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Regulation when platforms are layered

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Regulation when platforms are layered

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Abstract

This paper represents a synthesis and extension of earlier work, applying the Lehr & Sicker (2018a,b) regulatory approach to the layered platform model of Claffy & Clark.³ Today's Internet ecosystem is comprised of multiple digital network platforms organized into a multi-layer architecture. Lower layer IP platforms provided by access and backbone ISPs collectively support the Internet, on which complementors may build higher-layer platforms, such as the digital network platforms provided by Google, Amazon, Facebook and Apple ("GAFA"). Each of these firms control and operate multiple platforms operating at multiple layers that comprise ecosystems within the larger Internet ecosystem to which they belong. Herein, we explore the viability of the Lehr & Sicker regulatory framework for a reformed and newly authorized FCC with authority to address the regulatory challenges confronting policymakers in this multi-layered ecosystem.

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² [Euro ITS](#) (Helsinki, June 16-19, 2019).

³ See Figure 2b in Claffy & Clark (2014).

Table of Contents

1.	Introduction	3
2.	Review of Earlier Work	4
2.1.	Model for a <i>newFCC</i>	4
2.2.	Internet ecosystem as a complex of layered platforms	6
2.3.	Normative goals for the Internet Ecosystem	7
2.4.	A <i>newFCC</i> and the regulation of layered platforms	8
3.	Framework for Evaluating <i>newFCC</i> Regulatory Options	10
3.1.	Digital Network Platforms Characterized	10
3.1.1.	Digital, On-line	12
3.1.2.	Platforms provide useful functionality to complementors who build on top	13
3.1.3.	Extreme returns to scale and scope	13
3.1.4.	Multisided markets (often)	14
3.1.5.	Network effects, direct and indirect	14
3.1.6.	Unique opportunities to collect use data and market intelligence	14
3.1.7.	Global reach potentially	14
3.1.8.	Public Interest	15
3.2.	Typology of FCC Policy Concerns	15
3.2.1.	Universal Access	15
3.2.2.	Connectivity and Interoperability	18
3.2.3.	Anticompetitive Behavior	20
3.2.4.	Privacy	26
3.2.5.	User Data and Market Intelligence	27
3.2.6.	Promoting healthy markets	28
3.2.7.	Reliability of critical digital network infrastructures	29
3.2.8.	Cybersecurity	30
3.2.9.	Governance	31
3.2.10.	Economic Growth, Productivity and Jobs	31
3.3.	Criteria for Evaluating FCC Intervention Options	32
4.	Scenarios for Platform Regulatory Intervention	32
4.1.	Broadband Platforms and Last-mile Access	33
4.2.	Domain Name System	36
4.3.	Application Development Environment and the Apple Store	39
4.1.	Amazon eCommerce platform	43
4.2.	Facebook and WhatsApp	45
4.3.	Google Search and EU intervention	49
5.	Summing up and Lessons Learned	52
6.	References	53
7.	Appendices	57
7.1.	Appendix Note 1: Neo-Brandeisian Antitrust Debate	57

1. Introduction

Numerous authors have pointed out the inadequacies in legacy telecommunications regulatory frameworks and called for new policy approaches to address the challenges confronting today's broadband Internet environment.⁴ Lehr & Sicker (2018a,b) proposed a model for how to reform U.S. communications policy.⁵ Claffy & Clark (2014) pointed out that today's broadband Internet ecosystem is comprised of a complex matrix of layered digital platforms. Any framework for coherent regulatory policy for the Internet ecosystem ought to take into account how this layered platform structure impacts policy options.

This paper represents a synthesis of this earlier work, applying the Lehr & Sicker regulatory approach to the layered platform model of Claffy & Clark.⁶ Specifically, we explore the viability of the Lehr & Sicker regulatory toolset to a series of test cases to highlight the regulatory challenges posed by the rise of such important players as Google, Amazon, Facebook, and Apple ("GAFA").⁷ Each of these firms controls an ecosystem of multiple digital network platforms that operate across multiple layers of the Internet ecosystem that they are part of, interacting with each other, other digital network platform providers, and policymakers in complex ways.

The regulatory test cases we consider include:

- (1) Broadband access providers, which serves as a bridge to legacy FCC policy concerns and an introduction to how the layered nature of platforms impacts regulatory policy;
- (2) The Domain Name System (DNS), which provides critical functionality for the Internet ecosystem and helps illustrate how the choice of the layer at which to provide this functionality impacts the ecosystem;
- (3) The Application Development Environment, which highlights the ways in which the Internet ecosystem facilitates and supports Internet application developers and illustrates the role of the Apple App store;
- (4) The Amazon eCommerce platform which provides an example of an application layer platform provided by another of the large multi-platform operators;

⁴ For example, see Lehr & Sicker (2018a, b), Claffy & Clark (2014), Khan (2017), Noam (2018), Feld (2019), and Whitt (2018), to name a few.

⁵ Sicker & Lehr (2018a, 2018b) posit two regulatory titles that would replace the existing Communications Act of 1934: a new Title II that would authorize a new FCC (the sector-specific regulator) to employ strong public-utility-style tools (including mandating strong structural remedies such as structural separation) in contexts where bottleneck facilities exist; and a new Title III that would be applied where more light-handed, market-based regulatory frameworks were more appropriate. In neither paper did they consider precisely what tools would be needed to address higher-layer platforms, nor how both Titles might jointly be applied to the same firm(s) in different market contexts (e.g., a firm like Comcast, Apple, or Amazon that offers platforms at multiple levels of the Internet ecosystem).

⁶ See Figure 2b in Claffy & Clark (2014).

⁷ With the addition of Microsoft, GAFA becomes GAFAM, and with Netflix, it is sometimes referred to as FAANG (see <https://www.investopedia.com/terms/f/faang-stocks.asp> or https://en.wikipedia.org/wiki/Big_Four_tech_companies).

- (5) Facebook and the case for divestiture of WhatsApp, which highlights the regulatory issues arising from Facebook's rise as a global power and the challenges of imposing structural remedies to address those challenges; and,
- (6) Google and the regulatory interventions by the EU, which highlights the policy issues raised by Google and the challenge of regulating global platform operators by national authorities.

Section 2 reviews the earlier work that provides a foundation for the current paper. Section 3 discusses the special economic features that characterize the digital network platforms, lays out a typology of regulatory concerns or potential harms that those platforms raise, and criteria for evaluating alternative regulatory intervention strategies at different layers. Section 4 discusses each of the case studies noted above. Section 5 concludes.

2. Review of Earlier Work

In this section, we briefly review the major themes from our earlier papers that provide a foundation for the current work.

2.1. Model for a *newFCC*

Lehr & Sicker (2018a) proposed the structure for a new Communications Act to replace the 1934 legacy legislation. The approach was high-level, focusing on sketching out the basic titles to help frame a reform agenda. A key goal of the paper was to argue for the continuing need for a sector-specific, independent, national regulatory authority – or, *newFCC*.⁸ Of greatest relevance to this paper is the proposal in Lehr & Sicker (2018a) for new Titles II and III. The new Title II would include the regulatory tools traditionally associated with Public Utility-style regulation, which range from full-government ownership of a communications infrastructure utility (e.g., similar to the PTTs that prevailed in many countries or the local, municipally-owned telecommunication providers that continue to exist in some markets in the U.S.) to less-constrained versions of public utility oversight (e.g., associated with price cap-style rules). Although public utility regulation comes in many flavors, all of those flavors imply a strong degree of regulatory intervention.⁹ In making the case for the same sort of strong public utility authority that exists under today's current Title II, Lehr & Sicker (2018b) explicitly argued against framing Title II as common carriage,

⁸ Herein, we will use "*newFCC*" to refer to the new sector-specific regulatory agency that will replace the existing FCC.

⁹ Establishing, managing, and sustaining any such regulatory intervention imposes significant costs that are both direct (e.g., include the direct regulatory oversight process and institutional costs) and indirect. The latter include the potential distortions to innovation, interference in the free choice of individual firm decision-making, and all of the other attendant adverse efficiency impacts of regulation that have motivated regulatory economists to prefer market competition to public utility regulation whenever reasonably competitive effective competition is attainable.

tying it more directly to a public utility framework wherein the focus is on shared access to a bottleneck (or public) infrastructure.¹⁰

Lehr & Sicker's new Title III proposed a market-based, light-handed regulatory model, more appropriate to situations where public utility-style, heavy-handed regulation is infeasible or undesirable. Under Title III, the regulator would promulgate general principals as ex ante, rules-of-the-road that may include certain more specific requirements (e.g., a non-discrimination rule). These principles are intended to provide guidance on acceptable market behavior to help steer or manage the market toward desired outcomes, as well as to signal behaviors that may elicit a regulatory response (e.g., injunction, penalty or structural remedy). Title III was intended as a managed-market approach that would rely less on detailed rules and more on targeted, ex post enforcement actions to counter market-failure problems such as abuses of market power or coordination problems.¹¹ Simultaneously, Title III would provide the *newFCC* with authority and tools to act proactively to address market failure issues such as gaps in universal service (e.g., where private investment returns were inadequate to ensure appropriate levels of service).

Table 1 provides a summary of the various regulatory tools that Lehr & Sicker (2018a,b) argued should be in the *newFCC*'s arsenal.

¹⁰ If there exists a public utility infrastructure, then it needs public utility regulatory oversight, even if it exists in co-existence with competing private infrastructures. This may be the case with municipally-owned or community-owned broadband that competes with investor-owned broadband providers.

¹¹ Much of the regulatory policy focus has been on addressing abuses of market power, but problems may also arise in effectively competitive markets. These may include Lemons Problems (inability of firms to signal higher quality resulting in low quality pooling equilibria), interoperability problems (failure of firms to coordinate on standards), or failure to sustain pricing equilibria that are sufficient to recover long run costs (a problem that may arise in the presence of significant shared, fixed or sunk costs).

Table 1: *newFCC* Regulatory Toolset

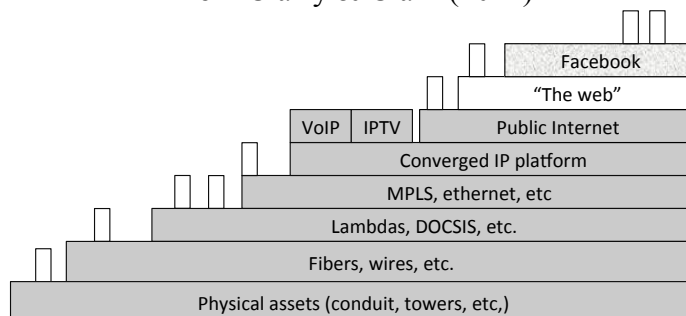
Title II: Public Utility Regulation
<ul style="list-style-type: none"> • Bottleneck Access Rules: authority to impose mandatory sharing rules for bottleneck facility, including setting terms and pricing for access • Associated PUC style regulatory oversight, with authority to set prices, terms, product selection, investment priorities, etc.
Title III: Light-Handed Regulation
<ul style="list-style-type: none"> • (a) Information sharing: transparency & disclosure, measurement, investigations, convening workshops, PR • (b) Subsidies (e.g., universal service) • (c) Adjudication of Disputes, Inquiries, and Enforcement Actions: expert agency able to respond to complaints about violation of market behavior guidelines (e.g., Powell's Principles and take enforcement actions (e.g., fines, injunctions). May include NOI leading to new (d) or (e) rules. • (d) Industry mandates: standards, requirements (e.g., minimum QoS) • (e) Special actions or rules: may include structural remedies, non-discrimination rules, data handling rules directed either at all market participants or potentially, asymmetrically, applied to dominant firms

Whereas Lehr & Sicker (2018a,b) highlighted a model for reforming the regulatory framework and sketched out how a newly enfranchised FCC might apply its authority, especially in the case of addressing bottlenecks associated with lower layer network resources like conduit and outside structures, they did not discuss the challenges of applying their framework toward the regulation of the digital network platforms provided by Google, Amazon, Facebook, or Apple (or "GAFA") that are such important players in the Internet ecosystem.

2.2. Internet ecosystem as a complex of layered platforms

Claffy & Clark (2014) noted that the broadband Internet ecosystem is best viewed as a layered collection of digital platforms that may be combined and interact with each other in complex ways that are relevant to understand if the goal is to identify or address potential policy challenges that may arise (see Figure 1).

Figure 1: The Internet Ecosystem – a complex of layered platforms
From Claffy & Clark (2014)



Their platform framework highlights the relationships between lower layer infrastructures like the fiber optic cables that may have IP networks layered on top. Those IP networks may be used internally by the owners of the underlying fiber (e.g., Verizon, Comcast) to provide higher-level services like IPTV or broadband Internet access. The IP networks of multiple firms are combined to create the multi-firm global Internet, and still higher-layer platforms like Facebook may be layered on top of those underlying IP networks. Clark & Claffy's focus was on developing a model for talking about regulatory issues that accurately reflects the reality of today's Internet ecosystem comprised of multiple, layered platforms.¹²

In the platform model of Claffy & Clark, some platforms are private to the firms that create them and some are intended for use by other firms. A question we explore here is whether the layered platform nature of the Internet ecosystem raises any new issues from a regulatory perspective (or more generally, from the perspective of possible government intervention to remedy some concern).

In general, there are at least four ways in which the layered platform character of the ecosystem may change the reasoning about regulation. First, the platform structure leads to interactions among the actors at different layers, which in some cases may disadvantage certain actors. We want to understand the nature of those interactions, as a starting point to asking whether any of them might rise to the level that would warrant regulatory intervention. Second, if regulators find that intervention is justified, the layered structure may provide more than one option for how to intervene. We need some method to reason about where the most effective intervention might be directed. Third, a platform operator, especially one that operates multiple platforms, potentially at multiple layers, may be able to exploit the operator's expansive power for market surveillance to create an information asymmetry that may be used to harm the public interest. Fourth, the architecture and technical features of platforms may hinder the creation and operation of certain sorts of applications.

2.3. Normative goals for the Internet Ecosystem

A common theme in both strands of the authors' earlier work is the notion that communications policy is not and should not be limited solely to the goal of promoting effective competition and the smooth functioning of markets. Communications policy rightly embraces normative goals that include preferences for particular types of market outcomes. It includes aspirational goals that are intended to ensure that the U.S. has the communications infrastructure and supports the sorts of market outcomes that we desire for society and the economy, rather than just accepting whatever competitive markets may deliver.

Were the protection of effective competition the sole concern, the case for a sector-specific regulatory authority would be greatly weakened. One might instead seek to rely on antitrust

¹² Herein, we use *ecosystem* to refer to the collection of firms, their users, the markets and their environment, which includes the institutions, regulations, rules, standards, and norms, that shape the interactions of firms and users. When we speak of the Internet ecosystem, we are including the firms, services, and users that contribute to creating, sustaining, and making use of the Internet. We also speak of the ecosystems associated with each of the GAFA that are distinct parts of the larger Internet ecosystem.

policy.¹³ We recognize that threats to competition from anticompetitive behavior are not the only threats to ensuring that consumers and businesses have access to broadband and Internet services with the appropriate level of choice, quality, and affordability desired as a matter of national industrial policy.¹⁴ Lehr, Clark et al. (2019) and Clark & Claffy (2015) highlighted aspirations for important features or outcomes that would characterize the sort of broadband Internet ecosystem we believe regulatory policy should play an important role in promoting. Those include promoting a broadband Internet that is (1) subject to no more government intervention than is necessary, but one that (2) facilitates affordable universal access to (3) high quality infrastructure that provides (4) global connectivity to a (5) diverse range of applications and services to suit the diverse tastes and requirements of Internet and broadband users, is (6) (reasonably) efficient (cost-effective), is (7) trustworthy, is (8) evolvable, (9) enables permission-less-innovation (of the sort the Internet has supported), and a host of other desirable attributes. We recognize that such "mom and apple pie" aspirations are hard to disagree with but require significant contextual elaboration before they can be used for effective policy. When appropriately contextualized, the goals are often conflicting and the distributional implications imply that stakeholders often disagree on appropriate courses of action.

2.4. A *newFCC* and the regulation of layered platforms

In an effort to better contextualize our discussion of regulatory policy reforms, we focus on a series of difficult concerns and potential issues that we see arising as a consequence of the growing economic and social importance of the leading digital network platform providers, GAFAM. In the past, the communications infrastructure focus of the FCC was directed at regulating telecommunication and cable television network providers and media broadcasters, with limited scope and authority to regulate the behavior of edge-providers who make use of the basic infrastructure. Under the legacy framework, GAFAM are considered as edge-providers. Herein, we ask what should a *newFCC* do if newly empowered with a broader regulatory policy mandate for

¹³ Antitrust policy is most effective in responding to threats to existing competition, and is much weaker with respect to proactive actions to promote competition. Recently, a number of scholars have called for more activist antitrust policy, provoking a global debate over the need for reforms to antitrust. This paper is informed by this debate, which is motivated significantly by the rise of the large Internet ecosystem platform players that are also a focus of this paper; however, this paper will focus on the role of the sector regulator and how it may overlap with and complement reformed antitrust policies. When protecting competition in the Internet or broadband ecosystems is the policy issue of concern, the FCC may serve as the expert agency to support antitrust enforcement. For an overview of the antitrust policy debate, see Evans & Schmalensee (2018), Katz (2019), Khan (2017), or Yoo (2018) for various perspectives on the evolving debate.

