NEMO Performance assessment

ISC BoF

June 21, 2016 - ISC

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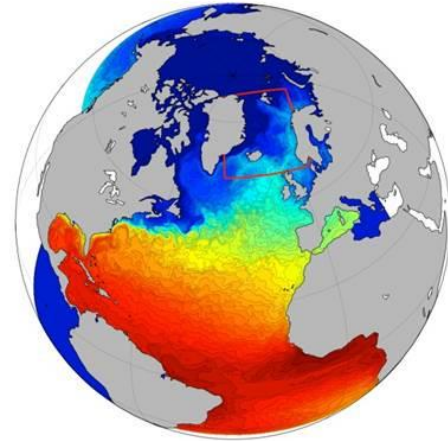# 1 Background

Background/Context
NEMO presentation

► NEMO is an oceanographical application developed by an European consortium.

► ATOS is working with NEMO developers to improve its performances.

► We asked to BSC and POP to work on NEMO profiling to:
  – Evaluate the BSC tools
  – find some hints to improve the NEMO behavior

► A Priori
  – NEMO is a memory bandwidth limited application
  – not optimal scalability.

Background/Context
BSC deliverable

► From traces obtained by ATOS, BSC provided

  – a very clear and useful report on the NEMO analysis.
  – several hints on the work which could be done to improve the scalability, but also the vectorization.

► BSC expert are very reactive and propose an excellent service

► The next step will be to work with BSC on the memory pattern in order to decrease the memory bandwidth pressure

2 Analysis

Application structure

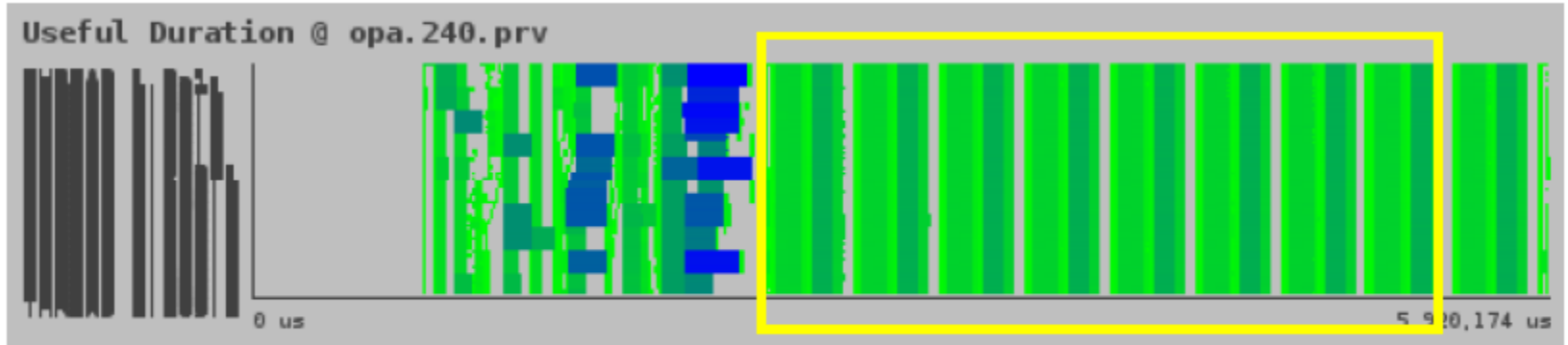► The spatio-temporal structure of the behavior of the run with for the whole run

