



Basic Campus Network Design

Date: 28-30 April 2021

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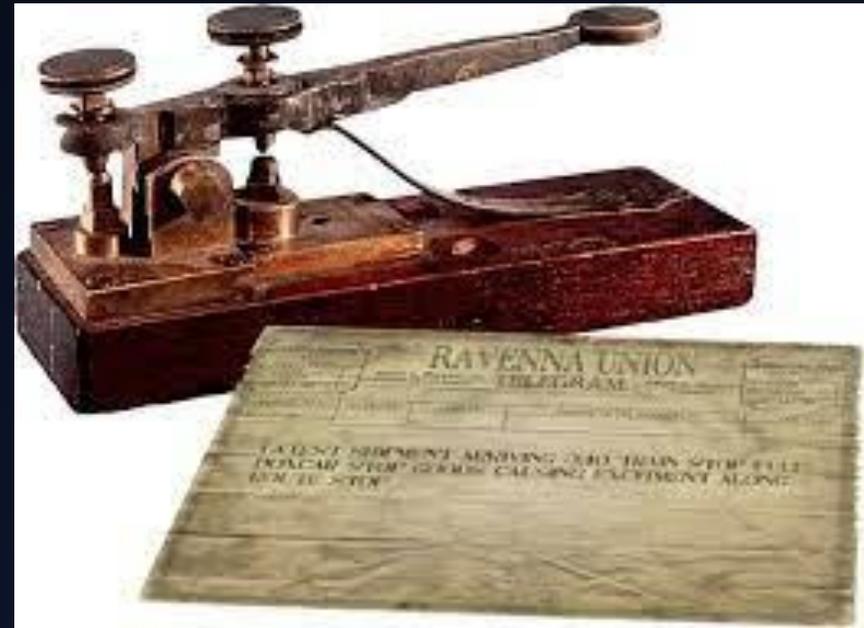
Learning Objective

Day-1:

- Internet ecosystem
- **Fundamental of Networking**
- Impact of Research and Education Network (REN)
- Campus Network Design Principles
- Campus Network Cabling Best Practices

Evolution of Internet

- 1836 - Invention Of The Telegraph:
 - The telegraph allowed people to communicate quickly over long distances. Prior to the telegraph people had to rely on letter which might take weeks or even months to get from one place to another.
- Next Timeline



Evolution of Internet

- 1876 - INVENTION OF THE TELEPHONE:
- Alexander Graham Bell introduced the first telephone.
- It required an operator to connect the lines.



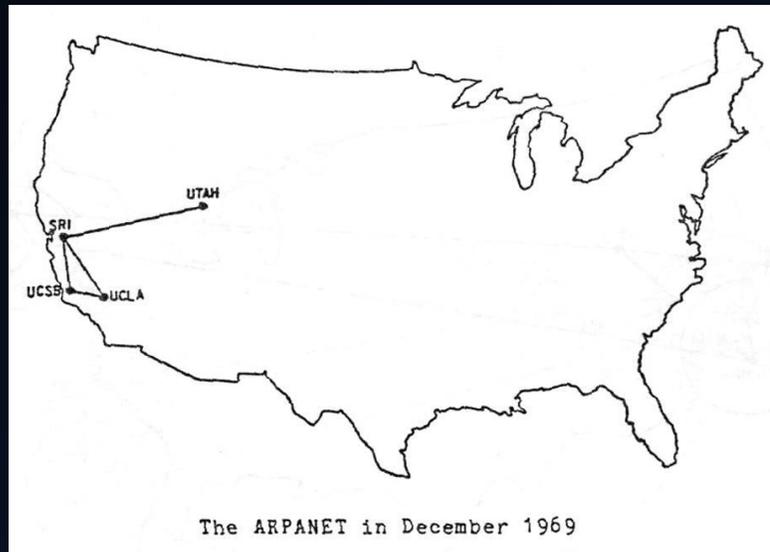


Evolution of Internet

- **DARPA (February 1958)**
 - **Defence Advanced Research Project Agency.**
 - **It is used to secure the leading technology of the US**
 - information was manually transferred by human
 - a plan was developed to eliminate the manual processing

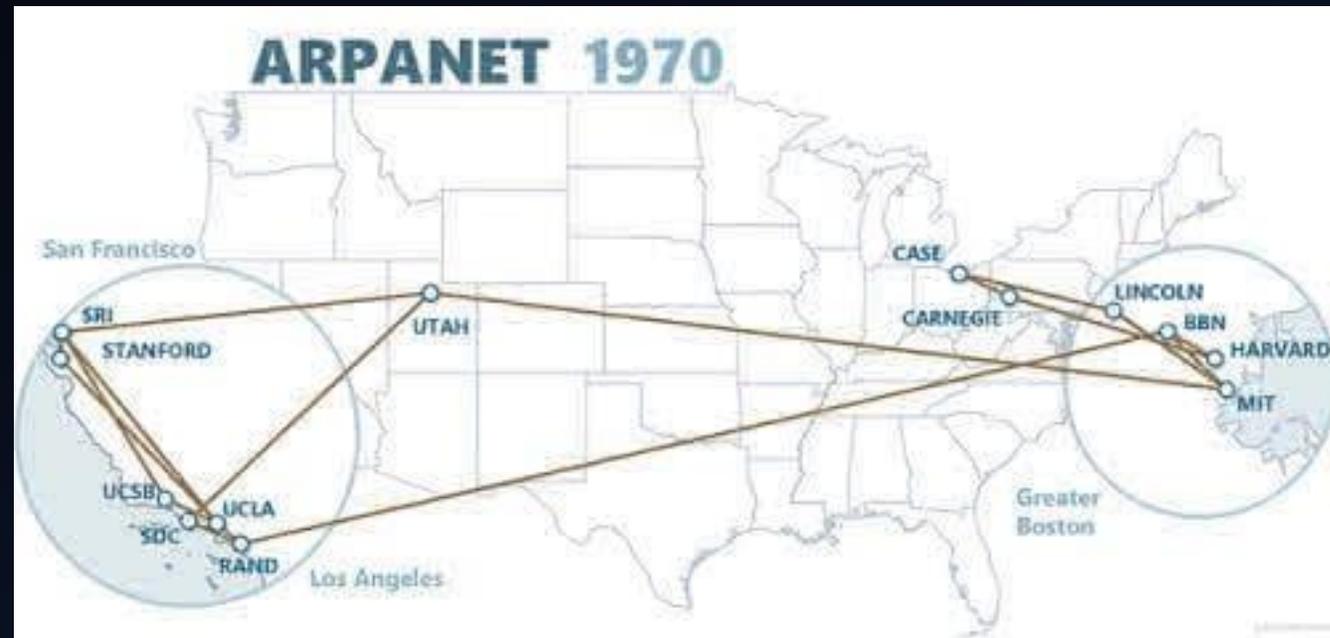
Evolution of Internet

- 1969- Arpanet (Advanced Research Project Agency Network):
- Arpanet was the first real network to run on packet switching technology (new at the time). On the October 29, 1969, computers at Stanford and UCLA connected for the first time. In effect, they were the first hosts on what would one day become the Internet.
- The first message sent across the network was supposed to be “Login”, but reportedly, the link between the two colleges crashed on the letter “g”.



