



## TI Technology Days 2010

# Code Composer Studio v4 and BIOS6 IDE and Real-Time OS for all TI Processors

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**Texas Instruments  
FAE Embedded Processors**

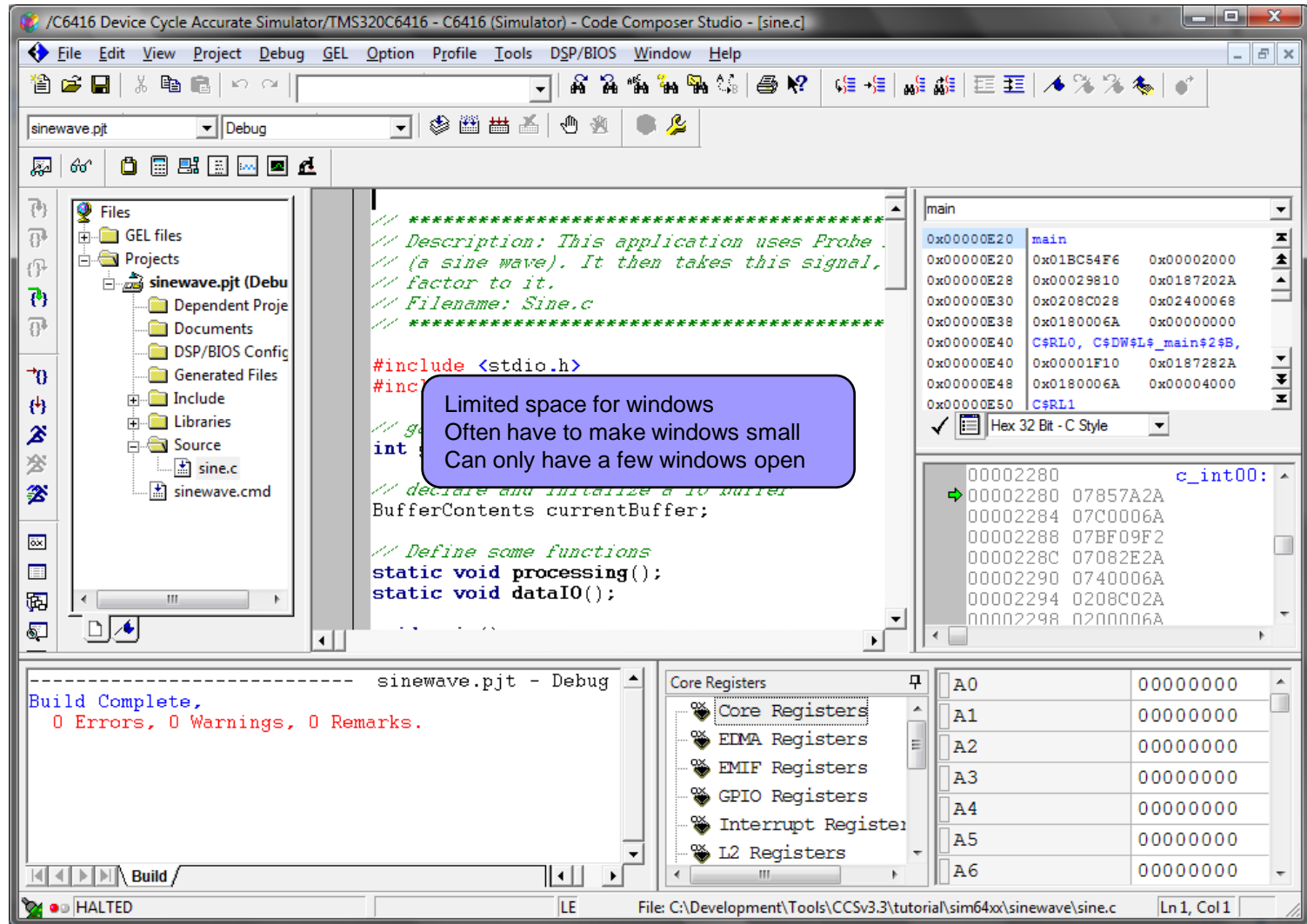
# Agenda

- Code Composer Studio v4: IDE
  - What is CCS?
  - CCSv3.3 vs. CCSv4
  - Key features: project manager and editor
  - Code Generation Tools; Emulation
  - Available CCS Versions
  - Getting support
- BIOS6: Real-Time Operating System

