AKADEMIA GÓRNICZO-HUTNICZA
IM. STANISŁAWA STASZICA W KRAKOWIE

Procesory i Architektura Systemów Komputerowych

Wstęp

IET
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Literatura

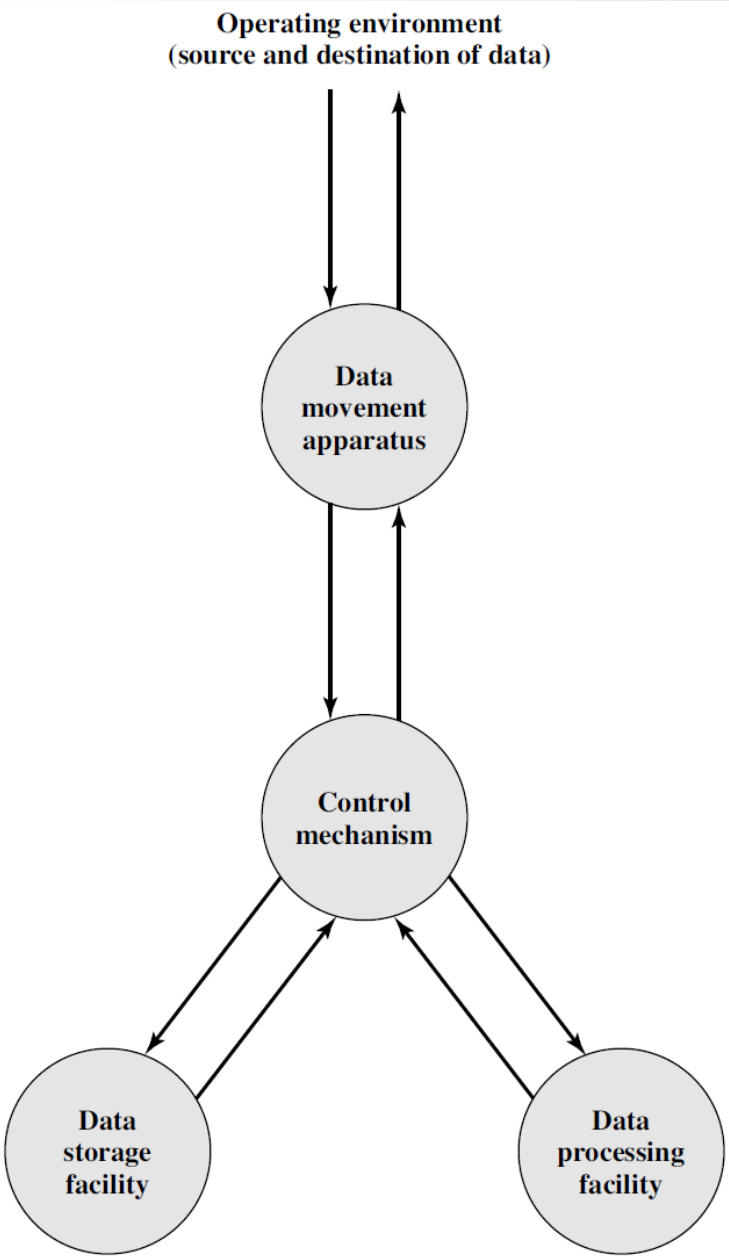
1. **Wiliam Stallings: Computer organization and architecture. Designing for performance.**
2. **David A. Patterson, John L. Hennessy: Computer Organization and Design. The hardware/software interface.**
3. **Jean-Loup Baer: Microprocessor Architecture. From simple pipelines to chip multiprocessors.**

- **Computer architecture** refers to those attributes of a system visible to a programmer or, put another way, those attributes that have a direct impact on the logical execution of a program.
- **Computer organization** refers to the operational units and their interconnections that realize the architectural specifications.

