Title of the presentation

Regional seminar on trade of telecommunication services

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Trade agreements between Internet backbones

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Note - The views expressed in this presentation are those of the author and do not necessarily reflect the opinions of ITU or its membership.

Summary

Title of the presentation

- The players
- Interconnection regimes
- Rights and obligations of backbones
- International interconnection
- Possible evolution
- Conclusions

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Chief Internet players

- End-users are customers who use services offered via the Internet
- Internet service providers (ISPs) offer end-users Internet access points, either through the PSTN or by dedicated link
- Content providers are connected to service providers by dedicated link, through which they provide, round the clock, the information needed by end-users
- Internet backbones provide ISPs with the passband needed to allow them to communicate with each other.

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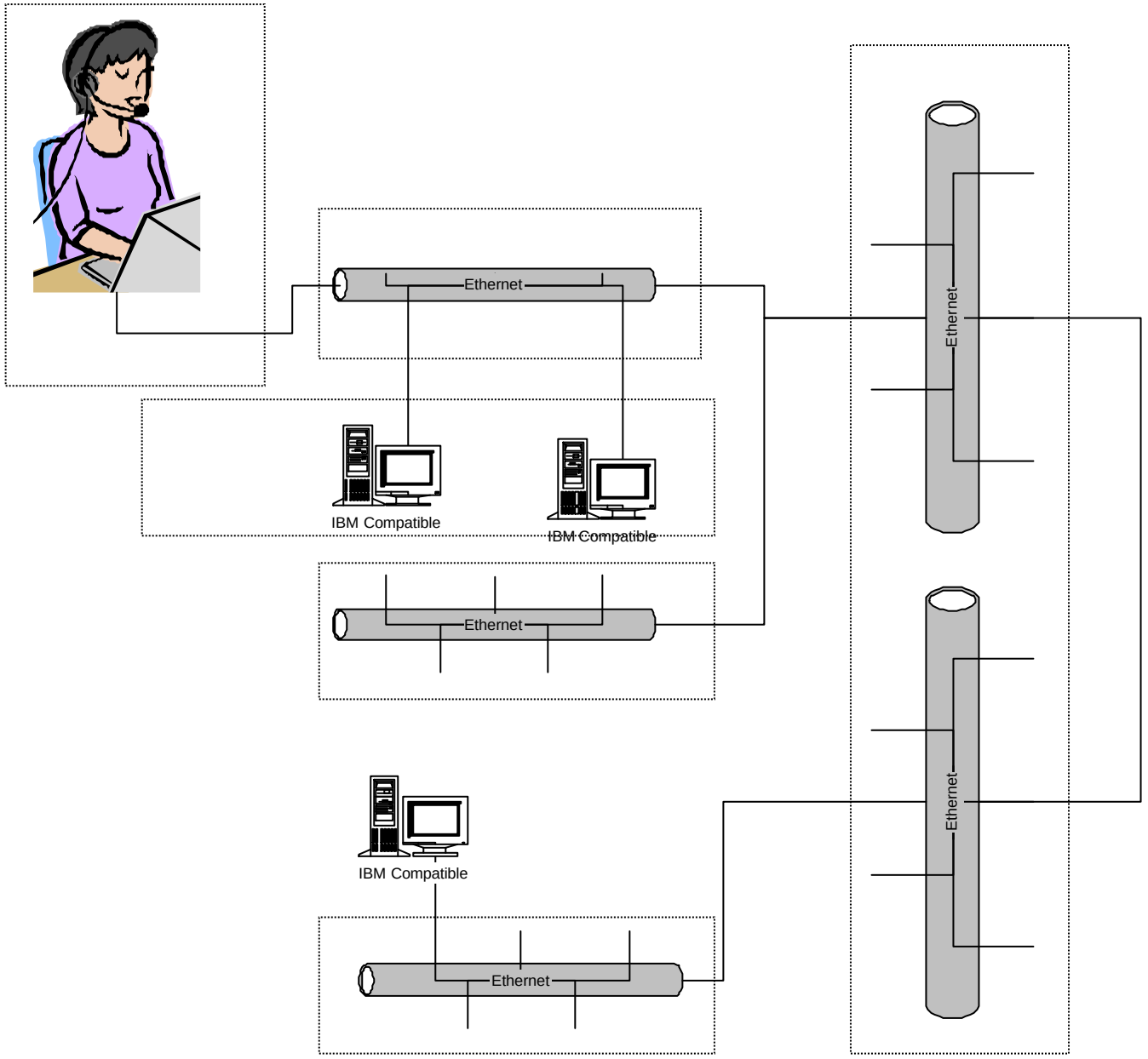

