Embedded Connectivity Summit 2004

Getting Started with Metrowerks CodeWarrior™ Tools

Launched by Motorola

freescale™ semiconductor

What Is An IDE?

Integrated development environment (IDE)

Tools included in the development chain

- project manager
- editor
- search engine
- source code browser
- custom tools

compiler

assembler

linker

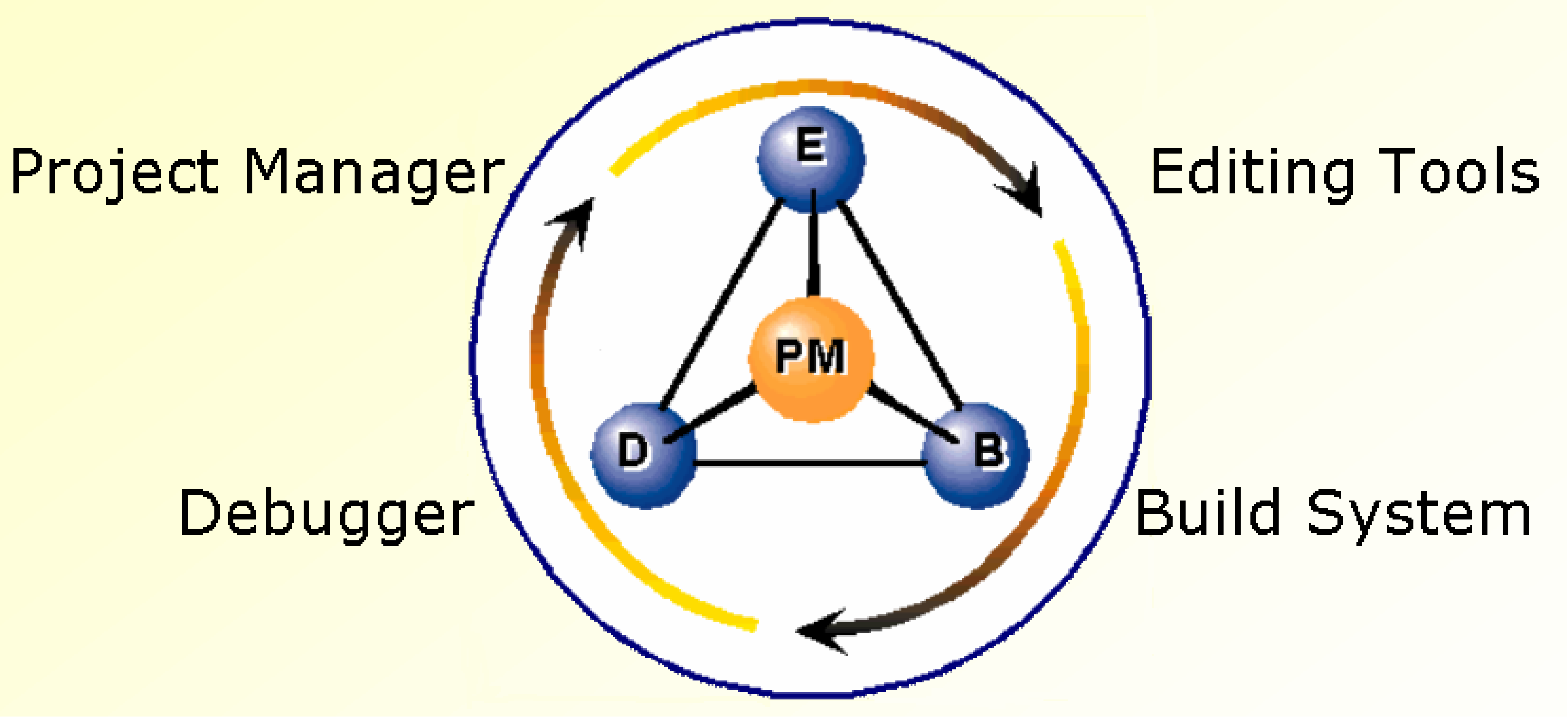
debugger

Joined seamlessly - integrated

Single environment for software development

- consistent operation
- move among all the tools freely
- a non-modal design

IDE Architecture



CodeWarrior Targets

Wireless/ Netcom	Embedded	Transportation	Entertainment /Consumer
DSP 568xx/568xxE E68K/Coldfire PowerPC ISA StarCore DSP	ARM, M-Core, PowerPC, ColdFire	Freescale HC05, HC08, HC11, HC12, HC16 DSP568xx/568xxE ColdFire PowerPC 5xx, 55xx	
Palm OS/Enterprise QNX, ENEA OSE, Symbian, LINUX	Arc (Precise) MQX Quadros RTXC LINUX	OSEK/VDX mobileGT LINUX	
Palm	Nortel Proximity I Wireless Switch		Game Boy Advanced Nintendo GameCube PlayStation, PlayStation 2, Sega Dreamcast
			Linux (x86, PPC) Mac OS/OS X (PPC) Novell Netware (x86) Solaris (SPARC) Win32 (x86)

Project Manager

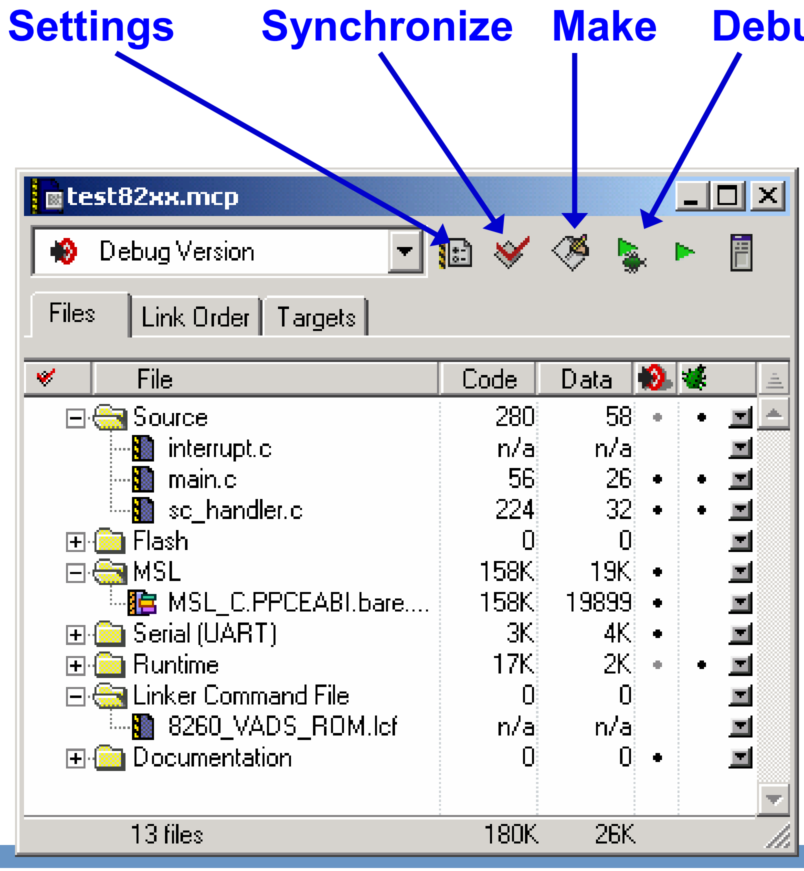
Managing Projects

Embedded Connectivity Summit

Slide 5

Project Manager

The CodeWarrior Project Manager gives you everything you need to manage complex projects and reduce your time to market



Settings

Synchronize

Make

Debug

✓	File	Code	Data		
	⊟ Source	280	58	•	•
	interrupt.c	n/a	n/a		
	main.c	56	26	•	•
	sc_handler.c	224	32	•	•
	⊞ Flash	0	0		
	⊟ MSL	158K	19K	•	
	MSL_C.PPCEABI.bare....	158K	19899	•	
	⊞ Serial (UART)	3K	4K	•	
	⊞ Runtime	17K	2K	•	•
	⊟ Linker Command File	0	0		
	8260_VADS_ROM.lcf	n/a	n/a		
	⊞ Documentation	0	0	•	
	13 files	180K	26K		

- **Automatic dependency management eliminates the need for complicated make files**
- **Multi-threaded, multi-target concept lets you build one target while editing another**
- **Built-in stationery lets you create new projects faster. Definition of user defined stationery possible**
- **Support Sub-Project and dependant Build Targets**

Five Ways to Start a New Project

From Stationery

- Stationery = Project Template
- Support for User Defined Stationery

Using the project wizard*

- GUI guiding you though project set up.

From Empty Project (From Scratch)

- Not recommended, needs a lot of time to set up a project.

Make file importer*

- Importing make files written by hand

Import an XML file

- Previously exported by CodeWarrior, or
- Created by a custom process. Contents must conform to CodeWarrior project DTD

The Project Window

You can have multiple projects open simultaneously

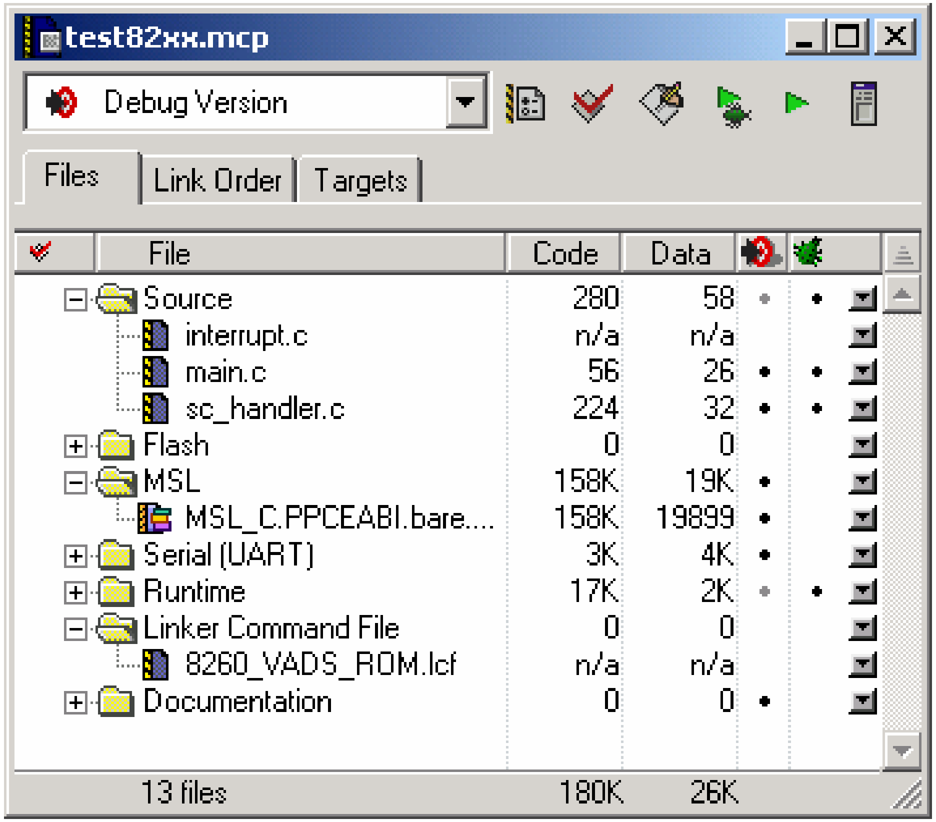
Toolbar has a target popup

Totals size appear along the bottom

There are different views - click tab to change views

- Files
- Link Order
- Targets
- Processor Expert*

Pop up Menu available



test82xx.mcp

Debug Version

Files | Link Order | Targets

✓	File	Code	Data		
	Source	280	58	●	●
	interrupt.c	n/a	n/a		
	main.c	56	26	●	●
	sc_handler.c	224	32	●	●
	Flash	0	0		
	MSL	158K	19K	●	
	MSL_C.PPCEABI.bare....	158K	19899	●	
	Serial (UART)	3K	4K	●	
	Runtime	17K	2K	●	●
	Linker Command File	0	0		
	8260_VADS_ROM.lcf	n/a	n/a		
	Documentation	0	0	●	

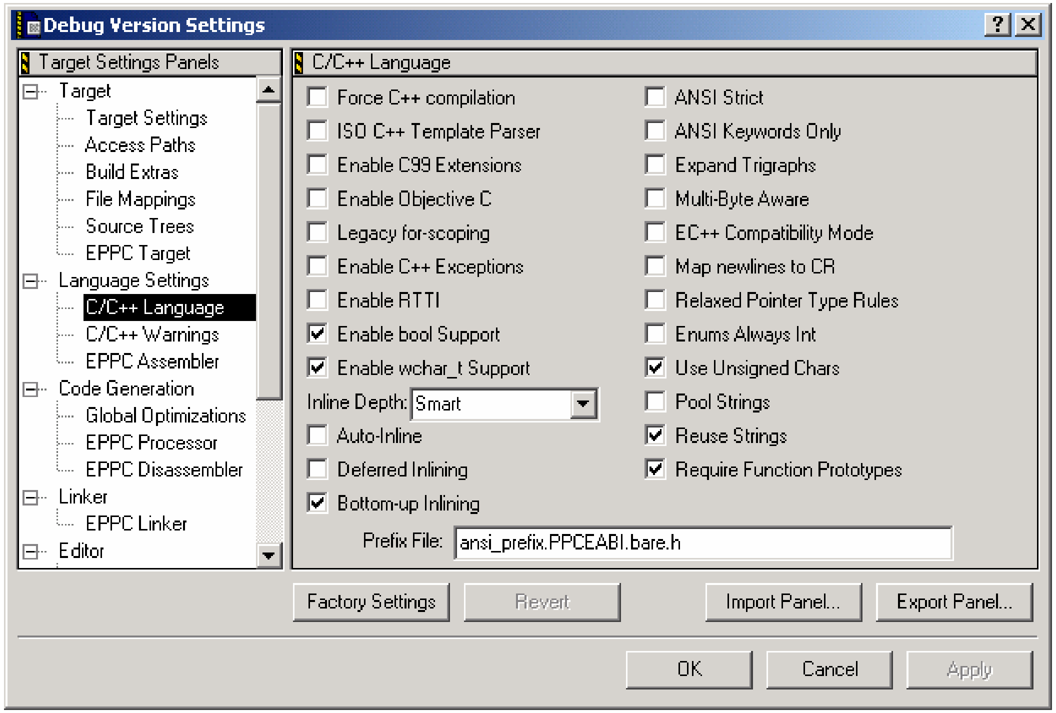
13 files 180K 26K

Using the Settings Window

Can have multiple settings windows open (one/target)

To modify settings

- select the panel in the hierarchical list
- use the UI controls in the panel
- use buttons to save apply (save) settings, revert[1], import/export, or restore defaults
- settings do not take effect until you save them by pressing on the Apply or OK button



C/C++ Language

□ Force C++ compilation	□ ANSI Strict
□ ISO C++ Template Parser	□ ANSI Keywords Only
□ Enable C99 Extensions	□ Expand Trigraphs
□ Enable Objective C	□ Multi-Byte Aware
□ Legacy for-scoping	□ EC++ Compatibility Mode
□ Enable C++ Exceptions	□ Map newlines to CR
□ Enable RTTI	□ Relaxed Pointer Type Rules
☑ Enable bool Support	□ Enums Always Int
☑ Enable wchar_t Support	☑ Use Unsigned Chars
Inline Depth: Smart	□ Pool Strings
□ Auto-Inline	☑ Reuse Strings
□ Deferred Inlining	☑ Require Function Prototypes
☑ Bottom-up Inlining	

