Part 4: Eating Some Pi

1. We’ve extended the .cpp file to include the OpenMPI routines to run on four nodes; by including the necessary changes in the .cpp file, then executing ‘mpiexec -n 4 ser\_calc\_pi’
2. Once making the .cpp adjustments, we then execute and get the following for our 1,000,000th iteration and total runtime under the different rank/node distributions:

**mpiexec -n 1 ./ser\_pi\_calc\_p2:**

After 1000000 throws, average value of pi = 3.15120000

Real value of PI: 3.1415926535897

Total runtime: 0.036455 seconds

**mpiexec -n 2 ./ser\_pi\_calc\_p2**

After 1000000 throws, average value of pi = 3.13600000

Real value of PI: 3.1415926535897

Total runtime: 0.020246 seconds

**mpiexec -n 3 ./ser\_pi\_calc\_p2**

After 1000000 throws, average value of pi = 3.13111311

Real value of PI: 3.1415926535897

Total runtime: 0.014873 seconds

**mpiexec -n 4 ./ser\_pi\_calc\_p2**

After 1000000 throws, average value of pi = 3.12960000

Real value of PI: 3.1415926535897

Total runtime: 0.012719 seconds

1. Below is the results and runtimes after we divide the number of rounds amongst the different ranks. There are clear improvements in the runtime calculations as we distribute above 1 rank:

**mpiexec -n 1 ./ser\_pi\_calc\_p3:**

Starting parallel version of pi calculation using dartboard algorithm...

After 100 rounds, average value of pi = 3.14174400

Real value of PI: 3.1415926535897

Total runtime: 0.035544 seconds

**mpiexec -n 2 ./ser\_pi\_calc\_p3**

Starting parallel version of pi calculation using dartboard algorithm...

After 100 rounds, average value of pi = 3.14193600

Real value of PI: 3.1415926535897

Total runtime: 0.009178 seconds

**mpiexec -n 3 ./ser\_pi\_calc\_p3**

Starting parallel version of pi calculation using dartboard algorithm...

After 100 rounds, average value of pi = 3.14744202

Real value of PI: 3.1415926535897

Total runtime: 0.005017 seconds

**mpiexec -n 4 ./ser\_pi\_calc\_p4**

Starting parallel version of pi calculation using dartboard algorithm...

After 100 rounds, average value of pi = 3.14291200

Real value of PI: 3.1415926535897

Total runtime: 0.003087 seconds