



A Survey of THE Online Video Environment

2009-2010

In Support of Innovation,
Competition, and Broad Participation



THE
OPEN VIDEO
ALLIANCE

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Competition, and Broad Participation

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I. INTRODUCTION

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II. CREATING VIDEO

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- Standards and the growth of the web
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I. Introduction

A CROSSROADS

The internet is fast becoming the preferred channel of communication, supplanting and subsuming all forms of traditional media: radio, print journalism, telephony, and television. Such radical change is often occasion for sudden bursts of innovation and reconfiguration. The internet has given us the ability to find anything, anywhere (Google), the world's biggest, most-up-to-date encyclopedia (Wikipedia), essentially free international telephony (Skype), and many other wonderful things that were imaginable 10 or even 5 years ago.

At some point, all these technologies lived on the periphery. Yet we can now take them for granted, for they have enriched our lives and empowered new transactions and dialogues.

Today, the internet is at a crossroads. In the next 5 years, a new set of essential technologies will emerge. These technologies will constitute a set of protocols and best practices for the creation, distribution, and consumption of video on the Internet. This blossoming of web video is not simply "more YouTube." Rather, it is a diffusion of moving images into all web communications. It is a shift with huge magnitude—in the same way the web blossomed and overcame walled services like America Online, we will soon see a rapid evolution of web video and moving images overcoming simple "video on-demand."

Most web pages will incorporate video or rich media. Internet-connected cell phones, televisions, cameras, portable media players, netbooks, desktop computers, and devices that have yet to be invented will all be parts of this internet video ecosystem.

Someday, these video technologies and their supporting infrastructure will be considered “essential.” We will take them for granted. But it is not clear what these technologies will look like. It is not yet clear how the legal environment will adapt to address them.

Creative potential and innovation on the internet are directly correlated with the balance of freedoms and constraints we face in sharing, manipulating, finding, and consuming media. Moreover, a literacy shift is underway: though we are inundated with hours and hours of professionally-produced video content, the tools for creating content are not yet evenly distributed. The video conversation is heavily weighed toward traditional cultural producers, and individuals are in uneven footing in this new sphere of literacy. As such, the rules of the emerging online video medium have particularly interesting consequences for citizen participation and political engagement.

Will video be as ubiquitous as text and images, fully integrated into the semantic web? How will users share interesting videos with each other? Will online video delivery be consolidated, or distributed? Will we privilege the rights of intellectual property owners over the design of the network? These are questions that will be resolved, one way or another. But cultural and educational institutions, policymakers, and technologists can tilt the scales—and they should.

There are certain developments that should trouble media reformers. Should we accept, for example, systems of automatic content-filtration for copyright violations, as YouTube has instituted? Should professionally-produced video content require user authentication (and thus, forfeited anonymity) before it can be viewed? How interactive will video be? How dynamic? Who will control the distribution and playback of the moving image? These are all interesting questions, for which the answers are not yet in focus. And operating in the early days of this transformation, it is hard to say how institutions should react. Values are, arguably, our only guide.

In recommending a course for this new medium, this report

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argues that public policy should be guided by 3 key values:

- **Innovation** is the engine of economic growth and technological progress. It is not always painless, but it ushers in new products, services, and efficiencies.
- **Competition** is good for consumers. It provides them with choice and a higher degree of self-determination. In the field of media reform, it helps ensure that many voices can be heard. The technologies, policies and practices that underpin web video must not limit competition.
- **Broad participation** is not easily measurable. It has many forms. If more people are choosing to express themselves using video, are free to participate in public dialogues, or are active in shaping their environment, it is a sign that the media system is healthy and vibrant. Participation is a metric for media democracy.

Whatever the eventual shape of the online video medium, its design will be no accident. For this reason, research and advocacy to protect core values like citizen participation is needed. The design and regulation of information technologies shapes public discourse and expands the possibility space of the internet. We will need to understand how video is created, distributed, and consumed, and ensure that policy helps the medium reach its fully democratic potential.

HOW IS VIDEO CHANGING THE INTERNET?

As video and other rich media become staples of the internet, they create tensions among content creators, content distributors and technology providers.

These tensions are well understood by academics and lawyers. Yet despite a well-developed body of scholarship, questions persist about the future of the internet, and whether it can continue to develop as a zone for innovation and free expression worldwide. The development of internet video is one area that will affect the development of the greater web. If incumbent media interests succeed in shaping the online video ecology (which has implications for both intellectual property and telecommunications policy) the internet will be a far less participatory medium.

This danger is now evident on sites like YouTube. In order to

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placate IP rights-holders, YouTube has installed sophisticated surveillance systems to detect and filter copyrighted content. One such system is called “ContentID.” Through ContentID, each video that is uploaded to YouTube is analyzed for copyrighted images and audio. Videos are given a stored fingerprint, which can later be used to automatically remove videos on the basis of copyright infringement or other criteria. Though the system is effective in stemming piracy, it’s also automated—instances of parody, critique, or pure accident are quite frequently swept into an IP-protectionist dragnet and creators are denied a voice. Without human review to distinguish legitimate discourse from “piracy” these systems are vulnerable to abuse.

This story serves not to single out a single provider—YouTube is a privately-operated platform and is free to operate in the way it sees fit. In fact, by instituting and operating systems like ContentID, YouTube is being responsive to the concerns of copyright holders and other outside forces. But as systems like this spread and are normalized, we risk losing some essential creative and political freedoms. ContentID should help us understand the stakes inherent in the technical design of the online video medium.

The irony is that these types of threats to free cultural exchange have emerged just as vast possibilities are unfolding. The emergence of video as the web’s killer app has already set in motion substantial changes for the way we communicate with the world. The most obvious symptom of this change is the slow-motion burial of the TV broadcast model, with consumers increasingly moving to an online, on-demand viewership model. Video is becoming a primary tool for self-expression. Things like video cameras and desktop editing software are now cheap and ubiquitous, making it easy for casual computer users to speak to a mass audience. Though they portend a world that is more creative and connected, these developments upend the existing balance between network operators, content creators, and consumers.

Thus, the legal and technological battles surrounding online video are, at their core, battles for the future of the internet. Video on the web can’t simply be “internet TV” or a glorified on-demand system. For its potential to be fully realized, online video must be a dynamic medium that invites clipping, archival, remix, collage, repurposing, and other transformations that are currently inhibited by law or by lack of tools. As a medium, online video will be most powerful when it is fluid, like a conversation. Like the rest of the internet, online video must be designed to encourage partici-

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pation, not passive consumption. Most importantly, the networks on which these conversations will unfold must not privilege certain conversations above others.

There are possibilities in this space for significant media reform. The stakes are fundamentally important: will citizens be privileged to many sources of video content, or just a few? Who will control our shared cultural vocabulary? How effectively will individuals wield the moving image?

OPEN VIDEO AS A HEURISTIC

The open video movement consists of a broad number of actors working on multiple fronts. The center of gravity for the movement is software. But equally important is the work of scholars and activists toward balanced network/telecommunications policy and balanced intellectual property policy. Together, these two policy areas have the most direct impact on whether users can engage in critical dialogues using video.

There are many efforts already underway to build an open technical infrastructure for internet video. The Mozilla Foundation, for example, has supported the development of the open source Theora codec as an alternative to the proprietary H.264 and Flash VP6 codecs. This open format will power video on Wikipedia and other public interest projects. The Participatory Culture Foundation develops the open-source “Miro” player to encourage user-driven video aggregation and playback. These and other organizations promote open standards in video publishing and distribution.

Yet there are few targeted efforts to address media and IP policy as it specifically relates to video. Where these efforts exist, they are sporadic and lack strategic coordination with other public interest organizations. Thus, we must seek to develop a research and advocacy framework unified by the idea of the “open video.”

The idea of open video draws from the more well-known trope of the “open web.” The open web describes a vision of a network whose key characteristics are consensus, cooperation, and compatibility. The bedrock of the open web is open technologies. Basic protocols like TCP/IP and HTTP govern routing and data transport. Resting on these technical foundations are software programs which understand the protocols and use them to connect to other clients. These software programs, usually available in free and open source implementations, negotiate transac-

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tions over the network and reconfigure bits into something meaningful. Above all, these individual parts of the network operate on the “end-to-end” principle. That is, particular patterns of traffic on the network are never privileged over each other.

At every level on this hierarchy, the open foundation for internet video is weak. A key assumption of this survey is that online video will be most **innovative, competitive, and participatory** when the medium adheres to the open web principles.

In short, will technology and public policy support a more participatory culture—one that encourages and enables free expression and broader cultural engagement? Or will online video become a glorified TV-on-demand service, a central part of a permissions-based culture?

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II. Creating Video

Creation is the first step in the lifecycle of any content.

For most of history, moving images were created with very expensive, specialized technologies. The technologies for capturing and manipulating media were, by necessity, proprietary technologies.

As the technologies for creating video become more evenly distributed in the form of cheap consumer-grade cameras, camera phones, and desktop editing suites, standardization becomes a necessary driver for continued growth and lower-cost implementations.

STANDARDS AND THE GROWTH OF THE WEB

Internet history is brief by any measure, but on one point its scholars and architects agree. A critical part of the success formula for the

early internet was the fact that the essential web technologies were always transparent and freely implementable. Because these essential protocols were available to anyone without cost, a large number of research institutions opted into the network. And because of this low-friction environment, innovation occurred more rapidly, and the network continued to grow. Sir Timothy Berners-Lee, the visionary director of the World Wide Web Consortium and one of the fathers of the web, explained this phenomenon before the U.S. Congress in a hearing on the “Digital Future of the United States” in 2007:

“The success of the World Wide Web, itself built on the open Internet, has depended on three critical factors: 1) Unlimited links from any part of the Web to any other; 2) open technical standards as the basis for continued growth of innovation applications, and; 3) separation of network layers, enabling independent innovation for network transport, routing and information applications” (...)
“The Web has not only been a venue for the free exchange of ideas, but also it has been a platform for the creation of a wide and unanticipated variety of new services. Commercial applications including eBay, Google, Yahoo, Amazon.com are but a few examples of the extraordinary innovation that is possible because of the open, standards-based, royalty-free technology that makes up the Web.” (...)
“The lesson from the proliferation of new applications and services on top of the Web infrastructure is that innovation will happen provided it has a platform of open technical standards, a flexible, scalable architecture, and access to these standards of royalty free (0 dollar fee patent licenses) terms.”¹

Most cyberscholars concur on the importance of open standards for the development of the Internet. Jonathan Zittrain, co-director of the Harvard Berkman Center for Internet and Society, contrasts

the success of open networks with the demise of proprietary ones in his book *Future of the Internet (And How to Stop It)*:

“Today’s Internet is not the only way to build a network. In the 1990s, the Internet passed unnoticed in mainstream circles while networks were deployed by competing proprietary barons such as AOL, CompuServe and Prodigy. The technorati placed bets on which baron would prevail over the others (...). All those bets lost. The proprietary networks went extinct, despite having accumulated millions of subscribers. They were crushed by a network built by government researchers and computer scientists who had no CEO, no master business plan, no paying subscribers, no investment in content, and no financial interest in accumulating subscribers. The framers of the Internet did not design their network with vision of mainstream dominance. Instead, the very unexpectedness of its success was a critical ingredient.”²

The work of scholars like Zittrain, Lessig, van Schewick, and others—not to mention the public statements of the key architects of the internet—helps us understand what traits gave rise to the Internet as we know it. Because the essential technologies of the web are free and open, innovation comes from unexpected corners, leading to a virtuous cycle that Zittrain calls “generativity.” Unforeseen applications and services can surface because there is a foundational set of technologies that are transparent and freely implementable. And no incumbent interests can shift the playing field to disfavor a new entrant, because they exercise no control over these essential technologies.

Today, the essential technologies for creating and sharing video are neither free nor open. They are not freely implementable, and the agreements that govern them are not transparent. There is a strong argument to be made that this is slowing the pace of innovation on the video web.

