Network Architecture at Taiwan Photon Source of NSRRC

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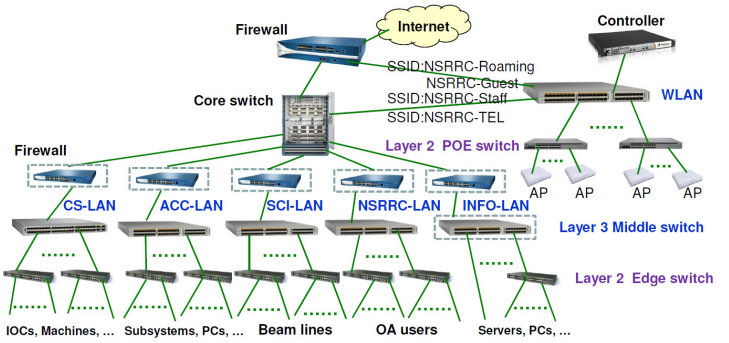
Abstract

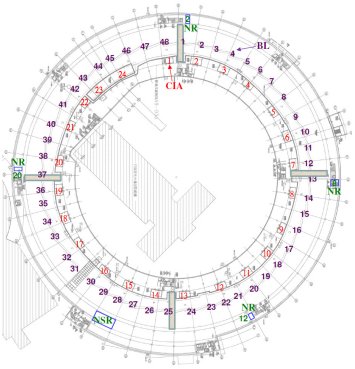
A robust, secure and high throughput network is necessary for the 3 GeV Taiwan Photon Source (TPS) in NSRRC. The NSRRC network divides into several subsets according to its functionality and includes CS-LAN, ACC-LAN, SCI-LAN, NSRRC-LAN and INFO-LAN for the instrumental control, subsystem of accelerator, beam-line users, office users and servers for the information office respectively. Each LAN is connected via the core switch by routing protocol to avoid traffic interference. Subsystem subnets connect to control system via EPICS based channel-access gateways for forwarding data. Outside traffic will be block by a firewall to ensure the independence of control system (CS-LAN). Various network management tools and machines are used for maintenance and troubleshooting. The network system architecture, cabling topology and maintainability will be described in this report.

The Network Architecture of NSRRC

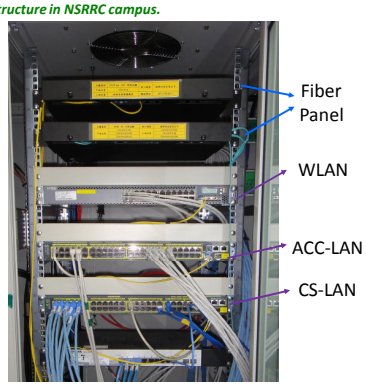
- There exists 5 layer-3 middle switches labelled as CS-LAN, ACC-LAN, NSRRC-LAN, SCI-LAN and INFO-LAN for the instrumental control, subsystem of accelerator, beam-line (BL), office users and servers for the information office respectively, shown in Fig. (a).
- The bandwidth of the backbone is 10 Gbps and the bandwidth for users 1 Gbps.
- Control and subsystem network services are available in 24 control instrumentation areas (CIAs) with an individual edge switch in the inner ring area. There are 4 network rooms and one network & server room outside the ring for network services.
- The traffic of wireless LAN (WLAN) is independent of the wired network in order to insure the normal operation of wireless while the local wired network breaks down.



(a) The network infrastructure in NSRRC campus.



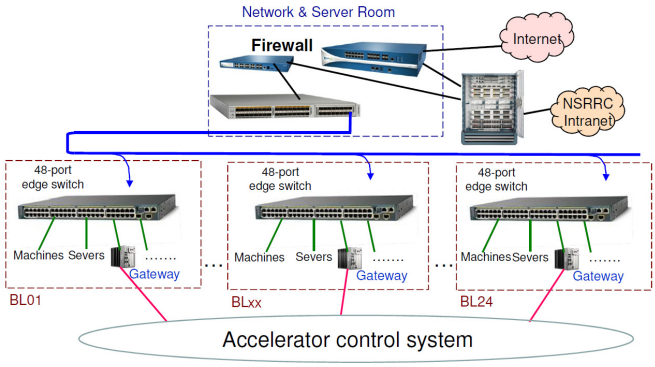
(b) The distribution of network rooms (NRs) and network and server room (NSR) in TPS.



