

10-1 Promoting Innovation in Nuclear Energy with Computational Science

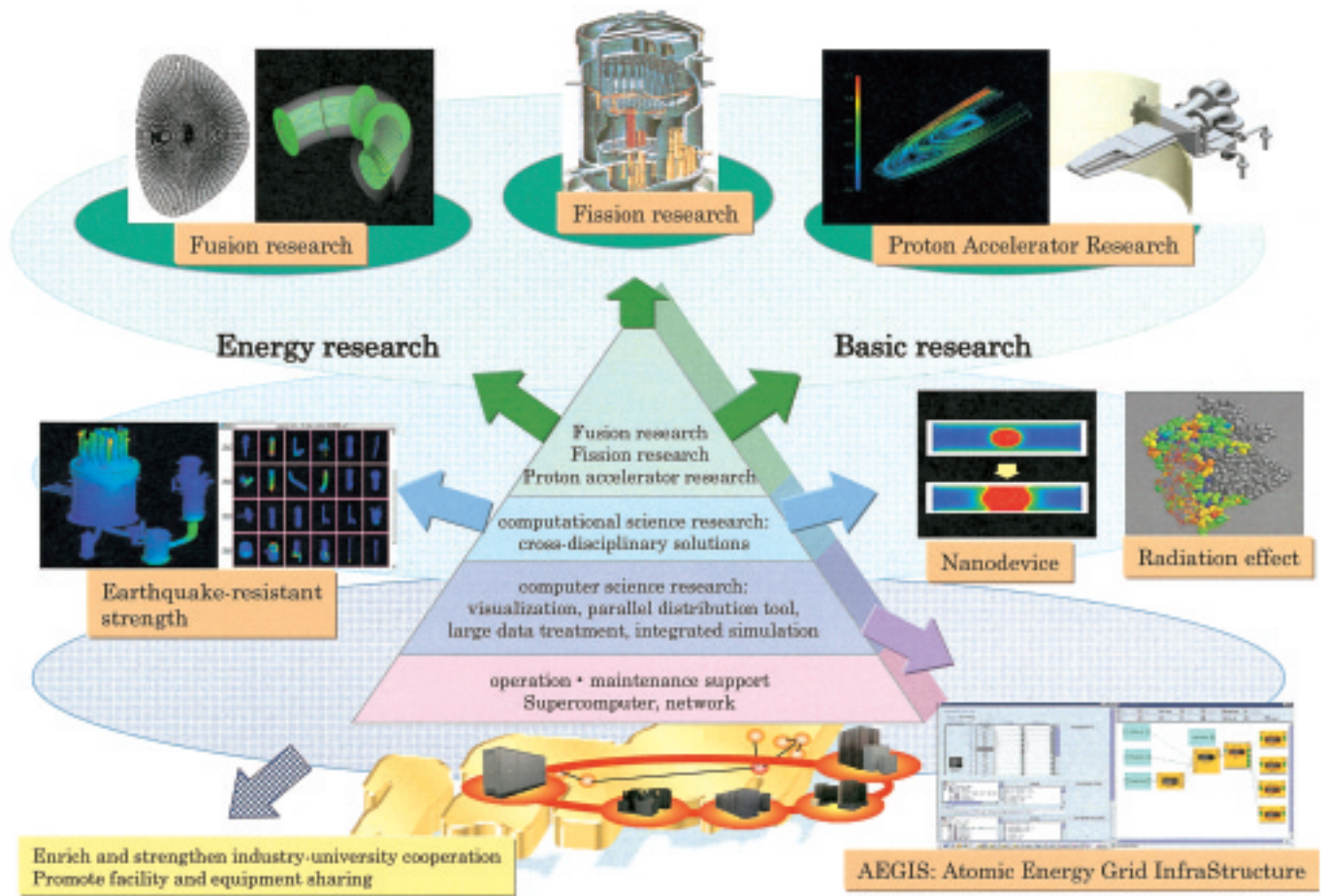


Fig.10-1 Roles of computational science in atomic energy field

Center for Computational Science and E-systems promotes leadership of experiments and creation of new ways in atomic energy field with research of computational science, research of computer science and operation and maintenance of computer and network systems.

Computational science has an important roles in atomic energy research, since experiments in such a large scale facilities are difficult due to stretched budgets or danger to the environment. Computational study is widely known as the third way adding to theoretical and experimental studies, and has gone far beyond the role of tools for verifying. It can lead in establishing a new theory such as detecting embrittlement mechanisms due to metal impurity, or a new experimental method for nuclear fusion from the results of simulations.

To meet such demands, CCSE has been promoting two research policies as follows:

- (1) Joint promotion of computational science, computer technology, and computer and network system operation and maintenance support.

CCSE is promoting R&D for computational infrastructure and its application. The former aims for a suitable computation environment for high-performance computing. So far, we have established a virtual research environment sharing 57TFLOPS computer capacity in the Information Technology Based Laboratory (ITBL) project. The latter promotes research in such areas as quake-resistance of nuclear facilities, nano-devices, and radiation in the human body. We made numerical simulations to determine safety of nuclear power plant against extra-large earthquakes, and to design a high accuracy super-conducting neutron detector. These two results were selected as an honorable mention and the Gordon Bell Finalist respectively, at SC2005, one of the world's largest international supercomputing conferences.