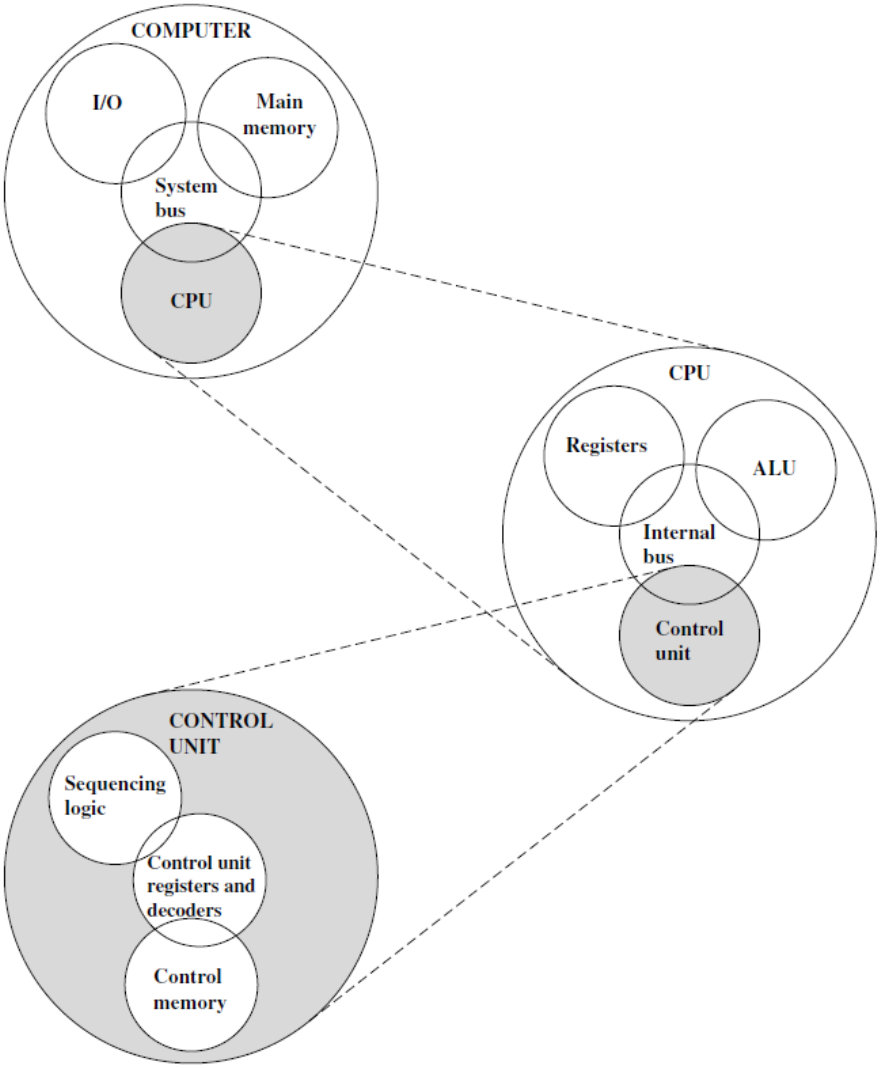
Examples of architectural attributes include the instruction set, the number of bits used to represent various data types (e.g., numbers, characters), I/O mechanisms, and techniques for addressing memory. Organizational attributes include those hardware details transparent to the programmer, such as control signals; interfaces between the computer and peripherals; and the memory technology used.

- **Structure:** The way in which the components are interrelated
- **Function:** The operation of each individual component as part of the structure

A Functional View of the Computer



The Computer:Top-Level Structure



Four main structural components

- **Central processing unit (CPU):** Controls the operation of the computer and performs its data processing functions; often simply referred to as **processor**.

- **Main memory:** Stores data.

- **I/O:** Moves data between the computer and its external environment.

- **System interconnection:** Some mechanism that provides for communication among CPU, main memory, and I/O. A common example of system interconnection is by means of a system bus, consisting of a number of conducting wires to which all the other components attach.

CPU major structural components

- **Control unit:** Controls the operation of the CPU and hence the computer

- **Arithmetic and logic unit (ALU):** Performs the computer's data processing functions

- **Registers:** Provides storage internal to the CPU

- **CPU interconnection:** Some mechanism that provides for communication among the control unit,ALU, and registers

