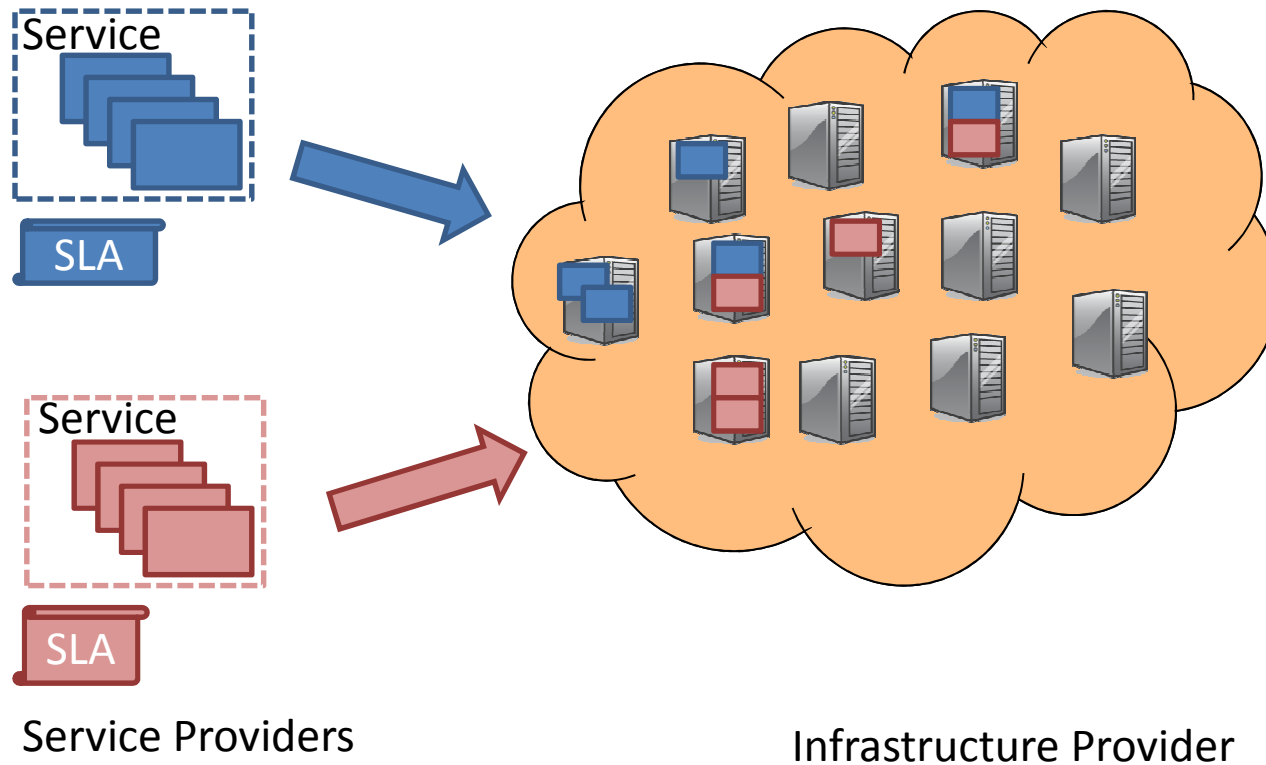


Resource Management for Isolation Enhanced Cloud Services

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XCG, Microsoft Research

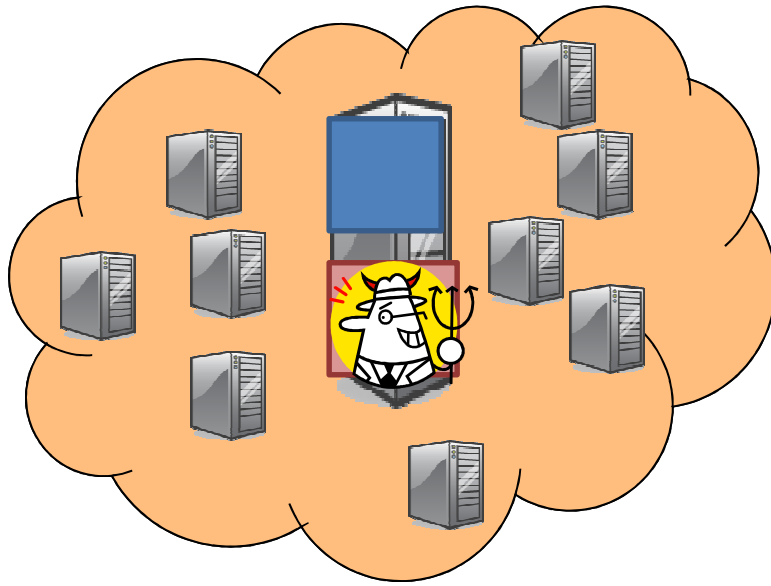
Motivation

- Isolation issues in shared-resource computing infrastructures



Motivation

- Side-channel attacks compromising performance and security Isolation