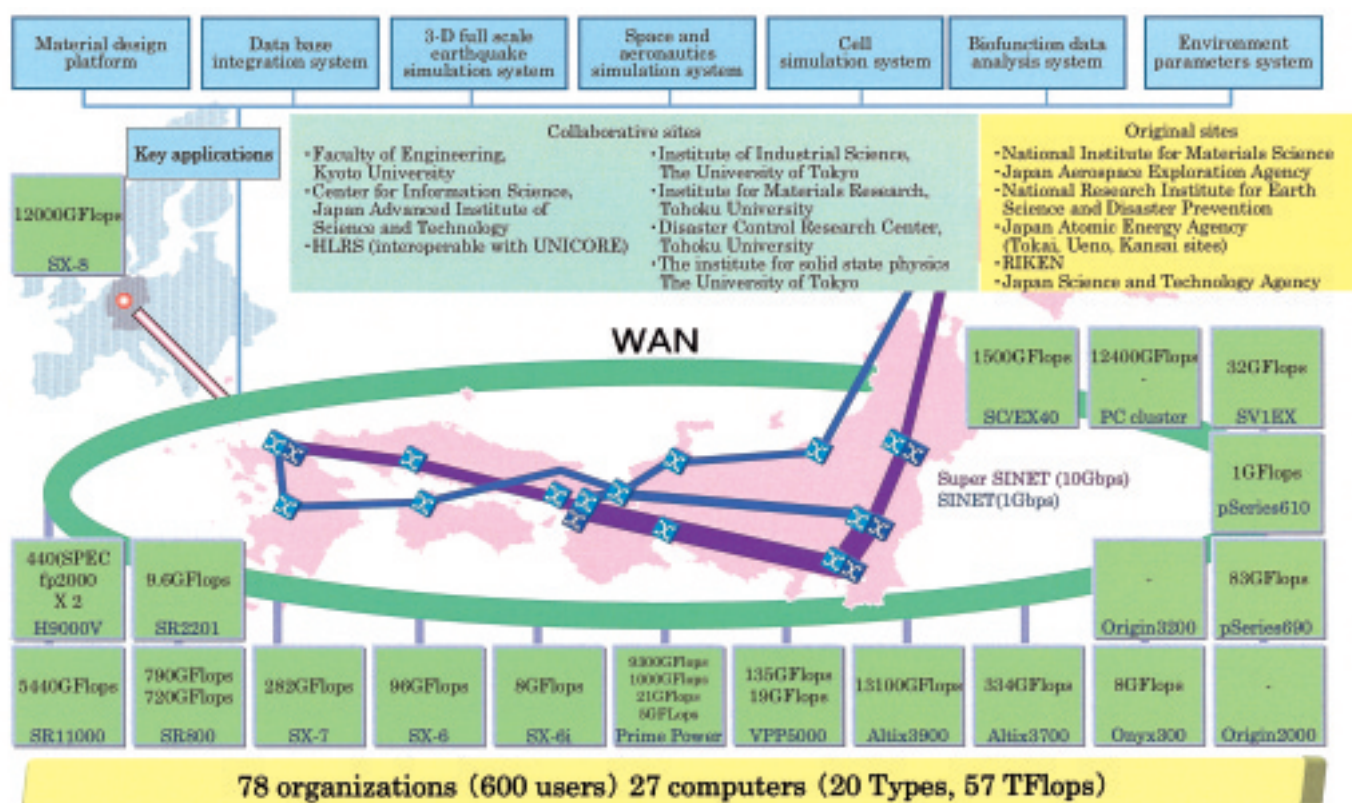


Fig.10-2 The environment established in ITBL project

Thanks to the collaborative works of ITBL member organizations, ITBL shares 27 supercomputers of 20 different types and offers 57TFLOPS using ITBL middleware. (as of Mar. 2005). SX-8 (12 TFLOPS) at HLRS, Germany is also available through the interoperability between UNICORE and ITBL middleware. This figure also shows key applications developed by ITBL research.

(2) Cross - disciplinary approach for theoretical and experimental studies in collaboration with other divisions

CCSE contributes a great deal to the sophistication and improvement of various studies with its cross- disciplinary approaches. Especially, CCSE promotes elucidation of phenomena with simulations, and analysis through interpolation of experimental data, digitalization of facilities in computer systems, and construction of a “Design by Analysis” system for fast-breeder reactors.

Next, we briefly describe the activity of CCSE in the ITBL project mentioned in (1) above.

CCSE has participated in ITBL (FY2001-FY2005), which is one of the e-Japan priority policy programs. The project has made a virtual research environment that allows its users to be able to execute complicated and advanced simulations and to do collaborative work with remote locations. This has been accomplished by R&D to gather computer resources, information, and know-how which lie scattered throughout the Internet. CCSE has taken important roles in developing and operating the ITBL middleware and researching and developing applications. ITBL shares its 57TFLOPS computer capacity with domestic and foreign institutions

using ITBL middleware. The number of domestic and foreign universities, institutes and companies that have joined the ITBL totals 78, and the total number of users is over 600. The ITBL project has expanded its environment by interoperating ITBL middleware and UNICORE, a middleware developed in Europe. This expansion and international collaboration has enabled ITBL users to use super computers at the High Performance Computing Center, Stuttgart (HLRS).

CCSE has been promoting new research on the Atomic Energy Grid Infrastructure System (AEGIS) to develop the computational infrastructure required in the atomic energy field. We conduct international collaborations with not only Germany but also France and the United States to offer a worldwide scale virtual research environment for large-scale experimental facilities of atomic energy research. In addition, we joined a national project called “Development and Applications of Advanced High - Performance Supercomputer” which has started in FY2006 to establish information infrastructure for sophisticated technology. In this project as well we are working on middleware for the infrastructure.