIRE routine now accepts a `timeout` parameter.

## Managed COBOL Language Features

The following new syntax elements are now available in managed COBOL:

**Local Variables** In managed COBOL, Data items can now be declared in the procedure division, using the DECLARE statement. In addition, they can be declared inline as the iterator in a PERFORM statement, or as an exception message in a TRY ... CATCH ... FINALLY statement block.

**Collections** There are two new collection types in managed COBOL: LIST and DICTIONARY. For a LIST, you can add elements to a list, retrieve the nth element of the list, replace the nth element, iterate through the list and clear the list. For a DICTIONARY, you can add key value pairs, retrieve a value corresponding to a key, to replace the value corresponding to a key, iterate through the dictionary and clear the dictionary.

<b>Properties</b>	In managed COBOL, a property can now be defined using PROPERTY-ID and GETTER and SETTER phrases to access to the property. The previous technique of specifying the keyword PROPERTY on a data declaration is still available.
<b>Indexers</b>	In managed COBOL, an indexer can now be defined using INDEXER-ID and GETTER and SETTER phrases to access the indexer value. Indexers are similar to properties, except that their accessors take parameters. Indexers allow instances of a class or valuetype to be indexed just like arrays.
<b>Zero-based Indexing</b>	The managed COBOL syntax for arrays now uses zero-base indexing to access arrays when square brackets are specified. For backward compatibility, one-base indexing is used when round parentheses are specified.

## Data Access

Visual COBOL version 2.0 provides the following enhancements:

- Improved IDE integration with SQL directives - now supports handling of deprecated and removed directives. Also supports filtering of the choices offered to the user by product type, project type, and platform.
- OpenESQL has been enhanced and it now:
  - defaults to optimal performance
  - supports 64bit ODBC across all platforms
- The OpenESQL ADO.NET managed run-time has been redesigned so it now works faster. It also supports multiple result sets with stored procedures.

## Run-Time Tunables

Visual COBOL 2.0 provides the following new tunables:

- printer\_raw\_redirection - use this to redirect WRITE statements through the Windows print spooler as RAW data types.
- subsystem\_cancel\_mode - use this to override the default cancel mode when you use the CBL\_SUBSYSTEM library routine to cancel a subsystem.

## Samples

The following new samples are now available:

- CGI demonstrations:
  - Complex CGI application - demonstrates how to use native COBOL to create CGI programs which accept data from a form on a Web page and then redisplay that data in another Web page
  - Simple CGI application - demonstrates how to use native COBOL to create CGI programs which accept data from a form on a Web page and then redisplay that data in another Web page
- The following samples have been added to the COBOL for .NET section:
  - Collections - demonstrates the new LIST and DICTIONARY collection types
  - Local Variables - shows how to declare data items in the procedure division in the DECLARE, PERFORM and TRY statements
- The code in the Properties sample in the **COBOL for .NET** section of Samples Browser has been enhanced to use the new PROPERTY-ID syntax. The sample also includes a sample program for Indexers which illustrates the new INDEXER-ID syntax.

## Vision Data File Searching

Visual COBOL 2.0 provides the following new ACUCOBOL-GT compatible environment variables to help search for Vision data files at run time:

APPLY\_FILE\_PATH  
FILE\_CASE  
FILE\_PREFIX  
FILE\_SUFFIX

## XML Support

The IBM-style XML GENERATE syntax is now supported in .NET managed COBOL.

# What was New in Visual COBOL 2010

Visual COBOL 2010 provided enhancements as part of the following releases:

- [New Features in Enterprise Developer 2010 R4 Update 2](#)
- [New Features in Enterprise Developer 2010 R4](#)

## Features Added in Visual COBOL 2010 R4 Update 2

### Documentation for the Dialog System AddPack

Documentation for the Dialog System AddPack is now available and is integrated with the Visual COBOL documentation.

This documentation describes the AddPack, which enables you to modernize Dialog System applications within Visual COBOL. You migrate an application to Visual COBOL and from there you can run the application without change, or modernize it over time.

The documentation describes some modernization techniques such as:

- A Windows Forms form replacing a Dialog System dialog, where the form can contain .NET controls. See the Customer + .NET WinForm sample `CustomerWinForm.sln`.
- A Windows Forms control wrapped as an ActiveX control and used on a Dialog System dialog. See the Customer + .NET GridView User Control sample `custgrid.sln`.
- A WPF user control hosted by a Windows Forms user control, which is then exposed as ActiveX ready for use by Dialog System. See the Customer + .NET WPF GridView User Control sample `CustGridWPF.sln`.
- A .NET code application interacting with Dialog System as native COBOL `.dll`. See the .NET COBOL Customer sample `ManagedCustomer.sln`.

### Native OO COBOL Class Library Reference

Help for the following native OO COBOL class libraries is available:

Base class library  
GUI class library  
OLE class library  
OLE Automation class library

The Help is available in the file `nrxclr.chm`, which is installed in the Help folder of your installation. The default location is `%ProgramFiles(x86)%\Micro Focus\Visual COBOL\Help`.

To open the help, double-click `nrxclr.chm` in File Explorer.

### Net Express Project Import Wizard

Visual COBOL for Visual Studio includes a Net Express Project Import Wizard that converts NetExpress projects into Visual Studio solutions. The wizard analyzes the Net Express project file and its configuration settings, creates one or more Visual Studio native projects based on this information, imports the existing

source code into them and sets the appropriate directives. When the process is complete, it can optionally display a detailed conversion report.

## Features Added in Visual COBOL 2010 R4

### ACUCOBOL-GT Compatibility

The Compiler and run-time continue to provide support for ACUCOBOL-GT. The directive ACU is the main switch for turning on ACUCOBOL-GT compatibility. The ACU directive enables various ACUCOBOL-GT syntax extensions and other language elements. Additional ACUCOBOL-GT compatibility features include the following:

- When using a CALL statement, the USING and GIVING/RETURNING phrases can now appear in either order.
- The following ACUCOBOL-GT standard library routines can now be used with Visual COBOL in native code:
  - C\$CALLED BY
  - C\$CALLERR
  - C\$CHDIR
  - C\$MAKEDIR
  - C\$MEMCPY
  - C\$MYFILE
  - C\$PARAMSIZE
  - C\$RERR
  - M\$ALLOC
  - M\$FREE
  - M\$COPY
  - M\$FILL
  - M\$GET
  - M\$PUT
  - WIN\$VERSION
- The following ACUCOBOL-GT 'ccbl' compiler options can now be used with Visual COBOL:
  - -E, -V
  - -Cv
  - -Da, -Db, -Dd31, -DL1/2/4/8, -Dq, -FpRounding
  - -La, -Li, -Lc, -Lf, -Ll, -Lo, -Ls, -Lw

Note: The output that these list options provide differs in Visual COBOL.

  - -Qm
  - -Rc, -Rn, -Rw
  - -Sa, -St, -Sd, -Sp, -S1...-S9
  - -noTRUNC, -truncANSI, -Dz
  - -Td, -Te
  - -Vc
  - -Za, -Zc, -Zl, -Zn, -Zs, -Zi, -Zr1, -Zy, -arithmeticVSC2

Full ACUCOBOL-GT compatibility is documented under the *Programming* section in the product help.

### ADO.NET Runtime Improvements

The OpenESQL ADO.NET runtime has been re-engineered, offering several advantages over previous versions, providing:

- Better performance - the new runtime is much faster and can as much as double your performance, depending on the specifics of your application.



- Support for multiple run unit processing.
- Support for both client applications and SQL CLR stored procedures.
- For stored procedure applications:
  - Support for input/output parameters defined as COBOL data types, in addition to the previously supported .NET data types
  - Support that enables stored procedures to return more than one result set.
  - Static SQL Support for the DIALECT=MAINFRAME Compiler directive.
- For client-based applications:
  - Support for dynamic SQL that uses an SQLDA structure to pass parameter and result host variables, specifically including the following embedded SQL statements:

```
EXEC SQL
    PREPARE stmt1 INTO :sqlda FROM :stmt-buf
END-EXEC
```

- EXECUTE - For example, the following statement executes a prepared statement using a previously constructed SQLDA structure:

```
EXEC SQL
    EXECUTE stmt1 USING DESCRIPTOR :sqlda-structure
END-EXEC
```

- OPEN - For example, the following statement opens a cursor using a previously constructed SQLDA structure:

```
EXEC SQL
    OPEN c1 USING DESCRIPTOR :sqlda-structure
END-EXEC
```

For complete information on using these statements, see the *PREPARE*, *EXECUTE*, and *OPEN* topics.

- Additional support for result set processing that allows you to receive more than one result set back from a stored procedure.
- Support for applications built to target .NET Framework versions 2.0, 3.0 and 3.5, in addition to .NET Framework version 4.0.



**Important:** To take advantage of these improvements you must recompile your applications with the DBMAN=ADO Compiler directive. However, if you want to continue using the functionality available in previous releases, we now provide the DBMAN=OADO directive to use in place of the DBMAN=ADO directive. DBMAN=OADO provides the same functionality as was available with previous versions of the DBMAN=ADO Compiler directive, and has 100% backward compatibility with applications designed and developed with Visual COBOL R3.

## Debugging Enhancements

The ability to load core dump files in Visual Studio has been added. This feature works with native COBOL only.

## Embedded HTML

We now support the use of Embedded HTML (EHTML) in COBOL CGI programs, which enables you to output HTML directly from your applications.

## Language Improvements

The following improvements have been made to managed COBOL:

- Extension methods and extending operators** Managed COBOL now supports extension methods. This feature enables you to add methods to existing types without the need to edit or recompile the code. You can also extend operators.
- The SYNC modifier for methods** The SYNC modifier locks the values of the arguments sent to the method, so that they do not change while the method is processing.
- Nested classes** In managed COBOL, a nested class can now be defined so that it can access the instance fields, properties and methods in its containing class. To allow this, you add the optional SHARING PARENT phrase to the nested class definition.

## RM/COBOL Compatibility

The Compiler and run-time continue to provide support for RM/COBOL. Additional RM/COBOL compatibility features include the following:

- The following RM/COBOL standard library routines can now be used with Visual COBOL in native code:
  - C\$Century
  - C\$ConvertAnsiToOem
  - C\$ConvertOemToAnsi
  - C\$DARG
  - C\$Delay
  - C\$GetEnv
  - C\$GetNativeCharset
  - C\$LogicalAnd
  - C\$LogicalComplement
  - C\$LogicalOr
  - C\$LogicalShiftLeft
  - C\$LogicalShiftRight
  - C\$LogicalXor
  - C\$NARG
  - C\$SetEnv
  - C\$RERR
  - DELETE
  - RENAME
- The RM/COBOL file handler can now be used with Visual COBOL, enabled by using the CALLFH"ACUFH" Compiler directive, and then configuring an add-on to the Vision file handler.

Full RM/COBOL compatibility is documented under the *Programming* section in the product help.

## XML Extensions



**Note:** This functionality is supported in native COBOL only.

You can now use XML Extensions, the system that enables your COBOL applications to interact with XML documents, with Visual COBOL.

XML Extensions has many capabilities. The major features support the ability to import and export XML documents to and from COBOL working storage. Specifically, XML Extensions allows data to be imported from an XML document by converting data elements (as necessary) and storing the results into a matching COBOL data structure. Similarly, data is exported from a COBOL data structure by converting the COBOL data elements (as necessary) and storing the results in an XML document.

For more information about XML Extensions, refer to the *XML Extensions User's Guide*, available from the RM/COBOL product documentation set, in the Customer Care section of the Micro Focus Web site.

# Significant Changes

This section describes significant changes in behavior or usage in each successive release. These changes could potentially affect the behavior of existing applications or impact the way the tools are used.

## Significant Changes in Visual COBOL 9.0

This section describes significant changes in behavior or usage. These changes could potentially affect the behavior of existing applications or impact the way the tools are used.

The numbers that follow each issue are the Support Case Number followed by the Defect number (in parentheses).

- [.NET Support](#)
- [Compiler](#)
- [Data Tools](#)
- [Documentation](#)
- [Enterprise Server](#)
- [File Handling](#)
- [Micro Focus Directory Server](#)
- [Runtime System](#)
- [Setup Issues \(Windows\)](#)
- [Visual Studio IDE](#)

### .NET Support

[Back to the list](#)

- The 9.0 release installs several .NET 6 NuGet packages each of which contains the assemblies for a specific Micro Focus functionality. New .NET projects, as well as existing projects you edit or build in 9.0 are linked to a core package, `MicroFocus.COBOL.Runtime.Core`, that includes the basic functionality for the projects. You need to add any additional packages (such as a specific file handler, COBOL Accept/Display etc.) manually to the projects.

Building existing .NET COBOL projects created prior to 9.0 might result in build errors. You can ensure compatibility by enabling the use of the `MicroFocus.COBOL.Runtime` metapackage. Alternatively, you need to add any required NuGet packages manually to the older projects.

See *Upgrading existing .NET COBOL project files* in the product Help for details on how to upgrade.

### Compiler

[Back to the list](#)

- Preprocessor options of more than 256 bytes are now supported, and no longer cause the Compiler to crash.

02289875 02308713 (272069)

### Data Tools

[Back to the list](#)

- A new print function available from the **File** group and the **File** menu enables you to print the records shown in the editor.

00367084 (12432)

- An enhancement to the **Compare Files** function has been added, so that when a comparison is made, the **File Information** option shows a statistics overview of the comparison being displayed.  
02200177 (222157)
- In the Data File Editor, the **Compare Files** function has been enhanced to allow you to select start and end columns in which to compare, so only a subset of a record is compared, rather than the entire record.  
02306654 (222159)
- A **Quick final page access** option has been added to the **Preferences** dialog box of the Data File Editor. When selected, large variable sequential files (files > 10,000 records) immediately jump to the last page of the file when it is opened.  
02330923 02365033 02399254 (294002)


## Documentation


[Back to the list](#)

- To correct an error that sometimes occurred when generating IMTK clients, you must install the latest version of the Visual Studio MSVS Workload > C++ x64/x86 component.  
(400031)

## Enterprise Server

[Back to the list](#)

- A new option to uninstall a PAC installed on an enterprise server region before deleting the region has been added to ensure that all PAC components are properly removed.  
01907370 (124107)
- ESCWA now validates the TLS properties to help prevent errors on entry.  
 **Note:** If ESCWA has an invalid TLS configuration, it reverts to starting without TLS enabled.  
01983736 (203178)
- In ESCWA, a **Stop** for IMS MPRs, JES Initiators, and JES Printers now operates correctly.  
02311796 (286178)
- An issue with not being able to update or navigate the ESCWA UO though the job output in the spool while it is still running has been resolved.  
02322494 (286142)
- In ESCWA, the default dashboard can now be modified for all users of a server.  
02458710 (392040)
- In ESCWA, the FCT Fix Up button has been added to the Active FCT page. See *Active FCT* in your product Help for more information.  
(374021)
- The **Job View** page in ESCWA now includes a list of job steps that have run during the current enterprise server region up time.  
(347033)
- A new configuration property has been added to ESCWA to enable the default language the UI displays to be overridden from the user's browser locale.  
02227239 02307446 (260128)
- ESCWA now supports TLS enabled Redis repositories.  
(306097)

- In ESCWA, the **Process ID** column has been added to the table on the **Dynamic Debug** page. See *Dynamic Debug* in your product Help for more information.  
(350029)
- In ESCWA, a new PAC **Client List** page has been added. This page displays a list of PAC members and associated information. See *PAC Client List* in your product Help for more information.  
(384037)
- An alternate index has been added to the non-recoverable temporary storage file TXTSNR. This is to enable queues to be returned in alphabetical order when browsing with INQUIRE. When warm starting non-recoverable TS, if TXTSNR has only a single key then the file will automatically be upgraded to include the alternate index. If there is a problem during the upgrade process then message CAS11405S will be written to the console indicating the failure and that the enterprise server region will fail to start. In this case, the file will either need to be repaired or temporary storage will need to be cold started.  
 **Note:** Once TXTSNR has been upgraded it can no longer be used on an older version of the product that does not contain this fix.  
02441509 (389045)
- Corrected the spelling for the **db\_server\_name** Configuration Manager property. You will need to update existing 8.0 enterprise server region configurations by either applying any change on the ESCWA **General >Advanced** page, or by updating the **mfConfigManagerData** MFDS property through the ESCWA API. If this is not performed, the warning message `CASCF0071W` Configuration Manager - The requested property (db\_sever\_name) was not found will be displayed in the Console log during region initialization. This will not cause any issues if the **Region Database Server Name** property was not previously used, or if it was set though the `ES_DB_SERVER` environment variable. Otherwise, you will need to reset this property using the above methods as the previous configuration for **Region Database Server Name** will not be honored, which might result in the region failing initialization.  
(350050)
- In the context of a multi-hop Distributed Program Linking (DPL), if the last stage used the default mirror transaction, its back-end could be left hanging if a SYNCPOINT was invoked by the upstream partner. This has been fixed.  
02432614 02434318 (377071)
- You can now list job steps to enable users to perform advanced restarts. Job steps can be outputted to JSON by `casout /%jnumber`. Job steps can be output to a table by `casout /%tnumber`. See *casout* in your product Help for more information.  
(401023)
- The Redis server supplied with the product is now version 6.2.6. In ESCWA, you must now specify the **Certificate Authority Filepath**, **Certificate Filepath**, and **Private Key Filepath** properties on the **Advanced Region Properties** page for all enterprise server regions that are members of a PAC that has a TLS-enabled Redis Scale-Out Repository (SOR). See *Scale-Out Repositories* in your product Help for more information.  
00373756 (12618)
- During XA recovery, if a resource manager reports an in doubt transaction which has no log entry, a `CASXO0040W` message will now be displayed in the console.  
(425081)
- If a SOR cannot be connected during enterprise server region start up, then the region no longer starts. Previously, this only applied to the PSOR, but now applies to other SORs which were only used for TS and TD queues. This change was made because the previous behavior could lead to queues being written to different locations (SORs or disk) across the PAC. If a PSOR cannot be connected during a process start up when the region is already running, then the process will be blocked until the connection can be established. Retries will be attempted at increasingly longer intervals. If a (non-PSOR) SOR cannot be connected to at process start up when the enterprise server region is already running, then the process will continue to start up. At queue access time, for a queue that must go to

that SOR, the connection will be retried. If this is unsuccessful then the command will receive an IOERR.

