UTSA
The University of Texas at San Antonio™

What is HPC and Why Do we Care About it? Lovelace 1815 Event

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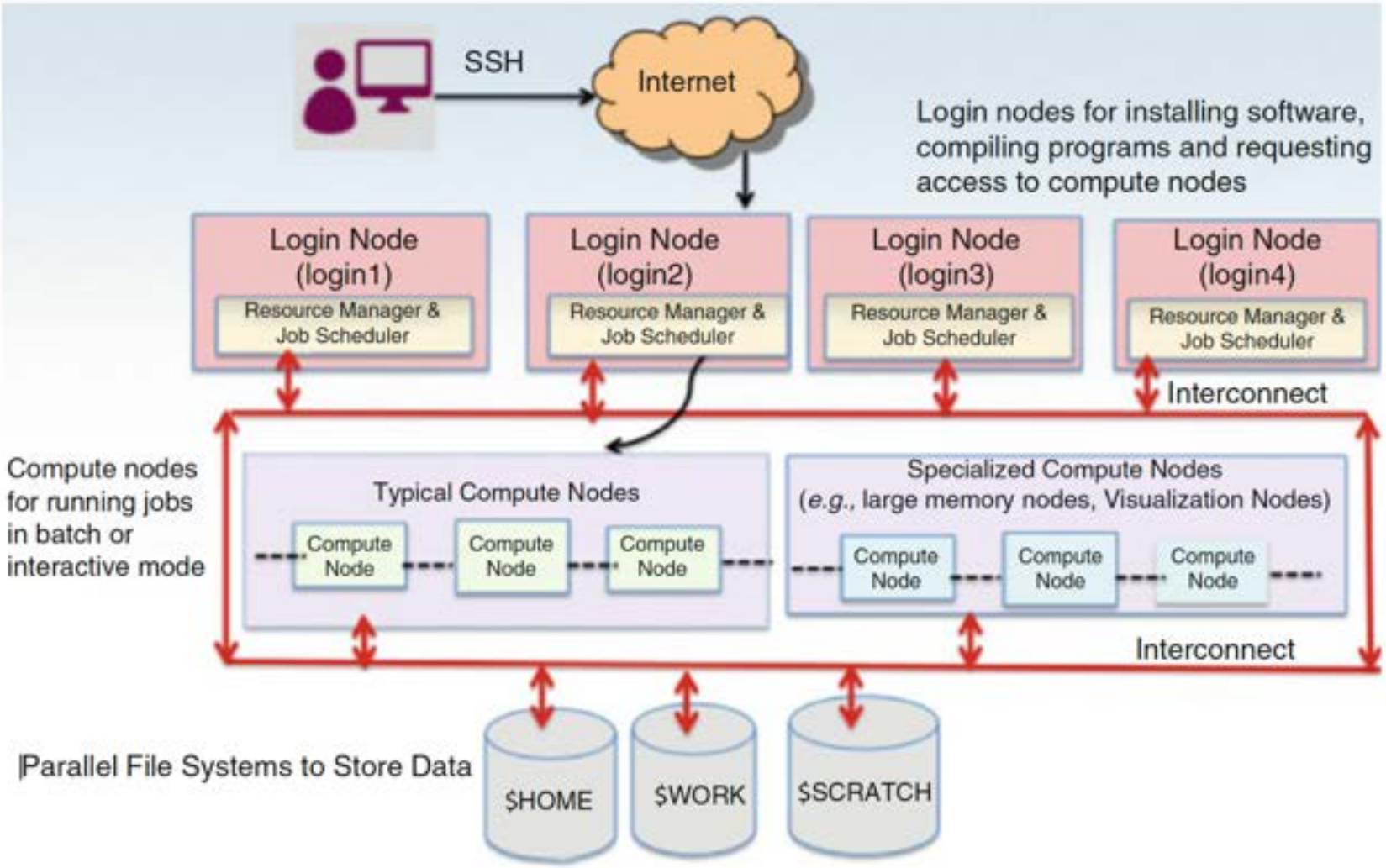
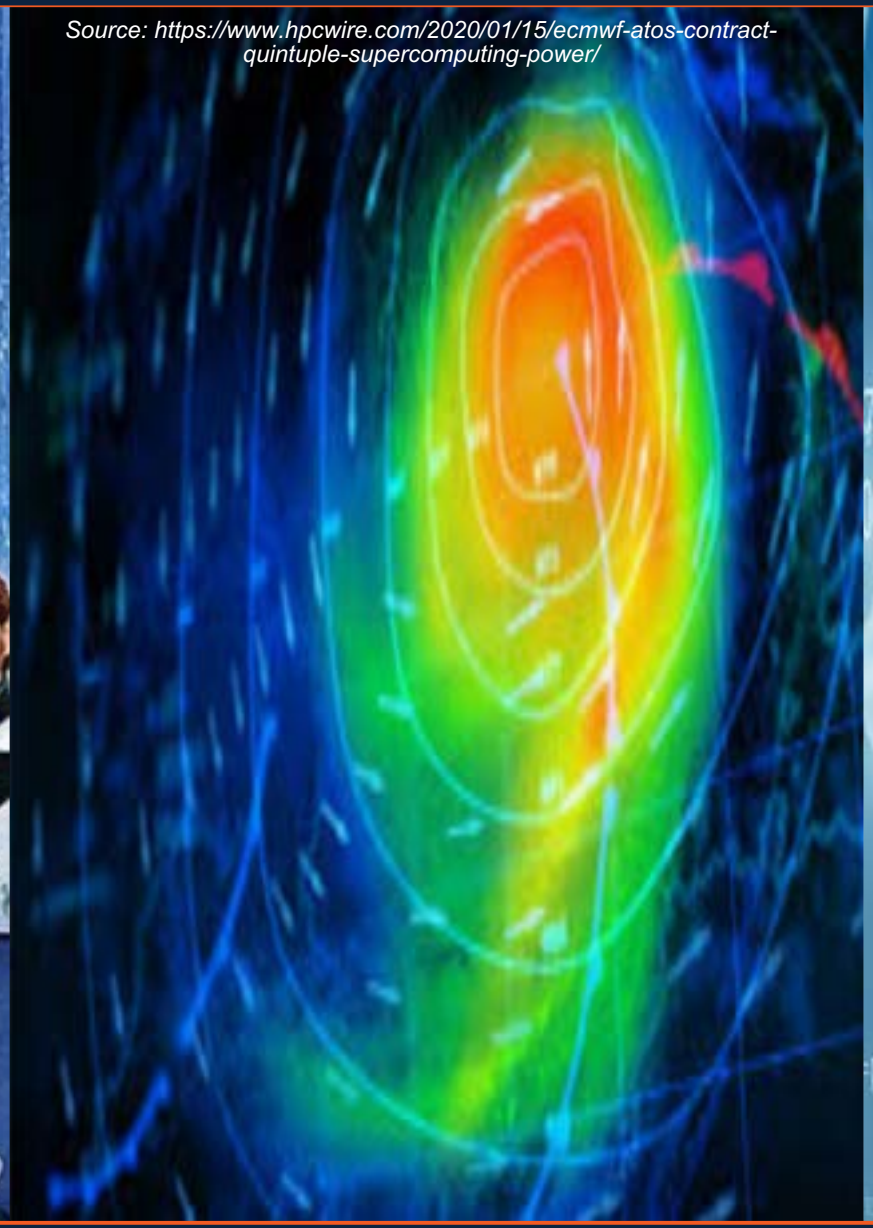


