RĪGAS TEHNISKĀ UNIVERSITĀTE

HPC for digital industry

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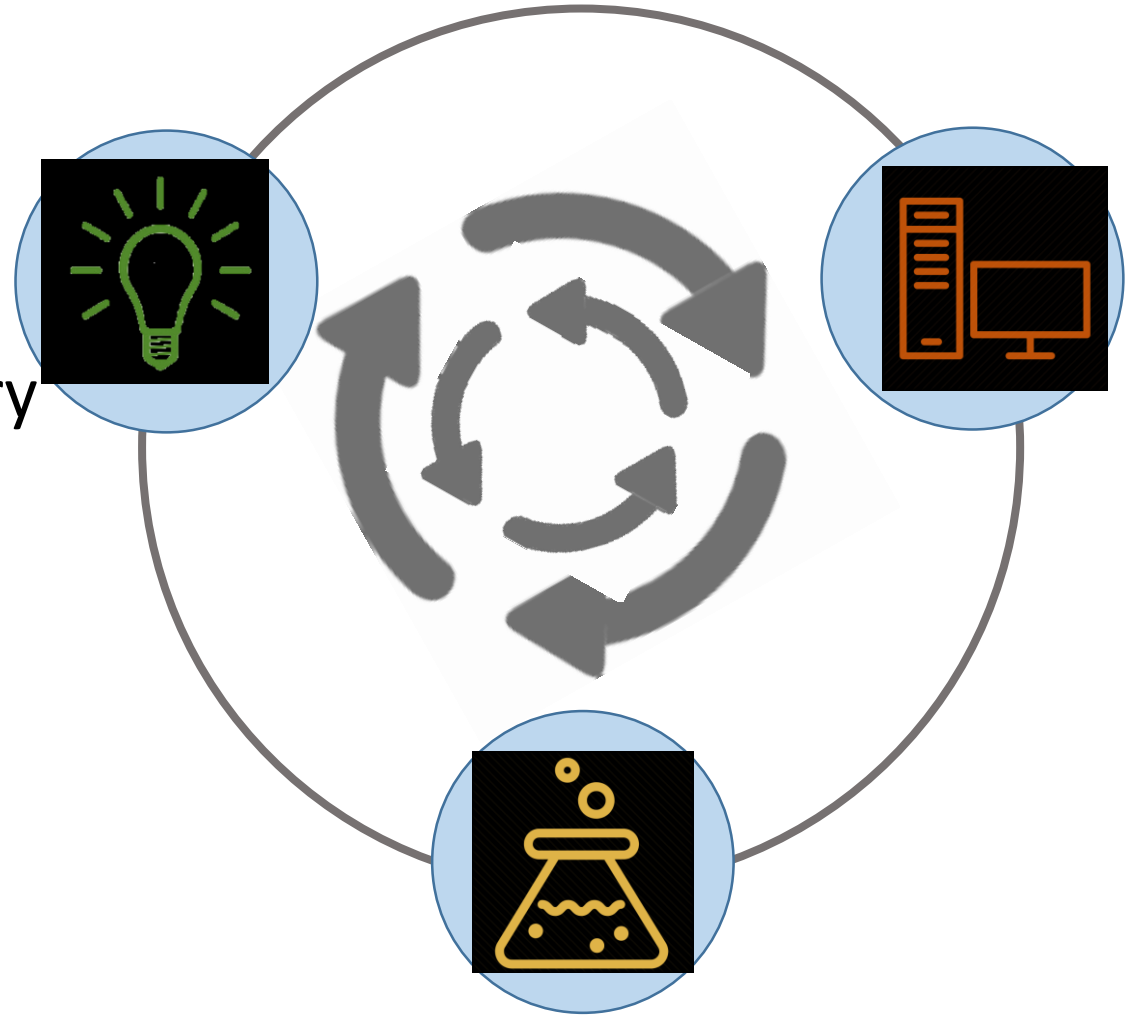
Head of HPC centre

Outline

- About RTU HPC centre
- What is HPC and why do we need it
- HPC in the World and Europe
- Efforts to support industry