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HOW SOFTWARE PATENTS ARE HURTING INNOVATION IN WEB VIDEO

Video codecs, for instance, are an essential part of the technical ecosystem. Uncompressed video is very heavy, so much so that it is unsuitable for distribution. A codec (short for compressor-decompressor) is a technology that helps shrink the footprint

of video content, assisting in efficient delivery. Using a codec, a creator can shrink a raw video file to 1/10th of its size, with very little perceptible degradation of the picture. A good codec maximizes the quality of a video while minimizing its file size.

There are several codecs in wide usage for consumer electronics and on the internet. Nearly all these technologies, and the clever optimizations and tricks that they share in common, are extremely patent-encumbered. Since a huge number of companies have patent claims on different parts of codec technology, patent pooling arrangements are necessary—not just to collect royalties, but to provide a kind of broad liability insurance against expensive and unpredictable claims of patent infringement.

Almost all modern digital video cameras and camcorders use the H.264 or MPEG2 codecs. These codecs, and the associated patent pools, are administered by MPEG-LA LLC, the MPEG Licensing Authority. The H.264 patent pool includes licensors from Apple, Dolby, Fujitsu, LG, Microsoft, Panasonic, Samsung, Siemens, Sony, Toshiba, and many others. The pool simplifies royalty payments—instead of negotiating with a few dozen parties to implement video functionality into a product, service, or device, manufacturers can simply negotiate with MPEG-LA, which collects and distributes royalties to all the parties in the pool.

But the licenses are very expensive, even prohibitive. And setting aside cost, they introduce complexity for the makers of free software like Firefox and Linux. The H.264 license terms (as specified in the AVC Terms Summary³) are incompatible with most free software licenses, and software decoders cannot be freely redistributed.

Fortunately, alternatives to using AVC/H.264 exist—Theora (developed by the open source Xiph.org community) and WebM (developed, primarily, by Google) are free and open codecs that are reasonably efficient and already used by several important players in online video.

Unfortunately, representatives of MPEG-LA have suggested that both these codecs infringe upon patents owned by its licensors. MPEG-LA has not disclosed the affected patents, and no patent holders have pursued claims to date. But there is certainly at least one patent claim to be made on some element of the sophisticated algorithms that power the open codecs. Sensing opportunity, MPEG-LA has announced its intention to create a VP8 patent pool

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for people and companies who would like to collect revenue from companies using WebM.

The MPEG-LA patent pool illustrates a problem unique to software patents. In real terms, any commercial entity who wishes to implement the de facto standards for video compression must pay MPEG-LA. And even the alternative technologies (open codecs like Theora or WebM) are subject to submarine patents, grand-standing, and other threats—the effect of which is to discourage commercial entities from using the alternative technologies. The thicket of software patents, and in particular the MPEG-LA patent pool, essentially creates a tax on video-enabled products, services, and devices, as the cost of licenses and the expectation of liability is amplified through the supply chain.

Web standards don't work like this. Until very recently, the patent enclosure of video technologies has not been an open web issue. But video is becoming an essential part of the fabric of the web, and the new version of language of the web, HTML5, includes native support for video. Now, the web's reliance on expensive, wholly-owned proprietary technologies is cause for concern: if we accept that the technologies for transmitting moving images need not be free and open, we accept that other parts of the web need not be free and open. This is why the advent of web video is a fundamental inflection point—it throws the open character of the network into question.

Public awareness has not been focused on this issue, in part because many web broadcasters do not need to pay license fees to use H.264 codec technology. Providers of “free-to-watch” content have typically been exempt from paying fees, so families, small businesses, and others who post H.264 encoded content never need to pay for a license. But professional videographers, companies that sell access to content, hardware and software manufacturers all need to license the technology for their products and services.

Critics of MPEG-LA noted that, even for parties who were providing free-to-watch content, this agreement was only temporary. Then, MPEG-LA seemingly bolstered H.264's status as an “open” codec—deciding to extend this royalty-free period (detailed in a document called “Free Internet Broadcasting AVC License”) to December 2015, and later to extend it through the entire life of the license. This news provoked enthusiasm from people who thought that the Internet was finally getting a high-quality and acceptable

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open standard for compressing and decompressing video, and that H.264 could perhaps take its place as the official web video standard to complement the HTML5 video tag.

In real terms, this decision did not amount to much difference. Despite this gesture, H.264 still doesn't respect the two crucial criteria that history has proven to be essential to web standards: it isn't free, it isn't open.⁴ The scope of the "Free Internet Broadcasting AVC License" is very limited. The use of the H.264 codec is only free to end-users willing to broadcast their videos for free. If you charge money for your content, if you do any conversion or transcoding, if you make a software or a device that records or plays back H.264, you must acquire a license. It is free for some people, but it generates costs for others. And there is no doubt that those costs will get handed to consumers in the end.

Simon Phipps, an open source engineer for IBM and Sun, summarizes the patent minefield presented by proprietary standards like H.264: "The future of the web and of web videos depends on open source software, and H.264 remains unusable in open source because of patent threats."⁵

HOW SOFTWARE PATENTS ARE HURTING COMPETITION IN WEB VIDEO

In theory, a patent is only justified if it advances over the prior art. Patents and other forms of intellectual property are designed to serve the public good: in order to incentivize innovation, we bestow a limited monopoly to inventors.

The patent thicket around online video is not incentivizing innovation. In fact, it is a serious handicap for innovation, since entrepreneurial developers cannot freely use the basic "building blocks" of video to develop other products. In the case of MPEG-LA, some parties also argue that the H.264 patent-pooling arrangement is deeply anti-competitive. MP NERO AG, a German software company, filed an antitrust lawsuit against MPEG-LA in May 2010.⁶

NERO claims that MPEG-LA hasn't respected the promises it made to the US Department of Justice in 1997, such as hiring independent experts to ensure that only essential patents would be placed in the patent pools or making sure that the licensing terms would be "fair, reasonable and non-discriminatory." In its lawsuit, NERO makes very strong claims against MPEG-LA: "On information and belief, MPEG-LA has extended the duration and scope of its monopoly power in the relevant technology markets

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for the licensing of patents relating to the MPEG-4 Visual and AVC [H.264] standards by adding nonessential patents to its MPEG-4 Visual and AVC pools, which now contain more than 1000 and 1300 patents, respectively.” NERO claims that MPEG-LA has “formulated and imposed licensing terms that are unfair, unreasonable, and discriminatory” and conclude that “MPEG-LA’s unlawful actions have caused, and will continue to cause, Nero irreparable harm for which it has no adequate remedy at law, (...) In sum, MPEG-LA’s predatory and abusive conduct has caused antitrust injury to innovation, competition, and consumers in the relevant technology markets.”

Many technologists and entrepreneurs have been vocal about the need for patent reform—not just in the realm of video. Yet courts have generally declined to limit software and business method patents. This year, reformers were disappointed when the U.S. Supreme Court declined to take action in the landmark suit in *re Bilski*. Barring fundamental reform, the best hope for open source video will result from a verdict in the Nero suit. But as even the strongest sanctions are not likely to alter the competitive landscape, it seems that patent reform will need to be legislated.

With Silicon Valley and other innovation centers located in the U.S., the U.S. Patent and Trademark Office plays an enormous role in the continued global development of open source video. In *The Economics of Patents and Copyright*, Yann Ménière and François Lévêque write about “the factors that encourage patent offices to lower their guard and approve applications carelessly.” Examiners are influenced by numerous counter incentives: patent offices earn money when examiners accept patents and lose money when they reject applications; rejection of an application entails additional work because, unlike an approval, it must be justified; and, since opposition is by nature contrary to the interests of the filers and their lawyers, this can reduce an examiner’s chances of finding employment with one of the major law firms specialized in patents. “There is, therefore, a need to rebuild a system of incentives that realigns the interests of the patent offices with those of society in general, and not just with those of filers.” These are fixes that only legislation can address.

In summation, software patents are stifling the development of open video standards, limiting innovation and competition. And there is a close relationship between technical openness and media democracy: for more voices to be heard, the essential technologies for video must be available to all.

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III. Distributing Video

In a few short years, the dominant broadcast paradigm has shifted from a few speaking to many, to many speaking to many. What once required a galaxy of skilled producers and creative talent can now be copied and redistributed by a single person.

Now that the public internet provides a distribution channel for video content, it is important to distinguish data carriage from delivery of content. Many internet service providers are also providers of premium video content, and frequently this content is delivered over the same lines as wholesale internet traffic. Though this creates economic pressure for internet service providers, we must nonetheless establish an expectation of separation between the “network” and “application” layers for video.

This analysis is U.S.-centric, but the U.S. was the birthplace of the web, and the economic and legal forces shaping the web are still concentrated in the U.S. Drawing from observations about how video is distributed in the U.S., this report suggests a framework and principles that are applicable in many national contexts. It will include a look at potential threats to open broadband access which may limit competition and stifle innovation in wireline and wireless networks, and to the devices and applications which operate on those networks. The ultimate goal is to assess the landscape in which people may to continue to use the internet as an open platform for the distribution, consumption, and creation of video.

A MORE VIDEO-RICH WEB

Video is Rapidly Becoming the Most Common Form of Internet Traffic

Video is becoming the most common form of data accessed over the Internet. Currently, video accounts for about 33% of all Internet traffic. According to a recent Cisco study, in four years, by 2013, video will account for over 91% of all consumer traffic, and it will account for 66% of mobile traffic.⁸

Video Requires Higher Bandwidth Infrastructure

The rising prevalence of video is a direct result of, and is driving, the increased prevalence of broadband or “high-speed” internet networks. These broadband networks have largely replaced dial-up modems, the first generation of widely-adopted residential consumer internet networking technology. Deployed over the existing phone lines which reached essentially every American household, dial-up modems offered consumers internet access at speeds of 56kbps, which was sufficient to handle the mostly text-based webpages, audio and image files, and generally small file-size traffic of the early consumer internet. However, modems—and the phone lines they operate on—were woefully insufficient to allow for meaningful high-speed traffic of large files such as video, and real-time streaming video and audio feeds. Whereas a single page of digital text is on the order of 10 kilobytes in size (though of course can be larger or smaller), a video file such as a movie is generally around 1 gigabyte in size (about 10 million times larger). The richer format of video requires huge amounts of bandwidth. Increasingly, consumers have demanded and utilized these richer mediums of communication, driving cable and phone companies to invest in next-generation broadband technologies that can handle large amounts of traffic.

What is Broadband Internet?

Broadband can generally be thought of as internet service that is “always connected” and “high speed.” Broadband internet is an unspecific term that refers to the generation of faster internet services which replaced relatively slow dial-up connections using 56k modems and dedicated phone lines. Because broadband replaced dial-up as the main means of accessing the internet, it is sometimes referred to as the “Next-Generation Network” (NGN).

Whereas a single page of digital text is on the order of 10 kilobytes in size (though of course can be larger or smaller), a video file such as a movie is generally around 1 gigabyte in size (about 10 million times larger). The richer format of video requires huge amounts of bandwidth.

No technical definition or formal speed standards exist for broadband, although the FCC as of 2010 cites current expectations for broadband to be at least 4 mbps download and 1 mbps upload.¹⁰ Worldwide, standards for broadband are defined differently. In India, for example, the telecom authority rates broadband as any connection 256k or above—1/8th the standard set in the United States. The standards for broadband are expected to increase will upgrade as each successive generation of technology raises the bar for consumer expectations, but levels of service acceptability range by country and by level of relative development.

Broadband Internet is Mainly Delivered Over Fixed Cable and Phone Lines (Wirelines)

Broadband access is mainly delivered over a wire: a phone line called DSL (Digital Subscriber Line) or cable line. These lines, which carry the electrical signals for phone, TV and internet to consumers' homes, are installed, maintained and owned by phone companies such as AT&T and cable companies such as Comcast, commonly called "providers."

