SOLUTION OPPORTUNITY BRIEF

Professional electronics Gaming Industry

Game-Changer

Application-ready intelligent platforms (ARiP) for professional electronic gaming machines simplifies development

Executive Summary

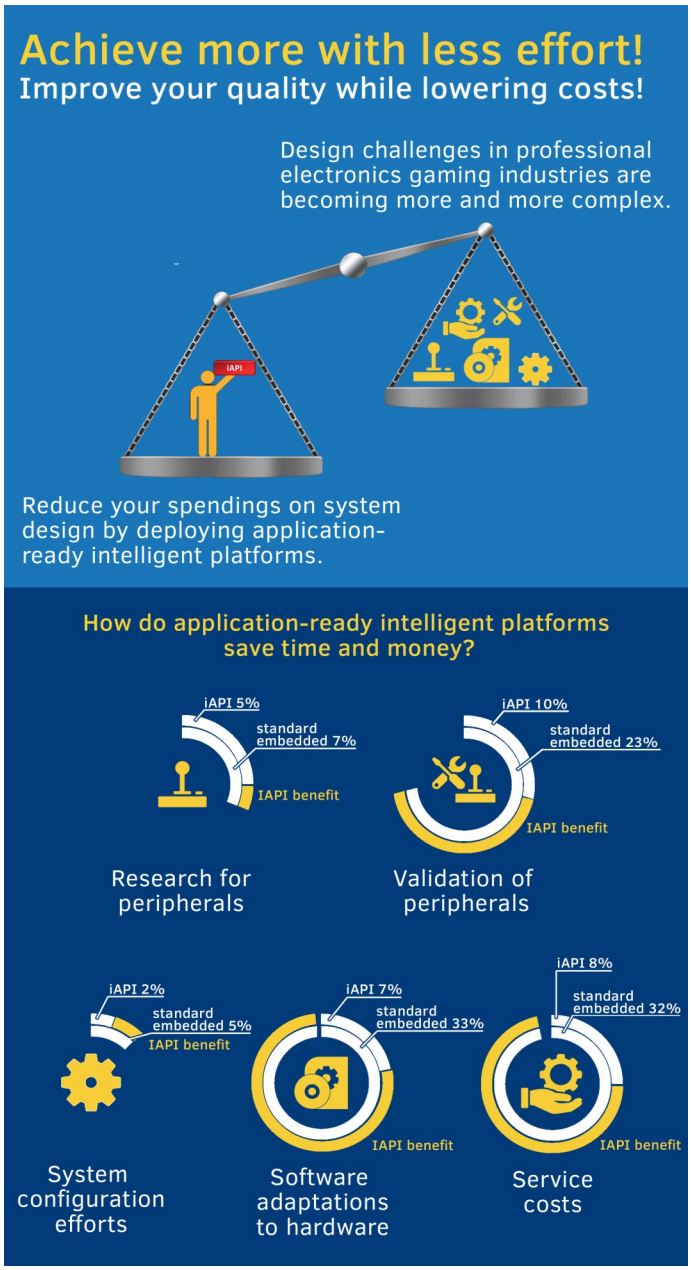
Professional electronic gaming machines are becoming ever more complex while the entire market is getting increasingly competitive. Application-ready intelligent platforms help to significantly reduce OEMs' engineering efforts.

Market environment

Analysts forecast the global casino gaming market to grow at a CAGR of 8.96 percent over the period 2015-2019[i]. This estimated healthy growth is driven by prospering new economies in Asia Pacific. But even the mature US market expects qualified growth of at least 5 percent[ii], which points to additional factors driving global progress. One of these factors is the trend toward online casinos and cloud-based gaming, which is expected to grow at a CAGR of more than 29 percent during the forecast period 2016-2020[iii]. The cloud -gaming megatrend is set to put the established market for professional electronic gaming machines – whether in casinos, hotels, restaurants, shopping malls and various other tourist attractions such as indoor amusement parks and cruise liners - under extreme pressure. Operators are constantly on the lookout for even more stunning user experiences to compete against online innovations and are highly interested in each and every potential enhancement – if the price is right.

The gaming machine vendors' challenge

Presently, gaming machine vendors are forced to integrate spectacular new features and functions at even lower costs. This leads to extreme price pressure where only the most competitive vendors can survive. And it's not just one, but whole series of enhancements of which vendors must be aware, as computer technologies are constantly improving. Within short time frames, new performance classes and power saving options, as well as the latest graphics codecs and higher resolutions supporting even more monitors, are popping up in the market.



