Lessons Learned from Satellite Uses in Education Field

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Satellite communication systems have been used mainly for broadcasting pictures of teachers and students and presentation materials in the field of education by taking advantage of its wide bandwidth and wide coverage. As collaborative learning leads to higher level in education, our activities focused on the collaborative learning environment. Through workshops, which were held at 10 sites in 6 countries 30 times for two years on satellite channels, we have learned the importance of multisite collaborative learning environment and easy operation of satellite communication equipment. An inter-university collaboration network using a satellite was proposed by NIME (National Institute of Multimedia Education) and was realized under the name of SCS (Space Collaboration System). More than 159,000 site × hours of collaborative activities were conducted among 150 stations in 123 universities and colleges for 13 years. The inter-university collaboration system motivated and encouraged participants in their studies and researches, and the experiences concerning distance education and collaborative activities were accumulated in universities, which will lead to the improvement of the quality of education.

1. Introduction

Satellite systems have been used actively for broadcasting and relaying signals making the most of their potentials to distribute higher quality video signals to wide and remote areas. The big antenna has been a symbol of modern telecommunication systems. People must have been watching respectfully the satellite engineers who realize the telecommunication. The same atmosphere is now observed when we see masters of Internet or computer software around us. These sparkling eyes are preferable for the future of Japan where the scientific or engineering minds do not necessarily receive enough respect recently. It is, however, equally important for the society that the technology itself is used widely.

After having had experiences in the development of ETS-V satellite and the mobile satellite communications experiments, the author happened to be in a position to investigate satellite applications in the field of education and could have some experiences through satellite workshops, inter-university collaboration and supporting universities. These experiences became possible by the support of and through the cooperation with many elders, colleagues, industries, universities and other organizations. The author at first expresses his thanks to those related people and tries here to retrace these activities a little subjectively.

2. Supporting universities and satellite workshops experiments

The Ministry of General Affairs and Communications Research Laboratories (CRL. now National Institute of Information and Communications Technology, NICT) started PARTNERS project in the extended utilization phase of ETS-V (Engineering Test Satellite 5) launched by National Agency of Space Development in Japan (NASDA, now Japan Aerospace Exploration Agency, JAXA), after finishing the mobile communications experiments.

Fig. 1 Education exchange experiments using ETS-V satellite

National Institute of Multimedia Education (NIME, now ICT and Distance Education Center, The Open University) could purchase two sets of ETS-V communication terminals including antennas, through which 64 kbps video and audio signals could exchange. We carried and assembled them by ourselves at site in various universities to help their educational exchange activities for more than ten times. Through these supports, the author could learn the existence of regional gaps in educational opportunities. Too small number of students or lecturers could not realize some classes in provincial areas and professors and researchers in provincial areas could not easily join significant research conferences or symposium which tended to be held in the densely populated area. It was the days when 28Kbps Modems or Windows 95 was not yet found in the market. Satellite system was thought as one of the ideal systems to solve the problem.

As the satellite system was expensive to use, the educational experiments using satellite systems tended to be held by limited number of authoritative people who had rich research funds. More importance was to the contents than to the technologies and many experiments for delicately varied contents were held relying on backstage technical people who were in charge of linking two sites or rarely more than three sites, in such case "Multi-point relaying" would be used as an important catch phrase. The conclusions of these activities always included that satellite utilization was useful and effective. The knowledge and know-how about the satellite application were, however, accumulated only in limited number of people through these occasional events and the possible problems and ideas in the steady operation to come could only be imagined by few people with rich imagination.

ETS-V communication terminals were installed just around then in several sites including Thailand, Indonesia and Papua New Guinea. The group activity sharing satellite channels looked useful, because participants in a group could equally use information thrown into the group and the shared idea could be output from any site. The verification trial using a satellite was thought significant.

Satellite Workshops (SAWS) where more than two institutions exchanged ideas on satellite channels was proposed in 1992. Although it was an impudent proposal for taking participants' times regularly, 10 ETS-V stations in 6 countries agreed to the proposal; they were CRL headquarters, CRL Kashima, and those in Thailand, Indonesia, Papua New Guinea, Fiji, University of Electro Communications, NASDA, NIME and the PEACESAT Hawaii station which was originally installed by CRL before the PARTNERS project.

More than 30 times of workshops on the satellite channels were held for two years. All the stations were not always present but many participants got together or invited lecturers to hold seminars or conferences and to exchange ideas about things interesting for ourselves who were operating the equipments for participating. The participant sites invited other people, for example many students were present in KMITL site almost every time. The author expresses his thanks to all the partners in this experiment for their kind cooperation.