¹⁴ For example, the National Broadband Plan (FCC, 2010) set forth a vision of broadband platform capabilities consistent with visions of promoting Smart-X developments across multiple sectors from healthcare to education, from energy grids to supply chains. Part III of the report (chapters 10 through 16) set forth a vision of National priorities that depended on expanded national broadband communications infrastructure. Similarly, Michael Powell's articulation of the four Internet freedoms offers part of a vision of what is expected from the broadband Internet ecosystem in terms of choice (Powell, 2004) and something like those should provide the "rules of the road" to guide market behavior under the new Title III, as discussed in Lehr & Sicker (2018a,b). While we believe both the National Broadband Plan and Powell's four principles are useful starting points, we believe further refinement would be desirable but that is beyond the scope of this paper.

the Internet ecosystem to address potential threats from GAFAs or other digital network platforms that are part of the Internet ecosystem? What sorts of threats (or failures to deliver what we want) are matters of public interest concern that the *newFCC* ought to address and how might the *newFCC* best address such issues?

If there is to be a sector-specific regulator, as we believe is desirable, then it is necessary and desirable for that regulator to have the authority and tools to regulate platform providers (or others) and to take corrective actions if market outcomes are not consistent with national communication policy goals. However, lest this turn into an unrestricted mandate for arbitrary regulation, we think it is important to be able to limit the *newFCC's* authority. Before acting, the *newFCC* needs to be able to articulate a clear threat to a well-understood policy goal and to justify its intervention as the best available alternative. We expect that justifying interventions by the *newFCC*, especially when such justification is framed as a matter of public interest, will be difficult and contentious.

Before launching into our discussion of example issues, we provide a framework for evaluating the appropriate course of action for the *newFCC*. We find that valuable for multiple reasons. First, although we think the argument for enabling a *newFCC* to have particular tools may proceed with reference only to the sorts of potential market outcomes (or more specifically, harms) that *might* justify regulatory intervention, consideration of when it is appropriate to use particular tools requires greater attention to the specific context and harm in which use of a tool is being considered. Indeed, Clark & Claffy (2014), Feld (2019), and OECD (2019) all stress the importance of starting with an articulation of a policy concern before moving to consideration of potential remedies.¹⁵ The analysis in Lehr & Sicker (2018a,b) is consistent with that perspective since even when a potential issue is deemed to be *in scope* for the FCC to consider intervening, that does not imply that the FCC is the best institution to take action in a particular situation. Moreover, even if an action by the FCC may be deemed warranted, the choice of how to intervene will be context dependent.

Second, our goal is to address policy challenges for a rapidly changing market and regulatory environment. The regulatory reform agenda is being advanced on multiple fronts, with calls for reforms to general competition policies for digital platforms that would impact both antitrust policy and the FTC in the U.S. and elsewhere. The so-called neo-Brandeisian movement that crystalized in the U.S. following the publication of Khan (2017), recent actions by competition authorities in the European Union,¹⁶ and growing consensus regarding some of the key features that are shared

¹⁵ Indeed, one way to organize the titles that might form the text for new Communications Act might be in terms of the policy concerns the *newFCC* would need to address. That is not the strategy Lehr & Sicker (2018a) followed, but is one worth considering.

¹⁶ For example, over the past three years, European Union competition authorities have fined Google \$9.3B associated with competitive abuses (see <http://bit.ly/2QDFJjB>); German regulators found Facebook guilty of abusing its market power (see <http://bit.ly/3124fQq>); the European Commission launched a competition investigation of Amazon in September 2018 (see <http://bit.ly/2Wkk8CQ>); and Spotify has initiated an antitrust claim against Apple with European Commission in March 2019 (see <http://bit.ly/2EKSELR>). These actions mirror related recent decisions in the U.S.: in May 2019, the FTC was rumored to be preparing a \$5 billion fine against Facebook associated with alleged violations of its 2011 consent decree regarding the handling of user data (see <https://reut.rs/2Z3VXps>); and the Supreme Court decided to allow an antitrust

(as well as those that differentiate) the large Internet platforms¹⁷ suggest that the world in which the *newFCC* would operate would be different in multiple respects. The view we take in this paper is that the methods for antitrust enforcement will adapt to better address the challenges posed by the economics of multisided, Internet platform providers. This will include a demonstrated willingness and capabilities to address allegations of anticompetitive abuses by dominant multisided digital platforms. Although the *newFCC* will retain its own abilities to address such issues, our focus here will be on emphasizing the FCC's ability to address potential threats or market failures associated with the evolution of our national communications infrastructure that may not be attributable principally or practically to failures of competition.¹⁸ Our articulation of the potential policy concerns that may emerge associated with our communications infrastructure in the next section provides context for that perspective.

3. Framework for Evaluating *newFCC* Regulatory Options

In the following three sub-sections, we address the following:

- (1) Define what we mean by *Digital Network Platforms*;
- (2) Provide a typology of policy issues; and,
- (3) Offer a framework for evaluating FCC policy interventions in a particular context

3.1. Digital Network Platforms Characterized

We are in the midst of a global transition to a Digital Economy, in which Information & Communications Technologies (ICTs) are permeating every facet of our economic and social lives. There are a plethora of buzz words for emerging technologies that are at the forefront of this transition, including 5G, IoT, Big Data, Artificial Intelligence, autonomous vehicles, and augmented reality. Ultimately, the hope is that we will be successful in leveraging ICTs to enable electronic computing and communication enhanced decision-making and control of all kinds of systems and processes throughout our world. In its extreme form, this is a vision of pervasive computing in which the real and virtual worlds are capable of being seamlessly integrated to enable *Smart-X*, where X can be replaced with "cities," "supply chains," "highways," "healthcare," et cetera.¹⁹

On the path to this digital future, we are already confronting significant policy challenges across the entire spectrum of public policy. The media industry has been significantly disrupted by the shift toward online entertainment and digital platforms like Facebook, Reddit, and Twitter have helped fuel "fake news" and attacks on our electoral processes and public discourse. The rise of digital payment systems, including crypto-currencies, are fundamentally altering finance and banking, including facilitating the rise of new online markets for illegal activity like Silk Road. On a more positive note, Smart-energy grids to integrate renewable power sources will have to be

claim associated with Apple's monopoly control of its app store to proceed on May 13, 2019 (see <http://bit.ly/2Knm1Yy>).

¹⁷ These will be reviewed briefly in the next section.

¹⁸ Moreover, the ability of the FCC to address competition issues on its own provides a bulwark in case the assumption of more enlightened antitrust enforcement proves incorrect.

¹⁹ See Lehr (2019).

part of our energy management future if we are to succeed in tackling global climate change. And, the proliferation of digital platforms like Uber, AirBnB, TaskRabbit, and a host of others that have given rise to the so-called "Gig" or "Sharing" economy are disrupting legacy sector and issue-specific regulatory frameworks across multiple domains, including labor and consumer protection, the hospitality and drive-for-hire sectors, healthcare and pharmacies, et cetera.

No single policy framework or regulatory agency, and certainly not the *newFCC*, can be responsible for all of these issues. We can imagine that sorting out how to reform and replace (when necessary) our existing regulatory frameworks and assign lead responsibility for issue domains will present an on-going challenge. As already noted, we anticipate that our *newFCC* will operate in a world with a newFTC, newAntitrust, et cetera. While we do not expect the *newFCC* to be responsible for all of the issues arising from the digital transition, all of these issues are likely to impact and may overlap with the *newFCC*'s scope for action, especially in light of the fact that the *newFCC* will be expected to be one of the leading agencies with significant in-house technical expertise to address digital network-related issues.

In protecting our public interest, the *newFCC* is expected to be the independent regulator tasked with ensuring that our national goals and aspirations for our communications network infrastructure are met. In calling it basic infrastructure, we are identifying it among the class of social and economic inputs that are used broadly across society and the economy and are a member of the class of infrastructures that include roads, electricity, and water.²⁰ As we discuss in the next sub-section where we consider "universal access," determining precisely what the public interest should be in ensuring access to basic infrastructure will remain an evolving challenge.

In writing this paper, we have struggled with alternative notions of how to characterize our basic communications infrastructure and the viability of using such a characterization to scope the focus for the *newFCC*. In the days of legacy telephone service, it was relatively easy to identify our national telecommunications network infrastructure with the PSTN and the associated network of transmission, switching and associated facilities, capabilities and services that are needed to support universal access to telephony and telephone-like messaging services. The firms and industry value chain that provided those services were readily identified. With the rise of digital platforms and the erosion of traditional industry and market boundaries separating telecommunications from computing, edge from core network services, content from conduit services, it has become more difficult to identify which firms or market activities should be in-scope for potential *newFCC* regulation and what should be out-of-scope.²¹ These challenges are evident in the debate over whether to classify broadband access as a "telecommunication" or "information service," a decision that determines whether the FCC may apply its legacy Title II common carrier regulatory authority to providers of broadband services. Under current law, telecommunications are defined as an end-to-end transmission service.²²

²⁰ For an even broader definition of what constitutes basic infrastructure, see Frischman (2004).

²¹ As noted earlier, we believe it is important to limit the scope of the *newFCC* to ensure effective agency governance.

²² According to 47 U.S.C. § 153(43): "'telecommunications' means 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."

The services that are provided by last-mile broadband platform operators like Comcast and Verizon and by other digital platform providers like GAF A do not fit easily into these legacy notions of telecommunications v. information, conduit v. content, network v. edge provider services. As an alternative, we suggest thinking of the *newFCC*'s domain of responsibility as bounded by its focus on *Digital Network Platforms*, which we will define shortly, and the issues they may raise in a range of policy areas which we discuss in the following section.

The term *Digital Network Platforms* is intended to include the many different types of platforms that contribute to and participate in the Internet ecosystem. It includes the broadband platforms provided by last-mile broadband access providers like Charter, Comcast, AT&T and Verizon (fixed and mobile); the mobile device and application store platforms associated with the Apple iOS and Google Android operating systems; and application platforms like those provided by Amazon, Facebook, and Twitter. Our principal focus in this paper will be on the GAF A platform providers because they are currently in a class (nearly) by themselves in terms of global size and significance, and the attention they have attracted from policymakers recently.²³ However, most of what we have to say about the GAF A platforms is true about other platforms. We will also discuss issues arising with last-mile access providers, in part, to provide a bridge with core issues and focus of legacy FCC concerns, which will remain a core focus for the *newFCC* also.

In the following sub-sections, we will highlight eight key features that are commonly found in the digital platforms we are interested in. In compiling this list, we have drawn on the work of numerous scholars who have sought to characterize the special features that give rise to distinctive economic behaviors and outcomes associated with digital platforms. These include Cremer et al. (2019), Feld (2019), Furman (2019), Gawer and Cusamano (2014), Khan (2018), Morton (2019), and Parker et al. (2016). The eight distinguishing features include:

1. Digital, On-line
2. Platforms provide useful functionality to complementors who build on top
3. Extreme returns to scale and scope
4. Multisided markets (often)
5. Network effects, direct and indirect
6. Unique opportunities to collect use data and market intelligence
7. Global reach potentially
8. Public Interest

3.1.1. Digital, On-line

The first most important feature is that the platforms are *digital*, which brings with it all of the distinguishing economic features that differentiate digital from physical goods. Those include low

²³ We say nearly because the triumvirate of Baidu, Alibaba, and Tencent from China (“BAT”) are emerging as potential global competitors, and given the rapidity with which GAF A have grown globally, it is far from clear how many and which of the mega-platform providers will expand and sustain the dominant positions they have acquired thus far. See OECD (2019) for an extensive discussion of the multiple ways to taxonomize digital platforms and case studies of many of the important platforms.

(near zero cost) for replicating and distributing digital goods, which contributes to the increasing returns to scale that are common with digital goods.

The platforms are data-centric, meaning that a central feature of the platform businesses and key to understanding their differences depends on understanding how they relate to, collect, process and use digital data.

Furthermore, the digital platforms are connected to networks, and are associated with being "on-line" as in participating as part of the Internet ecosystem. We make this distinction because some of the platforms may best be thought of as operating below or above the Internet platform layer.

3.1.2. Platforms provide useful functionality to complementors who build on top

A platform is comprised of a set of functions or capabilities that complementors make use of to produce valuable products and services, including the construction of higher-layer platforms that may be built on top of the platform.

Following Gawer & Cusamano (2014) and Claffy and Clark (2014), the platforms may be open or closed, and may be provided by one or multiple firms. An open platform permits third-party, unaffiliated complementors to access, share and use the platform, whereas a closed platform is reserved for affiliated complementors only. For example, the Internet is an open platform provided by multiple firms that operate independent Autonomous Systems (ASes). A broadband platform provider like Comcast operates a closed DOCSIS modem-based IP platform on which it provides and contributes to a mix of closed and open platforms such as the Internet and specialized services that are configured as IP networks on top of Comcast's underlying IP network. Apple's iOS is an open platform that is built on top of Apple's closed hardware platform.²⁴ Apple operates a monopoly but an open application store platform on its hardware and iOS platform.

3.1.3. Extreme returns to scale and scope

The digital network platforms often exhibit extreme returns to scale and scope, sometimes apparently without limit. This is due to the low (potentially near zero) marginal cost associated with adding subscribers or with scaling output. Additionally, digital platform networks can commonly scale with significantly less investment than would be required with physical goods. Taken together, these effects allow digital network platforms to grow quickly.²⁵

²⁴ It is worth noting that platforms differ significantly in terms of their degree of openness – that is, the extent to which they allow users or complementors flexibility in how they use the platform. For example, Apple's iOS and its Application store permit far less flexibility for users and complementors than does the Internet.

²⁵ The last-mile mobile and fixed broadband platforms are different in this respect. They require significant fixed and sunk investments in physical assets dependent on the geographic area they wish to provide service to, rather than the number of subscribers they may actually attract in those areas. However, in geographic areas where they have facilities, the incremental costs of adding subscribers are much lower, but not trivial.

3.1.4. Multisided markets (often)

Many of the platforms that are of interest, including those operated by GAFAs, are multisided.²⁶ Such platforms provide simultaneous service to two or more user groups. The demands of the multiple user groups are co-dependent meaning that the optimal strategy for the platform provider needs to consider user behavior on multiple sides of the market jointly. When the platform is multi-sided, that further contributes to the distinctive economics that many digital network platforms exhibit.

3.1.5. Network effects, direct and indirect

Another key feature of digital network platforms is that they exhibit positive network effects, whereby the value to individual users increases with the total number of users of the platform. Like increasing returns to scale, the presence of network effects means that larger networked platforms are more valuable.

Moreover, when the platforms are multisided they may evince indirect cross-platform network effects. For example, the Amazon eCommerce platform evinces indirect network effects since having more consumers use the platform makes it more attractive to more vendors, which expands the range of products that consumers can access via the platform; and visa versa, having more vendors with more products on offer makes the platform more valuable to consumers.

The increasing returns to scale and network effects can jointly contribute to winner-take-all (or mostly all) market economics. These economic effects cause digital network platform markets to often trend toward increased concentration, which unchecked, can lead to monopoly control of the market in which the platform is dominant.

3.1.6. Unique opportunities to collect use data and market intelligence

Another special feature of the digital network platforms is their ability to collect unprecedented amounts of user data and market intelligence. Whereas individual firm or consumer users of a platform have limited insight into what other users are doing, the platform operator may be able to observe the behavior of all users. This is especially true of multisided platform operators, like GAFAs, that operate multiple platforms at multiple layers. These multi-layered, multi-platform providers are in a relatively unique position to acquire extremely large data sets on user behavior and other market intelligence (e.g., on the strategic plans of complementors or suppliers). Modern data analytic techniques and AI can be used to integrate, augment, and process this data, allowing the operators to acquire significant information assets that may provide the basis for significant market power relative to competitors lacking access to such information assets.

3.1.7. Global reach potentially

Digital networks, including the Internet, are inherently transnational or even global in scale. This poses a special challenge for a national regulator.

²⁶ Some lower-layer platforms like those operated by access providers may be closed and are not characterized as multi-sided markets.

Digital platforms can take advantage of softwarization, and the virtualization that supports. That allows the execution of functions to be logically and physically separated in time and space. It allows functionality and control to be delocalized. This can be used to consolidate activities like network operations centers, further enabling the realization of scale and scope economies. It also facilitates on-demand resource sharing and network slicing.

3.1.8. Public Interest

Finally, to limit the scope of our consideration, we focus on issues and networks that are associated with an important public interest. Large network platforms that provide service to the general public meet that standard easily. Other closed platforms that are sufficiently important for one of the policy concerns we address in the next section also meet that standard. Small or specialized networks are not a focus of our discussion here.

In the next section, we discuss the policy concerns that the *newFCC* will confront.

3.2. Typology of FCC Policy Concerns

In this section, we describe several types of policy concerns that arise in our world of Digital Network Platforms. Many of these are not new policy concerns for the FCC, but are newly complicated by the growing importance and complexity of the potential interactions between and among dominant digital platform providers and regulators, each of whom may engage in actions that may have complex cross-layer implications.

