



Increasing Vending Profitability with More Intelligent Machines

Intel reference design helps increase sales through an enhanced vending experience and new business opportunities for product manufacturers and operators, while reducing operating costs.



The Internet of Things increases retail opportunities in vending.

Vending and the Digital Age

The Internet is accelerating the beat rate of innovation and transforming markets, not the least of which is the vending industry. One example of this is the emerging Internet of Things (IoT), which is taking today's isolated systems and connecting them to the Internet, a trend that is already underway for vending machines.

"The era of digital vending has begun," explains president of Venditalia* and CONFIDA*, Lucio Pinetti. "All the machines can be connected to the Internet, have access to social networking, and become authentic peripherals interacting online. This is why we are certain that in the future, vending machines will have a considerably greater number of functions, offering extra services today unheard of."¹

For product manufacturers and operators, this new reality offers opportunities for financial upside, brand visibility, customer engagement, and operating cost reductions.

Today's Limitations

Until fairly recently, vending machines have performed a single task. Customers put in money, and the machine dispenses product – end of story. This limited functionality is largely due to the internal architecture of most machines, which hinders the integration of new technologies, thus stifling progress.

The vast majority of machines are designed with a Vending Machine Controller (VMC) that manages many basic subsystems, such as payment, refrigeration and lighting control, coin and product handling, and so on. Since the VMC is usually based on a low-end microcontroller, it lacks the computing power, connectivity, security, manageability, and ease of reprogramming needed to support new services post-installation, such as running loyalty programs and marketing campaigns.



The Intel® Reference Design for Intelligent Vending enables vending machines to connect to the Internet, allowing brands and operators to take advantage of new business opportunities, cloud services, and data analytics.

Making Vending Machines Smart

Bringing vending machines into the 21st century is quite straightforward. For the most part, it is just a matter of moving the VMC functionality to a PC-based computing platform with a Vending Machine IO (VMI) board.

Greatly simplifying this task, the Intel® Reference Design for Intelligent Vending provides developers with a proven recipe. It includes a VMI hardware reference board design (schematics and Gerber files) and Application Programming Interfaces (APIs) used by application software to more easily access typical machine peripherals (for example, coin dispenser, refrigeration), as shown in Figure 1. This comprehensive reference design is intended to significantly reduce the time to market for intelligent vending machines, and allow manufacturers to spend their time developing innovative applications and differentiating at a higher level.

Among other things, the reference design enables vending machines to connect to the Internet, allowing brands and operators to take advantage of new business opportunities, cloud services, and data analytics. Some examples are shown in Figure 2.

Improving the Vending Experience²

The vending industry is undergoing a sea-change, using intelligent systems technologies to deploy innovations as diverse as high-definition, touch-enabled screens and remote device management software to go far beyond simply dispensing food and drink. There is a strong appetite for vending innovation from consumers, with respondents to Intel's survey indicating they would use machines that offered services as well as products. Mobile phone charging (55 percent), free Wi-Fi (54 percent), and printing from USB drives (50 percent) were the most in-demand services.

Advertisers and machine owners will also be able to send coupons to customers' mobile phones to encourage them to come back or direct them to purchase more product in a local store. Responses to Intel's survey indicated this capability could address an existing customer need: 30 percent of participants wanted to be able to set their own favorites on vending machines, while 62 percent would like to receive discounts for items they purchase regularly.