Prefix File: ansi_prefix.PPCEABI.bare.h

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Project Manager

Managing Complex Projects

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Managing Complex Projects

Analyze your build system

- identify subsystems and their boundaries
- determine different ways you will build the code

Create projects and targets to match

Create dependencies

CodeWarrior supports

- Target dependency
- Linked target
- Sub-Project
- Linked Sub-Project

Creating Target Dependencies

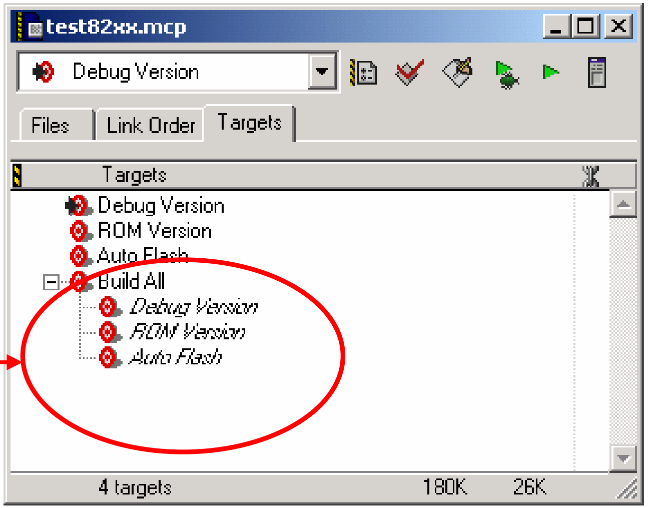
Primary target

- appears in italic in target view
- is built before dependent target
- its object code is not linked into dependent target automatically

Arranges set of independent builds that occur together

- build all (debug and release versions of program)
- shared libraries and the app that uses them

Build All depends on Debug Version ROM Version and Auto Flash


test82xx.mcp

Debug Version

Files | Link Order | Targets

Targets
- Debug Version
- ROM Version
- Auto Flash
- Build All
  - *Debug Version*
  - *ROM Version*
  - *Auto Flash*

4 targets 180K 26K

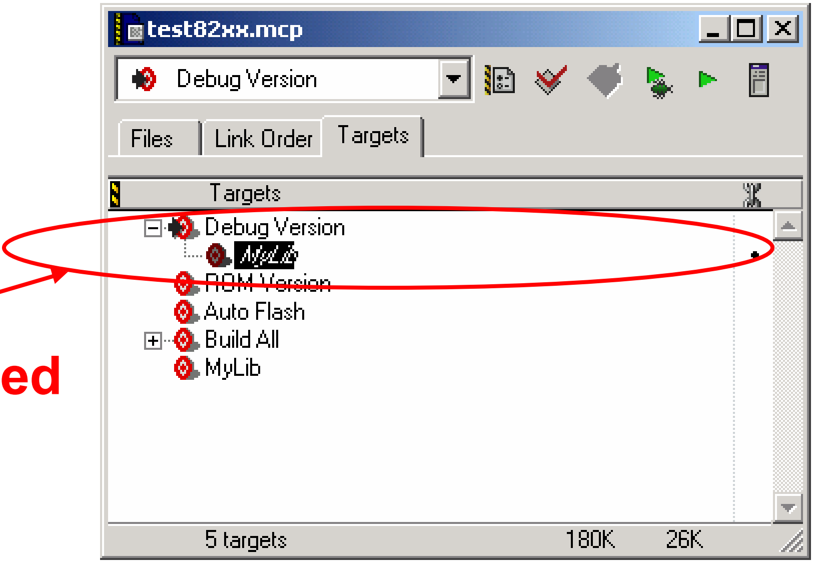
Creating Linked Targets

Click the link column for the primary target so a dot appears

Primary target's object code is linked in the dependent target

Useful for

- a library subproject’s build target
- compile a set of files with a different options set



test82xx.mcp

Debug Version

Code from MyLib is linked to Debug Version

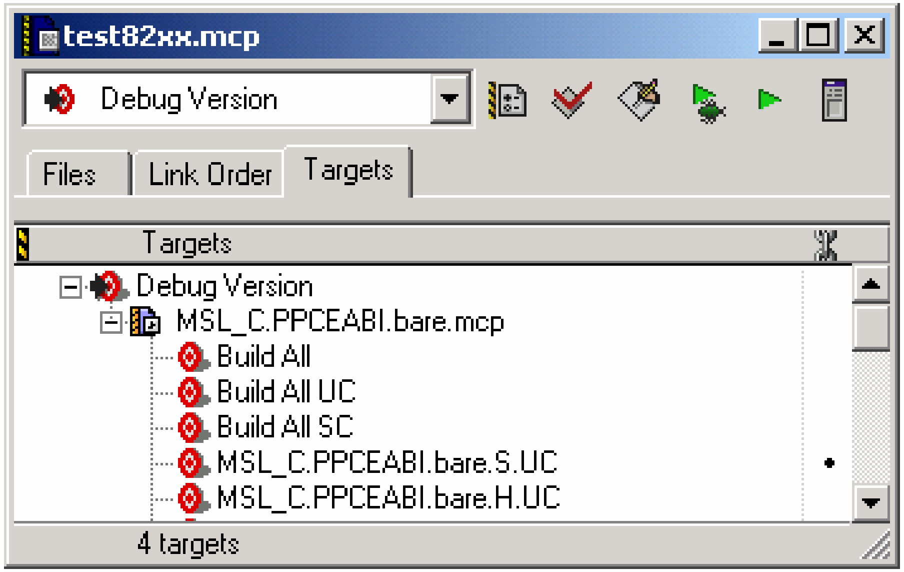
Specifying a Subtarget

In Targets view, parent target becomes hierarchical

- contains subproject, which has subtargets
- use tree control to expose subtargets
- choose subtarget(s) to build by clicking target icon

Building a target will build specified subtarget(s)

- will link in object code for the target if specified
- use link control in Targets view to assign target
- if link not assigned, object code is generated but not linked into output file


test82xx.mcp

Debug Version

Targets

- Debug Version
  - MSL_C.PPCEABI.bare.mcp
    - Build All
    - Build All UC
    - Build All SC
    - MSL_C.PPCEABI.bare.S.UC •
    - MSL_C.PPCEABI.bare.H.UC

4 targets

Project Manager

Managing Source Files

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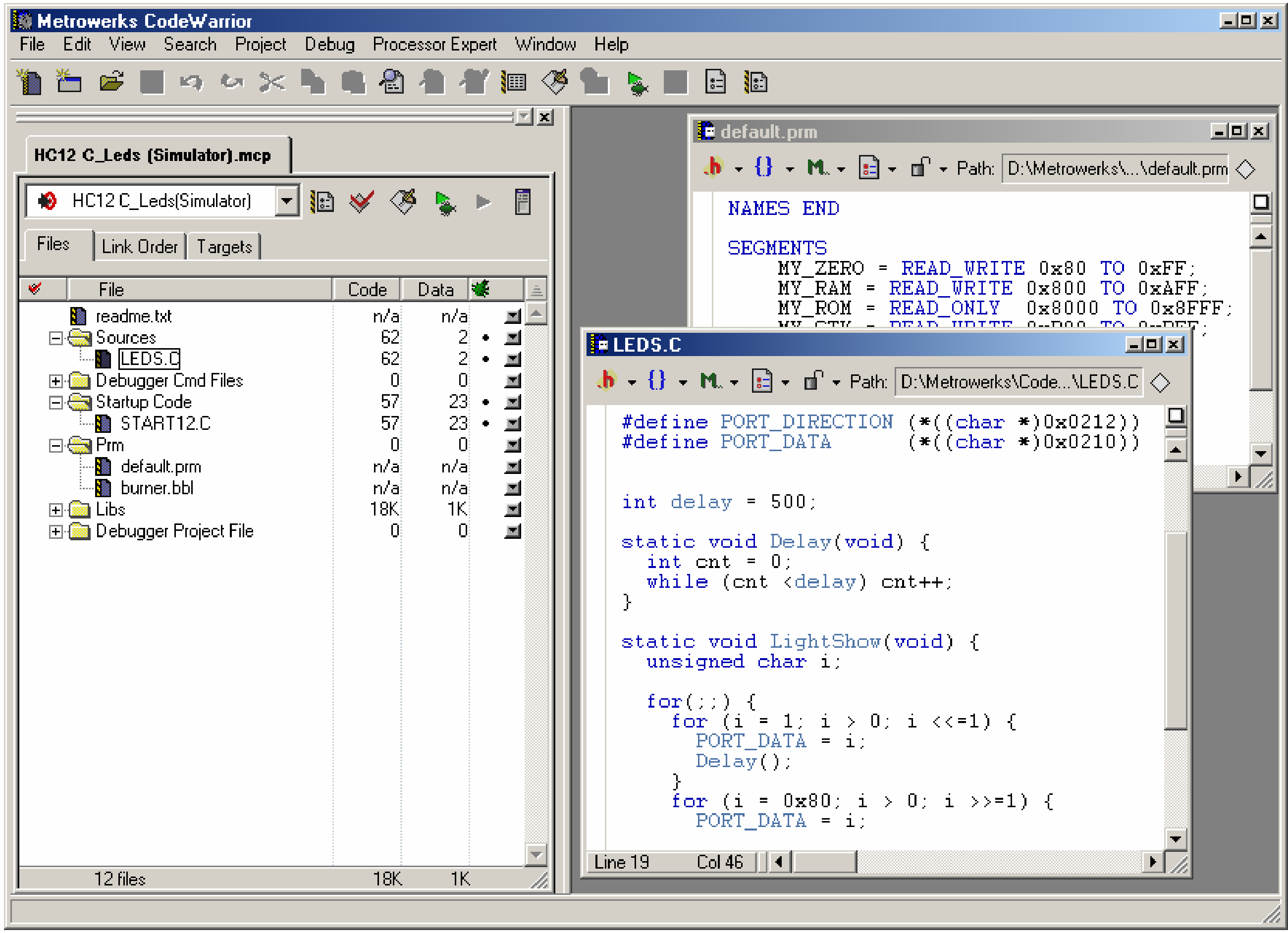
Built-In Editor

- **Any text file can be opened directly from the project window**
- **Language specific Syntax coloring***
- **Configurable auto formatting**
- **Code completion**
- **Standard Windows features:**
  - Drag & Drop
  - Column selection
  - …


Metrowerks CodeWarrior
File Edit View Search Project Debug Processor Expert Window Help
HC12 C_Leds (Simulator).mcp
HC12 C_Leds(Simulator)
Files
Link Order
Targets
default.prm
LEDS.C
Path:

File	Code	Data
readme.txt	n/a	n/a
⊟ Sources	62	2 •
LEDS.C	62	2 •
⊞ Debugger Cmd Files	0	0
⊟ Startup Code	57	23 •
START12.C	57	23 •
⊟ Prm	0	0
default.prm	n/a	n/a
burner.bbl	n/a	n/a
⊞ Libs	18K	1K
⊞ Debugger Project File	0	0
12 files	18K	1K

default.prm — Path: D:\Metrowerks\...\default.prm

```
NAMES END

SEGMENTS
    MY_ZERO = READ_WRITE 0x80 TO 0xFF;
    MY_RAM = READ_WRITE 0x800 TO 0xAFF;
    MY_ROM = READ_ONLY  0x8000 TO 0x8FFF;
```

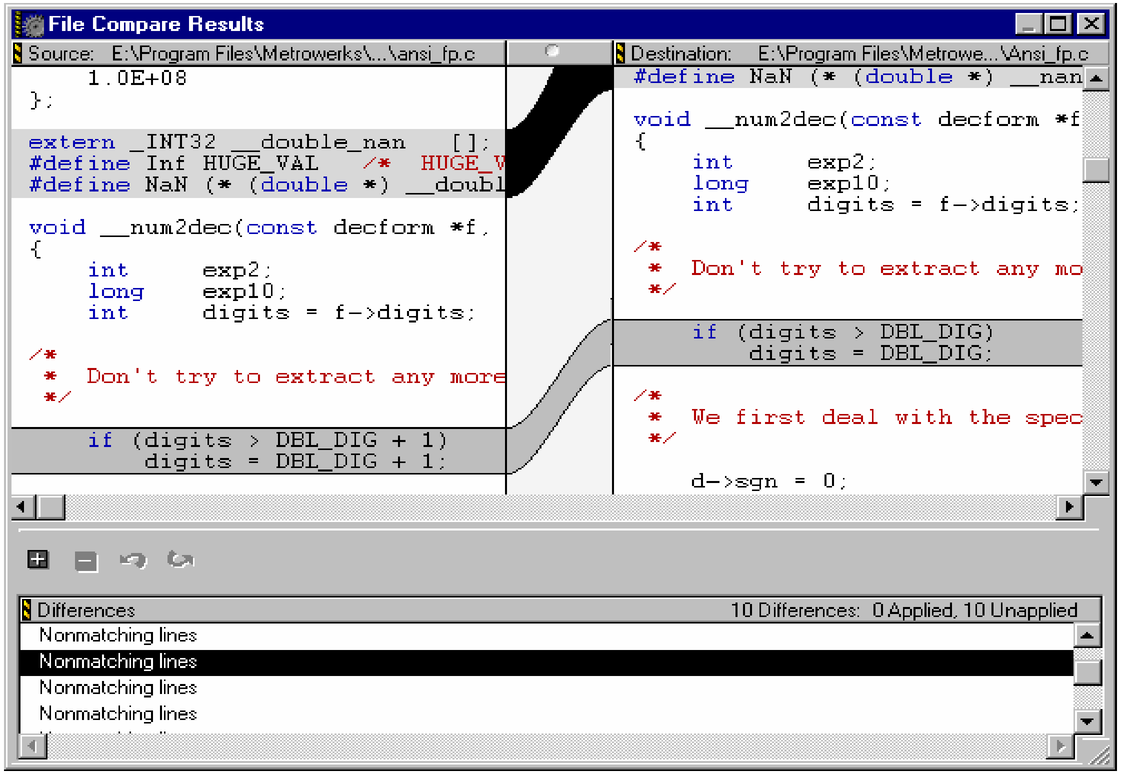
LEDS.C — Path: D:\Metrowerks\Code...\LEDS.C

```
#define PORT_DIRECTION (*((char *)0x0212))
#define PORT_DATA      (*((char *)0x0210))


int delay = 500;

static void Delay(void) {
  int cnt = 0;
  while (cnt <delay) cnt++;
}

static void LightShow(void) {
  unsigned char i;

  for(;;) {
    for (i = 1; i > 0; i <<=1) {
      PORT_DATA = i;
      Delay();
    }
    for (i = 0x80; i > 0; i >>=1) {
      PORT_DATA = i;
```

Line 19 Col 46

Graphical Differencing

The finest graphical difference utility in the industry for increased productivity



File Compare Results

Source: E:\Program Files\Metrowerks\...\ansi_fp.c

```
     1.0E+08
};

extern _INT32 __double_nan   [];
#define Inf HUGE_VAL   /*  HUGE_V
#define NaN (* (double *) __doubl

void __num2dec(const decform *f,
{
     int      exp2;
     long     exp10;
     int      digits = f->digits;

/*
 *  Don't try to extract any more
 */

     if (digits > DBL_DIG + 1)
         digits = DBL_DIG + 1;
```

Destination: E:\Program Files\Metrowe...\Ansi_fp.c

```
#define NaN (* (double *) __nan

void __num2dec(const decform *f
{
     int      exp2;
     long     exp10;
     int      digits = f->digits;

/*
 *  Don't try to extract any mo
 */

     if (digits > DBL_DIG)
         digits = DBL_DIG;

/*
 *  We first deal with the spec
 */

     d->sgn = 0;
```

Differences — 10 Differences: 0 Applied, 10 Unapplied

Nonmatching lines
Nonmatching lines
Nonmatching lines
Nonmatching lines

- Both files stay synchronized when scrolling allowing for faster visual difference comparing
- Shading helps to contrast the differences between files for faster recognition
- Allows to compare singles files or whole directories.

