No. 11-1355

ORAL ARGUMENT NOT YET SCHEDULED

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

VERIZON ET AL.,

Appellants,

v.

FEDERAL COMMUNICATIONS COMMISSION,

Appellee.

ON PETITION FOR REVIEW OF AN ORDER OF THE
FEDERAL COMMUNICATIONS COMMISSION

BRIEF AMICUS CURIAE OF INTERNET ENGINEERS AND TECHNOLOGISTS URGING THAT THE FCC'S ORDER BE AFFIRMED

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November 15, 2012

CERTIFICATE AS TO PARTIES, RULINGS, AND RELATED CASES

A. PARTIES AND AMICI

All parties, intervenors, and amici appearing in this Court are listed in the Joint Brief of Appellants Verizon and MetroPCS and in the Brief for Appellee Federal Communications Commission, except for the following parties who are appearing as amici:

- Marvin Ammori, Jack M. Balkin, Michael J. Burstein, Center for Democracy and Technology, Anjali S. Dalal, Rob Frieden, Ellen P. Goodman, David R. Johnson, Dawn C. Nunziato, David G. Post, Pamela Samuelson, Rebecca Tushnet and Barbara van Schewick

- Tim Wu

- It is also our understanding that two additional amicus briefs will be filed—one on behalf of various venture capital investors, and one on behalf of former FCC Commissioners.

B. RULINGS UNDER REVIEW

References to the rulings at issue appear in the Joint Brief of Appellants Verizon and MetroPCS.

C. RELATED CASES

All related cases of which Amici are aware are listed in the Joint Brief of Appellants Verizon and MetroPCS.

TABLE OF CONTENTS

TABLE OF AUTHORITIES

ADMINISTRATIVE DECISIONS

REGULATORY COMMENTS

[*] Authorities upon which we chiefly rely are marked with asterisks.

SECONDARY AUTHORITIES

STATUTES AND REGULATIONS

All applicable statutes and regulations are contained in the Joint Brief of Appellants Verizon and MetroPCS and in the Brief for Appellee Federal Communications Commission.

RULE 29 STATEMENTS

Pursuant to Fed. R. App. P. 29(c)(5), counsel for amici certifies that no counsel for any other party authored this brief either in whole or in part, and no persons made any monetary contribution to its preparation or submission.

Pursuant to Circuit Rule 29(d), counsel certifies that a separate brief is necessary. Amici include some of the nation's most preeminent Internet engineers, computer scientists, and technologists who provide a unique technical expertise and perspective to help inform the Court's decision. The technical background for these issues has not been fully developed by the parties and, to the best of counsel's knowledge, will not be fully addressed by other amici.

INTERESTS OF AMICI

Amici urge the Court to uphold the FCC's *Order*. *Preserving the Open Internet*, 25 FCC Rcd 17905 (2010) (*Order*). We are Internet engineers, computer scientists and technologists, many of whom have played important roles in creating and improving the protocols and technologies that gave rise to the Internet. Our interest is to ensure that the Internet remains an open platform for innovation, new markets, and economic growth. Other parties are addressing the constitutional and statutory questions, and we do not attempt to interpret the relevant statutes. We write instead to provide the Court with a technical perspective on both the practical benefits of open networks and the concrete threats to innovation and economic growth posed by abandoning traditional openness principles. We also address some of the technological arguments that Verizon and MetroPCS raise in their Joint Brief ("Verizon Br."). All parties and intervenors have consented to this brief.

The amici joining this brief in their personal capacity include:

- **Scott Bradner**, *Senior Technical Consultant, Office of CTO, Harvard University; involved in the design, operation and use of data networks since the early days of the ARPANET; held numerous management roles in the Internet Engineering Task Force.*

- **Lyman Chapin**, *Interisle Consulting Group; former Chair, Internet Architecture Board; former Chief Scientist, BBN Technologies*.

- **Dr. David Cheriton**, *Professor, Computer Science Department, Stanford University.*

- **Dr. Douglas Comer**, *Distinguished Professor of Computer Science, Purdue University.*

- **Phil Karn**, *Formerly with Qualcomm, Bell Labs, and Bellcore; wrote first general-purpose computer Internet software widely used by individuals and early Internet Service Providers.*

- **Dr. Leonard Kleinrock**, *Distinguished Professor of Computer Science, University of California, Los Angeles; Member, National Academy of Engineering; supervised UCLA lab that served as first node of the ARPANET; Recipient, 2007 National Medal of Science.*

- **Dr. John Klensin**, *Former Chair, Internet Architecture Board; played early and continuing role in design of Internet applications and administrative policies; former Internet Architecture Vice-President at AT&T Labs; first MCI Distinguished Engineering Fellow.*

- **Dr. James Kurose**, *Distinguished University Professor in the Department of Computer Science, University of Massachusetts.*

- **Dr. Nick McKeown**, *Professor of Electrical Engineering and Computer Science, Stanford University; Member, National Academy of Engineering.*

- **Dr. Craig Partridge**, *early member of the Internet Engineering Task Force and Internet Engineering Steering Group; architect of how email is routed through the Internet; Fellow, Institute of Electrical and Electronics Engineers; Fellow, Association for Computing Machinery.*

