International Charging Arrangements for Internet Services (ICAIS)

Module 3 Presentation APECTEL21

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Terms of Reference Module 3

Prepare an analysis of:

1. the current systems of international charging arrangements for internet services, including inter alia the effect of these arrangements on the development of the Internet in the APEC region; and
2. a range of alternative charging arrangements, including those identified by participants in Modules 1 and 2 of the study;

The Criteria

Analysis should be based upon clearly stated and transparent criteria, in considering the extent to which each arrangement is:

1. compatible with APEC principles of trade liberalisation and market-orientation
2. sustainable, in continuing to attract investment that meets demand for connectivity in the medium and long term
3. recognised by industry participants as being equitable in distribution of costs and benefits
4. sufficiently robust to remain economically viable in the medium and long-term, and
5. conducive to promoting establishment of high-bandwidth connectivity among APEC economies.

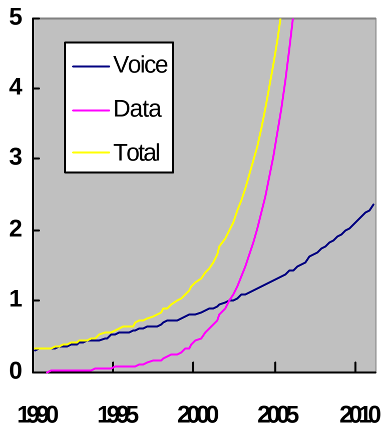
The Internet is a fundamental redesign of communications

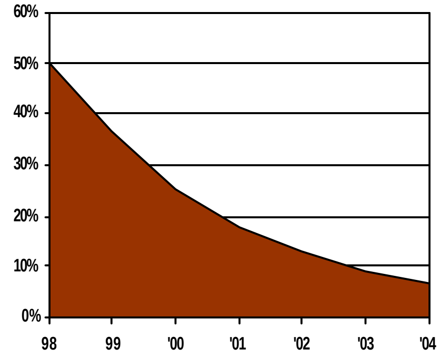
- States are at the core of telephony; networks are at the core of the Internet. The Net is inherently global in scale – the “local calling area” is the world.
- The Internet represents a fundamental reconstruction of communications technology:
  - There are are no calls, no circuits, no minutes of use, only packets guided by routers;
  - There is no guarantee of delivery - “best efforts” only;
  - Failure of packets to arrive is the only feedback mechanism;
  - Packet paths can be within the control of the end user, not the provider, so that **relative packet flows can be arbitrarily manipulated by a client.**

The rate of change is driven by software

- The Internet is an invasion of computer ideas into telephony: competition, innovation, extermination.
- The Internet was designed to keep the intelligence in the computer, rather than in the network. The network is stupid; intelligence is in the terminal.
- Consequently the rate of change on the Internet is driven by advances in software products and services. Change propagates “virally”, as people buy or download new software.
- The rate of change is driven by advances in computer power, and available bandwidth.