In the following subsections, we highlight the range of policy concerns that may arise in each of the following areas:

1. Universal Access
2. Connectivity and Interoperability
3. Anticompetitive Behavior
4. Privacy
5. Use of Network Information, Market Intelligence
6. Promoting healthy markets (stimulating competition)
7. Reliability of critical digital network infrastructures
8. Cybersecurity
9. Governance
10. Economic Growth, Productivity and Jobs

3.2.1. Universal Access

Ensuring that all citizens have access to essential basic infrastructure is a fundamental responsibility for government policy. Under existing communications policy, the FCC oversees subsidy programs that total \$8.7 B per year to support universal access to advanced

communications services.²⁷ Historically, the focus was on ensuring universal access to telephony services, which were originally limited to fixed-line, voice POTS;²⁸ today, it includes promoting access to both fixed and mobile broadband Internet access services that provide access to a broader range of communication and information capabilities;²⁹ and tomorrow, the range of digital communication and computing services that society determines should be included in the universal access policy mandate may expand still further.

In light of the continuing debates over what the minimum speed standard should be for assessing whether the universal service obligations are being met and the continuing improvements in the average speed of available broadband services, we expect that interpreting precisely what should be provided under future universal access mandates will continue to be contentious and pose a challenge for regulators tasked with meeting this obligation.³⁰

In the case of physical infrastructure (wires, fiber optic cables, cell towers and the like), ensuring the availability of broadband access requires significant sunk-cost investment in local facilities. In some high-cost cases (mostly in rural areas), the potential returns are insufficient to justify private investment in even a single provider network, let alone multiple wired or wireless networks. In other cases, even when service may be available, the quality may be deemed inadequate to meet universal service obligations. Furthermore, meaningfully meeting a universal access mandate implies more than just ensuring physical availability to certain technical capabilities for all citizens. Ensuring "access" also implies that the service be affordable and accessible (i.e., citizens possess the requisite skills and equipment to make use of the service).³¹ Even in communities where service is available, and potentially from multiple providers, the pricing and plans on offer may be

²⁷ In 2016, total Universal Service Fund disbursements were \$8.7 B, spread over the four programs: High-Cost Support (\$4.5B), Low-income Support (\$1.5B), Rural Health Care (\$0.3B) and Schools & Libraries (\$2.4B) (see Table 1.10 Universal Service Monitoring Report: 2017, prepared by Federal-State Joint Board on Universal Service, available at https://www.fcc.gov/sites/default/files/2017_universal_service_monitoring_report.pdf).

²⁸ POTS is Plain Old Telephone Service, and was a commonly used acronym to refer to basic, voice telephony service, to distinguish it from more advanced telephony services such as voice conferencing, voice-mail, and other messaging services.

²⁹ Internet access expands significantly the options for electronic communications to include telephony, multimedia messaging, chats, email, et cetera. These may be used simultaneously as substitute alternatives or complements to augment and enrich communication modalities. Moreover, the any-to-any communications facilitated may include machines as well as humans on either end.

³⁰ As the range of capabilities and maximum potential performance (speed, latency) improves, the gap between what might be provided and what is deemed necessary to provide will expand, increasing the potential for diverse views..

³¹ Evidence that the service is not actually being adopted will be viewed appropriately as evidence of problems in meeting the policy mandate. Hence, data on all of these aspects will be needed for informed, evidence-based decision-making regarding universal service policies

deemed insufficient to meet universal service obligations.³² Universal Service policy must confront all of these challenges.

The multi-layer platform character of this infrastructure has made planning of policy alternatives much more complex than in the era of telephone service, where it was clear what the service was (i.e., basic telephone service), what the technology was (i.e., copper pairs to the home), and in many cases who the developer would be (i.e., the incumbent telephone provider, who could be burdened with a duty to serve).

Today, there is a range of possible services that might be viewed as critical for universal access. Modern cable systems and fiber to the home can support a range of services, including modern cable television and telephone offerings as well as broadband Internet access. Policy-makers must determine if the universal service aspiration applies to a platform layer that can offer these (and other) services, or whether it applies more narrowly to the broadband Internet layer, which itself may be able to offer variants of these and other services. This decision will then shape what sorts of technology options are acceptable as a platform for the service. Dense neighborhood deployments of fiber optics involve high-cost, sunk investments, but when undertaken provide significant future headroom for supporting flexible future architectures, traffic growth, and new services.³³ In most communities, having a single such infrastructure is likely to provide sufficient capacity to handle both fixed and mobile broadband traffic, and for many locations we may have only a single (or no) such high-capacity backbone network. In the coming world of 5G, the capabilities, and perhaps the networks, of fixed and mobile broadband services are expected to converge and greater sharing of network resources is to be expected.³⁴

Figuring out what the optimal architecture should be to promote universal and consumer choices in the services they subscribe to will pose numerous challenges for policymakers. For example, in seeking to promote access to both mobile *and* fixed broadband services (the current goal), the policy-maker must decide at which layer to intervene in order to achieve the service goal. Would construction of middle-mile fiber access, or open-access cell towers, be enough to attract private sector investment in fiber optic facilities in target communities lacking such facilities? Or, must

³² Most would agree that universal service ought to allow consumers some degree of choice in service (e.g., speed tiers) and some might argue that it should also include choice among service providers, which implies service-based competition, which may or may not require facilities-based competition. And, facilities-based competition may occur in multiple ways, including partial facilities-based (i.e., relying on shared facilities) and via diverse technologies or business models (e.g., wired v. wireless, end-user v. service-provider deployed, etc.).

³³ In addition to being long-lived, the capacity of installed fiber can be expanded at relatively low incremental cost using DWDM and other technologies.

³⁴ Networks are provisioned to meet peak capacity requirements and hence are designed to be shared. Sharing resources among heterogeneous networks is somewhat rarer and depends on the business model. The offloading of cellular traffic onto WiFi networks is an example of such sharing. In the future, the models for sharing of last-mile infrastructures (cell sites, fiber optics for backhaul, locally distributed caches) are likely to expand. For discussion of 5G, see Lehr (2019) and for what the *newFCC* might do to encourage voluntary sharing of infrastructure, see Lehr & Sicker (2018b).

the policy-maker undertake to construct all the service layers necessary to bring connectivity to the home?³⁵ How important is it that subscribers have choices in mobile and fixed broadband providers? All these decisions interact in complex ways that are fundamentally interdisciplinary, requiring substantial understanding of technology as well as economic and social factors.

3.2.2. Connectivity and Interoperability

Historically, the FCC has been responsible for ensuring end-to-end connectivity for telephony services. Within the U.S., this has involved regulating the interconnection and technologies used by telephone service providers, including setting interconnection charges for long distance and local calling when those services were required to be provided by separate providers. When it came to international calling, the FCC participated in and looked to the International Telecommunications Union (ITU) and the process for setting international telephone settlement rates to regulate transnational calling.

With respect to the Internet, the FCC has eschewed responsibility for regulating interconnection. This was justified in part by the FCC's decision to regard Internet access as an information service and the perception that the FCC lacked the authority, capability, and need to regulate Internet interconnection, especially beyond its potential role in regulating last-mile Internet access. Since the Internet and the global network platforms that support it are transnational in many cases, the question of how to ensure end-to-end connectivity becomes more difficult for a national regulator like the FCC. With the rise of VoIP, regulators have ceded much of their direct authority over regulating end-to-end telephone services both domestically and internationally.

Nevertheless, it seems fundamental to the character of a communication service that it be able to support end-to-end communications. The fact that this policy goal may be difficult to achieve in the more complex Internet ecosystem does not render it less important. If a single provider's network does not provide end-to-end connectivity, then the traffic needs to be handed off to that other network to terminate the traffic. Multiple network hops may be needed to move the traffic from its source to destination. If the networks are under the control of different companies (in the case of the Internet, Autonomous Systems, or ASes), then those networks need to interconnect with interoperable (compatible) technologies. Furthermore, if the goal is to support connectivity between arbitrary physical locations then all of the links between source and destination have to exist and provide sufficient capacity to support the desired level of service. Who and how to ensure that the necessary routes or transmission paths to support the delivery of traffic exist between sources and destinations, and who and how to pay for the use of those paths is something that heretofore has been left mostly to industry participants to sort out. Indeed, one of the ways that the ecosystem has responded to this challenge is via the emergence of digital network platform providers like Content Delivery Networks (CDNs) that help content providers (like Netflix, the

³⁵ A community or municipally-owned network may offer one strategy for accomplishing the goal of provisioning the last-mile broadband infrastructure, but that network would then need options for interconnecting to the Internet and wider-area networks and services, which might require regulatory intervention.

New York Times, and individual content providers) ensure that digital paths exist to get content to end-user subscribers.³⁶

Moreover, since a key source of the Internet ecosystem's ability to scale, its robustness, and evolvability has been its ability to support connectivity across diverse network technologies, it is important that policymakers continue to support a future in which diverse networking technologies can co-exist and interoperate, ideally on a global scale.³⁷ Tools like standards, promulgation of best-practices, and potentially, open access or interconnection mandates may be applicable to promoting these goals.

Whereas the purpose of a network is to provide connectivity among its end-points, in a layered system, the different layers play different roles in creating end-to-end connectivity. The design of the Internet is based on a technical concept called a *spanning layer*, a layer whose specification defines how global connectivity is created. The Internet consists of regions (called *Autonomous Systems*), which interconnect to form the resulting global system. The actual Internet Protocol (IP) defines the addresses of the end-points, and the routing protocols of the Internet define the means by which packets of data are forwarded to their destination based on those addresses.

The Autonomous Systems that are regions of the Internet are most often built and operated by a single firm. The technology that is utilized by those firms, which include communication technology such as fiber optics and wireless, and forwarding technology such as routers, need only provide connectivity at the scope of the firm. These lower layers can be used by the firm to implement other services (for example, delivery of digital video) that do not demand connectivity at a global scope. As well, these single firm platforms can be interconnected to implement services (for example Voice over IP or VoIP) that provide global scope, but not scope that is isomorphic to that of the Internet.

Above the spanning layer that is the Internet itself, application designers can utilize that global connectivity to build applications that can be used from all parts of the Internet. The design of these applications can vary widely. One application might be completely decentralized, and realized using software that runs on the end-nodes, another completely centralized, and realized using a single large server. It is the global reach and generality of the spanning layer that facilitates the design of applications.

What this means for regulation is that the potential tensions and inefficiencies that might arise will be very different at different layers. The Autonomous Systems that interconnect to form the Internet are at the same time competitors, and business issues may lead to inefficient patterns of interconnection. In the context of the Internet, these issues have historically been resolved without regulatory intervention. In other networks, such as the traditional telephone network, the dominant service provider (the Bell system or AT&T) had a regulatory obligation to interconnect with its

³⁶ See Stocker et al. (2017).

³⁷ For networks to evolve, it is necessary to be able to gracefully transition from older to newer technologies. Achieving this goal is quite challenging and the appropriate choice of layer at which to interface new and old technologies represents an important architectural choice.

competitors. The issue of interconnection among regions of the Internet is one that warrants attention, but at the present time does not seem to justify regulatory intervention.

At higher layers, applications are often designed and operated by one firm. While the Internet is built out of Autonomous Systems, firms like Google and Facebook offer services with global scope without the need to interconnect with other firms. At these layers, the potential regulatory issues are very different. In an attempt to create a more competitive landscape, there may be calls for regulation to *require* interconnection with competitors. That interconnection has nothing to do with increasing the reach among end-points, but rather with facilitating market entry and thus competition.

At the lower layers, the issues are again very different. Wireless networks require access to spectrum, which has always been managed by government regulation. The construction of wireline facilities may require regulation to assure access to right-of-ways. Undersea cables may require permission from multiple jurisdictions, depending on the rules of those countries. Satellites operate in the context of international regulation of orbits. All of these issues have their own distinctive scope and scale. But all of them need to be seen in the context of the overall objective (in the context of the Internet itself) of global, general connectivity among end-points that empowers the layers above.

3.2.3. Anticompetitive Behavior

Most of the investment in digital network platforms will be by private sector actors, and to protect the public interest, a focus of regulatory policy will continue to need to be on addressing potential risks and instances of anticompetitive behavior. In the Internet ecosystem, comprised of layered platforms that are sometimes provided by firms that operate multiple platforms, often at multiple layers that are global in scope (which is the case for GAFAs), the potential for providers with significant market power to engage in anticompetitive activity is greatly expanded and inherently more complex to evaluate.

As noted earlier, the so-called neo-Brandeisian Antitrust movement, launched by Khan (2017), highlighted inadequacies in current antitrust methods and practice in addressing the challenges raised by the rise of the digital platforms like GAFAs for effective antitrust enforcement, including the review of mergers and acquisitions.³⁸ The scholars who have engaged in this debate have focused on the extent to which the digital platforms exhibit certain common economic features. Those were summarized in Section 3.1. Those features have a number of important implications for regulating anticompetitive behavior.

Digital network platforms that evince extreme returns to scale and network effects are prone to tipping, or *winner-take-all*, competition. The natural trend in such markets is for them to trend toward increased concentration and eventual monopolization as a dominant winner emerges. A firm that succeeds on its merits by out-performing other competitors in offering customers a better product can be expected to capture market share from less capable, higher cost competitors. The

³⁸ See Appendix for a brief review of this on-going debate that helps provide context for our current paper.

success of such a firm increases consumer surplus and is what the Invisible Hand of market competition is supposed to promote. Hence, the success of such a firm should not be regarded as prima facie evidence of anticompetitive behavior. However, capturing a dominant position in a market can also motivate firms to engage in anticompetitive activity such as raising rivals' costs.³⁹ Protecting competition from such behavior is a challenge for competition authorities and regulators.

In the case of the largest digital platform providers that are active across multiple platforms, many of which are multi-sided, it is often quite challenging to dislodge dominant incumbents once they are established. This is because such platforms benefit from direct and indirect network effects and scale/scope economies across multiple markets and user groups; and because there may be significant switching costs for users that lock users into continued use of the platform. Of course, the same factors that enabled the digital platforms to grow so large so fast in the first place may be exploitable to replace the incumbents in relatively short order. Whether or not switching costs are high and how easy it would be for a new competitor for the market to challenge or replace the dominant incumbent is context dependent and not uniform across platforms.

Network effects, both direct and indirect, interoperability limitations, lack of user data portability and other factors contribute to creating high switching costs. Strategies by platform providers and regulators can impact these factors (as we will discuss further below), and hence, can impact whether switching costs are too high to enable competition *for* the market to be deemed *contestable*.⁴⁰

Another important implication of digital network platform economics that arises in the context of the layered Internet ecosystem is the ability of platform providers to take advantage of scale and scope economies and network effects to facilitate entry into other platforms and to act across layers in complex ways. This can assist the firms in establishing significant economic power that may not appear as dominant power in any single market, but which results in significant market power because of the platform provider's control of platforms across multiple markets and potentially at multiple layers. This enables the platform operators to engage in anticompetitive behavior across multiple markets and platforms.

³⁹ Firm's may undertake strategies in the pursuit of competitive advantage that have, as a byproduct, the effect of increasing the costs for competitors (rivals). The behaviors that raise antitrust concern are strategies that are undertaken with the prime purpose of raising the costs to rivals. In pursuing such strategies, firms with market power demonstrate a willingness to reduce total surplus in an effort to capture a bigger piece of pie from a smaller pie of total surplus. Identifying when a firm's behavior enhances total surplus or is anticompetitive poses a difficult challenge for competition authorities.

⁴⁰ Baumol (1982) launched contestability theory to explain how a market that may be served by a monopoly provider may still behave as if confronting effective competition if potential competition is poised to erode away any monopoly profits on short notice should the current monopolist seek to exploit its market power. The ability of potential competition to discipline market behavior depends on whether entry confronts significant entry barriers and customer switching costs are one such barrier. Under its original framing, contestability theory focused on competition *in a market*, rather than competition *for a market*.