Broadband Internet May Also Be Delivered Over Wireless Networks

There are alternative methods of accessing broadband, distinct from the wirelines controlled by the cable and phone providers. Wireless access is available in many areas. Providers may offer satellite links to the home to connect laptop and desktop computers to the internet. Phone companies in some areas offer next-generation mobile phone infrastructure that delivers broadband access to mobile phones. This network is being upgraded to accommodate user adoption of new smartphones such as iPhones and Android phones whose advanced capabilities and large screens allow users to access high-bandwidth forms of mobile media such as streaming video. Mobile broadband networks are far from providing seamless coverage across the U.S., as these networks have yet to be built in most areas of the country. Furthermore, the networks that have been built are not fully integrated. The FCC's regulations on roaming, which allow users to make phone calls outside their provider's network by requiring providers to grant access to competitors' networks, do not yet apply to data service though the FCC has proposed extending the rules to include data.¹¹ However, as the exponential adoption of

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smartphones continues, wireless broadband access will become an increasingly important means of broadband access across the globe.

Wireline Providers Have a Natural Monopoly

Cable and phone companies have a “natural monopoly” over Internet wireline infrastructure. It is not economically efficient to lay multiple lines to each residential house given that only one of each will be used, and so most American households are only reached by one or two private phone and cable companies. According to the FCC and U.S. Census data, only 4% of U.S. households are reached by more than 2 wireline providers.¹² Although the FCC historically has regulated and subsidized the natural monopoly on phone service to ensure that all U.S. citizens have competitive and fair access to phone service, the Internet has escaped similar regulation in the United States. The result is a U.S. broadband network that lacks sufficient competition and has fallen behind other countries in key metrics such as speed, cost, and availability.

Open Video is a Litmus Test for Net Neutrality

Because of its large bandwidth requirements, video—more than other types of data such as text or image files—is intrinsically linked to the concept of net neutrality. In the ecosystem that is internet traffic, video requires large amounts of resources to move uninterrupted.

However, any provider’s network has a limited amount of bandwidth in which to deliver service to customers. To increase total potential bandwidth, providers would need to invest in laying more and/or higher quality lines to customers. Laying and maintaining more physical infrastructure is expensive, and costs the providers. Hence, providers have a vested interest in maximizing the amount of paying traffic they can send over their lines. Wireless providers are similarly limited by the amount of wireless spectrum they can access, and the network infrastructure they have to support that access. Some providers might seek to maximize traffic by limiting the amount of bandwidth that their customers use. For these providers, video, which is a particularly bandwidth-heavy type of information, is a big potential target for interference and restriction. At higher levels, the new alternative content ecosystems threaten the viability of the programmed broadcast services. For this reason, the ability of Internet consumers to access video

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openly and without restriction is something of a litmus test for net neutrality.

The Internet is Crowded: Good Traffic Management Can Help Ease Congestion

ISPs face a daunting challenge in trying to provide customers with fast, reliable, uninterrupted Internet service over increasingly congested networks. Unbiased traffic management, which attempts to smoothly deliver all customers' requested information without judging which traffic is worthy of delivery, is a necessary tool that allows ISPs to maximize the efficient use of their networks, ultimately benefiting both the ISP and customers. To ease the traffic burden, some ISPs have shown willingness to work with application makers and other parties to design more efficient traffic management systems that embrace high-bandwidth applications such as files-sharing. With researchers at Yale University and a group of companies that make file-sharing software, Verizon collaborated to enable faster downloads for consumers and lower costs for participating ISPs.¹³ The collaboration, identified as the Peer 4 Peer working group, attempted to "create a standardized protocol through which P2P firms and ISPs could work together. The idea was that sharing an ISP's network topology would help P2P companies route traffic in ways that are advantageous to both the ISP and the end user."¹⁴

The Verizon collaboration found that "when an ISP cooperates with a file-sharing software maker they can speed downloads an average of 60 percent — though collaboration boosted some downloads six-fold on fast Internet connections."¹⁵ This is one encouraging example of how ISPs can work with those using their networks to ease traffic. In general, good traffic management seeks to use engineering tools and policies to help all users access the Internet as smoothly as possible.

Threats to Net Neutrality: Tiered Traffic, Private Alliances and Provider Discrimination

Cable and phone company executives have publicly declared interest in setting up tiered traffic systems to regulate traffic. Wireless carriers have long stated that the infrastructure costs of supporting internet traffic is excessive, and that to fund it carriers should have leeway in how they levy fees and tier traffic.¹⁶ Speaking publicly in 2009, Verizon CEO Ivan Seidenberg alluded to

new business models that would allow network operators to sell different tiers of service. Verizon's CEO said that without the ability to provide these types of services that the FCC will essentially be "taking away the company's ability to make a return on their investment."¹⁷

Under these proposed systems, providers would tier traffic by charging companies fees to deliver their content to customers faster. Service providers could also make deals with content providers in order to block out competing content providers from reaching customers. These systems would end net neutrality as it has existed so far, and close off the open-access internet which has allowed small companies to compete with big ones and provide novel services directly to customers without having to negotiate expensive, stifling, or impossible to obtain permission from providers.

Providers have done more than declare their intent to discriminate amongst the types of traffic they transport: some have actually done so in practice. In 2008, the FCC fined Comcast for violating FCC net neutrality policies by intentionally slowing traffic using the BitTorrent file-sharing protocol.¹⁸ Comcast sued the FCC, and was vindicated when the court ruled that the FCC did not have authority to regulate how ISPs manage their traffic. It remains an open issue whether, and under what auspices, the FCC will assert authority over issues such as traffic management and net neutrality. In some foreign countries without clear policies supporting new neutrality, provider discrimination—on the part of ISPs or the government—can be widespread. In 2008, the government of Australia announced an intention to filter internet content and applications at the ISP level, ostensibly to block content such as terrorist-related materials and child pornography, and applications such as peer-to-peer file-sharing services.¹⁹ In 2009, Eircom, the largest ISP in Ireland, reached a deal with major record companies requiring Eircom to monitor and selectively block the activities and internet connectivity of its customers who were considered to be improperly using file-sharing and other services to illegally share music.²⁰ Under the scheme, suspect customers are to receive a series of notices from Eircom before having their internet service cut off for a year. Looking both to recent U.S. history and international examples, provider discrimination and harms from unclear or ineffective government policies are potential threats to net neutrality—and even, perhaps, the network itself.

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Net Neutrality Must be Preserved to Ensure Competition and Innovation

A neutral internet allows for innovation, competition, and economic growth. A network that is fundamentally neutral to the traffic travelling over it does not promote the traffic of big companies over small ones or individuals, and thus provides a level playing field.

In this open environment, new products and services can thrive and become huge national economic drivers. Examples of innovators which have benefited from open competition on a neutral internet include Google, Facebook, Yahoo!, myriad small websites and bloggers: indeed, nearly all of the applications and services on the internet to date. Recent moves and proposals by broadband providers to end net neutrality would degrade the innovative and competitive environment online. According to Vinton G. Cerf, one of the founding architects of the internet and the Chief Internet Evangelist at Google, "Allowing broadband carriers to control what people see and do online would fundamentally undermine the principles that have made the Internet such a success."²¹ Without net neutrality, large companies in established positions might be able to control traffic in ways that prevent or discourage consumers from accessing competitors' services. For example, an established video platform such as YouTube could in theory form agreements with ISPs to prioritize customers' access to its site over that of its competitors. These types of restricted environments would discourage competition and make it more difficult for the next YouTube, Google, or Facebook to reach customers and thrive. From the customers' perspective, the loss of net neutrality would make the Internet a less open place, more closely resembling the restrictive and closed-off access system build around cable TV service. Customers might find themselves frustrated at being unable to access desired webpages or services, or gaining access at slow speeds prone to service interruptions. Customers trying to video chat with distant friends over the Internet might find themselves unable to do so, because the ISP has not prioritized that particular service. "[P]rioritizing certain online uses—think YouTube as the new HBO offered by Verizon . . . would dismantle the nondiscriminatory platform for innovation that our new all-purpose pipe has provided in the past."²²

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NETWORK INFRASTRUCTURE: WIRELINE

Broadband Service is Dominated by a Natural Monopoly of Providers

Broadband access in the U.S. is dominated by a small handful of wireline providers. These cable and phone companies control 98% of the broadband market. Because cable and phone lines reached the majority of U.S. households by the time consumer demand for broadband arose, these outlets became the dominant means of supplying broadband service. However, these few providers have a “natural monopoly” on the broadband market, as it is not economically efficient for multiple providers to lay redundant physical lines to a single consumer’s home. According to the FCC, “[g]iven that approximately 96% of the population has at most two wireline providers, there are reasons to be concerned about wireline broadband competition in the United States.”²³

Wireless is Not Yet Competitive with Wireline Service

Although many residential customers have the option of purchasing satellite broadband rather than service from wireline providers, the effective monopoly of wireline providers remains intact. The FCC’s presentation of satellite broadband as a viable consumer choice “misrepresents the actual competitiveness of the market. Satellite is generally not a full substitute for DSL or cable modem service, because it has higher prices, slower speeds, and high latency.”²⁴

Are More Providers Necessary to Ensure High Quality, Low Cost Broadband?

There is an open debate over whether the natural monopoly or duopoly of broadband providers allows for sufficient competition in the marketplace. However, a review of the academic literature as well as comparisons to foreign broadband markets seem to indicate that if certain conditions are met, then multiple wireline infrastructures may not be necessary to ensure the delivery of competitively priced, high-quality broadband service. Competitive pricing need not imply competing infrastructures. In a natural monopoly, where the cost of infrastructure is very high, regulation forcing the sharing of infrastructure among multiple companies might be a lower-cost substitute that approximates the results of competing infrastructure, without requiring the outlay of multiple

infrastructure costs.

Rob Friedan points to issues of poor regulation as a primary culprit in delaying broadband infrastructure upgrades, rather than an absolute need for more providers and market competition. “[N]ear absolute reliance on marketplace resource allocation left the U.S. in a comparatively mediocre position in terms of most measures of progress in broadband deployment.”²⁵ Friedan points to the need to adopt global best practices, which include clear government vision and policies; incentives and subsidies when needed to ensure universal access and infrastructure investments; disincentives for litigation and tactics that delay infrastructure advancements; offering online municipal and federal services such as healthcare and licensing; and promoting digital literacy.

Ultimately, some or all of these strategies must be applied carefully and considerately to achieve a broadband marketplace with high quality universal access at fair prices. Solutions will not always require building more infrastructures. The issue is ultimately one of “how to attain the right balance of the cost-efficiency of fewer networks and the competitive benefits of more networks.”²⁶

Wirelines Are a Natural Monopoly Like Phone Lines

A “natural monopoly” situation exists when it is economically inefficient to provide more than one service option. In the case of physical infrastructure like phone lines and water pipes to residential homes, it is costly and hurts both competitors and customers to lay more than one line, as the other lines are redundant, will not be used, and the costs of laying and maintaining them will be borne by either customers or taxpayers. Where sufficient broadband wireline service is already provided, it is not necessary to lay new lines. However, it may be necessary to regulate – as is the case with phone and water services – to make sure that customers are being charged fair prices for a decent quality of service.

Good Wireline Infrastructure Policy Strikes a Delicate Balance Between Interest Groups

The economics of natural monopolies present unique challenges. The goal is to promote market competitiveness, which benefits customers, while at the same time protecting companies’ investments in the monopoly infrastructure and providing an environ-

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ment in which these companies can still achieve profitability. Furthermore, the business and regulatory environments must be such that companies will be incentivized to continue to invest in upgrades and expansions to their infrastructure networks. A delicate balance exists between the interests of customers and infrastructure providers in these situations. Good regulatory policy will strive to maintain that balance, ensuring that customers have access to high-quality service at a decent price, and creating or maintaining incentives for providers to invest in infrastructure. To ensure customers have a choice of services and some degree of price competition exists in the market, one tactic regulators have used is to force the owners of infrastructure monopolies to lease space on their infrastructure to providers of competing services.²⁷ Robert Atkinson points out that “[a] ‘softer’ alternative to regulation, but one that would still be premised on a mature duopoly market, would be to use existing antitrust and consumer protection rules more aggressively to limit abuses.”²⁸ In other words, rather than pursue pre-emptive regulations which may have unintended negative consequences on a young industry—such as stifling innovation—regulators may choose to have a more “hands-off” approach, giving the market space to grow and suing, regulating, or fining companies which pursue undesirable practices. To promote innovation, governments can also offer incentives such as tax breaks or reimbursements to providers to help ease the costs of investing in infrastructure. Each of these tactics can potentially help or harm the quality of service and level of competition in a broadband industry, depending on how it is used. Tactics such as regulation and financial incentives to build infrastructure should not be seen as absolute goods or evils. Rather, they should be used as needed to achieve the end goal of high-quality, low price broadband service that is profitable to providers, who have a standing incentive to invest in creating faster and more robust networks.

