Microcontroller Software and Services Enablement

FTF-SDS-F0125

Clark Jarvis | Software Technical Marketer

APR. 08. 2014
Agenda

• Enablement for Microcontrollers
  – Web Experience
    *(Solution Advisor and Software Apps Store)*
  – Development Hardware
    *(Tower System and Freedom Development Platform)*
  – Rapid Online Prototyping
    *(mbed development platform)*
  – Development Tools
    *(Kinetis SDK, Processor Expert, Kinetis Design Studio, Kinetis Bootloader)*
  – Development Software
    *(MQX / MQX Lite RTOS, PEG Graphics Software)*

• Application Specific Libraries and Solutions

• Software Support and Professional Services
Growing Importance of Enablement, Support, and Services

Average MCU Flash size grew x8 in the last decade

FIRMWARE now accounts for 83% of MCU implementation cost

53% of projects are delayed >3 months due to FIRMWARE

Firmware is MCU developers **BIGGEST** pain point

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<tr>
<th>Software and Hardware Evaluation &amp; Dev Tools</th>
<th>Customer Application</th>
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<tr>
<td>Stacks (TCP/IP, USB)</td>
<td>Middleware</td>
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<tr>
<td>Libraries (DSP, Math, Encryption)</td>
<td>Application Specific</td>
</tr>
<tr>
<td>BSP, Drivers &amp; HAL</td>
<td>Operating System</td>
</tr>
<tr>
<td></td>
<td>Bootloader</td>
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</tbody>
</table>

MCU Hardware
Robust Software & Development Ecosystem

Applications

Tools, OS, Middleware

Architectures

>800 Embedded Software Engineers

Key Software Acquisitions & Investments

1999: Metrowerks
2002: AMC, Lineo
2008: Intoto
2009: MQX Runtime Platform
2010: Processor Expert, Chipwerks, Swell
Kinetis Enablement Overview

Kinetis MCU

**ARM Cortex-M0+ Core**
- 48MHz, 1.77 CoreMark/MHz,
- 2-Stage Pipeline, 1-Cycle GPIO,
- Micro Trace Buffer

**ARM Cortex-M4 Core**
- 50-150MHz, 3.40 CoreMark/MHz,
- HW-divide, MAC, DSP-commands, FPU option

**Differentiators**
- Low-power, Performance, Flex-Memory, Mixed-Signal,
- Security, HMI Features

**Special Functions**
- Analog Pre-Processing, 24b-Sigma Delta ADC, sub -1GHz & 2.4 GHz Transceiver

Enablement

**Freescale Bundle**

**Hardware**
- Freedom board, Tower Platform

**Software**
- CodeWarrior, Processor Expert, Driver Suite,
- eGUI, PEG, FreeMASTER

**RTOS**
- MQX, MQX Lite

ARM Eco System
Freescale Microcontroller Enablement Bundle

**Solution Advisor**
- Part Selector

**Development Platforms**
- Tower System
- Freedom Development Platform

**Online Enablement**
- Cloud enablement through freely available online design tools, communities, part selectors

**Development Tools**
- Kinetis Design Studio
- Processor Expert

**Development Software**
- Complimentary MQX RTOS
  - MOX/MOX-Lite Software Stacks and Libraries
  - PEG GUI Solutions
  - Application Notes

**Find best-fit processors and tools with web-based interactive product selector**

**Low cost hardware platforms for prototyping application development**

**Cloud enablement through freely available online design tools, communities, part selectors**

**Visual and automated framework to accelerate development time, deliver software components**

**Comprehensive solution for embedded control and connectivity**
Microcontrollers Software & Services

Solution Advisor Part Selector

Find best-fit processors and tools with web-based interactive product selector
Solution Advisor Web Application

Interactive MCU selector guide based

Quickly identify best-fit processor solutions

Product Features
- Solution Advisor helps you quickly identify best-fit processor solutions.
- Interactive MCU selector guide based on:
  - operating characteristics
  - packaging options
  - memory and FlexMemory requirements
  - a library of configurable hardware modules
- Dynamic, sortable, downloadable solution matrix
- Pin Muxing verification and suggested placement
- Session Management
- Save, restore, invite, and share
- Generates session summary reports

Learn more at: www.freescale.com/solutionadvisor
Microcontrollers Software & Services

Development Platforms

Tower System

Freedom Development Platform

Low cost hardware platforms for prototyping application development
Tower System Modular Development Platform

