

Comparison of OpenMPI Algorithms for Collective Operations

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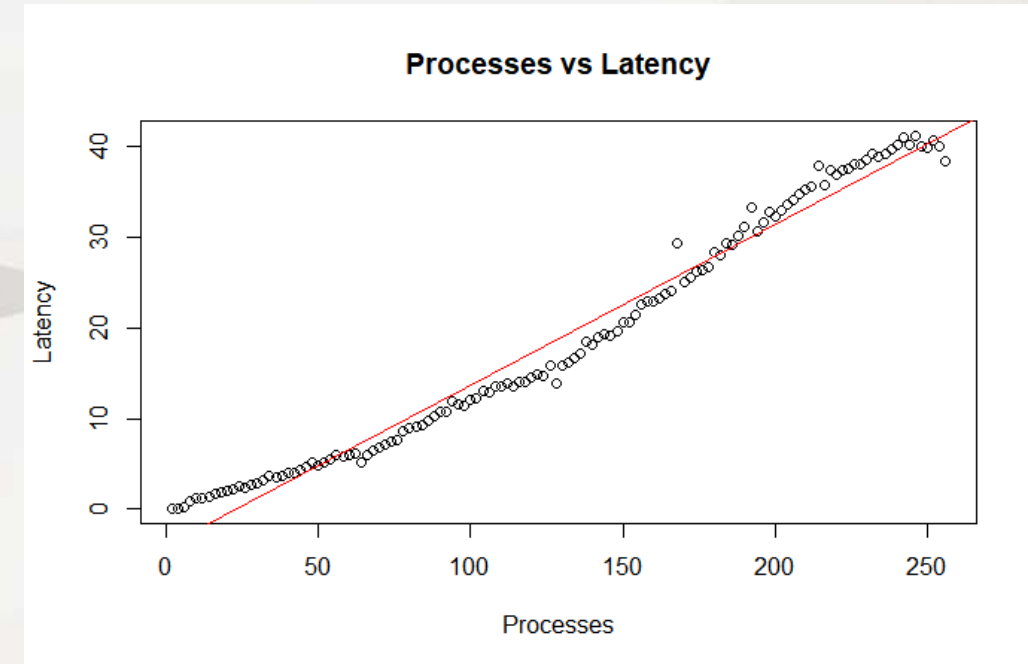
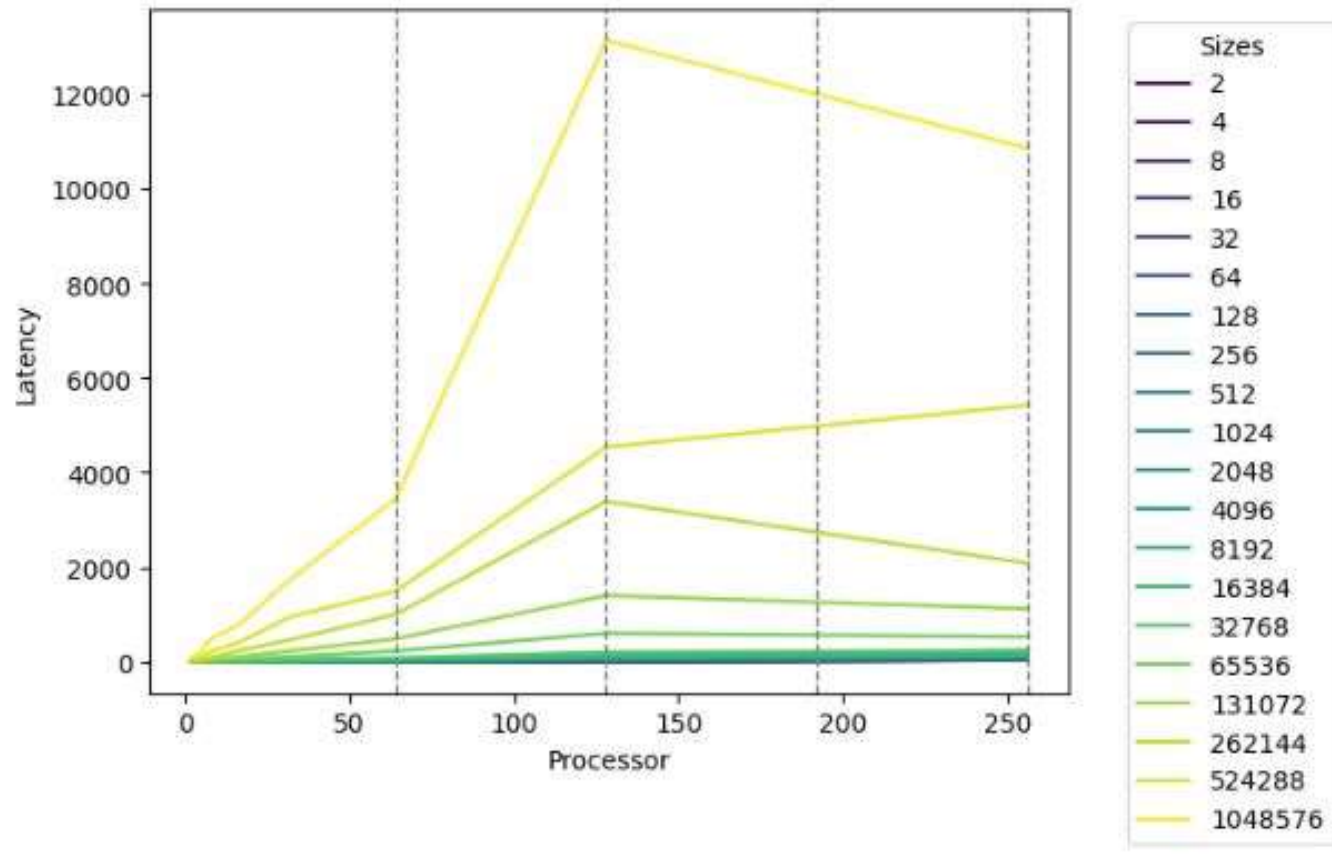
Broadcast

Broadcast algorithms enable the distribution of a message from a source process to all other processes within the communicator. ■

Different algorithms vary in communication topology and data transmission approach.