What is HPC?

- HPC is the use of aggregated high-end computing **resources** (or supercomputers) along with **parallel or concurrent processing techniques** (or algorithms) for solving both compute- and data-intensive problems
- There are multi-core and many-core processing elements in the nodes (or servers) in an HPC platform for executing application tasks in parallel, thereby, reducing the overall run-time of an application
- The processing elements are often connected to multiple levels of memory hierarchies and parallel filesystems for high performance

Source: https://www.amazon.com

Source: https://www.hpcwire.com/2020/01/15/ecmwf-atos-contract-quintuple-supercomputing-power/



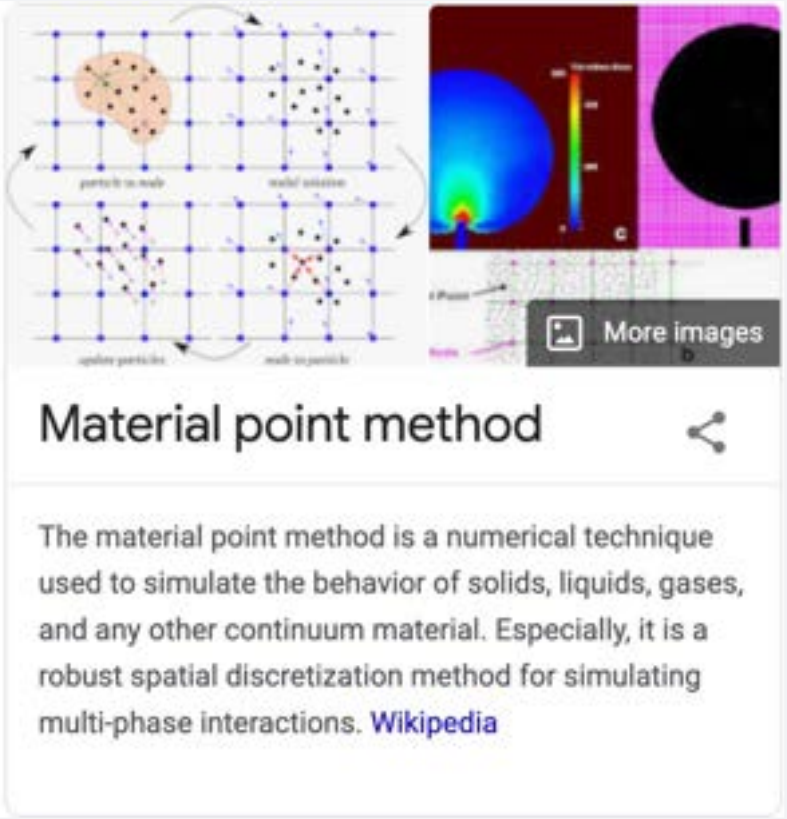
Source: https://today.uconn.edu/2019/04/drug-discovery-partnership-ai-biotech-company-reaps-promising-early-results/

HPC Plays a Vital Role in Our Lives: From Entertainment, to Weather Forecasting to Drug Discovery

Let us discuss how HPC is used in entertainment

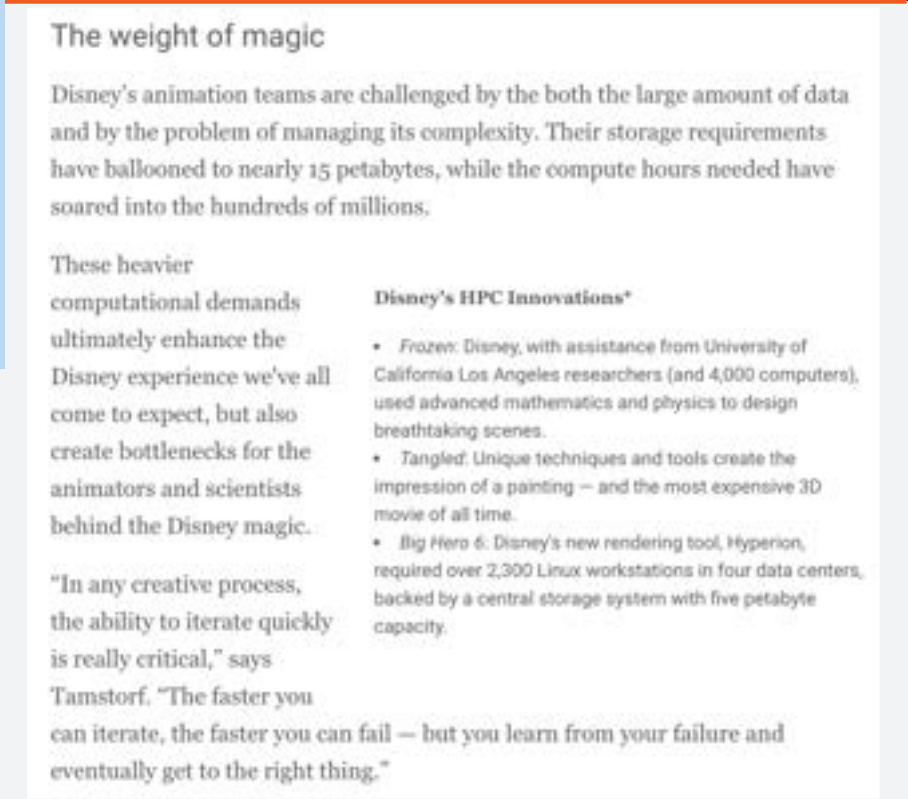
https://www.youtube.com/watch?v=L0MK7qz13bU

Exercise: Is there anything remarkable about the animation in the video?



