Announcing the MPLAB® Harmony, Integrated Software Framework for PIC32
MPLAB® Harmony is a comprehensive, interoperable, tested software development framework for Microchip’s PIC32 microcontrollers.

- The framework integrates both internal and 3rd party middleware, drivers, peripheral libraries and real time operating systems, simplifying and accelerating the 32-bit development process.
- The MPLAB Harmony framework operates within the MPLAB® X IDE development environment and is supported by Microchip.
MPLAB® Harmony
First to provide...

- **Comprehensive Development Environment**
  - Flexible, Robust tool that provides a complete framework for PIC32 firmware development
  - An innovative approach to Harmonize in-house & 3rd party software solutions
  - Layered and Modular architecture for software interoperability
- **Direct Resale by Microchip**
  - Direct resale and licensing of third-party Harmony libraries from microchipDIRECT
- **First Line of Support**
  - First line of support provided by Microchip for all Harmony components, including third-party solutions
- **Comprehensive Web Portal**
  - Includes Licensing, Resale, Technical Support & Collateral for Microchip & third-party Harmony components
Today’s Embedded Challenges

- End Systems’ Sophistication Increasing
  - Complexity of Projects Growing
  - Development Time Stretching
  - S/W % Total Development Time* → 60%

- Switching between RTOSs leads to rework
  - Lack of software compatibility creates new bugs
  - Greater Risk with Re-Work of Code

- Challenge to Integrate RTOS, Middleware, Drivers All in One Platform
  - Generally Multiple 3rd Party Software Suppliers

* 2013 UBM Embedded Market Study
Today’s Embedded Challenges, cont’d

**DEFECT DRAG**
- Increased Verification & Debug Time Means Less time to Focus on Critical Applications
- 60% of Software Resource Involved in Verification**
- Defects Found during Verification Cost 10x More Than Found in Design***

**FRAGMENTED**
- Difficult to Procure all the S/W Components from Single Vendor’s Website
  - Full Feature Set Offerings are Costly
  - Scattered Support for 3rd Party Offerings

**UNPREDICTABLE FUTURE**
- Unpredictable Future Competitive Environments
  - Increasing Pressure to Quickly Adapt
  - Economic Risks of 3rd Party Companies

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**Notes:**

** Defect Prevention: Reducing Costs and Enhancing Quality, isixsigma – Mukesh Soni

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MPLAB® Harmony Solves!

- Reduces Development Costs: Example 40% Harmony Base Code Usage Saves 24%

- Microchip Tested, Debugged, Interoperable Code is Ready for RE-USE

- Customer Code Developed in Harmony Framework has Higher Reusability

- Modular Architecture Enables Efficient Integration

- Pre-tested Software Eliminates These Bugs

- Single Source Support for MPLAB® Harmony Code (including 3rd party solutions) by Microchip

- Improved Reaction Time to Ever Changing Markets


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MPLAB® Harmony – Architecture

Application Layer
- Implements the overall desired behavior
- No direct HW access enables easy porting across Microchip parts

Common System Services
- Manages shared resource modules to avoid conflicts.
- Provides common functionality to avoid duplication

Middleware
- Implements complex libraries & protocols (USB, TCP/IP, Graphics, etc.)
- Provides highly abstracted application program interface

Device Drivers
- Provides simple & abstracted interface to peripheral
- Manages peripheral access control to avoid conflicts

Peripheral Libraries (PLIB)
- Access library that provides low-level direct access to a peripheral
- Provides common functional interface for PIC32 cross-family compatibility

MPLAB® Harmony

INTEGRATE

HARMONIZE
Third Party Partners

• Microchip’s growing ecosystem of third-party partners for MPLAB® Harmony

- Micrium RTOS
- freeRTOS
- OpenRTOS
- ThreadX® RTOS
- TCP/IP -- NicheStack
- CyaSSL Embedded SSL

• Expanding list of leading OS Vendors & Software Library Specialists are developing solutions for PIC32
• Modular list of downloads available via microchipDIRECT or from partner sites
**MPLAB® Harmony**

**Modular Options**

(Free & Premium)

### MPLAB® Harmony – Nov. 2013

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**3rd Party SW – Direct Sell & First line Support from Microchip**

- InterNiche TCP/IP
- freeRTOS
- OpenRTOS
- Micrium µC-OS/III™
- CyaSSL Embedded SSL

**3rd Party SW – Direct Sell & First line Support from Microchip**

- InterNiche TCP/IP
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- OpenRTOS

**Initial Support for PIC32 Hardware**

- PIC32MZ
- PIC32MX

**Full Support for PIC32 Hardware**

- PIC32MZ
- PIC32MX

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Resources

Where to get MPLAB® Harmony?
- Download MPLAB Harmony: www.microchip.com/Harmony
- Live on Nov. 18, 2013

Support
- User Forum, Microchip Tech Support, FAQ, Documentation: www.microchip.com/Harmony
- Live on Nov. 18, 2013

Pricing
- Basic framework and most libraries are FREE!
- Select Tools & Premium libraries available for purchase
SUMMARY

**All in One Ecosystem for PIC32**
- Industry’s most comprehensive 32-bit software development environment

**One-Stop Shop**
- First to Integrate Licensing, Resale and Support of internal & 3rd party solutions

**Easy Migration**
- Supports all PIC32 product families
- Architecture allows for easy migration between the broad portfolio of PIC32 MCUs

**Shorter Development Time**
- Pre-tested, proven components require very little effort to integrate
BACK-UP
MPLAB® Harmony Components

**USB**
- HS/FS/LS
- Multi-Instance
- Device
- Host
- HUB (Planned)

**TCP/IP**
- IPv4/IPv6
- Transport/App Layers
- Wi-Fi®
- IPv6 Cert

**Graphics**
- GDD X (GUI)
- Graphics Library
- Graphics Resource Converter (GRC)

**File System**
- FAT32
- MPFS
- Multi-File System
- Multi-Drive
- Multi-Partition

**System Services**
- Timers
- Interrupts
- PORTS
- Clocks
- Misc

**Drivers/PLIBs**
- Abstracted Interface
- Multi-Client
- Dynamic/Static
- Peripheral Access

**Embedded Security**
- Cryptographic Library
- Compression and Hash Libraries
- Embedded SSL Library (CyaSSL)

**3rd Party**
- Real Time Engineers Ltd.
- Wittenstein
- InterNiche Tech.
- wolfSSL

**OSAL**
- FreeRTOS
- OpenRTOS
- uC/OS-III™

**Planned**
- Bluetooth Audio Stack
- v2.1 + EDR
- Audio Decoders

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