

Pacific Association for Clinical Training: e-Learning Telecommunication Infrastructure Assessment in the U.S.-Affiliated Pacific Islands

Christina Higa, MA

Address correspondence and reprint requests to: Christina Higa, MA, Associate Director, Telecommunications and Information Policy Group (TIPG), and Director, Pan Pacific Education and Communication Experiments with Satellite (PEACESAT) Social Science Research Institute, University of Hawai'i at Manoa, 2424 Maile Way, Saunders Hall 713, Honolulu, Hawai'i 96822-1192; christina@tipg.net.

Abstract

This article summarizes the key points of a technology and telecommunications infrastructure assessment conducted by the University of Hawai'i Telecommunications and Information Policy Group (TIPG) in partnership with the Pacific Association for Clinical Training (PACT). It includes an overview of telecommunications infrastructure and services in the U.S.-Affiliated Pacific Islands (USAPI) jurisdictions. The objective is to review the technical capacity, in the USAPI, to support PACT e-learning programs and activities. Telecommunication infrastructure is fundamental for successful and sustainable e-Learning programs. This article outlines the capabilities that may be available for multipurpose uses including health, education, research and other public service applications. (PHD 2007 Vol 14 No 1 pp 89-97)

Introduction

The Pacific Association for Clinical Training (PACT), in planning for the most effective and efficient means of delivering health-related education and training programs in the U.S.- Affiliated Pacific Islands (USAPI), recognized that delivery of these programs through e-Learning may potentially increase program distribution and participation. However, major constraints of e-Learning in the USAPI involve Information Communication Technology (ICT), particularly in telecommunications capacity, access and cost. In order to plan for the development and implementation of appropriate and innovative e-learning modules, PACT, in partnership with the Telecommunications and Information Policy Group (TIPG) of the University of Hawai'i (UH), conducted a technology and telecommunications assessment in the USAPI.

The information collected from the assessment is useful for the planning of health education and training and also for improvement in the facilitation of public service network development across various user sectors. These sectors include, but are not limited to, health, education, and government. There are several successful examples of multipurpose and shared networks in the Pacific Islands. These examples include partnerships

between health and education agencies that facilitate the sharing of telecommunications equipment, service costs, and skilled human resources for the operation and maintenance of the technical infrastructure and systems.

Components of Effective e-Learning Programs

There are many factors that contribute to effective e-Learning activities in any sector. This article does not address all of them. Some factors will briefly be discussed and will identify where technology fits into the overall objectives of e-Learning. Successful implementation requires an institutional framework that will address partnerships, accreditation, and certifications among and between education, health and/or professional institutions; an institutional business plan for sustainability, including faculty/teacher compensation, participant registration, support, and program overhead; intellectual property rights; and, finally, the management of learning and teaching objects. Many of these factors require institutional leadership support, individual faculty/staff champions, and resources.

Since e-Learning generally means that the learner and the teacher are in different locations, it is essential for the content, focus, and topics to be relevant, appropriate, and adaptable to the learner's environment (e.g., culture, way of doing things, laboratory conditions, availability of supplies and equipment). In developing e-Learning courses, pedagogy and e-Learning instructional design need to take into consideration the technical capacity of the hosting institutions and learner. The application of educational technology in teaching is more than

knowing how to use a computer. It is also knowing how to incorporate appropriate computer applications to enable and enhance learning. Technical infrastructure is an important fundamental prerequisite that plays a role in determining the appropriate and optimal e-Learning modality. This article has a primary focus on the available technical infrastructure to support public service applications in the USAPI.

Varying Levels of Development and Funding Support

The level of development, accessibility, and affordability of telecommunications services for distance learning varies dramatically across the USAPI jurisdictions. There are several U.S. federal government programs that support the development of public service telecommunications networks and services. Some of these programs include the National Telecommunications and Information Administration of the U.S. Department of Commerce, the Rural Utilities Services of the U.S. Department of Agriculture (Rural Development), and other programs of the U.S. Department of Education and U.S. Department of Health and Human Services. There is also the U.S. Universal Service Fund that, unlike these federal discretionary funding programs, is not subject to annual scrutiny via U.S. Congressional appropriations.

