



The 17th Annual International Symposium on High Performance Computing Systems and Applications

17ième symposium international sur les applications et systèmes de calcul de haute performance

Introduction to HPC

Presented by

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Introduction to HPC

Summary of the presentation

- 1) Who needs HPC?
- 2) HPC Architectures
- 3) What goes on inside a computer?
- 4) Overall Performance Strategy

Introduction to HPC

Who needs HPC?

What defines High Performance Computing?

“We use HPC to solve problems that could not be solved in a reasonable amount of time using a single desktop computer.”

Problems solved using HPC :

- Are Long to compute
and/or
- Needs large quantity of RAM
and/or
- Requires large quantity of runs
and/or
- Are Time Critical

Introduction to HPC

Who needs HPC?

HPC Domains of Application

“More and more scientific domains of application are now requiring HPC facilities. It is not any more the strong hold of Physics, Chemistry and Engineering...”

HPC domains of applications

- Fluid dynamics and heat transfer
- Physics and Astrophysics
- Nanoscience
- Chemistry and Biochemistry
- Biophysics and Bioinformatics
- Geophysics and Earth imaging
- Medical Physics and Medicine
- Databases and Data Mining
- Financial Modelling
- Signal and Image Processing
- And more

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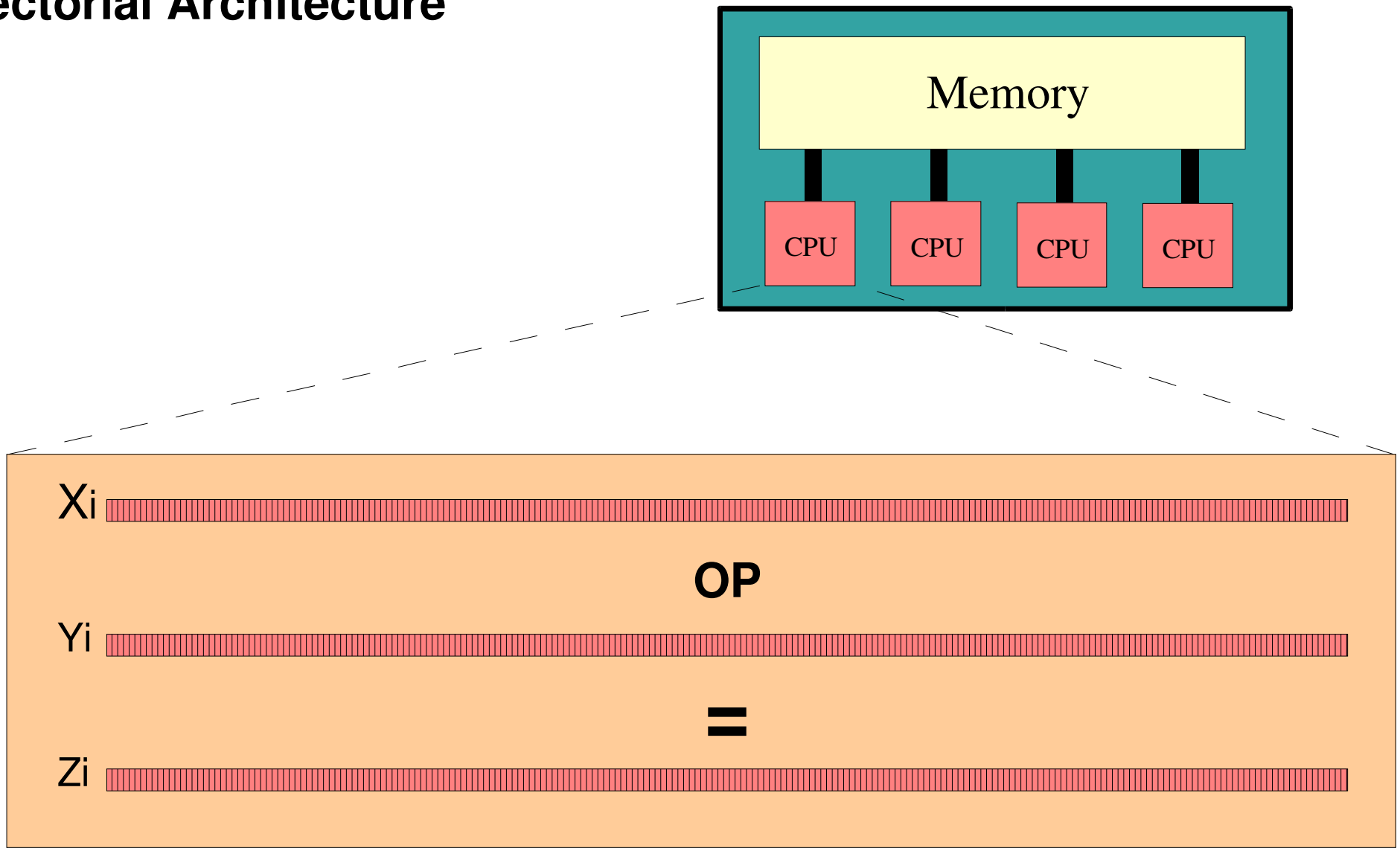
HPC Architectures

