STM8/32 Tools, RTOS and ……

Oct. 2012

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STM8 C Compiler

If you need a free RTOS for STM8 go to: **Atomthreads Open Source RTOS**

STM8 HW tools

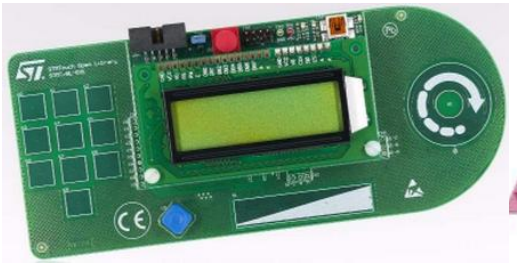
STICE

ST-Link-v2

Raisonance - RLink

STM8-Discovery

Eva-Boards



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STM32

Extensive SW and HW ecosystem around the STM32.
You will find your solution, fitting your requirements in terms of price, license and support.

ST-designed software	Open source	Partners
• Built in-house, making the most of the STM32 and STM8	• Proposed by community or partners	• Generic solutions proposed by many companies, portable to/from other platforms
• Source code or binaries	• Source code, from BSD or GPL licenses to commercial products	• Source code or binaries
• Supported by ST	• Supported by open source community or partners	• Supported by partners

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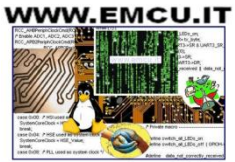

STM32 a large community of partners

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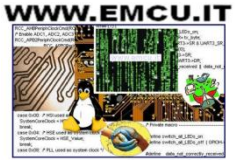

STM32 C Compiler

IAR SYSTEMS

KEIL™ Tools by ARM

atollic

hitex

RAISONANCE

Green Hills SOFTWARE

POuL have a lot of fun...

CooCox

Eclipse + GCC + OpenOCD + freeRTOS.

eclipse + GCC + OpenOCD + freeRTOS™ Why would you select anything else?

What should I use to develop on STM32 ?

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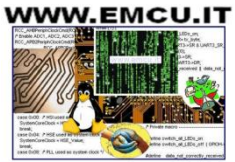

STM32 HW Tools

IAR SYSTEMS

KEIL™ Tools by ARM

SIGNUM SYSTEMS

hitex

SEGGER

LAUTERBACH DEVELOPMENT TOOLS

mbest

Aarium

ST-LINK-v2

The complete list is here

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STM32 RTOS

A **real-time operating system** (**RTOS**) is an operating system (OS) intended to serve real-time application requests.
A **key characteristic of a RTOS is the level of its consistency concerning the amount of time it takes to accept and complete an application's task**; the variability is **jitter**.
A **hard real-time operating system has less jitter than a soft real-time operating system**.
The chief design goal is not high throughput, but rather a guarantee of a soft or hard performance category.
A RTOS that can usually or generally meet a deadline is a soft real-time OS, but if it can meet a deadline deterministically it is a hard real-time OS.
A real-time OS has an advanced algorithm for **scheduling**. Scheduler flexibility enables a wider, computer-system orchestration of process priorities, but a real-time OS is more frequently dedicated to a narrow set of applications.
Key factors in a real-time OS are minimal interrupt latency and minimal **thread switching latency**, but a real-time OS is valued more for how quickly or how predictably it can respond than for the amount of work it can perform in a given period of time.

* Source: *wikipedia*

STM32 RTOS
Why use an RTOS ?

The use of a RTOS can simplify the design of what would otherwise be a complex software application.

Focus on Application Development

Leave basic system management to the RTOS kernel
Avoid re-writing resource management code that already exists
Reduce porting and testing overheads

ARM Cortex is RTOS friendly due to CMSIS Libraries.

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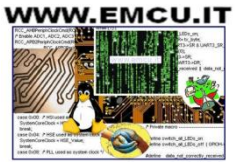


STM32 RTOS
Witch RTOS ?

