



Parallel OPM-flow Past Present And Future

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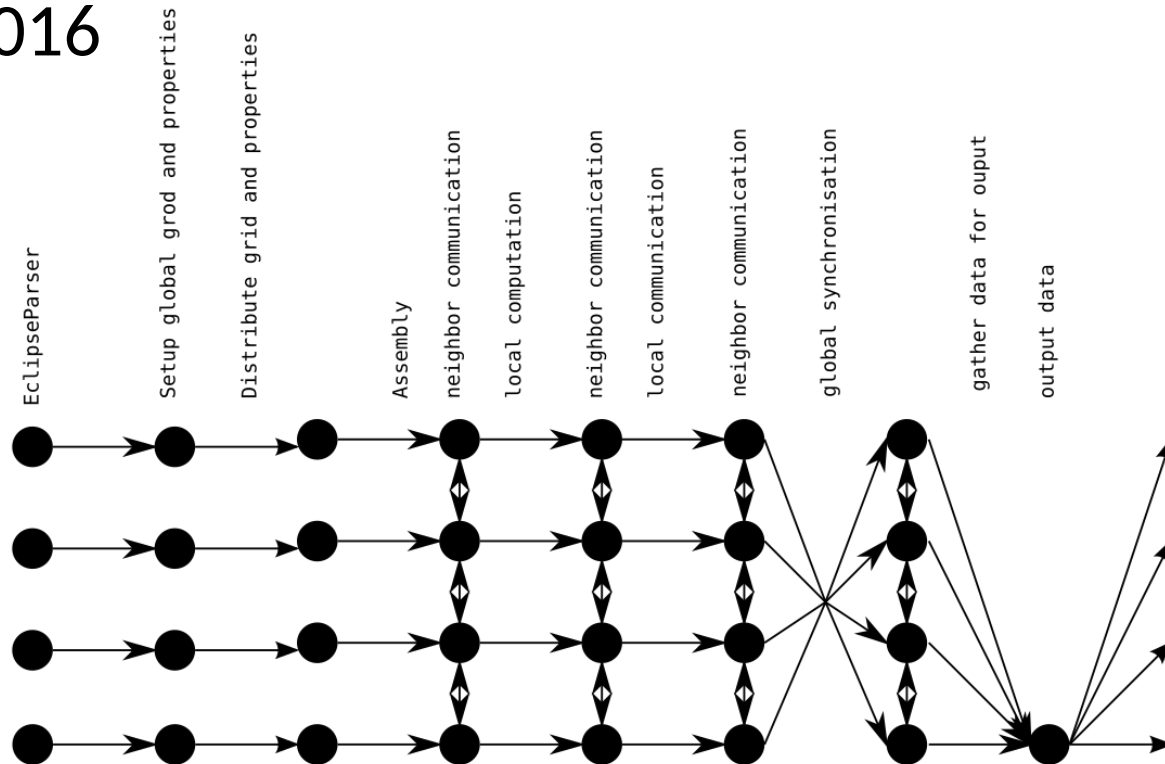
O P M - O P

