# 6. Data/Network

## 1. Introduction

We operate and upgrade data and the network infrastructure (both hardware and software) to advance experimental control, data acquisition, and data analysis at SACLA and SPring-8. At SACLA, we have built a data center for data acquisition and analysis. It can reliably store data with a maximum data rate of 6 Gbps and perform the associated data analysis with a typical data size of a few tens of TB per experiment [1,2]. Data generation will increase gradually, and the related infrastructure upgrades will be carried out in 2021 and 2022. In contrast to SACLA, we foresee a significant increase of data at SPring-8 in accordance with the upgrade of the beamlines and the introduction of the higher speed and higher pixel count detectors. In addition to the significant data size increase, we see other demands such as remote access to the beamlines and the upgrading of the beamline control software. To cope with these requirements, we have started conceptualizing new data and network for SPring-8 with the data center at its core. The multiple data systems spread over the beamlines now under operation will be merged into one centralized SPring-8 data center by implementing these upgrades. Furthermore, the SPring-8 data center will be connected to many high-performance computers, such as "Fugaku", under a high-performance computing infrastructure (HPCI) consortium and private cloud operators. This year, we have carried out the first step toward realizing the SPring-8 data center concept.

## 2. Upgrade of network infrastructure at SPring-8

We have started to build a new network infrastructure for the upgrading of SPring-8 beamlines. It consists of three zones, a data acquisition zone, a data analysis zone, and a user support zone. The data acquisition zone is used for experimental control and data acquisition. The data analysis zone is used for experimental data analysis and data transfer from SPring-8 to the outside. The user support zone is used for experimental research and other works. In the data acquisition and data analysis zones, users cannot access the global network except for software updates. Users can access the data analysis and user support zones from outside the SPring-8 campus via a virtual private network (VPN). The data acquisition zone supports remote experimental control.

In FY2020, we introduced the new network to BL09XU.

## 3. Development of BL-774 system

We have been developing an instrument control platform, BL-774 (Fig. 1), for beamline experiments at SPring-8. BL-774 is developed with Python and uses XML-RPC servers responsible for socket communication. BL-774 has a configuration function that allows BL staff to set device settings in a simple and user-friendly manner. BL-774 aims to separate and balance the implementation of standard APIs and functions with those of individual applications. We systematically develop and maintain the source code of BL-774 to standardize it so that it can be reused in other beamlines.

In FY2020, we started the integration of BL-774 into BL09XU (full) and BL20B2 (partial).

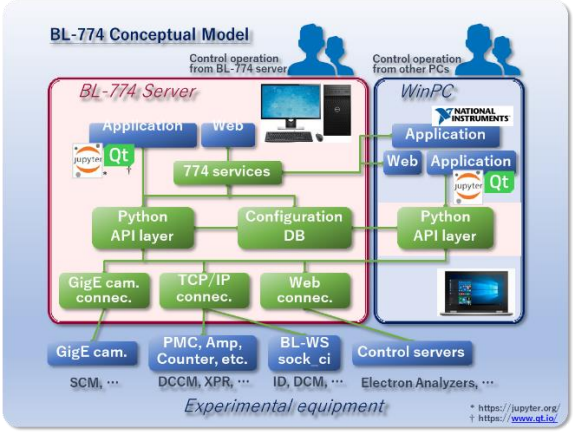


Fig. 1. BL-774 conceptual model.

## 4. Improvement of data handling environment at SACLA from outside SPring-8 campus

To reduce the risk of COVID-19 infection, the number of onsite participants is expected to be minimized. Therefore, we improved the data handling environment at SACLA to facilitate discussions and data analysis with collaborators outside the SPring-8 campus.

For documents and data sharing, we made it possible to access Google Docs, Sheets, and Drives from the experimental control terminal via a proxy server. We introduced FastX to improve the operating speed of GUI via VPN when collaborators outside the SPring-8 campus analyze data with SACLA HPC. FastX can be used from a web browser (Fig. 2) without the need to install special software on the user's PC. The operation feel of FastX has been well received by not only domestic users but also foreign users. We started the trial use of Nextcloud on the premises. Nextcloud is functionally similar to Google Drive, allowing users to transfer more data faster. We also installed a data transfer server for high-speed data transfer from SACLA to the outside without going through a VPN.

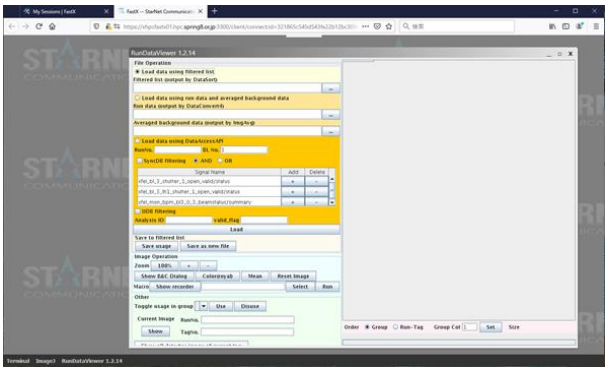

Fig. 2. Example of FastX utilization.

## 5. SPring-8 Data and Network Committee

The SPring-8 Data Network Committee was established in 2019. The 2nd committee meeting was held online on Oct. 2, 2020 [3]. The committee discussed the data network operation policy and responsible systems related to experiments at SPring-8 and SACLA, and formulated the basic policy, management/operation system rules, and network usage guidelines.

Yasumasa Joti and Takaki Hatsui
Innovative Light Source Division,
RIKEN SPring-8 Center

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