

# Chapter 1. Introduction

## I. Purpose of this Report

The report seeks to present in a comprehensible form key aspects and considerations around the concern that launched this study, which is that, currently, Asian and Australian carriers must pay the entire cost of lines across the Pacific to reach Internet resources in North America. If nothing is done, this situation may continue indefinitely. This differs from the previous model, derived from the characteristics of the voice telephone era, where the cost of these lines was shared by carriers, rather than assumed exclusively by parties outside North America. In the telephone era, costs were shared according to agreements among telephone companies, called “settlements”.

The Internet era marks a decisive change in how carriers are paying for the cost of distance. Why this should be so, whether anything can be done about it, and whether anything should be done about it, are the subjects of this report.

On one side are parties claiming that the current Internet pricing scheme is in principle unfair. Some portion of the cost of these international lines should be picked up by North American carriers and, in turn, North American Internet users. No reduction of the unit costs of transmitting data across the Pacific will change their perception of unfairness.

On the other side are parties claiming that the Internet works according to free market principles – contrary to traditional international telephone settlements – and that the situation complained about results from natural advantages, and the absence of anti-competitive behaviour. Nothing can or should be done to change these arrangements, they would argue.

The term “International charging arrangements for Internet services” (ICAIS) is a label for the issue of “who should pay, and how much?”. Varieties of charging arrangements among the telecommunications carriers are proxies or ways of talking about the fairness or equity of these arrangements.

This third and final Module of the APEC TEL *Study of International Charging Arrangements for Internet Services* reviews the existing data and current state of rapid change in order to examine what kind of international charging arrangements for Internet services are possible or likely in the emerging environment.

The authors critique each of the various charging mechanisms now employed, as well as new methods currently under discussion. The authors then analyze the likely implications of undertaking any one of these given avenues using two sets of criteria: the impact of a given set of charging arrangements on the growth of the Asia Pacific Information Infrastructure (APII), and the parameters set in Section 6.4 of the Module 3 Request for Proposals. The Module 3 analysis rests on the empirical foundation of

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Modules 1 and 2 of the ICAIS *Study*, as well as extensive original research and consultation.

The analysis is structured and put forward to assist APEC TEL in the formulation of recommendations and advice to APEC Ministers for Telecommunications and Information Industry (TELMIN) at TELMIN4 to be held in May 2000. Consequently, the authors of this *Study* do not make recommendations and do not express opinions regarding the charging arrangements under review. The authors' estimation of the likely outcomes and the discussion of future scenarios are based upon the empirical base of the past Modules, new research, and other pertinent facts.

## II. Background

It is universally agreed that the Internet is the core building block of the APII. The power and potential of this technology are just now beginning to emerge. The velocity with which the Internet has come to dominate the world of communications is unprecedented: policy-makers, economists, regulators, carriers and even Internet Service Providers (ISPs) are scrambling to integrate the Internet into every aspect of their plans and processes.

Inevitably, this astonishing rate of change leaves the perception that some existing economic, regulatory and policy arrangements are quite possibly inadequate, obsolete, or superfluous.

Moreover, as we set forth in Module 1 of this *Study*<sup>1</sup>, the Internet emerged from collaborative effort between scientists, researchers, and the United States government. Indeed, the US government had a central role in the Internet until the mid-1990s and, to this day, the Internet is centred –to the extent it has a centre – in the US. Most importantly, the Internet evolved as a system of private networks, interconnecting (or not) as their owners saw fit, under no public service obligations.

Networks, not states, are the core of the Internet. Unlike the world of telecommunications, which has evolved over 100 years (the International Telecommunication Union dates back to 1865), the Internet has no structure for handing traffic from one economy to another. Indeed, the concept of state boundaries does not exist in the Internet. The Internet is designed to ignore political boundaries, and a domestic e-mail message may pass efficiently through three or four economies before arriving at its destination, which may be as close as in the same town or even in the same building as the sender.

The Internet was designed to be global: its architecture recognizes only networks, not political boundaries. By contrast, the core of telephone communications is a structure

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<sup>1</sup> Savage, Frieden, Denton, *ICAIS Module 1 Final Report: Issues Paper*, March 1999, at [www.apii.or.kr/telwg/ICAIS/ICAIS-frame.html](http://www.apii.or.kr/telwg/ICAIS/ICAIS-frame.html).

built around political frontiers. Specific international gateway points link neighbouring and distant economies. The borders are real, and the economic arrangements, based upon venerable postal models, are precise in their determination of accounting rates, settlements, proportionate returns and other regulatory arcana.