U.S. Universal Service Fund and Program

The Telecommunications Act of 1996 established the U.S. Universal Service Fund and Program. This is one of the major contributing factors in the recent expansion and sustainability of networks for health and education. The Universal Service Fund and Program is funded via mandated contributions from all interstate telecommunications service providers in the United States. There are four major areas of the program: High Cost (to assist telecommunication carriers that provide service in rural and expensive-to-serve areas); Low Income (to assist low-income consumers with basic telephone services); Rural Health Care (to assist health care facilities in rural areas) and Schools and Libraries (to assist schools and libraries gain access to more affordable services).

Schools and Libraries Program – Educational Rate (E-Rate)

The Pacific Island U.S. Territories have received significant funding for telecommunications network infrastructure and services from the Schools and Libraries program, otherwise known as the E-Rate

program. Since initiation of the program in 1998 to 2005, American Samoa has received a total of \$15 million U.S. E-Rate funds; Guam received nearly \$19 million and the Commonwealth of the Northern Mariana Islands (CNMI) received about \$8.5 million. With this level of funding support, the telecommunications infrastructure and services have improved dramatically. Every public and private school in American Samoa has connectivity to the Internet and video teleconferencing (VTC) services. Guam and CNMI, through the U.S. Universal Services Fund, have developed robust networks for elementary and high schools, and libraries.

Rural Health Care Program

The goal of the U.S. Universal Service Rural Health Care Program (RHCP) is to ensure equal access to affordable telecommunications services for rural health care providers. Generally it is more costly and not financially profitable to develop telecommunications infrastructure in rural areas. This is because of the large geographic distances, challenging terrain (e.g., vast ocean) and high cost for the physical infrastructure (e.g., fiber optic, coax cable). Rural areas generally have smaller populations, markets and revenues.

RHCP funding is determined by a rural and urban cost comparison of telecommunications services. Under this program the rural health care provider receives comparable services at the comparable services at the same cost as health care providers in urban areas. RHCP subsidizes the difference between the rural and urban telecommunication rates.

For example, in Honolulu an urban health care provider may pay approximately US\$400 per month for a T-1 (1.533 Mbps [megabits per second]) connection and in the island of Kaua'i (designated as rural) the cost for the same service is approximately US\$1,050 per month. Under the RHCP, the health care provider located in Kaua'i would pay the urban rate of US\$400 and the RHCP would pay the difference of US\$650. This benefits the telecommunications services provider that is paid the full amount of US\$1,050 per month. This program is utilized, in part, to subsidize the State Telehealth Access Network (STAN), which connects nearly 40 health care facilities in the State of Hawai'i.

Health care providers in American Samoa, Guam and the CNMI, however, have not been able to receive

The level of development, accessibility, and affordability of telecommunication services for distance learning varies dramatically across the USAPI jurisdictions.

any benefits from the RHCP, although their telecommunications carriers have contributed to the Universal Services Fund. The first reason was a problem with the Federal Communications Commission's (FCC) definitions of 'urban' and 'rural', developed primarily for states located in the continental U.S. These definitions were not appropriate for the Pacific Islands, given the demographics and geography of the region. The definition for 'urban' included areas with a population of at least 50,000 and access to specialized health care services or advanced medical facilities. Although no communities in the Pacific Islands met this definition, the FCC designated their largest population centers as urban. For example, the entire island of Tutuila in American Samoa, the island of Saipan in CNMI, and the city of Agana in Guam were all designated as urban. Urban areas are not eligible for RHCP funding. In 2003, upon review of the situation and in response to many comments from the Pacific Island constituencies regarding this matter, the FCC created a special provision that designates these jurisdictions as "all rural", however with no urban comparison and therefore no basis to establish an RHCP discount. In 2005, the FCC created a special 50% discount of advanced telecommunications services for health care providers designated as completely rural. Unfortunately, even with the 50% discount, the jurisdictions have not applied for subsidies because of the unaffordable matching costs. A T-1 circuit from American Samoa to Hawai'i, for example, costs \$28,000 per month; half of this amount is still cost prohibitive.

The U.S. Universal Service Program and Freely Associated States

The Freely Associated States (FAS), which include the Federated States of Micronesia (FSM), the Republic of Palau and the Republic of the Marshall Islands (RMI), are not eligible for U.S. Universal Service Program funds. These jurisdictions are not governed by FCC regulation and do not contribute to the U.S. Universal Service funding. The Republic of Palau made attempts to join the U.S. National Exchange Carrier Association (NECA), which would also provide inclusion in the U.S. Universal Service Program.¹ These efforts were associated with terms for renewal of the U.S. Compact of Free Association and Palau's good effort to join NECA never materialized.