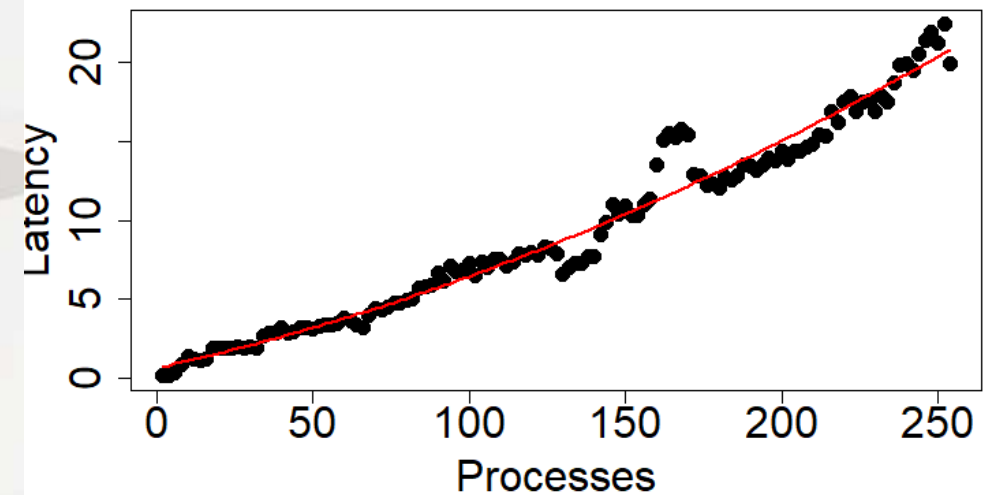
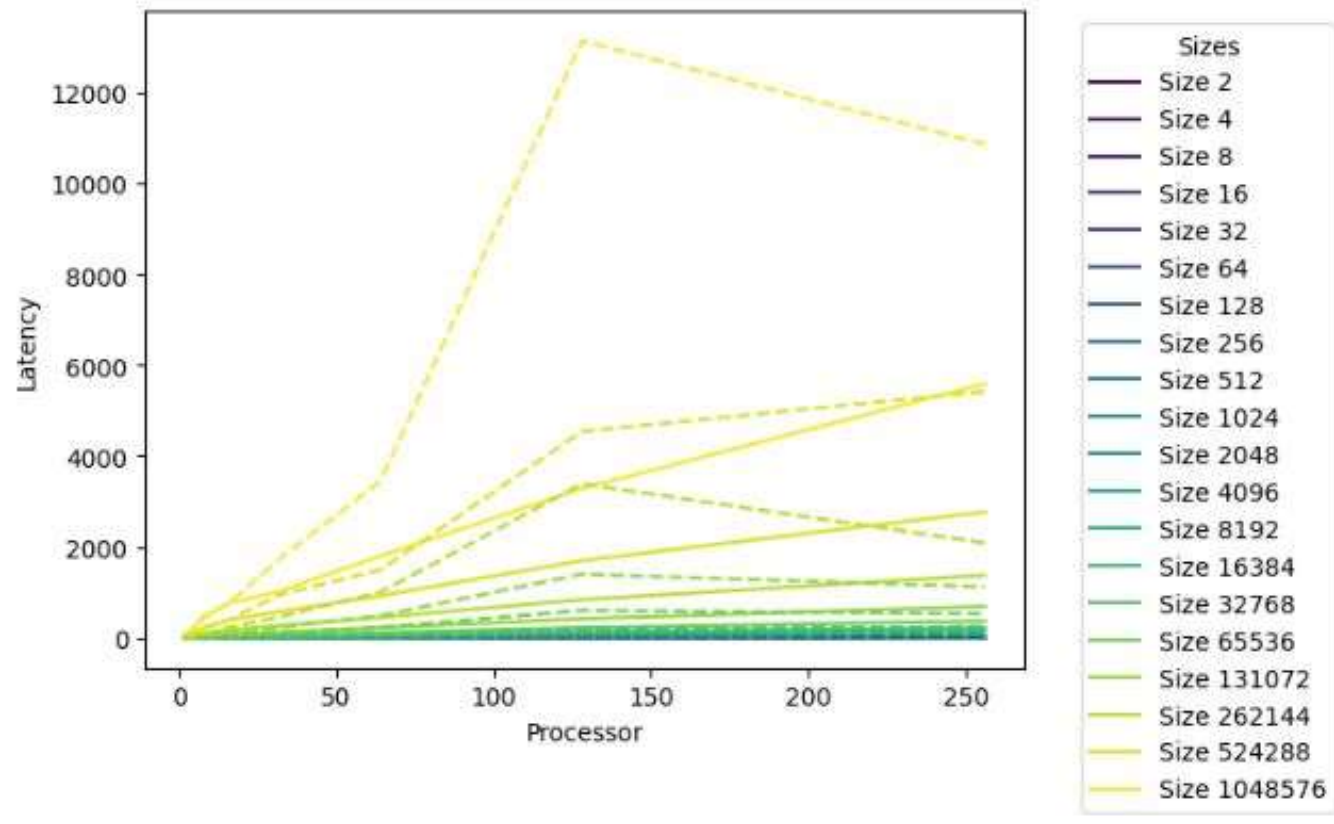
Four distinct algorithms were chosen: basic linear, chain, binary tree, and knomial tree.

