

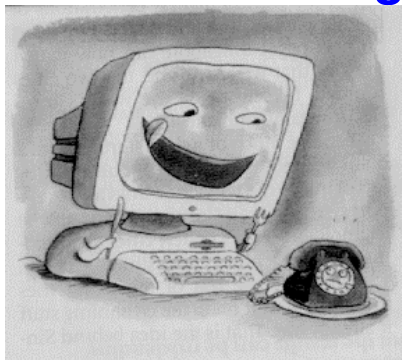
International interconnection: Part 3: The Internet changes everything

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Note: The views expressed in this presentation are those of the author and do not necessarily reflect the opinions of the ITU or its membership. Dr Tim Kelly can be contacted by e-mail at Tim.Kelly@itu.int

**“We started out running the Net
on top of the phone system, and
we’ll end up with telephony
running over the Net.”**



*Eric Schmidt,
CEO, Novell,
Quoted in
Wired, August 1997*

The Economist
May 2nd 1998



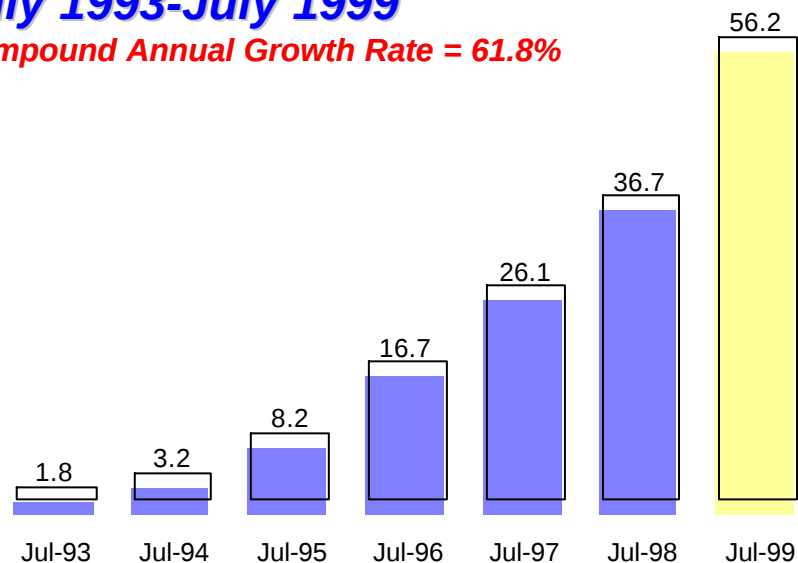
Agenda

- The phenomenal growth of the Internet
- Internet peering:
 - ⇒ What makes it different from traffic settlements?
 - ⇒ Who sets the rules?
 - ⇒ Who wins, who loses?
- Developing country concerns
 - ⇒ Why should they be worried?
- Scenarios
 - ⇒ New business models, or old ones in disguise?

Internet hosts (million)

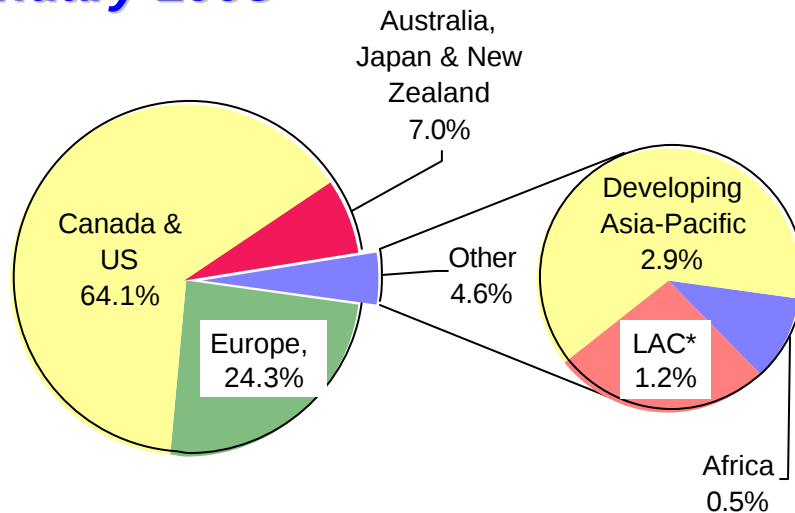
July 1993-July 1999

Compound Annual Growth Rate = 61.8%



Source: ITU "Challenges to the Network: Internet for Development, 1999", Network Wizards.

