Enabling the Adoption of Intel® Architecture with a Customizable Firmware Solution for Digital Surveillance System Applications

Intel® Firmware Support Package (Intel® FSP)
Design House and Platform Solutions

Introduction

Specializing in video surveillance products and solutions, Hikvision leads the security industry by designing products with cutting-edge technology. Video streams captured by cameras need to be routed to a video management software where they are processed and monitored. The routing of video streams is managed by the efficient pairing of a video firmware and a computing platform that delivers processing performance, power efficiency, and reliability.

Challenges

- **Enabling a sustainable firmware solution.** Customizing the BIOS involves engaging BIOS vendors for their engineering services and may require obtaining permission to use their intellectual property in the form of a royalty payment. For a developer to design and continue evolving and improving a series of products over a long term production, this approach may not be sustainable.

- **Controlling the source code for the firmware.** The BIOS source code is the intellectual property of the BIOS vendor, and the full source tree might not be made available to customers. Without the source code of the firmware, customers would have difficulties to customize and optimize the firmware, for example, to improve boot speed, to increase boot efficiency, and to reduce the firmware size.

- **Entrenched in existing firmware solution.** Even with the BIOS source code, developers face a high threshold when it comes to customizing the BIOS, often times having to read comprehensive firmware and BIOS programming guides that are a few hundred pages long. As a result, developers are less likely to explore alternative approaches that could significantly improve their design cycle.

Solution

- **Adopt alternative firmware solution using Intel® FSP on a computing platform powered by the Intel® Celeron® processor N3000 series (formerly known as Braswell)** With support from Intel, developers at Hikvision integrated the Intel® FSP binary into coreboot*, an open source boot loader. As a result, Hikvision has an alternative firmware for their video gateway, and its developers receive the source code which enables them to customize the firmware for optimum performance. Furthermore, the Intel® FSP solution and coreboot are provided for free, which in turn reduce the development and product cost for Hikvision.

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Leading the way with innovation using Intel® Architecture

With Intel® Firmware Support Package, developers at Hikvision gain access to the source code of the firmware, enabling them to have control over how to customize the firmware for curent and future development.

Customizing the Firmware

A video gateway is a specialized product that performs a dedicated function. The firmware for the system can be customized and optimized for performance and reliability, for example, by removing unnecessary features and leaving only the core features needed for the system to perform its functions. One option is to engage the engineering services of a firmware vendor to provide a firmware solution. Instead, Hikvision chose to develop their own firmware by self-integrating the Intel® FSP binary into coreboot, an open-source firmware stack.

coreboot is an open-source initiative that provides the source code for customization, and it has an online community that provides technical support. coreboot is designed to be simple, flexible, and fast, which makes it suitable for the requirements of the video gateway. coreboot may be downloaded from www.coreboot.org.

Intel® FSP solution provides a binary that initializes the essential and basic functions of Intel® processors, and then coreboot takes over to perform the remaining functions to initialize the platform. The Intel® FSP solution (which includes the binary and the Binary Configuration Tool) is available for free to everyone. By creating the interface between coreboot and the Intel® FSP binary, developers at Hikvision are able to use forthcoming releases of Intel® FSP that support more Intel® processors. The firmware can be expected to work with minimum porting effort.

Hikvision has different product lines, each with their specific design requirements. With support from Intel, developers at Hikvision modified coreboot for board-specific implementations, which are then used for their video gateway solution. The developers have access to the source code, enabling them to have control over how to customize the firmware for current and future development. For long-term production at high volumes, Hikvision finds this level of control over the firmware very attractive.

Migrating to Intel® Architecture

There are two avenues of support for developers should the reference release of Intel® FSP and coreboot not fulfill their specific product requirements. Normally, for developers who do not have the experience modifying coreboot and who are under tight time-to-market deadlines, the fastest way to get support is to engage any Intel Ecosystem Partners (see the list in www.intel.com/fsp). There is an one-time engineering service fee incurred, depending on the agreement between the developer and the ecosystem partner, and the level of support required.

