Session Introduction

• This sessions introduces the i.MX 6 series portfolio including software and hardware enablement
  – Understand the target markets and benefits that i.MX 6 can bring to your design through some example case studies.
  – With over 35 devices in the portfolio (30 pin-compatible devices), learn how to select the device which is the best fit for your application.
  – We will tackle multiple topics like multicore processing, feature integration and connectivity, multimedia performance, power benchmarking, packaging, environmental robustness and usage models and product longevity.
  – To make the most of getting started with your i.MX 6 development, become familiar with the available hardware and software enablement that exists from Freescale and through the Freescale Connect program.

• About myself:
  – My name is Amanda McGregor, I am the Product Manager for the i.MX 6 series portfolio. I am based in Austin, Texas.

• This session will last about 90min with Q&A at the end.
Session Objectives

• After completing this session you will be able to:
  – See where i.MX 6 series is winning today and how the portfolio is addressing common customer design concerns
  – Select the right i.MX 6 series family for your design
  – Understand the difference between commercial, industrial and automotive devices within an i.MX 6 series family
  – Know your options for hardware and software development through Freescale and the Freescale Connect Program
Agenda

• i.MX 6 series introduction
  - Product line overview
  - Customer case studies
• Selecting the right i.MX 6 series device for your design
  - Benefits of multicore processing
  - Multimedia performance
  - Integration and connectivity
  - Power consumption
  - Know your use case
  - Understand the packaging options
• Software and hardware enablement
Freescale’s Roadway of Innovation
Making the World a Smarter Place
Our Products Power The Internet of Things

Microcontrollers | Digital Networking | Auto MCU | Analog and Sensors | RF
INTERNET OF THINGS
Different Services, Different Technologies
Different Meanings for Everyone

And the Word “SMART” Is Everywhere!
NXPscale IoT Offerings

Xtrinsic Sensing
Intelligent Contextual Sensing.

The right combination of intelligent integration, logic and customizable software on the platform to deliver smarter, more differentiated applications.

For IoT it provides Context: Identity, Activity, Location, & Time

Connectivity BAN/ PAN/ LAN

Fully integrated Short Range radios with best in class power performance, and Powerline Communications

Edge products:
• Very small
• Low cost
• Low power
• Low complexity
• Industrial grade & robust

Kinetis Microcontrollers
Design Potential. Realized

Industry’s most scalable ultra-low-power, mixed-signal MCU solutions based on the ARM® Cortex™-M and Cortex™-M0+ architectures.

Vybrid Controller Solutions
Rich Apps in Real Time.

Real-time, highly integrated solutions with best-in-class 2D graphics to enable your system to control, interface, connect, secure and scale.

i.MX Applications Processors
Your Interface to the World.

Industry’s most versatile solutions for multimedia and display applications, with multicore scalability and market-leading power, performance & integration.

QorIQ Processors built on Layerscape Architecture
Accelerating the Network’s IQ

Industry’s first software-aware, core-agnostic networking system architecture for the smarter, more capable networks of tomorrow – end to end.

Scalable Industry Standard Solutions, Software and Development Ecosystem
i.MX 6 Series Introduction
Six Generations of Application Processors

1995
- **Dragonball**
  - 1st FSL Apps Processor

2001
- **i.MX1**
  - 1st FSL ARM9 Apps Processor

2003
- **i.MX2 Series**
  - 90nm LP
  - HW Video Accel
  - Analog Integration

2005
- **i.MX3 Series**
  - ARM11
  - GPU Integration

2009
- **i.MX5 Series**
  - 65nm LP/GP
  - ARM Cortex-A8
  - >1GHz

2012
- **i.MX 6 Series**
  - 40nm LP
  - ARM Cortex-A9
  - Multi-core family

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- **Clear market leader** for eReader apps processors (IDC)
- **No. 1** in Apps Processors (IDC 12/2011)
- **No. 2** in Auto Infotainment (Strategy Analytics)
One Platform, Differentiated Products

- Provide customers and partners with the **broadest range** of choices
- Reduce **development costs** and **improve** time to market
- **Performance scalability** is key to implement this strategy
- **Quad** = 4x Cortex-A9, **Dual/DualLite** = 2x Cortex-A9, **Solo/SoloLite** = 1x Cortex-A9
# 6 Series At a Glance

Scalable Series of Five ARM Cortex-A9-Based SoC Families

<table>
<thead>
<tr>
<th>i.MX 6SoloLite</th>
<th>i.MX 6Solo</th>
<th>i.MX 6DualLite</th>
<th>i.MX 6Dual</th>
<th>i.MX 6Quad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single ARM Cortex-A9 at 1GHz</td>
<td>Single ARM Cortex-A9 at 800MHz/1GHz</td>
<td>Dual ARM Cortex-A9 at 800MHz/1GHz</td>
<td>Dual ARM Cortex-A9 at 850MHz/1GHz/1.2GHz</td>
<td>Quad ARM Cortex-A9 at 850MHz/1GHz/1.2GHz</td>
</tr>
<tr>
<td>256KB L2 cache, Neon, VFPvd16, Trustzone</td>
<td>512KB L2 cache, Neon, VFPvd16, Trustzone</td>
<td>512KB L2 cache, Neon, VFPvd16, Trustzone</td>
<td>1 MB L2 cache, Neon, VFPvd16, Trustzone</td>
<td>1 MB L2 cache, Neon, VFPvd16, Trustzone</td>
</tr>
<tr>
<td>2D graphics</td>
<td>3D graphics with 1 shader</td>
<td>3D graphics with 1 shader</td>
<td>3D graphics with 4 shaders</td>
<td>3D graphics with 4 shaders</td>
</tr>
<tr>
<td>32-bit DDR3 and LPDDR2 at 400MHz</td>
<td>2D graphics</td>
<td>2D graphics</td>
<td>Two 2D graphics engines</td>
<td>Two 2D graphics engines</td>
</tr>
<tr>
<td>10/100 Ethernet</td>
<td>64-bit DDR3 and 2-channel 32-bit LPDDR2 at 400MHz</td>
<td>64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533MHz</td>
<td>64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533MHz</td>
<td>64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533MHz</td>
</tr>
<tr>
<td>EPD controller</td>
<td>1080p30 video</td>
<td>1080p30 video</td>
<td>1080p60 video</td>
<td>1080p60 video</td>
</tr>
<tr>
<td></td>
<td>Gigabit Ethernet</td>
<td>Gigabit Ethernet</td>
<td>PCIe (x1 lane)</td>
<td>PCIe (x1 lane)</td>
</tr>
<tr>
<td></td>
<td>PCIe (x1 lane)</td>
<td>PCIe (x1 lane)</td>
<td>Gigabit Ethernet</td>
<td>Gigabit Ethernet</td>
</tr>
<tr>
<td></td>
<td>LVDS, MIPI</td>
<td>LVDS, MIPI</td>
<td>LVDS, MIPI</td>
<td>LVDS, MIPI</td>
</tr>
<tr>
<td></td>
<td>EPD controller</td>
<td>EPD controller</td>
<td>EPD controller</td>
<td>EPD controller</td>
</tr>
</tbody>
</table>