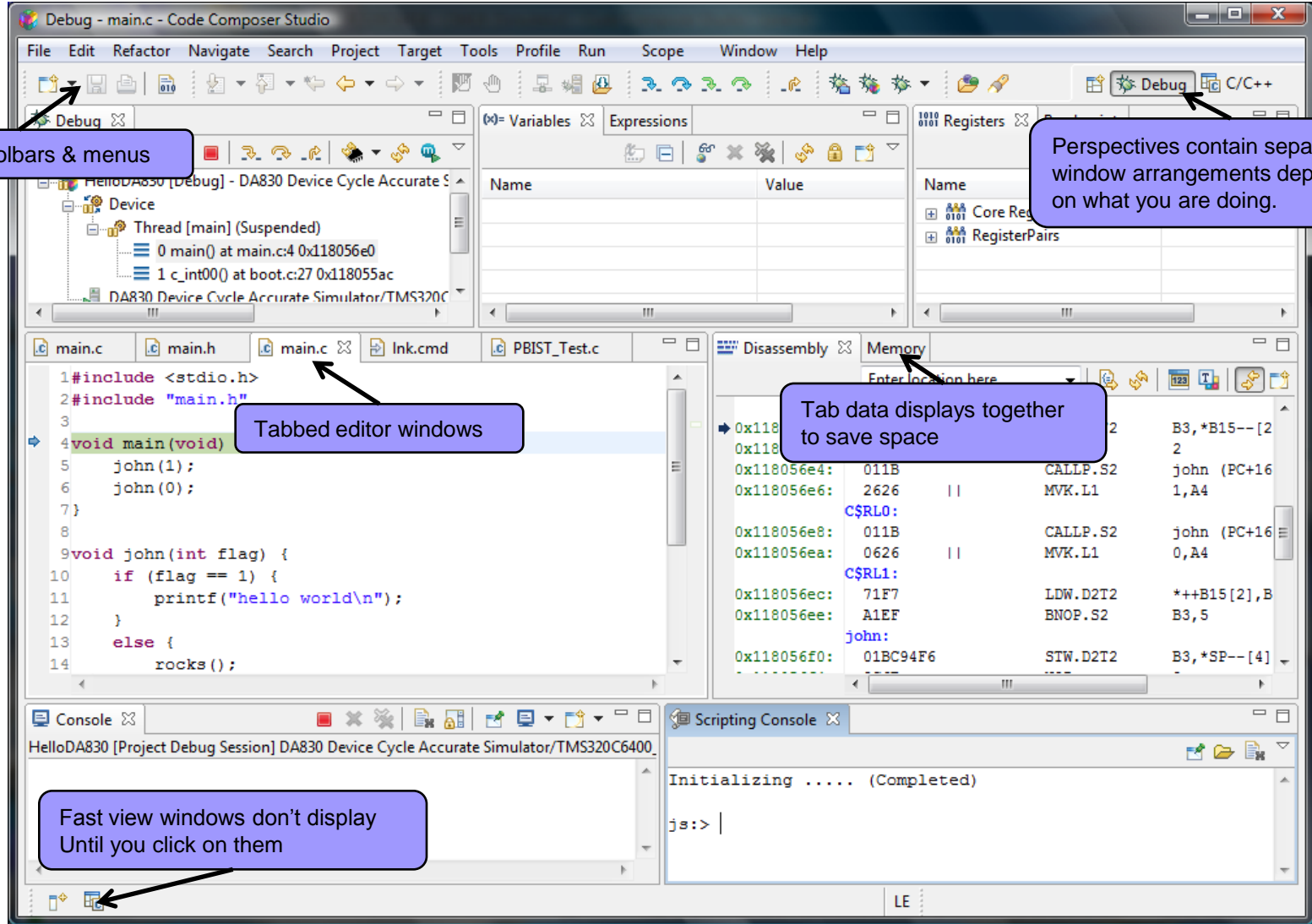
# Code Composer Studio Summary

- What is CCS?
  - Integrated development environment for TI embedded processors
  - Based on Eclipse open source software framework
  - A suite of development tools for compiling, editing, debugging, profiling and analyzing embedded applications
- Why Eclipse?
  - Quickly becoming a standard for IDEs
  - Excellent software architecture
  - Ability to leverage the work of others
  - Wide selection of 3rd party plug-ins available
- What device families does CCS support?
  - MSP430, C28x, Stellaris, TMS470, TMS570, Sitara, OMAP, DaVinci, C5000, C6000...