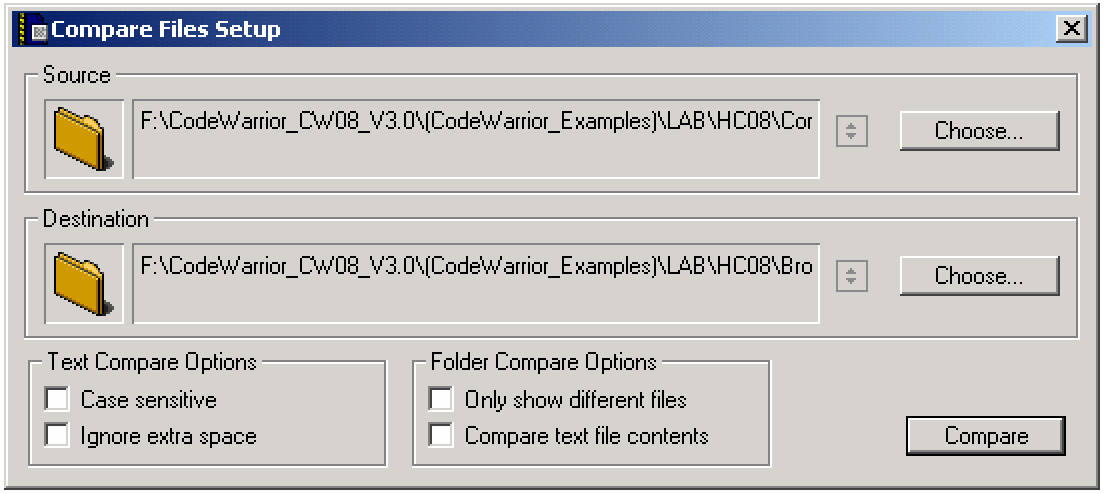
Comparing Directories - 1

Search | Compare Files… command

- specify directories – source and destination

Set the text and folder compare options

- comparison based on date and file size, OR
- set Compare Text File Contents



Compare Files Setup

Source

F:\CodeWarrior_CW08_V3.0\(CodeWarrior_Examples)\LAB\HC08\Cor

Destination

F:\CodeWarrior_CW08_V3.0\(CodeWarrior_Examples)\LAB\HC08\Bro

Text Compare Options

□ Case sensitive

□ Ignore extra space

Folder Compare Options

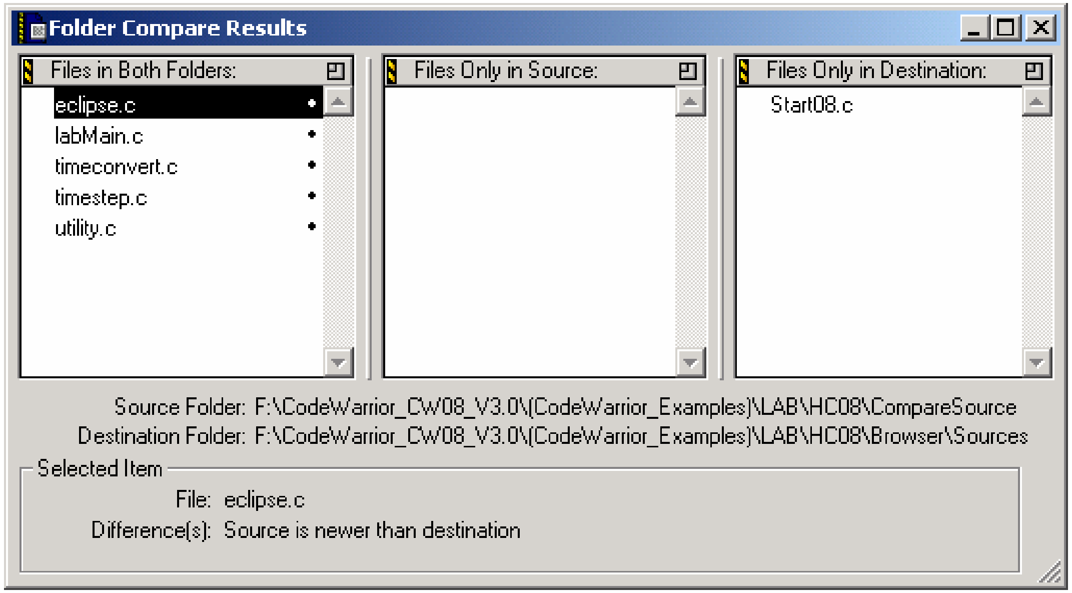
□ Only show different files

□ Compare text file contents

Comparing Directories - 2

Compare and see

- files in both folders, only source, and only destination
- different files identified by black dot
- select a file to see the nature of the differences
- double-click a file to compare files and resolve differences



Files in Both Folders:		Files Only in Source:	Files Only in Destination:
eclipse.c	•		Start08.c
labMain.c	•		
timeconvert.c	•		
timestep.c	•		
utility.c	•		

Source Folder: F:\CodeWarrior_CW08_V3.0\(CodeWarrior_Examples)\LAB\HC08\CompareSource
Destination Folder: F:\CodeWarrior_CW08_V3.0\(CodeWarrior_Examples)\LAB\HC08\Browser\Sources

Selected Item
File: eclipse.c
Difference(s): Source is newer than destination

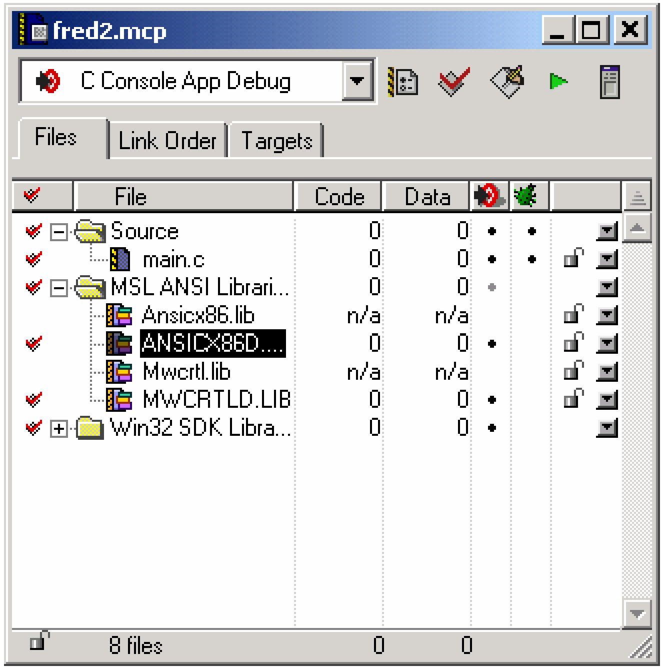
Using Version Control

Our API is publicly available

- 3rd party VCS plug-ins exist
- Metrowerks provides some plug-ins and wrappers

When active, these changes occur in the UI

- menu bar has VCS menu
- Project window has VCS status column
- editor window has working VCS popup



✓	File	Code	Data			
✓	⊟ Source	0	0	•	•	
✓	main.c	0	0	•	•	🔓
✓	⊟ MSL ANSI Librari...	0	0	•		
	Ansicx86.lib	n/a	n/a			🔓
✓	ANSICX86D....	0	0	•		🔓
	Mwcrtl.lib	n/a	n/a			🔓
✓	MWCRTLD.LIB	0	0	•		🔓
✓	⊞ Win32 SDK Libra...	0	0	•		
🔓	8 files	0	0			

Version Control Operations

Vary based on which VCS plug-in you use

Typically you can

- check files in and out
- compare current and checked-in state
- revert to last checked-in state
- use our file compare utility in place of ‘diff’
- perform other VCS operations

Issue commands from either

- VCS menu
- editor window popup
- contextual menu

Version Control Availability

Availability depends upon host platform

	Windows	Linux	Solaris	Mac OS
ClearCase	Yes	No	No	No
CVS	Yes	Yes	Yes	Yes
SourceSafe	Yes	No	No	No
Perforce	Yes	No	No	Yes
Alianbrain	Yes	No	No	Yes

See http://www.metrowerks.com/MW/Develop/Desktop/VersionControl.htm for VCS plug-in availability

Editing Tool

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Editor and Code Navigation System

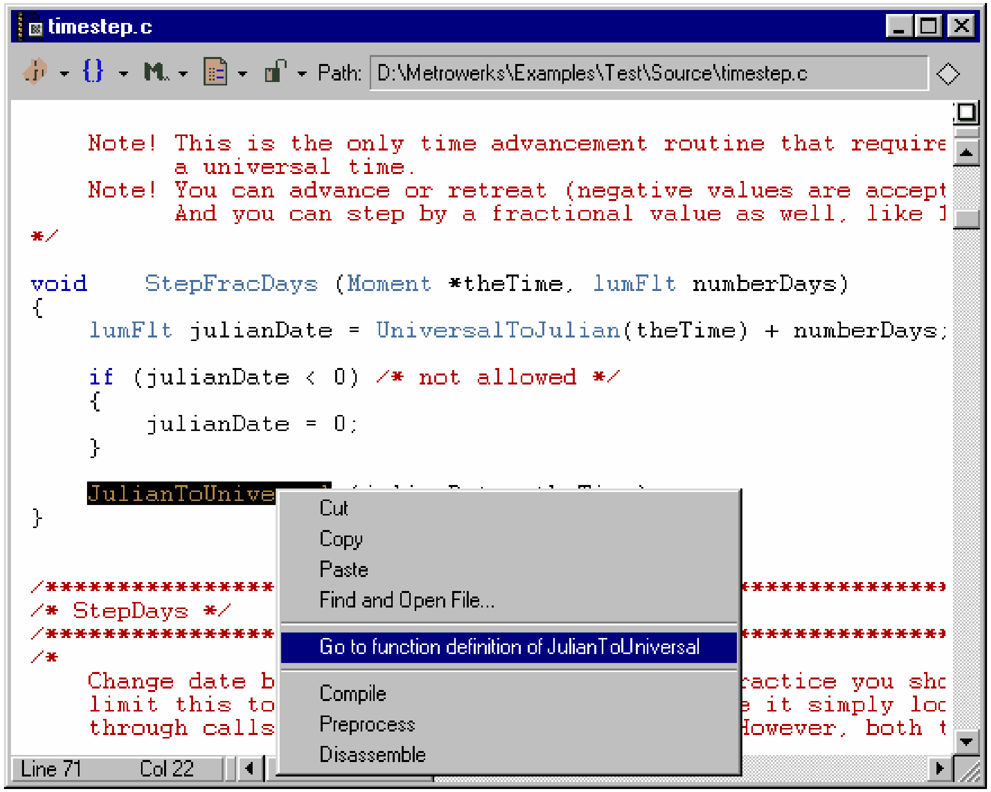
Ideal tool for creating and modifying source code

Source code browsing

Built-in drag and drop support

Access to frequently used code with function and header pull down lists

Ability to customize the environment with user-defined keywords



timestep.c
Path: D:\Metrowerks\Examples\Test\Source\timestep.c
Cut
Copy
Paste
Find and Open File...
Go to function definition of JulianToUniversal
Compile
Preprocess
Disassemble
Line 71
Col 22

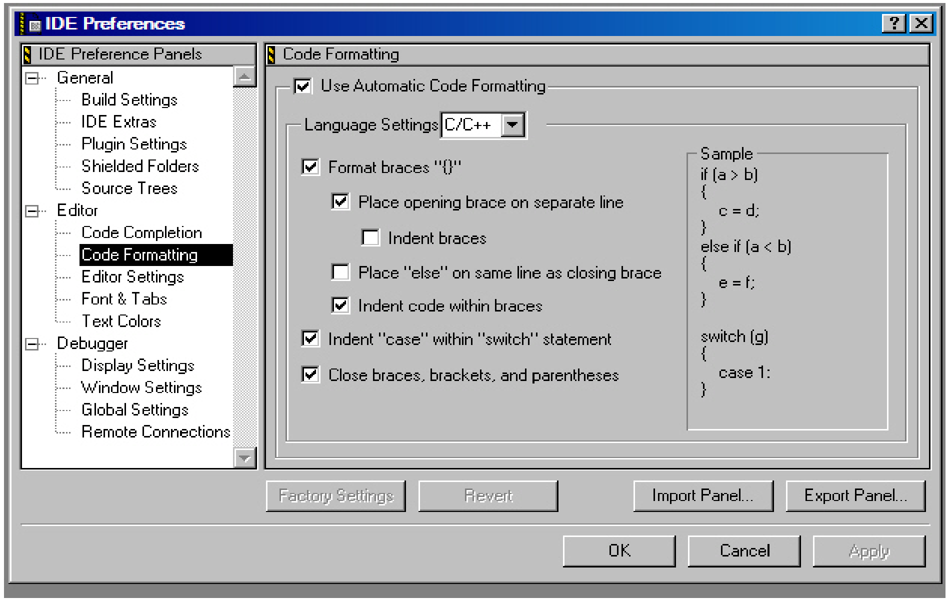
```
    Note! This is the only time advancement routine that require
          a universal time.
    Note! You can advance or retreat (negative values are accept
          And you can step by a fractional value as well, like 1
*/

void    StepFracDays (Moment *theTime, lumFlt numberDays)
{
    lumFlt julianDate = UniversalToJulian(theTime) + numberDays;

    if (julianDate < 0) /* not allowed */
    {
        julianDate = 0;
    }

    JulianToUnive
}


/****************                                ***************
/* StepDays */
/****************                                ***************
/*
    Change date b                                ractice you shc
    limit this to                                e it simply loc
    through calls                                However, both t
```

Slide 24

Code Formatting

Automatically Format Code as You Type:

- Language Sensitive
  - C
  - C++
  - Java
- Only for New Entry
- Automatically Match "{" & "("
- Inserts Spaces, Tabs, & Returns Based on Preference Settings
- If/ Else Preference



Code Formatting

☑ Use Automatic Code Formatting

Language Settings: C/C++

☑ Format braces "{}"

