Chair of Connected Mobility
School of Computation, Information and Technology
Technische Universität München

# Distributed State Management for Cloudless Edge Orchestration

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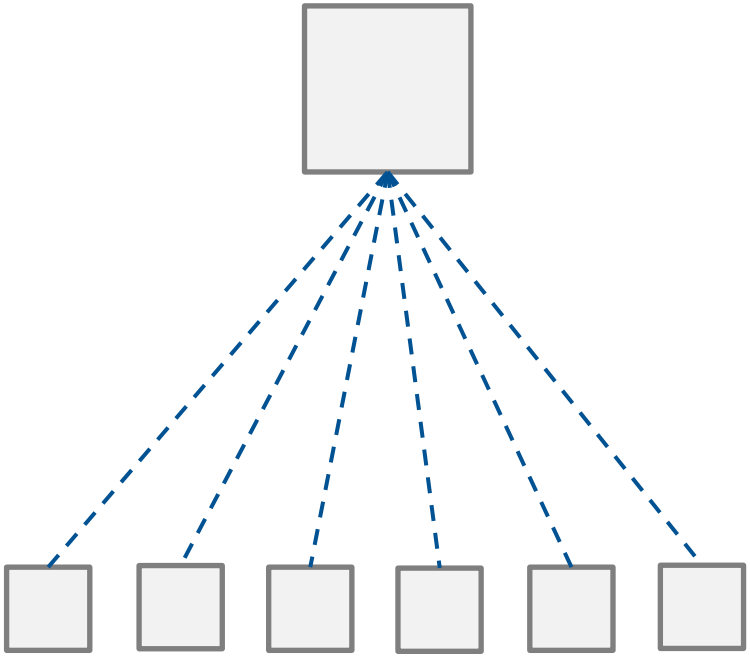
# Cloudless Edge Computing



