Dear Alfons Muzon,

I am glad to know that our organisation is thriving and all our efforts are paying dividends. Further, using computational modelling to perform simulations along with wind tunnel experiments will definitely be a beneficial. For our requirements, since Computational Fluid Mechanics (CFD), Finite Elements Analysis (FEA) and other Computer Aided Methods require very high computational capability, so we cannot simply use regular PC's or workstations, we need specialised computing units which can support large calculations. In particular, if we have multiple independent cores in our system we could implement parallel programming which effectively uses the hardware to distribute work and perform the calculations faster.

Since we do not have sufficient experience with high performance computers, at this point I suggest purchasing the commercial machine, these devise are highly capable of performing large calculations in parallel and serves our purpose. Also these systems require less maintenance and are easy to install.

In this regard I would recommend 2nd Gen AMD EPYC High frequency processors (7H 12/7702/7702p) **[1].**. These machines are suitable for High Performance computing, these have 64 CPU cores with 128 threads on single socket board, but on dual socket board this can be increased up to 128 CPU cores with up to 256 threads. This significantly helps in work sharing for high computational loads.

For the dual socket we could consider 2HE AMD Dual-CPU RA2208 Server **[2]**. This server can support 2 CPU's of up to 64 physical cores each. Each AMD EPYC chip has only two NUMA (Non-Uniform Memory Access) domains which is a great advantage for the memory access by different cores. Other specifications for 7H12 chips are Base clock 2.6 Ghz (max boost up to 3.3 Ghz) this helps in increasing FLOP's (Floating Point Operations) and Thermal Design Power of 280W, 260 MB l3 Cache and PCIe 4.0 which has high bandwidth; Also the server can have up to 1TB RAM and 31 TB SSD, which offers more memory bandwidth than traditional HDD. More data specifications could be found at **[1].** Overall this provides good computational capability for modelling such as structural analysis, finite elements and fluid dynamics etc. as it has high frequency, good memory bandwidth, storage with decent power consumption.

Adding to that, we can implement hybrid programming, with (Message Passing Interface) MPI and OpenMP parallelization technique. Since we have two processors with two NUMA domains each, with in each of these domains OpenMP implementation produce best results, and to share data amongst these NUMA domains we can implement MPI communications. In this way it break downs larger problem into smaller chunks and produce results. This could be utilized in CFD, FEA etc.

where the meshes, nodes and elements are divides among cores/tasks /processes and collectively produce results.

Also to emphasise on financial aspect, each AMD chip costs around $7,200 and server around $2000, so for our requirement we would have to invest about $18,000 and additional costs for installation and other hardware may make up to $2000. So overall this proposal could be achieved within $20,000.

Once we invest this fund in to this device, it is more or less a permanent investment; we can effectively use this for all our simulations and computations.

Regards,

Rohan Krishna Balaji

For Further Reference:

1. https://www.amd.com/en/products/cpu/amd-epyc-7h12

2. https://www.thomas-krenn.com/en/products/rack-server/2u-servers/amd-dual-cpu/amd-ra2208.html?gclid=Cj0KCQjwjer4BRCZARIsABK4QeXwic2Wtd8UqWSuKwr8IV7IOJvcSp00pYD6MnArM5oxLoF1o870LL0aArNDEALw_wcB