WHITE PAPER

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System-Level Software Performance:

How to get the most performance out of the OMAP™ 4 platform

Introduction

TI's OMAP™ 4 platform is the most highly optimized platform that addresses the features of today's applications and tomorrow's Smartphones and Mobile Internet Devices (MIDs). With a flexible, open platform designers can stay ahead of the rapid rate of innovation in the market and deliver products that offer stunning user experiences.

The OMAP 4 platform includes the industry-leading OMAP 4 applications processor, a comprehensive software suite, optimized power management technology, and pre-integrated support for connectivity and third-party modems. All together, the OMAP 4 platform delivers a complete solution that can help OEMs get to market faster and reduce research and development costs while still delivering breakthrough multimedia improvements beyond those of today's most popular Smartphones.

The comprehensive software suite supports all major mobile operating systems (OSs) that are fully integrated and real-world tested up to the application level. This comprehensive software suite saves OEMs development time as well as lowering research and development costs. The OMAP 4 software suite, coupled closely with the integrated hardware accelerators, enables new user experiences and use cases not available today, including: base drivers and enablers, multimedia codecs, connectivity, application framework, Web browsing, mobile OSes and an applications suite. The innovative development features that TI has poured into its comprehensive software suite helps OEMs take advantage of every performance enhancement and feature of the OMAP 4 platform.

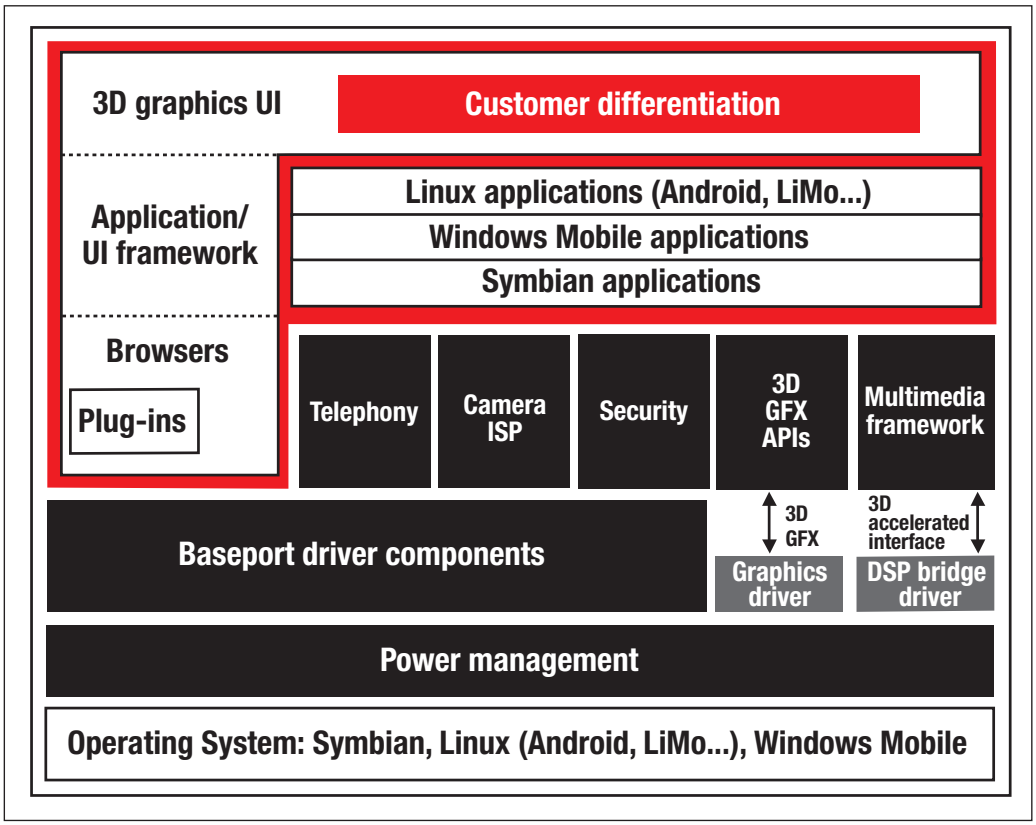
TI's software architecture

Drawing on its proven wireless and system-level solution expertise, TI provides the same use cases OEMs and application developers want to deliver products with breakthrough multimedia performance, including:

- Full 1080p multi-standard HD record and playback
- Digital SLR-like performance with up to 20-megapixel imaging
- PC-like Internet browsing experience
- 3D graphics enabled user interfaces with larger displays, life-like graphics and intuitive touch screens
- Exceptional power management technology for extended battery life

The OMAP 4 comprehensive software suite is available at all software layers from drivers up to the application level and is highly customizable to give developers the flexibility they need to differentiate their product. With the breadth of the OMAP 4 system-level software suite, OEMs and developers can reuse most of the platform software from TI so they can

redirect their resources to focus on key differentiation aspects, such as the user interface (UI) and other applications. These efficiencies save time and cost when bringing new products to market. The OMAP 4 platform – supporting multiple OSes, including Symbian, Windows Mobile and Linux, (Android, LiMo) – gives OEMs and developers the flexibility to address multiple segments of smart phone and MID markets with the same platform.



▲ *Comprehensive software suite*

The OMAP 4 comprehensive software suite has following key differentiators:

- Video
- Imaging
- Graphics/UI
- Power management
- Security
- Connectivity/modem

Video software

To complement and work with the IVA hardware accelerator, TI offers the industry's broadest list of video codecs supporting 1080p resolution at 30 frames-per-second and programmable support for the following:

- MPEG4 ASP
- H.264 HP
- VC-1 AP
- RealVideo 10
- ON2 VP7
- AVS 1.0
- DivX 6
- Sorenson Spark v1

These codecs support multiple use cases such as video playback and streaming, camcorder functionality, transcoding, video teleconferencing, multichannel playback, multichannel camcorder and video push/conferencing and local record. Using the OMAP 4 platform's programmability, OEMs and developers can address the industry's evolving video standards to provide users the best possible

		24/25/30 fps	Supported Level	Average Bit Rate
Playback	H.264 BL/MP/HP	720p30 (w/ER) 1080i60/1080p30	4.0	20 Mbps
	H.263 P3L70	720p30/1080p30	>70	–
	MPEG4 SP/ASP	720p30/1080p30	>5.0 (prop)	20Mbps
	VC-1 SP/MP/AP	720p30/1080i60/1080p30	3.0	20 Mbps
	RV 8/9/10	720p30/1080p30	–	20 Mbps
	AVS 1.0	1080i30/1080p30	–	20 Mbps
	MPEG1 / MPEG-2 MP	720p30/1080i60	Main	20 Mbps
	Divx 5/6	720p30/1080p30	–	20 Mbps
	ON2 VP6.2/7	720p30/1080p30	–	10 Mbps
	H.264 Annex G	480-720p30	Scalable Baseline	10 Mbps
	Sorenson Spark v0.v1	720p30/1080p30	–	20 Mbps
	Still image viewer	96 megapixel/s	–	–
Camcorder	H.264 BL/MP/HP	720p30 (w/ER) / 1080i60/1080p30	4.0	20 Mbps
	H.263	720p30/1080p30	70	–
	MPEG4 SP/ASP	720p30/1080p30	>5.0 (prop)	20 Mbps
	VC-1 SP/MP/AP	720p30/1080i60/1080p30	3.0	20 Mbps
	MPEG2	720p30/1080i60	Main	20 Mbps
	AVS 1.0	1080p30	–	20 Mbps
	Still image capture	96 megapixel/s	_	–
Slo-Mo Camcorder	H.264, MPEG4, VC-1	480p 120fps	–	–
Multichannel Playback	H.264, MPEG4, VC-1	4x 480p30 decode or encode	–	–
Transcode	H.264, MPEG4, VC-1, MPEG2	720p30	3.1	10 Mbps
VTC	H.264 BL/HP	720p30fp (VGA 30fps w/ER)	3.0	4 Mbps
	MPEG4 ASP/H.263	720p30fp (VGA 30fps w/ER)	6.0	4 Mbps
	VC-1 AP	720p30	2.0	4 Mbps
	ON2 VP7	VGA 30fps (under analysis)	–	2 Mbps