As was often the case with the experiments done by researchers, almost all kinds of trouble were experienced; the link was not connected, expected stations did not appear, a cable was disconnected, a switch was not on, a circuit breaker worked, audio signals looped, lighting was insufficient, audio levels were not well adjusted and camera operation was bad, etc. Unfortunately these troubles seemed to happen just when VIPs visited us. Although weak in English, the author became fluent in special phrases such as "Can you hear me?" or "Can you see me?". Most sites were operated by few researchers and also in the NIME site, one or two members managed all things including setting topics, inviting lecturers, gathering and distributing materials, adjusting operational schedule, link connection, session management, etc. The international call or fax in NIME was unfortunately limited then only at the administration desk 6 floors down from the session room and, to make the matter worse, the elevator moves very gently. Almost regularly happening "emergencies", therefore, forced us to run down and up stairs to communicate with other sites and/or resend the materials to be used in the sessions.

These valuable experiences helped us to understand not only the importance of the basic physical strength, video conferencing effects and collaboration effects between more than two sites but also the easy outbreak of panic in the operation of equipments when it was done in the middle of discussion, which had been simple and easy just before the session. The easy operation is one of the important characteristics of systems to be used. And we should be careful to design this characteristic, sometimes with more efforts or more budgets.

3. Proposal of the inter-university collaboration system

When we visited universities in other countries, we often saw they were each competitive rather than cooperative claiming their own identities and usefulness. In Japan also, there was an anxiety about promoting the collaboration between universities. Stronger courses from other universities might take off some jobs in traditional courses. Avoiding this problem temporally, however, would not solve the problem. The wave of advancement of network technologies and the rationalism would come eventually from outside and would force us to collaborate even if we didn't do it by ourselves.

Just then, from late 1990's to around 2000, the Tsunami wave of virtual university attacked the world and the demagogic mood covered the society that traditional universities with physical buildings would be replaced by virtual universities within 30 years. Higher performances of PC, easier operability represented by Windows 95, commercial digital cameras and the coverage of optical fibers for 100 thousands cities coming to 20 % around 1998 showed that the Internet and PC image application were getting popular. Should we wait for the wide-band Internet to be realized in the future as for the inter-university collaboration system? But considering that only small fraction of people in universities had experiences of video conferencing, it was thought important to realize the environment to come by devising technologies and increase the experienced people in remote exchange activities. More people, thereby, would be able to discuss distance education together, otherwise people would be just receiving know-how from the authorized people.

Decision making were not done as a single organization, but done independently and proudly by each university, which may have different knowledge and technical levels. It is necessary to aim that various collaborations were to be performed naturally and easily by as many faculties as possible. For the easy use of satellite systems, easy operation itself is of course necessary but also the necessity of license operator has to be resolved for universities. There was a HUB-VSAT configuration that could eliminate licensed operator at VSAT sites, the examples of which were seen in lower bit rate data collecting systems for the river current observation data and sales data at chain stores.

There was a little concern about the possibility of university's transmission of two 1.5 Mbps signals being initiated by the control signals from the HUB station. It was admitted by the competent authority in the end and the basic design of the structure was fixed where all university's stations were to be controlled by the central station in NIME.

A confirmatory experiment was done as an educational event obtaining cooperation from telecom, satellite communication companies and a group of graduate schools. The proposal for professors or lecturers to operate the equipments was strongly denied. They insisted that they were educators and operation was out of their ideas. There was not enough time for them, it was true, to be accustomed to the equipments. Anyway, the basic function and effects of sharing 1.5 Mbps channels among plural sites were successfully checked.

4. Inter-university collaboration

The idea that professors themselves transmit images and interact in two-way mode with each other in different universities was introduced to the Ministry of Education through the superior of the author. The idea needed repetition of explanation due to the stereotype that the educational application of satellite meant a broadcast education, but it survived and the budget was approved.

By the successive budgets, the system grew to have 150 stations including one mobile wagon station in 123 institutions such as universities, colleges and collaboration centers. This inter-university collaboration system was named as SCS (Space Collaboration System). All the sites could behave with equivalent functions including transmission and chairmanship.

An unknown institution that built up the large system covering many universities often received impolite phrases from authorities or institutions that had been influential over universities, when it explained the system in meetings. The aim of the system remained not well understood by those people in earlier days. The author, however, cannot forget the happiness when the bitter outside researcher spoke in a meeting that this system was useful even though there were many other dull systems before.

In SCS, universities could easily interact with each other, transmitting two 1.5Mbps signals and receiving three. The utilization of the system for a variety of collaboration activities including joint classes and research conferences continued to increase until the peak of 37,000 site × hours in a year in

2003. The system was designed to be connectable anytime like a telephone system when the user wanted and we wanted such operation to be approved. But the reservation eventually became necessary a week in advance because the contract was forced connection by connection considering the attitude of the Board of Audit and it had to be done through a go-between agency. A special advance reservation system was set up with good intentions to support important activities such as 10 or 15 times successive classes for their curriculum or big events like symposium that collected many participants and needed careful preparation. It was sad, however, to find later that it turned to be a source of the reverse rumor that the reservation was needed three months in advance in spite of publicity campaigns.

