B211 Internet Computing

Who Says and Who Pays? How the Internet is controlled and payed for

Learning Objectives

1. Based on the ownership structure of the Internet equipment (hardware and software), understand who is actually paying for Internet operations.
2. Know the major bodies responsible for setting Internet standards, and guiding the development of the Internet.

Lecture Outline

- The Internet ownership structure
- Who pays for the Internet operations?
- Internet standards organizations

Who owns the international core backbones networks?

- International submarine backbone networks and satellite systems are usually owned and operated either by:
  - consortium of major national carriers, or
  - global multi-national companies (eg. Level 3, Global Crossing, IntelSat) who leases long-term allocated bandwidth to national carriers.
    - » A lot of these multi-national companies are in financial difficulty, mainly because they ran up huge debts in building the backbone networks in anticipation of unrealistically optimistic growth forecast in Internet data traffic.

Impact of Global Telecoms Crash

- Probably the worst hit sector in the current global financial crisis is the telecom sector.
  - The global telecoms crash is about 100 times worst than the famous dotcom crash - the estimated on-paper loss is about US$1 trillion.
- Many multi-national telecoms companies like WorldCom, Global Crossing, 360Networks, have gone declared bankruptcy.
  - The control of these core backbone networks are being bought up by the previous national monopoly carriers (eg. Telstra in Australia).
- We are moving back to the situation where control of most of the networks around the world are in the hands of dominant national carriers, as it was before the 1990's.

Who owns the national terrestrial backbone networks?

- National backbone networks are usually owned and operated by major carriers. They act as Network Service Providers (NSPs).
  - Historically, these carriers are single monopoly PTT (Public Telephone & Telegraph) companies in each country.
    - – Eg. Telstra (previously Telecom) Australia.
  - With deregulations, more and more companies are starting to own their own national backbones all over the world.
    - – Eg. Optus and PowerTel in Australia
- These carriers connect internationally by either:
  - Owning international lines through a consortium, or
  - Leases bandwidth from organizations who owns international lines.

Who owns the LANs?

- LAN equipment (networking software, online services, and hardware like routers, hubs, cables, etc) are usually owned and operated by the Internet Service Providers (ISPs).
  - Eg. Murdoch University is an ISP with a campus LAN and provides Internet connection to students/staff on campus and at home.
- ISPs leases national and international access from major carriers.
  - Unless they are major carriers themselves who are in the ISP business (eg, Telstra, Optus)
  - Many of the larger ISPs today have also received carrier licenses and are building their own national backbone infrastructure.

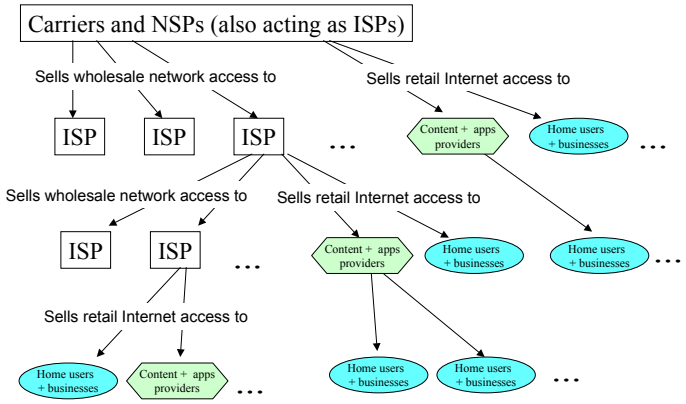
Connections between LANs

- Consortiums of LAN owners also shares in the ownership and operations of **exchange points**, where ISPs exchange data with each other.
  - Eg through *peering* arrangements.
- Example exchange points in W. Aust.:
  - WA Internet Exchange (http://www.waia.asn.au/waix/)
  - Perth Academic Network Exchange (http://www.parnet.edu.au/)

Applications and Content Providers

- People and organizations who offer services, applications and content is another important set of owners of the Internet.
  - You are a part of this set if you have your own web site!
  - The term application service providers (ASPs) refers to those who provides applications as services - don't confuse this "ASP" with Active Server Pages, which we will talk about later in the semester.
- The applications and content is where most believe direct revenues can be gained from users.
  - Many NSP and ISP (eg Telstra and Optus in Australia) are trying to partner content providers like Foxtel to get into the action.

Service Provider Hierarchy



Service Provider Hierarchy

- Note that on the previous page, the content and application providers are usually also home and business users.
  - Think about most web sites you see on the web.
  - They provide their contents, applications and services by buying **web-hosting** services from ISPs.