- Vectorial
- Shared Memory
- Distributed Memory : Clusters
- Hybrid

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HPC Architectures

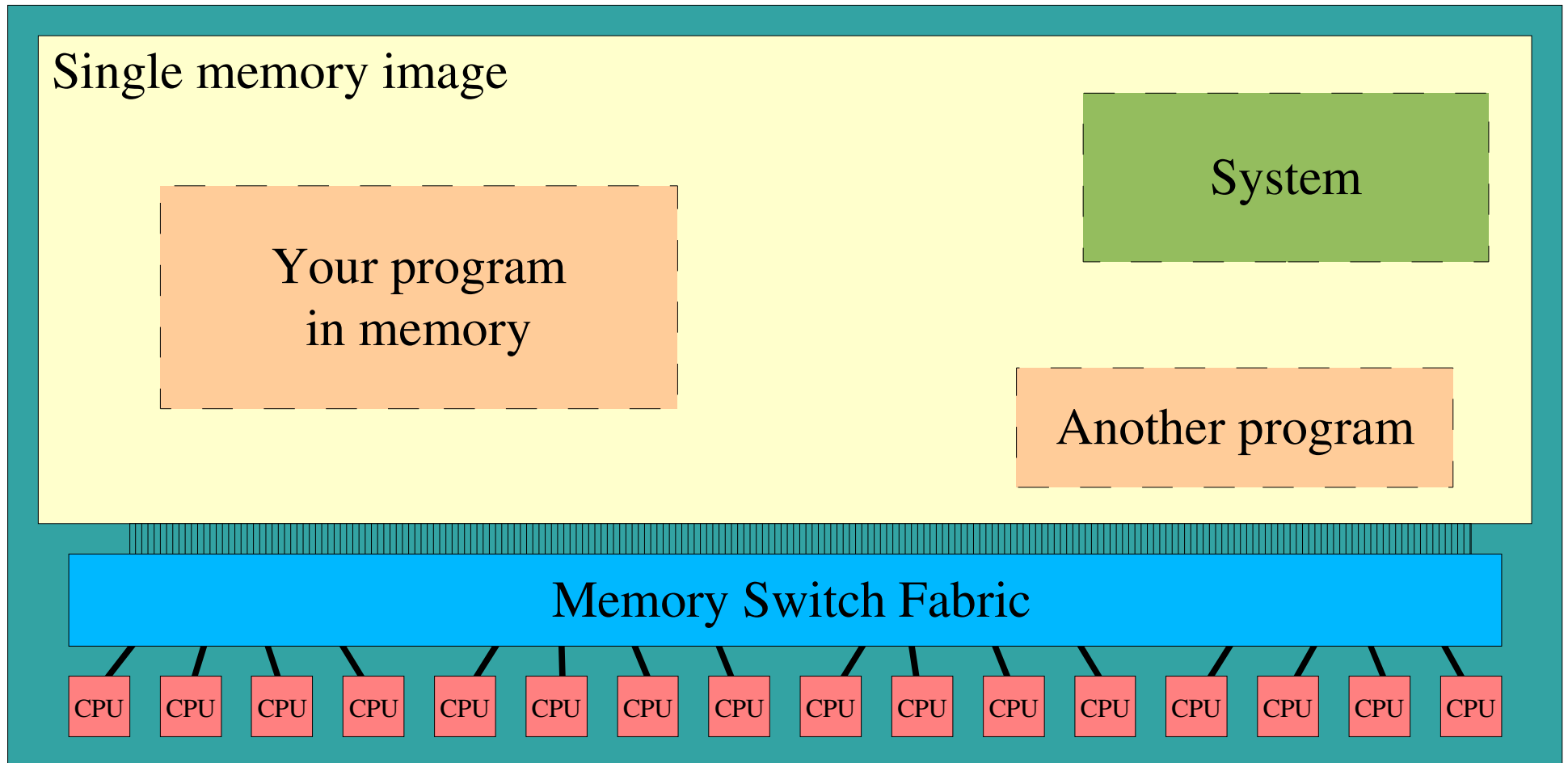
Vectorial Architecture



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HPC Architectures