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Commercial agreements

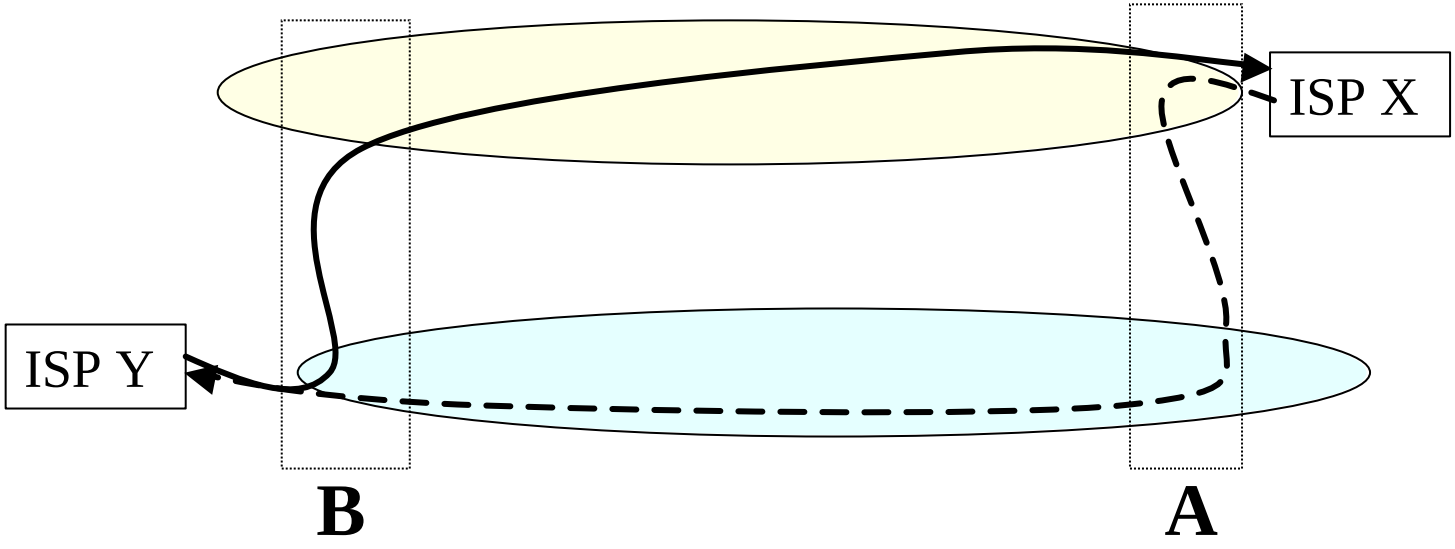
- The rapid growth of the Internet is due to a large extent to the universal access it allows, without the end-user needing to worry about the geographical location of information sources
- For this, the backbones which interlink ISPs need to be interconnected
- There are no rules governing this interconnection
- The backbones conclude two types of commercial agreement with each other: peering and transit

Peering

- This is a joint agreement concluded between two backbones (A and B)
- Peering applies only to traffic originating from a customer of one of the backbones and intended for a customer of the other
- Peering partners exchange traffic without financial adjustment (bill-and-keep, sender-keeps-all)
- The only costs which the backbones bear are for their own equipment and the transmission capacity needed to bring partners to the connection point

"Hot potato" routing

- The partners in a peering agreement can meet at several geographical locations
- To ensure parity of costs incurred, backbones adopt the "hot potato" routing mechanism