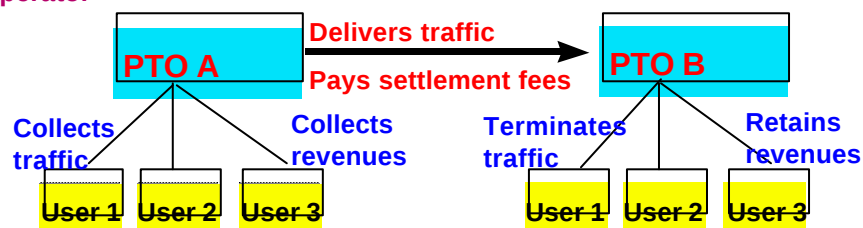
Distribution of Internet hosts, January 1998



Source: ITU "Challenges to the Network: Internet for development, 1999".

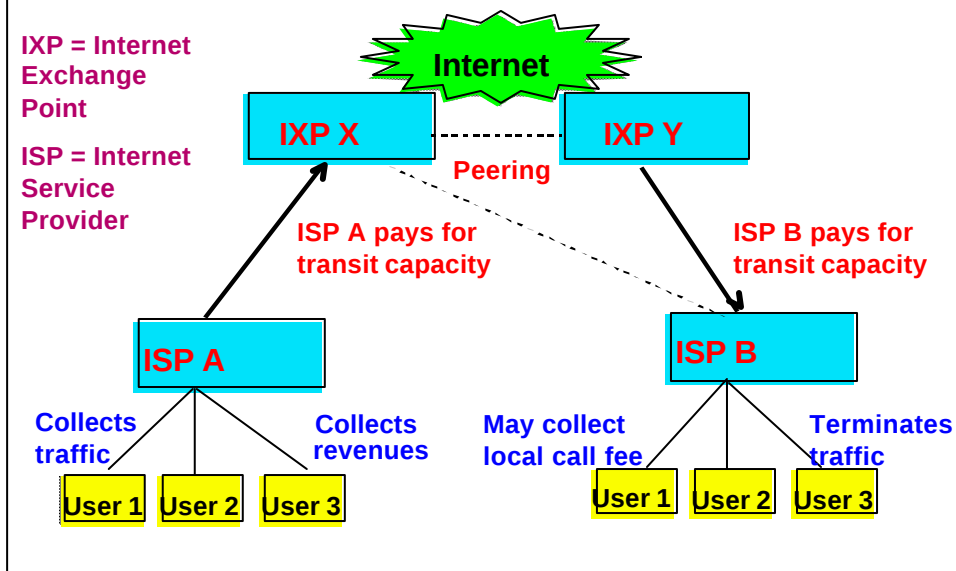
Settlements-based traffic

PTO = Public
Telecommunications
Operator



For accounting rate traffic, a direct bilateral relationship is established between the origin and termination operators. Intermediate transit operators are compensated from the accounting rate which is usually split 50:50. PTO B retains net settlement.

Internet telephony traffic



Different wholesale pricing arrangements

Public switched telephone service

- Per minute wholesale pricing of end-to-end int'l traffic
- International accounting rate and settlements system applies
- Domestically-regulated interconnect regimes
- Access charges payable for call origination and termination
- Some transparency

Public Internet service

- Usage-based wholesale pricing is rare (NZ and AUS are exceptions)
- Peering arrangements, usually based on capacity or traffic exchanged
- No end-to-end int'l settlement payments
- No regulation of peering arrangements
- No access charges payable for IP traffic in US
- No transparency



Peering: What's on the menu?

- **Peer-to-peer bilateral**
 - ⇒ Each Internet Exchange Point (IXP) has similar size, traffic flow, technology
- **Hierarchical bilateral**
 - ⇒ IXPs in “Mother/Daughter” relationship with ISPs and smaller IXPs
 - ⇒ “Mother” may require capacity-based traffic settlements from “Daughter”
- **Third-Party Administrator**
 - ⇒ Network Access Points (NAPs)
 - ⇒ Metropolitan Area Networks (MAEs)
- **Co-operative agreement**



Settlements and Peering: What's the difference?

- **Settlement-payment traffic**
 - ⇒ Substantial revenue transfers, from core to periphery of network
 - ⇒ Promotes “organic” network growth
 - ⇒ BUT, Operators generating less traffic than they receive have an incentive to keep prices high
- **Peering traffic**
 - ⇒ Some revenue transfers, from periphery to core of network
 - ⇒ Promotes “spontaneous” network growth
 - ⇒ BUT, ISPs generating less traffic than they receive have an incentive to force prices down

Top ten international telecom carriers, 1997 (billions of minutes)

AT&T	US	10.3
MCI / WorldCom	US	7.3
Deutsche Telekom	Germany	5.3
BT	UK	3.7
France Telecom	France	3.5
Sprint	US	2.8
Telecom Italia	Italy	2.4
Swisscom	Switz.	1.9
C&W Comms	UK	2.1
Stentor	Canada	1.8

