

# Why Supercomputer?

- Q.** If supercomputers use the same processors as laptops & cell phones, could we just use cloud-computing resources to do the same?
- A.** No. Emergent properties arising from many interacting entities (*e.g.*, life) could only be studied as a whole [“More is different,” P. W. Anderson, *Science* 177, 393 ('72) <http://cacs.usc.edu/education/cs596/Anderson-MoreIsDifferent-Science72.pdf>]. This would require innovative hardware & software solutions to tightly couple massive computations:
- Hardware:** Ultrafast network interconnect among billions of processing elements, *cf.* human brain has  $10^3$  synapses per neuron.
- Software:** Communication-minimizing divide-conquer-recombine algorithms that accurately describe many-body interaction.

