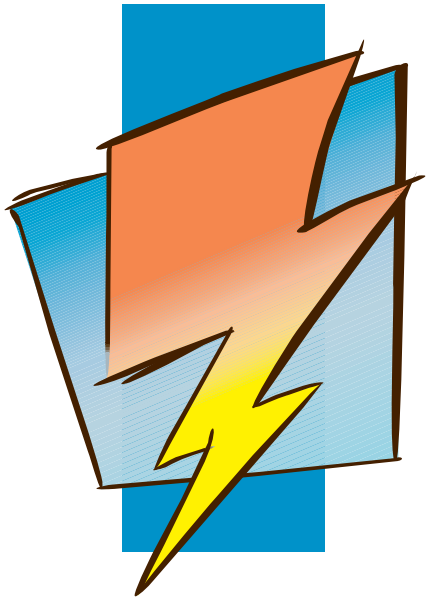
Open Watcom FORTRAN 77

Getting Started



Version 2.0

Open Watcom

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1 Introduction to Open Watcom FORTRAN 77

Welcome to the Open Watcom FORTRAN 77 2.0 development system. Open Watcom FORTRAN 77 is an Open Source successor to commercial compilers previously marketed by Sybase, Powersoft and originally WATCOM International Corp.

Version 2.0 of Open Watcom FORTRAN 77 is a professional, optimizing, multi-platform FORTRAN 77 compiler with a comprehensive suite of development tools for developing and debugging both 16-bit and 32-bit applications for DOS, extended DOS, Novell NLMs, 16-bit OS/2, 32-bit OS/2, Windows 3.x, Windows 95/98/Me, Win32s, and Windows NT/2000/XP (Win32).

You should read the entire contents of this booklet, as it contains information on new programs and modifications that have been made since the previous release.

Special NOTE to users of previous versions! See the section entitled "Release Notes for Open Watcom FORTRAN 77 2.0" on page 35 **to determine if you need to recompile your application.**

1.1 What is in version 2.0 of Open Watcom FORTRAN 77?

Version 2.0 incorporates the features professional developers have been demanding:

Open, Multi-target Integrated Development Environment

The IDE allows you to easily edit, compile, link, debug and build applications for 16-bit systems like DOS, OS/2 1.x, and Windows 3.x and 32-bit systems like extended DOS, Novell NLMs, OS/2, Windows 3.x (Win32s), Windows 95/98/Me, and Windows NT/2000/XP. Projects can be made up of multiple targets which permit a project to include EXEs and DLLs. The IDE produces makefiles for the project which can be viewed and edited with a text editor. The IDE is hosted under Windows 3.x, Windows 95/98/Me, Windows NT/2000/XP, and 32-bit OS/2.

The Widest Range of Intel x86 Platforms

Host Platforms

- DOS (command line)
- 32-bit OS/2 (IDE and command line)
- Windows 3.x (IDE)
- Windows 95/98/Me (IDE and command line)
- Windows NT/2000/XP (IDE and command line)

16-bit Target Platforms

- DOS
- Windows 3.x
- OS/2 1.x

32-bit Target Platforms

- Extended DOS
- Win32s
- Windows 95/98/Me
- Windows NT/2000/XP
- 32-bit OS/2
- Novell NLMs

Cross-Platform Development Tools

The core tools in the package permit cross-platform development that allows developers to exploit the advanced features of today's popular 32-bit operating systems, including Windows 95/98/Me, Windows NT/2000/XP, and OS/2. Cross-platform support allows you to develop on a host development environment for execution on a different target system.

Multi-Platform Debugger

The new debugger advances developer productivity. New features include redesigned interface, ability to set breakpoints on nested function calls, improved C++ and DLL debugging, reverse execution, and configurable interface. Graphical versions of the debugger are available under Windows 3.x, Windows 95/98/Me, Windows NT/2000/XP, and 32-bit OS/2. Character versions of the debugger are available under DOS, Windows 3.x, Windows NT/2000/XP, and 32-bit OS/2. For VIDEO fans, we have kept the command line compatibility from the original debugger.

Performance Analysis

The Open Watcom Execution Sampler and Open Watcom Execution Profiler are performance analysis tools that locate heavily used sections of code so that you may focus your efforts on these areas and improve your application's performance.

Editor The Open Watcom Editor is a context sensitive source editor, integrated into the Windows 3.x, Windows 95/98/Me and Windows NT/2000/XP version of the IDE.

Graphical Development Tools

Open Watcom FORTRAN 77 includes a suite of graphical development tools to aid development of Windows 3.x, Windows 95/98/Me and Windows NT/2000/XP applications. The development tools include:

Resource Editors Enable you to create resources for your 16-bit and 32-bit Windows applications. For 32-bit OS/2 PM development, Open Watcom FORTRAN 77 interoperates with IBM's OS/2 Developer's Toolkit (available from IBM). These tools have been seamlessly integrated into the IDE. The resource compiler allows you to incorporate these resources into your application.

Resource Compiler Produces a compiled resource file from a source file.

Zoom Magnifies selected sections of your screen.

Heap Walker Displays memory usage for testing and debugging purposes.

Spy Monitors messages passed between your application and Windows.

DDESpy Monitors all DDE activity occurring in the system.

Dr. Watcom Enables you to debug your program by examining both the program and the system after an exception occurs; monitors native applications running under Windows 3.x, Windows 95/98/Me or Windows NT/2000/XP.

Assembler

An assembler is included in the package. It is compatible with a subset of the Microsoft macro assembler (MASM).

Royalty-free 32-bit DOS Extender

Open Watcom FORTRAN 77 includes the DOS/4GW 32-bit DOS extender by Tenberry Software with royalty-free run-time and virtual memory support up to 32MB.

Support for wide range of DOS Extenders

Open Watcom FORTRAN 77 allows you to develop and debug applications based on the following DOS extender technology: CauseWay DOS Extender, Tenberry Software's DOS/4G and Phar Lap's TNT DOS Extender. You can also develop applications using DOS/32A and FlashTek's DOS Extender but, currently, there is no support for debugging these applications.

Sample programs and applications

Open Watcom FORTRAN 77 includes a large set of sample applications to demonstrate the integrated development environment.

1.2 Technical Support and Services

We are committed to ensuring that our products perform as they were designed. Although a significant amount of testing has gone into this product, you may encounter errors in the software or documentation. Technical support is provided on an informal basis through the Open Watcom FORTRAN 77 newsgroups. Please visit http://www.openwatcom.org/ for more information.

1.2.1 Resources at Your Fingertips

Open Watcom FORTRAN 77 contains many resources to help you find answers to your questions. The documentation is the first place to start. With each release of the product, we update the manuals to answer the most frequently asked questions. Most of this information is also accessible through on-line help.

The "README" file in the main product directory contains up-to-date information that recently became available.

Answers to frequently asked questions are available on the Open Watcom World Wide Web server (http://www.openwatcom.org/).

1.2.2 Contacting Technical Support

Our technical support is available to help resolve technical defects in the software. Note that all support is currently informal and free. The following are ways to contact technical support.

Newsgroups The easiest way to get support is through the Open Watcom newsgroups at news://news.openwatcom.org/.

World Wide Web You can also submit bug reports or enhancement requests through the Open Watcom bug tracking system at http://bugzilla.openwatcom.org/.

1.2.3 Information Technical Support Will Need to Help You

The more information you can provide to technical support, the faster they can help you solve your problem. A detailed description of the problem, short sample program, and a summary of steps to duplicate the problem (including compiler and linker options) are essential. Concise problem reports allow technical support to quickly pinpoint the problem and offer a resolution. Here is a list of information that will help technical support solve the problem:

Contact information
We would like your name, as well as telephone and fax numbers where you can be reached during the day.

Product information
Please tell us the product name and exact version number.

Hardware configuration
Please tell us what type of processor you are using (e.g., 2.2GHz Intel Pentium 4), how much memory is present, what kind of graphics adapter you are using, and how much memory it has.

Software configuration
Please tell us what operating system and version you are using.

Concise problem report with short sample program
Please provide a complete description of the problem and the steps to reproduce it. A small, self-contained program example with compile and link options is ideal.

1.2.4 Suggested Reading

There are a number of good books and references that can help you answer your questions. Following is a list of some of the books and documents we feel might be helpful. This is by no means an exhaustive list. Contact your local bookstore for additional information.

1.2.4.1 DOS Developers

PC Interrupts, Second Edition
Ralf Brown and Jim Kyle; Addison-Wesley Publishing Company, 1994.

Relocatable Object Module Format Specification, V1.1
The Tool Interface Standards (TIS) OMF specification can be obtained from the Open Watcom website. Here is the URL.

```
http://www.openwatcom.org/ftp/devel/docs/omf.pdf
```

This file contains a PDF version of the TIS OMF V1.1 specification.

1.2.4.2 Extended DOS Developers

Extending DOS—A Programmer's Guide to Protected-Mode DOS, 2nd Edition
Ray Duncan, et al; Addison-Wesley Publishing Company, 1992.

DOS Protected-Mode Interface (DPMI) Specification
The DPMI 1.0 specification can be obtained from the Open Watcom website. Here is the URL.

```
http://www.openwatcom.org/ftp/devel/docs/dpmi10.pdf
```

This file contains a PDF version of the DPMI 1.0 specification.

1.2.4.3 Windows 3.x Developers

Microsoft Windows Programmer's Reference
Microsoft Corporation; Microsoft Press, 1990.

Programming Windows 3.1, Third Edition
Charles Petzold; Microsoft Press, 1992.

Windows Programming Primer Plus
Jim Conger; Waite Group Press, 1992.

1.2.4.4 Windows NT Developers

Advanced Windows NT
Jeffrey Richter; Microsoft Press. 1994.

Inside Windows NT
Helen Custer; Microsoft Press. 1993.

Microsoft Win32 Programmer's Reference, Volume One
Microsoft Corporation; Microsoft Press, 1993.

1.2.4.5 OS/2 Developers

The Design of OS/2
H.M. Deitel and M.S. Kogan; Addison-Wesley Publishing Company, 1992.

OS/2 Warp Unleashed, Deluxe Edition
David Moskowitz and David Kerr, et al; Sams Publishing, 1995.