Modular development platform for 8-, 16- and 32-bit processors

Enables advanced development through rapid evaluation and prototyping

Product Features

- Modular and Expandable
  - Controller modules provide easy-to-use, reconfigurable hardware, can be used stand-alone
  - Interchangeable peripheral modules add functionality and make customization easy
  - Open-source hardware and standardized specifications promote customization
  - >80 modules to choose from

- Speeds Development Time
  - Open source hardware and software allow quick development with proven designs
  - Integrated debugging interface allows for easy programming and run control via standard USB cable

- Cost Effective
  - Sold individually and in complete kits, typically starting at $69 USD.
  - Tool re-use through interchangeable modules eliminates need to purchase redundant hardware

Learn more at: www.freescale.com/tower
Tower System Specialist Program

- What defines the Tower System Partner Program?
  - Partner makes available a **Tower System compatible product/solution**
  - Partner enters agreement with Freescale to **resell** their Tower System compatible product/solution, without holding inventory

- What “qualifies” a partner to participate in the program?
  - **HW compatibility**, as outlined within the Tower Partner Guidelines Package
  - Ability of partner to **stock and ship inventory**
  - Ability of partner to respond to support requests and community inquiries
  - Agreement to terms of Freescale Reseller Program
  - Freescale Connect membership at a Partner level

Learn more at: [www.freescale.com/tower/specialist](http://www.freescale.com/tower/specialist)
Ultra low-cost/low-power development platform

Enables quick application prototyping and demonstration of Kinetis MCU families

Product Features

- Low-cost ($12-29USD MSRP)
- Designed in an industry-standard compact form factor (Arduino R3)
- Easy access to the MCU I/O pins
- Integrated open-standard serial and debug interface (OpenSDA)
- Compatible with a rich-set of third-party expansion boards

Customer Application

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<td>MCU Hardware</td>
<td></td>
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Learn more at: [www.freescale.com/freedom](http://www.freescale.com/freedom)

FRDM-KL25Z | FRDM-KL05Z | FRDM-KL46Z | FRDM-K64F
Microcontrollers Software & Services

Online Enablement

Online Enablement through freely available online design tools, communities, part selectors
What is the mbed development platform?

Highly-productive platforms and tools for MCUs:
- Software libraries
- Hardware designs
- Online tools

Developer Community
- Large developer community
- User collaboration
- Support
mbed Software Stack

- CMSIS-CORE: hardware register access and Cortex-M startup code
- Hardware Abstraction Layer (HAL) for MCU peripherals
- High-level peripheral drivers in C with C++ wrappers
- Easy-to-use C++ APIs
- CMSIS-RTOS implementation
- Networking and USB stacks

mbed Components Database
Accelerometer, GPS, 802.15.4/6LoWPAN, Cellular, Compass, ...

mbed SDK
Runtime, Memory Model, Peripheral APIs, STDIO, RTOS, Networking, Platform features

C/C++ Programs
Runtime Platforms (Java ME, .NET MF, eLua)

CMSIS-CORE

Apache 2.0 License
Microcontrollers Software & Services

Development Tools

Kinetis Design Studio
Processor Expert

Visual and automated framework to accelerate development time, deliver software components
Kinetis Software Development Kit (SDK)

A complete software framework for developing applications across all Kinetis MCUs

HAL, peripheral drivers, libraries, middleware, utilities, and usage examples.

Product Features

• Open source Hardware Abstraction Layer (HAL) provides APIs for all Kinetis hardware resources

• BSD-licensed set of peripheral drivers with easy-to-use C-language APIs

• Comprehensive HAL and driver usage examples and sample applications for RTOS and bare-metal.

• CMSIS-CORE compatible startup and drivers plus CMSIS-DSP library and examples

• RTOS Abstraction Layer (OSA) with support for Freescale MQX, FreeRTOS, Micrium uC/OS, bare-metal and more

• Integrates USB and TCP/IP stacks, touch sensing software, encryption and math/DSP libraries, and more

• Support for multiple toolchains including GNU GCC, IAR, Keil, and Kinetis Design Studio

Learn more at: www.freescale.com/KSDK

The OSI logo trademark is the trademark of Open Source Initiative.
Kinetis SDK Software Stack

HAL
- AbSTRACTED IP level Basic operations
- USEABLE low level drivers

System Services
- Clock Manager, Interrupt manager, Low power manager, HW timer…
- Can be used with HAL, PD and Application

FSL Peripheral Drivers
- Use case driven high level drivers

OS Abstraction Layer (OSA)
- Adapt to different OS (MQX, FreeRTOS and uC/OS) through corresponding OSA

BSP & Configuration
- Board Configuration, Pin Muxing, GPIO Configuration

Stacks & Middle Wares
- USB stack, TCP/IP stack, Connectivity
- Audio, Graphics, more…

Learn more at: www.freescale.com/KSDK
Create, configure, generate software and drivers for Freescale microcontrollers.

