```
ubuntu@ip-172-31-43-252:~/csci455/Lab4-Timing_Model_Comparison$ make test_mpi_latency
# TODO 2: Run first code (mpi_latency.c) on 2 processors with N (size) as
#         10, 50, 100, 200, 500, 1000, 2000, 3000, 4000, 5000, respectively,
#         to see the send/recv timing costs.
Platform: Linux (96 cpu cores recognized)
MPIRUN mpi_latency with 5 node processes:
INFO: Number of processes = 5
INFO: Only executing 2 tasks - extra cluster processes will be ignored
task 1 has started...
task 0 has started...
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 10
****************************************
Rep#       T0          T1         deltaT
   1        0.00        5.68        5.68
   2       11.51       14.88        3.37
   3       19.45       22.13        2.69
   4       25.03       27.72        2.69
   5       31.54       34.47        2.93
   6       37.10       56.29       19.20
   7       60.46       63.54        3.08
   8       67.85       70.65        2.80
   9       73.92       76.61        2.69
  10       80.03       82.53        2.50
****************************************
*** Avg round trip time = 4.761000 microseconds
*** Avg one way latency = 2.380500 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 50
****************************************
Rep#       T0          T1         deltaT
   1      100.73      103.47        2.74
   2      107.40      110.01        2.61
   3      112.65      115.35        2.70
   4      119.17      134.79       15.63
   5      138.79      142.04        3.25
   6      148.38      150.67        2.29
   7      152.85      154.90        2.06
   8      156.98      158.66        1.69
   9      160.81      163.71        2.91
  10      167.01      169.02        2.01
****************************************
*** Avg round trip time = 3.788800 microseconds
*** Avg one way latency = 1.894400 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 100
****************************************
Rep#       T0          T1         deltaT
   1      186.61      188.24        1.63
   2      191.03      192.66        1.63
   3      196.20      197.72        1.51
   4      200.47      202.55        2.08
   5      206.01      207.97        1.96
   6      211.78      213.83        2.05
   7      217.71      220.08        2.37
   8      223.72      225.68        1.95
   9      228.58      230.47        1.89
  10      234.29      235.99        1.70
****************************************
*** Avg round trip time = 1.877300 microseconds
*** Avg one way latency = 0.938650 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 200
****************************************
Rep#       T0          T1         deltaT
   1      265.65      267.81        2.15
```

```
   2      271.45      273.94        2.49
   3      277.58      280.12        2.54
   4      283.72      285.78        2.06
   5      288.65      291.72        3.08
   6      295.34      298.55        3.20
   7      301.99      304.32        2.33
   8      307.86      310.50        2.64
   9      312.71      315.47        2.76
  10      319.32      322.24        2.92
****************************************
*** Avg round trip time = 2.616900 microseconds
*** Avg one way latency = 1.308450 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 500
****************************************
Rep#       T0          T1         deltaT
   1      339.01      345.11        6.10
   2      347.91      350.51        2.60
   3      354.30      357.09        2.79
   4      359.75      362.92        3.17
   5      365.72      368.34        2.61
   6      371.70      374.17        2.47
   7      377.03      379.42        2.39
   8      382.17      384.69        2.51
   9      388.24      390.58        2.34
  10      393.65      396.02        2.37
****************************************
*** Avg round trip time = 2.935400 microseconds
*** Avg one way latency = 1.467700 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 1000
****************************************
Rep#       T0          T1         deltaT
   1      410.52      414.07        3.54
   2      417.60      421.33        3.73
   3      425.75      428.76        3.01
   4      431.91      436.54        4.62
   5      440.10      443.83        3.73
   6      446.15      450.10        3.95
   7      453.54      456.85        3.31
   8      460.57      465.16        4.59
   9      468.70      472.03        3.33
  10      475.75      479.12        3.36
****************************************
*** Avg round trip time = 3.718000 microseconds
*** Avg one way latency = 1.859000 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 2000
****************************************
Rep#       T0          T1         deltaT
   1      495.01      498.91        3.89
   2      501.54      505.55        4.01
   3      509.14      513.14        3.99
   4      516.32      520.85        4.52
   5      524.47      528.78        4.31
