

THE PACIFIC ISLANDS TELECOMMUNICATIONS AND INFORMATION INFRASTRUCTURE. LEAP FROG OR WIDENING GAP?

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1. ABSTRACT

This paper explores the telecommunications and information infrastructures of the microstates of the Pacific Region and analyzes its implications for the ability of these countries to participate in the emerging Global Information Infrastructure (GII). Specifically, this paper explores the question of whether the recent telecommunications developments will enable Pacific Islands countries to "leap-frog" into the GII or whether narrowband networks and services will continue to be the dominant but "backroad" GII interconnection for the Pacific Region.

2. INTRODUCTION

There is considerable dialogue in developed countries about the ongoing convergence of computing, communications, and entertainment technologies, and the development of "National Information Infrastructures" (NII). These discussions often focus on the continuing revolution in telecommunications and information technologies and the role of the NII in economic and business development; consumer services such as entertainment, video on demand, and interactive multimedia; and, public service applications such as distance education and telemedicine. The underlying assumption of these dialogues is that bandwidth via optical fiber cable, direct broadcast terrestrial and satellite services, and any other emerging and appropriate technology, will be available to carry the market and application requirements inexpensively.

The discussions within the developed nations are parallel to discussions at the regional and international forums focused on the interconnection of the country NII networks to form a "Global Information Infrastructure." Meetings of the G7, Asia-Pacific Economic Cooperation (APEC), Asia-Pacific Telecommunity (APT), and other regional and international organizations have had many discussions on the development of a GII. These regional and international organizations are addressing the many issues of international cooperation, development communications, trade liberalization, and standards.

The continuous revolutionary developments in technology, coupled with the deregulation of telecommunications within nations, trade liberalization of telecommunications among nations, and the dialogues over national and global information infrastructures have encouraged some Pacific Islands observers to suggest a possible "leap-frog" in the telecommunications and information infrastructure by the Pacific Islands Region, even to a

point beyond the developing countries of the Pacific Rim.(1) While it is hopeful that a leap-frog will occur, there are many policy, market, and other barriers that will have to be overcome to allow such a desirable progression into the future.

The purpose of this paper is to explore the telecommunications and information infrastructures of the microstates of the Pacific Region and the implications for the ability of these countries to participate in the emerging Global Information Infrastructure. Specifically, this paper explores whether the recent telecommunications developments will result in a "Pacific leap-frog" into the GII or whether narrowband networks and services will continue to be the dominant but "backroad" GII interconnection for the Pacific Region. The paper reviews developments in the Pacific Region in relationship to world wide trends, discusses barriers to development of an information infrastructure, identifies public service telecommunications as an area for priority development and suggests an agenda for policy makers in the Pacific Islands Region.

3. THE PACIFIC ISLANDS REGION

A brief review of the Pacific Region is appropriate since it is sometimes difficult to comprehend the extent of the vast distances, small island land masses and populations, and huge differences between the smallest and the largest countries of the region.(2)

The Pacific Region as shown in Figure 1 consists of thousands of islands scattered throughout the Pacific. The vast physical distances among these countries is best illustrated by looking at the water area of the region about 54 million square kilometers or 21 million square miles of ocean. The Pacific Ocean covers one third of the world and the small land masses of the Pacific Islands together with their Exclusive Economic Zones (EEZ's) of surrounding ocean are larger than the land masses of the continental United States and Latin America combined.

Table 1 shows at a glance, the population, land area, sea area, and political status of the Pacific microstates. The table shows the relative small populations and vast sea areas in the region. Papua New Guinea (PNG), Fiji and the Solomon Islands are the most populous countries of the region and have over 80% of the region's population.

Table 1 also shows the great differences between Pacific countries. Papua New Guinea, for example, has a land mass of 462 thousand square kilometers and a population of 4.2 million people compared with Niue with 259 square kilometers and a population of 2,500. The countries, in general, are not well endowed with natural resources and are very dependent on foreign aid. Some exceptions are Papua New Guinea, because it has diverse and rich resources, and Nauru because it has low population and very high per capita incomes due to its rock phosphate resource. The economies of most Pacific Countries are based on subsistence agriculture and fishing with pockets of export potential in mining, deep sea fishing, tourism, small scale manufacturing, and some specialized agricultural products. Many of the smaller countries are without any natural resources except the ocean surrounding them.