- **Dr. Vern Paxson**, *Professor in Electrical Engineering and Computer Sciences Department, University of California-Berkeley.*

- **Dr. David P. Reed**, *past member of FCC's Technological Advisory Council; contributor to early development of local area networks, TCP/IP and the User Datagram Protocol; co-authored foundational paper on the end-to-end design principle.*

- **<u>Dr. Scott Shenker</u>**, *Professor in Electrical Engineering and Computer Sciences Department, University of California-Berkeley; Member, National Academy of Engineering.*

- **<u>Dr. Don Towsley</u>**, *Distinguished University Professor in the Department of Computer Science, University of Massachusetts.*

- **<u>Dr. Paul Vixie</u>**, *Chairman and Founder of Internet Systems Consortium; author of BIND, the most widely-used DNS server software.*

- **<u>Steve Wozniak</u>**, *Co-Founder, Apple Computer, Inc.*

SUMMARY OF ARGUMENT

The Internet's remarkable ability to generate innovation, investment, and economic growth is a product of its openness. On the Internet, innovation requires no permission. It is a general-purpose platform that supports a wide variety of applications and services at its edges. The network has not traditionally discriminated against specific applications, nor has it been optimized for any one application. In this respect, its openness is similar to the electricity grid, which treats Dell computers the same as Maytag refrigerators or any other device that may be plugged into it.

The *Order* is a modest measure that preserves the economic, social, and civic benefits of an open and accessible Internet, while simultaneously ensuring that access providers have wide latitude to address their network's needs. We support the *Order*, and write to provide the Court with additional technical background to help inform its decision. We begin with an overview of how the Internet works and how individual networks collaborate to form a larger "network of networks" that can transmit any type of data across many types of technological mediums. We also describe some of the specific architectural features that allow the Internet to generate innovation. Following the technical background, we make the following points:

First, protecting openness promotes not only application innovation, but also leads to greater investment in network infrastructure and deployment. Innovative applications cause people to demand better and faster networks. Verizon and MetroPCS, however, challenge this view, but we respectfully disagree with their position. History illustrates that edge innovation does drive network deployment. Indeed, the rise of the World Wide Web, a classic example of edge innovation, was the "killer app" that created skyrocketing demand for Internet access, which led access providers to invest in and improve their networks in the 1990s. Further, the relationship between application innovation and demand for faster networks is not a novel concept, but was acknowledged by the FCC over a decade ago, and has even been recognized in Verizon and MetroPCS's comments in this proceeding.

Second, the *Order* preserves the benefits of the open Internet by preventing extreme forms of application-specific discrimination by access network owners.

Traditionally, the Internet has generated innovation because it is a level playing field where users independently choose the applications they prefer. Application-specific discrimination—the act of singling out certain websites and services for preferential or discriminatory treatment—not only distorts markets, it strikes at the very foundation of the Internet's ability to generate low-cost innovation and new markets. Indeed, Verizon and MetroPCS candidly acknowledge that the discretion they seek includes the ability to impose these most extreme forms of discrimination. Verizon Br. 16-17 ("The [FCC's] no blocking rule denies broadband providers discretion in deciding which traffic from so-called edge providers to carry[.] . . . [and] denies broadband providers discretion over carriage terms by setting a uniform price of zero[.]"). The *Order* represents a modest effort to prevent these measures. The *Order*, quite appropriately, does not prevent network owners from adopting measures to protect the network's security, to address congestion, to monetize their networks, to adopt reasonable network management practices, or to adopt uniform pricing structures. Instead, it merely ensures that these practices will be adopted in a manner that does not threaten the next World Wide Web from being introduced.

BACKGROUND

The Internet's ability to fuel innovation and investment stems from its flexibility and expansive reach. The Internet is not tethered to any specific technology. It allows users to receive any type of content, across any type of network, using any type of device. The Internet allows computers to connect with any other computer on the network. This global connectivity creates markets of unprecedented scope and variety. Every new startup has instant access to billions of potential customers, just as each customer has access to a seemingly infinite variety of services and content. In this section, we explain the sources of these key characteristics. We begin with a general introduction of the Internet, and then explain some of the network design principles that enable innovation and investment.

A. A Brief Introduction to the Internet

The story begins with the "packet." Digital technology allows any type of information to be represented by strings of 1s and 0s, which are known as binary digits or "bits." Computers translate these strings of bits and display them as emails, video streams, music, or any other type of content. To transmit information across the Internet, computers break down this content—these strings of bits—into smaller discrete blocks of bits (or data) called packets. Packets are similar to envelopes that the Postal Service transmits. They include addressing information on the outside and content (the "payload") on the inside.

The Internet is therefore a "packet-switched" network. The information it sends is first broken down into individual packets, which are then routed independently across the network to the final destination. The individual packets may take very different paths to reach the destination. The process is similar to separating a book into individual pages, placing each into a separate envelope, and sending each envelope along a separate path to a final destination where they are reassembled in order.[1] Packet-switched networks thus differ from circuit-switched telephone networks in which the provider creates a dedicated connection between two callers (or nodes) that lasts the duration of the call.