The FAS vary in levels of telecommunications infrastructure development, each jurisdiction is in severe need of more accessible and affordable telecommunications services and support. Each jurisdiction has established national ICT policies to address telecommunications

costs existing infrastructure, and future plans for development. However, there are no Universal Services provisions implemented in the FAS.^{2,3,4,5}

National Bioterrorism (BT) Program

Until recently, hospital facilities were lacking sufficient telecommunications infrastructure in both technical and human resources to support basic operations, telehealth, and distance learning. Many improvements are developing in part through national Bioterrorism (BT) funding from the U.S. Center for Disease Control (CDC) and the U.S. Health Resources and Services Administration (HRSA). The BT Program is presently funded for a period of five years. One of the BT Program objectives is to prepare hospitals and health facilities for emergency response and many multi-purpose networks are now being established.

Using bioterrorism funding, the FSM has made a commitment for all hospitals in FSM to support a 64 Kbps (kilobits per second) leased line connection to the Internet through these programs. Local area networks (LANs) are also being implemented in the hospital facilities.

The dial-up connection is very slow with actual transmission speeds that are as low as 8 kbps.

In the Republic of Palau bioterrorism funds were used to establish a first response communication network. This network will be described in more detail later in the article.

Telecommunications Networks and Services

Private Sector, Internet Service Providers (ISP)

In the majority of Pacific Islands the ISP remains a monopoly, with the exception of Guam, American Samoa, and CNMI. In the Freely Associated Pacific Islands, dial-up Internet costs include a monthly fee of approximately US\$10-30 and hourly fees from US\$1.95 to US\$3.60 per account. The dial-up connection is very slow and often much slower than advertised speeds. This slow connectivity increases the cost and prohibits the effective use of many applications. The basic Internet package in Palau cost US\$15.00 per month including 4 hours of usage and US\$2.50 each additional hour.⁶ Palau LocalNet Access provides free access to any servers located in Palau. International Internet access in Palau incurs a per-minute fee. The RMI National Telecommunications Authority charges a basic monthly rate of US\$10.00 and US\$3.50 per hour (no free hours included).⁷ In the FSM, the basic Internet package is US\$19.95 per month with up to 10 hours of dial-up access and US\$1.95 each additional hour.⁸ FSM Telecommunications Corporation (FSMTC)

provides other service packages including a "Home Saver" rate that provides five Internet user accounts for US\$44.95 per month with 30-hours and US\$19.95 each additional hour. The FSMTC also offers prepaid Internet access at \$.08 per megabyte and prepaid email at \$4.95 per month.⁸ A rate structure based on data throughput verses per-minute usage generally provides consumers with a cost savings because the cost is based on actual data transmission and reception and not just connection time. The limited bandwidth and slow transmission speeds could result in long connection times and very little data resulting in the consumer paying more for less data.

If leased line options are available, they are also costly. For example, a 128 Kbps circuit ranges from US\$980 (e.g., FSM)⁸ to several thousand dollars per month (e.g., US\$2,000 in the RMI).⁷ It is reported that information communications technology service fees in the Pacific Island jurisdictions, on average, are five times higher and range up to 20 times higher than in APEC developing economies.⁹

Public Service Networks

American Samoa

American Samoa is advanced in terms of ICT infrastructure, partnerships, and programs. Their advanced level is partly due to the establishment of a consortium of government agencies specifically focused on sharing ICT resources. This consortium has leadership with a clear vision of the importance and potential benefits of ICT. American Samoa leadership has prioritized and developed ICT capacity-building programs for local management and operations of the networks.

American Samoa Distance Education Learning and Telehealth Applications (ASG – DELTA) Consortium

The ASG DELTA Consortium is made up of all major government agencies and educational institutions. The American Samoa Telecommunications Authority (ASTCA) donated a 384 Kbps circuit from LBJ Tropical Medical Center to the TIPG/PEACESAT (Pan Pacific Education and Communication Experiments by Satellite) Network Operations Center (NOC) at the UH. This link is dedicated to public service applications including e-Learning, e-Health, and e-Commerce. The link also interconnects the American Samoa Community College (ASCC), government agencies, American Samoa Power Authority, and Pacific e-Commerce Development Corporation (eCDC).

