



The Abdus Salam
International Centre
for Theoretical Physics



Supercomputing: the F1 for Computers

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Outline

- A quick and “interesting” story
- The needs of High-Performance Computing
- The race to the fastest SuperComputer
- The Art Behind the Fashion



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Based on a True Story

2006



2009



2012

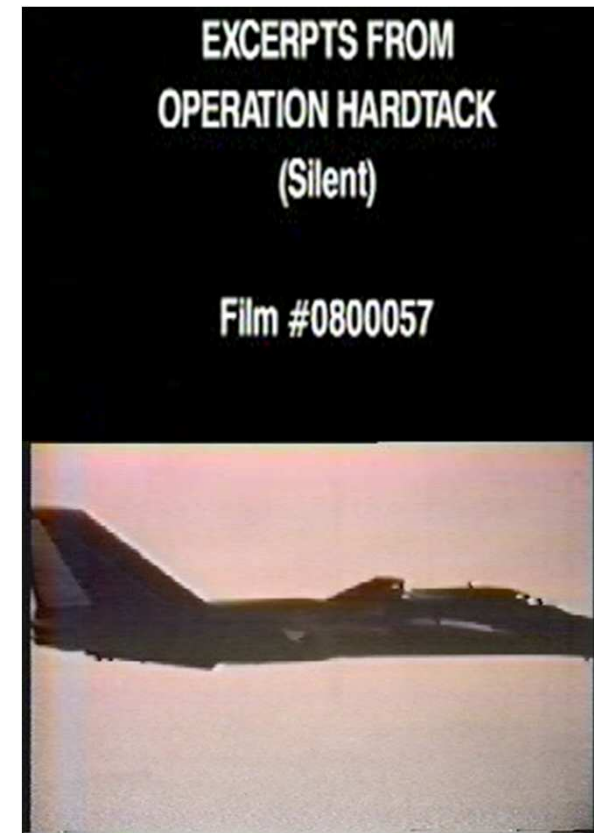




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Why Compute Simulations?





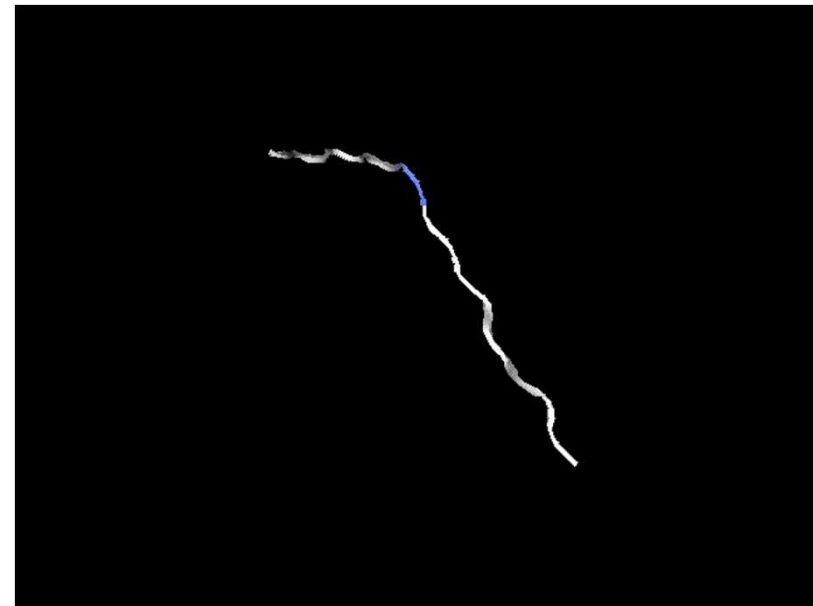
What are The Challenges?

To simulate the folding of
a 300 amino acid protein in water:

of atoms: $\sim 32,000$

folding time: 1 millisecond

of FLOPs: 3×10^{22}



A 1 PetaFLOP/s (10^{15}) machine running for 1 year



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The Technological Solution

To satisfy current and upcoming **scientific discovery challenges**, research bodies and vendors are constantly investing in R&D to build the next generation of **Supercomputers**. Term on which I indicate an high-end system built **to break a capacity limit** in term of compute processing



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Building a Supercomputer





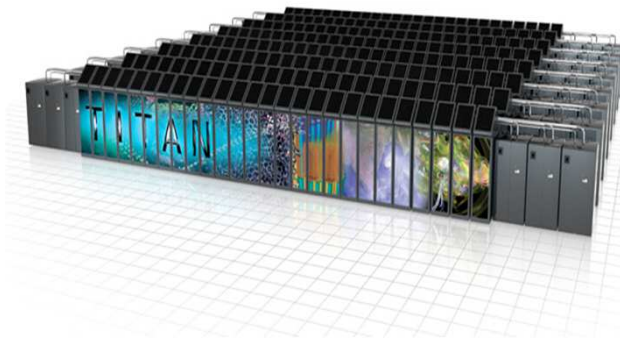
The Race

Sequoia - BlueGene/Q,
Power BQC 16C 1.60 GHz,
Custom - #1572864 cores



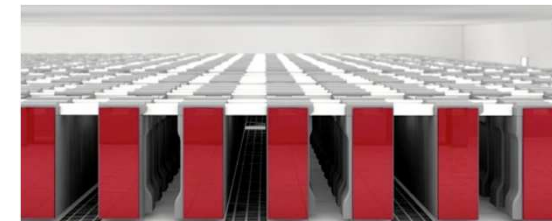
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Titan - Cray XK7 , Opteron 6274 16C
2.200GHz, Cray Gemini interconnect,
NVIDIA K20x - #560640 cores