Packet-switched networks have many advantages over traditional circuit-switched telephone networks. For one, they are more resilient. If one part of the network fails, the packets can be quickly rerouted along another path. Second, packet-switched networks are generally more efficient. The traditional circuit-switched telephone network wasted network capacity. The dedicated connection

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[1] Jonathan E. Neuchterlein and Philip J. Weiser, DIGITAL CROSSROADS: AMERICAN TELECOMMUNICATIONS POLICY IN THE INTERNET AGE 42-43 (2005).

required capacity even if the callers were not speaking.[2] In packet-switched networks, no dedicated capacity is necessary and more users can "share" the line.

The Internet "knows" where to send the packets because all computers on the network share communications protocols. Much like a language, a protocol is a set of agreed-upon rules and conventions that enable computers to share information. One key protocol is the "Internet Protocol" (IP), which creates a universal addressing system that allows the network to route packets to their proper destination.[3] Routers—computers within the network that direct packets—traditionally looked only at the packet's addressing information and determined the most efficient path to its destination. The payload data inside the packet was irrelevant to the routing process.

In this respect, the Internet Protocol is similar to the zip code "protocol" that the Postal Service uses to "route" mail across the country. The zip code system can route mail across a diversity of physical "networks" (planes, trucks, mail carriers) regardless of the content inside the packages. Like the zip code system, the Internet Protocol addresses are independent from any underlying technological medium, and can be used to route any type of content.

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[2] Patricia L. Bellia, et al., CYBERLAW 16 (2007).
[3] DIGITAL CROSSROADS, *supra* note 1, at 121-25.

"The Internet," then, is not a single network, but the aggregation of millions of smaller networks—a network of networks. No single centralized server oversees it. The Internet appears to be a seamless network because the individual networks and computers adhere to open, non-proprietary protocols such as the Internet Protocol that allow them to communicate with each other. Although a wide variety of networks and computers comprise "the Internet," we focus here on three categories that are especially relevant to this case: (1) backbone networks; (2) access networks; and (3) edge providers and end users. All three are essential components in exchanging information across the Internet.

Backbone Networks. Backbone networks are the interstate highways of the Internet. Specifically, they are "high capacity long-haul transmission facilities" that interconnect with each other and with access networks.[4] They include high-speed routers and generally consist of fiber-optic links capable of transmitting high volumes of data. Comments of AT&T at 48-50, GN Docket No. 10-127 (July 15, 2010). JA __. Backbone networks exchange traffic with each other through peering agreements (under which data is mutually exchanged at no charge), transit agreements (under which one backbone provider charges another to transmit its data), or some variation of these two forms of agreement. *Id.* Today, there are

[4] *Verizon Commc'ns and MCI Applications for Approval of Transfer of Control*, 20 FCC Rcd 18433, 18493 (2005).

multiple backbone providers and the current market is generally considered competitive. The *Order*'s rules do not apply to backbone networks. *Order* at ¶47 (noting that "broadband Internet access service" does not include "Internet backbone services").

Broadband Access Networks. If backbone networks are the interstate highways, broadband access networks are the local roads. As the name suggests, these networks—for a fee—provide individual users and edge services with *access* to the global Internet. (The term "broadband" refers to higher-speed Internet access.) These networks thus provide the link between end users and the Internet backbone. Critically, access networks include "last mile" facilities that connect the premises of an end user (or edge provider) to the larger network. They therefore include the "side streets" and "driveways" that ultimately lead to the user's house. The most common last-mile access networks consist of coaxial cable, copper wire, fiber, or wireless technologies. The *Order*'s rules apply only to broadband access providers. *Order* at ¶50 ("[T]hese rules apply only to the provision of broadband Internet access service[.]").

Edge Services and End Users. Edge services and end users represent the "ends" of the network—the origin and destination of Internet data. Edge services refer broadly to any entity that uses the Internet as an information-delivery platform to make content, applications, and services available to end users. Edge providers thus encompass websites such as the *Washington Post*, eBay, and Google; applications such as the World Wide Web, Internet Explorer, and iTunes; and mobile applications and services such as Netflix (a video streaming service) and Instagram (a photo-sharing "app"). Both end users and edge providers typically pay access providers for their connections to the Internet. Comments of Open Internet Coalition at 27, GN Docket No. 09-191 (Jan. 14, 2010) ("In the Internet ecosystem, each user . . . pays a broadband Internet access provider to provide and receive content from the Internet."). JA __. The *Order*'s rules do not apply to edge services or end users. *Order* at ¶50 ("[T]hese rules apply only to the provision of broadband Internet access service and not to edge provider activities[.]").

Collectively, these three components of the Internet facilitate data transmission. To illustrate, consider the (simplified) example of a user in Florida accessing the eBay website whose content is stored on a server in California. The user "requests" the data by clicking a link. That request is broken down into individual packets that travel through the end user's *access* network in Florida, through one or more *backbone* networks, and then through eBay's local *access* network in California where the packets are reassembled and translated by the eBay server. The response is then repeated in the opposite direction.