By taking advantage of new technologies, each vending machine can now become

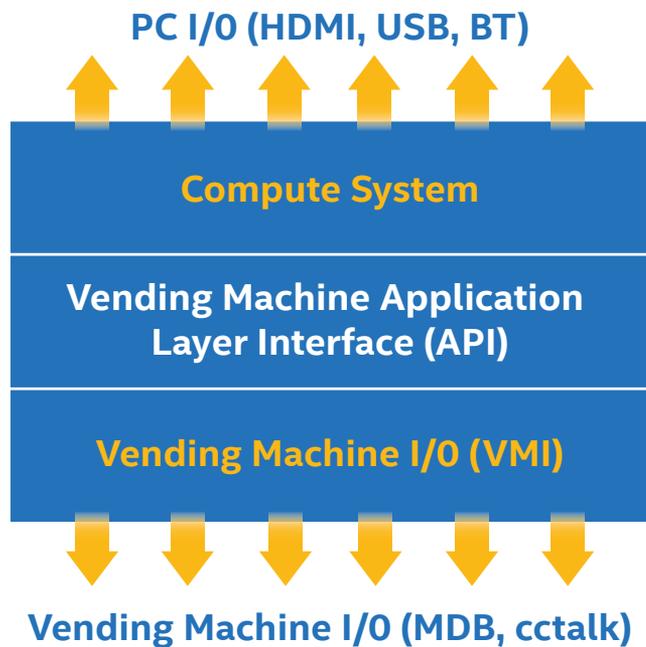


Figure 1. Intel® Reference Design for Intelligent Vending

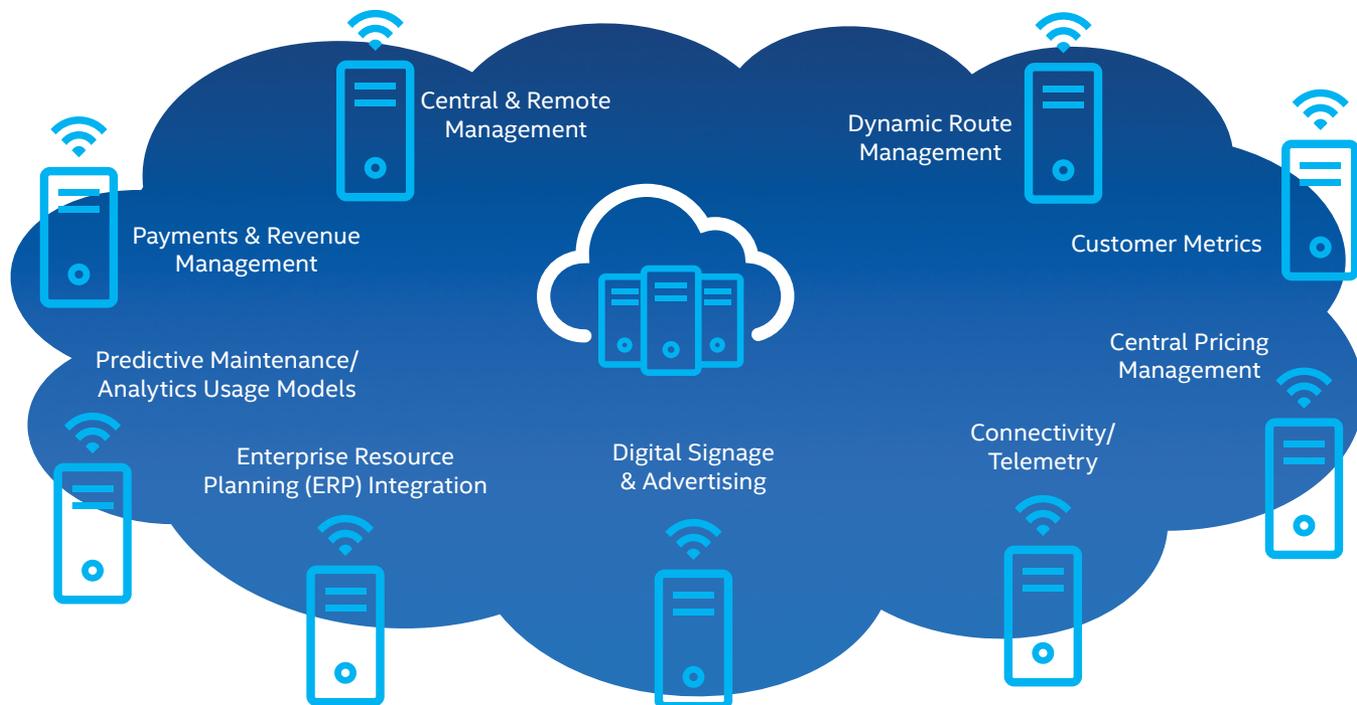


Figure 2. Examples of business models and cost reduction enabled by the Internet of Things.

