Distributed Global Scheduling in Datacenters

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Underutilised Datacenter resources

Azure*
- 60% VMs have <= **20%** CPU usage!

Alibaba** -
- Average server CPU **50%**
- Memory <= **60%**

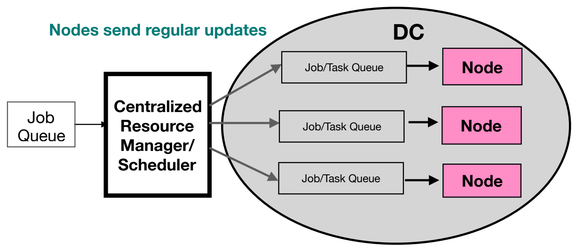
100MW DC*
1% compute cycles = Small City Energy-Saving

Datacenter resources can be better utilised!

**Resource Central, SOSP'17*
***https://github.com/alibaba/clusterdata*
****Scalable system scheduling for HPC and big data, JPDC'17*

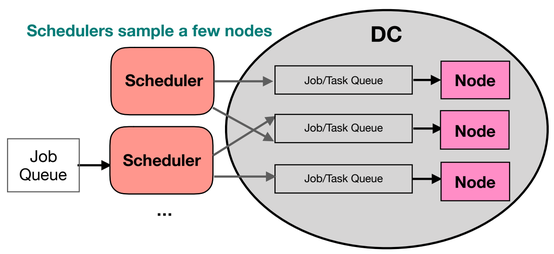
Schedulers In Datacenter

Centralized



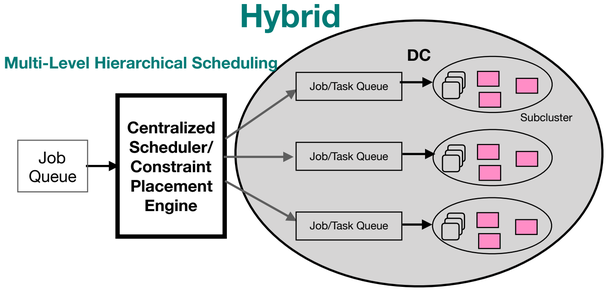
Examples - Mesos *[NSDI'11]*, **Yarn, Apollo** *[OSDI'14]*
- ☑ **Global resource view**
- ✖ **Scheduler bottleneck**
- ✖ **Large node status traffic**

Decentralised



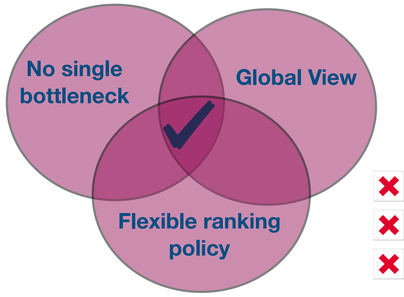
Example - Sparrow *[NSDI'14]*
- ☑ **Fast and simple**
- ✖ **Unsuited for Long Running Applications**
- ✖ **Not globally optimal**

Hybrid



Example - Hydra *[NSDI'19]*, **Medea** *[EuroSys'18]*, **Borg** [EuroSys'15]
- ☑ **Better job/task placement**
- ☑ **Lesser node information traffic**
- ✖ **Central components**

Node Level Global Scheduling Intelligence

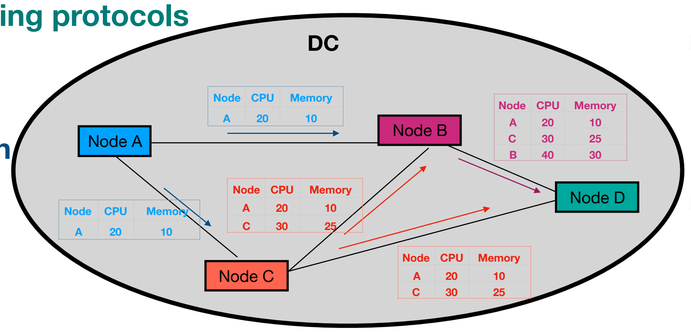


- ✖ Unsuited for short jobs
- ✖ Large node status traffic
- ✖ Non-trivial convergence time

Timely Current Global View At Each Node

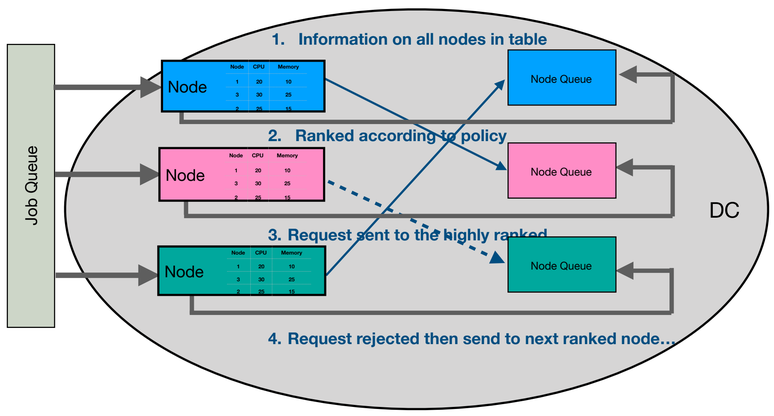
Proposed solution inspired by routing protocols

- ☑ **BGP, OSPF, ...**
- ☑ **Resource information propagation**
- ☑ **Global view convergence**
- ☑ **Identical ranking policy**



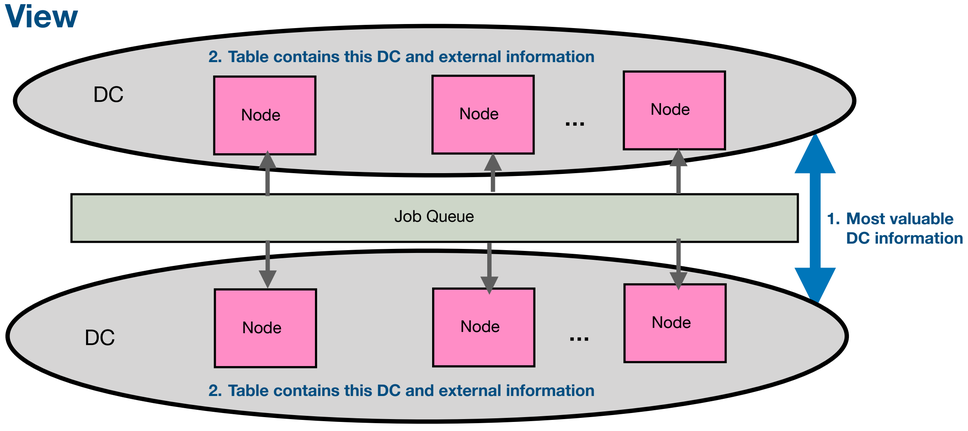
- ☑ **Resource Information**
  - ❖ **Current resource utilisation**
  - ❖ **Predicted future utilisation**
- ☑ **Ranking**
  - ❖ **Better load balancing**
  - ❖ **Higher utilisation**
  - ❖ **Best fit, worst fit, ...**

Scheduling Using Timely Current Global View



Intra-DC Load Balanced Scheduling

Various Design Approaches
- **Multiple job requests sent**
- **Resource pattern learning**
- **Suggestions?**



Inter-DC Load Balanced Scheduling