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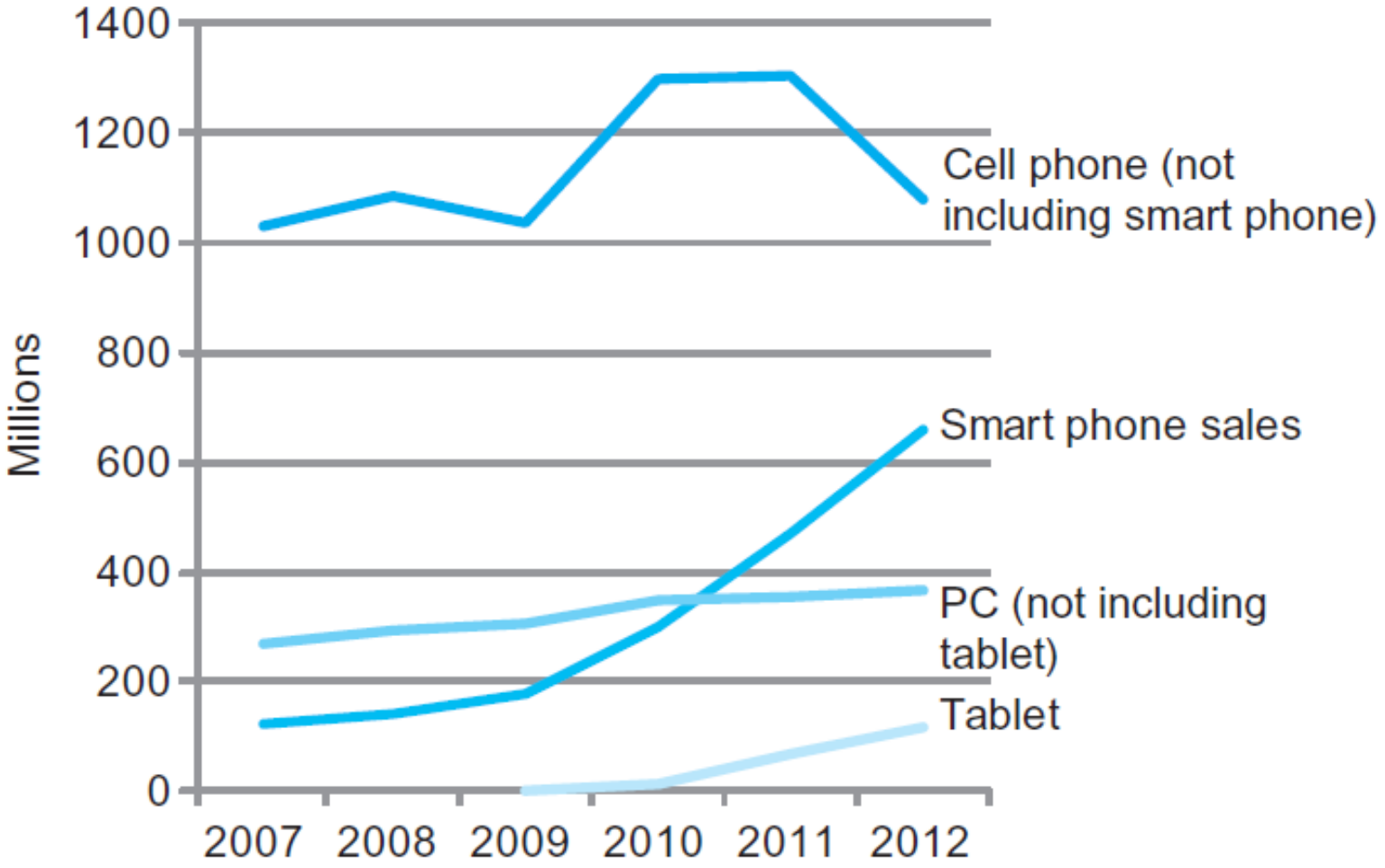
Dwójkowe i dziesiętne jednostki miary (np. pojemności pamięci)

Decimal term	Abbreviation	Value	Binary term	Abbreviation	Value	% Larger
kilobyte	KB	10^3	kibibyte	KiB	2^{10}	2%
megabyte	MB	10^6	mebibyte	MiB	2^{20}	5%
gigabyte	GB	10^9	gibibyte	GiB	2^{30}	7%
terabyte	TB	10^{12}	tebibyte	TiB	2^{40}	10%
petabyte	PB	10^{15}	pebibyte	PiB	2^{50}	13%
exabyte	EB	10^{18}	exbibyte	EiB	2^{60}	15%
zettabyte	ZB	10^{21}	zebibyte	ZiB	2^{70}	18%
yottabyte	YB	10^{24}	yobibyte	YiB	2^{80}	21%

The number manufactured per year of tablets and smart phones, which reflect the PostPC era, versus personal computers and traditional cell phones.



Personal computers (PCs) - A computer designed for use by an individual, usually incorporating a graphics display, a keyboard, and a mouse.

Servers – A computer used for running larger programs for multiple users, often simultaneously, and typically accessed only via a network.