an intelligent system that offers a richer, more engaging customer experience, whether it is selling soft drinks or services. Sixty one percent of respondents to Intel’s survey said they would like their vending experience to be more interactive and fun, with 62 percent expressing a desire for touch screens, and 17 percent wanting to operate machines using hand gestures. It is no longer just about delivering snacks. Vending is truly becoming a new retail location.³

Exploring New Business Strategies

A common marketing strategy for increasing transaction size and sales volumes is to offer promotions, like dynamic pricing, vouchers, coupons, and loyalty programs, but this is virtually impossible with conventional vending machines. Not surprisingly, implementing new business strategies and gathering business intelligence is much easier than before with intelligent vending machines.

For instance, some of today’s machines not only “know” what was purchased, but what was looked at and not purchased, giving product manufacturers and operators more insight into the drivers of sales and

customer satisfaction. They are also detecting and messaging specifically to individual patrons with directed advertisements based on their demographics.

Offering New Transaction Models

The vending industry need no longer rely on customers to have hard cash in their pockets. Intelligent vending machines deliver more payment options, like credit and debit cards, QR codes, swiping a phone using near field communications, and other contactless payments methods.

In much greater numbers, shoppers will conduct transactions for goods or services made by scanning, tapping, swiping, or checking in with a mobile phone at the point of sale. A recent eMarketer study projects mobile payment transactions in 2016 will reach \$26.5 billion (USD), more than 25 times the slightly over one billion in 2013.⁴

Reducing Operating Costs

When vending machines are connected to the Internet, operators have many new avenues available for lowering their operating costs. They can diagnose and repair systems remotely, thereby

reducing machine downtime and service costs. Keeping business running smoothly, machines stay in contact with operators via the cloud by sending real-time notifications that report any technical or supply problems with text or online messages.

Operators can automate and streamline their business by tying machines to corporate systems, such as Enterprise Resource Planning (ERP) and central pricing. Intelligent machines can potentially save cost by accessing cloud-based services, such as dynamic route management condition-based maintenance, which identifies excessively worn parts so they can be replaced before they fail.

Intelligent Vending Platform: System View

From a systems perspective, the Intel Reference Design for Intelligent Vending addresses five main machine functions, as shown in Figure 3. Vending peripheral control is handled by the reference design’s VMI board. The other main functions – connectivity and telemetry, touch interface, and machine management – are carried out by applications running on an Intel processor-based computing platform.

Intel® Reference Design for Intelligent Vending

The result is the majority of machine functionality becomes software-based and flexible, which enables machines to more easily evolve over time.

Reference Design

The Intel Reference Design for Intelligent Vending provides a fast and easy recipe for re-architecting traditional vending machines into highly-capable, Internet-connected machines. Vending machine manufacturers can use the reference design to architect future machines or to retrofit existing ones. The reference design contains several hardware and software components, including:

Computing System

An Intel processor-based platform with a VMI board replaces traditional vending machine controllers (VMC), thus providing machines with wired Ethernet or broadband wireless connectivity to the outside world and the computing power needed to deploy emerging services.

Vending machine manufacturers can choose two scalable families of processors, which can run the same code (that is, providing backward compatibility) and are supported by a very large, established ecosystem of Independent Software Vendors (ISVs).

- Intel® Core™ vPro™ processors deliver top-of-the-line performance for multi-display and compute-intensive tasks, including high-definition digital signage, data analytics and content management. They also support Intel® Active Management Technology (Intel® AMT),⁵ a remote management capability described in the next section.

