Chapter 10
Scheduling Hybrid Task Sets

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Objectives

What are you about to learn?

Knowledge Objectives

- Understand the definition of a hybrid task set.
- Understand the scheduling problem for hybrid task sets with *independent*, *periodic and aperiodic* tasks.
- Understand how a background server, polling server, and sporadic server work.

Skill Objectives

- Ability to design a plan for a hybrid task set using the background server, polling server, and sporadic server algorithms

10.1 Hybrid Task Sets

The scheduling algorithms in the previous chapter have dealt with homogenous task sets where all tasks are periodic.

Hybrid task sets are task sets that are comprised of periodic and aperiodic tasks.

The periodic tasks are considered having hard timing constraints.
The aperiodic tasks are considered having either hard or soft timing constraints.

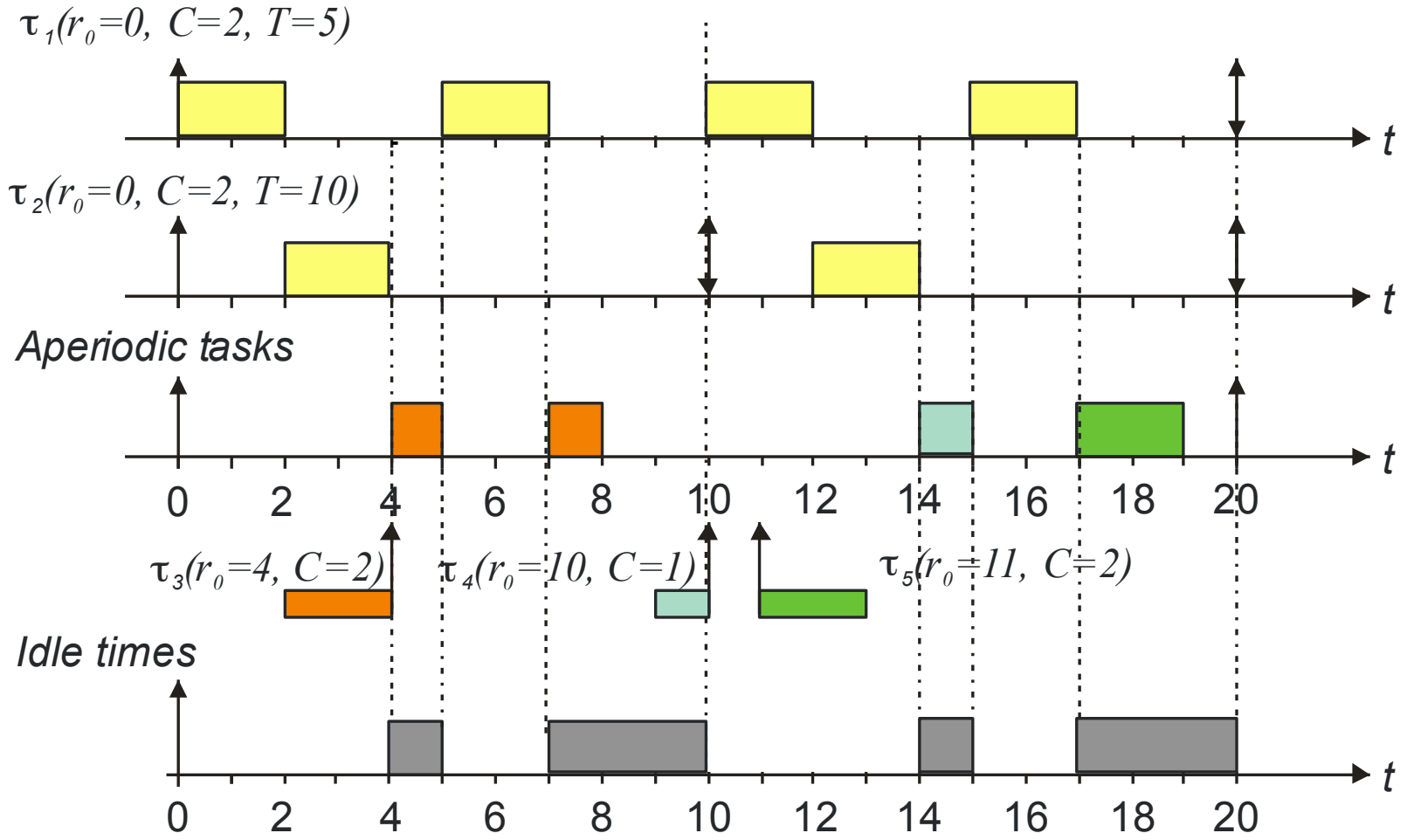
In the following, we limit ourselves to scheduling aperiodic tasks with soft timing constraints.

