Before the Federal Communications Commission
Washington, D.C. 20544

In the Matter of	)	
	)	
Restoring Internet Freedom	)	WC Docket No. 17-108

Comments of:

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1 https://interviews.slashdot.org/story/01/12/17/1235220/ms-oversight-committee-hopeful-stephen-satchell-answers – more information at end of Comment.

Illustrations

1. Introduction

This Comment concentrates on the following aspects of what has been termed *Network Neutrality*:

- Extremely limited choice of broadband providers
  - Functional monopoly or duopoly
  - Private use of public/utility facilities (by license, “franchise agreements,” action in law)
  - Legal actions by monopolies to block competitive broadband deployment
- Conflicts of interest: Network management practices influenced by other, non-network portions of a company, to the detriment of network-service customers
- Interfering with, and disrupting, the clear transmission of data by interception, modification, throttling, and blocking
  - Discriminating by source
  - Adding tracking “cookies” to HTTP and HTTPS
  - Blocking or throttling what the ISP believes to be incidents of copyright violations
  - Restrictions of certain applications, such as virtual private networks and encryption
  - Interference that can introduce errors and security vulnerabilities
- Passive monitoring, collection, and aggregation of content for the purpose of selling traffic patterns to third parties, or in order to generate targeted ad content
  - TCP connection history
  - Web browsing
  - Web search history
  - Internet messaging
  - Electronic mail metadata and content
  - VoIP placed-call metadata

This Comment does not directly address the following issues:

- Discrimination in general (one of the original reasons for Title II classification)
- Surcharges to users and content providers for interconnection
- So-called “zero rating”

1.1 Summary of proposals in this Comment

1.1.1 ➡ PROPOSAL: Invite the IETF to codify a list of acceptable network practices

> *"The pilots said our standards and regulations were very unclear, and didn't contribute to air safety. We followed up with focus groups of commercial pilots, mechanics, and general aviation pilots. They all said the same thing! They can't understand what we write. That's startling information!"*
>
> – FAA Plain Language Initiative
> http://web.archive.org/web/20010124062900/www.faa.gov/language/

The Internet Engineering Task Force (IETF)[2] is an organized activity of the Internet Society (ISOC),[3] which has become an ANSI-recognized Standards Provider. Despite their being called Requests for Comments (RFCs), the RFCs *are* Standards in the eyes of the Federal Government.[4] RFCs were, and are, the vehicle that researchers and others use for proposing and developing new protocols and applications, through community consensus. The IETF working groups follow the rules set by ANSI for developing and publishing Standards.

From the RFCs, the FCC can extract, or cause to be extracted, a list of common and accepted source- and content-agnostic network management practices. This list can be part of any rule that the FCC develops, so that network operators will *know* what is acceptable

Precedent for the FCC consulting Standards Working Parties for guidance: The Part 68 rules development comes to mind, when the FCC asked the Modem Working Party[5] for technical assistance. (At the time, several of the members of the Modem Working Party were also employees of Bell Labs.)

The overriding benefit of this proposal to ask the IETF for help is that the entire Internet community – the FCC, telephone companies, cable companies, wireless providers, applications (Web, e-mail, chat, &c) providers, and users – can help shape the development of a document

2 https://www.ietf.org/
3 http://www.internetsociety.org
4 In the early days of the Network Working Party, the members exchanged research ideas, implementation reports, and issues encountered over the ARPAnet. The first editor of the early RFC corpus was Jon Postel.
5 The Modem Working Party later became a Working Group in the Telecommunications Industry Association (TIA) as TR-30.

to provide a comprehensive Best Practices Standard so that there is *no* uncertainty regarding operations or about how future innovations can be incorporated into the existing structure.

If there is an issue outside the four corners of the resulting document, there is a procedure within the IETF to update and amend the resulting Standard.

If the FCC is uncomfortable with any part of such a document, the FCC's rules can include a forbearance, or an amplification, via its usual procedures.

1.1.2 ➡ PROPOSAL: Attach Title II regulatory status only to those access ISPs that satisfy well-defined and narrow criteria; the rest of the ISPs to be regulated otherwise under Title I

Proposed: A*n ISP is deemed to be a Title II ISP if it meets ALL of the following criteria*:

- Provides access services (defined below);
- Has exclusive use of data media (wire, coaxial cable, fiber-optic cable, spectrum) to customers by virtue of act of Law, license, contract, or agreement ("franchise agreements") with any level of government;
- Has fewer than four direct competitors, selling comparable services, serving in all parts of the ISP's service area; and
- Has more than 35,000 customers in *any* of the State subdivisions, such as a county or county equivalents, in the ISP's service area.[6]

Ideally, procedures should be defined so as to permit any ISP or customers of an ISP to petition the FCC for a change in regulatory status. The market will be changing, and what was once a "monopoly" ISP may become a competitive ISP, and vice versa.

1.1.3 ➡ PROPOSAL: With Congress, take the necessary steps to correct the inaccuracies in 47 USC 230 and 231

The language in these sections does not reflect the reality of today's Internet. These language-related problems are discussed elsewhere in this Comment.

6 Actual numbers may differ. The intent of this criterion is to encourage development in sparsely populated or underserved areas, and to encourage smaller businesses to do the development.

1.2 A capsule history of the Internet

1.2.1 The telephone system

In the beginning, there was the telephone. The early public telephone networks were switched by operators at plugboards. After the advent of the Strowger ("step-by-step") switch – which was invented in order to remove any *conflicts of interest* on the part of the people who were running local switchboards[7] – the human operators were gradually phased out as the primary means of switching calls. The telephone system grew to be ubiquitous in the United States (and the world, although the FCC's direct influence stops at the borders of the U.S.A.), largely because it could be used by just about anyone who could hear and speak. No special skills were required, apart from being able to operate a rotating dial, and later a 4x3 set of push-buttons, as the TouchTone® keypad was deployed by the various telephone companies.

One of the non-voice uses of the telephone network and its assets was the Telex systems. Some of those systems originally used baseband current-loop signaling over telephone cable plant. Later, to reduce inter-circuit interference with voice and other services, networks shifted to using Bell 101 and later Bell 103 datasets (modems). The Telex systems were primarily used by businesses to transmit data from one teletypewriter to another.

There were other non-voice uses of the telephone wire plant: newspaper wire services (an outgrowth of telegraphy), WirePhoto,™ alarm circuits, background-music services, radio studio-to-transmitter links, and more.

1.2.2 Computer system data interchange

The original tabulating machines stored data on punched cards;[8] Herman Hollerith developed a system of tabulation equipment for processing the 1890 U.S. Census.[9] The literature describes the original system in detail. The tabulating machines included three major components: (1) sensors, to sense the holes in the cards; (2) counters, to count the occurrences

7 Almon Brown Strowger was an undertaker. He was irked by the telephone operator in his town: when someone said "connect me to an undertaker," the operator violated the rules of the Bell System and connected those calls to Strowger's competitor, who happened to be the operator's brother.

8 The idea of punched cards was not new in the 1890s. Drawlooms that produced intricate patterns in silk and other fine threads had been in use for centuries. In 1725, the fallible "draw boys" were replaced by less error-prone punched bands of paper; the holes in the paper bands defined the warp threads that were to be lifted at the next shot of the shuttle. Jacquard improved on this method by using a chain of paper cards punched to define the weaving pattern.

9 Automation of this process was necessary because the Bureau of the Census predicted it would take more than ten years to process the data starting in 1900 – such that the next Census would start before the current one had been completed.

of a particular hole in a card; and (3) sorters, which would pop open a door for a card when the card in the reader met certain criteria.

As the state of the art in tabulation equipment advanced, we saw automated duplicating card punches, high-speed card sorters, “card interpreters” that would print the contents of the card in some way on each card, and tabulating machines to generate reports, billing statements, and bills that included so-called “turnaround documents.”

During the ’60s and ’70s, in universities, card decks were prepared by the users, and trays full of these cards would be trucked to the computers to run the jobs, and returned. The printouts produced by these runs would then be trucked back to the user. Because the cards were prepared on off-line card-punch machines, this wasn’t technically computer-to-computer interchange. Later, teletypes and “glass CRTs” replaced the card punch as the way to input data to the computer, and to get output much faster than with batch processing.

Cards weren’t the only paper system. A punched-paper-tape setup was originally used in the Monotype® typesetting composition system. Paper tape also played a role in the Telex network, as well as in newspaper systems coupled with wire service – especially for automating the composition of the stock market pages in newspapers using TeleTypesetter (TTS) coding connected to Linotype and Intertype type-casting machines.

We move on. Digital magnetic tape, originally used in the UNIVAC I in 1951, steadily became the preferred portable, denser, data storage medium in the ’50s and ’60s, and is still popular today. One advantage of magnetic tape is that it is easy to transport, resists damage from normal handling, and can hold large amounts of data (with the meaning of the word “large” changing as time goes on).[10]

As computer applications matured, and as the “need for speed” came to the forefront in business, the physical transport of data became less satisfactory. In the ’70s, companies (such as Kraft Corporation) linked a number of its computers by means of Bell 208 and Bell 209 modems, using IBM’s SNA networking protocols. Non-IBM companies offered a similar networking capability for their own computers that were located at multiple remote sites.

10 Network engineers are fond of saying “never understate the bandwidth of a Boeing 747.”

There were so many proprietary networks, all incompatible with each other, that interconnections between computer networks begat specialty companies building bridge products. The result of this evolution in data exchange led to a large number of isolated islands of computers. This Tower of Babel extended to the military.

1.2.3 ARPAnet and RFCs

As a creation of the ’60s-era Cold War, the ARPAnet was the first packet-switching network designed from a 1969 Department of Defense research and development program.[11] The idea was to see if a computer network could be designed to “heal” itself if one or more nodes were taken out in nuclear warfare. Another target was how many different makes of computer could be connected simultaneously. These computers could be as small as the DEC PDP-8 minicomputer or as large as an IBM System/360 or DEC PDP-10 mainframe.

The Network Working Group assigned to this project published its initial ideas and findings in a number of [paper] computer journals. The publishing cycle for journals is long, – measured in months – so once the project was well enough along to exchange data between locations, the researchers started to “eat their own dog food” and distribute their working papers in the form of *Requests for Comments*[12] on the ARPAnet itself, thereby uncoupling the Network Working Group from journal publishing schedules. The RFC system has continued to this day, with the Internet Engineering Task Force (IETF) managing the publication of new papers as an ANSI Standards Provider, working under the rules of ANSI. So the RFC corpus comprise the Standards documents upon which the current Internet is built and operated.

ARPAnet was ruled with an iron hand by the U.S. Department of Defense Advanced Research Projects Agency (DoD ARPA). Researchers were free to innovate, provided that they stayed within well-defined boundaries. Some major applications were developed under this regime: TELNET, FTP et al., various time protocols, and DOMAIN (ancestor of DNS).

ARPAnet was a military network. It was later split into MILnet and the unclassified DDNnet. And then there came to be another network, as we shall see below.

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11 *DDN Protocol Handbook, Volume 1* (December 1985) NIC 50004, pp. 1–21.

12 The first RFC was “Host Software,” written by Steven Crocker of UCLA, describing the software protocol for talking with the ARPAnet Interface Message Processor (IMP) computer that serves as a switch node on the ARPAnet.

1.2.4 The National Science Foundation Network (NSFnet)

The National Science Foundation build a packet-switching network separate from the Department of Defense networks, so that academic and research institutions unable to connect to ARPAnet or DDNnet could be connected together. The first version of the network was the Computer Science Network (CSNET). Later, the NSF built a network that included, as nodes, five super-computing centers and the National Center for Atmospheric Research (NCAR).

NSFnet grew, adding more academic institutions and, later, commercial information access providers like AOL, the WELL, and BIX. The NSF was **very strict** about applying a series of rules for using NSFnet, including a strict no-commercialization policy. Any violation of the rules could lead to the permanent disconnection of the offending network from NSFnet.[13] NSFnet was decommissioned in 1995.

1.2.5 The commercial Internet

During the era of NSFnet, people who chafed at the NSF rules built private networks, separate from NSFnet. These private networks formed the backbone of today's Internet. With the growth of these privately owned networks, the ban on commercial activity disappeared. FTP and Gopher, two popular file-transmission protocols, allowed people to download datasets and programs, and, as time passed, audiovisual files. The "killer app" for these commercial networks was the World Wide Web (HTTP/HTTPS), invented by Sir Tim Berners-Lee in the early '80s.

Access to the commercial Internet is provided by a class of entities collectively known as *Internet Service Providers (*ISPs). ISPs provide one, two, or three services: access, switching, and applications (see "What is an Internet Service Provider (ISP), exactly?" below).

The early ISPs that provided access services to individual customers did so over the Public Switched Telephone Network (PSTN), a resource that was shared more or less equally by all access ISPs, including the ISPs owned and operated by the telephone companies. When the telephone companies started to deploy ADSL to homes, small business, and other locations, non-telephone-company ISPs were given access to the ATM network, which in turn provided transport to the Digital Subscriber Line Access Multiplexers (DSLAMs). Again, this meant that non-phone-company ISPs could provide broadband using DSL lines.[14] Unfortunately,

13 The task of keeping a system's users in line with the National Science Foundation rules was the responsibility of the system administrator.

14 https://transition.fcc.gov/Bureaus/Common_Carrier/Orders/2001/fcc01026.pdf, "in which we [FCC] required incumbent local exchange carriers (LECs) to make a portion of their voice customer's local loop available to

DSL over ATM is being phased out in some markets, in favor of DSL over fiber-optic cable. Access to such fiber-based DSL circuits is not available outside of the telephone company.[15]

Those early ISPs that provided access services to businesses, educational institutions, and government data centers did so over leased lines that were provided, under tariff, by the phone company. In some circumstances, lines leading from business networks to an ISP would use private cable that was not part of the telephone system.

The early ISP companies had just one focus, namely, providing network services. Thus, they had no conflicting interests. This still holds true today for small ISPs; accordingly, they are not part of the net neutrality problem.

1.2.6 Aggregation and lack of specialization

There is a trend toward homogenization in today's information ecosystem, as companies merge and smaller ones are acquired by larger ones. It's true with newspapers, it's true with AM and FM radio stations, it's true with television stations... and it's true for Internet Service Providers. In some cases, the resulting merged companies have built-in conflicts of interest.

Case in point: Consider the history of the cable broadband modem. Several companies (including Hybrid Networks, LANcity, Zenith, COM21,[16] and CDLP) had developed a method of providing Internet Access Service over coaxial cable in the early 1990s. But it wasn't until 1997, when CableLabs produced the DOCSIS standard, that we started to see wide deployment of cable-based Internet. As the Internet continued to grow, and new standards increased the speed of broadband over cable, the movie/TV streaming market was born. Netflix started streaming content in 2007. Within that same narrow timeframe, the Hulu streaming service came on the market. Since then, we've added Amazon Prime and HBO Go, among others.

When asked about streaming video (apart from pornography), most people will shout "YouTube!" Oddly enough, however, this popular service began relatively recently, in 2005, and didn't start live streaming until 2010.

Now, consider this situation from the viewpoint of cable TV companies. Their prime product is television broadcasting using frequency-division multiplexing of analog TV signals

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competing providers of advanced services."