- Intel® Atom™ processors balance compute and graphics performance to provide an excellent price-point for mid-range vending machines.

I/O Interface Module

Today's vending machines use a wide range of bus protocols (for example, CAN, ccTalk, MDB, USB) to communicate between the VMC and machine peripherals, such as control mechanics and note readers. The Intel reference design contains a VMI board that supports these I/O interfaces and more. Vending equipment manufacturers can incorporate the module design in one of several ways:

1. Purchase an I/O interface module from an OEM or ODM, such as Advantech*.
2. Request a OEM/ODM to build a customized version of the module.
3. Build a board themselves using the

Gerber files available from Intel.

4. Integrate the function onto an Intel processor-based computing board using the schematics and BOM available from Intel.

The I/O board, shown in Figure 4, is a low-cost design that provides a high-level of I/O flexibility. The bus protocol conversion is handled by the VMI board and the required software is also available from Intel.

Software Stack

Figure 5 shows the software architecture of the reference design abstracts the vending IO, allowing vending machine manufacturers to concentrate on high level applications and what is displayed on the screen. This is achieved through two types of APIs: a low-level API (LLAPI) for accessing specific vending IO protocols and a high-level API (HLAPI) for accessing a type of peripheral without requiring programmers to know the particulars for the actual device.

The LLAPI provides low level access to a device, but the associated code will likely be specific, making it difficult to reuse on another machine. On the other hand, the HLAPI details how a device type works, but the communication

