Scheduling

Operating Systems

process types

compute-bound

I/O-bound

long computational burst

process **A**

process **B**

waiting for I/O

short computational burst

process **A** is *compute-bound*

process **B** is *I/O bound*

compute-bound tasks have long CPU bursts, infrequent I/O stalls.

I/O-bound tasks have frequent I/O waits.

when to schedule

a new process is created

a process exits

a process blocks
waits for input/output
waits to enter a critical section

a hardware interrupt occurs

input/output device interrupts

clock interrupts

scheduling algorithm types

preemptive

non-preemptive

process **A** starts

process **A** exits

process **B** starts

process **A**

process **B**

process **A**

process **B**

waiting for I/O

process **A**

process **B**

process **A**

process **B**

time slice has expired

waiting for I/O

time slice has expired

scheduling algorithm categories

batch

interactive

real-time

common goals

fairness

balance

batch schedulers

common goals
  maximize throughput
  minimize turnaround
  maximize CPU utilization

first-come first-served
shortest job first
shortest remaining time next

interactive schedulers

common goals

minimize response time

round-robin scheduling
priority scheduling
shortest process next

lottery scheduling

fair-share scheduling

real-time schedulers

common goals

meet deadlines

real-time system types

hard real time

soft real time

hard real time systems

have absolute deadlines that **must** be met.

soft real time systems have a level of tolerance toward missed deadlines.

missing deadlines in soft real-time systems is still undesirable.

event types

periodic

aperiodic

periodic events occur at regular intervals.

aperiodic events occur unpredictably.

A periodic system with *n* events of a period *Ti* with *Ci* seconds of CPU time to complete is **schedulable** only if…

$$\sum_{i=1}^{n} \frac{C_i}{T_i} \leq 1$$

real-time OS

FreeRTOS

QNX Neutrino

VxWorks

Reading

Operating Systems Design and Implementation,
Third Edition by Andrew S. Tanenbaum

Chapter 2 (2.1, 2.4)

Supplemental Reading

Understanding the Linux kernel, Third Edition by Daniel P. Bovet and Marco Cesati

Chapter 7

Supplemental Reading

Windows Internals, Part 1 (6th Edition) by Mark E. Russinovich and David A. Solomon

Chapter 5

Supplemental Reading

Mac OS X and iOS internals : to the apple's core
by Jonathan Levin

Chapter 11