 - DoS, Information leak (key stealing not shown for VMs yet)



Areas lacking:

- SLA specification
- Isolation mechanisms
- Resource management

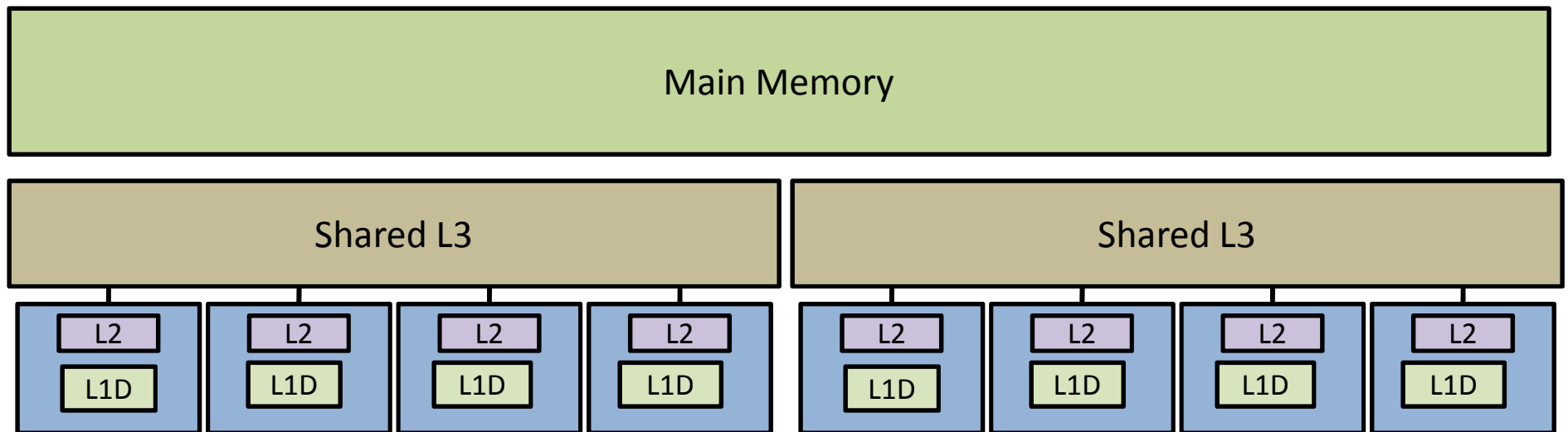
Proposed Solution

- *Isolation attributes* part of the SLA
- *Mechanisms* for better isolation
- Enhanced *resource management*
 - Include constraints based on isolation attributes

