Biweekly MSc Thesis Progress Presentation – Lukas Strebel

September 19, 2018

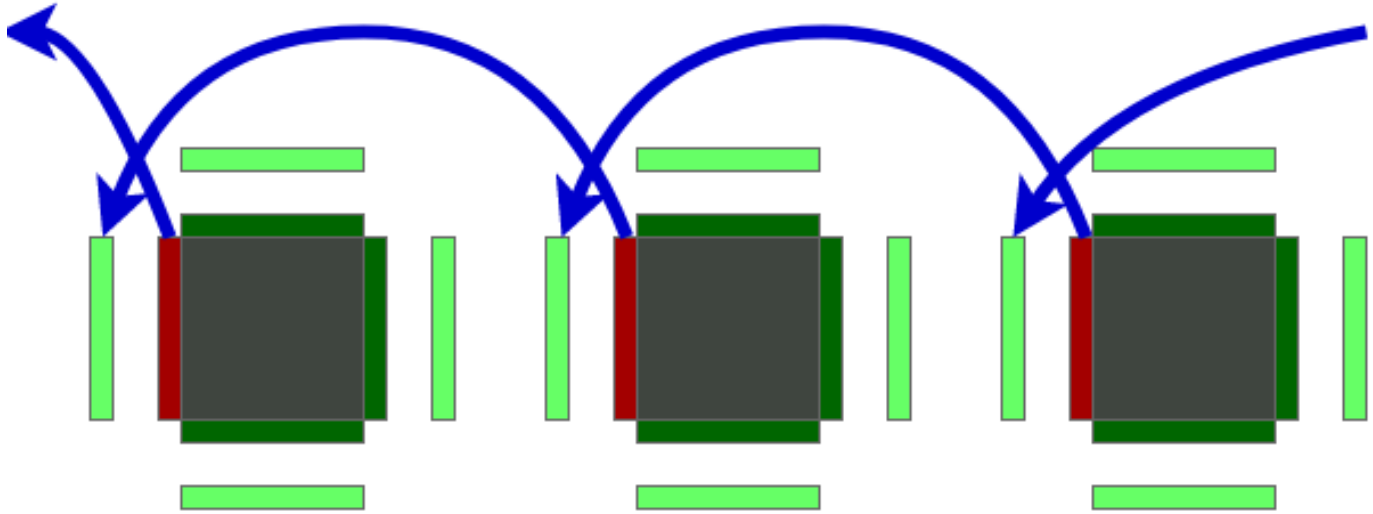
CSCS
Centro Svizzero di Calcolo Scientifico
Swiss National Supercomputing Centre

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

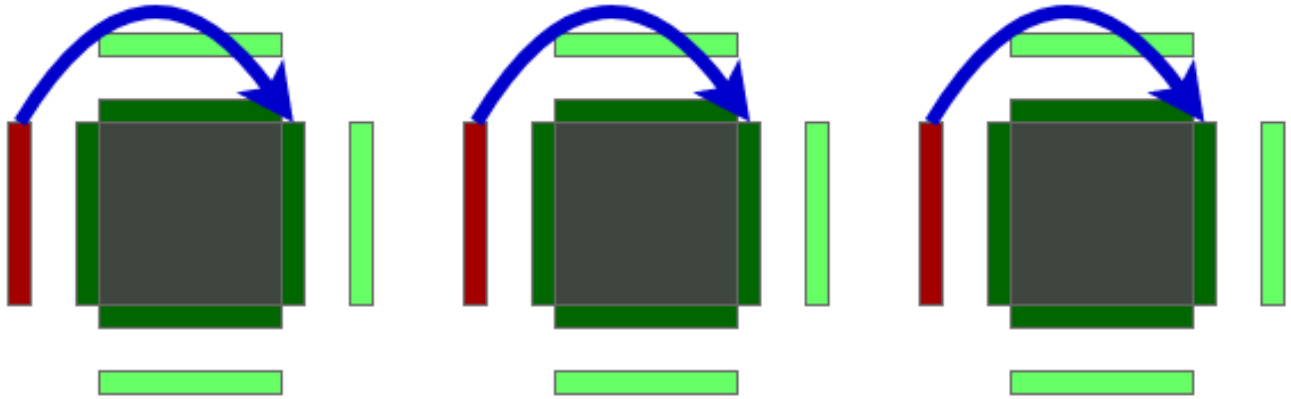
Updates from Last time

- MPI One Sided
  - Get() always returned zero – Synchronization problem.
  - Could not find the Problem – Changed to Put() instead – Worked immediately.