- **Pin-to-pin and Power Compatible**
- **Software Compatible**
  - ARM Cortex-A9 based solutions ranging up to 1.2GHz
  - HD 1080p encode and decode (except 6SoloLite)
  - Integrated IO’s may include HDMI v1.4, MIPI and LVDS, display ports, MIPI camera, Gigabit Ethernet, multiple USB 2.0, SATA and PCI-Express
  - SW support: Google Android™, Linux®, QNX (3rd party), Windows® Embedded CE (3rd party)

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*Features vary by product family*
Freescale i.MX 6: Unmatched Pin-Compatibility

**Competitors**

- Pin-compatibility inside a family (typically frequency scaling)
- Pin-compatibility between families
- Freescale >30 pin compatible devices!

- Competitors
  - i.MX 6Solo
  - i.MX 6DualLite
  - i.MX 6Dual
  - i.MX 6Quad

- Pin-compatibility inside a family (frequency scaling, fewer features, different qualifications)
i.MX 6 Series: Where We Are winning

**Automotive**
- Infotainment
- Telematics
- Instrument Clusters
- Vision/Camera Systems

**eReaders**
- Monochrome eReader
- Color eReaders

**Smart Devices**
- IPTV/Streaming Media
- Transportation – in-flight infotainment, marine navigation, in-car signage
- Health Care – patient monitoring, telehealth, fitness equipment
- Factory, process and building automation
- Handheld scanners and printers
- Digital signage
- Thin Client and cloud server
- Point of sale terminal and printer
- Tablets – medical, educational, industrial
- IPTV/Streaming media
- IP phone
- Test and Measurement
- Appliances
- Home audio
i.MX 6 Series: Why We Are Winning

• **Scalable Product Platform for Embedded**
  - Ability to start at any of 4 entry points and scale as needed
  - Wide ball pitch BGA packages
  - Industrial, Automotive and Consumer availability

• **Long Term Availability**
  - Freescale as a trusted provider long term
  - We fit the needs of long term embedded customers (7+ years)
  - Automotive and industrial devices on Freescale’s Product Longevity Program

• **Targeted Embedded Solutions**
  - Interfaces: LVDS, PCIe, SATA, 4x USB
  - Memory: LPDDR2 and DDR3/DDR3L
  - Voltages: <=3.6v for GPIOs (no level shifters)

• **Embedded Ecosystem i.MX Support**
  - Easy to build/engage on i.MX
  - Multiple 3rd parties: EBS, Solution Providers assist in OEM design-in
i.MX 6 Series: Powering Key Designs

Amazon Kindle™

- Portable e-reader device that delivers book content in an electronic form to customers, with industry leading low-power design.
- Based on i.MX 6SoloLite.

BAM Labs Touch-Free Life Care™

- BAM Labs' Touch-Free Life Care (TLC) System utilizes Freescale technology to track biosignals without keeping people tethered to bedside monitors.
- Based on i.MX 6 series.
- www.freescale.com/BAMLabs

OrCam Wearable Vision Assist

- OrCam is a sensor that sees what is in front of you, understands what information you seek and provides it to you through a bone-conduction earpiece.
- Based on i.MX 6Quad.
- www.freescale.com/OrCam
Selecting the Right i.MX 6 Series Devices for Your Design
Question: Do I Need Multicore Processing?

• The current i.MX 6 series architecture is based on homogenous ARM Cortex-A9.

• Questions to ask:
  - Do you need additional MIPS performance for your application, or room to grow?
  - Do you need multiple isolated software execution environments for system security or “real-time” responsiveness?
  - Are you concerned with run-time power consumption for CPU intensive tasks?

• Pin-compatible 4x/2x/1x product offerings gives ultimate flexibility during SW product development

* i.MX 6SoloLite is not pin-compatible
Benefits of Multicore Processing

• SMP = Symmetric Multicore Processing, e.g. same OS runs on all cores.
  - This gives the greatest performance boost for applications like web browsing, or where a single core can be dedicated to a certain processing function.
  - Low power is also a benefit here as multiple cores can be engaged but running at lower frequency, thus consuming less power (lower voltage), while the same amount of work can still be done.

• AMP = Asymmetric Multicore Processing, e.g. different OS runs on core 1 vs. core 2.
  - A growing number of embedded use cases require concurrent execution of isolated software environments within the system, for:
    • Real-time performance
    • System integrity
    • System security
Question: What is the Multimedia Performance Target?

- External memory bandwidth is a key contributor to multimedia performance.

- Questions to ask:
  - What type of video performance is required?
    - Multi-stream 1080p video encode/decode?
    - Single-stream 1080p video encode/decode?
  - Do I need to drive multiple displays?
  - What are the UI requirements?
    - Multi-layered UI with shading and texturing?
    - 3D gaming is required for my design?
    - Simple UI with 1-2 layers and basic blending?

- Pin-compatible product offerings gives ultimate flexibility during SW product development.

- i.MX 6SoloLite has 32-bit DDR with no hardware video processing and no 3D GPU. For a multimedia-centric device (multi-layered UI with shading/texturing plus video) the i.MX 6Solo should be considered the starting point.
Balanced Processor Architecture

**Application**
- HW Dependency #1
- HW Dependency #2
- HW Dependency #3
- User satisfaction ‘metric’

**Browsing**
- CPU speed (rendering)
- Video HW unit
- Memory bandwidth
- Fast page draw

**Imaging**
- JPEG HW dec
- Memory bandwidth
- 2D perf (swipe)
- Fast image viewing

**Video Playback/Streaming**
- HW video unit
- Memory bandwidth
- Jitter-free video

**Games**
- CPU speed (geometry)
- 3D HW unit (TPS)
- Memory Bandwidth (complexity)
- Richer graphics, no ‘lag’

**User Interface**
- CPU speed (geometry)
- 3D HW unit
- Memory BW
- Responsiveness

**Email/IM**
- CPU speed
- Memory Bandwidth
- Responsiveness
Intelligent Integration of Multimedia

**i.MX 6Dual/6Quad VPU**
- H.264 MVC1080p60 decode
- H.264 MVC 720p60 encode

**Image capture**

**VPU**

**2x/4x ARM Cortex-A9s**

**IPU**

**i.MX 6Dual/6Quad IPU**
- Four Display support (2x MIPI-DSI, Parallel, HDMI v1.4a)
- Stereoscopic camera input
- Color adjustments and gamut mapping
- Gamma correction and contrast stretching
- Compensation for low-light conditions & backlight reduction

