



Prof. Dr. Matthias Müller



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Chair of High Performance Computing (Informatik 12)

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■ Focus on Efficient Parallel Programming for HPC

■ Topics

→ Parallel Programming Paradigms

→ OpenMP and others

→ Correctness Checking

→ MPI, MPI+OpenMP, other paradigms

→ Total Cost of Ownership

→ Energy Efficiency, Programmability, Performance

→ Analysis of Parallel Architectures

■ Lecture: Performance and Correctness Analysis of Parallel Programs



■ Correctness Analysis – Examples

```
int main ()
{
    double a[10];

    for (int i=0; i<11; ++i)
    {
        a[i] = i;
        sum += i;
    }
    // more
}
```

Traditional debugging technology
(serial & parallel programs)

```
int main ()
{
    double a[10];
    #pragma omp parallel for
        reduction(+:sum)
    for (int i=0; i<10; ++i)
    {
        a[i] = i;
        sum += i;
    }
    // more
}
```

Data race detection (parallel programs)

■ Correctness analysis

- Automatic detection of common mistakes & tools
- Design methods towards less error-prone programming

■ Performance analysis

- Performance requirements, metrics, evaluations
- Commonly used benchmarks/ workloads
- Monitoring techniques & tools
- Energy efficiency

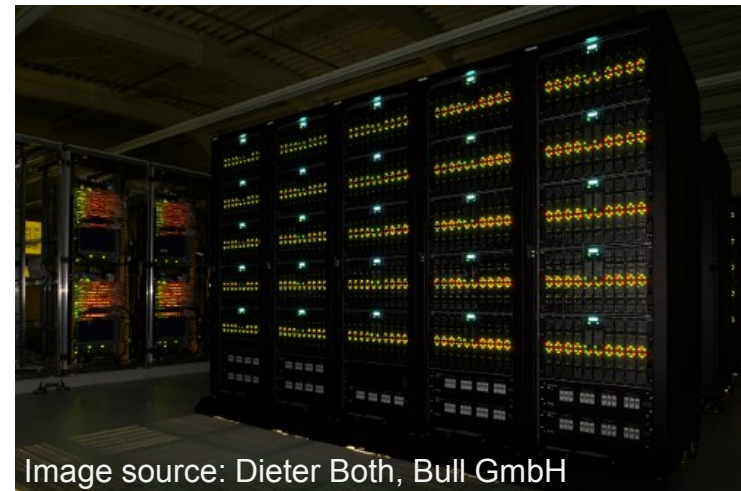


Image source: Dieter Both, Bull GmbH

■ Performance and Correctness Analysis of Parallel Programs *Leistungs- und Korrektheitsanalyse paralleler Programme*

→ BSIInf, MSInf, MSCES, MSSSiSc

→ 6 CP, 3+1 SWS (lecture & exercise)

→ Wednesdays 10.15 – 11.45h

→ Fridays 8:30 – 10.00h

→ English or German (depending on what students want)

→ Probably oral exam

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■ Prerequisites

→ Knowledge of serial programming and elementary programming techniques

→ Mastery of essential concepts of parallel processing, e.g.

Introduction to High-Performance Computing (Prof. Müller, SS 2015)