American Samoa Community College

The ASCC campus is connected to the Internet through a local area network. There are four VTC locations that utilize Polycom and PictureTel H.323 codecs. The systems are located in their Departments of Nursing and Continuing Education, and Small Business Development Center and offices.

ASCC is a member of the DELTA Consortium and currently has four strands of single mode fiber on the DELTA/PEACESAT Network. Through the DELTA connections, ASCC receives interactive video, audio, and data services.

American Samoa Department of Education

The E-Rate Network of the American Samoa Department of Education interconnects all public and private schools and the public library. This connection is established through a high-speed fiber optics network on Tutuila Island at 135 Mbps rates. The other islands of Manu'a and Aunu'u are connected via microwave at T-1 speeds that can support up to three simultaneous VTC sessions operating at 384 Kbps.

Pacific eCommerce Development Corporation (Pacific eCDC)

The Pacific eCDC is a 501(c)(3) private non-profit corporation focused on education and charitable economic development through eCommerce business development. Pacific eCDC is an instrumental partner in the design and development of ICT training, computer literacy and e-Learning practices and theory courses, and works in collaboration with the DELTA Consortium, Department of Education, ASCC, and UH TIPG.

This prioritization enables quality video conferencing at a defined rate and allows for reallocation of bandwidth for data in the absence of video conference in sessions.

Commonwealth of the Northern Mariana Islands CNMI Public School System

The CNMI Public School System (PSS) has benefited tremendously from the U.S. Universal Service's School and Libraries Division E-Rate Program. The current CNMI PSS E-Rate Network consists of T-1 connections between Tinian and Saipan, Rota and Saipan, and Saipan and Honolulu. The CNMI PSS E-Rate Network is very robust with a Gigabit Ethernet fiber optic backbone. The hub is connected to 1 Gbps Ethernet segments with a maximum of four nodes per segment. There are two T-1 connections off-island (to TIPG/PEACESAT at the UH) for H.320 video conferencing and Internet access.

Northern Marianas College

The Northern Marianas College (NMC) supports

three fully-equipped computer classrooms on Saipan and computer labs on Tinian and Rota. For VTC, an asymmetric Digital Subscriber Line (DSL) 384 Kbps is used. The quality of the VTC varies as it utilizes the commodity Internet.

Guam

Guam Public School System (GPSS)

The GPSS has an E-Rate Network which consists of two T-1 lines to Honolulu and fiber connectivity between all schools. The GPSS network is primarily a fiber-based 100 Mbps Ethernet network with an ATM (Asynchronous Transfer Mode) backbone. ATM is implemented for off-island T-1 links to provide certain levels of service, such as H.320 video conferencing priority over data. This prioritization enables quality video conferencing at a defined rate and allows for reallocation of bandwidth for data in the absence of video conference sessions.

University of Guam (UOG)

The UOG's Computer Center routes multiple T-1's around the campus and to the public Internet but most of the Micronesian islands are serviced by the Telecommunication and Distance Education Operation (TADEO). The UOG's TADEO is equipped with multiple PEACESAT earth stations that are capable of interactive VTC and digital data services. TADEO has an Accord multipoint conferencing unit that supports ISDN (Integrated Services Digital Network) connectivity primarily for on-island use as international ISDN circuits remain costly (US\$86 per hour per 128 Kbps). TADEO's telecommunications infrastructure enables cross connection of various networks in the Asia-Pacific region. The PEACESAT NOC at TADEO connects the Guam Education Network to the Pacific Islands PEACESAT locations. UOG PEACESAT has an operations staff that facilitates daily programs and manages network scheduling and program requests.

Federated States of Micronesia

College of Micronesia, FSM

The National Campus in Palikir has a 768 Kbps global leased line connection through FSM Telecom for Internet services. This connection is shared with all state campuses for Internet services, each of which have a 128 Kbps domestic leased line connection to the National Campus through FSM Telecom for Internet connectivity.

FSM State Departments of Education Yap State, FSM

There is a 384 Kbps connection from the Yap Department of Education (Yap DOE) Technology Center to FSM Telecom. There is also a 64 Kbps circuit from Ulithi High School to the Technology Center. FSM Telecom has a 256-Kbps international link for dial-up Internet services. The hospitals, clinics, public library, and historical preservation office are incorporated into the Yap DOE wide area network (WAN) design.