Imaging software

TI's imaging software is optimized for the OMAP 4 platform imaging sub-subsystem (ISS) to deliver up to 20-megapixel imaging resolution at one-second shot-to-shot delay. This performance is equivalent to or better than the performance of digital SLR cameras today. TI supports pre-validated and optimized software through third parties that provide imaging applications such as:

- Red-eye reduction
- Face detection
- Image stabilization / Anti-shake technology
- Video noise filter
- Smile detect
- Panoramic stitch
- Blink detect
- Auto focus / auto white balance / autoexposure
- High ISO noise filter: 3200 ISO

The imaging software was developed and optimized for the OMAP 4 platform to take advantage of its performance and power savings. With this highly optimized software, coupled with the corresponding imaging subsystem hardware, the OMAP 4 platform delivers the best imaging performance.

Graphics software

Mobile devices are becoming more graphically intensive and are being driven by the user interface demands. This means that every new feature on the handset will require graphics support. Next-generation mobile devices will include 3D graphics enabled user interfaces with larger displays, life-like graphics and intuitive touch screens to deliver the more graphical applications of tomorrow. In addition to these more complex graphics and displays, users will demand seamless transitions between menus or other graphics-driven displays, requiring better performance and highly optimized graphics software.

The OMAP 4 platform integrates Imagination Technologies POWERVR™ SGX530 core to enable 2D/3D graphics for user interfaces and gaming. TI provides highly optimized software for the integrated SGX530 core to support all the major APIs, including: OpenGL ES v2.0, OpenGL ES v1.1, OpenVG v1.1 and EGL v1.3. TI's graphics software combined with the OMAP 4 platform's hardware delivers graphics that will astound users.

Power management software

The OMAP 4 platform integrates TI's industry-leading SmartReflex™ 2 technologies to enable high performance at low power. SmartReflex 2 technologies combine intelligent and adaptive silicon, circuit design and software to solve power and performance management challenges at smaller process nodes. These features enable OEMs to offer sleeker, multimedia-rich mobile devices with longer battery life and less heat dissipation. Technologies and software embedded in the OMAP 4 platform adjust voltage, frequency and power based on device activity, modes of operation and temperature for maximum power reduction. The open software framework provides the intelligent coordination among lower-level hardware technologies and compatibility with OS-based and third-party power management software.

All OMAP 4 platform software suite applications are written to take full advantage of SmartReflex 2 power management technologies. Customer-written applications must be developed to hook into the platform's power management framework correctly and efficiently to achieve the power savings. With the inclusion of power management software and hardware, the OMAP 4 platform enables OEMs and application developers to add new multimedia applications to mobile wireless devices without sacrificing standby time, talk time or battery life.

Security software

TI's M-Shield™ mobile security technology solution is incorporated into the OMAP 4 platform to provide the highest level of terminal and content security in the industry today. M-Shield mobile security technology is a system-level security solution that intimately interleaves hardware and software technologies to achieve this high level of security. The M-Shield software security technology on the OMAP 4 platform is built on top of and strengthened by M-Shield hardware technology and encompasses:

- Secure signing and flashing tools
- Toolkits for development and signature of protected applications running in a secure environment
- Security middleware component (SMC) with associated Protected Applications and SDKs
- Security packs to strengthen HLOS security

In addition, the M-Shield SMC provides sets of standard APIs that solve the problems of defragmentation and porting complexity. Software can be reused across platform generations, allowing APIs on the current platforms to continue being utilized.

