CLOUD COMPUTING CONCEPTS

with Indranil Gupta (Indy)

SCHEDULING

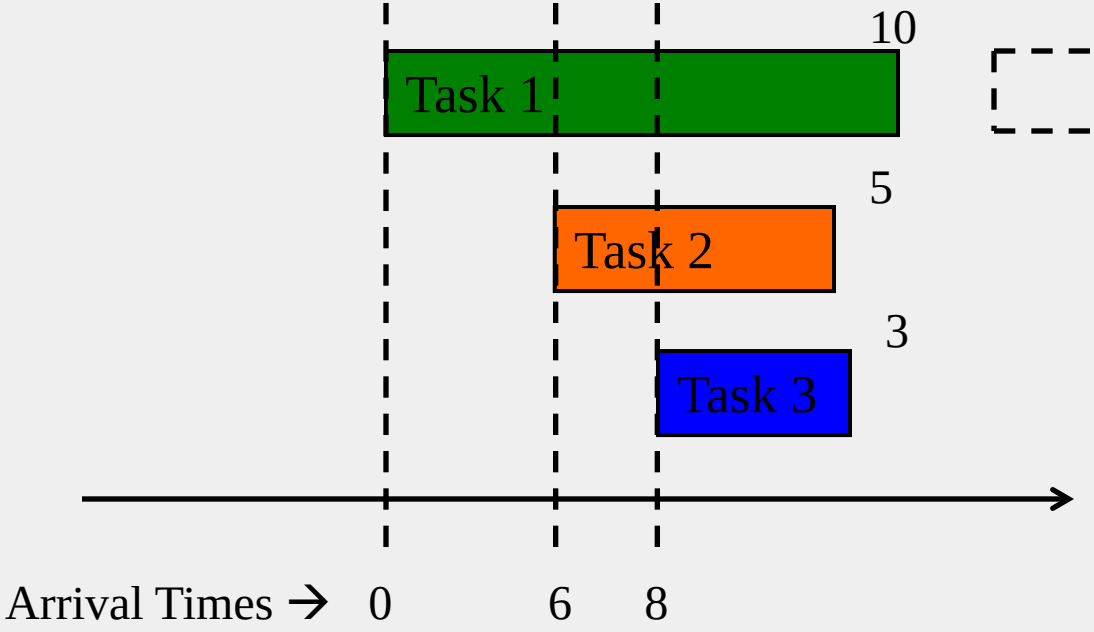
Lecture A

SINGLE-PROCESSOR SCHEDULING

Why Scheduling?

- Multiple “tasks” to schedule
  - The processes on a single-core OS
  - The tasks of a Hadoop job
  - The tasks of multiple Hadoop jobs
- Limited resources that these tasks require
  - Processor(s)
  - Memory
  - (Less contentious) disk, network
- Scheduling goals
  1. Good throughput or response time for tasks (or jobs)
  2. High utilization of resources