2 Installation

The package contains the following components:

- *Open Watcom FORTRAN 77 CD-ROM*
- *This manual*

2.1 Hardware and Software Requirements

Open Watcom FORTRAN 77 requires the following minimum configuration:

- IBM PC compatible
- An 80386 or higher processor
- 8 MB of memory
- Hard disk with enough space available to install the components you require.
- A CD-ROM disk drive

In addition to the above requirements, you need one of the following operating systems:

- DOS version 5.0 or higher
- Microsoft Windows version 3.1 running in enhanced mode
- Microsoft Windows 95 or higher
- Microsoft Windows NT version 3.1 or higher
- IBM OS/2 2.1 or higher

2.2 The README File

Before you install Open Watcom FORTRAN 77, you should read the contents of the "README" file which is stored in the root directory of the CD-ROM. It contains valuable, up-to-date information concerning this product.

2.3 Installing Open Watcom FORTRAN 77

The installation program in this version has been completely redesigned with several new "smart" features. If you have installed a previous version of Open Watcom FORTRAN 77 then you should install Open Watcom FORTRAN 77 2.0 into the same path (except for the reason described in the following paragraph). It will examine a previous installation to determine what features were previously installed. It will use this information to establish default settings for the installation that you are about to attempt. Of course, you can add or remove features as you progress through the installation steps.

If you are installing only one of the Open Watcom C/C++ or Open Watcom FORTRAN 77 products and you have an older version of the other product, we do NOT recommend that you install the new product into the same directory as the old product. The Open Watcom C/C++ and Open Watcom FORTRAN 77 products are compatible at the same version number. However, the Open Watcom C/C++ and Open Watcom FORTRAN 77 products are usually NOT compatible across different version numbers. If this is the case, care must be exercised when switching between use of the two products. Environment variables such as **PATH** and **WATCOM** must be modified and/or corrected. System files such as `CONFIG.SYS` and `SYSTEM.INI` must be modified and/or corrected.

If you are installing both Open Watcom C/C++ 2.0 and Open Watcom FORTRAN 77 2.0, we recommend that you install both products under the same directory. This will eliminate duplication of files and, as a result, reduce the total required disk space. The two products share the use of certain environment variables which point to the installation directory. If separate installation directories are used, problems will arise.

When you install Open Watcom C/C++ and Open Watcom FORTRAN 77 in the same directory, you should not deselect any options when running the second installation; otherwise the second product's install may remove files that were installed (and are required) by the first product's install. This isn't an issue if you only have one of Open Watcom C/C++ or Open Watcom FORTRAN 77. The problem is that Open Watcom C/C++ and Open Watcom FORTRAN 77 don't know about the installation options you have selected for each other's product.

If you wish to create a backup of your previous version, please do so before installing Open Watcom FORTRAN 77 2.0.

If you decide to install Open Watcom FORTRAN 77 2.0 into a different directory than the previously installed version, you will have to manually edit system files (e.g., CONFIG.SYS, AUTOEXEC.BAT, SYSTEM.INI) after the installation process is complete to remove the old version from various environment variables (e.g., PATH, DEVICE=). This is necessary since the path to the new version will appear after the path to the old version. To avoid this extra work, we recommend installing the new version into the same path as the old version.

As an example, here are a few of the environment variables and "RUN" directives that are modified/added to the OS/2 `CONFIG.SYS` file. You should make sure that all references to the older version of the software are removed.

Example:

```
LIBPATH=...;D:\WATCOM\BINP\DLL;...
SET PATH=...;D:\WATCOM\BINP;D:\WATCOM\BINW;...
SET HELP=...;D:\WATCOM\BINP\HELP;...
SET BOOKSHELF=...;D:\WATCOM\BINP\HELP;...
SET INCLUDE=...;D:\WATCOM\H\OS2;D:\WATCOM\H;
SET WATCOM=D:\WATCOM
SET EDPATH=D:\WATCOM\EDDAT
RUN=D:\WATCOM\BINP\NMPBIND.EXE
```

You may wish to run Open Watcom FORTRAN 77 under more than one operating system on the same personal computer. For every operating system that you use, simply start up the operating system and run the corresponding install procedure.

If you run the Windows 3.x installation procedure, you do not need to run the DOS installation procedure also.

If you plan to use Win-OS/2 as a development platform under OS/2, you must run the Windows 3.1 install program (selecting Windows 3.1 host support).

Place the CD-ROM disk in your CD-ROM drive. Select one of the following procedures depending on the host operating system that you are currently running. Below, substitute the CD-ROM drive specification for "x:".

DOS Enter the following command:

```
x:\setup
```

Windows 3.x Start Windows 3.x and choose Run from the File menu of the Program Manager. Enter the following command:

```
x:\setup
```

Windows 95/98/Me Choose Run from the Start menu and enter the following command:

```
x:\setup
```

Windows NT/2000/XP Log on to an account that is a member of the "Administrator" group so that you have sufficient rights to modify the system environment. Choose Run from the File menu of the Program Manager. Enter the following command:

```
x:\setup
```

OS/2 Start an OS/2 session and enter the following command:

```
x:\install
```

2.4 Incremental Installation

You may wish to install Open Watcom FORTRAN 77, and subsequently install features that you omitted in the first install. You can also remove features that you no longer wish to have installed. You can achieve this as follows:

1. Start the installation program.
2. Select any new features that you wish to install.
3. Deselect any features that you wish to remove.
4. Re-run the installation program for each host operating system that you use.

2.5 System Configuration File Modifications

The install program makes changes to your operating system startup files to allow Open Watcom FORTRAN 77 to run. We strongly recommend that you allow the install program to modify your system configuration files for you, but you may do it by hand. The changes required may be found in any of the following files which have been placed in the root of the installation directory:

CONFIG.NEW Changes required for `CONFIG.SYS` (DOS, Windows, Windows 95/98/Me, OS/2)

AUTOEXEC.NEW Changes required for `AUTOEXEC.BAT` (DOS, Windows, Windows 95/98/Me, OS/2)

CHANGES.ENV Changes required for the Windows NT/2000/XP environment

2.6 Installation Notes for Windows 3.x

1. When you use the Integrated Development Environment under Windows 3.x, it is important that the IDE's batch server program be able to run in the background. Therefore, make sure that the "Exclusive in Foreground" checkbox is NOT checked in the "Scheduling" options of "386 Enhanced" in the "Control Panel".

2. When you use the Integrated Development Environment under Windows 3.x, the line

   ```
   OverlappedIO=ON
   ```

   in your "SYSTEM.INI" file can cause problems. This controls (disables) the queuing of DiskIO and makes some changes between DOS box timings to allow some processes to finish.

3. When you use the Integrated Development Environment under Windows 3.x, it is important that the line

   ```
   NoEMMDriver=ON
   ```

   not appear in your "SYSTEM.INI" file. It will prevent a link from succeeding in the IDE..

4. When you use the Integrated Development Environment under Windows 3.x on the NEC PC-9800 series, it is important that the line

   ```
   InDOSPolling=TRUE
   ```

   not appear in your "SYSTEM.INI" file. It will prevent a make from succeeding in the IDE.

5. Central Point Software's anti-virus programs (VDEFEND, VSAFE, VWATCH) conflict with the Integrated Development Environment under Windows 3.x.

6. The Program Information File "BATCHBOX.PIF" is used by the Integrated Development Environment (IDE) to start up a background batch server for compiling, linking, etc. The PIF references "COMMAND.COM". If you are using a substitute for "COMMAND.COM" such as "4DOS.COM" then you must modify the PIF accordingly using a PIF editor.

2.7 Installation Notes for OS/2

1. The Integrated Development Environment (IDE) uses the IBM OS/2 Enhanced System Editor (EPM) for editing text files. You must ensure that EPM is installed in your OS/2 system if you are planning to use the IDE. You can selectively install the Enhanced Editor by running the OS/2 Setup and Installation program (Selective Install) and choosing "Enhanced Editor" from the "Tools and Games" detail page.

2. On some systems with limited memory that use the UNDELETE feature of OS/2, compile times may be slow because OS/2 is saving copies of compiler temporary files. You may start the BATSERV process using the OS/2 `STARTUP.CMD` file with **DELDIR** turned off as illustrated below.

```
SET OLD_ DEL_ DIR=%DELDIR%
SET DELDIR=
DETACH C:\WATCOM\BINP\BATSERV.EXE
SET DELDIR=%OLD_ DEL_ DIR%
SET OLD_ DEL_ DIR=
```

3. If you plan to use the Named Pipe Remote Debugging support of the Open Watcom Debugger then the `NMPSERV.EXE.` program must be running. It may be started during OS/2 initialization via a "RUN=" statement in your `CONFIG.SYS` file or manually as needed through the DETACH command.

3 Hands-on Introduction to Open Watcom FORTRAN 77

Let's get started and introduce some of the tools that are in Open Watcom FORTRAN 77. The purpose of this chapter is to briefly test out the new graphical tools in Open Watcom FORTRAN 77 using an existing application.

In this tutorial, we will take an existing set of FORTRAN 77 source files, create a project in our integrated development environment, and perform the following tasks:

- Add multiple targets
- Make a target
- Make all targets
- Execute the program
- Debug the program
- Correct errors
- Sample and profile the executable
- Save the project
- Terminate the session

3.1 Outline

Open Watcom's Integrated Development Environment (IDE) manages the files and tools that a programmer uses when developing a project. This includes all the source files, include files, libraries, compiler(s), linkers, preprocessors, etc. that one uses.

The IDE has a graphical interface that makes it easy to visualize the make-up of a project. A single IDE session shows a project. If the project consists of a number of components, such as two executables and one library, these are each shown as target windows in the project window. Each target window shows the files that are needed to construct the target and is associated via its filename extension with a rule that describes the construction mechanism. For example, a filename with the extension ".EXE" may be associated with the rule for constructing 32-bit Windows executables, or a filename with the extension ".LIB" may be associated with the rule for constructing static libraries. Different projects can refer to the same target. If they do, the target is shared and can be manipulated via either project, with changes made through one affecting the other.

The IDE itself is a collection of programs that manages the various files and tools used to create the target libraries and executables. It creates makefile(s) from the information in the target descriptions and invokes Open Watcom Make to construct the targets themselves. A configuration file contains built-in knowledge of the Open Watcom compilers, editors, Profiler, and Browser, as well as all their switches.