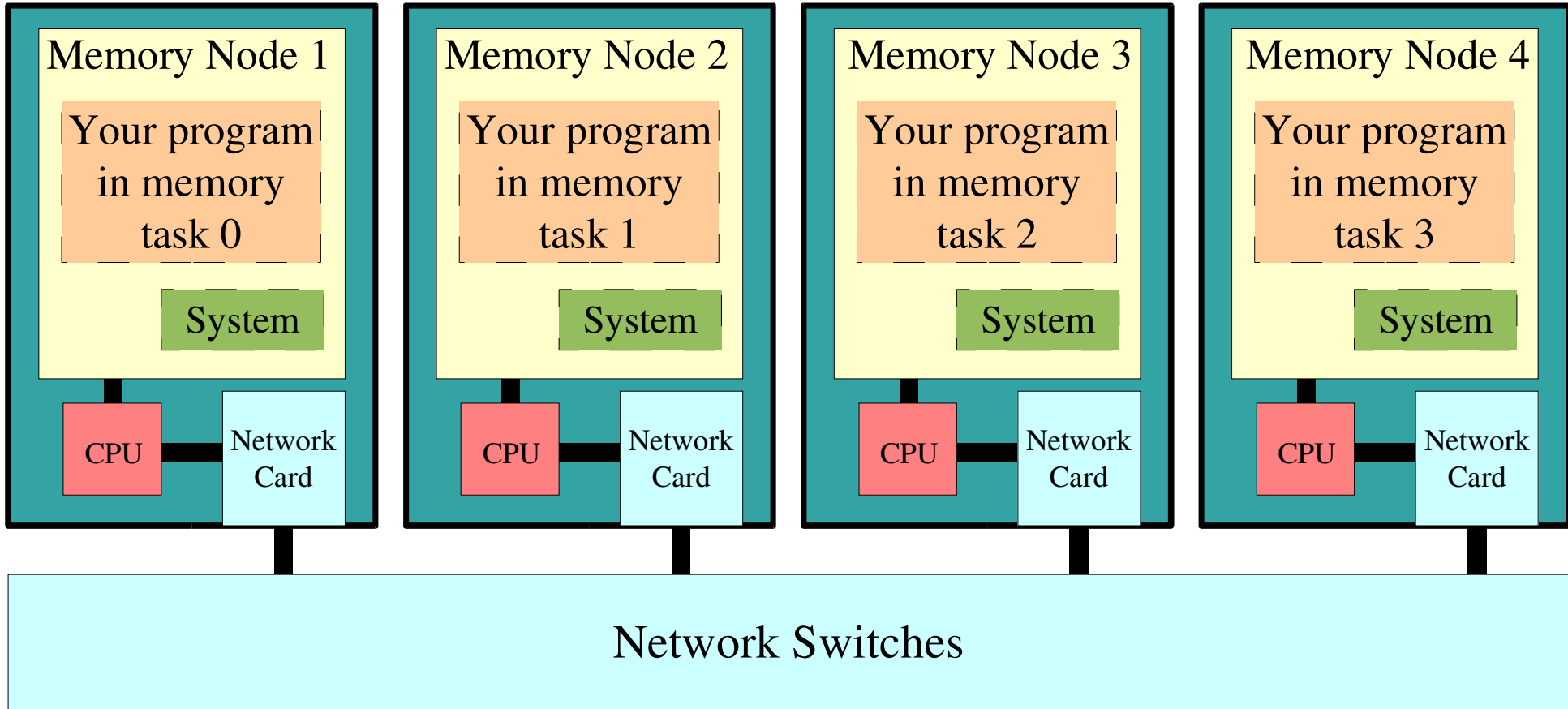
Shared Memory Architecture



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HPC Architectures

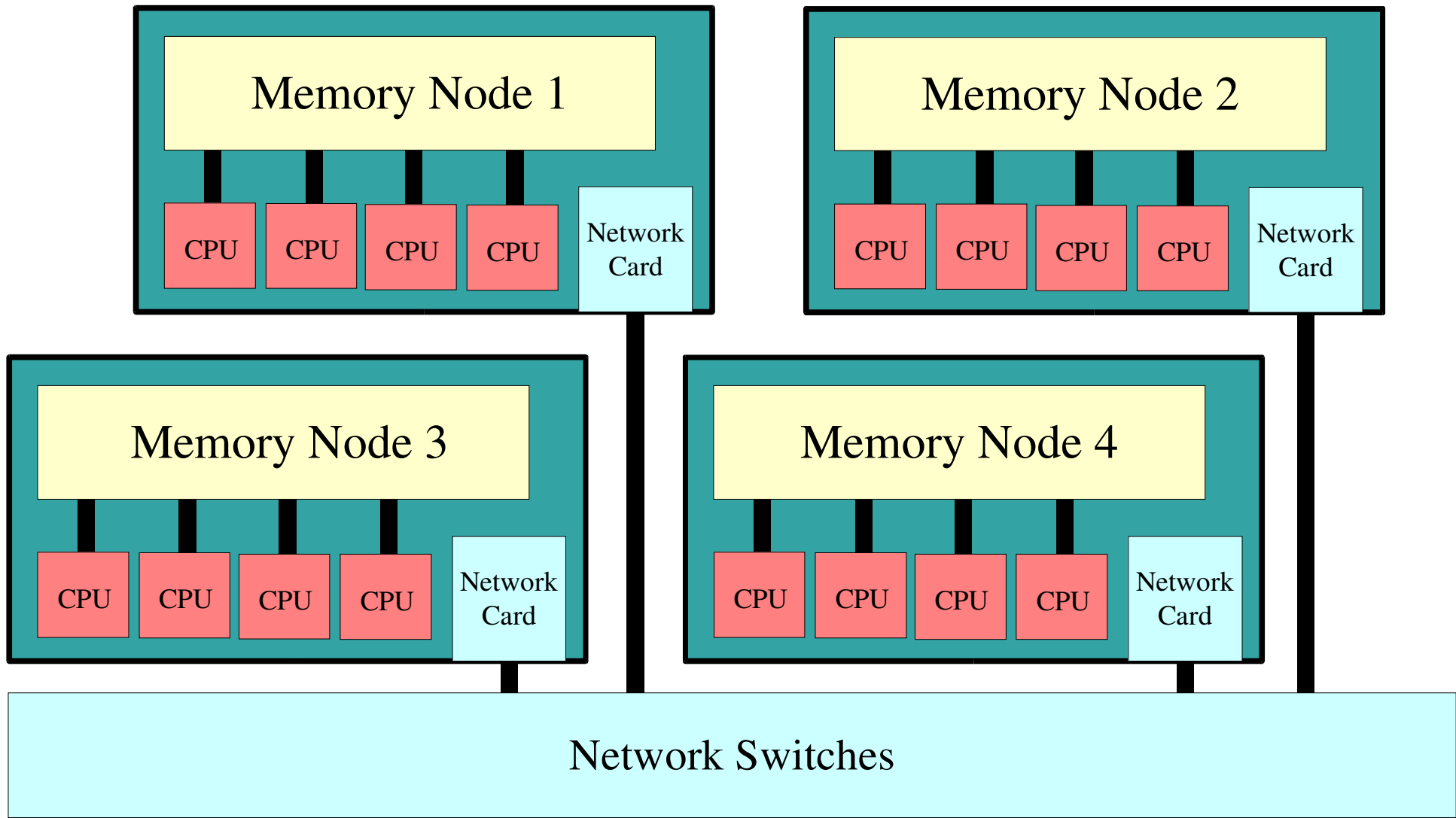
Distributed Memory Architecture : Clusters