Pohnpei State, FSM

At the time of this writing, Pohnpei State DOE consists of 30 schools of which five have dial-up access to the Internet through FSM Telecom. The schools with dial-up Internet access are: Pohnpei Island Center School, Kolonia Elementary School, Ohmine Elementary School, Sokehs Pha Elementary School and Wone Elementary School. There is no WAN connecting the schools and administrative offices. A high frequency (HF) radio system is available for communication to the outer islands. There is a joint project between DOE and TADEO (mainly Mr. Bruce Best) to implement HF radio email systems in the outer island schools.

Kosrae State, FSM

Kosrae has a total of seven public schools (one high school and six elementary schools). All schools, with the exception of Walung Elementary, have computer labs that are networked and have a minimum dial-up Internet service. Walung is located in the westernmost region of Kosrae and does not have terrestrial telephone service. Communication between Walung Elementary and the DOE is made through the principal's cellular telephone.

Basic FSM Telecom Internet service is used at a cost of US\$19.95 per month; after 10 hours, a usage fee of US\$1.95 per hour is assessed. Many schools go over the 10-hour-per-month allocation. According to the DOE Information Technology (IT) Director, Mr. Lugo Skilling, a summary of the number of computers in Kosrae's DOE schools is as follows: Kosrae High School (30 personal computers [PCs], 128 Kbps shared through COM [College of Micronesia]), Lelu Elementary School (14 PCs), Tafunsak Elementary School (12 PCs), Malem Elementary School (7 PCs), Utwe Elementary School (12 PCs), Sansrik Elementary School (8 PCs) and Walung Elementary School (2 PCs). Each school has approximately one staff designated to cover ICT matters.

Chuuk, FSM

The Department of Education oversees 32 schools (two

PEACESAT reliability issues include interruption of services due to intermittent problems with the satellite, earth station equipment, or operations.

high schools and 30 elementary schools). Total student population is approximately 16,673. Chuuk High School has two computer labs consisting of 16 PCs and a dial-up Internet connection. Chuuk High School has a student population of 1,236 and 51 teachers with one computer lab staff. The other schools do not have computer labs or access to the Internet.

Republic of the Marshall Islands PEACESAT Consortium

Although telecommunications access is limited and costs are high in the RMI, a consortium of PEACESAT users, consisting of Majuro Hospital, College of the Marshall Islands, Emergency Management Office, and Pacific Resources for Education and Learning (PREL), has taken advantage of various e-Learning programs. This PEACESAT Consortium was established to support data and VTC using the PEACESAT system. VTC services are available at the Majuro Hospital (Telemedicine Room), College of the Marshall Islands (IT Division) and the PREL Service Center.

Majuro Hospital

The nurses, physicians, and health care providers of Majuro Hospital are ranked as the highest users of the PEACESAT interactive VTC services. Some of the programs delivered by various health care providers and educators include Continuing Medical Education (CME) and Grand Rounds. Examples of CME topics are Treating Motor Fluctuations in Parkinson's Disease, Retinopathy of Prematurity, Skin and Wound Care Treatment, and Geriatric Care. Other examples of health-related programs include the RMI Diabetes Program, Pacific Deaf and Blind Advisory meeting, E Ninau Aku I Ke Kauka (Ask a Doc), and the Pacific HIV/AIDS teleconference.

Leroj Kitlang Memorial Health Center, Ebeye

The Ebeye Health Center provides an excellent model for collaborating in developing network infrastructure and maximizing resources. The Ebeye Health Center, through a U.S. Department of Interior (DOI) grant, upgraded a PEACESAT earth station in 2006. The system now supports interactive VTC and a computer lab consisting of 10 computers donated by the U.S. Department of Health and Human Services (DHHS) Office of Public Health and Human Services, Region IX Office of the Regional Health Administrator, and is being coordinated with the World Health Organization (WHO) distance education initiatives in the Pacific. UH's TIPG and PEACESAT worked with DHHS Region IX in transferring and refurbishing the computers with