To our sense of geography and, in particular, to those from a point-to-point, distance-sensitive telecommunications background, the Internet's scattering of packets about the globe makes no logical sense. How does one chart this kind of traffic? How can costs be determined and prices be derived? Do transit economies have a right to revenue? Do they even know the traffic is there? Is there economic value in the packets? Is the value in the network infrastructure? Or is it in the content, raising all those "value chain" arguments familiar to those who recall the multimedia debates of the early 1990s?

There has arisen in this vacuum a perception on the part of many that developing economies and those distant from the Internet's North American hub are at a structural disadvantage. Internet providers the world over must connect to the Internet's major network access points (NAPs), most of which are in the US. ISPs and carriers must pay for wholly-owned circuits to the US mainland. (There is a carry-over of telephone language in the use of "circuits".) In one way or another, Internet users outside North America are carrying the cost burden of those high-capacity links to Silicon Valley and other North American points.

It was the perceived unfairness, according to some, of this cost burden that gave rise to this study.

Even as NAPs and popular local content are established in other parts of the world, some carriers in Asia and elsewhere predict that the overall bandwidth requirements to North America will nevertheless steadily increase as a result of streaming video and other new applications. Indeed, the vast amount of new trans-Pacific bandwidth capacity charted in Module 2 is premised upon this growth in demand.<sup>2</sup>

## **The role of APEC TEL**

In an effort to clarify these issues, TELMIN called upon the organization to "study...compatible and sustainable international charging arrangements for Internet services...(and to) encourage member economies to enhance access to the APII, particularly in Internet infrastructure, by expanding high bandwidth connectivity among economies. In this regard, Ministers request the APEC Telecommunications Working Group to study how to create sustainable and equitable financing arrangements for the establishment of these links".<sup>3</sup>

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<sup>2</sup> Savage, Frieden, Denton, *ICAIS Module 2 Final Report*, March 1999, at [www.apii.or.kr/telwg/ICAIS/ICAIS-frame.html](http://www.apii.or.kr/telwg/ICAIS/ICAIS-frame.html). The report is in MS-Power Point presentation format, with detailed essay-format notes appended or available in MS-Word.

<sup>3</sup> Paragraphs 11, 22, Singapore Declaration

APEC TEL has undertaken a pioneering effort to delineate the international economics of the Internet and determine whether it is possible to identify international charging arrangements for the Internet that are both equitable and sustainable. Greater knowledge of the existing and potential charging structures would achieve two objectives (1) to permit smaller economies to participate fully in the APII and, (2) to create a stable international economic structure that will foster longer-term economic planning, perceived as especially important for the growth of e-commerce within the region.

## **The APEC TEL ICAIS Study 1998-2000**

In Module 1, the authors provided an *Issues Paper* that put forward a framework for understanding the structural elements and economics of the Internet<sup>4</sup>. At the heart of the ICAIS issue is the difficulty of applying telecommunications economics models to the reality of the Internet's current international charging arrangements. Because the Internet's international evolution took place – and is still taking place – largely outside any formal structure or legal requirements, smaller economies and those more distant from the Internet's historical North American core find themselves at a perceived disadvantage as a result of the lack of a telephone-style settlement regime.

The Module 1 *Issues Paper* detailed how the Internet network evolved and exists. The nature of the Internet is innately ubiquitous and transcends geography. This renders traditional distance-based economic models obsolete. However, someone still must pay for the underlying networks that carry Internet protocol (IP) traffic. Module 1 identified some key issues for APEC TEL's discussion on this topic:

1. Internet charging arrangements evolved in an ad hoc manner, creating few incentives to manage use of traffic;
2. Asymmetries between the cost-causer and cost-reimbursers mean some ISPs bear a disproportionate share of cost;
3. The "Sender-keep-all"(SKA) model means that larger ISPs shoulder the bulk of network development costs and have an incentive to peer bilaterally (and privately);
4. The same SKA model creates an incentive for a network to grow as fast as possible to global scale,
5. Smaller and more remote ISPs have the additional burden of provisioning their own facilities to the nearest NAP;
6. Most Internet traffic transits through North America, based on current capacity and bandwidth costs.

