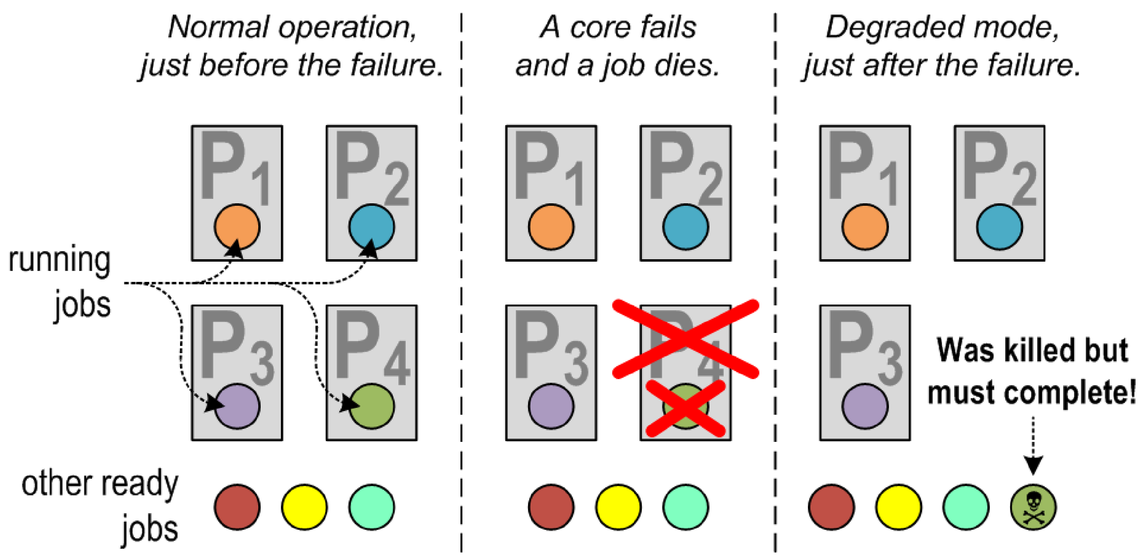
Towards realistic core-failure-resilient scheduling and analysis

CISTER - Research Center in
Real-Time & Embedded Computing Systems

Borislav Nikolić and Konstantinos Bletsas
{borni, ksbs}@isep.ipp.pt

(1) The scheduling problem

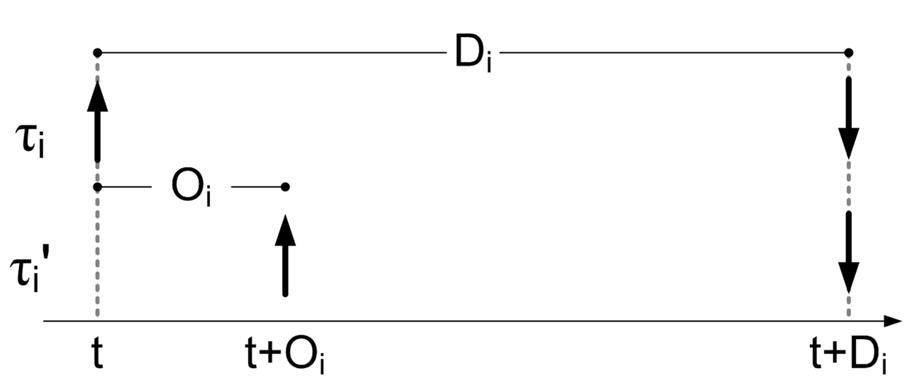
- **Goal:** Meeting all task deadlines on a multicore platform even when a core suddenly fails and is rendered unusable.
- **Model:** When a core fails, whichever task was running there is killed but its deadline **must still be met** .



- Our basic scheduling arrangement and analysis for this problem (RTCSA 2015) makes many simplifying assumptions. We want to make it more realistic.