15 In 2002, this make-available order was vacated: *"The court concluded that the FCC had not considered the availability of competitive facilities on a sufficiently granular basis"* (Wikipedia)

16 Disclosure: Commenter provided consulting services to COM21 a decade ago regarding COM21's coax system implementation.

over a waveguide, or digital transmission of TV signals over their own dedicated circuits. The presence of "upstarts" on the Internet does two things: (i) it competes with the cable company's prime business, and (ii) it invalidates design models for the Internet-over-cable services.

In other words, there is now a conflict of interest between prime products and Internet service. This conflict has been exacerbated by the increase in the number of "cord-cutters" – that is, people who are canceling cable service and obtaining their entertainment via the 'Net. Consequently, it's ridiculously easy for cable operating companies to interfere with the Internet transmission of streaming content, thereby encouraging customers who want a good experience to come back to the core services of the cable companies.

This is not mere speculation. In 2008, "by a 3-to-2 vote, the Federal Communications Commission found that the cable company [Comcast] had tried to cripple the transmission of content from online video sites that competed with its on-demand service"[17] [18] – a move that violated the FCC's four Internet freedoms. The issue was that Comcast was blocking its customers' use of peer-to-peer networking protocols over its Internet access service. The federal court rejected this FCC ruling. That finding and rebuke by a federal court were based on the grounds that the FCC "lacked authority" to keep ISP networks open to all forms of content."[19] [20]

2. What is the Internet, really?

You wouldn't know from reading 47 CFR 230 ("Blocking offensive material") and 231 ("blocking harmful-to-minors material"), because the statutes read as though Congress views the Internet as just one, large monolith, under the command of "Internet Central." From a regulatory point of view, to Congress the Internet is a single entity that can block traffic that is "harmful" or "offensive" to someone. Wrong.

The classic definition of "Internet" is "a network of networks." The reality behind this simple, unambiguous phrase is this: you have more than 60,000 (sixty thousand) separate networks of computer systems worldwide[21] – and growing – that are linked together by a hodge-

17 http://www.latimes.com/business/la-fi-net-neutrality-timeline-20170502-htmlstory.html
18 In re Formal Compl. of Free Press & Public Knowledge against Comcast Corp. for Secretly Degrading Peer-to-Peer Applications, 23 F.C.C.R. 13,028 (2008).
19 http://www.washingtonpost.com/wp-dyn/content/article/2010/04/06/AR2010040600742.html
20 https://apps.fcc.gov/edocs_public/attachmatch/DOC-297356A1.pdf
21 And about 50,000 independent managers of those 60,000 networks

podge of interconnections and peering agreements. This tangled mess faithfully mimics the structure of the Internet's grandparent, the ARPAnet[22] of the '60s, writ large.

Each network node, or a small collection of nodes, on the Internet is owned by an independent entity, such as a school, business, government agency, NGO, charity, utility company, co-op, or (in rare cases) by an individual person. Everything Internet operates by consensus among all of those parties. It's cooperation on a huge scale.

Consider this: some aviators humorously define a helicopter as being "10,000 spare parts flying in close formation."[23] The Internet has more parts... and no single pilot, and no all-important "Jesus nut."

The result is a planetary web of layered links among local computer networks, with more than 50,000 (fifty thousand) individual "owners" based in almost every country on earth. These independent system managers work together to form a network that strives to provide "universal service" to all the people on this big blue marble. It is a federation of equals – not a structured tree of "bosses" and "subordinates," or "monarchs" and "subjects." Indeed, the Internet doesn't recognize national borders or territorial boundaries, despite the stated desire of some countries to isolate, by means of firewalls, certain chunks of the 'Net from their citizens.

The rulebook used by all of these network administrators who help build and nurture today's Internet consists of the corpus of "Requests for Comments" (RFCs) initiated by the Network Working Party for ARPAnet with RFC 1 in 1969, and the contributions added over the last 48 years: a corpus that has now becomes a body of recognized Federal Standards, developed and maintained under the rules for "Standards providers" set by the American National Standards Institute (ANSI), and that is also recognized as Standards in most of the world's countries.

2.1 How routing works in today's Internet

The writers of the Notice appear to confuse call routing in the Public Switched Telephone Network with packet routing in the World Wide Internet.

22 ARPAnet, a project of the United States Department of Defense, run by the Defense Advanced Research Projects Agency (DoD DARPA).

23 A similar description was applied to the Douglas Aircraft Company Transport Aircraft, the DC-3, a.k.a. "Dakota," praised by General Eisenhower as one of the four corner-stones of America's success in World War II.

In the telephone system, a static circuit is set up between two telephones (or equivalent instruments) for the duration of the connection. If one of the trunks connecting the call breaks, one of the callers has to re-establish the connection manually.

Contrariwise, packet routing is the function of the ISP Switching Service. The truth of the matter is that many, many ISPs are involved in a co-operative manner with regard to routing packets around the world. Routing is done in an on-the-fly, distributed manner *for each packet*; even the packets that are sent back in response to a request can take a different path from the outgoing packets[24].

Before we talk about routing itself, we need to understand how all of the players "know" enough about the current topology of the Internet to make intelligent (in a military sense) decisions on how to route packets. We will limit this discussion to the so-called "public" Internet, leaving aside the issues of private routing within an Autonomous System, the "unit" of routing, or private InterSubNets that use so-called "private ASNs."

Every Autonomous System (AS) – usually an ISP of some sort, "fronting" for a number of users and applications servers, but never a single individual – is assigned an identifier, the Autonomous System Number (ASN), by a regional or local numbering authority. This identifier is analogous to the toll-office label in the PSTN.

Each AS "owns" one or more blocks of IP addresses. The "smarts" are done in routers that implement Border Gateway Protocol (BGP). Each router advertises what IP addresses it "owns" to its immediate neighboring routers – indeed, this process is akin to the office "grapevine" except that it goes on continuously. Each router also "advertises" the other "netblocks" (blocks of IP addresses) of which it is made aware by its "neighbors" (that is, the other routers to which the router is connected).[25]

Has a netblock gone off-line? The rest of the world knows about it within minutes. Has a new netblock just been advertised? That's grist for the gossip mill. Has a link gone down? Routers update what they remember about the netblocks that were reachable through that link, and the news then flies everywhere. In short, when the topology of the Internet changes, the Router Corps learns about it quickly.

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24 This situation happens frequently enough that network engineers have a term for it: *asymmetric routing*.
25 Yes, this does sound like the Telephone Game, but any resemblance is purely accidental.

So, those routers that maintain a full BGP routing table will know what IP addresses are currently "on the 'Net," and that table further contains the clues that let the router select the "best" path from among all of the possible paths available to its neighbors, for varying definitions of "best."

Does a router contain only a partial table? No problem – the router will still try to pick the right outgoing path... but when in doubt, it will kick the can (ahem, packet) upstairs, doing so via a default uplink, which then passes the buck (ahem, routing problem) to another ISP.

With this basic background (I'm sure some of my colleagues will sniff at this description as being "too simple"), let's see how the process works in practice. The following explanation is taken from *Linux IP Stacks Commentary*:[26] [27]

> In a well-known experiment done in the 1960s, researchers found that a letter, addressed (by name only) to a randomly selected individual and entrusted to a given living person, reached the addressee after a remarkably small number of person-to-person transfers. (In fact, the researchers concluded that any living person could theoretically reach any other living person in six or fewer "hops.") The purpose of the experiment was to show how many people each human being knows directly and, by concatenation and extension, how interconnected all of humanity is.
>
> [Let's talk about packet-switching.] Before the data [payload] goes anywhere, it has to be [sectioned into package-sized pieces, and each section] properly "gift-wrapped." In the Internet, the bow-adorned object is an IP packet, which consists of a box with data inside, wrapping paper to ensure that the data stays together, and a tag that states who is sending the packet and who is supposed to receive it. Unlike the typical recipient of a gift, the intended recipient of an IP packet may be miles, or continents, away, and the IP tag tells you absolutely nothing about how to get the package to the right giftee.
>
> … Back to your gift-wrapped data package. The IP packet starts out from its point of origin in Truth or Consequences, New Mexico. The first router that your packet reaches on the Internet contains a collection of hints in its routing table [courtesy of BGP], gathered from its neighboring routers, that suggests the best way to forward a packet toward Ouagadougou [Burkina Faso, on the continent of Africa]. (In the data-transmission world, "best way" may mean any of several things. It might be either the fastest way to send information, the method that's cheapest in terms of resources or money, the route that's the least sensitive politically, or the path that's least likely to damage the data.)

26 Stephen T. Satchell and H.B.J. Clifford, *Linux IP Stacks Commentary*, ©2000 Coriolis Open Press, ISBN 1-57610-470-2, pp 488-9; the text has been re-ordered slightly from the original.

27 Used with permission of the authors.

The first router sends your package to a second router which, with luck, is located well on the way toward your destination. This second router then makes its best guess about how to pass the data, and speeds the package toward the net router. This process continues until the package reaches its destination in Ouagadougou and the recipient opens it. In the very worst case, the package never gets to Ouagadougou. Instead, it hits a digital dead-end and is dumped unceremoniously into a bit-bucket.

[How many routers can a packet pass through? Some systems will set a limit of 30. For international (or interplanetary) traffic, that's too few. The upper limit for the maximum number of router-to-router hops is 255.[28] At least with the current versions of the Internet Protocol.]

3. What is an Internet Service Provider (ISP), exactly?

There seems to be a **huge** amount of confusion as to what an ISP really is. Part of the issue is that people try to impose a definition that was devised back in the century of telephony. Let's talk about reality instead.

The non-technical answer to this question is "a company, department, or organization that provides Internet services." Simple, but not very precise, inclusive, or definitive. The FCC's definition, "*We [the FCC] believe that Internet service providers [ISPs] offer the 'capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via telecommunications,'*" strays far from what an ISP is, and instead folds the rest of the Internet marketplace into its definition. It also fails to provide any basis for identifying the distinction between one ISP and another. (Yes, here the FCC is quoting a Congressional statute. However, the statute is wrong, too.[29] [30])

28 The "time to live" field was added to the Internet Protocol header because of an event seen on ARPAnet in the early '70s. At one point, there were so many packets that could *never* reach its ultimate destination that they just kept recirculating, eating up the communications channels. Eventually Bolt, Beranek and Newman company, administrator for ARPAnet, was forced to "reboot" the entire 'Net to get rid of the circulating trash.

29 Thank you, Senator Ted Stevens.

30 http://boingboing.net/2006/07/02/sen-stevens-hilariou.html

Wikipedia's definition is more focused and detailed: "An **Internet service provider** (**ISP**) is an organization that provides services for accessing and using the Internet." This definition then lists several different types of ISPs:

- Access providers
- Mailbox providers
- Hosting ISPs
- Transit ISPs
- Virtual ISPs (read "resellers" and "outsource/packagers")
- Free ISPs
- Wireless ISPs

That's a better start. Let's dig a little deeper and be more specific. An **Internet service provider** is a company, department, or organization that provides one, two, or three of the following sets of services: network packet switching service, access service, and applications service(s).

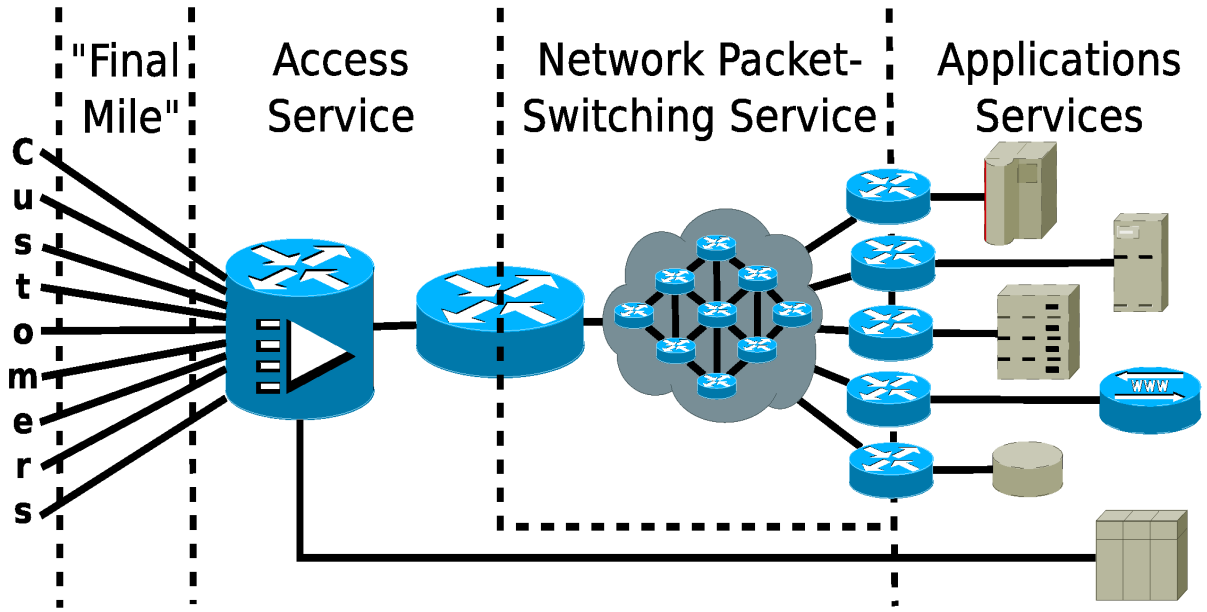
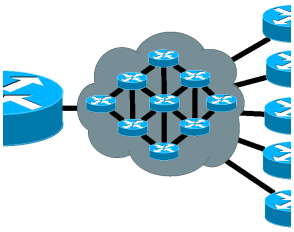


Illustration 1. – Simplified schematic view of Internet services.

Let's look at each type of service in detail.

3.1 Network Packet-Switching Service



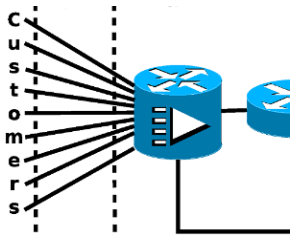
Network Packet-Switching Service is what allows packets – sent via (i) the single or aggregated final-mile links, (ii) dedicated uplinks, and/or (iii) application servers – to be injected into the Internet proper and routed to their destination. Firewall and attack-monitoring devices can live in the network packet-switching system, where they provide protection for the network itself, the application services, and the user.

Network Neutrality principles apply to this service set.

In almost every instance, ISPs provides some form of packet-switching and packet-forwarding services, even if the configuration is as simple as a local-area network with a DSU-based uplink, or a single WiFi access point with a wired uplink, or a mesh of wireless network nodes connected to an Internet access point.

This packet-switching service set can stand alone. Backbone ISPs only provide connectivity (but what a *lot* of it) to the Internet, including cross-connections among what used to be called the Tier-1 and Tier-2 backbone networks.

3.2 Access Service



Access service connects a customer to the Internet service provider, doing so via a telecommunications data link ("uplink"). In residential service, this uplink is also referred to as "the final mile" (even when the physical link is longer than one statute mile). In business service, the uplink is between the customer entity's computers or local network and the ISP.[31] Many ISPs that offer access will aggregate multiple customer uplinks into a single packet stream inbound to the switching services, and forward response packets coming back from the switching services to the sending customer.