Performance

- Predictable behaviour
- Low latency
- High number of interrupt levels

Ease of Use

- Flexible API and implementation
- Tool-chain integration
- Scheduling options
- Multitasking, Pre-emptive, Round Robin

System Friendly

- Consumes small amount of system resource
- Proven kernel
- Low cost

STM32 RTOS
Popular RTOS

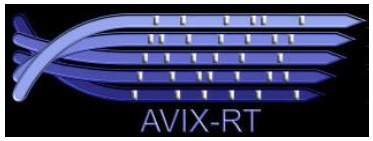
Some popular real-time operating systems:

VxWorks - (WinRiver)
Integrity - (Green Hills)
FreeRTOS (Freertos.org)
uC/OS (Micrium Technologies)
CMX-RTX (CMX Systems)
embOS (Segger)

These are not real-time operating systems:

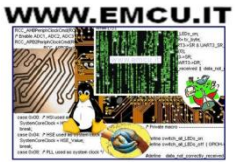
Linux
Android
Windows

STM32 RTOS



Introduction to FreeRTOS

RTOS, TCP/IP, FileSystem, USB, etc



STM32 SW Tools 1/2

Hardware abstraction layer fully covering the microcontroller, STM32 or STM8

Compliant with standards

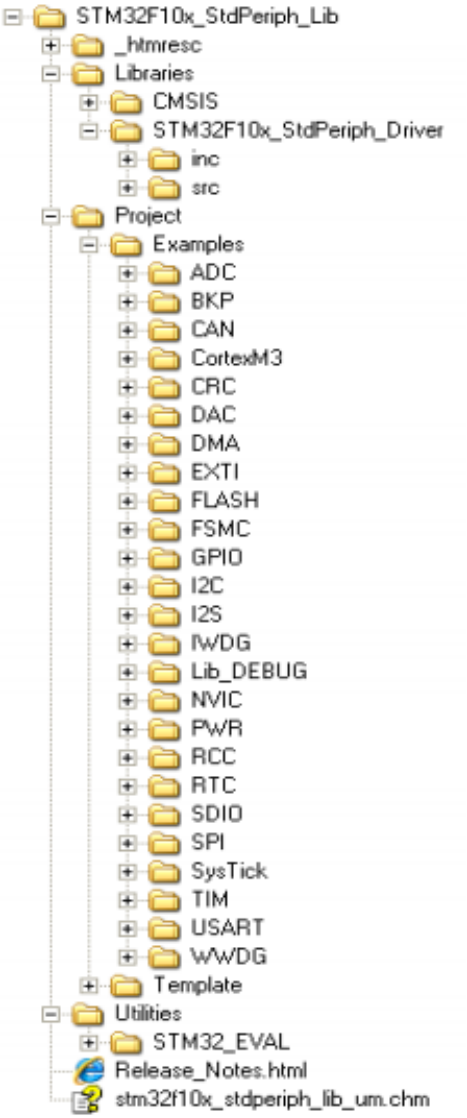
- ANSI-C source code
- Misra and ST coding rules
- ARM-CMSIS compliant for STM32

As real help for developers

- Comes with a multitude of examples demonstrating usage

IEC 60335 Class B library

CMSIS COMPLIANT
ARM® Cortex™ Microcontroller Software Interface Standard



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STM32 SW Tools 2/2

File System

USB

TCP/IP

RTOS

802.15.4

Ligthing control

Motor Control

TFT Color LCD

GUI library

Radio

Touch

WiFi

*Tutorial on **Electrical Motors***

Crypto

I2S audio codec

IEC 60335 Class B library

Bluetooth

AUDIO
ADPCM
Speex
MP3 decoder
MP3 codec
VMA decoder

Introduzione al Networking e a Ethernet (TCP, IP, UDP, ecc)

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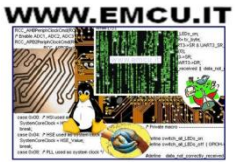
Application field – Industrial

Stack	Meaning
EtherCAT, Profinet, Ethernet/IP, Powerlink …	Industrial Ethernet protocols for factory automation. Ethernet field buses are the latest trend in this application domain.
Profibus PA	Standard for field bus communication in automation technology (PA – process automation). Originally designed for EIA-485 but also available for fiber optics. Profibus is an open standard.
CANopen	Based on CAN physical layer. Industrial Ethernet protocols very often support the CANopen device profiles.
J1939	Standard used for communication and diagnostics with vehicle components (e.g. agricultural machines).
DeviceNet	Based on CAN physical layer. The common industrial protocol (CIP) is an industrial protocol for industrial automation applications. CIP is used in Ethernet/IP and DeviceNet.
Modbus	Originally designed for EIA-485. Modbus TCP is its Ethernet variant.
OPC-UA server	OPC defines communication of real-time process data over Ethernet between industrial equipment from different manufacturers (process instrumentation). All SCADA/HMI products support OPC-UA.
IO-Link	IO-Link is used for the lowest field level communication. It offers an additional and integrated digital data channel down to the smallest sensor and actuator in factory automation.



