UPS

A UPS (Uninterruptible power supply is a device designed to provide power to one or more devices when utility power is disrupted for some reason. It is also known as a Batter Backup System.

Definitions

Electricity comes in two common forms; Alternating Current (AC) and Direct Current (DC). I won't go into details here, but stuff you use at home is almost always Alternating Current supplied by your utility company. This is 124 Volt 60 Hz Sine Wave in the US.

Your car, Recreational Vehicle, cell phones and tablets all run off of DC provided by batteries built into them (Recreational Vehicles can be run from AC in many cases).

It is possible to convert AC to DC and DC to AC using special electric circuits. Each conversion costs you power (you put in more power than you get out). So, charging your cell phone (battery, DC) actually requires more power if you use the charger at home (AC) than if you use one in your car (also DC), since you must convert the AC to DC to do this (this statement is actually a lie since you are using different voltage, but I won't go into it)

UPS' generally have batteries (DC) inside them, are charged from utility power (AC) and output very clean utility power (AC).

Power Rating of UPS's is the maximum power they can run. So, a server which is rated at 1500 Watts should, in theory, have a 1500 watt UPS. However, many servers only run at a fraction of the power they are rated at. One of ours (HP Proliant DL-380 G7) is currently running less than 200 Watts. Add about 20% for power up surges, so this one would need a UPS rated at 240 Watts. I, personally, would double it to 500 Watts.

Runtime is how long a UPS will keep its equipment up at **full power**. So, a 1000 Watt UPS rated at 3 minutes would keep a 1000 watt unit up for 3 minutes. In the case of our HP server running at 200 watts, we are only using 1/5 the power, so actual runtime would be 3 x 5, or 15 minutes.

UPS Types

There are three basic types of UPS'

1. Standby or Offline:
    1. These run utility power to the system and only go to battery when power is lost.
    2. Transfer time is generally slower than the others
    3. Cost is cheapest
    4. The power “costs” are cheapest since only minimal additional power to occasionally charge the batteries is used.
2. Line Interactive
    1. These run off of battery and utility power at the same time
    2. Transfer time, cost and power cost are between Offline and Online.

3. Online
    1. These run off the battery all the time, with utility power only being used to charge the battery.
    2. Transfer time is 0, since the battery is always powering the systems
    3. These are the most expensive UPS'
    4. The power used is highest (close to 90% more power)

Transfer Time is the time it takes to change from utility power (line power) to battery power. This is measures in milliseconds (ms), and should be below 8ms for most applications.

Power Usage is the additional power needed to provide power to the connected devices. In order to charge the batteries, the incoming utility power (which is AC, or Alternating Current) must be converted to DC (Direct Current). The batteries must then convert their electricity from DC back to AC. Each of these conversions use extra power, as does the actual act of charging and discharging the batteries.

Power Output

UPS's have their emergency power stored in a battery (DC). To be used by most devices, this must be converted to AC since that is what they were designed to run on.

Three basic types of output are available.

- square wave
    - Cheapest due to it's inexpensive circuitry.
    - Lower power loss
    - Works on equipment which simply converts the electricity back to some form of DC, or can blindly accept any kind of “dirty power”.
- stepped square wave
    - Middle of the road cost and power loss
- true sine wave
    - Most expensive
    - Greatest power loss in conversion
    - Works on all equipment, even high end equipment which is very sensitive to the type of electricity it is getting

Summary

Most workstation computers and older servers work just fine with low transfer time and square wave (or stepped square wave).

Newer servers perform Power Factor Adjustments, which requires true sine wave to work. See https://serverfault.com/questions/199861/ups-with-a-hp-proliant-server for more information.

From:
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Last update: **2017/06/15 00:30**