The goal is to provide good average response times.

10.2 Background Scheduling of Aperiodic Tasks

With this scheduling strategy, aperiodic tasks are scheduled when there are no periodic tasks ready to execute. Aperiodic tasks are queued on a first-come-first-served strategy.

Example:



10.3 Polling Server

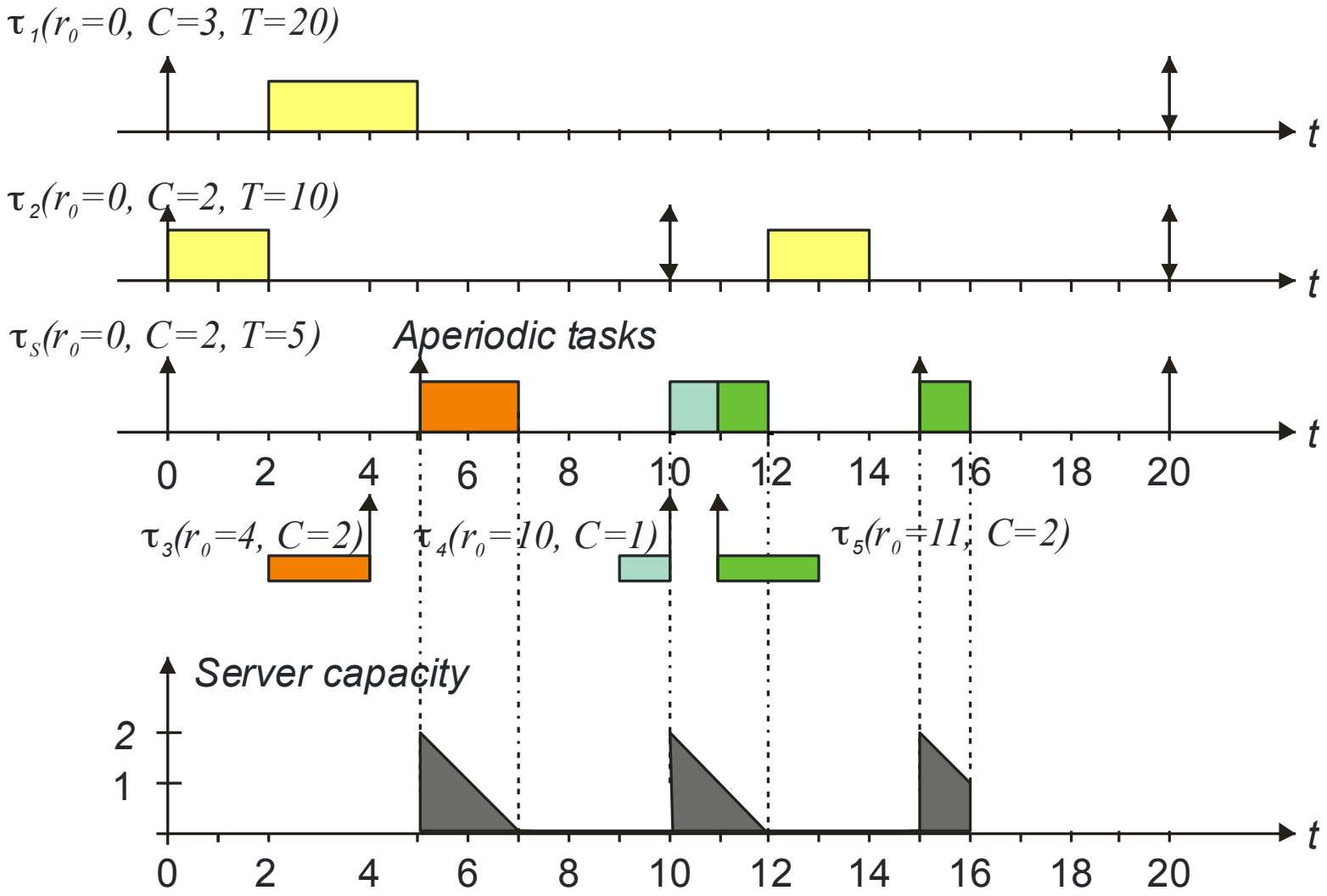
A server is a periodic task whose purpose is to serve aperiodic requests. A server is characterized by a period and a computation time called the server capacity.

