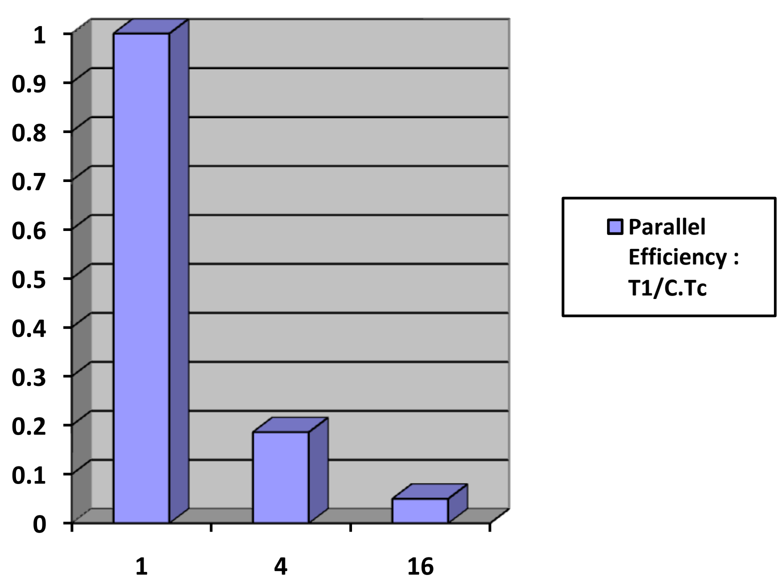
MULTIPLE COMPUTERS

No. of computers (C)	Avg. time in as seen by the client (Tc milliseconds)	Parallel Efficiency : T1/C.Tc
1	82084 (T1)	82084/82084 = 1
4	41072	82084/(4x41072) = 0.186
16	32572	82084/(16x32572) = 0.05

SPECIAL CASE C=1

Case	Avg. time in as seen by the client (milliseconds)
Same VM	25078
Same computer, Different VMs	43024
Different computers, Different VMs	82084

PARALLEL EFFICIENCY GRAPH



Across the three cases : C=1,4,16 it can be seen that the parallel efficiency decreases with increase in number of parallel processors. This suggests that the degree of parallelization keeps decreasing and approaches zero as more parallel computational power is added to the infrastructure. This was an expected result. Not all tasks can achieve perfect parallelization, and this also holds good for the TSP task which we experimented with.

However, we see a clear difference in numbers when compared to homework #3. The parallel efficiency obtained from both homeworks for TSP is compared in the table below :

No. of computers (C)	Homework #3 Parallel Efficiency	Homework #4 Parallel Efficiency
1	1	1
4	0.874	0.186
16	0.547	0.05

For both homeworks, we used the same input containing 12 cities. In homework 3, the decomposition depth in class *TspTask* was 2 i.e. After the second level of decomposition, we permuted all possible paths for the remaining 10 cities and returned the least-cost tour. In homework 5, the decomposition depth was increased to 5 levels in class *TspTask*. After the 5th level of decomposition, each computer used a depth-first search algorithm to systematically traverse all possible paths locally and prune nodes along the way using the branch-and-bound strategy.

As seen in the table above, the parallel efficiency has surprisingly decreased in homework#4. We suspect that this is likely due to the RMI overhead in queuing tasks in the compute space.

Some numbers below :

Number of concurrent RMI jobs produced in last stage of decomposition (level 5) in TSP in homework #4 : 11*10*9*8 = 55440.

Number of concurrent RMI jobs produced in last stage of decomposition (level 5) in TSP in homework #3 : 11*10 = 110.

We find that 55440 – 110 = 55330 extra RMIs happened in this experiment which may have tilted the numbers. However, we also noticed that machines in CSIL lab where we deployed compute nodes were relatively busy throughout our experiments. Hence it is unclear if a high degree of context switches in compute nodes have produced the false impression of a huge RMI overhead.