Application field – Industrial

Provider	Solution name	Application	Model	Cost	Availability			
					STM32F1	STM32L1	STM32F2	STM32F4
Andrea Informatique	DLMS / COSEM	Metering	Binaries	License + royalties	Y	Y	Y	N[1]
Embedded Labs	OPC-UA server	Factory and building automation	Binaries	License + royalties	N	N	Y	Y
Embedded Solutions	Modbus RTU/ASCII	Factory automation	Binaries	License + royalties	Y	N	Y	N[1]
eCosCentric	eCosPro-CAN	Factory Automation	Sources	License	Y	N	Y	N[1]
eCosCentric	CANopen	Factory Automation	Sources	License	Y	N	Y	N[1]
Embex	IO-Link	Factory automation	Binaries	License + royalties	Y	N	N	N[1]
IXXAT	CANopen	Automation, medical	Source	License	Y	N	Y	N[1]
IXXAT	DeviceNet	Factory Automation	Source	License	Y	N	Y	N[1]
IXXAT	J1939	Commercial vehicles	Source	License	Y	N	Y	N[1]
IXXAT	ModbusTCP	Factory automation	Source	License	Y	N	Y	N[1]
IXXAT	Ethernet/IP[3]	Factory automation	Source	License	N[1]	N	Y	N[1]
IXXAT	PROFINET[3]	Factory automation	Source	License	N	N	N[2]	N

1: Please contact supplier.
2: Possible with external memory usage
3: Also possible with external HW to support Real Time features

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Application field – Industrial

Provider	Solution name	Application	Model	Cost	Availability			
					STM32F1	STM32L1	STM32F2	STM32F4
IXXAT	POWERLINK[1]	Factory automation	Source	License	Y	N	Y	N[2]
IXXAT	EtherCAT[3]	Factory automation	Source	License	Y	Y	Y	N[2]
IXXAT	Sercos III[3]	Factory automation	Source	License	Y	Y	Y	N[2]
IXXAT	IEEE1588 PTP	Factory automation	Source	License	Y	N	Y	N[2]
IXXAT	openSAFETY	Factory automation	Open source	Free	Y	N	Y	N[2]
MESCO	IO-Link	Factory automation	Binaries	License + royalties	Y	N	N	N[2]
MESCO	Profibus PA	Factory automation	Binaries	License + royalties	Y	Y	N	N[2]
MESCO	HART Master/Slave	Process automation	Source	License + royalties	Y	N	Y	N[2]
MESCO	Modbus	Factory automation	Source	License + royalties	Y	N	N	N[2]
MicroControl	DeviceNet	Factory automation	Binaries	License + royalties	Y	N	Y	N[2]
MicroControl	EtherCAT	Factory automation	Binaries	License + royalties	N	N	Y	N[2]
MicroControl	CANopen	Factory automation	Binaries	License + royalties	Y	N	Y	N[2]
Micrium	µC/Modbus	Factory automation	Source	License	Y	N	Y	N[2]
Port	CANopen	Factory automation	Source	License	Y	N	Y	N[2]

1: Also possible with external HW to support Real Time features
2: Please contact supplier
3: Requires external HW

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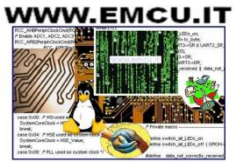

Application field – Industrial

Provider	Solution name	Application	Model	Cost	Availability			
					STM32F1	STM32L1	STM32F2	STM32F4
Port	Modbus RTU/ASCII	Factory automation	Source	License	Y	N	Y	N[2]
Port	DeviceNet	Factory automation	Source	License	Y	N	Y	N[2]
Port	EtherCAT[3]	Factory automation	Source	License	Y	N	Y	N[2]
Port	PROFINET	Factory automation	Source	License	N	N	Y	N[2]
Port	EtherNet/IP[3]	Factory automation	Source	License	Y	N	Y	N[2]
Port	ModbusTCP[3]	Factory automation	Source	License	Y	N	Y	N[2]
Port	POWERLINK[3]	Factory automation	Source	License	Y	N	Y	N[2]
PTPd	PTPd	Factory automation	Open source (BSD)[1]	Free	N	N	N[2]	N[2]
ST	DMX	Lighting/home & building automation	Source[4]	Free	Y	N[2]	N[2]	N[2]
TMG	IO-Link	Factory automation	Source	License	Y	Y	Y	Y
TMG	Profibus DP and PA	Factory automation	Source	License	Y	Y	Y	Y
TMG	Profinet	Factory automation	Source	License + royalties	N	N	Y	Y
TMG	Ethernet/IP	Factory automation	Source	License + royalties	N	N	Y	Y