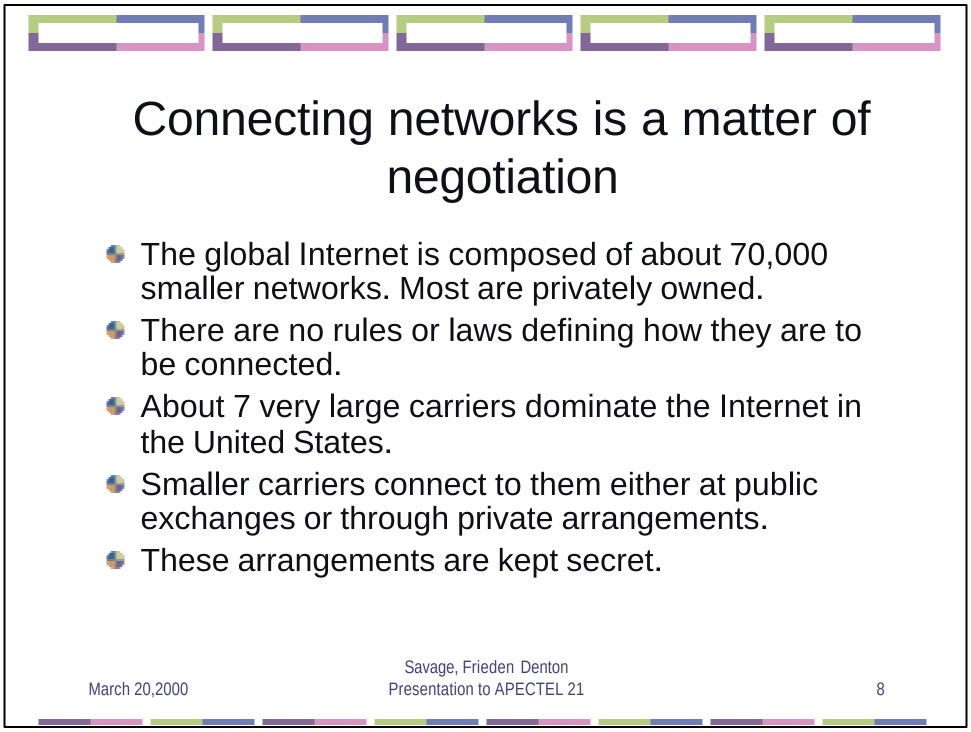
Proportion of voice traffic sinks





The Internet has been kept free of price regulation

- By "regulation" is meant price and entry regulation, by agencies of government, and not "the rule of law". Computer services have never been price regulated.
- The relations of carriers to *Internet service providers* is generally regulated as to prices and conditions. (It is still an open question in the US re coaxial cable).
- The relations of carriers to carriers, as regards Internet data traffic, has so far fallen outside of economic regulation.
- The relations of carriers in unregulated portions of their business comes under the purview of competition law.



About 7 very large carriers dominate the Internet in the United States.

Most would agree that they are: Cable and Wireless, GTE Internetworking, PSINet Inc., Sprint Corp.,UUNet Technologies, AT&T, Qwest Communications International Inc.

Smaller carriers connect to them either at public exchanges or through private arrangements.

Smaller carriers can connect t the tier-1 carriers at public metropolitan area exchanges (MAEs) or Network Access Points (NAPs). However smaller carriers also connect privately by high-speed lines, and these links are referred to as “direct connections”.

These arrangements are kept secret.

Consequences

- Telephone settlement ideas have not mapped onto the Internet.
- The absence or inadequacy of settlements causes networks to keep their costs internal; hence the urge to grow as large as possible, as fast as possible.
- The largest and oldest ISPs set up direct peering links with one another and share the cost. But smaller ISPs have to buy their way in to this club, or send their traffic through congested public peering points, or pay to transit their traffic.
- All offshore and Canadian carriers are in the same position as smaller domestic American carriers - pay up! - unless they are large enough to peer.
- Smaller Canadian and US ISPs have less distance to pay for than Asian and Australian carriers, so they are less affected by this arrangement.

The facts not in dispute

- The total cost of data transmission links between the United States and Asian countries is borne entirely by the Asian ISPs, even though the link may carry a significant amount of traffic that was initiated by America customers.
- Internet traffic volumes are generally opposite in direction to the source of request.
- Internet traffic volumes are asymmetrical between the United States and Asia, as they are to most other parts of the world. A ratio of about 70/30 applies.
- Where American ISPs offer services in foreign countries, they generally will not advertize their domestic routes to the competitor in these markets. Hence the Asian or European ISP cannot use the American owned trans-oceanic link for the transmission of packets to the US even if the traffic session request originated in the United States.

Peering and Transit Defined

- Peering is usually a bilateral arrangement, where two providers agree to accept traffic from one another, and from one another's customers (and thus from their customers' customers)
- Peering does not include the obligation to carry traffic to third parties (transit).
- Historically, peering has often been done on a bill-and-keep basis, without cash payments, where both parties perceive roughly equal exchange of value; however, there is always an element of barter.
- Where peering provides access to one provider's customers, transit usually provides access at a predictable price to the entire Internet.

Payment Arrangements

- Peering
  - Sender Keep All. A rough equivalence of traffic volumes results in no cash trading hands. Advantage: no bookkeeping. Peering connects you only to the other peer and its clients, and not to the whole of the Internet.
- Client/supplier
  - The client supplies the access line and then pays an access charge to connect to the Internet through the supplier. Carriers connecting to US Internet suppliers have to use this model. The charge for connection to all other Internet carriers is the transit fee.
- Settlement Peering
  - The costs of the line are shared; traffic is measured, and the receiving party pays an amount for the difference. Used in Pacific and between US Tier 1 and Tier 2 carriers.