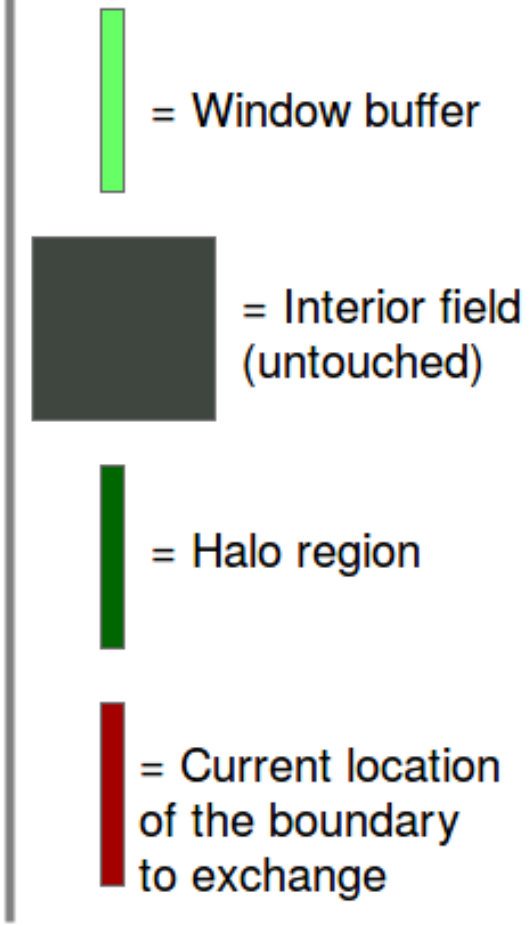
Step 1 : MPI one sided put() the halo region into the corresponding window buffer of the neighboring subdivision.



Step 2: Copy the window buffer into the halo region of the opposite site.



Step 3: Repeat step 1 and 2 for all other directions.



