Introduction of visualization system for RIBF control network monitoring

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The RIBF control system is a distributed control system consisting of various types of Ethernet-based modules, VME-based modules, programmable logic controllers, and so on.[1)] In the case of the Ethernet-based module, the LAN is also utilized as a field bus of Ethernet-based modules. The network switches for the control system LAN are installed in the whole area of the RIBF accelerator facility including RILAC and AVF.

As mentioned above, since the control system LAN is used not only for various services, but also as a fieldbus, it is an essential part of the infrastructure of the RIBF control system. For this reason, in order to make the RIBF control system highly reliable, an alive monitoring feature for the LAN is necessary. On the other hand, when backing up a large amount of data such as the image file of the virtual OS, the usage rate of the network bandwidth and the response speed decrease in some cases. Therefore, network traffic monitoring between the network router and the switches is also needed for stable accelerator operation. Because the network monitoring and switch management are very important, we introduced a network visualization system for the RIBF control network.

Considering network monitoring, the following two key protocols are utilized to construct this visualization system. One is the simple network management protocol (SNMP). SNMP is adapted to monitor the network switch state. SNMP is an application layer protocol for monitoring and controlling communication devices connected to a TCP/IP network, such as a network router, switch, and server, via a network. For example, a network router sends the information of its system health, which includes memory usage, CPU load average, and so on, to the SNMP manager from the SNMP agent. Another is the NetFlow protocol, which is a feature to be introduced to correct network traffic data on Cisco routers and it can passively monitor traffic flowing over a network.[2)] In the RIBF control system, the network topology is a star type, adopting Cisco Catalyst 4506 as the network router in the center of the LAN. It is suitable for monitoring with NetFlow because Cisco Catalyst 4506 has a feature of sending the data passed through the router from each network switch as NetFlow protocol, if only plug-in is installed. In order to visualize data of NetFlow and SNMP, we adopted the commercial software PRTG[3)] and constructed a monitoring system. As a result of testing the NetFlow collection software, we confirmed that its implementation is inexpensive in term of both introduction and daily operation. In addition to low cost, the reason for adopting PRTG is that it is available to collect and visualize data of both SNMP and NetFlow protocols. Moreover, it can monitor the service port of the server, such as the address resolution protocol (ARP), hypertext transfer protocol (HTTP), and file transfer protocol (FTP). In the usual case, the PRTG is installed in the server computer and collects the NetFlow data, which is transmitted by UDP from the network router. The specifications of the server computer for PRTG are a Xeon E3-1220v3 CPU (3.1GHz), 16 GB memory, and a TB RAID1 hard disk. By utilizing a Web application as the user interface of PRTG, it is possible to view the data not only from the control system network but also from the office network via the proxy server.[4)] A screen capture of the user interface for PRTG is shown in Fig. 1.

As a result, it possible to check the status of all the network switches via the Web by using SNMP, for example, the high load average for the network switches and fan failure situation. Since we can analyze the data traffic volume at the protocol level by using NetFlow, this network visualization system can help minimize the system risk such as network performance degradation caused by insufficient network bandwidth.

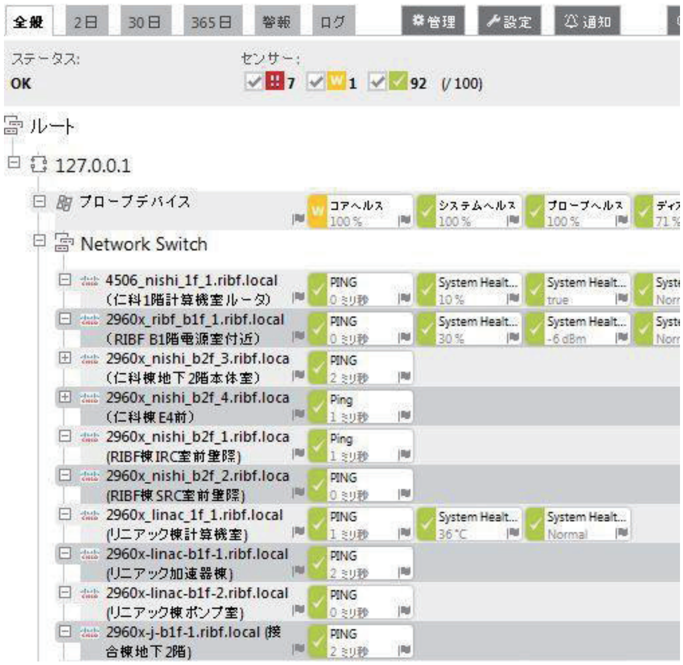

Fig. 1. Screen capture of Web-based user interface for PRTG.

References

1) M. Komiyama et al. Proc. ICALEPCS 2013, San Francisco, CA, USA (2013), p. 348.
2) http://www.cisco.com/go/netflow
3) https://www.paessler.com/
4) A. Uchiyama et al. Proc. ICALEPCS 2011, Grenoble, France (2011), p. 1161.

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