

# The Generations of The Internet (Past, Present and the Future)

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**Abstract:** The concept of the internet started over 50 years ago when computers filled the entire room, today it is an ubiquitous information infrastructure, the initial prototype of what J. C. R. Licklider called the inter-galactic computer network. Its history is complex and involves many aspects – technological, organizational, and community; its influence reaches not only to the technical field of computer communications but throughout society. Categorizing internet into different generations seeks to give us a microscopic view of what the internet was, what it is now and its future. The internet generation is divided into four (4) guided by its usage, number of users, technology, protocols device used and transmission technology.

**Keywords:** ARPANET, Internet, IoT, World Wide Web, internet generations.

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## 1st Generation: Research and Development (1965-1980)

In the first generation, internet was a vague idea, and concepts which dwell majorly in the laboratory and publications, it was purpose built to solve specific problems of research, knowledge transfer and avoid the doubling up of already existed information, four (4) network concepts existed, the ARPANET, RAND Corporation (US Military), NPL (National Physical laboratory) a commercial network in England, and the French scientific network

CYCLADES. The inter-connection of this four (4) concepts eventually became the internet.

During this period, network device companies operate a limited self-developed system internally and severely incompatible, proprietary and network protocols existed internally; computer networks at this period were

independent, incompatible and not interoperable.

The main features of the first-generation internet are:

- Very few hosts about 2000
- Independent
- Incompatible
- Not interoperable
- The protocols were incompatible (vendor-developed and proprietary standards)
- Very Slow backbone connection speed about 56kb/s
- IMPs (interface message processors) dominated usage as interfaces to the Mainframe timeshared services.
- Operated by the government and military.
- Usage was mainly for emails.

The pioneer protocols were the X.25 Protocol stack and NCP (network control protocol) used by the ARPANET, 75% of the internet traffic were mostly email.

## 2nd Generation: Creating the Internet (1980 -1994)

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The formalization and harmonization of the TCP/IP protocol suite for ARPANET, unified technologies and paved way for the interconnection of several intranets to the internet, more countries joined internet, thus solving the problem of independent, incompatible and not interoperability. The ISO (International Standard Organization) OSI (Open System Interconnect) model was created in an effort to standardize computer networking device manufacturing and production, this also solved the problem of vendor developed proprietary standards.

This lead to one of the first definitions of "internet" as a connected set of networks (specifically those using TCP/IP, and "Internet" as connected TCP/IP internets). The NCP (network control protocol) of the ARPANET was replaced by the TCP/IP; and it went global, hence the internet was born. DNS servers where developed so that people wouldn't have to remember the IP addresses of the specific computer they are trying to reach.

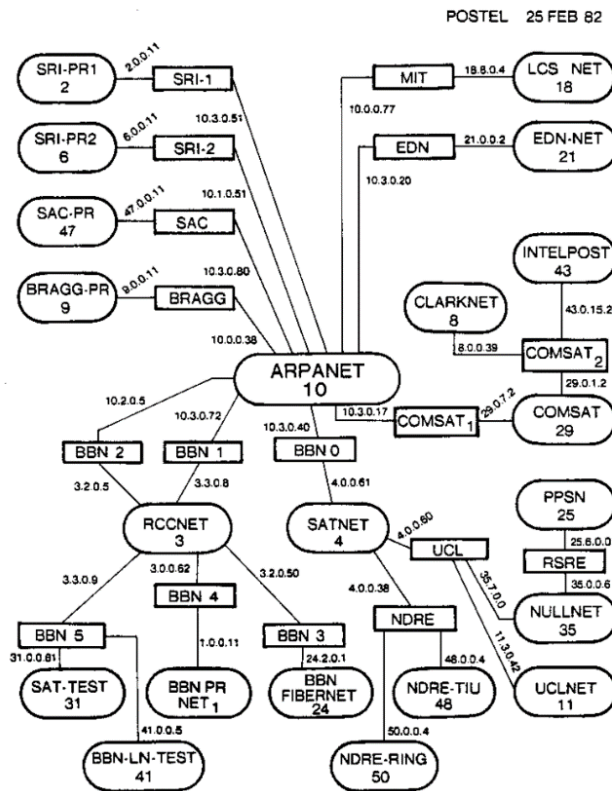
The World Wide Web was developed by Tim Berners-Lee during this period as a way for people to share information.