02399193 (356005)

- ESMAC is disabled by default. ESMAC can be enabled from the **Advanced Region Properties** page in ESCWA.

(397027)

## File Handling

[Back to the list](#)

- The SQL Server ENQ/DEQ implementation has been modified to eliminate any possibility of ENQ request failures occurring due to an intermittent Service Broker problem. The new implementation introduces a new ENQ stored procedure, and modification of the existing DEQ one to allow it to work with both the Service Broker and non-Service Broker implementations.

(285197)

- The OPEN EXTEND operation now follows the behavior expected from the OPEN statement as documented.

02454638 (386087)

## Micro Focus Directory Server

[Back to the list](#)

- The External Security Manager (ESM) checks did not occur when an enterprise server region started or stopped. This has been fixed.

02402188 (355001)

- To query Enterprise Server security configuration information (details of configured external Security Managers and so forth) from the Micro Focus Directory Server when access is restricted, the authorized Enterprise Server user must have at least **Read** permission for the **Enterprise Server Administration** resource class **User Administration** entity.

(285199)

- Micro Focus Directory Server now restricts access to enterprise server regions that a signed-on user is not authorized to view.

02305916 (285169)

- Four new MFDS-only audit event codes (2 300, 2 301, 2 302, and 2 303) have been added. See *Audit Event Codes* in your product Help for more information.

02412285 (365149)

## Run-Time System

[Back to the list](#)

- By default, CTF information no longer appears in AUX Trace of an enterprise server region. To enable it, you now need to set `mftrace.emitter.es#level` in the MFTRACE\_CONFIG.

(328008)

- Previously, .NET COBOL applications that use OpenESQL/ODBC could fail to run with a license error when deployed to a COBOL Server. This has now been fixed.

02490119 (406153)

- If an error occurs during thread clean-up, the runtime will now attempt thread clean-up again. If it fails for a second time the runtime will call `_exit()` to terminate the process immediately.

02286519 (258130)

- Attempting to call COBOL functionality after calling the `cobtidy()` API, to de-initialise the COBOL RTS, will now result in a COBRT090 error message. Previously it was documented that the results were undefined and it could cause subsequent problems, and/or errors, especially in a threaded environment. The aim of this change is to give a more meaningful error message, earlier, to help diagnose such issues.  
(301136)
- The limit for the MAXGENERATION emitter property (for both BINFILE and TEXTFILE) has been increased from 10 to 100. The file size limit for each of these generations, as set by the MAXFILESIZE property, is 1000000KB.  
02405466 (359001)

## Setup Issues (Windows)

[Back to the list](#)

- Micro Focus Host Access for the Cloud emulator replaces the Micro Focus Rumba+ Desktop emulator previously supplied with the installer for Enterprise Developer for Eclipse or Visual Studio. Customers that have Rumba+ Desktop entitlement can continue to use it within Rumba+ Desktop.  
(335003)
- In Windows 11 it is now possible to open COBOL 32-bit and 64-bit command prompts from the Terminal application.  
(421016)
- On Windows, you must uninstall earlier versions of this product before installing 9.0.  
(380028)
- 32-bit Windows is no longer supported.  
(382034)

## Visual Studio IDE

[Back to the list](#)

- In this release, new native COBOL projects in Visual Studio are configured to build on both x86 and x64 platforms. If the project is added to an existing solution, the build target configured for that solution will be used. For new solutions, the x64 targets are always selected by default. This change in behavior does not apply to Dialog System projects or imported 32-bit Net Express projects. There are some known limitations of x64 templates, so users will need to set the correct platform. Some templates remain 32-bit only.  
(409099)

# Significant Changes in Visual COBOL 8.0

This section describes significant changes in behavior or usage. These changes could potentially affect the behavior of existing applications or impact the way the tools are used.

The numbers that follow each issue are the Support Case Number followed by the Defect number (in parentheses).

- [Code Analysis](#)
- [Common Communications Interface](#)
- [Compiler](#)
- [Containers](#)
- [Enterprise Server](#)
- [Machine Administration](#)

- [File Handling](#)
- [Micro Focus Directory Server](#)
- [Run-time System](#)
- [SQL: OpenESQL](#)

## Code Analysis

[Back to the list](#)

- Rules in nested folders are now correctly processed, as well as rules with the same name.  
(207020)

## Common Communications Interface

[Back to the list](#)

- For improved security, SSL/TLS connections are now restricted to TLS versions 1.2 and 1.3 by default. This is an industry best practice. If you need to use older, less-secure protocol versions with legacy clients or servers you should consult the product online help for instructions on configuring TLS protocol versions.  
PSEC:103001 (87188)

## Compiler

[Back to the list](#)

- When a RELEASE or RETURN statement is executed in an input or output procedure of a sort statement, if the SORT-RETURN special register is found to contain a value of 16, then the sort should be aborted, even in a case where the RELEASE or RETURN statement is at a lower perform level than the input or output procedure itself. Previously, this was not happening for programs compiled to JVM or .NET COBOL, but this erroneous behavior is now fixed.  
01723392 (104114)
- When a variable is defined in a DECLARE statement with no explicit type, but a value that is a non-integer numeric literal, the type is assumed to be float-long (i.e. a 64 bit floating point).  
(148103)

## Containers

[Back to the list](#)


- The containers image build tool now supports custom Java run-times which helps to keep the size of Java-based applications smaller.  
(182004)

## Enterprise Server

[Back to the list](#)

- The Security Manager passwords no longer appear in the `commonwebadmin.json` configuration file.  
(203052)
- The X-XSS-Protection header will now be set on all requests instead of only on API requests.  
01938835 (138176)
- In ESCWA, the colors and contrast have been adjusted to improve visual accessibility.  
01995403 (158071)



- ESCWA now displays an improved message if there is an issue with loading the application, especially in the case where there is a browser incompatibility.  
(241013)
- ESCWA now handles enterprise server regions that use character encodings other than windows-1252.  
00370773 (11742)
- In ESCWA, the **Console Log** page now enables you to easily traverse and navigate the log. The new paging feature uses an API call from the Communications Server group documented in the Enterprise Server Administration Server API, typically located at `http://localhost:10086/docs/#/Communications_Server` on the machine where you have the product installed.  
02085456 (191017)
- ESCWA now supports multiple PACs in a single Redis store.  
(248003)
- ESCWA now handles enterprise server regions that use character encodings other than windows-1252.  
(91001)
- In ESCWA, on the **Communications Process** page you can now specify a Requested Status for the communications process.  
00669779 OCTCR50A69378 (69378)
- In ESCWA, the **Catalog DCB** page now displays the file size in bytes.  
01909652 (138002)
- ESCWA now supports Circular Logging. On the **Tracing and Logging Settings** page you can now specify the **Log Max File Size** and the **Log File Count** fields. By default, these fields are set to 1024kB and 5 respectively. See *Tracing and Logging Settings* in your product Help for more information.  
02083633 (191019)
- In ESCWA, a new optional **Logon security resource** has been added. This can be used to control users' ability to log on. See *Security Resources to Control ESCWA and API Access* in your product Help for more information.  
01886579 (124022)
- You can now define and install shared SOR Models. In the **SOR Model** dialog box, check **Shared** to enable the SOR Model to be shared between PACs.  
(244088)
- For LDAP-based security in Enterprise Server, the processing of password changes has been modified to address security issues, inconsistencies among configurations, and other issues. See *Understanding passwords with LDAP-based security* in your product Help for more information.  
(118088)
- Enterprise Server with LDAP-based security now denies a sign-on attempt by default if it includes a password-change request (a new password is supplied), and the password change fails. This was the existing behavior in some configurations but not in others. It is now consistent and configurable. See *MLDAP ESM Module Custom Configuration Information* in your product Help for more information.  
(108046)
- A change has been made to the way that TS queues and TD queues are stored in a PAC. This was to ensure that deleting a OTSQ did not also delete all queues that had a OTSQ\_ name prefix.  
 **Note:** After the update is applied you must cold start your PAC.  
(183044)
- In a PAC, the SIT setting is now honored when a TS or TD is to be applied to the enterprise server region if the TS or TD is not under a SOR, MFDBFH, or Fileshare. This means that if a SIT has to cold start for TS or TD and the files are either in the workarea or on disk then the SIT settings will be applied, otherwise the PAC-wide settings will be applied.

02149316 (204020)

- EZASOKET traffic will now be assigned to Communications Process instance #1. You might need to consider this if you use load balancing.

02060014 (201009)

- When a PAC is cold started, the configuration file specified by MFDBFH\_CONFIG will be uploaded to the PSOR and a temporary file created in the enterprise server region's workarea. This temporary file will be used by all the processes for that enterprise server region. Subsequent enterprise server regions joining the PAC will then create a temporary file in its workarea for the MFDBFH\_CONFIG from the PSOR store. If an enterprise server region in the PAC is killed or is terminated abruptly than the restart of the enterprise server region will try to recover the previous UUID left in the PAC and DEQ all remaining ENQs in MFDBFH that were created from the previous run. New messages will be created in the console.log identifying if the recovery was initiated and successful, if the enterprise server region could not be recovered automatically, the region will stop. A log file will be created in the workarea with the following file naming convention:

```
Caspac_Recover_UUID_XXXXXXXXXXXXX.log
```

For example: CASCD4012W Region was not stopped properly, recovering previous region UUID 14BAAA87B4C010BFBDE278A5F65B350C 18:15:17CASCD4014I UUID recovery file log C:\Users\mag.CORPDOM\Documents\Micro Focus User\Enterprise Developer\WORKAREA\RAS1\Caspac\_Recover\_UUID\_14BAAA87B4C010BFBDE278A5F65B350C.log 18:15:18. Using the caspac utility with the -aStatus parameter will display if the enterprise server region in a PAC has lost its connection to the PSOR. If you determine that the region is no longer in the PAC, then you can run the caspac utility with the -aRecoverUUID parameter to recover the enterprise server region. If the -aRecoverUUID parameter is used, then a file will be created in the current directory with the following file naming convention:

02081952 02123645 (182093)

```
Caspac_Recover_UUID_XXXXXXXXXXXXX.log.
```

See *caspac* in your product Help for more information.

- Functions have been added to file\_utilities which check a given file name against either a default blacklist containing operating system reserved file names, or a passed blacklist. Read, write, and delete in AES and MSCPD use this function to disallow secret names which are inappropriate names.

OCTCR50A7844 (112022)

- Fileshare is no longer used to locate the Resource Definition and CNV file.

00468648 (69010)

- MQ updates did not rollback on step failure. This has been fixed.

01976727 02161235 (155010)

- PSOR stores are now prefixed by the PAC NAME and a version number enabling you to run multiple PACs in the same PSOR, simplifying the incompatible upgrade process. The caspac utility enables you to add the PAC Name as part of the command line parameters using -pPACName or if not specified using the ES\_PAC environment variable. See *caspac* in your product Help for more information.

(202162)

- The XA reconnect mechanism now attempts to reconnect to all XA entries marked as "enabled" at the start up of the enterprise server region. To prevent the reconnect attempts, do one of the following:
  - Remove the XA manager from the enterprise server region definition.
  - Set the XA manager as disabled before starting the enterprise server region.

01991481 02003277 (151008)

- A new MLDAP ESM custom configuration section has been added. The [Prefix Search] option enables the Prefix Search wildcard optimization for limiting the scope of wildcard resource entities checked under a resource class. See *MLDAP ESM Module Custom Configuration Information* in your product Help for more information.

00726158 (73180)

- For LDAP-based security in Enterprise Server, the processing of password changes has been modified to address security issues, inconsistencies among configurations, and other issues. See *Understanding passwords with LDAP-based security* in your product Help for more information.

(118088)

- Enterprise Server with LDAP-based security will now by default deny a signon attempt if it includes a password-change request (a new password is supplied), and the password change fails. This was the existing behavior in some configurations but not in others. It is now consistent and configurable. See *MLDAP ESM Module Custom Configuration Information* in your product Help for more information.

(108046)

## File Handling

[Back to the list](#)

- The `dbfhadmin` utility has been enhanced to allow the integrity of a datastore to be verified, and optionally, fixed up: use the `dbfhadmin -verify -list|-recover` options. See *The dbfhadmin Command Line Utility* in your product Help for more information.

00778044 (90143)

- The `dbfhadmin` command-line utility has been enhanced to provide the capability for verifying and optionally repairing (cross-)region databases.

02123645 (193071)

- The cross-region database heartbeat interval can now be configured using the `dbfhconfig -add|-update -heartbeat interval-in-seconds` command. The default heartbeat interval remains as 5 seconds. A warning message is now output to the Enterprise Server console during region database start-up if the heartbeat interval is configured to be >15 seconds. The larger the heartbeat interval, the longer the time that is required to be able to recover (cross-)region database resources. Recovery can only take place for a process if its associated heartbeat record has not heartbeat within the last "heartbeat-interval + 5" seconds.

02155269 (202149)

- The performance of PostgreSQL optimized I/O has been improved. If you use the `psqlodbc` device driver, you will need to ensure that you are running with version 12.02.0000 or later. This change has been tested with version 13.01.0000. To take advantage of the performance benefits of this change, specify `BatchSize=100` for each of your ODBC DSNs. Using a version of the driver earlier than 12.02.0000 could result in a performance degradation when deploying large files to datastores.

(125032)

- Table record locking and database record locking are incompatible and may lead to data corruption if used together by separate processes when processing the same file. MFDBFH has been enhanced to ensure that if a file is already opened in a process with table locking, all other processes attempting to open the same file, even if requesting database locking, will also use table locking. However, if a process has a file opened using database locking, other processes attempting to open the file will only be allowed to do so if they are transactional files (i.e. database record locking can only be used for transactional files). An attempt to open the file as non-transactional will fail. Refer to the *Record Locking Strategies* documentation for more information.

(102011)

- MFDBFH now enforces the existing requirement that a region database used by a PAC, or a region database used by an ES region configured to use `ES_LOCK_DB`, is not used by any other PAC or `ES_LOCK_DB` regions. This is necessary to avoid problems such as jobs with the same name submitted to two separate regions, but erroneously using the same region database, from being blocked by waiting on `SYSZJOB` and/or `SYSZJOB` ENQs. A check is now performed during region start-up to ensure that the region database is not already being used by another region. If it is, the region start up will fail, with error messages indicating the cause of the failure output to the ES console. Existing ES PACs/regions will need to be stopped and restarted for these new region database state checks to take

effect. The `dbfhadmin -region -status [-reset]` command has been introduced to allow a region database's state to be displayed and, optionally, reset. See *Resource Locking* in your product Help for more information..

(121030)

## Machine Administration

[Back to the list](#)

- A problem with using the .NET 3.5 framework has been fixed.

(204144)

- A problem with CPU conversion has been corrected.

(199042)

## Micro Focus Directory Server

[Back to the list](#)

- The `mfds /s` option supports the specification of the optional Enterprise Server `user id` and `password` parameters using a configured Micro Focus Vault Facility location rather than using literal strings for credentials. For example:

```
mfds /s 1 mfsecret:user/user_001/id mfsecret:user/user_001/pwdwhere user/
user_001/id and user/user_001/pwd
```

Are secrets stored in the default-configured vault. These values can be populated and administered using the `mfsecretsadmin` utility. See *Vault Facility* in your product Help for more information. The `mfds /x` and `/g` command-line options also support credentials stored in the vault.

02131532 (193088)

- If MFDS is configured to store sensitive values in the vault (for example, XA openstring or autostart credentials), these values were not being included in legacy data format or XML export of Enterprise Server configuration information. Subsequently, these values could not be reimported. These sensitive values are now included in the exported data. Micro Focus recommends that you protect the exported files with appropriate access control.

(202272)

## Run-time System

[Back to the list](#)

- The native COBOL multi-threaded demo is now available for Windows development products.

(3765)

- Basic support for `xterm-256color` has been implemented.

(57591)

## SQL: OpenESQL

[Back to the list](#)

- A performance problem in a SQL program using fixed-length character arrays when compiling a COBOL program and using array fetch has been resolved.

02152406 (203060)

- A new feature to assist migration between databases has been added. SQL error codes and messages may be mapped to different values or suppressed to match those expected by the application.

