

Thailand:

IP Telephony and the Internet

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1 Introduction

The purpose of this paper is to examine the emergence of new voice services, generally referred to as IP telephony, in a developing economy, Thailand. The study is set against the background of broader technological developments, national policy, regulatory and market structure realities.

The introduction of Internet Protocol (IP) in many national and international networks over the past three years reflects a number of broad trends in the overall evolution of both global and national information infrastructures. One of these trends is the emergence of a much more vibrant market for long-distance and international calls. There is even a hint of the excitement and chaos of a real marketplace with new sellers and buyers rapidly entering, new products and prices being offered monthly, if not daily.

IP telephony has been an 'emerging' product since at least 1994¹ (see also Section 3.1) and some of the early issues and incentives for the introduction of such a service are noted in the following observations:

'Companies offering Internet telephony have been attracted by the lack of regulatory hurdles and the ability to undercut long-distance operators' tariffs by avoiding international settlement fees, although quality of service remains a problem.

*... Although traditional telecom carriers such as Telecom Finland, Sprint and France Telecom are studying the technology, the first widespread commercial offerings are coming from callback operators.'*²

While new entrants to the long-distance and international market aggressively employed the early applications of IP for voice services, they also opened up opportunities for traditional carriers as well. By early 1997 a number of major carriers were preparing to offer a variety of IP telephony products.

The markets for long-distance and international, both domestic and international, were soon to become much more active both in terms of new products and new price levels. To give some sense of this emerging 'outdoor' or 'open-air' market for international calling, consider the following recently announced prices (US cents) per minute:

1. Singapore to New York - 5 cents (SingTel – eVoiz –Internet-based service)⁴;
2. Bangkok to New York - 50 cents (CAT, Thailand – phoneNet – Voice Over Internet Protocol-based service – VOIP);⁵ and
3. New York to Bangkok – 39 cents (World Quest Networks – a phone card-based service)⁶.

The emerging market for international and domestic long-distance and international services is being driven more by technology and economics, than by national policy and licensing, as barriers to entry dissipate, not by regulatory initiative, but by the rapid adoption of new technologies by both new entrants and traditional suppliers.

Whether all the traditional operators will be able to find a place in this new, 'open-air' market, remains to be seen. However, the 'early and rapid adapters' stand the best chance of sustaining themselves in this new environment while the 'wait and see' group may gradually witness their customers exiting and their traditional markets eroding.

Thailand, as a developing economy, provides an example of how traditional monopoly markets for long-distance and international are becoming contestable due to technological developments such as cellular

1 'Challenges to the Network – Internet for Development', International Telecommunication Union, Geneva, Switzerland, February 1999, Figure 6.4, page 113.

2 'EC to close IP telephony loop-holes' by Kenneth Cukier, CommunicationsWeek International, 19 May 1997, page 3.

3 'IP telephony offers niche for carriers' by John Blau, CommunicationsWeek International, 19 May 1997, page 13.

4 'SingTel offers overseas calls via Internet', Bangkok Post, Business Section, 7 March 2000, page 2.

5 See Table 2, page 27. (CAT's phoneNet Service)

6 Bangkok Post Website (<www.bangkokpost.net>) (advertisement by World Quest Networks-week of 20 March 2000)

7 'Internet Economics – A thinker's guide', The Economist, 1 April, 2000, pp. 64-66.

mobile and more recently Internet telephony. The two major state-owned carriers, The Communications Authority of Thailand (CAT) and the Telephone Organization of Thailand (TOT) have both announced their intention to introduce IP-based voice services. In fact, the CAT's new service, 'phoneNet', is competing with TOT's traditional international long distance service. In turn, the TOT's domestic VoIP service will compete with the domestic long-distance and international service offered by the two major cellular mobile operators. Consequently, *de facto* rivalry has emerged in these two market segments in advance of them being formally liberalised.

Prior to the recent rise in technology-driven market liberalisation, as opposed to policy-driven market entry, the process of telecom market liberalisation in developing economies generally followed a different path than that followed in developed economies. During the formative years of telecommunications liberalisation in most developed economies, from the 1970s to 1990s, the process of opening markets was one of control and evolution. Entry was permitted to increasingly larger telecommunication market segments on a somewhat sequential basis, for example, first customer equipment, subsequently private line and later domestic trunk and international long distance markets. The pressure to open these traditional markets came largely from potential new entrants and larger business customers.