**Movie Content**

**Recording Video**

**3D LCD**

**Publish**

**Game Content**

**3D Television**

**i.MX 6Dual/6Quad Triple-Play Graphics**
- 3 engines: 3D, OpenVG and BLT
- 200 MT/s, 4 shaders, 3 separate engines
- High quality 3D games optimized for mobile
- Augmented reality views (real world + 3D objects)
- Advanced 3D video formats (source/depth format)

**i.MX 6Dual/6Quad – 2x/4x cores**
- Create, transform, enhance, & publish multimedia fast!
- Intuitive User Interfaces for content viewing
- Scalability for ‘the next big use case’
i.MX 6 Series: Graphics Processing Goals

- **Diverse markets** and applications call for multiple GPUs

- **Accelerate** existing windowing environments (Android, X11, Wayland, etc) and base user interfaces with a low-power high-performance composition engine

- Provide **compelling vector capabilities** for high-quality fonts and components in automotive instrument clusters in a manner that assures quality of service in performance

- Accelerate **next-generation 3D** and GPGPU applications with a feature-rich, high-performing unified multi-API graphics processor

**Competitors typically only offer a single, power hungry GPU which is inefficient for multi-context applications**
# i.MX 6 Series Triple-Play Graphics Support

<table>
<thead>
<tr>
<th>Processor</th>
<th>Composition (2D BLIT)</th>
<th>600Mpix/s</th>
<th>Vector Graphics</th>
<th>300Mpix/s</th>
<th>3D GPU</th>
<th>1 shader core</th>
<th>53Mtri/s, 266Mpix/s</th>
<th>3D + GP GPU</th>
<th>4 shader cores</th>
<th>176Mtri/s, 1Gpix/s, GPGPU</th>
</tr>
</thead>
<tbody>
<tr>
<td>i.MX 6SoloLite</td>
<td></td>
<td></td>
<td>VIVANTE GC320</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VIVANTE GC355</td>
<td></td>
</tr>
<tr>
<td>i.MX 6Solo / 6DualLite</td>
<td></td>
<td></td>
<td>VIVANTE GC320</td>
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<td></td>
<td></td>
<td></td>
<td>VIVANTE GC355</td>
<td></td>
</tr>
<tr>
<td>i.MX 6Quad / 6Dual</td>
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<td></td>
<td>VIVANTE GC320</td>
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<td></td>
<td></td>
<td>VIVANTE GC355</td>
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</tr>
</tbody>
</table>

**Same GPU drivers for all i.MX 6 Processors**
User Interfaces – Characteristics and Implications

• UI content is inherently dynamic
  - Unlike games (which use pre-cached images/textures)
  - User content can/will change at any time
  - Therefore UI **must** refresh continuously in case new content emerges
  - Requires high speed (533MHz) and wide (64-bit) memory bus to ensure high frame rates

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**Conclusion:** Recommend Dual Core + 64-bit Memory Bus

**i.MX 6Solo**
- 32-bit
- 8fps

**i.MX 6DualLite**
- 64-bit
- 15-20fps

**i.MX 6Quad**
- 64-bit
- 30-40fps
Browsing and Image Viewing

<table>
<thead>
<tr>
<th>App</th>
<th>1 Core</th>
<th>2 Core</th>
<th>Dual Core vs Single Core</th>
<th>4 Core</th>
<th>Quad Core vs Dual Core</th>
</tr>
</thead>
<tbody>
<tr>
<td>JPEG</td>
<td>.2 fps</td>
<td>~1fps</td>
<td>5x faster</td>
<td>~4.5 fps</td>
<td>4x faster</td>
</tr>
<tr>
<td>Browser Scroll Time</td>
<td>289</td>
<td>36.25</td>
<td>&gt;87% faster</td>
<td>15</td>
<td>&gt;50% faster</td>
</tr>
<tr>
<td>Browser FPS</td>
<td>3.45</td>
<td>27.58</td>
<td>8x higher</td>
<td>64.4</td>
<td>&gt;2x higher</td>
</tr>
</tbody>
</table>

• All workloads implemented on CPU
• Does not use HW accelerators at all
• Done in order to test CPU capabilities

Watch it live! [http://www.youtube.com/watch?v=JYFmBlk3itl#t=2m49s](http://www.youtube.com/watch?v=JYFmBlk3itl#t=2m49s)
Video Playback and Streaming

- Video Playback or Streaming performance is highly dependent upon screen resolution
  - 1080p playback on a 1024x768 screen takes less bandwidth than 1080p on a 1920x1080 LCD

- Available Memory bandwidth on 32bit DDR-400 is ~1600MB/s
  - 64bit memory is up to 3200MB/s
  - This assumes 50% utilization of the interface (generous)

- Total Memory B/W required for 1080p playback
  - On 1024x768 screen: ~800MB/s
  - On 1920x1080 screen: ~1100MB/s
  - If performing parallel tasks, will add to memory bandwidth needs
  - System activity + screen size Can vary memory bandwidth by up to 500MBs

Recommend Dual Core + 64bit Memory Bus for 1080p Playback
Balanced Multimedia Platform Performance

- Benchmarking multimedia rich performance is tricky
  - Dependent upon the 3D HW, the CPU speed and DDR memory BW
  - Must balance all three to get best performance
- Review websites use generally available benchmarks to rate tablets
  - Example: Basemark, NenaMark, Antutu, Quadrant

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>6Quad @ 1GHz</th>
<th>6Quad @ 1.2GHz</th>
<th>6DualLite @ 1GHz</th>
<th>6Solo @ 1GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taiji Girl (Basemark ES2)</td>
<td>28.9 fps</td>
<td>28.9 fps</td>
<td>9.2 fps</td>
<td>7.67 fps</td>
</tr>
<tr>
<td>NenaMark 2 3D Benchmark</td>
<td>58.5</td>
<td>58.5</td>
<td>30.5</td>
<td>27.2</td>
</tr>
<tr>
<td>AnTuTu 3.0.3</td>
<td>14235</td>
<td>16494</td>
<td>5583</td>
<td>4531</td>
</tr>
<tr>
<td>Quadrant 2</td>
<td>3891</td>
<td>4654</td>
<td>3005</td>
<td>2414</td>
</tr>
</tbody>
</table>
Question: What Integration and Connectivity is Needed?

- How many and what types of displays do I need to drive?
  - LVDS, HDMI, MIPI, RGB, e-Ink

- Do I need to connect to external PCIe-based Wi-Fi or FPGAs?

- Do I need external SSD?

- What are my boot sources?

- Does my design require automotive or industrial connectivity (CAN, MLB)?
Question: What is my SoC Power Target?