3.2 The Open Watcom FORTRAN 77 Tutorial

This tutorial walks you through the creation and execution of a FORTRAN 77 program under Windows. This will give you an understanding of the basic concepts of the IDE and its components, and it will detail the steps involved in project development. The result of this tutorial is a three dimensional drawing of a kitchen which you can manipulate using either the menus or the icons on the toolbar. You can rotate and resize the drawing, as well as adjust the lighting and contrast.

To begin, start the IDE. This is done by double-clicking on the "IDE" icon in the Open Watcom FORTRAN 77 window.

A status field at the bottom of the IDE window indicates the function of the icon on the toolbar over which your mouse cursor is currently positioned. If the status area does not show you the function of the icons as you move the mouse cursor over them, check that no item in the menu bar is highlighted (if one is highlighted, press the Alt key).

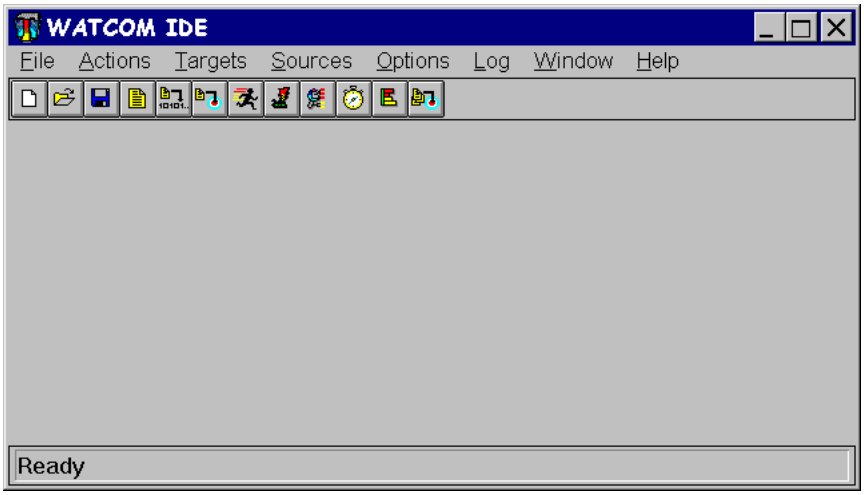

Figure 1. *The initial IDE screen*

3.2.1 Defining a Project

In this tutorial, you will be creating a new project called `KITCHEN`. Here are the steps required to accomplish this task.

1. Define a new project by pulling down the *File* menu and selecting the *New Project...* item. You can also define a new project by clicking on the "Create a new project" icon on the toolbar.

2. A choice of different sample project directories is available. Assuming that you installed the Open Watcom FORTRAN 77 software in the `\WATCOM` directory, you will find the sample project directories in the following directory:

   ```
   \WATCOM\SAMPLES\IDE\FORTRAN
   ```

   For purposes of this tutorial, we recommend that you select one of the following project directories:

WIN for an example of 16-bit Windows 3.x application development when using Windows 3.x under DOS as a host development system,

WIN386 for an example of 32-bit Windows 3.x application development when using Windows 3.x under DOS as a host development system,

WIN32 for an example of 32-bit Win32 application development when using Windows NT/2000/XP or Windows 95/98/Me as a host development system, and

OS2 for an example of 32-bit OS/2 application development when using 32-bit OS/2 as a host development system.

Thus the `target` that we refer to below should be one of `WIN`, `WIN386`, `WIN32`, or `OS2` depending on your selection. The tutorial uses the `WIN32` example for illustrative purposes. You will find some minor variations from your selected target environment.

When asked for a project name, you can do one of two things:

1. enter the following pathname:

   ```
   d:[path]\SAMPLES\IDE\FORTRAN\target\KITCHEN
   ```

   where `d:[path]` is the drive and path where you installed the Open Watcom software, or

2. use the file browser to select the following directory:

   ```
   d:[path]\SAMPLES\IDE\FORTRAN\target
   ```

   and specify the filename `kitchen`.

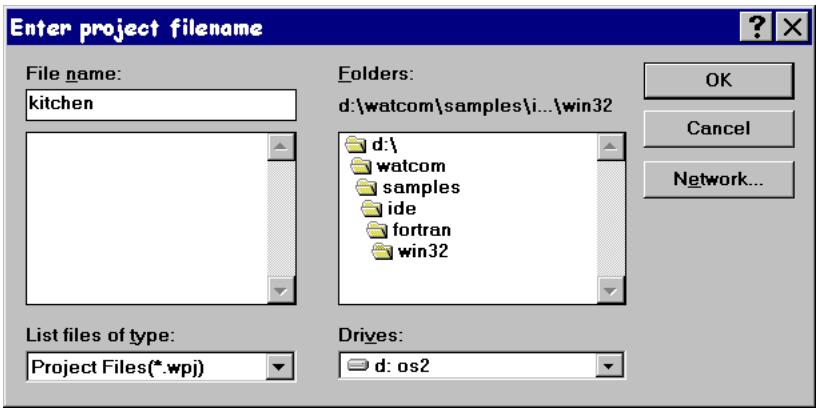

Figure 2. *Creating a new project*

Press the Enter key or click on OK (OPEN).

The project description will be stored in this file and the IDE will set the current working directory to the specified path during your session.

3. You will be prompted for a target name. Since we will be attaching pre-defined targets, just click the *Browse* button when prompted for the target name. Select the "draw" target file (it will be one of `draw16.tgt`, `draw.tgt`, `draw32.tgt`, `drawos2.tgt` depending on your selection of target).

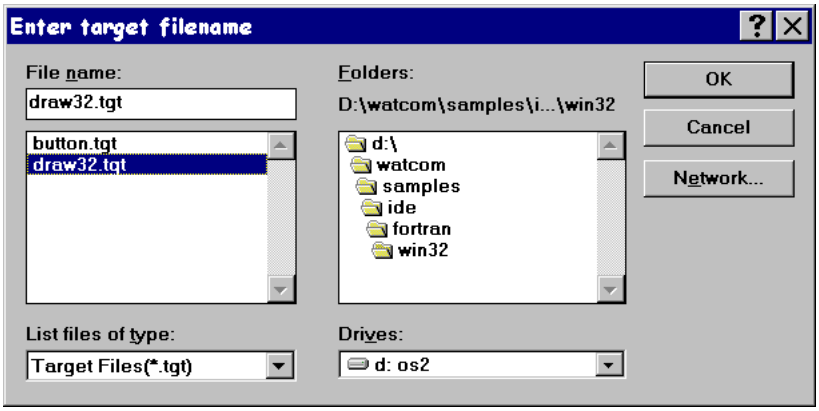

Figure 3. *Attaching existing targets*

Press the Enter key or click on OK (OPEN).

4. You can ignore the settings displayed for *Target Environment* and *Image Type* since the target definition already exists (we created it for you). The settings are important when you are defining a new target (i.e., one that was not predefined).

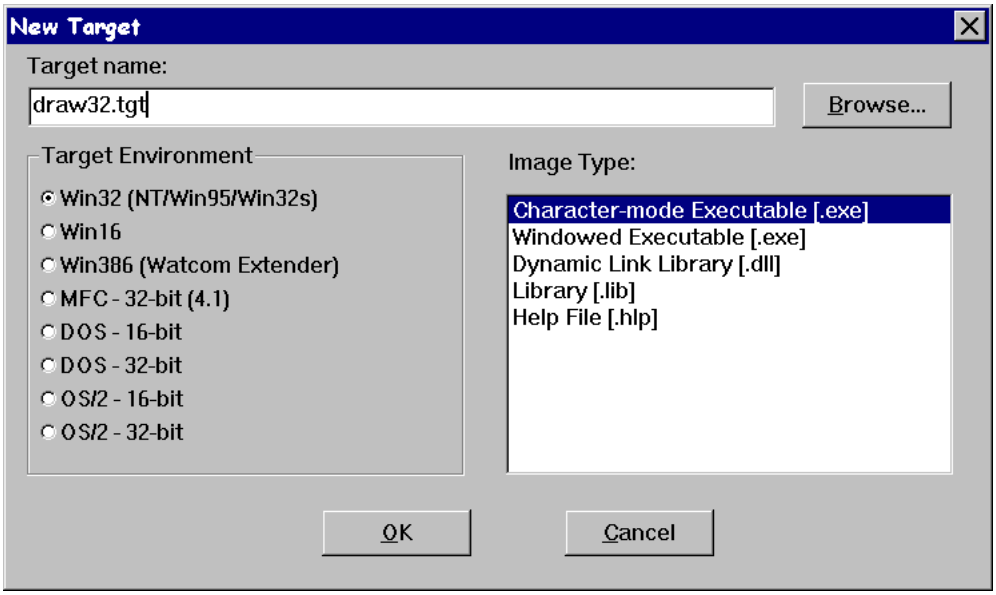

Figure 4. *Selecting a target type*

Press the Enter key or click on OK.

A target window is created in the project window for the "draw" target. This window contains all of the files associated with the target. You can click on any of the "Folder" icons to hide or un-hide all files with a particular extension. For example, you may wish to un-hide all the files with a `.bmp` extension by clicking on the folder icon associated with bitmap files.

3.2.2 Adding Multiple Targets

Open Watcom's IDE allows you to have multiple targets in any particular project. Note that targets can be used by multiple projects. To add a new target to the project, do the following.

1. Pull down the *Targets* menu and select the *New Target...* item.

2. Enter `button.tgt` as the target name for the new target to be added to the project. Do not forget to include the `.tgt` extension. It is required when selecting a pre-existing target.

3. You can ignore the settings displayed for *Target Environment* and *Image Type* since the target definition already exists (we created it for you). The settings are important when you are defining a new target (i.e., one that was not predefined).

4. Press the Enter key or click on OK.

A target window is created in the project window for the `button` target.

3.2.3 Making a Target

Open Watcom's IDE will automatically generate the sequence of steps required to build or "make" each of the targets in a project. Note that the targets in a project can be made individually or collectively. To make the `button.lib` target, do the following.

1. Click on the window of the target you wish to make. In this case, click on the `button.lib` target window.

2. Pull down the *Targets* menu and select the *Make* item (you can also do this by clicking on the "Make the current target" icon on the toolbar, or by right-clicking on the target and selecting the *Make* item from the pop-up menu).

The IDE will now construct a makefile based on its knowledge of the target and construction rules, and then invoke the make utility to create the target, in this case `button.lib.` The output of this procedure is displayed in the Log window.