How connection deals are made

- Typical US backbone interconnection guidelines
  - Bi-coastal US presence, with multiple potential points of interconnection
  - Significant transcontinental bandwidth
  - Consistent routes at all locations
  - Competent staff, professional 7 x 24 operation
  - Rough balance of ingress/egress traffic
  - Sufficient scale to justify transaction costs
- Where criteria are not met, a backbone may:
  - decline to exchange traffic, OR
  - expect cash or non-cash compensation in return
- Backbone providers make case by case business decisions on traffic exchange terms and conditions.

Who are the peers?
(Tier 1 ISPs)

- Cable & Wireless Inc. (Vienna, Va.), GTE Internetworking (Cambridge, Mass.), PSInet Inc. (Herndon, Va.), Sprint Corp. (Kansas City, Mo.), and UUnet Technologies Inc. (Fairfax, Va.). AT&T (Basking Ridge, N.J.) and Qwest Communications International Inc. (Denver).
- There are 60 private peering connections among members of the club. Nearly half of Cable & Wireless' private links are to other members, as are more than half of Sprint's.
- Peering contracts are secret. Information is closely held, and this practice is universal among the peers.

Traffic is highly concentrated

- Measuring traffic in T-3 equivalents, it was found that:

Network	mid 96	year end 97
MCI	75	400
UUNet	<50	400
BNN	30	52
AGIS	35	61
PSINET	20	51
Sprint	50-70	137

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Given the fact that Internet bandwidth has to double very four months to keep track of demand, these figures are radically out of date. They are however, the best that could be obtained in the public domain.

“BYLINE: Matt Roush

HIGHLIGHT:

Apex Global Information Systems, Internet data communications provider, declared bankruptcy sales amounted to $12 mil in 1999

BODY:

Apex Global Information Systems Inc (AGIS), a provider of Internet data communications services to Internet service providers, has declared bankruptcy. AGIS was founded in Dearborn,MI, in 1994 and has since moved its headquarters to Bethesda, MD. AGIS has listed about $45 mil

in debt to its 20 largest unsecured creditors, however, the company made

only $12 mil in sales in 1999.

One of metro Detroit's oldest Internet-based businesses declared Chapter 11 bankruptcy Feb. 25.

Four factors affect Asia-Pacific Internet costs

1. A small number of very large operators impose transit fees over *all* smaller ISPs (not just Asian and Australian);
2. Intra-regional peering is insufficient; local interconnection charges are high;
3. Distance to the United States is great;
4. The flow of traffic tends more towards English-language sites in the US.

The Nature of the Dispute

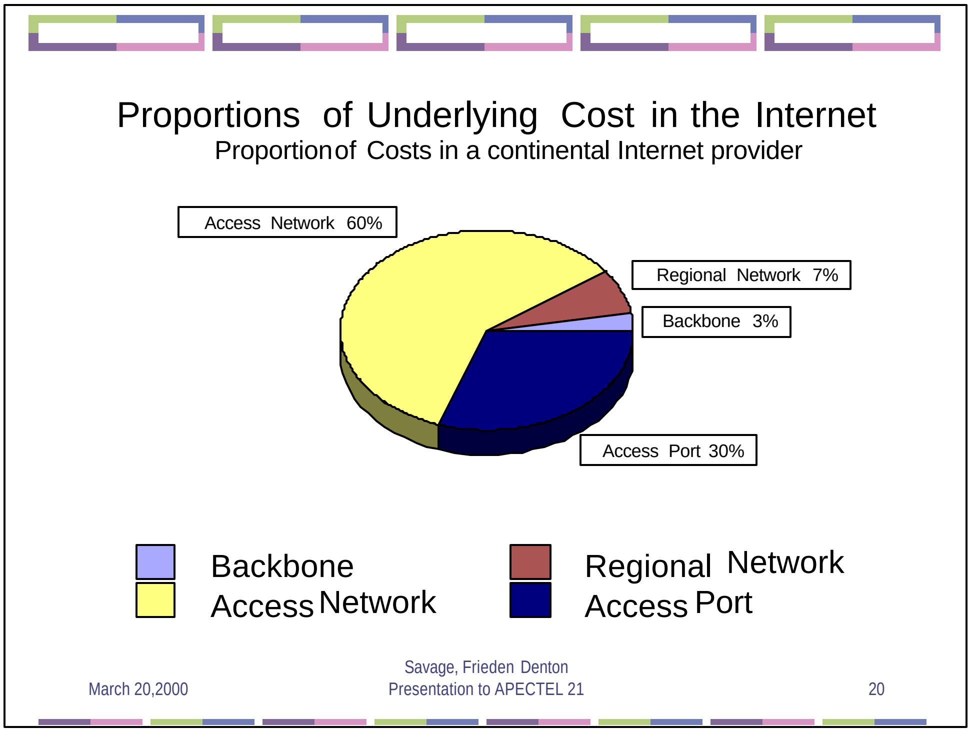
- In both telephony and the Internet, costs are recovered in two different ways. In the Internet, costs are averaged out among all users and recovered in the monthly charge.
- If two networks of different size exchange traffic, then a settlement must be made on the relative size of the networks, which is a proxy for costs.
- This is complicated further because many costs are still distance-sensitive.
- Although the Internet is the "death of distance" it is not the "death of the cost of distance"