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HPC Architectures

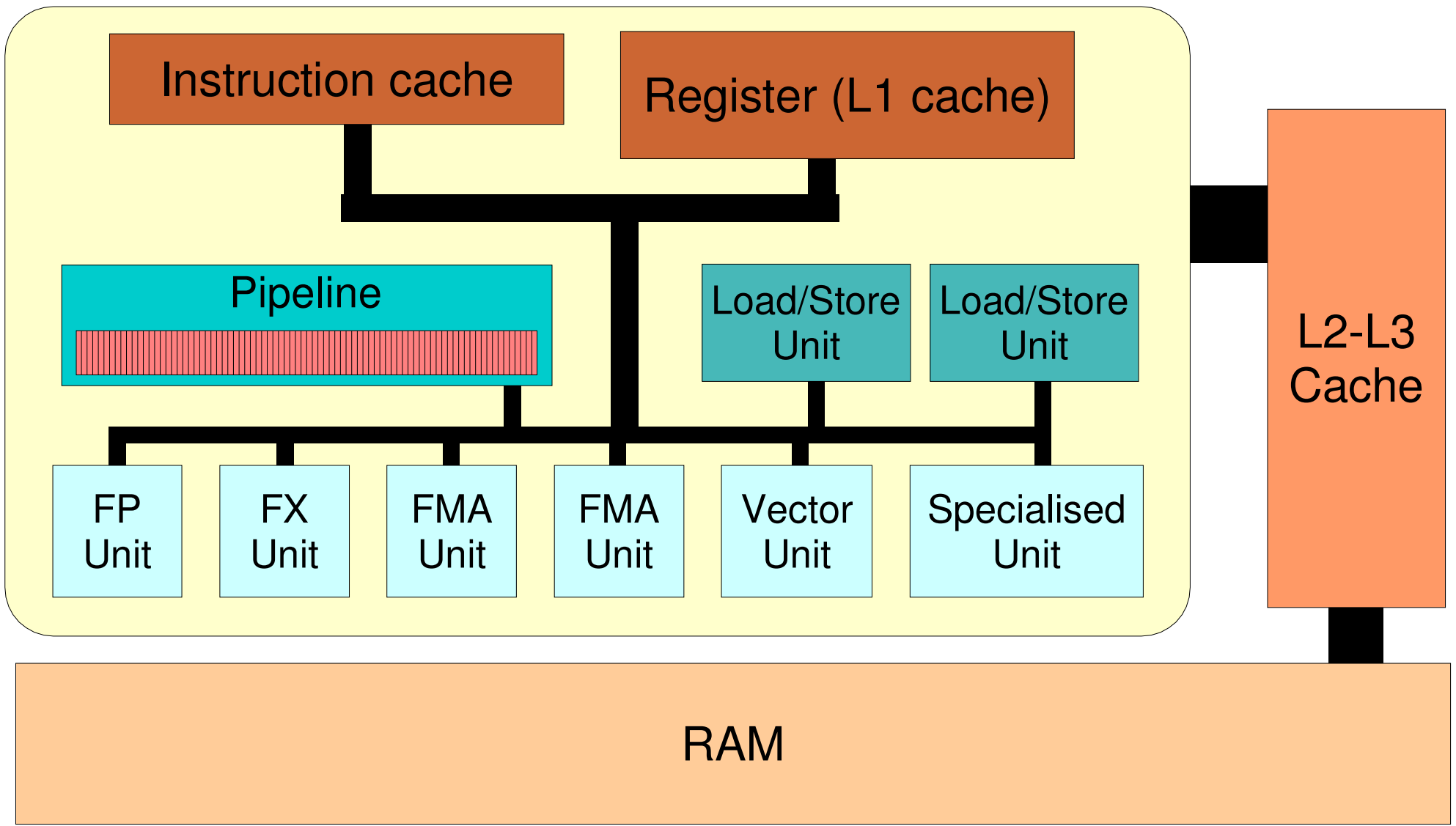
Hybrid Architectures



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What goes on inside a computer?

