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DIGING INTO THE FUTURE OF THE PAST

Following the eEurope Initiative: An Information Society for All, that emphases digitalization as an essential activity in preserving national and collective heritage, in this paper you'll find a little bit different notes about topics that usually are connected with the digitalization in general-as some mentioned above.

As one can see, further in the text, the point will be focused not so much to the digitalization of the past, but to some real-time and also future problems associated with manipulating of vast amount of incoming digital data, including storage and transfer of them between distributed resources and, finally about the quantum computing, for now, only at the horizon.

In general, digitalization assumes search and retrieval, in digit form, historic, cultural and scientific heritage. Despite a lot of open problems yet exist, the process goes toward unification of standards, procedures and technologies. The more you go into the past, in the name of digitalization, the greater is the number of data acquired and that demands greater memory computer storage capacitates. . But what about real, today and everyday increasing stream of digital data, produced and gathered by new, advanced scientific or research facilities in astronomy, physics, molecular biology or mathematics, for instance.

Nowadays, computers have become indispensable to scientific research and the exponential growth of computer power is now launching the new field of computational science: how to develop large-scale predictive simulations of highly complex technical or experimental problems. Some of the challenges that computational science must meet are how to increase computer performance and how to program for these high-performance machines. To achieve this, scientists within so-called DARPA–project are developing a 2-petaflop ($2x10^{15}$) floating-point operation per second computer by 2010 and involving high-performance software infrastructure to increase scientific research productivity

Many of the complex problems have to be simulated (such as supernova or nuclear explosions) and that means an enormous quantity of data. On the other hand, some of the recent big projects in physics, CERN's LHC will soon produce more terabyte of data in one year. In not so far future, new accelerator facilities will produce intense, coherent, ultra fast pulses of hard X-rays of about 10^{12} photons in a very, very short time of around few hundreds femptosec (10^{-15} sec).

Another one, very interesting event, involves multidisciplinary approach in one-year monitoring the passage of cosmic particles, moons through the great Pyramid of the Sun in Teotihuacan, Mexico. These kinds of mesons, now called moons, are sub - nuclear particles created when protons from cosmic rays hit the Earth's atmosphere, rain down uniformly and are absorbed when they interact with matter. During penetration, moons lose their energy primarily by ionization (at high err energies dominate radiation effect), then during electron-positron pair production, photonuclear and other interactions. Scientists find the surplus of moons in a given direction, in other words, the statistically significant difference between measured and simulated moon flow. . All of the year, data from the detector chamber are sent to distant laboratory by means of mobile GPS phone.

Despite the continuous rise of computer storage memory, another problem yet arise: how to transfer such a quantity of data, so the scientists around the world are now preparing a brand new kind of computer and information infrastructure-the GRID, that will enable very fast (tens of Gbits/sec) data transfer, also providing improved and safer way of entering and searching through the distant computer resources.

In order to ensure the availability of scientific information over a long period network such as GRID, non-commercial one and internationally controlled, should take over responsibility for long-term archiving and standardization of data formats and interfaces. Also it must provide open source-based access software but as a broad base of scientific knowledge that kind of network requires special regulatory form.

The new electronic platforms comprise complete documentation of the scientific material and enable use of multimedia tools, archiving original data and provide online-net working of the sources used, no matter how they are remote.

Let's here back to the passage of a cosmic ray or particle through computer chip that can trigger so called soft fail but no one can be sure whether the frequency of these fails poses a hazard. Some types of computer problems are termed soft fails, in which a single digit changes without command and testing points no way of repeating the event. In some studies done about, that the conclusion is that only heavy ionizing particles generally represent a potential threat but the problem will become more serious as more compact computer chips come into use. Despite these effects are negligible, it would be better to think about some protection against possible influence of cosmic particles/rays, especially to the memory-storage units. On their way cosmic particles which produce mesons like moons, falling down to the Earth uniformly and constantly-may cause some changes in the human brain also, but there has no evidence yet-for any damage from single particle. As we said previously that computer memory might be similarly affected and this is a problem observed on the long-term satellite flights.

Here we pointed out only a few possible troubles with arising of new digital data from many different sources, together with working on very complex scientific problems, with enormous quantity of data, such as it maybe requires a quite new, fundamentally different way of computing. This new field, now known as quantum computing started practical ten years ago, when Peter Shoor discovered that, for certain problems, computation with quantum states instead of classical bits can produce in huge savings in computational time. Today, quantum information, or qubit can be measured, mixed, concentrated, diluted and manipulated. The atomic quantum bits or qubits can also store the information 0 or 1, as two internal quantum states but they are not limited to hold only 0 or 1: they can also store a superposition state with 0 and 1 together. Not so long ago, physicists succeeded in creating a huge ultra-cold atomic cloud, named Bose-Einstein condensate, which respond as a very big quantum register with over 100.000 qubits. Each of the as many as 100.000 atoms can then act as a quantum bti (qubit) constructing an arithmetical register for highly parallel computer operation. Within this very cold environment, near absolute zero, atoms start to display collective properties.

For some purposes, quantum computers are particularly interesting due to their ability, in principle to perfectly calculate the behavior at other complex systems. This could be another, big step toward the era of quantum computing.

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