- i.MX 6 series is a Freescale “Energy-Efficient Product Solution”.

- All i.MX 6 families contain internal LDOs to help simplify the overall power management sub-system. Freescale development platforms include Freescale’s PF0100 PMIC.

- Freescale BSPs support the available low-power modes in i.MX 6 series.

- Power application notes are available on freescale.com; they provide measured data for various use cases (video, 3D).
  - All results include power at the chip (cores, accelerators, peripherals, DDR I/O) as well as the power consumption of the external DDR3 ICs.
  - Power application notes listed in the presentation contain the full breakouts for the chip and DDR3. Note that use of LPDDR2 memory will substantially reduce memory IC power consumption.
  - Video results use external HDMI monitor.
Question: What is the Use Case?

- i.MX 6 series portfolio offers > 30 pin compatible devices that:
  - Address cost-sensitive consumer devices that require long battery life with typical consumer usage model (i.e. not 24/7 operation).
  - Provide environmental robustness for maximum operating lifetime in industrial-like applications (i.e. 24/7 operation).
  - Can operate in a high temperature environment (up to $T_j=125^\circ C$) for example in automotive applications.

- Industrial and automotive devices are part of Freescale’s Product Longevity Program.
  - [www.freescale.com/productlongevity](http://www.freescale.com/productlongevity)
  - Industrial devices will ship until at least 2022
  - Automotive devices will ship until at least 2027

<table>
<thead>
<tr>
<th></th>
<th>Commercial</th>
<th>Industrial</th>
<th>Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>i.MX 6Quad</td>
<td>21,900 PoH</td>
<td>87,600 PoH</td>
<td>13,140 PoH</td>
</tr>
<tr>
<td>i.MX 6Dual</td>
<td>21,900 PoH</td>
<td>87,600 PoH</td>
<td>13,140 PoH</td>
</tr>
<tr>
<td>i.MX 6DualLite</td>
<td>21,900 PoH</td>
<td>87,600 PoH</td>
<td>13,140 PoH</td>
</tr>
<tr>
<td>i.MX 6Solo</td>
<td>21,900 PoH</td>
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<td>13,140 PoH</td>
</tr>
<tr>
<td>i.MX 6SoloLite</td>
<td>21,900 PoH</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* PoH = Power on Hours
Question: Which Package is Right for My Design?

- 4 out of 5 i.MX 6 families are pin-compatible
  - > 30 pin-compatible devices
  - Design once for performance scalability

- What is my thermal signature?
  - Non-lidded parts have lower z-height and a graphite heat spreader can be directly attached for maximum thermal dissipation
  - Lidded parts are mandatory for automotive and industrial devices (i.MX 6Quad/6Dual)

- Do I have tight xy design constraints in my end product?
  - If choosing between i.MX 6Solo and i.MX 6SoloLite, size may be an important consideration.
  - i.MX 6SoloLite is available in the smallest package, at 13x13 BGA.
    - No blind and buried vias
    - Can achieve 6-layer board design
Thermal Management: Summary

• Highly integrated SOCs using ARM-based cores are powerful and can generate significant heat
  - However, typically in the sub 5W range vs 100’s of Watts for Intel

• Heat is a function of what you are doing with the processor + memory
  - Only running Video (~2Watts)
  - Only running 3D (~1.7Watts)
  - Video + 3D + 3 Cortex A9s at high speed (4.6W)
  - 4 Cortex A9’s at high speed only (2.3W)
  - Note: all based on SOC + DDR3 power consumption

• ALL modern day devices using ARM based processors have some sort of thermal management system in place
  - Typically: cheap graphite heat spreader
  - Sometimes: metal tabs for conducting heat
  - Almost never: a full active heatsink
Re-cap: How to choose the right i.MX 6 for my design?

Questions to ask:
• Do I need multicore processing?
• What are my multimedia performance requirements?
• What integration and connectivity do I need?
• What are my power consumption targets?
• What is my use case?
• Which package is right for me?
Software and Hardware Enablement
Freescale Enablement

- Development Systems
- BSPs
- imxcommunity.org
- Software Services
i.MX 6 Series Overview: Enablement

Hardware Platform

- Application focused development systems and accessories
- Ease of Use – BSP and demo images, development environment build demonstration, video tutorials, schematics and layout, documentation

SABRE, EVK

+ Software

- Mature, full-featured, scalable and optimized BSPs for latest Linux and Android releases
- Optimized audio/video codecs and infrastructure to support on-chip multimedia accelerators

Apps

API

Stacks

Drivers

HW

Codec

MW

OS

+ Ecosystem

- Hardware – Embedded Board Solutions (EBS)
- Tool chains
- Software – RTOS, OS, codecs, middleware/applications
- Design services
- System integrators
- Training

Full hardware evaluation and development platforms

Complete software package to streamline software development

Technology alliances for building smarter, better

www.freescale.com/imxcommunity
SABRE Platforms: Enabling Faster Time to Market

i.MX 6 series development tools are Freescale designed

SABRE Platform for Smart Devices
- i.MX 6Quad or i.MX 6DualLite
- Multiple connectivity options: Wi-Fi®, Bluetooth®, GPS, Ethernet, SD, parallel/serial interfaces, SATA (i.MX 6Quad only), mPCI Express® and MIPI CSI
- SABRE Board plus:
  - 10.1” capacitive multi-touch display
  - 4MB SPI NOR Flash
  - MIPI display connector, 2x MIPI camera sensors
  - 2x digital microphones
  - Ambient light sensor, GPS module with antenna
  - EPDC connector (i.MX 6DualLite only)

SABRE for Auto Infotainment
- Available to Tier 1 automotive OEMs
- i.MX 6Quad or i.MX6DualLite CPU card and i.MX 6 series base board
- Support for terrestrial and satellite radio tuners, Wi-Fi, Bluetooth, GPS, cellular modem, iAP authentication modules, MOST vehicle networking, cameras and displays
- Processor capability ranges from single ARM Cortex-A9 core at 800 MHz up to a quad core at up to 1 GHz

SABRE Board for Smart Devices
- i.MX 6Quad
- Intelligently designed with connectors on only two sides of board to eliminate ‘octopus effect’ on lab tables
- Evaluate the smartly integrated features of the i.MX 6Quad processor including an LVDS controller, USB PHYs, HDMI PHYs, SATA, mPCI Express®, on-board power management and Ethernet
- LVDS display sold separately

i.MX 6SoloLite Evaluation Kit
- i.MX 6SoloLite
- Integrated E Ink® display controller
- Enables EPD and/or LCD or HDMI display, touch control and audio playback, and the ability to add WLAN, a 3G modem or Bluetooth technology
- E Ink display available separately

www.freescale.com/imxcommunity
<table>
<thead>
<tr>
<th>Display Option</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVK</td>
<td>$399 USD MSRP</td>
</tr>
<tr>
<td>HDMI</td>
<td>$49 USD MSRP</td>
</tr>
<tr>
<td>EPD</td>
<td>$499 USD MSRP</td>
</tr>
<tr>
<td>LCD</td>
<td>$250 USD MSRP</td>
</tr>
</tbody>
</table>
Freescale Enablement