For this case—in conjunction with the Architectural Conversion (AC) Program launched by Intel IOTG (Internet of Things Group) in 2015—Hikvision receives complimentary direct support from Intel. This enables Hikvision to convert its platform designs from a competitor's architecture to Intel® Architecture with custom firmwares based on Intel® FSP and coreboot. Intel provides support to enable key features not included in the reference coreboot release; the support includes adding code and editing the reference coreboot source code to enable legacy OS boot, to define thermal zones (thermal throttling and processor

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thermal trip), and to enable PXE boot.

Furthermore, under the terms of the SLA (Source Code License Agreement) with Intel, Hikvision receives the source code for Intel® FSP. Together with the source code for coreboot, Hikvision has full control over the firmware it develops.

Under the AC program, Intel works with Hikvision to complete the migration to a platform powered by Intel® Celeron® processor N3000 series (formerly known as Braswell). When the migration is completed, the support for Intel® FSP enters an agreed-upon sustaining period. Until this period ends, Intel continues to provide support for any outstanding issues with the enabled features; however, requests for new features are not supported. For other coreboot support, Hikvision can either refer to the open source community, to an ecosystem partner, or to their own developers (should they have enough experience with coreboot).

Conclusion

To stay ahead of the competition, Hikvision's approach to lead the market forward in innovation is a strategic advantage. Moving away from the UEFI BIOS and developing its alternative firmware, developers at Hikvision have control over the schedules and development resources of the custom firmware.

Typically, developers face significant obstacles when developing an alternative firmware, having to deal with limited technical support, restricted access to the firmware source code, and constrained engineering resources. For Hikvision, the solution is Intel® FSP, which includes technical support, source code, and a binary component to initialize the Intel silicon, all of which are available for free to developers. The Intel® FSP binary is then integrated into coreboot—an open source firmware stack that is also available currently for free—to initialize the remaining functions.

Using the Intel® FSP solution, and with Intel providing initial technical support, Hikvision has developed an alternative firmware for its video gateway, which is based on a computing platform powered by the Intel® Celeron® processor N3000 series (formerly known as Braswell). Developers at Hikvision have access to the source code of the firmware, and they are able to perform customization to extract maximum performance from their designs. Furthermore, Intel® FSP also extends the reach of developers to other Intel® processor families, giving Hikvision the flexibility to scale their designs for future requirements.

With a custom firmware developed using Intel® FSP and coreboot, Hikvision is one of the first Intel customers in the People's Republic of China to replace the UEFI BIOS in its actual product deployment.
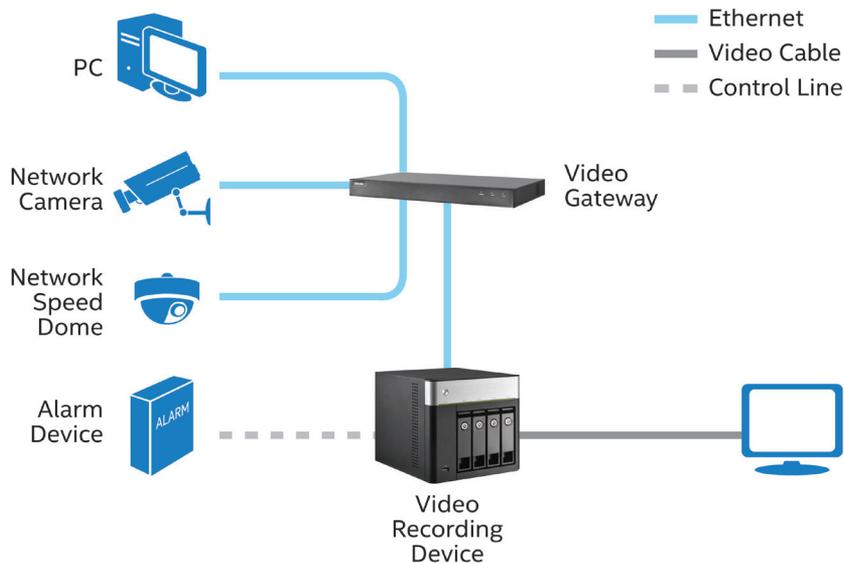
A video gateway receives data streams from security devices and routes them to a video recording device where the information can be monitored and, if necessary, the alarm triggered.

For more information on Intel® Firmware Support Package, visit
www.intel.com/fsp