Distributed Global Scheduling in Datacenters

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State-of-the-Art Scheduling

Underutilised Datacenter Resources

Azure[1]

❖ 60% VMs have <= **20%** CPU usage!

Alibaba[2]

❖ Average server CPU **50%**

❖ Memory <= **60%**

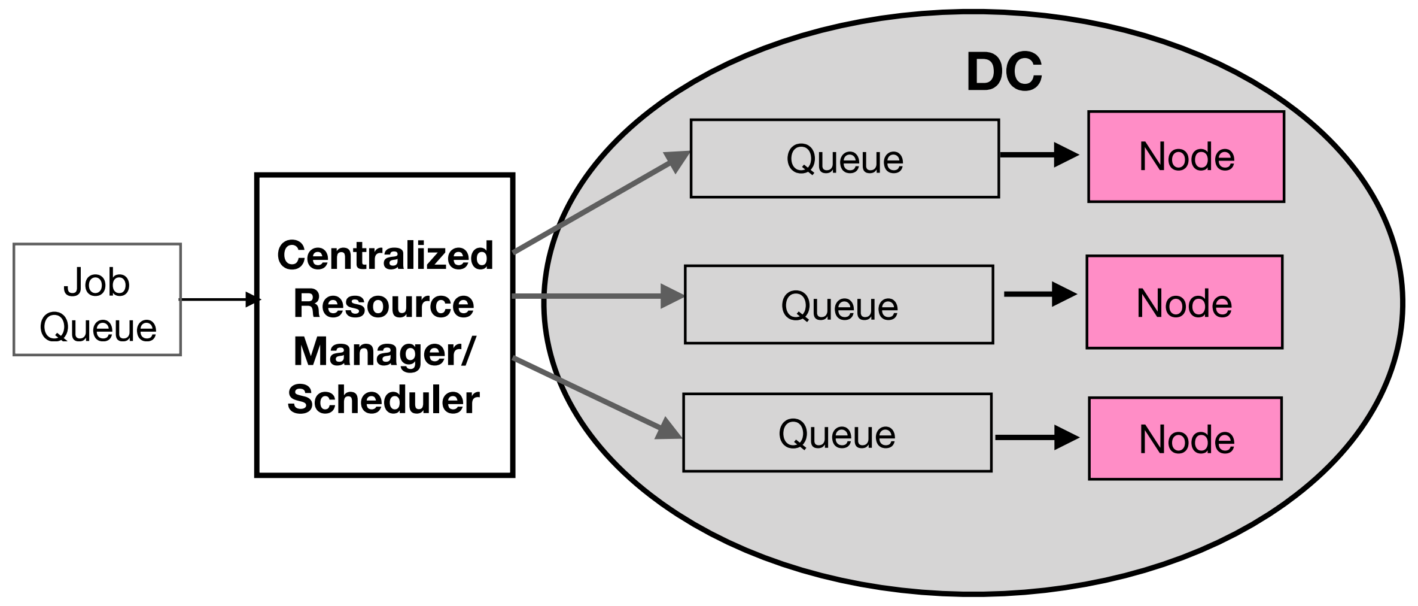
Underutilisation is expensive![3]

[1] *[Resource Central, SOSP,'17]*

[2] [https://github.com/alibaba/clusterdata]