Applications that are developed on M-Shield mobile security technology today will be binary compatible on devices incorporating an ARM® core with TrustZone® hardware extensions. Similarly, services developed today using ARM TrustZone software APIs will run on the OMAP 4 platform with the included M-Shield mobile security technology.

Connectivity and modem software

The OMAP 4 platform delivers complete software that is pre-integrated and validated for TI's connectivity technologies, including GPS, WiFi, *Bluetooth*® and FM. TI's complementary connectivity suite allows OEMs to design the best mix of features for their handset to deliver the applications and performance customers demand. The OMAP 4 connectivity and modem software optimizes power and performance to take full advantage of TI's SmartReflex 2 technologies included on the platform.

The OMAP 4 platform also includes pre-integrated hardware and software interfaces to connect easily to any external modem, giving OEMs choice and flexibility. With the driver optimization already complete for the OMAP 4 platform connectivity and modem technologies, OEMs will realize faster development times for connectivity as well.

Application framework

TI makes use of the application frameworks provided by OS providers, like Linux, Symbian and Microsoft Mobile, to enable all applications. By meeting customer expectations at the UI level, the application framework enables developers to achieve the performance they need at lower software levels.

User interface

The UI is customer driven and is a differentiation opportunity for OEMs. The OMAP 4 platform supports any UI of future generation mobile devices. TI has integrated the OMAP 4 platform's hardware accelerated graphics into the OS windowing and graphics subsystem to ensure future compatibility. In addition, each OS includes a UI engine that utilizes the OMAP 4 platform will give the best user experience possible.

Customer differentiation

The OMAP 4 platform delivers a comprehensive software suite that supports all the major mobile OSs, including Symbian, Windows Mobile, Linux and Android, and is fully integrated and tested up to the application level. This software suite enables faster and easier development for handset OEMs and applications developers. However, there are certain features of the handset that are highly differentiable and therefore not included on the OMAP 4 platform.

Each handset has a unique UI that defines that product. While TI does not provide the UI, the software hooks to make the developer's choice of UI come to life are included on the OMAP 4 platform.

TI makes use of the application framework provided by the OS. The OMAP 4 platform enables an OEM to add or subtract from the application framework to make the right product for its particular market segment.

TI provides drivers that can be customized for an OEMs particular camera sensor or LCD. The same is true for modems. TI provides the pre-integrated hardware and software interfaces that connect easily to any modem, but the OEM must provide the specific external modem.

The OEM also makes all decisions for multimedia device management customization. For example, if a user is in the middle of capturing video using his handset and a call comes in, should the handset stop the capture and take the call or send the call directly to voice mail? These types of decisions are highly dependent on use cases and have to be customized for each product.

The final customization the OEM must provide is the actual form factor design – product size, design, build materials. TI provides the vast majority of software and hardware needed to develop a product using the OMAP 4 platform. With the addition of a few components, OEMs can quickly and efficiently design a new mobile device that is highly optimized and with the best performance available.

A comprehensive software suite

The OMAP 4 platform from TI delivers mobile computing performance and a flexible architecture to future-proof mobile handset designs for applications yet to be imagined. The industry-leading OMAP 4 applications processors combined its comprehensive software suite deliver breakthrough multimedia improvements beyond the functionality of today's most popular Smartphones. These features include full 1080p30 multi-standard HD record and playback, up to 20-megapixel imaging, PC-like Internet browsing, 3D graphics enabled user interfaces, and best-in-class power management technology with SmartReflex 2 technologies.

The OMAP 4 software suite enables OEMs and application developers to quickly and easily develop new handsets and applications that deliver the performance their customers demand. With this flexible, open platform, designers can stay ahead of the rapid rate of innovation in the market and deliver stunning user experiences.

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