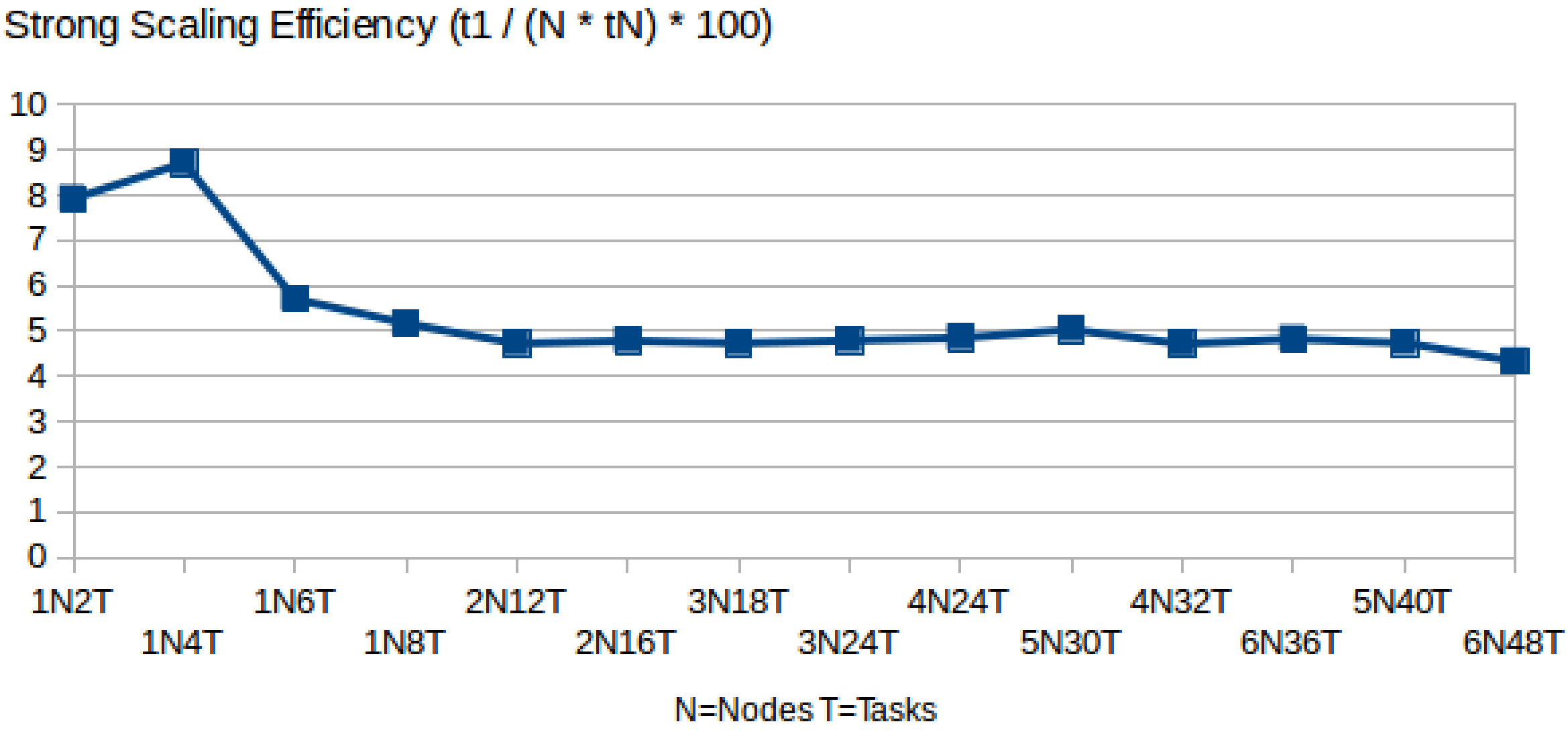
Updates from Last time

- Shallow Water Equation on a Sphere
  - Changed to version without pole treatment (limit band to -85° to 85°).
  - Solutions look okay when visualized
  - Had to change domain slightly to handle periodic correctly (values at 2π = values at 0)
  - Multiple stencils (Lax-Wendroff and Diffusion) in sequence on same fields requires copy of field?