Nearly all Pacific countries are dependent on foreign aid, which on a per capita basis across the region, is the highest in the world. Dependence on foreign aid is itself an issue both for donors as well as for recipient countries. There are large differences in the relative abilities of Pacific countries to absorb this aid effectively and growing signs of aid fatigue are evident among donors. It is clear that not many Pacific countries will be able to continue even their current low growth rates should the donor countries continue to retreat from the region.

It is useful therefore to differentiate the Pacific countries according to their relative ability to build a potentially viable economy at current or reduced levels of aid. One key indicator in this regard is their ability to develop their telecommunications infrastructure and integrate it with the GII.

4. DOMESTIC AND INTERNATIONAL TELECOMMUNICATIONS IN THE PACIFIC REGION

The domestic and international telecommunications infrastructures of the Pacific countries have improved dramatically over the past 20 years, although a few countries continue to lag behind in their domestic communications particularly as measured in telephone lines per 100 of population.

4.1 DOMESTIC TELECOMMUNICATIONS

The progress in the development of the telecommunications infrastructure in the Pacific Islands Region has been a priority, during the past two decades, for governments and regional institutions, such as the South Pacific Forum Secretariat. Before the prioritization, the general telecommunications environment of the Pacific Region can only be described as primitive. There were very few switches and telephones and most inter-island links were by HF radio, often of World War II vintage. Satellites were not used for domestic communications because Intelsat, the dominant satellite operator, at that time, provided only for international services. Today, a survey would reveal a dramatic improvement in both domestic and international telecommunications and the information infrastructure as a whole.

Table 2 shows the service level deployment of lines for telephony service and government ownership. The table also shows that several of the Pacific countries have a significant number of main lines per 100 of population and nearly all of the countries have established digital switches in their main urban centers. Table 2 also shows that the ownership of the telecommunications infrastructure generally remains in the hands of government or government corporations. The Commonwealth of the Northern Mariana Islands (CNMI) and the Republic of the Marshall Islands (RMI) are notable exceptions. Telephone companies in the CNMI are completely privately owned and in the RMI the National Telecommunications Authority is also a private corporation with 30% of the shares owned by government.

4.2 INTERNATIONAL TELECOMMUNICATIONS

International telecommunications in the Pacific Region have also improved dramatically during the past 20 years. The Pacific countries almost without exception have replaced old HF radio serving international routes with satellite services, most of which have already been converted to digital carrier technology. Submarine cable systems which provide international connectivity to some island countries are mostly the incidental landings of intercontinental cables installed to carry trans-Pacific traffic. These links traditionally have provided excellent service to a few fortunate Pacific countries but their numbers are shrinking as new technology cables span greater distances, minimizing landings for shore based service facilities.

Table 3 shows the submarine cables that have been deployed or planned. Many more are in the North rather than in the South Pacific. Figure 2 shows the submarine cable network in the Asia-Pacific Region in the 1980's and Figure 3 shows the optical fiber submarine cables that are planned or in service. Together, these figures show that the only countries in the region that are served by submarine cables are Guam, Fiji and Papua New Guinea. The CNMI is expected to have fiber connectivity in 1996 that will link Saipan, Tinian, and Rota to Guam. (3) Palau is in the process of investigating the possibility of a fiber connection.

An interesting situation that will come about with the further installation of submarine fiber cables is the retirement of copper cables. As this process proceeds, there will likely be a reduction of countries that will have cable access. Fiji and PNG, for example, may be in danger of losing their cable feeds since it is no longer necessary to land the new technology cables as often for power feeding and maintenance access. The economic cost of landing the fiber cables has not been justified by the small communications markets in these Island Countries.

Satellite communications have been, and will continue to be for the foreseeable future, the principal international telecommunications infrastructure of the Pacific Region. (4) Intelsat is the almost exclusive satellite carrier of public telecommunications in the Pacific and has full Pacific coverage through its global and hemispheric satellite footprints. Although there are many commercial satellites with footprints covering parts of the Pacific these new satellites are not being used by Island Countries for their public telecommunications networks, and little if at all for other services. None of the high power spot beams on any of these satellites is primarily focused on the Pacific Region for obvious market reasons.

The new satellite technologies likely to impact soon on the Pacific are the Low Earth Orbit (LEO) systems. However, it appears likely that these systems will not be designed for broadband applications. As such, they will not be able to replace the missing high power spot beams from the geostationary satellites and so will not be capable of providing Pacific connectivity with the broadband information highways in the developed world.

