
Appendix B

Reference guide

B.1. Communication products

B.1.1 USB:

SEGGER emUSB Device: is a high speed USB device stack specifically designed for embedded systems. The software is written in ANSI "C" and can run on any platform.
<https://www.segger.com/emusb.html>

B.1.2 Networking:

FreeRTOS+TCP Networking Tutorial

https://www.freertos.org/FreeRTOS-Plus/FreeRTOS_Plus_TCP/TCP_Networking_Tutorial.html

The TCP/IP Model and Protocol Suite Explained for Beginners

<http://www.steves-internet-guide.com/internet-protocol-suite-explained/>

TCP/IP Model Explained | Cisco CCNA 200-30

www.tcpipguide.com/free/t_UnderstandingTheOSIReferenceModelAnAnalogy.htm

Serial data transmission standards

<https://www.electronics-notes.com/articles/connectivity/serial-data-communications/transmission-standards.php>

Segger

SEGGER emNet CPU independent TCP/IP stack: 'a high performance library optimized for speed, versatility and a small memory footprint that can be use on virtually any CPU'.

<https://www.segger.com/products/connectivity/emnet/>

B.2. File systems

SEGGER emFile is a file system for embedded applications which can be used on any media, for which you can provide basic hardware access functions. emFile is a high performance library that has been optimized for minimum memory consumption in RAM and ROM, high speed and versatility.

<https://www.segger.com/emfile.html>

B3 Graphical User Interfaces

OpenGL ES video.

https://www.youtube.com/watch?v=VN_qGY43A1Y

PEG - Portable Embedded Graphics.

www.swellsoftware.com

Segger emWIN

<https://www.segger.com/products/user-interface/emwin/>

Video emWin

<https://www.youtube.com/watch?v=SwlkysAKggU>

B.4. Performance measures

Dhrystone benchmark:

Dhrystone Benchmarking for ARM Cortex processors:

https://static.docs.arm.com/dai0273/a/DAI0273A_dhrystone_benchmarking.pdf

Dhrystone: *A synthetic system programming benchmark*, Reinhold P. Weicker, Computing Practices, Vol.27, No.10, pp 1013-1030, Oct.1984.

<http://en.wikipedia.org/wiki/Dhrystone>

Whetstone benchmark:

A Synthetic Benchmark, H.J.Curnow and B.A.Wichmann, Computer Journal, Vol.19, No.1, pp 43-49, Jan.1976.

http://en.wikipedia.org/wiki/Whetstone_%28benchmark%29

Hartstone benchmark:

Is a series of timing requirements for testing a system's ability to handle hard real-time applications.

Hartstone: *Synthetic Benchmark Requirements for Hard Real-Time Applications*, N.Weiderman, Technical Report, Software Engineering Institute, Carnegie Mellon University CMU/SEI-89-TR-23, June 1989.

<http://www.sei.cmu.edu/reports/90tr007.pdf>

Rhealstone benchmark:

The Rhealstone figure is a sum obtained from six categories of activity most crucial to the performance of real-time systems, irrespective of the actual application

The Rhealstone metric chiefly helps developers select real-time computer systems appropriate for their applications.

<https://www.sciencedirect.com/science/article/pii/S147466701741398X>

Implementing the Rhealstone Real-Time Benchmark, R.P.Kar, Dr. Dobbs Journal, pp 46-102, April.1990.

SPEC benchmarks:

These are designed to provide performance measurements that can be used to compare compute-intensive workloads on different computer systems

<http://www.spec.org/benchmarks.html>

SPEC as a Performance Evaluation Measure, R.Giladi and N.Ahituv, IEEE Computer, Vol.28, No.8, pp 33-42, August 1995.

EEMBC benchmark software:

These help to predict the performance of embedded processors and memory subsystems in a range of applications.

<http://www.eembc.org/products/index.php>

CoreMark:

Is a benchmark that aims to measure the performance of central processing units (CPU) used in embedded systems. It was developed in 2009 by Shay Gal-On at EEMBC and is intended to become an industry standard, replacing the antiquated Dhrystone benchmark.

<http://en.wikipedia.org/wiki/Coremark>

B.5 RTOS**Azure** (formerly ThreadX)

Azure RTOS is an embedded development suite including a small but powerful operating system that provides reliable, ultra-fast performance for resource-constrained devices.

<https://azure.microsoft.com/en-us/services/rtos/>

Deos™ is a proven, full featured DO-178 Level A certifiable real-time operating system (RTOS) which addresses the issues of high robustness and formal certifiability for avionics and safety critical applications.

http://www.ddci.com/products_deos.php

embOS

embOS, from Segger, is designed to be used as a foundation for the development of embedded real-time applications.

<http://www.segger.com/embos.html>

eSOL is a leading provider of software development solutions for multi-core and many-core processors,

http://www.esol.com/embedded/multicore_manycore.html

FreeRTOS is a market-leading real-time operating system for microcontrollers and small microprocessors - free for use.