[3] *[Scalable system scheduling for HPC and big data, JPDC,17]*

Centralised



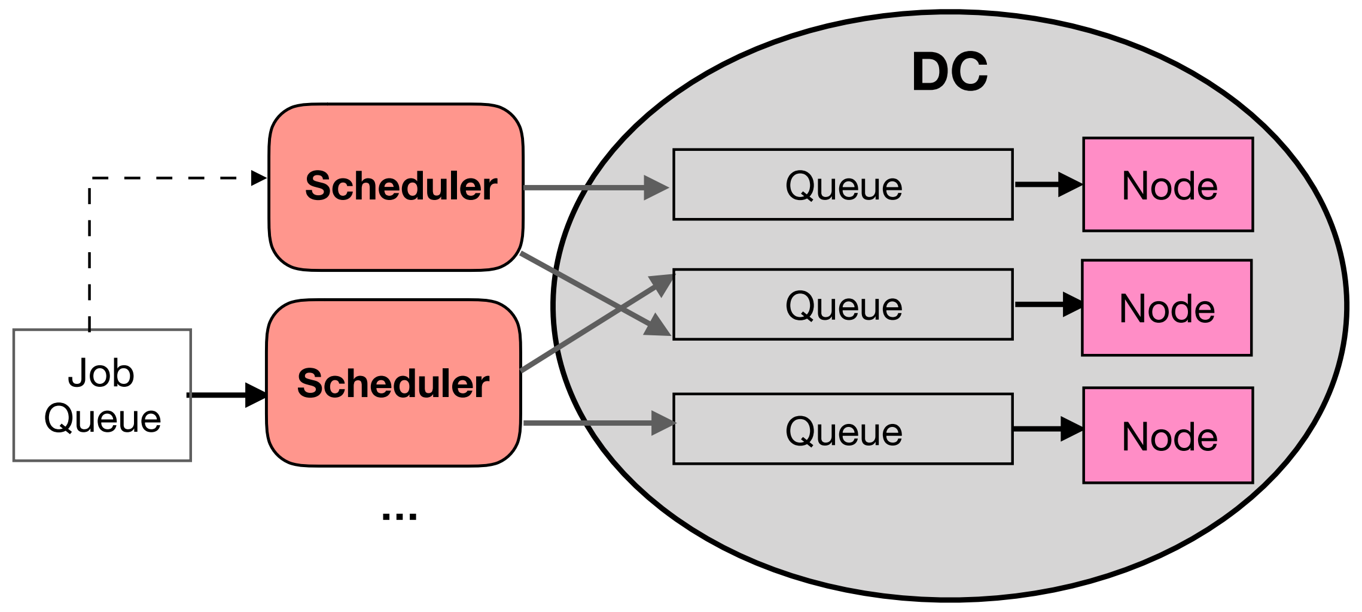
Examples - Mesos *[NSDI'11]*, **Yarn, Apollo** *[OSDI'14]*

