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Multimedia and Middleware for Smart Mobile Devices

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Senior Product Manager
Session Introduction

► Overview of Smart Mobile Devices and the Consumer market

► Review the various software platforms and Linux® as a widespread choice

► Outline the pieces of Multimedia and Middleware required for proper enablement of Smart Mobile Devices

► Benefits of i.MX solutions with the different software stack pieces
Agenda

► Internet penetration trends

► Growth of Smart Mobile Devices

► Software platforms

► Middleware requirements for Smart Mobile Devices

► Freescale i.MX: multimedia codecs, graphics and Adobe® Flash®

► Review and Q&A
Agenda

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Historical Growth Drivers

Year


% US GDP Change YoY

% Semi Market Revenue Change YoY

-10% 0 5% 10% 15% 20% 25% 30% 35% 40% 45% 50% 55% 60% 65% 70% 75% 80%

-40% -30% -20% -10% 0 10 20 30 40 50 60 70 80

Historical Growth Drivers

- Energy
- Computing
- Internet
- Mobile Comm
- Web 2.0

Source: St. Louis Fed Research

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Internet Penetration

Source: Internet World Stats, Industry estimates

- **2009**: 23.8% Internet Penetration
  - 1.4 Billion PCs
  - 4.7 Billion Mobile Phones

- **2015**: +50% Internet Penetration

World Population

Internet Users

Source: Internet World Stats, Industry estimates
New Computing Cycles Supported by 10x More Devices

Note: 
PC installed base reached 100mm in 1993, cellphone / Internet users reached 1B in 2002 / 2005 respectively; 
Source: ITU, Mark Lipacis, Morgan Stanley Research
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The Fourth Screen: Learning, Reading, Entertainment, Education, Communication and Beyond

Display Centric Connected Devices

- Smartbooks
- Tablets
- Photo Frames
- Media Phones
- Touch Screen Printers
- Mobile Internet Device
- Factory HMI
- Infotainment/Telematics
- Advanced Smartphones
- eReaders

Trends driving need for a intuitive, rich user experience with seamless connectivity. See it and touch it

- Proliferation of tablet centric devices
- Content consumption vs content creation
- Instant on and always connected
- Great user experience – HMI and multimedia

Requirements:

- Optimized performance at lowest power
- Price and performance scalability
- Open OS support with complete solution
- Strong ecosystem
- Tightly integrated graphics and multimedia

Smart processing solutions for the connected world

Enabling the Connected Multimedia Experience
Smart Mobile Devices

**Smartphones***

- 2009: 123
- 2010: 173
- 2011: 234
- 2012: 299
- 2013: 385

**eReaders**

- 2009: 3
- 2010: 6
- 2011: 10
- 2012: 16
- 2013: 30

**Auto Infotainment**

- 2009: 99
- 2010: 114
- 2011: 133
- 2012: 153
- 2013: 173

**Smartbooks**

- 2009: 1
- 2010: 10
- 2011: 40
- 2012: 80
- 2013: 130

* Gartner -- Forecast: Mobile Device Sales to End Users by Device Category, 2003-2013 3/09  ** ARM estimates

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Smartphones

- Wireless connectivity anywhere
- Internet enabled
- E-mail, SMS and IM
- Full browser capability
- Access to rich application stores
- Location-aware content
- All-day battery life
eBook Readers

► **Wireless** enabled
► Access to rich content – books, newspapers, blogs
► Carry **entire library** with you
► Conventional book features – quick page turns, make notes
► New teaching modes
► Week-long battery life
Smartbooks

Computing functionality of a netbook, Connectivity and battery-life of a smartphone

► Internet enabled
► Third or Fourth Screen
► Personal feel vs. compute feel
► Always on and instant resume
► Multi-hour social networking
► High-definition video player
► Location aware services
► All-day battery life
Automotive Infotainment Systems

“Smartbook on Wheels”
► Internet enabled
► Connectivity to other smart mobile devices
► Multimedia rich audio and video capability
► Location-aware content – GPS and navigation
► Familiar user interface
What Do Consumers Want?