Network Neutrality principles apply to this service set.

A facilities-based ISP runs wires, coax, or fiber-optic cables to the customer. Other ISPs that want to provide access service can rent facilities from the (monopoly) telephone company, from the (monopoly) cable company, or else can build a wireless network of some kind – or use

31 Multi-home access, whether to several of an ISP's offices or to completely different ISPs, is a variation of access used by larger businesses. However, this topic lies beyond the scope of this Comment.

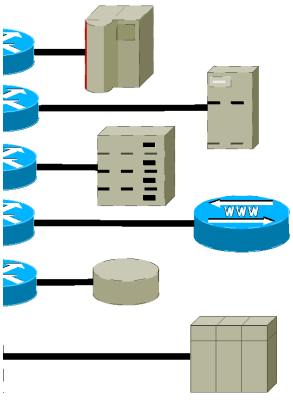
some combination of these methods. Then there are those die-hard ISPs who still support PSTN dial-up access... although their numbers are shrinking.

Some ISPs don't aggregate individual customer links into the packet-switching network at all. However, the ISPs that offer access (i.e., connectivity) to downstream customers do perform this type of aggregation.

The access-service set may stand alone, serving individual neighborhoods, apartment buildings, or high-rise office buildings. An ISP serving individual neighborhoods or buildings is limited to user-link aggregation, exchanging packets with another upstream ISP that offers full routing services to and from the Internet.

Today, broadband access service is provided by an ever-shrinking number of providers, to the point that in our urban and suburban areas there is a choice of at most two broadband providers – and those providers have conflicts of interest that encourage the corruption of pure data transport by those providers. Other broadband players serve those areas whose population densities are too sparse to be of interest to those two 800-pound gorilla providers: (a) the exurban and rural markets, and (b) the public wireless access points commonly available in restaurants, coffee shops, and hotels. Those pockets of sparsely settled customers are serviced by companies who have NO conflicts of interest.

3.3 Applications service(s)[32]



Applications service(s) provide the "smarts" for the activity initiated by the customer. Applications services are hosted on servers that may be connected directly to an access service, connected via the "cloud" (of packet-switching services), or connected via some combination of those two methods. Some application services run on cloud-based services such as Amazon AWS.

Note that the only difference between a user and an application service is that an application server doesn't require a human being. However, it *is* a network node that has its own IP address (or addresses), and is not embedded in the packet-switching network itself. In other words, to the packet-switching network there is no difference between a customer's link and the application server's link.

32 The illustration for this segment shows multiple applications service(s) providers... including an application service that is connected directly to the access service in the main diagram, such that the bottom application service communications bypasses the "cloud" for local access-service customers.

The principles of Network Neutrality do not apply to this service set. Absent interference from the packet-switching and/or access-service set, the application service set is competitive.

Web hosting, e-mail, and certain content companies each offer only two parts, namely, network packet-switching service and applications service.

Such applications include, but are not limited to:

- DNS directory service (name-to-address translation)
- Human-language translation
- Electronic mail service
- Web services
- Access to ISP-hosted and/or -cached content
- Messaging services
- Search engines
- On-line data repositories and databases (including the FCC's Public Comments for 17-108) and on-line databases such as WestLaw, PubMed, and other research libraries
- Travel reservation systems
- Special-application services, such as electrical network systems monitors, chemical-plant monitors, weather monitors, medical monitors, road-monitoring camera services, and much, much more.

3.4 A brief note about edge routers in Switching Service

Network-security functions may be performed in any of the three service sets. The most elementary security is contained in the routers that are located between applications and access servers, on the one hand, and network packet-switching service, on the other hand. These routers are called *edge routers*, because they reside on the "edge" of the rest of the Internet.

In the edge router, the software creates a **firewall**, which blocks the transmission and reception of certain IP protocols, certain TCP and UDP ports, and certain IP addresses. The protocols, ports, and IP addresses are carefully selected to avoid blocking legitimate traffic, while stopping malicious attacks.[33] Also implemented in the edge router is **traffic shaping**, which reorders the stream of outgoing traffic to prioritize the packets in some way. Such shaping is usually done to improve the performance of applications that require real-time handling of packets, such as in on-line gaming, video streaming, and Voice over IP.[34]

33 Firewalls work by blocking traffic. When firewalls are configured to stop malicious traffic, they benefit the ISP's customer. When configured to stop legitimate traffic, such as VPNs and other encrypted data streams, their actions are detrimental to the user, sometimes in ways that are not immediately apparent to the user.

34 Improper application of traffic shaping can also degrade the user's experience, sometimes to the benefit of the ISP's other business(es).

Security-appliances may be associated with one or more edge routers. **Intrusion detectors** monitor the incoming traffic and trigger an alarm when they see a packet pattern that is associated with malicious traffic. The output from intrusion detectors feeds data flow-control devices (which may be integrated into the detectors) to block bad traffic that would otherwise sneak past a static firewall.

4. Recent increases in conflicts of interest

One of the biggest changes in the Internet between 1995 and today is the nature of the businesses that provide access services to the Internet. In the "dim dark past" (Internet time), the providers were almost always dedicated specialists with no other interests; or a telephone company operating under the FCC rules that required the telephone company to provide so-called "unbundled network elements" (UNEs).

Today, broadband providers are often part of much larger corporations with multiple interests, some of which are at odds with the competing services offered by application ISPs.

4.1 Utilities and the "natural monopoly"[35] [36] [37]

In the early 1930s, AT&T's then-President Theodore Newton Vail aggressively promoted telephone service as a "natural monopoly." But what is a natural monopoly? For utilities such as electricity, water, and natural gas, the first customer for the first provider is always the most expensive customer. Each subsequent customer adds revenue with relatively little capital expense, so the per-customer cost of providing service drops. Accordingly, the first (or only) provider of a utility service has a distinct advantage over any future entrants into the market, because the second provider must necessarily incur the large initial capital expense for *its* first customer, as well as having to compete with the existing first provider.

Assuming that the second and subsequent entrants can get that far, their next task is to obtain physical space for their facilities. Because the land needed by new facilities is almost invariably owned by other parties, the new utility players are forced to find space by acquiring easements on property. And every easement has a gatekeeper. For "telephone poles," this gatekeeper is either the electrical power company or the telephone company that either grants or denies access.

35 https://www.nap.edu/read/10235/chapter/11
36 https://www.mackinac.org/6033
37 https://cs.stanford.edu/people/eroberts/cs181/projects/corporate-monopolies/benefits_natural.html

Local governments tend to limit the facilities for each type of utility to one company in each area, doing so through a contract or franchise agreement. It wouldn't be efficient to have two sets of electricity wires, or two different water systems, or two different gas pipes leading to each home or building. Consequently, a single company operates the part of each utility that is located between the central supply or distribution point and the demarcation point in each building. This is utility monopoly.

What price do the providers of monopoly service pay for this exclusivity? Not necessarily a monetary one. More often, the cost is measured in terms of increasingly strict regulation and oversight. Because these companies are sole-source providers of a service, the various public-utility commissions require that the providers disclose their costs, rates, and terms of service. The FCC's analogous rules for telephone companies are its Title II regulations, codified in 47 USC 251-261 ("Development of Competitive Markets").

In order to loosen the grip of tighter regulations, the utility companies came up with the idea of making parts of their services more competitive. Thus, the electrical-power companies reduced their "footprint of monopoly" by separating the local distribution of electricity from other functions, such as electricity generation, long-haul (e.g., interstate) distribution, and customer fulfillment. The natural-gas utilities segregated local distribution from the central supply, allowing wholesale purchasing on a competitive basis. And water companies emulated the gas-utility model, buying water from wholesale suppliers.

And the telephone company? In its 1974-82 antitrust case, the U.S. federal courts took a huge step toward reducing the telephone company's "footprint of monopoly" by breaking up AT&T into a group of local operating companies,[38] one long-distance company, and the Yellow Pages. Under the terms of the ruling, AT&T retained Bell Laboratories, as well as a series of service companies such as Western Electric.

During the course of the decade-long AT&T antitrust case, Microwave Communications of America, Inc. (MCI) was providing private telephone "tie line" business. MCI eventually became a long-distance vendor – and a competitor of AT&T. Other companies followed suit, bringing competition into long-distance telephone service without recourse to the courts.

38 The numerous "baby Bells" merged into the seven Regional Operating companies in 1984.

4.2 The Internet and "natural monopoly"

During the pre-Obama "ideal Internet" era, the Bell telephone companies were required by Congress (47 USC 251, 1996) and the FCC (96-325, 1996[39]) to reduce its "footprint of monopoly." The reduction mechanism consisted of unbundling the network elements and letting third parties sell services that leased those elements. This change allowed independent internet service providers (ISPs) to provide ADSL broadband service with no need to install extensive facilities or to negotiate with utility gatekeepers. Instead, the ISPs could use the telephone company's own ATM network to connect the independent vendors to the particular part of the physical cable plant that provides the data service – thereby effectively becoming competitors of the segment of the telephone company that was acting as an ISP.

The D.C. Circuit Court of Appeals, in *United States Telecom Association v. FCC,*[40] "vacates the provisions of the Third Report & Order dealing with the four challenged punch-list capabilities" (at IV). If I'm reading the Opinion correctly, all of the affected items on the "punch list" were related to rules that had been enacted to accommodate the requests of law-enforcement authorities under the Communications Assistance for Law Enforcement Act (CALEA). From the opening paragraphs of the Opinion:

> Opinion for the Court filed by Circuit Judge Tatel.
>
> TATEL, Circuit Judge: "The Communications Assistance for Law Enforcement Act of 1994 requires telecommunications carriers to ensure that their systems are technically capable of enabling law enforcement agencies operating with proper legal authority to intercept individual telephone calls and to obtain certain 'call-identifying information.' In this proceeding, telecommunications industry associations and privacy rights organizations challenge those portions of the FCC's implementing Order that require carriers to make available to law enforcement agencies the location of antenna towers used in wireless telephone calls, signaling information from custom calling features (such as call forwarding and call waiting), telephone numbers dialed after calls are connected, and data pertaining to digital 'packet-mode' communications."

Most notably, the FCC order issued in response to this Opinion left it up to the various States to decide how UNE should be handled.[41] This, I believe, is one of the reasons why my ISP is able to maintain ADSL service to existing customers in the Reno, Nevada area.

Contrast this reduced footprint of monopoly on the part of the telephone companies with the fact that the cable TV companies that provide broadband services through utility easements

39 https://transition.fcc.gov/Bureaus/Common_Carrier/Orders/1996/fcc96325.pdf (a 737-page document).
40 227 F.3d 450 (2000).
41 https://www.lw.com/upload/pubContent/_pdf/pub794.pdf

have never been subject to any unbundling requirements. Any resale of broadband services by third-party companies is available only at the full-product level, where the reseller has no way to add value (other than technical support) to the service. In particular, customers of resold cable-based broadband services are finding that abusers of those service have degraded the "reputation" of the IP addresses that are provided by the service, and that there is no available alternative pool of IP addresses that are being properly administered by the reseller's staff or by the cable company's staff. Moreover, because the resellers don't have access to the basic signal coming from the "final mile." they cannot provide faster access to the securities and commodities markets via dedicated links. Day-traders are especially interested in fast access, because milliseconds can make the difference between successful trades and massive losses.

4.3 Congress and the FCC should further subdivide Title II

The regulations are codified in the following sections of the U.S. Code:

- Title I: 47 USC 200-250 ("Common Carrier")
- Title II: 47 USC 251-261 ("Development of Competitive Markets")
- Title III: 47 USC 271-276 ("Special Provisions Concerning Bell Operating Companies")

The vast majority of these sets of statutes relate exclusively to telephone service generally, and to the Bell System in particular. This is a lot of mental baggage for the FCC, as well as for organizations (ISPs) thrust under its control, and the general public. There are also some major problems with regard to the Internet – which is why the FCC is now reviewing the Title II Order as part of this Notice.

One example of this deficiency is the fact that 47 USC 230 and 231 fail to recognize the recent changes in the environment of the Internet. In the history of the telephone, the reason for the promulgation of the Title II rules was that when the Communications Act of 1934 was enacted, almost all of the telephony services were provided by monopolies. When Congress revisited these statutes over the course of the following decades, it failed to craft laws that properly addressed the Internet as it is currently structured (see above). The latest regulations say nothing about how monopoly providers of certain services are to be controlled, as in the Utility Monopoly model – leaving it up to the various States to attempt to mitigate any undue advantages that those providers might enjoy thanks to the absence of competitive pressure.

4.4 Melding network and non-network businesses

The advent of **conflicts of interest** in the provision of network access and network packet-switching services is a relatively recent phenomenon. Innovations in the Internet have put some businesses at risk, just as the automobile wiped out the buggy-whip market. When the at-risk businesses also control the network, those businesses respond to conflicts in ways that affect the transmission of packets for competing products to and from customers and the application services.

The statement **"[f]or nearly two decades, the Internet flourished under a bipartisan, light-touch regulatory framework"**[42] fails to recognize this recent shift in the Internet and its providers. In particular, it fails to recognize the providers' temptation to "monetize" parts of Internet access by playing "man in the middle," especially when you consider that the customer is paying for a subscription to the ISP's access services.

Another statement – **"The Internet wasn't broken in 2015**"[43] – may in fact be true. However, the seeds of trouble were sown much earlier, and the problem expanded so gradually that people didn't see it – and many still don't. It should also be recalled that Chairman Pai's statement was made in the context of the imposition of Title II regulations on *all* ISPs, and not just on the miscreants and potential troublemakers.

According to some technical experts, the Internet is supposed to "be able to route around damage." The problem is that for most broadband customers, *no alternate route is available.* When a monopoly ISP interferes with the customer's data and expectations, the customer has little or no recourse.

This growth of actual and potential conflicts of interest would be far less worrisome if there were a plethora of providers for a customer to choose from. Unfortunately, the worst violators of Net Neutrality are the providers that have a monopoly or duopoly, especially when these same violators fight tooth and nail against the ability of other facilities-based providers to set up shop in a given community.[44] [45] [46]

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42 Chairman Ajit Pai, oral statement at the 2017 May 18 FCC meeting, at ¶1.
43 Chairman Ajit Pai, oral statement at the 2017 May 18 FCC meeting, at ¶4.
44 https://arstechnica.com/information-technology/2016/08/att-explains-why-it-sometimes-delays-google-fiber-access-to-poles/
45 http://www.mercurynews.com/2016/03/10/google-fights-att-comcast-over-bay-area-google-fiber-service/
46 http://www.fiercetelecom.com/installer/google-fiber-s-rise-changing-utility-pole-access-regime – *"Interestingly, the telco announced it was targeting parts of the city with its [one gigabit-per-second] service a week following the suit, raising suspicion that AT&T is trying to put a cap on new competition."*

Even when there is robust competition, the cost of switching providers may be prohibitive for the customer, and the collateral damage may be unacceptable. For example, in the cellular wireless Internet, changing providers means changing phone numbers – and so the customer needs to update everyone who has the old number. In some cases, changing providers also means changing phones, with the issue of transferring phone directories, contact lists, and e-mail address books, just to name a few chores. For wired broadband, customers who were using their providers' e-mail have to go through the same process associated with a change in an e-mail address.