1: PTPd ported on STM32: read Application note
2: Please contact supplier.
3: with external MAC or with ESC1100/1200 (EtherCAT)
4: Code is provided on request. Contact your local ST sales office.

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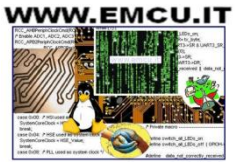
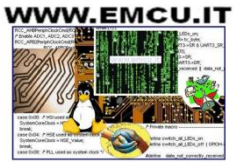


Application field – Industrial

Click ***here*** for a complete list of websites



Ethernet

Often seen acronyms	
ARP	Address resolution protocol: Provides physical address from IP address
IP	Internet protocol: Primary protocol in Internet Protocol Suite. 2 flavors: IPv4 and IPv6. IPv4 will disappear as it only supports up to 2^{32} addresses, not enough for future needs, while IPv6 supports 2^{128}
6LoWPAN	IPv6 over low power wireless personal area networks: Provides IPv6 connectivity to low rate wireless networks
IPSec	Internet protocol security: Secured version of IP, using cryptography
TCP	Transmission control protocol: Provides reliable, ordered delivery of a stream of bytes
UDP	User datagram protocol: Provides unreliable service. Datagrams may arrive in any order, duplicated, or may be missing. Used for time-sensitive applications, when data drop is better than delay
DHCP	Dynamic host configuration protocol: Provides means to allocate IP address dynamically
DNS	Domain name system: Translates domain names meaningful to humans into numerical IP ones
FTP	File transfer protocol: Provides means to copy files from one host to another
TFTP	Trivial file transfer protocol: Similar to FTP, but based on UDP, and simpler (for example, no directory)
SMTP	Simple mail transfer protocol: Used to send e-mail to a server
POP	Post office protocol: Used to retrieve e-mail from a server
HTTP	Hypertext transfer protocol: Used by web browsers
SSL/TLS	Transport layer security: Secured container for application protocols using cryptography. Example: HTTPS means HTTP over SSL, FTPS, etc.. IPSec applies cryptography at a lower level than SSL/TLS, making it more universal. However SSL is widely used.

Introduzione al Networking e a Ethernet (TCP, IP, UDP, ecc)

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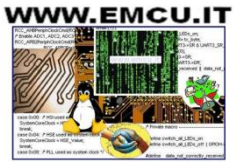


USB

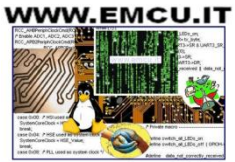
Often seen acronyms	
OTG	On-The-Go: An OTG peripheral can switch host and device role on the fly
HUB	Defines what protocols to implement to build a hub application
MS	Mass storage: Protocols to interact with storage block devices (for files)
HID	Human interface device: Protocols for peripherals interacting with human body (mouse, keyboard, etc.)
CDC	Communication device class: Protocols for serial communications, different sub-classes define details, for instance ACM (abstract control model) for a standard COM port, or ECM (Ethernet networking control model) for modems
Printer	Defines what protocols to implement to build a printer application
Audio	Defines what protocols to implement to build an audio application (microphone, headset, etc.)
DFU	Device firmware upgrade: Protocols to implement firmware upgrade ability

Bluetooth

Often seen acronyms	
HCI	Host/controller interface: Standardized communication between controller and radio chips
SPP	Serial port profile: Profile that emulates serial line over Bluetooth
A2DP	Advanced audio distribution profile: Profile to stream high quality audio
HSP	Headset profile: Profile to implement a basic headset application
HDP	Health device profile: Profile designed to facilitate transmission and reception of medical data
HFP	Hands-free profile: Typical profile used in cars for hands-free phone usage. Implements more features than HSP, such as voice dialing or last number redial

