Safety of information systems

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Hardware means - UPS, RAID...

### RAID - Redundant Array of Inexpensive/Independent Disks

is a data storage virtualization technology that combines multiple physical disk drive components into a single logical unit for the purposes of data redundancy, performance improvement, or both.

Data is distributed across the drives in one of several ways, referred to as RAID levels, depending on the required level of redundancy and performance. The different schemas, or data distribution layouts, are named by the word RAID followed by a number, for example RAID 0 or RAID 1. Each schema, or RAID level, provides a different balance among the key goals: reliability, availability, performance, and capacity.

Raid-0 (Stripping) - The capacity of a RAID 0 volume is the sum of the capacities of the disks in the set.
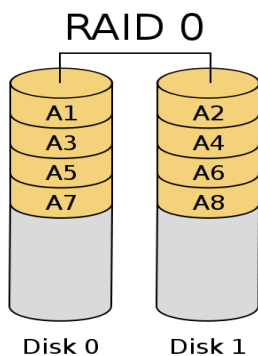
Raid-1 (Mirroring)
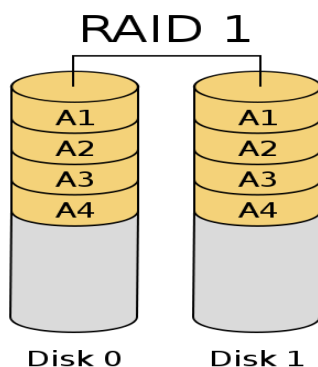
Raid 2 - Four disks - data storage, three disks - error correction information. The discs are synchronized, so on all disks the heads are in the same position - from the viewpoint of the rotation and exposure disc.

Raid 3,4 – like Raid 2 with one redundancy disc. Data on disks that have a malfunction can be reconstructed from existing data and parity regardless of how large the disk array is. If the disk has a failure, the parity bit is read and the data is reconstructed from the remaining bits, including the bit parity.

Disadvantage of Raid 3 - difficult deployment on systems with a transaction priority.
Raid 4 - Suitable for applications with high volume I / O requirements; each disc is independent.

Raid 5 - Block-level distributed parity, RAID-5 - fault-tolerant: implement "rotation parity" for increased drive reliability and reduced "single point of failure". Parity is stored on all disks. Cannot solve the condition when the disorder has multiple disks

Raid-6 - consists of block-level striping with double distributed parity. Two parities are counted. The parity is stored in separate blocks on different disks. Two additional discs are needed. Two-disc failure – restore of data is still possible.
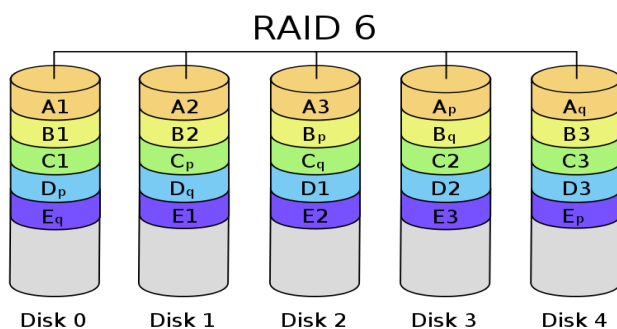
RAID:

- Hybrid RAID
  - RAID 0+1: creates two stripes and mirrors them
  - RAID 1+0: creates a striped set from a series of mirrored drives
- Software-based RAID implementation
- Non-standard:
  - Linux MD RAID 10
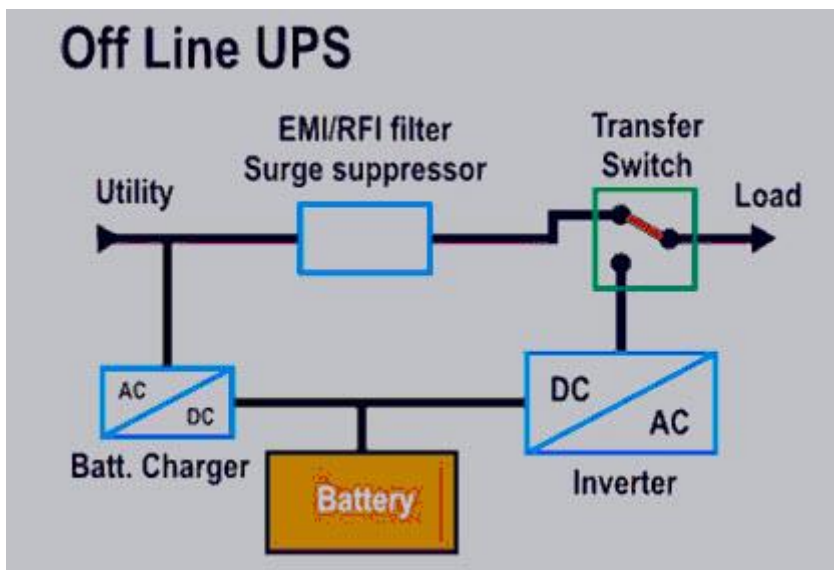 - Hadoop – HDFS file system
  - BeeGFS (parallel file system)

RAID Rebuild - Reset parity protection on the disk array after a disk failure.