Basic linear



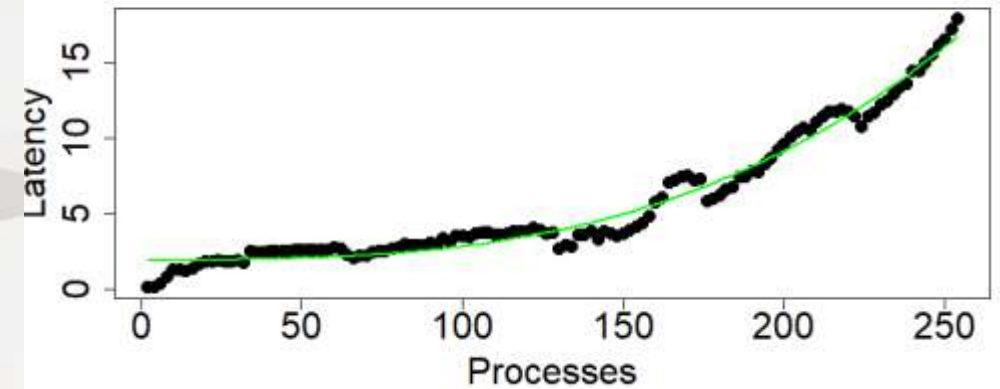
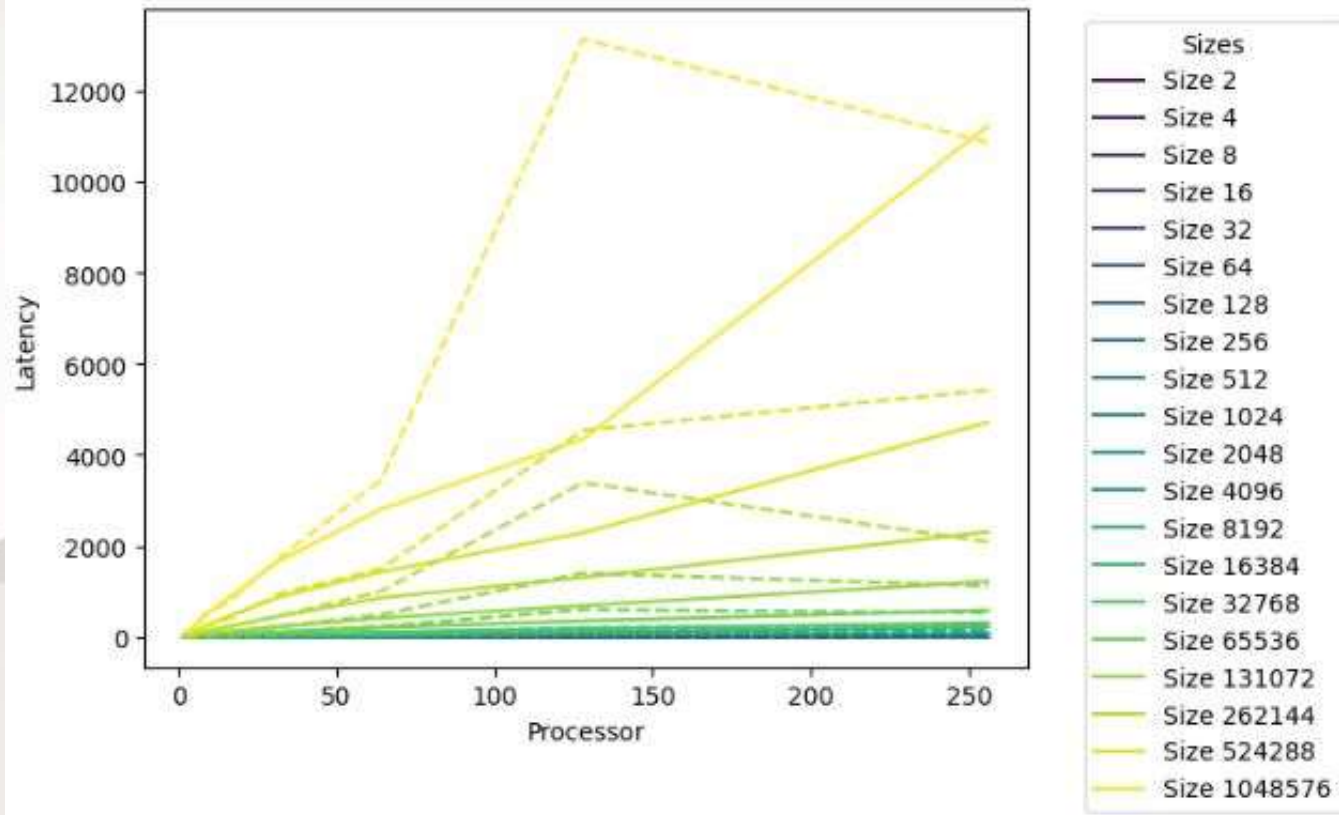
$$y = -4.055 + 0.177 \times \text{processes}$$