SLA Isolation Attributes

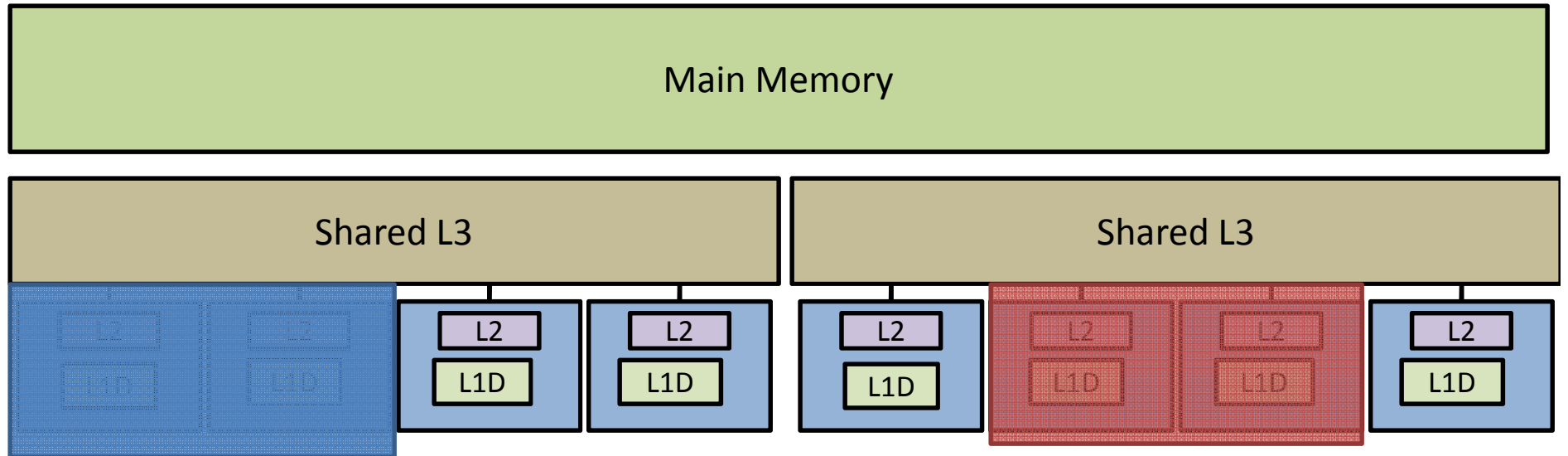
- Degree of hardware fault resistance (n)
 - Type: Integer, e.g., $n = 5$
- Cache-based side channel attack avoidance
 - For DoS and Information leakage avoidance
 - Type: Boolean