New knowledge/theory

Invention



Modelling and simulation

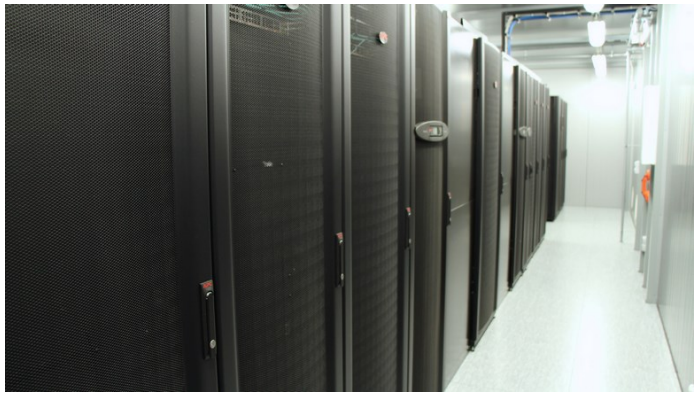
Experiment

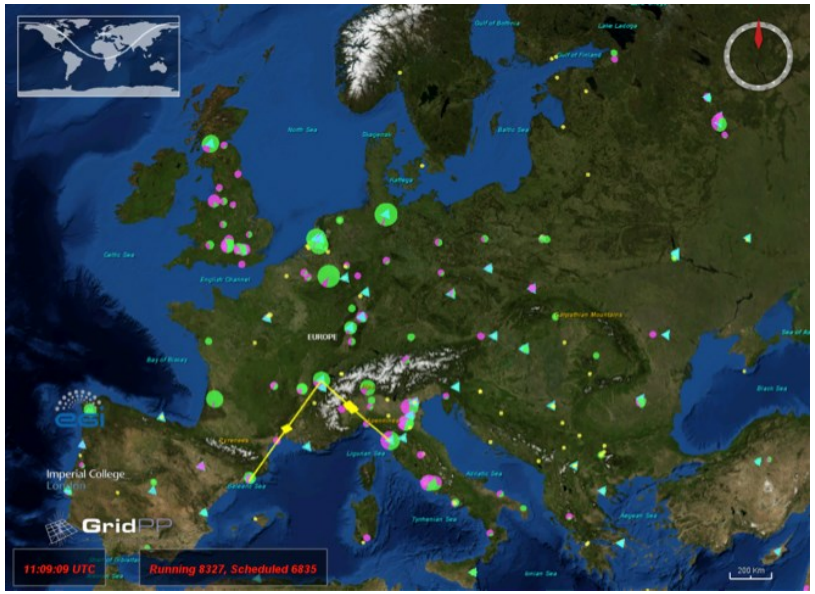
Prototyping/production

RTU HPC centre provides

- access to modern computing infrastructure (supercomputer, data storage)
- link to European e-infrastructures
- modelling and simulation services
- scientific software license management
- technical support and training

- Open to cooperation with industry





Timeline

5 nodes x 1 single core CPU

+312 CPU cores
+ 6 GPUs
+ 6 Tflops

+384 CPU cores
+ 8 GPUs
238 TB storage
+ 27 Tflops

+496 CPU cores
+ 8 GPUs
1.5 TB RAM
+ 106 Tflops

RTU HPC Centre

RTU IT department

FP6 and FP7 project *Balticgrid*

2005 2006 2010 2012 2015 2018

Why do we need HPC?

Powerful computing systems or supercomputers

***H**igh*
***P**erformance*
***C**omputing*

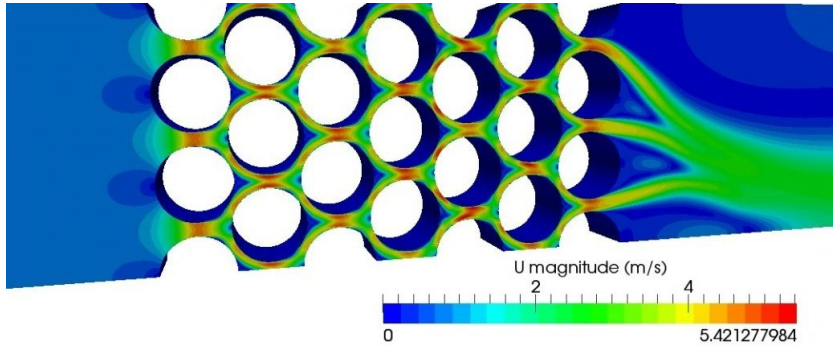
Effective methods/solvers, optimized and parallel code

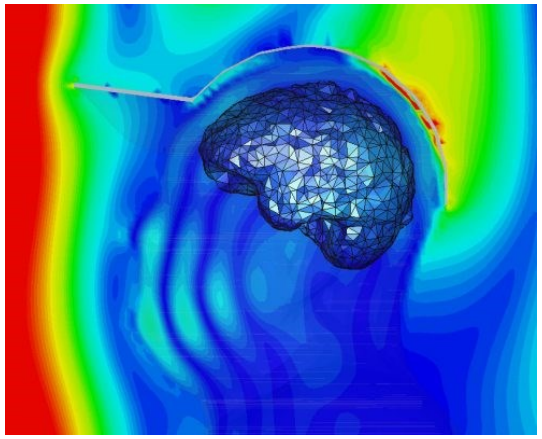
- For **scientific** and **technical** computing