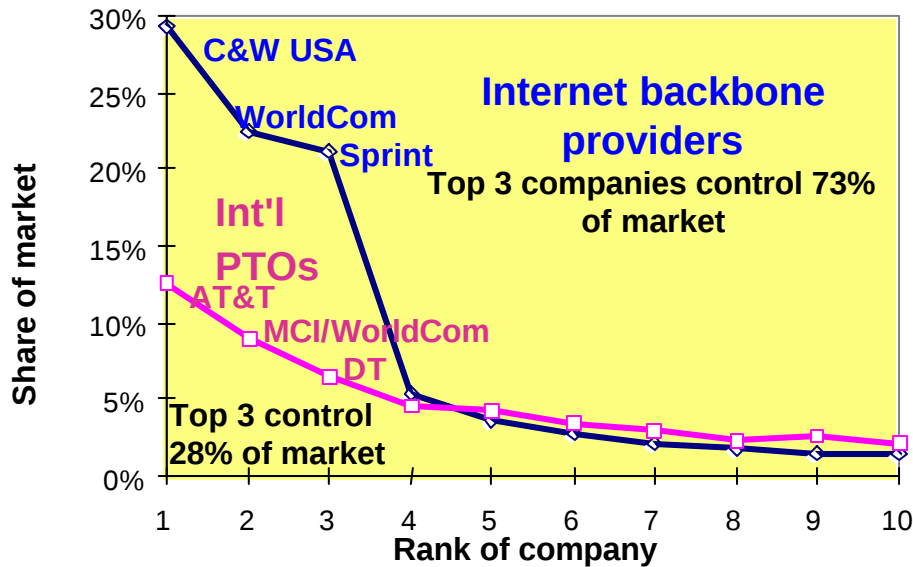
Source: ITU/TeleGeography Inc.

Top ten Internet backbone carriers, 1998 (ISP connections)

C&W USA (ex-MCI)	US	1'944
WorldCom (UUNET/ANS/CompuServe)	US	1'496
Sprint	US	1'407
GTE Internetworking (BBN)	US	354
AGIS	US	237
Digex	US	183
CRL Communications	US	144
Winstar Goodnet	US	114
SAVVIS Communication	US	102
Verio Networks	US	93

Source: Boardwatch Magazine, ISP Directory.

Internet backbone market is much more concentrated than int'l telephone traffic



Internet traffic flows are highly asymmetric

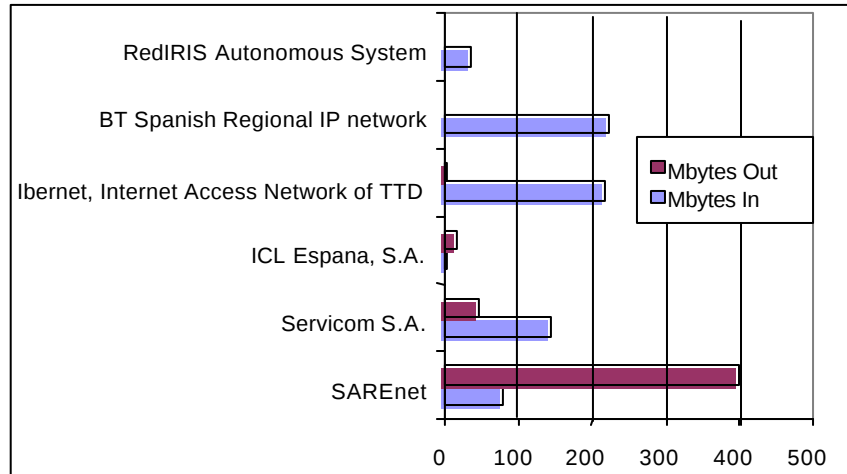
Public switched telephone service

- Traffic flows are bilateral and broadly match value flow in that caller, who initiates the call, also pays for it
- Call-back reverses the direction of the call, from a statistical viewpoint, but caller still pays & benefits
- Traffic flows unbalanced between developed and developing countries

