â€ What is the Internet?â€ February 18, 2015.

A. Michael Noll
Columns · 2015
Original: http://quello.msu.edu/what-is-the-internet-by-a-michael-noll/
Archived copy, Internet Archive snapshot 2015-02-24

What is the Internet? by A. Michael Noll

by Guest Author

February 18th, 2015

Introduction

It is amazing to me that there seems to be confusion and controversy in answering the basic question: “What is the Internet?” I have no problem in defining it and have a short and simple answer to the question based on my personal experience with its predecessor, the ARPANET, from over 40 years ago.

This short essay is an attempt to explain the Internet using a simple approach with basic analogies from the past. Also some history will be reviewed about the development of the Internet.

The essay will conclude that the Internet is a packet-switched network. Today that network is formed from many regional and competitive packet networks that all link together to create a “network of networks.”

A Historical Perspective of Telephone Networks and Common Carriage

One way of understanding this is to consider the telephone network of the past. It was a circuit-switched network consisting of transmission facilities and circuit switches, along with a means of controlling the assignment of circuits (what telephone engineers called signaling). Circuits were assigned and carried signals over distances. Telephones and modems were connected to the network. The telephone network evolved into a network of networks. Standards were needed so these networks could interconnect and also interconnect internationally.

The Internet uses packet switching rather than circuit switching. Packet switching is more efficient for computerized data that occurs in short bursts. The header information that is included in a packet is comparable to the signaling information of the circuit-switched telephone network. Optical fiber, satellites, coaxial cable, and copper wire are some of the transmission media used for networks – circuit or packet switched.

In the even more distant past, stagecoaches carried packages over distances. The concept of common carriage was invented to regulate this industry. What was in a package was not the business of the common carrier. Rates were set by weight and distance. The common-carriage

principle was then applied to the telephone network. As a common carrier, a telephone network operator was not involved with the content carried over a circuit. A circuit was defined in terms of its bandwidth, and a user could fill that bandwidth with any signal. Distance and the length of a call set charges.

A Little Personal History of Packet Switching

Packet switching was invented in the late 1960s as a way for the ARPA (Advanced Research Projects Agency) community to share then-costly data circuits. An early data circuit obtained from a telephone company carried only 56 kilobits per second. The intent was to allow the ARPA community to share computer resources, but the new network was used mostly for sending text, documents and early email. The concept was to place about 1,000 bits of data in a packet, along with information about its destination and source. The packets would then be really switched along to the destination and there reassembled.

Back in the early 1970s, the ARPANET was available only to ARPA researchers, but National Science Foundation (NSF) researchers also wanted access. ARPA wanted to sell that access. However, the White House Office of Telecommunications Policy (OTP) did not want an agency of the Federal government to be operating and selling a packet-switched telecommunication service, such as the ARPANET. I was then working on the staff of the White Office of Science and Technology (OST) and spoke to Dick Bolt of Bolt, Beranek, and Newman about the policy issue. As a result, BBN created a new company, Telenet, to offer packet switched service to the public.

A big issue back then was whether the ARPANET was a regulated common-carrier telecommunication service, or, since it involved access to computers, a non-regulated computer service or information service. The ARPANET used computers to switch the packets, and thus it was claimed to be a computer service. I believed that since the ARPANET, or any packet-switched network transmitted signals and switched them, it was a common-carrier service and should be regulated. The academic community that formed ARPA did not want any regulation, and this lobbied for the ARPANET and packet switching to be treated as a computer service. I felt then, and now, that it was a telecommunication service. If transmission and switching are the prime components of a service, then it is a telecommunication service – not a computer service. Indeed, the ARPANET could be used to gain access to computers, databases, and information, but that did not make it a computer service, anymore than the use of a modem over a telephone line would make the telephone network a computer or information service.

What Then Is the Internet?

The Internet is a packet-switched network of packet-switched networks. These networks could be public (open) or private (closed). Data signals are carried over that network over various transmission media and are packet switched along the way to their destinations. The data could represent voice, video, image, or text. The source could a home computer and the destination might

be a large computerized database. Taken as a whole, the Internet and the various databases and other computerized services form a giant “world wide web” – or simply, the Web.

The controversy today seems to involve whether the Internet should be regulated, and if so, by whom and in what way. Should it be treated as if a common carrier? The confusion seems to go all the way back to its formation when computers and computing were confused with telecommunication transmission and switching.

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2 thoughts on “What is the Internet? by A. Michael Noll”

William Dutton says: February 18, 2015 at 3:54 pm Michael, really nice historical context. Thanks for this post. You might be surprised, but in line with your title, we had an entire seminar devoted to various faculty at the Oxford Internet Institute answering that question: What is the Internet? I keep going back to a network of networks, but surely this network of networks is not simply a common carrier. Others might view it as a broadcasting network, and given its malleability, it could be viewed as a newspaper, a broadcaster, a common carrier, etc, meaning that any single regulatory framework is not a good fit. Reply

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Mitchell Shapiro says: February 19, 2015 at 10:40 am I agree with Bill’s point that no single regulatory framework is an ideal fit for the full scope of what we normally consider “the Internet.” But I also agree with what I think Michael is saying, that Title II common carrier is the best and most useful model we currently have in the U.S. for regulating the layer of the Internet that is a “packet-switched network of packet-switched networks.” And I’d add to that the importance of the forbearance option under Title II, which provides flexibility to focus regulation on the key network elements that are subject to very limited competition (i.e., local access), and also to limit regulatory provisions to those that maximize freedom of expression and support healthy competition (such as was done with mobile voice, which has experienced massive growth and investment though subject to Title II regulation). While the Internet can and does mimic a broadcasting network in important ways, the regulatory treatment of broadcasting was premised on the allocation of limited spectrum to a limited number of broadcast licensees in exchange for a commitment to serve the public interest. As I explained in an earlier post, that regime was an effort to accommodate 1930s-era technology and proved unwieldy at best, leading to eventual phasing out of any meaningful “public interest” requirements by the 1980s. As such, the broadcast regulatory model seems increasingly

irrelevant to the Internet and today's technology environment–especially as more and more spectrum is migrating from broadcasting to what is essentially a "mobile Internet" usage model. The newspaper model strikes me as applicable to content carried over the Internet, but not to the "packet-switched network of packet-switched networks" Michael refers to. While we can and do refer to both of these as "the Internet," they are distinctly different layers in a multi-layer architecture whose scope includes physical transport and routing of bits (which is essentially a telecommunications service) up through the kind of content that resembles newspapers from a First Amendment perspective (and should therefore be as free as possible from regulation). I think a muddying of these distinctions is what led the FCC under Michael Powell to classify broadband Internet access as an "information service." It is also reflected in legal arguments such as those made by Verizon that network neutrality rules violate the company's First Amendment rights as an Internet access provider (as I recall, the court ruled in that case without getting to this element of Verizon's argument). In my view, this Verizon argument, taken to its logical endpoint, is a serious threat to a truly open and free Internet, and to the First Amendment rights of every "speaker" except those that own the Internet access ramps the rest of us rely on to communicate with each other. As I see it, the current FCC is wisely trying to treat different layers of the Internet with different levels and types of regulatory oversight. And while I agree with critics of this approach that regulatory regimes originated decades ago might not be ideal for this purpose, I think the Commission's "Title II + forbearance" approach–coupled with its planned action to encourage competitive access networks by preempting anti-competitive state laws–is wisely pragmatic, and sufficient to see us through the next phase of the Internet's evolution as an open platform that attracts massive amount of creative expression and collaboration, as well as healthy levels of investment. Reply
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