☑ Global resource view

✗ Scheduler can be a bottleneck

✗ Delayed, high volumes of resource updates

Decentralised



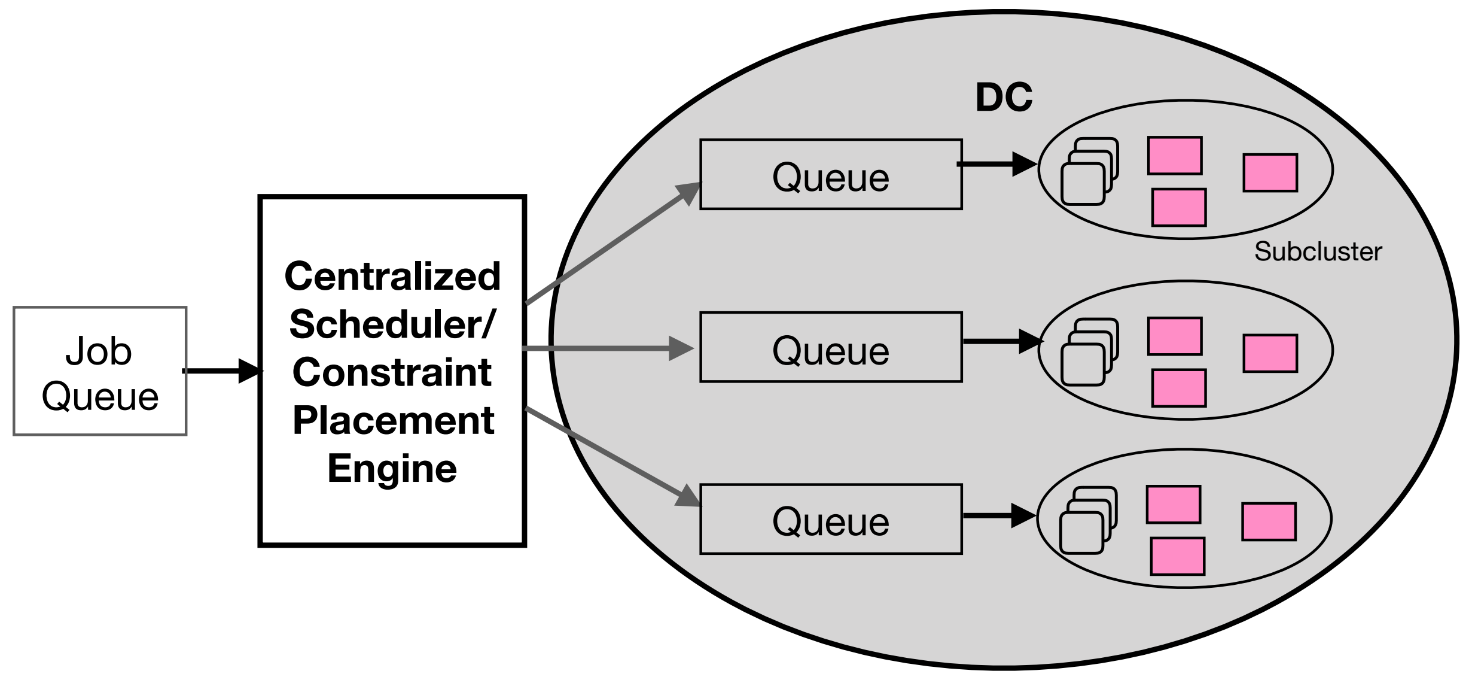
Example - Sparrow *[NSDI'14]*

☑ Fast and simple

✗ Unsuitable for long running jobs

✗ Not globally optimal

Hybrid



Example - Hydra *[NSDI'19]*, **Medea** *[EuroSys'18]*, **Borg** *[EuroSys'15]*

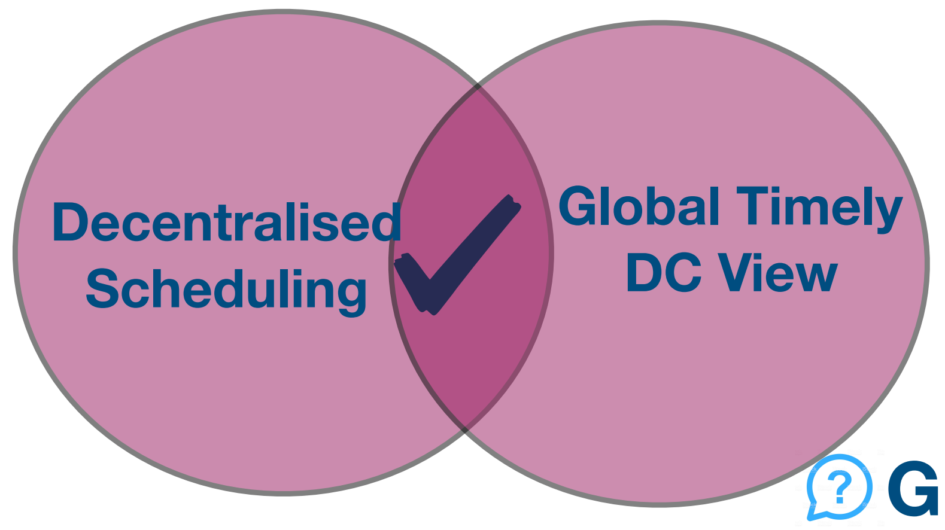