3.2.4 Making All Targets

Click the "Make all targets in the project" icon on the toolbar to make all of the targets in the current project. If one target depends on another target, the latter target will be made first. In this tutorial `button.lib` will be made first (there will be nothing to do since it was made previously) and then `draw???.exe,` since `button.lib` is in the list of files associated with `draw???.exe.` In each case, the IDE constructs makefiles based on its knowledge of the target and construction rules. The output of this procedure is displayed in the Log window.

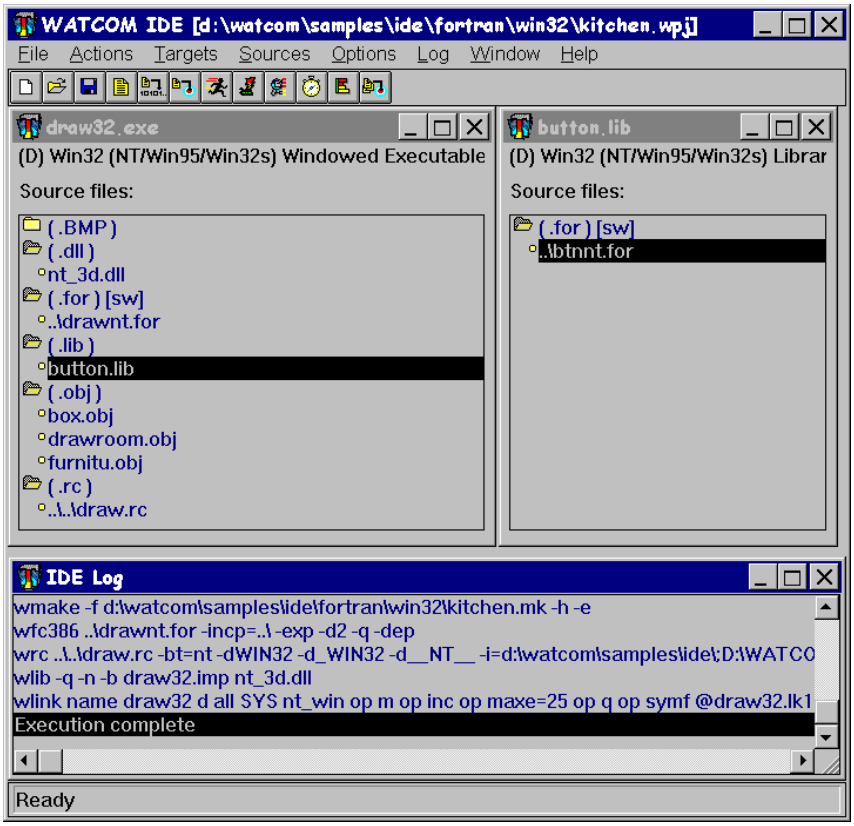

Figure 5. *Making one or more targets*

3.2.5 Executing the Program

The project should have built without errors, so now you are ready to execute the program you have developed.

Click on the `draw???.exe` target window and simply click on the "Run the current target" icon on the toolbar. You can also do this by selecting *Run* from the *Targets* menu, or right-clicking anywhere on the target window outside of the inner frame and selecting *Run* from the pop-up menu (right-clicking is context sensitive and the pop-up menu that results will vary depending on the area of the window in which you right-click).

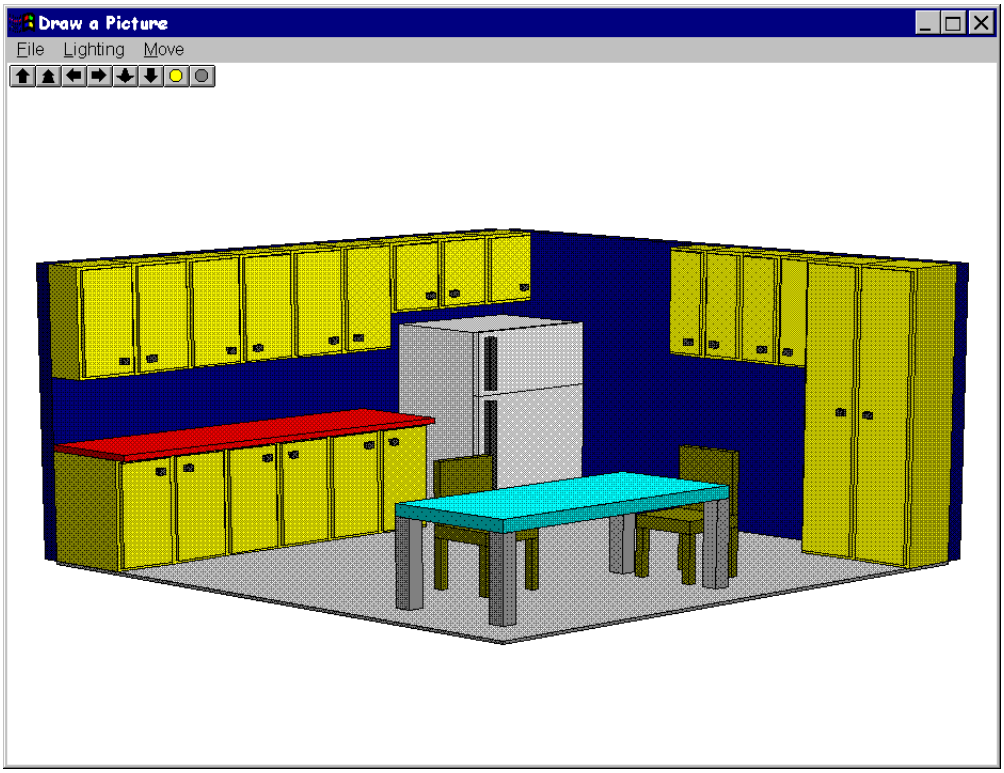

Figure 6. *The kitchen demo*

The demo you have created is a simple three dimensional drawing of a kitchen. By using either the icons on the toolbar or the menus you can rotate the picture left, right, up, and down, make the picture brighter or dimmer, move the picture closer or farther away, and increase or decrease the amount of contrast (this latter feature is found in the "Lighting" menu). Choose *Exit* from the *File* menu to exit the demo program when you are finished.

3.2.6 Smart Editing

The IDE recognizes the type of file you wish to edit, and invokes the appropriate editor for the task. To edit a file, you either double-click on it or select it and click the "Edit" icon on the toolbar. Files with a `.c, .cpp, .h, .hpp, .for, .asm` or `.rc` extension are edited with a text editor; files with a `.bmp, .ico,` or `.cur` extension are edited with the Image Editor; files with a `.dlg` or `.res` extension are edited with the Resource Editor.

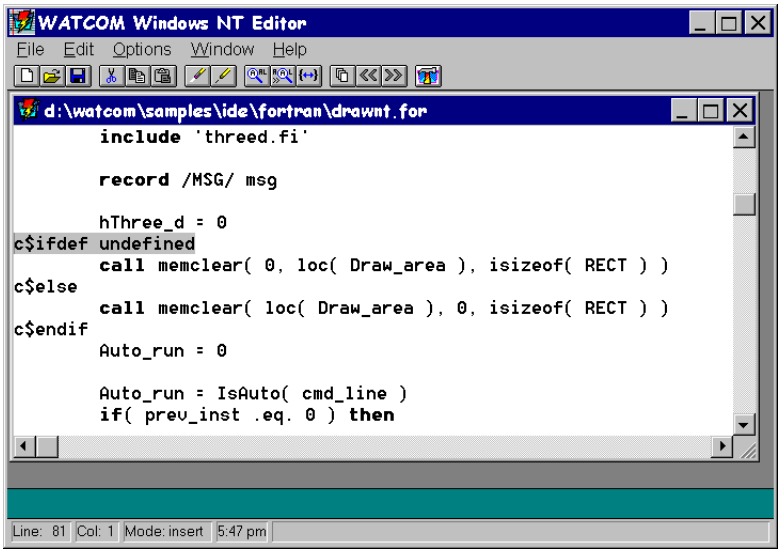

Figure 7. *The Open Watcom Editor for Windows*

Now we will edit one of the source files and introduce an error into the application.

1. Double-click on the "draw" source file (i.e., `draw???.for`) to load the source file into the editor.

2. Search for the line containing the text:

   ```
   c$ifdef undefined
   ```

   For Windows users, "Find" is in the "Edit" menu. If you are building a WIN386 application, search for the second line containing this text (located in subroutine `memclear`).

3. Now, to introduce an error into the application, add the line

   ```
   c$define undefined
   ```

   just before the line containing `c$ifdef`.

4. Save your changes by clicking on the "Write the current file to disk" icon or select *Save* from the *File* menu.

5. Return to the IDE (by clicking on it if it is visible on your screen, or by using Alt-Tab), re-make your project, and run it. A fault occurs in your application, so the next step is to track down the problem using the Open Watcom Debugger.

3.2.7 Debugging the Program

To debug a program it must first be compiled to include debugging information. The IDE maintains two sets of switches for each target in a project. These are known as the Development Switches and the Release Switches.

1. Right click on `draw???.for` and select *Source options* from the pop-up menu. Select *Fortran Compiler Switches* from the sub-menu.

By default, your target is placed in development mode with the debugging switches for the compiler and linker set to include debugging information. You can either set the switches in each category manually or you can copy the default Release switches using the CopyRel button. This method of setting switches is especially convenient since you can specify everything from diagnostic, optimization, and code generation switches to special linker switches all without having to memorize a cryptic switch name — you simply click next to the switches you wish to use for a particular item.

2. Scroll through the categories using the >> button until you get to:

```
4. Debugging Switches
```

We can see that full debugging information was used in the compile, so just click on *Cancel* to exit this screen.

Figure 8. *Setting compiler switches*

3. To invoke the debugger, pull down the *Targets* menu and choose the *Debug* item or select the "Debug the current target" icon from the toolbar.

The Open Watcom Debugger is designed to be as convenient and intuitive as possible, while at the same time providing a comprehensive and flexible environment for serious debugging. You can configure your environment to display exactly the information you require to be most productive. Among the windows available are source and assembly, modules, functions, calls, threads, images, watches, locals, globals, file variables, registers, 80x87 FPU, stack, I/O ports, memory display, and a log window. You can step through your source using the keys or icons on the toolbar. Execute one line at a time by stepping over calls or stepping into calls, or execute until the current function returns. Right-mouse button functionality gives context-sensitive pop-up menus.