- Development Systems
- BSPs
- imxcommunity.org
- Software Services
**Commitment:** 9 Android OS versions released over past 7 years

**Broad Acceptance:** 25,000+ downloads of BSP to date

**Fast Development:** ~4 months from development start to production release on multiple Android versions

**Cross market robustness:** Automotive, Embedded/Industrial, Consumer

**Continued support:** New OS releases for 2 years after silicon production qual

**Leadership:** i.MX – only Android system shipping in a top 5 OEM infotainment platform today
## History of Android Development

<table>
<thead>
<tr>
<th>Android</th>
<th>Google Release</th>
<th>First Freescale Release</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cupcake</td>
<td>Android 1.0 (September 2008)</td>
<td>R3 (June 2009)</td>
</tr>
<tr>
<td></td>
<td>Android 1.1 (February 9, 2009)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Android 1.5 (April 2009)</td>
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</tr>
<tr>
<td>Donut</td>
<td>Android 1.6 (September 2009)</td>
<td>R5 (September 2009)</td>
</tr>
<tr>
<td>Eclair</td>
<td>Android 2.0 (October 2009)</td>
<td>R7 (January 2010)</td>
</tr>
<tr>
<td></td>
<td>Android 2.0.1 (December 2009)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Android 2.1 (January 2010)</td>
<td></td>
</tr>
<tr>
<td>Froyo</td>
<td>Android 2.2 (May 2010)</td>
<td>R9 (August 2010)</td>
</tr>
<tr>
<td></td>
<td>Android 2.2.1 (January 2011)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Android 2.2.2 (January 2011)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Android 2.2.3 (November 2011)</td>
<td></td>
</tr>
<tr>
<td>Gingerbread</td>
<td>Android 2.3 (December 2010)</td>
<td>R10 (January 2011)</td>
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<tr>
<td></td>
<td><strong>Android 2.3.3 (February 2011)</strong></td>
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<tr>
<td></td>
<td>Android 2.3.4 (April 2011)</td>
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<tr>
<td></td>
<td>Android 2.3.5 (July 2011)</td>
<td></td>
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<tr>
<td></td>
<td>Android 2.3.6 (September 2011)</td>
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</tr>
<tr>
<td></td>
<td>Android 2.3.7 (September 2011)</td>
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<tr>
<td>Honeycomb</td>
<td>Android 3.2 (July 2011)</td>
<td>R11 (September 2011 – i.MX53)</td>
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<td><strong>Android 3.2.1 (September 2011)</strong></td>
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<td>Android 3.2.2 (August 2011)</td>
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<td>Android 3.2.4 (December 2011)</td>
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<td></td>
<td>Android 3.2.6 (February 2012)</td>
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</tr>
<tr>
<td>Ice Cream Sandwich</td>
<td>Android 4.0.1 (October 2011)</td>
<td>R13 (December 2011)</td>
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<td>Android 4.0.2 (November 2011)</td>
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<td>Android 4.0.3 (December 2011)</td>
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<td><strong>Android 4.0.4 (March 2012)</strong></td>
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<td></td>
<td>Android 4.2 (December 2012)</td>
<td>JB 4.2 Beta – Feb 2012</td>
</tr>
<tr>
<td></td>
<td>Android 4.3 (July 2013)</td>
<td>JB 4.2 GA – April 2012</td>
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<tr>
<td></td>
<td></td>
<td>JB 4.3 GA – November 2013</td>
</tr>
<tr>
<td>Kit Kat</td>
<td>Android 4.4 (November 2013)</td>
<td>KK 4.4.2 Alpha – Jan 2014</td>
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<tr>
<td></td>
<td></td>
<td>KK 4.4.2 Beta – May 2014</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KK 4.4.2 GA – June 2014</td>
</tr>
</tbody>
</table>
**Linux Roadmap**

### Legacy Distribution

<table>
<thead>
<tr>
<th>LTIB</th>
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<tbody>
<tr>
<td>X server 1.6.1</td>
</tr>
<tr>
<td>GStreamer 0.10.35</td>
</tr>
<tr>
<td>Vivante p12</td>
</tr>
<tr>
<td>L3.0.35_4.1.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X server 1.6.1</th>
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<td>Vivante p13</td>
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<tr>
<td>L3.0.35_4.1.1</td>
</tr>
</tbody>
</table>

### Yocto Releases

- **Yocto 1.5 “Dora”**
  - L3.10.9_1.0.0-alpha
  - L3.10.17_1.0.0-beta
  - X server 1.14.0
  - Qt4-embedded 4.8.5
  - Wayland 1.1
  - Mesa 9.1.5
  - DRM 2.4-45
  - DirectFB 1.6.3
  - WebGL 1.0.1

- **Yocto 1.6 – “Daisy”**
  - L3.10.X_1.1.0-alpha
  - L3.10.X_1.1.0-beta
  - L3.10.X_1.2.0-alpha

### Yocto 1.5 “Dora”

- L3.10.9_1.0.0-alpha
- L3.10.17_1.0.0-beta
- X server 1.14.0
- Qt4-embedded 4.8.5
- Wayland 1.1
- Mesa 9.1.5
- DRM 2.4-45
- DirectFB 1.6.3
- WebGL 1.0.1

### Yocto 1.6 – “Daisy”

- L3.10.X_1.1.0-alpha
- L3.10.X_1.1.0-beta
- L3.10.X_1.2.0-alpha

### Next GA release will be based on 3.10.x LTS Linux kernel

- LTS = Long-term Stable
- Beta – available via Yocto project
- GA in early 2014 – available via Yocto project and freescale.com
- Add support for device tree and HW floating point GPU binaries

**Linux Roadmap**

<table>
<thead>
<tr>
<th></th>
<th>L3.0.X_1.0.0</th>
<th>L3.10.X_1.0.0</th>
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<td>4Q</td>
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<tr>
<td>2013</td>
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<tr>
<td>2014</td>
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</tr>
</tbody>
</table>

- i.MX6Q/i.MX6D SabreSDB/SDP, SabreAI
- i.MX6D/Li.MX6S SabreSDB, SabreAI
- i.MX6SL EVK
Codec Availability on i.MX 6 Series

- Freescale has an extensive portfolio of multimedia codecs

  1. Standard Distribution
     - Audio decoders – AAC, AACPlus, MP3, Vorbis, FLAC
     - Audio encoders – SBC, MP3
     - Speech codecs – G.723.1, G.726, G.711, G.729AB, NB/WB AMR
     - Video decoders – MPEG-4 ASP, XVID, H.264 HP, H.263, MPEG-2 MP, MJPEG BP, VP8, Sorenson-H263
     - Video encoders – MPEG-4 SP, H.264 BP, H.263, MJPEG BP
     - Image codecs – JPEG, BMP, GIF, PNG
     - Distribution is done via freescale.com. Customer must accept click-thru license agreement prior to download.

