

Zukunft des High Performance Computing

Dieter Kranzlmüller

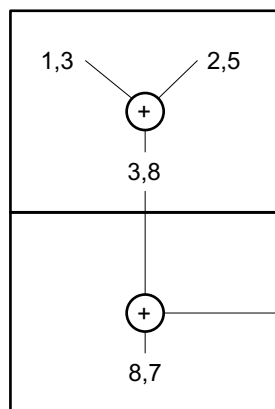
Munich Network Management Team
Ludwig-Maximilians-Universität München (LMU) &
Leibniz Supercomputing Centre (LRZ)
of the Bavarian Academy of Sciences and Humanities



Paralleles Rechnen

$$1 + 2 = 3$$

$$1,3 + 2,5 = 3,8$$



LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN **Hochparalleles Rechnen** **lrz**

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LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN **Der Supercomputer SuperMUC Phase 1 + 2** **lrz**

Phase 1
3.2 PFLOP/s

SuperMUC

Phase 2
3.2 PFLOP/s

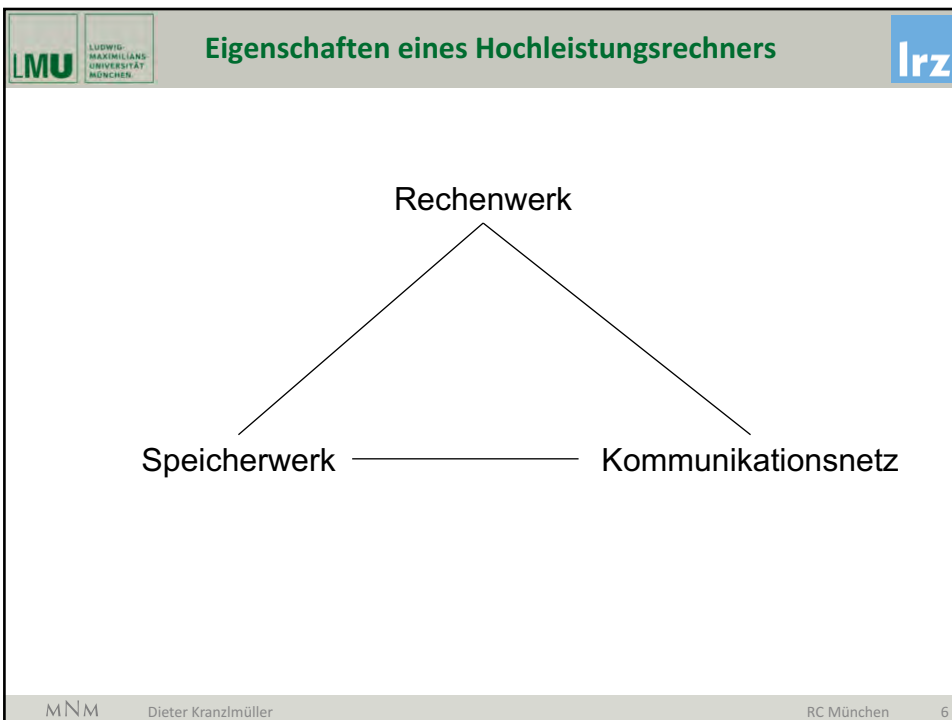
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LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN **Top 500 Supercomputer List (June 2012)** lrz

Rank	Site	Computer/Year Vendor	Cores	R_{max}	R_{peak}	Power
1	DOE/NNSA/LLNL United States	Sequoia - BlueGene/Q, Power BQC 16C 1.60 GHz, Custom / 2011 IBM	1572864	16324.75	20132.66	7890.0
2	RIKEN Advanced Institute for Computational Science (AICS) Japan	K computer , SPARC64 VIII/x; 2.0GHz, Tofu interconnect / 2011 Fujitsu	705024	10510.00	11280.38	12659.9
3	DOE/SC/Argonne National Laboratory United States	Mira - BlueGene/Q, Power BQC 16C 1.60GHz, Custom / 2012 IBM	786432	8162.38	10066.33	3945.0
4	Leibniz Rechenzentrum Germany	SuperMUC - iDataPlex DX360M4, Xeon E5-2680 8C 2.70GHz, Infiniband FDR / 2012 IBM	147456	2897.00	3185.05	3422.7
5	National Supercomputing Center in Tianjin China	Tianhe-1A - NUDT YH MPP, Xeon X5670 6C 2.93 GHz, NVIDIA 2050 / 2010 NUDT	186368	2566.00	4701.00	4040.0
6	DOE/SC/Oak Ridge National Laboratory United States	Jaguar - Cray XK6, Opteron 6274 16C 2.200GHz, Cray Gemini interconnect, NVIDIA 2090 / 2009 Cray Inc.	298592	1941.00	2627.61	5142.0
7	CINECA Italy	Fermi - BlueGene/Q, Power BQC 16C 1.60GHz, Custom / 2012 IBM	163840	1725.49	2097.15	821.9
8	Forschungszentrum Juelich (FZJ) Germany	JuQUEEN - BlueGene/Q, Power BQC 16C 1.60GHz, Custom / 2012 IBM	131072	1380.39	1677.72	657.5
9	CEA/GCC-GENCI France	Curie thin nodes - Bullx B510, Xeon E5- 2680 8C 2.700GHz, Infiniband QDR / 2012 Bull	77184	1359.00	1667.17	2251.0
10	National Supercomputing Centre in Shenzhen (NSCS) China	Nebulae - Dawning TC3600 Blade System, Xeon X5650 6C 2.66GHz, Infiniband QDR, NVIDIA 2050 / 2010 Dawning	120640	1271.00	2984.30	2580.0

www.top500.org

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ACGT
ACC
ACGG
AAGC

ACGT
ACC-
ACGG
AAGC

Sequencing → Alignment → Phylogenetic Tree

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- 4226517247809112252219618802377042809718932383449
8822942857479880831434032178759024536798491951168
3076494692867414802738570221298292428457687814873
4552121861861600804474608426626044448936698500560
2468116186441264227425440726676614927906540649360
2976397461917469326750931190889241406694054603576
66015625
- $\approx 4.22 \times 10^{301}$