(193003)

# Significant Changes in Visual COBOL 7.0

This section describes significant changes in behavior or usage. These changes could potentially affect the behavior of existing applications or impact the way the tools are used.

The numbers that follow each issue are the Support Case Number followed by the Defect number (in parentheses).

- [Common Communications Interface](#)
- [Compiler](#)
- [Data Tools](#)
- [Enterprise Server](#)
- [File Handling](#)
- [Header-to-COPY Utility](#)
- [Interface Mapping Toolkit](#)
- [Run-time System](#)
- [SQL: OpenESQL](#)

## Common Communications Interface

[Back to the list](#)

- The default TLS Security Level has been increased from 0 to 1. This change will not affect you if you have specified your own security options. If you rely upon the default TLS security options you might find that some old clients that are restricted to the use of weak ciphers will no longer be able to connect. See *Security Levels* and *Specifying a Server Protocol and Cipher Suite Preference* in your product Help for more information on the change to Security Level 1.

(8453)

## Compiler

[Back to the list](#)

- Programs with file records greater than the documented limit of 62KB will now generate an error that they previously did not (COBCH0649) - although being an E level message, the program can still be executed and will work if it did so previously.

3227892 (12447)

- Two of the available Ant parameters for compiling COBOL programs have been renamed as follows (functionality remains the same):

- forceCompile becomes mf.forceCompile
- threadCount becomes mf.buildThreadCount

3230709 (12665)

## Data Tools

[Back to the list](#)

- The editor now automatically selects the first record in comparison when first loaded. The Editor will automatically select first record in comparison when first loaded

3212848 (11362)

- Data File Tools now provides the Data Explorer, which is a catalog view that can connect to either ESMAC or ESCWA. When connecting to ESCWA, it enables you to open multiple data sets.

(70242)

- The scrolling speed for formatted records has been increased.  
00366018 (11378)

## Enterprise Server

### [Back to the list](#)

- Previously, there was no security check performed when an ESMAC user tries to access the console, traces, or dumps. This is no longer the case. If you use LDAP-based security you can now add the new DIAGS resource under OPERCMDS class and provide access to ESMAC users accordingly.  
3231918 (12556)
- The "Requested Licenses" field has been removed from the ESCWA General Properties page as it is not used.  
(3956)
- Added the option to delete the associated package when the service has an associated package and that service is the only one with that associated package.  
00370971 (22264)
- When a new region is created in ESCWA, the Web listener's conversation type is now correctly set to "Web" instead of "SOAP and J2EE (legacy)".  
3244594 (21270)
- The Group can now be specified when starting or stopping a region using ESCWA.  
00371543 (12436)
- For Enterprise Developer 6.0 and later, the installer on Windows has automatically started the Enterprise Server Common Web Administration (ESCWA) service as part of the installation process. When using the Japanese system locale on the Windows operating system, the ESCWA service does not start automatically. During the installation process you might be required to press Retry to complete a successful product install. Even after a successful product install, ESCWA does not start until you have installed a valid license.  
00368527 (12747)
- In ESCWA, the Security Manager properties could be set too long, causing a crash. This has now been fixed.  
(61192)
- This fixes an issue with the change to the behavior introduced with the passtoken changes in previous patch updates. An issue might occur in a stacked environment with OS ESM and MLDAP\_ESM. Job dispatch would issue a deny when `casub` was used.  
3229601 (11524)
- An issue when using a secured MFDS, with an LDAP ESM as first in the stack, and a PAM ESM as second in the stack, and with federation enabled, has been resolved. Previously, if the security was reinitialized through any means (such as clicking the apply button, or reordering the ESMs and changing them back), the MLDAP ESM would not be able to correctly determine that the PAM ESM user `user1` in `group1` matched the LDAP resource rule which described `group1` within the resource rule. This should have worked because the group information is shared when federation is enabled. With this fix, the resource rule in LDAP correctly identifies that the `group1` rule applies to the PAM ESM user `user1`, on both initialization and reinitialization. Behaviour Change: When SAFMGR was reinitialized, PAM ESM was pointing to the old shared groups table, so MLDAP ESM and PAM ESM ended up pointing to different shared groups tables. It should have been the same table as federation was enabled. PAM ESM groups table is now cleared on initialization, so that the ESMs will now point to the same groups table.  
3221760 (11697)
- ESMAC now includes cross-site request forgery protection. A 403 Forbidden page is now returned whenever a user attempts to bypass the protection. If you want to access more than one region in

ESMAC at the same time, it can no longer be done in the same browser session. You can access the regions in separate private browsing sessions.

3216052 (13208)

- A new resource class, DCBINFO, enables you to control who can access the DCB information for cataloged datasets in ESMAC for a LDAP secured region. DCBINFO must be created for existing users to be able to access the DCB information in ESMAC.

3231918 (13300)

- MQ commands did not work because Windows installations of MQ are client, not server. This has been corrected.

(46022)

- MFDS now correctly uses the specified region user in the ESCWA Directory Server Scripts page or Directory Server user in the ESCWA Directory Server Configuration page. Otherwise, it defaults to the current user.

(8727)

- If MFDS is set to "Restricted Access" and the MFDS "Anonymous access" option is off (the default), then valid authorized credentials will be required to access information stored in the Directory Server either via the legacy UI, ESCWA, or utilities such as mdump.

(62100)

- When MFDS is TLS enabled and a client connects on the non-TLS port, it will now send a HTTP 302 Found response to the client to redirect it from the non-TLS port to the TLS-enabled port. This is seamless to the Web browser.

(46024)

## File Handling

[Back to the list](#)

- Within MFDBFH, enhancements have been made to optimized I/O to further improve performance. Enterprise Developer 6.0 and Enterprise Developer 7.0 only: The dbfhconfig utility has been enhanced with the addition of the -optiokeyreads and -optioseqreads command-line options. These options are used to override the default number of records read ahead by MFDBFH when optimized I/O is enabled.

00726932 (83019)

- The SFF (Signed Free Form numeric) input field is now supported in the TRAILER3 operand.

3217597 (12477)

- A File Handler limit on the maximum record size (62KB) has resulted in the documented limits for data-driven unit tests to be revised. See *Restrictions in the Micro Focus Unit Testing Framework*.

(25064)

## Header-to-COPY Utility

[Back to the list](#)

- When h2cpy is used to convert C header files to COBOL copy files, function prototypes with const \*, which produce BY REFERENCE parameters in the ENTRY statement for the COBOL call prototype, will now include the CONSTANT reserved word. In this context, it means the variable is read-only in the callee, just like in C.

(10214)

## Interface Mapping Toolkit

[Back to the list](#)

- Headers are no longer mapped in the output of WS2LS.  
3235120 (12606)
- Top-down CWS generation from WSDL now properly marks hexBinary fields in the generated WSBIND.  
3236069 (11690)
- WS2LS now assigns usage COMP-3 to items mapped from decimal and integer types in the WSDL. Behaviour Change: WS2LS will now assign usage COMP-3 to items mapped from decimal and integer types in the WSDL. This will affect the generated copybooks and WSBIND. Previously-generated files will still work, and users should be using the WSBIND and copybooks from a single execution of WS2LS in their environment anyway, since changing one results in (or reflects) changes to the other.  
3235120 (13494)
- In copybooks generated by WS2LS, several data types now have mappings that are closer to those generated by IBM's DFHWS2LS. Behaviour Change: In copybooks generated by ws2ls, several data types will now have mappings closer to those generated by IBM's DFHWS2LS.  
00365433 (11693)

## Run-time System

[Back to the list](#)

- When defining the file name for CBL\_CREATE\_STACKDUMP, %f now expands to basename of the program correctly when used cross-process.  
(60049)
- When CTF trace level is set to info (for post-offset values only) or debug (for pre-offset, offset and post-offset values) and component rts#process is set to true, the API will now dump the captured metrics to the output CTF file.  
(27040)

## SQL: OpenESQL

[Back to the list](#)

- An issue with compiling native programs that use SQL TYPE IS XML AS CLOB has been resolved.  
3240037 (12679)

# Significant Changes in Visual COBOL 6.0

The numbers that follow each issue are the Support Incident Numbers followed by the Reported Problem Incident (RPI) number (in parentheses).

- [Adis](#)
- [Call prototyping in library routines](#)
- [Common Communications Interface](#)
- [Compiler](#)
- [Database Access - OpenESQL](#)
- [Data Tools](#)
- [DB2](#)
- [Documentation](#)
- [Early warning of compatibility issues with current operating systems](#)
- [Enterprise Server](#)
- [Enterprise Server Common Web Administration](#)
- [Enterprise Server Security](#)



- [File Handling](#)
- [Handling of Anonymous Root Field in JSON](#)
- [HCO for DB2 LUW](#)
- [IDE](#)
- [Micro Focus Directory Server](#)
- [National data items in .NET COBOL code](#)
- [Run-Time System](#)
- [SQL Option for DB2](#)
- [VALUE clause not permitted to follow items that use the OCCURS DEPENDING ON clause when ODOSLIDE in effect](#)

## Adis

[Back to the list](#)

- In RM/COBOL, the ACCEPT of a screen with an input field beyond the end of the screen would operate as if the field was at the last character of the screen. Previously, ADIS would ignore any fields past the end of the screen. Now, with Dialect"RM" set and the appropriate ADISCTRL settings, behavior will now match RM/COBOL in this case.

3138718 (1112690)

## Call prototyping in library routines

[Back to the list](#)

The copybooks `cbltypes.cpy` and `cblproto.cpy`, provided by this system for call prototyping in library routines, include features of the latest syntax, specifically the CONSTANT keyword. If these files are used in conjunction with the MF directive, it should be set to the current level, 21; otherwise, you should remove the directive, or do not use these copybooks.

## Common Communications Interface

[Back to the list](#)

- The default TLS Security Level has been increased from 0 to 1. This change will not affect any user that has specified their own security options. Users relying upon the default TLS security options might find that some old clients that are restricted to the use of weak ciphers will no longer be able to connect. See "Security Levels" and "Specifying a Server Protocol and Cipher Suite Preference" in your product Help for more information on the change to Security Level 1.

## Compiler

[Back to the list](#)

- "file not found" error messages now provide more information about the key the user needs to press. The new format of the messages is as follows: "File name.cpy not found - Press [S]top/[R]etry/[C]ontinue/[A]lter-path".
- External data and files declared in an instance context (such that is not within STATIC/END STATIC and without the STATIC qualifier) can no longer be accessed from a static method. The STATIC qualifier is now allowed in combination with EXTERNAL.

3216822 (1119228)

## Data Tools

[Back to the list](#)

- You are no longer able to modify data in a structured record that is identified as comp-2 floating point - an alert is displayed if attempted. This is in order to prevent the data becoming corrupted.

3213037 (1118867)

- Data File Tools now utilizes the configurable codesets facility to use a variety of character sets - see 'Working with Different Character Sets' in the documentation for more information.

3161243 (1114482)

## Database Access - OpenESQL

[Back to the list](#)

Just like other DBMS SQL COBOL precompilers, OpenESQL now follows embedded SQL standards and disallows the use of group host variables in WHERE <column> = :hostvar clauses. In the past, this was not flagged at compile-time, and would lead to unpredictable results when executed.

## DB2

[Back to the list](#)

- There is no longer a problem using an XML CLOB host variable in COBOL and PL/I program SQL statements when compiling with the DB2 ECM Compiler directive.

3204413 (1118115)

## Documentation

[Back to the list](#)

- The information about the -flag and warn compiler options has been updated.

3190928 (1120000)

## Early warning of compatibility issues with current operating systems

[Back to the list](#)

In order to better support modern operating systems, we are aligning closely with their operability guidelines. We now detect previously-undefined behavior when interacting with OS level functions.

Error RTS096 alerts you to any calls to the operating system's fork() API, in a process that has directly or indirectly called COBOL functionality, in your code.

The error gives you an early diagnosis of a situation which, if left unchecked on modern operating systems, could lead to deadlocks, crashes or other failures at run time. These problems would often occur intermittently and be very challenging to track down.

See the KB article <https://community.microfocus.com/t5/Visual-COBOL-Knowledge-Base/fork-rts64-Error-96-encountered-in-child-process/ta-p/1771191> for more details.

## Enterprise Server

[Back to the list](#)

- IF an XA open string uses the BATCHONLY option, CRCN will not monitor the XA connection to the resource manager. If the BATCH SEP encounters a severe XA error, the batch SEP will be recycled until the connection is recovered. This emulates the previous version of the XA reconnect feature when ES\_XA\_????\_NB\_RETRIES=-1 was set. Consequently, if an open string contains BATCHONLY, only a batch SEP will be able to access the resource manager and, as CRCN is a CICS transaction, it will not monitor this entry.

3213379 (1118913)

- The initPac option for the caspac command line utility has a change in behavior. Prior to PU5, if the command detected that there were active regions in the PAC, the command would return an error and not initialize the PAC. This only occurred when: 1. There are active regions in the PAC. 2. There are no active regions in the PAC, but a region has shutdown without notifying the PAC SOR (PSOR), for

example, if the region was killed. In this case, it was not possible to cold start a PAC without manually correcting the appropriate value in the PSOR. The initPac option will now prompt for confirmation on whether you really wants to initialize the PAC, giving you the option to cancel. CAUTION: Only use this option for scenario 2, ensuring that no cas\* or mfcs processes remain for regions within the PAC. If it is used when there are active regions in the PAC, the regions will no longer function correctly.

(642125)

- Enterprise Server now supports Redis Cluster as a SOR. See "Prerequisites" in the "Scale-Out Performance and Availability Clusters" chapter in your product Help for more information.
- When compiled with the XAID Compiler directive, JCL batch SQL applications now work correctly when MFDBFH is enabled.

3223257 (1119804)

## Enterprise Server Common Web Administration

[Back to the list](#)

- By default, ESCWA now runs on port 10086.
- When using the Vault Facility, the ESM passwords are now accessed by the ESM's Universal Unique Identifier (UUID) which makes the key for the vault. If this UUID cannot be found it uses the old name based mechanism as the key for the vault. Note: All new ESMs have a UUID that conforms to 4122 RFC. The earlier ESM UID standard is still supported.
- PAC names are now limited to eight characters or fewer in ESCWA.
- The default ESCWA configuration file now sets ESCWA to run in loopback-only mode.

## Enterprise Server Security

[Back to the list](#)

- The MLDAP ESM Module for Enterprise Server now interprets the ".\*" wildcard sequence in a manner closer to that of mainframe RACF. This behavior is configurable. See "Wildcards for Resource, User, and Group Names" and "MLDAP ESM Module Custom Configuration Information" in your product Help for more information.

3206992 (1118359)

## File Handling

[Back to the list](#)

- The supervisor password is no longer displayed when cobfsclose is executed from the command line.

3195772 (1117571)

- Usernames in the Fileshare password file are no longer obfuscated; they are shown in plain text.

3120656 (641976)

- Fileshare can now read a password file stored in the Vault Facility. Use the /uv option when starting Fileshare to read the specified password file from the vault. Note: You must have uploaded the password file to the vault before starting Fileshare.
- File and folder names that are deployed to PostgreSQL datastores are now case-insensitive. This ensures consistency of behavior with DB2 and SQL Server datastores.

## Handling of anonymous root field in JSON

[Back to the list](#)

For JSON (RESTful) service interfaces, the IMTK no longer forces the outermost (root) structure of a JSON message body to always be a JSON object, but now also supports a root JSON array or primitive. Though the root is obligatorily nameless in the JSON message, in the Interface Mapper the anonymous root must

now be defined in the operation's interface fields as the top-level body field. Consequently, since there cannot be more than one input top-level body interface field nor more than one output top-level body interface field in an operation, all interface fields that appear in the body of a message must now be children of the top-level body field. Any non-conforming pre-6.0 JSON service interface is still supported as-is, but conformance would be required upon any modification in the Interface Mapper.

## IDE

[Back to the list](#)

- In fixed format COBOL code, lines in custom code snippets will now be automatically wrapped if they reach the end of area A/B.  
3201628 (1117874)
- Server Explorer in Eclipse and in Visual Studio now requires you to specify user names and passwords if security is enabled to connect to the nodes. The default credentials are no longer automatically applied.

## Micro Focus Directory Server

[Back to the list](#)

- UNC paths are no longer supported when importing or exporting to MFDS by default. To re-enable them, set the environment variable MFDS\_ALLOW\_UNC to 'Y'.

## National data items in .NET COBOL code

[Back to the list](#)

.NET COBOL code that uses IS NUMERIC tests on NATIONAL or NATIONAL NUMERIC data items, or uses NATIONAL NUMERIC data items in programs compiled with the CHECKNUM Compiler directive must be recompiled in this release. Compiled code from earlier products that uses such constructs will generate a `MissingMethodException` error when run under this release.

## Run-Time System

[Back to the list](#)

- Previously, the value of the fill character and the option to use it were ignored in the RM window control block. With this fix, the character will be used if `Dialect"RM"` is set and an appropriate `ADISCTRL` configuration is used.  
3138692 (1112552)

## SQL Option for DB2

[Back to the list](#)

- The XDB Service name has been shortened.  
3195822 (1119897)

## VALUE clause not permitted to follow items that use the OCCURS DEPENDING ON clause when ODOSLIDE in effect

[Back to the list](#)

If your Working Storage contains a data item with the OCCURS DEPENDING ON phrase, and ODOSLIDE is in effect, any subsequent data items at the same or higher level must not contain a VALUE clause. If they do, an error (COBCH1962) is now generated.