Current high-end processors provide, for example, vivid, highly immersive visuals for up to three independent 4k displays only via their integrated graphics. This means that additional graphics cards are no longer needed. This type of multi-head SoC platform provides benefits in two areas: more cost-efficiency and better user experience. But how can costs be saved within these fast embedded computer technology design cycles? And how can customer demands – including all the latest SoC improvements, implementation of new improved camera and sensor technologies for tracking player involvement and keeping audiences interested – be satisfied?

Reducing the costs of increased complexity

Vendors of embedded computer technologies can help OEMs of electronic gaming/gambling machines, or EGM for short, to be more competitive in this business by delivering application-ready intelligent gaming platforms. These platforms are mature and ready for deployment without any substantial engineering efforts. And they enable OEMs to leverage the mini-max challenge of delivering the latest technologies for the most innovative, stunning, and valuable big-data generating professional gaming machines. They also help OEMs to keep design-in efforts to a minimum and consequently result in lower costs.

So what makes an embedded computer a truly application-ready intelligent platform? A printed circuit board (PCB) with appropriate building blocks and a platform-proven standard board support package (BSP) does not suffice. What's required is a platform that is completely validated and certification-ready, and offers support for all the relevant professional gaming computer peripherals available – on a global scale.

Independent of the chosen hardware and peripheral setup, an application-ready intelligent platform also provides a standardized and proven API to the end-user and management applications so that the OEM's software development can always interface to hardware with identical instruction sets for functionally identical peripherals. In the IoT world, the definition of application-ready includes that these platforms support gaming cloud applications – if required. OEM engineers only need to specify the setup, order the components and plug them together. The design of all the active intelligent components is easily comparable to the plug & play functionalities of USB devices. This type of setup is a true asset for OEMs, as so many different options are available in the market, and (inter-)operability often needs to be managed via vendor-specific settings, which can often be quite tricky. By offering a unified API that accommodates third-party peripherals, design-in efforts are reduced to a simple configuration task. Ultimately, application engineers are freed from all the time-consuming interoperability challenges, which – at the end of the day – provide no obvious value to the customer. This leaves OEMs more time for designing new applications.

Interoperability and standardization challenges

Embedded computer technology vendors such as ADLINK Technology have accepted the interoperability challenge to save OEMs time. Their strategy: standardization and modularization of features to offer real application-ready intelligent platforms for professional electronic gaming machines. ADLINK has moved up the value chain and invested a great amount of engineering effort into this standardization and normalization process and its comprehensive middleware. Three major task forces have been created:

- A hardware task force concentrating on the design of the embedded computing hardware platform.
- A peripherals task force focusing on standardized driver integration of all major third-party peripherals.
- A software task force that has normalized feature sets and implemented them in a glue logic of middleware that builds the basis for the unified API.

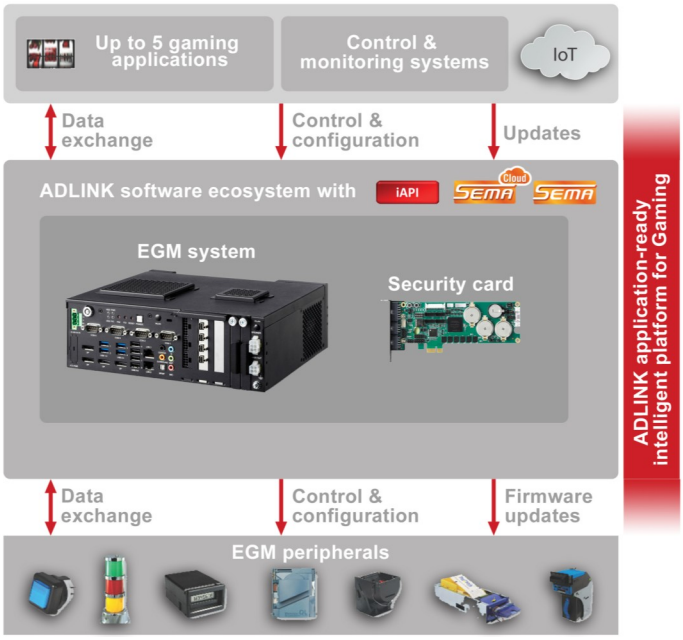


Figure 2. The application-ready intelligent gaming platforms from ADLINK Technology consist of highly scalable modular hardware and intelligent iAPI middleware. This enables easy connection of applications to third-party peripherals.

Embedded computer hardware

On the embedded computer hardware platform alone, myriad demands needed to be fulfilled to create real application-ready intelligent platforms for professional electronic gaming machines.

