

Parallel Computing Project / Exercise 6.3

The source code for tasks *a)* and *b)* is attached. The implementations work for any MPI datatype, any number of processes and any of the processes may be the root.

Derived Running Times

Given are the latency α , the bandwidth β , the time for communication of one package between two processes T_0 , the number of processes p and the amount of data to be transferred L .

Naive Scatter

$$T_{comm}^{naive}(L) = (\alpha + \beta L)T_0 + (p - 1)$$

The root process has to send L full packages to $p - 1$ other processes.

Tree Scatter

$$T_{comm}^{tree}(L) = \sum_{i=1}^{\log p} (\alpha + \beta 2^{-i} L) T_0$$

We take $\log p$ steps because of the tree structure. In each step, the amount of data tranferred is halved. From the lecture, we know this simplifies to:

$$\frac{p-1}{p} L \beta T_0 + \alpha T_0 \log p$$

Measured Running Times

All times are averages of 10 measurements in milliseconds, each being a scatter of 100 000 32-bit integers.

p	Naive	Tree	MPI
2	1.12185	1.05312	0.23484
4	1.84664	1.63285	0.37801
8	3.08375	2.83654	0.70191
16	6.03996	5.66702	1.54766
32	12.8085	11.2765	4.04168
64	142.755	58.4122	133.585
128	978.539	216.875	934.956