



NS-3 performance analysis and development of effective load balancing algorithms

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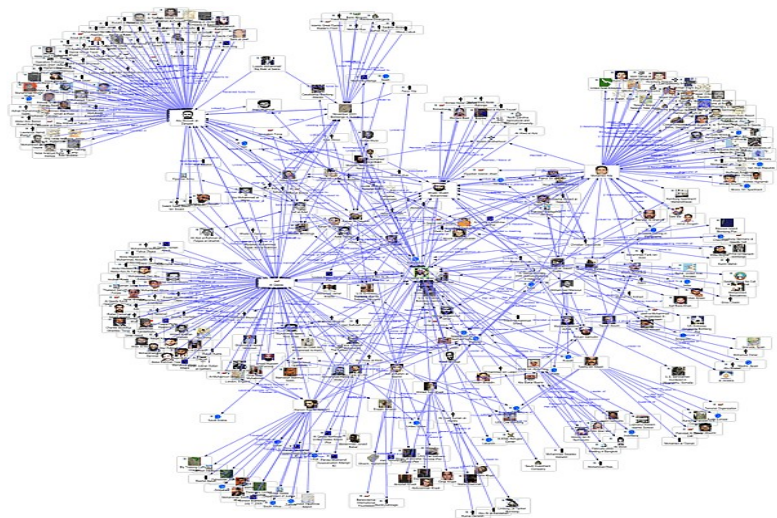
<http://osll.fruct.org>

Outline

Networks modeled by NS-3 can
be large...
Or very large...
Or very very very large...

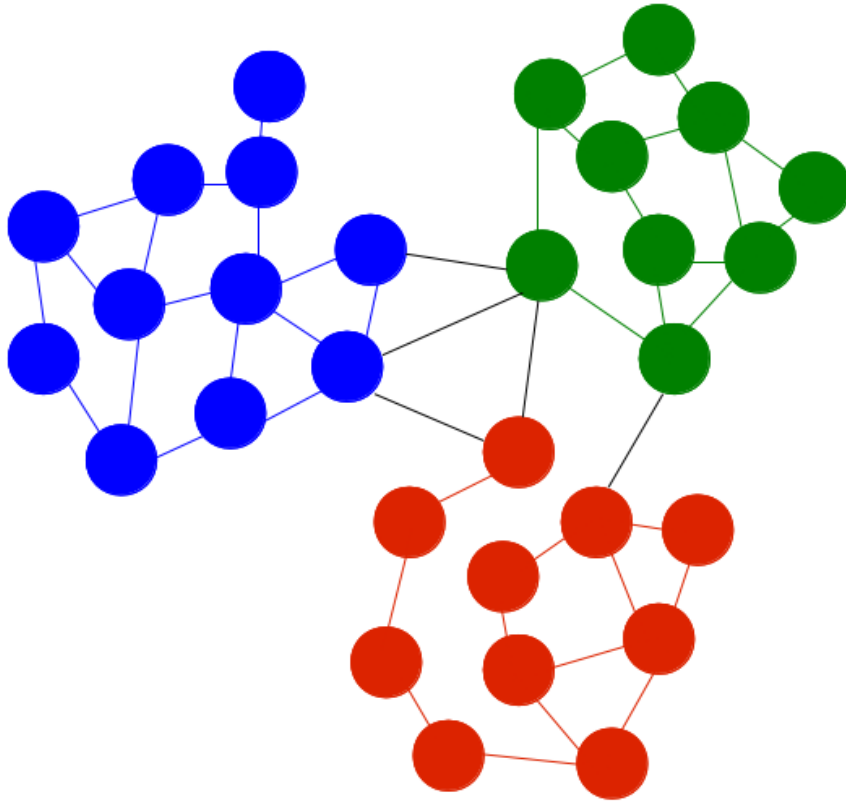


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When you are modeling very very large networks and want to get some statistics you can wait results for a very very long time...

Basic idea



- Main idea

Local events in each subnetwork can be performed independently

- Main problem

Synchronize subnetworks

Synchronization algorithms



- Optimistic

- Desynchronization happens rare
- Periodically interrupting and fixing synchronization errors