S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology; often written as SMART) is a monitoring system included in computer hard disk drives (HDDs) and solid-state drives (SSDs).
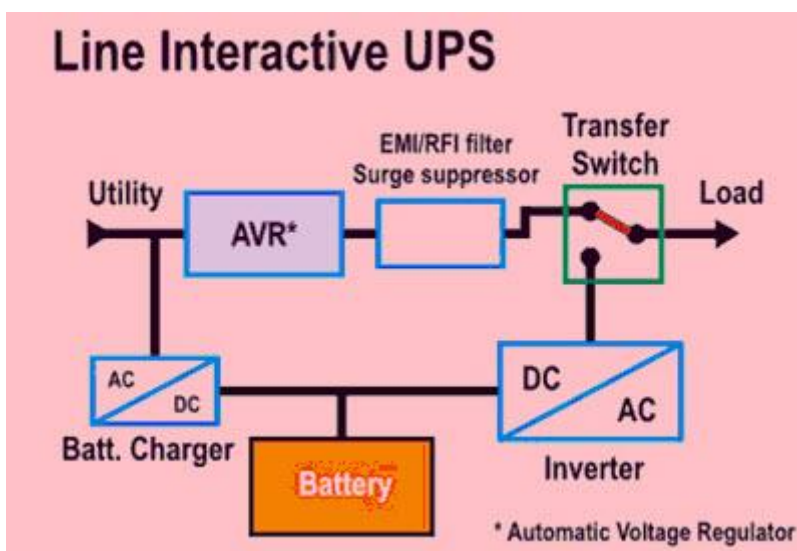
UPS - Uninterruptible Power Supply

UPS is an electrical device that provides emergency power to a load when the input power source or mains power fails, by supplying energy stored in batteries.
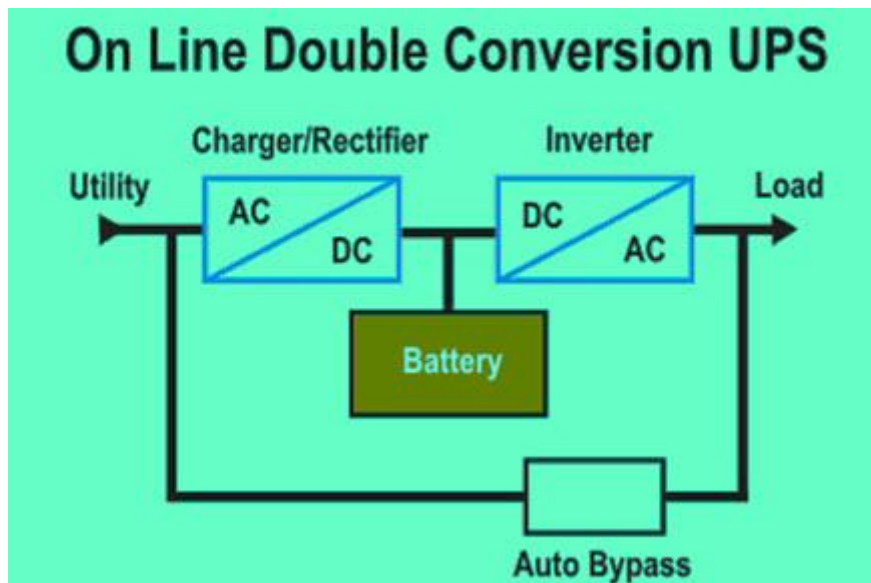
- **Off-line (Back)** - The supply voltage flows from the input directly to the output, when the power supply is interrupted, it switches to the voltage output from the inverter powered by the battery
- **Line-interactive (Smart)** - Jump stabilization of the output voltage (by switching the transformer branches) without using the battery energy
- **Online/double conversion**

Source: https://www.elprocus.com/types-of-uninterruptible-power-supply-devices/

Source: https://www.elprocus.com/types-of-uninterruptible-power-supply-devices/

On Line Double Conversion UPS

Source: https://www.elprocus.com/types-of-uninterruptible-power-supply-devices/

Parameters of UPS:

- Performance (Common computer - 500 - 1000 VA, servers from kVA)
- Dimension
- Weight
- Type
- Number of sockets (IEC320 - computers, SCHUKO)
- Cold start option (no connected voltage)
- Does the UPS provide adequate surge protection?
- Does it have a built-in anti-interference filter?
- Which states are optically signaled?
- Which states are alerted by an alert?
- Does UPS have additional data line protection (RJ11, RJ45)?

Power problems:

- Voltage spike or sustained overvoltage
- Momentary or sustained reduction in input voltage
- Noise, defined as a high frequency transient or oscillation, usually injected into the line by nearby equipment
- Instability of the mains frequency
- Harmonic distortion, defined as a departure from the ideal sinusoidal waveform expected on the line
- Frequency change - Deviation from standard frequency (50 Hz, eg changing engine speed, "falling" of the computer)
- Voltage shocks - Flashing peaks up to 20,000 volts, caused by spark arrester switching and electrostatic discharge. They can result in data errors or computer damage.

Undervoltage - a condition where the supply voltage is less than 15% of the nominal value.

Loss of battery capacity - about a year, up to 3 years.

What does UPS do not do?

- Laser printer - up to 1 kW at start up - UPS overload and shutdown
- Electric kettle, microwave, cooker

Impact of battery life:

- Location in colder place
- Cleaning away from dust
- Regular discharge cycles