- When PC resources insufficient
  - Time consuming tasks
  - High memory requirements
  - Big Data

The main HPC application areas at RTU

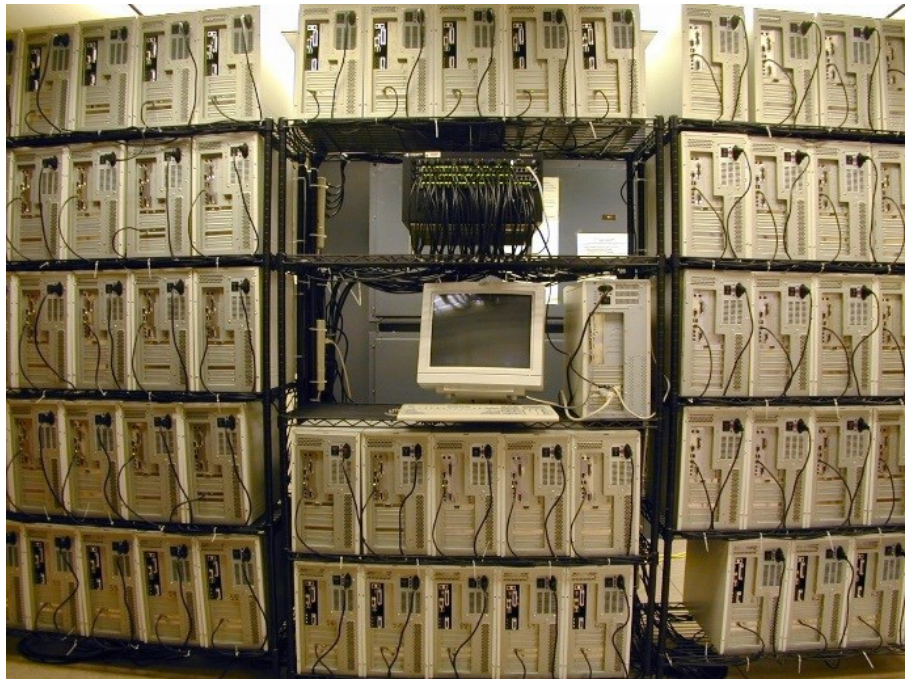
- Development of **deep learning** (neural network) algorithms
- Monte-Carlo simulations in statistical physics
- **CFD** simulations
- Analyses of whole **genome data**
- Computational **chemistry**
- Photogrammetric processing of digital images
- Solving of complex electrodynamic problems
- Simulation of communication networks





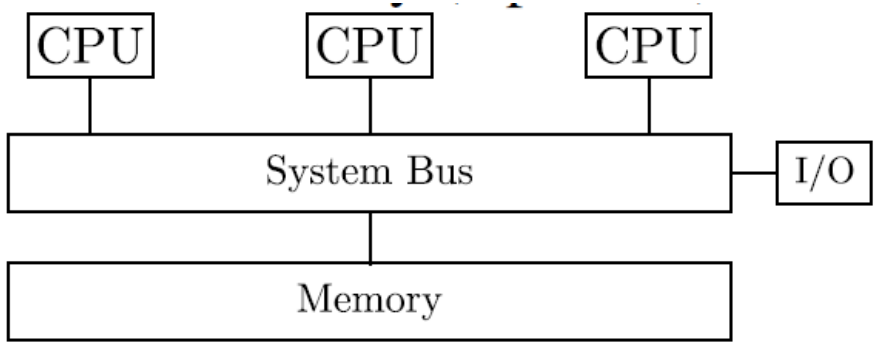
What is supercomputer?