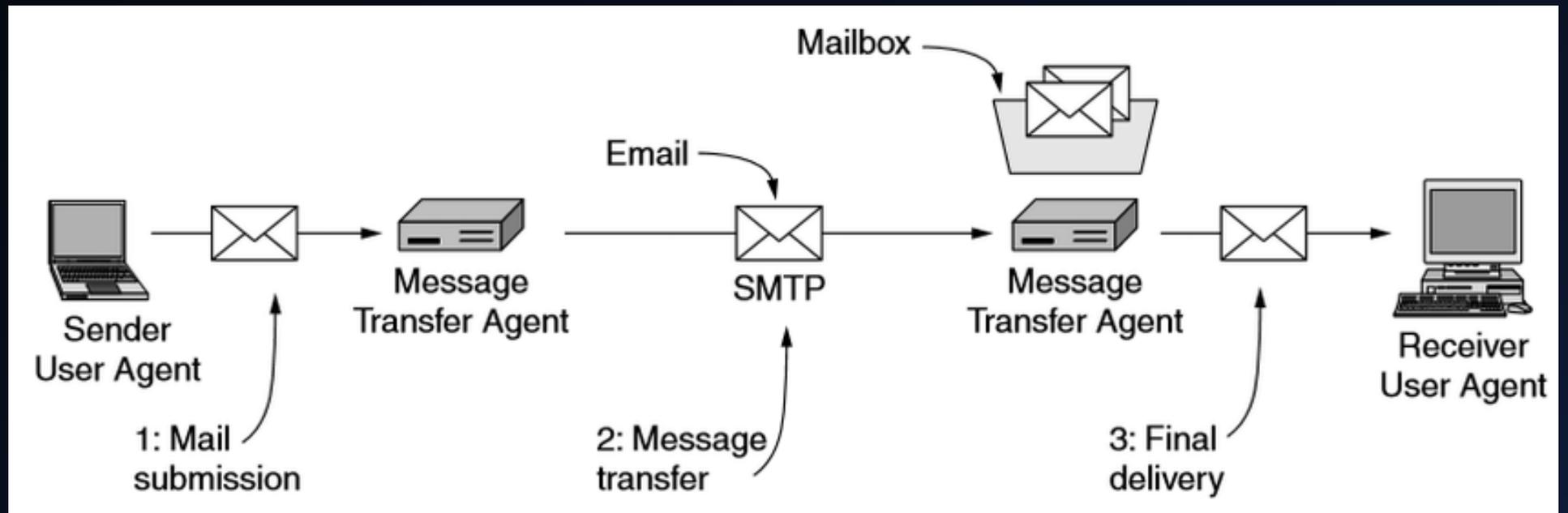
Evolution of Internet

- **1970 - Arpanet network:** An Arpanet network was established between Harvard, MIT, and BBN (the company that created the “interface message processor” computers used to connect to the network) in 1970.



Evolution of Internet

- **1971-Email:** Email was first developed in 1971 by Ray Tomlinson, who also made the decision to use the “@” symbol to separate the user name from the computer name (which later on became the domain name).





Evolution of Internet

- 1973: The first trans-Atlantic connection and the popularity of emailing
- Arpanet made its first trans-Atlantic connection in 1973, with the University College of London.



Evolution of Internet

- 1974: The beginning of TCP/IP
- 1974 was a breakthrough year. A proposal was published to link Arpa-like networks together into a so-called “inter-network”, which would have no central control and would work around a transmission control protocol (which eventually became TCP/IP).



Evolution of Internet

- 1975: The email client
- With the popularity of emailing, the first modern email program was developed by John Vittal, a programmer at the University of Southern California in 1975. The biggest technological advance this program (called MSG) made was the addition of “Reply” and “Forward” functionality



Evolution of Internet

- **1977: The PC modem**
- 1977 was a big year for the development of the Internet as we know it today. It's the year the first PC modem, developed by Dennis Hayes and Dale Heatherington, was introduced and initially sold to computer hobbyists.



Evolution of Internet

- 1978: Spam is born
- 1978 is also the year that brought the first unsolicited commercial email message (later known as spam), sent out to 600 California Arpanet users by Gary Thuerk.

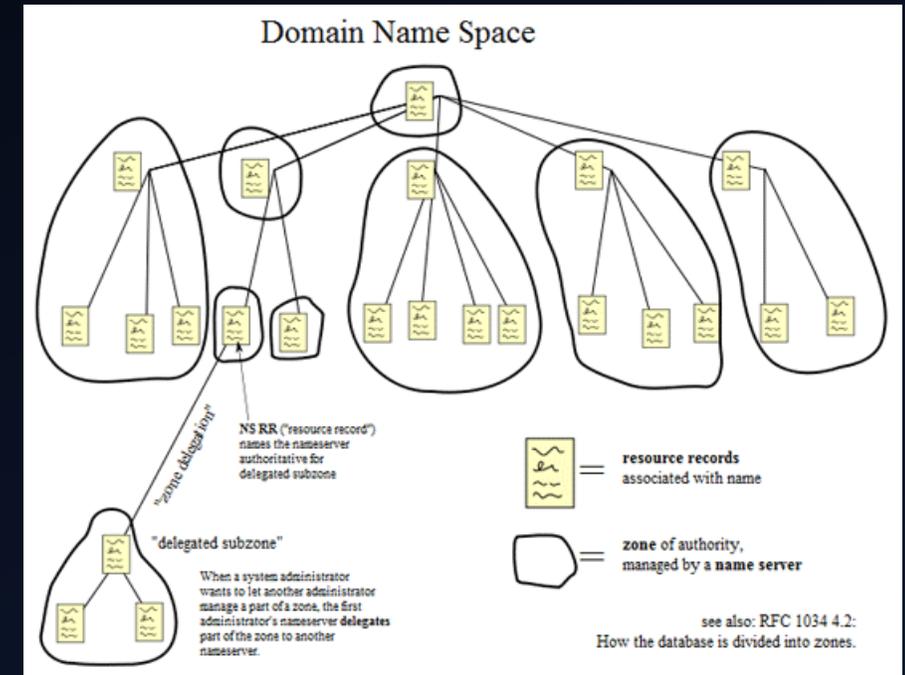


Evolution of Internet

- **1983: Arpanet computers switch over to TCP/IP**
- January 1, 1983 was the deadline for Arpanet computers to switch over to the TCP/IP protocols developed by Vinton Cerf. A few hundred computers were affected by the switch. The name server was also developed in '83.

