

7 - 24 Design and Progress of HIAF Control Network in 2022

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The HIAF control network undertakes the operation of the whole HIAF facility and the big data transmission of each experimental terminal. It is an indispensable part for the HIAF construction and operation period. This system should have the characteristics of stable, advanced, flexible and highly available while meet the requirements of HIAF operation and data transmission, user service and efficient operation and maintenance.

The system is designed based on three-level (core, aggregation, access) network architecture, and achieves 40 Gbps backbone network. The core level adopts two switches for virtualization deployment. All the aggregation nodes are deployed by double aggregation switches, and all the access switches are linked to the aggregation switch by double links to ensure data reliability to the greatest extent. The aggregation nodes divide their work and cooperate to ensure the convergence of all access nodes. The access switch adopts the mode of 10 Gigabit uplink and Gigabit downlink to ensure high data throughput. In order to ensure the security of the control network and prevent Internet viruses and intrusions, the high-performance firewall is adopted. At the same time, the industrial control network audit system is also applied, which is responsible for the security audit of all industrial control protocols and data, which can discover abnormal behaviors in the control network and block them also.

According to the big data transmission requirements of experimental terminals, especially for the high-energy integrated terminals, HFRS and external target experimental terminals, a 40 Gbps data width private network is designed to realize the data transmission from the detector data acquisition dsystem to the laboratory terminal. The architecture of the HIAF control network is shown in Fig. 1.

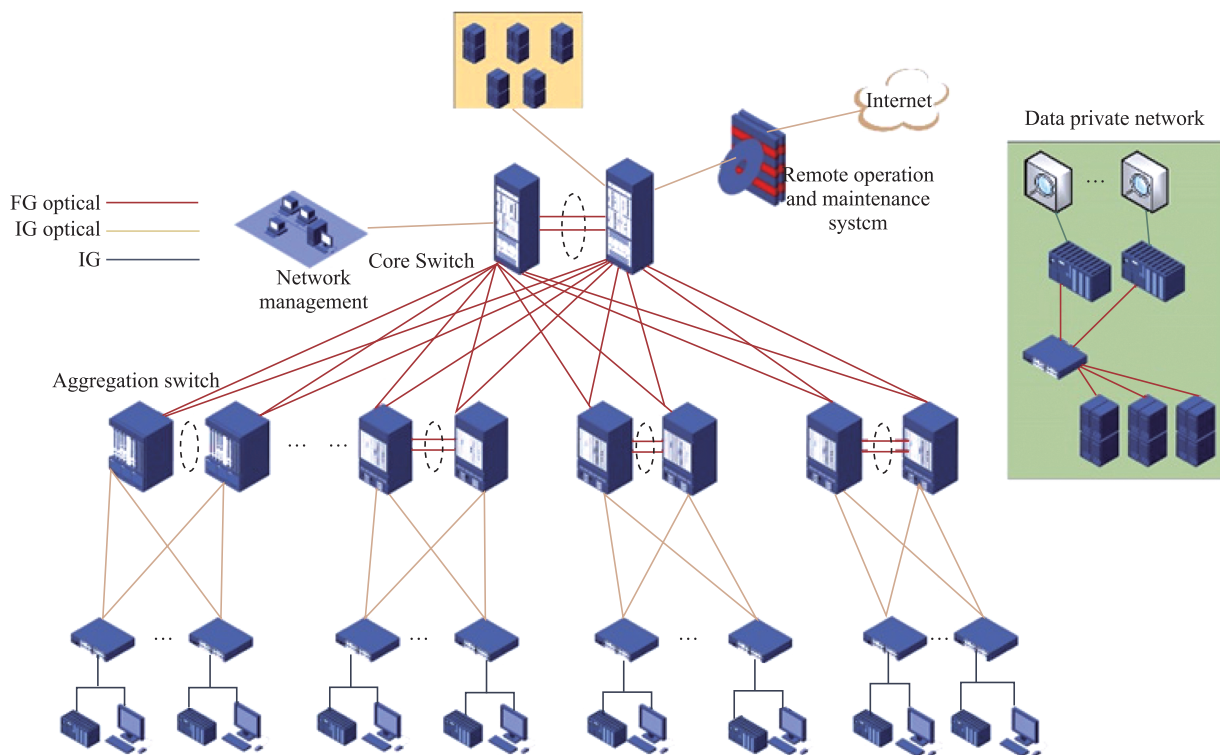


Fig. 1 (color online) Architecture of the HIAF control network.