Display

Often seen acronyms	
Anti aliasing	Technique to minimize distortion artifacts known as aliasing when presenting a high-resolution image at a lower resolution. Aliased images show some stair effects on curves. Anti-aliasing removes this by modifying edge pixel colors.
Alpha blending	Alpha blending is the process of combining a translucent foreground color with a background color, thereby producing a new blended color.
GUI	Graphical user interface
bpp	Bits per pixel (also known as color depth: Number of bits used to represent the color of a single pixel in an image. 1 bpp corresponds to monochrome images.
Palette	Technique to lower image memory size by storing the set of colors used in a table and using this table for each pixel
JPEG	Commonly used method of lossy compression for digital image. The degree of compression can be adjusted, allowing a trade-off between storage size and image quality. JPEG typically achieves 10:1 compression with little perceptible loss in image quality.
RGB	Color model in which red, green and blue are merged to reproduce a broad array of colors.
Widgets	Element of a graphical user interface that can be changed by the user (such as text box, radio button)



Touch Sensing

Often seen acronyms	
Surface Capacitance	The capacitance of a single ended electrode is modified when the finger gets close to it.
Projected Capacitance	The capacitance between two sensing electrodes is modified when the finger gets close to them.
RC acquisition	Resistor-Capacitor acquisition for surface capacitance only. It consists in measuring the charge and discharge time duration of a RC cell made of the electrode capacitance and a load resistor.
CT acquisition	Charge Transfer acquisition for surface capacitance only. It consists in measuring the duration for charging the electrode capacitance and transferring part of the accumulated charge into a sampling capacitor. The CT acquisition is more robust than the RC one.
ProxSense™ acquisition	Charge Transfer acquisition for projected capacitance. This acquisition offers enhanced features such as integrated sampling capacitor, automatic electrode tuning, electrode parasitic capacitance compensation, … The ProxSense™ acquisition is more robust than the CT one.

Audio

Often seen acronyms	
Codec	A codec is a program capable of encoding and decoding a digital data stream. The encoded stream can be compressed or not, with a lossy (MP3, WMA, …) or lossless (FLAC, ALAC, …) mechanism.
PCM	Pulse-code modulation: Digital representation of an analog signal, in which the magnitude of the analogue signal is sampled regularly, each sample being quantized to the nearest value within a range of digital steps.
AAC, MP3, WMA	Music codecs with patents. Royalties need to be paid to patent owners.
Vorbis	Open source, no royalties music codec
Speex	Open source, no royalties speech codec
G711	Simple codec with no royalties often used in telephony
G726	ADPCM (adaptive differential pulse code modulation): Simple compression of PCM data

Motor Control

Often seen acronyms	
BLDC	Brushless DC: permanent magnet motor with trapezoidal shaped B-EMF, FOC applicable
PMSM	Permanent magnet synchronous motor: with sinusoidal shaped B-EMF, FOC applicable
ACIM	AC induction motor: type of motor, FOC applicable
FOC	Field-oriented control: Mathematical technique used to achieve decoupled control of the flux and torque in a 3-phase motor.

Automotive

Often seen acronyms	
J1939	Vehicle standard used for communication and diagnostics with vehicle components (e.g. agricultural machines).
LIN	Local interconnect network: The LIN bus is a small and slow network system that is used as a cheap sub-network of a CAN bus to integrate intelligent sensor devices or actuators in today's cars. The LIN specification is enforced by the LIN-consortium, with the first exploited version being 1.1, released in 1999. Since then, the specification has evolved to version 2.1 to meet current networking needs. Bit rates vary within the range of 1 to 20 Kbit/s.
CAN	Controller-area network (CAN or CAN-bus): This is a standard vehicle bus designed to allow microcontrollers and devices to communicate with each other within a vehicle without a host computer. Possible bit rates from 125 Kbit/s up to 1 Mbit/s.

Provider	Solution Name	Model	Cost	Availability			
				STM32F1	STM32L1	STM32F2	STM32F4
ArcCore	ArcticCore Autosar stack	Open Source or source	License	Y	N[1]	N[1]	N[1]
Vector	CANbedded	Source	License	Y	N[1]	N[1]	N[1]
Vector	CANbedded J1939	Source	License	Y	N[1]	N[1]	N[1]

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