☑ Place opening brace on separate line

☐ Indent braces

☐ Place "else" on same line as closing brace

☑ Indent code within braces

☑ Indent "case" within "switch" statement

☑ Close braces, brackets, and parentheses

Sample

```
if (a > b)
{
    c = d;
}
else if (a < b)
{
    e = f;
}

switch (g)
{
    case 1:
}
```

Using Balance Features

Automatic balancing while typing

- type closing punctuation, opening punctuation flashes
- customize in Edit | Preferences > Editor Settings panel

Double-click a punctuation mark ({ })

- selects text to the opposite mark

Using the Edit | Balance command

- set the text cursor between punctuation marks
- command selects the text between them
- repeat to extend the selection outward

Useful for complex if statements

Editing Tool

Navigating Source Code

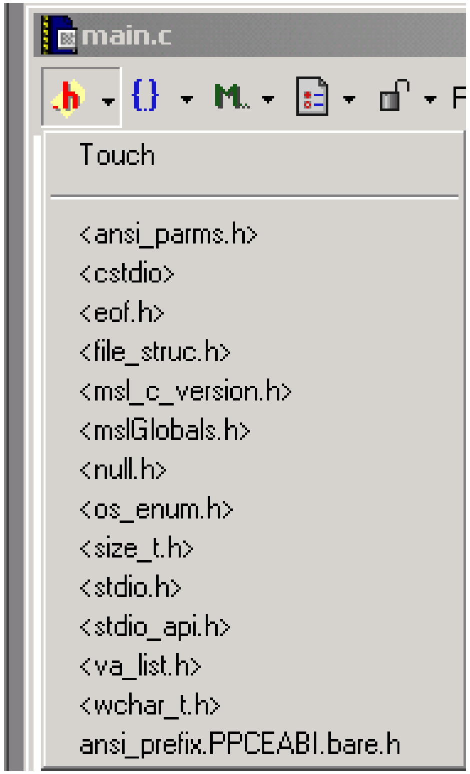
Opening Related Files – After Compile

Header files included in a source file

- in the Editor window for the source file use the header popup

Source files that include a header file

- in the Editor window for the header file use the header popup

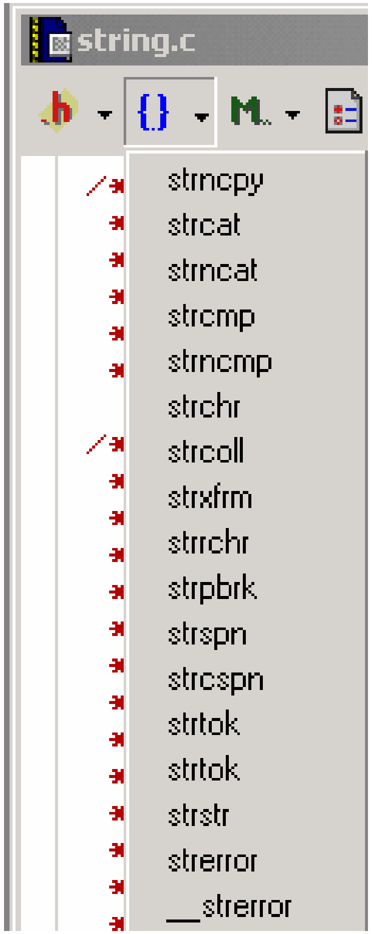


Using the Function Pop-up

Click the button, choose a function

- no need to compile the file
- limited to functions for that file

Set arbitrary markers with `#pragma mark` ***`MarkerName`***



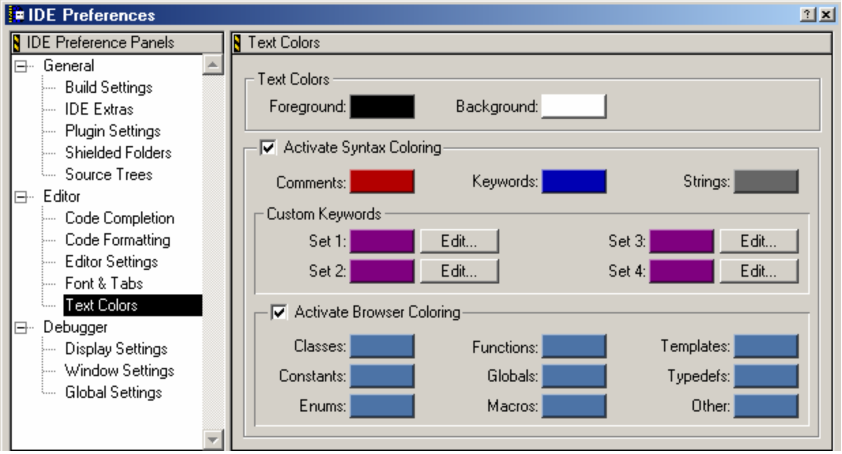
Browser Basics

The compiler generates a database of symbols

- unique and powerful navigation features
- available only after code is processed
- Language parser available as an alternative*

Set colors in the Text Colors preferences

- Edit | Preferences > Text Colors panel



IDE Preferences

IDE Preference Panels

- General
  - Build Settings
  - IDE Extras
  - Plugin Settings
  - Shielded Folders
  - Source Trees
- Editor
  - Code Completion
  - Code Formatting
  - Editor Settings
  - Font & Tabs
  - Text Colors
- Debugger
  - Display Settings
  - Window Settings
  - Global Settings

Text Colors

Text Colors

Foreground: ⬛ Background: ⬜

☑ Activate Syntax Coloring

Comments: 🟥 Keywords: 🟦 Strings: ⬛

Custom Keywords

Set 1: 🟪 Edit... Set 3: 🟪 Edit...

Set 2: 🟪 Edit... Set 4: 🟪 Edit...

☑ Activate Browser Coloring

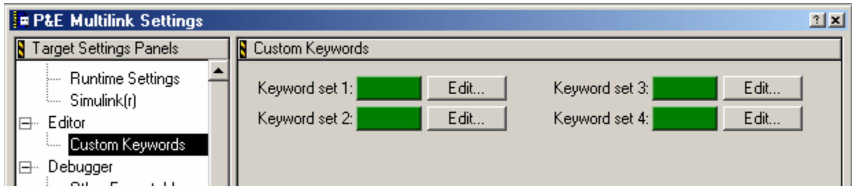
Classes: 🟦 Functions: 🟦 Templates: 🟦

Constants: 🟦 Globals: 🟦 Typedefs: 🟦

Enums: 🟦 Macros: 🟦 Other: 🟦

Set colors for Custom Keywords

- Project Preferences > Custom Keywords



P&E Multilink Settings

Target Settings Panels

- Runtime Settings
- Simulink(r)
- Editor
  - Custom Keywords
- Debugger

Custom Keywords

Keyword set 1: 🟩 Edit... Keyword set 3: 🟩 Edit...

Keyword set 2: 🟩 Edit... Keyword set 4: 🟩 Edit...

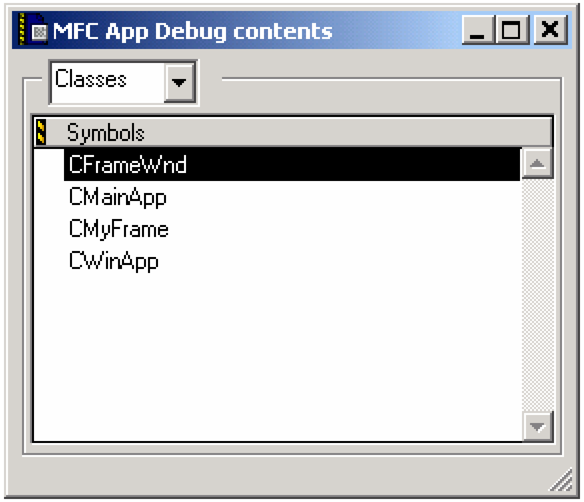
Using Browser Contents

Choose View | Browser Contents

Choose a category (Classes, Constants, Enums, Functions, Globals, Macros, Templates, Typedefs)

Double-click an item to go to preferred location

Right-click to jump to alternate locations



MFC App Debug contents

Classes

Symbols

CFrameWnd

CMainApp

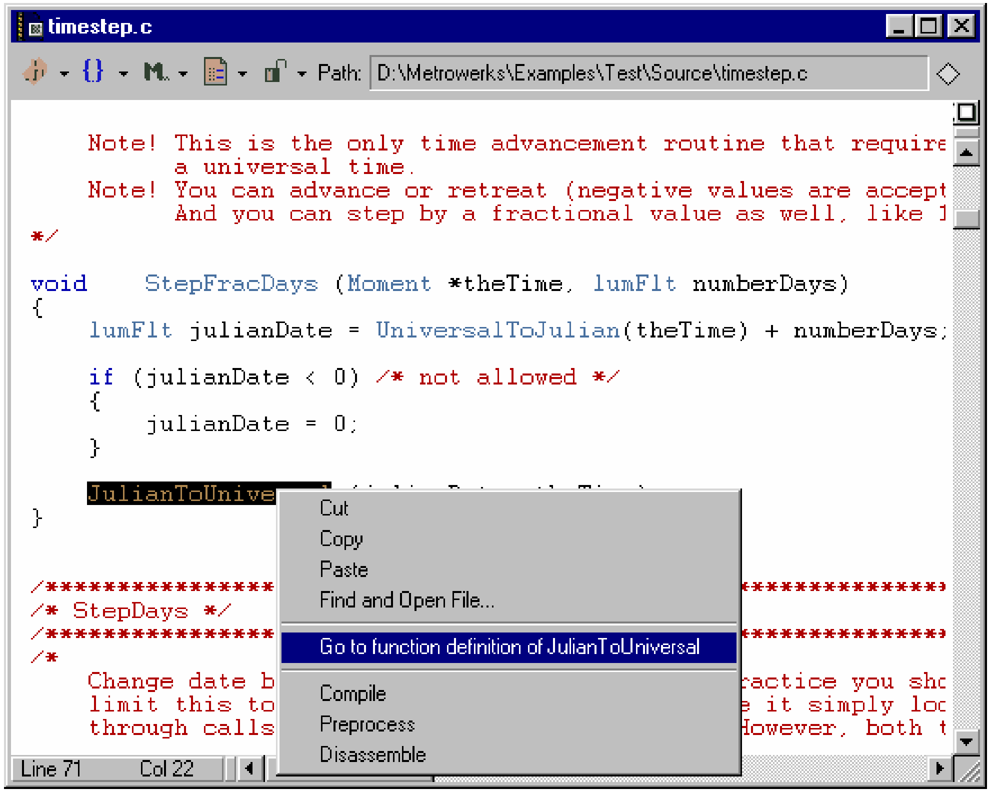
CMyFrame

CWinApp

Source Code Browser

The Pop up menu entry “Go to …” is used to jump to the selected element definition.

- **Can be used to retrieve:**
  - **A function implementation**
  - **A variable definition**
  - **A constant definition**
  - **A typedef definition**
  - **A macro definition**
- **Browser maintains a list of the views you used**
  - **Allows to move through browser history.**
- **Code completion available too**


timestep.c
Path: D:\Metrowerks\Examples\Test\Source\timestep.c
Cut
Copy
Paste
Find and Open File...
Go to function definition of JulianToUniversal
Compile
Preprocess
Disassemble
Line 71
Col 22

```
    Note! This is the only time advancement routine that require
          a universal time.
    Note! You can advance or retreat (negative values are accept
          And you can step by a fractional value as well, like 1
*/

void    StepFracDays (Moment *theTime, lumFlt numberDays)
{
    lumFlt julianDate = UniversalToJulian(theTime) + numberDays;

    if (julianDate < 0) /* not allowed */
    {
        julianDate = 0;
    }

    JulianToUnive
}


/****************                         ***************
/* StepDays */
/****************                         ***************
/*
    Change date b                         ractice you sho
    limit this to                         e it simply loc
    through calls                         However, both t
```

Editing Tool

Navigating Object-Oriented Code

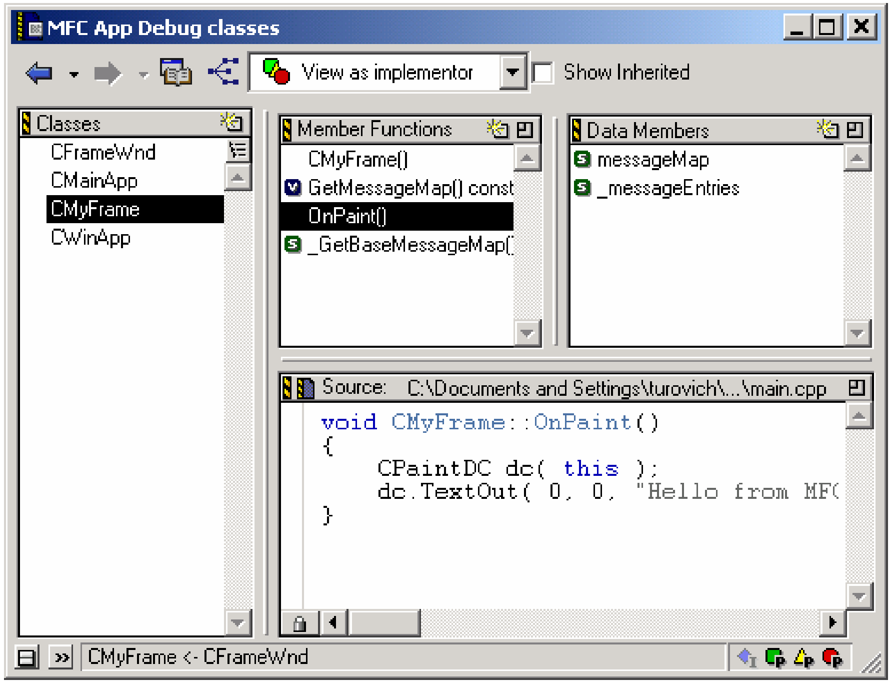
Using the Class Browser

Multiple panes

- classes, functions, data members, code
- member icons for virtual, static, pure virtual members

Controls for classes

- view classes alphabetically or hierarchically
- show or hide entire pane
- class declaration control to see class declaration



Source: C:\Documents and Settings\turovich\...\main.cpp

```
void CMyFrame::OnPaint()
{
    CPaintDC dc( this );
    dc.TextOut( 0, 0, "Hello from MF(
}
```