Enforcing Cache Isolation

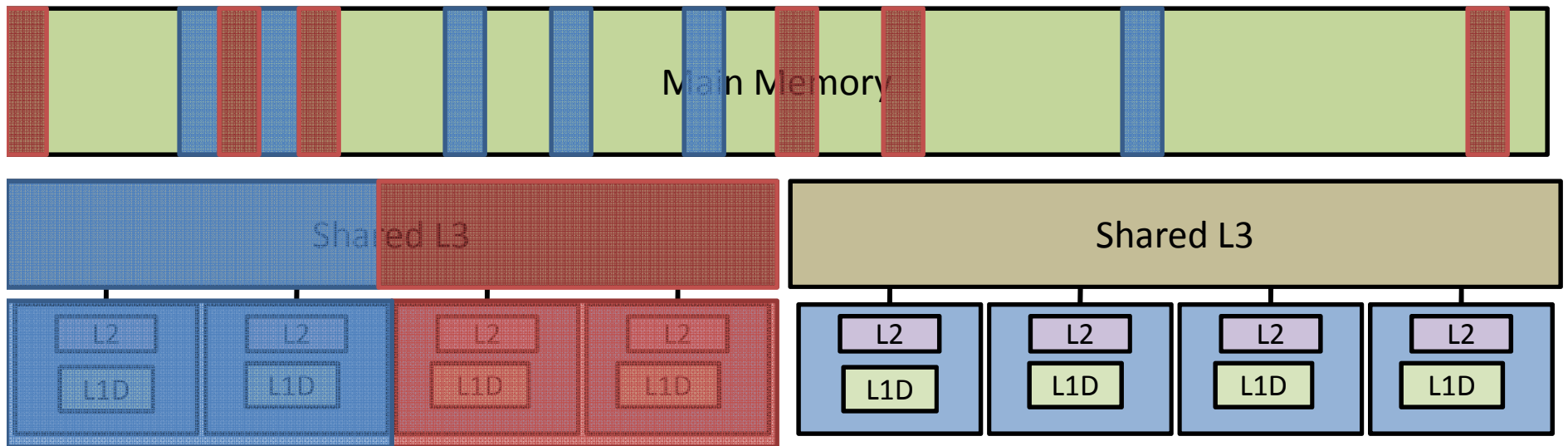


- Cache hierarchy aware core assignment
- Page-coloring based cache partitioning

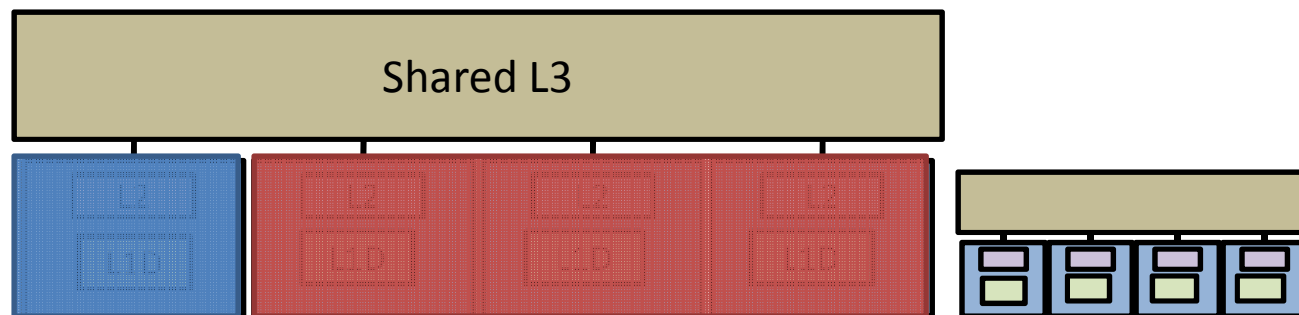
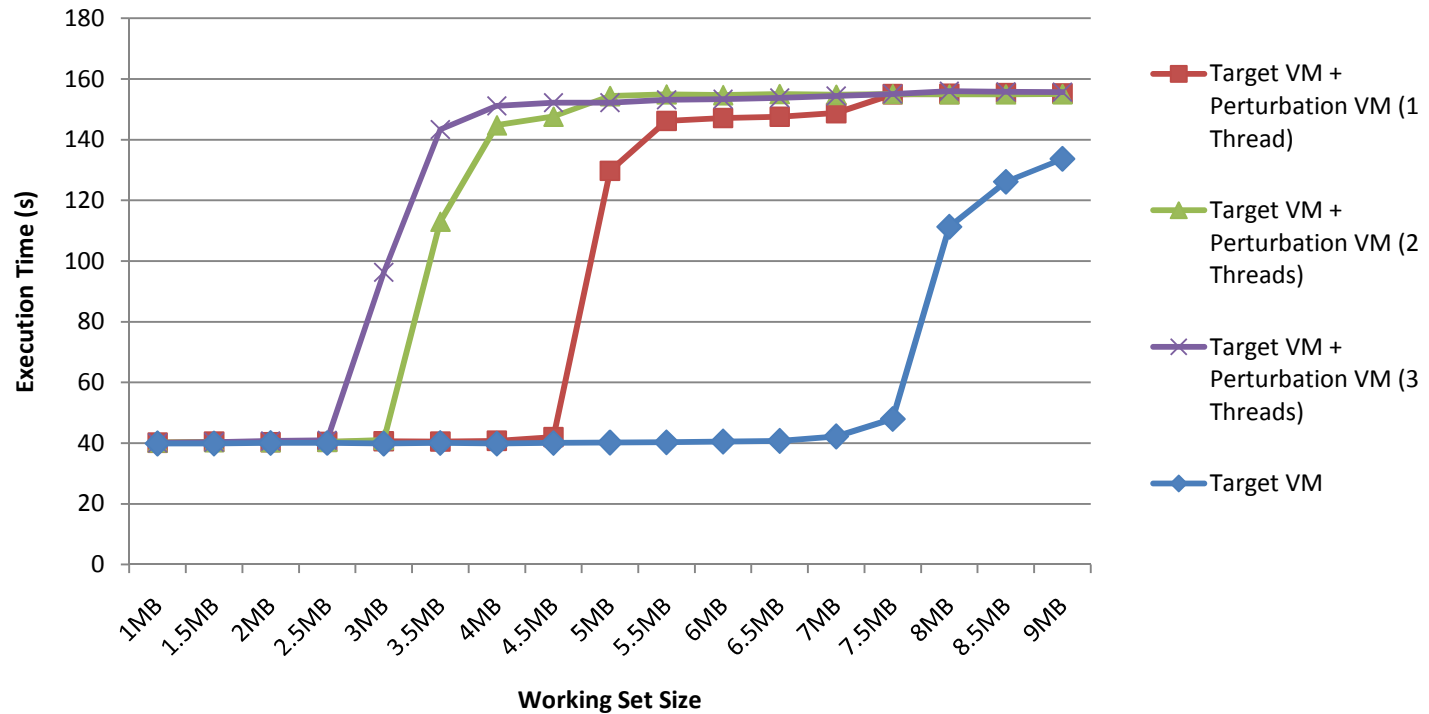
Cache Hierarchy Aware Core Assignment