Effective | Difficult to implement

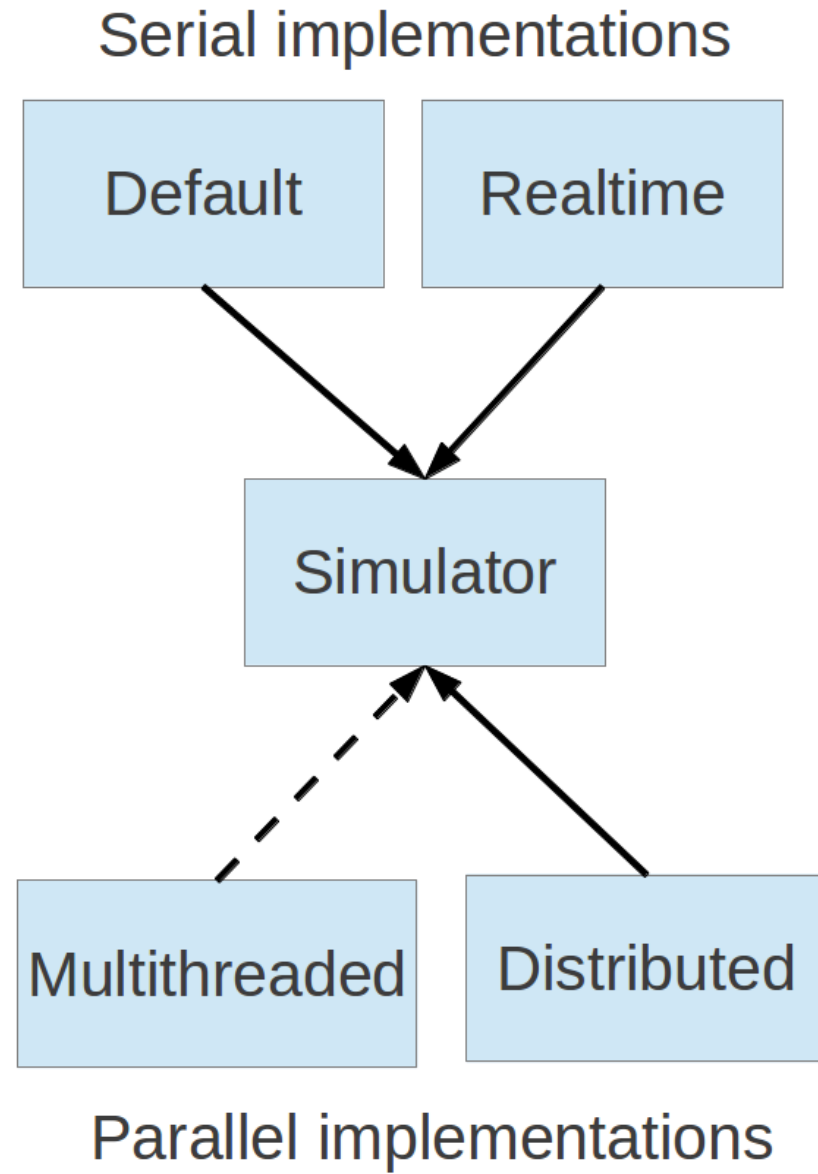
- Conservative

- Avoid desynchronization

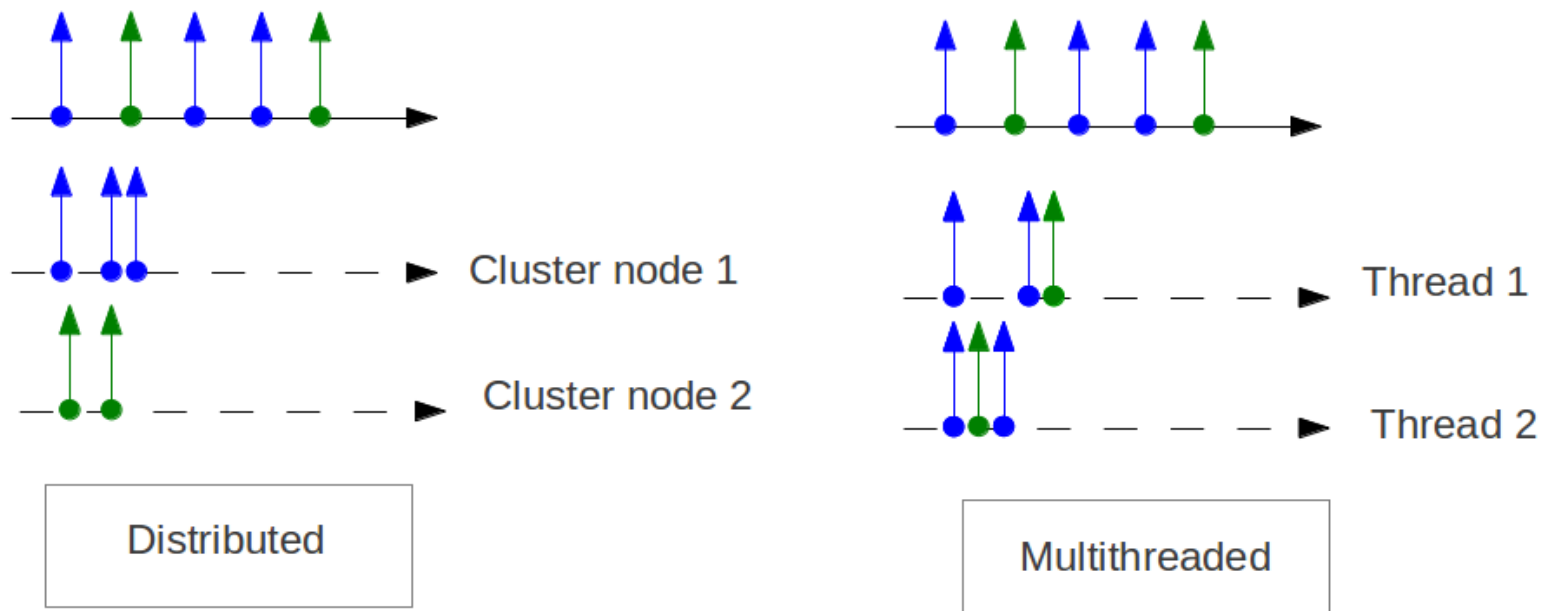
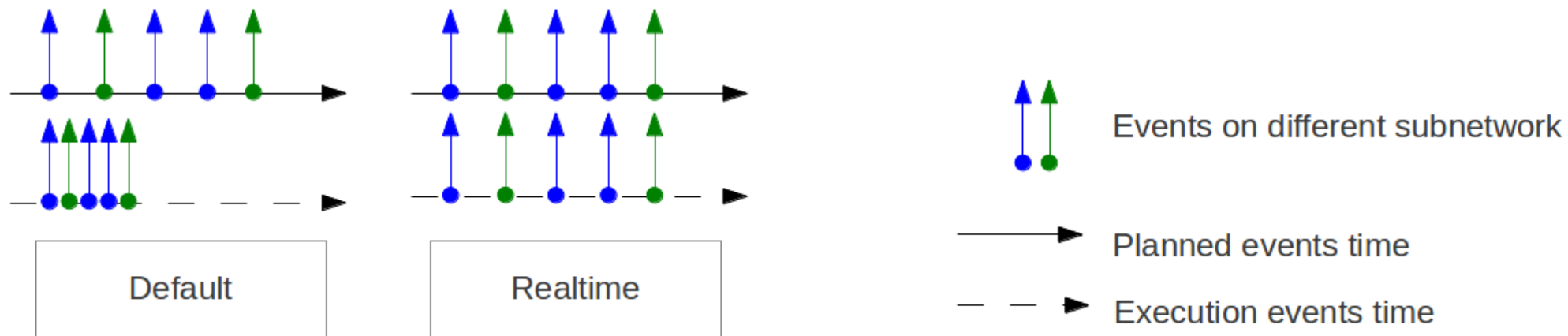
Easy to implement | Not so effective