The GAFSA providers have all availed themselves of multi-platform strategies to establish their dominant positions in the Internet ecosystem (although folks disagree as to the extent to which their growth may have been the result of their merits or anticompetitive behavior). For example:

- Apple's iOS ecosystem is a layered series of platforms comprised of Apple's various devices, iOS, application store, and related services (e.g., Apple music). Subscribers to Apple's ecosystem benefit from common interfaces, easier interoperability, familiar "look and feel," and from sharing in the scope and scale economies that Apple realizes from integrating the platform layers.
- Amazon offers its vendors a suite of product delivery and fulfillment services that share scale and scope economies that are hard to match by standalone vendors, while confronting consumers with a suite of Amazon services offered over its array of platforms for searching for products and negotiating purchase transactions (for new and used goods), for accessing a range of on-line media, and other sundry services. Both vendors and consumers of Amazon's eCommerce platform benefit from Amazon's integration across multiple layers of functionality and across most types of retail goods.
- Google offers its users a range of services from email to VoIP to search to cloud services across its global assortment of digital network platforms. Those include access networks (e.g., FTTH in certain communities in the U.S.), multimedia content, Android mobile broadband OS, Google Cloud Services, Internet search functionality, Google's range of end-user messaging and document management services, its Chrome browser platform, its YouTube platform, et cetera.
- Facebook started out as a social network, but has added messaging, document sharing, content access and a range of other applications to its platform. Its acquisition of WhatsApp expanded Facebook's role in messaging apps, and it is building a payment platform.⁴¹

While the benefits of these multi-platform operators are substantial, they also pose potential risks for protecting competition. The users of the platforms may also become direct competitors of the platforms when a platform operator integrates forward to compete directly in the markets served by the platform users. Apple provides applications that compete with Apple app store applications provided by third-parties and Amazon offers products via its eCommerce platform that compete directly with the products offered by third-party vendors on its platform. There is a complex set of incentives at work that need to be considered to figure out whether the behavior is anticompetitive and merits regulatory intervention. There is a mutual dependency: the complementor cannot exist without the platform, and the platform is of no value without complementors. At the same time, both the platform and the complementors are anticipated to be profit-seeking entities and may be contesting for the same pool of revenues. Typically, both parties have a degree of market power and their tussle is part of how market competition ought to play out. A regulatory intervention

⁴¹ "Facebook building cryptocurrency-based payment system," Wall Street Journal, May 2, 2019, see <https://www.wsj.com/articles/facebook-building-cryptocurrency-based-payments-system-11556837547>.

which over-constrains the bargaining power of one side may strengthen the bargaining power of the other, resulting in a potentially worse outcome for consumers.⁴²

When dominant platform providers pursue such multi-layer, multi-platform strategies in an effort to capture or control a market, such strategies confound traditional methods for defining markets and assessing market power. First, traditional empirical methods for assessing market power focus on shorter-term behaviors and outcomes that may not capture the actual game being played. A platform provider that is competing to capture a dominant position in a global market may be pursuing a much longer-term strategy than antitrust authorities have previously focused on. Such a firm (and its investors) may be willing to sacrifice profits over a longer horizon in the hopes of securing a much bigger future pie of monopoly profits.

Second, the source of a multi-platform operator's economic power may stem from their control and integration of multiple markets – their control of an ecosystem – that is not readily amenable to traditional methods of defining markets. For example, for almost all of the services that these providers offer there are currently multiple alternatives (although in certain markets, they are clearly the dominant providers as measured by traditional market shares).⁴³ For example, Amazon and Google (and a number of other digital platforms like eBay, Barnes-and-Noble, etc.) offer competing platforms for searching for product goods. These platforms link potential vendors, consumers, and online advertisers. Likewise, there are numerous competing alternatives for all of the messaging services that these platforms offer. An analysis of market power that focused on final goods markets would fail to adequately capture the economic role played by the digital network platforms operated by GAFA and others.

A further implication of the economics of digital network platforms is their potential to be disruptive to markets across both digital and non-digital sectors of the economy or parts of sectors. The rapidity with which digital network platforms may grow and scale can result in significant disruption costs that in themselves may pose a significant policy challenge. The rise of Uber, AirBnB and other sharing-economy platforms have caused significant disruption to legacy off-line sectors, necessitating changes to legacy sector-specific regulations and disrupting labor markets. The rise of eCommerce has threatened the viability of local bricks-and-mortar retail and the

⁴² This is an example of the old adage “my enemy’s enemy is my friend” – in asymmetrically constraining the market power of a dominant platform player at one layer, regulatory policy may accentuate the market power of a dominant player at another layer, resulting in a less competitive Internet ecosystem overall. At a local level, this was our concern in commenting on the original 2010 Net Neutrality Order (see Clark, Lehr, Bauer, 2009). Constraining the bargaining power of broadband access ISPs through network neutrality rules that leaves edge providers such as Netflix, Google, and Viacom unregulated has the potential of producing a less neutral Internet and leaving broadband subscribers less well off. At an international level, policies that limit the market power of GAFA but leave BAT intact may result in a less competitive global Internet ecosystem.

⁴³ For example, Apple has a dominant position in controlling the iOS ecosystem (although the Android ecosystem is globally larger); Facebook is the clear market leader among social networks (but there are lots of niche competitors like LinkedIn); Amazon is the leader in eCommerce retailing (although there are lots of competing platforms targeting most product markets as well as niche markets); and Google is the clear market leader in general search (but there are horizontal and vertical search alternatives).

commercial retail hearts of many communities. Even when the overall changes may ultimately be welfare enhancing, the distributional effects of the changes (who wins/who loses) may be inconsistent with social goals of promoting equity and impose additional burdens on policymakers tasked with helping facilitate management of the adjustment costs (e.g., retraining workers for the digital economy, repurposing retail real estate that has moved online). Those adjustment costs are real costs for society and hence matter to an assessment of the public interest, however such costs are seldom born by the digital entrepreneurs.⁴⁴

Another challenge that the rapid growth of digital network platforms presents is the potential that the success of a dominant platform architecture or provider may emerge prematurely (e.g., because of the lock-in effects of first-mover advantages), before adequate experimentation may occur. The winner of such races to dominance may not be the best or most efficient choice from the perspective of maximizing total surplus or welfare. The potential to lock-in to an inferior choice for a dominant network platform is a well-known problem that arises in standardization processes where bandwagon equilibria are common.⁴⁵

Taken together, these effects may justify a public interest in slowing the pace of growth of a dominant platform or, on the other hand, the pace at which a dominant platform may be replaced, even if it is recognized to be inefficient. Considering such effects is unlikely to be something that would be addressed appropriately by general competition authorities and may require the context-specific, sector-specific expertise of the *newFCC*.

The key anticompetitive harms that may arise associated with a digital network platforms include (1) setting prices too high (monopoly pricing); (2) coopting or raising rivals costs to foreclose competition and potentially access to welfare-enhancing innovations;⁴⁶ and (3) exploiting their special abilities to collect market intelligence to harm competitors. Each of these raise somewhat different regulatory concerns.

⁴⁴ See Zuboff (2019).

⁴⁵ In markets with extreme network effects, switching costs (that render adoption decisions imperfectly reversible) and multiple equilibria, early adopters base their decisions on their anticipation of what the winning technology will be. Everyone wants to adopt the technology with the greatest number of adopters, which can become a self-fulfilling prophecy and means that small events, early on in the adoption process, that influence expectations about which technology will be the winner can determine the winner. Such equilibria are referred to as bandwagon equilibria – users want to join the winning bandwagon before knowing precisely which wagon that will be.

⁴⁶ On its path to dominance or to sustain its dominance, a firm may seek to acquire rivals in any of the markets that the multi-platform, multi-layer digital network provider may be active in. That might be a rival offering a competing platform or a platform in an adjacent market at the same or another layer in the Internet ecosystem. Traditional antitrust typically looks at such efforts to coopt competition as either horizontal *or* vertical mergers, but in the multi-layered world of digital network platforms, those classifications seldom apply neatly. Moreover, for the reasons already cited, assessing the market power risk from permitting an acquisition by a digital network platform provider presents challenges that may allow too many acquisitions of potential rivals to be approved.

With respect to the first risk – that a dominant platform provider may set monopoly prices, classic antitrust policy recognizes that one of the benefits of becoming a successful monopolist is the privilege of charging higher prices. Moreover, classic platform theory would say that if the platform operator sets fees at a level that discourages the complementors from entering the market, such behavior will be self-destructive, since the platform itself cannot succeed without complementors. In this respect, pricing of a platform should be at least partially self-correcting. However, a platform provider may elect to integrate forward into its user markets and into other platform markets to capture downstream profits, rendering such self-correction less effective. From a regulatory perspective, there seems to be little appetite in the U.S. these days for direct price regulation, even if the prices seem excessive. However, in the EU, there is more willingness to rein in excessive prices.⁴⁷

The fact that the GAFAM platform providers all operate multi-sided platforms raises an added challenge since users on one side of the platform typically receive services for free.⁴⁸ Such pricing that takes account of demand effects on users on multiple sides of the platform is often optimal and part of the fundamental business strategy for the platform operator. However, to traditional antitrust authorities, such free or negatively-priced goods look like predatory pricing and make it hard to evaluate market shares.

The second case of potentially anti-competitive behavior is blocking or excluding certain complementors from the platform, perhaps because they compete with an offering provided by the platform operator but also perhaps for other business reasons. In some contexts, there has been strong concerns about blocking (or throttling) the traffic of platform complementors. For example, "network neutrality" may be viewed a response at the platform layer of the Internet. But in other contexts (app stores, for example) there seem to be fewer concerns. We illustrate this in some of the case studies below.

The third case arises from the fact that the operator of the platform can observe the behavior of the complementors. The information thus gained can potentially be used by the platform operator to disadvantage the complementor. Perhaps the platform operator can use the information they can gather as a basis to decide whether to develop an offering that competes with the complementor, or to manipulate the fees charged to the complementors.

In the above, we have discussed the myriad ways in which digital network platforms can raise anticompetitive concerns. In all such cases, a general competition authority such as the DoJ or FTC may be called upon to intervene, and when they do intervene, a question arises as to what role the *newFCC* ought to play. Our view is that if the matter is indeed generally recognized as fundamentally about protecting the process of competition, then the *newFCC* ought to take a secondary role. However, there may also be public interest considerations or non-market power competition issues (e.g., market coordination failures) that may not be adequately addressed by competition authorities and that the *newFCC* would need to address. Moreover, as the expert

⁴⁷ See, for example, TFEU Article 102 (a).

⁴⁸ Actually, since the platform providers incur costs in providing free-service to users, the services may be viewed as being provided with a negative price.

agency with the best on-going capabilities for monitoring technical and market trends impacting digital network platforms and the Internet ecosystem, the *newFCC* may be the best agency to enforce remedies to address anticompetitive behavior.⁴⁹

Among the remedies that a *newFCC* may seek to use to address anticompetitive behavior are strategies to promote platform or ecosystem characteristics that will render competition *for* the market more contestable. That includes efforts such as more stringent M&A review to limit the ability of dominant platform providers from harming potential entrants by either taking them off the table prematurely (acquiring nascent competition) or further raising entry barriers (e.g., by raising the ante for acquiring user data and market intelligence). It also includes promoting policies that facilitate interoperability and interconnection to allow entrants and platform competitors to potentially share in network effects and reduce user switching costs. Policies that make it easier for users to multi-home and facilitate data portability also may help in rendering anticompetitive threats less worrisome. Enabling data portability will also be important for addressing the privacy and market intelligence concerns raised by platforms (see further discussion below), and their implementation/application will likely require detailed understanding of the technical architectures and operations of the digital network providers. Finally, in its role of providing a forum for adjudication of complaints, the *newFCC* may alter the balance of proof to better address future risks: rather than being responsible for proving that a future risk is probable, the burden of proof may be shifted to the defendant to prove that the future risk is improbable and to offer guarantees that strategies exist to address that risk should it arise (i.e., that the feared outcome is reversible or detectable and may be ameliorated before significant harm to the ecosystem results). A *newFCC* with greater authority and scope for imposing industry behavior norms (standards, best practice mandates, minimum quality standards, and open access/non-discrimination obligations) that are closely tailored to the technical and market realities of the digital platforms would be in a better position to implement such policies.⁵⁰

3.2.4. Privacy

The protection of individual privacy and enforcing individual property rights over personal information is not unique to any particular sector or even to the digital realm. Consequently, we do not believe that a sector-specific regulator would take the primary lead in defining or enforcing privacy rights in the digital context. Whereas it may be reasonable for an issue-specific regulatory authority like the FTC, with responsibility for enforcing competition policy across all sectors of the economy, to play a leading role in enforcing privacy policies, we anticipate that the role for the *newFCC* would be more specialized and perhaps secondary, following the lead from other

⁴⁹ For example, the FTC or DoJ may determine what the remedies ought to be but leave it to the *newFCC* to monitor and enforce compliance with those remedies.

⁵⁰ Harold Feld (2019) and Morton (2019) call for an expert agency to address these digital network platforms competition concerns, but are unclear whether this expert agency should be a *newFCC*, the *newFTC*, or yet some other new authority. We believe that the *newFCC* is the most logical agency to assume this role, while also anticipating that a *newFTC* will also be involved.

regulatory authorities.⁵¹ However, we expect that situations will arise in which the *newFCC* may play an important and more specialized role in enforcing national privacy policies.

Examples include the interplay of privacy and encryption, and the issues surrounding privacy that arise in the advertising-funded regions of the digital ecosystem. These issues do not relate to platforms specifically, but to the defining aspects of the digital ecosystem more generally. With respect to platforms, one interesting observation is that multiple layers may be in a position to gather personal data, and all of these layers may be either cooperating or competing to use that data to extract value from the advertising ecosystem. This reality may generate contention among the operators of different platform layers as to which is privileged to gather certain forms of data. We illustrate this in the discussion of DNS over HTTPS (DoH) below.

To further illustrate how a policy concern might arise in our layered ecosystem, consider that the capacity provisioning by lower platform layers depends, in part, on the ability to forecast the demand from higher layer platforms, and eventually end-users. If lower layers could engage in DPI or other techniques to learn about the user behavior of customers at higher layers, that would provide information that may be used to improve network management, enabling higher utilization of available capacity and thereby reducing overall average costs. On the other hand, the use of such techniques and the acquisition of such information by lower layer platforms may pose an unacceptable threat to individual privacy and the confidentiality of platform complementors and users at higher layers. Privacy-preserving encryption at a higher layer may complicate cross-layer coordination of capacity investments. A solution to this quandary may be to allow greater scope for longer-term capacity contracting and greater tolerance for congestion events as alternative ways to deal with a future where platforms at different layers may share less information with which to forecast traffic requirements.

3.2.5. User Data and Market Intelligence

A central feature of digital network platform businesses is their ability and need to acquire, manipulate, and make use of digital information about user behavior and other network and market-related events. For the digital network platforms to perform their basic functions they often have to collect significant amounts of data, including much that is not identified as individual personal data (and so a matter for personal privacy). Dominant digital network platform providers, many of which control multiple platforms and may operate at multiple layers are in an especially powerful position to acquire and integrate data from many sources. Digital technologies enable this wealth of data to be augmented and integrated with other data sources and processed with AI to create new and valuable information assets that can be used to forecast market trends. This can produce significant benefits for consumers by allowing businesses with access to such data to better customize products and services, respond more rapidly to changing circumstances, and more generally efficiently match supply to demand. This data can also enable companies to more easily engage in a variety of anticompetitive strategies, and the lack of access to such data capabilities

⁵¹ As part of its role as the regulatory authority responsible for protecting competition, the FTC enforces truth-in-advertising, which provides a powerful tool with which to hold digital service providers liable for adhering to their data use policies, including their promises to their users regarding how they will make use of personal information.

may pose a significant barrier to entry to nascent competition. Such data stores and the AI tools that make use of them may also be utilized to manipulate consumer behavior in ways that give rise to worrisome threats to the public interest (e.g., dissemination of fake news).⁵²

As part of promoting healthy markets, regulators have responsibility to ensure participants have access to the information they need to make informed decisions. That means platform providers, complementors, and users across the layered ecosystem need access to market intelligence. To ensure that is the case, the *newFCC* may use focused disclosure and transparency mandates, active measurement and reporting requirements, and support studies to identify, track, and validate salient metrics of market performance (price, traffic, capacity, business practice trends, etc.) in order to supplement public information gaps.⁵³

Additionally, to address the potential risks that the dominant digital platforms ability to acquire huge, asymmetric information assets that might enable an excessive concentration of economic control over our digital future and pose a threat to competition, policymakers may need to intervene to offset those advantages. Interventions may take the form of requiring digital platforms to limit the uses to which they may apply certain data, requiring that some of the data or the information assets created with the data (e.g., forecasts based on anonymized user data), or perhaps even divesting or engaging with affiliated platforms via arms-length data sharing arrangements. Figuring out how to manage data sharing and management issues across platforms and users at the same or different layers in the Internet ecosystem will pose a difficult challenge.

3.2.6. Promoting healthy markets

Policymakers have an on-going interest in promoting the health of markets across the multiple layers of the Internet ecosystem. Such promotion efforts need not depend solely on a desire to protect against or respond to anticompetitive behavior, a topic we addressed earlier above. It is possible that the outcome of competitive markets may fail to deliver the digital services desired. There may be too little choice among offerings, not the right degree of quality, an industry structure that concentrates too much economic power in too few private hands, or digital services that fail to offer sufficient overall system reliability. Markets may fail for many reasons unrelated to market power. Lots of chicken-egg problems may impede the development of new markets, a problem that is exacerbated when investments across multiple layers need to be coordinated. Indeed, one of the reasons for efficiencies realized by firms that operate multiple platforms at multiple layers is the greater control that may afford them in coordinating cross-layer interactions. For example, Apple's control of the user device (Apple's hardware platforms that include the iPhone, iPad, Apple watch, etc.), the operating system platform (iOS), and the selection of user applications available via Apple's App store platform allows Apple a much greater degree of control over the user

⁵² See Zuboff (2019).

⁵³ We anticipate that in a healthy Internet ecosystem, most of the information used by consumers and firms to make informed market decisions will be provided by other participants in the market (e.g., firm marketing materials, consumer research firms, trade press, et cetera), but gaps are also likely to exist. The FCC's Measuring Broadband America program is an example of the sort of active measurements that the *newFCC* may sponsor (see <https://www.fcc.gov/general/measuring-broadband-america>).

experience than is feasible by hardware or app store vendors operating in the Android ecosystem. Whether that control leads to a better end-user experience depends on whom you talk to.

Not all platforms are intended to be used by other parties. The developer of the platform may intend to use the platform as a basis to develop and provide higher-level offerings itself. In other words, the platform is designed to be used internal to the firm (or firms) that develop it. This arrangement, of course, has the consequence that competitors cannot enter the market and offer competing higher-level services without developing their own alternative to that platform.