This example illustrates that all three components are essential for data transmission. It also highlights the unique leverage that access providers enjoy within this system. *See* Declaration of Vijay Gill, Reply Comments of Google, Appx. B at ¶¶14-15 ("Given the realities of network engineering, providers of last mile broadband infrastructure to end user customers occupy a unique place of control.") ("*Gill Declaration*"). JA __. Access providers are the last stop on the way to the end user. Although the eBay data packets may travel over many different paths along the backbones, there is typically only one path to the end user's premises—the last mile access network (i.e., the "driveway"). All the packets must ultimately reunite at this point in the network. In this respect, access providers enjoy a "terminating access monopoly" with respect to their users. They are therefore uniquely positioned to differentiate among the packets that their customers request. They can speed some packets up, slow them down, or even block them based on information on the outside or, increasingly, the *inside* of the packets.

B. How the Internet's Design Generates Innovation and Investment

The Internet's architectural design is the specific source of its flexibility—and thus its ability to generate innovation and economic growth. While the Internet has evolved in important ways, it has remained faithful to certain broad design principles since its inception. Below, we describe two of these features that work together to create an open platform for innovation: (1) layering and (2) end-to-end designs.

Layering. The Internet is a layered network, which means that different functional tasks are assigned to distinct parts of the network. Layering relieves engineers from the difficult task of designing a single protocol to handle all network functions.[5] Instead, the Internet relies on a division of labor. "Physical" layer protocols govern the electrical transmission of data across the physical infrastructure. "Network" and "transport" layer protocols (including the Internet Protocol) route packets to their proper location, while "application" layer protocols send and receive packets across the Internet to implement the services (e.g., email, video streams) we use every day.

These layers can be conceptualized in terms of "stacks"—just like stacked boxes.[6] The physical layer sits at the bottom of the stack as the foundation, while the application layer rides on top. A key benefit of layering is that changes can be implemented in one layer without impacting any other layer. This design thus enables application independence in that the underlying protocols allow arbitrary applications to be built and deployed without changing the Internet itself or its routers. Indeed, the Internet existed and was being used long before the World

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[5] *Gill Declaration*, at ¶¶8-9. JA __.
[6] CYBERLAW, *supra* note 2, at 16-19.

Wide Web, iTunes, or Skype were invented. Further, these same high-level applications operate unchanged whether the access network is cable, copper wire, fiber, or cellular wireless technology.

End-to-End Design. The Internet's "end-to-end" design is an important source of its openness to new technologies.[7] In simple terms, the concept means the network should be as general as possible in order to support a wide range of applications. In more technical terms, end-to-end refers to the design principle that application-specific functions (e.g., the ability to translate bits into a Netflix movie within a browser) should be located within the *higher layers* of the stack.[8] In other words, the specific functionality needed to operate Netflix itself should rest not with the network but with the computers on the edge sending and receiving the Netflix packets.

In this respect, application-specific functionality is located at the "ends" of the networks where applications are sent and received—rather than within the network's core. By contrast, the network itself was purposely designed to be as

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[7] The concept was initially articulated in J.H. Saltzer, D.P. Reed, and D.D. Clark, *End-to-End Arguments in System Design*, 2D INT'L CONFERENCE ON DISTRIBUTED COMPUTING SYSTEMS (1981). JA __.

[8] Marjory S. Blumenthal & David D. Clark, *Rethinking the Design of the Internet: The End-to-End Arguments vs. the Brave New World*, ACM TRANSACTIONS ON INTERNET TECHNOLOGY, Vol. 1, No. 1 (2001). Professor Barbara van Schewick refers to this concept as the "broad" version of the end-to-end design principle. Barbara van Schewick, INTERNET ARCHITECTURE AND INNOVATION 57-60, 67-75 (2010).

general as possible. This combination of a general network core that is open to new and unanticipated edge technologies is the secret of the Internet's success in generating innovation. Blumenthal & Clark, *supra* note 8 ("The edge orientation for applications and comparative simplicity within the Internet together have facilitated the creation of new applications, and they are part of the context for innovation on the Internet."). Optimizing the lower layers to benefit specific applications would limit the network's generality—just as replacing roads with train tracks would limit the types of vehicles the roads can support in the future.

The end-to-end design further promotes innovation by creating a level playing field for new applications in at least two respects. First, end-to-end design prevents discrimination against applications. A network that respects the layering and end-to-end principles is unable to distinguish among the applications running over its network. Thus, the "application-blindness" of the network shields applications from discrimination and blocking by network providers.

Second, end-to-end design protects user choice.[9] The Internet is a general purpose technology that creates value not through its own existence, but by enabling users to do what they want. The Internet thus creates maximum value when users remain free to choose the applications they most highly value. An application-blind network ensures that users—as opposed to network providers—

[9] INTERNET ARCHITECTURE, at 349-51, 362-63, 293-94.

will decide which applications will succeed in the global marketplace. In this respect, end-to-end design allows markets to work more efficiently by ensuring that consumption is driven by consumer utility rather than by contractual agreements with access network owners.