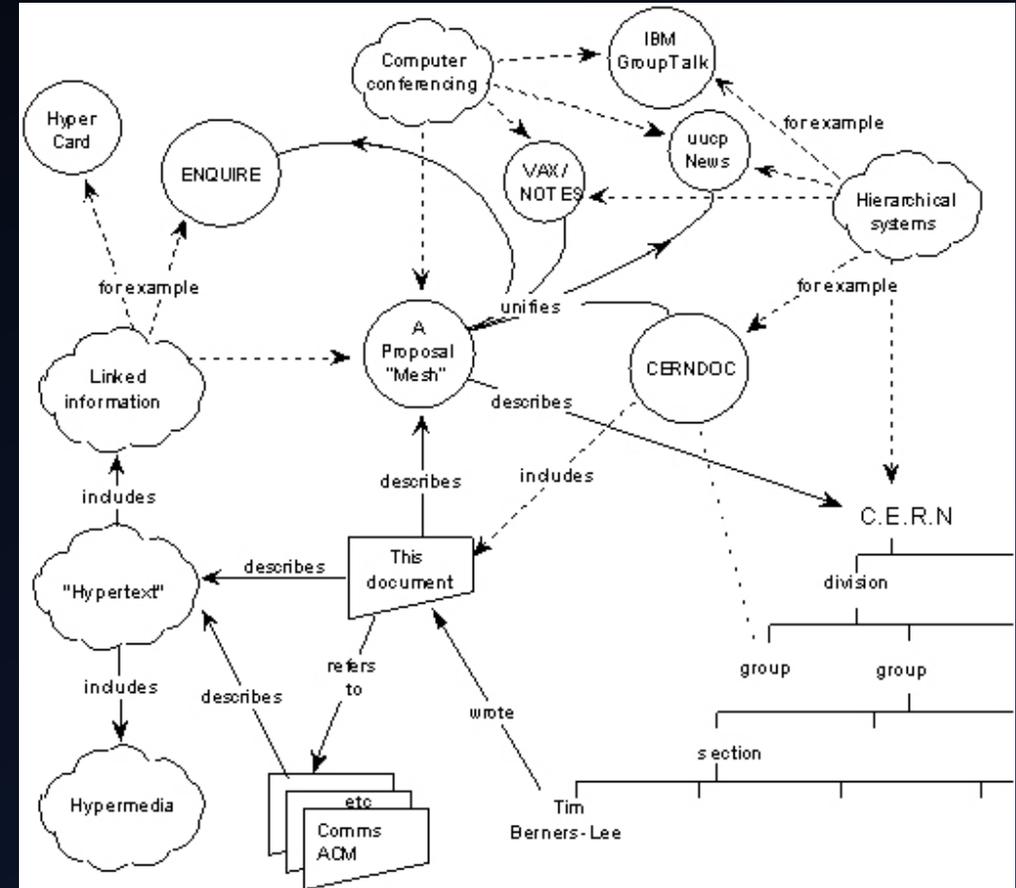
Evolution of Internet

- 1984: Domain Name System (DNS).
- The domain name system was created in 1984 along with the first Domain Name Servers (DNS). The domain name system was important in that it made addresses on the Internet more human-friendly compared to its numerical IP address counterparts. DNS servers allowed Internet users to type in an easy-to-remember domain name and then converted it to the IP address automatically.



Evolution of Internet

- 1989: The proposal for the World Wide Web
- 1989 also brought about the proposal for the World Wide Web, written by Tim Berners-Lee. It was originally published in the March issue of MacWorld, and then redistributed in May 1990. It was written to persuade CERN that a global hypertext system was in CERN's best interest. It was originally called "Mesh"; the term "World Wide Web" was coined while Berners-Lee was writing the code in 1990.





Evolution of Internet

- 1990: First commercial dial-up ISP
- 1990 also brought about the first commercial dial-up Internet provider, The World. The same year, Arpanet ceased to exist.
- 1990: World Wide Web protocols finished
- The code for the World Wide Web was written by Tim Berners-Lee, based on his proposal from the year before, along with the standards for HTML, HTTP, and URLs.

Evolution of Internet

- 1991: First web page created

World Wide Web

The WorldWideWeb (W3) is a wide-area [hypermedia](#) information retrieval initiative aiming to give universal access to a large universe of documents.

Everything there is online about W3 is linked directly or indirectly to this document, including an [executive summary](#) of the project, [Mailing lists](#), [Policy](#), November's [W3 news](#), [Frequently Asked Questions](#).

[What's out there?](#)

Pointers to the world's online information, [subjects](#), [W3 servers](#), etc.

[Help](#)

on the browser you are using

[Software Products](#)

A list of W3 project components and their current state. (e.g. [Line Mode](#), [X11 Viola](#), [NeXTStep](#), [Servers](#), [Tools](#), [Mail robot](#), [Library](#))

[Technical](#)

Details of protocols, formats, program internals etc

[Bibliography](#)

Paper documentation on W3 and references.

[People](#)

A list of some people involved in the project.

[History](#)

A summary of the history of the project.