# CCSv3.3 Environment

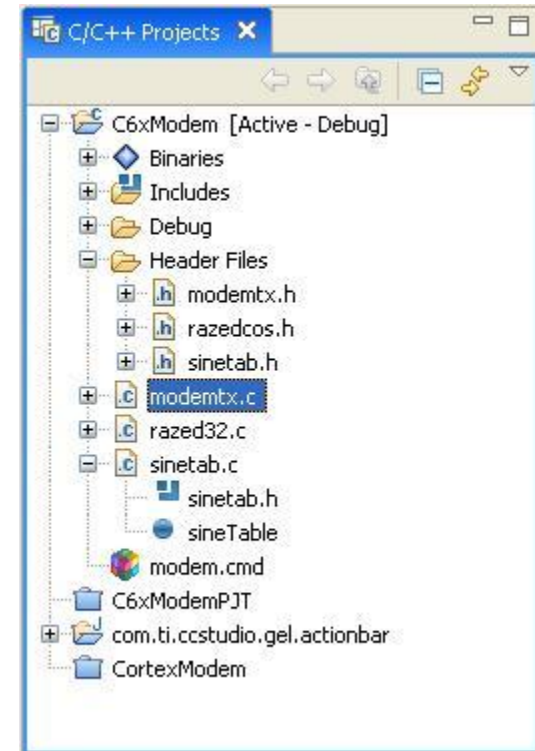


# Now: CCSv4 Environment



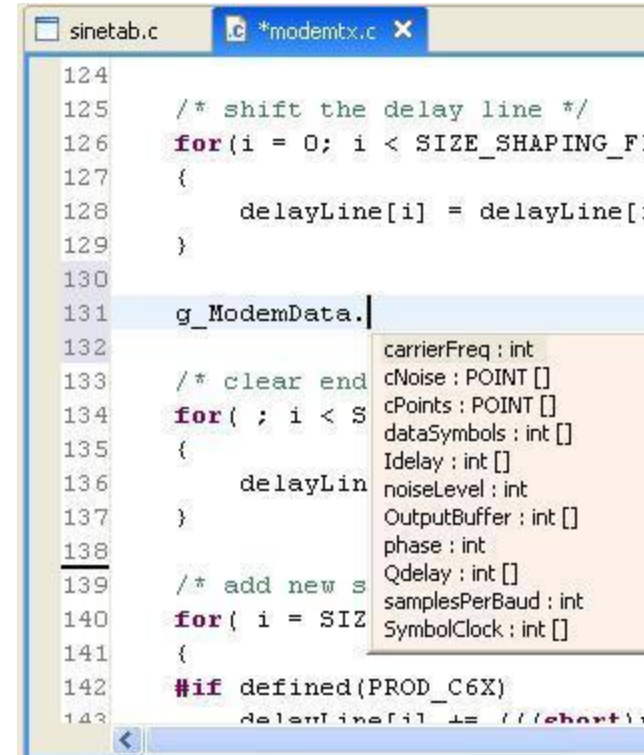
# C/C++ Projects View

- All files in the project directory are in the project
- “Add” files copies them into the project directory
- “Link” files just references the files and leaves them in their original location
- Folder structure represents directory structure of project
  - Dragging files between folders will move them
- “Includes” displays header search paths
- Can use certain compiler and DSP/BIOS version for each project
  - Use “older” tools for projects in maintenance mode
  - Use latest tools for current projects



# Advanced Editor Features

- Code Completion
  - Complete word
  - Auto-member information
  - Auto-parameter information
  - ...
- Navigation
  - Back/Forward buttons
  - Back to last edit button
  - Go to definition
  - Go to declaration

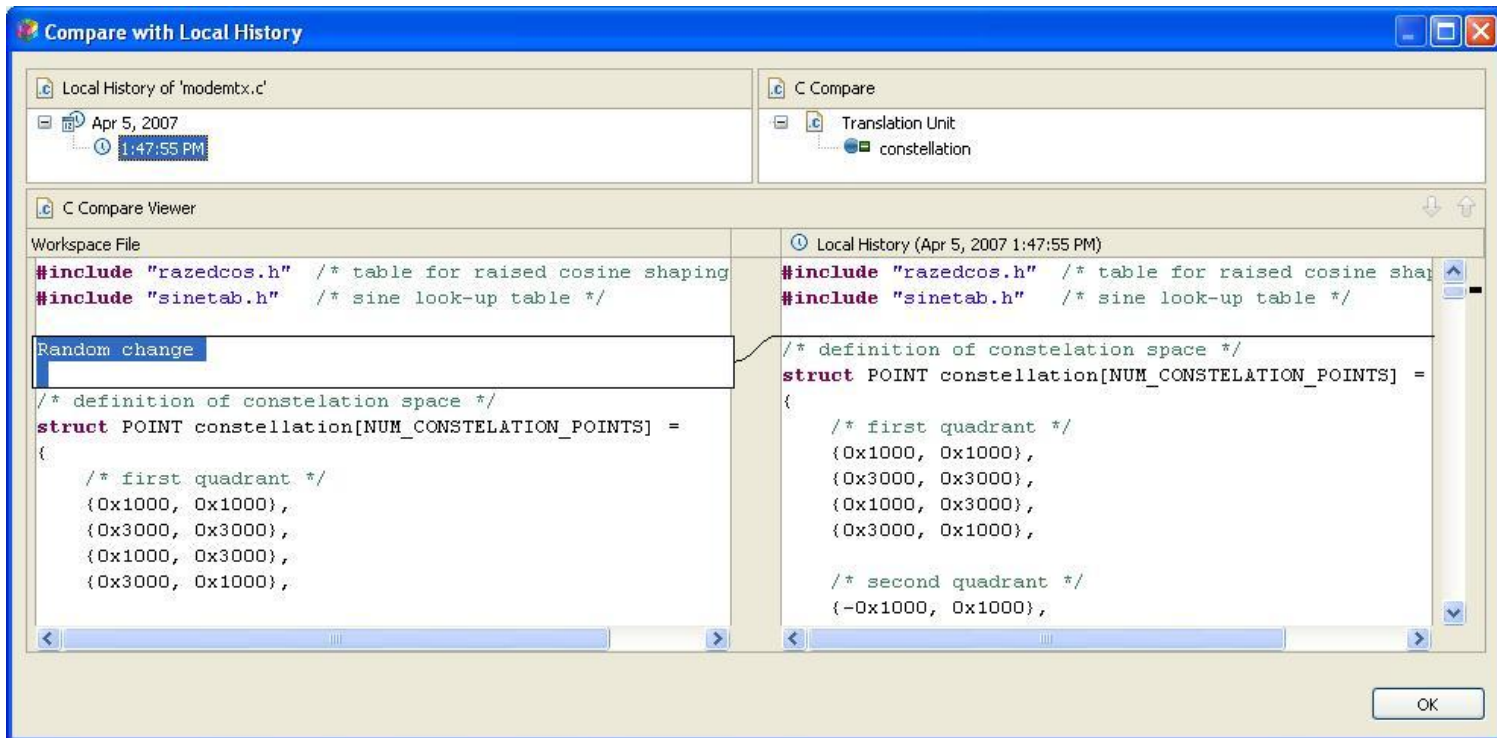


- Show line numbers
- Code Folding
  - Collapse functions

```
53  /******  
54  int SineLookup(int sample) {  
72  
73  /******
```