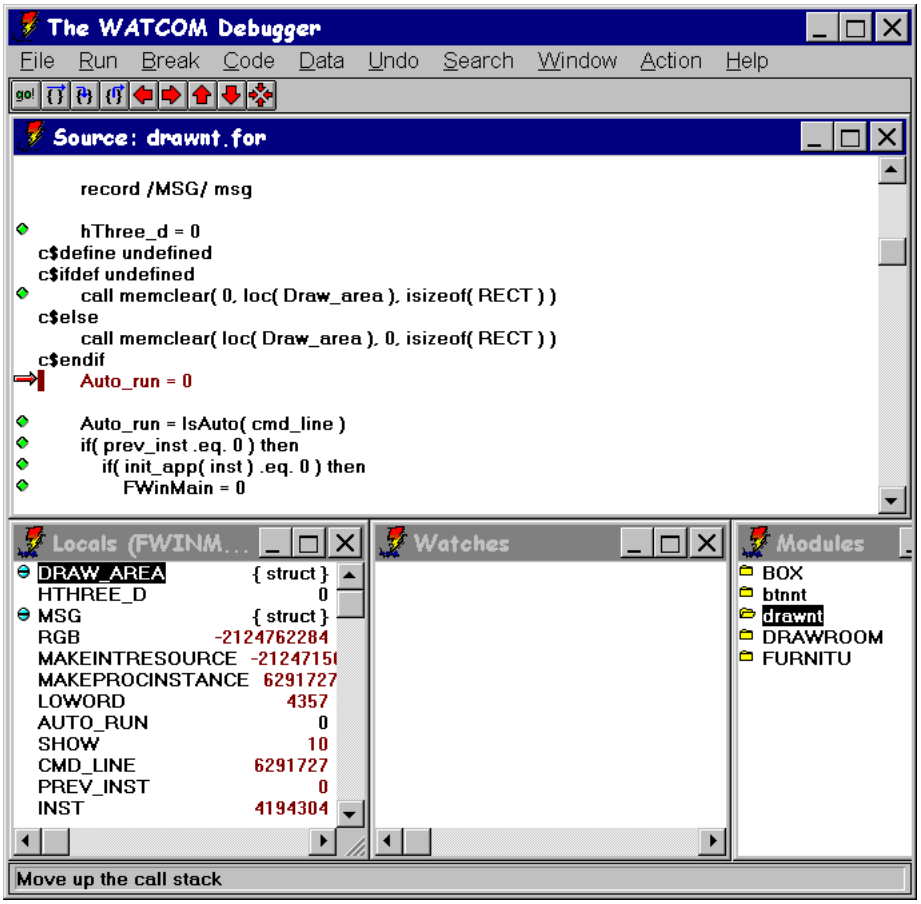

Figure 9. *The Open Watcom Debugger*

We know that a fault has occurred in `draw???.exe`, so we will run the application and examine the state of the program when the fault occurs.

1. Click on the "go!" icon on the toolbar to begin execution of the program. The exception occurs and the source window shows the line

   ```
   arr( cnt ) = ch
   ```

   in the subroutine `memclear` as the last line executed before the exception. Examining the Locals window you will see that the array location or address, `locale`, is 0. This means that the array `arr` was mapped to location 0. For the 32-bit Windows example, we also needed to use the "array" pragma to force a far pointer reference to cause the exception.

2. We can now move up the call stack by clicking on the "Move up the call stack" icon on the toolbar (red up arrow) to follow the program's execution. On the previous executable line of code, we see `memclear` is called from the main program with three arguments.

   ```
   call memclear( 0, loc(Draw_ area), isizeof(RECTL) )
   ```

   We see that `memclear` is called with 0 as the first argument and `loc(Draw_ area)` as the second argument which is backwards to the way it should be. An artificial error was introduced for the purposes of this tutorial.

3. By removing the line

```
c$define undefined
```

we can undo this error. Exit the debugger.

4. Double-click on `draw???.for` to load the source file into the editor.

5. Go to the line in question using "find" or "search" and delete the line. Save your changes by clicking on the "Write the current file to disk" icon or selecting *Save* from the *File* menu.

6. Return to the IDE (by clicking on it if it is visible on your screen, or by using Alt-Tab) and re-make your project.

7. Run your project to see the kitchen demo.

3.2.8 Correcting an Error

We are now going to introduce an error into the source code to illustrate another feature of the IDE.

1. Double-click on `draw???.for` to load the source file into the editor.

2. Search for the line containing the text:

```
c$ifdef undefined
```

For Windows users, "Find" is in the "Edit" menu.

3. Now, to introduce a syntax error into the application, add the line

```
hThree_ d + 0
```

just before the line containing `c$ifdef.`

4. Save your changes by clicking on the "Write the current file to disk" icon or select *Save* from the *File* menu.

5. Return to the IDE (by clicking on it if it is visible on your screen, or by using Alt-Tab).

6. Click the "Make all targets in the project" icon to re-make the project.

An error is encountered during the make and error message(s) appear in the log window. Additional information on the error is available by selecting the error, pulling down the *Log* menu and selecting the *Help on Message* item.

1. Double-click on the error message

```
drawwin.for(83): *ERR* ST-17 column 9, undecodeable statement or
misspelled word HTHREE_ D
```

The offending source file (`draw???.for`) is loaded into the Editor and the cursor is positioned at the line which caused the error.

2. Delete the line to correct the error.

3. Save your changes.

4. Return to the IDE and re-make the project.

3.2.9 Editing a Bitmap

You can edit bitmaps, icons, or cursors associated with your project using Open Watcom's Image Editor. Double-click on a file with a `.bmp`, `.ico`, or `.cur` extension and the file is loaded into the Image Editor. The editor has many features to design your images, including resizing, rotation, shifting, and a utility to take a "snapshot" of another image and import it.

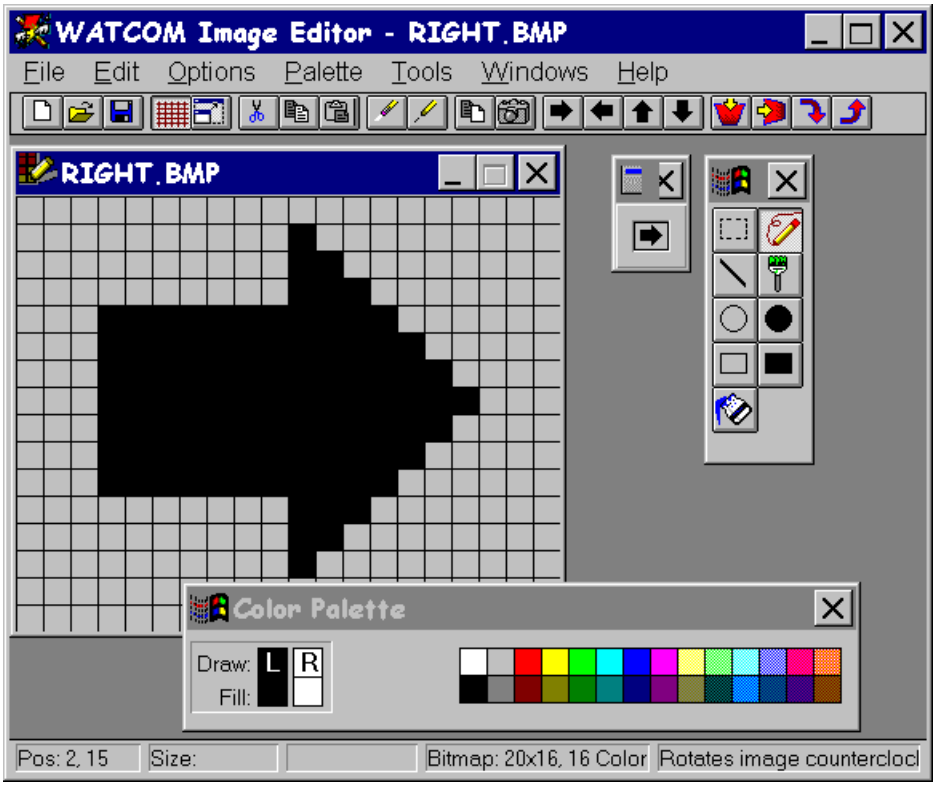

Figure 10. *The Open Watcom Image Editor*

Suppose you wanted to change the color of the right-arrow icon in your application.

1. If the "Folder" icon next to `.bmp` is closed, click on it to restore all the files with a `.bmp` extension to the file list.

2. Scroll the window until the file `right.bmp` is visible.

3. Double-click on `right.bmp` in the `draw???.exe` target window.

4. Select the "Paint Can" icon from the Tool Palette.

5. Select a color from the Color Palette.

6. Click on the arrow.

7. Save your changes using the "Save" icon on the toolbar and exit the Image Editor.

8. Click the "Make all targets in the project" icon to rebuild the project with the change incorporated.

3.2.10 Editing Menus

Next, you will add source files to the list of items that make up `draw???.exe`.

1. Pull down the *Sources* menu and select the *New Source...* item.

   Note: You can do this either by choosing from the menu bar or by positioning the mouse over the file list area and clicking the right mouse button. The IDE displays a pop-up menu from which you can choose the desired action.

2. Enter the filename `draw.res` (or `drawos2.res` for OS/2). For OS/2, click OK when you have entered the source file name. For all other systems, click on Add when you have entered the source file name and then click on Close. Now we will remove the `.rc` file from the project so that our changes to the `.res` file will not be overwritten. When an `.rc` file is present, the `.res` file is generated from the `.rc` file.

3. Right click on `draw.rc` (or `drawos2.rc` for OS/2), then select *Remove Source* from the pop-up menu.

4. Double-click on `draw.res` (or `drawos2.res`). The Resource Editor is invoked, displaying all the available resources (in this case, icons, bitmaps, and menus).