   6      533.11      537.26        4.15
   7      540.80      544.49        3.69
   8      547.24      551.62        4.38
   9      555.29      559.10        3.81
  10      561.73      565.96        4.23
****************************************
*** Avg round trip time = 4.099000 microseconds
*** Avg one way latency = 2.049500 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 3000
****************************************
```

```
Rep#       T0          T1         deltaT
   1      585.60      601.91       16.31
   2      606.20      611.73        5.53
   3      615.19      619.97        4.79
   4      624.04      629.54        5.51
   5      632.92      637.75        4.82
   6      641.40      646.51        5.11
   7      649.93      654.60        4.66
   8      658.34      663.57        5.23
   9      669.02      673.72        4.70
  10      677.42      682.52        5.10
****************************************
*** Avg round trip time = 6.175800 microseconds
*** Avg one way latency = 3.087900 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 4000
****************************************
Rep#       T0          T1         deltaT
   1      707.81      713.38        5.58
   2      717.23      723.91        6.68
   3      728.23      733.52        5.29
   4      736.76      742.80        6.04
   5      746.49      752.14        5.65
   6      755.66      762.01        6.35
   7      765.39      771.15        5.76
   8      774.43      780.36        5.93
   9      785.52      791.50        5.98
  10      794.07      800.48        6.41
****************************************
*** Avg round trip time = 5.967100 microseconds
*** Avg one way latency = 2.983550 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 5000
****************************************
Rep#       T0          T1         deltaT
   1      828.21      875.62       47.41
   2      880.08      894.50       14.41
   3      898.61      910.49       11.87
   4      914.62      926.17       11.55
   5      931.48      943.40       11.92
   6      947.26      958.55       11.29
   7      962.23      972.54       10.31
   8      976.83      987.18       10.35
   9      991.79     1002.46       10.67
  10     1006.97     1018.51       11.54
****************************************
*** Avg round trip time = 15.134400 microseconds
*** Avg one way latency = 7.567200 microseconds
SUMMARY STATISTICS/ESTIMATIONS:
t_comm(1) = 2.553685 microseconds
t_startup = 2.553685 microseconds
t_data    = -0.000000 microseconds
MPIRUN mpi_latency with 10 node processes:
INFO: Number of processes = 10
INFO: Only executing 2 tasks - extra cluster processes will be ignored
task 1 has started...
task 0 has started...
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 10
****************************************
Rep#       T0          T1         deltaT
   1        0.00        6.64        6.64
   2       13.63       16.93        3.30
   3       21.32       23.75        2.42
   4       27.07       29.00        1.93
   5       32.35       34.47        2.13
   6       37.90       39.75        1.85
```

```
   7       43.54       45.46        1.93
   8       49.47       51.28        1.81
   9       57.39       59.47        2.07
  10       63.09       64.91        1.83
****************************************
*** Avg round trip time = 2.591600 microseconds
*** Avg one way latency = 1.295800 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 50
****************************************
Rep#       T0          T1         deltaT
   1       82.49       84.67        2.18
   2       88.31       90.67        2.36
   3       93.91       95.87        1.96
   4       99.13      106.44        7.32
   5      110.35      112.13        1.78
   6      116.74      125.78        9.04
   7      129.91      132.52        2.61
   8      135.96      137.40        1.44
   9      141.91      143.32        1.41
  10      146.79      148.41        1.62
****************************************
*** Avg round trip time = 3.172200 microseconds
*** Avg one way latency = 1.586100 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 100
****************************************
Rep#       T0          T1         deltaT
   1      169.97      171.90        1.94
   2      175.81      177.54        1.73
   3      181.01      182.97        1.95
   4      186.11      187.40        1.29
   5      190.89      192.64        1.75
   6      196.26      197.73        1.47
   7      201.30      203.07        1.77
   8      206.54      208.08        1.54
   9      212.83      214.10        1.28
  10      217.95      219.25        1.29
****************************************
*** Avg round trip time = 1.600600 microseconds
*** Avg one way latency = 0.800300 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 200
****************************************
Rep#       T0          T1         deltaT
   1      240.15      241.92        1.76