# Local History

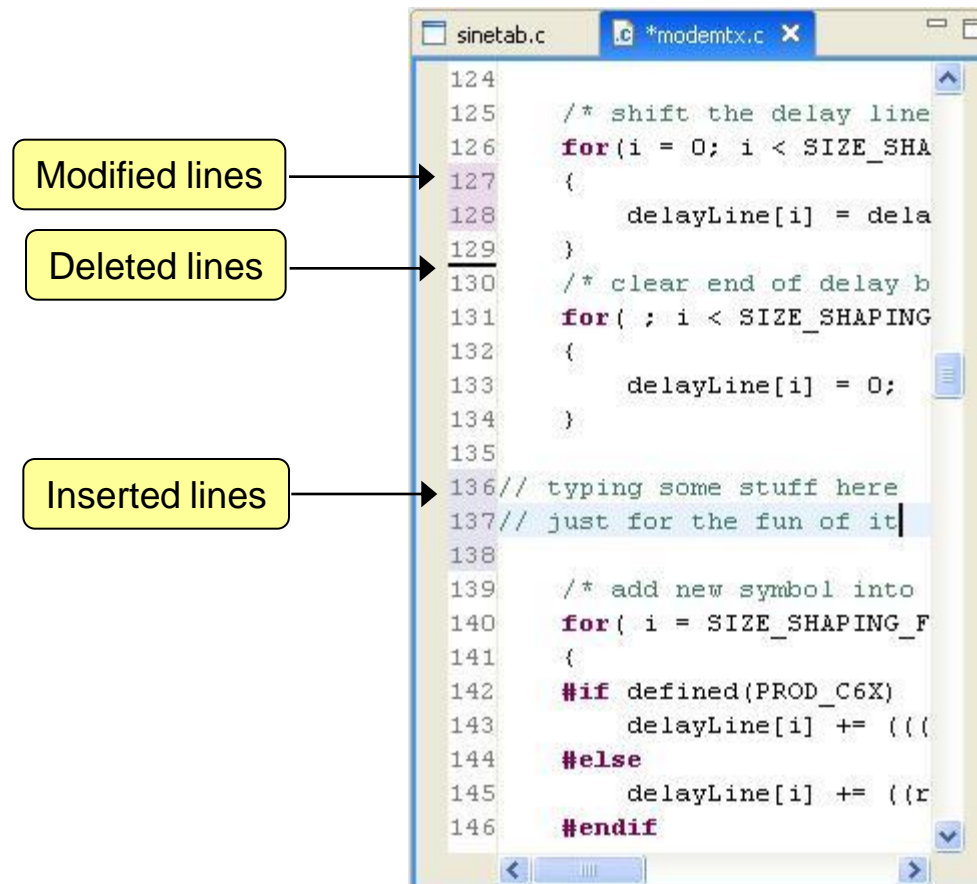
- Eclipse keeps a local history of source changes
- You can compare your current source file against any previous version or replace it with any previous version





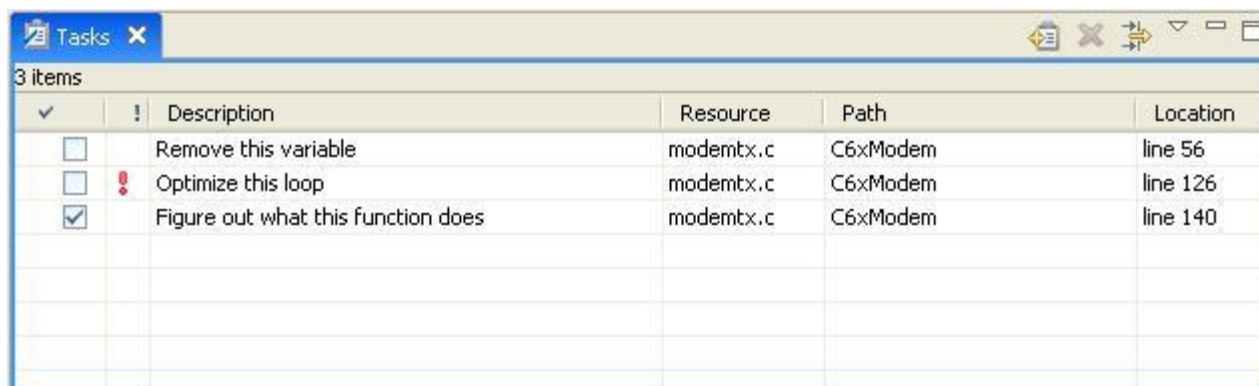
# Edit Markers

- If you have the line number column on it also indicates changes in your source file since your last save



# Tasks

- Your own TODO list
  - Allows you to keep track of things to do
- Associate tasks with source lines
  - Add a task by right clicking in the editor left selection margin
- Tasks view shows tasks that are contained in your workspace



✓	!	Description	Resource	Path	Location
<input type="checkbox"/>		Remove this variable	modemtx.c	C6xModem	line 56
<input type="checkbox"/>	!	Optimize this loop	modemtx.c	C6xModem	line 126
<input checked="" type="checkbox"/>		Figure out what this function does	modemtx.c	C6xModem	line 140

# Update Delivery

- Problems:
  - People are unsure of what updates are needed
  - Downloading updates is painful
- Solution:
  - CCS will automatically check for updates on startup and indicate if content is available
  - Spectrum Digital & Blackhawk drivers are included in the CCS install
  - Service releases will only install content relevant to your installation (i.e. C2000 users only see C2000 content)
  - Much faster file server!!!!!!!!