"But what about WISPs (Wireless Internet Service Providers)," you ask? The problem here is not conflict of interest; rather, it's a matter of spectrum. When a WISP deploys in a rural or exurban environment, there is very little competition for unlicensed spectrum. In suburban and urban areas, the unlicensed spectrum is loaded with users competing for the relatively few available channels. Consequently, the areas that offer the most promising opportunities for providing competitive wireless broadband services are those areas in which there no existing service, or in which the existing service is spotty. This is great for expanding broadband. But it does little to provide services for poor neighborhoods, and does essentially nothing to encourage competition.

4.5 Facilities ISPs versus non-facilities ISPs – Access services

ISPs that provide access services can be divided vertically by whether they use (1) their own physical facilities (such as twisted pair, coax cable, fiber, or power lines), (2) the physical facilities of another company or utility, or (3) wireless technologies. In the early days of the Internet, the overwhelming majority of ISPs used the Public Switched Telephone Network (PSTN), and also dedicated lines leased from the telephone companies. With the growth of cable TV companies, and their installation of their physical plant in homes and businesses, the newly installed second wire became useful as a means of providing Internet access.

In earlier FCC proceedings, the Commission mandated the unbundling of the elements of the telephone network, so that, for example, ISPs could use the telephone company's facilities in order to make the "final-mile" connection. The Order mandating this unbundling has since been vacated.

No proceedings to date have required cable TV companies to "unbundle" access to their physical plant. That said, some cable companies permit non-facilities-based ISPs to resell services, but *not* to the point where the connection to the customer terminates at the non-

facilities-based ISP. (I used to have such cable Internet service. Unfortunately, I didn't have access to the unique services provided by my ISP. Specifically, my IP address was "owned" by the cable company, not by my ISP or by me. I had no choice in this matter. Now my service is with the telephone company, and the situation regarding unique services is exactly the same as the one I experienced with cable.)

5. The problem with the FCC's definition of ISP

The problem with the FCC's definition –

> "*We* [the FCC] *believe that Internet service providers* [ISPs] *offer the 'capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via telecommunications.'*"[47]

– is that although it's fine to describe the entire Internet ecosystem, it is not an accurate description of what any given individual Internet Service Provider *is*. Instead, the definition describes the effect of the conglomeration of *all* the ISPs in the world. This shortsighted view represents a form of tunnel vision, in that it assumes that an ISP *must* provide all three types of service sets, and that those services are offered exclusively to individuals in homes. The confusion displayed by the FCC is understandable. Congress is equally confused, as it gave you this definition in statute, and got it wrong; or else the definition is outdated. *C'est la vie*... (I've written letters containing these suggestions to all of my Congressional representatives.)

In terms of product offerings, ISPs are *not* like the telephone companies. The difference is that ISPs can pick and chose exactly what services they offer in-house to customers, and what services they provide by outsourcing – especially for application services. Moreover, application services are available on a competitive basis, so that any broadband customer connected via a net-neutrality-conforming ISP can use those competitive services.

The original view of the Internet held by the FCC (and by Congress) appears to be rooted in the on-line services marketplace of the '80s and early '90s. That marketplace affected how Internet service providers built their products at the beginning of the Internet Age in order to compete with the established, non-connected services.

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47 FCC 17-60, page 9, at 27, with citation to 47 USC 153(24): "The term "information service" means the offering of a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via telecommunications, and includes electronic publishing, but does not include any use of any such capability for the management, control, or operation of a telecommunications system or the management of a telecommunications service."

At that time, commercial services like CompuServe, GEnie, American OnLine (AOL), and various offshoots of bulletin-board systems offered a number of services – what we now call "applications" – that were available via dial-up modems but were not interconnected in any significant way beyond the boundaries of each service. (Ignoring, for the purposes of this part of our discussion, ARPANET, FIDO, UUNET, and inter-campus academic and government and exchange networks.) Access to the Internet in the '80s was initially via calls to dial-up modems connected to nodes at universities. Other ISPs followed with dial-up service. Later, AOL,[48] the WELL (Whole Earth 'Lectronic Link), the Byte Information eXchange (BIX), and others offered gateways to the Internet. During the dial-up era, the marketplace saw Web sites spring up like mushrooms in a water-soaked field – despite their slow loading rates.[49]

When broadband prices started to drop to affordable levels in the '90s, people started to order broadband in their homes, thereby sparking the growth of today's Internet service providers. In order for those broadband ISPs to compete with the entrenched modem-based services and to attract customers, the ISPs needed to provide comparable applications services as part of a "bundle." Some ISPs felt that, in order to earn back their investment and make a profit on those applications, they had to discourage customers from using competing applications.

It is only in the last decade that broadband speeds, on the one hand, and computer/graphics power, on the other hand, have enabled a generally acceptable display of television and movie entertainment over the Internet. Internet access is being built into today's TV sets, bypassing the need for a computer to act as an intermediary in the transmission of streaming data. Early streaming efforts were crude; however, as the trend continued toward higher speeds and greater computing power, we started to see places like YouTube (and its pornographic siblings) spring up. Today, Internet streaming poses a significant threat to the cable-TV model, with increasing numbers of cable subscribers "cutting the cord."

48 When AOL first started to offer Internet access as part of its service, old-timers from NSFnet days referred to the change in culture, caused by the newcomers, as "eternal September." Before AOL, each new academic year ushered in the freshmen who were new to the 'Net, and not yet inculcated with the social norms of the Internet community. The arrival of AOL was the first time oldsters predicted the "Death of the Internet."

49 I was invited to give a talk at a OS/2 convention in Phoenix. The topic was web site design in the early days of the World Wide Web. At one point in my talk, I held up a gatefold ad in an issue of *Time* magazine for a car maker, saying "one of the biggest mistakes a web designer makes is to include a large graphic that takes *forever* to load." A groan came from the back of the room: "That's EXACTLY what they have on their web page!" Q.E.D.

Cable TV companies, secure in their monopoly position, can leverage their legal monopoly of coax by offering broadband over cable, making use of their existing facilities. Some business offices were tempted to intentionally degrade Internet streaming, in order to prevent any competing streaming services from attracting the revenue that the business offices would otherwise receive from the traditional cable-TV method of content delivery.

Meanwhile, in the 2010 decade, the art of providing applications such as e-mail and web sites have outgrown the ability of the jack-of-all-trades system administrator to handle. In fact, the state of the art has advanced, becoming quite specialized in each application area. As the Internet marketplace has matured, those companies, departments, and organizations providing Internet service have splintered into, or outsourced to, specialized groups for each type of service.

In conclusion, the definition of “ISP,” which forms the backbone for FCC regulation of the Internet, is now antiquated and fatally flawed. Intelligent conversation becomes difficult when this flawed definition dominates the discussion.

6. Comment on the Notice of Proposed Rulemaking, FCC 17-60

6.1 NPRM – I. Introduction (pages 2-3)

"Americans cherish a free and open Internet." (at 1) – The problem is that conflicts of interest on the part of some Internet access providers are causing them to distort the information being passed back and forth, or to monitor – without permission – the data flowing by.

"Today, we take a much-needed first step toward returning to the successful bipartisan framework that created the free and open Internet and, for almost twenty years, saw it flourish." (at 5) – That would be a fine step – *if* we also rolled back the market to an environment of many small, specialized providers of access services. That's not going to happen; the ship of change has long since sailed. So any regulatory framework must take into account the circumstances that prevail today.

6.2 NPRM – II. Background (page 3 *et seq*.)

"Basic services offered 'pure transmission capability over a communications path that is virtually transparent in terms of its interaction with customer supplied information' and were 'regulated under Title II of the [Communications] Act.'" (at 6) – Another look at the definitions of access and network packet-switching services will confirm that those ISP services correspond *exactly* to the definition of Basic Services.

"Enhanced services were 'any offering over the telecommunications network which is more than a basic transmission service.'" (at 6) – In the Internet world, the "more" is the applications services, distinct from any access service or switching service. The problem is that the FCC rulings overlook the fact that the Basic Services and Enhanced Services can be, and should be, easily separated by an ISP. Thus, the issue then revolves around how to regulate access and network switching, separate from any access services, doing so only when absolutely necessary in order to provide a "free and open Internet," regardless of the presence of any conflicts of interest affecting the entity that owns the ISP.

"The Commission was also guided by its belief that 'broadband services should exist in a minimal regulatory environment that promotes investment and innovation in a competitive market,' and the knowledge that regulatory uncertainty 'may discourage

investment and innovation.'" (at 11) – So where is the "competitive market" in broadband, particularly in urban areas? If the cable TV company offers broadband, and decides to filter access, where does the poor hapless customer go? I believe that the 2002 *Cable Modem Order* falls down badly in this regard.

"In reaching this conclusion, the Commission relied on the plain text of the Act, finding that 'providers of wireline broadband Internet access service offer subscribers the ability to run a variety of applications that fit under the characteristics stated in the information service definition,' and that users of wireline broadband Internet access service were provided 'more than [a] pure transmission' path whenever they accessed the Internet." (at 14) – So plain old telephone service offers subscribers the ability to talk to anyone they want to talk to. The Commission's finding is also false to fact, in that customers of broadband access service and switching service *are* being offered a pure transmission path. The value-add for the customer lies in the application services provided by one or more ISPs.

6.3 NPRM – III. Ending public-utility regulation of the internet (page 8 *et seq*.)

"Section 3 of the Act defines an 'information service' as 'the offering of a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via telecommunications, and includes electronic publishing, but does not include any use of any such capability for the management, control, or operation of a telecommunications system or the management of a telecommunications service.'" (at 27) – Unfortunately, access/switching ISPs do not fit this definition, because they don't make any such offering. Rather, the offering is made by applications ISPs. Access/switching ISPs merely provide a transmission path that allows applications ISPs to generate, acquire, store, transform, process, retrieve, utilize, or make available information – even when the two ISP's parts live under the same roof.

In other words, both the Commission and Congress are starting from assumptions that are false to the facts in the world of the modern Internet.

"We believe that Internet service providers offer the 'capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via telecommunications.'" (at 27) – See the preceding paragraph.

The Commission and Congress are starting from assumptions that are false to the facts in the world of the modern Internet.

"In short, broadband Internet access service appears to offer its users the 'capability' to perform each and every one of the functions listed in the definition—and accordingly appears to be an information service by definition." (at 27) – No, no, no, *no*, NO! Broadband Internet access service is the "on-ramp" to *other* ISPs (or another part of the same ISP, in rare instances) who provide "each and every one of the functions listed in the definition."

The Commission and Congress are starting from assumptions that are false to the facts in the world of the modern Internet.

"If broadband Internet access service does not afford one of the listed capabilities to users, what effect would that have on our statutory analysis?" (at 27) – It causes your analysis to fail, because it makes assumptions that are false to fact. Broadband access service is about customers' ability to access application servers that perform the function. This ability itself is *not* an integral part of the access service. It's like saying "a road offers the capability for a customer to buy tires, pump gasoline, stay at inexpensive motels, purchase rapidly prepared food, and take in a movie."[50] The tires are sold at tire salons accessible via the road. Gasoline is sold by filling stations accessible via the road. Motels are accessible via the road. Rapidly prepared food is served by restaurants accessible via the road. Movies are shown at a theater – perhaps a drive-in theater – accessible via the road. To attribute these capabilities to the road itself is ludicrous.

"More fundamentally, we seek comment on how the Commission should assess whether a broadband provider is 'offering' a capability. Should we assess this from the perspective of the user, from the provider, or through some other lens?" (at 27) – The foregoing road analogy is a good place to start your analysis. Next, shifting to the user's viewpoint, "the Internet" is a black box that transforms some form of input to some form of

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50 This analogy was inspired by a line spoken by Judge Doom in the film *Who Framed Roger Rabbit?* The scene in question, which takes place at the Acme warehouse, typifies the conflict-of-interest issue:
Eddie Valiant: "Who is going to drive this lousy 'freeway' of yours when they can ride the Red Car [trolley line] for a nickel?"
Judge Doom: "They'll have to. I bought the Red Car so that I could dismantle it."

output. The perspective of the provider depends a great deal on what the provider is offering. So a bird's-eye view exposes the truth that is the Internet and its many pieces. Remember, the original definition of the Internet was, and still is, "a network of networks."

An "autonomous system" is the smallest unit defined for routing in Border Gateway Protocol (BGP). Autonomous systems (AS) are almost always administrated by a company or organization that is separate from all the others – and each AS represents a local network or extended network with many users and servers. In short, the Internet consists of multiple entities, in the form of numerous individually managed players who cooperate with each other as peers. At least that's the plan.

Worldwide, there are more than 60,000 such autonomous systems. Each one is uniquely identified by an "autonomous system number" (ASN) assigned by the Local Internet Registry (LIR), who in turn gets blocks of ASNs from a Regional Internet Registry (RIR): AFRINIC, ARIN, APNIC, LACNIC, and RIPE.

"We seek comment on how consumers are using broadband Internet access service today. It appears that, as in 2002 and 2013, broadband Internet users "obtain many functions from companies" other than their Internet service provider. It also appears that many broadband Internet users rely on services, such as Domain Name Service (DNS) and email, from their ISP. Is that correct?" (at 28) – That very much depends on the customer. Casual customers, especially home-based customers who are new to "this Internet thing," will obediently use the DNS and e-mail applications service provided by the ISP, while obtaining other applications software (such as Web browsers) from their operating system vendor or directly from the software publishers. (The Google Chrome web browser is one example of an application that customers acquire directly from its "publisher" ... although OS vendors are slowly adding Chrome to their distributions.) Other customers may choose to use alternative providers of DNS, such as Google or DynDNS, and web-based mail provided by Google, Yahoo, and other companies.

"Is a consumer capable of accessing these online services without Internet access service?" – Yes, if what you mean is "without *broadband* Internet access service." There are still providers of Internet access via the Public Switched Telephone Network (PSTN), and some are access ISPs still routinely provide service via point-to-point data services. (In fact, the ISPs themselves gain access to the Internet at large by means of T1, T3/DS3, and fiber-based data circuits connected to companies that specialize in this type of wholesale-level access.) Here in Reno, Nevada the cable TV company offers so-called "business fiber Internet," for which it

runs fiber from its point of presence to the customer's premises, installing a router on the customer's premises. (This router is known as the "demarcation-point.")

"In contrast, Internet service providers do not appear to offer 'telecommunications,"' i.e., 'the transmission, between or among points specified by the user, of information of the user's choosing, without change in the form or content of the information as sent and received,' to their users. For one, broadband Internet users do not typically specify the 'points' between and among which information is sent online. Instead, routing decisions are based on the architecture of the network, not on consumers' instructions, and consumers are often unaware of where online content is stored." (at 29) – According to the definition coined by Congress, as quoted above, the telephone companies don't provide telecommunications, either. Callers do not typically specify the "points" between and among which a call is routed. Instead, switching decisions are based on the architecture of the network, not in obedience to customers' instructions, and consumers often do not know exactly where their call terminates.[51]

What broadband access and switching services are *supposed* to do is transfer the user's information, with no change in the form or content of the information, as sent and received between the user and the applications ISP. Any transformations of the information are performed by the servers hosted by applications ISPs.