   2      245.44      247.19        1.75
   3      250.54      252.85        2.32
   4      256.19      258.55        2.36
   5      262.06      263.97        1.92
   6      268.18      270.68        2.50
   7      274.12      277.07        2.95
   8      281.47      283.78        2.32
   9      288.94      291.14        2.21
  10      294.85      297.36        2.51
****************************************
*** Avg round trip time = 2.259400 microseconds
*** Avg one way latency = 1.129700 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 500
****************************************
Rep#       T0          T1         deltaT
   1      318.49      327.40        8.91
   2      331.39      334.03        2.64
   3      337.33      339.58        2.25
   4      343.08      345.14        2.06
```

```
   5      348.54      350.65        2.12
   6      353.86      356.30        2.44
   7      360.01      361.99        1.98
   8      365.14      368.04        2.90
   9      371.67      373.62        1.95
  10      376.89      379.48        2.59
****************************************
*** Avg round trip time = 2.983300 microseconds
*** Avg one way latency = 1.491650 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 1000
****************************************
Rep#       T0          T1         deltaT
   1      403.54      405.92        2.38
   2      409.49      412.59        3.10
   3      415.78      418.52        2.74
   4      421.70      424.38        2.67
   5      427.67      430.22        2.56
   6      433.72      437.16        3.44
   7      440.79      443.17        2.38
   8      446.44      449.08        2.64
   9      452.86      455.77        2.91
  10      459.67      462.67        3.00
****************************************
*** Avg round trip time = 2.782300 microseconds
*** Avg one way latency = 1.391150 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 2000
****************************************
Rep#       T0          T1         deltaT
   1      485.53      489.49        3.96
   2      493.15      496.73        3.58
   3      499.96      503.20        3.24
   4      506.76      509.99        3.23
   5      513.25      516.58        3.34
   6      521.82      525.60        3.79
   7      529.35      533.03        3.68
   8      536.37      539.98        3.61
   9      543.76      546.95        3.19
  10      549.95      553.41        3.46
****************************************
*** Avg round trip time = 3.508700 microseconds
*** Avg one way latency = 1.754350 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 3000
****************************************
Rep#       T0          T1         deltaT
   1      575.88      591.56       15.68
   2      595.78      600.24        4.46
   3      604.09      608.11        4.02
   4      611.20      615.61        4.41
   5      619.12      623.50        4.38
   6      627.06      631.71        4.65
   7      635.18      639.32        4.14
   8      642.94      647.23        4.29
   9      651.11      656.23        5.12
  10      659.64      664.55        4.91
****************************************
*** Avg round trip time = 5.606500 microseconds
*** Avg one way latency = 2.803250 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 4000
****************************************
Rep#       T0          T1         deltaT
   1      684.37      688.84        4.47
   2      692.73      698.23        5.49
```

```
   3      701.70      706.54        4.83
   4      710.15      715.17        5.01
   5      718.73      723.44        4.71
   6      727.59      732.35        4.76
   7      736.14      740.46        4.32
   8      744.12      749.38        5.27
   9      752.66      757.77        5.12
  10      761.20      765.73        4.53
****************************************
*** Avg round trip time = 4.852500 microseconds
*** Avg one way latency = 2.426250 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 5000
****************************************
Rep#       T0          T1         deltaT
   1      787.49      823.07       35.58
   2      827.40      840.14       12.74
   3      844.91      854.72        9.81
   4      858.87      869.11       10.24
   5      873.35      883.29        9.94
   6      887.22      896.36        9.14
   7      900.22      909.52        9.30
   8      913.36      922.68        9.32
   9      926.73      935.75        9.03
  10      939.78      949.88       10.09
****************************************
*** Avg round trip time = 12.519000 microseconds
*** Avg one way latency = 6.259500 microseconds
SUMMARY STATISTICS/ESTIMATIONS:
t_comm(1) = 2.093805 microseconds
t_startup = 2.093805 microseconds
t_data    = -0.000000 microseconds
MPIRUN mpi_latency with 20 node processes:
INFO: Number of processes = 20
INFO: Only executing 2 tasks - extra cluster processes will be ignored
task 1 has started...
task 0 has started...