Of more concern, therefore, is the narrowband service which LEO's will deliver in the Pacific. Those LEO systems with large footprints and gateway earth stations which are too expensive to deploy in the Pacific Countries and will be biased towards providing only international services, unless the LEO itself can provide the links on both sides of the gateway for a domestic connection. The alternative is for the LEO operator to negotiate a very inexpensive backhaul via conventional satellite or cable facilities and that does not look a likely proposition given the small traffic volumes involved.

Those LEO systems which have footprints too small to cover the distance between Pacific Islands and Pacific littoral countries will not be able to provide any service at all unless their gateway stations are affordable in the Pacific Countries. It is too early yet to be sure what the outcomes will be and exactly what sort of narrowband services the LEO's will be able to provide in the Pacific.

5. INTERNET IN THE PACIFIC AND THE GII

For many Pacific countries "Internet," next to basic Telephone service, is one of the most important telecommunications services to government, education, and other nonprofit institutions. Access to information, electronic mail, and the ability to transfer computer files are important to many government and educational institutions, and especially regional organizations that have a need to communicate with other organizations around the world.

With over 70 million users and almost every organization of size connected in some way in the developed and

emerging economies, Internet is viewed as one of the most important communications tools to help overcome some of the severe information barriers to development which impact on Pacific countries.(5)

The traditional transport of written and printed information is through the postal service. In the Pacific, the postal service can take anywhere from three days by special delivery, one to two weeks normally, and perhaps up to two months given the remoteness of some destinations in the Pacific. Thus, it is no surprise that Internet, and more specifically electronic mail, is viewed by the developing microstates of the Pacific Region as a means to reduce disparities in access to needed resources.

Ultimately, Internet is poised to become a means to improve education, enhance health and welfare services, facilitate economic development, and to enable participation of Pacific people in the GII. The growth of Internet and the information and services that are available through the Internet, suggest that it could become the most important single factor in reducing the "information gap" between the developed world and the developing countries of the Pacific.

There are several reasons why the use of Internet, especially its interactive services, has been limited in the Pacific Region. First, there is a general lack of understanding of its potential. Most of the potential users of Internet in the Pacific have yet to experience "surfing the net" or even the exchanging of electronic mail. This lack of understanding and experience makes it difficult for both users and policy makers to be able to understand the benefits and value of Internet.

Second, the cost of dial-up telecommunications are high and there are no policy frameworks, programs, or other subsidies which lessen the very high cost of connecting to the Internet through a voice circuit via Australia or New Zealand to the West or the USA to the East. The international telephone per-minute rates for calls in the Pacific countries are considerably higher than they are developed countries. The rates may vary from 75 cents per minute to \$3.00 per minute, depending on the time of day and day of week the call is made. The cost of "dial-up" calls simply puts this method out of reach for the Pacific market, even for batch mail transfers through "UUCP" type connections.

The cost of leased services is also very high. For example, as reported by Okamura, Blake, Lam and Mukaida (1995:811), "the University of the South Pacific (USP) at the Suva, Fiji campus is currently paying \$90,000 Fijian annually (about \$60,000 US Dollars) for a 4.8 Kbps link from Fiji to Australia."(6) The dedicated circuit is used solely for USP access to Internet. This bandwidth will not support Internet applications beyond electronic mail and other text services for its user population but it is far better than not having any Internet services. The high cost of leased services also inhibits Internet access from the extension centers of USP.(7)

To address both of these barriers to access, the Forum Secretariat Telecommunications Division proposed a "value-trial" of Internet in the Pacific Region. The trial began service in Fiji in December 1995. The purpose of the trial is to provide a subsidized Internet service for as many participants as possible from Fiji and other Pacific countries to test the market and to generate a core of knowledgeable Internet users. The ability to provide a trial subsidy for a limited time period was made possible by provision of international transmission from Telecom New Zealand and Fiji International Telecommunications Ltd. By this means, it is hoped that entrepreneurs in the Pacific will also develop their knowledge and use of the network to export Pacific information to the world as well as to import information and E-mail from the world for use in the Pacific.

Access to Internet and electronic mail is better in parts of the North Pacific. There are several Internet and electronic mail service providers in Guam, the Commonwealth of the Northern Mariana Islands, the Federated States of Micronesia, and American Samoa. However, the cost of the services is still beyond the financial means of many public service institutions and the general population.