[How can I help ?](#)

If you would like to support the work

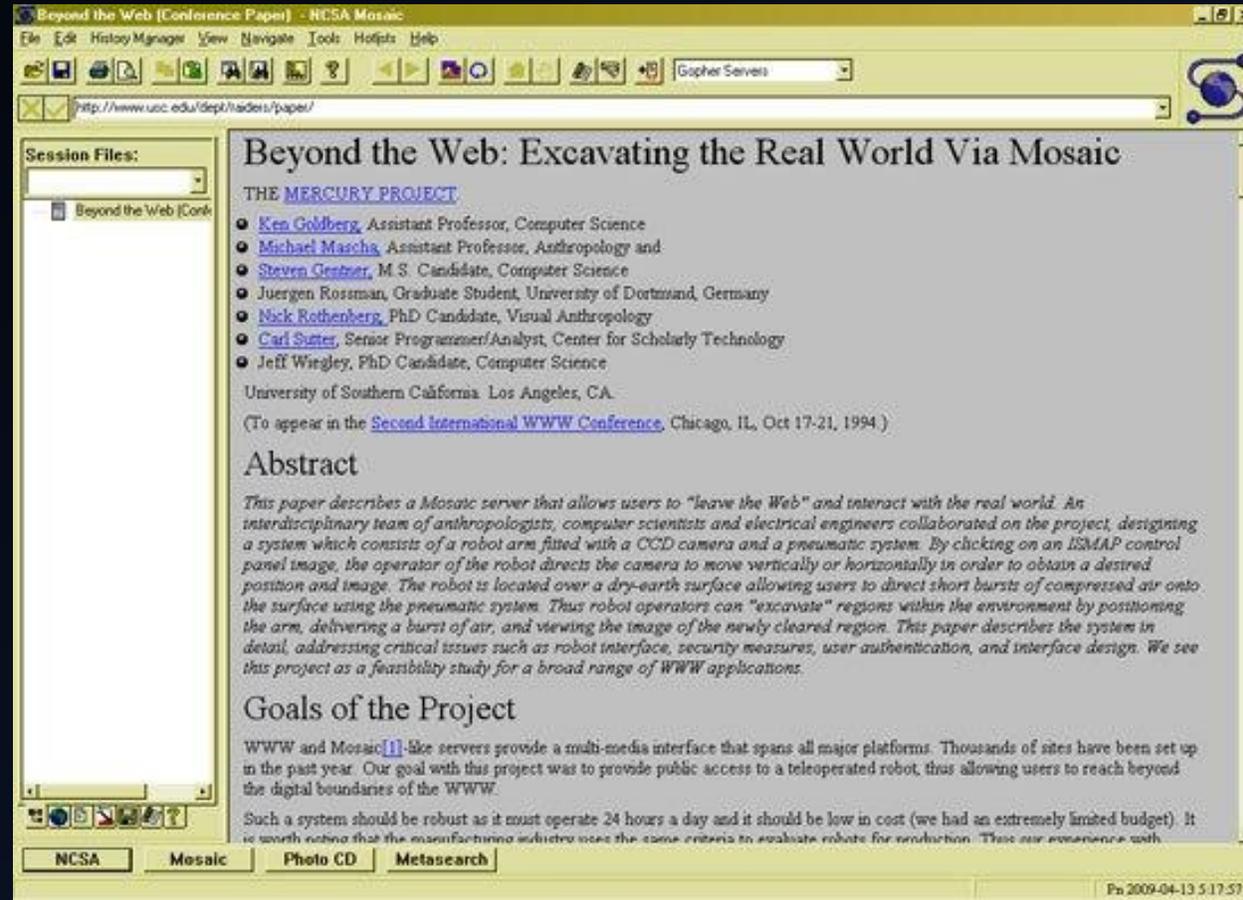
Evolution of Internet

- 1991: First content-based search protocol
- Also in the same year, the first search protocol that examined file contents instead of just file names was launched, called Gopher.
- 1991: MP3 becomes a standard
- Also, the MP3 file format was accepted as a standard in 1991. MP3 files, being highly compressed, later become a popular file format to share songs and entire albums via the internet.
- 1991: The first webcam



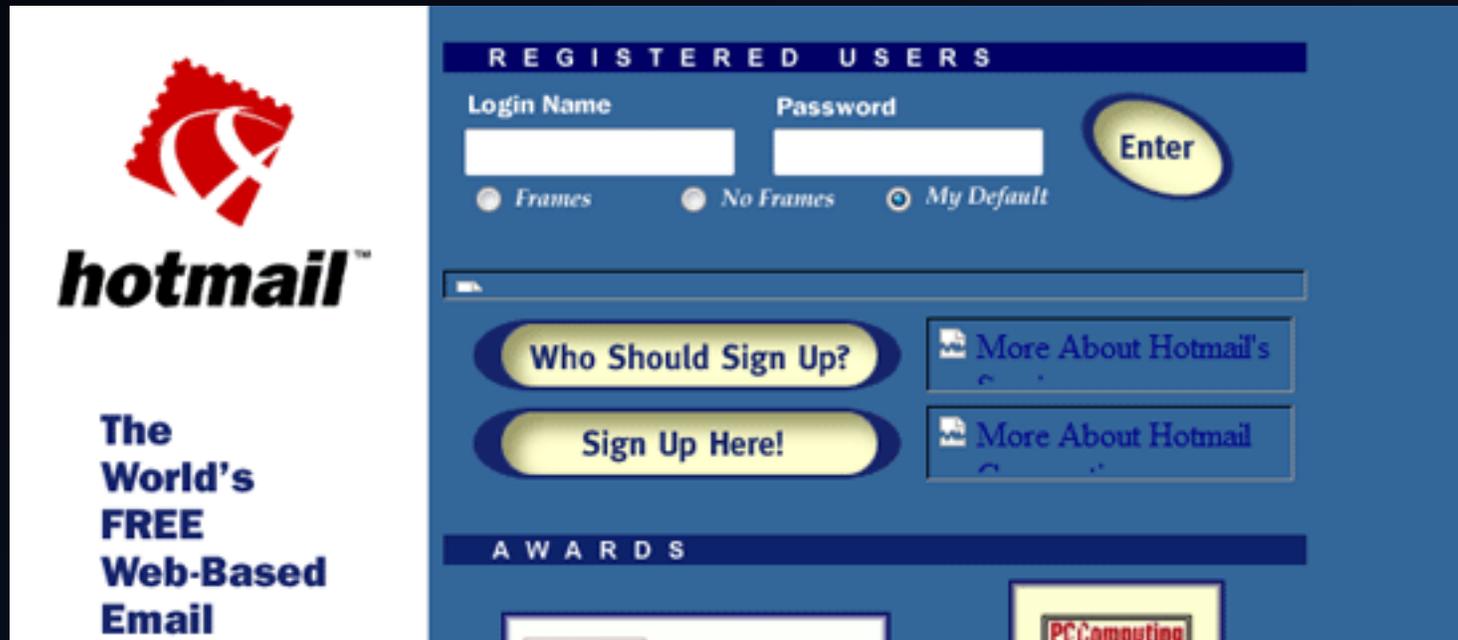
Evolution of Internet

- 1993: Mosaic - first graphical web browser for the general public



Evolution of Internet

- 1996: First web-based (webmail) service



Evolution of Internet

- 1998: Google!



