Improving Backfilling Scheduling

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Backfilling

• Allows job to start before other jobs in waiting queue if these are not delayed
• Need job runtimes to check delays
• Imprecise runtime estimates
• First-come-first-served backfilling order
• Delay guarantees frequently of little practical value
Basic Improvements

- Priority order improves not only high priority jobs, but average performance, too
- Random order as extension of priority order
- Shortest-first backfilling order, and combination with priority order
- Eliminating delay guarantees
Speculative Backfilling

- Speculate smaller than estimated runtimes, e.g., 1/2 of estimated runtimes
- Speculative Test Runs:
  run long jobs for around 5 minutes to check if they fail
Application Reconfiguration

- Run jobs with different parallelism
- Greedy strategy
- Always use smaller parallelism
- Smaller parallelism before start, widen at start, if possible
Basic Improvements

PBS Bounded slowdown

Slowdown Delay

Normalized Metric

BF
P
R
1/L
P/L
R/L
P-NG
R-NG
1/L-NG
P/L-NG
R/L-NG
Speculation & Reconfiguration

![Bar chart showing bounded slowdown for different configurations: BF, BF-NG, P, P-NG, P/L, P/L-NG. The y-axis represents bounded slowdown, and the x-axis shows different configurations. The chart includes data for orig, spec, spec+test, greedy-2, Halfsw, and Halfsptrsw.]