CMyFrame <- CFrameWnd

Authoring Classes

Available when Class Browser is active

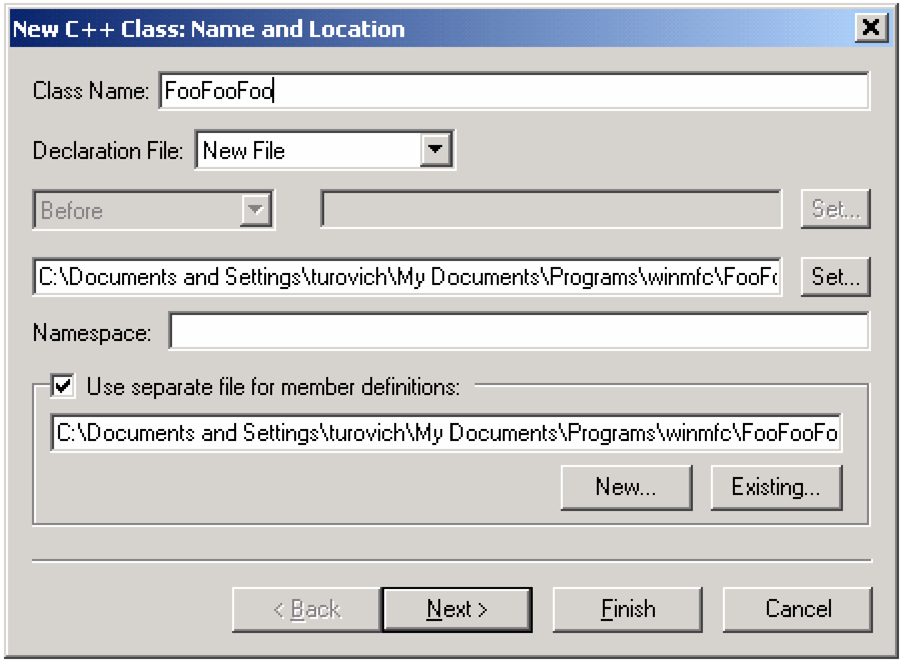
- Select
  - "Browser | New Class…"
- wizard appears

Wizards available for C++

- classes, functions, data members

Fill in fields in the wizard dialogs

CodeWarrior creates header, implementation files


New C++ Class: Name and Location

Class Name: FooFooFoo

Declaration File: New File

C:\Documents and Settings\turovich\My Documents\Programs\winmfc\FooF

Namespace:

☑ Use separate file for member definitions:

C:\Documents and Settings\turovich\My Documents\Programs\winmfc\FooFooFo

Using the Hierarchy Views

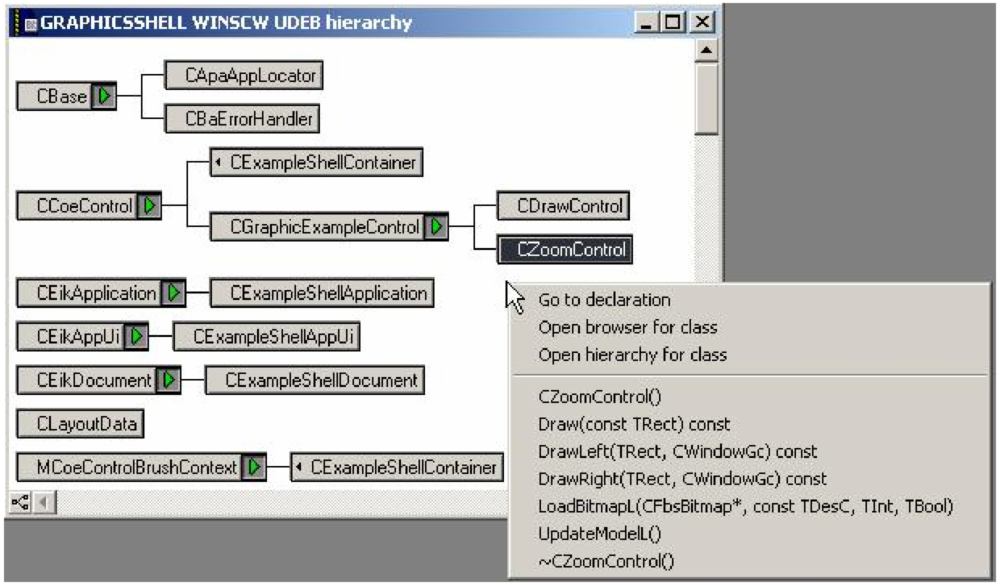
Multi-class hierarchy to view all class inheritance

- wide and deep disclosure of trees
- multiple ancestors available in a popup
- display lines as right angles or fan-style
- click the control to left of scrollbar to toggle lines
- state of window remembered automatically

Single-class hierarchy

- Similar, but focused on a single class

Use the context popup navigate



Building Code

Build Tools

Compiler

- C, C++, EC++, Assembly
- Support segmentation for Variable, Code, Constants
- Statement Level inline Assembler
- Support for command line tool
- Generate standard ELF/DWARF object file

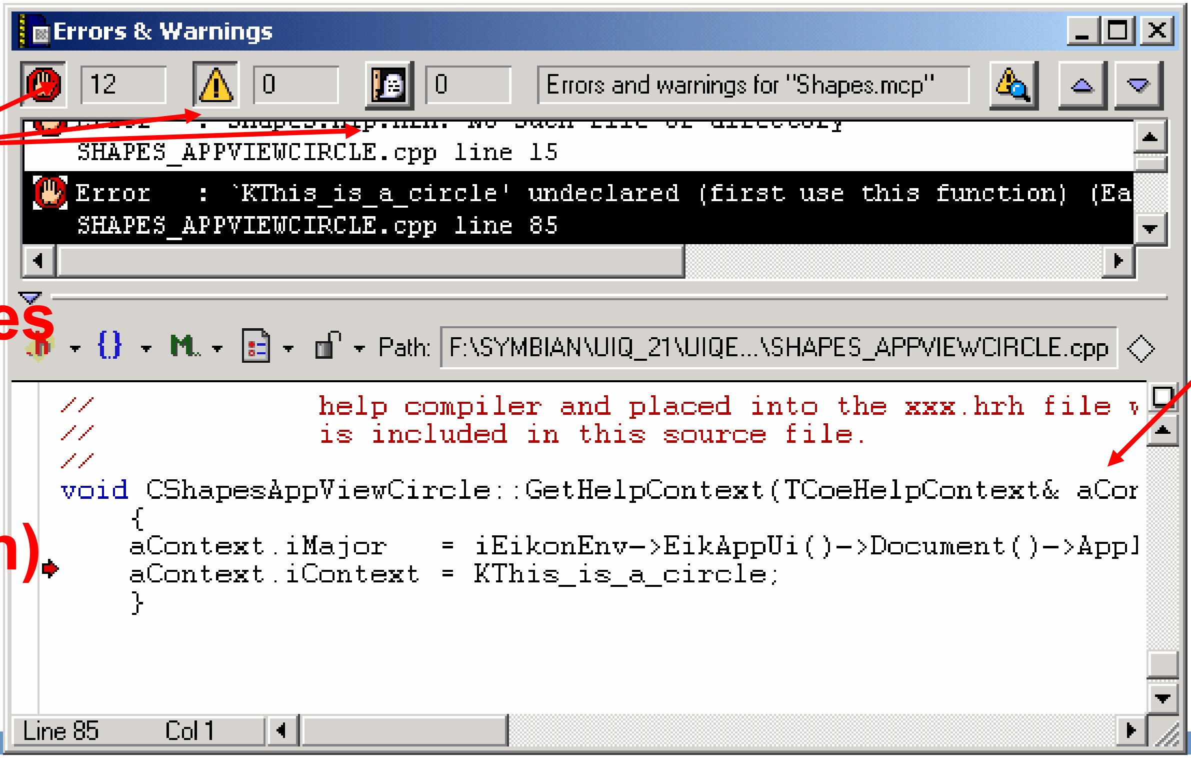
Linker

- Linker dead strip unused code
- Full configurable startup code
- Supports linker defined symbol to access segment start and end address in C source code
- Generation of a MAP file containing info about the build process

Fixing Errors and Warnings

Error window appears automatically if necessary

- It works like the search results window
- You can show/hide errors/warnings
- Edit in place; there is no need to open the file



Errors & Warnings
12
0
0
Errors and warnings for "Shapes.mcp"
Path: F:\SYMBIAN\UIQ_21\UIQE...\SHAPES_APPVIEWCIRCLE.cpp
Line 85
Col 1

```
Error   : Shapes.hrp.hrh: No such file or directory
SHAPES_APPVIEWCIRCLE.cpp line 15
Error   : `KThis_is_a_circle' undeclared (first use this function) (Ea
SHAPES_APPVIEWCIRCLE.cpp line 85
```

```
//              help compiler and placed into the xxx.hrh file w
//              is included in this source file.
//
void CShapesAppViewCircle::GetHelpContext(TCoeHelpContext& aCon
    {
    aContext.iMajor   = iEikonEnv->EikAppUi()->Document()->Appl
    aContext.iContext = KThis_is_a_circle;
    }
```

Toggles display of messages (Error, Warning, Information)

Edit Window

Slide 39

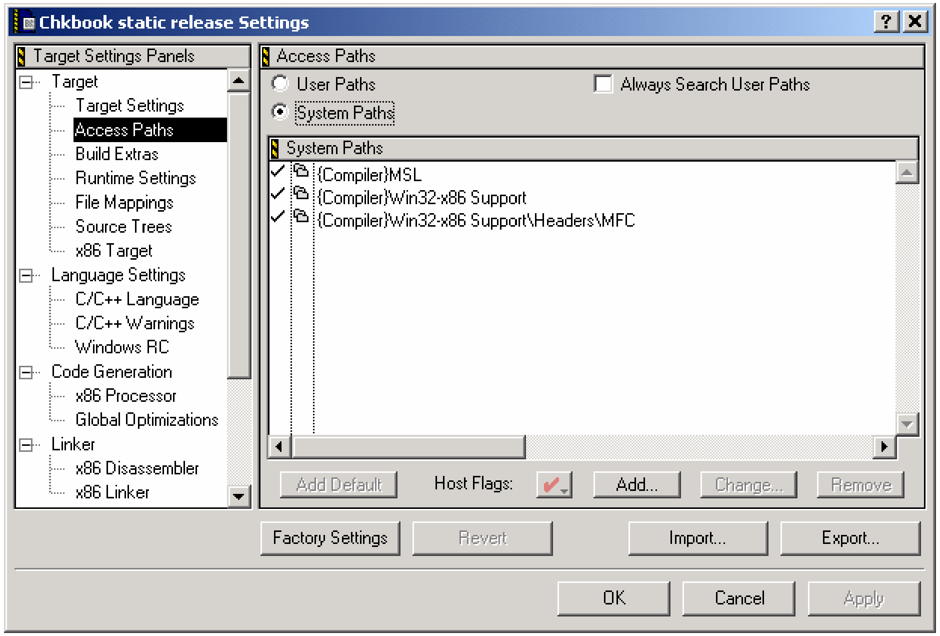
What Are Access Paths?

Where the project manager looks for files

Critical when compiling

Control with the Access Paths settings panel

- Edit | *TargetName* Settings > Access Paths panel



Chkbook static release Settings

Access Paths

○ User Paths □ Always Search User Paths

● System Paths

System Paths

✓ {Compiler}MSL

✓ {Compiler}Win32-x86 Support

✓ {Compiler}Win32-x86 Support\Headers\MFC

User path example

- your project folder

System path examples

- library source file directory
- OS interfaces directory

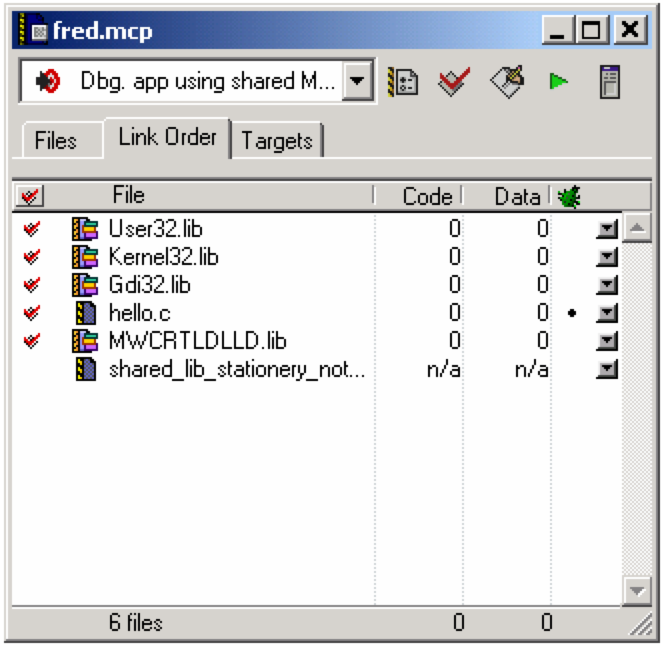
Changing Link Order

Use the project window Link Order view

Drag files into the desired order

For targets that support code segments or overlays

- Link Order is called Segments or Overlays view



✓	File	Code	Data	
✓	User32.lib	0	0	
✓	Kernel32.lib	0	0	
✓	Gdi32.lib	0	0	
✓	hello.c	0	0	•
✓	MWCRTLDLLD.lib	0	0	
	shared_lib_stationery_not...	n/a	n/a	
	6 files	0	0	

Debugging

Embedded Connectivity Summit

Viewing Code - Thread Window

Source pane

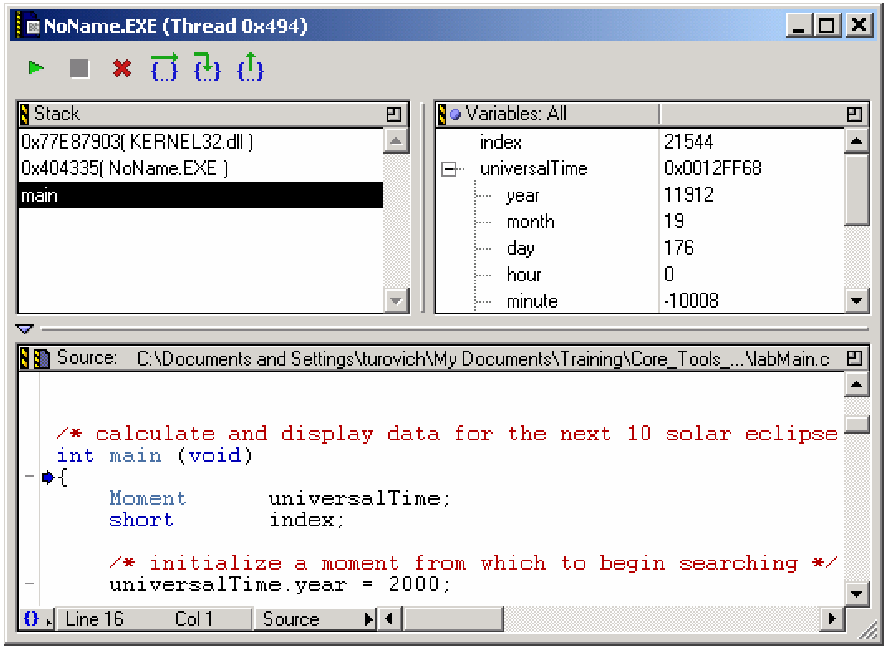
- displays executing code - not editable
- view as source, assembly, or mixed
- step through code and set breakpoints
- can hide the source pane and use editor to step

Stack pane

- displays ordered list of calling chain
- select function to see source and variables
- variables show the current values

Variables pane

- shows all variables in scope
- covered in another lesson[1]



NoName.EXE (Thread 0x494)

Stack

```
0x77E87903( KERNEL32.dll )
0x404335( NoName.EXE )
main
```

Variables: All

index	21544
universalTime	0x0012FF68
year	11912
month	19
day	176
hour	0
minute	-10008