Consider, for instance, how these design principles collectively facilitated the rise of the World Wide Web application. Because the network is general, its founder Tim Berners-Lee could introduce it without requiring any changes to—or permission from—the underlying physical network. Instead, he could simply "plug" it into the network in the same way he could have plugged a new lamp into the wall. In addition, because the Internet was application-blind, the network did not treat the World Wide Web differently than any other application. Users were free to adopt it if they valued it.

ARGUMENT

I. OPENNESS CREATES INVESTMENT IN NETWORK INFRASTRUCTURE

The Internet's openness has long been recognized as an important source of its ability to generate new applications, services, and markets. Indeed, these edge services are the reason people use the Internet. These innovations, however, can also drive network investment by causing users to demand faster and better networks for the services they enjoy. Verizon and MetroPCS reject this argument as "conjectural." Verizon Br. 28-31. History illustrates, however, that edge innovation has led directly to increased network investment. The best example is the rise of the World Wide Web.

To begin, innovation often creates the initial demand for infrastructure. One of the designers of the original Internet protocols, Dr. Vinton Cerf, raised this point in a congressional hearing in 1994 on Internet security, well before the disputes at issue in this case had developed. He stated:

> Infrastructure development is almost always preceded by critical inventions which motivate the need for the infrastructure. The light bulb preceded and motivated the need for power generation and distribution. The invention of the internal combustion engine and its application in automobiles motivated the need for better roads, service stations, gasoline refining and distribution. Once the roads were in place, their ubiquity and easy accessibility stimulated the production of a vast array of different vehicles[.] . . . The products and services which can be built atop the computer and communication infrastructure simply have no logical limits. It is this ceaselessly changing, growing, transmuting information resource which will fuel the economic engine of the information infrastructure.[10]

The history of the Internet's growth confirms this vision. In its early years, the Internet was used primarily by government agencies and academic research

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[10] *Hearing on Internet Security Before the H. Comm. on Science, Space, and Technology*, 103d Cong. (Mar. 22, 1994) (written testimony of Dr. Vinton G. Cerf).

institutions.[11] Although several factors led to its sudden exponential growth in the mid-1990s, one key factor was the development of the Mosaic browser, which was the precursor to the popular Netscape Navigator browser. Prior to Mosaic, the World Wide Web was far more difficult to navigate. The Mosaic browser—and its successors—became the "killer app" that allowed a technically unsophisticated, mass audience of users to navigate the World Wide Web for the first time.[12] Stuart Minor Benjamin, et al., TELECOMMUNICATIONS LAW AND POLICY 720 (2012) (noting that Mosaic and Netscape browsers "led to the Web we know today" and "provided the killer app to drive the widespread growth of the Internet"). The World Wide Web, in turn, made possible a new era of e-commerce as new websites and applications were introduced to a global audience of unprecedented size.

The public's demand for the World Wide Web (as enabled by the Mosaic and Netscape Navigator browsers) generated, in turn, a strong demand for better and faster networks. Contemporary newspapers illustrate this relationship. In 1995, *USA Today* reported that the World Wide Web's growth was fueling demand

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[11] J. Kempf & R. Austein, *Rise of the Middle and the Future of End-to-End*, RFC 3724, at 6 (2004) ("[T]he end users in the Internet of 15 years ago were few, and were largely dedicated to . . . academic research[.]").

[12] Peter H. Lewis, *Why Java May Sound Like Magic*, N.Y. TIMES, at C5 (1996) (stating that it was the "Mosaic . . . browser that opened up the World Wide Web to a general audience and led to that service's phenomenal growth.").

for new Integrated Services Digital Network (ISDN) lines that provided faster transmission. Julie Schmit, *Demand Surges for Superfast Phone Lines*, USA TODAY, Nov. 9, 1995 ("For a growing number of homes and businesses, simple telephone lines no longer are enough. For those who want speedier computer connections, an ISDN line [] is a must. … The speed is enticing to the growing number of telecommuters and to computer users accessing the Internet's World Wide Web."). *See also* Peter H. Lewis, *Peering Out a 'Real Time' Window*, N.Y. TIMES, Feb. 8, 1995 ("Internet bandwidth capacity is already being expanded rapidly *to meet the growing demands by businesses for such services as the World Wide Web*.") (emphasis added); Timothy J. Mullaney, *Ciena Founders Resigns to Start New Venture*, BALTIMORE SUN, May 13, 1997 ("Ciena's business got a boost from the development of the World Wide Web, *which caused an explosion in the demand for high-capacity long-distance links* capable of rapidly carrying pictures, video and text[.]") (emphasis added).

The effects of this dynamic relationship between the World Wide Web and network investment continue to be felt today. Consider, for instance, the evolution of video-streaming. The World Wide Web made personal video broadcasting possible to a mass audience for the first time. Johnny Ryan, A HISTORY OF THE INTERNET AND THE DIGITAL FUTURE 116 (2010) ("Users quickly found novel ways to use the Web. Among these was the web cam.") Because these streams were initially sluggish, it created demand for higher-speed networks. The higher-speed networks, in turn, created the necessary conditions for even better video-streaming services such as YouTube and Netflix that would have been impossible in the dial-up era. Even today, the investments in access networks are motivated by consumer demand for ever-improving video-streaming applications and services. *Order* at ¶14. ("Streaming video and e-commerce applications . . . have led to major network improvements such as fiber to the premises, VDSL, and DOCSIS 3.0."). Thus, many of the investments today were initially motivated by two critical edge applications—the World Wide Web and the browsers that made it accessible to all.

