Computer Architecture

Performance Evaluation Methods

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Lecture Outline

- Performance Matrics
- Benchmarks

Computer Architecture

- computer architecture is **a set of rules and methods that describe the functionality, organization, and implementation of computer systems.**
- The architecture of a system refers to its structure in terms of separately specified components of that system and their interrelationships.

Typical Performance Metrics

- Response Time
- Throughput
- CPU Time
- Wall Clock Time
- Speedup

Typical Performance Metrics

When Can we say that one computer/ architecture/ design is better than other?

- For PC/Laptop: Execution time of a program
- For Servers: Transactions/unit time called Throughput

Typical Performance Metrics

When can we say X is n times faster than Y ?

- Execution time$_Y$ / Execution time$_X$ =n
- Throughput $_x$/ Throughput $_y$ =n

Benchmarks

Standard Programs used for comparing two machines/architecture

Benchmarks

- Toy programs (e.g. sorting, matrix multiply)
- Synthetic benchmarks (e.g. Dhrystone)
- Benchmark suites (e.g. SPEC06, SPLASH)

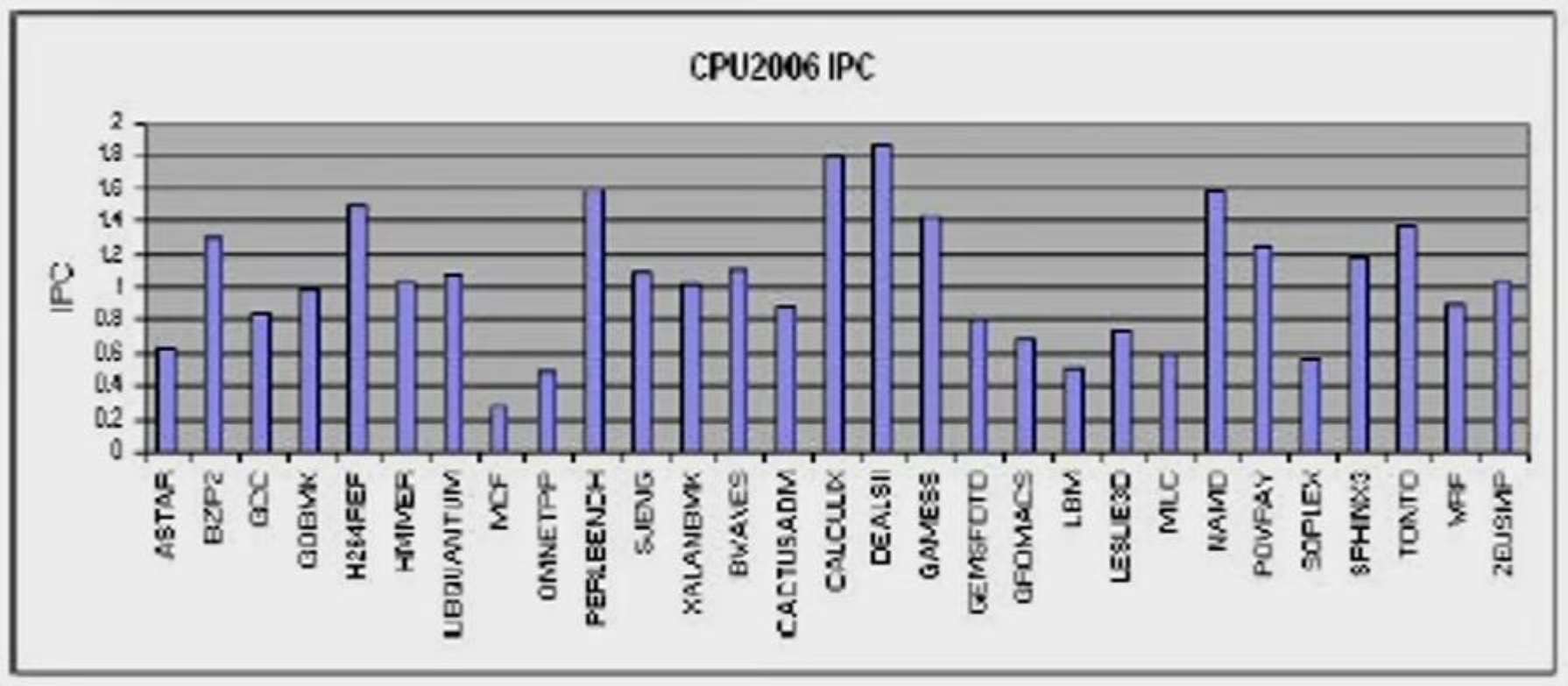
Benchmarks Suite

SPEC CPU2006 Programs

	Benchmark	Language	Descriptions
CINT2006 (Integer) 12 programs	400.perlbench	C	PERL Programming Language
