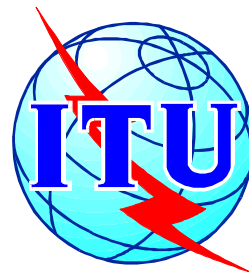


Internet Economics

Five factors that make the Internet different

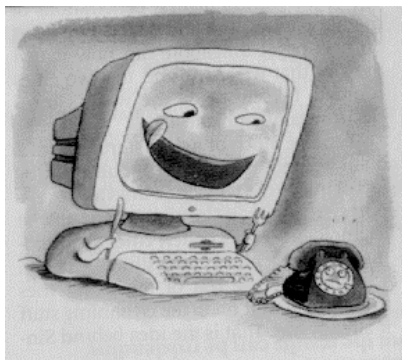
Dr Tim Kelly,
International
Telecommunication
Union



Sydney,
22 September 1998

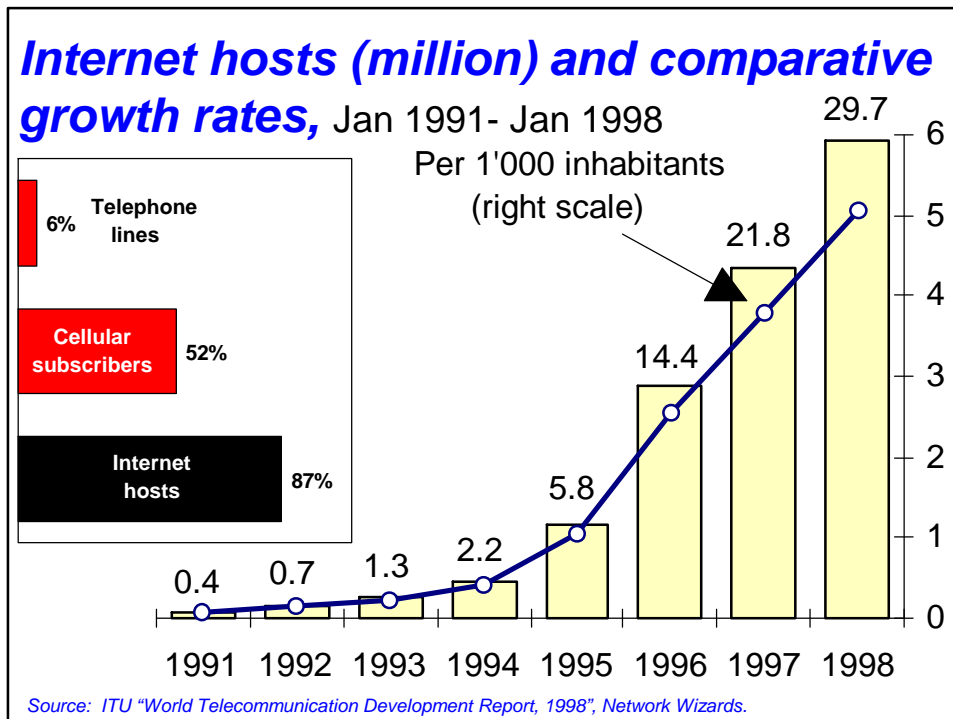

The views expressed in this paper are those of the author and do not necessarily reflect the opinions of the ITU or its Membership. Dr Kelly can be contacted by e-mail at Tim.Kelly@itu.int

**“IP is to communications what
the PC was to computing ... it’s
that fundamental a shift”**



*Dan Schulman,
AT&T WorldNet Services,
Quoted in
Tele.Com, May 1998*

The Economist
May 2nd 1998

Internet Economics: Five factors that make the Internet different

- 1. Packet-switched network architecture**
 - ⇒ Connection-less not connection-oriented
- 2. Pricing independent of distance & duration**
 - ⇒ Average message covers 15 or more "hops"
- 3. Peering arrangements, not settlements**
 - ⇒ Based on a full-circuit regime, not on half-circuits
- 4. Traffic flows unrelated to value-flows**
 - ⇒ Dominant flow is to terminal that initiates a session (though this is changing)
- 5. The United States sets the rules!**
 - ⇒ There is no "Internet Telecommunication Union"

1. Circuit-switching versus packet-switching

Circuit-switched networks (e.g., PSTN)

- More than 100 years old
- Hybrid, digital and analogue technologies
- Optimised for voice communications
- Controllable and quantifiable quality of service
- Connection-oriented
- Structured, direct and transit relations

Packet-switched networks (e.g., Internet)

- More than 25 years old
- Digital, computer-to-computer technology
- Optimised for data communications, but adaptable to voice/fax
- “Best efforts” quality of service
- Connection-less
- “Never the same route twice”



