

# The Integration of Computational Power: From CNGrid to IoSC

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CNGrid, the national high-performance computing environment in China, is consist of high-performance computing resources contributed by many supercomputing centers, universities and research institutes. It aims to provide high quality computing services to scientific researchers and industrial users. In last few years, CNGrid focused on upgrading its service and operation to higher levels, and better supports scientific discoveries and industrial innovation. Compared with traditional HPC clusters, the HPC environments shows its advantages in robust services and abundant software, hence the better service quality for users. CNGrid provides computing resources through unified access entry, and uses programming APIs to support the construction of specialized communities and platforms. It also helps applications of large scientific equipment by providing high throughput data processing power.

With the appearance of new concepts such as Metaverse, Computational Power Network and Wide-Area Resource Scheduling, CNGrid also needs the upgrading to the new era. Internet of Super-Computing (IoSC), the large structure composed of HPC infrastructures, storage, software and applications that are highly connected by the network, has been seen as the next generation of HPC environments. Being as the national level heterogeneous computing architecture and the national strategic reserve of computing resources in China, IoSC will be constructed to found the basement of high-performance computing research, development, application, construction, service, operation and education. The computing services provided by the IoSC will be turned from resource-oriented to task-oriented, which provides multi-form cross-domain computational power. IoSC aims to promote the connectivity of computing resources, the coordination among subjects and the merging of research work and industrial demands.

Similar to the OSI model, IoSC is designed to have multiple layers. The bottom level is the Physical Layer, which includes computing infrastructures such as clusters, storage and bandwidth. The next level is the Network Layer that is founded by the software-defined network, which greatly increases the data transmission performance across the HPC environment. The Service Layer contains a series of core HPC functionalities, including the task scheduling and the resource management for computational power, software and data in IoSC. The Presentation Layer bases on the functionalities provided by the Service Layer, and establish programming APIs, models and gateways. The top level is the Application Layer, which provides diversified and workflow-fit computing services to users through programming APIs and models.

Being as the high-end national computing facilities, IoSC will keep exploring and practicing the operation and management mechanism in the context of large scale cross-domain and cross-organization HPC environment. It will also continuously improve the evaluation system on aspects such as service level and data security.

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