Ubuntu open source Linux-based software. After careful consideration of the available budget, and applications and computer support in Ebeye, it was decided, together with the Ebeye Health Center Administration, that free, open source software was appropriate. The computers are used in a lab environment and so, in the event that something should go wrong, it will be easier to reinstall the complete Ubuntu program rather than require a skilled computer specialist to reconfigure it. The Ebeye Health Center will evaluate whether the Ubuntu open source software meets their needs and applications. To further leverage resources, two Carnegie Mellon University student consultants, through the Technology Consulting in the Global Community Program, provided extended 10-week training for Health Center staff on the use of

the computer lab, VTC and network operations and maintenance. The Health Center was only required to pay for the students' accommodations. The collaborating partners included the DOI, which funded the PEACESAT system upgrade, the DHHS Region IX Office, which donated the laptop computers for the lab, TIPG / PEACESAT, which installed the systems and provides telecommunications services for voice and data at no per-minute fee, and the Carnegie Mellon

University's student consultant program that provided the ongoing training. This is a very good example of synergy in planning, coordination, collaboration for increasing the overall value of funds and effort. Ebeye Hospital health professionals actively participate in diabetes collaborative projects and other CME programs by VTC.

Republic of Palau Palau National Hospital

Through the use of Bioterrorism Preparedness funding, the Belau National Hospital has implemented an improved first response system utilizing HF and very high frequency (VHF) radio systems. The emergency and ambulatory communication systems have extended reliable communication coverage. There is also an extension of HF radio communications to dispensaries in remote areas. Most impressive is the interoperability between the dispensaries, the Hospital, National Emergency Management Office, Fire Department, Police Department, the Airport, Quarantine, Customs, Immigration, Environmental Health, Koror State Rangers, and Marine Law (D. Rykken: personal correspondence, 2005 Apr 11).

Palau Area Health Education Center (AHEC)

The Palau Area Health Education Center (AHEC) conducts effective regional distance learning using

Always in parallel to assessing enabling technical infrastructure, an assessment of human capacity and resources in support of the networks and systems is critical.

audio telephone conferencing. The Palau AHEC is a collaboration for “in-country and community-based¹⁰ postgraduate family practice for Micronesian physicians”. Commercial audio teleconferencing is used for regional telephone conferences. The cost generally includes a per-hour fee of approximately US\$15 - \$20 for use of the audio conference bridge. The participants pay for the long distance per-minute charges to the bridge. Visual media, such as PowerPoint presentations, are often emailed in advance and played locally.

Palau Community College

The Palau Community College (PCC) has limited Internet access available to students and faculty. PCC utilizes three DSL circuits from Palau National Communication Corporation (PNCC) for Internet services. The main DSL 128 Kbps circuit connects a total of 149 workstations. The library and federal programs share another 128 Kbps DSL circuit that connects 66 computers. Finally, the Financial Aid Office and College President share a 192 Kbps circuit that connects 25 workstations. San Diego State University (San Diego, California) works with PCC in delivering on-line Bachelor of Arts (BA) and Master of Science (MS) programs.

Palau Ministry of Education

Seventeen of the 20 public schools in Palau connect through the Ministry of Education (MOE) gateway, at 192 Kbps, to the PNCC. An Internet café, at 128 Kbps, and the MOE, at 64 Kbps, share the same HDSL (High bit-rate Digital Subscriber Line) telecommunications connection to PNCC. There is a wireless network connection between MOE and Palau High School. Four public elementary schools connect to the MOE by 768 Kbps DSL while the other 13 use 56 Kbps dial-up.

Regional Networks in USAPI – PEACESAT Network and Cross-Connections

The Pan Pacific Education and Communication Experiments by Satellite (PEACESAT) is a satellite telecommunications network that supports distance learning, telehealth, and other public service applications. There are no per-minute fees to use the service that includes narrowband interactive VTC, voice conferencing, and access to the Internet. The Network provides access to affordable services. At times there are interruption of services due to intermittent problems with the satellite, earth station equipment, or operations. PEACESAT headquarters at the UH works with the National Aeronautics and Space Administration (NASA) and the National

Oceanic and Atmospheric Administration (NOAA) in the maintenance of the satellite and space segment to minimize interruption of services. Other issues include the reliability of the local operations managed by the organizations hosting the PEACESAT earth stations. These stations are primarily in education, health, or emergency management agencies. Some jurisdictions are able to provide more reliable services than others. PEACESAT is looking to improve the overall reliability of network technology and support resources. This effort requires local commitment and continued collaboration.

The network capacity within the USAPI jurisdictions varies and the PEACESAT Network is constrained by the limited total capacity. PEACESAT's role in those jurisdictions with robust networks is to assist in coordinating programs that may be supported by these networks. For other locations without robust networks, PEACESAT's primary role is to assist them in obtaining additional bandwidth and utilizing the available limited resources.

