Real-time Operating Systems and Systems Programming

Real Time Operating Systems
Lecture 12

ARVUTITEADUSE INSTITUUT
DEPARTMENT OF COMPUTER SCIENCE

Overview

- OSE
- OSEK/VDX
- Nucleus
- VRTX
- VxWorks
- µC/OS

OSE by ENEA

- Operating System Embedded
- One of the most popular RT operating systems
- 1.5 billion run-times deployed
- Swedish company
- Characterized by event messages for interprocess communication
- Multicore edition
- Wide support for processors

OSEK/VDX

- Automotive standard with many implementations (consider POSIX)
- *Offene Systeme und deren Schnittstellen für die Elektronik in Kraftfahrzeugen*
- “Open Systems and their Interfaces for the Electronics in Motor Vehicles”
- Runs without memory protection
- Open standard

OSEK/VDX Specifies

- Static tasks, stacks, mutexes
- Tasks
  - Basic: never block
  - Enhanced: can wait on objects
- Priorities, round robin for same level
- Deadlock prevention with Priority Ceiling
  - Task which holds a priority object will prevent lower priority tasks from running

Nucleus

- 1.6 billion run-times deployed (according to developer)
- Closed source
- Windowing system
- Products
  - Motorola, Samsung, LG cellular phones
  - Creative Zen soundcards
  - Many iPhone clones

VRTX

- Versatile Real-Time Executive
- Two kernels: microcontroller and scalable
- Runs on Hubble Space Telescope
- Also used by Motorola

VxWorks

- Started as improvement on VTRX (1985)
- Kernel was replaced later
- Name is probably a pun on VTRX
- Development done on host such as Linux, Unix, Windows with cross-compiling to ease testing
- Honda ASIMO; Boeing 787, 747-8; Linksys WER54G, Canon DIGIC-II & DIGIC-III; Apache Longbow attack helicopter; Spirit&Opportunity rovers

µC/OS-II & -III

- Started as a two part article in Embedded Systems Programming magazine
- Free for noncommercial use
- $10000 (-5) per end product otherwise
- Also certified for use in safety critical contexts

How to Choose?

- Main characteristics:
  - Worst case performance documented
  - Interrupt latency known
  - Context switch time
- Exclude from the list:
  - **Processor**
  - **Real-time performance**
  - **Price**

Last optimization

- Compatibility of compiler
- Debugging issues
- Development tools
- Memory requirements
- Add-on software (network, usb, filesystems)
- Vendor experience

Emergency Meeting

- Exam times:
  - 10:00 24 May (encouraged)
  - 10:00 26 May (discouraged)
  - Same room (IT-137A)
- Next lecture can be Revision of important things
- Last lecture could/should be something completely different