Master complex peripherals with a few mouse clicks, without the need to read thousands of data sheet pages.

**Product Features**
- Standalone or Integrated for
  - Eclipse based IDE’s
  - Freescale CodeWarrior
  - IAR Embedded Workbench
  - Keil MDK
- Supports Kinetis, S08, S12, S12Z, ColdFire, DSC and Power Architecture with reusable software components
- Knowledge base of pins, registers, muxing, clocks and dependencies
- Initialization and driver code generation with design time consistency checking
- Bare Metal and RTOS drivers
- On-chip and Off-chip Device Drivers
- Middleware and Stacks: RTOS, TSS libraries and communication stacks
- Component Development Environment (CDE) to create and distribute own components

Learn more at: [www.freescale.com/ProcessorExpert](http://www.freescale.com/ProcessorExpert)
Processor Expert Project Design

Learn more at: www.freescale.com/ProcessorExpert

Create Project
• Create a new project with Processor Expert

Configure Components
• Use Inspector to set all component settings

Generate Code
• Let Processor Expert generate all components drivers code

Build and Debug
• Build the application common way
• Debug the application with CodeWarriror

Processor Expert Project Design Timeline

Add Components
• Select components required in the project from Components Library

Verify Settings
• Make sure there are no design-time errors in the project

Write Code
• Write application code using code generated for components
Kinetis Design Studio

No-cost integrated development environment (IDE) for Kinetis MCUs

Eclipse and GCC-based IDE for C/C++ editing, compiling and debugging

Product Features

- A free of charge and unlimited IDE for Kinetis MCUs
- A basic IDE that offers robust editing, compiling and debugging
- Based on Eclipse, GCC, GDB and other open-source technologies
- Includes Processor Expert with Kinetis Platform SDK integration
- Host operating systems:
  - Windows 7/8
  - Linux (Ubuntu, Redhat, Centos)
  - Mac OS X
- Support for SEGGER, P&E and Open SDA/CMSIS-DAP debugger targets
- Support for Eclipse plug-ins including RTOS-awareness (i.e. MQX, FreeRTOS)
- CodeWarrior project importer

Learn more at: www.freescale.com/KDS
Kinetis Design Studio – Block Diagram

Commercial Support/Packages

Eclipse Plugins

Eclipse Framework
- NPW
- CDT (C/C++)
- Processor Expert
- GNU ARM Eclipse

Kinetic Design Studio
- GDB
- MQX KA
- CL Debug
- GDB Server Connection

Partner Plugins

ARM GNU Tools
- newlib-nano
- newlib
- KPSDK

Windows 7/8
Linux
Mac OS X*

* Coming in late 2014

Learn more at: www.freescale.com/KDS
Kinetis Design Studio / CodeWarrior Roadmap

- **KDS 1.0**
  - **Kinetis K Series:**
    - K24F, K63F, K64F
    - K22FN256, 512
    - K11D, K12D, K21D, K22D
    - K21F, K22F
  - **Kinetis L Series:**
    - KL03Z
    - KL14Z, KL15Z
    - KL24Z, KL25Z
    - KL16Z, KL26Z
    - KL34Z, KL36Z, KL46Z

- **KDS 1.1**
  - **Kinetis K Series:**
    - K65F, K66F
    - K22FN128
  - **Kinetis V Series:**
    - All
  - **Kinetis W Series:**
    - All
  - **Kinetis E, L & K**
    - TBD

- **KDS 1.x**
  - TBD

- **KDS 2.x**
  - TBD

- **CW MCU 10.5**
  - **Kinetis E Series:** KE02Z
  - **Kinetis K Series:** K21F, K22F
  - **Kinetis M Series:** KM13Z, KM14Z, KM32Z, KM33Z, KM34Z, KM38Z

- **CW MCU 10.6**
  - **Kinetis E Series:** KE02Z, KE04Z, KE06Z
    - KEAZN8/64/128
  - **Kinetis V Series:** KV10Z
  - **Kinetis K Series:** K24F, K63F, K64F

- Yearly Maintenance Release

- **CW MCU 10.6.x**
  - Yearly Maintenance Release

- Production
- Execution
- Planning
- Proposal

- Product Public Release (right edge)