Source: C:\Documents and Settings\turovich\My Documents\Training\Core_Tools_...\labMain.c

```
/* calculate and display data for the next 10 solar eclipse
int main (void)
{
    Moment      universalTime;
    short       index;

    /* initialize a moment from which to begin searching */
    universalTime.year = 2000;
```

Line 16 Col 1 Source

Slide 43

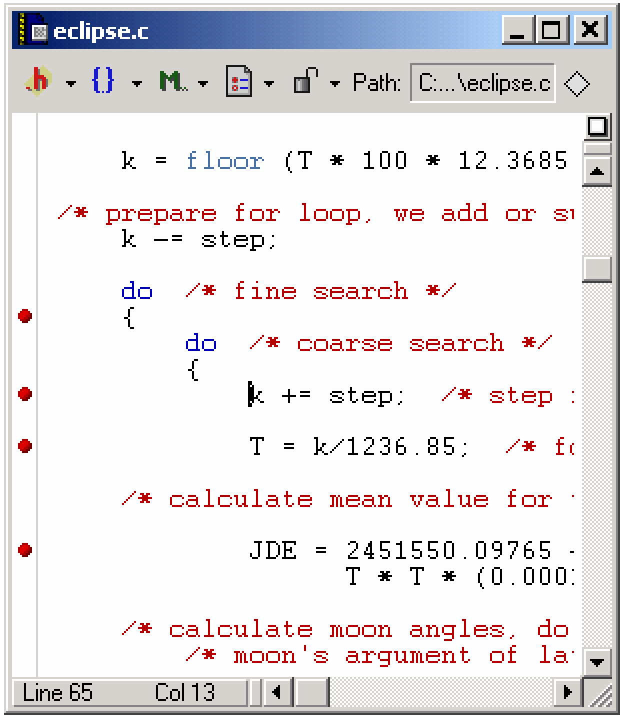
Breakpoint Basics

Breakpoints available while editing or debugging

- breakpoint column is at the left in any source view

Project manager associates breakpoint with source file

- breakpoint is persistent between debug sessions
- affects all targets in project that use the file
- source file remains a plain text file



```
      k = floor (T * 100 * 12.3685
   /* prepare for loop, we add or s
      k -= step;

      do  /* fine search */
●     {
          do  /* coarse search */
          {
●             k += step;  /* step :
●             T = k/1236.85;  /* f
      /* calculate mean value for :
●             JDE = 2451550.09765 -
                    T * T * (0.000:
      /* calculate moon angles, do
          /* moon's argument of la
```

Setting a Conditional Breakpoint

Set the breakpoint if it does not exist

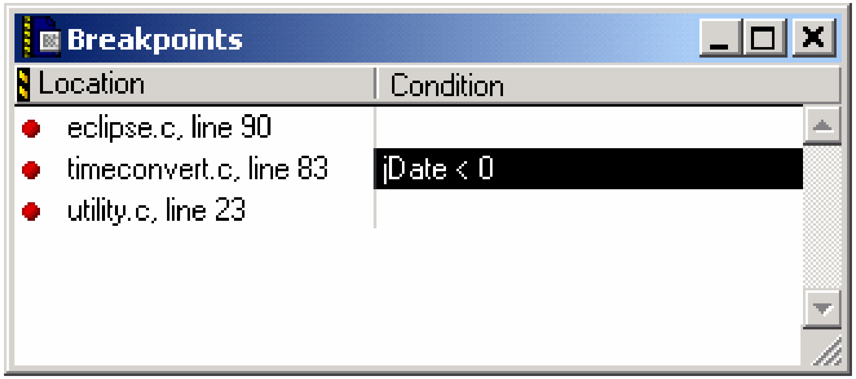
Open the breakpoints window

- use View | Breakpoints command

Double-click the condition column

Enter or edit the condition

- use C syntax
- condition can't create side-effects
  - can’t call functions
  - can’t change values



Location	Condition
● eclipse.c, line 90	
● timeconvert.c, line 83	iDate < 0
● utility.c, line 23	

Breakpoint stops execution if the condition is true (`0==false`, `!0==true`)

Eventpoint Basics

Eventpoint

- a conditional breakpoint
- performs a task
- does not halt program execution

Types of eventpoints

- Log point-logs to msg window and/or speaks a string or expression
- Pause point-pauses to refresh debug data
- Script point-runs a script, application, or other item
- Skip point-skips execution on a line of source
- Sound point-plays a sound

Data Basics

Debugger can display (among other things)

- all variables - local and global
- memory
- processor registers

Data appears in panes and separate windows

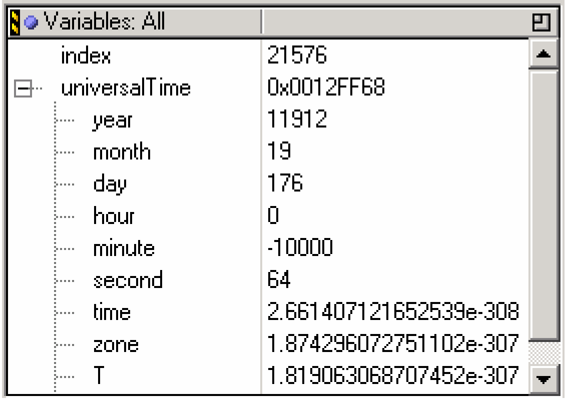
Variables have a name and a value

- select name OR value to initiate actions

Values are almost always editable

Use hierarchy control for structures, pointers

Viewing Local Variables



Variables: All	
index	21576
⊟ universalTime	0x0012FF68
year	11912
month	19
day	176
hour	0
minute	-10000
second	64
time	2.661407121652539e-308
zone	1.874296072751102e-307
T	1.819063068707452e-307

Primary location is the
Thread window variables pane

- opens when you launch code under debugger control
- typically shows variables for executing function

Select an item in the stack pane, its variables appear

- values are *current* values
- pointer contents may have changed

Can view and track variables
in other ways as well, e.g.

- tooltips
- expressions window

Viewing Global Variables

Primary location is the global variables window[1]

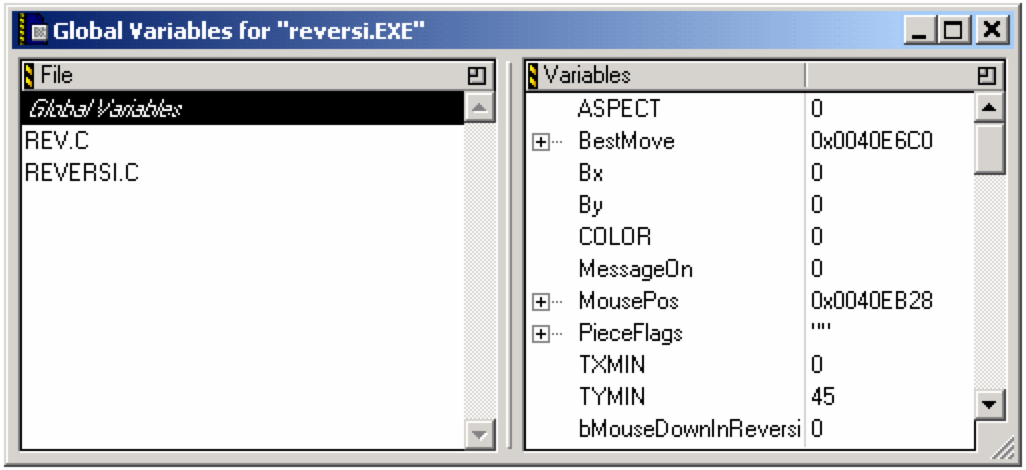
Open with View | Global Variables Window command

Select an item in the file pane to

- view all globals, OR
- see static variables declared in a file

Can view and track variables in other ways as well, e.g.

- tooltips
- expressions window



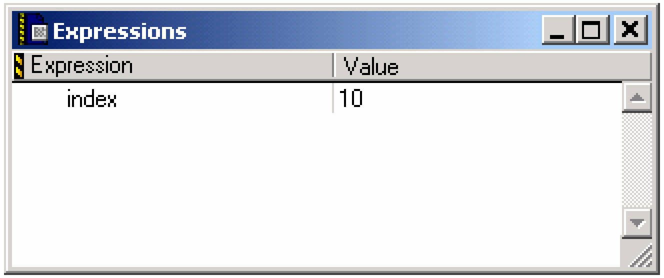
Global Variables for "reversi.EXE"

File

- *Global Variables*
- REV.C
- REVERSI.C

Variables	
ASPECT	0
⊞ BestMove	0x0040E6C0
Bx	0
By	0
COLOR	0
MessageOn	0
⊞ MousePos	0x0040EB28
⊞ PieceFlags	""
TXMIN	0
TYMIN	45
bMouseDownInReversi	0

Tracking a Variable



Expressions

Expression	Value
index	10

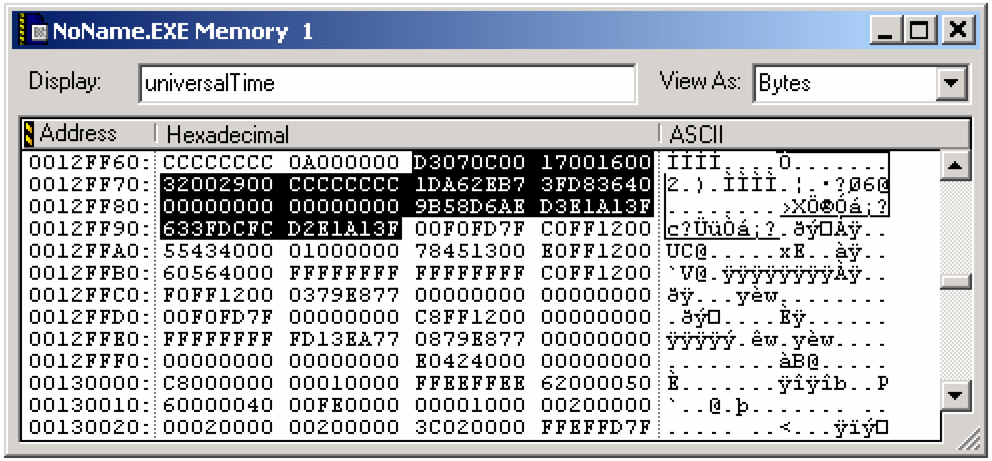
Display a variable in the Expressions window

- select name, Data | Copy to Expression command, OR
- drag from any variable pane, OR
- copy and paste name to a new expression

Advantages

- variable persists across scope boundaries
- no need to set up again when re-entering a routine
- open tree persists for structured variables
- information persists across debugging sessions
- can have multiple instances of the same variable

Viewing and Editing Memory



Display: universalTime

View As: Bytes

```
Address    Hexadecimal                             ASCII
0012FF60: CCCCCCCC 0A000000 D3070C00 17001600 ÌÌÌÌ....Ó.......
0012FF70: 32002900 CCCCCCCC 1DA62EB7 3FD83640 2.).ÌÌÌÌ.¦.·?Ø6@
0012FF80: 00000000 00000000 9B58D6AE D3E1A13F ........›XÖ®Óá¡?
0012FF90: 633FDCFC D2E1A13F 00F0FD7F C0FF1200 c?ÜüÒá¡?.ðý.Àÿ..
0012FFA0: 55434000 01000000 78451300 E0FF1200 UC@.....xE..àÿ..
0012FFB0: 60564000 FFFFFFFF FFFFFFFF C0FF1200 `V@.ÿÿÿÿÿÿÿÿÀÿ..
0012FFC0: F0FF1200 0379E877 00000000 00000000 ðÿ...yèw........
0012FFD0: 00F0FD7F 00000000 C8FF1200 00000000 .ðý.....Èÿ......
0012FFE0: FFFFFFFF FD13EA77 0879E877 00000000 ÿÿÿÿý.êw.yèw....
0012FFF0: 00000000 00000000 E0424000 00000000 ........àB@.....
00130000: C8000000 00010000 FFEEFFEE 62000050 È.......ÿîÿîb..P
00130010: 60000040 00FE0000 00001000 00200000 `..@.þ..........
00130020: 00020000 00200000 3C020000 FFEFFD7F ........<...ÿïý.
```

Set the base address

- enter a literal value
- copy or drag a variable name
- select a variable before opening the window

Edit contents - hex or ASCII[1]