Objectives

- Analyze existing parallel implementations performance
- Effective network clustering
- Effective load balancing

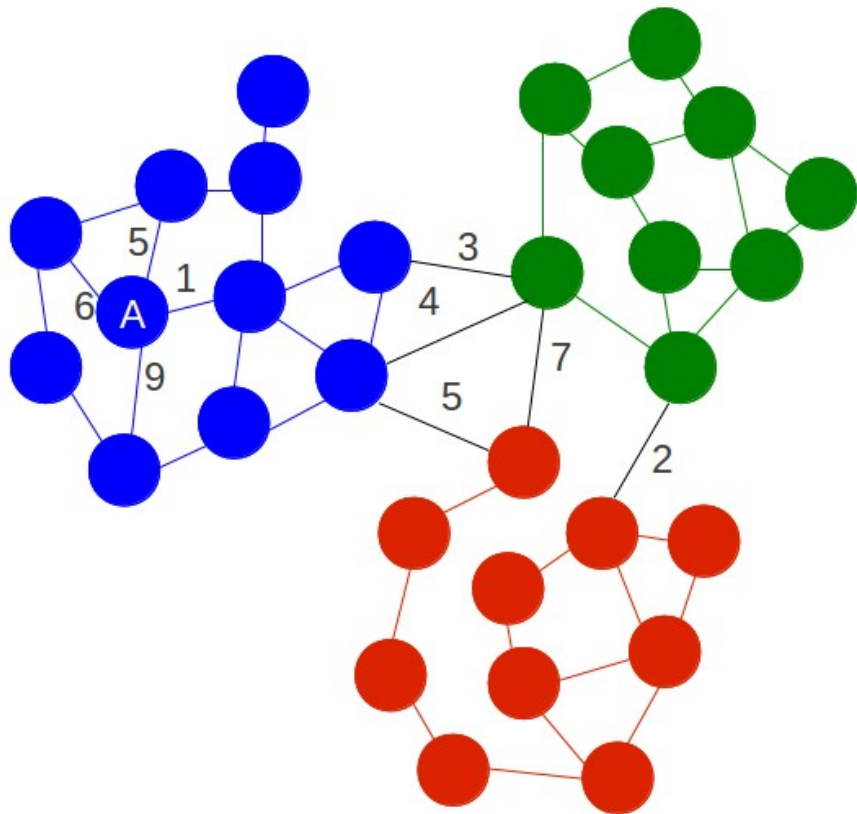


Algorithms



Synchronization

Lookahead concept: Event in one node can affect another node with delay not less then delay in channel between them