The question is: Do these factors hinder the development of the APII?<sup>5</sup>

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<sup>4</sup> ICAIS Module 1 Final Report: Issues Paper

<sup>5</sup> Ibid., Chapter 3

## Discussion at Miyazaki (APEC TEL 19)

As a result of the *Issues Paper*, a dynamic discussion took place in March, 1999 at the ICAIS Task Force seminar at APEC TEL 19 in Miyazaki, Japan. Two conclusions emerged from the Task Force's deliberations there:

1. Two distinct schools of thought on Internet economics were emerging on the ICAIS issue. The first maintained that the bandwidth pricing issue was critical to APII, as self-provisioning circuits to North America were inherently inequitable, and that the network's evolution fostered a continuing competitive advantage for North American networks and carriers. The second group maintained that the asymmetrical traffic flows are at heart a time-lag problem, and that the issue would be rendered obsolete within 12-24 months as a consequence of the vast growth of bandwidth and Asian-based NAPs currently taking place.
2. These differing viewpoints meant that ICAIS could not be analyzed solely as a matter of international private line pricing models: the impact of ICAIS on the APII must be understood in the context of other Internet access cost elements, such as domestic private line and access pricing, the level of competition amongst carriers and ISPs within economies, the existing of metered versus flat-rate local telephone access for ISP dial-up customers, and so forth.

## Module 2

The team was selected to conduct a large-scale analysis and data-gathering exercise as Module 2 of the ICAIS *Study*. While many carriers and ISPs were reluctant to share what could be commercially-sensitive data, the team was able to bring together a pioneering set of APEC ICAIS economic data<sup>6</sup>

Based upon the data, Module 2 revealed certain key points:

1. Backbone carriers and ISPs outside North America must provide wholly-owned circuits to North American NAPs;
2. Within North America, long-distance bandwidth costs comprise only 6% of the total cost of a network. There was no reason to suppose that the costs of the long-distance portion of a data network in Asian, Latin American and Pacific Basin economies differed significantly, that is, by more than twice that figure;<sup>7</sup>
3. American carriers and ISPs may employ these same circuits to gain access to Internet data on the western side of the Pacific, creating a perception that North American users may be "free-riders";
4. Trans-Pacific and intra-Asian capacity is more expensive and less competitive than is the case within North America, on trans-Atlantic routes, or within Europe.

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<sup>6</sup> ICAIS Module 2 Final Report

<sup>7</sup> In particular, see page 15 of the ICAIS Module 2 Final Report

- This situation has, relatively speaking, been exacerbated during 1999 as Atlantic and European prices have plummeted;
5. There is only a tiny “competitive capacity market” for trans-Pacific or intra-regional capacity compared to North America or Europe. This will probably change rapidly as a consequence of Item 6 below;
  6. North American and other backbone carriers are expanding rapidly in the Asia-Pacific region;
  7. The rapid deployment of new capacity will dramatically reduce the unit cost of international charges, irrespective of the structure of the charging arrangements;
  8. The traditional telecommunications half-circuit charging model may be used on new routes and on some traditional cables;
  9. Purely Internet/data carriers/ISPs are less likely to favour this model, preferring to either establish their own NAPs within the Asia-Pacific region or require international carriers to link to their North American NAPs. Developing economies will continue to suffer from a comparative disadvantage due, only in part, to higher-cost international bandwidth.

### **III. Changes in the ICAIS Environment During the Course of this Study**

Modules 1 and 2 of the ICAIS *Study* established the analytical framework from which the following review of current and proposed ICAIS arrangements is put forward. However, it is important to note that during the course of Modules 1 and 2 the ICAIS environment has evolved rapidly.

In reviewing the above conclusions from Module 2, delivered in October 1999, the following changes have taken place:

1. *Backbone carriers and ISPs outside North America must provide wholly-owned circuits to North American NAPs.*

This remains the case, although new Asia-Pacific NAPs are coming on-line very quickly. Smaller and medium-sized ISPs should have little difficulty in obtaining full Internet access at major regional centres such as Singapore, Hong Kong, Tokyo, and Sydney. The situation remains somewhat more critical for some APEC economies in Latin America.

2. *Within North America, long-distance bandwidth costs comprise only 6% of the total cost of a network. There was no reason to suppose that the costs of the long-distance portion of a data network in Asian, Latin American and Pacific Basin economies differed significantly, that is, by more than twice that figure.<sup>8</sup>*

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<sup>8</sup> Ibid.

At APECTEL 19 in Miyazaki, Japan, it was decided that the ICAIS study must accommodate the local cost elements, such as dial-up access, metered telephone charges, domestic interconnection costs, as well as the overall state of the domestic telecommunications network. Module 2 revealed that these local, intra-economy costs comprise a sizeable part of the cost of Internet access. Indeed, a recent study of Internet development in the Pacific Islands did not mention ICAIS but centred on the local and intra-regional economic challenges<sup>9</sup>.