The FCC itself has recognized the relationship between application innovation and network investment in prior reports that predate the current disputes. *Deployment of Advanced Telecommunications Capacity: Third Report*, 17 FCC Rcd 2844, 2871 (2002) ("Analysts predict that new and unforeseen capacity hungry applications that require advanced service platforms will drive demand, and in turn deployment, in the future."); *Deployment of Advanced Telecommunications Capacity: Second Report*, 15 FCC Rcd 20913, 20916-17 (2000) ("We [] recognize that the speed and ubiquity of advanced telecommunications capability deployment will depend in large measure on consumers' demand for content and services that require this capability.").

The parties challenging the *Order* have also acknowledged the relationship between network investment and application innovation. Specifically, both MetroPCS and Verizon acknowledged in the record of this proceeding that innovative applications can create demand that fuels network investment. In its comments, MetroPCS writes:

> [The Internet] is the model of the virtuous cycle: innovators are creating content and application products that consumers desire, which drives consumers to purchase from service and equipment providers, which in turn drives investment in infrastructure and new technology in response to consumer demand.

Comments of MetroPCS at 16, GN Docket 09-191 (Jan. 14, 2010). JA __. Verizon made a similar point in its comments:

> [T]he social and economic fruits of the Internet economy are the result of a virtuous cycle of innovation and growth between that ecosystem and the underlying infrastructure—the infrastructure enabling the development and dissemination of Internet-based services and applications, with the demand and use of those services . . . driving improvements in the infrastructure which, in turn, support further innovation in services and applications.

Comments of Verizon at 42, GN Docket No. 09-191 (Jan. 14, 2010) (quoting Comments of NTIA) (*Verizon Comments*). JA __. Verizon also submitted the declaration of Dr. Michael D. Topper, who observed "the virtuous cycle that exists where next-generation broadband networks stimulate innovation in applications and content, requiring more bandwidth, and in turn encouraging even more advanced networks[.]" *Verizon Comments* at 52, Appx. C, Declaration of Michael D. Topper. JA __.

These statements illustrate that the parties' actual dispute is a narrow one. The challenging parties acknowledge that innovative applications can create demand that leads to more network deployment. The only issue in dispute is the *source* of the initial innovation. Verizon and MetroPCS essentially argue that it is the access networks' *own actions* that will stimulate the innovation that initiates the virtuous cycle. Their argument, however, is too narrow. The better answer to the question of "what creates innovation?" is "all of the above." The Internet's traditional openness—which the *Order* preserves—has been recognized for decades as a key source of generating innovation (as the World Wide Web illustrates). Indeed, with open networks, anyone with a broadband connection can introduce a new idea. And innovation will more likely result from the imagination of millions of users than from the more centralized decision making of a few access providers. At the same time, though, network investment helps enable higher-capacity innovative applications. In short, both openness and investment generate innovation, and both should be protected. The *Order*—by preserving openness while maintaining flexibility for access providers—strikes this balance.

II. THE *ORDER* PROMOTES INNOVATION AND GROWTH BY PRESERVING THE INTERNET'S TRADITIONAL OPENNESS

A. Application-Specific Discrimination Threatens the Internet's Openness

The Internet's openness—and thus its ability to generate innovation and new markets—is a product of its architectural design. Specifically, the Internet's end-to-end "application-blind" design made it impossible for access providers to discriminate against the applications and content on their networks. Verizon, however, argues that the *Order* violates law by preventing access providers from differentiating among edge applications and services. Verizon Br. 11. We are concerned by the scope of the parties' asserted authority, particularly their candid acknowledgement that it includes the ability to engage in extreme forms of discrimination such as blocking, and imposing access fees upon, individual websites and edge providers. Verizon Br. 16-17 ("The [FCC's] no blocking rule denies broadband providers discretion in deciding which traffic from so-called edge providers to carry[.] . . . [and] denies broadband providers discretion over carriage terms by setting a uniform price of zero"); *id*. at 14-15 (critiquing the *Order* for "requiring broadband providers to carry the traffic of all edge providers . . . at a common nondiscriminatory rate of zero"); *id*. at 18 (critiquing the "no blocking rule [which] effectively prohibits price discrimination").

In this section, we explain why these types of application-specific discrimination threaten the open Internet and provide specific examples of such practices. By "application-specific discrimination," we refer to the practice of leveraging the terminating access monopoly to single out individual websites (e.g., Netflix) or specific classes of applications (e.g., all video-streaming services) for preferential or discriminatory treatment. Such practices are similar to addressing traffic jams by selectively removing Nissan brand automobiles from the highway rather than through more neutral means such as limiting all types of traffic equally.

