Solution Brief

Intel® Product Technologies

Digital Signage Industry

Computing Technologies for Digital Signage

Advanced Intel® product technologies reduce TCO and increase signage capabilities

Digital signage solutions are creating multimedia customer experiences with compelling advertising and targeted messaging. They have become hugely effective sales tools for connecting with customers, offering much more than traditional closed-loop video stream advertising. Today's digital signage systems support rich media blending, multiple zones and large LCDs through the use of power-efficient Intel® multi-core processors. Lowering total cost of ownership (TCO), Intel® processor-based systems save power through advanced power management features and reduce the number of expensive on-site repairs with innovative remote management capabilities.

Advanced technologies are also enabling advertisers to measure the impact of advertising with solutions offering "proof of impression." This is done by measuring the number of viewers, viewing duration and audience demographics and correlating this data to actual purchases by cross-checking sales receipts with audience analytics reports. For example, many digital signage systems are equipped with "anonymous video analytics" capabilities that can determine whether consumers are paying attention to the display, just glancing or ignoring it. Equipped with USB cameras and facial recognition software, these systems help advertisers gauge content effectiveness and target consumers by adapting advertising and messaging in real-time, based on the demographic composition of the audience.

As the digital signage market expands, equipment manufacturers can differentiate themselves by offering cutting-edge content display capabilities, reduced TCO and video analytics. Helping digital signage manufacturers achieve these objectives, Intel processors, chipsets and product technologies are providing many capabilities to provide key benefits, such as:

- **Reducing equipment support costs** by improving remote diagnostic and power-down capabilities
- **Balancing performance and power consumption** by saving power whenever the software workload decreases
- **Enabling anonymous video analytics** through power-efficient Intel multi-core processors

This solution brief discusses how technologies built into Intel® silicon components increase remote management capabilities and power efficiency. In addition, Intel® Core™2 Duo processors with multi-core technology supply the computing horsepower required for state-of-the-art displays and video analytics.

Reducing Equipment Support Costs

Today, almost every digital signage system is connected to a network in order to access video streams and information from back office systems. The network may also be the communications link for remote management terminals, supporting IT tasks such as updating software, repairing systems and collecting inventory information. Traditionally, most digital signage systems use the same networking functionality (e.g., Ethernet NICs, CPU, operating system, protocol stacks) for both standard LAN and remote management communications. When equipment fails, the "in-band" approach has the drawback of relying on the continued operation of many equipment components: CPU, operating system, hard disk drive and system memory. What happens if the target system isn't switched on or a malicious virus corrupts the operating system? Dispatching a technician may be the only option.

Providing a significant remote management breakthrough, Intel® Active Management Technology (Intel® AMT)[1] implements a unique capability (i.e., circuit) in the Intel® chipset that can access and control the system, even when the system is powered off or the software is corrupted. This circuit establishes an "out-of-band" link that allows the system to communicate with a management console without relying on the system's standard networking functionality. Intel AMT, available with select Intel® Core™2 Duo processors and Intel® Xeon® processors, is a cross-platform solution, meaning it can support digital signage systems, point of sale (POS) terminals, kiosks and servers, as shown in Figure 1.

Cutting IT Support Costs

By employing Intel AMT-based management solutions, IT can remotely fix a wide assortment of system defects, track inventory – including warranty and software license information – and reduce utility bills by powering down systems during off hours, as described in Table 1. This capability can reduce cost and save time by supporting devices without going on-site.