In developing economies, the liberalisation of telecommunication market segments was primarily focused on new market segments such as cellular mobile as opposed to the traditional segments for example, the domestic and international long distance segments. One result of the difference between the trend and speed of liberalisation in developed versus developing markets is that significant pricing reform in the long distance/trunk markets, both domestic and international, has not occurred in many developing economy markets at the same rate as that in developed economies.

Consequently, and somewhat ironically, some of the more enthusiastic buyers of low-priced IP telephony are in those markets that, to-date, are the least liberalised. The consequences for demand to shift in these markets, due to the magnitude of price declines envisaged from Internet telephony, are substantial. All things being equal, informed consumers will rapidly shift their demand for national and international calling-minutes from traditional network services to internet protocol based-services whether they be offered by ISPs, new entrants employing VOIP technology or traditional operators employing VOIP.

In turn, such a shift in the structure of the traditional long-distance and international market segment has national information policy implications as well as financial implications for traditional operators. One of the implications related to both national policy as well as the financial sustainability of incumbent operators is with respect to the achievement of universal service and/or universal access. In many developing economies the current telephony penetration rate – telephones per hundred population – is in the order of less than 10. Penetration rates in the main urban centres of developing economies tend to be substantially higher due to higher concentrations of both fixed, cellular mobile and wireless local loop access. However, in rural, remote and smaller urban centres network access, and consequently access to the Internet, remains limited.

While IP telephony presents an opportunity to bring lower prices for distance calling to those consumers already connected to the information infrastructure, it offers little to the unconnected. However, the technology has immense potential to provide access at an investment cost some 5 to 8 fold less than that of a PSTN line. Therefore, national policy makers in developing economies must also consider the implications of IP telephony in the context of their plans and objectives for bringing universal access to those parts of their nations which remain either not served or under-served by their information infrastructure. A market deprived of the participation of more than fifty percent of the potential consumers (households) is neither dynamic nor developed.

The following elements⁸ of a policy strategy for developing countries should be considered in the context of addressing both the introduction of IP telephony, as it is currently offered, as well as the full liberalisation of the international long distance market:

1. Ensure accounting, settlement and collection rates are either closely representative of costs or that international operators have a defined plan for reaching cost-oriented price-levels for international services within the next two to three year period;
2. Ensure that international operators are either employing or planning to employ the most efficient technology available for international voice services within the next three year period;
3. Require all international operators to ensure that settlement rates are essentially uniform from one route to another in order to limit the opportunities for arbitrage;
4. Ensure any 'sender-keeps-all' arrangements are discontinued or re-negotiated to prevent the 'dumping' of incoming traffic from such destinations; Negotiate with foreign operators to share the cost of international leased lines employed for Internet traffic; and
5. Ensure the policy for the international information infrastructure is comprehensive in that it addresses not only traditional IDD service but also IP telephony, call-back, country-direct, calling-cards, and simple resale as well as the general liberalisation of the market segment;

Notwithstanding the above-mentioned policy and operator initiatives with respect to settlement and collection rates, national regulators and policy-makers also need to recognise certain underlying trends in the 'flow' of national and international minutes and revenues.

- The first of these is the migration of minutes from the switched-PSTN to the public Internet network (PIN).
- A second and related trend is the decline in net international settlements in both developed and developing economies due to lower prices and reductions in settlement rates as well as the fallout from the above-mentioned trend of minutes migrating from the PSTN to the PIN.

However, the impact of the decline in net international revenues will be particularly acute in the smaller developing economies where net international revenues tend to represent a much more significant proportion of total revenues than they do in developed economies.

Consequently, national policymakers, regulators and operators in smaller developing economies need to examine universal service and access objectives and plans in the light of these trends in international revenue and traffic. Such an examination needs to reconcile their universal service and access objectives with these underlying trends to ensure those currently served continue to have access at affordable prices and those unserved have a reasonable opportunity to gain access to both national and international information infrastructures at affordable prices.

Developing the economic and intellectual potential of those at the lower end of the income spectrum in both developed and developing economies is both a noble objective and a feasible task with the effective development and deployment of a nation's information infrastructure. Hopefully, the issues and options raised in this as well as the other case studies in this series will contribute to the achievement of such a worthy, national information infrastructure objective.