3. *American carriers and ISPs may employ these same circuits to gain access to Internet data on the western side of the Pacific, creating a perception that North American users may be “free-riders”.*

Large North American backbone providers are redressing the balance somewhat with a massive investment in the construction of new facilities within the Asia-Pacific region<sup>10</sup>. They are, in effect, self-terminating both their own westbound traffic and that of many smaller ISPs via their own wholly-owned trans-Pacific circuits. In theory, this might create an eastbound “free-ridership” issue in certain instances for small ISPs that interconnect with a US carrier’s NAP in, say, Hong Kong.

4. *Trans-Pacific and intra-Asian capacity is more expensive and less competitive than is the case within North America, on trans-Atlantic routes, or within Europe. This situation has, relatively speaking, been exacerbated during 1999 as Atlantic and European prices have plummeted.*

This was demonstrated within the Module 2 *Final Report*<sup>11</sup>. International market pricing for bandwidth has declined far more dramatically on trans-Atlantic routes and within the Americas than it has within the Asia-Pacific region or on trans-Pacific routes. Since the Module 2 Final Report, spot prices for E-1 capacity circuits have declined at the following averages (from September 1999 through January 2000)<sup>12</sup>:

• Los Angeles-Tokyo	-6.5% a month (avg)
• Los Angeles-Hong Kong	-1.5%
• Los Angeles-Beijing	-0.0%
• New York-London	-9.4%
• New York-Frankfurt	-9.6%
• London-Milan	-12.2%
• London-Paris	-18.9%

In particular, one notes the dramatic price differences between Asian routes and intra-European routes. Band-X analysts predict that the price of an STM-1 from London to New York will decrease from \$1.5 million in January 2000 to \$0.6 million by the end

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<sup>9</sup> Michael Ogden, “Islands on the Internet”, in *Pacific Telecommunications Review* 21:2, Fourth Quarter 1999, 5-15.

<sup>10</sup> Current initiatives are detailed in Appendix 2 of the *Module 2 Final Report*. Several new initiatives have been announced since that time.

<sup>11</sup> *ICAIS Module 2 Final Report*, slides 34-36.

<sup>12</sup> Band-X Index of International Bandwidth Prices, at [www.band-x.com](http://www.band-x.com) at 16 Feb 2000

of the year. These declines are attributable to a number of factors, including (1) the immense growth of fibre within Europe; (2) the rapid deregulation of the European market at national and EU-wide levels; (3) the related growth of competitive local exchange carriers and competitive networks within Europe such as COLT, KPNQwest, RSL, MCI WorldCom, Cegetel and many others; (4) the rapid increase in the number of NAP networking hubs and “telehouses” (facilities where many carriers can share space and interconnect, also known as carrier hotels or pooling points); and, (5) the evolution of a spot market in capacity fuelled by organizations such as Band-X.

5. *There is only a tiny “competitive capacity market” for trans-Pacific or intra-regional capacity compared to North America or Europe. This will probably change rapidly as a consequence of Item 6 below.*

This also explains the disparities shown in Item 4 above. In fact, there have been a number of developments in recent months. Asia Capacity Exchange, a Hong Kong-based company, has established an Asian and trans-Pacific version of Band-X or Rate Exchange, i.e., a spot market for Asian bandwidth designed to grow as the total capacity in the region increases several-fold<sup>13</sup>.

This will serve to drive prices downwards, as will the expansion in Asia of the bandwidth market under development by Enron Broadband Services, an affiliate of the US power utility. Enron is seeking to create a market on a commodities market model, wherein Enron would be a centralized buyer and seller, leading to a faster-paced trading environment consciously modeled on markets in natural gas, spare electricity capacity, and agricultural products<sup>14</sup>.

6. *North American and other backbone carriers are expanding rapidly in the Asia-Pacific region.*

Appendix 2 in Module 2 provides several examples of the dramatic growth of North American carriers in the Asia-Pacific region. The rapid expansion of MCI WorldCom, Teleglobe, Level 3, AT&T, Global Crossing, PSI Net and others in the region is well known. But it is also important to note the extent to which Asia-Pacific carriers are investing in North American facilities. For example, several Asian carriers have established strategic alliances with or equity stakes in US-based internetworking firms.<sup>15</sup>

The logical direction of these initiatives is the creation of multinational and regional backbone powerhouses. Other carriers may decide to maximize the economic value of the Internet through on-line services and other content-driven applications,