- Science in entertainment: MPM was used to simulate snow in Frozen
- A large amount of computational power was used for rendering the Frozen movie – realistic simulation of hair, snow, clothes is computationally expensive

Source: https://tinyurl.com/y5pp929p



The weight of magic

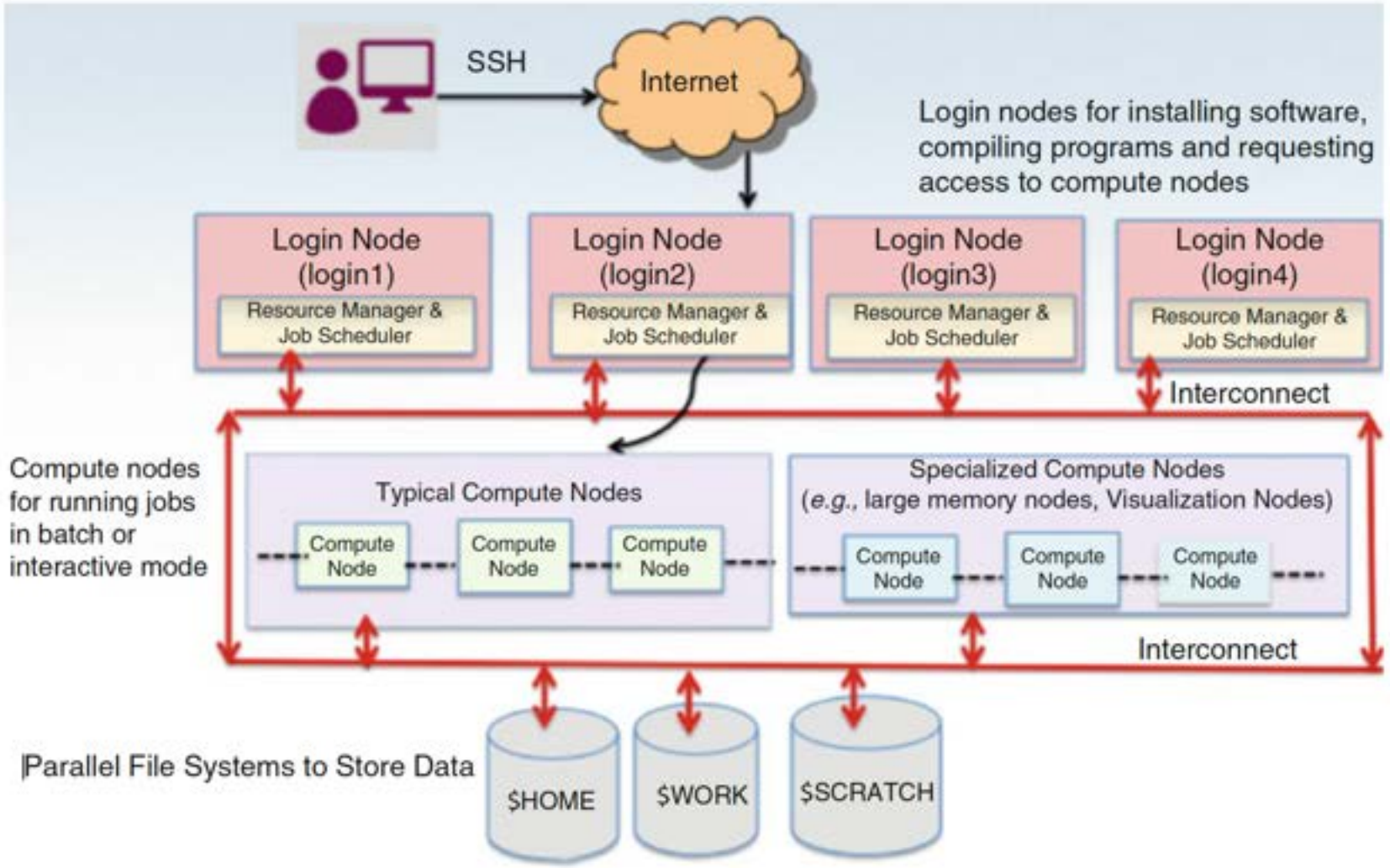
Disney's animation teams are challenged by the both the large amount of data and by the problem of managing its complexity. Their storage requirements have ballooned to nearly 15 petabytes, while the compute hours needed have soared into the hundreds of millions.