Data | View Memory As command

- view memory as structured type
- can filter members to see what is of interest

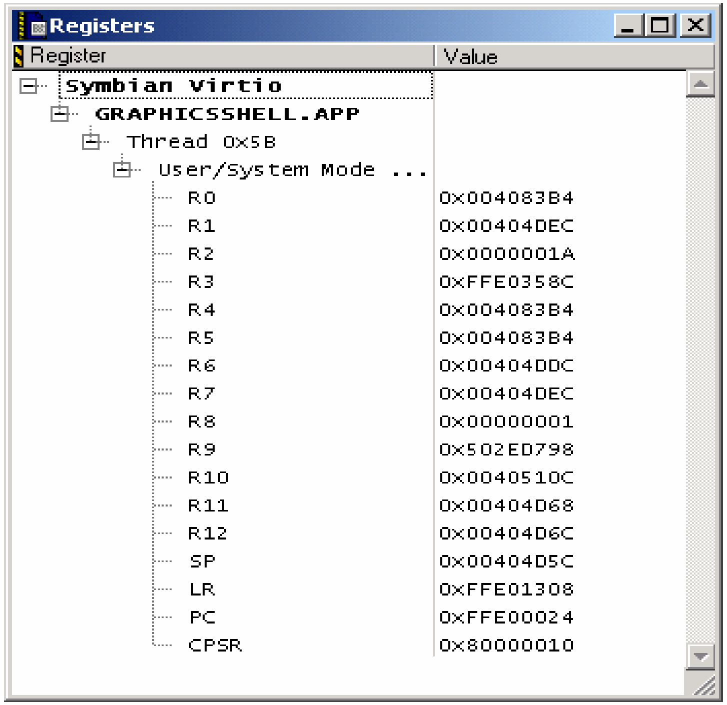
Viewing and Editing Registers

Use “View | Registers” command to display registers

Displayed by thread

Use Disclosure controls to view/hide each set

Double-click a register value to edit

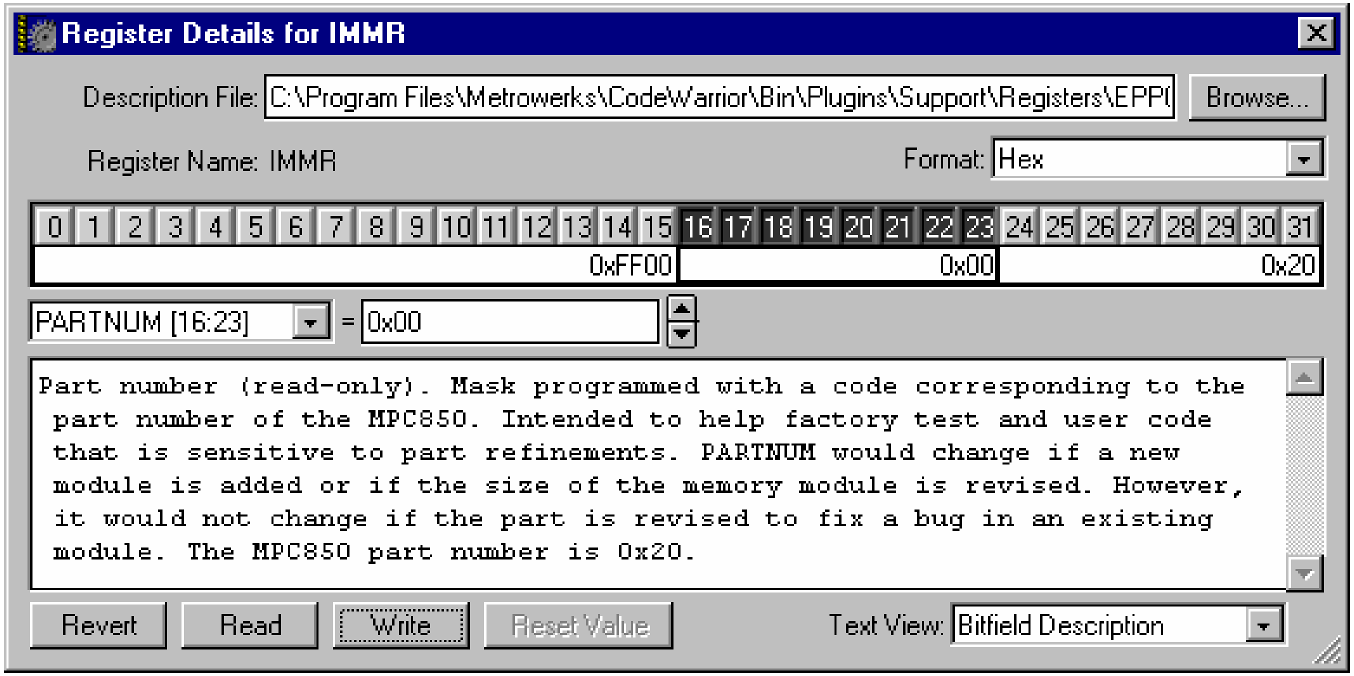


Register	Value
Symbian Virtio	
GRAPHICSSHELL.APP	
Thread 0x5B	
User/System Mode ...	
R0	0x004083B4
R1	0x00404DEC
R2	0x0000001A
R3	0xFFE0358C
R4	0x004083B4
R5	0x004083B4
R6	0x00404DDC
R7	0x00404DEC
R8	0x00000001
R9	0x502ED798
R10	0x0040510C
R11	0x00404D68
R12	0x00404D6C
SP	0x00404D5C
LR	0xFFE01308
PC	0xFFE00024
CPSR	0x80000010

Register View in Debugger

"There's no guesswork involved in determining a PowerPC specific register value"

- Every PowerPC Register Supported
- Register or bit-field modification
- Each register and bit field described



Description File: C:\Program Files\Metrowerks\CodeWarrior\Bin\Plugins\Support\Registers\EPP(

Register Name: IMMR

Format: Hex

0xFF00 0x00 0x20

PARTNUM [16:23] = 0x00

```
Part number (read-only). Mask programmed with a code corresponding to the
 part number of the MPC850. Intended to help factory test and user code
 that is sensitive to part refinements. PARTNUM would change if a new
 module is added or if the size of the memory module is revised. However,
 it would not change if the part is revised to fix a bug in an existing
 module. The MPC850 part number is 0x20.
```

Text View: Bitfield Description

Advanced Debugging

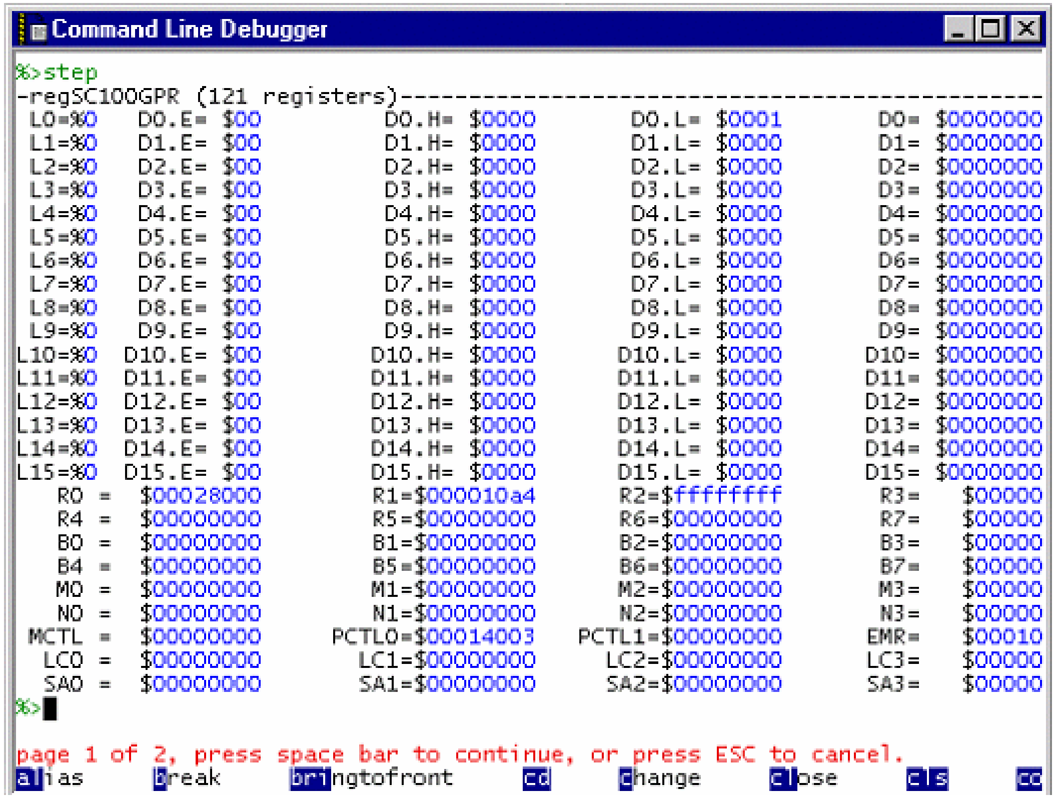
Embedded Connectivity Summit

TCL Command-line Debugger*

Can issue commands

- through the command-line
- from within the IDE
- or both

Additional debugger commands available



```
%>step
-regSC100GPR (121 registers)-----------------------------------------------
 L0=%0   D0.E= $00         D0.H= $0000       D0.L= $0001       D0= $0000000
 L1=%0   D1.E= $00         D1.H= $0000       D1.L= $0000       D1= $0000000
 L2=%0   D2.E= $00         D2.H= $0000       D2.L= $0000       D2= $0000000
 L3=%0   D3.E= $00         D3.H= $0000       D3.L= $0000       D3= $0000000
 L4=%0   D4.E= $00         D4.H= $0000       D4.L= $0000       D4= $0000000
 L5=%0   D5.E= $00         D5.H= $0000       D5.L= $0000       D5= $0000000
 L6=%0   D6.E= $00         D6.H= $0000       D6.L= $0000       D6= $0000000
 L7=%0   D7.E= $00         D7.H= $0000       D7.L= $0000       D7= $0000000
 L8=%0   D8.E= $00         D8.H= $0000       D8.L= $0000       D8= $0000000
 L9=%0   D9.E= $00         D9.H= $0000       D9.L= $0000       D9= $0000000
L10=%0  D10.E= $00        D10.H= $0000      D10.L= $0000      D10= $0000000
L11=%0  D11.E= $00        D11.H= $0000      D11.L= $0000      D11= $0000000
L12=%0  D12.E= $00        D12.H= $0000      D12.L= $0000      D12= $0000000
L13=%0  D13.E= $00        D13.H= $0000      D13.L= $0000      D13= $0000000
L14=%0  D14.E= $00        D14.H= $0000      D14.L= $0000      D14= $0000000
L15=%0  D15.E= $00        D15.H= $0000      D15.L= $0000      D15= $0000000
   R0 =  $00028000        R1=$000010a4      R2=$ffffffff       R3=   $00000
   R4 =  $00000000        R5=$00000000      R6=$00000000       R7=   $00000
   B0 =  $00000000        B1=$00000000      B2=$00000000       B3=   $00000
   B4 =  $00000000        B5=$00000000      B6=$00000000       B7=   $00000
   M0 =  $00000000        M1=$00000000      M2=$00000000       M3=   $00000
   N0 =  $00000000        N1=$00000000      N2=$00000000       N3=   $00000
 MCTL =  $00000000     PCTL0=$00014003   PCTL1=$00000000      EMR=   $00010
  LC0 =  $00000000       LC1=$00000000     LC2=$00000000      LC3=   $00000
  SA0 =  $00000000       SA1=$00000000     SA2=$00000000      SA3=   $00000
%>

page 1 of 2, press space bar to continue, or press ESC to cancel.
alias     break     bringtofront     cd     change     close     cls     cc
```

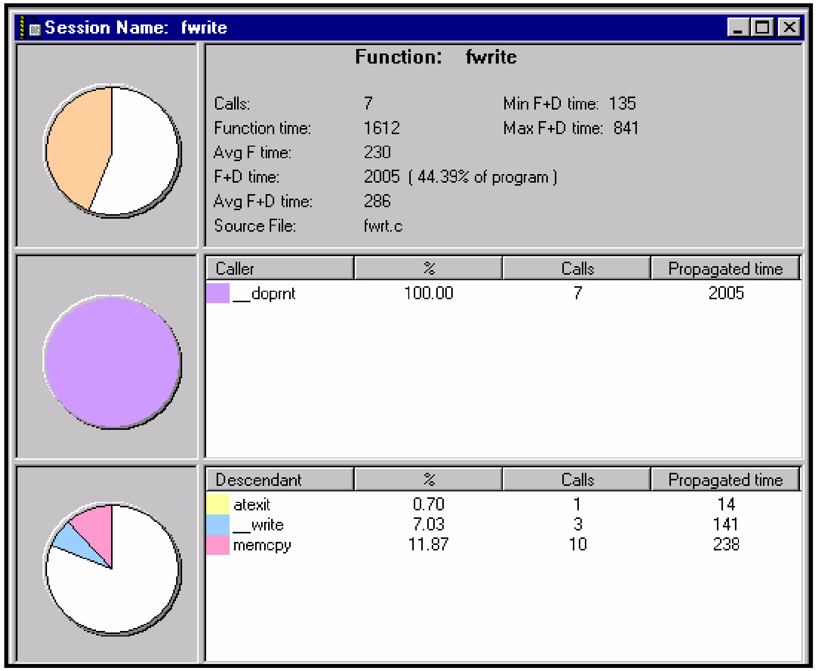
Slide 55

CodeWarrior Profiler Utility*

Ability to profile applications to achieve optimum performance

Displays graphical information about a specific function and its immediate callers and descendants

Easy to read the graphical and tabular formats



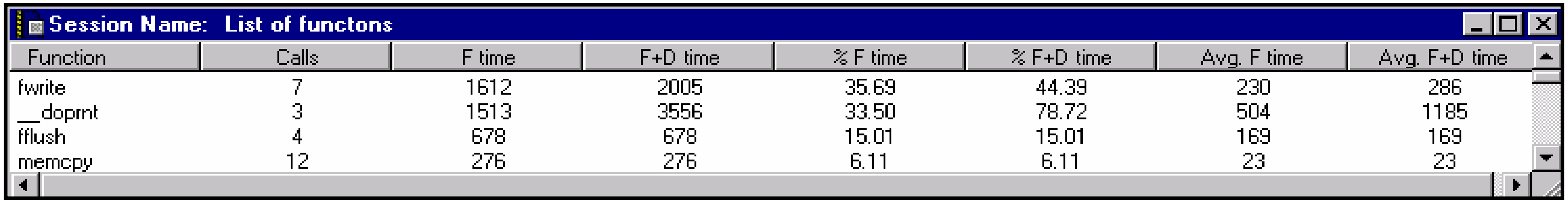
Session Name: fwrite

Function: fwrite

Calls:	7	Min F+D time:	135
Function time:	1612	Max F+D time:	841
Avg F time:	230		
F+D time:	2005 (44.39% of program)		
Avg F+D time:	286		
Source File:	fwrt.c		

Caller	%	Calls	Propagated time
__doprnt	100.00	7	2005

Descendant	%	Calls	Propagated time
atexit	0.70	1	14
__write	7.03	3	141
memcpy	11.87	10	238



Session Name: List of functons

Function	Calls	F time	F+D time	% F time	% F+D time	Avg. F time	Avg. F+D time
fwrite	7	1612	2005	35.69	44.39	230	286
__doprnt	3	1513	3556	33.50	78.72	504	1185
fflush	4	678	678	15.01	15.01	169	169
memcpy	12	276	276	6.11	6.11	23	23

Launched by Motorola
freescale™ semiconductor

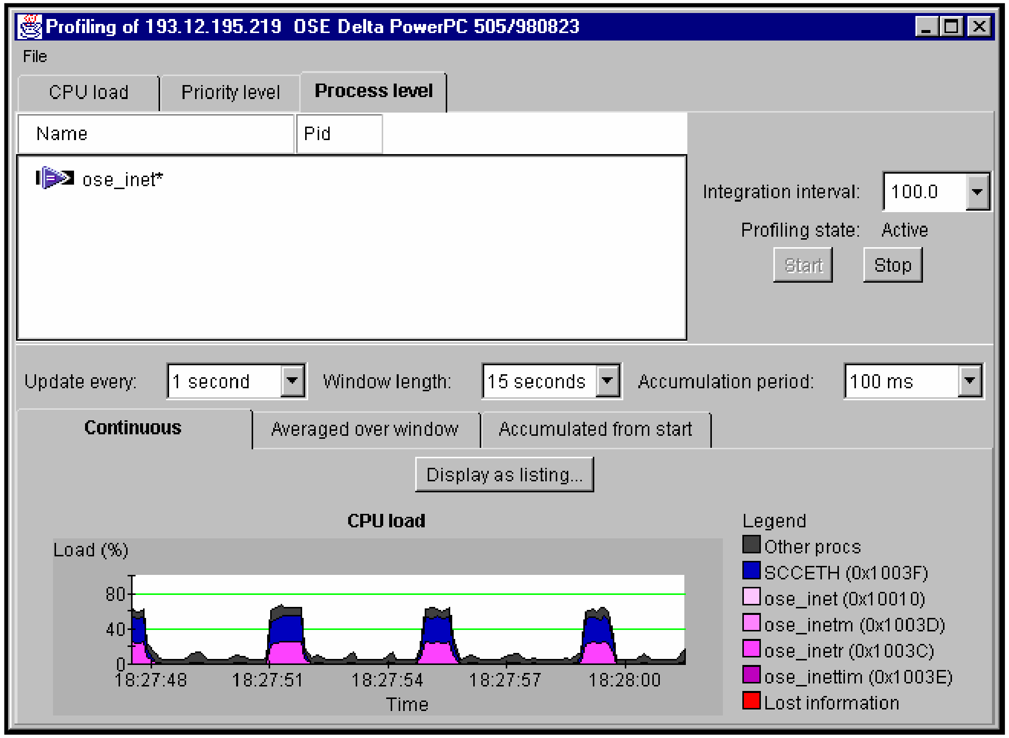
CodeWarrior RTOS Aware Debugging*

RTOS-Awareness Plug-in

- Published RTOS awareness API
- Sample Plug-in source available

Provides access to:

- Process
- Threads
- Task
- Queues
- Semaphores
- Mailboxes



Profiling of 193.12.195.219 OSE Delta PowerPC 505/980823

Name	Pid
ose_inet*	

Integration interval: 100.0

Profiling state: Active

Update every: 1 second

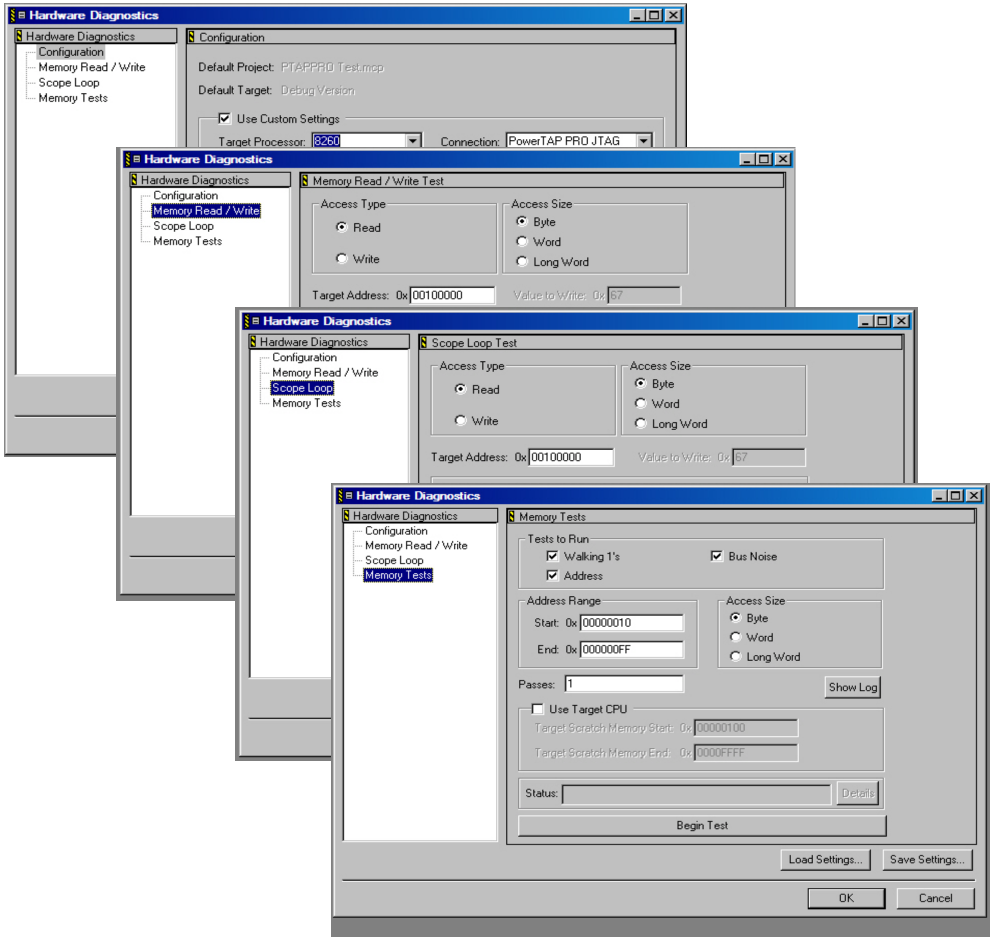
Window length: 15 seconds

Accumulation period: 100 ms

Hardware Tools

Embedded Connectivity Summit

Hardware Diagnostics*



Configuration

Default Project: PTAPPRO Test.mcp

Default Target: Debug Version

☑ Use Custom Settings

Target Processor: 8260 Connection: PowerTAP PRO JTAG

Memory Read / Write Test

Access Type: ● Read ○ Write

Access Size: ● Byte ○ Word ○ Long Word

Target Address: 0x 00100000 Value to Write: 0x 67

Scope Loop Test

Access Type: ● Read ○ Write

Access Size: ● Byte ○ Word ○ Long Word

Target Address: 0x 00100000 Value to Write: 0x 67

Memory Tests

Tests to Run: ☑ Walking 1's ☑ Bus Noise ☑ Address

Address Range: Start: 0x 00000010 End: 0x 000000FF

Access Size: ● Byte ○ Word ○ Long Word

Passes: 1

☐ Use Target CPU

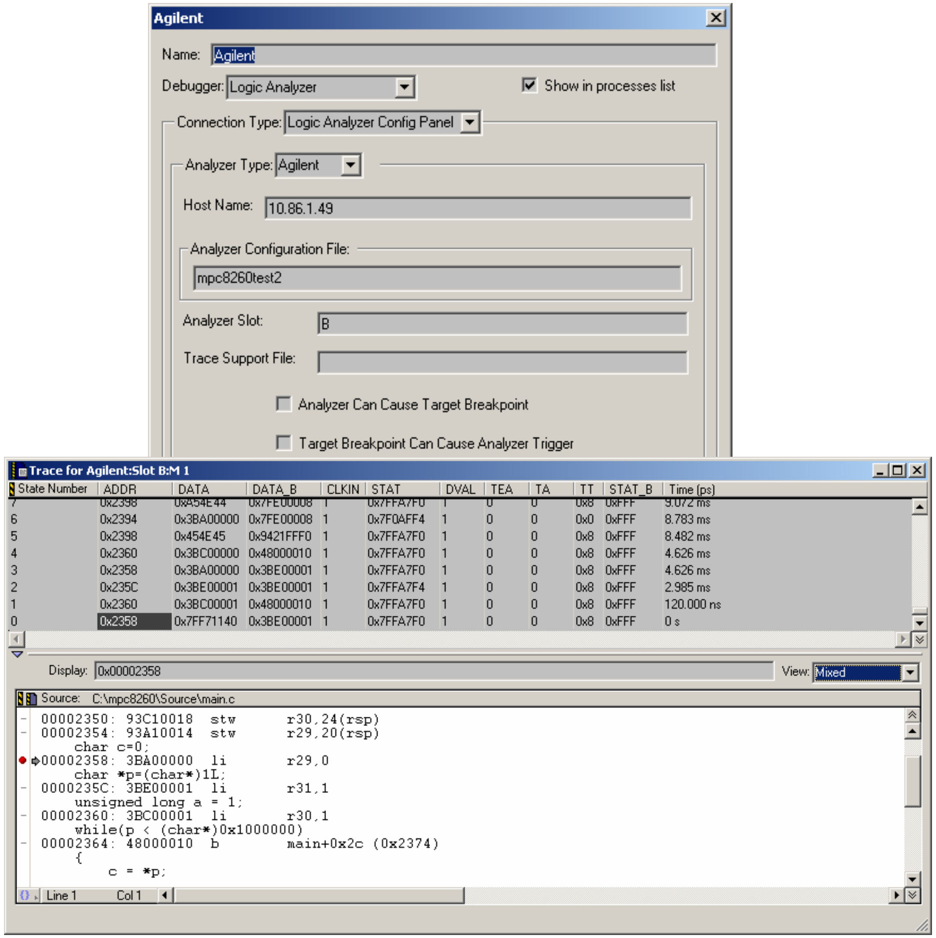
Target Scratch Memory Start: 0x 00000100

Target Scratch Memory End: 0x 0000FFFF

Status:

- Diagnoses memory operation errors (most common errors once you can control the CPU)
- Performs single/repeated memory accesses for one location, various access sizes
- Memory Tests: Walking 1's, Address, Bus Noise
  - On memory ranges
  - Multiple access sizes
  - Multiple passes
  - Via Debug Interface (JTAG/BDM) or using the CPU.

Logic Analyzer Interface* - Trace



Agilent

Name: Agilent

Debugger: Logic Analyzer

☑ Show in processes list

Connection Type: Logic Analyzer Config Panel

Analyzer Type: Agilent

Host Name: 10.86.1.49

Analyzer Configuration File: mpc8260test2

Analyzer Slot: B

Trace Support File:

□ Analyzer Can Cause Target Breakpoint

□ Target Breakpoint Can Cause Analyzer Trigger

Trace for Agilent:Slot B:M 1

State Number	ADDR	DATA	DATA_B	CLKIN	STAT	DVAL	TEA	TA	TT	STAT_B	Time (ps)
7	0x2398	0xA54E44	0x7FE00008	1	0x7FFA7F0	1	0	0	0x8	0xFFF	9.072 ms
6	0x2394	0x3BA00000	0x7FE00008	1	0x7F0AFF4	1	0	0	0x0	0xFFF	8.783 ms
5	0x2398	0x454E45	0x9421FFF0	1	0x7FFA7F0	1	0	0	0x8	0xFFF	8.482 ms
4	0x2360	0x3BC00000	0x48000010	1	0x7FFA7F0	1	0	0	0x8	0xFFF	4.626 ms
3	0x2358	0x3BA00000	0x3BE00001	1	0x7FFA7F0	1	0	0	0x8	0xFFF	4.626 ms
2	0x235C	0x3BE00001	0x3BE00001	1	0x7FFA7F4	1	0	0	0x8	0xFFF	2.985 ms
1	0x2360	0x3BC00001	0x48000010	1	0x7FFA7F0	1	0	0	0x8	0xFFF	120.000 ns
0	0x2358	0x7FF71140	0x3BE00001	1	0x7FFA7F0	1	0	0	0x8	0xFFF	0 s

Display: 0x00002358 View: Mixed

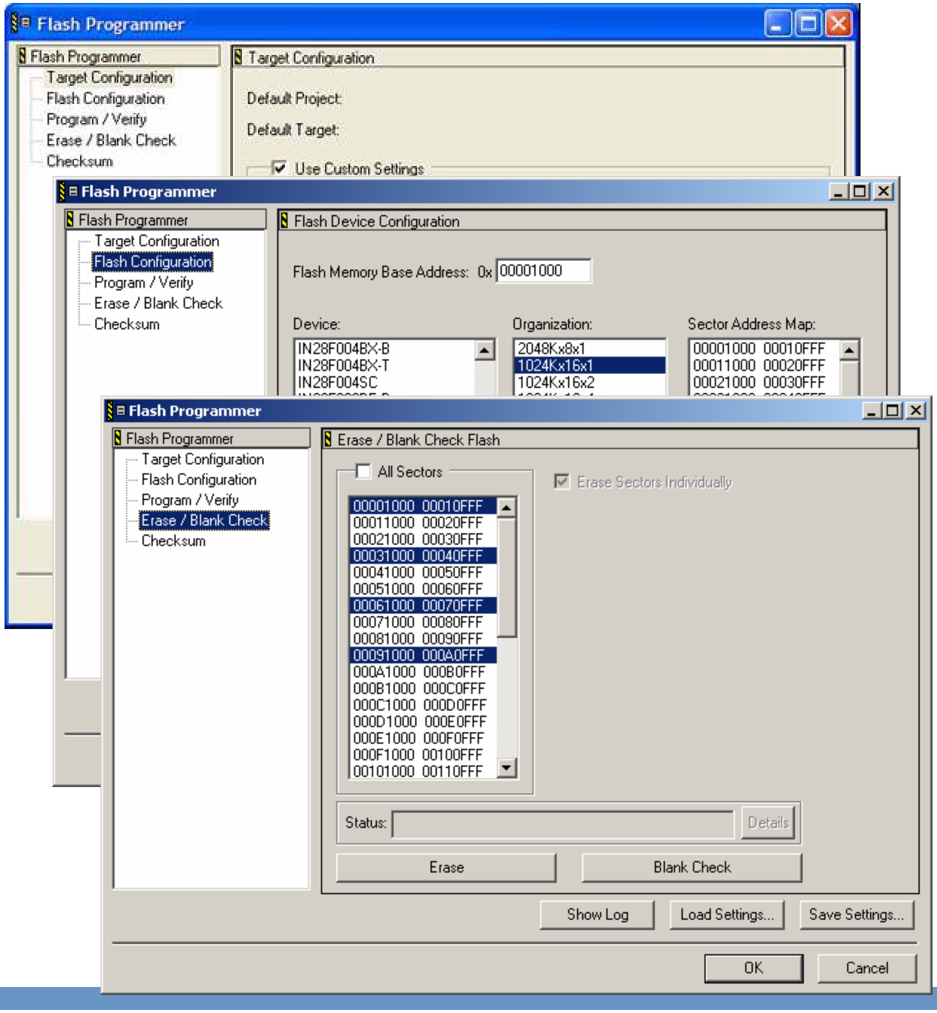
Source: C:\mpc8260\Source\main.c

```
- 00002350: 93C10018  stw      r30,24(rsp)
- 00002354: 93A10014  stw      r29,20(rsp)
      char c=0;
● ⇨00002358: 3BA00000  li       r29,0
      char *p=(char*)1L;
- 0000235C: 3BE00001  li       r31,1
      unsigned long a = 1;
- 00002360: 3BC00001  li       r30,1
      while(p < (char*)0x1000000)
- 00002364: 48000010  b        main+0x2c (0x2374)
      {
          c = *p;
```

Line 1 Col 1

- Trace On/Off
- Trace Everything
- Trace History
- Start Trace Based on Specified Address
- Start Trace on Address Range
- Trace All in Address Range
- Breakpoint on Trigger
- Trigger Tracing on Breakpoint
- Support for:
  - Tektronix
  - Agilent

Flash Programmer Interface*



Flash Programmer

- Flash Programmer
  - Target Configuration
  - Flash Configuration
  - Program / Verify
  - Erase / Blank Check
  - Checksum

Target Configuration

Default Project:

Default Target:

☑ Use Custom Settings

Flash Programmer

Flash Device Configuration

Flash Memory Base Address: 0x 00001000

Device:

```
IN28F004BX-B
IN28F004BX-T
IN28F004SC
```

Organization:

```
2048Kx8x1
1024Kx16x1
1024Kx16x2
```

Sector Address Map:

```
00001000  00010FFF
00011000  00020FFF
00021000  00030FFF
```

Flash Programmer

Erase / Blank Check Flash

□ All Sectors

☑ Erase Sectors Individually

```
00001000  00010FFF
00011000  00020FFF
00021000  00030FFF
00031000  00040FFF
00041000  00050FFF
00051000  00060FFF
00061000  00070FFF
00071000  00080FFF
00081000  00090FFF
00091000  000A0FFF
000A1000  000B0FFF
000B1000  000C0FFF
000C1000  000D0FFF
000D1000  000E0FFF
000E1000  000F0FFF
000F1000  00100FFF
00101000  00110FFF
```

Status:

- **Support for multiple flash parts**
  - Approx. 140-150
- **Improved user interface**
  - Parameters related to flash programming are co-located in the flash programmer user interface
- **Support for any hardware design**
- **Standalone or integrated operation**
- **Flash driver is position independent**
- **Flash programmer can program**
  - Binary
  - S-Record
  - elf file formats
- **Configuration files containing all configuration parameters can be saved and loaded easily.**