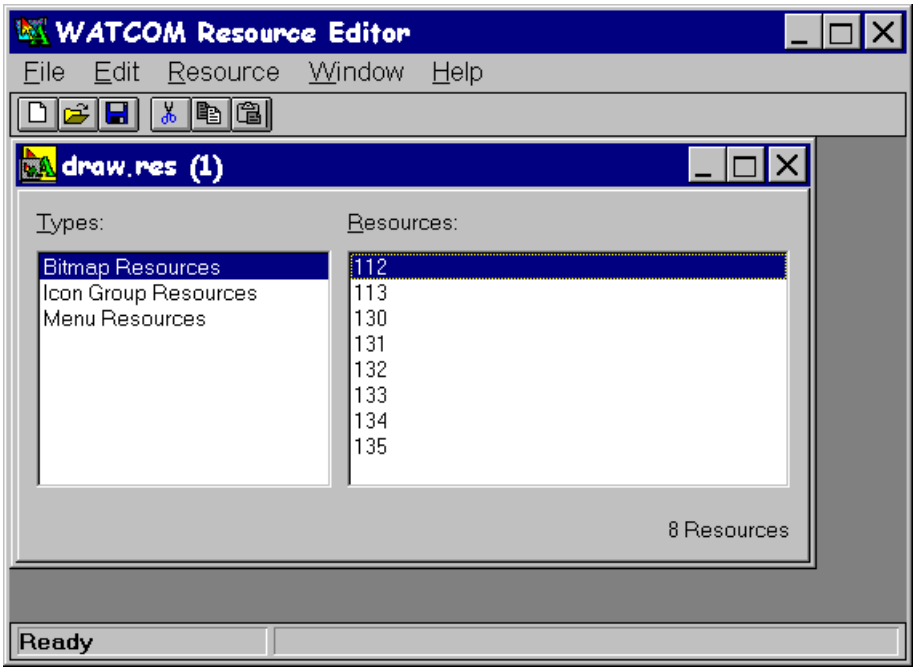

Figure 11. *The Open Watcom Resource Editor*

5. Click on "Menu Resources".

6. Double-click on "DrawMenu" in the right-hand box. This will bring up the Menu Editor. The Menu Editor displays the menus defined for the resource `DrawMenu`. You can specify pop-up menus, menu items and sub-items, text, separators, attributes, break styles, and memory flags.

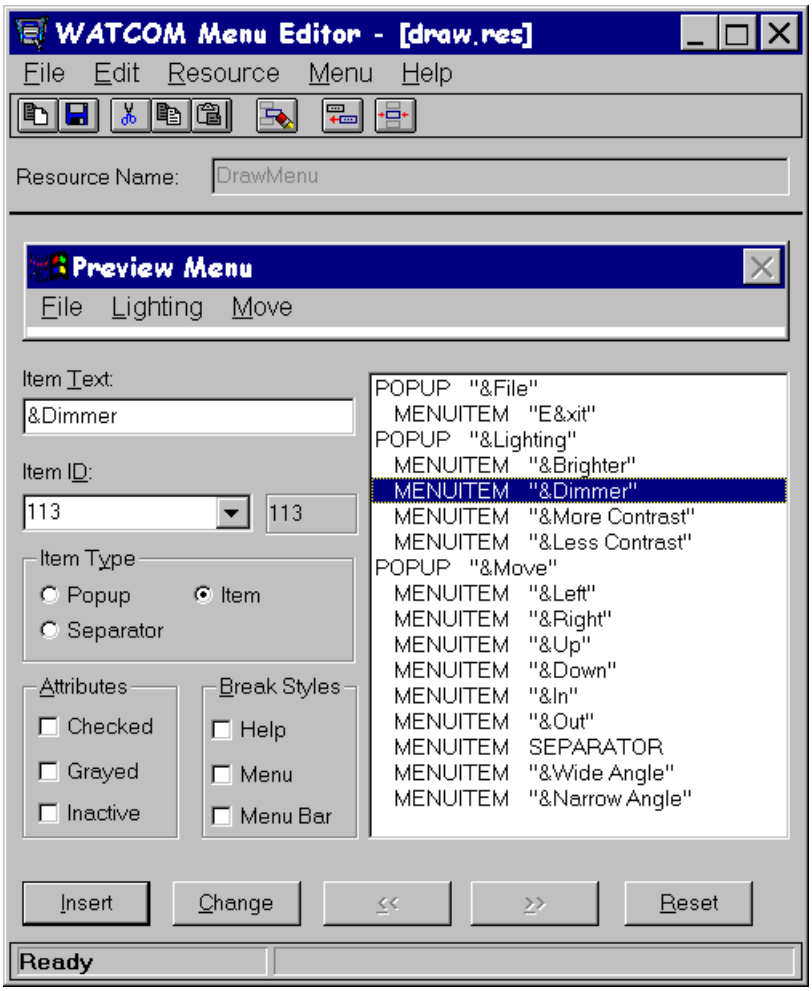

Figure 12. *The Open Watcom Menu Editor*

7. Click on `MENUITEM "&Dimmer"` in the item list window.
8. In the "Item Text" window change the item to `&Darker` and then click on the "Change" button.
9. Select *Update* from the *File* menu or click on the "Update the file with this menu" icon.
10. Exit the Menu Editor.
11. Now, select *Save* from the *File* menu or click on the "Save this file" icon and exit the Resource Editor.
12. Click the "Make all targets in the project" icon to re-make the project.

3.2.11 Sampling and Profiling an Executable

Together, the Open Watcom Execution Sampler and the Open Watcom Execution Profiler allow you to pinpoint the areas of your code that are the most heavily used, indicating possible candidates for performance improvements.

1. Click on the `draw???.exe` target.

2. Select the *Sample* item from the *Targets* menu item, or click on the "Run and sample the current target" icon from the toolbar. The Open Watcom Execution Sampler is invoked and your application begins to execute.

3. Try rotating and resizing the image a few times. The sampler takes a "snapshot" of the code that is being executed at regular intervals. Exit the application. A samples file with extension `.smp` is created in the current directory. This file is input for the profiler.

4. You are now ready to profile the executable. Do this by selecting *Profile* from the *Targets* menu, or by clicking on the "Profile the current target" icon on the toolbar. The profiler scans the `.smp` file and reports the activity in the various modules of the application. The percentage of time spent in the modules is indicated as an absolute percentage (percent of total samples) and as a relative percentage (percent of samples in the `.exe` image).

5. Double-click on the module or routine names to step down to the exact source being executed when a sample was taken. For more details, you can adjust the sampling rate of the Sampler to get a better picture of your code. To do this, exit the Profiler, pull down the *Targets* menu, and select *Target options,* then *Sample Switches...* from the pop-up menus. Specify a sampling rate such as 2 (for 2 milliseconds), click on OK, then run the Sampler and Profiler again.

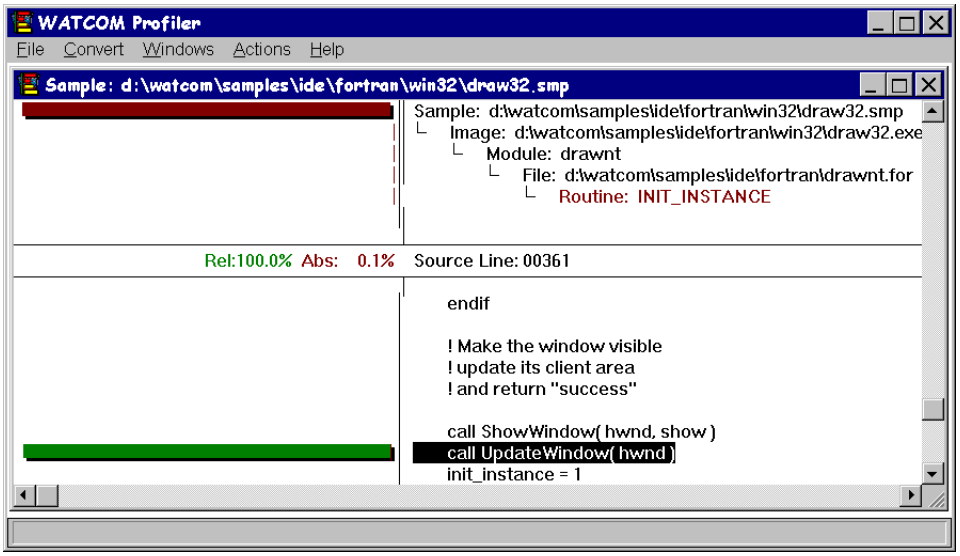

Figure 13. *The Open Watcom Execution Profiler*

3.2.12 Saving the Project and Terminating the Session

You can now exit the IDE session by selecting *Exit* from the *File* menu. If you have not already saved your project, you will be prompted to do so. Choose "Yes" and the session ends.

3.3 Tutorial Review

In this tutorial, you created a project called `kitchen.wpj`, which was composed of two targets: `draw???.exe` and `button.lib`. You compiled and linked it into an executable program using the WMAKE utility, the Open Watcom FORTRAN 77 compiler, and the Open Watcom Linker. You executed it both directly and under the control of the Open Watcom Debugger.. You browsed the source, and made changes using the text and resource editors. Finally, you sampled and profiled the application.

When you saved the project, you created the following permanent files:

- `kitchen.wpj` — describes the screen layout and refers to the target files called `draw???.tgt` and `button.tgt`.
- `draw???.tgt` — describes the target executable `draw???.exe` and all switches required to link it. It also describes the `.for` files and switches required to compile them.
- `button.tgt` — describes the target library and all switches required to create it. It also describes the `.for` file and the switches used to build the library.

4 Documentation

The following manuals comprise the Open Watcom FORTRAN 77 documentation set. When you install the software, the Open Watcom FORTRAN 77 documentation set is provided as on-line help files. Subsequent sections describe how to access this on-line help.

The following describes the titles in the Open Watcom FORTRAN 77 documentation set.

Open Watcom FORTRAN 77 User's Guide
This manual describes how to use Open Watcom FORTRAN 77. It contains an introduction to the compiler and a tutorial section. It also describes compiler options, include file processing, libraries, memory models, calling conventions, pragmas, in-line assembly, and environment variables.

Open Watcom FORTRAN 77 Tools User's Guide
This manual describes the command line oriented tools including the compile and link utility, library manager, object file disassembler, far call optimization tool, assembler, patch utility, strip utility, make utility, and touch utility.

Open Watcom Graphical Tools User's Guide
This manual describes Open Watcom's Windows and OS/2 graphical tools including the Integrated Development Environment, Browser, Dr. Watcom, Spy, DDE Spy, Image Editor, Resource Editor, Sampler/Profiler, Resource Compiler, Heap Walker, Zoom, and Editor.