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 10
****************************************
Rep#       T0          T1         deltaT
   1        0.00       10.48       10.48
   2       16.95       19.05        2.09
   3       22.92       24.72        1.80
   4       28.03       29.82        1.79
   5       32.95       34.78        1.83
   6       38.09       39.86        1.78
   7       43.26       45.05        1.79
   8       48.22       50.03        1.81
   9       53.19       54.97        1.78
  10       58.25       60.05        1.80
****************************************
*** Avg round trip time = 2.695400 microseconds
*** Avg one way latency = 1.347700 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 50
****************************************
Rep#       T0          T1         deltaT
   1       82.62       84.65        2.03
   2       92.30       94.16        1.86
   3       97.70       99.50        1.79
   4      102.72      111.28        8.56
   5      115.38      117.19        1.82
   6      120.56      128.63        8.06
   7      132.27      135.53        3.26
   8      138.95      140.25        1.30
   9      143.39      145.09        1.70
```

```
  10      149.65      151.10        1.45
****************************************
*** Avg round trip time = 3.183200 microseconds
*** Avg one way latency = 1.591600 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 100
****************************************
Rep#       T0          T1         deltaT
   1      175.67      177.64        1.97
   2      181.06      183.05        1.99
   3      186.69      188.89        2.19
   4      192.09      194.05        1.95
   5      197.39      199.11        1.72
   6      202.31      203.62        1.31
   7      206.81      208.59        1.78
   8      212.07      213.67        1.60
   9      216.94      218.84        1.90
  10      222.28      224.01        1.73
****************************************
*** Avg round trip time = 1.813700 microseconds
*** Avg one way latency = 0.906850 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 200
****************************************
Rep#       T0          T1         deltaT
   1      243.43      244.78        1.36
   2      248.15      250.19        2.04
   3      253.47      255.68        2.21
   4      259.11      261.20        2.09
   5      264.36      266.75        2.40
   6      270.40      272.61        2.20
   7      275.71      278.36        2.65
   8      282.41      284.56        2.15
   9      288.22      290.19        1.96
  10      293.35      295.70        2.35
****************************************
*** Avg round trip time = 2.141100 microseconds
*** Avg one way latency = 1.070550 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 500
****************************************
Rep#       T0          T1         deltaT
   1      317.66      323.91        6.25
   2      327.79      330.03        2.24
   3      333.26      335.69        2.44
   4      338.90      340.89        1.99
   5      344.36      346.61        2.25
   6      349.88      352.46        2.58
   7      355.60      357.93        2.33
   8      361.52      363.96        2.45
   9      367.30      369.57        2.27
  10      373.77      376.39        2.62
****************************************
*** Avg round trip time = 2.741200 microseconds
*** Avg one way latency = 1.370600 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 1000
****************************************
Rep#       T0          T1         deltaT
   1      394.86      398.27        3.41
   2      401.49      404.68        3.19
   3      408.73      411.76        3.04
   4      415.06      418.86        3.79
   5      422.32      425.06        2.74
   6      429.57      432.94        3.38
   7      436.17      439.00        2.83
```

```
   8      442.59      445.74        3.15
   9      449.24      451.87        2.62
  10      455.18      458.22        3.04
****************************************
*** Avg round trip time = 3.118500 microseconds
*** Avg one way latency = 1.559250 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 2000
****************************************
Rep#       T0          T1         deltaT
   1      480.06      484.54        4.48
   2      487.93      491.65        3.72
   3      494.78      498.32        3.54
   4      501.64      505.72        4.08
   5      509.12      512.45        3.33
   6      516.03      520.23        4.19
   7      523.77      527.55        3.78
   8      531.00      534.43        3.43
   9      539.00      542.31        3.30
  10      545.60      549.33        3.72
****************************************
*** Avg round trip time = 3.758900 microseconds
*** Avg one way latency = 1.879450 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 3000
****************************************
Rep#       T0          T1         deltaT
   1      571.86      585.64       13.78
   2      589.53      594.44        4.91
   3      597.99      602.48        4.49
   4      605.83      609.94        4.11
   5      613.52      618.17        4.65
   6      622.54      627.97        5.43
   7      632.14      653.48       21.34
   8      658.94      664.83        5.89
   9      668.33      672.86        4.52
  10      676.09      680.61        4.53
****************************************
*** Avg round trip time = 7.365300 microseconds
*** Avg one way latency = 3.682650 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 4000
****************************************
Rep#       T0          T1         deltaT
   1      701.98      706.58        4.60
   2      709.97      714.83        4.86
   3      718.15      723.07        4.91
   4      726.45      731.70        5.25
   5      735.05      740.01        4.96
   6      743.59      748.45        4.86
   7      751.74      756.71        4.96
   8      760.31      765.58        5.27
   9      770.04      774.64        4.60
  10      779.01      785.12        6.12
****************************************
*** Avg round trip time = 5.040100 microseconds
*** Avg one way latency = 2.520050 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 5000
****************************************
Rep#       T0          T1         deltaT
   1      806.31      842.66       36.35
   2      847.23      860.06       12.83
   3      863.84      874.91       11.07
   4      878.82      889.34       10.52
   5      893.58      903.60       10.02
```

```
   6      907.94      917.52        9.57
   7      921.39      932.09       10.70
   8      937.07      948.82       11.75
   9      953.95      963.99       10.04
  10      968.14      977.50        9.36
****************************************
*** Avg round trip time = 13.222200 microseconds
*** Avg one way latency = 6.611100 microseconds
SUMMARY STATISTICS/ESTIMATIONS:
t_comm(1) = 2.253980 microseconds
t_startup = 2.253980 microseconds
t_data    = -0.000000 microseconds
MPIRUN mpi_latency with 40 node processes:
INFO: Number of processes = 40
INFO: Only executing 2 tasks - extra cluster processes will be ignored
task 1 has started...