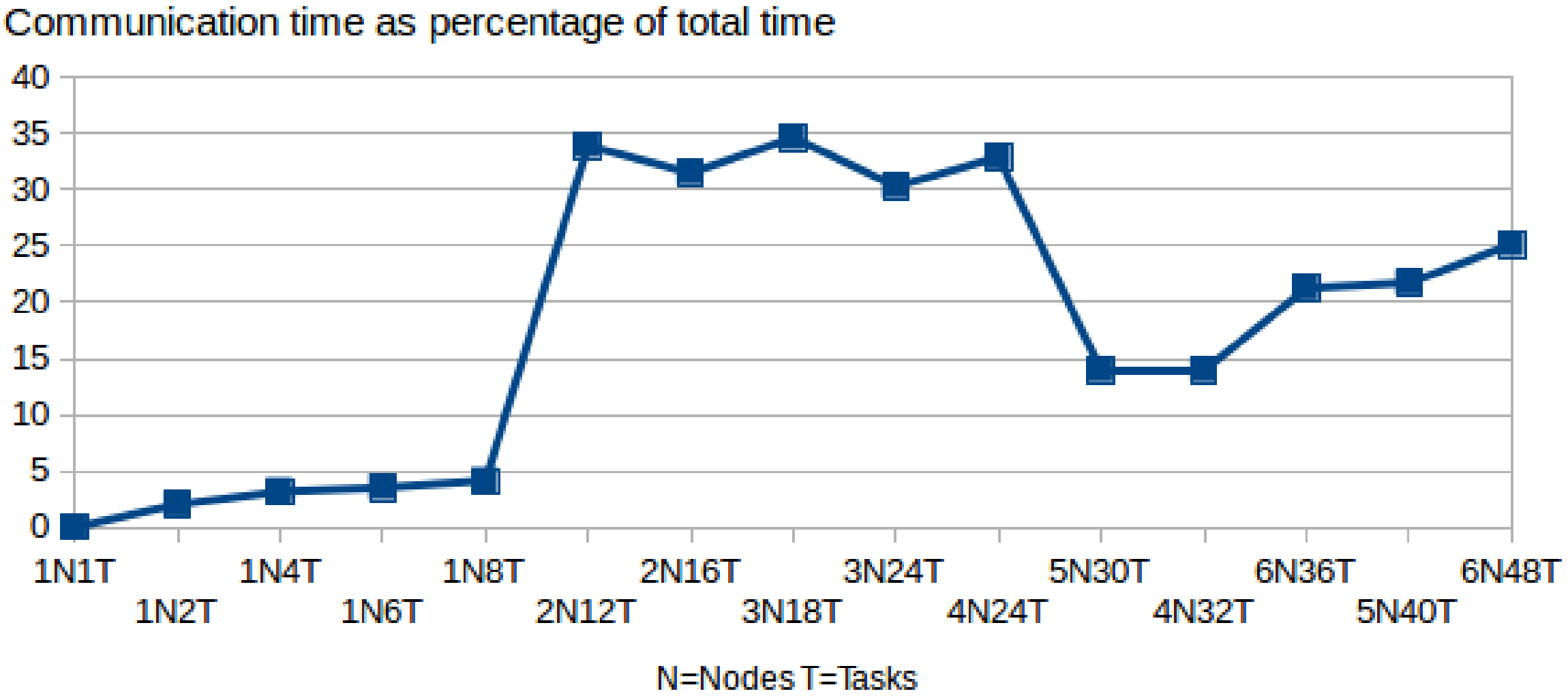
Scaling Experiments on Greina

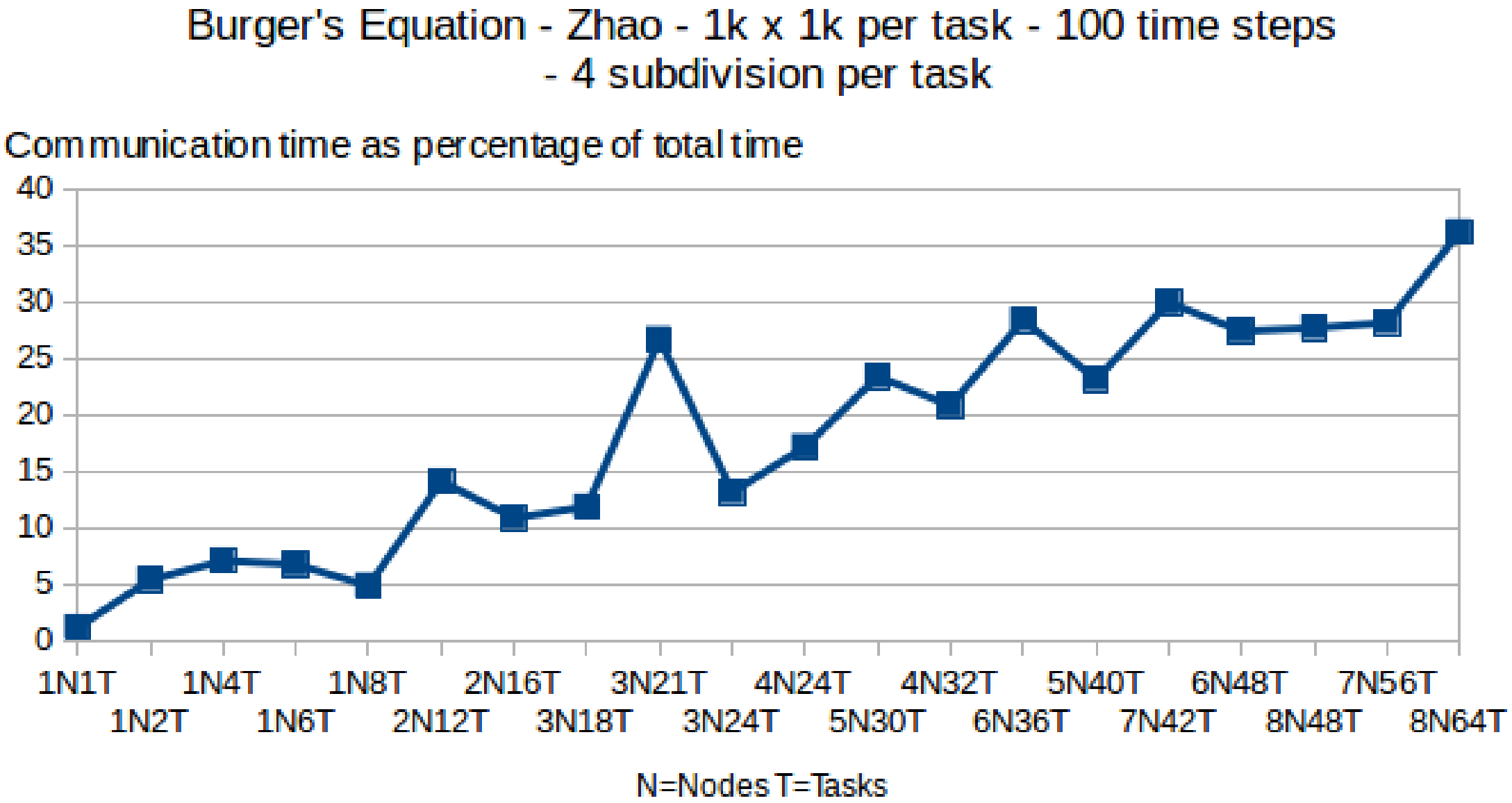
- Limitations: Burger's equation:
  - Reference has memory limit after 24k x 24k (32k x 32k does not run)
  - DD has memory limit after 32k x 32k (48k x 48k does not run)
    - Initial value generation with NumPy arrays before saving to file fails.
  - MPI One Sided – Creates a MPI Communicator for each Window
    - Limited to ~2k – DD runs into this limit sometimes because 6 windows for each field and each subdivision.
    - e.g. 10 fields allow ~30 subdivisions only.
    - Would need rewrite code to not have a window per direction, field, and subdivision to make MPI One-Sided scalable. But then One-Sided communication would not be similar to 2-way communication.

