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FAULT-TOLERANT MULTI-PROCESSOR SCHEDULING WITH BACKUP COPY TECHNIQUE

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Aim: Development of a run-time, self-adaptive scheduling algorithm for Multi-Processor System-on-Chip taking into account faults and thereby treating unreliable system components

Keywords: Fault-tolerant design, Mapping and scheduling, Multi-processor platform

Context:

- ▶ Increasing demand on multi-processor systems for high performance and low power consumption
- ▶ Rising susceptibility of system failure because of transistor scaling and diminution of operating voltage

Issues:

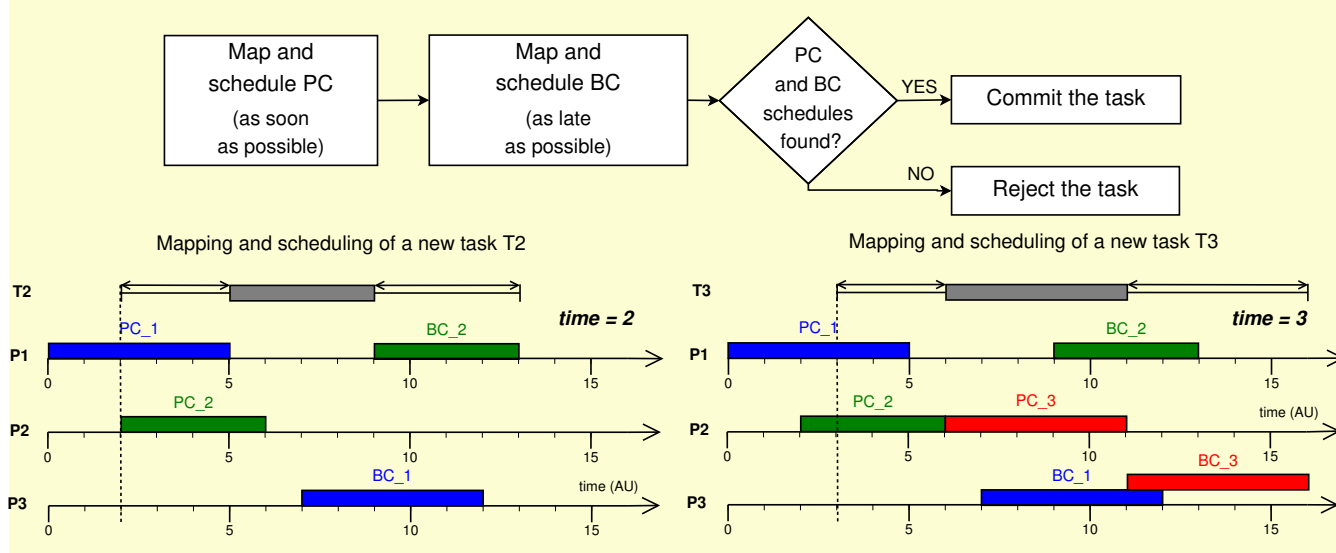
- ▶ Trade-off between parallel computing (performance) and spatial redundancy on multi-cores (reliability)
- ▶ Mapping and scheduling control on multiprocessor platforms

Assumptions:

- ▶ P identical processors
- ▶ Aperiodic and independent tasks
- ▶ Dynamic mapping and scheduling without preemption
- ▶ Only one processor failure at any instant of time
- ▶ Primary/backup (PB) approach: each task T has two identical copies: primary copy (PC) and backup copy (BC)

PRINCIPLE OF MAPPING AND SCHEDULING BASED ON THE PRIMARY/BACKUP APPROACH

Algorithm to map and schedule tasks



Fault management algorithm

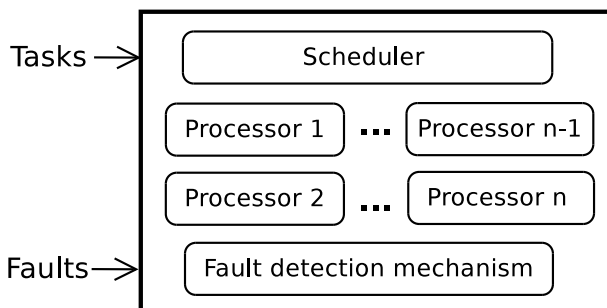
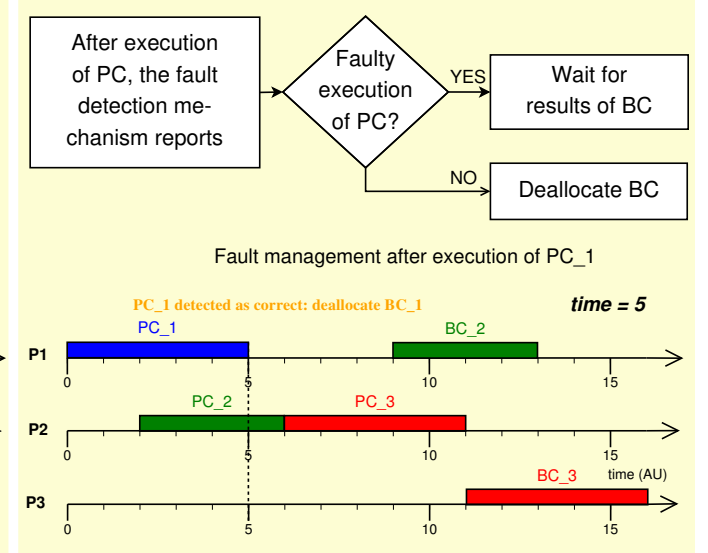


