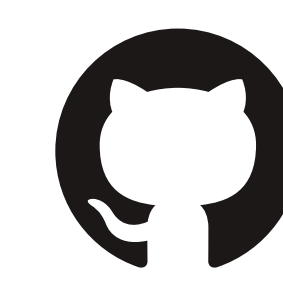
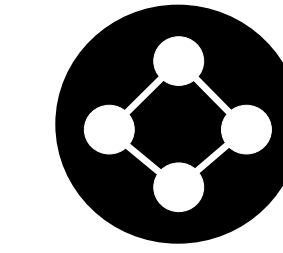


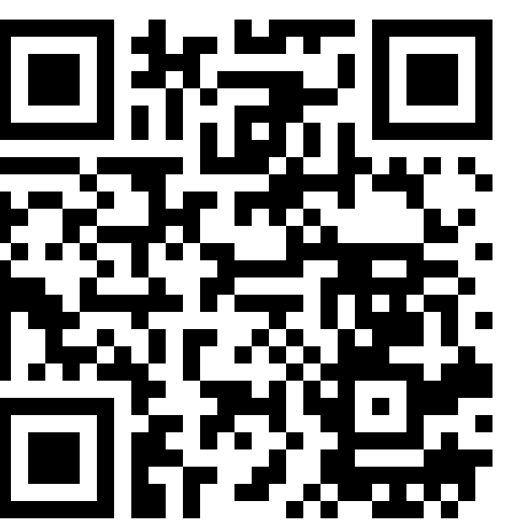
ESTEE: A Simulation Toolkit for Distributed Workflow Execution



