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High-Performance Data Transfer for Full Data Replication between ITER and the Remote Experimentation Centre

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A high-performance data transfer method has been developed for full data replication between ITER and the remote experimentation centre (REC) in Japan for the first time. Fast data transfer technology has been investigated as the crucial activity of REC with F4E, JAEA, NIFS, and NII collaboration. Full replication of ITER data will be expected to provide not only an equivalent research environment for the remote site but also data security against unexpected disasters. To realize the full replication, (1) A long-distance fast data transfer method, (2) high read/write throughputs on sender/receiver storages, and (3) 10–100 Gbit/s dedicated link, will be essential.

The preliminary test result of MMCFTP, which is developed by NII, show 1.9 Gbit/s speeds on Japan–EU layer-3 (L3) Internet. On a 10 Gbit/s layer-2 virtual private network (L2VPN) of SINET4, 8.5 Gbit/s speed was successfully sustained over 100 s.

The performance difference between L3 and L2VPN has been particularly tested between NIFS, NII, and REC sites. Internet L3 connections are obliged to use firewall and intrusion prevention systems (FW/IPS) for security; however they inevitably lower the packet forwarding rates. Tests on actual 10 Gbit/s FW/IPS show the performance limits around 2–4 Gbit/s. Hence, the international L2VPN is recommended between ITER and REC because it can provide more than 80% data transfer efficiency inside the closed network without any FW/IPS.

High-speed tests are also being prepared with ITER and other EU sites for after April 2016 to evaluate the improved efficiency using the 20 Gbit/s JA–EU direct link of SINET5. NII plans to upgrade the JA–EU link to 100 Gbit/s before the ITER experiment.

To make full use of 10–100 Gbit/s bandwidth, the read/write performance of the data storage must be improved correspondingly at both ends. A new double-layer storage structure has been developed in which high-speed frontend SSD arrays are added to the high-capacity main HDD ones. LHD's bulk data writing tests have demonstrated throughputs up to 2 GByte/s (roughly 20 Gbit/s).

The demonstrated technology would also be applicable to bidirectional data replication for ITER supporting machines in Japan, such as JT-60SA. It can change conventional remote participation and make local and remote sites equivalent regarding data accessibility.

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