RECENT ACTIVITIES TOWARD WORLDWIDE REMOTE OPERATIONS OF ACCELERATORS

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Abstract

Following the GAN (Global Accelerator Network) proposal[1] for the future linear collider development, the series of workshop discussing the issues on the remote operation of accelerators and physics experiment equipment, also known as 'collaboratory,' has been held. As a result of these workshop, a working group under the ICFA beam dynamics panel was established. This talk will reports the discussions in these workshops and the activity in the working group. Recent activities in 'collaboratory' related research will be also reported.

GAN:GLOBAL ACCELERATOR NETWORK

In March 2000, ICFA task force was formed to study the idea of GAN(Global Accelerator Network) purposed by Prof. Albrecht Wagner of DESY[1]. According to the report published by this task force[2], GAN concept is defined as[Figure 1]:

> This is a global collaboration to construct, commission and operate a large new accelerator facility, based on the experience of current large detector collaborations. The multiple tasks involved are carried out at the home institutions of the collaboration members; this allows active remote participation from laboratories dispersed around the world and maintains accelerator expertise and involvement in all of the collaborating institutions.

Following the report of this task force, a series of workshop on GAN was planned and organized[3, 4, 5]. Two of them were held in 2002, the first workshop at the Cornell University and the second workshop in the Shelter Island, NY hosted by BNL. Third workshop of this series will be held in October, 2003 at Trieste, Italy. There was also a workshop on Collaboratory tools at Berkeley in August 2002 as related activity to GAN. Accelerator operators from accelerator laboratories in many countries also discussed issues on GAN and remote operation of in the workshop on accelerator operation 2003(WAO200), held at Hayama, Japan on March, 2003. The issues discussed in these meeting are:

Through the discussion in the GAN workshops and related meetings, it become apparent that there are needs for remote operation even in the existing accelerators. And also the many concerns on the issues on sociological and physiological aspects in the global remote operation environment.

Figure 1: **a schematic view of the GAN operation scenario**

At this point, I understand that GAN is a network of :

Laboratories/Organizations,

People,

Remote operation rooms distributed over the world.

It means that world wide remote control of an accelerator is a key component of GAN but NOT a last one. And also it should be pointed out that GAN discussion was started linear collider project in mind, but not limited to it.

One of important outcome from the GAN discussion is a working group on remote experiment on Accelerator physics(REAP) . It is formed as a working group under the ICFA beam dynamics panel to promote "collaborative accelerator physics experiments carried out using the evolving techniques of remote operation[6]." and is playing important role in the international collaboration on the study toward GAN-based control system.

REMOTE CONTROL OF AN ACCELERATOR

As pointed out many times in the past, a modern control system is essentially GAN-ready. Is a network based, distributed control system which allows multiple access to the system through the network. For fully functional GAN-like control system, we might need to add other functionality to

the system, such as “security” and “remote diagnosis” of the system.

For the security, the system should provide two basic functionality, authentification and dynamic access control. User of the system should be authorized by solid authentification mechanism, such as PKI:Personal Key Infrastructure, when he/she access the control system. Even if they are authorized to access a control system, they may not be allowed to access some part of accelerator hardware through the control system. It not a desirable situation if several people in other places access same part of accelerator at same time. The operators in the responsible control rooms should monitors all accesses to the control system and should have right to control remote access from outside of the responsible control system. It seems that there is not the “generic” solution for this dynamic access control yet.

According to the GAN scenario, person who designed or constructed a hardware may not stay at the local site where the accelerator is build. In GAN-ready system, we expect that the designers of hardware can diagnose their equipment from their institute or even from their home. The control system and accelerator equipment should be designed for remote diagnosis. In some cases, we might want to install extra modules in the hardware layer of the control system just for remote diagnosis. The control system should also provide tools to support remote diagnosis.

RELATED ACTIVITIES IN OTHER FIELDS

There are many related works outside of accelerator operation, such as GRID and collaboratory. GRID is mostly concentrate on the sharing of computer resources, including CPU power and storage, among the researchers over the network. Focus of “collaboratory” study is on the communications between researchers. These are the key components of GAN, but may not all. Remote operation of an accelerator requires should has higher “real-time”-ness compared to these system.