Costs in an Internet Network

- The biggest single cost component of any network, whether it is electrical distribution, cable TV, telephony is the cost of the distribution network to reach the end user. The cost of the network is a direct function of the number of users and the distances between users and the source point of the network.
- In traditional voice telecom the cost of distance is incorporated in the cost of the telephone call.
- Instead with the Internet the cost of the network is distributed equally amongst all users and is buried in their basic access fee. As a result, Internet packets have an intrinsic value that will vary from packet to packet based on the distance the packets have traveled from the point of origination.

Costs in an Internet network -2

- Assume two ISPs – ISP A and ISP U. ISP U is geographically a much larger network than ISP A. Hence the cost of the ISP U's network is going to be larger the cost of the ISP A network,
- The cost of a network is a function of
  1. the size of the network,
  2. the number of users, and
  3. the average per kilometer cost of telecommunications.



Discussions with people who run ISPs and backbone networks have supplied us with the following insights into cost structures. The picture may vary from network to network, and purely trans-oceanic networks without local access may have a different cost structure, but this picture is a model, based on the assumptions set out below.

Generally as a rule of thumb, everything is multiples of 10 on the Internet.

For every $1 you spend on backbone link, you will spend $10 on a regional link. And for very $1 you spend on a regional link you will spend $10 on an access link. Most likely this model extends to trans Ocean links, so a trans Oceanic link cost is 1/1000 of typical Tier 1 ISPs costs.

Of course there are more exceptions to this rule than there are those in concurrence. Global Crossing for example has very few regional links or access links so its costs will be heavily dominated by its overseas costs.

MCI/UUnet or Sprint, however more closely follow this rule of thumb model

Derivation of the cost model

- It is a model of a continental system's costs; it is *not* a model of a transoceanic ISPs costs.
- Generally as a rule of thumb, everything is multiples of 10 on the Internet. For every $1 you spend on backbone link, you will spend $10 on a regional link. And for very $1 you spend on a regional link you will spend $10 on an access link. Most likely this model extends to trans-Oceanic links, so a trans-Oceanic link cost would be 1/1000 of typical Tier 1 ISP's costs.
- Of course there will be many exceptions to this rule. Global Crossing for example has very few regional links or access links so its costs will be heavily dominated by its overseas costs. MCI/UUnet or Sprint, however more closely follow this rule-of-thumb model.

Derivation of cost model - 2

1. For every 10 dial customers you have one dial port - cost $5/month
2. For every 100 dial ports you have one T1 circuit and radius server - 1.5 Mbps - cost $1000/mo
3. For every 100 T1 (access circuits) you have 1 regional circuit OC3 plus routers and switches - cost $10,000/month
4. For every 100 OC3 regional circuits you have one backbone OC-48 circuit plus core routers, severs, POPs etc - cost $500K per month

To serve one customer the breakdown in costs are as follows: Assume an ISP with one OC-48 backbone:

- Backbone - $.5million/month
- 100 OC3 - $1m/month
- 10,000 T1 - $10m/month
- Access Ports -$5m/month
- Total $16.5m per month

Derivation of the Cost Model -3

Therefore on a per customer basis:

- Backbone is 3% of costs
- Regional network is 7% of costs
- Access network is 60% of costs
- Access port is 30% of costs

The costs of trans-oceanic links have to be considered against access and port access costs. More importantly if a country has high internal T1 and OC3 costs then it will be at a serious disadvantage.