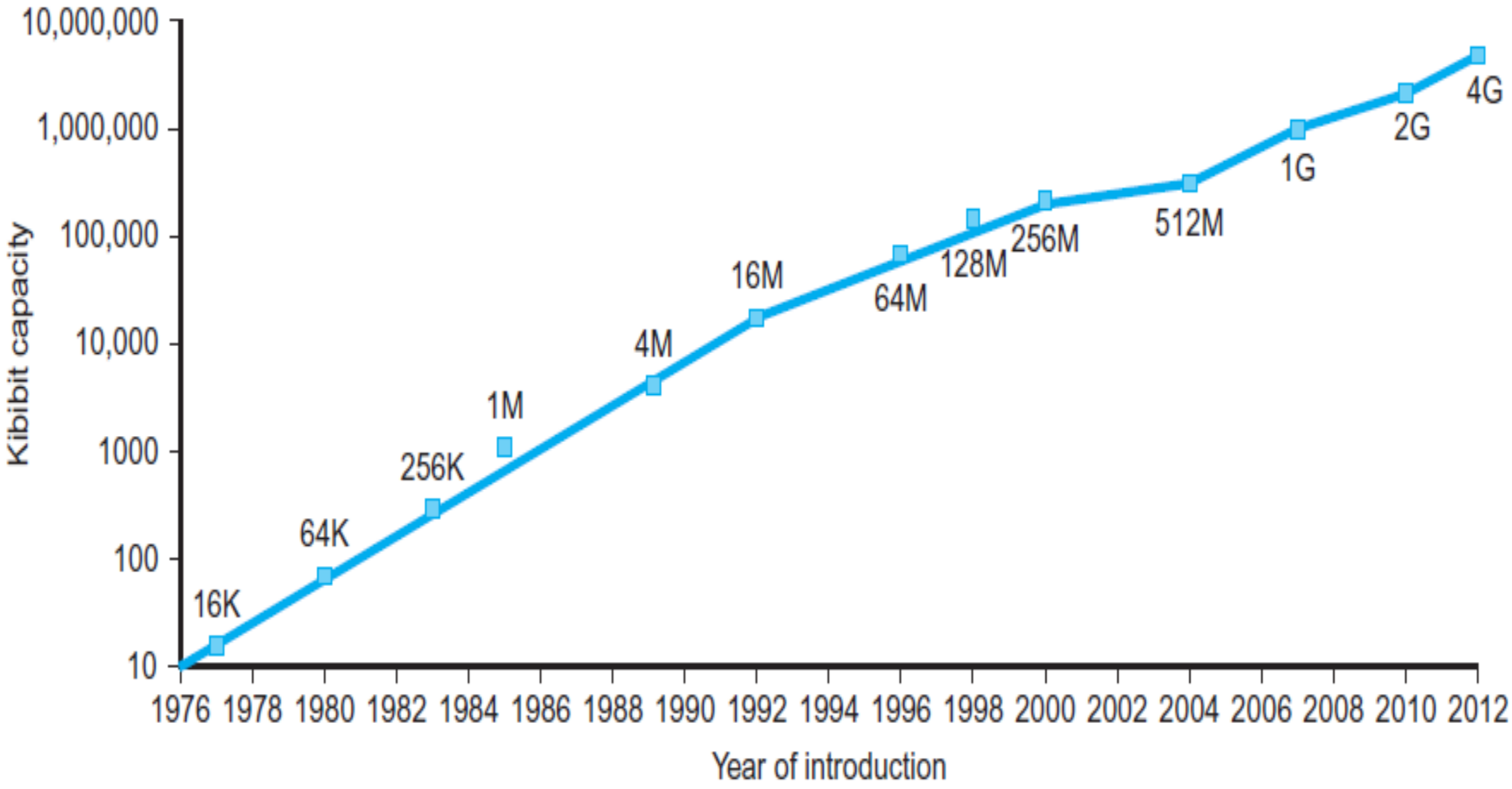
Supercomputers - A class of computers with the highest performance and cost; they are confi gured as servers and typically cost tens to hundreds of millions of dollars.

Embedded computer - A computer inside another device used for running one predetermined application or ollection of software.