task 0 has started...
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 10
****************************************
Rep#       T0          T1         deltaT
   1        0.00       21.90       21.90
   2       31.59       34.44        2.85
   3       37.94       40.36        2.41
   4       42.68       45.40        2.72
   5       48.55       50.71        2.16
   6       53.93       56.01        2.08
   7       59.79       61.92        2.13
   8       65.06       67.13        2.07
   9       70.58       72.40        1.82
  10       75.86       77.69        1.83
****************************************
*** Avg round trip time = 4.197800 microseconds
*** Avg one way latency = 2.098900 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 50
****************************************
Rep#       T0          T1         deltaT
   1       99.69      101.61        1.93
   2      105.58      107.40        1.81
   3      111.90      113.70        1.79
   4      117.16      134.55       17.38
   5      140.21      143.03        2.82
   6      146.58      155.33        8.75
   7      158.94      162.13        3.19
   8      165.44      166.75        1.31
   9      170.08      171.71        1.63
  10      174.95      176.18        1.23
****************************************
*** Avg round trip time = 4.184200 microseconds
*** Avg one way latency = 2.092100 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 100
****************************************
Rep#       T0          T1         deltaT
   1      195.32      196.88        1.55
   2      200.44      202.22        1.79
   3      205.52      207.33        1.81
   4      210.84      212.52        1.67
   5      216.27      217.58        1.31
   6      221.09      222.91        1.82
   7      228.52      229.89        1.37
   8      233.41      235.08        1.66
   9      238.61      240.41        1.80
  10      243.69      245.45        1.76
****************************************
*** Avg round trip time = 1.653500 microseconds
```

```
*** Avg one way latency = 0.826750 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 200
***************************************
Rep#       T0          T1         deltaT
   1      267.13      269.16        2.04
   2      272.46      274.28        1.82
   3      276.35      278.69        2.35
   4      282.23      284.30        2.06
   5      287.88      290.62        2.74
   6      292.71      294.63        1.93
   7      297.98      300.42        2.44
   8      303.98      306.14        2.16
   9      309.32      312.08        2.77
  10      315.41      319.21        3.80
***************************************
*** Avg round trip time = 2.409500 microseconds
*** Avg one way latency = 1.204750 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 500
***************************************
Rep#       T0          T1         deltaT
   1      338.15      347.11        8.96
   2      350.59      353.04        2.45
   3      356.49      358.63        2.14
   4      360.73      362.98        2.25
   5      366.29      368.38        2.08
   6      372.57      375.06        2.49
   7      378.80      381.05        2.24
   8      384.69      386.84        2.15
   9      389.16      391.15        1.99
  10      394.32      396.29        1.97
***************************************
*** Avg round trip time = 2.872800 microseconds
*** Avg one way latency = 1.436400 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 1000
***************************************
Rep#       T0          T1         deltaT
   1      412.56      415.04        2.48
   2      417.38      420.51        3.13
   3      423.83      426.96        3.13
   4      430.47      433.59        3.11
   5      437.08      439.95        2.87
   6      444.12      447.49        3.37
   7      450.88      453.65        2.76
   8      456.91      460.20        3.29
   9      463.99      466.96        2.97
  10      470.34      473.96        3.61
***************************************
*** Avg round trip time = 3.073100 microseconds
*** Avg one way latency = 1.536550 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 2000
***************************************
Rep#       T0          T1         deltaT
   1      491.25      494.87        3.62
   2      498.50      502.56        4.06
   3      506.23      509.75        3.52
   4      513.97      517.68        3.72
   5      520.96      524.24        3.27
   6      527.83      531.55        3.72
   7      534.83      538.06        3.22
   8      542.11      545.82        3.71
   9      548.97      552.40        3.43
  10      555.98      559.64        3.66
```

```