THE PAST / ONCE UPON A TIME

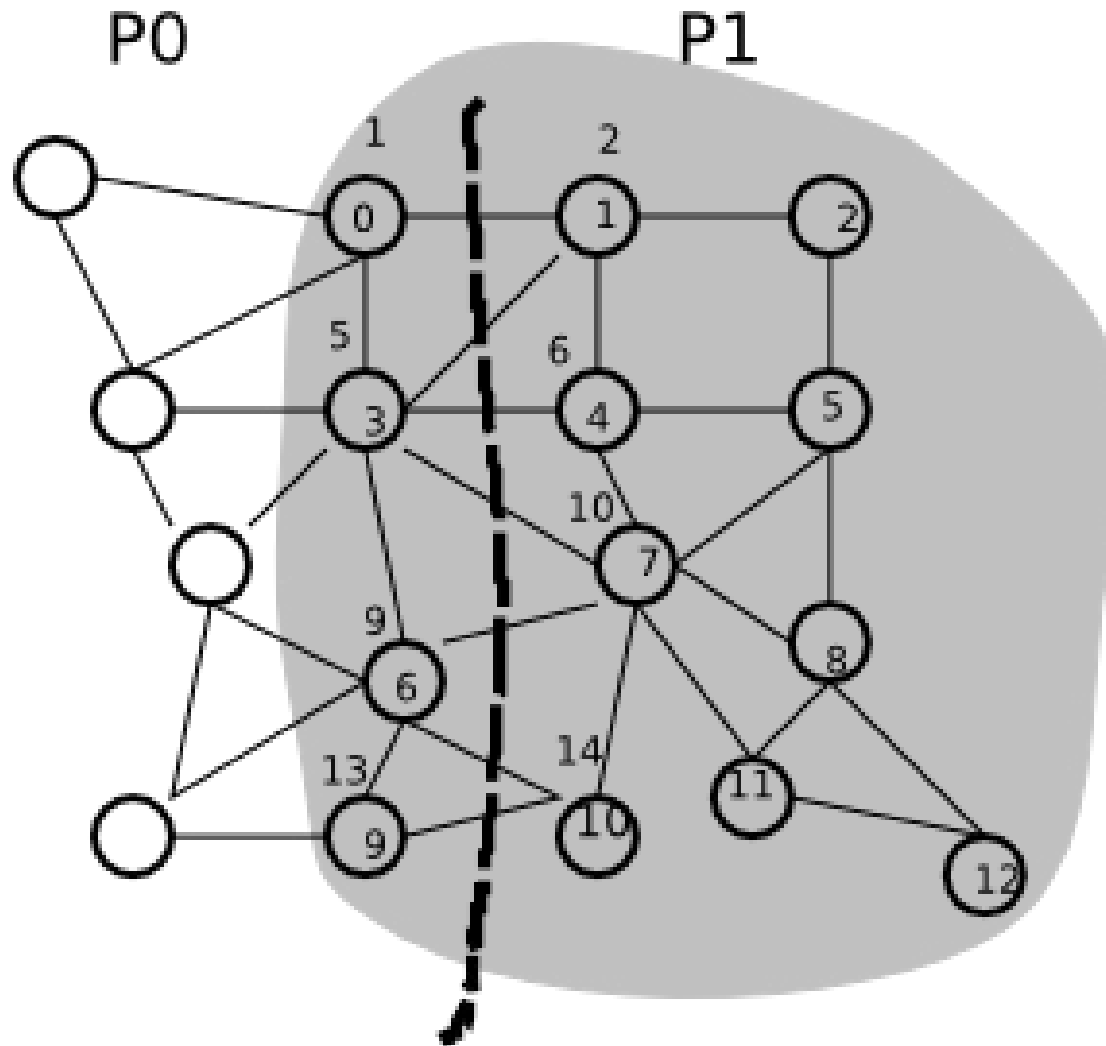
Who needs Parallel / Who needs DUNE?

HISTORY OF MPI PARALLELISM IN FLOW

- MPI Parallel Cpgrid and solvers based on DUNE from me (2015)
- Parallel Async Output by Robert Klöfkorn (NORCE) 2015-2016

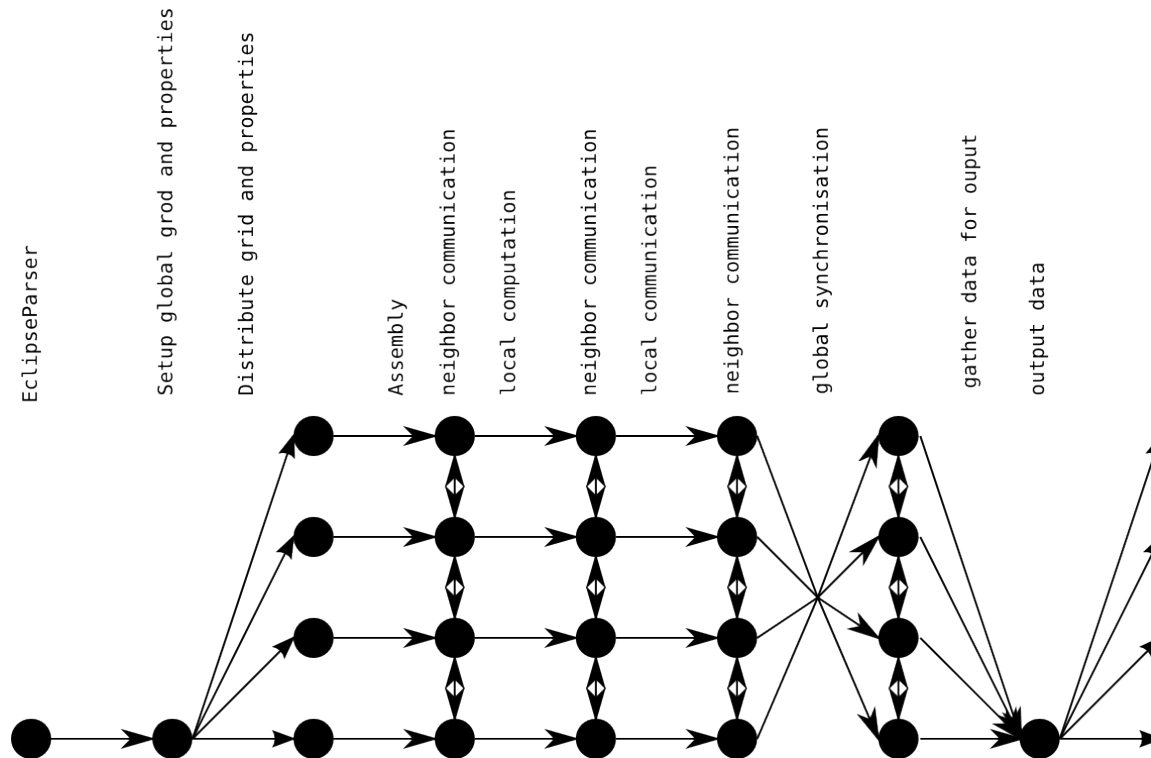


OPM - OP Process Local Storage (MPI)