it4innovations/estee



https://def.it4i.io

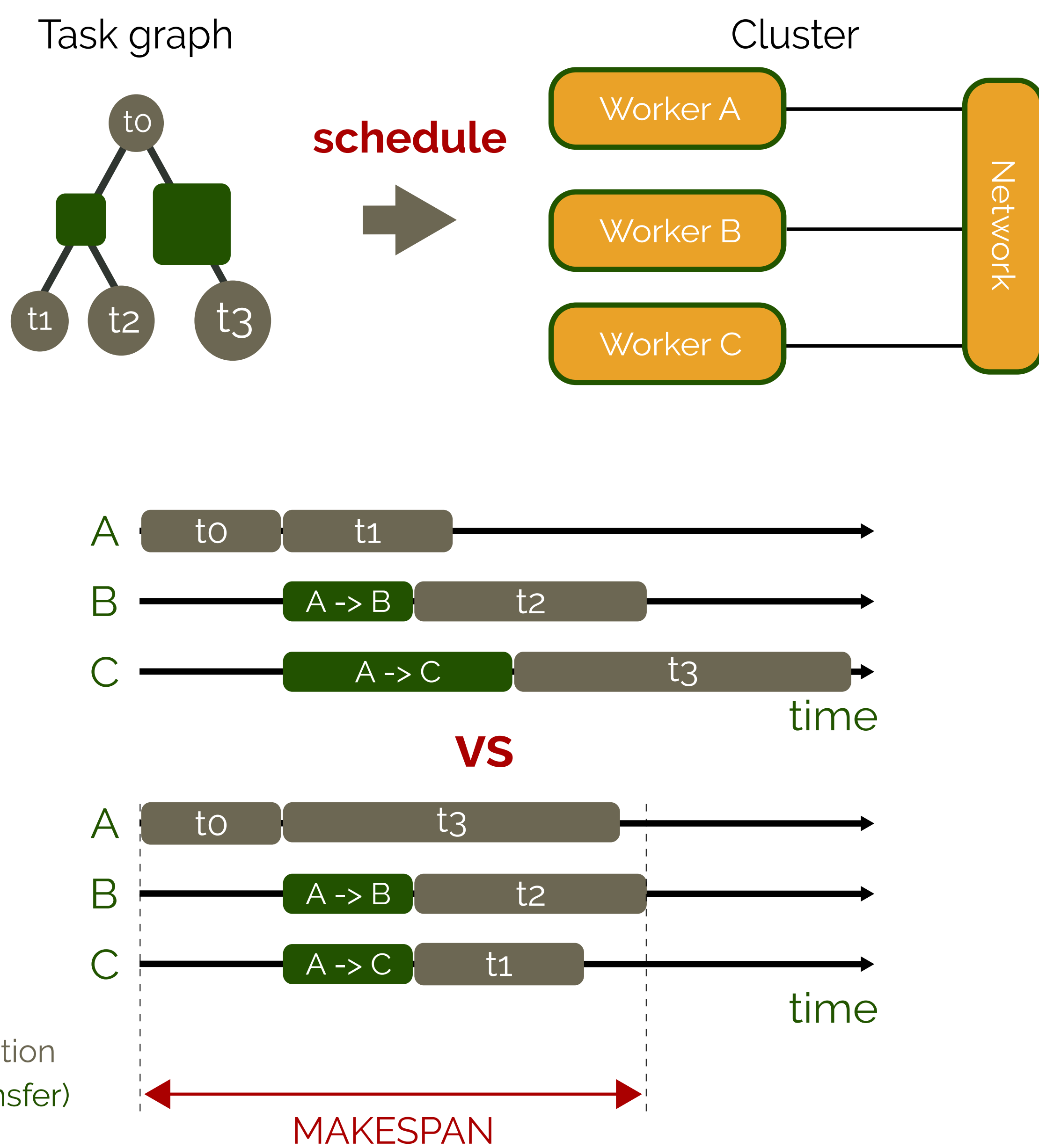


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ESTEE is an open-source discrete event simulation environment for simulating distributed task graphs (workflows) that focuses on modularity and extensibility.

