Distributed Global Scheduling in Datacenters

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Underutilised Datacenter resources

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

Alibaba** -
- Server CPU - 50% and memory usage
- Memory <= **60%**

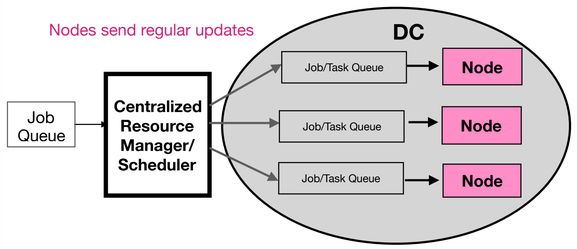
100MW DC*
1% compute cycles = Small City Energy-Saving

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*

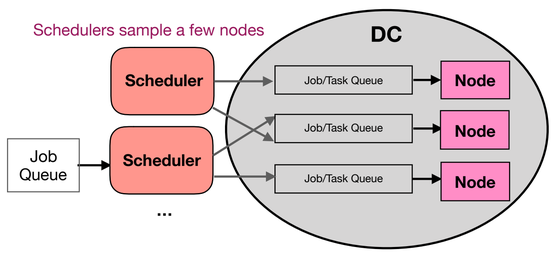
Schedulers In Datacenter

Centralized



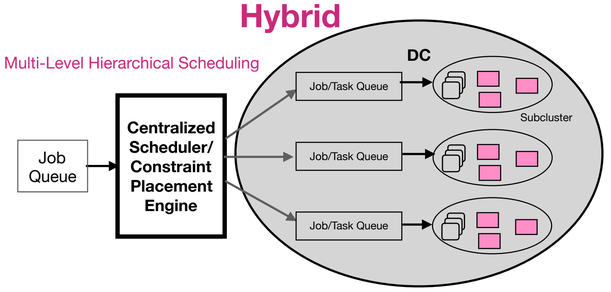
Examples - Mesos *[NSDI'11]*, Yarn, Apollo *[OSDI'14]*
☑ Global resource view
✖ Scheduler bottleneck
✖ Large node status traffic

Decentralised



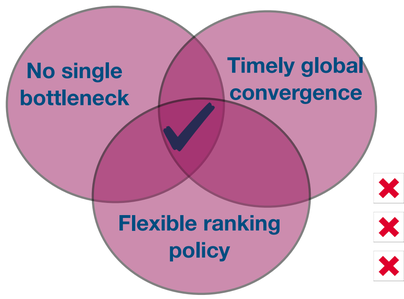
Example - Sparrow *[NSDI'14]*
☑ Fast and simple
✖ Unsuitable for Long Running Applications
✖ Not globally optimal

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

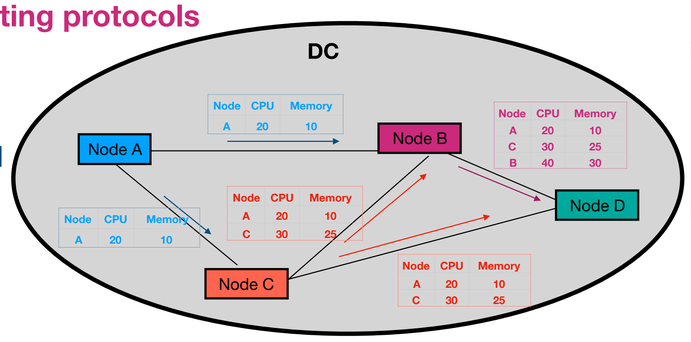


✖ Unsuited for short jobs
✖ Large node status traffic
✖ Non-trivial convergence time

Timely Current Global View At Each Node

Proposed solution inspired by routing protocols

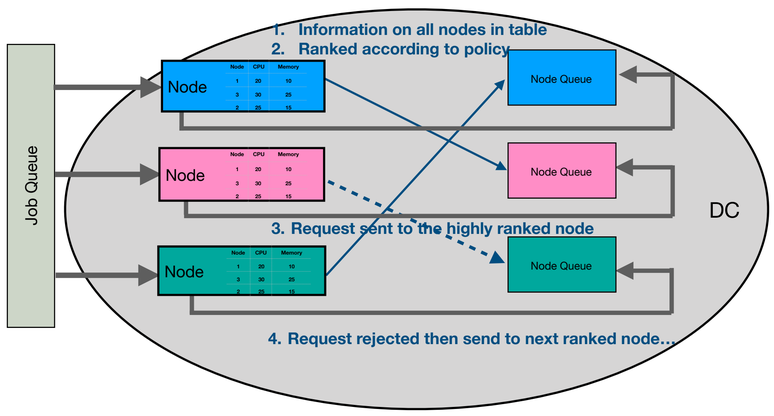
☑ **BGP, OSPF, ...**
☑ **Resource information propagated**
☑ **Global convergence**
☑ **Identical ranking policy**



☑ **Resource Information**
- ❖ **Current resource utilisation**
- ❖ **Predicted future utilisation**

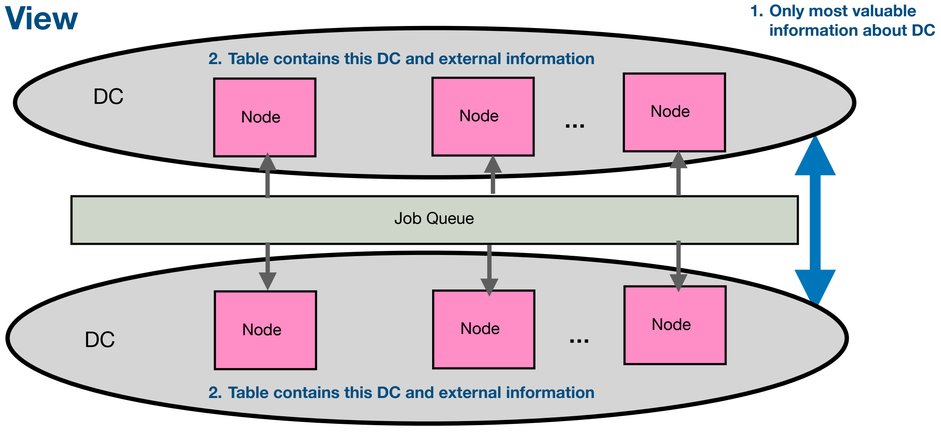
☑ **Ranking**
- ❖ **Better load balancing**
- ❖ **Higher utilisation**
- ❖ **Best fit, worst fit, ...**

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