Burger's Equation - Zhao - 24k x 24k - 100 time steps - 1 subdivision per task

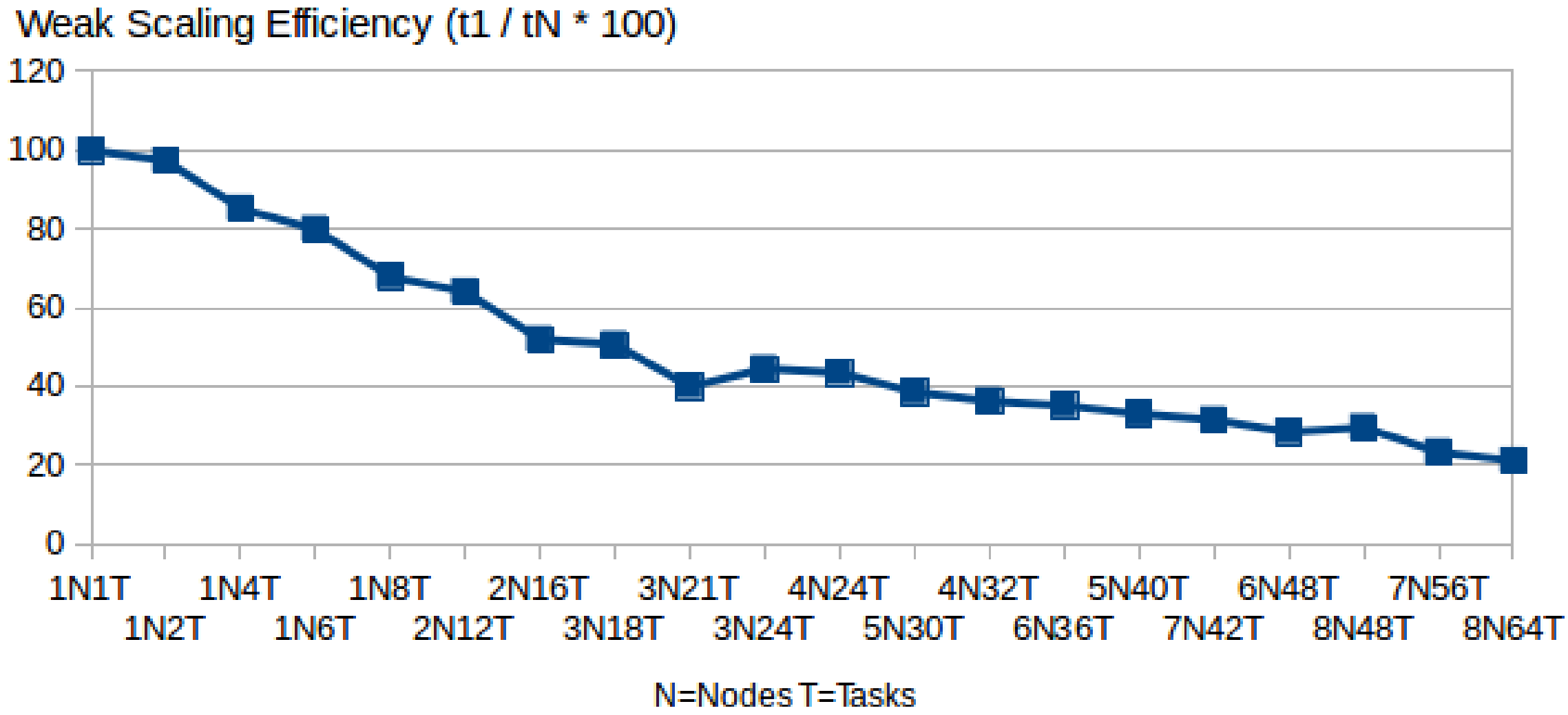