1KITE Dataflow

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Wissenschaftliche Publikationen



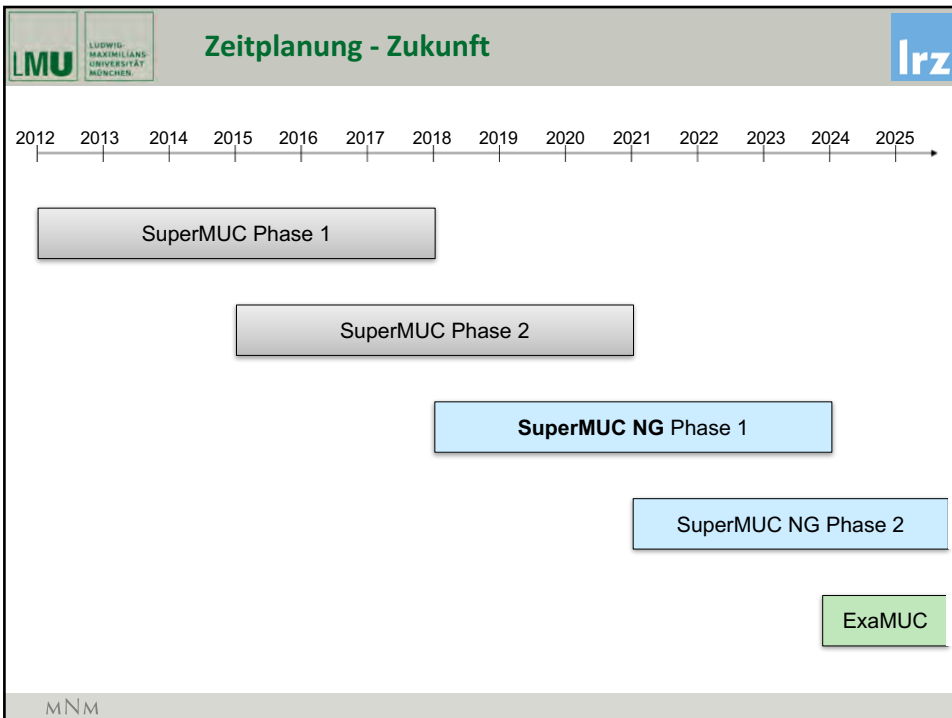

Science
 310 22 DECEMBER 2014
 science.org
 AAAS
Avian genomes
 Sequencing across the bird species tree
 p. 1305
 SPECIAL ISSUE



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 310 7 NOVEMBER 2014
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 AAAS
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 Molecular insights into insect origins and evolution
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Heißwasserkühlung im SuperMUC

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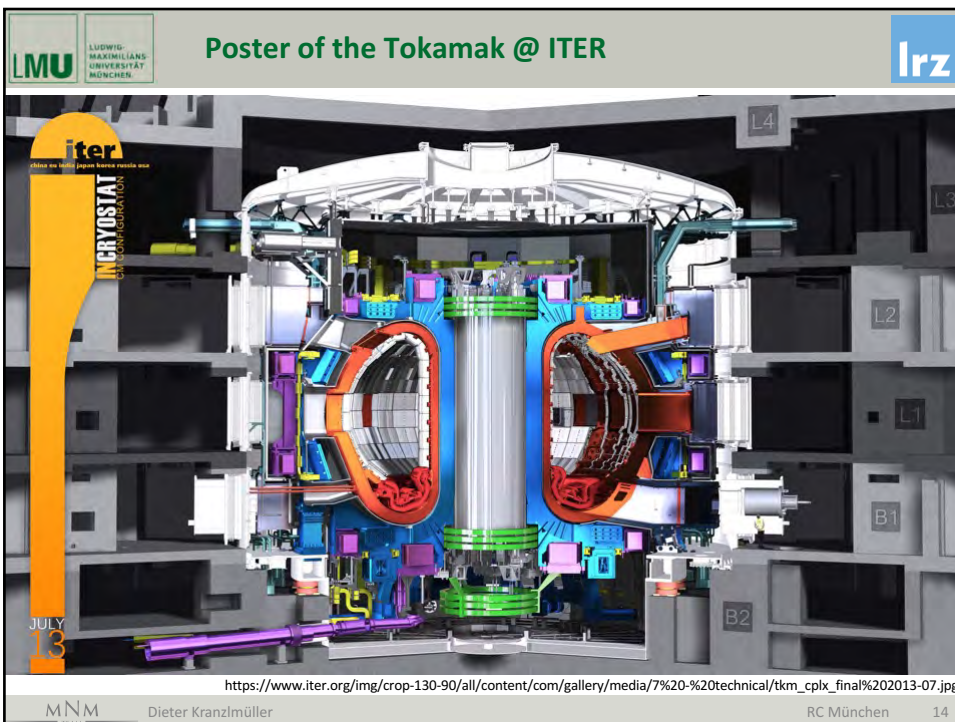
Energieeffizienz beim Rechnen auf SuperMUC

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Fotos: Torsten Bloth, Lenovo

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Photo: ITER Organization/EJF Riche, August 2017



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