Public Internet service

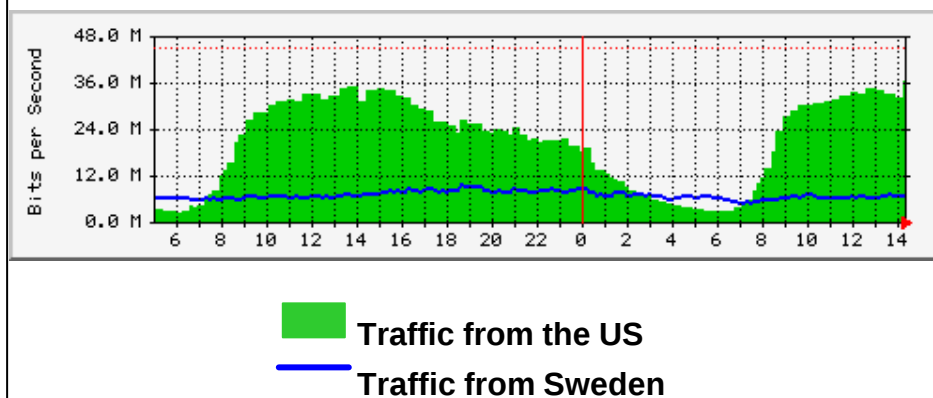
- Traffic flows are multi-lateral: A single session may poll many countries
- Web-browsing is dominant form of traffic: traffic flow is dominantly towards user who initiates the call. Web traffic highly asymmetric
- Newer forms of Internet traffic (telephony, push media, streaming video etc) reverses traffic flow to be from user which initiates the call

Traffic flows between Telstra (Australia) and selected Spanish ISPs (Feb. 99)



Source: OECD, Telstra.

Traffic flows between Telia (Sweden) and US Internet backbone. By time of day



Source: Stefan@telia.net

Which value-flow model best fits the Internet? (or neither of them?)

Magazine Publishing

- Content providers publish journals, newspapers
- Content providers gain revenue from subscriptions and advertising
- Distribution effected through kiosques, shops
- Shop-owner gains money from sales and/or directly from content provider

Content Provider pays distributor

Broadcast TV

- Content providers own rights, make films, programs
- Content providers gain revenue from sales of rights, programs and merchandising
- Distribution effected through TV channels which package programmes into schedules
- TV channel owner gains money through sale of subscriptions and ads

Distributor pays for content

If usage-based settlements were introduced on the Internet

- Different types of traffic would need to be identified and tagged (**problematic**)
- Traffic flows would need to be measured and billed on a bilateral basis between nodes (**difficult**)
- Correspondent relations would need to be established between nodes (**very difficult**)
- All intermediate transit providers would need to be compensated (**extremely difficult**)
- The system would need widescale agreement which could only be enforced, when necessary, by cutting off service (**virtually inconceivable**)



Developing country concerns

- Developing countries receive no international settlement payments for IP traffic
 - ⇒ Increasingly, incoming IP traffic includes IP telephony and fax traffic which they must terminate
- They must pay to peer with US backbone
 - ⇒ Peering costs are rising as IP traffic continues to grow exponentially
- They must pay both half-circuits of the International Private Line to the USA
 - ⇒ Even though traffic flows in both directions over the circuit, once it is established
- Telephone and fax traffic shifting to the Internet

Gains and losses ...

	<i>Gains / opportunities</i>	<i>Losses / Threats</i>
Developed country Telcos	● Increased demand for leased lines ● Additional subscriber lines ● Higher value services / e-commerce	● Lower international fax and voice call charges ● Markets for e-mail and content lost ● Multiple new market entrants
Developing country Telcos	● As above, plus lower barriers to entry to developed country markets	● As above, plus significant reduction in net settlements ● Requirement to pay full-circuit costs

Winners and losers ...

Factor	Winners	Losers
Erosion of settlements system	Telcos with big deficits (e.g., AT&T, Sprint, MCI/WorldCom)	Telcos with big surpluses (e.g., Nitel, Telkom SA, KPTC)
Increased demand for leased lines	Infrastructure suppliers (e.g., Project Oxygen, INTELSAT)	Developing country Telcos locked into long-term supply agreements
"All calls are local calls"	Telcos with measured local service	Telcos with "free" local calls
"Own" the customer	Local loop providers	Long-distance service providers

Joint Statement on the Cost Sharing of the International Internet Interconnection Link between the USA and Asia-Pacific

Resolves:

- that it is inappropriate for the ISPs and operators in the region to bear the entire cost of the international Internet backbone between AP and the US;
- that the current practice should be rectified;

Urges Operators, ISPs and the ITU:

- to study appropriate mechanisms to measure the actual traffic as the basis of usage-based or cost-oriented charging and settlement arrangements

Declaration signed on 26th January 1999 by CAT, Chungwa Telecom, IndoSat, KDD, Korea Telecom, PLDT, SingTel, Telecom Malaysia.



Possible scenarios

- **USA sets the rules**

- ⇒ **USA continues to dominate, as home of most content and principal backbone, and continues to require all-comers to pay full-circuit costs plus peering charges.**

- **Internet diffuses globally**

- ⇒ **Internet grows at a faster rate outside USA, with regional backbones being set-up and local content expanding. Leased line prices fall dramatically.**

- **Internet converges with telephone network**

- ⇒ **Network access and quality of service become major issues. Separate Internets, largely owned by PTOs, are established with gateways to public Internet. PTOs offer to carry traffic at commercial rates and with traffic-based settlements between Internets.**