The faculties themselves, who had been appealing the need of the chances to exchange with other universities or insisted that contents were more important than connecting technologies, seemed to have changed their minds urging now that SCS was just a video conferencing system or that Internet was new technologies but satellite technologies was old. Which was important for them, educational improvement or new technologies? Careful study will be required to enter into projects for universities.

It would have been fascinating for people to manage the big system that covers 150 sites or to organize big activities over that and observing the human competition for the leadership being guided by that fascination was interesting. On the other hand, this design aiming to realize one man operation and for any university to organize activities with many partner universities revealed its effectiveness. Even in a year or two after the start of the operation, one third of the sessions were operated by one lecturer by grace of the carefully designed systems such as the central control system, touch panel monitors for the chairman operation and audio visual system control and a start up button of terminal systems, etc. Two other thirds were also operated by students, colleagues or administrators. A team of ten or twenty members contracted to manage events used to occupy a space in the session room operating the equipments and even the questions and answers were carefully scheduled. It was like living in different age to see inexpert lecturers or students in any university operating all equipments including cameras and switchers and switching around university sites in a pluralistic event even with more than 100 sites.

Fig. 2 SCS antenna

Insufficient lighting, focusing or camera angles were often seen, but these troubles were basic studio techniques and would naturally decrease when we got accustomed. We could be practical about these troubles believing that important was the collaboration activities and accumulated know how.

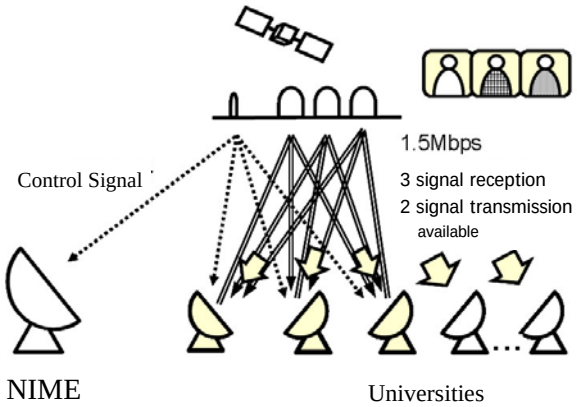

Fig. 3 Session management in SCS

More than 90 times of coordination activities with paralleling Post PARTNERS experiments provided many universities with attractive chances for international exchange activities. Considering the time spent for the patient arrangement and connection and also for the stressful coping with troubles where participants were waiting, it was reasonable for young researchers to demand to explain the relationship with their research or the necessity of their cooperation. An elder researcher who had lesser expectation in research cooperated many times, but watching at the backstage the brightening eyes of young students in exchange activities was somehow rather pleasant.

Fig. 4 International educational collaboration in the SCS studio

Being supported by many professors and faculty staffs, SCS had been used for a variety of inter-university collaborative activities of more than 23,700 hours and 159,000 site × hours for 13 years from its opening. The half of the activities was joint classes, and symposium and seminar activities followed. Students were stimulated in exchange activities with other university students or professors, and lecturers themselves could learn many things from other university classes. A breath of a fresh air came into traditional classes where students learned from a fixed lecturer in a closed class. Easy inter-university collaboration made cooperative research activities more effective. Research work is important for university professors. And many faculties could experience distance educations and inter-university collaborations that only limited people could experience before. These results were believed to have brought down good effects on the improvement of educational quality in universities.

5. Summary

The standardization of H323 and MPEG4 was done in 1998 and 1999, respectively. The Internet population coverage reached 30% and ADSL services started in Japan in 1999. The approval of credits for media based education was admitted in 1998 and the credit for Internet-based classes was also admitted in 2000. PC technologies advanced and the Internet use became popular sharply around 2000. In these circumstances, the SCS use began to decrease after its peak in 2001. And the system was closed in March, 2009, after having been used for a variety of collaboration activities over 159,000 site × hours as a result, with a slight concern if it was truly understood by people as was the system for inter-university collaboration and not for distance education.

The collaborative learning that students of different level and experience give effects to each other and can reach higher level of learning than those who learn independently is attracting many people recently for its effects and importance. The aim of SCS was to realize the environment where the same collaborative activities as were performed in a classroom were easily and naturally possible in a group of universities, between universities having different ideas, different specialty and different demography.

As the European Commission started the project focusing inter-organization collaboration in 2006 noticing that brainstorming or team design activities yielded higher creativity, the collaboration itself remains an important concept. The advent of new concepts are expected regarding the collaboration and the satellite application.

Reference:

Kimio Kondo, "*Inter-university Collaboration System-10 years of SCS and the Future*", Information Processing Society of Japan (IPSJ) Magazine, Vol.49, No.04, pp.450-457, 2008.