Chain



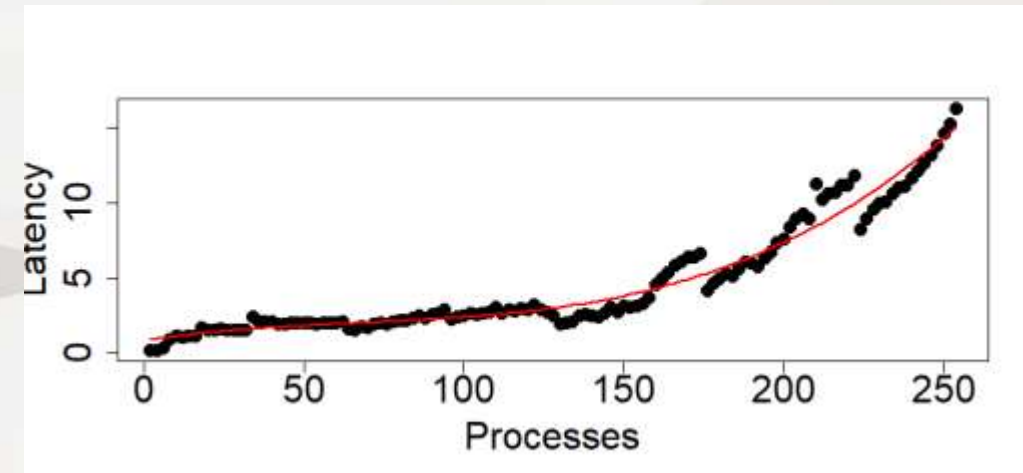
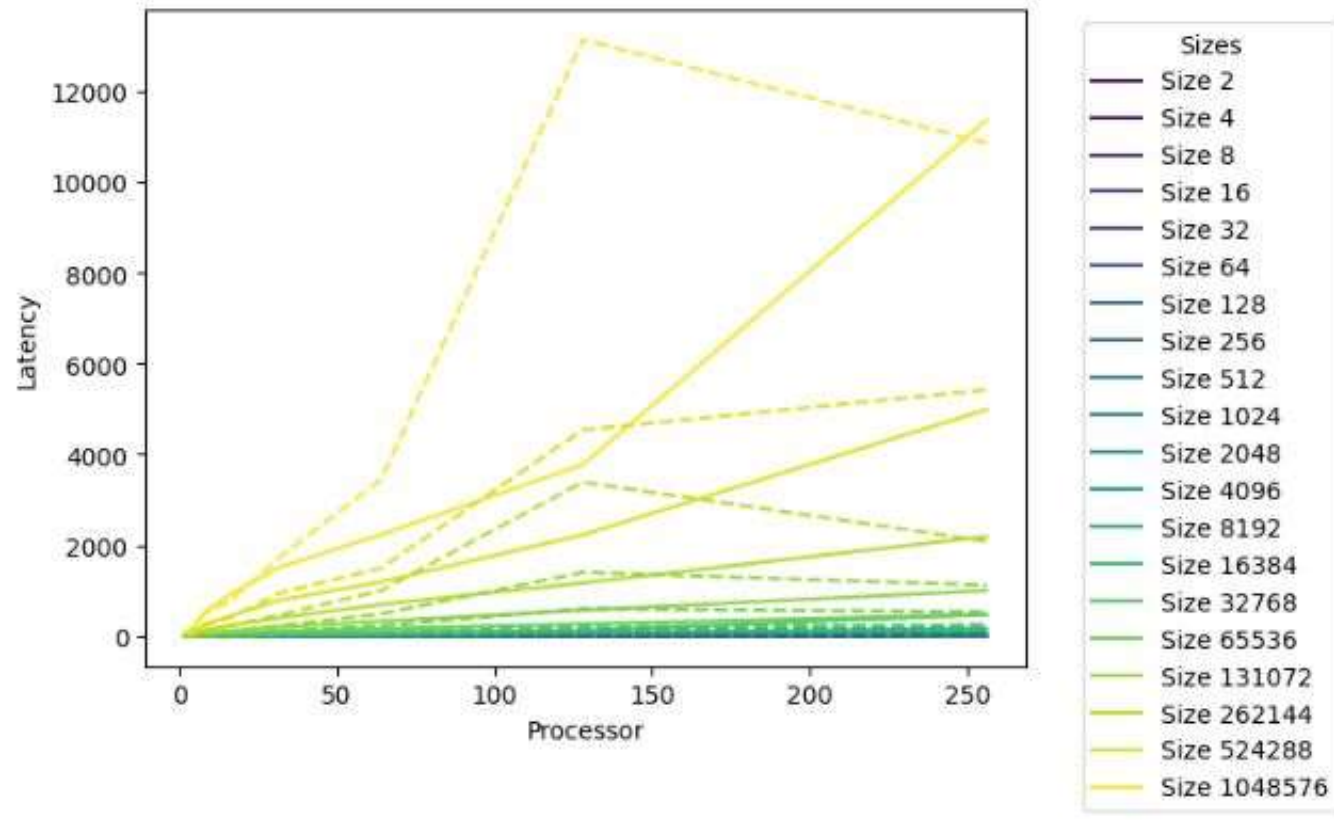
$$y = 6.443 e^{-1} + 4.416 e^{-2} \text{ processes} + 1.392 e^{-4} \text{ processes}^2$$

Binary tree



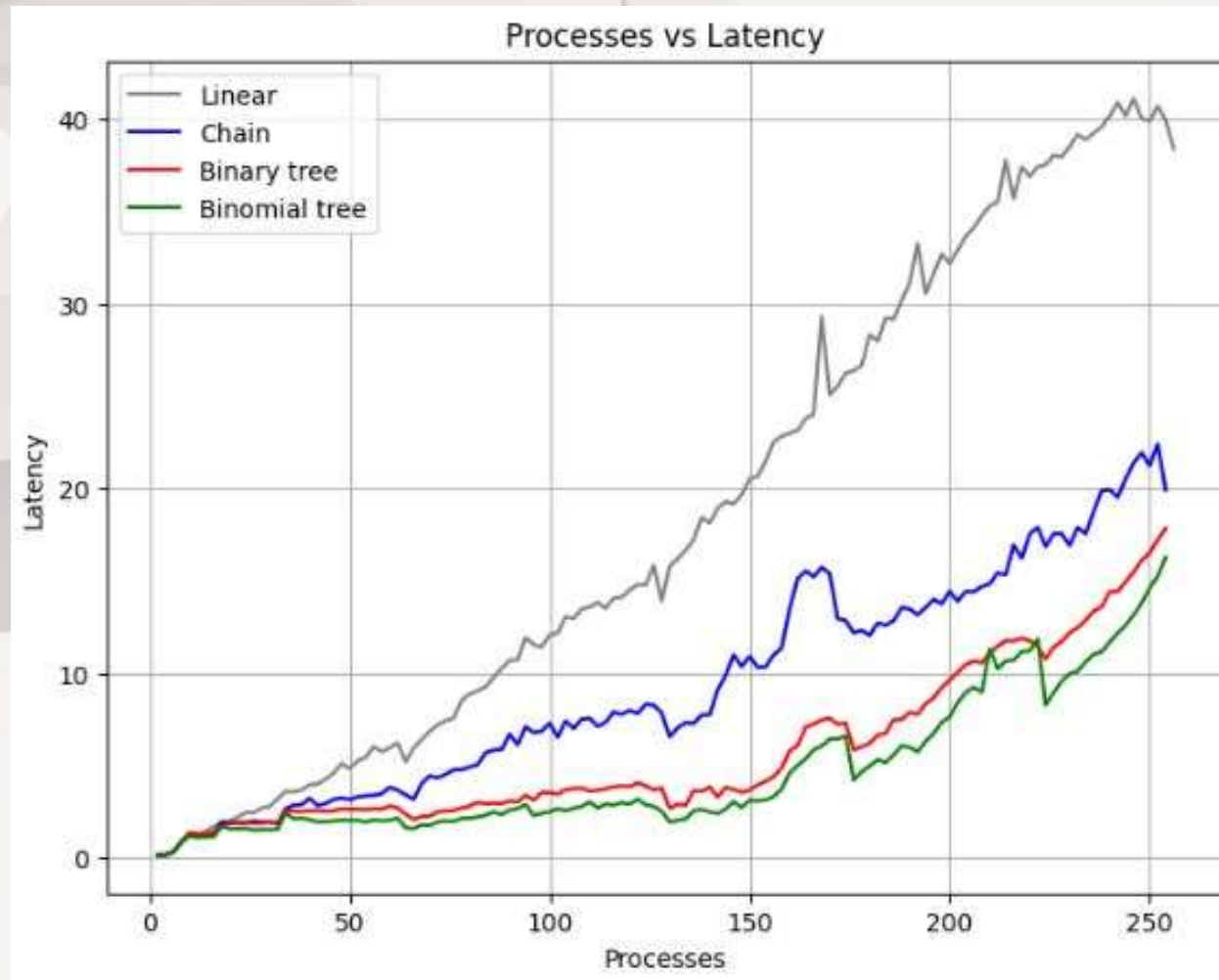
$$y = 1,957 + 8,99 e^{-2} \text{ processes}^3$$

