

# Measuring computer performance

- Program execution time (system performance)
- CPU time(CPU performance):
  - User CPU time
  - System CPU time

CPU time = Instruction count  $\times$  CPI  $\times$  Clock cycle time

CPI = average number of clock cycles per instruction  
(depends on the program)

CPU time = CPU clock cycles  $\times$  Clock cycle time

# Evaluating computer systems

## Relative performance

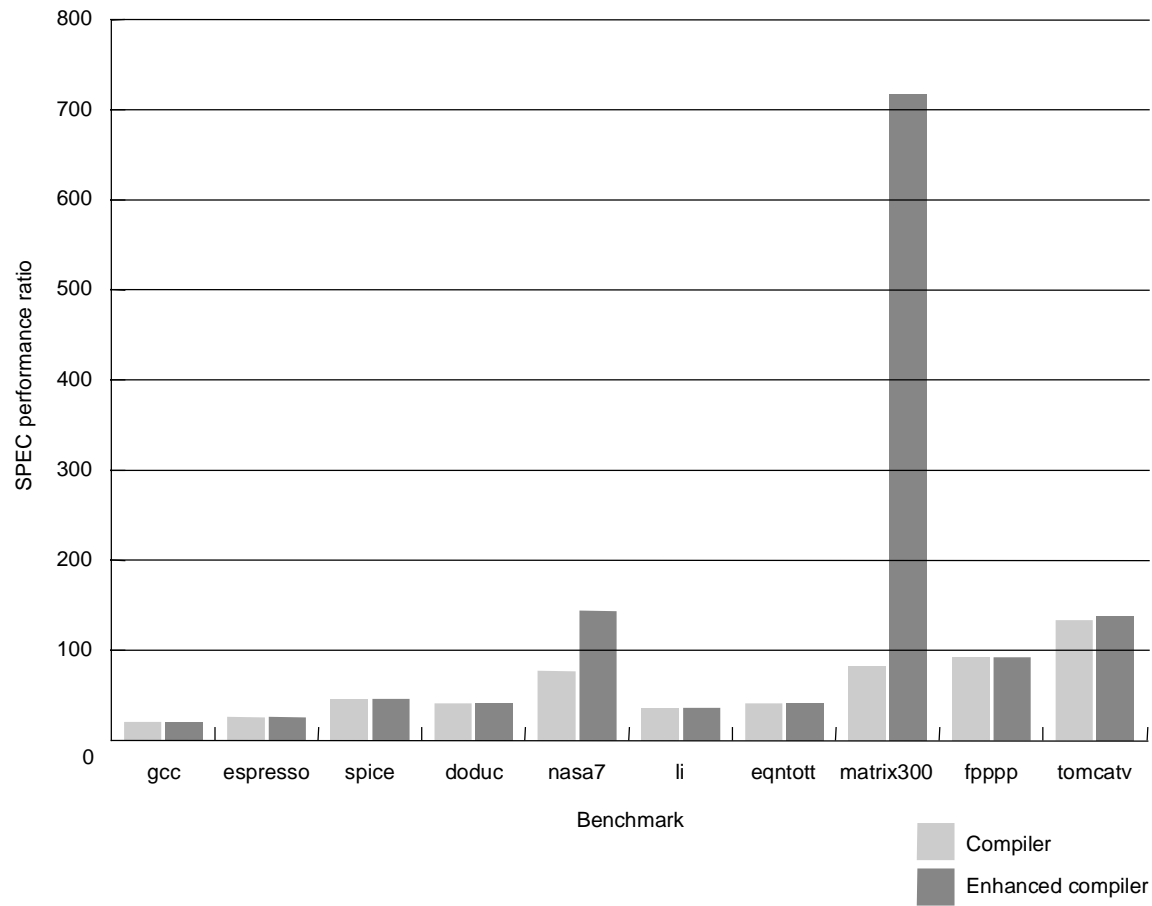
- Different computers running a single program
- Different programs running on a single computer

## Workload

- $P_1, P_2, \dots, P_n$
- $W_1, W_2, \dots, W_n$
- Performance =  $(1/n) * (T_1 * W_1 + T_2 * W_2 + \dots + T_n * W_n)$

Benchmarks: SPEC performance ratio (related to SPARCstation 10)

# Benchmarks



SPEC performance ratio for IBM Powerstation 550 using two different compilers

# Categories of parallelism

- Single instruction stream, single data stream (SISD)
- Single instruction stream, multiple data streams (SIMD)
- Multiple instruction streams, single data stream (MISD)
- Multiple instruction streams, multiple data streams (MIMD)