Motivation



Hello world example

```
from estee.common import TaskGraph
from estee.schedulers import BlevelGtScheduler
from estee.simulator import Simulator, Worker, MaxMinFlowNetModel

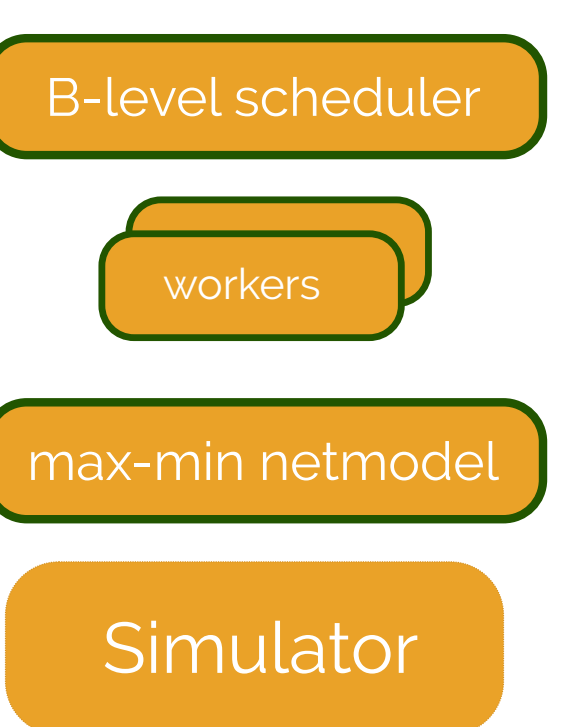
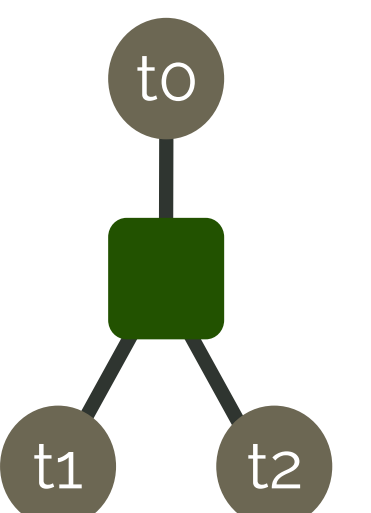
# Create task graph containing 3 tasks
# (each task runs 1s and requires 1 CPU)
task_graph = TaskGraph()
t0 = task_graph.new_task(duration=1, cpus=1, output_size=50)
t1 = task_graph.new_task(duration=1, cpus=1)
t1.add_input(t0)
t2 = task_graph.new_task(duration=1, cpus=1)
t2.add_input(t0)

# Create B-level scheduler
scheduler = BlevelGtScheduler()

# Define cluster with 2 workers (1 CPU each)
workers = [Worker(cpus=1) for _ in range(2)]

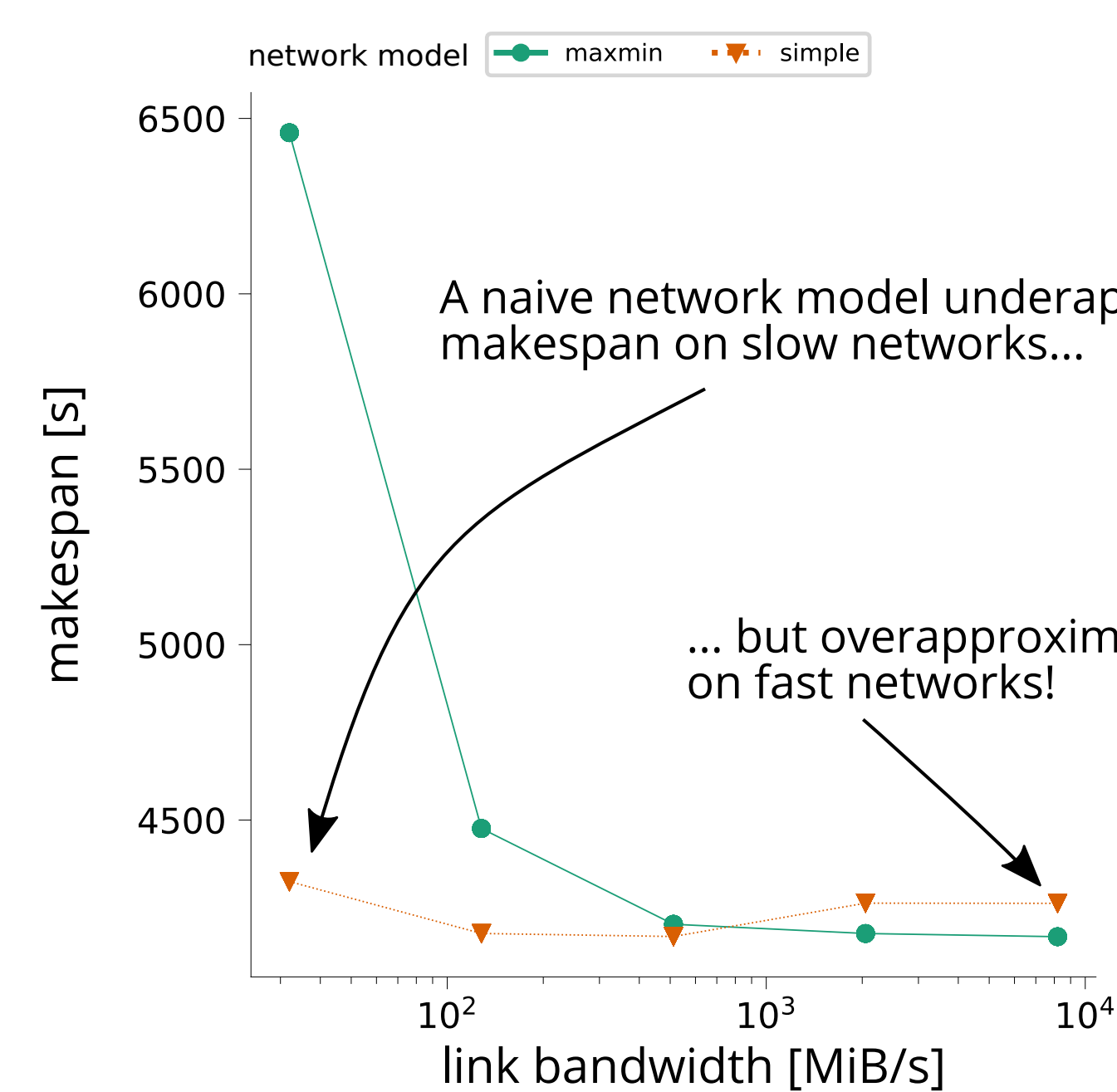
# Define MaxMinFlow network model (100MB/s)
netmodel = MaxMinFlowNetModel(bandwidth=100)

# Create a simulator and run it
simulator = Simulator(task_graph, workers, scheduler, netmodel, trace=True)
makespan = simulator.run()
```