PEACESAT/TIPG Network Operations Center (NOC)

The PEACESAT/TIPG NOC maintains a full, 7-day-per-week operation schedule for facilitating video and audio teleconferences, network cross-connections, network scheduling and monitoring, and technical support. The NOC operates two-multipoint VTC bridges that enable the cross-connection of direct network links (PEACESAT, Hawai'i State Telehealth Access Network (STAN), and the Pacific Partnering Networks), and switched networks using ISDN or Internet protocols (IPs). The PEACESAT/TIPG NOC enables cross connections to UH network links including: University of the South Pacific in Suva, Fiji; via the Australia Academic Research Network (AARNET; 155 Mbps); the Asia Pacific Advanced Network in Japan (APAN; 155 Mbps); and the Internet2, based in the U.S. (10 Gbps).

World Health Organization (WHO) Pacific Open Learning Health Net (POLHN)

There are several health centers in the Pacific Islands that have received funding through WHO's Pacific Open Learning Health Net (POLHN) Project, for a computer laboratory with Internet service. The program supported the first year of Internet service fees. POLHN Centers in the USAPI are located in Palau, Majuro, Yap, Pohnpei, Kosrae, and Chuuk.¹¹ There are approximately 12 Windows XP Professional operating system computers in the lab running off a 56 Kbps leased line from local

In order to achieve a successful collaborative e-Learning program in the Pacific Islands region, some resources must be reserved for ICT capacity building.

telecom carriers. In general, each laboratory is open for use by hospital staff and the community at large during normal hours of operation.

Open Source Course Management System – Moodle (Modular Object-Oriented Dynamic Learning Environment)

Telecommunications network infrastructure is a fundamental requirement to successfully support e-Learning activities. There are other systems that further support and enable e-Learning, such as course management systems. Moodle is a very powerful open source eCourse management tool that has similar functions as commercial products, such as WebCT and BlackBoard. Moodle is open source, meaning that there is no cost for software or licensing fees.

Implementing any on-line eCourse management system may be problematic for Pacific Islands with limited Internet bandwidth. In these cases, managing local Moodle servers is ideal for local programs, but it may be difficult to support regional programs that need synchronized course materials. Synchronizing the eCourse management systems is difficult since they do not have the ability to update local cache servers through remote updates. PACT, the American Samoa Pacific ICT Academy (PICTA), and the CNMI Public School System implemented Moodle. Course material, such as syllabi, PowerPoint presentations, handouts, video clips and web references, are all stored on Moodle. Moodle also includes interactive discussion forums, an online quiz creator, a grade book, a calendar, and many other features that make it easier to manage an e-Learning course.

Discussion

The effective application of ICT provides a potential avenue for increased connectivity to information and resources in the Pacific Islands. Moreover, there are associated benefits in terms of local, regional, and international e-Learning, e-Health, and economic development opportunities.

This article summarizes some of the existing telecommunications networks in the USAPI that support interactive VTC and Internet services for e-Learning, e-Health, and other public service applications. These networks include: Pacific Partnering Networks – American Samoa DELTA Network, American Samoa E-Rate Network, CNMI E-Rate Network, Guam PSS E-Rate Network, and the PEACESAT Network. These networks are able to cross connect to other educational institutions in the Asia/Pacific region, such as the University of Hawai'i, University of the South

Pacific, National University of Samoa, and others through VTC bridging services from the UH TIPG/PEACESAT. It is important to note that these networks do not incur per-minute fees, as they are primarily based on IP technologies and not ISDN. Affordable telecommunications is a critical component in the sustainability of e-Learning programs. However, it is also important to carefully analyze network capacity and operations because quality of service of IP-based VTC and other high bandwidth intensive applications will also impact the quality of the e-Learning program.

Although there are several reliable networks with good connectivity for interactive VTC and Internet services, access to these services from the Pacific Islands is still a major challenge and concern. It is important to recognize that there are some very innovative projects and ideas for bringing connectivity to remote areas or outer islands and islets. Some of these are projects using technologies such as HF radio, and weather systems (e.g., Emergency Managers Weather Information Network – EMWIN, or Radio and Internet Communications – RANET) for e-mail and transmission of other information. Last mile solutions may include telephone lines with HDSL technology, coaxial cable, electric power lines (power line communications), and wireless technology. It is recommended that anyone interested in developing an e-Learning program continue to pursue a multimedia approach to e-Learning in the Pacific Islands where there are varying levels of development.

