



Stock-take for NEMO HPC WG

HPC Working Group Meeting
January 2019

Overview

- This is a short summary of a stock-take document prepared by the NEMO HPC WG
- It is quite a large group which meets about once every 6 weeks by Webex
- There has been good progress on most issues
- Topics to be covered
 - Inter-node communication
 - Shared memory parallelism
 - Single core performance
 - Designing a flexible user-friendly code structure
- Other topics
 - Mixed precision calculations
 - Porting to GPUs
 - Sea-ice
 - Biology

Inter-node exchanges

- A **lot of improvements** have been included in version **4.0** or ready to be merged
 - Number of communication calls reduced
 - MPI interface improved; preparing for increased halo size
 - Information on timings improved
 - North fold bottleneck identified and improved
 - Automated choice of best domain decomposition
- Plans for 2019
 - Explore use of larger halos (possibility to reduce number of comms)
 - Tasks exploring/improving use of xios2
 - Profiling analyses using BSC tools
- **Who's involved**
 - Seb, Gurvan, Rachid (CNRS), Silvia, Francesca (CMCC), Mirek (Met Office), Andrew, Simon (NOC), Miguel, Mario, Stella (BSC), Erwan, Louis, David (BULL), Eric (Cerfacs)

Single core and shared memory

- Coarse grain parallelisation (tiling):
 - applied to advection kernel – 10% reductions
 - applied to isopycnal diffusion & TKE scheme - 50% & 20% reductions
 - applied OpenMP quite efficiently at the tiling level
 - nice design for horizontal tiling (Gurvan)
- Improvements to vectorisation using SIMD – some 10% reductions
- Plans for 2019
 - Introduce horizontal tiling (who will do it and impact tbc)
 - Introduce SIMD into trunk (CMCC)
- Who's involved:
 - Gurvan (CNRS), Italo, Francesca (CMCC), Maff, Mike (Met Office)

Mixed precision

- Reduces both memory and CPU usage - can almost halve run-time
- Some proof of concept of an automated tool by BSC (Oriol)
- Some open questions on how to proceed
- Plan for 2019: [Group forming to clarify plans](#) (BSC, ECMWF, CNRS)

Porting to GPUs

- A basic port can be done with minimal OpenACC directives
- NEMO vectorises well so runs reasonably well on a basic port
- Plan for 2019: TBD: Met Office, Nvidia interest

Design of code structure

- Designing a flexible user-friendly code structure
 - Gurvan's design for tiling with OpenMP is a good step forward
 - Andy Porter is making progress with parsing of NEMO into Psyclone
 - Simplest implementation of OpenACC is light-weight
- Questions for 2019 ?
 - Is implementation of OpenACC in trunk acceptable ?

Sea-ice

- SI3 code seems reasonably efficient
- Load balance in global models poor if uses ocean domain decomposition
- Plan for 2019: No plans ?

Biology

- Has not been discussed much
- Performance assessment would be first step