MISRA Compliant TCP/IP Stack
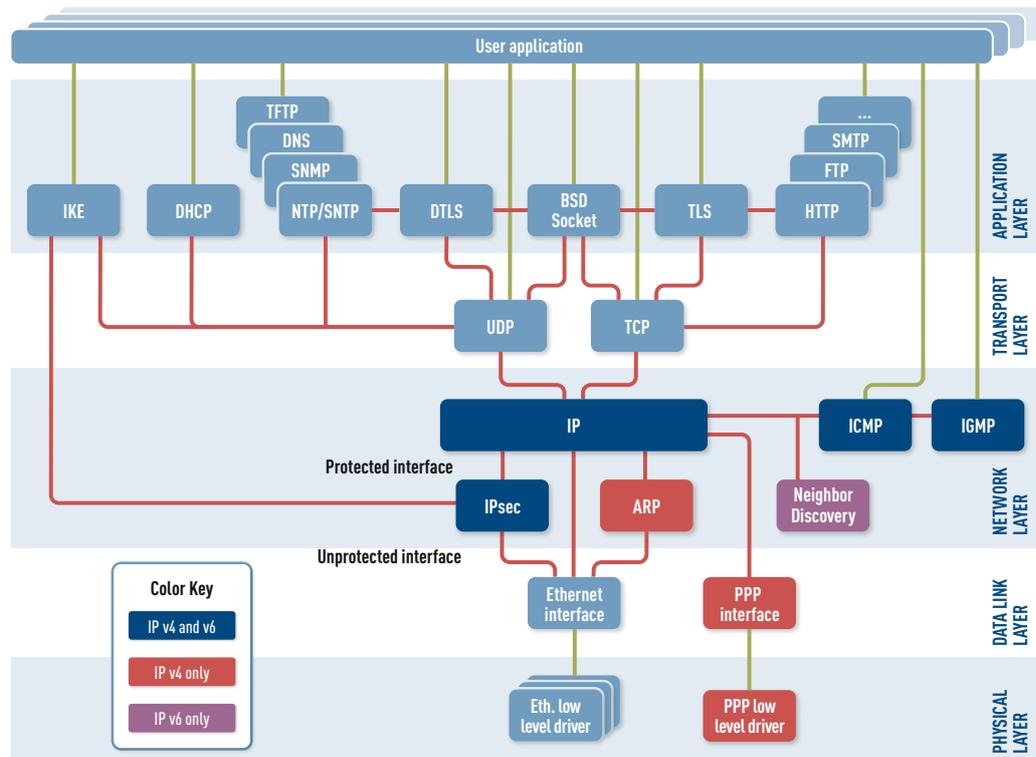
**MISRA compliant TCP/IP,
developed without compromise**

Network quality and security issues are not usually caused by problems with the requirements or security protocols, but with implementation. Traditional freestyle 'code-then-test' methods are not sufficient to guarantee correctness and security. However there are formal development methods used in many industries which are proven to minimise the risk of errors.

HCC's TCP/IP stack was developed using a 'V model' methodology. It uses a strongly typed subset of the 'C' language based on a strict adherence to MISRA[1] compliance and is supplied with detailed static and dynamic analysis reports. It is also supplied with test suites that verify interoperability and code integrity. HCC's networking stack provides a significant range of protocols as well as support for both IPv4 and IPv6, providing flexibility and long-term network compatibility.

[1] „MISRA" is a registered trademark of MIRA Ltd, held on behalf of the MISRA Consortium. No endorsement by MISRA is claimed or implied for any product.

Supported Protocols

The following protocols are available for HCC's MISRA-compliant TCP/IP Stack

User application

| APPLICATION LAYER | TFTP · DNS · SNMP · NTP/SNTP · IKE · DHCP · DTLS · BSD Socket · TLS · SMTP · FTP · HTTP |

IKE   DHCP   NTP/SNTP   DTLS   BSD Socket   TLS   HTTP

TRANSPORT LAYER

UDP   TCP

NETWORK LAYER

IP
ICMP   IGMP

Protected interface

IPsec   ARP   Neighbor Discovery

Unprotected interface

Color Key

IP v4 and v6

IP v4 only

IP v6 only

DATA LINK LAYER

Ethernet interface   PPP interface

PHYSICAL LAYER

Eth. low level driver   PPP low level driver

High Quality TCP/IPv4, IPv6, Dual IPv4/v6 Stacks

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. All stacks are available with an extensive set of applications and protocols and can be supplied tightly integrated with HCC's other storage and communications solutions if required.

All stacks are 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 reliability and long-term network compatibility.

Verifiable TLS/SSL

HCC's TLS/SSL is a highly optimized software module designed to provide secure network communications for embedded devices. It is delivered with a full MISRA compliance report and a test suite that includes 100% MC-DC coverage. The importance of using a strong development process and source code control has been emphasized by a number of high-profile security

problems caused by source code errors. Network security requires a high degree of quality and traditional methods of 'freestyle coding' and test do not provide sufficient guarantees of correctness.

