

## TI Linux and Open Source Initiative Backgrounder

Texas Instruments Incorporated (TI) has supported the use of embedded real-time operating systems in digital signal processing (DSP) for many years with the DSP/BIOS™ kernel. As DSP-based solutions have evolved to include an ARM® processor to complement the DSP, high-level operating systems, particularly Linux, have emerged on the scene as a key requirement. As such, TI has supported Linux on DaVinci™ digital media processors and OMAP™ applications processors via MontaVista™ Linux commercial offering for the past few years. However, customers and innovators want even more capabilities. To help realize this opportunity, many are requesting hardware featuring open source, Linux-based software. TI's open source initiative extends what TI does with software to drive toward open source technologies and take a more active role in the open source community to quickly innovate better Linux-based software solutions running on TI processors.

### Why Open Source?

Why is TI getting involved in the open source community? There is an increased interest among developers and customers who want to work with the community version of Linux for creating products based on TI processors. By providing resources to spur continued development, engage and fuel passionate developers, and help provide content upstream, TI is engaging and enhancing the overall state of the open source community to further its growth and foster more collaboration. Additionally, this leads to faster innovation and better solutions for TI processor based products.

*Faster innovation.* Top developers focus their innovation efforts on open source and implement new and more speculative features in the software. The result of their work flows downstream from this point as source code is made available faster than internal product development release cycles. Faster innovation comes from:

- Collaboration. The developer community works with this source code and in return can make valuable upstream contributions such as suggesting improvements or helping to fix bugs that invariably arise. Potential users can have an influence on what the kernel will look like when it enters commercialized distribution. This is particularly important to developers who design with TI devices and want to make certain that their ideas about support for specific device functions are considered.
- Constant access and updates. Developers can move more quickly with their designs and be assured that their products will take advantage of the most recent kernel improvements. Also, TI is accelerating the delivery of patches, and by using a starting point that is closer to the latest community offering, commercial vendors benefit by having the ability to back port newer kernel features and have a base to move up to even newer kernels. This is a key advantage as the vendors no longer need to constantly update all of the drivers to support the latest kernel when performing update patches
- Community support. Developers working in a small team can tap into the expertise of some of the world's top programmers. Even developers in large teams prefer to work with the very latest open source software and collaborate with talented, like-minded individuals around the world.

*Better Solutions.* Better solutions come from:

- Quality improvement. A popular open source comment is, “Given enough eyeballs, all bugs are shallow.” Developers can have their newly created code peer-reviewed by some of the world’s leading experts. In this way, they can leverage resources far beyond their own companies. The entire community can make suggestions on improvements and also run far more test cases, and do so more thoroughly than could a programming team of any size working alone.
- Faster feedback. Experts from different domains – wireless, medical and video to name a few – will be able to use a single forum to reuse software expertise to create devices that incorporate multiple technologies integrated together. They also can provide faster feedback on product requirement and tools.
- Peer support. Once a software project is complete, this community approach offers the benefit of easier long-term support. A small army of people who have become very familiar with a piece of software during its development are in an excellent position to support peers in the community who later work with this software.
- University minds. The free code availability, and inexpensive development platforms and tools for prototyping, motivate university talent to work and contribute to the community as well.

## Why Linux?

Of the several embedded operating systems, why Linux? The Linux community has become a concentration point for leading-edge software development. As a full-featured open source operating system, Linux is becoming an OS of choice and is used widely in many advanced electronics applications. With full networking capabilities and a large array of development tools, middleware and applications, Linux offers a broader range of choices and greater flexibility. In addition, Linux offers developers convenience and more control and visibility compared to proprietary operating systems.

Linux has a history of attracting diverse and creative developers for several reasons.

- Vendor independence. Linux source code is freely available to anyone for application and platform development. Original equipment manufacturers (OEMs) can work with a commercial Linux distribution, such as that from MontaVista, and develop systems software completely by themselves using open source software or do a combination of both.
- Customization and optimization. The Linux kernel and driver code, and most of the operating system utilities and tool chains, are readily available in source form. Developers can leverage this open source base to tailor Linux to their particular applications. Linux allows OEMs unprecedented control over their technological destiny.
- Reference code. The open source community supports a great diversity of standards, specifications and application types. Linux, as the focus for much open source development, fosters significant code reuse and serves as a foundation for reference implementations for technologies in embedded systems.

