China made a supercomputer that performs 1 million billion operations per second

Professor Yutong Lu was born in 1969 in China. She has obtained her bachelor, master and doctor degrees from the National University of Defense Technology. She has participated in the research and development of several series of supercomputers in China for more than 18 years. Professor Lu arrived in Bulgaria for the Europe – China high-performance computing (HPC) conference, the first of its kind, which runs from 8 to 11 April in Sofia.

− **The very fact that a Europe – China conference on the application of supercomputers in science and industry takes place means that both sides have good experience they can share. What is the experience of China in this field?**

− The infrastructure for high performance computing, in particular supercomputing at the highest level, should always be a national strategy; there must be strong support from the national government, including funding and interdisciplinary collaboration.

China sticks to independent research and develops its own supercomputers in the last years. We brought together the experience of the related technologies and the talent in developing interconnects, system software and applications. We have developed a number of technologies, such as the interconnect chip-set "Galaxy".

We have successful experience in the research, development and maintenance of large computing systems and, especially in recent years, we have experience in building supercomputer centers to provide high-performance computing resources nationwide. We gradually improved the Chinese high performance computing network, linking major supercomputing centers and connecting universities and research institutes. Chinese high-performance machines linked in a network can provide powerful supercomputing resources.

‒ **When did China begin work in this area and what are its most significant achievements to date?**

China's efforts in this field date more than 40 years back. For example, the National University of Defense Technology has a strong achievements record in computer systems. It was NUDT that developed the first supercomputer, the first gigaflops, the first teraflops and the first petaflops systems in China in 1983, 1992, 2000 and 2009 respectively.

‒ **What do these terms mean?**

‒ Flops are the operations performed per second. Gigaflops means one billion operations per second, teraflops – one thousand billion operations per second, and petaflops – one million billion operations per second. The most famous supercomputer is Tianhe-1A, which made it possible for China to reach for the first time number 1 in the Top 500 List in November 2010.

‒ **Who makes this list?**

‒ The International Conference on Supercomputing, held twice a year – in June in Germany and in November in the UK. China became the first country other than the US and Japan which managed to climb to the very top.

‒ **In recent years, China has become one of the fastest-growing economies, including in the application of supercomputers. Can you point a few areas where supercomputers are successfully applied in China?**

‒ Supercomputers are widely used in weather forecasting, aerospace, energy, material science, exploration and production of oil, life science, and industry, as well as other large-scale scientific computing projects and data processing. They are also applied in financial risk analysis, sociological forecasts and more.

‒ **In which areas in your opinion can supercomputers be most useful in China and in the world over the next 5-10 years? What are China's plans for this period?**

‒ Over the next 5-10 years, China's high performance computers will be focused on scientific discoveries, technical innovations, industrial revolution, and the improvement of social life. Among the most important areas are climate- and environmental research, bio-medicine and life sciences, new energy, construction, data acquisition and processing. The Chinese Ministry of Science and Technology launched a project at the National University of Defense Technology for the development of a 100-petaflops supercomputer in the 12th five-year period until 2015. Until 2020 we expect to present an exascale system, meaning a supercomputer that performs one thousand million billion operations per second.

– How can China and Europe cooperate in the field of supercomputers? What projects could be of common interest?

– Sharing HPC infrastructure resources, development and implementation of exascale-oriented algorithms and models, parallel software, applications in materials science, chemistry, life sciences, engineering, and industry.

– Are you looking for cooperation with other parts of the world except Europe? Are there countries whose experience in supercomputing deserves special attention? Which countries do you consider as having a worldwide leading role in the field of supercomputers?

– China aims to establish friendly and mutually beneficial cooperation relations with countries around the world. Europe is rich in both scientific and theoretical results and demonstrates the benefits of practical applications and the software. Of course, the United States have always been leading the development of supercomputer technologies in general, especially in terms of revolutionary new technologies, and always had the largest share among the Top 500 supercomputers. The US have had and will keep having the most important role in the HPC community.

– You are in Bulgaria for the first time. Do you think that a cooperation in the field of supercomputing can be established between China and Bulgaria?

– I see that high-performance computers in Bulgaria are advanced, so I think we can establish a broad strategic partnership and find the right way for the practical application.