"Domain names must be translated into IP addresses (and there is no one-to-one correspondence between the two)." (at 29) – What do domain names have to do with the Internet? Domain Name Service (DNS) is an *application* service. It's not absolutely necessary in all cases. Customers can designate a numeric IP address (or, for IPv6, a hexadecimal IP address) directly in order to tell a local application where to connect to an application server on the Internet, such that DNS is *not* mandatory at all. In fact, when setting up their computers (or routers, or wireless access points), customers *must* specify the IP address – *not* a domain name – of the recursive DNS server that is to be used over the channels. No names are allowed – because how would a router be able to obtain a name translation when it doesn't know where to go to get it?

While we're at it, we should note that telephone numbers must be translated into office, frame, and wire-pair numbers, and that there is no one-to-one correspondence between a

51 Call forwarding and foreign-exchange service can mask the *town* where the call terminates… or the *state*, for that matter. (My own business service is for Incline Village, Nevada, although I'm now located in Reno. I've kept the Incline number because so many people know and use it. At one point, that number was also forwarded to my landline phones in Massachusetts and California, and to a cell phone in California.)

telephone number and the tuples of the line's physical location. This is particularly true when a customer has call-forwarding service in place, or uses an established foreign-exchange circuit, as I do for the business telephone number that I've used for more than 15 years.

"We believe that consumers want and pay for these functionalities that go beyond mere transmission – and that they have come to expect them as part and parcel of broadband Internet access service. We seek comment on our analysis. How are broadband Internet users' requests for information handled by Internet service providers today?" (at 29) – Internet service providers (ISPs) do not provide computer terminals or other human-accessible equipment as part of their service. At most, customers receive a modem or a router, owned by the provider, with a RS-232 serial port or an Ethernet jack (which serves as the demarcation point for the service). Most Internet customers use their own computer or a smart cell phone, calling up an app or a program that converts their human input to a form that can then be presented, in the form of packets, to the provider of access service. The access-service provider then passes the packet to the switching service, which then sends the packet into the "cloud," from which it then "poofs out" at the desired destination (assuming no blocks or other interference). Responses come back the same way, although not necessarily using the same routing in the cloud that was followed by the original request.

What, you may ask, is the source of the app or program that performs the conversion. There are several, starting with operating-system distributions, or the popular "app stores." Some people get programs over the Internet, directly from the software vendor. And there are still some computer user groups that, at their meetings, hand out software on discs or on USB thumb-drives that their members can physically take home.

"What functionalities beyond mere transmission do Internet service providers incorporate into their broadband Internet access service?" (at 29) – The short answer heard most often in this context is "Nothing that the customer wants" – especially as web sites have evolved into systems that dynamically generate information. All of the functionalities reside in the applications ISP servers... which, for those ISPs who offer applications services, could be housed at the facilities of the access-service ISP, .

"We particularly seek comment on the Title II Order's assertion that the phrase 'points specified by the user' is ambiguous—how should we interpret that phrase so that it carries with it independent meaning and is not mere surplusage? Is it enough, as the Title II Order asserted, for a broadband Internet user to specify the information he is trying to access but not the 'points' between or among which the information will be

transmitted? Does it matter that the Internet service provider specifies the points between and among which information will be transmitted?" (at 29) – Changing "points" (plural) to "point" (singular) will solve this problem. Users in the modern Internet are *never* able to specify intermediate "points" – the dynamic routing system will find a path, if it can, working by successive approximation through each router, many of which are *not* owned by the ISP. (See the section describing how BGP-based routing works.) As for the ISP, it can't specify routing, either. (If it tries to do so, the whole routing scheme breaks down.) The switching service of an ISP can make its own routing decisions regarding how to pass on a packet, but what happens after that is up to the subsequent routers, which are usually owned by other administrations.

In the old UUNET network, the user would specify a "bang path" to indicate how a message or file should be routed through the network. Those days are long behind us – nobody uses bang paths, or anything like them, any more. In today's Internet, the first switching ISP can decide what of several possible paths a packet should take. This decision may be based on any of several factors, such as the capacity of the circuits, transmission costs to the router owner, length of the projected routing path, peering arrangements with other switching service providers, and even political preferences (e.g., to avoid going through a portion of the Internet that is monitored by certain nation-states), and other criteria. This on-the-fly distributed decision making is how the Internet routes traffic around damaged areas.

"For another, Internet service providers routinely change the form or content of the information sent over their networks—for example, by using firewalls to block harmful content or using protocol processing to interweave IPv4 networks with IPv6 networks. The Commission has acknowledged that broadband Internet networks must be reasonably managed since at least the 2005 Internet Policy Statement. We believe that consumers want and pay for these functionalities that go beyond mere transmission – and that they have come to expect them as part and parcel of broadband Internet access service." (at 30) – This is so wrong on so many levels. Neither of your examples represents a "change [to] the form or content of the information sent over their networks."

Firewalls and security appliances, properly used, prevent degradation of service and malicious attacks, doing so by catching and blocking bad traffic, in both the inbound and outbound directions. Such devices can enhance the customer's experience. Improperly applied, they can hurt the customer by blocking a necessary legitimate service or by degrading a

legitimate service to such a point that customers will turn to other avenues in order to get the particular information that they want.

Customers expect that an access-service ISP and the switching-service ISPs will provide a "wire with smarts," so that those customers can make effective use of the services available on the Internet with a minimum of fuss.

Network management is a complex subject, and the object of continued research and evaluation. It would be worthwhile for the FCC to ask the members of the Internet Engineering Task Force for their ideas about Best Network Practice as it applies to ISP access-server and switching service. (An in-depth discussion of proper traffic shaping, routing strategy, buffer-bloat mitigation, and hundreds of other topics that have a direct bearing on the customer experience is far beyond the scope of this Comment.)

Yes, customers do want attack mitigation and traffic shaping, so that real-time traffic (such as voice-over-Internet calls) will take priority over bulk traffic (such as file transfers). Without necessarily being aware of it, customers also want small packets to be favored over large packets. (Think of "ACK" packets in TCP, name requests/responses in DNS, and sound packets in Voice over Internet.) This type of prioritization by size is also useful to online gamers. Customer do not want "selective" shaping based solely on source. As for "fast lanes," if a content provider wants to bypass the cloud and provide a direct link, the content provider should be free to do so at its own expense – not at the expense of the ISP.[52]

"For instance, [47 USC] Section 230 defines an interactive computer service to mean 'any information service, system, or access software provider that provides or enables computer access by multiple users to a computer server, including specifically a service or system that provides access to the Internet and such systems operated or services offered by libraries or educational institutions.' On its face, the plain language of this provision deems Internet access service an information service. We seek comment on this analysis, on the language of [47 USC] Section 230, and on how it should impact our classification of broadband Internet access service." (at 31) – This statute is flawed in that it fails to identify accurately all of the players involved in such access service. For example, I can use my landline telephone to call the telephone that rings on the reference desk at my local library, but that does not mean that my telephone service is an "information service."

52 https://arstechnica.com/tech-policy/2017/06/the-internet-needs-paid-fast-lanes-anti-net-neutrality-senator-says, and Commenter agrees with the Senator, that *"ISPs should be able to sell 'fast lanes' to websites and online services that are willing to pay for quicker access to customers."*

"[47 USC] Section 231 is even more direct. It expressly states that 'Internet access service' 'does not include telecommunications services.' And it defines Internet access service as one offering many capabilities (like an information service): 'a service that enables users to access content, information, electronic mail, or other services offered over the Internet, and may also include access to proprietary content, information, and other services as part of a package of services offered to consumers.'" (at 32) – So does that mean that if I use a Part 68 modem and call my ISP's dial-up service, the telephone magically becomes an "information service" instead of a telecommunications service, as recognized today? At the very least, 47 USC 231 is outdated. In any event, the primary purpose of the Congressional statute quoted above was to prevent minors from gaining access to harmful content – not to provide general regulation of telecommunications services.

"The structure of Title II appears to be a poor fit for broadband Internet access service. In the Title II Order, the Commission, on its own motion, forbore either in whole or in part on a permanent or temporary basis from 30 separate sections of Title II as well as from other provisions of the Act and Commission rules. The significant forbearance the Commission granted in the Title II Order suggests the highly prescriptive regulatory framework of Title II is unsuited for the dynamic broadband Internet access service marketplace. We seek comment on this analysis, and on what weight we should give this analysis in examining the future of this model of regulation." (at 33) – The structure of Title II is a poor fit for the majority of small and medium-sized ISPs that provide access services. I propose that the Title II rules be applied only to those broadband access ISPs that meet the several well-focused and non-discriminatory criteria that would apply to ISPs that engage in monopoly service. (For further details of this suggestion, please see the Proposals at the beginning of this Comment.)

In short, I would suggest that the burden of Title II be applied to those broadband companies that are monopoly or duopoly providers of access service, and let all of the other broadband companies continue to be governed by the Title I regulations.

"The purposes of the Telecommunications Act appear to be better served by classifying broadband Internet access service as an information service. Congress passed the Telecommunications Act to 'promote competition and reduce regulation' and '[n]othing in the 1996 Act or its legislative history suggests that Congress intended to alter the current classification of Internet and other information services or to expand traditional telephone regulation to new and advanced services.'" (at 34) – Commenter

agrees in part and disagrees in part. When Congress amended the Telecommunications Act, there were very few, if any, conflicts of interest that pitted Internet Service Providers against application providers, and thus no immediate need for tighter regulation. Now that we as a country have seen how conflicts of interest can interfere with the provision of clear broadband access services, it behooves us to limit Title II regulation to those relatively few monopoly broadband access ISPs that are the primary source of the problem with regard to clear signaling.

"More broadly, we seek comment on the text, structure, and purposes of the Communications Act and the Telecommunications Act, as well as any additional facts about what Internet service providers offer, how broadband Internet access service works, and what broadband Internet users expect that might inform our analysis." (at 35) – Detailed discussions of what Internet service providers offer appear in the sections of this Comment entitled *What is the Internet, Exactly?* and *What is an Internet Service Provider (ISP), exactly?*. In brief, however, Internet users in general and broadband access users in particular expect "the Internet" to serve as a communications channel extending from the applications program residing on their computer or smart phone to the applications servers on the Internet. Users expect the "stuff in the middle" to act like a semi-intelligent piece of wire that poses a minimal barrier, or none at all, to the use of the desired application. Users also expect that all of the parties involved will protect their network from any harm caused by ne'er-do-wells who engage in "socially disruptive" activities or outright attacks on the users' computers. And, of course, this protection should be provided in a way that's seamless and invisible to socially adept users.

Moreover, users expect their streaming and voice over IP calls to happen without jitter and without pauses – indeed, without any distortions of any kind. Users expect their surfing to take place efficiently and speedily. Users expect the ISPs not to make any changes to their access that might degrade the users' experience (such as inserting ads or "tracking cookies," or throttling competing content. (They don't ask for much, do they?)

"Second, the Title II Order found that DNS and caching used in broadband Internet access service were just used 'for the management, control, or operation of a telecommunications system or the management of a telecommunications service.' The Commission has previously held this category applies to 'adjunct-to-basic' functions that are 'incidental' to a telecommunications service's underlying use and 'do not alter [its] fundamental character.' As such, these functions generally are not 'useful to end users, rather than carriers.' We seek comment on how DNS and caching functions are now used,

whether they benefit end users, Internet service providers, or both, and whether they fit within the adjunct-to-basic exception. How would broadband Internet access service work without DNS or caching? Would removing DNS have a merely incidental effect on broadband Internet users, or would it fundamentally change their online experience? Absent caching, would broadband Internet users that now expect high-quality video streaming see only incidental changes or more fundamental changes? Are there other ways that DNS or caching are used for 'for the management, control, or operation of a telecommunications system'? Are there any other aspects of the Title II Order's treatment of DNS or caching that should be reconsidered here?" (at 37) – Lots of questions. Let me try to break down this query into digestible chunks.

DNS: Domain Name Service is an *application service*. Any number of ISPs offer recursive lookup services suitable for use by computer systems. ISPs typically offer their own DNS application servers or the DNS service of an affiliate, while leaving the customer free to choose from the universe of DNS servers available.

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For the majority of users, DNS is an absolute requirement... but that requirement can be satisfied by using 8.8.8.8 and 8.8.4.4[53] (or 2001:4860:4860::8888 and 2001:4860:4860::8844 for IPv6 addresses) in the customer's DNS resolver configuration, instead of the IP addresses indicated in the documentation provided by the access service ISP. Interestingly, home and/or SOHO routers and WiFi access points routinely offer DNS services within them, with some amount of caching of DNS responses. (Curious users can verify this point by checking the configuration of their domestic router or wireless access point.)

53 These addresses are provided by Google for its public DNS service.

Caching: Numerous different types of caching may be involved. Judging from the inaccuracies I've seen so far, I can guess where the FCC (and Congress) gets its notions, and surmise that in this instance you are referring to Web caching. Originally, Web caching was used in cable TV Internet to mitigate the rather limited upstream bandwidth available to the provider to the rest of the Internet. However, the usefulness of Web caching is receding, because more and more web sites have moved to dynamic page generation (in which the pages change with each request that is submitted to the same web site). As a result, Web caching is becoming less and less desired by customers.

How would they work without ISP-provided DNS and caching: Very well, thank you. Caching benefits the provider, not the customer, given the current state of the Web art. This state of affairs is unlikely to change. (For DNS, see the eponymous paragraph above.)

Absent caching? Given the current state of the art, customers would see very little if any difference in their browsing experiences.

"We seek special comment on two aspects of the Title II Order's interpretation of the Act. First, the Title II Order claimed its interpretation sprang in part from a change in 'broadband providers' marketing and pricing strategies, which emphasize speed and reliability of transmission separately from and over the extra features of the service packages they offer.' It claimed this marketing 'leaves a reasonable consumer with the impression that a certain level of transmission capability—measured in terms of 'speed' or 'reliability' – is being offered in exchange for the subscription fee, even if complementary services are also included as part of the offer.'" (at 38) – I was recently invited to switch from cable modem Internet service to AT&T U-verse® service. All of the representations made to me by the seller emphasized speed and clarity of transmission. *Nothing* was said about any other services. Because I run my own mail server, any enticements involving available e-mail service fell on deaf ears. As for DNS, I run DNS BIND[54] on my own servers, while also using Google public DNS (8.8.8.8 and 8.8.4.4) as well as DNS servers that are part of a VPN link to my employer's network. What this meant is that of the three services (e-mail, DNS, and packet transmission) that U-verse® offered, the only one that was useful to me was packet transmission. The AT&T technician arrived, installed the broadband router, and departed, leaving me with nothing but plain old "telecommunications" as the only service that I'm receiving from AT&T.

54 https://www.isc.org/downloads/bind/ DNS BIND, from the Internet Systems Consortium, can be configured to provide recursive DNS name-resolution service, as well as acting as an authoritative DNS server for domain names.