The polling server becomes active at regular intervals equal to its period and serves pending aperiodic requests within the limit of its capacity.

If no aperiodic requests are pending, the polling server suspends itself until the beginning of its next period and the time originally reserved for aperiodic requests is used by periodic tasks.

Main drawback of polling server is that if an aperiodic task enters just after the server has suspended itself, the task has to wait until the next period of the server to execute.

Example for polling server:



10.4 Sporadic Server

A server is a periodic task whose purpose is to serve aperiodic requests. A server is characterized by a period and a computation time called the server capacity.

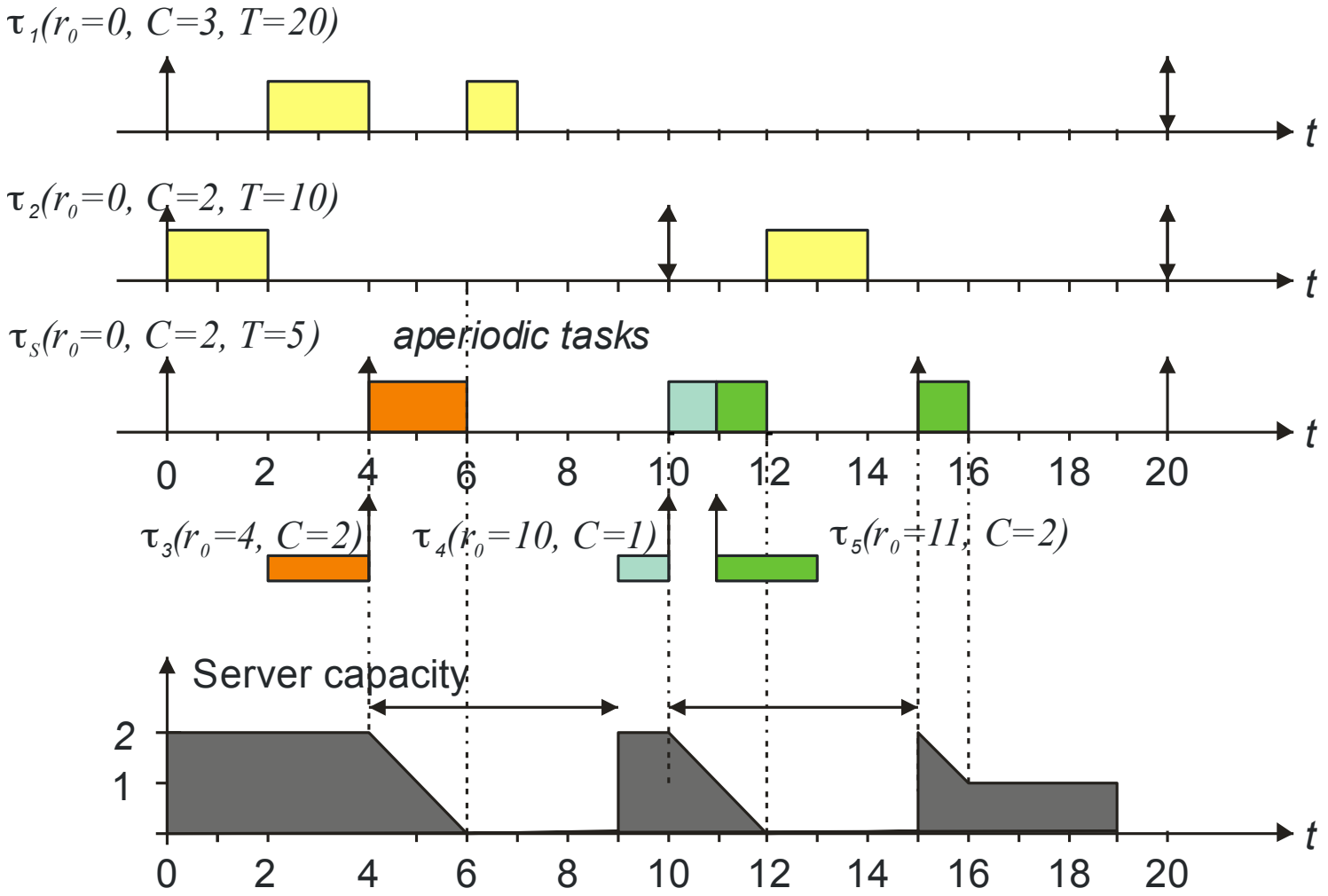
The sporadic server preserves its capacity until a sporadic request occurs.

