Real-time operating systems for C166 devices

V1.0, Summer 2022

keil-feedback@arm.com

Contents

Introduction

Keil PK166 Professional Developer's Kit supports the C166 architecture with two real-time operating systems:

- RTX166 Tiny is included in the package, and it is designed for single-chip applications where code size is the most important factor.
- ARTX-166 is available as a separate purchase and offers multitasking and adds a flash file system and TCP/IP networking support.

RTX166 Tiny

RTX166 Tiny is a small real-time kernel designed for single-chip applications where code size is the most important factor. The kernel requires only 1,500 bytes of code space and is well-suited for applications that don't need RTOS features like messaging, semaphores, and memory pool management.

- It supports all memory models of the Keil C166 Compiler. Operating system variables and task stacks are stored in internal memory.
- It performs round-robin and cooperative multitasking only. Preemptive task switching and task priorities are not supported. If you need these features, you should consider ARTX-166.
- It uses one timer (0-6) for the operating system timer tick and requires 1,500 bytes of code space and 4 bytes of data space for each task. No other hardware resources are used.
- RTX166 Tiny is royalty-free.

Features

For a comprehensive list of features refer to the C166 RTOS Comparison Table. Here are the highlights:

- RTX166 Tiny tasks are integrated into the C166 C Compiler language. The following example shows how tasks are declared:

```
void display_task (void) _task_ 1
{
}
```

- Kernel routines are provided by a library that is automatically included by the linker. All you must do is specify the RTX166TNY directive.
- Interrupts may be used to trigger tasks or to start standard C166 interrupt functions.
- RTX166 Tiny supports all C166 Compiler memory models.

ARTX-166

ARTX-166 is an advanced real-time kernel for the Infineon XC16x and C16x as well as the STMicroelectronics ST10 families of microcontrollers. It is designed to solve several problems in embedded programs:

- **Multitasking** allows you to manage several jobs (tasks) on a single CPU.
- **Real-time control** allows you to configure tasks so that operations execute within a defined period. You have control over task priorities, round-robin, preemptive context switching, and support for multiple instances of the same task function.
- **Flash file system** allows you to create, save, read, and modify files stored on a flash memory device.
- **TCP/IP networking** is a ground-up implementation specifically designed for embedded applications. It helps you to create TCP/IP solutions that connect to standard internet browsers.

Features

For a comprehensive list of features refer to the C166 RTOS Comparison Table. Here are the highlights:

Kernel

- Tasks are integrated into the C166 C Compiler language. The following example shows how tasks are declared:
```
void display_task (void) __task
{
}
```
- Kernel routines are provided by a library that is automatically included by the linker. All you must do is specify the AR166 linker directive or select Advanced RTX166 within the µVision IDE.
- Interrupts may be used to trigger tasks or to start standard C166 interrupt functions.
- Several methods of inter-task communication are provided including events, mailboxes, and semaphores.
- ARTX-166 supports all C166 Compiler memory models except the Tiny Model.

Flash File System

- Stores data in binary, ASCII, or any other format.
- Flash file system applications are written using standard C constructs.
- You may specify numerous configuration parameters including maximum number of files, file I/O buffer size, and sector layout.
- Code to write and erase flash blocks is easy to configure for each project.

TCP/IP Networking

- A TCP/IP Library supports internetworking on C16x, XC16x, and ST10 devices.
- Protocols supported: ARP, UDP, TCP, HTTP, TFTP, SMTP, DHCP, Telnet.
- Pre-configured for Crystal CS8900A and Asix Ax88796 Ethernet Controllers. Other Ethernet controllers may be used with user-configured initialization routines.
- Several example projects are available.

Documentation

All C166 documentation (including RTX166 Tiny and ARTX-166) is available here:
developer.arm.com/documentation/101638/latest/

C166 RTOS Comparison Table

Key: ● Included ○ Not included	Product	
	ARTX-166	RTX166 Tiny
Kernel Source Code	●	●
Flash File System	●	○
TCP/IP Stack	●	○
Multitasking		
Round-Robin	●	●
Preemptive	●	○
Cooperative	●	●
Task Specifications		
Priority Levels	256	1
Defined Tasks (max)	256	32
Active Tasks (max)	256	32
Context Switch Time	< 25 µsec (At 20 MHz)	400 – 4,000 states
Interrupt Latency	0.2 µsec (At 20 MHz)	4.0 µsec (At 20 MHz)
Memory Requirements		
CODE Space	4 Kbyte	1.5 Kbyte
RAM Space	≈ 500 byte min.	8 byte + 4 byte per task
Timers/Signals/Events		
Timeouts	●	●
Intervals	●	●
User Timers (max.)	Unlimited	○
Signals	●	●
Signals (max.)	16 per task	1 per task
Timers Used	0 – 8	0 – 6
System Clock Divisor	1,000 – 4,000	250 – 65,535
Inter-Task Communication		
Semaphores (Counting)	●	○
Semaphores (max.)	Unlimited	○
Mailboxes	●	○
Mailboxes (max.)	Unlimited	○
Mailbox Size	Unlimited (default: 20)	○