These heavier computational demands ultimately enhance the Disney experience we've all come to expect, but also create bottlenecks for the animators and scientists behind the Disney magic.

"In any creative process, the ability to iterate quickly is really critical," says Tamstorf. "The faster you can iterate, the faster you can fail — but you learn from your failure and eventually get to the right thing."

Disney's HPC Innovations*

- *Frozen*: Disney, with assistance from University of California Los Angeles researchers (and 4,000 computers), used advanced mathematics and physics to design breathtaking scenes.
- *Tangled*: Unique techniques and tools create the impression of a painting — and the most expensive 3D movie of all time.
- *Big Hero 6*: Disney's new rendering tool, Hyperion, required over 2,300 Linux workstations in four data centers, backed by a central storage system with five petabyte capacity.



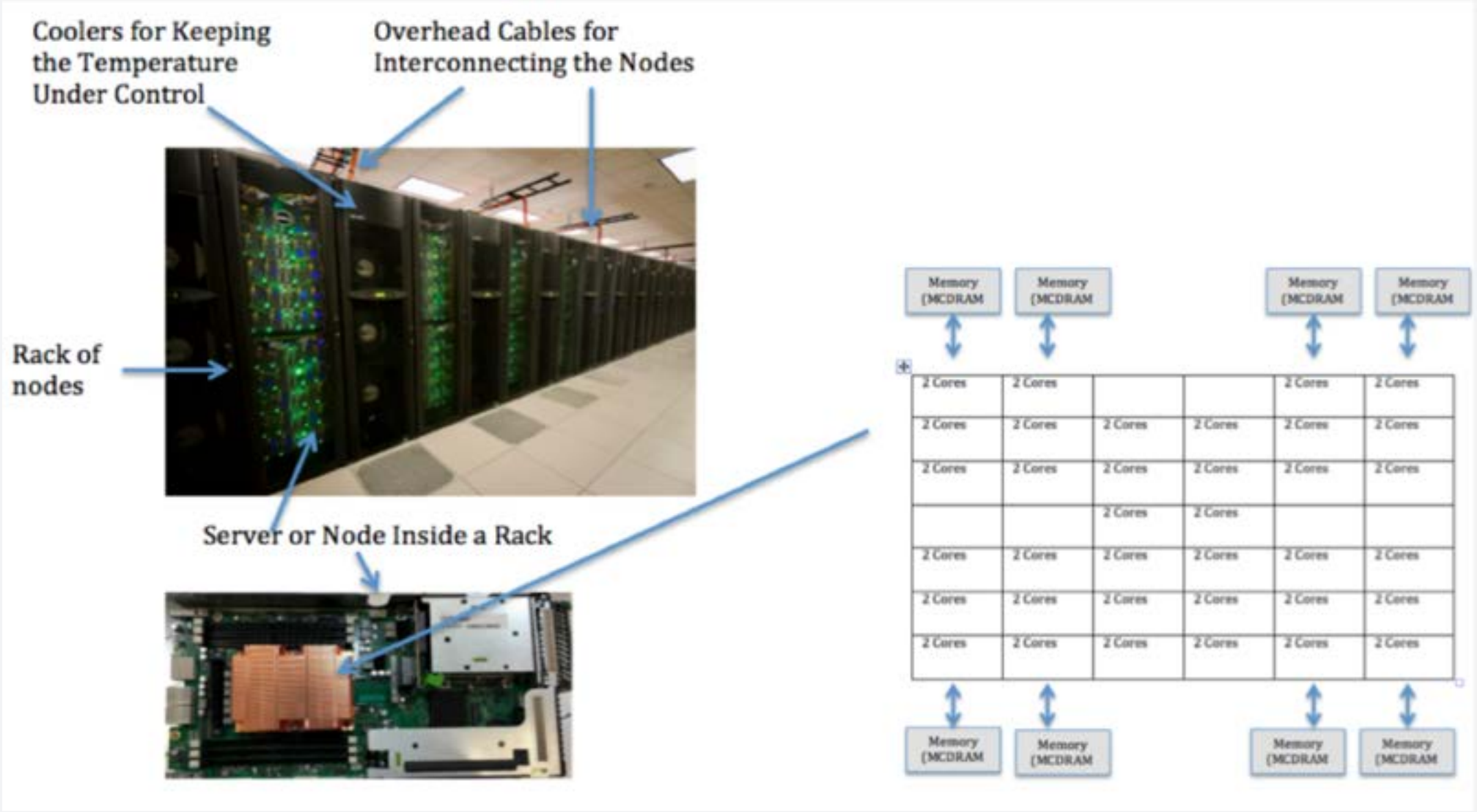
What is High-Throughput Computing (HTC)?