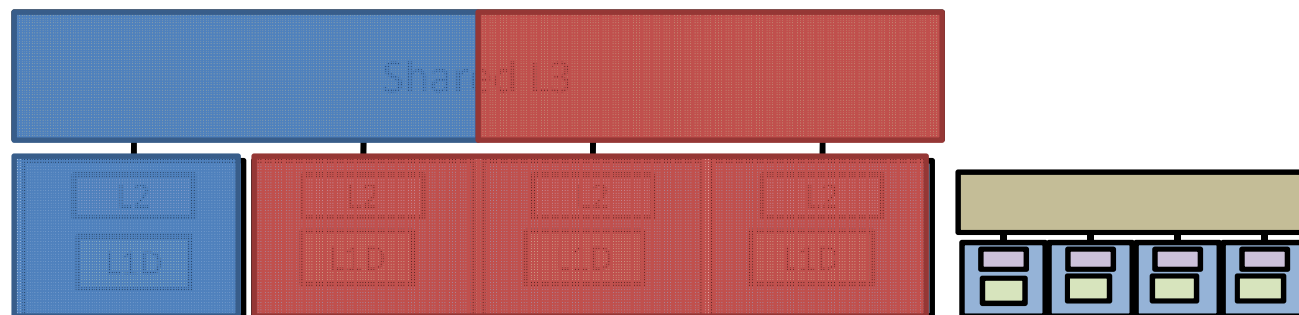
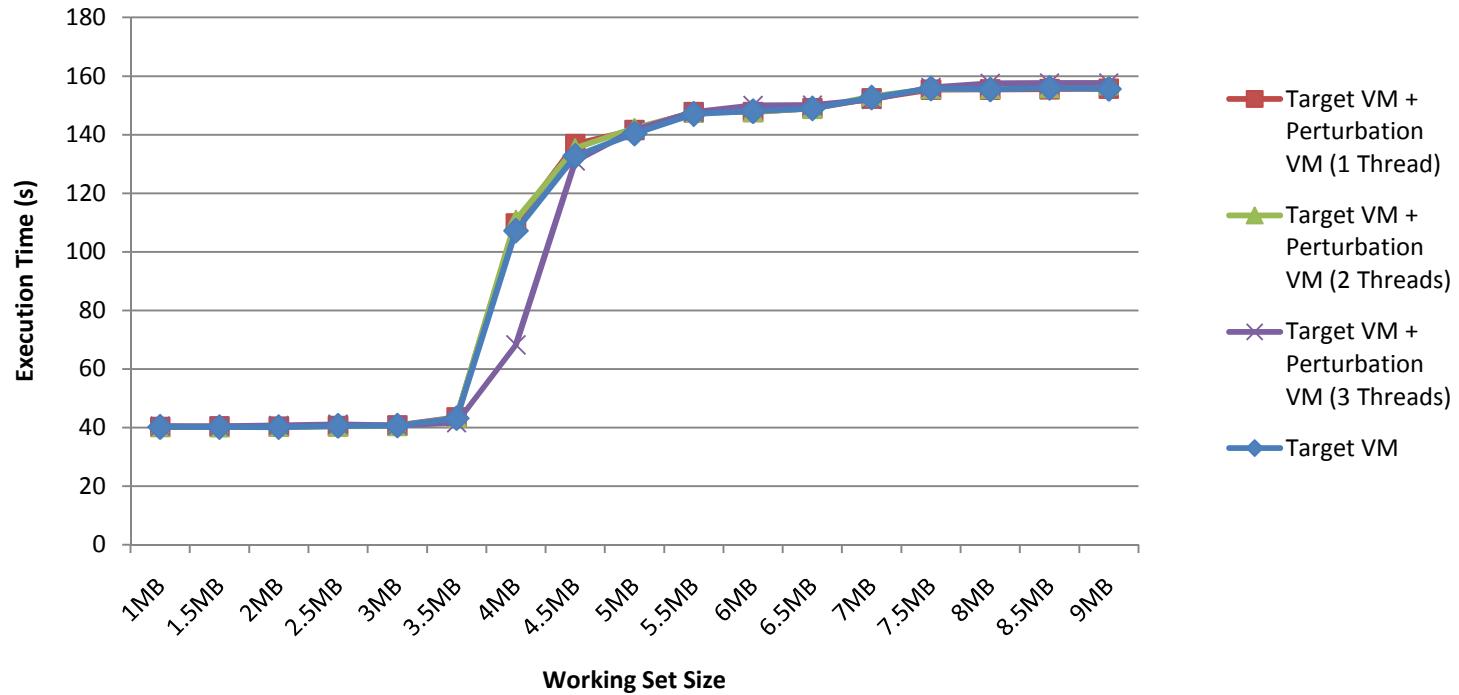
Page-coloring Based Cache Partitioning