# Compilers

- Goals
  - Make performance of TI silicon easily accessible via high-level language
  - DSP & MCU customers should be able to write all their code in C (or C++) and meet their performance and code size requirements
- Key Requirements
  - Expressiveness - within widely accepted standards
  - Optimization - targeted to DSP / SIMD code
  - Robustness - via validation and internal usage
  - Standards – strict ISO C/C++ compliance
- Availability
  - Available as a standalone package, or part of Code Composer Studio
  - TI DSP Compilers are a FREE download
    - [https://www-a.ti.com/downloads/sds\\_support/TICodegenerationTools/index.htm](https://www-a.ti.com/downloads/sds_support/TICodegenerationTools/index.htm)
    - Download site includes binaries, READMEs, and Documentation

# JTAG Emulation

- XDS100 class
  - Super low cost at \$79, includes free CCS license limited to use with XDS100
  - Robust and efficient JTAG emulation controller
  - XDS100 v1: C28x, C54x, C55x, C674x processors
  - XDS100 v2 adds ARM7/9/R4/A8 and C64x+
  - <http://tiexpressdsp.com/wiki/index.php?title=XDS100>
- XDS510 class
  - Industry benchmark product designed for reliability and simplicity.
  - Balance of cost and performance
  - Available from many partners
- XDS560 class
  - Technologically most advanced product offering high speed data transfers through processor and system level tracing
  - High performance with faster TCLK rates
  - Available in a variety of interfaces: USB, Ethernet, PCI
  - XDS560T model supports DSP pin Trace
- MSP430 FET
  - MSP430 is supported via separate USB Flash Emulation Tool at ~\$100



# Available CCS Versions

- Microcontroller Edition, which supports
  - MSP430
  - TMS320C2800
  - Stellaris M3, TMS570 (Cortex R4)
- Platinum Edition, which supports
  - TMS320C5500
  - TMS320C6000
  - TMS320C2800
  - MSP430
  - Stellaris
  - ARM7, ARM 9, ARM 11
  - ARM Cortex M3, ARM Cortex R4, ARM Cortex A8
  - TMS470,
  - TMS570

# Licensing Options

- Evaluation license
  - Full version for 120 days (30 days plus 90 days extension)
- Free version
  - Tied to XDS100 emulator or Starter Kits
- Node locked
  - Tied to one PC
- Floating
  - Install on multiple PCs
  - Use on a single PC

# CCSv4 Pricing Summary

Item	Description	Price
Platinum Eval Tools	Full tools with time limit	FREE
Platinum Bundle	EVM/DSK, sim, XDS100 use	FREE
Platinum Node Locked	Full tools tied to a machine	\$1995
Platinum Floating*	Full tools shared across machines	\$2995
Microcontroller Core	MSP/C2000 code size limited	FREE
Microcontroller Node Locked	MSP/C2000/Stellaris	\$495
Microcontroller Floating*	MSP/C2000/Stellaris	\$795

\*3, 5, 10, 25 user bundles available as well

Part #s: [http://tiexpressdsp.com/index.php/Licensing\\_-\\_CCSv4#Part\\_.23s](http://tiexpressdsp.com/index.php/Licensing_-_CCSv4#Part_.23s)