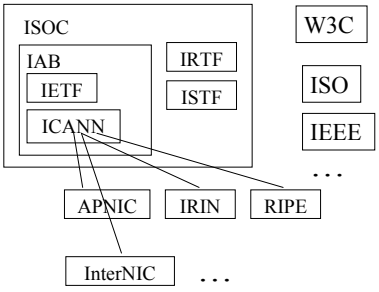
Internet Charges

- Based on the previous description of ownership and operations, all the players will have their costs.
- All players (besides the users) tries to charge the entities below them in such a way so that they
  - can sustain their operations
  - maximise profit
  - are as competitive with their competitors as possible
  - not violate government pricing regulations

Internet Charges

- The users will be the ones at the end where all charges end up.
- The ways a user can be assured of fair prices are by having:
  - proper supply/demand and competition at every level of the hierarchy, and/or
  - public subsidies for access (such as government subsidies for access to rural areas), and/or
  - government regulations restricting price rises.

Who Sets the Standards for the Internet?



The Internet Society (ISOC)

- A non-governmental, non-profit, professional membership society
  - Membership of more than 175 organization and 8,600 individual members in over 170 countries.
  - Provides leadership in addressing issues that confront the future of the Internet, and is the organization home for the groups responsible for Internet infrastructure standards, including the IETF and IAB.
- Mission statement: To assure the open development, evolution and use of the Internet for the benefit of all people throughout the world.

Request for Comments (RFCs)

- A series of notes, started in 1969, about the Internet.
- The notes discuss many aspects of computing and computer communication focusing in networking protocols, procedures, programs, and concepts, but also including meeting notes, opinion, and sometimes humor.
- All standards on the Internet are published as RFCs.
- RFCs are reviewed as Internet Drafts (I-Ds) before officially released.
- http://www.rfc-editor.org

The Internet Engineering Task Force (IETF)

- A large open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet.
- The body most responsible for technical developments on the Internet.
- The IETF holds meetings three times per year.

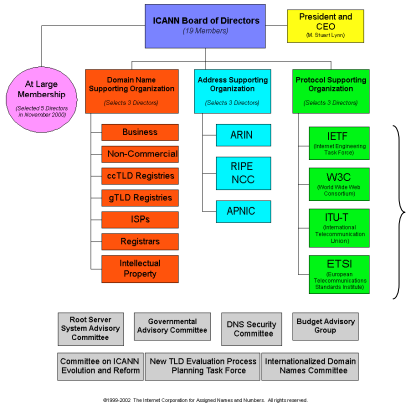
IETF Working Groups

- The actual technical work of the IETF is done in its working groups, which are organized by topic into several areas (e.g., routing, transport, security, etc.).
- Group members communicate through mailing lists, and produces results through RFCs.
- Each area has an Area Manager (AD) – the ADs forms the Internet Engineering Steering Group (IESG).

The Internet Corporation for Assigned Names and Numbers (ICANN)

- Responsible for
  - Internet-wide IP and domain name address assignment,
  - root server system management,
  - determining standard port numbers,
  - protocol parameter assignment,
  - etc.

ICANN Organizational Chart



This means that ICANN liaise with these organizations. It does NOT mean these organizations are UNDER the control of ICANN

The Regional Internet Registries

- IP addresses all over the world are distributed by one of the following regional registries:
  - Asia-Pacific Network Information Center (APNIC)
  - American Registry for Internet Numbers (ARIN)
  - Reseaux IP Europeens Network Control Center (RIPE)
- Parts of Africa are shared between the three.

Domain Name Registries

- gTLDs can be registered through different bodies. Eg:
  - The International Council of Registrars (CORE)
  - Internet Names WorldWide (INWW)
  - Network Solutions Inc.
- Different organizations in different countries are delegated with responsibility to register the country domains. Eg. Melbourne IT in Australia.
- For a list of ICANN accredited registrars, see:
  - http://www.icann.org/registrars/accredited-list.html

The World Wide Web Consortium (W3C)

- Responsible for standards on the World Wide Web.
  - HTTP (Hypertext Transfer Protocol)
  - HTML (Hypertext Mark-up Language)
  - XML (Extensible Mark-up Language)
  - etc.
- Also develops guidelines for use of web technologies.
- A consortium of many organizations
  - unlike IETF, consortium membership is by payment.

Other Organizations

- There are other organizations which creates standards which impacts on the developments of the Internet.
- Eg.
  - ITU (International Telecommunications Union)
  - ISO (International Standards Organization)
  - IEEE (Institute of Electrical and Electronics Engineers)
  - etc.

Standards Bodies

- The above organizations are only standards and steering bodies.
  - The usually consist of people and organizations who are very heavily involved with Internet development.
  - They set standards which players (users, content producers, software developers, hardware vendors, etc) **should** follow, but do not have the power to act directly if someone does not.
  - When someone does not follow the standards, then it means they will not excluded from sharing in the infrastructure that already exists and is currently being developed.

A Question of Legitimacy

- Also, all the above organizations have limited membership and limited involvement, but claims to represent the global community.
  - Even in the case where there is total involvement by the approx 600 million Internet users today, it is still only a fraction of the global population of 6.2 billion plus.

References for standards organizations

- For further references on the standards organizations mentioned in this lecture:
  - http://www.isoc.org/
  - http://www.ietf.org/
  - http://www.irtf.org/
  - http://www.istf.org/
  - http://www.icann.org/
  - http://www.w3.org/
  - http://www.itu.org/