Competition Extends Naturally in a Given Area Due to Regional Pricing

Not all homes in an area need to have multiple infrastructures to benefit from competitive pricing. As long as there is sufficient competition across a region, the individual may still benefit due to the fact that plans are priced by the region and not the individual home.

As Robert Atkinson suggests, “if there is competition in the overall

local market—indeed this seems to be the case as pricing plans are often statewide or multistate—then individual households with access to fewer providers will still benefit from competition.”²⁹

Increased Wireless Availability Can Improve Wireline Competitiveness

Though in some places upgrades to wireline infrastructure may be necessary, the improved availability of broadband wireless service can compel wireline providers to become more competitive by lowering prices and/or improving service. The FCC has made increased wireless/wireline competition a key point in its National Broadband Plan. It intends to spur this, in part, by making more spectrum available for faster next-generation wireless networks. Increased competition should offer consumers more broadband options at better prices.

An Uneven Network: Wireline Service Often Provides Slower Upload Speeds Than Download Speeds

It is common for wireline service providers to provide customers with slower upload speeds than download speeds. The reasons for this are several and include limitations of the infrastructure and on traffic management. The infrastructure of phone lines, later repurposed to provide internet service (Digital Subscriber Lines or DSL) as well as phone service, provides limited bandwidth for transmitting data. In order to continue to provide uninterrupted phone service, two different means of transmission are used over the same line: a high frequency data signal, and a low frequency voice signal.³⁰ Filtering is used to make sure the signals don't interfere with each other. This system provides additional service out of pre-existing wireline infrastructure; however, as the infrastructure wasn't intended for carrying voice, data uploads, and data downloads, providers must prioritize traffic to provide customers with good and consistent service. Most early internet customers did significantly more downloading than uploading, so providers designed their systems accordingly to maximize the use of resources and improve the delivery of service—which meant prioritizing downloads over uploads given the limited bandwidth available. As increasing numbers of individuals become creative and require distribution, and legacy networks become phased out, home internet connections must begin to address this imbalance.

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Slow Upload Speeds Harm Users' Ability to Broadcast and Share Video

Slow upload speeds impair users' abilities to broadcast video for both personal and business purposes. Lag times and interruptions in video broadcast can frustrate attempts at person-to-person video communication. To promote innovative new businesses that harness video, and to maintain the integrity of users to communicate with each other via video, efforts must be made to ensure that upload speeds continue to advance to meet users' higher-bandwidth broadcasting needs.

If customers had better upstream access to the internet, they could upload more types of content more easily, including high-bandwidth content like video. This means that individuals could share video with more people, without suffering lag times, interruptions of service, or caps on the number of people who could view a video in a given amount of time.

What Can Be Done to Improve Broadband Service?

Clearly, there is a need for policies, incentives and regulations to improve broadband service. This can include spurs to upgrade networks, such as making more wireless spectrum available to wireless to increase wireline/wireless competition. It is also important to provide third-party monitoring of providers' service, so that there is transparency about what kinds of service are actually being provided to customers. This transparency will allow customers to see what kind of service they are buying, and allow them to compare and choose between competing services. Service standards would also help customers understand what they are getting in currently vaguely defined advertised services like "broadband," and "video streaming." The FCC's National Broadband Plan contains recommendations to create standards, improve transparency, and spur competition among broadband providers, which if properly implemented should improve customers' ability to navigate the broadband landscape.

NETWORK INFRASTRUCTURE: WIRELESS SERVICE

Wireless broadband is a widely available alternative to wireline broadband, but is generally more expensive, has higher latency, and is less reliable. There are two main types of wireless providers: WISPs and cell phone service providers.

WISPs and the Origin of “Last Mile” Residential Wireless Broadband Service

Wireless Internet Service Providers (WISPs) are generally small companies that mainly offer wireless broadband to the rural areas that large wireline providers failed to reach (the so-called “Last Mile” between a provider’s infrastructure network and a customer’s home).³¹ Laying wirelines to customers’ homes is economically less feasible in rural than in urban areas, because low customer density results in a lower return on the wireline investment. WISPs operate by accessing a fast wireline service, and then broadcasting that signal locally from a tower to reach homes within a roughly 30 mile radius. Residential customers must obtain a home satellite dish and often must place it within line-of-sight of the tower to receive a signal. While wireless home internet purchased through WISPs is an important means for Internet access for those living outside of areas served by wireline providers, this type of internet service is relatively limiting and cumbersome compared to Internet service accessible on mobile devices and networks. Mobile services and devices have proliferated rapidly towards ubiquity in the U.S. due to their ease of use and the extensive infrastructure networks of cell phone providers.

Cell Phone Companies as Providers of Mobile Broadband

WISPs primarily serve residential broadband customers in their homes, but do not have nationwide networks to support the seamless national mobility that a smartphone demands. Nationwide smartphone coverage is thus provided by national phone companies such as AT&T and Verizon, which have augmented their national cellphone networks to accommodate smartphones, an important new source of revenue.

Cell Phone Companies Provide Wireless Service Over Upgraded Cell Phone Networks

Major cell phone providers—notably AT&T, Verizon, Sprint/Nextel, T-Mobile—are rapidly upgrading their networks to support the high-bandwidth advanced capabilities of smartphones: video broadcast and download; fast access to e-mail, file transfers, Internet browsing, GPS directions on Google Maps, and other forms of real-time data and computing applications. However, as of yet national coverage leaves much to be desired and many parts of the country—particularly though not exclusively rural areas—

are considered “dead” zones because, lacking a sufficient high-bandwidth network, smartphones will not be able to use advanced features in these parts of the country. In areas that do have coverage, the networks are often not robust enough to handle the large amount of cell phone and smart phone traffic. Data traffic, particularly high bandwidth applications such as video, mobile applications, file transfers, and web browsing, is overwhelming networks. AT&T’s network is notoriously slow, due largely to AT&T being the sole provider of the popular and feature-laden iPhone.³² Slow networks mean that customers face latency issues: their data transfers are delayed, interrupted, or delivered at poor quality. This has serious implications, particularly for real-time communications such as voice over IP and video over IP.

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Mobile Broadband Standards: 3G and 4G

Mobile broadband is delivered to cellphones over a variety of privately built networks leveraging various technologies, including satellite and radio. However, substantive upgrades in technology that deliver meaningful new services to customers are commonly referred to as successive generations of technology, such as “third-generation” (3G), which is the current standard. Though 3G services may be delivered over a range of different network technologies, these technologies all share a common set of protocols for encrypting and routing information, which were formulated by the International Telecommunications Union.³³ 3G service started becoming available in the US in 2003, several years behind wireless pioneers Japan and South Korea, and was notably the first mobile broadband service enabling video services such as video on demand and video conferencing. The rollout of service in the US is still progressing, as providers invest in purchasing additional spectrum from the government, and in upgrading their networks and equipment accordingly. 4G service is expected to become available in 2011-2013.³⁴

The Need for More Spectrum

A significant limitation to the expansion of mobile broadband is the availability of spectrum allocated for broadband. In the U.S., spectrum is regulated and licensed by the FCC for various purposes, including TV broadcasts, radio transmissions, cell phone service and mobile broadband. It appears that more spectrum will be made available, as the FCC’s recent National Broadband Plan contains a recommendation to “make more spectrum available for existing and new wireless broadband providers in order

to foster additional wireless-wireline competition at higher speed tiers.”³⁵ Spectrum will be re-allocated from other governmental and private uses. Spectrum reassignment is necessary to accommodate the rise of new technologies that use the airwaves: a major spectrum auction in 2006 allowed providers such as AT&T and Verizon to purchase spectrum on which to operate their high-bandwidth 3G networks. Next-generation 4G networks are anticipated to require substantially more spectrum than is currently available.

The Limits of “Unlimited Data Plans”

Although some mobile service providers offer unlimited data plans, these plans are increasingly at odds with the providers’ ability to deliver high bandwidth data services over their limited networks. In addition to investing in infrastructure upgrades, some service providers are seeking to ease the load on their networks by limiting or “capping” data plans. These new plans place a cap on how much data each customer can access, and charge higher fees for data access beyond the cap. For the iPhone and iPad, among the first generation of rich mobile devices, AT&T announced in June 2010 that customers will now be able to purchase plans capped at 200MB or 2 GB, and pay for additional data beyond those limits. Although this type of plan is no longer termed “unlimited,” previous unlimited plans were often in actuality limited, and charged consumers with hidden and exorbitant fees for hitting unstated data caps.³⁶

Regardless of the charge for data, a customer’s ability to actually access data is practically limited by the ability of the provider’s network to deliver service. Newly limited plans, such as the AT&T plan described above, offer customers who use low amounts of bandwidth an initial monthly service fee that is lower than what they might have paid previously under unlimited plans. In addition, data caps are more transparent than the hidden caps that existed before, and consumers can plan their data accessing behaviors accordingly to minimize fees.

Data caps will halt the rapid expansion of bandwidth-heavy applications such as video. This is a necessary load-balancing move for the wireless networks as they brace for a rush of video-hungry devices on their networks. But if growth is to continue over the next few years as carriers augment the capacity of their networks, data caps must be gradually phased out. If users must consider

the cost of accessing a bandwidth-heavy service each time they reach for their device, the market for such services will be still-born.

Data Caps Are a Potential Threat to Mobile Video

Limiting the amount of data that customers can access, and charging for additional access, creates a financial disincentive for customers to access bandwidth heavy applications. This is a particular concern for video applications and services.

In response to AT&T's announcement of capped data plans, the New York Times speculated that "video services for phones could take the largest hit in the new metered phone world," and reports that some video application companies are considering offering lower-bandwidth video in order to keep customers from receiving high mobile data charges.³⁷

Data caps come at a time when devices are enabling a vast expansion in the ability of consumers to capture, edit, share, and view mobile video. Lightweight, multi-functional devices such as the iPhone allow users to easily record and download video over their existing phone plans. The ubiquitous presence of smartphones means that users can conceivably access video on-the-go and at any time. Whereas previously users had to carry a dedicated video camera, the omnipresent mobile phone means that everyone with a smartphone also has an internet-connected video camera and player. This has broad implications for innovation and increased prevalence of citizen journalism, as users anywhere can—with a click of a button—capture and share live events, newsworthy or not. Entertainment is rapidly evolving; users can record live concerts, and download or stream live or pre-recorded video such as TV shows or movies. Personal video is rapidly evolving as well, as smartphones enable users to record videos of vacations or personal events, and share and store them instantly via mobile Internet connections. The distinction between video consumer and producer is changing, as mobile video creation and sharing becomes a part of daily life for millions of people.

Mobile video is revolutionary in certain sectors, as evidenced in new health applications and doctor consultations enabled by tele-medicine.

However, all of these mobile video applications depend on the access to a robust network capable of handling high-bandwidth

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applications without interference from latency issues or dead zones. The price of such access must be affordable for applications to reach widespread consumer adoption. Data caps, while representing an understandable need for network service providers to make sure their networks aren't overwhelmed and that customers can reliably access basic services, will limit consumers' ability to use mobile video in the long term.

In addition to complicating customers' and developers' unrestricted distribution of video, data caps provide a disincentive for investors looking to invest in mobile video services. If customers' abilities to access video service are restricted, then the potential customer base for video applications shrinks, as do prospects for the growth of video businesses. The data plan caps come at a time of significant growth in high-bandwidth applications and devices. The iPad, video-chat enabled iPhone, and Netflix streaming video service all launched in 2010, and all require large amounts of bandwidth (too much, even—the iPhone's video calling ability is currently limited to Wifi networks only!). To encourage innovation and growth of video services, a low-cost solution for mobile bandwidth access will need to be realized. This would benefit both device makers—who could continue to sell new video applications and devices—as well as everyday users. It remains to be seen what this solution will look like, but many countries have built far more advanced networks than what currently exists in the U.S.