Evolution of Internet

- 2001: Wikipedia is launched



The screenshot shows the Wikipedia Main Page interface. At the top left is the Wikipedia logo, a circular emblem with a quote: "There is distinguished only by his reason; but that of this singular passion for other animals, which is a lion in the mind, that by a perseverance of delight in the continual and indefatigable generation of knowledge, exceeds the short vehemence of any carnal pleasure." Below the logo is the text "WIKIPEDIA The Free Encyclopedia". To the right of the logo are navigation links: "Main Page", "Recent changes", "Protected page", "History", "Special pages" (with a dropdown arrow), and a "Go" button. Below these are links for "Printable version" and "Other languages: German | Esperanto | Spanish | French | Dutch | Polish | Portuguese". The main heading is "Main Page" in a large, bold font, followed by the text "From Wikipedia, the free encyclopedia." Below this is a welcome message: "Welcome to [Wikipedia](#), a collaborative project to produce a complete [encyclopedia](#) from scratch. We started in January [2001](#) and are already on [48152 articles](#), with more being added and improved all the time including *you*, can edit any article right now, without even having to copyedit, expand an article, write a little or write a lot. See the [Wikipedia:Welcome](#) page for more background information about the project, and the [help page](#) on how to use and contribute to Wikipedia." At the bottom, it states: "The content of Wikipedia is covered by the [GNU Free Documentation License](#), which means that it is free and will remain so forever. See [Wikipedia:Copyrights](#) for details and [Wikipedia:Copyrights and free content](#) for background information." On the left side of the page, there is a sidebar with links: "Main Page", "Recent changes", "Random page", "Watch list", "Current events", "Protected page", "Talk page", "History", "What links here", and "Watch links".

Evolution of Internet

- 2004: “The” Facebook open to college students





Evolution of Internet

- 2005: YouTube - streaming video for the masses
- YouTube launched in 2005, bringing free online video hosting and sharing to the masses.

- 2006: Twitter gets twittering
- Twitter launched in 2006. It was originally going to be called twittr (inspired by Flickr); the first Twitter message was “just setting up my twttr”.

Internet Eco-System

Main Gateway of Information

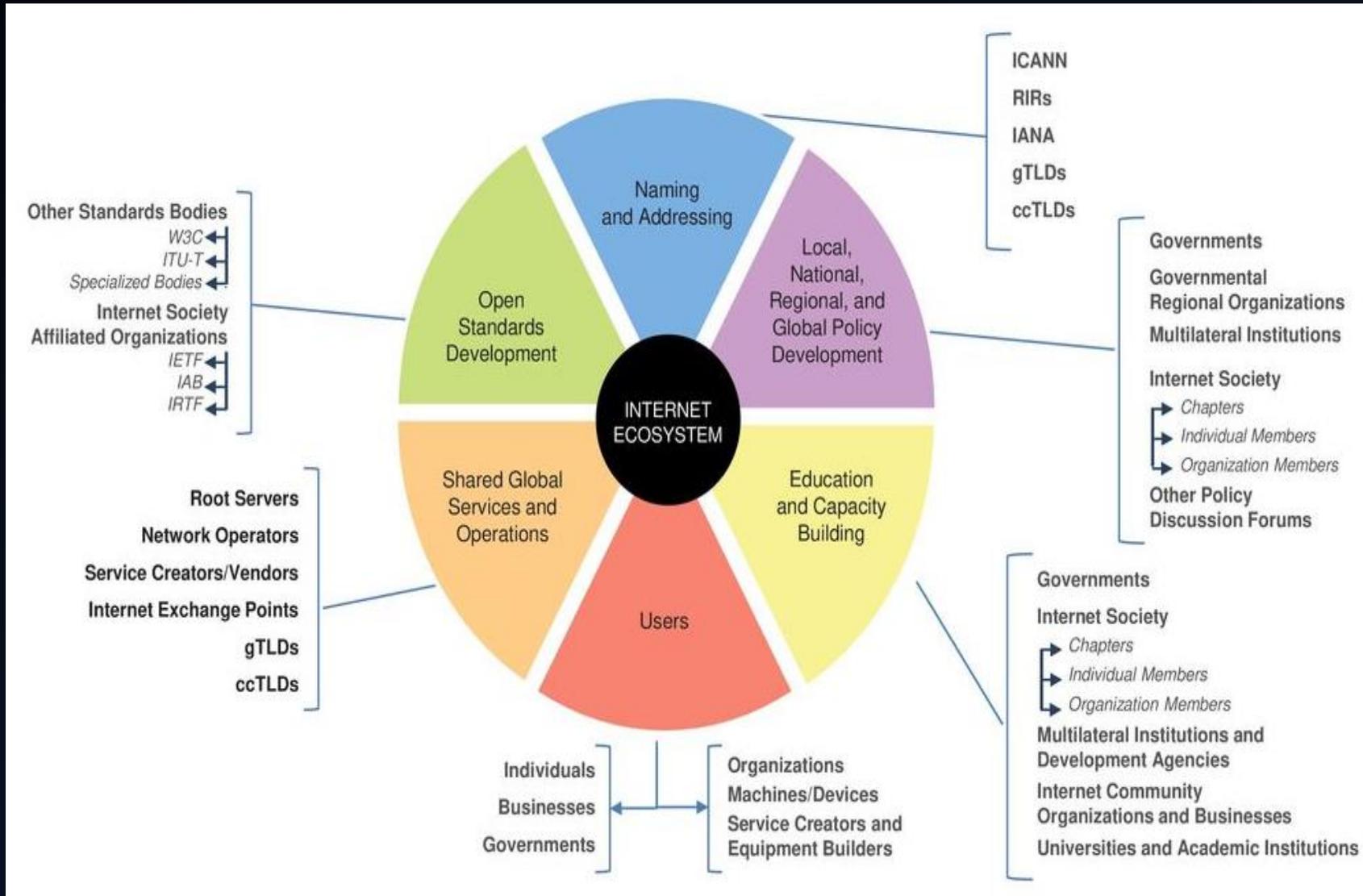
The Internet is a vast network of computers and devices around the world. Over the years, it has evolved to become a primary gateway of information.