► Easy to Use
  • Simple and intuitive user interface
  • Customizable

► Constant connectivity
  • “Always-on” – WiFi, Bluetooth®, 3G/4G

► Great Internet experience
  • Excellent browser experience
  • Excellent graphics & video

► Instant-on
  • Fast boot within few seconds
  • Cold boot as well as resume from sleep

► All-day battery life
  • Power management ‘without a fan’
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► Middleware requirements for Smart Mobile Devices

► Freescale i.MX: multimedia codecs, graphics and Adobe® Flash®

► Review and Q&A
A software platform essentially provides a complete solution to application development on connected devices. It is defined as the combination of:

- Operating system for a collection of compatible mobile devices
- Application programming interfaces (APIs)
- Software development libraries
- Programming tools
## Operating Systems

<table>
<thead>
<tr>
<th>PC</th>
<th>Smartphone</th>
<th>Smartbook</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Windows" /></td>
<td><img src="image" alt="Android" /></td>
<td><img src="image" alt="Windows Embedded" /></td>
<td><img src="image" alt="Windows Embedded" /></td>
</tr>
<tr>
<td><img src="image" alt="Apple" /></td>
<td><img src="image" alt="Symbian" /></td>
<td><img src="image" alt="Android" /></td>
<td><img src="image" alt="Google Chrome" /></td>
</tr>
</tbody>
</table>

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**Notes:**
- The chart displays operating systems for different device categories: PC, Smartphone, Smartbook, and Other.
- Each category lists supported operating systems, including Windows, Android, and others.

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**Trademark Information:**
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Linux solution reusability

► Linux kernel provides the ability for scalability across multiple segments – as a result there is considerable reuse across the software stack

► A layered approach with the right selection of components would enable companies to easily provide a common Linux solution that decreases investment in resources
  • There is a perception that considerable investment needs to be done for specific Linux SDKs since the requirements are vastly different
  • If done right, there would be a common SDK that enables customers to easily migrate across SoCs and penetrate the markets that they want to engage in
## Linux® Software Stack and Ecosystem

### HMI
- X-Window
- Skins
- Fonts
- Sounds
- Manager

### Application Layer
- Player
- Navigation
- Mobile Office
- Misc. Apps for Target Markets
- Launcher
- PIM
- Browser

### Middleware Layer
- Media Framework
- Network Connectivity
- Device Connectivity
- Graphics Libraries
- Segment Specific Libs

#### Core services / infrastructure
- DBUS, UDEV, GSM, GPS, etc.

#### Power Management
- Security / DRM

### OS Layer
- SoC Drivers
- Drivers for Connectivity, PM, etc.
- Accelerated Codecs

- Bootloader
- Kernel
- Core Libraries

### Hardware
- Board and Peripherals

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Hardware
- Board and Peripherals

Application Portability

Device Acceleration
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Multimedia and Middleware for SMD

► Browsers
► BT, USB, WiFi Connectivity
► Codecs
► DRM/MTP
► Adobe Flash
► Java™
► Navigation
► Security
► Speech technologies
► UI/HMI
► VoIP/V2IP
Challenges on ARM Smart Mobile Devices

► Fine tuning of power management
  • Enablement of ‘bios-type’ features – resume, sleep, hibernate

► Multimedia codecs integration
  • Tight integration with hardware (custom graphics accelerators)

► Graphics acceleration integration
  • OpenGL®ES compared to OpenGL
  • X windows legacy

► Ecosystem extension and enablement
  • Flash 10
  • V2IP
  • Other 3rd parties

► Application compatibility
  • Approaching the x86 level of compatibility
Multimedia and Middleware

End customer UI/MMI Application

| Internet browser | DVB-H | DVB-T | Camera/Player/VT | VoIP/V2IP IM |

Multimedia and Applications Framework

- Standard Wrappers (Gst, Dshow, OMX)
- Codecs API
- Codecs

OS abstraction layer

- BSP (Drivers)

OS (Linux, Windows CE, RTOS)

Hardware

Multimedia
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i.MX Optimized Multimedia Codecs

Key Features:

► Comprehensive suite of optimized codecs (~40+ Audio/Video/Image codecs)

► Highly optimized software that is coded by Freescale processor experts

► Consistent application programming interface (API) and frameworks across all software packages including OpenMAX™ support

► Codec APIs have been optimized from system design perspective and achieve optimal system performance along with related middleware wrappers

► Supplemented with Freescale development tools, sample test streams and documentation
Codec Software Packages include:

► Codec libraries with a standard C-callable API

► Gstreamer/DShow/OMX plugins that provide an API layer between the multimedia framework and the codec library

► Audio/video file containers (parsers) that support popular multimedia content, such as .aac, .avi, .asf, .mp3 and .mp4 files

