Internet Economics

Five factors that make the Internet different

**Dr Tim Kelly,
International
Telecommunication
Union**

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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

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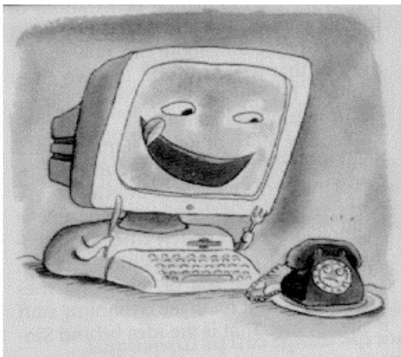
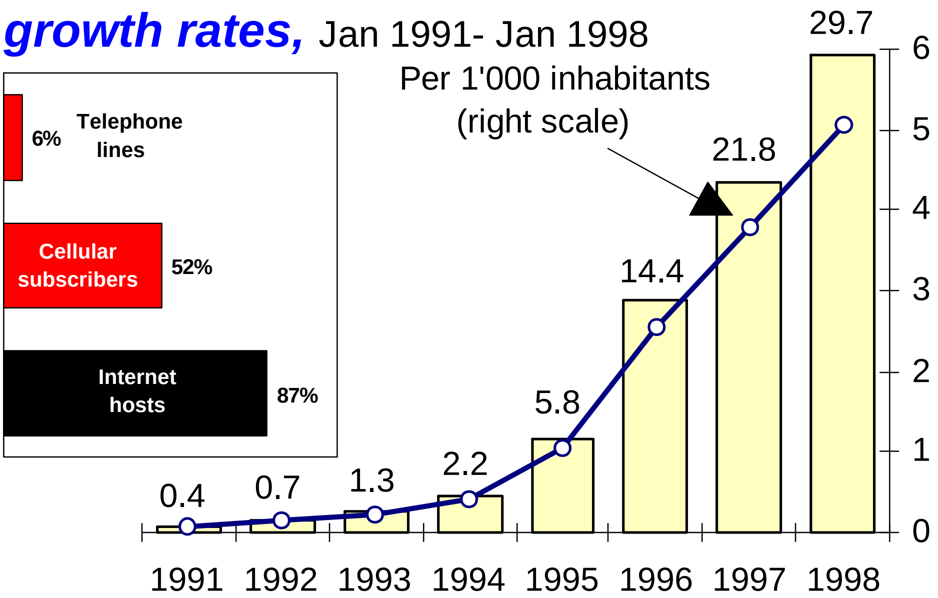
"IP is to communications what the PC was to computing … it's that fundamental a shift"



The Economist
May 2nd 1998

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

Internet hosts (million) and comparative growth rates, Jan 1991- Jan 1998



Source: ITU "World Telecommunication Development Report, 1998", Network Wizards.

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)	Packet-switched networks (e.g., Internet)
● More than 100 years old	● More than 25 years old
● Hybrid, digital and analogue technologies	● Digital, computer-to-computer technology
● Optimised for voice communications	● Optimised for data communications, but adaptable to voice/fax
● Controllable and quantifiable quality of service	● "Best efforts" quality of service
● Connection-oriented	● Connection-less
● Structured, direct and transit relations	● "Never the same route twice"

Telco responses to threat of "death by packet switching"

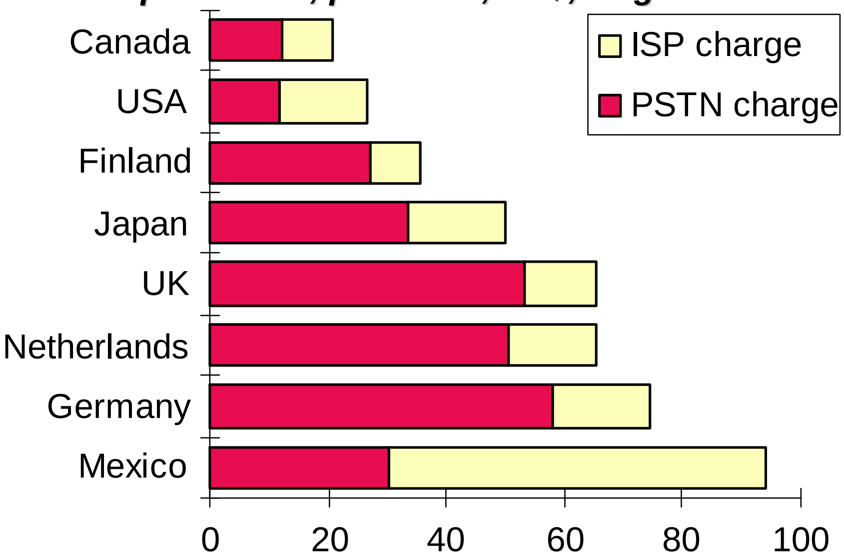
- **Build a new network or an overlay**
  - ⇨ e.g., Sprint's Integrated On-demand Network (ION)
- **Create a Joint Venture to invest in new network**
  - ⇨ e.g., AT&T/BT tie-up
- **Merge to acquire a dominant position in Internet Services and infrastructure provision**
  - ⇨ e.g., Original intention 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	Public Internet service
● Priced by the mile	● Distance-independent pricing
● Priced by the minute	● Duration-independent pricing (except for dial-up access charges)
● Time of day/week discounts to encourage off-peak use	● Peak-rate & volume usage regulated by congestion
● International service priced at premium	● No international premium
● Interconnect reflects call termination costs	● No interconnect or termination charges paid by user (except for IP telephony/fax)
● Retail price structure still reflects historical cross-subsidies	● Cost-oriented pricing