On October 13, 2003, NSF(National Science Foundation) announced that it is taking a first step to a state-of-art cyberinfrastructure, which is announced in January 2003. In Japan, there are activities to enhance research activity using IT technology, including material science, fusion science, astronomy, agriculture and so on.

These activity surely benefit us to achieve the goal of realistic global remote operation system.

ACTIVITY IN KEK FOR “REMOTE OPERATION”

Collaboration of multiple institutes for material science in Japan, Institute for Materials Research(IMR) of Tohoku University, The Institute for solid state physics(ISSP) of Tokyo University, Institute for Molecular Science(IMS) of Okazaki National Research Institutes, Institute for Chemical Research of Kyoto University, and Institute of Materials structure Science of KEK, started the collaboratory project. One of objective is to establish a system which allows user of equipment in KEK at the other institute to operate the equipment and to collect data from the experiments performed by remote operation.

They already demonstrated that the user can operate the equipment remotely. They mostly used off-the-shelf software for their system including a video conferencing system. To enhance security for remote operation, VPN system which uses PKI technology for authentification will be introduced to their system this fiscal year.[Figure 2].

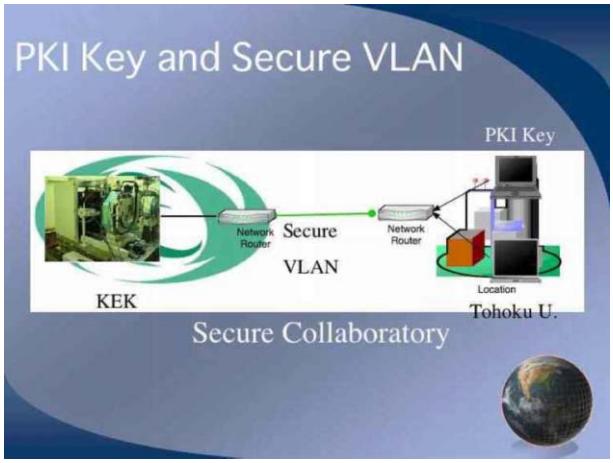

Figure 2: **Secure VLAN configuration used in the collaboratory project in KEK and others. VLAN authentification uses PKI key.**

This activity also resulted a group to study a security for remote operation in KEK. Member from every institutes/laboratories in KEK discussing the requirement for the authorization mechanism for the GAN-like remote control system.

CONCLUSION

GAN was originally proposed for a linear collider constructed under international collaboration. Through the activity in the series of GAN workshop and the related meetings, it became obvious that the need and interest for the remote operation of the equipment from the remote institute. GAN initiated collaborative study on the remote experiments and related subjects.

As we can see, effort to building information infrastructure for remote collaboration are widely spreading , such as GRID or Collaboratory. There are still be some problems to achieve the goal of global remote operation such as high quality video conferencing system which allows participants from both sides or multiple sites and efficient use of it. In spite of the problems, trend to remote operation of equipment cannot be stop and we should aware of progress

in these area and impact on the control systems. Steve Hunt said in the second GAN workshop, ”Requirements for remote operation are anyway desirable for a control system. Therefore any modern well designed control system should be suitable for remote operations without modification!” We can say same words in an opposite way: ”Therefore a control system designed for remote operation should be suitable for any control system without modification!”.

REFERENCES

[1] A. Wagner, The Global Accelerator Network, presentation at the ICFA Seminar at FNAL (1999)

[2] “A Global Accelerator Network: ICFA Task Force Reports”, http://www.fnal.gov/directorate/icfa/icfa_tforce_reports.html, Dec. 2001

[3] http://www.lns.cornell.edu/ganwkshp/

[4] http://www.agsrhichome.bnl.gov/RemOp/

[5] http://www.ens-lyon.fr/ llefevre/gan03/

[6] http://www.lns.cornell.edu/public/icfa/REAP/