Access and affordability of reliable telecommunications services is a primary challenge. This is in part due to limited market size, lack of infrastructure, and, in some cases, outdated telecommunications policy, regulatory regimes, and government-owned telecommunication monopolies. Some USAPI jurisdictions have initiated telecommunications policy reform to enable sustained development of local and regional network infrastructure and market liberalization. It will require several years for policy transformation to directly impact quality of service, access and cost. However since this is a critical issue in the implementation of successful e-Learning programs, following, supporting and advocating policy development and change is important, not only to the private sector, but also the public sector.

Finally, in order to achieve successful collaborative e-Learning programs in the Pacific Islands region, some resources must be reserved for ICT capacity building. There is, however, an opportunity to use available network infrastructure and, in parallel, provide local education and training in the design, development, and

delivery of e-Learning programs in the Pacific Islands region.

References

1. Republic of Palau Office of the President. Press Release: Palau and the United States hold annual bilateral consultations. Koror, Republic of Palau; June 25, 2003. Available from: <http://www.palaugov.net/president/press.html>.
2. Federated States of Micronesia Telecommunications Corporation. 2006 – 2011 Strategic Plan. Pohnpei, FSM: Federated States of Micronesia Telecommunication Corporation Board; 2006.
3. Susaia AH. National Policy on Telecommunication for the Federated States of Micronesia, Final Draft. Pohnpei, FSM: Office of the Secretary, Department of Transportation, Communication and Infrastructure, Federated States of Micronesia; 2004.
4. Remengesau TE Jr, President, Republic of Palau. Executive Order No. 193 – Established the Communications Information Technical Advisory Group (CITAG) to develop a comprehensive 5-year Information and Communications Technology (ICT) plan, Economic Development Plan, FY2002 – FY2006. Melekeok, Republic of Palau; 2001.
5. Division of Transportation and Communication, Ministry of Commerce, Republic of Palau. Information and Communications Technology (ICT) 2003 Plan. Melekeok, Republic of Palau; 2003.
6. Palau National Communications Corporation [webpage on the Internet]. Koror, Republic of Palau; c.2007 [cited 2007 Feb 10]. PNCC Service Rates; Available from: <http://www.palaunet.com/pdf/PNCC%20Toll%20Services%20&%20Rates.pdf>.
7. Marshall Islands National Telecommunications Authority [webpage on the Internet]. Majuro, Republic of the Marshall Islands; c.2006 [cited 2007 Feb 10]. Marshall Islands NTA Services and Rates; Available from: <http://www.ntamar.net/>.
8. Federated States of Micronesia Telecommunications Corporation [webpage on the Internet]. Pohnpei, Federated States of Micronesia; c.2005 [cited 2007 Feb 10]. FSMTC Internet Rates and Information; Available from: <http://telecom.fm/internet/rates.htm>.
9. Guild RL. Pacific Island States. In: Riding the waves of change: transforming the digital divide into digital opportunities. Yoon C-S, Akhtar S, Charron C-Y, Hoon MNL, editors. Digital Review of Asia Pacific 2003/2004 [serial on the Internet]. Asia Pacific Development Information Programme of the United Nations Development Programme, Pan Asian Networking Programme of the International Development Research Centre, Orbicom, Southbound, publishers. 2003. Available from: http://www.digital-review.org/03_Pacific_Island_States.htm.
10. Dever G, Finau SA, McCormick R, Kuartei S, Withy K, Yano V, et al. In-country and community-based postgraduate family practice training for Micronesian physicians—the Palau AHEC: a collaborative effort. *Pac Health Dialog*. 2002 Mar;9(1):141-5.
11. POLHN [webpage on the Internet]. Suva, Fiji Islands: Pacific Open Learning Health Net; c.2006-2007 [cited 2006 Jul 25]. World Health Organization Office of the Western Pacific Region. Available from: <http://polhn.org/files/Polhncd.html>.

13 years ago in Pacific Health Dialog, S. A. Finau, stated, “Pacific men must be domesticated. This can be easily done if children to whom women have had the most access, are socialised to new gender roles.” PHD, 1995;2(1):101.