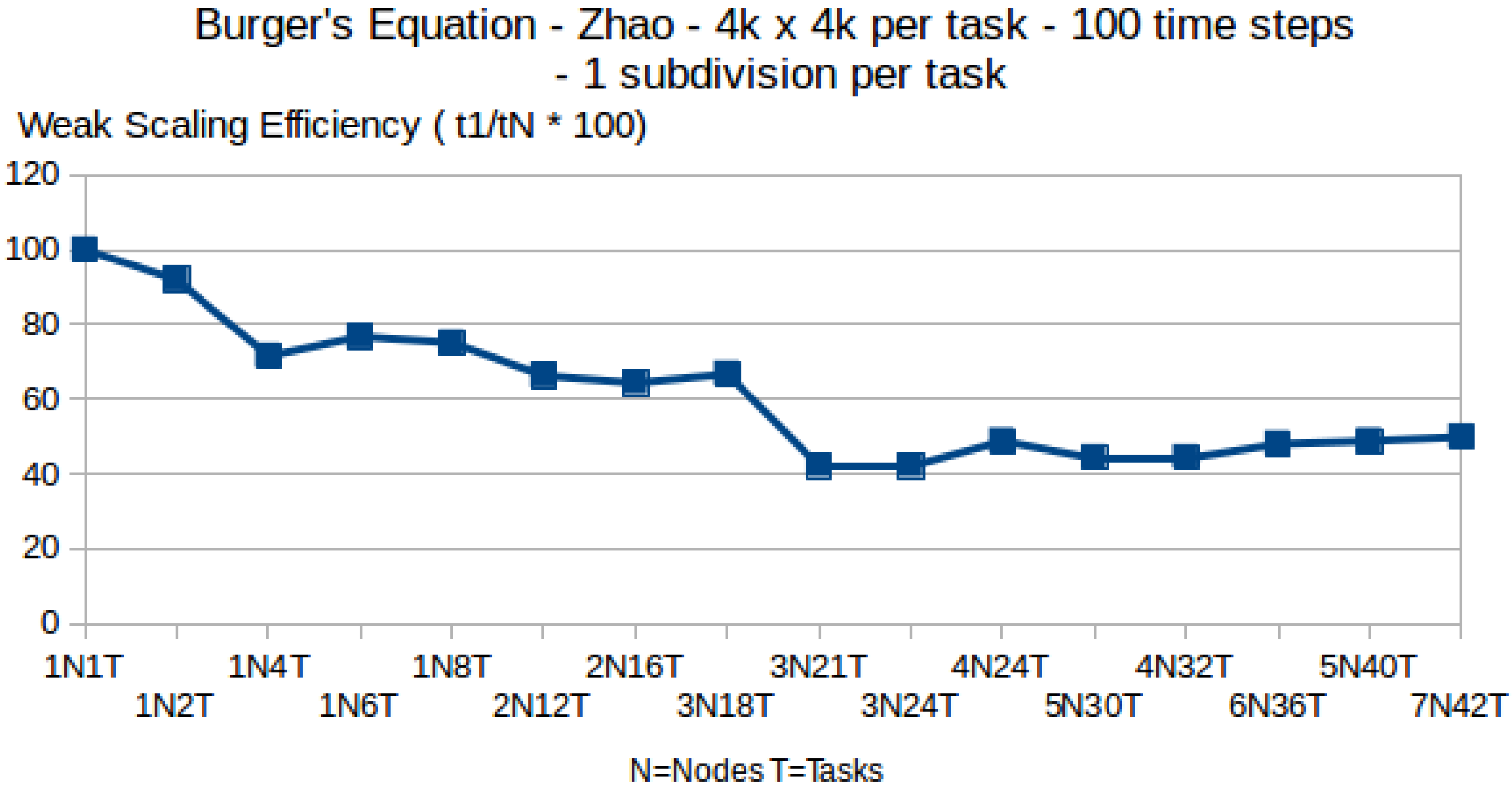
Burger's Equation - Zhao - 24k x 24k - 100 time steps - 1 subdivision per task