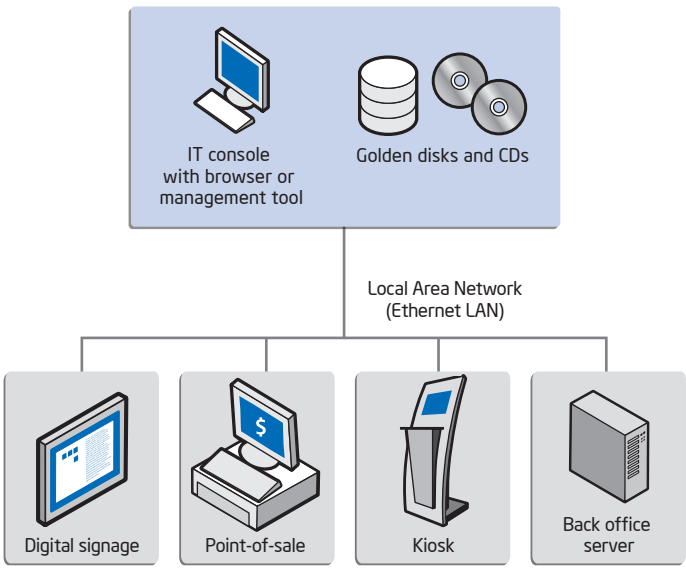

Figure 1. Retail Remote Management Example

Reduce Repair Costs

When a digital signage system doesn't boot due to corrupted software (e.g., OS, driver or critical application), the usual remedy is to send a technician on-site to reload the software image. Using Intel AMT, it's possible to remotely boot a device from a networked drive (golden disk in Figure 1) with known good software, which greatly aids troubleshooting. IT can also remotely change BIOS configuration settings, load new drivers or load a new operating system, whether or not the system is running.

Track Inventory Without Physical Interaction

For many retailers, performing a fixed asset inventory can be time consuming, especially when equipment resides in geographically dispersed stores, which makes physical methods resource intensive. Minimizing human intervention, Intel AMT enables management systems to generate a comprehensive list of hardware and software components for any device that's plugged into the network and an electric outlet. This capability also allows IT departments to track software, by version and license, for every device on the network.

Lower Utility Costs

Although most retailers could power down some systems at the close of business to save power, many don't because IT departments typically send software and data updates during off hours. A solution is to configure remote management software, based on Intel AMT, to turn systems off after work hours and turn them back on when IT requires access. This feature, combined with the power-efficiency of Intel processors, can generate considerable cost savings and help protect the environment.

Balancing Performance and Power Consumption

Digital signage developers understand the profound impact power consumption has on device size, end user utility bills and attainable performance. A very effective way to manage power consumption is to put the system into a lower power state when the system workload decreases. Intel processors support a number of power states that enable substantial power savings and design flexibility and are accessible through the industry standard Advanced Configuration and Power Interface (ACPI). For example, the power states of the Intel® Core™2 Duo processor SU9300[Δ] support a wide range of power consumption levels, from 10 W to 0.25 W TDP (thermal design power), as shown in Figure 2 on the next page.

Capabilities	Benefits
Fix Hung Systems	Restore systems by cycling power, reloading software or booting from a "gold" hard drive on the network.
Run Inventory Reports	Remotely read system configuration data from non-volatile memory, even if the system is switched off.
Reduce Power Consumption	Save power by powering down systems during off hours using the remote on/off switching option.

Table 1. Intel® Active Management Technology Capabilities and Results

In conjunction with power states, the Intel® technologies listed in Table 2 enable systems to strike the right balance between computing performance needs and power consumption. They give software developers granular control over the state of the processor and its operation. Developers may also use Enhanced Intel SpeedStep® technology to put a ceiling on the system power consumption. Limiting the maximum power consumption may be useful when digital signage equipment manufacturers want to reuse board designs in more thermally constrained environments. This is easily done by software engineers, who can prohibit systems from entering higher performance states, thus meeting more stringent power consumption requirements. Power management technologies address many design challenges, like conserving power and creating a scalable platform, as described in the following sections.

Reduce Average Power Consumption

Users of digital signage, such as retailers, medical offices and airports, take overall power consumption seriously because they must pay for electricity to power their equipment and then again to remove the generated heat from their buildings. Application software can intelligently cut power consumption by moving to a lower power state or invoking Intel SpeedStep technology and Intel® Dynamic Front Side Bus Frequency Switching when equipment is operating below maximum load.