OPM - O P Reduce Memory Requirements

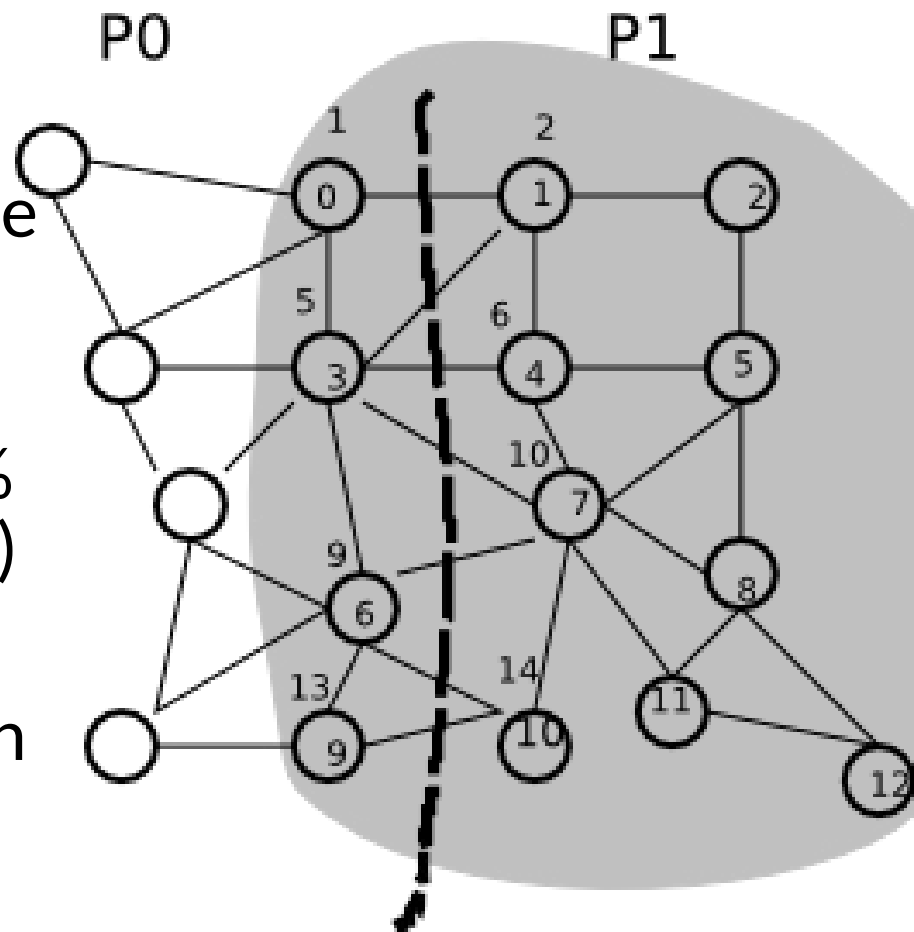
- 2019 Hold global grid only on rank 0 (me)
- 2020 Parse data files only on rank 0 (Arne Morten Kvarving / SINTEF)



