

A Real Time Operating System Survey

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What the heck is a Real Time system anyway?

From Donald Gillies:

“A real-time system is one in which the correctness of the computations not only depends upon the logical correctness of the computation but also upon the time at which the result is produced. If the timing constraints of the system are not met, system failure is said to have occurred.”

From POSIX 1003.1:

“Realtime in operating systems: the ability of the operating system to provide a required level of service in a bounded response time”

What makes a good RTOS?

- A RTOS (Real-Time Operating System) has to have a real-time kernel
- Good documentation
- Good device support
- Good tools

Why are there so darn many? (Classes of RTOS)

- low-end (small)
 - AMX
 - C-Executive
 - CMX
 - Precise/MQX
 - Nucleus
 - C-Task
 - RTEMS
 - eCOS

Why are there so darn many? (Classes of RTOS)

- Mid-range
 - RT-Linux
 - OS-9
 - QNX
 - VRTX
 - VxWorks
 - RTEMS
 - eCOS

Why are there so darn many? (Classes of RTOS)

- High-end (large)
 - ChorusOS
 - LynxOS
 - RT-Linux
 - Solaris

How can I sort through this mess?

A couple of examples of choosing:

- High-end (Solaris 2.X)

Virtual trigger connection between the VLA and the 140 ft.

- Mid-range (VxWorks)

Telescope control

- Low-end (C-Task)

Monitor and Control system for an Inertial Navigation System test stand

And now for something completely different

Some “Free” RTOS options

- High-end (RT-Linux)
- Mid-range (RT-Linux, RTEMS, eCOS)
- Low-end (C-Task, eCOS, uCOS, ...)

RTEMS – Real Time Executive for [Multiprocessor, Military, Missile] Systems

- Scalable Architecture
- Multiple APIs - "Classic", POSIX
- Event-driven, priority-based, preemptive scheduling
- Multitasking
- Optional rate monotonic scheduling
- Intertask communication and synchronization

RTEMS – Real Time Executive for [Multiprocessor, Military, Missile] Systems

- Priority inheritance and ceiling protocols
- Homogeneous and heterogeneous multiprocessor systems
- Responsive interrupt management
- High level of user configurability
- Reentrant ANSI C Library
- BSD Sockets

RTEMS – Processors supported

- Motorola PowerPC, M683x0, M680x0, Cold-fire
- Intel ix86, i960
- MIPS R46x0
- SPARC
- Hitachi SH
- AMD 29K
- HP PA-RISC

eCOS – embedded Cygnus Operating System

- Hardware Abstraction Layer (HAL)
- Real-time kernel
- Interrupt handling
- Exception handling
- Choice of schedulers
- Thread support

eCOS – embedded Cygnus Operating System

- Rich set of synchronization primitives
- Timers, counters and alarms
- Choice of memory allocators
- Debug and instrumentation support
- uITRON 3.0 compatible API layered on top of the basic kernel
- ISO C library

Not really ready for prime time

eCOS – Processors supported

- Matsushita MN10300 32-bit Microcontroller Series
- Toshiba TX39 32-bit TX SystemRISC Series
- MPC800 Embedded PowerPC(tm) Family (beta)

uCOS – MicroComputer Operating System

- Real time kernel only
- Runs on many micros, down to the Atmel AVR series, and on to the iX86 chips
- support third-party TCP/IP, etc
- Free for educational and “peaceful” research uses

Are you nuts? Use Free code?

What are some issues involving choosing to use one of these?

What about Support? Warranties?
Upgrades?

Support for OpenSource products

- Commercial companies
 - Cygnus Solutions
 - Cyclic Software
 - Red Hat Software
 - OAR
- Web sites
- Newsgroups

Warranties and Upgrades?

- Have you ever read a software warranty?
- As for upgrades:

Yes, Master:– cc68k -v
gcc version cygnus-2.7.2-960126

Is OpenSource the future?

Apache, which runs over 50% of the world's web servers

Perl, which is the engine behind most of the 'live content' on the World Wide Web.

BIND, the software that provides the DNS (domain name service) for the entire Internet.

sendmail, the most important and widely used email transport software on the Internet.

Conclusions, Discussions, and URLs

<http://www.realtime-info.be/encyc/market/rtos/rtos.htm> for an RTOS Buyer's Guide

<http://www.faqs.org/faqs/realtime-computing/faq/> for the FAQ.

<http://www.cygnus.com> Sells GnuPro tools, eCOS, GNU support, etc.

<http://www.oar.com> Sells RTEMS support

<http://www.ucos-ii.com/> A (mostly) free microcomputer OS

<http://www.opensource.org> for general Open Source propaganda