  2. Restricted Distribution
     - Microsoft: WMA10 decoder, WMA8 encoder, WMV7/8/9MP decoder
     - Dolby: AC3 (Dolby Digital) and E-AC3 (Dolby Digital Plus) decoder
     - Rovi: DivX 3/4/5/6 decoder
     - Distribution is done via extranet site and requires agreement to be in place with Microsoft, Dolby or Rovi for the specific technology prior to accessing, in order to comply with 3rd party requirements. Customer must accept click-thru license agreement prior to download. Once the customer is given access to the codec, all silicon shipments are considered “enabled” with this technology and may require reporting obligations to the 3rd party technology owner, per the customer’s specific license agreement with the 3rd party.

- Licensing
  - Customers may need to obtain additional licensing or other rights (e.g. MPEG LA, Via). Freescale does not charge a license fee or royalty. Freescale is legally unable to provide guidance on when, where and how to obtain licenses as these are done by 3rd parties with varying and (sometimes) changing terms.
Freescale Enablement

- Development Systems
- BSPs
- imxcommunity.org
- Software Services
i.MX Community backed by Freescale Community

- i.MX Community revamped in Sept 2012 is integrated with Freescale.com and i.MX support, ensuring a true “one-stop” solution spot for all i.MX needs.

- The community also merges existing communities, wikis and forums to a single, full-featured site and includes thousands of members and i.MX experts.

- Product spaces will utilize functionality required to meet specific needs/goals and evolve as needs change.

- Private groups for support teams, single-customer support spaces, NPI product repositories, etc.

- There are significant changes that will improve your ability to find answers quickly, learn valuable information to help get to market faster and provide opportunities to highlight your business.

Success since 2012
- Generating 18,000 page views per day
- Amassed over 5,000 discussions
- 2,000 published answers to members’ questions
- Greater than 1500 active members
- Containing more than 400 technical documents
- Supported by a team of more than 100 Freescale contributors
Freescale Enablement

- Development Systems
- BSPs
- imxcommunity.org
- Software Services
worldwide Software Presence

Software Services
Linux, Android, BSPs and drivers/stacks
• Customization
• Integration
• Development
• Porting
• Testing
• Optimization
• Issue analysis, debug and fix

Long-term support on customer hardware

100+ Partners

Ecosystem
UI & Applications
Middleware
FSL BSP
Drivers
OS Kernel

Primary Focus Area

300+ Software Engineers
Ecosystem Enablement

• Overview of the Ecosystem
• Embedded Board Solutions (EBS)
• Development Boards and Communities (RIOT, wandboard, Udoo)
• Reference Designs (One Box, WaRP)
EcoMAPS: i.MX applications processor based on ARM™ core

For more partner options, visit freescale.com/partners

https://community.freescale.com/community/imx
Ecosystem Enablement

- Overview of the Ecosystem
- Embedded Board Solutions (EBS)
- Development Boards and Communities (RIOT, wandboard, Udoo)
- Reference Designs (One Box, WaRP)
EBS Program: FSL Offering

• Part of Connect Partner Program
  
  - 24 EBS Proven Partners Power Architecture and ARM solutions and growing
  - More than 250 ready solutions based on QorIQ, PowerQUICC, i.MX and Vybrid
  - OS: Linux, WinCE, Android, VxWorks, QNX, OSE, Integrity, LynxOS…

• Partners and solution list at www.freescale.com/EBS

• Technical support done by our partners

• Advantages for our customers:
  
  - faster time-to-market,
  - addressing higher complexity,
  - resource limitation
  - reducing development cost…
Ecosystem Enablement

• Overview of the Ecosystem
• Embedded Board Solutions (EBS)
• Development Boards and Communities (RIOT, wandboard, Udoo)
• Reference Designs (One Box, WaRP)
## Community Boards Enabled by Freescale Technology

<table>
<thead>
<tr>
<th>Feature</th>
<th>RIoTboard</th>
<th>WaRP</th>
<th>UDOO</th>
<th>WANDBOARD.ORG</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Price</strong></td>
<td>$74 USD</td>
<td>$149 USD MSRP</td>
<td>$69-$135 USD</td>
<td>$79-$129 USD</td>
</tr>
<tr>
<td><strong>CPU</strong></td>
<td>i.MX 6Solo processor based on ARM Cortex-A8 architecture operating at 1 GHz, Kinetics K20 MCU and Freescale PMIC (MMPF010G)</td>
<td>i.MX 6SoloLite processor based on ARM Cortex-A8 architecture (main board) and Kinetics K16 MCU based on ARM Cortex-M0+ (sensor hub)</td>
<td>i.MX 6DualLite/Quad processor based on ARM Cortex-A9 architecture</td>
<td>i.MX 6Solo/DualLite/Quad processor based on ARM Cortex-A9 architecture</td>
</tr>
<tr>
<td><strong>Linux or Android™ enabled</strong></td>
<td>Both</td>
<td>Android</td>
<td>Both</td>
<td>Both</td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td>1 GB DDR3 RAM</td>
<td>LPDDR2+eMMC NAND</td>
<td>1 GB</td>
<td>0.5/2GB</td>
</tr>
<tr>
<td><strong>Camera Interface</strong></td>
<td>CCD or CMOS and MIPI CSI data lanes @ 1 Gb/s</td>
<td>-</td>
<td>CSI</td>
<td>MIPI</td>
</tr>
<tr>
<td><strong>Integrated Sensors</strong></td>
<td>FXOS8700CQ Mag/Accelerometer (main board), Xtrinsic MMD9558 Motion Sensing Pedometer (sensor hub)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Connectivity/Ethernet</strong></td>
<td>HDMI, LVDS, parallel RGB, 3.5 mm audio, 1 x USB 2.0 OTG, mini USB, 4 x USB 2.0 HOST, uSD Card, SD Card, 10 M/100 M/GB Ethernet, 2-channel 2C, 2-channel SPI, 3-channel PWM, PIO, 10-pin JTAG, 9-pin debug port</td>
<td>WLAN/Bluetooth® 4.0</td>
<td>Ethernet, SATA, HDMI, Wi-Fi</td>
<td>Ethernet, SATA, Wi-Fi</td>
</tr>
<tr>
<td><strong>Partners</strong></td>
<td>Freescale, Element14</td>
<td>Freescale, Kynetics, Revolution Robotics</td>
<td>Secco</td>
<td>Technexion</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>Available now</td>
<td>Coming 2Q14</td>
<td>Arduino compatible, Available now</td>
<td>Available now</td>
</tr>
<tr>
<td><strong>More Information</strong></td>
<td>RIoTboard.org</td>
<td>WaRPboard.org</td>
<td>UDOO.org</td>
<td>Wandboard.org</td>
</tr>
</tbody>
</table>
UDOO: Android Linux Arduino in a tiny single-board computer by SECO