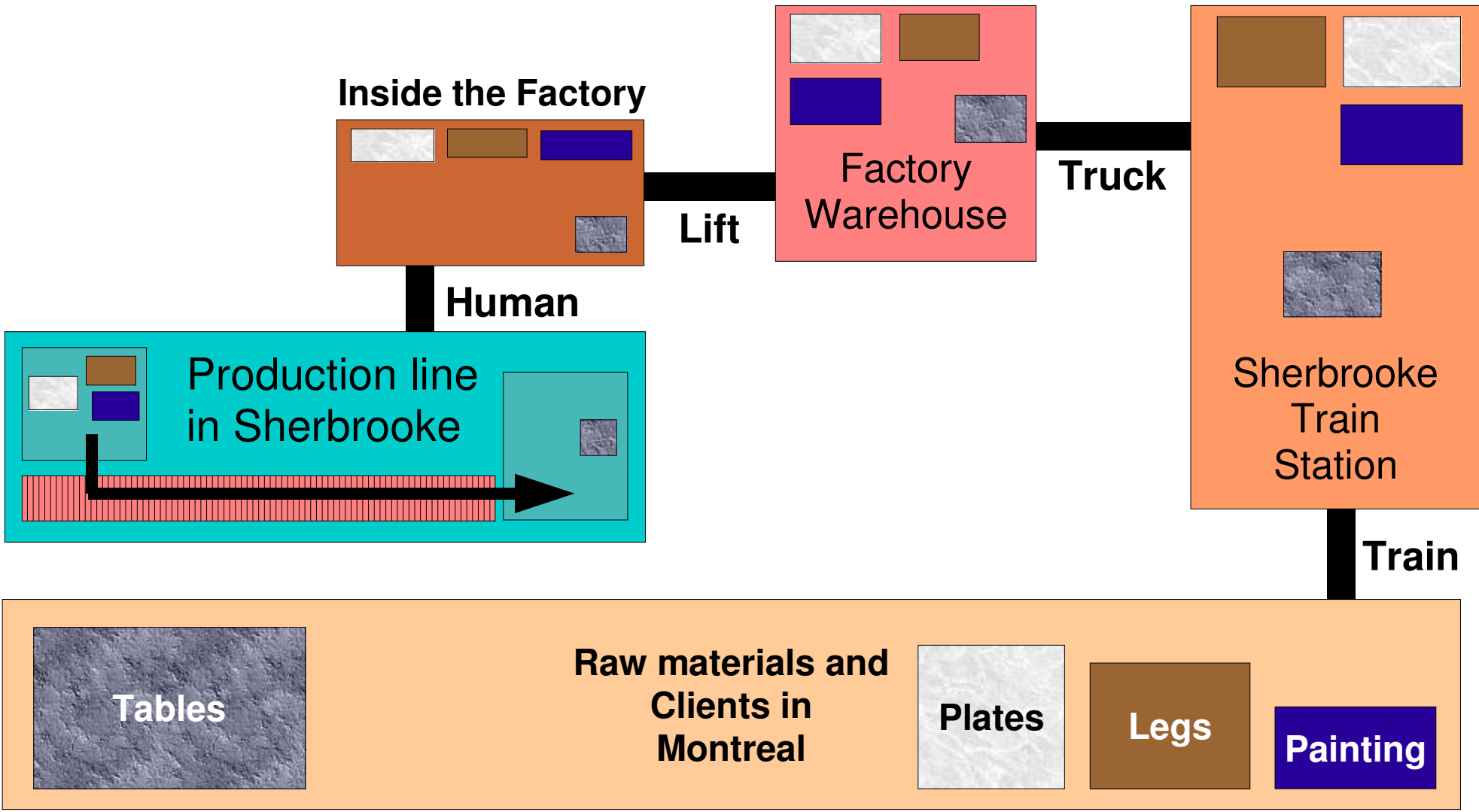
CPU Insights



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What