- FTF Americas

- Timeline:
  - 2013:
    - 3Q
    - 4Q
  - 2014:
    - 1Q
    - 2Q
    - 3Q
    - 4Q
  - 2015:
    - 1Q
    - 2Q
### CodeWarrior Support Models - Microcontrollers

<table>
<thead>
<tr>
<th>Support Model</th>
<th>Last Major CodeWarrior Release</th>
<th>Support Needed (Min)</th>
<th>New NPIs</th>
<th>Improve Feature/Perf</th>
<th>Latest OS Support</th>
<th>Planned Product Releases</th>
<th>Dedicated Engineer Team</th>
<th>Customer Critical Defects Fix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinetis</td>
<td>Minimum</td>
<td>MCU 10.6</td>
<td>3 yrs</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yearly</td>
<td>No</td>
</tr>
<tr>
<td>DSC</td>
<td>Minimum</td>
<td>MCU 10.6</td>
<td>5 yrs</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yearly</td>
<td>No</td>
</tr>
<tr>
<td>S08/RS08</td>
<td>Minimum</td>
<td>MCU 10.6</td>
<td>5 yrs</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yearly</td>
<td>No</td>
</tr>
<tr>
<td>CFv1-v4</td>
<td>Minimum</td>
<td>MCU 10.6</td>
<td>3 yrs</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yearly</td>
<td>No</td>
</tr>
<tr>
<td>PSX -e200</td>
<td>Frozen</td>
<td>MCU 10.5</td>
<td>3 yrs</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>HC12/S12</td>
<td>Frozen</td>
<td>CW12 V5.1</td>
<td>3 yrs</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

### Full Maintenance
- New Device Support – Scheduled Releases and Service Packs
- Dedicated engineering and support team
- Current on latest and supported OS’s as required.

### Minimum Maintenance
- New Device Support – Support for existing devices continues but no new products are scheduled to be added.
- Yearly release to support current and new OS’s as required
- Support critical customer reported defects as required

### Frozen Maintenance
- New Device Support – Support for existing devices continues but no new products are scheduled to be added.
- Hot fixes/patches for customer critical issues
- Support critical customer reported defects as required
- Frozen on OS versions of the release

### No Support
- No support provided
Kinetis customer using CodeWarrior today have several options.

1. Continue to use CodeWarrior for existing project or projects using currently supported Kinetis devices.

2. Migrate to a partner’s commercial tool.

3. Use the new Kinetis Design Studio
# Kinetis Development Tools Options

<table>
<thead>
<tr>
<th>Strategic Tools Partners</th>
<th>Freescale Products</th>
<th>ARM Ecosystem Options</th>
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<tbody>
<tr>
<td>atolllic</td>
<td><img src="CodeWarrior.png" alt="CodeWarrior" /></td>
<td>GNU</td>
</tr>
<tr>
<td>IAR Systems</td>
<td><img src="KinetisDesignStudio.png" alt="Kinetis Design Studio" /></td>
<td>EMPROG</td>
</tr>
<tr>
<td>Green Hills Software</td>
<td></td>
<td>SYSTEM</td>
</tr>
<tr>
<td>KEIL</td>
<td></td>
<td>TASKING</td>
</tr>
<tr>
<td></td>
<td>CodeWarrior for Microcontrollers</td>
<td>Lauterbach</td>
</tr>
</tbody>
</table>
Kinetis Bootloader

Product Features

- A common bootloader for all Kinetis MCUs
- Source code provided under a permissive BSD open source license
- ROM based on select Kinetis devices
- Pre-programmed into flash (on devices without a dedicated ROM) for built-in factory programming capabilities
- Fully customizable for use in customer applications providing reliable field updates
- Serial communications with a host via UART, SPI, I2C, USB HID, or CAN
  - Active peripheral detection
  - Common command protocol for all peripherals.
- Command-line and GUI tools provided for Windows, Linux and Mac hosts

in-system flash programming over a serial connection: erase, program, verify

ROM or flash based bootloader with open-source software and host-side programming utilities.

