Module #01 Internet: History, Today and Future

Objectives:

Gives a brief retrospective view on the Internet evolution up to the current state along with emerging issues.

Keywords:

Packet Switching, TCP/IP Suit, Fido Net, NSF, ISP, Web, Cloud Networking, IAB, IETF, IEEE, GRID, ITU

Outlines:

The Global Information Infrastructure (**GII**) of the contemporary Internet is based on Info-Communication Technologies (**ICT**) originated from the first Public Switched Telephone Networks (**PSTN**) of the 20-th century. The Internet today embraces significant concepts inherited upon the telephone/radio paradigm of the worldwide market, industry, researches, and institutions. At meanwhile, the International Telecommunication Union (**ITU**) embodies the radio/telephone segment of the global telecommunication world. The ITU is the specialized agency of the United Nations which is responsible for information and communication technologies. Therefore, the ITU in particular plays a leading role in the whole Internet world community.

The history of the Internet roots back to the first computers of the **1950s** based on the Mainframe architecture; it supports communication between the in-lab computer terminals and the central Mainframe processor. **Leonard Kleinrock** and **Paul Baran** (in the late **1950**s) originated the two revolutionary concepts of the computer intercommunication: decentralized (peer-to-peer) computer relationship and packet switching technique. Packet switched networks (such as ARPANET) were developed in late **1960s** and early **1970s** using a variety of protocols. The first ARPANET link established between the University of California, Los Angeles and the Stanford Research Institute on **October 29, 1969**. The solely two first letters of the word "login" had been successfully transmitted via the cable link and then the connection crashed. However, a new era started in computer telecommunication sphere. The ARPANET in particular led to the development of protocols for internetworking (**IP-protocol**), where multiple separate networks joined together into a network of networks.

By December of **1969**, a 4-node network created by adding the University of Utah and the University of California, Santa Barbara. By **1981**, the number of hosts had grown to 213, with a new host added approximately every twenty days. Based on ARPA's research, packet switching network standards developed by the ITU in the form of **X.25** and related standards (**1976**). While using packet switching, X.25 built on the concept of virtual circuits emulating traditional telephone connections. Unlike ARPANET (in USA), X.25 (in Europe) was commonly available for business use. First computer networks employed the conventional PSTN channels for long distance data transfer. Therefore, the data transmission was rather expensive. To override the telephone line tax, the popular hobbyist computer community Fido Net emerged, many of them hackers and amateur radio operators.

In December of **1974** the first specification o the **TCP/IP** protocol suite was issued (*RFC 675).* Stemming from it, TCP/IP emerged in mid-late **1978** in nearly final form. By **1981**, the standards were published as **RFC**s 791,2,3 and adopted for use. On January 1, **1983**, known as **flag day**, TCP/IP protocols became the only approved protocol on the ARPANET, replacing the earlier protocols.

The early networks based on the ARPANET were government funded and therefore restricted to noncommercial uses such as research; unrelated commercial use was strictly forbidden. During the **1980**s, the connections expanded to the more educational institutions, and even to a growing number of companies such as Digital Equipment Corporation and Hewlett-Packard, which were participating in research projects. In **1981** **NSF** of USA supported the development of the Computer Science Network (**CSNET**) connected with ARPANET using TCP/IP, and ran TCP/IP over X.25. The CSNET became de facto backbone and exchange point for the Internet. Late in **1980**s, first Internet service provider (**ISP**) companies were formed. The Commercial Internet eXchange (CIX), Metropolitan Area Exchanges (MAEs), and later Network Access Points (**NAP**s) were becoming the primary

interconnections between many networks. In **1986** officially started the Internet Engineering Task Force (**IETF**).

In **1991**, Tim Berners-Lee posted a World Wide Web (**WWW**) project summary as a publicly available service on the Internet.

For his work in developing the World Wide Web, Berners-Lee received the Millennium technology prize in **2004**.

In **1993**, a graphical "Mosaic" **Web browser** developed by Marc Andreessen, superseded in **1994** by Andreessen's Netscape Navigator.

On January **199**4, The **Superhighway Summit** was held − the "first public conference bringing together all of the major industry, government and academic leaders to begin the national dialogue about the Information Superhighway.

This NeXT Computer was used by Tim Berners-Lee at CERN and became the world's first Web server.

The final restrictions on carrying commercial traffic ended on April of **1995**.

The Internet is now sufficiently embedded in society that it is regularly triggering social, economic and regulatory issues (the hot topics are **network neutrality**, **network management**, imposing regulatory limits on Internet service providers).

Professor **David Clark** presented (*see presentations item*) some today's and emerging issues, such as the role of the social network as a platform, the problems of building a more secure and available Internet, the emerging requirement for identity mechanisms, and the industrial implications of network virtualization and overlays.

Presentations:
1.1.Internet History and Growth
1.2. Audio recording of lecture
1.3. Power Point Presentation

References:
1.1. Paul Baran and the Origins of the Internet.
1.2. Leonard Kleinrock (2005). The history of the Internet.
1.3. MobilityFirst Future Internet Architecture Project