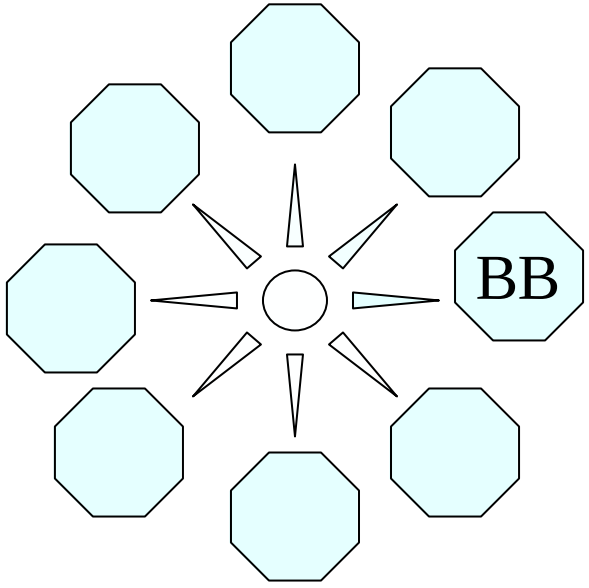


Peering and quality

- A peering agreement offers no quality guarantee in regard to delivery of packets from the backbone which received them
- The latter promises only to make the "best possible effort" to deliver the packets received
- Bearing in mind the number of backbone providers, establishing a special peering link with each of them would have been extremely expensive in transmission costs
- The first peering agreements were concluded at the level of network access points (NAPs)

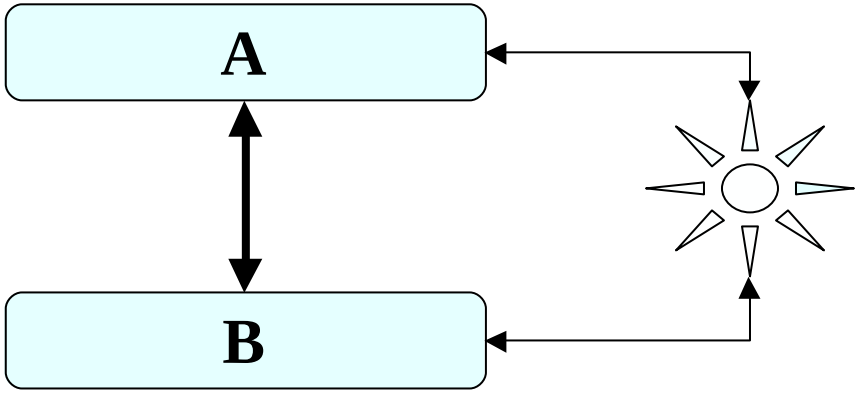
Network access points (NAPs)

- The NAP is a convergence point for backbone access links
- NAPs manage connection authorizations between two backbones and ensure data exchange between them



Private peering agreements

- The limited number of NAPs and the very rapid growth in traffic volume between backbones have led to considerable network congestion
- Backbones have therefore established direct interconnections, called "private peering"



- NAPs are however beginning to use ATM and are thus becoming very attractive again

The return of public peering

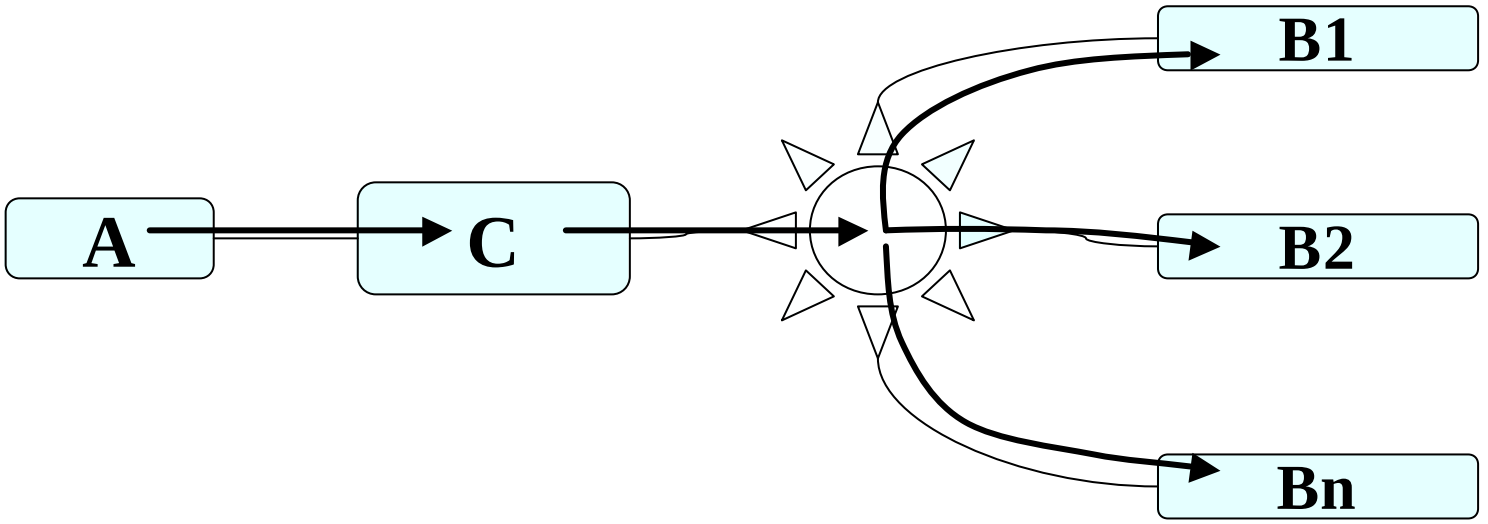
- The use of ATM switching at NAP level offers a very high processing capacity
- Another important consideration is that these exchanges have to a large extent benefited from international standards allowing them to manage information on volumes of traffic exchanged (see Recommendation D.224)
- The use of ATM is therefore very favourable for public peering and for the establishment of links between different-sized backbones