Learn more at: www.freescale.com/Kibble
Kinetis Bootloader Configurations

**Source Code**
- C language source code released publicly under a complimentary, open-source BSD license

**Flash Based – integrated**
- User configured bootloader customized for user’s board and use case
- Callable from user application for application upgrades in the field

**ROM based – stand-alone**
- Available on KL03Z and future Kinetis devices with boot ROM.
- Failsafe boot mechanism for factory and field programming
- User configurable via parameters stored in user flash

**Flash Based – stand-alone**
- Pre-programmed into user flash by Freescale on new Kinetis devices without a boot ROM (starting in Q2, 2014)
- Provides a one-time flash programming mechanism for factory programming

Learn more at: [www.freescale.com/Kibble](http://www.freescale.com/Kibble)
Microcontrollers Software & Services

Development Software

Complimentary MQX RTOS

MQX/MQX-Lite
Software Stacks and Libraries
PEG GUI Solutions
Application Notes

Comprehensive solution for embedded control and connectivity
Freescale MQX™ Software Solutions

**Product Features**

- **MQX™ Real Time Operating System Kernel**
  - Deterministic multi-tasking preemptive scheduler
  - Extensive inter-task synchronization, message passing, and much more

- **MQX™ Real Time Communication Suite**
  - Broad networking protocol support (TCP, UDP, ICMP, HTTP, DHCP, FTP, Telnet, …)
  - Fully re-entrant, responsive, designed for embedded systems

- **MQX™ File System**
  - Embedded FAT file system compatible with FAT-12, FAT-16, or FAT-32 file systems

- **MQX™ USB Host/Device Stack**
  - USB 1.0/2.0; low-/full-/high-speed

- **Board Support Packages**
  - Pre-configured MQX Kernel, stacks, and peripheral drivers for Freescale HW

Learn more at: [www.freescale.com/mqx](http://www.freescale.com/mqx)
Freescale MQX™ Lite

Very light MQX™ kernel for Kinetis MCUs

Easy to configure – packaged as a Processor Expert component

Product Features

- MQX™ Real Time Operating System Kernel
  - Lite configuration of MQX™ Kernel requiring less than 4 KB RAM
  - All lightweight components
  - Static memory allocation
- Packaged as a Processor Expert component
- Get started in minutes – Just drop in the MQX™ Lite RTOS component to your project
- I/O capability provided by Processor Expert
- Upward code migration – MQX™ Lite RTOS is a true subset of the full MQX™ RTOS
- Available for all Kinetis K-, L-series devices and select E-series devices
- Get now within the Processor Expert Driver Suite and CodeWarrior Development Studio for MCUs

Learn more at: www.freescale.com/mqx
## MQX & MQX Lite Comparison

<table>
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<tr>
<th></th>
<th>MQX RTOS</th>
<th>MQX Lite RTOS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Delivery Mechanism</strong></td>
<td>Traditional installer with full source for Kernel, services and Board Support Packages</td>
<td>Processor Expert (PEx) Kernel and services component</td>
</tr>
<tr>
<td><strong>I/O Drivers</strong></td>
<td>MQX POSIX compatible drivers with option for using PEx drivers</td>
<td>PEx drivers only</td>
</tr>
<tr>
<td><strong>Configurability</strong></td>
<td>User selects needed services from full or lightweight versions</td>
<td>Reduced services available; lightweight options only</td>
</tr>
<tr>
<td><strong>Example Footprint (3 tasks, sem, event)</strong></td>
<td>&lt;10 Kbytes FLASH</td>
<td>&lt;8 Kbytes FLASH</td>
</tr>
<tr>
<td><strong>Components</strong></td>
<td>Kernel, TCP/IP stack, USB stack, file system, middleware, and peripheral drivers.</td>
<td>Kernel only, with additional components including USB stack provided by PEx</td>
</tr>
<tr>
<td><strong>Availability</strong></td>
<td>Kinetis K Series, Vybrid, select ColdFire, select Power Architecture</td>
<td>Kinetis L Series, Kinetis K Series, select Kinetis E Series</td>
</tr>
</tbody>
</table>

Learn more at: [www.freescale.com/mqx](http://www.freescale.com/mqx)
MQX Support Use Cases

Product Development Life Cycle

Evaluation of processor & software
- Evaluation board
- Familiarization
- Features
- Code size
- Performance Report
- Installation
- HW Set up
- Demos / examples

Proof of Concept
- Evaluation board
- Documentation
- API Features
- Code size

Preliminary application development
- Evaluation / Custom boards
- Possible bugs
- App architecture
- MQX Feature use
- Configuration

Final application development
- Custom boards
- BSP migration
- Integration with 3rd party SW
- Integration with Legacy SW
- Boot loaders

Integration and product validation
- Custom boards
- Memory leaks
- Timing issues
- Networking issues
- Performance tuning

Typical Issues

Level 1 Base Support
- Code examples, application notes, online video training
- MQX Online Community
- Support for Freescale MQX software on Freescale evaluation boards
- Bug report/Feature request
- Quarterly software releases only

Level 2 Standard Package - $3K
- Senior level support engineers
- BSP customization support
- Troubleshooting support
- Hot Fixes for fast issue resolution
- 20 hours
- 4 hrs live web conferencing for remote debug