****************************************
*** Avg round trip time = 3.593700 microseconds
*** Avg one way latency = 1.796850 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 3000
****************************************
Rep#       T0          T1         deltaT
   1      575.83      590.24       14.41
   2      594.15      599.17        5.02
   3      602.51      606.63        4.12
   4      610.38      615.02        4.64
   5      618.27      622.68        4.40
   6      625.98      630.68        4.70
   7      633.98      638.64        4.66
   8      642.33      646.92        4.59
   9      650.41      655.01        4.61
  10      658.44      662.92        4.48
****************************************
*** Avg round trip time = 5.562800 microseconds
*** Avg one way latency = 2.781400 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 4000
****************************************
Rep#       T0          T1         deltaT
   1      684.83      689.35        4.52
   2      693.77      699.11        5.34
   3      702.36      706.95        4.59
   4      710.42      715.33        4.91
   5      718.48      723.06        4.58
   6      726.69      732.18        5.48
   7      735.41      740.67        5.25
   8      744.18      749.24        5.06
   9      752.89      757.79        4.91
  10      761.06      766.25        5.18
****************************************
*** Avg round trip time = 4.983300 microseconds
*** Avg one way latency = 2.491650 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 5000
****************************************
Rep#       T0          T1         deltaT
   1      786.51      827.24       40.73
   2      831.63      845.36       13.72
   3      849.66      860.36       10.70
   4      864.34      874.46       10.13
   5      879.28      889.21        9.93
   6      892.94      902.69        9.75
   7      906.42      915.74        9.32
   8      919.45      929.38        9.93
   9      933.03      942.58        9.55
  10      946.17      955.87        9.69
****************************************
*** Avg round trip time = 13.346300 microseconds
*** Avg one way latency = 6.673150 microseconds
SUMMARY STATISTICS/ESTIMATIONS:
t_comm(1) = 2.293850 microseconds
t_startup = 2.293850 microseconds
t_data    = -0.000000 microseconds
MPIRUN mpi_latency with 60 node processes:
INFO: Number of processes = 60
INFO: Only executing 2 tasks - extra cluster processes will be ignored
task 1 has started...
task 0 has started...
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 10
****************************************
```

```
Rep#       T0          T1         deltaT
   1        0.00       25.68       25.68
   2       35.84       38.91        3.07
   3       44.40       46.70        2.30
   4       51.57       54.01        2.43
   5       58.39       60.83        2.43
   6       64.61       67.41        2.79
   7       72.21       74.70        2.49
   8       79.44       82.20        2.77
   9       86.88       89.12        2.24
  10       94.04       96.71        2.68
****************************************
*** Avg round trip time = 4.887900 microseconds
*** Avg one way latency = 2.443950 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 50
****************************************
Rep#       T0          T1         deltaT
   1      118.53      120.48        1.96
   2      124.57      126.47        1.89
   3      129.91      132.18        2.27
   4      135.46      143.90        8.44
   5      147.45      149.34        1.88
   6      152.62      161.56        8.94
   7      168.61      171.95        3.34
   8      176.58      178.34        1.76
   9      181.70      183.61        1.91
  10      187.22      188.69        1.47
****************************************
*** Avg round trip time = 3.387300 microseconds
*** Avg one way latency = 1.693650 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 100
****************************************
Rep#       T0          T1         deltaT
   1      211.90      213.31        1.41
   2      216.74      218.92        2.18
   3      222.12      224.03        1.91
   4      227.34      228.71        1.37
   5      231.90      233.21        1.31
   6      236.44      237.94        1.50
   7      241.14      242.85        1.72
   8      246.42      247.76        1.33
   9      251.05      252.35        1.30
  10      255.79      257.52        1.73
****************************************
*** Avg round trip time = 1.575900 microseconds
*** Avg one way latency = 0.787950 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 200
****************************************
Rep#       T0          T1         deltaT
   1      277.97      279.36        1.39
   2      282.55      284.38        1.83
   3      287.50      289.72        2.22
   4      293.30      295.27        1.97