If you cannot remove the VALUE clauses from your source code or remove ODOSLIDE, contact SupportLine.

# Significant Changes in Visual COBOL 5.0

Where present, the numbers that follow each issue are the Support Incident Numbers followed by the Reported Problem Incident (RPI) number (in parentheses).

- [Common Communications Interface](#)
- [Data Tools](#)
- [Documentation](#)
- [Enterprise Server](#)
- [Enterprise Server Auditing](#)
- [File Handling](#)
- [Interface Mapping Toolkit](#)
- [Micro Focus Directory Server](#)
- [MFCRYPTLIB](#)
- [Request Packet Interface API](#)

## Common Communications Interface

[Back to the list](#)

- Certificate subject names are now correctly checked against the name the client is attempting to connect to. Certificates registered to "localhost" should now work as expected.
- The default Cipher Suites List now includes @SECLEVEL=0. This indicates that backwards compatibility with old certificates such as MD5 is to be retained. As a result of this change, you need to review your use of the Cipher Suites List and of any old certificates.
- If using Micro Focus Common Client(MFCC) or Micro Focus Communications Server(MFCS) to connect to a non-existent remote host, it was possible to create a connection to a server listening on the same port on the local system. This is no longer possible and a bad address error is reported in the error logs.
- By default, in this and previous releases an SSL/TLS CCI client can trust a server which resides on an IP address that is not an intended connection target. You can now specify the `ssl_only_verify_literally` option in your CCI.INI file to restrict the certificate check to improve security. See "CCITCP Security Options in the CCI.INI File" in your product Help for more information. When connecting to a non-CCI protocol server, all clients perform strict certificate checking as the new default behavior

## Data Tools

[Back to the list](#)

- Accessing a dataset through the Data File Editor now obtains a shared lock on Enterprise Server when you open the file in shared mode.  
3170479 (1115346)

## Documentation

[Back to the list](#)

- The ANIM Compiler directive has changed its default when compiling from the command line on Windows platforms. The default is now ANIM. (Compiling from the IDE still defaults to ANIM.)
- The validation of server certificates for TLS (also known as SSL) connections has been corrected. This is likely to cause connection failures in cases where previously connections were incorrectly allowed. For example, if Fileshare is secured with TLS, client applications must be configured to use the hostname of the Fileshare server as it appears in the server's certificate. If the Micro Focus Directory Server is secured with TLS, then MFDS clients, such as the `casstart` command-line utility, will need to connect to it using a hostname that appears in the certificate MFDS is using. (Note that a certificate can contain multiple hostnames.) Consult your Certification Authority administrator for more information.

3192497 (1117068)

## Enterprise Server

[Back to the list](#)

- A number of audit events now contain some additional information.

3140310 (1112666)

- Previously, the /x option of the CASRDTEX utility had been duplicated to drive XML output. This prevented the export of transactions which was the original meaning of /x. To generate an XML export, you must now specify the option /xm.

3180233 (1116108)

- casfhsf could hang when processing HSF files that contain records from tasks that ran in different months.

3177385 (1115884)

- A new system transaction, CRCN, is now available to monitor the state of XA connections for each resource manager (RM) entry defined in the system. CRCN is a replacement for the former XA Reconnect facility that recycled SEPs on connection loss. The XA Reconnect facility was configured by setting the ES\_XA\_RECONNECT environment variable. CRCN also uses this environment variable, although its usage differs slightly. For more information see your product Help.

3174272 (1115727)

- On Windows, any casout and cassub messages are displayed on cassub and casout API invocation if the environment variable ES\_CAS\_API is not set to "ON".

3160400 (1114458)

## Enterprise Server Auditing

[Back to the list](#)

- Auditing on big-endian platforms now correctly interprets numeric audit data.

## File Handling

[Back to the list](#)

- RELFORMAT=MF|RM is now enabled for FOLDER and other filename tags.

3164916 (1114803)

- The SORT-CONTROL special register is now supported during a SORT statement.

3159740 (1114389)

- To direct the handling of relative files to a particular file handler (either MF COBOL or RM/COBOL), use the RELFORMAT=MF or RELFORMAT=RM configuration options within the [REL-DEFAULT] tag of the EXTFH.CFG file. (The default is RELFORMAT=MF.)

3157247 (1114149)

## Interface Mapping Toolkit

[Back to the list](#)

- If you try to deploy a stateful EJB SVI from the Visual Studio IDE after unchecking the "Reuse container after application termination" check box (in the Deployment Characteristics tab of the Runtime Environment Configuration dialog box), you receive a warning message informing you that the "Reuse container after application termination" setting will be set to true for the deployment in order to prevent the crash. In the Eclipse IDE, the unchecking of this option will just be ignored, and the option re-selected. A warning to not uncheck the option for stateful EJB SVIs is also displayed on the prior page (to the dialog box).

2663812 (1090987)

- WSDL and JSON Schema files generated for bottom-up CICS Web services now include a "maxLength" parameter for all string fields.

3175039 (1116241)

### Micro Focus Directory Server

[Back to the list](#)

- The event codes for several MFDS audit points have changed.
- On Windows, by default, the Enterprise Server Administration Web interface can only be contacted using the loopback address (localhost or 127.0.0.1). You can enable remote access to the Web interface by turning off the loopback mode. See "Using the Loopback Address" in your product Help for more information.

### MFCRYPTLIB

[Back to the list](#)

- Passing an incorrect keyfile passphrase no longer results in receiving an RTS115 error in MFDS.

3181743 (1116186)

### Request Packet Interface API

[Back to the list](#)

- The default behaviour for TLS certificate Common Name (CN) matching has changed for release 5.0. It now requires a strict match on the CN value or any Subject Alternate Name (SAN). For example, 127.0.0.1 and localhost are no longer implicitly equivalent, nor are hostname and its IP address or fully-qualified domain name (FQDN) variants. When starting a region from the Enterprise Server Administration Web interface, a resolved IP address is used for the casstart -m parameter value. A resolved IP address is also used even if a hostname is specified on a command line startup.

To change this behavior and use a resolved hostname value (as determined by the machine TCP configuration, for example, hosts file entries.) set the environment variable MFDS\_DNS\_RESOLVE=Y. To use an unresolved string literal hostname, for example, a value explicitly passed in via the casstart -m command line parameter, set MFDS\_DNS\_RESOLVE=N.

3194613 (1117203)

## Significant Changes in Visual COBOL 4.0

This section describes significant changes in behavior or usage in Visual COBOL 4.0. These changes could potentially affect the behavior of existing applications or impact the way the tools are used.

Where present, the numbers that follow each issue are the Support Incident Numbers followed by the Reported Problem Incident (RPI) number (in parentheses).

- [Code Coverage](#)
- [Codeset Support](#)
- [Common Communications Interface](#)
- [Communications Server](#)
- [Compiler](#)
- [Data Tools](#)
- [Documentation](#)
- [Enterprise Server](#)
- [Enterprise Server Auditing](#)

- [Executables require relinking](#)
- [File Handling](#)
- [MF Server Administrator \(GUI\)](#)
- [Micro Focus Directory Server](#)
- [Run-Time System](#)

## Code Coverage

[Back to the list](#)

- Schema changes that affect the test coverage results generated from the `tcutil` utility mean that if you propagate the results to a third-party application (for example, an XSLT processor), and rely on the `<copyFileCoverage>` element, you need to alter your transformations to focus on `<sourceFileCoverage>` instead. The element was renamed to more appropriately reflect its contents, as `tcutil` now gives global coverage for all source files (not just copybooks).

## Codeset Support

[Back to the list](#)

- Code-set mappings between ASCII and EBCDIC have been updated when Simplified Chinese is the language in effect. ASCII table 5210 now maps to EBCDIC CCSID 836 for SBCS conversions. This replaces the previously conversion (where ASCII table 1042 was used), which would convert the “\” character to “\$”.  
3124321 (1111464)
- New single-byte character set tables for MF CODESET have been added in order to improve support for DB2 LUW - both for off-mainframe databases and for access to z/OS DB2. A number of existing MF CODESET mappings have also been updated. See 'Supported Country Codes' for a full listing of ASCII/ANSI <-> EBCDIC mappings.  
3111843 (1109984)

## Common Communications Interface

[Back to the list](#)

- You can now configure the Micro Focus Directory Server and enterprise server region's listeners to only use the server's configured SSL and TLS protocols and define a priority ordered cipher suite collection. This forces connecting clients to use the server's preferred ordered list of cipher suites when using the specified protocols.  
2866265 (1105526)
- In some circumstances it was possible for a connection to incorrectly accept the identity of an SSL/TLS peer and allow a connection to complete when the connection should have been denied. This occurred due to a failure to check the peer's entire identity certificate chain. This has now been fixed. NOTE: You might need to correct your system's configured certificate chains that fail verification checks at secure connection creation time.
- In some circumstances it was possible to crash the CCITCP module when it was attempting to obtain detailed error information about a closed connection. This has been fixed.

## Communications Server

[Back to the list](#)

- TN3270 conversations to Enterprise Server now correctly handle the receive (idle) timeout setting configured for the listener. There are also two new settings for configuring TN3270 timeouts, "Printers time out" and "Output resets timeout". See the online product documentation for more information.  
3144133 (1113024)



- MFCS listeners can now be SSL-enabled without the need to have DemoCA installed.  
2868627 (1105777)
- MFCS no longer initializes the Security Facility if there are no External Security Managers defined for the region.

## Compiler

[Back to the list](#)

- Programs containing EVALUATE statements of the form: EVALUATE true | false WHEN conditional-expression where conditional-expression included inline method invokes would give an RTS 114 error when run as .int code, and an "Illegal .int code" error when generated. This has been fixed. Also, short circuit evaluation is now correctly observed, such that when evaluating condition-1 AND condition-2, if condition-2 contains an inline method invoke and condition-1 is false, then the inline method invoke is not executed. Previously, despite being correctly evaluated, the inline method invoke in condition-2 was being executed. Similar behavior relating to OR evaluations has also been corrected.  
3138510 (1112492)
- During compilation, characters within literals that are unknown in the current locale are now less likely to cause spurious errors. However, the correct (and safest) solution is to ensure that the locale has been set correctly, to match the source encoding of these characters. On UNIX, this means setting LANG, LC\_CTYPE, or LC\_ALL appropriately; each of these variables takes precedence over the former. On Windows, this means setting the system locale in the 'Region and Language' section of Control Panel.  
3123935 (1111148)
- The Compiler now produces an E level message - COBCH1888 Typedef is defined differently in another external program - if different external programs have conflicting definitions of the same typedef name. (To restore the previous behavior, where the earlier definition was ignored, use the directive HIDEMESSAGE"1888".)
- An issue with the Compiler has been fixed so that in the RECORD VARYING clause, if the minimum and maximum lengths are specified, the maximum length must be greater than the minimum length.

## Data Tools

[Back to the list](#)

- Records with an invalid value for a conditional field will no longer result in a match for that conditional layout.  
2853226 (1103406)

## Documentation

[Back to the list](#)

- You can use 'byte' or 'BYTE' as a synonym for the binary-char unsigned data type. As a result, 'byte' and 'BYTE' are now reserved words in Managed COBOL. Use the REMOVE"BYTE" Compiler directive to prevent an error being produced for existing programs that use the reserved word as a user-defined word.  
3147576 (1113323)
- As of version 3.0, references to types within an assembly other than mscorlib need to be explicitly referenced. You can achieve this by using the ILREF Compiler directive. (Previously, in certain circumstances, the Compiler would allow access to types within the System.dll assembly without the need for an ILREF"System" directive.  
3121002 (1111373)

## Enterprise Server

[Back to the list](#)

- The External Security Facility (ESF) can now be configured to throttle large volumes of incoming Verify (user authentication / signon) requests to improve resilience to denial-of-service and brute force attacks. See "Verify Request Throttling" for more information.

3113639 (1110160)

- The LDIF files used to create the sample configuration for Enterprise Server LDAP-based security no longer create an empty "PHYSFILE" resource class. Changes in the JCL engine as of ES 3.0 caused most jobs to fail when submitted to a security-enabled region using such a configuration. See the product help for more information.
- The MLDAP ESM Module, part of the Enterprise Server External Security Facility, now supports the Argon2 hash algorithm for creating password verifiers. See MLDAP ESM Module Custom Configuration Information in the product help for more information. NOTE: The Argon2 hash is optional and not enabled by default.
- The MQ pages in ESMAC are now controlled by a new security resource, MQL. This enables you to either restrict or grant users access. 'MQL\*' is a new resource that needs to be added under MFESMAC similar to existing resources such as 'PCT\*' or 'XAT\*'. The following is a sample export of the LDAP repository:

```
*****
# Sample security definitions for ESMAC MQ Listeners/Writers pages

#####
##### MQL*          ##
#####
dn: CN=MQL*,CN=MFESMAC,CN=Enterprise Server Resources,CN=Micro
Focus,CN=Program Data,DC=X
changetype: add
cn: MQL*
objectClass: microfocus-MFDS-Resource
microfocus-MFDS-Resource-Class: MFESMAC
microfocus-MFDS-Resource-ACE: allow:SYSADM group:alter
microfocus-MFDS-Resource-ACE: deny:*:execute
microfocus-MFDS-UID: mfuid
#description: Allow full access any ESMAC MQ Listeners/Writers Screen

*****
```

3143258 (1112990)

- You can now use the `ECIResponse.getReturnCode()` method to obtain the return code for any errors from Enterprise Server.

3142092 (1113248)

- Communication with the console daemon has been improved. Messages are displayed more quickly and requests are being processed more efficiently and, as a result, times for initialization and shutdown might be reduced.

3136867 (1112483)

- Administrators can now add, delete or modify XA resources in the Enterprise Server Administration Web UI while a region is running.

2589624 (1085625)

## Enterprise Server Auditing

[Back to the list](#)

- The `maxRetryTime` value in the audit configuration file now treats 0 as a no timeout time, and any negative number as an infinite timeout.

3150566 (1113592)

- Any extra information that was added to the syslog messages will now correctly appear in the structured data items.

## Executables require relinking or recompiling

- Due to an internal change in version 4.0 of your product, you must at least relink any executable programs compiled prior to this version, to make them compatible with the latest run-time system. However, a full recompilation of your source code is the recommended action, to allow your executables to benefit from the product's latest programming and performance enhancements.

Relinking an executable without recompiling means using the original object code with the `cbllink` utility. Original object code is typically the binary file output (usually containing the `.obj` extension) produced during the original compilation process. An application can contain one or more binary files.

## File Handling

[Back to the list](#)

- In some cases the ESF LDAP Security Administration Web Interface inadvertently removed users from groups when changing their password. This has been fixed.  
3124294 (1111259)
- The ESF LDAP Security Administration Web Interface can now filter by Class and Resource name, description, and ACL. Previously, you could only filter on Class name.  
2871549 (1106119)
- For .NET applications, set `XFHLOG=DEFAULT` to create the `XFHLOG` file in the current directory; otherwise it is created in `C:\ProgramData\Micro Focus\[ED/VS]\[Release]`. From release 4.0 onwards, this variable also has an effect for native applications.  
3115116 (1110323)
- Setting the configuration option `ASCIISOSI=ON` will add the required SOSI characters to the relevant EBCDIC DBCS character strings, in order for them to be displayed or written out correctly.  
3113802 (1110183)
- The OPEN mode of SYSOUT files now honors the DISP specified in the JCL.  
3109432 (1109745)
- OPEN I-O of a virgin ESDS file now correctly returns a file status of 35, as it does on the mainframe.  
2887724 (1108443)

## MF Server Administrator (GUI)

[Back to the list](#)

- The total number of active sessions or clients in MFDS is now limited to 2000.

## Micro Focus Directory Server

[Back to the list](#)

- The `mfd`s -g options D, O, and S have been added to the product Help.  
2848627 (1102864)
- MFDS now disables and limits the scope of Web listeners on add. It also emits a warning if any insecure Web listeners are displayed in the validate and listener tables.

## Run-Time System

[Back to the list](#)

- The run-time system now produces a more precise error message if a shared object of the wrong bitism is loaded.
- `scan64` is no longer available. This has been superseded by the COBOL Analysis functionality in the IDE.

# Significant Changes in Visual COBOL 3.0

Visual COBOL version 3.0 includes significant changes in the following areas:

- [Compatibility AddPack](#)
- [Compiler](#)
- [Documentation](#)
- [Enterprise Server](#)
- [File Handling](#)
- [IDE](#)
- [Micro Focus Directory Server](#)
- [OpenESQL](#)
- [Reserved words](#)
- [SQL Option for DB2](#)

## Compatibility AddPack for Visual COBOL

Compatibility AddPack for Visual COBOL is now deprecated and will not be available with release 3.0 and later.

The Dialog System GUI and run-time components and Dialog System Character Mode (on Windows and UNIX) which were part of the AddPack are now installed as part of Visual COBOL for Visual Studio. The run-time components are installed as part of COBOL Server. These are only included for backward compatibility and Micro Focus does not recommend that you use them for new development.

The other components which were part of the AddPack, the Character-Based Data File Editor, CSBIND and Screens, will be available upon request from Micro Focus SupportLine.