OPNET tool is used to build a simulation model for the network performance simulation. Configuration test has been performed for the common applications in the network, such as EPICS CA, HTTP, FTP, OPC, OPC UA, etc. The current running data of various devices have also been added to the model to simulate and analyze the established network. Simulation and analysis results verify the feasibility of the scheme.

The HIAF control network and the office network operate independently. IPsec VPN is deployed to meet the needs of data transmission from the experimental terminal to the headquarters for analysis and remote processing. By setting policies, the data flow control and user audit are realized to achieve the safe transmission of data, as shown in Fig. 2.

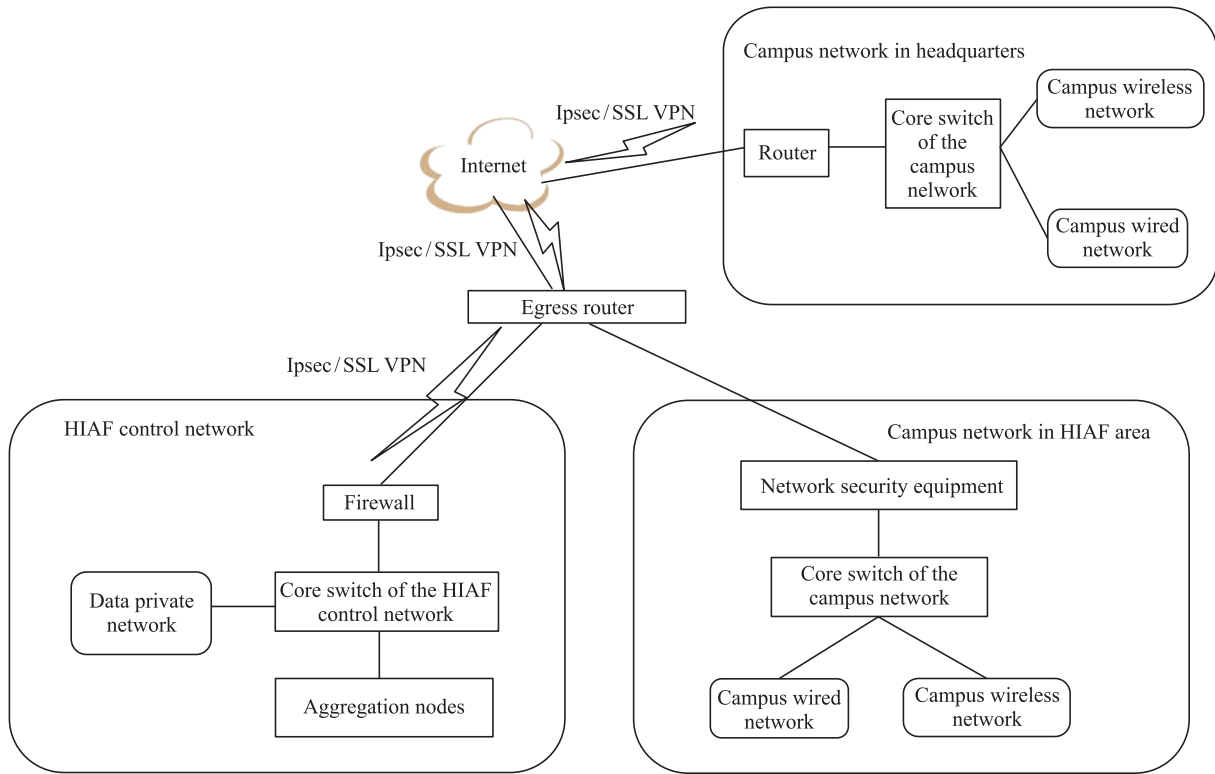


Fig. 2 (color online) Architecture of the HIAF control network.

According to the overall project schedule, the HIAF control network system will be installed and deployed in the second half of 2023, and the construction of the whole system will be completed by the end of 2024.