- Unique Linux and Arduino SBC
- i.MX 6Solo/Dual/Quad
- Microcontroller M3 (Arduino) R3 1.0 input
- DDR3 1GB
- 76 fully available GPIO
- HDMI and LVDS + Touch (I2C signals)
- Ethernet RJ45 (10/100/1000 MBit)
- WiFi Module
- Mini USB and Mini USB OTG
- USB type A (x2) and USB connector (requires a specific wire)
- Analog Audio and Mic
- SATA (Only Quad-Core version)
- Camera connection
- Micro SD (boot device)
- Power Supply 12V and External Battery connector

www.UDOO.org

In Production since Q4’13
Wandboard: i.MX 6 open source community board
by TechNexion

- Unique Linux and Arduino SBC
- i.MX 6Solo/DualLite/Quad
- 512 MB to 2GB DDR3
- Audio
- Optical S/PDIF
- HDMI
- Camera interface
- Micro-SD slot
- Serial port
- Expansion Header
- USB
- USB OTG
- SATA
- Gigabit LAN
- WiFi (802.11n)
- Bluetooth

In Production since Q2’13
i.MX 6Solo: open source development platform by Element14/Embest

- i.MX 6Solo + Kinetis K20 MCU
- OS: Linux and Arduino
- 1 GB DDR3 RAM
- CCD or CMOS and MIPI CSI data lanes @ 1 Gbps
- HDMI, LVDS, parallel RGB, 3.5 mm audio,
- 1 x USB2.0 OTG, mini USB, 4 x USB2.0 HOST,
- uSD Card, SD Card, 10M/100M/GB ethernet,
- 2 channel I2C, 2 channel SPI, 3 channel PWM,
Ecosystem Enablement

- Overview of the Ecosystem
- Embedded Board Solutions (EBS)
- Development Boards and Communities (RIOT, wandboard, Udoo)
- One Box IoT Gateway Platform
- Wearables Reference Platform (WaRP)
• Human beings’ vital statistics monitored via edge nodes communicating through body area networks (BAN) and personal area networks (PAN)

• Many other “things” in the smart home using local area network (LAN)

• All communicate with a home hub/gateway, which in turn communicates to the cloud via wide area networks (WAN)
IoT ‘Box-level’ Product View

- **Edge Product**
  - BAN/PAN/ 
    - Wired/Wireless, 
      - Power Line 
        - LAN

- **Hierarchical Layers**
  - Aggregation / 
    - Hubs / Gateways

- **Wired/Wireless,**
  - Power Line 
    - WAN

- **Remote**
  - Cloud-based 
    - Processing

**Application/Action**
- User-driven actions via 
  - devices with screens 
  - or automatically driven 
    - actions based on data 
      - parameters

**Insights/Big Data**
- Data analytics for 
  - business intelligence

**Layers of Embedded Processing**
- S

**Sensors & Actuators**
- P

**Connectivity: BAN/PAN/LAN/WAN**
- C

*Medtronic's glucose monitor uses Bluetooth to "talk" to Ford Sync*
Diversity Of Service Providers For The Smart Home

Future Smart Home:
Digitally Controlled via Local Automation and Remote Cloud Processing – Host of New Generations Of Services

One Gateway Controlling Future Smart Home

Traditional Service Providers
- Internet
- Landline Phone
- Cable/Satellite
- Mobile Phone
- Security
- Electric
- Water
- Gas

Future Smart Home Services
- Home Health
  - Elderly Monitoring & Care
- Home Automation Services
- Home Landscape & Maintenance
- New Types of Infotainment
  - Many Other Services
  - Home Meal Services
  - Remote Education
  - Remote Pet Care
  - Many Other Services
**OneBox Means Integrating All “Boxes” Into One**

**BAN/PAN/LAN/HAN Side**

- **Standards**
  - Bluetooth
  - Zigbee, 802.15.4
  - WiFi, DASH7, ISA100
  - Wireless HART, EnOcean
  - Wireless MBus
  - Ethernet, EtherCAT, Profinet, Modbus, IS485
  - HPGP
  - Etc.

- **Wired & Wireless**
  - Switching & Routing
  - Protocol Conversion
  - Firewall & VPN
  - Ethernet, EtherCAT, Profinet, Modbus, IS485
  - Weightless

**NAN/WAN Side**

- **Standards**
  - Ethernet / Fiber
  - Weightless
  - Cellular
  - Sub Gig
  - Satellite
  - PLM/PLC (G3, Prime, etc.)
  - Etc.

- **Cloud**

**What devices to monitor/ control**

**What short-range device access link**

**Targeting CPE**

**What Cloud access link**

Need to optimize the communications, processing, and storage requirements of all stakeholders (i.e. teleco providers, security, utility, energy, automation, control, and other future service providers), @Home, @Factory, @Hospital, or other target facilities / environments.
One-Box: What is It?

One-Box is a scalable gateway device using scalable i.MX or Kinetis SOC’s and built with JAVA for Oracle big data services.
OneBox Software/Hardware (i.MX 6 based)

Software
- Sensinode
  - JAVA SE Aggregator
  - Local & Complex Events
- Sensinode
  - JAVA SE Apps Wrapper
- Sensinode
  - Local Directory
- JAVA Embedded Suite (JES)
- OEP Embedded
- VLAN, DNS, IPS
- Encrypted Data
  - Open SSL, DTLS
- TR69 Remote Provisioning

FSL openWRT AP-WLAN
Wireless Router Gateway Platform

FSL MPU Linux-SDK BSP
Software Drivers
- ZigBee 1.0
- ZigBee 2.0
- Gb Enet
- Bluetooth 4.0
- Wi-Fi

Hardware
- USB2
- GMI
- SDIO
- FLASH
- USB2
  - Think-Eco
- USB2
  - Mohave
- Gb Phy
- SDIO Silex - Module
- On-board 8 GB Flash

Phy Interface
Inside Box Modules
FSL i.MX 6Q Board Design
One-Box Deployment Example: Health Care