## Compiler

- Replacing a partial token no longer causes the second part of the token to appear on a new line. This could happen if the new text was larger than the text being replaced.

2869185 (1105763)

## Documentation

- There have been a number of new reserved words added to the language in this release; these are all in effect under MFLEVEL"19", which is the default level when running under the MF dialect. Any of the following words are now not allowed under default conditions, and you will need to remove/rename them, or specifically configure your environment to allow them: ALLOCATE FREE JSON END-JSON

## Enterprise Server

- WEB CONVERSE now supports a value of 0 for the USERLEN and PASSWORDLEN options which matches the behavior on the mainframe. There is no change to the behavior of WEB SEND (client) which is to return LENGERR 139/140 when USERLEN or PASSWORDLEN are 0.

2989188 (1108602)

## IDE

- Disabling CICS support from the properties of a file in your project within the IDE now correctly sets the NOCICSECM Compiler directive on that file.

## File Handling

- A problem that generated a 39 error when attempting to access a VSAM file via an alternate index PATH element has been fixed.  
2874622 (1106562)

## Micro Focus Directory Server

- In the Enterprise Server Administration HTML GUI, the "Scripts" page functionality is only available if administration access is restricted and the logged on user has sufficient authority.  
3101625 (1109025)
- Some additional CSRF security measures have been added to the Enterprise Server Administration HTML GUI.  
3101205 (1108916)

## OpenESQL

The new OpenESQL OPTIMIZECURSORS SQL compiler directive option is turned on by default for both ADO.NET (DBMAN=ADO) and ODBC (DBMAN=ODBC). For ADO.NET, this reduces cursor memory consumption thereby providing optimal performance. This also ensures that, for ODBC, embedded SQL cursors that use WITH HOLD and FOR UPDATE clauses have the same data integrity across all databases.

If your applications require the OpenESQL preprocessor to use the behavior provided in an earlier release, compile them using OPTIMIZECURSORS=NO.

## Reserved words

- There have been a number of new reserved words added to the COBOL language; these are all in effect under MFLEVEL"19", which is the default level when running under the MF dialect. Any of the following words are now not allowed under default conditions, and you will need to remove/rename them, or specifically configure your environment to allow them:

ALLOCATE  
FREE  
JSON  
END-JSON

## SQL Option for DB2

- Help buttons previously available on the XDB Server Configuration Utility, XDB Service Controller, Options Dialog, Bind Utility, and Linker Config (Link Profile) UIs have been removed with the exception of error messages in the SQLWizard, Migrate, and Declaration Generator.

# Significant Changes in Visual COBOL 2.3 Update 2

Visual COBOL version 2.3 update 2 includes significant changes in the following areas:

- [Compiler](#)
- [Enterprise Server](#)
- [MF Directory Server](#)
- [Monitoring and Management](#)
- [Run-Time System](#)

## Compiler

- The ILPINVOKE directive is now allowed only in an initial \$SET. This is in line with similar directives like ILREF and ILTARGET. Previously, the ILPINVOKE directive was allowed in other positions in the source code, but could later result in 'Insufficient memory' errors.

2860347 (1104422)

- Replacing a partial token no longer causes the second part of the token to appear on a new line. This could happen if the new text was larger than the text being replaced.

2869185 (1105763)

- There is no longer a problem opening an RM/COBOL indexed file when the program has a RECORD CONTAINS n CHARACTERS clause and there are record descriptions with lengths less than n. This situation previously caused a 39 error on the OPEN (other than OPEN OUTPUT) because there was a mismatch in the minimum record length.

## Enterprise Server

- Previously, it was possible to install groups that should not have been installed. If a group name, as defined in the Startup List, did not exist in the list of Groups then the next Group in the alphabetical order would be loaded instead. Now, if a Group is not defined in the list of Groups, a warning that the Group could not be loaded is issued.

2869848 (619107)

## MF Directory Server

- The "-n" option for the mfd command now supports hostnames as the network addresses in addition to IPv4 addresses.

2816871 (1099564)

## Monitoring and Management

- Messages that are written to the console log by applications that perform "display upon console" now contain a standard message ID (CASMG0001I).

2854207 (1103659)

## Run-Time System

- The command\_line\_linkage tunable has been deprecated; equivalent functionality can be achieved by using the COMMAND-LINE-LINKAGE Compiler directive instead.

2838118 (1101539)

# Significant Changes in Visual COBOL 2.3 Update 1

Visual COBOL version 2.3 update 1 includes significant changes in the following areas:

- [Data Tools](#)
- [Dialog System](#)
- [Editor Writing Assistance](#)
- [Run-Time System](#)
- [SQL: OpenESQL](#)
- [SQL Option for DB2](#)

## Data Tools

- When filtering a data file, if there is no valid temporary directory set, you are prompted to set one using the option in the Preferences dialog box.
- The editor no longer allows you to open a file if the file size (without header size) is not a multiple of the record size on disk; an error is produced instead.
- The editor no longer allows you to open a file if the file size without header size is not a multiple of the record size on disk; an error is produced instead.
- The level numbers displayed in a record layout correspond to the levels used in the .idy file that was used when the structure file was created.

## Dialog System

- Versions of the Micro Focus Compatibility AddPack released with version 2.3 of Enterprise Developer or Visual COBOL 2.3 or with earlier versions supported the use of the "MFOLECL\_NO\_THREAD\_INIT" environment variable. Using this variable, you could disable the default OLE Class Library COM threading initialization. This helped avoid issues that could manifest as hangs and crashes, especially on Microsoft's Windows 8.x or 10 and with applications that are a hybrid between Dialog System, OLE class library and .NET elements - see [http://community.microfocus.com/microfocus/cobol/visual\\_cobol/w/knowledge\\_base/20715.exception-occurs-when-native-dialog-system-program-calls-managed-winform.aspx](http://community.microfocus.com/microfocus/cobol/visual_cobol/w/knowledge_base/20715.exception-occurs-when-native-dialog-system-program-calls-managed-winform.aspx).

In the version of the Micro Focus Compatibility AddPack released with Enterprise Developer 2.3.1 or Visual COBOL 2.3.1, this environment variable is now enabled by default and no longer needs to be set exclusively. To restore the previous behavior, use a new environment variable, MFOLECL\_THREAD\_INIT, and set it to Yes.

2848875 (1102920)

## Editor Writing Assistance

- IntelliSense (Visual Studio) or Content Assist (Eclipse) suggestions are no longer offered if you start typing numbers and automatic triggering of suggestions is enabled.
- Pressing TAB in the Visual Studio editor now always inserts the highlighted item in the IntelliSense list of suggestions.

## Run-Time System

- The Audit Manager contains a new TIMEOUT option. When a client sends an audit event using the 'CBL\_AUDIT\_EVENT' API, the event gets placed in the next available slot in a shared memory block. If shared memory is full (i.e. no slots are available), the event is re-tried until a slot becomes available.

If no Audit Manager is running, no events are removed from shared memory, and no slots will ever become available. Therefore, use the new TIMEOUT option so that a client will only retry sending until the TIMEOUT duration is reached; after which, it will stop sending audit events. If Audit Manager is recycled, events will start to be sent again.

To set the TIMEOUT for all Audit Manager clients, specify the following line in the Audit Manager configuration file:

```
mfaudit.timeout = n
```

Where n is the timeout value in milliseconds.

To set the TIMEOUT for an individual Audit Manager client, use the 'CBL\_AUDIT\_CONFIG\_PROPERTY\_SET' API. It takes an integer property-value, which should be the timeout value in milliseconds.

If TIMEOUT is set using both methods, the client property TIMEOUT takes precedence, unless this property is set to zero; in such cases, the TIMEOUT in the configuration file is used. If you use the 'CBL\_AUDIT\_CONFIG\_PROPERTY\_GET' API on the 'TIMEOUT' property, it only returns the TIMEOUT value for the client property; it does not return the value set in the configuration file.

2838689 (1101685)

- Several changes have been made to the implementation of IS DBCS, IS KANJI and IS JAPANESE class condition tests:

- IS [NOT] DBCS

When CHARSET"EBCDIC" is in effect, the IS DBCS test returns true when each character in the string is deemed to be a valid DBCS character. A valid character has its first byte in the range 0x41 through 0xFE, and the second byte in the range 0x41 through 0xFE, or the character is an EBCDIC space (0x4040). When CHARSET"ASCII" is in effect, the DBCS test uses an OS call to determine if the string contains only valid double-byte character, and returns true if valid.

- IS [NOT] KANJI

When CHARSET"EBCDIC" is in effect, the IS KANJI test returns true when each character in the string is deemed to be a valid Kanji character. A valid character has its first byte in the range 0x41 through 0x7F, and the second byte in the range 0x41 through 0xFE, or the character is an EBCDIC space (0x4040). When CHARSET"ASCII" is in effect, the IS KANJI test uses an OS call to determine if the string contains only valid Kanji character, and returns true if valid.

- IS [NOT] JAPANESE

When CHARSET"EBCDIC" is in effect, the IS JAPANESE test is not supported, and will generate a COBCH1806 Feature not supported in selected charset message on compilation.

When CHARSET"ASCII" is in effect, the IS JAPANESE test returns true when the string contains only double-byte Japanese characters or single-byte Japanese Katakana characters, and returns true if valid. When NSYMBOL"NATIONAL" is in effect, these class tests are not supported, and will generate a COBCH0303 Operand has wrong data-type message on compilation.

2812895 (1098401)

## SQL: OpenESQL

- The DB2 CONCAT function and operator now convert to SQL Server using the HCOSS-supplied dbo.CONCAT for character, numeric and datetime data. If you are using BINARY or VARBINARY data, you must apply the HCOSS-supplied dbo.CONCAT\_BINARY function. HCOSS applications deployed with earlier versions of Visual COBOL are affected, if they use string or binary concatenation. The mainframe dialect DB2 || operator and CONCAT function now call a new SQL Server scalar function dbo.CONCAT(). All existing programs with dialect=mainframe that use DB2 concatenation syntax should be recompiled. All existing SQL Server databases that are accessed by these programs must have dbo.CONCAT installed. To create the new function in your application's SQL Server database, you can either:

- Run a DSN bind against the customer database. Or:
- Execute the %ALLUSERSPROFILE%\Micro Focus\Enterprise Developer\hcoas  
\InstallDigitsFunction.sql script.

This is a one-time only change to the database.

2843818 (1102248)

## SQL Option for DB2

- Spurious errors were sometimes returned while querying using an ALIAS.

2830383 (1100609)

# Significant Changes in Visual COBOL 2.3

Visual COBOL version 2.3 includes significant changes in the following areas:

- [Building](#)



- [Converting Additional Directives to Projects' Properties](#)
- [CAS Security](#)
- [CAS XA Switch modules](#)
- [Compiler](#)
- [Data Tools](#)
- [File Handling - External File Handler](#)
- [IDE](#)
- [J2EE Connector](#)
- [MF Server Administrator \(GUI\)](#)
- [Updated Run-Time System](#)

## Building

- Visual COBOL now supports Visual Studio parallel builds for COBOL projects. Parallel builds enable you to build multiple projects faster on multi-CPU machines.

If, after upgrading to this version of Visual COBOL, you start receiving unexpected build errors when compiling an existing multi-project solution, this may be a result of enabling support for parallel project builds. These are a couple of examples of issues that might be causing these errors:

- Using file references to project outputs in the same solution. You need to use project-to-project references instead.

Use **Project > Project Dependencies** to manage the project dependencies and build order within your solution.

- A customized build process such as one that is using pre- or post- build events.

If resolving any of these issues does not help resolve the build errors, consider disabling the parallel build support - click **Tools > Options > Projects and Solutions > Build and Run** and **set maximum number of parallel project builds** to 1.



**Note:** Parallel builds are not supported with Personal Edition licensing

## Converting Additional Directives to projects' properties

Starting with this release, an **Update Project Properties** dialog box might start to appear when you are opening existing COBOL solutions. The dialog box recommends converting some of the directives specified in **Additional directives** to project's properties. This is to address an issue where you might try to set file properties that differ from the project directives and the directives specified in **Additional directives** that have a property equivalent take precedence over the file properties. As a result of this you might receive unexpected build issues when building your applications.

This dialog box helps eliminate the issue by converting the directives specified in **Additional directives** to project properties.

If you do not want the IDE to perform this check, click **Tools > Options > Micro Focus > General** and uncheck **Check Additional Directives for project properties**.

## CAS Security

- The Enterprise Server External Security Facility now includes MLDAP ESM Module 2.0, with a new algorithm for identifying the best-matching resource-access rule and ACE for resource-access security checks. This algorithm is faster and matches most customers' expectations. The new algorithm also provides an optional "username substitution" feature. It can be enabled by setting "rule substitutions" to "yes" in the [Operation] section in the Security Manager configuration text area. When this is enabled, the string "\${user}" in a resource-rule name will be replaced with the name of the user that makes the request. For example, a DATASET rule named "USERS.\${user}.\*" would apply to datasets with the requesting user's name as the second qualifier. In rare cases, customers with complex, ambiguous resource-access security rules might see experience changes in behavior as a result of the new

algorithm. The old algorithm is still supported and can be enabled by setting "version 1 authentication" to "yes" in the [Operation] section of the Security Manager configuration.

2807531 (1097783)

### **CAS XA Switch modules**

- The XA switch modules now support dynamic registration.

2682101 (1092325)

- The XA switch modules now support batch-only operations when multiple XA Resource Managers have been defined.

2664675 (1091082)

- In Visual COBOL 2.2 update 2, Micro Focus identified undefined run-time behavior when the following combination of directives was specified: SIGN"EBCDIC", CHARSET"ASCII", and one of the following: HOST-NUMMOVE, HOST-NUMCOMPARE or SIGN-FIXUP. Previously (Visual COBOL 2.2 update 1 and earlier), if this combination was specified, the SIGN"EBCDIC" directive should have been ignored, to avoid a mixture of ASCII and EBCDIC characters; however, SIGN"EBCDIC" was still being honored, resulting in undefined run-time behavior. Therefore, this combination of directives is now invalid for Visual COBOL 2.2 update 2 or later, and if specified, will be rejected at compile time.

2786397 (1095265)

### **Compiler**

- For native COBOL, the size limit of the Data Division now stands at 2GB -1.

2796076 (1096384)

- COBDATA has no effect on compilation. The output of the Compiler is the same location regardless of whether COBDATA is set.

Previously, it was not possible to specify sign(EBCDIC) with sign-fixup, host-num-move or with host-num-compare. This combination is now supported in native COBOL but remains invalid for managed COBOL code. This is applicable to version 2.2 U2 HotFix 10 onwards.

2824577 (1100823)

### **Data Tools**

- DFCONV now returns the correct return-code; previously, it would always return 0.

### **File Handling - External File Handler**

- Custom file handlers (using DYNREDIR) are now called for each part of a concatenated file.

2795077 (1096322)

### **IDE**

- The default warning level for new COBOL projects in Visual COBOL for Visual Studio is now "Include recoverable errors (Level E)". This also includes "Severe errors only (Level S)" and unrecoverable (Level U) errors. Micro Focus recommends you set the warning level on the COBOL page in a project's properties to "Include warnings (Level W)" where appropriate to help avoid potential coding problems.

### **J2EE Connector**

- Visual COBOL version 2.3 provided a new command-line argument to Java, mf.ssl.algorithm, which can be set to an appropriate algorithm.

2799213 (1096684)

### MF Server Administrator (GUI)

- Passwords that entered through either the MFDS or the ESMAC interface now use the same encoding.  
2792382 (1096011)

### Updated Run-Time System

- COBOL Server now provides an execution environment capable of running applications that were each built using different development products. A consequence of this is that if your application has a main COBOL executable (.exe) that was built with a version of Visual COBOL prior to version 2.3, you should ensure that the executable is rebuilt and packaged with the new run-time system. You can rebuild from the IDE or the command line.

Other COBOL subprograms built with previous versions of Visual COBOL are not required to be rebuilt.

## Significant Changes in Visual COBOL 2.2 Update 2

Visual COBOL version 2.2 update 2 includes significant changes in the following areas:

- [Compiler](#)
- [Compiler Front-end](#)
- [Documentation](#)
- [J2EE Connector](#)

### Compiler

- When using the HOSTRW directive with the mainframe dialect, Report Writer will now produce the full range of ASA control characters and will emulate mainframe print files.

2697615 (1094527)

### Compiler Front-end

- Fixed Binary (p<=7) is now an 8-bit, signed, 2's complement binary integer by default.

### Documentation

- The default setting for the MFALLOC\_PCFILE environment variable has changed; the default is now set to Y, which means that when cataloguing a file that has a DCB attribute of DSORG=PS, a physical file is created for it if one does not exist. Previously, the default was set to N, which meant that a file was not created.

2697571 (1094370)

### J2EE Connector

- The listSystem.properties file in package com.ibm.ctg.client was missing documentation for some sections.

(606556)

## Significant Changes in Visual COBOL 2.2 Update 1

Visual COBOL version 2.2 update 1 includes significant changes in the following areas:

- [.NET Compiler](#)
- [SQL: COBSQL](#)

## .NET Compiler

- In member reference in managed COBOL syntax, you may now only use parentheses when referencing methods. You can no longer specify parentheses when referencing fields or properties, as this will produce a syntax error. For example:

```
set intLength to testString::Length()
```

must change to:

```
set intLength to testString::Length
```

## SQL: COBSQL

- COBSQL now displays appropriate COBOL syntax errors after encountering EXEC SQL statement errors.

