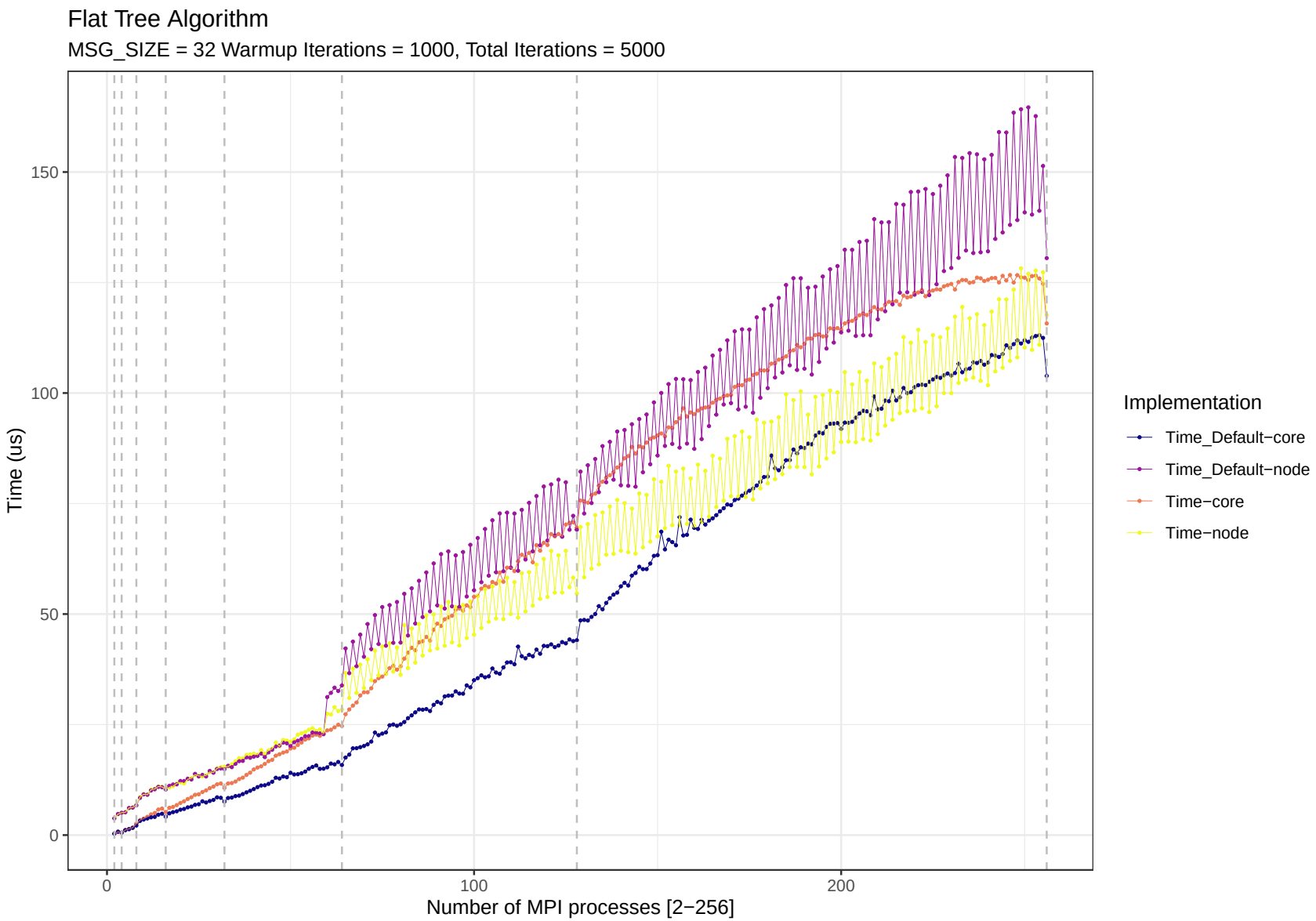
Implementation of MPI Collective Communication Algorithms