Multistakeholder Model

The success of the Internet can be attributed to its unique multistakeholder model. Many organizations and individuals (you included) have a part to play.

Continued Development

Each group in this ecosystem helps shape the Internet through continued development in the areas of technology, processes, standards, operations, and policies among other things.



Internet Organizations

Key Internet Bodies

There are many key enabling organizations that help sustain the growth, stability and security of the Internet.



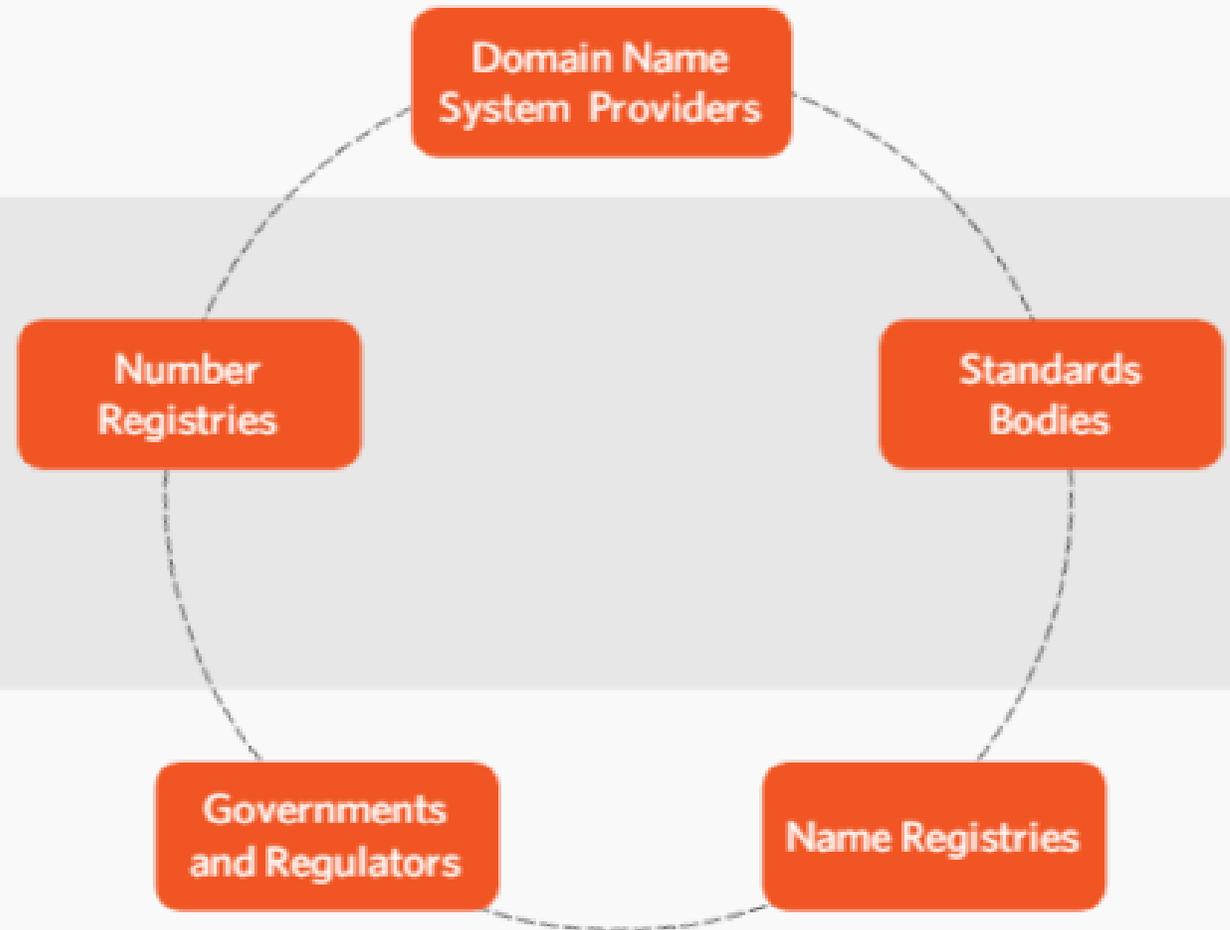
Growth



Sustainability



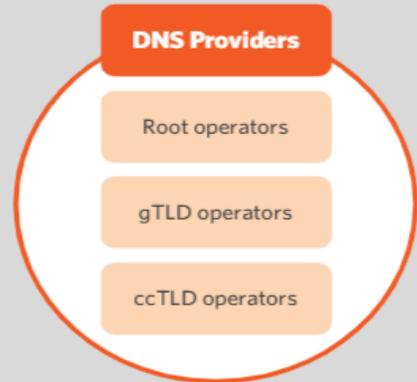
Security



These Internet bodies that make up the ecosystem can be grouped as follows.

Click **each group** to learn more.

Internet Organizations Cont.



DNS providers include root operators, gTLD and ccTLD operators.



I E T F®

Standards bodies include the Institute of Electrical and Electronic Engineers (IEEE) and the Internet Engineering Task Force (IETF).



Name registries include the Internet Corporation for Assigned Names and Numbers (ICANN).



Governments and regulators have a big role to play in creating rules and policies that help provide service.



Internet Assigned Numbers Authority



Number registries include the regional, national, and local Internet registries that are involved in the distribution of IP and other number resources.

The Number Registries

The Number Registries

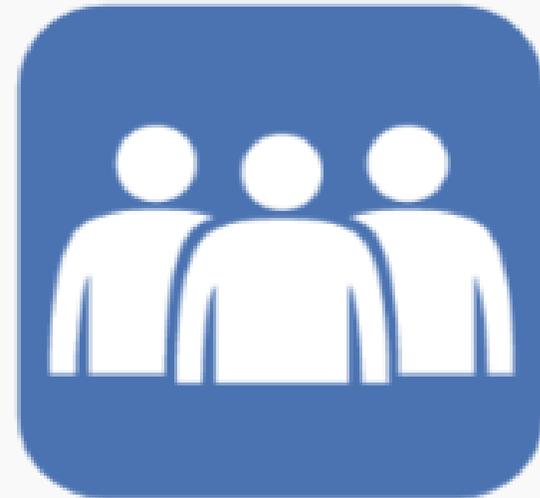
Number registries are key parts of the Internet community.
These are organizations that manage resources for addressing capabilities.



What are Internet
number resources?



What is the role of the
number registries?



Who are part of the
number registries?

The Number Registries

What are Internet number resources?