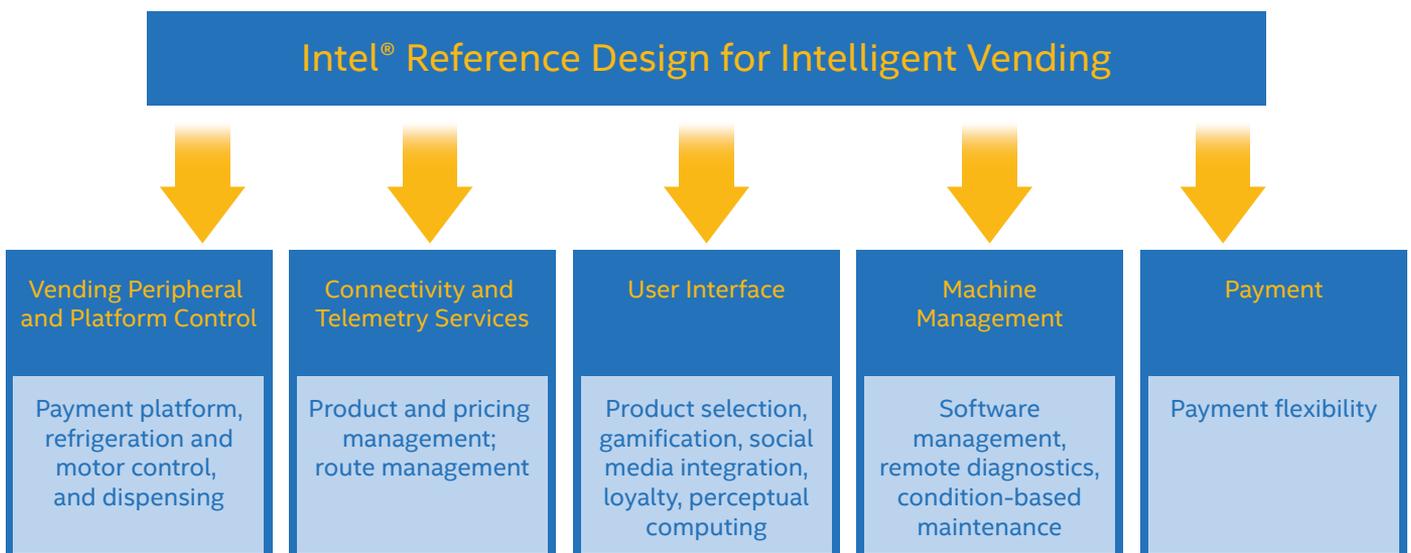


Figure 3. Intelligent Vending Platform: System View

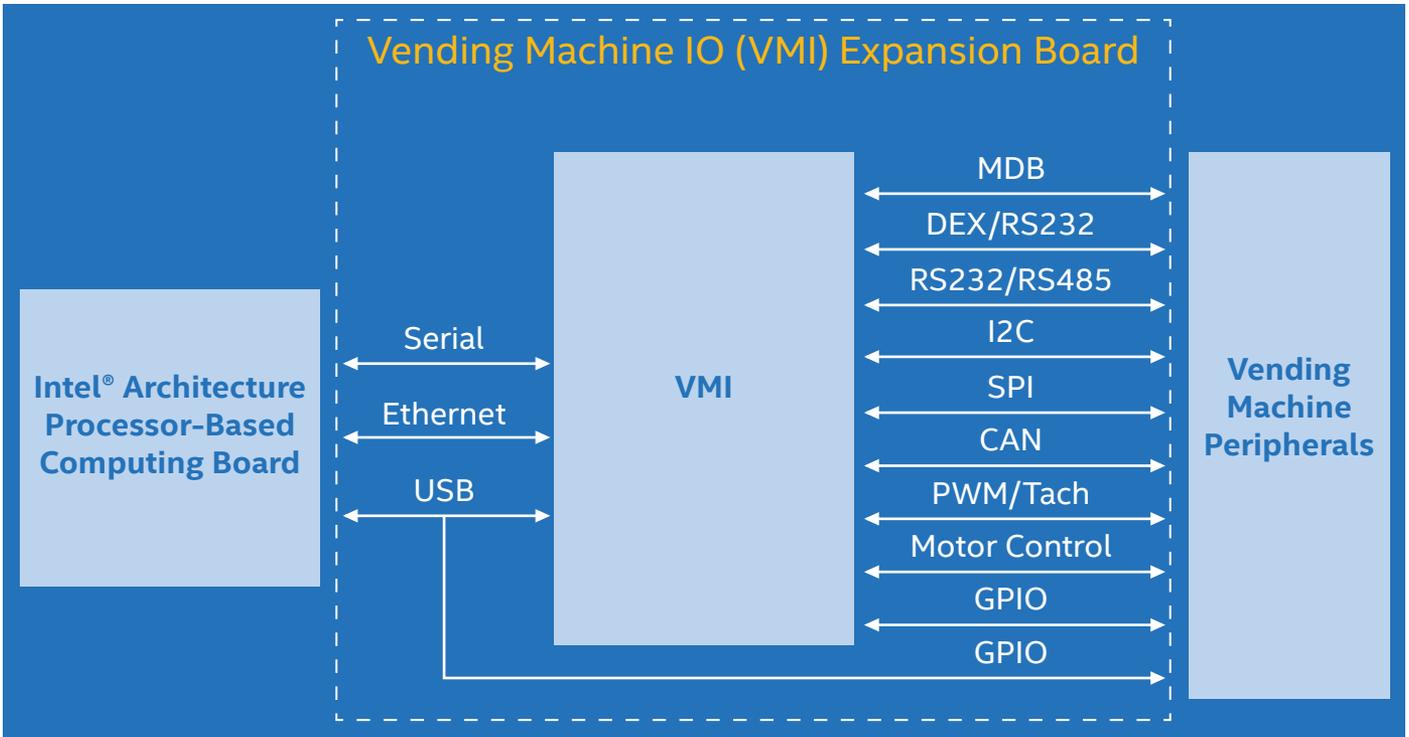


Figure 4. Vending Machine I/O Expansion (VMI) Module

details are abstracted, allowing applications to be reused for other machine configurations. Essentially, the HLAPI makes it easy to write a vending application and may enable vending operators to use one application over their entire fleet of machines.

