Internet Fragmentation, the DNS, and ICANN

Briefing Paper for ICANN75 Plenary Session

Internet Layers

Internet Fragmentation: An Overview, a 2016 white paper from the World Economic Forum, outlines five functional layers of the Internet:

> The lowest is the physical or hardware link layer over which packets are carried, such as Ethernet, Wireless Wi-Fi, dedicated optical telecommunications circuits, or satellite links. Moving up the stack, the network or Internet layer is where the Internet protocol (IP) carries packets from a source to a destination, using the routing protocols to determine the paths taken by the packets. Moving further up, the transport layer comprise protocols for various kinds of data transport, such as sequenced and assure delivery of data using the Transmission Control Protocol (TCP), or the User Datagram Protocol (UDP) for real-time but not necessarily sequenced or guaranteed delivery. Each IP packet carries an indication of which protocol is to be used to handle the contents or payload of each Internet packet. Finally, at the top one finds the applications layer where utility protocols such as File Transport Protocol (FTP), Hypertext Transfer Protocol (HTTP), Simple Mail Transport Protocol (SMTP), and many others reside. [...] In discussing how the Internet is actually used and how that usage may be impeded, the addition of this fifth nominal layer is helpful. The concept could be seen as very roughly analogous to the distinction in traditional telecommunications between network carriage and its content.

These layers can be depicted as:

5. Content and Transactions Layer
4. Application Layer
3. Transport Layer
2. Network/IP Layer
1. Physical/Link Layer

The Domain Name System

Humans identify the location of information online through domain names such as www.icann.org. The DNS operates at the application layer and translates domain names into IP addresses. Internet applications, like web browsers and email clients, use IP addresses as the source and destination of information exchange.

The DNS is hierarchical, which means that like a boss delegating authority over work to subordinates, the owner of a domain can delegate control over a part of their domain, known as a subdomain. This avoids the problem of a single point of failure and having all queries arrive at one place. Different parties can keep this data locally, but anyone who wants access to this data can access it globally through a certain query process.

There are three important components to the DNS: namespace, name servers, and resolvers. Namespace refers to the database, which is often represented as an inverted tree, starting with the root on the top. The database is kept in servers called name servers. Name servers keep this data to serve the resolvers. Resolvers send queries while name servers answer queries.

ICANN

The mission of ICANN is to help ensure a stable, secure, and unified global Internet. ICANN was formed in 1998 as a not-for-profit public-benefit corporation to help coordinate and support the unique identifiers of the Internet. ICANN policies must be developed through a consensus-based multistakeholder model.

ICANN is composed of three parts:

- The **ICANN community** consists of three Supporting Organizations (SOs) and four Advisory Committees (ACs) that organize commercial, noncommercial, end user, governmental, security, and technical interests. The three SOs are the Generic Names Supporting Organization, the Country Code Names Supporting Organization, and the Address Supporting Organization. The SOs are primarily responsible for making policy recommendations on domain names and Internet Protocol addresses to the ICANN Board. The four ACs are the At-Large Advisory Committee, the Governmental Advisory Committee, the Root Server System Advisory Committee, and the Security and Stability Advisory Committee. These ACs are composed of representatives from the Internet community who have expertise in specific areas.
- The **ICANN Board** provides strategic oversight of the ICANN organization, ensuring that it acts within its mission and operates effectively, efficiently, and ethically. The ICANN Board also oversees and considers policy recommendations of the ICANN community. The ICANN community selects the ICANN Board.
- The **ICANN organization** implements the policies developed by the ICANN community and provides resources to support the ICANN Board and ICANN community.

Internet Fragmentation

Internet fragmentation is not new and happens every day. This complex topic can be understood through three frameworks as outlined in *Internet Fragmentation: An Overview.*

- **Technical fragmentation:** Conditions in the underlying infrastructure that impede the ability of systems to fully interoperate and exchange data packets and of the Internet to function consistently at all endpoints. These generally pertain to layers 1-4.
- **Governmental fragmentation:** Government policies and actions that constrain or prevent certain uses of the Internet to create, distribute, or access information resources. These generally are targeted at the 5th layer, but they may involve actions taken at the lower technical layers as well.
- **Commercial fragmentation:** Business practices that constrain or prevent certain uses of the Internet to create, distribute or access information resources. These generally are targeted at the 5th layer in our model, but they may involve actions taken at the lower technical layers as well.

ICANN75 Plenary Session

This plenary session, proposed and developed by an ICANN community planning team, provides an opportunity to build a common understanding of Internet fragmentation and the challenges it presents to the ICANN mission. Discussants from several ICANN community groups, sharing the perspectives of the commercial and noncommercial sectors, end users, governments, security, and technical experts will define Internet fragmentation and then discuss its relevance to the DNS. The plenary session will also explore the role of ICANN in this context. Two in-person moderators and one virtual moderator will guide the plenary session, encouraging participation from discussants and the in-person and virtual audiences.

Resources

1. Getting to Know ICANN
2. Getting to Know the ICANN Board
3. How Domain Name System Policy is Developed
4. ICANN Learn: DNS Fundamentals
5. Internet Fragmentation: An Overview