⁸ For a more comprehensive discussion on policy and operator strategy options see - 'Challenges to the Network – Internet for Development', International Telecommunication Union, Geneva, Switzerland, February 1999, Chapter Six.

2 Internet Development and the Voice Telephony Market in Thailand

2.1 Background

According to the Telegraph and Telephone Act of 1934, the government has a statutory monopoly in the ownership and operation of public telecommunications network. Thus, the two state-owned enterprises namely, the Telephone Authority of Thailand (TOT) and the Communication Authority of Thailand (CAT), are monopolies in the local and international call services respectively. Private firms are prohibited from owning or operating a public telecommunications network. During the rapid expansion of the Thai economy in the early nineties, it became evident that the TOT and CAT alone could not expand their services to meet the surge in demand. To circumvent legal restrictions, a number of Built-Transfer-Operate (BTO) concessions were granted to private companies. These concessions allow the state agencies (as concession providers) and the private companies (as investors of network construction and service providers) to share monopoly benefits by revenue or profit sharing schemes. These concessions have led to a limited competition in the telecommunications market⁹.

The state monopoly, together with the BTO scheme, thus constitutes a unique feature of the Thai telecommunication market. It is in this context that the VoIP technologies offer a new dimension of competition.

2.2 Long-Distance and International Markets in Thailand

2.3 Domestic Long-Distance Market

In developed countries where fixed-line penetration level is high, a mobile phone service serves as a complement to the fixed-line service. In developing countries where the penetration level is low, however, the former serves as a substitute for the latter (ITU 1998). In the case of Thailand, the situation is more complicated. While mobile phones complement fixed-line services in the local call market, the two compete directly in the distance call market.

Due to their lower per minute rates, the mobile services are successful in attracting a large share of domestic long-distance call traffic. For example, while the TOT and their fixed-line concessionaires charge a maximum rate of Baht (Bt) 18 per minute, the rate applicable to mobile services is only Bt 12 per minute, or 50 per cent lower¹⁰. The cellular operators also offer promotional packages with various pricing schemes to suit the needs of different customer groups. These include, for example, deep discounts for new subscribers or off-peak calls. Table 1 shows recent pricing strategies of the two largest mobile phone operators.

Responding to competition, the TOT recently started to offer cheaper and more flexible pricing schemes. Table 2 shows the new rates. The first package maintains the status quo rate and is designed to attract users who seldom make long-distance calls. The second package is aimed at businesses and other users who frequently make long-distance as well as local calls. The last package is designed for users who spend more time making long-distance calls than local ones. In addition to lowering the rates, the state agency also adjusted its pricing criteria for part-minute calls. According to the new pricing scheme, there would be no charge for a call of less than 30 seconds, while those exceeding 30 seconds would be charged as one minute. (The Nation, March 3, 2000)

⁹ Currently, concessions have been granted to 2 fixed-line telephone operators, 5 mobile phone operators, 18 Internet service providers, and more than 25 pager, VSAT, and other value-added service providers. See (TDRI, 1999) for more information.

¹⁰ However, the cost of a fixed-line handset, at approximately Bt 6,000, is lower than that of a mobile phone at Bt 9,000-30,000.

Table 1: Pricing Strategies of Major Mobile Phone Operators

Total Access Communication Plc (TAC)	
Package 1	A monthly fee of Bt500. Bt1 per minute for local calls and a maximum of Bt12 for a long distance call for the first three years.
Package 2	A monthly fee of Bt800. Free 400 minutes of local calls per month plus 40 minutes of free long-distance calls for the first two years.
Package 3	A monthly fee of Bt500. Fifty per cent discount from the normal rates for both local and long-distance calls.
Advance Info Service (AIS)	
Package 1	A monthly fee of Bt500. Free 400 minutes of local calls per month. Additional calls at normal rates.
Package 2	A monthly fee of Bt990 for 200 minutes of local calls during peak times and 100 minutes at off-peak times. Additional calls at normal rates.
Package 3	A monthly fee of Bt 1,290 for 200 minutes of nationwide at peak times plus 100 minutes at off-peak times. Additional calls at normal rates.