Open Watcom FORTRAN 77 Programmer's Guide
This manual includes 5 major sections each of which describes operating system specific development issues. The operating systems covered include extended DOS, OS/2, Windows 3.x, Windows NT/2000/XP, Windows 95/98/Me, 32-bit Windows 3.x (using Open Watcom's Supervisor technology) and Novell NLMs. Topics include creating a sample program, operating system specific error messages, and debugging techniques.

Open Watcom FORTRAN 77 Language Reference
This manual describes the ANSI FORTRAN 77 programming language and extensions which are supported by Open Watcom FORTRAN 77.

Open Watcom FORTRAN 77 Graphics Library Reference
This manual describes the graphics libraries supported by Open Watcom FORTRAN 77. The graphics functions are used to display graphical images such as lines and circles upon the screen. Functions are also provided for displaying text.

Open Watcom Debugger User's Guide
This manual describes the Open Watcom Debugger and discusses advanced debugging techniques.

Open Watcom Linker User's Guide
This manual describes how to use the Open Watcom Linker to generate executables for target systems such as extended DOS, Windows 3.x, Windows 95/98/Me, Windows NT/2000/XP, OS/2, and Novell NLMs.

4.1 Accessing On-line Documentation

The following sections describe how to access the on-line help that is available for DOS, Windows and OS/2.

4.1.1 On-line Documentation under DOS

The Open Watcom Help program, ***WHELP***, may be used under DOS to access on-line documentation. The Open Watcom Help command line syntax is:

```
WHELP help_ file [topic_ name]
```

Notes:

1. If *help_file* is specified without an extension then ".IHP" is assumed.
2. The *topic_name* parameter is optional.
3. If *topic_name* is not specified, the default topic is "Table of Contents".
4. If *topic_name* contains spaces then it must be enclosed in quotes.

The following help files are available:

CLIB	***Open Watcom C Library Reference***
FMIX	***Open Watcom FORTRAN 77 Master Index***
FPGUIDE	***Open Watcom FORTRAN 77 Programmer's Guide***
FTOOLS	***Open Watcom FORTRAN 77 Tools User's Guide***
FUGUIDE	***Open Watcom FORTRAN 77 User's Guide*** (excludes Diagnostic Messages appendix which is available as a separate help file)
F77LR	***Open Watcom FORTRAN 77 Language Reference***
F77GRAPH	***Open Watcom FORTRAN 77 Graphics Library Reference***
LGUIDE	***Open Watcom Linker User's Guide***
F_README	***Open Watcom FORTRAN 77 Getting Started manual***
RESCOMP	Documentation for the Open Watcom Resource Compiler (excerpt from the ***Open Watcom Graphical Tools User's Guide***)
WD	***Open Watcom Debugger User's Guide***
WPROF	Documentation for the Open Watcom Execution Sampler and Open Watcom Execution Profiler (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

WFCERRS Documentation for the Open Watcom F77 Diagnostic Messages (excerpt from the ***Open Watcom FORTRAN 77 User's Guide***).

4.1.2 On-line Documentation under Windows

On-line documentation is presented in the form of Windows Help files (".HLP" files). When the software is installed under Windows 3.x, Windows 95/98/Me or Windows NT/2000/XP, a number of program groups are created. You can access the on-line document by opening a program group and double-clicking on a help icon.

Open Watcom FORTRAN 77 Group

Getting Started ***Open Watcom FORTRAN 77 Getting Started***

Open Watcom FORTRAN 77 Tools Help Group

Accelerator Editor Help Documentation for the Accelerator Editor (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

C Library Reference ***Open Watcom C Library Reference***

DDE Spy Help Documentation for the DDE Spy utility (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

Debugger Help ***Open Watcom Debugger User's Guide***

Dialog Editor Help Documentation for the Dialogue Editor (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

Dr. Watcom Help Documentation for Dr. Watcom (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

Editor Help Documentation for the Open Watcom Editor (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

FORTRAN 77 Error Messages Documentation for the Open Watcom F77 Diagnostic Messages (excerpt from the ***Open Watcom FORTRAN 77 User's Guide***)

FORTRAN 77 Master Index The master index for all of the Open Watcom FORTRAN 77 on-line help

Heap Walker Help Documentation for the Heap Walker utility (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

IDE Help Documentation for the Interactive Development Environment (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

Image Editor Help Documentation for the Image Editor (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

Linker Guide ***Open Watcom Linker User's Guide***

Menu Editor Help Documentation for the Menu Editor (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

Profiler Help Documentation for the Open Watcom Execution Sampler and Open Watcom Execution Profiler (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

Programmer's Guide ***Open Watcom FORTRAN 77 Programmer's Guide***

Resource Compiler Help Documentation for the Resource Compiler (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

Resource Editor Help Documentation for the Resource Editor (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

Spy Help Documentation for the Spy utility (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

String Editor Help Documentation for the String Editor (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

Tools Guide ***Open Watcom FORTRAN 77 Tools User's Guide***

User's Guide ***Open Watcom FORTRAN 77 User's Guide***

Zoom Help Documentation for the Zoom utility (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

4.1.3 On-line Documentation under OS/2

On-line documentation is presented in the form of OS/2 Information files (".INF" files). When the software is installed under OS/2, the Open Watcom FORTRAN 77 folder is created. You can access the on-line document by opening the Open Watcom FORTRAN 77 folder and double-clicking on a help icon.

C Library Reference ***Open Watcom C Library Reference***

Debugger Help ***Open Watcom Debugger User's Guide***

FORTRAN 77 Error Messages Documentation for the Open Watcom F77 Diagnostic Messages (excerpt from the ***Open Watcom FORTRAN 77 User's Guide***)

FORTRAN 77 Master Index The master index for all of the Open Watcom FORTRAN 77 on-line help

Getting Started ***Open Watcom FORTRAN 77 Getting Started***

IDE Help Documentation for the Interactive Development Environment (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

Profiler Help Documentation for the Open Watcom Execution Sampler and Open Watcom Execution Profiler (excerpt from the ***Open Watcom Graphical Tools User's Guide***)

Programmer's Guide ***Open Watcom FORTRAN 77 Programmer's Guide***

Tools Guide ***Open Watcom FORTRAN 77 Tools User's Guide***

User's Guide	*Open Watcom FORTRAN 77 User's Guide*

5 Release Notes for Open Watcom FORTRAN 77 2.0

There are a number of enhancements and changes in this new version of Open Watcom FORTRAN 77. The following sections outline most of the major changes. You should consult the User's Guide for full details on these and other changes made to the compiler and related tools. You should check the next section to determine if you need to recompile your application.

5.1 Changes in 11.0 that may Require Recompilation

Do not attempt to mix object code generated by earlier versions of the compilers with object code generated by this release or with the libraries provided in this release.

clock() The ***clock*** function accuracy has changed from 100 ticks per second to 1000 ticks per second (i.e., ***CLOCKS_PER_SEC*** has changed). Source code that uses the ***clock*** function and ***CLOCKS_PER_SEC*** in its calculations must be recompiled before linking the application with new libraries.

5.2 Major Differences from Version 10.6

The following sections summarize the major differences from the previous release of Watcom FORTRAN 77.

- Some of the Win32 and 32-bit OS/2 versions of our tools are now available in DLL form.

```
EXE      DLL        Description
------   -------    ----------------------
wlink    wlink      Open Watcom Linker
wlib     wlibd      Open Watcom Library Manager
```

This provides better performance when using the Integrated Development Environment or Open Watcom Make. See the description of the `!loaddll` preprocessing directive in Open Watcom Make for more information.

5.2.1 Changes to the Code Generator for 11.0

- A new optimization, "branch prediction", has been added. This optimization is enabled by the "OBP" or "OX" compiler options. The code generator tries to increase the density of cache use by predicting branches based upon heuristics (this optimization is especially important for Intel's Pentium Pro).

- We have added Multi-media Extensions (MMX) support to the in-line assembler.

5.2.2 Changes to the Compiler Tools for 11.0

- The Open Watcom Linker supports incremental linking.

- The Open Watcom Linker can now process COFF and ELF format object files, as well as OMF et al. The Open Watcom Linker can now read both AR-format (Microsoft compatible) libraries and old-style OMF libraries.

- Support for creating 16-bit DOS overlaid executables has been removed from the linker.

- The Open Watcom Library Manager (WLIB) can now process COFF and ELF format object files, as well as OMF et al. The Open Watcom Library Manager can now read/write both AR-format (Microsoft compatible) libraries and old-style OMF libraries. The default output format is AR-format and this can be changed by switches. The Open Watcom Library Manager can output various format import libraries.

- We have added Multi-media Extensions (MMX) support to the Open Watcom Assembler (WASM).

- A new version of the Open Watcom Disassembler (WDIS) is included. It can process ELF, COFF or OMF object files and ELF, COFF or PE format (Win32) executables.

  The old disassembler (WDISASM) has been retired and is not included in the package.

- We have added new tool front-ends that emulate Microsoft tools. These are:

  - rc

  These programs take the usual Microsoft arguments and translate them, where possible, into equivalent Open Watcom arguments and spawn the equivalent Open Watcom tools.

- Open Watcom Make now processes Microsoft format makefiles when the "ms" option is used.

5.2.3 Changes to the C/C++ Libraries for 11.0

- We have added multi-byte and wide character (including UNICODE) support to the libraries.

- We have added Multi-media Extensions (MMX) support to the libraries.

- The ***clock*** function accuracy has changed from 100 ticks per second to 1000 ticks per second (i.e., ***CLOCKS_PER_SEC*** has changed).

5.2.4 Changes to the DOS Graphics Library for 11.0

- The graphics library now performs the VESA test *before* testing for vendor specific graphics cards. This fix is intended to broaden the number of graphics cards that are supported.

5.2.5 Changes in Microsoft Win32 SDK Support for 11.0

- The Win32 SDK is included for Windows 95 and Windows NT platforms.

5.3 Changes in 10.6 that may Require Recompilation

_diskfree_t The struct members of the _diskfree_t structure has been changed from UNSIGNED SHORTs to UNSIGNED INTs. This is to deal with possible HPFS partitions whose size will overflow a short, as well as Microsoft compatibility.

clock() The ***clock*** function accuracy has changed from 100 ticks per second to 1000 ticks per second (i.e., ***CLOCKS_PER_SEC*** has changed). Source code that uses the ***clock*** function and ***CLOCKS_PER_SEC*** in its calculations must be recompiled before linking the application with new libraries.