- ❑ Running multiple copies of serial applications in parallel with different input parameters or data such that the overall runtime is reduced is called HTC
- ❑ Often little or no code reengineering may be required in the application to adopt HTC on HPC platforms and yet reduce the time-to-results
- ❑ You can use special tools like GNU Parallel for doing HTC on HPC platforms

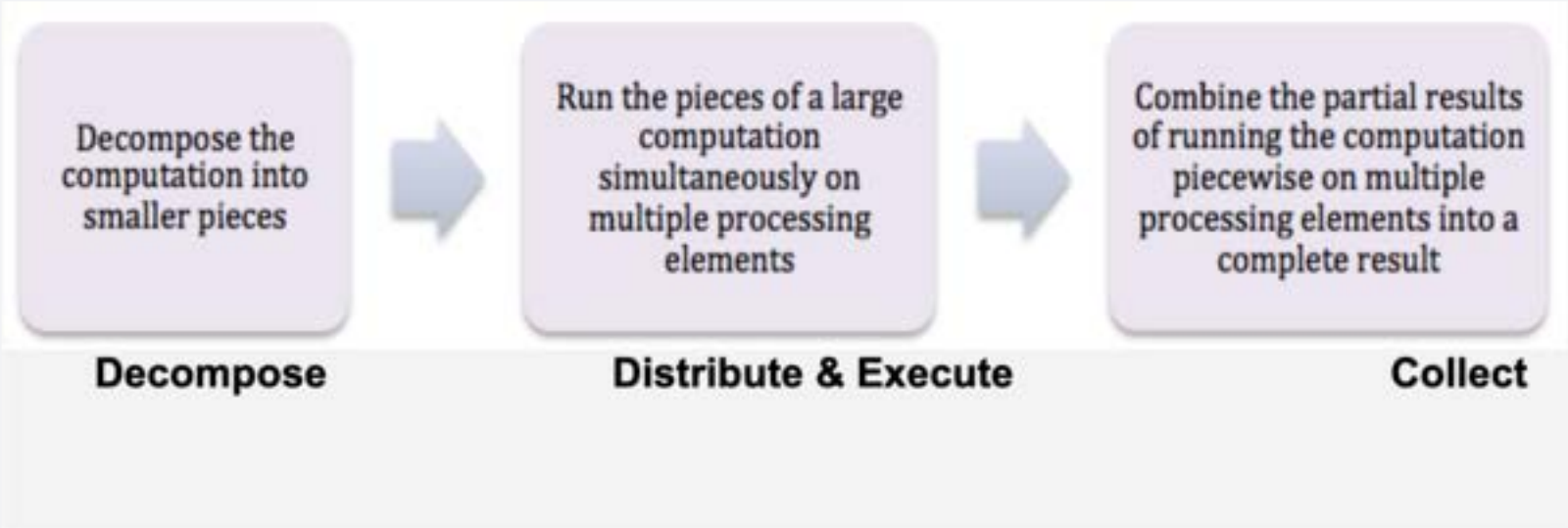
Photo courtesy: Texas Advanced Computing Center