goes on inside a computer?

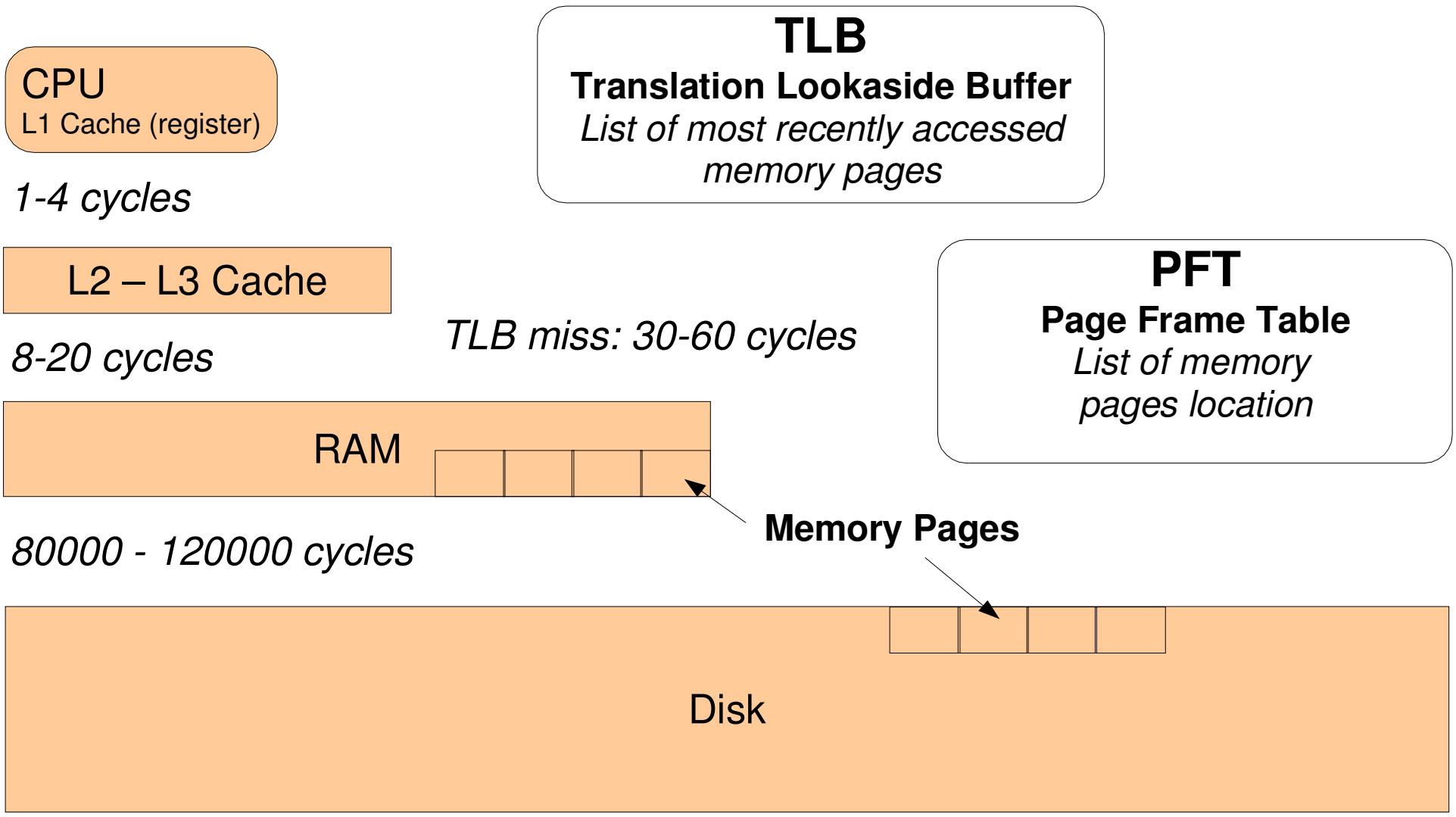
The Process of Building and Delivering Tables!