☑ Policy-driven job/task placement

☑ Less node information traffic

✗ Centralised or decentralised components

Proposed Direction

Global Scheduling at Node Level



Challenges

? Good for long and short jobs

? Volume and frequency of updates

? Time from local to global view

Up-to-Date Global View at Each Node

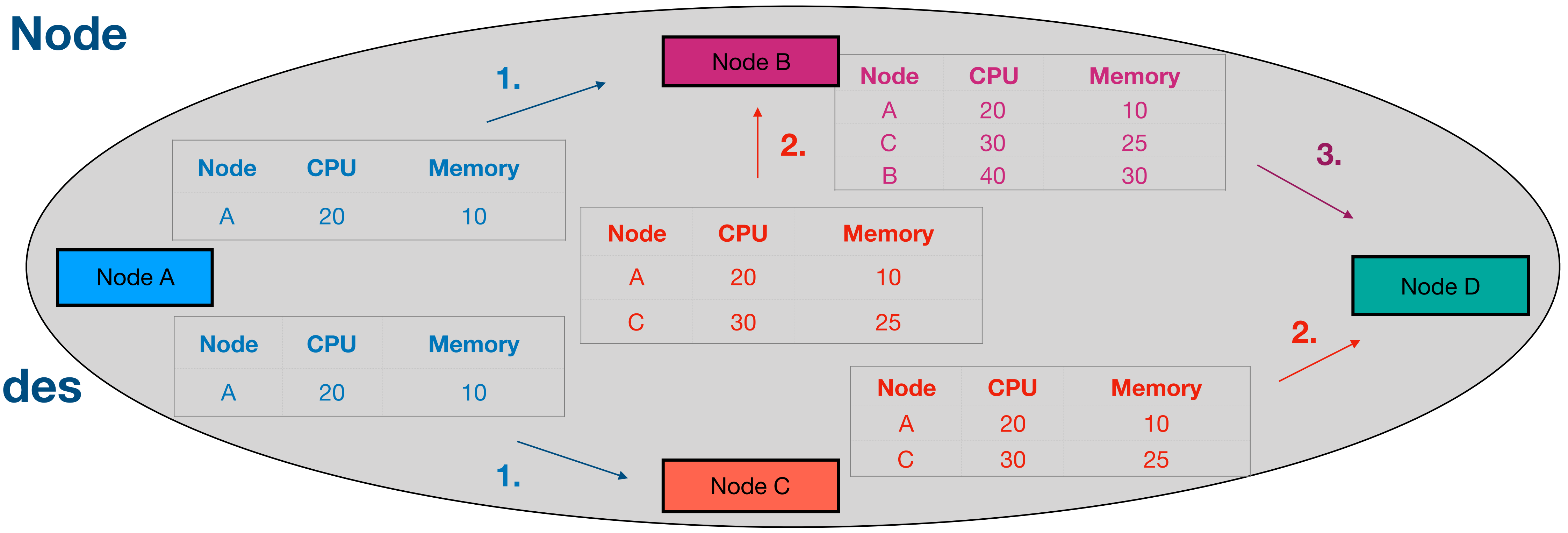
Inspired by routing protocols

☑ BGP, OSPF, ...