The transit regime

- The transit regime between backbones is an agreement between two parties (in contrast to the practice in telephony relations)
- When backbone C offers transit to backbone A, the customers of A will be able to access customers of all other backbones having a peering agreement with C

What distinguishes transit from peering?

- In a transit relation, the backbone requesting transit pays a fee to the backbone providing it and thus becomes its wholesale customer
- The backbone selling the transit will route the transit customer's traffic towards its other peering partners
- Certain very large backbones prefer not to have any transit relationships: they are called "top tiers"; but confidentiality agreements do not allow their exact number to be known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C
B1
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Interconnection logic

- Interconnection regimes on the Internet make no distinction between domestic backbones and foreign backbones
- No accepted rule or convention defines the circumstances in which two backbones will or should establish a peering relationship
- The term "peer" seems, however, to suggest equality, and it could be agreed that backbones of comparable size would be likely to establish peering agreements

Interconnection and competition

- The concept of equality or similarity can, however, be very difficult to define
- In practice, a peering agreement is the result of a business negotiation, with each backbone basing its decision on the benefits it can derive
- But isn't refusal to conclude a peering agreement with a requesting backbone liable to harm competition?
- In the United States, where most of the backbones reside, the FCC has formulated a policy of endeavouring to maintain a competitive communication market and to protect the public interest where the markets do not do so

Interconnection and competition (continued)

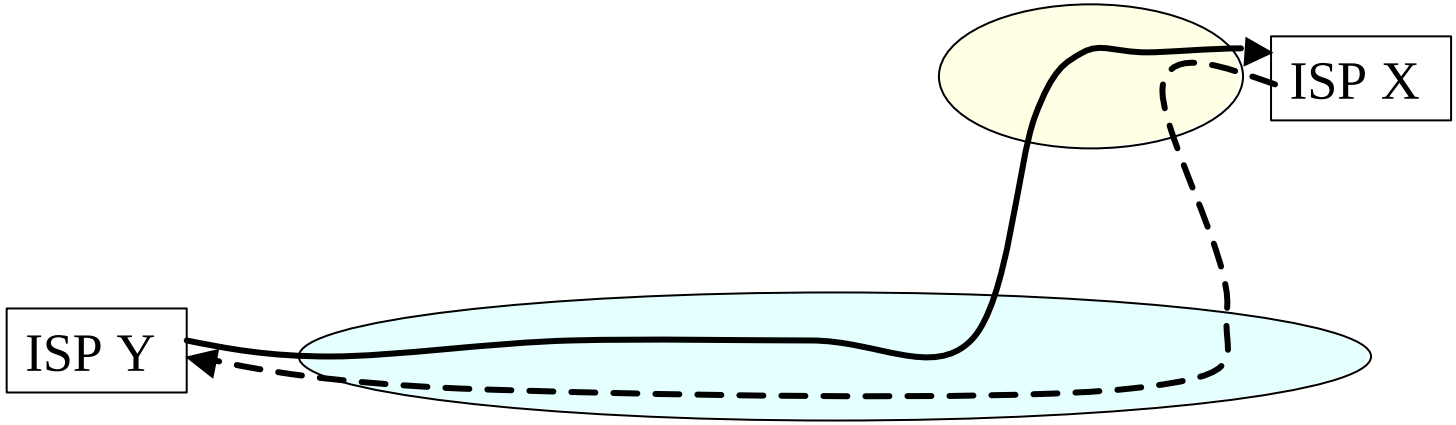
- Application of this policy is based on the following principles:
  - *The global market environment must be such that the customer always has the choice between several competitive offers*
  - *Anti-trust legislation must protect the consumer against the establishment of dominant backbones which could abuse that position*
  - *The FCC envisages regulatory measures if, despite everything, the market does not guarantee the public interest*