The hyper-text (Hyper link) format available through his web made the internet much easier to use because all documents could be seen easily on-screen without downloading. The first "internet browser" software "Mosaic" - was introduced by Marc Andreessen in 1993, and it enabled more fluid use of images and graphics online and opened up a new world for internet users.

The main features of the second-generation internet are:

- Users numbered in millions (estimated at 16 million users by 1993)
- MiNET separated from the Arpanet
- Standardization of protocols
- interconnected
- Fast backbone connection speed (44.736Mbps)
- Deployment of DNS servers
- Usage was mainly for world wide web (WWW)

The pioneer protocol during this era was the hypertext transfer protocol (HTTP), the world wide web dominated the traffic.



**Diagram 1** (Contemporary map of the entire Internet in semi-production phase (many hosts attached to the ARPANET were still using NCP at this point) in February 1982. The ovals are sites/networks (some sites included more than one physical network), the rectangles are individual routers. No individual hosts are shown. Drawn by Jon Postel of the Information Sciences Institute, under a DARPA research contract as part of Internet development.) Source: [1].

**3rd Generation (1995 - 2017): Commercializing the Internet**

The internet was separated from the military completely and not controlled by the government, it became commercialized and accessible to all for a fee, more and more services was rendered through the internet including, online adverts, ecommerce, online education, internet banking, online entertainment, it became part of everyday life of an individual.

Smart mobile devices, wearables and breakthroughs in data transmission technologies made it a lot easier for more people to be connected.

The Internet became a lucrative source of income, many tech giants emerged, likes of google and facebook worth hundreds

of billion dollars with Amazon CEO, Jeff Bezos as the richest person in the world [2].

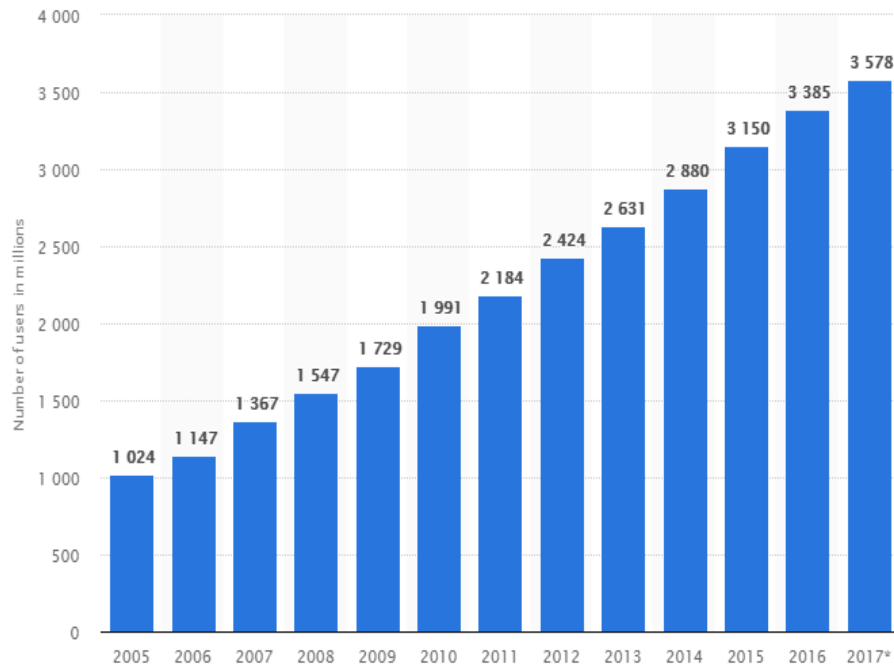
Furthermore, its importance and influence can be felt in every facet of our very existence, politics, governance, health and education.