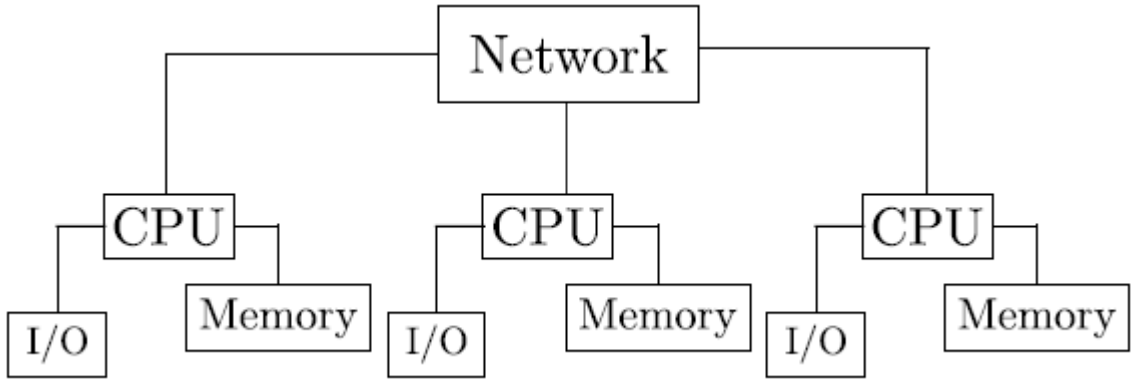
Shared-memory system, mainframe, MPP, SMP…



Computing cluster

What is supercomputer?





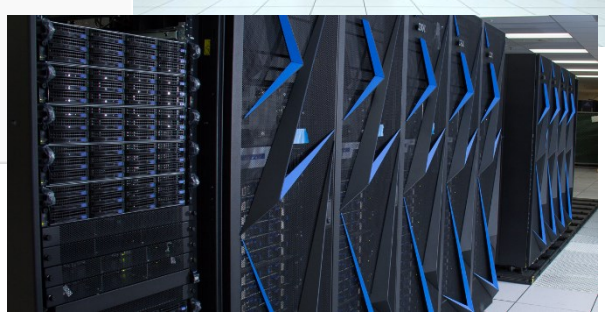
Shared-memory system, mainframe, MPP, SMP…

Computing cluster

The most powerful supercomputers

TOP500 The List.

Rank	System	Cores	Rmax (TFlop/s)	Rpeak (TFlop/s)	Power (kW)
1	**Summit** - IBM Power System AC922, IBM POWER9 22C 3.07GHz, NVIDIA Volta GV100, Dual-rail Mellanox EDR Infiniband , IBM DOE/SC/Oak Ridge National Laboratory United States	2,282,544	122,300.0	187,659.3	8,806
2	**Sunway TaihuLight** - Sunway MPP, Sunway SW26010 260C 1.45GHz, Sunway , NRCPC National Supercomputing Center in Wuxi China	10,649,600	93,014.6	125,435.9	15,371
3	**Sierra** - IBM Power System S922LC, IBM POWER9 22C 3.1GHz, NVIDIA Volta GV100, Dual-rail Mellanox EDR Infiniband , IBM DOE/NNSA/LLNL United States	1,572,480	71,610.0	119,193.6	