(c) The switch layout in each CIA.

Beam-line Network

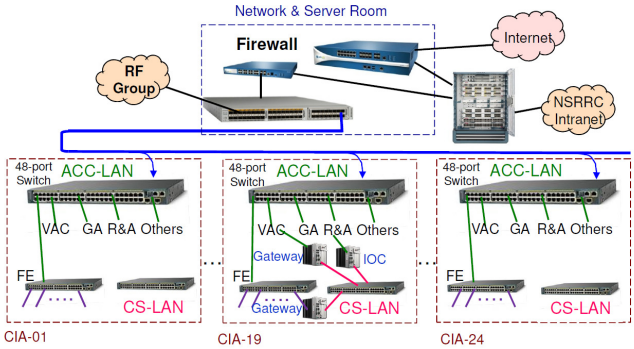
- The SCI-LAN will serve for the TPS beam line and experimental stations.
- Each beam line has a Class C regional private IP for control and data acquisition and intranet private IP for intranet access.
- Data exchange with the accelerator control system is via dedicated EPICS gateways.



TPS SCI-LAN infrastructure.

Subsystem Network

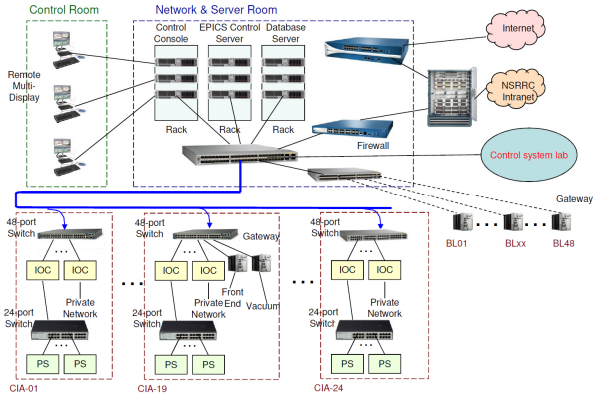
- The ACC-LAN serves for the vacuum, front-end, glider alignment, radiation monitoring and access control system.
- Two subnets of private IP are provided for each subsystem. The traffic of one subnet is limited within its subnet and the traffic of the other subnet is allowed inside NSRRC campus via the routing of core switch and outside the campus via NAT of the firewall.
- The data exchange between sub-systems and control system is through dedicated EPICS gateways or IOCs.



ACC-LAN infrastructure for the vacuum (VAC), front-end (FE), gilder alignment (GA), radiation monitoring and access (R&A) control system, etc.

Control System Network

- Control network services are available at the control room, network and server room, 24 CIAs, linear accelerator equipment area, tunnel, transport lines, main power supply equipment room and control system laboratories.
- One class B subnet is used for IOC network. For the IP 172.20.xx.yy, xx represents locations (e.g. number of CIA) and yy identifies for functional groups.
- There are multiple Class C private networks for respective subsystems, such as power supplies, motion controllers, GigE Vision, etc.
- Power supplies for dipole, quadrupole and sextupole are connected to the EPICS IOCs by a Class C private Ethernet within the CIAs to reduce network traffic and provide additional access security.
- GigE vision for diagnostics is based on the IP standard and can be adapted to EPICS environment. The images can be easily accessed through network for machine studies.



TPS control system infrastructure.

Network Management & Security

- Network monitoring software (e.g. Cacti or MRTG) is used to monitor traffic to realize and avoid bandwidth bottlenecks.
- Network tunneling tools, such as virtual private network (VPN), is used to penetrate the firewall system of the protected network.
- NTP is used for synchronizing the clocks of computer systems over the TPS control network.
- The security gateway and intrusion prevention system (IPS) are used to block worm attacks and quarantine suspicious hosts.

Current Status & Summary

- All backborn fiber network are finished in October, 2013.
- Full access of the network for ACC-LAN, CS-LAN, WLAN is available in the first quarter of 2014 for the subsystem installing and beam commissioning.
- The network for the SCI-LAN is scheduled and under installing. That will be finished before the users of beam-line is needed.
- The basic function of network manager tools such as Cacti and IPS is finished. The detail setting is under way for obtaining the complete information.

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