Single Processor Scheduling

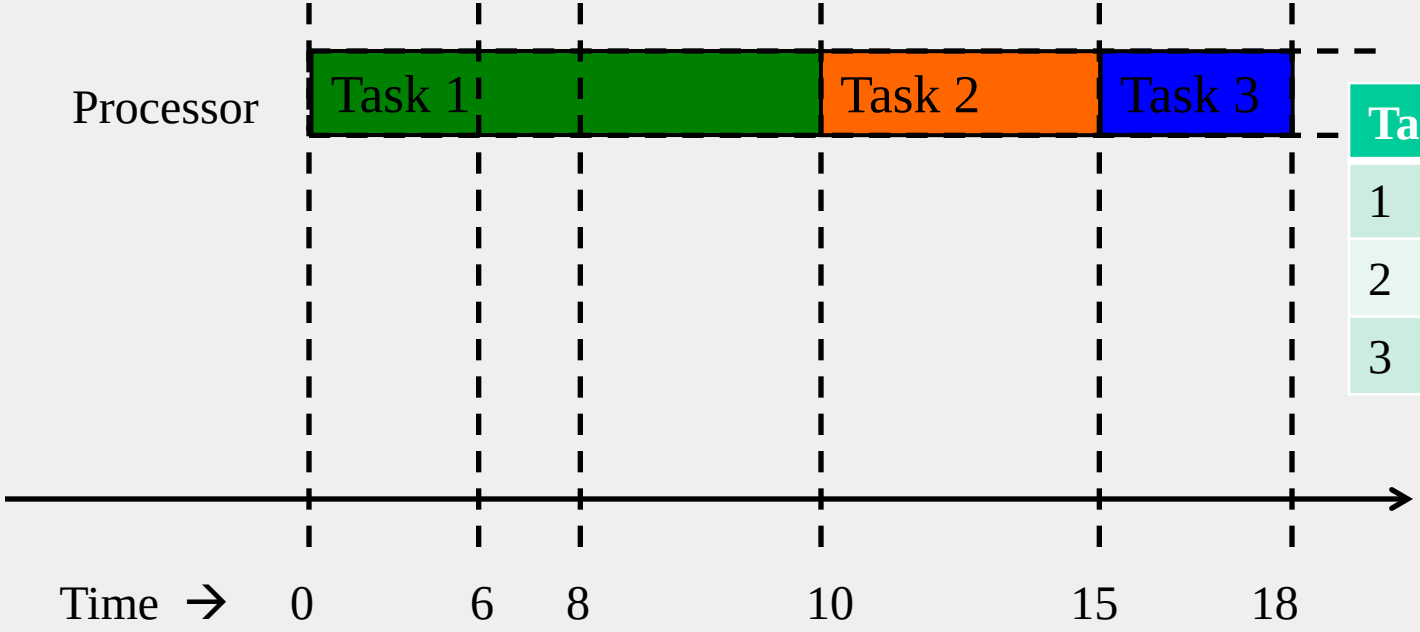


Which tasks run when?

Processor

Task	Length	Arrival
1	10	0
2	5	6
3	3	8

FIFO Scheduling (First-In First-Out)/FCFS



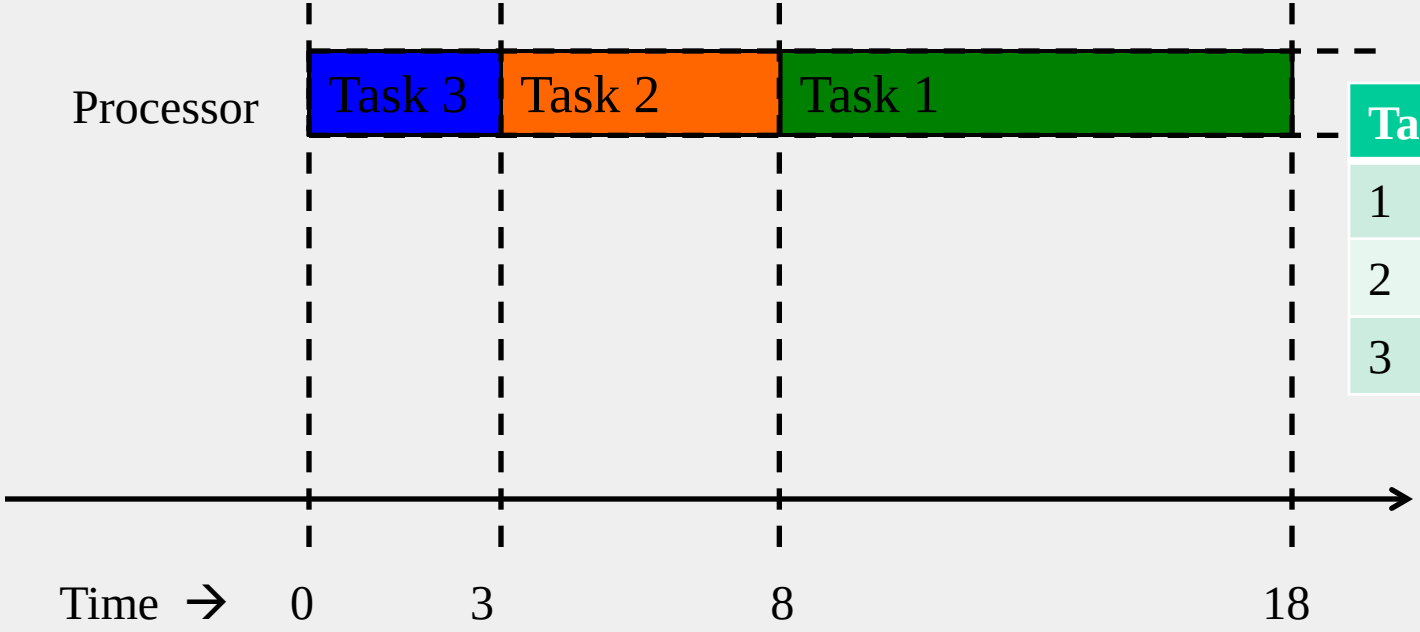
Task	Length	Arrival
1	10	0
2	5	6
3	3	8

- *Maintain tasks in a queue in order of arrival*
- *When processor free, dequeue head and schedule it*