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<sup>13</sup> [www.ace-asia.com](http://www.ace-asia.com)

<sup>14</sup> [www.enron.net](http://www.enron.net)

<sup>15</sup> Simone Deane, “Telstra Forms US Network Alliance,” *Total Telecom*, 9 Dec 1999; and Reuters, “Road Runner Says Has Had Telstra Talks,” *Total Telecom*, 17 Jan 2000.

eschewing completely the complicated economics of internetworking. This may have fuelled Telekom Malaysia's decision to sell its Internet infrastructure.<sup>16</sup>

7. *The rapid deployment of new capacity will dramatically reduce the unit cost of international charges, irrespective of the structure of the charging arrangements.*

Modules 1 and 2 indicate clearly that the massive growth of Asia-Pacific capacity will lead to a dramatic decrease in tariffs. In the European case, this is under way at the moment, having followed a one-to-two year lag behind the actual entry into service of most of the new capacity. Graham Finnie of TeleGeography notes that "shore to shore, the raw material price is going to be very much lower as soon as Pacific Crossing-1, Japan-US, China-US and Southern Cross are in service. Quoted ownership pricing and IRU (Indefeasible Rights of Use) prices on these cables are far lower than on existing cables, and they have more open ownership structures and more owners who will be looking to offer leases".<sup>17</sup>

8. *The traditional telecommunications half-circuit bilateral charging model may be used on new routes and on some traditional cables.*

In certain cases carriers may privately agree to a settlement method more resembling the traditional half-circuit model, based upon a calculation of traffic sent bilaterally. The packetized, self-routing nature of Internet traffic is such that the bilateral traffic may or may not be routed through a specific circuit on a specific cable. But carriers may wish to create an economic settlements model that enables them to exchange data traffic in this "virtual correspondent" manner. This model may be seen as equitable and, amongst similarly-sized carriers, is probably sustainable. The peering agreement in this instance acts like a traditional telecommunications direct correspondent agreement.

For most carriers and ISPs, however, this bilateral settlements method may create a too-rigid structure in which scale economies, non-traditional arrangements, and other contractual arrangements may be restricted. The merits and disadvantages of a bilateral settlements mechanism are detailed below.

9. *Purely Internet/data carriers/ISPs are less likely to favour a bilateral peering model, preferring to either establish their own NAPs within the Asia-Pacific region or require international carriers to link to their North American NAPs. Developing economies will continue to suffer from a comparative disadvantage due, in part, to higher-cost international bandwidth.*

Whether carriers and ISPs choose a telecommunications-style bilateral settlement process or a bilateral peering agreement in which traffic is freely exchanged, there

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<sup>16</sup> Reuters, "Telekom Malaysia Plans Sale of Net Infrastructure", *Total Telecom*, 16 Feb 2000.

<sup>17</sup> Graham Finnie in Nick Ingelbrecht, "Asian Carriers Face Bandwidth Tsunami", *Communications Week International*, 4 Oct 1999.

may be considerable incentive on the part of the largest backbone carriers to create their own Asia-Pacific infrastructure.

The advantages of building one's own facilities are numerous, and include the following:

- Self-terminating traffic obviates all but local charges at the distant end;
- Enables comprehensive service to largest customers – no other carriers involved – so easier to guarantee quality of service and security guarantees;
- Enable carrier/ISP to capture customers at distant end, especially if extension into new markets involves acquisition or creation of local ISPs;
- Economies of scale;
- Creation of global brand presence;
- Improves terms of trade with vendors, eg undersea cable providers, home and distant-end ISPs and resellers, web portals, content providers, ancillary businesses.

#### **IV. Domestic Costs and Interconnection**

Both the Module 2 results and several other recent analyses<sup>18</sup> reveal the important role of domestic charging arrangements in the overall cost of access of the APII. Within Modules 1 and 2 there was considerable discussion regarding the extent to which domestic arrangements should be factored into the ICAIS discussion. Module 2 created a database of local access charges, local ISP rates, a table of flat vs. metered telephone access pricing and several other domestic matrices.

These were deemed necessary in order to assess the extent to which domestic considerations overshadow the role of international charging arrangements. APEC TEL has launched, separately, a study of interconnection issues within APEC economies.

It is beyond the scope of the Module 3 analysis to undertake a study of these domestic elements except where they have a direct impact on ICAIS. But it is vital that the APEC TEL ICAIS Working Group and other readers of this report bear in mind that ICAIS comprises only one part of the overall economics of the Internet.

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<sup>18</sup> OECD, others CITE