Binomial tree



$$y = 8.297e^{-1} + 3.261e^{-2} \text{ processes} - 3.403 e^{-4} \text{ processes}^2 + 1.704 e^{-6} \text{ processes}^3$$

Comparison

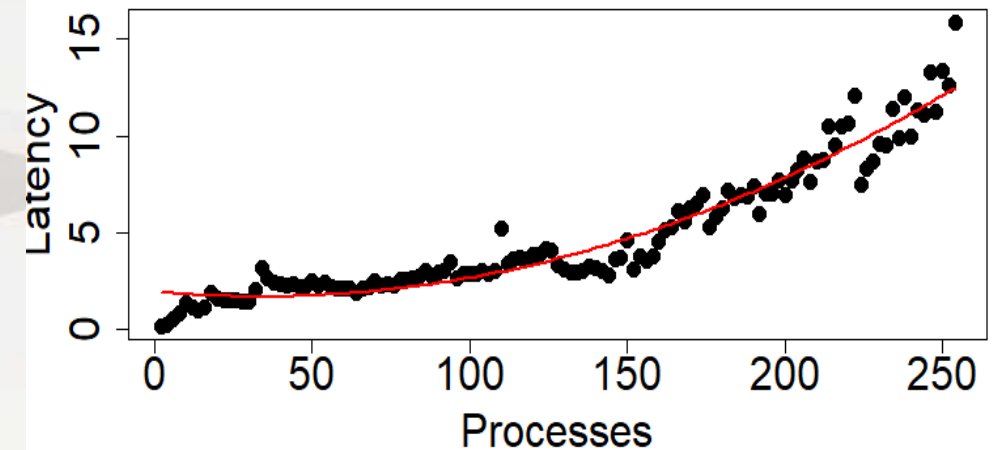
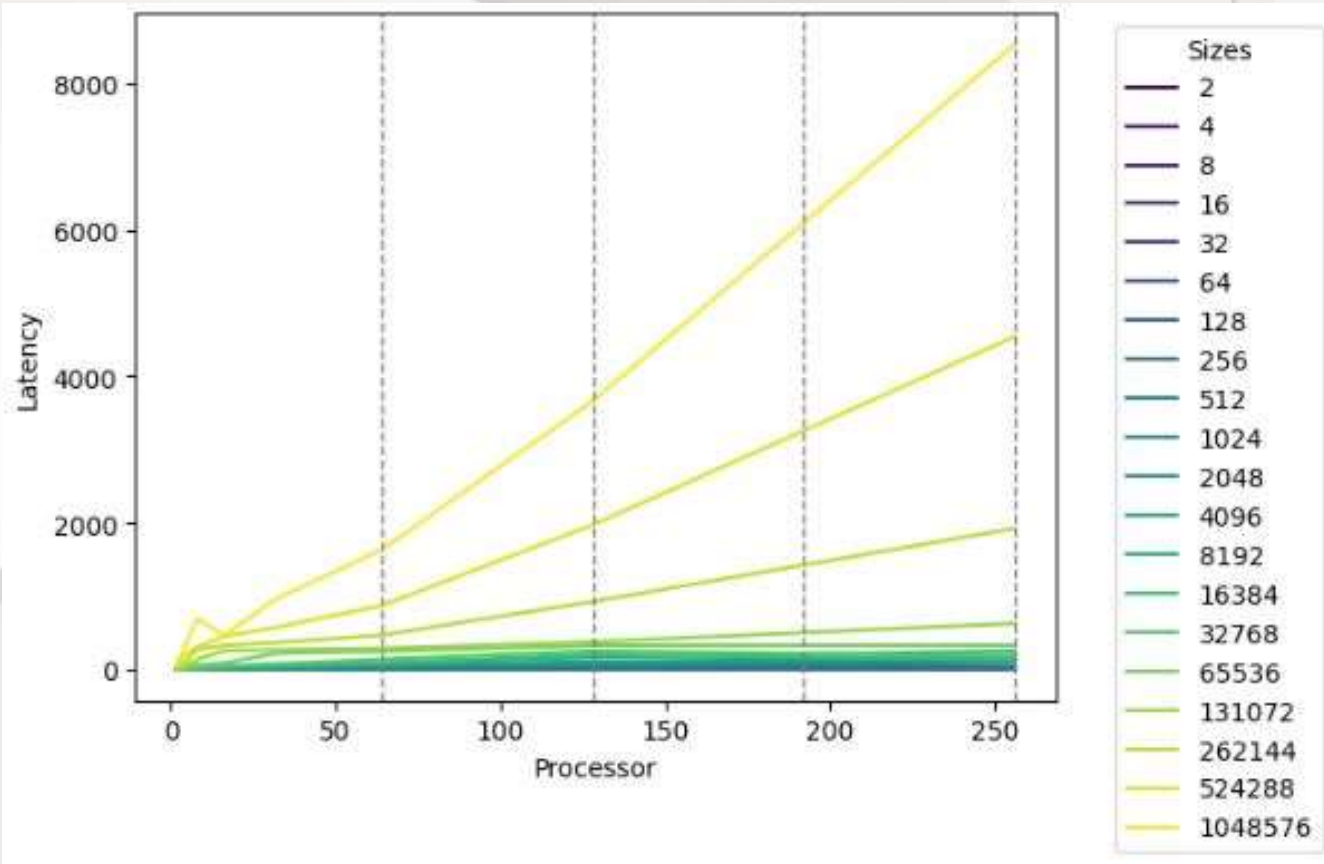