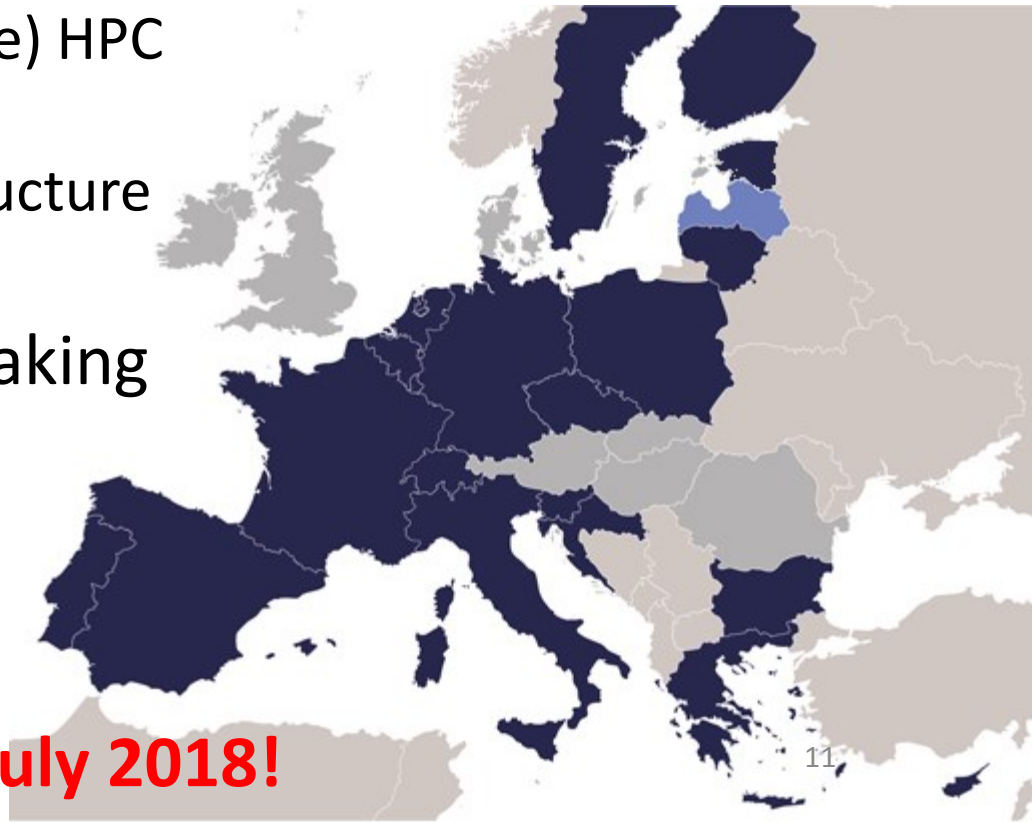


Performance of modern processor ≈ 400 Gflops $= 4 \cdot 10^{11}$ flops

Nr.1 supercomputer (06.2018) ≈ 122 Pflops $= 122 \cdot 10^{18}$ flops

EuroHPC Declaration

- European initiative to coordinate efforts in HPC
  - procure and deploy two pre-exascale machines (1st phase)
  - make it available to public and private users
  - support development of next generation (exascale) HPC technologies in Europe
  - build world-class European HPC and data infrastructure ecosystem
- 22 country have joined EuroHPC Joint Undertaking
- Budget: 1b Euro



Latvia joined on 17 July 2018!

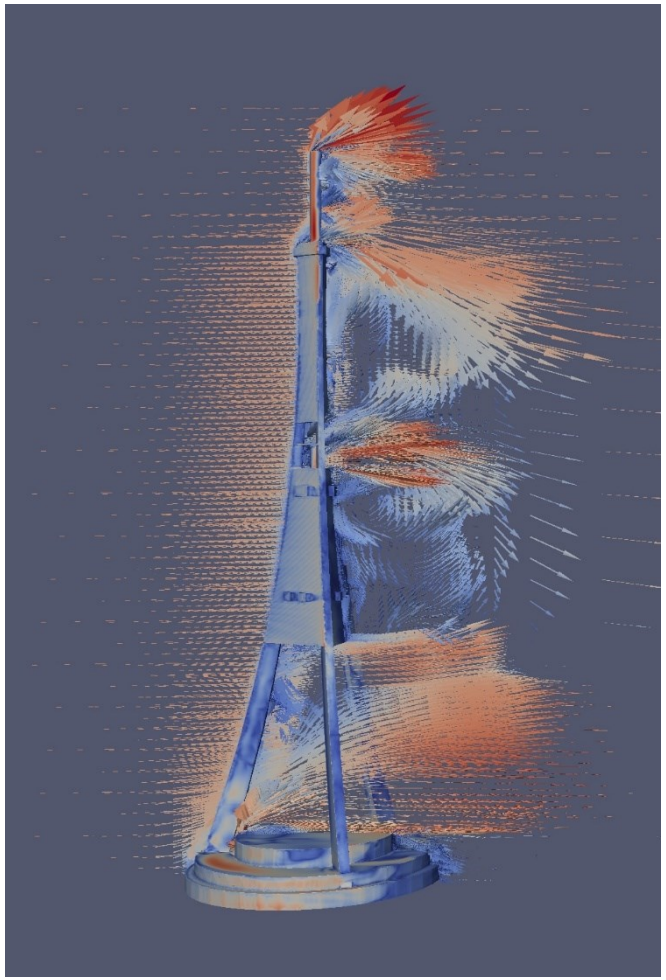
EuroHPC workgroup on SMEs

- SMEs are a focus group of the EuroHPC JU
  - increase the innovation potential of SMEs
  - provide SMEs with access to best HPC infrastructures and services
- Access time (of supercomputer) for commercial use
  - up to 20%
  - based on market prices
- Categorisation of SMEs with a focus on HPC users
  1. SMEs making use of HPC systems and services
  2. SMEs not making use of HPC systems and services

EuroHPC workgroup on SMEs (cont.)

Example at RTU: Modelling & simulation as a service

- Computational fluid dynamics (CFD): one of the most time consuming computing problems
- CFD experts group
  - scientists working at university
  - multidisciplinary: chemistry, mechanics, construction
  - good expertise in HPC
- What do we offer
  - create a simulation model from 2D/3D drawing
  - run parallel simulations on supercomputer
  - analyse and interpret the results
- Targeting innovative industries (*SMEs, start-ups*) wanting to improve R&D process



Airflow analyses of LVRTC Television Tower

Thank you!

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