Internet resource numbers are Internet identifiers such as IP addresses (IPv4, IPv6) and Autonomous System Numbers.



The Number Registries

What is the role of the number registries?

The main purpose of the number registries is to distribute IP and AS number resources in a fair and consistent way that meets the management goals of conservation, aggregation, and registration.

The Number Registries

Who are part of the number registries?

IANA, RIRs, NIRs, and LIRs all comprise the number registries.



Internet Assigned
Numbers Authority



Regional Internet
Registry



National Internet
Registry



Local Internal
Registry

The Number Registries

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Internet Assigned
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Local Internal
Registry

The Number Registries

IANA and its Functions



Internet Assigned Numbers Authority

1

2

3

4

The Internet Assigned Numbers Authority, commonly known as IANA, is the body responsible for the global coordination of the Internet's unique identifiers that are vital for the smooth running and interoperability of the Internet. Today the services are provided by Public Technical Identifiers, a purpose-built organization for providing the IANA functions to the community.

IANA

Global
Coordination

The Number Registries

1

2

3

4

IANA was formed in 1988, although its functions date back in the early 1970s. In 1998, the IANA project was transferred to ICANN, making it an operating arm of ICANN.



The Number Registries

Internet Assigned Numbers Authority

IANA's functions can be divided into three core areas.



Domain names

manages the root zone, including the assignment of ccTLDs, gTLDs, .int and .arpa zones



Number Resources

coordinates the allocation of global IP and AS number space, generally to the RIRs



Protocol Assignments

acts as a central repository for protocol names and number registries as used in many Internet protocols

The Number Registries

1

2

3

4

Internet Assigned Numbers Authority

Among these functions, our focus is on the second item - Number Resources.



Number Resources

coordinates the allocation of global IP and AS number space, generally to the RIRs

Internet number resources



For more information about IANA, please see: <https://www.iana.org/>

The Number Registries

Regional Internet Registries

Regional Internet Registries or RIRs are organizations responsible for:



Managing the distribution and registration of IP and AS numbers in their respective regions



Distribution of IP and AS numbers in a fair and consistent manner

There are five RIRs operating around the world.



The Number Registries

Regional Internet Registries

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Distribution of IP and AS numbers in a fair and consistent manner

There are five RIRs operating around the world.

 **APNIC**

 **AFRINIC**
The Internet Number Registry for Africa

 **lacnic**

 **ARIN**
American Registry for Internet Numbers

 **RIPE NCC**
EUROPEAN REGISTERED PROVIDER COORDINATION CENTRE

The Number Registries



AFRINIC
The Internet Numbers Registry for Africa



The African Network Information Center (AFRINIC) is the fifth regional Internet registry formed in 2005. AFRINIC is responsible for the distribution and management of Internet number resources for the African region.

The Number Registries



(A) APNIC

The Asia Pacific Network Information Centre (APNIC) was formed in 1993 and operates within the Asia Pacific region, comprising 56 economies throughout Asia and Oceania.

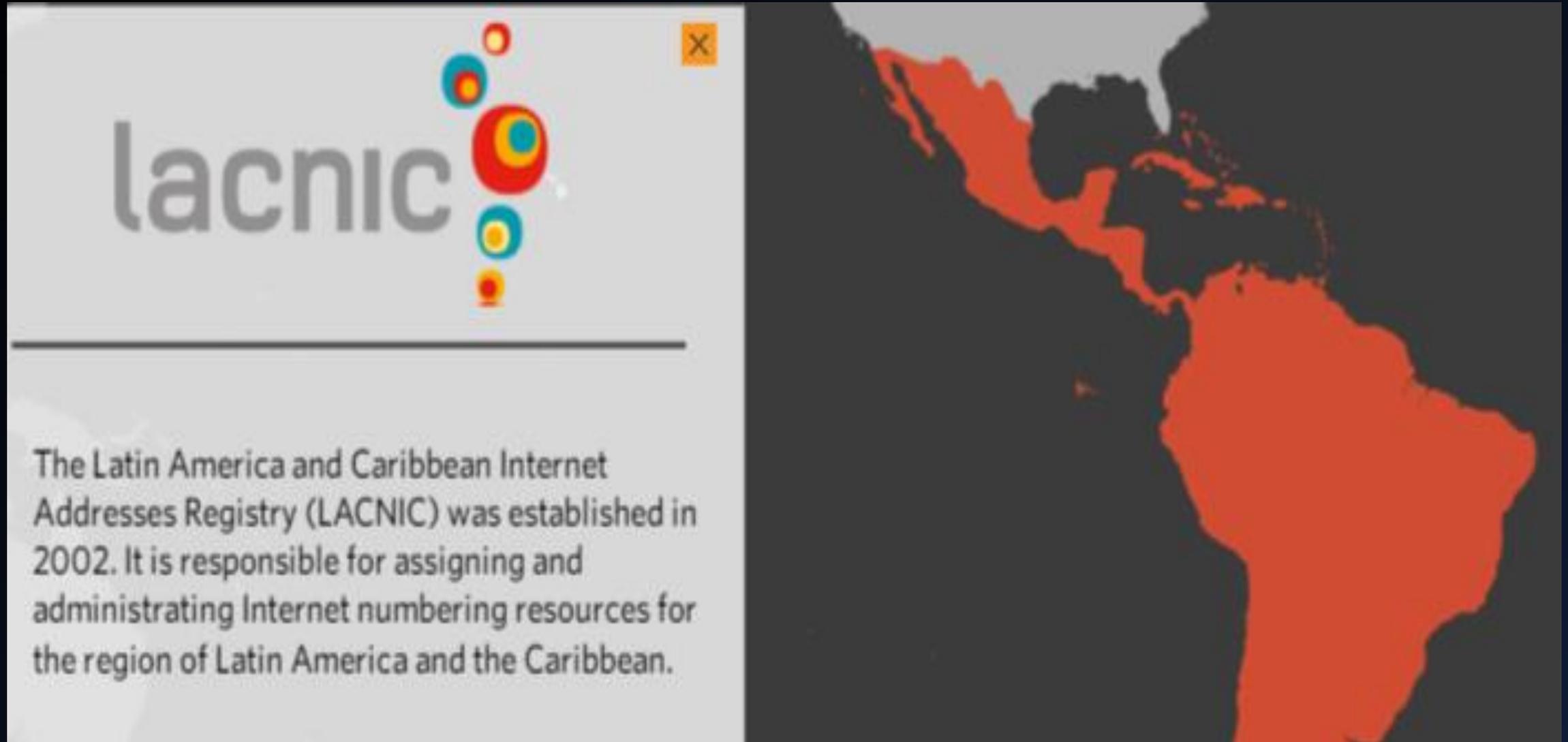
The Number Registries



ARIN

The American Registry for Internet Numbers (ARIN) was established in 1997. As the RIR for North America, it serves the United States, Canada and parts of the northern Atlantic region.