The HLAPI also handles variations in protocols, such as MDB, and provides additional flexibility to adapt to slight variations in bus protocols, which is needed when peripheral manufacturers deviated from standard specs. In other words, the HLAPI allows vending machine manufacturers to make rather easy configuration changes to support bus protocols that were modified by peripheral vendors.

Applicable Intel Technologies

Delivering new business models, security, and manageability, this powerful set of Intel technologies brings the Intel reference design to a whole new level:

- **Content Management System (CMS):** Intel® Retail Client Manager (Intel® RCM) allows vending machine operators to create sales opportunities by composing relevant and high-impact campaigns in minutes; no technical knowledge required. Messages can be deployed to a single screen or across a network, and screens can be managed independently – and remotely – from a single location.
- **Analytics:** Integrated in Intel® RCM, the optional Intel® Audience Impression Metrics Suite (Intel® AIM Suite) gives product manufacturers and operators valuable insights into how vending machine customers are responding to visual messaging and how they are engaging with the machine and its products. The software aggregates viewer statistics by gender, age range, impression counts, and dwell times, information that can be used to play directed advertisements and measure campaign effectiveness, as well as determine lost sales from customers who walked away without making a purchase. This is all done anonymously and while respecting viewer privacy.
- **Manageability:** Intel® AMT, available on Intel® Core™ vPro™ processors, enables an IT management console to remotely monitor, diagnose, and in many cases, fix corrupted software remotely, thus avoiding an onsite visit. If a vending system malfunctions, an alert containing system diagnostics can be sent automatically to maintenance staff, reducing downtime and lost sales opportunities.
- **Security Software:** McAfee* Embedded Control maintains the integrity of vending machines by allowing only authorized code to run and only authorized changes to be made. It automatically creates a dynamic whitelist of the “authorized code” on the system. Once the whitelist is created and enabled, the system is locked down to the known good baseline, and no program or code outside the authorized set can run. Whitelisting helps to prevent viruses, spyware, worms (like the Stuxnet worm), and other malware from executing.
- **Operating System:** Wind River* Linux* is the leading commercial embedded Linux platform and the first to bring the advantages of open source without the risks to companies in all industries. The reference design also supports Microsoft* Windows*.