Granted, I am by no means a "typical" broadband customer. I run Linux systems, not Microsoft Windows (a fact that drives ISP help desks crazy on the rare occasions when I need their assistance). However, the ranks of us "oddballs" are growing as we encounter more and more issues with access-ISP bundled services.[55]

This trend is by no means a new one. Over a decade ago, I became the first commercial customer of ADSL in northern Nevada, under Nevada Bell and Pacific Telesys. E-mail that I sent would be rejected by the recipient's mail server because Pacific Telesys's administration of its mail servers was less than stellar – largely because when I first started my DSL service, those mail servers were listed in several different DNS-based block lists.[56] That situation was the initial impetus for setting up my own mail server.

There is another growing trend regarding e-mail: people are buying their own domains, and using them for their mail and other applications. (This is akin to "number portability" in the telephony world, with the difference that it is implemented by the customer instead of by the Internet service provider.) When the customer moves to a new service provider, the customer doesn't "get" a new e-mail address, and doesn't have to go through the time-consuming hassle of letting everyone know, reprinting business cards and stationery, and updating contact information on any affected Web sites.

6.3.1 Title II Order – Commentary

FCC 15-24, at 15-16: The language about no blocking still applies today. Missing from the Title II order is the reason why some ISPs impose blocks, namely, conflict of interest with non-network portions of the ISP's (or the ISP owner's management) intruding into the ISP's stewardship of access and network services. Also missing is that the language should be applied only to those access ISPs that have monopoly or duopoly control in the market.

FCC 15-24, at 32: **"Reasonable Network Management"** – the Title II Order does not define "reasonable network management" – at least not in a way that ISPs can use as a bright-line guide. I propose that, to fix this problem, the FCC consult with the Internet Engineering Task Force on the topic of network management best practices, and incorporate any IETF contribution into its subsequent rules.

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55 (And comparable difficulties with Windows-based operating systems.)

56 When Nevada Bell made ATM access available to third-party ISPs, I moved to that ISP as quickly as I could. One thing that sold me on the move was the vigor with which the System Administrator terminated customers who violated the ISP's Terms of Service (which terms included, in part, a prohibition on sending spam).

FCC 15-24 at 78: **"Broadband providers function as gatekeepers for both their end user customers who access the Internet, and for various transit providers, CDNs, and edge providers attempting to reach the broadband provider's end-user subscribers. As discussed in more detail below, broadband providers (including mobile broadband providers) have the economic incentives and technical ability to engage in practices that pose a threat to Internet openness by harming other network providers, edge providers, and end users."** – This issue is at the core of my point about conflict of interest, namely, that those access-service ISPs who maintain a monopoly position need stricter regulation. The market can't operate in a natural way when there is insufficient competition to allow customers to sidestep unwanted gatekeeper effects.

(Time constraints prevent Commenter from analyzing and commenting on an Order that is 400 pages long. That may well be part of the problem with the Title II Order – it's just *too long*.)

And one additional point remains to be made regarding the Title II Order:

FCC 15-24 page 255, in III.A: **"The end result of all this? Even for the most basic web browsing functions, an ISP is doing more than merely offering transmission between points of the user's choosing. Indeed, as one commenter put it, 'it is literally impossible for a broadband user to specify the 'points' of an Internet 'transmission' on the web' since the user is really just 'specifying the original source of the information the user wants to retrieve' and the ISP then uses that information to choose the endpoint among several alternatives. Or as the Stevens Report put it, Internet access service enables subscribers 'to access information with no knowledge of the physical location of the server where that information resides,' not 'between or among points specified by the user.'"** – Here is yet another statement that is based on assumptions that are false to fact. The access ISP is *not* offering any other service apart from providing a path for packets to enter the packet-switching (routing) phase, such that through that routing process (which involves many ISPs), the packets that were entrusted to the access ISP eventually reach the desired destination server.

6.4 NPRM – III. Ending public-utility regulation of the internet, continued (page 14 *et seq.)*

"We believe the Commission under Democratic and Republican leadership alike was correct in these decisions to classify broadband Internet access service as an information service and that, 20 years after the passage of the Telecommunications Act, we should be reluctant to second-guess the interpretations of those more likely to understand the contemporary meaning of the terms of the Telecommunications Act. We seek comment on our assessment." (at 39) – The decisions were arguably correct *at the time when the Telecommunications Act was amended*. However, times change. Since the enactment of that Act, there has been a growth in the number of broadband-access ISPs that provide free, open, proper and fair Internet service. However, increasing numbers of these ISPs are also vulnerable to conflicts of interest.

The issue could be resolved through the implementation of two separate categories of ISPs that provide telecommunications services, namely, (i) monopoly providers and (ii) competitive providers. See the Proposal near the beginning of this Comment.

"The Commission has previously concluded that Congress formally codified information services and telecommunications services as two mutually exclusive types of service in the Telecommunications Act. The Title II Order did not appear to disagree with this analysis, finding that broadband Internet access service was a telecommunications service and not an information service. We believe this conclusion regarding mutual exclusivity is correct based on the text and history of the Act. We seek comment on this analysis." (at 40) – The view of access service and switching service as "telecommunications" and applications service as an "information service" easily passes the laugh test – it's clear that access and packet-switching are not 'advanced services' at all. Where the conclusion breaks down, in regulatory terms, is that it completely ignores the factor of competition in access services. Lumping *all* broadband access service into Title II imposes an undue burden on the majority of the ISPs that offer access service.

Attention needs to be focused on the broadband services provided by an ISP that is a monopoly provider, particularly when the monopoly position is established by an act of law, a license, or an agreement (such as a concession or franchise agreement) with a government entity, or through an exclusive contract with an entity that provides wires, coaxial cable, or fiber-optic in a public or utility right-of-way.

"Finally, the Title II Order deviated further from Commission precedent to extend its authority to Internet traffic exchange or 'interconnection,' 111 an area historically unregulated and beyond the Commission's reach. We believe Internet traffic exchange, premised on privately negotiated agreements or on a case-by-case basis, is not a telecommunications service." (at 42) – In point of fact, peer service *is* a telecommunications service – but one that does not need Title II regulation, if any regulation at all. The reason is that peer and backbone networks are run by specialty companies, with little or no potential (let alone actual) conflict of interest with the networking function. To date, this Commenter has seen no complaints of malfeasance on the part of any of the core networks. Unlike the hapless customer at the end of an access-service circuit, peers usually have multiple interconnections available, and can easily "route around" any "bad apples."

"We note that the Commission's Title II Order also went well beyond agency precedent in important ways. For instance, the Commission did not limit its analysis to the 'last mile' connections at issue in the Brand X and the FCC's underlying proceeding in that case. Rather, the Commission's Title II Order defined Internet access service as extending far deeper into the network. We seek comment on the significance of this expansive departure from agency precedent." (at 43) – The core ISPs would have needed to build the cost of complying with regulations into the costs of their services; the customers of the core ISPs would have to add these increases to their budgets, and consequently to the rates they charge *their* customers. Call it a form of "FCC tax" in the wholesale interconnect market. Any perceived benefit of imposing such a tax is far outweighed by its cost. It makes sense to remove this burden from a group that historically has not required regulation, and in whose culture the ISPs provide the regulation, rather than being subject to it.

"Following the 2014 Notice and in the lead up to the Title II Order, Internet service providers stated that the increased regulatory burdens of Title II classification would lead to depressed investment." (at 45) – FCC regulation is not tailored to fit the size of the organizations it regulates. The same legal effort – and its cost – are borne by small, large, and not-for-profit organizations, including government organizations. The Title II Order is over-broad in encompassing all ISPs. In contrast, my proposal to limit Title II regulation to those companies that hold monopoly status in their markets would, quite properly, relieve the burden that would otherwise be imposed on the smaller players.

That relaxation of regulation would encourage small players, and non-profit players, to invest in expanding broadband in underserved areas and in poor areas whose populations can't afford the subscription price. It might also encourage new facilities-based ISP development in urban areas, to compete with the established (and in many cases monopoly) ISPs that use facilities located in public and/or utility spaces.

"We also seek specific comment on how the classification of broadband Internet access service as a telecommunications service has impacted smaller broadband Internet access service providers, many of whom lack the dedicated compliance staffs and financial resources of the nation's largest providers." (at 47) – As noted earlier in this Comment, the cost of understanding the regulations is the same for both large and small providers. The large providers can spread this cost across a larger customer base, which puts them at an advantage. By removing Title II status from the smaller players, the cost of regulation under Title I, which is considerably less, would prevail. As a result, expansion by smaller players would become more attractive to investors and lenders. If the small players grow larger and become monopoly players, the scope of the regulations governing them can be changed to fit the circumstances.

However, the smaller players are not the problem.

"We also seek comment on specific ways in which consumers were harmed under the light-touch regulatory framework that existed before the Commission's Title II Order. Much of the Title II Order focused extensively on hypothetical actions Internet service providers 'might' take, and how those actions 'might' harm consumers, but the Title II Order only articulated four examples of actions Internet service providers arguably took to justify its adoption of the Internet conduct standard under Title II. Do these isolated examples justify the regulatory shift that Title II reclassification entailed? Do such isolated examples constitute market failure sufficient to warrant pre-emptive, industry-wide regulation? Were pre-existing federal and state competition and consumer protection regimes, in addition to private sector initiatives, insufficient to address such isolated examples, and if so, why?" (at 50) – Let's take each question one at a time.

Isolated examples: First, ordinary consumers would not recognize that the problems they experience when attempting to gain access to their favorite web sites, or while using their favorite applications, are the result of intentional disruptions by their access-service ISP. Indeed, the average consumer is not competent to diagnose network and network-induced problems of any kind. To most customers, the Internet is this "big black box" that lets them send and receive e-mail, surf the web, stream audio-visual content, tweet, share pictures, make

Internet telephone calls and video calls, and participate in on-line conferencing. As these consumers see it, the system either works, or it doesn't.[57]

Here is a comparable instance: Why doesn't the FCC catch more people violating Part 15[58] of the rules? Because it *can't*. And why not? Because the disciplinary process is driven by complaints. But in order for complaints to be submitted to the FCC in the first place, the people making them must be technically knowledgeable enough to (i) understand that a problem exists, *and* (ii) detect that the problem was due to interference by another party, *and* (iii) comply with the process of filing a complaint. That's quite a few "and"s.

The Title II Order, without actually discussing it by name, exposed the conflict-of-interest issue within certain ISPs. The imposition of Title II status was not limited to ISPs with conflicts of interest and monopoly operations, but was ladled onto all ISPs like barbecue sauce over a rack of ribs. My proposal for the selective imposition of Title II regulation would solve this problem.

Justification: Where there's smoke, there may well be fire. The four examples cited above proved the existence of a problem. Because customers can't accurately determine blame in order to make complaints, the very existence of the four problems means there are far more exemplars which have not been discovered – rather like the visible 10% of an iceberg, with the other 90% out of sight underwater.[59]

Market failure: See "Justification" above. Customers will not switch to other providers, (assuming there *are* any other providers) unless they understand that the problems they are having are caused by their current provider. Compare the situation with ownership of a car: customers aren't aware that there are defects or other problems in their vehicle until the repair bills get too high, or until some enterprising media outlet breaks the news (usually with "the sky is falling"-style headlines). Only then will the customer consider shopping for a replacement.

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57 Even people well-versed in network operations can get tripped up. Exhibit A: My experience with AT&T U-verse.® When I ordered my U-verse® service, I also ordered a fixed IP address, with assurance that my mail server would work. So I switched from my old service to my new service on a Saturday. Everything appeared to work, for both receiving *and sending* e-mail. On Tuesday, I was astonished when people said they weren't getting my e-mail messages. I switched back to my old Charter cable modem service, because that service worked. After considerable troubleshooting, I discovered that AT&T had imposed a block on port 25/tcp outbound... *on business class service* (and on a Sunday)! It took many calls to the AT&T U-verse® help desk ("No, I'm sorry, but I don't use Windows"). Only after escalating the ticket to a specialist was I successful in having that block removed.

58 47 CFR 15.

59 In computer software development and mathematics, there are only three numbers that matter: "zero," "one," and "many."

Consumer protection regimes insufficient: Yes, to being insufficient. The Internet, and the inner workings of a TCP/IP system, are far too complex for most consumer protection agencies to understand, let alone mitigate or prosecute. Witness the inaccuracies in the law itself, in 47 USC 230 and 231, as described in my answers to your questions about them. If the rules are not well defined, the existing agencies, *including the FCC*, are at a disadvantage in terms of enforcing them. The Wild West nature of the current Internet is a far cry from the orderliness of its NSFnet precursor, whose the rules were spelled out in detail, and it was much easier to determine the appropriate actions to take with regard to those rules.

6.5 Cellular broadband Internet, generally (NPRM pages 15-25)

I believe your detailed questions about cellular broadband Internet are outside my area of competence. However, in the research I've done on some of your questions, I have yet to find a compelling argument for treating cellular broadband Internet access services any differently from any other form of wireless (or wireline) broadband Internet access services, at least as far as Net Neutrality is concerned.

I base much of this opinion on the research that was published in *Communications of the ACM* and *ACM Computing Surveys* on AlohaNet, which was Ethernet over radio. (Indeed, Robert Metcalf, of Xerox Palo Alto Research Center [Xerox PARC], was inspired by AlohaNet to invent Ethernet networking, by using coax as "ether" and applying the lessons from AlohaNet in order to make the system work.)

6.6 NPRM – IV. A light-touch regulatory framework (pages 25-37)

"Proposing to restore broadband Internet access service to its long-established classification as an information service reflects our commitment to a free and open Internet." (at 70) – Quite: just as removing all police presence from city streets reflects a city's commitment to free and open travel and association. Not to mention the freedom to be mugged on a regular basis by people who don't subscribe to the idea of the freedom to be left alone. It could work... for a while. But the eventual result will annoy peace-loving people who hope for fair play.

"To the extent we decide to retain any of the Commission's ex ante regulations, we seek comment on whether, and how, we should modify them, specifically considering different approaches such as self-governance or ex post enforcement that may effectuate our goals better than across-the-board rules." (at 70) – We should consider the circumstances surrounding each ISP – specifically, whether the ISP is operating in a monopoly environment – and impose stricter regulations only on monopoly ISPs.

"Do the standard and its implementing factors provide carriers with adequate notice of what they are and are not allowed to do? Does the standard benefit consumers in any way and, if so, how? We believe that eliminating the Internet conduct standard will promote network investment and service-related innovation by eliminating the uncertainty caused by vague and undefined regulation. Do commenters agree?" (at 73) – This Commenter agrees in part, and disagrees. Let's look at each question.

Adequate notice: The current rules assume a fixed environment, and do not allow for changes. The rules are also vague. I would prefer to see a set of rules developed by a formal Standards-setting body – especially one that operates under American National Standards Institute (ANSI) rules for forming Standards. One such body is the Internet Engineering Task Force (IETF). Further, if the IETF formulates the rules, then network engineers will be able to read and understand them, and moreover teach management et al. what the rules mean in a business setting. Even more importantly, as the Internet ecosystem evolves, changes in the proposed Standards can be implemented considerably more quickly through the Working Parties than through the FCC rule-making process. The Standards-making process allows *all* of the interested parties – not just the "propeller-heads" – to participate and to contribute constructively to the development of the Standards.

The precedent for such an action can be found in the FCC's actions in developing the Part 68 rules for telephone network connections to "foreign" devices. During that effort, the FCC consulted with the Modem Working Party.