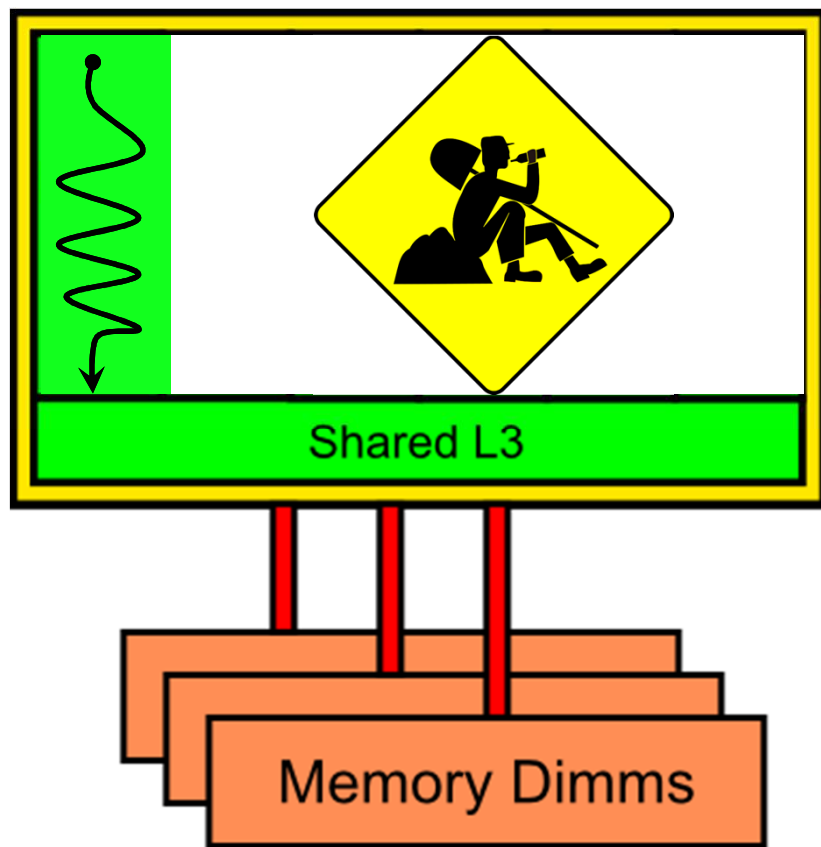
1

K computer - SPARC64 VIIIfx
2.0GHz, Tofu interconnect -
#705024 cores



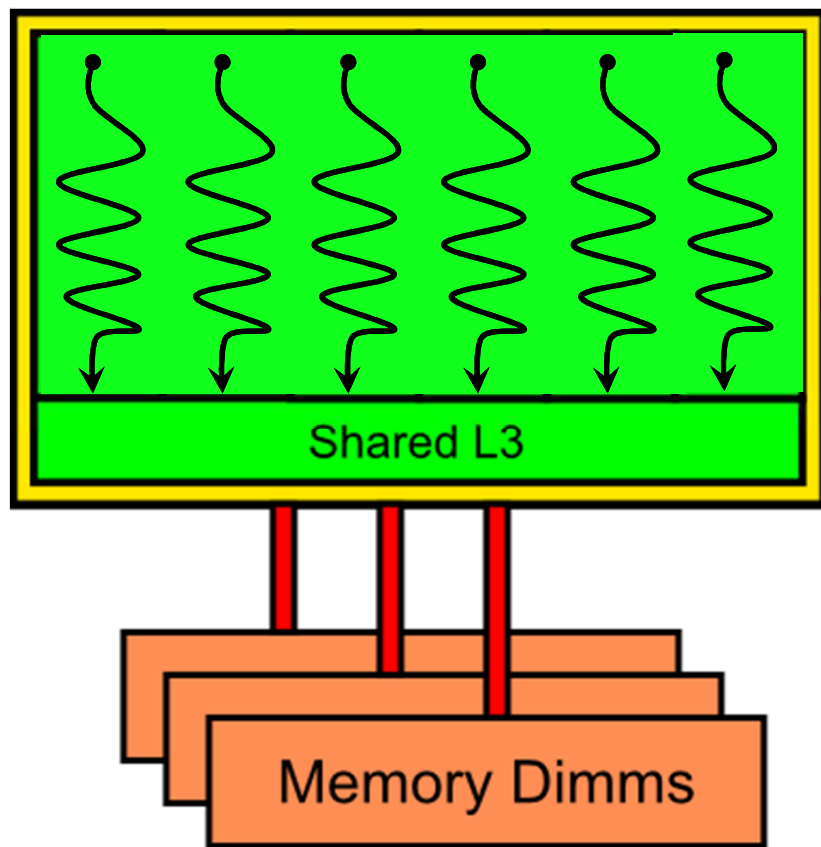
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Multi-core system Vs Serial Programming