The main features of the 3<sup>rd</sup> -generation internet are:

- High capacity transmission technologies (Fibre optics, Wifi, 3G, 4G-LTE)
- Users numbered in billions, 1 in every 7 people on earth access Facebook
- The internet goes global

- Upsurge of malware and DDoS attacks and growth of cyber terrorism (Ransom-Ware etc)
- Very fast internet backbone links (Gb/s)
- IPv4 addresses exhausted and to be replaced IPv6 address

## Number of internet users worldwide from 2005 to 2017



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*Diagram 2:* Internet Users [3]

### **4th Generation (2018 □): The Future (Politicized internet / Internet of Everything)**

The internet is a work in progress, its usage and capability not yet fully exploited, with the invention of the IPv6 with number of host reaching  $2^{128}$  (enough for every single device and individual on earth to have a unique IP address) and advances in routing and switching technology such as the MPLS (multi-protocol label switching).

There have been several assumptions about the future of the internet, but the internet of the future will be motivated by politicizing the internet and Internet of Everything (IoE) including implants such as radio frequency identification (RFID). These will be characterized by the following:

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1. Politicizing the internet, The internet because of its ubiquity and ease of access, will be more and more exploited for political gains by politicians and people with political interest; according to a research carried out by Pew Research Center, 35% of respondents within the ages of 18 and 29 years opined that social media was the most helpful source of news information about the 2016 American presidential campaign [4]. Exploiting the internet to influence politics can also be seen in Facebook–Cambridge Analytica data scandal where personal identifiable information (PII) of about 87 million Facebook users were exploited to influence voter opinions in 2015 campaign of united states and 2016

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Brexit vote [5]. Most likely, there will be more and more political interests on the internet to police fake news, cyber-bullying, cyber-warfare and internet as human right.

2. Wireless technology will continue to evolve, giving us ability to connect at unprecedented speeds, technologies like 4G-LTE, WiMAX, 5G and LIFI (light fidelity) will give us the ability to access the Internet wirelessly at speeds comparable to broadband connections, it is evident that the Internet connection speed will be faster, more pervasive and available.

3. Everyone on earth will have access to the internet, connection to the internet will become a right, that cannot be alienated.

4. Internet of things (IoT): A means where connected devices can be accessed/pinged by other connected devices is called Internet of Things (IoTs). It is estimated that 26 billion devices / units to be installed within the Internet of Things by 2020 [6], example, our coffee makers, electric cookers, home light switches, cars, body implants etc. this do not include PCs, tablets and mobile phones. Devices will be able to talk to one another, take decision without the need for human interventions and becomes self-aware.

5. A mix of machine learning / artificial intelligence with the internet of things (IoT) will give the internet of the future unimaginable capacities; like online intelligent doctors and lawyers etc.

## Conclusion

The internet is developing at a fast pace, with recent developments and innovations in computing power,

miniaturization of devices, virtual reality and advances in developing artificial intelligence and machine learning, the future of the internet is beyond imagination; but it's evident the internet of the future will be politicized because of its ubiquity and ease of access and everything else will be connected to the internet (IoE) as new marketing advertising innovations.

## References:

- [1] Wikipedia (2018a, February 14). History of the Internet; Retrieved from [https://en.wikipedia.org/wiki/History\\_of\\_the\\_Internet](https://en.wikipedia.org/wiki/History_of_the_Internet)
- [2] Forbes (2017, February 14), Forbes Billionaires 2017. Retrieved from [https://www.forbes.com/billionaires\\_2017](https://www.forbes.com/billionaires_2017)
- [3] Statista (2018, February 14), Number of Internet Users Worldwide, The Portal for Statistics Retrieved from <https://www.statista.com/statistics/273018/number-of-internet-users-worldwide>
- [4] Pew Research Center (2016, February 2016), The 2016 Presidential Campaign – a News Event That's Hard to Miss. Retrieved from <http://www.journalism.org/2016/02/04/the-2016-presidential-campaign-a-news-event-thats-hard-to-miss>.
- [5] Wikipedia (2018b, February 14). Facebook–Cambridge Analytica data scandal; Retrieved from [https://en.wikipedia.org/wiki/Facebook%E2%80%93Cambridge\\_Analytica\\_data\\_scandal](https://en.wikipedia.org/wiki/Facebook%E2%80%93Cambridge_Analytica_data_scandal)
- [6] Gartner (2013, December 12), Gartner Says the Internet of Things Installed Base Will Grow to 26 Billion Units By 2020. Retrieved from <https://www.gartner.com/newsroom/id/2636073>