

HISTORY OF THE INTERNET: ORIGINS, KEY MILESTONES, AND EVOLUTION
AND
COMPARISON OF COMMON NETWORK TOPOLOGIES

BY

AYESANMI OWOLABI TEMITOPE
COMPUTER SCIENCE DEPARTMENT
COLLEGE OF POSTGRADUATE STUDIES
REDEEMER'S UNIVERSITY
EDE, OSUN STATE, NIGERIA

CSC 828 ASSIGNMENTS

LECTURER-IN-CHARGE
DR. S.A. ADEPOJU

HISTORY OF THE INTERNET: ORIGINS, KEY MILESTONES, AND EVOLUTION

1.0 Introduction

The Internet is a global system of interconnected computer networks that has revolutionized communication, commerce, and information sharing. Its development involved contributions from government agencies, academic institutions, and private enterprises. This paper explores the origins of the Internet, key milestones, major technological advancements, and its transition from an academic research tool to a worldwide commercial and communication platform.

2.0 Origins and Early Development of the Internet

2.1 ARPANET: The Foundation of the Internet

The foundation of the Internet can be traced to the root of the Advanced Research Projects Agency Network (ARPANET), funded by the U.S. Department of Defense in the 1960s. ARPANET was designed to create a decentralized communication network that could withstand partial outages, such as those caused by nuclear attacks (Leiner et al., 2009).

- In 1969, the first successful message was sent between UCLA and Stanford Research Institute, marking the birth of ARPANET (Abbate, 1999).
- In 1971, Ray Tomlinson developed email, introducing the "@" symbol to distinguish user names from host machines (Hauben & Hauben, 1997).

2.2 TCP/IP: The Standard Protocol

A major breakthrough came with the development of the Transmission Control Protocol/Internet Protocol (TCP/IP) by Vint Cerf and Bob Kahn in 1974. This protocol enabled different networks to communicate, which formed the basis of the modern Internet (Cerf & Kahn, 1974).

- In 1983, ARPANET officially adopted TCP/IP, leading to the creation of the "Internet" (National Science Foundation, n.d.).

3.0 Expansion and Institutional Support

3.1 NSFNET and Academic Growth

In the 1980s, the National Science Foundation Network (NSFNET) replaced ARPANET, connecting supercomputing centers across the U.S. and fostering academic collaboration (Greenstein, 2015).

- In 1986, NSFNET expanded with high-speed backbone networks, increasing accessibility for universities and research institutions.
- In 1990, ARPANET was decommissioned, with NSFNET becoming the primary infrastructure (Leiner et al., 2009).

3.2 Domain Name System (DNS) and User Accessibility

The introduction of the Domain Name System (DNS) in 1985 replaced numerical IP addresses with human-readable names (e.g., .com, .edu), making the Internet more user-friendly (Mockapetris, 1983).

4.0 The World Wide Web and Commercialization

4.1 Invention of the Web (1989–1993)

- In 1989, Tim Berners-Lee proposed the World Wide Web (WWW) at CERN, introducing HTML, HTTP, and URLs to organize and access information (Berners-Lee, 1989).
- In 1993, the Mosaic web browser (which is later known as Netscape) popularized graphical web browsing, leading to exponential growth in Internet usage (Andreessen, 1993).

4.2 Privatization and the Dot-Com Boom

- In 1995, the U.S. government privatized Internet infrastructure, allowing commercial Internet Service Providers (ISPs) to expand (Wu, 2010).
- In the Late 1990s, the dot-com boom saw companies like Amazon, Google, and eBay emerge, transforming the Internet into a commercial hub for businesses (Greenstein, 2015).

5.0 Modern Internet: Broadband, Mobile, and Social Media

5.1 Broadband and High-Speed Access

- In Early 2000s, dial-up was replaced by broadband, enabling faster and always-on Internet access (FCC, 2020).
- In 2010s till present, fiber-optic and 5G networks further increased speeds, supporting streaming, cloud computing, and IoT devices.

5.2 Rise of Social Media and Mobile Internet

- In 2004 till present, platforms like Facebook, YouTube, and Twitter revolutionized communication (Perrin, 2021).
- Smartphones (e.g., iPhone, android OS) made the Internet accessible anytime, anywhere.

5.3 Transition from Academic Tool to Global Platform

The Internet has evolved from a military-academic project into a commercial and social necessity due to:

1. Privatization (e.g., ISP competition, e-commerce).
2. Technological Innovations (e.g., browsers, search engines, mobile apps).
3. Global Infrastructure (e.g., undersea cables, satellite Internet).

Conclusion

The Internet's development was driven by collaboration between governments, academia, and private enterprises. Key milestones—ARPANET, TCP/IP, the World Wide Web, and broadband—transformed it into an essential global platform. Today, the Internet continues to evolve with advancements in AI, IoT, and decentralized technologies.

