

Serie 13

Remark: Programs shall be executed on the cluster lcvmlc2!

Exercise 1 Complete the program `mv_blas.c` calling the BLAS function `dgemv_` which does the multiplication $y = A * x$ and apply it to the particular case of the 16×20 matrix

$$A_{ij} = |i - j|, \quad 1 \leq i \leq 16, \quad 1 \leq j \leq 20$$

and the vector of order 20

$$x_j = j - 1, \quad 1 \leq j \leq 20.$$

The makefile is called `Make.dgemv`.

Exercise 2 The matrix of the preceding exercise is partitioned by blocks of size 4×4 . Complete the program `mv_pblas.c` doing the multiplication $y = A * x$ with the help of the PBLAS function `pdgemv_`; like in the example of the course, the blocks are distributed on a 2×2 grid of processors. Validate the code by comparing to the result of Exercise 1. The makefile is given by `Make.pdgemv`. Hint: the block partition of the matrix reads:

$$A = \begin{pmatrix} A_0 & A_1 & A_2 & A_3 & A_4 \\ A_5 & A_6 & A_7 & A_8 & A_9 \\ A_{10} & A_{11} & A_{12} & A_{13} & A_{14} \\ A_{15} & A_{16} & A_{17} & A_{18} & A_{19} \end{pmatrix},$$

and is cyclically distributed on the 2×2 grid as follows:

A_0	A_2	A_4	A_1	A_3
A_{10}	A_{12}	A_{14}	A_{11}	A_{13}
A_5	A_7	A_9	A_6	A_8
A_{15}	A_{17}	A_{19}	A_{16}	A_{18}

Because of the Fortran storage, one declares for each processor an array `A[12][8]` which receives the transposed of the corresponding submatrix. For example, the processor $(0,0)$ receives the matrix

$$\begin{pmatrix} A_0^t & A_{10}^t \\ A_2^t & A_{12}^t \\ A_4^t & A_{14}^t \end{pmatrix},$$

through the pointer to its first entry. For PBLAS, one shall consider the vector x as a $1 \times n$ matrix and the vector y as a $n \times 1$ matrix.