	401.bzip2	C	Compression
	403.gcc	C	C Compiler
	429.mcf	C	Combinatorial Optimization
	445.gobmk	C	Artificial Intelligence: go
	456.hmmer	C	Search Gene Sequence
	458.sjeng	C	Artificial Intelligence: chess
	462.libquantum	C	Physics: Quantum Computing
	464.h264ref	C	Video Compression
	471.omnetpp	C++	Discrete Event Simulation
	473.astar	C++	Path-finding Algorithms
	483.Xalancbmk	C++	XML Processing
CFP2006 (Floating Point) 17 programs	410.bwaves	Fortran	Fluid Dynamics
	416.gamess	Fortran	Quantum Chemistry
	433.milc	C	Physics: Quantum Chromodynamics
	434.zeusmp	Fortran	Physics/CFD
	435.gromacs	C/Fortran	Biochemistry/Molecular Dynamics
	436.cactusADM	C/Fortran	Physics/General Relativity
	437.leslie3d	Fortran	Fluid Dynamics
	444.namd	C++	Biology/Molecular Dynamics
	447.dealII	C++	Finite Element Analysis
	450.soplex	C++	Linear Programming, Optimization
	453.povray	C++	Image Ray-tracing
	454.calculix	C/Fortran	Structural Mechanics
	459.GemsFDTD	Fortran	Computational Electromagnetics
	465.tonto	Fortran	Quantum Chemistry
	470.lbm	C	Fluid Dynamics
	481.wrf	C/Fortran	Weather Prediction
	482.sphinx3	C	Speech recognition

Source: http://www.spec.org/cpu2006/

Benchmarks based Evaluation



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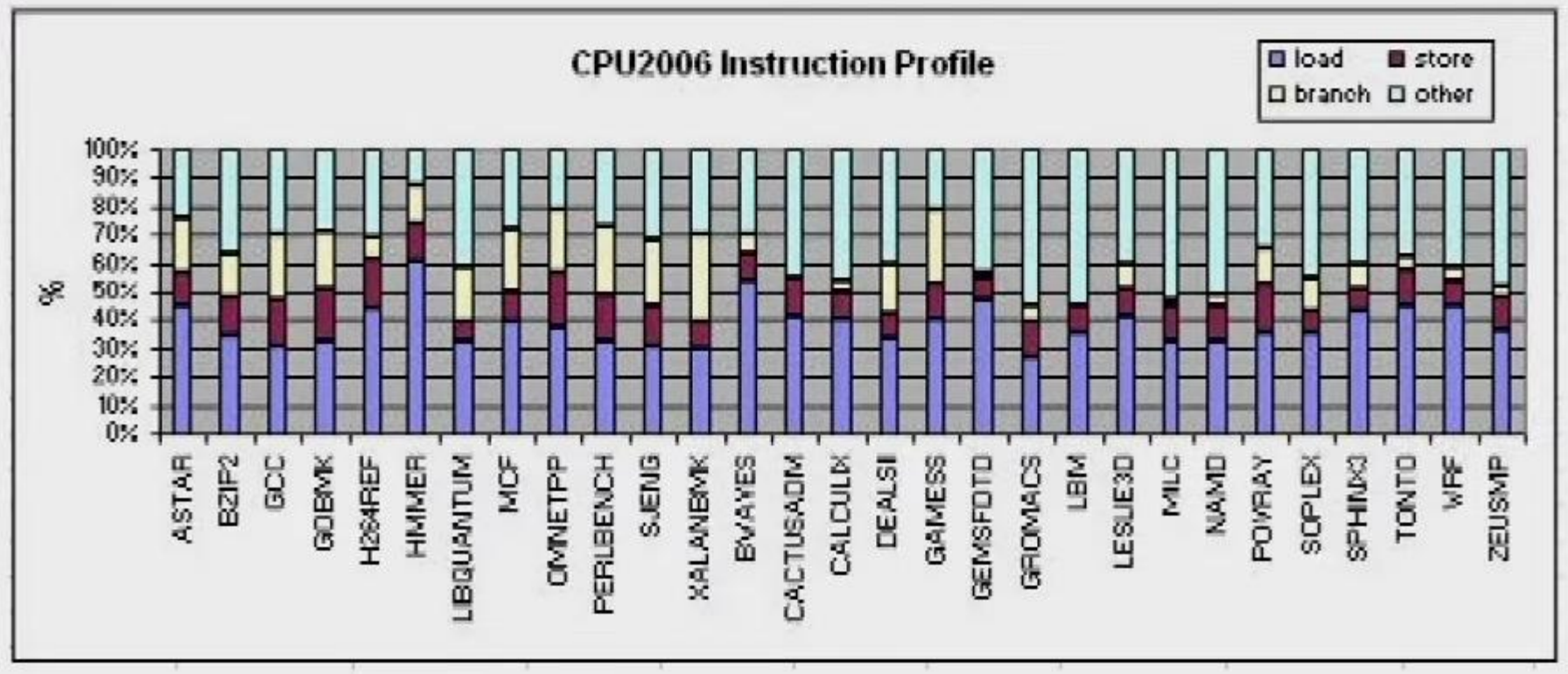