2673619 (1093197)

# Significant Changes in Visual COBOL 2.2

Visual COBOL version 2.2 included significant changes in the following areas:

- [.NET Compiler](#)
- [CCI Session Layer Code](#)
- [Compiler](#)
- [Interface Mapping Toolkit](#)
- [MF Directory Server](#)
- [MF Server Administrator \(GUI\)](#)
- [Request Handler](#)
- [Samples Browser](#)
- [Visual Studio IDE](#)

## .NET Compiler

- The use of ILSMARTLINKAGE in sub-programs is now working correctly. In previous versions, if it was specified in a sub-program, a dynamic call of that program from another program could cause execution failure.

2608825 (1087435)

- In managed code, the statement DISPLAY UPON SYSERR now behaves as expected. Previously, it was behaving the same as DISPLAY UPON CONSOLE.

2589053 (1085576)

- When the PROPERTY keyword is used on a numeric edited field, the SET method now works correctly when the program specifies DECIMAL POINT IS COMMA.

2588508 (1085560)

## CCI Session Layer Code

- A new option, use\_global\_namespace, is available for the cci.ini file in the Windows %SystemRoot% folder. If use\_global\_namespace is set, all the ccishared memory objects are created in a system-wide address space, and the applications hosted by different users, including system services, can communicate. To use this facility, edit the cci.ini file and ensure use\_global\_namespace is set to "yes". [ccismem-base] # Allow interaction between users on a # single system. Using this option reduces security as # all users will have access to the same name space. use\_global\_namespace=yes If the value of this option is anything other than "yes", or if the option is missing, no change is made to the existing behavior.

2195519 (1062800)

## Compiler

- The default for the NSYMBOL directive under DIALECT(ENTCOBOL) has been changed to NSYMBOL(NATIONAL) to emulate the equivalent IBM default.  
2657471 (1090355)
- To improve RM/COBOL and ACUCOBOL compatibility, the SIGN clause at a group level is no longer applied to non-DISPLAY usage signed numeric data items within the group, just as it is not applied to unsigned numeric data items and non-numeric data items within the group.  
2549904 (1082171)
- Previously, even though no code was generated, the Compiler allowed the ON EXCEPTION and NOT ON EXCEPTION phrases in the DISPLAY statement in formats that do not allow these phrases. As a result, if the DISPLAY statement was in the ON EXCEPTION phrase of another statement, the NOT ON EXCEPTION phrase would bind incorrectly with the DISPLAY statement instead of with the intended containing statement - for example, ACCEPT or CALL.

## Interface Mapping Toolkit

- For program-based Service Interfaces, if the program-id name in the COBOL source is in lowercase and is not surrounded by quotes, its corresponding entry-point name is now forced to uppercase when used in a Service Interface Operation. Previously, the case was preserved. As a result of this change, existing Service Interfaces will become invalidated if you refresh their program's annotations because of the new spelling of the entry-point name. To avoid this, you need to surround the program-id name in the COBOL source with quotes before you refresh the annotations.

## MF Directory Server

- The mfd command line option for exporting registered Enterprise Server definitions to an XML file now supports the "\*" option. This exports all registered servers rather than a specified server. Multiple server definitions are now exported into the target directory and saved into a file with the default name ALLSERVERS.xml. The import option now also supports the import of multiple server definitions from a single XML file.  
2641890 (1088838)
- mdump now supports a new option, -e, to help you query the Security Manager configuration details. The possible values of the option are: "1" - shows security configuration that applies to any returned enterprise servers; "2" - shows security configuration for MFDS and the default Enterprise Server security configuration. This requires MFDS version 1.15.00 or higher; "3" - returns the properties of all configured external Security Managers.  
2487164 (1081693)

## MF Server Administrator (GUI)

- When adding a user to an external security manager, you can now include a password expiry time in the Advanced Configuration section of the Add New User wizard in Enterprise Server Administration. The field value is specified using generalized time format (YYYYMMDDHHMMSS.OZ), and can be used by the MLDAP ESM for calculating whether a user's password has expired and requires updating. This value may only be specified using this page when adding a user. You need to use an external directory services configuration tool to edit it.  
2562118 (1083203)

## Request Handler

- A problem that caused BIS to create log files in a directory named C:\ProgramData\AcuCorp\BIS\LogFiles was fixed. BIS no longer creates log files unless specified and the BIS logging service is now disabled by default. To enable it, you need to use the following global environment variable:  
BIS\_LOG=[ OFF | ON | <directory> ] Where the values are:

- OFF - disables logging (the same as if BIS\_LOG is not specified or is left blank)
- ON - enables logging and directs the log files into the default location, which must not be read-only.
- <directory> - enables logging and directs the log files into the specified directory. The user must ensure that the BIS request handler has write rights for this directory. The directory must be an absolute path or network path. If the specified directory does not exist, BIS will attempt to create it. The containing directory must exist.

The BIS\_LOG variable is only examined when the BIS application pool is started or recycled. After setting or changing BIS\_LOG, IIS must be restarted in order for the variable to take effect.

## Samples Browser

- If you have installed the version of this product for both Visual Studio 2010 and Visual Studio 2012, the Samples Browser now provides links for you to open the samples in either one of them.

## Visual Studio IDE

- Performance when loading and building COBOL projects that consist of a large number of files has been improved.  
2657121 (1090316)
- When building a project outside of the IDE, adding a new file to a project no longer results in a full rebuild of the project.  
2617003 (1089623)
- You can now change the display format of values on individual rows in the Watch window using modifiers after the names of variables and expressions. To do this, click a row, press F2, and type a modifier after the name of the variable or the expression as follows - type VariableName,h or VariableName,x to always display the variable or the expression in hexadecimal format; type VariableName,d to always display numeric variables in decimal format and strings - as text.  
2614182 (1087959)
- When you perform a search in the IDE for copybooks that your programs depend upon, the COPYEXT directive you set from the Additional directives field on the COBOL tab in your project's properties is now used in preference to the list of copybook extensions specified in Tools > Options > Text Editor > Micro Focus COBOL > Advanced, and in Copybook extensions. This change does not affect the project build and background parsing that already use COPYEXT.  
2612053 (1087773)
- Attempting to restart an enterprise server failed if the process took longer than fifteen seconds.  
2607051 (1087259)
- When you debug native code and query a data item which contains null bytes, the value displayed in the Watch window is no longer truncated at the first null byte.  
2604749 (1087235)
- A new setting, "Define DEBUG constant", is now available on the COBOL page in the project properties of managed projects for the Debug configuration. You can select it to add "constant"DEBUG(1)" to the build directives.  
2600567 (1086629)
- The Output window now displays a notification when the compilation of the IMS files has been successful.  
2600137 (1086667)
- A problem with the value of "Link with objs" setting being duplicated after you reload the COBOL Link properties page has been resolved.  
2595408 (1086091)
- IntelliSense now displays data names longer than 32 characters correctly.

2594901 (1086053)

- Previously, when you upgraded COBOL projects with signed assemblies from Visual Studio 2003 format to Visual Studio 2010 format, the signed assembly property was lost.

2585458 (1085258)

- There is an improvement in the performance of the cursor in the text editor when working with larger files and projects.

2585450 (1085255)

- Using linked files in projects has been improved as follows:
  - Folders that only contain linked files no longer disappear from the project when you reload it.
  - The location of linked files is preserved in the project structure when you reload the project.
  - Moving a linked file within a project no longer moves the actual file on the disk but only moves the link inside the project structure.
  - It is no longer possible to copy a linked file into the same project where, previously, this created a copy of the actual file on the disk.

2574102 (1084208)

- When you convert Net Express projects that compile to .int or .gnt files to Visual COBOL for Visual Studio, the application environment variables are now imported successfully.

2569777 (1083953)

- It is now possible to convert Net Express projects that do not contain any COBOL source files to Visual Studio projects.

2568638 (1083900)

- You can now set environment variables used by the native COBOL Run-Time system during initialization from the project properties - click Environment on the Application tab.

2539447 (1081251)

- Pressing Enter to create a new line now preserves the indent in the COBOL editor in Smart edit mode.

2496411 (1077769)

- Pressing End inside the writing area of the COBOL editor now positions the cursor on the first non-blank character, if columns 12-72 contain any text. If the line is blank, the cursor is positioned on column 73.

2496351 (1077767)

- The COBOL editor now supports a "Smart edit mode" (see Tools > Options > Text Editor > Micro Focus COBOL > Margins) which is enabled by default. In Smart edit mode, when you press ENTER in the code (A/B) area the comments move to the next line and stay in the right-hand area.

2496350 (1077768)

- You now receive a suitable error message when you try to use "Start Without Debugging" with Mainframe Subsystem Application projects.

2495298 (1078343)

- You can now use Solution folders to group projects in your solution.

2259310 (1065760)

- If, when you start debugging, the debug target does not exist you now receive an error message that correctly states the missing filename.
- Any leading or trailing spaces you added to the name specified in the "Output name" field on the Application tab in the properties of a native project are now ignored.
- Class view no longer contains outdated information from previous background syntax checking after classes have been renamed.
- Class view no longer contains outdated information from previous background syntax checking when the files defining types have been removed.
- A problem with navigating to member definitions from the Class View has been resolved.

- A problem with navigating to member definitions from the Class View has been resolved.
- An issue where canceling some of the dialogs in Tools > Options resulted in the changes being saved anyway, or the pages not reverting when next loaded, has been resolved.
- You can now start and stop servers from the Server Explorer when using the local machine's IP address or DNS name.
- It is now possible to debug a project that has its "Compile for debugging" setting enabled in the project properties for the Release configuration.
- Selecting a project in Class View now triggers background syntax checking, if it has not been performed for that project yet.
- If you have .NET Framework v. 4.5 installed, creating a COBOL Web application with Visual Studio 2010 Shell was failing with a Signal 114 error and was causing the IDE to crash. This issue has been resolved for the IDE. To work around the issue when you compile COBOL Web Applications from the command line, you need to manually set the environment variable VisualStudioVersion to 10.0 before compiling.
- Using the tab character in comments no longer causes issues with the colorization of the code.
- The Visual Studio IDE no longer crashes if you try to close it while directives scan is in progress.
- Adding files to a project when directives scan is disabled was taking a long time to complete.
- Friend assemblies (as identified by the InternalsVisibleToAttribute) are now correctly handled during syntax checking, and types are correctly found within friend assemblies when they are present.
- An issue with adding new platforms or configurations to a project or solution when the project contains pre- or post-build events has been resolved.
- A problem with navigating to member definitions from the Class View, when the definitions occurred within copybooks used within partial classes, has been resolved.
- A problem where trying to navigate to the source of an item from the Class View positioned you on the wrong line, has been resolved.
- An issue where the Implements smart tag was present for interfaces that were fully implemented (when some of the methods from that interface were implemented explicitly; and in addition to another interface which was not fully implemented) has been fixed.
- An issue where method signatures were rendered incorrectly if the member had a 78 level item in its local storage has been resolved.

## Significant Changes in Visual COBOL 2.1 Update 1

Visual COBOL version 2.1 update 1 includes significant changes in the following areas:

- [Documentation](#)

### Documentation

- To ensure no loss of functionality when accessing Vision and RM/COBOL data files, you should use the appropriate IDXFORMAT Compiler directive setting or file handling option, and not use the CALLFH(ACUFH) Compiler directive. See 'Configuring Access to Vision Files' and 'Configuring Access to RM/COBOL Data Files' for more information.

## Significant Changes in Visual COBOL 2.1

Visual COBOL version 2.1 includes significant changes in the following areas:

- [Compiler](#)
- [IDE](#)
- [Run-Time System](#)
- [Vision File System](#)



## Compiler

- The use of extended ACCEPT or DISPLAY statements in Windows applications (ilsystem"2") now produces error COBCH1634: Extended ACCEPT/DISPLAY not allowed with a Windows GUI executable (ILSYSTEM"2"). Remove the syntax or change the output type of your application to 'Console Application'.

2575702 (1084365)

## IDE

- A problem with the item templates in the Add New Items dialog box not available for PL/I projects has been resolved.  
2581187 (1084876)
- There is now a build summary report for projects that compile to multiple output files.  
2578006 (1084506)
- Previously, Visual Studio used to always rebuild the entire project after you changed the project properties or added files when there were build error. This has been changed so that during subsequent builds Visual Studio only rebuilds the files that are out-of-date.  
2576400 (1084393)
- A new setting has been added to the COBOL tab in the project properties, "Generate listing option", which produces an .lst file in a Listing subfolder in the project directory. The "Generate directives file" setting now generates the directive file in the project output directory.  
2494484 (1077662)
- Command line arguments are now passed to the program when started via the 'Start without Debugging' option in the Visual Studio IDE.
- Previously, if you started debugging using CBL\_DEUGBREAK and there was a COBOL source file open in the editor, when you stopped debugging its dictionary file (.idy) was not being released. This resulted in any subsequent builds and rebuilds failing. This problem has been resolved.
- The native COBOL projects in Visual Studio have been enhanced so that you can now build them to multiple executables - each COBOL program in the project producing a separate executable.
- You no longer receive an error message when adding an event handler to an object in a COBOL WPF project if the .xaml code behind file includes a class that does not have methods in it.
- The IDE no longer ignores certain Run-Time System errors from the Compiler which previously caused the build to fail without an explanation.
- Compile extensionless COBOL files with the IDE no longer fails.
- Using the UI to add COBOL switches or environment variables to a COBOL Web Application (right-click the configuration file in Solution Explorer and select Edit) no longer causes a configuration error when you run the application.

2558133 (1082871)

## Run-Time System

- When running a full-screen application inside a terminal emulator on Linux, the actual size of the terminal is read at startup and reread when the terminal is resized. This behaviour is also supported on AIX, HP/UX, and Solaris. The Micro Focus vt220 terminfo entry now correctly describes a 24-line display. A vt220-25 terminfo entry is included for compatibility with the previous behaviour.

2579335 (1084817)

## Vision File System

- When you configure your application to return RM/COBOL file status codes, by setting COBFSTATCONV=rmstat, the codes returned are ANSI'85 codes.

2553438 (1082469)

# Significant Changes in Visual COBOL 2.0

Visual COBOL version 2.0 includes significant changes in the following areas:

- [Compiler](#)
- [DB2](#)
- [File Handling](#)
- [IDE](#)
- [OpenESQL](#)
- [Run-Time System](#)

## Compiler

- An attempt to serialize a class containing COBOL data such as PIC X or group items could lead to a serialization exception.  
2555177 (1082730)
- Dependent assemblies (ones that are required by other assemblies) that fail to load now issue a COBCH1581 warning "Could not load dependent assembly AssemblyName". Previously, they generated a COBCH0942 error. If an assembly generates both COBCH0942 and COBCH1581 errors, the error report lists only the COBCH0942 error.  
2507380 (1078845)
- The scope of the ILUSING Compiler directive when used in a \$set command has changed. The scope of the directive is now limited only to the source file it is set in, and not globally. This new behavior may mean that your source files no longer compile. To resolve this, add the required ILUSING statements to the required individual source files, or add the ILUSING directive on the command line. Alternatively, use the IDE to achieve the required behavior: in Visual Studio, use the Namespaces tab; in Eclipse, set the directive in the Additional Directives field.

## DB2

- The DB2 ECM has been updated to resolve run-time errors returned when compiling against mainframe databases in 64-bit mode.  
2549058 (1082441)

## File Handling

- When reading a file cataloged as DISP=SHR the file handler now buffers the read for better performance.  
2518330 (1079491)

## IDE

- Using File > New > Solution From Net Express Project to convert a Net Express project to a Visual COBOL solution on a machine with a language locale other than English or Japanese produced an empty solution.  
2548551 (1082073)
- The COBOL tab in the project properties of a new WPF Application sometimes was not showing any settings.  
2535705 (1080950)
- In some menus and dialogs in the IDE copybooks were referred to as copy files. They are now consistently referred to as copybooks.

- The project properties have been enhanced. The SQL directives are no longer shown in Build Settings on the COBOL page where they sometimes appeared as out-of-date. The SQL directives now appear only on the SQL page.
- Adding a watch on an item of the form `buffer(1:size)` caused the IDE to hang when "size" was not initialized.
- ActiveX components in the Windows Forms of a managed project could cause the programs to crash at run-time. Previously, to work around this problem, you had to check the ActiveX references in the project and set their CopyLocal reference property to True. This is now done automatically when the references are added.

2536071 (1080978)

- Adding an existing Windows Form to another project as a linked file did not function correctly. When you reopened the project, the designer and the resx files were missing from all Windows Forms in the project.

2524313 (1079984)

### OpenESQL

- OpenESQL did not always return a consistent error message or it returned an incorrect error message when a data conversion exception occurred within the ADO.NET run-time system.

### Run-Time System

- On Windows 7, building 64-bit native COBOL applications always rebuilt the entire project. This was caused by the Microsoft FileTracker tool, used by the COBOL projects to track dependencies, not working because of Windows 7 security updates. This product now includes a fix to work around this issue.

## Unsupported or Deprecated Functionality

The following topics describe functionality that was removed or deprecated at each product release.