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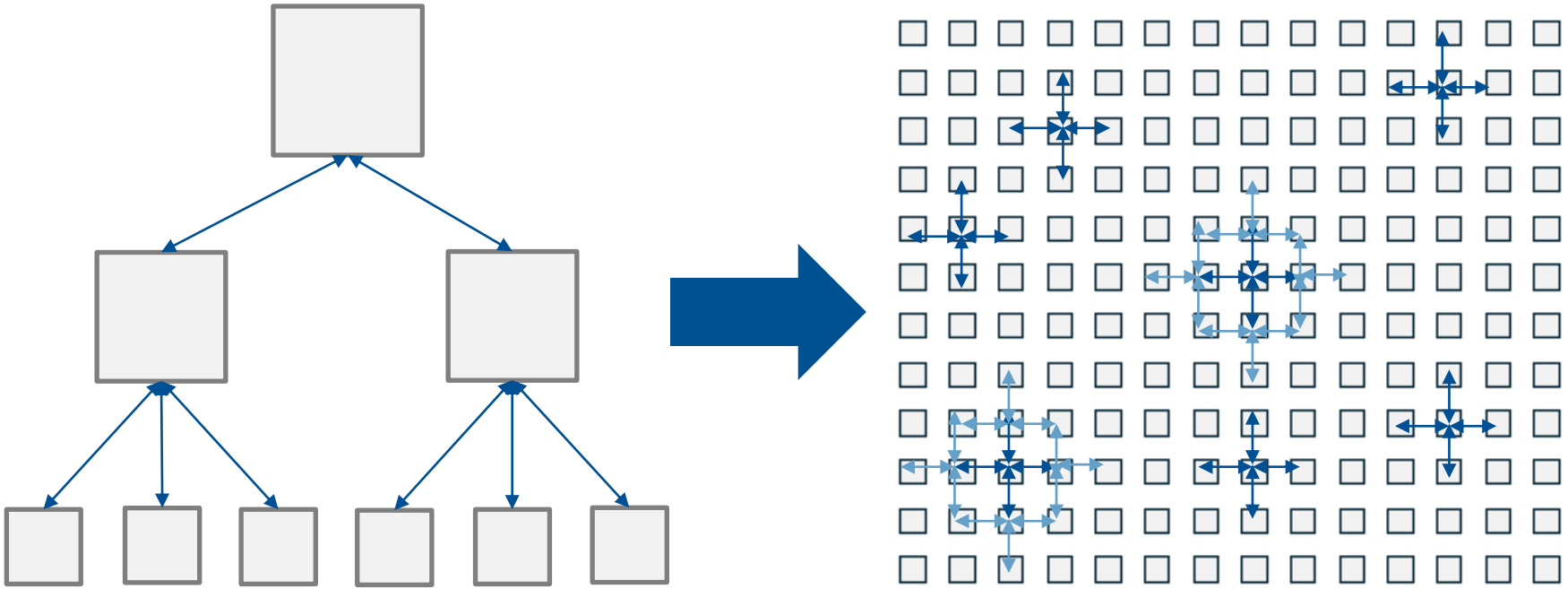
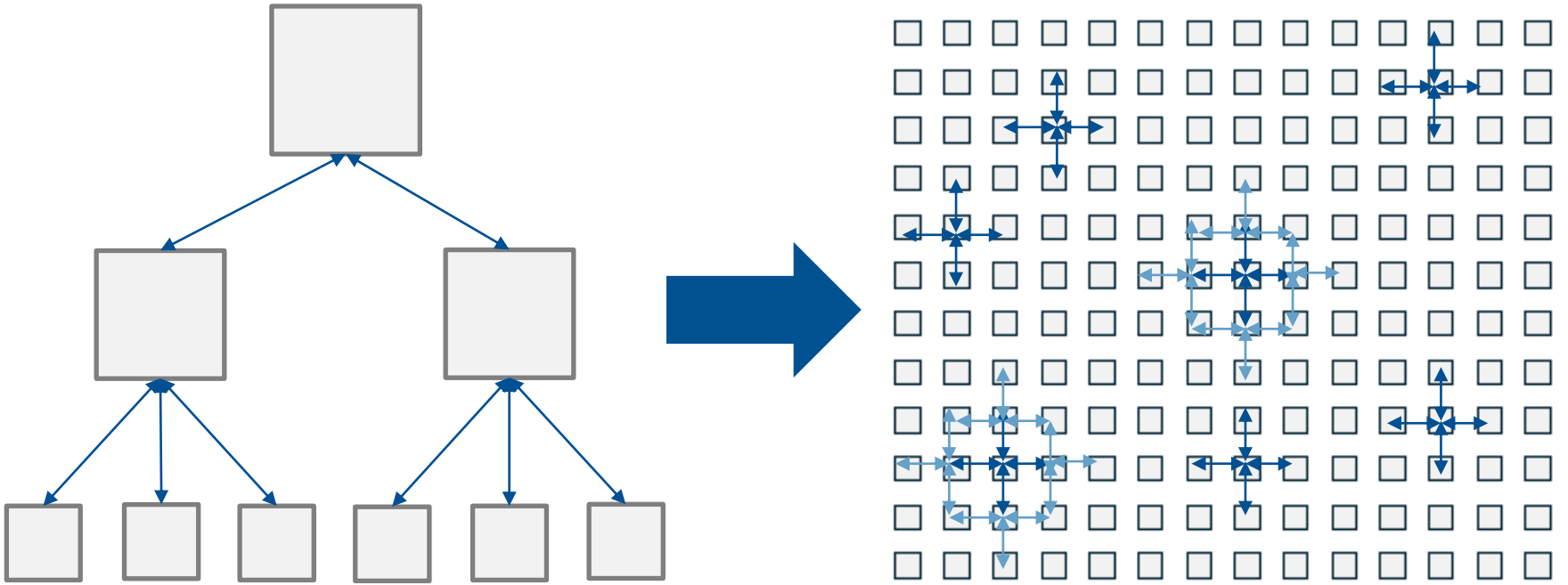
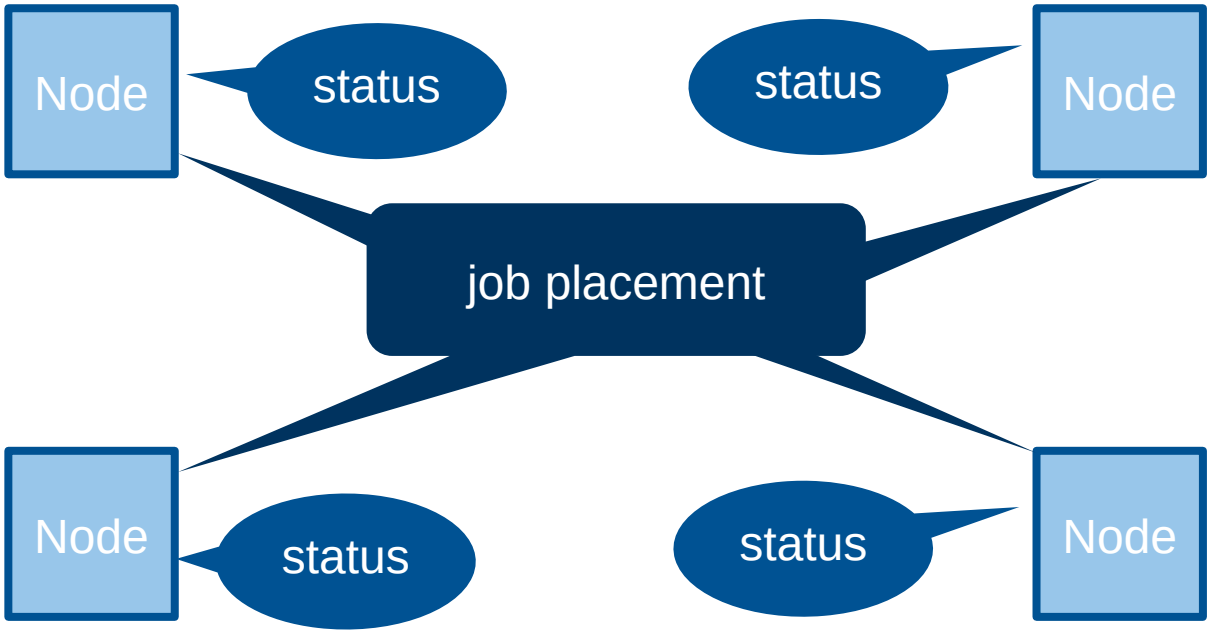
# Cloudless Edge Computing