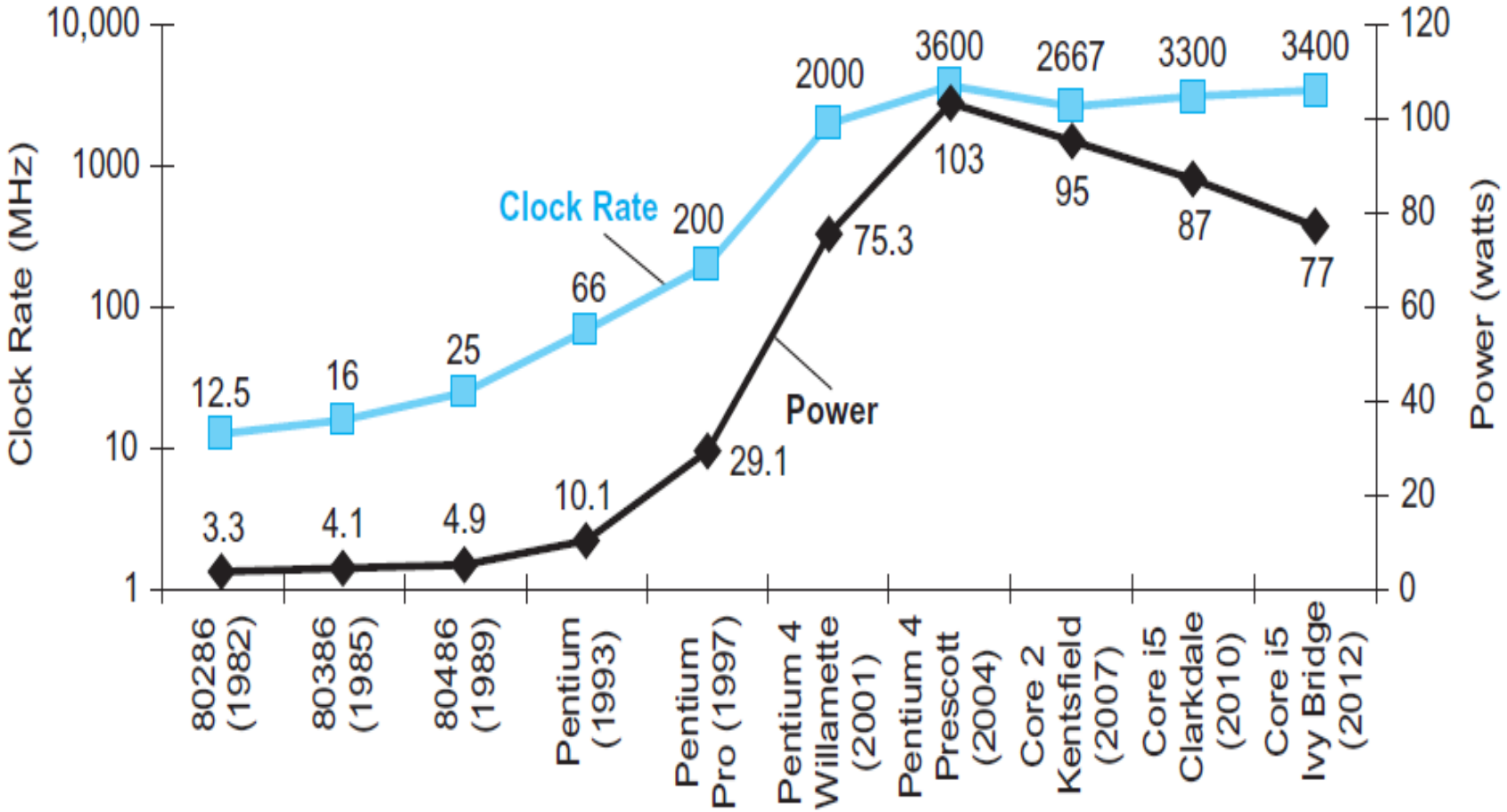
Year	Technology used in computers	Relative performance/unit cost
1951	Vacuum tube	1
1965	Transistor	35
1975	Integrated circuit	900
1995	Very large-scale integrated circuit	2,400,000
2013	Ultra large-scale integrated circuit	250,000,000,000

Relative performance per unit cost of technologies used in computers over time.