- Recent kernel updates. Developers can work with recent Linux kernel optimized for TI devices. This is in contrast to commercial distributions that take a little longer time period to put a new kernel into their offerings, but adds extra utilities, applications and testing for robust commercialized products.

## TI: Leading-Edge Software for Leading-Edge Hardware

While TI has been providing open solutions with the availability of Linux board support packages (BSPs) and development tools, recent excitement around new products that were not previously available has pushed TI to become more actively engaged with the open source community of innovative developers.

Until now, much of TI's support has been handled through commercial Linux distribution, such as MontaVista. This remains an important part of TI's strategy, but the company is broadening its scope by intensifying its support of community-based offerings with affordable, interesting hardware and software platforms for open source developers concentrating in the video and wireless handset markets, as well as the broader market,

- *Open source for the broad market: OMAP35x platform*  
With the superscalar ARM Cortex™-A8, TMS320C64x+™ DSP core and a 2D/3D graphics engine, TI's OMAP35x applications processors provides the perfect combination for performance and power to deliver an optimized GUI, browser and hand-held computing and multimedia experience.
- *Open source for wireless handsets: OMAP34x platform*  
Delivering unparalleled advances in the mobile user experience, the OMAP34x platform introduces a level of performance that enables consumer-electronics-like productivity and entertainment in handsets. Recognizing the anticipated growth Linux will experience in the mobile space – reaching more than 23 percent penetration in Smartphones worldwide by 2012, according to market researcher Strategy Analytics – the OMAP 3 platform delivers an open, flexible, complete system solution for advanced graphics standards, including OpenGL® ES 2.0 and OpenVG™ support.
- *Open source for video: DaVinci™ DM6446 and DM355*  
DaVinci digital media-based processors are optimized for digital video systems and include DSP-based system-on-chips (SoCs), multimedia codecs, APIs, frameworks and development tools.

These innovative combinations of the ARM, general-purpose DSP core, hardware acceleration blocks and plentiful peripherals are attracting attention from a growing number of developers as they will be able to create entirely new and unique products, or expand on their current products with additional innovative features.

After selecting the right hardware, TI has assembled and fully-tested industry standard software and tools, providing open source developers a more streamlined software development process.

The EVMs are equipped with initial Linux board support package, which is tested on corresponding TI devices and shipped with ARM specific patches.

- *Open source for the broad market: OMAP35x Evaluation Module (EVM)*  
A modular and extensible OMAP35x Evaluation Module (EVM) provides all the components needed to develop on OMAP35x devices, incorporates application-specific daughter cards and support for Linux developers. An OMAP35x EVM offers an OMAP3503 processor-based Linux board support package based on the 2.6.22 kernel, in addition to peripheral drivers, U-boot for boot loading and a Busybox-based root file system. For OMAP platform developers looking for the confidence of a commercial OS offering, MontaVista Pro 5.0 Linux will be available later this year.
- *Open source for wireless handsets: OMAP34x platform-based Zoom Mobile Development Kit (MDK)*  
A MDK, established with LogicPD, enables wireless handset product development and offers a complete system with a built-in wireless handset modem for development and validation on the OMAP 3 platform. The Zoom MDK offers a Linux BSP based on the 2.6.22 kernel, boot for boot loading and a Busybox-based root file system.
- *Open source for video: DaVinci DM6446 Digital Video EVM*  
A software development platform to enable DaVinci-based digital media product development for advanced video applications. For DaVinci digital media processors, TI creates the base BSP so the driver in the BSP can abstract the hardware into a well-known interface, which works well for developers not familiar with the low-level device intricacies of the peripheral. This also helps significantly shorten the development cycle.

## Online Resources for Open Source Software on TI Processors

Developers looking to work in a collaborative, open community environment on TI processors have several resources to give them access to others working specifically with Linux on OMAP and DaVinci processors. These include constant access to engineering advices and suggestions through the availability of mailing lists, wikis and platform forums.