<http://www.freertos.org/>

HeartOS from DDC-I is a POSIX-based hard real-time operating system that is fast, light and well featured for most for small to medium embedded applications, including safety-critical applications.

http://www.ddci.com/products_heartos.php

INTEGRITY

INTEGRITY, from Green Hills Software, is a leading RTOS for use in critical embedded systems.

<http://www.ghs.com/products/rtos/integrity.html>

ITRON is a Japanese open standard for an RTOS meant for hard real-time embedded applications. ITRON and [μITRON](#) are the name of RTOS specifications coming out of ITRON projects. 'μ' means that the particular specification is meant for the smaller 8-bit or 16-bit CPU targets. Examples of open source RTOS that incorporates API based on [μITRON](#) specification are eCos (<http://ecos.sourceforge.org/>) and RTEMS (<http://www.rtems.com/>).

http://en.wikipedia.org/wiki/ITRON_project

QNX

The QNX Neutrino RTOS supports both asymmetric multiprocessing (AMP) and symmetric multiprocessing (SMP), as well as bound multiprocessing (BMP).

<http://www.qnx.co.uk/products/neutrino-rtos/index.html>

RTX Real-Time Operating System

The Keil RTX is a royalty-free, deterministic Real-Time Operating System designed for ARM and Cortex-M devices.

<http://www.keil.com/rl-arm/kernel.asp>

SAFERTOS

SAFERTOS is a safety certified real time operating system (RTOS) for embedded microcontrollers. SafeRTOS and its Industrial Design Assurance Pack are available pre-certified by TÜV SÜD to IEC 61508 SIL 3.

<http://www.highintegritysystems.com/safertos/>

Also see their interesting white papers at

<https://www.highintegritysystems.com/white-papers/>

SMX

SMX, from Micro Digital, is a real time operating system specifically designed for embedded systems.

<http://www.smxrtos.com/about.html>

ThreadX (now Azure)

ThreadX, from expresslogic, has been designed specifically for deeply embedded applications. It has also been certified for safety-critical applications.

<http://rtos.com/products/threadx/>

VxWorks

VxWorks, from Wind River, is possibly *the* major RTOS for embedded systems. It comes in a number of variants, being tailored to specific industries.

<https://www.windriver.com/products/vxworks>

μC/OS-III

μC/OS-III, from Micrium, is 'a highly portable, ROMable, scalable, preemptive, real-time, deterministic, multitasking kernel for microprocessors, microcontrollers and DSPs'.

<http://micrium.com/rtos/ucosiii/overview/>

B.6 TOOLS

'The **QNX® Momentics®** Tool Suite is 'a comprehensive, Eclipse-based integrated development environment with innovative profiling tools for maximum insight into system behavior. It gives developers at-a-glance views of realtime interactions, memory profiles. Multi-core specific tools help developers migrate code cleanly from single-core to multi-core systems, and safely optimize performance'.

<http://www.qnx.org.uk/products/tools/qnx-momentics.html>

Atollic® TrueSTUDIO® is a C/C++ compiler and debugger development suite for ARM® microcontrollers.

Atollic® TrueINSPECTOR® is a professional tool for static source code analysis.

Atollic® TrueANALYZER® measures the test coverage during system testing.

Atollic TrueVERIFIER analyze your source code, auto-generate a test suite with unit tests for each function, and execute it automatically in your target board.

<http://www.atollic.com/index.php/product-overview>

IAR Embedded Workbench for Arm, an integrated development environment, and the included IAR C/C++ Compiler generates the fastest performing, most compact code in the industry for Arm-based applications.

Tracealyzer 'is a powerful and intuitive visualization allows you to troubleshoot faster and to improve software quality, performance and robustness'.

<http://percepio.com/>

RAPID RMA:

'The multiple analysis tools contained in RAPID RMA allow designers to test software models against various design scenarios and evaluate how different implementations might optimize the performance of their systems (by isolating and identifying potential scheduling bottlenecks in both soft and hard real-time systems)'.

<https://www.tripac.com/>

Stateviewer

Is 'a plug-in kernel-aware debugger for use by engineers working in either an IAR Embedded Workbench, Keil or Eclipse environment'.

<https://www.highintegritysystems.com/tools/stateviewer>

SEGGER Embedded Studio

Is 'a streamlined and powerful C/C++ IDE (Integrated Development Environment) for ARM microcontrollers'.

<https://www.segger.com/embedded-studio.html>

Keil μ Vision IDE

The μ Vision IDE from Keil combines project management, make facilities, source code editing, program debugging, and complete simulation in one powerful environment'.

<http://www.keil.com/uvision/>

Green Hills Probe

Is 'an advanced hardware debug device that connects to the onboard debug ports present on most modern microprocessors, such as IEEE 1149.1 JTAG and BDM. With support for more than one thousand devices from over thirty manufacturers, a flexible electrical interface, and out-of-the-box support for the largest multicore systems, the Green Hills Probe provides fast, reliable debugging, programming, and system visibility to projects present and future'.

<http://www.ghs.com/products/probe.html#overview>

END OF CHAPTER