Access providers have the unique ability to impose application-specific discrimination because of their location in the overall network. As noted earlier, access networks include the last-mile "driveways" that connect the end user's house to the broader network. When an end user requests data from a site like YouTube, all the packets must necessarily pass through the local access network's terminating facilities. This location gives access networks the ability to block and discriminate against disfavored applications. For instance, Verizon could conceivably charge application providers for the right to access Verizon customers, or to obtain prioritized "first-class" delivery to them. (We refer to these additional charges on edge providers as "access fees."). And though edge providers (like end users) already pay their own access providers for *access* to the Internet (*see supra* at 10-11), they have never paid their *users'* access providers additional charges to reach individual users who have requested these applications.

Access providers are capable of implementing these measures through new technologies that could effectively eliminate the Internet's traditional application-blindness. These technologies include "deep packet inspection," a practice that allows access providers to look inside the packet's payload and discriminate against the packet on that basis. In other words, access providers can open their customers' mail to determine whether to transmit, delay, or discard it. Further, access providers also have the financial incentive to block applications and services that compete with their own services. The record indicates, for instance, that access providers who offer video services view edge providers such as iTunes and Netflix as "a potential competitive threat to their core video subscription service." *Order* at ¶22.

In sum, access providers have both the means and the incentive to eliminate application-blindness. Implementing such practices, however, would undermine the level playing field that innovation requires and would enable anticompetitive conduct. Blocking, for instance, prevents applications from reaching users who might prefer to use them. In this respect, blocking prevents the Internet from creating maximum value because it allows network owners—rather than users—to pick winners and losers. Consider, for instance, if network providers had blocked the social networking site Facebook in order to give preference to a site like MySpace or to their own proprietary social networking service. In this hypothetical world, MySpace might have outperformed Facebook not because users valued it most highly, but because the access network—in its unfettered discretion—chose not to block it.

The threat of blocking also threatens innovation both by reducing developers' incentives to introduce new services and by making it more difficult to obtain funding. The record includes examples of startup companies who faced difficulties obtaining capital because of the threat of blocking. For instance, the founders of an online DVD rental company called Zediva explained that potential investors "repeatedly" raised the concern that access providers with competing video services might "exploit their control over the provision of broadband access to put us [Zediva] at a competitive disadvantage." *Zediva Letter to FCC*, at 2. JA __. The inability to obtain funding will fall most heavily on smaller startup companies and innovators who lack access to capital. Raising the entry costs for new applications in this manner would be particularly harmful given that so many of the Internet's most popular services were created by small startups with little capital—or even by individuals as hobbies or in dorm rooms.

Imposing novel access charges on edge providers would harm innovation in similar ways. Specifically, it would increase the transaction costs involved with developing and introducing new applications. In such a world, application developers could be forced to negotiate with network providers across the country to obtain preferential treatment or to avoid discriminatory treatment. Alternatively, access providers could wait until an application becomes sufficiently popular—or goes "viral"—before imposing access fees from them. The ability of access providers to impose such fees without warning would create significant uncertainty, thus making it more difficult (and more expensive) to obtain venture capital or other investment funding—particularly for smaller startups.

These harms are not abstract fears. In recent years, access providers have implemented or proposed concrete measures that threaten the Internet's openness by singling out specific applications for differential treatment. In 2007, the FCC discovered that Comcast (a broadband access provider) was secretly blocking peer-to-peer applications through the use of deep packet inspection. *Comcast Network Management Order*, 23 FCC Rcd 13028, 13050-51 (2008). Because this discrimination was concealed, users had no way of knowing what caused it—and likely blamed the application. As a result, users were harmed because they could not use their preferred applications, and application providers were harmed because they had no other means of reaching their users. Comcast's blocking also affected future applications in that any new bandwidth-intensive applications that included a peer-to-peer component would face more difficulty in obtaining funding.

Comcast, however, was not alone in discriminating against peer-to-peer applications that were potential competitors. As the *Order* indicates, evidence exists that cable access providers Cox Communications and RCN also blocked these applications. *Order* at ¶36. Similarly, in 2005, the FCC found that a rural telephone company called Madison River was blocking Voice-over-Internet-Protocol ("VoIP") applications that competed with its traditional voice services. *Madison River Consent Decree Order*, 20 FCC Rcd 4295 (2005).

Recent proposals by MetroPCS further illustrate these potential market distortions. In late 2010, MetroPCS proposed a new set of wireless broadband access service plans (or "data plans"). Under its proposal, the lowest-priced data plan would not include access to any video streaming website other than YouTube.[13] To access other video streaming websites, customers would have to pay a higher fee. For these customers, the optimal video streaming website would be selected not by individual users, but by MetroPCS itself.

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[13] Ryan Singel, *MetroPCS 4G Data-Blocking Plans May Violate Net Neutrality*, WIRED (Jan 7, 2011) ("MetroPCS, the nation's fifth largest mobile carrier, announced . . . data plans . . . that would block online video streaming—except for YouTube—for its lowest level plan, and block the use of internet-phone calling apps for all plans[.]"). *See also MetroPCS Letter* at 8-10, GN Docket No. 09-191 (Feb. 14, 2011) (explaining rationale for these proposals). JA __.