Advanced Mobile Networks: Asia Leads the Way

Japan and South Korea pioneered advanced mobile networks, launching the first 3G networks in 2001 and 2002.³⁸ In addition to being an early developer next generation mobile technologies, Japanese companies have invested heavily in infrastructure. Japan's major telecommunications company NTT pursued a clearly stated vision of a ubiquitous, nationwide mobile broadband network, pouring \$40 B of investments into infrastructure between 2005 and 2010 to complement its already internationally leading mobile service network.³⁹ For nearly 10 years, since the launch of its 3G network, NTT's mobile offshoot Docomo has provided Japanese customers with leading high-bandwidth mobile service. Docomo continues to invest in next generation infrastructure, recently announcing a \$3.4 B investment in building an LTE (Long Term Evolution) mobile network.⁴⁰ Though Japan and South Korea's mobile markets are undoubtedly aided by geographically concentrated, tech-savvy populations, the investment in next

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generation technologies is a critical precursor to the development of leading mobile networks. To remain internationally competitive, the U.S. should look to the mobile success stories in Japan and South Korea and use a carefully considered balance of regulation, policies, subsidies and incentives to achieve desired advancements in mobile service.

WHAT WE CAN LEARN FROM INTERNATIONAL COMPARISONS

The U.S. Is No Longer the World Leader in Broadband

According to a study by Harvard's Berkman Center for Internet and Society, which compared broadband services internationally, the U.S. is now a "middle of the pack" performer in delivering broadband service to its citizens.⁴¹ ". . . it appears that the United States opened the first decade of the 21st centuries in the top quintile in penetration and prices, and has been surpassed by other countries over the course of the decade."⁴²

US is Behind in High-Speed and Mobile Broadband

Although the U.S.'s price-performance index on services such as low-speed internet access is internationally competitive, the availability and price of high-speed internet leave much to be desired. Next generation technologies such as mobile broadband have been pioneered abroad in countries like Japan years before reaching the U.S.

Access and Quality to Remain a Center of Innovation

Broadband access is crucial for the U.S. to remain internationally competitive as a center of innovation. New video and high-bandwidth dependent companies cannot thrive unless customers have high-quality, inexpensive, reliable access to broadband. Video-based education and entertainment applications, for example, might require that customers have reliable mobile broadband capable of supporting hours of video viewing each day. New services such as Netflix's proposed streaming video service would certainly require substantial upgrades in mobile broadband service. Greater broadband access will give entrepreneurs the space in which to create the next YouTube or Google.

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IV. Watching and Sharing

Amateur cultural producers—an accident of the sudden explosion in technologies for creation and copying—are now among the most creative and prolific forces on the internet. This category includes bloggers, remix artists, photoshoppers, web developers, and hobbyists. Even though they constitute a small percentage of the total web user base, they are responsible for the most interesting new communications we see. They are also powering participatory projects like Wikipedia, open source software like Firefox, and creative communities like DeviantArt. These producers are at the very tip of an iceberg—if public policy fosters an environment that is friendly to them, new ideas, new dialogues, and new possibilities will flourish.

The introduction of a toolset for video presents unimaginable possibility. From the webcam embedded in your laptop screen, to the lens of the indie filmmaker, to the cell phone camera of the citizen journalist—we are surrounded by devices and software that enable us to powerfully wield the moving image. Thanks to a proliferation of tools for recording, editing, and distributing video online, anyone can be a broadcaster. These developments enable emerging artistic forms like video commentary and remix/mashup, creating new vocabularies for creative expression and civic participation. But they also upend legal and social conventions that have been developed over the long march of electronic mass media.

THE SHRINKING GAP BETWEEN PRODUCER AND CONSUMER

The distinction between producer and consumer is blurring. In the first place, the cost of producing video content is trending steeply downward. While producing video is not yet free, it is approaching free. Because of affordable video hardware, people can more easily pursue filmmaking, documentary, and other forms as a hobby. As a result, platforms like YouTube are rife with amateur content—some of which is every bit as polished and compelling as professionally-produced content.

A parallel trend is users “playing” with video content—reworking existing productions, recontextualizing them, quoting them. People can use professionally-produced video content as building blocks for their own productions. There are millions of examples of this remix/mashup phenomenon—many of which have serious technical, artistic, and authorial merit.

Though the law has frequently discouraged this kind of activity, 2010 saw some key victories for users. Before this year, to create remixes or mash-ups, video artists needed access to the original source materials in order to legally create a new work. It was illegal to break copy-protection on DVDs in order to get at these materials. Now, thanks to an exemption to the anti-circumvention provisions of the Digital Millennium Copyright Act (which rendered legitimate activity illegal in a technical loophole), artists are free to rip DVDs for these purposes. In truth, this change amounted to little in the real world, since these rules were totally unenforceable. But formal recognition of the practice of remix, and a growing respect for “fair use” of copyrighted materials, is a very positive development.

OWNERSHIP TENSIONS

Media literacy: speaking with video

Users must be able to “speak” with video as easily as they can “listen,” and quotation is an essential element of argumentation. Broadcast news works on this principle—anchors show what happened earlier in a press conference, or what happened on a rival network.

In an ideal world, everyday users would be able to easily copy and

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In an ideal world, everyday users will be able to easily copy and paste portions of video, as they already can with text. Of course the benefits of a more open system will go far beyond remixing, cutting, and pasting—when open video standards and formats are widely embraced, it will be possible to index, search, and access rich media in ways similar to what we do today with text.
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paste portions of video into new compositions, as they already can with text. We have every expectation that text artifacts—books, magazine articles, essays, op-eds—will be endlessly quoted, recontextualized, and reformulated. It is part of the free exchange inherent in the medium. In order to realize a participatory video medium, public policy must not discourage the same characteristics that make text an effective way of spreading ideas.

There are calls from the entertainment lobby in the U.S. to protect video content from copying. In technical terms, it is essentially impossible to design a system that will protect content 100% of the time. The only fully effective protections require hardware-level agreements among manufacturers, which are only likely to occur as a result of a technical mandate from regulators. As a general rule, technical mandates for consumer electronics and the web are bad for innovation. In this case, they would be especially bad, as hardware-level restrictions on copying would definitively kill the possibility of more textual interaction with protected video. For instance, film students would be unable to critique selections of films that were protected by a given studio. We would not accept word processors that forbid copying text, and we should not accept that our computers are forbidden from copying video.

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Many of these wireless devices are “locked in” to only work with a certain phone company or ISP. A typical example is the iPhone, which only operates on the AT&T network. Many other phone companies offer customers proprietary devices. This means that device owners often have little or no choice about which mobile provider they will use to connect to the internet.

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PRESERVING THE FREEDOM TO CHOOSE

Devices, Content, Applications

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Ensuring that users have a range of choices for interoperable devices, content, and applications is a powerful deterrent to monopolization. The internet works because any user can join, with any computer, on any ISP, and enjoy content and applications of their choosing.

There are many functional ecosystems that limit choice. Bundled services, like Apple’s iTunes ecosystem, can be profitable and good for consumers. But there are downsides: Apple iPods, iPhones, and iPads only work with the iTunes software. And video content purchased from iTunes only works on Apple devices. Users who want to watch iTunes content do not have a choice of hardware, and users of Apple hardware do not have a choice of where to buy content.

As long as there are alternatives to the Apple ecosystem, users

still have a choice. But increasingly, user autonomy and choice is limited by the selection of a certain device, type of content, application, or service provider. If this continues, users will not have a choice at all. In this section, we explore ways that choice is limited, how choice is detrimental to continued growth, and how policy might remedy a lack of choice.

Proliferation of Wireless Devices

The wireless devices people use to access mobile internet have advanced greatly in capability, number, and type in recent years. These devices generally support broadband connectivity and many have large color screens that support video functions. People use their smartphones for communication by voice, video, email and SMS, and increasingly to perform other sophisticated tasks, play games, watch movies, and surf the internet. Netbooks, small laptops optimized for web-browsing and basic tasks, have gained popularity due to their convenient size and affordable price (they often retail for under \$300). Apple's iPad, launched in 2010, is a commercially successful, internet-connected tablet computer that may launch a wave of competing tablet-computer devices. The proliferation of mobile devices has created many new opportunities for innovation and new businesses, and entrepreneurs and companies have responded by creating thousands of new and innovative applications for distributing media, for e-commerce, for communications, and for many other purposes. Certain applications are much more suited to mobile devices than traditional PCs or laptops, including some types of voice and video recording, and GPS enabled services. In recent years, countless applications have been designed around the uniquely mobile capabilities of smart phones and other devices. For example, mobile-based services such as Foursquare and Twitter are used by millions of people to communicate with and locate each other. It is expected that in the coming years, smart phones and other mobile computing devices will continue to proliferate and serve as important means of Internet access.

Wireless Device “Lock-In”

Many of these wireless devices are “locked in” to only work with a certain phone company or ISP. A typical example is the iPhone, which (ostensibly) operates only on the AT&T network. Many other phone companies offer customers proprietary devices. This means that device owners often have little or no choice about which

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mobile provider they will use to connect to the internet. This has real-world implications about what types of technology and services consumers can use, often discriminating along geographic lines. For example, an iPhone user may only connect the device to the internet with AT&T. But if the user lives in or travels to an area where the AT&T network has no coverage, the user's device is rendered useless. Although a different provider, such as Verizon, might have excellent coverage in this area, the user does not have the option to purchase service from the alternative provider, and so is left without functioning service. In addition to quality-of-service issues, device lock-in affects price competition. Customers cannot choose to switch to a lower-priced alternative provider, if they own a locked-in device.

Although consumers are legally allowed to attempt to connect their devices to different networks, they often face technical, financial, and other barriers in doing so. For example, a phone company will not necessarily help a customer unlock a device. Customers who attempt to do so themselves often must tinker with the device in order to access internal parts, which may void consumer protections such as warranties on those parts. In a common example, customers who remove a cell phone's casing to switch SIM cards risked voiding the phone's warranty. Device makers and phone companies also maintain device lock-in through the use of restrictive policies around software and operating systems. Many devices will only work with a certain operating system, and vice-versa. An example is the iPhone OS, which will only work on iPhones. Customers with iPhones can only use applications on the phone which are approved by the maker of the iPhone, Apple. This means that applications which are not approved by Apple are not available to consumers. Notoriously, Apple bans applications which it believes are "obscene," such as applications involving nudity and profanity, though it has also blocked a range of applications including political cartoons.⁴³ Apple has also banned some competing companies' products such as Google Voice, a voice-over-IP service, and Google Latitude, a social application that allows users to broadcast their locations to other users (some of these banned applications were later approved under unclear circumstances).⁴⁴ Currently, customers on mobile devices must navigate a sea of restrictions around network access, service contracts, and hardware and software barriers creating device lock-in.

Devices connected to the public phone lines, however, are not "locked in" to any service provider. A person may, in theory,

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In an unlocked world, businesses would have greater access to mobile customers. Because the potential market for any product or service would be greater, businesses and investors would have greater incentive to invest more in creating and upgrading products and services.
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connect any type of lawful telephone device to the public phone network. This freedom was granted in a 1968 regulatory decision by the FCC (the “Carterfone” ruling), and resulted in a wave of innovation that included fax machines, answering machines, and modems—which directly enabled the consumer Internet.⁴⁵

The Carterfone regulation only applies to landline phones. It could in principle be extended to wireless phones, as some academics and companies have suggested. This extension would benefit many businesses including wireless application companies, which could offer their services to many more wireless customers over a broader range of devices and networks. The company Skype, which provides traditional phone service as well as video-chat over users’ Internet connections, asked the FCC in 2007 to extend the Carterfone regulation to wireless phones. The FCC declined at the time, though under its new chairmanship it has decided to revisit the issue.⁴⁶ Software makers, device makers, and other businesses would all benefit from increased access to mobile customers.