Source: Compiled from (The Nation, March 13, 2000)

Although the new pricing scheme makes the TOT long distance services more attractive to users, the maximum rates charged are still not below those offered by mobile phone service operators. Only the new VoIP service, due to be launched later this year will, offer truly competitive rates and prepare the state agency for competition in a more liberalized market. See section 4 for details of the TOT proposal.

2.3.1 International Market

The international market is different from the domestic one in that it is completely monopolized by the CAT with no competition from BTO operators. Being a monopoly, however, does not fully protect the state agency from other forms of competition. In recent years, the CAT has seen its revenue eroded by competition from international call back services, substitution of fax and phone call by e-mail, ICQ, and other Internet-based services.

Table 2: Rates of Domestic Long-Distance Telephone Call

Package	Monthly Fee		Local Call Rates		Maximum Long Distance Call Rates	
	Baht	US\$	Baht	US Cents	Baht	US cents
1	100	2.63	3 per call	7.9 per call	18	47 per min.
2	120	3.16	3 per call	7.9 per call	12	32 per min.
3	90	2.37	1 per min.	2.6 per min.	12	32 per min.

Source: The TOT (Approximate conversion – 1US\$ = 38 Bt)

¹¹ There are few exceptions, however. For example, the CAT's paid for its one-third, equity share in Internet Thailand, a pioneer ISP. This is because other state agencies -- i.e., the TOT and the National Science and Technology Development Agency (NSTDA), paid for their shares. There is thus no rationale for CAT to be the only agency to obtain the shares for free.

Another important reason for the declining revenue is the decrease in international settlement surplus that used to contribute a significant proportion of revenues to the state agency's coffers. Due to these changes, the CAT's revenue fell to Bt30.3 billion in 1999 from Bt33 billion in 1998. During the same period, its profit also plunged by 39 per cent from Bt7.369 billion to Bt4.497 billion (The Nation, November 24, 1999).

It is in this context that the CAT decided to introduce its VoIP services. For discussions of the CAT proposal, see Section 4.

2.4 Internet Market in Thailand

The Internet market is classified as an international telecommunications service, and thus falls within the monopolistic domain of the CAT. Since 1995, however, the state agency has granted concessions to 18 Internet service providers (ISPs). These concessions are different from most other BTO concessions in that they are based on a profit-sharing scheme, rather than a revenue-sharing scheme. Moreover, the CAT demands a 32 per cent equity share for free and 3 additional per cent for its employees at par value¹². Its representative will also assume the position of a chairman in the company.

Previous research indicates that the CAT's intervention in the Internet market has posed a major obstacle to the growth of the market. For example, the 32% equity handout is estimated to increase the cost of services at the retail level by 20 per cent, assuming that the ISPs' required rate of return of 30 per cent (TDRI, 1997). The mandatory equity handout and the monopoly in the international leased line services have made Internet services in Thailand much more expensive than those in other Asian countries (See Table 3).

Moreover, the CAT also imposes many operational restrictions on the ISPs. Among these, the CAT representatives can veto the ISPs' business decisions it finds inappropriate. Voice services are also banned. Violators are threatened to have their concessions withdrawn. The threat seemed credible as Loxley Information Services (LoxInfo), a major ISP, which attempted to provide the PC-to-Phone telephony service, was given due warning by the CAT in 1998 (The Nation *).

Table 3: Comparison of Internet Pricing in Asian Countries

(Unit: US\$ – approximate conversion 1US\$ = 38 Baht)

Country	Dial-up service (20 hours)		Corporate leased-line service (64 Kbps)	
	Start-up fee	Monthly fee	Start-up fee	Monthly fee
Thailand	-	12.63	1,621.05	1,533.34
Hong Kong SAR	6.37	17.55	N.A.	303.53
Taiwan	6.42	12.84	N.A.	N.A.
Singapore	23.44	3.50	311.03	909.61
South Korea	-	17.29	129.58	736.95
Malaysia	-	10.82	-	519.37
Indonesia	6.16	14.34	N.A.	N.A.
Japan	N.A.	31.87	N.A.	351.47

Source: TDRI, 2000

¹² There are few exceptions, however. For example, the CAT's paid for its one-third, equity share in Internet Thailand, a pioneer ISP. This is because other state agencies -- i.e., the TOT and the National Science and Technology Development Agency (NSTDA), paid for their shares. There is thus no rationale for CAT to be the only agency to obtain the shares for free.