Level 2 Premium Package - $12K
- Senior level support engineers
- BSP customization support
- System level diagnosis / Troubleshooting support
- Hands-on support of customer-provided boards
- Hot Fixes for fast issue resolution
- Early access to scheduled software releases
- 100 hours
- 10 hrs live web conferencing for remote debug

Learn more at: www.freescale.com/mqx
Product Features

- Graphical user interface (GUI) solutions for embedded devices:
  - PEG Lite – Basic GUI, free on Freescale
  - PEG Plus – Professional GUI, flexible framework
  - PEG Pro – Higher performance GUI development

- Meets widely varying power, performance and memory requirements.

- Flexible PEG hardware drivers are capable of targeting any RTOS or OS and interfacing with any display type supported by the processor.

- PEG WindowBuilder development tool automatically generates C++ source code that is ready to be compiled and linked into any application.
## PEG Graphics Suite Comparison

**PEG Lite**
- Free on Freescale Silicon,
- Basic UI Widgets, Minimal Set of Predefined Elements

**PEG Plus**
- Customizable UI Widgets,
- Full Set of Predefined Elements

**PEG Pro**
- Higher Color Depth, Effects,
- Customizable UI Widgets,
- Full Set of Predefined Elements

<table>
<thead>
<tr>
<th>Feature</th>
<th>PEG Lite</th>
<th>PEG Plus</th>
<th>PEG Pro</th>
</tr>
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<tbody>
<tr>
<td>Color Depth</td>
<td>Monochrome to 65K High Color</td>
<td>Monochrome to 16.7M True Color</td>
<td>65K High Color to 16.7M True Color with Alpha</td>
</tr>
<tr>
<td>Custom Bitmap Elements</td>
<td>Buttons and Images</td>
<td>…adds Widgets and Animation</td>
<td></td>
</tr>
<tr>
<td>Predefined Widgets</td>
<td>Text Button, Checkbox, Radio, Progress Bar, Slider, Dial, Scroll, Combo Box, …</td>
<td>…plus, Windows, Charts, Spreadsheet, Tables, Tabs, Menu and Status Bars, …</td>
<td>…adds gradients and transparency effects</td>
</tr>
<tr>
<td>Multilingual Support</td>
<td>Dual Language</td>
<td>Full Multi-lingual</td>
<td></td>
</tr>
<tr>
<td>Anti-Aliasing</td>
<td>Simple Anti-Aliasing</td>
<td>True Anti-Aliasing</td>
<td></td>
</tr>
<tr>
<td>Window Builder</td>
<td>Full WYSIWYG editor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional Features</td>
<td>Runtime themes/skins, Runtime image decoding</td>
<td>…adds Swipe detection, Alpha blending</td>
<td></td>
</tr>
<tr>
<td>Starting Cost</td>
<td>Free on Freescale silicon $5,000</td>
<td>$7,000</td>
<td>$7,500</td>
</tr>
</tbody>
</table>

Learn more at: [www.freescale.com/PEG](http://www.freescale.com/PEG)
PEG Licensed / Professional Support and Maintenance

Who has access to this level of support?

• Anyone who has a valid PEG support plan.
  • 1-year of support is included with a valid license of PEG, with purchasable 1-year extensions

What does this level of support cover?

• Responses to any inquiries beyond “Standard Support” with the exception of custom driver development and testing
  • Source code related questions and project integration support
  • Driver development guidance (excluding driver development)
• Maintenance of PEG application
  • Access to new releases and patches

How is this support provided?

• Service Requests will be responded to via dedicated PEG Development Engineers

How much does the support level cost?

• 1-year included with valid PEG License (excluding free PEG Lite licenses)
• 1-year extensions price depend on current license type, refer to www.freesale.com/peg for complete pricing* details.

*1-year support extension is typically 20% of license cost.
PEG Driver Development Support

Who has access to this level of support?
• Anyone with a valid PEG support plan who has purchased a PEG Driver Development Package
• PEG Driver Development Packages available for:
  • Screen Drivers, RTOS Drivers, and Input Drivers

What does this level of support cover?
• Basic driver development for any compatible hardware
  • Driver development only, no modifications to PEG source code to accommodate unique circumstances.
  • Validation of driver on actual hardware provided to Freescale under Freescale specific NDA, hardware non-returnable

How is this support provided?
• Drivers developed by PEG Development Engineers

How much does the support level cost?