☑ Resource data propagation

☑ Global view convergence

☑ Same ranking policy across nodes



Node	CPU	Memory
A	20	10

Node	CPU	Memory
A	20	10

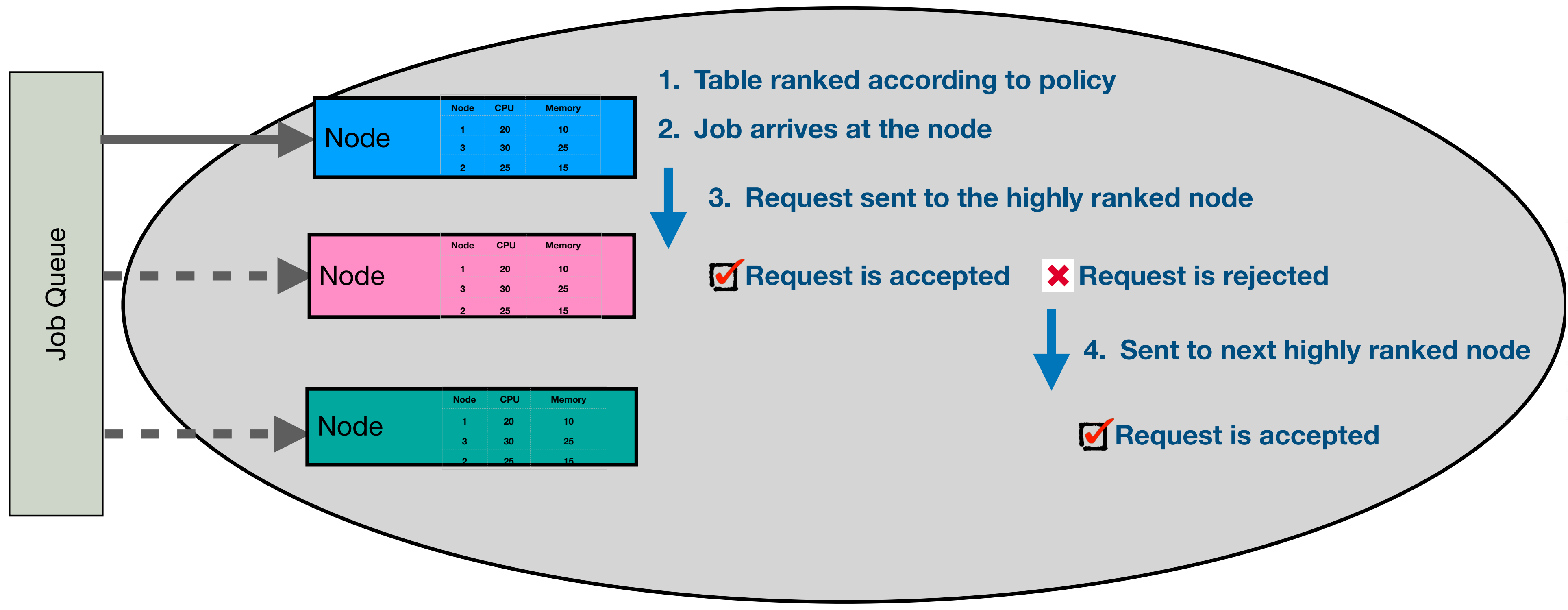
Node	CPU	Memory
A	20	10
C	30	25

Node	CPU	Memory
A	20	10
C	30	25
B	40	30

Node	CPU	Memory
A	20	10
C	30	25

Scheduling Using "Up-to-Date" Global View

Intra-DC Scheduling



Node	CPU	Memory
1	20	10
3	30	25
2	25	15

Node	CPU	Memory
1	20	10
3	30	25
2	25	15

Node	CPU	Memory
1	20	10
3	30	25
2	25	15

1. Table ranked according to policy
2. Job arrives at the node
3. Request sent to the highly ranked node

☑ Request is accepted ✗ Request is rejected

4. Sent to next highly ranked node

☑ Request is accepted

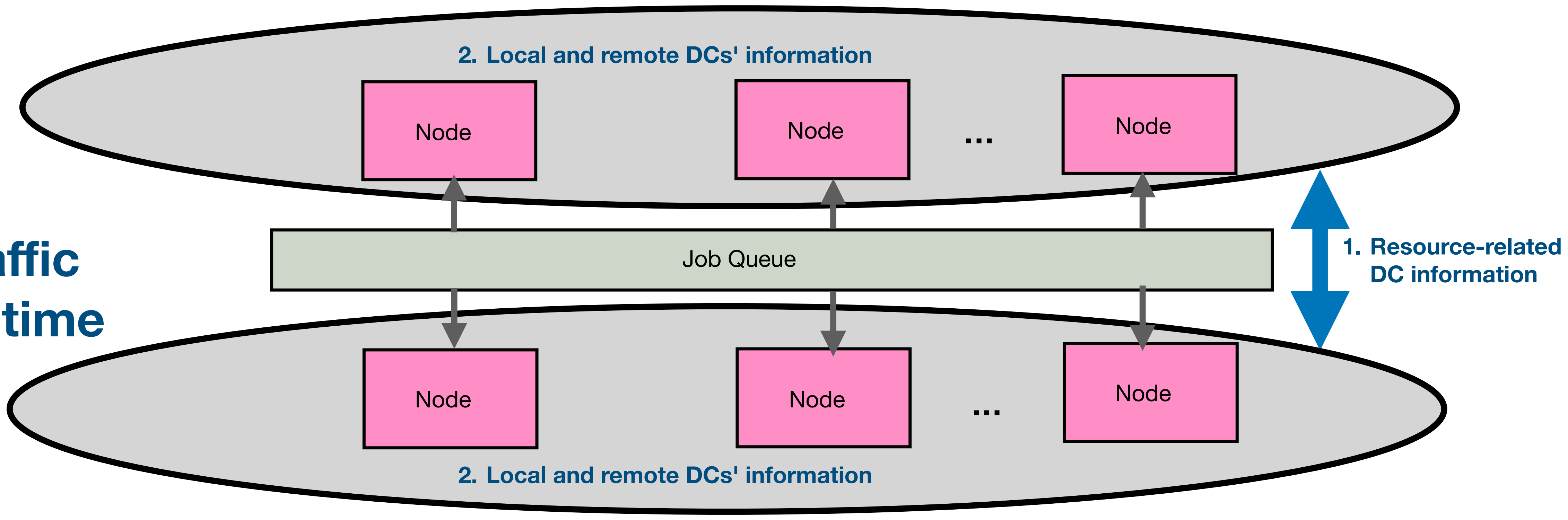
Challenges

? Collision avoidance

? Minimise inter-DC traffic

? Minimise scheduling time

Inter-DC Scheduling


2. Local and remote DCs' information
Node
Node
...
Node
Job Queue
1. Resource-related DC information
Node
Node
...
Node
2. Local and remote DCs' information