3 Convergence of IP Telephony and PSTN Telephony

3.1 Overview of IP Telephony Technical Issues

The convergence of the traditional circuit-switched and IP networks to deliver public telephone service is accentuating the convergence of voice, data and video information services over the Internet infrastructure. However, a number of network-related issues particularly in respect quality of service (QoS) and peering need to be resolved in order to satisfy the mutual interests of consumers and service providers. Price and quality of service attract consumers, while service providers are driven to improve market share, revenues, and returns.

Despite these unresolved network-related issues the permeation of IP services outlined below is an example of the impact of consumer expectations and interactions with the capabilities of new technology over the counteracting traditional influences of incumbent operators and regulatory controls of the long-distance and international market. Consumer demand propelled by the power of technology has triggered changes in the traditional voice telephony market culture and the resulting convergence of voice or voice-based services offered by the circuit-switched PSTN and packet-switched IP networks. In addition, evolving opportunities for provision of multimedia services over the Internet are expected to accelerate the process of convergence.

The foreground for these changes were set out with the announcement of results of experiments in real time voice communications using IP in 1994. At the time, the success story¹³ barely drew the attention of the dominant stakeholders controlling the long-distance and international voice sector of the telecommunications market. It was then viewed to be a toy of computer fanatics.

A change in the attitude of the participants in the traditional voice sector began to occur with the introduction of IP telephony products offering initially, PC to PC communications using proprietary software in early 1995.¹⁴

This untapped market of unsatisfied latent demand was exploited sooner than some incumbent operators expected by the initial providers of PC to PC telephony.

3.2 Voice/Data over Internet Protocol – PC to PSTN

The growing use of PC-to-PC, IP telephony, which in some cases attracts no usage charges,¹⁵ conditioned the market for the entry of several new Voice-over Internet Protocol (VoIP) products. These services offer lower-priced international calls from PCs to telephones over the Internet although the services lacked certain traditional features of the PSTN.

¹³ Technofile at <<http://coverage.cnet.com/Content/Gadgets/Techno/Telephony/ss01.html>> states that in three years, Internet telephony has gone from being a curiosity for computer geeks to a real phone service for the rest of us.

¹⁴ The first generation of IP telephony products were PC to PC based point to point applications that converted voice into data packets enabling these packets to be transmitted over a packet-switching, data network using TCP/IP protocols. These data networks, unlike the PSTN, are not optimized for any specific type of traffic flow the concept of voice telephony evolved from the use of the VocalTec's Internet Phone introduced in Feb 1995. Others followed these applications, such as, Netspeak, and Microsoft's, Netmeeting. The service provided by these early products, at least to most destinations, were plagued by poor sound quality and delays. No standards existed, restricting the use of the applications to those who had the same software application. In addition, the applications supported, in many instances, only *half-duplex modes*, meaning only one person could talk at a time - hardly conducive to a spontaneous speaking style.

¹⁵ Such as in the case of flat rate based charges for local access and Internet usage.

Many of these new services began to employ the ITU-T standard H323¹⁶ adopted in May 1997.¹⁷ This standard, H323, is comprised of the following four components:

1. terminals- end-user devices used for real time multimedia communications such as a PC or stand-alone device;
2. gateways¹⁸ - a device that provides connectivity between two dissimilar networks;
3. Gatekeepers¹⁹ – provide call control services such as address translation and bandwidth, management accounting, billing and pricing.
4. Multipoint control units (MCUs) – provided support for conferences between three or more terminals.

When these components are combined into a network they provide one or more of the following types of information infrastructure configurations that support data, voice, and video information services or any combination thereof as determined by the end user:

1. Point-to-point information services; or
2. Point-to-multi-point information services;

Consumer demand for VoIP-based services was stimulated not only by the attractive price-levels but also by some of the features offered in the service package such as one or more of the following:

- a) on-line procurement of prepaid service,
- b) on-line billing,
- c) voice telephony, text/graphics, voice messaging, fax service,
- d) log of telephone numbers and email addresses of frequently called parties for on-line, automated dialing,
- e) monitoring of Quality of Service,
- f) processing of claims for rebates, and/or
- g) Informing called parties for establishment of free PC to PC calls, if necessary.