<table>
<thead>
<tr>
<th></th>
<th>Screen Driver</th>
<th>RTOS Driver</th>
<th>Input Driver</th>
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</thead>
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<tr>
<td>Freescale Silicon</td>
<td>$2,500</td>
<td>$1,500</td>
<td>$2,000</td>
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<tr>
<td>Non-FSL Silicon</td>
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<td>$2,000</td>
<td>$3,200</td>
</tr>
</tbody>
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Learn more at: [www.freescale.com/PEG](http://www.freescale.com/PEG)
Freescale Audio Solutions Framework

Integrated framework with consistent API to enable rapid development of audio software

- A highly configurable and integrated audio solution
- An integrated solution based on industry standard audio decoders, encoders, audio post processing libraries, and popular consumer electronics connectivity
- Architected to meet the needs of low-end to high-end solutions with consistent implementation across all ARM based microcontroller product lines, from Kinetis to i.MX

Product Features

Implementation of industry standard audio decoders, encoders, audio post processing libraries, and connectivity

Software and Hardware Evaluation & Dev Tools

- Stacks (TCP/IP, USB)
- Middleware
- Application Specific
- Libraries (DSP, Math, Encryption)
- Operating System
- BSP, Drivers & HAL
- Bootloader

Customer Application

- Customer Applications
- Freescale Audio Solutions (Common Audio Framework API)
- Low Level Drivers
- OS Abstraction Layer
- Media Components
- Media Player
- Media Browser
- Media Indexing
- Playlist/Play Queue
- Media Device Support
- Reference OS / Android Apps

To learn more: contact Freescale Sales
Microcontrollers Software & Services

Application Specific Libraries and Solutions
Freescale Touch Sensing Software

Integrated touch solution, allowing reduced system complexity

Innovative features such as noise filtering, advanced detection algorithms, and water tolerance

Product Features
- Support for Kinetis MCUs with Touch Sensing Interface (TSI) capabilities
- Easy integration with:
  - MQX RTOS
  - Kinetis SDK
  - Processor Expert
- Advanced Filtering and Integrating Detection (AFID)
- TSI Noise mode
- Water tolerant
- Proximity and shielding electrode(s)
- Analog decoder algorithms

Learn more at: www.freescale.com/TSS
Motor Control Libraries

Energy efficient motor control

Broad motor control devices portfolio

Software and Hardware Evaluation & Dev Tools

Customer Application

Stacks
(TCP/IP, USB)

Middleware

Application Specific

Libraries
(DSP, Math, Encryption)

Operating System

BSP, Drivers & HAL

Bootloader

MCU Hardware

Product Features

- Motor Control Applications
  - 1-Phase AC Induction Motor
  - 3-Phase AC Induction Motor
  - Brushed DC Motor
  - Brushless DC (BLDC) Motor
  - Permanent Magnet Synchronous Motor
  - Stepper Motor
  - Switched Reluctance Motor
  - Universal Motor
- Debug Tools
- DSC and Kinetis based devices
- Expert Support
- Documentation
- Safety System for IEC 60730

Learn more at: www.freescale.com/motorcontrol
Wireless Charging Solutions

**Broad flexibility in customer designs**

**Optimized HW and SW platform**

**Product Features**

- **Software**
  - Firmware library to perform wireless power core functions
  - Programmable interface to adjust core function parameters
  - Customize feature set and behavior
  - Ability to add additional features outside of wireless core function

- **Hardware**
  - Transmit controller ICs with high performance core & peripherals
  - Power efficient control loop processing
  - Digital demodulation and foreign object detection

- **Reference designs**
  - Production-ready reference designs for key markets
  - Ready designs with minimal configuration
  - Easy-to-use real-time tuning & debug tool

Learn more at: www.freescale.com/wirelesscharging

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**Software and Hardware Evaluation & Dev Tools**

**Stacks**
- TCP/IP, USB

**Middleware**

**Application Specific**

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**Operating System**

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**Bootloader**

**MCU Hardware**

**Customer Application**
Microcontrollers Software & Services

Software Support and Professional Services
Professional Services - *Beyond Support*

1. To provide **system level services and solutions** directly on **customer Hw/Sw**

2. By bridging the Gap between “**Standard enablement**” and “**additional customer needs**”

3. Leveraging our deep **SoC and BSP expertise** to ensure project success with highest **level of quality**

Learn more at: [www.freescale.com/engservices](http://www.freescale.com/engservices)
Customer’s Development Environment

MCU Software & Services
- Answering custom needs in terms of quality, content and compliance
- Targeting Customer environment (SW & HW)

Free support
Community / FAE’s / TIC free support provided on FSL Reference platform and BSP’s