In some cases, the platform may constitute a natural monopoly (e.g., FTTH in most local markets) such that having a single platform provider offers the minimum cost solution. Moreover, as already noted, some platform markets may exhibit winner-take-all economics with the result that they will tend toward increased concentration and ultimately monopoly, even if the dominant firm that emerges may not be the lowest-cost, most efficient provider.⁵⁴

In cases where replication of that platform is either not efficient or practical, and where competition in those higher-level services is considered important to the overall ecosystem, the platform may be deemed to constitute a bottleneck resource (i.e., a resource that higher-level services require access to), and regulatory intervention may be justified to allow the monopolized platform to be shared with potential competitors. The decision to mandate such shared access need not depend on any evidence that the dominant platform provider was excluding other users in pursuit of some anticompetitive purpose, but rather that sharing the platform was in the public interest. This case is perhaps most easily made when there is consensus that the platform is a natural monopoly, but as noted above, that is not necessary.

3.2.7. Reliability of critical digital network infrastructures

Ensuring the reliability and viability of our banking system, transportation and energy grids, critical government services, and public safety networks requires coordination and oversight on behalf of multiple government entities. Every sector of the economy is becoming increasingly dependent on digital network platforms for basic communications and other computing capabilities, which increases the dependency of society and the economy on having access to robust and reliable digital network infrastructures.

The sector-specific regulator will play an important role in making sure that provisions are in place to ensure the reliability of critical digital network infrastructures, including ensuring that there are sharing agreements in place and best-practice procedures for preventing and responding to emergency or other network failure situations. Accomplishing this task requires competing providers to share detailed technical information and negotiate mutual aid and back-up solutions in the event of individual network failures, as well as strategies for more catastrophic events. The *newFCC* will need to monitor such negotiations to ensure they do not enable dominant firms to cartelize the industry.

⁵⁴ Fortuitous circumstances may have allowed one platform to obtain early first-mover-advantages (e.g., early adopters) that allowed that platform to out-perform slower-starting but potentially higher-welfare-producing competing platforms.

In the ecosystem of multi-layered platforms, the failure of higher-layer platforms should not pose a risk to lower-layer platforms, but the reverse is not true, unless the higher-layer platforms are multihomed. Higher-layer digital platforms like the Internet or Amazon's eCommerce platform depend on lower-layer access platforms from last-mile providers. Whereas the failure of a local access network may completely cut off a community from the Internet or from Amazon's eCommerce platform, the loss of a subset of local subscribers would not result in a failure of the Internet or Amazon platforms. This illustrates the sense in which the cross-layer dependencies are complex.

3.2.8. Cybersecurity

Cybersecurity is a growing problem across the entire globe and across all sectors, and is not amenable to being solved by any single regulatory authority. Collectively, we do not know or agree on what the best practice responses ought to be to respond to cybersecurity threats, although progress has been made to varying degrees across differing sectors. For example, the financial community, which has long been leaders in adopting information technology and has long been an obvious candidate for attack by cyber criminals (since that is where the money is), is fairly advanced in its processes and procedures for addressing cybersecurity threats and countering many common forms of attack (e.g., credit card fraud). Small businesses and consumers are much less sophisticated in their responses to cybersecurity threats.

Lacking firm guidance and consensus on what might be most helpful, most government efforts to address the threat have eschewed regulatory mandates in favor of relying on voluntary adoption of cybersecurity measures.

It is not clear that a voluntary approach is the best one. In many cases, the most effective investments in defensive strategies may not be by the entities that are most at risk from an effective attack. A data breach may not directly harm the entity whose databases were breached but harm other entities against which the data breach might be exploited (e.g., to conduct financial fraud or facilitate other cybercrimes). Often early adopters may not be able to determine what investments in protection will be effective or are unable to predict the risk of suffering an attack in a victim rich environment. Investments in defense are personally costly, but the benefits spill over to others because they tend to reduce the incentives of attackers to invest in attacks (if the protections actually are effective), which benefits all potential victims, not just those that adopted the protections. In such situations, voluntary adoption may result in too little investment in protection. A regulatory mandate to target and induce efficient adoption of cyber defense strategies may be needed to address these failures of relying on voluntary mechanisms.

Any attempt to impose regulatory obligations to improve cybersecurity will require an agency with deep technical expertise. The cybersecurity challenge needs to be broken down into actionable parts, and the responsibility for each part needs to be assigned to the set of actors best positioned to deal with it. In some cases, several classes of actors may need to take action, so there are serious coordination problems to be addressed, as well as externalities.

Again, the layered platform structure of the ecosystem makes the analysis and mitigation of cybersecurity problems more complex. Security problems, like other problems of reliability and robustness, can arise at any layer. A regulator could assign to a given layer the responsibility for

detecting and mitigating all the security problems that might arise at that layer, but this responsibility may be hard to implement. Some security problems may arise at one layer but only be detectable at higher layers. So it may take cross-layer coordination, which in turn may imply coordination among actors whose interests are not always aligned to improve cybersecurity. In some cases, the best approach may be to impose an obligation on a higher layer to implement mechanisms to deal with security problems that actually originate at a lower layer.

This topic is complex, and there is not scope in this paper to delve into how the cybersecurity problem could be broken down into actionable parts, and how responsibility for detection and mitigation should be allocated among the layers.⁵⁵ But it is clear that if the government is going to play a role that is more than hopeful cheerleading, an agency with deep expertise will be required. Further, because many (although not all) of the cybersecurity problems are global, this agency cannot be framed as totally domestic and inward looking. In contrast to some of the other issues discussed here, such as universal access, which can be addressed internal to a given country, improvement of cybersecurity will require cooperation among policy-setting and regulatory bodies across the globe, which implies an international role for the sector-specific agency.

3.2.9. Governance

The issue of governance of the digital ecosystem is illustrated by the previous discussion of cybersecurity above. Regulation is normally domestic; cyberspace is global. Some of the layers (in particular the layers with physical assets such as residential access technology) are local to a jurisdiction, but this is not always true. There are lower layers that are transnational, including undersea cables, spectrum, and management of satellite orbits. At higher levels, platforms are more likely to be transnational. This means that the same platform (for example a search platform like Google) may be subject to different (and indeed, potentially inconsistent) domestic regulation in different jurisdictions. Local regulation of global platforms will be a growing issue for the digital ecosystem. Some of the issues will be highly technical, and will require sector-specific expertise.

3.2.10. Economic Growth, Productivity and Jobs

One of the underlying themes of the digital revolution has been its role in economic growth. Innovation, which plays a role in economic growth, is a powerful aspiration in Washington, and since competition is often a driver of innovation, competition is also an aspiration. A sector-specific expert agency would probably not be given a mandate to stimulate economic growth, but its charter might include the goal of stimulating competition. The Telecommunications Act of 1996 begins: "An Act: To promote competition..." In this context, it is worth noting the implications of layered platforms for innovation and competition. One of the desired features of a platform is stability, so that the complementors that use the platform have confidence that their offerings will not be disrupted by changes in their infrastructure. The desire for stability will limit certain sorts of innovation of the platform itself—the primary role of a platform may be to stimulate innovation at the layer above.

There are forms of innovation that are certainly open to platform operators—innovations that reduce capital or operating expenses, and which allow the platform to scale more efficiently. The

⁵⁵ For a fuller discussion of these issues, see Clark (2018).

protocol that defines the Internet platform was specified in 1981. The stability of that interface has been one of the key factors in the success of the Internet. However, the speed of the Internet has increased by orders of magnitude, and the reach of the Internet has expanded to cover the globe. These factors do not require that the platform complementors—the developers of Internet applications—rewrite their code. The increasing speed has allowed whole new classes of applications to be developed, such a streaming video, but the stability of the Interface has reduced uncertainty and maintenance costs for application developers.

Because of the expectation of stability that complementors have for platform interfaces, one should be cautious in assuming how increased competition might drive innovation and in turn drive economic growth. Competition may indeed play a role in driving platform innovation, but the best driver of economic growth may be *investment* in the platform, which increases its scale and scope, which in turn drives economic growth that emerges at the higher layer. The strategic question for governments will be how best to stimulate investment in platforms. Innovation and competition will only be part of that equation.

3.3. Criteria for Evaluating FCC Intervention Options

The layers of platform not only shape (and in some cases complicate) the analysis of harms, they also add complexity to the crafting of remedies. Harms can arise at one or another layer, and remedies can be applied at one or another layer. Devising a remedy at different layers can have different consequences, different needs for coordination, and different potential for success. Because the targeting of a remedy at a different layer may have different consequences, there may be a stronger or weaker argument about the *validity* of targeting a particular layer.

We propose the following criteria for evaluating regulatory options at different layers, once the policy decision has been taken that intervention is justified.

- *Stability*: the layer at which regulation is targeted should be stable. Layers that manifest rapid technical evolution may be difficult to regulate, since it may be hard to write regulation that is sufficiently neutral to technology that it continued to be applicable. In a worst case, evolution may remove some layers from the stack all-together, rendering regulation irrelevant.
- *Utility*: is there sufficient argument or evidence that the remedy will be effective? A regulator must model how the regulated sector will respond to the proposed obligation. What are the options for regulatory escape?
- *Parsimony*: regulate no more than you have to. Will regulation of one layer eliminate the need to regulate other layers? Try to avoid redundant regulation, and avoid an outcome where an obligation at one layer produces interactions that trigger a need to impose obligations at another layer to compensate.

We illustrate how these criteria might apply in some of the case studies that follow

4. Scenarios for Platform Regulatory Intervention

In the following sub-sections, we analyze some case studies of regulatory concerns associated with Internet platform providers. In selecting these examples, our goal is to be illustrative rather than

all-inclusive. We use the cases to illustrate some of the ambiguities and our current thinking as to how those may be resolved. We include the following cases:

- (1) Broadband platforms and last-mile access in order to illustrate how the multi-layered platform concerns may arise with legacy FCC policy concerns;
- (2) Domain Name Service (DNS) and the debate over new approaches to providing the service in order to highlight a complicated debate over which layer should be responsible for providing DNS;
- (3) Application Development Environment to highlight how the multi-layered nature of the Internet depends on multi-platform, multi-layer providers such as the Apple App store;
- (4) Amazon's eCommerce platform which provides an example of an application layer platform that is helping to reshape the nature of retail trade;
- (5) Facebook and the divestiture of WhatsApp to highlight Facebook's role as a leading platform provider and explore the issues raised by strong structural remedies such as mandatory divestiture as a tool for addressing higher level platform issues; and,
- (6) Google and antitrust investigations motivated by its role in search to highlight Google's role and the ambiguous role that a *newFCC* may have relating to investigations lead by antitrust authorities.

These cases were selected to address both the differences and commonalities across each of the GAFA participants and our preliminary thinking on topical issues that we have been grappling with in recent months.

4.1. Broadband Platforms and Last-mile Access

A long-standing regulatory concern centers on last-mile access, which may be subject to monopoly power in many markets. This is the classic threat of natural monopoly provisioning that was a focus of legacy telecoms regulation and justified strong public utility regulation. Last-mile access represents an essential facility for a range of critical services (telephony, entertainment television delivery, *and* Internet access) that could be abused to extract monopoly rents, limit choice (or quality), and harm innovation (e.g., foreclose competition). The historic remedy was to regulate the last-mile as a public utility, but over time the trend has been to relax direct regulatory control over decision-making by broadband platform providers.

We mention this case here, because it provides a relatively well-understood and accepted justification for legacy FCC regulation and was the principal focus of the analysis in Lehr & Sicker (2018a,b). However, the layered nature of today's technology (and industry structure) renders the analysis of last-mile access regulation more complex. Assume for the moment that the preferred remedy is to mandate sharing of the access platform at a given layer. At what layer should this requirement be imposed?

Lehr & Sicker (2018a,b) argued that ensuring shared access to conduit or outside structures may prove sufficient to respond to the risk of market-power abuses by last-mile providers. Additionally, Lehr & Sicker pointed to spectrum policy reform which expands access to RF for wireless competitors and to other reforms that remove regulatory barriers to new business models for providing last-mile access. These latter may include municipal or community networking or other

models for edge-based, end-user self-provisioning alternatives to traditional, service-provider last-mile access services. In some cases (e.g., where private investment incentives are inadequate to justify investment in appropriate infrastructure), it may even be desirable for government to promote public utility investment in the broadband platform.⁵⁶

Mandating sharing at a given layer creates the potential for competitive services to be offered at the next layer of the platform stack. For any proposed intervention (e.g., mandated sharing of a platform), the regulator must be able to defend the argument that the anticipated set of services thus created or protected (e.g., a market) is viable, and sufficiently serves the public interest that the mandate is justified. This reasoning will be different at different layers.

- (a) Conduit/Outside Structures: these are perhaps the easiest to understand as natural monopoly facilities that are locally provided. Investment in these is long-lived and sunk, and the technologies for provisioning these assets is relatively stable (at least compared to networking hardware and software). Moreover, there is a long tradition in regulated sharing of these resources among utilities. A mandate to require sharing of conduit and outside structures could encourage the construction of separate facilities, which could in turn support a wide range of services. However, the landscape of outside structures is highly heterogeneous, and major costs would remain for the potential market entrant. The regulator would have to argue that the remedy would provide sufficient scope for an entrant to be successful, and that the return on investment (presumably in competition with some incumbent), would attract a competitor.
- (b) Unbundled Network Elements (UNEs): The Telecommunications Act of 1996 mandated that an incumbent telephone provider unbundle the different network components that make up their network. The UNEs included copper loops, switch ports, and a number of other elements. However, this approach fails the *stability* test, because while it makes sense to unbundle the physical copper pair that runs to a home, this conception of sharing is technology dependent. More modern access technologies, such as the hybrid fiber/coax of the cable industry, or fiber to the home, make use of physical circuits that are shared among a number of residences. With such hybrid fiber/coax architectures, there is no easy way to unbundle a physical network element corresponding to the path to a single residence. A new mode of sharing would have to be defined to allow the sharing of such local distribution networks. By 2000, efforts to implement the UNE approach were significantly abandoned in light of the inability to enforce the framework and the growing recognition that the near-term future would involve duopoly (wired) intermodal competition between telco and cable TV based broadband platform providers.
- (c) In the case of fiber optic access links, under some circumstances it might be possible for multiple competitors to share the fiber infrastructure, perhaps by using different optical wavelengths of the fiber, or different fiber strands in a bundle. If such sharing were possible,

⁵⁶ For example, a number of communities with locally owned electric utilities (such as Concord, MA) have found it viable to offer municipal broadband alternatives (FTTH in the case of Concord) that compete with service provider alternatives. Concord is a rich community and was not "unserved," and yet the community opted to support its utility offering broadband services, thereby expanding the range of provider choices available to residents.

it would greatly reduce the cost of competitive provision of higher-level services. If the fiber is owned by the community or some other third-party (like the high-power cell towers that mobile operators mostly rely on), then such access might enable facilities-based competition. On the other hand, this approach runs the risk of failing the *stability* criterion, since it would be easy for an incumbent to deploy a fiber system such that this mode of sharing was not practical; Or, if sharing was mandated on a particular fiber system, that might make it difficult to migrate to more advanced fiber systems in the future.⁵⁷

- (d) As an alternative to sharing of physical access technology, a regulator could mandate shared access at a higher layer. Almost all access technologies include a layer that breaks the transport capacity into logical transmission units, such as packets, frames or cells. The regulator could mandate that capacity be shared at this layer, an approach sometimes called *bit-stream* access. This approach has several benefits. First, it is likely to be a more stable approach, since it is more technology-independent. Second, the bit-stream sharing can be mandated to reach not just across the access link itself, but further into the network of the incumbent, to a point of interconnection with the competitor. This further reduces the cost of entry for the competitor. However, as the competitor uses more of the incumbent's network, it is constrained by the features of this network, which may limit the ability of the competitor to innovate new services. In the limit, the competitor may be restricted by the technology of the incumbent to offering services that are essentially copies of what is offered by the incumbent, which may prove a barrier to market entry. One hope for bit-stream sharing is that may allow market entry by a competitor that later moves to install its own facilities. If the goal is to promote facilities-based competition among Internet Service Providers (ISPs), this may prove a viable strategy and the jury remains out as to its longer-term merits.⁵⁸

As one moves up the layers, the costs of deploying competing last-mile network services is reduced, lowering the barriers to competitive entry for partial-facilities-based providers. However, the range of services and type of competition that higher-layer "resellers" may offer is constrained by the nature and mechanism for managing sharing of the lower-layer resource. Today's incumbents offer a triple play of video, telephone, and broadband Internet access services. The policy-maker must decide whether, for a competitor to survive, it must be able to offer all these services, and whether there is a compelling public interest in creating competition in all these markets. Today, video and telephony are available as "over the top" (OTT) offerings over the Internet. Telephone service can be provided using cellular technology. So perhaps it is sufficient, both to serve the public interest and to create successful competition, that a form of sharing be mandated that only creates competition in retail Internet access. Sharing at the bit-stream layer may enable partial-facilities-based competition among ISPs for broadband access services, but may not enable the competitor to offer video programming and VoIP telephony. If end-customers want the triple play, then the platform provider may be able to threaten the viability of ISP competitors.

