Digital signage solutions from QNAP Systems Inc. use embedded Linux* to support usage models for advertising, marketing, and other types of public multimedia displays in venues that include hotels, retail stores, restaurants, casinos, and airports.

RAPID EMBEDDED LINUX* DEVELOPMENT FOR A COMPETITIVE ADVANTAGE

The Yocto Project* helps QNAP streamline custom development of digital signage solutions, for increased efficiency and faster time to market.

Multimedia content that can be updated constantly makes intelligent, connected digital signage solutions far more effective than conventional physical signs. In addition to being eye-catching, digital signs enhance their effectiveness with user interactivity that can include targeting based on factors such as physical location, time of day, and even weather. Similar to the familiar flight-information screens at airports all over the world, usage models for digital signage range from menus at fast food restaurants to personalized advertising at points of sale and “interactive walls” at conferences and other events.

Headquartered in Taipei, QNAP Systems Inc. produces turnkey hardware and software solutions to meet a broad spectrum of digital signage requirements, such as its line of digital signage players powered by custom versions of embedded Linux* on Intel® Core™ processors. To meet customer demands for rapid development and support of a broad range of the latest Intel® embedded platforms, QNAP has adopted templates, tools, and best practices provided by the Yocto Project*.

Incorporating base functionality and board support packages (BSPs) from the Yocto Project enables QNAP to significantly streamline its product development lifecycle. As a result, the company can more easily support the full range of digital signage implementations with the performance and energy-efficiency benefits of leading-edge hardware.

CHALLENGE
QNAP must rapidly develop and customize embedded Linux* for its turnkey digital signage solutions based on the latest embedded Intel® platforms, with the efficiency needed to compete in the face of diverse interactive requirements in its fast-growing market segment.

SOLUTION
The Yocto Project relieves QNAP of many of the low-level tasks associated with creating custom Linux OSs and BSPs, allowing the company’s engineers to focus on core competencies and value-added functionality.

RESULT
QNAP has been able to dramatically optimize its time to market and development costs through its adoption of the Yocto Project. Whereas it used to take two engineers approximately one month to bring up a new hardware system, the efficiency advantages of the Yocto Project (with an associated BSP) have shortened that requirement to just two to three days.¹
Driving Up Development Efficiency
Companies that build embedded solutions place a premium on tailoring a lightweight OS to the specific needs of a given project. Linux provides that flexibility, allowing developers to choose and modify components as needed.

The trade-off for that flexibility is the common requirement for an extensive time investment to create the custom Linux version. A lack of uniformity among BSPs and tools—which often must be acquired from chip or motherboard manufacturers—adds further complexity.

Too often, the result is redundant development effort by companies all over the world, which cuts into efficiency and distracts programming effort away from creating value-added features.

The Yocto Project addresses this fragmentation and inefficiency with a solid foundation that companies can use as the basis for their own embedded Linux versions, requiring only relatively minor customizations. As a result, OS development time can be reduced dramatically, enabling the following advantages:

- Faster time to market
- Lower product or software development costs
- More comprehensive, competitive product offerings

Enabling a Comprehensive Approach
The efficiencies provided by the Yocto Project help QNAP produce turnkey digital signage solutions, rather than point products. The company builds flexible solution stacks that include the following:

- **Digital signage players** at a variety of capability levels and price points
- **Video wall controllers** to support configurations of up to nine displays per controller
- **Custom Linux OSs** tailored to the needs of individual systems with the benefit of the Yocto Project
- **Supporting applications**, including content management, scheduling, and administration

The scope of this effort provided a competitive advantage for QNAP as it introduced new solutions, gained in part through its adoption of the Yocto Project.
The streamlined development process enabled by the Yocto Project helps QNAP support solutions for a broad and growing range of digital signage usage models. Alleviated from many of the low-level details of creating custom Linux distributions and BSPs, QNAP developers can focus on maintaining a comprehensive product line of digital signage players that deliver Full-HD and 4K Ultra-HD experiences by regularly adopting the latest Intel platforms.

Moreover, the Yocto Project has enabled QNAP developers to focus on introducing value-added functionality such as user interactivity and the ability to customize content based on changing factors such as time of day, weather, and GPS coordinates.

**High-End Video Wall Solutions**

Digital signage players combined with video wall controllers create large-scale displays from multiple content streams or a single image divided among monitors. Typical demands include the following:

- Up to nine moderate to large displays per controller
- Ultra-high definition (greater than 1080p) still or video content
- HDMI*, DVI*, or DisplayPort* connectivity
- Secured wireless networking and remote manageability

**Mainstream, Flexible Solutions**

Robust mid-range digital signage players are widely deployed in usages such as information displays and restaurant menus, with typical demands such as the following:

- Up to three moderately sized displays per player
- Ultra-high definition (greater than 1080p) still or video content
- HDMI, DVI, or DisplayPort connectivity
- Secured wireless networking and remote manageability

**Simple, Cost-Effective Solutions**

Entry-level digital signage players target simple usage models such as in-store brand promotion, with typical demands such as the following:

- A single, moderately sized display per player
- HD (1080p) still or video content
- HDMI connectivity
- Secured wireless networking and remote manageability
ENHANCED FLEXIBILITY AND CAPABILITIES
FOR CROSS-PLATFORM EMBEDDED LINUX PRODUCTS

The ability to create and maintain solution offerings for a broad range of price points and capabilities is vital to QNAP’s success. Using technologies from the Yocto Project helps ensure that these cross-platform requirements do not result in excessive time and labor expenditures. As a result, support for new processor architectures or board designs can be accommodated without undue impact to QNAP’s ability to maintain strong product roadmaps.

