GPI – THE BOOSTER FOR STENCIL BASED INDUSTRY APPLICATIONS

- Easy transition from bulk-synchronous MPI
- Minimal porting effort
- Complete re-use of legacy kernels
- Improved scalability
- Improved performance

RTM: 3D acoustic wave equation: Results

Joint work with Mauricio Araya-Polo (Repsol USA)
GPI

- Industry proven, small yet powerful PGAS API
- One-sided, non-blocking, truly asynchronous and zero-copy communication
- Minimal interference between computation and communication
- Full hardware utilization
- Excellent scalability TAU\[1\], BQCD\[2\], UTS\[3\]
- Accelerator support (NVIDIA Tesla, Intel® Xeon Phi™)

Stencil

- 3D acoustic wave equation kernel (fdtd-method: 8\textsuperscript{th}-2\textsuperscript{nd} order approximation)
- Bulk-synchronous legacy MPI implementation
- Domain decomposition
- Tight neighbor coupling

Asynchronous implementation

\[ b \leftarrow 0 \]
for \( t = 0 \) to \( t = N_t \) do
\[
/* Compute boundary regions */
data_{LB}[1-b] = compute (data_{LB}[b])
data_{RB}[1-b] = compute (data_{RB}[b])
/* Exchange boundary regions */
write (data_{LB}[1-b])
\quad \rightarrow \ data_{RH}[1-b], LN) and notify
write (data_{RB}[1-b])
\quad \rightarrow \ data_{ RH}[1-b], RN) and notify
/* Compute inner regions */
data_{IN}[1-b] = compute (data_{LB}[b])
/* wait for halo validity */
WAIT for notifications
/* Swap buffers */
\quad b \leftarrow 1 - b
end for

[1] Simmendinger, Christian; Jägersküpper, Jens; Machado, Rui; Lojewski, Carsten: A PGAS-based Implementation for the Unstructured CFD Solver TAU; in 5\textsuperscript{th} Conference on Partitioned Global Address Space Programming Models, Tremont House, Galveston Island, Texas, USA, October 2011
