Embedded Operating System
RTOS dynamic priority servers

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Dynamic priority servers

Dynamic scheduling algorithms vs. Fixed priority scheduling

Higher schedulability bounds

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Processor better utilized

Higher capability of aperiodic server	Higher aperiodic responsiveness

Example – Server capability

Suppose two periodic tasks with $U_1 = U_2 = 0.3$, then $U_P = 0.6$

Periodic task with RM + Aperiodic requests served by Slack Stealing

$U_{ss} = 2 / P - 1$ where $P = (U_1+1)(U_2+1) = 0.18$

Periodic task served with EDF

$U_{ss} = 1 - U_p = 0.4$

Dynamic priority servers

Goal	Decreasing average response time for aperiodic tasks	
	Preserving the schedulability of periodic tasks	
Solutions	Adaptation of static servers (EDF instead of RM for periodic tasks)	Dynamic priority exchange server
		Improved priority exchange server
		Dynamic sporadic server
	Total Bandwidth Server	Whenever an aperiodic request enters the system the total bandwidth of the server is immediately assigned to it, whenever possible

Adaptation of static servers with EDF

Long period for the server

Execution of the aperiodic requests delayed significantly.

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Then what about shortening the period for the server?

To keep the server utilization constant, the capacity has to be reduced proportionally

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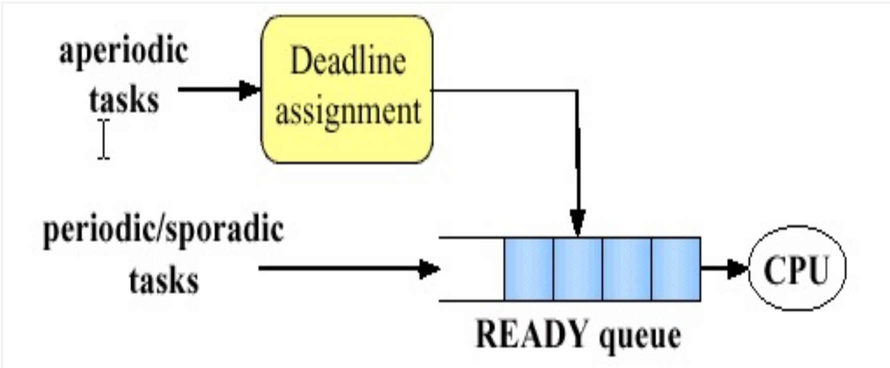
Increment of the run-time overhead of the algorithm because

- More frequent replenishments
- Higher number of context switches

An alternative – Total bandwidth server

- Dynamic priority server, used with EDF
  - Each aperiodic request is assigned a deadline so that the server demand does not exceed a given bandwidth U_s
  - Aperiodic jobs are inserted in the ready queue and scheduled together with the hard tasks



Periodic tasks are guaranteed
if and only if
$U_p + U_s \leq 1$

Total bandwidth server - Deadlines

- Deadline assignment
  - Job J_k with computation time C_k arriving at time r_k is assigned a deadline

$$d_k = r_k + C_k / U_s$$

- To keep track of the bandwidth assigned to previous jobs, d_k must be computed as

$$d_k = \max(r_k, d_{k-1}) + C_k / U_s$$

- Deadline used to assign priority

Total bandwidth server - Schedulability

Given

- A set of *n* periodic tasks with processor utilization U_p
- And a TBS with processor utilization U_s

The whole set is schedulable by EDF — iff $U_p + U_s <= 1$

Total bandwidth server – Example

Task	C	T	a
$\tau 1$	1	4	0
$\tau 2$	3	6	0
ape 1	2		1
ape 2	1		3