Support Many Devices with One Platform

Since there are many functional similarities between digital signage, POS and kiosk systems, equipment manufacturers may consider supporting all of them with a scalable platform. Such a platform must have high-performance options for top-end systems and low power alternatives for space-constrained environments. Intel® platforms with Enhanced Intel SpeedStep technology satisfy both because designers can run the processor full-board in performance systems or lock in a processor frequency and voltage combination that meets strict power requirements. This allows equipment manufacturers to create a family of products with different performance and power consumption objectives using a single platform based on Intel's silicon products.

Enabling Anonymous Video Analytics

Already compute intensive, digital signage solutions of the future will have to process more frames per second, support higher image resolutions and handle more content sources. Intel Core 2 Duo processors are delivering the performance needed for these encoding video workloads, as well as satisfy emerging requirements like anonymous video analytics. Systems performing video analytics must handle millions of pixels (e.g., high resolution and frame rate), track multiple objects at one time and decide, in tenths of a second, which content to display.

This capability allows advertisers to gauge the interest of consumers watching advertisements in stores, airports or just about anywhere. Advertisers can also target specific demographic groups by displaying ads that are compelling to the viewing audience. For example, the systems can dynamically change their content if the audience is male, female, a senior or a child. By accurately identifying their target audience, these digital signage systems can help advertisers reach the right customers, with the right content, at the right time. The demand for video analytics will increase as costs decline, fueled by Intel® multi-core technology and the ability of equipment manufacturers to increase software scalability.

Scalability Lowers Cost

Scalability enables manufacturers who are developing a family of products to reach higher levels of development efficiencies. Video analytics equipment manufacturers can run a common code base across a wide variety of scalable Intel processors and reduce development cost through substantial software reuse. With relatively little software effort, system performance can be scaled higher by adding processor cores to the system or by using special Intel® software libraries that make extensive use of parallel instructions. The development environment is also scalable, because developers may use the same code developed on laptops and workstations for the target system instead of working with a second development environment supporting a specialized processor. Intel® architecture-based processors are designed to efficiently execute highly parallel software and facilitate code reuse, as described in Table 3 and the following sections.

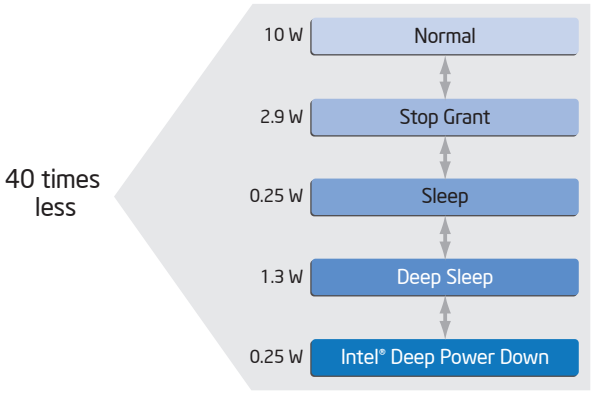

Figure 2. Power State Example

Power Management Technologies	Results
Processor States (C-states)	C-states manage power consumption at the processor core level.
Enhanced Intel SpeedStep® Technology	Allows applications and operating systems to change the processor supply voltage and frequency, enabling optimal performance at the lowest power.
Intel® Dynamic Front Side Bus Frequency Switching	Halves the processor front side bus (FSB) frequency, as directed by application software, providing further power savings.

Table 2. Power Management Technologies and Capabilities

Intel® Architecture Features	Results
Intel® processors with multi-core technology and purpose-built libraries	Increases video analytics performance
Large family of scalable, backwards-compatible processors	Maximizes code reuse
Identical development and product environments	Simplifies development environment

Table 3. Intel® Architecture Feature and Results

Maximize Software Parallelism

Video Analytics code is highly parallel and running these workloads on more processor cores provides a substantial speed up without adding more hardware components. Intel® Hyper-Threading Technology[2] (Figure 3) enables the Intel® Atom™ processor used in entry-level systems to process two threads on one core, which can increase throughput by 25 to 50 percent.[3] Decreasing software development effort and increasing performance, Intel® Integrated Performance Primitives (Intel® IPP) is an extensive library of multicore-ready, highly optimized software functions for video and image processing applications.

