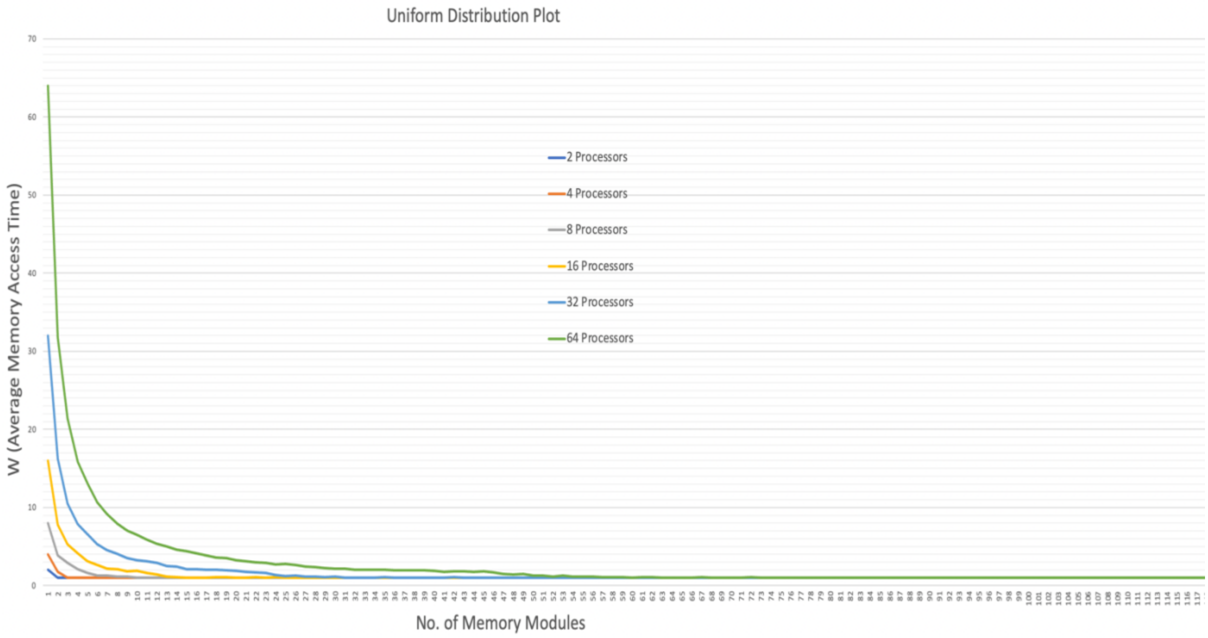

Figure1: W(Average memory access time) vs No. of memory modules graph for uniform distribution

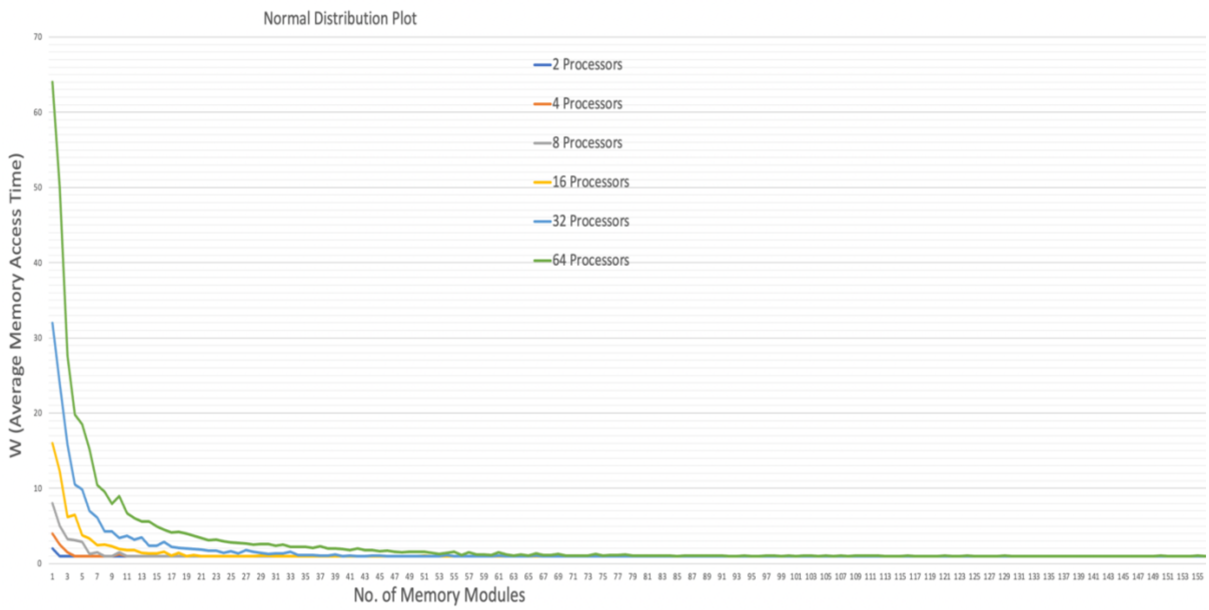

Figure2: W(Average memory access time) vs No. of memory modules graph for normal distribution

For readability, we have shown less number of memory modules on above snapshots. **The graph for all 2048 memory module can be seen with this link -** **Graph for 2048 memory modules**

If this simulation is in the context of making a decision to buy expensive memory modules for a given number of powerful processors, what would you recommend? Why?

- As the number of memory modules increases, the average memory access time for the processors reduces i.e. on average a processor's frequency to access memory module will increase.
- However, we can see from the graph that the average memory access time converges to **1 as we keep on increasing the number of memory modules and it remains 1 even if we further increase the number of memory modules.**
- Based on the above two points, we can conclude that for a given number of processors, there is an optimum number of memory modules, say **m such that as we increase the number of memory modules from 1 to m we see improvement in average memory access time. However, beyond m memory modules the average memory access time remains 1 i.e. on average each processor accesses memory in every cycle if the number of memory modules is more than m.**
- Hence, we can say that for a given number of processors, it would not make sense to buy an arbitrary large number of memory modules (i.e. memory modules more than the optimum number m). Since one processor can access only one memory module in a cycle, if we have an arbitrary large number of memory modules many memory modules would remain idle. **Hence, it would make sense to buy up to m memory modules**.

  Note: Optimum number of memory modules **(m)** will be different for different numbers of processors. Below is an estimated **m** value based on data from our simulation:

	2 Processors	4 Processors	8 Processors	16 Processors	32 Processors	64 Processors
Optimum number of memory (m) for **uniform** distribution	2	3	10	17	38	76
Optimum number of memory (m) for **normal** distribution	2	4	11	23	42	94

Table1: Optimum number of memory modules

How does the memory request distribution affect the behaviour of the system?

- When the number of memory modules is less than the optimum value **m**, we can see that the W value is more for normal distribution compared to uniform distribution for a given number of memory modules. **Hence, we can conclude that for the normal distribution case, on average a processor will have less number memory access granted compared to uniform distribution <u>when the number of memory modules is less than the threshold m.</u>**
  Detailed simulation data i.e. W value for different number of processor and different number of memory modules can be referenced by this link - Uniform vs Normal Distribution Data.

- Additionally, we can see from above link and from table 1 that the W value converges to 1 slightly faster in case of uniform distribution compared to normal distribution. **Hence, we can conclude that with uniform distribution, we can reach the converged state (i.e. where on average each processor has access to memory in every cycle) with less number of memory modules compared to normal distribution.**