► Bundle of Freescale audio/video sample test streams

► Complete documentation, including API documentation, release notes and data sheets
# i.MX Platforms and Multimedia Capability

<table>
<thead>
<tr>
<th>SoC</th>
<th>ARMv5 Codecs</th>
<th>ARMv6 Codecs</th>
<th>Neon Codecs</th>
<th>Hardware Codecs</th>
</tr>
</thead>
<tbody>
<tr>
<td>i.MX31</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
<td>MPEG4-SP encode (VGA)</td>
</tr>
<tr>
<td>i.MX27</td>
<td>Yes</td>
<td>-</td>
<td>-</td>
<td>MPEG4, H.264 decode/encode (D1)</td>
</tr>
<tr>
<td>i.MX37</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
<td>MPEG4, H.264, VC1 decode (D1)</td>
</tr>
<tr>
<td>i.MX35</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>i.MX25</td>
<td>Yes</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>i.MX51</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>All video codecs (720p decode, D1 encode)</td>
</tr>
<tr>
<td>i.MX53</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>All video codecs (1080p decode, 720p encode)</td>
</tr>
</tbody>
</table>
## Codecs Portfolio

<table>
<thead>
<tr>
<th>Video</th>
<th>Audio</th>
<th>Speech</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPEG4 SP/ASP Encoder/Decoder *</td>
<td>WMA10 Decoder (Std, Pro, Lossless)</td>
<td>G.726 Encoder/Decoder</td>
<td>GIF Decoder</td>
</tr>
<tr>
<td>H.263 Baseline Encoder/Decoder *</td>
<td>MP3 Encoder/Decoder</td>
<td>G.723.1 Encoder/Decoder</td>
<td>PNG Decoder</td>
</tr>
<tr>
<td>WMV9/VC-1 SP/MP/AP Decoder *</td>
<td>AAC-LC Decoder</td>
<td>AMR-NB Encoder/Decoder</td>
<td>BMP Encoder/Decoder</td>
</tr>
<tr>
<td>Real Video Decoder *</td>
<td>AACPlus Enhanced Decoder</td>
<td>AMR-WB Encoder/Decoder</td>
<td>WBMP Decoder</td>
</tr>
<tr>
<td>H.264 BP/MP Encoder/Decoder *</td>
<td>Real Audio 8 Decoder</td>
<td>G.711 Encoder/Decoder</td>
<td>JPEG Encoder/Decoder *</td>
</tr>
<tr>
<td>MPEG2 MP Decoder/Encoder *</td>
<td>SBC Encode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DivX Decoder *</td>
<td>WMA Encode</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* indicates VPU accelerated or s/w codecs
Graphics acceleration

► Using OpenVG™ and OpenGL/ES effectively

► X windows acceleration (Ubuntu/Chromium™)
  • X server video driver
  • EGL for X

► Android™ graphics acceleration
  • Efficient Hardware blitting
  • Hooking in OpenGL/ES calls

► Windows® Embedded
  • UI/UX rendering
  • Silverlight
Adobe Flash Lite® and Flash 10

► Adobe Flash is the most successful interactive multimedia tool to deliver web content

► Flash Lite
  • Lightweight version for mobile devices
  • Flash Lite also has user interface capabilities
  • Can take advantage of Open VG acceleration
  • Uses HW acceleration for video playback (non standard MM framework)

► Flash 10
  • Full web browsing like for smartbooks
  • Web sites that use 3D rendering and rotations (AS3)
  • Takes advantage of Open GL/ES acceleration
  • Uses HW acceleration for Video playback (OpenMax framework)

*If interested you can attend class: CON_F0851 on Adobe Flash*
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Session summary

► There is an exploding market for Smart Mobile devices

► Consumers have some common needs: ease-of-use, instant-on, constant connectivity, all-day battery life and a great experience

► There are several software platforms and Linux provides a good foundation for distributions – Middleware and Multimedia are key adaptations

► There are certain key Middleware enablers that customers need to focus on for specific Smart Mobile Devices

► Freescale’s i.MX solutions with Codecs and associated Middleware streamline complexity in design
A Freescale supported open web community of developers sharing common interest in transforming i.MX applications processors into practically anything imaginable.

i.MX Community

• Serves all component enablement peripherals including basic to complex software
• i.MX Forums, Groups and Blogs Posts
• News, Photos and Videos
• Training, Events and Promotions

Check it out!
Become a member today and you will be entered to win a i.MX development system of your choice. Drawing will be held on June 30th.

www.iMXcommunity.org