Application-specific discrimination also threatens to distort the future of the video market. The Department of Justice has recognized the disruptive potential of online video distributors ("OVDs") such as YouTube and iTunes to compete with traditional video providers such as cable and satellite companies. Accordingly, in approving Comcast's recent merger with NBC-Universal, the Department took steps to prevent Comcast from discriminating against these particular services. In short, it ensured the video market would develop on a level playing field.

> Comcast . . . could disadvantage OVDs in ways that would prevent them from becoming better competitive alternatives to Comcast's video programming distribution services. OVDs are dependent upon ISPs' access networks to deliver video content to their subscribers. Without [these] protections . . . Comcast would have the ability, for instance, to give priority to non-OVD traffic on its network, thus adversely affecting the quality of OVD services that compete with Comcast's own [video] or OVD services. Comcast also would be able to favor its own services by not subjecting them to the network management practices imposed on other services.

U.S. v. Comcast, *Proposed Final Judgment and Competitive Impact Statement*, 76 Fed. Reg. 5440, 5456 (2011).

We recognize, of course, that network owners need flexibility to achieve objectives such as protecting security, managing congestion, or monetizing their networks. Our concern, therefore, is not with these objectives per se, but with the *application-specific manner* in which they may be implemented. As the record indicates, these objectives can all be achieved in an application-agnostic manner that does not threaten the Internet's openness.[14]

B. The *Order* Preserves the Internet's Openness by Preventing Application-Specific Discrimination

The *Order* is a limited and conservative measure that protects the Internet's openness by preventing the extreme forms of discrimination described above. At the same time, it ensures that access network owners have the flexibility to address their networks' needs.

To begin, the *Order* applies only to broadband *access* service. *Order* at ¶50 ("[T]hese rules apply only to the provision of broadband Internet access service[.]"). In engineering terms, these protections thus apply only to activities of access network owners. In short, the rules apply only to local roads, and not to vehicle manufacturers. For this reason, any criticism premised on the idea that the *Order* treats applications differently than access providers confuses the crucial differences between network operators and edge services providers. Verizon Br. 52 ("The Order is also arbitrary and capricious because . . . other players in the Internet ecosystem are not so restrained."). Such arguments are similar to criticizing electricity grid rules regarding the delivery of power because the same

[14] *Van Schewick White Paper*, at 14-16 (submitted in GN Docket No. 09-191, Dec. 14, 2010). JA __.

rules are not applied to the items (such as hair dryers and lamps) plugged into the network.

The content of the *Order*'s specific rules also protect openness by maintaining a level playing field for applications and edge services. Indeed, these rules are not novel, but merely track and protect the design principles that are the source of the Internet's ability to generate innovation. For instance, the *Order*'s "no blocking" rule helps preserve the competitive benefits of the Internet's end-to-end design by preventing fixed access providers from blocking applications, content, and specific users. *Order* at ¶¶62-67. It also prevents wireless access providers from blocking lawful websites or applications that compete with their voice or video telephony services. *Id*. at ¶¶93-96. These protections collectively ensure that the network will not distort competition by favoring specific applications over others or by reducing user choice.

The *Order*'s "no unreasonable discrimination" rule further preserves these benefits. *Id*. at ¶¶68-79. In determining what discrimination is "unreasonable," the FCC listed several factors it would consider. These include: (1) the transparency of the practice; (2) its effect on end-user control; (3) whether the practice was "use-agnostic"; and (4) whether it conformed to "standard practices." *Id*. at ¶¶68-76. Critically, these factors do not prevent access providers from adopting measures to protect their networks, to manage congestion, or even to monetize their network in innovative ways. Instead, they merely ensure that access providers will enact these measures *in a manner consistent with the Internet's openness.* For instance, the emphasis on "use-agnosticism" and "end-user control" are simply means to ensure that the network remains a level playing field for innovative applications even when network management measures become necessary.

CONCLUSION

The Internet's unprecedented ability to generate innovation has created new markets, increased economic growth, and improved productivity. This ability stems directly from an open and application-blind architecture that creates a level playing field where users pick winners and losers. The *Order* merely preserves the benefits of openness and we respectfully request that it be affirmed.

CERTIFICATE OF COMPLIANCE

This brief complies with the type-volume limitation of Fed. R. App. P. 32(a)(7)(B) and 29(d) and because this brief contains 6,973 words, excluding the parts of the brief exempted by Fed. R. App. P. 32(a)(7)(B)(iii) and Circuit R. 32(a)(1).

This brief complies with the typeface requirements of Fed. R. App. P. 32(a)(5) and the type style requirements of Fed. R. App. P. 32(a)(6) because this brief has been prepared in a proportionally spaced typeface using the 2010 version of Microsoft Word in 14 point Times New Roman.

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I, John Blevins, hereby certify that on November 15, 2012, I filed a copy of this brief electronically with the Clerk of the United State Court of Appeals for the D.C. Circuit via the Court's CM/ECF system, which will send notice of such filing to all counsel who are registered CM/ECF users. Others, marked with an asterisk, will receive service by mail unless another attorney representing the same party and sharing the same address is receiving electronic service.

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