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What goes on inside a computer?

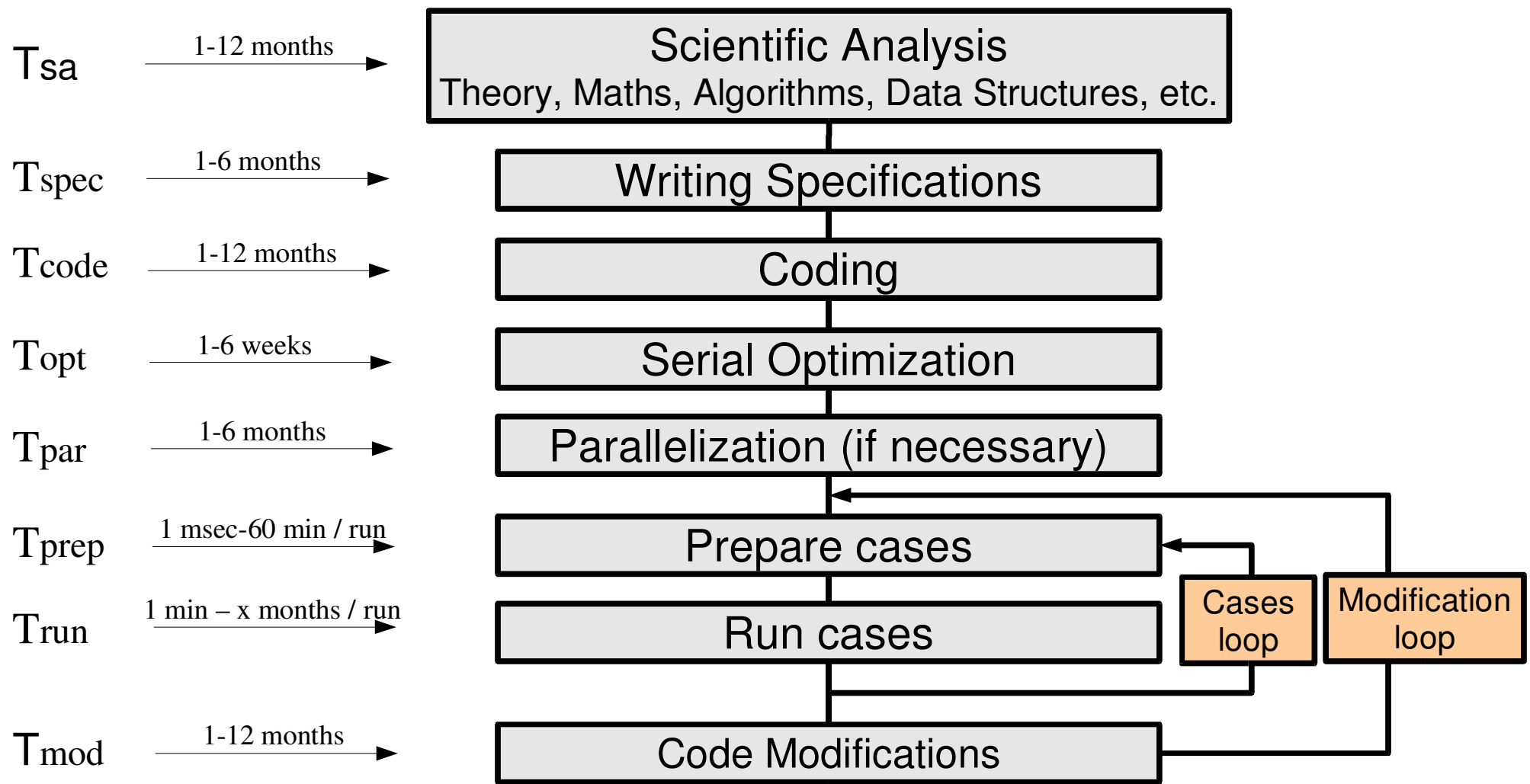
Memory Access vs Clock Cycles



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Overall Performance Strategy