Scatter

Scatter is an operation involving the distribution of data from a source process to all other participating processes. This process divides a message into parts and sends it to different processes, each of which receives a specific portion of the message, facilitating the parallelization of complex tasks and improving overall performance.

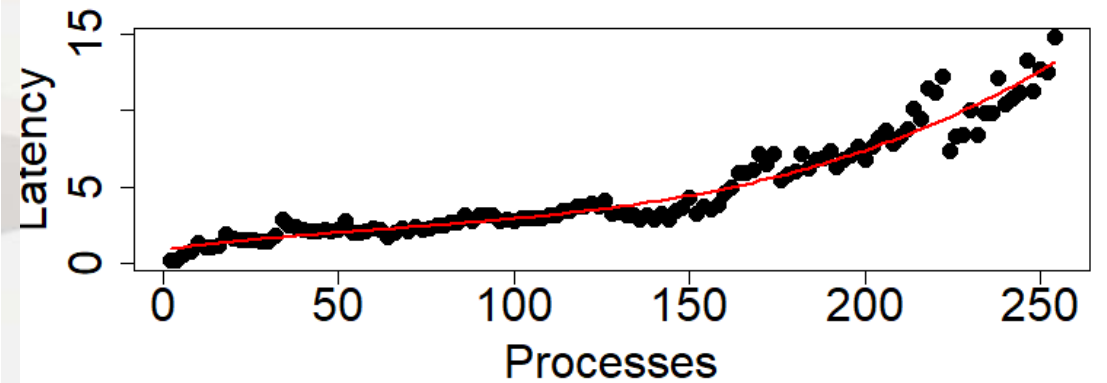
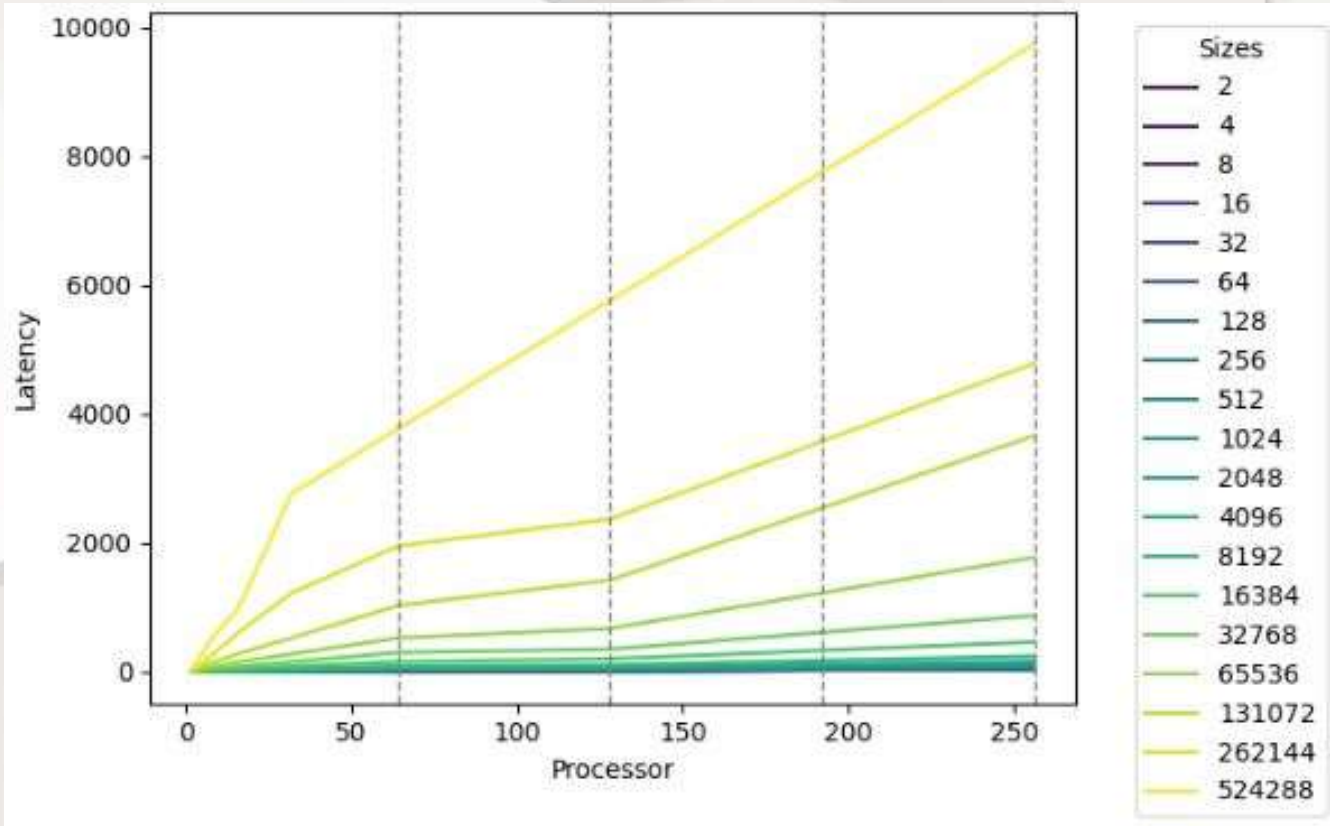
Four different algorithms were used: ignore, basic linear, binomial, and non-blocking linear.