The Number Registries



The screenshot shows the LACNIC website interface. At the top left, the word "lacnic" is displayed in a large, grey, lowercase font. To its right is a logo consisting of several overlapping circles in red, blue, and yellow. Below the logo is a horizontal line. Underneath the line, a paragraph of text reads: "The Latin America and Caribbean Internet Addresses Registry (LACNIC) was established in 2002. It is responsible for assigning and administrating Internet numbering resources for the region of Latin America and the Caribbean." The background of the entire slide is a dark blue map of Latin America and the Caribbean, with the landmasses highlighted in a bright orange-red color.

The Number Registries



The Number Registries

Number Resource Organization

At the heart of the RIR system is the Number Resource Organization (NRO). It is an umbrella organization that coordinates the activities of the five RIRs.

The mission of the NRO is to actively contribute to an open, stable and secure Internet, through:

-  Providing and promoting a coordinated Internet number registry system.
-  Being an authoritative voice on the multi-stakeholder model and bottom-up policy process in Internet governance.
-  Coordinating and supporting joint activities of the RIRs.



Content Source: APNIC

The Number Registries

National Internet Registries

Within the APNIC region, we also have National Internet Registries (NIRs).

NIRs are registries that operate on a national level to cater for the more specific needs of the local community.

NIRs provide registration and delegation services in line with APNIC policies.

We currently have seven NIRs



Indonesia



China



India



Japan



Korea



Taiwan



Vietnam

Click **each logo** to learn the economy assignment.

With these different NIRs, let us look at a diagram that summarizes how they are connected to APNIC and IANA.

Content Source: APNIC

The Number Registries

Local Internet Registry (LIR)

is a term used to describe an organization that primarily assigns address space at a local level to the users of the network services that it provides.

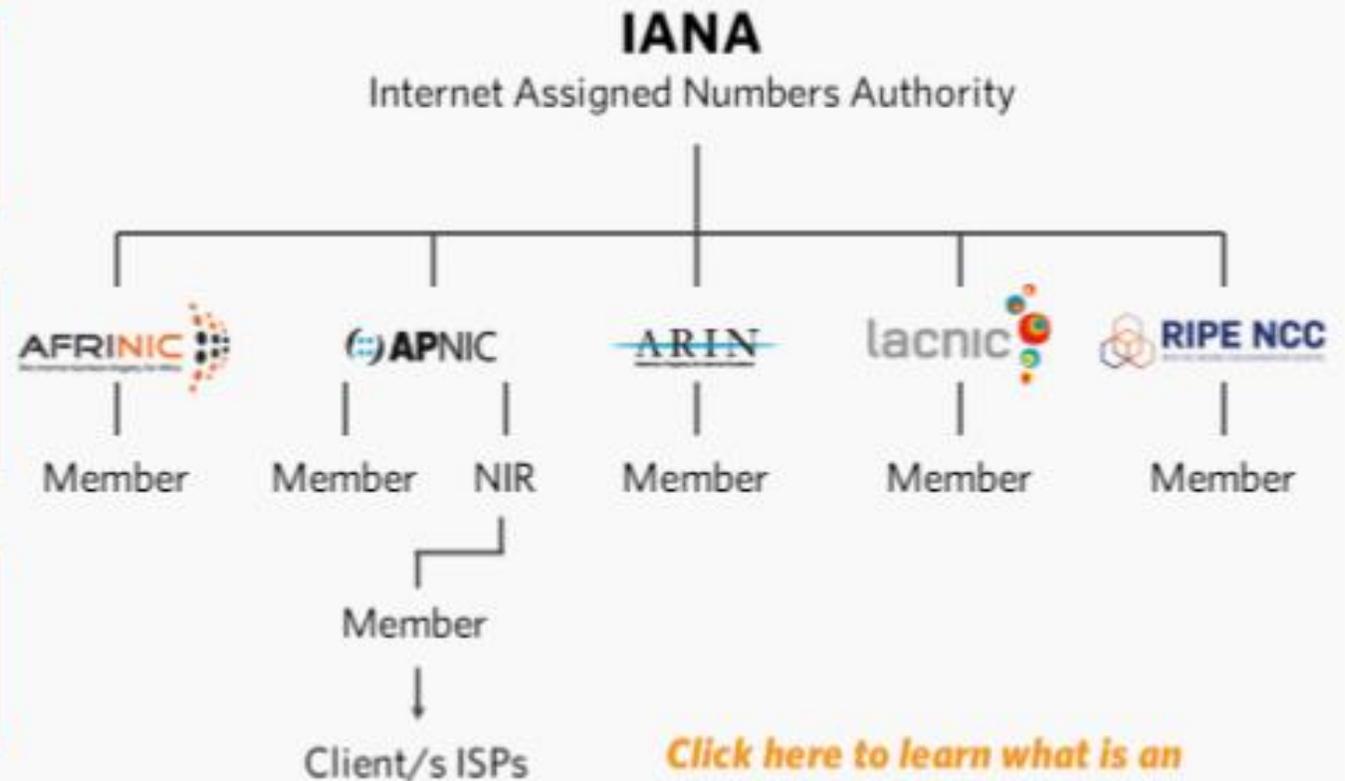
LIRs are generally Internet Service Providers (ISPs), and may assign address space to their own network infrastructure and to end-user customers or other downstream ISPs.

The Number Registries

Internet Registries

So far, we have introduced you to the Internet number registries. The diagram below summarizes the relationship between IANA, the RIRs, the NIRs, and the LIRs.

- 1 IP and ASN resources are maintained by IANA in a central pool.
- 2 These are then distributed to the five RIRs. RIRs will then distribute these to Members, LIRs or NIRs
- 3 LIRs will then further delegate these IP and ASNs to their customers or downstream ISPs.



Content Source: APNIC



Resources

- <https://www.internetsociety.org/internet/history-internet/brief-history-internet/>
- https://en.wikipedia.org/wiki/History_of_the_Internet
- <https://academy.apnic.net/en/course/internet-resource-management/>



Thank You

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