This was a "straw man" for the purpose of discussion. It is based on real costs in North America. **A transoceanic ISP might have a much different cost structure.**

The Analysis

The consultants have attempted to scope the size of the problem of trans-oceanic costs relative to total system costs, and have found reason to think they are relatively small. Local access costs have a much greater bearing on total system costs than long-haul portions. However, we have not been supplied reliable cost estimates for a trans-Pacific carrier.

Nonetheless, for carriers having to bear the entire costs of lines to the United States, an issue of principle is involved. The US carriers flatly refuse to share a portion of the costs of reaching US Internet sites.

The client-supplier model

This model is objected to because Asian and Australian carriers must pay the costs of transmission to and from the United States.

The model is unpopular with some parties (offends criterion #3), but it satisfies several other criteria:.

- Investment in transport infrastructure is being made at a rapid pace (criterion #2);
- It is consistent with trade liberalization and a market orientation (criterion #1);
- Increase in the supply of high-bandwidth connectivity among APEC nations is not affected by this model. Vast increases of bandwidth are being made in Asia-Pacific (criterion#5).

Competition Policy Issues

- Competition policy principles provide *clearly stated and objective criteria* for assessing charging arrangements. Such principles have been adopted by APECTEL's liberalization steering group. They are found in all the common-law jurisdictions.
- We have yet to see cartelized or anti-competitive behaviour.
  - No denial of service to anyone
  - No joint planning of investments;
  - No ability to monopolize trans-Pacific bandwidth;
  - A bandwidth commodity market is beginning to emerge.
  - One of the original peers (AGIS) went bankrupt in February 2000.
- We have seen major carriers use the inelastic demand for web content to extract money from smaller carriers, but that is not illegal.

The Settlement Peering model

- The settlement – peering model also satisfies many rational criteria. It satisfies the principle of proportionate sharing of costs of the access to the US Internet.
- It may be less pro-competitive if joint ownership of cable is involved (criterion #1).
- It is easily compatible with the other stated criteria.
- US carriers refuse to engage in it for reasons of rational self-interest.

What can be done?

- We must draw a sharp distinction between what APEC governments might do and what Asian and Australian carriers should do.
- Governments face a choice between doing nothing – letting current trends continue and taking action on other fronts – and doing something – by which we mean addressing the charging issue directly.

Arguments for taking action on other fronts

- The chief policy concern is to make bandwidth and connectivity as affordable as possible – which may be contrary to the interests of some carriers but not to those of consumers and producers in an Internet era.
- The great bulk of costs is local and national.
- Reduce costs of telecommunications carriage everywhere you can. Encourage computer ownership
- Remember that the local calling area of the Internet is the whole world. Why make it expensive for your producers to reach their customers around the world?

Arguments for taking action on other fronts - 2

- Bandwidth prices are about to come down dramatically in Asia-Pacific, though this will only encourage more Internet traffic to the United States unless local and intra-regional prices decline.
  - Global Crossing and others are putting in cable capable of 120 Gigabits/second.
  - Cable can be planned, financed and laid in the space of 3 years, at greatly reduced cost/bit
- Higher demand for local content in local languages is occurring.
- Local ISPs will cache and mirror sites, and improve exchange points.
- Asia-Pacific ISPs may combine, and expand networks into US to take advantage of the more competitive internal market.

Take action scenarios

The core of the objection of the Asian and Australian carriers to this system is that US Internet carriers are saying, in effect, they can get away with placing no dollar value on being able to reach trans-Pacific economies. They reach these economies largely on bandwidth supplied at the expense of trans-Pacific carriers.

Changing the incentives faced by US carriers is the key, but how? Internet telephony may provide the key. Right now, the Internet provides no differentiated services; no application has priority over another. Voice services will likely change this.

Will voice services require a payment settlement scheme?

- The human ear requires packets to arrive fast and continuously enough to produce audible speech.
- Voice services over the Internet will require a billing system.
  - VoIP with quality comparable to the PSTN is likely to require traffic exchange supporting differentiated services
- Differentiated services may imply tiered payments between providers. How to evolve payments schemes is not yet clear.
- In the meantime, the logic of the Internet is to grow your networks as fast as possible and to reduce domestic telecom access prices.

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