Customer benefit: The development of a set of Standards benefits customers by giving management time to implement some of the more draconian ideas that have been proposed, in order to address the issues related to conflicts of interest. The presence of the Standards doesn't stop the conflicts. Instead, it's like having police officers and security guards on the beat, discouraging burglars and vandals from breaking into businesses and homes.

Promote network investment: Yes, eliminating the vague rules will improve investment by reducing the risk. Replacing the vague rules with more definitive and understandable ones will accomplish the same thing. If the rules are couched in the language of network engineers, the risk is even lower, and there is *more* of an incentive to expand, because the lawyers (in consultation with the network engineers) can see the bright lines and use them as a guide for the application of element identification against clear rules whenever an action is proposed.

"Case-by-case basis using a 'non-exhaustive list of factors'... The Report, and the investigation that preceded it, left Internet service providers with two options: either wait for a regulatory enforcement action that could arrive at some unspecified future point or stop providing consumers with innovative offerings. We seek comment on whether this roving mandate has impacted innovation, and what impact that has had on consumers. We seek comment on whether eliminating this vague standard will spur innovation and benefit consumers." (at 74) – This is no way to run a railroad. "[N]on-exhaustive list of factors" – what exactly does that mean?[60] "Incomplete"? Trying to impose regulation on an *ad hoc* basis merely leads to more he-said/she-said fights, increasing the risk of investing in new broadband or in competing broadband. In the days of NSFnet, the National Science Foundation provided clear and concise guidelines for how member network operators should act, and judged any breach of the rules against those guidelines.

Impacting innovation and customers: Customers are unable to understand the current rules, let alone determine whether they have grounds to file a complaint. Innovation appears to have been impacted only in a minor way; people are still developing and releasing new Internet applications, with an eye toward circumventing any roadblocks erected by the ISPs. But those circumventions slow down development, increases the risk to the developers, and reduce the robustness of those applications – and thus hampers innovation.

Benefit to eliminating vague standards: Elimination will change the environment in which developers operate, but can easily open the door to malfeasance on the part of monopoly providers. Replacing the vague standards with well-defined Standards (with a capital "S"), developed by all of the members of the network community (for example, in the way provided by the ANSI-mandated methods of developing Standards – which the IETF also supports), will spur innovation and benefit customers, because lawyers can apply element identification against well-defined, recognized Standards and make concrete decisions with considerably less risk.

60 Black's Law Dictionary is silent about the phrase "non-exhaustive"

"Beyond the few, scattered anecdotes cited by the Title II Order, have there been additional, concrete incidents that threaten the four Internet Freedoms sufficient to warrant adopting across-the-board rules?" (at 77) – Of course there have been concrete instances of actions by monopoly ISPs that threaten the four Internet Freedoms. Monopoly ISPs with conflicts of interest will do just enough to achieve their goal of reducing competition without sticking their heads above the foxhole rim. It is in the monopoly ISP's best interest to "fly under the radar" as much as it can, to avoid bad PR or even more damaging consequences.

In other words, the problem is that customers are <u>not aware</u> that their broadband access ISP is playing these games. Customers are less than skilled in detecting their occurrence, and further have no idea how to complain about them, until some enterprising soul recognizes the problem and makes a big noise about it, usually on YouTube or in the press. Sometimes these disclosures are mistaken, which makes YouTube and the press unreliable sources for finding trustworthy reports of other incidents.

Further, your question does not define what you mean by "across-the-board rules." Here again, Commenter suggests that the FCC ask the Internet Engineering Task Force (IETF) to define a specific and explicit set of rules that are easy for a network engineer to understand, so that network engineers can then provide useful advice to attorneys and management. Such a path encourages certainty, while also easing the FCC's task of applying element identification to the issues brought to light by complaints.

And if by "across-the-board" you mean "everyone," I must disagree with that definition. <u>Strict rules should be applied only to ISPs that are operating as a monopoly in broadband access service</u>. It is in that sector of the marketplace that you find the entities that are most likely to let their conflicts dilute their network business effectiveness and their fair dealing.

"The Commission partially justified the 2015 rules on the theory that the rules would prevent anti-competitive behavior by ISPs seeking to advantage affiliated content. With the existence of antitrust regulations aimed at curbing various forms of anti-competitive conduct, such as collusion and vertical restraints under certain circumstances, we seek comment on whether these rules are necessary in light of these other regulatory regimes. Could the continued existence of these rules negatively impact future innovative, pro-competitive business deals that would not by themselves run afoul of merger conditions or established antitrust law?" (at 78) – Show me *one* instance in the 2000 and 2010 decades in which other regulatory regimes have applied their rules against ISPs, especially those with conflicts of interest, and succeeded in stopping anti-competitive conduct.

"Given that an ISP can avoid Title II classification simply by blocking enough content, are the purported benefits of the existing rules more illusory than they initially appear? By disclosing to consumers that it is offering a "curated internet experience," can an ISP escape from the ambit of the rules entirely? We seek comment on the implications of the D.C. Circuit's observation." (at 79) – If you are rescinding the Title II order, then this point is moot.

"The Commission has repeatedly found the need for a no-blocking rule on principle, asserting that 'the freedom to send and receive lawful content and to use and provide applications and services without fear of blocking is essential to the Internet's openness.' We merely seek comment on the appropriate means to achieve this outcome consistent with the goals of maintaining Internet freedom, maximizing investment, and respecting the rule of law." (at 80) – Currently, the best practice for blocking traffic by port and by IP address is addressed by Internet Standards documents (RFCs).[61] [62] Other Standards documents mention the implementation of blocking for specific network-management purposes. These Standards evolve. This is why I suggest that the FCC ask the Internet Engineering Task Force (IETF) for recommendations.

Once you have a good list of rules, then you have to apply them. Most malicious blocking is done by ISPs that possess monopoly power and also have conflicts of interest. It's hard to measure the latter, but the former can be defined fairly easily. My proposal for limiting Title II regulation to ISPs meeting the criteria for monopoly service and size appears at the beginning of this Comment.

There is no need to saddle all ISPs with Title II – just the ISPs that, while providing access services, have the ability to lock in their customers through monopolistic practices.

"In the Title II Order, the Commission concluded that throttling was a sufficiently severe and distinct threat that it required its own, separate, codified rule. ... We seek comment on whether this rule is still necessary, particularly for smaller providers. How does the rule benefit consumers, and what are its costs? When is "throttling" harmful to consumers? Does the no- throttling rule prevent providers from offering broadband Internet access service with differentiated prioritization that benefits consumers? Does the no-throttling rule harm latency-sensitive applications and content? Does it prevent product differentiation among ISPs?" (at 83) – Throttling can be beneficial to customers

61 https://en.wikipedia.org/wiki/Ingress_filtering
62 https://tools.ietf.org/html/rfc2827

if and when it is applied evenhandedly. For example, an ISP can offer "tiers" of service with different bandwidth capabilities (such as speed) at different prices. The slower the transfer rate, the cheaper the subscription. This kind of throttling should be permitted.

Throttling can also reduce the need for an ISP to purchase additional uplink bandwidth, as long as the throttling is done for *all* of the packets coming from the cloud. (I'm excluding CDNs from this group, because they bypass the bottleneck between the ISP and the cloud.)

Through the use of discriminatory throttling, ISPs with conflicts of interest can ensure that a customer's experience of a product via the Internet is less pleasant than that same customer's experience of the same product via the ISP owner's proprietary transport mechanism. When the ISP in question is a monopoly provider, the customer has no recourse but to either endure the impaired experience or buy the non-Internet product.

"We seek comment on current traffic delivery arrangements online. How do content, application, and service providers host their data online? Do they rely on installing their own servers in data centers, content delivery networks, or cloud-based hosting? ... It appears that some larger online content providers like Netflix host their own data centers and interconnect directly with Internet service providers. Is that still true? ... How should the existence of these arrangement impact our evaluation of whether Internet service providers should be able to offer an alternative delivery option [for] such paid prioritization?" (at 87) – First, the phrase "service provider" should be removed from this question, because content providers and applications providers are both, by definition, "service providers." Next, application-service ISPs use a variety of means to host their data online. One or more of:

- They could have servers located in their offices or data centers, with an uplink to one or more wholesale access-service providers.
- They can co-locate equipment at ISP data centers, private data centers, and "telco hotels."
- They can use cloud-based services (such as Amazon AWS) to create "virtual servers."
- They can sink a caisson full of running servers to the bottom of Puget Sound.
- They can make arrangements with Content Delivery Networks (CDNs) to host and/or deliver their contents. Such CDNs can have dedicated links to certain large ISPs, by contract, to bypass the ISP uplinks to avoid clogging those uplinks, and links to the Internet in general for traffic going to other ISPs.

The concept of "paid prioritization" can be evaluated from a variety of viewpoints, any or all of which may be held by an ISP, such as:

- "That site over there, that wants to send so much data through my uplinks to my customers, will eat up an unreasonable percentage of my upstream bandwidth, so I will throttle their traffic to something 'reasonable.' That way, all of my customers will have a chance to access their sites over the Internet."
- "That other site, that wants to send so much content through my uplinks to my customers, can't do it for free. It needs to pay for the right to talk to my customers, even though my customers have paid a subscription fee that entitles them to 'unlimited' Internet access."
- "If my customers want to talk to a bloated-bandwidth-user provider, they need to pay more money (i.e., a surcharge) for the privilege."
- Some combination of the above three viewpoints.
- "If you want faster access to my customers, you'll have to pay for a port and lease a line to connect to it. Then your traffic will pass through fewer routers, and arrive at my customer more quickly, and without any delays caused by my uplink(s) being saturated by other traffic." (This is what CDNs, and some larger content providers, do.)
- "If you want faster and better access by my customers, you can co-locate a server in my data center."

(NOTE: Several years ago, when I worked at a web-hosting company, I was surprised when a blue 1U server sporting the Google logo was delivered. I was told that Google was co-locating a search node at our data center. My employer's company did not provide access service, but did provide co-location services.)

My take on paid prioritization is this: If you are going to charge for prioritization, it had better include increased bandwidth or better and/or faster customer access. If the charge is a pure "bandwidth tax" unaccompanied by improved service, it's a no-no.

"Scope. Should we keep any of the existing bright-line rules or the transparency rule, we propose maintaining the definitions of the services applicable to the rules, the scope of the term 'lawful content,' the exception for reasonable network management, and other provisions adopted in the Title II Order so as not to impact ISPs rights or obligations with respect to other laws or safety and security considerations. Reasonable network management 'allow[s] service providers the freedom to address legitimate needs such as avoiding network congestion and combating harmful or illegal content' without running afoul of the rules. With respect to the definition of 'reasonable network management,' we seek comment on whether we should eliminate the restriction imposed by the Title II Order that the exception will only be considered if used for a 'technical management justification rather than other business justifications,' or if we should return to the 2010

definition of 'reasonable network management' that did not contain that qualifier." (at 93) – As noted earlier, the current rules are vague. Consequently, I suggest that the FCC ask the Internet Engineering Task Force (IETF) to provide a list of best network management practices. The Standards-setting process would then allow all interested parties to provide input regarding any responses, particularly from the ISPs' network engineers.

"Application to Mobile. To the extent we keep or modify any of the existing rules, we seek comment on whether mobile broadband should be treated differently from fixed broadband." (at 95) – So far, I have seen no compelling arguments in favor of treating mobile broadband any differently than any other media for broadband access services.

6.7 NPRM cost-benefit analysis, generally (pages 35-37)

The Commenter does not feel comfortable trying to answer any of the specific questions asked in this part of the Notice. (Please do not confuse me with the Dr. Stephen Satchell who is an Economics Fellow at Trinity College, Cambridge, England, or the other one at the University of Cambridge, England.)

6.8 NPRM – Statements of the Commissioners (pages 59-75)

6.8.1 Statement of Chairman Ajit Pai (pages 59-61)

"[f]or nearly two decades, the Internet flourished under a bipartisan, light-touch regulatory framework." (PAI ¶1) – This statement is a very short-sighted view of the growth and development of today's Internet. It reflects a surprising degree of unfamiliarity with the history and evolution of the Internet. Specifically:

- It fails to take into account the fact that ARPAnet (the precursor to the Internet) was run with an iron fist by the Department of Defense Advanced Research Projects Agency.
- It also disregards the fact that the civilian version of the Internet, the National Science Foundation Network (NSFnet), was managed with an iron fist by the Foundation. In particular, the NSF adamantly insisted that its network not be used for any commercial purposes at all, and that all of the connected networks "play nice," with "nice" being well-defined.
- This statement glosses over the fact that, thanks to the draconian regulation of the then-publicly funded TCP/IP networks, an industry grew up to operate in parallel with those networks, in order to avoid some of the stultifying regulations. NSFnet eventually was

retired in favor of these commercial networks. It was this rebellion "against the rules" that created the Internet as we know it today.

- Last, the statement completely ignores the impact of the regulation of the telephone network, and in particular the breakup of "Ma Bell" in the Consent Decree of 1982 (originally filed by the U.S. Department of Justice in 1974) and its aftereffects on the evolution of the Internet.

"The Internet wasn't broken in 2015" (Pai ¶4) – Agreed, the Internet was not broken in 2015. Nevertheless, it was suffering from a chronic illness: a form of nervous disorder that damaged and distorted the proper flow of data. And the problems that the 2015 Title II Order tried to solve had been in place for years prior that time. The nature of the malady can be characterized in a few short words, to wit: "conflict of interest, with a touch of discriminatory marketing," in the parts of the system run by monopoly providers.

See the section entitled "Aggregation and lack of specialization" for the complete discussion about this point, including a history of cable modems.

> NOTE: In my personal experience as a network and mail administrator, I can describe a practice that made renumbering a brace of web sites and mail domain services a major headache. Specifically, the DNS service provided by some, if not all, cable companies had the habit of ignoring the time-to-live (TTL) parameter in DNS look-up answers. Instead, the service imposed a one-week hold in its caches. Any time another service provider had to change the Internet Protocol (IP) address of its services, it would take almost a week for all of the requests from cable customers to resolve all of the new IP addresses properly.
>
> Why, you ask, was it necessary for my company to change its numbers? Well, for years my company had used IP addresses provided by its upstream service. Every time the company had to change providers (such as when it switched from Global Crossing to MCI) the company also had to replace the IP addresses it was currently using with the addresses provided by the new service. It wasn't until much later – and after a change in ownership – that my company "bit the bullet" and obtained its own block of IP addresses from the American Registry for Internet Numbers (ARIN).

Comcast's attempt to hinder the free exchange of data is a case in which the network operator was caught by someone (or perhaps multiple someones) who cared enough to file a complaint. Other blockades by other operators may not yet have been exposed, or have not yet risen to the level of triggering the filing of a customer complaint, or the publication of an expression of outrage.