Freescale Reference Platform

Customer Board

Learn more at: www.freescale.com/engservices
Software Support & Services Life Cycle Coverage

Customer’s Development Life Cycle

Evaluation

- Freescale Reference Platform
  - Standard Silicon Support
  - Baseline BSP SW Support

Proof of Concept

Design

Project Development

Customer’s Custom Board & SW

- Silicon Support
- Commercial Tech Support
- Professional Eng. Services

Productization

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Software Support & Services Life Cycle Coverage

Customer’s Development Life Cycle

- **Evaluation**
  - Freescale Reference Platform
    - Standard Silicon Support
    - Baseline BSP SW Support

- **Proof of Concept**
  - Freescale Public Communities
  - Freescale Standard Technical Support
    - Bug Reports / Feature Request
    - Bug Fixes According to Release Cadence
    - Community Posts ➔
      [http://community.freescale.com](http://community.freescale.com)

- **Design**

- **Project Development**
  - Customer’s Custom Board & SW
    - Silicon Support
    - Commercial Tech Support
    - Professional Eng. Services

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**Freescale Public Communities**

**Freescale Standard Technical Support**
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- Bug Fixes According to Release Cadence
- Community Posts → http://community.freescale.com

**Commercial Technical Support Reproducible on Freescale’s Reference Platform**
- Prioritized Access / Guaranteed Response
- Senior Level Engineering
- Private Portal
- Hot Fixes

**Customer’s Development Life Cycle**
- Evaluation
- Proof of Concept
- Design
- Project Development
- Productization

**Customer’s Custom Board & SW**
- Silicon Support
- Commercial Tech Support
- Professional Eng. Services

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Commercial Technical Support Reproducible on Freescale’s Reference Platform
- Prioritized Access / Guaranteed Response
- Senior Level Engineering
- Private Portal
- Hot Fixes

Premium Service Request – Short Term Engagements 1 - 5 days

Professional Engineering Services

Software Services
- Linux, Android, MQX
- BSP’s, Drivers/Stacks
  - Integration
  - Development
  - Porting
  - Optimization

Hardware Services
- Schematic and Layout Optimization & Review
- Simulation
- On-site board bring-up

Customer’s Custom Board & SW
- Silicon Support
- Commercial Tech Support
- Professional Eng. Services

Providing Answers

Providing Resources

Learn more at: www.freescale.com/engservices
Professional Services Focus

Software Services
- Linux, Android, MQX BSP’s, Audio Framework, Drivers/Stacks
  - Customization
  - Integration
  - Development
  - Porting
  - Testing
  - Optimization
  - Issue analysis, Debug & Fix
- Long-term support on Customer Board

Hardware Services
- Schematic and layout optimization & review
- Simulation
- On-site board bring-up

Learn more at: www.freescale.com/engservices
Professional Services Key Points

1. We do **NOT** replace FAE’s, we provide **additional** value-add services

2. We propose **solutions** to bridge **gaps** in our standard offering to address **specific requirements**

3. We provide a **flexible way** for our customers to augment their **expertise** and deliver on their project needs

4. Because we are a **paid service**, we can address any customers **no matter the HW sales size**

Learn more at: [www.freescale.com/engservices](http://www.freescale.com/engservices)
Microcontrollers Software & Services
Enablement, Software, and Services
Enablement, Support, and Services - Recap

Software and Hardware Evaluation & Dev Tools

- Hardware evaluation kits, compilers, IDEs, GUI layout editors, data profiling and visualization, etc.
- Communication stacks including TCP/IPv4/IPv6, ZigBee, BLE, WiFi, and USB
- Pre-compiled software such as HW accelerator drivers, C libraries, and proprietary algorithms

Customer Application

- Stacks (TCP/IP, USB)
- Middleware
- Application Specific

- Libraries (DSP, Math, Encryption)
- RTOS
- HAL & Drivers
- Bootloader

MCU Hardware

- Wide range of software including touch solutions, graphics suites, utilities, etc.
- e.g. Audio Solutions, Motor Control, Wireless Charging
- Real-time operating systems; e.g. MQX, uC/OS, FreeRTOS, uVelocity, and more
- Initialization and configuration; HW abstraction layers; peripheral drivers
Enablement, Support, and Services - Recap

**Freescale Reference Platform**

- Community / FAE’s / TIC free support provided on FSL Reference platform and BSP’s

**Freescale MCU Software & Services**
- Answering custom needs in terms of quality, content and compliance
- Targeting Customer environment (SW & HW)

**Customer Board**

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