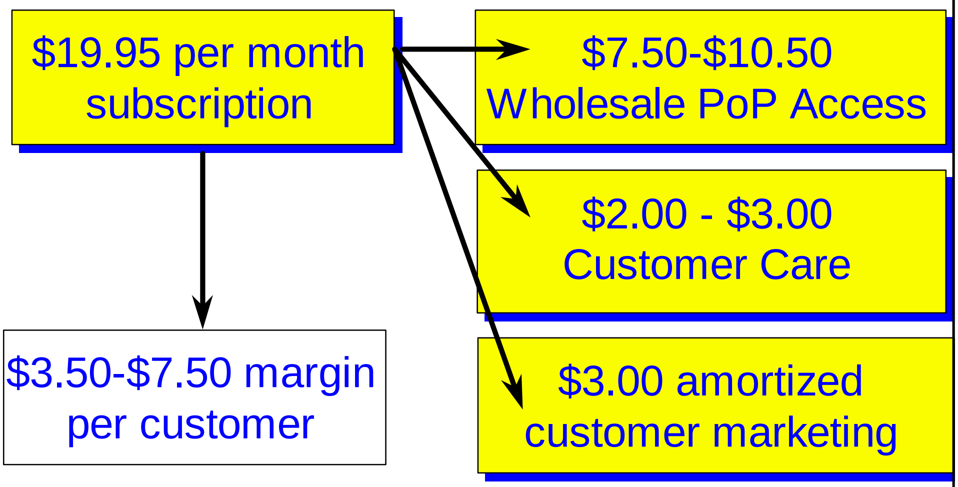
Internet charges

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



Source: Adapted from Paul Stapleton, ISP$ Market Report, Boardwatch Magazine.

3. Different wholesale pricing arrangements

Public switched telephone service

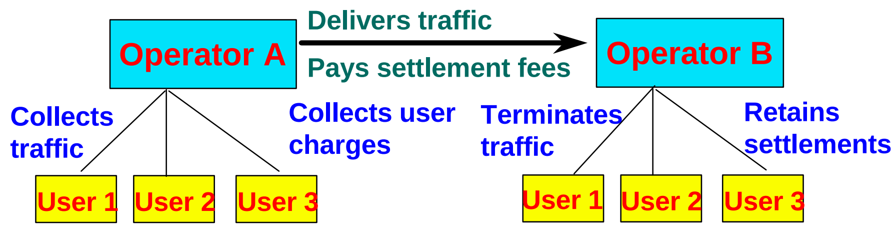
- **Per minute pricing of wholesale int’l traffic**
- **International accounting rate and settlements system applies**
- **National interconnect regimes, regulated domestically**
- **Access charges payable for call origination and termination**

Public Internet service

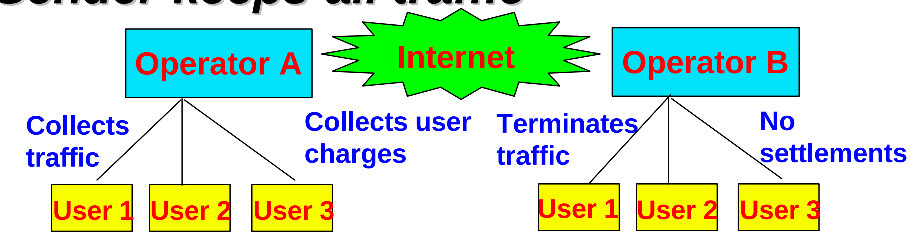
- **Usage-based wholesale pricing is rare (NZ and AUS are exceptions)**
- **Peering arrangements, usually based on capacity requested**
- **No traffic-based settlement payments**
- **No regulation of peering arrangements**
- **No access charges payable for IP traffic**

Wholesale pricing: what's the difference?