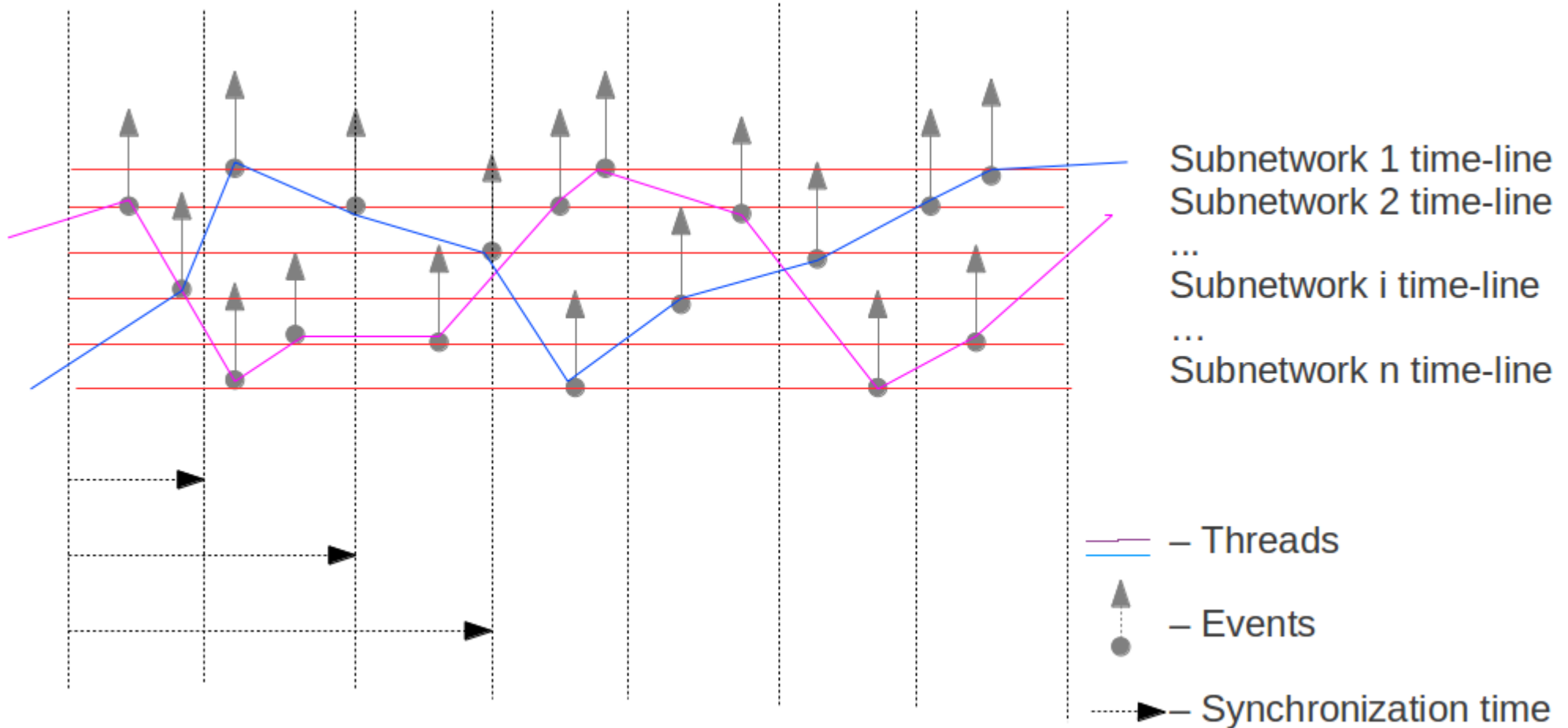
In Multithreaded version lookahead:

- Local for each node
- Minimal delay between node and its neighbors
- For node A: $\min(5, 6, 1, 9) = 1$

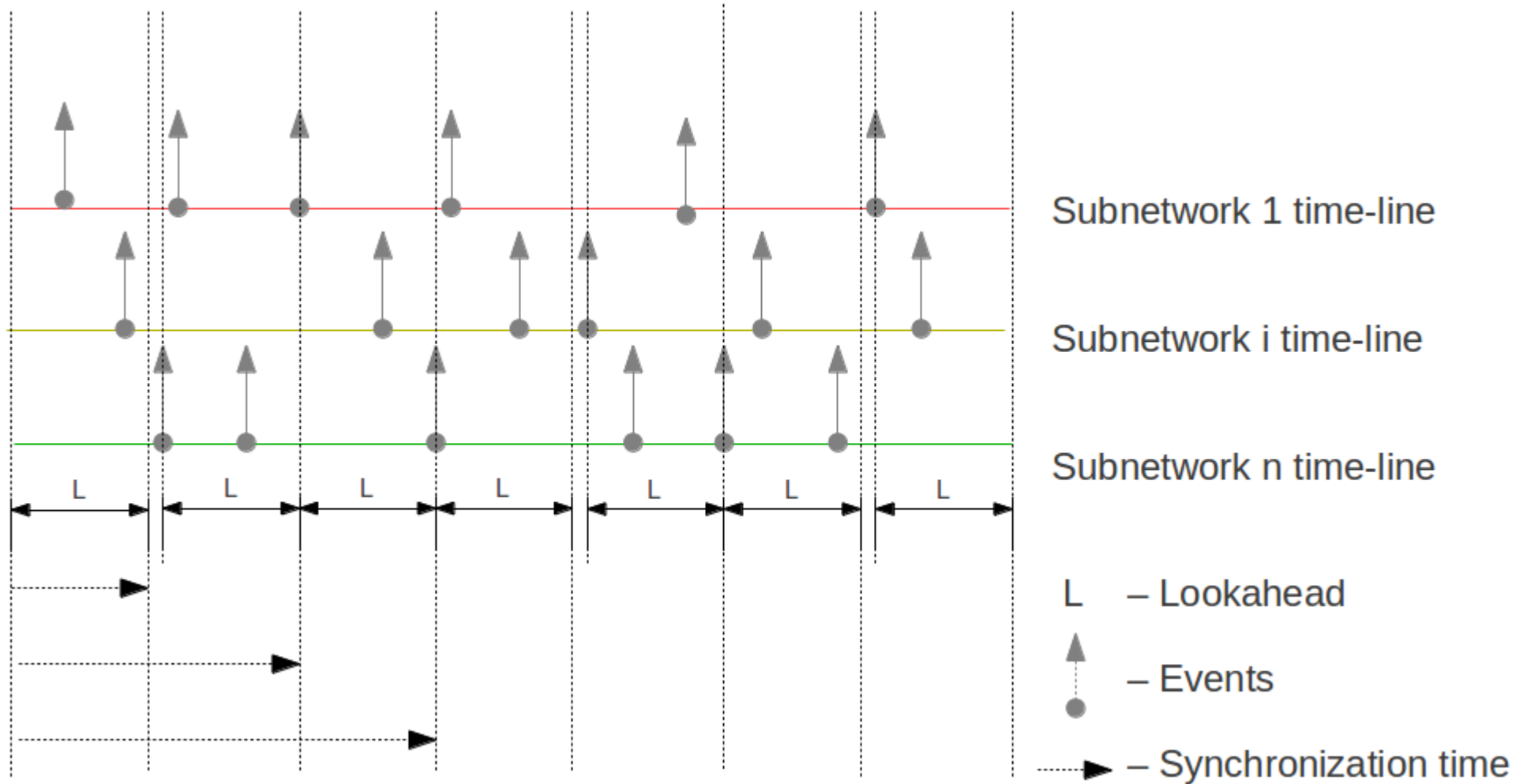
In Distributed version lookahead:

- Global
- Minimal delay between subnetworks
- $\min(3, 4, 5, 6, 7, 2) = 2$

Multithreaded algorithm



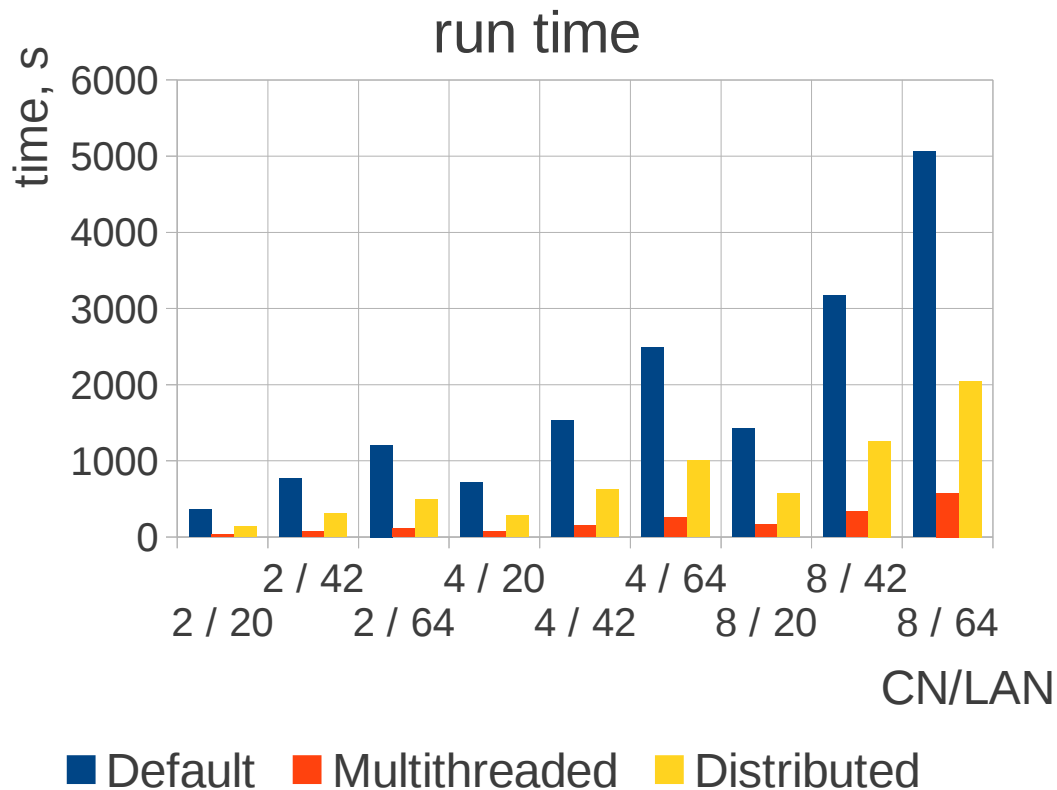
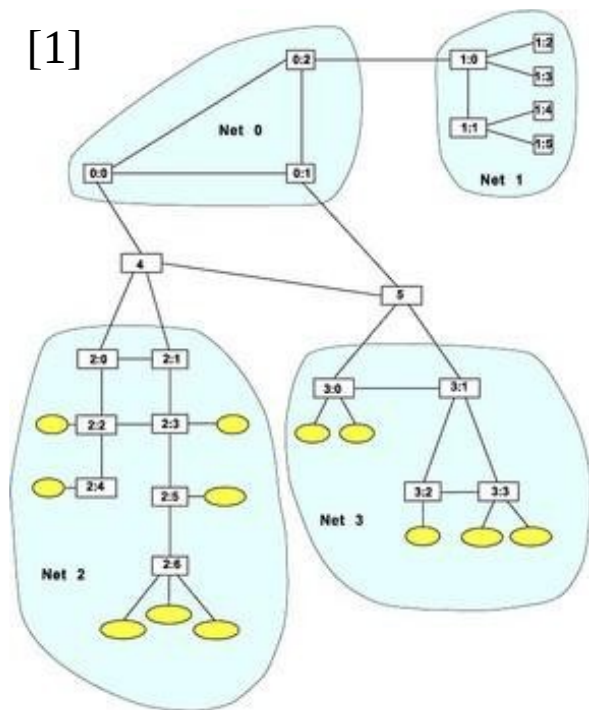
Distributed algorithm



Analysis

DARPA NMS Campus Network

[1]



Hardware:

Default & Multithreaded.: Intel(R) Core(TM) i5-2320 CPU @ 3.00GHz X 4

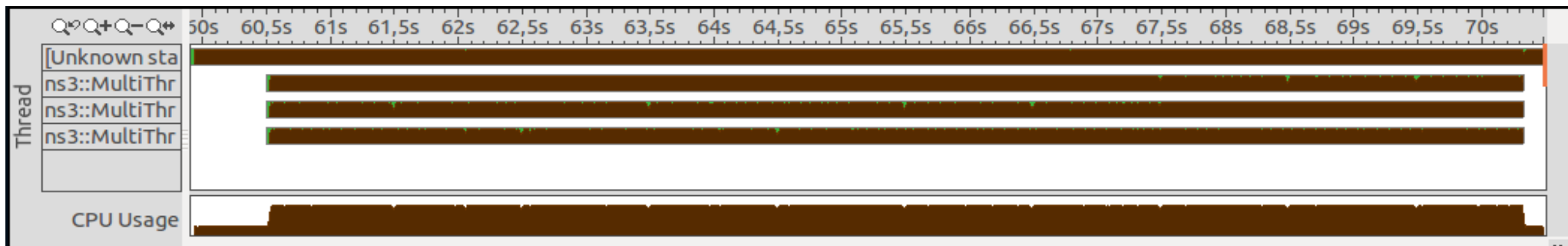
Distributed: Cluster 2 X Intel(R) Core(TM) i5-2320 CPU @ 3.00GHz X 4

1 - <http://www.ssfnet.org/Exchange/gallery/baseline/index.html>

Profiling

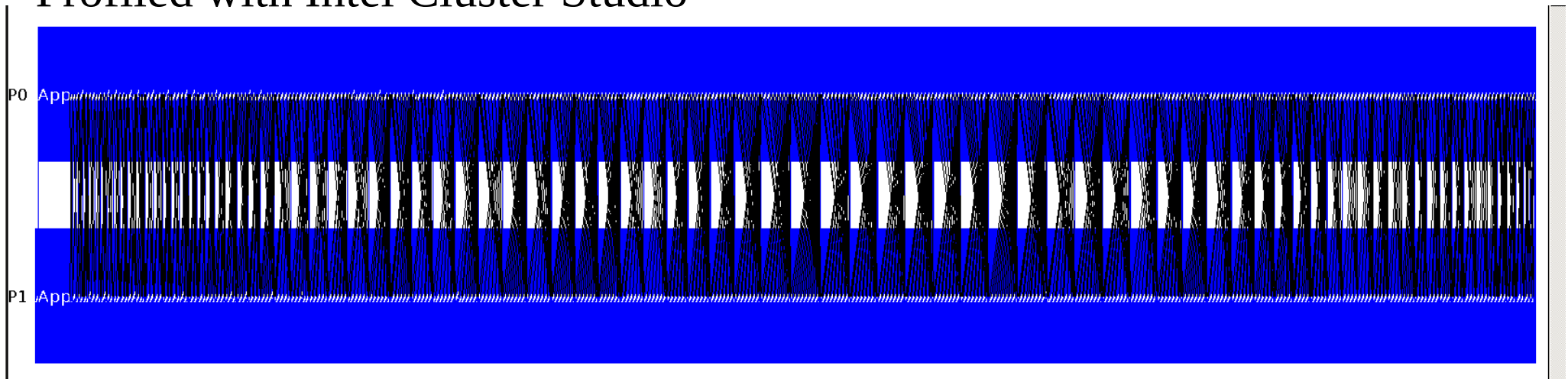
Multithreaded version

Profiled with Intel Parallel studio



Distributed version

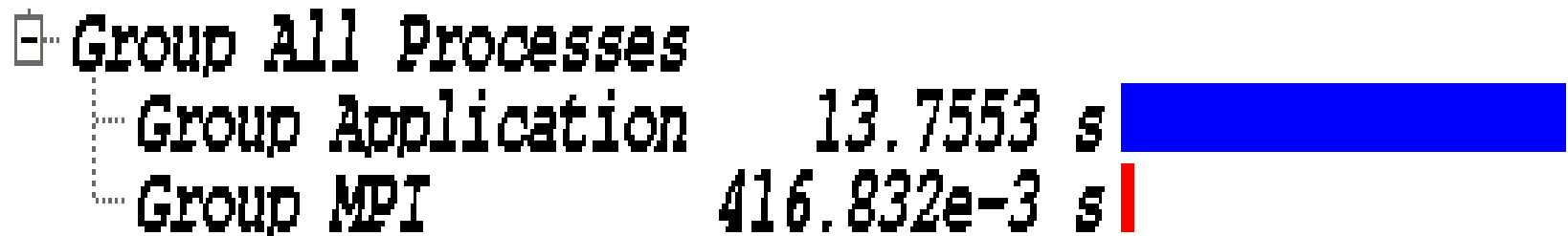
Profiled with Intel Cluster Studio



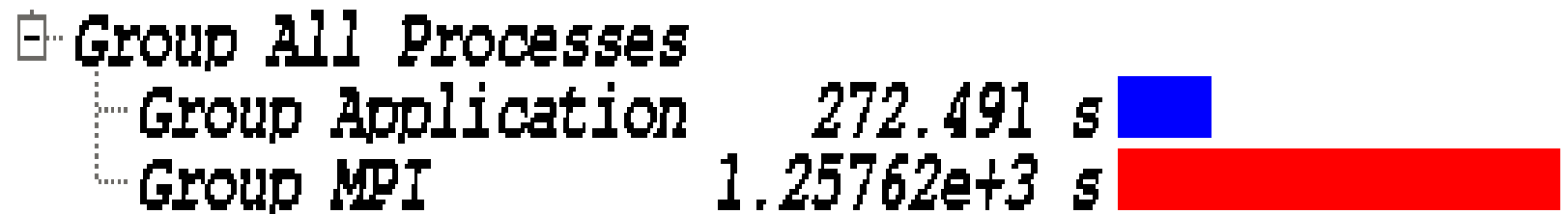
Motivation

Why effective network clustering is important?