Interconnection and competition (continued)

- *Boardwatch* defines a national backbone as a backbone managing an access point in at least five different states of the United States, coast to coast, and offering peering agreements at the main NAPs
- There were 42 national backbones in the United States as at September 2000
- Some of these national backbones are suspected of hindering competition by refusing to conclude peering agreements with small-scale backbones

Interconnection and competition (continued)

- In a peering agreement between backbones of different sizes, the more extensive one is likely to bear most of the costs



Interconnection and competition (continued)

- To offer the new real-time services on the Internet, backbones wish to be different in refusing to interconnect in order to provide these services, thus departing from the principle of universal connectivity which has ensured the success of Internet services
- In principle, to the extent that backbones are of comparable size, it is an advantage for them to interconnect so as to profit from external access
- Peering with small backbones therefore gives rise to concern

Interconnection and competition (continued)

- Backbones whose customer base consists of service providers (as opposed to end-users) are not necessarily sought-after as peering partners since they send the largest volumes of information, thereby distorting the balanced traffic hypothesis

Interconnection and competition (continued)

- In short, a large number of national backbones require:
  - *That peering partners are desirous and capable of interconnecting simultaneously at a given number of different sites*
  - *That their clientele consist essentially of end-users (including their transit clientele)*
  - *That they be in a position to guarantee from the outset a volume of traffic exceeding a determined threshold*

Interconnection and competition (continued)

- The small backbones are virtually forced to opt for the transit regime in order to grow and qualify for peering
- When the market is competitive, transit tariffs should be cost orientated
- And if the market is not competitive? The question remains unanswered

Abuse of dominant positions

- A dominant backbone could:
  - *Raise and maintain, to its advantage, selling prices higher than those of a competitive market*
  - *Cease cooperation with small backbones by:*
    - Refusing interconnection
    - Exerting tariff pressure (vertical firm increasing access prices to increase small backbone end-user tariffs)
    - Decreasing the interconnection quality
- Such practices make the application of regulation in the public interest justifiable

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Problems

- There is no regulatory basis for interconnection between two backbones from different countries
- Since most of the top tiers are in the United States, United States backbones apply the same principles of business negotiation to backbones in the rest of the world
- United States backbones essentially offer (paying) transit services to backbones in the rest of the world, regardless of their size
- Although monitoring the market structure of backbones in the United States provides protection for everyone, anti-trust legislation, in contrast, applies only for consumer protection in the United States

Problems (continued)

- In public peering, transmission links go from each backbone to the peering points, the NAPs; when the peering points are in two different countries, how should the business relationship between them be defined?
- In private international transit, each backbone constitutes a peering point; how does each backbone bear the cost of transmission?

Findings

- International interconnection remains a significant problem, and this will increasingly be the case
- Draft Recommendation D.iii (ITU-T/SG 3) attempts to lay the basis for equitable sharing of transmission costs
- The boom in real-time services on the Internet will make a consensual agreement essential to safeguard the interests of the developing countries

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The balkanization of the Internet

- The universal connectivity we have today will not be guaranteed in the long term:
  - *Backbones are beginning to restrict certain services to their own customers only*
  - *Interconnection will be restricted increasingly to certain services unlikely to adversely affect the QoS of real-time services*
  - *Backbones, under the present arrangements, will have no motivation to invest in increasing their capacity with a view to terminating traffic of other backbones with a good QoS*
- Unless current market structures and relations change, backbones will become introverted and will balkanize the network, as occurred initially in telephony

Paying for quality

- The losses resulting from the lack of external facilities in a balkanized network are far more costly than the mutual payments needed to guarantee a good QoS for universal provision of real-time services
- Economic logic indicates that a payment system related to traffic volume should be established between the backbones
- The use of ATM exchanges in regard to NAPs offers real possibilities not only for increasing the network capacity but also for measuring traffic (D.224) and making possible mutual payment which is financially attractive and economically justified at both the national and international levels

Conclusions

- The commercial arrangements governing relations between backbones on the Internet are those in force in the United States
- Those arrangements are based on market dynamics and consumer protection
- The market structure will not resist the requirement of QoS in the provision of real-time services
- Backbones will have to establish a payment system related to traffic volume
- This system will, however, probably be based on free and mutually beneficial business agreements
- The international community must nevertheless take in hand the situation of small backbones in the developing countries whose negotiation capacity is limited