Today, Guam has the most developed Internet environment both for the public as well as the private sector. There are several options for electronic mail access through the competitive international carriers and small companies. The University of Guam also has a 64 Kbps link to the University of Hawaii used for educational purposes. The Guam link costs about \$48,000 per year.(8) There are also other Internet providers for the private sector. In the FSM, CompuServe and other services are available through an economy packet network service.

6. "PUBLIC SERVICE" NETWORKS IN THE PACIFIC

At the same time as there is a growing awareness of the importance and usefulness of an information infrastructure in the Pacific Region there is also a renewed interest in "public service" networks, some of which have been around for many years. "Public Service" telecommunications have been defined broadly by Okamura and Mukaida (1995:14) as "the use of telecommunications and information technologies by government, educational, and nonprofit organizations for education, medical and health services, emergency management, environment and resource management, and economic development."

In most developed countries the use of telecommunications and information technologies for public services are

well-developed and accepted concepts. Public radio, public television, and rural distance education and telemedicine programs are a few examples of subsidized programs in developed countries. In many developing countries, however, the concept has not been fully developed or even explored in depth. Further, in the past, the concept of public service telecommunications has been mostly regarded with suspicion if not hostility by established monopoly Telco's, but attitudes are changing and there is good cause for optimism for the future of these services.

The increasing awareness of the potential of "Public Service" telecommunications operators in the Pacific Islands region may be attributed to four major sources. First, regional organizations, especially in the South Pacific, have been aggressively promoting a telecommunications and information infrastructure for their own organizational purposes. Regional organizations must maintain communication with their constituencies and a good telecommunications infrastructure is essential.

Second, regional organizations led by the Forum Secretariat have been directing attention to the regulatory issues and on opportunities for organizations, both mainstream telecommunication carriers and those on the fringes, to contribute to improved service delivery and affordability of both basic and value-added services.

Third, programs such as the Telecommunication and Information Infrastructure Assistance Program of the United States have generated considerable interest by government and educational institutions in the information infrastructure.

Finally, experimental programs such as the Pan Pacific Education and Communication Experiments by Satellite (PEACESAT) and Pan Pacific Regional telecommunications Network Experiment and Research by Satellite (PARTNERS) have provided a stimulus to advance concepts of public service telecommunications. The fact that PEACESAT, which already provides basic access to Internet for some government, education, and non-governmental users throughout the Pacific, is being up-graded to increase its digital capacity, connectivity and service in the Pacific Islands Region has caused great interest.(9)

There are several existing satellites that provide limited services for "Public Service" network operators without charging for the space segment in both the North and South Pacific. These satellite systems have very limited capacity and are primarily designed for other purposes. PEACESAT, for example, uses a satellite that was originally designed and launched for weather data gathering purposes.(10) The Japan "PARTNERS" network, which is used for distance education and telemedicine experiments in Fiji, PNG, and Hawaii, uses the ETS-V satellite which was originally developed for mobile satellite communication experiments.(10) Intelsat also has a SHARE program that enables microstates to use excess bandwidth on a preemptive basis.(11) Parts of the University of the South Pacific Network used the Intelsat SHARE links for a period of time.(12)

7. BARRIERS TO A PACIFIC INFORMATION INFRASTRUCTURE

There still remains a considerable gap in both basic and advanced services despite the fundamental improvements in the telecommunications and information infrastructure of countries in the Pacific Region. Cutler and Associates (1994) suggests that the gap in basic telephony services will take many years, perhaps decades, to overcome if capital investment remains at present levels. This indicates that, at best, the existing gap between Pacific countries and their neighbors of the Pacific Rim will stay much as it is at present for basic telephony services, neither reducing nor increasing. The gap for value-added services and the information services of the future is likely to widen because of the inability of Pacific countries to gain access to the benefits of optical fiber and V-SAT technologies which provide inexpensive digital bandwidth.

In many advanced countries attention is being given to extending the present definition of basic service on which notions of community service obligations of telephone companies are both based and costed. The basic service of the future is likely to be able to deliver a range of simple information, facsimile, banking, and other services made possible by digital technology, on top of the basic voice service. The conventional view is that there is little chance of such a redefinition of basic service in the Pacific Region until the plain old telephone service is available to everyone.

