

HCC Embedded



■ HCC, Protecting IOT Data

HCC's mission is to ensure that any data stored or communicated by an embedded IoT application is secure, safe and reliable.

Most embedded software used to transmit or store embedded data is not developed using recognised quality standards. Most flash file systems can't ensure reliable, safe storage. Many network stacks are vulnerable to security risks. HCC applies quality practices used to develop functional safety applications to ensure that software is robust, reliable and that quality claims can be verified. All drivers and abstractions are provided meaning virtually no integration is required. This means any embedded system can be upgraded to be safer, more reliable, and more secure.

■ History and Mission

HCC was founded in 2000 by CEO Dave Hughes and has been privately held, self-funded and profitable since its incorporation. The company today has offices in San Jose, Edinburgh and Budapest, and it provides advanced software and technical support to hundreds of engineers around the world. Amongst many significant milestones in the company's history, HCC released the world's first fully MISRA compliant TCP/IP stack and supplies Encryption Modules, TLS/SSL and IPSec/IKE developed using functional safety coding methods to improve network security.

In 2017 HCC achieved ISO 9001:2015 certification. This enables us to demonstrate our commitment to customers through strong, process driven business management and software development. We don't make vague, empty claims about quality – we aim to provide our customers with the means to verify quality for themselves by providing documentation, analysis and test for all critical software modules.

■ AEF – Future Proof Software

Every new software development at HCC conforms to a completely flexible and 'future proof' Advanced Embedded Framework (AEF). HCC believes that some of the foremost challenges in embedded development are in dealing with the complexity and incompatibility of peripherals and that legacy software should not be constrained by a single RTOS or processor eco-system. All of HCC's software components are developed as completely target independent modules, meaning they are independent of RTOS, MCU, hardware, compiler, endianness or toolchain. HCC customers can easily switch RTOS, compiler or MCU in any future project whilst using the same reliable peripheral software.

■ Software Verification and Embedded Data Protection

HCC's range of encryption and security software is developed according to a rigorous process using static and dynamic analysis and fully documented design methodologies. Using this approach it is possible to ensure that there is the lowest possible risk of data loss, corruption or theft. Source code is developed to be compliant with MISRA-C:2004 which has become a 'best-practice' coding standard, widely used in the medical, industrial, automotive and aerospace industries. HCC has developed its own rigorous coding standard to create a concise, strongly typed subset of the C language for use in embedded systems.

Critical software modules including Encryption, TLS, IPSec, IKE, SNMP, MQTT and HTTPS are developed using methods borrowed from functional safety to protect data by ensuring the software quality is high. Many high profile security data breaches such as Heartbleed occurred because of simple coding errors that would have been detected using formal software process. Using formal development processes significantly improves flash and network security by minimizing the risks associated with informal, 'freestyle' software development.

The software and documentation are capable of meeting some of the requirements for many standards including IEC61508 SIL3, FDA510(k) and EU certification for various industries. Artifacts required for certification are supplied under our software services program.

■ Secure Communications

HCC communications products are designed to ensure reliable, high performance embedded network communications with enhanced security and safety. USB, TCP/IPv4, IPv6, TLS/SSL, IPSec/IKE and Encryption technology are all developed using a modern, portable software

framework. Security and networking products benefit from HCC's quality process capability and are available with Static Analysis Reports, Source and Object Code Coverage tests and MC-DC analysis to ensure quality can be verified.

TCP/IPv4, IPv6, Encryption, TLS/SSL, MQTT, SNMP: The key to a successful embedded application is to use high-quality software that is verifiably developed and ensures a stable, low-risk development platform. HCC's TCP/IP stack was developed with a rigorous approach to quality using a strongly typed subset of the 'C' language. The approach incorporates a strong adherence to the MISRA-C:2004 standard and was validated using advanced verification tools. All software is provided with optimized Ethernet drivers and will integrate easily with any RTOS. The implementation was designed for high performance on a micro-controller. There are no unnecessary copies, well thought out static memory management and dedicated memory areas and cache are fully exploited. HCC's networking solution provides a significant range of protocols as well as support for both IPv4 and IPv6, providing flexibility and long-term network compatibility.

USB Device, Host & OTG: USB solutions from HCC are mature, widely used stacks that can support almost any embedded USB configuration. The USB suite provides highly efficient basic class drivers like HID, Hub and Mass Storage. Support is also available for more sophisticated configurations requiring Isochronous Transfer, Composite Devices and multiple USB interfaces. In addition, HCC's range of advanced class drivers provides access to File Systems and communications networks including Ethernet. This means developers can exploit USB to its full potential with ease, without having to worry about developing highly specialized drivers. Software is distributed as source code and sample projects integrated with most popular RTOSes, MCU's and compilers can be provided. The stacks support all interface speeds, all transfer types, USB 1.1/2.0, Host, Device and OTG modes. There are implementations for an extensive range of MCUs including proprietary interfaces as well as OHCI and EHCI.