The sporadic server replenishes its capacity each time t_R it becomes active and its capacity is greater than 0. Active means the sporadic server task priority is smaller or equal to the priority of the currently executing task, including the server task itself.

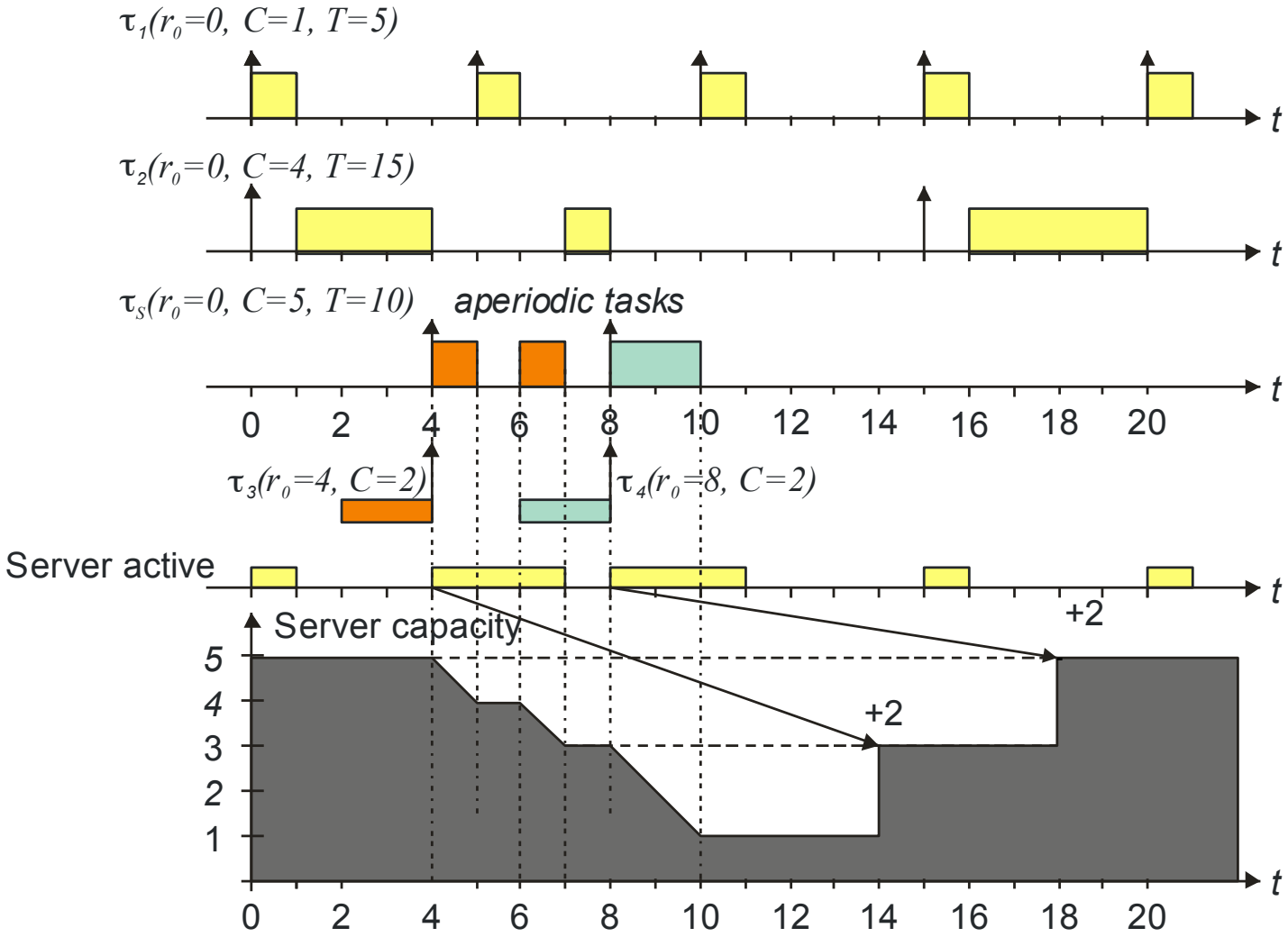
The replenishment time is set to t_R plus the server period.

The replenishment amount is set to the capacity consumed within the interval t_R and the time when the sporadic server becomes idle or its capacity has been exhausted.

Example for a high-priority sporadic server:



Second example for a medium-priority sporadic server:



Points to Remember