- **[www.ti.com/tidevnetwork](http://www.ti.com/tidevnetwork)**: TI is also supported by an extensive Developer Network that specializes in software to create, market, support and maintain. They too have a robust, competitive marketplace that supports their continuing engineering on TI platforms. This will result in improved software quality and availability.
- **[Kernel.org](http://Kernel.org)**: TI's support of kernel.org allows TI to be involved with the very cutting edge of Linux development
- **<http://linux omap.com>**: Many congregate this Linux mailing list hosted off VGER.KERNEL.ORG, which maintains email list services for Linux kernel developers and presently supports almost 100 topic-specific lists. The linux-omap list includes many of TI's top Linux experts who actively turn to each other for advice, and have others look at their code, make contributions to the kernel and see the applications work of their colleagues.

- **<http://opensource.ti.com>**: TI hosts a site to provide open source developers with a single location to view the communities, projects and other resources, such as information regarding open source industry initiatives and projects supported by TI. It aims to provide downloads, documentation, tutorials, support forums and links to resources such as utilities, patches and archives to help developers start development.
- **Industry initiatives:** In addition, TI participates in a number of open source industry initiatives and projects. Support for these communities is another example of TI's ability to deliver proven software solutions for all major operating systems for portable electronics and advance the company's activity in the open source community.

Android - An Open Handset Alliance Project	<u><a href="http://code.google.com/android/">http://code.google.com/android/</a></u>
CE Linux Forum	<u><a href="http://celinuxforum.org/">http://celinuxforum.org/</a></u>
Khronos Group	<u><a href="http://www.khronos.org/">http://www.khronos.org/</a></u>
LiMo Foundation	<u><a href="http://www.limofoundation.org/">http://www.limofoundation.org/</a></u>
Linux Foundation	<u><a href="http://www.linux-foundation.org">http://www.linux-foundation.org</a></u>
Open Handset Alliance	<u><a href="http://www.openhandsetalliance.com/">http://www.openhandsetalliance.com/</a></u>

## TI devices

OMAP35x applications processors & EVM	<u><a href="http://www.ti.com/omap35x">www.ti.com/omap35x</a></u>
OMAP34x applications processors	<u><a href="http://focus.ti.com/general/docs/wtbu/wtbuprod/uctcontent.tsp?templateId=6123&amp;navigationId=11989&amp;contentId=4682">http://focus.ti.com/general/docs/wtbu/wtbuprod/uctcontent.tsp?templateId=6123&amp;navigationId=11989&amp;contentId=4682</a></u>
OMAP34x Zoom MDK	<u><a href="http://focus.ti.com/general/docs/wtbu/wtbusplashcontent.tsp?templateId=6123&amp;contentId=36405">http://focus.ti.com/general/docs/wtbu/wtbusplashcontent.tsp?templateId=6123&amp;contentId=36405</a></u>
DaVinci DM6446	<u><a href="http://focus.ti.com/paramsearch/docs/parametricsearch.tsp?family=dsp&amp;sectionId=2&amp;tabId=1860&amp;familyId=1302">http://focus.ti.com/paramsearch/docs/parametricsearch.tsp?family=dsp&amp;sectionId=2&amp;tabId=1860&amp;familyId=1302</a></u>
OMAP applications processors	<u><a href="http://www omap.com">www omap.com</a></u>

## Conclusion

TI is taking a more active role in the open source communities, especially embedded Linux, by pushing content upstream, actively monitoring mailing lists, joining organizations, creating partnerships, and increasing its reach and cost effectiveness of devices and development boards to developers. The right hardware and software is enabling savvy developers to participate in communities by getting access to and on recent kernel versions. TI's continued participation in future conversations will spur new projects and applications from students, partners and customers.

No matter what the application, no matter how experienced the development team, TI is working to make it easier than ever to create applications around Linux. Developers will have open and immediate access to the expertise of a worldwide community of like-minded programmers to drive faster innovations and better solutions based on TI processors.