This view, however, is in stark contrast to at least one Pacific observer who suggests that "all is not as bleak as it sounds." Ogden (1995:593), for example, acknowledges that "[a]ccording to conventional wisdom, ... [it] appears that the Pacific Islands states and territories are much too small, too poorly endowed with resources, and too isolated from the centers of economic growth for their inhabitants ever to rise above their present condition of dependence on the largess of the wealthier metropolitan nations." However, Ogden argues that "[a]s pernicious as this view has been in past as well as present development planning in the Pacific Islands, all is not as bleak as it sounds. In a perverse way, many of the Pacific island nations are fortunate that they have lagged so far behind the curve when it comes to telecommunication technologies. Rapid technological advances in digital telecommunications coupled with declining costs mean that latecomers can 'leap-frog' to a level of services not much different from those that even the relatively rich Rim countries could only have dreamed of five years ago."

This optimistic view must be evaluated in relationship to the realities of the Pacific Islands region. There are several important barriers that contribute to the continuation of the availability gap in both basic and value-added services. First, the geography, low population and absence of an abundance of natural resources in the Pacific countries will continue to be a barrier to the development of telecommunications and information infrastructures in the region. In essence, this barrier translates as insufficient capital investment to service profitable opportunities and to cross-subsidize unprofitable but socially desirable services.

Second, and understandably, there are conflicting views of the value of such an infrastructure. There is always a real question as to whether scarce budget resources should be spent on books or computers. Although we are not addressing such issues here, it is important that they be at least acknowledged. Further, there are always questions about the impact of new communications technologies on Pacific cultures and whether the imposition of these developments are in the interests of the Pacific peoples or those of external countries and companies. These conflicting views are not often documented but are ever present in discussions of the Pacific Islands Region.

Third, there is a lack of trained personnel to support the development of an information infrastructure within many of the Pacific countries. This problem cannot be resolved through a one-time training program, but requires a continuous effort in human resources development.

Fourth, there is no contemporary policy framework to support the development of a national information infrastructure in many of the Pacific countries. The institutional and regulatory disability in most countries derives from their colonial legacy of legislation and regulation which was framed many years ago and which in most cases remains in place today. In some countries, even the advent of corporatized or partially privatized telecommunications service providers has not significantly altered this situation. Even in those countries which have established a framework of policy and legislation commensurate with contemporary structures of the service providers, these new frameworks are often too rigid to allow evolutionary changes at the speed which is desirable given the market place changes happening now. Some of the exclusive joint venture franchise agreements negotiated in the relatively recent past are seen now as too inflexible to be always in the best national interest.

At the same time, Ogden may be correct in postulating that Pacific countries will be able to participate fully in the enhanced capability of the basic telephone service, or at least those people who have a telephone and can afford the costs will do so.

Most Pacific countries have converted their international links and their main switches from analogue to digital technology. This creates the technical possibility for enhanced services. However, it is a much more risky proposition to forecast when basic services will be available to everyone in the Pacific region and just as difficult to predict when digital services will be delivered to customers premises. There are few indications that the digital revolution can extend to Pacific countries as rapidly as it has in the developed world.

8. PACIFIC INFORMATION INFRASTRUCTURE - AN AGENDA FOR POLICY MAKERS

In summary, any discussion of an NII or GII based on high-capacity networks for the Pacific Region is simply irrelevant today. The microstates of the Pacific Region, with the exception of Guam, the Commonwealth of the Northern Mariana Islands, and perhaps Palau, will not be connected via fiber to the international grid in the foreseeable future. Further, even though there are many satellites that have footprints over the Pacific, there is presently little indication that these footprints will put high satellite power (EIRP) onto Pacific countries to facilitate the inexpensive V-SAT services and private broadband networks that are available in the Northern Hemisphere. This chronic lack of inexpensive bandwidth in almost all countries will mean that the dominant mode of connections from the Pacific into the GII will continue to be based on narrowband links, at least for the foreseeable future.

This will lead to the development of a Pacific Information Infrastructure which is far different than those of developed countries and different even from developing countries of East and Southeast Asia. For the Pacific Islands Region, the need is for more telephones, more basic data communications, basic access to electronic mail and file transfer services, and better radio and television services. The GII for the Pacific means the effective interconnection of these services with the rest of the world, and in particular, it means access to electronic mail and the Internet, and the creative applications of narrowband technologies in high potential areas such as trade and economic development, education, and health and medical services.

