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A Data Grid Environment for Research Using Ultra-High Voltage Electron Microscopy

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Background

Recently, remote observation of Ultra-High Voltage Electron Microscopy (UHVEM) at Osaka University has become feasible. However, an infrastructure for easy access to image data is not available. The image data are generated at a CCD (Change Coupled Device) camera-control terminal (Microsoft Windows 2000). To obtain the image data requires a lot of time for the remote user. For remote observation of electron microscopy, remote operation as well as remote access to image data should be enabled. The remote access should be simple and as easy as possible. Remote users will want to share data in research groups and do image processing such as tomographic/3D reconstruction.

Our Approach

As a solution to satisfying the above requirements, we have constructed a data grid environment with NAREGI grid middleware. Figure 1 shows the proposed system.

The Japanese NAREGI (National Research Grid Initiative) project has made fundamental building blocks in the Cyber Science Infrastructure (CSI) project promoted by the National Institute of Informatics (NII), and NAREGI's goal is to provide an integrated grid computing environment for widely distributed research and education. The NAREGI grid middleware has been developed in order to create such an environment, and its platform is the Globus Toolkit version 4.0.

The data flow in the proposed system is as follows. (1) Uploading data. The data created at the CCD camera-control terminal are uploaded semi-automatically to a Gfarm client server. The Gfarm client imports the data into a Gfarm file system (a shared file system). The NAREGI middleware does not provide a function for data transfer from the CCD camera-control terminal to the shared file system. Therefore, we have developed software that links up with the operation of electron microscopy and transfers the data to the shared file system mounted by Samba on the control terminal. (2) File browsing. The user can browse and search the data imported to the shared file system on the NAREGI web portal, and can also do image processing without being conscious of file transfer to worker nodes. (3) Data transfer and downloading. The data in the shared file system are available through the NAREGI portal. The user can copy the data to a local GridFTP server. Those features in (2) and (3) are provided in the NAREGI middleware.

Future Plans

Currently, we are evaluating the function of the file transfer to the GridFTP server provided by NAREGI middleware to give priority to the demands of users who wants to obtain the data. For the next step, we need an evaluation of workflow for image processing such as is used in tomographic/3D construction. Moreover, we will consider providing a command-line interface for the user who does not prefer the Web-user interface.

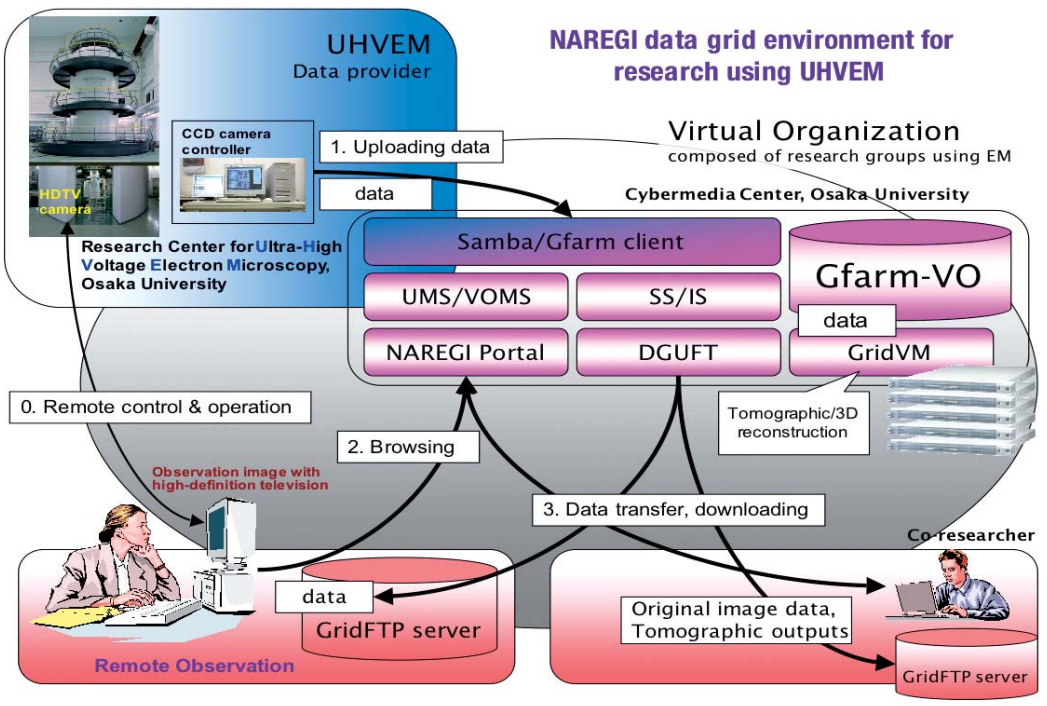

Figure 1. NAREGI data grid environment for research using UHVEM

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