Telco responses to threat of “death by packet switching”

- Build a new network or an overlay
 - ⇒ e.g., Sprint’s Integrated On-demand Network (ION)
- Create a Joint Venture to invest in new network
 - ⇒ e.g., AT&T/BT tie-up
- Merge to acquire a dominant position in Internet Services and infrastructure provision
 - ⇒ e.g., Original intention of MCI/WorldCom merger
- Create a subsidiary offering cheap telephony
 - ⇒ e.g., SwissCom subsidiary offers “SurfCall”
- Buy into IP telephony technology
 - ⇒ e.g., Deutsche Telekom acquires 21.1% of VocalTec

2. Different retail pricing structures

Public switched telephone service

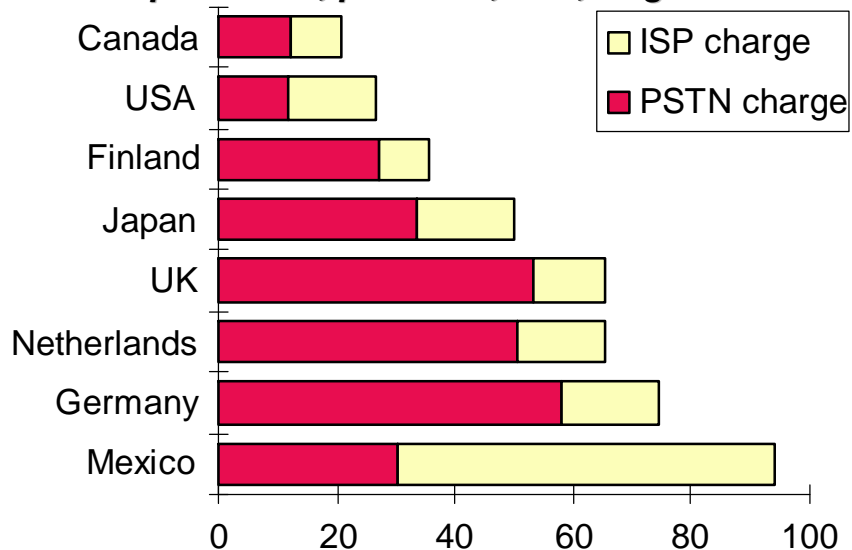
- Priced by the mile
- Priced by the minute
- Time of day/week discounts to encourage off-peak use
- International service priced at premium
- Interconnect reflects call termination costs
- Retail price structure still reflects historical cross-subsidies

Public Internet service

- Distance-independent pricing
- Duration-independent pricing (except for dial-up access charges)
- Peak-rate & volume usage regulated by congestion
- No international premium
- No interconnect or termination charges paid by user (except for IP telephony/fax)
- Cost-oriented pricing

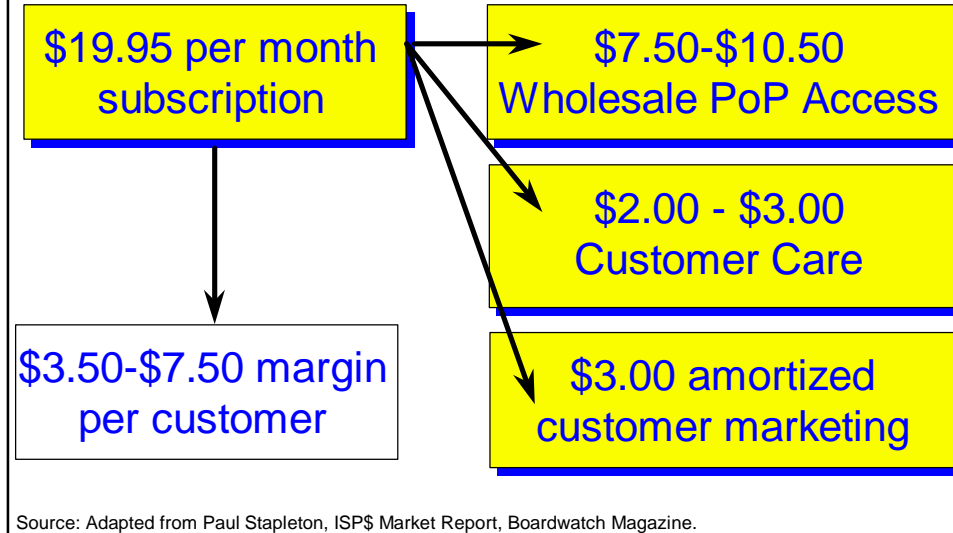
Internet charges

20 hours per month, peak rate, US\$, Aug. 96



Note: ISP = Internet Service Provider. PSTN = Public Switched Telephone Network.
 Source: OECD, quoted in ITU "Challenges to the Network: Telecoms and the Internet", 1997.