# Cloudless Edge Computing



# Who writes what?



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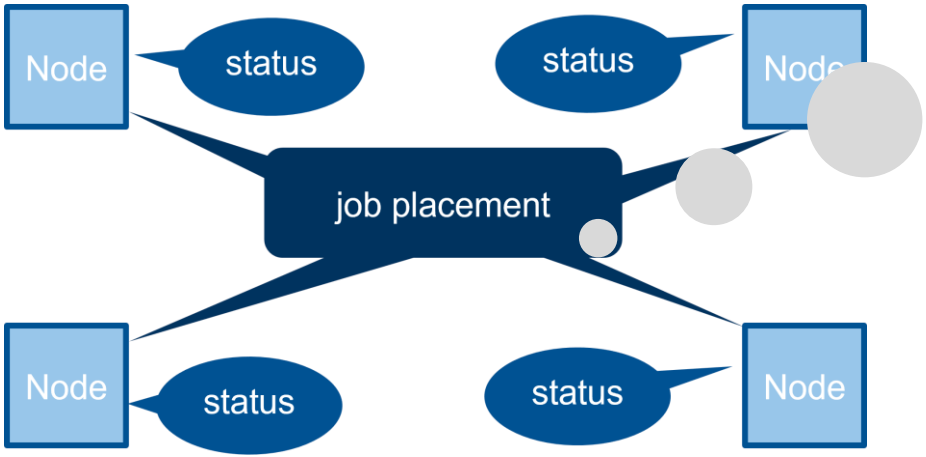


**For now:**
**How far do we get without consensus?**

# System properties

| Job |
| --- |
| cycles needed<br>ram needed |

- uniform arrival
- uniform distributed sizes & cycles needed (~execution times)

| Node |
| --- |
| #CPUs<br>cycles per CPU & clock tick<br>RAM |
| currently available RAM<br>currently available CPUs<br>queue size |