Unlocking Devices Would Lead to More Consumer Choice

Unlocking devices would allow consumers to have much greater choice in both networks and devices. Customers could choose from every product and service available. For example, a consumer who wishes to purchase a wireless device that supports video broadcasting (it may have a particularly good built-in camera or screen for editing) may not be able to use it currently because the network it is tied to has poor support for video services. In an un-locked world, the consumer could switch to a provider that provides better support for his or her particular needs, in this case video broadcasting.

In an unlocked world, businesses would have greater access to mobile customers. Because the potential market for any product or service would be greater, businesses and investors would have greater incentive to invest more in creating and upgrading products and services. Opening up the wireless world would lead to more competition and innovation. In addition to businesses that seek to provide innovative services over wireless networks, consumers also have an interest in extending Carterfone regulations to wireless devices. Consumers would have more choice over what device they use, what network they access, what applications and software they use, and what price they pay. Consumers in aggregate also have a broad interest in determining wireless

networks should be used, as consumers bear the costs of those network through wireless service subscription fees, taxes, and government investment and subsidies.⁴⁷

Locked Devices Stifle Innovation

The design of locked devices is often greatly influenced by what the carrier wants, sometimes at the expense of what the consumer wants. For example, carriers seeking to decrease the amount of traffic on their networks might impede features that would encourage bandwidth-heavy video traffic. According to law professor Tim Wu, “Carriers have also forced manufacturers to include technologies, like ‘walled garden’ Internet access, that neither equipment developers nor consumers want.”⁴⁸ Wu lists e-mail, GPS, internet capabilities, sound and photo file transfers, and advanced SMS services as device features that have at some point in time been intentionally crippled by carriers.

Locked Devices May Stifle Competition

Apple, the maker of the iPhone, is notorious for singularly determining what types of applications customers can use on its smartphone, in addition to requiring that all customers in the United States use AT&T as the sole carrier. Many users have been frustrated for years at the seemingly summary judgments Apple sometimes makes when approving or denying apps made by third-party developers for release to the public on its App Store. Apple has strict ideas about what apps it will allow. For example, in keeping with the brand’s family-friendly image Apple bans apps that promote or provide nudity. However, in recent actions blocking a major competitor’s app from the app store, Apple has attracted attention from the U.S. government. The FCC is looking into Apple’s rejection of the Google Voice app, which provides free and low-cost phone services, as a possible instance of anti-competitive behavior.⁴⁹ Apple also limits users’ internet activity through its iPhone operating system (OS), which also does not support Flash, common proprietary software for viewing videos. Apple has a competing proprietary interest as the developer of the Quicktime video playback technology.

In designing public policy, it is important to maintain an environment where entrepreneurial disruption can happen—which means making sure that the fundamental principles of net neutrality are preserved.

FOSTERING MORE FLEXIBLE DISTRIBUTION CHANNELS

TV vs. configurable space

One of the strengths of the web is that it is a configurable medium. Unlike any previous analog media, there are no hard rules about channels, packaging, or containers. This means that creators and distributors can be agile about how they deliver their message.

They can design a website, build an application, or create a network. They can stream video on-demand, aggregate video, collect user-generated video, broadcast a live event, leverage peer-to-peer protocols. They can build rich, interactive experiences around video. They can encode video in any format, from H.264 to Theora to Egyptian cuneiform. They can do all of the above, in any combination, and in ways that haven't been invented yet. The possibilities are literally endless—there are no limits, except on available bandwidth, and, for live video, the degree of latency. Of course, making any of these propositions commercially viable is not guaranteed. But the architecture of the web does not include hard limits on what is possible.

Contrast this with previous forms of media. Broadcast TV is limited by spectrum—there are a finite number of channels available. The carrying capacity of each channel is limited, since there are only 24 hours in the day, so each channel operator must make hard decisions about what to broadcast.

We are moving away from a media environment that is shaped by the hard, physical limits of engineering. A goal for public policy is to ensure that the fluidity of the medium remains throughout the transition to a more media-rich web. Internet-native products like Boxee and Roku augur a world in which entrepreneurs are free to innovate, and users have maximum choice and control about what they consume.

Policy Should Optimize for Creating a Competitive and Open Environment

A robust internet video ecosystem is in direct competition with cable and premium TV—and for many users, their ISP is also a cable company.

As the Internet evolves, and relationships between ISPs, content providers, consumers and application providers change, it is

crucial to maintain an open environment that allows new businesses, ideas and applications to flourish.

There are reasons to be concerned about the continued “openness” of the Internet. The Google/Verizon proposal on net neutrality, announced in 2010, would allow ISPs such as Verizon and large content providers such as Google to form strategic partnerships. In these partnerships, ISPs could prioritize some Internet traffic over other traffic, fundamentally altering customers’ ability to have equal access to each website and service on the Internet. Large partnerships such as the proposed Google/Verizon alliance could negatively impact small entrepreneurs, who might find themselves unable to distribute their product or service to customers on an equal footing with large companies. Another emerging threat to net neutrality is vertical integration deals, in which a customer can only access a particular website if the customer’s ISP has paid that website a subscription fee. ISPs such as Comcast have systematically blocked customers from accessing certain services such as file-sharing services.

Although the networks that provide the infrastructure for broadband internet traffic in the U.S. are controlled by a few private companies, the traffic that travels over those networks can move about freely regardless of whose network it is traveling on. Similar to how a customer of Verizon can make a phone call to a person on the AT&T network without any limitation and without restrictions on the content he or she wishes to say over the line, a user who connects to the internet can access any web page or information without restriction by the ISP. “Users pay ISPs for access to the whole Internet...The present regime on the Internet does not distinguish in terms of price (or in any other way) between bits or information packets depending on the services that these bits and packets are used for. This regime, called ‘net neutrality,’ has prevailed on the Internet since its inception.”⁵¹ This principle has been the foundation for much national growth, including the creation of many large companies such as eBay, Amazon, and Google. In an open environment such as the internet, consumers are free to choose amongst products and services based on quality and preference, rather than limiting and irrelevant considerations (which website is it “easier” or cheaper for a consumer to access). Consumers can access all internet sites and services equally, at least in principle. This freedom of choice allows better products and services to grow quickly, iterate, and compete with each other. The result is economic growth, and a competitive, innovative envi-

ronment that benefits both entrepreneurs and consumers.

Net Neutrality is Crucial to Continued Innovation and Fair Competition

It is crucial to maintain net neutrality to ensure the internet remains an open platform that is conducive to innovation and fair competition, in which new start-up companies, information, and applications can thrive. This open, unbiased network has been the key to the internet's success to date, as stated by technology innovators such as Vint Cerf and leading academics such as Barbara van Schewick in testimony delivered during FCC and Congressional hearings on this issue. Vint Cerf, a creator of the internet and VP at Google, testified before Congress in 2006 that "The Internet's open, neutral architecture has proven to be an enormous engine for market innovation, economic growth, social discourse, and the free flow of ideas...This 'neutral' network has supported an explosion of innovation at the edges of the network, and the growth of companies like Google, Yahoo, eBay, Amazon, and many others."⁵² Cerf testified that an end to net neutrality would threaten the innovation that has made the internet such a successful platform for innovation. "Allowing broadband carriers to control what people see and do online would fundamentally undermine the principles that have made the Internet such a success." Internet scholar Barbara van Schewick testified that network management which discriminates among applications would threaten consumer choice and the subsequent innovation and development of new applications. "[I]t is impossible to predict what future successful applications will be. Enabling widespread experimentation at the application-level and enabling users to choose the applications they prefer is at the heart of the mechanism that enables innovation under certainty to be successful...Consumers, not network providers, should continue to choose winners and losers on the Internet."⁵³

Reasonable Traffic Management Need Not Preclude Net Neutrality

Proper traffic management can ensure that all traffic gets to its intended destination safely, as quickly as possible, without unduly disrupting other users or packets of information. However, many providers are experimenting with collecting fees, blocking, or speeding up or specific traffic. Other providers have, in practice, and often without transparency, favored some applications

It is crucial to maintain net neutrality to ensure the internet remains an open platform that is conducive to innovation and fair competition, in which new start-up companies, information, and applications can thrive.

over others by prioritizing web traffic. For example, Comcast has acknowledged its systematic practice of blocking or “throttling” bandwidth-heavy applications like file-sharing services.⁵⁴

Comcast was sued by the FCC for blocking its customers from accessing the file-sharing service BitTorrent. In testimony on net neutrality given before the House Judiciary Committee, academic and Internet law professor Susan Crawford stated that because the Internet is a major means of communication, any interference with customers’ traffic by ISPs would amount to a violation of customers’ First Amendment rights to free speech.⁵⁵ “[O]ur American First Amendment values require that we all have the opportunity to speak (and invent) without being censored by public or private gatekeepers. We are now moving our communications online...and our common concern for liberty, speech and innovation requires that we keep access to the Internet neutral.” It is essential that whatever traffic management systems come into effect do not jeopardize the fundamental neutrality of the Internet: the ability of anyone to send or receive data from any source without interruption or interference.

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Tiered Traffic—Paying for Faster Delivery of Information

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Some providers have proposed implementing systems for tiered traffic management. Under these systems, companies or individuals would pay the provider a fee to have their traffic delivered to its destination preferentially over other traffic. This is a tricky proposition with regards to net neutrality, as it would potentially create a system where the “haves” benefit even more, and the “have nots” are even less able to compete. The playing field would become much more uneven. A big content distributor such as YouTube could pay to have its content delivered to customers faster and with less interruption than the content of its competitors. YouTube and the ISP to which it pays fees would benefit, and YouTube would gain a competitive advantage in the market—and perhaps more customers—by being able to deliver content faster than its competitors. However, the small business, entrepreneur, or individual attempting to distribute a video online would not be able to afford the same content-delivery fees that a YouTube could pay. This would limit overall competition and stifle innovation, as the myriad of small players would be severely disadvantaged in the marketplace.

Companies that are large and already well-established in a market

have inherent competitive advantages due to their market positions. YouTube, which is a dominant source for posting and watching online video, is able to harness network effects in a way that smaller competitors cannot. Because it is already a major destination for online video consumers, content creators are incentivized to put their content there to reach the largest audience. If network effects are combined with a system of controlled content delivery, such as tiered traffic or ISP/content provider alliances, then the ability of a large established company to outperform any competitor becomes dangerously entrenched. This type of environment could easily stifle innovation, to the detriment of both companies and consumers.

The Google/Verizon Proposal to End Net Neutrality on Mobile Broadband

On August 9, 2010, Google and Verizon announced a joint policy proposal on net neutrality. The proposal endorsed an open internet as it currently exists today on wireline internet but proposes that a potentially less neutral, different standard should apply to wireless internet because it is a young industry and “the mobile marketplace is more competitive and changing rapidly.”⁵⁶ The proposal would allow mobile providers to offer “additional, differentiated online services,” such as faster service for select healthcare applications or entertainment broadcasts—in effect, creating tiered traffic based on fee systems. Critics of the proposal noted that it could create one or more walled-off, pay-for-service Internets which run parallel to the open and publicly accessible internet as it exists currently, much as cable TV channels are accessible only to paying customers, although public TV channels are accessible to all over the same network infrastructure.⁵⁷ Whereas TV is mainly a one-way transaction—content is delivered to consumers’ homes—the Internet is fundamentally a two-way, interactive environment. People both consume and create content, and thus the considerations for managing competition are more different.

On a tiered traffic system, all information and products would not be equally accessible to consumers. The consumers and businesses that could afford to ally themselves with ISPs in preferential deals would have an advantage in the marketplace. A large content provider such as Google could form a business alliance with a large ISP such as Verizon, putting Google’s competitors like Yahoo and Bing at a disadvantage for reaching customers. Recognizing the potential of such alliances to skew the playing field,

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companies such as Facebook have spoken out against the Google/Verizon proposal, saying that it threatens net neutrality.⁵⁸ Unsurprisingly, other mobile ISPs such as AT&T have spoken in support of the proposal, as tiered traffic would allow ISPs to collect more fees for the use of their existing networks.⁵⁹

Vertical Integration: Blocking Internet Content or Enhancing It?