⁵⁷ This is a problem that has bedeviled DSL sharing of copper wired plant. To the extent DSL sharing is successful, it may deliver competitive choices among DSL providers (sharing the incumbent exchange carriers copper plant) that may expand consumer choice and result in more intense competition in the short-run, but at the expense of making it more difficult for the incumbent to retire copper plant and migrate to a next-generation fiber network.

⁵⁸ See Cave (2014).

Sharing at the lowest levels (conduit/outside structures or UNE) may fail the parsimony criterion, since it may be necessary to require sharing at other layers as well to attract new market entrants. UNE unbundling is complex to implement and enforce, and offers so many ways for an incumbent to avoid full compliance as to be effectively unworkable. Hence, we conclude that UNE sharing fails the utility criterion. That was the lesson learned from efforts to implement the UNE framework under the Telecommunications Act of 1996.

Ordering bit-stream access seems better from the perspective of both parsimony and utility, but it is unclear how much of an expansion in competitive options such access may enable and whether the focus on Internet access ought to be with respect to enabling choices in the access ISP that is reachable via the broadband platform or with respect to end-user choices in the providers of the key functionality that ISPs provide (e.g., access to email, to the Web, VoIP, etc.). Even if a user has only a single ISP, many of these services may be obtained (and at no additional monetary charge) from Internet platform providers like Google or Facebook. Thus, the benefits of ordering bit-stream access provisioning may fail to satisfy the validity criteria. To serve the public interest in ensuring adequate broadband Internet access, it may be sufficient to regulate the Internet layer itself, to prevent blocking of higher-level services.

The above discussion illustrates how the layered nature of services and platforms in the Internet ecosystem complicates regulatory policy even when applied to legacy issues such as last-mile access platforms. As we discuss in subsequent examples, the situation is even more challenging when thinking about functionality or platforms associated with other platforms or participants in the Internet ecosystem.

4.2. Domain Name System

The Domain Name Service (DNS) is the Internet functionality that allows user-friendly ("Domain") names to be mapped to network (IP) addresses. Although there are many ways in which such basic functionality might be provided, a global service for accomplishing this task of mapping from the name-space to the address-space is essential for the functioning of the Internet. Today's DNS ecosystem has evolved to meet this need and has scaled remarkably well to ensure affordable (free for many) access to high-quality DNS resolution globally.⁵⁹

We consider the DNS here because it is a case that illustrates many of the regulatory concerns we listed above (and tensions between those concerns). The DNS system raises issues of security, privacy, tussle between layers, governance and the role of competition.

First, because domain names have become associated with brand names they have become important economic properties with associated intellectual property rights. This has posed the risk that control over domain names might be abused to extort end-users seeking DNS names or to threaten the brand equity of DNS name holders if the property rights to specific domains are not adequately protected. Second, the lack of security in DNS resolution has allowed the DNS to be a

⁵⁹ Although most users do not pay for DNS, some do and may pay for additional services such as DNS monitoring, redundancy, etc., although most of the users that pay are enterprise customers.

vector of spoofing, hijacking, and other sorts of cyber-security attacks. Third, the governance of the DNS ecosystem is distributed and relies on governance by the non-profit entity ICANN, which coordinates the maintenance and procedures for managing the domain name spaces and procedures for mapping names to addresses. Historically, ICANN was under the control of the U.S. Department of Commerce, and although moves were made to transition ICANN to an international, multi-stakeholder governance model, problems remain and hence the future governance structure remains unclear. Fourth, related to privacy, DNS queries provide a valuable source of information about user behavior on the Internet. If query resolution is centralized that could provide a powerful tool for influencing and tracking user behavior.

In spite of these and other issues, today's DNS continues to work reasonably well. Most ISPs provide DNS for free and end-users have the option of pointing their Internet protocol stacks at the DNS resolver of their choice. There are a number of high-quality DNS resolvers from a number of large providers available to choose among. Most end-users choose not to actively select their DNS resolver and rely on others to configure the choice for them. In the common case, users rely on the DNS resolver provided by their ISP.

The insecurity of the DNS arises from its core design. The DNS was conceived as a key service that allowed other services to function. Without the ability to convert names to addresses, essentially nothing else would work. Hence, in the early days of the Internet, the query protocol for the DNS was designed to favor simplicity and availability over other considerations. The client computer sends a query (not encrypted) to a specific port on a machine that provides the resolution service. The service itself may be corrupted and return the wrong answer—there is no way for a client to verify that the answer is valid. The client computer can specify the address of a different resolver if it does not trust the default server it was configured to use. However, a malicious ISP can redirect this query to a different server for resolution, and the user cannot tell. Finally, the protocol specifies that the client will accept the first answer that it gets, so a nearby machine on a wireless network can simply answer more quickly than the intended resolver, and the client will accept the answer.

To deal with these concerns, the IETF has been discussing a number of security enhancements. The Domain Name System Security Extensions (DNSSEC) allow the client receiving a response to a query to verify that the response is legitimate. DNSSEC depends on an infrastructure to distribute trustworthy encryption keys and adds cost to the processing of queries. DNSSEC has not been universally implemented, even though it has been specified for some time, for a number of reasons, including the processing and storage costs, and the fact that the beneficiaries of the deployment (the users of the Internet) are not the actors who bear the cost. This is a classic example of a network externality that hinders deployment of better security.

To deal with the insecurity of the query, as well as the loss of privacy that results from the sending of the query, the IETF has developed options for sending the query in an encrypted form. There are two variants of this scheme, called DNS-over-TLS (DoT) and DNS-over-HTTP (DoH). The two are based on the same use of encryption; they both will enhance security and privacy protection by reducing the likelihood of "man-in-the-middle" eavesdropping or hijacking attacks since it will allow end-user browser queries to be encrypted end-to-end (using HTTPS). However, the two schemes differ in one critical way: DoT uses the existing network layer mechanisms for deciding

which DNS infrastructure resolves client queries, while DoH moves the resolution choice into the application layer developer's hands. DoH is an example of a function moving from one layer to another. The original design of DNS positioned the function at the level of the operating system and (in most cases) at the level of the ISP. DoH moves the operation of the DNS up to the application layer.

Google and Mozilla are testing providing DNS-over-HTTP as an alternative way to do DNS resolution.⁶⁰ Opponents of this approach include a number of the large access ISPs that fear that large-scale adoption of this approach will allow the browser providers excess centralized control over DNS resolution and will limit opportunities for innovation in the Internet ecosystem.⁶¹

We do not intend to offer our own perspective on this evolving debate about what may seem to most users and non-networking experts as an arcane discussion about technical standards. The reason this is an interesting example is because it illustrates how tweaks to key functionality on which the Internet depends might impact market outcomes that are of relevance to the *newFCC*. The IETF has developed DoH standards and a number of participants in the Internet ecosystem are in various stages of implementing use of DoH. No one appears to be arguing that DoH poses an imminent catastrophic threat to the Internet's future, but large stakeholders in the ecosystem are voicing serious concerns about the advisability of wide-spread adoption of DoH in the absence of alternatives to provide viable work-arounds.

However, the real dispute about DoH seems to be about privacy and user profiling. While a third party (for example an ISP) can observe the DNS query (which is a serious concern in the context of regions where censorship is in place), the server providing the response must, of necessity, see the IP address of the client that sent the query, and the name that the client wanted resolved. That gives the provider of the resolver a view into all of the activities of the client. In the original DNS (and in DoT) this provider is typically the ISP. DoH removes the ability of any ISP to see this information, and instead privileges the resolution service picked by the application, which might (for example) be Google. The privacy community has concerns about all the different ways that actors like Google and Facebook are capturing information about user behavior. DoH shifts yet another source of information to the application layer.

We do not propose, in this paper, to take sides in this privacy debate. The proponents of DoH have issued privacy policies that seem to give the individual users considerable protection. Of course, these policies could change—they are not embedded in the protocols.

A third concern about DoH is that the control of the implementation is in the hands of a small number of powerful application developers. If there is to be any innovation in this space (whether

⁶⁰ For explanations, see https://en.wikipedia.org/wiki/DNS_over_HTTPS, <https://hacks.mozilla.org/2018/05/a-cartoon-intro-to-dns-over-https/>, <https://blog.apnic.net/2018/10/12/doh-dns-over-https-explained/>, <https://www.networkworld.com/article/3322023/dns-over-https-seeks-to-make-internet-use-more-private.html>, and <https://www.netspark.com/blog/web-security/pros-cons-dns-over-https/>.

⁶¹ See IETF RFC8484 (<https://tools.ietf.org/pdf/draft-livingood-doh-implementation-risks-issues-02.pdf>, March 20, 2019) which discusses the risks and issues associated with centralized DoH deployment.

for good or otherwise), control over the opportunity for innovation is limited to those actors. DoH shifts of control of the DNS from a large set of actors (most commonly the ISPs), who typically must coordinate their actions through a standards body such as the IETF, to a smaller set of actors who could conceivably act to reshape the DNS outside of the scope of the IETF.

With an issue like this, we do not think it would be appropriate for the *newFCC* to mandate either that operators do or do not adopt DoH. As a general matter, we do not think the *newFCC* should attempt to define the protocols used by stakeholders in the Internet ecosystem. However, it is reasonable to expect that the *newFCC* should maintain technical expertise to stay abreast of such issues because of the real concern that bad choices by stakeholders might disrupt the smooth functioning of the Internet.

With such a watch-and-see type of issue, the *newFCC* might use its "bully pulpit" power and potentially its power to mandate disclosure and transparency to shine light on the practice and engage stakeholders in a debate over its possible ill-effects and options for work-arounds for users who are unhappy. The *newFCC* could convene a workshop to air debates about the pros-and-cons of the practice. As a general matter, we believe that technical developments or business practices that unnecessarily restrict or limit choice for end-users or application providers in the ecosystem raise potential regulatory concerns. In many cases, such restrictions are consistent with worthy goals (e.g., to enhance security, reduce costs, or pursue reasonable profits), but since promoting choice is an aspirational goal, it is worthwhile checking that decisions by stakeholders that limit choice have a reasonable foundation.

In the unlikely event that centralized DoH was leading to an ecosystem where a powerful actor were seen to have excess market power over DNS, giving it unfair access to the meta-data about Internet user behavior or a powerful tool to control the flow of network traffic, the *newFCC* might order that the platform provider divest its business interest in providing DNS. Such an example of strong structural separation would be an extreme tool to address an extreme problem. Although that outcome seems unlikely, part of the point we would like to make is the need for the regulatory authority to stand ready to act in contingencies that are unlikely, and by so doing, may render those contingencies even less likely.

4.3. Application Development Environment and the Apple Store

The tools for development of Internet applications have greatly evolved in the last decade or so. In the early days of the Internet, the end-nodes on the computer were time-sharing systems supporting collections of users. In the 1980's the personal computer emerged as another class of end-node. But these were the only platforms that were available to the application developer. It was possible for an application developer to purchase and operate a large computer to serve as a server as part of the application, but the application developer had to include this effort as part of the development.

This situation has changed with the emergence of new platform elements that facilitate application development by lowering the initial investment costs and making it more scalable. These platform elements include:

- So-called *cloud* services that provide massive storage and computing on demand. Applications can build on top of these, and since cloud services can provide as much capacity as the application demands at it grows, applications can now scale almost without effort.
- Applications that need to position content (or other service elements) close to the users can exploit *content delivery networks* (CDNs), which again can provide capacity on demand. CDNs provide a highly decentralized platform element without the application designer having to invest any effort in the development of that capability. Since the development of a highly decentralized delivery platform would be an impractical effort for a newly minted application, CDNs allow new sorts of applications to be designed and launched.⁶² Applications that are highly successful (consider, for example, Netflix) can migrate from the third-party CDN platform offerings to their own distributed servers when their scale justifies it, but the third-party platforms provide a means to get started.⁶³
- The *app store* is a way for developers and potential users to find each other. App stores are a classic example of a *multi-sided platform*, where the two classes of participants can meet and transact. They emerged in the context of the mobile devices, but are also now emerging to serve applications targeted to more traditional computing platforms such as PCs.
- *Software Development Kits* (SDKs) are collections of tools that facilitate the development of applications, in particular applications for mobile devices (smart phones). They enrich the basic capabilities of the underlying operating system with libraries of useful functions, development tools, and the like. As applications themselves become platforms for other applications, those applications often provide an application-specific SDK to facilitate the development on top of that platform. Thus, Facebook provides an SDK specific to Facebook to allow the development of new services that run on top of Facebook. The Facebook SDK facilitates such actions as analytics, login, message sending, ad placement, and utilization of user data. SDKs greatly reduce the effort of developing a new application.

All of these elements are themselves *platforms*. The application developer today depends on a range of platform elements that are much richer than the actual Internet, even if they think of their application as an "Internet app". This reality raises an important question about the scope of authority for a regulator charged with responsibility for the Internet. Application developers depend on these assets, and they are used to build Internet applications. These platform elements can raise all the potential concerns as the platform layers of the Internet itself: extraction of revenues from higher layers that may seem excessive, exclusion of certain applications from the platform, observation by the platform of the activities of the application positioned on top of it, and so on. This reality suggests that the *newFCC* should have the authority to monitor these other platforms, even though they are not "communication infrastructure" in the traditional sense. An expansion of scope in this way will no doubt raise concerns and resistance, but if the charge to the

⁶² This facilitates experimentation and innovation in app development since it lowers the investment risk (an entry barrier) for app development.

⁶³ For a discussion of the ecosystem of CDN options and how they have evolved, see Stocker et al. (2017).

newFCC is to protect the Internet, and the experience of using the Internet depends on these platform elements, it seems rational to define the scope of the *newFCC* to include platform elements of these sorts.

Let us turn now to consideration of the Apple Application store, which provides an example of an application development platform.

Apple helped jumpstart the smartphone revolution and the mass adoption of mobile broadband with the launch of its iconic iPhone in the summer of 2007. Since then, Apple has grown to be one of the largest and most valuable platform providers in the world. Applications for iPhones are provided via an *app store*, a marketplace (and two-sided platform) where app providers and users meet.⁶⁴ Apple requires that apps for their mobile devices be made available *only* through the Apple app store. Again, the application developer is dependent on this platform, but a seller has no *right* to sell in the Apple app store, selling is a privilege controlled by Apple. Apple's control of the iOS ecosystem with its control over the iPhone and other iOS devices and its application store gives Apple significant market power over a large number of users in the mobile broadband Internet ecosystem.⁶⁵

Since 2007, the ecosystem of Android has emerged to offer strong competition to iOS, with a much larger global share of end-users relying on the Android ecosystem (over which Google has significant economic power). Although there are other mobile broadband OS ecosystems (such as Blackberry and Microsoft) providing consumers and application providers with choices, Apple is in a somewhat unique position with market power over mobile application providers which it can exercise through Apple's policies regarding what applications to allow on its platform.⁶⁶

One criticism of Apple in this context is they charge a fee of 30% for all purchases in the app store, a fee that has been criticized as excessive, given that Apple need not purchase at wholesale, pay

⁶⁴ The two-sided characterization of the app store is a useful simplifying construct. However, one might view the app store as being a many-sided market that links multiple classes of distinct users: app sellers and iPhone users, that may themselves be segmented into distinct user classes. Different classes of applications make use of (are allowed to make use of by Apple) of the Apple iOS and app store platform in distinctly different ways. For some analytic purposes these differences may not be important, but treating apps as differentiated goods in a homogenous app store "market" is likely to be misleading in other contexts. Consider for example the differences between VoIP, mapping, privacy, gaming, or business utility applications – each of these has its own, sector or class-specific features that interact across classes on both sides of the market (e.g., road warrior professional versus consumer, communications versus utilities).

⁶⁵ Having adopted an OS platform, users confront non-trivial switching costs should they want to switch to another OS. The extent to which such costs afford market power to Apple is open to debate. We think it would be foolish to argue that Apple has no market power, but also foolish to argue that Apple does not also face significant competition from competitors in other OS ecosystems.

⁶⁶ Bresnahan & Greenstein (2014) contrasted the Apple and Android ecosystems. Whereas Android enables third-party firms to participate on both the device and application sides of the OS platform, Apple only allows such competition on the application side. From the perspective of the role of the mobile OS as platforms matching device and application firms, the Apple platform is a one-sided market and the Android platform is a two-sided market.

significant costs to stock inventory, and so on. As we discussed above, there seems to be little appetite in the U.S. to regulate pricing, even by a monopolist, but the situation in the E.U. is different, where regulation explicitly finds excessive pricing grounds for intervention.

Another aspect of the Apple app store is that Apple does not accept every app that requests to be listed. Apple takes care to curate the applications that are provided in its store and iPhone users appreciate when that care leads to applications that are more likely to be free of malware and operate in ways that are consistent with the branding that Apple has spent significant resources developing and promoting. However, the decision as to whether to block an app is made by Apple; as the operator of the platform they have sole control of what is listed.