- equal specifications
- connected through links (grid structure)

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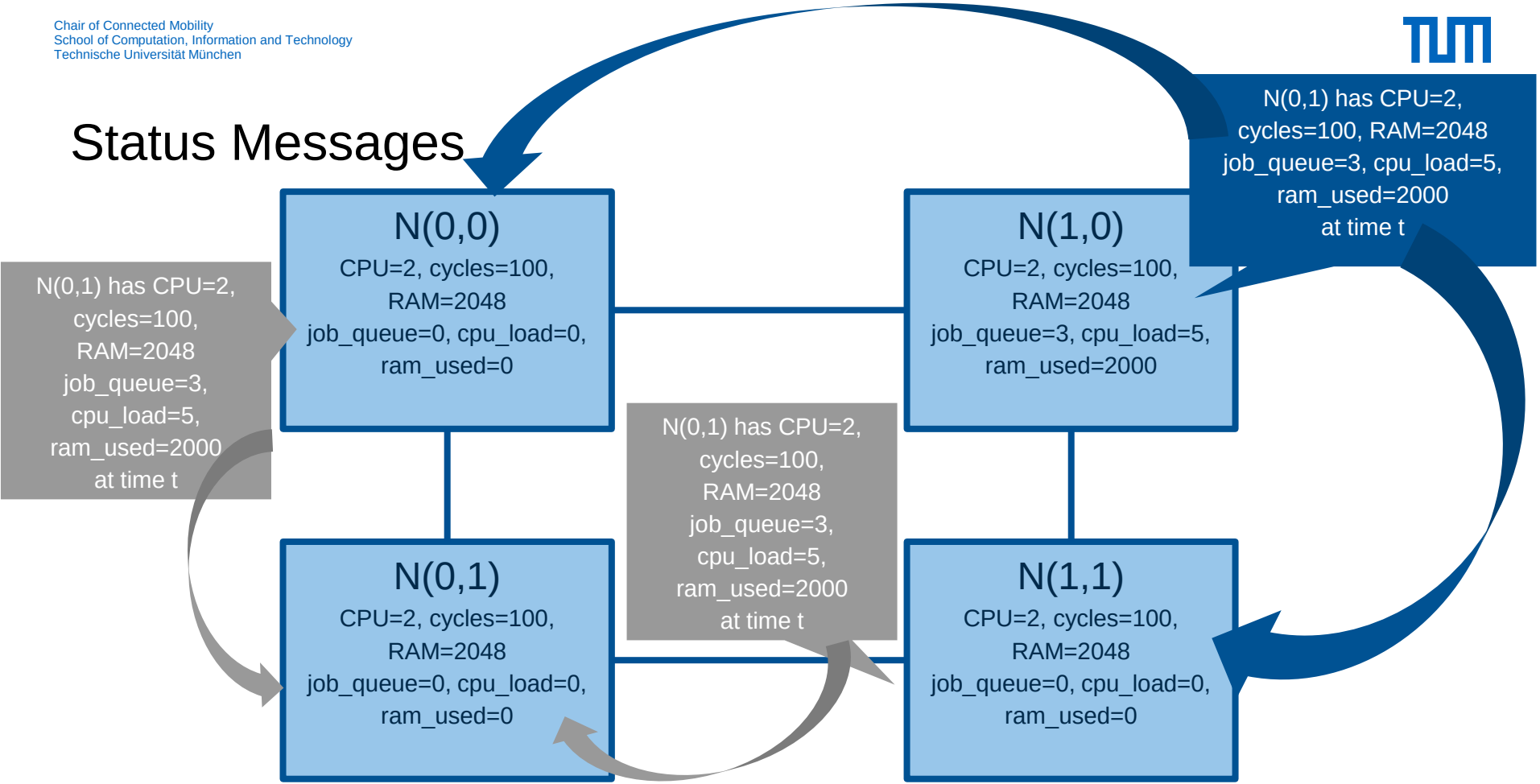
# Status Messages



