Advanced Cyberinfrastructure Platform Design

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On an advanced cyberinfrastructure platform (ACP), data logistics should logically be partitioned into each project for security reasons. For example, medical image recognition for cancer detection and genomic analysis have to manage persistent personal characteristics, and such kind of data must be protected perfectly. In contrast in traditional HPC systems, many shared resources are used. The access control including file permission mechanism is used but there are strong demands for higher security.

To fulfill such demands, the platform should employ double protection like file access control & logical separation, and the policy of double protection is helpful for accountability to stakeholders.

To realize logical separation from the other project on ACP, network level and storage level separation are considerable. In terms of network level separation, Virtual LAN (VLAN) can manage multiple independent segments. pKey in InfiniBand is very similar technology to VLAN. To expand VLAN technology to resource management, the technologies for Software Defined Network (SDN) can be used. In a certain project, the sensors, computing resources, and storages must be enclosed into a single VLAN. In terms of storage level separation, NVMe over Fabrics (NVMeoF) is promising approach to assign the block device mapping to the host dynamically. NVMeoF can achieve high performance IO using enhancement of NVMe protocol for SSD drive.

Data acquisition through Internet and heavy computations like simulation, machine learning, and so on can be executed on different subpart of ACP. Data acquisition processes should be performed on the front-end nodes of ACP (or Virtual Machines). On the front-end node, roughly filtered data for integrity should be stored into the storage directly. After that, data will be preprocessed by various kinds of accelerators, for example, inference of machine learning, and dataset is generated. Finally, heavy computation

process using huge generated dataset is executed by large-scale computing resource like traditional HPC systems.