Where does the money go? Typical Internet Service Provider cash-flow



3. Different wholesale pricing arrangements

Public switched telephone service

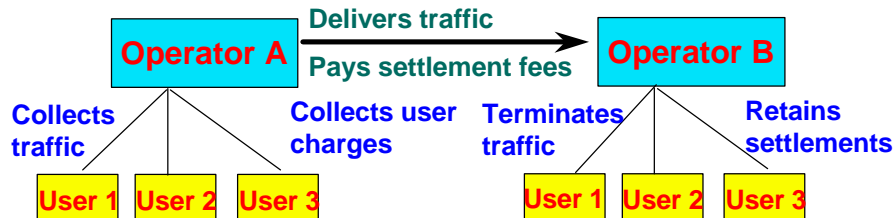
- Per minute pricing of wholesale int'l traffic
- International accounting rate and settlements system applies
- National interconnect regimes, regulated domestically
- Access charges payable for call origination and termination

Public Internet service

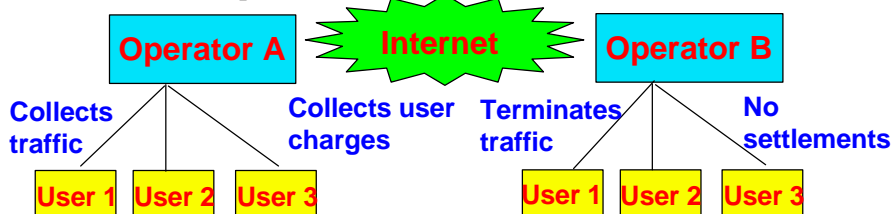
- Usage-based wholesale pricing is rare (NZ and AUS are exceptions)
- Peering arrangements, usually based on capacity requested
- No traffic-based settlement payments
- No regulation of peering arrangements
- No access charges payable for IP traffic

Wholesale pricing: what's the difference?

