

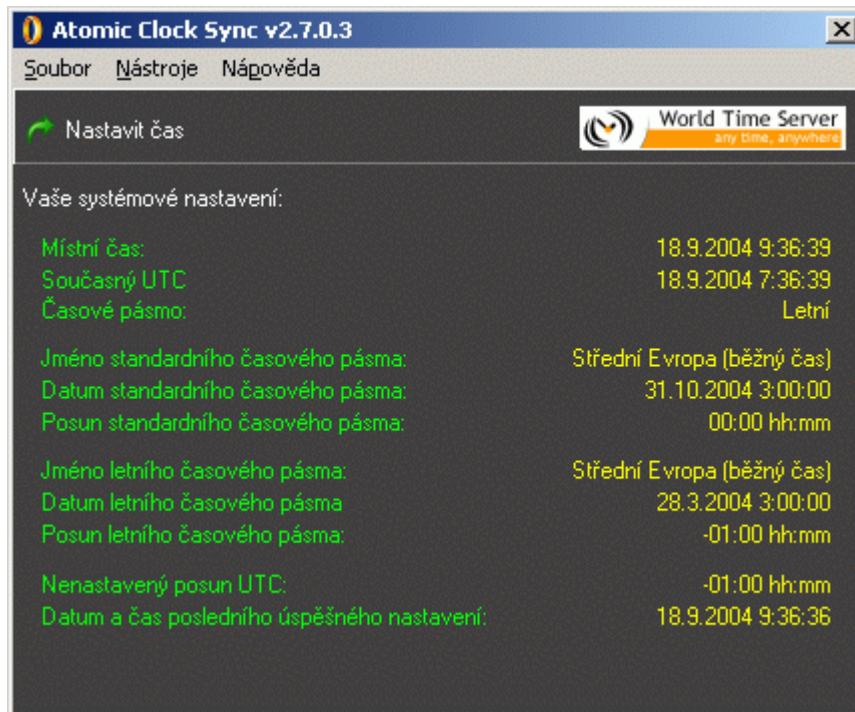
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Basic Principle of Atomic Clock

Have you wondered when there is no electrical power how is time regulated? Even when power comes back later, how do you know when to set your time to? The existence of atomic clock solves both problems. An atomic clock is a precision clock that depends for its operation on an electrical oscillator regulated by the natural vibration frequencies of an atomic system



Atomic clocks keep time better than any other clock. They even keep time better than the rotation of the Earth and the movement of the stars. Without atomic clocks, GPS navigation would be impossible, the Internet would not synchronize, and the position of the planets would not be known with enough accuracy for space probes and landers to be launched and monitored. Atomic clocks are not radioactive because they do not rely on atomic decay. Simply, they have an oscillating mass and spring like an ordinary clock.



So what is the difference between an ordinary clock and atomic clock? The big difference is that the oscillation in an atomic clock is between the nucleus of an atom and the surrounding electrons. This oscillation is not exactly a parallel to the balance wheel and hairspring of a clockwork watch, but the fact is that both use oscillations to keep track of passing time. The oscillation frequencies within the atom are determined by the mass of the nucleus and the gravity and electrostatic "spring" between the positive charge on the nucleus and the electron cloud surrounding it.

The invention of atomic clock started in 1945 when Columbia University physics professor Isidor Rabi suggested that a clock could be made from a technique he developed in the 1930s called atomic beam magnetic resonance. By 1949, the National Bureau of Standards (NBS, now the National Institute of Standards and Technology, NIST) announced the world's first atomic clock using the ammonia molecule as the source of vibrations. By 1952, the institute announced the creation of the first atomic clock using cesium atoms as the vibration source, NBS-1.

There are different types of atomic clocks, but all of them follow the basic principle. The major difference is associated with the element used and the means of detecting when the energy level changes. The first type of atomic clock is the cesium atomic clock. For this type of atomic clock, it employs a beam of cesium atoms. The clock separates cesium atoms of different energy levels by magnetic field. The second type of atomic clock is the hydrogen atomic clock. This atomic clock maintains hydrogen atoms at the required energy level in a container with walls of a special material so that the atoms don't lose their higher energy state too quickly. The last type of atomic clock is the rubidium atomic clock. It is the simplest and most compact of all the atomic clocks. Specifically, it uses a glass cell of rubidium gas that changes its absorption of light at the optical rubidium frequency when the surrounding microwave frequency is just right. The most accurate atomic clocks available today use the cesium atom and the normal magnetic fields and detectors.