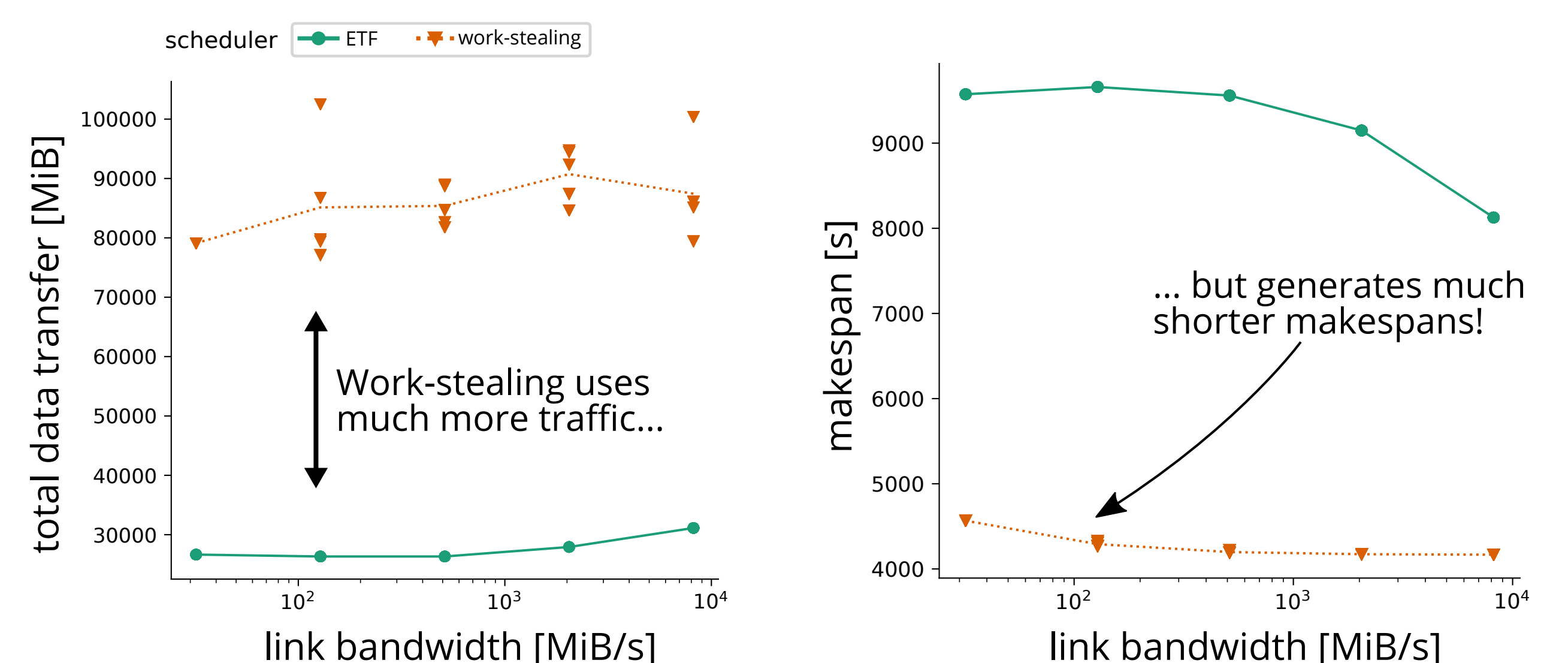
Demonstration

HLFET scheduler, 32 workers, cross-validation task graph, ~200 tasks



Observation: The complexity of the used network model may significantly affect the simulated workflow execution makespan.