The Yocto Project eliminates a significant amount of redundant development effort, enabling product teams to take better advantage of the work they have done for one platform as they create support for others.

This efficiency in developing for various platforms frees up resources to create comprehensive, feature-rich QNAP products. Moreover, each generation of more robust processors enhances solution capabilities such as more advanced user interactions, rich media decoding, and encryption within the constraints of the digital signage environment’s real-time requirements.

As a result, QNAP products include features such as frame-splitting, where the display of an image or video can be divided among several monitors. Intel® Active Management Technology supports remote power management and remote screenshots as proof-of-play documentation.

Easier development for new hardware even makes enhanced customer revenues possible, through innovations such as location-based digital signage in public transportation, where advertising content can be enhanced based on GPS coordinates.

Technical contributions by Intel to the Yocto Project*, including board support packages, help providers such as QNAP easily get optimal results from the full range of embedded Intel® platforms.
COMMUNITY-BASED INNOVATION
WITH THE YOCTO PROJECT

Like many companies that produce embedded solutions, QNAP used to roll its own custom Linux distributions from scratch, a tedious process that typically required the full-time attention of two developers for a full month. By adopting components, tools, and practices from the Yocto Project, QNAP has been able to reduce that figure to just a couple of days. Such are the benefits of collaborating with the worldwide community of open-source developers.

Derived in part from the collection of recipes, classes, and associated files that make up OpenEmbedded-Core, the Yocto Project is continually refined, tested, and updated by an active community. As a result, companies such as QNAP have the tools they need to accelerate embedded Linux development across a breadth of platforms. Several Intel engineers are among the project’s participants, providing rich features and BSP support for emerging hardware.

Support for the Hob graphical interface further enhances the efficiency among developers using the Yocto Project. This tool is being continually enhanced by community-based design, simplifying efforts to create, modify, build, and deploy images, for beginner and experienced Linux developers alike.

QNAP has also found the Yocto Project community to be very responsive to requests for technology support.

“Intel has provided us with professional technology support and addressed our previous challenge of needing to rebuild our system in case of version or technical updates. Our development has been substantially accelerated as well.”

– YT Lee, Director of QNAP Digital Signage Business Division, QNAP Systems, Inc.
Hosted by the Linux Foundation, the Yocto Project is a collaborative, open-source project that facilitates and streamlines the development of custom embedded Linux with proven templates, tools, methods, and community support.

The Yocto Project has received the backing of some of the industry’s top embedded silicon makers, OS vendors, and embedded board makers. Significant project contributions by Intel help ensure pre-validation for Intel® hardware platforms, and an extensive lineup of prebuilt and tested BSPs offer solid Linux support across Intel® embedded platforms. The project provides diverse benefits.

### Fostering Cross-Ecosystem Innovation

In the best spirit of open source, the Yocto Project facilitates work across the ecosystem:

- **Simplified license inclusion tracking.** Programming filters and automatic reporting on GPL license types simplifies legal compliance.

- **Cross-architecture solution.** Porting across application and device types on any hardware architecture, including x86 (32-bit and 64-bit), ARM®, PPC, and MIPS, requires only a minor configuration change for the project to automatically rebuild without additional user effort.

- **Advisory board participation.** Intel participates in the Yocto Project Advisory Board.

### Accelerating Product Development

The Yocto Project enables fast time-to-market for high-quality products:

- **UI framework-agnostic.** Developers have the flexibility to use their preferred UI tools, such as Clutter, QT, HTML5, Gnome, and more.

- **Economical transition to commercial OS.** In addition to supporting roll-your-own OSs, Enea, Mentor Graphics, and Wind River offer commercial OS support and services, protecting code and design investments when moving from a proof of concept to a commercial OS.

- **Ease-of-use.** A rich graphical UI can simplify rapid adoption and day-to-day operation.

- **Automatic device customization.** An application development toolkit is created with each image, enabling access to only the capabilities needed for a specific device or application.

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**Yocto Project® Training Video**

Interested in getting a jump-start in using the Yocto Project? Scott Garman, Embedded Linux® Engineer, Intel Corporation, provides developers with a quick orientation and explains how to build an initial Linux image and run it through the emulator. [http://vimeo.com/36450321](http://vimeo.com/36450321)
Yocto Project Compliance Program

The Yocto Project Compliance Program offers businesses a means to demonstrate interoperability by registering their products and components as Compatible, while companies can denote their alignment with the goals and directions of the Yocto Project by registering as a Participant.

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The Yocto Project provides an opportunity to help Intel customers differentiate and create unique solutions in the embedded market segment. Intel remains committed to choice in operating systems and our Intelligent Systems roadmap for embedded views the Yocto Project as a way to provide our customers with a flexible Linux-enabling vehicle.

— Ton Steenman, Vice President and General Manager, Intelligent Systems Group, Intel

Test drive the Yocto Project to streamline custom embedded Linux development:

www.yoctoproject.org

Learn more about open source at Intel, the Yocto Project, and QNAP digital signage solutions:

www.intel.com/opensource
www.qnap.com
Intel takes pride
in being a long-standing
member of the open-source community.
We believe in open source development as a
means to create rich business opportunities,
advance promising technologies, and bring
together top talent from diverse fields to
solve computing challenges. Our contributions
to the community include reliable hardware
architectures, professional development tools,
work on essential open-source components,
collaboration and co-engineering with leading
companies, investment in academic research
and commercial businesses, and helping to
build a thriving ecosystem around open source.