FIFO/FCFS Performance

- Average completion time may be high
- For our example on previous slides,
  - Average completion time of FIFO/FCFS =
    (Task 1 + Task 2 + Task 3)/3
  = (10+15+18)/3
  = 43/3
  = 14.33

STF Scheduling (Shortest Task First)



Task	Length	Arrival
1	10	0
2	5	0
3	3	0

- *Maintain all tasks in a queue, in increasing order of running time*
- *When processor free, dequeue head and schedule*

STF Is Optimal!

- Average completion of STF is the shortest among *all* scheduling approaches!
- For our example on previous slides,
  - Average completion time of STF =

    (Task 1 + Task 2 + Task 3)/3

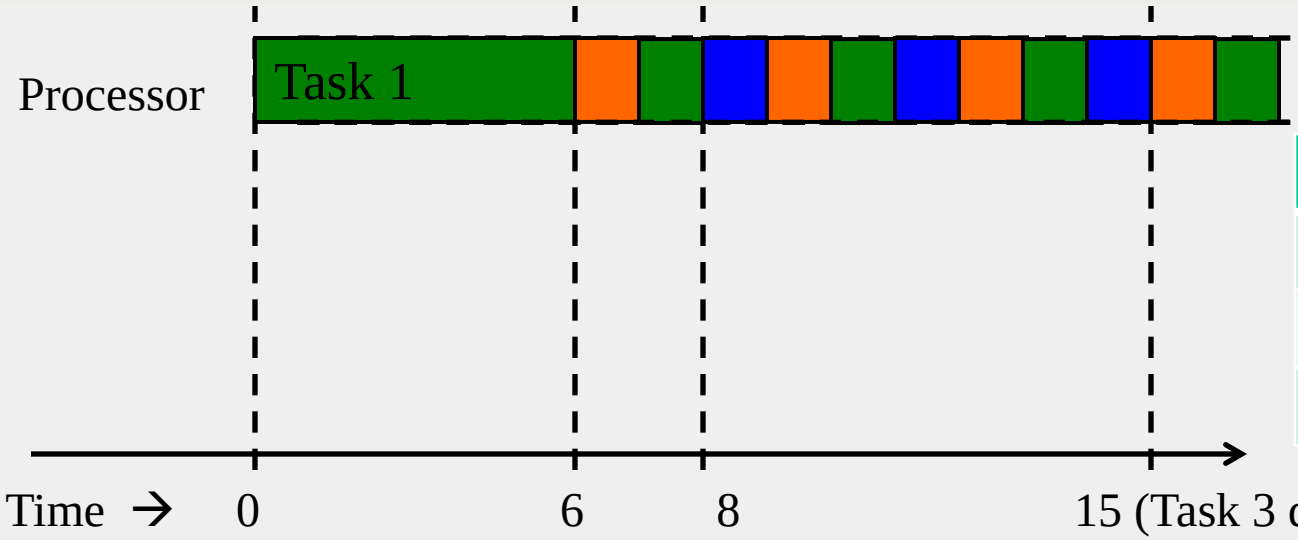
    = (18+8+3)/3

    = 29/3

    = 9.66

    (versus 14.33 for FIFO/FCFS)
- In general, STF is a special case of *priority scheduling*
  - Instead of using time as priority, scheduler could use user-provided priority

Round-Robin Scheduling



Task	Length	Arrival
1	10	0
2	5	6
3	3	8

- *Use a quantum (say 1 time unit) to run portion of task at queue head*
- *Pre-empts processes by saving their state, and resuming later*
- *After pre-empting, add to end of queue*

Round-Robin vs. STF/FIFO

- Round-Robin preferable for
  - Interactive applications
  - User needs quick responses from system
- FIFO/STF preferable for Batch applications
  - User submits jobs, goes away, comes back to get result

Summary

- Single processor scheduling algorithms
  - FIFO/FCFS
  - Shortest task first (optimal!)
  - Priority
  - Round-robin
  - Many other scheduling algorithms out there!
- What about cloud scheduling?
  - Next!