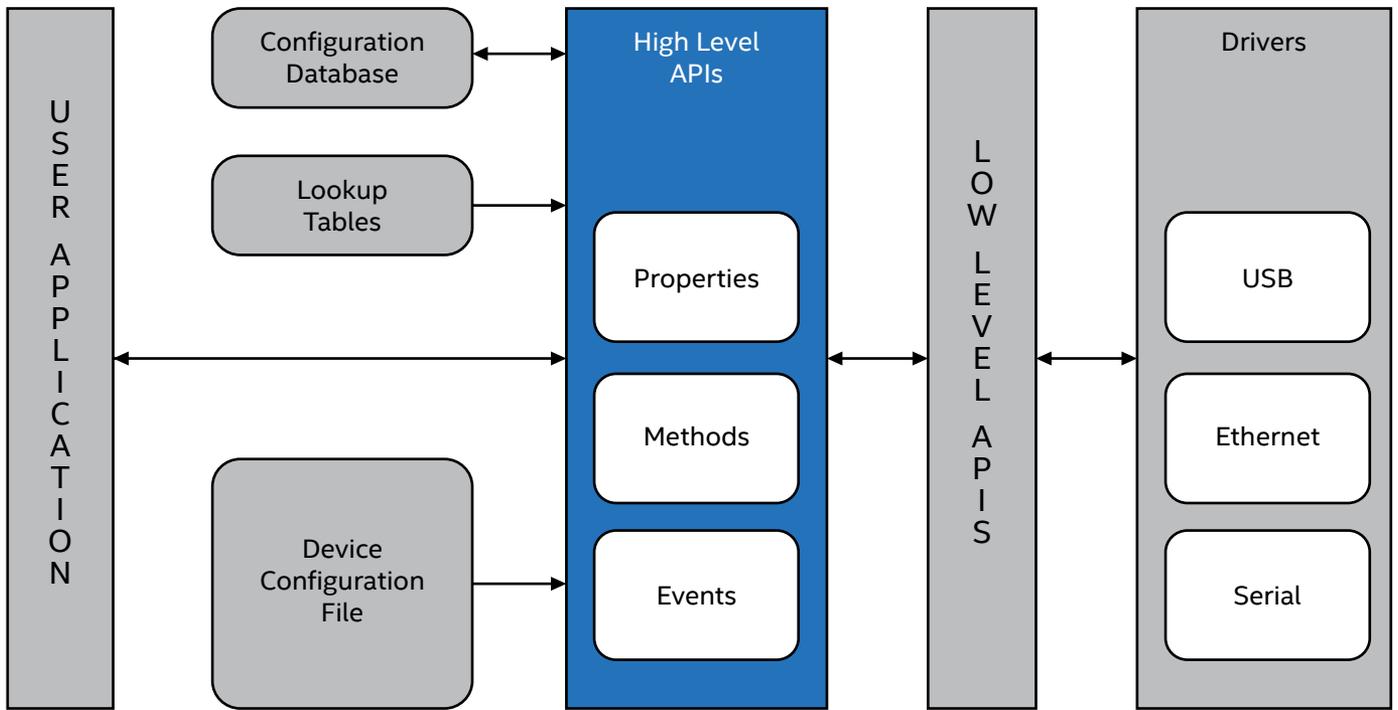


Figure 5. Software Stack for the Intel® Reference Design for Intelligent Vending

Access Design Guides from Intel Website

Intel maintains the Intel® Embedded Design Center (Intel® EDC) website to assist hardware and software engineers developing products using Intel® architecture processors. Developers can download the Intel® Reference Design for Intelligent Vending at <http://www.intel.com/content/www/us/en/intelligent->

[systems/retail/reference-design-for-intelligent-vending.html](http://www.intel.com/content/www/us/en/systems/retail/reference-design-for-intelligent-vending.html). Deployment-ready, I/O interface modules are also available from members of the Intel® Internet of Things Solutions Alliance: [see solutions directory](#).

Learn more about Intel solutions for the vending industry at www.intel.com/vending

¹ Venditalia* website, <http://www.venditalia.com/en/venditalia-2012-%E2%80%93-digital-vending-here>.

² The Smart Vending Survey is based on data collected by Redshift Research - an independent market research company. Online interviews were used to collect responses across eleven countries within EMEA and the USA, with 6,018 individuals surveyed in total. The European countries surveyed were: France, Germany, Italy, Netherlands, Poland, Russia, Spain, Sweden, Turkey, UK and Ukraine. Fieldwork was completed in October 2012.

³ Aviel Dafna, President, VE Global Vending, Inc. in "Innovative Vending Machines Deliver New Value to Retailers" whitepaper found at <http://www.intel.com/content/www/us/en/retail/innovative-vending-solutions-deliver-value-retailers-brief.html>.

⁴ US Mobile Payments to Top \$1 billion in 2013." eMarketer. July 11, 2013, www.emarketer.com/Article/US-Mobile-Payments-Top-1-Billion-2013/1010035.

⁵ Requires activation and a system with a corporate network connection, an Intel® Active Management Technology (Intel® AMT)-enabled chipset, network hardware and software. For notebooks, Intel AMT may be unavailable or limited over a host OS-based VPN, when connecting wirelessly, on battery power, sleeping, hibernating or powered off. Results dependent upon hardware, setup and configuration. For more information, visit Intel Active Management Technology.

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