At the same time, the development of the narrowband Pacific infrastructure is no less important for the prosperity of Pacific countries than the development of a broadband infrastructure is in other parts of the world. Accordingly, the development of a domestic Information infrastructure and its connections to the emerging global information infrastructure should become, once more, a priority area of interest for policy makers in the Pacific Region, as was the development of the telephone network in the 1980's. A revitalization of interest in the information infrastructure is a precondition to ensure that the "telecommunications gap" does not widen further, especially for value-added and information services.

The recognition of such priorities should ideally lead to discussions among stakeholders - government and education policy makers, users, carriers, public service carriers, and others (e.g. regional organizations and non-governmental organizations) to develop appropriate regional strategies, programs, and regulatory changes designed to benefit both national and regional interests.

Many difficult issues will need to be addressed in order to build on the successes of the past to secure the benefits of the revolution in telecommunications and information technology. Some of these issues include the redefining of roles and relationships among users, ministries and carriers, the optimizing of the role of the "Public Service" telecommunications networks, the development of appropriate reinvestment strategies for telecommunications carriers, and the pricing and cross subsidies for value-added services. "Public Service" networks promoted by the University of Hawaii and innovative experiments by the South Pacific Forum Secretariat are offered as examples of how a Pacific Information Infrastructure is being actively promoted. These activities should be seen as complementary and vital to the participation of Pacific microstates in the future Information economy, and not competitive with the mainstream operators.

Although in the past most Pacific countries have been preoccupied with national rather than regional issues there have been a few outstanding, successful regional initiatives. The PACT DAMA network promoted by the Forum Secretariat and largely financed by Australia is one of these, and the PEACESAT network, initiated by the University of Hawaii and funded with U.S. assistance, is another.

The long term availability of space segment capacity for "Public Service" network providers is another very important concern for policy makers and for Pacific Countries. Up to now, the National Telecommunications and Information Agency (NTIA) of the U.S. Department of Commerce has been almost alone in leading the discussion on the future possibilities for the continuing availability of this very valuable resource. Today, it may be timely for a regional interest group of NGO's, regional organizations, Island Counties and principal donor's of aid programs in the Pacific to collaborate on this very important question.

9. CONCLUSIONS

There is no indication that technology will become available in the foreseeable future which will enable people and countries of the Pacific Region to afford to participate in the broadband information infrastructure which is rapidly evolving in the Northern Hemisphere and Asia. Unit costs and prices in the sparsely populated Pacific may never be as low as they will be in the developed world. At the same time, the real needs of Pacific people can be met, and a very effective interconnection with the global information infrastructure can be developed using narrowband technology, provided that the application of this technology is sufficient to cover the entire region.

Low earth orbit satellite technology will obviously present some opportunities for the Pacific but, like nearly all communications technologies designed for application in other parts of the world, some adaptation either technically or organizationally is likely to be required if an optimum application is to be achieved for island countries. Likewise with existing, and other emerging technologies it is likely that the policy, organizational, and regulatory issues will be more important than the technology itself in determining the information future of the Pacific Region.

There are some indications that these policy, organizational, and regulatory issues are being addressed by countries and regional organizations. For example, in the South Pacific, the Forum Secretariat has been closely involved in technical training and technology planning issues of telecommunications for the last two decades. Now the focus of the Forum Secretariat has shifted to the institutional and regulatory issues and promotion of value-added and information services to complement basic voice services. It has also shifted to a concern for the consumers of telecommunications that are not being served by traditional service providers.

Women, community organizations and grass roots providers of education, health and welfare services are high on the list of consumers of telecommunications that are not being well-served. This reality must be viewed against the background of falling aid to the traditional telecommunications sector. The implication is that aid in the future for telecommunications is likely to target telecommunications consumers rather than traditional service providers. NGO's and regional organizations currently providing such grass roots services are likely to be well placed in the contest for what aid funds continue to flow in the telecommunications sector as we approach the end of the 1990's.

In the North Pacific, there are also indications that these issues are being addressed. The Association of Pacific Island Legislatures, for example, has established a committee that is attempting to address telecommunication issues and to develop a regional program effort in the area of telecommunications. The Pacific Basin Development Council (regional organization), the Pacific Caucus of Emergency Managers (Users), the U.S. Department of Interior, the U.S. Federal Emergency Management Agency, and PEACESAT have collaborated to initiate the development of an Emergency Management Network. Guam is seriously studying the possible privatization of its telecommunications corporation.