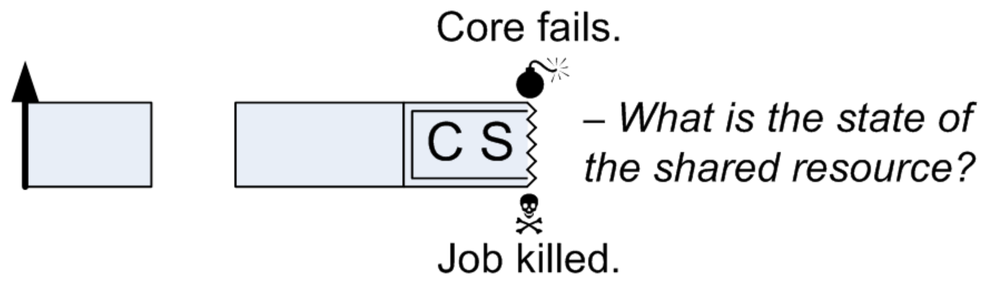
(2) The baseline approach

- Global fixed-priority scheduling.
- Generalisation of two simple but "faulty" ideas:
  - Full task replication (Resource-inefficient!)
  - Restart task upon failure (May be too late!)
- For each job by task τ_i, release a ***copy job*** after a time offset O_i, relative to the main job.
  - smaller O_i: more redundant execution.
  - bigger O_i: harder to meet deadline.
  - Optimal O_i: the biggest value that allows provably meeting deadlines in every case.



(3) Critical sections

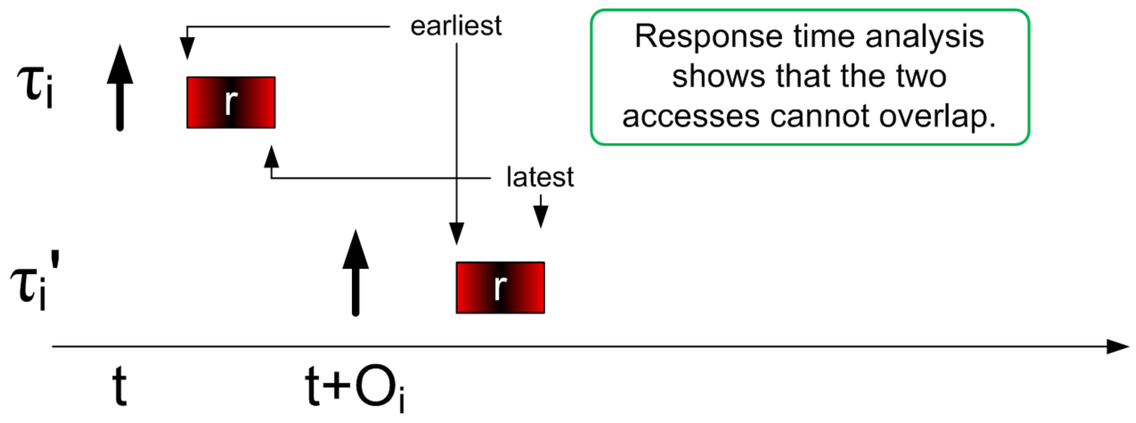
- Provisions for resource sharing under some adaptation of an existing protocol are needed.
- But what happens if a task dies while executing a critical section?



- Transaction semantics (with COMMIT and ROLLBACK) appear as an appropriate solution.

(4) Indirect resource sharing

- With job copies, *all* resources suddenly become shared (between the main job and its copy)!
- Possible solutions:
  - Critical sections everywhere (inefficient).
  - Code-level analysis also considering O_i, in order to rule out some access hazards.



(5) Implementation aspects

- Facility for detecting/handling core failures.
- Facility for launching, tracking and terminating jobs early.
- Incorporation of overheads into the analysis, taking into account the actual implementation.

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CISTER Research Centre/INESC-TEC
ISEP, Polytechnic Institute of Porto
Rua Dr. Antº Bernardino de Almeida, 431
4200-072 PORTO Portugal
tel: +351-228340502
fax: +351-228340509
http://www.cister.isep.ipp.pt
cister-info@isep.ipp.pt