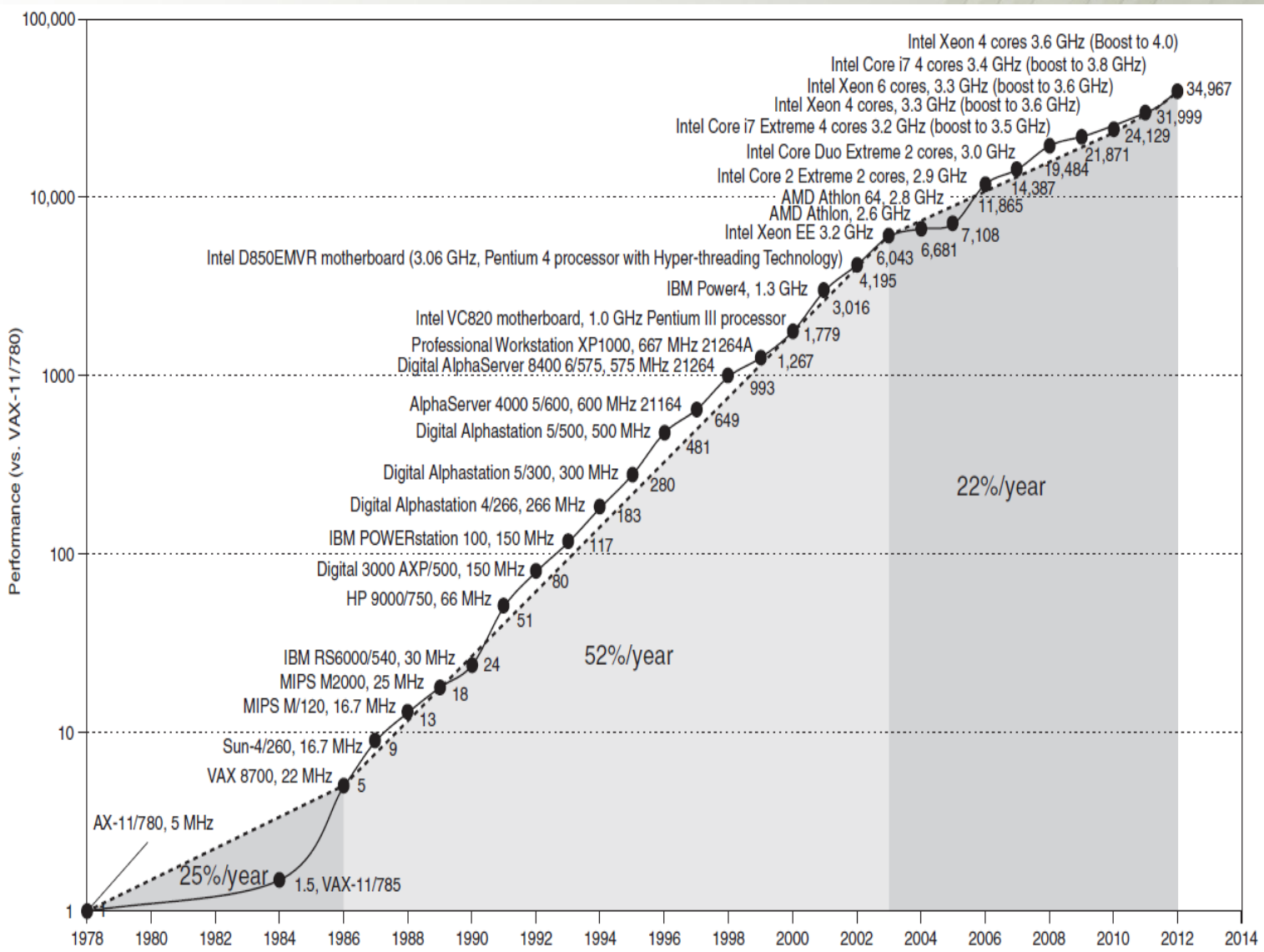
Growth of capacity per DRAM chip over time.



Clock rate and Power for Intel x86 microprocessors over eight generations and 25 years.



Growth in processor performance since the mid-1980s.



SPECINTC2006 benchmarks running on a 2.66 GHz Intel Core i7 920.

Description	Name	Instruction Count x 10^9	CPI	Clock cycle time (seconds x 10^{-9})	Execution Time (seconds)	Reference Time (seconds)	SPECratio
Interpreted string processing	perl	2252	0.60	0.376	508	9770	19.2
Block-sorting compression	bzip2	2390	0.70	0.376	629	9650	15.4
GNU C compiler	gcc	794	1.20	0.376	358	8050	22.5
Combinatorial optimization	mcf	221	2.66	0.376	221	9120	41.2
Go game (AI)	go	1274	1.10	0.376	527	10490	19.9
Search gene sequence	hmmer	2616	0.60	0.376	590	9330	15.8
Chess game (AI)	sjeng	1948	0.80	0.376	586	12100	20.7
Quantum computer simulation	libquantum	659	0.44	0.376	109	20720	190.0
Video compression	h264avc	3793	0.50	0.376	713	22130	31.0
Discrete event simulation library	omnetpp	367	2.10	0.376	290	6250	21.5
Games/path finding	astar	1250	1.00	0.376	470	7020	14.9
XML parsing	xalancbmk	1045	0.70	0.376	275	6900	25.1
Geometric mean	–	–	–	–	–	–	25.7