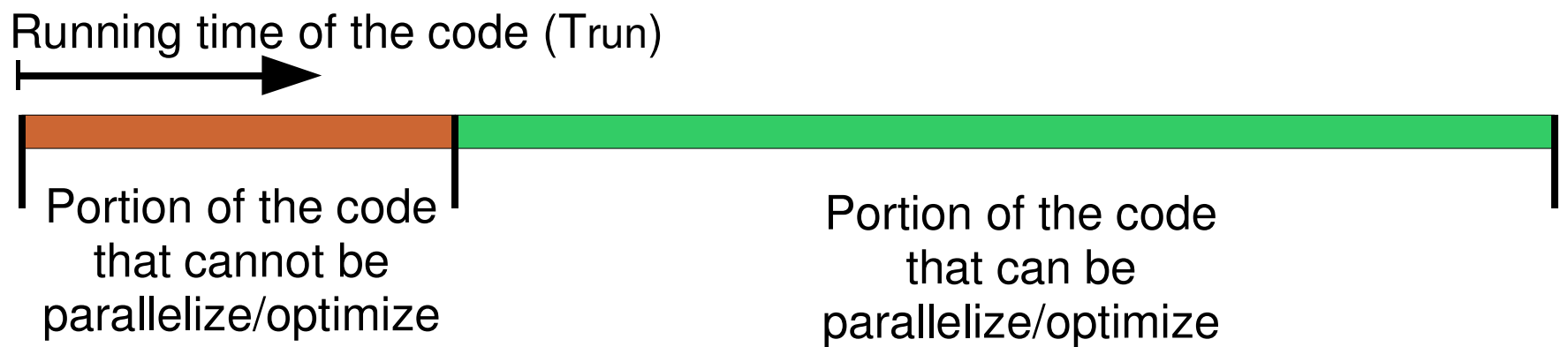
Scientific Application Development Steps



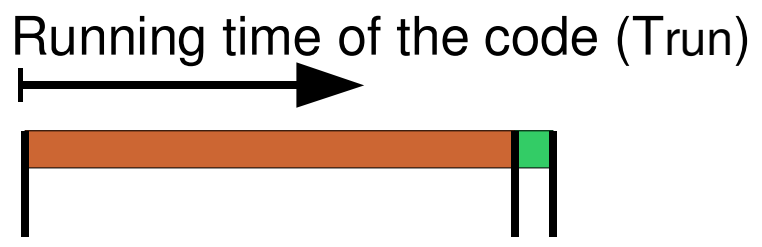
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Overall Performance Strategy

Amdahl's Law



Even after an excellent parallelisation or optimisation...



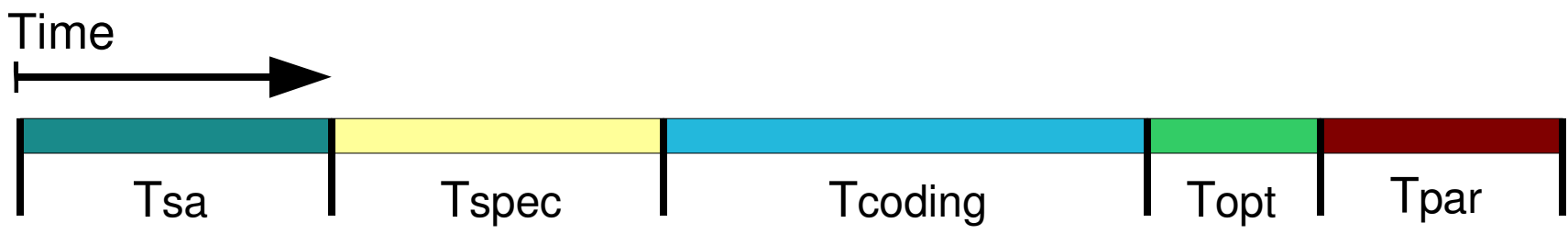
.... this code will never run more than 3 times faster !!!

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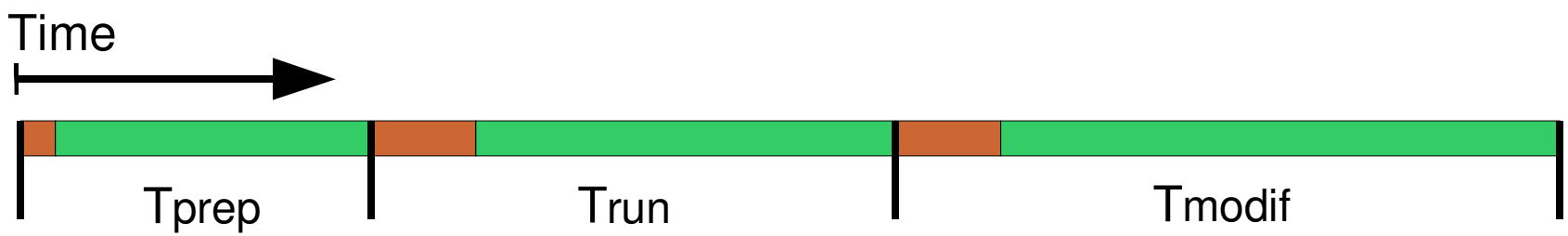
Overall Performance Strategy

Overview of Development and Production Time

Development



Production



Coffee Break ...

**Next
Code Optimization**