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The Evolution of Video Streaming and Digital Content Delivery

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INTRODUCTION

It is a time of great change in telecommunications. New platforms have emerged that stream videos and voice over the Internet and deliver content via tablets and smartphones. These systems have expanded the multi-platform mix for communications, entertainment, and commerce. At the same time, an "Internet of Things" based on sensors and machine-to-machine communications offers the potential to forge new relationships between customers and businesses.

In this paper, I examine the future of video streaming and digital content delivery systems during a time of major transformation. I discuss what these changes mean for people, businesses, and governments. Briefly, I argue that there are many opportunities in the move to a multi-platform world. New models have the potential to become more flexible, adaptive, and cost-effective. But officials need to promote innovation that maximizes the benefits of new developments. We need to make sure that populations such as the elderly, disabled, and those living in rural areas are able to reap the benefits of the technology revolution.

THE EXPLOSIVE GROWTH OF VIDEO STREAMING

The biggest growth area in Internet usage has been video streaming. There has been tremendous interest among consumers in watching movies on-demand and viewing video content on every device: television, video players, desktops,

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laptops, tablets, and smartphones. People enjoy the convenience of online video and the high-resolution and 3-D features that now are available.

In the entertainment area, it is estimated that video streaming is responsible for 30 percent of overall Internet traffic.[1] Companies such as Netflix, Time Warner, Comcast, Amazon, and Hulu, among others are working to meet this demand. The upsurge of video requires more of telecommunications networks in terms of speed and network design. Internet providers are reengineering the network to accommodate the explosive growth of video and are making it easier to share experiences online. Social media are part of the consumer experience because people enjoy commenting on their experiences and sharing recommendations with their friends and associates.

But streaming also is moving beyond the entertainment area into education and health care, among other areas. Educators see documentaries, movies, and instructional videos as a vital part of the learning process. Students love to learn through moving images as opposed to text alone and there have been tremendous advances in mobile learning. Teachers are incorporating educational apps onto tablets and mobile phones, and helping students take responsibility for their own knowledge acquisition.[2]

Health care providers have made important advances in video usage.[3] Physicians use video conferencing to confer with patients who have difficulty coming to medical offices. There are numerous websites that incorporate video and digital content into their offerings. Patients often do research on symptoms, diseases, and treatment before they talk to a doctor. The growth in information resources helps patients become more informed about their medical care and enables them to play a more active role in maintaining their health.

The dramatic growth of video in a number of areas requires investment in network infrastructure. Consumers want networks that are fast enough to watch and share various kinds of videos. This requires considerable resources on the part of Internet and content providers.

THE INTERNET PROTOCOL TRANSITION

Telecommunications firms are moving to replace copper wire with fiber-optics and wireless technology. Consumers are moving from landlines to mobile devices and Internet delivery systems. Increasingly, people are accessing content on many different platforms: television, Internet streaming, tablets, and smartphones. They obtain information, undertake transactions, and communicate via the Internet as opposed to traditional communications. About 40 percent of Americans rely exclusively on mobile phones as opposed to landlines.[4]

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I see this consumer shift in several different areas. In telecommunications, people make calls through services such as Skype, Google Hangouts, and FaceTime, among other means. Advances in videoconferencing enable individuals and businesses to communicate via high-resolution computer networks. Videos, movies, and television shows are available over tablets and mobile devices anywhere, at every hour of the day.

During this transition, it is necessary to ensure that those who obtain information via landlines don't lose access to necessary services. This is critical for the elderly and disabled and people living in rural areas. It is vital to emergency services and home security systems that those who require access are able to get it through relevant platforms. For some, this may be mobile devices while with others it is Voice over Internet Protocols (VoIP).

AT&T is undertaking a multi-year experiment overseen by the Federal Communications Commission (FCC) in West Delray Beach, Florida and Carbon Hill, Alabama. It hopes to better understand how to speed the transition to faster Internet Protocol networks and the manner in which this shift affects customer access and emergency service delivery. New customers who seek phone services won't be able to sign up for landlines but instead will be given mobile devices, Internet phone service, or traditional phones that connect through routers and electrical outlets. If the experiment works, telecommunications providers will shift towards VoIP and mobile, and will rely less on expensive copper phone landlines.[5]

It is focusing on these cities because each represents particular kinds of challenges. In West Delray Beach, for example, half of the residents are senior citizens so the experiment

is designed to see if older people can access the phone services they need through mobile devices or broadband services. Carbon Hill meanwhile is an old mining town with a number of poor residents and people who currently rely on landlines.[7]

The FCC has established several principles designed to ensure that "Americans have the opportunity to succeed using the new network." For example, it requires robustness in networks so that consumers can get emergency assistance. It also wants people "to have affordable access to high-speed fixed and mobile broadband networks" and that the 54 million Americans with disabilities "be able to make full use of broadband networks and the video, voice, and data services that run over these networks."

As part of the IP Transition, telecommunications firms are opening up their networks to make them more agile, adaptive, and cost-effective. As new technologies and platform delivery systems come online, companies want to respond to user needs and seek to lower costs. In particular, companies plan to "provide APIs, enable better participation of third parties, and improve visibility [and] increase the number of suppliers and partners AT&T can do business with."[8] More services will be delivered via data centers and cloud computing, and firms will rely on Software Defined Networking (SDN) and Network Function Virtualization Infrastructure (NFVI).