**Tablet with Medical User Interface (i.MX6)**

**Reference Platform Gateway (i.MX28)**

- **Panic Alarm (MC12311)**
- **Nonin Pulse Ox (MC9S08GP32)**
- **868MHz RF**
- **868MHz RF**
- **Bluetooth HDP**
- **Bluetooth Low Energy**
- **Bluetooth SPP**
- **Thermometer**
- **Blood Glucose Meter**
- **Blood Pressure Monitors**
- **Weight Scale**
- **Bluetooth Low Energy**
- **USB PHDC**
- **HealthCare**
- **ETHernet**

**HOME AUTOMATION**

- **Expanding the Reference Platform**
  - Smart Plugs
  - Smart Appliances
  - Safety/Security
  - Lighting Control
  - Local Display

**Wired connection**

**Wireless connection**

**Medical monitoring**

**WWW connection**

- **Physician**
- **Social Networking**
- **Monitoring Center**
- **Loved Ones**

---

**freescale™**

External Use | 66
Ecosystem Enablement

- Overview of the Ecosystem
- Embedded Board Solutions (EBS)
- Development Boards and Communities (RIOT, wandboard, Udoo)
- One Box IoT Gateway Platform
- Wearables Reference Platform (WaRP)
WearAble Reference Platform enabled by Freescale

Speeds and eases development for creating wearable devices by addressing key technology challenges which frees developers to focus on creating differentiated features.

- Form Factor
- Maximizing Battery Life
- Usability
- Cost
Wearables is Not Just Smart Watches…

- Wearable Ring Scanner
- Headset Running Voice Recognition
- Nymi, Heart-rate Based Password Authentication
- Kiwi Wearables – Personal Tracker
- Fitness/Activity Monitors
- Angel – first open sensor for health and fitness
- Bone Conduction Bluetooth headset cap
- Virtual Reality Headset
## Wearable Market: Segmentation

<table>
<thead>
<tr>
<th>Vertical</th>
<th>Categories</th>
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| **Fitness & Wellness** | *Sports & Heart Rate Monitors*  
Pedometers, Activity Monitors  
Smart Sport Glasses  
Smart Clothing  
Sleep Monitors  
Emotional Measurements  |
| **Healthcare & Medical** | CGM (Continuous Glucose Monitoring)  
ECG Monitoring  
Pulse Oximetry  
Blood Pressure Monitors  
Drug Delivery (Insulin Pumps)  
**Wearable Patches** (ECG, HRM, SpO2) |
| **Infotainment** | **Smart Watches**  
Augmented Reality Headsets  
**Smart Glasses**  
Wearable Imaging Devices |
| **Industrial & Military** | Hand-worn Terminals  
Augmented Reality Headsets  
Smart Clothing |
# WaRP Architecture

| Small Form Factor | • Small foot print: 13x13 mm i.MX6SL  
|                   | • Main board 38 x16 mm |
| Battery Life      | • Key components selected for power mgmt capabilities  
|                   | • Hybrid Architecture- Cortex A9 & M0+ sensor hub  
|                   | • Wireless Charging |
| Usability         | • Modular architecture  
|                   | • Flexibility: LCD & E-Ink displays, Wi-Fi & BT 4.0  
|                   | • Android 4.3 |
| Cost              | • $149 sales price  
|                   | • All components available through distribution  
|                   | • Open Source: BOM available |
Main Board PCB size: 38 mm x 16 mm (1.49” x 0.55”)

Daughter Board PCB size: 42 mm x 42 mm (1.65” x 1.65”)

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**Main Board**

- **Battery Single Cell LiPo**: 300mAh
- **Power Management**: Maxim MAX77696
- **Memory**: LPDDR2 + eMMC (Samsung MCP KBMN5W000ZM-B207)
- **Micro USB**
- **Micro USB**
- **Wearable Reference Platform (WaRP)**

**Daughter Board**

- **Micro USB**
- **Memory**: LPDDR2 + eMMC (Samsung MCP KBMN5W000ZM-B207)
- **Power Management**: Maxim MAX77696
- **WLAN / Bluetooth 4.0**: Murata LBEH17YSHC
- **3-axis Accelerometer**: FXOS8700CQ
- **i.MX 6SL**
  - ARM® Cortex™-A9
  - Apps Processor
  - Running Android
- **Wearable Reference Platform (WaRP)**

**Miscellaneous**

- **Button 1**
- **Button 2**
- **Motion Sensing Pedometer**: MMA9553
- **Wireless Charging**
- **HUB Sensor MCU**: Kinetis KL16
  - ARM Cortex™ M0+
- **SPI**
- **I2C**
- **USB**
- **Wi-Fi**
- **BT/BLE**
- **Eink ET017QC1**
- **LH154Q01**
- **38 mm x 16 mm (1.49” x 0.55”)**
- **MCU – Kinetis KL16**: ARM Cortex™ M0+
- **Button 1**
- **Button 2**
- **3-axis Accelerometer**: FXOS8700CQ
- **3-axis Magnetometer**: FXOS8700CQ
- **i.MX 6SL**
  - ARM® Cortex™-A9
  - Apps Processor
  - Running Android
- **LPDDR2 + eMMC**
  - Samsung MCP KBMN5W000ZM-B207
- **Power Management**: Maxim MAX77696
- **Battery Single Cell LiPo**: 300mAh
- **RGB**
- **I2C**
- **EPDC**
- **SDIO**
- **BT/BLE**
- **WIFI**
- **Micro USB**
- **USB**
- **Motion Sensing Pedometer**: MMA9553
- **Wireless Charging**
- **Button 1**
- **Button 2**
Re-cap: What products and services are available to me for my i.MX 6 based design?

- Freescale is a leader in Android development for embedded designs.
- Freescale has a range of development systems and BSP offerings for the i.MX 6 series portfolio. Designed and supported by Freescale.
- The Freescale i.MX community (imxcommunity.org) is the place to go for all of your technical support questions.
- Freescale has paid support options for time-sensitive support needs and professional services options for custom software and hardware development.
- Freescale has a broad network of partners to assist with your design.
- Freescale is reaching into innovative new technology areas such as Wearables.
Summary

i.MX 6 series is a powerful, scalable portfolio of applications processors with over 35 devices to meet your application needs applications.

- **i.MX 6Quad to i.MX 6Solo fully pin-compatible**
  Commercial, industrial and automotive qualified devices
  Over 30 pin-compatible and software-compatible devices
  i.MX 6SoloLite for cost-sensitive applications

- **Broad range of i.MX 6 enablement is available**
  Freescale provides development systems and BSPs
  Freescale has paid support and services options
  Broad ecosystem with expert knowledge on SW and HW

- **i.MX 6 Series continues to expand**
  New devices based on Cortex-M4 integration
  Continued BSP development on Linux and Android
  Reference platforms like WaRP to enable new categories of products