# Utility Functions

distributed

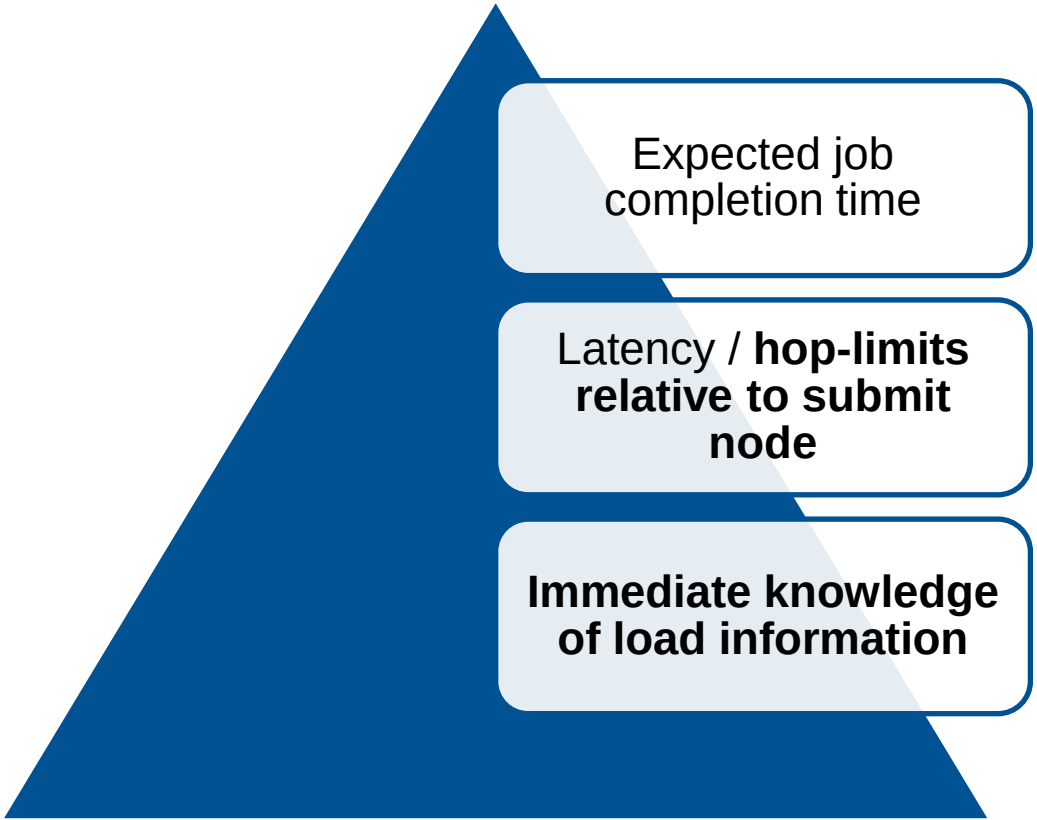
Sufficient RAM

Utility function

Neighbor reuse

- **linear** / polynomial **combinations of load, RAM used, latency, queue length …**
- best / worst fit of RAM (absolute & relative)
- job queue length
- latency / hop limit
- random / hash-based

# Oracle



# Utility Functions

- **linear** / polynomial **combinations of load, RAM used, latency, queue length …**
- best / worst fit of RAM (absolute & relative)
- job queue length
- latency / hop limit
- random / hash-based
- expected job completion time

distributed

oracle

Sufficient RAM

Utility function

**Hop** / latency **limit**

Neighbor reuse

# Example Simulation

- Nodes: all equal 2048 MB RAM, 2 CPUs, 100 “cycles” per clock tick per CPU
  - 5x5 grid; status updates every 100 clock ticks
- Links:
  - Data rate: 10 Gbit/s
  - Latency: 10 ms
- Jobs (#350):
  - Arrival rate: U(10,100)
  - Size (code : state : data) : U(64,256) : U(8,32) : U(128,512) in MB
  - Cycles: U(250000,500000)
  - Start nodes: distributed over whole grid
- Linear weights 10*load + 4*ram + 100*latency + 2*queue_length
- Oracle direct neighbors only (max_hops 1)