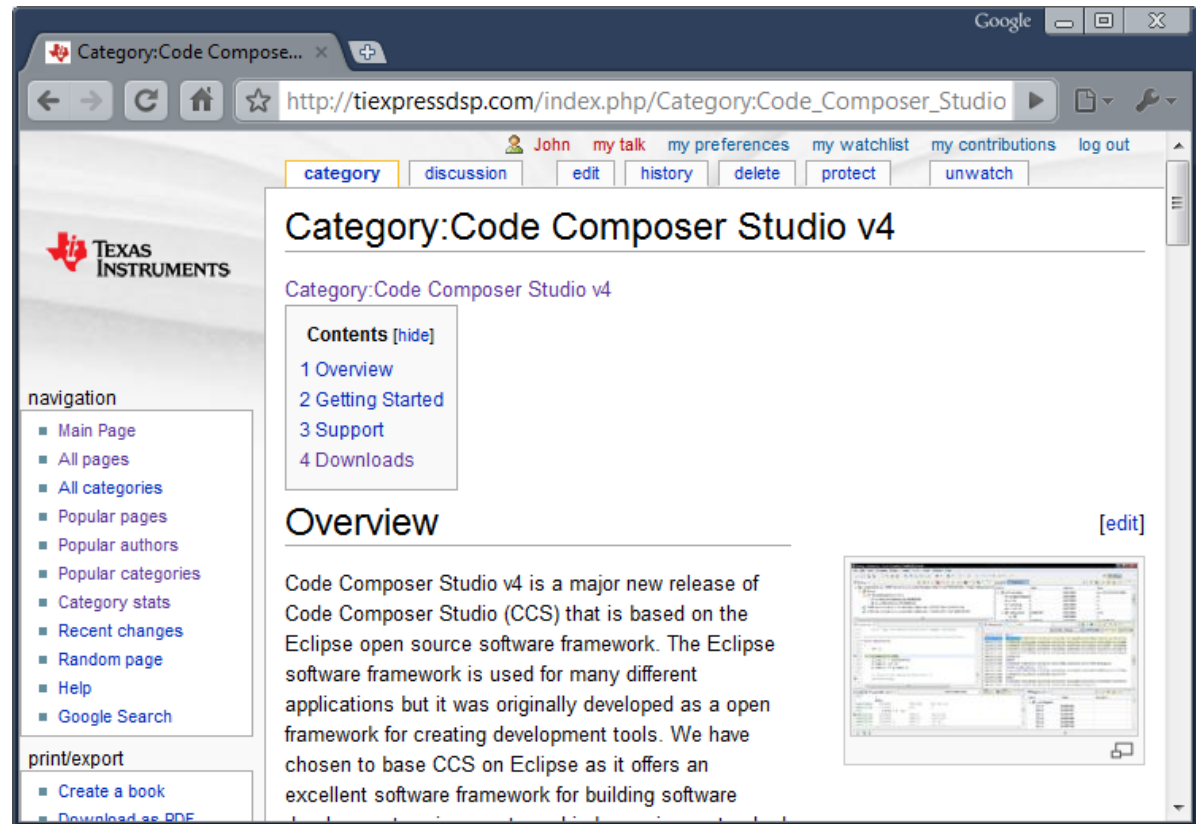
# Licensing - FAQs

- Who gets v4 Upgrades?
  - Code Composer Studio users and under subscription.
  - Code Composer Essentials Pro users who purchased after June 1 2008
- What happens with 3.3 “site” licenses?
  - Every customer with a site license will be contacted by TI and provided with an equivalent v4 floating license package
- Can I upgrade free eval tools to full tools?
  - Yes
- Can TI extend free eval tools?
  - Yes
- What happens if my computer is off the network and I am using a floating license?
  - You can continue to use CCS, it will just let you know it could not get a license in the title bar
- How do I get the free XDS100 license?
  - Just download the CCSv4 image and click the button to generate a bundle license
- Full set of FAQs on the CCSv4 mediawiki
  - [http://tiexpressdsp.com/index.php/FAQ\\_-\\_CCSv4#Licensing](http://tiexpressdsp.com/index.php/FAQ_-_CCSv4#Licensing)

# #1 Resource for Information: TI Wiki

- CCSv4 Mediawiki

- [http://tiexpressdsp.com/wiki/index.php?title=Category:Code\\_Composer\\_Studio\\_v4](http://tiexpressdsp.com/wiki/index.php?title=Category:Code_Composer_Studio_v4)
- Documentation
- FAQs
- License info
- Training
- Downloads

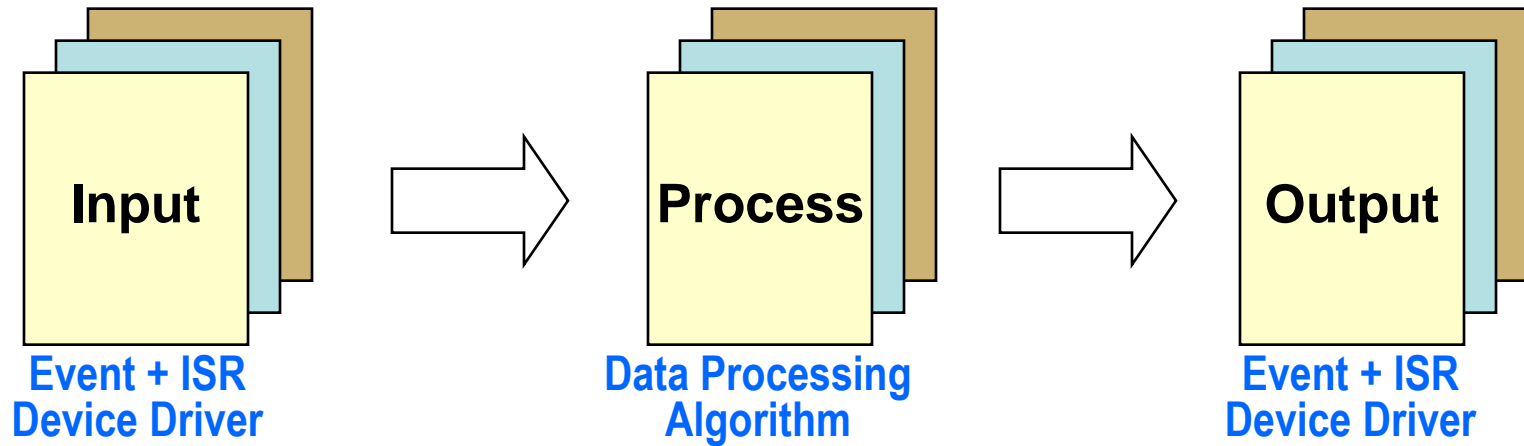


# Getting Support

- See if the question is already answered
  - Check the FAQs and topics on the wiki
  - Search the e2e forums
- Post a question or issue to the Code Composer Studio or TI C/C++ Compiler forums on e2e community
  - [www.ti.com/e2e](http://www.ti.com/e2e)
- Check the status of a bug
  - <https://cqweb.ext.ti.com/pages/SDO-Web.html>
  - Can create your own queries to track issues important to you