> Another first-hand case in point: I recently subscribed to AT&T's U-verse® Internet product through a reseller. When I first made my connection, I found that port 25/tcp upstream was blocked. I called my [reseller] vendor, who was not aware that this block was in place, and as it turned out did not have a procedure for removing such a block. After repeated calls to AT&T directly over the period of four days, I finally got the block removed so that my on-premises electronic mail server would work properly... but when I asked for a list of Internet Packet protocols, TCP services, and UDP services that are blocked in some way, the answer from the company representative was "We don't have such a list."
>
> More interestingly, the "technical specialist" who called me back *said the exact same thing*, namely, "We don't have such a list." So if there were any more nerve damage in the AT&T service, I won't find out about it until I tried to use an application that runs up against the unpublished restrictions.

This situation exists in spite of the existing Title II regulation of broadband Internet. The clear implication is that we cannot depend on the larger Internet Service Providers to "police" themselves, or to practice transparency in their network management practices.

In view of his background as a lawyer for Verizon[63], I will yield the floor to Commissioner Pai for a description of some of the anti-customer network practices currently employed by the cellular Internet-access companies.

"... small ISPs faced new regulatory burdens associated with common carrier compliance." (Pai, ¶5) – Agreed. Saddling all broadband carriers (and possibly other Internet Service Providers) with Title II regulation is like swatting a fly with a sledgehammer. In my research of broadband carrier violations of network neutrality, zero miscreants can be classified as "small ISPs." Virtually all of the violators of what the FCC has termed *The Four Internet Freedoms* [64] are major corporations with large, and in many cases "captured," customer bases located in geographic areas where market choice is *not* available.

63 https://www.fcc.gov/about/leadership/ajit-pai

64 As outlined in a speech by Chairman Michael Powell in 2003, the Four Internet Freedoms:

- Access the lawful content of their choice.
- Run applications and services of their choice.
- Connect their choice of legal devices that do not harm the network.
- Have competition among network, application and content providers.

"We propose to return to the Clinton-era light-touch framework that has proven to be successful." (Pai, ¶6) – And should we also return to the Clinton-era environment of the Internet, in which Internet access service is provided by a multitude of independent, tightly focused players? Since the Clinton era, we have seen a dramatic drop in the number of providers. A glance at the major TV markets shows that broadband traffic is dominated by one or two players that provide Internet access service to homes, businesses, schools, and government entities, doing so exclusively through the use of public facilities. Some states have even passed laws that prevent municipalities from offering *any* broadband service. And the established players are fighting tooth and nail to prevent companies like Google from building out competing facilities-based Internet service.[65] [66] [67]

What about municipal broadband? The FCC tried to prevent states from blocking the deployment of municipal broadband services, but were shot down in court.[68] [69] So it isn't just Title II designation that is preventing the expansion of broadband deployment.

"These 150 small ISPs... critical to injecting competition into the broadband marketplace… closing the digital divide by building out in lower-income rural and urban areas..." (Pai, ¶10) – And, I might add, ISPs that have no reason to be any part of the data-mauling malady that is infecting the Internet today. These smaller ISPs typically have Internet service as their *only* business. Commenter agrees that imposing Title II on smaller, more focused entities is not in the best interest of the consumer, the Internet, or the United States.

However, unilaterally removing Title II from *all* ISPs is not the answer, either. And, as mentioned earlier, we can't trust the larger ISPs (the ones with conflicts of interest) to "play nice" with the rest of the Internet. (Sometimes I long for the NSF days when bad apples could be summarily removed from the Internet by consensus of the operators. Alas, today's Internet doesn't allow for that, and indeed shouldn't. But one can dream...)

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65 https://www.techdirt.com/articles/20160314/09374733901/isps-are-blocking-google-fibers-access-to-utility-poles-california.shtml

66 https://arstechnica.com/tech-policy/2016/07/frontier-teams-with-att-to-block-google-fiber-access-to-utility-poles/

67 https://consumerist.com/2016/09/20/comcast-att-try-again-to-stall-google-fiber-in-nashville-by-writing-law-to-slow-it-down/

68 https://consumerist.com/2016/09/20/comcast-att-try-again-to-stall-google-fiber-in-nashville-by-writing-law-to-slow-it-down/

69 http://www.opn.ca6.uscourts.gov/opinions.pdf/16a0189p-06.pdf – State of Tennessee (15-3291); State of North Carolina (15-3555) v. Federal Communications Commission.

"... this authority lets bureaucrats question whether literally every network management decision is 'reasonable.'" (Pai, ¶12) – The FCC need not conduct detailed analyses of these decisions in a vacuum. There is a body of Standards, recognized by the American National Standards Institute (ANSI), that describe the Best Practices for network management, among other things. Ask the Internet Engineering Task Force (IETF) to collate these rules, in a manner similar to what the Department of Defense did in 1985 when it published the *DDN Protocol Handbook*.

History: One of the original sets of standards, consisting of a collection and codification of the Requests for Comments (RFC) framework, consisted of the NIC[70] 50004, NIC 50005, and NIC 5006 standards. Codified in 1985 by the U.S. Defense Communications Agency (DCA), they became known collectively as the *DDN Protocol Handbook*. This set of standards defined the TCP/IP protocol, universally used in the Internet, and the applications protocol that ride on Level 7[71] of the ISO network model.

Subsequently, the Internet Engineering Task Force (IETF)[72] (an organized activity of the Internet Society (ISOC)[73]), became an ANSI-recognized Standards Provider. The RFCs are the vehicle for proposing and developing new protocols and applications, based on a community consensus. Moreover, despite their name, the RFCs are regarded as Standards by the Federal Government. The IETF working groups follow the rules set by ANSI for the development and publication of Standards.

From the RFCs, the FCC can extract (or arrange for the extraction of) a list of common, customary, and accepted networking practices. This list can be incorporated into any rules that the FCC develops, so that network operators will *know* what behavior on their part is and is not acceptable.

➡ PROPOSAL: <u>That the FCC ask the IETF to create a list of accepted good practices</u>.

The notion of having the FCC's ask Standards Working Parties for guidance is supported by precedent. For example, the development process for the Part 68 rules[74] comes to mind.

70 "NIC" is "DDN National Information Center"
71 https://support.microsoft.com/en-us/help/103884/the-osi-model-s-seven-layers-defined-and-functions-explained.
72 https://www.ietf.org/
73 http://www.internetsociety.org
74 47 CFR 68.

The overriding benefit of this proposal is that the entire Internet community – the FCC, telephone companies, cable companies, wireless providers, applications (Web, e-mail, chat, &c) providers – can help shape the development of a document that embodies a comprehensive Best Practices Standard, so that there is *no* uncertainty regarding how networks should be operated and how future innovations can be incorporated with minimal disruption.

If an issue arises that falls outside the four corners of the resulting document, there is a procedure within the IETF for the amendment and updating of the corresponding Standard. And if the FCC is uncomfortable with any part of such a document, it can include in its rules a forbearance or an amplification, using its customary procedures.

6.8.2 Dissenting statement of Commissioner Mignon L. Clybord (pages 62-74)

"For those of us who are fortunate enough to have broadband access at home, and do not have to trek to a library and wait for a free terminal or troll for free Wi-Fi on street corners or fast food establishments, not only are you fortunate, but you know that it is among the first utilities you make sure is working, right after your electricity and water. … That you can run your online business, access content over the internet, and exercise free speech, without your service provider or anyone else getting in the way." (MLC ¶9) – This statement overlooks an entire class of broadband users: citizens who work from their home as employees who telecommute. Some companies, particularly companies in large cities, recognize the commuting to and from work adds to local road congestion. For those employees who don't need to be physically present in the office, telecommuting reduces pollution, reduces non-working time, and reduces potential losses of productivity. More than ever, broadband Internet makes telecommuting possible.

I am one such telecommuter. My job is to write and maintain software to manage a number of sets ("racks" or "pods") of Cisco telecommunications devices, monitoring the health of these devices, and reporting any problems to the on-site technicians. (And, on certain rare occasions, during off-hours, I physically commute the 3,000 feet between home and office to fix problems that require physical hands-on attention to the hardware.)

Those racks are used by network engineers worldwide to practice their skills in preparation for Cisco CCNA, CCNP, and CCIE certification exams. In order for network engineers to pass the timed exams, they must not only be familiar with the technologies, but also know how to apply their knowledge quickly and accurately, fix problems, and implement changes to improve

network operation. The racks provided by my company let the engineers hone their skills on equipment that is connected to the Internet not directly, but through a buffer. This arrangement allows the engineers to access the devices, while preventing any potentially adverse results of the engineers' exercises from affecting the 'Net itself.

What started as a convenience and a cost-saving measure for my employer turned into a necessity when I was diagnosed with PAH (Pulmonary Arterial Hypertension) coupled with COPD (Chronic Obstructive Pulmonary Disease), which require me to use an auxiliary oxygen supply 24 hours a day. The fact I'm tied down by that damned breathing hose and the oxygen concentrator doesn't prevent me from being a productive member of society. Indeed, in view of my condition, limitations, and age, without the ability to telecommute I would have been a candidate for Social Security Disability instead of a productive taxpayer.

"I find it ironic, however, that many of the voices who support [17-108], including the [sitting] majority of the Commission, said that it should be Congress's place to decide the future of broadband regulation." (MLC, ¶13) – I asked all of my three Congressional representatives (two Republicans and one Democrat) if they believed that the task of creating broadband regulation should rest with Congress. "No, it's the FCC's job. If the FCC feels that there needs to be legislation," they said, "the FCC should formally ask Congress to provide it" (paraphrased). I submitted letters containing the present suggestions to them anyway.

"No consultation of FCC staff technologists or other technologists?" (MLC, ¶21) – My recollection is that some consultation of this nature did take place. For example, during the previous Net Neutrality cycle, at a panel discussion held at the THINK ("Hackers") Conference in California, some of the panelists consisted of the outside technologists who had been invited to speak with Commission staff. I also recall that non-staff technologists provided specific answers in response to the questions that were asked in the NPRM for that cycle, in the same way as I have done in this Comment for the present NPRM, drawing upon my own expertise, knowledge, and experience. Thus, the cited point implies assumptions that are arguably false to fact.

"Today's broadband networks are multi-sided platforms. They create value by bringing together customers, services, and devices and facilitate interactions between all of them to create value for the entire internet ecosystem. When there is no platform competition, consumer and social welfare can suffer." (MLC, ¶25) – Commenter strongly disagrees. Today's broadband access services – wire, coax, fiber, or wireless – are simply on-ramps to the Internet, nothing more. The Internet *as a whole* creates value by bringing together

customers, services, and devices, and facilitates interactions among all of them to create value for the entire Internet ecosystem.

Broadband access networks, by themselves, are useless. Gone is the heyday of the all-in-one information service like CompuServe, GEnie, Delphi, and AOL, just to name a few. Sadly, 47 USC 230 and 231 seem to be mired in this antiquated view of the information ecosystem, instead of adopting a more accurate view of the role of the contemporary Internet – which, in contrast to its predecessors, does not depend on a single management to provide the access to information that we enjoy (and often take for granted) today.

"Tellingly, the majority [of the Commissioners] does not propose any provision of law to underpin any of the open [I]nternet rules on which it seeks comment." (MLC, ¶66) – Are new laws necessary? Or just modifications and "tweaks" to existing ones?[75] Some of the talking points of Net Neutrality center around technical issues, while others pertain to business policy and conflicts of interest. Recent jurisprudence shows that in terms of enforcing non-technical regulations (or technical regulations that stem from non-technical actions), the current situation is a quagmire. If, in its regulations, the FCC would limit itself to technical issues and leave the "social engineering" aspects to, say, the Federal Trade Commission, the FCC could relieve itself of a major burden.

However, I do believe that 47 USC 230 and 231 need to be updated, and have said so to my representative and senators.

"While the majority engages in flowery rhetoric about light-touch regulation and so on, the endgame appears to be no-touch regulation and a wholesale destruction of the FCC's public[-]interest authority in the 21st century." (MLC, ¶81) – Commenter shares this view. After seeing what interest-conflicted ISPs have done in the furtherance of their private interests to the detriment of the public interest, and having observed the conscienceless conduct of corporations in other markets, I hold out very scant hope for the consumer, especially when the monopoly players put a heavy thumb on the scales of data presentation, all the way from their on-ramp to the 'Net to the applications services. Or, worse, put up toll booth or road blockades.

75 Such as modernization of 47 USC 230 and 231, to harmonize the statutes with reality.

6.8.3 NPRM – Statement of Commissioner Michael O'Reilly (page 75)

"I was not persuaded, based on the record before us, that there was evidence of harm to businesses or consumers that warranted the adoption of net neutrality rules, much less the imposition of heavy[-]handed Title II regulation on broadband providers" (MO'R ¶1) – Commenter agrees in part and disagrees in part. Determining "harm" is a tough nut to crack. Broadband providers with significant conflicting interests will cry "Harm!" when their financial bottom line is affected by an FCC action (such as enforcement of the Four Internet Freedoms). (And in many cases, customer don't recognize when they are being "played" by conflict-ridden Internet services, because the damaging actions are subtle enough to avoid attracting attention.) Broadband providers with a somewhat clearer focus on the most important element of being an Internet Service Provider – namely, their customers – will not be harmed by such FCC actions.

The same holds true for the telephone companies, which have major conflicts of interest when they provide telephony services in the face of Internet-based equivalents: Voice over IP and products such as Skype and GoToMeeting. Some actions will be draconian or dramatically obvious, while others will be so discreet that all the customer is aware of is a vague sense that a particular application leaves something to be desired... when the problem is actually the nervous malady in the ISP that degrades real-time applications without causing them to fail outright.

The imposition of Title II across the board was not a wise decision. It's worth reiterating: Title II should be applied only to ISPs that are using "public" facilities (whether by law or under a government contract) in a monopolistic way that effectively shuts out competition. When Bad Things Happen,™ customers should be able to vote with their wallets. But in most locations, they can't. So, just as the telephone monopoly begat telephony regulation with Congress and the FCC, so also should Internet monopoly beget similar Internet regulation – but only for the industry players who structurally constitute a monopoly in their marketplaces, and who are large enough to stifle any competition.

7. About the Commenter

- Data interchange research and development, Southern Illinois University.
- ARPAnet and Network Graphics Protocol, University of Illinois.
- Wire-service capture for MetroText, MGD Graphics System (a Rockwell company).
- Automated Clearing House (ACH) transmission over synchronous dial-up and dedicated leased lines, Cummins-Allison Corp.
- Winmodem test manager, Motorola ISG.
- Columnist, reviewer, and Director of Hardware Testing, *InfoWorld* magazine.
- Consultant and freelance writer, *Ziff-Davis Publications* and ZD Labs.
- System, network, and mail administrator, AM [Web] Hosting (Reno, NV).
- Cisco equipment automation and support, INE Inc. (formerly Internetwork Expert, Inc.).
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- Former member, Association for Computing Machinery (ACM).
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- Former member and Standards editor, Telecommunication Industry Association (TIA) TR-30.3 Working Group.
- Charter member of the Internet Press Guild, http://www.netpress.org.
- Co-author, *Linux IP Stacks Commentary*, ©2000 Coriolis Open Press, ISBN 1-57610-470-2.

Respectfully submitted for your consideration,

Stephen T. Satchell

Electronic mail regarding this Comment may be sent to the “wc-17-108” mailbox at my mail domain, “satchell” (dot) “net” for immediate processing. Mail to the registered e-mail address associated with this Comment is a “catchall” and thus e-mail addressed there will experience delays in processing.