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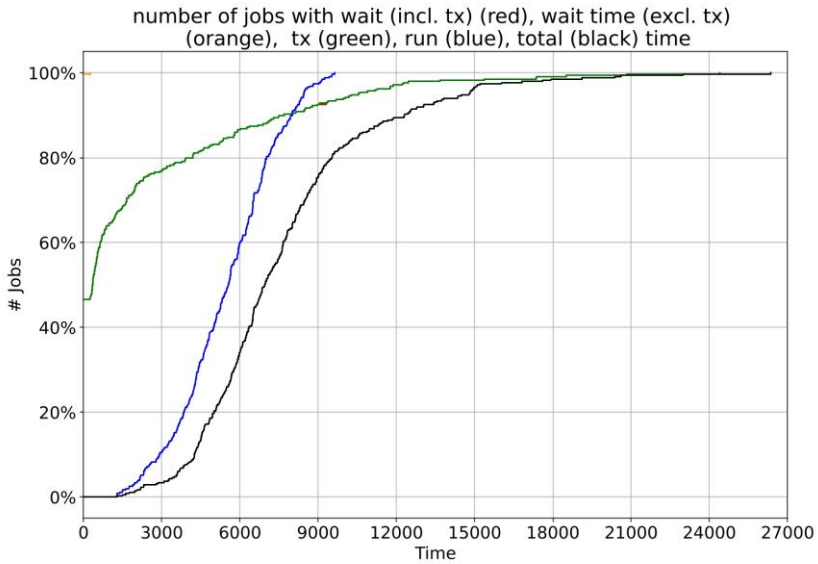
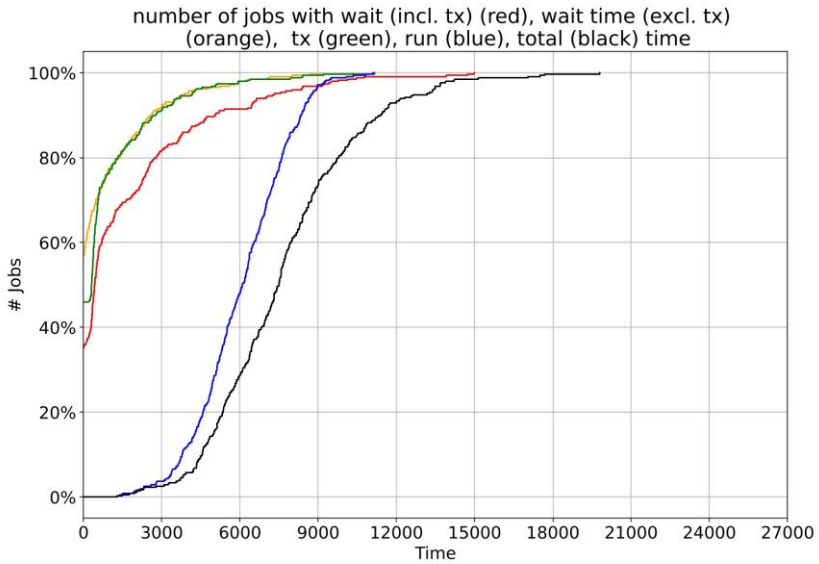
# Linear weights




Wait (incl. tx): 2156.62 Transmission: 2155.89
Run: 5465.04 Total: 7621.66 Completion Time: 34393

# Oracle




Wait (incl tx): 1616.74 Transmission: 852.17
Run: 6058.89 Total: 7675.63 Completion Time: 30946

