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Scheduling Jobs Across Geo-distributed Datacenters

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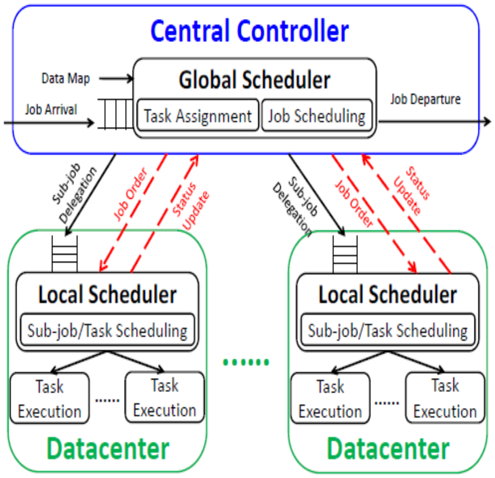
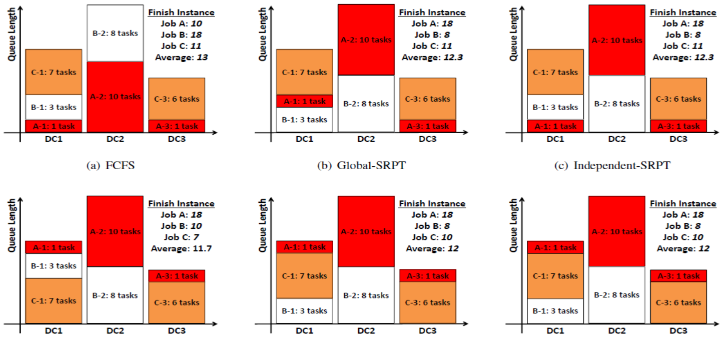
Motivation and System Architecture

- Tasks of the jobs are distributed across the datacenters for data locality to save bandwidth and completion time.
- The imbalance in tasks distribution and the workloads at each datacenters necessitate new scheduling techniques.

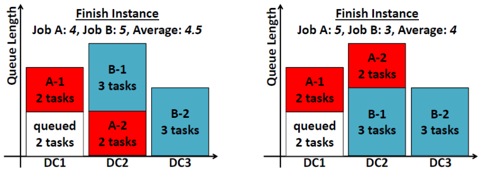




(a) FCFS (b) Global-SRPT (c) Independent-SRPT

(d) *SWAG* (e) Global-SRPT w/*Reordering* (f) Independent-SRPT w/*Reordering*

Job ID	Arrival Sequence	#Remaining Tasks in DC1	#Remaining Tasks in DC2	#Remaining Tasks in DC3	Total #Remaining Tasks
A	1	1	10	1	12
B	2	3	8	0	11
C	3	7	0	6	13



(a) SRPT-based Approach (b) Better Approach

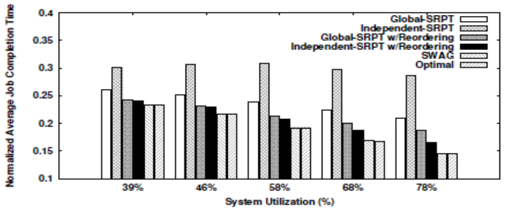
Reordering-based Scheduling Approach

✓ Serve as a post-processing adjustment to improve any scheduling results.
✓ Yield the resources to other tasks if not hurting its job's overall completion time.
✓ Provably do no harm to the average job completion time for any job scheduling.

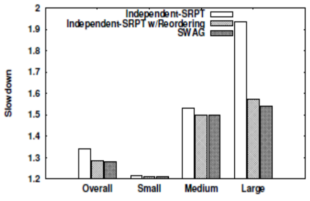
*W*orkload-*A*ware *G*reedy *S*cheduling (SWAG)

✓ A generic scheduling solution that computes the job order for all the jobs.
✓ Prioritize the jobs based on estimated finish times along with current workload.
✓ Greedily schedule the job that can finish quickly across all the datacenters.

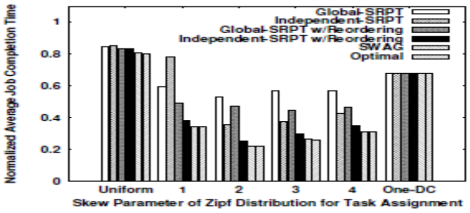
Performance Improvements



Fairness



Performance Sensitivity



★ SWAG and Reordering result in a significant performance improvement, up to **50%** and **30%** respectively, over SRPT-based scheduling.

★ SWAG and Reordering improve average job completion time while maintaining reasonable fairness, even for the large jobs, compared to SRPT-based scheduling.

★ The biggest improvements are observed when the system is highly-loaded or there exists a high skew in workload, either in job sizes or in task assignments.

★ Without workload skew or in lightly-loaded systems, SWAG and Reordering exhibit similar performance compared to SRPT-based scheduling.

Summary and Extensions

- SWAG vs. Reordering
  -SWAG provides greater improvements with reasonable overhead.
  -Reordering is light-weight and easily added to any scheduling approach.
- Heterogeneous datacenter capacity (#slots)
- Scheduling jobs with DAG of tasks
- Flow scheduling for intermediate data shuffling