Settlement-payment traffic



Sender-keeps-all traffic



4. Traffic flows not necessarily related to value flows

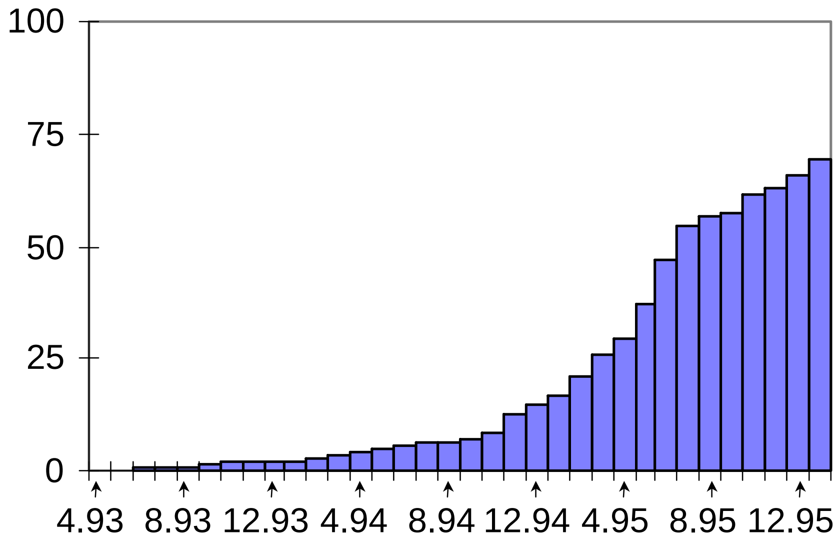
Public switched telephone service

- 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

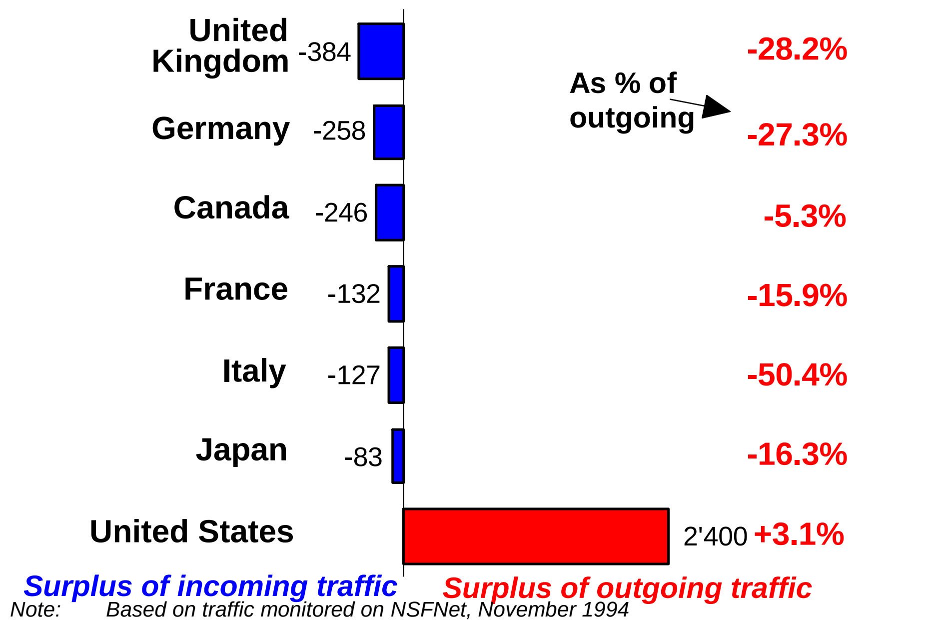
- Traffic flows are multi-lateral: A single session may poll many countries
- Web-browsing is dominant form of traffic: traffic flow is dominantly towards user who initiates the call
- Newer forms of Internet traffic (telephony, push media, video-conferencing etc) reverses traffic flow to be from user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



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!

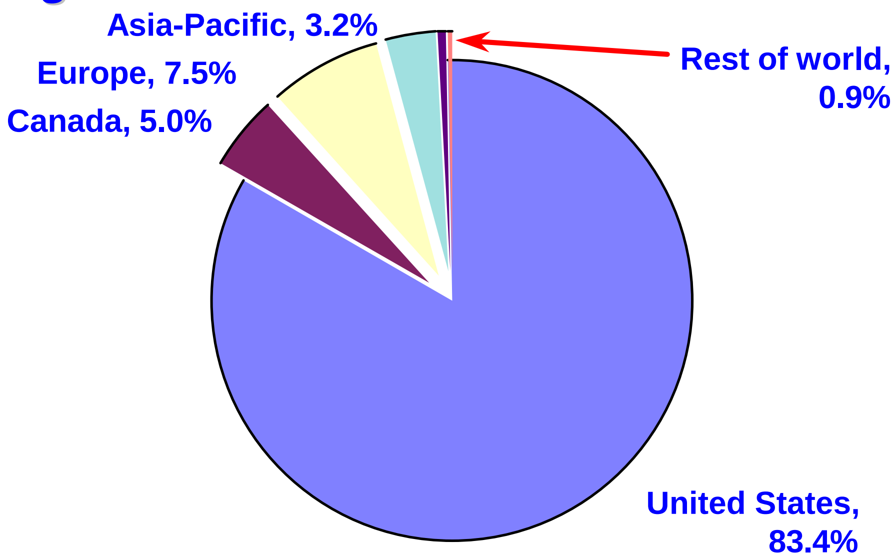
Public switched telephone service

- 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.**