¹⁶ H.323 is part of the H.32x family of recommendations specified by ITU-T. The standard enables the transmission of real-time audio, video, and data communications over packet-based networks. It specifies the components, protocols, and procedures providing multimedia communication over packet-based networks. Packet-based networks include IP-based (including the Internet) or Internet packet exchange (IPX)-based local-area networks (LANs), metropolitan-area networks (MANs), and wide-area, corporate networks (WANs). H.323 is applicable for a variety of service products - audio only (IP telephony); audio and video (video telephony); audio and data; and audio, video and data - multipoint-multimedia communications. It has the capability to be applied in a wide variety of areas—consumer, business, and entertainment applications.

¹⁷ The IETF has announced a new protocol that may change the way next generation VoIP networks are built. This protocol known as Session Initiation Protocol (SIP) is expected to overcome the inefficiencies inherent in H323. The most prominent being the call set-up duration that is much longer than that of the PSTN and the other is the need to create separate phone numbering schemes for H323.

¹⁸ H323 – A gateway for IP telephony provides bi-directional connectivity between an IP network and the PSTN or any switched network.

¹⁹ Gatekeepers in H323 networks are optional. However, where gatekeepers are present in the network, then gateways and terminals must interact with them.

3.3 IP Telephony and Quality of Service

The quality of service in terms of the end-users' perception consists of both the quality of the conversation path as well as other 'packaging' aspects of the 'product' such as convenience/ergonomics of dialing/operating, and passwords. In addition, the convenience of on-line procurement/charging and prepaid cards for network access arrangements as well as real time billing are other components of the overall quality of service as perceived by the consumer. The introduction of IP telephony has raised a number of issues related to the quality of service (QoS) of both VoIP-based services and traditional voice telephony services.

By the time VoIP products reached the market, some consumers had become accustomed to the quality offered by PC to PC voice-service products, without any guarantee of service quality. The quality of PC to PC services varied significantly according to availability of bandwidth in the backbone and the throughput of routers. However, the lower quality²⁰ of the VoIP services as compared to that of end-to-end PSTN services appears to be more than compensated for by the much lower prices that enable consumers to meet their unsatisfied demand.

The voice quality on a network is influenced by several factors and can vary due the performance of gateway equipment, client software, telephone systems, backbone routes/networks, ISPs and time of the day etc. The key components that effect quality may be categorized as follows:

- a) Intelligibility - depends mainly on the voice coder/decoder (Vocoder)²²
- b) Echo²³ and,
- c) Latency - is the most dominant variable and, if excessive, will severely impact the QoS of voice telephony.

As the most dominant factor that severely degrades the QoS in telephone conversations is delay or latency, the minimization of latency is one of the primary goals of the service provider in the context of providing an acceptable quality of service.

In the traditional PSTN, one way latency is normally less than 150 milliseconds and at these levels of delay the latency is not noticeable to most people. A user's perception of latency is that the quality deteriorates with an increase of one way latency until it degrades beyond 450 millisecond when it becomes difficult to hold a normal conversation.

3.4 Quality of Service and Peering

Until the introduction of Internet telephony, traffic on the Internet comprised mainly mail and file transfer and web information. This type of traffic is not sensitive to the delays introduced by high-speed transmission networks. However, this is not the case with VoIP traffic where real-time discussion becomes increasingly difficult when the delay exceeds 450 msec. For real-time voice services, there is a relationship between delay, as reflected in voice quality, and price.

Management of latency in the provision of an IP telephony service is one of the keys to the success of the service. The inability to manage latency may occur when traffic is routed via equipment and media that are

²⁰ The PC to PC IP telephony products do not currently offer guarantees of quality of service.

²¹ 'Next-generation Telcos' survey by Pulver.com and several others refer to a number of VoIP service providers such as [Interline ITXC](#), [GXC](#) (Global Exchange Carrier), [PairIt](#) (PC to PC, phone), [Dialpad](#), via Java Applet, [Net2Phone](#), and Deltathree.

²² Some types of commonly employed telephony 'vocoders' on the market are based on ITU-T standards such as the G729 and G711 standards at 64 Kbps; G723.1 at 6.4 Kbps or 5.3 Kbps. These are generally selected as default speech encoders for IP telephony.

²³ The echo arises from a mismatch in impedance at the two-wire to four-wire separation. This factor may be partially compensated for by echo cancellation equipment that is used for suppressing the irritable far-echo that increases with delay.