Settlement-payment traffic



Sender-keeps-all traffic



4. Traffic flows not necessarily related to value flows

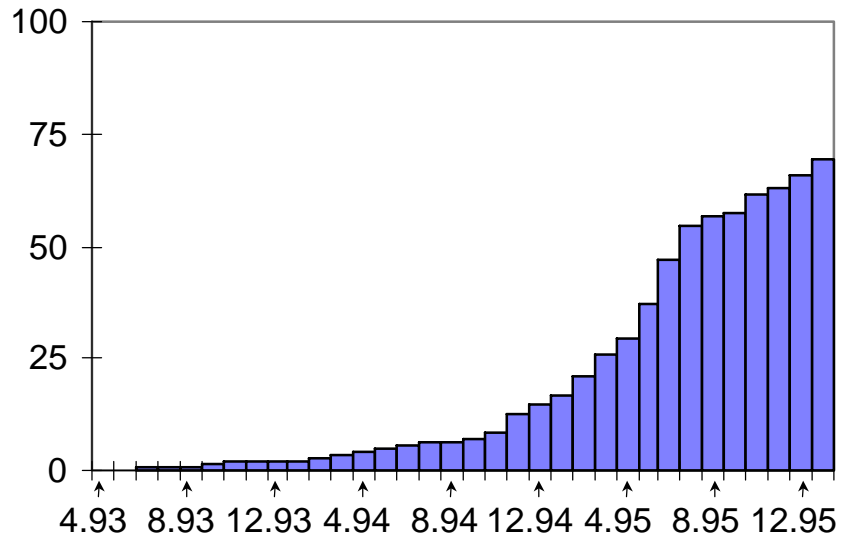
Public switched telephone service

- 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

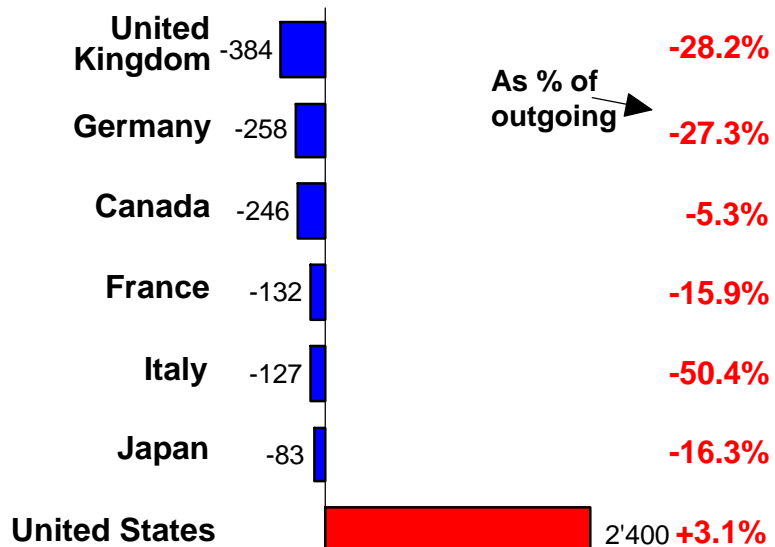
- Traffic flows are multi-lateral: A single session may poll many countries
- Web-browsing is dominant form of traffic: traffic flow is dominantly towards user who initiates the call
- Newer forms of Internet traffic (telephony, push media, video-conferencing etc) reverses traffic flow to be from user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

World Wide Web as % of Internet traffic



Source: NLANR, quoted in ITU "Challenges to the Network: Telecoms and the Internet", 1997.

Balance of Internet traffic, G7, million packets



Surplus of incoming traffic
Surplus of outgoing traffic

Note: Based on traffic monitored on NSFNet, November 1994

Source: ITU/TeleGeography "Direction of Traffic, 1996"



If 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**)

5. The United States sets the rules!

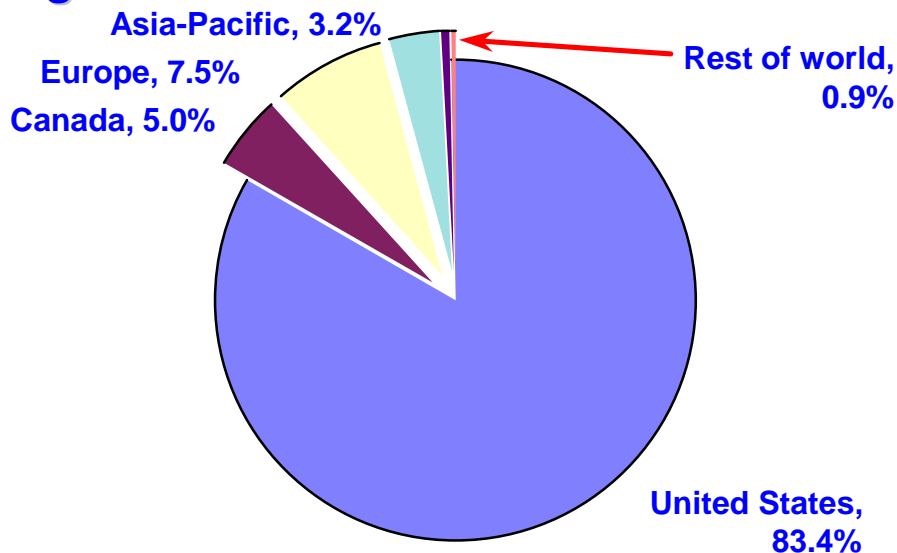
Public switched telephone service

- Around 30% of all international traffic is routed through the US
- Around 20% of all users are located in the US
- The accounting rate system operates on a half-circuit regime with revenues being shared
- Numbering policy established nationally following int'l recommendations

Public Internet service

- More than 90% of Internet traffic passes through the US
- Around 60% of all users are located in the US
- 94 of top 100 content sites are US based
- To link to the US Internet backbone, a foreign operator must pay leased line costs for the full circuit
- Numbering and domain-name policy effectively set in the US

Origin of international Internet traffic



Note: Based on traffic monitored on NSFNet, November 1994
Source: ITU/TeleGeography "Direction of Traffic, 1996"



Study Questions for Rapporteur's Group

- Identify international network components used by Internet
- Determine cost issues
- If appropriate, propose set of principles for cost compensation for int'l circuit providers

But ...

- US would most likely oppose any attempt to introduce a traffic-based settlements system
- US continues to dominate most traffic flows and to "set the rules"

So: Perhaps concentrate on establishing metrics



Possible scenarios

- **Continuation of status quo**
 - ⇒ **US continues to dominate, as home of most content and principal backbone, and continues to require all-comers to pay full-circuit costs.**
- **Internet diffuses globally**
 - ⇒ **Internet grows at a faster rate outside US, with regional backbones and content providers being set-up. A global governance forum is established and half-circuit operation is norm.**
- **Internet progressively privatised**
 - ⇒ **Quality of service becomes major issue and separate, privately-owned Internets are established with gateways to public Internet, but offering to carry traffic at commercial rates.**