

# Introduction to Parallel and Distributed Systems

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# Outline

- 1 Introduction on Use Cases
- 2 Broad fields of parallelism

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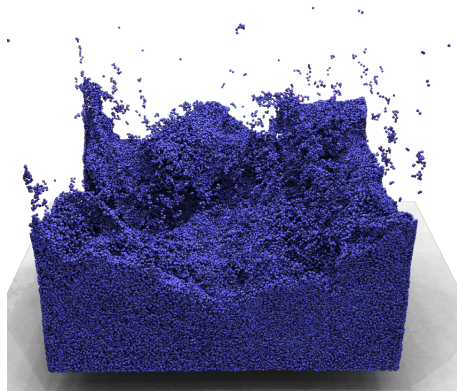
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# Use Case 1 - Fluid Simulation Visualization

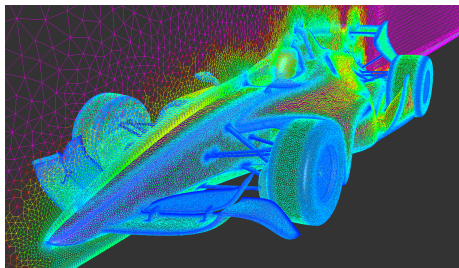
## Fluid Simulation

- In a fluid dynamics lab, visualization of fluid circulation.
- Need: from the numerical simulation data, render one particular instant of the simulation ( $10^7$  points, 8 GB data in RAM)



# Use Case 1 - Car Model

- In the car industry, a R&D department works on CAD models.
- Need: compute the heat transfer from the engine to the rest of the vehicle on a  $10^8$  cell mesh (100 GB of data in mesh).



# Use Case 2 - Scene Rendering

- In the film industry, produce an animated cartoon based on digital images.
- Need: compute the scene rendering for  $10^5$  images

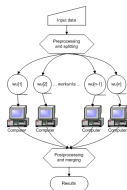


# Use Case 3 - RC5-72

## Breaking a Ciphering Key

- Find the cryptographic key used to cipher a message.
- Need: scan all possible keys using brute force and find which one matches.
- See for example the **RSA Secret-Key Challenge**

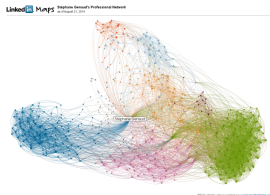
## Archi. Distributed.net



# Use-Case 4: Social Network

- Compute properties on the graph
- Need: Recommend a user new connections, i.e people he/she may know by transitivity. Do it for  $10^6$  users.

## Graph





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# Multi Threaded

- key technologies: *OpenMP* - *CUDA* - *OpenCL*
- architecture : single host

# Message-passing

- key technologies: *MPI*
- architecture : multi-hosts connected through fast network (clusters)

# Bag-of-tasks

- key technologies: *BOINC* - *Globus derivatives*
- architecture : distributed hosts connected through LANs or WANs. Grids, Clouds, Internet Computing

# MapReduce

- key technologies: *Google MapReduce - Hadoop*
- architecture : multi-hosts connected through fast network (clusters)