5.4 Major Differences from Version 10.5

The following sections summarize the major differences from the previous release of Watcom FORTRAN 77.

5.4.1 Windows 95 Help File Format

We have included Windows 95 format help files.

5.4.2 Changes to the C Library

The following new functions were added to the library.

_getw read int from stream file

_putw write int to stream file

The ***clock*** function accuracy has changed from 100 ticks per second to 1000 ticks per second (i.e., ***CLOCKS_PER_SEC*** has changed).

5.4.3 Changes to the Image Editor

- Support has been added for > 16 colors for bitmaps.
- Support has been added for 16 X 16 icons.
- Support has been added for 48 X 48 icons.

5.4.4 Changes to the Dialog Editor

- Support has been added for Windows 95 controls.
- Support has been added for adding new control styles to existing controls.
- Support has been added for new dialog styles.
- Support has been added for allowing help IDs to be specified in dialog and control statements.
- Support has been added for generating new resource statements in .RC files.

5.4.5 Changes to the Resource Editor

- Support has been added for new Windows 95 resource types.
- Support has been added for generating new resource statements in .RC files.

5.4.6 Changes to the Resource Compiler

- Support has been added for extended styles for dialogs.
- Support has been added for the RCINCLUDE keyword.

5.5 Major Differences from Version 9.5

- The functionality of Open Watcom FORTRAN 77/16 and Open Watcom FORTRAN 77/32 is included in a single package.
- OS/2 3.0 Warp is supported.
- Windows NT 3.5 is supported.
- Windows 95 (Chicago) is supported.
- An Integrated Development Environment for Windows 3.x, Windows 95, Windows NT and OS/2 PM is included.
- New, redesigned debugger with GUI interfaces for Windows 3.x, Windows 95, Windows NT and OS/2 PM is included.
- TCP/IP remote debug servers for OS/2 and Windows NT are included.
- The optimizer has been enhanced.
- New, redesigned user interface for the Profiler.
- Windows resource editing tools are included:

Dialog Editor
Bitmap Editor
Resource Editor
Menu Editor
String Editor
Accelerator Editor

• Windows development tools are included:

Dr. Watcom (a post mortem debug utility)
Spy (Windows message spy program)
DDESpy
Heap Walker
Zoom

• On-line documentation is included.

• Creation of FlashTek DOS extender applications is supported.

• Compiler executables have been created that run under all supported operating systems. They are located in the BINW directory.

5.5.1 Items No Longer Supported

• Debugging of Ergo OS/386 DOS extender applications

• DESQView remote debugging

5.5.2 Changes that may Require Recompilation

FORTRAN applications should not require recompilation, but *you should recompile your application if you want to take full advantage new features in the debugger.*

5.6 Major Differences from Version 9.0

The following lists some of the new features/differences between version 9.5 and 9.0.

1. The "/resource" option has been added and allows run-time messages to be placed in the executable file as resource information instead of being linked with the application. The resource file containing these messages is called "wf77.res" and is locating in the root of the directory in which you installed the software. The strip utility (WSTRIP) can be used to place the resource information in the executable file. Special libraries for processing resource information will be required when you link your application. These libraries are called "wresf.lib" (for 32-bit register calling convention), "wresfs.lib" (for 32-bit stack calling convention), "wresm.lib" (for 16-bit medium memory model), and "wresl.lib" (for 16-bit large and huge memory models) and are located in the "lib386" and "lib286" directories of the directory in which you installed the software.
2. The "/5" option has been added and causes the compiler to generate code that is optimized for the Pentium. This is the default. The "/fp5" option has been added and causes the compiler to

generate floating-point code that is optimized for the Pentium. This is not the default. The default floating-point option is "/fp3".

3. The "/3" option has been added and causes the compiler to generate code optimized for a 80386 processor. The "/4" option has been added and causes the compiler to generate code optimized for a 80486 processor. The "/5" option has been added and causes the compiler to generate code that is optimized for the Pentium. In addition, the "/fp5" option has been added and causes the compiler to generate floating-point code that is optimized for the Pentium.
4. The "/descriptor" option has been added which specifies that string descriptors are to be passed for character arguments. You can specify the "/nodescriptor" option if you do not want string descriptors to be passed for character arguments. Instead, the pointer to the actual character data and the length will be passed as two arguments. The arguments for the length will be passed as additional arguments following the normal argument list. For character functions, the pointer to the data and the length of the character function will be passed as the first two arguments.
5. The "oi" option has been added. This option causes code for statement functions to be generated in-line.
6. The floating-point model used when generating in-line 80x87 instructions has changed. If you wish to call subprograms compiled with version 9.0 you must specify the "/fpr" option.
7. Support for records in text files separated by only a line feed character has been added. Previously, records in text files had to be separated by a carriage return/line feed sequence.
8. The "/debug" option has been divided into two separate options. The "/bounds" option generates array and character subscript checking code. The "/trace" option generates code that allows a run-time traceback to be generated when a error is issued.
9. The "/quiet" option has been added to suppress banner/summary information. The "terminal" option only affects the display of diagnostic messages (extensions, warnings and errors). For example, compiling with the "/quiet" option will only display diagnostic messages (if any).
10. The "/cc" option has been added. It specifies that unit 6 is a carriage control device and that output to this unit will be assumed to contain carriage control characters. Note that a blank carriage control character will automatically be generated for list-directed output.
11. The "/automatic" option causes all local variables (including arrays) to be allocated on the stack. Care should be taken when using this option since the stack requirements of your application may increase dramatically.
12. The "/wild" option has been added. It suppresses the compile-time checking that normally causes an error to be issued when an attempt is made to transfer control into a block structure from outside the block structure and vice versa. This option is only to be used when compiling existing code that contains GOTO statements of this type; it does not encourage this style of programming.
13. National language support has been added. The "/japanese" option causes the compiler to process Japanese double-byte characters in variable names and character data. Similarly, the "/chinese" option will process Traditional Chinese characters and the "/korean" will process Korean characters.
14. The "/ob" option has been added. This allows the code generator to use register ESP as a base register to reference local variables and subprogram arguments. Note that when this option is specified, the compiler will abort when there is not enough memory to optimize the subprogram. By default, the code generator uses more memory-efficient algorithms when a low-on-memory condition is detected.
15. The GROWHANDLES() function has be added. This function increases the number of files that can be opened by a program to the specified amount. The value returned is the new maximum. This may be less than the requested amount because of operating system limitations.
16. The IARGC() and IGETARG() functions have been added. IARGC is an integer function that returns the argument count. IGETARG is an integer function that takes two arguments. The first argument is of type INTEGER and is the index of the argument to be returned. The second argument is of type CHARACTER and is used to return the argument. The value returned by the function is the length of the argument.

17. The SHARE= specifier has been added to the OPEN statement. It allows the program to specify how other processes can access a file that is opened by the original process. Possible values for the SHARE= specifier are as follows.

    DENYRW - deny read and write access
    DENYWR - deny write access
    DENYRD - deny read access
    DENYNO - allow read and write access
    COMPAT - compatibility mode

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```
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```

7 Trouble-Shooting

This section is intended to provide you with help on some of the common (and not so common) problems that users have encountered when trying to run the software.

Symptom: The message "Cannot connect to batch spawn server" is displayed.

Resolution: This message occurs when the Open Watcom IDE is trying to connect to the batch server. The batch server is a program that is employed by the Open Watcom IDE to run "makes" in the background. There are several reasons why you may receive this message.

- *Installing Under the Host System and Selecting "Modify System Files" During Install*

  For the IDE to run properly under a particular host operating system, the install program must be run on that system.

  It is very important to check the "Modify System Files" when running the install on the host platform. Otherwise, changes required in the host system's environment will not be made. If this is the problem, you should re-install under the host environment and select this option.

- *System stability*

  If for some reason the operating system has become unstable, the IDE may have trouble connecting to the batch server. This can happen if you have run a badly behaved application that caused an exception, for example a page fault. If this is the problem, you should shutdown the operating system and reboot.

- *Running Windows 3.1 in Enhanced Mode*

  The IDE requires at least version 3.1 of Windows to be running, in enhanced mode. Windows 3.0 is not supported.

Running Third-Party Shell Programs

If you run 4DOS.COM or some other shell besides COMMAND.COM, you must change the "BATCHBOX.PIF" file accordingly. You can do this using the standard Windows PIF editor.

Running Virus Checkers

If you are running Central Point's PCTOOLS, VWATCH, or some other virus checker, it may be conflicting with our batch server. To isolate the problem, uninstall the virus checker and see if the IDE works again.

386 Enhanced "Exclusive in Foreground" Option

If you go to the Windows Control Panel, "Scheduling Options" of "386 Enhanced", and the "Exclusive in Foreground" checkbox is checked, uncheck it. This causes our batch server to starve under Windows.

Changes to the SYSTEM.INI File

The WDEBUG.386 driver is required to be installed in the [386Enh] section of SYSTEM.INI. This should have been done automatically by the WATCOM install program when the software was installed under the host environment and the "modify system files" option was selected.

It has been reported that the line

```
OverlappedIO=on
```

not appear in the SYSTEM.INI file.

It appears the user's problem was related to conflicts with other devices installed in the SYSTEM.INI file. On its own, the above line does not appear to affect the execution of the IDE.

It has been reported that the line

```
NoEMMDriver=ON
```

not appear in the SYSTEM.INI file. It will prevent a link from succeeding in the IDE.

7.1 Win-OS/2 and OS/2 Specific

Installing for a Win-OS/2 Host

For Win-OS/2, the install must be run under OS/2 and "Modify System Files" must be selected. This installs the batch server under OS/2, which we require under Win-OS/2. Then the Windows install program should be run under Win-OS/2 so that the program groups will be created. "Modify System Files" should also be checked for the Win-OS/2 install.

Named Pipe Conflicts

Under OS/2, the batch server is a named pipe. Win-OS/2 uses the OS/2 named pipe for the batch server, hence the OS/2 IDE will conflict with the Win-OS/2 IDE if they are both running. If this is the problem, you should run only one of the OS/2 and Win-OS/2 IDE, not both at the same time.

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