#### **JURECA**

### First modular supercomputer worldwide

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- Curiosities
- 2 Architecture
- Classifications
- 4 Other resources

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### Organization

- Forschungszentrum Jülich is a interdisciplinary research centre in Germany;
- Institute for Advanced Simulation (IAS);
- Jülich Supercomputing Centre (JSC);
  - Supercomputing centre since 1987;

### Managed supercomputers

- JUSUF;
- JUWELS (position 311);
  - Helped Google demonstrate the quantum supremacy (source);
    - Quantum computer: 200 seconds;
    - Fastest supercomputer: 10.000 years;
- JURECA (position 56<sup>1</sup>);
  - The name is short for Jülich Research on Exascale Cluster Architectures;

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### **JURECA**

- 2015-04: begins to operate the cluster;
- 2017-11: included a buster module;
- First modular supercomputer worldwide (source);

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### JURECA Cluster



### JURECA Cluster

- 1872 compute nodes<sup>2</sup>
  - 2 Intel Xeon E5-2680 v3 Haswell CPUs per node
    - 2 x 12 cores, 2.5 GHz
  - 75 compute nodes with 2 NVIDIA K80 GPUs
    - 2 x 4992 CUDA cores
    - 2 x 24 GiB GDDR5 memory
  - DDR4 memory (2133 MHz)
    - 1605 compute nodes with 128 GiB memory
    - 128 compute nodes with 256 GiB memory
    - 64 compute nodes with 512 GiB memory

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#### JURECA Cluster

- 12 visualization nodes
  - 2 Intel Xeon E5-2680 v3 Haswell CPUs per node
  - 2 NVIDIA K40 GPUs per node
    - 2 x 12 GiB GDDR5 memory
  - 10 nodes with 512 GiB memory
  - 2 nodes with 1024 GiB memory

## Summary - JURECA Cluster

- 1872 compute nodes
- 12 visualization nodes
- 45.216 CPU cores
- 1.8 (CPU) + 0.44 (GPU) Petaflop per second
- 100 GiB per second storage connection

### JURECA Buster



### Summary - JURECA Buster

- 1640 compute nodes<sup>3</sup>
  - 1 Intel Xeon Phi 7250-F Knights Landing CPUs per node
    - 68 cores, 1.4 GHz
    - 96 GiB memory plus 16 GiB MCDRAM high-bandwidth memory
- 111.520 CPU cores
- 5 Petaflop per second
- 100+ GiB per second storage connection

### Softwares

- CentOS 7 Linux distribution
- Intel MPI and ParTec MPI
- OpenMP
- ...

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### **F**lynn

Based on the instruction stream and the data stream.

- SISD
- SIMD
- MISD
- MIMD

### Memory sharing

They use MPI to communicate between nodes.

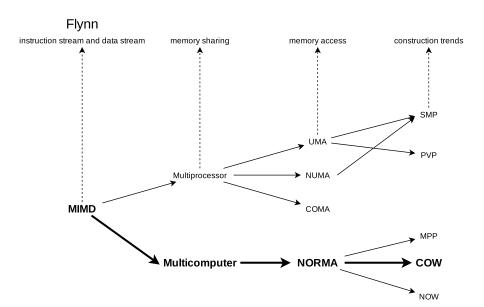
- Multiprocessor
- Multicomputer

# Type of memory access

- UMA
- NUMA
- COMA
- NORMA

### Construction trends

- PVP
- SMP
- MPP
- NOW
- COW



# Flynn

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#### Other resources

- Time lapse video of the installation
- Jülich Supercomputing Centre