Some apps have been blocked for reasons that have nothing to do with security. In May 2018, Apple rejected an application from STEAM, a provider of a multi-player gaming platform that would have allowed users who had purchased games that ran on other platforms to use those games on iOS devices.⁶⁷ In effect, STEAM is an overlay platform on the iPhone. In that sense, it is analogous to the way Facebook is an overlay on the Internet. From one perspective, arguably, the STEAM application would expand access to the iOS and reduce platform switching costs that might otherwise serve to limit mobile broadband platform competition. It might even promote increased access to choices in games by lowering the costs of introducing a new game.⁶⁸

Speculation on the Web is that Apple blocked STEAM because it is possible to purchase games (and make in-game purchases) inside the STEAM platform, and Apple would not receive their 30% cut for those purchases.⁶⁹ Were Apple a physical retailer, the natural limits to the capacity of physical distribution channels (e.g., like the shelf space in a grocery store) might provide a valid economic rationale for excluding applications from the store. In the case of digital platforms, however, such limits on application choice do not readily apply. In the case of Apple's decision to reject STEAM (or any other application), it is not unreasonable that the application provider might bring an antitrust charge that Apple was acting so as to restrict competition. Without commenting on the likelihood of the plausibility of any such claim or regarding the details of the STEAM case, we note that our interest in this case stems from the potential role of an overlay platform application like STEAM to impact the mobile broadband ecosystem. To the extent that appears to be the case, it makes the question relevant for consideration by the *newFCC*, regardless of its merits as an antitrust matter. (To illustrate the challenges for researchers to analyze such situations, it is worth noting that as of May 2019, the STEAM app has been allowed onto the Apple app store.)⁷⁰

The existence of the application store is a key component of the current mobile broadband ecosystem. The existence of multiple application stores provides a way to decouple and facilitate

⁶⁷ See https://www.reddit.com/r/apple/comments/8lwzv6/steam_link_app_for_ios_rejected_by_apple/,

⁶⁸ Application game providers who want to address the entire market need to develop OS-specific versions of their games. That increases development costs confronting the application developers with the choice of either incurring those incremental fixed costs or limiting their addressable market. A platform solution like STEAM that allows applications to be portable offers a work-around to that problem.

⁶⁹ <https://www.cultofmac.com/550533/silly-app-store-bans-have-gone-too-far-with-steam-link/>

⁷⁰ <https://www.engadget.com/2019/05/15/ios-steam-link-app/>

edge-based innovation in the Internet ecosystem. Before the advent of the iPhone, many expected that application innovations would be mediated via browsers and the principle concern for ensuring competition and an open innovation environment was to focus on an industry ecosystem that afforded consumers and other stakeholders browser choices. With the emergence of the smartphone application ecosystem, an alternative innovation path has emerged. For example, today, users who wish to access mobile content often have a choice whether to do it via a browser application or via a dedicated application. While we would not want to have a single choice of mobile OS and a single, centrally-controlled application store, or a single browser choice, we also would be unlikely to benefit from having too many choices of either (i.e., more than a relatively small integer number). Choice that is somewhat limited helps realize scale and scope economies, which reduces costs for consumers and application developers.

Above, we observed that if a regulator determines that a remedy to a harm is appropriate, the layered platform ecosystem may provide more than one option to structure a remedy. The case of the app store provides a good example of this flexibility. If Apple were found to be abusing their market power with respect to their app store, one possible remedy would be to require that Apple allow competitive app stores for Apple apps. A regulator might hope that by forcing the app store space to be more competitive, the harms might somehow be resolved.

However, in this case it is not clear that outcome would follow. If there were multiple app stores, each would want to make money. It is possible that app developers would discover that users did not search all app stores but looked only in their customary store for new apps. In this case, an app would need to be listed in *all* the app stores, and the app developer would have to bargain with each of them separately. Competition might not drive down the cost to the app developer, it might increase it. At the same time, the quality of curation of the apps might go down, leading to an overall less trustworthy experience.

As an alternative to mandating competition and hoping that the right outcome follows, a better approach might be to accept that Apple has market power over their app store, and impose obligations on it. The *newFCC* might require that Apple not discriminate among qualified applications, and make public the criteria by which applications are evaluated. The *newFCC* could review these criteria to see if they could result in unreasonable discrimination.

While we do not think that the *newFCC* ought to have intervened in the case of Apple's decision regarding STEAM, we do believe that the policies used by mobile application store providers which are found to have significant market power in the Internet ecosystem (which we believe Apple arguably has along multiple dimensions) should be subject to scrutiny by the *newFCC*.

4.1. Amazon eCommerce platform.

Amazon is an Application Layer platform, rather than a platform for Application development.

Products on Amazon show up in two ways. The original model for Amazon (i.e., books) mimicked traditional merchandizing: Amazon bought wholesale and sold at retail. However, the Amazon seller program provides a different way for sellers to reach Amazon purchasers. Amazon provides a set of tools for a seller to list their product on the Amazon web site, and charges a fee (typically between 8 and 15%) when an item is sold. As well, for additional fees, Amazon will stock the

product in their fulfillment centers and deal with product delivery. This model has many interesting implications. First, Amazon need not make a decision about whether a product is going to generate enough sales that they should use their capital to purchase and stock the product. Sellers of low-volume niche products can list their product on the Amazon web site, relying on the search tools provided by Amazon to let customers find their products and fulfill the purchases themselves. Amazon will deal with the payment process, which makes the process painless for the seller. As well, the seller has access to Amazon-provided features that allow purchasers to post reviews, ask questions about the product, and so on. As a result, users of the Amazon web site can find "almost anything," since it is so easy for a seller to market their products through Amazon.

However, this means that sellers are totally dependent on the features of the Amazon seller platform, and if issues arise, the seller may not have recourse to the means to resolve them. If "purchasers" post critical reviews, Amazon may demand that the seller resolve the issue, even if the seller considers the reviews to be unjustified. The "rules of the game" are defined by Amazon, and the seller must use the platform on a "take it or leave it" basis. Amazon considers that selling on their platform is a privilege, not a right, and can suspend that privilege at their discretion.

These problems are not unique to on-line nor do they necessarily present a public-interest problem.⁷¹ However, as eCommerce grows to account for an ever-larger share of retail trade, concerns may justifiably arise (and seem to have already arisen) as to whether Amazon's economic control of an important eCommerce platform is excessive, even if Amazon's market power over retail sales in any of the retail goods markets that make use of its online platform services, taken on a case-by-case basis, appears limited.

What is unique about the rise of on-line eCommerce platforms like Amazon is the way in which they can enrich and expand the retail experience. For example, when books first being sold on-line, researchers noted that price dispersion increased, which seemed counter-intuitive to many since the expanded competition that online afforded and the greater ease of price comparisons might lead one to expect that the "law-of-one-price" ought to assert itself. In reality, the availability of online access expanded options for retail book purchasing and options for booksellers to differentiate themselves, implying that the same book purchased in different ways (different delivery terms, formats, book sellers) should be regarded as a differentiated good.⁷² Just as the rise of the Internet helped transform and expand telephony services into a richer set of user experience

⁷¹ For example, we allow malls and department stores significant latitude to manage the presentation and terms of goods that are offered for sale. Part of this justification depends on the fact that such physical distribution channels incur significant local physical costs (e.g., limited shelf space, real estate costs) and regulatory obligations (e.g. local community "look and feel" zoning restrictions). Moreover, in physical world there are limits on scale that do not apply on-line; although the rise of chains like Walmart and big box store chains have raises similar market power concerns.

⁷² Ever since Stigler (1961) addressed the implications of costly product/price search on market behavior, there has been a lively theoretical and empirical literature on search. For research on why on-line price dispersion did not contract as initially expected, see Brynjolfsson & Smith (2000), Clay et al. (2001), Ellison (2016), or Pan et al. (2004).

options for electronic communications,⁷³ so on-line commerce has expanded options for retail sales by linking new and used goods, ancillary services like flexible delivery options, insurance, and product review information.

Yet another challenge that arises with online platforms is the risk to sellers on the Amazon platform that Amazon, by necessity, can track all the transactions of every seller (and every buyer). Amazon might use this information for purposes other than the completion of the transaction. They might detect that a given product (or class of product) was proving very popular, and introduce their own product to compete with the products from the unaffiliated sellers that use the Amazon platform. This is an example of the risk we identified above—the platform operator can observe what the complementors are doing on the platform, and potentially use that information to the detriment of the complementors.

In this context, it is interesting to speculate about whether the Amazon platform could become so essential for selling products online that a regulator would be justified in intervening and defining what are acceptable and unacceptable "rules of the road." Perhaps a platform operator like Amazon should be prohibited from using information it gathers as part of completing a sales transaction in any other context. We do not believe that we are in this situation now, but we raise this hypothetical question to illustrate that platforms other than the basic communications platform of the Internet might someday become essential to the health of a part of the Internet ecosystem.

Finally, in light of the significant scale and scope economies and other benefits that Amazon's set of comprehensive retail trade services offer to both sellers and consumers on its multisided platforms, and as part of Amazon's "ecosystem" of related products and services (e.g., search, streaming media, eCommerce, cloud services, et cetera), disrupting Amazon's multi-layered, multi-platform business model to counter the implicit winner-take-all (or most) economics of eCommerce platforms may be counter-productive, failing to expand total surplus (the first concern) or even to promote viable and sustainable effective competition among eCommerce platform providers. While having a dominant eCommerce provider may threaten market power abuses, having too many platforms would likely increase total costs for sellers and buyers alike. In light of the fundamental economics that have contributed to the global growth of the largest of the digital network platform providers like GAFa, competition may not offer the best regulatory strategy for disciplining the risks associated with the concentration of economic power those providers present.

4.2. Facebook and WhatsApp

Facebook, along with the other members of GAFa, has attracted significant policy attention in the U.S. and internationally. For example, its offering of FreeBasic service as a sponsored version of a more limited Internet access service induced some countries (e.g., India) to limit Facebook's

⁷³ That is, with the addition of voice mail, multi-party calling, multi-media messaging, chat, email, and other options for electronic communications, telephony has morphed into a more complex set of communication services.

ability to offer the service;⁷⁴ while concerns about Facebook's use of user data has prompted regulatory actions in Germany and the U.S.;⁷⁵ and more recently, has led to calls for structural remedies to break-up Facebook, including requiring Facebook to divest WhatsApp.⁷⁶

Facebook acquired WhatsApp in 2014 for \$19.3 billion. By 2018, WhatsApp had over 1.5 billion users internationally, making it the most widely used messaging application in the world. Some questions to consider include: (1) Should Facebook be required to divest WhatsApp, and if so, what other structural remedies may be required? (2) With 20-20 hindsight, was the decision to approve acquisition of WhatsApp an example of mistaken merger review and what guidance does that give for future merger review? And (3) What other regulatory remedies are available for addressing the potential harms that Facebook may pose?

An entire paper could be written about each of the above questions, which is not what we will attempt here. We will not even attempt a definitive answer to the questions above, but instead will highlight some of the thinking that the above questions prompted for us and our initial thoughts on what we assume will be a much longer discussion as the regulatory actions ongoing globally involving Facebook play out. Our principal interest herein is to argue that these issues are sufficiently complex and bound to technical questions that we expect the *newFCC* to have a role in monitoring and supporting whatever – if any – regulatory actions are taken in the future.

First, with respect to the question of whether Facebook should divest WhatsApp, it is worth asking what policy concerns might motivate undertaking such a strong intervention. The most obvious one is concern that Facebook's growth has resulted in an unacceptable concentration of economic power both directly in light of its global user-base, and indirectly via the complex ecosystem of third-party complementors that have emerged to take advantage of the multiple platforms that Facebook now provides across multiple layers of the Internet ecosystem (ranging from access via its FreeBasic service to social networking which has been its key focus to messaging and other ancillary applications).

⁷⁴ In 2016, India banned Facebook's FreeBasics service because of the perceived threat to network neutrality (see <https://www.wired.com/2016/02/facebooks-free-basics-app-is-now-banned-in-india/>). This was part of the global debate over the appropriateness of "zero rated" services. The issues raised by zero rating services are real, but might also be viewed as part of the tussle between Google (a major advocated for network neutrality and opponent to zero-rating services in the U.S. and abroad) and Facebook for global share of mobile consumers' attention.

⁷⁵ As of April 2019, rumors circulated that the FTC was preparing to impose a \$5B fine on Facebook for violation of its 2011 consent decree with Facebook over how it uses consumer data (see <https://www.nytimes.com/2019/04/24/technology/facebook-ftc-fine-privacy.html>). In February 2019, German regulators imposed limits on Facebook's ability to integrate and use user data acquired via its separate platforms such as the Facebook and WhatsApp applications (see https://www.bundeskartellamt.de/SharedDocs/Meldung/EN/Pressemitteilungen/2019/07_02_2019_Facebook.html).

⁷⁶ For recent calls from Tim Wu and Elizabeth Warren to break-up big platform providers like Facebook, Amazon, and Google, see <https://www.theverge.com/2018/9/4/17816572/tim-wu-facebook-regulation-interview-curse-of-bigness-antitrust> and <https://www.nbcnews.com/tech/tech-news/elizabeth-warren-calls-break-facebook-google-amazon-n980911>. For a discussion of the antitrust case against Facebook, see Srinivasan (2019).

In addressing this question, it is worth noting that like with the earlier discussion of the Amazon and Apple "ecosystems," and the underlying digital network platform economics that have helped fuel Facebook's rise, that divesting Facebook of WhatsApp might reduce Facebook's market power without fundamentally altering the long-term dynamics of competition, while risking causing significant losses of surplus in the short-term. Since Facebook's key services are already free to consumers, the likelihood of short-term consumer surplus gains seems minimal. Furthermore, what is to stop Facebook from investing in its own version of WhatsApp, or a divested WhatsApp from investing in its own version of a social networking platform and either of them rapidly re-establishing the same kind of dominance that prompted the calls for divestiture in the first place. In a winner-take-most context, competition may be inherently unstable, and empowering a new entrant may cause creative destruction that just leads to a new winner. We are reminded of "Meet the new boss, just like the old boss; We won't get fooled again."

Structural remedies that limit a provider from participating in multiple platforms (e.g., social networking and messaging) might be considered, but strike us as being ill-advised in so far as they would limit options for complementor innovations that have proven so valuable within the Internet ecosystem more generally. While we would stop short of saying such structural limitations should never be considered, we are skeptical that this case fits justifies such structural remedies.

With respect to the question of 20/20 hindsight, we are uncertain what the right decision should have been regarding the approval of the WhatsApp merger in 2014. Although at the time, we recognized the merger as posing a potential risk for competition and were glad to see policymakers take care in reviewing the merger, none of us were overly alarmed when the merger was approved. If a general lesson is to be gleaned from that earlier review process, it should be separated from allegations of Facebook's special faults,⁷⁷ and focus on the general case of a dominant network platform provider acquiring another platform provider in an adjacent market. The discussion above leads us to recognize that acquisitions by dominant digital platforms ought to receive a heightened level of review, even if the target of the acquisition does not possess significant market power and even if after the acquisition legacy methods for assessing market power may not imply a significant increase in market power for the merged entity.⁷⁸ However, we do not believe it is *necessarily* problematic for a dominant platform to acquire a complementor or smaller rival or to otherwise expand into adjacent markets since that is often the most efficient way for the platform provider to build its "ecosystem," and we have already noted that there are often efficiency benefits associated with such ecosystems.

Another policy concern that motivates the call for stronger regulation of Facebook relates to its asymmetric ability to acquire user data and market intelligence. Part of the way Facebook was able to acquire its data was via its ability to integrate user data from both the Facebook and WhatsApp platforms, and from other sources in ways that most users of each of those services were unaware of. That might suggest that divestiture might be a viable regulatory remedy to address that problem

⁷⁷ For example, allegations that Facebook did, in fact, misuse user data and may have engaged in anticompetitive behavior to secure its dominant position, instead of succeeding on its merits.

⁷⁸ In the case of Facebook's acquisition of WhatsApp, it is arguable that WhatsApp did possess significant market power.

as well, but for the reasons already cited, we do not think divestiture would solve the data concerns either. Another class of remedies may be more appropriate. Those could include (1) an obligation for digital network platforms to commit to some form of "best practice" behaviors regarding the use of user data; and (2) enable data portability for platform users.

The first option is close to how the FTC has sought to promote better privacy protection and prevent anticompetitive abuses of user data. This approach is amenable to being framed by a national debate over what those best-practice behaviors ought to be and then a mandatory obligation that any firms (in any sector and not limited to digital platform providers) disclose their commitments for how they will comply with those best-practice guidelines regarding user data. The FTC can then enforce those commitments, interpreting violations as false advertising. Under this approach, the *newFCC* might have a role in monitoring compliance for digital network platforms to provide evidentiary support to FTC-lead enforcement actions.

The second option of enabling data portability would have the dual effect of providing an additional check on abuses of market power by a dominant platform provider, since it would help make platform markets more contestable; and would provide a mechanism for users to assert their right to control their data, once the scope of such a right is determined. Users unhappy with a platform provider's behavior could take advantage of data portability to move to another provider, or at least terminate their relationship with the platform provider. With such remedies, we can imagine that the understanding of digital technology in the *newFCC* would likely be of much greater importance and relevance. That is because even cursory consideration of what it means to enable data portability of platform user data quickly leads to the conclusion that that is a complex question that would require different mechanisms and would have different implications at different platform layers.