   5      298.73      301.14        2.42
   6      304.36      306.58        2.22
   7      309.74      312.50        2.76
   8      315.70      317.80        2.10
   9      321.21      324.12        2.91
  10      327.33      329.54        2.21
****************************************
*** Avg round trip time = 2.202200 microseconds
*** Avg one way latency = 1.101100 microseconds
Beginning latency timing test:
        Number of reps = 10
```

```
        Data Size      = 500
****************************************
Rep#       T0          T1         deltaT
   1      350.56      360.05        9.49
   2      363.50      365.94        2.43
   3      369.10      371.26        2.16
   4      374.45      376.47        2.02
   5      379.88      382.03        2.14
   6      385.25      387.81        2.56
   7      391.24      393.46        2.22
   8      396.67      399.04        2.37
   9      402.28      404.51        2.22
  10      407.59      410.14        2.55
****************************************
*** Avg round trip time = 3.017800 microseconds
*** Avg one way latency = 1.508900 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 1000
****************************************
Rep#       T0          T1         deltaT
   1      433.65      436.26        2.61
   2      439.41      442.55        3.14
   3      445.89      448.81        2.92
   4      453.52      456.44        2.91
   5      459.67      462.51        2.84
   6      466.26      469.28        3.02
   7      472.68      475.29        2.61
   8      478.45      481.99        3.54
   9      485.12      488.57        3.45
  10      491.87      494.91        3.05
****************************************
*** Avg round trip time = 3.009000 microseconds
*** Avg one way latency = 1.504500 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 2000
****************************************
Rep#       T0          T1         deltaT
   1      518.02      521.43        3.41
   2      524.64      528.29        3.65
   3      532.04      535.10        3.07
   4      538.38      541.87        3.50
   5      545.07      548.20        3.13
   6      551.64      555.23        3.58
   7      558.83      562.00        3.17
   8      565.29      568.85        3.55
   9      572.38      575.76        3.38
  10      578.95      582.45        3.50
****************************************
*** Avg round trip time = 3.395200 microseconds
*** Avg one way latency = 1.697600 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 3000
****************************************
Rep#       T0          T1         deltaT
   1      601.88      617.89       16.01
   2      622.26      627.61        5.35
   3      631.17      635.56        4.39
   4      638.76      643.25        4.49
   5      646.52      650.93        4.41
   6      654.28      658.99        4.71
   7      662.37      666.46        4.09
   8      670.06      674.71        4.65
   9      678.40      682.50        4.10
  10      685.85      690.14        4.30
****************************************
*** Avg round trip time = 5.648900 microseconds
*** Avg one way latency = 2.824450 microseconds
```

```
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 4000
***************************************
Rep#       T0          T1         deltaT
   1      710.63      715.38        4.75
   2      720.31      725.62        5.31
   3      729.23      733.68        4.44
   4      736.88      741.55        4.67
   5      745.16      749.55        4.40
   6      753.25      758.26        5.01
   7      761.48      766.05        4.56
   8      769.54      774.45        4.91
   9      777.62      782.21        4.60
  10      785.65      790.74        5.09
***************************************
*** Avg round trip time = 4.774000 microseconds
*** Avg one way latency = 2.387000 microseconds
Beginning latency timing test:
        Number of reps = 10
        Data Size      = 5000
***************************************
Rep#       T0          T1         deltaT
   1      810.89      859.03       48.14
   2      863.80      877.30       13.50
   3      881.37      892.60       11.23
   4      896.80      906.90       10.09
   5      910.46      920.49       10.03
   6      925.11      935.84       10.73
   7      939.83      950.16       10.33
   8      953.81      965.38       11.57
   9      969.47      980.03       10.55
  10      983.76      993.76       10.01
***************************************
*** Avg round trip time = 14.618300 microseconds
*** Avg one way latency = 7.309150 microseconds
SUMMARY STATISTICS/ESTIMATIONS:
t_comm(1) = 2.325825 microseconds
t_startup = 2.325825 microseconds
t_data    = -0.000000 microseconds
ubuntu@ip-172-31-43-252:~/csci455/Lab4-Timing_Model_Comparison$
```