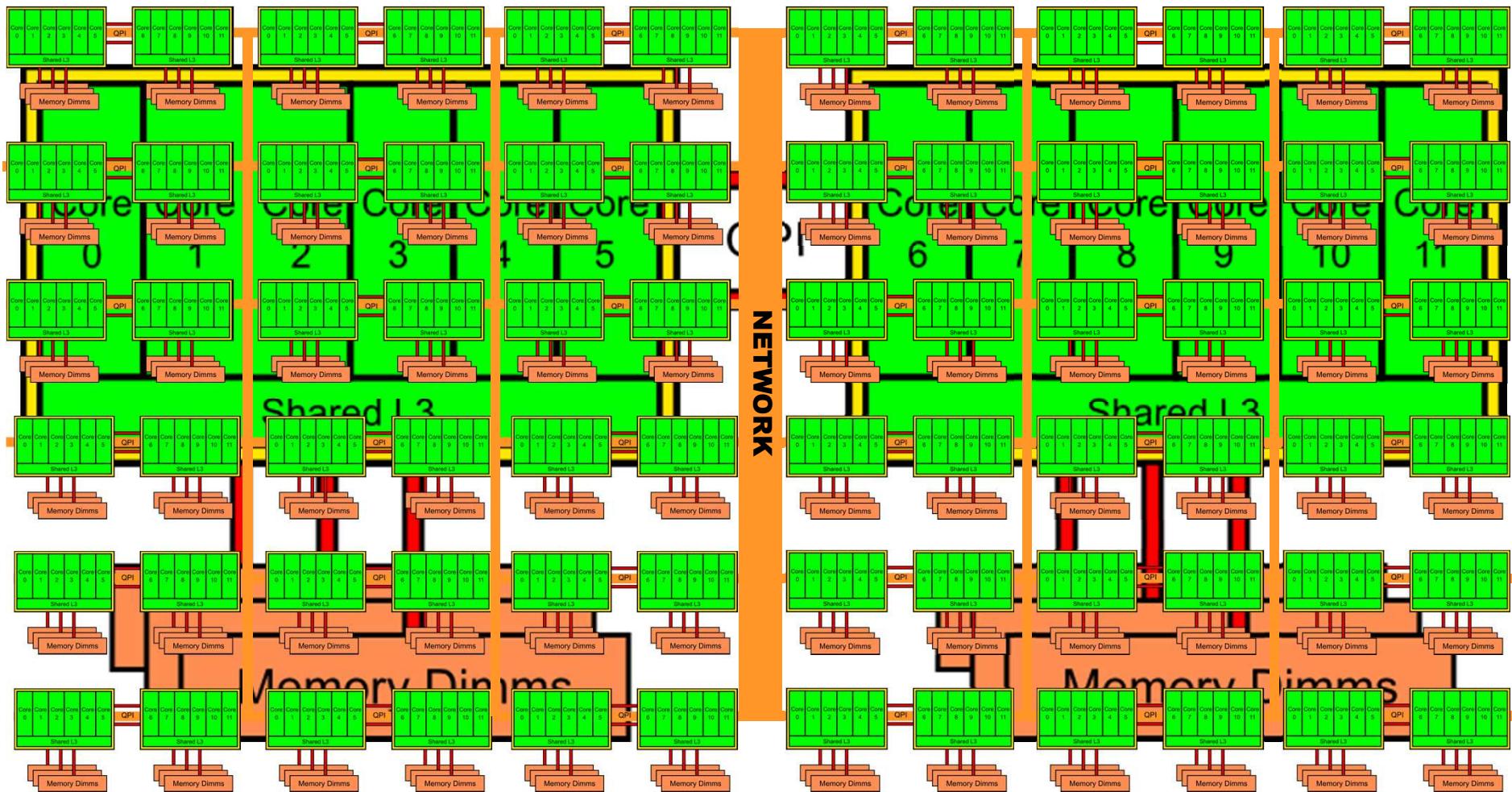


Xeon E5650
hex-core
processors
(12GB - RAM)

Multi-core system Vs // Programming



Xeon E5650
hex-core
processors
(12GB - RAM)





The Art of Parallel Programing

- Development of parallel algorithm to solve more or less complex scientific problems
- Translation on one or more programming languages for scientific computing: C, FORTRAN, C++, scripting languages (i.e., Python), etc...
- Mix of technological and scientific knowledge



HPC Computing & Application @ ICTP

- Deployment of High-End Technologies for scientific simulation
- Development of parallel programs to exploit massively parallel systems
- Enablement of scientific simulation on High-Performance Computing system at large scale
- Dissemination and educational programs



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Thanks for your attention!!





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**How do you see yourself in
10 years and in which %
(from 1 to 100) do you think
the university will have
influenced your carrier?**