Figure: System model

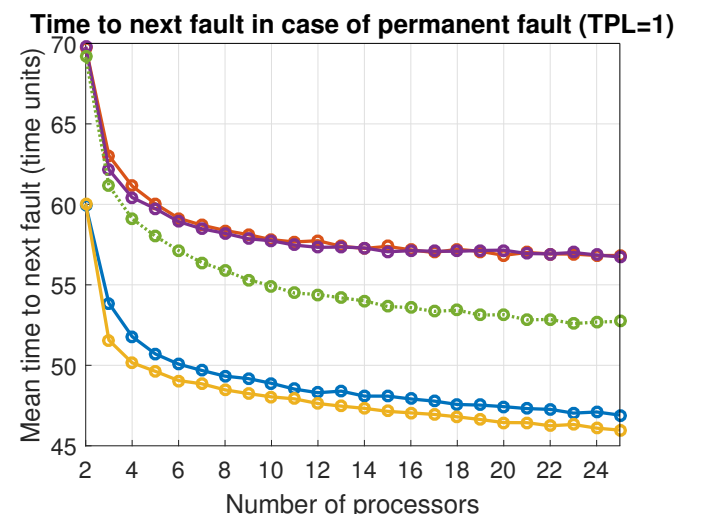
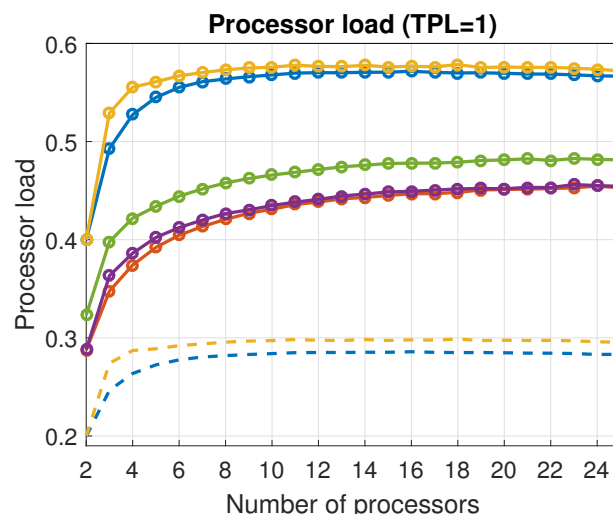
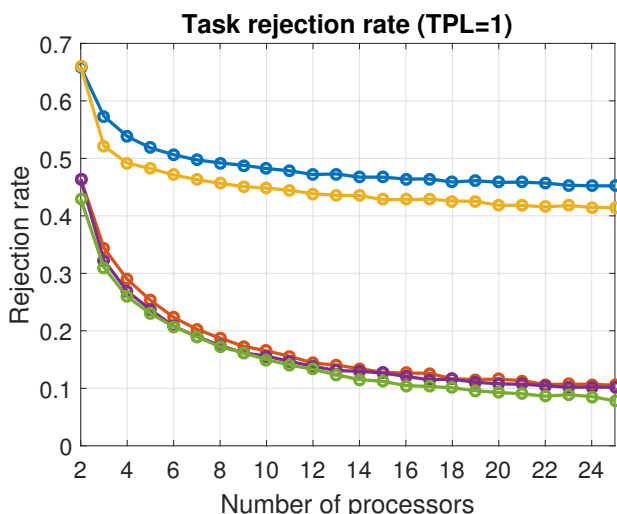
Parameter	Value
Number of processors	2-25
Targeted processor load (TPL)	0.25-2.25

Table: Simulation parameters

Task attribute	Distribution	Min	Max
Arrival time a	Poisson	-	-
Computation time c	Uniform	1	20
Deadline d	Uniform	$2c$	$5c$

Table: Task parameters

RESULTS



● PB
■ PB + BC deallocation
◆ PB + BC overloading
▲ Active PB + BC deallocation + BC overloading