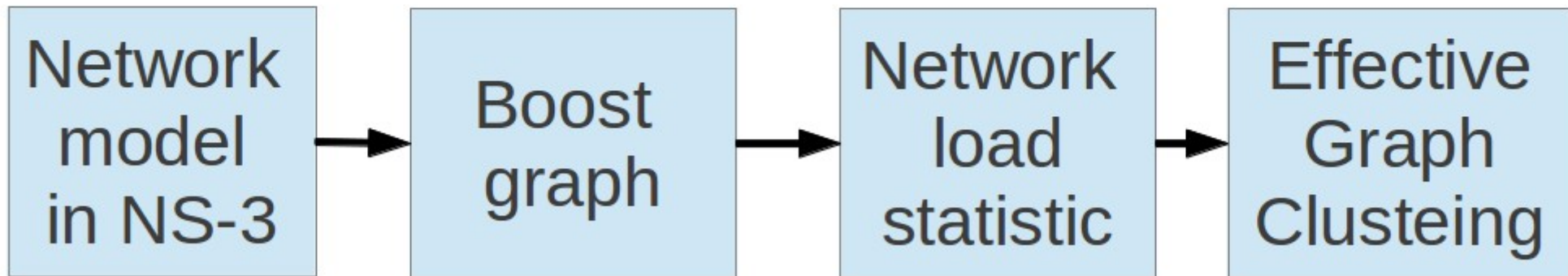
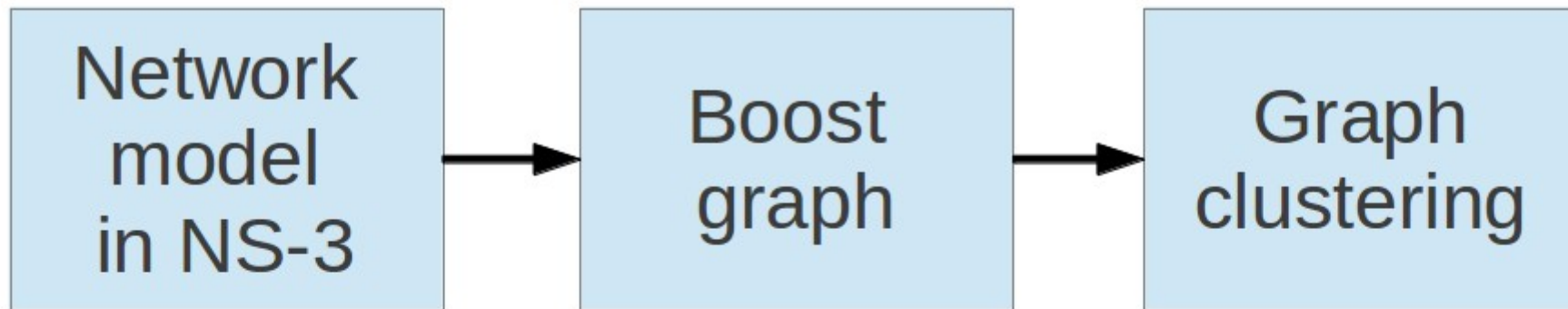
Good
clustering