### Unsupported or Deprecated at Visual COBOL 9.0

The following features or functionality are no longer supported or are deprecated at version 9.0:

- The SafeNet Sentinel licensing system has been deprecated and will be not available in this product starting with the next major release after release 9.0. The SafeNet Sentinel licenses will not be supported after release 9.0 and you need to use AutoPass licenses if you use these releases.  
You can replace your SafeNet Sentinel licenses with AutoPass licenses starting with release 8.0. Contact Micro Focus Customer Care for further information.
- The HOSTSIGNS Compiler directive is no longer supported. Micro Focus recommends that you use the following Compiler directives instead: SIGN-FIXUP, HOST-NUMMOVE, and HOST-NUMCOMPARE. This is a change since version 3.0 of this product.

### Unsupported or Deprecated at Visual COBOL 8.0

- Data File Editor - The method used to filter data files has been deprecated and replaced with new functionality.

### Unsupported or Deprecated at Visual COBOL 7.0

The following Compiler directive option has been deprecated:

- ILCLR(2) - this is as a result of deprecating support for versions 3.0 and 3.5 of the .NET Framework. Applications that have this option set will produce an E level message when compiled in this release of Visual COBOL.

## Unsupported or Deprecated at Visual COBOL 6.0

No additional features were unsupported or deprecated at version 6.0.

## Unsupported or Deprecated at Visual COBOL 5.0

No additional features were unsupported or deprecated at version 5.0.

## Unsupported or Deprecated at Visual COBOL 4.0

There are no features or functionality unsupported or deprecated at version 4.0.

## Unsupported or Deprecated at Visual COBOL 3.0

The following features or functionality are no longer supported or are deprecated at version 3.0:

- The HOSTSIGNS Compiler directive is no longer supported. Micro Focus recommends that you use the following Compiler directives instead: SIGN-FIXUP, HOST-NUMMOVE, and HOST-NUMCOMPARE.
- Compatibility AddPack for Visual COBOL - this is now deprecated and will not be available with release 3.0 and later.

The Dialog System GUI and run-time components and Dialog System Character Mode (on Windows and UNIX) which were part of the AddPack are now installed as part of Visual COBOL for Visual Studio. The run-time components are installed as part of COBOL Server. These are only included for backward compatibility and Micro Focus does not recommend that you use them for new development.

The other components which were part of the AddPack, the Character-Based Data File Editor, CSBIND and Screens, will be available upon request from Micro Focus SupportLine.

- Audit Manager is deprecated and provided for backward compatibility only. We recommend that you use syslog events instead. See *Enterprise Server Auditing* for more information.
- The following DB2 environment variables are deprecated at version 3.0, and provided for backward compatibility only.
  - HCOBND - Micro Focus recommend you use either the BIND or the BINDDIR compiler directive option.
- The following compiler directives are deprecated at version 3.0, and provided for backward compatibility only.
  - CONVERTRET
  - IDYSRCPATH
  - ILOBJECTIFY
  - OPTION
  - SPZERO
  - TRICKLE
- The following file handling options are deprecated at version 3.0, and provided for backward compatibility only. Micro Focus recommend you use IDXFORMAT"8" instead:
  - STRIPING
  - MAXSTRIPEDIGITS
  - MAXSTRIPEFILES
  - MAXSTRIPESIZE
  - STRIPE-X

- STRIPENAMETYPE

## Unsupported or Deprecated at Visual COBOL 2.3 Update 2

The following features or functionality are no longer supported or are deprecated at version 2.3 Update 2:

- The `command_line_linkage` tunable has been deprecated; equivalent functionality can be achieved by using the `COMMAND-LINE-LINKAGE` Compiler directive instead.

## Unsupported or Deprecated at Visual COBOL 2.3 Update 1

The following features or functionality are no longer supported or are deprecated at version 2.3 update 1:

### Windows Azure versions

- Starting with Visual COBOL 2.3 Update 1, versions of the Microsoft Azure SDK earlier than version 2.8 are no longer supported.
- Support for the Microsoft Azure SDK is no longer provided in Visual COBOL for Visual Studio 2012. If you have COBOL Azure projects created with earlier versions of Visual COBOL for Visual Studio 2012, to maintain them, use Visual COBOL for Visual Studio 2013 or 2015.

## Unsupported or Deprecated at Visual COBOL 2010

The following Net Express features or functionality were not supported or were deprecated from the first version of Visual COBOL:

These Net Express compiler directives are not supported by Visual COBOL :

01SHUFFLE	EXPANDDATA	REGPARM
64KPARA	FIXING	SEGCROSS
64KSECT	FLAG-CHIP	SEGSIZE
AUXOPT	MASM	SIGNCOMPARE
CHIP	MODEL	SMALLDD
DATALIT	OPTSIZE	TABLESEGCROSS
EANIM	OPTSPEED	TRICKLECHECK
EDITOR	PARAS	WB2
ENSUITE	PROTMODE	WB3
		WB



**Note:** The directive `SPZERO` was already deprecated from Net Express 5.0 onwards, and is provided for backward compatibility only. You should instead use `SIGN-FIXUP`.

and the pseudovariables of the following Net Express environment variables are obsolete and cannot be used:

BASENAME  
FILENAME  
PATH  
TARGETDIR

# Known Errors and Restrictions

Refer also to the *Known Issues and Restrictions* topic in the *Product Information* section of your product Help.

The following errors and restrictions are known to apply to Visual COBOL version 9.0:

## .NET COBOL

- An issue with the Call method in the COBOL RunUnit class prevents it from being used when you target the .NET Framework. A fix is going to be available with Patch Update 1 of this release. This issue does not affect .NET 6.

## Compiler

- In Visual COBOL 4.0 and 5.0 in an extremely small and limited set of cases, an issue could occur with running .NET executables and .dll files, or JVM .class files, created with an earlier version of the product. This issue only occurred if:
  1. The application performs an IS NUMERIC condition test on a variable declared with USAGE NATIONAL.
  2. The application has been created with Visual COBOL 3.0 or earlier, then executed in Visual COBOL 4.0 or 5.0.

In these rare cases, the IS NUMERIC test could provide the wrong answer.

In order to resolve this issue, in Visual COBOL 6.0 and later, the .NET COBOL and JVM COBOL run-times reject any program using IS NUMERIC on a NATIONAL item which was compiled with a version 5.0 or earlier of the product. You receive a "missing method" exception. To resolve the issue, you need to recompile any programs that use this construct in the newer versions of Visual COBOL.

Programs that do not use NATIONAL data, or those that have been recompiled in Visual COBOL 6.0 or later are not affected.

## Operating Systems

- The Server Core form of Windows Server 2019 is not supported.

## Visual Studio IDE

- .NET COBOL projects only support Windows and Linux OS. The **Create a new project** dialog box in Visual Studio, however, shows other platforms as supported.
- If, after installing the product for Visual Studio 2022, you cannot access the Micro Focus functionality, execute the following command from a Visual Studio command prompt:

```
devenv /updateconfiguration
```

# Upgrading from Net Express to Visual COBOL

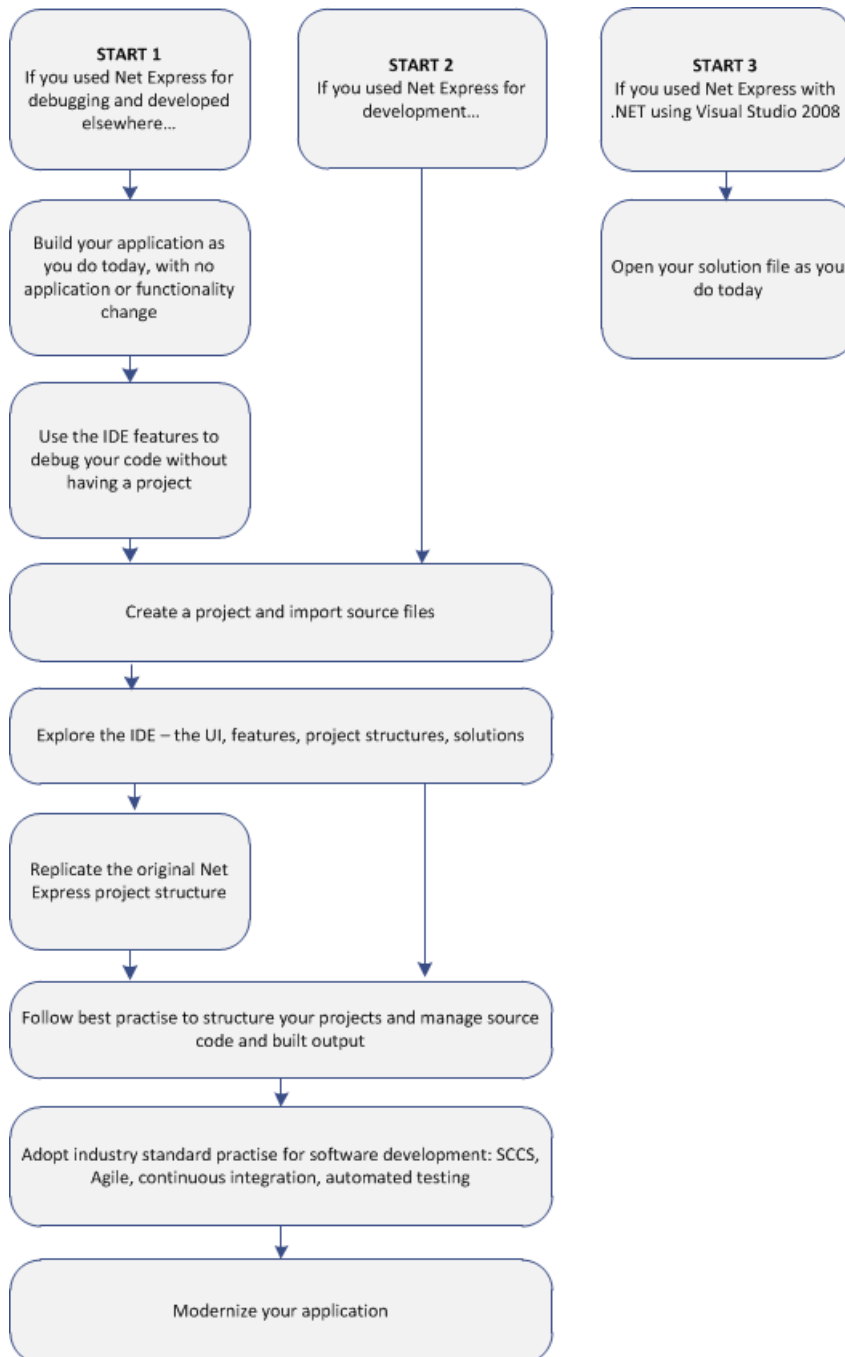
The following topics show you the process of moving existing Net Express applications into Visual COBOL for Visual Studio.

# An introduction to the process of upgrading your COBOL applications

The following topics show you the process of moving existing Net Express applications into Visual COBOL for Visual Studio. This information assumes one of the following starting points:

- You currently use Net Express just for debugging, and edit files and compile projects by other means (START 1)
- You currently use Net Express for all your development tasks (START 2)
- You currently use Net Express for .NET in Visual Studio 2008 (START 3)

The steps to move to Visual COBOL are illustrated below:



After following this process you will be able to use the Visual COBOL for Visual Studio features to improve development and modernize your applications.

## Compile at the Command Line Using Existing Build Scripts

Application executables that were compiled using earlier Micro Focus products must be recompiled from the sources using Visual COBOL. If you do not recompile, you may receive an error. The exact error depends on the operating system you are running.

Most Net Express projects should compile cleanly using your existing build scripts and makefiles without any changes to your code, as Visual COBOL can use the `cobol` and `cbllink` commands to create `.int` and `.gnt` files. By specifying the `ILGEN` compiler directive you can also use these commands to create `.NET-compatible .exe` files, or use the `JVMGEN` directive to create `JVM-compatible .exe` files.

### Fixing compilation issues

You might encounter some problems when compiling your Net Express applications in Visual COBOL.

Micro Focus continues to enhance the COBOL language, for example, by expanding the list of reserved COBOL words and adding new keywords to it as part of new levels of the COBOL language (each Micro Focus release corresponds to a particular level). Applications created with an older Micro Focus product might use data names that are now reserved keywords in Visual COBOL, which can result in a COBOL syntax error COBCH0666 ("Reserved word used as data name or unknown data description qualifier"). See [Reserved Words Table](#) for a comprehensive list of reserved words and level at which they are supported.

Also, these Net Express compiler directives are no longer supported:

01SHUFFLE	EXPANDDATA	REGPARAM
64KPARA	FIXING	SEGCROSS
64KSECT	FLAG-CHIP	SEGSIZE
AUXOPT	MASM	SIGNCOMPARE
CHIP	MODEL	SMALLDD
DATALIT	OPTSIZE	TABLESEGCROSS
EANIM	OPTSPEED	TRICKLECHECK
EDITOR	PARAS	WB2
ENSUITE	PROTMODE	WB3
		WB

In addition, the pseudovariables of the following Net Express environment variables are obsolete and can't be used:

BASENAME  
FILENAME  
PATH  
TARGETDIR

You should consider using the following methods to solve these problems:

- Rewrite the source to avoid using these keywords in your code and directives files.
- Use the `REMOVE` Compiler directive to remove individual keywords from the reserved words list.
- Use the `MF` or `MFLEVEL` compiler directive to select an earlier version of Micro Focus COBOL that your code is compatible with. For example, setting `MFLEVEL "1.2"` ensures compatibility with Mainframe Express 3.0 and 3.1; Net Express 4.0, 5.0, and 5.1; and Server Express 4.0, 5.0, and 5.1. Refer to [Reserved Words Table](#) for the value to use to ensure support for your existing reserved words.



## Setting REMOVE and MFLEVEL directives from the command line

To use REMOVE from a Visual COBOL command prompt, type the following:

```
cobol myprogram.cbl remove(title) ;
```

The command above removes TITLE as a keyword from the language so you can use it as an identifier in a COBOL program.

To use the set of reserved words that was used for Net Express v5.1 WrapPack 5, use this command line:

```
cobol myprogram.cbl mflevel"15" ;
```

## Setting REMOVE and MFLEVEL directives in the source code

To set either one of the directives in your source code, type the following starting with \$ in the indication area of your COBOL program:

```
$set remove "ReservedWord"
```

Or:

```
$set mflevel"nn"
```

## Single-threaded run-time system

The single-threaded run-time system is not available in Visual COBOL on Windows. Instead, both single-threaded and multi-threaded applications run using the multi-threaded run-time system. This has no effect on your existing applications.

# Debugging Without a Project

Having compiled your existing code into the required format, it is possible to debug your code using the debugger in the same way that you did with Net Express, even before you create a Visual COBOL project in the IDE and import the code into it (although with the lack of a project, elements of the program have no context and the scope of debugging is limited).

You can cause debugging to be triggered at a specific point in your code by using the CBL\_DEBUGBREAK and CBL\_DEBUG\_START library routines. You can also use the debug\_on\_error runtime tunable to enable the debugger to start when your a running program terminates with a run-time system error.

Run your program. When the routines or tunable trigger debugging, Visual Studio starts, displaying the source file at the current line of code being executed. You can then make use of the debugging features of Visual COBOL which include:

- Step into the next statement at the current line of code and suspend execution.
- Step over the next statement at the currently executing line of code without entering it, and suspend execution. The method will be executed normally.
- Return from a method or paragraph that has been stepped into, and suspend execution. The remainder of the code inside the method is executed normally.
- Resume execution of the program from a suspended line of code.
- Display values of all variables contained on the current execution line.

# Create a project and import source

Follow these steps to use your source files in a new project in Visual COBOL. These instructions are correct with Visual Studio 2017:

1. In Visual Studio, click **File > New > Project**.
2. In the **New Project** dialog box, expand **Installed > COBOL**. Click **Native**. In the **Create a new project** dialog box, select **COBOL** from the **Language** drop-down list.

This gives you a list of the following project types. The main difference between these types is the nature of the artefacts they build, and after creating a project, you can easily change its type and output accordingly.



- **Windows Application** - creates a project that builds a single executable `.exe` by default, and is best used for graphical applications.
- **Console Application** - creates a project that builds a single executable `.exe`, and is best used for character-based applications that use the console subsystem. You can configure it to build an `.exe` file for each source program.
- **Link Library** - creates a project that builds a single `.dll` file.
- **INT/GNT** - creates a project that, by default, outputs one `.int` file for each of your source programs. You can change the build order to `.gnt` by right-clicking the project in Solution Explorer and choose **Properties**, select the COBOL tab, and choose **Compile to .gnt**.

The other fields in this dialog box specify the folder structure in which your project will be placed:

- **Project nameName** - the name of the project.
- **Location** - the folder in which the project will be created. If you specify a folder that doesn't exist, Visual Studio will create it.
- **Solution name** - a solution is a container in which you can group logically-related projects. Only one solution can be open in Visual Studio at a time. At this stage you can either create a new solution that will use the name specified, or add the project to the solution currently open in Visual Studio.

You can check **Place solution and project in the same directory** **Create directory for solution** in order to give the solution a different name to the project name. This is useful when you are likely to have several projects in the same solution.

3. Right-click your project in Solution Explorer and select **Add > Existing Item**.
4. Click **Add** and navigate to the folder containing the files you want to add to the project.
5. Choose the files you want to add and then click **Add**.