Max-min network model, 32 workers, cross-validation task graph, ~200 tasks

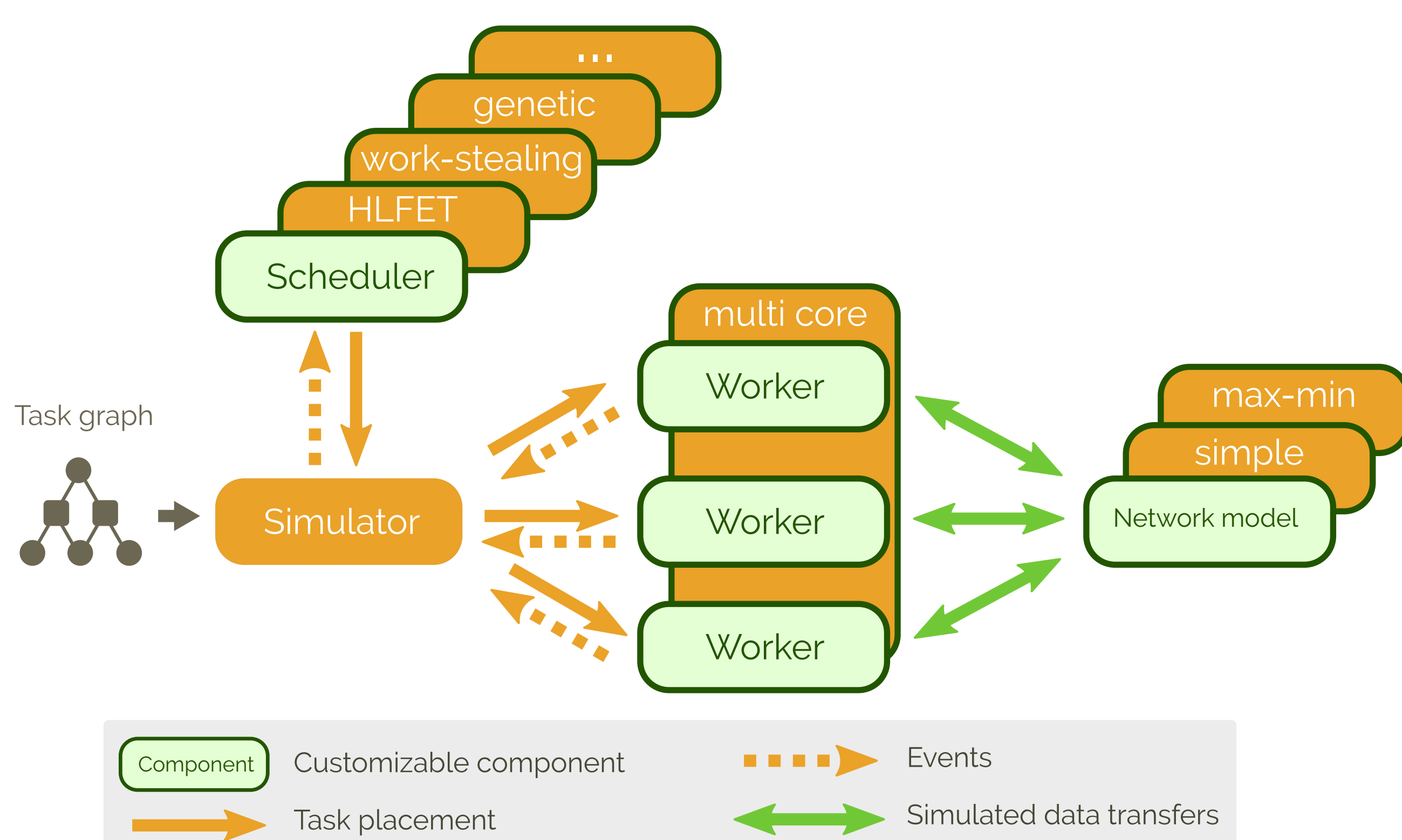


Observation: Larger amount of data transfers does not always translate to longer makespans. Some schedulers are able to exploit the additional bandwidth to distribute jobs better among the workers.

Features

- Simulates execution of task graphs
- Considers task dependencies
- Considers network contention
- Supports multi-core workers
- Supports task resources (# of cores)
- Outputs detailed simulation traces
- You can easily add your own:
 - scheduler
 - network model
 - worker behavior
- 10+ implemented schedulers
- Fully open source (BSD license)

Architecture



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