Ignore



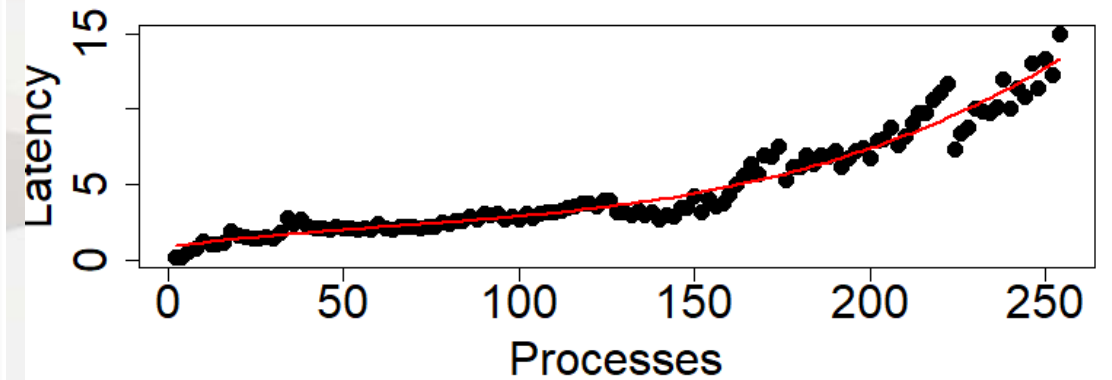
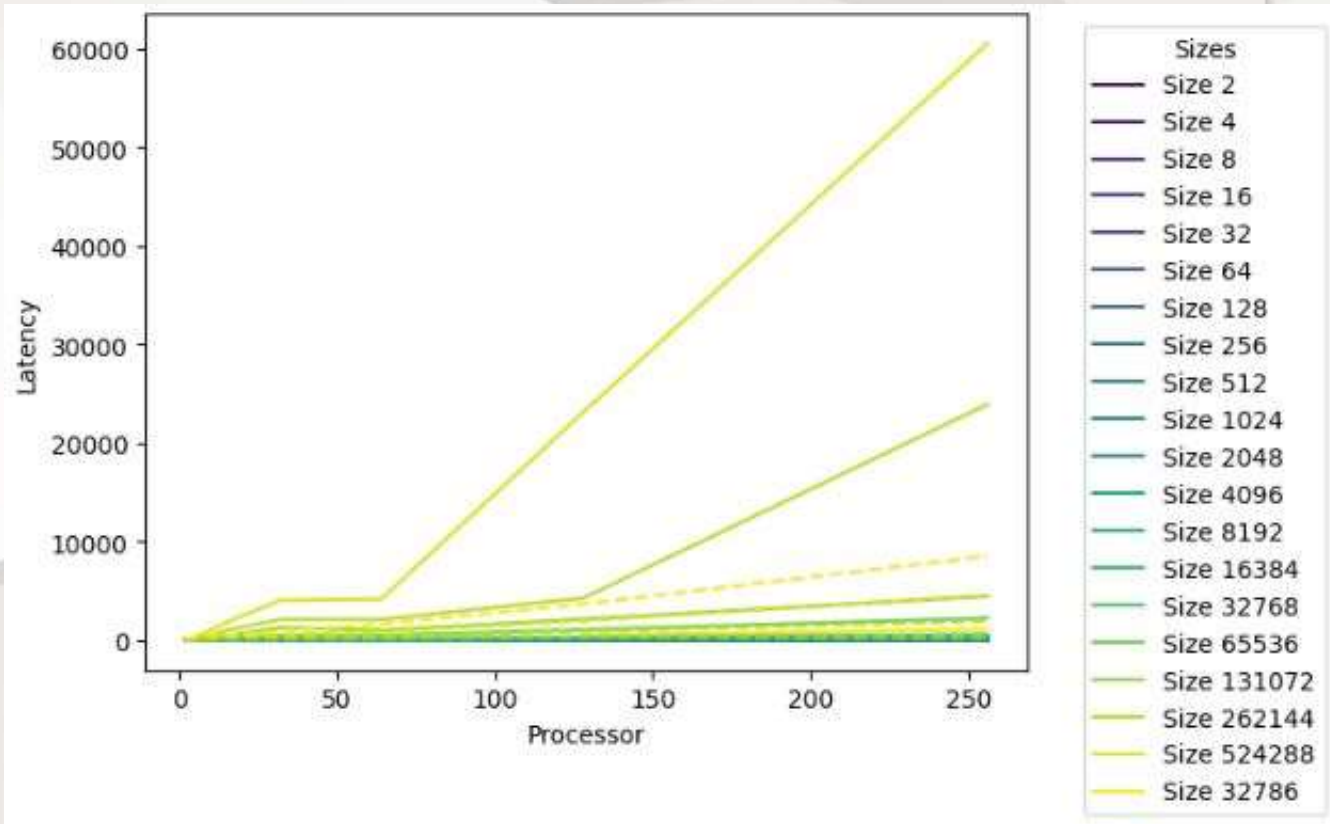
$$y = 1.937 - 1.493 e^{-2} \text{ processes} + 2.223 \text{ processes}^2 + 4.640 \text{ processes}^3$$