Deals between content providers and ISPs approximate a type of vertical integration, in which the content and the means of distribution are controlled by a company or association of companies. On the whole, a person connecting to the internet from any ISP can currently access any legal site or content online. For example, whether a person has Comcast, AT&T, or TimeWarner as an internet provider, he or she can access The New York Times website. Vertical integration deals that would block people from accessing sites on the internet are contrary to the principle and practice of net neutrality.

Vertical Integration Precedent: ESPN3

Google and Verizon seem to have presented their proposal as vertical integration deal that would “enhance” rather than block internet service for select customers. It remains to be seen how a proposal like this would play out and what the effect on net neutrality would be. A currently existing vertical integration deal between an online content provider, ESPN3.com (formerly ESPN360.com), and various ISPs, may provide some insight. ESPN3 provides sports coverage, including many live and HD broadcasts, on its website. The site may only be visited by customers whose ISP has paid a subscription fee to ESPN3 for access to the site.⁶⁰ That means that customers of small ISPs which cannot afford the subscription fee, cannot visit ESPN3.com. The site is also unavailable to the customers of large ISPs that choose not pay the fee. With regard to ESPN3, customers who connect to the internet through certain providers are restricted in their activity online.

Economics professor Nicolas Economides notes that both tiered traffic and vertical integration may stifle competition on the internet. “Coordinated reduction of capacity in ‘plain’ service is remi-

ESPN3 provides sports coverage, including many live and HD broadcasts, on its website. The site may only be visited by customers whose ISP has paid a subscription fee to ESPN3 for access to the site. That means that customers of small ISPs which cannot afford the subscription fee, cannot visit ESPN3.com.

niscent of cartel behaviour...Therefore, introduction of coordinated price discrimination may have anti-competitive consequences.”⁶¹ According to Economides, the end of net neutrality has clearly negative consequences for competition, and the only question is not whether to intervene, but when: should pre-emptive anti-discrimination regulation be created? Or should regulators wait until anti-trust suits are filed? Given the length of time suits can take and the vast economic importance of the internet, Economides favors taking pre-emptive action to preserve net neutrality. Other organizations and critics differ in opinion of whether creating pre-emptive regulation or waiting for an anti-trust lawsuit would be a better course of action.

Premium Internet Content and ISPs: Where Do We Go From Here?

The network and the traffic that travels over it should remain unlinked. This principle is fundamental to the open nature of the internet. It remains to be seen what effect bundling “premium” content such as sports broadcasts or news sites with ISPs will have on the open nature of the internet. In the meantime, steps that promote consumer choice, transparency, and fair competition will help keep the internet neutral as it evolves.

FCC Leadership: A Bright Horizon?

The new chairman of the FCC, Julius Genachowski, has made moves to promote net neutrality and increase the availability of broadband in the U.S. He has also publicly stated his commitment to preserving net neutrality, an encouraging hint at the direction the FCC may take in the coming years. “Mr. Genachowski said . . . that ‘any deal that doesn’t preserve the freedom and openness of the Internet for consumers and entrepreneurs will be unacceptable.’⁶²” However, despite public statements consistently supporting net neutrality, the FCC’s ability to do so in practice rests upon it clarifying and firmly establishing its authority to regulate the internet, its providers, and its users.

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V. Looking Ahead

The New Relationship Between Content and Provider: Will the Internet Become More Like Cable TV?

Cable TV companies dictate which content channels a customer can access, and at what cost. In the case of TV, the service providers control content. Providers of Internet service, by contrast, have historically not controlled which content their customers access. These differences between ISPs and cable providers are currently in a period of flux. Large providers of traditional TV content, such as the major TV networks ABC, NBC, and Fox, are concerned about the diffusion of their proprietary material over the Internet. These particular companies have made an attempt to control the entry of their content into cyberspace by in 2007 launching Hulu.com, a website that allows users to watch TV shows and movies, with revenue being generated by ads and distributed to the content providers. It remains to be seen whether other TV networks will pursue this or different models for making their shows accessible online. ABC, NBC and Fox may also choose not to pursue into the future their early experiment with Hulu.

A major move recently occurred at the intersection of TV and internet, which may help influence how the relationship between those mediums develops. In 2010, Comcast acquired NBC. In this transaction, one of the nation's largest cable service providers absorbed one of the premier content providers, creating a joint entity that creates and distributes TV content over both TV and Internet. Competing cable operators have expressed concern about the deal, and requested the government to ensure that they will have access at reasonable fees to Comcast's infrastructure network. Competing ISPs have expressed concern about their ability to distribute Comcast's content—particularly online video—over their own networks. Content creators and distributors have requested assurances that they will be able to deliver their content to Comcast's customers unfettered. The details of the deal, and its consequences for competitors and consumers, remains to be seen. This type of integration may or may not fundamentally alter the character of the Internet, leading to more restrictive access to content and networks that limits choice for consumers and limits competition among businesses. On the upside, these types of integration deals may provide consumers with access to a greater range of content.

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Video and Expected to Become More Prevalent

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Video, advanced video, and mobile video accessed via smartphones are becoming more prevalent. Cisco estimates that the global online video community will include over 1 billion people by the end of 2010. Recent events have brought international attention to bear on the rising importance of internet-based video, and the importance of neutrality and high-capacity in the global networks that enable it. The world saw a surge in videoconferencing after the eruption of Iceland's Eyjafjallajökull volcano on April 14, 2010. The eruption clouded the skies over Europe and grounded tens of thousands of flights for days, spurring vast numbers of people to conduct business and personal communications over internet-enabled real-time video rather than in person. On June 20, 2009, the death of Iranian protester Neda Agha-Soltan was captured on video and broadcast over the internet. It was seen by millions of people around the world and became a rallying point for the opposition to the Iranian government. The video was widely seen online before being broadcast on traditional networks such as CNN. Online video broadcast, which allows videos to be posted immediately and without restrictions or censorship, is a crucial means for free expression and communication in the digital age.

Video Is an Increasingly Important Means of Cultural Interaction, Communication, and Artistic Expression

Internet-enabled, collaborative, and remixed video projects have recently gained attention and legitimacy. Star Wars Uncut, a collaborative and open-sourced remix project conducted online, recently won an interactive Emmy award. In the project, fans submitted home remakes of 15-seconds' worth of the movie Star Wars. The resulting clips were assembled into a complete, fan-made and unique version of the film that blended a myriad of techniques, viewpoints, and artistic sensibilities. The Yes Men, a group of political activists, have used online video to distribute their work free of censorship and the burdens of traditional cable TV and movie theater distribution deals. They operate an online TV channel, and have also seen success distributing one of their films, The Yes Men Fix The World, online via the peer-to-peer file-sharing service BitTorrent. To preserve political, journalistic, personal and artistic freedoms, it is important that valid means of expression such as independent video content or peer-to-peer distribution services not be discriminated against in the internet of the future.

Advanced Video Use Expected to Increase

According to a landmark Cisco study, we will see a 7-fold increase in video communications by the year 2014. We will also see a rise in forms of advanced Internet video such as 3D and HD. Video-on-demand and real-time video are growing in importance as well. Video is expected to become increasingly relevant in terms of personalized video consumption and broadcast; education, interpersonal and business communication, and as a tool to enhance political freedom and transparency.

Real-time and Advanced Video May Require Unforeseen Network Capabilities

The internet may need to evolve in as-yet unforeseen ways to accommodate future demand for video. Real-time, high definition, and other advanced video capabilities will need to be supported by sophisticated and robust networks that can continually evolve to meet the needs of users. As this happens, rules and policies governing networks, devices, and applications will need to be continually re-examined to ensure that the principles of net neutrality, open competition, and transparency continue to guide the environment.

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VI. Afterword

Creating a unified policy framework for open video—one that weaves concerns about technology, telecommunications and intellectual property policy into a unified vision—is no small task. We have likely not achieved it yet. As such, we view the creation of this report a first step in a long process.

Many thousands of people are exploring our future mediascape, and working to make it better. It would be very difficult to acknowledge each person, but several must be recognized here: Jonathan Zittrain and the entire Berkman Center faculty, Anthony Falzone and Barbara van Schewick of the Stanford Law School Center for Internet and Society; James Vasile of the Software Freedom Law Center; the people of Mozilla and Red Hat; Sunil Abraham and the Centre for Internet and Society, India; Ronaldo Lemos and the FGV Law School faculty; the brilliant and inspiring Susan Crawford, and NYU's Gabriella Coleman. You have inspired this report, and some have contributed to the ideas here.

Our deep thanks and gratitude to the Ford Foundation, for supporting thinkers and doers in the task of building a more just, representative, and democratic media system.

Lastly, thanks are due to the tens of thousands of contributors to the most important public benefit projects of our time—open source movements like Wikipedia, Mozilla, Linux, and the rest.

VII. Endnotes

- 1 Testimony of Sir Timothy Berners-Lee before the United States House of Representative, Hearing on the “Digital Future of the United States: Part I – The Future of the World Wide Web”, March 1st, 2007. Online at <http://dig.csail.mit.edu/2007/03/01-ushouse-future-of-the-web>
- 2 Zittrain, Jonathan. The Rise and Stall of the Generative Net, in “The Future of the Internet and How to Stop It”, p.7, online at <http://futureoftheinternet.org/download>
- 3 http://www.mpegla.com/main/programs/avc/Documents/AVC_TermsSummary.pdf
- 4 For a definition of open source and open standards, see Bob Sutor’s article on Open Source vs. Open Standards, notably p.3: <http://www.sutor.com/c/essays/osvsos/>
- 5 Phipps, S. “Hold the celebrations; H.264 is not the sort of free that matters”, <http://blogs.computerworlduk.com/simon-says/2010/08/hold-the-h264-celebrations/>
- 6 Original version of the antitrust lawsuit: <http://www.courthousenews.com/2010/05/17/Antitrust.pdf>
- 7 Lévêque, F and Ménière, Y. “The Economics of Patents and Copyright”, Berkeley Electronic Press, 2004. To download the book: <http://ideas.repec.org/b/bep/eptcpy/1.html>
- 8 Cisco Visual Networking Index, 2009-2014. Accessible online at: http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-481360_ns827_Networking_Solutions_White_Paper.html
- 9 Benkler study “Next Generation Connectivity: A review of broadband Internet transitions and policy from around the world.” The Berkman Center for Internet and Society at Harvard University. February 2010. Available online at: <http://cyber.law.harvard.edu/pubrelease/broadband>.
- 10 “Broadband Internet Access.” Wikipedia. http://en.wikipedia.org/wiki/Broadband_Internet_access. Accessed Sept. 20, 2010.
- 11 Esther Shein. “FCC Data Roaming Proposal Divides Opinions.” InformationWeek. June 16, 2010. “<http://www.informationweek.com/news/government/mobile/showArticle.jhtml?articleID=225700383>. Accessed September 25, 2010.
- 12 Federal Communications Commission. “National Broadband Plan.” Chapter 4, pg. 37. Online at: <http://www.broadband.gov/plan/>. Accessed Sept. 15, 2010.
- 13 Peter Svensson. “Verizon to speed up, not police, Internet traffic.” Associated Press. March 14, 2008. <http://www.msnbc.msn.com/id/23630791>. Accessed September 26, 2010.
- 14 Stacey Higginbotham. “Does the Internet Need More Roads or Better Traffic Signals?” Gigaom. April 10, 2008. <http://gigaom.com/2008/04/10/does-the-internet-need-more-roads-or-better-traffic-signals>. Accessed September 25, 2010.
- 15 Peter Svensson. “Verizon to speed up, not police, Internet traffic.” Associated Press. March 14, 2008. <http://www.msnbc.msn.com/id/23630791>. Accessed September 26, 2010.
- 16 Clair Cain Miller and Miguel Helft. “Google Plan With Verizon Disillusions Some Allies.” The New York Times. http://www.nytimes.com/2010/08/16/technology/16google.html?pagewanted=1&ref=net_neutrality. Accessed September 23, 2010.
- 17 Marguerite Reardon. “Verizon CEO slams Net neutrality.” CNET. October 21, 2009. http://news.cnet.com/8301-30686_3-10379932-266.html?tag=mncol. Accessed September 26, 2010.
- 18 Ceclia Kang. “Court rules for Comcast over FCC in “net neutrality” case.” The Washington Post. April 7, 2010. <http://www.washingtonpost.com/wp-dyn/content/article/2010/04/06/AR2010040600742.html>. Accessed September 21, 2010.
- 19 Jacqui Cheng. “Net filters “required” for all Australians; no opt out.” Ars Technica. October 16, 2008. <http://arstechnica.com/tech-policy/news/2008/10/net-filters-required-for-all-australians-no-opt-out.ars>. Accessed September 20, 2010.
- 20 John Collins. “Eircom to cut broadband over illegal downloads.” The Irish Times. May 24, 2010. <http://www.irishtimes.com/newspaper/frontpage/2010/0524/1224271013389.html>. Accessed September 23, 2010.
- 21 Vinton G. Cerf. “Prepared Statement of Vinton G. Cerf Vice President and Chief Internet Evangelist Google Inc.” U.S. Senate Committee on Commerce, Science and Transportation. Hearing on “Network Neutrality.” February 7, 2006.
- 22 Susan Crawford and Lawrence Lessig. “Opinion: Google-Verizon should prompt FCC to demand Net Neutrality.” Mercury News. August 12, 2010. http://www.mercurynews.com/opinion/ci_15745767?nclink_check=1. Accessed September 26, 2010.
- 23 Federal Communications Commission. “National Broadband Plan.” Online at: <http://www.broadband.gov/plan/>. Accessed Sept. 15, 2010. FCC National Broadband Plan
- 24 Robert Atkinson, “The Role of Competition in a National Broadband Policy.” Journal of Telecommunications and High Technology Law. March 16, 2009. Available online at <http://www.jthtl.org/content/articles/V7I1/JTHTLv7i1-Atkinson>. PDF. Accessed August 22, 2010.

