Performance Analysis

Benchmarks evaluate computer performance. They involve running specific sets of programs on two computers to compare execution times of the same workload

Amdhals Law demonstrates how potential performance improvements from a system enhancement are constrained by the frequency of the features used. It quantifies the limited impact of an improvement in overall system performance.

As hardware performance has historically improved, a challenge known as the Power Wall limits potential future gains. Power consumption in electronics is computed as: $Power = Capacitive\ load \times voltage^2 \times frequency$.

Attempts to reduce voltage have become infeasible as further reductions face physical and technical limitations. Instead, managing heat and enhancing cooling systems are costly, making it impractical for widespred consumer-level implementation.

Multiprocessors integrate multiple cores on a chip, where the chip is the physical unit and cores are the individual processing units inside. This setup enables simultaneous execution of tasks for better performance. To take advantage of this, programmers must use explicit parallel programming, which involves breaking tasks into smaller concurrent sub-tasks. This is difficult due to challenges like task division, dependencies and maintaining consistency accross threads.

Load balancing is crucial for multi processor environments as it ensures all processors are utilized to their full capacity. Effective load balancing distributes workloads evenly accross multiple cores, preventing scenarios where some cores are idle and others remain idle.