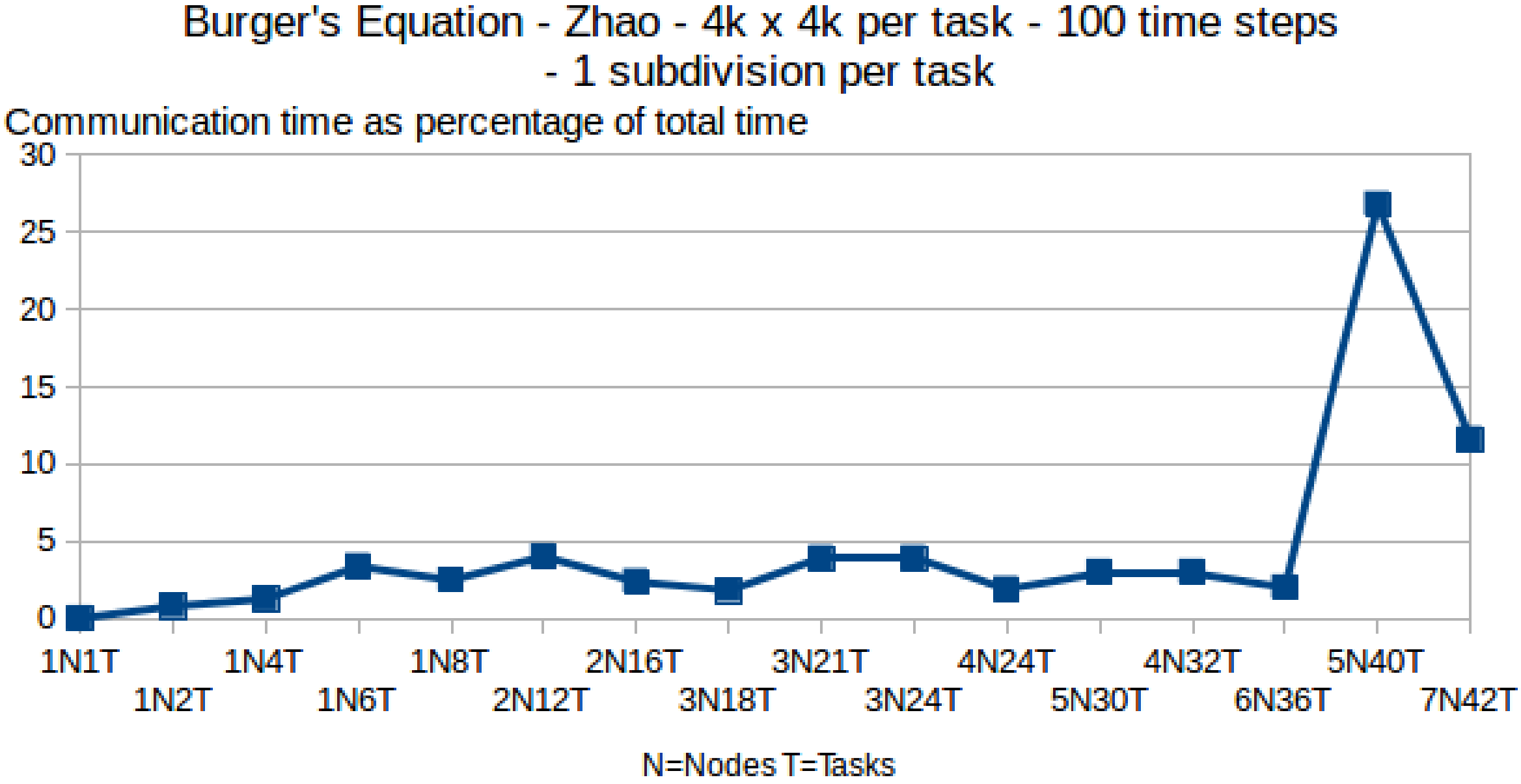



Burger's Equation - Zhao - 1k x 1k per task - 100 time steps
- 4 subdivision per task
Communication time as percentage of total time
40
35
30
25
20
15
10
5
0
1N1T
1N2T
1N4T
1N6T
1N8T
2N12T
2N16T
3N18T
3N21T
3N24T
4N24T
5N30T
4N32T
6N36T
5N40T
7N42T
6N48T
8N48T
7N56T
8N64T
N=Nodes T=Tasks

Burger's Equation - Zhao - 1k x 1k per task - 100 time steps - 4 subdivision per task




Burger's Equation - Zhao - 4k x 4k per task - 100 time steps
- 1 subdivision per task
Weak Scaling Efficiency (t1/tN * 100)
120
100
80
60
40
20
0
1N1T
1N2T
1N4T
1N6T
1N8T
2N12T
2N16T
3N18T
3N21T
3N24T
4N24T
5N30T
4N32T
6N36T
5N40T
7N42T
N=Nodes T=Tasks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30
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1N1T
1N2T
1N4T
1N6T
1N8T
2N12T
2N16T
3N18T
3N21T
3N24T
4N24T
5N30T
4N32T
6N36T
5N40T
7N42T
N=Nodes T=Tasks

Scaling experiments still to do

- Weak scaling for larger starting Grid
  - Starting with 4k x 4k still results in small / not very efficient subdivision for many Nodes
- Scaling for Shallow Water Equation – Strong and Weak

- Others?

Thesis text

- Experiments chapter / Shallow Water Equation chapter
- MPI One Sided chapter
- Abstract / Conclusion

- Want to be done by next Wednesday 26th
- Will send first complete draft by Friday 29th

Next Milestone – September 15

- Complete Implementation
- All benchmarks and optimizations

After that:

October 1 – Complete Thesis for reviews

October 15 – Complete Thesis document incl. reviews.

October 20 – Thesis text submission to Thomas Schulthess

November 13 – Thesis text submission to ETH (Deadline)