OPM - OP MPI Optimizations From Simula

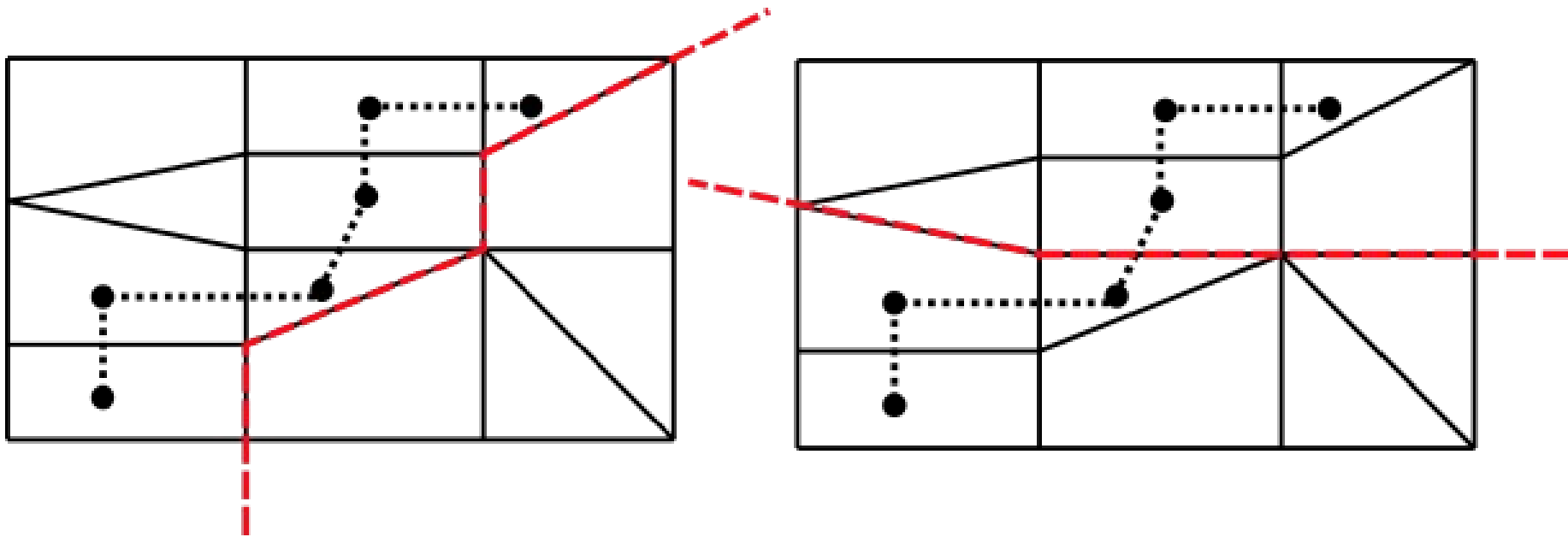
Namely: Andreas Thune

- Experiments with edge weights during loadbalance (2019)
- Remove unnecessary computations in ILU0: 20% improvement on 32 (2019)
- Indices of owners are first now: 10% improvement on 16-32 (2020)



OPM - OP Distributed Wells (2021)

- Wells are allowed to cross over process boundaries
- 5-14% performance boost for real black oil case
- Benchmarked by Andreas Thune (SIMULA)



HISTORY ACCELERATORS (FPGA/GPU) 2019-2022

Contributed from Tong Dong Qiu (BDA) and colleagues

- First version with linear solvers on the GPU
- Wells were the tricky part.
- Experiments with FPGA ([Paper](#): Hardware Acceleration of High-Performance Computational Flow Dynamics Using High-Bandwidth Memory-Enabled Field-Programmable Gate Arrays” by Hogervorst, Nane, Marchiori, Qiu, Blatt, Rustad)

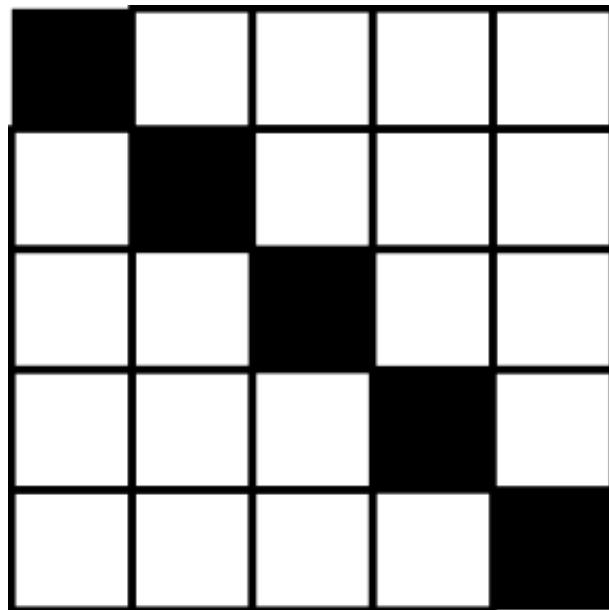
OPM - OP Linear Solver Using OpenCL 2020-2022

Contributed from Tong Dong Qiu (BDA) and José Eduardo Chiarelli Bueno Filho (Unicamp)

- No vendor lock-in
- Full well support
- Experiments with various OpenCL libraries (e.g. amgCL)
- 2022 Incomplete ISAI (José Eduardo)

OPM-OP 2022 GPU And MPI Guys Join Forces

- Meeting: Equinor, IT4Innovations, LinksFoundation, OPM-OP, SIMULA, SINTEF, Unicamp
- Use Block Jacobi with incomplete solves and domains from load balancer (Andreas Thune)
- Even better than Chow-Patel fine grained ILU0



DISCUSSION ABOUT THE FUTURE

