

A Brief History of the Internet and Related Networks

Introduction

In 1973, the U.S. Defense Advanced Research Projects Agency (DARPA) initiated a research program to investigate techniques and technologies for interlinking packet networks of various kinds. The objective was to develop communication protocols which would allow networked computers to communicate transparently across multiple, linked packet networks. This was called the Internetting project and the system of networks which emerged from the research was known as the "Internet." The system of protocols which was developed over the course of this research effort became known as the TCP/IP Protocol Suite, after the two initial protocols developed: Transmission Control Protocol (TCP) and Internet Protocol (IP).

In 1986, the U.S. National Science Foundation (NSF) initiated the development of the NSFNET which, today, provides a major backbone communication service for the Internet. With its 45 megabit per second facilities, the NSFNET carries on the order of 12 billion packets per month between the networks it links. The National Aeronautics and Space Administration (NASA) and the U.S. Department of Energy contributed additional backbone facilities in the form of the NSINET and ESNET respectively. In Europe, major international backbones such as NORDUNET and others provide connectivity to over one hundred thousand computers on a large number of networks. Commercial network providers in the U.S. and Europe are beginning to offer Internet backbone and access support on a competitive basis to any interested parties.

"Regional" support for the Internet is provided by various consortium networks and "local" support is provided through each of the research and educational institutions. Within the United States, much of this support has come from the federal and state governments, but a considerable contribution has been made by industry. In Europe and elsewhere, support arises from cooperative international efforts and through national research organizations. During the course of its evolution, particularly after 1989, the Internet system began to integrate support for other protocol suites into its basic networking fabric. The present emphasis in the system is on multiprotocol interworking, and in particular, with the integration of the Open Systems Interconnection (OSI) protocols into the architecture.

Both public domain and commercial implementations of the roughly 100 protocols of TCP/IP protocol suite became available in the 1980's. During the early 1990's, OSI protocol implementations also became available and, by the end of 1991, the Internet has grown to include some 5,000 networks in over three dozen countries, serving over 700,000 host computers used by over 4,000,000 people.

A great deal of support for the Internet community has come from the U.S. Federal Government, since the Internet was originally part of a federally-funded research program and, subsequently, has become a major part of the U.S. research infrastructure. During the late 1980's, however, the population of Internet users and network constituents expanded internationally and began to include commercial facilities. Indeed, the bulk of the system today is made up of private networking facilities in educational and research institutions, businesses and in government organizations across the globe.

The Coordinating Committee for Intercontinental Networks (CCIRN), which was organized by the U.S. Federal Networking Council (FNC) and the European Reseaux Associees pour la Recherche Europeenne (RARE), plays an important role in the coordination of plans for government- sponsored research networking. CCIRN efforts have been a stimulus for the support of international cooperation in the Internet environment.

Internet Technical Evolution

Over its fifteen year history, the Internet has functioned as a collaboration among cooperating parties. Certain key functions have been critical for its operation, not the least of which is the specification of the protocols by which the components of the system operate. These were originally developed in the DARPA research program mentioned above, but in the last five or six years, this work has been undertaken on a wider basis with support from Government agencies in many countries, industry and the academic community. The Internet Activities Board (IAB) was created in 1983 to guide the evolution of the TCP/IP Protocol Suite and to provide research advice to the Internet community.

During the course of its existence, the IAB has reorganized several times. It now has two primary components: the Internet Engineering Task Force and the Internet Research Task Force. The former has primary responsibility for further evolution of the TCP/IP protocol suite, its standardization with the concurrence of the IAB, and the integration of other protocols into Internet operation (e.g. the Open Systems Interconnection protocols). The Internet Research Task Force continues to organize and explore advanced concepts in networking under the guidance of the Internet Activities Board and with support from various government agencies.

A secretariat has been created to manage the day-to-day function of the Internet Activities Board and Internet Engineering Task Force. IETF meets three times a year in plenary and its approximately 50 working groups convene at intermediate times by electronic mail, teleconferencing and at face-to-face meetings. The IAB meets quarterly face-to-face or by videoconference and at intervening times by telephone, electronic mail and computer-mediated conferences.

Two other functions are critical to IAB operation: publication of documents describing the Internet and the assignment and recording of various identifiers needed for protocol operation. Throughout the development of the Internet, its protocols and other aspects of its operation have been documented first in a series of documents called Internet Experiment Notes and, later, in a series of documents called Requests for Comment (RFCs). The latter were used initially to document the protocols of the first packet switching network developed by DARPA, the ARPANET, beginning in 1969, and have become the principal archive of information about the Internet. At present, the publication function is provided by an RFC editor.

The recording of identifiers is provided by the Internet Assigned Numbers Authority (IANA) who has delegated one part of this responsibility to an Internet Registry which acts as a central repository for Internet information and which provides central allocation of network and autonomous system identifiers, in some cases to subsidiary registries located in various countries. The Internet Registry (IR) also provides central maintenance of the Domain Name System (DNS) root database which points to subsidiary distributed DNS servers replicated throughout the Internet. The DNS distributed database is used, inter alia, to associate host and network names with their Internet addresses and is critical to the operation of the higher level TCP/IP protocols including electronic mail.

There are a number of Network Information Centers (NICs) located throughout the Internet to serve its users with documentation, guidance, advice and assistance. As the Internet continues to grow internationally, the need for high quality NIC functions increases. Although the initial community of users of the Internet were drawn from the ranks of computer science and engineering, its users now comprise a wide range of disciplines in the sciences, arts, letters, business, military and government administration.

Related Networks

In 1980-81, two other networking projects, BITNET and CSNET, were initiated. BITNET adopted the IBM RSCS protocol suite and featured direct leased line connections between participating sites. Most of the original BITNET connections linked IBM mainframes in university data centers. This rapidly changed as protocol implementations became available for other machines. From the beginning, BITNET has been multi-disciplinary in nature with users in all academic areas. It has also provided a number of unique services to its users (e.g., LISTSERV). Today, BITNET and its parallel networks in other parts of the world (e.g., EARN in Europe) have several thousand participating sites. In recent years, BITNET has established a backbone which uses the TCP/IP protocols with RSCS-based applications running above TCP.

CSNET was initially funded by the National Science Foundation (NSF) to provide networking for university, industry and government computer science research groups. CSNET used the Phonenet MMDF protocol for telephone-based electronic mail relaying and, in addition, pioneered the first use of TCP/IP over X.25 using commercial public data networks. The CSNET name server provided an early example of a white pages directory service and this software is still in use at numerous sites. At its peak, CSNET had approximately 200 participating sites and international connections to approximately fifteen countries.

In 1987, BITNET and CSNET merged to form the Corporation for Research and Educational Networking (CREN). In the Fall of 1991, CSNET service was discontinued having fulfilled its important early role in the provision of academic networking service. A key feature of CREN is that its operational costs are fully met through dues paid by its member organizations.