²⁴ One gateway is involved if the call is from a PC to the PSTN and two are involved if a VoIP call is between two PSTN telephones.

not effectively controlled by end-to-end service providers. In particular, the inability of service providers to select routing equipment that supports prioritization of routes or provides RSVP to guarantee a specified level of throughput is the major cause contributing to the increase in latency.

Several regional ISPs have collectively been striving to find solutions to the peering problem.²⁵ Private peering relationships between ISP's are important to help to relieve network congestion. ISP's that rely solely on public network access points are unlikely to find solutions to overcome problems of varying latency.

A VoIP clearinghouse helps to overcome the peering problem by bringing together regional and local service providers for origination and termination of telephony minutes. One of the functions of the 'clearinghouse' is to relieve national ISPs from the burden of pursuing traffic-sharing agreements with hundreds of service providers in different destinations around the world. In addition, regional clearinghouse services have also emerged for the purpose of gathering traffic from dispersed national networks in specific geographic areas of the world and pooling that traffic for low-cost termination to global clearinghouses or other regional operators. Clearinghouses provide Internet service providers (ISPs), and telecommunications companies with a complete solution, for offering Internet telephony, fax, and a range of value-added services with guaranteed latency. They also act as intermediaries for the financial settlement of IP Telephony and fax traffic and guarantee payment to all members. Another alternative is to establish Intranets, such as that proposed by TOT or virtual private networks to overcome the peering problem, and hence the delay.

4 Present Trends and Future Developments

4.1 The CAT Proposal

As mentioned in Section 2, although being designated as having a monopoly in the provision of international telecommunication services, the CAT has not been fully protected from competition. In recent years, the CAT has seen its revenue eroded by competition from international call back and substitution of fax and voice calls by e-mail, ICQ, and other Internet-based services. To regain its falling revenue, the CAT has launched its VoIP services called phoneNet as a low priced alternative to its basic international telephone service. The state agency has subcontracted Hatari Technology Co. Ltd. to market the service. In return, Hatari will earn 10 per cent on sales of the service up to Bt40 million and 15 per cent on sales of Bt100 million for five years (The Nation, November 24, 1999).

The service now covers about 75 countries. To access the phone-to-phone service, users must first buy a calling card that will give them a 12-digit access code. There are two types of calling cards: Silver and Gold Cards. The cards cost Bt 5,000 and Bt 10,000, respectively. With the cards, users can make an international call from any phone, including mobile and public telephones.

Table 4 shows the price of phoneNet compared to CAT's existing prices. As can be seen from the Table, the prices of phoneNet are 21-40 per cent lower than the normal prices and 0-17 per cent lower than the nighttime discount prices. In addition to lower rates, Hatari Technology claims that there are other benefits to the users. Firstly, the service is not charged in blocks or units of time as in the case of international call, but in the number of actual seconds used. Thus the prices of the service will be effectively lower than the simple comparison. Secondly, with the calling cards, users can more easily control the expenditures. It is interesting to note that the prices of phoneNet do not change with the time of the day. Thus it seems that the service will be most attractive for users that cannot change the time to make telephone calls, e.g., business users.

²⁵ The Tech Web reports that the executive of Savvy Communications has, with three other ISPs, formed a group, which was to launch a company, called the Brokered Private Peering (BPE). The BPE is expected to help to create a balanced model for network peering.

Table 4: Comparison of Phone Net and International Telephone Rates For Major Destinations profit.

With the VoIP service, the CAT expects to increase its revenue to Bt31.1 billion next year, with Bt4 billion
 (Unit: Bt – approximate conversion – 1US\$ = 38 Bt)

Destinations	Standard Rate (1)*	Economy Rate (2)**	Reduced Rate (3)***	Phone Net Rate	% Discount from (1)	% Discount from (2)	% Discount from (3)
East Asia (Japan, South Korea, Taiwan)	36	29	25	24	33.3	17.2	4.0
Hong Kong SAR	30	24	24	20	33.3	16.7	16.7
ASEAN (Philippines, Indonesia, Brunei)	34	27	27	27	20.6	0.0	0.0
Singapore	28	22	22	22	21.4	0.0	0.0
Middle East	46	37	32	32	30.4	13.5	0.0
Europe (excluding UK)	42	34	30	28	33.3	17.6	6.7
Australia/New Zealand	24	20	20	24	0.0	-20.0	-20.0
North America/Canada	24	20	20	20	16.7	0.0	0.0
South/Central America	55	44	39	39	29.1	11.4	0.0

Notes: * Between 07.00 a.m. to 09.00 p.m.