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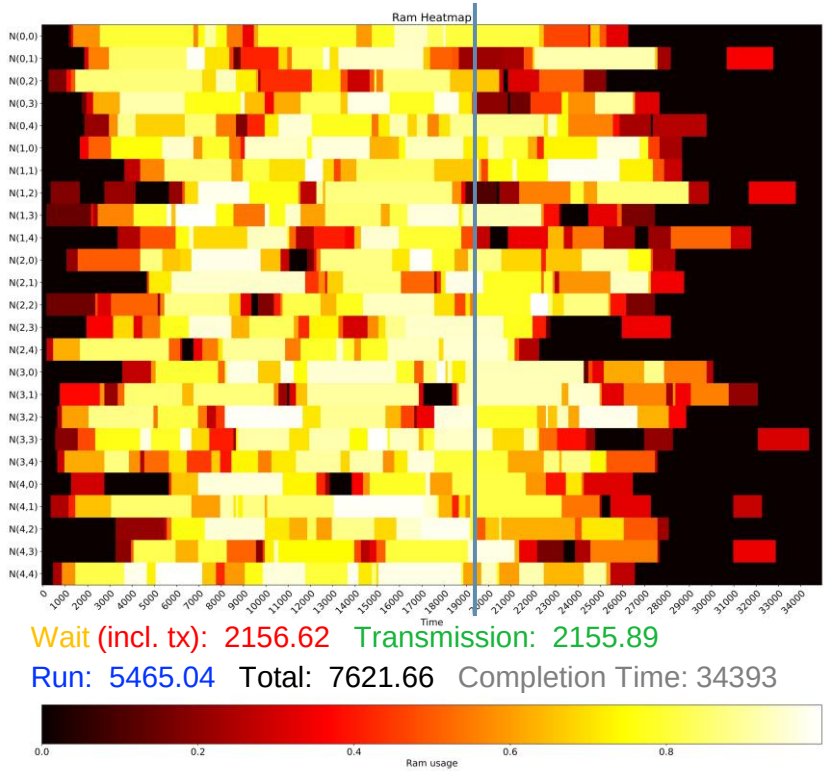
# Linear weights

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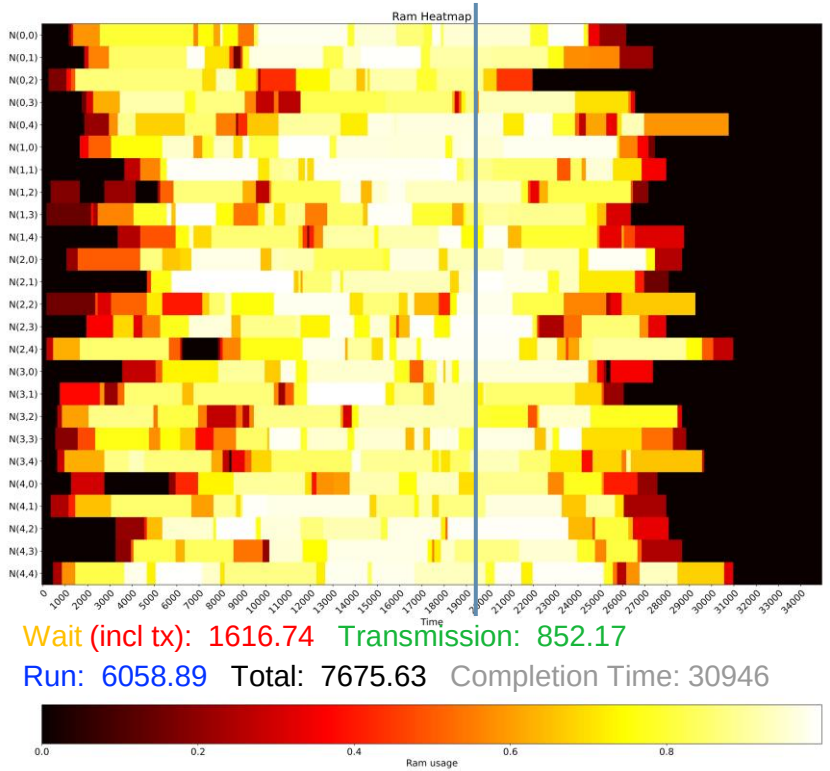


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expected last start

# Next Steps

- System properties
  - constraint job deadlines
  - code / data cashing
  - returning results to original node
  - state information aggregation
- Utility Function / Algorithms
  - sharing distance information
  - reconsideration of placement decision along the way
- Comparison to consensus protocols