Introduction

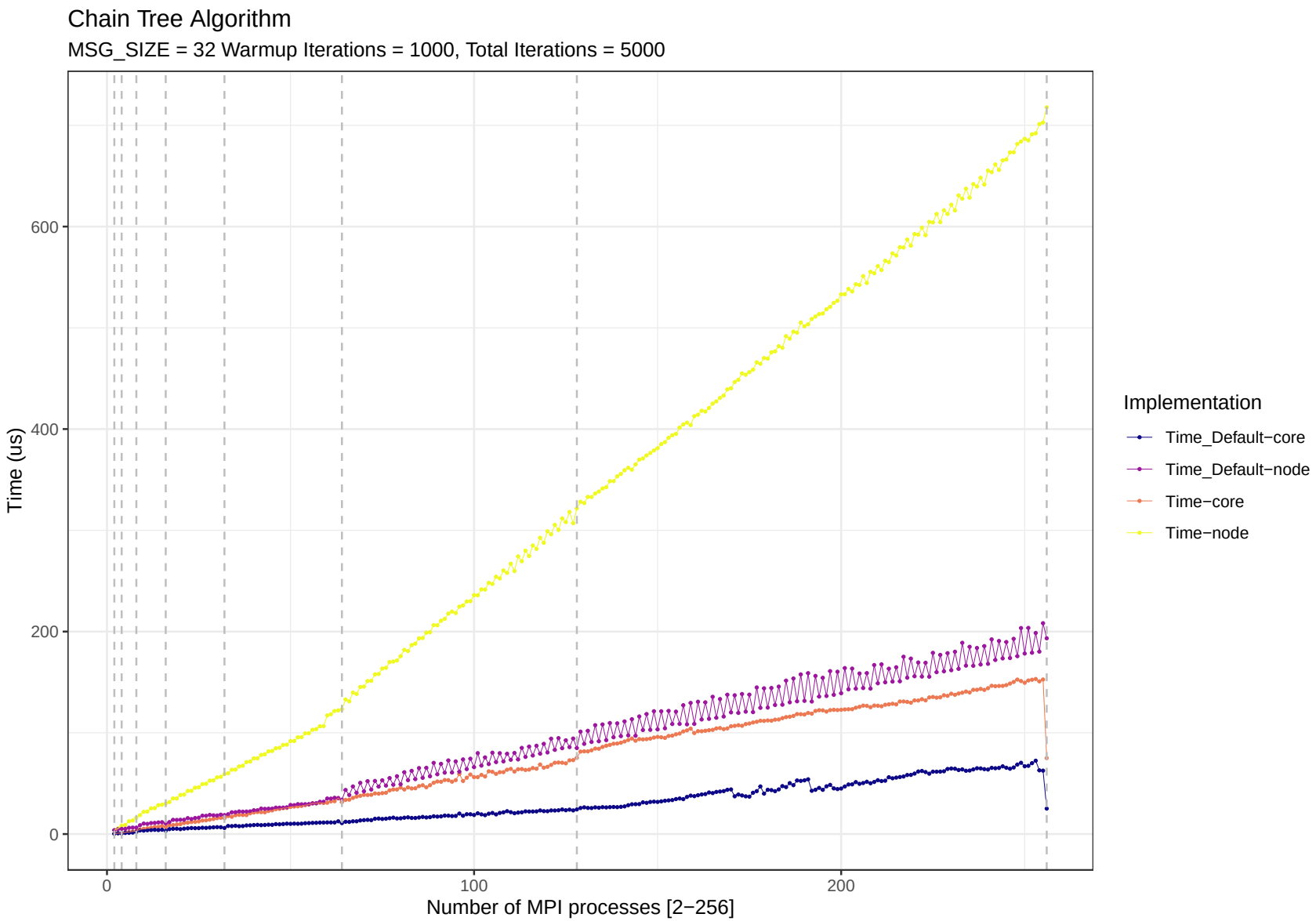
A number of aspects to consider:

- Different algorithms [flat tree, chain tree, binary tree]
- Number of MPI processes [up to 256]
- Size of the buffer [up to 1MB]
- Topology of the nodes and allocation of the computing resources
- Parameters of experiment [# iterations, estimator]
- Possible interactions between these factors