** Between 09.00 p.m. to 12.00 p.m. and 05.00 a.m. to 07.00 a.m.

*** Between 12.00 p.m. to 05.00 a.m.

Source: The CAT and Hatari Technology

4.2 The TOT Proposal

The TOT plans to launch its VoIP service under the name Y-Tel 1234 to provide a cheap domestic long-distance call service in the first half of 2000. The service is part of the state agency's efforts to compete with mobile-phone services and is also in line with the Government's policy of low-cost services in the provinces²⁶.

To use the service, users do not need cards or a subscription. All they have to do is to dial extra digits '1234' before dialing the destination number. The service is available to any telephone including public telephones. Currently, however, only the TOT subscribers will be able to use the service. The TOT's BTO concessionaires, i.e., TelecomAsia Corporation Plc (TA) and Thai Telephone and Telecommunication Plc (TT&T) have yet to develop similar services.

Table 5 summarizes the prices for the service. From the summary, it can be seen that maximum rates (7:00 - 18:00 of working days) for the VoIP service ranges from Bt2-8 per minute. This is significantly lower than the current long-distance rates of Bt3-18 per minute and is competitive with the rates of mobile phone services. (See rates of mobile phone services in Section 2.)

Technically, the IP traffic will be passed to the public fixed-line network, unlike most VoIP services which use private networks. It appears that the TOT is attempting to fully utilize its public line capacity. Concerning the quality of voice, the TOT claims that the delay experienced by the users of Y-Tel 1234 is no more than 100 ms, a significant improvement over 250 ms delay of the satellite-based telephone service.

²⁶ For other examples of TOT offers of lower priced distance services, see Section 2.

Table 5: Rates of Y-Tel Service

(Unit: Baht – approximate conversion – 1US\$ = 38 Baht)

Day	Time	0-50 Km	51-100 Km	101-200 Km	More than 200 Km
Working Days	07:00-18:00	2	4	6	8
	18:00-22:00	1	2	3	4
	22:00-07:00	0.75	1.5	2.25	3
Holidays	07:00-18:00	1.5	3	4.5	6
	18:00-22:00	0.75	1.5	2.25	3
	22:00-07:00	0.5	1	1.5	2

Source: The TOT

Voice quality will be also on par with that of mobile phones with a comparable compression rate (TOT's Y-Tel 1234 Public Relation Document).

The state agency hopes that the new service will be a quick success and improve its declining revenues. TOT projects that the service will soon capture 5 per cent of total long-distance call demand (The Nation, December 20, 1999).

4.3 Conclusion and Future Prospects

While VoIP services are usually offered as lower priced calling packages by new entrants in a liberalized market, in Thailand the services are provided by incumbent state agencies to protect their falling revenues. The services are currently monopolized by the agencies, but the situation is about to change. In fact, the year 2000 is a year of changes for the Thai telecommunication market.

Firstly, the law to establish the National Telecommunications Committee (NTC), an independent regulatory body, has become effective in March. Once established, the NTC will replace the state agencies as the regulator. Secondly, the Telecommunication Act, which will determine the market structures and the rules for competition, was approved by the Cabinet and is in the process of parliamentary reading. Thirdly, the CAT and the TOT are due to be corporatized and later privatized. Finally, thirty-three concessions between the state agencies and their concessionaires are in the process of being converted, rendering more freedom to conduct businesses for the private sector participants. In the long term, the whole process will result in a much more liberalized market.

At this stage, however, it is too early to assess the degree of liberalization and the impact of the regulatory changes on the provision of VoIP and other long-distance and international services. The draft Telecommunication Act approved by the Cabinet provided little details concerning the future market structure except that the CAT and the TOT will be able to continue to provide their existing services. The pace of the liberalization, the licensing conditions, and the numbers of licenses to be issued are all subject to regulation by the NTC. How much and how soon the Thai people will fully benefit from fully liberalised markets and further technological innovations, such as VoIP services, remains to be seen.