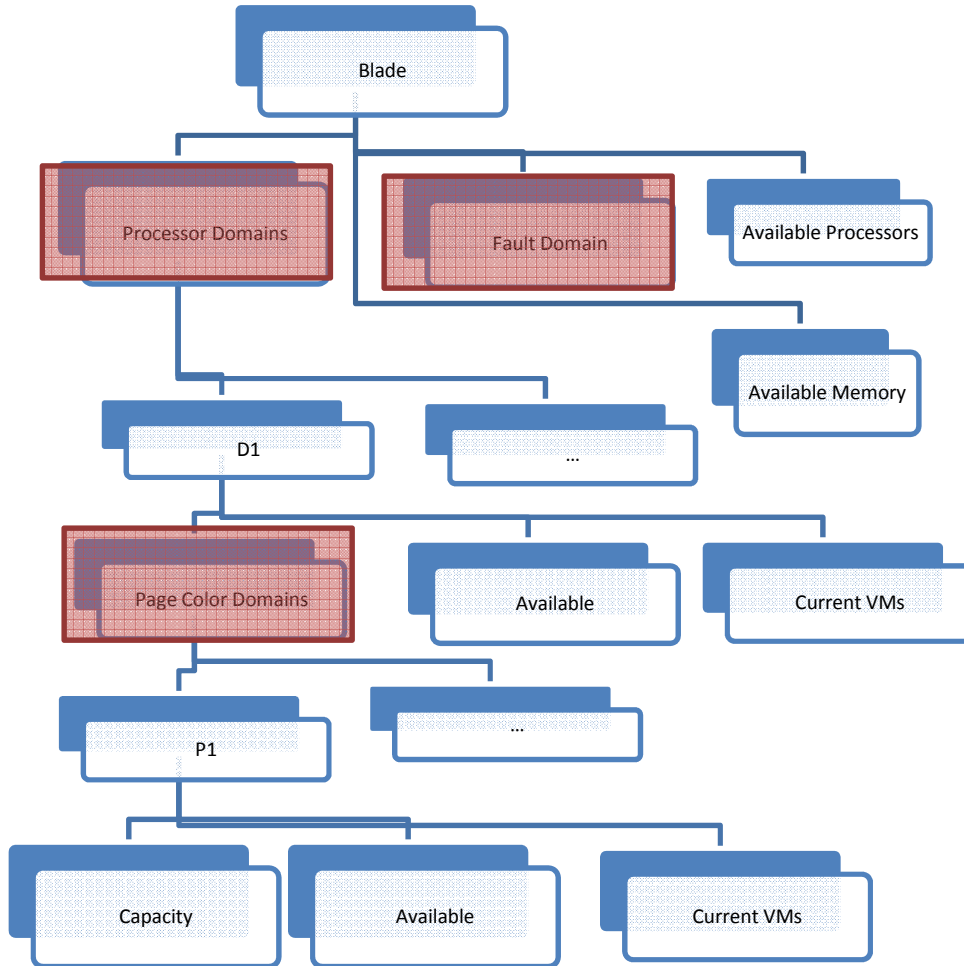
Results: No Isolation



Results: Cache-coloring



Integration with VM Placement System



- Constraints on resources
 - New isolation constraints
- 4000 blade cloud, <80% utilization, ~30-40 ms for search without backtracking (with high success probability)
- Working on other heuristics for CSP with system dynamism
 - Migration

Conclusions

- Incorporation of isolation attributes in the SLA
- System-level mechanisms to address isolation
- RM enhancements with isolation related constraints



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