Those files are then added to the project in Solution Explorer. These files are copied, not moved, to the project folder in the file system. If you click the down arrow on the **Add** button, you can choose **Add as Link**, which adds a reference to the file in the project but neither moves or copies the original. Added files have the icon ; linked files are indicated by the icon .



**Note:** If you right-click your project in Solution Explorer and choose **Add Existing COBOL Items**, you choose a folder instead of individual files. All files in that folder with the extensions listed in the Specify Source Files page of the import wizard are then added to the project in Solution Explorer. You can only add files as links using this method.

## Adding copybooks

You can add copybooks to your projects in the same way as COBOL files, by right-clicking your program, choosing **Add > Existing Item** and browsing to a copybook. However, it is not compulsory to add copybooks to your project. You can set the copybook dependency paths for your project from the **Project Properties > Copybook Paths** page. Copybooks are not compiled at build time due to the file's **Build Action** property being automatically set to **None**. (You can also set this property for COBOL source files too, to keep a file in the project but not include a built version in any output.)

By default, Visual COBOL identifies files as copybooks by their `.cpy` extension. You can specify other file extensions as copybooks in the IDE preferences - click **Tools > Options > Text Editor > Micro Focus COBOL > Advanced > Copybook Extensions**, and enter the additional values in the text box.

Alternatively, you can add the copybook with unknown extension to your project and then reference the file from within a COBOL program using the COPY statement. Visual COBOL then recognizes that extension as a copybook but only across the current solution.

## Setting Compiler directives

Some Compiler directives are set on project creation, and differ between the Debug and the Release configurations. To add directive to your project, right-click on the project in Solution Explorer and choose

**Properties.** On the **COBOL** tab, you can see directives that are set by the IDE in the **Build Settings** text box. Enter others in the **Additional Directives** text box as a space-separated list.

If you use a separate text file to manage your directives, you can reference this instead by entering the `USE"directives file"` directive. You should enter a path relative to the project directory.

### Building the project

Having added all the files and made any necessary configuration changes, you can compile and link the COBOL source and generate the output. Right-click the project in Solution Explorer and click **Build**.

If your source code contains tab stops compilation might fail, as while a COBOL tab is eight characters long, the IDE's tab is four characters long, and lines of code might be starting in the sequence number and indicator areas section (columns one to seven) of the program instead of from column eight.

You can fix this problem using the `SOURCETABSTOP(n)` compiler directive, where *n* is the number of space characters by which to expand tab characters during compilation.

## Using Visual COBOL for Visual Studio

### Understanding the structure of Visual COBOL solutions

On creating a new project, the following files are created in the file system with the following structure:

```
...
|_Location
|_Solution
|_Name
|_bin
|_x86
|_Debug
|_Release
|_x64
|_Debug
|_Release
|_obj
|_x86
|_Debug
|_Release
|_x64
|_Debug
|_Release
|_Properties
_Solution.sln
_Name.cblproj
_Name.dep
_Program1.cbl
```

If you select the Create Directory for Solution option when creating a solution, the structure is slightly different.

In the *Solution* folder:

- **Solution.sln** - a description of the solution and what it contains.
- **Name.cblproj** - the project file that is opened in Visual Studio, which holds the description of the project and all its related configuration and directives information.

- COBOL source files - when you create a project, a skeleton COBOL source file `Program1.cbl` is added for most of the project templates.

In the *Name* folder:

- `..\bin` - this is the default location of build artefacts. With this folder are the subfolders `x86\Debug` that contains the executables or libraries, and `.idy` file for each of the project's COBOL source files. The `.idy` files contain information required for debugging your application. When you use the Release build configuration, build output goes to a subfolder `x86\Release` and no `.idy` files are created.

Debug and Release are standard build configurations that you launch from the Visual Studio task bar. They use a different set of compiler directives as well as outputting different files. You can create your own build configurations by clicking **Build > Configuration Manager** and choosing **New** from the **Active solution configurations** drop-down list.

The `x86` folder exists because the default output platform is 32-bit. If you change this to be 64-bit, you will instead find your output in an `x64` folder.

- `..\obj` - this also has `x86\Debug` subfolders, and contains an `.obj` file for each source file, used in intermediate build stages. The `obj` folder also holds supporting information such as logs and file lists.



**Note:** The project file `.cblproj` is an msbuild file, much like a makefile but consisting of XML that you can extend and modify to customise your builds. You can use this directly from command line, as it uses the same build environment as the IDE, and behavior is identical. This means you can have a single source of configuration information that makes your build process easier to maintain.

If you open a command prompt and change to the *Location* folder, you can execute the `msbuild` command, without needing to specify the `.cblproj` file.

## Finding your way around the IDE's features

- **Solutions and projects**

A solution is a container holding one or more projects that work together to create an application. The solution has the extension `.sln`. A COBOL project has the extension `.cblproj` and a C# project has the extension `.csproj`.

Solution Explorer shows the solution that is open and the projects therein.

You can use the project's properties pages to display a list of the files in your solution with file details like output file type and location, COBOL dialect, and the number of errors generated by the file. To display the properties, click **Project > Name Properties**.

- **COBOL editor**

The COBOL editor provides help such as column cut and paste, and background syntax checking, which underlines errors with red wavy lines (also known as "squiggles"), which you can then hover over to display details of the syntax error.

When you are editing, you can insert code snippets and navigate forward and backward quickly, and the **Find All References** option enables you to search for references of any COBOL data items, section and paragraph names in the solution.

You can customize the editor to display line numbers, adjust colorization, tabs, and margins, from the **Text Editor > Micro Focus COBOL > Advanced** page in **Tools > Options**.

When developing code, the editor provides IntelliSense that helps you write syntactically correct code and, in .NET COBOL code, helps when you need to type more complicated constructs, such as the code to override the members that a class inherits from a base class or the code for implementing an interface.

The Light Bulbs feature for implementing an interface helps complete incomplete interface declarations. A Light Bulb appears at the beginning of the declaration: click it and choose the missing member(s) of the inheriting interface.

When you encounter a COPY statement, or data item that is defined in a copybook, if you put your cursor on that code and press F12 the appropriate copybook opens in the editor at the relevant line. You can also do this by right-clicking the line and selecting **Show copybook name**.

- **Setting Compiler directives**

Many Compiler directives are set automatically by certain configuration options in the IDE, but you can explicitly add directives to your project. Right-click on the project in Solution Explorer and choose **Properties**. In the COBOL tab, you can see directives that are set by the IDE in the **Build Settings** text box. Enter others in the **Additional Directives** text box as a space-separated list.

If you use a separate text file to manage your directives, you can reference this instead by entering the USE "*directives file*" directive. You should enter a relative path.

- **Build Tools, the Output Pane and the Error List**

Build configurations define how to build a project or solution. There are default configurations of Debug and Release for each project type, and you can create your own specific configurations.

The Output window shows the results of your build together with errors. You can double-click an error and navigate directly to the appropriate line in the source code. You can do the same from the Error List.

- **Debugging**

When you debug the application, you can step through the code, hover over a data item to see its value, and watch data item values in a variety of ways. You can specify breakpoints on a range of conditions, such as when an expression is true or changes, or when a line is hit a specified number of times.

In native code, you can set COBOL watchpoints on data items and watch for changes in the area of memory associated with the watchpoints. When the memory changes or a condition associated with the watchpoint has been met, the debugger breaks on the line that follows the line on which the data change occurred.

Also in native code, you can use the Memory window to watch the contents of the memory that is associated with data items or expressions.

## Change the Defaults to Replicate Your Existing Project Structure

### Change the location of source files

To add an existing COBOL source file to your project, right-click the project in Solution Explorer and choose **Add > Existing item**. You can then browse to the sources you want to add.

- If you click **Add**, Visual COBOL makes a copy of the file, which it saves in the project folder. Any edits you make to this file do not get applied to the original.
- If you click **Add As Link**, a reference to the original file, rather than a copy of it, is added to the project in Solution Explorer. If you then open the file in Visual Studio, any edits are applied to the file in its original location.

You can also drag files from Windows Explorer and drop them into your project in Solution Explorer. This also makes a copy of the file and leaves the original in place.

To remove a file from your project, but not delete the file on disk (whether added as a link or not), right-click the file in Solution Explorer and choose **Exclude From Project**.

### Change the location of built files

By default, built artefacts for the Debug configuration are created in the `..\Location\Solution\Name\bin\x86\Debug` folder.

You might want to change this, so that several developers can save built items in the same folder for example. To do this, right-click the project in Solution Explorer and choose **Properties**. In the COBOL tab,

change the value of the **Output path** field to the preferred folder. (We recommend you always use relative paths when entering this value.) When the project builds, the output files will be saved in this folder, and the folder created if it doesn't already exist.

To change the output path for the Release configuration, select **Release Configuration** in the COBOL property page and change the value of the output path.

### Change the type of built files

The default output and target types when you create a project depend on the project type. You can change these settings on the project **Properties** page. Use the following table to show the default output and target types for each project and the possible changes once the project has been created :

Project type	Output type	Target type	Possible output types	Possible target type	
Native	Console application	.exe	single	.dll, .exe	single, multi
	Windows application	.exe	single	.dll, .exe	single, multi
	Link library	.dll	single	.dll, .exe	single, multi
	Enterprise Server application	.dll	multi	.dll, .exe	single, multi
	INT/GNT application	.int	multi	.int, .gnt	multi
Managed	Console application	.exe	single	.dll, .exe	single
	Windows application	.exe	single	.dll, .exe	single
	Link library	.dll	single	.dll, .exe	single
	Procedural multi-output project	.dll	multi	.dll, .exe	multi

## Best Practice in Visual COBOL Development

### Break down large projects

Projects with a large number of source files and build artefacts can be hard to navigate and slow to build. If you find this the case, we recommend that you review the contents of large projects and split them into separate projects (and possible separate solutions) in which you group items that are logically related. These projects can still be built in the same output folder if required.

For example:

- If you have different versions of a product for different customers, keep common source in one project and a separate project for each customer. You could also have a master solution into which you add projects from other solutions by right-clicking a solution and selecting **Add > Existing Project**.
- If you have core code that is rarely changed or recompiled, keep that in one project and have separate projects for those areas that change regularly.

### Referencing common sources

To avoid repetition and reduce maintenance effort, you should consider keeping all your Compiler directive settings in a directives file and reference this file in each project. Similarly you should keep copybooks in a single project and add this project as a dependency to your COBOL projects.

If using .NET COBOL code and multiple projects, use project references rather than file references.

## Create templates

After creating and configuring a project, you can save the settings as a template that can be reused and distributed to other users. It can be added to the list of project types available when clicking **File > New > Project** and then typing `COBOL` in the search field of the **Create a new project** dialog box expanding **Installed > COBOL**.

To create a template of the open project, click **File > Export Template** and follow the steps explained in the Export Template Wizard.

## Use relative paths

Keep source relative to a base path and avoid full paths so that code is portable and easy to use with source control systems. You should also avoid using network shares or drives.

# Modernize Your Applications and Processes

## Following industry standard development practices

Many source code control systems and Agile tools can be integrated into the Visual Studio IDE.

You should also consider using continuous integration, which involves the automatic building and testing of an application after a change occurs to the source code. This method traps errors sooner in the development life cycle and can greatly improve efficiency and reduce costs.

## Interface modernization

Visual COBOL enables you to use Visual Studio's built-in design tools to create more intuitive user interfaces. By wrapping existing procedural COBOL in an wrapper class you can integrate your code into Windows Forms (WinForms) and Windows Presentation Foundation (WPF) technology, and WebForms for ASP.NET browser-based applications.

## Multi-user applications

Visual COBOL includes a Run Unit API to enable multiple users to simultaneously use an application based on COBOL code that was designed originally for a single user.

## Developing Web-based applications

You can use Visual COBOL to migrate existing, core applications to a service oriented architecture as Web services, and deploy them using Micro Focus COBOL Server and Enterprise Server, so that you can develop COBOL-based software components to be invoked across the Web.

You can do this by creating an Enterprise Server application

## Developing .NET applications

Both new and existing COBOL can be compiled as .NET code. This enables you to:

- Reuse existing COBOL business logic and data access across the .NET environment
- Access .NET Framework classes and features from COBOL applications including Windows Forms and Web Forms
- Create and extend composite applications consisting of COBOL, C#, VB.NET, C++ and ASP.NET
- Reuse and extend Open ESQLE applications

Both procedural and native OO COBOL are supported within the .NET framework. Native OO COBOL classes can inherit classes written in other Microsoft .NET languages and vice versa.

The .NET COBOL syntax includes many extensions to the COBOL language to support .NET features; for example, the `TRY ... CATCH` syntax to enable exception handling in COBOL.

There are also certain directives that help integrate your .NET COBOL with other languages in the .NET environment. For example, you can now expose the Linkage section and entry points in your COBOL to other managed languages by compiling with the ILSMARTLINKAGE directive.

### Modernizing Dialog System applications

Visual COBOL provides the following support for Dialog System applications:

- Dialog System run-time system and run-time components.
- Panels V2.
- Dialog System painter.
- GUI class library and OLE class library. These libraries are needed if you migrate an existing Dialog System application that was extended using those libraries.

Projects for building the GUI and OLE class libraries from source are also supplied. Additionally, a project file for the Base class library was added in Visual COBOL 2.0.

- Visual Studio plug-in to associate screensets in Visual Studio with Dialog System. Double-clicking a screenset in Solution Explorer in Visual COBOL starts the Dialog System painter.
- Sample applications demonstrating a range of modernization techniques.
- Supporting documentation in this Help explaining the significant elements of the sample code.

You can modernize Dialog System applications within Visual COBOL. You migrate an application to Visual COBOL and from there you can run the application without change, or modernize it over time.

Modernization techniques include:

- A Windows Forms form replacing a Dialog System dialog, where the form can contain .NET controls. See the Customer + .NET WinForm sample `CustomerWinForm.sln`.
- A Windows Forms control wrapped as an ActiveX control and used on a Dialog System dialog. See the Customer + .NET GridView User Control sample `custgrid.sln`.
- A WPF user control hosted by a Windows Forms user control, which is then exposed as ActiveX ready for use by Dialog System. See the Customer + .NET WPF GridView User Control sample `CustGridWPF.sln`.
- A .NET code application interacting with Dialog System as native COBOL `.dll`. See the .NET COBOL Customer sample `ManagedCustomer.sln`.

### Data File Tools

Visual COBOL comes with two versions of the Data File Tools utility: Data File Tools and Classic Data File Tools.

The Classic Data File Tools is the utility that was previously available in Net Express. It includes the Data File Converter, Data File Editor, and the Record Layout Editor. This utility is only available on Windows.

Data File Tools is a new version of the utility and comprises the Data File Editor and the Structure File Editor. This utility is available on both Windows and UNIX.

## Procedural COBOL Compared with .NET COBOL



**Note:** Visual COBOL for Visual Studio 2017 supports .NET COBOL. To develop applications for JVM COBOL, install our Visual COBOL for Eclipse product.

Procedural COBOL is regular COBOL without any of the new syntax that has been added for .NET and JVM. Procedural COBOL is still actively supported today and is being enhanced. Since the days of Net Express, Server Express, and Mainframe Express, it now supports inline local declarations (as in DECLARE). It also supports new syntax such as XML PARSE, JSON GENERATE, UTF-8, and more.

You can compile to native or (in most cases) .NET COBOL. The core COBOL syntax is supported in .NET COBOL. However, there are some features that are not supported (for example Panels V2, Dialog System



and ACUCOBOL-GT). This means that you can take most existing COBOL applications and recompile to create .NET COBOL applications.

## **.NET COBOL**

.NET COBOL is COBOL with extensions to support the .NET Framework. It offers OO syntax support and syntax to allow access to the available class libraries.

When you compile .NET COBOL, the compiler generates code: `.il` for the .NET framework.

## **.NET COBOL and Native COBOL**

You can compile your COBOL program to .NET COBOL code using the `ilgen` compiler directive. From within the IDE this happens automatically if you are using a .NET COBOL project.

The compiler has now created an intermediate language (`.il`).

COBOL and all other .NET languages (for example C# and VB) compile to this format, which makes mixed language applications easy to write.

You can also create native code applications. In Visual Studio, there are native COBOL project templates.

The compiler generates `.exe/.dlls` as the result of a native compilation.

The native COBOL application has to call the appropriate management services available for the operating system, whereas a *managed* application can take advantage of the management services provided by the run time such as exception handling, garbage collection, and thread management.

## **Run Time**

The intermediate language (`.il` files) can be deployed to a Windows platform running Microsoft's Common Language Runtime (CLR) for execution.

All programs written for the .NET Framework are executed by the Microsoft's Common Language Runtime (CLR) which makes mixed language application programming seamless.

The CLR's just-in-time (JIT) compiler compiles the `.il` into code native to the operating system. The CLR provides additional services including memory management, exception handling, garbage collection and thread management.

## **Developing Native and .NET COBOL Applications**

You use the IDE to develop, compile and debug both native and .NET COBOL applications. You can write new COBOL code or you can recompile existing COBOL applications to native or .NET COBOL code, potentially without any code changes.

You can deploy and further debug the application under the run-time system provided by COBOL Server.

.NET COBOL applications are deployed to Windows platforms running Microsoft's CLR.