VII. Endnotes

- 25 Rob Friedean. "Assessing the Need for More Incentives to Stimulate Next Generation Network Investment." 2010. The Selected Works of Rob Frieden.
- 26 Available at: http://works.bepress.com/robert_frieden/22.26 Robert Atkinson, "The Role of Competition in a National Broadband Policy." *Journal of Telecommunications and High Technology Law*. March 16, 2009. Available online at <http://www.jthtl.org/content/articles/V7I1/JTHTLv7i1-Atkinson>. PDF. Accessed August 22, 2010.
- 27 Ben Charney. "FCC Loosens Broadband Rules." CNet news. February 20, 2003. <http://news.cnet.com/2100-1033-985313.html>. Accessed September 25, 2010.
- 28 Robert Atkinson, "The Role of Competition in a National Broadband Policy." *Journal of Telecommunications and High Technology Law*. March 16, 2009. Available online at <http://www.jthtl.org/content/articles/V7I1/JTHTLv7i1-Atkinson>. PDF. Accessed August 22, 2010.
- 29 Robert Atkinson, "The Role of Competition in a National Broadband Policy." *Journal of Telecommunications and High Technology Law*. March 16, 2009. Available online at <http://www.jthtl.org/content/articles/V7I1/JTHTLv7i1-Atkinson>. PDF. Accessed August 22, 2010. Robert D. Atkinson. "The Role of Competition in a National Broadband Policy."
- 30 "Digital Subscriber Line." Wikipedia. http://en.wikipedia.org/wiki/Digital_Subscriber_Line. Accessed September 21, 2010.
- 31 Wireless Internet Service Providers. Wikipedia. http://en.wikipedia.org/wiki/Wireless_Internet_service_provider. Accessed September 14, 2010.
- 32 Marguerite Reardon. "Is AT&T ready for the iPhone 4?" CNET news. June 16, 2010. http://news.cnet.com/8301-30686_3-20007846-266.html. Accessed September 21, 2010.
- 33 "3G." Wikipedia. http://en.wikipedia.org/wiki/3G_wireless. Accessed on August 31, 2010.
- 34 "3G." Wikipedia. http://en.wikipedia.org/wiki/3G_wireless. Accessed on August 31, 2010. Ibid.
- 35 Federal Communications Commission. "National Broadband Plan." Chapter 4: Broadband Competition and Innovation Policy. Page 35. Available online: <http://www.broadband.gov/plan/>
- 36 Marguerite Reardon. "Is AT&T ready for the iPhone 4?" CNET news. June 16, 2010. http://news.cnet.com/8301-30686_3-20007846-266.html. Accessed September 21, 2010.
- 37 Claire Cain Miller and Brad Stone. "App Makers Worry as Data Plans Are Capped." *The New York Times*. June 6, 2010. <http://www.nytimes.com/2010/06/07/technology/07data.html?pagewanted=1&r=1>. Accessed September 25, 2010.
- 38 "3G." Wikipedia. <http://www.nytimes.com/2010/06/07/technology/07data.html?pagewanted=1&r=1>. Accessed September 18, 2010.
- 39 Geoff Hiscock. "In Japan, broadband moves toward ubiquity." CNN. December 20, 2006. <http://www.nytimes.com/2010/06/07/technology/07data.html?pagewanted=1&r=1>. Accessed September 25, 2010.
- 40 Serkan Toto. "Under 'Xi' Brand: Docomo to Invest \$3.4 Billion in Japanese LTE Infrastructure." *Mobile Crunch*. August 2, 2010. <http://www.mobilecrunch.com/2010/08/02/under-xi-brand-docomo-to-invest-3-4-billion-in-japanese-lte-infrastructure>. Accessed September 25, 2010.
- 41 "Next Generation Connectivity: A review of broadband Internet transitions and policy from around the world." The Berkman Center for Internet and Society at Harvard University. February 2010. Available online at: <http://cyber.law.harvard.edu/pubrelease/broadband>. "Next Generation Connectivity: A review of broadband Internet policy and transitions from around the world." February 16, 2010. Available online at: <http://cyber.law.harvard.edu/pubrelease/broadband/>
- 42 "Next Generation Connectivity: A review of broadband Internet transitions and policy from around the world." The Berkman Center for Internet and Society at Harvard University. February 2010. Available online at: <http://cyber.law.harvard.edu/pubrelease/broadband.Ibid>.
- 43 Ryan Singel. CNN. "Apple app store bans Pulitzer-winning Satirist." April 16, 2010. http://articles.cnn.com/2010-04-16/tech/apple.app.bans.mark.fiore.wired.1_app-store-apple-banned?_s=PM:TECH. Accessed September 26, 2010.
- 44 Jenna Wortham. "Even Google Is Blocked With Apps for iPhone." *The New York Times*. July 28, 2009. <http://www.nytimes.com/2009/07/29/technology/companies/29apps.html>. Accessed September 26, 2010.
- 45 "Carterfone." Wikipedia. Accessed August 31, 2010. <http://en.wikipedia.org/wiki/Carterfone>
- 46 Spencer Ante. "Opening the Wireless Internet: The Importance of Carterfone." *The Tech Beat Blog*. Businessweek. August 3, 2009. Accessed August 31, 2010. http://www.businessweek.com/the_thread/techbeat/archives/2009/08/opening_the_wireless_internet_the_importance_of_carterfone.html
- 47 Matthew Lasar. *Ars Technica*. June 26, 2008. <http://arstechnica.com/tech-policy/news/2008/06/carterfone-40-years.ars>. Accessed September 26, 2010.
- 48 Tim Wu. "Wireless Carterfone." *International Journal of Communication*, Vol. 1, p. 387, 2007. Available online at: <http://ssrn.com/abstract=962027>

VII. Endnotes

- 49 Erica Ogg. "Report: FCC inquiries into Apple, AT&T rejection of Google Voice app." Cnet news. July 31, 2009. Accessed August 30, 2010. http://news.cnet.com/8301-13579_3-10301259-37.html
- 50 Tim Wu. "Wireless Carterfone."
- 51 Nicholas Economides. "Internet, economics of the." The New Palgrave Dictionary of Economics. September 1, 2010. The New Palgrave Dictionary of Economics Online. Palgrave Macmillan. <http://www.dictionaryofeconomics.com/article?id=pde2008_E000244> doi:10.1057/9780230226203.0840
- 52 Vinton G. Cerf. "Prepared Statement of Vinton G. Cerf Vice President and Chief Internet Evangelist Google Inc." U.S. Senate Committee on Commerce, Science and Transportation. Hearing on "Network Neutrality." February 7, 2006.
- 53 Barbara Van Schewick. "Official Testimony at Second FCC En Banc Hearing." April 17, 2008. Available online at: http://www.fcc.gov/broadband_network_management/041708/vanschewick-written.pdf.
- 54 Mark Jewell. "FCC ready to curb ISP traffic management." Associated Press. February 25, 2008. Online at MSNBC.com. <http://www.msnbc.msn.com/id/23340949>. Accessed September 25, 2010.
- 55 Susan Crawford. "Written Statement of Susan Crawford, Visiting Associate Professor, Yale Law School Hearing On: Net Neutrality and Free Speech on the Internet Before the Committee on the Judiciary, Task Force on Competition Policy and Antitrust Laws, United States House of Representatives, March 11, 2008. Available online: <http://judiciary.house.gov/hearings/pdf/Crawford080311.pdf>.
- 56 Tom Tauke. "Joint Policy Proposal for an Open Internet." Policy Blog. <http://policyblog.verizon.com/BlogPost/742/JointPolicyProposalforanOpenInternet.aspx>. Accessed Aug. 21, 2010.
- 57 Claire Cain Miller and Miguel Helft. "Web Plan from Google and Verizon Is Criticized." The New York Times online. Published August 9, 2010. Accessed August 31, 2010. <http://www.nytimes.com/2010/08/10/technology/10net.html?scp=3&sq=google%20verizon&st=cse>
- 58 Miguel Helt. "Facebook Breaks With Google on Net Neutrality." Bits Blog. The New York Times online. August 11, 2010. Accessed August 31, 2010. <http://bits.blogs.nytimes.com/2010/08/11/facebook-breaks-with-google-on-net-neutrality/?scp=5&sq=net%20neutrality&st=cse>
- 59 Claire Cain Miller and Brian Stelter. "Web Plan is Dividing Companies." The New York Times online. August 11, 2010. Accessed August 31, 2010. <http://www.nytimes.com/2010/08/12/technology/12net.html?scp=6&sq=net%20neutrality&st=cse>
- 60 "ESPN3." Wikipedia. Accessed August 31, 2010. <http://en.wikipedia.org/wiki/ESPN3>
- 61 Economides, Nicholas. "Internet, economics of the." The New Palgrave Dictionary of Economics. September 1, 2010. The New Palgrave Dictionary of Economics Online. Palgrave Macmillan. <http://www.dictionaryofeconomics.com/article?id=pde2008_E000244> doi:10.1057/9780230226203.0840
- 62 Claire Cain Miller and Miguel Helft. "Web Plan from Google and Verizon Is Criticized." The New York Times online. Published August 9, 2010. Accessed August 31, 2010. <http://www.nytimes.com/2010/08/10/technology/10net.html?scp=3&sq=google%20verizon&st=cse>
- 63 Amy Schatz. "Comcast competitors Seek Conditions on NBC Purchase." The Wall Street Journal. August 21, 2010. <http://online.wsj.com/article/SB10001424052748703579804575441723370135074.html>. Accessed September 26, 2010.
- 64 Amy Schatz. "Comcast competitors Seek Conditions on NBC Purchase." The Wall Street Journal. August 21, 2010. <http://online.wsj.com/article/SB10001424052748703579804575441723370135074.html>. Accessed September 26, 2010.
- 65 Cisco Visual Networking Index, 2009-2014. Accessible online at: http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-481360_ns827_Networking_Solutions_White_Paper.html. CISCO study. Vision 2014.
- 66 Campbell, Matthew. "Internet Traffic, Video Meetings Surge as Ash Grounds Europe." Bloomberg.com. April 20, 2010. <http://www.bloomberg.com/news/2010-04-20/internet-traffic-video-business-conferences-surge-as-ash-grounds-europe.html>

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