Find and summarize the current generation processors from each of the following manufacturers Intel, AMD, IBM with respect to manufacturing technology, clock speeds, core count, cache sizes.

Parameter	Intel Core i7-8700K	Intel Core i7-8700	Ryzen 7 1700X	Ryzen 7 1700	IBM Power8
Cores/Threads	6 / 12	6 / 12	8 / 16	8 / 16	6 / 12
Base Frequency	3.7 GHz	3.2 GHz	3.4 GHz	3.0 GHz	2.75 Ghz
Boost Frequency	4.7 GHz	4.6 GHz	3.8 GHz	3.7 GHz	4.2 Ghz
Memory Speed	DDR4-2666	DDR4-2666	DDR4-1866 to DDR4-2667	DDR4-1866 to DDR4-2667	DDR3-1600
PCI Express (Gen3)	x16 Gen3, 16 lanes	x16 Gen3, 16 lanes	x16 Gen3, 16 lanes	x16 Gen3, 16 lanes	3 PCIe controllers, 32 lanes
Cache (L2+L3)	13.5MB	13.5MB	20MB	20MB	8.5MB
Architecture	Coffee Lake	Coffee Lake	Zen	Zen	Power ISA 2.07
Process	14nm++	14nm++	14nm GloFo	14nm GloFo	22nm

What can you find out about the Chinese Sunway processor?

Sunway, or ShenWei, is a series of computer microprocessors, developed by Jiāngnán Computing Lab in Wuxi, China. It uses a reduced instruction set computing (RISC) architecture. The four generations of processors are as:

- First Gen: “Sunway SW-1” released in 2006; Single-core; 900 MHz
- Second gen: “Sunway SW-2” released in 2008; Dual-core; 1400 MHz
- Third gen: “Sunway SW-3, SW1600” released in 2010; 16-core, 64-bit RISC; 975–1200 MHz
- Fourth Gen: “Sunway SW26010” released in 2016; 64-bit RISC processor; Manycore architecture, with 4 CPU clusters on a chip, each comprising 64 lightweight compute CPUs with an additional management CPU, linked by a network-on-a-chip, instead of having a traditional cache hierarchy. The same is being used in TaihuLight(fastest supercomputer as of Nov 2016 list of Top500) which uses a total of 40,960 SW26010 processors. Each processor chip contains 256 processing cores, and an additional four auxiliary cores for system management for a total of 10,649,600 CPU cores across the entire system.

Explain what is meant by an accelerator and provide examples of some current accelerators available.

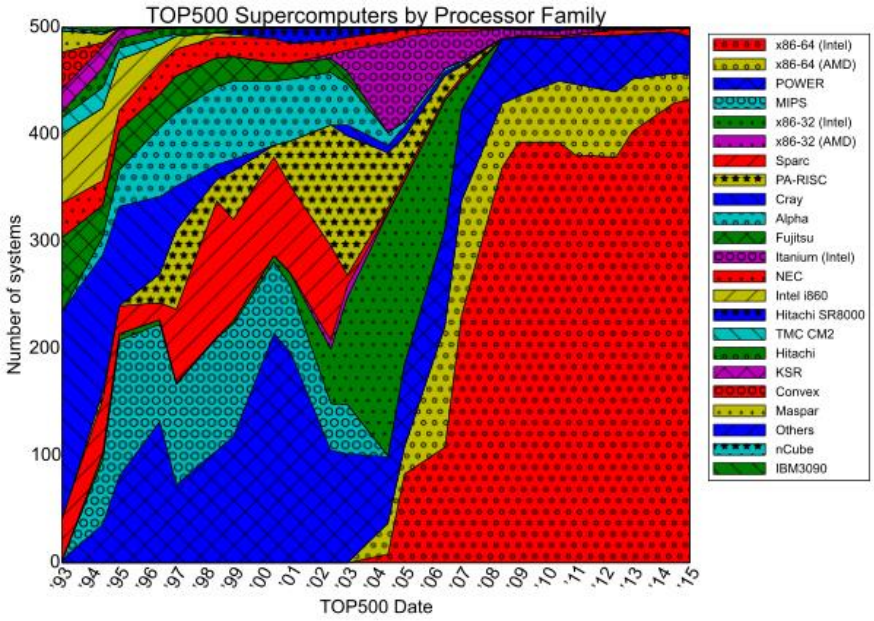
The hardware that performs the acceleration, when in a separate unit from the CPU, is referred to as a hardware accelerator. Hardware accelerators improve the execution of a specific algorithm by allowing greater concurrency, having specific data-paths for its temporaries, and possibly reducing the overhead of instruction control. Examples of accelerators: GPU aka Graphics processing Unit (to accelerate creation of images in a frame buffer intended for output to a display device), Cryptographic accelerator(accelerates cryptographic operations), AI accelerator (to accelerate artificial neural networks, machine vision and other machine learning algorithms for robotics, internet of things and

other data-intensive or sensor-driven tasks), application-specific integrated circuit aka ASIC (is an integrated circuit, usage is customizable depending on the intended purpose), Field Programmable gate array (is also an integrated circuit, which is programmed by the designer, based on requirements) etc.