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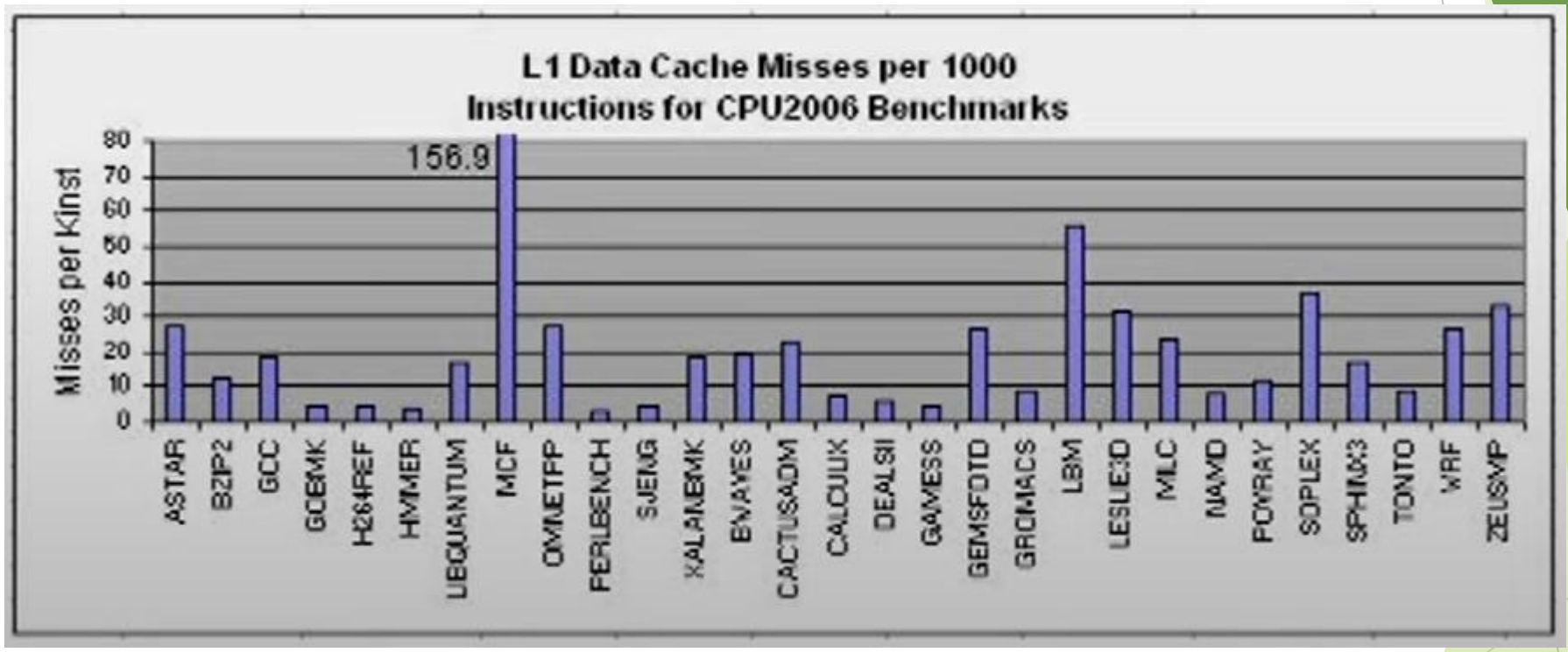

Benchmarks based Evaluation