For example, data portability applied to a broadband access provider would be different than data portability applied to a higher-layer platform provider like Amazon or Facebook. Some of these differences were highlighted in the debate in the U.S. after the FCC enacted its sweeping privacy rules in 2016 that were subsequently repealed by the new FCC administration following the election of President Trump. The FCC's original privacy rules for broadband access providers were justified by the argument that they had a uniquely comprehensive view of user online behavior that was different from what edge providers like Google, Facebook, and Amazon had.⁷⁹ Finally, one might imagine if users are allowed to port their data at different layers, it could have complex interlayer implications. Imagine that a next generation emergency service (e.g., updated version of a way to integrate healthcare data and public safety) requires matching a user's location (maybe controlled by the broadband access platform) with user real-time health data (maybe provided via

⁷⁹ In the 2016 Order, the FCC argued that "BIAS providers' gatekeeper position allows them to see every packet that a consumer sends and receives over the Internet," whereas "edge providers only see a slice of any given consumer's Internet traffic" (see ¶30 in FCC (2016), *Report and Order*, In the Matter of Protecting the Privacy of Customers of Broadband and Other Telecommunication Services, Before the Federal Communications Commission, WC Docket No. 16-106, adopted October 27, 2016, available at <https://docs.fcc.gov/public/attachments/FCC-16-148A1.pdf>). While it is true that broadband access providers and edge providers (like GAFA) have different perspectives for observing consumer online behavior, it is misleading to claim that large edge providers like GAFA are at a significant disadvantage when it comes to threatening the privacy of Internet users.

a higher-level application platform). Arbitrary user decisions to port their data could break such services. To understand when such problems may arise and how portability architectures (what data moves and how it moves) may impact cross-layer considerations is likely to require on-going oversight by regulatory authorities interested in promoting data portability with substantial digital technology expertise.

Summing up, we conclude that the role of the *newFCC* in addressing policy concerns raised by higher layer platforms like Facebook seem less likely to motivate a regulatory intervention lead by the *newFCC*, although we expect its expertise to be relevant. First, we do not regard access to a particular social network as being something that necessarily belongs within the *newFCC*'s universal service mandate (although some might argue Facebook should be included). Second, we believe higher-layer platform providers that build their platforms on top of the Internet should be allowed latitude in the design of the ecosystem they seek to create. Enabling that flexibility to innovate and offer customized solutions is a capability that the general-purpose Internet platform is intended to support. To the extent issues arise about anticompetitive behavior that amounts to a purely competition-related concern or threatens end-user privacy, then lead responsibility for addressing those issues does not require a sector-specific regulator. Those issues might be addressed by the FTC, with the *newFCC* providing digital network technology expertise as needed.

4.3. Google Search and EU intervention

Google is one of the most powerful actors in the Internet ecosystem. They have developed and operate a number of platforms, including the Android operating system (a platform for mobile app developers), their search capability (a platform for advertising as well as search), broadband Internet access in certain cities, a map/geolocation platform, and a platform for ad placement on third-party web sites. The Google platforms are individually powerful, and Google's control of all of them gives them the ability to exploit synergies among them. As with Amazon, Facebook, and Apple discussed earlier, Google operates multiple platforms at multiple layers that comprise an ecosystem of complementary platforms with significant influence over the overall Internet ecosystem to which they belong.

The harms that might arise with these platforms fit into the patterns we described earlier where a platform operator has the power to exercise unreasonable control or constraint over the complementors that use Google's various platforms. The European Commission has ruled in three different cases that Google was in violation of antitrust considerations in their control over their platforms; these cases illustrate the range of issues that can arise, all of which fit into this same pattern.

- In March 2019, EU fined Google 1.5B euros for requiring customers of its AdSense business to sign a contract in which they agreed not to accept advertising from rival search engines. The EU antitrust commission found that this restraint prohibited firms from competing in this space.
- The EU fined Google 4.3B Euros in 2018 for abusing market dominance in mobile, where they had bundled their own browser with their Android operating system. They were required to allow users to install rival browsers and search engines on their smart phones.
- They fined Google 2.4B in 2017 for manipulating shopping search results, where they favored their preferred results over those of rivals.

In total, the EU has fined Google a total of \$9.3B for antitrust violations.⁸⁰ These cases illustrate the power of a platform operator to exploit their control over that platform and the potential to integrate and build on dominance in one platform into adjacent markets either at the same or other layers in the ecosystem.⁸¹ They also illustrate a difference between the U.S. and E.U. conceptions of antitrust enforcement, where the current U.S. enforcement guidelines might not have triggered an investigation of these cases. In 2013, the FTC closed its antitrust investigation of Google without taking action, although recently, it was announced that the U.S. Department of Justice (DoJ) would be initiating an investigation.⁸²

Thus far, the regulatory focus on Google has been led by antitrust competition authorities in the E.U. and U.S., with a special focus on Google's dominance of on-line advertising markets. In so far as the FCC has engaged with Google, it has mostly been related to Google's role as an "edge provider" advocating for Network Neutrality regulations to ensure non-discriminatory access by broadband Internet access subscribers to content and applications that include Google's suite of free applications (email, VoIP, documents, etc.) and (mostly free) content (Google News, YouTube, and YouTube TV).

At this point, we expect that along with the newly invigorated policy concerns over alleged antitrust and privacy violations by each of the GAFAs participants, the principal regulatory actions will continue to be led by competition authorities. We think that would be appropriate even in the world of our *newFCC*.⁸³ However, we think the same reasoning that we have argued in the prior cases would suggest a role for the *newFCC* in supporting the investigations by competition authorities with the *newFCC*'s technical expertise, supported by on-going monitoring of technical trends and practices, and their interaction within the Internet ecosystem.

The scope of recent antitrust investigations has been relatively narrow, focusing only on the competitive impacts. The tools of antitrust are limited (but strong). That is appropriate since the scope for initiating investigations and taking actions is broad (potentially encompassing any market where anticompetitive behavior may be alleged). By way of contrast, the FCC's toolset is

⁸⁰ See <https://www.theverge.com/2019/3/20/18270891/google-eu-antitrust-fine-adsense-advertising>

⁸¹ Each of the GAFAs has one Internet platform that they are, perhaps, best known for: search in the case of Google, eCommerce in case of Amazon, iOS in case of Apple, and social networking in case of Facebook.

⁸² See Kendall, B. and J. McKinnon (2019), "Justice Department Is Preparing Antitrust Investigation of Google," Wall Street Journal, June 1, 2019, available at <https://www.wsj.com/articles/justice-department-is-preparing-antitrust-investigation-of-google-11559348795>. The authors quote an FTC staff memo from 2012: "evidence paints a complex portrait of a company working toward an overall goal of maintaining its market share by providing the best user experience, while simultaneously engaging in tactics that resulted in harm to many vertical competitors, and likely helped to entrench Google's monopoly power over search and search advertising."

⁸³ Since President Trump's election in 2016, the FCC has taken a number of significant deregulatory actions that suggest that it has no appetite for active regulation, and in light of those decisions, the FCC may increasingly find it difficult to justify active regulation of broadband platform providers, let alone higher-layer platforms such as those provided by GAFAs. The current debate over FCC regulation of legacy concerns (e.g., Internet broadband access) in the U.S. has shifted to the State legislatures and the Courts.

much broader and its mandate is not limited to promoting competition, but includes promoting the public interest, which may not be the same as what a competitive market would produce.

Since Google's most often asserted source of market power is associated with its dominance of search, and subsequently, how Google has leveraged that to establish a dominant position in online advertising, it is worth considering what the new FCC's role regarding search might be.⁸⁴ First, search is essential functionality for all kinds of ICT systems and is especially important in networked environments.⁸⁵ Ensuring a robust ecosystem for search functionality is important to ensure that the Internet continues to operate as a global, general purpose platform. There are many kinds of search, and Google emerged in the late 1990s as a leader in general purpose search, allowing users to quickly identify Websites and content that matched open-ended, natural language search queries. Google's success was far from pre-ordained and numerous search engines continue to emerge and compete with Google, although Google remains the dominant search engine in use in the U.S., Europe, and many other parts of the world; and as such, is very much part of the end-user experience of the Internet. Identifying Google with search, however, belies the complexity and options for supporting such functionality within the Internet ecosystem.

Today, there are many vertical search engines that focus on specific types of content or queries. Google operates a number of these itself like Google Scholar (academic research with tools to allow easy collection of citations), Google Maps (for directions, geolocation information, and linked content), Google Shopping (for product search), Google Flights (for travel planning), et cetera. In some domains, like product search, Amazon may be more dominant, and just as Google has leveraged its strength in search into adjacent search markets, so also has Amazon.⁸⁶

Having all of these search options to support queries of all sorts (deep dives by experts as well as general purpose queries by neophytes to the online world) is one of the features that makes the Web platform, built on top of the Internet, such a compelling and useful societal and economic tool for the dissemination and management of online content. Users want search queries to be responded to quickly. Often they do want their searches censored (e.g., to block malware and sometimes pornography) and may want them biased (e.g., curated by an editor that might be an AI system that has tried to learn their preferences). What consumers typically do not want is the queries to be manipulated in ways that may conflict with their interests (e.g., to facilitate first-degree price discrimination by directing users to sponsored sites that match the interests of the sponsor rather than the consumer). For example, users do not want to think that the airline or product prices they are quoted are higher than what the consumers would be charged if they had access to a differently biased or enabled search engine.

⁸⁴ A complementary discussion of Google's role with respect to its platforms that are part of the Android mobile broadband ecosystem that Google helps sustain might also be provided here, but is beyond the scope of this paper.

⁸⁵ Search to locate records in a database, files on a computer, or in network environments, to identify endpoints for end-to-end traffic delivery.

⁸⁶ Amazon's product search engine provides link to additional services, product reviews, et cetera. These are logical extensions that initiated the original query.

A valid antitrust concern arises because of the inherent capability to bias or manipulate search results to preferentially promote affiliate interests or harm rivals, and to extract additional surplus from end-users. Indeed, the desire for fast responses to queries may run counter to the desire of advertising supported search engines to render users attention sticky. Fast query responses are important for the ecosystem and attention to how responses are structured and information is exchanged across layers in the multilayered architecture is important to ensure smooth functioning of the layered platforms.⁸⁷

Distinguishing what is good search technology and its use from what constitutes unacceptable behavior (what biases or censorship is appropriate and what not) is not obvious and we believe that continued innovation in search and the further expansion of the rich ecosystem of horizontal and vertical search engines, constructed as layered platforms, is important to protect. As such, it seems reasonable to call to task any firm that engages in demonstrably antitrust behavior (i.e., behaviors that can only be justified in terms of the harm to rivals). Identifying those behaviors will require taking account of the special economics that digital network platforms demonstrate, and the *newFCC* would have an obvious role in providing expert technical support to any such inquiry.

5. Summing up and Lessons Learned

Today's broadband Internet ecosystem comprises a complex matrix of layered digital platforms. Any framework for coherent regulatory policy for the Internet ecosystem ought to take into account how this layered platform structure impacts policy options.

We believe that the Internet ecosystem will benefit from (and indeed require) a sector-specific expert agency, which we have called the *newFCC*. It would function under new law that gives it a different scope and a different authority. We characterize the *newFCC*'s domain of responsibility as bounded by its focus on *Digital Network Platforms*, which have attributes that we discuss in Section 3. The term *Digital Network Platforms* is intended to include the many different types of platforms that contribute to and participate in the Internet ecosystem. It includes the broadband platforms provided by last-mile broadband access providers like Charter, Comcast, AT&T and Verizon (fixed and mobile); the mobile device and application store platforms associated with the Apple iOS and Google Android operating systems; and application platforms like those provided by Amazon, Facebook, and Twitter.

We believe that the scope of the *newFCC* should not be defined by reference to specific platform layers or industry sectors, but by *behaviors*; certain behaviors, no matter at what layer they occur, should bring the issue within scope of the *newFCC*. Similarly, the range of tools that the *newFCC* is authorized to use would derive from specific market outcomes or behaviors (or classes of harms) and not the position of a firm in the digital ecosystem. We believe that this approach would provide an agency with the flexibility to deal with the ecosystem as it evolves, while providing assurance that the agency is not being given an open-ended mandate for regulation.

⁸⁷ For example, browser platforms also have important impact on users' Web search experience (e.g., should a web page be displayed before ads are loaded, what about loading active content, et cetera).

In protecting our public interest, the *newFCC* is expected to be the independent regulator tasked with ensuring that our national goals and aspirations for our communications network infrastructure are met. In calling it infrastructure, we are identifying it among the class of social and economic inputs that are used broadly across society and the economy.

With respect to antitrust, we argue that the layered platform structure of the Internet ecosystem raises the possibility of new sorts of harmful behaviors that do not quite fit traditional concepts of antitrust abuse. Recently, a number of scholars have called for a more activist antitrust policy, provoking a global debate over the need for reforms to antitrust. This paper is informed by this debate, which is significantly motivated by the rise of the large Internet ecosystem platform players that are also a focus of this paper. We believe that new law (or enforcement guidelines) will be required to limit certain sorts of harm, and that an expert agency should play a role in enforcement, even if primary authority is elsewhere.

An important role for the *newFCC* is to keep abreast of technical developments in the ecosystem. It is appropriate that the agency be cautious about intervening, but it should be a repository of knowledge about technology and industry structure. Its preferred methods to shape the ecosystem might include information and discourse generating debate (via its bully pulpit or transparency and disclosure authority), rather than stronger interventions. If intervention is justified, we recommend a focused application of (for example) a non-discrimination rule, rather than more disruptive interventions that try to remedy harms indirectly by creating competition. We believe that only rarely would there be a need to order stronger divestiture/structural remedy rules. However, keeping these options in the toolkit (restricted to only certain classes of harms) is in itself a disciplinary force.

Because the Internet and its ecosystem has become critical infrastructure for society, society needs a voice in the shape and character of that ecosystem. The scope of the regulator must not be limited to enforcement of antitrust harms and ensuring a functioning marketplace. There are issues that rise to the level of public interest which do not derive from concerns regarding market power. At a high level, a primary justification for a *newFCC* is that an expert agency will be required as a focal point for decision-making about the best ways to shape the ecosystem so that the public interest is served.

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7. Appendices

7.1. Appendix Note 1: Neo-Brandeisian Antitrust Debate

Because the writing of this paper is being undertaken concurrently with an on-going and complex debate among antitrust scholars and policymakers that is beyond the scope of this paper to fully engage, but because the outcome of which bears on our thinking about the potential role of a new FCC with respect to the Internet platforms, we include a brief high-level summary of the debate here.

Khan (2017) argued that antitrust policy has drifted too far from its activist origins in adopting the Chicago School's attack on traditional antitrust enforcement, most notably with respect to predatory pricing and vertical foreclosure. Khan criticized the ability of current antitrust policies to adequately evaluate the impact of large Internet mega-platform providers like Amazon that are active across a range of Internet-related markets and the failure of the consumer welfare standard as applied to adequately address longer-term welfare interests in innovation, quality, and structural properties like the allocation of economic power. Wu (2018) argues that rise of Amazon and other platforms represents a "new gilded age" and that antitrust policymakers have given the large platform players a pass in allowing them to acquire economic power through mergers and acquisitions that faced inadequate review, arguing that "Innovation and dynamic effects, being harder to measure, do not get due consideration... and we might also consider a return to structural presumptions, such as a simple but per se ban on mergers that reduce the number of major firms to less than four" (pages 128-129, Kindle Edition). Proponents of this perspective have labeled this movement neo-Brandeisian in honor of Justice Louis Brandeis, who served on the Supreme Court from 1916 to 1939, and is viewed as a champion of America's Madisonian traditions – which aim at a democratic distribution of power and opportunity in the political economy" (Khan, 2018, page 131).

The neo-Brandeisian movement has attracted numerous detractors who have branded it as "Hipster Antitrust," and criticize it on historical (mis-reading the legal history), empirical (failing to adequately account for market concentration trends), methodological (mischaracterizing the consumer welfare standard), and practical (threatening to render antitrust more political and less objective) grounds. For example, see, Yoo (2018) or Sacher & Yoon (2019).

The debate over the need for reforms to antitrust policy and its enforcement due to the rise of the large Internet platforms continues to rage and is unlikely to be settled soon. (For further discussion of the issues, see FTC, 2018).

While full consideration of this debate is beyond the scope of this paper, it should be noted that the authors of this paper are sympathetic to the challenge that Internet platforms pose both methodologically and philosophically for antitrust policy. We expect that many of the insights emerging from this debate will frame general competition policy and enforcement in the future.

Although we do not address antitrust policy in detail herein, in considering the scope for future FCC action, we anticipate that the *newFCC* may complement and serve as an expert agency consultant to antitrust policymakers when competition authorities focus on firms and issues within the *newFCC*'s purview. Thus, one of the key considerations for the *newFCC* in the future will be whether responses to anticompetitive behavior alleged against Internet platforms ought to be pursued as an antitrust action in a court proceeding (potentially with the *newFCC* acting as a friend of the Court and expert agency) or undertaken as a regulatory enforcement action under the *newFCC*'s authority. That choice will depend both on the specific circumstances and how antitrust enforcement policy evolves in the future.

Whereas the focus of antitrust policy is not sector-specific and needs to be economy-wide (addressing multisided platform issues in whatever competitive context they may arise), the focus of the FCC is sector-specific. Its agenda of concerns for its sector are broader than those of competition authorities and its tools more multi-faceted, but its scope is more limited.