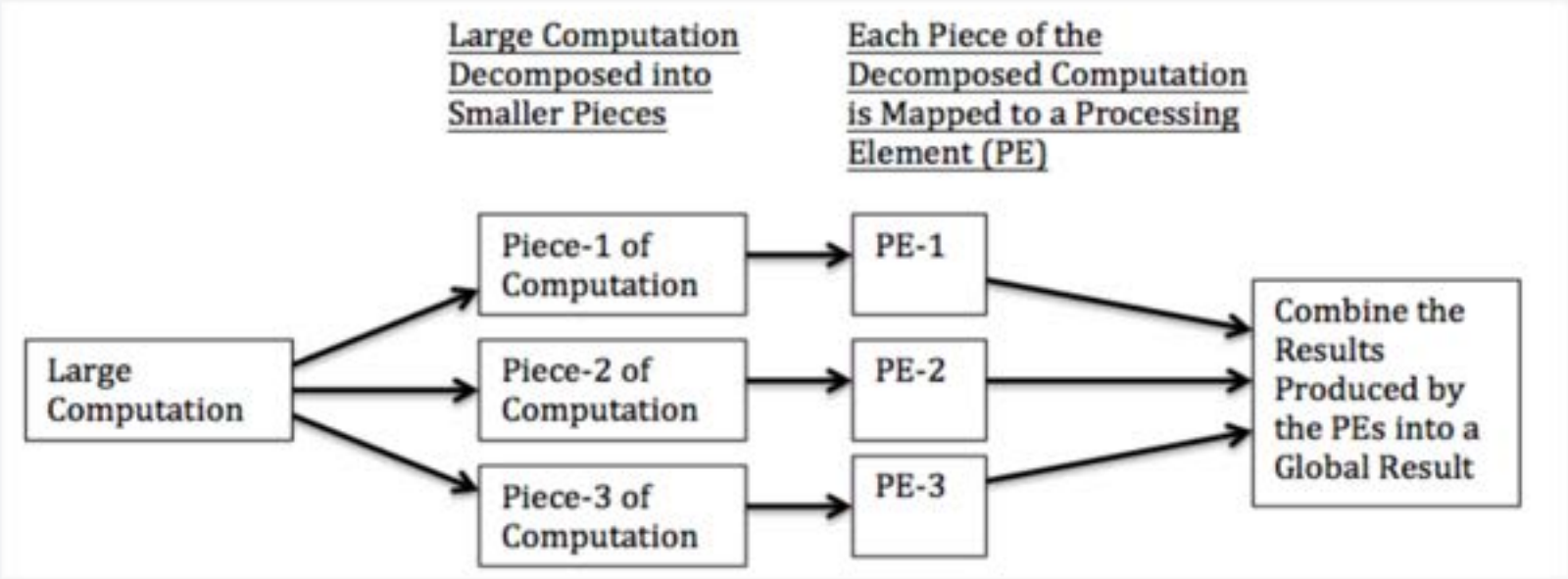
Accessing the HPC systems without any direct cost to you

- Accounts on the HPC platforms will be needed for getting access to the supercomputers/HPC platforms
  - For example, by submitting a request for an account on the Arc HPC system at UTSA, and through UTRC/TACC on Lonestar6
- Arc Wiki page
  - https://hpcsupport.utsa.edu/foswiki/bin/view/ARC/WebHome



What is inside these racks?





What is Parallel Processing or Parallel Computing?

- ❑ Decomposition of large computations into smaller units of computation such that these smaller units of computation can be processed simultaneously using multiple processing elements
- ❑ The processing elements can be multiple cores on a single processor or can be multiple independent processors
- ❑ The results obtained by executing multiple smaller units of computations are combined meaningfully to obtain the final or global result

The link for the summer internship application with NSA is here: https://www.lps.umd.edu/2023-future-computing-summer-internship/

Please note that the deadline is the end of the day on 31 January 2023

There's lot of information on the site about the past year's workshop and logistical information.

The students will be paid and there will be a competitive selection process for U.S citizen applicants.

Any questions, comments, or concerns?

Thank You!

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