COMPARISON OF COMMON NETWORK TOPOLOGIES

Network topologies define the arrangement of nodes and connections in a network. Each topology has unique structural characteristics, advantages, and disadvantages, making them suitable for different real-world applications. Below is a detailed comparison followed by a decision framework.

1.0 Bus Topology: All devices are connected to a single central cable (called the "bus") and data travels in both directions, and devices listen for data meant for them.

Advantages:

- Simple and inexpensive to set up.
- Requires less cabling than other topologies.

Disadvantages:

- If the main cable fails, the entire network goes down.
- Performance degrades with heavy traffic due to collisions.

Real-World Use Case:

1. Early Ethernet networks (10BASE2 and 10BASE5).
2. Small office or home networks with limited devices.

2.0 Star Topology: All devices are connected to a central hub or switch while communication flows through the central node.

Advantages:

- Easy to install and manage.
- Failure of one node does not affect others
- Scalable i.e. new devices can be added easily.

Disadvantages:

- Central hub failure brings down the entire network.
- Higher cabling cost due to individual connections.

Real-World Use Case:

1. Modern Ethernet LANs (using switches).
2. Home Wi-Fi networks (router acts as the central hub).

3.0 Ring Topology: Devices are connected in a closed loop and data travels in one direction (unidirectional) or both (bidirectional).

Advantages:

- No data collisions due to token-passing mechanism.
- Equal network access for all devices.

Disadvantages:

- Failure of one node can disrupt the entire network.
- Adding/removing devices requires network reconfiguration.

Real-World Use Case:

1. Token Ring networks (IBM legacy systems).
2. Fiber Distributed Data Interface (FDDI) networks.

4.0 Mesh Topology: Each node are connected to every other node (full mesh) or selectively (partial mesh).

Advantages:

- High redundancy and fault tolerance.
- No traffic congestion due to dedicated links.

Disadvantages:

- Expensive due to high cabling and maintenance.
- Complex to configure and manage.

Real-World Use Case:

1. Military communication networks.
2. Internet backbone infrastructure.

5.0 Hybrid Topology: This combines two or more different topologies together (e.g., Star-Ring, Star-Bus).

Advantages:

- Flexible and scalable.
- Balances strengths of different topologies.

Disadvantages:

- Complex design and costly implementation.
- Requires expert management.

Real-World Use Case:

1. Large enterprise networks.
2. University campus networks.

6.0 Tree Topology: This makes use of hierarchical arrangement with root (central hub) and branches (sub-networks).

Advantages:

- Scalable for large networks.
- Isolates network segments for better management.

Disadvantages:

- Dependent on the root node—failure disrupts the entire network.
- Expensive due to cabling and hardware.

Real-World Use Case:

1. Wide Area Networks (WANs).
2. Corporate networks with multiple departments.

Decision Framework for Selecting a Network Topology

Criteria	Bus	Star	Ring	Mesh	Hybrid	Tree
Cost	Low	Medium	Medium	High	High	High
Scalability	Low	High	Medium	Medium	High	High
Fault Tolerance	Low	Medium	Low	High	High	Medium
Ease of Setup	High	High	Medium	Low	Low	Medium
Performance	Low (under heavy traffic)	High	Medium	High	High	High
Best Use Case	Small networks	Offices, LANs	Legacy systems	Critical systems	Large enterprises	WANs, ISPs

References

- Abbate, J. (1999). *Inventing the Internet*. MIT Press.
- Andreessen, M. (1993). *NCSA Mosaic technical summary*. National Center for Supercomputing Applications.
- Berners-Lee, T. (1989). *Information management: A proposal*. CERN.
- Cerf, V., & Kahn, R. (1974). *A protocol for packet network intercommunication*. IEEE Transactions on Communications, 22(5), 637–648.
- Federal Communications Commission (FCC). (2020). *Broadband deployment report*. <https://www.fcc.gov>
- Greenstein, S. (2015). *How the Internet became commercial*. Princeton University Press.
- Hauben, M., & Hauben, R. (1997). *Netizens: On the history and impact of Usenet and the Internet*. IEEE Computer Society.
- Leiner, B. M., et al. (2009). *A brief history of the Internet*. ACM SIGCOMM Computer Communication Review, 39(5), 22–31.
- Mockapetris, P. (1983). *Domain names—Concepts and facilities*. RFC 882.
- National Science Foundation. (n.d.). *NSF and the birth of the Internet*. <https://www.nsf.gov>
- Perrin, A. (2021). *Social media usage trends*. Pew Research Center.
- Wu, T. (2010). *The master switch: The rise and fall of information empires*. Knopf.
- Forouzan, B. A. (2012). *Data communications and networking* (5th ed.). McGraw-Hill.
- Stallings, W. (2021). *Data and computer communications* (11th ed.). Pearson.
- Tanenbaum, A. S., & Wetherall, D. J. (2021). *Computer networks* (6th ed.). Pearson.
- Cisco. (2023). *Network topologies: Overview and guide*. Retrieved from <https://www.cisco.com>