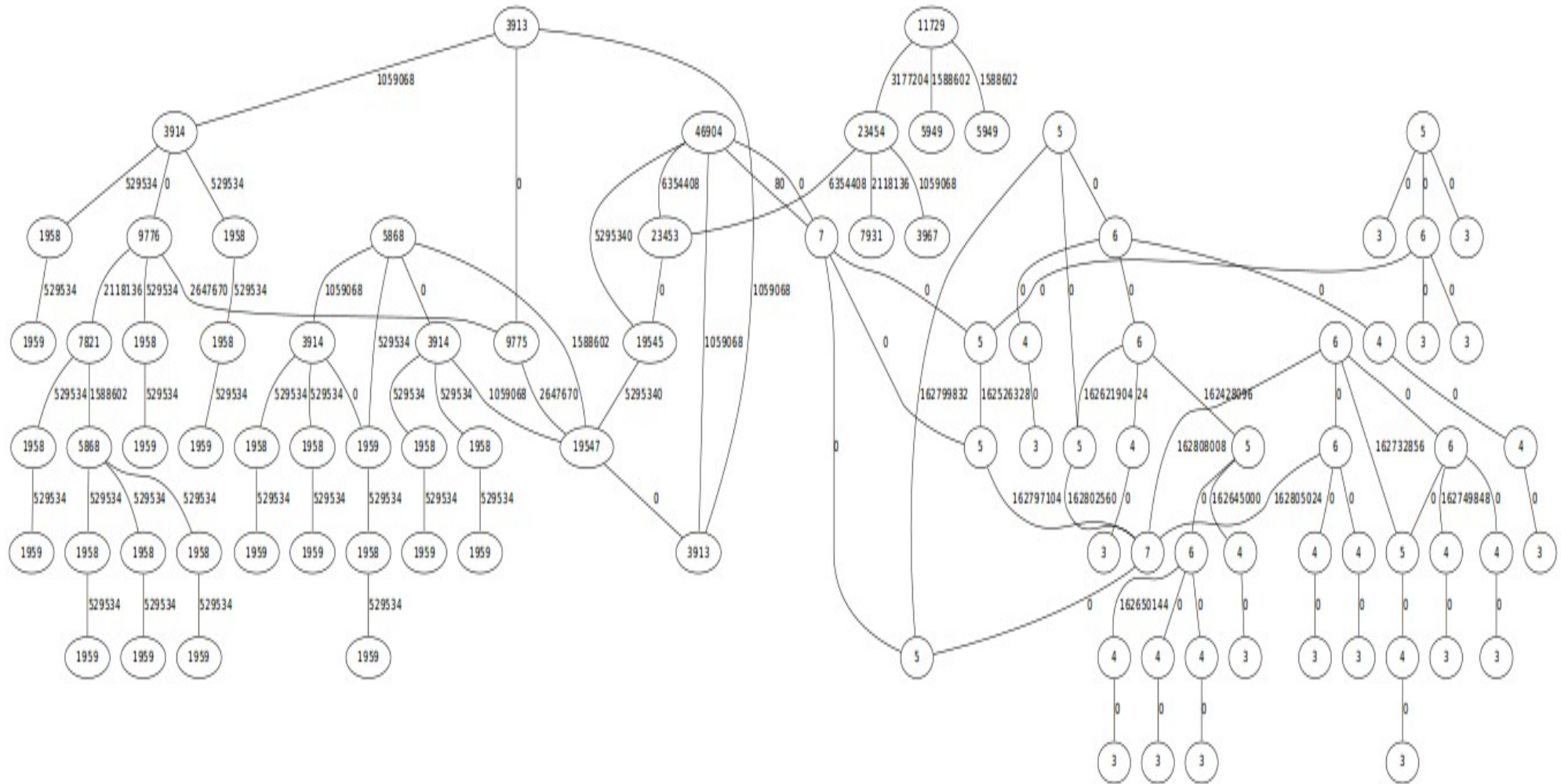
Bad
clustering



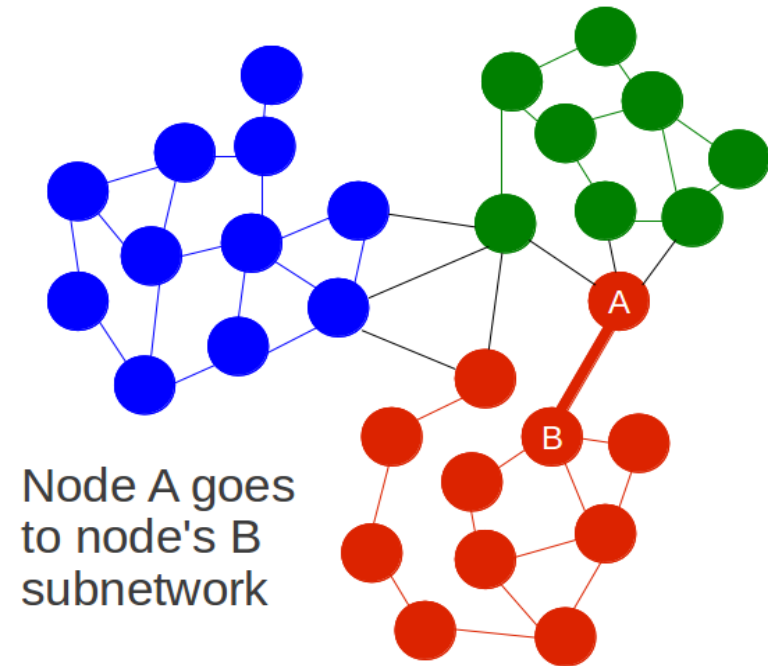
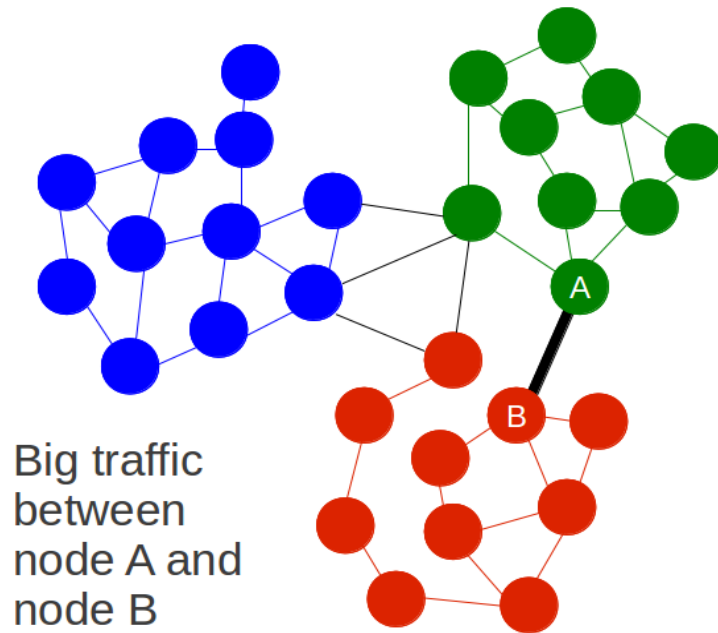
Static load balancing



Weighted graph



Dynamic load balancing



Results & Future Work



■ Results

- Multithreaded & Distributed algorithms analyzed
- Complete simulators profiling performed
- Static load balancing for Distributed Simulator developed

■ Future Work

- Dynamic load balancing for Distributed Simulator



Questions & Answers

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