For its part, the FCC is seeking to facilitate technology innovation and new applications. It recently announced plans to "free up more airwaves for Wi-Fi and wireless broadband."[9] Specifically, it is repurposing spectrum previously reserved for unlicensed outdoor advertising and Advanced Wireless Services to be used for new generation Wi-Fi. The goal is to encourage mobile communications and help people access high-definition video and online streaming.

SMART DEVICES AND THE INTERNET OF THINGS

In 2009, writer Kevin Ashton coined the term, the "Internet of Things" to describe the emergence of machine-to-machine communications linked through high-speed networks and radio-frequency identification (RFID) tags.[10] Building on a corporate presentation he had made years earlier, he described smart objects that enable manufacturers to track their supply chains more effectively. Through RFID tags attached to particular items, managers can see where their supplies are and whether they have the inventories needed to build particular products.

In conjunction with global positioning systems (GPS), this technology has transformed a number of different areas. Consultant Nam Pham has analyzed the situation and concluded that "with the increased adoption of mobile phones throughout the world and the growth of phones with GPS positioning capabilities, mobile phones and networks now represent essential tools for agriculture, transportation/logistics and emergency response and disaster management."[11]

Smart appliances help consumers keep track of their heating and security needs. For example, consumers can use mobile devices to set their thermostats or turn on their home security systems. They can make sure that dish-washers run at optimal times from the standpoint of saving energy and refrigerators keep products cool. Smart meters show people how they are consuming energy and what the cost is at various points in time.

Motor vehicles now are equipped with GPS chips that monitor engine performance and make sure that the cars are operating at peak efficiency. Smart cars can help people park in tight spaces and anticipate possible accidents through early warning systems.

Wearable devices are becoming more ubiquitous. People are wearing computerized watches, glasses, and accessories that keep people connected around the clock. Innovators are integrating devices into people's lives rather than having computers that function as separate devices

As the world evolves from person-to-device computing to machine-to-machine (M2M) communications, mobile devices take on even greater value. Once they are embedded in a range of daily activities, it will become apparent how much they contribute to a number of different endeavors. According to Maravedis, "20% of mobile carriers say M2M will be a number one source of revenue growth 2013-2017."[12] These communications open up new possibilities for business and commerce.

IMPROVING SPECTRUM ACCESS

Federal Communications Commission Chairman Tom Wheeler has laid out an ambitious agenda to transform telecommunications and move the country fully into the information age. Since he has taken office, he has launched several major initiatives on protecting competition, channel sharing, improving access, helping students, ensuring an open Internet, and adapting regulation to 21st century markets.

Recently, he discussed his ideas for moving America forward. Foremost among the items is the need to free up spectrum for wireless applications. Speaking about this issue during a visit to the Brookings Institution, the Chairman praised the emergence of what he called the fourth network revolution of wireless connectivity of computer devices (the successor wave to the printing press, railroad, and telegraph).[13]

He predicted that the upcoming incentive auction and sharing technology would "revolutionize the way we manage our air waves" and promote economic growth and innovation in education, health care, energy, and transportation. At this point, he said the task was to remove unnecessary obstacles that limit advances and ensure the availability of ingredients to modern networks, such as wir eless spectrum.

Congress has given the FCC the authority to hold an incentive auction and Wheeler said the upcoming auction would address the economic roots of spectrum policy and "match the economics of demand with the economics of current spectrum resources." Wheeler described this as a "once in a lifetime opportunity for broadcasters" to continue their current business model while repurposing under-utilized spectrum. The biggest uncertainty at this time is how many providers will participate and what the rules will be guiding the auction.

PROTECTING CONSUMERS DURING PERIODS OF TECHNOLOGICAL DISRUPTION

During a time of enormous technological change, it is important to think about ways to modernize regulatory structures and improve institutional functioning. Technology offers the opportunities for communications networks to become more adaptive, video-oriented, and data-driven. But we need governmental processes that match the agility and adaptability of the innovation ecosystem.

Public officials should consider ways to speed up regulatory decisions. Too often, decision-making processes drag out for months or years. By the time decisions are reached, the original controversy that provoked the public action may have become moot. In a fast-moving sector, government agencies need to expedite decision-making.

Regulators need to be open to new business models and applications with the potential to improve consumer communications and commerce. This is especially relevant in technology sectors due to the fast pace of change and ability of firms to produce valuable applications that improve convenience and functionality for consumers.

Saddling innovators with detailed operational rules devised years ago is less helpful than ensuring that companies respect broad principles of diversity, inclusiveness, fairness, and competition.

At a time of technological disruption, for example, we need to make sure that vulnerable groups such as the elderly, disabled, and those living in rural areas are not left behind. The technology revolution offers many virtues but its centrality to the modern economy means that policymakers have an appropriate role to play in promoting access and ensuring fairness in the marketplace.

Running experiments represents a novel way to measure the impact of change and determine what shifts help consumers and which ones are problematic. When people are in the midst of a revolution and there are numerous moving pieces in the ecosystem, it is hard to know in advance what approaches are most productive. Data-driven regulation represents a way to determine the best path forward. Regulations can use data to match the needs and responsibilities of the public sector with the innovation capacity of the private sector.

Handling this transition to a 21st century digital economy should be a top priority for policymakers. Having an infrastructure that supports innovation in commerce, health care, education, transportation, and energy makes it possible to bring the benefits of the technology revolution to a broad set of people. Encouraging investment in wired and wireless networks is vital to the future of innovation. Government officials should work to promote innovation and safeguard consumers during this extraordinary period of technological transformation.

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