First and foremost, there was the need to identify the right processor vendor. OEMs require the broadest possible scalability in order to offer ideal computing performance, graphics capabilities, power and cost for each individual requirement. Intel, for example, offers highly scalable, 7+ years long-term availability as well as best-in-class graphics performance and a relatively attractive price point.

In cost-sensitive designs with medium graphics demands, such as Pachinko or Pachislot systems for example, Intel® Celeron® processors can be deployed. In high-end arcade gaming and electronic table games, 6th generation Intel® Core™ processors with the latest DirextX12 support, quad-core CPU and Intel® HD graphics for up to three independent 4k displays are an ideal choice. This is all based on the same microarchitecture from Intel, which delivers the first required standardized basis for all the different variants, as it is impossible to standardize firmware features that are processor vendor-dependent. Take, for example, the Intel® VPro™ technology for virtualization, remote system management and security, including Intel® BIOS Guard and Intel® Boot Guard.

Processor standardization is a relatively easy task compared to the standardization of the EGM's security features, where high-level security demands from an abundance of jurisdictions worldwide have to be followed. A comprehensive understanding of worldwide gaming is therefore paramount for standardization measures.

Examples of security features that are required globally include a dedicated security chip for cryptography and authentication (e.g. SHA-256 engines), a non-volatile RAM for secure storage of recent game data and unique IDs branded into the system serving as an unchangeable identifier. Additionally, a true random number generator, additional dedicated EEPROMs and one time programmable (OTP) components as well as a trusted platform module (TPM) to provide a root of trust for overall system and software security are required.

Many regulations also specify some form of access detection for critical compartments, e.g., where the program data is stored. This can be executed via dedicated I/Os for intrusion detection and optional sensors for shock and vibration to prevent system manipulation.

Moreover, EGM platforms have to provide a power-off monitoring option with date and time stamps to log and store events in a non-volatile memory, such as battery-powered NVRAM. These have to be accompanied by ESD-protected and -buffered digital I/Os, including high current output support, e.g. controlling additional lights or sirens at the EGMs. So if embedded computer vendors can provide platforms covering all of these components, OEMs are one step closer to an application-ready platform. Providing a platform that has been designed from scratch to be certified by Gaming Laboratories International (GLI) is – from a standardization point of view – best practice, as the work of GLI is trusted by regulators in more than 475 jurisdictions worldwide.



Figure 3. ADLINK Technology's application-ready intelligent box PC for gaming is ready for GLI certification and can support up to three monitors and with additional embedded PEG Cards up to seven monitors – and a range of extensions and peripherals.

Enabling evolution and customization

Being ready for certification off-the-shelf is a good approach, as it helps engineers reduce their design efforts to meet the specifications required by regulators, but not necessarily for customers. This does not, however, solve the engineers' problem of how to continuously integrate new and improved base technologies. Both demands need to be met, which requires extensive market research and lots of expert interviews to build platforms that subsequently meet the majority of demands off-the-shelf without exceeding costs for the dedicated system.

Consequently, an application-ready platform features modularity for very specific I/Os, as well as a specific set of standard interfaces for gaming applications. In terms of graphics, for example, today it is standard for new systems to support DisplayPort, as this standard is capable of supporting resolutions of up to 4k. Besides three video outputs that are typically integrated, the application-ready intelligent platform should also be capable of supporting dedicated graphics cards

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for even higher graphics performance for up to seven independent displays. This is relevant, for example, for high-end slot machines, as well as electronic table games, which currently provide a dedicated monitor for each player. For user-defined LEDs, buttons and switches, the platforms should also provide the common 1-wire bus and iButton options, plus a broad range of serial interfaces. These include not only USB, but also the classic serial RS-232, RS-232/TTL, RS-422 and RS-485interfaces, including 9 data bit support and ccTalk compliance. All these interfaces are commonly used to connect EGM hardware, such as coin and note readers, note recyclers, coin hoppers, barcode scanners, card readers and ticket printers. Last but not least, an optional audio amplifier integrated in the EGM to connect loud speakers is another requirement that is best addressed as a modular solution.

Peripheral support

Having a perfect set of interfaces on a system ready for GLI certification and based on a processor architecture that can be scaled from entry level up to the highest performance class is one critical design feature for an ARiP. Application-readiness, however, also means providing plug & play functionality for the entire set of peripheral devices this type of system requires. Embedded computing vendors such as ADLINK Technology have invested a tremendous amount of effort in developing gaming machine-specific middleware validated for their systems. But where do the advantages lie compared to an on-the-fly implementation? First, the validation process has been carried out in advance. and that frees OEM engineers from these time-consuming tests. In addition, engineers are able to specify a dedicated system setup from a list of components – covering most commonly used peripherals - that the application-ready platform actively supports. So, basically, the number of tasks that deliver no obvious added value to the customer is reduced to zero.