Basic linear



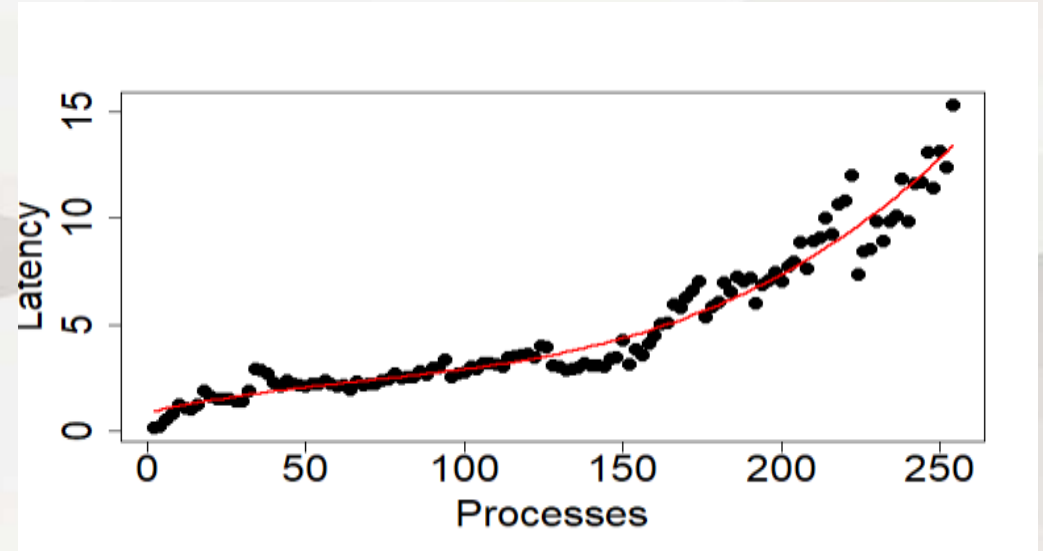
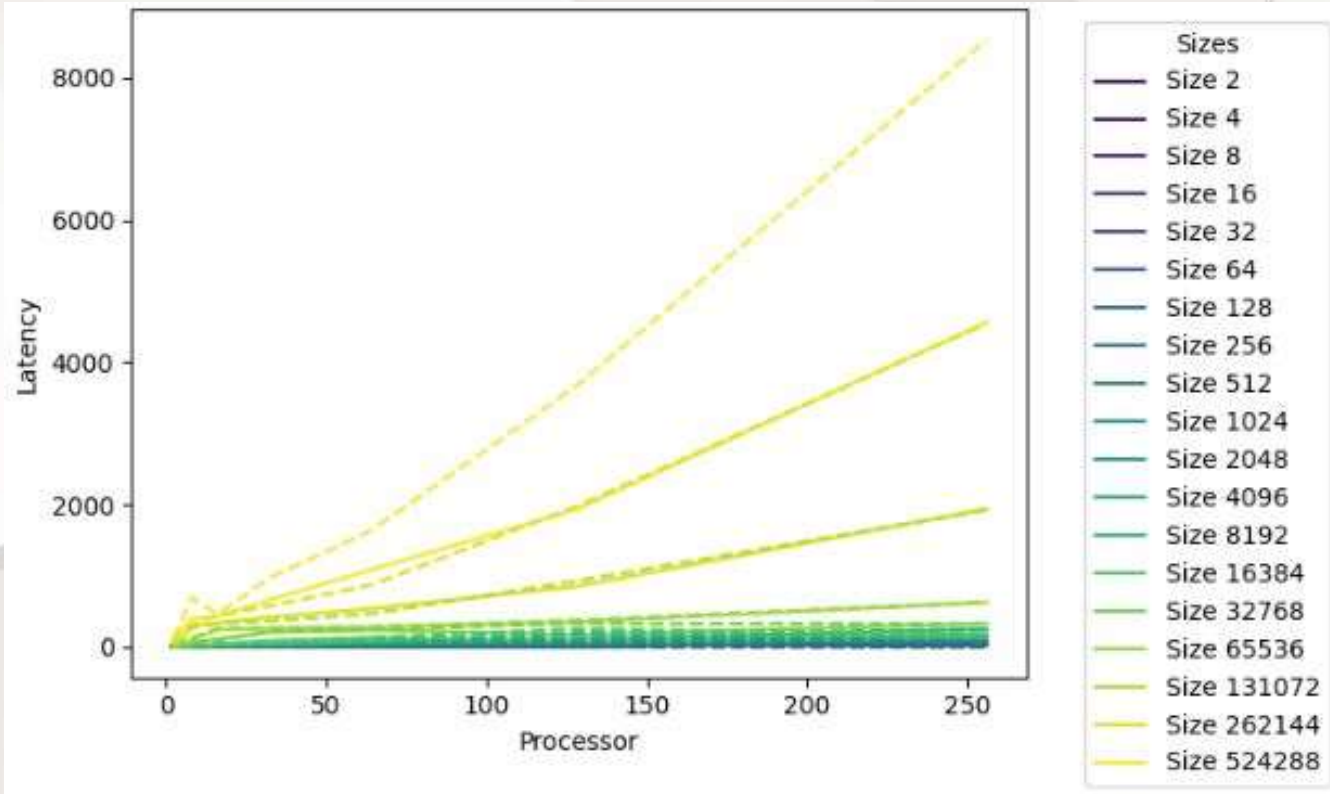
$$y = 8.708 e^{-1} + 3.008 e^{-2} \text{ processes} + 1.009 e^{-6} \text{ processes}^3$$

Binomial



$$y = 8.705 e^{-1} + 3.060 e^{-2} \text{ processes} + 1.135 e^{-6} \text{ processes}^3$$

Non blocking linear



$$y = 8.753 e^{-1} + 3.324 e^{-2} \text{ processes} + 1.247 e^{-6} \text{ processes}^3$$

Comparison