Describe the top500 list of supercomputers.

Top500 list of supercomputers details the 500 most powerful non-distributed computer systems in the world. The list is updated twice a year. The TOP500 list is compiled by Jack Dongarra et al. Currently, the Chinese Sunway TaihuLight is the world's most powerful supercomputer, reaching 93.015 petaFLOPS on the LINPACK benchmark (June 2016 – present).

Share of processor architecture families in TOP500 supercomputers by time trend is shown as below:



Top five processor generations:
Intel Xeon E5 (Haswell) – 221
Intel Xeon E5 (Ivy Bridge) – 118
Intel Xeon E5 (Sandy Bridge) – 66
Intel Xeon E5 (Broadwell) – 21
Power BQC – 19

Top five vendors: Sugon is the top vendor by performance share in November). By vendor share (ranking is same in November as for) June:
Hewlett-Packard – 127
Lenovo – 84
Cray Inc. – 60
Sugon[18] – 51
IBM – 38

Top five operating systems
Linux – 334
CentOS – 61
Cray Linux Environment – 42
SUSE Linux Enterprise Server 11 – 24
bullx SCS – 9

Operating system family
Linux – 498
Unix – 2 (ranked 493rd and 494th)

What sorts of programmes run on a selection of the machines in the top 10?

Heterogeneous computing, mostly using Nvidia's graphics processing units (GPU) as coprocessors, is being used to reach a better performance per watt ratio and higher absolute performance. The same is required to make top 10 list with some exceptions like SPARC computer without any coprocessors. An x86-based coprocessor, Xeon Phi, has also been used.

Describe the Linpack benchmark and explain how it works.

The performance measured by the LINPACK benchmark consists of the number of 64-bit floating-point operations, generally additions and multiplications, a computer can perform per second, also known as FLOPS. They measure how fast a computer solves a dense n by n system of linear equations Ax = b. However, a computer's performance when running actual applications is likely to be far behind the maximal performance it achieves running the appropriate LINPACK benchmark. For each computer system, the following quantities are reported:

- Rmax: the performance in GFLOPS for the largest problem run on a machine.
- Nmax: the size of the largest problem run on a machine.
- N1/2: the size where half the Rmax execution rate is achieved.
- Rpeak: the theoretical peak performance GFLOPS for the machine.

These results are used to compile the TOP500 list.

Find some other benchmarks that are sometimes used to rank computer systems.

Other benchmarks are:

- Standard Performance Evaluation Corporation (SPEC) benchmarks for computers. SPECfp is a computer benchmark managed by SPEC.
- HPC Challenge Benchmark combines several benchmarks to test attributes of the performance of HPC systems.
- NAS Parallel Benchmarks (NPB) are a set of benchmarks targeting performance evaluation of highly parallel supercomputers.

- Deisa benchmark suite: DEISA produced a benchmark suite to help computer scientists assess the performance of parallel supercomputer systems.
- BAPCo, Business Applications Performance Corporation (benchmarks for personal computers based on popular software applications and operating systems).
- The AIM Multiuser Benchmark, also called the AIM Benchmark Suite VII or AIM7 (benchmark used by UNIX computer system vendors).
- Livermore loops (also known as the Livermore Fortran kernels or LFK) is a benchmark for parallel computers
- Princeton Application Repository for Shared-Memory Computers (PARSEC) is a benchmark suite composed of multithreaded emerging workloads that is used to evaluate and develop next-generation chip-multiprocessors.
- Hierarchical INTegration, or HINT for short, is a computer benchmark that ranks a computer system as a whole
- The Whetstone benchmark is a synthetic benchmark for evaluating the performance of computers.
- SuperPrime is a computer program used for calculating the primality of a large set of positive natural numbers, which is used as a benchmark to test the speed and stability of a system.
- IBM iSeries benchmarks, one of which is Computational Intensive Workload (CIW) that measures performance in a situation where there is a high ratio of computation to Input/Output communication.