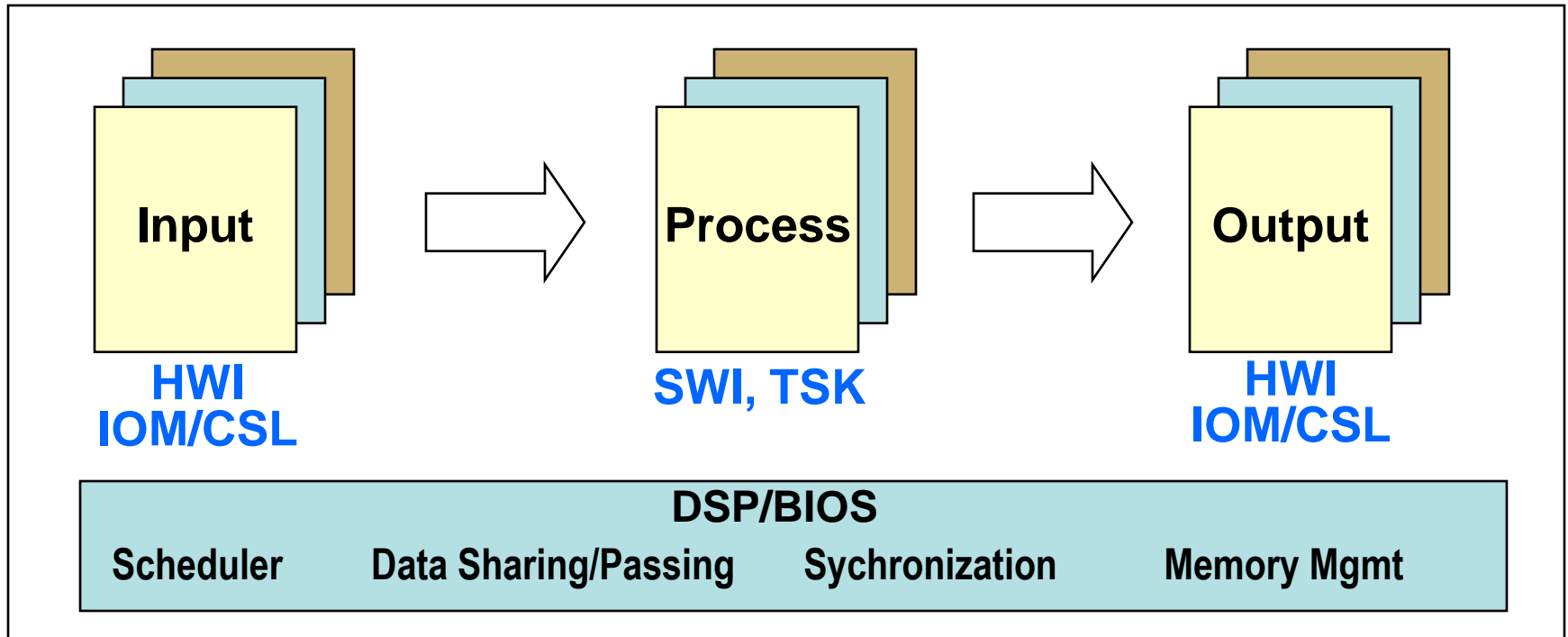
# **DSP/BIOS: A Free RTOS For TI Processors**

# Need for an Operating System



- Simple system: single I-P-O is easy to manage
- As system complexity increases (multiple I-P-O):
  - Can they all meet real time ?
  - Synchronization of events?
  - Priorities of threads/algos ?
  - Data sharing/passing ?
- 2 options: “home-grown” or use existing (DSP/BIOS)  
(either option requires overhead)
- If you choose an existing O/S, what should you consider ?
  - Is it modular ?
  - Is it reliable?
  - Is it easy to use ?
  - Data sharing/passing ?
  - How much does it cost ?
  - What code overhead exists?

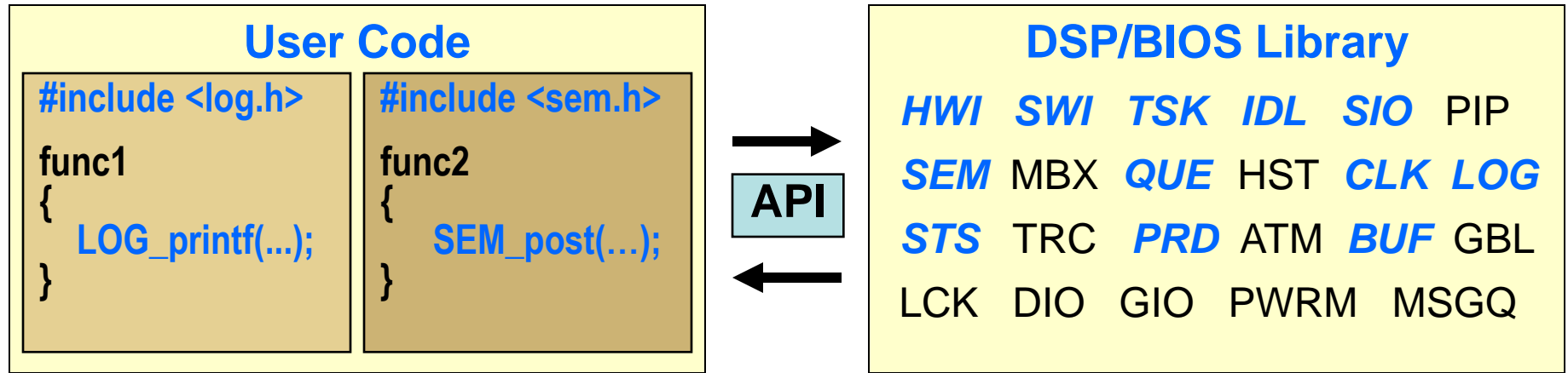
# DSP/BIOS Overview



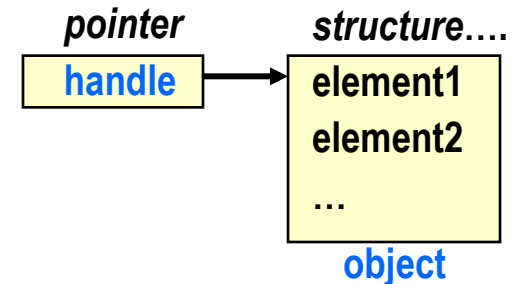
**DSP/BIOS is a scalable, real-time kernel used in 1000s of systems today:**

