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Computers of Generation Omega

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Abstract: No matter how fast modern computers are, there are still problems that take too much computational time and, thus, cannot yet be handled by modern computers. To solve these problems, we must design faster and faster computers. So far, the speed of the computers has been doubling every 18 months; this is known as Moore's law. Can we keep up with this increase?

According to modern physics, all velocities are bounded by the speed of light; thus, to make computer elements faster, designers try to decrease the size of these elements. Every hardware technology eventually reaches its limit, i.e., the smallest element size that this technology can achieve; after that, to decrease the size further, we need to invent a new technology. Computers that use this new technology are usually called computers of a new generation.

The existing (4th) generation computers are based on VLSI technology. At the current speed-up rate, this technology will soon exhaust its potential. Physicists and engineers are therefore working on new technologies for fifth, sixth, etc., generations of computers. Vague ideas are proposed for technologies suitable for even further generations. It is therefore desirable to get a clear view of the computers of the very distant future generations - generation omega.

Several schemes have been proposed for such computers. The most promising scheme is quantum computing, in which quantum effects are used to speed up computations. Due to peculiar properties of quantum physics, quantum computers have a potential to do many unexpected things:

- They can do exhaustive search in a list of n elements (a problem which normally requires n steps) in only square root of n time.
- They can crack most existing codes really fast, and
- They can do many other exciting things.

Due to the extraordinary potential abilities of quantum computations, main computer companies (IBM, AT&T, Microsoft, Intel) are currently trying to make quantum computing real.

Other schemes have been proposed for fast computations, from more practical ones involving DNA computing etc. to more futuristic ones involving black holes, time machines, and subtle effects of quantum field theory.

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2:10–3:00pm

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