Figure 4. The ADLINK ADi-BSEC intelligent security and NVRAM PCI Express Card is a high-speed PCIe card with up to 16 MB NVRAM. It offers a crypto and authentication security chip featuring SHA-256, RNG, UID, EEPROM and OTP with power-off monitoring and date/time stamping to meet Gaming Laboratories International's certification requirement.

The peripherals driver task force was also necessary to elevate the application-ready hardware platforms to the next level of standardization: the design of the normalized glue logic. This glue logic forms the basis for the unified API that has full and transparent access, even to the most exotic I/O interfaces, in a standardized manner. The glue logic plays an even greater role as the unified API forms the basis for each new upcoming implementation, enabling engineers to deploy it independently of the platforms and peripherals used for data exchange between the system for configuration, control and even firmware updates. At the end of the day, an extensive library is not the major game changer, but rather the ability to standardize the applications' access to boards, systems and peripherals is. This leads to the major new enhancement of application-ready intelligent gaming platforms: a comprehensive set of middleware and a unified API.

Middleware and API

A software ecosystem with comprehensive middleware frees developers from time-intensive, low-level peripheral management and control. It enables developers to easily bridge their applications with peripheral devices, sensors and surrounding solutions up to the casino's central monitoring and control systems. This is why ADLINK Technology delivers its gaming platforms with a unique software ecosystem with various middleware functions, called intelligent Application Programming Interface or iAPI for short. iAPI is basically a complete management layer with optional secure IoT functionalities. Developers can work independently of processor architectures and operating systems (Windows and Linux are both common operating systems for gaming) and – what is most important for the majority of EGM OEMs – independently of peripheral device and component manufacturers. The Hardware Abstraction Layer (HAL) of the iAPI makes this possible.

Simplifying peripheral device management with iAPI

With the iAPI middleware, OEMs can also create a standardized real-time inventory management that is, for example, capable of collecting peripheral device names, manufacturer data and serial numbers, as well as version numbers of firmware and protocols. It can do more, though. iAPI also enables OEMs to gather all the data that is generated by the peripheral devices, which are normally not accessible via standard monitoring tools. Translated by the iAPI into the required format, centralized monitoring systems can thus leverage even this data and inform operators instantly, minimizing downtimes and keeping the revenue up. Furthermore, the iAPI middleware enables OEMs and/or operators to update firmware. Depending on the peripheral device, the physical interface and the protocol, currency firmware updates enable recognition when new bank notes are introduced (which recently happened in Europe with the 20 Euro note). This can help to dramatically

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reduce service costs and, consequently, cost-of-ownership for the operator. This iAPI functionality is built on the basis of ADLINK's Smart Embedded Management Agent (SEMA), which requires a dedicated, hardware-based board management controller for local data management and encrypted communication with a SEMA Cloud or OEM server. Thus, even apps for operator dashboards on smartphones can characterize the feature set of application-ready intelligent gaming platforms designed by embedded computing vendors such as ADLINK Technology.

Summary

True application-ready intelligent platforms are game-changers for the electronic gaming machine market. They provide OEMs with a highly scalable, reliable and modular off-the-shelf platform that can be flexibly configured to meet individual performance, graphics and power needs at an optimized price point. These platforms are ready for GLI certification, feature reliable operation by design and support all required gaming specific I/Os and protocols off-the-shelf. Most compelling is the comprehensive iAPI middleware, which allows simplified and unified application development without dependencies on the peripheral devices. All in all, vendors have an out-of-the-box solution to design innovative and stunning professional gaming machines requiring a minimal design-in efforts and, therefore, lower costs. And for forward-looking application engineers who are peeking over the fence towards cloud-connected professional casino gaming systems, ADLINK Technology already offers the SEMA Cloud, an application-ready cloud connectivity option.

For more information

ADLINK Technology is enabling the Internet of Things (IoT) with innovative embedded computing solutions for edge devices, intelligent gateways and cloud services.
For more information about ADLINK Technology, visit their web site at http://www.adlinktech.com

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[i] http://www.technavio.com/report/global-casino-gaming-market-2015-2019#sthash.SBD5K2Tu.dpuf

[ii] http://www.technavio.com/report/usa-gaming-casino-gaming-market

[iii] http://www.technavio.com/report/global-gaming-cloud-market#sthash.fdus0aay.dpuf

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