The resilience and creativity of the regional organizations and the persistence by which government policy makers, administrative ministries, and users seek to address these issues will be very important factors in the future of Pacific telecommunications and the development of an appropriate Information Infrastructure for the Pacific.

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ENDNOTES

* The opinions and the interpretations in this paper are those of the authors and do not necessarily represent, nor do they purport to represent, the views, opinions, or the work programs of the South Pacific Forum Secretariat or the Social Science Research Institute of the University of Hawaii.

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1. The idea of a "leap-frog" is ever-present in papers discussing telecommunications in the Pacific Islands region. In 1983, for example, Karunaratne (1983: 93) suggests that "[t]he Pacific Islands Nations face the prospect of leap-frogging into an information era from a subsistence economy." Twelve years later, the same sentiment is echoed by Ogden (1995). These views emphasize the promise of telecommunications and information technology, but, unfortunately, tend to ignore important policy, political, cultural, and economic (market) barriers that would enable the leap-frog to occur.

2. There are very large differences among the Pacific Island microstates in culture, geography, political organization, extent of urbanization, and so on. These differences cannot be explored in this paper, but need to be acknowledged at the start.

3. "Tenorio signs lease for fiber optic cable." Marianas Variety News and Views, November 11, 1995. The article reported that the cost of telephone calls between CNMI and the continental U.S. will be \$.55 per minute. The article cited the current costs for voice telephony at \$1.85 for the 1st minute and \$1.75 for each subsequent minute.

4. See Cooperman (1995) for a useful discussion of satellites in the region.

5. No one really knows how many computers are attached to the Internet. However, the latest estimate reported by Dr. Haruhisa Ishida, President of the Internet Society, at a meeting of the Asia-Pacific Telecommunity held in Tokyo, Japan (October 17, 1995), is 70 million.

6. The same information on the cost of Internet was reported by John Clayton, Manager of the Computer Center at the University of the South Pacific, at the 11th World Communications Forum in Shibuya, Japan, October 26-27, 1995. His estimate was that USP pays U.S. \$50,000 for the 4.8 Kbps link to the Australia Research and Education Network through TELSTRA.

7. In the South Pacific the USP operates Extension Centers in 12 other countries. Due to the cost of leased line telecommunications in the region, none of these centers except for Fiji can access Internet on a 24-hour, 7 day-a-week basis.

The high cost and low service of this access led the USP to hire a consultant to explore the potential of a consortium to purchase additional bandwidth to support both the University and a group of other NGO's. The report of the consultant recommended that a link of 19.2 Kbps be leased to initiate such a group service.

8. The cost of the link was reported by Dr. Hiro Kurashina, Director, Micronesian Area Research Center, the University of Guam, at the Honolulu Meeting on the Guidelines for Distance Education in the Pacific Islands, Sasakawa Peace Foundation, Honolulu, Hawaii, January 26, 1995.

9. See Okamura and Mukaida (1995, September; and 1994) for a discussion of the current and planned directions of PEACESAT.

10. PEACESAT currently uses an obsolete geostationary weather satellite, GOES-2, provided by the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce. The satellite has a very limited bandwidth of 10 MHz and low power. As such, it has a limited capability for support of the Pacific.

11. The Japan PARTNERS Network was established by the Japan Ministry of Posts and Telecommunications in celebration of International Space Year in 1990. The network enables sites in Fiji and PNG to participate in distance education seminars and discussions through the use of the Engineering Test Satellite (ETS-V). The video teleconferences are 64 Kbps.

12. The Intelsat links used by USPNET include Fiji, Tonga, Cook Is, Vanuatu, Solomon Islands, Fiji. HF is used in Western Samoa, Tuvalu, Niue, Nauru. The Marshalls, Kiribati, Tokelau have no access. Intelsat originally donated the use of these links for a period of time. It is not known how much the links currently cost.

13. The USPNET consists of a single voice circuit used mainly for the administration of the extension program. Tutorials are also supported through the network. USP was a leader in the early 1970s in the use of satellite communications for "distance learning." Today, the extension program is essentially a correspondence program with tutorial support provided by faculty and local tutors. These developments were supported by USP's access via PEACESAT from 1972-1985.

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