■ Reliable Storage

An extensive range of safe, reliable storage options includes file systems, media drivers, flash translation layers (FTL), smart-meter software, bootloaders and encryption technology. These products are designed to operate securely and reliably with any type of flash or storage medium including NAND, NOR, SSD, eMMC or any removable media. Traditional software vendors often provide inadequate, general-purpose file systems with only vague references to reliability and security. HCC storage products can be optimized for any hardware and provides detailed requirements for all layers that ensure a system can be reliable by design. Without these specifications it is not possible to create a system that can cope with power-fail or unexpected reset.

FTL Flash Management: There are many NAND and NOR Flash memory devices, interfaces and technologies that developers can choose. Integrating them reliably and achieving the maximum potential life and high performance presents a significant design challenge. HCC has developed robust fail-safe flash management software and file systems and it has support for hundreds of different kinds of memory types, interfaces and controllers. HCC's truly fail-safe SafeFTL 'Flash Translation Layer' provides a high-performance solution that allows developers to interface with any Flash-based media. SafeFTL presents a simple logical sector interface to an application, such as a file system, and manages the underlying complexity efficiently and safely. When used in conjunction with HCC's advanced file systems there is a complete solution for almost any type of flash storage media and performance requirement.

FAT & Flash File Systems: HCC's highly optimized range of file systems is designed to meet the performance requirements of any application. Using HCC file systems will make your application more reliable and will help to protect your customer's data. HCC file systems can be seamlessly dropped into any environment to support any storage media, RTOS, compiler or microcontroller. Highlights include;

- Highly optimized file systems: a number of finely-tuned file systems designed to provide the best performance for a range of scenarios. With full support for traditional FAT and flash file systems, developers can choose a system optimized for flexibility, performance or resource-limited environments.
- Extensive target media drivers: HCC collaborates closely with the industry's leading storage suppliers and can provide support for almost any flash device or storage medium. We routinely supply drivers for everything from simple USB pen drives and SD cards, to the most advanced NAND and NOR flash and managed flash such as eMMC.
- No-compromise fail-safety: HCC has developed truly fail-safe file systems that guarantee the highest possible data integrity.

Smart-Meter File Systems: Smart-meter systems must meet significant technical challenges in order to lower manufacturing cost and power consumption and to achieve high reliability. HCC has developed an advanced Smart-meter File System (SMFS), custom designed for the needs of smart-energy and smart-meter applications. This can result in a lower cost of manufacturing, shorter development time, reduced field maintenance, and longer guaranteed life of operation. Instead of using a traditional file based system, HCC has taken the radical approach of defining a system built around the needs of smart-meters. Metering applications usually have well-defined record structures and HCC has used its extensive flash experience to take advantage of this. By taking a data-focused approach instead of a file-focused one, it is possible reduce the required number of write/erase cycles by an order of magnitude. Traditional file systems do not have built-in cyclic buffer logic for storing records and this can add complexity, significantly increasing the number of times flash must be accessed. SMFS uses a structured database to reduce the complexity of the application. This improves the performance in almost every way: speed, power consumption, and flash life.

Bootloaders: HCC has developed a range of high quality bootloader solutions that will fit almost any scenario. The bootloaders can boot using flash, USB or serial interfaces using minimal resources on the target controller. The benefits of using HCC Bootloaders include small footprint, high-speed operation, optimized performance and a high-quality stable implementation that has been widely used in commercial applications. Additionally the bootloaders use a library of standard components and are customized to user specifications. HCC bootloaders are truly fail-safe and, if the boot process is interrupted for any reason, the system will fully recover. All boot loaders have the option to add an advanced AES encryption module for secure data transfer. It is possible to configure them to support multiple complex interfaces.

■ IEC61508, FDA510k and ISO26262 Compliance Services

HCC has an advanced, mature process driven development capability based on meeting the requirements of IEC61508 SIL2/3. Many off-the-shelf products are supplied as standard with artefacts from the v-model development process including MC-DC analysis, MISRA compliance reports, 100% Object and Source Code coverage testing. HCC supply services to provide embedded communications and storage components capable of achieving certification to a number of standards used in Automotive, industrial, Medical and Aerospace.



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