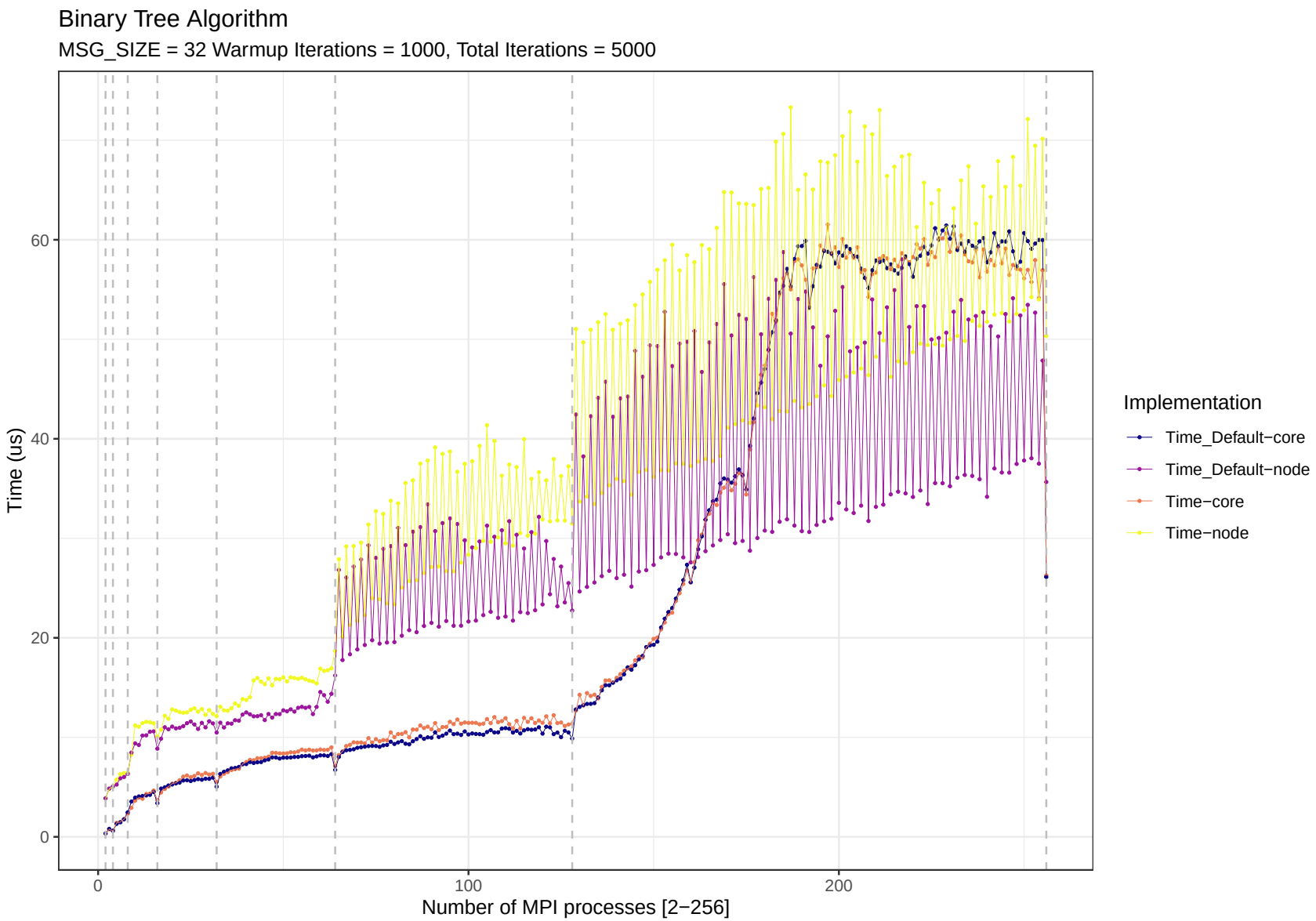
Weak Scaling: Flat Tree Algorithm



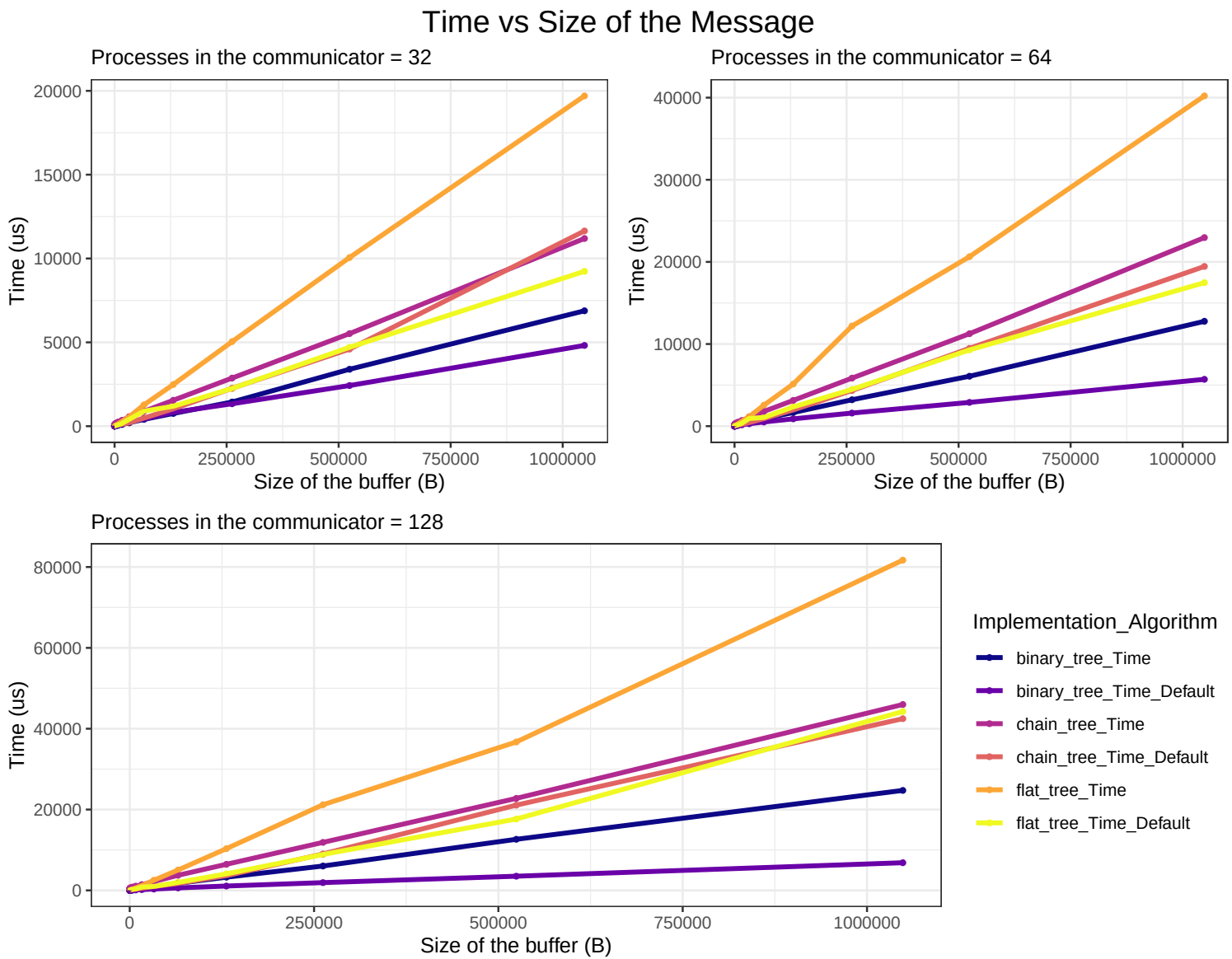
Weak Scaling: Chain Tree Algorithm



Weak Scaling: Binary Tree Algorithm



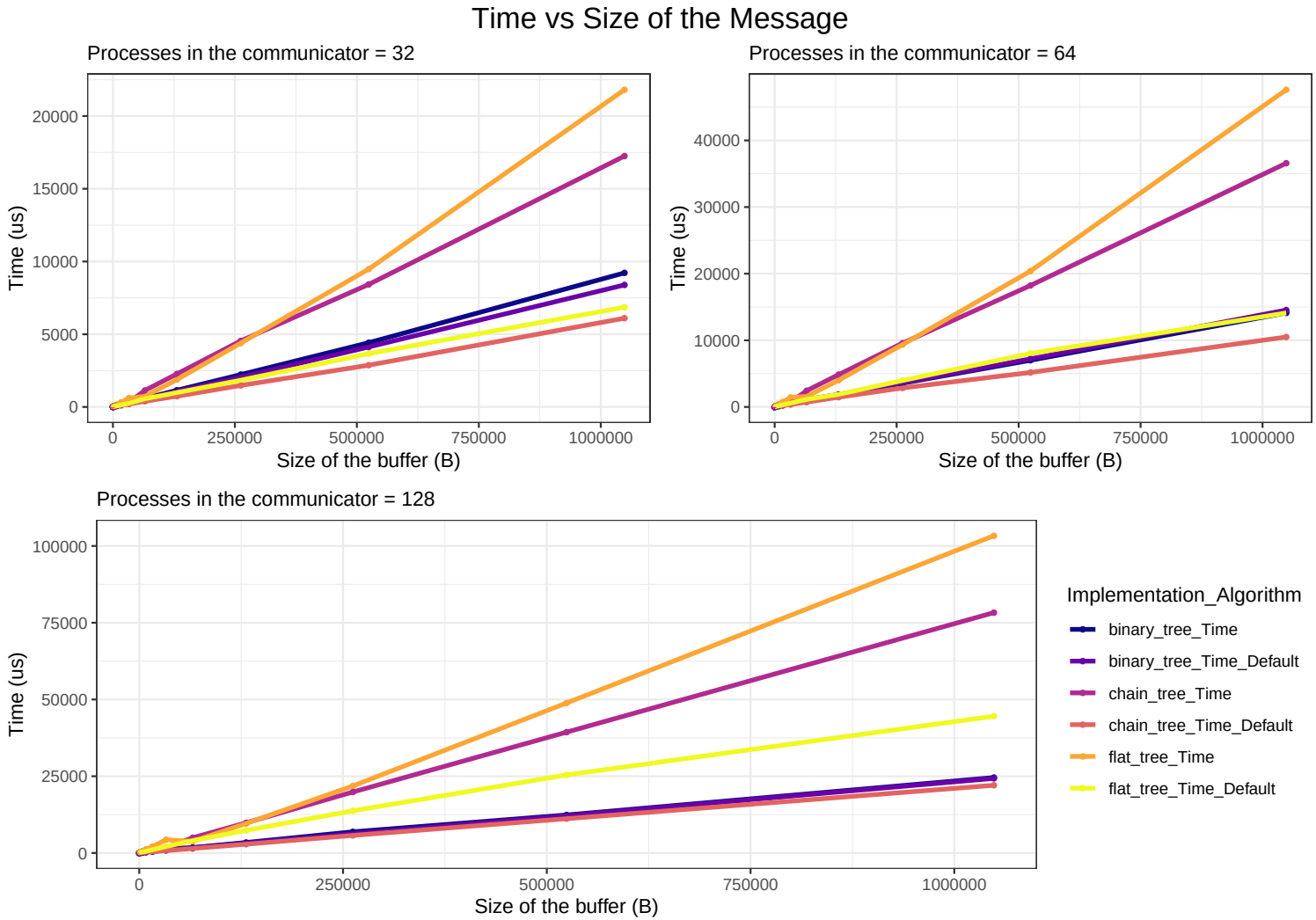
Strong Scaling: Allocation by Node



Allocation by Node, Results of the Linear Model

	Estimate	Std. Error	t value	Pr(>|t|)
binary_tree_Time	1.867e-04	7.594e-06	24.591	<2e-16
binary_tree_Time_Default	5.328e-05	7.594e-06	7.016	8.01e-12
chain_tree_Time	3.490e-04	7.594e-06	45.951	<2e-16
chain_tree_Time_Default	3.160e-04	7.594e-06	41.611	< 2e-16
flat_tree_Time	6.004e-04	7.594e-06	119.834	<2e-16
flat_tree_Time_Default	3.828e-04	7.594e-06	76.398	<2e-16

Strong Scaling: Allocation by Core



Allocation by Core, Results of the Linear Model

	Estimate	Std. Error	t value	Pr(>|t|)
binary_tree_Time	1.939e-04	4.831e-06	40.13	<2e-16
binary_tree_Time_Default	1.914e-04	4.831e-06	39.62	<2e-16
chain_tree_Time	5.736e-04	4.831e-06	118.73	<2e-16
chain_tree_Time_Default	1.642e-04	4.831e-06	34.00	<2e-16
flat_tree_Time	7.332e-04	4.831e-06	151.77	<2e-16
flat_tree_Time_Default	3.152e-04	4.831e-06	65.23	<2e-16