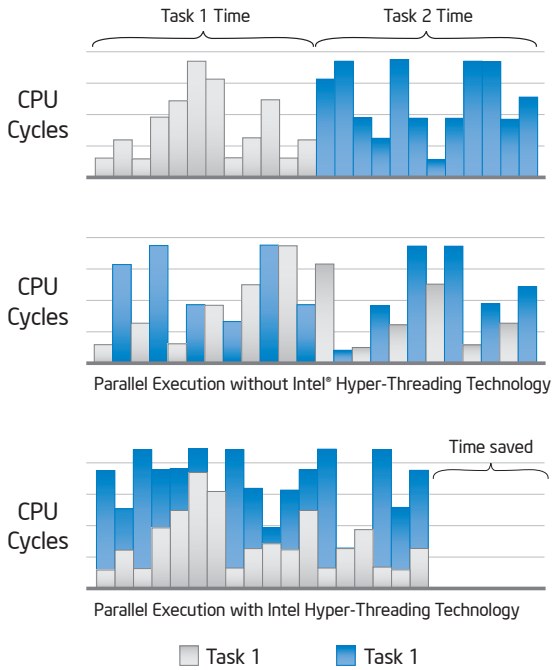

Figure 3. Benefit of Intel® Hyper-Threading Technology

Use Common Code Base

An effective way to reduce software development and maintenance cost is to maximize code reuse by using a common code base across multiple platforms. This is easily accomplished with software compatible Intel architecture-based processors, which span from price-performance Intel Atom processors to high-performance Intel Core 2 Duo processors. When using video processing accelerators, the Intel® QuickAssist Technology Accelerator Abstraction Layer (AAL) eases the migration from one bus interconnect technology (e.g., PCI Express*) to another with minimum impact to applications.

Simplify Development Environment

Video analytics algorithms are often developed on Intel architecture-based laptops and workstations and later ported to a digital signal processor (DSP), which is very time consuming. Instead, it's possible to run most, if not all, of the video analytics code on high performance Intel processors, saving development steps and enabling quicker prototyping. This approach unifies the development and target environments and can leverage Intel development tools that facilitate performance tuning and software thread checking.

Innovating with Advanced Technologies

Digital signage computing requirements are soaring, led by innovative applications such as anonymous video analytics. Intel advanced technologies and multi-core processors are helping manufacturers deliver systems with higher performance, greater energy efficiency and lower TCO through enhanced remote management and advanced power management capabilities.

For More Information

For more information on Intel® digital signage solutions, visit www.intel.com/go/digitalsignage.

For more information on Intel® product technologies, visit www.intel.com/technology/advanced_comm.

Additional information about Intel® embedded products can be found at www.intel.com/products/embedded/index.htm.

[Δ] Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See www.intel.com/products/processor_number for details.

[1] Intel® Active Management Technology (Intel® AMT) requires the computer system to have an Intel AMT-enabled chipset, network hardware and software, as well as connection with a power source and a corporate network connection. Setup requires configuration by the purchaser and may require scripting with the management console or further integration into existing security frameworks to enable certain functionality. It may also require modifications of implementation of new business processes. With regard to notebooks, Intel AMT may not be available or certain capabilities may be limited over a host OS-based VPN or when connecting wirelessly, on battery power, sleeping, hibernating or powered off. For more information, see www.intel.com/technology/platform-technology/intel-amt.

[2] Intel® Hyper-Threading Technology (Intel® HT Technology) requires a computer system with an Intel® processor supporting Intel HT Technology and an Intel HT Technology enabled chipset, BIOS, and operating system. Performance will vary depending on the specific hardware and software you use. See www.intel.com/products/ht/hyperthreading_more.htm for more information including details on which processors support Intel HT Technology.

[3] Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, visit Intel Performance Benchmark Limitations.

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