- Pre-emptive Scheduler to design system to meet real-time (including sync/priorities)
- Easy to use through a set of standard APIs
- Modular – pre-defined interface for interthread communications
- Reliable – 1000s of applications have used it for more than 10 years
- Footprint – deterministic, small code size, can choose which modules you desire
- Cost – free of charge

# DSP/BIOS Environment



- ◆ **DSP/BIOS is a library** that contains a collection of modules with a particular
  - ◆ Interface and calling conventions
  - ◆ Set of data structures defined in the module's header file
- ◆ **Application Program Interfaces (API)** define the interactions with a module
  - ◆ Relates a set of constants, types, variables and functions visible to user programs
  - ◆ Object based: global parameters that control operation of *each* instance
- ◆ **Objects** - are structures that define the state of a component
  - ◆ Pointers to objects are called **handles**
  - ◆ References to the object are via the handle
  - ◆ Object based programming offers:
    - ◆ *Better encapsulation and abstraction*
    - ◆ *Multiple instance ability*



# BIOS in CCSv4

- CCSv4 includes two versions of DSP/BIOS
  - 5.40
    - Binary compatible with BIOS5.3
    - Updated to support CCSv4 integration
    - Recommended if migrating existing projects to CCSv4
    - Does not support execution graph
  - 6.20
    - Supports complete real-time analysis tools including execution graph
    - BIOS now available for all TI processor families (including ARM9, Cortex M3, in future MSP430)
      - No BIOS6 support for C5000, new C55x devices supported in BIOS 5.x
    - Many new kernel and analysis features
    - Much faster task performance
    - New APIs with enhanced error handling
    - 100% compatible DSP/BIOS 5.3x API layer
    - Legacy and new APIs can be used in the same application

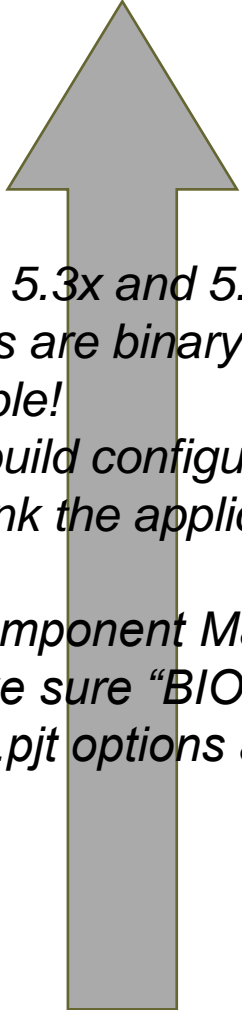


# DSP/BIOS 5.x

- DSP/BIOS 5.x will continue to be supported in “maintenance mode”
  - Bug fixes. Minor device variants. No new features.
- We still support and maintain DSP/BIOS releases from 5-10 years ago
  - Source code is under version control and we can rebuild old versions with original compilers to be bit-exact with the original release.
- New devices and features will be supported in DSP/BIOS 6.x

# Recent DSP/BIOS 5.x History

- DSP/BIOS 5.31 (Aug 2006)
  - Added TCI6488 and TCI6486 Support
  - 5.31.01 – 5.31.08 maintenance releases
- DSP/BIOS 5.32 (Oct 2007)
  - Added 28x Floating Point Device
  - 5.32.01 – 5.32.04 maintenance releases
- DSP/BIOS 5.33 (Sept 2008)
  - Added C674x (floating point GEM) Support
  - 5.33.01 – 5.33.06 maintenance releases
- DSP/BIOS 5.40 (April 2009)
  - CCSv4 Support (tooling and project integration)
  - Identical target code as 5.33.06
- DSP/BIOS 5.41 (Sept 2009)
  - CCSv3 and CCSv4 in single release
  - Different installer for CCSv3 tooling vs CCSv4 tooling
  - DSP/BIOS 5.41 target code is nearly identical to DSP/BIOS 5.33.06



*All BIOS 5.3x and 5.4x  
Releases are binary and API  
compatible!*

*Just re-build configuration  
and re-link the application.*

*(use “Component Manager”  
and make sure “BIOS  
Builder” .pjt options are in  
synch)*

# DSP/BIOS 6.x Scope

- DSP/BIOS 6.x is a major 'rewrite' of the Kernel and Tools
  - Refactored the kernel to be more modular and portable
    - Added key features as requested by large BIOS 5 customer base
    - Mostly 'C' code instead of assembly code
  - Real-time Analysis (RTA) and Run-time Object View (ROV) based on Data Visualization Toolkit (DVT) and CCSv4/Eclipse IDE
    - Better user interface and expanded feature set
  - Design is based on Real-Time Software Components (RTSC) Eclipse Project
    - See [rtsc.eclipse.org](http://rtsc.eclipse.org) for more information
  - Open and Extensible Configuration tooling
    - Configuration tool now supports non-BIOS target content
- Existing test suites are used to ensure quality

# Kernel Highlights

- Open Source
  - Eclipse Public License for DSP/BIOS 6.21 and beyond
- Support for ARM and DSP Cores
- Many new Kernel and Analysis Features
- Much faster task performance
- New APIs with unified error handling
- Compatible DSP/BIOS 5.3x API layer
  - Legacy and new APIs can be used in the same application
  - A few (seldom or never used) modules are not supported
  - Zero source changes are required

# BIOS Schedule

- Current Version: 6.20
  - Support for C2000, C6000, Stellaris M3
- Version 6.30: end of May
  - 6.30 will include source with BSD open-source license
  - Support for MSP430 added
- With version 6.30: name change from DSP/BIOS to SYS/BIOS
- No support for C55x planned ☹

**Thank You!**