- SSL3.0, TLS1.0/1.1/1.2
- Full certificate management
- All mandatory cipher suites supported including AES, 3DES, DSS, EDH, MD5, RSA and SHA

■ Verifiable IPSec & IKE

HCC's IPv4 & IPv6 stack is supported by an extensive set of protocols and applications and, thanks to the development of a 'clean' stack developed for embedded systems, provides unrivalled performance and security. All software components are created using a strong development process and are supplied with quality verification including a full MISRA compliant static analysis report. Other 'v-model' life cycle artifacts are available on request but are not supplied with the standard license.

IPSec provides a robust approach to security in embedded applications such as cars, 'point-of-sale' terminals, medical devices, industrial equipment and many others. It ensures integrity, confidentiality and authentication between two devices in a network, providing strong defense against threats such as 'man in the middle' attacks and packet sniffers.

■ Embedded Encryption Manager

HCC's Embedded Encryption Manager (EEM) allows developers to secure embedded systems using multiple encryption or hash algorithms through a uniform interface. Using a well-defined interface shortens development time as developers can now simply drop-in the EEM and encrypt data stored on flash or transmitted across a network. Such security is necessary to block potential hackers looking for a backdoor to access embedded system data.

Developed using a formal process, the EEM undergoes verification to ensure stability and enhanced integrity. It is delivered with a full MISRA compliance report and a test suite that includes 100% MC-DC coverage. This level of verifiable quality in the area of security and encryption stands in direct contrast with the widely used 'code-then-test' methods, which have resulted in serious security breaches, such as Heartbleed.

■ Small Footprint, High Throughput, Low CPU Cycle Operation

An innovative approach to design has resulted in an extremely high-speed data transfer rate, with minimal system resource requirements.

Tests have shown that packet processing runs up to four times faster than comparable embedded stacks, while using around 14kB of ROM, in a typical application scenario[2]. RAM requirements can vary widely depending on application needs but are typically as low as 12kB. It is possible, with a minimum configuration UDP application, to use less than 5kB of ROM and a few hundred bytes of RAM (plus network buffers).

[2] Based on measurements taken using the LPC2468 MCU

- No dynamic memory allocation (no malloc/free)
- Standard BSD sockets interface
- Zero copy
- 85Mb/s bi-directional throughput on STM32F457 with 27% CPU idle time
- Small footprint (RAM/ROM)
- High speed data transfer
- Low power consumption due to low CPU overhead
- Verified compatibility with most popular embedded RTOSes
- Efficient operation without an RTOS

■ Broad Range of Target Processors & Tools

HCC's MISRA-compliant TCP/IP can operate efficiently on a broad range of target processors. Designed so that it can be ported easily and quickly to new architectures, the stack is available with drivers for a range of leading processors.

RTOS Abstractions

RTOS abstractions are available for the following systems: CMX RTX, eCOS, emBOS, EUROS, FreeRTOS, Keil RTX, Nucleus, Quadros RTXC, ThreadX, µ-velOSity, µC/OS-II, and many others. Importantly, for custom schedulers and super loops, HCC offers an abstraction for 'No RTOS'. We also offer our own eTaskSync, a small cooperative scheduler, which is designed to handle all processing and interface requirements of HCC middleware. This means that developers can choose our robust quality and outstanding performance irrespective of their legacy software.

Extensive Compiler Support

Eclipse/GCC, IAR Embedded Workbench, Keil ARM Compiler, Freescale CodeWarrior, Atmel AVR Studio, Green Hills Multi, Microchip MPLAB, Renesas HEW, TI Code Composer Studio, Mentor CodeSourcery, Atollic True Studio and many more.

Microcontrollers

ARM Cortex-M0/M1/M3/M4/R4/A8, ARM7/9/11; **Atmel** AVR32, SAM3/4/7/9; **Freescale** ColdFire, Kinetis, PowerPC, i.MX, Vybrid, QorIQ; **Infineon** C164, XMC1000, XMC4000; **Microchip** PIC24, PIC32; **NXP** LPC1300/1700/1800/2000/3000/4000; **Renesas** SuperH, RX, RL, 78k; **SiliconLabs** EFM32, SIM3; **Spansion** FM0/FM3/FM4; **STMicroelectronics** STM32; **Texas Instruments** MSP430, Stellaris, C2000, Hercules, DaVinci, Sitara, Tiva; **Toshiba** TMP M0/M3;

■ Licensing & Purchasing

All HCC reusable software components are royalty-free and distributed in source form with support and maintenance included for one year with all purchases. We deliver sample projects tailored to an environment agreed with customers to ensure the quickest possible start. Visit HCC's website to find a sample license and to obtain the contact details of your local sales representative. Or, simply send an email to info@hcc-embedded.com and we will send all the details you require. All trademarks and registered trademarks are the property of their respective owners.

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