Figure 1: Useful duration view for whole trace at 240 processes

► In the yellow box, the region of interest (ROI) with iterative computations
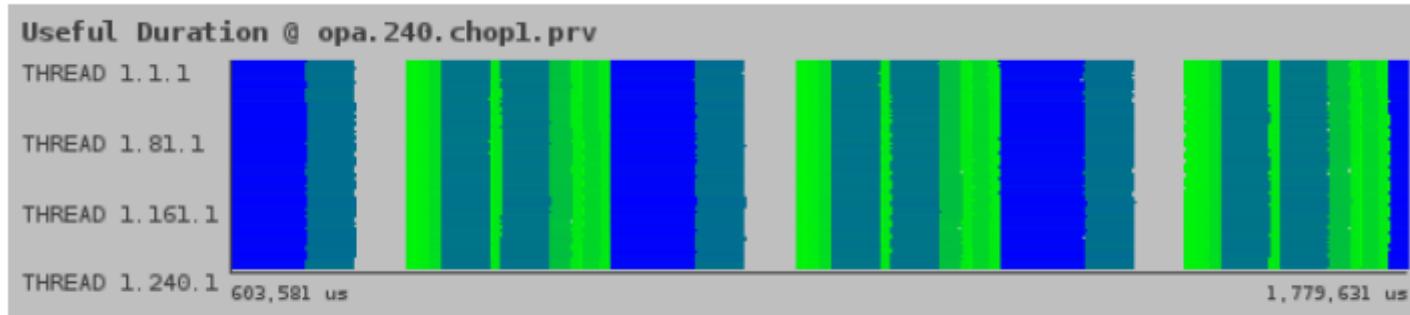
ROI (Region of interest)

▶ Zoom on only 3 iterations

Figure 2: structure of ROI for 240 processes

▶ each lasts longer than 1ms

Load balance

► extremely low inbalance

	24	48	72	96	240	360	480
Instr. LB	0.9995	0.9992	0.9992	0.9974	0.9991	0.9971	0.9914
Cycles LB	0.9934	0.9992	0.9840	0.9712	0.9811	0.9720	0.9777

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Computational cost of RIO regions

► Extrae shows that the major part of the code has a poor performance (**I**nstruction **P**er **C**ycle is low)
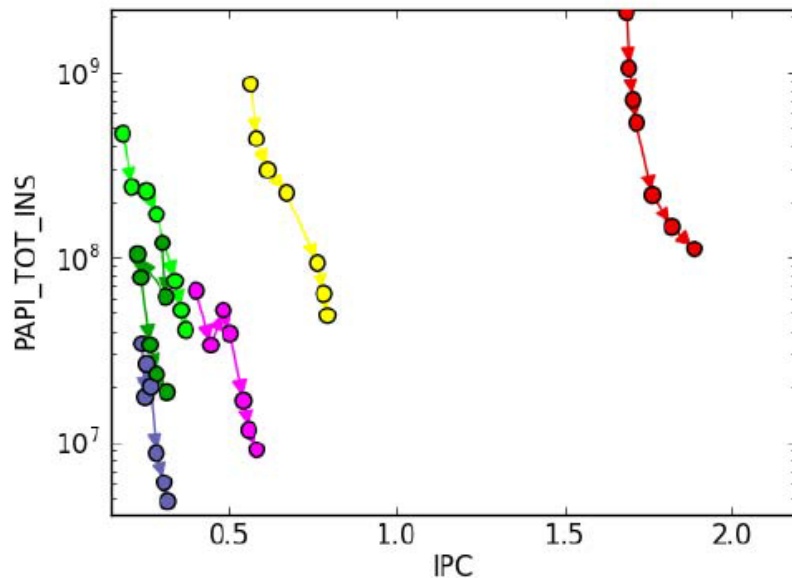

Figure 6. Evolution of #instructions vs. IPC for the main clusters when scaling from 24 to 480 processes.

3 Conclusion

Summary observations/recommandations

▶ BSC gave us several hints to improve NEMO performances :
  – poor IPC which suggest that some part of the code should be restructured
  – some operation could be easely overlap thanks to OpenMP instructions.

▶ Services provided by POP are very precise and focused immediately on the point of interest that could allows to improve the performance of your code.
▶ "The services are **free of charge** to organizations in the EU!"

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Future work

► BSC have analyzed burst traces with sampling information of runs between 24 and 480 processes of the NEMO code. Traces should be re create with more information about the source code and memory pattern

► The future work will be focused on :
  – determine which part of the source code that could be optimized
  – make an analysis of the memory pattern

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Thank You!

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